***Table of Contents***

**XTX Series Tractors**
**Service/Diagnostic Manual SM 8-15002**

**1 GENERAL**
Safety Rules, General Information and Torque Specifications .....1001 SM

**2 ENGINE**
**NOTE:** *For Service and Overhaul procedures refer to your Engine Service Manual.* SM
Error Codes: Tier 2 Tier 3

**3 FUEL**
**NOTE:** *For Service and Overhaul procedures refer to your Engine Service Manual.*

**4 ELECTRICAL**
Electrical Troubleshooting and Schematics.....4001 SM
Instrument Cluster Programming.....4002 SM
Battery Servicing and Testing.....4004 SM

**5 STEERING**
Steering Column and Steering Hand Pump Removal .....5001 SM
Rexroth Steering Hand Pump.....5002 SM

**6 TRANSMISSION**
Transmission How it Works .....6
Guidelines for Separating the Speed and Range Transmissions .....6003 SM
8 Speed Powershift Transmission Servicing .....6006 SM
Range Transmission Servicing .....6007 SM
Differential and Differential Lock Servicing .....6012 SM
MFD Clutch Servicing .....6017 SM
Rear Axle Removal .....6018 SM
PTO Servicing - shiftable/reversible .....6019 SM
MFD Front Axle (20.29 Rigid Axle) .....6021 SM
MFD Front Axle (20.43 Rigid Axle) ..... 6021-A SM
MFD Front Axle (20.29 Suspended Axle) .....6022 SM
MFD Front Axle (20.43 Suspended Axle) ..... 6022-A SM

**7 BRAKES**
Brakes How it Works..... 7
Service Brakes ..... 7002 SM

**8 HYDRAULICS**
Hydraulics How it Works ..... 8
Hydraulic Troubleshooting and Schematic ..... 8001 SM
Charge/Lubrication Pump ..... 8003 SM
Remote Valves..... 8008 SM

**9 CHASSIS**
Pedal, Lever and Switch Adjustments ..... 9001 SM

https://truckmanualshub.com/

**10CONTROLLER SYSTEMS**

Electrical Controllers How it Works..... 10
Auxiliary/Remote Valve Controller - Error Codes,
Troubleshooting and Schematics ..... 10001 SM
Hitch/PTO Controller - Error Codes,
Troubleshooting and Schematics ..... 10002 SM
Independent Front Suspension Axle Controller - Calibration,
Error Codes, Troubleshooting and Schematics..... 10003 SM
Transmission and Cab Controller - Calibration, Error Codes,
Troubleshooting and Schematics ..... 10006 SM
Instrument Cluster Controller - Error Codes,
Troubleshooting and Schematics ..... 10009 SM
Controller Reprogramming
(Using The McCormick Diagnostic Centre) ..... 10010 SM
Cab Suspension Controller - Calibration, Error Codes,
Troubleshooting and Schematics ..... 10011 SM
Automatic Temperature Control - Error Codes,
Troubleshooting and Schematics ..... 10012 SM

**NOTE:** *Information contained in this manual may cover features that are not available in all markets worldwide.*

**NOTE:** *References throughout this manual may be made to sections currently not available. These Sections will be made available at a later date.*

https://truckmanualshub.com/



# Section 1001

## SAFETY, GENERAL INFORMATION AND STANDARD TORQUE SPECIFICATIONS

McCORMICK

SM 8-10080

© 2001 McCormick Tractors International Limited.

March 2001

https://truckmanualshub.com/



# TABLE OF CONTENTS

SAFETY ..... 3

GENERAL INFORMATION
- Cleaning ..... 5
- Inspection ..... 5
- Bearings ..... 5
- Needle Bearings ..... 5
- Gears ..... 5
- Oil Seals, O-Rings And Gaskets ..... 5
- Shafts ..... 5
- Service Parts ..... 5
- Lubrication ..... 5

STANDARD TORQUE DATA FOR NUTS AND BOLTS
- Chart 1 (Plain Nuts/Bolts) ..... 6
- Chart 2 (Phosphate Coated Nuts/Bolts) ..... 6
- Chart 3 (Zinc or Cadmium Plated Nuts/Bolts) ..... 7

https://truckmanualshub.com/



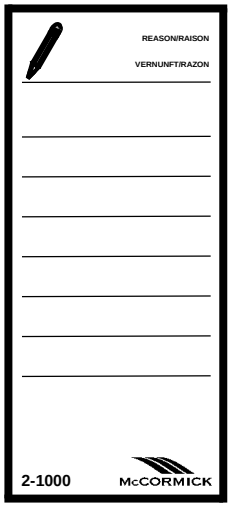
# SAFETY

***This symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED. The message that follows the symbol contains important information about safety. Carefully read the message. Make sure you fully understand the causes of possible injury or death.***

To prevent injury always follow the Warning, Caution and Danger notes in this section and throughout the manual.

Put a warning tag as shown below on the key for the key switch when carrying out servicing or repairs to the tractor. Warning tags (publication number 2-1000) are available from your McCormick dealer.




***WARNING: Read the operators manual to familiarize yourself with the correct control functions.***

***WARNING: Operate the machine and equipment controls from the seat position only. Any other method could result in serious injury.***

***WARNING: This is one a man machine, no riders allowed.***

***WARNING: Before starting engine, study Operator's Manual safety messages. Read all safety signs on machine. Clear the area of other persons. Learn and practice safe use of controls before operating.***
***It is your responsibility to understand and follow manufacturers instructions on machine operation, service, and to observe pertinent laws and regulations. Operator's and Service Manuals may be obtained from you McCormick dealer.***

***WARNING: If you wear clothing that is too loose or do not use the correct safety equipment for your job, you can be injured. Always wear clothing that will not catch on objects. Extra safety equipment that can be required includes hard hat, safety shoes, ear protection, eye or face protection, heavy gloves and reflector clothing.***

***WARNING: When working in the area of the fan belt with the engine running, avoid loose clothing if possible, and use extreme caution.***

***WARNING: When doing checks and tests on the equipment hydraulics, follow the procedures as they are written. DO NOT change the procedure.***

***WARNING: When putting the hydraulic cylinders on this machine through the necessary cycles to check operation or to remove air from a circuit, make sure all people are out of the way.***

***WARNING: Use insulated gloves or mittens when working with hot parts.***

https://truckmanualshub.com/



***CAUTION: Lower all attachments to the ground or use stands to safely support the attachments before you do any maintenance or service.***

***CAUTION: Pin sized and smaller streams of hydraulic oil under pressure can penetrate the skin and result in serious infection. If hydraulic oil under pressure does penetrate the skin, seek medical treatment immediately. Maintain all hoses and tubes in good condition. Make sure all connections are tight. Make a replacement of any tube or hose that is damaged or thought to be damaged. DO NOT use your hand to check for leaks, use a piece of cardboard or wood.***

***CAUTION: When removing hardened pins such as a pivot pin, or a hardened shaft, use a soft head (brass or bronze) hammer or use a driver made from brass or bronze and a steel head hammer.***

***CAUTION: When using a hammer to remove and install pivot pins or separate parts using compressed air or using a grinder, wear eye protection that completely encloses the eyes (approved goggles or other approved eye protectors).***

***CAUTION: Use suitable floor (service) jacks or chain hoist to raise wheels or tracks off the floor. Always block machine in place with suitable safety stands.***

***CAUTION: When servicing or repairing the machine. Keep the shop floor and operator's compartment and steps free of oil, water, grease, tools, etc. Use oil absorbing material and or shop cloths as required. Use safe practices at all times.***

***CAUTION: Some components of this machine are very heavy. Use suitable lifting equipment or additional help as instructed in this Service Manual.***

***DANGER: Engine exhaust fumes can cause death. If it is necessary to start the engine in a closed place, remove the exhaust fumes from the area with an exhaust pipe extension. Open the doors and get outside air into the area.***

***DANGER: When the battery electrolyte is frozen, the battery can explode if (1), you try to charge the battery, or (2), you try to jump start and run the engine. To prevent that battery electrolyte from freezing, try to keep the battery at full charge. If you do not follow these instructions, you or others in the area can be injured.***

***DANGER: Batteries contain acid and explosive gas. Explosions can result from sparks, flames or wrong cable connections. To connect the jumper cables correctly to the battery of this machine see the Operator's Manual. Failure to follow these instructions can cause serious injury or death.***

https://truckmanualshub.com/



# GENERAL INFORMATION

## Cleaning

Clean all metal parts except bearings, in mineral spirits or by steam cleaning. Do not use caustic soda for steam cleaning. After cleaning dry and put oil on all parts. Clean oil passages with compressed air. Clean bearings in kerosene, dry the bearings completely and put oil on the bearings.

## Inspection

Check all parts when the parts are disassembled. Replace all parts that have wear or damage. Small scoring or grooves can be removed with a hone or crocus cloth. Complete visual inspection for indications of wear, pitting and the replacement of parts necessary will prevent early failures.

## Bearings

Check bearings for easy action. If bearings have a loose fit or rough action replace the bearing. Wash bearings with a good solvent or kerosene and permit to air dry. DO NOT DRY BEARINGS WITH COMPRESSED AIR.

## Needle Bearings

Before you press needle bearings in a bore always remove any metal protrusions in the bore or edge of the bore. Before you press bearings into position put petroleum jelly on the inside and outside diameter of the bearings.

## Gears

Check all gears for wear and damage. Replace gears that have wear or damage.

## Oil Seals, O-Rings And Gaskets

Always install new oil seals, o-rings and gaskets. Put petroleum jelly on seals and o-rings.

## Shafts

Check all shafts that have wear or damage. Check the bearing and oil seal surfaces of the shafts for damage.

## Service Parts

Always install genuine McCormick service parts, when ordering refer to the Parts Catalog for the correct part number of the genuine McCormick replacement items. Failures due to the use of other than genuine McCormick replacement parts are not covered by warranty.

## Lubrication

Only use the oils and lubricants specified in the Operators or Service Manual. Failures due to the use of non specified oils and lubricants are not covered by warranty.

https://truckmanualshub.com/



# STANDARD TORQUE DATA FOR NUTS AND BOLTS

**NOTE:** *A "click type" torque wrench is recommended for the bolt torques listed below.*

## Chart 1 (Plain Nuts/Bolts)

| BOLT SIZE (mm) | TYPE 8.8 | | | | TYPE 10.9 | | | |
|---|---|---|---|---|---|---|---|---|
| | MIN | | MAX | | MIN | | MAX | |
| | lb ft | Nm | lb ft | Nm | lb ft | Nm | lb ft | Nm |
| M4 | 3.0 | 4.0 | 3.4 | 4.5 | 4.3 | 5.8 | 4.8 | 6.5 |
| M5 | 4.8 | 6.5 | 5.5 | 7.5 | 7.0 | 9.5 | 7.8 | 10.5 |
| M6 | 8.2 | 11.0 | 9.2 | 12.5 | 11.8 | 16.0 | 13.3 | 18.0 |
| M8 | 20.0 | 27.0 | 22.5 | 31.0 | 28.7 | 39.0 | 32.3 | 44.0 |
| M10 | 40.0 | 54.0 | 45.0 | 61.0 | 56.0 | 77.0 | 64.0 | 87.0 |
| M12 | 69.0 | 94.0 | 78.0 | 106.0 | 100.0 | 134.0 | 110.0 | 151.0 |
| M14 | 110.0 | 150.0 | 125.0 | 170.0 | 160.0 | 215.0 | 180.0 | 240.0 |
| M16 | 175.0 | 235.0 | 190.0 | 260.0 | 245.0 | 335.0 | 275.0 | 375.0 |
| M20 | 345.0 | 470.0 | 390.0 | 530.0 | 480.0 | 650.0 | 540.0 | 730.0 |
| M22 | 475.0 | 640.0 | 530.0 | 720.0 | 655.0 | 890.0 | 735.0 | 1000.0 |
| M24 | 600.0 | 810.0 | 675.0 | 915.0 | 830.0 | 1125.0 | 930.0 | 1265.0 |
| M30 | 1190.0 | 1615.0 | 1340.0 | 1815.0 | 1645.0 | 2235.0 | 1855.0 | 2515.0 |
| M36 | 2080.0 | 2825.0 | 2340.0 | 3175.0 | 2875.0 | 3900.0 | 3235.0 | 4390.0 |

## Chart 2 (Phosphate Coated Nuts/Bolts)

| BOLT SIZE (mm) | TYPE 8.8 | | | | TYPE 10.9 | | | |
|---|---|---|---|---|---|---|---|---|
| | MIN | | MAX | | MIN | | MAX | |
| | lb ft | Nm | lb ft | Nm | lb ft | Nm | lb ft | Nm |
| M4 | 2.3 | 3.0 | 2.6 | 3.4 | 3.2 | 4.4 | 3.6 | 4.9 |
| M5 | 3.6 | 4.9 | 4.1 | 5.6 | 5.2 | 7.1 | 5.9 | 8.0 |
| M6 | 6.2 | 8.3 | 6.9 | 9.4 | 8.9 | 12.0 | 10.0 | 13.5 |
| M8 | 15.0 | 20.3 | 16.9 | 23.3 | 21.5 | 29.2 | 24.2 | 32.8 |
| M10 | 30.0 | 41.0 | 34.0 | 46.0 | 42.0 | 58.0 | 48.0 | 65.0 |
| M12 | 52.0 | 71.0 | 59.0 | 80.0 | 75.0 | 101.0 | 83.0 | 113.0 |
| M14 | 83.0 | 113.0 | 94.0 | 126.0 | 120.0 | 161.0 | 135.0 | 180.0 |
| M16 | 131.0 | 176.0 | 143.0 | 195.0 | 185.0 | 251.0 | 205.0 | 280.0 |
| M20 | 259.0 | 353.0 | 293.0 | 400.0 | 360.0 | 490.0 | 405.0 | 550.0 |
| M22 | 355.0 | 480.0 | 400.0 | 540.0 | 490.0 | 665.0 | 550.0 | 750.0 |
| M24 | 450.0 | 608.0 | 506.0 | 686.0 | 625.0 | 845.0 | 700.0 | 950.0 |
| M30 | 893.0 | 1211.0 | 1005.0 | 1361.0 | 1235.0 | 1675.0 | 1390.0 | 1885.0 |
| M36 | 1560.0 | 2119.0 | 1755.0 | 2381.0 | 2156.0 | 2925.0 | 2425.0 | 3295.0 |

https://truckmanualshub.com/



## Chart 3 (Zinc or Cadmium Plated Nuts/Bolts)

| BOLT SIZE (mm) | TYPE 8.8 | | | | TYPE 10.9 | | | |
|---|---|---|---|---|---|---|---|---|
| | MIN | | MAX | | MIN | | MAX | |
| | lb ft | Nm | lb ft | Nm | lb ft | Nm | lb ft | Nm |
| **M4** | 2.6 | 3.5 | 2.9 | 3.9 | 3.7 | 5.0 | 4.1 | 5.6 |
| **M5** | 4.1 | 5.6 | 4.6 | 6.3 | 5.9 | 8.0 | 6.6 | 9.0 |
| **M6** | 7.0 | 9.5 | 7.8 | 10.6 | 10.0 | 13.6 | 11.3 | 15.3 |
| **M8** | 17.0 | 23.1 | 19.1 | 25.9 | 24.4 | 33.1 | 27.4 | 37.2 |
| **M10** | 34.0 | 46.0 | 38.3 | 52.0 | 48.0 | 65.0 | 54.0 | 74.0 |
| **M12** | 59.0 | 80.0 | 66.0 | 90.0 | 85.0 | 114.0 | 94.0 | 128.0 |
| **M14** | 94.0 | 128.0 | 106.0 | 145.0 | 136.0 | 183.0 | 153.0 | 205.0 |
| **M16** | 149.0 | 200.0 | 161.0 | 220.0 | 208.0 | 285.0 | 235.0 | 320.0 |
| **M20** | 293.0 | 400.0 | 330.0 | 450.0 | 408.0 | 555.0 | 460.0 | 620.0 |
| **M22** | 400.0 | 545.0 | 450.0 | 615.0 | 555.0 | 755.0 | 625.0 | 850.0 |
| **M24** | 510.0 | 690.0 | 575.0 | 780.0 | 705.0 | 955.0 | 790.0 | 1075.0 |
| **M30** | 1010.0 | 1375.0 | 1140.0 | 1545.0 | 1400.0 | 1900.0 | 1580.0 | 2140.0 |
| **M36** | 1770.0 | 2400.0 | 1990.0 | 2700.0 | 2445.0 | 3315.0 | 2750.0 | 3730.0 |

https://truckmanualshub.com/

McCORMICK B-POWER 24 valve

# Service Manual

## Electronic Common Rail
## 6 Cylinder (Tier 2) Engines

McCORMICK

SM 8-12900

© 2003 McCormick Tractors International Limited.
November 2003

https://truckmanualshub.com/

This publication provides the features, data and correct method of repair operations that can be performed on every single component of the engine.

Following the instructions given and using the special tools will ensure correct repairing, within the scheduled times, while also protecting operators against possible accidents.

Before starting any repair work, make sure that all accident-prevention equipment is close at hand and in efficient conditions.

Therefore, check and wear the items specified by the rules of safety: goggles, helmet, gloves, shoes.

Before use, check all the working, hoisting and handling equipment.

The possibility exists that the information given in this manual may not be up to date as a result of modifications adopted by the Manufacturer at any time for reasons of a technical or commercial nature or to adjust to the laws in force in the different Countries.

The reproduction, even only in part, of the text and illustrations is forbidden.

https://truckmanualshub.com/


# CONTENT OF SECTIONS

General information **1**

Fuel **2**

Duty - Industrial applications
Common Rail Engines **3**

Overhaul and technical specifications **4**

Tools **5**

Safety prescriptions **Appendix**

## PREFACE TO USER'S GUIDELINE MANUAL

Section 1 describes the engine illustrating its features and working in general.

Section 2 describes the type of fuel feed.

Section 3 relates to the specific duty and is divided in four separate parts:

1. Mechanical part, related to the engine overhaul, limited to those components with different characteristics based on the relating specific duty.
2. Electrical part, concerning wiring harness, electrical and electronic equipment with different characteristics based on the relating specific duty.
3. Maintenance planning and specific overhaul.
4. Troubleshooting part dedicated to the operators who, being entitled to provide technical assistance, shall have simple and direct instructions to identify the cause of the major inconveniences.

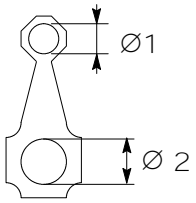
Sections 4 and 5 illustrate the overhaul operations of the engine overhaul on stand and the necessary equipment to execute such operations.
The appendix reports general safety prescriptions to be followed by all operators whether being in-charge of installation or maintenance, in order to avoid serious injury.

https://truckmanualshub.com/

## SPECIAL REMARKS

Where possible, the same sequence of procedures has been followed for easy reference.
Diagrams and symbols have been widely used to give a clearer and more immediate illustration of the subject being dealt with, (see next page) instead of giving descriptions of some operations or procedures.

Example




Ø 1 = housing for connecting rod small end bush

Ø 2 = housing for connecting rod bearings




Tighten to torque
Tighten to torque + angular value

https://truckmanualshub.com/
ED. NOVEMBER 2003

# Graph and symbols

| | |
|---|---|
|  | Removal<br>Disconnection |
|  | Refitting<br>Connection |
|  | Removal<br>Disassembly |
|  | Fitting in place<br>Assembly |
|  | Tighten to torque |
|  | Tighten to torque + angle value |
|  | Press or caulk |
|  | Regulation<br>Adjustment |
|  | Warning<br>Note |
|  | Visual inspection<br>Fitting position check |
|  | Measurement<br>Value to find<br>Check |
|  | Equipment |
|  | Surface for machining<br>Machine finish |
|  | Interference<br>Strained assembly |
|  | Thickness<br>Clearance |
|  | Lubrication<br>Damp<br>Grease |
|  | Sealant<br>Adhesive |
|  | Air bleeding |

| | |
|---|---|
|  | Intake |
|  | Exhaust |
|  | Operation |
|  | Compression ratio |
|  | Tolerance<br>Weight difference |
|  | Rolling torque |
|  | Replacement<br>Original spare parts |
|  | Rotation |
|  | Angle<br>Angular value |
|  | Preload |
|  | Number of revolutions |
|  | Temperature |
|  | Pressure |
| > | Oversized<br>Higher than....<br>Maximum, peak |
| < | Undersized<br>Less than....<br>Minimum |
|  | Selection<br>Classes<br>Oversizing |
|  | Temperature < 0°C<br>Cold<br>Winter |
|  | Temperature > 0°C<br>Hot<br>Summer |

https://truckmanualshub.com/


SECTION 1

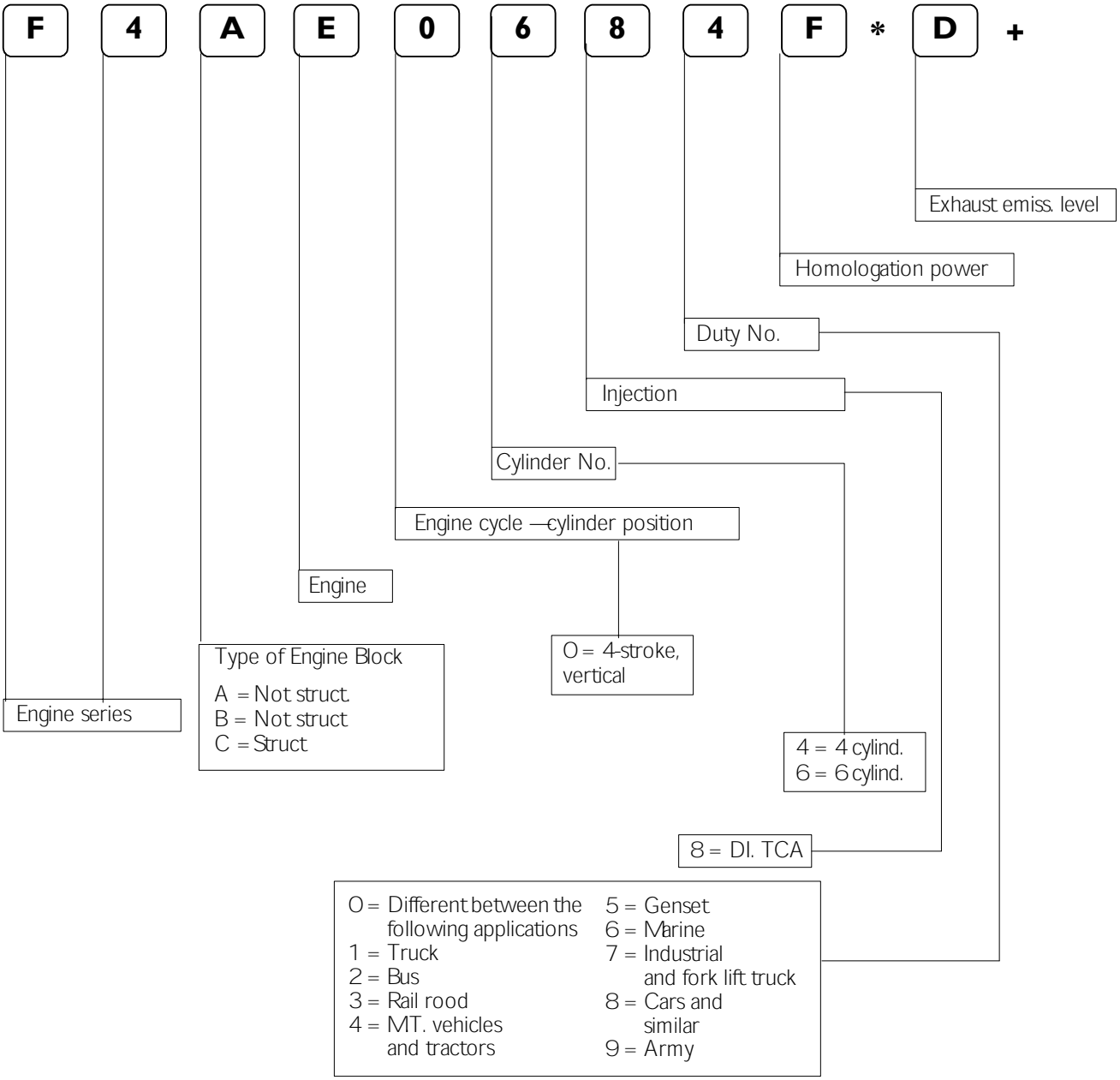
# General Specifications

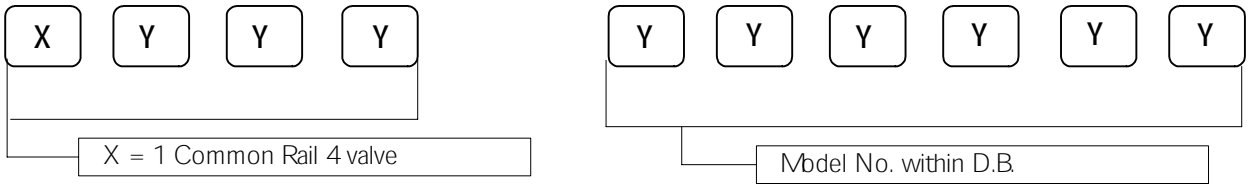

| | Page |
|---|---|
| ENGINE ID. CODE | 3 |
| LUBRICATING CIRCUIT, 4 AND 6 CYLINDERS | 5 |
| OIL VAPOUR RECIRCULATING SYSTEM | 7 |
| COOLING CIRCUIT SYSTEM, 4 AND 6 CYLINDERS | 8 |
| AIR INDUCTION BOOST DIAGRAM | 12 |

https://truckmanualshub.com/

https://truckmanualshub.com/

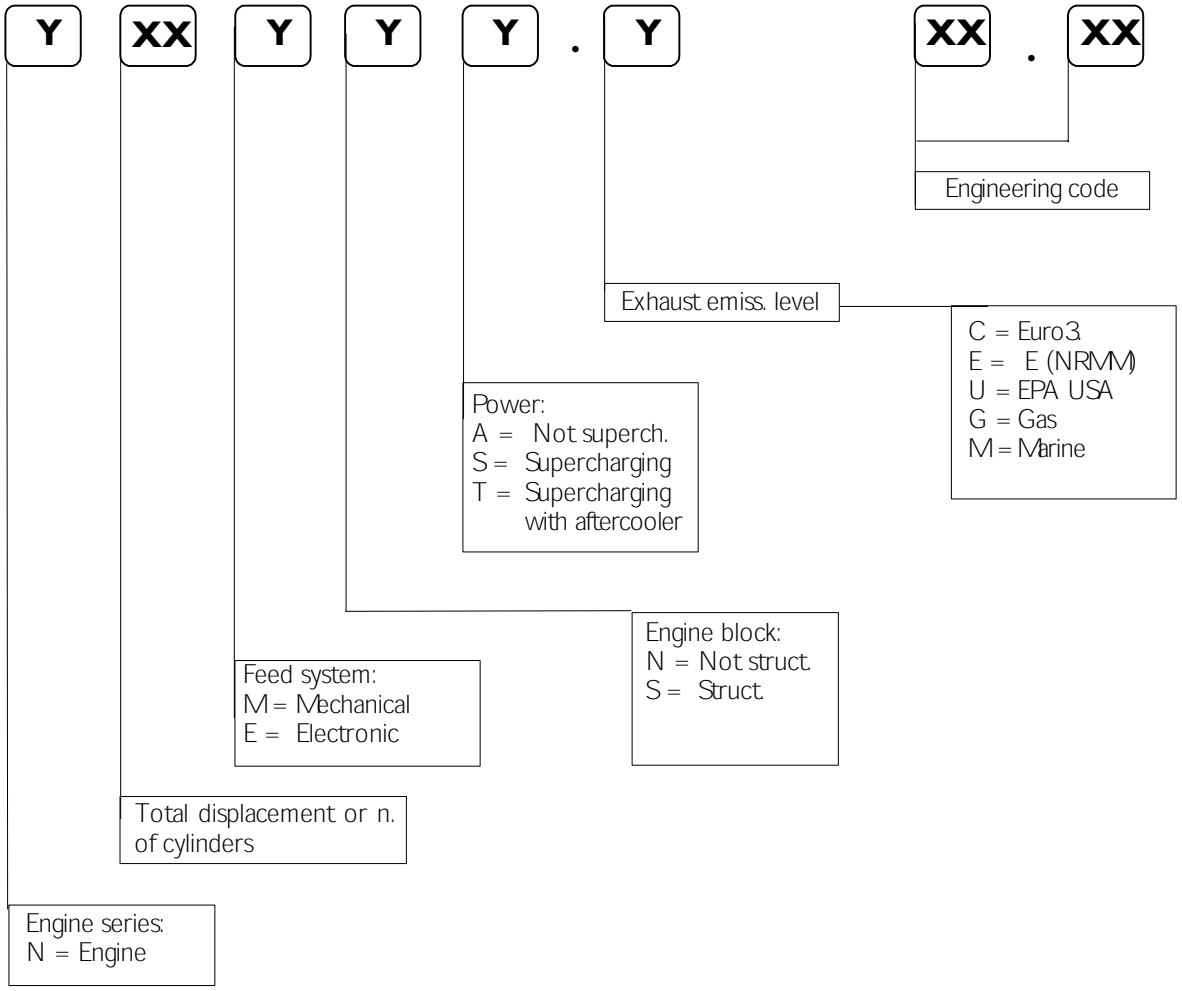

## ENGINE IDENTIFICATION CODE



https://truckmanualshub.com/

## SPECIFIC ENGINE CODE




EXAMPLES:

N40ENT.C
N = Engine
40 = 4 liters
E = Electronic
N = Type of Engine block
T = Supercharger with aftercooler
C = Euro3

https://truckmanualshub.com/

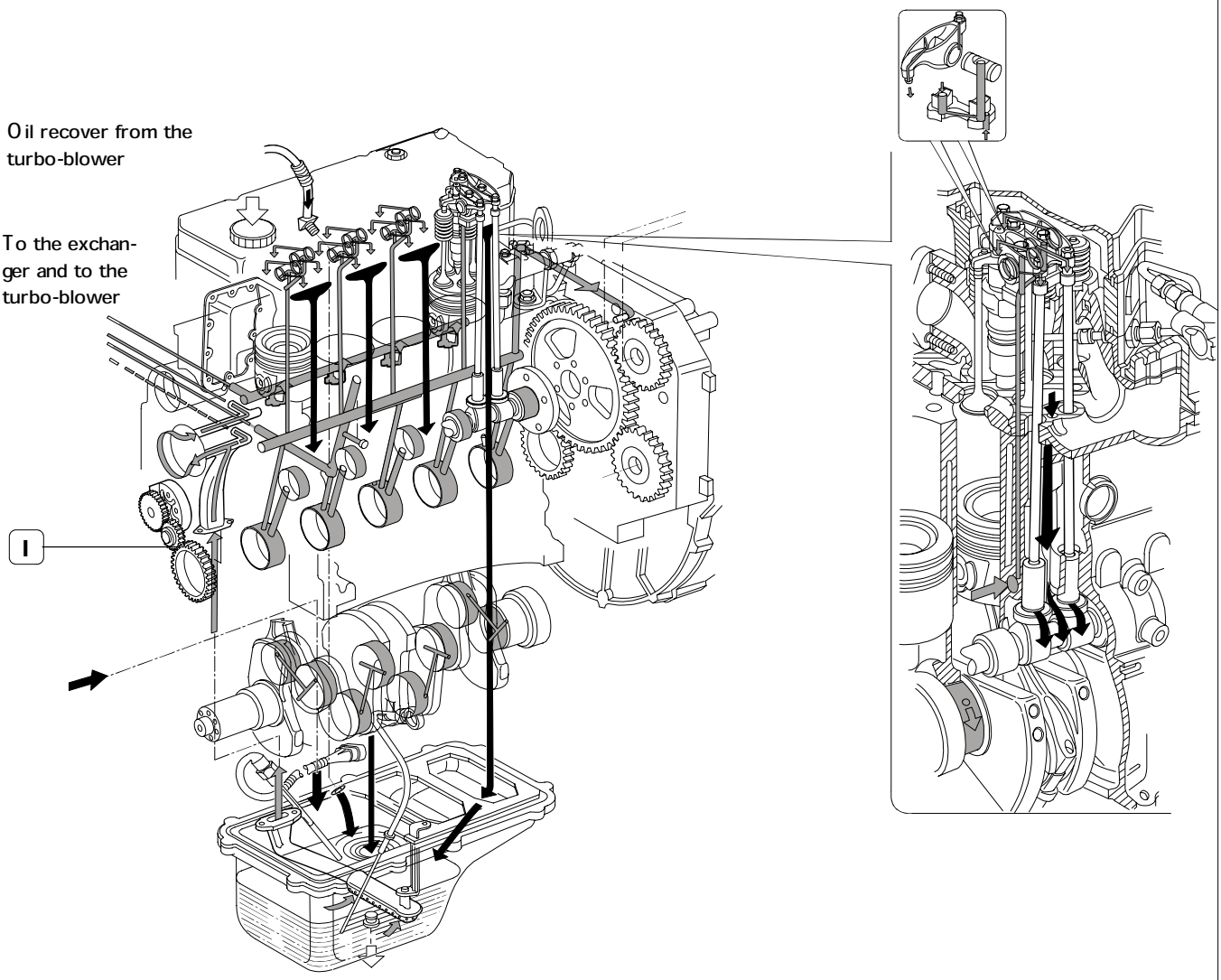

## LUBRICATION (4 CYLINDERS)

Lubrication by forced circulation is achieved through oil rotary expansion pump (1), placed in the front part of the basement, driven by the straight-tooth gear splined to the shaft's bar hold.

From the pan, the lubrication oil flows to the driving shaft, to the camshaft and to the valve drive.

Lubrication involves the heat exchanger as well, the turbo-blower and the eventual compressor for any eventual compressed air system. All these components may often vary according to the specific duty and will therefore be examined in the specific section.

Figure 1




LUBRICATION SYSTEM LAYOUT

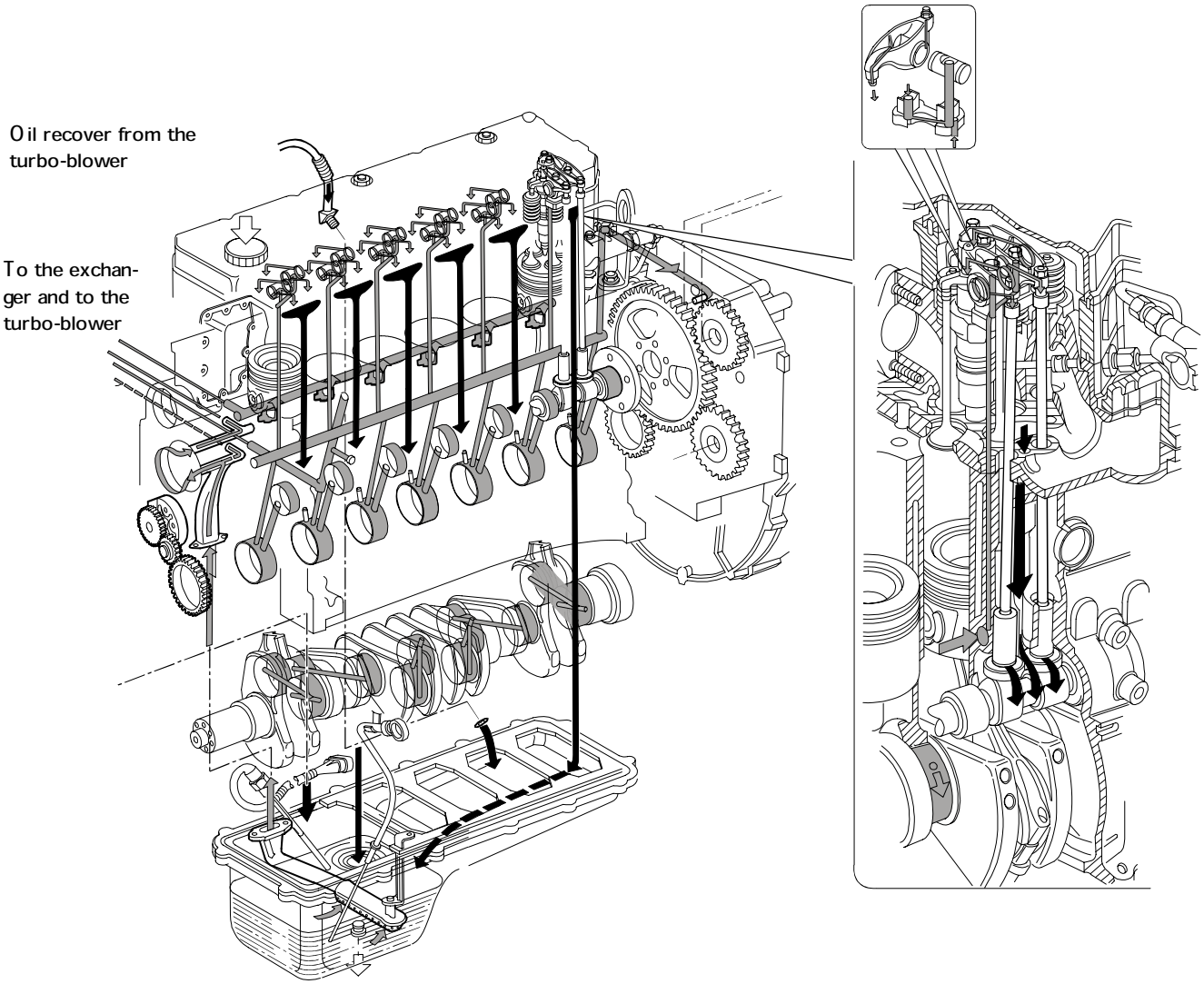
https://truckmanualshub.com/

## LUBRICATION (6 CYLINDERS)

Even for the 6 cylinders version lubrication is obtained by forced circulation and achieved through an oil rotary expansion pump similar to the 4 cylinders' one.

Also in this case, the components such as the oil exchanger, the turbo-blower and the eventual compressor are specifically studied and made out to suit the equipment or the duty for which the engine has been developed.

Figure 2




Routing of oil under pressure

Routing of oil return by gravity to sump

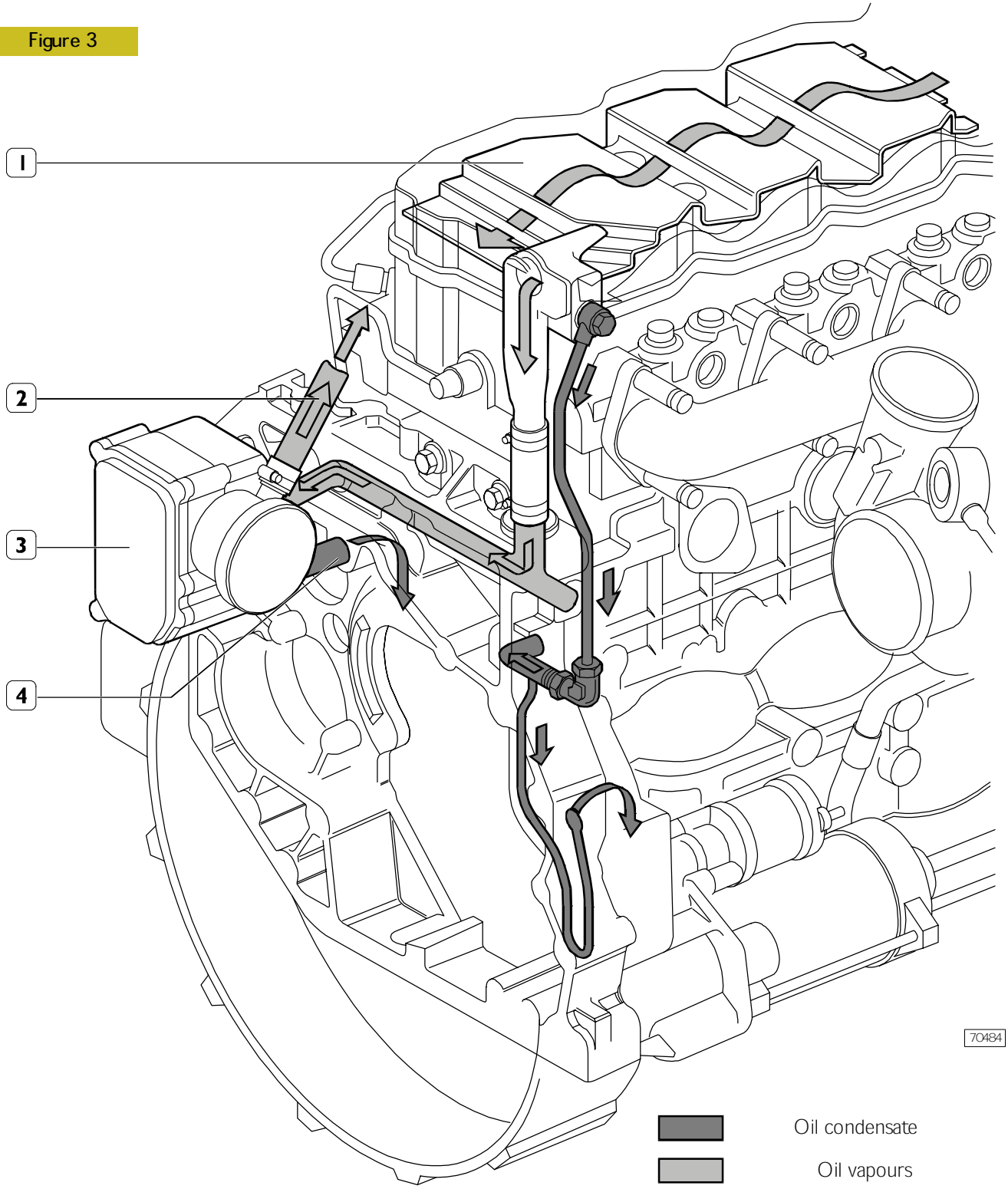
Introduction of oil

LUBRICATION SYSTEM LAYOUT

https://truckmanualshub.com/


## OIL VAPOUR RECYCLING

Figure 3




1. Pre-separator - 2. Exhaust to the outside (temporary) - 3. Filter - 4. Return to engine

The tappet cover houses the pre-separator (1), whose shape and position determines an increase in oil vapour outlet speed and condenses a part of vapours at the same time.

Condensate oil returns to the oil sump whereas the residual vapours are ducted, collected and filtered in the blow-by (3).

In the blow-by (3), part of the vapours condense and return to the oil sump whereas the remaining part is put into cycle again through pipe (2).

https://truckmanualshub.com/

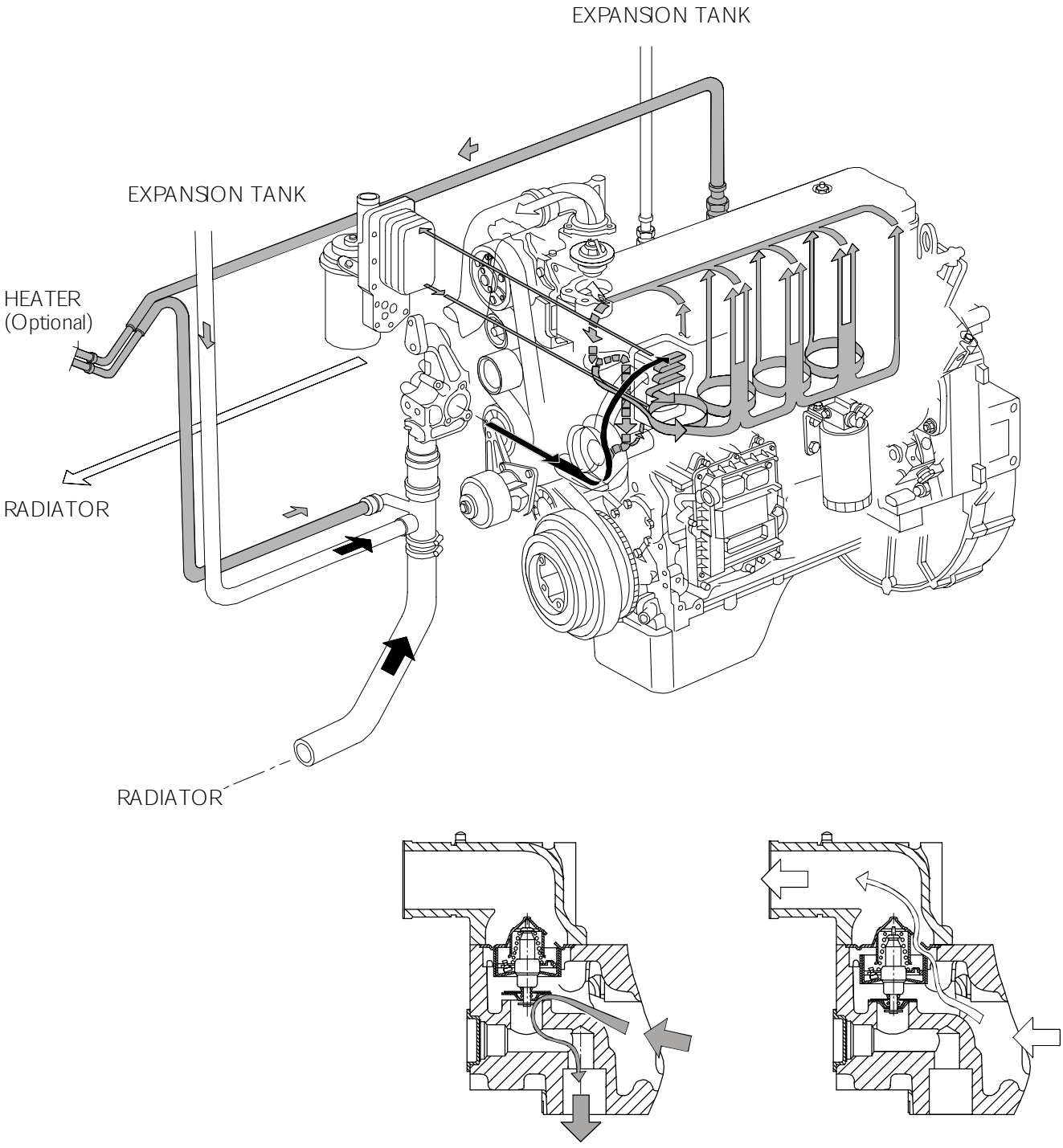
## COOLING SYSTEM (4 CYLINDERS)

The engine cooling system, closed circuit forced circulation type, generally incorporates the following components:

- ❑ Expansion tank; placement, shape and dimensions are subject to change according to the engine's equipment.
- ❑ Radiator, which has the duty to dissipate the heat subtracted to the engine by the cooling liquid. Also this component will have specific peculiarities based on the equipment developed, both for what concerns the placement and the dimensions.
- ❑ Viscous pusher fan, having the duty to increase the heat dissipating power of the radiator. This component as well will be specifically equipped based on the engine's development.
- ❑ Heat exchanger to cool the lubrication oil: even this component is part of the engine's specific equipment.
- ❑ Centrifugal water pump, placed in the front part of the engine block.
- ❑ Thermostat regulating the circulation of the cooling liquid.
- ❑ The circuit may eventually be extended to the compressor, if this is included in the equipment.

https://truckmanualshub.com/


Figure 4




COOLING SYSTEM LAYOUT

74194

https://truckmanualshub.com/

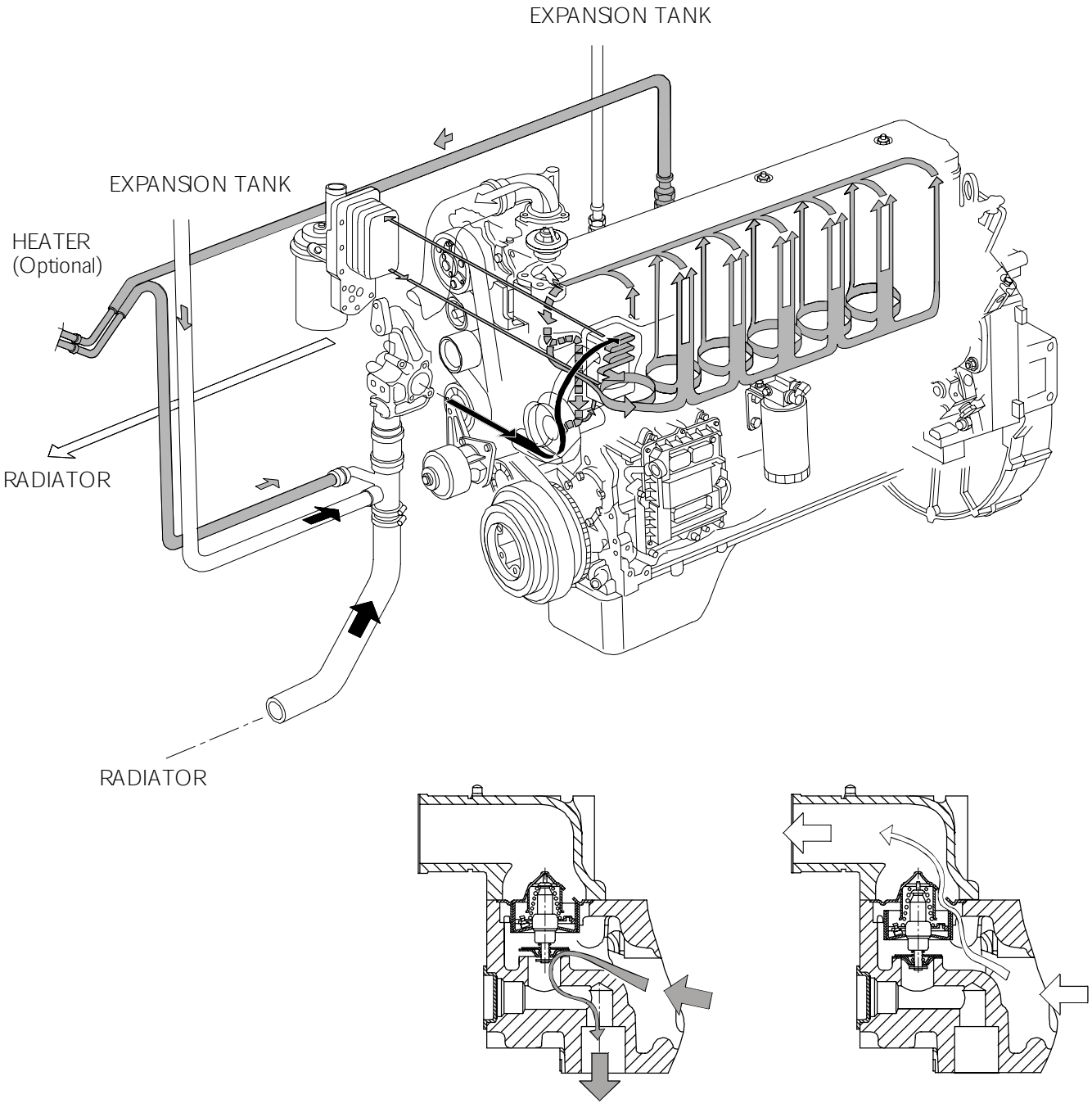
## COOLING SYSTEM (6 CYLINDERS)

The engine cooling system, closed circuit forced circulation type, is of a similar design as the 4 cylinders engine.

It incorporates necessary components such as the radiator, the heat exchanger, the expansion tank and some ancillary components such as the heater or the compressor for the compressed air.

Such components always vary according to the engine's equipment and duty.

Figure 5



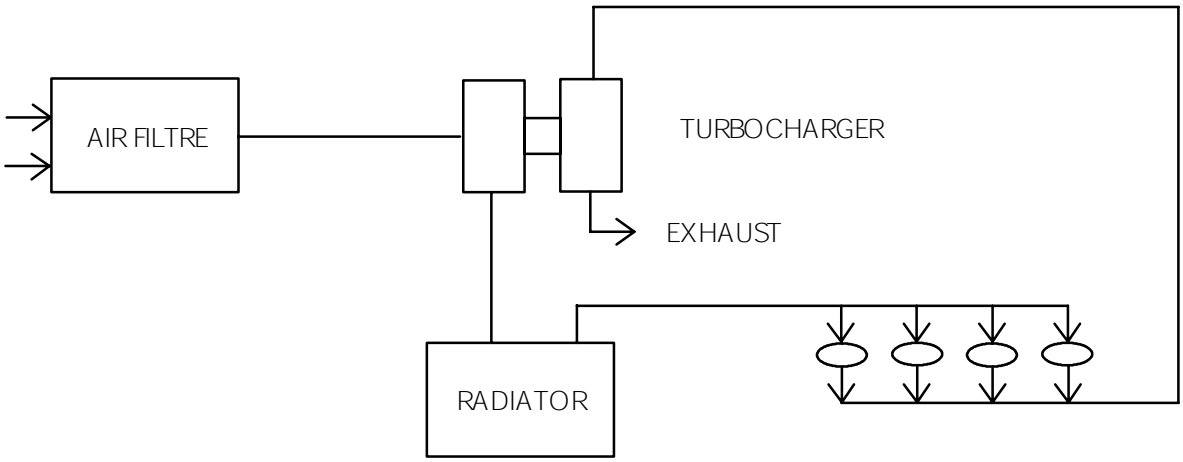

COOLING SYSTEM LAYOUT

https://truckmanualshub.com/

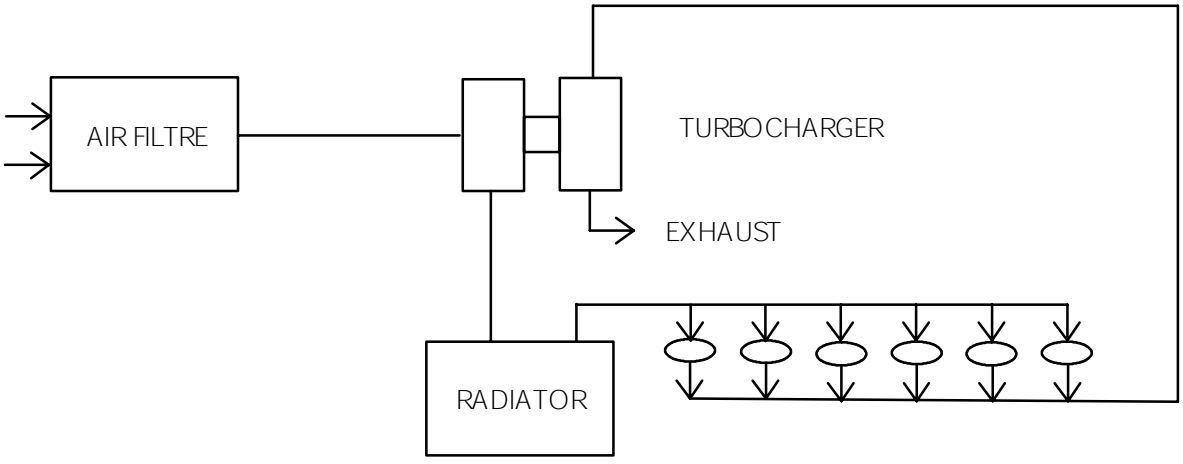

## AIR INDUCTION - BOOST DIAGRAM

Figure 6

### 4 Cylinders version




### 6 Cylinders version




74195

### Description

The turbocharger is composed by the following main parts: one turbine, one transforming valve to regulate the boost feeding pressure , one main body and one compressor.

During engine working process, the exhaust emissions flow through the body of the turbine, causing the turbine disk wheel's rotation.

The compressor rotor, being connected by shaft to the turbine disk wheel, rotates as long as this last one rotates, compressing the drawn air through the air filter.

The above mentioned air is then cooled by the radiator and flown through the piston induction collector.

The turbocharger is equipped with a transforming valve to regulate the pressure , that is located on the exhaust collector before the turbine and connected by piping to the induction collector.

It's funchon is to restrict the exhaust of the emissions , releasing part of them directly to the exhaust tube when the boost feeding pressure, over the compressor, reaches the prescribed bar value.

The cooling process and the lubrication of the turbocharger and of the bearings is made by the oil of the engine.

https://truckmanualshub.com/


# SECTION 2

## Fuel


| | Page |
|---|---|
| COMMON RAIL | 3 |
| WORKING PROCESS | 5 |
| FUEL SYSTEM LAYAUT | 6 |
| MECHANICAL FUEL PUMP | 8 |
| CP3 HIGH PRESSURE PUMP | 9 |
| RAIL (PRESSURE ACCUMULATOR) | 13 |
| BOOST GAUGE VALVE | 14 |
| FLOW LIMITERS | 15 |
| ELECTRO-INJECTOR | 16 |
| PRESSURE LIMITER FOR FUEL RETURN | 17 |

https://truckmanualshub.com/

https://truckmanualshub.com/

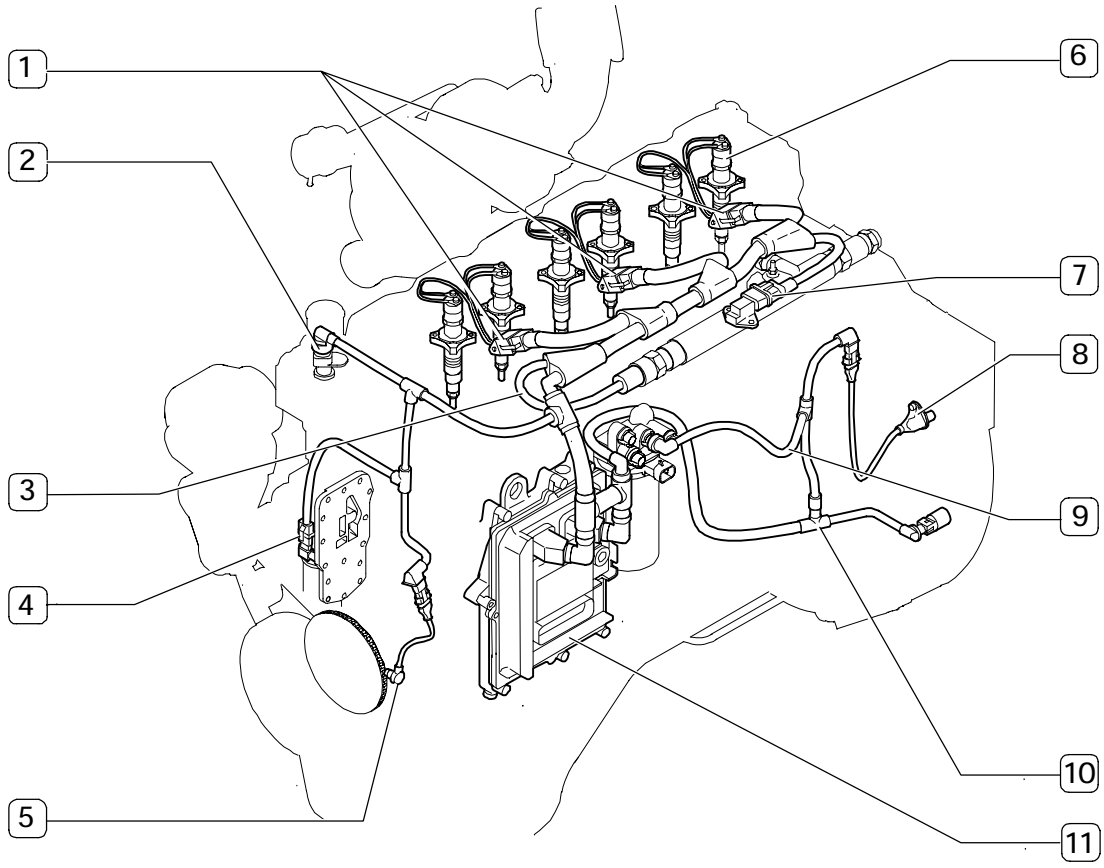

# COMMON RAIL
## General Specifications

In order to reduce PARTICULATES emissions, very high injection pressures are required.
The Common Rail system allows injecting the fuel up to pressures reaching 1450 bar, at the same time, the injection precision, obtained by the electronic system control, optimizes the engine performance, reducing emissions and consumption.

### System description

### Electric system

Figure 1




1. Connection to Electro-injectors - 2. Sensor monitoring temperature of engine's cooling liquid - 3. Fuel pressure sensor cable - 4. Sensor of engine's oil temperature and pressure - 5. Driving shaft sensor - 6. Electro-injector - 7. Temperature and air pressure sensor - 8. Camshaft sensor - 9. Fuel heater cable and fuel temperature sensor - 10. Pressure gauge cable - 11. EDC 7 gearbox.

Through the sensors, present on the engine, the ECU controls the engine operation.

### Air pressure/temperature sensor

It is a component integrating a temperature sensor and a pressure sensor.

Fitted on the intake manifold, it measures the max. inlet air capacity to calculate precisely the fuel quantity to inject at every cycle.

The outlet voltage is proportional to the pressure or temperature obtained by the sensor.

### Engine oil temperature and pressure sensor

Same as air pressure/temperature sensor, it is fitted on the engine oil filter, in a horizontal position.

It measures engine oil temperature and pressure.

https://truckmanualshub.com/


**Fuel pressure sensor**

Assembled on a rail end, it measures the fuel pressure in the rail in order to determine the injection pressure.

The injection pressure value is used to control the pressure and to determine the electric injection control length.

**Fuel temperature sensor**

It is a sensor that is equal to the previous one.

It measures fuel temperature to provide the control unit with an index of the diesel fuel thermal state.

**Coolant temperature sensor**

It is a variable-resistance sensor suitable to measure the coolant temperature to provide the control unit with an index of the engine thermal state.

**Output shaft sensor**

It is an inductive sensor placed on the front engine part. Signals generated through the magnetic flow that is closed on the phonic wheel, change their frequencies depending on output shaft rotation speed.

**Timing sensor**

It is an inductive sensor placed on the engine rear left part. It generates signals obtained from magnetic flow lines that are closed through holes obtained on the keyed gear on the camshaft. The signal generated by this sensor is used by the ECU as injection phase signal.

Though being equal to the flywheel sensor, it is NOT interchangeable since it has a different outside shape.

**System functionality**

Self-diagnosis

The ECU self-diagnostic system checks signals coming from sensors by comparing them with threshold data.

**Code recognition**

The EDC7 control unit communicates with the Immobilizer control unit (if fitted) to obtain the startup consent.

**Engine pre-heating resistance check**

The pre-post heating is activated when even only one of the water, air or fuel temperature sensors signals a temperature that is less than 5 °C.

**Phase recognition**

By means of signals coming from camshaft sensor and flywheel sensor, the cylinder on which fuel must be injected is recognised upon startup.

**Injection control**

The control unit, depending on information coming from sensors, controls the pressure regulator, and changes pre-injection and main injection modes.

**Closed-loop control for injection pressure**

Depending on engine load, measured by processing signals coming from various sensors, the control unit controls the regulator in order to always have the optimum pressure.

**Pilot and main injection spark advance control**

The control unit, depending on signals coming from various sensors, computes the optimum injection point according to an internal mapping.

**Idle speed control**

The control unit processes signals coming from various sensors and adjusts the amount of injected fuel.
It controls the pressure regulator and changes the injection time of injectors.
Within certain thresholds, it also takes into account the battery voltage.

**Maximum speed limiting**

At 2700rpm, the controlunit limits fuel flow-rate by reducing the injectors opening time.
Over 3000 rpm it deactivates the injectors.

**Cut Off**

Fuel cut off upon release is controlled by the control unit performing the following logics:

- ❑ it cuts off injectors supply;
- ❑ it re-activates the injectors shortly before idle speed is reached;
- ❑ it controls fuel pressure regulator.

**Smoke control upon acceleration**

With strong load requests, the control unit, depending on signals received by air inlet meter and engine speed sensor, controls the pressure regulator and changes the injectors actuation time, in order to avoid exhaust smoke.

**Fuel temperature control**

When the fuel temperature exceeds 75 °C (measured by the sensor placed on fuel filter) the control unit intervenes by reducing injection pressure.
If the temperature exceeds 90 °C, the power is reduced to 60%.

**AC compressor engagement control (if fitted)**

The control unit is able to drive engagement and disengagement of the electromagnetic compressor clutch depending on coolant temperature.
If the coolant temperature reaches about 105 °C, it disengages the clutch.

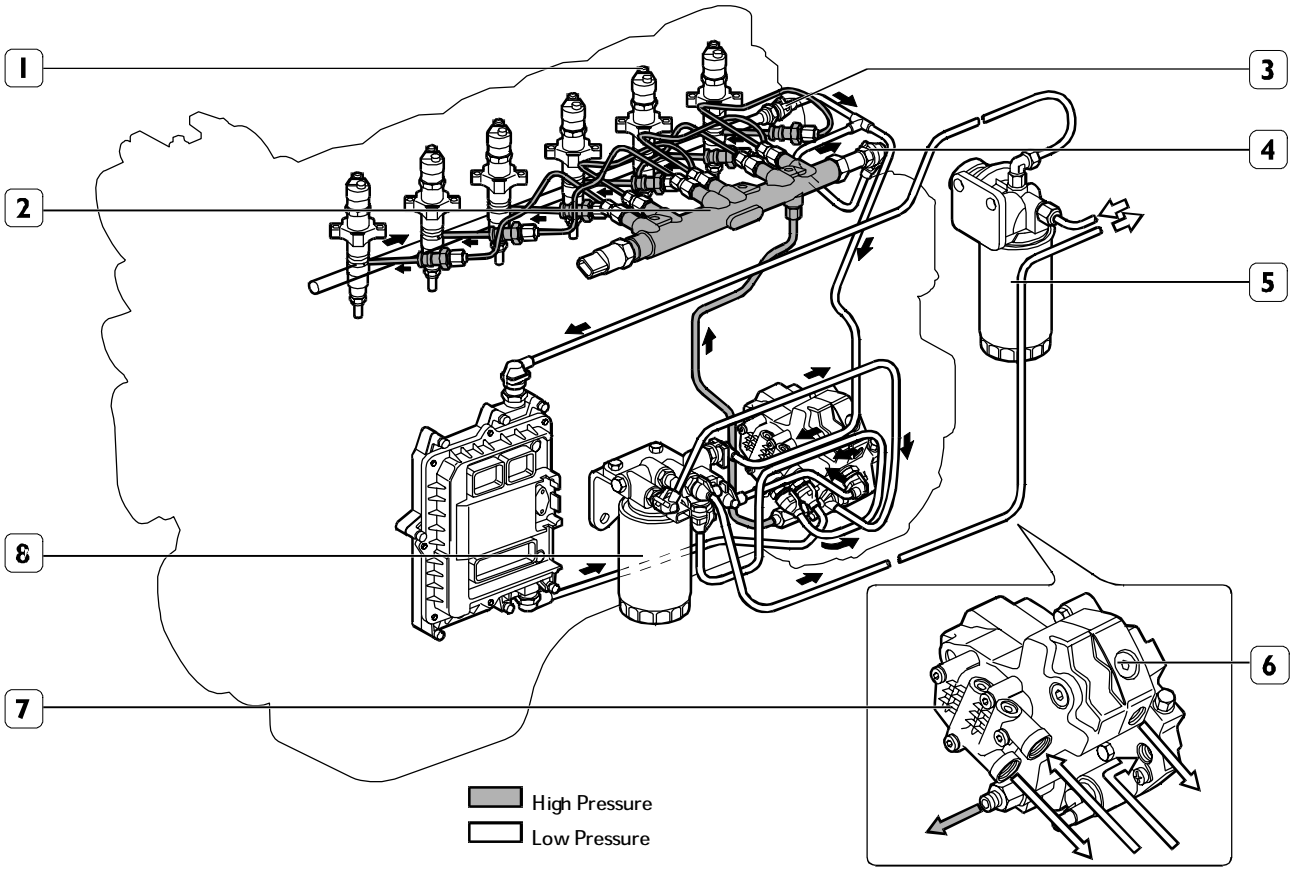
**After Run**

The control unit microprocessor allows storing certain EPROM data, among which failure memory and Immobilizer information, in order to make them available upon the following startup.

https://truckmanualshub.com/


## WORKING PROCESS

Figure 2




1. Injector - 2. Common Rail - 3. Pressure limiter for fuel return - 4. Rail overpressure valve - 5. Prefilter assembled on chassis - 6. High-pressure pump - 7. Mechanical rotor pump - 8. Fuel filter.

The Common Rail system has a special pump that continuously keeps fuel at high pressure, independently from stroke and cylinder that has to receive the injection and accumulates fuel in a common duct for all injectors.

Therefore, fuel at the injection pressure computed by the ECU is always available at the injectors inlet.

When an injector solenoid valve is energised by the electronic control unit, the injection of fuel directly taken from rail takes place in the related cylinder.

The hydraulic system is implemented by a low-pressure circuit and a high-pressure circuit.

The high-pressure circuit is composed of the following pipings:

- ❑ piping connecting high-pressure pump outlet to rail;
- ❑ pipings supplying injectors from rail.

The low-pressure circuit is composed of the following pipings:

- ❑ fuel suction piping from tank to prefilter;
- ❑ pipings supplying the mechanical supply pump through the control unit heat exchanger, manual priming pump and prefilter;
- ❑ pipings supplying the high-pressure pump through the fuel filter.

The fuel draining circuit from rail and from injectors and the high-pressure pump cooling circuit complete the system.

https://truckmanualshub.com/


## FUEL SYSTEM LAYOUT

This fuel system is a Common Rail injection with CP3 high pressure pump and this layout is for 4 cylinder version.
(The 6 cylinder version is similar design as the 4 cylinder engine).

The pressure regulator, placed upstream of the high-pressure pump, adjusts the fuel flow that is necessary on the low-pressure system. Afterwards, the high-pressure pump takes care of supplying the rail properly. This arrangement, by pressurising the necessary fuel only, improves the energetic efficiency and limits fuel heating in the system.

Function of the pressure relief valve (2), assembled on the high-pressure pump, is keeping the pressure, at the pressure regulator inlet, constant at 5 bars, independently from the efficiency of the fuel filter and of the system set upstream.

The pressure relief valve (2) intervention brings about a fuel flow increase in the high-pressure pump cooling circuit, through inlet and drain piping (16) from piping (8).

The pressure relief valve housed on the cylinder head, assembled on injector return (3), limits the fuel return flow from injectors at a pressure of 1.3 to 2 bars.

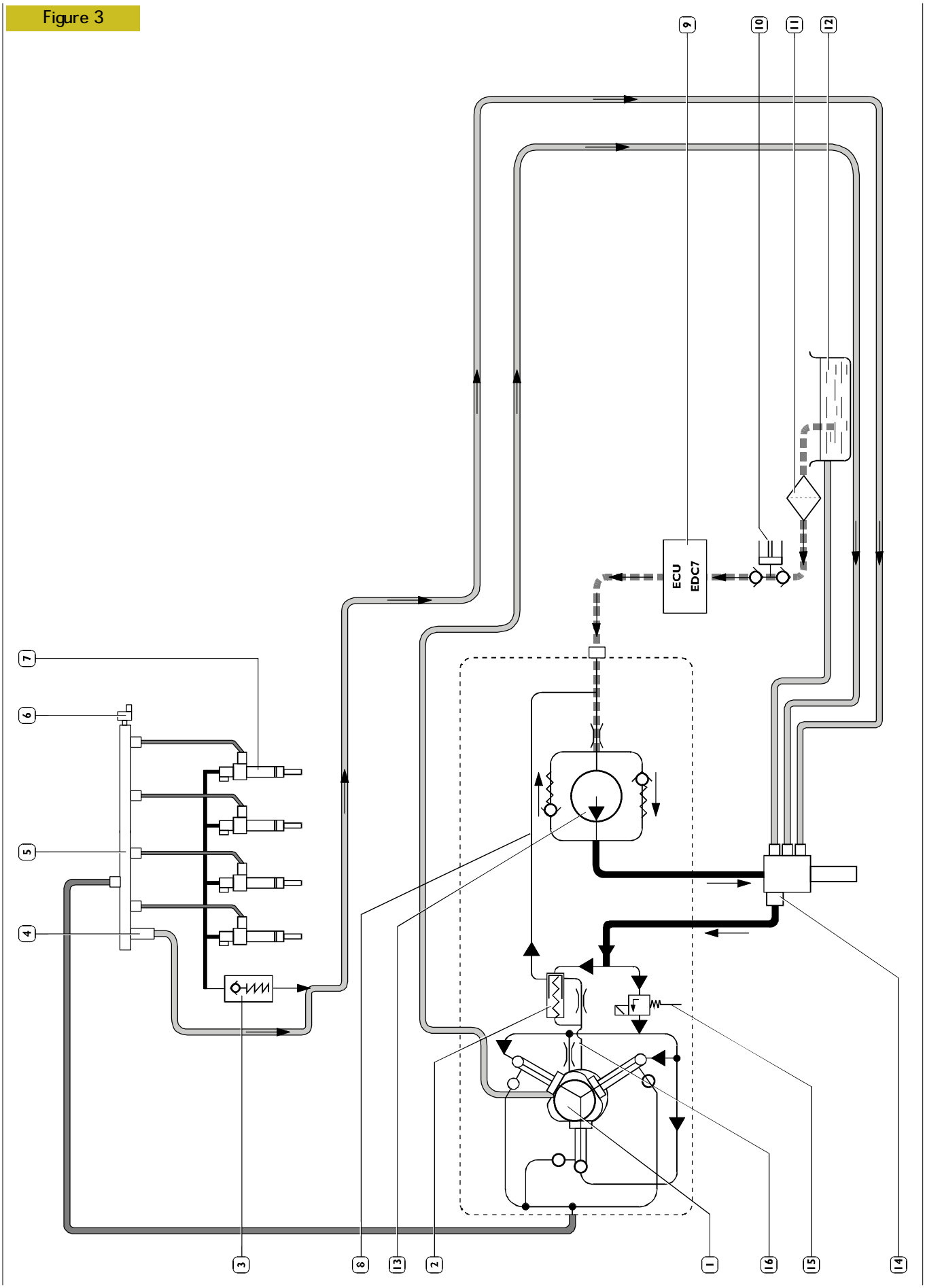
Two by-pass valves are placed in parallel with the mechanical supply pump.

The by-pass valve (18) allows fuel to flow from mechanical pump outlet to its inlet, when the fuel filter inlet pressure exceeds the allowed threshold value.

The by-pass valve (17) allows filling the supply system through the manual priming pump (10).

1. High-pressure pump. —2. Pressure relief valve on high-pressure pump, 5 bars. —3. Pressure relief valve assembled on fuel return from injectors, 1.3 to 2 bars. —4. Rail overpressure valve. —5. Common Rail. —6. Pressure sensor. —7. Injector. —8. Return piping. —9. Control unit heat exchanger. —10. Mechanical priming pump. —11. Prefilter assembled on chassis. —
12. Fuel tank. —13. Mechanical supply pump. —14. Fuel filter. —15. Pressure regulator. —16. High-pressure pump cooling piping. —17. By-pass valve. —18. By-pass valve.

Figure 3



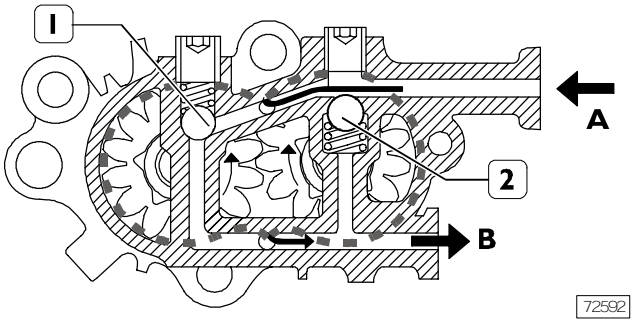
https://truckmanualshub.com/


## MECHANICAL FEEDING PUMP

Gear pump, placed on rear part of the high pressure pump, whose function is to feed the high pressure pump. It is driven by the high pressure pump's shaft.

### Ordinary working condition

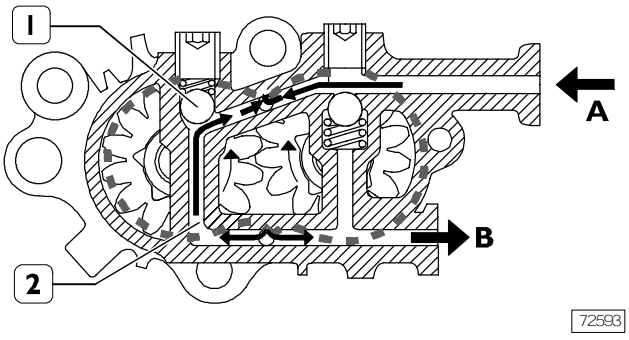
Figure 4




A- Fuel entry flowing from the tank. B- Fuel exhaust to filter, 1 - 2 By-pass valves in close position.

### Overpressure condition in Exhaust unit

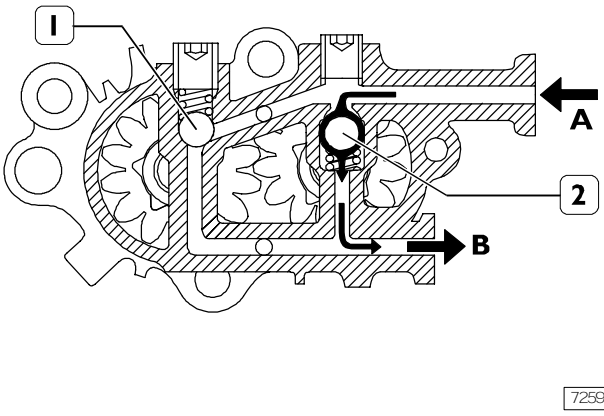
Figure 5




The by-pass valve (1) is activated in case of overpressure on B Exhaust unit. The actual pressure, overcoming the resistance of the valve's spring (1), connects the exhaust with the entry through the gallery (2).

### Jettison condition

Figure 6




The dump by-pass valve (2) is activated in case, when the engine is off, it is necessary to fill the feeding system through the priming pump. In this condition the by pass valve (1) keeps closed while the dump by-pass valve (2) opens up due to the pressure effect on the entry unit so the fuel flows to the exhaust unit B.



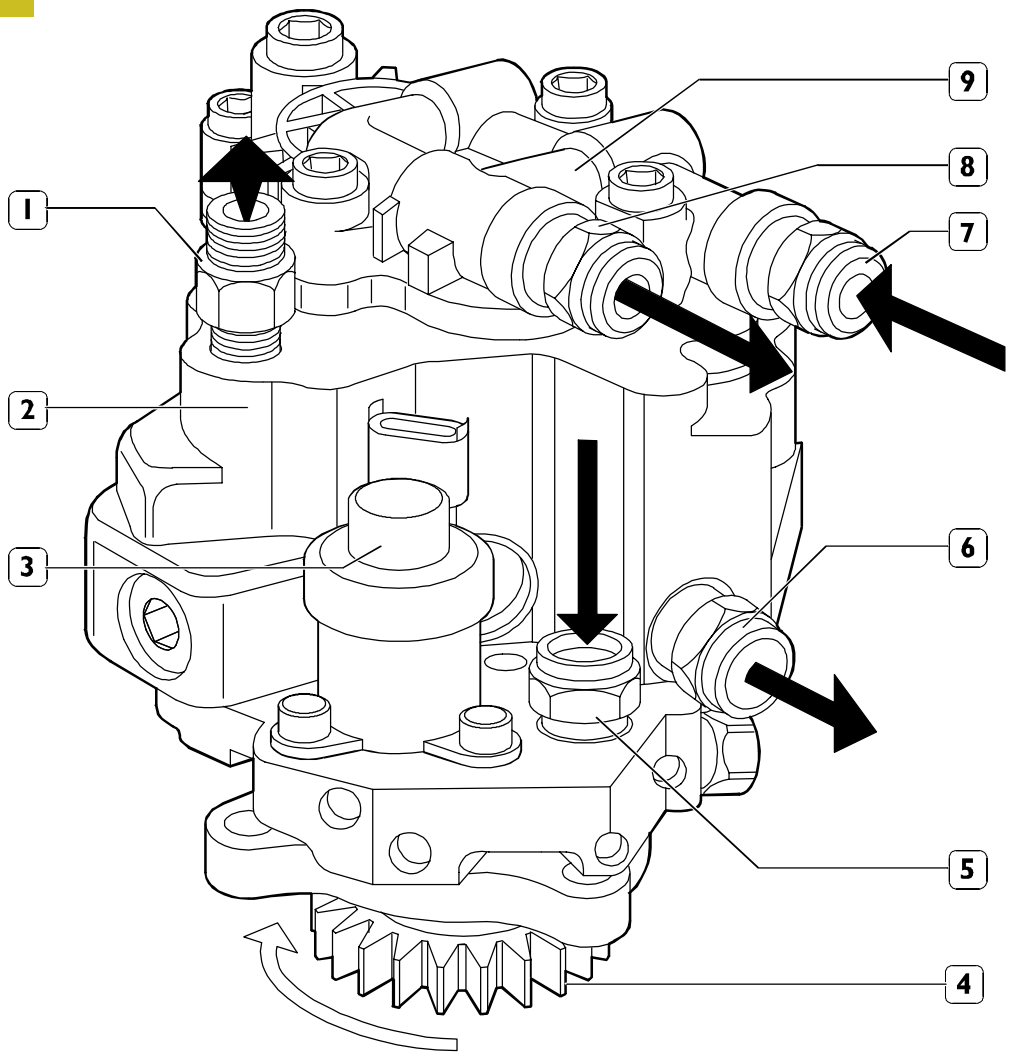
The mechanical feeding pump cannot be replaced separately, therefore it must not be disassembled from the high pressure pump.

## CP3 HIGH PRESSURE PUMP

Pump provided with 3 radial pumping elements driven by the timing system gear, no need of timing. The mechanical feeding pump driven by the high pressure pump's shaft is assembled to the rear side of the high pressure pump.

The high pressure pump unit - feeding pump is not subject to overhaul , therefore it must not be disassembled neither the fixing screws must be tampered.The only operation allowed is the replacement of the driving gear.

Figure 7

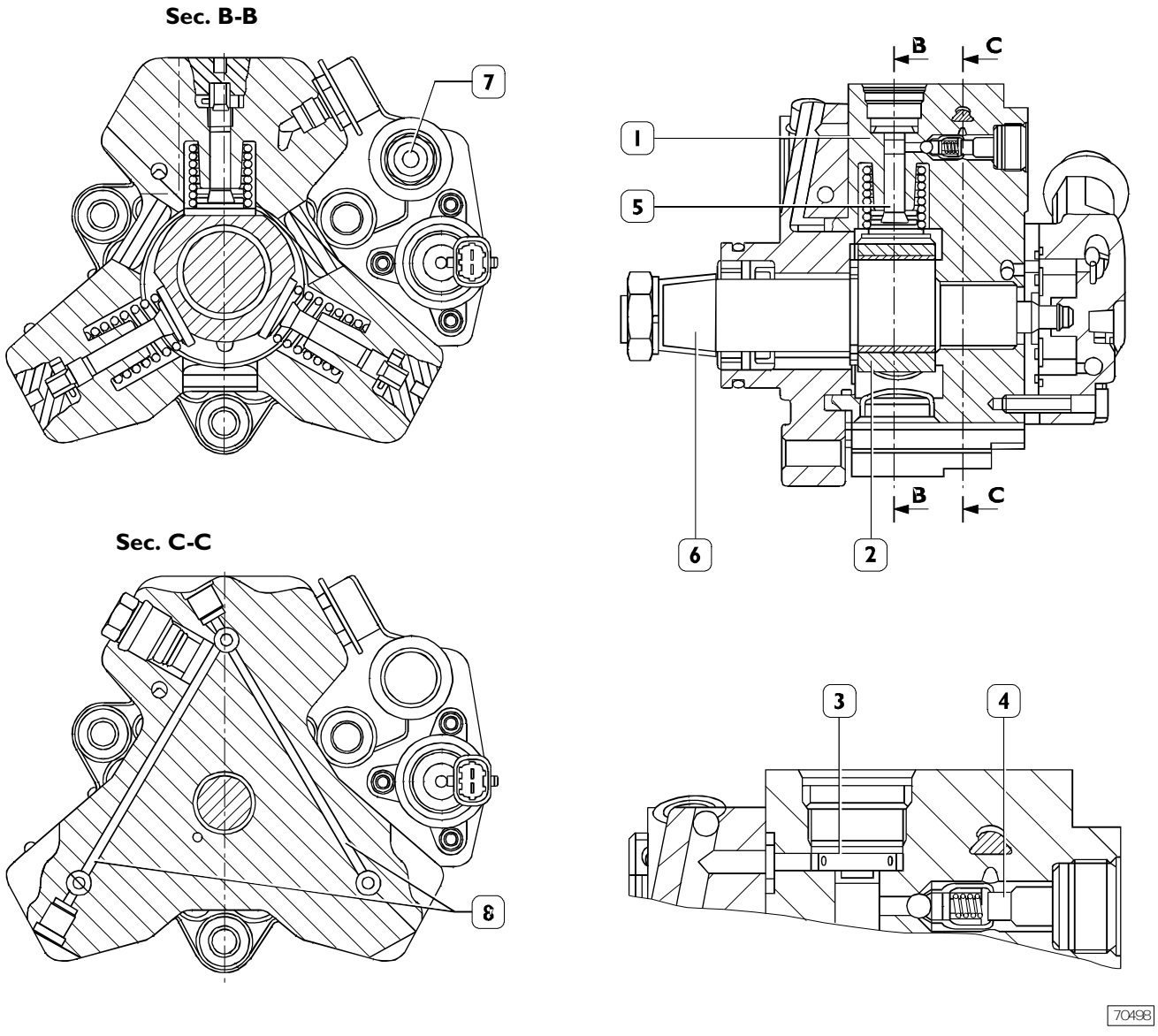



1. Fuel exhaust connector to rail - 2. High pressure pump - 3. Pressure regulating gauge - 4. Driving gear - 5. Connector to fuel entry flowing from filter - 6. Connector to fuel exhaust to filter support - 7. Connector to fuel entry flowing from engine control module heat exchanger - 8. Connector to fuel exhaust flowing from mechanic pump to filter - 9. Mechanical feeding pump.

https://truckmanualshub.com/


**High pressure pump-inside structure**

Figure 8



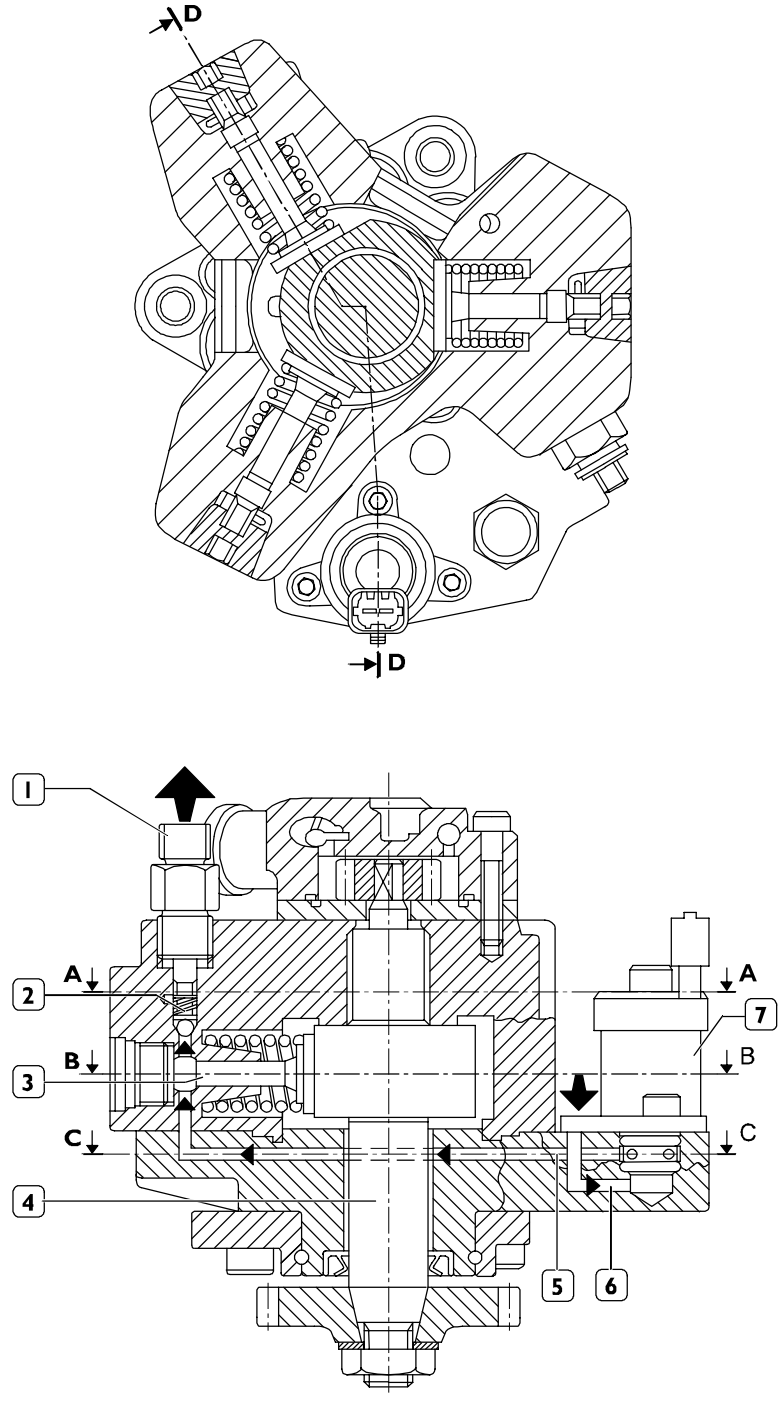

1. Cylinder. —2. Three-lobe element. —3. Cap intake valve. —4. Ball delivery valve. —5. Piston. —6. Pump shaft. —7. Low-pressure fuel inlet. —8. Pumping elements supplying fuel ducts.

Every pumping unit is composed of:

- a piston (5) actuated by a three-lobe element (2) floating on the pump shaft (6). The element (2), being floating on a misaligned part of the shaft (6), when the shaft rotates, does not rotate therewith but is only translated in a circular movement along a wider radius, with the resulting alternate actuation of the three pumping elements;
- cap intake valve (3);
- ball delivery valve (4).

## Working principle

Figure 9



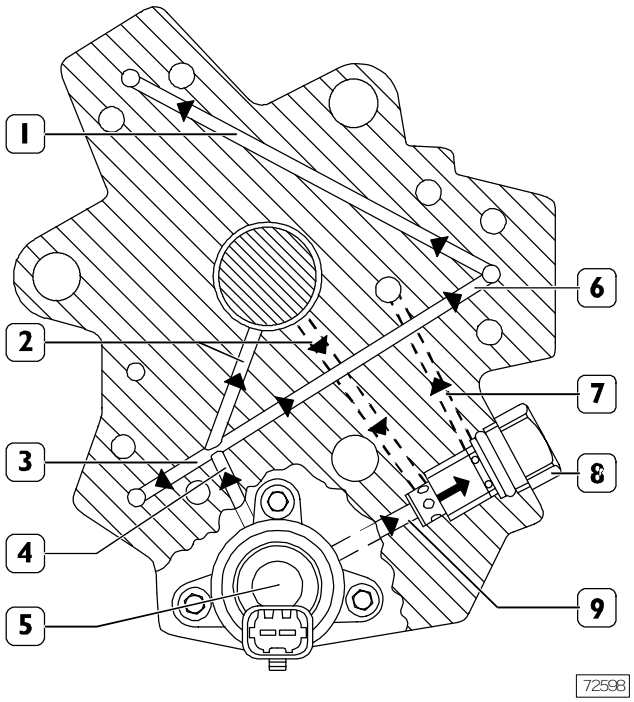

1. Cylinder. —2. Three-lobe element. —3. Cap intake valve. —4. Ball delivery valve. —5. Piston. —6. Pump shaft. —7. Low-pressure fuel inlet. —8. Pumping elements supplying fuel ducts.

The pumping element (3) is orientated towards the pump's camshaft (4). During the intake phase, the pumping element is fed through the feeding line (5). The quantity of fuel to flow to the pumping element is determined by the pressure regulating gauge (7). The pressure regulating gauge, according to the PWM command received by the engine control module, stops the fuel flow to the pumping element.

During compression phase of the pumping element, the fuel achieves the level of pressure determining the opening of the by-pass valve to common rail (2), feeding it through the exhaust unit (1).

https://truckmanualshub.com/


Figure 10




**Sec. C - C**

1. Cylinder. —2. Three-lobe element. —3. Cap intake valve. —4. Ball delivery valve. —5. Piston. —6- Pump shaft. —7. Low-pressure fuel inlet. —8. Pumping elements supplying fuel ducts.

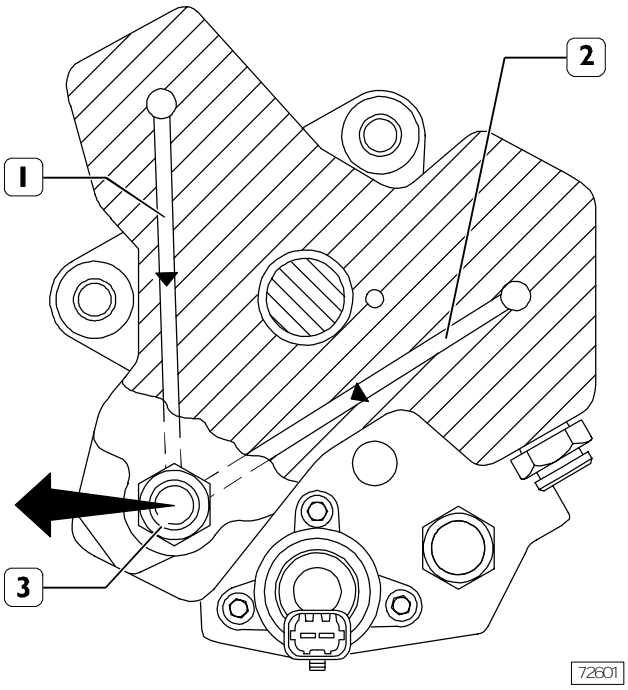
Picture 10 shows the fuel runs at low pressure inside the pump; the following elements are clearly visible: the main feeding line to the pumping elements (4); the feeding lines to the pumping elements (1-3-6), the duct lines run for the pump lubrication (2), the pressure gauge (5), the flow limiting valve to 5 bar (8) and the fuel exhaust flue (7).

The pump shaft is lubricated by the fuel through the feeding and recovery lines.

The pressure gauge (5) determines the quantity of fuel to feed the pumping elements: the fuel in excess flows through the exhaust gallery (9).

The limiting valve to 5 bar, in addition to recovering fuel exhaust as a collector has also function to keep the pressure constant to 5 bar limit at gauge entry.

Figure 11




**Sec. A - A**

1. Fuel exhaust flue - 2. Fuel exhaust gallery - 3 Fuel exhaust flowing from pump with connector to high pressure pipe for common rail.

Picture 11 shows the fuel flow under high pressure running through the exhaust galleries of the pumping elements.

https://truckmanualshub.com/


## Operation

The cylinder is filled through the cap intake valve only if the supply pressure is suitable to open the delivery valves set on the pumping elements (about 2 bars).

The amount of fuel supplying the high-pressure pump is metered by the pressure regulator, placed on the low-pressure system; the pressure regulator is controlled by the EDC7 control unit through a PWM signal.

When fuel is sent to a pumping element, the related piston is moving downwards (suction stroke). When the piston stroke is reversed, the intake valve closes and the remaining fuel in the pumping element chamber, not being able to come out, is compressed above the supply pressure value existing in the rail.

The thereby-generated pressure makes the exhaust valve open and the compressed fuel reaches the high-pressure circuit.

The pumping element compresses the fuel till the top dead center (delivery stroke) is reached. Afterwards, the pressure decreases till the exhaust valve is closed.

The pumping element piston goes back towards the bottom dead center and the remaining fuel is decompressed.

When the pumping element chamber pressure becomes less than the supply pressure, the intake valve is again opened and the cycle is repeated.

The delivery valves must always be free in their movements, free from impurities and oxidation.

The rail delivery pressure is modulated between **250** and **1350** bars by the electronic control unit, through the pressure regulator solenoid valve.

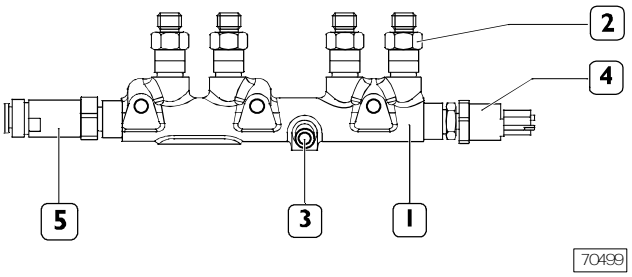
The pump is lubricated and cooled by the fuel.

The radialjet pump disconnection —reconnection time on the engine is highly reduced in comparison with traditional injection pumps, because it does not require setting.

If the pipe between fuel filter and high-pressure pump is to be removed-refitted, be sure that hands and components are absolutely clean.

## RAIL

Figure 12




1. Rail. —2. Flow limiters. —3. Fuel inlet from high-pressure pump. —4. Pressure sensor. —5. Overpressure valve.

The rail volume is comparatively small to allow a quick pressurisation at startup, at idle and in case of high flow-rates.

It anyway has enough volume as to minimise system spikes and the use of plenum chambers caused by injectors openings and closings and by the high-pressure pump operation. This function is further enabled by a calibrated hole being set downstream of the high-pressure pump.

A fuel pressure sensor (4) is screwed to the rail. The signal sent by this sensor to the electronic control unit is a feed-back information, depending on which the rail pressure value is checked and, if necessary, corrected.

https://truckmanualshub.com/

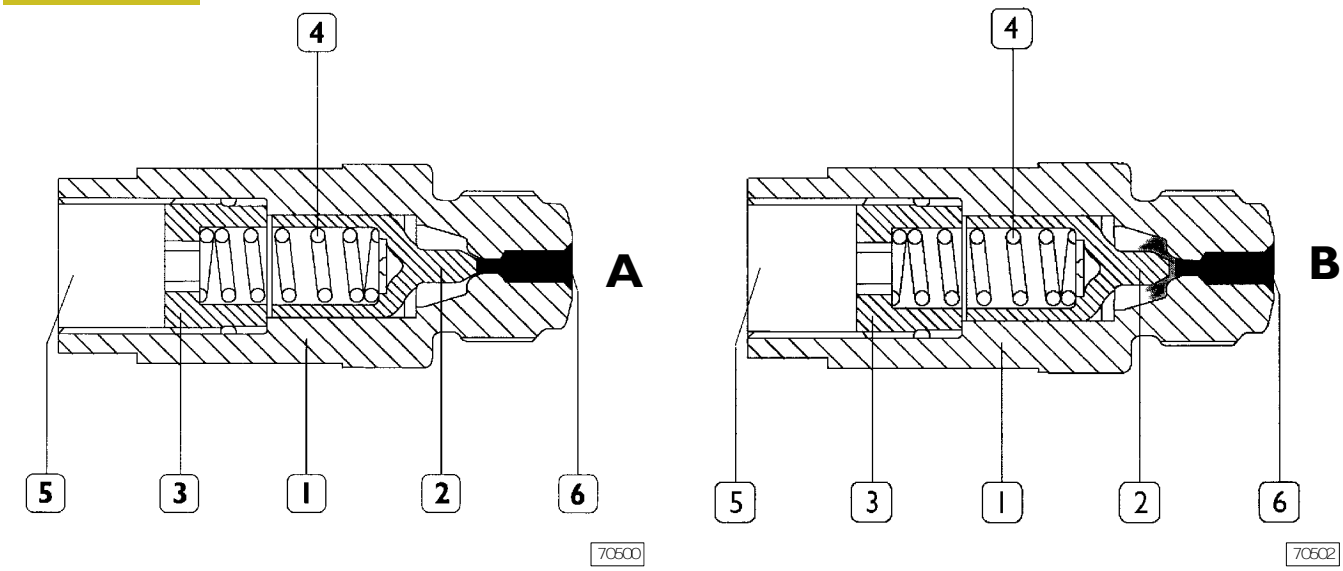

## BOOST GAUGE VALVE

The boost valve (1750 bars) is assembled to the rail with the purpose to protect the system's components in case of excessive increase of pressure within the high pressure system. Pressure limiter.

The valve can be single-stage (as the one showed in the picture) or double-stage with double working limit (1750 bars and 800 bars).
In the second case, when the pressure within the high pressure system reaches 1750 bars, the valve is activated as a single-stage one to exhaust the fuel and consequently reduce the pressure until reaching safety parameters. Then it provides mechanically gauging the pressure into rail to aprx. 800 bars. This way the valve enables working of the engine for extended timing at limited performances, avoiding the fuel's overheating and preserving the exhaust galleries.

If the above mentioned valve is activated, the engine control module excludes by isolation the pressure gauge and records the errore code 8.4.
The pump will flow the maximum delivery to the rail.

Figure 13




1. Body —2. Small piston —3. Stop —4. Spring —5. Direct tank discharge —6. Seat on rail.

A Normally, the tapered piston end keeps closed the discharge towards the tank.

B If the 1750 bar fuel pressure is exceeded in rail, the small piston is displaced and the excess pressure is discharged into the tank.

https://truckmanualshub.com/


## FLOW LIMITERS

They are placed on rail fuel outlet fittings, and are used to protect engine or vehicle integrity in case of internal leaks (for example, locked-open spray nozzle) or external leaks (example: damaged high-pressure pipings).

In such cases, system operation is, within certain limits, allowed through components remained unaffected in other cylinders.

After having blocked fuel from going out of the rail, the flow limiter is automatically re-primed under spring operation. If however the reason for its intervention is not removed, upon the following startup attempt, the engine could operate only at idling or at low speeds or be again turned off depending on the amount of leakage.

Figure 14

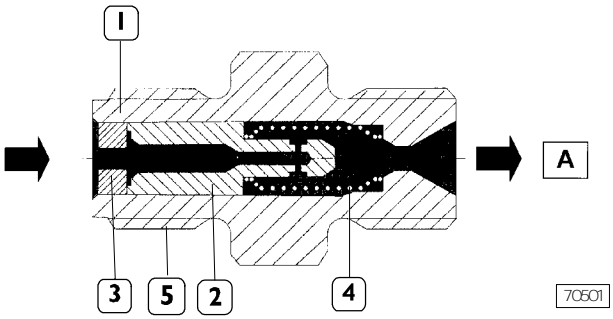
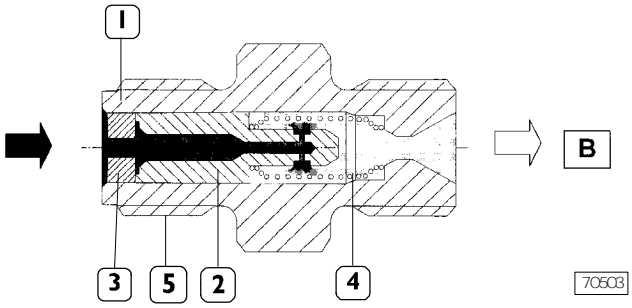



Figure 15

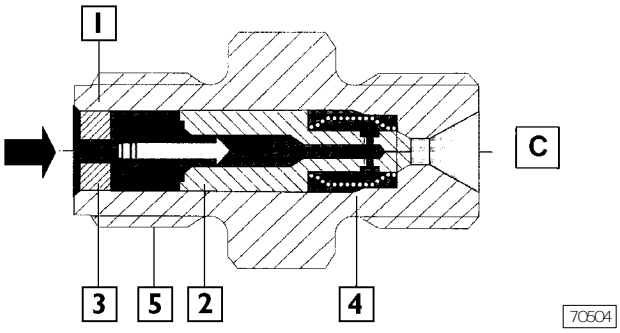



1. Body —2. Small piston —3. Fuel inlet —4. Spring —5. Rail-securing threading.

A The passage of fuel from rail to injectors is implemented through holes obtained on the small piston diameter. Under normal conditions, fuel pressure operates on the two piston sides, kept opened by the spring.

B In case of strong pressure leaks downstream of the limiter, the inlet pressure becomes greater and displaces the piston to the opposite side, closing fuel outlet.

Figure 16




C Limiter with piston in outlet closing position.

https://truckmanualshub.com/


## ELECTRO-INJECTOR

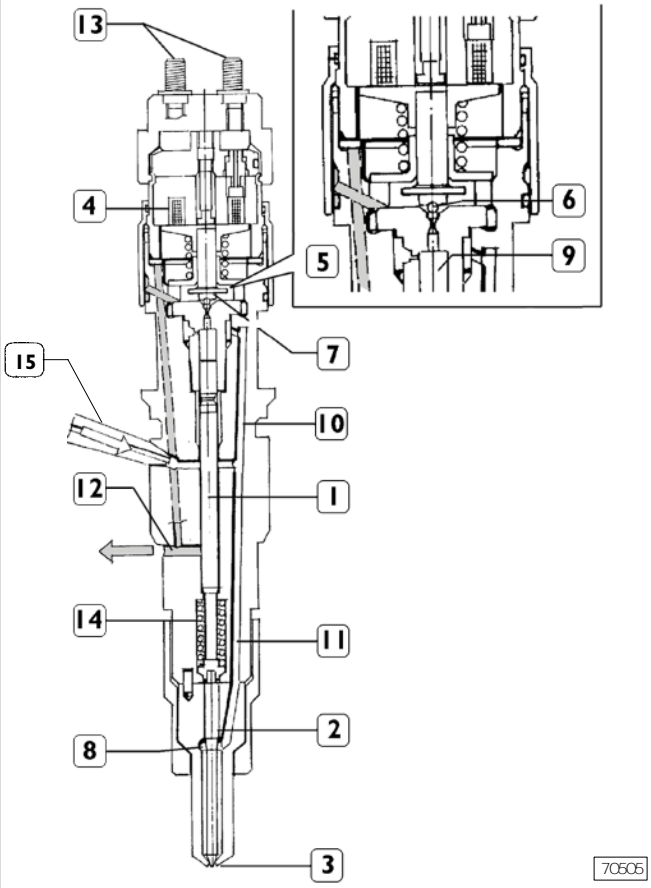
The injector is similar as construction to the traditional ones, apart from the absence of plunger return springs.
The injector can be deemed as composed of two parts:

- actuator —spray nozzle composed of pressure rod (1), plunger (2) and nozzle (3);
- control solenoid valve composed of coil (4) and pilot valve (5).

The solenoid valve controls spray nozzle plunger lift.

### Injector in rest position

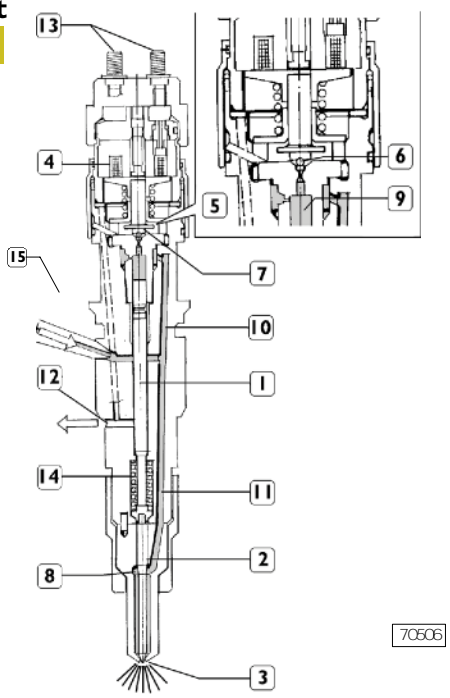
Figure 17




1. Pressure rod —2. Plunger —3. Nozzle —4. Coil —5. Pilot valve —6. Ball shutter —7. Control area —8. Pressure chamber —9. Control volume —10. Control duct —11. Supply duct —12. Control fuel outlet —13. Electric connection —14. Spring —15. High-pressure fuel inlet.

### Injection start

Figure 18




When coil (4) is energised, it makes shutter (6) move upwards. The control volume (9) fuel flows towards flow duct (12) making a pressure drop occur in control volume (9). Simultaneously the fuel pressure into pressure chamber (8) makes plunger (2) lift, with following fuel injection into the cylinder.

### Injection end

When coil (4) is de-energised, shutter (6) goes back to its closing position, in order to re-create such a force balance as to make plunger (2) go back to its closing position and end the injection.



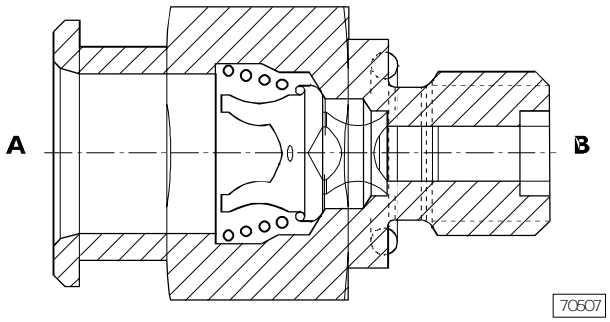
The injector cannot be overhauled and therefore it must not be disassembled.

https://truckmanualshub.com/


## PRESSURE LIMITER FOR FUEL RETURN

It is housed on the rear of the cylinder head, and adjusts the pressure of fuel returning from injectors at a pressure 1.3 and 2 bars. By guaranteeing this pressure to the return fuel, the fuel vapours formation inside injectors is avoided, optimising fuel spraying and combustion.

Figure 19




**A** To tank —**B** From injectors

https://truckmanualshub.com/

https://truckmanualshub.com/


# SECTION 3

## Duty - Industrial equipment


| | Page |
|---|---|
| GENERAL SPECIFICATIONS | 3 |
| ❑ Section pictures of complete engine Common rail version | 3 |
| ❑ Clearance data 4-6 cyl. | 4 |
| **PART ONE - MECHANICAL COMPONENTS** | 7 |
| ENGINE OVERHAUL | 9 |
| ❑ Preface | 9 |
| ❑ Engine setting operations for the assembly on turning stand | 9 |
| ❑ Disassembly of application components | 10 |
| ❑ Assembly of application components | 17 |
| ❑ Completion of the Engine | 29 |
| ❑ Checks inspection and control | 30 |
| TIGHTENING TORQUE | 31 |
| **PART TWO - ELECTRICAL EQUIPMENT** | 33 |
| ❑ Placement of sensors | 35 |
| ❑ EDC7 ECU | 36 |
| ❑ Connector to injectors | 37 |
| ❑ Feed connector to components and to functions of the specific equipment | 38 |
| ❑ Connector to sensors | 39 |
| ❑ Temperature and air pressure sensor | 40 |
| ❑ Sensor of engine's oil temperature and pressure | 40 |
| ❑ Driving shaft sensor | 40 |
| ❑ Timing system sensor | 40 |
| ❑ Fuel pressure sensor | 41 |
| ❑ Fuel temperature sensor | 41 |
| ❑ Resistor pre-post heating | 41 |
| ❑ Cooling liquid temperature sensor | 41 |
| ❑ Starter | 42 |
| ❑ Electro-injectors | 42 |

https://truckmanualshub.com/


Page

PART THREE - TROUBLESHOOTING 43

PREFACE 44

TROUBLESHOOTING WITH ERROR CODES 45

TROUBLESHOOTING WITHOUT ERROR CODES 47

Page

PART FOUR - MAINTENANCE PLANNING 61

❑ Recovery 63

❑ Regular maintenance and inspection planning

❑ Checks not included in maintenance planning - daily checks 64

MAINTENANCE PROCEDURES - CHECKS AND INSPECTIONS 64

❑ Checks and inspection 78

❑ Engine oil level check 64

❑ Combustion system inspection 65

❑ Cooling system inspection 65

❑ Lubricating system inspection 65

❑ Check of water presence within fuel filter or pre-filter 65

❑ Inspection / replacement of blow-by filter 66

❑ Inspection of drive belt tensioning 66

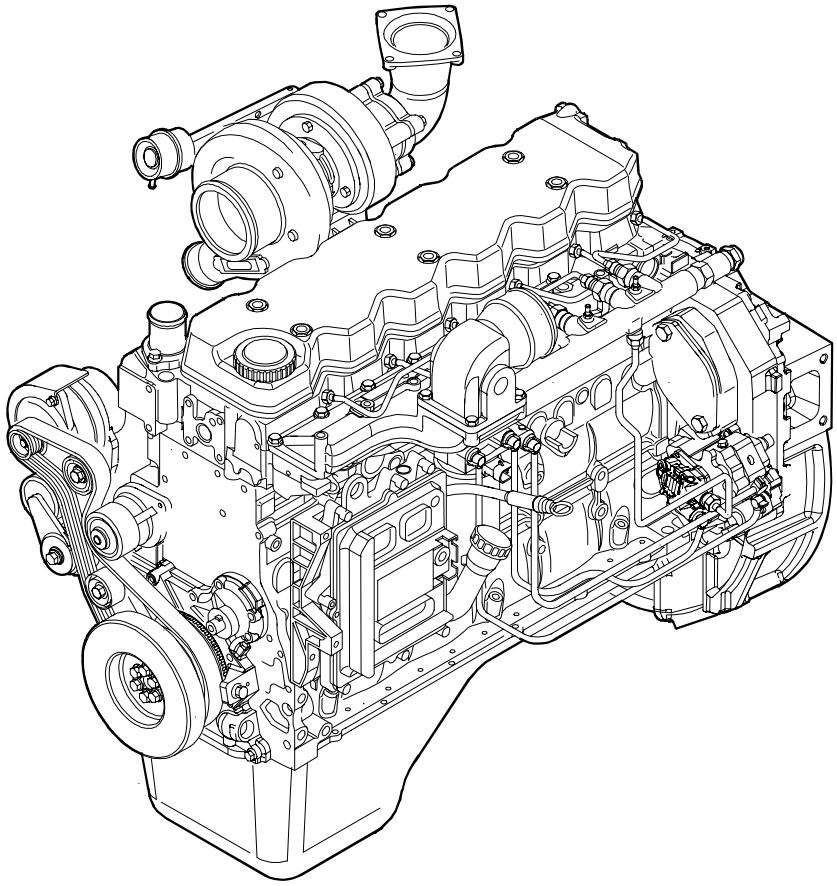
❑ Inspection and setting of tappet clearance 66

https://truckmanualshub.com/


# GENERAL SPECIFICATIONS

## Section pictures of complete engine - common rail version

Figure 1



74184

The F4 AE0484 and F4AE0684 engines are turbocharged a 4-stroke diesel engines with 6 cylinders or 4 cylinders, with 4 valves per cylinder.

They have high pressure injection fuelling (common rail) and are entirely electronically driven in order to optimise the working process in accordance to the operation, limiting as much as possible the pollution emissions and consumption.

Data, features and performances are valid only if the setter fully complies with all the installation prescriptions.

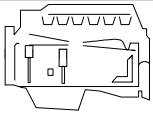
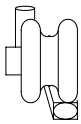
Furthermore, the users assembled by the setter shall always be in conformance to couple, power and number of turns based on which the engine has been designed.

The section herein described is composed or four sections:

- Section of mechanical overhaul prescribed in accordance to the engine's specific duty, illustrating all necessary operation to remove and assembly the external components of the engine, including cylinder heads, gearbox of the timing system and of the front part cover;
- Electrical section, describing the connections to the different components of the engine control module and of the sensors assembled to the engine;
- Diagnosis section;
- Section of preventive maintenance operations, providing instructions for the execution of the main operations.

https://truckmanualshub.com/


## CLEARANCE DATA - 4 CYL.

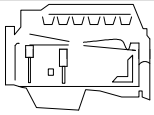
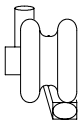
| | | | |
|---|---|---|---|
|  | Type | | F4AEC484B * D1 |
| ϱ | Compression ratio | | 17 : 1 |
|  | Max. output | kW<br>(HP)<br><br>rpm | 107<br>145<br><br>2300 |
|  | Max. torque | Nm<br>(kgm)<br><br>rpm | -<br>-<br><br>- |
|  | Loadless engine idling | rpm | - |
|  | Loadless engine peak | rpm | - |
| | Bore x stroke | | 102 x 120 |
| | Displacement | | 3920 |
|  | **TURBOCHARGING** | | with intercooler |
| | Turbocharger type | | GARRETT GT 22 |
|  | **LUBRICATION** | | Forced by gear pump, relief valve single action oil filter |
| | **Oil pressure (warm engine)** | | |
| | - idling | bar | 0.7 |
| | - peak rpm | bar | 4.0 |
| | **COOLING** | | By centrifugal pump, regulating thermostat, heat exchanger, intercooler |
| | **Water pump control** | | Through belt |
| | **Thermostat** | | |
| | - start of opening | °C | 82.2 |
|  15W40 ACEA E3 | **FILLING** | | |
| | engine sump | liters | 5.3 |
| | engine sump + filter | liters | 6.3 |

**Data, features and performances are valid only if the technician fully complies with all the installation requirements provided by McCormick.**

**Furthermore, the use of the unit after overhaul should conform to the original specified power and engine rev/min for which the engine has been designed.**

https://truckmanualshub.com/


## CLEARANCE DATA - 6 CYL.

| | | | |
|---|---|---|---|
|  | Type | | F4AE0684C * D1 |
| Q | Compression ratio | | 17 : 1 |
|  | Max. output | kW<br>(HP)<br><br>rpm | 155<br>210<br><br>2300 |
|  | Max. torque | Nm<br>(kgm)<br><br>rpm | -<br>-<br><br>- |
|  | Loadless engine idling | rpm | - |
|  | Loadless engine peak rpm | rpm | - |
| | **Bore x stroke**<br><br>Displacement | | 102 x 120<br><br>5880 |
|  | **TURBOCHARGING**<br><br>Turbocharger type | | with intercooler<br><br>HOLSET HX35W |
|   | **LUBRICATION**<br><br>**Oil pressure (warm engine)**<br>- idling<br><br>- peak rpm | <br><br><br>bar<br><br>bar | Forced by gear pump, relief valve single action oil filter<br><br><br>1.2<br><br>3.8 |
| | **COOLING**<br><br>**Water pump control**<br>**Thermostat**<br>- start of opening | <br><br><br>°C | By centrifugal pump, regulating thermostat, heat exchanger, intercooler<br><br>Through belt<br><br>from 81 to 83 |
|  15W40 ACEA E3 | **FILLING**<br><br>engine sump<br><br>engine sump + filter | <br><br>liters<br><br>liters | <br><br>15<br><br>15 + 1 |

**Data, features and performances are valid only if the technician fully complies with all the installation requirements provided by McCormick.**

**Furthermore, the use of the unit after overhaul should conform to the original specified power and engine rev/min for which the engine has been designed.**

https://truckmanualshub.com/

https://truckmanualshub.com/


# PART ONE - MECHANICAL COMPONENTS

https://truckmanualshub.com/

https://truckmanualshub.com/


# ENGINE OVERHAUL

## Preface

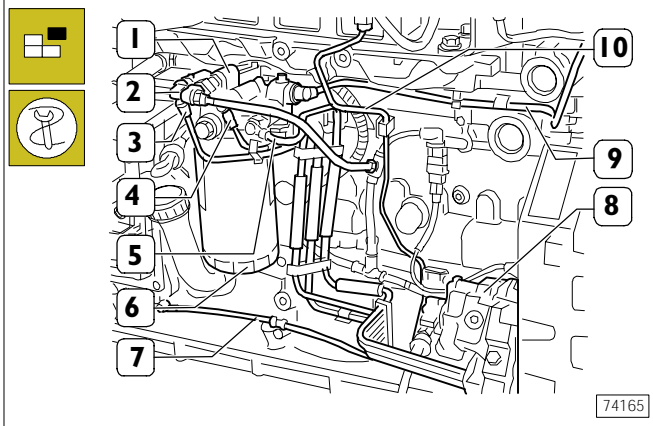
With regard to the engine disassembly operations from the machine, please apply for Information consulting the specific manual.
All operations of Engine disassembly operations as well as overhaul operations must be executed by qualified technicians provided with the specific tooling and equipment required.

The following information relates to the engine overhaul operations only for what concerns the different components customising the engine, according to its specific duties.

In section 4, "General overhaul", all the operations of engine block overhaul have been contemplated. Therefore the above mentioned section is to be considered as following the part hereby described.

## Engine setting operations for the assembly on turning stand

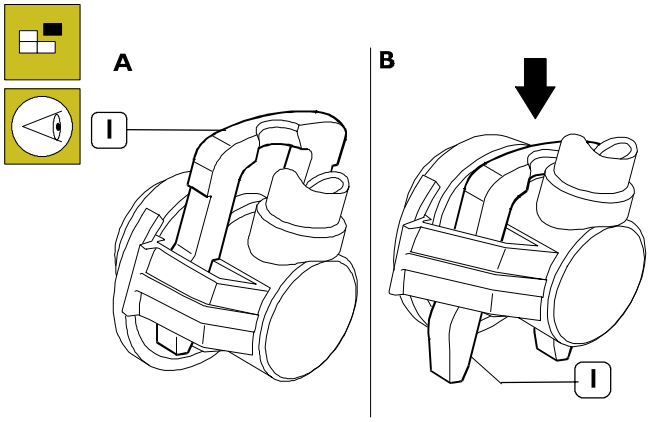
Figure 2




In order to apply the brackets 99341009 to the engine block to fix it on to the stand for the overhaul, it is necessary to perform the following operations on the left hand side of the engine:

- Using the tool 99360073 disassembly the fuel filter (6) and remove it from the support (1);
- Disconnect the electrical connection (2) from the support (1) and the heater's one (placed on the filter support as well);
- Disconnect the fuel low pressure pipelines (3-4-5) from the support (1);
- Disconnect pipeline (9) from the support (1);
- Remove the sustaining support bracket (1) from the block.

Figure 3




**A** Connector properly locked

**B** Connector released for removal-refitting

Press clamp (1), as shown in Figure **B**, to disconnect the low pressure fuel pipes (3 –4 –5, Figure 2) from the corresponding connections.

After disconnecting the pipe, reset the clamp (1) in locking position (Figure **A**) to prevent distortions.

Disconnect the high pressure fuel pipeline (10, Figure 2) from the rail diffuser and from the high pressure pump (8) and disassemble it from the engine block removing the fixing clamps.

Disconnect the pipeline (7) feeding the mechanic pump that is combined to the high pressure pump through the exchanger of the engine control module.

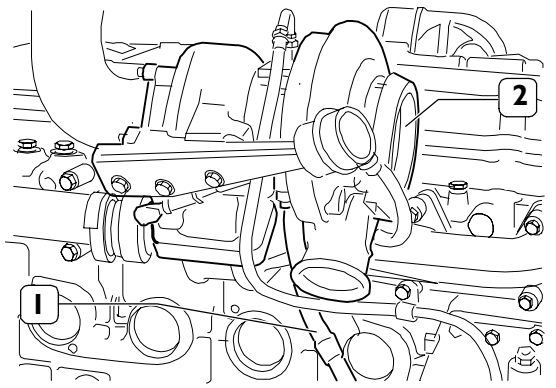
Because of the high pressure in the pipelines running from the high pressure pump to the rail and from this last one to the electro-injectors, it is absolutely required NOT to:

- disconnect the pipelines when the engine is working;
- re-use the disassembled pipelines.

https://truckmanualshub.com/

On the right hand side of the engine:

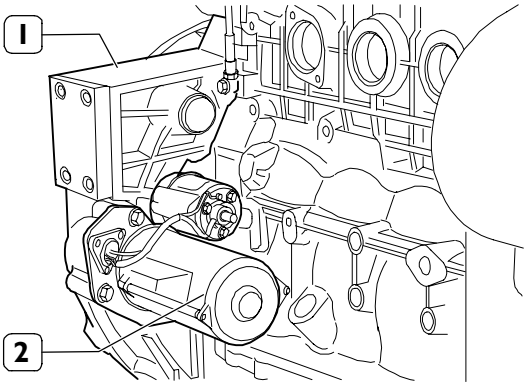
Figure 4




74167

Remove the screws and remove the oil pipe (1) from the turbocharger pipe (2) and from the engine block.

Figure 5




74166

Disconnect the oil feed pipeline unlocking the three screws M12x25. Remove the O-ring from the pipe.

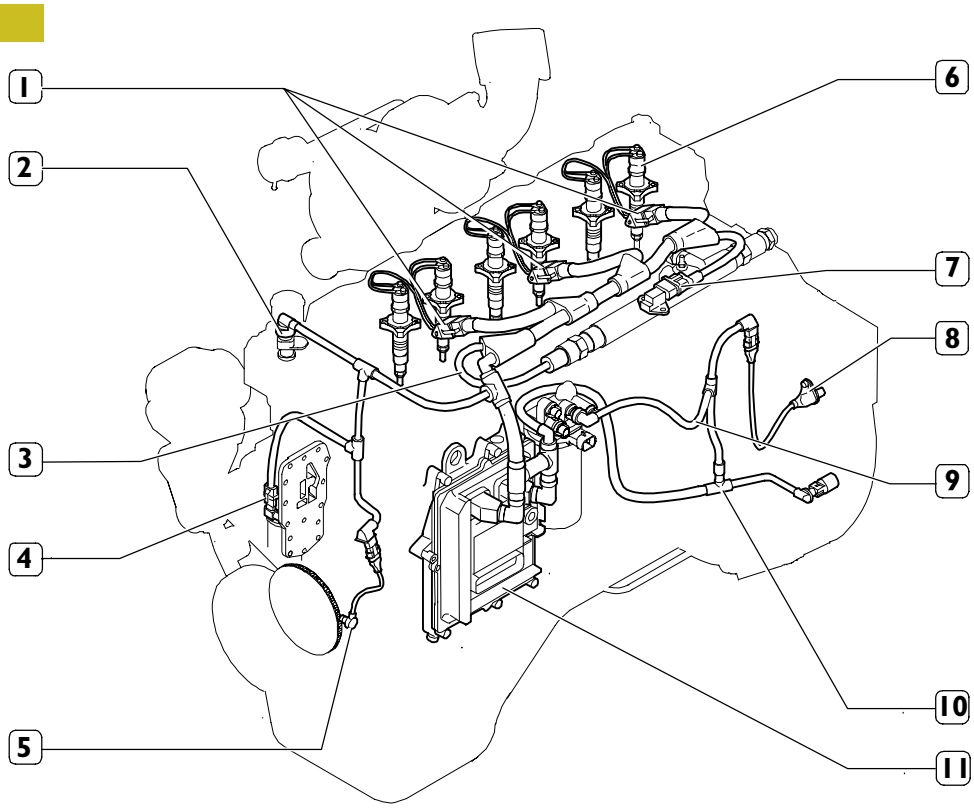
Remove the starter (2) from the flywheel housing (1).

Apply brackets 99361037 to engine block and use them to secure the engine to the revolving stand 99322205. Remove sump cap and drain out oil.

Remove the fan from the output shaft pulley.

## Disassembly of application components

Figure 6



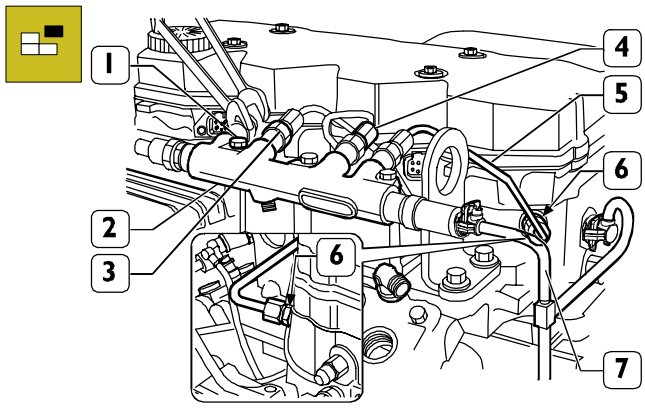

74168

1. Connections for Electro-injectors - 2. Engine cooling liquid temperature's sensor - 2. Cable of the fuel pressure sensor - 4. Sensor of engine's oil temperature and pressure - 5. Driving shaft sensor - 6. Electro-injector - 7. Temperature - air pressure sensor - 8. Timing system sensor - 9. Cable of fuel heater and fuel temperature's sensor - 10. Cable of pressure regulating gauge - 11. EDC 7 gearbox.

https://truckmanualshub.com/


Disconnect the engine's cable from the connectors (1. Figure 6) wiring harness to
Electro-injectors (6); (7) air pressure/temperature sensor; (3) fuel pressure sensor;
(11) engine control module; (10) high pressure pump sensor; (8) timing system sensor; (2) Thermostat sensor of engine cooling liquid's temperature; (5) sensor of engine's revolutions.

Figure 7



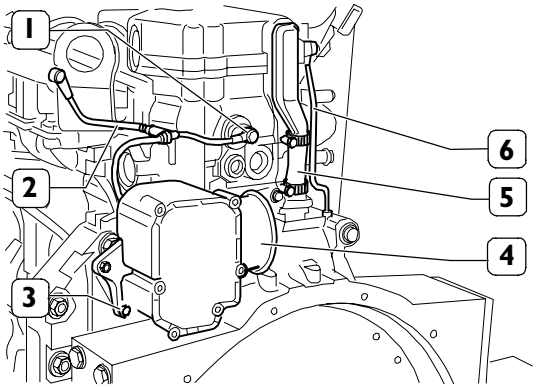

70236

Disconnect from the rail (2): the fuel pipe (7) according to procedures described in figure 3. Disconnect fuel pipes (5) from rail (2) and injector manifolds (6).

When releasing pipe (6) connections (4) to rail (2), use the proper wrench to avoid rotation of flow limiters (3).

Remove the screws (1) and disconnect the rail (2).

Figure 8




74170

Disconnect the pipeline (2) from the fuel recover pressure-limiter, working on the connections as described in Figure 3.

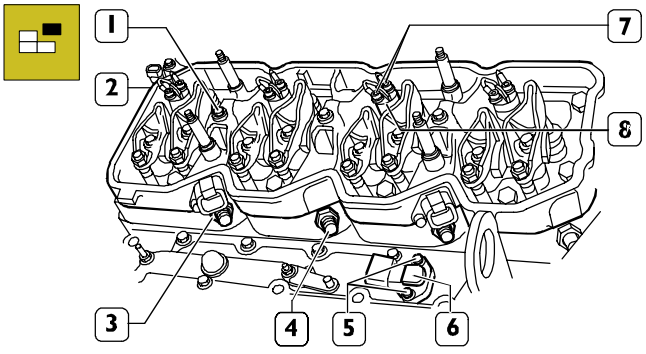
Unscrew the nut and loosen the clamp tightening the oil vapour pipe.

Remove the pipe (6).

Loosen the screws (3) and disassemble the blow-by filter (4).

Remove on the nuts and tappet cover.

Figure 9




70131

Remove nuts (7) and disconnect the electrical cables from injectors (8).

Remove screws (1) and disconnect injector wiring support (2) including the gasket.

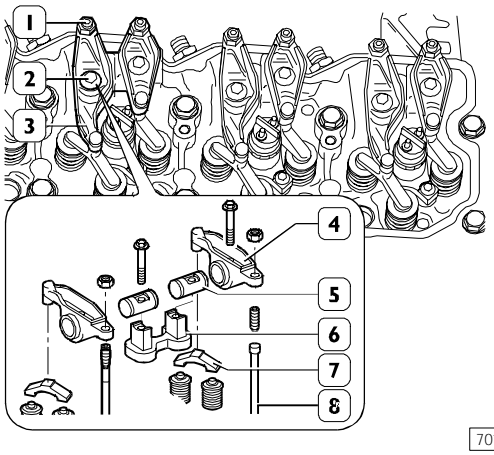
Remove screws (5), disconnect air pressure/temperature sensor (6).

Remove nuts (3) and remove fuel manifolds (4).

Disassembled fuel manifolds (4) must not be used again, replace with new ones during reassembly.

https://truckmanualshub.com/

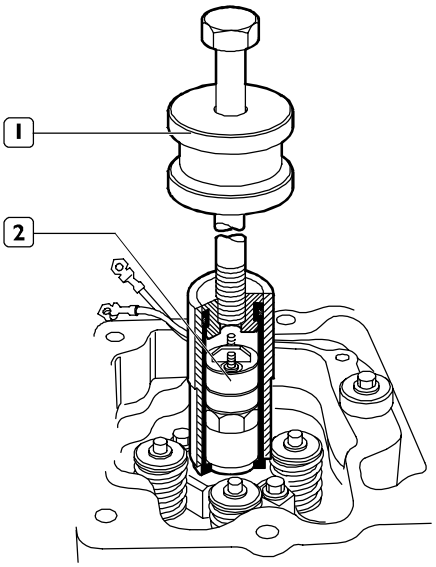
Figure 10




70132

Loosen tappet adjustment fastening nuts (1) and unscrew the adjusters.
Remove the screws (2), remove the rocker assembly (3), consisting of: bracket (6), rockers (4), shafts (5) and remove jumpers (7) from valves.
Remove rods (8).

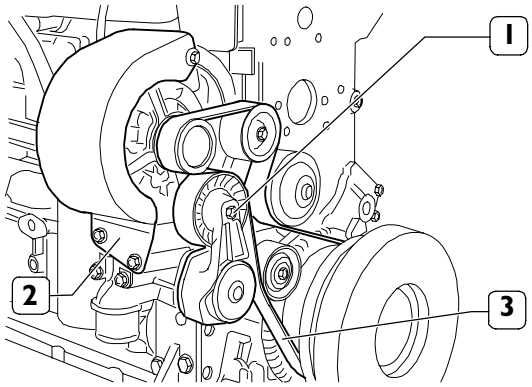
Figure 11




70133

Remove injector fastening screws. Use tool 99342101 (1) to remove injectors (2) from the cylinder head.

Figure 12




74171

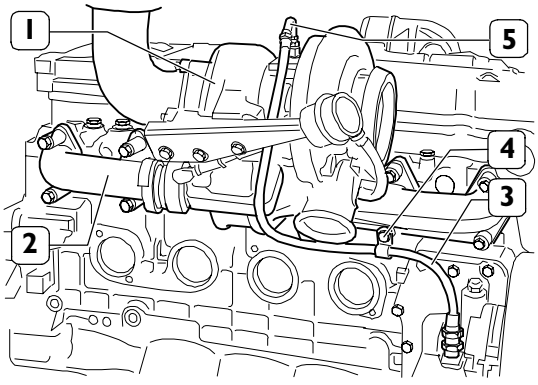
Loosen the screws fixing the alternator's protection to the support and remove it;

Release on the drive belt tensioner (1) and extract the belt (3) from the belt pulleys from the water pump ones and from the belt rebound pulleys;

Disassemble the belt tensioner;

Loosen the screws fixing the alternator to the support and disassemble it.

Figure 13




74172

Remove the screw (4) holding the fixing clamp of the turbocharger's lubricating oil pipeline.

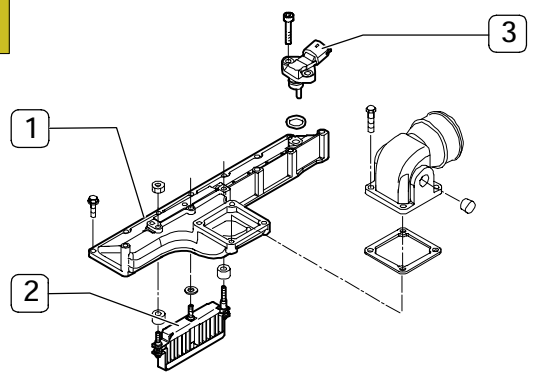
Disconnect the oil pipeline (3) from the supports of the heat exchanger / oil filter and from the pipe fitting (5) to the turbine.

Remove the fixing nuts and disassemble the turbocharger (1) from the exhaust collector (2).

Loosen the screws and disassemble the exhaust collector (2) from the cylinder head.

https://truckmanualshub.com/

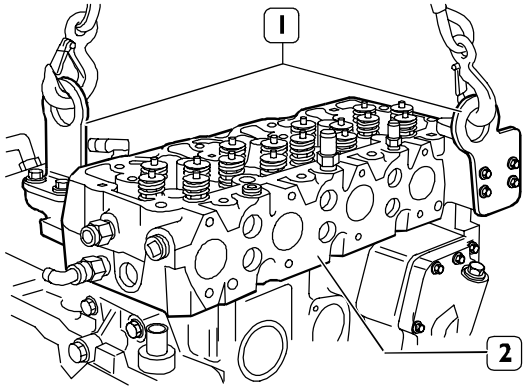

Figure 14




74173

On the opposite side, loosen the fixing screws of the inlet manifold (1) and disassemble the joint to the air heater (2) for the cold start.

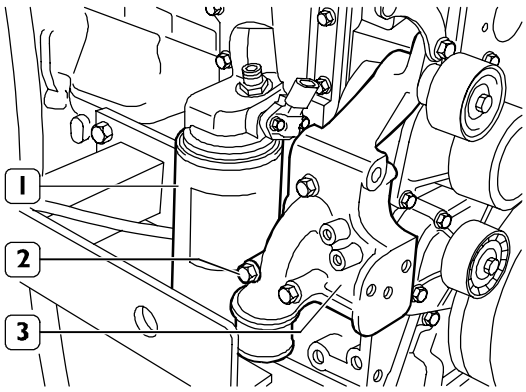
Figure 15




70137

Hook brackets (1) with suitable lifting chains and remove cylinder head (2) from block using hoist.

Figure 16

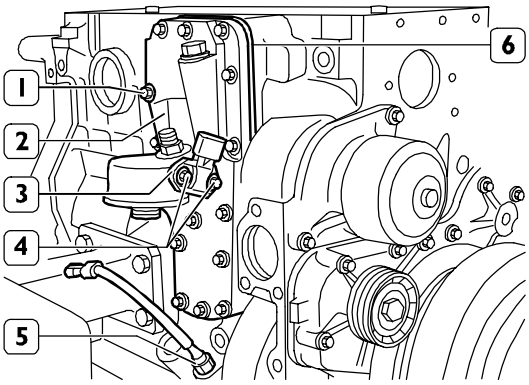



70140

Remove the screws (2) and disconnect the alternator support (3).

Use tool 99360076 to remove the oil filter (1).

Figure 17



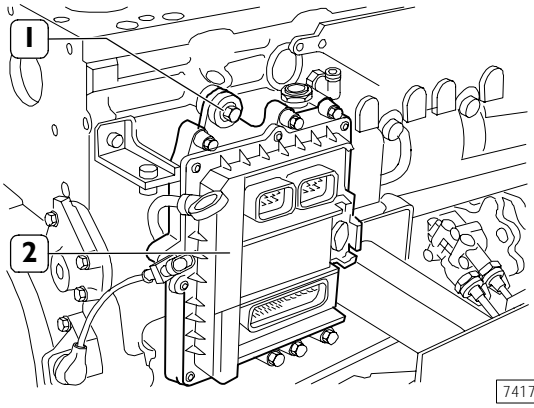

70141

Remove the screws (4) and disconnect the oil temperature/pressure sensor (3).

Remove the screws (1) and then remove: heat exchanger/oil filter support (2), intermediate plate (6) and relevant gaskets.

Remove the oil level sensor (5).

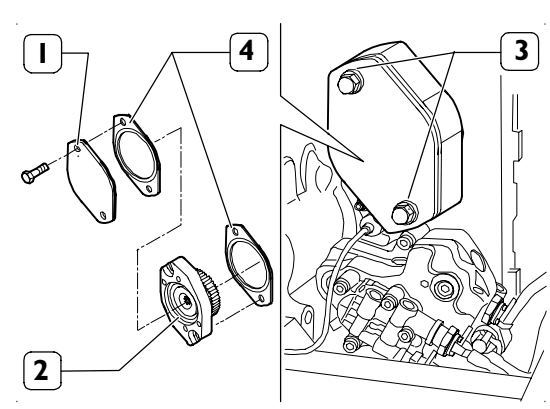
Figure 18




74174

Remove the screws (1) and disconnect the ECU (2) including the heat exchanger.

Figure 19

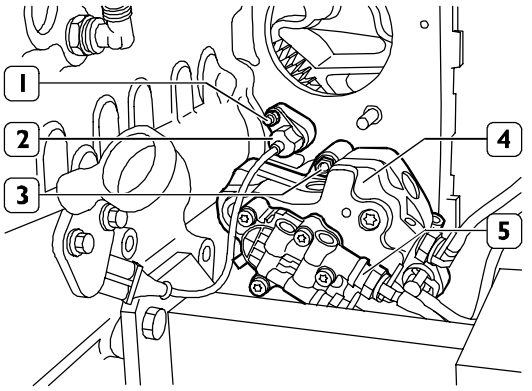



74176

Unloose the screws (3) and remove the cap (1). Keep the gasket (4), the power take-off (2) and the second gasket (4).

https://truckmanualshub.com/

Figure 20

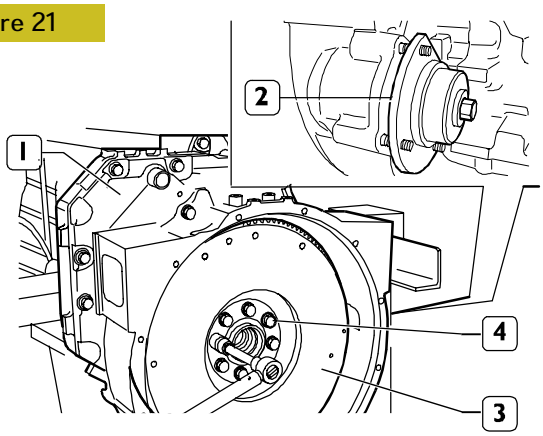



70145

Remove the nut (1) and disconnect the timing sensor (2).

Remove the nuts (3) and disconnect the high pressure pump (4) including the feed pump (5).

Figure 21

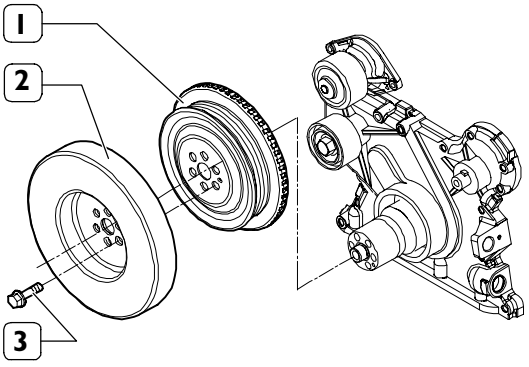



70146

Fit tool 99360339 (2) to the flywheel housing (1) to stop flywheel (3) rotation.

Loosen the screws (4).

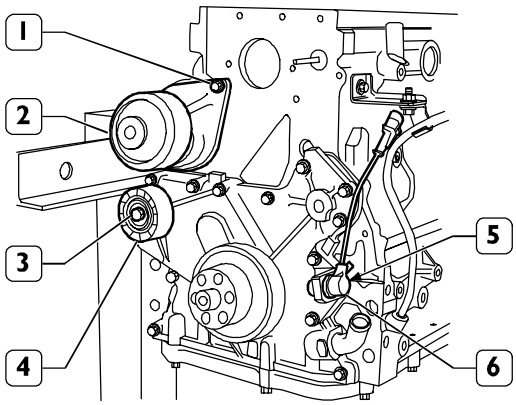
Figure 22




74175

Remove the screws (3) and disassemble the damping flywheel (2) and the pulley (1).

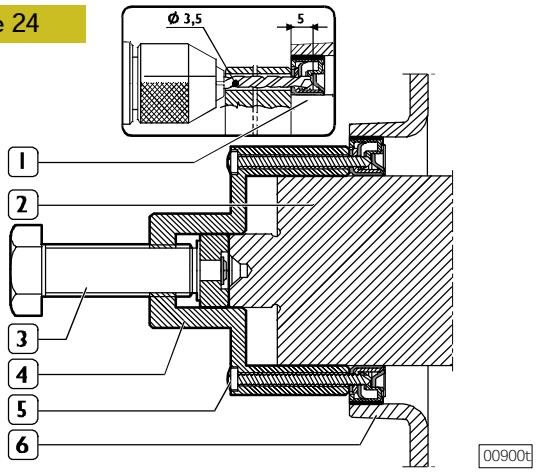
Figure 23




70148

Remove the screws (1) and disconnect the water pump (2).
Remove the screw (3) and the roller (4).
Remove the screw (5) and disconnect the engine speed sensor (6).

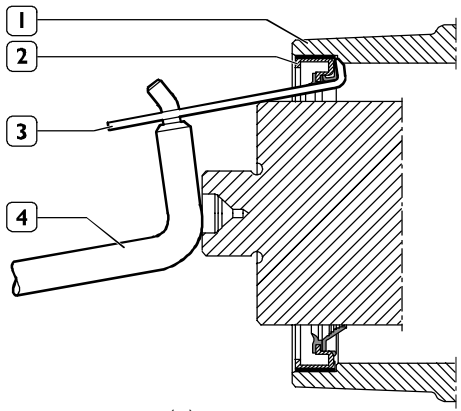
Figure 24




00900t

Remove the ring sealing the engine's driving shaft from the front cover. Use the tool 99340055 (4) to operate on the front bar hold of the driving shaft. Through the steering holes of the tool, perforate the inside holding ring (1) with a straight way drill (diam. 3,5mm) for the depth of 5mm. Fix the tool to the ring tightening the 6 screws provided with the equipment. Then proceed removing the ring (2) by tightening the screw (3).

Figure 25

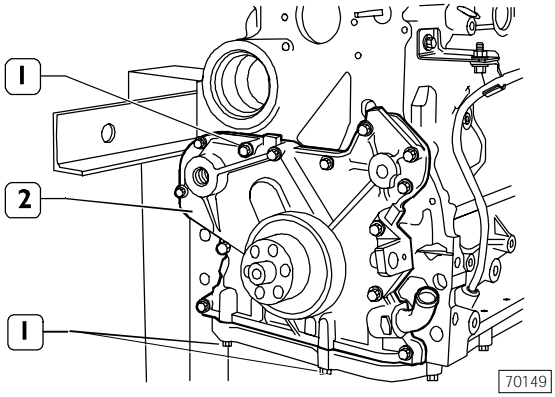



00904t

Using the specific tie rod (3) of the tool 99363204 and the ancillary lever (4), remove the external holding ring (2) from the front cover (1).

https://truckmanualshub.com/

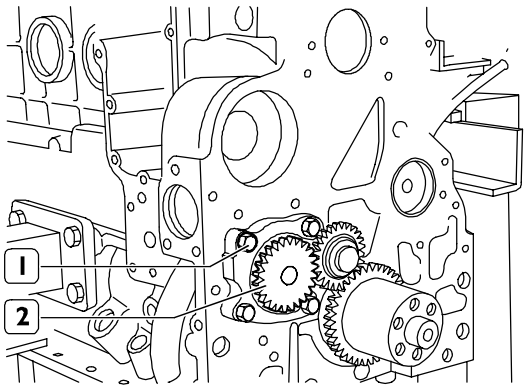

Figure 26




Remove the screws (1) and take out the front cover (2).

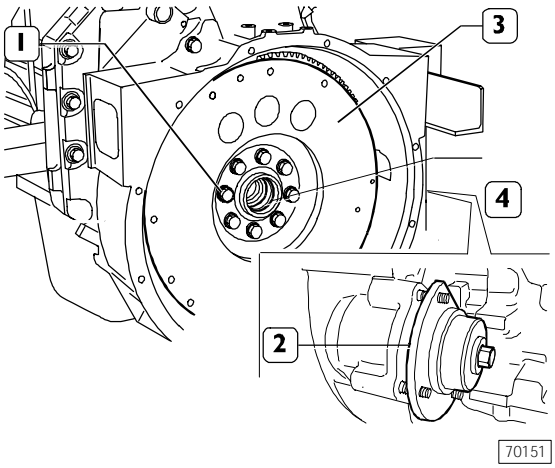
Take note of screw (1) assembling positions since they have different lengths.

Figure 27




Remove the screws (1) and disconnect the oil pump (2).

Figure 28

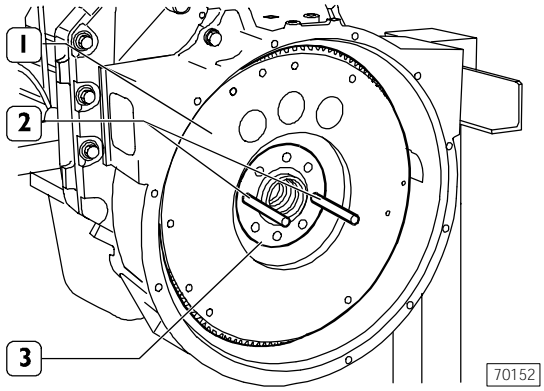



Remove two opposite screws (1) from the area where the withdrawal pins will be introduced (2, Picture 29).

Loosen the remaining flywheel fixing screws (3) from the driving shaft (4).

Remove the flywheel locking tool.

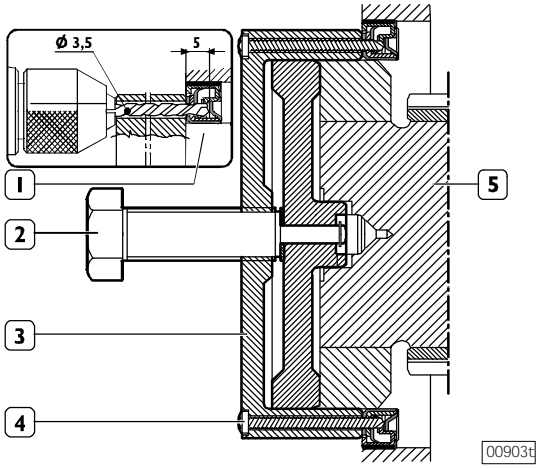
Figure 29




Tighten two screws of medium length into the holes (4) to sling the flywheel with the hoist.

Throughout the two guide pins (2) previously screw into the driving shaft holes (3) withdraw the engine flywheel (1) after slinging it with the hoist.

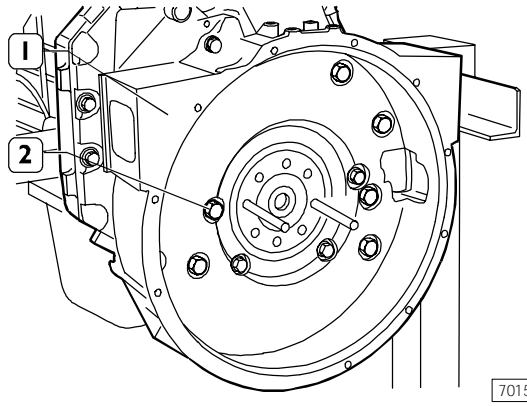
Figure 30




Remove the holding ring of the flywheel cover box using the tool 99340056 (3) to operate on the driving shaft's back bar hold (5).
Through the steering holes of the tool, perforate the inside holding ring with a straight way drill (diam. 3,5mm) for the depth of 5mm.
Fix the tool 99340056 (3) to the ring tightening the 6 screws provided with the equipment.(4)
Then proceed removing the ring (1) by tightening the screw (2).
Using a specific tie rod of the tool 99363204 and an ancillary lever, remove the external holding ring (2) from the front cover.

https://truckmanualshub.com/

Figure 31

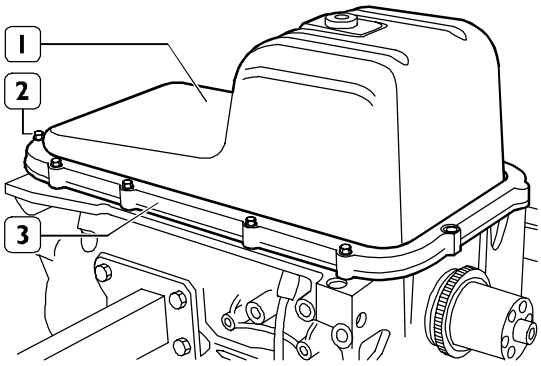



70153

Remove the screws (2) and take out the rear cover (1).

Take note of screw (2) assembling positions since they have different sizes.

Figure 32




70154

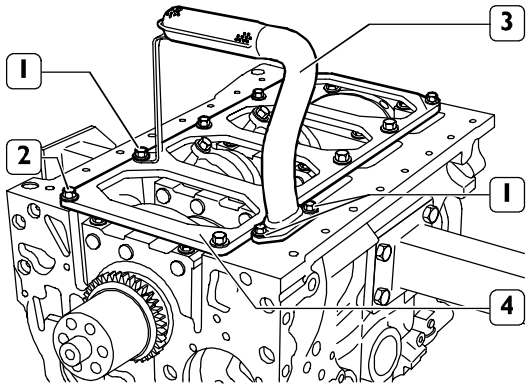
Overturn the engine.

Remove the screws (2), disassemble the plate (3) and disconnect the oil sump (1).

The shape and the dimensions of the oil pan and of the suction tube may vary according to the duty of the engine. The relevant pictures of the instructions are therefore providing an outline of the intervention to be executed.

However the procedures described are still applicable.

Figure 33

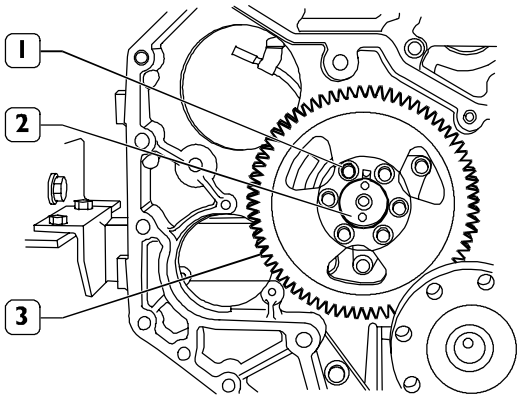



70155

Remove the screws (1) and disassemble the oil suction tube (3).

Remove the screws (2) and disassemble the stiffening plate (4).

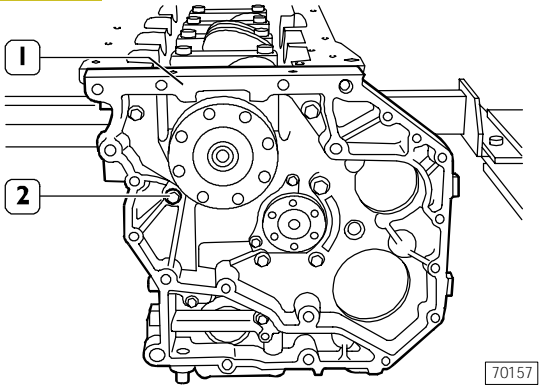
Figure 34




70156

Remove the screws (1) and remove the gear (3) from the camshaft (2).

Figure 35




70157

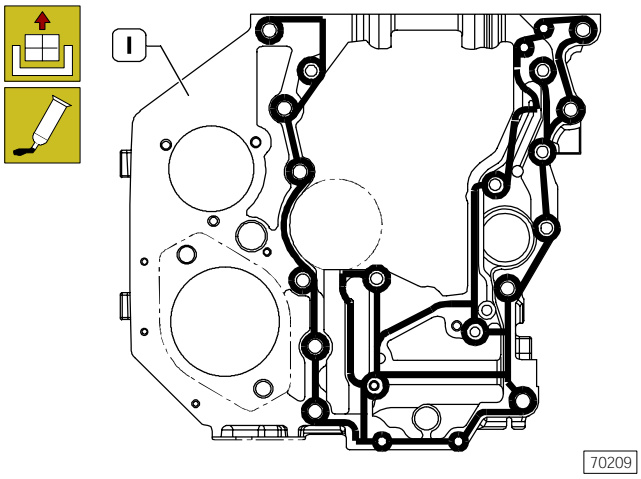
Remove the screws (2) and disconnect the timing gear case (1).

Take note of screw (2) assembling positions since they have different sizes.

https://truckmanualshub.com/


## Assembly of application components

Figure 36




LOCTITE 5205 SEALANT APPLICATION AREAS

Clean accurately the timing gear case (1) and the engine block.

Perfect seal is only obtained by cleaning accurately the surface to seal.

Smear the case with LOCTITE 5205 to obtain a bead of few mm diameter.

It shall be uniform (no clots), without air bubbles, thin areas or discontinuities.

Any imperfection shall be corrected as soon as possible.

Avoid to use excess material to seal the joint.

Excessive sealant could come out from joint sides and cause lubricant passage clogging.

After applying the sealant, the joint shall be assembled immediately (10 –20 minutes).

Figure 37

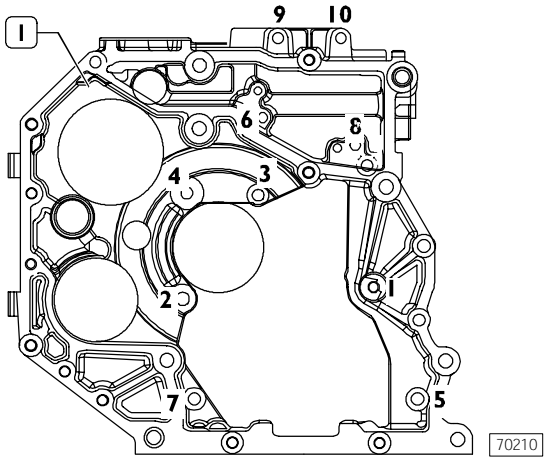


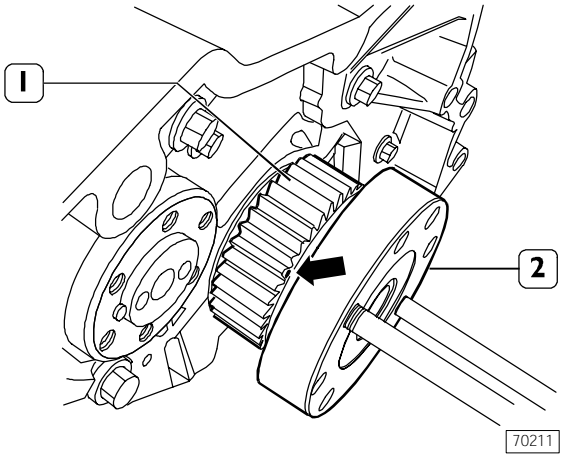

DIAGRAM FOR TIGHTENING THE REAR TIMING GEAR CASE FASTENING SCREWS

Refit the case (1) to the engine block.
Screw the fastening screws in the same position found at removal and tighten them to the following torque values in the sequence shown in the figure:

| | |
|---|---|
| Screws M12 | 65 to 89 Nm |
| Screws M8 | 20 to 28 Nm |
| Screws M10 | 42 to 52 Nm |

Before any assembly operation always verify that the hole and screw threads have no evidence of wear or dirt.

Figure 38

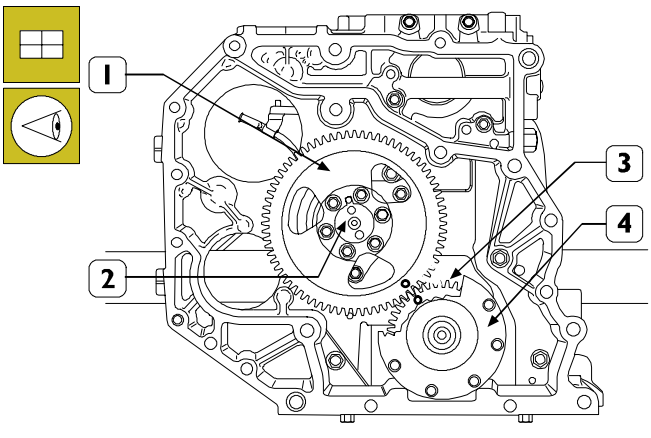



Use a felt pen to mark the driving gear (1) tooth fitted on the output shaft (2) having the mark (→) for timing on the side surface.

Fasten screwing of the two pins to facilitate the operation of engine driving shaft rotation.

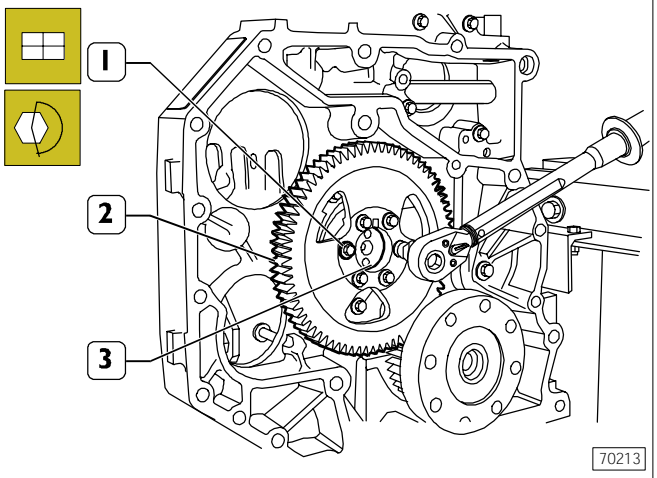
https://truckmanualshub.com/

Figure 39



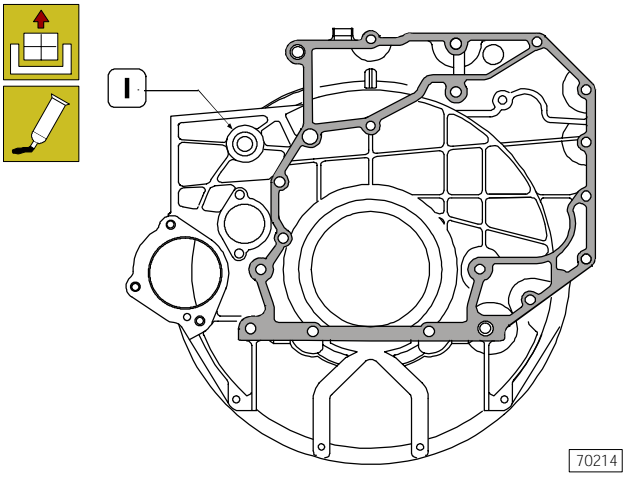

Rotate the output shaft (4) and the camshaft (2) so that when fitting the driven gear (1) on the camshaft the marks on the gears (1 and 3) are coinciding.

Figure 40




Tighten the screws (1) fastening gear (2) to camshaft (3) to the specified torque.

Figure 41




LOCTITE 5205 SEALANT APPLICATION AREAS

Perfect seal is only obtained by cleaning accurately the surface to seal.

Smear the case with LOCTITE 5205 to obtain a bead of few mm diameter.

It shall be uniform (no clots), without air bubbles, thin areas or discontinuities.

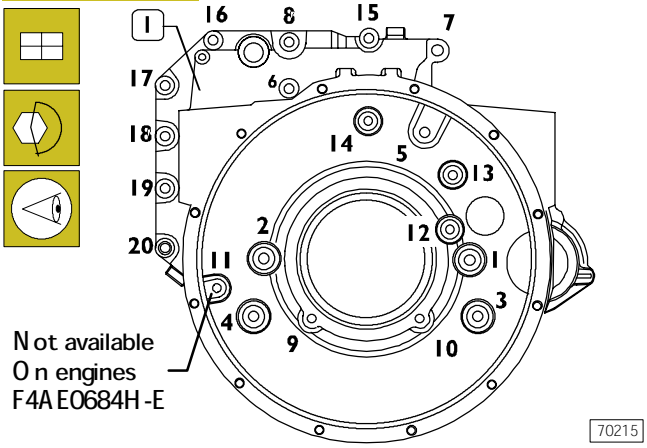
Any imperfection shall be corrected as soon as possible.

Avoid to use excess material to seal the joint.

Excessive sealant could come out from joint sides and cause lubricant passage clogging.

After applying the sealant, the joint shall be assembled immediately (10 —20 minutes).

Figure 42



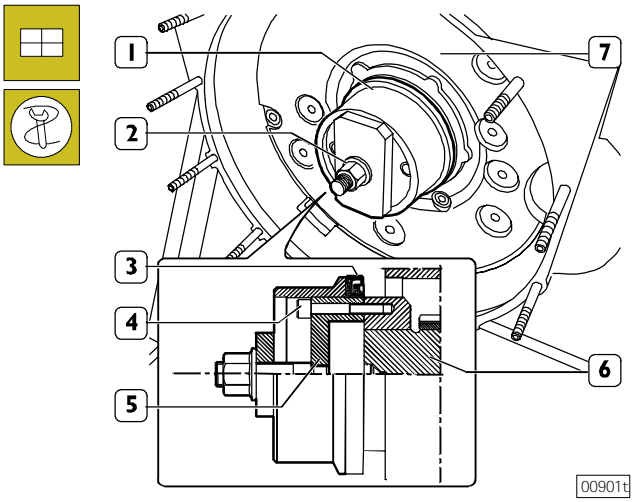

SEQUENCE FOR TIGHTENING THE FLYWHEEL HOUSING FASTENING SCREWS

Refit the housing (1) to the engine block and screw the fastening screws in the same position found at removal and tighten them to the following torque values in the sequence shown in the figure:

Screws M12 75 to 95 Nm
Screws M10 44 to 53 Nm

Before any assembly operation always verify that the hole and screw threads have no evidence of wear or dirt.

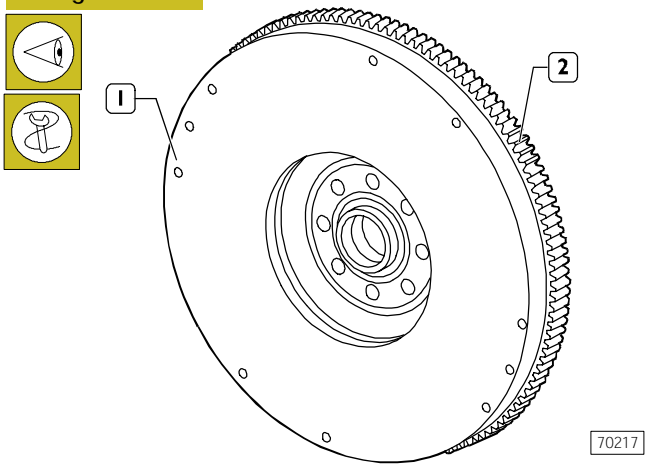
Figure 43




Apply tool 99346252 part (6) to the rear output shaft tang (5), secure it by screws (4) and fit the new sealing ring (3).

Position part (1) on part (5), screw nut (2) until completing sealing ring (3) fitting into flywheel housing (7).

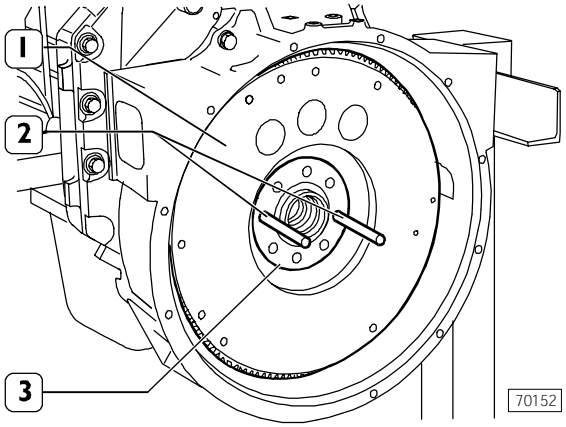
Figure 44




Where the engine is coupled to a mechanical clutch, verify that the flywheel nominal thickness of 49,6 ± 0,13 mm.

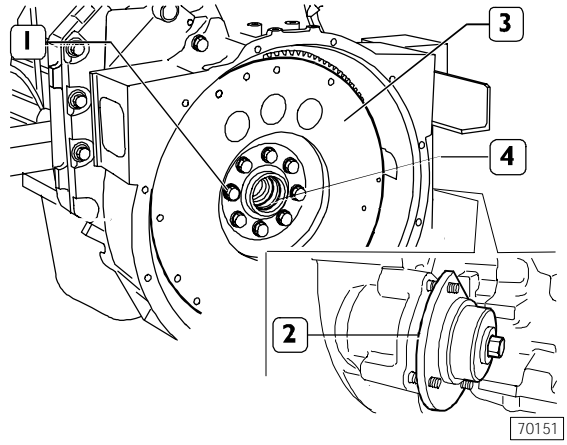
Check ring gear teeth (2), if breakage or excessive wear is found remove the ring gear from the engine flywheel (1, Figure 43) using a suitable hammer and fit the new one, previously heated to 150°C for 15 to 20 minutes. Chamfering on ring gear inside diameter shall be facing the engine flywheel.

Figure 45



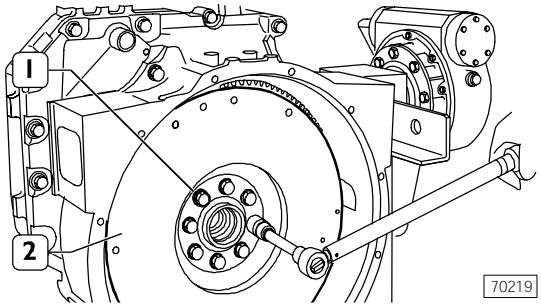

Screw two pins (2) having suitable length into shaft holes (3) and remove the engine flywheel (1) using proper sling and hoister.

Figure 46




Apply tool 99360339 (2) to the flywheel housing to stop engine flywheel (3) rotation. Tighten the screws (1) fastening the engine flywheel (3) to the output shaft.

Figure 47



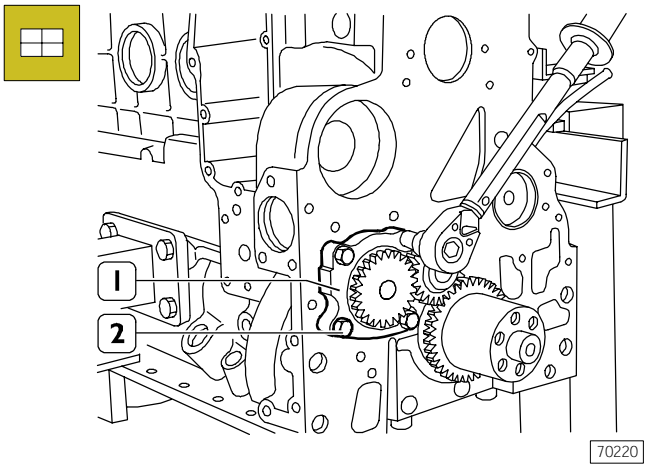

Tighten engine flywheel (2) fastening screws (1) in two stages:

- 1st stage, tightening to 30 ± 4 Nm torque with dynamometric wrench;
- 2nd stage, tightening to 60° ± 5° angle.

Tightening to angle is performed using tool 99395216.
Before any assembly operation always verify that the hole and screw threads have no evidence of wear or dirt.

https://truckmanualshub.com/

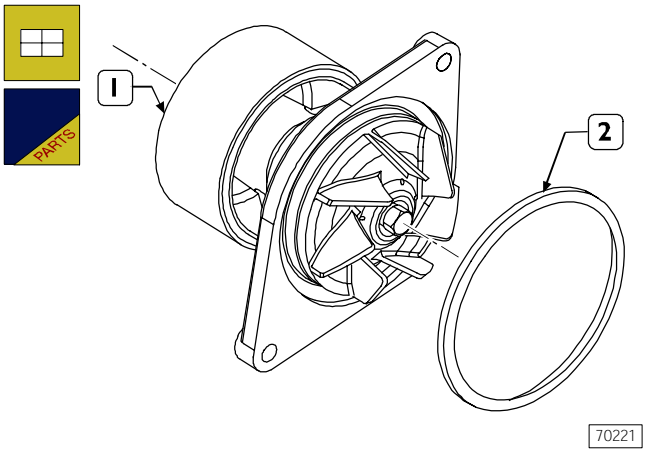
Figure 48




Fit the oil pump (1).

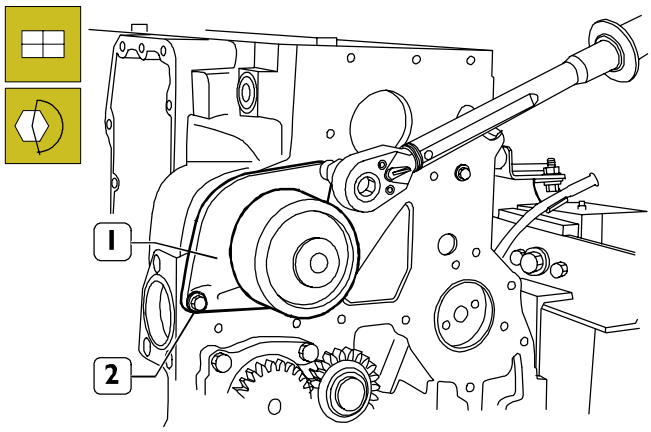
Tighten the fastening screws (2) to the specified torque.

Figure 49




Apply a new sealing ring (2) to the water pump (1).

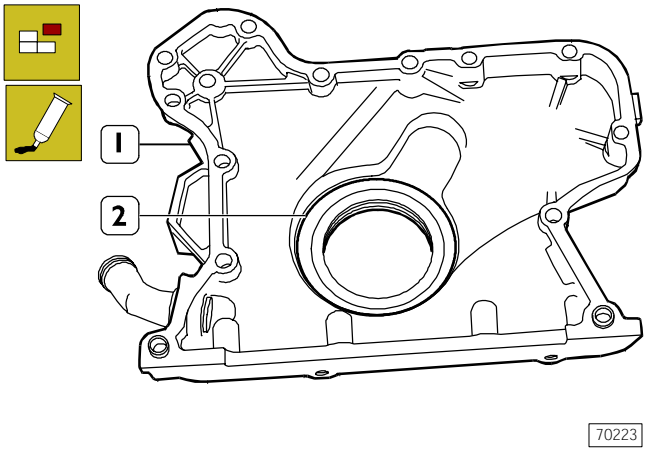
Figure 50




Fit the water pump (1).

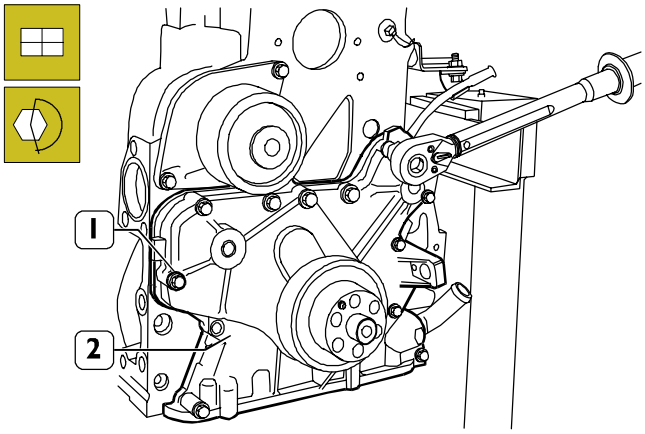
Tighten the screws (2) to the specified torque.

Figure 51



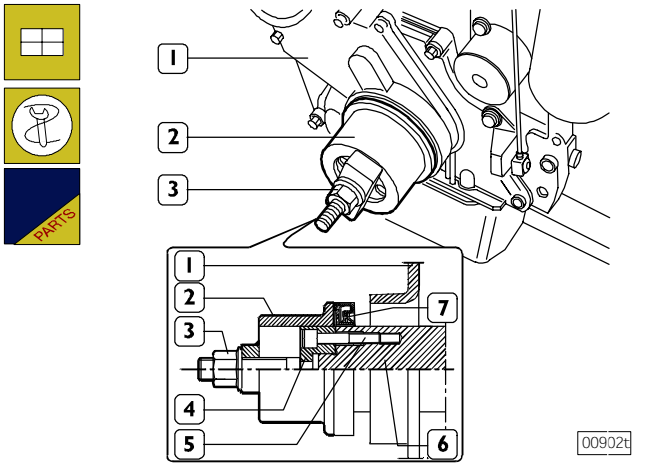

Remove the sealing ring (2) from the front cover (1), clean accurately the coupling surfaces and smear them with LOCTITE 5205.

Figure 52




Clean accurately the front cover (2) surface and refit it. Tighten the screws (1) to the specified torque.

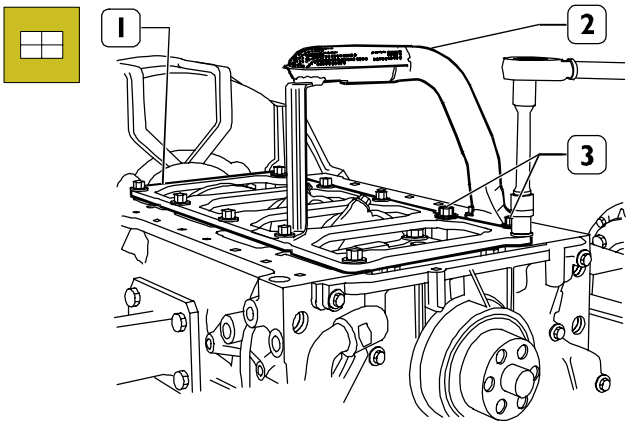
Figure 53




Apply tool 99346252 part (4) to the front output shaft tang (6), secure it by screws (5) and fit the new sealing ring (7). Position part (2) on part (4), screw nut (3) until completing sealing ring (7) fitting into front cover (1).

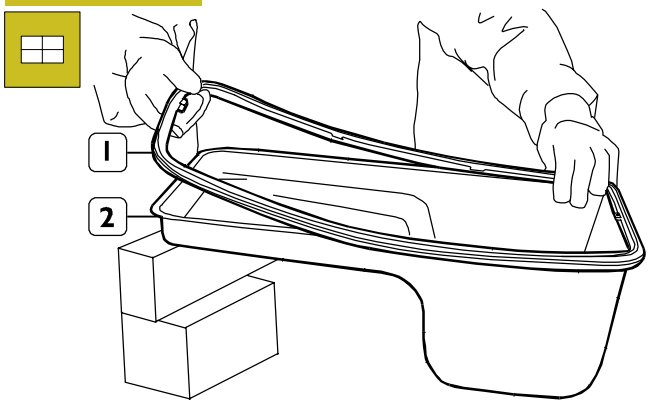
https://truckmanualshub.com/


Figure 54




Fit the plate (1), the oil pick up tube (2) and tighten the fastening screws (3) to the specified torque.

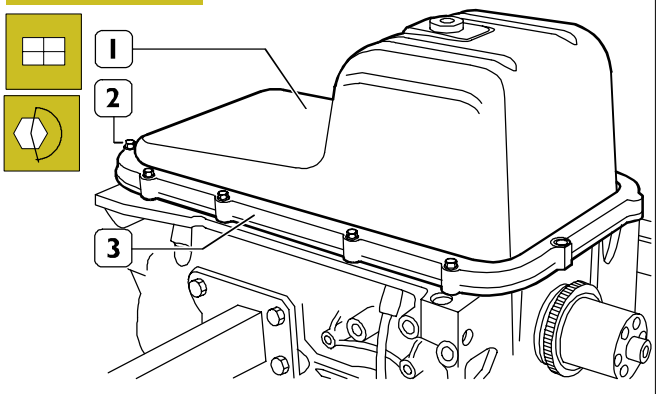
Figure 55




Set the gasket (1) on the oil sump (2).

The pictures of the instructions relating to the oil pan and to thesuction rose may not reflect the actual shape and dimensions of your engine equipment. However the procedures described are still applicable.

Figure 56

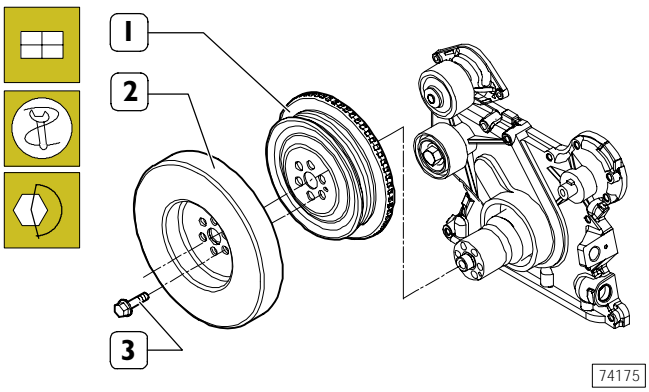



70154

Fit the oil sump (1) and apply the plate (3) to it. Tighten the screws (2) to the specified torque.

Before any assembly operation always verify that the hole and screw threads have no evidence of wear or dirt.

Figure 57

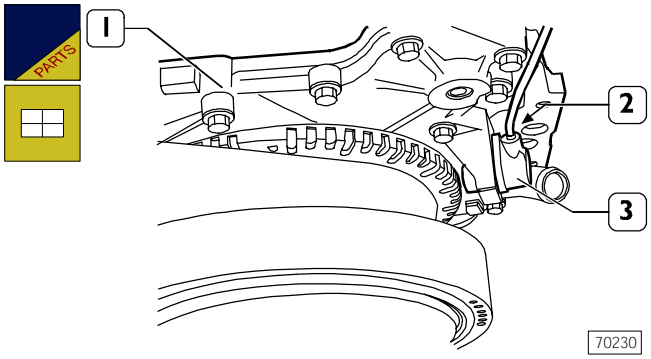



74175

Assemble the pulley (1) and the damping flywheel (2) to the driving shaft.

Tighten the fixing screws (3) and clamp them to the couple 68 ± 7 Nm.

Figure 58

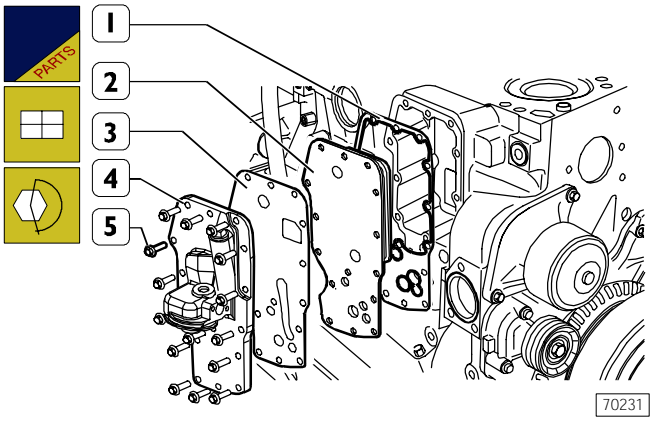



70230

Fit a new sealing ring on the speed sensor (3).

Fit the speed sensor (3) on the front cover (1) and tighten the screw (2) to the specified torque.

Figure 59




70231

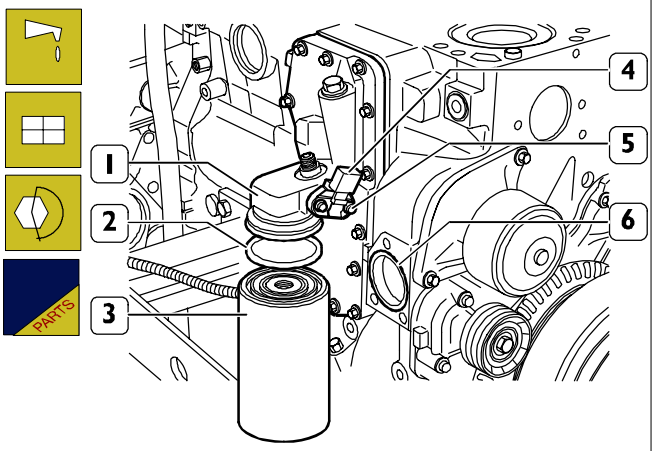
Fit on the engine block: a new gasket (1), the heat exchanger (2) a new gasket (3) and the oil filter support (4).

Tighten the screws (5) to the specified torque.

Before any assembly operation always verify that the hole and screw threads have no evidence of wear or dirt.

https://truckmanualshub.com/

Figure 60




Lubricate the sealing ring (2) with engine oil and set it on the oil filter (3).

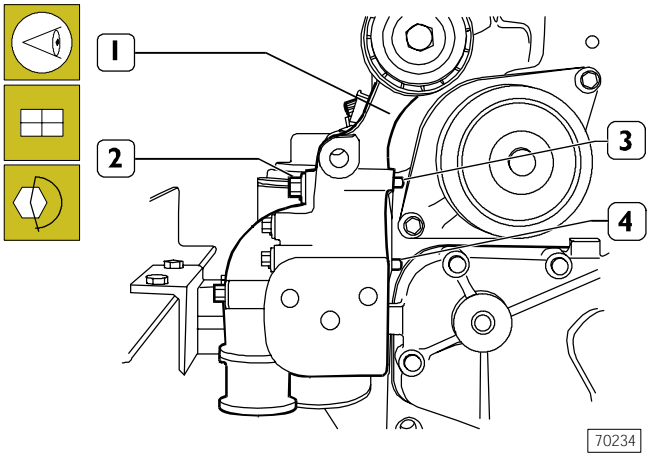
Screw manually to seat the oil filter (3) on the support connection (1) and then screw again the oil filter (3) by ¾ turn.

Apply a new sealing ring on the oil temperature/pressure sensor (4) and fit it on the support (1).

Tighten the screws (5) to the specified torque.

Fit a new sealing ring (6) in the engine block seat.

Figure 61

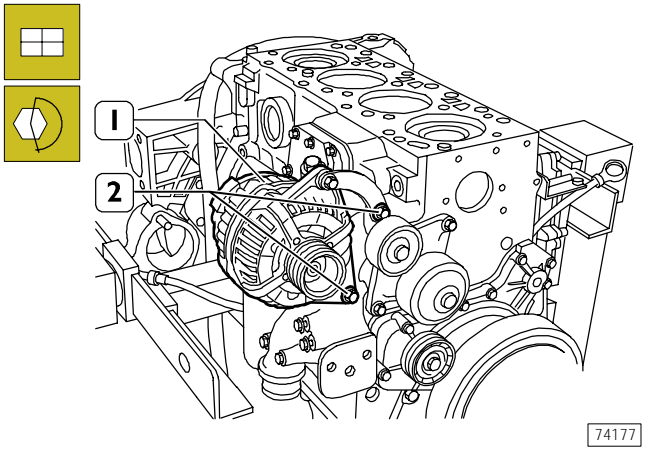



Position the alternator support (1) so that pins (3 and 4) are set against the engine block.

Tighten the screws (2) to the specified torque.

Before any assembly operation always verify that the hole and screw threads have no evidence of wear or dirt.

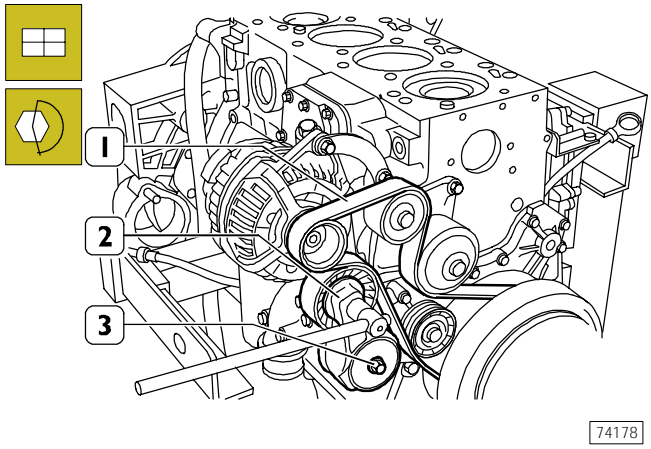
Figure 62




Refit the alternator (1).

Tighten the screw (2) to the specified torque.

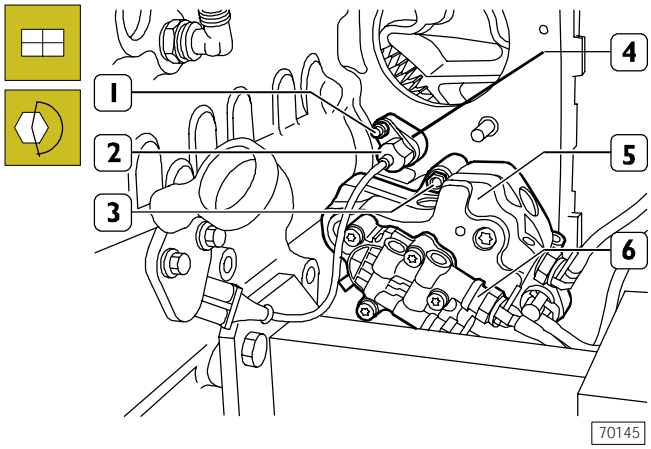
Figure 63




Refit the automatic belt tensioner (2).

Tighten the screw (3) to the specified torque using a wrench, turn the automatic belt tensioner (2) to fit the belt (1) on pulleys and guide rollers.

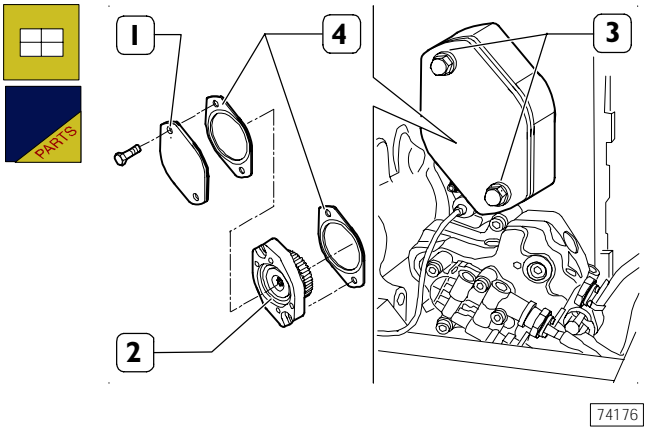
Figure 64




Refit the high pressure pump (6) including the feed pump (5) and tighten the nuts (3) to the specified torque. Fit the support (4) with a new sealing ring, the timing sensor (2) with a new sealing ring and tighten the relevant fastening nut (1) to the specified torque.

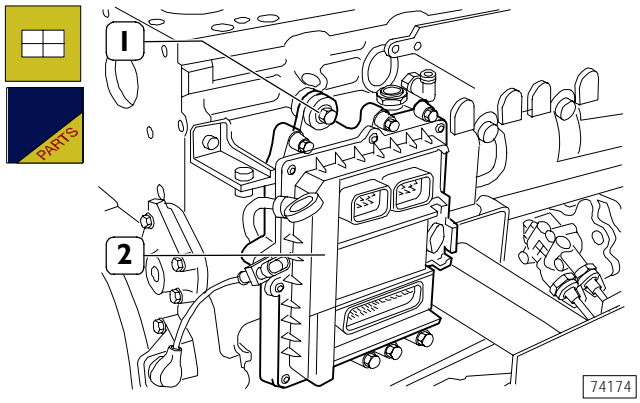
https://truckmanualshub.com/


Figure 66



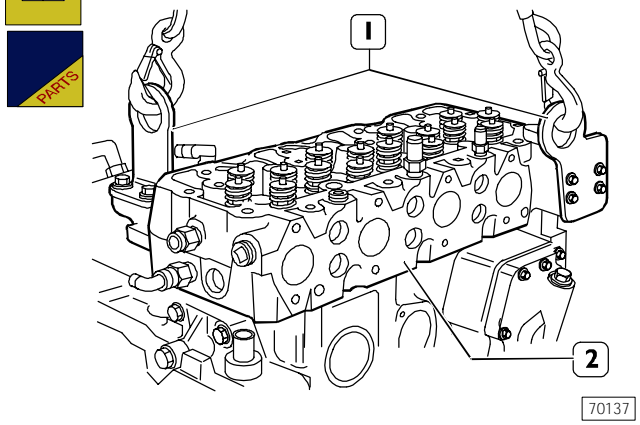

Insert the power take-off (2) equipped with the gasket (4), the cover (I) and its gasket (4).
Tighten the screws (3) to the prescribed matching couple.

Figure 67



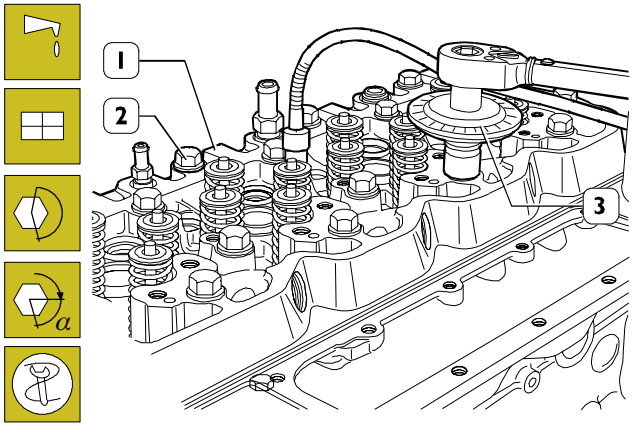

Assemble the electronic gearbox (2) equipped with the exchanger to the engine, fixing it with the screws (1).
In case the rubber buffers are cracked or excessively deformed, provide replacing them.

Figure 68




Apply a new gasket to the engine block and then place the cylinder head (2) slung by the hanger brackets (1).

Figure 69

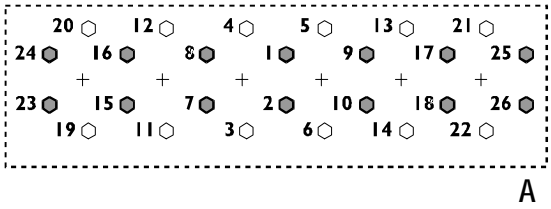



Assemble cylinder head (1), tighten the screws (2) in three following steps, following order and mode shown in the figure below.

The angle tightening is carried out through tool 99395216 (3).

Before any assembly operation always verify that the hole and screw threads have no evidence of wear or dirt.

Figure 65




6-cylinder engine

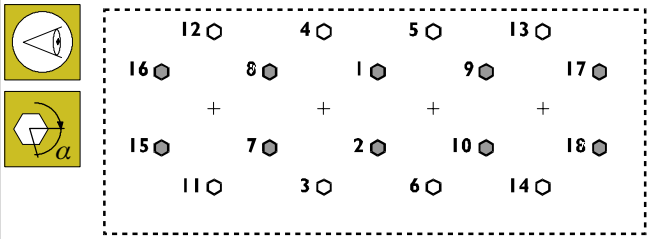
Tightening order layout for cylinder head fastening screws:

- ❑ 1st step pre-tightening with a torque wrench:
  - Screw 12x1.75x130 ( ⬢ ) 35 ± 5 Nm
  - A • Screw 12x1.75 x 150 ( ⬡ ) 55 ± 5 Nm
- ❑ 2nd step tightening with a 90° ± 5° angle
- ❑ 3rd step tightening with a 90° ± 5° angle

A = Front side

https://truckmanualshub.com/

Figure 70




4-cylinder engine A

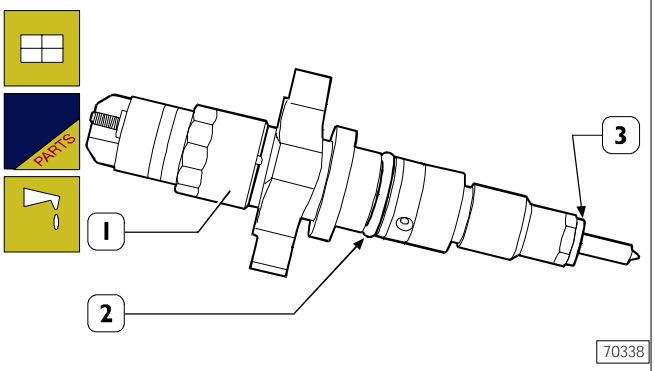
70337

Cylinder head fastening screws tightening sequence:

- ❑ 1st stage pre-tightening, with a torque wrench:
  - Screw 12x1.75x130 ( ⬢ ) 35 ± 5 N m
  - Screw12x1.75 x 150 ( ⬡ ) 55 ± 5 N m

  A = Front side
- ❑ 2nd stage tightening with angle 90° ± 5°
- ❑ 3rd stage tightening with angle 90° ± 5°

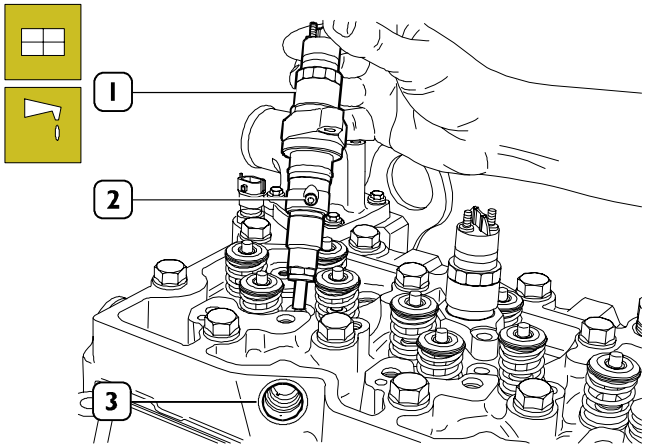
Figure 71




70338

Fit a new sealing ring (2) lubricated with petroleum jelly and a new sealing washer (3) on injector (1).

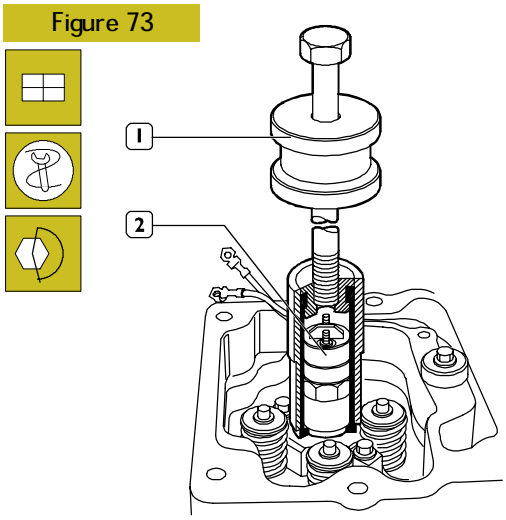
Figure 72




70339

Fit injectors (1) on the cylinder head seats, directed so that the fuel inlet hole (2) is facing the fuel manifold seat (3) side.

Figure 73



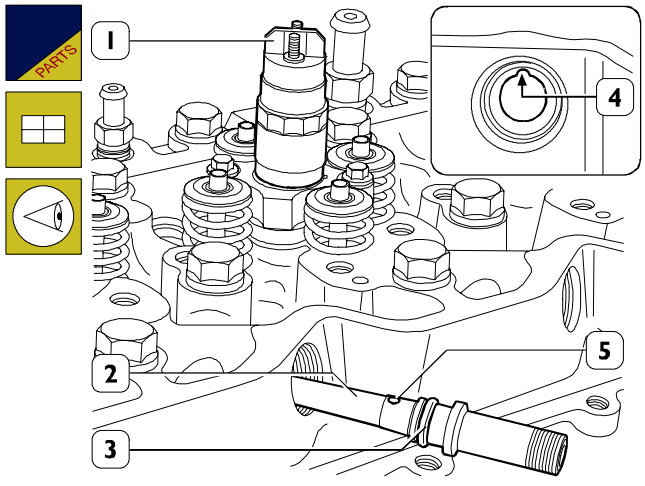

70133

Use tool 99342101 (1) to fit the injector (2) into its seat.

Screw injector fastening screws without tightening them.

https://truckmanualshub.com/


Figure 74



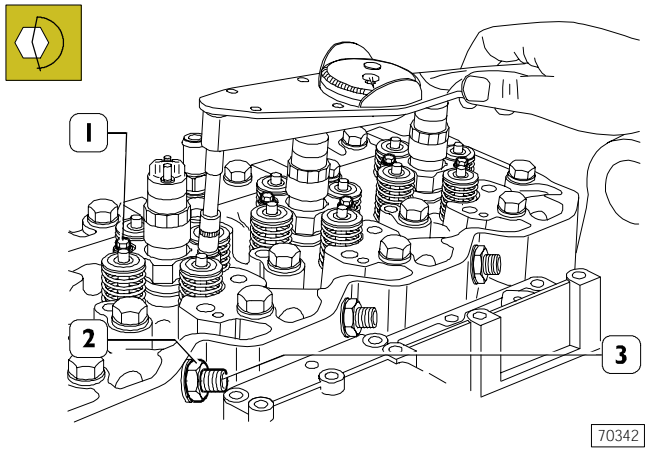

Fit a new sealing ring (3) lubricated with petroleum jelly on the fuel manifold (2) and fit it into the cylinder head seat so that the positioning ball (5) is coinciding with the relevant housing (4).

Disassembled fuel manifolds (2) must not be used again. Replace with new items.

Screw the fastening nuts (2, Figure 75) without locking them.

During this operation, the injector (1) shall be moved so that the manifold (2) is properly inserted into the fuel inlet hole (2, Figure 72).

Figure 75

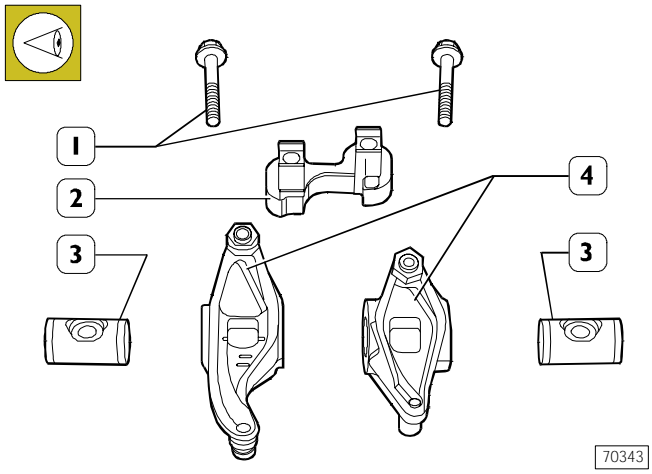



Use the torque wrench to tighten gradually and alternately the injector fastening screws (1) to 8.5 ± 0.8 N m torque.

Tighten the fuel manifold (3) fastening nuts (2) to 50 N m torque.

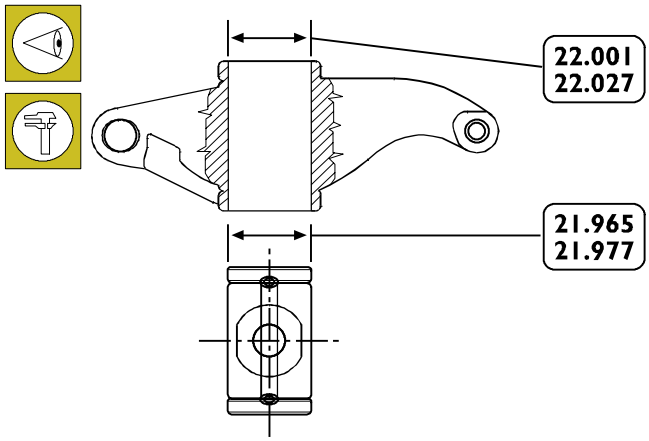
Carry out the assembly of the equalisers' unit, after previous check of the components.

Figure 76




ROCKER ASSEMBLY COMPONENTS:
1. Screws - 2. Bracket - 3. Shafts - 4. Rockers.

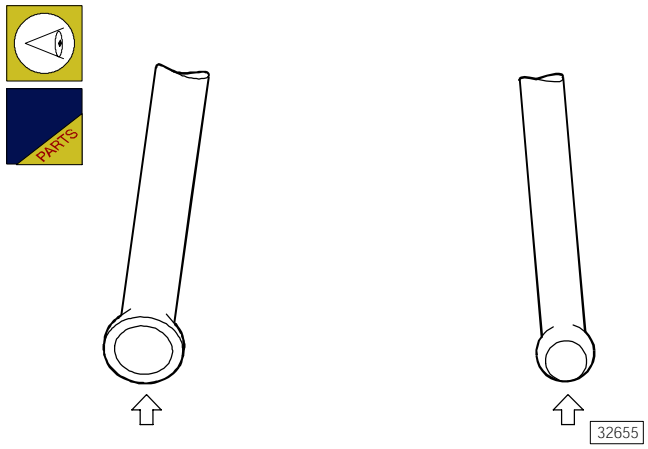
Figure 77




SHAFT-ROCKER MAIN DATA

Check that shaft/rocker coupling surfaces are not showing excessive wear or damages.

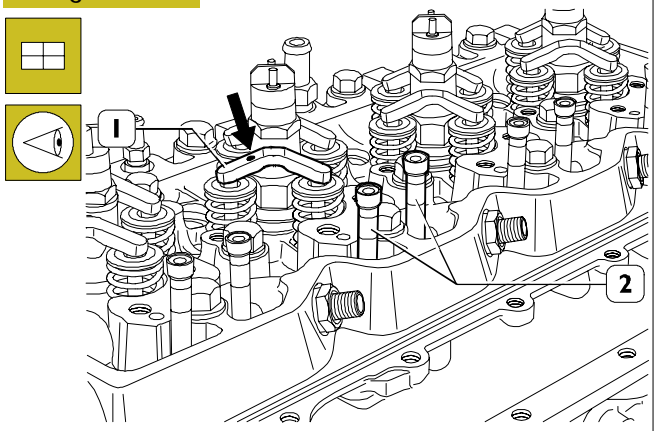
Figure 78




Rocker control rods shall not be distorted; the ball seats in touch with the rocker adjusting screw and with tappets (arrows) shall not show seizing or wear; otherwise replace them. Intake and exhaust valve control rods are identical and are therefore interchangeable.

https://truckmanualshub.com/


Figure 79

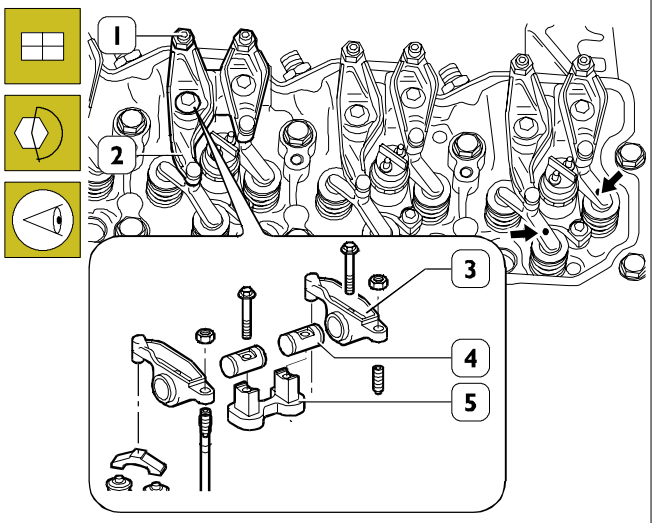



70345

Fit the rods (2).

Position jumpers (1) on valves with marks (→) facing the exhaust manifold.

Figure 80

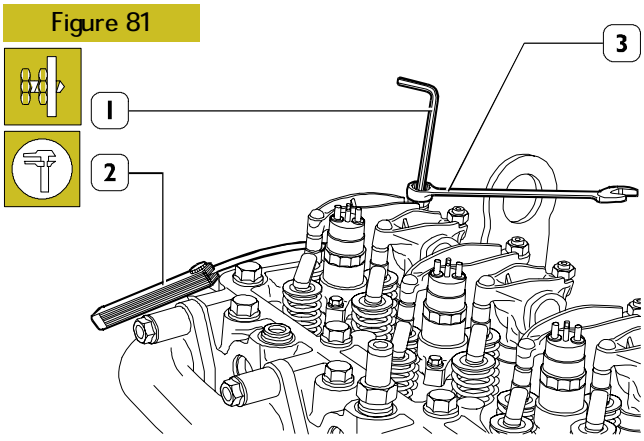



70346

Check that tappet adjusters (1) are loose to prevent their balking on the rods (2, Figure 79) when refitting the rocker assembly.

Then refit the rocker assembly consisting of: bracket (5), rockers (3), shafts (4) and secure them to the cylinder head by tightening the fastening screws (2) to 36 N m torque.

Figure 81




70520

Adjust clearance between rockers and valves using setscrew wrench (1), box wrench (3) and feeler gauge (2).

Working clearance shall be as follows:

- intake valves 0.25 ± 0.05 mm
- exhaust valves 0.51 ± 0.05 mm.

In order to more quickly perform the operating clearance adjustment for rocker arms — valves, proceed as follows:

rotate the drive shaft, balance cylinder 1 valves and adjust the valves marked by the asterisk as shown in the table:

| cylinder n. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| intake | - | - | * | - | * | * |
| exhaust | - | * | - | * | - | * |

Rotate the drive shaft, balance cylinder 6 valves and adjust the valves marked by the asterisk as shown in the table:

| cylinder n. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| intake | * | * | - | * | - | - |
| exhaust | * | - | * | - | * | - |

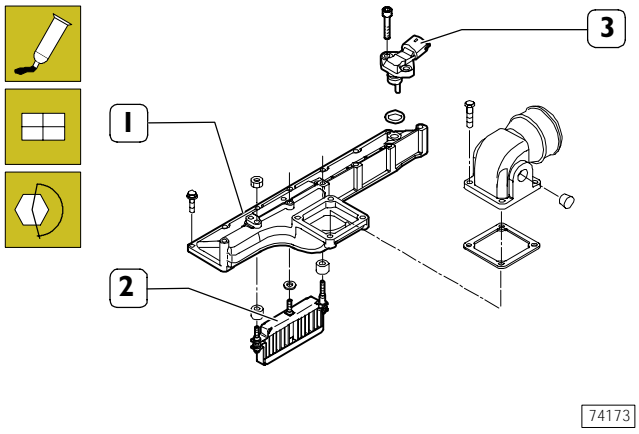
Engine with 4 cylinder: rotate the drive shaft, balance cylinder 1 valves and adjust the valves marked by the asterisk as shown in the table:

| cylinder n. | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| intake | - | * | * | * |
| exhaust | - | - | - | * |

Rotate the drive shaft, balance cylinder 4 valves and adjust the valves marked by the asterisk as shown in the table:

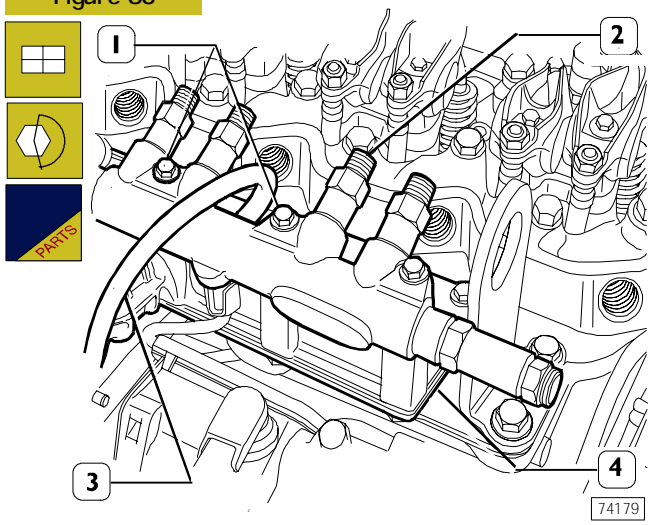
| cylinder n. | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| intake | * | - | - | - |
| exhaust | * | * | * | - |

Figure 82



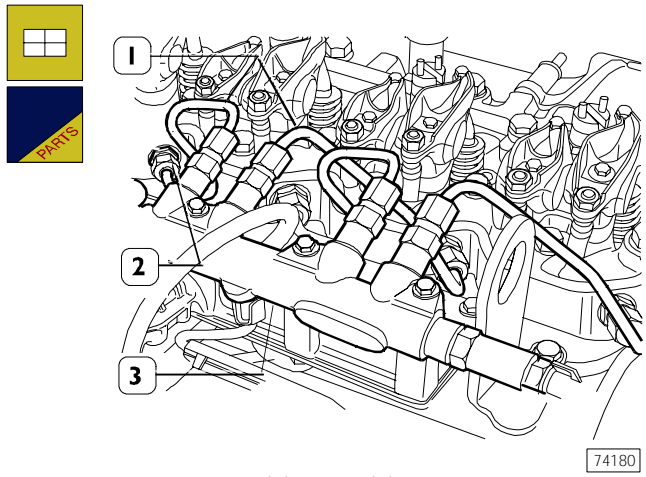

Apply to the coupling surface of the intake manifold (1) equipped with heater (2) a sufficient coat of LOCTITE 5999 and provide tightening the screws to the prescribed matching couple.

Figure 83



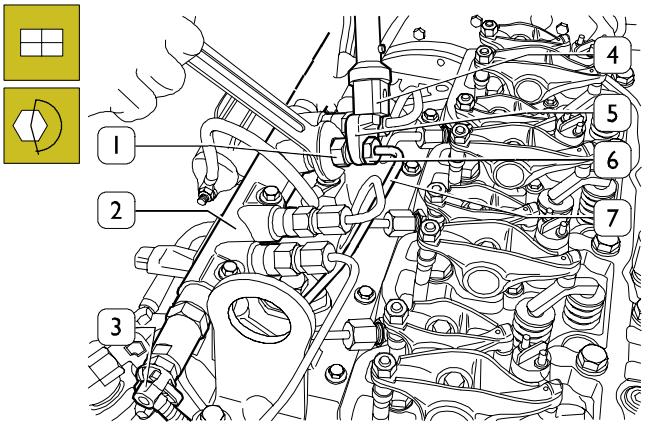

Fit the rail (2) and tighten the screws (1) to the specified torque, connect the ground cable (3) to the intake manifold (4) and tighten the fastening nut to the specified torque.

Figure 84




Connect new fuel pipes (1) to rail (3) and injector manifolds (2).

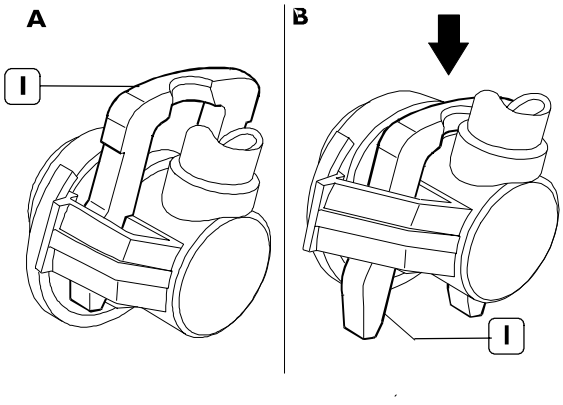
Figure 85




Pipe (7) connections shall be tightened to 20 Nm torque, using the proper wrench (5) and the torque wrench 99389833 (4).
Connections (6) shall be tightened by holding the flow limiting valve hexagon (1) with the proper wrench.

Connect the fuel pipe (3) to the rail (2) following the procedure shown in the following figure.

Figure 86

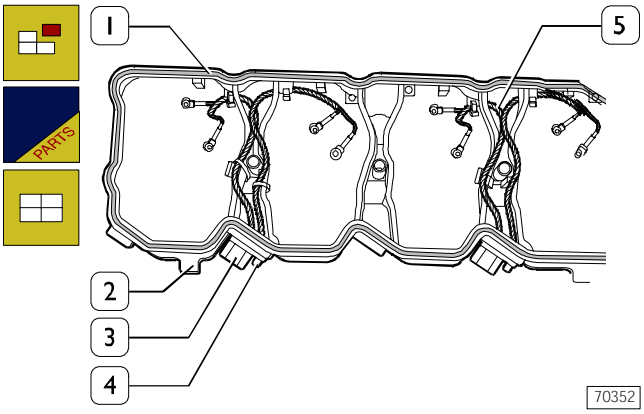



Press the clamp (1) in arrow direction (Figure B) and connect the pipe to the rail, reset the clamp to the initial locking position "A".

Check proper fuel pipe connection.

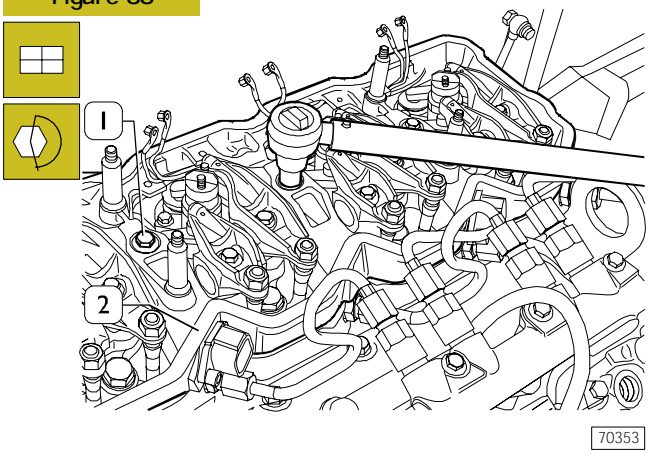
https://truckmanualshub.com/

Figure 87




Check electrical cable (5) conditions, replace if damaged by cutting the support (2) clamps and removing the screws (4) that secure it to connections (3).
Fit a new gasket (1) on the support (2).

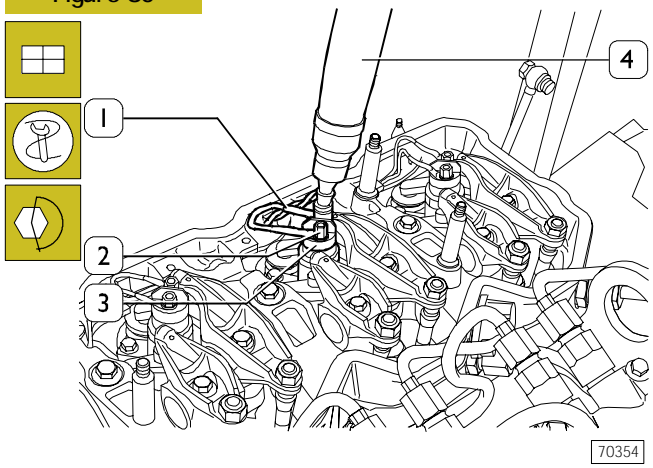
Figure 88




Fit the wiring support (2) and tighten the screws (1) to the specified torque.

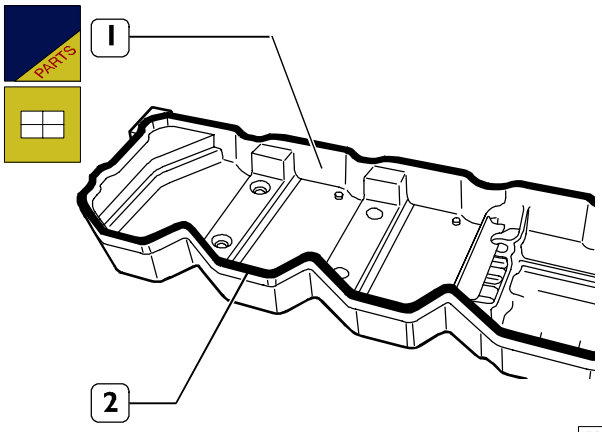
Before any assembly operation always verify that the hole and screw threads have no evidence of wear or dirt.

Figure 89




Connect the electrical cables (1) to the injectors (3) and use the torque wrench 99389834 (4) to tighten the fastening nuts (2) to the specified torque.

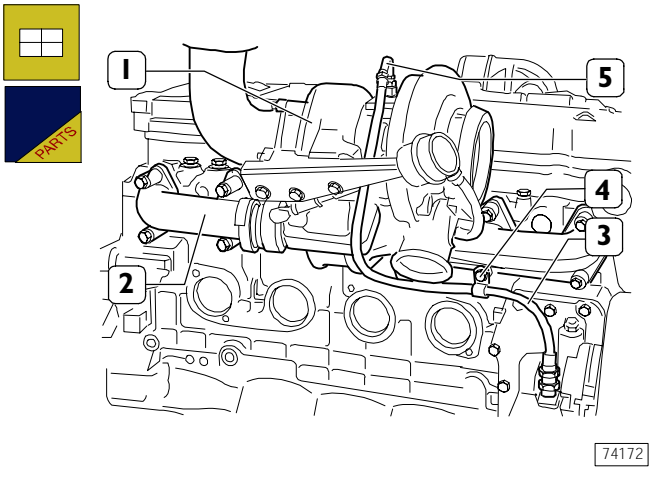
Figure 90




Fit a new gasket (2) on the tappet cover (1).

Place the tappet cover on, install the bolts in the correct position and tighten.

Figure 91



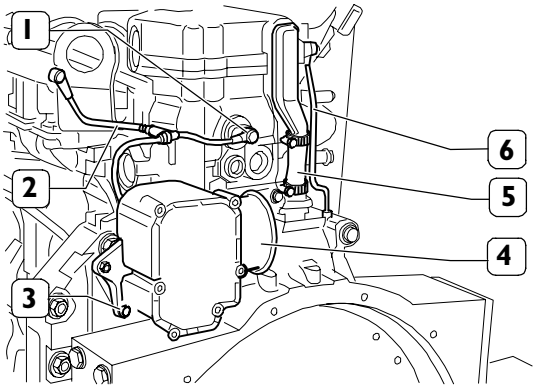

Reconnect the exhaust manifold (2) with new gaskets. Tighten the fastening screws (1) to the specified torque.

Sling the turbocharger (1) and place it over the manifold after having first inserted a new gasket.

Connect the oil pipeline (3) to the support of the heat exchanger /oil filter. Fix the pipe (3) to the pipe fitting on the turbocharger through the clamp (4) and the screw locking to the block.

https://truckmanualshub.com/


Figure 92




Insert the blow-by filter (4) tightening the screws.

Connect the pipeline (6) and fix the oil vapour recover pipe through the clamp (5); lock up the nut fixing it to the upper edge.

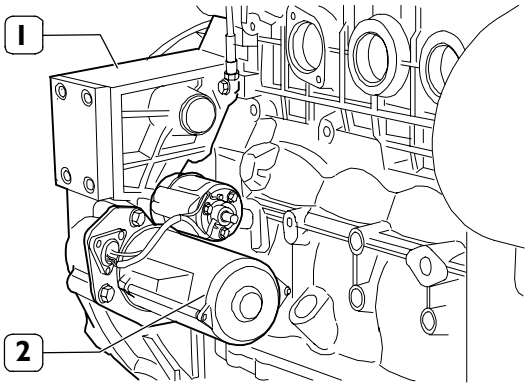
Connect the pipeline (2) to the pressure- limiter (1).

## Completion of the engine

Properly handle the engine holding it by a lifter, remove it from the rotating shaft, remove the brackets 99341009 and place it on proper suitable support to carry out the completion.

Proceed assembling the oil filter.

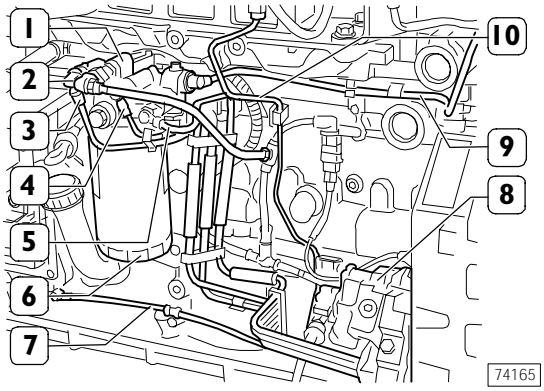
Figure 93




Assemble the starter (2) to the internal part of the flywheel cover.

Assemble the oil feeding pipe using a new O-ring. Fix with three M12x25 screws.

Figure 94



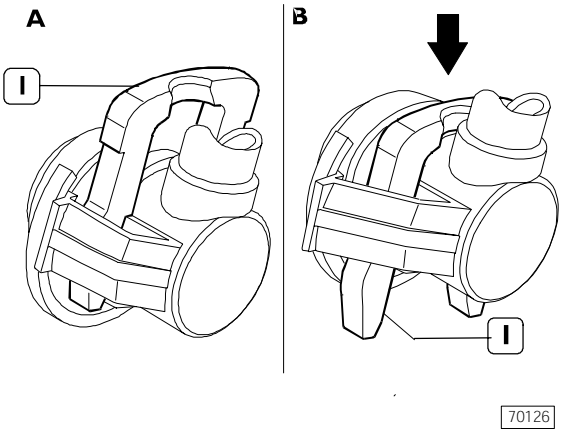

Assemble the bracket and the support (1) of the fuel filter (6).

Proceed connecting in sequence the pipelines (9,3,4 and 5) of the support (1) to the high pressure pump (8).

Connect the pipeline (7) from the high pressure pump to the engine control module heat exchanger.

Connect the pipeline (10) from the high pressure pump to the rail diffuser.

Figure 95




All the fuel pipelines are fixed using the clamps shown in the picture.

For the connection of the pipes, press the clamp (1) following the arrow's direction (Figure B) and connect the pipe to the clamp on the high pressure pump or on the support of the fuel filter.

Reset the clamp in the initial locking "A" position.

In case the pipes are re-employed, they must keep the sealing tops at the edges.
Make sure that the fuel pipeline is correctly connected.

Reconnect the engine harness to all the sensors, the engine control module and the rail diffuser (see Figure 6)

https://truckmanualshub.com/

## Checks and inspections



The following checking inspections must be carried out after the engine assembly on the vehicle .





Start the engine and leave it running just above the idling speed, wait until the coolant reaches the temperature necessary to open the thermostat and then check:

- ❑ that there are no water leaks from the connecting sleeves of engine cooling circuit pipes and cab internal heating pipes, tighten the clamping collars if required;
- ❑ check carefully the connection between the low pressure fuel pipes and the relevant connectors;
- ❑ that there are no oil leaks between the cover and the cylinder head, between oil sump and engine block, between heat exchanger oil filter and the relevant housings and between the different pipes in the lubricating circuit;
- ❑ that there are no fuel leaks from the fuel pipes;
- ❑ that there are no air leaks from pneumatic pipes (if fitted);
- ❑ check also proper operation of the warning lights set on the instrument panel and of the equipment disconnected when engine was removed.
- ❑ Carefully check and bleed the engine cooling equipment by repeated draining operations.

https://truckmanualshub.com/


## TIGHTENING TORQUE

| COMPONENT | TORQUE | |
|---|---|---|
| | Nm | kgm |
| Studs M6 for camshaft sensors | 8 ± 2 | 0.8 ± 0.2 |
| Studs M8 for feed pump | 12 ± 2 | 1.2 ± 0.2 |
| Screw M12 for fastening rear gear case | 77 ± 12 | 7.7 ± 1.2 |
| Screw M10 for fastening rear gear case | 47 ± 5 | 4.7 ± 0.5 |
| Screw M8 for fastening rear gear case | 24 ± 4 | 2.4 ± 0.4 |
| Nut M6 for fastening camshaft sensor | 10 ± 2 | 1 ± 0.2 |
| Screw M8 for fastening oil pump 1st stage | 8 ± 1 | 0.8 ± 0.1 |
| Screw M8 for fastening oil pump 2nd stage | 24 ± 4 | 2.4 ± 0.4 |
| Screw M8 for fastening front cover | 24 ± 4 | 2.4 ± 0.4 |
| Screw M8 for fastening camshaft longitudinal retaining plate | 24 ± 4 | 2.4 ± 0.4 |
| Screw M8 for fastening camshaft gear | 36 ± 4 | 3.6 ± 0.4 |
| Screw M10 for fastening crankcase plate | 43 ± 5 | 4.3 ± 0.4 |
| Nut M18 for fastening high pressure pump gear | 105 ± 5 | 10.5 ± 0.5 |
| Nuts M8 for fastening fuel pump | 24 ± 4 | 2,4 ± 0,4 |
| ½ inch plug on cylinder head | 24 ± 4 | 2.4 ± 0.4 |
| ¼ inch plug on cylinder head | 36 ± 5 | 3.6 ± 0.5 |
| ¾ inch plug on cylinder head | 12 ± 2 | 1.2 ± 0.2 |
| Screw M6 for fastening injectors | 8,5 ± 0,35 | 0.35 ± 0.035 |
| | 75° ± 5° | |
| Nut fastening for injector feed connector | 50 ± 5 | 5 ± 0.5 |
| Nut M6 for flame start grille on intake manifold | 8 ± 2 | 0.8 ± 0.2 |
| Screw M8 for fastening intake manifold | 24 ± 4 | 2.4 ± 0.4 |
| Screw M12 for fastening rear brackets for engine lifting | 77 ± 12 | 7.7 ± 1.2 |
| Screws M8 for fastening Common Rail | 24 ± 4 | 2.4 ± 0.4 |
| Connectors M14 for high pressure fuel pipes | 20 ± 2 | 2 ± 0.2 |
| Screw M12 (12 x 1.75 x 130) for fastening cylinder head } 1st stage | 35 ± 5 | 3.5 ± 0.5 |
| Screw M12 (12 x 1.75 x 150) for fastening cylinder head } 1st stage | 55 ± 5 | 5.5 ± 0.5 |
| 2nd stage | 90° ± 5° | |
| 3rd stage | 90° ± 5° | |
| Screw for fastening rocker bracket | 36 ± 5 | 3.6 ± 0.5 |
| Valve clearance adjusting nuts | 24 ± 4 | 2.4 ± 0.4 |
| Nuts M14 for fastening fuel pipes from high pressure pump to Common Rail | 20 ± 2 | 2 ± 0.2 |
| Screw M8 for fastening high pressure pipe connector | 24 ± 4 | 2.4 ± 0.4 |
| Screw M6 for fastening wiring bulkhead | 10 ± 2 | 1 ± 0.2 |
| Screw M8 for fastening electric wiring support for injector feed | 24 ± 4 | 2.4 ± 0.4 |
| Nuts for fastening wiring on each injector | 1,5 ± 0,25 | 0.15 ± 0.025 |
| Screw M12 for fastening fuel filter bracket | 77 ± 8 | 7.7 ± 0.8 |
| Screw M8 for fastening fuel filter holder | 24 ± 4 | 2.4 ± 0.4 |
| Fuel filter | contact + ¾ turn | |
| Screw M22 for fastening oil pressure relief valve on oil filter support | 80 ± 8 | 8 ± 0.8 |
| Screw M8 for radiator seal and oil filter support | 24 ± 4 | 2.4 ± 0.4 |
| Oil filter | contact + ¾ turn | |

https://truckmanualshub.com/

| COMPONENT | TORQUE | |
|---|---|---|
| | Nm | kgm |
| 11/8 inch connection on filter support for turbine lubrication | 24 ± 4 | 2.4 ± 0.4 |
| Nut M12 for fastening turbine lubrication pipe | 10 ± 2 | 1 ± 0.2 |
| Screw M10 for fastening engine coolant inlet connection | 43 ± 6 | 4.3 ± 0.6 |
| 90° elbow fastening (if required) to engine coolant inlet connection | 24 ± 4 | 2.4 ± 0.4 |
| Pipe on cylinder head for compressor cooling | 22 ± 2 | 2.2 ± 0.2 |
| Screw M6 for fastening engine coolant drain connector | 10 ± 2 | 1 ± 0.2 |
| Pin fastening on engine block for exhaust manifold | 10 ± 2 | 1 ± 0.2 |
| Screw M10 for fastening exhaust manifold on cylinder head | 53 ± 5 | 5.3 ± 0.5 |
| Screw M12 for fastening damper adapter and damper on output shaft — 1st stage | 50 ± 5 | 5 ± 0.5 |
| — 2nd stage | | 90° |
| Screw M10 for fastening pulley on output shaft | 68 ± 7 | 6.8 ± 0.7 |
| Screw M8 for fastening water pump | 24 ± 4 | 2.4 ± 0.4 |
| Screw M10 for fastening auxiliary component control belt tensioners | 43 ± 6 | 4.3 ± 0.6 |
| Screw M10 for fastening fixed pulleys for auxiliary component control belt | 43 ± 6 | 4.3 ± 0.6 |
| Screw M10 for fastening flywheel housing | 85 ± 10 | 8.5 ± 1 |
| Screw M12 for fastening flywheel housing | 49 ± 5 | 4.9 ± 0.5 |
| Screw M6 for fastening heat exchanger for control unit | 10 ± 2 | 1 ± 0.2 |
| Screw M8 for fastening heat exchanger for control unit | 24 ± 4 | 2.4 ± 0.4 |
| Connection M12 for fuel inlet-outlet on heat exchanger | 12 ± 2 | 1.2 ± 0.2 |
| Nut M8 for fastening valve cover | 24 ± 4 | 2.4 ± 0.4 |
| Screw M6 for fastening camshaft sensor | 8 ± 2 | 0.8 ± 0.2 |
| Screw M6 for fastening output shaft sensor | 8 ± 2 | 0.8 ± 0.2 |
| Screw M14 for fastening coolant temperature sensor | 20 ± 3 | 2 ± 0.3 |
| Screw M5 for fastening oil pressure/temperature sensor | 6 ± 1 | 0.6 ± 0.1 |
| Screw for fastening fuel pressure sensor | 35 ± 5 | 3.5 ± 0.5 |
| Screw M14 for fastening fuel temperature sensor | 20 ± 3 | 2 ± 0.3 |
| Screw for fastening air temperature/pressure sensor on intake manifold | 6 ± 1 | 0.6 ± 0.1 |
| Screw M12 for fastening engine oil level sensor | 12 ± 2 | 1.2 ± 0.2 |
| Turbine fixing to exhaust manifold — 6-cyl. pins M8 | 7 ± 1 | 0.7 ± 0.1 |
| 6-cyl. nuts M8 | 43 ± 6 | 4.3 ± 0.6 |
| 4-cyl. pins M8 | 7 ± 1 | 0.7 ± 0.1 |
| 4-cyl. nuts M8 | 24 ± 4 | 2.4 ± 0.4 |
| Adapter M12 on turbine for lubricant oil pipes (inlet) | 35 ± 5 | 3.5 ± 0.5 |
| Pipe fixing on adapter M10 for turbine lubrication | 35 ± 5 | 3.5 ± 0.5 |
| Oil pipe fixing on adapter M10 for turbine lubrication to block | 43 ± 6 | 4.3 ± 0.6 |
| Oil drain pipe fixing M8 on turbine | 24 ± 4 | 2.4 ± 0.4 |
| Connector fixing M6 for oil return from cylinder head to flywheel housing | 10 ± 2 | 1 ± 0.2 |
| Screw M12 for fastening engine flywheel — 1st stage | 30 ± 4 | 3 ± 0.4 |
| — 2nd stage | | 60° ± 5° |
| Screw M8 for fastening front bracket for engine lifting | 24 ± 4 | 2.4 ± 0.4 |
| Screw for fastening engine oil sump | 24 ± 4 | 2.4 ± 0.4 |
| **Alternator** | | 2.4 ± 0.4 |
| M10 Screw, Bracket fixing on water feed pipefitting | 43 ± 6 | 2.4 ± 0.4 |
| M10 Screw, alternator locking | 43 ± 6 | 2.4 ± 0.4 |
| **Starter** | | 2.4 ± 0.4 |
| Starter fixing screw | 43 ± 6 | 2.4 ± 0.4 |

https://truckmanualshub.com/

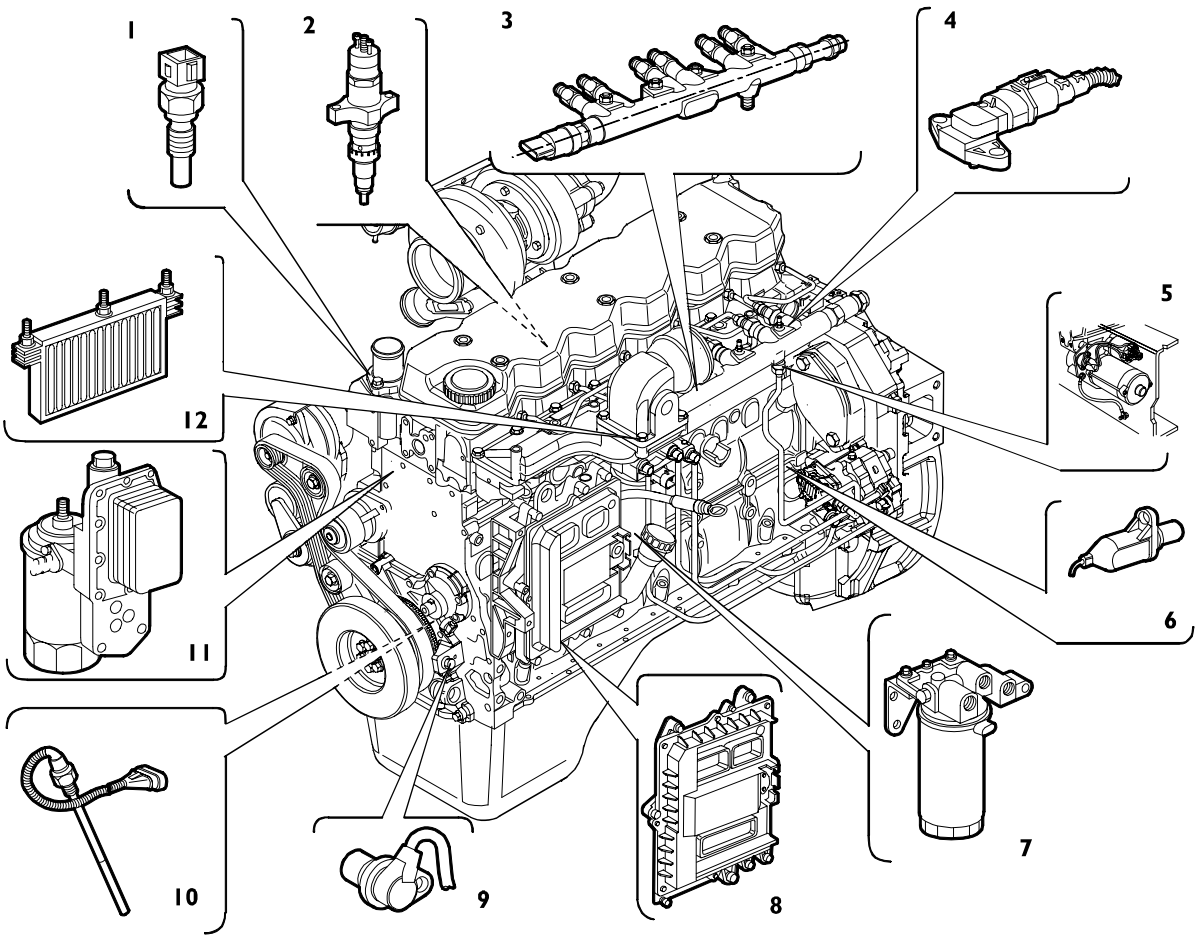

# PART TWO - ELECTRICAL EQUIPMENT

https://truckmanualshub.com/

https://truckmanualshub.com/


## PLACEMENT OF SENSORS

Figure 96




The F4A 0684 and F4A E0484 engines are fully driven by the electronic engine control module, which is assembled directly to the engine by means of a heat exchanger enabling its cooling, utilising rubber buffers to reduce vibration originated by the engine.

Through the engine control module it is possible to verify the correct working of the engine. (See part three of the hereby user's guide specifically dedicated to diagnostic).

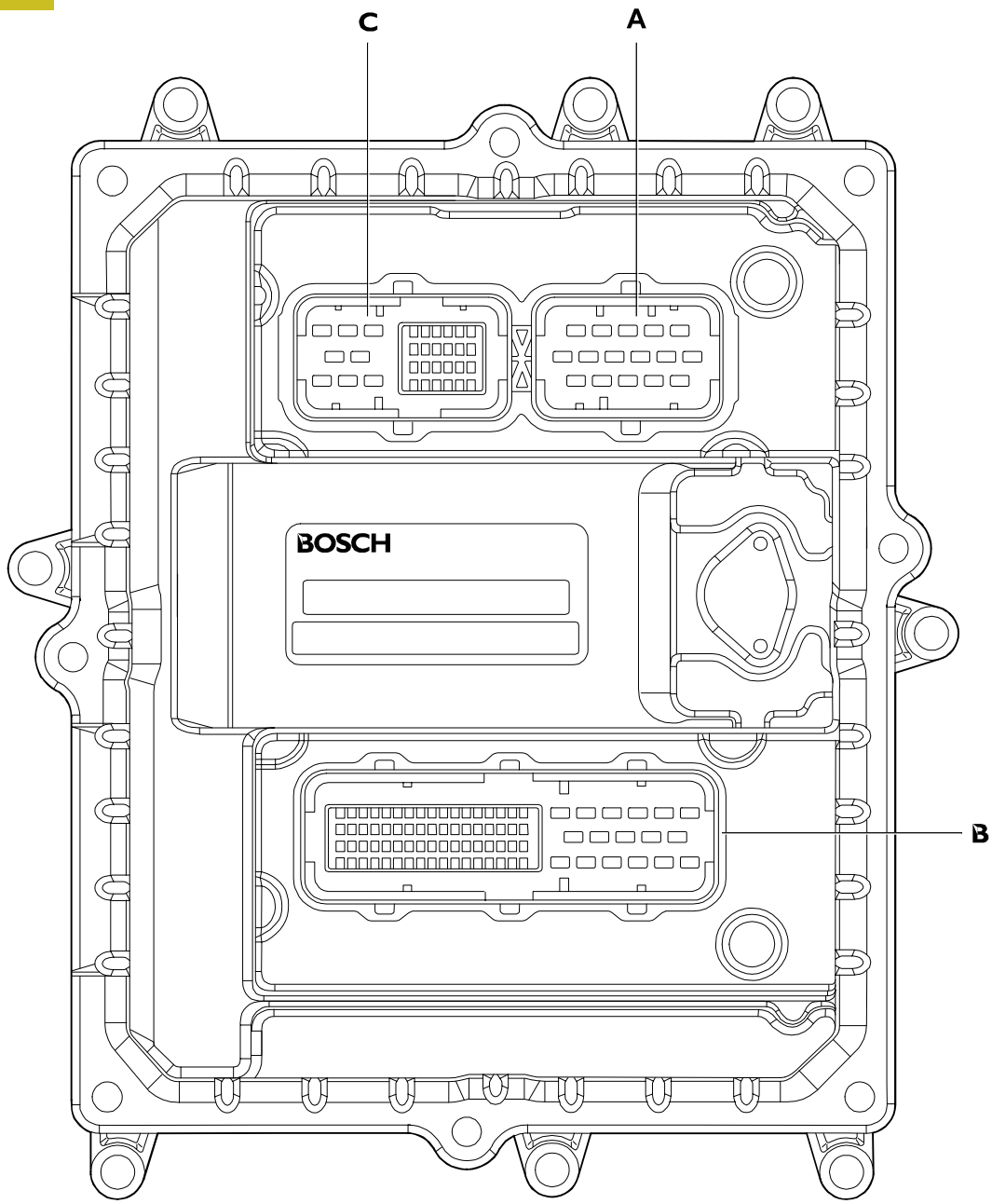
The electrical and electronic components of the engine are listed here following:

1. Temperature sensor of cooling liquid;
2. Electro-injector (from 4 to 6, according to whether the engine has 4 of 6 cylinders configuration);
3. Pressure sensor assembled to rail diffuser;
4. Temperature and air pressure sensor;
5. Starter;
6. Timing system sensor;
7. Fuel temperature sensor;
8. EDC 7 electronic module;
9. Driving shaft sensor;
10. Engine oil level transmitter;
11. Sensor of engine's oil temperature and pressure;
12. Pre-post heating resistor.

https://truckmanualshub.com/

## EDC7 ECU

Figure 97

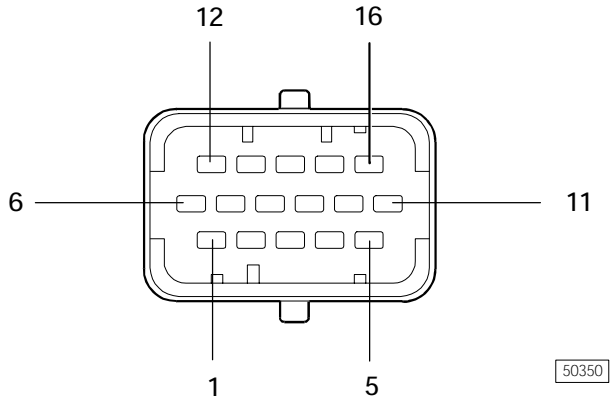



A - Connector to injectors; B - Connector to chassis (Provide reference of the vehicle to which the engine is assembled); C - Connector to sensors.

https://truckmanualshub.com/


## Connector to injectors (A)

Figure 98




| PIN ECU | CABLE COLOUR | FUNCTION |
|---|---|---|
| 1 | - | - |
| 2 | - | - |
| 3 | RU | Injector cylinder 2 |
| 4 | WP | Injector cylinder 3 |
| 5 | WV | Injector cylinder 4 |
| 6 | RW | Injector cylinder 2 |
| 7 | - | Earth |
| 8 | - | Injector cylinder |
| 9 | RG | Injector cylinder 1 |
| 10 | UN | Injector cylinder 6 (*) |
| 11 | UG | Injector cylinder 5 (*) |
| 12 | WR | Injector cylinder 3 |
| 13 | RY | Injector cylinder 1 |
| 14 | W | Injector cylinder 4 |
| 15 | UO | Injector cylinder 6 (*) |
| 16 | UY | Injector cylinder 5 (*) |

(*) Only for 6 cyl. versions.

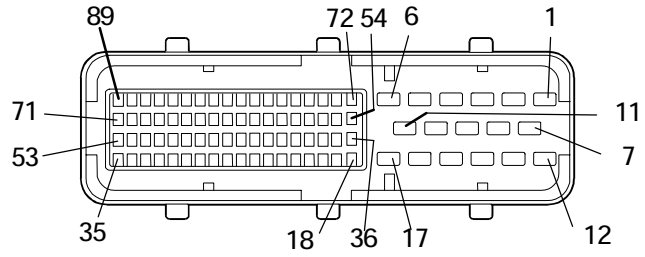
**Colour legend**

| | |
|---|---|
| B | Black |
| R | Red |
| U | Blue |
| W | White |
| P | Purple |
| G | Green |
| N | Brown |
| Y | Yellow |
| O | Orange |

https://truckmanualshub.com/

## Feed connector (B) to components and to functions of the specific equipment

Figure 99



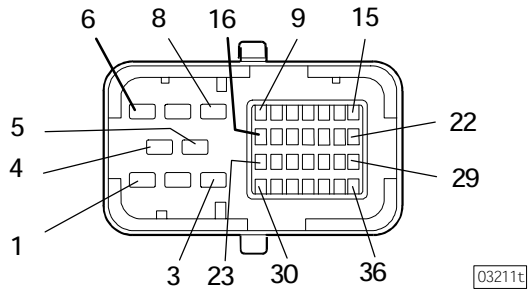

(*) F4A E0684H - E
(**) F4A E0684F

| PIN ECU | CABLE COLOUR | FUNCTION |
|---|---|---|
| 1 | 8150 | Positive driven by battery |
| 2 | 0087 | Negative for switch of fuel filter heater/starter |
| 3 | 0000 | Earth |
| 4 | 8885/0159 | Positive for pre-post heating resistor |
| 7 | 8150 | Positive driven by battery |
| 8 | 7777 | Positive for blink-code button/ oil low pressure led/ pre-heating led/ Air conditioner switch (if available) (*)/EDC |
| 9 | 0000 | Earth |
| 12/13 | 8150 | Positive driven by battery |
| 14/15 | 0000 | Earth |
| 16 | 0094 | Negative for post-heating resistor |
| 19 | 0150 | Negative start-stop push buttons from eng./accelerator pressed (**) |
| 20 | 8153 | Positive from change over switch to key in starting phase (+50) |
| 27 | 0156 | Positive from blink-code button |
| 28 | 5535 | Positive for EDC diagnostic led |
| 31 | 2298 | K Line for diagnosis connector, 30 poles (2 pin) |
| 32 | - | Negative for multi-switch couple-limiter (*) |
| 36 | 8837 | Positive for fuel filter heating switch |
| 37 | 8888 | Positive for starter |
| 39 | 8051 | Positive from key switch/ L line for diagnosis connector 30 poles (pin 11) |
| 44 | 9905 | Negative from starter push button from engine (**) |
| 45 | 9906 | Negative from engine stop push button from engine |
| 46 | 5553 | Negative for pre-heating led in on position |
| 49 | 5584 | Diagnosis connector (pin 28) |
| 50 | 0158 | Negative from accelerator push button pressed (*) |
| 52 | 6109 | CAN Line (whether equipped), diagnosis connector (pin 22) |
| 53 | 6108 | CAN Line (whether equipped), diagnosis connector (pin 22 |
| 55 | 5158 | Positive for sensor of foot accelerator pedal pos.(**)/Earth multi-switch (*) |
| 62 | 0160 | Negative for clutch sensor |
| 63 | 5503 | Negative for engine oil low pressure led |
| 64 | 0535 | Negative for EDC diagnosis led |
| 72 | 0159 | Positive from pressed accelerator push button (**)/multi-switch signal (*) |
| 73 | 0159 | Positive redundant from pressed accelerator push button (**) |
| 78 | 8162 | Positive air conditioner device (whether equipped) (*) |
| 81 | 0157 | Negative sensor of foot accelerator pedal pos.(**)/ Earth multi-switch (*) |
| 83 | 5157 | Signal from sensor of foot accelerator pedal pos.(**)/ Signal multi-switch (*) |
| 87 | - | Positive for couple multi-switch limiter (*) |
| 88/89 | - | - |

https://truckmanualshub.com/


## Connector to sensors (C)

Figure 100




**Colour legend**

| | |
|---|---|
| B | Black |
| R | Red |
| U | Blue |
| W | White |
| P | Purple |
| G | Green |
| N | Brown |
| Y | Yellow |
| O | Orange |

| PIN ECU | CABLE COLOUR | FUNCTION |
|---|---|---|
| 5 | NW | Earth for pressure regulator |
| 7 | NP | Pressure regulating drive |
| 9 | PY | Feed for engine oil temperature/pressure sensor |
| 10 | NY | Feed for air pressure and temperature sensor |
| 12 | GY | Feed for rail pressure sensor |
| 17 | YR | Earth for fuel temperature sensor |
| 18 | YN | Earth for cooling liquid temperature sensor |
| 19 | PN | Earth for engine oil temperature - pressure |
| 20 | GN | Feed for rail pressure sensor |
| 21 | N | Feed for air pressure - temperature sensor |
| 23 | U | Timing system sensor |
| 24 | U | Driving shaft sensor |
| 25 | R | Driving shaft sensor |
| 27 | GO | Signal from rail pressure sensor |
| 28 | NG | Signal from air pressure sensor |
| 29 | UO | Signal from air temperature sensor |
| 30 | R | Earth for timing system sensor |
| 33 | PO | Signal from engine oil temperature sensor |
| 34 | YU | Signal from fuel temperature sensor |
| 35 | PG | Signal from engine oil pressure |
| 36 | YO | Signal from cooling oil temperature |

https://truckmanualshub.com/

## Temperature and air-pressure sensor

It is a component integrating one temperature sensor and a pressure one.

It is assembled to the suction inlet manifold and measures the maximum capacity of air introduced, in order to provide to the engine control module the necessary data to calculate the quantity of fuel to be injected per each cycle.

It is connected to the engine control module by 21C and 29C pin (temperature), 10C and 28C (pressure) and has a 5 volt feeding.

21C Earth

29C NTC signal (temperature)

10C +5V feed

28C Signal (pressure)

## Sensor of engine's oil temperature and pressure

It is a component integrating one temperature sensor and a pressure one.

It is assembled to the engine oil filter in horizontal position.

It measures the temperature and the pressure of the engine's oil.

It is connected to the engine control module by 19C and 33C, 9C and 35C.

19C Earth

33C NTC signal (temperature)

9C +5V feed

35C Signal (pressure)

## Driving shaft sensor

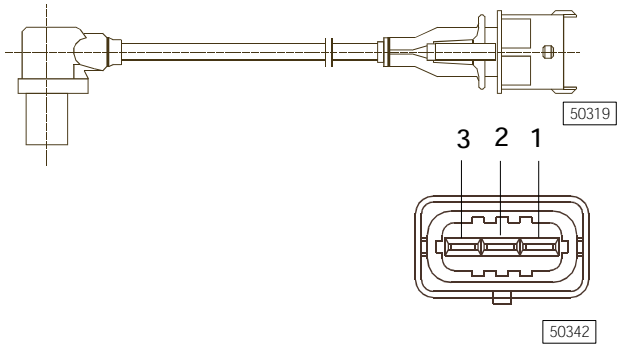
It is an inductive type sensor and it is placed on the front left part of the engine.

It generates some signals originated by the magnetic flow lines that close up through the openings of a phonic wheel splined to the driving shaft. The same signal is utilised to control the eventual electronic engine speed indicator placed on the vehicle instrument board.

It is connected to the engine control module by pin 25C (signal) and 24C (signal). The third pin is for screening.

The resistance value of the sensor is of about 900 Ω.

Figure 101




## Timing system sensor

It is an inductive type sensor and it is placed on the back left part of the engine.

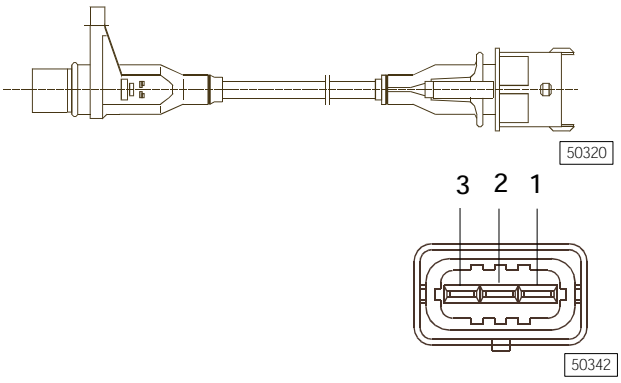
It generates some signals originated by the magnetic flow lines that close up through the ports drilled on the gear splined to the camshaft. The signal generated by this sensor is utilised by the electronic engine control module as signal of injection phase.

Even being equal to the flywheel sensor it is not interchangeable since the external shape is different.

It is connected to the engine control module by pin 23C (signal) and 30C (signal). The third pin is for screening.

The resistance value of the sensor is of about 900 Ω.

Figure 102



https://truckmanualshub.com/


## Fuel pressure sensor

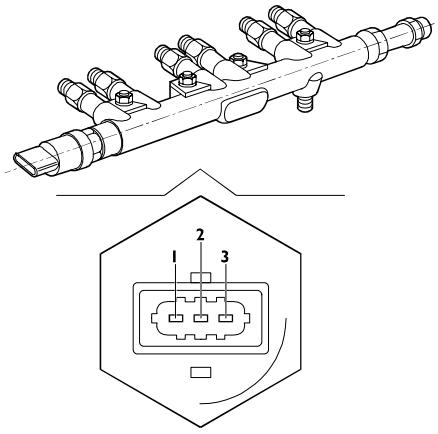
It is a sensor assembled to one end of the rail and measures the pressure of the fuel available in order to determine the injection pressure.

The value of the injection pressure is utilised to control the pressure itself and to determine the duration of the electronic injection device.

It is connected to the engine control module by pin 20C (Earth), 27C (signal) and 12C (feed).

It has 5 volt feeding.

Figure 103




1 - Earth; 2- Signal; 3- Feed.

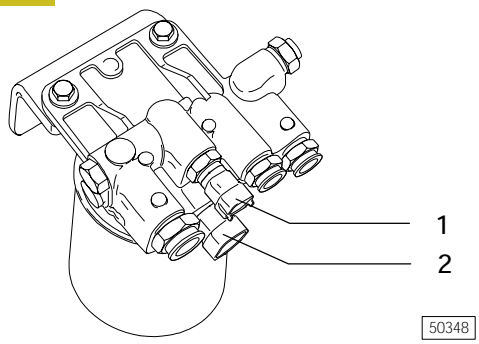
## Fuel temperature sensor

It is a sensor with variable resistor, able to detect the fuel temperature to provide to the engine control module an index of the fuel thermal status.

It is connected to the engine control module by pin 17C (Earth) and 34C (temperature signal).

The resistor to 20 °C = 2,5 kΩ.

Figure 104




1 - Fuel temperature sensor; 2 - Resistor

## Resistor pre-post heating

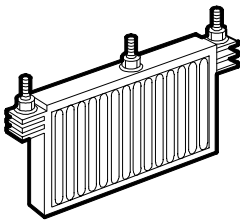
It is a resistor placed on the suction inlet manifold and is utilised to heat the air during the heating pre-post operations.

It is fed by a tele-switch usually placed very close to the engine. The resistor is for aprx. 0,5 kΩ.

The relay drive is connected to the gearbox by pin 4 and 16 of the chassis connector.

The drive is activated with water and/or fuel temperature < 5 °C.

Figure 105




## Cooling liquid temperature sensor

It is a sensor with variable resistor, able to detect the cooling liquid temperature to provide to the engine control module an index of the engine thermal status.

Usually, the same signal is driven by the engine control module to the temperature device placed within the vehicle's dashboard.

It is connected to the engine control module by pin 18C (Earth) and 36C (temperature signal).

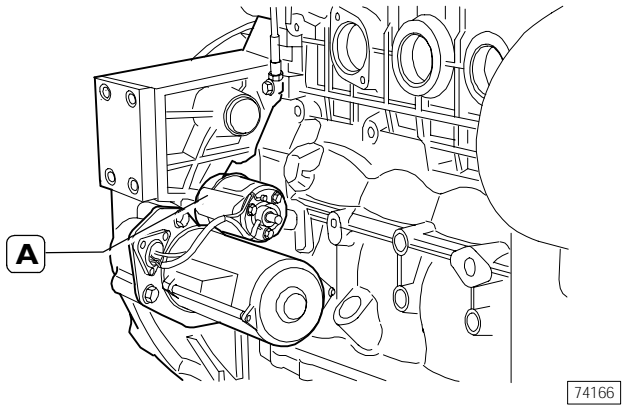
The resistor to 20 °C = 2,5 kΩ.

https://truckmanualshub.com/

## Starter

The starter is usually driven by the starting block assembled to the vehicle's dashboard and provides positive voltage to pin B20 of the EDC.

Figure 106

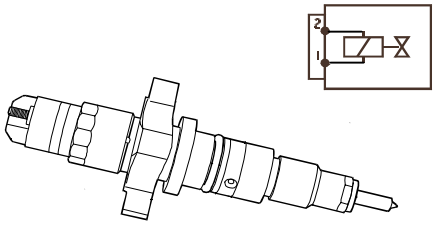


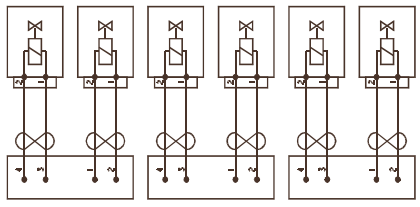

A - Feeding relay of the starter

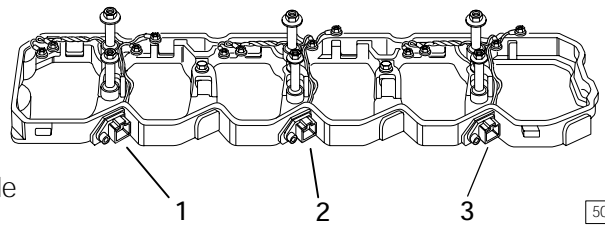
## Electro-injectors

| REFERENCE | | DESCRIPION | PIN EDC |
|---|---|---|---|
| CONNECTOR 1 | 1 | Injector cylinder 2 | 3 A |
| | 2 | Injector cylinder 2 | 6 A |
| | 3 | Injector cylinder 1 | 13 A |
| | 4 | Injector cylinder 1 | 9 A |
| CONNECTOR 2 | 1 | Injector cylinder 4 | 5 A |
| | 2 | Injector cylinder 4 | 14 A |
| | 3 | Injector cylinder 3 | 12 A |
| | 4 | Injector cylinder 3 | 4 A |
| CONNECTOR 3 (only for 6 cyl. versions) | 1 | Injector cylinder 6 | 10 A |
| | 2 | Injector cylinder 6 | 15 A |
| | 3 | Injector cylinder 5 | 16 A |
| | 4 | Injector cylinder 5 | 11 A |

Figure 107





https://truckmanualshub.com/


# PART THREE - TROUBLESHOOTING

https://truckmanualshub.com/


## PREFACE

A successful troubleshooting is carried out with the competence acquired by years of experience and attending training courses.

When the user complains for bad efficiency or working anomaly, his indications must be kept into proper consideration using them to acquire any useful information to focus the intervention.

After the detection of the existing anomaly, it is recommended to proceed with the operations of troubleshooting by decoding the auto-troubleshooting data provided by the EDC system electronic central unit.

The continuous efficiency tests of the components connected to, and the check of working conditions of the entire system carried out during working, can offer an important diagnosis indication, available through the decoding of the "failure/anomaly" codes issued by blinking of the failure led: the "blink-code" (whether programmed).

Please consider that the interpretation of the indications provided by the blink-code is not sufficient to guarantee the solution to the existing anomalies.

Using processing instruments, it is also possible to establish a bi-directional connection with the central unit, by which not only to decoding the failure codes but also input an enquiry relying on memory files, in order to achieve any further necessary information to identify the origin of the anomaly.

Every time there is a breakdown claim and this breakdown is actually detected, it is necessary to proceed inquiring the electronic unit in one of the ways indicated and then proceed with the diagnostic research making trials and tests in order to have a picture of the working conditions and identify the root causes of the anomaly.

In case the electronic device is not providing any indication, it will be necessary to proceed relying on the experience, adopting traditional diagnosis procedures.

In order to compensate the operators' lack of experience in this new system, we are hereby providing the USER'S GUIDELINE FOR TROUBLESHOOTING in the following pages.

The GUIDE LINE is composed of two different parts:

- Error Codes, mainly of electric and electrical nature; Otained using the McCormick Electronic Service Tool.

NOTE: Remove ALL error codes in the ECU at the end of any repair.

- Guidelines for troubleshooting without error code, divided per symptoms, describing all possible anomalies not detected by the electronic gearbox, often of mechanical and hydraulic nature.



Any kind of operation on the electronic center unit must be executed by qualified personnel, duly authorized.

Any unauthorized tamper will involve decay of after-sales service in warranty.

| ERROR CODE | | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 21 | | Short circuit of the sensor of engine cooling liquid temperature, in positive or earth or in open circuit. | | Verify component correct working and its resistor (2,5kOhm at 20°C). In case the component works, proceed checking the connection between the sensor and the gearbox connector to pin C18 - C36. | |
| 22 | | Short circuit of the sensor of air combustion temperature, in positive or earth or in open circuit. (The sensor is integrated with the air pressure sensor). | | Readout of parameters using multimeter. Verify correct working of the component and of its resistor between pin 1 and 2 (R = 2,5 kOhm at 20°C). If the sensor is working, proceed checking the connection between the sensor and the EDC connector to pin C21 - C29. | |
| 23 | | Short circuit of the sensor of fuel temperature, in positive or earth or in open circuit. | | Readout of parameters directly on the sensor using multimetre . (R = 2,5 kOhm at 20°C). If the sensor is working, proceed checking the connection between the sensor and the EDC connector to pin C17 - C34. | |
| 24 | | Short circuit of the sensor of air combustion pressure on suction collector, in positive or earth or in open circuit; or fed by tension out of specification. | | Readout of parameters using multimetre verifying feeding tension to the sensor. (aprx. 5V).<br>In case of tension within specification, check the wiring harness and the connection between the sensor and the EDC (Pin C10-C28). | |

https://truckmanualshub.com/

| ERROR CODE | | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 25 | | Short circuit of the sensor of air pressure (integrated in EDC) in positive or earth or in open circuit | | Apply for customer assistance for the intervention on the EDC. The sensor is integrated in the EDC and is not replaceable singularly. | The painting of the engine /EDC may inficiate on the correct working of the sensor. |
| 26 | | Short circuit of the sensor of engine oil pressure, in positive or earth or in open circuit. (The sensor is integrated with the oil temperature sensor). | | Readout of parameters using multimetre verifying feeding tension to the sensor. (aprx. 5V).<br>In case of tension within specification replace the sensor. In case of tension out of specification, check the wiring harness and the connection between the sensor and the EDC (Pin C9-C35). | |
| 27 | | Short circuit of the sensor of engine oil temperature. (integrated with the oil pressure sensor) , in positive or earth or in open circuit. | | Sensor Readout using multimetre, between pin 1 and 2 (R = 2,5 kOhm at 20°C).<br>If the sensor is working, proceed checking the connection between the sensor and the EDC (pin C19-C33). | |
| 28 | | Incorrect working of the fuel filter heating relé. | | Verify relé working status using the troubleshooting device. If the result is negative, replace the relé and test again.<br>If the anomaly still persists, check the wiring harness and the connections between relé and EDC connector (pin B2 - B36) | |

https://truckmanualshub.com/

| ERROR CODE | | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 29 | | Incorrect working of the pre-post heating drive relé. | Difficult starting with low external temperature, exhaust fumes immediately after starting. | Verify relé working status using the troubleshooting device. Check the correct working of the relé (R= aprx. 15 Ohm).<br>In case the relé works, check the wiring harness and the connections between relé and EDC connector (pin B4 - B16) | |
| 37 | | Signal for battery tension too high or too low. | Idling accelerated. | Carry out the due controls on the battery and on the recharge system.<br><br>If no anomaly is detected check the efficiency of the Earth points and the absence of fouling or oxidation on the feed wiring connectors of the EDC. | Eventually, the problem might not depend on the too high or too low tension but due to the incorrect detection of tension by the EDC. |
| 38 | | Defective pre-heating led or wiring harness short circuit in positive or earth or in open circuit. | Led always on light even with starting key in off position or always off.<br><br>Possible difficult starting (with low external temperature) and exhaust fumes at starting. | Verify working status using troubleshooting device.<br>If the result is negative replace the led and drive troubleshooting operation again. If the failure persists check connections and wiring harness between led and EDC (pin B46) | |
| 39 | | Pre-heating has not been working correctly. | Possible difficult starting (with low external temperature) and exhaust fumes at starting. | Using the multimetre, verify continuity of pre-heating resistor in the suction collector (R = aprx. 0,5 Ohm).<br>If the component is working, check the wiring harness and the connection between the resistor and the relevant driving relé. | Pre-heating is not working. |

https://truckmanualshub.com/

| ERROR CODE | | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 51 | | Electrical problem with Injector n. 1 | Engine running with one cylinder less. | Check the correct couple lock (1,5 +/- 0,25 Nm) of the cables the fixing nuts to the injector electro-valve.<br>Verify the working status of the injector's bobbin (R = aprx. 0,56 - 0,57 Ohm) and replace the injector if defective.<br>With new working bobbin, proceed checking the wiring harness and the connections between electro-valve and EDC connector (pin A9-A13) through the connector 1 of the pin overhead 3 and 4. | Such failure may generate power stage insufficiency (in the EDC ) feeding the electro-injector, involving working of only half of the cylinders as a consequence, and memorisation of the error 57. |
| 52 | | Electrical problem with injector n.2 | Engine working with one cylinder less. | Check the correct couple lock (1,5 +/- 0,25 Nm) of the cables the fixing nuts to the injector electro-valve.<br>Verify the working status of the injector's bobbin (R = aprx. 0,56 - 0,57 Ohm) and replace the injector if defective.<br>With new working bobbin, proceed checking the wiring harness and the connections between electro-valve and EDC connector (pin A3-A6) through the connector 1 of the pin overhead 1 and 3. | Such failure may generate power stage insufficiency (in the EDC ) feeding the electro-injector, involving working of only half of the cylinders as a consequence, and memorisation of the error 57 within 6 cylinder engines and 58 within 4 cylinder engines. |

https://truckmanualshub.com/

| ERROR CODE | | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 53 | | Electrical problem with injector n.3. | Engine working with one cylinder less. | Check the correct couple lock (1,5 +/- 0,25 Nm) of the cables the fixing nuts to the injector electro-valve.<br>Verify the working status of the injector's bobbin (R = aprx. 0,56 - 0,57 Ohm) and replace the injector if defective.<br>With new working bobbin, proceed checking the wiring harness and the connections between electro-valve and EDC connector (pin A4-A12) through the connector 2 of the pin overhead 3 and 4. | Such failure may generate power stage insufficiency (in the EDC ) feeding the electro-injector, involving working of only half of the cylinders as a consequence, and memorisation of the error 57. within 6 cylinder engines and 58 within 4 cylinder engines |
| 54 | | Electrical problem with injector n.4. | Engine working with one cylinder less. | Check the correct couple lock (1,5 +/- 0,25 Nm) of the cables the fixing nuts to the injector electro-valve.<br>Verify the working status of the injector's bobbin (R = aprx. 0,56 - 0,57 Ohm) and replace the injector if defective.<br>With new working bobbin, proceed checking the wiring harness and the connections between electro-valve and EDC connector (pin A5-A14) through the connector 2 of the pin overhead 1 and 2. | Such failure may generate power stage insufficiency (in the EDC) feeding the electro-injector, involving working of only half of the cylinders as a consequence, and memorisation of the error 57 within 6 cylinder engines and 58 within 4 cylinder engines |

https://truckmanualshub.com/

| ERROR CODE | | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 55 | | Electrical problem with injector n.5. | Engine working with one cylinder less. | Check the correct couple lock (1,5 +/- 0,25 Nm) of the cables the fixing nuts to the injector electro-valve.<br>Verify the working status of the injector's bobbin (R = aprx. 0,56 - 0,57 Ohm) and replace the injector if defective.<br>With new working bobbin, proceed checking the wiring harness and the connections between electro-valve and EDC connector (pin A11-A16) through the connector 3 of the pin overhead 3 and 4. | Such failure may generate power stage insufficiency (in the EDC ) feeding the electro-injector, involving working of only half of the cylinders as a consequence, and memorisation of the error 57 within 6 cylinder engines and 58 within 4 cylinder engines. |
| 56 | | Electrical problem with injector n.6. | Engine working with one cylinder less. | Check the correct couple lock (1,5 +/- 0,25 Nm) of the cables the fixing nuts to the injector electro-valve.<br>Verify the working status of the injector's bobbin (R = aprx. 0,56 - 0,57 Ohm) and replace the injector if defective.<br>With new working bobbin, proceed checking the wiring harness and the connections between electro-valve and EDC connector (pin A10-A15) through the connector 3 of the pin overhead 1 and 2. | Such failure may generate power stage insufficiency (in the EDC) feeding the electro-injector, involving working of only half of the cylinders as a consequence, and memorisation of the error 57 within 6 cylinder engines and 58 within 4 cylinder engines. |

https://truckmanualshub.com/

| ERROR CODE | | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 57 | | EDC output stage driving power to electro-injector couples 2 and 3 | Engine running with only 2 (3) working cylinders. | Clear the failure memory and test again.<br>If the failure persists, and only after having excluded injector defect, eventually replace the EDC with a new one re-programmed . | It can happen if the external part of the gearbox is driven to short circuit with the battery positive pole (accidental bridge made by wrench or other metallic object). |
| 58 | | EDC output stage driving power to electro-injector couples 4-5-6 | Engine running with only 2 (3) working cylinders. | Clear the failure memory and test again.<br>If the failure persists, and only after having excluded injector defect, eventually replace the EDC with a new one re-programmed . | It can happen if the external part of the EDC is driven to short circuit with the battery positive pole (accidental bridge made by wrench or other metallic object) |
| 61 | | Driving shaft sensor: no signal or unreliable signal. | Engine start requires more time than usual.<br>Power reduction and noise increase since the EDC is not controlling the pre-injection and the timing.<br>Engine working relies on recovery parameters. | Using the multimetre, verify the sensor's resistor value as well as its working status (R = aprx. 900 Ohm).<br>If the component is working, and the anomaly persists, check the wiring harness<br>between the sensor and the EDC connector (pin C24 - C25). | The failure is not detected when the engine is not running. If the driving shaft signal is not regularly working, it is necessary to rely on the speed signal of the camshaft sensor. |
| 62 | | Camshaft sensor: no signal or unreliable signal. | Difficult starting in all conditions.<br>Power reduction. | Using the multimetre, verify the sensor's resistor value as well as its working status (R = aprx. 900 Ohm). Verify correct assembly of the sensor: replace it if defective.<br>If the component is working, and the anomaly persists, check the wiring harness between the sensor and the EDC connector (pin C24 - C25). | The failure is not detected when the engine is not running. If the camshaft signal is not regularly working, it is necessary to rely on the phase signal of the driving shaft sensor. |

https://truckmanualshub.com/

| ERROR CODE | | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 63 | | Unreliable survey of engine speed. | Difficult starting in all conditions. Power reduction. | Using the multimetre, verify the sensor's resistor value as well as its working status (R = aprx. 900 Ohm). Verify correct assembly of the sensor: replace it if defective. If the component is working, and the anomaly persists, check the wiring harness between the sensor and the EDC connector (pin C24 - C25). | The failure is not detected when the engine is not running. If the camshaft signal is not regularly working, it is necessary to rely on the phase signal of the driving shaft sensor. |
| 64 | | Engine runaway speed rate. | | Verify the root-causes that might have generated a sudden load loss to the engine, involving consequent runaway speed rate. Runaway speed rate might also depend directly from the operator addicted to driving the vehicle, which the engine is installed to. | It is not a failure referred to one component but the alert for an actual engine runaway speed rate. |
| 65 | | Incorrect working of starter relé. | The engine does not start or disconnects. | Using multimetre, check the relé. In case the component works, check the wiring harness and the connection between relé and EDC connector (pin B27). | |
| 66 | | Signal from EDC to engine speed indicator. | The engine speed indicator does not work. | Check the wiring harness and the connection between engine speed indicator and EDC connector (pin B49). | |
| 68 | | Synchronisation signal with troubleshooting device. | Difficulties in communication between troubleshooting device and EDC. | Check the wiring harness and the connection between pin 23 of the troubleshooting tap end EDC connector to in B48 | |

https://truckmanualshub.com/

| ERROR CODE | | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 7.2 | | (*)<br><br>CAN Line Hardware defect. | (*)<br><br>Possible incorrect working or error alert signal of the electronic control devices connected via CAN Line. | Check wiring harness, connection and locking resistor (120Ohm) | On the equipment that is not provided with the CAN line, this is blanked by a 120Ohm resistor. |
| 7.6 | | **Defective oil pressure led lamp, or wiring harness short circuit in positive or earth or in open circuit.** | **Switching the key contact to ON position, the led is not lighting on or keeps lighted.** | Verify working status using troubleshooting device. If the result is negative replace the led and drive troubleshooting operation again.<br>In case of led correct working, check the wiring harness and the connections and wiring harness between led and EDC connector (pin B63) and the correct feed of the gauge with incorporated led. | |
| 8.1 | | Anomalia nella modulazione della pressione combustibile<br><br>(la centralina deve modificare troppo il segnale di comando al regolatore di pressione per modulare nel rail la pressione calcolata). | Significativa riduzione di potenza.<br><br>In caso di iniettore che rimane saltuariamente bloccato aperto, improvviso e temporaneo decadimento delle prestazioni, con avviamento possibile e buon funzionamento ai bassi regimi e carichi, ma il problema si ripresenta agli alti regimi e carichi. | Verify if the fuel arrives directly to the high pressure pump (no outlets in the sucked line, clogged filter or pre-filter, occluded pipes, consistent fuel leakage).<br><br>Verify there is no fuel leakage or loss from the high pressure line running from the pump and the rail or from the cylinders head.<br><br>In case a flow limiter has been activated, detect and identify the injector that is not working any more and replace it together with its relevant high pressure filler. | Further details relating to checks and controls to be made on the fuel's circuit are available in Troubleshooting section 2. |

https://truckmanualshub.com/

| ERROR CODE | | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 82 | | Rail pressure sensor's signal short circuit in positive or earth or in open circuit. | Significant power reduction. | Readout of parameters using troubleshooting device.<br><br>Check the wiring harness and the connection between the sensor and the EDC Connector (Pin C12-C20 -C27).<br><br>If everything is in order, replace the sensor. | |
| 83 | | Pressure gauge short circuit in positive or earth or in open circuit. | Significant power reduction.<br><br>Eventually blink code 81. | Using the multimetre, verify the working status of the pressure gauge electro-valve.<br>If the component is working, check the wiring harness and the connection between the gauge and the EDC connector pin C4-C5<br>After having excluded any other possibility, apply for<br>the eventual replacement of the pump with its gauge. | The single replacement of the pressure gauge only is not possible. |
| 84 | | Incorrect working of the boost gauge valve (only if double-stage type). | Significant power reduction. | Replace the rail boost valve. | |
| 85 | | Anomaly in rail pressure.<br>(Dropped to minimum value or over maximum limit). | Significant power reduction.<br><br>Possible contemporary blink code 81 - 84. | Verify if the fuel arrives directly to the high pressure pump (no outlets in the sucked line, clogged filter or pre-filter, occluded pipes, consistent fuel leakage).<br><br>Verify there is no fuel leakage or loss from the high pressure line running from the pump and the rail or from the cylinders head. | |

https://truckmanualshub.com/

| ERROR CODE | | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 94 | | Main relé is not disconnecting. | The gearbox is always fed and the EDC led keeps light on even with the key in Off position.<br><br>The battery discharges. | Try removing and replacing the fuse (to re-set the EDC)<br><br>If the problem persists, apply for the eventual replacement of the EDC. | The main relè is incorporated in the EDC and is not replaceable singularly. |
| 96 | | Anomaly within the routine control procedure that the gearbox provides to the system at each engine disconnection. | Significant power reduction. | Run the engine, drive it to idling and disconnect it correctly. | The failure might be memorised even in case of engine working in different conditions than the ones of the equipment (such as engine running on bench, without inertial load). |
| 97 | | Anomaly within sensors feed. | Memorisation of error on all sensors fed by the EDC gearbox.<br><br>The engine does not start nor disconnects, or difficult starting and bad working of the engine. | Verify working status and correct assembly of the EDC connector dedicated to sensors (C).<br><br>If the connector is working and correctly assembled,<br>apply to for the eventual replacement of the EDC. | |

https://truckmanualshub.com/

https://truckmanualshub.com/

https://truckmanualshub.com/


# GUIDELINES FOR TROUBLESHOOTING WITHOUT ERROR-CODES

https://truckmanualshub.com/

| ANOMALY | POSSIBLE CAUSE<br>(*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|
| Low performance at load request.<br><br>Possible exessive smoke.<br><br>Possible blink-code 81 | Insufficient fuel level in the tank. | Check fuel level. | The excessive smoke is due to the fact that, in case of insufficient fuel feeding, the engine control module tries to compensate prolonging the injectors working time. |
| | Fuel tank device partially obstructed by impurities or deformed because of overheating. | Check if the priming pump of the pre-filter is working correctly.<br><br>If the pump plunger is permanently depressed disassemble and check the tank pick.-up tube. If this is in order, replace the pre-filter. | |
| | Obstructed air filter. | Replace the air filter. | Solve the cause of the filter's obstruction. |
| | Excessive fuel blow-by from rail boost valve. | Check the O Rings and the correct connection of the pipe fittings under the feeding pump (the lockers must stay outside and the fittings must be well locked).<br>Visually check the low pressure pipeline integrity. | Unless the leakage is significant, no performance failures will be detected.<br>To verify O-rings integrity, extract from the tank the fuel recycling pipeline, seal the end and activate the priming pump driving the low pressure circuit. |
| | Excessive fuel blow-by from rail boost valve. | Disconnect the pipe and visually check if there are any significant blow-by from the boost gauge valve; in such case replace the valve. | |
| The engine suddenly stops (with no previous problems) and does not start again. | Obstructed fuel filter. | Replace the fuel filter. | Solve the cause of the filter's obstruction (empty and clean the tank and the part of the circuit over the filter, refill with clean fuel). |

https://truckmanualshub.com/

| ANOMALY | POSSIBLE CAUSE<br>(*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|
| The engine disconnects or does not start. | (*)<br><br>EDC "burned" by short circuit on the wiring harness of the friction clutch. | Eliminate the short circuit and replace the EDC. | Verify that the wire line, close to the pedal, is not exposed to. |
| Difficult start and low performance in all conditions. | Inefficient high pressure pump. | After having excluded any other possible cause, replace the high pressure pump. | |
| Difficult start, low performance and engine running with one cylinder less. | Injector with obstructer or solenoid (mechanical part) blocked open. | The non-working injector is easily recognisable detecting by feeling the absence of pulsing within the relevant high pressure pipe. | In case of low entity blow-by, inficiating the mechanical working of the injector but not involving flow limiter activation, there is no error memorisation in the engine control module.<br>If the flow limiter is activated. Check error code memory. |
| Starting requires in excess of ten seconds, followed by huge white exhaust fumes, and a fuel smell. | Injector blocked in open position (with no return). | The non-working injector is easily recognisable detecting by feeling the absence of pulsing within the relevant high pressure pipe. | Usually, whether such symptoms appear, it is instinctive to give up engine start.<br>However, by insisting, it is possible to start the engine.<br>As a matter of facts, by insisting, if within the rail the pressure makes the flow limiter close up, the engine starts with one cylinder less and gradually the grade of fumes reduces and disappears. |
| Breaking of high pressure pipeline from pump to rail. | Strange vibrations provoked by slack of pipe bracket. | Replace the pipeline ensuring the correct tightening of the anti-vibration bracket screws. | It is very important, in addition to correct blocking, to keep the brackets in the original position. |
| The engine works with one cylinder less, without memorising failure blink codes in the engine control module. | Injector blocked in closed position. | Identify the injector that is not working any more and the relating high pressure filler. | The non-working injector is easily recognisable detecting by feeling the absence of pulsing within the relevant high pressure pipe. |

https://truckmanualshub.com/

https://truckmanualshub.com/


# PART FOUR - MAINTENANCE PLANNING

https://truckmanualshub.com/

https://truckmanualshub.com/


# MAINTENANCE PLANNING

## Recovery

To ensure optimised working conditions, in the following pages we are providing instructions for the overhaul control interventions, checks and setting operations that must be performed on the engine at due planned dates.

The frequency of the maintenance operations is just an indication since the use of the engine is the main characteristic to determine and evaluate replacements and checks.

It is not only allowed but recommended that the staff in charge of the maintenance should also carry out the necessary maintenance and controlling operations even if not being included in the ones listed here below but that may be suggested by common sense and by the specific conditions in which the engine is run.

## Regular maintenance and inspection planning

| Checks and periodical inspections | Frequency (hours) |
|---|---|
| Visual check of engine | Daily |
| Inspection presence of water in fuel filter or pre–filter | Daily |
| Inspection blow–by filter elements | – |
| Inspection of belt wear status | – |
| Inspection and setting of tappet clearance | 4000 |
| EDC | – |
| Replacement of engine's oil and filter | 500 |
| Replacement of pre–filter | 1000 |
| Replacement of fuel filter | 500 |
| Replacement of blow by filter | 500 |
| Replacement of belt | 1500 |



The frequency of the maintenance operations is just an indication since the use of the engine is the main characteristic to determine and evaluate replacements and checks.

The maintenance operations are valid only if the setter fully complies with all the installation prescriptions provided by McCormick.

Further more, the users assembled by the setter shall always be in conformance to couple, power and number of turns based on which the engine has been designed.

https://truckmanualshub.com/

## Checks not included in maintenance planning-daily checks

It is a good habit to execute, before engine start, a series of simple checks that might represent a valid warranty to avoid inconveniences, even serious, during engine running. Such checks are usually up to the operators and to the vehicle's drivers.

- Level controls and checks of any eventual leakage from the fuel, cooling and lubricating circuits.
- Notify the maintenance if any inconvenience is detected of if any filling is necessary.

After engine start and while engine is running, proceed with the following checks and controls:

- check presence of any eventual leakage from the fuel, cooling and lubricating circuits.
- Verify absence of noise or unusual rattle during engine working.
- Verify, using the vehicle devices, the prescribed pressure temperature and other parameters.
- Visual check of fumes (colour of exhaust emissions)
- Visual check of cooling liquid level, in the expansion tank.

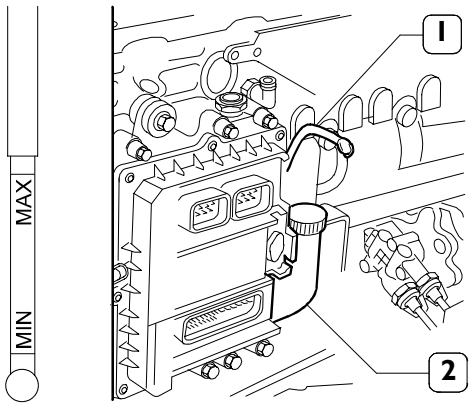
## MAINTENANCE PROCEDURES - CHECKS AND INSPECTIONS

### Engine oil level check.

The check must be executed when the engine is disconnected and possibly cool.

The check can be made using the specially provided flexible rod (1) placed on the right hand side of the EDC.

Figure 108



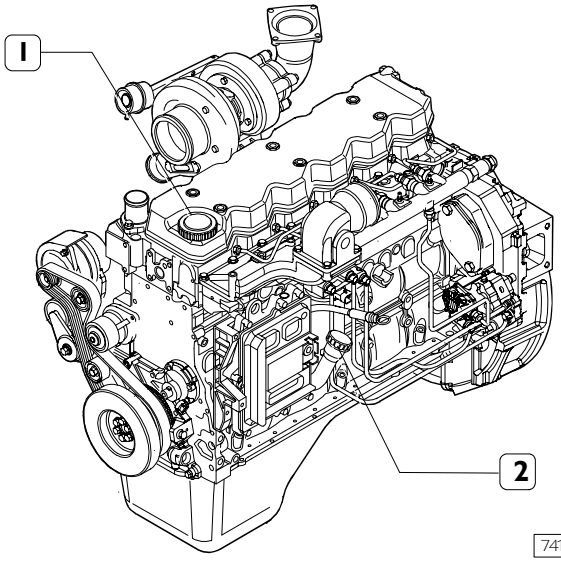

74174

Draw off the rod from its slot and check that the level is within the etched tags of minimum and maximum level.

Whether it should be difficult to make the evaluation, proceed cleaning the rod using a clean cloth with no rag grinding and put it back in its slot. Draw it off again and check the level.

In case the level results being close to the tag showing minimum level, provide filling lubrication of the engine's components.

Figure 109




74184

To provide filling, operate through the upper top (1) or through the lateral top (2). During filling operation, the tops must be removed as well as the rod in order to make the oil flow easier".

The engine oil is highly polluting and harmful.

In case of contact with the skin, rinse well with water and detergent.

Adequately protect the skin and the eyes, operate in full compliance with safety regulations.

Disposal must be carried out properly, and in full compliance with the law and regulations in force.

https://truckmanualshub.com/


## Combustion system inspection

The check must be executed both when the engine disconnected and when it is running.
The check operation consists in examining the fuel pipelines running from the tank to the pre-filter (if provided in the specific equipment), to the filter, to the high pressure pump and to the rail diffuser and from this last one to the head.

Special attention must be paid to the connections on the high pressure pipelines.



Due to the high pressure within the pipelines running from the high-pressure pump to the rail diffuser and from this last one to the electro-injectors, special attention must be aid also in checking presence of any leakage or blow-by.

Protect the eyes and the skin from any eventual high pressure jet: these may deeply penetrate under the skin surface provoking serious poisoning.

## Cooling system inspection

The check must be executed both when the engine disconnected and when it is running.

Check the pipelines from the engine to the radiator, from the expansion tank and vice-versa. Find out any blow-by, verify the status of the pipes specially close to the holding strips.

Verify that the radiator is clean, the correct working of the fan flywheels, the presence of any leakage from the connectors, from the manifold and from the radiating unit.



Due to the high temperatures achieved by the system, do not operate immediately after the engine's disconnection, but wait for the time deemed necessary for the cooling.
Protect the eyes and the skin from any eventual high pressure jet of cooling liquid.

The density of the cooling liquid must be checked any how every year before winter season and be replaced in any case every two year.



In case of new filling, proceed bleeding system, through the bleeds on the engine.

If bleeding of the system is not carried out, serious inconvenience might be caused to the engine due to the presence of air pockets in the engine's head.

## Lubricating system inspection

The check must be executed both when the engine disconnected and when it is running.

Verify the presence of any oil leakage or blow-by from the head, from the engine pan of from the heat exchanger.



The engine oil is highly polluting and harmful.

In case of contact with the skin, rinse well with water and detergent.

Adequately protect the skin and the eyes, operate in full compliance with safety regulations.

Disposal must be carried out properly, and in full compliance with the law and regulations in force.

## Inspection of water presence within fuel filter or pre-filter



The components of the common rail system can be damaged very quickly in presence of water or impurity within the fuel.

Timely proceed operating on the pre-filter (not available on the engine block) to carry out the drainage of the water within the feed circuit.

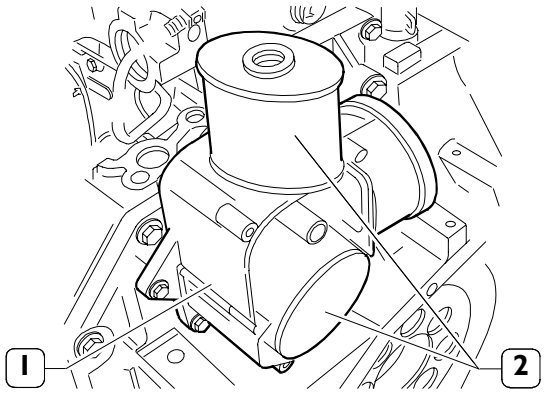
https://truckmanualshub.com/

## Inspection/replacement of blow-by filter

The filter in subject has been developed and equipped for the collection, filtering and condense of the lubricating oil vapours.

Within the filter unit (1) two cartridge filters are included (2).

Figure 110



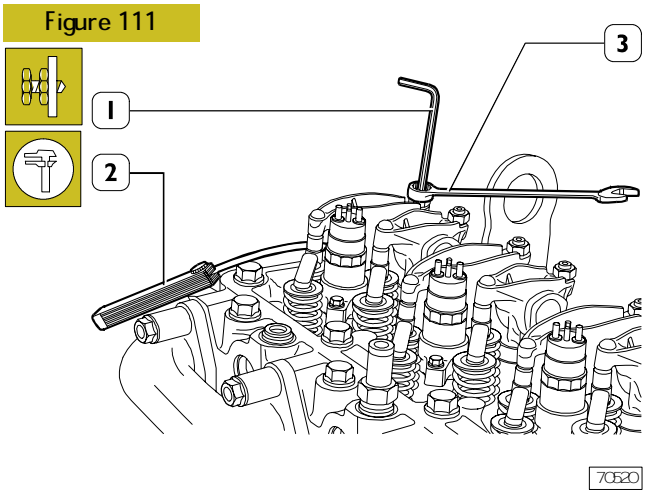

The check of the filtering element is carried out by removing the cover and drawing off the cartridges (2).

## Inspection of drive belt tensioning

The drive belt tensioning control is made using an automatic tensioning device therefore no intervention is required apart from checking the wear status of the belt itself.

## Inspection and setting of tappet clearance

Figure 111




Adjust clearance between rockers and valves using setscrew wrench (1), box wrench (3) and feeler gauge (2).

Working clearance shall be as follows:

- intake valves 0.25 ± 0.05 mm
- exhaust valves 0.51 ± 0.05 mm.

In order to more quickly perform the operating clearance adjustment for rocker arms —valves, proceed as follows:

rotate the drive shaft, balance cylinder 1 valves and adjust the valves marked by the asterisk as shown in the table:

| cylinder n. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| intake | - | - | * | - | * | * |
| exhaust | - | * | - | * | - | * |

Rotate the drive shaft, balance cylinder 6 valves and adjust the valves marked by the asterisk as shown in the table:

| cylinder n. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| intake | * | * | - | * | - | - |
| exhaust | * | - | * | - | * | - |

Engine with 4 cylinder: rotate the drive shaft, balance cylinder 1 valves and adjust the valves marked by the asterisk as shown in the table:

| cylinder n. | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| intake | - | * | * | * |
| exhaust | - | - | - | * |

Rotate the drive shaft, balance cylinder 4 valves and adjust the valves marked by the asterisk as shown in the table:

| cylinder n. | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| intake | * | - | - | - |
| exhaust | * | * | * | - |

https://truckmanualshub.com/


SECTION 4

## Overhaul and technical specifications


| | Pagina |
|---|---|
| GENERAL SPECIFICATIONS | 3 |
| CLEARANCE DATA | 4 |
| ENGINE OVERHAUL | 11 |
| ENGINE REMOVAL AT THE BENCH | 11 |
| REPAIR OPERATIONS | 12 |
| CYLINDER UNIT | 12 |
| ❑ Checks and measurements | 12 |
| ❑ Checking head supporting surface on cylinder unit | 13 |
| TIMING SYSTEM | 13 |
| ❑ Camshaft | 13 |
| ❑ Checking cam lift and pin alignment | 14 |
| BUSHES | 14 |
| ❑ Bush replacement | 16 |
| ❑ Tappets | 16 |
| ❑ Fitting tappets — camshaft | 16 |
| OUTPUT SHAFT | 17 |
| ❑ Measuring journals and crankpins | 17 |
| ❑ Replacing oil pump control gear | 21 |
| ❑ Fitting main bearings | 21 |
| ❑ Finding journal clearance | 21 |
| ❑ Checking crankshaft shoulder clearance | 22 |
| CONNECTING ROD — PISTON ASSEMBLY | 22 |
| ❑ Pistons | 23 |
| ❑ Measuring piston diameter | 23 |
| ❑ Piston pins | 24 |
| ❑ Conditions for proper pin-piston coupling | 24 |
| ❑ Split rings | 24 |
| ❑ Connecting rods | 25 |
| ❑ Bushes | 25 |
| ❑ Checking connecting rods | 26 |
| ❑ Checking torsion | 26 |

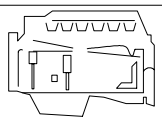
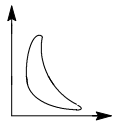
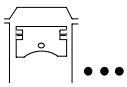
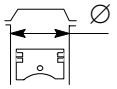
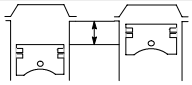
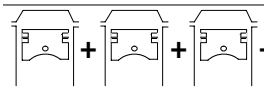
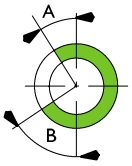
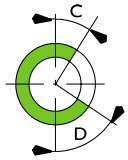
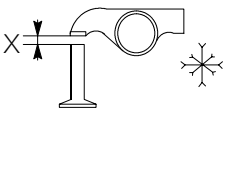
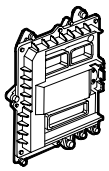
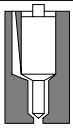
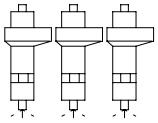
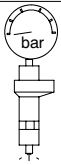
https://truckmanualshub.com/



| | Page |
|---|---|
| ❑ Checking bending | 26 |
| ❑ Fitting connecting rod-piston assembly | 26 |
| ❑ Connecting rod-piston coupling | 26 |
| ❑ Fitting split rings | 27 |
| ❑ Fitting connecting rod-piston assembly into cylinder barrels | 27 |
| ❑ Finding crankpin clearance | 28 |
| ❑ Checking piston protrusion | 29 |
| CYLINDER HEAD | 30 |
| ❑ Removing the valves | 30 |
| ❑ Checking cylinder head wet seal | 31 |
| ❑ Checking cylinder head supporting surface | 31 |
| VALVES | 32 |
| ❑ Removing carbon deposits, checking and grinding valves | 32 |
| ❑ Checking clearance between valve stem and valve guide and valve centering | 32 |
| VALVE GUIDE | 33 |
| VALVE SEATS | 33 |
| ❑ Regrinding —replacing the valve seats | 33 |
| VALVE SPRINGS | 36 |
| FITTING CYLINDER HEAD | 36 |
| ❑ Refitting the cylinder head | 37 |
| TIGHTENING TORQUE | 38 |

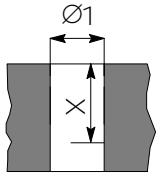
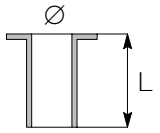
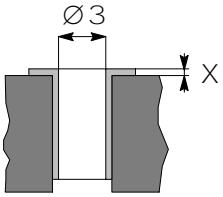
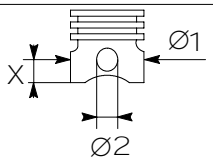
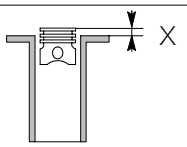
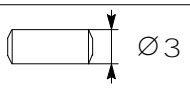
https://truckmanualshub.com/


## GENERAL SPECIFICATIONS

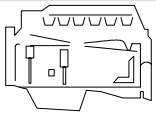
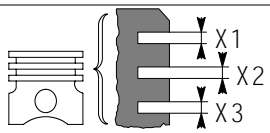
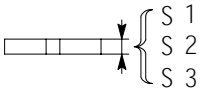
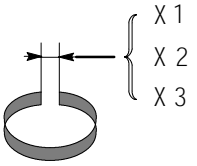
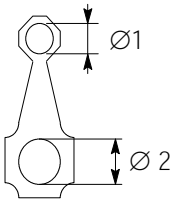
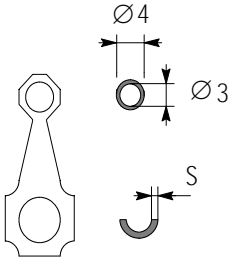
| | | | | |
|---|---|---|---|---|
|  | Type | | 4 CYLINDERS | 6 CYLINDERS |
|  | Cycle | | Four-stroke diesel engine | |
| | Power | | Turbocharged with intercooler | |
| | Injection | | Direct | |
|  | Number of cylinders | | 4 in-line | 6 in-line |
|  | Bore | mm | 102 | |
|  | Stroke | mm | 120 | |
|  | Total displacement | $cm^3$ | 3920 | 5880 |
|  | **TIMING** | | | |
| | start before T.D.C.<br>end after B.D.C. | A<br>B | 8.5°<br>8.5° | |
|  | start before B.D.C.<br>end after T.D.C. | D<br>C | 51°<br>12.5° | |
|  | Checking timing<br>X | mm<br>mm | -<br>- | |
| | Checking operation<br>X | mm<br>mm | 0.20 to 0.30<br>0.45 to 0.55 | |
|  | **FUEL FEED**<br>Injection<br>Type: | <br><br>Bosch | <br>high pressure common rail<br>EDC7 ECU | |
|  | Nozzle type | | Injectors | |
|  | Injection sequence | | 1 - 3 - 4 - 2 | 1 - 5 - 3 - 6 - 2 - 4 |
|  | Injection pressure | bar | 250 - 1450 | |

https://truckmanualshub.com/

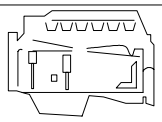
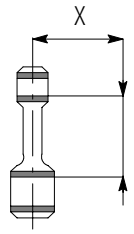
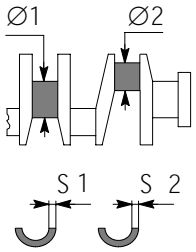
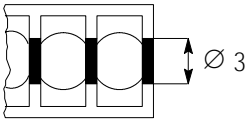
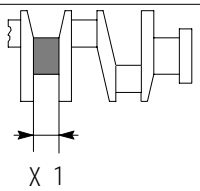
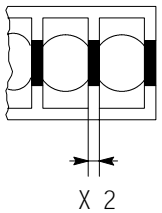
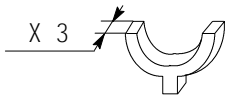

## CLEARANCE DATA

| | Type | 4 CYLINDERS | 6 CYLINDERS |
|---|---|---|---|
| | **CYLINDER UNIT AND CRANKSHAFT COMPONENTS** | **mm** | |
|  | Cylinder barrels Ø1 | 102.01 to 102.03 | |
|  | Cylinder barrels:<br>outside diameter Ø 2<br>length L | <br>-<br>- | |
|  | Cylinder barrels—housings on engine block (interference) | - | |
|  | Outside diameter Ø 2 | - | |
|  | Cylinder barrels:<br>inside diameter Ø 2 | - | |
|  | Spare pistons<br>type:<br>Size X<br>Outside diameter Ø 1<br>Pin housing Ø 2 | <br>12<br>101.883 to 101.897<br>40008 to 40014 | |
|  | Piston—cylinder barrels | 0.113 to 0.147 | |
|  | Piston diameter Ø 1 | 0.5 | |
|  | Piston protrusion X | 0.28 to 0.52<br>0.28 to 0.52 | |
|  | Piston pin Ø 3 | 39.9968 to 40.0032 | |
|  | Piston pin—pin housing | 0.0048 to 0.0172 | |

https://truckmanualshub.com/

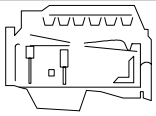
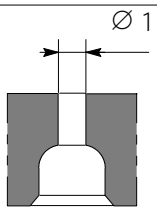
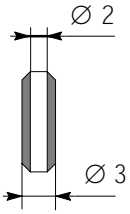
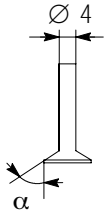
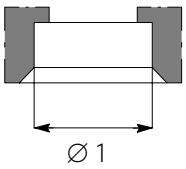
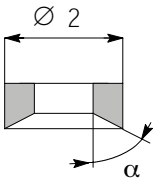
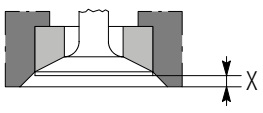

| | | | | |
|---|---|---|---|---|
|  | Type | | 4 CYLINDERS | 6 CYLINDER |
| CYLINDER UNIT AND CRANKSHAFT COMPONENTS | | | mm | |
|  | Split ring slots | X 1*<br>X 2<br>X 3 | 2.705 to 2.735<br>2.420 to 2.440<br>4.020 to 4.040 | |
|  | Split rings<br>* measured on 98 mm Ø | S 1*<br>S 2<br>S 3 | 2.560 to 2.605<br>2.350 to 2.380<br>3.975 to 4.000 | |
|  | Split rings - slots | 1<br>2<br>3 | 0.100 to 0.175<br>0.040 to 0.900<br>0.020 to 0.065 | |
| PARTS > | Split rings | | 0.5 | |
|  | Split ring end opening in cylinder barrel: | X 1<br>X 2<br>X 3 | 0.22 to 0.32<br>0.60 to 0.85<br>0.25 to 0.55 | |
|  | Small end bush housing<br>Big end bearing housing | Ø 1<br>Ø 2 | 42.987 to 43.013<br>72.987 to 73.013 | |
|  | Small end bush diameter<br>0 utside<br>Inside<br>Spare big end half bearings | Ø 4<br>Ø 3<br>S | 43.279 to 43.553<br>40.019 to 40.033<br>1.955 to 1.968 | |
|  | Small end bush —housing | | 0.266 to 0.566 | |
|  | Piston pin —bush | | 0.0362 to 0.0158 | |
| PARTS > | Big end half bearings | | 0.250 to 0.500 | |

https://truckmanualshub.com/

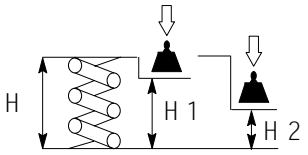
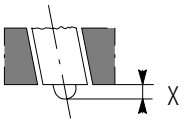
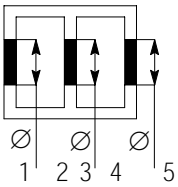
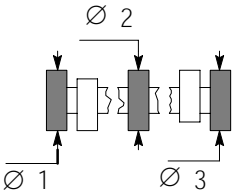
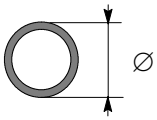
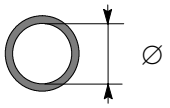
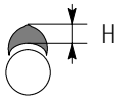

|  | Type | | 4 CYLINDERS | 6 CYLINDERS |
|---|---|---|---|---|
| **CYLINDER UNIT AND CRANKSHAFT COMPONENTS** | | | **mm** | |
|  | Size<br>Max. tolerance on connecting rod axis alignment | X<br>— | -<br>- | |
|  | Journals<br>Crankpins<br>Main half bearings<br>Big end half bearings<br>*provided as spare part | Ø 1<br>Ø 2<br>S 1<br>S 2 | 82.99 to 83.01<br>68.987 to 69.013<br>2.456 to 2.464<br>1.955 to 1.968 | |
|  | Main bearings<br>No. 1 —5<br>No. 2 —3 —4 | <br>Ø 3<br>Ø 3 | <br>87.982 to 88.008<br>87.977 to 88.013 | |
|  | Half bearings — Journals<br>No. 1–5 / 1-7<br>No. 2–3–4 / 2-3-4-5-6 | | <br>0.041 to 0.119<br>0.041 to 0.103 | |
| | Half bearings - Crankpins | | 0.033 to 0.041 | |
|  | Main half bearings<br>Big end half bearings | | + 0.250 to + 0.500 | |
|  | Shoulder journal | X 1 | 37.475 to 37.545 | |
|  | Shoulder main bearing | X 2 | 25.98 to 26.48 | |
|  | Shoulder half-rings | X 3 | 37.28 to 37.38 | |
|  | Output shaft shoulder | | 0.068 to 0.410 | |

https://truckmanualshub.com/

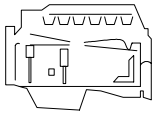
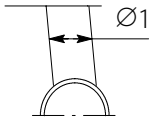
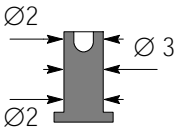
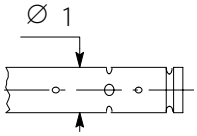
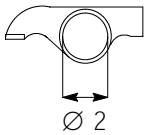


|  | Type | 4 CYLINDERS | 6 CYLINDERS |
|---|---|---|---|
| **CYLINDER HEAD — TIMING SYSTEM** | | **mm** | |
|  | Valve guide seats on cylinder head Ø 1 | 7.042 to 7.062<br>7.042 to 7.062 | |
|  | Valve guides Ø 2 | - | |
| | Ø 3 | - | |
|  | Valve guides and seats on head | - | |
|  | Valve guides | - | |
|  | Valves: Ø 4 α | 6.970 to 6.999<br>60° ± 0.25° | |
| | Ø 4 α | 6.970 to 6.999<br>45° ± 0.25° | |
|  | Valve stem and guide | 0.052 to 0.092 | |
|  | Housing on head for valve seat: Ø1 | 34.837 to 34.863 | |
| | Ø1 | 34.837 to 34.863 | |
|  | Valve seat outside diameter; valve seat angle on cylinder head: Ø 2 α | 34.917 to 34.931<br>60° | |
| | Ø 2 α | 34.917 to 34.931<br>45° | |
|  | Sinking X | 0.59 to 1.11 | |
| | X | 0.96 to 1.48 | |
|  | Between valve seat and head | 0.054 to 0.094<br>0.054 to 0.094 | |
|  | Valve seats | - | |

https://truckmanualshub.com/


| | Type | | 4 CYLINDERS | 6 CYLINDERS |
|---|---|---|---|---|
| **CYLINDER HEAD — TIMING SYSTEM** | | | **mm** | |
|  | Valve spring height:<br>free spring<br>under a load equal to:<br>339.8 ± 9 N<br>741 ± 39 N | <br>H<br><br>H1<br>H2 | <br>47.75<br><br>35.33<br>25.2 | |
|  | Injector protrusion | X | - | |
|  | Camshaft bush housings No. 1-5<br>Camshaft housings No. 2-3-4 | | 59.222 to 59.248<br>54.089 to 54.139 | |
|  | Camshaft journals:<br>1 ⇒ 5<br>1 ⇒ 7 | <br>Ø<br>Ø | 53.995 to 54.045 | |
|  | Camshaft bush outside diameter: | Ø | - | |
|  | Bush inside diameter | Ø | 54.083 to 54.147 | |
|  | Bushes and housings on block | | - | |
|  | Bushes and journals | | 0.038 to 0.162 | |
|  | Cam lift:<br>  <br>  | <br>H<br>H | <br>6.045<br>7.582 | |

https://truckmanualshub.com/


| | | | | |
|---|---|---|---|---|
|  | Type | | 4 CYLINDERS | 6 CYLINDERS |
| **CYLINDER HEAD —TIMING SYSTEM** | | | **mm** | |
|  | Tappet cap housing on block | Ø 1 | 16.000 to 16.030 | |
|  | Tappet cap outside diameter: | Ø 2<br>Ø 3 | 15.924 to 15.954<br>15.960 to 15.975 | |
|  | Between tappets and housings | | 0.025 to 0.070 | |
|  | Tappets | | - | |
|  | Rocker shaft | Ø 1 | 21.965 to 21.977 | |
|  | Rockers | Ø 2 | 22.001 to 22.027 | |
|  | Between rockers and shaft | | 0.024 to 0.162 | |

https://truckmanualshub.com/

https://truckmanualshub.com/

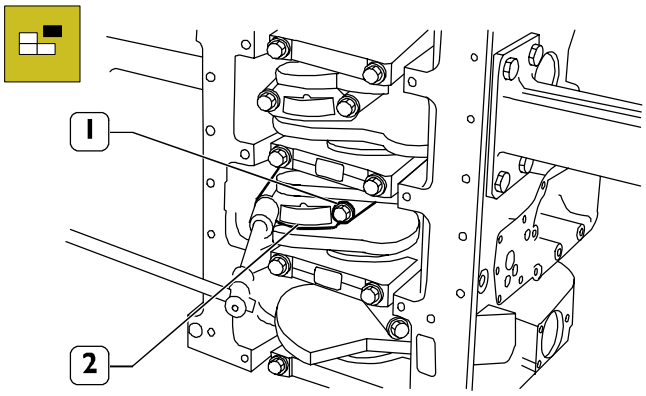

# ENGINE OVERHAUL
# ENGINE REMOVAL AT THE BENCH

The following instructions assume that the engine has previously been placed on the rotating bench and that removal of all specific components of the equipment have been already removed as well. (See Section 3 of the manual herein).

The section illustrates therefore all the most important engine overhaul procedures.

The following operations are relating to the 4 cylinder engine but are similar and applicable for the 6 cylinder.

**Figure 1**



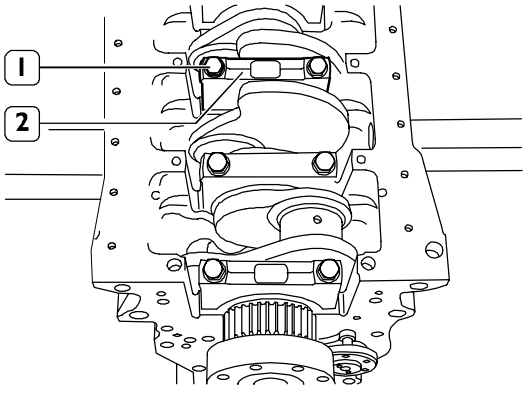

70158

Remove the screws (1) fastening the connecting rod caps (2) and remove them.

Withdraw the pistons including the connecting rods from the top of the engine block.

Keep the half-bearings into their housings since in case of use they shall be fitted in the same position found at removal.

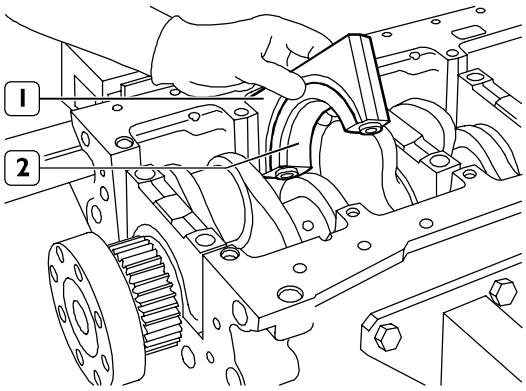
**Figure 2**




70159

Remove the screws (1) and the main bearing caps (2).

**Figure 3**

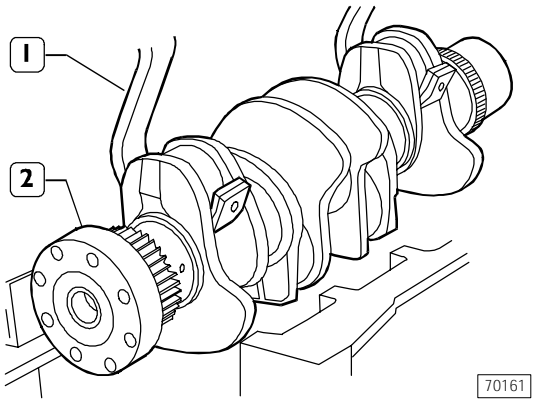



70160

The second last main bearing cap (1) and the relevant support are fitted with shoulder half-bearing (2).

Take note of lower and upper half-bearing assembling positions since in case of reuse they shall be fitted in the same position found at removal.

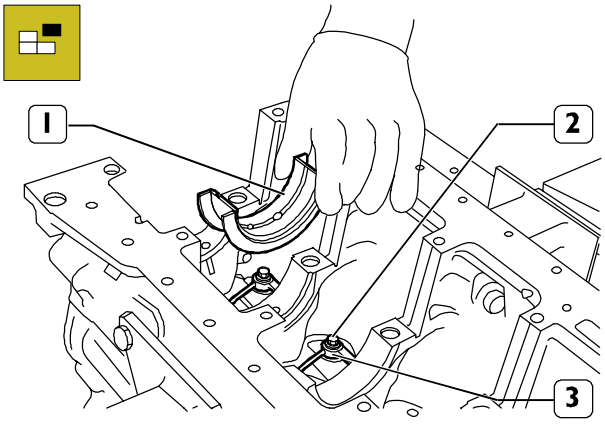
**Figure 4**




70161

Use tool 99360500 (1) and hoist to remove the crankshaft (2) from the block.

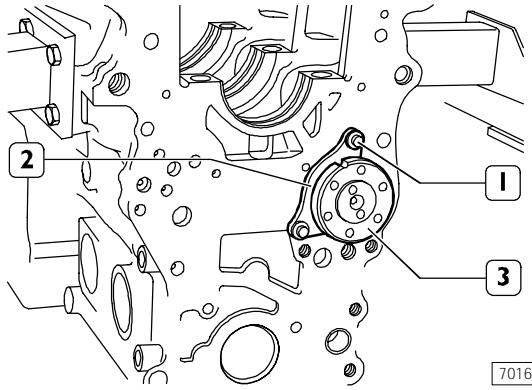
**Figure 5**




70162

Remove the main half-bearings (1).
Remove the screws (2) and remove the oil nozzles (3).

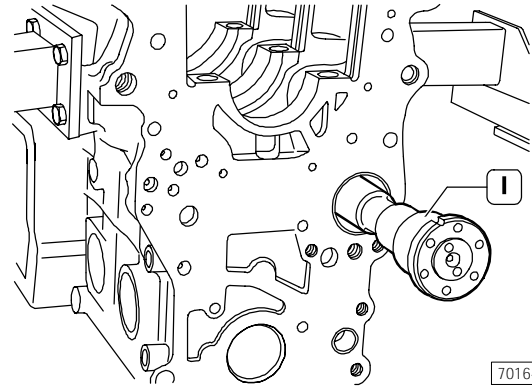
Figure 6




Remove the screws (1) and disconnect camshaft (3) retaining plate (2).

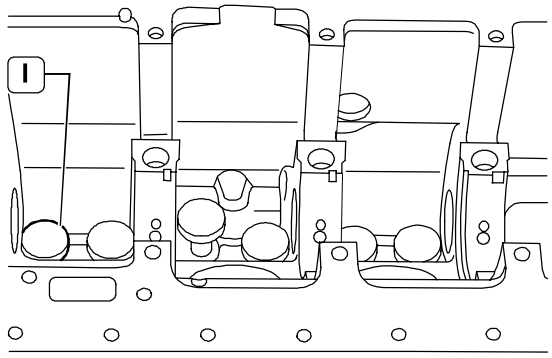
Take note of plate (2) assembling position.

Figure 7




Withdraw carefully the camshaft (1) from the engine block.

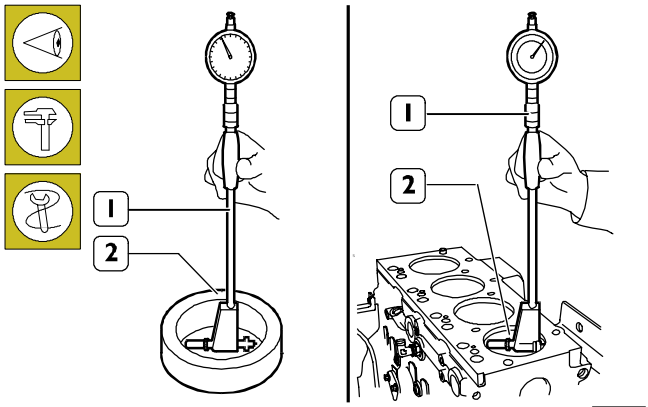
Figure 8




Withdraw the tappets (1) from the engine block.

## REPAIR OPERATIONS
## CYLINDER UNIT
### Checks and measurements

Figure 9




Once engine is disassembled, clean accurately the cylinder-block assembly.

Use the proper rings to handle the cylinder unit.

The engine block shall not show cracks.

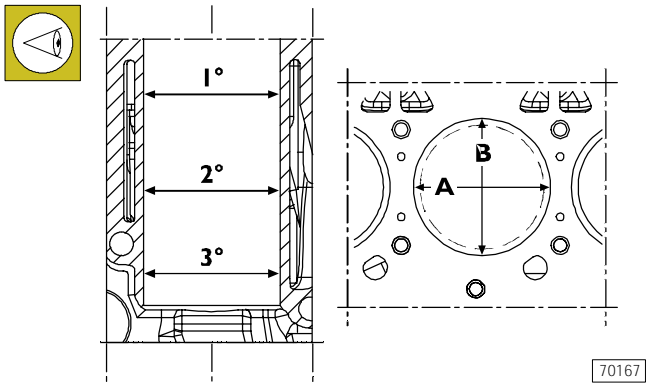
Check operating plug conditions and replace them in case of uncertain seal or if rusted.

Inspect cylinder barrel surfaces; they shall be free from seizing, scores, ovalisation, taper or excessive wear.

Inspection of cylinder barrel bore to check ovalisation, taper and wear shall be performed using the bore dial gauge 99395687 (1) fitted with the dial gauge previously set to zero on the ring gauge (2) of the cylinder barrel diameter.

Should the ring gauge be not available, use a micrometer for zero-setting.

Figure 10

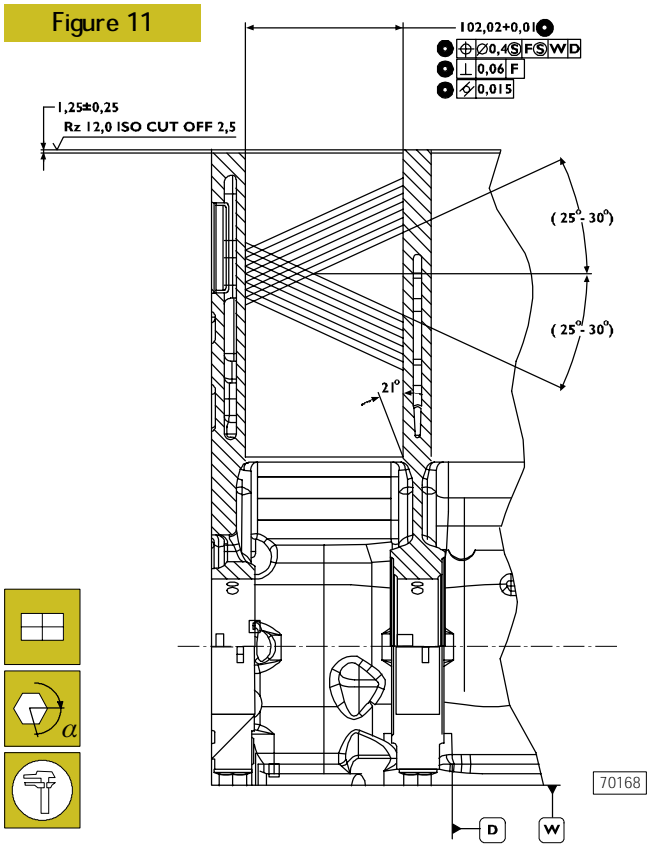



Measurements shall be performed on each cylinder, at three different heights in the barrel and on two planes perpendicular with each other: one parallel to the longitudinal axis of the engine (A), and the other perpendicular (B). Maximum wear is usually found on plane (B) in correspondence with the first measurement.

Should ovalisation, taper or wear be found, bore and grind the cylinder barrels. Cylinder barrel regrinding shall be performed according to the spare piston diameter oversized by 0.5 mm and to the specified assembling clearance.

https://truckmanualshub.com/


Figure 11




In case of regrinding, all barrels shall have the same oversize (0.5 mm).

Check main bearing housings as follows:

- ❑ fit the main bearings caps on the supports without bearings;
- ❑ tighten the fastening screws to the specified torque;
- ❑ use the proper internal gauge to check whether the housing diameter is falling within the specified value.

Replace if higher value is found.

### Checking head supporting surface on cylinder unit

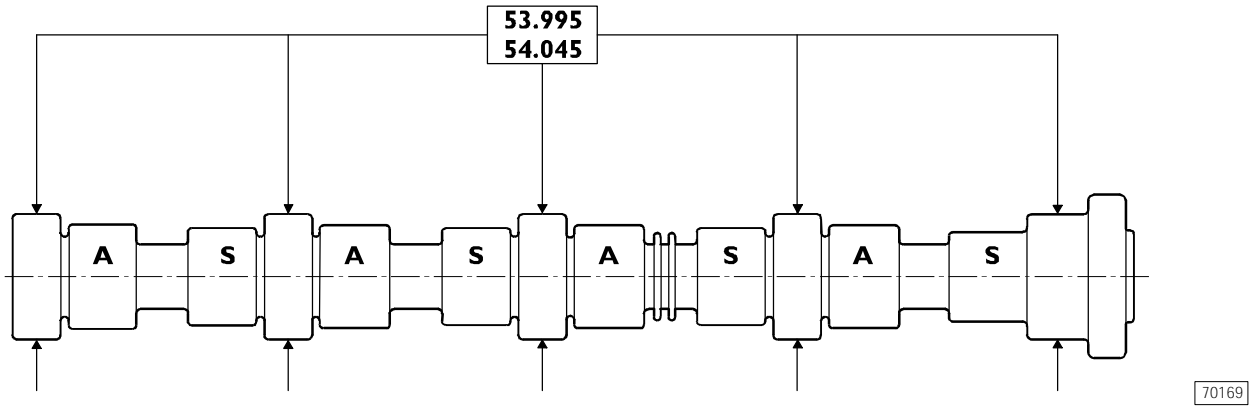
When finding the distortion areas, replace the cylinder unit.

Planarity error shall not exceed 0.075 mm.

Check cylinder unit operating plug (1) conditions, replace them in case of uncertain seal or if rusted.

## TIMING SYSTEM
### Camshaft

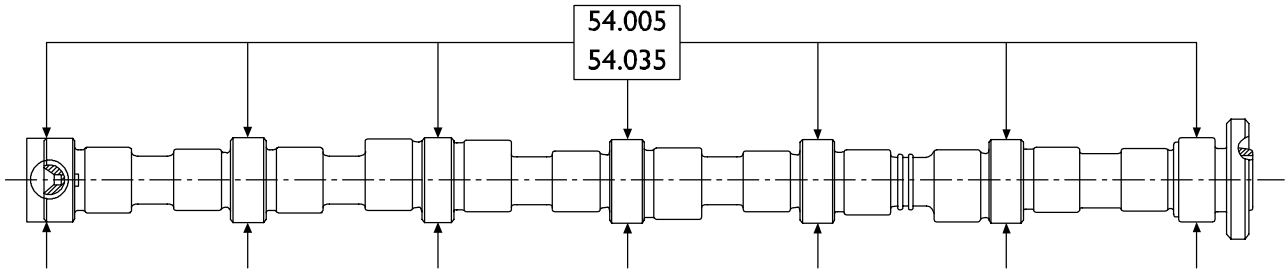
Figure 12




CAMSHAFT MAIN DATA (4 CYL.)
Specified data refer to pin standard diameter

https://truckmanualshub.com/


Figure 13




70512

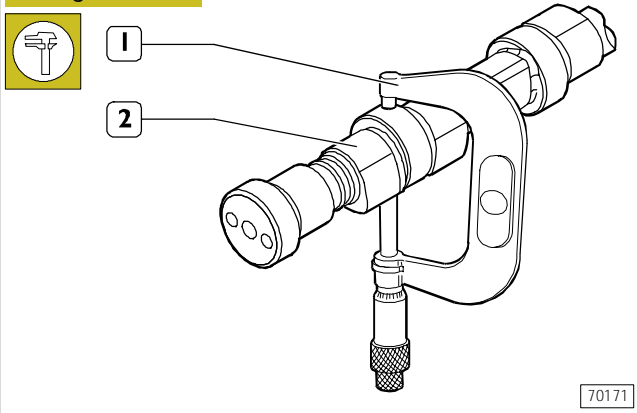
MAIN DATA ABOUT CAMSHAFT PINS (6 CYL.)

Camshaft pin and cam surfaces shall be absolutely smooth; if they show any traces of seizing or scoring replace the camshaft and the bushes.

## Checking cam lift and pin alignment

Set the camshaft on the tailstock and using a 1/100 gauge set on the central support, check whether the alignment error is not exceeding 0.04 mm, otherwise replace the camshaft. Check cam lift; found values shall be: 6.045 mm for exhaust cams and 7.582 mm for intake cams, in case of different values replace the camshaft.

Figure 14

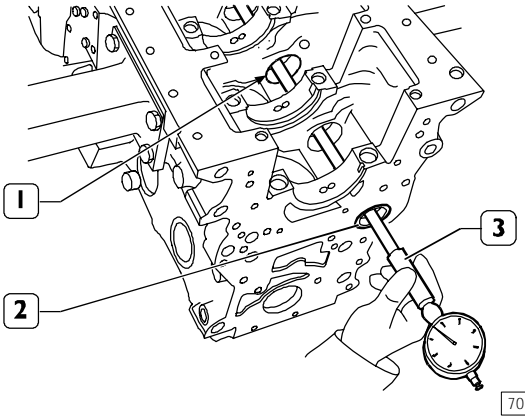



70171

Check camshaft (2) pin diameter using micrometer (1) on two perpendicular axes.

## BUSHES

Figure 15

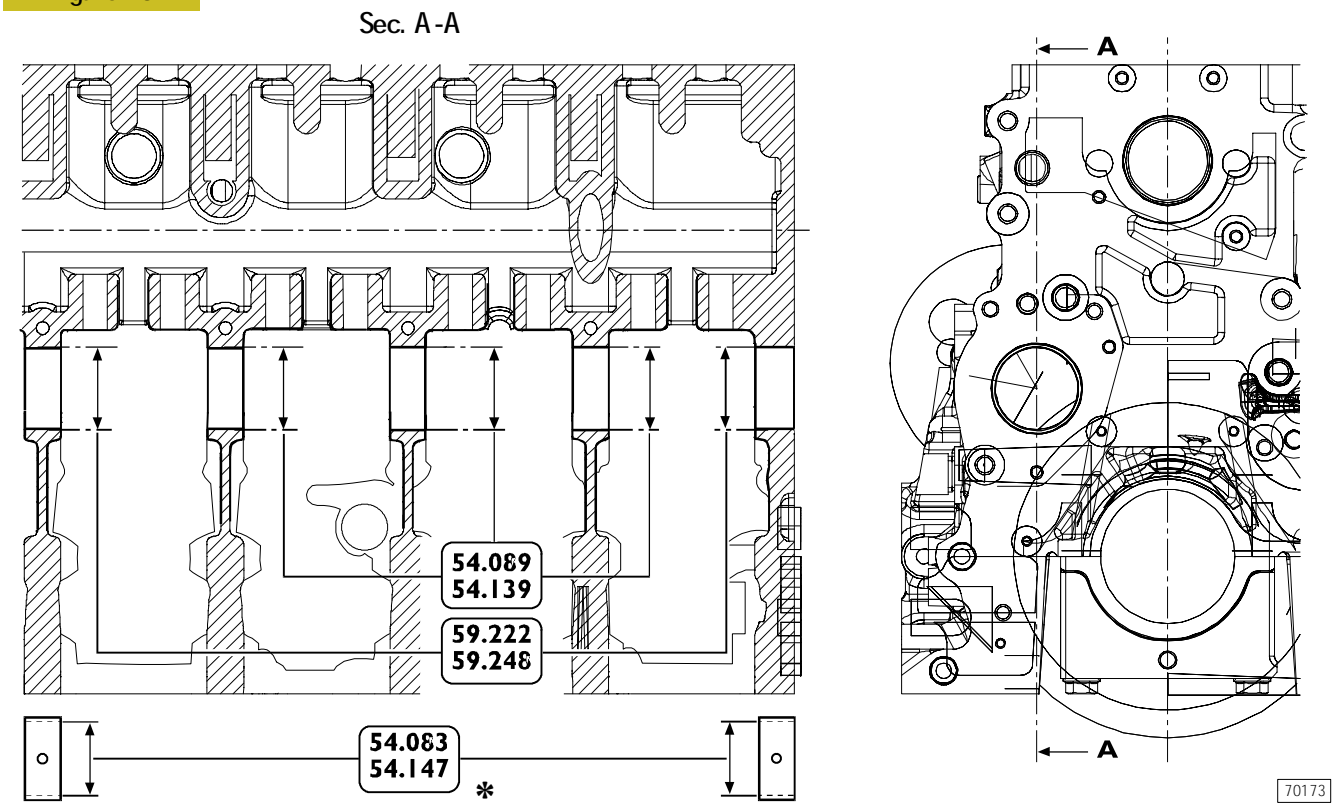



70172

Camshaft bushes (2) shall be pressed into their housings. Internal surfaces must not show seizing or wear.
Use bore dial gauge (3) to measure camshaft front and rear bush (2) and intermediate housing (1) diameter.
Measurements shall be performed on two perpendicular axes.

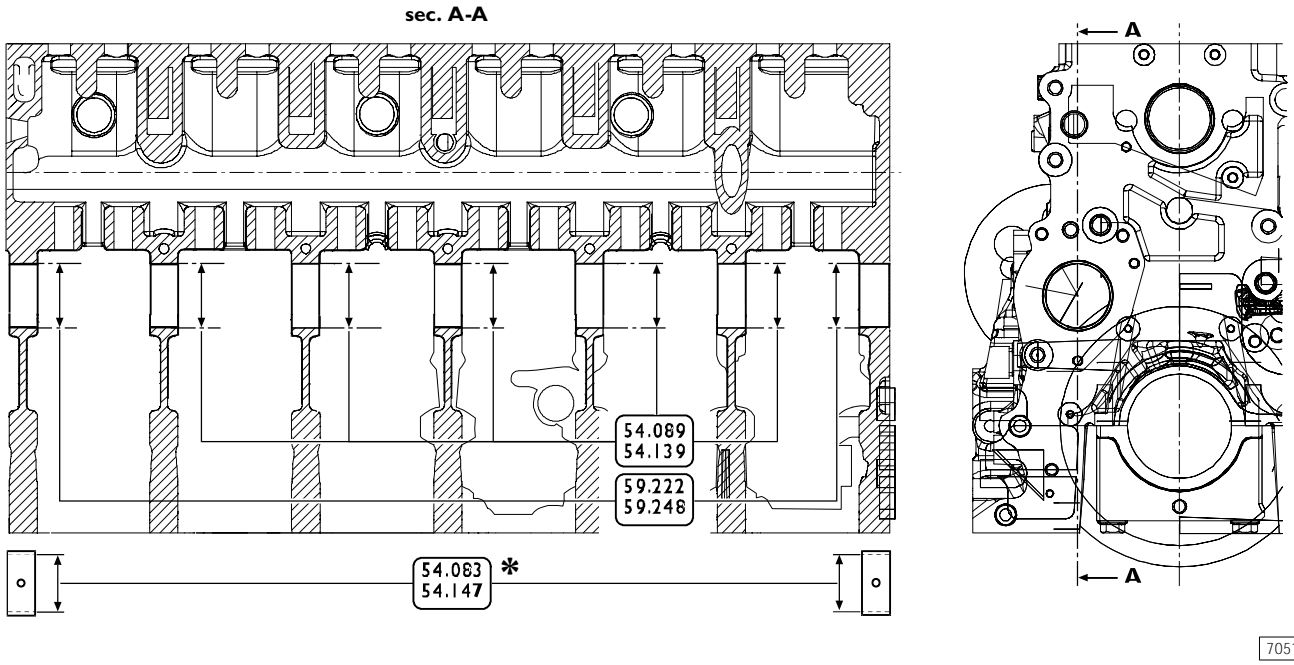
https://truckmanualshub.com/


Figure 16




CAMSHAFT BUSH AND HOUSING MAIN DATA
* Value to be obtained after driving the bushes.

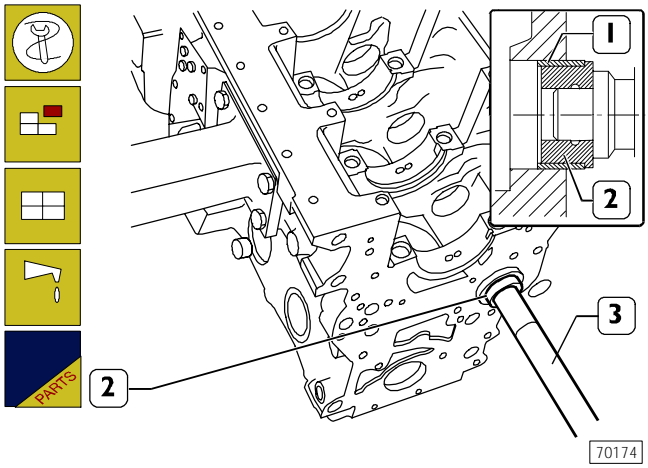
Figure 17




MAIN DATA ABOUT CAMSHAFT BUSHES AND RELATED HOUSINGS
*Height to be obtained after driving the bushes.

## Bush replacement

Figure 18

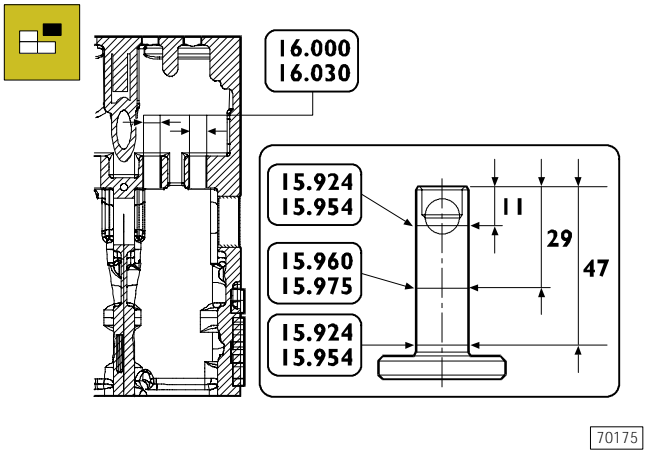



To replace front and rear bushes (1), remove and refit them using the beater 99360362 (2) and the handgrip 99370006 (3).

When refitting the bushes (1), direct them to make the lubricating holes (2) coincide with the holes on the block housings.

## Tappets

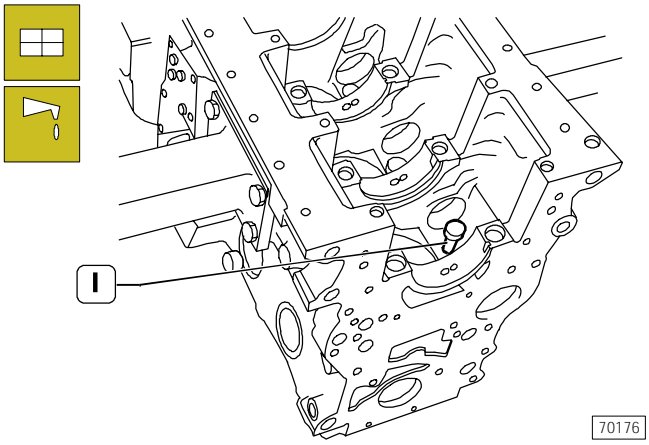
Figure 19




MAIN DATA CONCERNING THE TAPPETS AND THE RELEVANT HOUSINGS ON THE ENGINE BLOCK

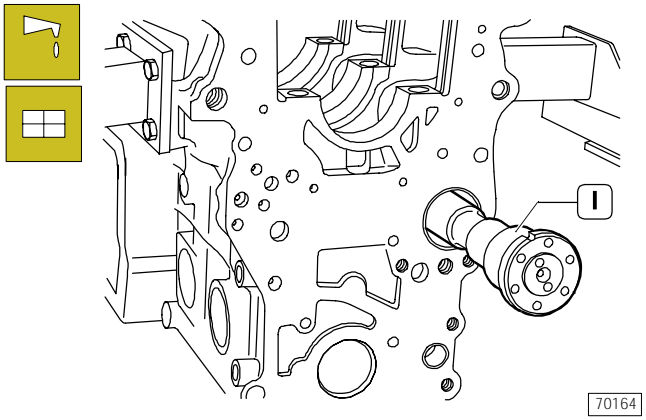
## Fitting tappets – camshaft

Figure 20



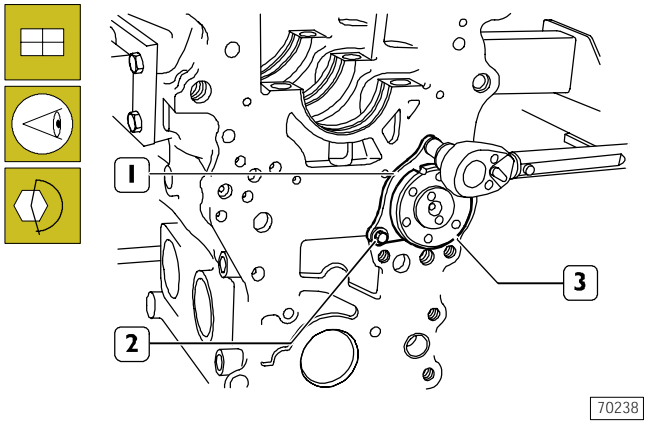

Lubricate the tappets (1) and fit them into the relevant housings on the engine block.

Figure 21




Lubricate the camshaft bushes and fit the camshaft (1) taking care not to damage the bushes or the housings.

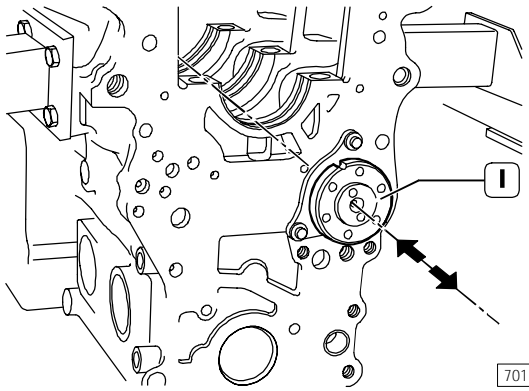
Figure 22




Set camshaft (3) retaining plate (1) with the slot facing the top of the engine block and the marking facing the operator, then tighten the screws (2) to the specified torque.

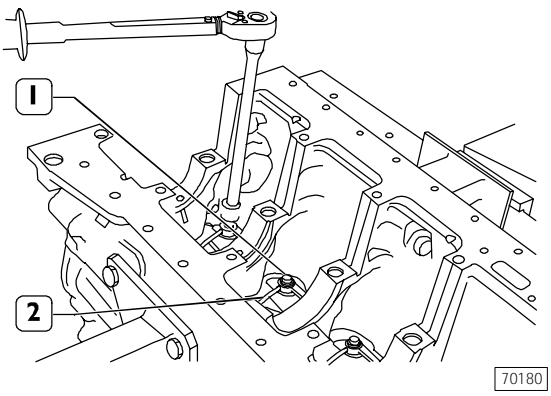
https://truckmanualshub.com/


Figure 23




Check camshaft end float (1).
It shall be 0.23 ± 0.13 mm.

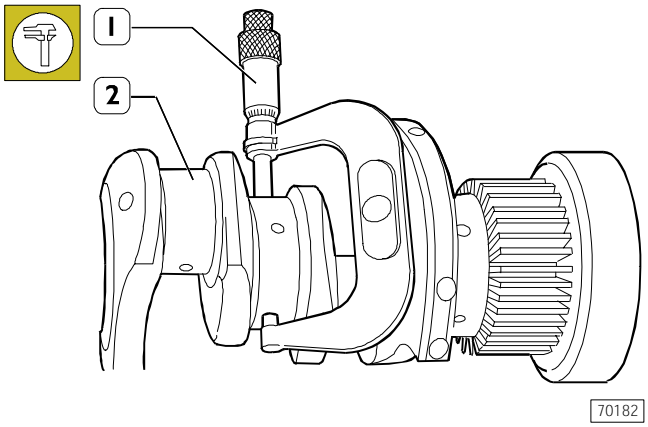
Figure 24




Fit nozzles (2) and tighten the fastening screws (1) to the specified torque.

## OUTPUT SHAFT
### Measuring journals and crankpins

Figure 25



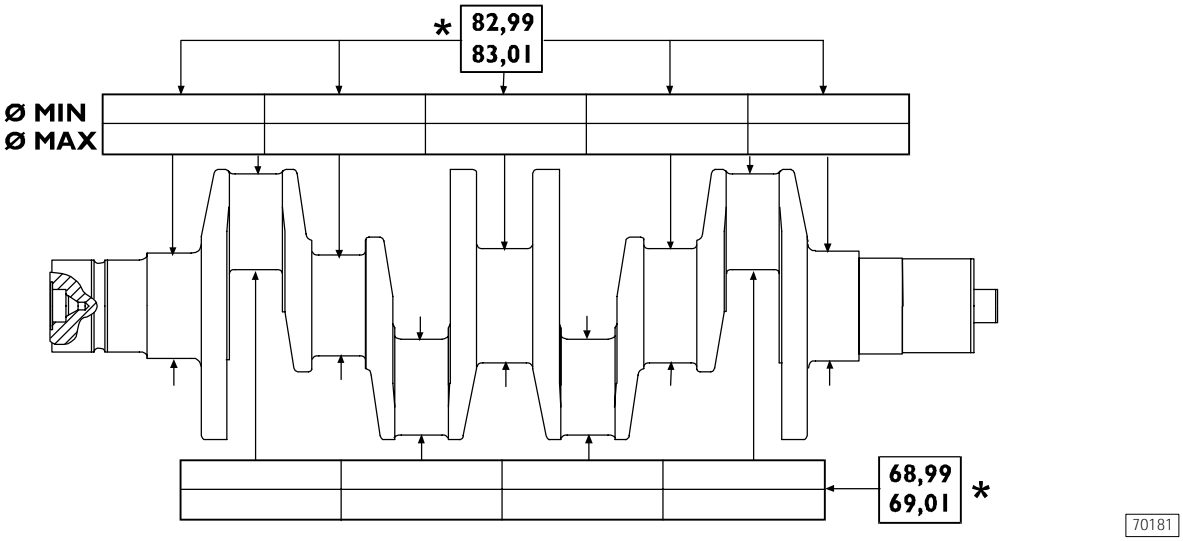

Grind journals and crankpins if seizing, scoring or excessive ovalisation are found. Before grinding the pins (2) measure them with a micrometer (1) to decide the final diameter to which the pins are to be ground.

It is recommended to insert the found values in the proper table.
See Figure 26.

Undersize classes are:

Journals and crankpins shall always be ground to the same undersize class.
Journals and crankpins undersize shall be marked on the side of the crank arm No.1.
For undersized crankpins: letter M
For undersized journals: letter B
For undersized crankpins and journals: letters MB

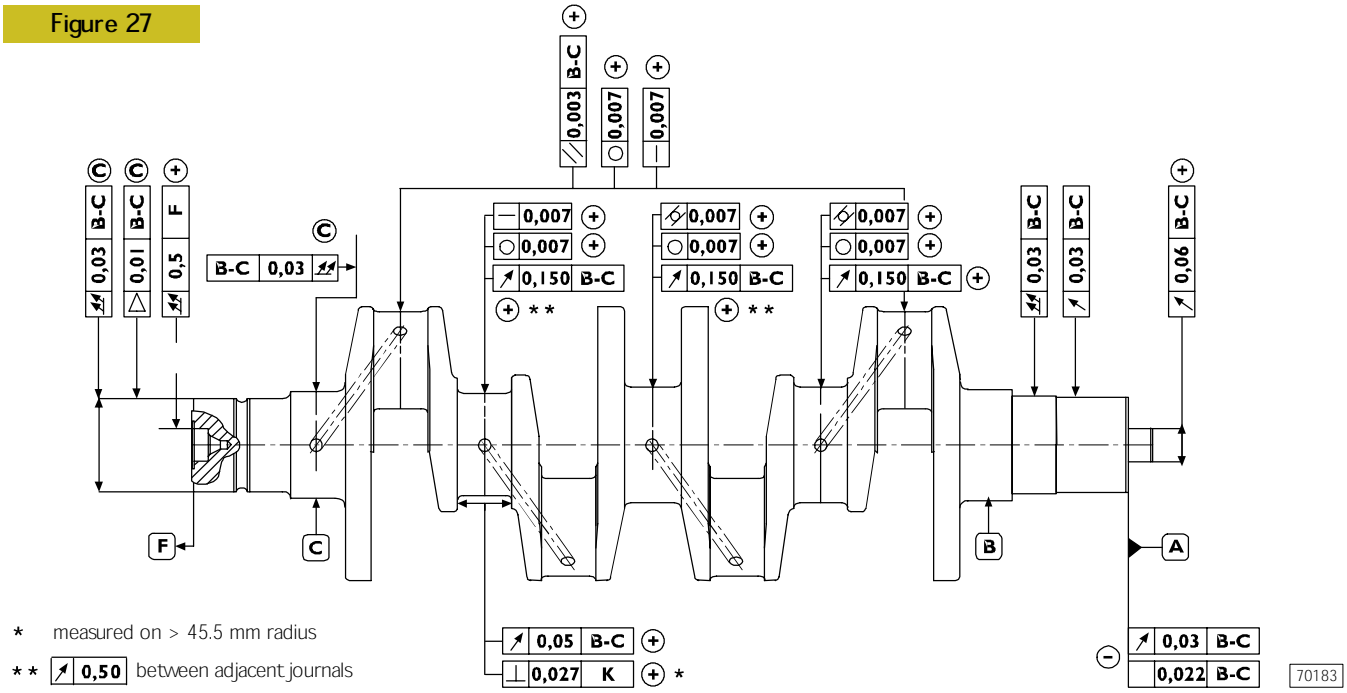
Figure 26




FILL THIS TABLE WITH OUTPUT SHAFT JOURNAL AND CRANKPIN MEASURED VALUES

*Rated value

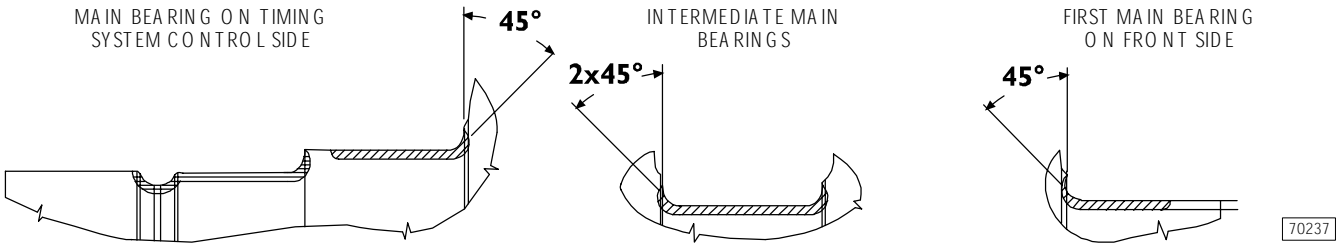
Figure 27




OUTPUT SHAFT MAIN TOLERANCES

| TOLERANCES | TOLERANCE CHARACTERISTIC | GRAPHIC SYMBOL |
|---|---|---|
| SHAPE | Roundness | ○ |
| | Cilindricity | /○/ |
| DIRECTION | Parallelism | // |
| | Verticality | ⊥ |
| | Straightness | — |
| POSITION | Concentricity or coaxiality | ◎ |
| OSCILLATION | Circular oscillation | ↗ |
| | Total oscillation | ⌰ |
| | Taper | ▷ |

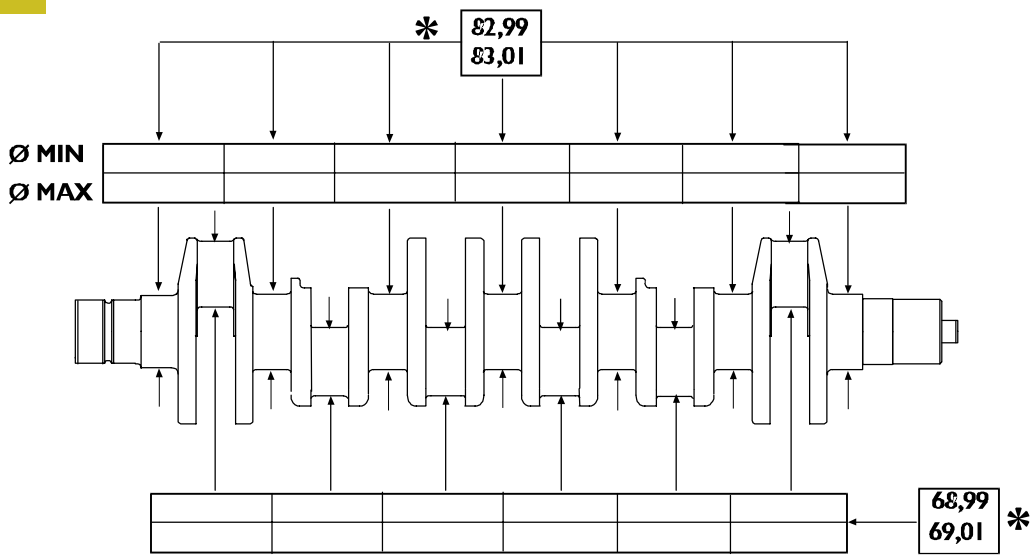
| LEVELS OF IMPORTANCE FOR PRODUCT CHARACTERISTICS | GRAPHIC SYMBOL |
|---|---|
| CRITICAL | Ⓒ |
| IMPORTANT | ⊕ |
| SECONDARY | ⊖ |



https://truckmanualshub.com/


## Measuring journals and crankpins

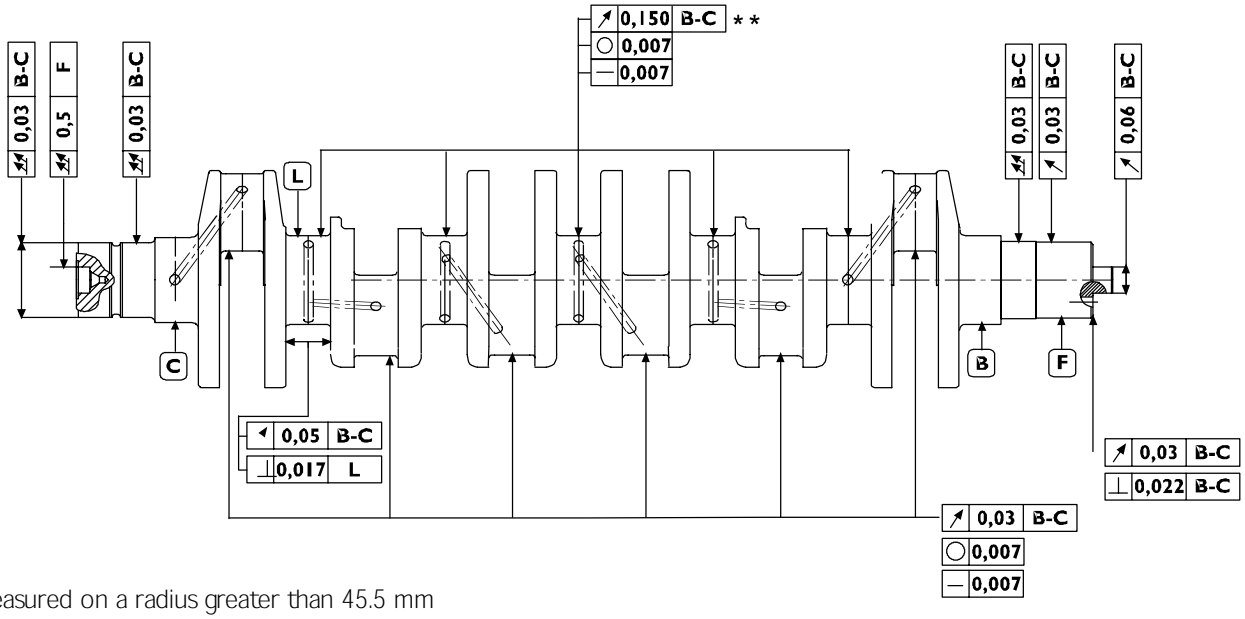
Figure 28




FILL THIS TABLE WITH OUTPUT SHAFT JOURNAL AND CRANKPIN MEASURED VALUES

*Rated value

Figure 29

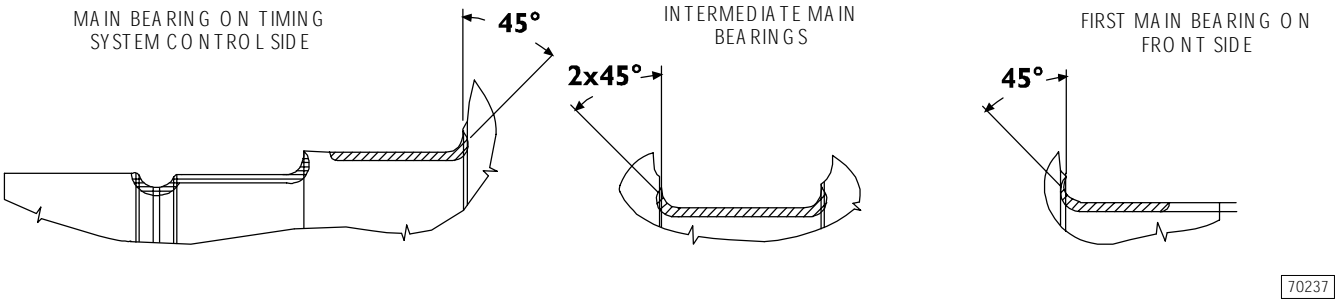



* Measured on a radius greater than 45.5 mm

** ↗ 0.500 between adjacent main journals

MAIN OUTPUT SHAFT TOLERANCES

Figure 30



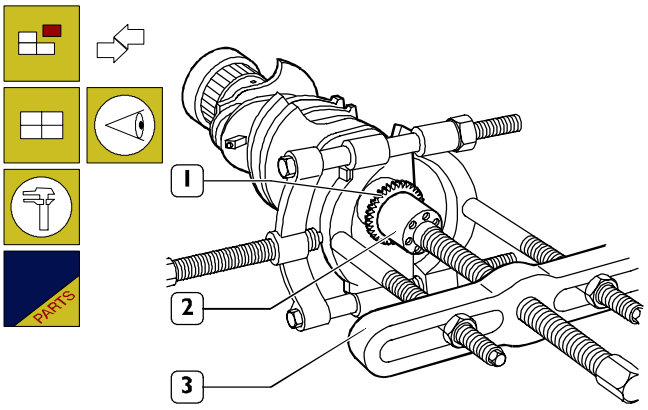

| TOLERANCES | TOLERANCE CHARACTERISTIC | GRAPHIC SYMBOL |
|---|---|---|
| SHAPE | Roundness | ○ |
| | Cilindricity | /○/ |
| DIRECTION | Parallelism | // |
| | Verticality | ⊥ |
| | Straightness | — |
| POSITION | Concentricity or coaxiality | ◎ |
| OSCILLATION | Circular oscillation | ↗ |
| | Total oscillation | ⌰ |
| | Taper | ⌓ |

| LEVELS OF IMPORTANCE FOR PRODUCT CHARACTERISTICS | GRAPHIC SYMBOL |
|---|---|
| CRITICAL | © |
| IMPORTANT | ⊕ |
| SECONDARY | ⊖ |

https://truckmanualshub.com/


## Replacing oil pump control gear

Figure 31

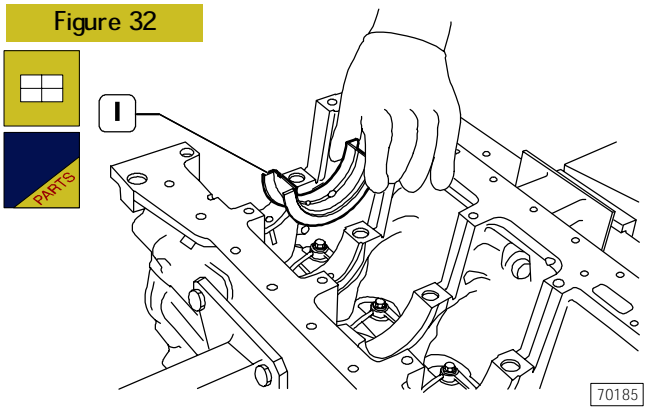



Check that gear toothing (1) is not damaged or worn, otherwise remove it using the proper puller (3).

When fitting the new gear, heat it to 180°C for 10 minutes in an oven and then key it to the crankshaft.

## Fitting main bearings

Figure 32




Refit the main bearings that have not been replaced, in the same position found at removal.

Main bearings (1) are supplied spare with 0.250 —0.500 mm undersize on the internal diameter.

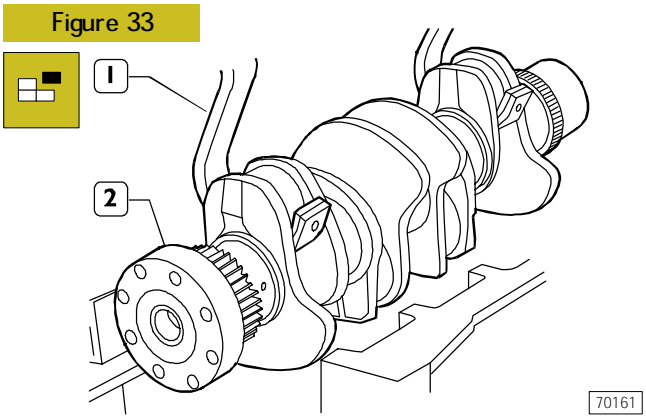
Do not try to adapt the bearings.

Clean accurately the main half bearings (1) having the lubricating hole and fit them into their housings.

The second last main half bearing (1) is fitted with shoulder half rings.

## Finding journal clearance

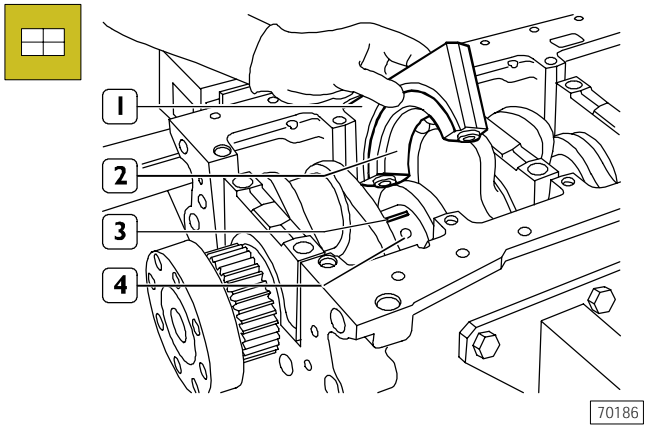
Figure 33




Refit the crankshaft (2).

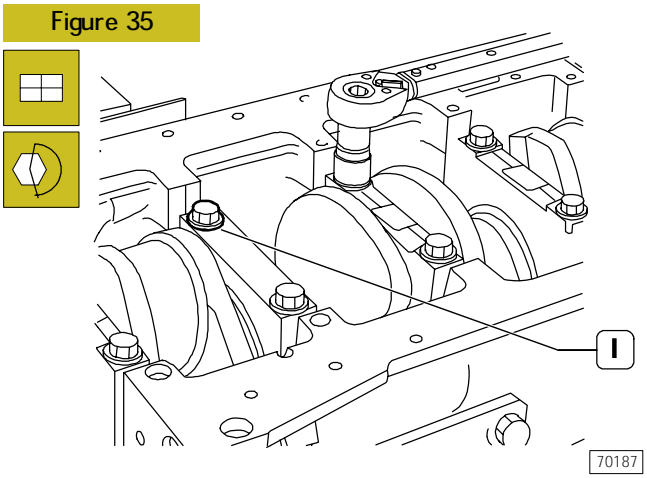
Check the backlash between crankshaf main journals and the relevant bearings as follows:

Figure 34




- ❑ clean accurately the parts and remove any trace of oil;
- ❑ position a piece of calibrated wire (3) on the crankshaft pins (4) so that it is parallel to the longitudinal axis;
- ❑ fit caps (1), including the half bearings (2) on the relevant supports.

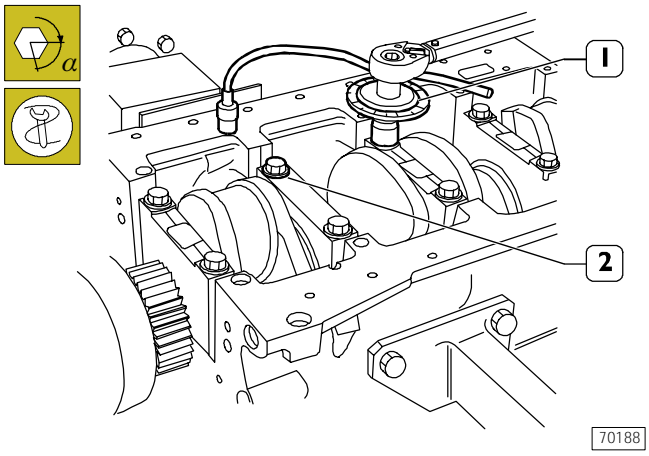
Figure 35




Tighten the pre-lubricated screws (1) in the following three successive stages:

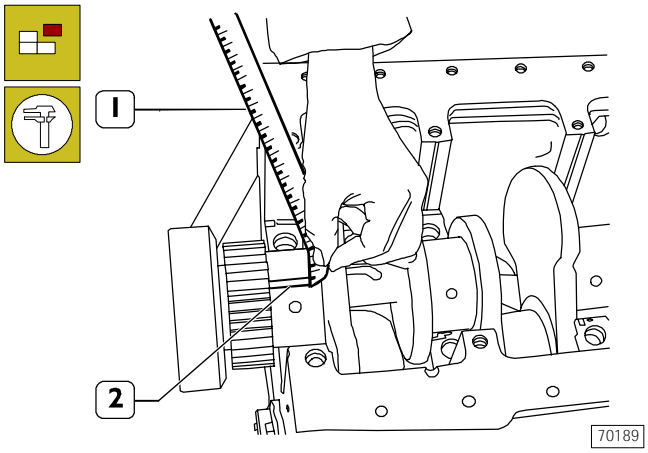
- ❑ 1st stage, with torque wrench to 50 ± 6 N m.
- ❑ 2nd stage, with torque wrench to 80 ± 6 N m.

Figure 36




❑ 3rd stage, with tool 99395216 (1) set as shown in the figure, tighten the screws (2) with 90° ± 5° angle.

Figure 37




❑ Remove caps from supports.

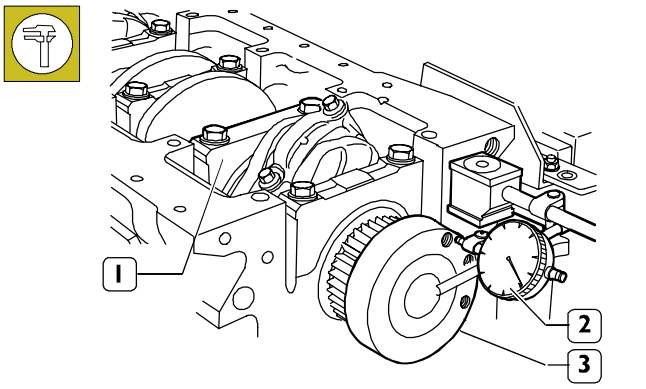
The backlash between the main bearings and the pins is found by comparing the width of the calibrated wire (2) at the narrowest point with the scale on the envelope (1) containing the calibrated wire.

The numbers on the scale indicate the backlash in mm.

Replace the half bearings and repeat the check if a different backlash value is found. Once the specified backlash is obtained, lubricate the main bearings and fit the supports by tightening the fastening screws as previously described.

## Checking crankshaft shoulder clearance

Figure 38

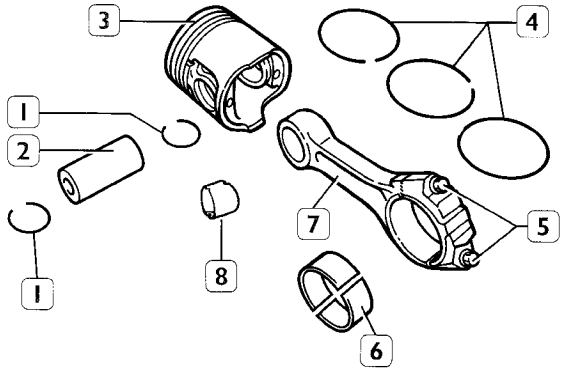



This check is performed by setting a magnetic-base dial gauge (2) on the crankshaft (3) as shown in the figure, standard value is 0.068 to 0.41.

If higher value is found, replace main thrust half bearings of the second last rear support (1) and repeat the clearance check between crankshaft pins and main half bearings.

## CONNECTING ROD – PISTON ASSEMBLY

Figure 39




CONNECTING ROD —PISTON ASSEMBLY COMPONENTS

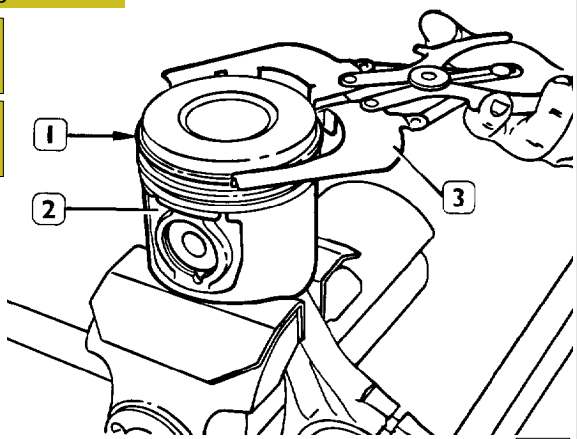
1. Stop rings - 2. Pin - 3. Piston - 4. Split rings - 5. Screws - 6. Half bearings - 7. Connecting rod - 8. Bush.

Pistons are supplied from parts with 0.5 mm oversize.

https://truckmanualshub.com/

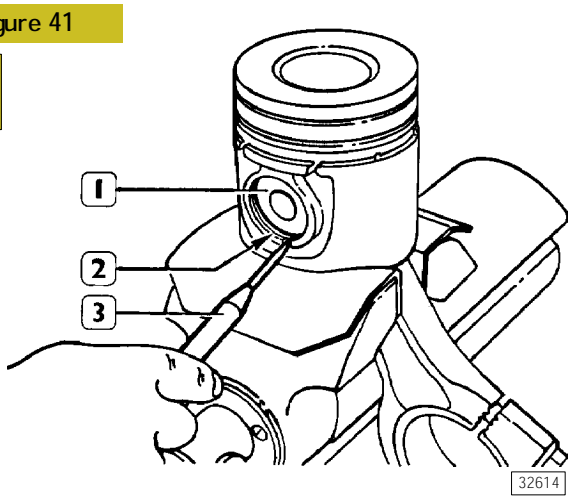

## Pistons
## Measuring piston diameter

Figure 40



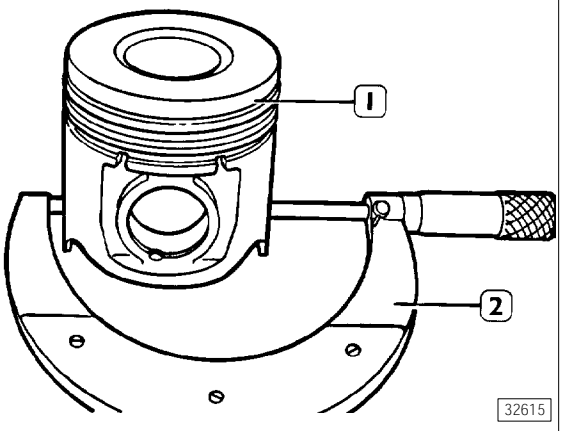

Remove split rings (1) from piston (2) using pliers 99360183 (3).

Figure 41




Piston pin (1) split rings (2) are removed using a scriber (3).

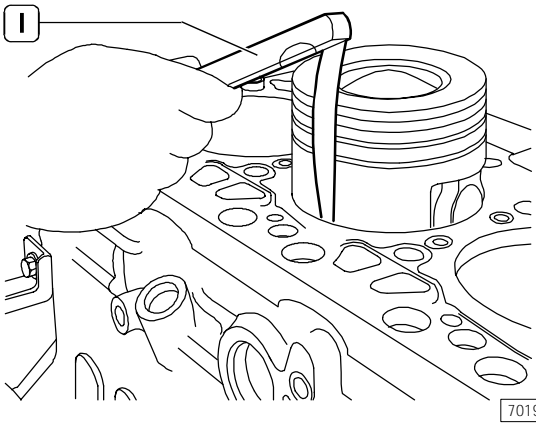
Figure 43




Using a micrometer (2), measure the diameter of the piston (1) to determine the assembly clearance.

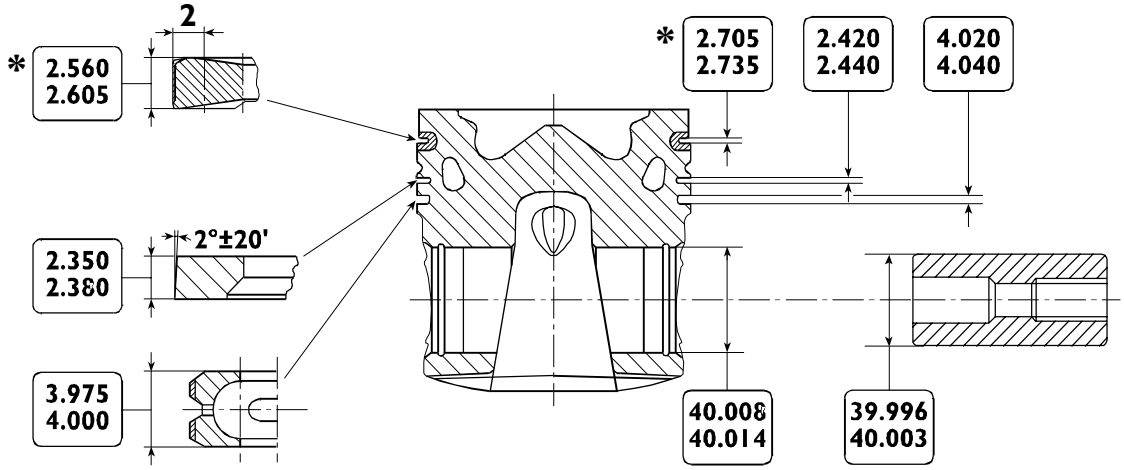
The diameter shall be measured at 12 mm from the piston skirt.

Figure 44




The clearance between the piston and the cylinder barrel can be checked also with a feeler gauge (1) as shown in the figure.

Figure 42

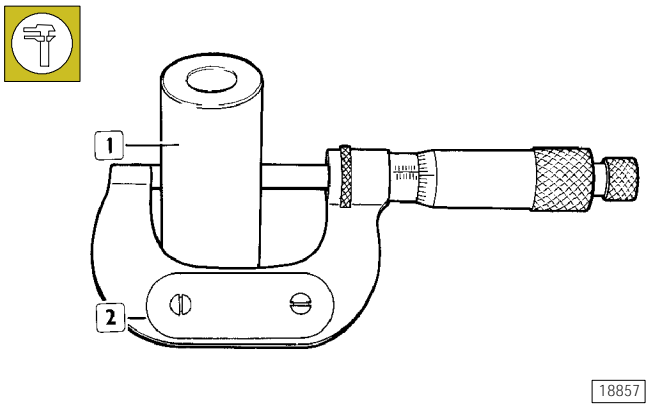



MAIN DATA CONCERNING KS. PISTON, PINS AND SPLIT RINGS

* Value measured on 99 mm diameter

## Piston pins

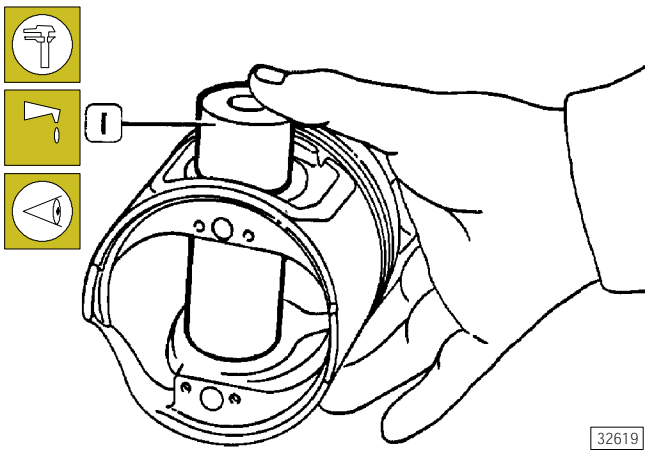
Figure 45




To measure the piston pin (1) diameter use the micrometer (2).

## Conditions for proper pin-piston coupling

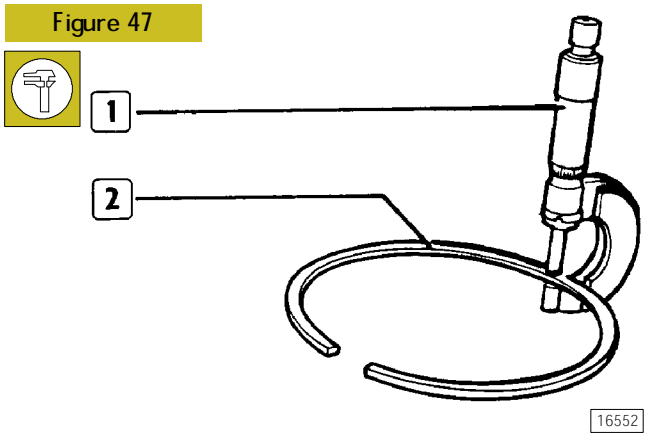
Figure 46




Lubricate the pin (1) and its seat on piston hubs with engine oil; the pin shall be fitted into the piston with a slight finger pressure and shall not be withdrawn by gravity.

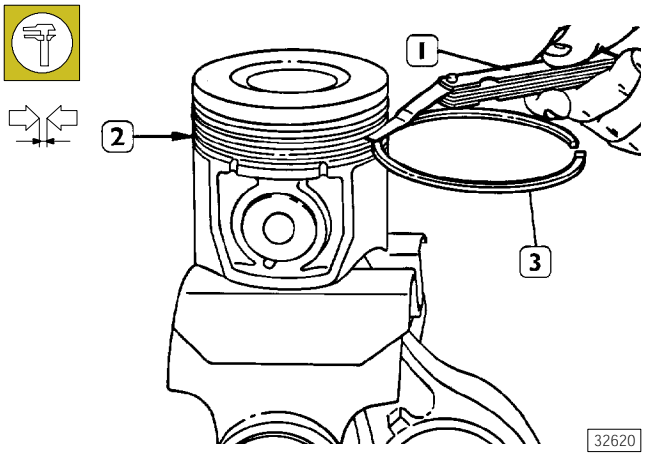
## Split rings

Figure 47




Use a micrometer (1) to check split ring (2) thickness.

Figure 48




Check the clearance between the sealing rings (3) of the 2nd and 3rd slot and the relevant housings on the piston (2), using a feeler gauge (1).

Figure 49

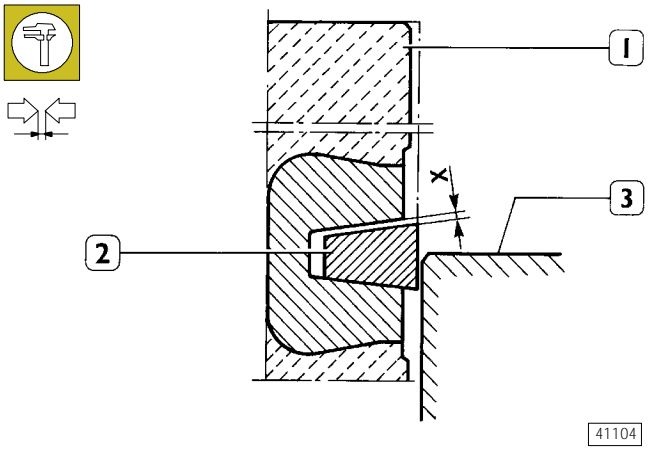


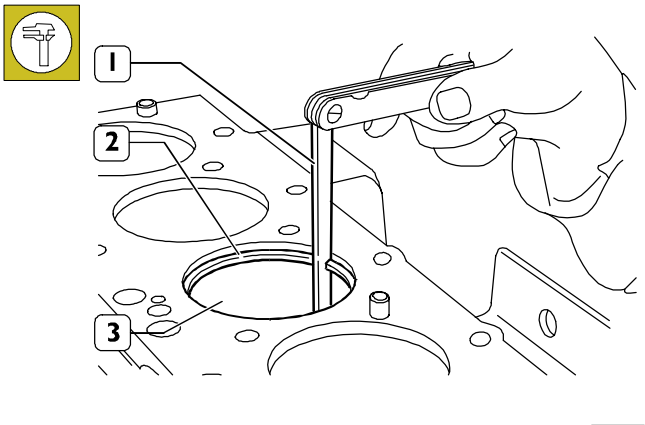

DIAGRAM FOR MEASURING THE CLEARANCE X BETWEEN THE FIRST PISTON SLOT AND THE TRAPEZOIDAL RING

Since the first sealing ring section is trapezoidal, the clearance between the slot and the ring shall be measured as follows: make the piston (1) protrude from the engine block so that the ring (2) protrudes half-way from the cylinder barrel (3).

In this position, use a feeler gauge to check the clearance (X) between ring and slot: found value shall be the specified one.

https://truckmanualshub.com/


Figure 50

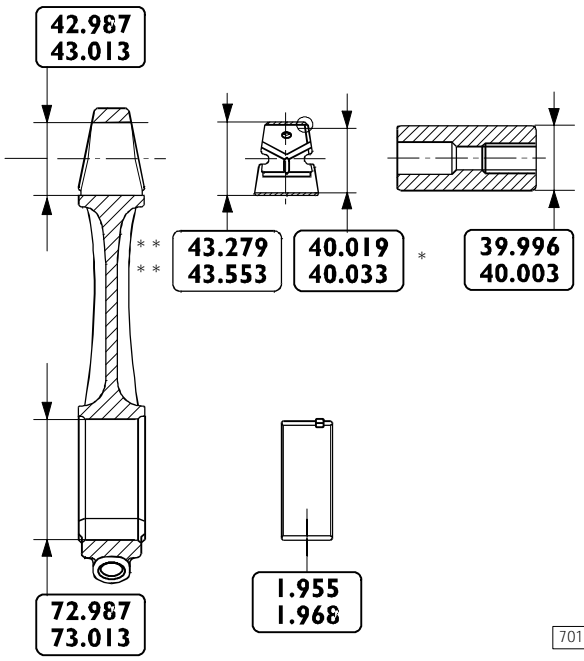



70194

Use feeler gauge (1) to measure the clearance between the ends of the split rings (2) fitted into the cylinder barrel (3).

## Connecting rods

Figure 51



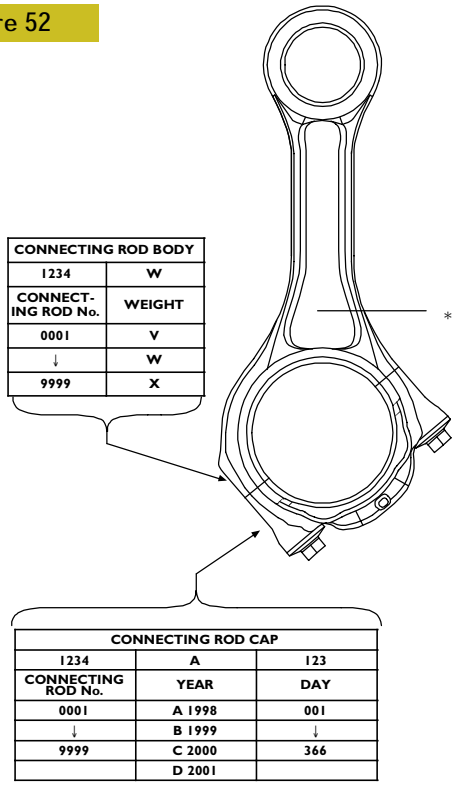

70195

MAIN DATA FOR CONNECTING ROD, BUSH, PISTON PIN AND HALF BEARINGS

* Value for inside diameter to be obtained after driving in connecting rod small end and grinding.
** Value not measurable in released condition

The surface of connecting rod and rod cap are knurled to ensure better coupling.
Therefore, it is recommended not to smooth the knurls.

Figure 52




| CONNECTING ROD BODY | |
|---|---|
| 1234 | W |
| CONNECTING ROD No. | WEIGHT |
| 0001 | V |
| ↓ | W |
| 9999 | X |

| CONNECTING ROD CAP | | |
|---|---|---|
| 1234 | A | 123 |
| CONNECTING ROD No. | YEAR | DAY |
| 0001 | A 1998 | 001 |
| ↓ | B 1999 | ↓ |
| 9999 | C 2000 | 366 |
| | D 2001 | |

70196

Every connecting rod is marked as follows:

- On body and cap with a number showing their coupling and the corresponding cylinder.
  In case of replacement it is therefore necessary to mark the new connecting rod with the same numbers of the replaced one.
- On body with a letter showing the weight of the connecting rod assembled at production:
  - V, 1820 to 1860 (yellow marking);
  - W, 1861 to 1900 (green marking);
  - X, 1901 to 1940 (blue marking);

Spare connecting rods are of the W class with green marking *.

Material removal is not allowed.

### Bushes

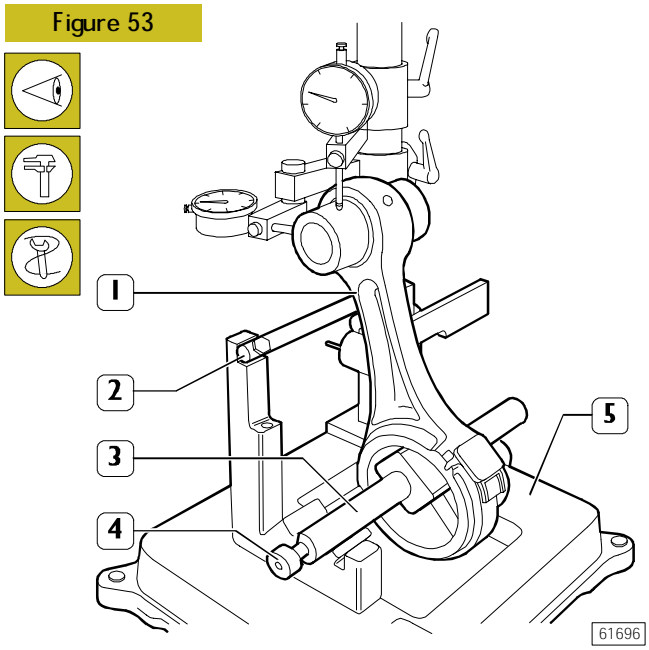
Check that the bush in the connecting rod small end is free from scoring or seizing and that it is not loosen. Otherwise replace.

Removal and refitting shall be performed using the proper beater.

When refitting take care to make coincide the oil holes set on the bush with those set on the connecting rod small end. Grind the bush to obtain the specified diameter.

## Checking connecting rods

Figure 53

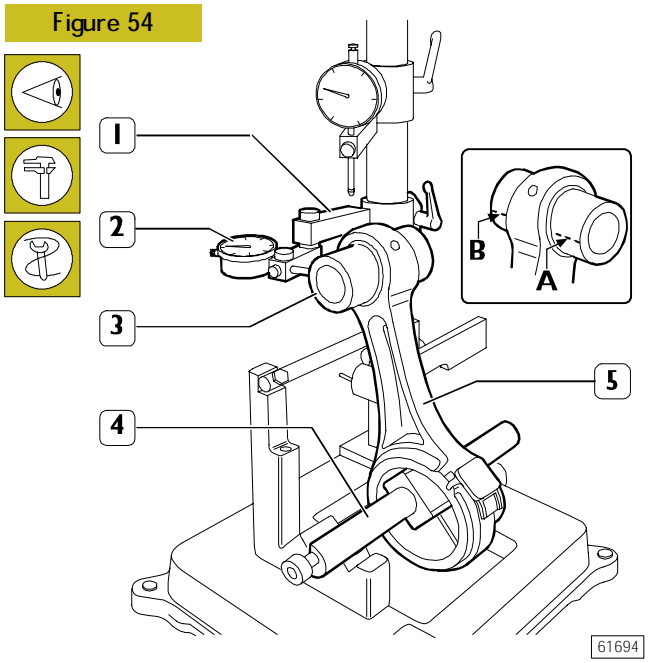



Check that the axis of the connecting rods (1) are parallel using tool 99395363 (5) as follows:

- ❑ fit the connecting rod (1) on tool 99395363 (5) spindle and lock it with screw (4);
- ❑ set the spindle (3) on V-blocks by resting the connecting rod (1) on the stop bar (2).

## Checking torsion

Figure 54

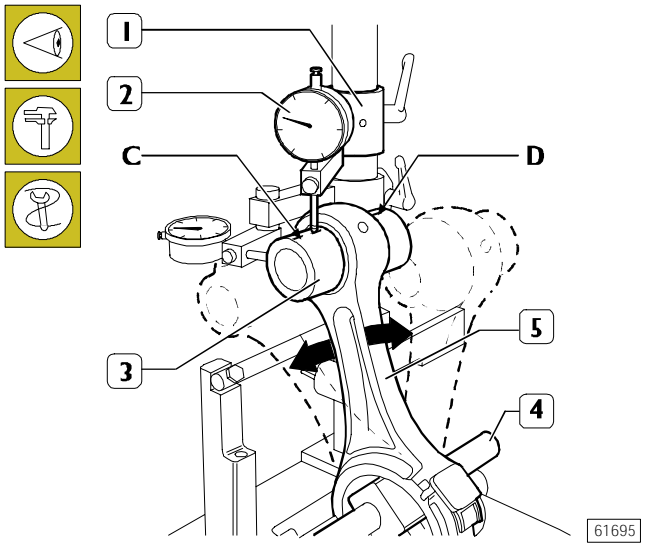



Check connecting rod (5) torsion by comparing two points (A and B) of pin (3) on the horizontal plane of the connecting rod axis.

Position the dial gauge (2) support (1) to obtain a preload of approx. 0.5 mm on the pin (3) in point A and then set the dial gauge (2) to zero. Move the spindle (4) with the connecting rod (5) and compare any deviation on the opposite side (B) of the pin (3): the difference between A and B shall not exceed 0.08 mm.

## Checking bending

Figure 55




Check connecting rod (5) bending by comparing two points C and D of the pin (3) on the vertical plane of the connecting rod axis.

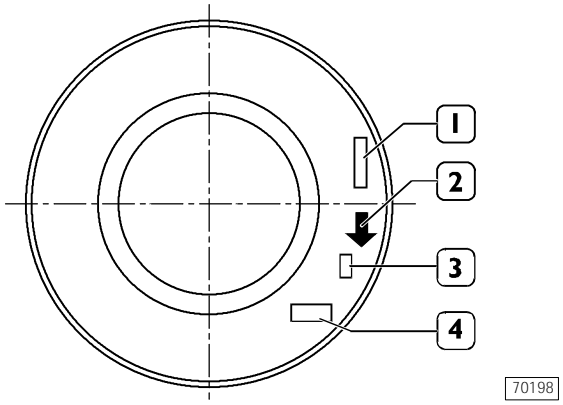
Position the vertical support (1) of the dial gauge (2) to rest the latter on pin (3), point C.

Move the connecting rod forwards and backwards to find pin top position, then in this condition reset the dial gauge (2).

Move the spindle with the connecting rod (5) and repeat the check of the top point on the opposite side D of the pin (3). The difference between point C and point D shall not exceed 0.08 mm.

## Fitting connecting rod-piston assembly
## Connecting rod-piston coupling

Figure 56

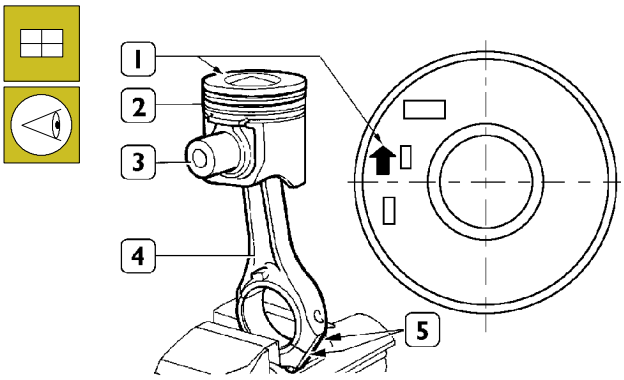



The piston crown is marked as follows:

1. Part number and design modification number;
2. Arrow showing piston assembling direction into cylinder barrel, this arrow shall face the front key of the engine block;
3. Marking showing 1st slot insert testing;
4. Manufacturing date.

https://truckmanualshub.com/

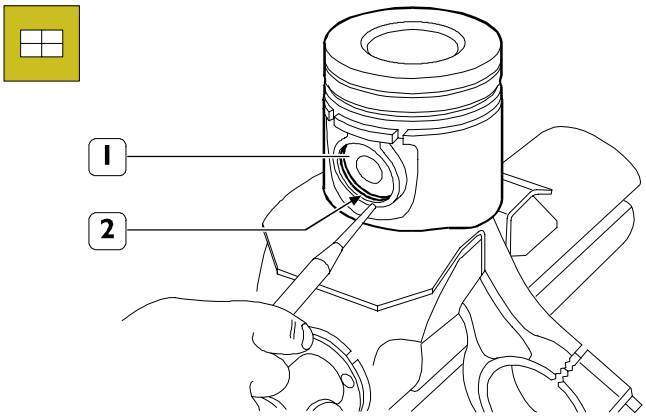

Figure 57




70199

Connect piston (2) to connecting rod (4) with pin (3) so that the reference arrow (1) for fitting the piston (2) into the cylinder barrel and the numbers (5) marked on the connecting rod (5) are read as shown in the figure.

Figure 58

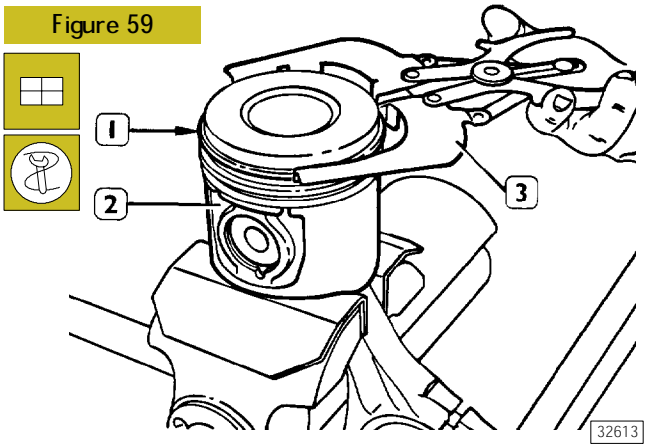



72705

Position the piston (1) on the connecting rod according to the diagram shown in the figure, fit the pin (3) and stop it by the split rings (2).

## Fitting split rings

Figure 59



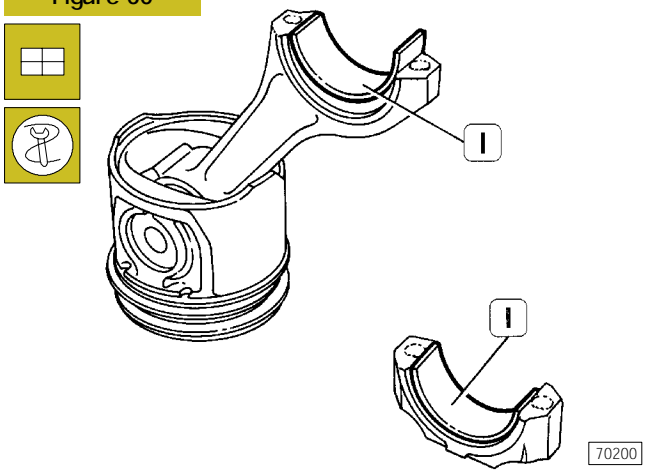

32613

Use pliers 99360183 (3) to fit the split rings (1) on the piston (2).
Split rings shall be fitted with the marking "TOP" facing upwards and their openings shall be displaced with each other by 120°.

Split rings are supplied spare with the following sizes:

- standard, yellow marking;
- 0.5 mm oversize, yellow/green marking;

Figure 60



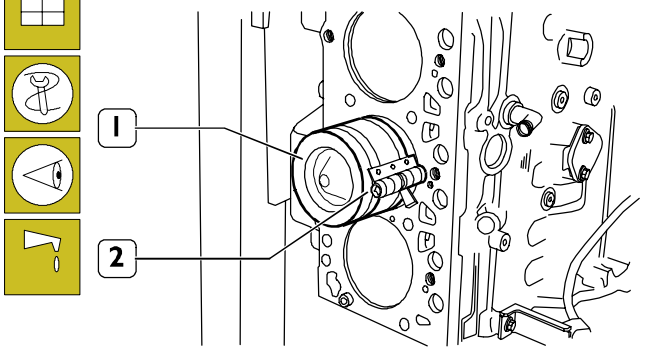

70200

Fit half bearings (1) on connecting rod and cap.

Refit the main bearings that have not been replaced, in the same position found at removal.
Do not try to adapt the half bearings.

## Fitting connecting rod-piston assembly into cylinder barrels

Figure 61

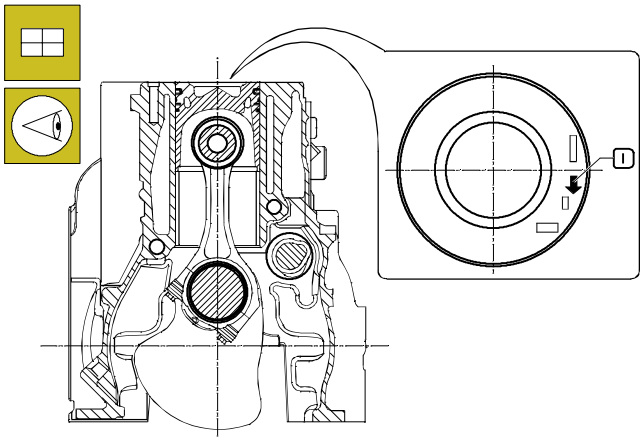



70201

Lubricate accurately the pistons, including the split rings and the cylinder barrel inside.
Use band 99360605 (2) to fit the connecting rod-piston assembly (1) into the cylinder barrels and check the following:

- ❑ the number of each connecting rod shall correspond to the cap coupling number.

Figure 62



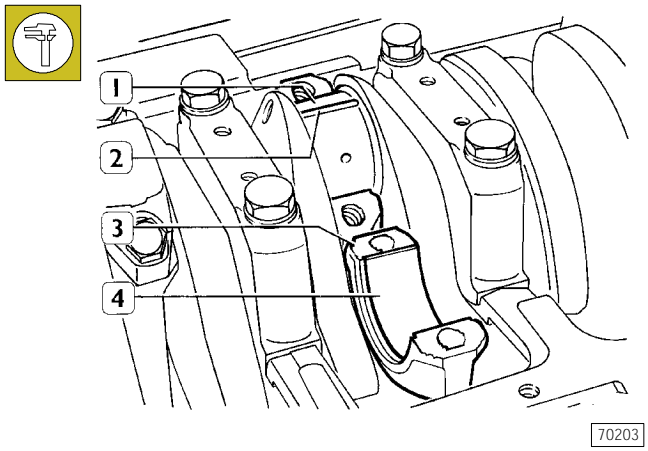

70202

DIAGRAM FOR CONNECTING ROD-PISTON ASSEMBLY FITTING INTO BARREL

- Split ring openings shall be displaced with each other by 120°;
- connecting rod-piston assemblies shall have the same weight;
- the arrow marked on the piston crown shall be facing the front side of the engine block or the slot obtained on the piston skirt shall be corresponding to the oil nozzle position.

## Finding crankpin clearance

Figure 63

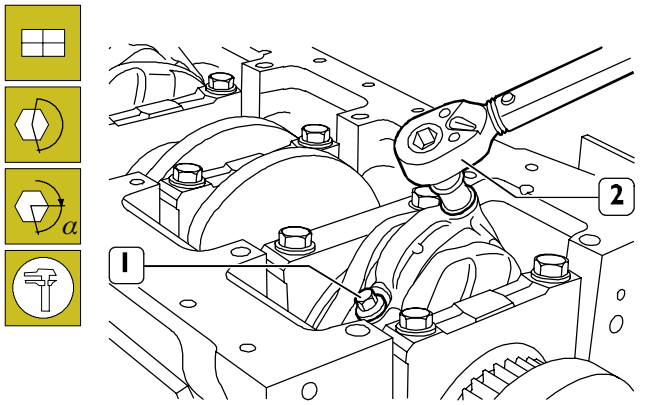



70203

To measure the clearance proceed as follows:

- clean the parts accurately and remove any trace of oil;
- set a piece of calibrated wire (2) on the output shaft pins (1);
- fit the connecting rod caps (3) with the relevant half bearings (4).

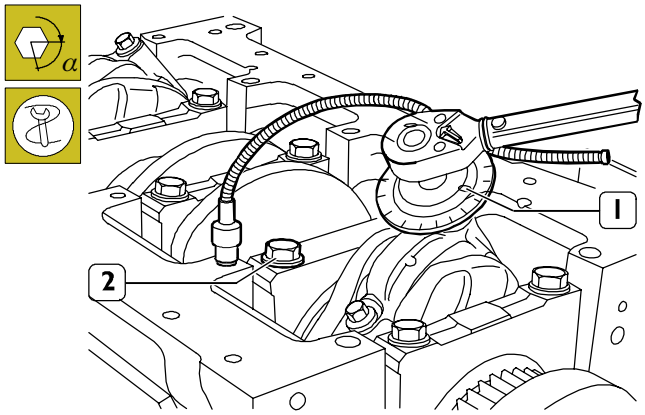
Figure 64




70204

- Lubricate the screws (1) with engine oil and then tighten them to the specified torque using the torque wrench (2).

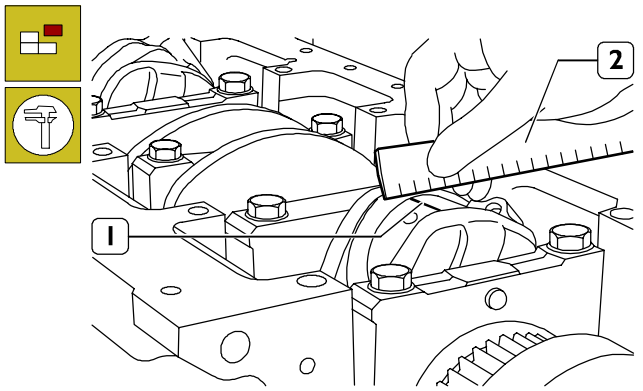
Figure 65




70205

- Apply tool 99395216 (1) to the socket wrench and tighten screws (2) of 60°.

Figure 66

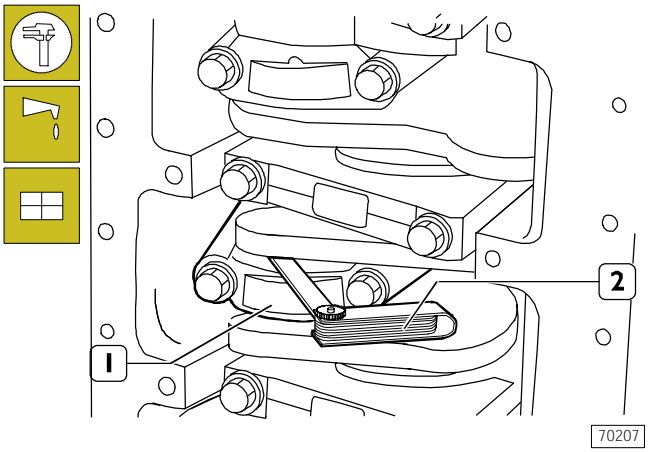



70206

- Remove the cap and find the existing clearance by comparing the calibrated wire width (1) with the scale on the wire envelope (2).

https://truckmanualshub.com/


Figure 67




If a different clearance value is found, replace the half bearings and repeat the check.

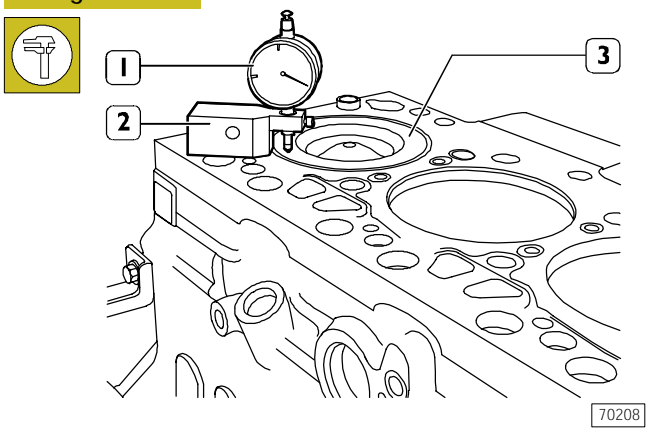
Once the specified clearance has been obtained, lubricate the main half bearings and fit them by tightening the connecting rod cap fastening screws to the specified torque.

Before the final fitting of the connecting rod cap fastening screws, check that their diameter measured at the centre of the thread length is not < 0.1 mm than the diameter measured at approx. 10 mm from screw end.

Check manually that the connecting rods (1) are sliding axially on the output shaft pins and that their end float, measured with feeler gauge (2) is 0.10 to 0.33 mm.

## Checking piston protrusion

Figure 68

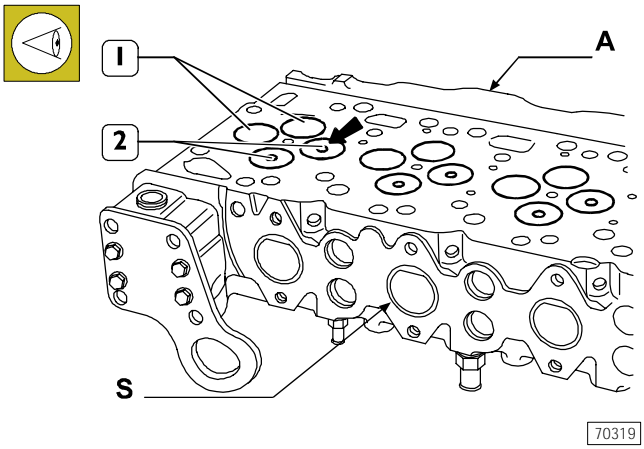



Once connecting rod-piston assemblies refitting is over, use dial gauge 39395603 (1) fitted with base 99370415 (2) to check piston (3) protrusion at T.D.C. with respect to the top of the engine block.

Protrusion shall be 0.28 to 0.52 mm.

## CYLINDER HEAD
### Removing the valves

Figure 69




70319

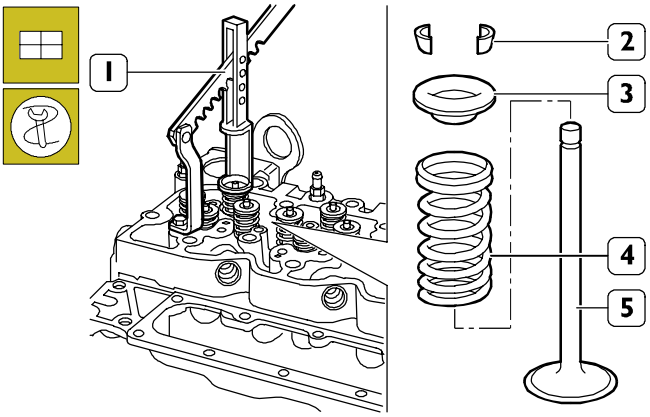
Intake (1) and exhaust (2) valves have heads with the same diameter.

The central notch (→) of the exhaust valve (2) head distinguishes it from the intake valve.

Should cylinder head valves be not replaced, number them before removing in order to refit them in the same position.

A = intake side — S = exhaust side

Figure 70



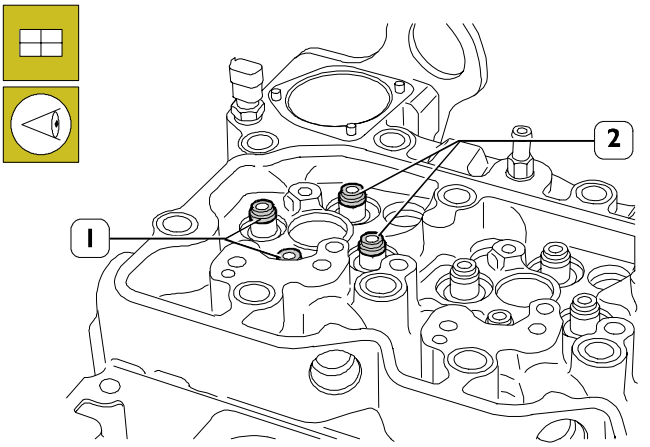

70321

Valve removal shall be performed using tool 99360268 (1) and pressing the cap (3) so that when compressing the springs (4) the cotters (2) can be removed. Then remove the cap (3) and the springs (4).

Repeat this operation for all the valves.

Overturn the cylinder head and withdraw the valves (5).

Figure 71




70322

Remove sealing rings (1 and 2) from the valve guide.

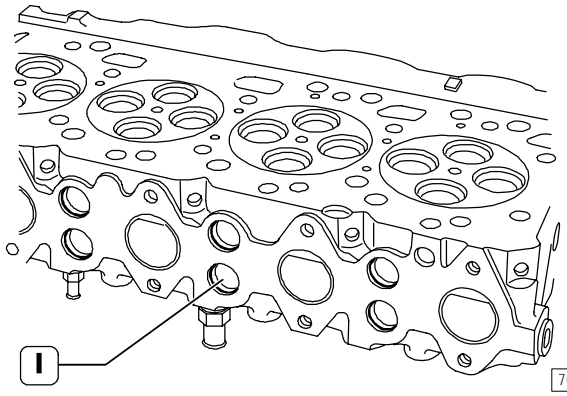
Sealing rings (1) for intake valves are yellow.

Sealing rings (2) for exhaust valves are green.

https://truckmanualshub.com/


## Checking cylinder head wet seal

Figure 72




This check shall be performed using the proper tools.

Use a pump to fill with water heated to approx. 90°C and 2 to 3 bar pressure.

Replace the core plugs (1) if leaks are found, use the proper punch for their removal/refitting.

Before refitting, smear the plug surfaces with water-repellent sealant.

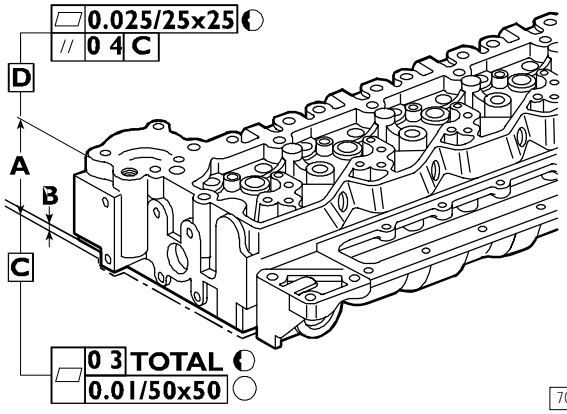
Replace the cylinder head if leaks are found.

## Checking cylinder head supporting surface

Distortion found along the whole cylinder head shall not exceed 0.20 mm.

If higher values are found grind the cylinder head according to values and indications shown in the following figure.

Figure 73

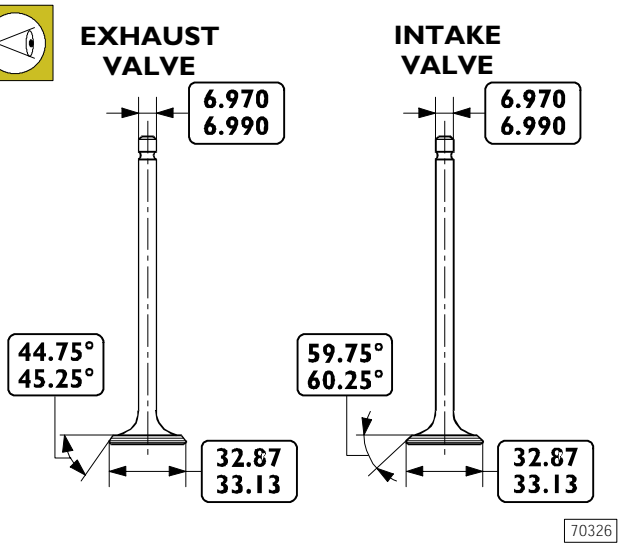



The rated thickness A for the cylinder head is 105 ± 0.25 mm, max. metal removal shall not exceed thickness B by 1 mm.

After grinding, check valve sinking. Regrind the valve seats, if required, to obtain the specified value.

## VALVES

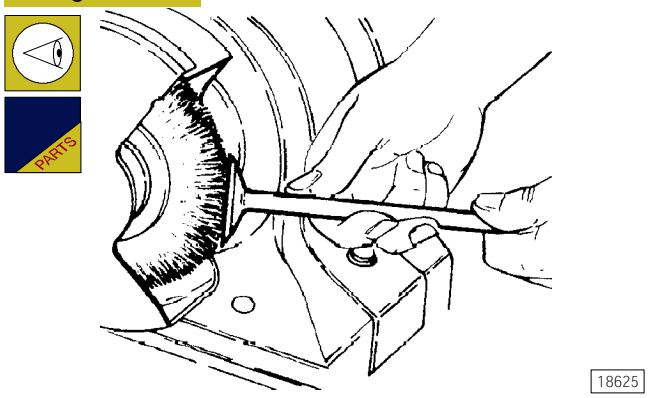
Figure 74




INTAKE AND EXHAUST VALVE MAIN DATA

### Removing carbon deposits, checking and grinding valves

Figure 75

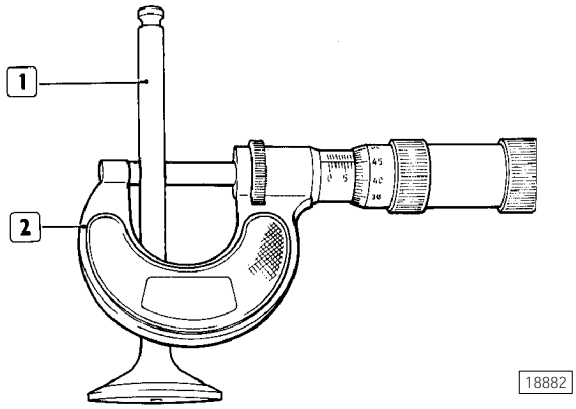



Remove carbon deposits from valves using the proper metal brush.

Check that the valves show no signs of seizing, scoring or cracking.

Regrind the valve seats, if required, using tool 99305018 and removing as less material as possible.

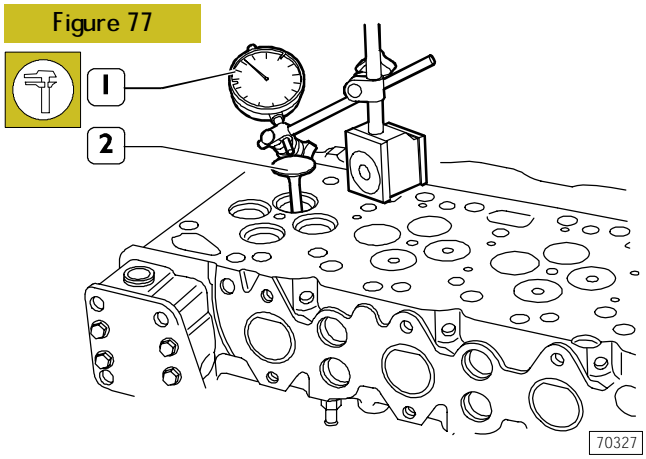
Figure 76




Check the valve stem (1) using a micrometer (2), it shall be 6.970 ± 6.999.

### Checking clearance between valve stem and valve guide and valve centering

Figure 77



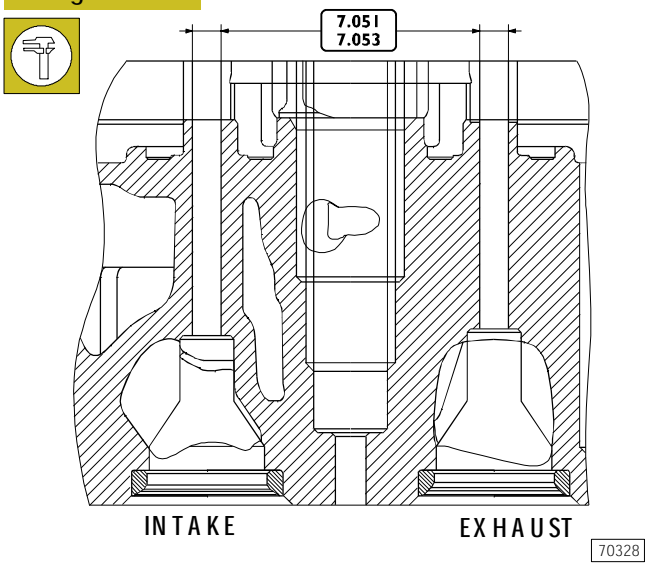

Use a magnetic base dial gauge (1) set as shown in the figure, the assembling clearance shall be 0.052 ± 0.092 mm.

Turn the valve (2) and check that the centering error is not exceeding 0.03 mm.

https://truckmanualshub.com/


## VALVE GUIDE

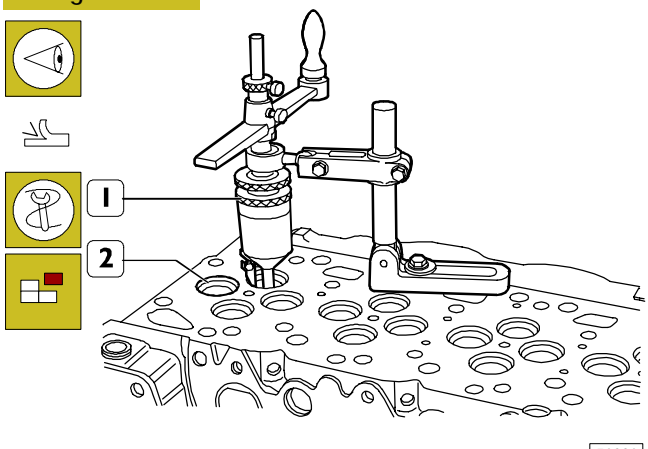
Figure 78




Use a bore dial gauge to measure the inside diameter of the valve guides, the read value shall comply with the value shown in the figure.

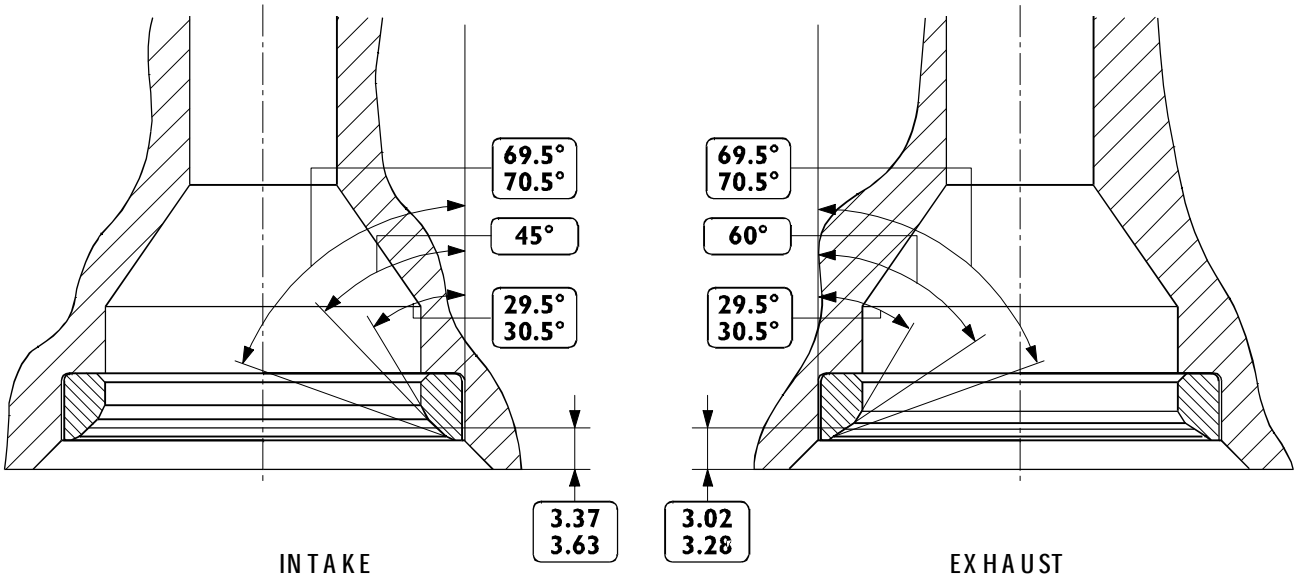
## VALVE SEATS
### Regrinding – replacing the valve seats

Figure 79




Check the valve seats (2). If slight scoring or burnout is found, regrind seats using tool 99305018 (1) according to the angle values shown in Figure 80.

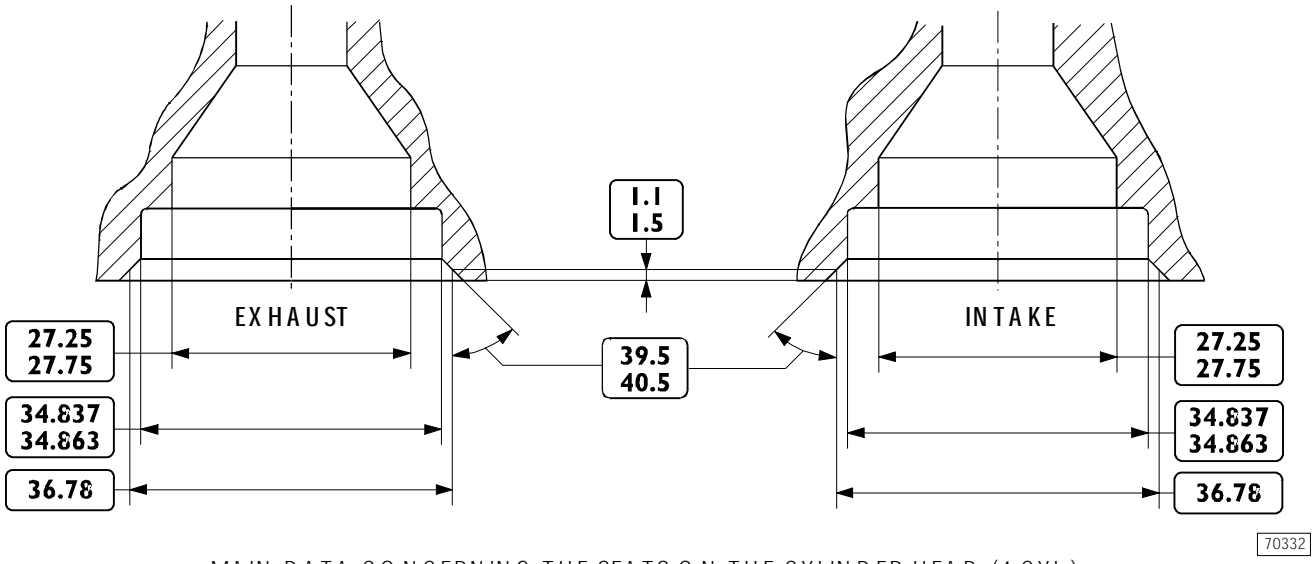
Figure 80




VALVE SEAT MAIN DATA (4 CYL.)

https://truckmanualshub.com/


Figure 81




MAIN DATA CONCERNING THE SEATS ON THE CYLINDER HEAD (4 CYL.)

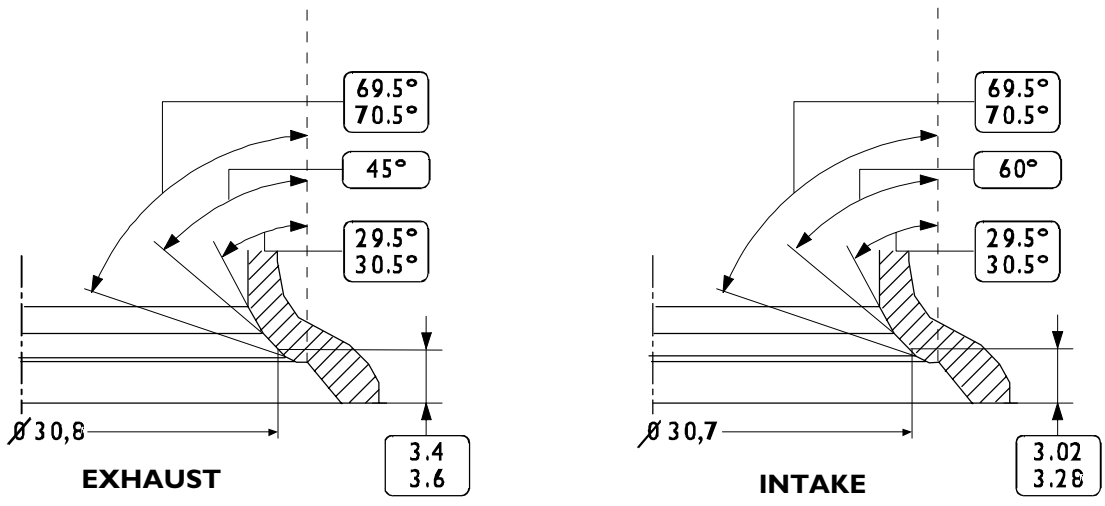
Should valve seats be not reset just by regrinding, replace them with the spare ones. Use tool 99305018 (Figure 79) to remove as much material as possible from the valve seats (take care not to damage the cylinder head) until they can be extracted from the cylinder head using a punch.

Heat the cylinder head to 80° - 100°C and using the proper punch, fit the new valve seats, previously cooled, into the cylinder head.

Use tool 99305018 to regrind the valve seats according to the values shown in Figure 80.

## CYLINDER HEAD VALVE SEATS (6 CYL.)

Figure 82

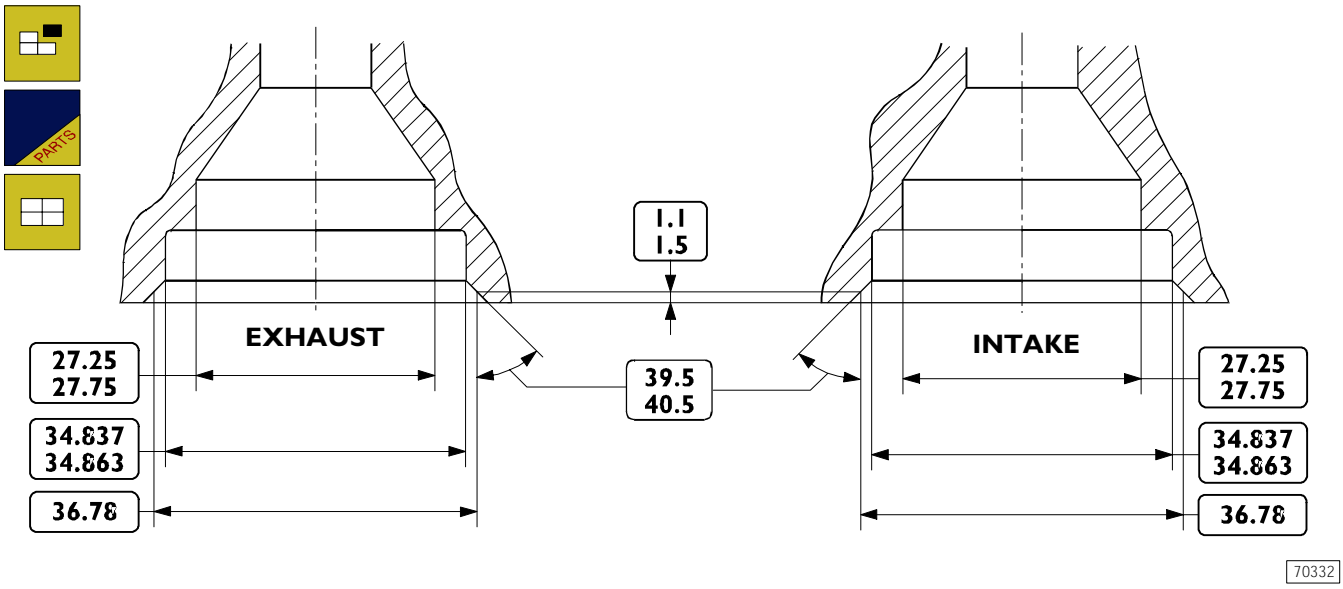



MAIN DATA ABOUT ENGINE VALVE SEATS

Valve seats are installed by cooling onto the cylinder head and machining to the correct dimension.

https://truckmanualshub.com/


Figure 83



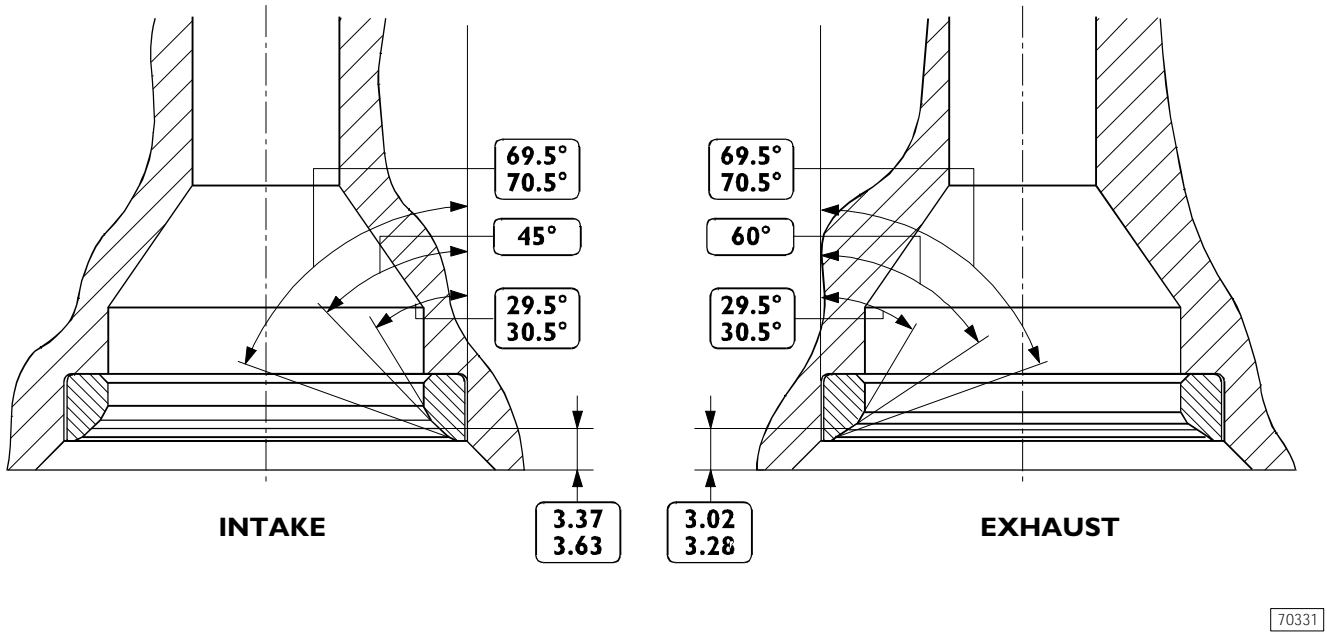

If valve seats cannot be restored just by regrinding, it is possible to assemble the spare inserts provided.

In this case, it is necessary to install seats into the cylinder head sized as shown in the figure and to assemble the valve seats.

In order to assemble the valve seats into the cylinder head, it is necessary to heat the cylinder head to 80° to 100°C and, through a suitable punch, to assemble the new, previously cooled valve seats (2) into the head.

Then, with tool 99305018, adjust valve seats according to the values shown in Figure 84.

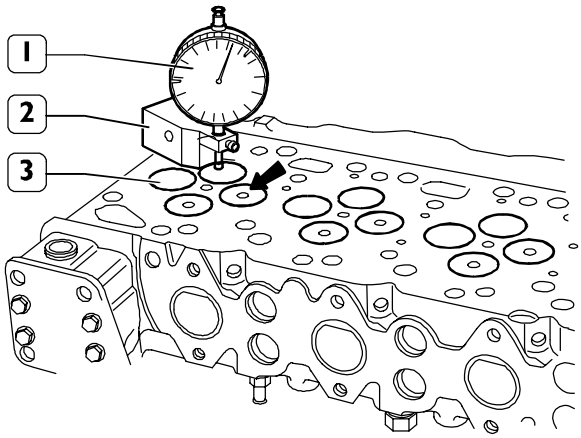
Figure 84




VALVE SEAT MAIN DATA (6 CYL.)

https://truckmanualshub.com/


Figure 85

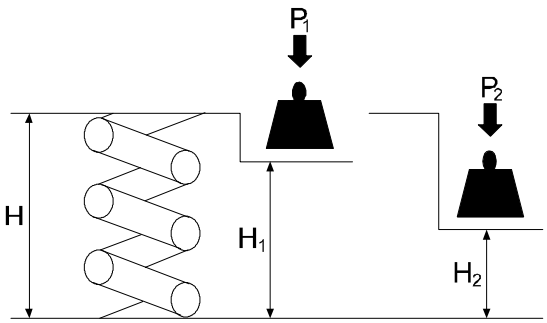



70333

After regrinding, check that valve (3) sinking value is the specified one by using the base 99370415 (2) and the dial gauge 99395603 (1).

## VALVE SPRINGS

Figure 86



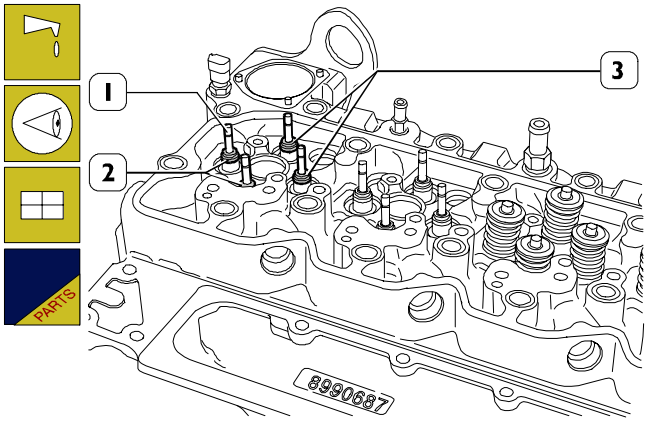

50676

MAIN DATA TO CHECK INTAKE AND EXHAUST VALVE SPRINGS

Before refitting use tool 99305047 to check spring flexibility. Compare load and elastic deformation data with those of the new springs shown in the following table.

## FITTING CYLINDER HEAD

Figure 87



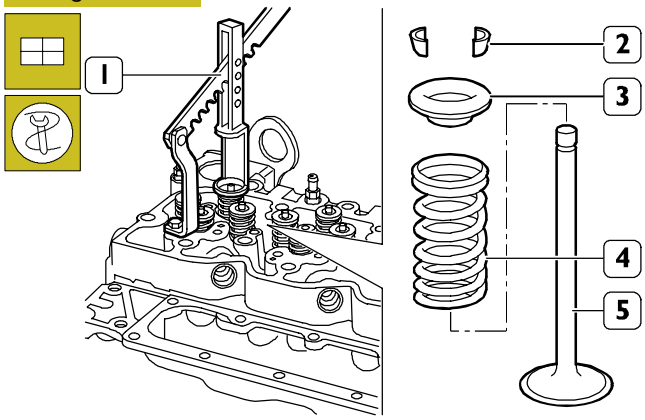

70334

Lubricate the valve stems (1) and fit them into the relevant valve guides according to the position marked at removal.

Fit the sealing rings (2 and 3) on the valve guide.

Sealing rings (2) for intake valves are yellow and sealing rings (3) for exhaust valves are green.

Figure 88



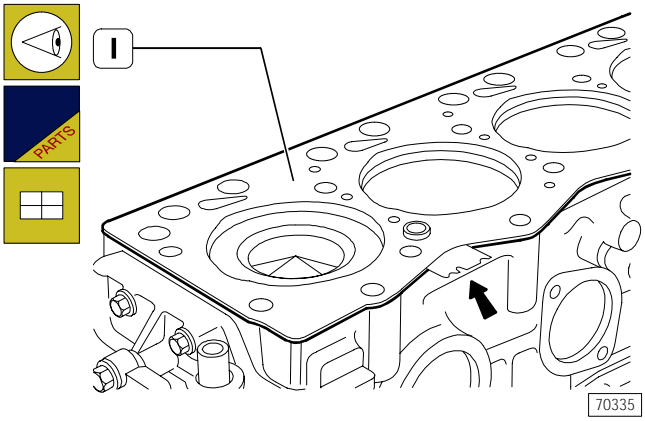

770321

Position on the cylinder head: the spring (4), the upper cap (3); use tool 99360268 (1) to compress the spring (4) and lock the parts to the valve (5) by the cotters (2).

https://truckmanualshub.com/


## Refitting the cylinder head

Figure 89




Check cleanness of cylinder head and engine block coupling surface.
Take care not to foul the cylinder head gasket.
Set the cylinder head gasket (1) with the marking "TOP" (1) facing the head.
The arrow shows the point where the gasket thickness is given.

Before re-utilising the fixing screws for the cylinder head, verify there is no evidence of wear or deformation and in that case replace them.

https://truckmanualshub.com/


## TIGHTENING TORQUE

| COMPONENT | | TORQUE | |
|---|---|---|---|
| | | Nm | kgm |
| Screw M8 for fastening cylinder barrel lubricating nozzles | | 15 ± 3 | 1.5 ± 0.3 |
| Screw M12 for fastening output shaft caps | 1st stage | 50 ± 6 | 5 ± 0.6 |
| | 2nd stage | 80 ± 6 | 8 ± 0.6 |
| | 3rd stage | 90° ± 5° | |
| Screw M8 for fastening camshaft longitudinal retaining plate | | 24 ± 4 | 2.4 ± 0.4 |
| Screw M8 for fastening camshaft gear | | 36 ± 4 | 3.6 ± 0.4 |
| Screw M11 for fastening connecting rod caps | 1st stage | 60 ± 5 | 6 ± 0.5 |
| | 2nd stage | 60° ± 5° | |

https://truckmanualshub.com/


# SECTION 5

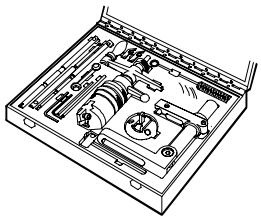
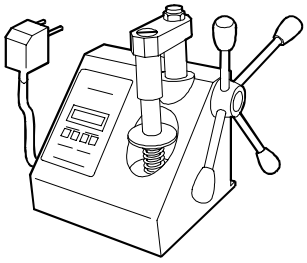
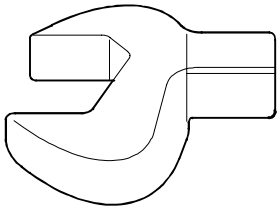
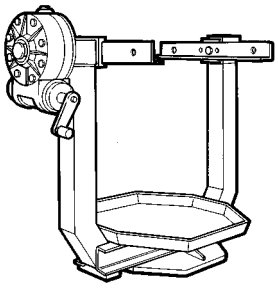
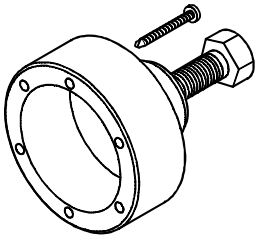
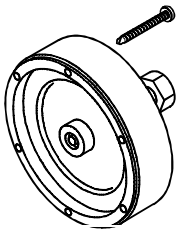
## Tools

Page

TOOLS . . . . . 3

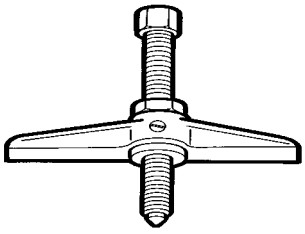
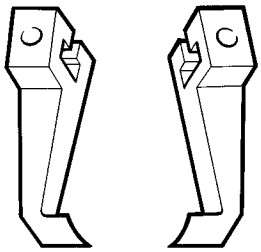
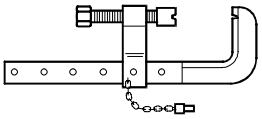
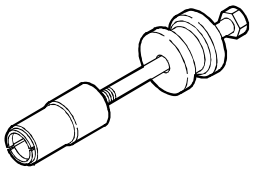
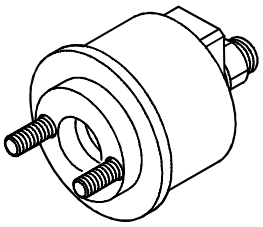
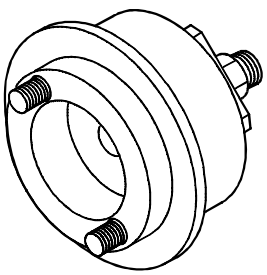
https://truckmanualshub.com/

## TOOLS

| TOOL No. | | DEFINITION |
|---|---|---|
| **99305018** |  | Kit for valve seat regrinding |
| **99305047** |  | Spring load tester |
| **99317915** |  | Set of 3 pin wrenches (14 - 17 - 19 mm) |
| **99322205** |  | Revolving stand for overhauling units (700 daN/m capacity, 120 daN/m torque) |
| **99340055** |  | Tool to remove output shaft front gasket |
| **99340056** |  | Tool to remove output shaft rear gasket |

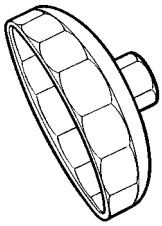
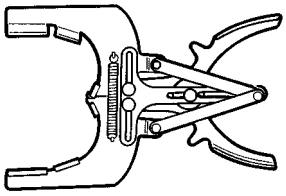
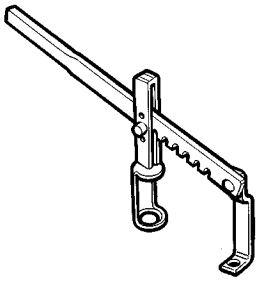
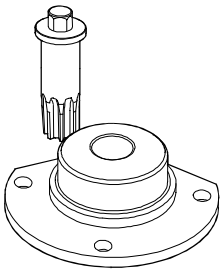
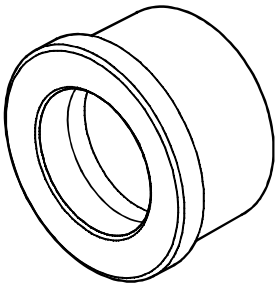
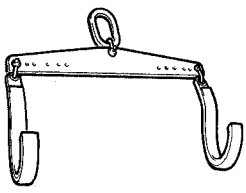
https://truckmanualshub.com/


## TOOLS

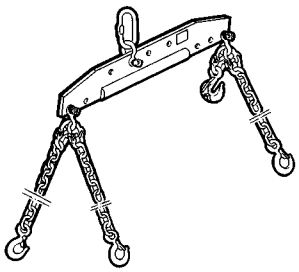
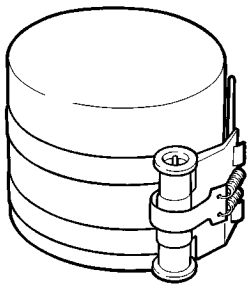
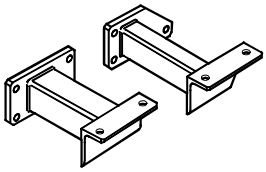
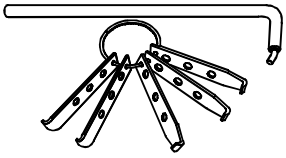
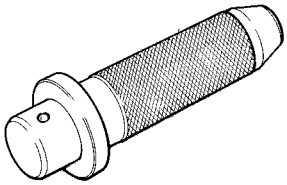
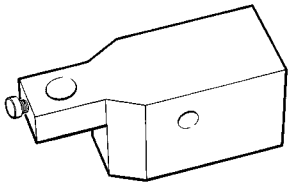
| TOOL No. | | DEFINITION |
|---|---|---|
| **99341001** |  | Double acting puller |
| **99341009** |  | Pair of brackets |
| **99341015** |  | Press |
| **99342101** |  | Tool to remove injectors |
| **99346252** |  | Tool for fitting output shaft rear gasket |
| **99346253** |  | Tool for fitting output shaft rear gasket |

https://truckmanualshub.com/


## TOOLS

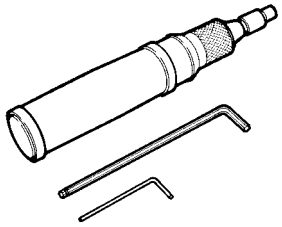
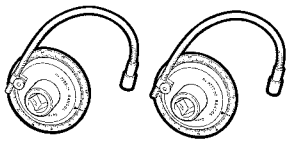
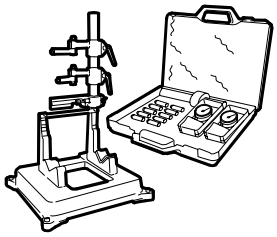
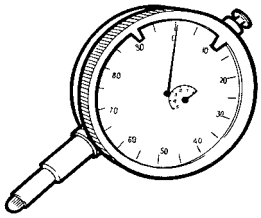
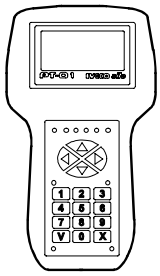
| TOOL No. | | DEFINITION |
|---|---|---|
| **99360076** |  | Tool to remove oil filter (engine) |
| **99360183** |  | Pliers for removing/refitting piston rings (65—110mm) |
| **99360268** |  | Tool for removing/refitting engine valves |
| **99360339** |  | Tool for rotating/stopping the engine flywheel |
| **99360362** |  | Beater for removing/refitting camshaft bushes (to be used with 993700069) |
| **99360500** |  | Tool for lifting the output shaft |

## TOOLS

| TOOL No. | | DEFINITION |
|---|---|---|
| **99360595** |  | Lifting rig for engine removal/refitting |
| **99360605** |  | Band for fitting piston into cylinder barrel (60—125 mm) |
| **99361037** |  | Brackets for fastening engine to revolving stand 99322205 |
| **99363204** |  | Tool to remove gaskets |
| **99370006** |  | Handgrip for interchangeable beaters |
| **99370415** |  | Gauge base for different measurements (to be used with 99395603) |

https://truckmanualshub.com/


## TOOLS

| TOOL No. | | DEFINITION |
|---|---|---|
| **99389834** |  | Torque screwdriver for injector solenoid valve connector stop nut setting |
| **99395216** |  | Pair of gauges with ½" and ¾" square head for angle tightening |
| **99395363** |  | Complete bush testing square |
| **99395603** |  | Dial gauge (0 – 5 mm) |
| **8093731** |  | Tester PT1 |

https://truckmanualshub.com/

https://truckmanualshub.com/


# APPENDIX

Page

SAFETY PRESCRIPTIONS . . . . . 3

https://truckmanualshub.com/


# SAFETY PRESCRIPTIONS

## Standard safety prescriptions

Particular attention shall be drawn on some precautions that must be followed absolutely in a standard working area and whose non fulfillment will make any other measure useless or not sufficient to ensure safety to the personnel in-charge of maintenance.

Be informed and inform personnel as well of the laws in force regulating safety, providing information documentation available for consultation.

- ❑ Keep working areas as clean as possible, ensuring adequate aeration.
- ❑ Ensure that working areas are provided with emergency boxes, that must be clearly visible and always provided with adequate sanitary equipment.
- ❑ Provide for adequate fire extinguishing means, properly indicated and always having free access. Their efficiency must be checked on regular basis and the personnel must be trained on intervention methods and priorities.
- ❑ Organize and displace specific exit points to evacuate the areas in case of emergency, providing for adequate indications of the emergency exit lines.
- ❑ Smoking in working areas subject to fire danger must be strictly prohibited.
- ❑ Provide Warnings throughout adequate boards signaling danger, prohibitions and indications to ensure easy comprehension of the instructions even in case of emergency.

## Prevention of injury

- ❑ Do not wear unsuitable cloths for work, with fluttering ends, nor jewels such as rings and chains when working close to engines and equipment in motion.
- ❑ Wear safety gloves and goggles when performing the following operations:
  - filling inhibitors or anti-frost
  - lubrication oil topping or replacement
  - utilization of compressed air or liquids under pressure (pressure allowed: ≤ 2 bar)
- ❑ Wear safety helmet when working close to hanging loads or equipment working at head height level.
- ❑ Always wear safety shoes when and cloths adhering to the body, better if provided with elastics at the ends.
- ❑ Use protection cream for hands.
- ❑ Change wet cloths as soon as possible
- ❑ In presence of current tension exceeding 48-60 V verify efficiency of earth and mass electrical connections. Ensure that hands and feet are dry and execute working operations utilizing isolating foot-boards. Do not carry out working operations if not trained for.
- ❑ Do not smoke nor light up flames close to batteries and to any fuel material.
- ❑ Put the dirty rags with oil, diesel fuel or solvents in anti-fire specially provided containers.
- ❑ Do not execute any intervention if not provided with necessary instructions.
- ❑ Do not use any tool or equipment for any different operation from the ones they've been designed and provided for: serious injury may occur.
- ❑ In case of test or calibration operations requiring engine running, ensure that the area is sufficiently aerated or utilize specific vacuum equipment to eliminate exhaust gas. Danger: poisoning and death.

## During maintenance

- ❑ Never open filler cap of cooling circuit when the engine is hot. Operating pressure would provoke high temperature with serious danger and risk of burn. Wait unit the temperature decreases under 50°C.
- ❑ Never top up an overheated engine with cooler and utilize only appropriate liquids.
- ❑ Always operate when the engine is turned off: whether particular circumstances require maintenance intervention on running engine, be aware of all risks involved with such operation.
- ❑ Be equipped with adequate and safe containers for drainage operation of engine liquids and exhaust oil.
- ❑ Keep the engine clean from oil tangles, diesel fuel and or chemical solvents.
- ❑ Use of solvents or detergents during maintenance may originate toxic vapors. Always keep working areas aerated. Whenever necessary wear safety mask.
- ❑ Do not leave rags impregnated with flammable substances close to the engine.
- ❑ Upon engine start after maintenance, undertake proper preventing actions to stop air suction in case of runaway speed rate.
- ❑ Do not utilize fast screw-tightening tools.
- ❑ Never disconnect batteries when the engine is running.
- ❑ Disconnect batteries before any intervention on the electrical system.
- ❑ Disconnect batteries from system aboard to load them with the battery loader.
- ❑ After every intervention, verify that battery clamp polarity is correct and that the clamps are tight and safe from accidental short circuit and oxidation.
- ❑ Do not disconnect and connect electrical connections in presence of electrical feed.
- ❑ Before proceeding with pipelines disassembly (pneumatic, hydraulic, fuel pipes) verify presence of liquid or air under pressure. Take all necessary precautions bleeding and draining residual pressure or closing dump valves. Always wear adequate safety mask or goggles. Non fulfillment of these prescriptions may cause serious injury and poisoning.

https://truckmanualshub.com/


- ❑ Avoid incorrect tightening or out of couple. Danger: incorrect tightening may seriously damage engine's components, affecting engine's duration.
- ❑ Avoid priming from fuel tanks made out of copper alloys and/or with ducts not being provided with filters.
- ❑ Do not modify cable wires: their length shall not be changed.
- ❑ Do not connect any user to the engine electrical equipment unless specifically approved.
- ❑ Do not modify fuel systems or hydraulic system unless specific approval has been released. Any unauthorized modification will compromise warranty assistance and furthermore may affect engine correct working and duration.

For engines equipped with electronic gearbox:

- ❑ Do not execute electric arc welding without having priory removed electronic gearbox.
- ❑ Remove electronic gearbox in case of any intervention requiring heating over 80°C temperature.
- ❑ Do not paint the components and the electronic connections.
- ❑ Do not vary or alter any data filed in the electronic gearbox driving the engine. Any manipulation or alteration of electronic components shall totally compromise engine assistance warranty and furthermore may affect engine correct working and duration.

## Respect of the Environment

- ❑ Respect of the Environment shall be of primary importance: all necessary precautions to ensure personnel's safety and health shall be adopted.
- ❑ Be informed and inform the personnel as well of laws in force regulating use and exhaust of liquids and engine exhaust oil. Provide for adequate board indications and organize specific training courses to ensure that personnel is fully aware of such law prescriptions and of basic preventive safety measures.
- ❑ Collect exhaust oils in adequate specially provided containers with hermetic sealing ensuring that storage is made in specific, properly identified areas that shall be aerated, far from heat sources and not exposed to fire danger.
- ❑ Handle the batteries with care, storing them in aerated environment and within anti-acid containers. Warning: battery exhalation represent serious danger of intoxication and environment contamination.

https://truckmanualshub.com/


# PART THREE - TROUBLESHOOTING

https://truckmanualshub.com/


## PREFACE

A successful troubleshooting is carried out with the competence acquired by years of experience and attending training courses.

When the user complains for bad efficiency or working anomaly, his indications must be kept into proper consideration using them to acquire any useful information to focus the intervention.

After the detection of the existing anomaly, it is recommended to proceed with the operations of troubleshooting by decoding the auto-troubleshooting data provided by the EDC system electronic central unit.

The continuous efficiency tests of the components connected to, and the check of working conditions of the entire system carried out during working, can offer an important diagnosis indication, available through the decoding of the "failure/anomaly" codes issued by blinking of the failure led: the "blink-code" (whether programmed).

Please consider that the interpretation of the indications provided by the blink-code is not sufficient to guarantee the solution to the existing anomalies.

Using processing instruments, it is also possible to establish a bi-directional connection with the central unit, by which not only to decoding the failure codes but also input an enquiry relying on memory files, in order to achieve any further necessary information to identify the origin of the anomaly.

Every time there is a breakdown claim and this breakdown is actually detected, it is necessary to proceed inquiring the electronic unit in one of the ways indicated and then proceed with the diagnostic research making trials and tests in order to have a picture of the working conditions and identify the root causes of the anomaly.

In case the electronic device is not providing any indication, it will be necessary to proceed relying on the experience, adopting traditional diagnosis procedures.

In order to compensate the operators' lack of experience in this new system, we are hereby providing the USER's GUIDELINE FOR TROUBLESHOOTING in the following pages.

The GUIDE LINE is composed of two different parts:

- Error Codes, mainly of electric and electrical nature; Otained using the McCormick Electronic Service Tool.

NOTE: Remove ALL error codes in the ECU at the end of any repair.

- Guidelines for troubleshooting without error code, divided per symptoms, describing all possible anomalies not detected by the electronic gearbox, often of mechanical and hydraulic nature.



Any kind of operation on the electronic center unit must be executed by qualified personnel, duly authorized.

Any unauthorized tamper will involve decay of after-sales service in warranty.

| EST ERROR CODES | CLUSTER CODES | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 21 | 3718 | Short circuit of the sensor of engine cooling liquid temperature, in positive or earth or in open circuit. | | Verify component correct working and its resistor (2,5kOhm at 20°C). In case the component works, proceed checking the connection between the sensor and the gearbox connector to pin C18 - C36. | |
| 22 | 3672 | Short circuit of the sensor of air combustion temperature, in positive or earth or in open circuit. (The sensor is integrated with the air pressure sensor). | | Readout of parameters using multimeter. Verify correct working of the component and of its resistor between pin 1 and 2 (R = 2,5 kOhm at 20 °C). If the sensor is working, proceed checking the connection between the sensor and the EDC connector to pin C21 - C29. | |
| 23 | 3800 | Short circuit of the sensor of fuel temperature, in positive or earth or in open circuit. | | Readout of parameters directly on the sensor using multimetre . (R = 2,5 kOhm at 20 °C). If the sensor is working, proceed checking the connection between the sensor and the EDC connector to pin C17 - C34. | |
| 24 | 3668 | Short circuit of the sensor of air combustion pressure on suction collector, in positive or earth or in open circuit; or fed by tension out of specification. | | Readout of parameters using multimetre verifying feeding tension to the sensor. (aprx. 5V).<br>In case of tension within specification, check the wiring harness and the connection between the sensor and the EDC (Pin C10-C28). | |

https://truckmanualshub.com/

https://truckmanualshub.com/

| EST ERROR CODES | CLUSTER CODES | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 25 | 3667 | Short circuit of the sensor of air pressure (integrated in EDC) in positive or earth or in open circuit | | Apply for customer assistance for the intervention on the EDC. The sensor is integrated in the EDC and is not replaceable singularly. | The painting of the engine ÆEDC may inficiate on the correct working of the sensor. |
| 26 | 3801 | Short circuit of the sensor of engine oil pressure, in positive or earth or in open circuit. (The sensor is integrated with the oil temperature sensor). | | Readout of parameters using multimetre verifying feeding tension to the sensor. (aprx. 5V).<br>In case of tension within specification replace the sensor. In case of tension out of specification, check the wiring harness and the connection between the sensor and the EDC (Pin C9-C35). | |
| 27 | 3802 | Short circuit of the sensor of engine oil temperature. (integrated with the oil pressure sensor) , in positive or earth or in open circuit. | | Sensor Readout using multimetre, between pin 1 and 2 (R = 2,5 kOhm at 20°C).<br>If the sensor is working, proceed checking the connection between the sensor and the EDC (pin C19-C33). | |
| 28 | Not Used | Incorrect working of the fuel filter heating relé. | | Verify relé working status using the troubleshooting device. If the result is negative, replace the relé and test again.<br>If the anomaly still persists, check the wiring harness and the connections between relé and EDC connector (pin B2 - B36) | |

| EST ERROR CODES | CLUSTER CODES | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 29 | Not Used | Incorrect working of the pre-post heating drive relé. | Difficult starting with low external temperature, exhaust fumes immediately after starting. | Verify relé working status using the troubleshooting device. Check the correct working of the relé (R= aprx. 15 Ohm).<br>In case the relé works, check the wiring harness and the connections between relé and EDC connector (pin B4 - B16) | |
| 37 | 168 | Signal for battery tension too high or too low. | Idling accelerated. | Carry out the due controls on the battery and on the recharge system.<br><br>If no anomaly is detected check the efficiency of the Earth points and the absence of fouling or oxidation on the feed wiring connectors of the EDC. | Eventually, the problem might not depend on the too high or too low tension but due to the incorrect detection of tension by the EDC. |
| 38 | Not Used | Defective pre-heating led or wiring harness short circuit in positive or earth or in open circuit. | Led always on light even with starting key in off position or always off.<br><br>Possible difficult starting (with low external temperature) and exhaust fumes at starting. | Verify working status using troubleshooting device.<br>If the result is negative replace the led and drive troubleshooting operation again. If the failure persists check connections and wiring harness between led and EDC (pin B46) | |
| 39 | Not Used | Pre-heating has not been working correctly. | Possible difficult starting (with low external temperature) and exhaust fumes at starting. | Using the multimetre, verify continuity of pre-heating resistor in the suction collector (R = aprx. 0,5 Ohm).<br>If the component is working, check the wiring harness and the connection between the resistor and the relevant driving relé. | Pre-heating is not working. |

https://truckmanualshub.com/

https://truckmanualshub.com/

| EST ERROR CODES | CLUSTER CODES | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 5.1 | 3811 | Electrical problem with Injector n. 1 | Engine running with one cylinder less. | Check the correct couple lock (1,5 +/- 0,25 Nm) of the cables the fixing nuts to the injector electro-valve.<br>Verify the working status of the injector's bobbin (R = aprx. 0,56 - 0,57 Ohm) and replace the injector if defective.<br>With new working bobbin, proceed checking the wiring harness and the connections between electro-valve and EDC connector (pin A9-A13) through the connector 1 of the pin overhead 3 and 4. | Such failure may generate power stage insufficiency (in the EDC ) feeding the electro-injector, involving working of only half of the cylinders as a consequence, and memorisation of the error 5.7. |
| 5.2 | 3815 | Electrical problem with injector n.2 | Engine working with one cylinder less. | Check the correct couple lock (1,5 +/- 0,25 Nm) of the cables the fixing nuts to the injector electro-valve.<br>Verify the working status of the injector's bobbin (R = aprx. 0,56 - 0,57 Ohm) and replace the injector if defective.<br>With new working bobbin, proceed checking the wiring harness and the connections between electro-valve and EDC connector (pin A3-A6) through the connector 1 of the pin overhead 1 and 3. | Such failure may generate power stage insufficiency (in the EDC ) feeding the electro-injector, involving working of only half of the cylinders as a consequence, and memorisation of the error 5.7 within 6 cylinder engines and 5.8 within 4 cylinder engines. |

| EST ERROR CODES | CLUSTER CODES | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 53 | 3813 | Electrical problem with injector n.3. | Engine working with one cylinder less. | Check the correct couple lock (1,5 +/- 0,25 Nm) of the cables the fixing nuts to the injector electro-valve.<br>Verify the working status of the injector's bobbin (R = aprx. 0,56 - 0,57 Ohm) and replace the injector if defective.<br>With new working bobbin, proceed checking the wiring harness and the connections between electro-valve and EDC connector (pin A4-A12) through the connector 2 of the pin overhead 3 and 4. | Such failure may generate power stage insufficiency (in the EDC ) feeding the electro-injector, involving working of only half of the cylinders as a consequence, and memorisation of the error 57. within 6 cylinder engines and 58 within 4 cylinder engines |
| 54 | 3816 | Electrical problem with injector n.4. | Engine working with one cylinder less. | Check the correct couple lock (1,5 +/- 0,25 Nm) of the cables the fixing nuts to the injector electro-valve.<br>Verify the working status of the injector's bobbin (R = aprx. 0,56 - 0,57 Ohm) and replace the injector if defective.<br>With new working bobbin, proceed checking the wiring harness and the connections between electro-valve and EDC connector (pin A5-A14) through the connector 2 of the pin overhead 1 and 2. | Such failure may generate power stage insufficiency (in the EDC) feeding the electro-injector, involving working of only half of the cylinders as a consequence, and memorisation of the error 57 within 6 cylinder engines and 58 within 4 cylinder engines |

https://truckmanualshub.com/

https://truckmanualshub.com/

| EST ERROR CODES | CLUSTER CODES | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 5.5 | 3812 | Electrical problem with injector n.5. | Engine working with one cylinder less. | Check the correct couple lock (1,5 +/- 0,25 Nm) of the cables the fixing nuts to the injector electro-valve.<br>Verify the working status of the injector's bobbin (R = aprx. 0,56 - 0,57 Ohm) and replace the injector if defective.<br>With new working bobbin, proceed checking the wiring harness and the connections between electro-valve and EDC connector (pin A11-A16) through the connector 3 of the pin overhead 3 and 4. | Such failure may generate power stage insufficiency (in the EDC ) feeding the electro-injector, involving working of only half of the cylinders as a consequence, and memorisation of the error 5.7 within 6 cylinder engines and 5.8 within 4 cylinder engines. |
| 5.6 | 3814 | Electrical problem with injector n.6. | Engine working with one cylinder less. | Check the correct couple lock (1,5 +/- 0,25 Nm) of the cables the fixing nuts to the injector electro-valve.<br>Verify the working status of the injector's bobbin (R = aprx. 0,56 - 0,57 Ohm) and replace the injector if defective.<br>With new working bobbin, proceed checking the wiring harness and the connections between electro-valve and EDC connector (pin A10-A15) through the connector 3 of the pin overhead 1 and 2. | Such failure may generate power stage insufficiency (in the EDC) feeding the electro-injector, involving working of only half of the cylinders as a consequence, and memorisation of the error 5.7 within 6 cylinder engines and 5.8 within 4 cylinder engines. |

| EST ERROR CODES | CLUSTER CODES | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 5.7 | 3817 | EDC output stage driving power to electro-injector couples 2 and 3 | Engine running with only 2 (3) working cylinders. | Clear the failure memory and test again.<br>If the failure persists, and only after having excluded injector defect, eventually replace the EDC with a new one re-programmed. | It can happen if the external part of the gearbox is driven to short circuit with the battery positive pole (accidental bridge made by wrench or other metallic object). |
| 5.8 | 3818 | EDC output stage driving power to electro-injector couples 4-5-6 | Engine running with only 2 (3) working cylinders. | Clear the failure memory and test again.<br>If the failure persists, and only after having excluded injector defect, eventually replace the EDC with a new one re-programmed. | It can happen if the external part of the EDC is driven to short circuit with the battery positive pole (accidental bridge made by wrench or other metallic object) |
| 6.1 | 3821 | Driving shaft sensor: no signal or unreliable signal. | Engine start requires more time than usual.<br>Power reduction and noise increase since the EDC is not controlling the pre-injection and the timing.<br>Engine working relies on recovery parameters. | Using the multimetre, verify the sensor's resistor value as well as its working status (R = aprx. 900 Ohm).<br>If the component is working, and the anomaly persists, check the wiring harness<br>between the sensor and the EDC connector (pin C24 - C25). | The failure is not detected when the engine is not running. If the driving shaft signal is not regularly working, it is necessary to rely on the speed signal of the camshaft sensor. |
| 6.2 | 3822 | Camshaft sensor: no signal or unreliable signal. | Difficult starting in all conditions.<br>Power reduction. | Using the multimetre, verify the sensor's resistor value as well as its working status (R = aprx. 900 Ohm). Verify correct assembly of the sensor: replace it if defective.<br>If the component is working, and the anomaly persists, check the wiring harness between the sensor and the EDC connector (pin C24 - C25). | The failure is not detected when the engine is not running. If the camshaft signal is not regularly working, it is necessary to rely on the phase signal of the driving shaft sensor. |

https://truckmanualshub.com/

https://truckmanualshub.com/

| EST ERROR CODES | CLUSTER CODES | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 63 | 190 | Unreliable survey of engine speed. | Difficult starting in all conditions. Power reduction. | Using the multimetre, verify the sensor's resistor value as well as its working status (R = aprx. 900 Ohm). Verify correct assembly of the sensor: replace it if defective. If the component is working, and the anomaly persists, check the wiring harness between the sensor and the EDC connector (pin C24 - C25). | The failure is not detected when the engine is not running. If the camshaft signal is not regularly working, it is necessary to rely on the phase signal of the driving shaft sensor. |
| 64 | Not Used | Engine runaway speed rate. | | Verify the root-causes that might have generated a sudden load loss to the engine, involving consequent runaway speed rate. Runaway speed rate might also depend directly from the operator addicted to driving the vehicle, which the engine is installed to. | It is not a failure referred to one component but the alert for an actual engine runaway speed rate. |
| 65 | Not Used | Incorrect working of starter relé. | The engine does not start or disconnects. | Using multimetre, check the relé. In case the component works, check the wiring harness and the connection between relé and EDC connector (pin B27). | |
| 66 | Not Used | Signal from EDC to engine speed indicator. | The engine speed indicator does not work. | Check the wiring harness and the connection between engine speed indicator and EDC connector (pin B49). | |
| 68 | Not Used | Synchronisation signal with troubleshooting device. | Difficulties in communication between troubleshooting device and EDC. | Check the wiring harness and the connection between pin 23 of the troubleshooting tap end EDC connector to in B48. | |

| ESTERROR CODES | CLUSTER CODES | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 7.2 | Not Used | (*)<br><br>CAN Line Hardware defect. | (*)<br><br>Possible incorrect working or error alert signal of the electronic control devices connected via CAN Line. | Check wiring harness, connection and locking resistor (120 Ohm) | On the equipment that is not provided with the CAN line, this is blanked by a 120 Ohm resistor. |
| 7.6 | Not Used | **Defective oil pressure led lamp, or wiring harness short circuit in positive or earth or in open circuit.** | **Switching the key contact to ON position, the led is not lighting on or keeps lighted.** | Verify working status using troubleshooting device. If the result is negative replace the led and drive troubleshooting operation again.<br>In case of led correct working, check the wiring harness and the connections and wiring harness between led and EDC connector (pin B63) and the correct feed of the gauge with incorporated led. | |
| 8.1 | 3828 | Anomalia nella modulazione della pressione combustibile<br><br>(la centralina deve modificare troppo il segnale di comando al regolatore di pressione per modulare nel rail la pressione calcolata). | Significativa riduzione di potenza.<br><br>In caso di iniettore che rimane saltuariamente bloccato aperto, improvviso e temporaneo decadimento delle prestazioni, con avviamento possibile e buon funzionamento ai bassi regimi e carichi, ma il problema si ripresenta agli alti regimi e carichi. | Verify if the fuel arrives directly to the high pressure pump (no outlets in the sucked line, clogged filter or pre-filter, occluded pipes, consistent fuel leakage).<br><br>Verify there is no fuel leakage or loss from the high pressure line running from the pump and the rail or from the cylinders head.<br><br>In case a flow limiter has been activated, detect and identify the injector that is not working any more and replace it together with its relevant high pressure filler. | Further details relating to checks and controls to be made on the fuel's circuit are available in Troubleshooting section 2. |

https://truckmanualshub.com/

https://truckmanualshub.com/

| EST ERROR CODES | CLUSTER CODES | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 82 | 3829 | Rail pressure sensor's signal short circuit in positive or earth or in open circuit. | Significant power reduction. | Readout of parameters using troubleshooting device.<br><br>Check the wiring harness and the connection between the sensor and the EDC Connector (Pin C12-C20 -C27).<br><br>If everything is in order, replace the sensor. | |
| 83 | 3830 | Pressure gauge short circuit in positive or earth or in open circuit. | Significant power reduction.<br><br>Eventually blink code 81. | Using the multimetre, verify the working status of the pressure gauge electro-valve.<br>If the component is working, check the wiring harness and the connection between the gauge and the EDC connector pin C4-C5.<br>After having excluded any other possibility, apply for<br>the eventual replacement of the pump with its gauge. | The single replacement of the pressure gauge only is not possible. |
| 84 | 3831 | Incorrect working of the boost gauge valve (only if double-stage type). | Significant power reduction. | Replace the rail boost valve. | |
| 85 | 3828 | Anomaly in rail pressure.<br>(Dropped to minimum value or over maximum limit). | Significant power reduction.<br><br>Possible contemporary blink code 81 - 84. | Verify if the fuel arrives directly to the high pressure pump (no outlets in the sucked line, clogged filter or pre-filter, occluded pipes, consistent fuel leakage).<br><br>Verify there is no fuel leakage or loss from the high pressure line running from the pump and the rail or from the cylinders head. | |

| EST ERROR CODES | CLUSTER CODES | POSSIBLE CAUSE (*) = if available in the equipment | POSSIBLE DERIVING ANOMALIES (*) = if available in the equipment | RECOMMENDED TESTS OR INTERVENTION | REMARKS |
|---|---|---|---|---|---|
| 94 | 3014 | Main relé is not disconnecting. | The gearbox is always fed and the EDC led keeps light on even with the key in Off position.<br><br>The battery discharges. | Try removing and replacing the fuse (to re-set the EDC)<br><br>If the problem persists, apply for the eventual replacement of the EDC. | The main relè is incorporated in the EDC and is not replaceable singularly. |
| 96 | 9902 | Anomaly within the routine control procedure that the gearbox provides to the system at each engine disconnection. | Significant power reduction. | Run the engine, drive it to idling and disconnect it correctly. | The failure might be memorised even in case of engine working in different conditions than the ones of the equipment (such as engine running on bench, without inertial load). |
| 97 | 3835 | Anomaly within sensors feed. | Memorisation of error on all sensors fed by the EDC gearbox.<br><br>The engine does not start nor disconnects, or difficult starting and bad working of the engine. | Verify working status and correct assembly of the EDC connector dedicated to sensors (C).<br><br>If the connector is working and correctly assembled,<br>apply to for the eventual replacement of the EDC. | |

https://truckmanualshub.com/

https://truckmanualshub.com/

# B Power Tier III Engine Fault Codes

# IVECO NEF Tier III Engine Error codes SPN & FMI

| | DMx FMI | | | | |
|---|---|---|---|---|---|
| HEX values | MAX = 3 | MIN = 4 | SIG = 2 | NPL = 12 | |
| | | | | | **Vehicle 1 (Sensors/Plausibility checks)** |
| 111 | x | x | x | x | Fault path 1 for vehicle Speed sensing |
| 211 | x | x | x | x | Fault path 2 for vehicle Speed sensing(CAN) |
| 311 | x | x | x | | Fault path 3 for vehicle Speed sensing(max.pulse width) |
| 112 | x | x | | x | Accelerator Pedal 1 |
| 212 | x | x | | x | Accelerator Pedal 2 |
| 113 | | | | x | Accelerator Pedal and brake not plausible |
| 114 | x | x | | x | Multiple State Switch |
| 115 | | | | x | Cruise control actuating device evaluation error |
| 116 | | | x | x | Main clutch signal |
| 117 | | | x | x | Brake signal |
| 118 | | | | x | Engine brake preselection switch status |
| 119 | | | x | | No terminal 15 signals detected |
| 11A | x | | | | Terminal 50 always pressed |
| 11B | | | | | |
| 11C | x | | | | Water in fuel |
| 11D | x | x | x | x | Loss of efficiency in SCR catalyst |
| 11E | x | | | | NH3Slip |
| 11F | x | x | x | x | Plausibility check of catalyst system |
| | | | | | **Vehicle 2 (Lamps/relays/actuators)** |
| 121 | x | x | x | x | Adjustable speed limit lamp |
| 122 | x | x | x | x | Power stage fault status for MIL |
| 123 | x | x | x | x | Power stage for system lamp |
| 124 | x | x | x | x | Cold start lamp |
| 125 | x | x | | | Main relay defect (High press pump) |
| 126 | x | x | | | Battery voltage fault |
| 127 | x | x | | | Main relay 5 (Eng.brake decompr.valve) |
| 128 | x | | | | Main relay SCBatt (Lambda H./Grid H./Batt.switch) |
| 228 | | x | | | Main relay SCGND (Lambda H./Grid H./Batt.switch) |
| 129 | x | x | | | Main relay 3 (A/C compr.) |
| 12A | x | x | | | Main relay 4 (Exhaust valve eng.brake) |
| 12B | x | x | x | | Power stage air heater 1 actuator |
| 12C | x | x | x | | Power stage air heater 2 actuator |
| 12D | x | x | | | Air heater test switch on (volt.below lower threshold) |
| 22D | x | x | | | Air heater test switch off (volt.exceeds higher threshold) |
| 12B | x | x | x | x | Error path for the glow control relay actuator |
| 12C | x | x | x | x | Error path for the glow display lamp |
| 12D | x | x | | | Errors of Glow control unit |

| | | | | | |
|---|---|---|---|---|---|
| 12E | x | x | x | x | error path of power stage pre-supply pump |
| 12E | x | | | | Grid heater always switched on |
| 12F | | | x | x | Air condition power stage CAN message |
| | | | | | **Engine 1 (Temperature and Pressure Sensors)** |
| 131 | x | x | x | x | Coolant temperature sensor |
| 132 | | | | x | Coolant temperature sensor dynamic test |
| 133 | x | x | x | | Boost Temp. Signal |
| 134 | x | x | x | x | Boost pressure sensor |
| 135 | x | x | | | Fuel Temp. Signal |
| 136 | x | x | | | Rail pressure sensor CP3 |
| 236 | x | x | | | Rail pressure sensor offset monitoring |
| 137 | x | x | x | | Rail pressure relief valve |
| 138 | x | x | x | x | Oil Pressure Sensor |
| 238 | | | | x | Oil Pressure too low |
| 139 | x | x | | | Error path for signal range check of duty cycle of air temparature signal |
| 239 | x | x | | | error path for signal range check of air temparature; do not enter into fault code memory, always use fault class 0 |
| 13A | x | x | x | x | Oil Temp. Sensor |
| 23A | | | | x | Oil Temperature above normal |
| 23B | | x | | | missing pressure in coolant circuit |
| 13C | x | x | x | | Atmospheric Temperature Sensor(Humidtiy?) |
| 23C | x | x | | | BET temperature sensor |
| 33C | x | x | | | ClgZn temperature sensor |
| 43C | x | x | | | Inside air temperature sensor |
| 13D | x | x | x | | Fuel pressure sensor |
| 23D | x | x | | | Fuel pressure sensor dynamic plausibility test |
| 13E | | | | x | Coolant temperature sensor absolute test |
| 13F | | | | x | coolant pressure sensor not plausbile |
| | | | | | **Engine 2 (Speed sensing/actuators)** |
| 141 | x | x | | | Crankshaft sensor failure |
| 142 | | x | | | Running with camshaft sensor only |
| 143 | x | x | | | Camshaft sensor failure |
| 144 | x | | | x | Offset between camshaft and cranksh. |
| 145 | x | x | x | x | Power stage Fan actuator |
| 146 | x | x | x | | Power stage Fan 2 actuator |
| 147 | x | x | | | Fan speed sensor signal |
| 148 | x | x | x | x | Air condition power stage |
| 149 | x | x | x | x | Fuel filter heating output |
| 14A | | | x | | Engine Compartment Start Button is stuck |
| 14B* | x | x | x | x | Blowby recircul. Control relay actuator |
| 14C* | x | | | | Blowby engine overspeed detection |
| | | | | | **Fuel metering CR Systems** |
| | | | | | **Fuel metering Unit Injector Systems** |
| 151 | x | | | | Rail pressure max.positive deviation exceeded |
| 251** | x | | | | Rail pressure positive deviation 2nd part |
| 151 | x | x | x | x | Cyl.1 specific errors |
| 152 | x | | | | Rail pr.max.pos.deviation exceeded conc.set flow of fuel |

| | | | | | |
|---|---|---|---|---|---|
| 152 | x | x | x | x | Cyl.2 specific errors |
| 153 | x | | | | Maximum negative rail pressure deviation with metering unit on lower limit is exceeded |
| 153 | x | x | x | x | Cyl.3 specific errors |
| 154 | x | | | | Minimum rail pressure exceeded |
| 154 | x | x | x | x | Cyl.4 specific errors |
| 155 | x | | | | Maximum rail pressure exceeded |
| 155 | x | x | x | x | Cyl.5 specific errors |
| 156 | x | | | | Rail pressure drop rate is higher than expected |
| 156 | x | x | x | x | Cyl.6 specific errors |
| 157 | x | | | | Setpoint of metering unit in overrun mode not plausible |
| 157 | | | x | | Disabled Cyl. Shutoff function |
| 158** | x | | | | Setpoint of fuel volume flow through metering unit is lower than calculated limit |
| 159** | | | x | x | Metering unit PWM-powerstage |
| 259** | x | | | | Short circuit to battery of metering unit output |
| 359** | | x | | | Short circuit to ground of metering unit output |
| 15A** | x | x | | | Metering unit AD-Channel |
| 15B** | x | | | | High pressure test(deactivates rail press. monitoring) |
| | | | | | **Injectors 1** |
| 161 | x | x | x | x | Cylinder1 - Short circuit Low/High |
| 162 | x | x | x | x | Cylinder2 - Short circuit Low/High |
| 163 | x | x | x | x | Cylinder3 - Short circuit Low/High |
| 164 | x | x | x | x | Cylinder4 - Short circuit Low/High |
| 165 | x | x | x | x | Cylinder5 - Short circuit Low/High |
| 166 | x | x | x | x | Cylinder6 - Short circuit Low/High |
| 167 | x | x | x | x | Cylinder1 - Open load |
| 168 | x | x | x | x | Cylinder2 - Open load |
| 169 | x | x | x | x | Cylinder3 - Open load |
| 16A | x | x | x | x | Cylinder4 - Open load |
| 16B | x | x | x | x | Cylinder5 - Open load |
| 16C | x | x | x | x | Cylinder6 - Open load |
| 16D | x | | | | Fault path to disable rail monitor. while compr.test active |
| | | | | | **Injectors 2** |
| 171 | x | x | x | x | Bank 1 specific errors - Short circuit / not classifyable |
| 172 | x | x | x | x | Bank 1 specific warnings - Open load |
| 173 | x | x | x | x | Bank 2 specific errors - Short circuit / not classifyable |
| 174 | x | x | x | x | Bank 2 specific warnings - Open load |
| 17B | x | | | | Misfire in multiple cylinders |
| 17C | x | x | x | x | Chip-specific errors-->stop engine |
| 27C | x | x | x | x | Chip-specific errors-->stop engine |
| | | | | | |
| 17E | x | x | x | | Fault path of injection limitation |
| | | | | | **Air inlet system / EGR** |
| 184 | x | | | | Messages SRA2EDC |
| 185 | x | | | x | error path for exceeding the maximum drift difference between load- and idle range |
| 285 | x | x | | | error path for exceeding the maximum drift limit in the low-idle range |

| | | | | | |
|---|---|---|---|---|---|
| 385 | x | x | | | error path for exceeding the maximum drift limit in the load range |
| 186 | x | x | | | Signal range check of supply voltag, (not in failue memory) |
| 286 | x | x | | | error path for the raw air mass signal |
| 386 | x | x | x | | error path for the raw air mass signal |
| 486 | x | x | x | | error path for signal range check of reference signal |
| 187 | x | | | | AirCtl permanent positive governor deviaton |
| 188 | | x | | | AirCtl permanent negative governor deviaton |
| 288 | x | x | | | AirCtl governor plausibility check |
| 189 | x | | | | Short circuit to Batt. for EGR power stage |
| 289 | | x | | | Short circuit to ground for EGR power stage |
| 389 | | | x | x | No load/excessive temperature for EGR power stage |
| 18A | x | x | x | | Power stage for EGR Bypass valve actuator |
| 18B | x | | | | Short circuit to BATT for throttle valve actuator powerst. |
| 28B | | x | | | Short circuit to GND for throttle valve actuator powerst. |
| 38B | | | x | x | No load and excess temp. for TVA powerst. |
| 18C | | | | x | Monitoring of the controller |
| 18D | x | | | | AirCtl permanent positive governor deviaton |
| 18E | | x | | | AirCtl permanent negative governor deviaton |
| 18F | | | | x | Too long time spent in transition mode RgnNrm |
| | | | | | **Boost system and turbine speed** |
| 191 | x | x | x | | Boost pressure actuator current AD-channel |
| 192 | x | | | | Short circuit to Battery for BPA powerstage |
| 292 | | x | | | Short circuit to Ground for BPA powerstage |
| 392 | | | x | x | No load/excessive temperature for BPA power stage |
| 193 | x | x | x | x | Turbine speed |
| 193 | x | | | | Error path for short-term overboost |
| 194 | x | | | | Multi signal defects in EPCtl |
| 195 | x | x | x | | P2 pressure errors in EPCtl |
| 194 | x | | | | Permanent governor deviation in PCR low boost |
| 195 | | x | | | Permanent governor deviation in PCR high boost |
| 295 | x | x | | | PCR governor plausibility check |
| 196 | x | | x | | P3 pressure errors in EPCtl |
| 196 | x | x | | | Errorpath for filtered energizing time of Cylinder 1 |
| 296 | x | x | | | Errorpath for filtered energizing time of Cylinder 2 |
| 396 | x | x | | | Errorpath for filtered energizing time of Cylinder 3 |
| 496 | x | x | | | Errorpath for filtered energizing time of Cylinder 4 |
| 197 | x | | x | x | Turbine speed errors in EPCtl |
| 197 | x | x | | | Errorpath for energizing time calibration injection of Cylinder 1 |
| 297 | x | x | | | Errorpath for energizing time calibration injection of Cylinder 2 |
| 397 | x | x | | | Errorpath for energizing time calibration injection of Cylinder 3 |
| 497 | x | x | | | Errorpath for energizing time calibration injection of Cylinder 4 |
| 198 | x | | | | Multi signal defects in PCR |
| 198 | x | x | | | Errorpath for filtered energizing time of Cylinder 5 |
| 298 | x | x | | | Errorpath for filtered energizing time of Cylinder 6 |
| 398 | x | x | | | Errorpath for energizing time calibration injection of Cylinder 5 |
| 498 | x | x | | | Errorpath for energizing time calibration injection of Cylinder 6 |
| 199 | x | x | x | | P2 pressure errors in PCR |

| | | | | | |
|---|---|---|---|---|---|
| 19A | x | | x | | Turbine speed errors in PCR |
| 19B | x | | | | High turbine speed and high air pressure |
| 19C | x | | x | | P3 pressure errors in PCR |
| 19D | x | x | | | Temperature of Inner control loop |
| 19E | x | x | | | Temperature of Outer control loop |
| 19F | x | | | | Multi signal defects in EGSys_NOxEstIv |
| | | | | | **Exhaust system (Aftertreatment)** |
| 1A1 | x | x | x | | Lambda linear signal of Nox Sensor |
| 2A1 | x | x | x | | Lambda binary signal of Nox Sensor |
| 1A2 | x | x | x | x | Nox signal of Nox Sensor |
| 1A3 | x | x | x | | Heater of Nox Sensor |
| 1A4 | x | | | | Message Nox Sensor timeout |
| 1A5 | x | | | | Message DM1DCU timeout |
| 1A6 | x | | | | Message SCR1 timeout |
| 2A6 | x | | | | Message SCR2 timeout |
| 1A8 | | x | | | SCR2 message: low urea level |
| 2A8 | x | x | x | x | Low urea level in tank |
| 3A8 | x | | | | Timeout for urea sensor |
| 4A8 | x | x | x | x | Wrong urea concentration |
| 1A9 | x | x | | | Exhaust gas temp.sensor before oxidation catalyst |
| 1AB | x | x | | | Exhaust gas temperature sensor before turbine |
| 2AB | x | x | | x | Exhaust Gas Pipe pressure sensor |
| 1AB | | | x | | Faults of CAN message VDC1 |
| 1AC | x | x | x | x | Heater used in EGR Mass Flow rate |
| 2AC | | | x | | CAN message EngGsFlowRt |
| 1AD | x | x | x | x | Recirculated Engine Exhaust Gas Temp. sensor |
| 1AE | x | x | | | Air humidity sensor |
| 1AF | x | | | | DM1DCU SPN1 message |
| 2AF | x | | | | DM1DCU SPN2 message |
| 3AF | x | | | | DM1DCU SPN3 message |
| 4AF | x | | | | DM1DCU SPN4 message |
| | | | | | **Interfaces 1 (CAN-Bus)** |
| 1B1 | x | | | | Busoff in CAN A |
| 1B2 | x | | | | Busoff in CAN B |
| 1B3 | x | | | | Busoff in CAN C |
| 1B4 | x | | | | Timeout for BC2EDC1 |
| 2B4 | x | | | | Timeout for BC2EDC2 |
| 1B5 | x | | | | Timeout for VM2EDC |
| 1B6 | | | x | | Timeout of CAN message WSI |
| 1B7 | | | x | | Timeout in CAN send messages |
| 1B8 | x | | | | Physical unplausibility of TSC-demand |
| 1B9 | x | | | | MIL visualization for BC2EDC1 |
| 1BA | x | | | | Message Dashboard Display timeout |
| 1BB | x | | | | Message ERC1DR timeout |
| 1BC | x | | | | Message RxAMCONIv timeout |
| 1BD | | | x | | Timeout error of RxCCVS message |
| 1BE | x | | | | Physical plausibility DCS |
| 1BF | | | x | | CAN message RxEngTemp2 |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | **Interfaces 2 (CAN messages timeout)** |
| 1C1 | | | x | | Timeout of CAN message EBC1 |
| 1C2 | | | x | | Timeout of CAN message ETC1 |
| 1C3 | | | x | | Timeout of CAN message TCO1 |
| 1C4 | x | | x | | Timeout of CAN message TSC1-AE |
| 2C4 | x | | x | | Timeout of CAN message TSC1-AR |
| 1C5 | x | | x | | Timeout of CAN message TSC1-DE |
| 2C5 | x | | x | | Timeout of CAN message TSC1-DR |
| 1C6 | x | x | | | Timeout of CAN message TSC1-PE |
| 1C7 | x | | x | | Timeout of CAN message TSC1-TE |
| 2C7 | x | | x | | Timeout of CAN message TSC1-TR |
| 1C8 | x | | x | | Timeout of CAN message TSC1-VE |
| 2C8 | x | | x | | Timeout of CAN message TSC1-VR |
| 1C9 | x | | | | Timeout of CAN message TF |
| 2C9 | x | | | | Timeout for message TimeDate |
| 3C9 | x | | | | Timeout for message HRVD (high resolution vehicle distance) |
| 1CA | | | | x | Monitor.temperature upstream of Oxid.Catalyst |
| 1CB | | | | x | Monitor.temperature upstream of Particul.filtre |
| 1CC | | | | x | Monitor.temperature upstream of Turbo charger |
| 1CD | x | | | | Too high regeneration demand |
| 1CE | x | | | | Temp.difference upstream from Oxidation catalyst of bank1 and 2 exceeded threshold |
| 1CF | x | | | | Temp.difference upstream from Particulate filtre of bank1 and 2 exceeded threshold |
| | | | | | **ECU 1 (internal checks)** |
| 1D1 | x | | | | Communication error of CJ940 |
| 1D2 | | x | x | x | Error state of EEPROM |
| 1D3 | | | | x | Recovery which is locked |
| 2D3 | | | | x | Recovery which is suppressed |
| 3D3 | | | | x | Recovery which is visible |
| 1D4 | | | | x | Communic.supervision Watchdog/Contr.-Flag |
| 1D5 | | x | x | x | Redundant shutoff paths during initial. |
| 1D6 | | | | x | Deviation between TPU and system time |
| 1D7 | | | x | x | Dataset variant coding |
| 1D8 | | | | x | Supervision of SPI-handler Flag |
| 1D9 | x | x | x | x | Error status ADC monitoring |
| 1DA | | | | x | Fault FMTC_trq2qBas_MAP containes non strictly monotonous q curves |
| | | | | | **ECU 2 (Powerst./Immobil./Overrun/Sensor supply)** |
| 1E1 | x | x | | | Short circuit to Batt or Ground, no load, excess.temp. for high side power stage |
| 2E1 | x | x | x | | Short circuit to Batt or Ground, no load, excess.temp. for low side power stage |
| 1E2 | | x | | | Error state of Immobilizer (no fuel release) |
| 1E3 | x | | | | Energising time exceeds limit of overrun monitoring |
| 1E4 | x | | | | Plausibility error in engine speed check |
| 1E5 | x | x | | | 12V sensor supply voltage |
| 1E6 | x | x | | | Sensor supply voltage 1 |
| 1E7 | x | x | | | Sensor supply voltage 2 |

| | | | | | |
|---|---|---|---|---|---|
| 1E8 | x | x | | | Sensor supply voltage 3 |
| 1E9 | x | | | | Supply voltage CJ940 upper limit |
| 1EA | | x | | | Supply voltage CJ940 lower limit |
| 1EB | x | x | | x | Atmospheric Pressure Sensor |
| | | | | | **Particulate trap** |
| 1F1 | | | | x | Part.filter differential pressure sensor not plausible |
| 1F2 | x | x | | | Part.filter differential pressure sensor |
| 1F3 | x | x | | | Part.filter pre temperature sensor |
| 1F4 | x | x | | | Flow resistance monitoring |
| 1F5 | x | | | | Differential pressure above limit |
| 1F6 | | | | x | Dynamics of differential pressure signal not plausible |
| 1F7 | x | x | | x | Differential pressure signal |
| 1F8 | | | | x | Pressure sensor frozen so signal not plausible |
| 1F9 | | | | x | Hose line defect so signal not plausible |
| 1FA | | | | x | Pressure sensor blocked so signal not plausible |
| 1FB | x | | | | Permanent regeneration |
| 1FC | x | x | | x | First exhaust gas temperature monitoring |
| 1FD | | | | x | General temperature not plausible |
| 1FE | x | x | | x | second exhaust gas temperature monitoring |
| 1FF | x | | | | Number of locked regenerations |
| 2FF | x | | | | Regeneration demand number 2 |
| 3FF | x | | | | Regeneration demand number 3 |
| | | | | | **Lambda sonde** |
| 611 | x | x | x | x | Monitoring of Lambdasensor 1 Nernst cell pin |
| 612 | x | x | x | x | Monitoring of Lambdasensor 1 Pump current pin |
| 613 | x | x | x | x | Monitoring of Lambdasensor 1 Heater powerstage |
| 614 | | | x | | Heater coupling defect of Lambdasensor |
| 615 | x | x | | | Monitoring of Lambdasensor 1 signal range |
| 616 | x | x | x | x | Monitoring of Lambdasensor 1 virtual ground pin |
| 617 | x | x | | | Monitoring of Lambdasensor 1 O2 volt.calibration value |
| 618 | x | x | | | Monitoring of Lambdasensor inner restistance calibr.val. |
| 619 | | | | x | SPI chip error defect of Lambdasensor (not plausible) |
| 61A | | x | | | SPI chip error defect of Lambdasensor (low batt.volt.) |
| 61B | | | x | | Shunting detection of Lambdasensor |
| 61C | x | x | | | Ri value monitoring of LSU0 |
| 61D | x | x | | | CO2 concentration error in full load oper.point |
| 61E | x | x | | | CO2 concentration error in part load oper.point |
| 61F | x | x | | | CO2 concentration error in overrun oper.point |
| | | | | | **Reserve** |
| 711 | x | | | | Error check of critical time for oil dilution |
| 712 | x | | | | Misfire Cylinder 1 |
| 713 | x | | | | Misfire Cylinder 2 |
| 714 | x | | | | Misfire Cylinder 3 |
| 7015 | x | | | | Misfire Cylinder 4 |
| 716 | x | | | | Misfire Cylinder 5 |
| 717 | x | | | | Misfire Cylinder 6 |
| 71B | x | x | x | | Additive valve actuator |
| 71C | x | x | x | | Intercooler Bypass Valve Powerstage |

https://truckmanualshub.com/

| | | | | | |
|---|---|---|---|---|---|
| 71D | | | | **x** | Runuptest is set to disable misfire detection during runup test |
| 71E | **x** | | | | Fault path for Runup test |
| 71F | | | | **x** | Dynamic error for LSU |

*) Blink code only existing in P342

**) Blink code only existing in P340

modified compared to V60/V62

https://truckmanualshub.com/



# Section 4001

## Electrical Schematics

## XTX185, XTX200 Tractors and XTX215 (Cummins Engine) Tractors

McCORMICK

SM 8-15150

© 2005 McCormick Tractors International Limited.

November 2005

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIAL TOOLS ..... 6

CIRCUIT TESTING
- General Information ..... 7
- Schematic Symbols ..... 8
- Schematic Legend ..... 9
- Wire Colour Code ..... 9

EUROPEAN SPECIFICATION FUSE LOCATION AND IDENTIFICATION ..... 10

AMERICAN SPECIFICATION FUSE LOCATION AND IDENTIFICATION ..... 12

COMPONENT IDENTIFICATION
- Hood Components ..... 14
- XTX185 and XTX200 Engine Components ..... 15
- XTX215 Engine Components ..... 16
- Instrument Panel Components ..... 17
- Right Hand Console Components (XtraSpeed and XtraSpeed - E Tractors Only) ..... 18
- Right Hand Console Components (XtraSpeed - E Plus Tractors Only) ..... 19
- Transmission Components ..... 20
- Fender Components (XtraSpeed and XtraSpeed - E Tractors) ..... 21
- Fender Components (XtraSpeed - E Plus Tractors) ..... 22
- Cab Components ..... 23
- Cab Roof Panel Components ..... 24

NEUTRAL START, COLD START, KEY SWITCH, CAB POWER, FUEL HEATER (For XTX185 and XTX200 Tractors)
- Neutral Start Circuit ..... 26
- Cold Start Circuit ..... 26
- Fuel Heater ..... 27
- Accessory Power Relay Circuit ..... 27
- Cab Power Relay Circuit ..... 27
- Schematic Circuit (For XTX185 and XTX200 Tractors) ..... 28

NEUTRAL START, COLD START, KEY SWITCH, CAB POWER AND WATER IN FUEL (For XTX215 Tractors)
- Starter Circuit ..... 30
- Cold Start Circuit ..... 30
- Water in Fuel Circuit ..... 30
- Accessory Power Relay ..... 31
- Cab Power Relay ..... 31
- Schematic Circuit (For XTX215 Tractors) ..... 32

https://truckmanualshub.com/



4TH AUXILIARY/REMOTE VALVE, IMPLEMENT INTERFACE CONNECTOR,
AUXILIARY POWER CONNECTORS AND BEACON LIGHT
4TH Auxiliary/Remote Valve Circuit
(XtraSpeed and XtraSpeed - E Tractors Only) ..... 35
Implement Interface Connector Circuit ..... 36
Front and Rear 3 Pin Auxiliary Power Connector Circuit ..... 36
Switched Fender Auxiliary Power Connector Circuit ..... 36
Beacon Light ..... 36
Schematic Circuit (For European Specification Tractors) ..... 37
Schematic Circuit (For American Specification Tractors) ..... 39

HORN, CIGAR LIGHTER AND SEAT
Horn Circuit ..... 40
Cigar Lighter Circuit. ..... 40
Electric Air Seat Circuit ..... 40
Schematic Circuit ..... 41

RADIO AND INTERIOR LIGHT
Radio Circuit ..... 42
Interior Light Circuit ..... 42
Schematic Circuit ..... 43

BLOWER AND AIR CONDITIONING
(For Tractors Without Automatic Temperature Control)
Blower Circuit ..... 44
Air Conditioning Circuit ..... 44
Schematic Circuit ..... 45

ELECTRIC MIRRORS AND WINDSHIELD WIPER/WASHERS
Electric Mirror Circuit ..... 46
Front Windscreen Wiper/Washer Circuit ..... 47
Rear Windscreen Wiper/Washer Circuit ..... 48
Schematic Circuit (For Tractors Not Equipped With Automatic Temperature Control) ..... 49
Schematic Circuit (For Tractors Equipped With Automatic Temperature Control) ..... 51

BRAKE LIGHTS AND AIR TRAILER BRAKE
Brake Light Circuit ..... 52
Air Trailer Brake Solenoid Circuit ..... 52
Schematic Circuit (For XtraSpeed and XtraSpeed - E Tractors) ..... 53
Schematic Circuit (For XtraSpeed - E Plus Tractors) ..... 55

SIDE/TAIL LIGHTS, NUMBER PLATE LIGHTS, RIGHT HAND CONSOLE
LIGHT, TURN SIGNAL AND HAZARD WARNING LIGHTS
(European Specification Tractors Only)
Side/Tail Light, Number Plate Light and
Right Hand Console Light Circuits ..... 57
Turn Signal and Hazard Warning Light Circuits ..... 57
Schematic Circuit (For XtraSpeed and XtraSpeed - E Tractors) ..... 59
Schematic Circuit (For XtraSpeed - E Plus Tractors) ..... 61

https://truckmanualshub.com/



WARNING AND TURN SIGNAL LIGHTS
(American Specification Tractors Only)
Turn Signal and Warning Light Circuits ..... 63
Schematic Circuit (For XtraSpeed and XtraSpeed - E Tractors) ..... 65
Schematic Circuit (For XtraSpeed - E Plus Tractors) ..... 67

GRILLE HEADLIGHTS, CAB MOUNTED HEADLIGHTS AND REAR FOG LIGHTS
(European Specification Tractors Only)
Grille Headlight Circuit ..... 68
Cab Mounted Headlight Circuit ..... 69
Rear Fog Light Circuit ..... 70
Schematic Circuit ..... 71

HEADLIGHTS, RIGHT HAND CONSOLE LIGHT AND TAIL LIGHTS
(American Specification Tractors Only)
Headlights Circuit ..... 72
Right Hand Console Light Circuit ..... 72
Rear Tail Light Circuits ..... 72
Schematic Circuit ..... 73

WORK LIGHTS
(European Specification Tractors Only)
Rear Work Lights ..... 75
Front Work Lights ..... 76
Schematic Circuit ..... 77

WORK LIGHTS
(American Specification Tractors Only)
Rear Work Lights ..... 79
Front Work Lights ..... 80
Schematic Circuit ..... 81

MAIN CONNECTORS ..... 83

**NOTE:** *For the controller system circuits, refer to the following sections within the XTX Service Manual.*

*Auxiliary/Remote Valve Controller ..... Section 10001*
*Hitch/PTO Controller ..... Section 10002*
*Indedendent Front Suspension Axle Controller ..... Section 10003*
*Cab and Transmission Controller ..... Section 10006*
*Instrument Cluster Controller ..... Section 10009*
*Cab Suspension Controller ..... Section 10011*
*Automatic Temperature Control ..... Section 10012*

https://truckmanualshub.com/



This Page Has Been Left Blank.

https://truckmanualshub.com/



# SPECIAL TOOLS



DD98H120

**MC2616 MULTIMETER KIT includes:**
**MC2616-1 MULTIMETER ONLY**
**MC2616-2 TEST LEADS**
**MC2616-3 TEMPERATURE PROBE**



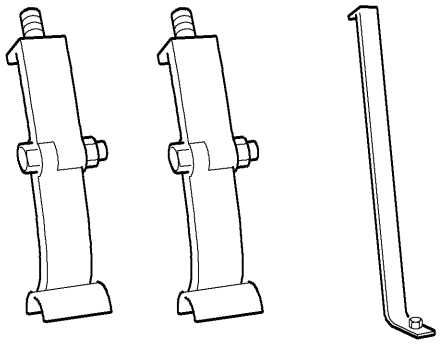
DD97E383

**MC31000 HARNESS REPAIR KIT**



DD99A051

**MC2656 TEST PROBE KIT**



DI97K101

**MC2530 and MC2531 CAB ROOF TILT TOOLS**

https://truckmanualshub.com/



# CIRCUIT TESTING

## General Information

**WARNING:** *Never operate the engine in a closed building. Proper ventilation is required under all circumstances.*

**IMPORTANT:** *All electrical checks must be made with the tractor parked on hard level ground with park brake engaged, the shuttle lever in Neutral or Park and the engine OFF.*

**IMPORTANT:** *Put blocks in front of and behind the rear wheels.*

**IMPORTANT:** *For tractors equipped with cab suspension, all checks must be carried out with the cab fully lowered or with the cab supported with suitable cab supports. To lower the cab refer to Section 10011.*

**IMPORTANT:** *The battery must be at full charge and all connections must be clean and tight before testing. Only use a HIGH IMPEDANCE multimeter for the tests. Do not use a test lamp or damage to the switches may occur.*

**IMPORTANT:** *Use MC2656 test probe kit when making electrical checks at connectors to avoid the risk of shorting between the connector pins or terminals.*

**IMPORTANT:** *When disconnecting harness connectors, always check the connector pins and terminals for damage and alignment.*

**NOTE:** *When measuring resistance values, always measure the resistance of the multimeter leads before testing components. Subtract the resistance of the multimeter leads from the component resistance to obtain a true resistance value.*

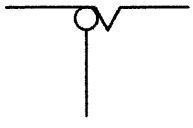
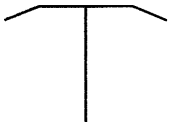
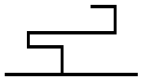
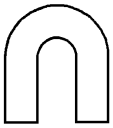
**NOTE:** *When testing diodes and diode modules use the multimeter diode test function.*

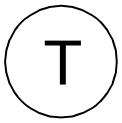
**NOTE:** *All components, wires and connectors disconnected during any electrical checks must be connected when the checks are completed.*

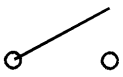
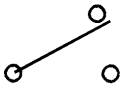
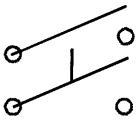
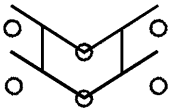
https://truckmanualshub.com/

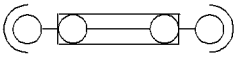


# Schematic Symbols

| ACTUATORS | | | |
|---|---|---|---|
|  LEVER |  HAND |  FOOT |  TEMPERATURE |
|  LIQUID LEVEL FLOAT |  PRESSURE |  COIL |  DIODE |
|  VARIABLE RESISTOR |  RESISTOR |  MAGNETIC | CONTACTS  MOMENTARY  MAINTAINED |

| HOUSINGS | | | | |
|---|---|---|---|---|
|  VACUUM SWITCH |  PRESSURE SWITCH |  TEMPERATURE SWITCH |  MOTOR |  LIGHT |

| SWITCH CONTACT CONFIGURATION | | | |
|---|---|---|---|
|  S.P.S.T. (SINGLE POLE SINGLE THROW) |  S.P.D.T. (SINGLE POLE DOUBLE THROW) |  D.P.S.T. (DOUBLE POLE SINGLE THROW) |  D.P.D.T. (DOUBLE POLE DOUBLE THROW) |

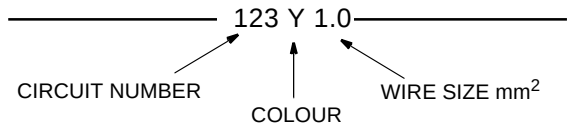
| MISCELLANEOUS SYMBOLS | | | |
|---|---|---|---|
|  FUSE |  CIRCUIT BREAKER | | |

**NOTE:** *Schematic symbols shown with tractor parked and power OFF.*

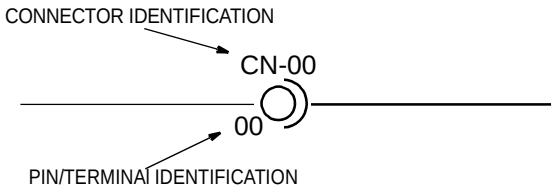
https://truckmanualshub.com/



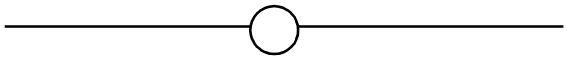
## Schematic Legend



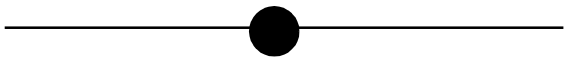

CIRCUIT TAG IF REQUIRED




INDICATES INLINE CONNECTION WITH TERMINALS



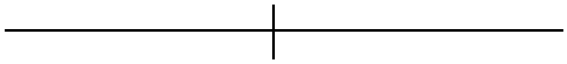
INDICATES CIRCUIT CONNECTION TO BATTERY POWER OR SWITCHED POWER STUD



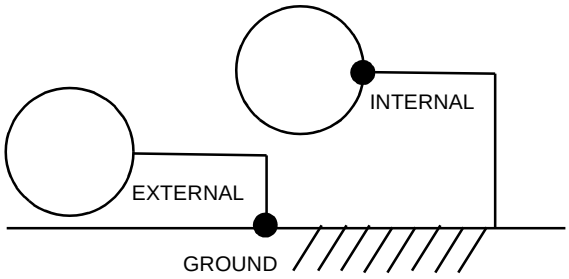
INDICATES CIRCUIT SPLICE CONNECTION



INDICATES CIRCUIT CAB MAIN SPLICE CONNECTION



INDICATES CIRCUIT CROSSING NOT CONNECTED




INDICATES CHASSIS GROUND CONNECTIONS

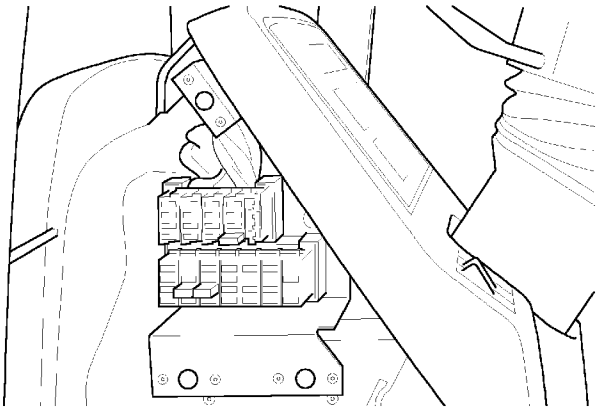
## Wire Colour Code

R..... RED
T..... TAN
W..... WHITE
Y..... YELLOW
B ..... BLACK
G ..... GREY
O ..... ORANGE
P..... PINK
V..... VIOLET (PURPLE)
BR ..... BROWN
DB ..... DARK BLUE
DG..... DARK GREEN
LB ..... LIGHT BLUE
LG .....LIGHT GREEN

https://truckmanualshub.com/



# EUROPEAN SPECIFICATION FUSE LOCATION AND IDENTIFICATION



MI03G058

To gain access to the fuses remove the instrument panel left hand side cover.

| | | | |
|---|---|---|---|
| 41 | 42 | 43 | 44 |
| 37 | 38 | 39 | 40 |
| 33 | 34 | 35 | 36 |
| 29 | 30 | 31 | 32 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**NOTE:** *Locations 3, 9, 10, 12, 32 and 44 are mini circuit breakers, which will reset automatically.*

| Fuse No | Circuit | Amps |
|---|---|---|
| 1 | HORN | 15 |
| 2 | FRONT LOWER CAB AND FRONT GRILLE WORK LIGHTS | 25 |
| 3 | LEFT HAND REAR CAB ROOF WORK LIGHTS (CIRCUIT BREAKER) | 25 |
| 4 | REAR FENDER WORK LIGHTS | 15 |
| 5 | TRANSMISSION CONTROLLER UNSWITCHED B+ | 7.5 |
| 6 | LEFT HAND SIDE/TAIL LIGHTS | 10 |
| 7 | RIGHT HAND SIDE/TAIL LIGHTS | 10 |
| 8 | SEAT, LOADER CONTROL | 15 |
| 9 | RIGHT HAND REAR CAB WORK LIGHTS (CIRCUIT BREAKER) | 25 |
| 10 | GRILLE HEADLIGHTS - LOW BEAM (CIRCUIT BREAKER) | 10 |
| 11 | REAR FOG LIGHT | 15 |
| 12 | LEFT HAND FRONT CAB WORK LIGHTS (CIRCUIT BREAKER) | 25 |
| 13 | GRILLE HEADLIGHTS - HIGH BEAM | 10 |

https://truckmanualshub.com/



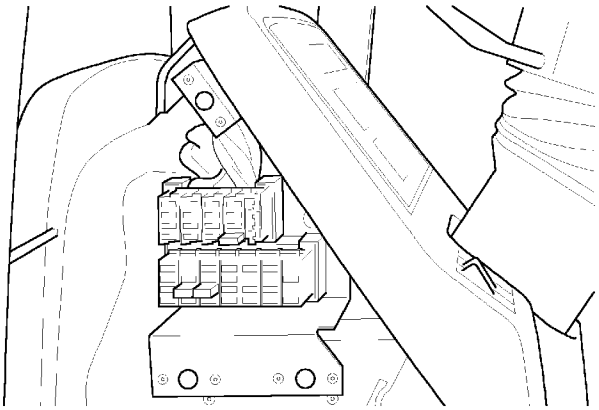
| Fuse No | Circuit | Amps |
|---|---|---|
| 14 | OPEN | ------- |
| 15 | CAB MOUNTED HEADLIGHTS | 15 |
| 16 | IMPLEMENT INTERFACE CONNECTOR UNSWITCHED B+ | 10 |
| 17 | OPEN | ------- |
| 18 | HAZARD WARNING LIGHTS | 15 |
| 19 | OPEN | ------- |
| 20 | (##) AUXILIARY VALVE CONTROLLER UNSWITCHED B+ | 7.5 |
| 21 | TURN SIGNAL LIGHTS | 15 |
| 22 | BEACON LIGHT | 15 |
| 23 | OPEN | ------- |
| 24 | BRAKE LIGHTS | 20 |
| 25 | INSTRUMENT CLUSTER SWITCHED B+ | 7.5 |
| 26 | MFD, DIFF LOCK | 30 |
| 27 | CAB CONTROLLER, HITCH CONTROLLER SWITCHED B+ | 7.5 |
| 28 | FRONT SUSPENDED AXLE CONTROLLER SWITCHED B+ | 10 |
| 29 | REAR FENDER AUXILIARY POWER CONNECTOR,<br>AIR TRAILER BRAKE (IF EQUIPPED) | 30 |
| 30 | FRONT AND REAR 3 PIN AUXILIARY POWER CONNECTOR SWITCHED B+ | 30 |
| 31 | REAR WINDSCREEN WIPER/WASHER | 15 |
| 32 | FRONT WINDSCREEN WIPER/WASHER, ELECTRIC MIRRORS (CIRCUIT BREAKER) | 15 |
| 33 | PTO SWITCHED B+ | 7.5 |
| 34 | TRANSMISSION CONTROLLER SWITCHED B+ | |
| 35 | (##) AUXILIARY/REMOTE VALVE CONTROLLER, ARMREST CONTROL | 7.5 |
| 36 | FRONT PTO SWITCHED B+ | 10 |
| 37 | INTERIOR LIGHT, INSTRUMENT CLUSTER, RADIO, CLOCK UNSWITCHED B+ | 7.5 |
| 38 | CAB CONTROLLER UNSWITCHED B+ | 7.5 |
| 39 | CIGAR LIGHTER, DIAGNOSTIC CONNECTOR | 10 |
| 40 | ACCESSORY POWER, INSTRUMENT CLUSTER, RADIO | 7.5 |
| 41 | REAR 3 PIN AUXILIARY POWER CONNECTOR, UNSWITCHED B+ | 30 |
| 42 | FRONT 3 PIN AUXILIARY POWER CONNECTOR, UNSWITCHED B+ | 30 |
| 43 | OPEN | ------- |
| 44 | RIGHT HAND FRONT CAB WORK LIGHTS (CIRCUIT BREAKER) | 25 |

(##) XtraSpeed - E Plus Tractors Only.

https://truckmanualshub.com/



# AMERICAN SPECIFICATION FUSE LOCATION AND IDENTIFICATION



MI03G058

To gain access to the fuses remove the instrument panel left hand side cover.

| | | | |
|---|---|---|---|
| 41 | 42 | 43 | 44 |
| 37 | 38 | 39 | 40 |
| 33 | 34 | 35 | 36 |
| 29 | 30 | 31 | 32 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

**NOTE:** *Locations 3, 9, 10, 12, 32 and 44 are mini circuit breakers, which will reset automatically..*

| Fuse No | Circuit | Amps |
|---|---|---|
| 1 | HORN | 15 |
| 2 | FRONT LOWER CAB AND FRONT GRILLE WORK LIGHTS | 25 |
| 3 | LEFT HAND REAR CAB ROOF WORK LIGHTS (CIRCUIT BREAKER) | 25 |
| 4 | REAR FENDER WORK LIGHTS | 15 |
| 5 | TRANSMISSION CONTROLLER UNSWITCHED B+ | 7.5 |
| 6 | TAIL LIGHTS | 10 |
| 7 | OPEN | ------- |
| 8 | SEAT, LOADER CONTROL | 15 |
| 9 | RIGHT HAND REAR CAB WORK LIGHTS (CIRCUIT BREAKER) | 25 |
| 10 | HEADLIGHTS - LOW BEAM (CIRCUIT BREAKER) | 10 |
| 11 | OPEN | ------- |
| 12 | LEFT HAND FRONT CAB WORK LIGHTS (CIRCUIT BREAKER) | 25 |
| 13 | HEADLIGHTS - HIGH BEAM | 10 |

https://truckmanualshub.com/



| Fuse No | Circuit | Amps |
|---|---|---|
| 14 | OPEN | ------- |
| 15 | NOT USED | 15 |
| 16 | IMPLEMENT INTERFACE CONNECTOR UNSWITCHED B+ | 10 |
| 17 | TURN SIGNAL LIGHTS | 15 |
| 18 | TURN SIGNAL LIGHTS | 15 |
| 19 | TURN SIGNAL LIGHTS | 5 |
| 20 | (##) AUXILIARY VALVE CONTROLLER UNSWITCHED B+ | 7.5 |
| 21 | OPEN | ------- |
| 22 | BEACON LIGHT | 15 |
| 23 | NOT USED | 20 |
| 24 | BRAKE RELAYS | 20 |
| 25 | INSTRUMENT CLUSTER SWITCHED B+ | 7.5 |
| 26 | MFD, DIFF LOCK | 30 |
| 27 | CAB CONTROLLER, HITCH CONTROLLER SWITCHED B+ | 7.5 |
| 28 | FRONT SUSPENDED AXLE CONTROLLER SWITCHED B+ | 10 |
| 29 | REAR FENDER AUXILIARY POWER CONNECTOR SWITCHED B+, 7 PIN TRAILER CONNECTOR SWITCHED B+ | 30 |
| 30 | FRONT AND REAR 3 PIN AUXILIARY POWER CONNECTOR SWITCHED B+ | 30 |
| 31 | REAR WINDSCREEN WIPER/WASHER | 15 |
| 32 | FRONT WINDSCREEN WIPER/WASHER, ELECTRIC MIRRORS (CIRCUIT BREAKER) | 15 |
| 33 | PTO SWITCHED B+ | 7.5 |
| 34 | TRANSMISSION CONTROLLER SWITCHED B+ | |
| 35 | (##) AUXILIARY/REMOTE VALVE CONTROLLER, ARMREST CONTROL | 7.5 |
| 36 | FRONT PTO SWITCHED B+ | 10 |
| 37 | INTERIOR LIGHT, INSTRUMENT CLUSTER, RADIO, CLOCK UNSWITCHED B+ | 7.5 |
| 38 | CAB CONTROLLER UNSWITCHED B+ | 7.5 |
| 39 | CIGAR LIGHTER, DIAGNOSTIC CONNECTOR | 10 |
| 40 | ACCESSORY POWER, INSTRUMENT CLUSTER, RADIO | 7.5 |
| 41 | REAR 3 PIN AUXILIARY POWER CONNECTOR, UNSWITCHED B+ | 30 |
| 42 | FRONT 3 PIN AUXILIARY POWER CONNECTOR, UNSWITCHED B+ | 30 |
| 43 | OPEN | ------- |
| 44 | RIGHT HAND FRONT CAB WORK LIGHTS (CIRCUIT BREAKER) | 25 |

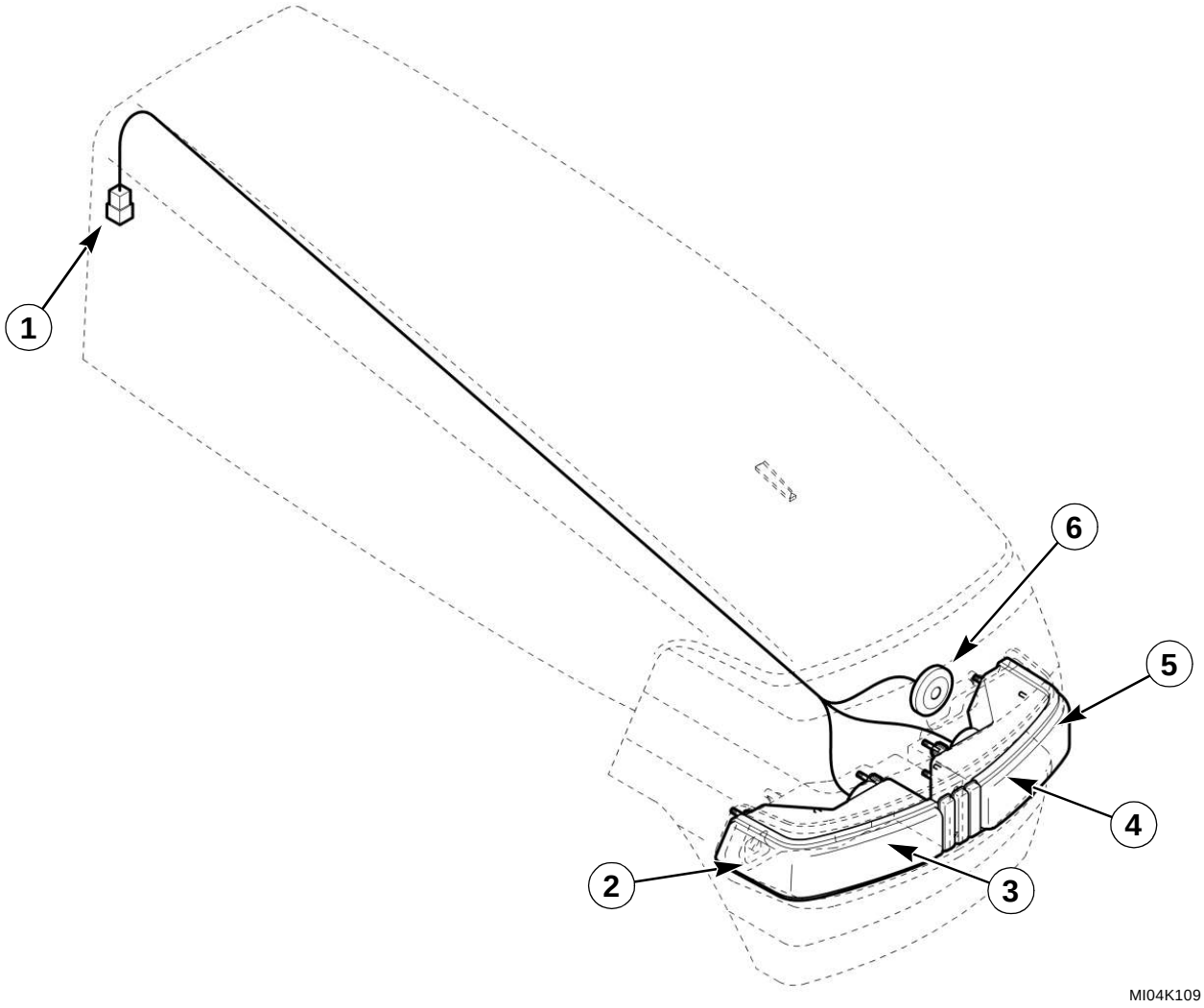
(##) XtraSpeed - E Plus Tractors Only.

https://truckmanualshub.com/



# COMPONENT IDENTIFICATION

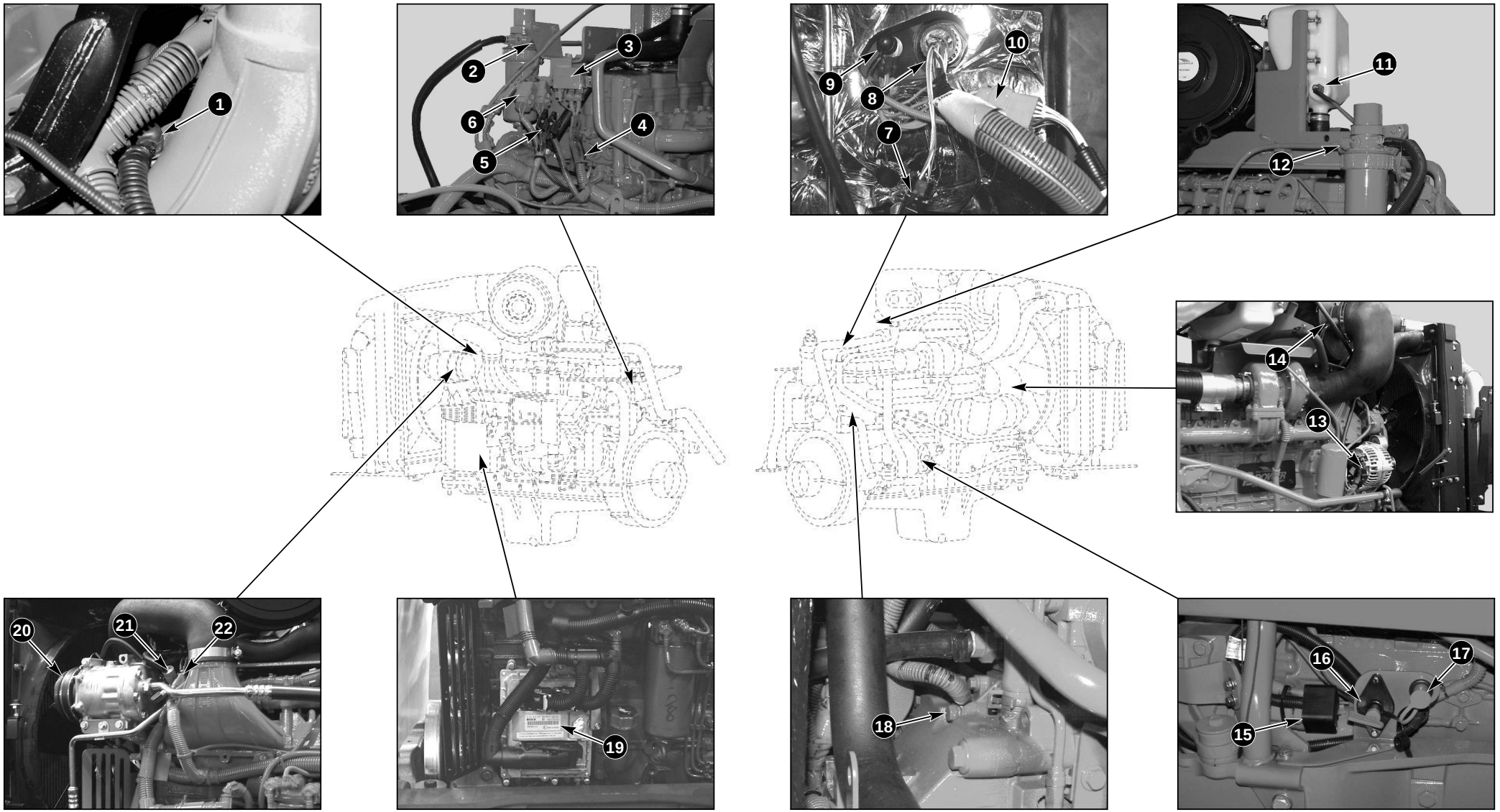
## Hood Components




1. CONNECTOR 67 (ENGINE HARNESS)
2. RIGHT HAND FRONT GRILLE WORK LIGHT
3. RIGHT HAND HEADLIGHT
4. LEFT HAND HEADLIGHT
5. LEFT HAND FRONT GRILLE WORK LIGHT
6. HORN

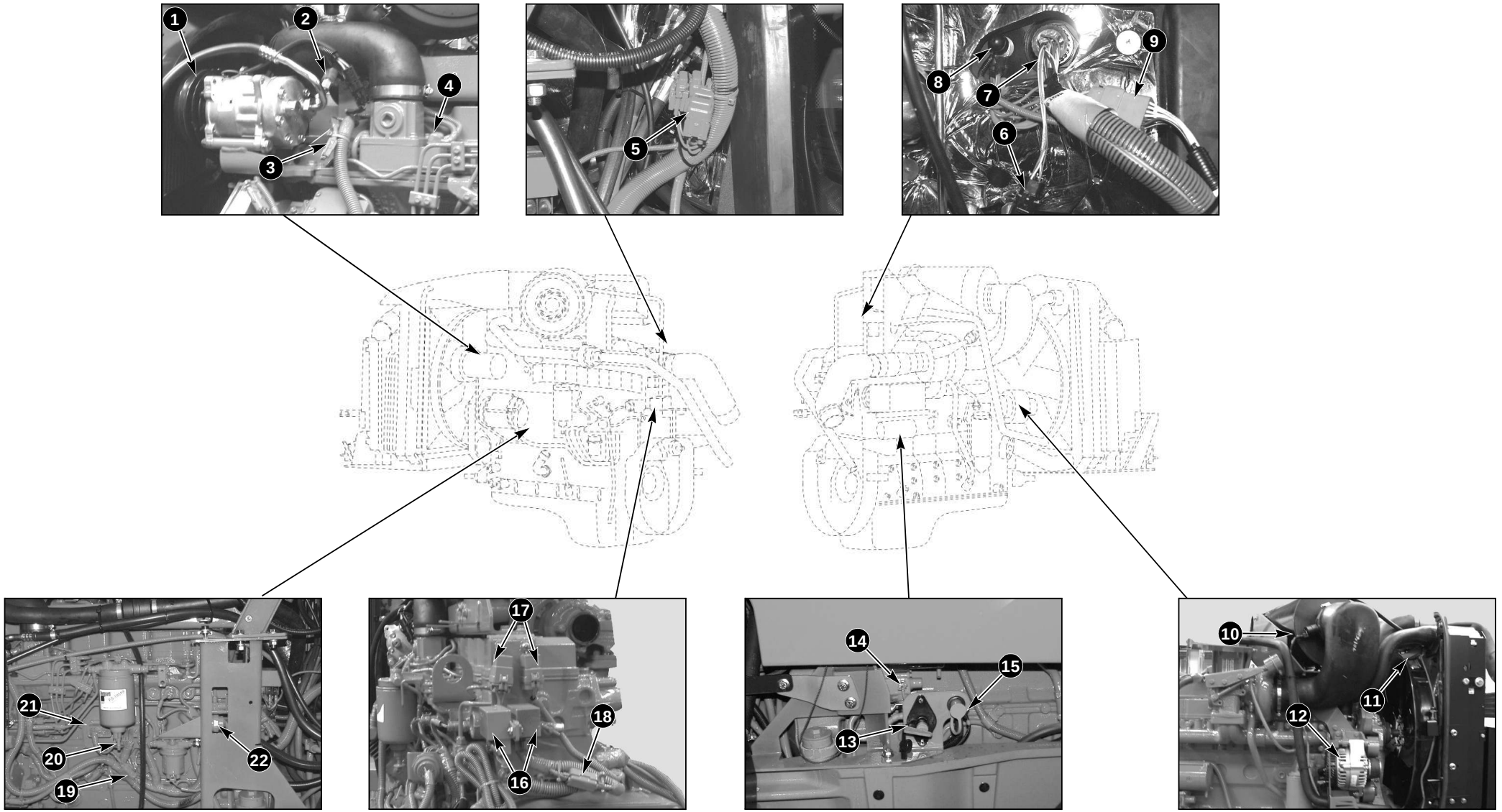
https://truckmanualshub.com/


## XTX185 and XTX200 Engine Components




1. GRID HEATER
2. WATER IN FUEL SENSOR MODULE
3. COLD START RELAY
4. COLD START FUSES (125 AMP)
5. INLINE FUSE (ENGINE CONTROLLER/FUEL HEATER)
6. STARTER RELAY/FUEL HEATER RELAY
7. RADAR HARNESS CONNECTOR
8. CONNECTOR 10 TO (INSTRUMENT PANEL HARNESS)
9. BATTERY POWER STUD
10. CONNECTOR 67 (TO HOOD HARNESS)
11. COOLANT LEVEL SENDER
12. FUEL HEATER LOCATION (IF EQUIPPED)
13. ALTERNATOR
14. AIR FILTER RESTRICTION SWITCH
15. STARTER MOTOR
16. MASTER DISCONNECT SWITCH (IF EQUIPPED)
17. JUMP START STUD (IF EQUIPPED)
18. CHASSIS GROUND LOCATION G6
19. ENGINE CONTROLLER
20. AIR CONDITIONING COMPRESSOR CLUTCH
21. AIR CONDITIONING HIGH PRESSURE SWITCH
22. AIR CONDITIONING COMPRESSOR CLUTCH DIODE

## XTX215 Engine Components

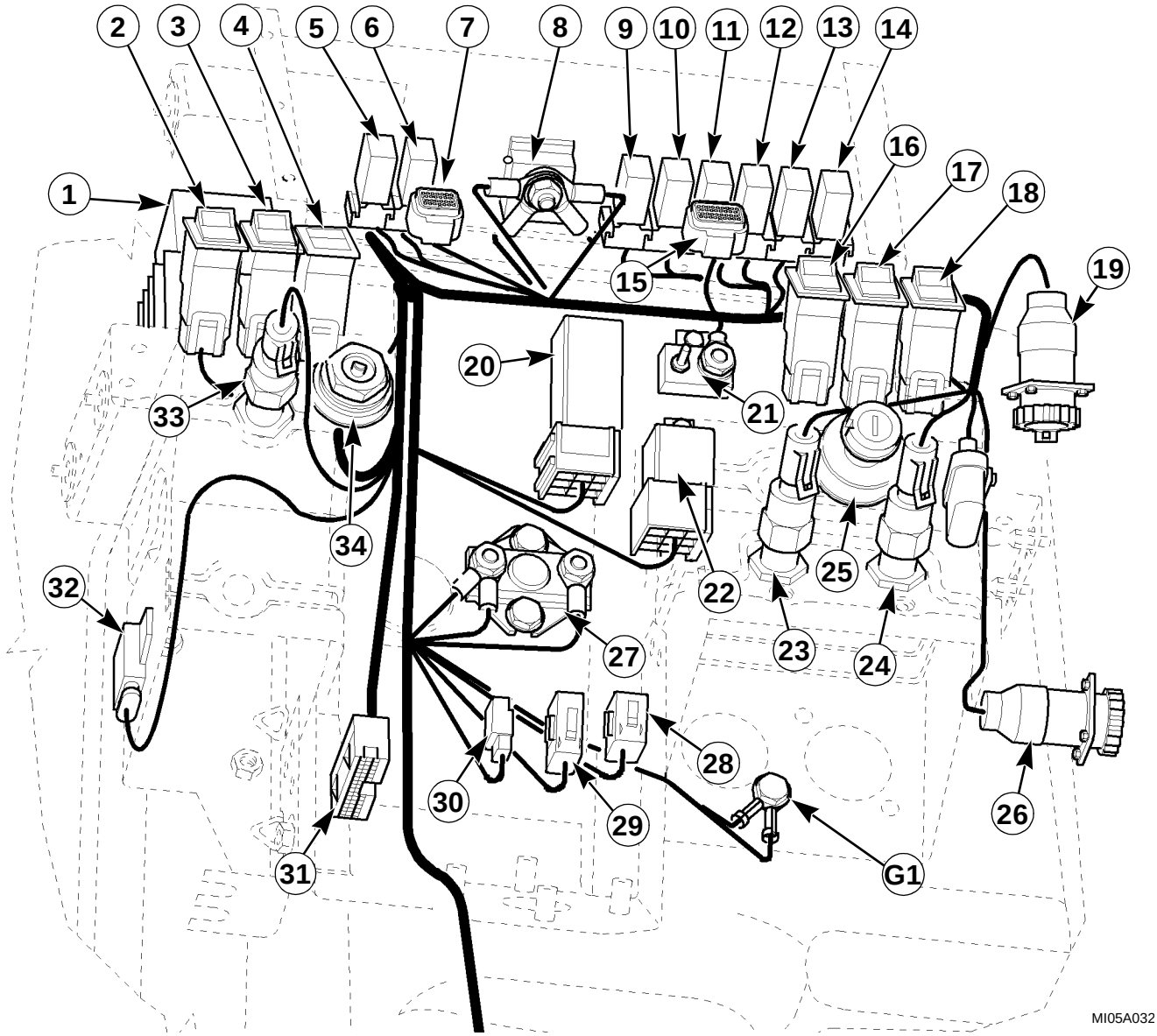



1. AIR CONDITIONING COMPRESSOR CLUTCH
2. AIR CONDITIONING HIGH PRESSURE SWITCH
3. AIR CONDITIONING COMPRESSOR CLUTCH DIODE
4. GRID HEATER
5. INLINE FUSES (ENGINE CONTROLLER B+)
6. RADAR HARNESS CONNECTOR
7. CONNECTOR 10 TO (INSTRUMENT PANEL HARNESS)
8. BATTERY POWER STUD
9. CONNECTOR 67 (TO HOOD HARNESS)
10. AIR FILTER RESTRICTION SWITCH
11. COOLANT LEVEL SENDER
12. ALTERNATOR
13. MASTER DISCONNECT SWITCH (IF EQUIPPED)
14. STARTER MOTOR
15. JUMP START STUD (IF EQUIPPED)
16. COLD START RELAYS
17. STARTER RELAY/VP44 FUEL PUMP RELAY
18. COLD START FUSES 1 AND 2 (125 AMP)
19. CAN BUS TERMINATION RESISTOR
20. WATER IN FUEL SENSOR
21. ENGINE CONTROLLER
22. CONNECTOR 60 (ENGINE CONTROLLER HARNESS)

https://truckmanualshub.com/



## Instrument Panel Components




1. FUSE BOX
2. FRONT WORK LIGHT SWITCH
3. REAR WORK LIGHT SWITCH
4. REAR FOG LIGHT SWITCH (IF EQUIPPED)
5. HEADLIGHT LOW BEAM RELAY
6. HEADLIGHT HIGH BEAM RELAY
7. CONNECTOR 31 (INSTRUMENT CLUSTER)
8. SWITCHED POWER STUD
9. FRONT LOWER/GRILLE CAB WORK LIGHT RELAY
10. LEFT HAND REAR CAB WORK LIGHT RELAY
11. ACCESSORY POWER RELAY
12. LEFT HAND FRONT CAB WORK LIGHT RELAY
13. RIGHT HAND FRONT CAB WORK LIGHT RELAY
14. RIGHT HAND REAR CAB WORK LIGHT RELAY
15. CONNECTOR 30 (INSTRUMENT CLUSTER)
16. (*) HAZARD WARNING LIGHT SWITCH
17. BEACON LIGHT SWITCH (IF EQUIPPED)
18. (*) UPPER/LOWER HEADLIGHT SWITCH
19. CAN DIAGNOSTIC CONNECTOR
20. FLASHER RELAY
21. CIRCUIT BREAKER
22. CAB POWER RELAY
23. LEFT HAND BRAKE SWITCH
24. RIGHT HAND BRAKE SWITCH
25. KEY SWITCH
26. AUXILIARY POWER CONNECTOR
27. BATTERY POWER STUD (UNSWITCHED)
28. CONNECTOR 32 (STALK SWITCH)
29. CONNECTOR 33 (F/N/R SWITCH)
30. TURN SIGNAL SELF CANCELLING MODULE CONNECTOR
31. CONNECTOR 1 (CAB HARNESS)
32. INCHING PEDAL POSITION SENSOR
33. INCHING PEDAL SWITCH
34. MAIN LIGHT SWITCH

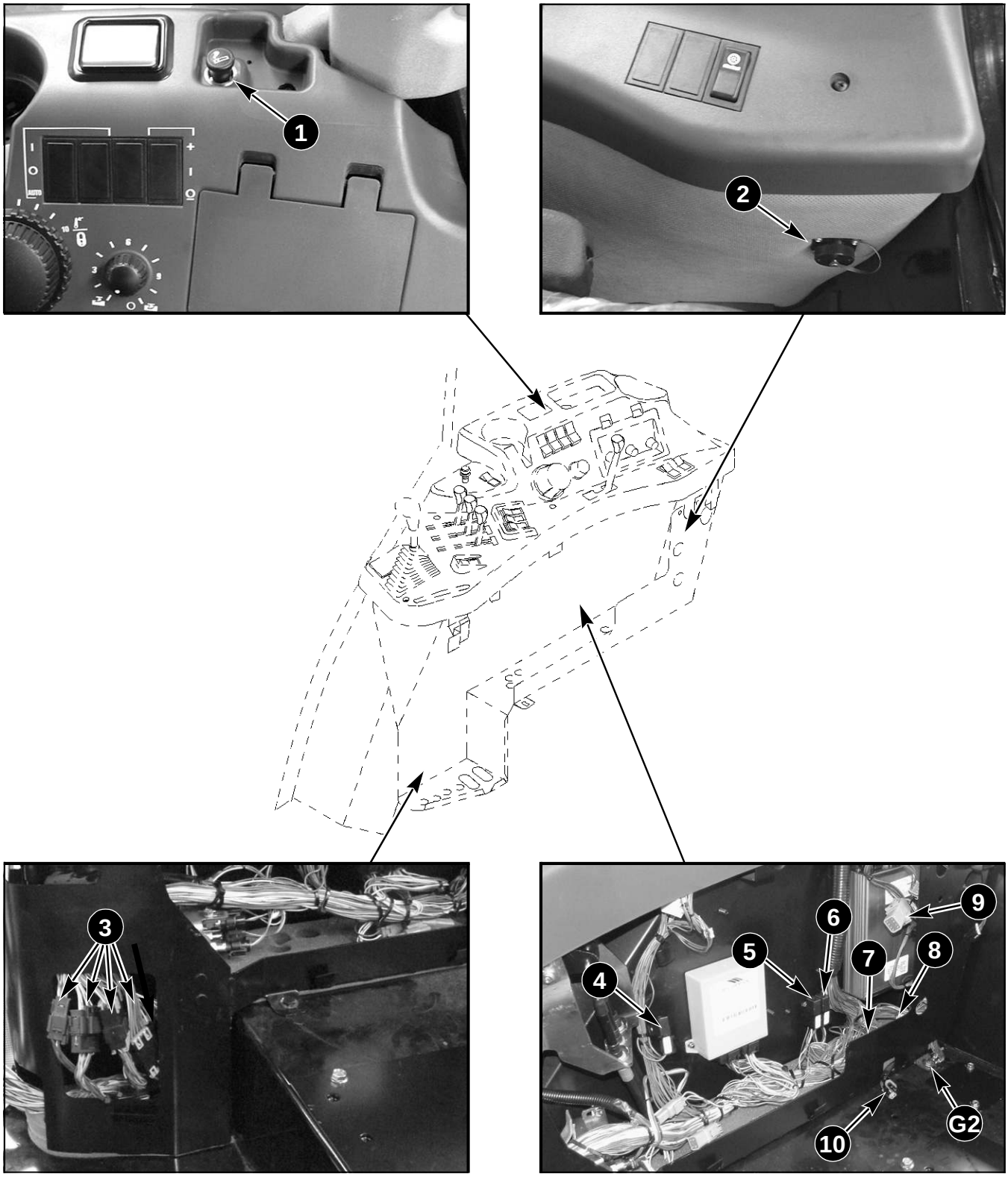
G1. CHASSIS GROUND CONNECTION G1

(*) EUROPEAN SPECIFICATION TRACTORS ONLY
(***) TRACTORS WITH AUTOSPEED ONLY

https://truckmanualshub.com/



# Right Hand Console Components (XtraSpeed and XtraSpeed - E Tractors Only)



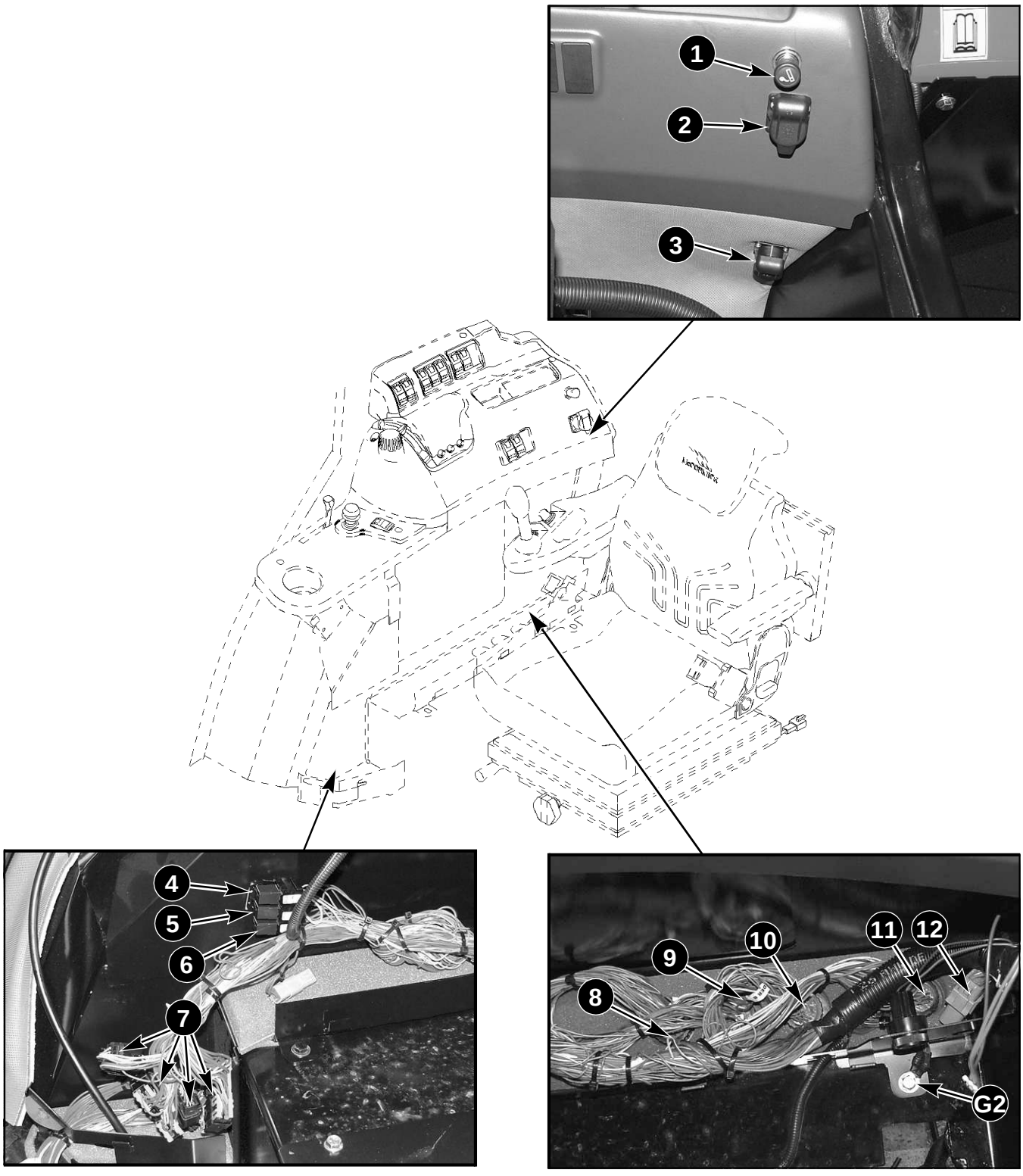

1. CIGAR LIGHTER
2. AUXILIARY POWER CONNECTOR
3. CONNECTORS 26, 27, 28, 29
4. MFD RELAY
5. LEFT HAND BRAKE RELAY
6. RIGHT HAND BRAKE RELAY
7. CONNECTOR 40
8. CONNECTOR 52
9. IMPLEMENT INTERFACE CONNECTOR
10. SEAT CONNECTOR

G2. CHASSIS GROUND CONNECTION G2

https://truckmanualshub.com/



# Right Hand Console Components (XtraSpeed - E Plus Tractors Only)



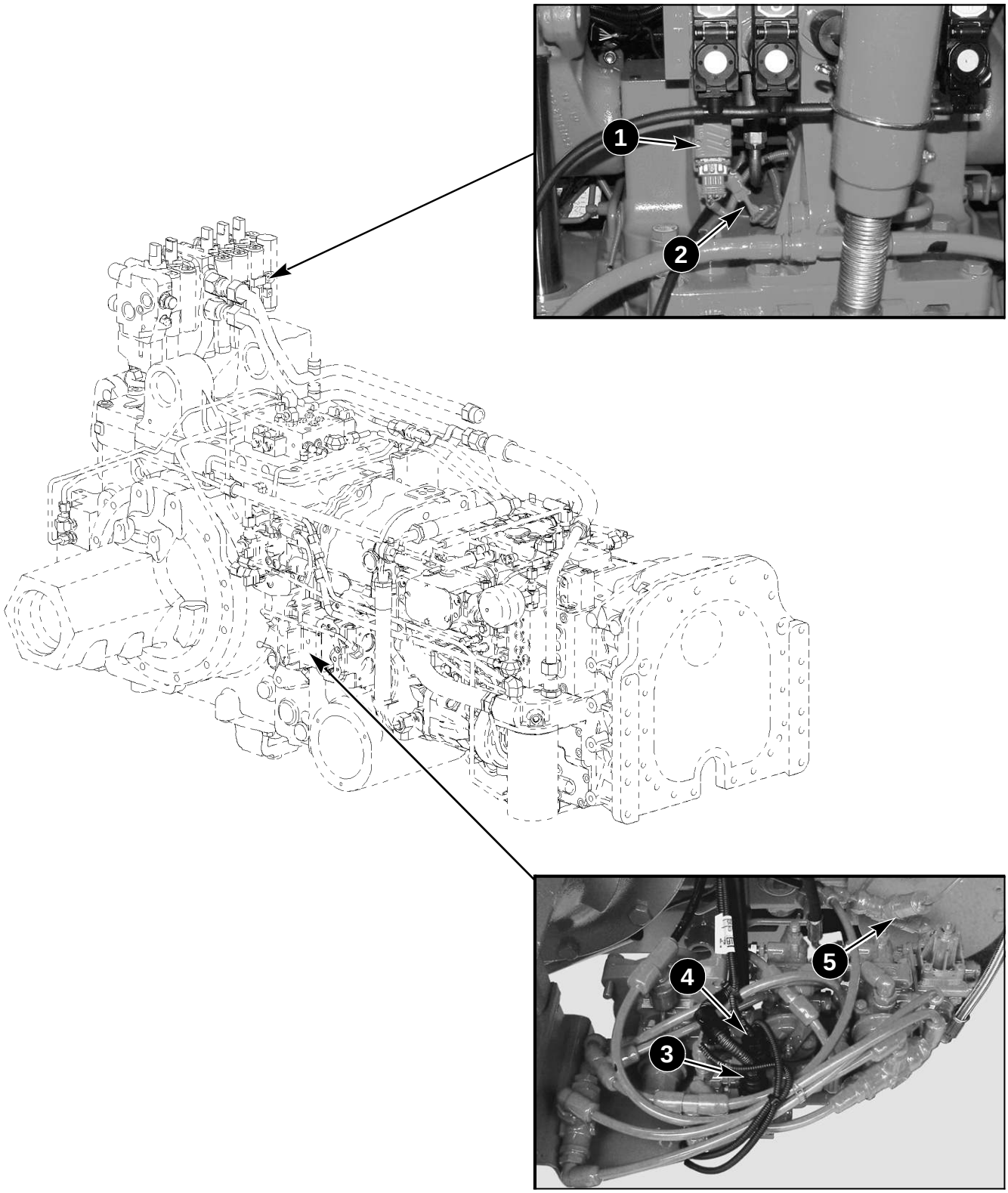

1. CIGAR LIGHTER
2. AUXILIARY POWER CONNECTOR
3. AUXILIARY POWER CONNECTOR
4. RIGHT HAND BRAKE RELAY
5. LEFT HAND BRAKE RELAY
6. MFD RELAY
7. CONNECTORS 26, 27, 28, 29
8. CONNECTOR 40
9. CONNECTOR 51
10. CONNECTOR 52
11. CONNECTOR 53
12. IMPLEMENT INTERFACE CONNECTOR

G2. CHASSIS GROUND CONNECTION G2

https://truckmanualshub.com/



## Transmission Components

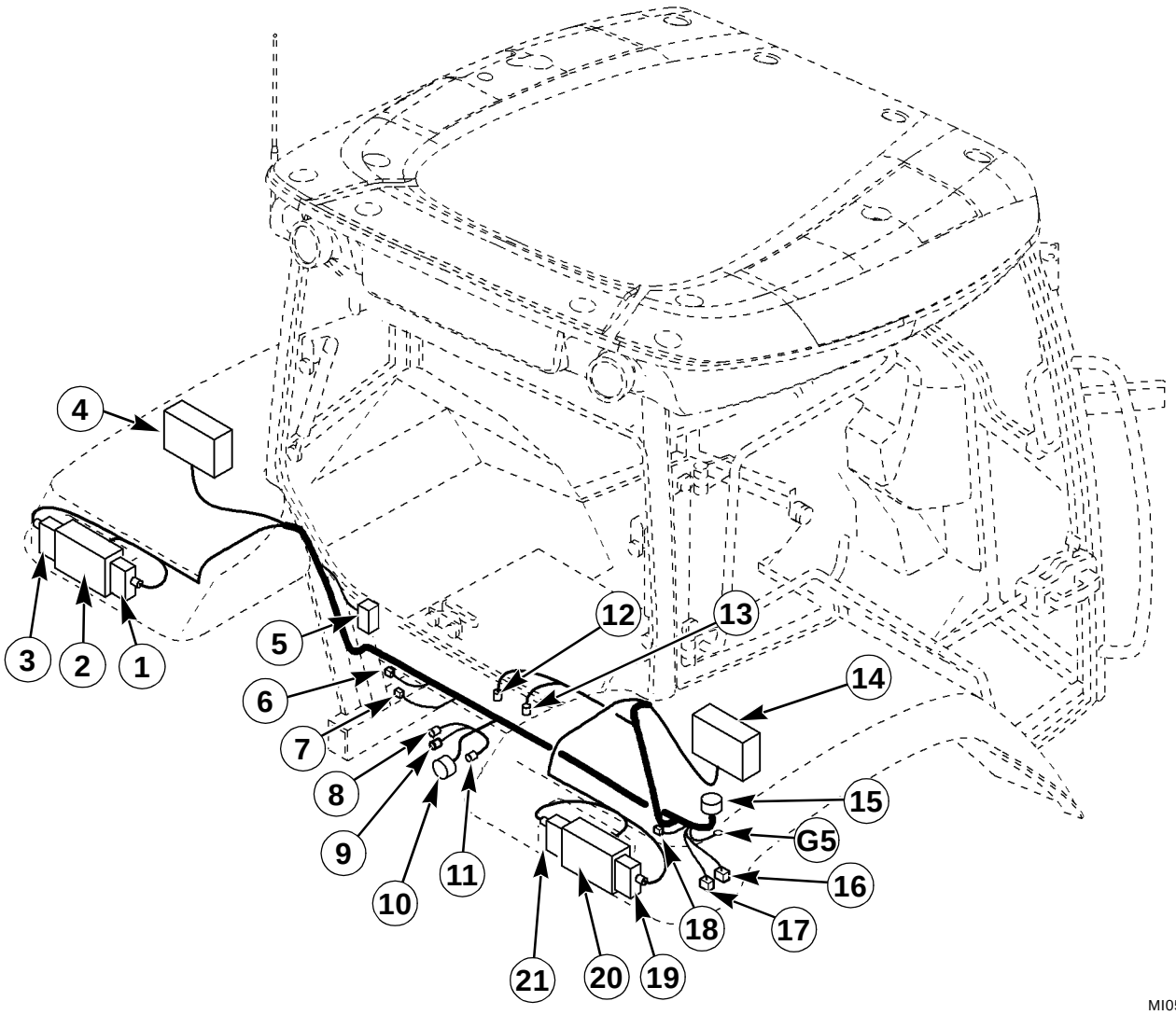



1. 4TH AUXILIARY/REMOTE VALVE
2. 4TH AUXILIARY/REMOTE VALVE RESISTOR PACK
3. AIR TRAILER BRAKE SOLENOID
4. AIR TRAILER BRAKE INSHOT SOLENOID
5. AIR TRAILER BRAKE PRESSURE SENDER

https://truckmanualshub.com/



# Fender Components (XtraSpeed and XtraSpeed - E Tractors)




1. LEFT HAND HITCH REMOTE SWITCH
2. LEFT HAND REAR LIGHT CLUSTER
3. LEFT HAND REMOTE PTO SWITCH (IF EQUIPPED)
4. LEFT HAND REAR FENDER WORK LIGHT
5. (*) OPTIONAL REAR No PLATE LIGHT
6. CAN TERMINATION RESISTOR
7. CAB SUSPENSION CONNECTOR
8. (*) AIR TRAILER BRAKE INSHOT SOLENOID CONNECTOR
9. (*) AUXILIARY POWER CONNECTOR
10. 7 PIN TRAILER CONNECTOR
11. TRAILED IMPLEMENT UP/DOWN SWITCH CONNECTOR
12. FRONT WINDSHIELD WASHER MOTOR
13. REAR WINDSHIELD WASHER MOTOR
14. RIGHT HAND REAR FENDER WORK LIGHT
15. CONNECTOR 52 (RIGHT HAND CONSOLE HARNESS)
16. CONNECTOR 80
17. CONNECTOR 82
18. (*) REAR FOG LIGHT CONNECTOR
19. RIGHT HAND REMOTE PTO SWITCH
20. RIGHT HAND REAR LIGHT CLUSTER
21. RIGHT HAND HITCH REMOTE SWITCH

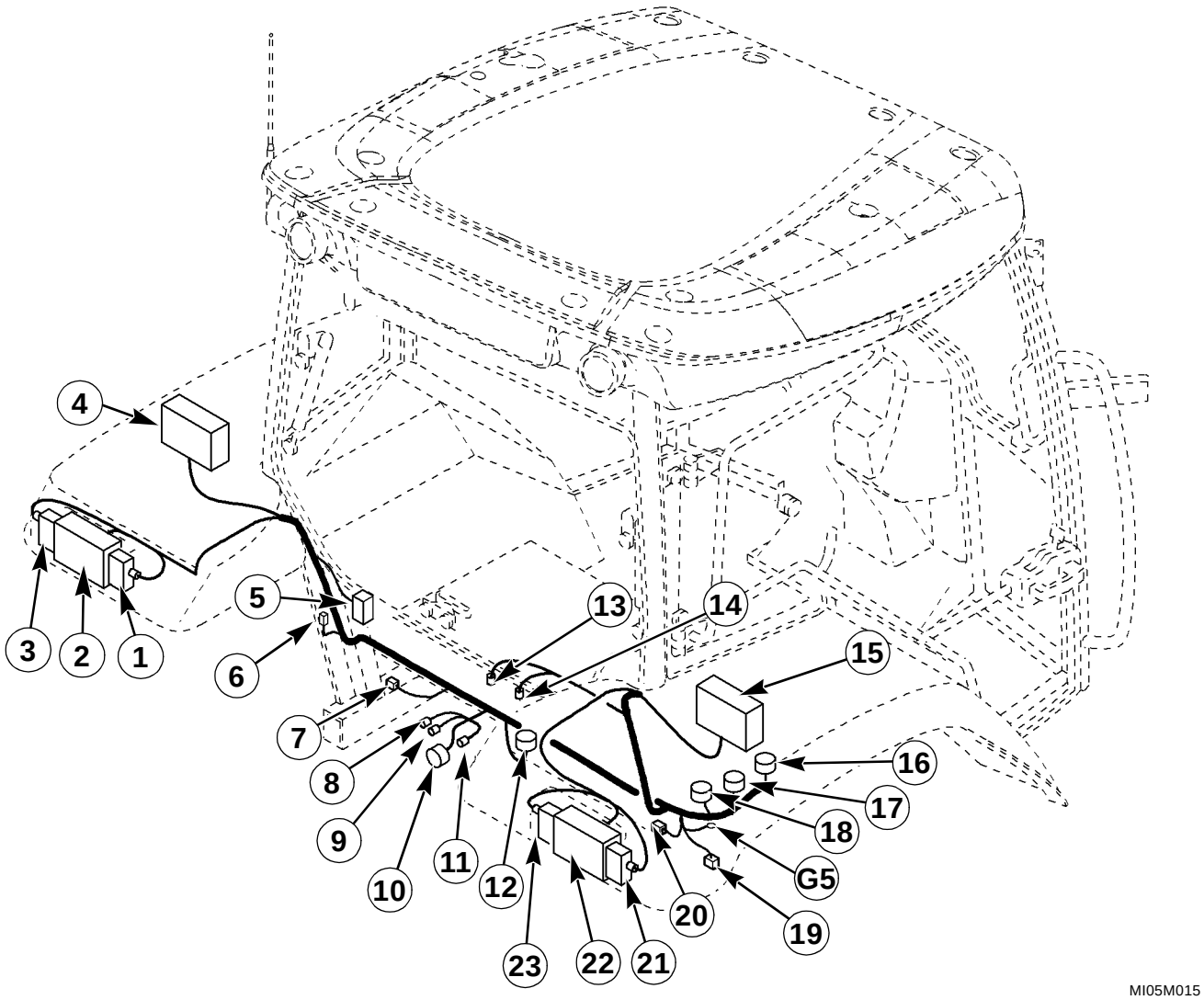
G5. CHASSIS GROUND CONNECTION G5

(*) EUROPEAN SPECIFICATION TRACTORS ONLY.

https://truckmanualshub.com/



# Fender Components (XtraSpeed - E Plus Tractors)




1. LEFT HAND HITCH REMOTE SWITCH
2. LEFT HAND REAR LIGHT CLUSTER
3. LEFT HAND REMOTE PTO SWITCH (IF EQUIPPED)
4. LEFT HAND REAR FENDER WORK LIGHT
5. OPTIONAL REAR No PLATE LIGHT
6. CAN TERMINATION RESISTOR
7. CAB SUSPENSION CONNECTOR
8. AIR TRAILER BRAKE INSHOT SOLENOID CONNECTOR
9. AUXILIARY POWER CONNECTOR
10. 7 PIN TRAILER CONNECTOR
11. TRAILED IMPLEMENT UP/DOWN SWITCH CONNECTOR
12. CONNECTOR 50 (ARMREST HARNESS)
13. FRONT WINDSHIELD WASHER MOTOR
14. REAR WINDSHIELD WASHER MOTOR
15. RIGHT HAND REAR FENDER WORK LIGHT
16. CONNECTOR 53 (RIGHT HAND CONSOLE HARNESS)
17. CONNECTOR 52 (RIGHT HAND CONSOLE HARNESS)
18. CONNECTOR 51 (RIGHT HAND CONSOLE HARNESS)
19. CONNECTOR 80
20. REAR FOG LIGHT CONNECTOR
21. RIGHT HAND REMOTE PTO SWITCH
22. RIGHT HAND REAR LIGHT CLUSTER
23. RIGHT HAND HITCH REMOTE SWITCH

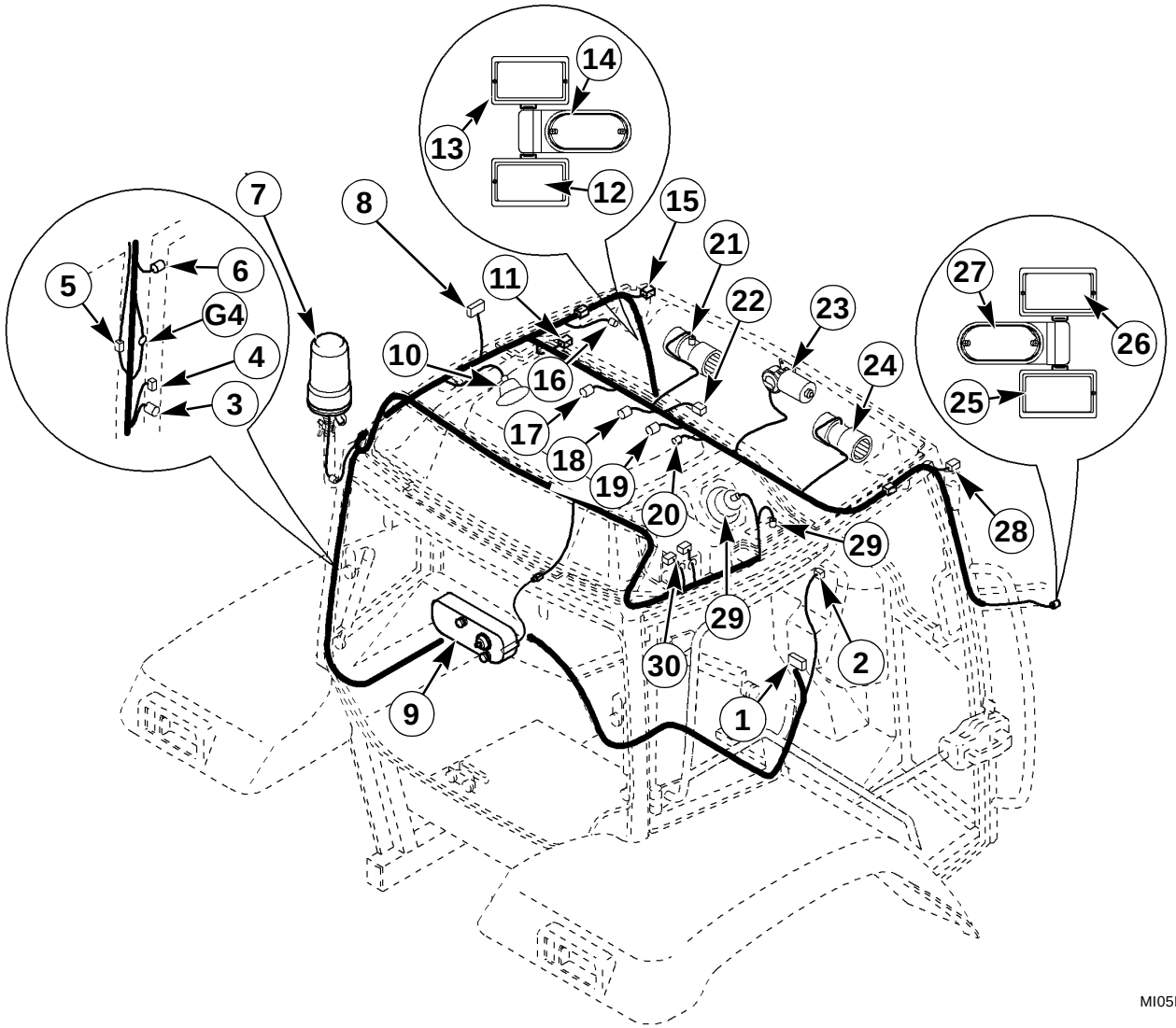
G5. CHASSIS GROUND CONNECTION G5

(*) EUROPEAN SPECIFICATION TRACTORS ONLY.

https://truckmanualshub.com/



## Cab Components




MI05M016

1. CONNECTOR 1 (INSTRUMENT PANEL HARNESS)
2. CIRCUIT BREAKER
3. MIRROR CONTROL SWITCH
4. HEATED MIRROR SWITCH
5. CONNECTOR 3 (ELECTRIC MIRROR HARNESS)
6. INTERIOR LIGHT DOOR SWITCH
7. BEACON LIGHT
8. CONNECTOR 2 (CAB ROOF HARNESS)
9. REAR WINDSHIELD WIPER MOTOR
10. LEFT HAND SPEAKER
11. INTERIOR LIGHT
12. LEFT HAND CAB LOWER FRONT WORK LIGHT
13. (*) LEFT HAND FRONT SIDE/TURN LIGHT CLUSTER
14. (*) LEFT HAND FRONT CAB HEADLIGHT
15. LEFT HAND MIRROR CONNECTOR
16. AIR CONDITIONING LOW PRESSURE SWITCH
17. FRONT WINDSHIELD WIPER SWITCH
18. BLOWER SWITCH
19. AIR CONDITIONING TEMPERATURE CONTROL SWITCH
20. AIR CONDITIONING LOCKOUT INDICATOR LIGHT
21. RIGHT HAND BLOWER MOTOR
22. AIR CONDITIONING RELAY
23. FRONT WIPER MOTOR
24. LEFT HAND BLOWER MOTOR
25. RIGHT HAND CAB LOWER FRONT WORK LIGHT
26. (*) RIGHT HAND FRONT SIDE/TURN LIGHT CLUSTER
27. (*) RIGHT HAND FRONT CAB HEADLIGHT
28. LEFT HAND MIRROR CONNECTOR
29. RIGHT HAND CONSOLE LIGHT
29. RIGHT HAND SPEAKER
30. RADIO CONNECTORS

G4. CHASSIS GROUND CONNECTION G4

(*) EUROPEAN SPECIFICATION TRACTORS ONLY

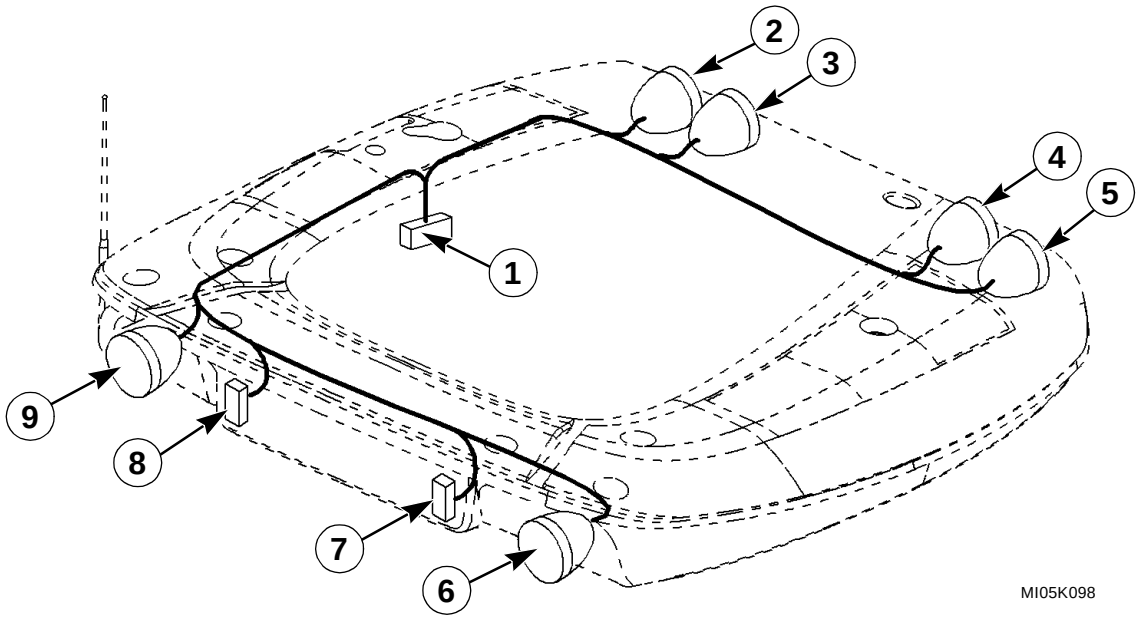
**NOTE:** *For Automatic Temperature Control components, refer to Section 10012.*

https://truckmanualshub.com/



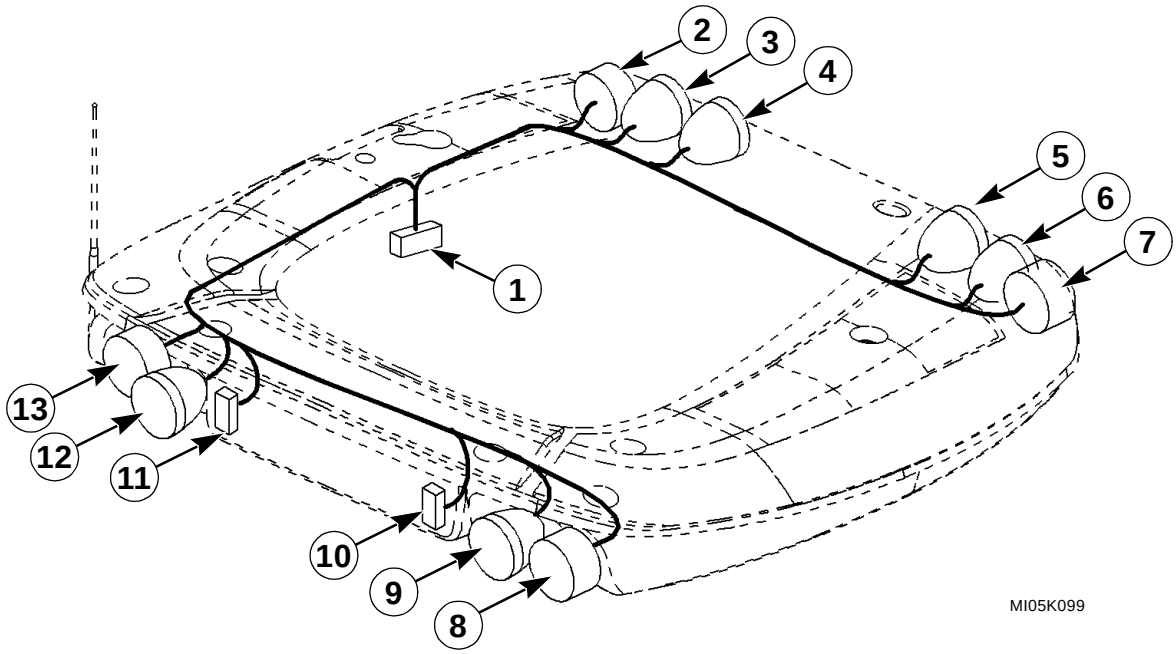
# Cab Roof Panel Components

### EUROPEAN SPECIFICATION TRACTORS




1. CONNECTOR 2 (CAB HARNESS)
2. LEFT HAND FRONT OUTER WORK LIGHT
3. LEFT HAND FRONT INNER WORK LIGHT
4. RIGHT HAND FRONT INNER WORK LIGHT
5. RIGHT HAND FRONT OUTER WORK LIGHT
6. RIGHT HAND REAR WORK LIGHT
7. RIGHT HAND REAR No PLATE LIGHT
8. LEFT HAND REAR No PLATE LIGHT
9. LEFT HAND REAR WORK LIGHT

### AMERICAN SPECIFICATION TRACTORS




1. CONNECTOR 2 (CAB HARNESS)
2. LEFT HAND FRONT TURN SIGNAL LIGHT
3. LEFT HAND FRONT OUTER WORK LIGHT
4. LEFT HAND FRONT INNER WORK LIGHT
5. RIGHT HAND FRONT INNER WORK LIGHT
6. RIGHT HAND FRONT OUTER WORK LIGHT
7. RIGHT HAND FRONT TURN SIGNAL LIGHT
8. RIGHT HAND REAR TURN SIGNAL LIGHT
9. RIGHT HAND REAR WORK LIGHT
10. RIGHT HAND REAR No PLATE LIGHT
11. LEFT HAND REAR No PLATE LIGHT
12. LEFT HAND REAR WORK LIGHT
13. LEFT HAND REAR TURN SIGNAL LIGHT

https://truckmanualshub.com/



This Page Has Been Left Blank.

https://truckmanualshub.com/



# NEUTRAL START, COLD START, KEY SWITCH, CAB POWER, FUEL HEATER (For XTX185 and XTX200 Tractors)

## Neutral Start Circuit

**NOTE:** *If the engine temperature is too low the wait to start symbol will appear on the instrument panel. With the key in the ON position the grid heater will switch ON. When the wait to start symbol turns off the engine can be started.*

The starter solenoid will only operate when the Shuttle lever is in the NEUTRAL position (for tractors not equipped with park lock) or PARK (for tractors equipped with park lock) and the engine coolant, engine oil and air inlet temperature is above -3℃ (26.6℉).

If one or more of the above temperatures are below -3℃ (26.6℉) the grid heater will be activated and the wait to start light on the instrument cluster will illuminate, see Cold Start Circuit below.

For tractors not equipped with park lock, with the key switch in the START position, battery power at terminal 1 of the key switch flows to terminal 2 then to the Forward/Neutral/Reverse switch at terminal 7. With the shuttle lever in the NEUTRAL position, power flows through the F/N/R switch from terminal 7 to terminal 5 then to the engine controller at pin 20 of connector 63. The engine controller will direct power from pin 37 of connector 63, to the starter relay at terminal 86.

For tractors equipped with park lock, with the key switch in the START position, battery power at terminal 1 of the key switch flows to terminal 2 then to the Forward/Neutral/Reverse switch at terminal 4. With the shuttle lever in the PARK position, power flows through the F/N/R switch from terminal 4 to terminal 5 then to the engine controller at pin 20 of connector 63. The engine controller will direct power from pin 37 of connector 63, to the starter relay at terminal 86.

**NOTE:** *If one or more of the engine coolant, engine oil or air inlet temperatures is below -3℃ (26.6℉) the engine controller will not direct power to the starter relay.*

Power flows through the starter relay windings to terminal 85 and back to the engine controller at pin 2 of connector 63. The controller then connects the power from pin 2 of connector 63 to the battery negative terminal (clean ground), energizing the relay.

With the starter relay energized, battery power flows from terminal 30 of the starter relay to terminal 87 and to the starter solenoid at terminal S. Power then flows to ground (internally through the starter motor), energizing the starter solenoid.

With the starter solenoid energized, battery power flows from the battery to the starter motor (through an optional jumper stud or battery master disconnect switch) to ground (internally through the motor), operating the motor.

**NOTE:** *For tractors equipped with a master disconnect switch, when the switch is in the OFF position all battery power is disconnected to the tractor except for power for the instrument cluster clock, interior light, radio and independent front suspension axle controller (if equipped).*

## Cold Start Circuit

When the engine controller detects that either the engine coolant, engine oil or air inlet temperature is below -3℃ (26.6℉) prior to starting the engine the cont roller will direct power from pin 16 of connector 63 to terminal A of the cold start relay. Power flows through the relay windings to terminal 85 and back to the engine controller at pin 4 of connector 63. The controller then connects the power from pin 4 of connector 63 to the battery negative terminal (clean ground), energizing the relay.

With the cold start relay energized, battery power from the starter motor terminal B will flow through the cold start fuse (125 amp) to the cold start relay. Power then flows through the cold start relay to the cold start grid heater and to ground (though the grid heater body), heating the grid heater element.

After approximately 15 seconds the wait to start light will go out and the power to the grid heater will be disconnected. When the engine starts the power to the grid heater will be reconnected, reheating the grid heater element for a post heat period of 60 to 120 seconds depending on temperature. The wait to start light will remain OFF during the post heat period.

https://truckmanualshub.com/

## Fuel Heater Circuit

When the engine controller detects that the fuel temperature is below 0°C (32°F) the engine controller will direct power from pin 36 of connector 63, to the fuel heater relay at terminal 86. Power flows through the fuel heater relay windings to terminal 85 and back to the engine controller at pin 2 of connector 63. The controller then connects the power from pin 2 of connector 63 to the battery negative terminal (clean ground), energizing the relay.

Battery power is connected the fuel heater relay at terminal 30. With the fuel heater relay energized power flows through the fuel heater relay from terminal 30 to terminal 87, power then flows to the fuel heater. If the fuel heater sensor temperature is below -5°(23°F) power will flow trough the fuel heater element to ground at G6, heating the fuel heater element.

When the engine controller detects that the fuel temperature has increased to above 5°C (41°F) the con troller will disconnect the power to the fuel heater relay, de-energizing the relay and disconnecting the power to the fuel heater.

## Accessory Power Relay

With the key switch in the ON or ACCESSORY position battery power at terminal 1 of the key switch flows through the switch to terminal 6. Power then flows to the accessory power relay terminal 1, through the relay windings to terminal 2 and to ground at G1 energizing the relay.

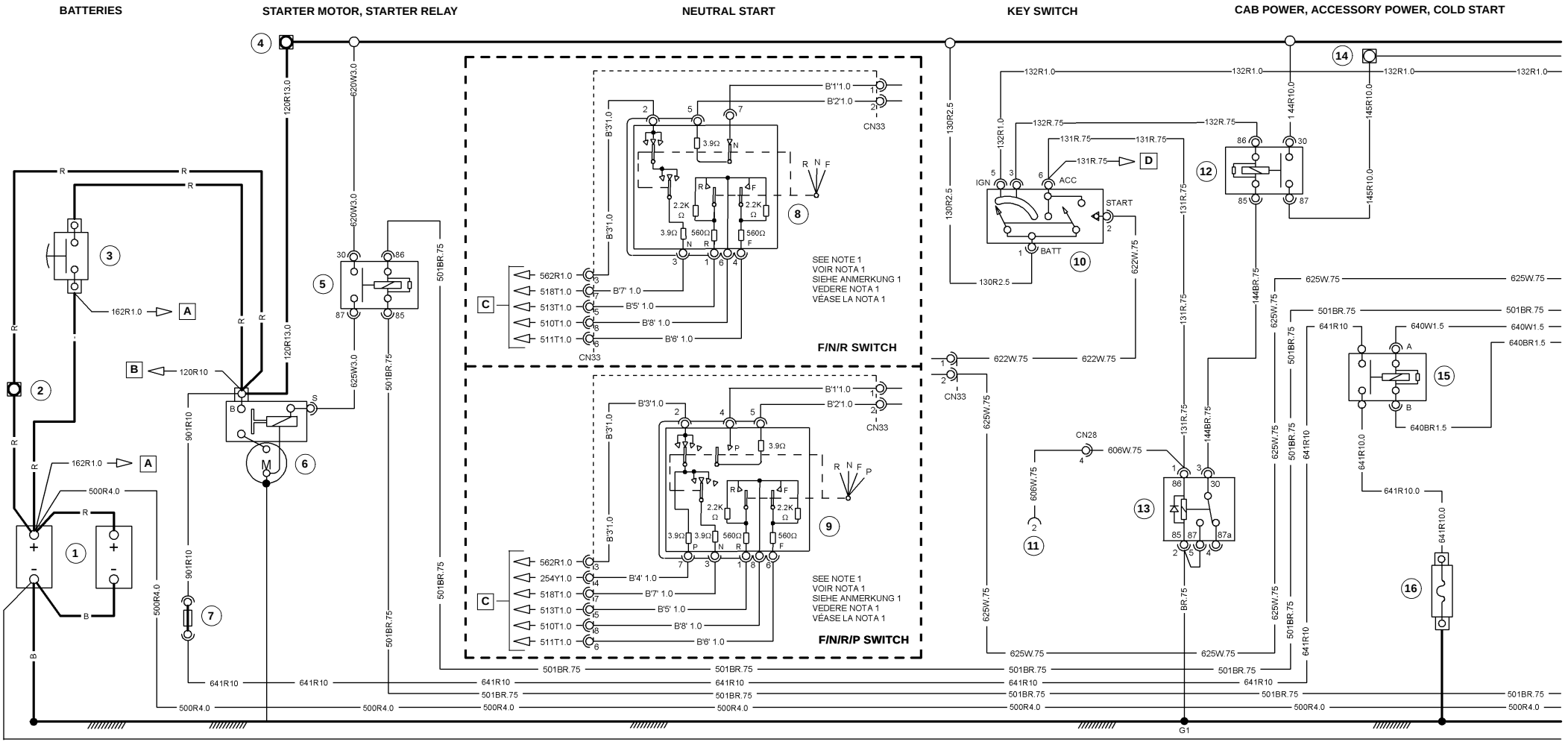
## Cab Power Relay

With the key switch in the ON position, battery power at terminal 1 of the key switch flows through the switch to terminal 3. Power then flows to the cab power relay terminal 86, through the relay windings to terminal 85 and to the accessory power relay terminal 3. With the accessory power relay energized (see above) power flows through the accessory power relay to terminal 5 and to ground at G1 energizing the cab power relay.

With the cab power relay energized battery power at terminal 30 flows through the relay to terminal 87 and to the switched power stud. The power available at the switched power stud supplies most fuses.

When the key switch is moved to the START position the accessory relay de-energizes. This will prevent power flow to ground from the cab power relay, which in turn de-energizes.

## Schematic Circuit (For XTX185 and XTX200 Tractors)




MI05J082

### Key

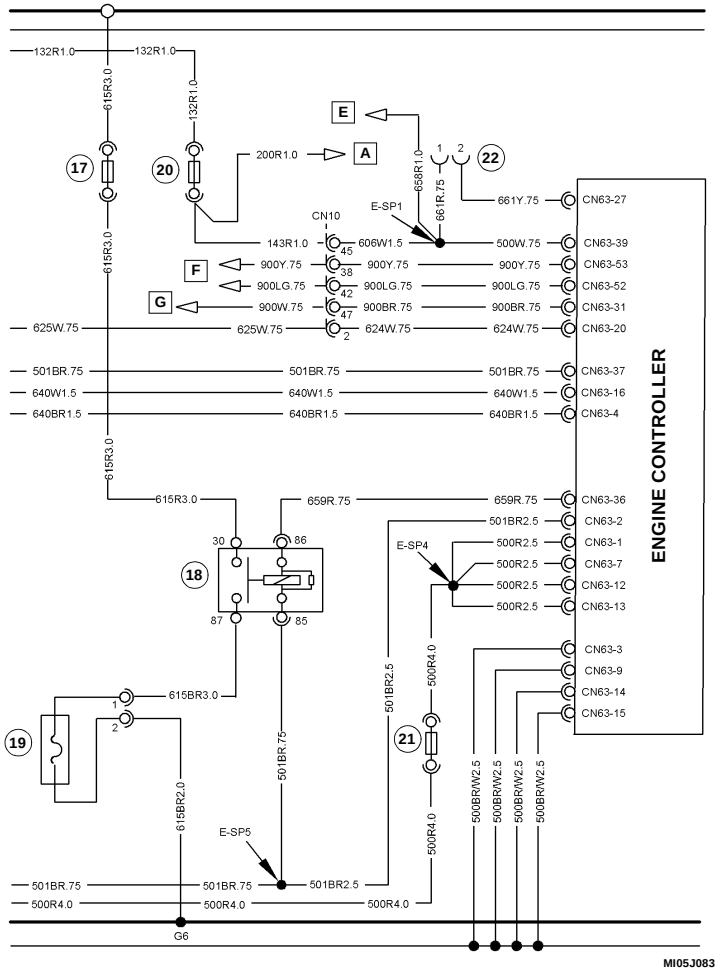
1. BATTERIES
2. JUMP START STUD (IF EQUIPPED)
3. MASTER DISCONNECT SWITCH (IF EQUIPPED)
4. BATTERY POWER STUD
5. STARTER RELAY
6. STARTER MOTOR
7. COLD START FUSE 1 (125A)
8. FORWARD/NEUTRAL/REVERSE SWITCH (IF EQUIPPED)
9. FORWARD/NEUTRAL/REVERSE/PARK SWITCH (IF EQUIPPED)
10. KEY SWITCH
11. IMPLEMENT INTERFACE CONNECTOR
12. CAB POWER RELAY
13. ACCESSORY POWER RELAY
14. SWITCHED POWER STUD
15. COLD START RELAY (GRID HEATER)
16. COLD START GRID HEATER
17. FUEL HEATER IN-LINE FUSE (20 AMP)
18. FUEL HEATER RELAY (IF EQUIPPED)
19. FUEL HEATER (IF EQUIPPED)
20. ENGINE CONTROLLER IN-LINE FUSE (20 AMP)
21. FUSE 25 (7.5 AMP)
22. DIAGNOSTIC SWITCH CONNECTOR (NOT USED)

A. TO INSTRUMENT CLUSTER
B. TO ALTERNATOR
C. TO TRANSMISSION CONTROLLER
D. TO RADIO/INTERIOR LIGHT
E. TO WATER IF FUEL SENSOR
F. TO CAN CIRCUIT
G. TO DIAGNOSTIC CONNECTOR (K-LINE)

**NOTE 1:** *Only use a HIGH IMPEDANCE multimeter to test the switches and circuits. Do not use a test lamp or damage to the switches may occur.*

https://truckmanualshub.com/


**FUEL HEATER, ENGINE CONTROLLER**




**ENGINE CONTROLLER CONNECTOR 63 PIN IDENTIFICATION**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | UNSWITCHED POWER | | 31 | K - LINE SIGNAL | | 61 | NOT USED |
| 2 | STARTER RELAY GROUND | | 32 | NOT USED | | 62 | NOT USED |
| 3 | CLEAN GROUND | | 33 | NOT USED | | 63 | NOT USED |
| 4 | GRID HEATER RELAY GROUND | | 34 | NOT USED | | 64 | NOT USED |
| 5 | NOT USED | | 35 | NOT USED | | 65 | NOT USED |
| 6 | NOT USED | | 36 | FUEL HEATER RELAY POWER | | 66 | NOT USED |
| 7 | UNSWITCHED POWER | | 37 | STARTER RELAY POWER | | 67 | NOT USED |
| 8 | NOT USED | | 38 | NOT USED | | 68 | NOT USED |
| 9 | CLEAN GROUND | | 39 | SWITCHED BATTERY POWER | | 69 | NOT USED |
| 10 | NOT USED | | 40 | NOT USED | | 70 | NOT USED |
| 11 | NOT USED | | 41 | NOT USED | | 71 | NOT USED |
| 12 | UNSWITCHED POWER | | 42 | NOT USED | | 72 | NOT USED |
| 13 | UNSWITCHED POWER | | 43 | NOT USED | | 73 | NOT USED |
| 14 | CLEAN GROUND | | 44 | NOT USED | | 74 | NOT USED |
| 15 | CLEAN GROUND | | 45 | NOT USED | | 75 | NOT USED |
| 16 | GRID HEATER RELAY POWER | | 46 | NOT USED | | 76 | NOT USED |
| 17 | NOT USED | | 47 | NOT USED | | 77 | NOT USED |
| 18 | NOT USED | | 48 | NOT USED | | 78 | NOT USED |
| 19 | IDLE SWITCH RETURN | | 49 | NOT USED | | 79 | NOT USED |
| 20 | ENGINE START SIGNAL | | 50 | NOT USED | | 80 | NOT USED |
| 21 | NOT USED | | 51 | NOT USED | | 80 | NOT USED |
| 22 | NOT USED | | 52 | CAN LOW | | 81 | NOT USED |
| 23 | NOT USED | | 53 | CAN HIGH | | 82 | NOT USED |
| 24 | NOT USED | | 54 | NOT USED | | 83 | NOT USED |
| 25 | NOT USED | | 55 | NOT USED | | 84 | NOT USED |
| 26 | NOT USED | | 56 | NOT USED | | 85 | NOT USED |
| 27 | DIAGNOSTIC SWITCH (NOT USED) | | 57 | NOT USED | | 86 | NOT USED |
| 28 | NOT USED | | 58 | NOT USED | | 87 | NOT USED |
| 29 | NOT USED | | 59 | NOT USED | | 89 | NOT USED |
| 30 | NOT USED | | 60 | NOT USED | | | |

https://truckmanualshub.com/


# NEUTRAL START, COLD START, KEY SWITCH, CAB POWER AND WATER IN FUEL (For XTX215 Tractors)

## Starter Circuit

**NOTE:** *If the inlet manifold temperature is too low the wait to start symbol will appear on the instrument cluster. With the key in the ON position the grid heaters will switch ON. When the wait to start symbol turns off the engine can be started.*

The starter solenoid will only operate when the Shuttle lever is in the NEUTRAL position (for tractors not equipped with park lock) or PARK (for tractors equipped with park lock).

For tractors not equipped with park lock, with the key switch in the START position, battery power at terminal 1 of the key switch flows to terminal 2 then to the Forward/Neutral/Reverse switch at terminal 7. With the shuttle lever in the NEUTRAL position, power flows through the F/N/R switch from terminal 7 to terminal 5 then to the starter relay at terminal 86. Power flows through the relay windings to terminal 85 and to ground (battery negative terminal), energizing the relay.

For tractors equipped with park lock, with the key switch in the START position, battery power at terminal 1 of the key switch flows to terminal 2 then to the Forward/Neutral/Reverse switch at terminal 4. With the shuttle lever in the PARK position, power flows through the F/N/R switch from terminal 4 to terminal 5 then to the starter relay at terminal 86. Power flows through the relay windings to terminal 85 and to ground (battery negative terminal), energizing the relay.

With the starter solenoid energized, battery power flows from the battery to the starter motor (through an optional jumper stud or battery master disconnect switch) and to ground (internally through the motor), operating the motor.

**NOTE:** *For tractors equipped with a master disconnect switch, when the switch is in the OFF position all battery power is disconnected to the tractor except for power for the instrument cluster clock, interior light, radio and independent front suspension axle controller (if equipped).*

## Cold Start Circuit

When the engine controller detects that the inlet manifold air temperature value is too low prior to starting the engine, the controller will direct power to terminal A of both the cold start relays. Power will flow through both relays to terminal B and to ground (battery negative terminal), energizing the relays.

With the cold start relay 1 energized, battery power from the starter motor terminal B will flow through the cold start fuse 1 (125 amp) to the cold start relay 1. Power then flows through the cold start relay 1 to the cold start grid heater 1 and to ground (though the grid heater body), heating the grid heater element.

With the cold start relay 2 energized, battery power from the starter motor terminal B will flow through the cold start fuse 2 (125 amp) to the cold start relay 2. Power then flows through the cold start relay 2 to the cold start grid heater 2 and to ground (though the grid heater body), heating the grid heater element.

**NOTE:** *The wait to start symbol will appear on the instrument cluster. When the wait to start warning appears the grid heaters will turn on. When the inlet manifold temperature rises to the correct temperature the wait to start warning will go out the grid heaters will switch off.*

## Water in Fuel Circuit

The engine controller directs power to the water in fuel sensor terminal A from the engine controller connector 61 pin 40. If water is detected in the fuel by the water in fuel sensor power flows through the sensor to terminal B and the engine controller connector 61 pin 20. When the engine controller detects power at pin 20 of connector 61 the controller will transmit a CAN Bus signal to the instrument cluster illuminating the water in warning symbol will be displayed on the instrument cluster.

https://truckmanualshub.com/

## Accessory Power Relay

With the key switch in the ON or ACCESSORY position battery power at terminal 1 of the key switch flows through the switch to terminal 6. Power then flows to the accessory power relay terminal 1, through the relay windings to terminal 2 and to ground at G1 energizing the relay.

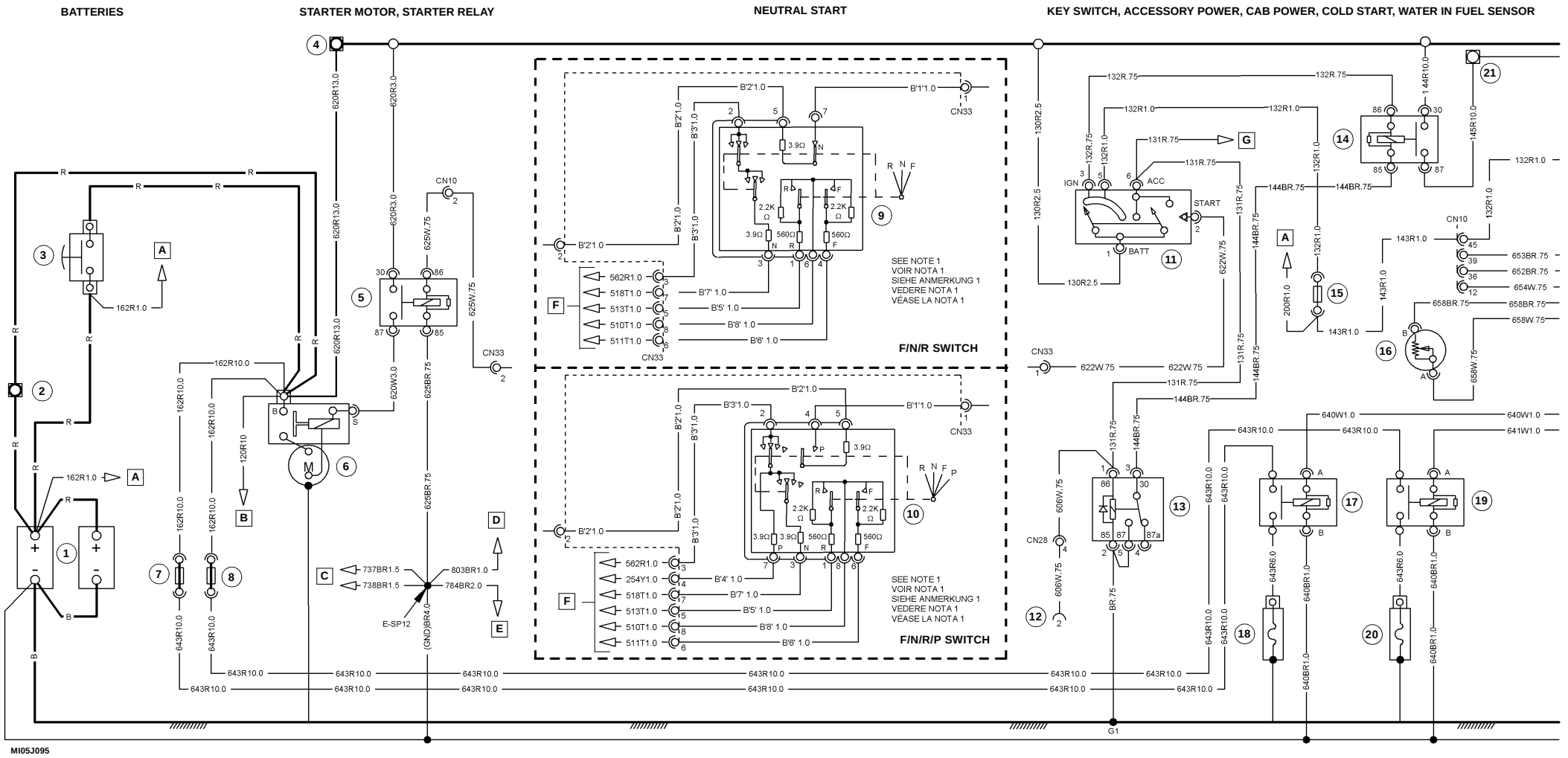
## Cab Power Relay

With the key switch in the ON position, battery power at terminal 1 of the key switch flows through the switch to terminal 3. Power then flows to the cab power relay terminal 86, through the relay windings to terminal 85 and to the accessory power relay terminal 3. With the accessory power relay energized (see above) power flows through the accessory power relay to terminal 5 and to ground at G1 energizing the cab power relay.

With the cab power relay energized battery power at terminal 30 flows through the relay to terminal 87 and to the switched power stud. The power available at the switched power stud supplies most fuses.

When the key switch is moved to the START position the accessory relay de-energizes. This will prevent power flow to ground from the cab power relay, which in turn de-energizes.

# Schematic Circuit (For XTX215 Tractors)




## Key

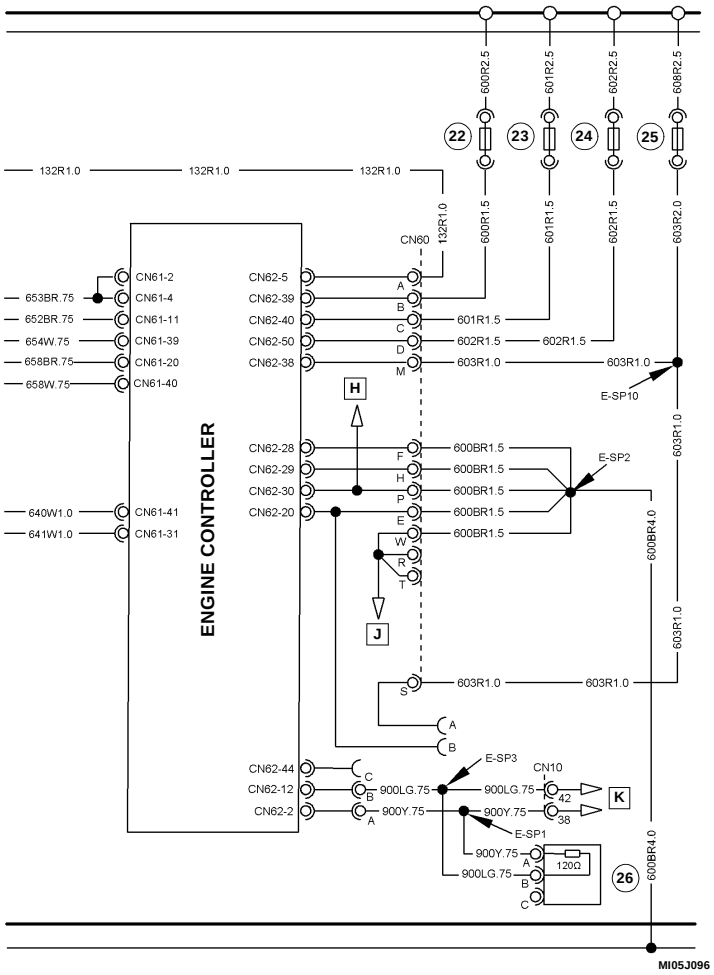
1. BATTERIES
2. JUMP START STUD (IF EQUIPPED)
3. MASTER DISCONNECT SWITCH (IF EQUIPPED)
4. BATTERY POWER STUD
5. STARTER RELAY
6. STARTER MOTOR
7. COLD START FUSE 1 (125 AMP)
8. COLD START FUSE 2 (125 AMP)
9. FORWARD/NEUTRAL/REVERSE SWITCH (IF EQUIPPED)
10. FORWARD/NEUTRAL/REVERSE/PARK SWITCH (IF EQUIPPED)
11. KEY SWITCH
12. IMPLEMENT INTERFACE CONNECTOR
13. ACCESSORY POWER RELAY
14. CAB POWER RELAY
15. FUSE 25 (7.5 AMP)
16. WATER IN FUEL SENSOR
17. COLD START RELAY 1 (GRID HEATER)
18. COLD START GRID HEATER 1
19. COLD START RELAY 2 (GRID HEATER)
20. COLD START GRID HEATER 2
21. SWITCHED POWER STUD
22. ENGINE CONTROLLER IN-LINE FUSE (7.5 AMP)
23. ENGINE CONTROLLER IN-LINE FUSE (7.5 AMP)
24. ENGINE CONTROLLER IN-LINE FUSE (7.5 AMP)
25. ENGINE CONTROLLER IN-LINE FUSE (10 AMP)
26. CAN TERMINATION RESISTOR

A. TO INSTRUMENT CLUSTER
B. TO ALTERNATOR
C. FROM HEADLIGHTS
D. FROM AIR CONDITIONING SUPPRESSION DIODE
E. FROM FRONT GRILLE WORK LIGHTS
F. TO TRANSMISSION CONTROLLER
G. TO RADIO/INTERIOR LIGHT
H. FROM FUEL LIFT PUMP (RETURN)
J. FROM ENGINE SENSORS (RETURN)

**NOTE 1:** *Only use a HIGH IMPEDANCE multimeter to test the switches and circuits. Do not use a test lamp or damage to the switches may occur.*

https://truckmanualshub.com/


**ENGINE CONTROLLER**




**ENGINE CONTROLLER CONNECTOR PIN IDENTIFICATION**

| CONNECTOR 61 (50 PIN) | | CONNECTOR 62 (50 PIN) | |
|---|---|---|---|
| 1 | NOT USED | 1 | NOT USED |
| 2 | WATER IN FUEL LIGHT GROUND (NOT USED) | 2 | CAN HIGH |
| 3 | NOT USED | 3 | NOT USED |
| 4 | WATER IN FUEL LIGHT GROUND (NOT USED) | 4 | NOT USED |
| 5 | NOT USED | 5 | SWITCHED POWER |
| 6 | NOT USED | 6 | INJECTION CONTROL SOLENOID (+) |
| 7 | NOT USED | 7 | INJECTION CONTROL SOLENOID (-) |
| 8 | NOT USED | 8 | ENGINE SPEED SENSOR (+5V) |
| 9 | NOT USED | 9 | ENGINE POSITION INPUT SIGNAL |
| 10 | NOT USED | 10 | ENGINE POSITION INPUT (+5V) |
| 11 | WAIT TO START LIGHT (NOT USED) | 11 | LIFT PUMP (PRIME PUMP) |
| 12 | NOT USED | 12 | CAN LOW |
| 13 | NOT USED | 13 | NOT USED |
| 14 | NOT USED | 14 | NOT USED |
| 15 | NOT USED | 15 | REAR PUMPING CONTROL SOLENOID (-) |
| 16 | NOT USED | 16 | NOT USED |
| 17 | NOT USED | 17 | ENGINE SPEED SENSOR SIGNAL |
| 18 | NOT USED | 18 | ENGINE SPEED SENSOR RETURN |
| 19 | NOT USED | 19 | ENGINE POSITION INPUT RETURN |
| 20 | WATER IN FUEL RETURN | 20 | CLEAN GROUND |
| 21 | NOT USED | 21 | FRONT PUMPING CONTROL SOLENOID (-) |
| 22 | NOT USED | 22 | LIFT PUMP (PRIME PUMP) |
| 23 | NOT USED | 23 | COOLANT TEMPERATURE SIGNAL |
| 24 | NOT USED | 24 | NOT USED |
| 25 | NOT USED | 25 | REAR PUMPING CONTROL SOLENOID (+) |
| 26 | NOT USED | 26 | NOT USED |
| 27 | NOT USED | 27 | COOLANT LEVEL HIGH SIGNAL |
| 28 | NOT USED | 28 | CLEAN GROUND |
| 29 | NOT USED | 29 | CLEAN GROUND |
| 30 | NOT USED | 30 | CLEAN GROUND |
| 31 | COLD START RELAY 2 SIGNAL | 31 | FRONT PUMPING CONTROL SOLENOID (+) |
| 32 | NOT USED | 32 | AMBIENT AIR PRESSURE SIGNAL |
| 33 | NOT USED | 33 | OIL PRESSURE SIGNAL |
| 34 | NOT USED | 34 | INTAKE MANIFOLD AIR TEMP SIGNAL |
| 35 | NOT USED | 35 | ACCUMULATOR FUEL TEMP SIGNAL |
| 36 | NOT USED | 36 | INJECTION CONTROL VALVE ID (+) |
| 37 | NOT USED | 37 | COOLANT LEVEL LOW SIGNAL |
| 38 | NOT USED | 38 | UNSWITCHED BATTERY POWER (VP44) |
| 39 | TORQUE DERATE (NOT USED) | 39 | UNSWITCHED BATTERY POWER 1 |
| 40 | WATER IN FUEL SENSOR SIGNAL | 40 | UNSWITCHED BATTERY POWER 2 |
| 41 | COLD START RELAY 1 SIGNAL | 41 | FAN CLUTCH DRIVER (NOT USED) |
| 42 | NOT USED | 42 | EXHAUST BRAKE ENABLE (NOT USED) |
| 43 | NOT USED | 43 | NOT USED |
| 44 | NOT USED | 44 | CAN GROUND (NOT USED) |
| 45 | NOT USED | 45 | BOOST PRESSURE SIGNAL |
| 46 | NOT USED | 46 | ACCUMULATOR FUEL PRESS SIGNAL |
| 47 | NOT USED | 47 | NOT USED |
| 48 | NOT USED | 48 | NOT USED |
| 49 | NOT USED | 49 | COOLANT LEVEL (+5V) |
| 50 | NOT USED | 50 | UNSWITCHED BATTERY POWER 3 |

https://truckmanualshub.com/


This Page Has Been Left Blank

https://truckmanualshub.com/



# 4TH AUXILIARY/REMOTE VALVE, IMPLEMENT INTERFACE CONNECTOR, AUXILIARY POWER CONNECTORS AND BEACON LIGHT

## 4TH Auxiliary/Remote Valve Circuit (XtraSpeed and XtraSpeed - E Tractors Only)

**NOTE:** *For XtraSpeed - E Plus tractors refer to Section 10001.*

Switched Power flows through fuses 34 to terminal 1 of the 4th auxiliary/remote valve control module, power flows through the control module to terminal 4 and to ground at G3, activating the control module. Power also flows to terminal 1 of the 4th auxiliary/remote valve resistor pack.

### Neutral

With the 4th auxiliary/remote valve switch in the OFF (neutral) position, 12 volt power at terminal 1 of the resistor pack flows through resistors R1 and R3 to ground at G3 through terminal 4 of the resistor pack. Power flowing through resistors R1 and R3 (potential divider) to ground will create a voltage drop to approximately 6 volts at terminal 2 of the resistor pack.

This voltage drop is detected at terminal 3 of the auxiliary/remote valve control module. When the auxiliary/remote valve control module detects a voltage of approximately 6 volts at terminal 3, the controller will move the auxiliary/remote valve to the NEUTRAL position.

### Lower

With the 4th auxiliary/remote valve switch in the LOWER position, 12 volt power at terminal 1 of the resistor pack flows through resistors R1 and R2 (in parallel) and resistor R3 to ground at G3 through terminal 4 of the resistor pack. Power flowing through resistors R1 + R2 and R3 (potential divider) will create a voltage drop to approximately 10.5 volts at terminal 2 of the resistor pack.

This voltage drop is detected at terminal 3 of the auxiliary/remote valve control module. When the auxiliary/remote valve control module detects a voltage of approximately 10.5 volts at terminal 3, the controller will move the auxiliary/remote valve to the LOWER position.

### Raise

With the 4th auxiliary/remote valve switch in the RAISE position, 12 volt power at terminal 1 of the resistor pack flows through resistors R1 and resistor R2 and R3 (in parallel) to ground at G3 through terminal 4 of the resistor pack. Power flowing resistors R1 and R2 + R3 (potential divider) will create a voltage drop to approximately 1.5 volts at terminal 2 of the resistor pack.

This voltage drop is detected at terminal 3 of the auxiliary/remote valve control module. When the auxiliary/remote valve control module detects a voltage of approximately 1.5 volts at terminal 3, the controller will move the auxiliary/remote valve to the RAISE position.

https://truckmanualshub.com/



## Implement Interface Connector Circuit

The Implement Interface Connector allows the implement systems to be connected to the tractor electrical system to power the unit and enable the unit to monitor wheel speed and ground speed.

## Front and Rear 3 Pin Auxiliary Power Connector Circuit

Battery power flows through fuse 42 to the front (instrument panel) 3 pin auxiliary power connector pin 15/30 for European specification tractors or pin 2 for American specification tractors. Power also flows through fuse 41 to both the rear (right hand console) 3 pin auxiliary power connectors, pins 15/30 for European specification tractors or pin 2 for American specification tractors.

Switched power flows through fuse 30 to the front (instrument panel) 3 pin auxiliary power connector pin 82 for European specification tractors or pin 1 for American specification tractors. Power also flows to both the rear (right hand console) 3 pin auxiliary power connectors, pins 82 for European specification tractors or pin 1 for American specification tractors.

## Switched Fender Auxiliary Power Connector Circuit

### European Specification Tractors

Switched power flows through fuse 29 to the switched fender auxiliary power connector.

### American Specification Tractors

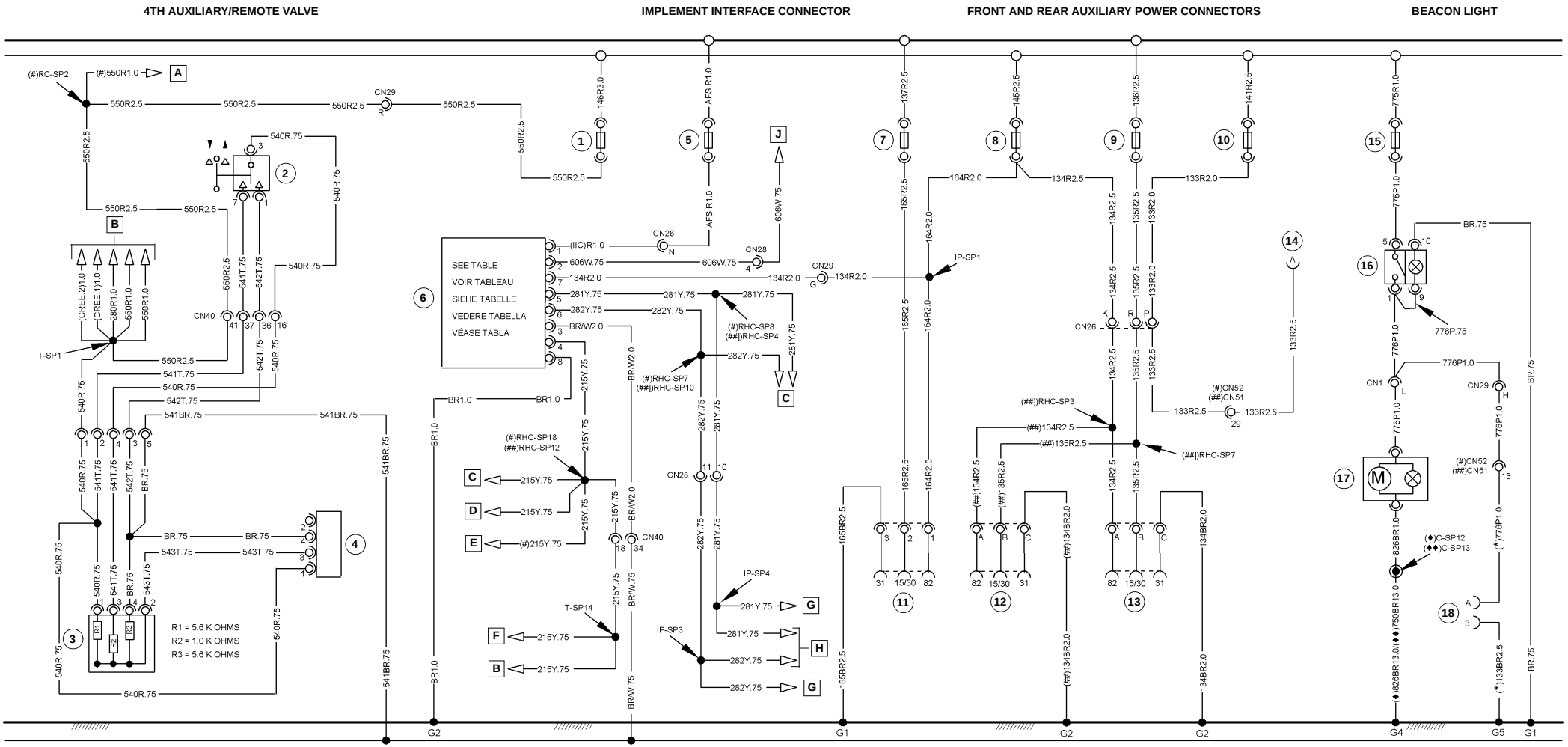
Switched power flows through fuse 29 to the 7 pin trailer connector pins 4 and 7. Power also flows to the switched fender auxiliary power connector.

## Beacon Light

Switched power flows through fuse 22 to the beacon switch terminal 5. With the switch in the ON position, power flows through the switch from terminal 5 to terminal 1, power then flows to terminal 9 of the switch, through the internal warning light to ground at G1 illuminating the warning light. Power also flows from terminal 1 of the switch to beacon light unit, through the light unit to ground at G4 operating the beacon motor and illuminating the light.

https://truckmanualshub.com/


# Schematic Circuit (For European Specification Tractors)




## Key

1. FUSE 34 (7.5 AMP)
2. 4TH AUXILIARY/REMOTE VALVE SWITCH
3. 4TH AUXILIARY/REMOTE VALVE RESISTOR PACK
4. 4TH AUXILIARY/REMOTE VALVE CONTROL MODULE
5. FUSE 16 (10 AMP)
6. IMPLEMENT INTERFACE CONNECTOR
7. FUSE 42 (30 AMP)
8. FUSE 30 (30 AMP)
9. FUSE 41 (30 AMP)
10. FUSE 29 (30 AMP)
11. FRONT AUXILIARY POWER CONNECTOR
12. (##) REAR AUXILIARY POWER CONNECTOR 2
13. REAR AUXILIARY POWER CONNECTOR
14. TRAILER AUXILIARY POWER CONNECTOR
15. FUSE 22 (15 AMP)
16. BEACON LIGHT SWITCH
17. BEACON LIGHT
18. 7 PIN TRAILER CONNECTOR

A. (#) TO RANGE SWITCHES
B. TO TRANSMISSION CONTROLLER
C. TO HITCH/PTO CONTROLLER
D. TO FRONT SUSPENDED AXLE CONTROLLER
E. TO CAB SUSPENSION CONTROLLER
F. TO FROM WHEEL SPEED SENSOR
G. FROM RADAR
H. TO INSTRUMENT CLUSTER
J. FROM ACCESSORY POWER RELAY TERMINAL 1

(♦) - TRACTORS NOT EQUIPPED WITH AUTOMATIC TEMPERATURE CONTROL ONLY.
(♦♦)- TRACTORS EQUIPPED WITH AUTOMATIC TEMPERATURE CONTROL ONLY.
(#) - XTRASPEED AND XTRASPEED - E TRACTORS ONLY.
(##) - XTRASPEED - E PLUS TRACTORS ONLY.

**IMPLEMENT INTERFACE CONNECTOR PIN IDENTIFICATION**

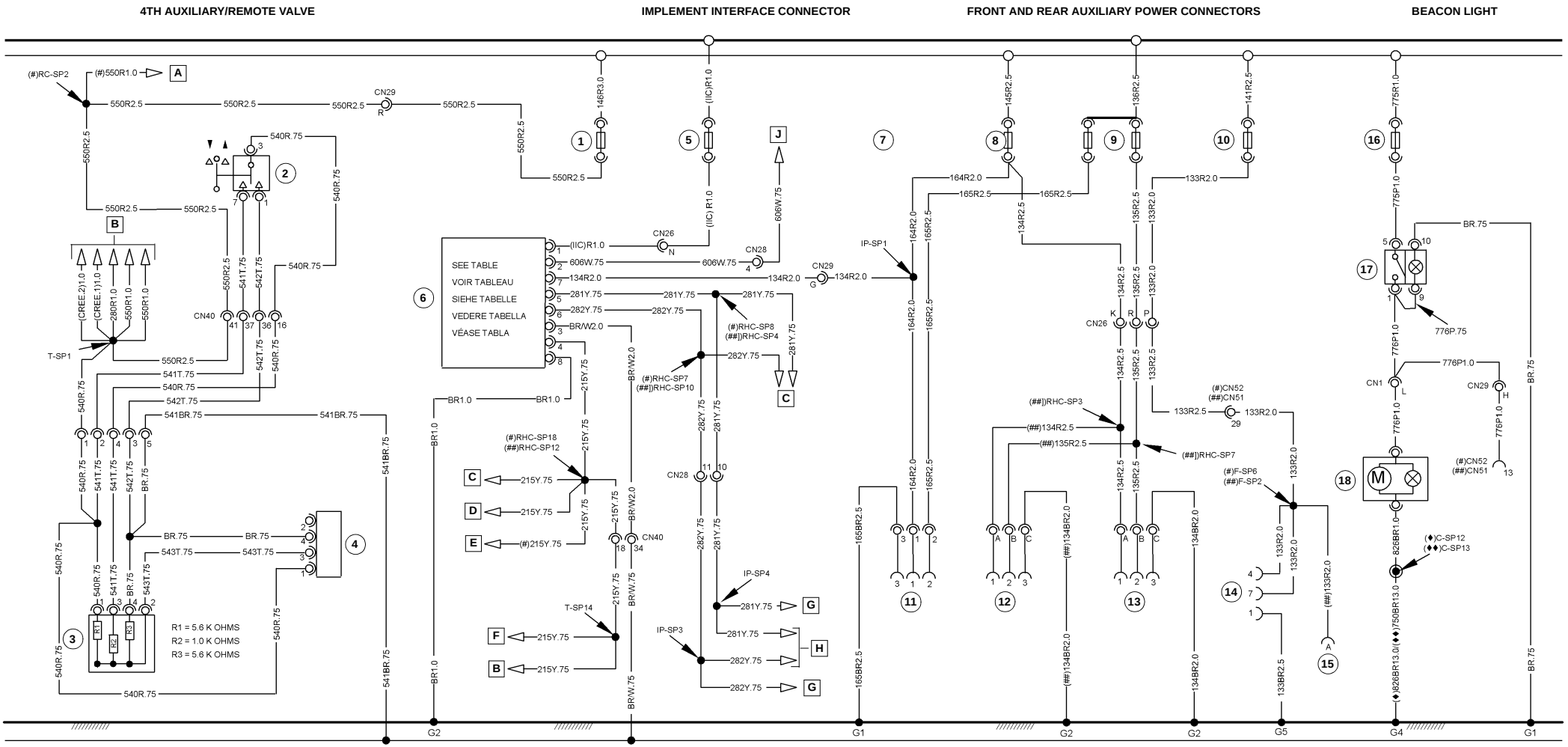
| | |
|---|---|
| 1 | UNSWITCHED BATTERY POWER |
| 2 | KEY SENSING |
| 3 | CLEAN GROUND |
| 4 | WHEEL SPEED |
| 5 | RADAR SIGNAL |
| 6 | RADAR PRESENT |
| 7 | SWITCHED BATTERY POWER |
| 8 | CHASSIS GROUND |

https://truckmanualshub.com/


This Page Has Been Left Blank

https://truckmanualshub.com/


# Schematic Circuit (For American Specification Tractors)




## Key

1. FUSE 34 (7.5 AMP)
2. 4TH AUXILIARY/REMOTE VALVE SWITCH
3. 4TH AUXILIARY/REMOTE VALVE RESISTOR PACK
4. 4TH AUXILIARY/REMOTE VALVE CONTROL MODULE
5. FUSE 16 (10 AMP)
6. IMPLEMENT INTERFACE CONNECTOR
7. FUSE 42 (30 AMP)
8. FUSE 30 (30 AMP)
9. FUSE 41 (30 AMP)
10. FUSE 29 (30 AMP)
11. FRONT AUXILIARY POWER CONNECTOR
12. (##) REAR AUXILIARY POWER CONNECTOR 2
13. REAR AUXILIARY POWER CONNECTOR
14. 7 PIN TRAILER CONNECTOR
15. TRAILER AUXILIARY POWER CONNECTOR
16. FUSE 22 (15 AMP)
17. BEACON LIGHT SWITCH
18. BEACON LIGHT

A. (#) TO RANGE SWITCHES
B. TO TRANSMISSION CONTROLLER
C. TO HITCH/PTO CONTROLLER
D. TO FRONT SUSPENDED AXLE CONTROLLER
E. TO CAB SUSPENSION CONTROLLER
F. TO FROM WHEEL SPEED SENSOR
G. FROM RADAR
H. TO INSTRUMENT CLUSTER
J. FROM ACCESSORY POWER RELAY TERMINAL 1

(♦) - TRACTORS NOT EQUIPPED WITH AUTOMATIC TEMPERATURE CONTROL ONLY.
(♦) - TRACTORS EQUIPPED WITH AUTOMATIC TEMPERATURE CONTROL ONLY.
(#) - XTRASPEED AND XTRASPEED - E TRACTORS ONLY.
(##) - XTRASPEED - E PLUS TRACTORS ONLY.

**IMPLEMENT INTERFACE CONNECTOR PIN IDENTIFICATION**

| | |
|---|---|
| 1 | UNSWITCHED BATTERY POWER |
| 2 | KEY SENSING |
| 3 | CLEAN GROUND |
| 4 | WHEEL SPEED |
| 5 | RADAR SIGNAL |
| 6 | RADAR PRESENT |
| 7 | SWITCHED BATTERY POWER |
| 8 | CHASSIS GROUND |

https://truckmanualshub.com/


# HORN, CIGAR LIGHTER AND SEAT

## Horn Circuit

Battery power flows from fuse 1 to the horn through the horn windings to terminal 31b of to the stalk switch. With the horn switch pressed ON (spring release to OFF) power flows through the switch to terminal 31 then to ground at G1 operating the horn.

## Cigar Lighter Circuit

Battery power flows through fuse 39 to the cigar lighter unit. When the cigar element is pushed IN power flows through the cigar lighter element to ground at G2 heating the element. When the element reaches the required temperature the element will partially eject and disconnect the power supply to the element.

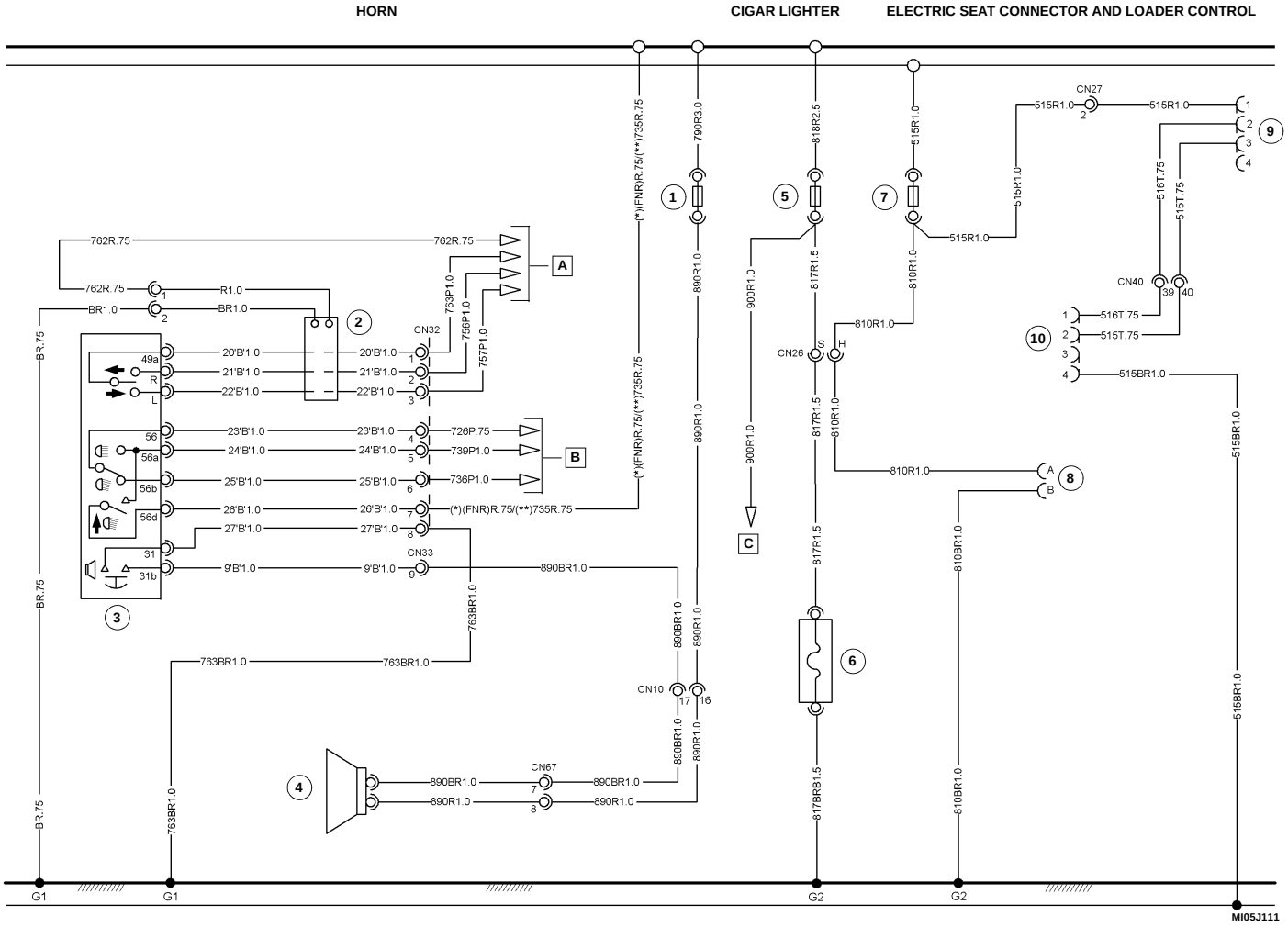
## Electric Air Seat Circuit

Switched power flows through fuse 8 to the seat connector terminal A. Depending on seat specification, power at terminal A of the seat connector will supply power to the various features of the seat i.e air compressor, heated cushion/back rest and lumber support etc.

Power flows through the required feature of the seat to terminal B of the seat connector. Power then flows to ground at G2 activating the feature.

https://truckmanualshub.com/


## Schematic Circuit




### Key

1. FUSE 1 (15 AMP)
2. TURN SIGNAL SWITCH SELF CANCELLING MODULE
3. STALK SWITCH (TURN/HORN/HIGH-LOW BEAM)
4. HORN
5. FUSE 39 (10 AMP)
6. CIGAR LIGHTER
7. FUSE 8 (15 AMP)
8. ELECTRIC SEAT CONNECTOR
9. LOADER CONTROL SWITCH CONNECTOR
10. LOADER CONTROL SOLENOID HARNESS CONNECTOR

A. TO TURN SIGNAL CIRCUIT
B. TO HEADLIGHT CIRCUIT
C. TO DIAGNOSTIC CONNECTOR

(*) - EUROPEAN SPECIFICATION TRACTORS ONLY
(**) - AMERICAN SPECIFICATION TRACTORS ONLY

https://truckmanualshub.com/


# RADIO AND INTERIOR LIGHT

## Radio Circuit

**NOTE:** *The radio can be connected directly to the tractor harness or connected using an adaptor harness. Adapter harnesses available are as follows:*

*Type 1 - Twin European ISO connectors to single Yazaki connector.*
*Type 2 - Twin European ISO connectors to Twin American ISO connectors.*

Power from the key switch in ACC and ON positions only, flows through fuse 40 (general radio supply) to the tractor harness radio connector terminal 7 (type 1 adapter harness connector 74 terminal 4, type 2 adapter harness connector 76 terminal D).

Battery power flows through fuse 37 (supply for radio memory and clock) to the radio connector 72 terminal 4, (type 1 adapter harness connector 74 terminal 7, type 2 adapter harness connector 76 terminal K).

The radio is connected to ground at G4 (through the main cab splice 11) from connector 72 terminal 8 (type 1 adapter harness connector 74 terminal 8, type 2 adapter harness connector 76 terminal I).

The radio speaker ground terminals are connected to the radio through connector 73 terminals 4 and 6 (type 1 adapter harness connector 75 terminal 4 and 6, type 2 adapter harness connector 76 terminal L and M).

The radio speaker signal terminals are connected to the radio through connector 73 terminals 3 and 5 (type 1 adapter harness connector 75 terminal 3 and 5, type 2 adapter harness connector 76 terminal E and F).

## Interior Light Circuit

Battery power flows directly from the battery positive terminal, through fuse 37 to the interior light unit terminal B. Power flows through the light to the internal switch.

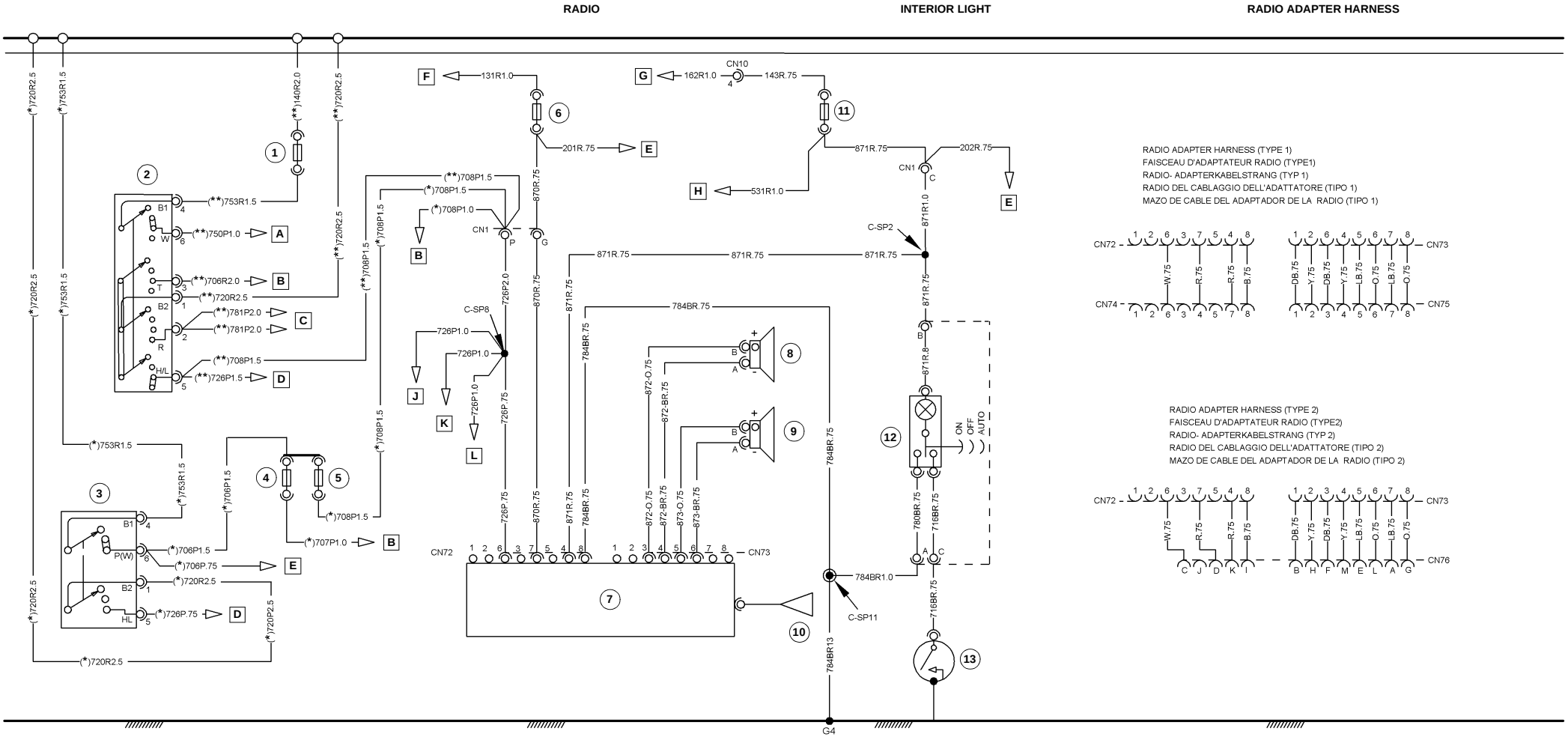
With the switch in the OFF position there is no circuit to ground at G4 and the light will not illuminate.

With the switch moved to ON power flows through the switch to terminal A to ground at G4, illuminating the light.

With the switch moved to AUTO power flows through the switch to terminal C and to the door switch. With the door open the switch contacts will close allowing power to flow through the switch to ground and the light will illuminate.

https://truckmanualshub.com/


## Schematic Circuit




MI04J113

## Key

1. FUSE 19 (5 AMP)
2. (**) MAIN LIGHT SWITCH
3. (*) MAIN LIGHT SWITCH
4. (*) FUSE 6 (10 AMP)
5. (*) FUSE 7 (10 AMP)
6. FUSE 40 (7.5 AMP)
7. RADIO
8. RIGHT HAND SPEAKER
9. LEFT HAND SPEAKER
10. AERIAL
11. FUSE 37 (7.5 AMP)
12. INTERIOR LIGHT
13. INTERIOR LIGHT DOOR SWITCH

A. TO TURN SIGNAL LIGHTS
B. TO SIDE/TAIL LIGHTS
C. TO WORK LIGHTS
D. TO HEADLIGHTS
E. TO INSTRUMENT CLUSTER
F. FROM KEY SWITCH TERMINAL 6
G. FROM BATTERY POSITIVE TERMINAL
H. TO SUSPENDED FRONT AXLE CONTROLLER
J. TO RIGHT HAND CONSOLE LIGHT
K. (*) TO REAR CAB No PLATE LIGHTS
L. (*) TO RIGHT HAND FRONT SIDE/POSITION LIGHT

(*) - EUROPEAN SPECIFICATION TRACTORS ONLY
(**) - AMERICAN SPECIFICATION TRACTORS ONLY

https://truckmanualshub.com/


# BLOWER AND AIR CONDITIONING
# (For Tractors Not Equipped With Automatic Temperature Control)

## Blower Circuit

The blower motors will operate in three speeds, Low, Medium and High and are controlled by the blower switch and the resistor board. Switched power flows through a 40 amp circuit breaker to the blower switch at terminal E.

### Low Speed Selected

With the blower switch in the low speed position power flows from terminal A of the switch to the resistor board and through both the 0.4 OHM and 0.16 OHM resistors. Power then flows to terminal A of each blower motor, through the motors to terminal B and to ground at G4, operating the motors at LOW speed.

### Medium Speed Selected

With the blower switch in the Medium speed position power flows from terminal B of the switch to the resistor board and through the 0.16 OHM resistor. Power then flows to terminal A of each blower motor, through the motors to terminal B and to ground at G4, operating the motors at MEDIUM speed.

### High Speed Selected

With the blower switch in the High speed position power flows from terminal C of the switch directly to terminal A of each blower motor, through the motors to terminal B. Power then flows from terminal B of the blower motors to ground at G4, operating the motors at HIGH speed.

## Air Conditioning Circuit

The air conditioning system will only operate when both the blower switch and air conditioning temperature control switch are in the ON position.

Switched power flows through a 40 amp circuit breaker to the fan speed switch terminal E. With the blower switch in the L, M or H speed position power flows from terminal F to the air conditioning temperature control switch.

With the temperature control switch in the ON position, power flows through the switch to terminals A on both the high and low pressure switches. Power also flows to the air conditioning lockout relay terminal 3, through the relay to terminal 4. The power will then flow to ground through the compressor clutch windings, engaging the clutch. The compressor clutch diode prevents the current flowing directly to ground.

If either the low or high pressure switches closes, power flows through the closed switch from terminals A to B then to the lockout relay terminal 1. Power then flows through the relay windings to terminal 2 and to ground at G4, energizing the relay.

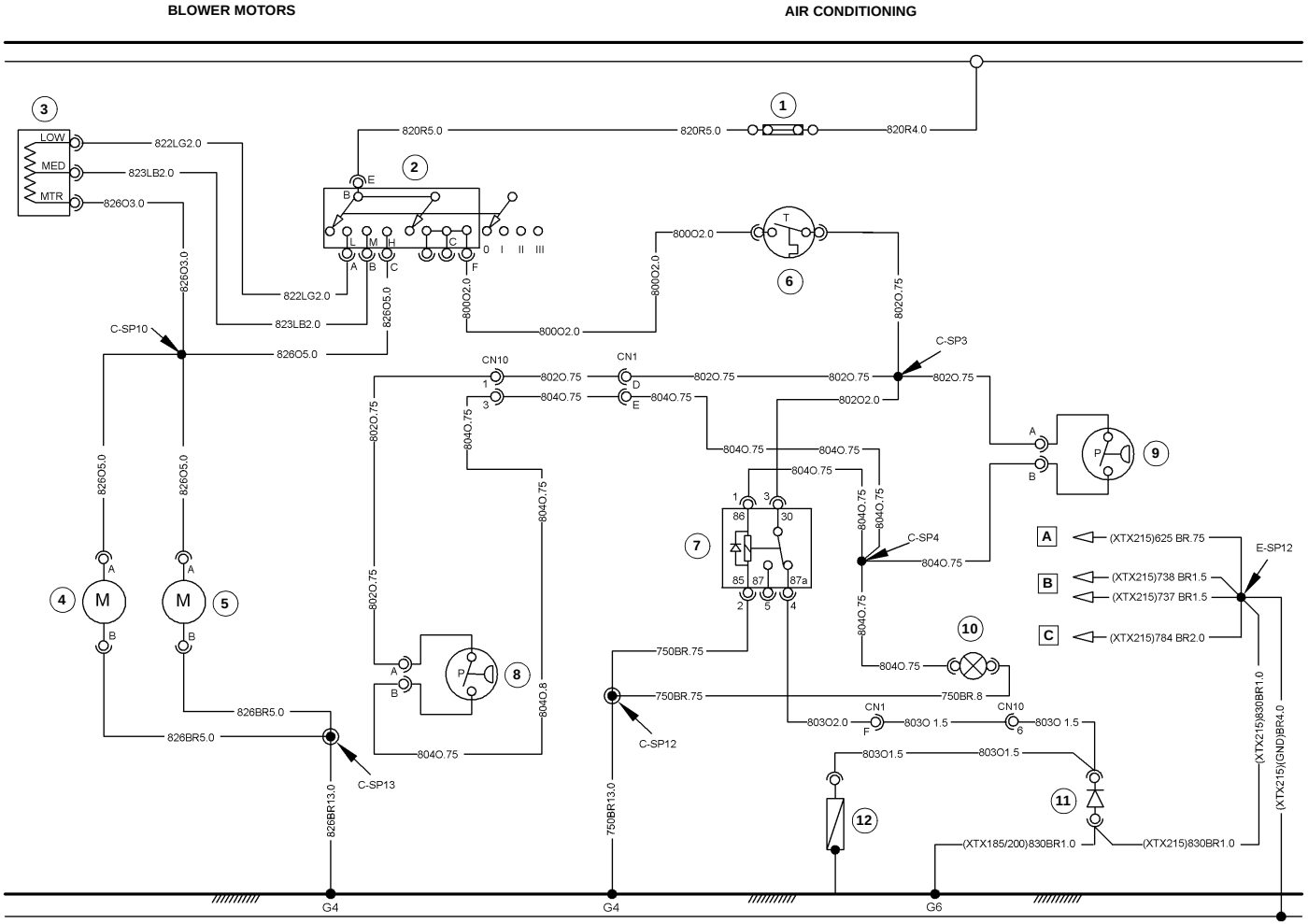
When the relay is energized the power now flows from terminal 3 to terminal 5 of the relay, disconnecting power to the compressor clutch from terminal 4, the compressor clutch will disengage. When the clutch disengages the clutch windings can induce a high voltage spike to flow backward into the circuit to find a path to ground.

This high voltage spike can damage switches, relays and electronic components in the circuit. To prevent damage to the circuit the compressor clutch diode is designed to allow power to flow through the diode directly to ground if the voltage in the circuit rises above a specified level. This will allow any high voltage spike induced by the compressor clutch to flow to ground directly through the diode.

With either the low or high pressure switches closed, power flows through the closed switch to the air conditioning warning light, through the light to ground at G4 illuminating the light. If the closed pressure switch opens the relay de-energizes, allowing power to flow to the compressor clutch windings, engaging the clutch. Also power flowing through the warning light will be disconnected and the light will not illuminate.

https://truckmanualshub.com/


## Schematic Circuit




### Key

1. CIRCUIT BREAKER 40 (AMP)
2. BLOWER SWITCH
3. RESISTOR BOARD
4. LEFT HAND BLOWER MOTOR
5. RIGHT HAND BLOWER MOTOR
6. TEMPERATURE CONTROL SWITCH
7. LOCKOUT RELAY
8. LOW PRESSURE SWITCH
9. HIGH PRESSURE SWITCH
10. LOCKOUT WARNING LIGHT
11. SUPPRESSION DIODE
12. AIR CONDITIONING COMPRESSOR

A. FROM STARTER RELAY
B. FROM HEADLIGHT CIRCUIT
C. FROM GRILLE WORK LIGHT CIRCUIT

https://truckmanualshub.com/


# ELECTRIC MIRRORS AND WINDSHIELD WIPER/WASHERS

## Electric Mirror Circuit

Switched power flows through circuit breaker 32 to the mirror control switch terminal 3, with the switch in the OFF (centre) position no power can flow through the switch.

### Left Hand Mirror - Up (Joystick up)

With the mirror control switch in the left hand mirror position and the switch lever moved to the UP position, switched power flows through the switch from terminals 3 to 7. Power flows from terminal 7 to one side of the left hand mirror Up/Down motor. Power then flows through the motor to terminal 8 of the mirror control switch, through the switch to terminal 9 and to ground at G4, energizing the motor and moving the mirror up.

### Left Hand Mirror - Down (Joystick down)

With the mirror control switch in the left hand mirror position and the switch lever moved to the DOWN position, switched power flows through the switch from terminals 3 to 8. Power flows from terminal 8 to one side of the left hand mirror Up/Down motor. Power then flows through the motor to terminal 7 of the mirror control switch, through the switch to terminal 9 and to ground at G4, energizing the motor and moving the mirror down.

### Left Hand Mirror - In (Joystick Forward)

With the mirror control switch in the left hand mirror position and the switch lever moved to the IN position, switched power flows through the switch from terminals 3 to 4. Power flows from terminal 4 to one side of the left hand mirror In/Out motor. Power then flows through the motor to terminal 7 of the mirror control switch, through the switch to terminal 9 and to ground (through cab splice 13), energizing the motor and moving the mirror in.

### Left Hand Mirror - Out (Joystick Rearward)

With the mirror control switch in the left hand mirror position and the switch lever moved to the OUT position, switched power flows through the switch from terminals 3 to 7. Power flows from terminal 7 to one side of the left hand mirror In/Out motor. Power then flows through the motor to terminal 4 of the mirror control switch, through the switch to terminal 9 and to ground at G4, energizing the motor and moving the mirror out.

### Right Hand Mirror - Up (Joystick Up)

With the mirror control switch in the right hand mirror position and the switch lever moved to the UP position, switched power flows through the switch from terminals 3 to 7. Power flows from terminal 7 to one side of the right hand mirror Up/Down motor. Power then flows through the motor to terminal 10 of the mirror control switch, through the switch to terminal 9 and to ground at G4, energizing the motor and moving the mirror up.

### Right Hand Mirror - Down (Joystick Down)

With the mirror control switch in the right hand mirror position and the switch lever moved to the DOWN position, switched power flows through the switch from terminals 3 to 10. Power flows from terminal 10 to one side of the left hand mirror Up/Down motor. Power then flows through the motor to terminal 7 of the mirror control switch, through the switch to terminal 9 and to ground at G4, energizing the motor and moving the mirror down.

### Right Hand Mirror - In (Joystick Rearward)

With the mirror control switch in the right hand mirror position and the switch lever moved to the IN position, switched power flows through the switch from terminals 3 to 7. Power flows from terminal 7 to one side of the left hand mirror In/Out motor. Power then flows through the motor to terminal 5 of the mirror control switch, through the switch to terminal 9 and to ground at G4, energizing the motor and moving the mirror in.

https://truckmanualshub.com/



### Right Hand Mirror - Out (Joystick Forward)

With the mirror control switch in the right hand mirror position and the switch lever moved to the OUT position switched power flows through the switch from terminals 3 to 5. Power flows from terminal 5 to one side of the left hand mirror In/Out motor. Power then flows through the motor to terminal 7 of the mirror control switch, through the switch to terminal 9 and to ground at G4, energizing the motor and moving the mirror out.

## Front Windscreen Wiper/Washer Circuit

Switched power flows through a circuit breaker located in fuse socket 32 to the front wiper/washer switch terminal E and to the wiper motor at terminal C.

### Intermittent Speed

The intermittent speed position is the range between the OFF and low speed positions. When the switch is near the OFF position there will be a long interval between each sweep of the wiper. When the switch is near the low speed position there will be only a short interval between each sweep of the wiper.

With the switch in the intermittent position power at terminal E flows to the internal electronic timer of the switch. The timer will open and close an internal switch (not shown) intermittently according to the exact position of the wiper switch.

With the internal switch closed power flows through the wiper switch to terminal B and to the wiper motor at terminal B. Power flows through the wiper motor to ground at G4 operating the motor at low speed.

### Low Speed

With the switch in LOW speed position power at terminal E flows through the switch to terminal B and to the wiper motor at terminal B. Power flows through the motor to ground at G4 operating the motor at low speed.

When the wiper motor is operating the wiper motor internal switch closes and power flows from terminals C to D of the wiper motor. Power then flows to terminal F of the wiper switch.

### High Speed

With the switch in HIGH speed position power at terminal E flows through the switch to terminal A and to the wiper motor at terminal A. Power flows through the motor to ground at G4 operating the motor at high speed.

When the wiper motor is operating the wiper motor internal switch closes and power flows from terminals C to D of the wiper motor. Power then flows to terminal F of the wiper switch.

### Park Position

When the wiper switch is turned OFF, power at terminal F of the wiper switch (flowing through the wiper motor internal switch) flows through the wiper switch to terminal B and to the motor at terminal A. Power flows through the motor to ground at G4 operating the motor at low speed.

When the wiper mechanism reaches PARK position the motor internal switch opens disconnecting the power supply from terminal C of the motor causing the motor to stop immediately.

### Windscreen Washer

With the washer switch pressed ON (spring return to OFF) power available at the wiper/washer switch terminal E flows through the switch to terminal C then to the washer motor. Power flows through the motor to ground at G5 and the motor operates.

https://truckmanualshub.com/



# Rear Windscreen Wiper/Washer Circuit

Switched power flows through fuse 31 to the rear wiper/washer switch terminal 3 and to the rear wiper motor through terminal B of the wiper motor assembly connector.

## Wiper ON

With the rear wiper switch in the ON position power at terminal 3 of the switch flows through the switch to terminal 4 to the wiper motor. Power flows through the motor to terminal C of the rear wiper assembly connector and to ground at G4 operating the motor.

## Park Position

Power at the motor from terminal B of the rear wiper assembly connector flows to an internal switch in the motor which is open when the wiper mechanism is in the PARK position but closed in all other position. With the internal motor switch closed power flows through the switch to terminal 1 of the wiper motor switch. With the wiper switch OFF power flows through the switch to terminal 4 then to the motor. Power flows through the motor to terminal C of the rear wiper assembly connector and to ground at G4 operating the motor.

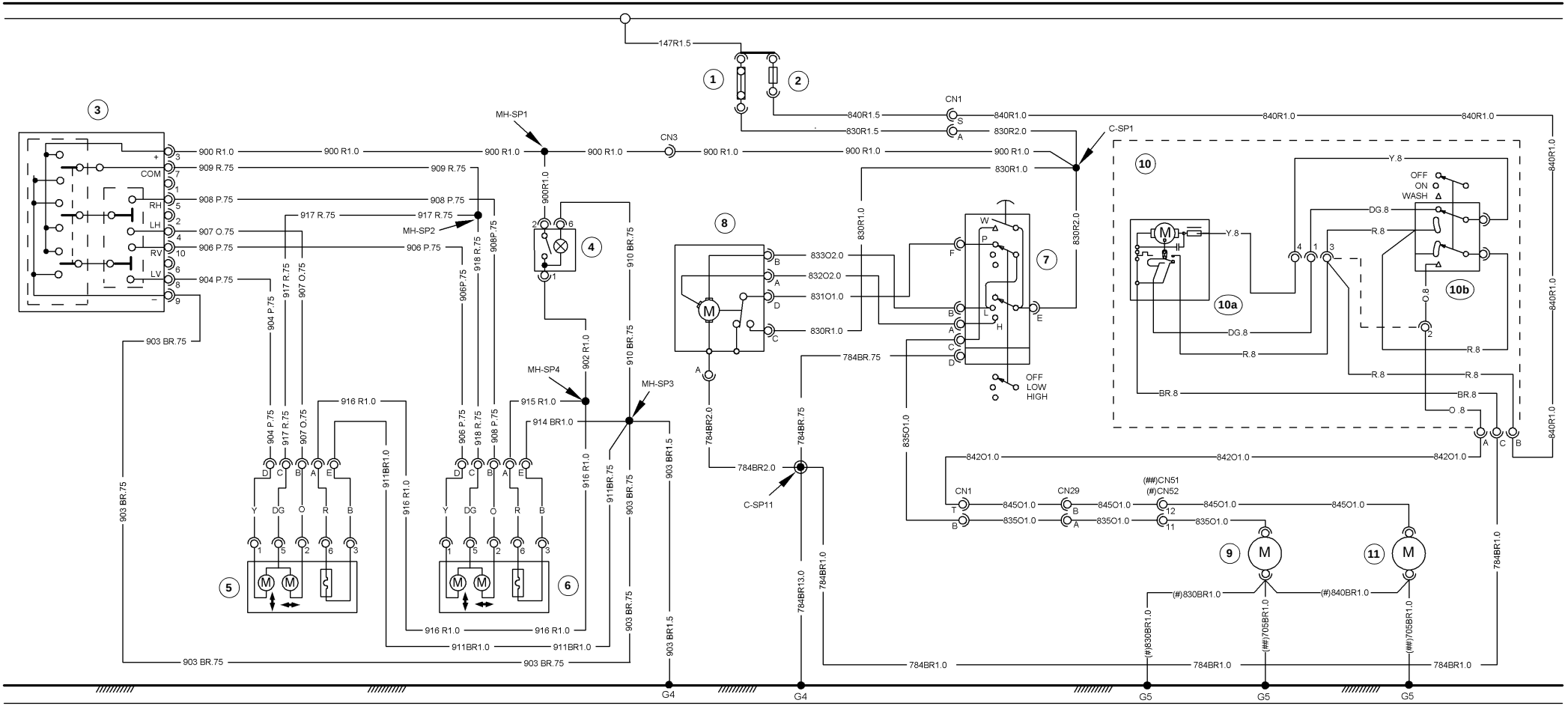
When the wiper mechanism reaches park position the motor internal switch will open. This will disconnect the power supply from the switch connector terminal 3. The current flowing in the circuit is disconnected causing the motor to stop immediately.

## Windscreen Washer

With the washer switch pressed ON (spring return to OFF) power available at the wiper/washer switch terminal 3 flows through the switch to terminal 2 then to the washer motor. Power flows through the motor to ground at G5 and the motor operates.

https://truckmanualshub.com/


# Schematic Circuit (For Tractors Not Equipped With Automatic Temperature Control)




MI05J122

## Key

1. CIRCUIT BREAKER - FUSE LOCATION 32 (15 AMP)
2. FUSE 31 (15 AMP)
3. MIRROR CONTROL SWITCH
4. MIRROR HEATER SWITCH
5. LEFT HAND MIRROR
6. RIGHT HAND MIRROR
7. FRONT WIPER/WASHER SWITCH
8. FRONT WIPER MOTOR
9. FRONT WINDSHIED WASHER MOTOR
10. REAR WIPER MOTOR ASSEMBLY
10a. REAR WIPER MOTOR
10b. REAR WIPER/WASHER SWITCH
11. REAR WINDSHIED WASHER MOTOR

(#) - XTRASPEED AND XTRASPEED - E TRACTORS ONLY.
(##) - XTRASPEED - E PLUS TRACTORS ONLY.

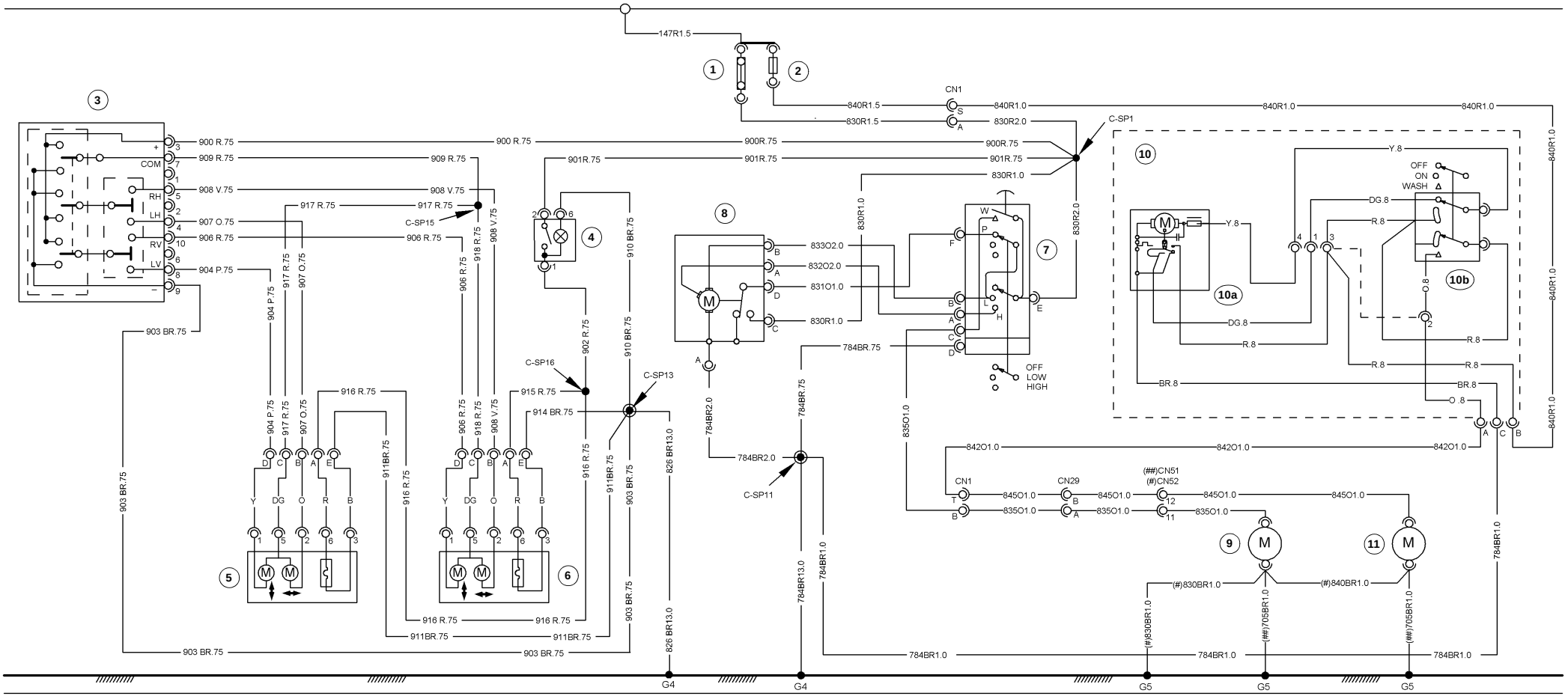
https://truckmanualshub.com/


This Page Has been Left Blank.

https://truckmanualshub.com/


# Schematic Circuit (For Tractors Equipped With Automatic Temperature Control)

ELECTRIC MIRRORS | FRONT WINDSHIELD WIPER/WASHER | REAR WINDSHIELD WIPER/WASHER




MI05J121

## Key

1. CIRCUIT BREAKER - FUSE LOCATION 32 (15 AMP)
2. FUSE 31 (15 AMP)
3. MIRROR CONTROL SWITCH
4. MIRROR HEATER SWITCH
5. LEFT HAND MIRROR
6. RIGHT HAND MIRROR
7. FRONT WIPER/WASHER SWITCH
8. FRONT WIPER MOTOR
9. FRONT WINDSHIED WASHER MOTOR
10. REAR WIPER MOTOR ASSEMBLY
10a. REAR WIPER MOTOR
10b. REAR WIPER/WASHER SWITCH
11. REAR WINDSHIED WASHER MOTOR

(#) - XTRASPEED AND XTRASPEED - E TRACTORS ONLY.
(##) - XTRASPEED - E PLUS TRACTORS ONLY.

https://truckmanualshub.com/


# BRAKE LIGHTS AND AIR TRAILER BRAKE

## Brake Light Circuit

Switched power flows through fuse 24 to terminal 3 of both brake relays, switched power also flows through fuse 26 to both brake pedal switches.

With the left hand brake pedal depressed, power flows through the left hand brake pedal switch to terminal 1 of the left hand brake relay. Power then flows through the relay windings to terminal 2 and to ground at G2 energizing the relay.

With the right hand brake pedal depressed, power flows from the right hand brake pedal switch to terminal 1 of the right hand brake relay. Power then flows through the relay windings to terminal 2 and to ground at G2 energizing the relay.

With the left hand brake relay or the right hand brake relay energized, power flows through the relay(s) from terminals 3 to 5. Power then flows from terminal 5 to both the left and right hand brake lights, through the brake lights to ground at G5 illuminating the lights. Power also flows and to terminal 6 of the 7 pole trailer socket.

## Air Trailer Brake Solenoid Circuit

Switched power flows through fuse 29 to the air trailer brake relay terminals 86 and 30.

With the either one or both brake pedals depressed, power flows from brake pedal switch(es) to terminal 1 of the brake relay(s). Power then flows through the relay windings to terminal 2 and to ground at G2 energizing the relay(s).

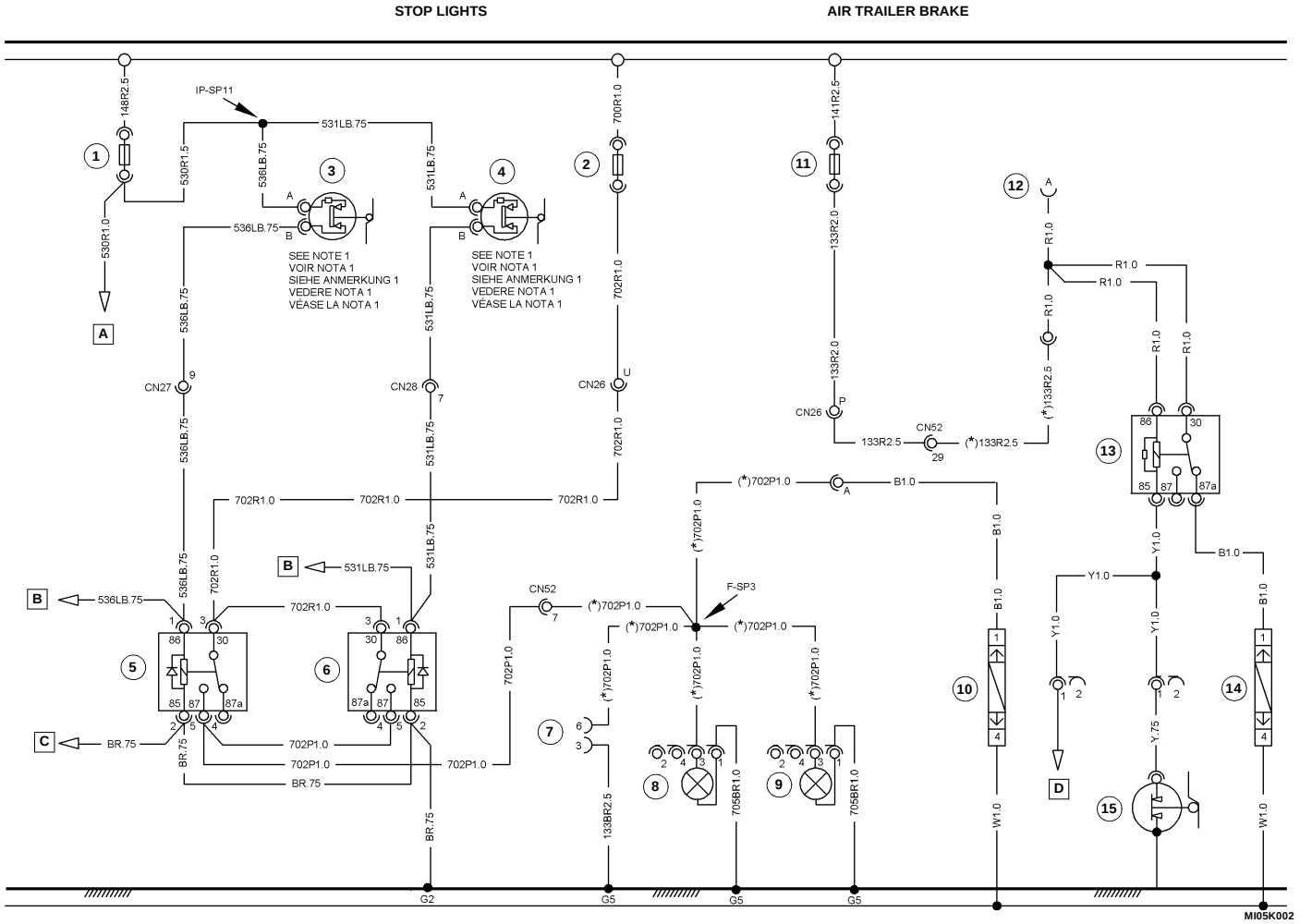
Power flows through the relay(s) from terminals 3 to 5, power then flows from terminal 5 of the relay to the air trailer brake ‘inshot solenoid’. Power then flows through the solenoid to ground, energizing the solenoid (priming the air brake lines with low pressure air).

With the park brake engaged power flows from terminal 86 of the air trailer brake relay, through the relay windings to terminal 85. Power then flows from terminal 85 of the relay through the park brake switch to ground, energizing the relay. With the relay energized power will not flow through the relay to the air trailer brake solenoid (solenoid OFF).

With the park brake disengaged power will not flow from terminal 85 of the relay to ground, de-energizing the relay. With the relay de-energized power flows through the relay from terminal 30 to terminals 87a and to the air trailer brake solenoid to ground, energizing the solenoid.

https://truckmanualshub.com/


## Schematic Circuit (For XtraSpeed and XtraSpeed - E Tractors)




### Key

1. (FUSE 26 (30 AMP)
2. FUSE 24 (20 AMP)
3. LEFT HAND BRAKE PEDAL SWITCH
4. RIGHT HAND BRAKE PEDAL SWITCH
5. LEFT HAND BRAKE RELAY
6. RIGHT HAND BRAKE RELAY
7. (*) 7 PIN TRAILER CONNECTOR
8. (*) LEFT HAND STOP LIGHT
9. (*) RIGHT HAND STOP LIGHT
10. (*) AIR TRAILER BRAKE INSHOT SOLENOID (IF EQUIPPED)
11. FUSE 29 (30 AMP)
12. (*) TRAILER AUXILIARY POWER CONNECTOR
13. (*) AIR TRAILER BRAKE RELAY (IF EQUIPPED)
14. (*) AIR TRAILER BRAKE SOLENOID (IF EQUIPPED)
15. PARK BRAKE SWITCH

A. TO MFD SWITCH, DIFFERENTIAL LOCK SWITCH
B. TO HITCH/PTO CONTROLLER
C. FROM MFD SOLENOID
D. TO INSTRUMENT CLUSTER

(*) - EUROPEAN SPECIFICATION TRACTORS ONLY.

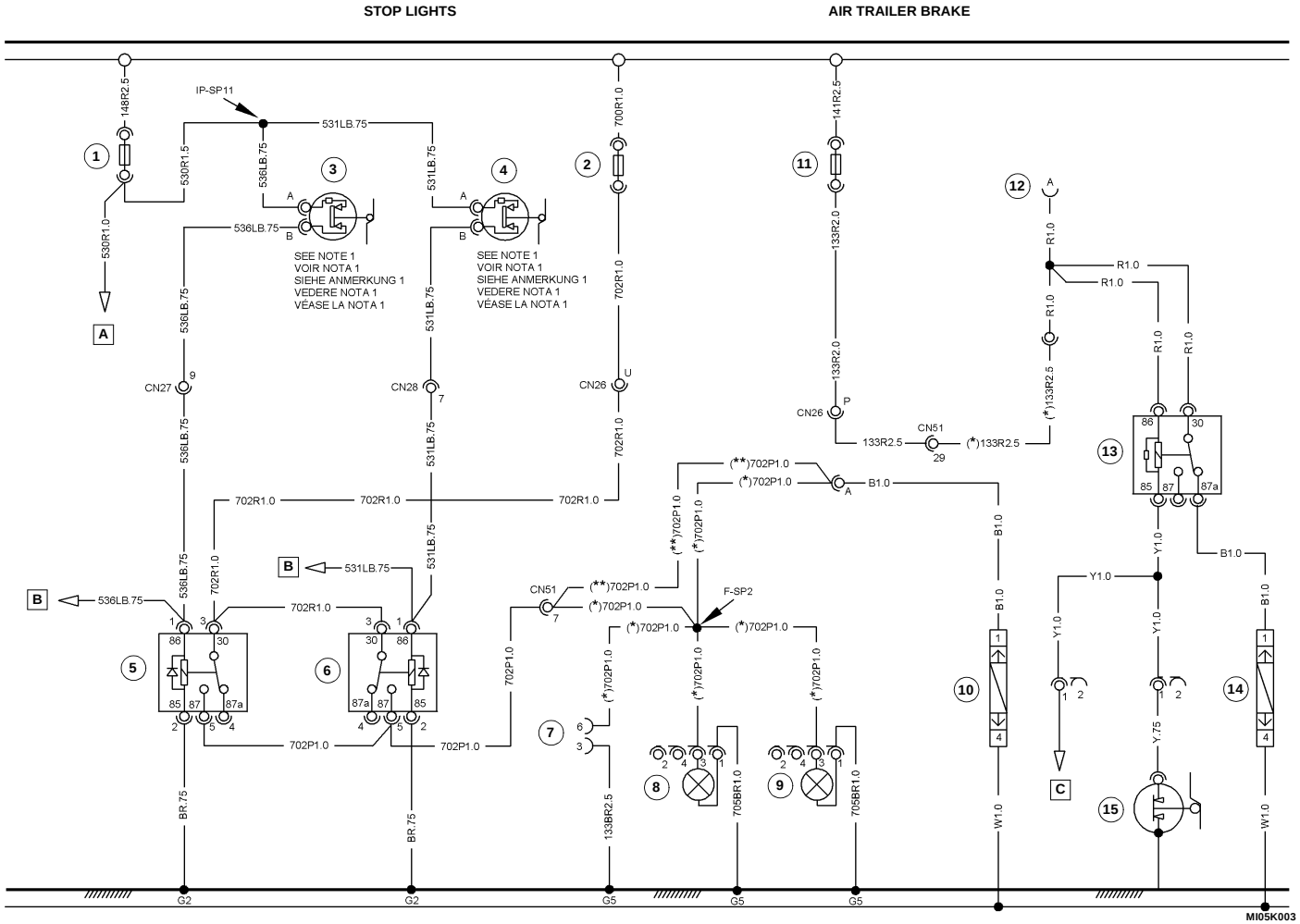
**NOTE 1:** *Only use a HIGH IMPEDANCE multimeter to test the switches and circuits. Do not use a test lamp or damage to the switches may occur.*

https://truckmanualshub.com/


This Page Has been Left Blank

https://truckmanualshub.com/


## Schematic Circuit (For XtraSpeed - E Plus Tractors)




### Key

1. (FUSE 26 (30 AMP)
2. FUSE 24 (20 AMP)
3. LEFT HAND BRAKE PEDAL SWITCH
4. RIGHT HAND BRAKE PEDAL SWITCH
5. LEFT HAND BRAKE RELAY
6. RIGHT HAND BRAKE RELAY
7. (*) 7 PIN TRAILER CONNECTOR
8. (*) LEFT HAND STOP LIGHT
9. (*) RIGHT HAND STOP LIGHT
10. (*) AIR TRAILER BRAKE INSHOT SOLENOID (IF EQUIPPED)
11. FUSE 29 (30 AMP)
12. (*) TRAILER AUXILIARY POWER CONNECTOR
13. (*) AIR TRAILER BRAKE RELAY (IF EQUIPPED)
14. (*) AIR TRAILER BRAKE SOLENOID (IF EQUIPPED)
15. PARK BRAKE SWITCH

A. TO MFD SWITCH, DIFFERENTIAL LOCK SWITCH
B. TO HITCH/PTO CONTROLLER
C. TO INSTRUMENT CLUSTER

(*) - EUROPEAN SPECIFICATION TRACTORS ONLY.
(**) - AMERICAN SPECIFICATION TRACTORS ONLY

**NOTE 1:** *Only use a HIGH IMPEDANCE multimeter to test the switches and circuits. Do not use a test lamp or damage to the switches may occur.*

https://truckmanualshub.com/


This Page Has been Left Blank

https://truckmanualshub.com/



# SIDE/TAIL LIGHTS, NUMBER PLATE LIGHTS, RIGHT HAND CONSOLE LIGHT, TURN SIGNAL AND HAZARD WARNING LIGHTS (European Specification Tractors Only)

## Side/Tail Light, Number Plate Light and Right Hand Console Light Circuits

Battery power is connected to the main light switch terminal 4. With the switch in position 2 or 3 power flows through the switch to terminal 6 then to fuses 6 and 7. Power also flows to the instrument cluster at connector 30 pin 24 power flows through the instrument cluster side/tail light warning lamp to connector 31 pin 14 (refer to Section 10009). Power then flows to ground at the battery negative terminal, illuminating the warning lamp.

### Side/Tail Lights

Power flows from fuse 6 to the left hand front side light, through the light to ground at G4, illuminating the light. Power also from fuse 6 to the 7 pin trailer socket terminal 7, fender number plate light (if equipped) and to the left hand rear tail light. Power flows through the left hand rear tail light and fender number plate light (if equipped) to ground at G5 illuminating the lights.

Power flows from fuse 7 to the right hand front side light through the light to ground at G4, illuminating the light. Power also from fuse 7 to the 7 pin trailer socket terminal 5 and right hand rear tail light. Power flows through the right hand rear tail light to ground at G5 illuminating the light.

### Right Hand Console Light

Power flows from fuse 7 to the right hand console light, power then flows through the light to ground at G4, illuminating the light.

### Number Plate Lights

Power flows from fuse 7 to both the right hand and left hand number plate lights, power then flows through the lights to ground at G4, illuminating the lights.

## Turn Signal and Hazard Warning Light Circuits

### Turn Signal

Switched power flows through fuse 21 to the hazard switch terminal 8 and to the turn signal self cancelling module. With the switch OFF power flows through the switch to terminal 6 then to the flasher relay terminal 49, through the relay to the stalk switch at terminal 49A.

With the stalk switch in right turn position, power flows through the switch to terminal L through the self cancelling module to the right hand turn signal lights and to the 7 pin trailer connector pin 4. Power flows through the right hand turn signal lights to ground (at G4 for the front turn signal and G5 for the rear turn signal) illuminating (flashing) the lights.

Power also flows to the instrument cluster connector 30 pin 22, power flows through the instrument cluster right turn signal indicator lamp to connector 31 pin 14 (refer to Section 10009). Power then flows to ground at the battery negative terminal, illuminating (flashing) the indicator lamp.

With the stalk switch in left turn position, power flows through the switch to terminal R through the self cancelling module to the right hand turn signal lights and to the 7 pin trailer connector pin 1. Power flows through the left hand turn signal lights to ground (at G4 for the front turn signal and G5 for the rear turn signal) illuminating (flashing) the lights.

Power also flows to the instrument cluster connector 30 pin 29, power flows through the instrument cluster left turn signal indicator lamp to connector 31 pin 14 (refer to Section 10009). Power then flows to ground at the battery negative terminal, illuminating (flashing) the indicator lamp.

Continued.....

https://truckmanualshub.com/



## Hazard Warning Light

Battery power flows through fuse 18 to the hazard switch terminal 2. With the switch ON power flows through the switch to terminal 6 then to the flasher relay terminal 49 and through the relay to terminal 49A. Power flows from terminal 49a to the hazard switch terminal 5, through the switch to terminals 1 and 3 and through the internal warning light to terminal 10 and to chassis ground at G1, illuminating (flashing) the warning light.

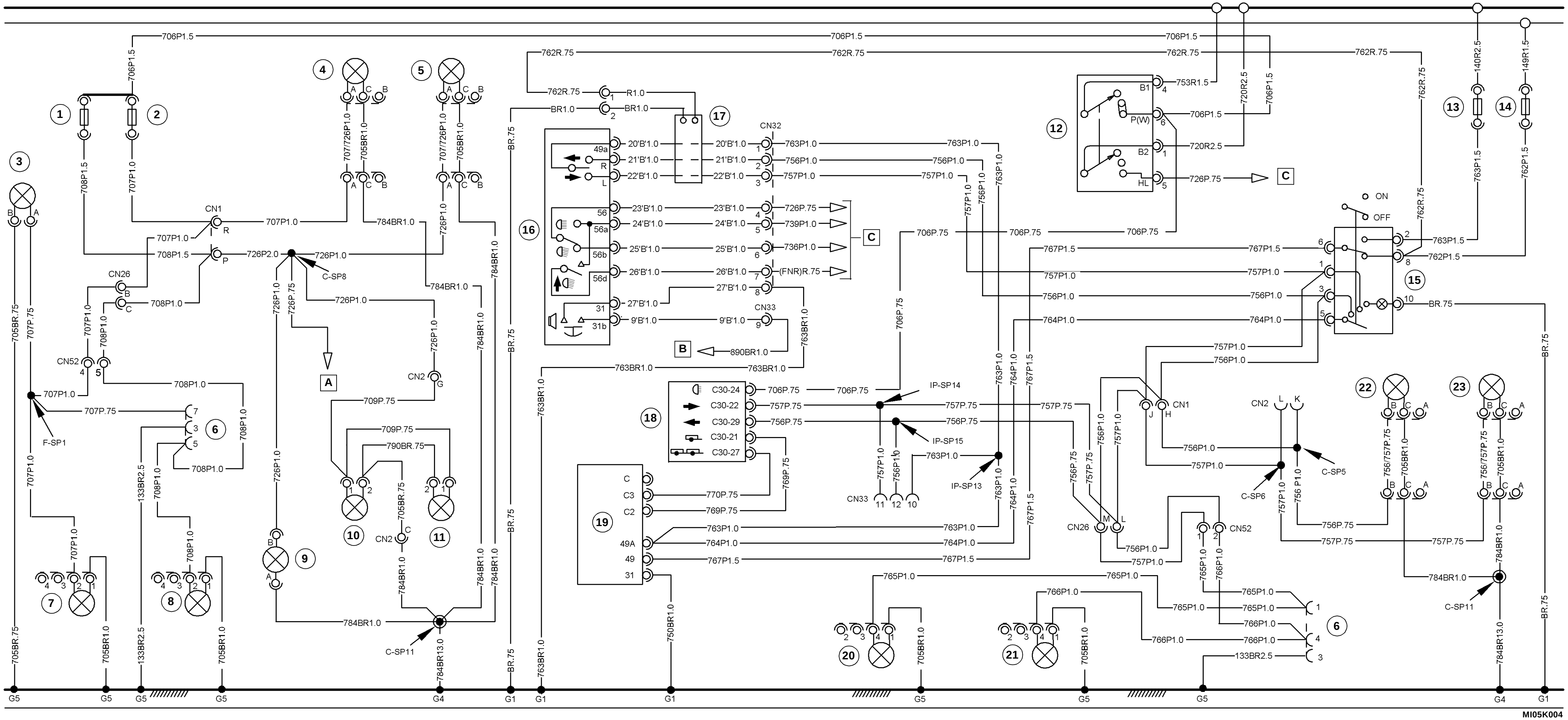
The power at terminal 1 flows to the 7 pin trailer socket terminal 4 and through the right hand turn signal lights to chassis ground illuminating the lights (See Turn Signal on Page 57).

The power at terminal 3 flows to the 7 pin trailer socket terminal 1 and through the left hand turn signal lights to chassis ground illuminating the lights (See Turn Signal on Page 57).

https://truckmanualshub.com/


## Schematic Circuit (For XtraSpeed and XtraSpeed - E Tractors)

**FRONT SIDE LIGHTS, TAIL LIGHTS, RIGHT HAND CONSOLE LIGHT, No PLATE LIGHTS** **TURN SIGNAL SWITCH, FLASHER RELAY, REAR TURN SIGNAL LIGHTS** **HAZARD WARNING LIGHT SWITCH, FRONT TURN SIGNAL LIGHTS**




## Key

1. FUSE 7 (10 AMP))
2. FUSE 6 (10 AMP)
3. FENDER NUMBER PLATE LIGHT (IF EQUIPPED)
4. LEFT HAND FRONT SIDE LIGHT
5. RIGHT HAND FRONT SIDE LIGHT
6. 7 PIN TRAILER CONNECTOR
7. LEFT HAND REAR TAIL LIGHT
8. RIGHT HAND REAR TAIL LIGHT
9. RIGHT HAND CONSOLE LIGHT
10. LEFT HAND NUMBER PLATE LIGHT
11. RIGHT HAND NUMBER PLATE LIGHT
12. MAIN LIGHT SWITCH
13. FUSE 18 (15 AMP)
14. FUSE 21 (15 AMP)
15. HAZARD WARNING LIGHT SWITCH
16. STALK SWITCH (TURN/HORN/HIGH-LOW BEAM)
17. TURN SIGNAL SELF CANCELLING MODULE (IF EQUIPPED)
18. INSTRUMENT CLUSTER
19. FLASHER RELAY
20. LEFT HAND REAR TURN SIGNAL LIGHT
21. RIGHT HAND REAR TURN SIGNAL LIGHT
22. LEFT HAND FRONT TURN SIGNAL LIGHT
23. RIGHT HAND FRONT TURN SIGNAL LIGHT

A. TO RADIO
B. TO HORN
C. TO HEADLIGHT CIRCUIT

https://truckmanualshub.com/


This Page Has been Left Blank

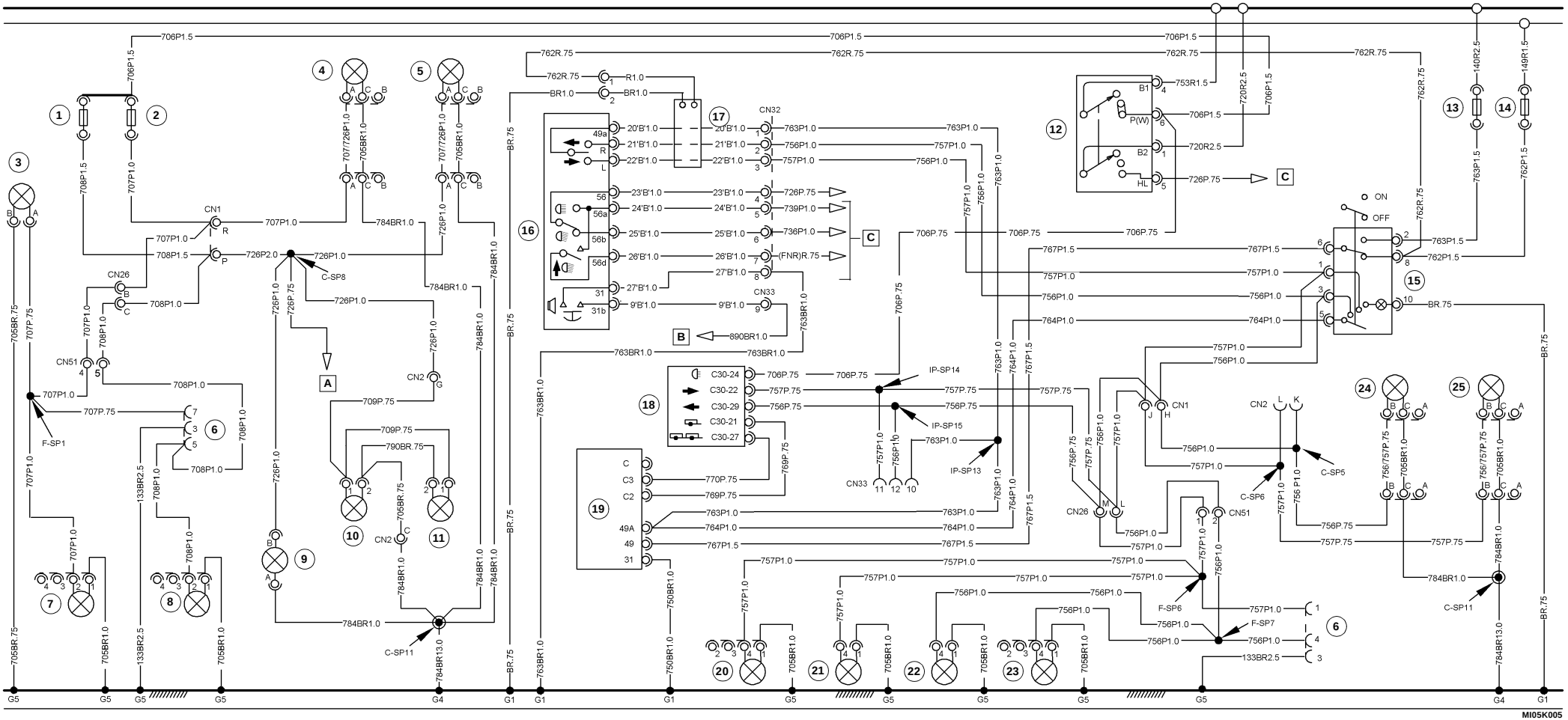
https://truckmanualshub.com/


# Schematic Circuit (For XtraSpeed and XtraSpeed - E Tractors)

**FRONT SIDE LIGHTS, TAIL LIGHTS, RIGHT HAND CONSOLE LIGHT, No PLATE LIGHTS**

**TURN SIGNAL SWITCH, FLASHER RELAY, REAR TURN SIGNAL LIGHTS**

**HAZARD WARNING LIGHT SWITCH, FRONT TURN SIGNAL LIGHTS**




## Key

1. FUSE 7 (10 AMP))
2. FUSE 6 (10 AMP)
3. FENDER NUMBER PLATE LIGHT (IF EQUIPPED)
4. LEFT HAND FRONT SIDE LIGHT
5. RIGHT HAND FRONT SIDE LIGHT
6. 7 PIN TRAILER CONNECTOR
7. LEFT HAND REAR TAIL LIGHT
8. RIGHT HAND REAR TAIL LIGHT
9. RIGHT HAND CONSOLE LIGHT
10. LEFT HAND NUMBER PLATE LIGHT
11. RIGHT HAND NUMBER PLATE LIGHT
12. MAIN LIGHT SWITCH
13. FUSE 18 (15 AMP)
14. FUSE 21 (15 AMP)
15. HAZARD WARNING LIGHT SWITCH
16. STALK SWITCH (TURN/HORN/HIGH-LOW BEAM)
17. TURN SIGNAL SELF CANCELLING MODULE (IF EQUIPPED)
18. INSTRUMENT CLUSTER
19. FLASHER RELAY
20. LEFT HAND REAR TURN SIGNAL LIGHT
21. OPTIONAL LEFT HAND TURN SIGNAL EXTREMITY LIGHT
22. OPTIONAL RIGHT HAND TURN SIGNAL EXTREMITY LIGHT
23. RIGHT HAND REAR TURN SIGNAL LIGHT
24. LEFT HAND FRONT TURN SIGNAL LIGHT
25. RIGHT HAND FRONT TURN SIGNAL LIGHT

A. TO RADIO
B. TO HORN
C. TO HEADLIGHT CIRCUIT

https://truckmanualshub.com/


This Page Has been Left Blank

https://truckmanualshub.com/



# WARNING AND TURN SIGNAL LIGHTS (American Specification Tractors Only)

## Turn Signal and Warning Light Circuits

### Warning Light Circuits

Battery power flows through fuse 19 to the rotary light switch terminal 4. With the light switch at positions 2 or 3, power flows through the switch to terminal 6 then to the flasher relay terminal 1. Power then flows from terminal 4 to ground at G1 activating the relay.

With the flasher relay is activated, battery power flows through fuse 19 to the flasher relay terminal 1 then through the relay to terminals 7, 5 and 4.

From terminal 7 power flows to the trailer connector terminal 5 and to the right hand rear fender turn signal light. Power also flows to the right hand cab mounted turn signal lights.

From terminal 5 power flows to the trailer connector terminal 3 and to the left hand rear fender turn signal light. Power also flows to the left hand front and rear cab mounted turn signal lights.

Power flows through the cab mounted turn signal lights to ground at G4 and the fender lights at G5, illuminating the lights (flashing).

### Turn Signal Light Circuits

Battery power flows through fuse 17 to the flasher relay terminal 2 and the self cancelling module (if equipped). Power also flows through fuse 18 to the stalk switch terminal 49A.

### Right Turn

With the stalk switch in right turn position, power flows through the switch to terminal L, through the self cancelling module (if equipped) to the flasher relay terminal 5. Power then flows to the trailer connector terminal 3 and to the left hand rear fender turn signal light. Power also flows to the left hand cab mounted turn signal lights.

Power flows through the left hand cab mounted turn signal lights to ground at G4 and the left hand fender turn signal light at G5, illuminating the lights (ON constant).

Power at the flasher relay terminal 5 controls the relay to direct power available at terminal 2 through the relay to terminals 3 and 7. Power at terminal 7 then flows to the right hand rear fender turn signal light and to the right hand cab mounted turn signal lights.

Power flows through the right hand cab mounted turn signal lights to ground at G4 and the right hand fender turn signal light at G5, illuminating the lights (flashing).

Power also flows to the instrument cluster connector 30 pin 22, power flows through the instrument cluster right turn signal indicator lamp to connector 31 pin 14 (refer to Section 10009). Power then flows to ground at the battery negative terminal, illuminating (flashing) the indicator lamp.

https://truckmanualshub.com/



## Left Turn

With the stalk switch in left turn position, power flows through the switch to terminal R then through the self cancelling module (if equipped) to the flasher relay terminal 7. Power then flows to the trailer connector terminal terminal 5 and to the right hand rear fender turn signal light. Power also flows to the right hand cab mounted turn signal lights.

Power flows through the right hand cab mounted turn signal lights to ground at G4 and the right hand fender turn signal light at G5, illuminating the lights (ON constant).

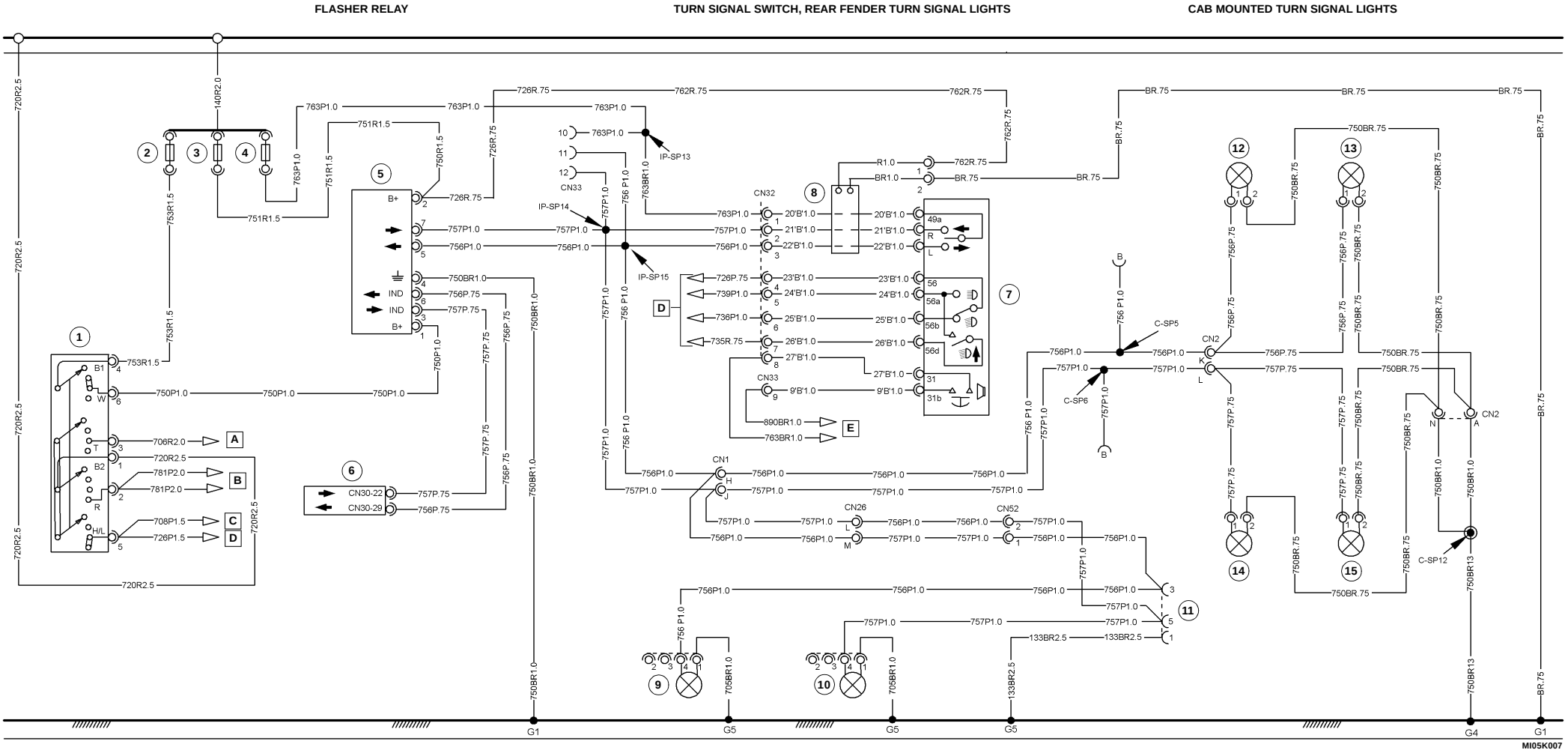
Power at the flasher relay terminal 7 controls the relay to direct power available at terminal 2 through the relay to terminals 5 and 6. Power at terminal 5 then flows to the left hand rear fender turn signal light and to the left hand cab mounted turn signal lights.

Power flows through the left hand cab mounted turn signal lights to ground at G4 and the left hand fender turn signal light at G5, illuminating the lights (flashing).

Power also flows to the instrument cluster at connector 30 pin 29 power flows through the instrument cluster left turn signal indicator lamp to connector 31 pin 14 (refer to Section 10009). Power then flows to ground at the battery negative terminal, illuminating (flashing) the indicator lamp.

https://truckmanualshub.com/


# Schematic Circuit (For XtraSpeed and XtraSpeed - E Tractors)




## Key

1. MAIN LIGHT SWITCH
2. FUSE 19 (5 AMP)
3. FUSE 17 (15 AMP)
4. FUSE 18 (15 AMP)
5. FLASHER RELAY
6. INSTRUMENT CLUSTER
7. STALK SWITCH (TURN/HORN/HIGH-LOW BEAM)
8. TURN SIGNAL SELF CANCELLING MODULE (IF EQUIPPED)
9. LEFT HAND REAR FENDER TURN SIGNAL LIGHT
10. RIGHT HAND REAR FENDER TURN SIGNAL LIGHT
11. 7 PIN TRAILER CONNECTOR
12. LEFT HAND FRONT CAB MOUNTED TURN SIGNAL LIGHT
13. LEFT HAND REAR CAB MOUNTED TURN SIGNAL LIGHT
14. RIGHT HAND FRONT CAB MOUNTED TURN SIGNAL LIGHT
15. RIGHT HAND REAR CAB MOUNTED TURN SIGNAL LIGHT

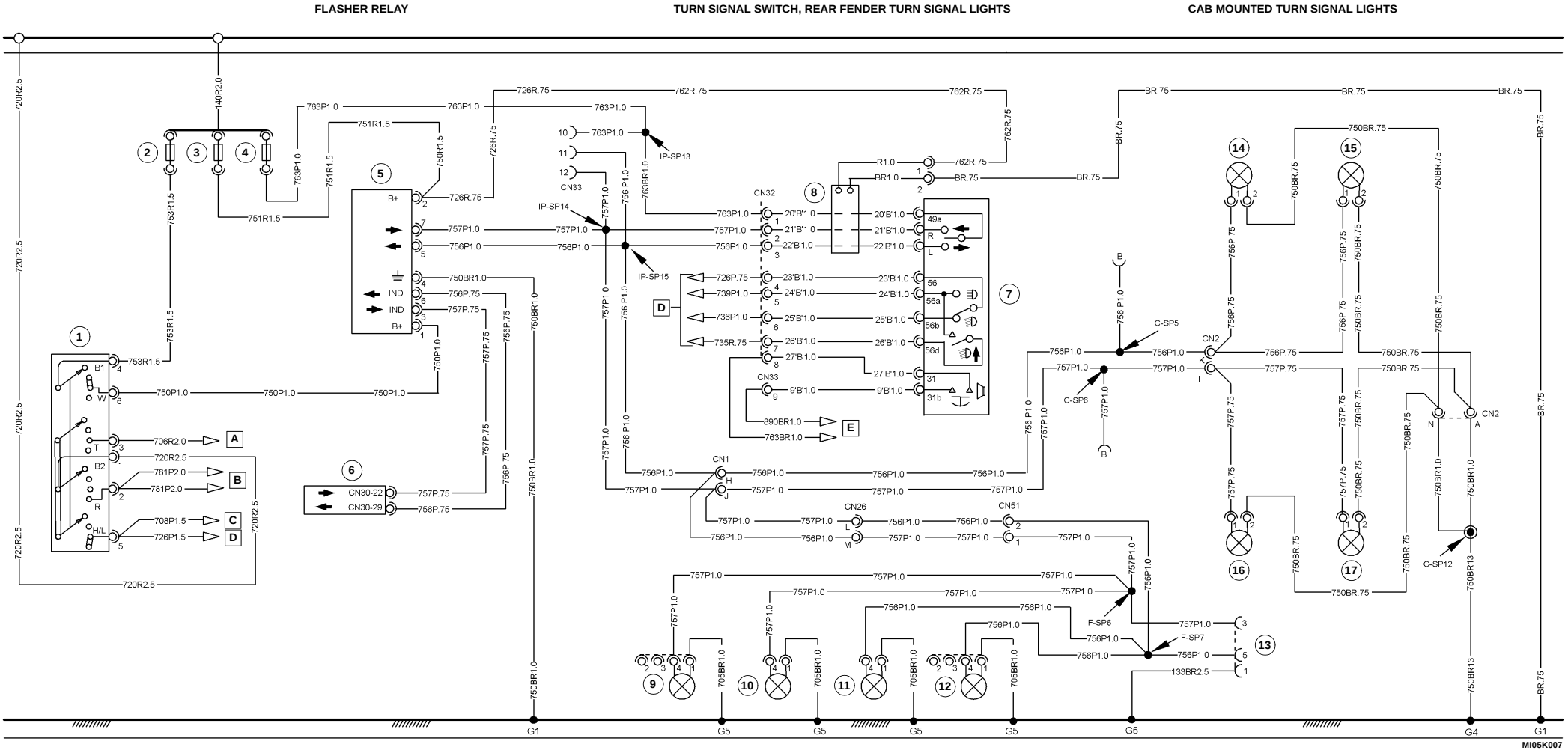
A. TO TAIL LIGHTS
B. TO WORK LIGHT CIRCUIT
C. TO RADIO/RIGHT HAND CONSOLE LIGHT CIRCUIT
D. TO HEADLIGHT CIRCUIT
E. TO HORN CIRCUIT

https://truckmanualshub.com/


This Page Has been Left Blank

https://truckmanualshub.com/


# Schematic Circuit (For XtraSpeed - E Plus Tractors)




## Key

1. MAIN LIGHT SWITCH
2. FUSE 19 (5 AMP)
3. FUSE 17 (15 AMP)
4. FUSE 18 (15 AMP)
5. FLASHER RELAY
6. INSTRUMENT CLUSTER
7. STALK SWITCH (TURN/HORN/HIGH-LOW BEAM)
8. TURN SIGNAL SELF CANCELLING MODULE (IF EQUIPPED)
9. LEFT HAND REAR FENDER TURN SIGNAL LIGHT
10. RIGHT HAND REAR FENDER TURN SIGNAL LIGHT
11. OPTIONAL LEFT HAND TURN SIGNAL EXTREMITY LIGHT
12. OPTIONAL RIGHT HAND TURN SIGNAL EXTREMITY LIGHT
13. 7 PIN TRAILER CONNECTOR
14. LEFT HAND FRONT CAB MOUNTED TURN SIGNAL LIGHT
15. LEFT HAND REAR CAB MOUNTED TURN SIGNAL LIGHT
16. RIGHT HAND FRONT CAB MOUNTED TURN SIGNAL LIGHT
17. RIGHT HAND REAR CAB MOUNTED TURN SIGNAL LIGHT

A. TO TAIL LIGHTS
B. TO WORK LIGHT CIRCUIT
C. TO RADIO/RIGHT HAND CONSOLE LIGHT CIRCUIT
D. TO HEADLIGHT CIRCUIT
E. TO HORN CIRCUIT

https://truckmanualshub.com/


# GRILLE HEADLIGHTS, CAB MOUNTED HEADLIGHTS AND REAR FOG LIGHTS (European Specification Tractors Only)

## Grille Headlight Circuit

### Headlight Power Supply Circuit

Battery power is connected to the main light switch at terminal 1. With the main light switch in position 3 power flows through the switch from terminal 1 to terminal 5, then to terminal 56 of the stalk switch. Power is also connected to terminals 30 of both the headlight low and high beam relays.

**NOTE:** *On tractors not equipped with cab mounted headlights, two jumper leads are installed into the upper/lower headlight switch connector instead of the switch.*

### Headlight Low Beam

With the stalk switch in the Low Beam position power flows through the stalk switch from terminal 56 to terminal 56b. Power then flows to the low beam relay terminal 1, through the relay windings to terminal 2 and to ground at G1, energizing the relay.

With the low beam relay energized battery power flows from terminal 3 to terminal 5 of the relay then to terminal 5 of the upper/lower headlight switch terminal block. Power flows from terminal 5 to terminal 7 of the upper/lower headlight switch terminal block through a jumper lead to the circuit breaker 10. Power flows from the circuit breaker 10 to both the left hand and right hand low beam headlights. Power then flows through the headlights to ground at G6 (for XTX185/200 tractors) or the battery negative terminal (for XTX215 tractors), illuminating both the low beam headlights.

### Headlight High Beam

With the stalk switch in the High Beam position power flows through the stalk switch from terminal 56 to terminal 56a. Power then flows to the high beam relay terminal 1, through the relay windings to terminal 2 and to ground at G1, energizing the relay.

With the high beam relay energized battery power flows from terminal 3 to terminal 5 of the relay then to terminal 6 of the upper/lower headlight switch terminal block. Power flows from terminal 6 to terminal 8 of the upper/lower headlight switch terminal block through a jumper lead to the fuse 13. Power flows from fuse 13 to both the left hand and right hand low beam headlights. Power then flows through the headlights to ground at G6 (for XTX185/200 tractors) or the battery negative terminal (for XTX215 tractors), illuminating both the high beam headlights.

Power also flows from the high beam relay terminal 5 to the instrument cluster connector 30 pin 31, power flows through the instrument cluster high beam warning lamp to connector 31 pin 14 (refer to Section 10009). Power then flows to ground at the battery negative terminal, illuminating the high beam warning lamp.

https://truckmanualshub.com/



# Cab Mounted Headlight Circuit

## Upper/Lower Switch OFF

With the upper/lower headlight switch OFF (grille position) the headlight circuit operates the same as the grille headlight circuit, except that the jumper leads are replaced with the upper/lower headlight switch.

## Upper/Lower Switch ON

With the stalk switch in the Low Beam position power flows through the stalk switch from terminal 56 to terminal 56b. Power then flows to the low beam relay terminal 1, through the relay windings to terminal 2 and to ground at G1, energizing the relay.

With the low beam relay energized battery power flows from terminal 3 to terminal 5 of the relay then to terminal 5 of the upper/lower headlight switch terminal block. Power flows from terminal 5 to terminal 1 of the upper/lower headlight switch to fuse 15. Power flows the fuse to both the left hand and right hand cab mounted headlights. Power then flows through the headlights to ground at G4, illuminating both the cab mounted headlights.

Power also flows from terminal 1 of the upper/lower headlight switch to terminal 9, through the internal warning light, to terminal 10 and to ground at G1 illuminating the internal warning light.

With the stalk switch in the High Beam position power flows through the stalk switch from terminal 56 to terminal 56a. Power then flows to the low beam relay terminal 1, through the relay windings to terminal 2 and to ground at G1, energizing the relay.

With the high beam relay energized battery power flows from terminal 3 to terminal 5 of the relay then to terminal 6 of the upper/lower headlight switch terminal block. Power flows from terminal 6 to terminal 2 of the upper/lower headlight switch to fuse 15. Power flows the fuse to both the left hand and right hand cab mounted headlights. Power then flows through the headlights to ground at G4, illuminating both the cab mounted headlights. Power also flows from terminal 2 of the upper/lower headlight switch to terminal 9, through the internal warning light, to terminal 10 and to ground at G1 illuminating the internal warning light.

With the high beam relay energized power flows from terminal 5 of the relay to the instrument cluster connector 30 pin 31, power flows through the instrument cluster high beam warning lamp to connector 31 pin 14 (refer to Section 10009). Power then flows to ground at the battery negative terminal, illuminating the high beam warning lamp.

https://truckmanualshub.com/



# Rear Fog Light Circuit

The rear fog light will only function when the rotary headlight switch is at position 2, low beam is selected and the upper/lower switch is OFF (grille) position.

Battery power is connected to the main light switch at terminal 1. With the main light switch in position 3 power flows through the switch from terminal 1 to terminal 5, then to terminal 56 of the stalk switch. Power is also connected to terminal 30 of the headlight low relay.

With the stalk switch in the Low Beam position power flows through the stalk switch from terminal 56 to terminal 56b. Power then flows to the low beam relay terminal 1, through the relay windings to terminal 2 and to ground at G1, energizing the relay.

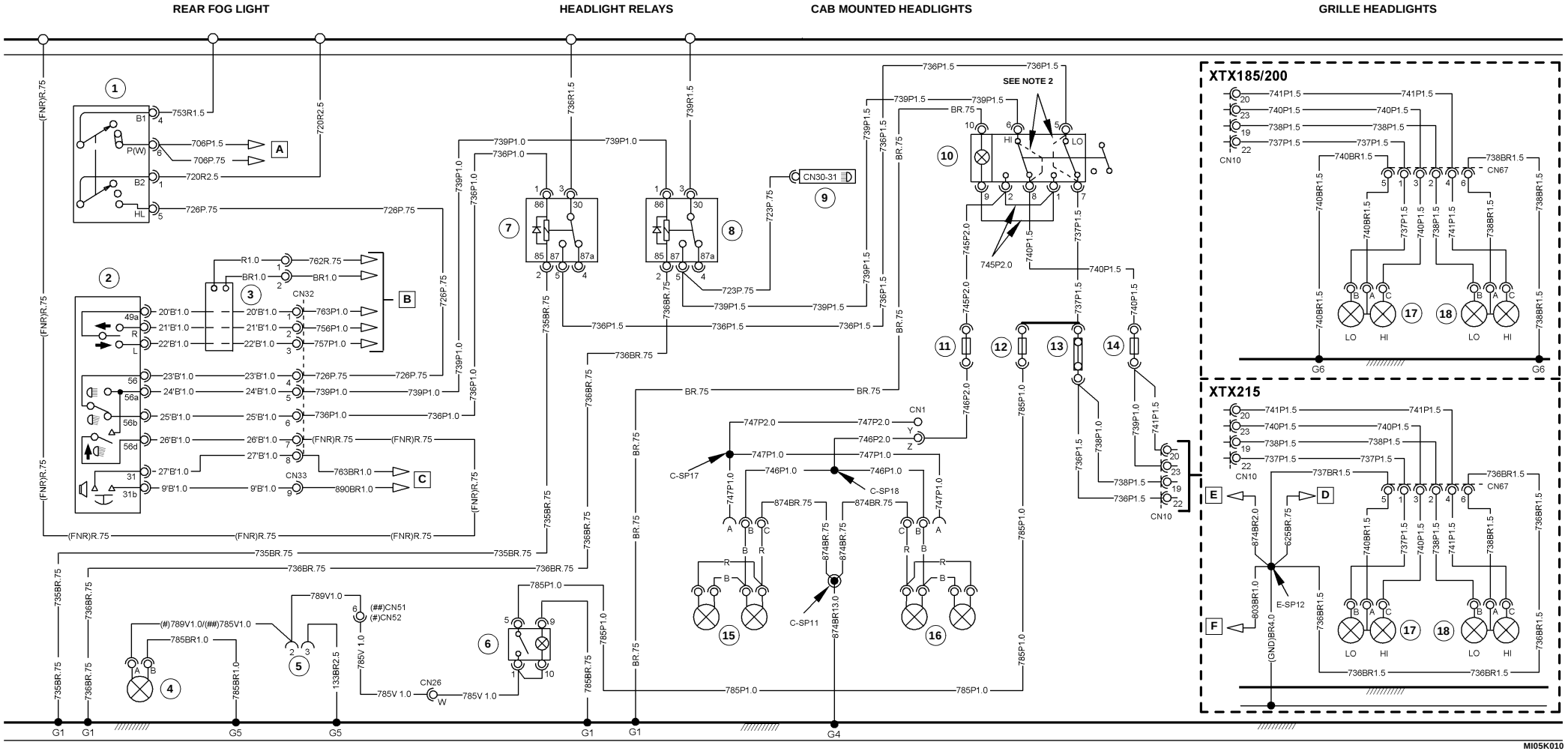
With the low beam relay energized battery power flows from terminal 3 to terminal 5 of the relay then to terminal 5 of the upper/lower headlight switch terminal block. Power flows from terminal 5 to terminal 7 of the upper/lower headlight switch terminal block through a jumper lead or through the upper/lower headlight switch to fuse 11.

Power flows through fuse 11 to the rear fog light switch terminal 5. With the switch in the On position power flows from terminal 5 to terminal 1 of the switch and to the rear fog light and the 7 pin trailer connector pin 2. Power then flows though the rear fog light to ground at G5, illuminating the rear fog light.

Power also flows from terminal 1 of the fog light switch to terminal 10, through the internal warning light, to terminal 9 of the switch. Power then flows to ground at G1 illuminating the internal warning light.

https://truckmanualshub.com/


## Schematic Circuit




### Key

1. MAIN LIGHT SWITCH
2. STALK SWITCH (TURN/HORN/HIGH-LOW BEAM)
3. TURN SIGNAL SELF CANCELLING MODULE (IF EQUIPPED)
4. REAR FOG LIGHT
5. 7 PIN TRAILER CONNECTOR
6. FOG LIGHT SWITCH
7. HEADLIGHT LOW BEAM RELAY
8. HEADLIGHT HIGH BEAM RELAY
9. INSTRUMENT CLUSTER
10. UPPER/LOWER HEADLIGHT SWITCH (IF EQUIPPED) - SEE NOTE 3
11. FUSE 15 (15 AMP)
12. FUSE 11 (15 AMP)
13. CIRCUIT BREAKER - FUSE LOCATION 10 (10 AMP)
14. FUSE 13 (10 AMP)
15. LEFT HAND CAB MOUNTED HEADLIGHT
16. RIGHT HAND CAB MOUNTED HEADLIGHT
17. LEFT HAND GRILLE HEADLIGHT
18. RIGHT HAND GRILLE HEADLIGHT

A. TO SIDE/TAIL LIGHTS
B. TO TURN SIGNAL CIRCUIT
C. TO HORN CIRCUIT
D. FROM STARTER RELAY
E. FROM GRILLE MOUNTED WORK LIGHTS
F. FROM AIR CONDITIONING SUPPRESSION DIODE

**NOTE 2:** *For tractors not equipped with cab mounted headlights, two pink 1.5 mm jumper leads are installed between the open terminals of the switch terminal block as shown.*

https://truckmanualshub.com/


# HEADLIGHTS, RIGHT HAND CONSOLE LIGHT AND TAIL LIGHTS (American Specification Tractors Only)

## Headlights Circuit

### Headlight Power Supply

Battery power is connected to the main light switch at terminal 1. With the main light switch in position 3 power flows through the switch from terminal 1 to terminal 5, then to terminal 56 of the stalk switch. Power is also connected to terminals 30 of both the headlight low and high beam relays.

### Headlight Low Beam

With the stalk switch in the Low Beam position power flows through the stalk switch from terminal 56 to terminal 56b. Power then flows to the low beam relay terminal 1, through the relay windings to terminal 2 and to ground at G1, energizing the relay.

With the low beam relay energized battery power flows from terminal 3 to terminal 5 of the relay then to terminal 5 of the upper/lower headlight switch terminal block (switch not used on American Specification tractors). Power flows from terminal 5 to terminal 7 of the switch terminal block through a jumper lead to the circuit breaker 10. Power flows from the circuit breaker 10 to both the left hand and right hand low beam headlights. Power then flows through the headlights to ground at G6 (for XTX185/200 tractors) or the battery negative terminal (for XTX215 tractors), illuminating both the low beam headlights.

### Headlight High Beam

With the stalk switch in the High Beam position power flows through the stalk switch from terminal 56 to terminal 56a. Power then flows to the high beam relay terminal 1, through the relay windings to terminal 2 and to ground at G1, energizing the relay.

With the high beam relay energized battery power flows from terminal 3 to terminal 5 of the relay then to terminal 6 of the upper/lower headlight switch terminal block switch not used on American Specification tractors). Power flows from terminal 6 to terminal 8 of the switch terminal block through a jumper lead to the fuse 13. Power flows from fuse 13 to both the left hand and right hand low beam headlights. Power then flows through the headlights to ground at G6 (for XTX185/200 tractors) or the battery negative terminal (for XTX215 tractors), illuminating both the high beam headlights.

Power also flows from the high beam relay terminal 5 to the instrument cluster connector 30 pin 31, power flows through the instrument cluster high beam warning lamp to connector 31 pin 14 (refer to Section 10009). Power then flows to ground at the battery negative terminal, illuminating the high beam warning lamp.

## Right Hand Console Light Circuit

Battery power is connected to the main light switch at terminal 1. With the main light switch in position 3 power flows through the switch from terminal 1 to terminal 5. Power then flows to the right hand console light. Power then flows through the right hand console light to ground at G4, illuminating the light.

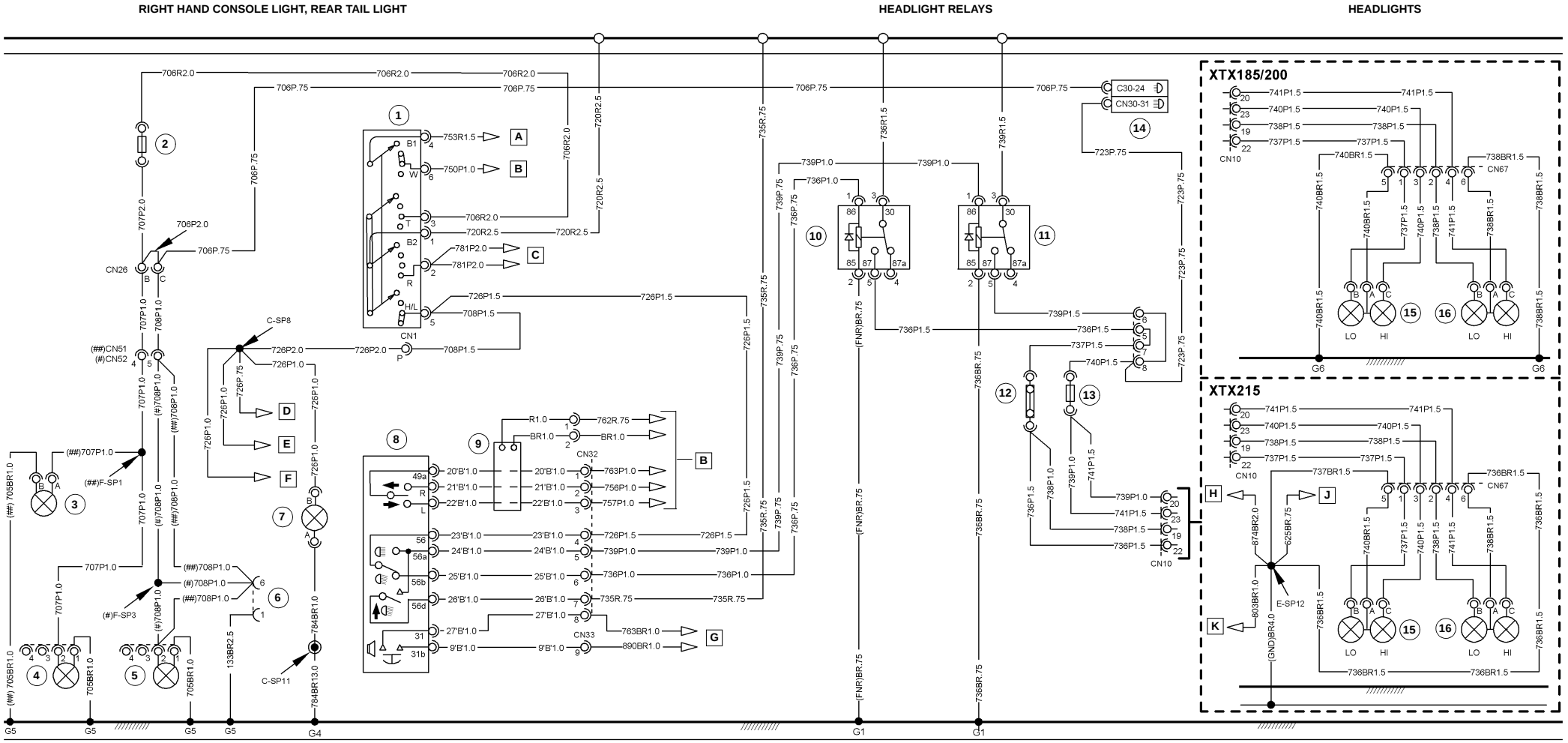
## Rear Tail Light Circuits

Battery power is connected to the main light switch at terminal 1. When the switch in position 3, power flows through the switch to terminal 3 then through fuse 6. Power flows through the fuse to the trailer connector terminal 6 and to both rear tail lights. Power flows through the lights to ground at G5 illuminating the lights.

Power also flows to the instrument cluster connector 30 pin 24 power flows through the instrument cluster tail light warning lamp to connector 31 pin 14 (refer to Section 10009). Power then flows to ground at the battery negative terminal, illuminating the warning lamp.

https://truckmanualshub.com/


# Schematic Circuit




MI05K011

## Key

1. MAIN LIGHT SWITCH
2. FUSE 6 (10 AMP)
3. (##) OPTIONAL REAR No PLATE LIGHT
4. LEFT HAND TAIL LIGHT (IF EQUIPPED)
5. RIGHT HAND TAIL LIGHT (IF EQUIPPED)
6. 7 PIN TRAILER CONNECTOR
7. RIGHT HAND CONSOLE LIGHT
8. STALK SWITCH (TURN/HORN/HIGH-LOW BEAM)
9. TURN SIGNAL SELF CANCELLING MODULE (IF EQUIPPED)
10. HEADLIGHT LOW BEAM RELAY
11. HEADLIGHT HIGH BEAM RELAY
12. CIRCUIT BREAKER - FUSE LOCATION 10 (10 AMP)
13. FUSE 13 (10 AMP)
14. INSTRUMENT CLUSTER
15. LEFT HAND HEADLIGHT
16. RIGHT HAND HEADLIGHT

A. FROM FUSE F19 (5 AMP)
B. TO TURN SIGNAL CIRCUIT
C. TO WORK LIGHT CIRCUIT
D. TO RADIO
E. TO REAR CAB No PLATE LIGHTS (NOT USED)
F. TO FRONT POSITION LIGHTS (NOT USED)
G. TO HORN CIRCUIT
H. FROM GRILLE MOUNTED WORK LIGHTS
J. FROM STARTER RELAY
K. FROM AIR CONDITIONING SUPPRESSION DIODE

(##) - XTRASPEED - E PLUS TRACTORS ONLY.

https://truckmanualshub.com/


This Page Has been Left Blank

https://truckmanualshub.com/



# WORK LIGHTS
# (European Specification Tractors Only)

## Rear Work Lights

### Rear Work Light Switch Power Circuit

Battery power is available at the rear work light switch terminal 3 through a circuit breaker in fuse location 3 and terminal 6 through fuse 4.

Battery power is also available at terminals 3 of the left and right hand rear work light relays, through the circuit breaker in fuse location 3 for the left hand rear cab relay and a circuit breaker in fuse location 9 for the right hand rear cab relay.

### Work Light Switch - Position 1

Battery power at terminal 6 of the rear work light switch flows through the switch to terminal 2 and to the rear fender work lights. Power flows through the rear fender work lights to ground at G5 illuminating the work lights.

Power also flows from terminal 2 of the rear work light switch to the instrument cluster connector 30 pin 25, power flows through the instrument cluster rear work light warning lamp to connector 31 pin 14 (refer to Section 10009). Power then flows to ground at the battery negative terminal, illuminating the rear work light warning lamp.

### Work Light Switch - Position 2

The rear fender work lights operate the same as in the switch position 1 with the additional lights as follows:-

Battery power at terminal 3 of the rear work light switch flows through the switch to terminal 1 and to both the left and right hand rear cab work light relays terminals 1. Power flows through the relays to terminals 2 and to ground at G1 energizing the relays.

With the left hand rear work light relay energized battery power flows from terminal 3 to terminal 5 of the relay and to the left hand rear cab work lights. Power flows through the left hand rear cab work lights to ground at G4 illuminating the work lights.

With the right hand rear work light relay energized battery power flows from terminal 3 to terminal 5 of the relay and to the right hand rear cab work lights. Power flows through the right hand rear cab work lights to ground at G4 illuminating the work lights.

Power also flows from terminal 1 of the rear work light switch to terminal 9, through the internal warning light, to terminal 10 and to ground at G1 illuminating the internal warning light.

https://truckmanualshub.com/



# Front Work Lights

## Front Work Light Switch Power Circuit

Battery power is available at the front work light switch at terminal 3 through a circuit breaker in fuse location 12 and terminal 6 through fuse 2.

Battery power is available at terminals 3 of the left and right hand front cab work light relays, through the circuit breaker in fuse location 12 for the left hand front cab relay and circuit breaker 44 for the right hand front cab relay. Battery power is also available at terminal 3 of the lower front/grille work light relay, through fuse 2.

## Work Light Switch - Position 1

Battery power at terminal 6 of the front work light switch flows through the switch to terminal 2 and to the front lower/grille work light relay terminal 1. Power flows through the relay to terminals 2 and to ground at G1 energizing the relay.

With the lower/grille work light relay energized battery power flows from terminal 3 to terminal 5 of the relay and to the front lower and grille work lights. Power flows through the front lower work lights to ground at G4 illuminating the work lights. Power flows through the grille lights to ground at G6 (for XTX185/200 tractors or the battery negative terminal for XTX 215 tractors), illuminating the work lights.

Power also flows from terminal 5 of the left hand front work light relay to the instrument cluster connector 30 pin 24, power flows through the instrument cluster front work light warning lamp to connector 31 pin 14 (refer to Section 10009). Power then flows to ground at the battery negative terminal, illuminating the front work light warning lamp.

## Work Light Switch - Position 2

The lower front and grille work lights operate the same as in the switch position 1 with the additional lights as follows:

Battery power at terminal 3 of the front work light switch flows through the switch to terminal 1 and to both the left and right hand front cab work light relays terminals 1. Power flows through the relays to terminals 2 and to ground at G1 energizing the relays.

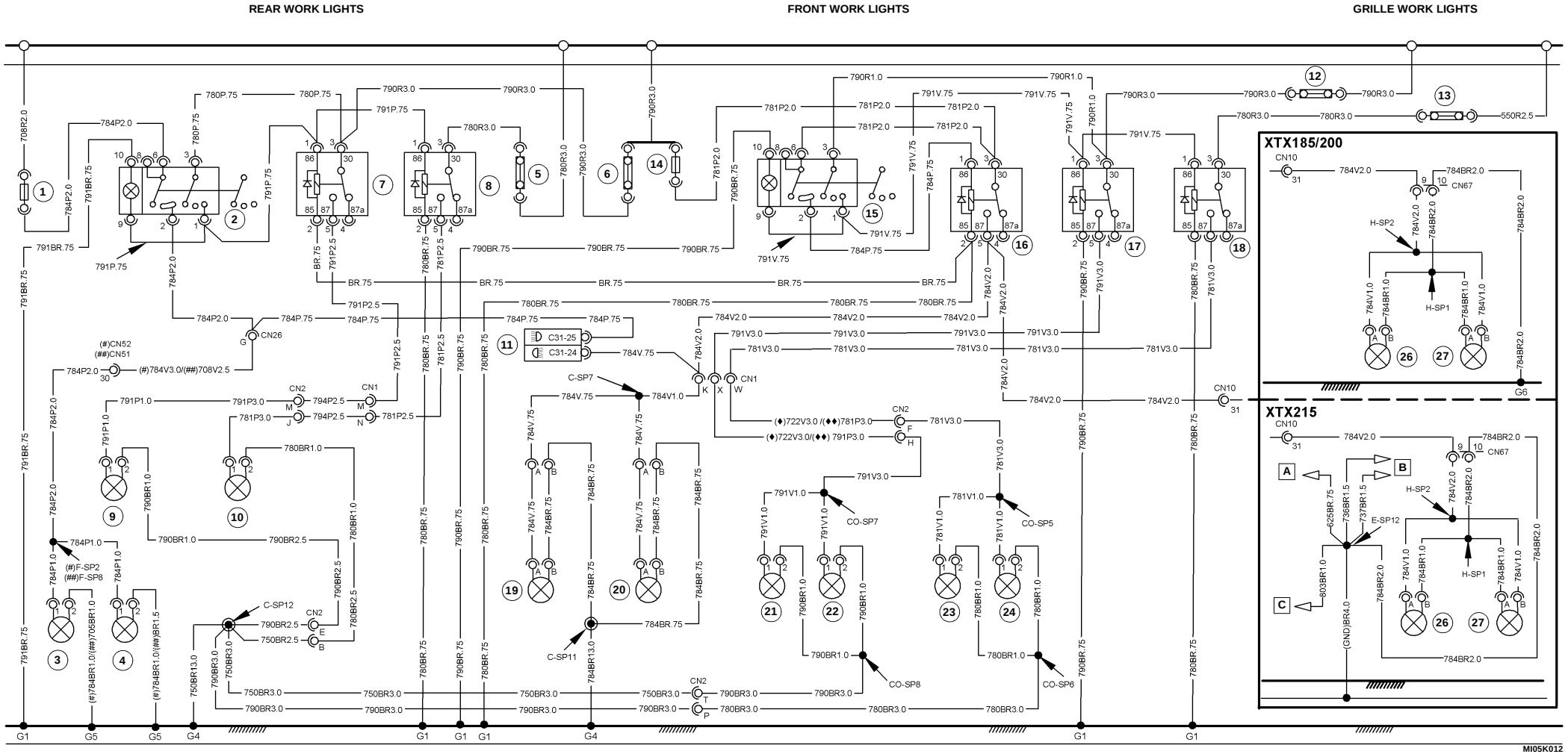
With the left hand front cab work light relay energized battery power flows from terminal 3 to terminal 5 of the relay and to the left hand front cab work lights. Power flows through the left hand front cab work lights to ground at G4 illuminating the work lights.

With the right hand front cab work light relay energized battery power flows from terminal 3 to terminal 5 of the relay and to the right hand front cab work lights. Power flows through the right hand front cab work lights to ground at G4 illuminating the work lights.

Power also flows from terminal 1 of the front work light switch to terminal 9, through the internal warning light, to terminal 10 and to ground at G1 illuminating the internal warning light.

https://truckmanualshub.com/


# Schematic Circuit




## Key

1. FUSE 4 (15 AMP)
2. REAR WORK LIGHT SWITCH
3. LEFT HAND REAR FENDER WORK LIGHT
4. RIGHT HAND REAR FENDER WORK LIGHT
5. CIRCUIT BREAKER - FUSE LOCATION 9 (25 AMP)
6. CIRCUIT BREAKER - FUSE LOCATION 3 (25 AMP)
7. LEFT HAND REAR CAB WORK LIGHT RELAY
8. RIGHT HAND REAR CAB WORK LIGHT RELAY
9. LEFT HAND REAR CAB WORK LIGHT
10. LEFT HAND REAR CAB WORK LIGHT
11. INSTRUMENT CLUSTER
12. CIRCUIT BREAKER - FUSE LOCATION 12 (25 AMP)
13. CIRCUIT BREAKER - FUSE LOCATION 44 (25 AMP)
14. FUSE 2 (25 AMP)
15. FRONT WORK LIGHT SWITCH
16. LOWER FRONT WORK LIGHT RELAY
17. LEFT HAND FRONT CAB UPPER WORK LIGHT RELAY
18. RIGHT HAND FRONT CAB UPPER WORK LIGHT RELAY
19. LEFT HAND FRONT LOWER CAB WORK LIGHT
20. RIGHT HAND FRONT LOWER CAB WORK LIGHT
21. LEFT HAND FRONT OUTER CAB WORK LIGHT
22. LEFT HAND FRONT INNER CAB WORK LIGHT
23. RIGHT HAND FRONT OUTER CAB WORK LIGHT
24. RIGHT HAND FRONT INNER CAB WORK LIGHT
26. LEFT HAND FRONT GRILLE CAB WORK LIGHT
27. RIGHT HAND FRONT GRILLE CAB WORK LIGHT

A. FROM STARTER RELAY
B. FROM HEADLIGHT CIRCUIT
C. FROM AIR CONDITIONING SUPPRESSION DIODE

(#) - XTRASPEED AND XTRASPEED - E TRACTORS ONLY.
(##) - XTRASPEED - E PLUS TRACTORS ONLY.
(♦) - TRACTORS NOT EQUIPPED WITH AUTOMATIC TEMPERATURE CONTROL ONLY.
(♦♦)- TRACTORS EQUIPPED WITH AUTOMATIC TEMPERATURE CONTROL ONLY.

https://truckmanualshub.com/


This Page Has been Left Blank

https://truckmanualshub.com/



# WORK LIGHTS
# (American Specification Tractors Only)

## Rear Work Lights

**NOTE:** *The rear work light will only operate with the main light switch in position 4.*

### Rear Work Light Switch Power Circuit

Battery power is connected to the main light switch at terminal 1. With the main light switch in position 4 power flows through the switch from terminals 3 and 6 of the rear work light switch.

Battery power is available at terminals 3 of the left and right hand rear work light relays, through the circuit breaker in fuse location 3 for the left hand rear cab relay and a circuit breaker in fuse location 9 for the right hand rear cab relay.

### Work Light Switch - Position 1

Power from the main light switch available at terminal 6 of the rear work light switch flows through the switch to terminal 2, through fuse 4 to the rear fender work lights. Power flows through the rear fender work lights to ground at G5 illuminating the work lights.

Power also flows from fuse 4 to the rear work light switch to the instrument cluster connector 30 pin 25, power flows through the instrument cluster rear work light warning lamp to connector 31 pin 14 (refer to Section 10009). Power then flows to ground at the battery negative terminal, illuminating the rear work light warning lamp.

### Work Light Switch - Position 2

The rear fender work lights operate the same as in the switch position 1 with the additional lights as follows:

Power from the main light switch available at terminal 3 of the rear work light switch flows through the switch to terminal 1 and to both the left and right hand rear cab work light relays terminals 1. Power flows through the relays to terminals 2 and to ground at G1 energizing the relays.

With the left hand rear work light relay energized battery power flows from terminal 3 to terminal 5 of the relay and to the left hand rear cab work lights. Power flows through the left hand rear cab work lights to ground at G4 illuminating the work lights.

With the right hand rear work light relay energized battery power flows from terminal 3 to terminal 5 of the relay and to the right hand rear cab work lights. Power flows through the right hand rear cab work lights to ground at G4 illuminating the work lights.

Power also flows from terminal 1 of the rear work light switch to terminal 9, through the internal warning light, to terminal 10 and to ground at G1 illuminating the internal warning light.

https://truckmanualshub.com/



# Front Work Lights

**NOTE:** *The front work light will only operate with the main light switch in position 4.*

## Front Work Light Switch Power Circuit

Battery power is available at the front work light switch at terminal 3 through a circuit breaker in fuse location 12 and terminal 6 through fuse 2.

Battery power is available at terminals 3 of the left and right hand front cab work light relays, through the circuit breaker in fuse location 12 for the left hand front cab relay and circuit breaker 44 for the right hand front cab relay. Battery power is also available at terminal 3 of the lower front/grille work light relay, through fuse 2.

## Work Light Switch - Position 1

Power from the main light switch available at terminal 6 of the front work light switch flows through the switch to terminal 2 and to the front lower/grille work light relay terminal 1. Power flows through the relay to terminals 2 and to ground at G1 energizing the relay.

With the lower/grille work light relay energized battery power flows from terminal 3 to terminal 5 of the relay and to the front lower and grille work lights. Power flows through the front lower work lights to ground at G4 illuminating the work lights. Power flows through the grille lights to ground at G6 (for XTX185/200 tractors or the battery negative terminal for XTX 215 tractors), illuminating the work lights.

Power also flows from terminal 5 of the left hand front work light relay to the instrument cluster connector 30 pin 24, power flows through the instrument cluster front work light warning lamp to connector 31 pin 14 (refer to Section 10009). Power then flows to ground at the battery negative terminal, illuminating the front work light warning lamp.

## Work Light Switch - Position 2

The lower front and grille work lights operate the same as in the switch position 1 with the additional lights as follows:

Power from the main light switch available at terminal 3 of the front work light switch flows through the switch to terminal 1 and to both the left and right hand front cab work light relays terminals 1. Power flows through the relays to terminals 2 and to ground at G1 energizing the relays.

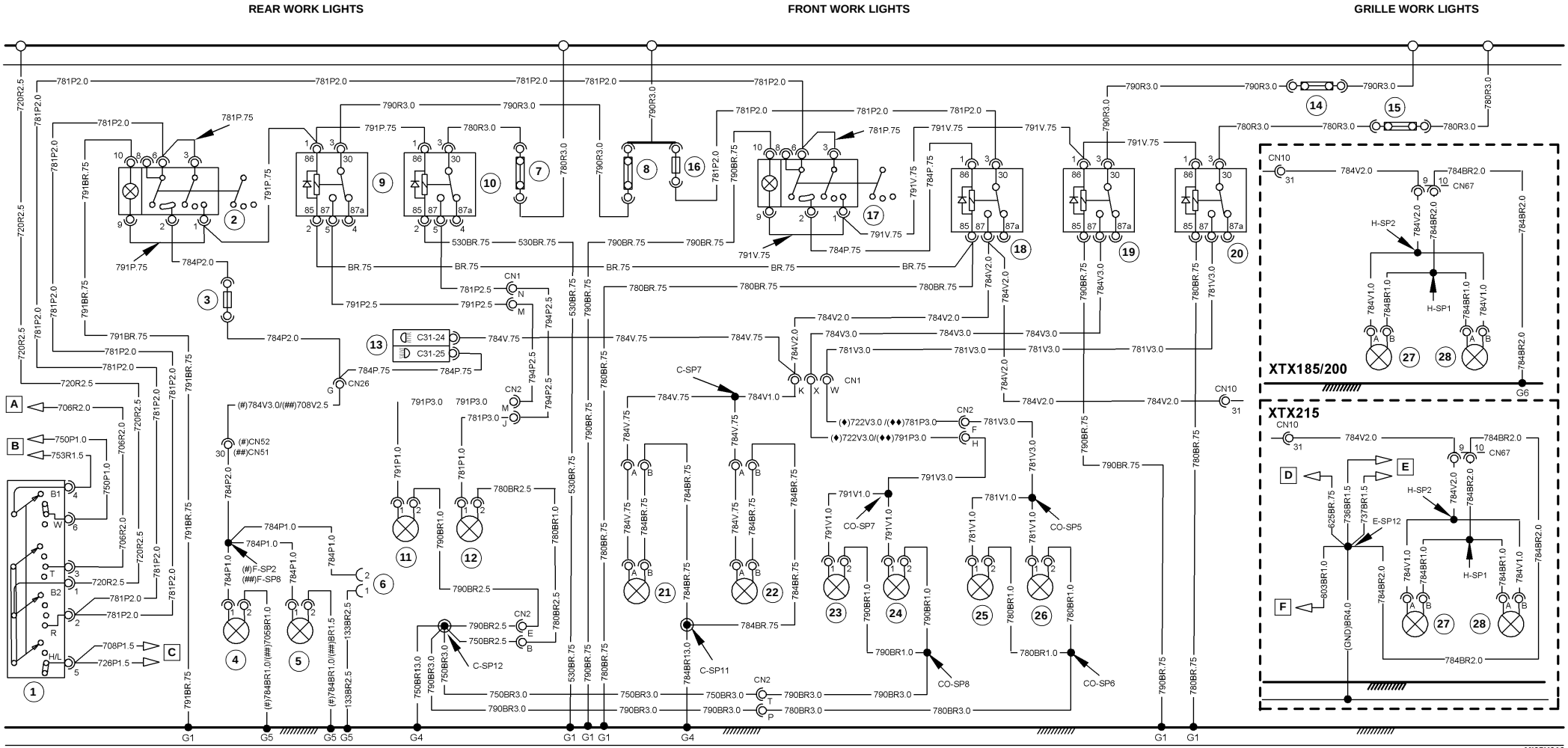
With the left hand front cab work light relay energized battery power flows from terminal 3 to terminal 5 of the relay and to the left hand front cab work lights. Power flows through the left hand front cab work lights to ground at G4 illuminating the work lights.

With the right hand front cab work light relay energized battery power flows from terminal 3 to terminal 5 of the relay and to the right hand front cab work lights. Power flows through the right hand front cab work lights to ground at G4 illuminating the work lights.

Power also flows from terminal 1 of the front work light switch to terminal 9, through the internal warning light, to terminal 10 and to ground at G1 illuminating the internal warning light.

https://truckmanualshub.com/


# Schematic Circuit




## Key

1. MAIN LIGHT SWITCH
2. REAR WORK LIGHT SWITCH
3. FUSE 4 (15 AMP)
4. LEFT HAND REAR FENDER WORK LIGHT
5. RIGHT HAND REAR FENDER WORK LIGHT
6. 7 PIN TRAILER CONNECTOR
7. CIRCUIT BREAKER - FUSE LOCATION 9 (25 AMP)
8. CIRCUIT BREAKER - FUSE LOCATION 3 (25 AMP)
9. LEFT HAND REAR CAB WORK LIGHT RELAY
10. RIGHT HAND REAR CAB WORK LIGHT RELAY
11. LEFT HAND REAR CAB WORK LIGHT
12. RIGHT HAND REAR CAB WORK LIGHT
13. INSTRUMENT CLUSTER
14. CIRCUIT BREAKER - FUSE LOCATION 12 (25 AMP)
15. CIRCUIT BREAKER - FUSE LOCATION 44 (25 AMP)
16. FUSE 2 (25 AMP)
17. FRONT WORK LIGHT SWITCH
18. LOWER FRONT WORK LIGHT RELAY
19. LEFT HAND FRONT CAB UPPER WORK LIGHT RELAY
20. RIGHT HAND FRONT CAB UPPER WORK LIGHT RELAY
21. LEFT HAND FRONT LOWER CAB WORK LIGHT
22. RIGHT HAND FRONT LOWER CAB WORK LIGHT
23. LEFT HAND FRONT OUTER CAB WORK LIGHT
24. LEFT HAND FRONT INNER CAB WORK LIGHT
25. RIGHT HAND FRONT INNER CAB WORK LIGHT
26. RIGHT HAND FRONT OUTER CAB WORK LIGHT
27. LEFT HAND FRONT GRILLE CAB WORK LIGHT
28. RIGHT HAND FRONT GRILLE CAB WORK LIGHT

A. TO SIDE/TAIL LIGHT CIRCUIT
B. TO TURN SIGNAL CIRCUIT
C. TO HEADLIGHT CIRCUIT
D. FROM STARTER RELAY
E. FROM HEADLIGHT CIRCUIT
F. FROM AIR CONDITIONING SUPPRESSION DIODE

(#) - XTRASPEED AND XTRASPEED - E TRACTORS ONLY.
(##) - XTRASPEED - E PLUS TRACTORS ONLY.
(♦) - TRACTORS NOT EQUIPPED WITH AUTOMATIC TEMPERATURE CONTROL ONLY.
(♦♦)- TRACTORS EQUIPPED WITH AUTOMATIC TEMPERATURE CONTROL ONLY.

https://truckmanualshub.com/


This Page Has been Left Blank

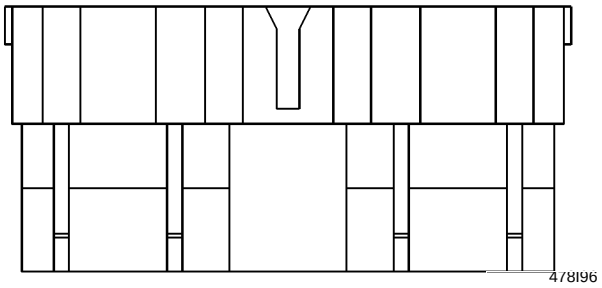
https://truckmanualshub.com/



# MAIN CONNECTORS

## Connector 1

**Location: Instrument panel**




**INSTRUMENT PANEL TO CAB HARNESS (CAB HARNESS SIDE)**

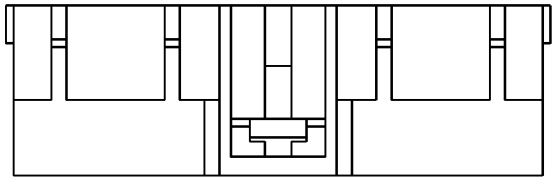
| Cavity | Wire No | Circuit |
|---|---|---|
| A | 830 R | FRONT WIPER MOTOR B+ |
| B | 835 O | FRONT WIPER/WASHER |
| C | 871 R | INTERIOR LIGHT, RADIO |
| D | 923 O | A/C HIGH PRESSURE SWITCH |
| E | 924 O | A/C HIGH PRESSURE SWITCH |
| F | 962 O | A/C COMPRESSOR |
| G | 870 R | RADIO SWITCHED B+ |
| H | 756 P | LH TURN SIGNAL |
| J | 757 P | RH TURN SIGNAL |
| K | 784 V | LOWER CAB WORK LIGHTS |
| L | 776 P | ROTARY BEACON LIGHT |
| M | 794 P | LH REAR CAB WORK LIGHTS |
| N | 794 P | RH REAR CAB WORK LIGHTS |
| P | 726 P | RH POSITION LIGHT/NO PLATE LIGHT |
| R | 707 P | LH POSITION LIGHT |
| S | 840 R | REAR WINDSCREEN WIPER B+ |
| T | 842 O | REAR WINDSCREEN WASHER |
| U | 952 B | BLOWER MOTOR PWM CONTROLLER CLEAN GROUND |
| V | 953 B | BLOWER MOTOR PWM CONTROLLER CLEAN GROUND |
| W | (♦)722 V | RH FRONT CAB WORK LIGHTS |
| | (♦♦)781 V | |
| X | (♦)722 V | LH FRONT CAB WORK LIGHTS |
| | (♦♦)791 V | |
| Y | 747 P | CAB HEADLIGHTS (HIGH) |
| Z | 746 P | CAB HEADLIGHTS (LOW) |

*(♦) Tractors Not Equipped with Automatic Temperature Control.*

*(♦♦) Tractors Equipped with Automatic Temperature Control.*

## Connector 2

**Location: Cab Roof**




**CAB HARNESS TO CAB ROOF HARNESS (CAB ROOF HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| A | 750 BR | (**) REAR TURN SIGNAL |
| B | 780 BR | RH REAR WORK LIGHT |
| C | 705 BR | NUMBER PLATE LIGHT |
| D | - - - - - | OPEN |
| E | 790 BR | LH REAR WORK LIGHT |
| F | 781 V | RH FRONT WORK LIGHT |
| G | 709 P | NUMBER PLATE LIGHT |
| H | 791 V | LH FRONT WORK LIGHT |
| J | 781 P | RH REAR WORK LIGHT |
| K | 756 P | (**) LH TURN SIGNAL |
| L | 757 P | (**) RH TURN SIGNAL |
| M | 791 P | LH REAR WORK LIGHT |
| N | 750 BR | (**) FRONT TURN SIGNAL |
| P | 780 BR | RH FRONT WORK LIGHT |
| R | - - - - - | OPEN |
| S | - - - - - | OPEN |
| T | 790 BR | LH FRONT WORK LIGHT |
| U | - - - - - | OPEN |
| V | - - - - - | OPEN |
| W | - - - - - | OPEN |
| X | - - - - - | OPEN |
| Y | - - - - - | OPEN |
| Z | - - - - - | OPEN |

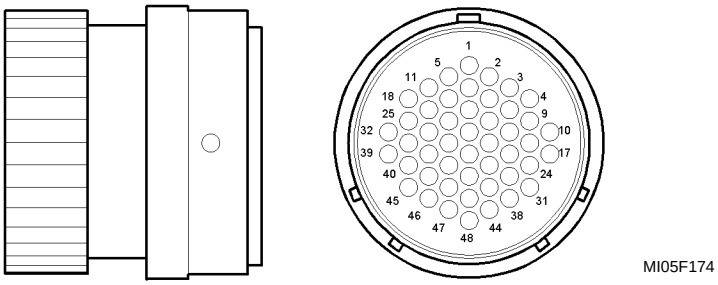
*(**) American Specification Tractors Only.*

https://truckmanualshub.com/



## Connector 10 - XTX185 and XTX200 Series Tractors Only

**Location: Cab Firewall**




MI05F174

**ENGINE TO INSTRUMENT PANEL HARNESS (ENGINE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 802 O | A/C HIGH PRESSURE SWITCH |
| 2 | 624 W | ENGINE CONTROLLER NEUTRAL START B+ SUPPLY |
| 3 | 804 O | A/C HIGH PRESSURE SWITCH |
| 4 | 162 R | UNSWITCHED B+ - CLOCK, RADIO AND INSTRUMENT CLUSTER |
| 5 | 200 Y | INSTRUMENT CLUSTER CLEAN GROUND (BATTERY - TERMINAL) |
| 6 | 803 O | A/C COMPRESSOR CLUTCH |
| 7 | - - - - - | OPEN |
| 8 | - - - - - | OPEN |
| 9 | 231 Y | COOLANT LEVEL |
| 10 | - - - - - | OPEN |
| 11 | - - - - - | OPEN |
| 12 | - - - - - | OPEN |
| 13 | 266 Y | AIR FILTER RESTRICTION SWITCH |
| 14 | 121 Y | ALTERNATOR D+ TERMINAL, WARNING LIGHT AND EXCITE |
| 15 | 829 BR/W | ATC CLEAN GROUND |
| 16 | 890 R | HORN B+ |
| 17 | 890 BR | HORN GROUND |
| 18 | 829 BR/W | ATC CLEAN GROUND |
| 19 | 738 P | RH HEADLIGHT - LOW BEAM |
| 20 | 741 P | RH HEADLIGHT - HIGH BEAM |
| 21 | 658 W | WATER IN FUEL |
| 22 | 737 P | LH HEADLIGHT - LOW BEAM |
| 23 | 740 P | LH HEADLIGHT - HIGH BEAM |

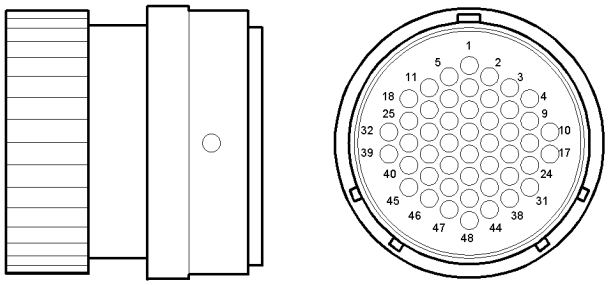
| Cavity | Wire No | Circuit |
|---|---|---|
| 24 | - - - - - | OPEN |
| 25 | 280 BR | RADAR GROUND |
| 26 | 281 Y | RADAR SIGNAL |
| 27 | 280 R | RADAR B+ |
| 28 | 282 Y | RADAR PRESENT |
| 29 | - - - - - | OPEN |
| 30 | - - - - - | OPEN |
| 31 | 784 V | WORK LIGHTS |
| 32 | - - - - - | OPEN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |
| 35 | - - - - - | OPEN |
| 36 | - - - - - | OPEN |
| 37 | - - - - - | OPEN |
| 38 | 900 Y | CAN HIGH |
| 39 | - - - - - | OPEN |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | 900 LG | CAN LOW |
| 43 | - - - - - | OPEN |
| 44 | 643 R | FOOT THROTTLE 5V SUPPLY |
| 45 | 600 W | ENGINE CONTROLLER SWITCHED B+ |
| 46 | 643 Y | FOOT THROTTLE SIGNAL |
| 47 | 900 BR | K - LINE |
| 48 | 643 BR | FOOT THROTTLE 0V RETURN |

https://truckmanualshub.com/



## Connector 10 - XTX215 Series Tractors Only

**Location: Cab Firewall**




MI05F174

**ENGINE TO INSTRUMENT PANEL HARNESS (ENGINE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 802 O | A/C HIGH PRESSURE SWITCH |
| 2 | 625 W | STARTER RELAY NEUTRAL START B+ SUPPLY |
| 3 | 804 O | A/C HIGH PRESSURE SWITCH |
| 4 | 162 R | UNSWITCHED B+ - CLOCK, RADIO AND INSTRUMENT CLUSTER |
| 5 | 200 BR/W | INSTRUMENT CLUSTER CLEAN GROUND (BATTERY - TERMINAL) |
| 6 | 803 O | A/C COMPRESSOR CLUTCH |
| 7 | - - - - - | OPEN |
| 8 | - - - - - | OPEN |
| 9 | 231 Y | COOLANT LEVEL |
| 10 | - - - - - | OPEN |
| 11 | 235 V | NOT USED |
| 12 | 654 W | NOT USED |
| 13 | 266 Y | AIR FILTER RESTRICTION SWITCH |
| 14 | 121 Y | ALTERNATOR D+ TERMINAL, WARNING LIGHT AND EXCITE |
| 15 | 829 BR/W | ATC CLEAN GROUND |
| 16 | 890 R | HORN B+ |
| 17 | 890 BR | HORN GROUND |
| 18 | 828 BR/W | ATC CLEAN GROUND |
| 19 | 738 P | RH HEADLIGHT - LOW BEAM |
| 20 | 741 P | RH HEADLIGHT - HIGH BEAM |
| 21 | - - - - - | OPEN |
| 22 | 737 P | LH HEADLIGHT - LOW BEAM |
| 23 | 740 P | LH HEADLIGHT - HIGH BEAM |

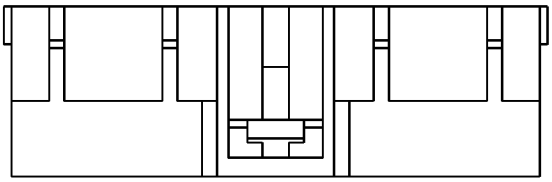
| Cavity | Wire No | Circuit |
|---|---|---|
| 24 | - - - - - | OPEN |
| 25 | 280 BR | RADAR GROUND |
| 26 | 281 Y | RADAR SIGNAL |
| 27 | 280 R | RADAR B+ |
| 28 | 282 Y | RADAR PRESENT |
| 29 | - - - - - | OPEN |
| 30 | - - - - - | OPEN |
| 31 | 784 V | WORK LIGHTS |
| 32 | - - - - - | OPEN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |
| 35 | - - - - - | OPEN |
| 36 | 652 BR | NOT USED |
| 37 | - - - - - | OPEN |
| 38 | 900 Y | CAN HIGH |
| 39 | 653 BR | NOT USED |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | 900 LG | CAN LOW |
| 43 | - - - - - | OPEN |
| 44 | 643 R | FOOT THROTTLE 5V SUPPLY |
| 45 | 132 R | ENGINE CONTROLLER SWITCHED B+ |
| 46 | 643 Y | FOOT THROTTLE SIGNAL |
| 47 | - - - - - | OPEN |
| 48 | 643 BR | FOOT THROTTLE 0V RETURN |

https://truckmanualshub.com/



## Connector 26

**Location: Right Hand Console**



477I96

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

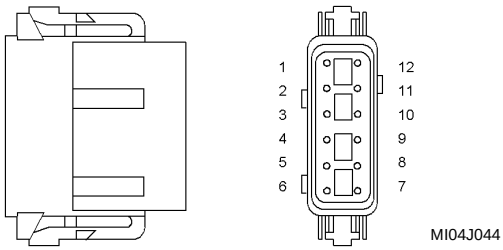
| Cavity | Wire No | Circuit |
|---|---|---|
| A | 590 BR | AUDIBLE ALARM |
| B | 707 P | LH TAIL/POSITION LIGHT |
| C | 708 P | RH TAIL/POSITION LIGHT |
| D | - - - - - | OPEN |
| E | 590 R | CAB CONTROLLER SWITCHED B+ |
| F | 501 R | HITCH/PTO CONTROLLER SWITCHED B+ |
| G | 784 V | REAR FENDER WORK LIGHTS |
| H | 810 R | SEAT B+ |
| J | 530 R | MFD AND DIFF LOCK B+ |
| K | 134 R | AUXILIARY POWER CONNECTOR SWITCHED B+ |
| L | 756 P | RH TURN SIGNAL |
| M | 757 P | LH TURN SIGNAL |
| N | (IIC) R | IIC UNSWITCHED POWER B+ |
| P | 133 R | AUXILIARY POWER FENDER HARNESS CONNECTOR (*)<br>7 PIN CONNECTOR (**) |
| R | 135 R | RH CONSOLE AUXILIARY POWER UNSWITCHED B+ |
| S | 817 R | CIGAR LIGHTER |
| T | 269 Y | PARK BRAKE WARNING LIGHT |
| U | 702 R | BRAKE RELAY B+ |
| V | - - - - - | OPEN |
| W | 785 V | REAR FOG LIGHTS (EUR) |
| X | 254 Y | PARK LOCK SIGNAL |
| Y | 276 LB | 1000 RPM PTO SWITCH |
| Z | (VP) R | AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ (XTRASPEED - E PLUS ONLY) |

*(*) European Specification Tractors Only.*

*(**) American Specification Tractors Only.*

## Connector 27

**Location: Right Hand Console**




**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

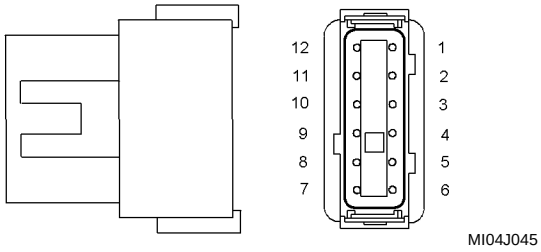
| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 240 Y | AIR TRAILER BRAKE PRESSURE |
| 2 | 515 R | LOADER CONTROLS B+ |
| 3 | 656 Y | CLUTCH POSITION SIGNAL |
| 4 | - - - - - | OPEN |
| 5 | 660 Y | BOTTOM OF CLUTCH SIGNAL |
| 6 | 233 Y | FUEL LEVEL SENDER |
| 7 | 656 BR | CLUTCH POSITION RETURN |
| 8 | 656 R | CLUTCH POSITION B+ |
| 9 | 536 LB | LH BRAKE SIGNAL |
| 10 | 267 Y | HYDRAULIC FILTER RESTRICTION SWITCH |
| 11 | - - - - - | OPEN |
| 12 | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 28

### Location: Right Hand Console

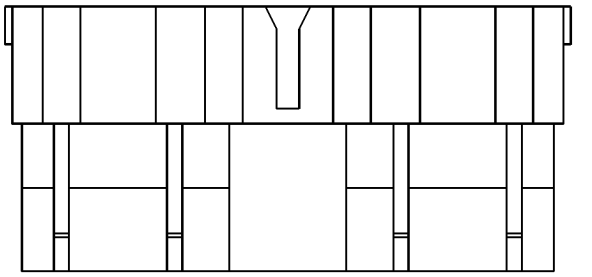



**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 510 T | F/N/R, FOOT THROTTLE 5V REF |
| 2 | 511 T | FORWARD SIGNAL |
| 3 | 562 R | F/N/R, F/N/R/P 12V SUPPLY |
| 4 | 606 W | IIC SWITCHED POWER SENSING |
| 5 | - - - - - | OPEN |
| 6 | 513 T | REVERSE SIGNAL |
| 7 | 531 LB | RH BRAKE SIGNAL |
| 8 | 514 T | NEUTRAL SIGNAL |
| 9 | - - - - - | OPEN |
| 10 | 281 Y | RADAR SIGNAL (HITCH) |
| 11 | 282 Y | RADAR PRESENT (IIC) |
| 12 | 563 LB | IMPLEMENT DOWN SWITCH |

## Connector 29

### Location: Right Hand Console




**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| A | 835 O | FRONT WINDSCREEN WASHER |
| B | 845 O | REAR WINDSHIELD WASHER |
| C | 550 R | FRONT PTO B+ |
| D | 551 LB | FRONT PTO SIGNAL |
| E | 590 R | REAR PTO SWITCHED B+ |
| F | 161 R | (##) AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ |
| G | 134 R | IIIC SWITCHED POWER |
| H | 776 P | ROTARY BEACON LIGHT |
| J | 531 R | MFD AXLE SUSPENSION UNSWITCHED POWER |
| K | 530 R | MFD AXLE SUSPENSION SWITCHED POWER |
| L | 900 Y | CAN HIGH |
| M | 900 LG | CAN LOW |
| N | - - - - - | OPEN |
| P | 500B R | CAB CONTROLLER UNSWITCHED B+ |
| R | 550 R | TRANSMISSION CONTROLLER SWITCHED B+ |
| S | 400 R | TRANSMISSION CONTROLLER UNSWITCHED B+ |
| T | 643 Y | FOOT THROTTLE SIGNAL |
| U | 643 BR | FOOT THROTTLE 0V RETURN |
| V | 160 R | (##) AUXILIARY/REMOTE VALVE CONTROLLER UNSWITCHED B+ |
| W | - - - - - | OPEN |
| X | 660 W | (#) CAB SUSPENSION CONTROLLER SWITCHED B+ |
| | 660 R | (##) CAB SUSPENSION CONTROLLER SWITCHED B+ |
| Y | (ARM) R | (##) ARMREST SWITCHED B+ |
| Z | - - - - - | OPEN |

*(#) XtraSpeed and XtraSpeed - E tractors only.*

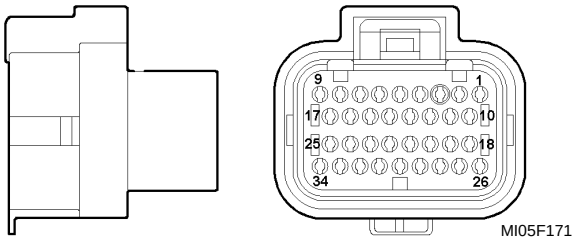
*(##) XtraSpeed - E Plus tractors only.*

https://truckmanualshub.com/



## Connector 30

**Location: Instrument Cluster**



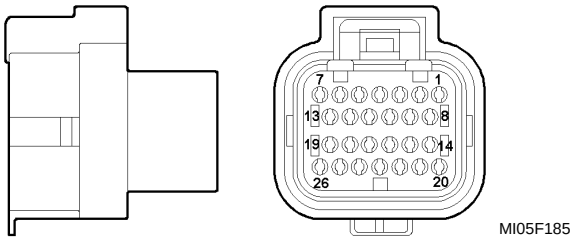

MI05F171

**INSTRUMENT PANEL HARNESS TO INSTRUMENT CLUSTER**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | - - - - - | OPEN |
| 2 | - - - - - | OPEN |
| 3 | 563 LB | TRAILED IMPLEMENT SIGNAL |
| 4 | 267 Y | HYDRAULIC FILTER RESTRICTION SIGNAL |
| 5 | - - - - - | OPEN |
| 6 | - - - - - | OPEN |
| 7 | - - - - - | OPEN |
| 8 | 233 Y | FUEL LEVEL SIGNAL |
| 9 | (GND) DB | BOOTLOAD GROUND |
| 10 | 900 Y | CAN HIGH |
| 11 | 551 LB | FRONT PTO SIGNAL |
| 12 | 282 Y | RADAR PRESENT SIGNAL |
| 13 | 269 Y | PARK BRAKE SIGNAL |
| 14 | - - - - - | OPEN |
| 15 | - - - - - | OPEN |
| 16 | - - - - - | OPEN |
| 17 | 280 BR | RADAR GROUND |
| 18 | 900 LG | CAN LOW |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | 769 P | 1ST TRAILER TURN SIGNAL |
| 22 | 757 P | RIGHT HAND TURN SIGNAL |
| 23 | - - - - - | OPEN |
| 24 | 706 P | SIDE/POSITION LIGHTS |
| 25 | - - - - - | OPEN |
| 26 | - - - - - | OPEN |
| 27 | 770 P | 2ND TRAILER TURN SIGNAL |
| 28 | 276 LB | 540/1000 PRO SPEED SELECTOR SIGNAL |
| 29 | 756 P | LEFT HAND TURN SIGNAL |
| 30 | 240 Y | AIR TRAILER BRAKE PRESSURE SIGNAL |
| 31 | 723 P | HIGH BEAM |
| 32 | - - - - - | OPEN |
| 33 | 658 W | WATER IN FUEL SIGNAL (XTX185/200) |
| 34 | - - - - - | OPEN |

## Connector 31

**Location: Instrument Cluster**




MI05F185

**INSTRUMENT PANEL HARNESS TO INSTRUMENT CLUSTER**

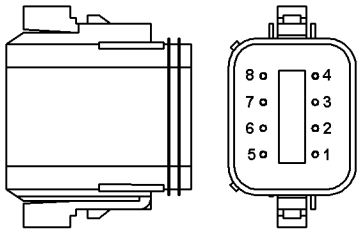
| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 202 R | UNSWITCHED BATTERY POWER |
| 2 | - - - - - | OPEN |
| 3 | - - - - - | OPEN |
| 4 | (BOOT) DB | BOOTLOAD |
| 5 | - - - - - | OPEN |
| 6 | 590 BR | AUDIBLE ALARM GROUND |
| 7 | 200 R | SWITCHED POWER |
| 8 | - - - - - | OPEN |
| 9 | - - - - - | OPEN |
| 10 | - - - - - | OPEN |
| 11 | 231 Y | COOLANT LEVEL SENDER |
| 12 | 121 Y | ALTERNATOR D+ (EXCITE) |
| 13 | 280 R | RADAR B+ |
| 14 | 200 BR/W | CLEAN GROUND |
| 15 | 281 Y | RADAR SIGNAL |
| 16 | (RST) DB | BOOTLOAD RESET |
| 17 | (TX) DB | RS232 TX |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | 266 Y | AIR FILTER RESTRICTION SIGNAL |
| 22 | - - - - - | NOT USED |
| 23 | (RX) DB | RS232 RX |
| 24 | 784 V | FRONT LOWER WORK LIGHTS |
| 25 | 784 P | REAR LOWER WORK LIGHTS |
| 26 | 201 R | ACCESSORY POWER |

https://truckmanualshub.com/



## Connector 32

**Location: Instrument Panel**



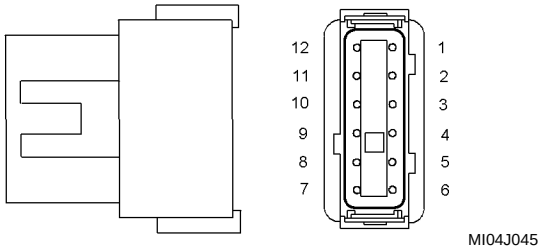

MI04B088

**INSTRUMENT PANEL TO STALK SWITCH HARNESS (INSTRUMENT PANEL HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 763 P | TURN SIGNAL COMMON |
| 2 | 756 P | LEFT TURN |
| 3 | 757 P | RIGHT TURN |
| 4 | 726 P | HEADLIGHT RELAYS B+ |
| 5 | 739 P | HIGH BEAM |
| 6 | 736 P | LOW BEAM |
| 7 | (*) (FNR) R<br>(**) 735 R | HEADLIGHT FLASH |
| 8 | 736 BR | HORN |

## Connector 33

**Location: Instrument Panel**




MI04J045

**INSTRUMENT PANEL TO SHUTTLE LEVER SWITCH (INSTRUMENT PANEL HARNESS SIDE)**

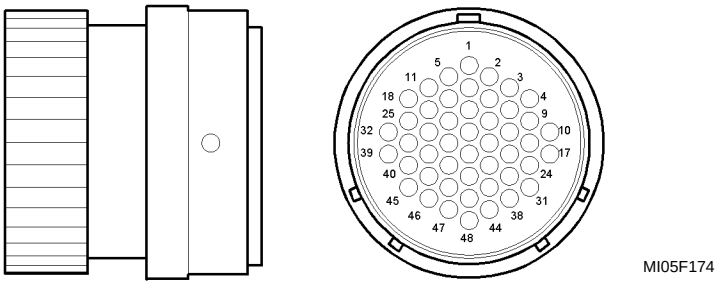
| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 622 W | NEUTRAL START |
| 2 | 625 W | NEUTRAL START |
| 3 | 562 R | F/N/R, F/N/R/P 12V SUPPLY |
| 4 | 254 Y | PARK LOCK SIGNAL |
| 5 | 513 T | REVERSE SIGNAL |
| 6 | 511 T | FORWARD SIGNAL |
| 7 | 518 T | NEUTRAL SIGNAL |
| 8 | 510 T | F/N/R 5V REF |
| 9 | 890 BR | HORN GROUND |
| 10 | 763 P | NOT USED |
| 11 | 757 P | NOT USED |
| 12 | 756 P | NOT USED |

https://truckmanualshub.com/



## Connector 40

**Location: Cab Floor (Right Hand Console)**




MI05F174

**RIGHT HAND CONSOLE HARNESS TO TRANSMISSION HARNESS (TRANSMISSION HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 543 LB | MFD SOLENOID B+ |
| 2 | 233 Y | FUEL LEVEL SENDER |
| 3 | 507 R | +8 V POSITION POTENTIOMETER |
| 4 | 507 LB | POSITION SIGNAL |
| 5 | 507 BR | POSITION POTENTIOMETER LOW |
| 6 | (LINK) R | TRANSMISSION CONTROLLER TO CAB CONTROLLER LINK |
| 7 | 500 BR/W | HITCH CONTROLLER CLEAN GROUND |
| 8 | 269 Y | PARK BRAKE WARNING LIGHT |
| 9 | 539 LB | DIFF LOCK SOLENOID B+ |
| 10 | 511 R | HITCH SOLENOID B+ |
| 11 | 513 LB | HITCH RAISE SOLENOID |
| 12 | 514 R | HITCH PIN +8 VOLTS |
| 13 | 515 LB | LH HITCH PIN SIGNAL |
| 14 | 514 BR | HITCH PINS LOW |
| 15 | 514 LB | RH HITCH PIN SIGNAL |
| 16 | 540 R | 4TH AUXILIARY VALVE |
| 17 | 512 LB | HITCH LOWER SOLENOID |
| 18 | 215 Y | WHEEL SPEED SIGNAL |
| 19 | 597 LB | PTO SOLENOID B+ |
| 20 | 597 BR | PTO SOLENOID GROUND |
| 21 | 267 Y | HYDRAULIC FILTER SIGNAL |
| 22 | 280 BR/W | PARK LOCK RETURN |
| 23 | - - - - - | OPEN |
| 24 | 900 Y | CAN HIGH |
| 25 | 900 LG | CAN LOW |

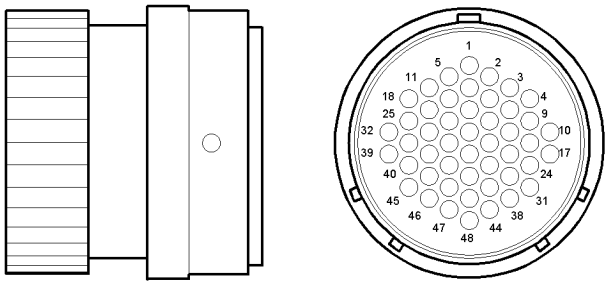
| Cavity | Wire No | Circuit |
|---|---|---|
| 26 | 224 Y | PTO SPEED SIGNAL |
| 27 | - - - - - | OPEN |
| 28 | - - - - - | OPEN |
| 29 | - - - - - | OPEN |
| 30 | 276 T | 540/1000 PTO SWITCH B+ |
| 31 | 240 Y | TRAILER BRAKE PRESSURE |
| 32 | 276 T | 540/1000 PTO SWITCH |
| 33 | 551 O | FRONT PTO SOLENOID |
| 34 | 500 BR/W | IIC CLEAN GROUND |
| 35 | - - - - - | OPEN |
| 36 | 542 T | 4TH AUXILIARY VALVE RAISE |
| 37 | 541 T | 4TH AUXILIARY VALVE LOWER |
| 38 | 400 R | TRANSMISSION CONTROLLER UNSWITCHED B+ |
| 39 | 516 T | LOADER SOLENOID RAISE |
| 40 | 515 T | LOADER SOLENOID LOWER |
| 41 | 550 R | TRANSMISSION CONTROLLER SWITCHED B+ |
| 42 | - - - - - | OPEN |
| 43 | - - - - - | OPEN |
| 44 | 500 BR/W | CAB CONTROLLER CLEAN GROUND |
| 45 | (VP IN) R | AUXILIARY/REMOTE VALVES B+ (XTRASPEED - E PLUS ONLY) |
| 46 | 656 R | CLUTCH POSITION B+ |
| 47 | 656 Y | CLUTCH POSITION SIGNAL |
| 48 | 656 BR | CLUTCH POSITION RETURN |

https://truckmanualshub.com/



## Connector 51 (XtraSpeed - E Plus Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 757 P | LEFT HAND TURN SIGNAL |
| 2 | 756 P | RIGHT HAND TURN SIGNAL |
| 3 | 507 R | HITCH POSITION POTENTIOMETER B+ |
| 4 | 707 P | LEFT HAND REAR SIDE/POSITION LIGHT |
| 5 | 708 P | RIGHT HAND REAR SIDE/ POSITION LIGHT |
| 6 | 785 V | REAR FOG LIGHT |
| 7 | 702 P | STOP LIGHTS |
| 8 | (VP) T | AUXILIARY/REMOTE VALVE VP OUT |
| 9 | 591 DB | DIFFERENTIAL LOCK SOLENOID B+ |
| 10 | 511 R | HITCH SOLENOID B+ |
| 11 | 835 O | FRONT WINDSCREEN WASHER |
| 12 | 845 O | REAR WINDSCREEN WASHER |
| 13 | 776 P | BEACON LIGHT (EUROPEAN SPECIFICATION TRACTORS ONLY) |
| 14 | 514 BR | LOAD PIN RETURN |
| 15 | 514 LB | RIGHT HAND LOAD PIN SIGNAL |
| 16 | 512 LB | HITCH LOWER SOLENOID |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | - - - - - | OPEN |
| 22 | - - - - - | OPEN |
| 23 | 224 Y | PTO SPEED SIGNAL |
| 24 | 850 R | CAB SUSPENSION CONTROLLER SWITCHED B+ |

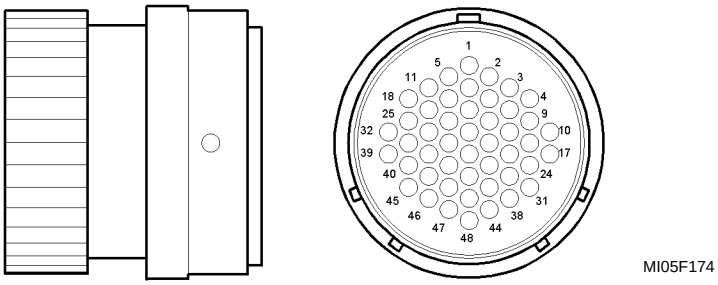
| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 513 LB | HITCH LOWER SOLENOID |
| 26 | 514 R | LOAD PIN 8V SUPPLY |
| 27 | 515 LB | LEFT HAND LOAD PIN SIGNAL |
| 28 | - - - - - | OPEN |
| 29 | 133 R | AUXILIARY POWER SWITCHED B+ |
| 30 | 784 P | REAR WORK LIGHTS |
| 31 | 507 LB | HITCH POSITION POTENTIOMETER SIGNAL |
| 32 | 507 BR | HITCH POSITION POTENTIOMETER RETURN |
| 33 | (LINK) R | CAB CONTROLLER/ TRANSMISSION CONTROLLER LINK |
| 34 | BR/W | HITCH CONTROLLER CLEAN GROUND |
| 35 | BR/W | CLEAN GROUND |
| 36 | 597 LB | PTO SOLENOID B+ |
| 37 | 597 BR | PTO SOLENOID RETURN |
| 38 | - - - - - | OPEN |
| 39 | - - - - - | OPEN |
| 40 | 542 LB | MFD RELAY SUPPLY |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | - - - - - | OPEN |
| 44 | - - - - - | OPEN |
| 45 | - - - - - | OPEN |
| 46 | - - - - - | OPEN |
| 47 | - - - - - | OPEN |
| 48 | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 52 (XtraSpeed and XtraSpeed - E Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 560 R | HITCH UPPER LIMIT POTENTIOMETER SUPPLY |
| 2 | 560 LB | HITCH UPPER LIMIT POTENTIOMETER SIGNAL |
| 3 | 560 BR | HITCH UPPER LIMIT POTENTIOMETER RETURN |
| 4 | 502 R | HITCH DROP SPEED POTENTIOMETER SUPPLY |
| 5 | 502 LB | HITCH DROP SPEED POTENTIOMETER SIGNAL |
| 6 | 502 BR | HITCH DROP SPEED POTENTIOMETER RETURN |
| 7 | 504 LB | HITCH POSITION COMMAND POTENTIOMETER SIGNAL |
| 8 | 504 R | HITCH POSITION COMMAND POTENTIOMETER SUPPLY |
| 9 | 504 BR | HITCH POSITION COMMAND POTENTIOMETER RETURN |
| 10 | 505 R | HITCH LOAD COMMAND POTENTIOMETER SUPPLY |
| 11 | 505 LB | HITCH LOAD COMMAND POTENTIOMETER SIGNAL |
| 12 | 505 BR | HITCH LOAD COMMAND POTENTIOMETER RETURN |
| 13 | - - - - - | OPEN |
| 14 | - - - - - | OPEN |
| 15 | - - - - - | OPEN |
| 16 | - - - - - | OPEN |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | 570 LB | SLIP CONTROL LIGHT SUPPLY |
| 22 | 567 LB | SLIP CONTROL ON SIGNAL |
| 23 | - - - - - | OPEN |
| 24 | 593 DB | AUTO PTO OFF SIGNAL |

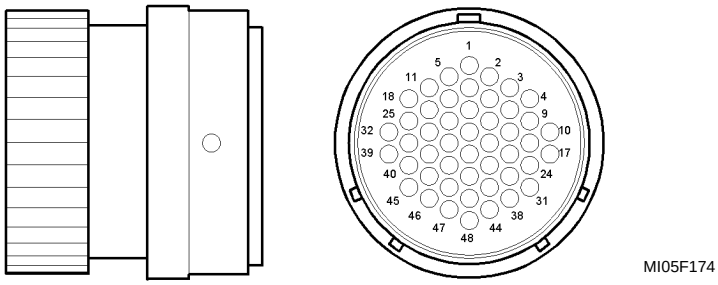
| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 531 R | MFD AXLE SUSPENSION UNSWITCHED B+ |
| 26 | 643 Y | FOOT THROTTLE SIGNAL |
| 27 | 281 Y | RADAR SIGNAL |
| 28 | 506 R | HITCH TRAVEL POTENTIOMETER SUPPLY |
| 29 | 506 LB | HITCH TRAVEL POTENTIOMETER SIGNAL |
| 30 | 506 BR | HITCH TRAVEL POTENTIOMETER RETURN |
| 31 | 590 R | REMOTE PTO SWITCH B+ |
| 32 | - - - - - | OPEN |
| 33 | 161 R | AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ |
| 34 | - - - - - | OPEN |
| 35 | 500B R | CAB CONTROLLER UNSWITCHED B+ |
| 36 | 572 LB | RIDE CONTROL ON SIGNAL |
| 37 | 573 LB | RIDE CONTROL OVERRIDE SIGNAL |
| 38 | - - - - - | OPEN |
| 39 | 282 Y | RADAR PRESENT SIGNAL |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | 534 DB | MFD AXLE SUSPENSION UP SIGNAL |
| 44 | 535 DB | MFD AXLE SUSPENSION DOWN SIGNAL |
| 45 | 533 DB | MFD AXLE SUSPENSION REGULATION ON |
| 46 | 542 DB | MFD AXLE SUSPENSION UNSWITCHED UP SIGNAL |
| 47 | 563 DB | MFD AXLE SUSPENSION INDICATOR LIGHT |
| 48 | 530 R | MFD AXLE SUSPENSION SWITCHED B+ |

https://truckmanualshub.com/



## Connector 52 (XtraSpeed - E Plus Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 560 R | HITCH UPPER LIMIT POTENTIOMETER SUPPLY |
| 2 | 560 LB | HITCH UPPER LIMIT POTENTIOMETER SIGNAL |
| 3 | 560 BR | HITCH UPPER LIMIT POTENTIOMETER RETURN |
| 4 | 502 R | HITCH DROP SPEED POTENTIOMETER SUPPLY |
| 5 | 502 LB | HITCH DROP SPEED POTENTIOMETER SIGNAL |
| 6 | 502 BR | HITCH DROP SPEED POTENTIOMETER RETURN |
| 7 | 504 LB | HITCH POSITION COMMAND POTENTIOMETER SIGNAL |
| 8 | 504 R | HITCH POSITION COMMAND POTENTIOMETER SUPPLY |
| 9 | 504 BR | HITCH POSITION COMMAND POTENTIOMETER RETURN |
| 10 | 505 R | HITCH LOAD COMMAND POTENTIOMETER SUPPLY |
| 11 | 505 LB | HITCH LOAD COMMAND POTENTIOMETER SIGNAL |
| 12 | 505 BR | HITCH LOAD COMMAND POTENTIOMETER RETURN |
| 13 | - - - - - | OPEN |
| 14 | - - - - - | OPEN |
| 15 | - - - - - | OPEN |
| 16 | - - - - - | OPEN |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | 570 LB | SLIP CONTROL LIGHT SUPPLY |
| 22 | 567 LB | SLIP CONTROL ON SIGNAL |
| 23 | - - - - - | OPEN |
| 24 | 593 DB | AUTO PTO OFF SIGNAL |

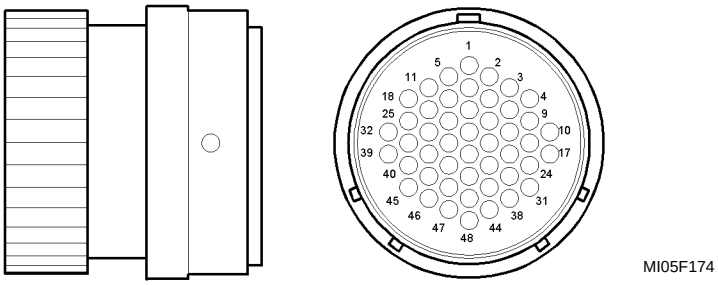
| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 531 R | MFD AXLE SUSPENSION CONTROLLER UNSWITCHED B+ |
| 26 | 643 Y | FOOT THROTTLE SIGNAL |
| 27 | 281 Y | RADAR SIGNAL |
| 28 | 506 R | HITCH TRAVEL POTENTIOMETER SUPPLY |
| 29 | 506 LB | HITCH TRAVEL POTENTIOMETER SIGNAL |
| 30 | 506 BR | HITCH TRAVEL POTENTIOMETER RETURN |
| 31 | 590 R | REMOTE PTO SWITCH B+ |
| 32 | - - - - - | OPEN |
| 33 | 161 R | AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ |
| 34 | - - - - - | OPEN |
| 35 | 500B R | CAB CONTROLLER UNSWITCHED B+ |
| 36 | 572 LB | RIDE CONTROL ON SIGNAL |
| 37 | 573 LB | RIDE CONTROL OVERRIDE SIGNAL |
| 38 | - - - - - | OPEN |
| 39 | 282 Y | RADAR PRESENT SIGNAL |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | 534 DB | FRONT AXLE SUSPENSION UP SIGNAL |
| 44 | 535 DB | MFD AXLE SUSPENSION DOWN SIGNAL |
| 45 | 533 DB | MFD AXLE SUSPENSION REGULATION ON |
| 46 | 542 DB | MFD AXLE SUSPENSION UNSWITCHED UP SIGNAL |
| 47 | 563 DB | MFD AXLE SUSPENSION INDICATOR LIGHT |
| 48 | 530 R | MFD AXLE SUSPENSION SWITCHED B+ |

https://truckmanualshub.com/



## Connector 53 (XtraSpeed - E Plus Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 532 LB | DIFFERENTIAL LOCK ON SIGNAL |
| 2 | 280 BR | PARK LOCK SOLENOID RETURN |
| 3 | 591 LB | PTO ON SIGNAL |
| 4 | 592 LB | PTO OFF SIGNAL |
| 5 | 592 DB | AUTO PTO ON SIGNAL |
| 6 | 501 R | HITCH/PTO CONTROLLER SWITCHED B+ |
| 7 | 541 LB | MFD ON SIGNAL |
| 8 | 254 Y | PARK LOCK ON SIGNAL |
| 9 | 272 Y | CREEP ON SIGNAL |
| 10 | 590 BR | PTO INDICATOR LIGHT |
| 11 | 563 LB | TRAILER IMPLEMENT SIGNAL (INSTRUMENT CLUSTER) |
| 12 | 594 DB | AUTO PTO SET SIGNAL |
| 13 | 562 R | SHUTTLE SWITCH 12V SUPPLY |
| 14 | 511 T | FORWARD SIGNAL |
| 15 | - - - - - | OPEN |
| 16 | 595 DB | AUTO PTO LIGHT |
| 17 | - - - - - | OPEN |
| 18 | 215 Y | WHEEL SPEED SIGNAL |
| 19 | 539 LB | AUTO DIFFERENTIAL LOCK LIGHT |
| 20 | - - - - - | OPEN |
| 21 | - - - - - | OPEN |
| 22 | 590 R | CAB CONTROLLER SWITCHED B+ |
| 23 | 160 R | AUXILIARY/REMOTE VALVE CONTROLLER UNSWITCHED B+ |
| 24 | 276 LB | 540/1000 PTO SELECTOR SWITCH SIGNAL |

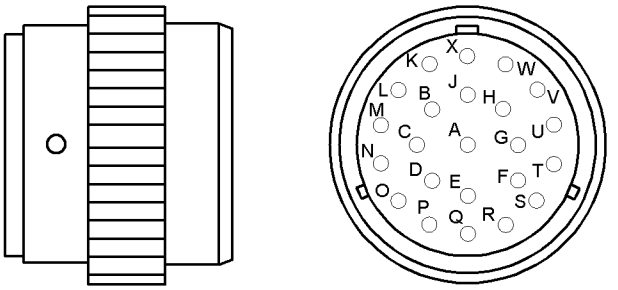
| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 513 T | REVERSE SIGNAL |
| 26 | (ARM) R | ARMREST CONTROL SWITCHED B+ |
| 27 | (vp) R | AUXILIARY/REMOTE VALVE CONTROLLER VP IN |
| 28 | 514 T | NEUTRAL SIGNAL |
| 29 | 303 T | OPERATOR PRESENCE SWITCH SIGNAL |
| 30 | - - - - - | OPEN |
| 31 | - - - - - | OPEN |
| 32 | - - - - - | OPEN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |
| 35 | 565 LB | AUTO MFD ON SIGNAL |
| 36 | 546 LB | AUTO DIFFERENTIAL LOCK ON SIGNAL |
| 37 | 536 LB | LEFT HAND BRAKE SIGNAL |
| 38 | 531 LB | RIGHT HAND BRAKE SIGNAL |
| 39 | - - - - - | OPEN |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | 900 Y | CAN HIGH |
| 44 | 900 LG | CAN LOW |
| 45 | 660 Y | CAB CONTROLLER BOTTOM OF CLUTCH SIGNAL |
| 46 | 510 T | F/N/R, FOOT THROTTLE 5V REF |
| 47 | - - - - - | OPEN |
| 48 | 643 BR | FOOT THROTTLE 0V REF |

https://truckmanualshub.com/



## Connector 60 - XTX215 Tractors

**Location: Engine**




MI04G012

**ENGINE CONTROLLER HARNESS TO ENGINE HARNESS (ENGINE HARNESS SIDE)**

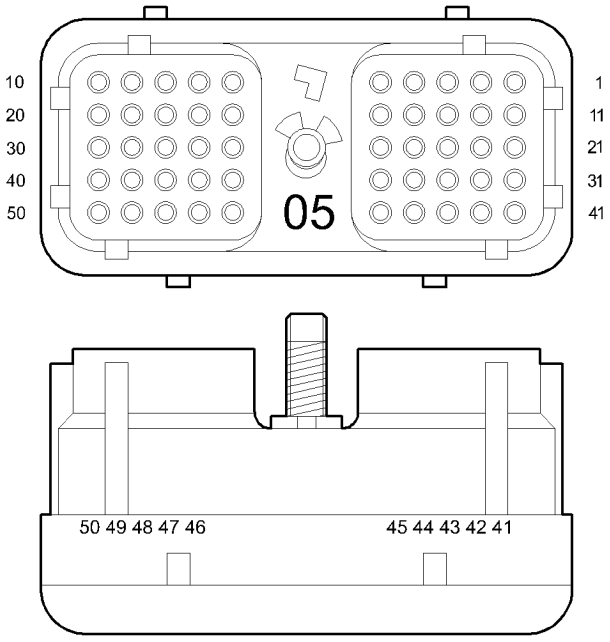
| Cavity | Wire No | Circuit |
|---|---|---|
| A | 132 R | SWITCHED POWER |
| B | 600 R | UNSWITCHED POWER (1) B+ |
| C | 601R | UNSWITCHED POWER (2) B+ |
| D | 602 R | UNSWITCHED POWER (3) B+ |
| E | 600 BR | CLEAN GROUND |
| F | 600 BR | CLEAN GROUND |
| G | - - - - - | OPEN |
| H | 600 BR | CLEAN GROUND |
| J | - - - - - | OPEN |
| k | - - - - - | OPEN |
| L | - - - - - | OPEN |
| M | 603 R | UNSWITCHED POWER (VP44) B+ |
| N | - - - - - | OPEN |
| O | - - - - - | OPEN |
| P | 600 BR | CLEAN GROUND |
| Q | - - - - - | OPEN |
| R | - - - - - | OPEN |
| S | 603 R | UNSWITCHED POWER |
| T | - - - - - | OPEN |
| U | - - - - - | OPEN |
| V | - - - - - | OPEN |
| W | 600 BR | CLEAN GROUND |
| X | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 61 - XTX215 Tractors

**Location: Engine**




**ENGINE CONTROLLER CONNECTOR**
**(ENGINE HARNESS TO ENGINE CONTROLLER)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | - - - - - | OPEN |
| 2 | 563 BR | NOT USED |
| 3 | - - - - - | OPEN |
| 4 | 563 BR | NOT USED |
| 5 | - - - - - | OPEN |
| 6 | - - - - - | OPEN |
| 7 | - - - - - | OPEN |
| 8 | - - - - - | OPEN |
| 9 | - - - - - | OPEN |
| 10 | - - - - - | OPEN |
| 11 | 562 BR | NOT USED |
| 12 | - - - - - | OPEN |
| 13 | - - - - - | OPEN |
| 14 | - - - - - | OPEN |
| 15 | - - - - - | OPEN |
| 16 | - - - - - | OPEN |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | 658 BR | WATER IN FUEL RETURN |
| 21 | - - - - - | OPEN |
| 22 | - - - - - | OPEN |
| 23 | - - - - - | OPEN |
| 24 | - - - - - | OPEN |
| 25 | - - - - - | OPEN |

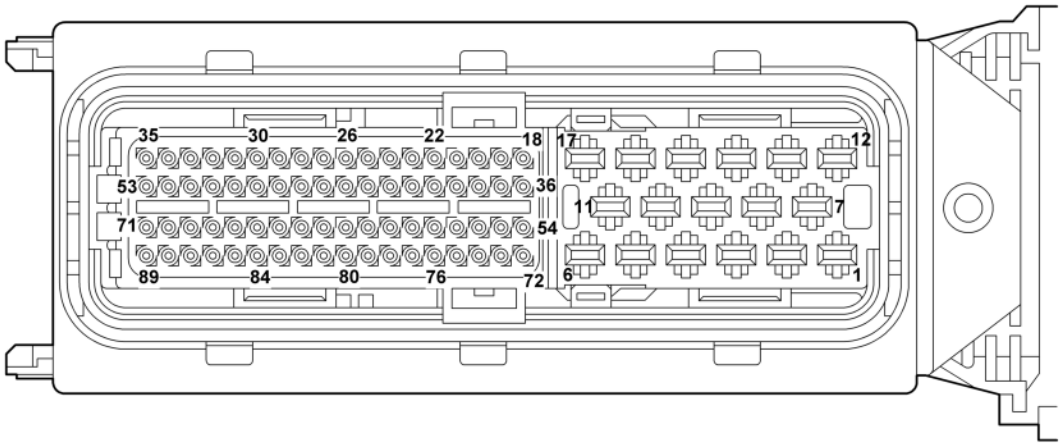
| Cavity | Wire No | Circuit |
|---|---|---|
| 26 | - - - - - | OPEN |
| 27 | - - - - - | OPEN |
| 28 | - - - - - | OPEN |
| 29 | - - - - - | OPEN |
| 30 | - - - - - | OPEN |
| 31 | 641 W | COLD START RELAY 2 SIGNAL |
| 32 | - - - - - | OPEN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |
| 35 | - - - - - | OPEN |
| 36 | - - - - - | OPEN |
| 37 | - - - - - | OPEN |
| 38 | - - - - - | OPEN |
| 39 | 654 W | NOT USED |
| 40 | 658 W | WATER IN FUEL SIGNAL |
| 41 | 640 W | COLD START RELAY 1 SIGNAL |
| 42 | - - - - - | OPEN |
| 43 | - - - - - | OPEN |
| 44 | - - - - - | OPEN |
| 45 | - - - - - | OPEN |
| 46 | - - - - - | OPEN |
| 47 | - - - - - | OPEN |
| 48 | - - - - - | OPEN |
| 49 | - - - - - | OPEN |
| 50 | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 63 - XTX185/200 Tractors

**Location: Engine**




MI04M049

**ENGINE CONTROLLER CONNECTOR**
**(ENGINE HARNESS TO ENGINE CONTROLLER)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 500 R | UNSWITCHED POWER B+ |
| 2 | 501 BR | STARTER RELAY RETURN |
| 3 | 500 BR/W | CLEAN GROUND |
| 4 | 640 BR | GRID HEATER RELAY RETURN |
| 5 | - - - - - | OPEN |
| 6 | - - - - - | OPEN |
| 7 | 500 R | UNSWITCHED POWER B+ |
| 8 | - - - - - | OPEN |
| 9 | 500 BR/W | CLEAN GROUND |
| 10 | - - - - - | OPEN |
| 11 | - - - - - | OPEN |
| 12 | 500 R | UNSWITCHED POWER B+ |
| 13 | 500 R | UNSWITCHED POWER B+ |
| 14 | 500 BR/W | CLEAN GROUND |
| 15 | 500 BR/W | CLEAN GROUND |
| 16 | 640 W | GRID HEATER RELAY FEED |

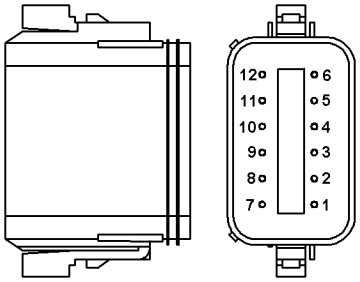
| Cavity | Wire No | Circuit |
|---|---|---|
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | 624 W | NEUTRAL START |
| 21 TO 30 | - - - - - | OPEN |
| 31 | 900 BR | K - LINE SIGNAL |
| 32 TO 35 | - - - - - | OPEN |
| 36 | 659 R | FUEL HEATER FEED |
| 37 | 501 BR | STARTER RELAY SIGNAL |
| 38 | - - - - - | OPEN |
| 39 | 500 W | SWITCHED B+ |
| 40 TO 51 | - - - - - | OPEN |
| 52 | 900 Y | CAN LOW |
| 53 | 900 LG | CAN HIGH |
| 54 TO 89 | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 67

**Location: Engine (Firewall)**



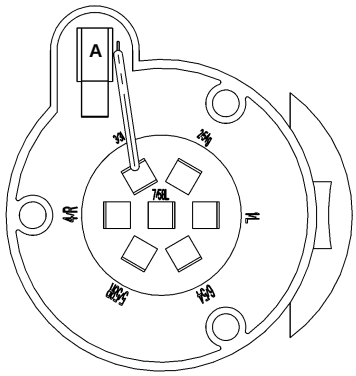

MI04J043

**ENGINE HARNESS TO HOOD HARNESS (ENGINE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 737 P | LH HEADLIGHT LOW BEAM |
| 2 | 738 P | RH HEADLIGHT LOW BEAM |
| 3 | 740 P | LH HEADLIGHT HIGH BEAM |
| 4 | 741 P | RH HEADLIGHT HIGH BEAM |
| 5 | 737 BR | LH HEADLIGHT GROUND |
| 6 | 736 BR | RH HEADLIGHT GROUND |
| 7 | 890 BR | HORN (GROUND) |
| 8 | 890 R | HORN (B+) |
| 9 | 784 V | WORK LIGHTS |
| 10 | 784 BR | WORK LIGHT GROUND |
| 11 | - - - - - | OPEN |
| 12 | - - - - - | OPEN |

## Trailer Connectors

### European Specification

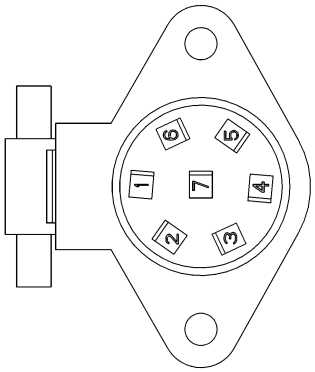



476I96

**VIEWED FROM HARNESS SIDE**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | (#) 765 P | LEFT HAND TURN SIGNAL |
| | (##) 757 P | |
| 2 | 789 V | REAR FOG LIGHT |
| 3 | 133 BR | CHASSIS GROUND |
| 4 | (#) 766 P | RIGHT HAND TURN SIGNAL |
| | (##) 756 P | |
| 5 | 708 P | RIGHT HAND POSITION LIGHT |
| 6 | 702 P | BRAKE LIGHTS |
| 7 | 707 P | LEFT HAND POSITION LIGHTS |
| A | 776 P | BEACON LIGHT |

### American Specification




**VIEWED FROM HARNESS SIDE**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 133 BR | CHASSIS GROUND |
| 2 | 784 P | WORK LIGHT |
| 4 | (#) 756 P | LEFT HAND TURN SIGNAL |
| | (##) 757 P | |
| 4 | 133 R | SWITCHED AUXILIARY POWER B+ |
| 5 | (#) 757 P | RIGHT HAND TURN SIGNAL |
| | (##) 756 P | |
| 6 | 708 P | TAIL LIGHTS |
| 7 | 133 R | SWITCHED AUXILIARY POWER B+ |

*(#) XtraSpeed and XtraSpeed - E tractors only.*

*(##) XtraSpeed - E Plus tractors only.*

https://truckmanualshub.com/



# Section 4002

## INSTRUMENT CLUSTER PROGRAMMING

## XTX Series Tractors

McCORMICK

SM 8-15121

© 2006 McCormick Tractors International Limited.
July 2005 (Revised July 2006)

https://truckmanualshub.com/



# TABLE OF CONTENTS

GENERAL INFORMATION ..... 3

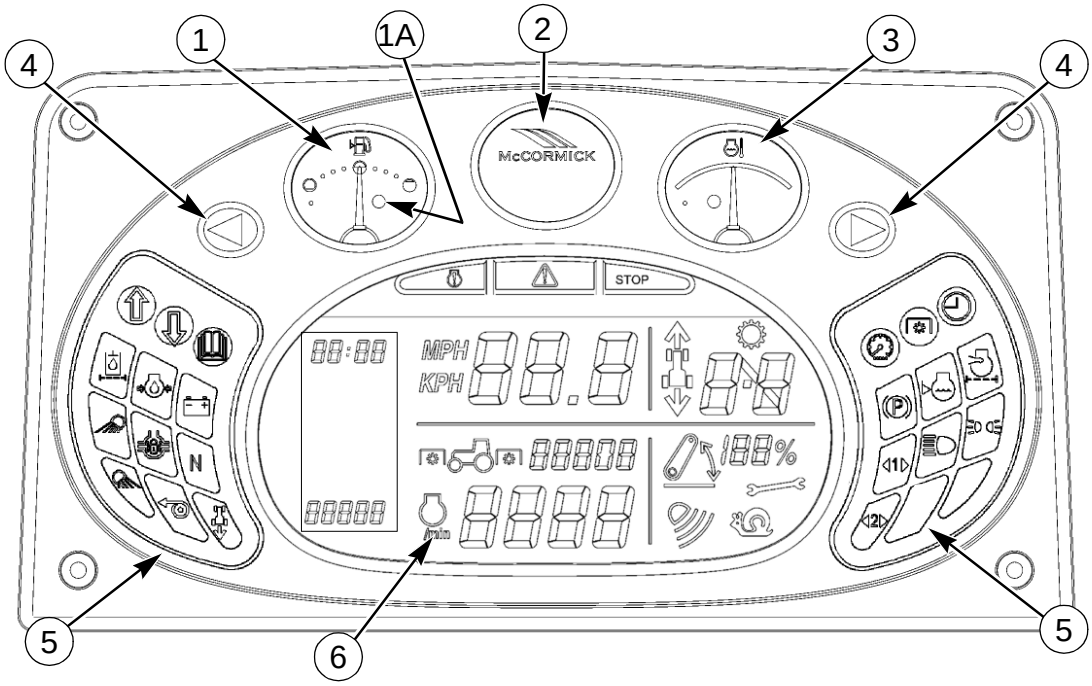
IGNITION ON/RUN MODE
- During normal operation ..... 5
- Entering The Programming Mode ..... 6
- Area Function (Menu 1) ..... 7
- Distance Function (Menu 2) ..... 11
- Percentage Wheel Slip (Menu 3) ..... 13
- Electrical System Voltage (Menu 4) ..... 14
- Cluster Hitch Position Display Calibration (Menu 5) ..... 15
- Rear Hitch Calibration (Menu 6) ..... 15
- Rear PTO Calibration (Menu 7) ..... 15
- Transmission Calibration (Menu 8) ..... 15
- Dynamic Calibration (Menu 9) ..... 16
- Cab Suspension Calibration (Menu 10) ..... 17
- Timer Function (If Equipped) (Menu 11) ..... 18

ACCESSORY MODE
- Entering The Programming Mode ..... 21
- Programming MPH or km/h (Menu 1) ..... 21
- Programming Tyre Radius (Menu 2) ..... 22
- Tire Radius Constant Table ..... 23
- Programming the Service Intervals (Menu 3) ..... 23
- Service Reminders (Menu 4) ..... 25
- Programming Implement Width (Menu 5) ..... 26
- Programming the “OLd” Instrument Cluster Hours (Menu 6) ..... 26
- Programming the PTO Constants (ALL PTO options) (Menu 7) ..... 27
- Programming A True Ground Speed Sensor (Radar) Constant (Menu 8) ..... 28
- Programming the Axle Ratio Constants (Menu 9) ..... 28
- Programming the Auxiliary/Remote Valve Constants (Menu10) ..... 29

https://truckmanualshub.com/



# GENERAL INFORMATION




MI03C064

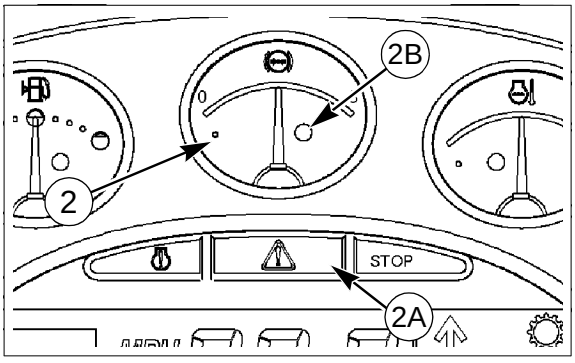
1. FUEL LEVEL GAUGE

1A. LOW FUEL WARNING LAMP

2. McCORMICK LOGO

   or

   AIR PRESSURE GAUGE (If Equipped) - indicates system pressure for pneumatic trailer brakes.




MI03D106

**NOTE:** *If the pressure drops below 4 bar (58 psi) the master warning lamp (2A) and low air pressure lamp (2B) will illuminate and an audible alarm will sound.*

3. ENGINE COOLANT TEMPERATURE GAUGE -

   **Yellow area:** low temperature.

   **Green area:** normal working temperature.

   **Red area**: high operating temperature.

4. TURN SIGNAL INDICATOR LAMPS

5. INDICATOR LAMPS - refer to Operators Manual for more information.

6. MAIN DIGITAL DISPLAY - refer to Operators Manual for more information.

https://truckmanualshub.com/



The Universal Data Display on the deluxe cluster provides various menus from service reminders, tractor performance and other cluster programming menus. The display will show different information depending upon Key switch position.

1. IGNITION ON/RUN MODE (Key switch one position clockwise from OFF). - The display provides tractor performance information, service reminders, calibration procedures, wheel slip etc.
2. ACCESSORY (PROGRAMMING) MODE (Key switch one position counterclockwise from OFF). This position will allow the operator to program certain parts of the cluster.

The deluxe instrument cluster is programmed when leaving the factory. Further programming of the instrument cluster will be necessary if the rear tyre size has been changed or if a new instrument cluster is to be installed. Programming the instrument cluster requires a number of predetermined “Constants” being entered into the instrument cluster memory. These “Constants” vary between the different tractor models, it is important that the correct procedure is followed for each model so an accurate read-out is displayed by the instrument cluster.

To enable the area function to work accurately, the implement width must be programmed into the cluster. Also if a more accurate loaded tire radius for the ground speed is required Dynamic Calibration of the cluster should be carried out. These two functions must be carried out by the operator during field operation.

**IMPORTANT:** *If accessory or battery power is lost before saving the programmed constant in the cluster memory, the selected constant will not be stored. When the power is restored the cluster will return to its normal operating mode and not to the programming mode.*

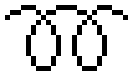
https://truckmanualshub.com/



# 1. IGNITION ON/RUN MODE

## During normal operation

While the tractor is in operation the cluster and various controllers are monitoring the tractors performance. On occasions the cluster will display certain messages/symbols on the Universal Data Display to advise the operator.



**Wait-To-Start.**
Do not try and start the engine with this symbol illuminated. Wait until the symbol goes off before trying to start the engine.

This symbol may also illuminate after start up to indicate the heater is still activated.



**Water in Fuel Detected.**
Drain fuel filter.



**Tractor Malfunction.**
An error has been detected within one or more of the tractor's controller systems and an error code has been generated (active errors only).

**Identify Controller Errors:**

Press the menu button to enter the menu.



Each controller is shown on the Universal Data Display,

Example:

| | |
|---|---|
| ENG | = ENGINE |
| IC | = INSTRUMENT CLUSTER |
| CC | = CAB CONTROL |
| TC | = TRANSMISSION |
| HC | = HITCH/PTO CONTROL |
| CS | = CAB SUSPENSION |
| AVC | = AUXILIARY VALVE CONTROL |
| AVC 1 to AVC 5 | = AUXILIARY VALVES |

followed by the number of identified errors for each controller.

Example:

| | |
|---|---|
| HC 0 | = No hitch errors. |
| HC 4 | = Four hitch errors detected. |

Using the UP button scroll through to establish if more than one controller has detected errors.



**To view error codes:**

Identify the controller with errors detected, as per previous procedure.

Press the menu button to enter the controller error code menu.



If more than one error code has been generated use the UP button to scroll through and identify each error code.



Press the menu button to exit.



https://truckmanualshub.com/



Quick Reference Example:

| | | |
|---|---|---|
| HC 3 | Three hitch/PTO errors detected. | |
| 1809 | PTO Error Code 1809 | |
| 2166 | Hitch Error Code 2173 | |
| 2208 | Hitch Error Code 2208 | |
| | Exit menu. | |

For further information and listings of error codes refer to relevant service manual controller sections.

## Entering The Programming Mode

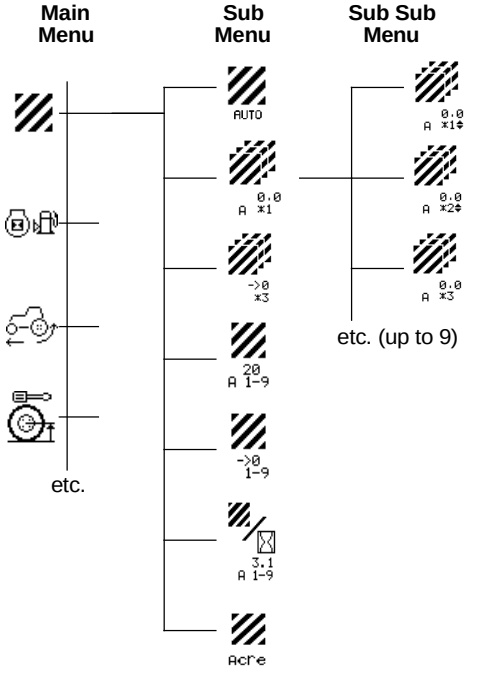
### STEP 1

Press and hold the menu button for 2 seconds.

### STEP 2

Use the UP button scroll through each menu until you reach the required display.

The programming structure consists of a number main menus. Certain main menus are then subsequently split into sub menus and sub sub menus. An example of the programming structure is shown below.

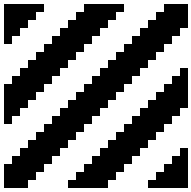



Exit the programming mode at any time by turning the key switch to the OFF position. When the key switch is turned to the on position the cluster will return to its normal operating mode.

https://truckmanualshub.com/



## Area Function (Menu 1)



The area function can display the sub-total area worked per field (up to a maximum of 9 fields), the total area worked (the total of all fields worked) and the area worked per hour.

*NOTE: Prior to using the area function the implement width must be programmed into the cluster. See Programming Implement Width (Menu 5) on Page 26 for correct procedure.*

*NOTE: For trailed implements, a connector is provided on the harness behind the seven terminal auxiliary electrical socket, to connect an implement position switch. This will turn the area function off when not required. Refer to main manual for further information with regard to the external implement switch.*

**NOTE:** ***You MUST first enter the main menu before being able to view the sub menus, as explained on Page 6.***

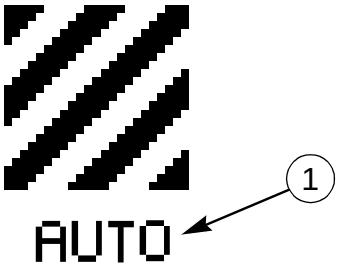
**To change the current area function status (Menu 1-1):**

### STEP 1



Momentarily press the menu button to enter the sub menu.

The current area function status (1) will be displayed under the area icon.




### STEP 2



Momentarily press the menu button again.



Use the UP and Down buttons to change the status accordingly.



**OFF** = Area Function Off.

**MAN** (ON) = Area Function On.

**AUTO** = Auto Mode will only accumulate the area worked when the implement is in the lowered position (working). The area count will turn on and off automatically when using either the hitch raise/lower switch, or an external implement switch, which has been connected into the wiring harness.

### STEP 3



Momentarily press the menu button to store the new setting and return to the main menu.

https://truckmanualshub.com/



**To select a specific field and view area worked with that field (Menu 1-2):**

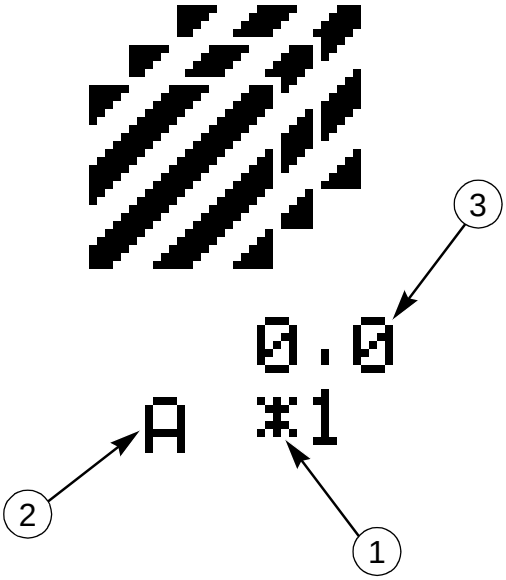
## STEP 1

Momentarily press the menu button to enter the sub menu.

## STEP 2

Use the UP button to scroll through the sub menus until the field selection menu is displayed, as shown below.

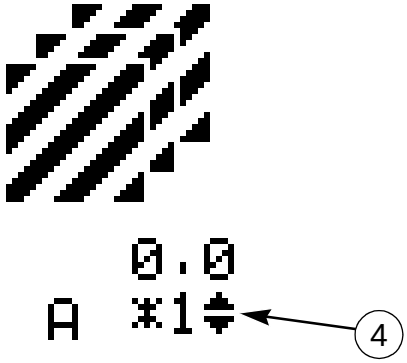
**NOTE:** *The STAR (1) next to the field number identifies which field is currently selected, (up to a maximum of nine).*




1. CURRENT FIELD SELECTED
2. UNIT OF MEASUREMENT
3. AREA COVERED

Once you have found the correct menu,

momentarily press the menu button again to enter the sub sub menu. The scroll up/down symbol (4) will appear next to the current field selected.

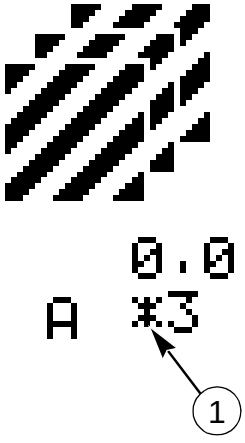



## STEP 3

Use the UP and Down buttons to scroll through the sub sub menus until the required field is found.

## STEP 4

Momentarily press the menu button to store the new field.




**NOTE:** *The STAR (1) next to the field number should appear to identify the new field has been successfully selected.*

https://truckmanualshub.com/



**To reset a specific field area counter (to zero) (Menu 1-3):**

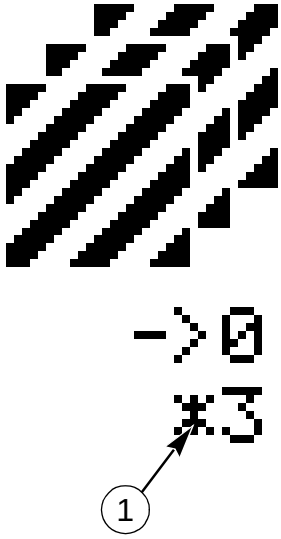
### STEP 1

Momentarily press the menu button to enter the sub menu.

### STEP 2

Use the UP button to scroll through the sub menus until the correct menu is displayed, as shown below.

**NOTE:** *The STAR (1) next to the field number identifies which field is currently selected.*




Once you have found the correct menu,

momentarily press the menu button again to enter the sub sub menu.The scroll up/down symbol will appear next to the current field selected.

### STEP 3

Use the UP and Down buttons to scroll through the sub sub menus until the required field is found.

### STEP 4

Momentarily press the menu button and the area counter will zero, will return to the sub menu and display the current field selected.

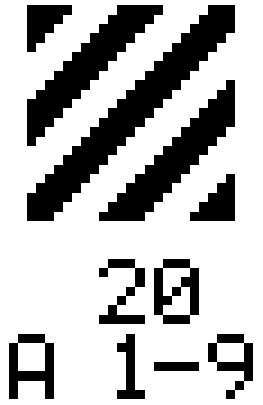
**To view the total area worked (of all fields, up to a maximum of nine) (Menu 1-4):**

### STEP 1

Momentarily press the menu button to enter the sub menu.

### STEP 2

Use the UP button to scroll through the sub menus until the correct menu is displayed, as shown below.




### STEP 3

Use the UP and Down buttons to scroll through to the next sub menu.

https://truckmanualshub.com/



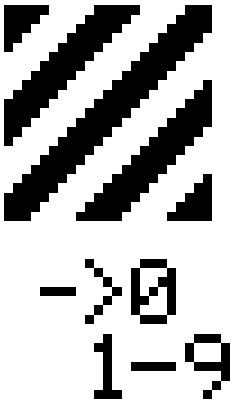
**To reset the total area counter (to zero) (Menu 1-5):**

**STEP 1**

Momentarily press the menu button to enter the sub menu.

**STEP 2**

Use the UP button to scroll through the sub menus until the correct menu is displayed, as shown below.




Once you have found the correct menu, momentarily press the menu button to reset the total area counter.

*NOTE: When you reset the total area counter each individual field counter will also be reset and will return to Menu 1-4.*

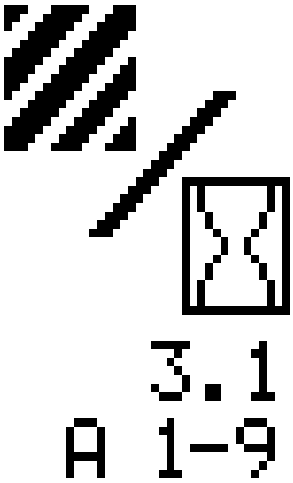
**To view the total area per hour (of all fields, up to a maximum of nine) (Menu 1-6):**

**STEP 1**

Momentarily press the menu button to enter the sub menu.

**STEP 2**

Use the UP button to scroll through the sub menus until the correct menu is displayed, as shown below.




**STEP 3**

Use the UP and Down buttons to scroll through to the next sub menu.

https://truckmanualshub.com/



**Programming hectares or acres (Menu 1-7):**

### STEP 1

Momentarily press the menu button to enter the sub menu.

### STEP 2

Use the UP button to scroll through the sub menus until the correct menu is displayed, as shown below.




### STEP 3

Momentarily press the menu button to enter the sub menu.

Use the UP and Down buttons to change the unit of measurement.

Momentarily press the menu button to store the new setting and return to the sub menu.

**NOTE:** *If you hold the menu button you will exit the programming mode.*

## Distance Function (Menu 2)



The distance function records and displays the distance travelled.

Within the Distance menu there are three sub menus, one to turn the distance function On/Off, one to read current distance travelled and one to read a accumulative distance travelled.

**NOTE:** *The units for distance travelled is automatically selected based upon the ground speed units.*

*e.g. If your cluster is programmed for m.p.h., then miles will be displayed. If your cluster is programmed for km/h, then kilometers will be displayed.*

**NOTE:** ***You MUST first enter the main menu before being able to view the sub menus, as explained on Page 6.***

https://truckmanualshub.com/



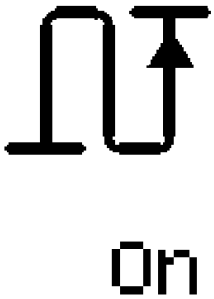
**To start the distance function (Menu 2-1):**

## STEP 1

Momentarily press the menu button to enter the sub menu.

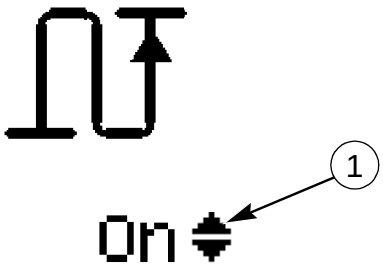
## STEP 2

Use the UP button to scroll through the sub menus until the correct menu is displayed, as shown below.




Once you have found the correct menu,

momentarily press the menu button again to enter the sub menu. The scroll up/down symbol (1) will appear next to the current status.




## STEP 3

Use the UP and Down buttons to turn the distance function ON or OFF.

## STEP 4

Momentarily press the menu button to store the new status and return to the sub menu.

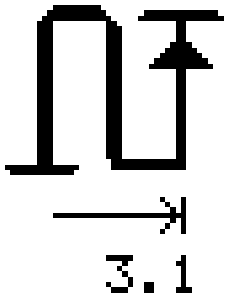
**To view the current total distance worked (Menu 2-2:**

## STEP 1

Momentarily press the menu button to enter the sub menu.

## STEP 2

Use the UP button to scroll through the sub menus until the correct menu is displayed, as shown below.




**To reset the counter:**,

simply press the menu button and the total area will zero.

https://truckmanualshub.com/



**To view the accumulative total distance worked (Menu 2-3):**

### STEP 1

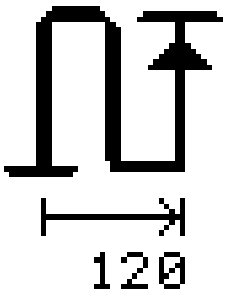


Momentarily press the menu button to enter the sub menu.

### STEP 2



Use the UP button to scroll through the sub menus until the correct menu is displayed, as shown below.



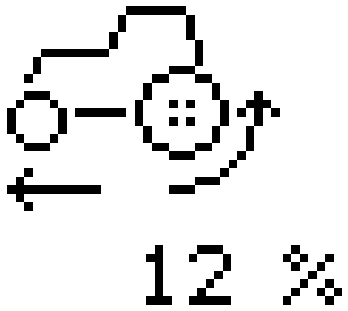

**To reset the counter:**,

simply press the menu button and the total area will zero.



**NOTE:** *When you reset the accumulative total counter the current total counter will also reset to zero.*

## Percentage Wheel Slip (Menu 3)



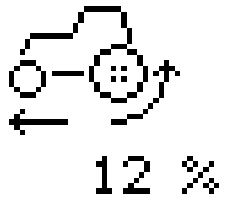

This screen will show the actual wheel slip and by entering the programme menu the slip limit can be changed.

### STEP 1



Momentarily press the menu button to enter the menu.

The current wheel slip setting will be displayed.






Use the UP and Down buttons change the setting accordingly.



Maximum setting is 25% and the minimum is 10%.

### STEP 2

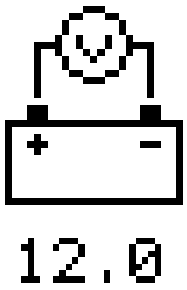


Momentarily press the menu button to store the new setting and return to the main menu.

https://truckmanualshub.com/



## Electrical System Voltage (Menu 4)

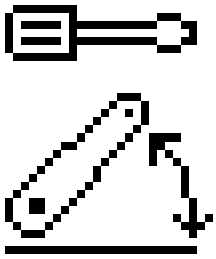



This screen displays the approximate electrical system voltage.

https://truckmanualshub.com/



## Cluster Hitch Position Display Calibration (Menu 5)



For the cluster to display an accurate hitch position the hitch needs to be calibrated.

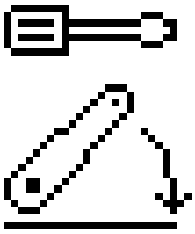
### STEP 1



Momentarily press the menu button to enter the calibration mode.

### STEP 2

The 'lower the hitch' icon will appear on the display.

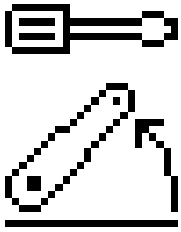


Lower the hitch to the bottom stop.

Press  to store the lower hitch position.

### STEP 3

The 'raise the hitch' icon will now appear on the display.



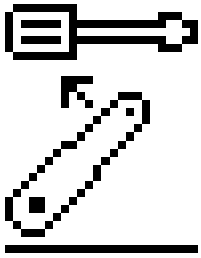
Raise the hitch to the upper limit.

**NOTE:** *Make sure the Upper Limit Control is set to maximum (11) position.*

Press  to store the upper hitch position.

### STEP 4

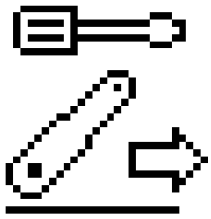
The 'hitch override' icon will appear on the display.



Simply press  again and return to the main menu.

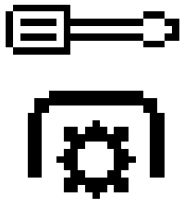
Calibration is now completed.

## Rear Hitch Calibration (Menu 6)



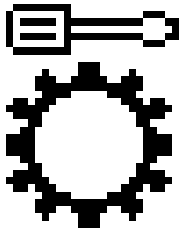
Refer to section 10002 for further information.

## Rear PTO Calibration (Menu 7)



Refer to section 10002 for further information.

## Transmission Calibration (Menu 8)

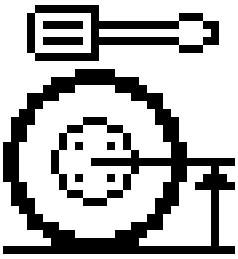


Refer to section 10006 for further information.

https://truckmanualshub.com/

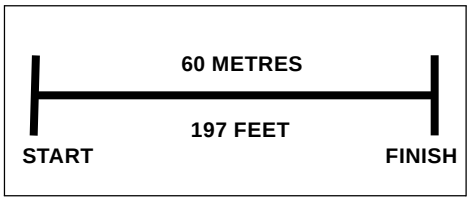


# Dynamic Calibration (Menu 9)



**Prior to entering the Dynamic Calibration Mode:**

## STEP 1




Mark off a straight line distance of 60 metres (197 ft). Use an acceptable method to mark the start line and finish line.

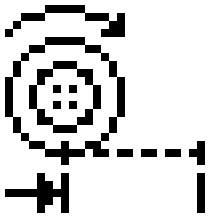
**To enter the Dynamic Calibration Mode:**

## STEP 2

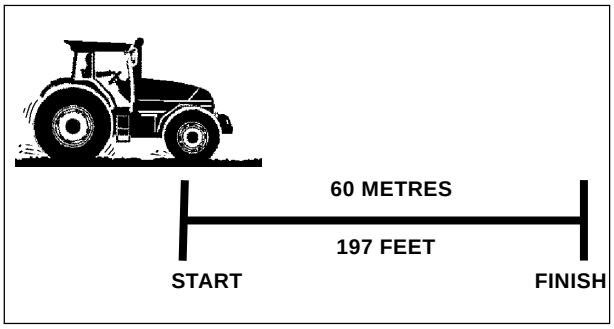


Momentarily press the menu button to enter the calibration mode.

The cluster will prompt you to drive the tractor to the start line by displaying the following icon.



## STEP 3



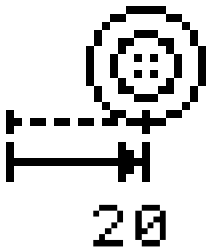

DI96J517

Start the tractor and drive SLOWLY toward the start line.

When the tractor reaches the start line, momentarily press the menu button.



The number of pulses displayed on the cluster will start to increase and the following icon will be displayed.




## STEP 4

When the tractor reaches the finish line, momentarily press the menu button.



The number of pulses displayed will be stored automatically into the cluster and will return to the main menu.

Calibration is now completed.

https://truckmanualshub.com/



## Cab Suspension Calibration (Menu 10)

**WARNING:** *The following procedure should only be carried while sat in the operators seat. Make sure any other person or persons are clear of the area around the cab.*

### STEP 1

Park the tractor on hard level ground, apply the Park Brake and put the forward/reverse shuttle lever in NEUTRAL or PARK. Put blocks in front of and behind the front and rear wheels.

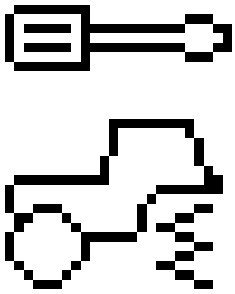
### STEP 2

Start the engine and momentarily press the instrument cluster menu button to enter the sub menu.

**WARNING:** *Never operate the engine in a closed building, proper ventilation is required under all circumstances.*

### STEP 3

Use the UP button to scroll through the sub menus until the correct menu is displayed, as shown below.



### STEP 4

Momentarily press the instrument cluster menu button again. The menu number will momentarily change to 10.1 to indicate the cab suspension controller has entered the calibration mode.

### STEP 5

The cab suspension calibration will now begin and the calibration sequence will be as follows.

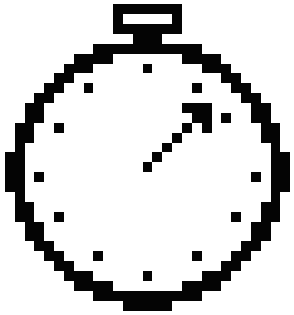
3. The cab will fully raise.
4. The cab will fully lower.
5. The cab will fully raise.
6. The cab will fully lower.
7. The cab will raise to the mid position.

When the cab calibration is complete turn the key OFF position.

https://truckmanualshub.com/



## Timer Function (If Equipped) (Menu 11)



The timer function gives the operator the ability to record the time spent in any individual field (up to a maximum of 9 fields) and the total elapsed time of all the selected fields.

The timer will display the elapsed time in minutes and hours.

**NOTE:** ***You MUST first enter the main menu before being able to view the sub menus, as explained on Page 6.***

### To start the timer function (Menu 11-1):

STEP 1

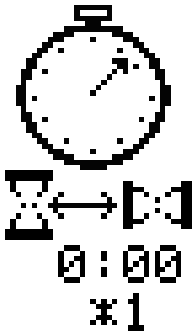


Momentarily press the menu button to enter the sub menu.

STEP 2



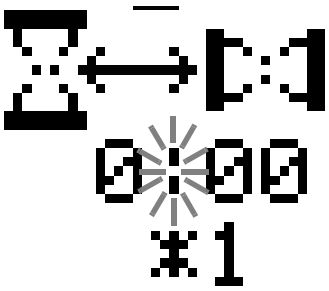
Use the UP button to scroll through the sub menus until the correct menu is displayed, as shown below.




Once you have found the correct menu,



momentarily press the menu button to start the timer.




The colon symbol will start flash to indicate the time function is active.

The timer will display the elapsed time in minutes and hours.

STEP 3



Momentarily press the menu button to stop the timer.

https://truckmanualshub.com/



## To select a specific field (Menu 11-2):

The timer function is not limited to one field. The elapsed time can be recorded in a total of nine fields.

STEP 1



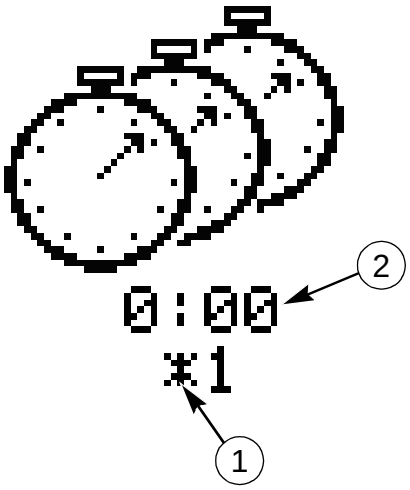
Momentarily press the menu button to enter the sub menu.

STEP 2



Use the UP button to scroll through the sub menus until the field selection menu is displayed, as shown below.

*NOTE: The STAR (1) next to the field number identifies which field is currently selected, (up to a maximum of nine).*

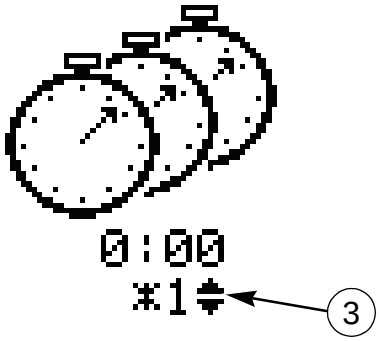



1. CURRENT FIELD SELECTED
2. TIME TAKEN

Once you have found the correct menu,



momentarily press the menu button again to enter the sub sub menu. The scroll up/down symbol (3) will appear next to the current field selected.




STEP 3



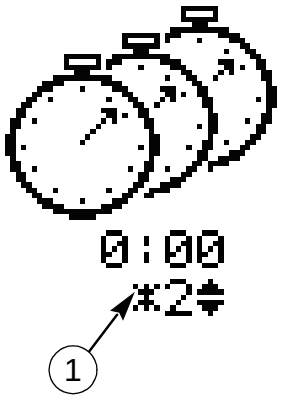


Use the UP and Down buttons to scroll through the sub sub menus until the required field is found.

STEP 4



Momentarily press the menu button to store the new field.




*NOTE: The STAR (1) next to the field number should appear to identify the new field has been successfully selected.*

https://truckmanualshub.com/



## To reset a specific field timer to zero (Menu 11-3):

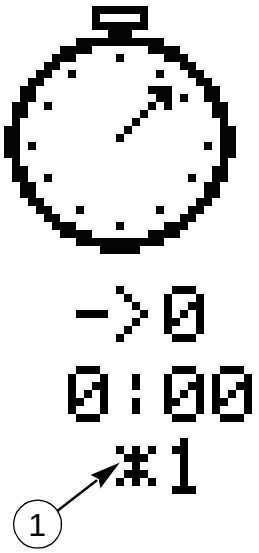
STEP 1

Momentarily press the menu button to enter the sub menu.

STEP 2

Use the UP button to scroll through the sub menus until the correct menu is displayed, as shown below.

*NOTE: The STAR (1) next to the field number identifies which field is currently selected.*




Once you have found the correct menu,

momentarily press the menu button again to enter the sub sub menu.The scroll up/down symbol will appear next to the current field selected.

STEP 3

Use the UP and Down buttons to scroll through the sub sub menus until the required field is found.

STEP 4

Momentarily press the menu button and the area counter will zero, will return to the sub menu and display the current field selected.

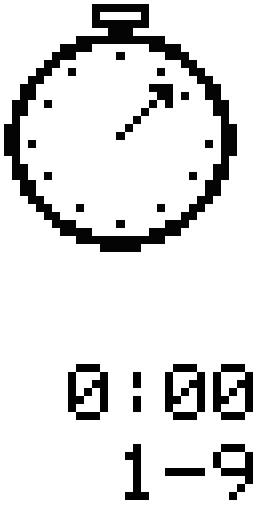
## To view the total time (of all fields, up to a maximum of nine) (Menu 11-4):

STEP 1

Momentarily press the menu button to enter the sub menu.

STEP 2

Use the UP button to scroll through the sub menus until the correct menu is displayed, as shown below.




STEP 3

Use the UP and Down buttons to scroll through to the next sub menu.

https://truckmanualshub.com/



## 2. ACCESSORY MODE -(One position counterclockwise from OFF)

### Entering The Programming Mode

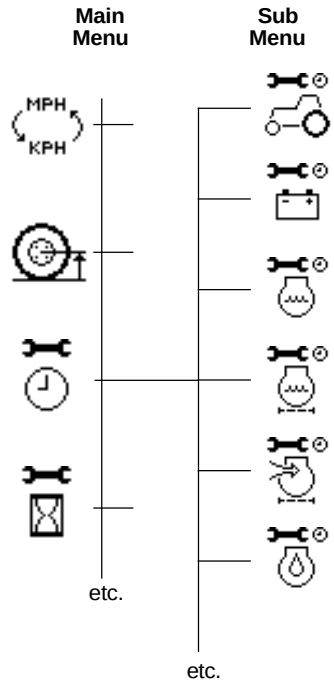
**STEP 1**

Press and hold the menu button for 2 seconds.

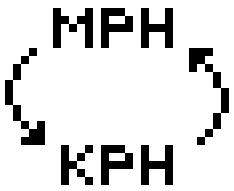
**STEP 2**

Using the UP and Down buttons scroll through each menu until you reach the required display.

The programming structure consists of a number main menus. Certain main menus are then subsequently split into sub menus. An example of the programming structure is shown below.




### Programming MPH or km/h (Menu 1)




**STEP 1**

Momentarily press the menu button to enter the menu.

Use the UP and Down buttons to change the setting accordingly.

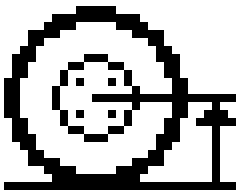
**STEP 2**

Momentarily press the menu button to store the new setting and return to the main menu.

https://truckmanualshub.com/



# Programming Tyre Radius (Menu 2)



In order for the cluster to display the correct ground speed, the correct tyre radius constant must be programmed. This setting is normally programmed into the cluster at the factory and should not have to be changed. However if different wheel/tyre equipment is installed then the new tyre radius constant must be programmed into the cluster.

**NOTE:** *Use the tables on Page 23 and Page 23 the determine the correct tire radius constant to be programmed into the cluster.*

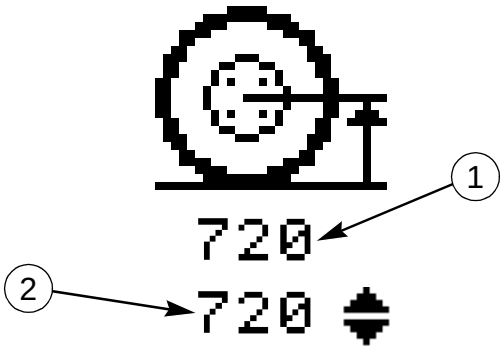
The radius can differ depending on tyre manufacturer, tyre wear, tyre pressures and load. The tyre radius constants quoted in the table above will provide the correct tractor ground speed, however the if a more accurate reading is required then a dynamic calibration is recommended. See page 16 for further information.

**NOTE:** ***You MUST first enter the main menu before being able to view the sub menus, as explained on Page 21.***

## STEP 1



Momentarily press the menu button to enter the menu.




The current tyre radius constant (1) will be shown under the icon and directly under that will be the new constant to be programmed (2).

## STEP 2





Use the UP and Down buttons to change the constant accordingly.

## STEP 3



Momentarily press the menu button to store the new constant and return to the main menu.

https://truckmanualshub.com/



# Tire Radius Constant Table

| Rear Tire Size | Constant |
|---|---|
| 8.3 - 24 | 470 |
| 9.5 - 20 | 445 |
| 11.2 - 20 | 465 |
| 12.4 - 20 | 490 |
| 13.6 - 24 | 560 |
| 14.9 - 24 | 590 |
| 14.9 R - 46 | 882 |
| 15.5 - 38 | 745 |

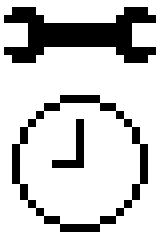
| Rear Tire Size | Constant |
|---|---|
| 18.4 - 24 IND | 635 |
| 20.8 - 34 | 805 |
| 21.3 - 30 | 810 |

| Rear Tire Size | Constant |
|---|---|
| 420/70 R24 | 590 |
| 420/80 R 46 (R1 TREAD) | 886 |
| 460/70 R24 | 590 |

| Rear Tire Size | Constant |
|---|---|
| 620/65R42 | 860 |
| 650/65R42 | 905 |

**NOTE:** *If the size of tire installed on the tractor is not listed, refer to the tire manufactures specification for the rolling circumference. Divide the specified rolling circumference by 6.28 to give the correct Ground Speed tire radius constant.*

## Programming the Service Intervals (Menu 3)



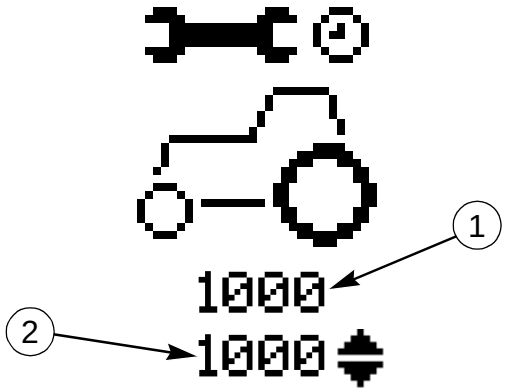
This menu allows the you to program numerous service reminders. With each service item programmed, once the relevant time has elapsed the service indicator symbol will illuminate.

Within the Service Timers menu there are numerous sub menus. Each menu allowing the operator to program the relevant service interval. These service intervals will normally be factory set and will correspond with the Service Interval Quick Reference Chart found in the Lubrication Section of this manual, however they may be changed as required.

### STEP 1



Momentarily press the menu button to enter the menu.




The current service interval (1) will be shown under the icon and directly under that will be the new interval to be programmed (2).

### STEP 2





Use the UP and Down buttons to change the service interval accordingly.

https://truckmanualshub.com/



### STEP 3

Momentarily press the menu button to store the new interval and return to the main menu.

### STEP 4

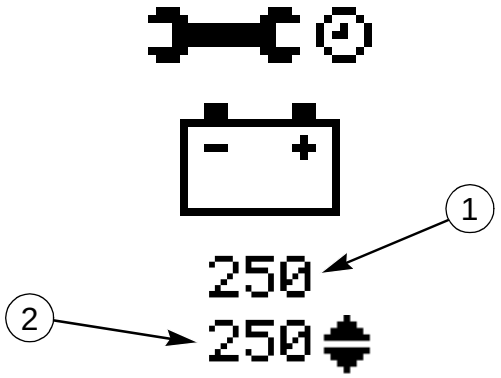
If you wish to change a further service interval you will have to enter the menu again.

Momentarily press the menu button to enter the menu.

Use the UP and Down buttons to scroll through the menus until you reach the required service.

### STEP 5

Momentarily press the menu button.




Once again the current service interval (1) will be shown under the icon and directly under that will be the new interval to be programmed (2).

### STEP 6

Use the UP and Down buttons to change the service interval accordingly.

### STEP 7

Momentarily press the menu button to store the new interval.

By pressing the button again you will exit the sub menus and return to the main menu.

Repeats steps 4 to 7 as required.

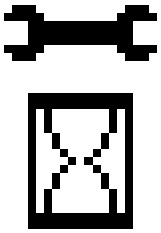
https://truckmanualshub.com/



**Icon Recognition**

| | |
|---|---|
|  | Tractor Main Service |
|  | Battery |
|  | Engine Coolant |
|  | Engine Air Filters |
|  | Engine Oil |
|  | Engine Oil Filter |
|  | Engine Fuel Filter |
|  | Transmission/Hydraulic Oil |
|  | Transmission/Hydraulic Filters |
|  | Cab Air Filter |
|  | Transmission/Hydraulic Strainer |
|  | Engine Coolant Filter |

## Service Reminders (Menu 4)



This menu displays the total number of hours remaining before a service is due for each of the pre programmed service intervals, (as per the previous menu).

As each service interval has elapsed the service indicator symbol (Spanner/Wrench) will illuminate.

### STEP 1



Momentarily press the menu button.

### STEP 2





Press either the UP and Down buttons to display the relevant service icon and the hours remaining before the next service is required.

### STEP 3

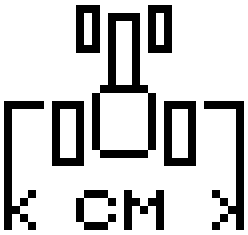


Momentarily press the menu button to return to the main menu.

https://truckmanualshub.com/



## Programming Implement Width (Menu 5)




To calculate an accurate Area Worked it is necessary to programme the correct implement width into the cluster.

### STEP 1



Momentarily press the menu button.

### STEP 2





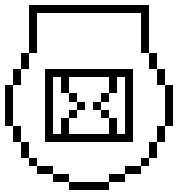
Use the UP and Down buttons to change the implement width accordingly.

### STEP 3



Momentarily press the menu button to store the new implement width and return to the main menu.

## Programming the “OLd” Instrument Cluster Hours (Menu 6)



The cluster hourmeter display reading can not be changed. A new cluster will always start recording at ‘0”. If a new cluster is installed, the recorded hours from the old cluster can be programmed into a separate ‘OLd hour display in the new cluster. This function provides the option to store and display the hours recorded by a replaced cluster, so an accurate recording of the tractors total hours can be kept electronically.

### STEP 1



Momentarily press the menu button.

### STEP 2





Use the UP and Down buttons to input the old cluster engine hours accordingly.

### STEP 3

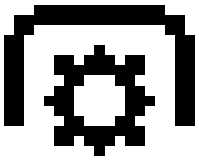


Momentarily press the menu button to store the old hours and return to the main menu.

https://truckmanualshub.com/



## Programming the PTO Constants (ALL PTO options) (Menu 7)



### STEP 1



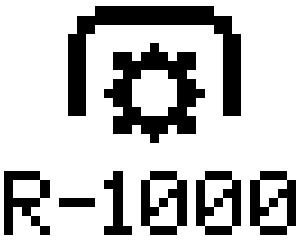
Momentarily press the menu button to enter the menu.

### STEP 2





Use the UP and Down buttons to scroll through the menus until you reach the required PTO constant to change.




### STEP 3

Once the correct PTO option has been found Momentarily press the menu button. This allows you to enter the menu and change the constant.



The current constant will be shown under the icon and directly under that will be the new constant to be programmed.

**F - 1000** = Front PTO

**R - 540** = Rear 540 rpm PTO

**R - 750** = Rear 750 rpm PTO

**R - 1000** = Rear 1000 rpm PTO

### STEP 4



Use the UP and Down buttons to input the new constants.



Refer to the following table for the correct constants to input into the cluster.

| FRONT PTO CONSTANTS | |
|---|---|
| Tractors Without Front PTO | 0 |
| Tractors With Front PTO | 200 |

| REAR PTO CONSTANTS | | | | |
|---|---|---|---|---|
| **Model** | **540E PTO** | **540 PTO** | **750 PTO** | **1000 PTO** |
| European Specification With 540E PTO | 1 | 0 | 0 | 1 |
| European Specification With 540 PTO | 0 | 1 | 0 | 1 |
| American Specification With 540E PTO | 1 | 0 | 0 | 1 |
| American Specification With 540 PTO | 0 | 1 | 0 | 1 |

**NOTE:** *Even though the XTX series tractors do not have a 750 rpm PTO option a zero (0) must be programmed into the cluster. This informs the cluster that this option is not available and therefore the cluster will not display any information for that option.*

### STEP 5

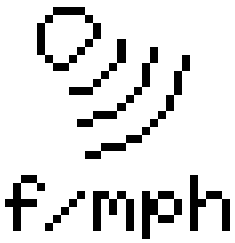


Momentarily press the menu button to store the new constant and return to the main menu.

https://truckmanualshub.com/



## Programming A True Ground Speed Sensor (Radar) Constant (Menu 8)




If a true ground speed radar is installed via the factory a constant will have been programmed into the cluster. However if a McCormick radar is installed as a dealer option it will be necessary to programme the cluster.

### STEP 1



Momentarily press the menu button to enter the menu.

### STEP 2





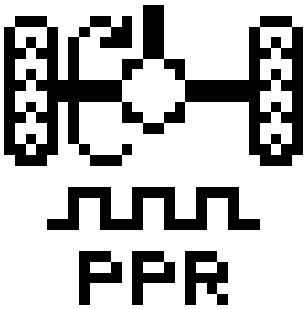
Use the UP and Down buttons to input the constant, **4150**.

### STEP 3



Momentarily press the menu button to store the constant and return to the main menu.

## Programming the Axle Ratio Constants (Menu 9)




### STEP 1



Momentarily press the menu button to enter the menu.

### STEP 2





Use the UP and Down buttons to input the constant, **378**.

### STEP 3

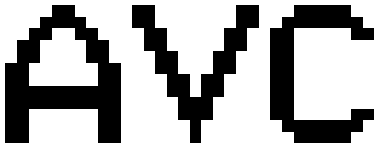


Momentarily press the menu button to store the new constant and return to the main menu.

https://truckmanualshub.com/



## Programming the Auxiliary/Remote Valve Constants (Menu10)




### STEP 1



Momentarily press the menu button to enter the menu.

### STEP 2





Use the UP and Down buttons to input the constant as follows:
**0** = XtraSpeed and XtraSpeed - E Tractors only.
**1** = XtraSpeed - E Plus Tractors only.

### STEP 3



Momentarily press the menu button to store the new constant and return to the main menu.

### To reset the total timer to zero (Menu 11-5):

STEP 1

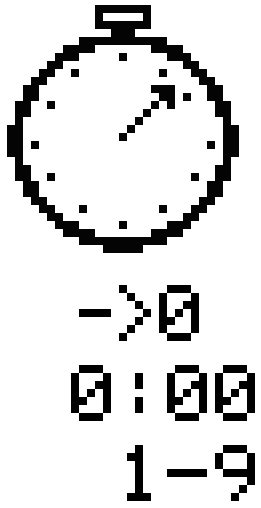


Momentarily press the menu button to enter the sub menu.

STEP 2



Use the UP button to scroll through the sub menus until the correct menu is displayed, as shown below.




Once you have found the correct menu,



momentarily press the menu button to reset the total area counter.

*NOTE: When you reset the total timer each individual field counter will also be reset and will return to Menu 11-4.*

https://truckmanualshub.com/



# Section 4004

## BATTERY SERVICING AND TESTING

McCORMICK

SM 8-10160

© 2001 McCormick Tractors International Limited.
March 2001

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIFICATIONS ..... 3

SPECIAL TOOLS ..... 3

SAFETY PROCEDURES ..... 4

MAINTENANCE
- Electrolyte Level ..... 4
- Inspecting and Cleaning the Battery, Cables and Terminals ..... 4

BATTERY TESTING
- Method One - Five Step Battery Test ..... 5
- Method Two - Using Heavy Duty Battery Tester ..... 6

CHARGING THE BATTERY ..... 8

PREPARING A DRY CHARGED BATTERY FOR USE ..... 8

BOOSTER BATTERY CONNECTIONS ..... 9

https://truckmanualshub.com/



## SPECIFICATIONS

Type of System..... 12 Volt, Negative Ground
Batteries..... One 12 Volt, Low Maintenance Hybrid Battery or
Two 12 Volt, Low Maintenance Hybrid Batteries Connected in Parallel
DIN Type 60527, Top Stud Terminals

| BATTERY TYPE | SAE (COLD CRANKING CAPACITY) | IEC | DIN | AMPERE HOURS | RESERVE CAPACITY |
|---|---|---|---|---|---|
| 629 | 1000 Amps | 670 Amps | 600 Amps | 170 | 320 mins |
| 644 | 660 Amps | 440 Amps | 400 Amps | 95 | 180 mins |
| 664 | 770 Amps | 515 Amps | 465 Amps | 105 | 210 mins |
| 648 | 810 Amps | 545 Amps | 490 Amps | 120 | 220 mins |

## SPECIAL TOOLS




DD98H086

**MC10930 HEAVY DUTY BATTERY TESTER OR EQUIVALENT**



DD98H115

**MC10932 OPTICAL ENGINE COOLANT AND BATTERY ELECTROLYTE TESTER OR EQUIVALANT**




DD98H115

**MC10931 RECHARGEABLE BATTERY PACK OR EQUIVALANT**

https://truckmanualshub.com/



# SAFETY PROCEDURES

**WARNING:** *THIS SAFETY ALERT SYMBOL INDICATES IMPORTANT SAFETY MESSAGES IN THIS MANUAL. WHEN YOU SEE THIS SYMBOL, CAREFULLY READ THE MESSAGE THAT FOLLOWS AND BE ALERT TO THE POSSIBILITY OF PERSONAL INJURY OR DEATH.* M171B

**WARNING:** *BATTERY ACID CAUSES SEVERE BURNS. Batteries contains sulphuric acid. Avoid contact with skin, eyes or clothing. Antidote: EXTERNAL - flush with water. INTERNAL - drink large quantities of water or milk. Follow with milk of magnesia, beaten egg or vegetable oil. Call a physician immediately. EYES - flush with water for 15 minutes and get prompt medical attention. BATTERIES PRODUCE EXPLOSIVE GASES. Keep sparks, flame and cigarettes away. Ventilate when charging or using in an enclosed space. Always shield eyes when working near batteries. KEEP OUT OF REACH OF CHILDREN.* M144A

**WARNING:** *When working around storage batteries, remember that all of the exposed metal parts are 'live'. Never lay a metal object across the terminals because a spark or short circuit will result.* M145A

**WARNING:** *Do not charge a frozen battery, it can explode, causing serious injury.* M529

**WARNING:** *Battery explosion and/or damage to electrical components can result from improper connection of booster batteries or charger. Connect positive to positive and negative to negative. Externally, battery acid can cause burns and blindness, and taken internally is poison.* M146A

**WARNING:** *Always connect the ground cable last and disconnect the ground cable first so you do not cause a spark at the battery. A spark can cause a battery explosion and cause injury.* M530

# MAINTENANCE

## Electrolyte Level

Check the electrolyte level in each cell every 300 hours of operation. The machine is equipped with either one (1) or two (2) Low Maintenance batteries.

If electrolyte level is low add distilled water to just cover the top of the separators. DO NOT OVER FILL. Do not use water which contains minerals. The level should be 3 to 6 mm (0.12 to 0.24 inch) below vent well.

When distilled water is added at ambient temperatures below $0^{o}$C ($32^{o}$F) the batteries must be charged immediately to mix the water and electrolyte or the water will freeze, because the water will stay on top of the electrolyte.

## Inspecting and Cleaning the Battery, Cables and Terminals

Inspect the battery at regular intervals for dirt, corrosion and damage. Electrolyte and dirt on the top of the battery can cause the battery to discharge by providing a passage for the current to flow. Make sure the vents are installed firmly in position and the battery top is clean and dry. The battery terminals must be kept clean and tight. Remove all corrosion with a wire brush, then wash with a weak solution of baking soda or ammonia. Apply petroleum jelly to the terminals to prevent more corrosion. DO NOT apply grease.

https://truckmanualshub.com/



# BATTERY TESTING

## Method One - Five Step Battery Test

Follow STEP 1 to STEP 5 to correctly determine the condition of the battery if Automatic Battery Tester MC10930 is not available.

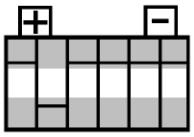
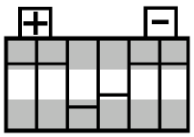
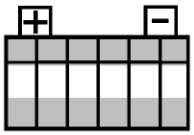
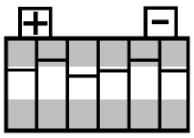
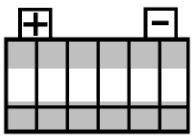
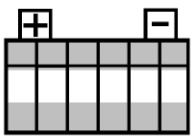
**NOTE:** *Batteries may be overcharged or undercharged due to a fault in the tractors electrical system. Always make sure the electrical system is working correctly.*

**NOTE:** *If the Voltmeter Reading in STEP 2 shows a reading of below 10 volts, it may not be possible to successfully recharge the battery and its further service life is often greatly reduced.*

**NOTE:** *Where discoloured electrolyte is observed, this is always due to a service related condition.*

### STEP 1. VISUAL CHECK

- Make sure cable connections are clean and tight. Clean foreign material from the battery top.
- Inspect the battery case, battery posts and cables for damage.
- Check the electrolyte level, refer to “Electrolyte Level” on page 4
- If you added distilled water to the battery, the battery must be charged for 15 minutes at 15 to 20 amperes to mix the water with the electrolyte.

| STEP 2. VOLTMETER READING | STEP 3. HIGH RATE DISCHARGE TEST | STEP 4. HYDROMETER READING (see NOTE 1) | STEP 5. BATTERY CONDITION |
|---|---|---|---|
| 10 to 11.5 volts | Below 9 volts (voltage often rises) | GREEN (ABOVE 1260 SG)<br>WHITE (1225 to 1260 SG)<br>RED (BELOW 1225 SG)  | REPLACE BATTERY |
| 10 to 11.5 volts | Below 9 volts (voltage often rises) | GREEN (ABOVE 1260 SG)<br>WHITE (1225 to 1260 SG)<br>RED (BELOW 1225 SG)  | REPLACE BATTERY |
| 0 to 12.6 volts | Below 3 volts (voltage normally zero) | GREEN (ABOVE 1260 SG)<br>WHITE (1225 to 1260 SG)<br>RED (BELOW 1225 SG)  | REPLACE BATTERY |
| 6 to 12.4 volts | Below 9 volts (voltage steadily falls) | GREEN (ABOVE 1260 SG)<br>WHITE (1225 to 1260 SG)<br>RED (BELOW 1225 SG)  | REPLACE BATTERY |
| Below 10 volts | Below 3 volts (voltage can be zero) | GREEN (ABOVE 1260 SG)<br>WHITE (1225 to 1260 SG)<br>RED (BELOW 1225 SG)  | RECHARGE BATTERY (see NOTE 2) |
| Above 11.5 volts | 3 to 9 volts (voltage remains stable) | GREEN (ABOVE 1260 SG)<br>WHITE (1225 to 1260 SG)<br>RED (BELOW 1225 SG)  | RECHARGE BATTERY |

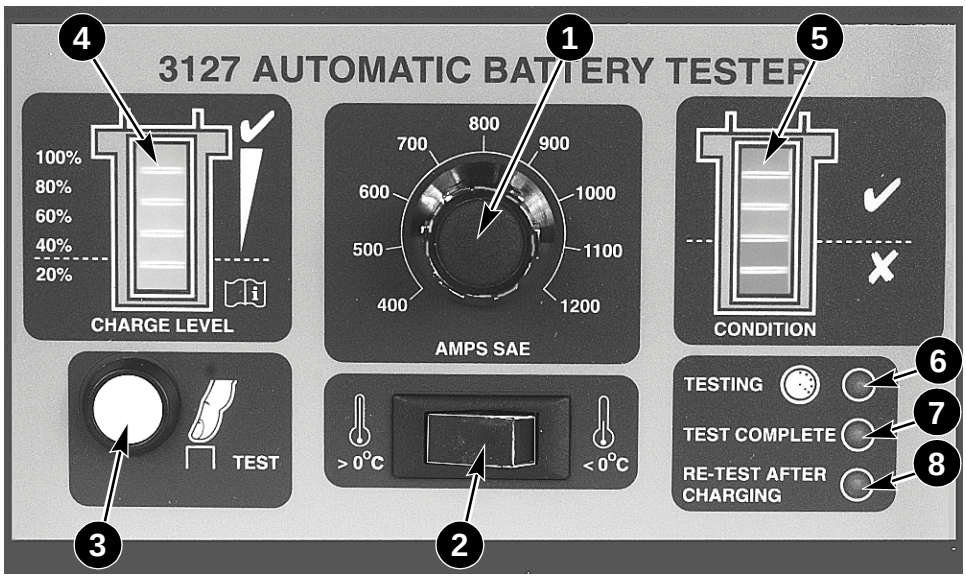
**NOTE 1:** *Record readings from each battery cell. The cell nearest the positive terminal is cell number 1. Using the hydrometer as a pump check the two end cells for discoloured electrolyte.*

**NOTE 2:** *The battery is over discharged and may not recover after recharging.*

https://truckmanualshub.com/



## Method Two - Using Heavy Duty Battery Tester




DD98H087

1. CONTROL KNOB (SAE CRANK AMPS)
2. TEMPERATURE SWITCH
3. TEST BUTTON
4. CHARGE LEVEL INDICATOR
5. BATTERY CONDITION INDICATOR
6. TEST IN PROGRESS INDICATOR LAMP
7. TEST COMPLETE INDICATOR LAMP
8. RE-TEST AFTER CHARGING INDICATOR LAMP

### STEP 1

Connect MC10930 heavy duty battery tester onto the battery. Set the AMPS SAE control knob (1) to the correct SAE (cold cranking capacity) for the battery installed, refer to “SPECIFICATIONS” on page 3

### STEP 2

Make sure the TEMPERATURE switch (2) is in the >0°C (normal) position.

**NOTE:** *In temperatures below 0°C (32°F) move the TEMPERATURE switch (2) to the <0°C (cold) position.*

### STEP 3

Connect the positive (+ RED) cable clamp of the automatic battery tester to the positive (+ RED) cable terminal on the machine battery.

Connect the negative (- BLACK) cable clamp of the automatic battery tester to the positive (- BLACK) cable terminal on the machine battery.

**NOTE:** *It is not necessary to disconnect and remove the battery from the tractor. If the automatic battery tester is incorrectly connected it will not work. If the bleeper sounds the battery must be recharged before the test can continue, refer to "CHARGING THE BATTERY" on page 8.*

### STEP 4

Press the TEST button (3) and the test will begin automatically. The test will be completed in 40 seconds or less, to determine the condition of the battery refer to “Test Results” on page 7.

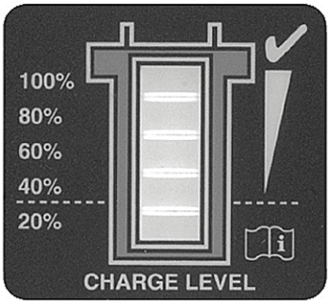
### STEP 5

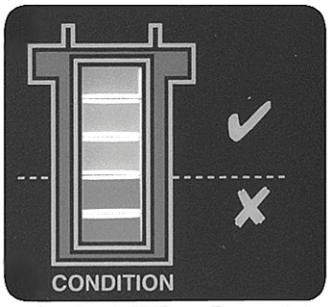
If the battery charge level is below 20% it is not possible to complete the test without a booster battery, the re-test after charging indicator lamp (8) will flash and a bleeper will sound. To re-test the battery, using the cables supplied connect MC10930 heavy duty battery tester to a booster battery and repeat STEP 4.
Alternatively connect MC10931 Rechargeable Battery Pack to MC10930 heavy duty battery tester and repeat STEP 4.

https://truckmanualshub.com/



## Test Results

| BATTERY CHARGE LEVEL | | |
|---|---|---|
| CHARGE LEVEL INDICATOR | DISPLAY READING | RESULT |
|  | Flashing Display | Result being calculated |
| | Solid Display | Result confirmed |
| | 5 Bars Illuminated | 100% (fully charged) |
| | 4 Bars Illuminated | 80% |
| | 3 Bars Illuminated | 60% |
| | 2 Bars Illuminated | 40% |
| | 1 Bar Illuminated | 20% |
| | 1 Bar Flashing | BATTERY FLAT, refer to “CHARGING THE BATTERY” on page 8 |

| BATTERY CONDITION | | |
|---|---|---|
| CONDITION INDICATOR | DISPLAY READING | RESULT |
|  | Flashing Display | Result being calculated |
| | Solid Display | Result confirmed and bleeper sounds |
| | 3 Green Bars Illuminated | Good battery - return to service |
| | 2 Green Bars Illuminated | Good battery - return to service |
| | 1 Green Bar Illuminated | Battery performance adequate (but may need replacing in near future) |
| | 1 Red Bar Illuminated | Replace battery - unserviceable |
| | 2 Red Bars Illuminated | Replace battery - unserviceable |
| | **NOTE:** *Red bars continue to flash at end of test.* | |

https://truckmanualshub.com/



# CHARGING THE BATTERY

**WARNING:** *Do not charge a frozen battery, it can explode, causing serious injury.* M529

**IMPORTANT:** *Before charging the battery check the electrolyte level, refer to "Electrolyte Level" on page 4*

**IMPORTANT:** *If the battery has been in storage check the voltmeter reading, if the reading is above 12.5 volts the battery does not need charging. If the voltmeter reading is below 12.5 volts follow the charging procedure to recharge the battery.*

## STEP 1

Install the battery onto a suitable variable battery charger. Select the correct battery type installed on your tractor, refer to “SPECIFICATIONS” on page 3. Set the charging rate at 5 to 7 amps for batteries above 90 Ampere Hours (set charging rate of 3 to 4 amps for batteries below 90 Ampere Hours). Charge the battery for 12 hours.

**NOTE:** *If an automatic battery charger is used, battery charging is complete when the GREEN indicator light is illuminated.*

## STEP 2

After charging allow the battery to stand for 24 hours before measuring battery voltage, the voltage reading should be above 12.7 volts.

If the battery is immediately required measure the cells with a hydrometer, the hydrometer reading for each cell should be a minimum of 1.270 Sg

**NOTE:** *If the voltage reading or hydrometer readings are not correct repeat STEP 2 and recharge the battery. If after a second charge the battery fails to achieve the correct readings, refer to "BATTERY TESTING" on page 5*

# PREPARING A DRY CHARGED BATTERY FOR USE

## STEP 1

Remove the battery vents and fill each cell with electrolyte to just cover the top of the separators. DO NOT OVER FILL. The level should be 3 to 6 mm (0.12 to 0.24 inch) below vent well. Install the battery vents.

## STEP 2

Follow the procedure above for CHARGING THE BATTERY.

https://truckmanualshub.com/



# BOOSTER BATTERY CONNECTIONS

**WARNING:** *Battery explosion and/or damage to electrical components can result from improper connection of booster batteries or charger. Connect positive to positive and negative to negative. Externally, battery acid can cause burns and blindness, and taken internally is poison.* M146A

**WARNING:** *Always connect the ground cable last and disconnect the ground cable first so you do not cause a spark at the battery. A spark can cause a battery explosion and cause injury.* M530

**IMPORTANT:** *When connecting a booster battery to the machine battery make sure the booster battery and the discharged battery have the same voltage (i.e. 12 VOLTS). Make sure you connect positive to positive and negative to a good ground on the machine chassis frame. DO NOT connect booster battery cables across the terminals of the starter. Always follow the procedure in your Operators Manual for Starting the Engine.*

## STEP 1

Position the machine with the booster battery next to the machine with the discharged battery so the booster cables can be easily connected. MAKE SURE the machines do not touch.

## STEP 2

Check the electrolyte levels and inspect the batteries, “MAINTENANCE” on page 4.

## STEP 3

On both machines turn OFF all electrical loads. Connect the positive (+) cable clamp of the booster battery to the positive (+ RED) cable terminal on the discharged battery. Connect the negative (-) cable clamp of the booster battery to a good ground on the chassis frame of the machine with the discharged battery.

## STEP 4

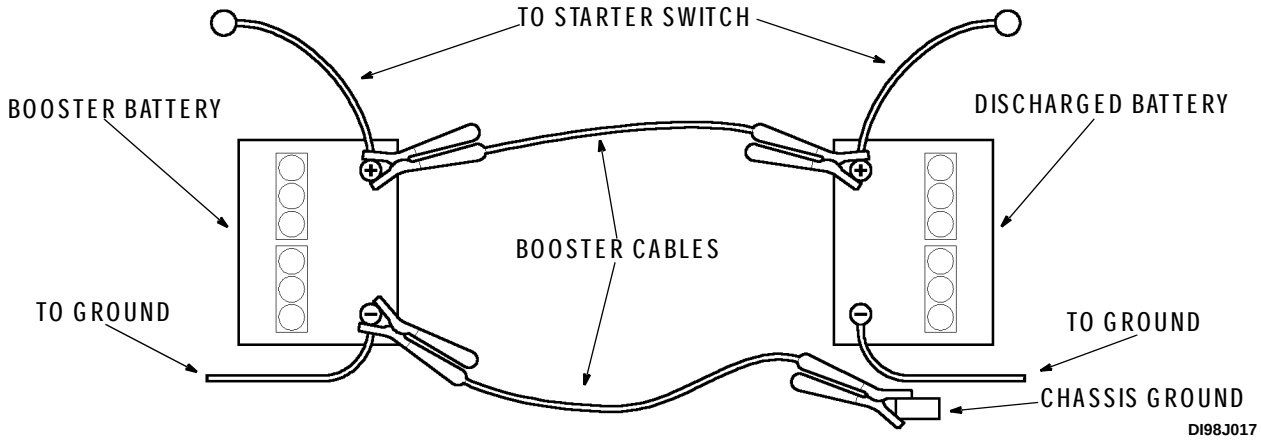
Start the engine of the machine with the booster battery and run for approximately two minutes.

## STEP 5

Follow the procedure in your Operators Manual and start the engine of the machine with the discharged battery. If the engine will not start after 30 seconds STOP THE PROCEDURE. Wait three minutes to allow the starter motor to cool.

## STEP 6

After starting allow the machine to idle, remove the negative (-) cable clamp from the chassis frame, then remove the negative (-) cable clamp from the booster battery. Remove the positive (+) cable clamp from the discharged battery, then remove the positive (+) cable clamp from the booster battery.



https://truckmanualshub.com/



# Section 5001

## STEERING COLUMN AND STEERING HAND PUMP REMOVAL

McCORMICK

SM 8-15270

© 2006 McCormick Tractors International Limited.
September 2006

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIFICATIONS ..... 3

SPECIAL TORQUES ..... 3

SPECIAL TOOLS ..... 3

STEERING COLUMN
- Removal and Installation ..... 4
- Disassembly and Assembly ..... 6

STEERING HAND PUMP
- Removal ..... 9
- Installation ..... 10

https://truckmanualshub.com/



## SPECIFICATIONS

Lower Splined Shaft Lubricant ..... Multi Purpose Lithium Grease

## SPECIAL TORQUES

Steering Column Retaining Locknut ..... 29 to 32 Nm
Steering Wheel Retaining Nut..... 45 to 54 Nm
Mounting Bracket to Steering Hand Pump
Retaining (Shoulder) Screw ..... 41 to 61 Nm

## SPECIAL TOOLS



DD98H114

**MC2612 BUSHING INSTALLER**
**(USE WITH HANDLE MC1924)**

https://truckmanualshub.com/



# STEERING COLUMN

## Removal and Installation

**NOTE:** *Items are numbered in the order of Removal, for Installation follow the Removal procedure in reverse order.*

Before removing the Steering Column it will be necessary to carry out the following:

- Park the tractor on hard level ground and apply the parking brake.
- Stop the engine and remove the key.
- Put blocks in front of and behind the rear wheels.

### STEP 1

Disconnect the battery, negative (-) terminal first.

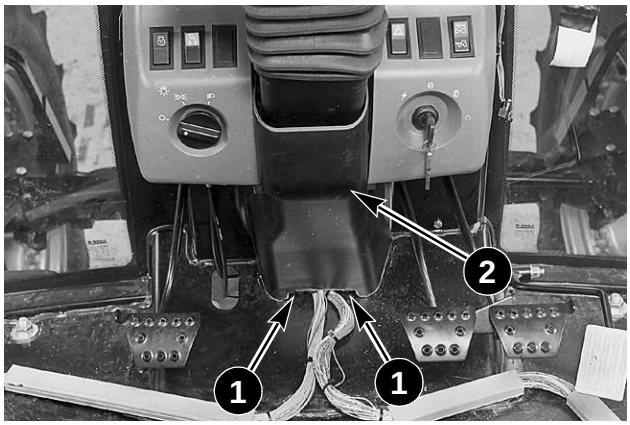
**NOTE:** *For Installation, connect the battery, positive (+) terminal first.*

### STEP 2

Remove the RH and LH instrument panel side covers.

**NOTE:** *Disconnect the harness from the auxiliary power socket on the RH side cover.*

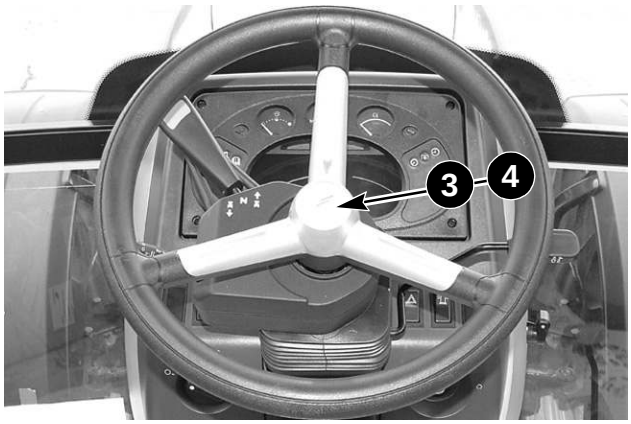
### STEP 3




DP98B076

Remove the cab floor mat and remove the two retaining screws (1) and remove the steering column cover (2).

### STEP 4

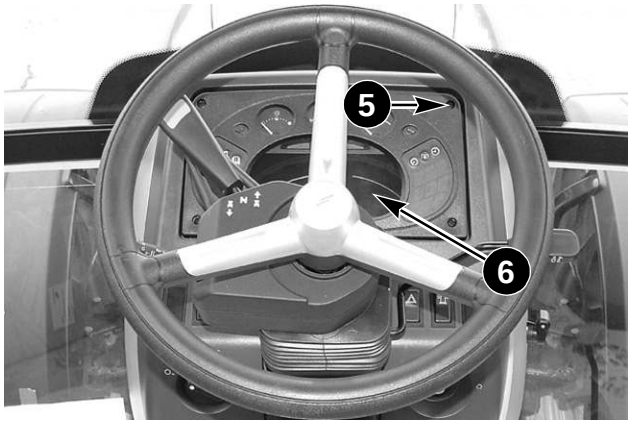



MD06F034

Remove the steering wheel cap. Remove the retaining nut (3) and washer (4), remove the steering wheel.

**NOTE:** *For Installation, tighten the steering wheel retaining nut (3) to a torque of 45 to 54 Nm.*

### STEP 5



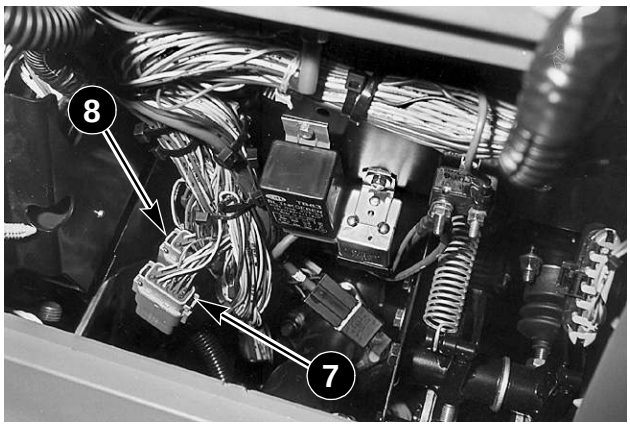

MD06F034

Remove the four retaining screws (5). Disconnect the harness and remove the instrument cluster (6).

https://truckmanualshub.com/



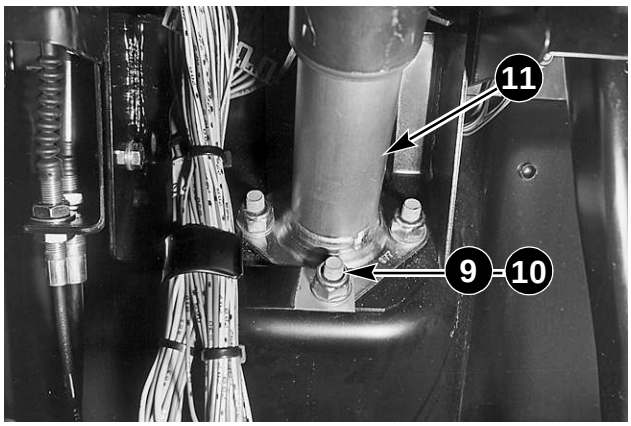
## STEP 6




DP98B073

Disconnect the FNR switch/turn signal harness connector (7) and turn signal self cancelling harness connector (8) (if equipped).

## STEP 7




DP98B072

Remove the harness from the clip. Support the steering column and remove and discard the four locknuts (9). Remove washers (10) and remove the steering column assembly (11).

**NOTE:** *For Installation, install new locknuts (9) and tighten to a torque of 29 to 32 Nm.*

**NOTE:** *For Installation, apply Multi Purpose Lithium grease, or equivalent, to the splines of the lower shaft of the steering column assembly (11).*

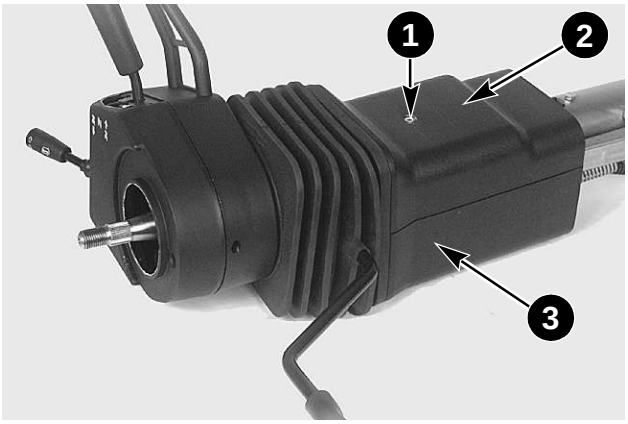
https://truckmanualshub.com/



## Disassembly and Assembly

**NOTE:** *Items are numbered in the order of Disassembly, for Assembly follow the same procedure in the reverse order.*

### STEP 8

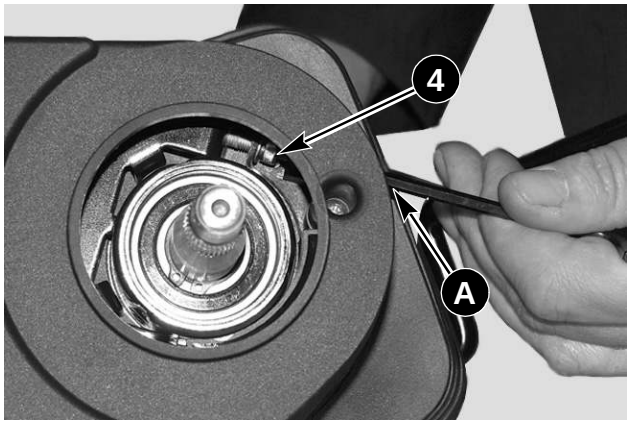



DD98A288

Remove the torx screws (1). Remove the upper cover (2) and the lower cover (3).

**NOTE:** *For tractors equipped with self cancelling turn signal switches it will be necessary to remove the FNR assembly top cover retaining screw and top cover. Loosen the locking allen screw and remove the self cancelling ring.*

### STEP 9

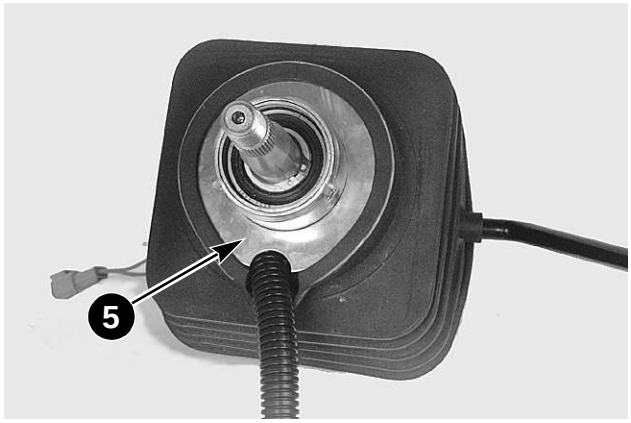



MD06F029

Gain access to the Allen screw through cut out (A) in the side of the FNR assembly, loosen the Allen screw (4) and raise the FNR assembly.

**NOTE:** *For installation, install and tighten allen screw (4)* to a torgue of 3Nm.

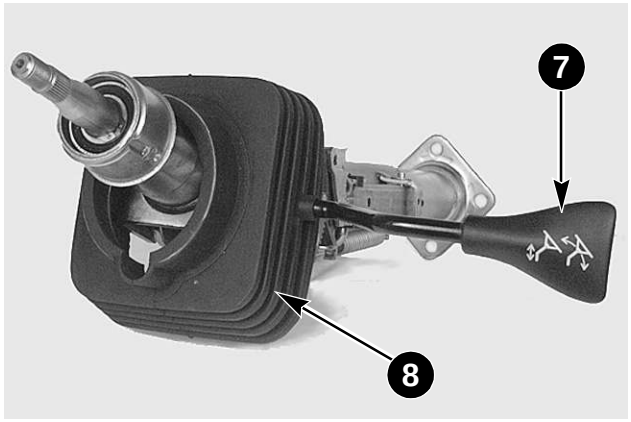
### STEP 10




DD98A295

Remove the plate (5) from the rubber bellows, thread the harness through the rubber bellows and remove the FNR assembly from the steering column.

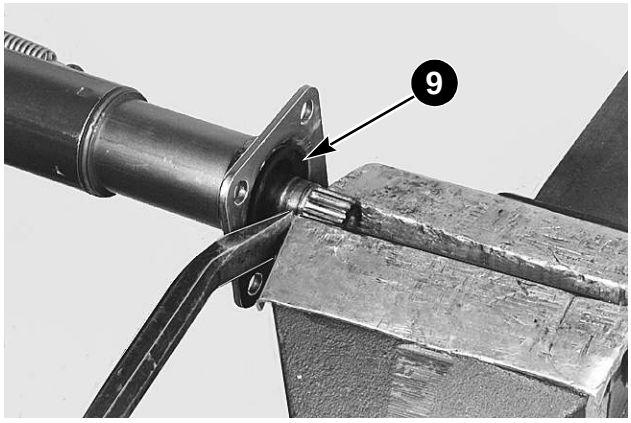
### STEP 11




DD98A296

Remove the knob (7) from the tilt/telescope lever and remove the rubber bellows (8).

### STEP 12

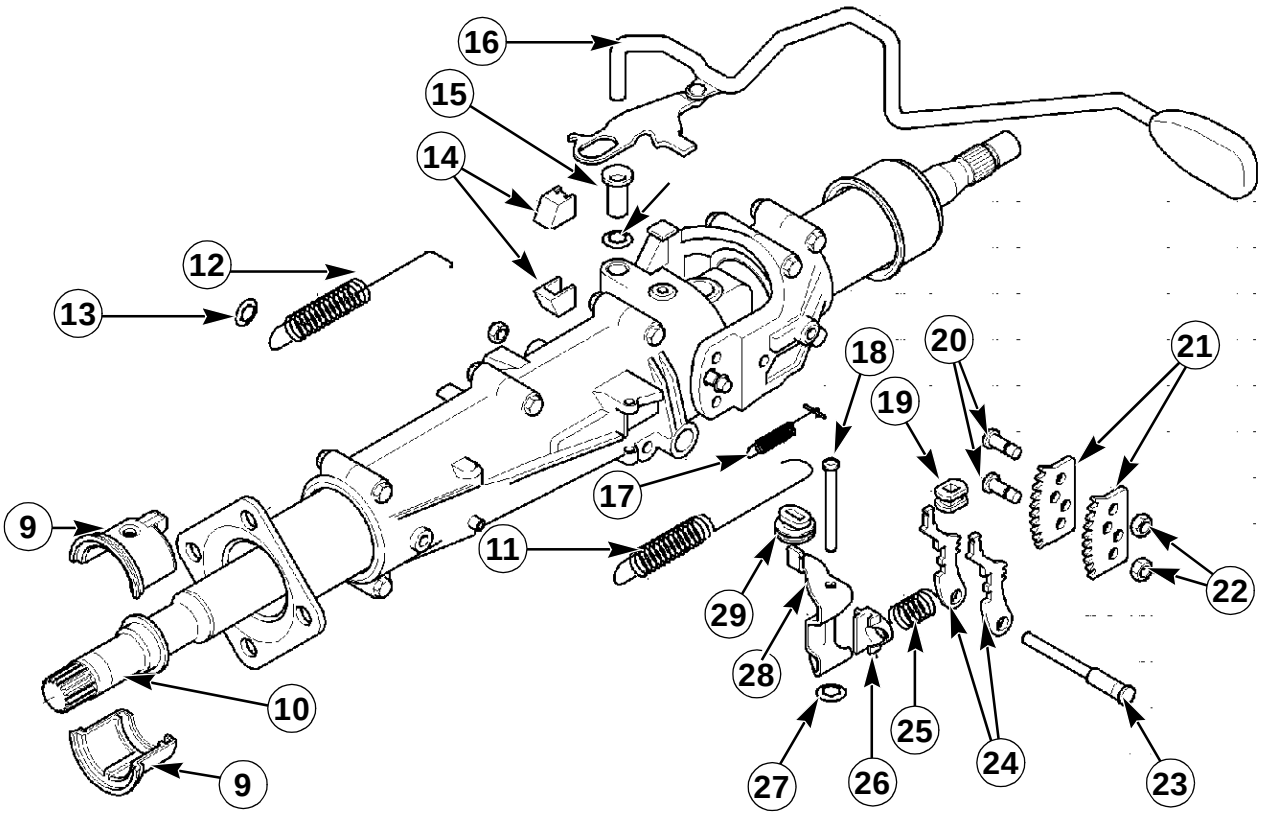



DD98G264

Put the splined end of the steering column in a soft jawed vice. Use a lever between the steering column and vice body, as shown, to remove the lower splined shaft and bushings from the steering column. Remove the bushings (9).

https://truckmanualshub.com/





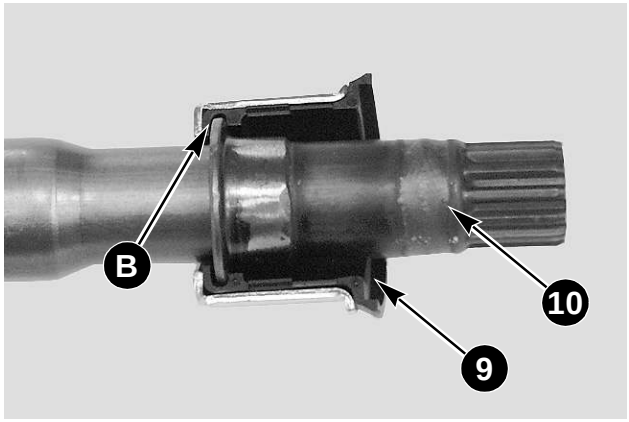

MI06F026

12. SPRING
19. STOP
26. CATCH

https://truckmanualshub.com/



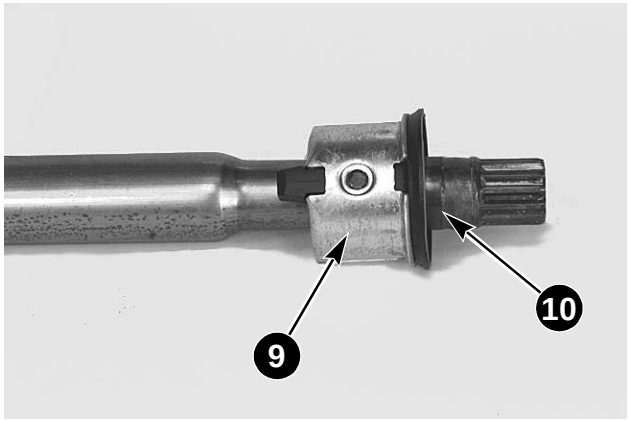
## STEP 13




MD06F031

Install one half of bushing (9) onto splined shaft (10), make sure shoulder (B) of lower splined shaft (10) is locate into the groove in bushing (9).

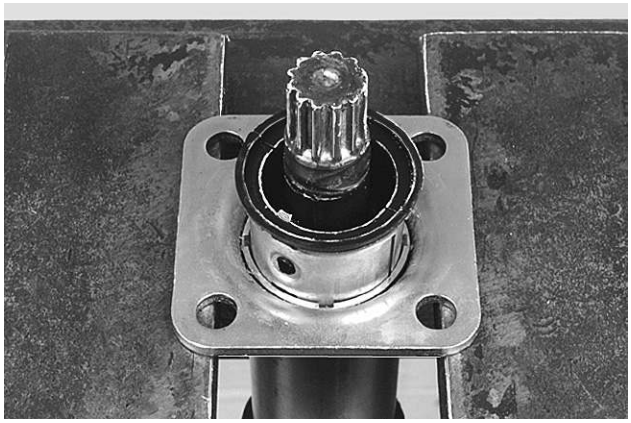
## STEP 14




DD98G265

Install the second half of bushing (9) onto splined shaft (10), make sure the tabs and slots in bushing (9) are aligned.

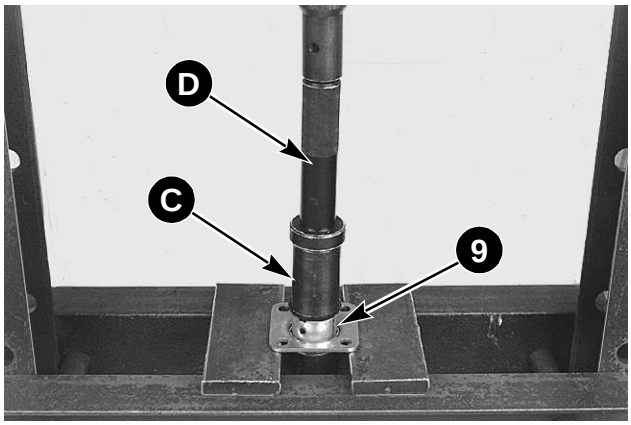
## STEP 15



DD98H117

Install the steering column into a suitable press. Install the lower splined shaft (10) onto the upper shaft splines.

## STEP 16




DD98H118

Install seal installer (C) MC2612 over the lower splined shaft onto bushing (9). Press bushing (9) into position.

**NOTE:** *Use handle* (D) *MC1924 as a spacer if necessary.*

## STEP 17

Lubricate the drive splines of lower splined shaft (10) with Multi Purpose Lithium grease.

https://truckmanualshub.com/



# STEERING HAND PUMP

## Removal

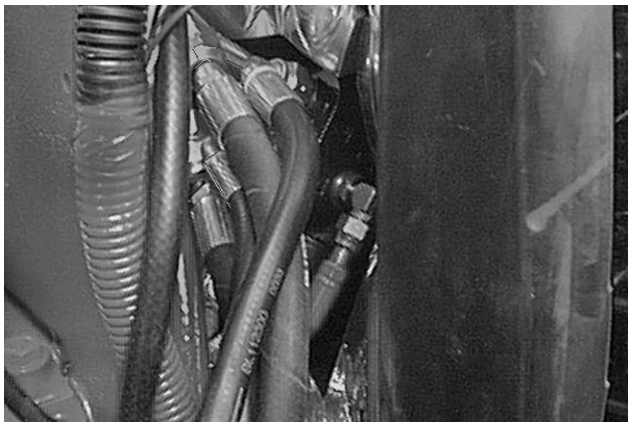
Before removing the Hand Pump it will be necessary to carry out the following:

- Park the tractor on hard level ground and apply the parking brake.
- Stop the engine and remove the key.
- Put blocks in front of and behind the rear wheels.
- Raise the hood and remove the side panels.

### STEP 1

Disconnect the battery, negative (-) terminal first.

### STEP 2



MD01C053

Put identification marks on and disconnect and cap the hoses from the steering hand pump, remove and discard the o-rings from the fittings.

### STEP 3

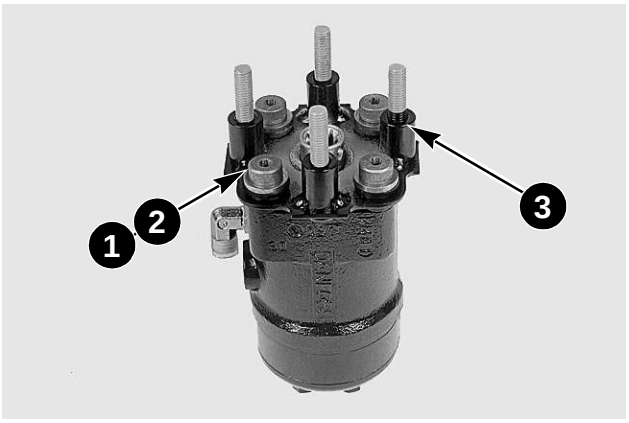
Support the steering hand pump and remove the Steering Column, refer to Page 4.

**NOTE:** *It is not necessary to remove the steering wheel.*

### STEP 4

Remove the Steering Hand Pump.

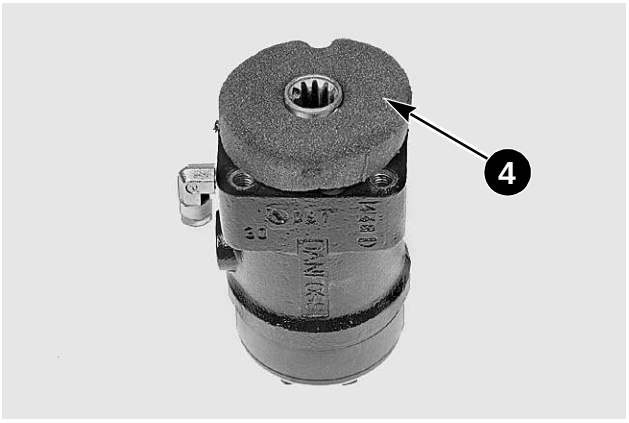
### STEP 5




DP98B354

Remove the four retaining screws (1) and washers (2), remove the bracket (3).

### STEP 6



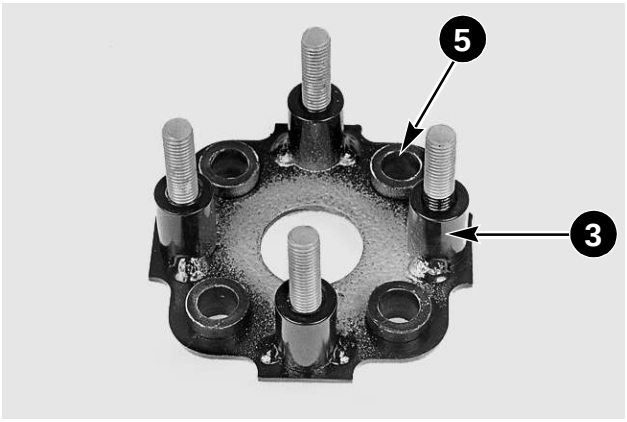

DP98B355

Remove the seal (4), check for wear or damage and replace if necessary.

https://truckmanualshub.com/



### STEP 7



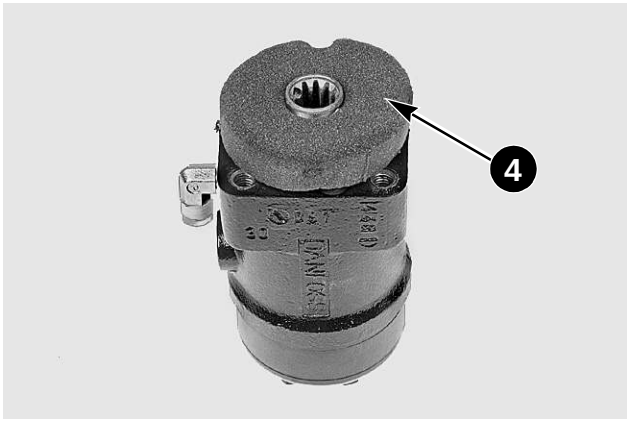

DP98B356

Check for wear or damage to the four rubber grommets (5) in the bracket (3) and replace if necessary.

**NOTE:** *For the Disassembly and Assembly of the steering hand pump, refer to Section 5002.*

## Installation

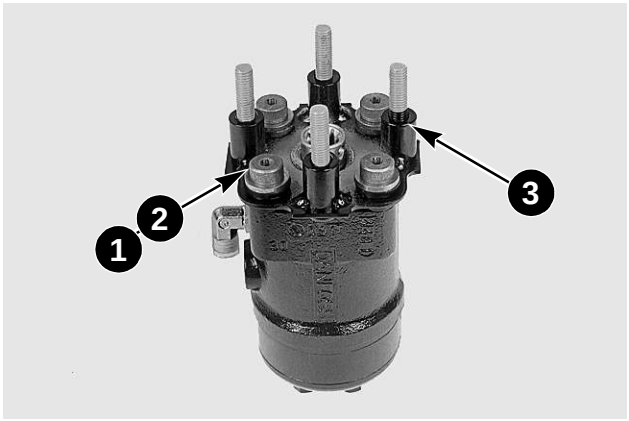
### STEP 8




DP98B355

Install seal (4) onto the steering hand pump.

### STEP 9




DP98B354

Install the bracket (3), washers (2) and retaining screws (1). Tighten the retaining screws to a torque of 41 to 61 Nm.

### STEP 10

Install the Steering Hand Pump and support in position.

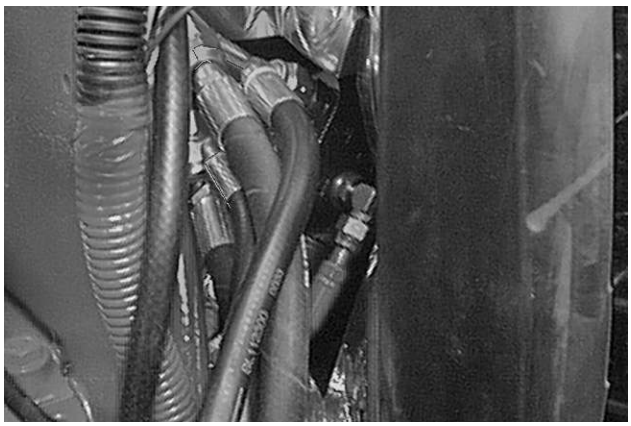
### STEP 11

Install the Steering Column, refer to Page 4.

https://truckmanualshub.com/



## STEP 12



MD01C053

Remove the caps from the tubes and fittings. Lubricate and install new o-rings the fittings and connect and tighten the hoses.

## STEP 13

Connect the battery, positive (+) terminal first.

## STEP 14

Start and run the engine and check the operation of the steering hand pump. DO NOT hold the steering wheel during engine start up.

**WARNING:** *Never operate the engine in a closed building. Proper ventilation is required under all circumstances.* SM100A

https://truckmanualshub.com/

5002

# Section 5002

## REXROTH STEERING HAND PUMP

## XTX 185, 200 and 215 Tractors

McCORMICK

SM 8-15260

© 2006 McCormick Tractors International Limited.
September 2006

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIFICATIONS....3

SPECIAL TORQUES....3

SPECIAL TOOLS....3

STEERING HAND PUMP
- Disassembly....4
- Inspection....6
- Assembly....6

https://truckmanualshub.com/



## SPECIFICATIONS

| | | |
|---|---|---|
| STEERING HAND PUMP DISPLACEMENT | | |
| XTX 185, 200 and 215 Tractors | Dual | 60/220cc/rev |

## SPECIAL TORQUES

| | |
|---|---|
| Steering Hand Pump End Cover Retaining Bolts | 25 to 35 Nm |

## SPECIAL TOOLS



DD97G084

**MC2552 SEAL INSTALLER**

https://truckmanualshub.com/



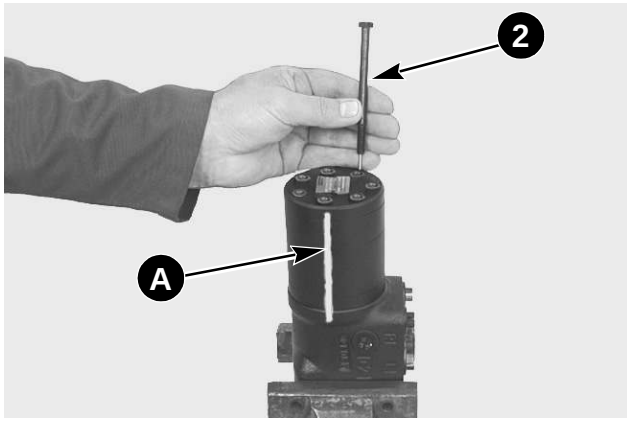
# STEERING HAND PUMP

## Disassembly

### STEP 1

Secure the steering hand pump in a clean soft jaw vice, DO NOT overtighten the vice. Remove the fittings, remove and discard the o-rings. Make a note of the position of the sensing hose fitting.

### STEP 2




D00H095

Put alignment marks (A) on pump body (37), valve plate (7) and (16), stators (5) and (13), valve body (10) and end cover (3). Remove retaining bolts (1), make a note of the position and remove special bolt (2). Remove the end cover (3), spacer (4), stator (5), rotor (6) and valve plate (7). Remove and discard o-rings (8) and (9).

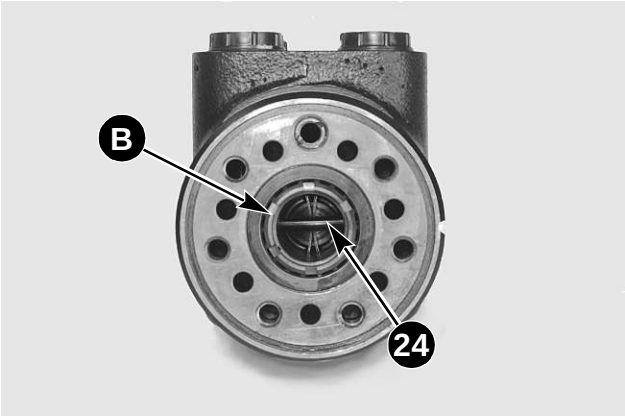
### STEP 3

Remove valve body (10), drive shaft (11), spacer (12), stator (13), rotor (14), drive shaft (15) and valve plate (16). Remove and discard o-rings (17), (18), (19) and (20).

### STEP 4

Remove spool (21) and spring (22) from valve body (10).

### STEP 5




DD00F065

Turn spool and sleeve assembly (B) until pin (24) is parallel to the fitting mounting face. Remove spool and sleeve assembly (B) and thrust bearing assembly (23) from pump body (37).

### STEP 6

Remove pin (24) from spool and sleeve assembly (B). Remove the spool (25) from sleeve (26), remove centering springs (27) and (28) from spool (25).

### STEP 7

Remove and discard seal (29) and dust seal (30).

### STEP 8

Remove threaded bushing (31) and ball (32).

**IMPORTANT:** *DO NOT use a magnet to remove ball (32).*

### STEP 9

Mark the position and remove valve pins (33) and balls (34). Remove shock valve assemblies (35).

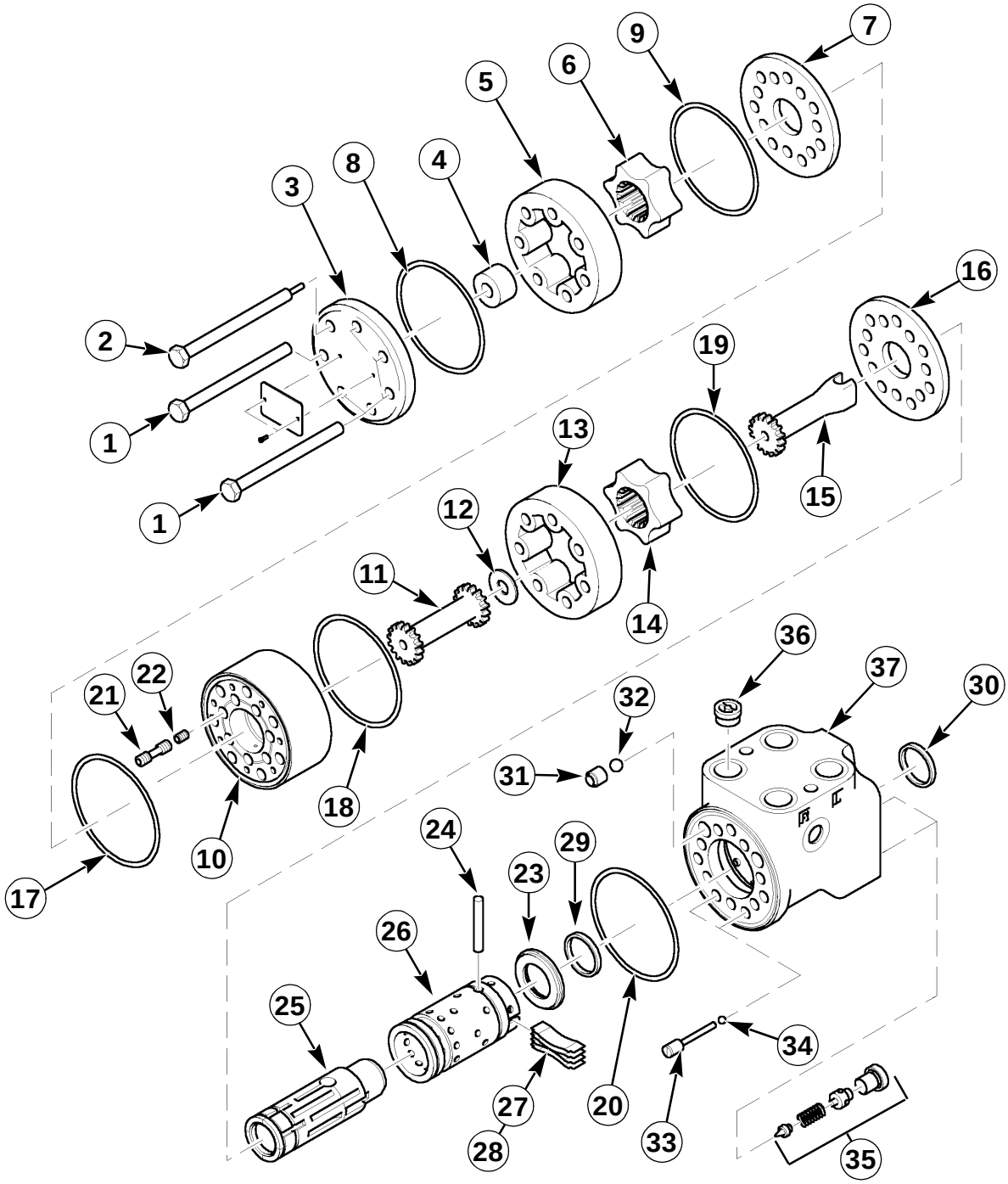
**IMPORTANT:** *DO NOT use a magnet to remove balls (34).*

**IMPORTANT:** *DO NOT remove check valve (36) from pump body (37).*

https://truckmanualshub.com/



**NOTE:** *Items are numbered in order of Disassembly.*




DI99J104

1.BOLT (6)
2.SPECIAL BOLT
3.END COVER
4.SPACER
5.STATOR
6.ROTOR
7.VALVE PLATE
8.O-RING
10.BODY
11.SHAFT
12.SPACER
13.STATOR
14.ROTOR
15.DRIVE SHAFT
16.VALVE PLATE
17.O-RING
18.O-RING
20.O-RING
21.SPOOL
22.SPRING
23.THRUST BEARING
24.PIN
25.SPOOL
26.SLEEVE
27.OUTER CENTERING SPRING (2)
28.INNER CENTERING SPRING (2)
30.DUST SEAL
31.THREADED BUSHING
32.BALL (8 MM DIAMETER)
33.VALVE PIN (2)
34.BALL (2) 5 MM DIAMETER)
35.SHOCK VALVE (2)
36.CHECK VALVE
37.PUMP BODY

https://truckmanualshub.com/

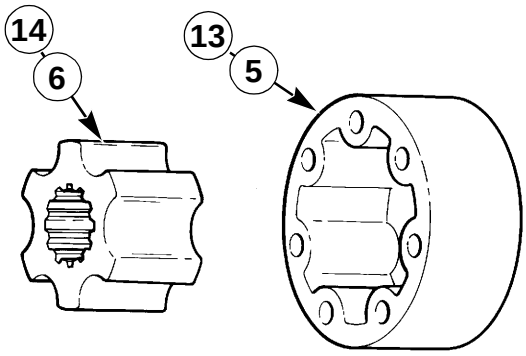


## Inspection

### STEP 10

Clean and inspect parts for wear or damage.

### STEP 11

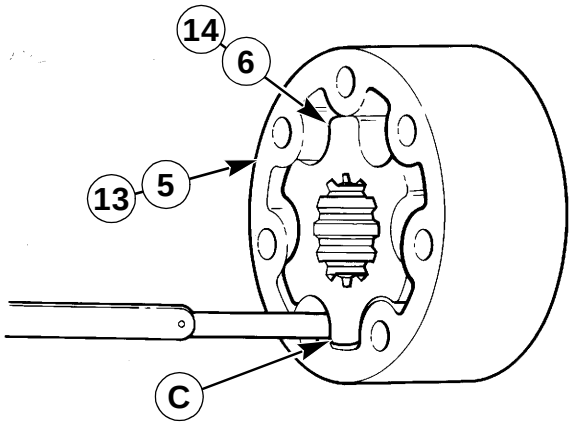



SM1298

Measure the thickness of rotor (6) and stator (5). If the rotor is 0.051 mm less than the stator, replace the steering hand pump.

Measure the thickness of rotor (14) and stator (13). If the rotor is 0.051 mm less than the stator, replace the steering hand pump.

### STEP 12




SM1297

Align rotor (6) and stator (5) as shown. Measure gap (C) between the rotor and stator, if the gap is 0.127 mm or more, replace the steering hand pump.

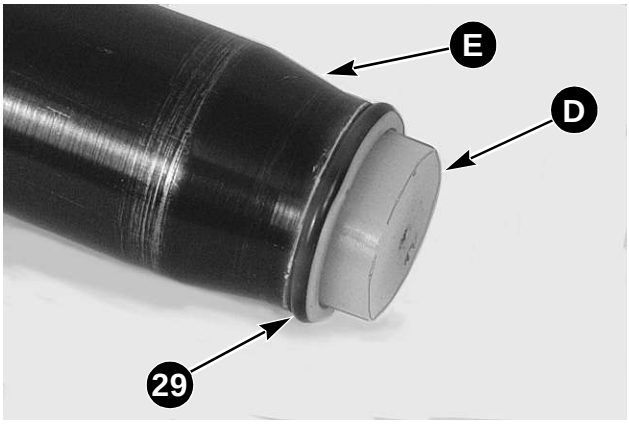
Align rotor (14) and stator (13) as shown. Measure gap (C) between the rotor and stator, if the gap is 0.127 mm or more, replace the steering hand pump.

## Assembly

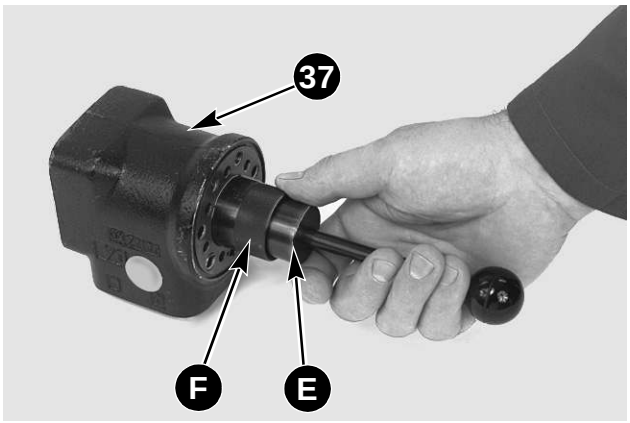
**NOTE:** *Refer to Page 9 for component identification.*

**NOTE:** *During assembly lubricate all parts with clean transmission oil.*

### STEP 13




DD98G094



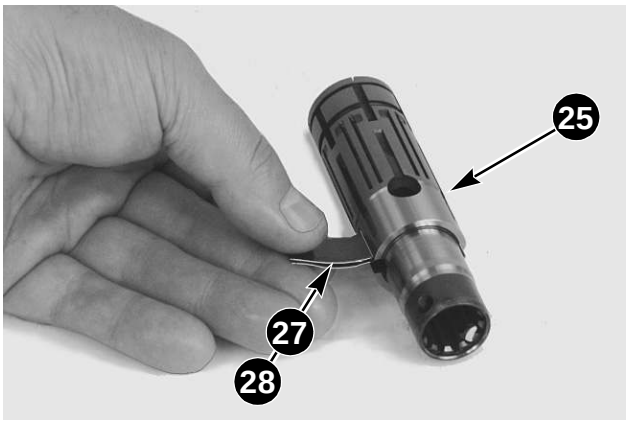

DD00F072

Lubricate a new seal assembly (29) with clean transmission oil. Using MC2552 seal installer, install locator (D) onto arbor (E), install seal assembly (29) onto locator (D) as shown. Install sleeve (F) into pump body (37). Fully install arbor (E) against the shoulder in the pump body (37). Remove arbor and sleeve, remove the locator forwards from pump body.

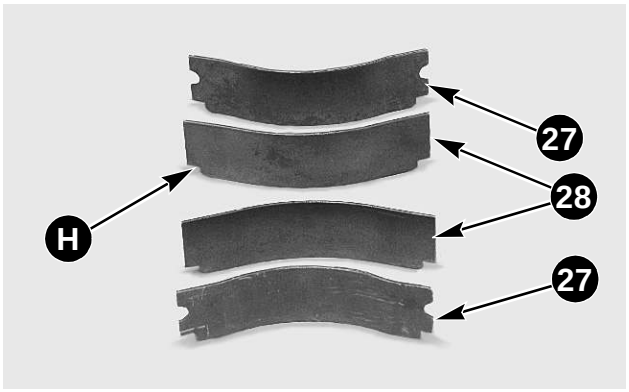
https://truckmanualshub.com/



## STEP 14




DD00F074

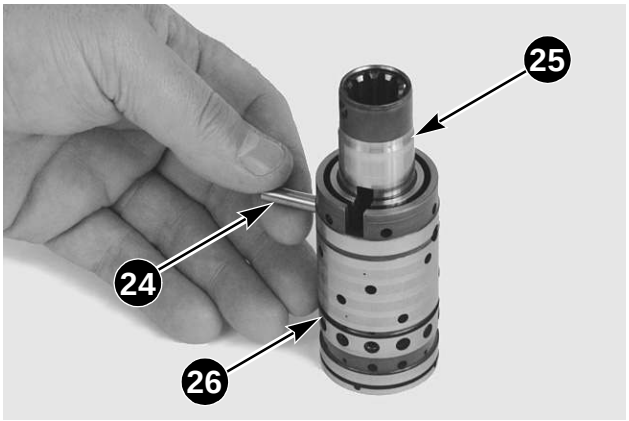



DDOOF069

Install and centralize the outer and inner centering springs (27) and (28) into the spool (25), in the positions shown.

**NOTE:** *Make sure the centering springs (27) and (28) are installed with the cut outs (H) towards the bottom of the spool (25).*

## STEP 15

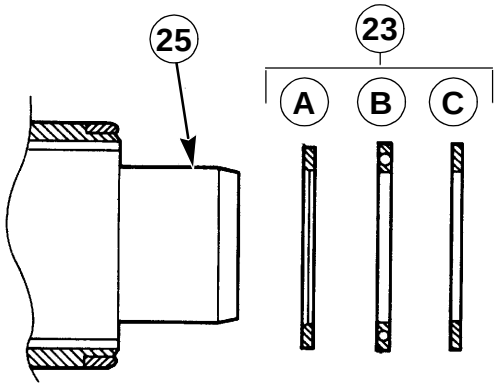



DD00F073

Install the spool (25) into sleeve (26). Make sure the springs (27) and (28) locate in slots of sleeve (26), install pin (24).

**NOTE:** *Heat from your hands may expand spool* (25) *preventing it from being installed. Allow the spool* (25) *to cool and repeat STEP 15.*

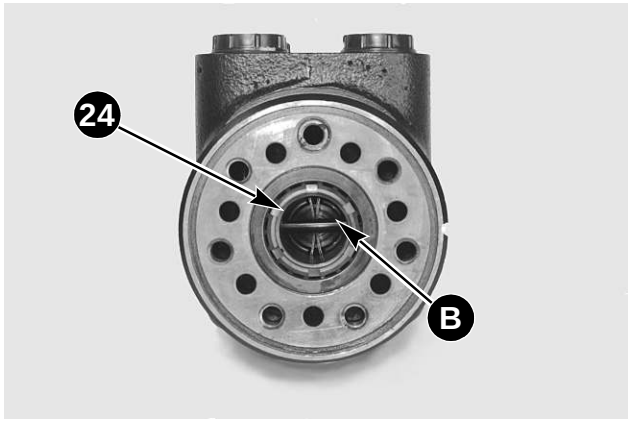
## STEP 16




SM1303

Install thrust washer assembly (23) onto spool (25) in the following order, small thrust washer (A), thrust bearing (B) and large thrust washer (C).

## STEP 17




DD00F065

Carefully install the spool and sleeve assembly into the pump body (37) with pin (24) parallel to the fitting mounting face as shown. DO NOT turn the spool and sleeve assembly (B).

**NOTE:** *Heat from your hands may expand spool and sleeve assembly (B), preventing the assembly being installed, DO NOT use force to install spool and sleeve assembly (B). Allow the assembly to cool and repeat STEP 16.*

## STEP 18

Install shock valve assemblies (35). Install balls (34) and install pins (33) in the positions noted in STEP 9, Page 4.

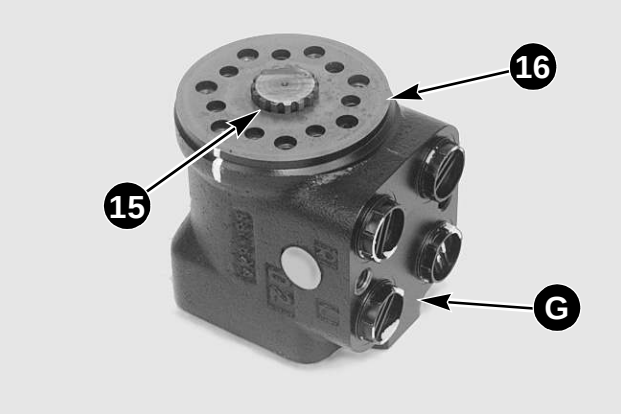
## STEP 19

Install ball (32) and install and tighten threaded bushing (31).

https://truckmanualshub.com/



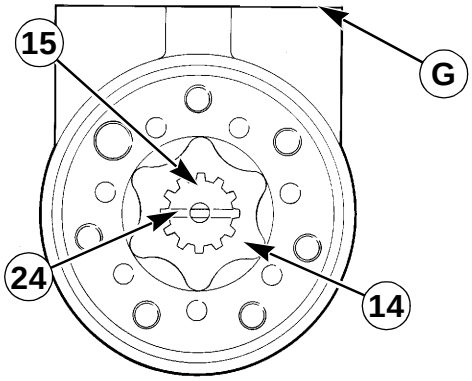
## STEP 20




DD98G278

Lubricate and install a new o-ring (20) into the groove in the pump body (35). Install the valve plate (16), align marks made in STEP 2, Page 4. With pin (24) parallel to fitting mounting face (G), install drive shaft (15). Make sure the pin (24) is between the slot in drive shaft (15).

## STEP 21




SM1296

Install rotor (14) onto drive shaft (15). When pin (24) is in the correct position one of the rotor gear teeth will be aligned with the connector mounting face (G) as shown.

**NOTE:** *If rotor (14) is installed incorrectly the steering hand pump will operate as a motor when installed onto the tractor and the engine is running. The steering wheel will rotate continually which may cause damage and injury.*

## STEP 22

Lubricate and install a new o-ring (19) into stator (13). Align the marks made in STEP 2, Page 4 and install stator (13).
Install spacer (12) on top of drive shaft (15).

## STEP 23

Install spring (22) and spool (21) into valve body (10). Lubricate and install new o-rings (18) and (17) and into valve body (10). Align the marks made in STEP 2, Page 4, install valve body (10) and drive shaft (11).

## STEP 24

Align the marks made in STEP 2, Page 4 and install valve plate (7). Install rotor (6) onto splines of drive shaft (11).

## STEP 25

Lubricate and install a new o-ring (9) into stator (5). Align the marks made in STEP 2, Page 4 and install stator (13).

## STEP 26

Install spacer (4) on top of drive shaft (11).

## STEP 27

Lubricate and install a new o-ring (8) into end cover (3).

## STEP 28

Install the end cover (3) and install the special bolt (2) in the position noted in STEP 2, Page 4. Install the remaining bolts (1), tighten the bolts (1) and special bolt (2) to a torque of 25 to 35 Nm.

## STEP 29

Install a new dust seal (30). Install new o-rings onto the fittings removed in STEP 1, Page 4.

## STEP 30

Install clean transmission oil into the return port and supply port. Cover all the ports with a clean cloth and slowly turn the pump input shaft clockwise and counterclockwise.

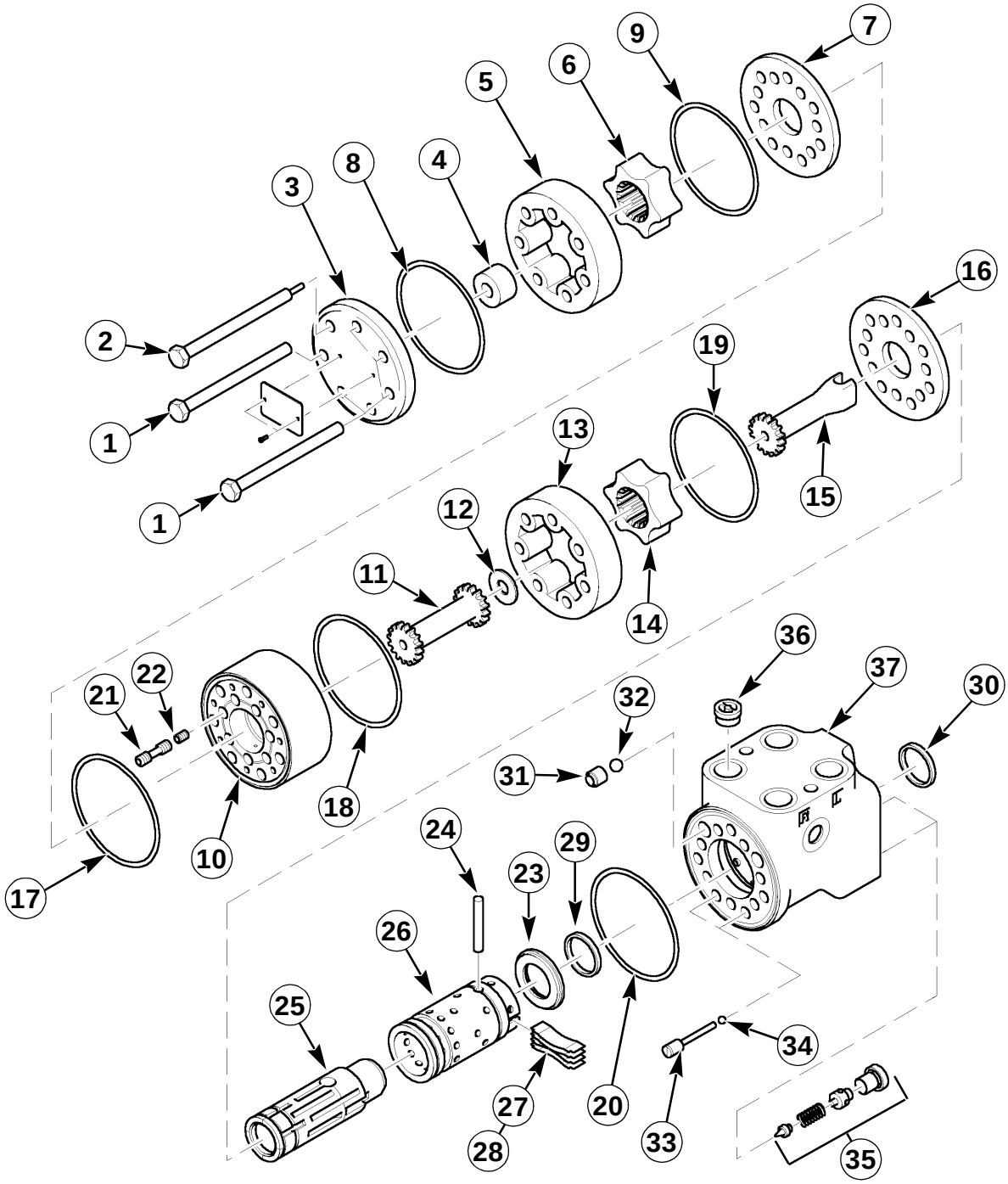
## STEP 31

Repeat STEP 30 until the steering hand pump is primed with oil.

https://truckmanualshub.com/



**NOTE:** *Items are numbered in order of Assembly.*




DI99J104

1.BOLT (5)
2.SPECIAL BOLT (2)
3.END COVER
4.SPACER
5.STATOR
6.ROTOR
7.VALVE PLATE
8.O-RING
10.BODY
11.SHAFT
12.SPACER
13.STATOR
14.ROTOR
15.DRIVE SHAFT
16.VALVE PLATE
17.O-RING
18.O-RING
20.O-RING
21.SPOOL
22.SPRING
23.THRUST BEARING
24.PIN
25.SPOOL
26.SLEEVE
27.OUTER CENTERING SPRING (2)
28.INNER CENTERING SPRING (2)
30.DUST SEAL
31.THREADED BUSHING
32.BALL (8 MM DIAMETER)
33.VALVE PIN (2)
34.BALL (2) 5 MM DIAMETER)
35.SHOCK VALVE (2)
36.CHECK VALVE
37.PUMP BODY

https://truckmanualshub.com/

# Section 6

## XTX TRANSMISSION

### How It Works



McCORMICK

DT50-50501

© 2006 McCormick Tractors International Limited.
Revised July 2005

https://truckmanualshub.com/



# TABLE OF CONTENTS

INTRODUCTION .....3

TRANSMISSION CONSTRUCTION .....8

DRIVE PATH DESCRIPTION .....9

TRANSMISSION LAYOUTS .....10

POWERSHIFT CLUTCH PRESSURE TESTING .....14

POWERSHIFT SOLENOID LOCATION .....15

CREEPER SPEED .....16

FORWARD AND REVERSE SHUTTLE .....18

FORWARD REVERSE MANIFOLD .....20

TRANSMISSION CONTROL .....21

FOUR SPEED RANGE SECTION .....22

RANGE SELECTION XtraSpeed-E & E plus TRACTORS .....25

MFD DRIVE AND PARK BRAKE .....26

REAR AXLE .....28

DIFFERENTIAL .....31

REAR AXLE OPTIONS .....32

PTO AND HYDRAULIC PUMP DRIVE .....34

PTO CLUTCH .....36

SHIFTABLE TWO SPEED PTO 540/1000 OR 540E/1000 RPM (Europe Only) .....38

SHIFTABLE TWO SPEED PTO 540/1000 OR 540E/1000 RPM (Europe Only) .....39

MFD CLUTCH .....40

MFD AXLES .....42

MFD DIFERENTIAL .....44

PARK LOCK ASSEMBLY .....46

https://truckmanualshub.com/



# INTRODUCTION

Several different transmission options are available for the XTX Series tractors.These are called XtraSpeed, XtraSpeed-E, and XtraSpeed-E*plus*. All the transmissions are fitted with a forward/neutral/reverse power shuttle and an eight speed, power shift transmission giving a 17% increase in each speed. Reverse speed is 15% faster than the corresponding forward speed enabling fast front loader work and increased productivity during repeated cycle operations.

## Transmission Build Options

The standard transmission has 32 forward and 25 reverse speeds and is available with 30, 40 and 50 km/h maximum speed options. (50 km/h availability dependant on laws for individual markets).

**NOTE:** *Although the mechanical parts of the transmission on 50 km/h tractors are the same, there are differences in the front cab glass, front axle driveshaft, brake operation, and the tractors are also fitted with front axle and cab suspension and solid wheel rims, which are all required by law. Any change to a tractor beyond its homologated specification is highly illegal.*

**NOTE:**

The transmission provides the following numbers of speeds:-

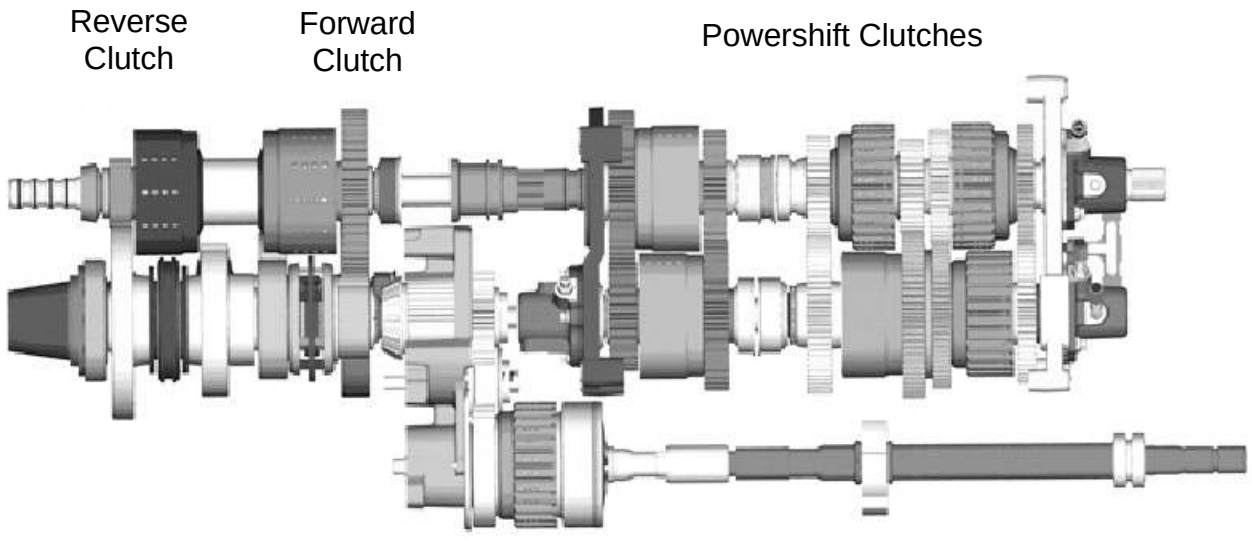
32 Forward = 4 ranges x 8 speeds and 25 Reverse = 3 ranges x 8 speeds plus 1st speed in fourth range only.

## Creep Speed

An optional hydraulically engaged planetary reduction creeper unit is available as a factory fit and provides extra creep speeds to the basic transmission in range 1 and 2 only. It provides the following numbers of speeds:-

48 Forward = 4 ranges x 8 speeds (standard) plus 2 ranges x 8 speeds (creeper)

41 Reverse = 3 ranges x 8 speeds plus 1st speed in fourth range plus 2 ranges x 8 speeds (creeper)



https://truckmanualshub.com/

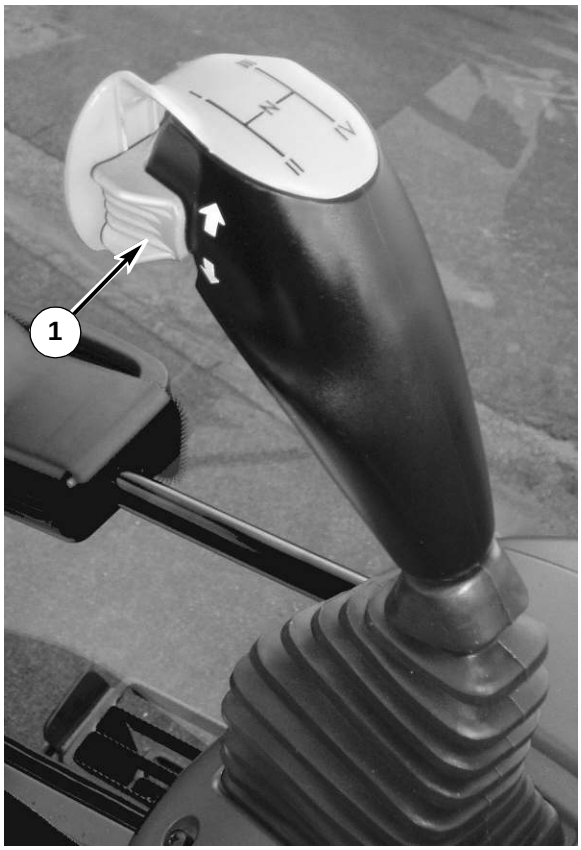


## XtraSpeed Transmission Option

The H pattern gear lever on the right-hand console allows the operator to select the four synchronised ranges. Incorporated in the range lever is a three position thumb switch which is sprung loaded to the centre position. Moving the switch (1) either up or down changes the powershift speeds, if the switch (1) is held the speeds will shift sequential within each range.

To make a range change either depress the clutch pedal or press the de-clutch button on the front of the range lever. When ranges 1 to 3 are engaged from stationary the transmission will select 5th powershift. If 4th range is selected then 1st powershift will be engaged. This is the highest gear where a standing start is allowed.

On the move, upward range changes will select 5th powershift as this is always a higher speed than the previously selected range. When down shifting 4th powershift will be engaged.




## Ground Speed Matching (4th Range Only)

If the operator presses the clutch pedal or selects neutral while the tractor is moving the tractor will begin to slow down. When the operator selects forward or reverse or releases the clutch pedal the transmission controller will select a gear which matches the speed of the tractor to ensure a smooth gear take up.

## Start off gear

The maximum gear that the tractor can be driven from stationary is 4th range,1st powershift.

https://truckmanualshub.com/



## XtraSpeed-E and E*plus* Transmission Options

Both these versions of the transmission are basically the same, the only difference is the position of the multi function lever and which remote auxiliary valves are fitted.

On E versions the multi function lever is mounted on the right hand console, and on E*plus* machines the lever is an integral part of the seat arm rest.

The operation of both the powershift speeds and the range changes are controlled by the upshift and downshift button on the multi function lever.



MD05F041A

**XtraSpeed-E**

(EQUIPPED WITH MECHANICAL REMOTE VALVES)



MD04K026

**XtraSpeed-E*plus***

(EQUIPPED WITH ELECTRONIC REMOTE VALVES)

Features within this version include:-

- Programable start up gears.
- Alternate shuttle gear pre-selection.
- Range skip shifting
- Speed matching.
- Auto Roading

https://truckmanualshub.com/



## Programmable Start up Gears

On starting the engine the factory default for the transmission is gear 2-5 (2nd range/5th powershift) in forward and in reverse. New start gears can be programmed by the operator. This allows the operator to bypass the lower gears and initially engage any desired start gear.

Starting gears all programmable from 1-1 (1st range/1st powershift) up to 3-5 (3rd range/5th powershift). To change the Start Gears the key switch must be in the on position **(engine must NOT be running).** Once a new start-up gear is programmed it will remain in the transmission controllers memory even if the tractor ignition is turned off**.**

## Shuttle Operation

The transmission will select the following speeds unless alternative shuttle gears are programmed:

(Ranges 1 & 2) the same forward and reverse gears are selected, no powershift changes occur.

(Ranges 3 & 4) irrespective of the powershift gear selected the transmission will always default to 1st powershift during shuttle operations.

## Alternative Programmable Shuttle Gears (Ranges 1- 3)

The transmission will normally select the same forward and reverse gear when a shuttle change is performed. For certain field operations an alternative shuttle gear ratio may be selected. This allows the operator to match forward and reverse speeds more closely. These are not stored in the memory.

## Range Skip

The operator may quickly up shift through any of the ranges by pressing the skip shift button at the rear of the multi function lever in conjunction with an up shift button.

This will select the following speeds.

- In powershifts 1 to 4 the 1st powershift in the next range will be selected.
- In powershifts 5 to 8 the transmission will speed match to the nearest gear in the next range.

Downshifting a range is only possible when stationary.

## Ground Speed Matching (4th Range Only)

If the operator presses the clutch pedal or selects neutral while the tractor is moving the tractor will begin to slow down. When the operator selects forward or reverse or releases the clutch pedal the transmission controller will select a gear which matches the speed of the tractor to ensure a smooth gear take up.

https://truckmanualshub.com/



## Auto Roading

The operator may choose to use this function for easier road operations. This allows the driver to simply select the auto function and the tractor will automatically shift up or down the gears.

Auto shifting mode will only become active when the transmission is in 4th range and both the up shift and range skip switch buttons are pressed. The transmission controller will compare the engine speed information from the engine controller against the cab controller throttle position information. The transmission controller will then process this information to determine the correct gear selection if required.

When auto shifting has been selected the instrument cluster will display an A in place of the range 1 to 4 display.

The electronic controller will provide intelligent shifting making it easier for the operator on road transport operations.

**Example:** *Tractor and trailer moving in 4th range. The operator now presses both rangeskip and powershift up buttons to activate Auto Mode. The throttle position will now determine the transmission gear shift points. If the engine can achieve the demanded throttle position the transmission will continue to up-shift.If a hill is encountered the transmission will now down shift accordingly to maintain the desired throttle position.*

To exit the auto shifting mode one of the following must be carried out:

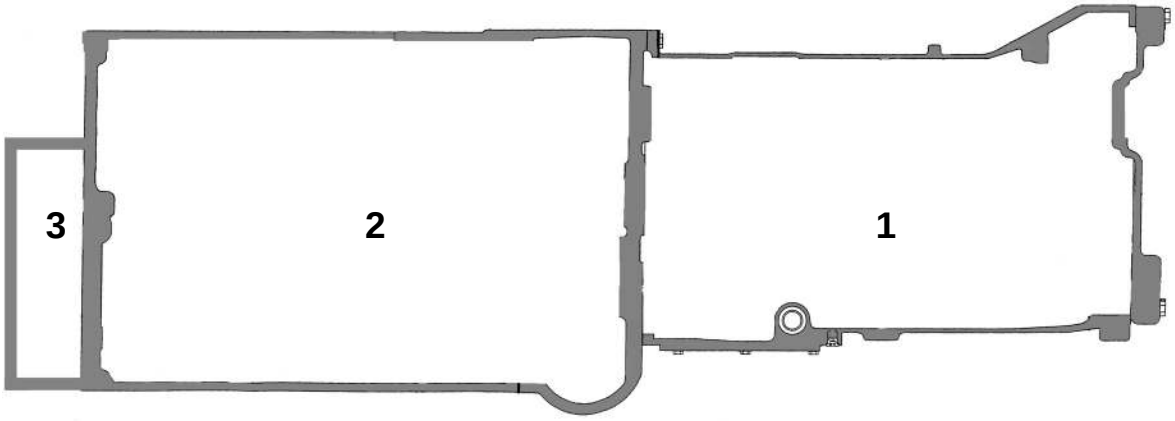
- A manual powershift request is made (up or down shift switch pressed).
- A manual range skip request is made (range skip switch pressed).
- The clutch pedal is depressed.
- The shuttle lever selection is changed.
- The key is turned to the OFF position.

https://truckmanualshub.com/



# TRANSMISSION CONSTRUCTION

The XTX transmission is made up of 3 main compartments as follows:-




1. SPEED/POWERSHIFT HOUSING
2. RANGE AND REAR AXLE HOUSING
3. PTO HOUSING

https://truckmanualshub.com/



# DRIVE PATH DESCRIPTION

## Drive input

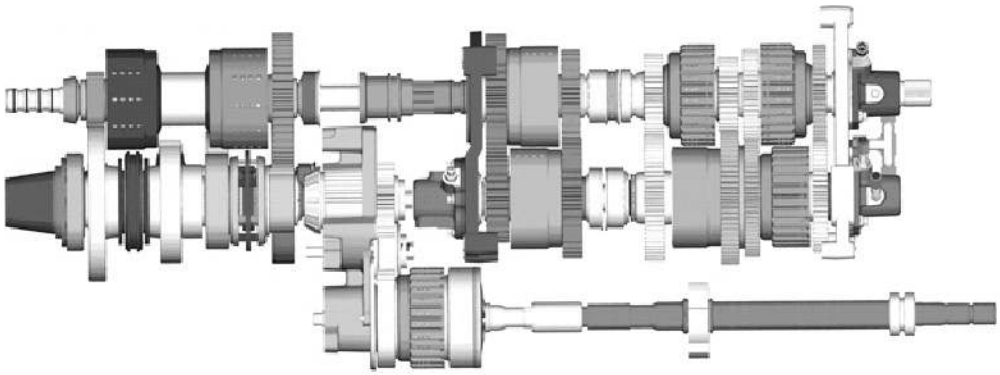
Drive is transmitted to the transmission from the engine torque damper via a short shaft with universal joints fitted at both ends (not shown), onto the top powershift shaft.

## Gear Selection

Each powershift speed is controlled electro hydraulically and can be shifted up and down without depressing the clutch pedal. To shift one of the eight speeds it is necessary to move either the thumb speed shift selector located on the XtraSpeed range lever on the right hand console or press the up or down change button on the multi function lever on XtraSpeed-E and E*plus* versions.

There are six solenoids used for controlling powershift gear selection. These are operated through the transmision electronic control module (ECM). Regulated oil pressure (P1) is supplied by the powershift valve to engage the selected clutch pack. The oil pressure acts on the clutch pack piston which then applies a clamping force to the friction plates, locking up the clutch.

There are always two powershift clutches engaged at any one time, there are four speed clutches in the front of the powershift housing and then there are two clutches behind these to give either high or low speed output from the powershift.



## Creep Speed

When drive leaves the powershift it is then passed directly through a coupling to the forward reverse shuttle shaft, or into the optional planetary reduction type creeper unit, before reaching the forward reverse shaft.

## Forward/Reverse Operation

The drive from the powershift or creepspeed enters the range housing on the forward reverse shaft and is then directed through either the forward or reverse clutch onto the countershaft from which the pinion shaft is driven through one of the four synchronised range gears. The control of the forward reverse clutches is again electro hydraulic and is done from the transmission electronic control module (ECM). Regulated oil pressure (P1) is supplied by the forward/reverse valve to engage the selected clutch pack.

https://truckmanualshub.com/



# TRANSMISSION LAYOUTS

## Drive Path through the Powershift Section

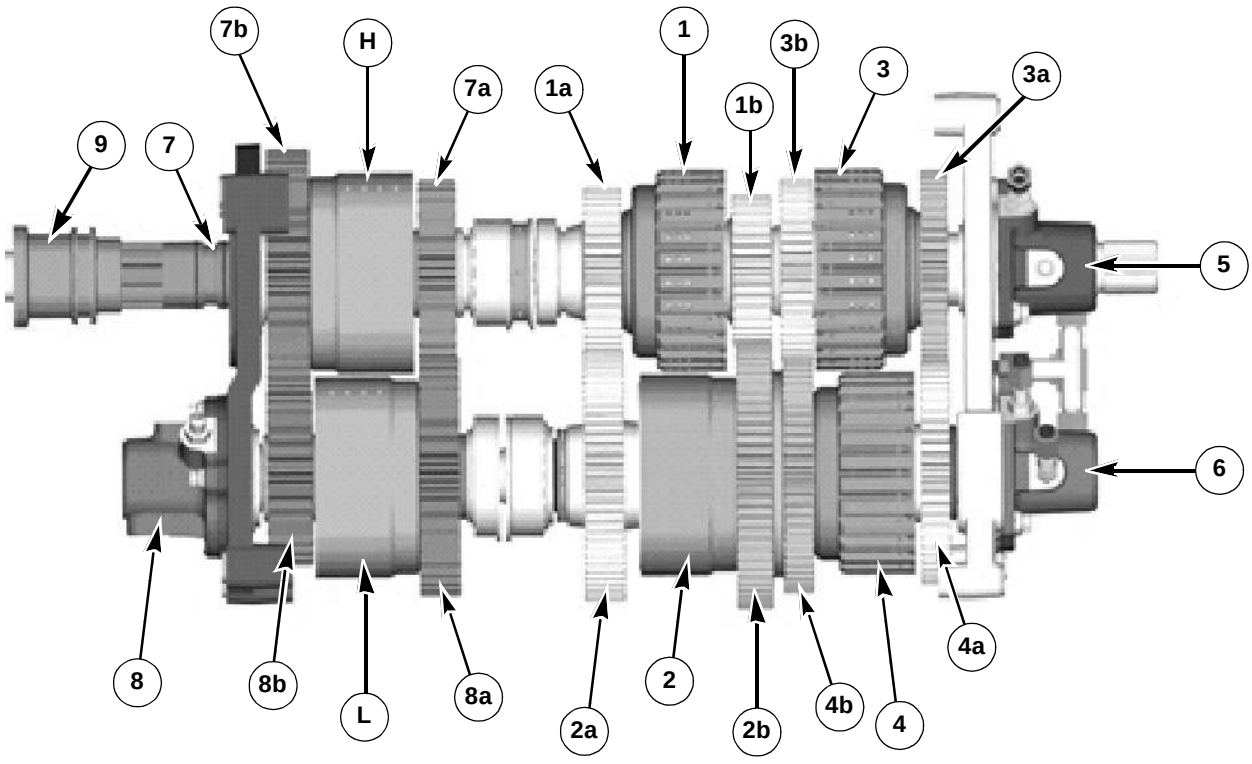
Drive from the engine is connected through the torque damper (not shown) to the input shaft (5).Mounted on the input shaft are the 1st (1) and 3rd gear (3) clutch packs, and mounted on the drop shaft are the 2nd (2) and 4th (4) clutches.

To allow the four powershift speeds to be doubled up to eight speeds there are two further clutches mounted directly behind the powershift, these are the high and low clutches (H&L).

Each clutch includes two gears. One gear is splined or welded to the shaft and the outer housing of the clutch pack, the other gear is splined to the inner friction discs of the clutch pack but is free to rotate on the shaft. When the clutch pack is engaged both gears will rotate as one unit to engage the selected gear.

First Speed Powershift selected:- The drive at the input shaft (5) is through the splined 1st speed gear (1a) to the 1st speed clutch (1). Then through this clutch to the 1st speed driven gear (1b), and the 2nd and 4th speed driven gear (2b) which is welded to the drop shaft (6).The drive then passes through the internal web in the transmission housing to the low clutch shaft (8), which is splined to the dropshaft. Gear (8a) and the low clutch housing is also welded to the shaft. Clutch (L) is engaged clamping gear (8B) to its shaft, so drive is then transmitted to gear (7b) that it is in constant mesh with.This gear is welded onto the high shaft (7) so drive is then transmitted to coupling 9 leading to the forward / reverse clutch or to the optional planetary reduction creep unit.

Second Speed Powershift selected:- The drive at the input shaft (5) is through the splined 1st speed gear (1a), the 2nd speed drive gear (2a) to the 2nd speed clutch (2). Then through this clutch to the 2nd and 4th speed driven gear (2b) which is welded to the drop shaft (6).The drive then passes through the internal web in the transmission housing to the low clutch shaft (8), which is splined to the dropshaft. Gear (8a) and the low clutch housing is also welded to the shaft. Clutch (L) is engaged clamping gear (8B) to its shaft, so drive is then transmitted to gear (7b) that it is in constant mesh with.This gear is welded onto the high shaft (7) so drive is then transmitted to coupling 9 leading to the forward / reverse clutch or to the optional planetary reduction creep unit.

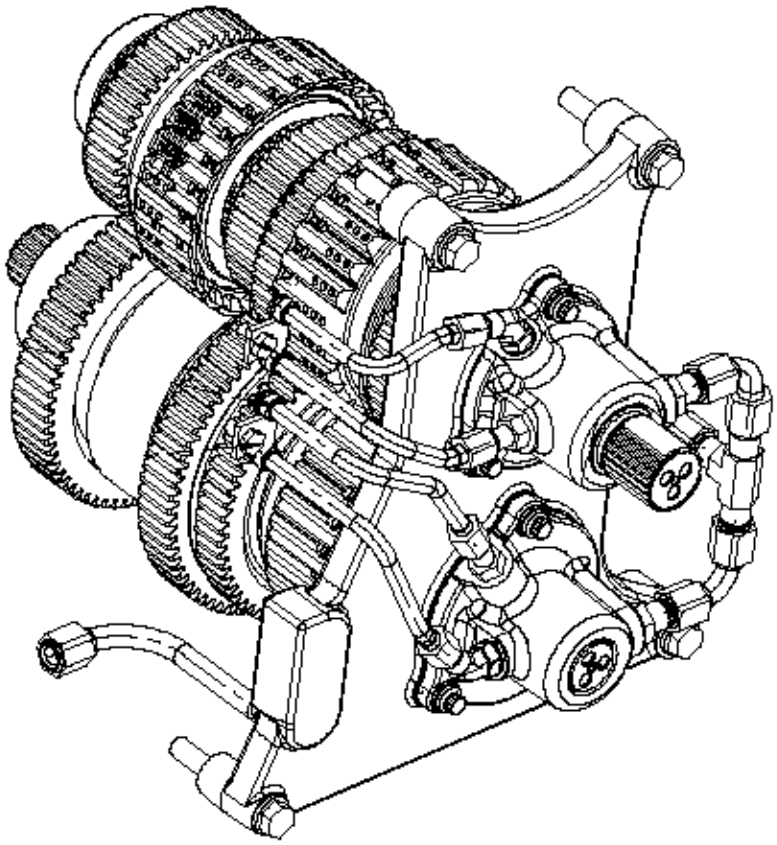


https://truckmanualshub.com/



Third Speed Powershift selected:- The drive at the input shaft (5) is through the 3rd speed drive gear (3a) which is welded to the shaft, to the 3rd speed clutch (3). Then through this clutch to the 3rd speed driven gear (3b) to the 2nd and 4th driven gear (2b) which is welded to the drop shaft (6).The drive then passes through the internal web in the transmission housing to the low clutch shaft (8), which is splined to the dropshaft. Gear (8a) and the low clutch housing is also welded to the shaft. Clutch (L) is engaged clamping gear (8B) to its shaft, so drive is then transmitted to gear (7b) that it is in constant mesh with.This gear is welded onto the high shaft (7) so drive is then transmitted to coupling 9 leading to the forward / reverse clutch or to the optional planetary reduction creep unit.

Fourth Speed Powershift selected:- The drive at the input shaft (5) is through the 3rd speed drive gear (3a) which is welded to the shaft, the 4th speed drive gear (4a) to the 4th speed clutch (4). Then through this clutch to the 2nd and 4th speed driven gear (2b) which is welded to the drop shaft (6).The drive then passes through the internal web in the transmission housing to the low clutch shaft (8), which is splined to the dropshaft. Gear (8a) and the low clutch housing is also welded to the shaft. Clutch (L) is engaged clamping gear (8B) to its shaft, so drive is then transmitted to gear (7b) that it is in constant mesh with.This gear is welded onto the high shaft (7) so drive is then On transmitted to coupling 9 leading to the forward / reverse clutch or to the optional planetary reduction creep unit.



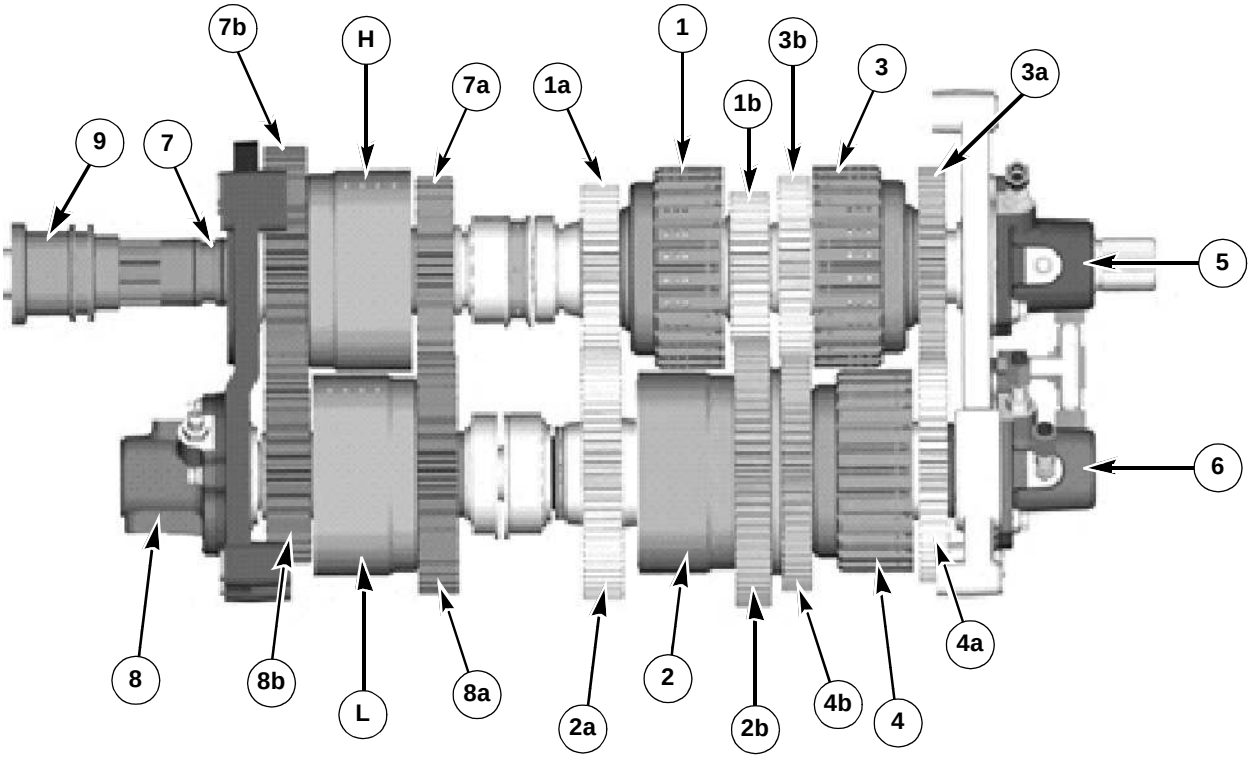
POWERSHIFT SPEED CLUTCH INSTALLATION

https://truckmanualshub.com/



Fifth Speed Powershift selected:- The drive at the input shaft (5) is through the splined 1st speed gear (1a) to the 1st speed clutch (1). Then through this clutch to the 1st speed driven gear (1b), and the 2nd and 4th speed driven gear (2b) which is welded to the drop shaft (6).The drive then passes through the internal web in the transmission housing to the low clutch shaft (8), which is splined to the dropshaft. Gear (8a) welded on the low clutch shaft is in constant mesh with gear (7a) which is clamped to its shaft (7) by the high clutch pack, so drive is then transmitted to coupling (9) leading to the forward / reverse clutch or to the optional planetary reduction creep unit.

Sixth Speed Powershift selected:- The drive at the input shaft (5) is through the splined 1st speed gear (1a), the 2nd speed drive gear (2a) to the 2nd speed clutch (2). Then through this clutch to the 2nd and 4th speed driven gear (2b) which is welded to the drop shaft (6).The drive then passes through the internal web in the transmission housing to the low clutch shaft (8), which is splined to the dropshaft. Gear (8a) welded on the low clutch shaft is in constant mesh with gear (7a) which is clamped to its shaft (7) by the high clutch pack, so drive is then transmitted to coupling (9) leading to the forward / reverse clutch or to the optional planetary reduction creep unit.

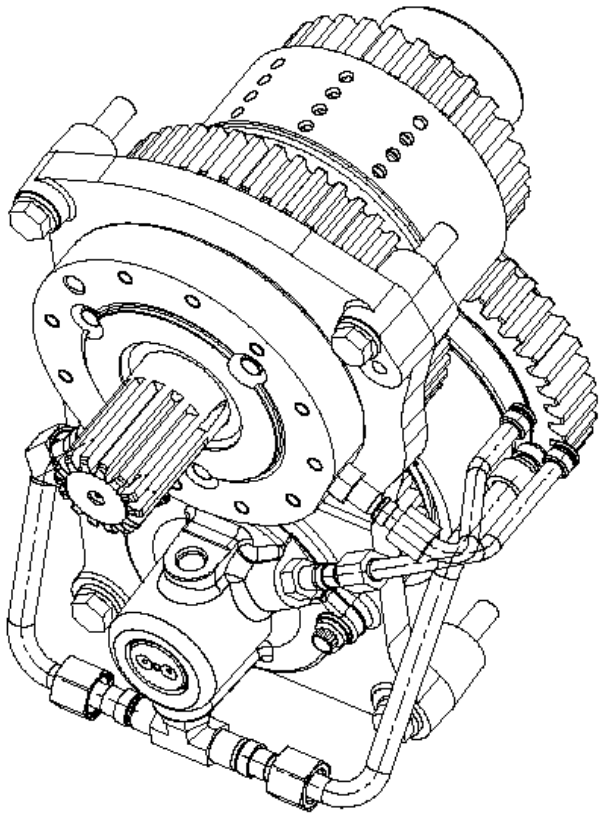


https://truckmanualshub.com/



Seventh Speed Powershift selected:- The drive at the input shaft (5) is through the 3rd speed drive gear (3a) which is welded to the shaft, to the 3rd speed clutch (3). Then through this clutch to the 3rd speed driven gear (3b) to the 2nd and 4th driven gear (2b) which is welded to the drop shaft (6).The drive then passes through the internal web in the transmission housing to the low clutch shaft (8), which is splined to the dropshaft. Gear (8a) welded on the low clutch shaft is in constant mesh with gear (7a) which is clamped to its shaft (7) by the high clutch pack, so drive is then transmitted to coupling (9) leading to the forward / reverse clutch or to the optional planetary reduction creep unit.

Eighth Speed Powershift selected:- The drive at the input shaft (5) is through the 3rd speed drive gear (3a) which is welded to the shaft, the 4th speed drive gear (4a) to the 4th speed clutch (4). Then through this clutch to the 2nd and 4th speed driven gear (2b) which is welded to the drop shaft (6).The drive then passes through the internal web in the transmission housing to the low clutch shaft (8), which is splined to the dropshaft. Gear (8a) welded on the low clutch shaft is in constant mesh with gear (7a) which is clamped to its shaft (7) by the high clutch pack, so drive is then transmitted to coupling (9) leading to the forward / reverse clutch or to the optional planetary reduction creep unit.



**HIGH/LOW POWERSHIFT CLUTCH INSTALLATION**

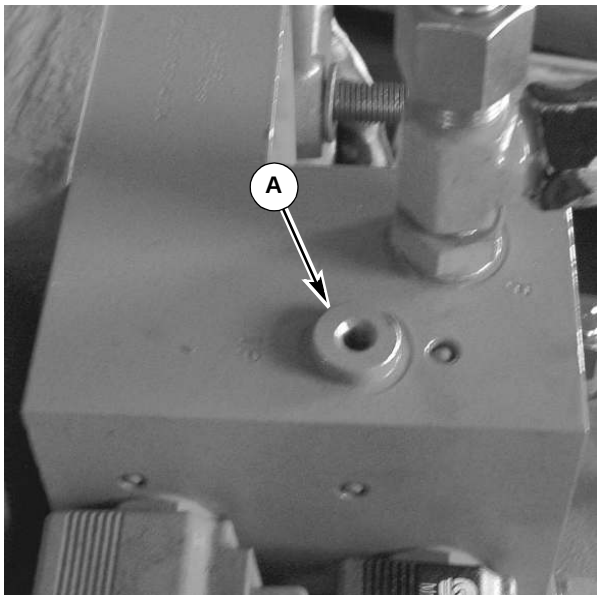
https://truckmanualshub.com/

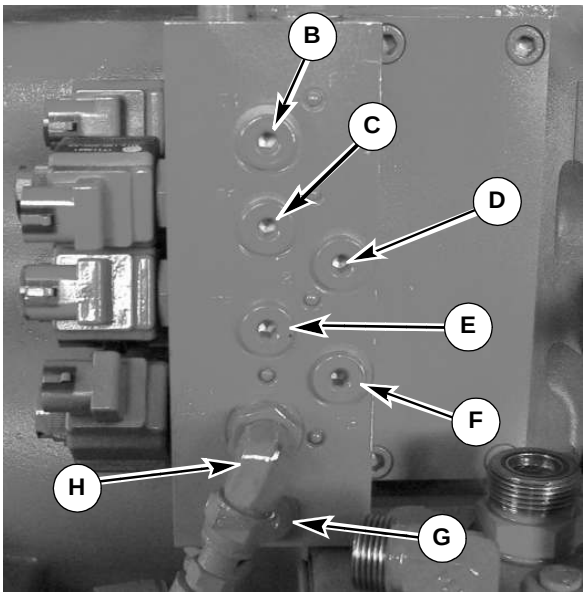


# POWERSHIFT CLUTCH PRESSURE TESTING

## Component and test point location

The following illustrations show the location of all the test points to measure hydraulic pressure for the powershift clutches and the position of the solenoids for the powershift housing. All the powershift clutches are clamped using regulated pressure (P1 = 22 to 24 bar).




A. REGULATED PRESSURE - P1

B. POWERSHIFT 3

C. POWERSHIFT H

D. POWERSHIFT 1

E. POWERSHIFT L

F. POWERSHIFT 2

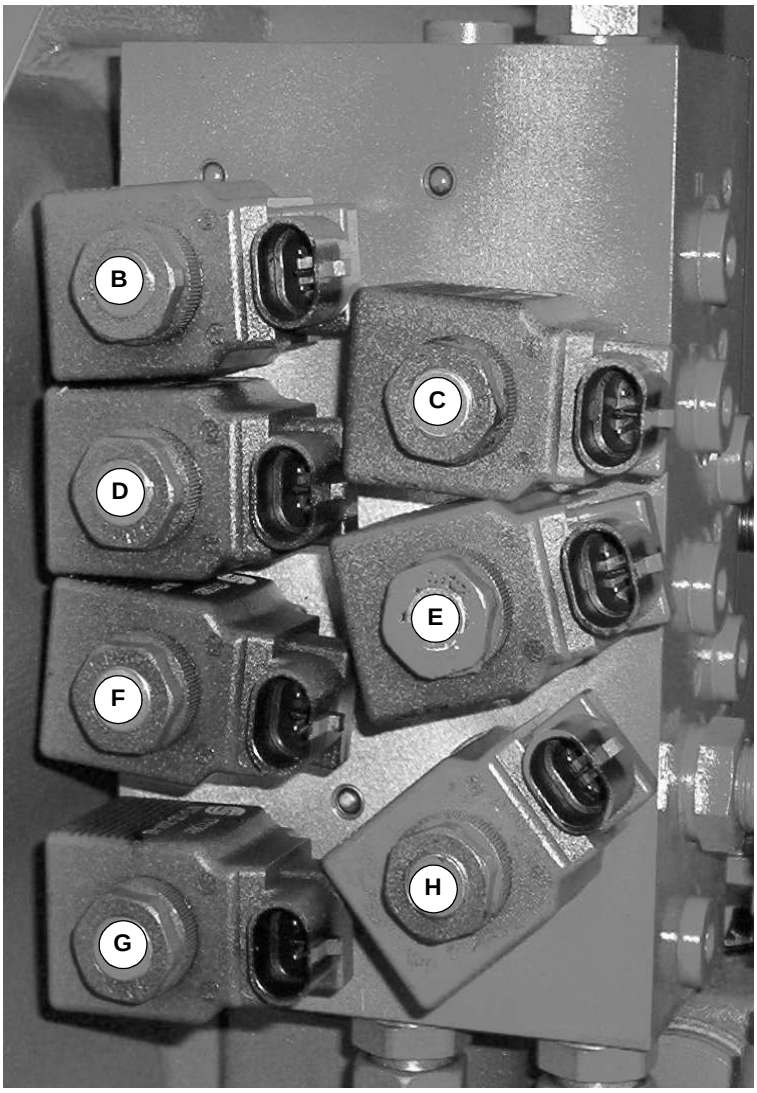
G. POWERSHIFT 4

H. PARK LOCK

https://truckmanualshub.com/



# POWERSHIFT SOLENOID LOCATION




A. REGULATED PRESSURE - P1

B. POWERSHIFT 3

C. POWERSHIFT H

D. POWERSHIFT 1

E. POWERSHIFT L

F. POWERSHIFT 2

G. POWERSHIFT 4

H. PARK LOCK

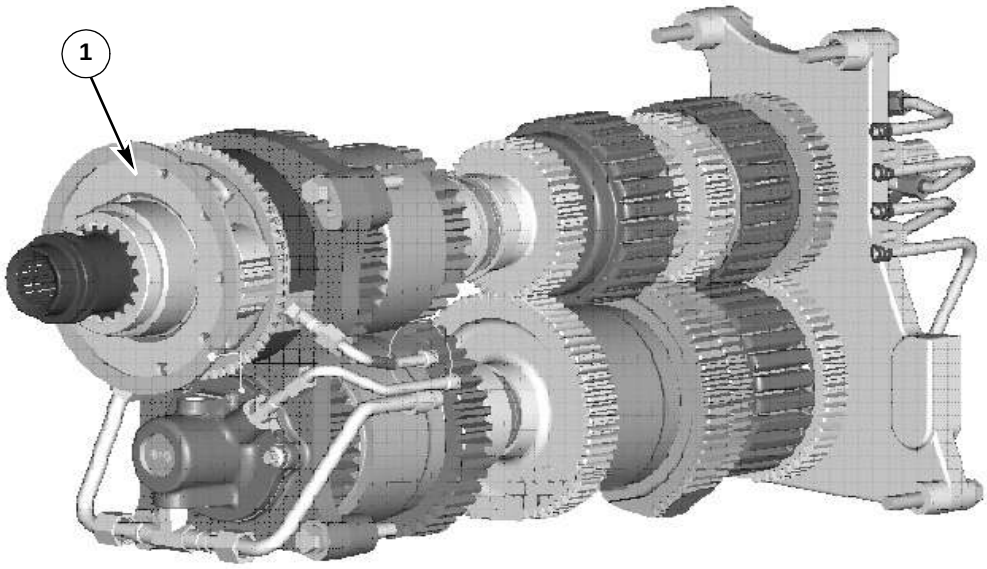
https://truckmanualshub.com/



# CREEPER SPEED

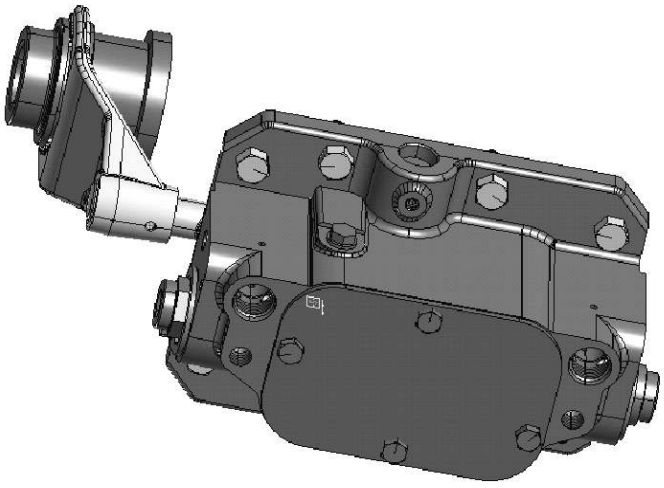
## Creeper Location

XTX tractors can be fitted with an optional creep speed system. This consists of a planetary reduction unit (1) to reduce the output speed from the powershift, mounted behind the powershift high/low clutches, and before the forward/reverse clutch shaft, as shown below.




## Creeper Engagement

Creep speed is engaged electro hydraulically via a switch on the right hand console. The switch operates a hydraulic servo, through the cab controller to move the creep speed selector in the gearbox housing. In order to engage creeper speed the forward/reverse shuttle must be placed in neutral.



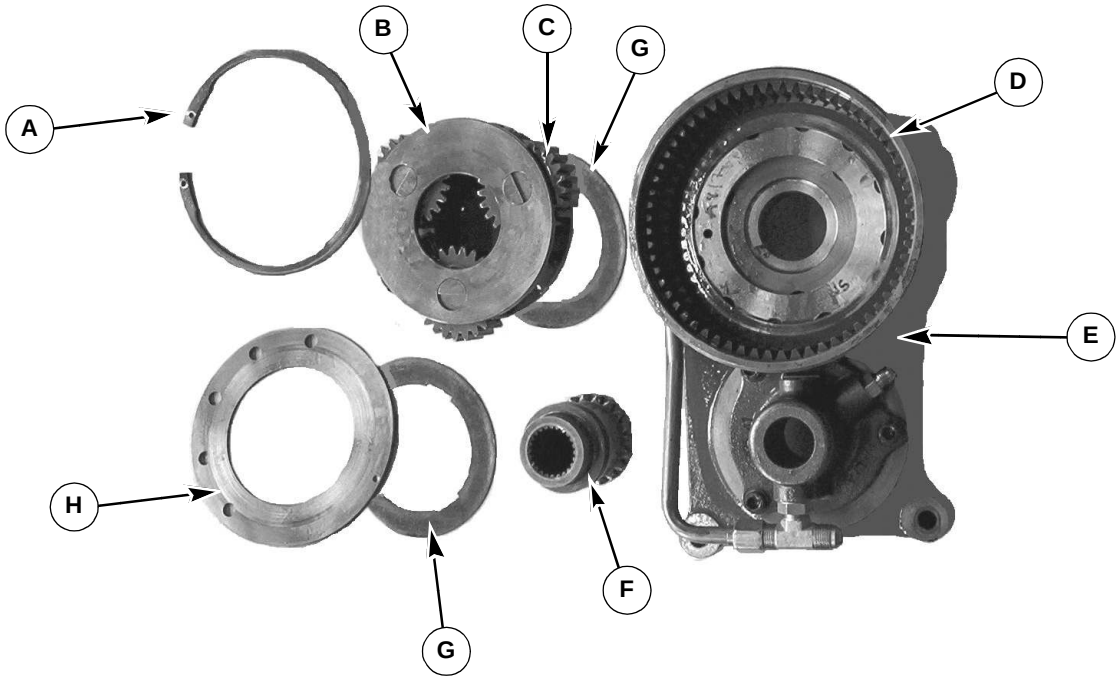
**CREEPER SERVO UNIT AND SELECTOR MECHANISM**

https://truckmanualshub.com/



## Drive Path Through The Creeper Section

Direct Drive selected:-
Drive is transmitted from the High clutch shaft, and directly to the forward/reverse clutch shaft assembly, through a sliding coupling.




A. CIRCLIP
B. PLANET CARRIER
C. PLANET GEAR
D. ANNULUS RING
E. HIGH/LOW CLUTCH SHAFT BEARING CARRIER
F. SLIDING COUPLING
G. BRONZE THRUST BEARINGS
H. END PLATE

Creeper Speed selected:-

When the operator places the transmission in neutral and presses the switch on the right hand console, a solenoid valve directs regulated pressure (P1) to an internal hydraulic cylinder in the creeper selector housing, moving the selector fork backwards.

Drive from the low clutch shaft is transmitted to the planet gears of the reduction unit which is in constant mesh with the clutch shaft.

The anulass ring of the planetary reduction unit is bolted to the high low clutch, bearing carrier and therefore cannot rotate. This means that the planet gear carrier as to rotate as a result.

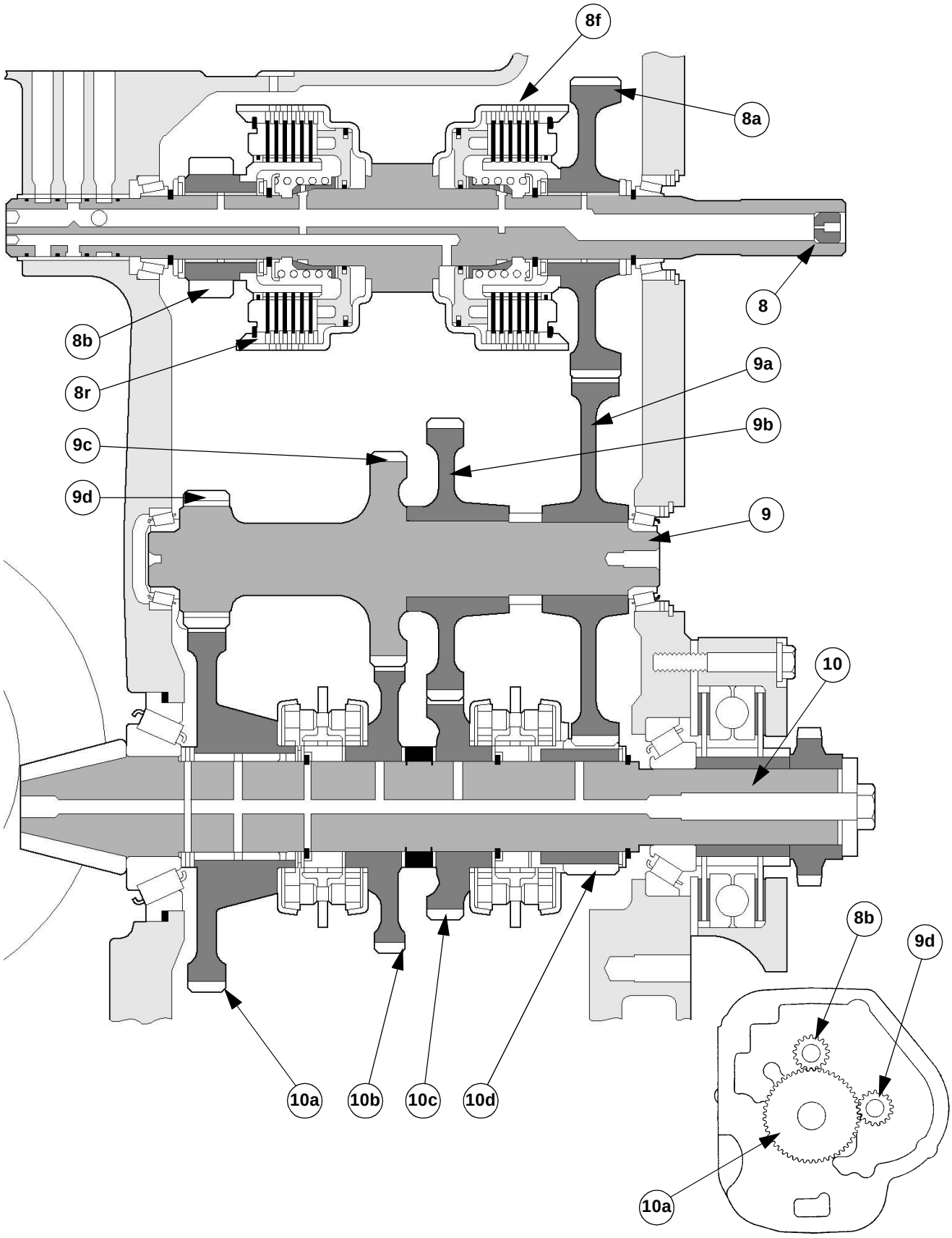
The sliding coupling between the high clutch shaft and the forward reverse clutch shaft assembly is moved backwards by the selector fork and the internal splines are taken out of mesh with the high clutch shaft.

As the sliding coupling also has external teeth on its front edge these are engaged in mesh with teeth in the planet carrier as the coupling is drawn backwards. This then transfers the drive through the planetary gear set onto the forward/reverse shaft.

https://truckmanualshub.com/



# FORWARD AND REVERSE SHUTTLE



https://truckmanualshub.com/



## Layout

The forward and reverse clutch packs (8f and 8r) are welded to the forward and reverse shuttle shaft (8) which is driven by the main shaft (shown on the previous page). The forward gear (8a) and the reverse gear (8b) are mounted on bearings on the forward and reverse shuttle shaft (8) and are free to rotate.

## Forward Clutch Selected

When the Forward position is selected on the Forward/Neutral/Reverse control switch, the Forward solenoid valve is energized and directs oil at 22 to 24 bar to the forward clutch pack (8f) through drillings in the forward and reverse shuttle shaft (8). At the same time the reverse solenoid valve is de-energized and oil pressure in the reverse clutch pack (8r) is allowed to fall to zero.

With the forward clutch pack engaged the forward gear (8a) is locked to the forward clutch pack (8f) by the clamping force on the clutch plates. The forward gear (8a) will now rotate with the forward and reverse shuttle shaft (8). The forward gear (8) meshes with the fourth range gear (9a) on the counter shaft (9).

## Reverse Clutch Selected

When the Reverse position is selected on the Forward/Neutral/Reverse control switch, the reverse clutch pack (8r) is supplied with oil at 22 to 24 bar. At the same time the oil pressure in the Forward clutch pack is allowed to fall to zero.

With the reverse clutch pack (8r) engaged the reverse gear (8b) is locked to the reverse clutch pack (8r) by the clamping force on the clutch plates. The reverse gear (8b) will now rotate with the forward and reverse shuttle shaft (8). The reverse gear (8b) drives with the first range gear (10a) on the pinion shaft (10) which drives the first range gear (9d) on the counter shaft (9).

**NOTE:** *To make the main illustration clearer, the three shafts have been drawn one above the other. The end view of the transmission shows the true layout of the shafts.*

## Lubrication Collar

A tapered collar is located on a seat on the forward and reverse clutch shaft, within the clutch packs and sits on top of the clutch piston. The lubrication collar is held in place, and on its seat by the clutch piston return spring.

In this position the flow of oil into the clutch pack for lubrication and cooling is through the orfice that is machined into the side of the collar only and is therefore a controlled flow.

When a clutch pack is engaged, the clutch piston starts to move up the shaft, and in doing so also lifts the lubrication collar of its seat. This allows a greater flow of oil into the clutch pack for cooling and lubrication, as the clutch needs maximum oil flow in at the point that the friction discs take up their drive as this is the point that the most wear and heat are generated.

If there was no lubrication collar fitted oil flow into the clutch would have to remain at maximum all the time and this would cause clutch drag when the clutch was disengaged, and cause unnecessary engine power consumption.

**NOTE:** *There is a set up procedure that must be used in the assembly process of the forward/reverse clutch shaft, to ensure that the lubrication collar is set correctly. This procedure will be found in section 6007 of the relevant service manual (Range Transmission Servicing).*

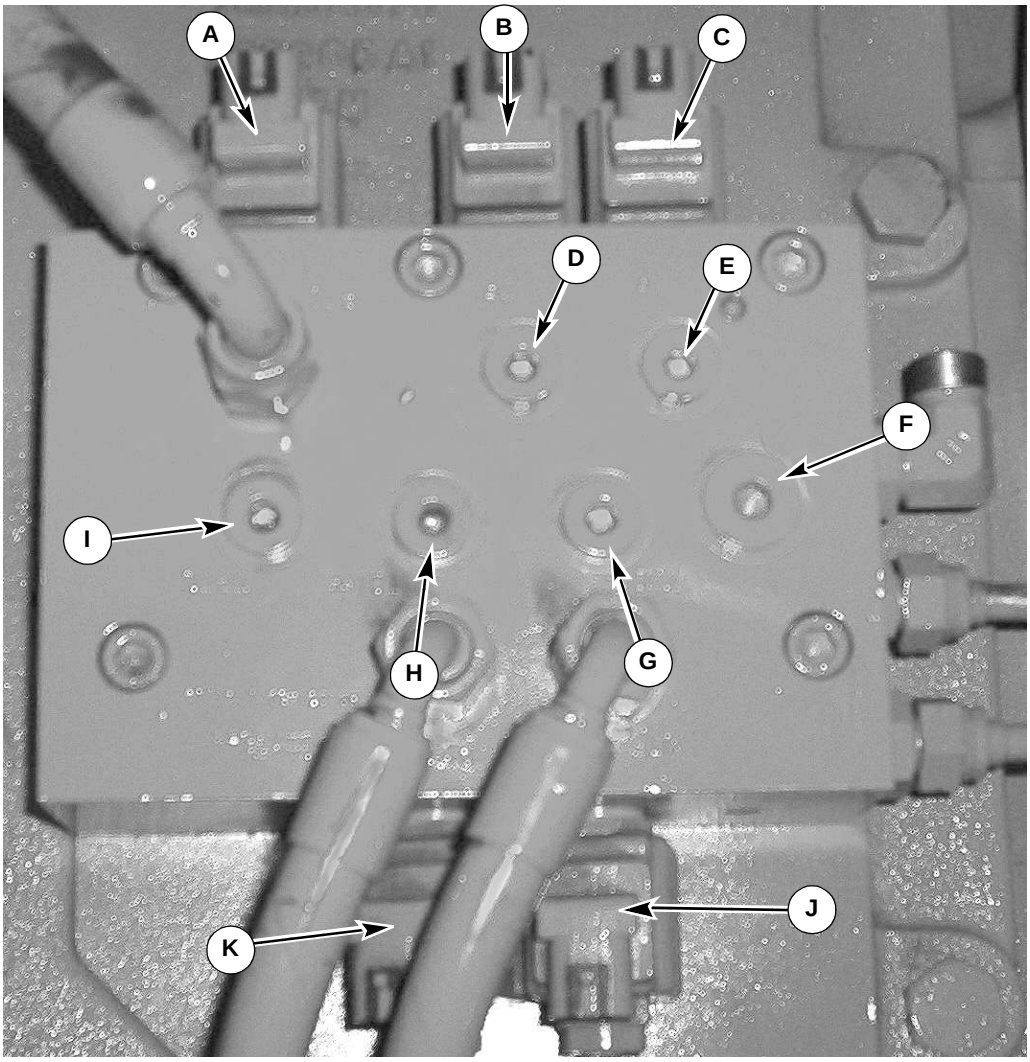
https://truckmanualshub.com/



# FORWARD REVERSE MANIFOLD

## Component and test point location

The following illustration shows the location of all the test points and solenoids for the forward / reverse and range housing.




A. PTO SOLENOID
B. FORWARD SOLENOID
C. REVERSE SOLENOID
D. FORWARD TEST POINT
E. REVERSE TEST POINT
F. REGULATED PRESSURE TEST POINT
G. MFD TEST POINT
H. DIFF LOCK TEST POINT
I. PTO TEST POINT
J. MFD SOLENOID
K. DIFF LOCK SOLENOID

https://truckmanualshub.com/



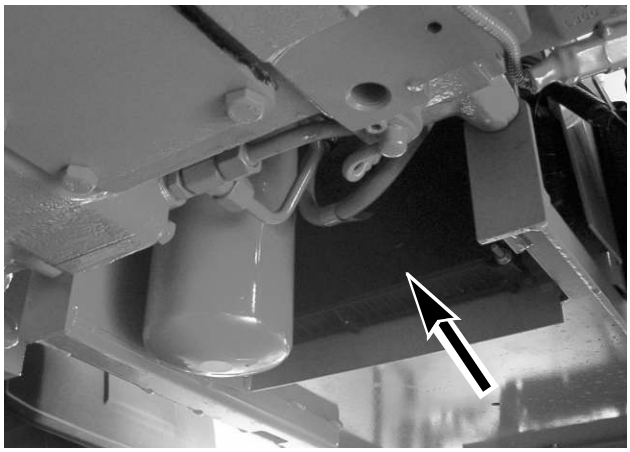
# TRANSMISSION CONTROL

The transmission controller monitors information directly from the following sensors.

- •Powershift clutch speed sensors.
- •Forward and reverse sensor.
- •Range position sensors (XtraSpeed-E and E*plus* tractors only).
- •PTO shaft speed sensors.
- •Transmission oil temperature sensor.
- •Clutch pedal position sensor.
- •Wheel speed sensor.

The transmission controller directly controls the operation of the following:

- •Powershift clutch solenoids (PS4).
- •Powershift clutch solenoids (PS2).
- •Range solenoids ~ (XtraSpeed-E and E*plus* tractors only).



**TRANSMISSION CONTROLLER**
(Located on the back of Battery Box)

The transmission controller processed the above information and will transmit information over the CAN Bus network to other controllers in the system. The transmission controller receives the following information over the CAN Bus network:

- •Switch and sensor status from the cab controller.
- •Calibration request from the instrument cluster.
- •PTO switch status from the hitch/PTO controller (engine power management).
- •Engine speed, load and temperature from the engine controller.
- •Engine type from the engine controller (for configuration).

The transmission controller transmits the following information over the CAN Bus network:

- •Configuration information to the cab controller.
- •Input and output signal information to the cab controller for error checking and monitoring.
- •Gear selected, travel direction and error messages to the instrument cluster.
- •Audible alarm request to the instrument cluster.
- •MFD engagement request the hitch/PTO controller (for park lock operation).
- •Engine speed command to the engine controller.
- •Engine torque level command to the engine controller.

Depending on the speed selected, transmission oil temperature and the load on the engine the transmission controller will then control the engagement of the correct powershift clutch pack, range solenoids and creep solenoid (if equipped). The transmission controller will then monitor the powershift and forward/reverse clutch speed sensor information to control the level of clutch slip to ensure a smooth gear take up during gear changes.

For tractors equipped with park lock, the transmission controller will control the park lock solenoid engagement along with the cab controller.

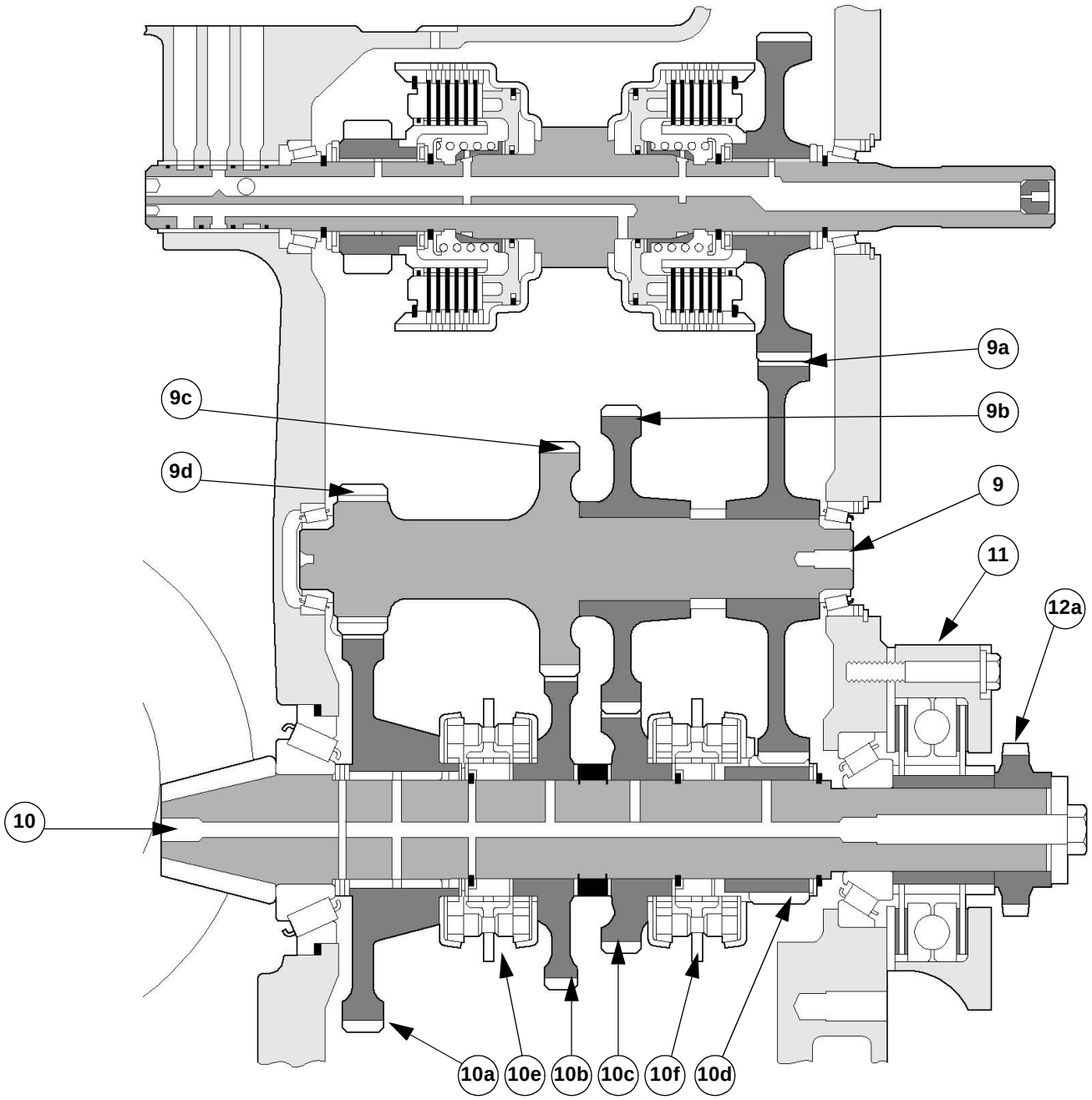
The transmission controller also transmits and receives information over the CAN Bus network and will process the engine speed and load (torque) information from the engine controller to control the correct gear selection and clutch engagement modulation depending on engine load. This information is also used by the transmission controller with CAN Bus information from the hitch/PTO controller to control the correct engine torque level.

The correct engine torque level is determined by the transmission controller monitoring the PTO shaft speed sensors PTO A and PTO B. During calibration and under no load, the PTO A speed sensor signal pulse is compared with the PTO B speed sensor pulse and the phase at which the signal pulses occur are stored by the controller. When the PTO is engaged and the torque on the shaft increases the PTO shaft speed sensor signal pulses will move out of phase, this allows the controller to measure the amount of torque on the PTO shaft. If the torque level increases to a set level the transmission controller transmits an engine high torque curve request to the engine controller. The engine will remain on the high torque curve until the PTO is disengaged.

https://truckmanualshub.com/



# FOUR SPEED RANGE SECTION



https://truckmanualshub.com/



## Layout

The range counter shaft (9) is driven when the forward or reverse clutch packs (8f and 8r) are engaged. All the countershaft gears are integral or splined to the countershaft.

All the range gears are supported on bearings on the pinion shaft (10) are free to rotate. The 1st/2nd range synchromesh (10e) and 3rd/4th range synchromesh (10f) are splined to the pinion shaft (10). On XTX models there is an extra support bearing and bracket mounted in the middle of the pinion shaft between second and third gears to give extra support and stop the pinion shaft from flexing.

## Range Gear Selection

For the operator to select a range the inching pedal or de-clutch button must be depressed to disconnect the forward reverse shuttle.

1st Speed Range selected:- Drive at the counter shaft (9) is connected through the integral 1st range gear (9d) to the 1st range driven gear (10a) which is mounted on bearings on the pinion shaft (10). Drive from this gear is connected through the 1st/2nd range synchroniser which is splined to the pinion shaft (10). A heavy duty synchroniser is used on the 1st & 2nd ranges.

2nd, 3rd or 4th Range selected:- The drive is the same as for 1st range except that the drive is directed through the respective 2nd, 3rd or 4th drive and driven gears and synchroniser's.

## Range Gear Lever Operation (XtraSpeed only)

The operator can select a range gear by pressing the inching pedal or de-clutch button to disconnect the forward reverse shuttle and then moving the range gear lever to the appropriate position to select a range gear.On the linkage from the range lever in the right hand console there are 4 electrical switches that allow a signal to be sent to the transmission ECM so that the correct powershift speed is engaged, when the inching pedal or declutch button is released.

When the fourth range gear is engaged, and reverse selected there is only number 1 powershift speed available. This is controlled by the transmission ECM as a safety feature.

## Range Gear Selection (XtraSpeed-E & E*plus*)

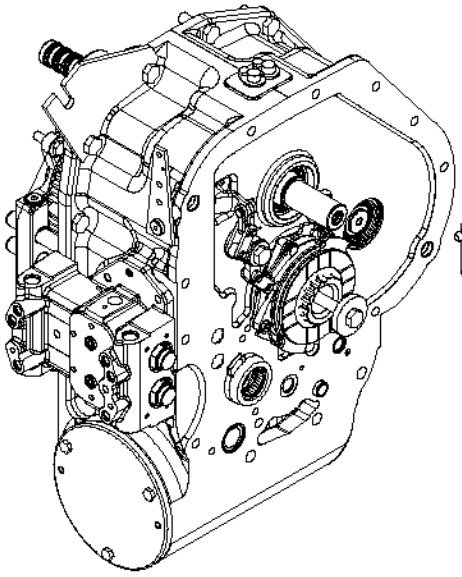
XtraSpeed-E and E*plus* models use a hydraulic servo range selection unit that is mounted in the place of the manual range selectors on the lower right side of the front range housing. This has four solenoid valves controlled by the transmission ECM and a supply of regulated oil pressure (P1) taken from the forward reverse valve.

There is no external gear linkage on these models. The servo unit has two horizontal pistons inside its housing that move a selector lever that is in mesh with the selector rails holding the range gear selectors. When oil is diverted by solenoid valves to either end of the servo piston the range selectors are moved to engage a gear.

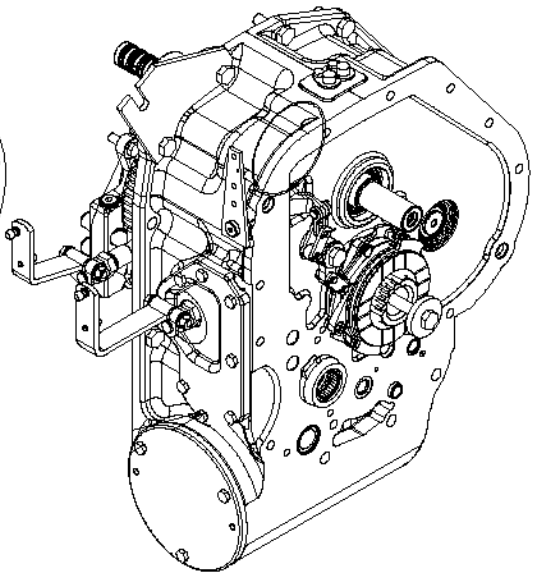
The servo pistons are specially shaped so that a position sensor can read from them to tell the transmission ECM the position of the range selectors and therefore the gear engaged.

https://truckmanualshub.com/

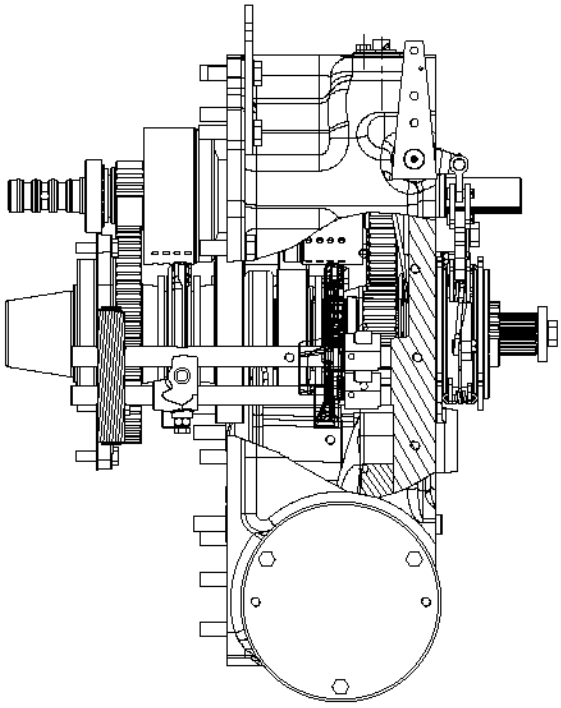




**RANGE SELECTION MECHANISM**
**(XtraSpeed-E and E*plus*)**



**RANGE SELECTION MECHANISM**
**(XtraSpeed Models)**



**INTERNAL SELECTOR MECHANISM**
**(All Models)**

https://truckmanualshub.com/

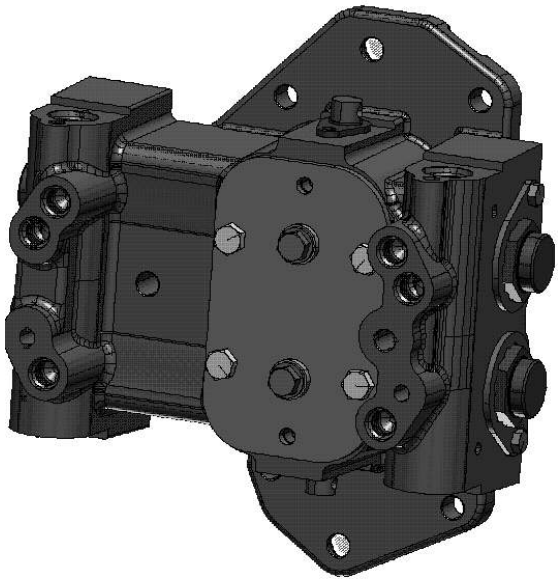


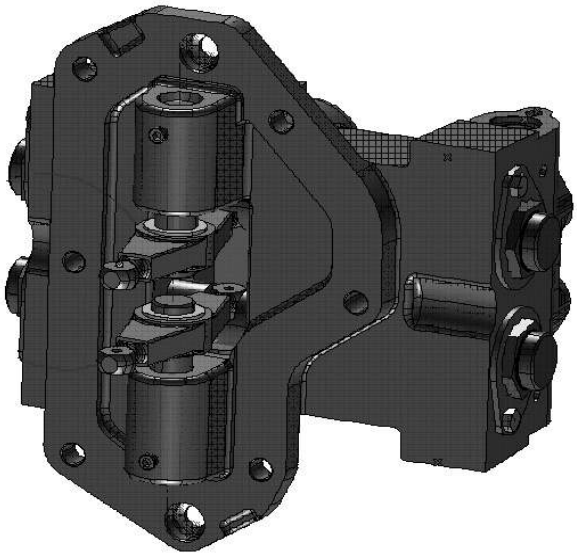
# RANGE SELECTION XtraSpeed-E & E *plus* TRACTORS

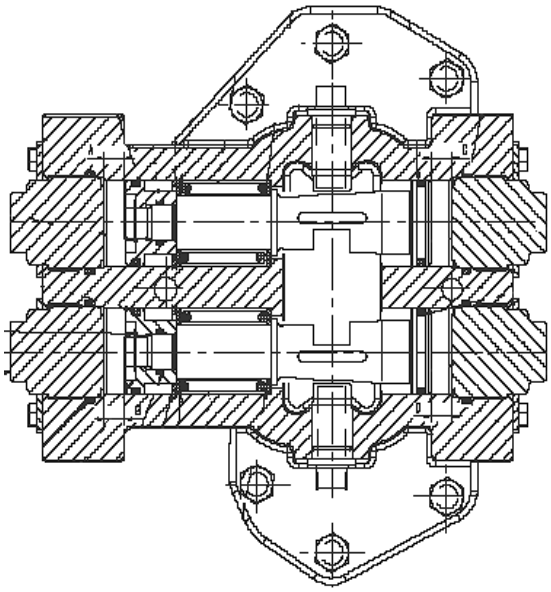
## Servo power range shift unit

The XtraSpeed-E and E*plus* versions use an electro hydraulic servo unit to control the range selection on the transmission. This unit consists of a housing containing 4 hydraulic pistons that move, two rails which move the gear selector mechanism. These rails are speacley shaped (tapered) so that a position sensor can send information regarding the position of the range selectors back to the transmission ECM.

There are four solenoid valves fitted to the servo unit and when a range is selected, the transmission ECM powers an individual solenoid so it can direct regulated pressure oil flow (P1) to the end of the piston on either rail to engage a range.







https://truckmanualshub.com/



# MFD DRIVE AND PARK BRAKE

## MFD Drive

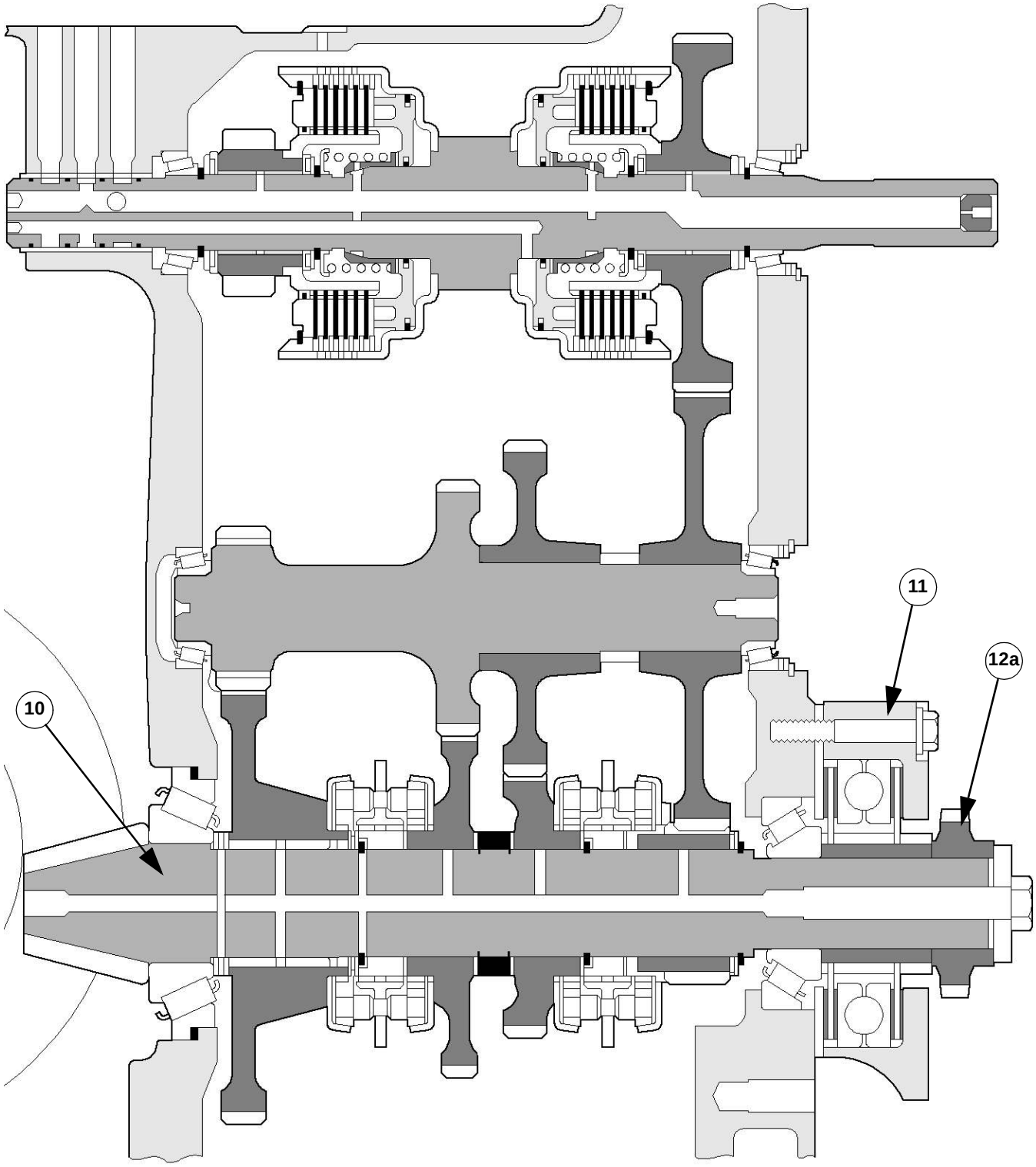
If MFD is fitted to the transmission, the MFD drive gear (12a), is splined to the front of the pinion shaft (10).

## Parking Brake

The parking (emergency) brake (11) is mounted on the front end of the pinion shaft (10) behind the MFD gear (12a).

https://truckmanualshub.com/





https://truckmanualshub.com/



# REAR AXLE

## Drive Path through the Differential and Rear Axles

The drive available at the pinion shaft is transmitted to the crown wheel bevel gear which is attached to the differential. Drive is transmitted through the four bevel gears and two side gears in the differential to the two side shafts, then through the epicyclic reduction gears to the rear axle half shafts.

## Differential Lock

The differential lock is electro-hydraulically operated by a switch on the R/H console. This energises a solenoid which directs oil flow to the through a passage in the transmission housing and R/H bearing carrier to the differential lock piston. When the clutch plates are clamped the differential lock hub, the R/H side gear and the R/H side shaft are locked to the differential assembly and prevents differential operation. Both side shafts will rotate in the same direction at the same speed.

When the differential lock is switched off, the solenoid is de-energised and oil pressure in the clutch reduces to zero. The piston returns to allow clearance between the friction plates.

## Service Brakes

The service brakes consist of multi plate inboard wet disc brakes which are splined to each side shaft and are lubricated and cooled by oil from the transmission lubrication circuit. The brakes are located in the brake housing between the differential section of the rear transmission housing and each rear axle. These brakes are hydraulically operated.

## Axle Reduction Gears

The driven differential side shafts have integral gears at the outer end of the shafts. These gears transmit the drive to a hub with three reduction gears. These gears are also in mesh with a outer ring gear fixed to the axle housing. As the driven reduction gears rotate, the shafts and the hub they are mounted on, also rotate as the gears travel around the ring gear. The hub is splined to the axle half shaft and rotates at a lower speed to the differential side shafts.

## Rear Axle Half Shafts

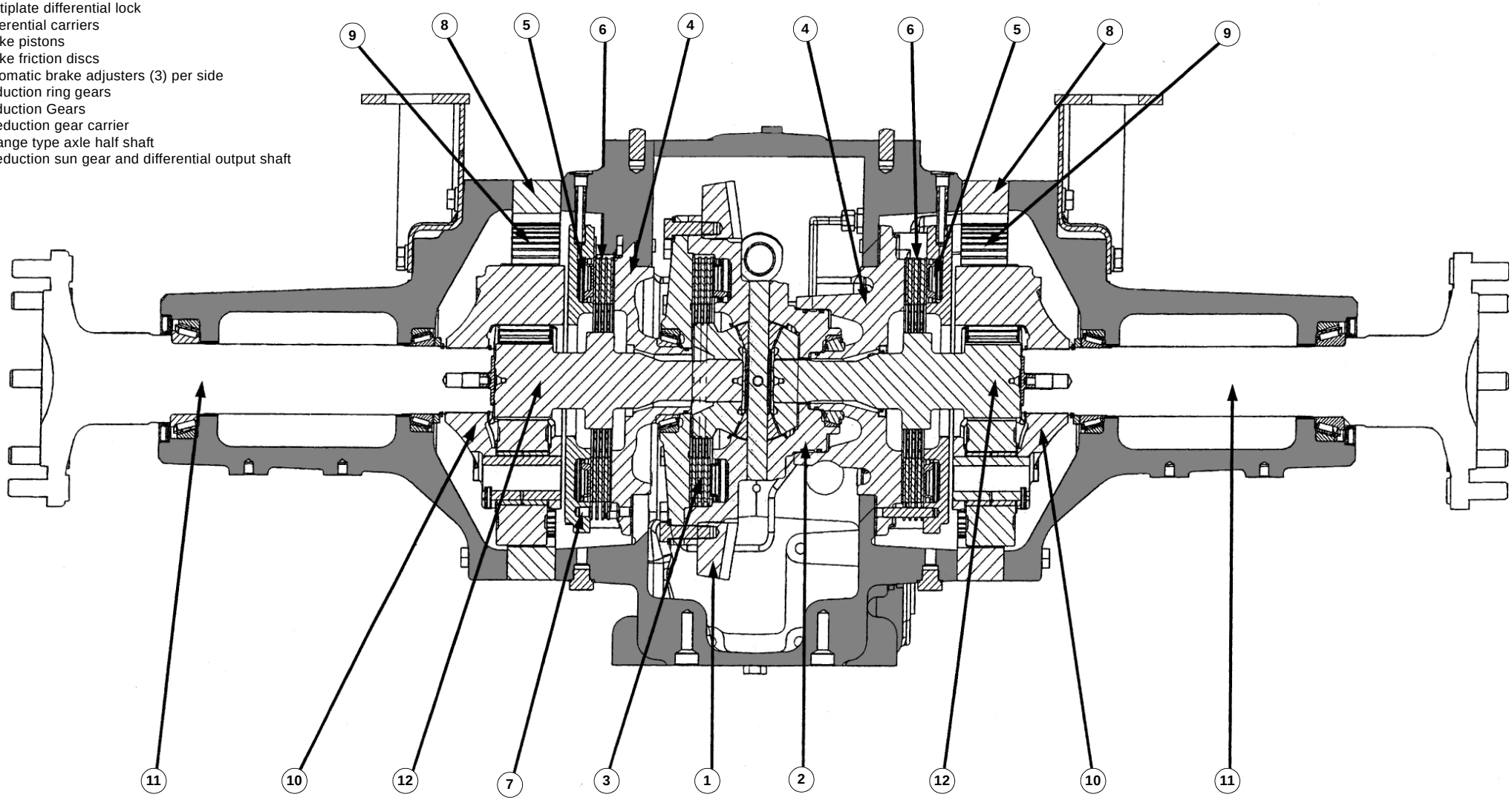
The rear axles are available with flange type or bar type (row crop) axle half shafts and are supported on two taper roller bearings.

https://truckmanualshub.com/


## CROSS SECTION OF XTX REAR AXLE

**Key to diagram**

1. Crown wheel ring gear
2. Differential assembly
3. Multiplate differential lock
4. Differential carriers
5. Brake pistons
6. Brake friction discs
7. Automatic brake adjusters (3) per side
8. Reduction ring gears
9. Reduction Gears
10. Reduction gear carrier
11. Flange type axle half shaft
12. Reduction sun gear and differential output shaft



https://truckmanualshub.com/

This page has been left blank

https://truckmanualshub.com/



# DIFFERENTIAL

## Layout

The differential assembly is attached to the crown wheel bevel gear which is driven by the pinion shaft.

The differential consists of four bevel gears which drive two side gears The side gears are splined to the side shafts which transmit the drive to the axle reduction gears and the brake discs.

The differential lock friction plates (3) are splined to the differential lock hub, which is splined to the right side shaft.

## Differential Lock Engaged

When the differential lock is switched on, the differential lock solenoid valve, located on the F/N/R manifold, is energized and directs oil at a regulated pressure of (22 to 24 bar) to the differential lock piston through drillings in the transmission housing and the right hand differential bearing carrier.

When the clutch plates are clamped, the differential lock hub and the right side shaft are locked to the differential assembly and prevents differential operation. When the differential lock is switched off, the solenoid is de-energized and oil pressure in the clutch reduces to zero. The clutch piston returns to allow clearance between the friction plates.

https://truckmanualshub.com/



# REAR AXLE OPTIONS

There are two options of Rear Axle, either flanged or sliding bar type axle half shafts.

Each rear axle incorporates an epicyclic gear reduction assembly which is mounted outboard of the brakes. The axle uses a three pin planetary reduction arrangement.

The side shaft drives planetary gears which are mounted with bearings on individual shafts secured to the reduction carrier.

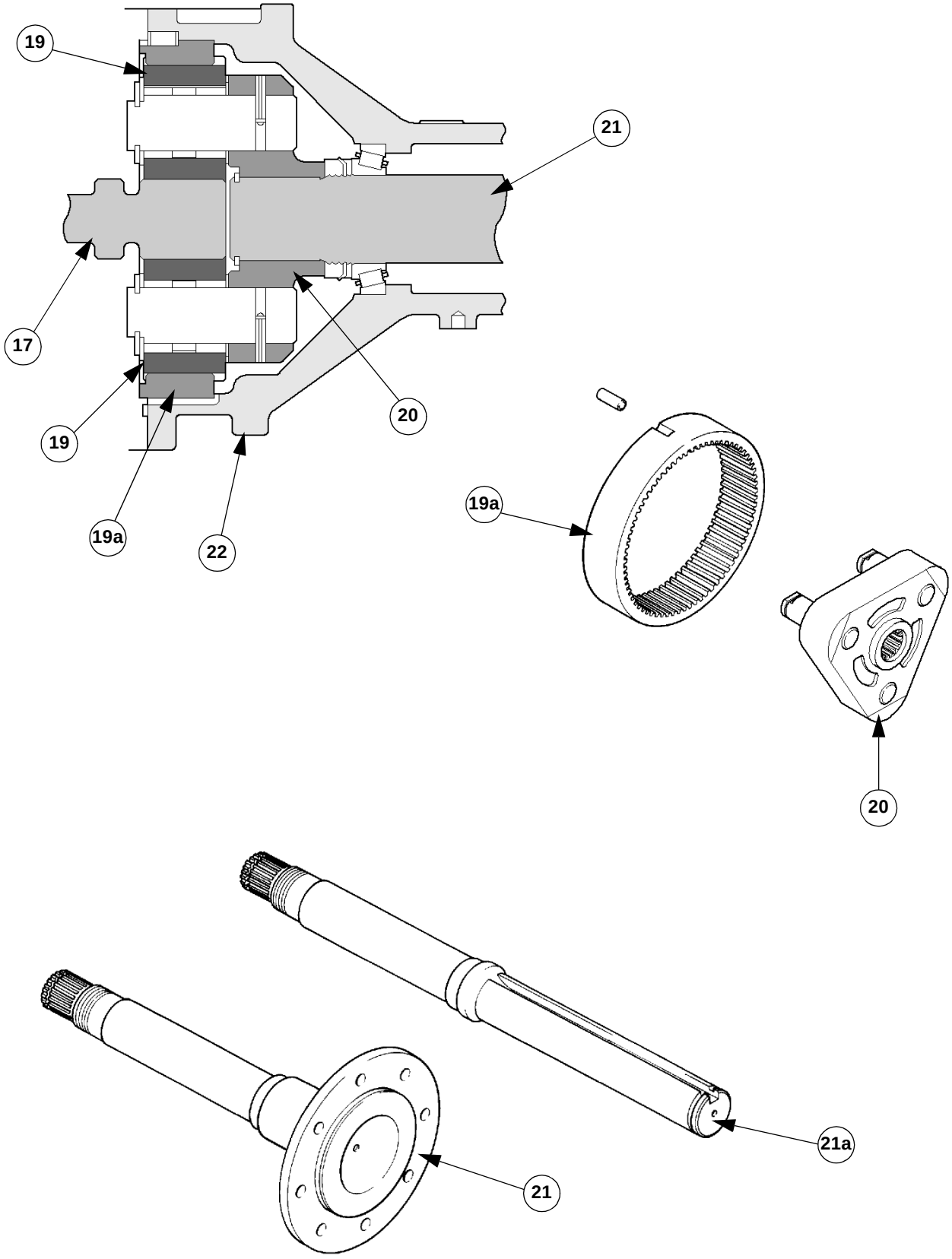
The planetary gears are also in mesh with a ring gear which is fixed to the axle housing and is not removable.

When the side shaft and planetary gears rotate, the planetary gears travel around the ring gear causing the reduction carrier to rotate.

The axle shaft is splined to the reduction carrier and will therefore rotate with it.

https://truckmanualshub.com/

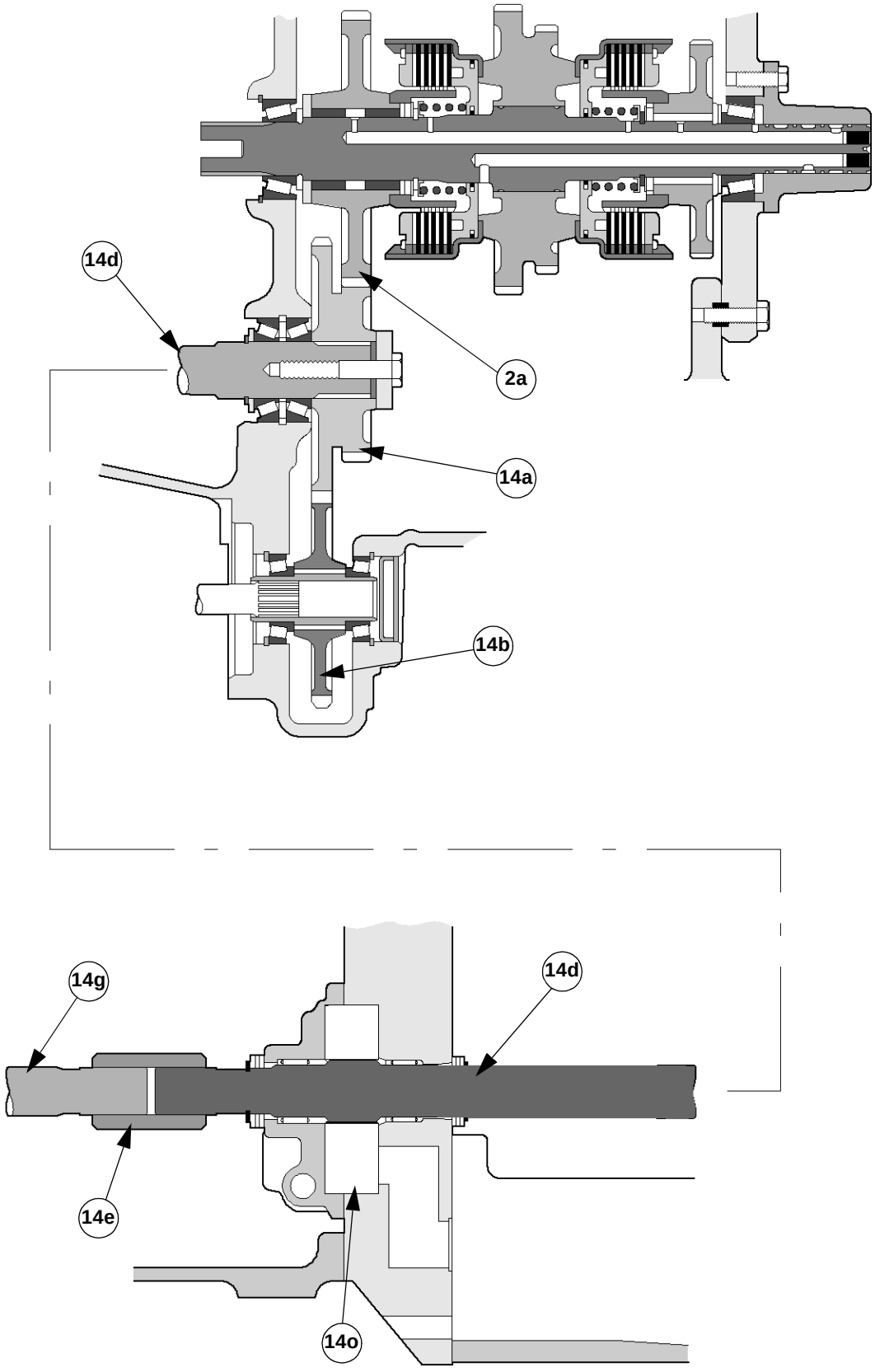




https://truckmanualshub.com/



# PTO AND HYDRAULIC PUMP DRIVE



https://truckmanualshub.com/



## PTO Drive

The rear PTO is driven by the speed housing gears directly from the engine flywheel.

The drop shaft 2nd speed gear (2a) drives the PTO gear (14a) which is splined to the PTO front shaft (14d).Which passes through the charge pump and then through a coupling connects the drive to the intermediate shaft (14f) and a second coupling (14e) connects the drive from the intermediate shaft (14f) to the rear PTO shaft (14g).

**NOTE:** *See the following pages for information about the PTO clutch.*

## Main Pump Drive

The PTO gear (14a) is a double gear and provides the drive for the main hydraulic pump drive gear (14b).

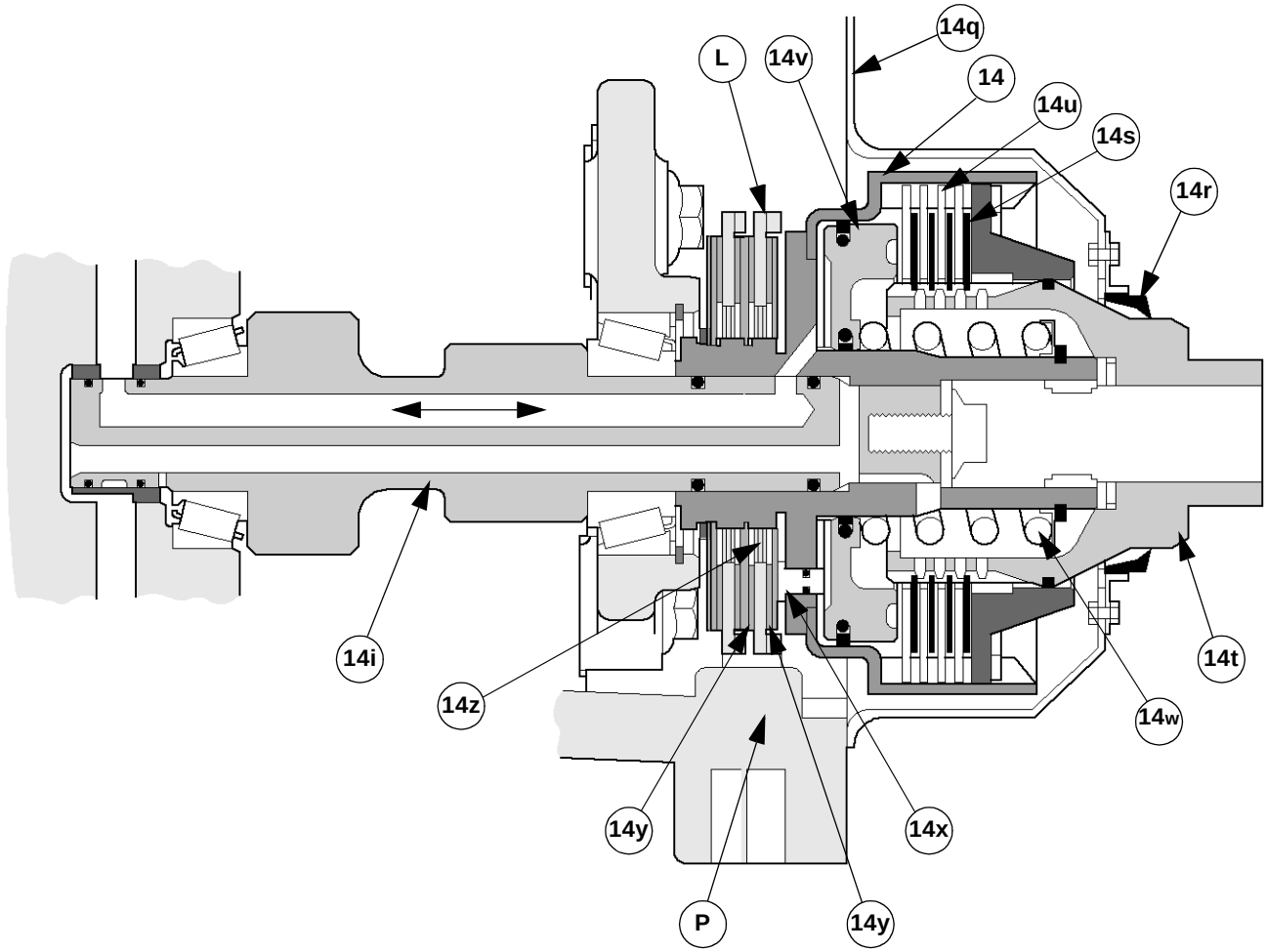
## Charge pump drive

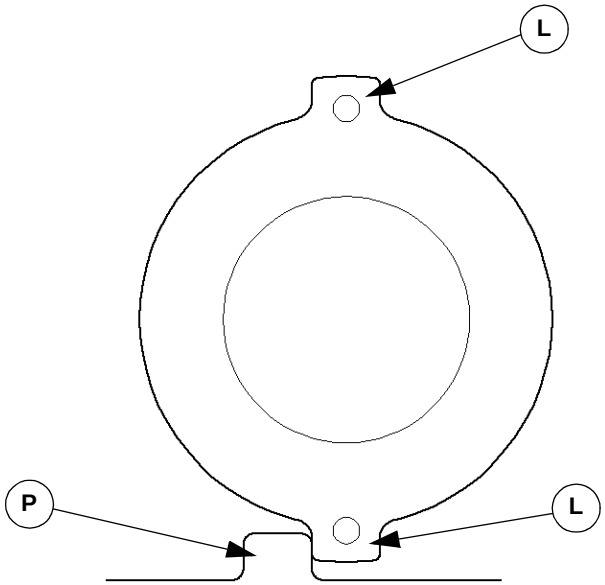
The charge pump is mounted inside the front range housing. Drive to the charge pump is from the PTO shaft, which passes directly through the middle of the pump and then through to a coupling to the rear of the tractor.

https://truckmanualshub.com/



# PTO CLUTCH



https://truckmanualshub.com/



## Layout

The PTO housing is separate from the range housing. The PTO clutch is located outside of the housing in the rear of the range transmission underneath the rear differential.

The clutch pack friction plates (14s) are splined to the inner hub (14t) which is splined to the PTO rear shaft (14g).

The clutch spacer plates (14u) are splined to clutch pack housing (14) which is secured to the lower PTO shaft (14i).

## PTO ON

When the rear PTO switch is moved to engage the drive, the PTO solenoid valve directs oil at a pressure controlled by the electronic module to the PTO clutch through drillings in the PTO housing and the lower shaft (14i).

The piston (14v) is moved by the oil pressure to clamp the clutch plates and lock the inner hub (14t) to the PTO lower shaft (14i). At the same time the piston spring (14w) is compressed by the piston and spring pressure is released from the three pins (14x) and PTO brake friction plates (14y).

The wave springs (14z) separate the brake plates and allow the clutch pack assembly and lower shaft (14i) to rotate freely.

## PTO OFF

When the PTO clutch is released, the piston spring (14w) returns the piston which frees the clutch plates and pushes the three pins (14x) against the brake friction plates (14y) to clamp the brake reaction plate (L) to the clutch pack housing (14). If oil drag causes the clutch pack housing to rotate it will only rotate until a lug on the brake reaction plate (L) contacts a protrusion on the PTO housing (P).

With the engine switched OFF the brake reaction plate will allow the PTO output shaft to rotate approximately $30^{o}$ to allow easy spline alignment of implement drive shafts.

**NOTE:** *On XTX tractors the hydraulic pressure sent to the clutch pack in 540 RPM PTO speed is limited to approx. 15 bar.This is done electronicaly with the use of PWM (Pulse Width Modulation) This is to safeguard the transmision and PTO driveline from excessive torque loads that could cause permanent damage to the tractor. Therefore all dynomometer testing should be carried out in 1000 RPM PTO speed.*

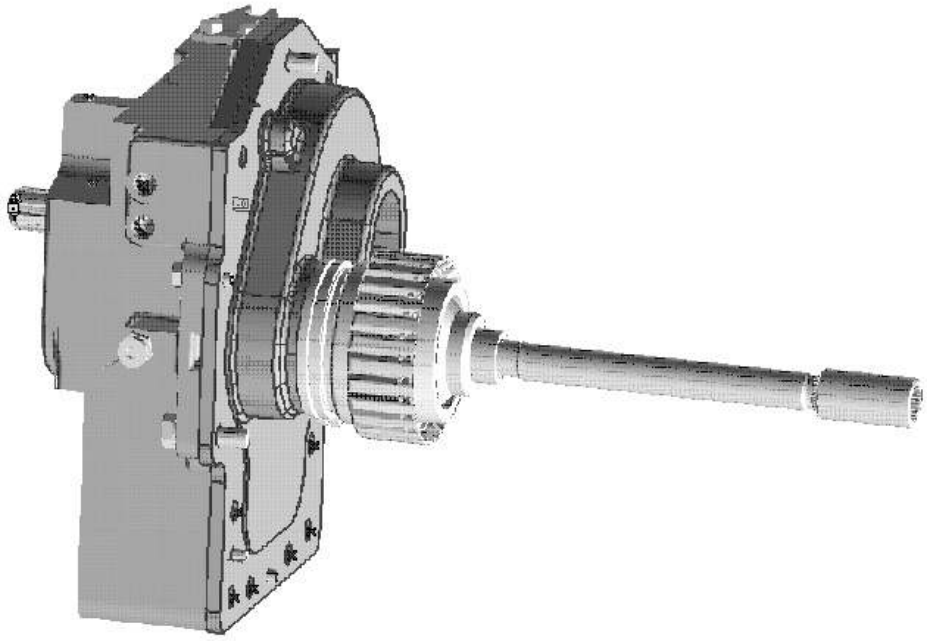
## Speed options

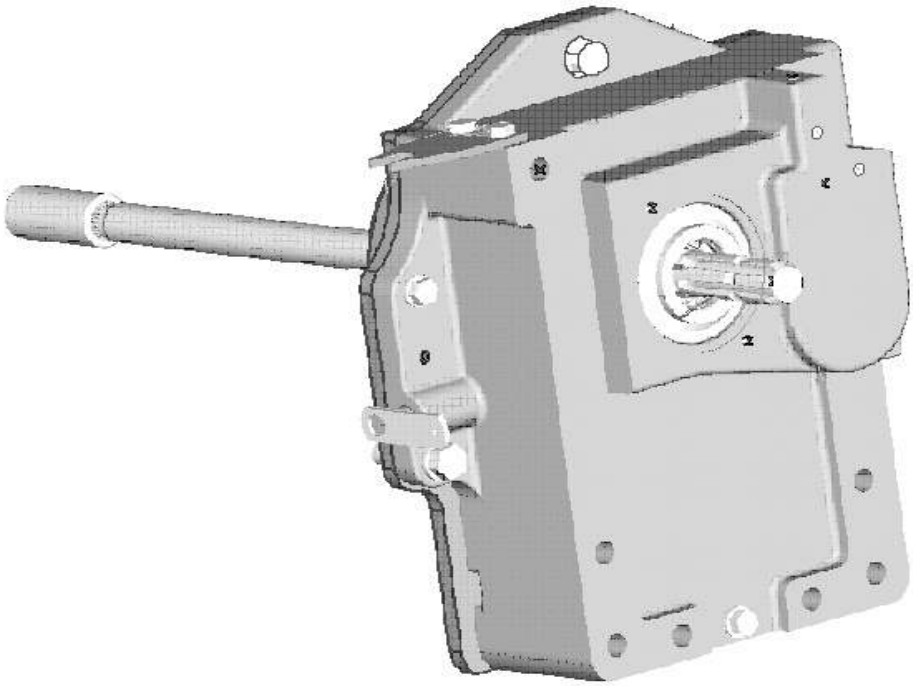
There are two different speed options of PTO available for XTX tractors depending on market requirements. These are the standard 540/1000 RPM option, and there is also an optional economy 540 RPM which gives the operator 540E (750)/1000 RPM operating speeds.

https://truckmanualshub.com/



# SHIFTABLE TWO SPEED PTO 540/1000 OR 540E/1000 RPM (Europe Only)



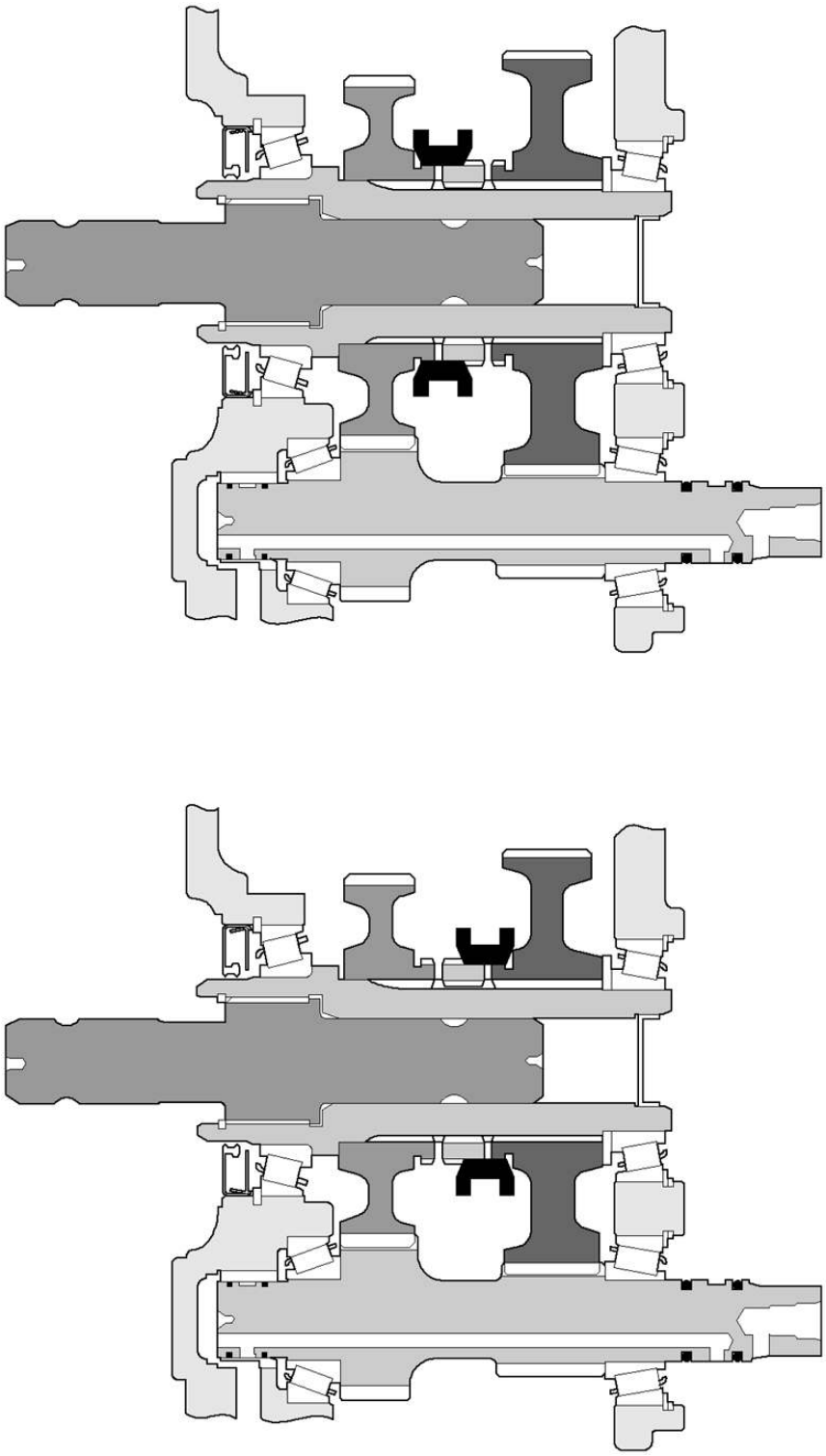


https://truckmanualshub.com/



# SHIFTABLE TWO SPEED PTO 540/1000 OR 540E/1000 RPM (Europe Only)

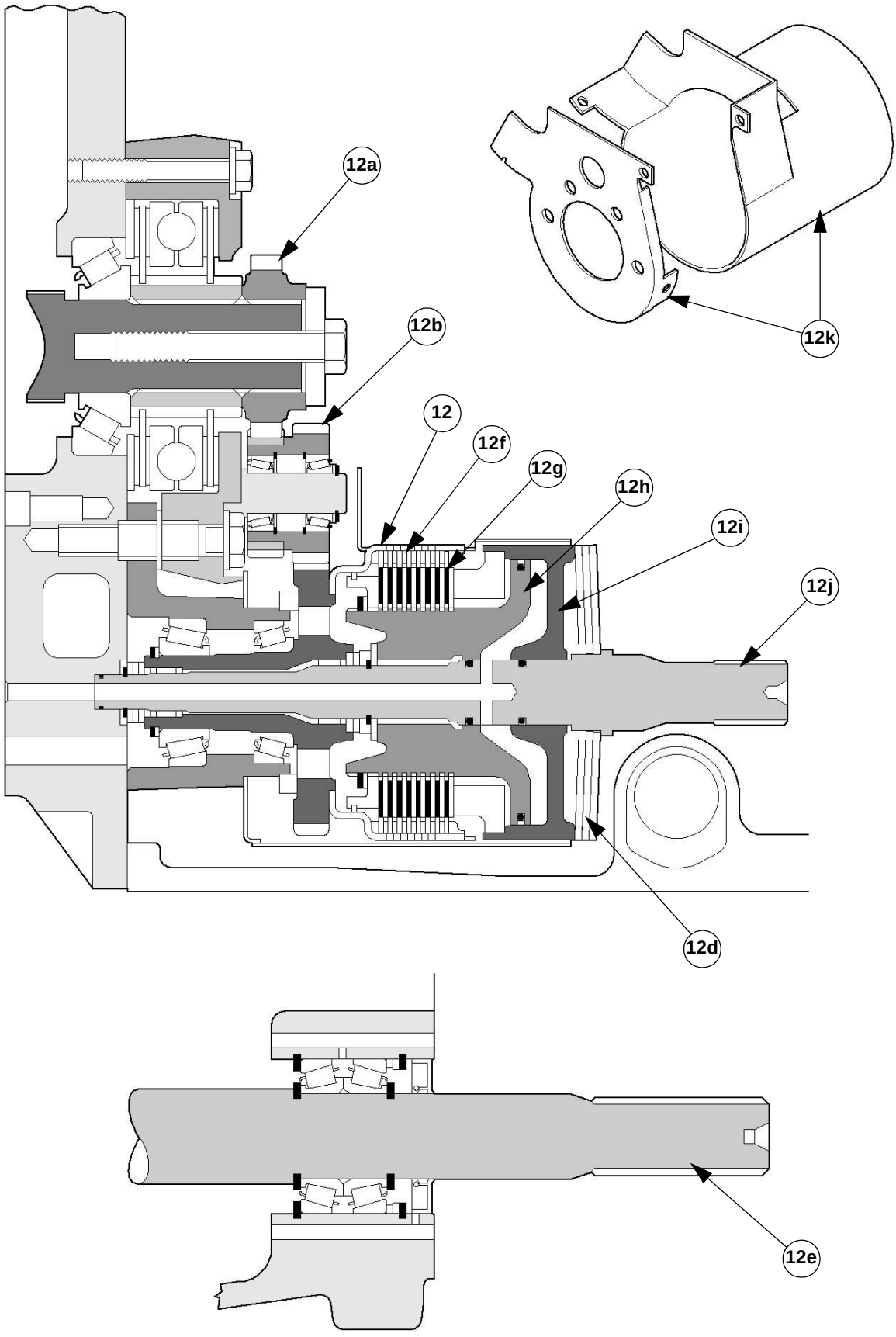
The illustration below shows the speed selector mechanism, and output shaft mounting for rear PTO installation. The PTO clutch assembly is mounted outside the speed housing on the end of the PTO input shaft as shown opposite.



https://truckmanualshub.com/



# MFD CLUTCH



https://truckmanualshub.com/



## Layout

The MFD clutch (12) is driven by the pinion shaft MFD drive gear (12a) through an idler gear (12b).

The MFD clutch spacer plates (12f) are splined to the clutch pack housing (12) and the friction plates (12g) are splined to the inner hub (12h) which is splined to the clutch output shaft (12j).

Three bellville springs on all models (12d) on the output shaft (12j) apply clamping force to the friction plates through the piston (12i). When the friction and spacer plates are clamped together the drive is transmitted through the clutch to the output shaft (12j) coupling and the drive shaft which has a support bearing on it also mounted inside the powershift housing (12e).

The clutch pack assembly is enclosed inside a two piece shield (12k) to reduce oil turbulence and heat generation.

## Operation

The MFD system is engaged by spring pressure, so that in the event of a system failure the tractor will be in 4WD.

## MFD - ON

When the tractor is started and the MFD switch is moved to the ON position, power to the MFD solenoid is stopped. Oil from the MFD clutch pack is allowed to vent to tank. Spring force will clamp the MFD clutch pack and provide drive for the front wheels.

## MFD - OFF

When the MFD switch is moved to the OFF position, the MFD solenoid is energised and oil at regulated pressure is directed to the clutch through drillings in the output shaft (12j). The hydraulic pressure overcomes the Belleville spring force and moves the piston (12i) to the right, allowing the friction plates to rotate freely.

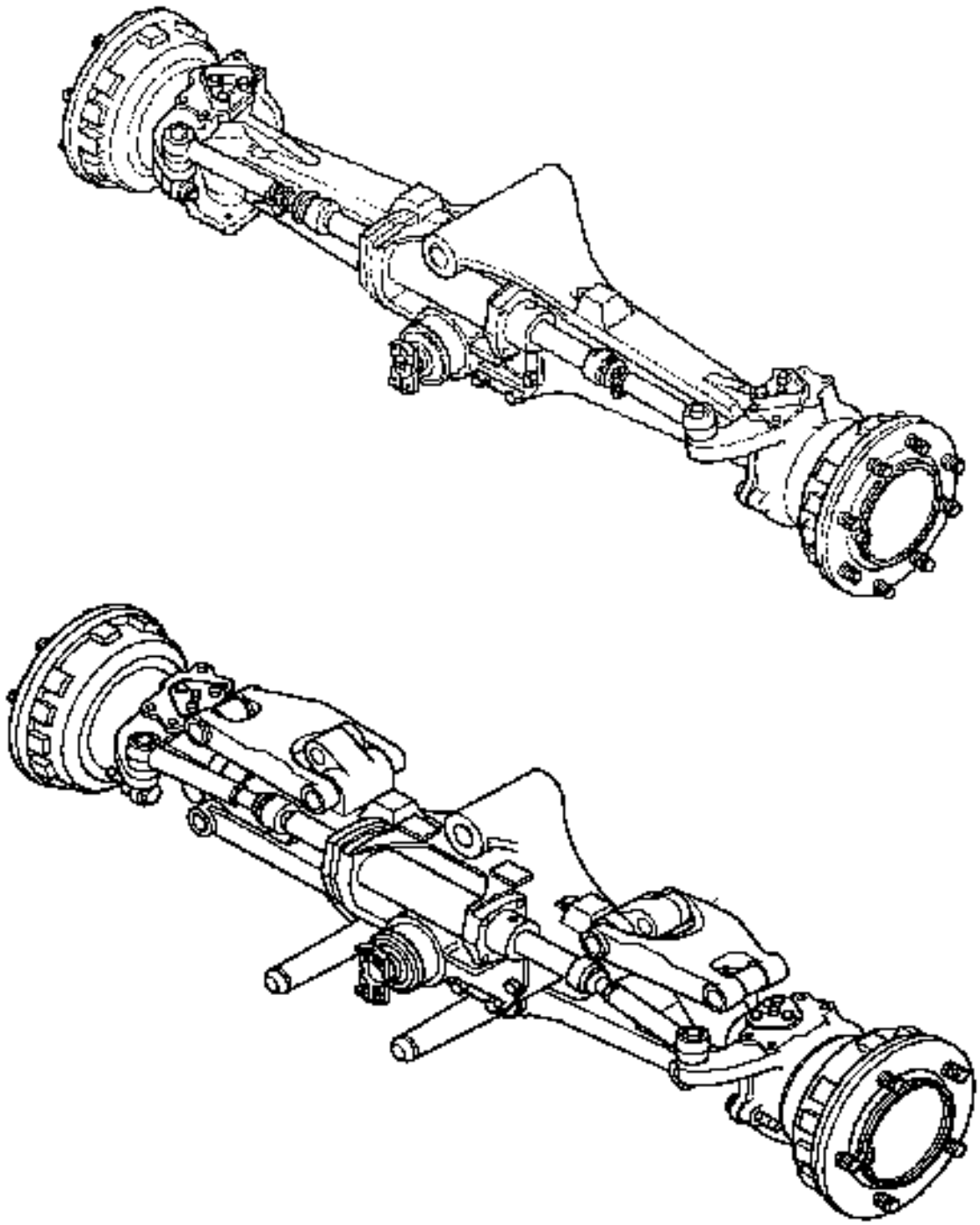
## MFD - AUTO

When the switch is in this position, the MFD receives an input from the Hitch controller. This will switch the MFD ON or OFF depending upon sensor information received by the controller.

https://truckmanualshub.com/



# MFD AXLES



https://truckmanualshub.com/



## Introduction

The front axles are manufactured by Carraro in Italy. There is the option of either a rigid beam type axle or an independently suspended axle that allows each side wheel to travel up and down independently, but the axle can also tip from its centre pivot to allow for undulating ground that the independent movement has not got enough travel to compensate for. The drive is taken from the transmission through the MFD clutch and out through the front of the transmission. The drive is then transferred to the centre of the axle by a drive shaft with sealed for life universal joints. The shaft is protected by a shield to prevent “wrapping”. The yoke at the transmission end is splined to allow for axle movement.

The axle has an integral steering cylinder, with tie rods connected and facility to adjust toe-in.

The swivel housings are mounted to the axle using taper cone bearings and the drive shafts have double universal joint couplings at the swivel housing to allow smooth operation on turning.

All axles are equipped with a limited slip type differential.

## Independent Front Axle Suspension Operation

The suspended front axle is mounted on the tractor in the conventional way that the rigid axle is mounted, and so the differential unit is unsprung, and so the angle of the MFD drive shaft only changes a little, and cannot exert excess loadings or angles onto the shaft therefore improving the long term reliability.

The steering swivels and front hub assemblies, are connected to the centre section of the axle by a top and bottom wishbone, and running between these are the axle drive shafts transferring drive from the differential to the front hub assemblys.

Supporting the wishbones and therefore the front of the tractor is a hydraulic cylinder on either side of the axle that is connected to the lower wishbone and the top of the centre section of the axle. Each cylinder is then connected hydraulically to a control valve and also in line to a nitrogen gas filled accumulator.This accumulator gives the spring effect, and pushes the wheel back down again after the wheel has come up against an obstacle. To give a controlled operation the inner lower pivot pin also acts as a torsion bar trying to force the wheel up to its maximum travel, so that the hydraulic circuit is always under tension.There is an electronic control module that controls the valve which is mounted in front of the right rear axle. According to the inputs the axle controller see’s from either the switches in the cab, or the left or right front axle potentiometers it will move the axle suspension accordingly. In normal operation the electronic controller will try to keep both sides of the front axle in there mid positions, by either sending or taking away hydraulic oil from both sides. Each side wheel has 100mm of independent travel, and the axle can still pivot to give increased movement if neccesary to allow for extremely undulating ground conditions.

**NOTE:** *For hydraulic information refer to section 8. For electrical information, error codes and trouble shooting refer to section 10003 in the relevant service manual.*

**IMPORTANT:** *When working on the suspended front axle take extreme care, as there is hydraulic pressure present in the system held by the accumulators and also mechanical tension in the system from the torsion bars.This section is only a description of operation of the system. For disassembly and assembly instructions refer to section 6022 in the relevant service manual.*

https://truckmanualshub.com/



# MFD DIFERENTIAL

## Front Axle Differential Lock Operation

The axles on XTX models use a Ball and Ramp type differential lock actuation method. This type of differential uses a two piece sun gear, that incorporates a ball and ramp type set up between the gear and its hub.

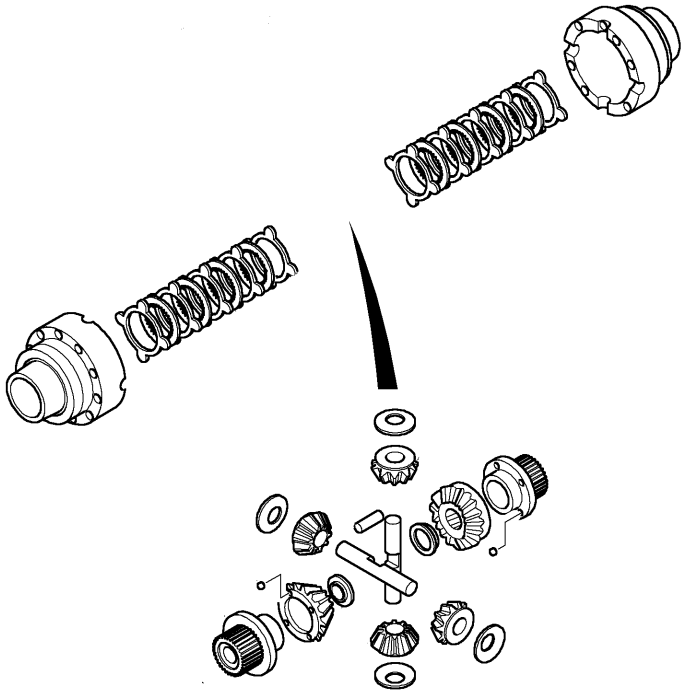
When differential wheel speeds occur in this unit the two halves of the sun gear twist against each other and in doing so operate the ball and ramp mechanism, expanding out the hub and compressing the differential lock plates in the housing, therefore locking the drive to that wheel up. Because of this, if the two halves of the sun gear change speeds even slightly, the locking mechanism will be activated and lockup the drive to that wheel in the differential, keeping traction equal between the wheels.

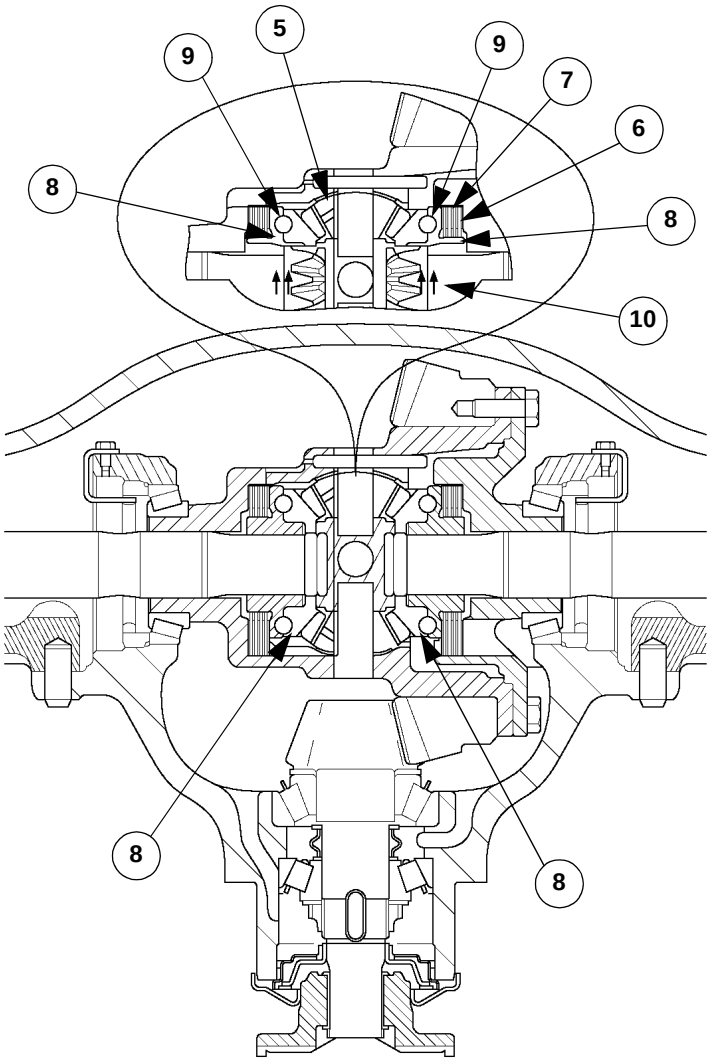
This type of differential is therefore much more positive and more sensitive and does not rely on a torque loading across the differential to lock it, as it will start to lock up with a speed difference only.

**NOTE:** *Due to the positive locking mechanism in this type of differential it may be neccesary on tractors used for continuous road operations to add an extra additive to the front axle oil to reduce the noise level that is generated by the Diff Lock mechanism while turning at high speeds. However for normal operations this characteristic is quite normal and is acceptable.*

https://truckmanualshub.com/







https://truckmanualshub.com/



# PARK LOCK ASSEMBLY

## Park Lock Description

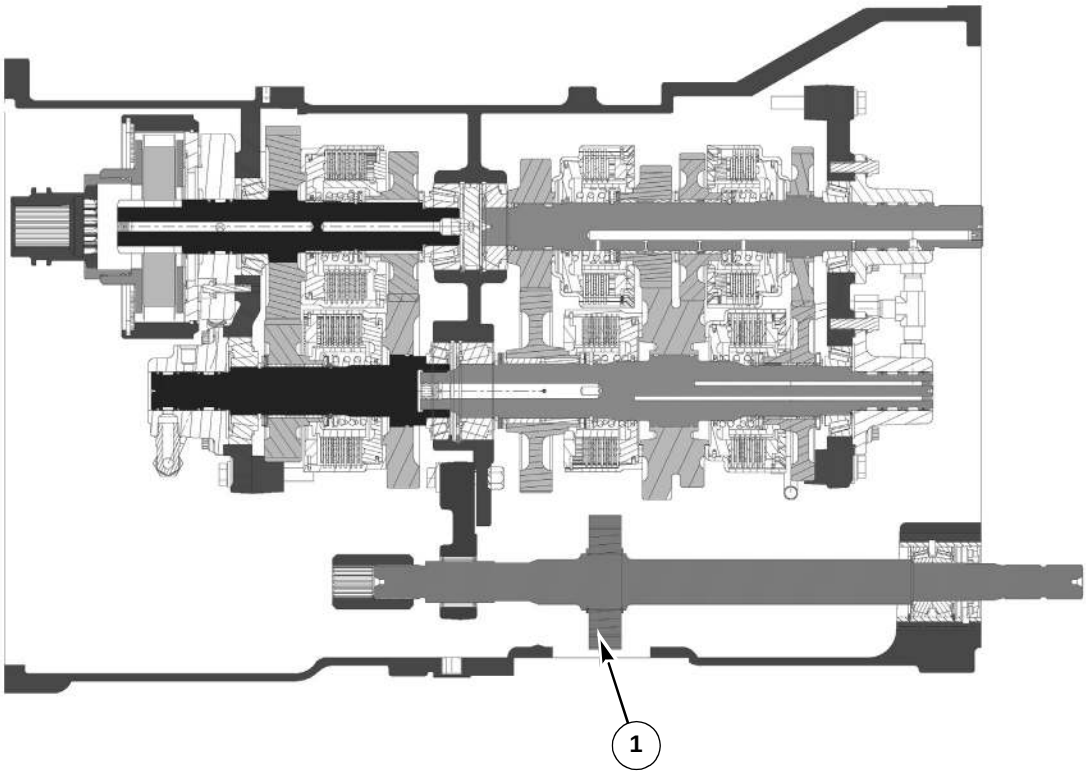
A mechanical park lock assembly is available as an option for markets that require it. This is a pawl and collar type lock that is located in the bottom of the powershift housing of the transmission and engages on the MFD driveshaft to stop movement of the tractor.

Bolted onto the bottom of the powershift housing under the dropshaft, running from left to right is a separate housing containing a spring loaded hydraulic actuator, and mechanical linkage to engage and disengage the park lock pawl.

The collar is located on the MFD output driveshaft before it leaves the powershift housing, and the actuator housing containing the locking pawl and its mechanism is directly below.

The system is sprung on and is turned of hydraulically using regulated oil pressure (P1), supplied from a solenoid valve on the powershift manifold.

When the forward / reverse shuttle lever is removed from the park position the cab controller tells the transmission controller to turn on the solenoid directing P1 oil to remove the park lock.

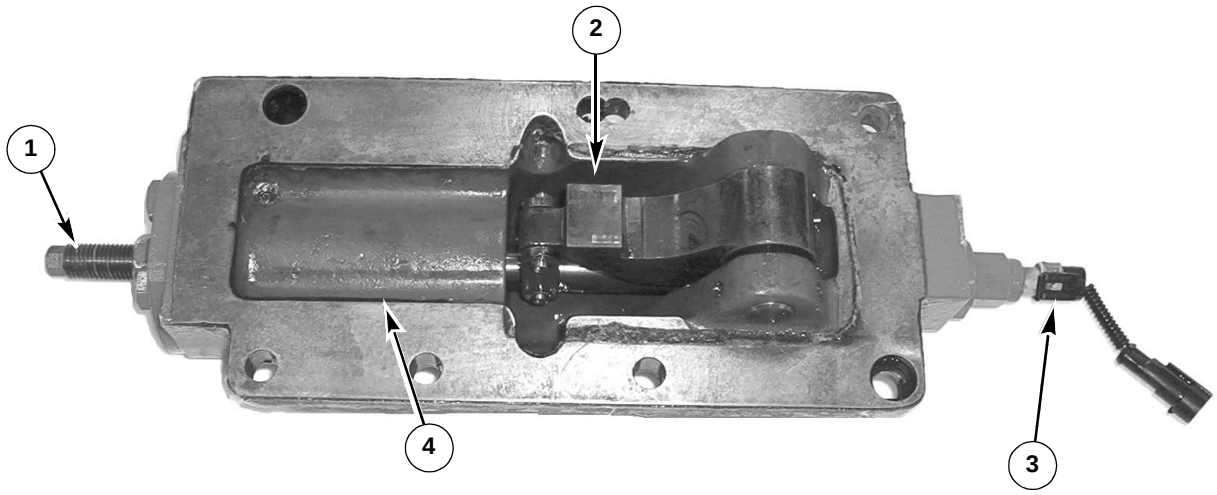



1. **PARK LOCK COLLAR ON MFD OUTPUT SHAFT**

https://truckmanualshub.com/



There is also a manual override on the system that will allow the park lock to be removed in the event of an engine or hydraulic failure. This consists of a screw that can be unlocked and screwed out to remove the pawl from its collar.




1. MANUAL OVERIDE ADJUSTER SCREW
2. PARK LOCK PAWL
3. PARK LOCK STATUS SWITCH
4. PARK LOCK HOUSING
   (Containing Hydraulic Piston and Actuator Spring)

https://truckmanualshub.com/

# Section 6003



## GUIDELINES FOR SEPARATING THE SPEED AND RANGE TRANSMISSIONS

## XTX185, 200 and 215 Tractors

McCORMICK

SM 8-15190

© 2006 McCormick Tractors International Limited.
September 2006

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIFICATIONS .....3

SPECIAL TORQUES .....3

GUIDELINES FOR SEPARATING THE
SPEED AND RANGE TRANSMISSION .....4

https://truckmanualshub.com/



# SPECIFICATIONS

| | | |
|---|---|---|
| Transmission Oil | | |
| Oil Type | | McCormick HTX |
| Capacity | 95 Litres | 25.1 US gals |

# SPECIAL TORQUES

| | | |
|---|---|---|
| Speed to Range Housing Retaining Bolts | 250 to 280 Nm | 185 to 206 lb. ft |
| Filter Screen Housing Retaining Bolts (With Loctite 242) | 58 to 65 Nm | 42 to 47 lb. ft |
| Filter Screen Housing Cover Retaining Bolts | 58 to 65 Nm | 42 to 47 lb. ft |
| Cab Mounting Nuts | 190 to 244 Nm | 199 to 229 lb.ft |
| Cab Mounting Bolt to Threaded Plate | 47 to 61 Nm | 35 to 45 lb.ft |
| Fuel Tank Support Brackets | | |
| Front | | |
| Zinc Coated | 295 to 330 Nm | 217 to 243 lb.ft |
| Rear | | |
| Zinc Coated | 295 to 330 Nm | 217 to 243 lb.ft |
| Phosphate Coated | 221 to 250 Nm | 163 to 185 lb.ft |
| MFD Shaft to Front Axle Retaining Bolts (with Loctite 275) | 77 to 87 Nm | 57 to 64 lb.ft |
| Rear Wheel Nuts | | |
| Flanged Axle | | |
| Rear Wheel Nuts | 485 to 550 Nm | 357 to 405 lb ft |
| Bar Axle | | |
| Rear Wheel to Hub Bolts | 485 to 550 Nm | 357 to 405 lb ft |
| Hub to Axle Clamping Bolts | | |
| Evenly in 50 Nm (36 lb ft) | 244 to 298 Nm | 180 to 220 lb ft |
| After 30 minutes Operation | 244 to 298 Nm | 180 to 220 lb ft |

https://truckmanualshub.com/



# GUIDELINES FOR SEPARATING THE SPEED AND RANGE TRANSMISSION

> **WARNING:** *The following should only be used as a guideline when separating the speed and range transmissions. All necessary precautions should be taken to ensure the operation is carried out in a safe and proper manner. Only suitable lifting and separating equipment MUST be used.*

To separate the speed and range transmission it will be necessary to follow the guidelines below.

1. Park the tractor on hard level ground, apply the parking brake, STOP the engine and remove the key. Put blocks in front and behind the front wheels
2. Install suitable wedges between the front axle and the bolster (both sides).
3. Disconnect the battery (Negative Terminal first).
4. Remove the MFD shaft shield and remove the MFD shaft to front axle retaining bolts and remove the MFD shaft.

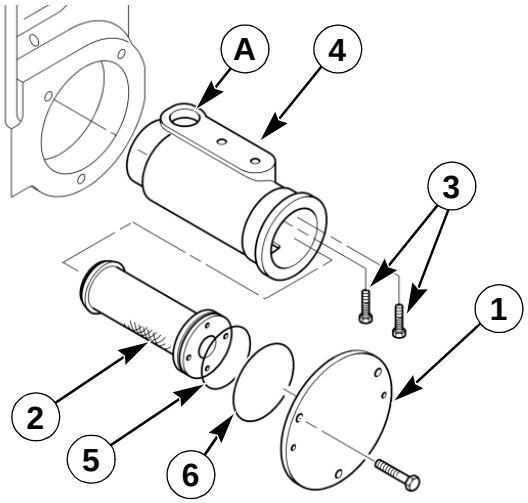
   **NOTE:** *For 50km/h tractors remove the two roll pins from the MFD shaft to transmission MFD output shaft coupling.*
5. Raise the rear of the tractor using suitable lifting equipment, remove the rear wheels and support the rear axles on suitable axle stands.
6. For tractors equipped with cab suspension, fully lower the cab, refer to Section 10011.
7. Remove the cab using suitable cab lifting equipment.
8. Drain the fuel tank into a suitable container (fuel tank capacity when full is 347 litres/91.7 U.S Gal).
9. Remove the trailer hitch assembly (if equipped).
10. Remove the three point hitch top and bottom linkages.
11. Drain the transmission oil into a suitable container with a capacity of at least 115 Litres (30.5 US. Gal). When the oil has drained install and tighten all drain plugs.
12. Disconnect and cap all necessary tubes and hoses.
13. Put identification marks on electrical connectors and disconnect as necessary.
14. Attach suitable tractor splitting stands to the speed and range transmissions. Support the tractor on the splitting stands and remove the axle stands from the rear axles.

    **IMPORTANT:** *When separating the transmission from the engine, suitable splitting equipment MUST be used. It is recommended MC30009A (splitting Stand), MC30010 (Adapter Set) and MC30029 (Adapter Set) be used.*

https://truckmanualshub.com/

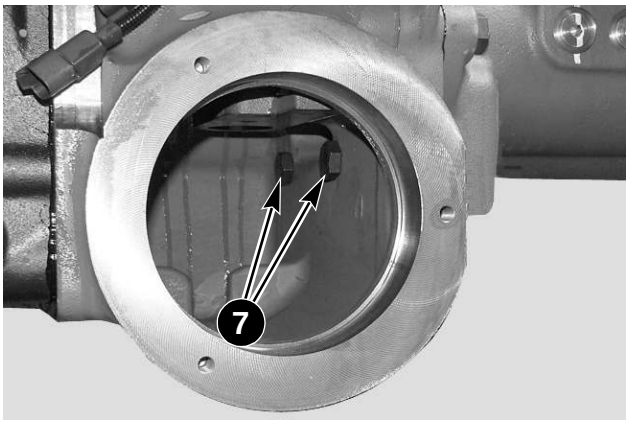


15. Remove the retaining bolts and remove the filter screen cover (1), filter screen (2), filter screen housing retaining bolts (3) and filter screen housing (4) to gain access to the speed to range transmission lower mounting bolts.




MI06B068

16. Remove the two internal speed to range transmission lower mounting bolts (7) and one left hand and one right hand outer mounting bolt. Install two 16 mm alignment studs MC1995A into the outer mounting bolt locations.




MD06G051

17. Remove the remaining outer mounting bolts.

18. Install and evenly tighten two jacking bolts into the left and right hand jacking bolt locations. DO NOT USE excessive force on the bolts, if the transmission fails to separate check all mounting bolts have been removed.

19. Carefully separate the speed and range transmission.

20. Clean the mounting faces of the transmission housings.

https://truckmanualshub.com/



## Speed/Range Transmission Connection.

**NOTE:** *When connecting the speed and range transmissions note the following.*

- *Make sure the sealing rings and locating dowels are installed.*
- *Apply a continuous bead of Loctite 515 to the range transmission mounting face.*
- *Make sure the MFD clutch and the Forward/Reverse Shuttle shaft drive coupling are installed.*
- *For tractors equipped with creeper make sure the creeper collar is installed onto the Forward/Reverse Shuttle shaft.*
- *Position the speed transmission onto the alignment studs until the transmissions are approximately 75 mm (3.0 inch) apart. Make sure the PTO drive shaft coupler/load sensing wheel is installed and aligned with the speed transmission PTO drive shaft.*
- *Turn the MFD output shaft, shuttle shaft and PTO drive shaft coupler/load sensing wheel to align the drive couplings and charge pump gerotor while connecting the transmissions.*
- *Tighten all nuts and bolts to the correct torque, refer to “SPECIAL TORQUES” on page 3.*
- *Install and lubricate new o-rings before connecting hoses and tube.*
- *Apply Loctite 515 to the area around the filter screen housing (4) outlet port (A). Install new o-rings (5) and (6) to the filter screen (2) and cover (1), refer to Page 5.*
- *Install the MFD drive shaft and tighten MFD drive shaft to front axle the retaining bolts (with Loctite 275) to the correct torque, refer to “SPECIAL TORQUES” on page 3.*
- *For 50km/h tractors install two new roll pins into the MFD shaft to transmission MFD output shaft coupling.*
- *Fill the transmission to the correct level with clean McCormick HTX transmission oil.*
- *Adjust linkages and cables, refer to Section 9001.*
- *Remove the air from the braking system, refer to Section 9001.*
- *For cab suspension tractors, remove the air from the cab suspension cylinders and calibrate the cab suspension, refer to Section 10011.*

https://truckmanualshub.com/

# Section 6006

## POWERSHIFT TRANSMISSION SERVICING

## XTX Series Tractors



McCORMICK

SM 8-15031

© 2006 McCormick Tractors International Limited.
September 2006

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIFICATIONS ..... 3

SPECIAL TORQUES ..... 3

SPECIAL TOOLS ..... 4

TRANSMISSION FRONT COVER
- Removal and Installation ..... 5
- Front Cover Oil Seal ..... 6

INPUT SHAFT AND DROPSHAFT
- Removal ..... 7
- Installation ..... 10

INPUT SHAFT
- Disassembly ..... 16
- Assembly ..... 20
- Cross Sectional Drawing of the Input Shaft ..... 27

DROPSHAFT
- Disassembly ..... 28
- Assembly ..... 32
- Cross Sectional Drawing of the Dropshaft ..... 39

Cross Sectional Drawing of the Powershift Transmission ..... 40

HIGH AND LOW SPEED CLUTCH SHAFTS
- Removal ..... 41
- Installation ..... 43

LOW SPEED CLUTCH SHAFT ..... 48
- Disassembly ..... 48
- Assembly ..... 50
- Cross Sectional Drawing of the Low Speed Clutch Shaft ..... 53

HIGH SPEED CLUTCH SHAFT ..... 54
- Disassembly ..... 54
- Assembly ..... 56
- Cross Sectional Drawing of the High Speed Clutch Shaft ..... 59

Cross Sectional Drawing of the High and Low Speed Transmission ..... 60

https://truckmanualshub.com/



# SPECIFICATIONS

| | | |
|---|---|---|
| Transmission Oil | McCormick HTX | |
| Friction Plate Thickness | 2.45 to 2.60 mm | 0.096 to 0.102 inch |
| Separator Plate Thickness | 2.16 to 2.31 mm | 0.085 to 0.091 inch |
| Backing Plate Thickness | 5.58 to 5.71 mm | 0.22 to 0.23 inch |
| Total Thickness | 10.8 to 11.05 mm | 0.425 to 0.435 inch |
| Number of Plates | | |
| 1st Clutch Pack (Input Shaft) | 5 Friction | 5 Separator |
| 3rd Clutch Pack (Input Shaft) See Note | 5 Friction | 5 Separator |
| 2nd Clutch Pack (Dropshaft) | 7 Friction | 7 Separator |
| 4th Clutch Pack (Dropshaft) | 6 Friction | 7 Separator |
| High Clutch pack | 8 Friction | 8 Separator |
| Low clutch pack | 8 Friction | 8 Separator |

**NOTE:** *The 3rd clutch pack friction plates are different and must not be installed into the 1st, 2nd or 4th clutch packs.*

| | | |
|---|---|---|
| Input Shaft End Play | 0.03 to 0.13 mm | 0.001 to 0.005 inch |
| Dropshaft End Play | 0.03 to 0.13 mm | 0.001 to 0.005 inch |
| High Clutch Shaft End Play | 0.03 to 0.13 mm | 0.001 to 0.005 inch |
| Low Clutch Shaft End Play | 0.03 to 0.13 mm | 0.001 to 0.005 inch |

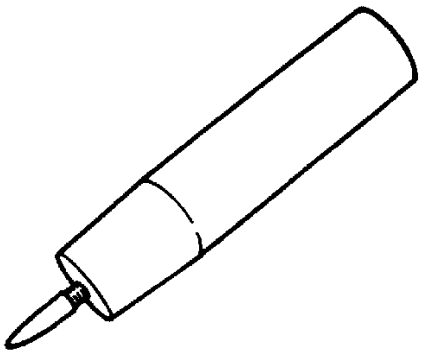
# SPECIAL TORQUES

| | | |
|---|---|---|
| Battery Box Retaining Nut and Bolts | 221 to 250 Nm | 163 to 184 lb ft |
| Front Fuel Tank Bracket Retaining Bolts | 285 to 320 Nm | 210 to 235 lb ft |
| Transmission Front Cover Retaining Bolts | | |
| 16 mm Retaining Bolts | 251 to 280 Nm | 185 to 206 lb ft |
| 12 mm Retaining Bolts | 101 to 113 Nm | 75 to 83 lb ft |
| Front and Rear Bearing Carrier Retaining Bolts | 101 to 113 Nm | 75 to 83 lb ft |
| Oil Distributor Retaining Bolts | 58 to 65 Nm | 43 to 48 lb ft |
| Drive Gear Retaining Bolt with Loctite 638 (680) | 101 to 113 Nm | 75 to 83 lb ft |

https://truckmanualshub.com/



# SPECIAL TOOLS



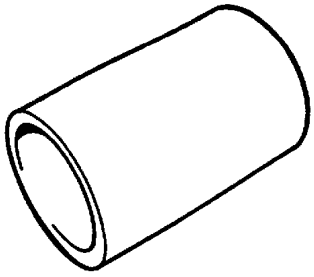
DS98B481

**DROPSHAFT SEAL EXPANDER/PROTECTOR, MC1999A**

**INPUT SHAFT SEAL EXPANDER/PROTECTOR, MC2316**

**LOW SPEED CLUTCH SHAFT SEAL EXPANDER/PROTECTOR, MC1999A**

**HIGH SPEED CLUTCH SHAFT SEAL EXPANDER/ PROTECTOR, 1034T1**



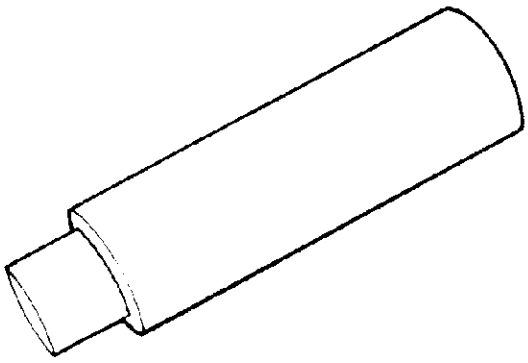
DS98B482

**DROPSHAFT SEAL COMPRESSOR, MC2005-1**

**INPUT SHAFT SEAL COMPRESSOR, MC2317**

**LOW SPEED CLUTCH SHAFT COMPRESSOR, MC2005-1**

**HIGH SPEED CLUTCH SHAFT COMPRESSOR, 1035T1**



DS98B484

**HANDLE ASSEMBLY, MC1924 (to be used with MC2527A)**

**ALIGNMENT STUD SET, MC1995A**

**SPRING COMPRESSOR, MC1992**

**IMPORTANT:** *When separating the transmission from the engine, suitable splitting equipment MUST be used. It is recommended MC30009A (splitting Stand), MC30010 (Adapter Set) and MC30029 (Adapter Set) be used.*

https://truckmanualshub.com/



# TRANSMISSION FRONT COVER

## Removal and Installation

**NOTE:** *Items are numbered in order of Removal. For Installation, follow the Removal procedure in reverse order.*

Some of the photographs and illustrations may not show your transmission but the procedure is the same.

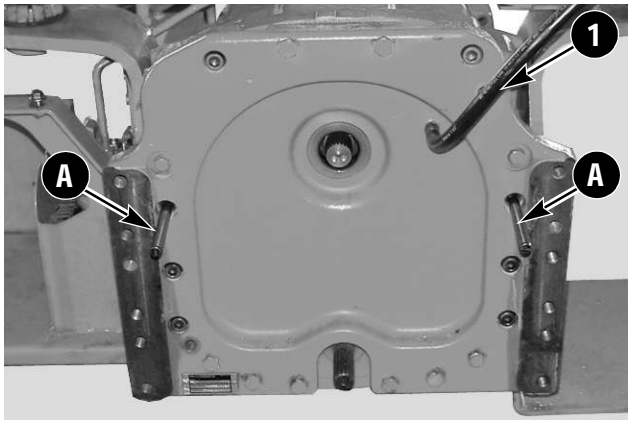
Before removing the Transmission Front Cover and servicing the Input and Drop Shafts it will be necessary to carry out the following:

- Park the tractor on hard level ground and apply the parking brake.
- Lower the rear Three Point Hitch and Front Hitch (if equipped).
- Stop the engine and remove the key.
- Put blocks in front of and behind the rear wheels.
- Disconnect the battery, Negative (-) terminal first.
- Remove batteries from tractor.
- Put suitable containers under the transmission drain plugs and drain the transmission.
- Separate the tractor between the Engine and Speed transmission, using suitable splitting equipment.

**NOTE:** *After Installation fill the transmission with clean McCormick HTX to the correct level. Connect the battery (+) terminal first.*

**IMPORTANT:** *It is not necessary to remove the front cover to install a new front cover oil seal, refer to Page 6.*

### STEP 1



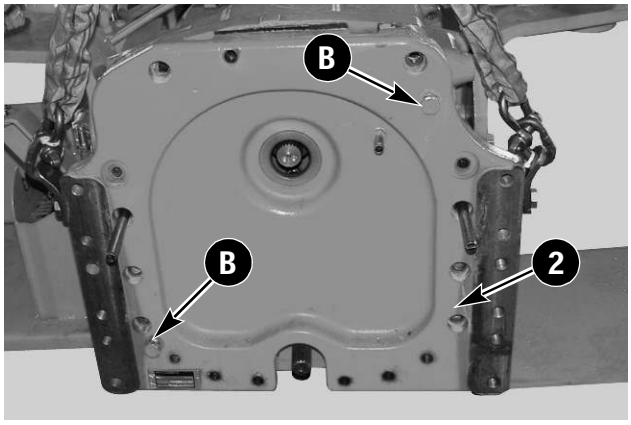

MK06K100

Remove hose clamp (1) and disconnect the brake return hose. Remove two 16 mm front cover retaining bolts and install two 16 mm alignment studs (A) MC1995A as shown.

**NOTE:** *The cab and fuel tank have been removed for photographic purposes only.*

**NOTE:** *For Installation, remove the alignment studs and install and tighten retaining bolts to a torque of 280 Nm (206 lb ft).*

### STEP 2




MD06K101

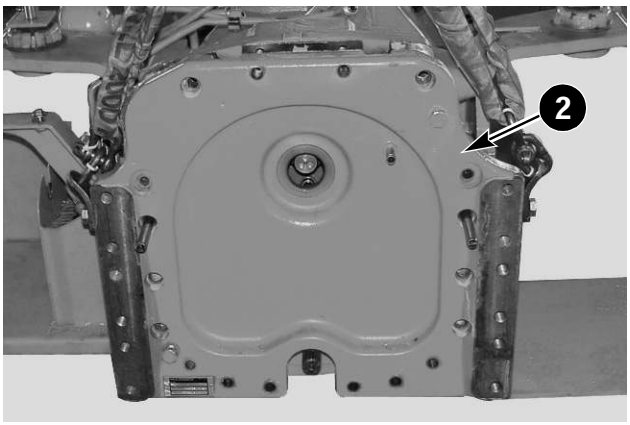
Remove the remaining 16 mm retaining bolts and two 12 mm retaining bolts. Install two 16 mm jacking bolts (A) as shown. Tighten the jacking bolts until the seal between the front cover (2) and the transmission is broken.

**NOTE:** *For Installation, install the retaining bolts. Tighten the bolts to the following torques:*
*16 mm Hexagon Head Bolts..280 Nm (206 lb ft)*
*16 mm Socket Head Bolts.....280 Nm (206 lb ft)*
*12 mm Hexagon Head Bolts...113 Nm (85 lb ft).*

https://truckmanualshub.com/



### STEP 3



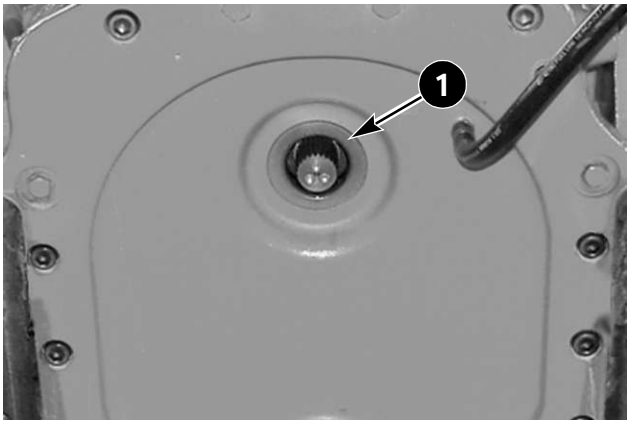

MD06K102

Carefully pull the front cover (2) forward along the alignment studs until suitable lifting equipment can be attached to front cover. Using the lifting equipment remove the front cover.

**NOTE:** *For Installation, clean the transmission front cover and transmission front cover mounting faces. Apply a continuous bead of Loctite 515 to the transmission front cover mounting face.*

## Front Cover Oil Seal

### STEP 1



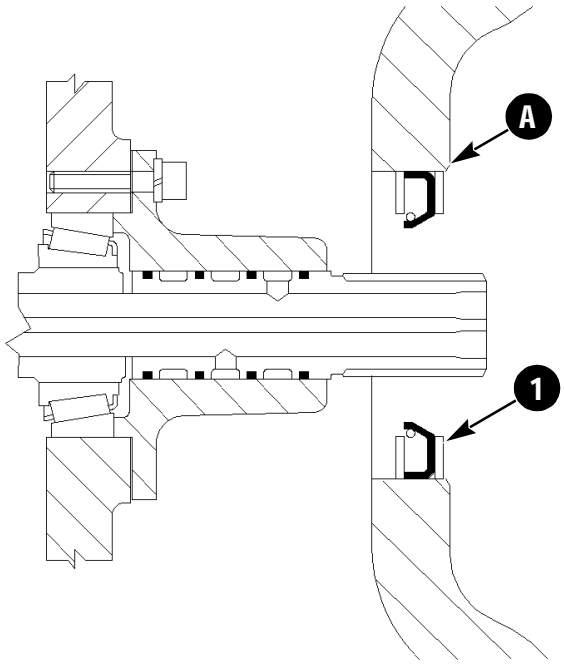

MD06K103

Remove the front cover oil seal (1).

### STEP 2



DD97A128




MI06K105

Use a suitable seal installer and install a new front cover oil seal (1). Make sure the seal is installed level with the transmission cover front face (A) as shown.

https://truckmanualshub.com/



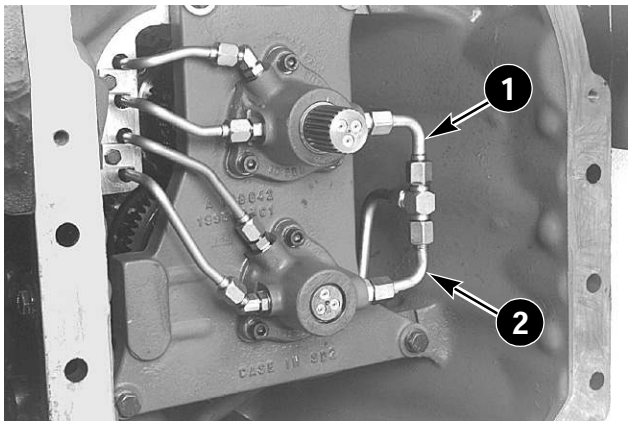
# INPUT SHAFT AND DROPSHAFT

## Removal

### STEP 1

Remove the transmission front cover, refer to Page 5.

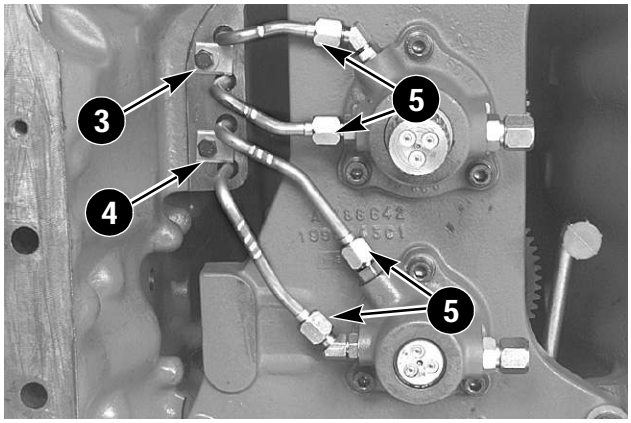
### STEP 2




DD96A023

Remove and cap lubrication tubes (1) and (2).

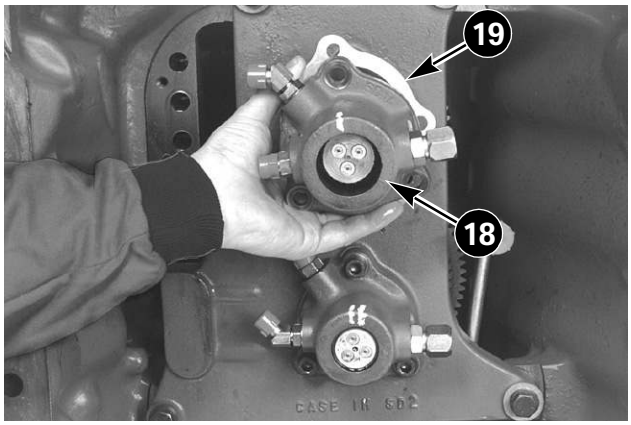
### STEP 3




DD96A024

Remove the feed tube retaining plate bolts and remove retaining plates (3) and (4). Put identification marks on the feed tubes (5), remove and cap tubes (5). Remove and discard the o-rings from the feed tubes.

### STEP 4

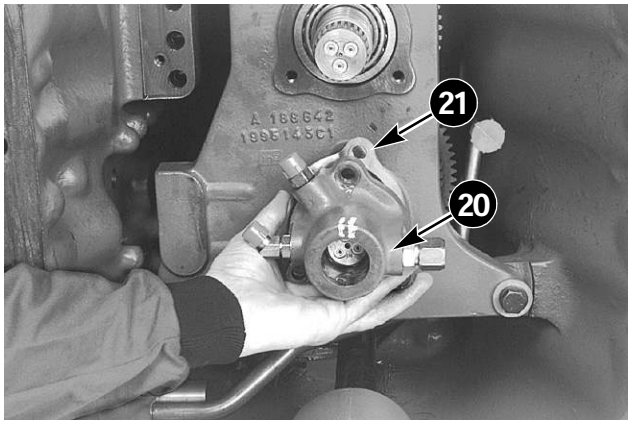



DD96A026

Put identification marks on the input shaft and drop shaft oil distributors. Remove the input shaft oil distributor retaining bolts and spring washers (if equipped). Remove the oil distributor (18) and shims (19).

**NOTE:** *Keep the shims (19) together for assembly.*

### STEP 5



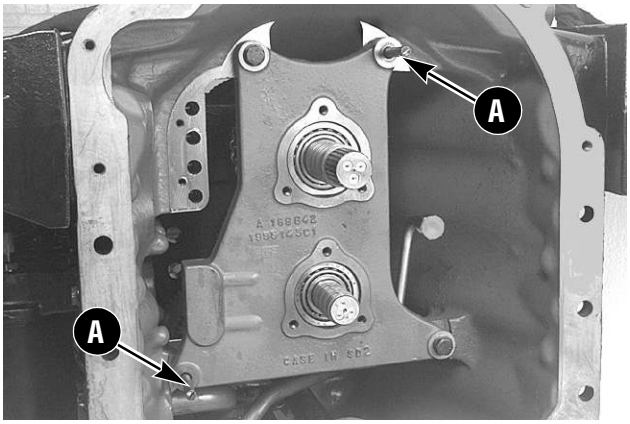

DD96A027

Remove the dropshaft oil distributor retaining bolts and spring washers (if equipped). Remove the oil distributor (20) and shims (21).

https://truckmanualshub.com/



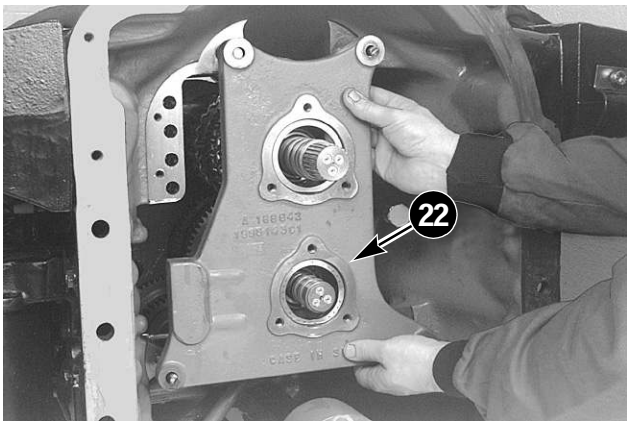
## STEP 6




DP96M042

Remove two front bearing carrier plate retaining bolts and washers. Install two alignment studs MC1995A (A), as shown.

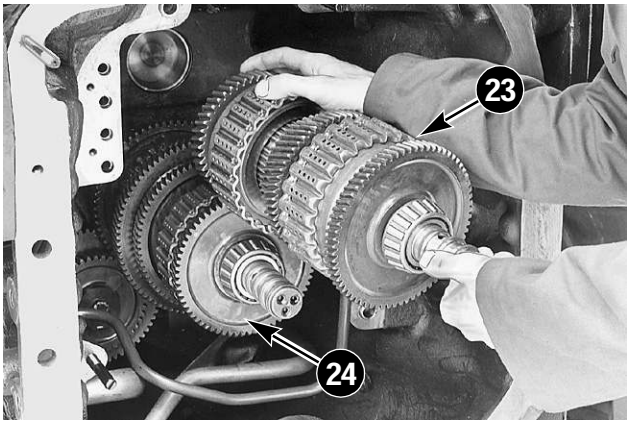
## STEP 7




DD96A029

Remove the two remaining bearing carrier retaining bolts and washers and remove the bearing carrier (22).

## STEP 8

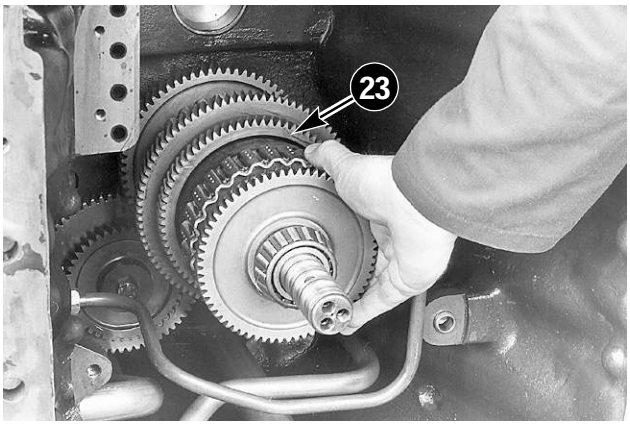



DP96A044

Support the dropshaft assembly (24) and carefully remove the input shaft assembly (23).

**NOTE:** *It will be necessary to pull the dropshaft assembly (24) forward a maximum of 5mm to allow the input shaft to be removed. DO NOT remove the dropshaft from the rear bearing cup.*

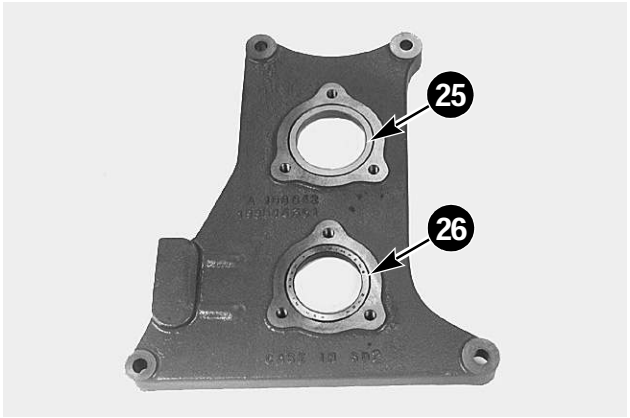
## STEP 9




DP96A045

Remove the dropshaft assembly (23).

## STEP 10



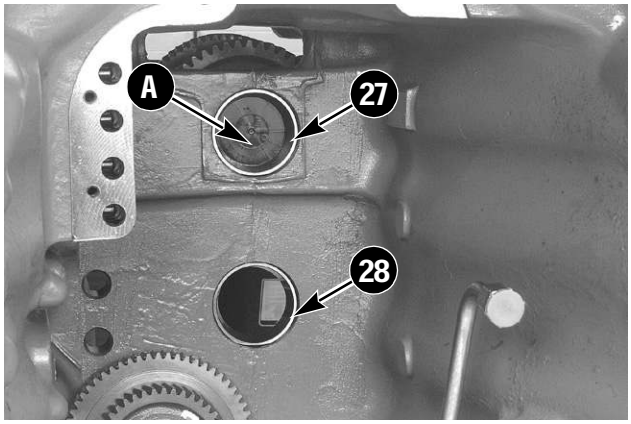

DD96A071

Use a suitable bearing driver and remove the input shaft bearing cup (25) and dropshaft bearing cup (26).

https://truckmanualshub.com/



**STEP 11**




DD96A035

Use a suitable puller and impact hammer to remove the input shaft rear bearing cup (27) and dropshaft rear bearing cup (28) from the transmission housing.

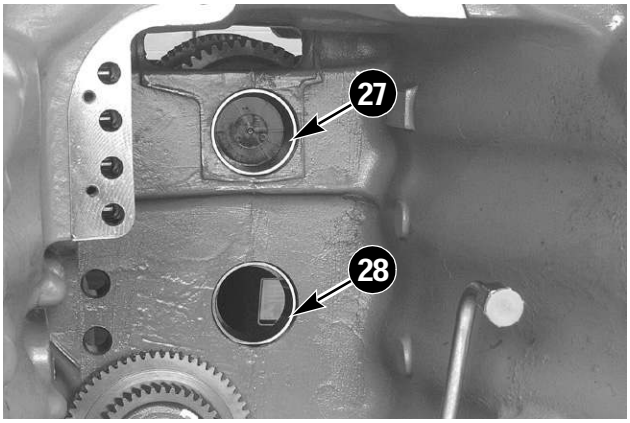
**IMPORTANT:** *Care must be taken not to damage the plastic lubrication disc (A).*

https://truckmanualshub.com/



## Installation

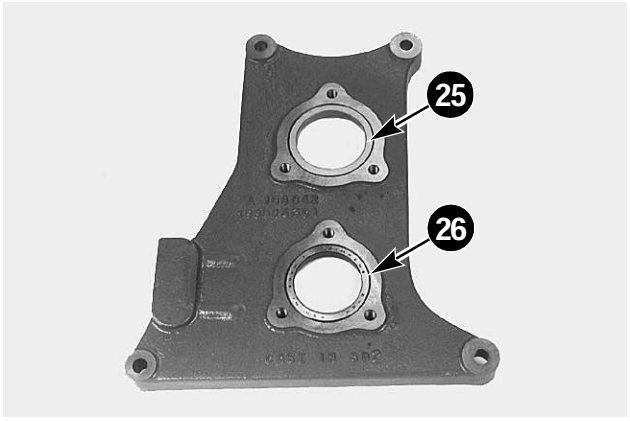
### STEP 12




DD96A035

Use a suitable bearing driver to install the dropshaft rear bearing cup (28) and input shaft rear bearing cup (27). Make sure the bearing cups are fully installed and are against the snap rings in the transmission housing.

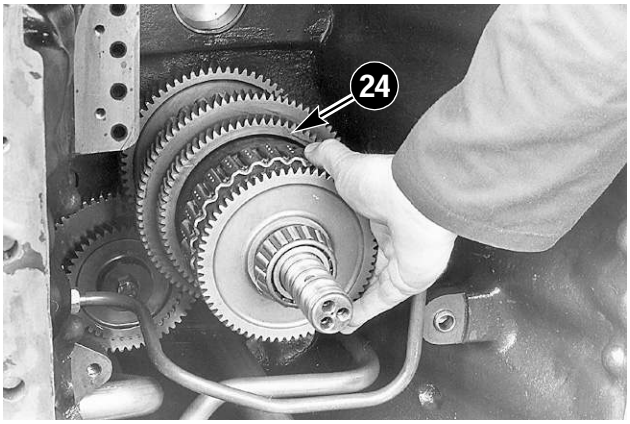
### STEP 13




DD96A071

Use a suitable bearing driver and install the dropshaft bearing cup (26) and input shaft bearing cup (25) into the bearing carrier housing. Make sure the bearing cups are level with the outer face of the bearing carrier.

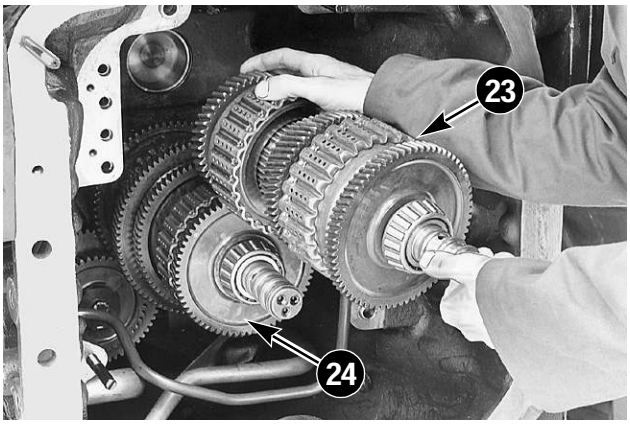
### STEP 14




DP96A045

Carefully install the dropshaft (24).

### STEP 15




DP96A044

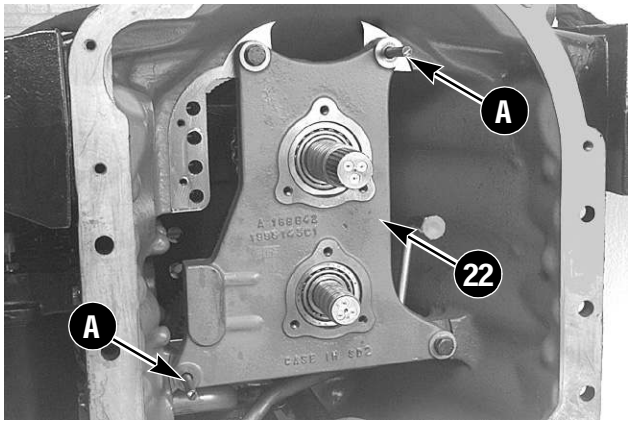
Support the dropshaft (24) and install the input shaft (23).

**NOTE:** *It will be necessary to pull the dropshaft assembly (24) forward a maximum of 5mm to allow the input shaft to be installed. DO NOT remove the dropshaft from the rear bearing cup.*

https://truckmanualshub.com/



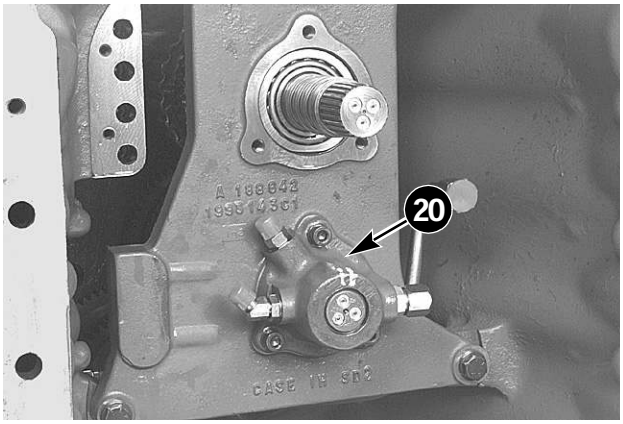
## STEP 16




DD96A028

Install the bearing carrier (22) and install two retaining bolts with washers. Remove the alignment studs (A) and install the remaining two retaining bolts with washers. Tighten the retaining bolts to 101 to 113 Nm (75 to 83 lb ft).

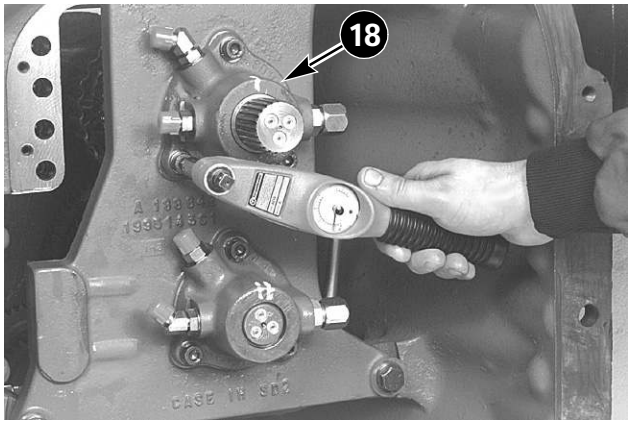
## STEP 17




DD96A030

Install the dropshaft oil distributor (20), without shims. Install the retaining bolts and washers. DO NOT tighten the bolts at this stage.

## STEP 18



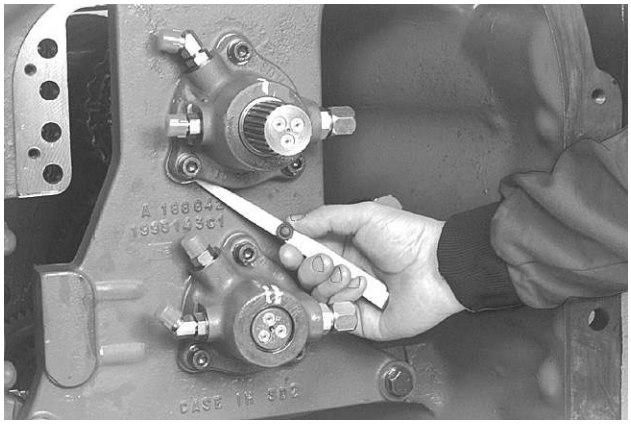

DD96A031

Install the input shaft oil distributor (18), without shims. Install and tighten the retaining bolts to a torque of 9 Nm (80 lb in). Rotate the input shaft and continue to tighten the retaining bolts until the torque remains constant at 9 Nm (80 lb in).

## STEP 19

Loosen the input shaft oil distributor retaining bolts, then tighten the retaining bolts to a torque of 2.8 Nm (25 lb in). Rotate the input shaft and continue to tighten the retaining bolts until the torque remains constant at 2.8 Nm (25 lb in).

## STEP 20



DD96A032

Using feeler gauges measure and make a note of the gap between the input shaft oil distributor and the front bearing carrier next to the three retaining bolts. If the difference between the three measurements is less than 0.05 mm (0.002 inch), use the average of the measurements to calculate the required shim pack, refer to STEP 21.

**NOTE:** *If the difference between the three measurements is more than 0.05 mm (0.002 inch), remove the oil distributor and check the input shaft bearing and cup for the correct seating.*

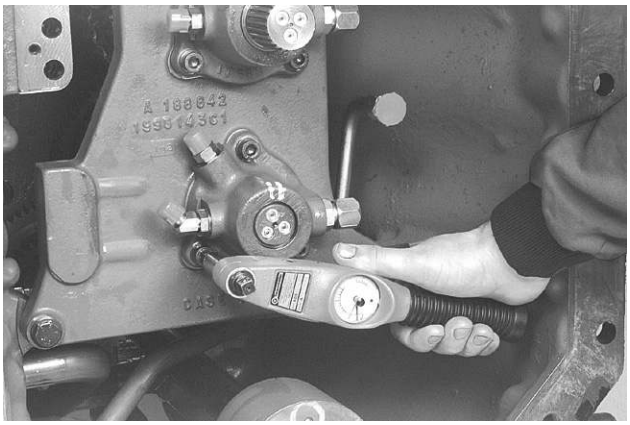
https://truckmanualshub.com/



## STEP 21

Add 0.36 mm (0.014 inch) to the average measurement noted in STEP 20 to determine the correct shim pack thickness (19). Make a note of the required shim pack thickness. Loosen the oil distributor retaining bolts.

## STEP 22



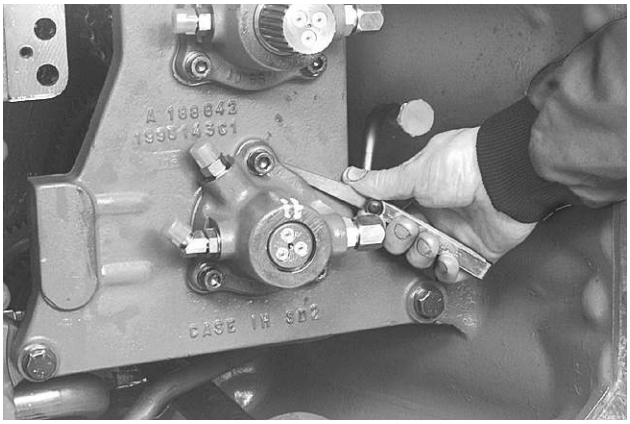
DD96A033

Tighten dropshaft oil distributor retaining bolts to a torque of 9 Nm (80 lb in). Rotate the input shaft and continue to tighten the retaining bolts until the torque remains constant at 9 Nm (80 lb in).

## STEP 23

Loosen the input shaft oil distributor retaining bolts, then tighten the retaining bolts to a torque of 2.8 Nm (25 lb in). Rotate the input shaft and continue to tighten the retaining bolts until the torque remains constant at 2.8 Nm (25 lb in).

## STEP 24



DD96A034

Using feeler gauges measure and make a note of the gap between the dropshaft oil distributor and the front bearing carrier next to the three retaining bolts. If the difference between the measurements is less than 0.05 mm (0.002 inch), use the average of the three measurements to calculate the required shim pack (21), refer to STEP 25.

**NOTE:** *If the difference between the three measurements is more than 0.05 mm (0.002 inch), remove the oil distributor and check the dropshaft bearing and cup for the correct seating.*

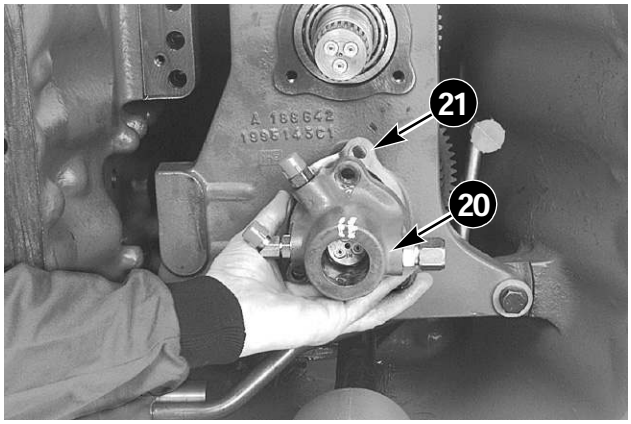
## STEP 25

Add 0.28 mm (0.011 inch) to the average measurement noted in STEP 24 to determine the correct shim pack thickness (21). Make a note of the required shim pack thickness.

https://truckmanualshub.com/



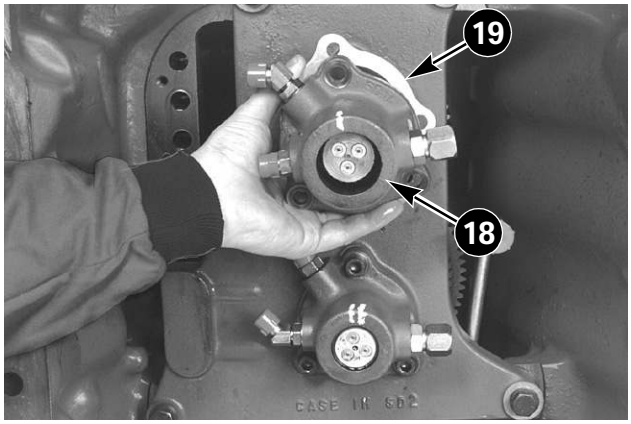
## STEP 26




DD96A027

Remove dropshaft oil distributor retaining bolts and oil distributor (20). Install the shims (21) (determined in STEP 25) and oil distributor (20). Install and tighten the retaining socket head cap screws with spring washers to the torque of 58 to 65 Nm (43 to 48 lb ft).
Rotate the dropshaft and check the retaining bolt torque.

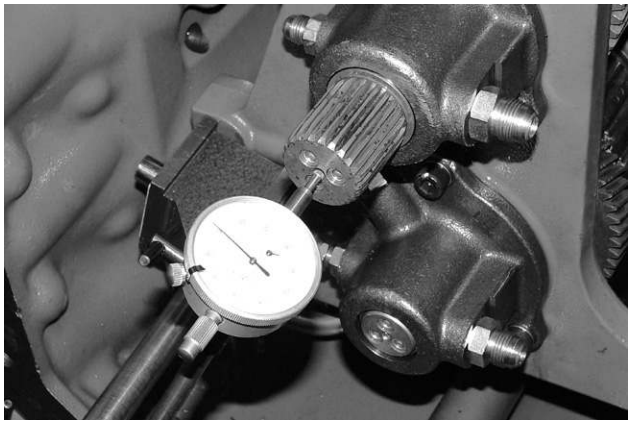
## STEP 27




DD96A026

Remove input shaft oil distributor retaining bolts and oil distributor (18). Install the shims (19) (determined in STEP 21), and oil distributor (18). Install and tighten the retaining socket head cap screws with spring washers to the torque of 58 to 65 Nm (43 to 48 lb ft).
Rotate the dropshaft and check the retaining bolt torque.

## STEP 28

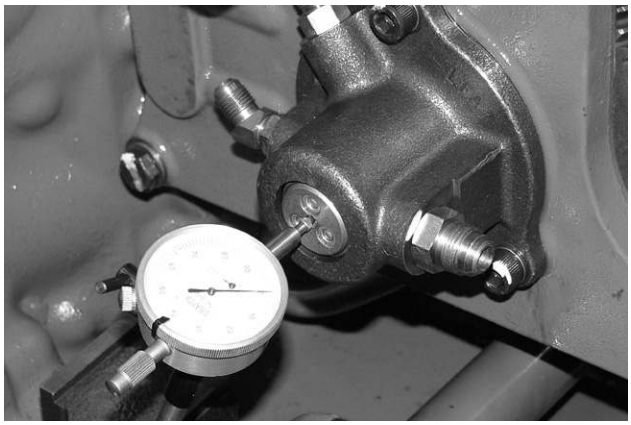


MD06K072

Use a soft faced hammer and gently drive the input shaft rearward to seat the rear bearing. Install a dial gauge onto the end of the input shaft, pull the input shaft forward and measure the end play. The end play must be 0.03 to 0.13 mm (0.001 to 0.005 inch).

*Add or remove shims until the correct end play is obtained.*

## STEP 29



MD06K073

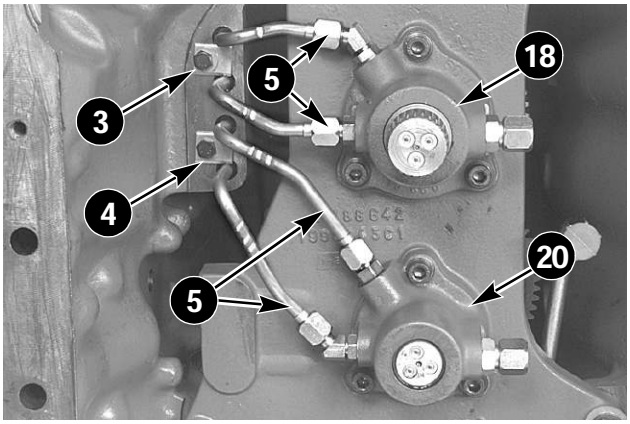
Use a soft metal drift and gently drive the drop shaft rearward to seat the rear bearing. Install a dial gauge onto the end of the drop shaft, pull the shaft forward and measure the end play. The end play must be 0.03 to 0.13 mm (0.001 to 0.005 inch).

*Add or remove shims until the correct end play is obtained.*

https://truckmanualshub.com/



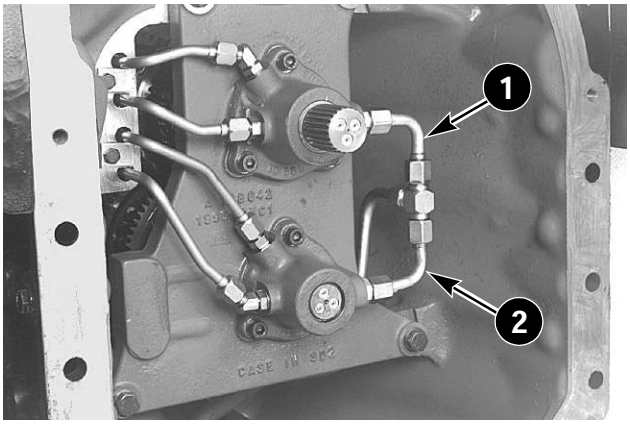
## STEP 30




DD96A023

Lubricate and install new o-rings onto the feed tubes (5) and install and tighten the tubes onto the oil distributors (18) and (20). Install the retaining plates (3) and (4) and install and tighten the retaining bolts.

## STEP 31




DD96A023

Install and tighten the lubrication tubes (1) and (2).

## STEP 32

Install the transmission front cover, refer to Page 5.

https://truckmanualshub.com/



This Page Has Been Left Blank

https://truckmanualshub.com/



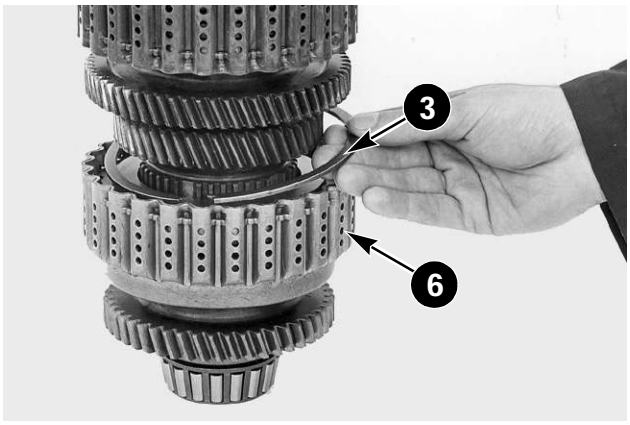
# INPUT SHAFT

## Disassembly

### STEP 1

Remove and discard the sealing rings (1). Use a suitable bearing puller and remove the bearing cone (2).

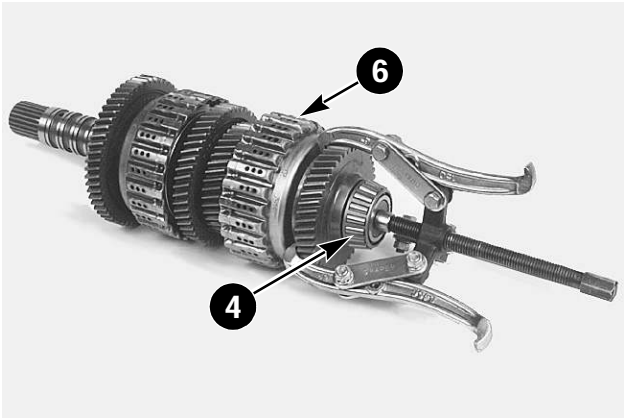
### STEP 2




DP96A043

Release the snap ring (3) from the groove in the 1st gear clutch housing (6).

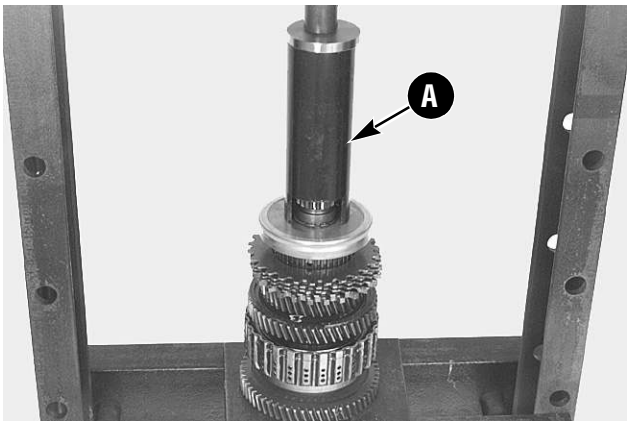
### STEP 3




DD96A079

Use a suitable puller and remove the bearing cone (4), o-ring (5) and clutch housing (6).

### STEP 4




DI96A040

Install the input shaft onto a suitable hydraulic press. Use the spring compressor MC1992 (A) to compress the piston return spring (16). Release the snap ring (7) from the groove in the input shaft. Release the pressure from the press and remove the spring compressor.

### STEP 5

Remove the snap ring (7) and piston (8). Remove and discard the piston sealing ring (9), o-ring (10), sealing ring (11) and o-ring (12).

### STEP 6

Remove the separator plates (13), friction plates (14), backing plate (15) and snap ring (3).

### STEP 7

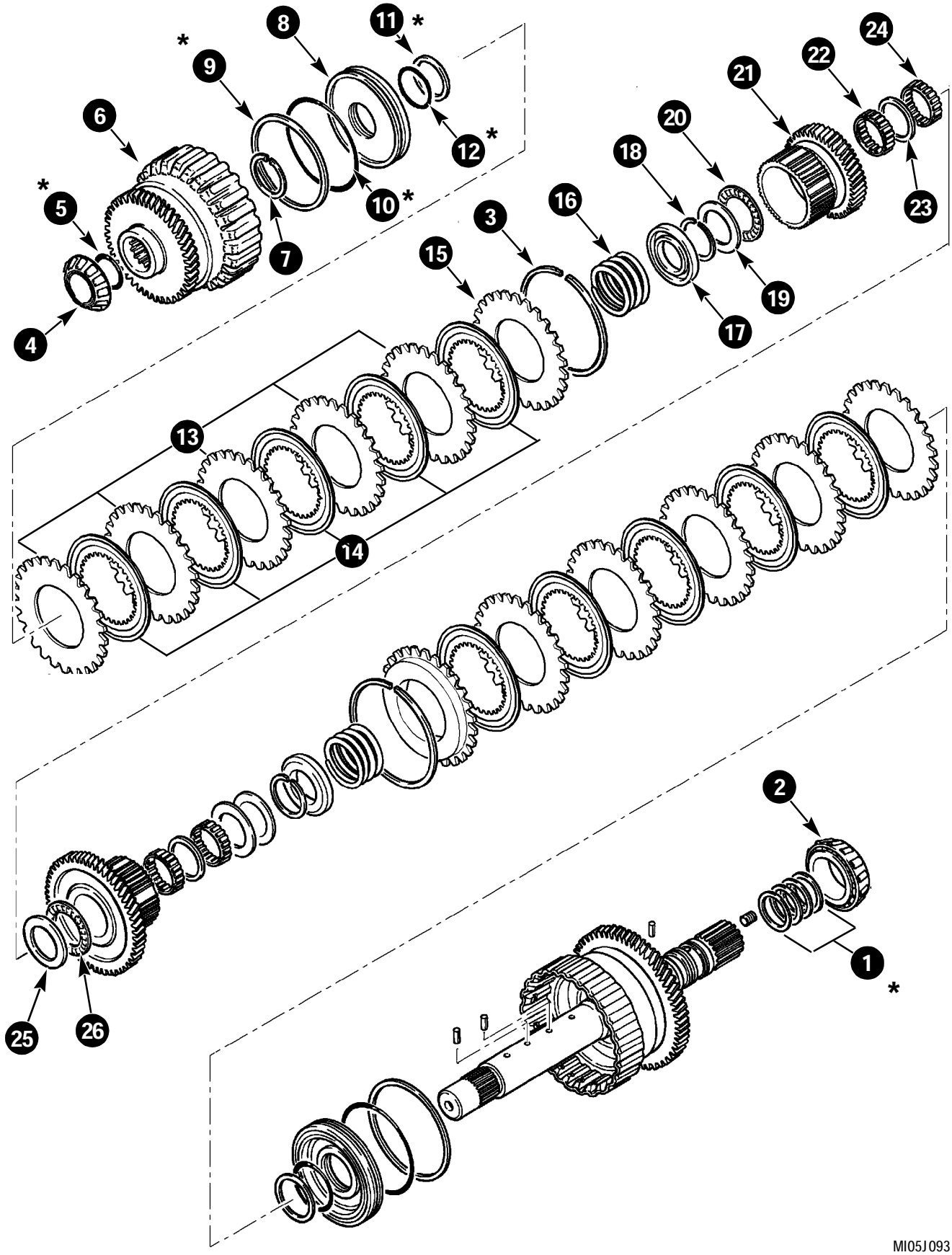
Remove the spring (16), spring retainer (17) and snap ring (18)).

### STEP 8

Remove the thrust washer (19), thrust bearing (20), 3rd gear hub (21), bearing cage (22), spacer (23) and bearing cage (24). Remove the thrust washer (25) and thrust bearing (26).

https://truckmanualshub.com/






**NOTE:** *Items are numbered in order of Disassembly, items marked* ✱ *must be replaced.*

https://truckmanualshub.com/



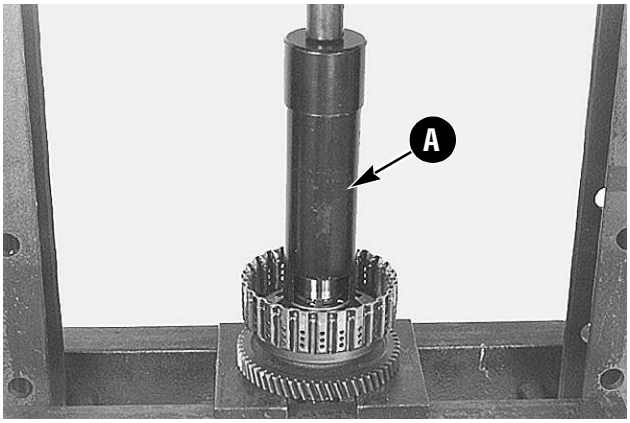
## STEP 9

Remove the 3rd gear hub (27), bearing cage (28), spacer (29) and bearing cage (30). Remove the thrust bearing (31) and thrust washer (32).

## STEP 10

Remove the snap ring (33), backing plate (34), friction plates (36) and separator plates (35).

## STEP 11




DD96A036

Install the input shaft onto a suitable hydraulic press. Use the spring compressor MC1992 (A) to compress the piston return spring (39). Release the snap ring (37) from the groove in the input shaft. Release the pressure from the press and remove the spring compressor.

## STEP 12

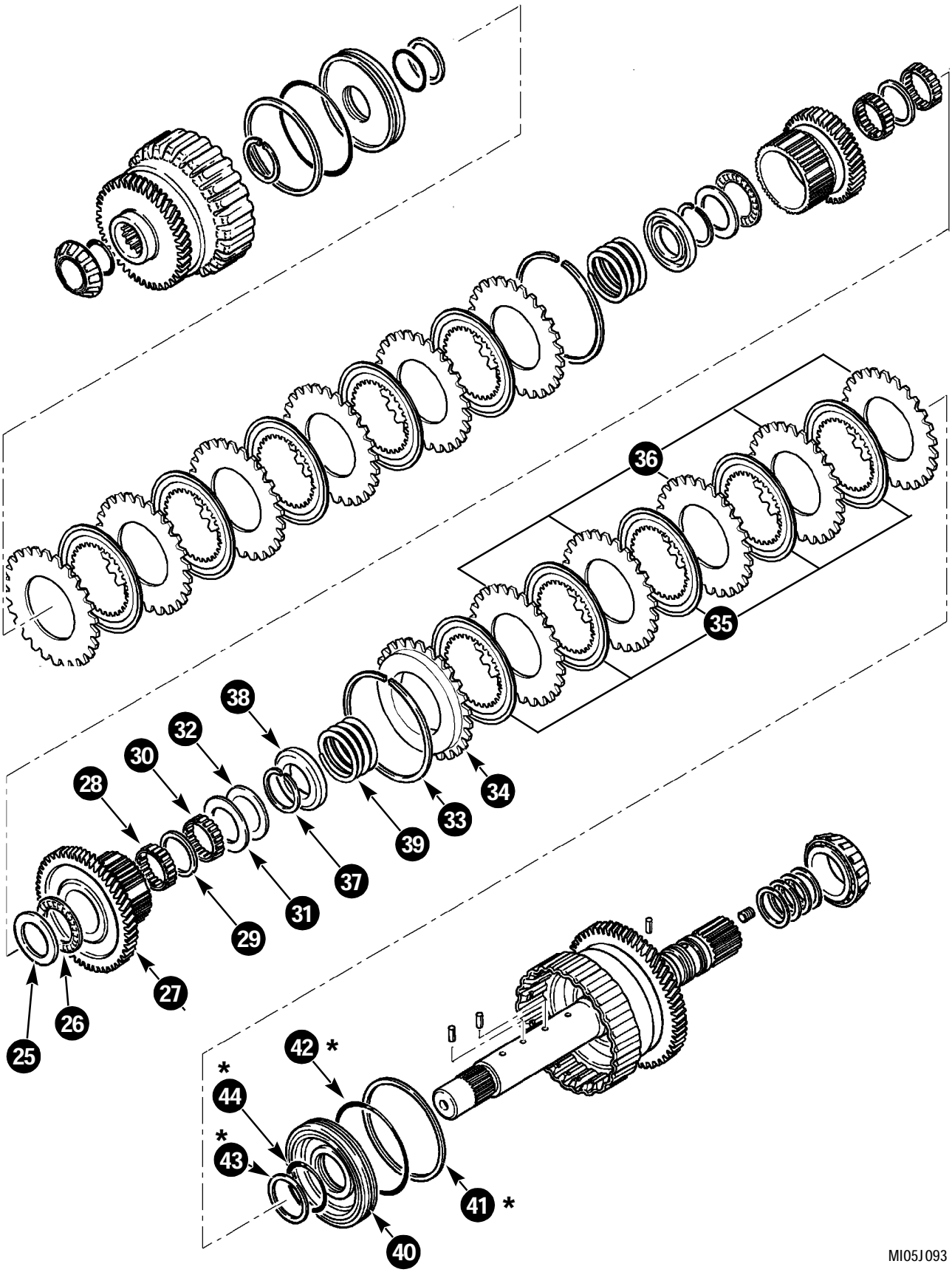
Remove the snap ring (37), spring retainer (38) and spring (39).

## STEP 13

Remove the piston (40) from the 3rd gear clutch housing. Remove and discard the piston sealing ring (41), o-ring (42), sealing ring (43) and o-ring (44).

https://truckmanualshub.com/






**NOTE:** *Items are numbered in order of Disassembly, items marked* ✱ *must be replaced.*

https://truckmanualshub.com/



## Assembly

### STEP 14

Lubricate and install a new o-ring (44) and sealing ring (43) into the inner groove of the piston (40). Lubricate and install a new o-ring (42) and sealing ring (41) into the outer groove of the piston (40).

**NOTE:** *Make sure the o-rings are installed before the sealing rings. Check the sealing rings (41) and (43) are not twisted or damaged.*

### STEP 15

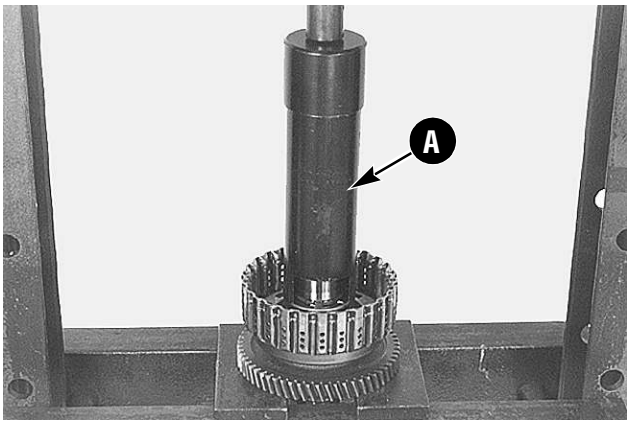
Install the piston (40) into the 3rd gear clutch housing (45). Make sure the grooved side of the piston is facing outward. Carefully push the piston into the housing using even pressure. If the piston locks up during installation, remove the piston and install again.

**IMPORTANT:** *Never use force to correct wrong alignment of the piston.*

### STEP 16

Install the piston return spring (39) and spring retainer (38). Make sure the spring (39) locates correctly into the cup side of the spring retainer (38). Install the snap ring (37) onto the input shaft.

### STEP 17




DD96A036

Install the input shaft onto a suitable hydraulic press. Use the spring compressor MC1992 (A) to compress the piston return spring (39). Install the snap ring (37) into the groove in the input shaft. Release the pressure from the press and remove the spring compressor.

### STEP 18

Install one metal separator plate (35) and one friction plate (36) into the 3rd gear clutch housing. Continue to install one metal separator plate (36) then one friction plate (36), until four metal separator plates and four friction plates have been installed. The last plate installed must be a friction plate.

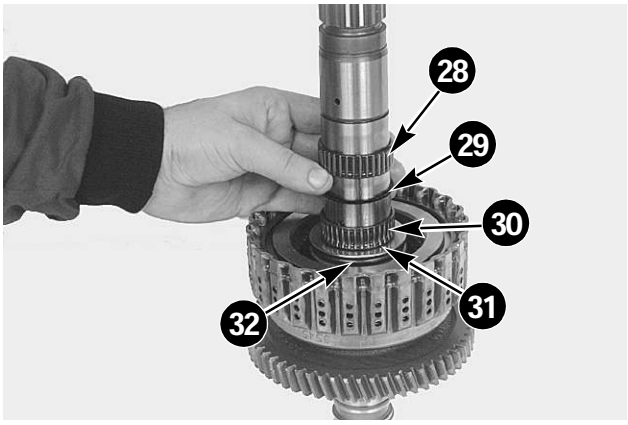
**IMPORTANT:** *The 3rd clutch pack friction plates are different to the 1st, 2nd and 4th clutch pack friction plates. When installing new 3rd clutch pack friction plates make sure the correct plates are installed.*

**IMPORTANT:** *If new friction plates are to be installed, make sure all the friction plates have the same friction material pattern and the friction plates have been soaked in clean transmission oil before installation.*

### STEP 19

Install the backing plate (34), make sure the recessed side of the backing plate is facing outward. Install the snap ring (33), make sure the snap ring is located correctly into the groove in the clutch housing.

### STEP 20




DD96A037

Install the thrust washer (32), thrust bearing (31), bearing cage (30), narrow spacer (29) and bearing cage (28) onto the input shaft.

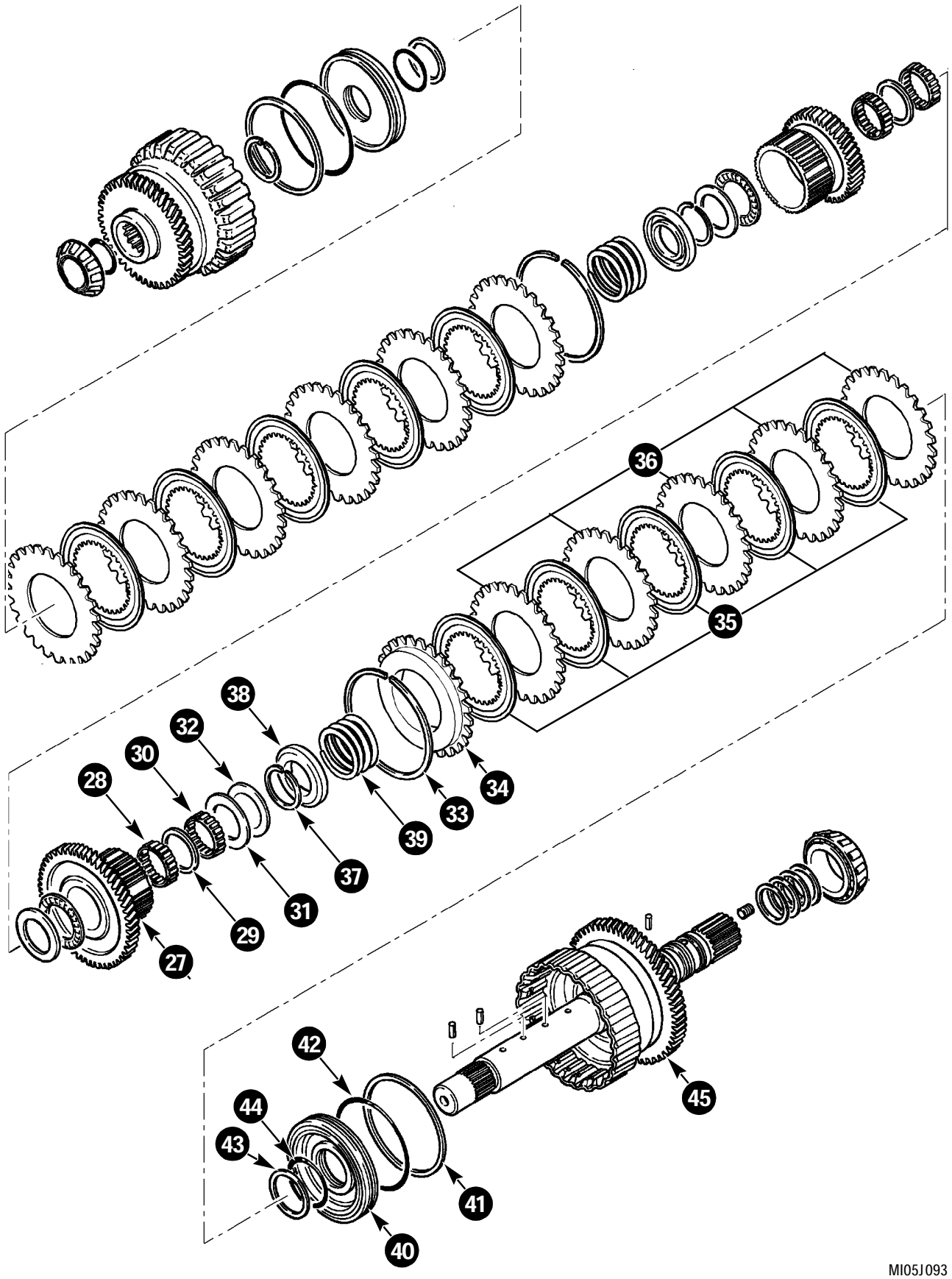
**IMPORTANT:** *Make sure the open side (needle rollers) of the thrust bearing (31) is towards the thrust washer (32).*

### STEP 21

Align the clutch pack friction plates and install the 3rd gear hub (27). Make sure all the friction plates engage onto the gear hub (27).

https://truckmanualshub.com/



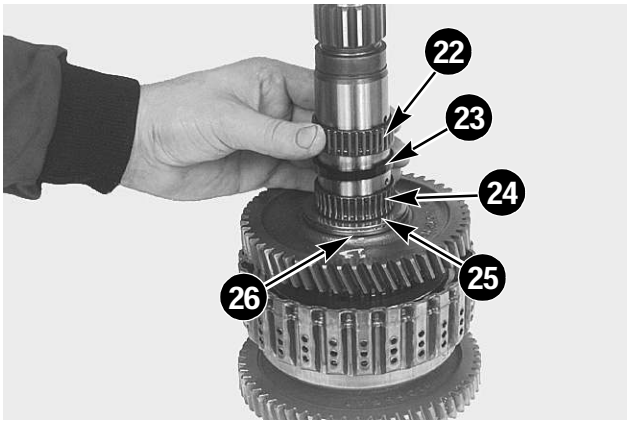



MI05J093

https://truckmanualshub.com/



## STEP 22

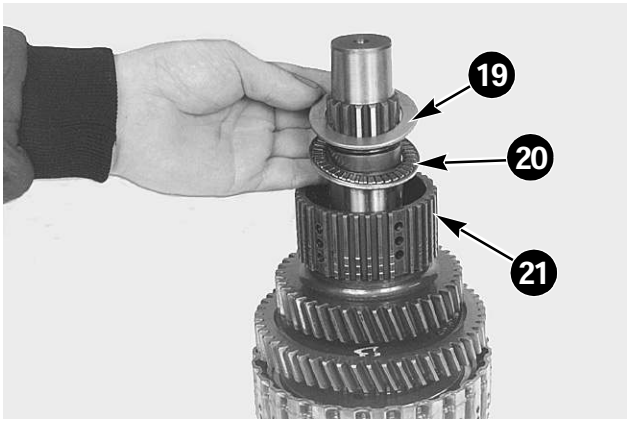



DD96A038

Install the thrust bearing (26), thrust washer (25), bearing cage (24), wide spacer (23) and bearing cage (22) onto the input shaft.

**IMPORTANT:** *Make sure the open side (needle rollers) of the thrust bearing (26) is towards the thrust washer (25).*

## STEP 23

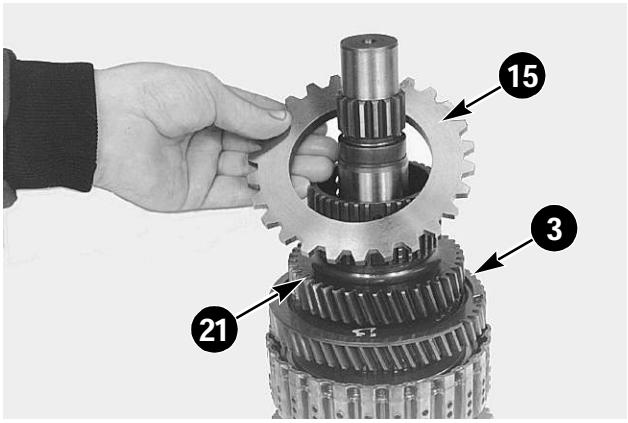



DD96A039

Install the 1st gear hub (21), thrust bearing (20) and thrust washer (19). Install the snap ring (18).

**IMPORTANT:** *Make sure the open side (needle rollers) of the thrust bearing (20) is towards the thrust washer (19) and the snap ring (18) is located correctly into the input shaft groove.*

## STEP 24




DD96A041

Install the snap ring (3) and backing plate (15) over the 1st gear hub (21).

## STEP 25

Install one friction plate (14) and a metal separator plate (13) onto the 1st gear hub (21). Continue to install one friction plate (14) then one separator plate (13), until four metal friction plates and four separator plates have been installed. The last plate installed must be a separator plate.

**IMPORTANT:** *The 3rd clutch pack friction plates are different to the 1st, 2nd and 4th clutch pack friction plates. When installing new 1st clutch pack friction plates make sure the correct plates are installed.*

**IMPORTANT:** *If new friction plates are to be installed, make sure all the friction plates have the same friction material pattern and the friction plates are soaked in clean transmission oil before installation.*

## STEP 26

Install the spring retainer (17) and spring (16). Make sure cup side of the spring retainer is facing towards the spring (16) and the spring locates correctly into the cup of the spring retainer (17).

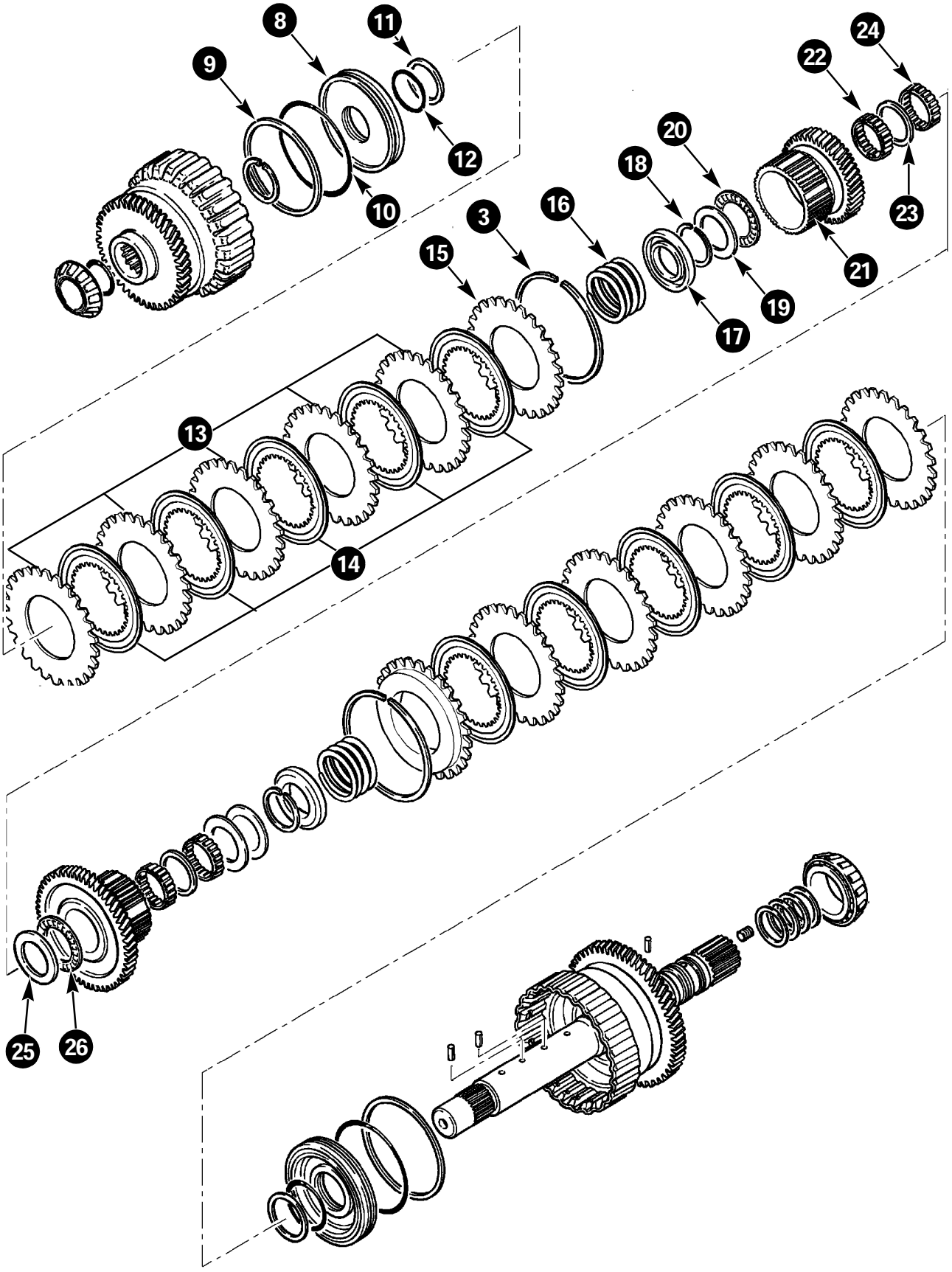
## STEP 27

Lubricate and install a new o-ring (12) and sealing ring (11) into the inner groove of the piston (8). Lubricate and install a new o-ring (10) and sealing ring (9) into the outer groove of the piston (8).

**NOTE:** *Make sure the o-rings are installed before the sealing rings.*

https://truckmanualshub.com/






MI05J093

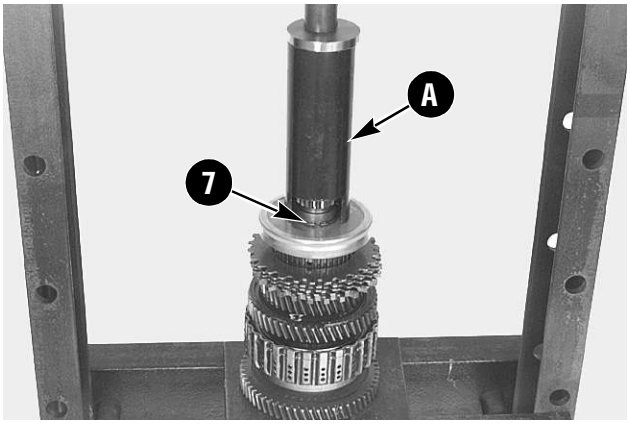
https://truckmanualshub.com/



## STEP 28

Install the piston (8) into the input shaft. Make sure the grooved side of the piston is facing down. Install the snap ring (7) onto the input shaft.

## STEP 29



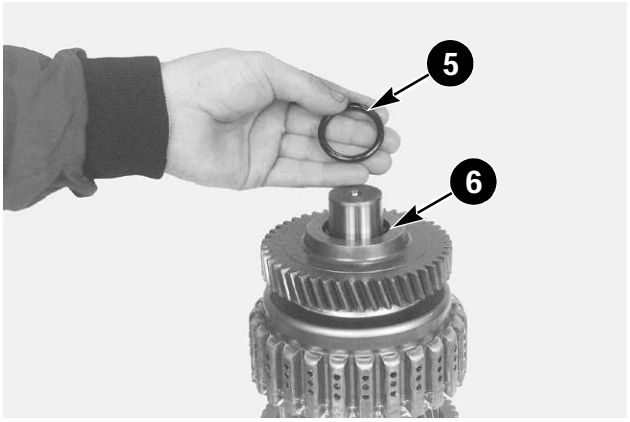

DI96A040

Install the input shaft onto a suitable hydraulic press. Use the spring compressor MC1992 (A) to compress the piston return spring (16). Install the snap ring (7) into the groove in the input shaft. Release the pressure from the press and remove the spring compressor.

## STEP 30

Align the clutch pack separator plates and install the 1st gear clutch housing (6). Make sure all the separator plates engage onto the clutch housing. Install the snap ring (3) into the groove in the clutch housing.

## STEP 31




DI96A042

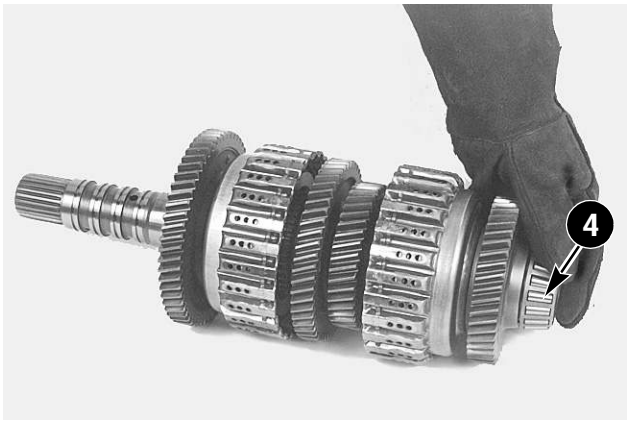
Lubricate and install a new o-ring (5) onto the input shaft.

**IMPORTANT:** *Make sure the o-ring (5) is located below the surface of the gear hub (6).*

## STEP 32

Heat the bearing cones (2) and (4) in a bearing oven to a temperature of 110°C (230°F).

## STEP 33

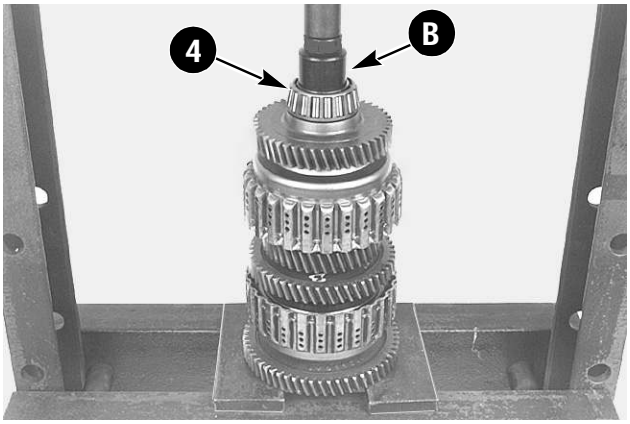



DD96A074

Install the bearing cone (4) onto the input shaft. Make sure the bearing cone is against the gear.

**WARNING:** Always wear heat protective gloves or mittens when handling heated parts.

## STEP 34



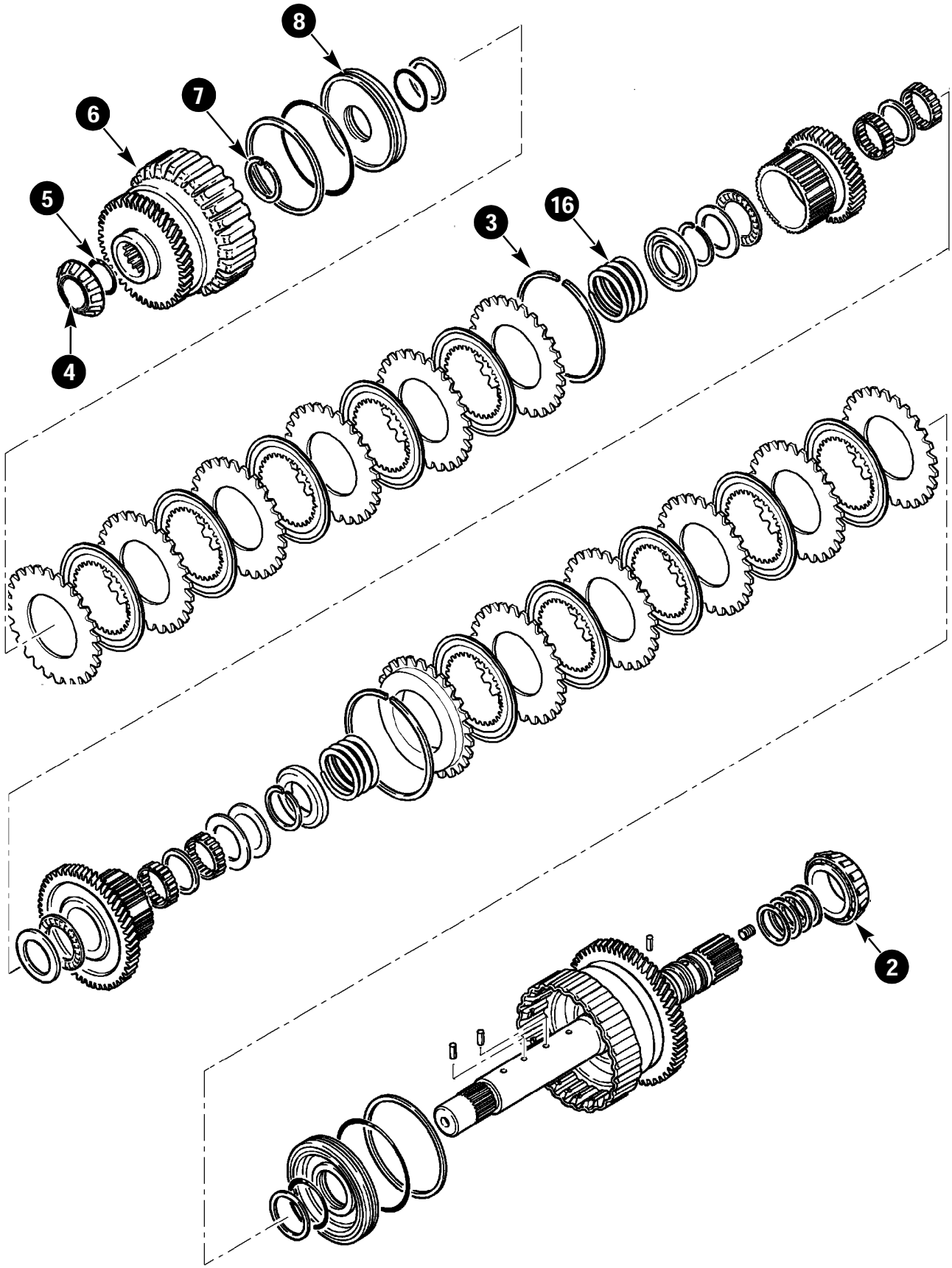

DD96A072

Use a suitable hydraulic press onto bearing cone (4) inner race and press into position.

**IMPORTANT:** *Make sure the bearing cone cage does not make contact with the press. Install a suitable spacer (B) between the press and the bearing cone inner race.*

https://truckmanualshub.com/



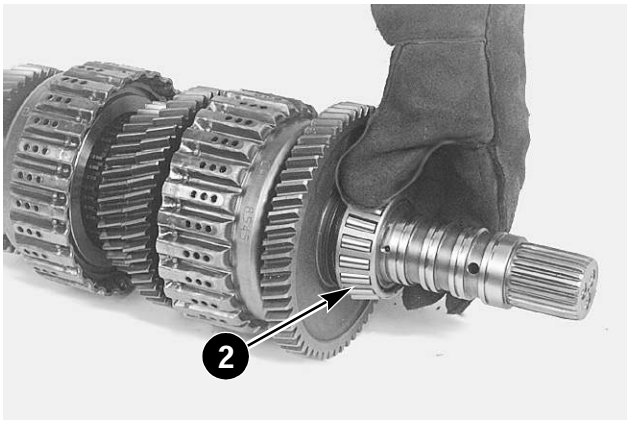



MI05J093

https://truckmanualshub.com/



## STEP 35

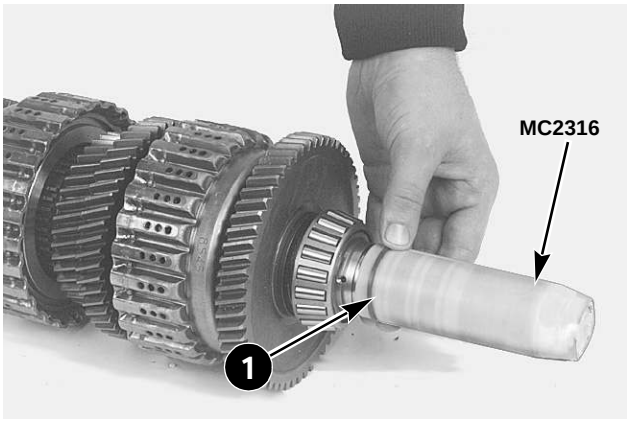



DD96A080

Install the bearing cone (2) onto the input shaft. Make sure the bearing cone is against the gear.

**WARNING:** Always wear heat protective gloves or mittens when handling heated parts.

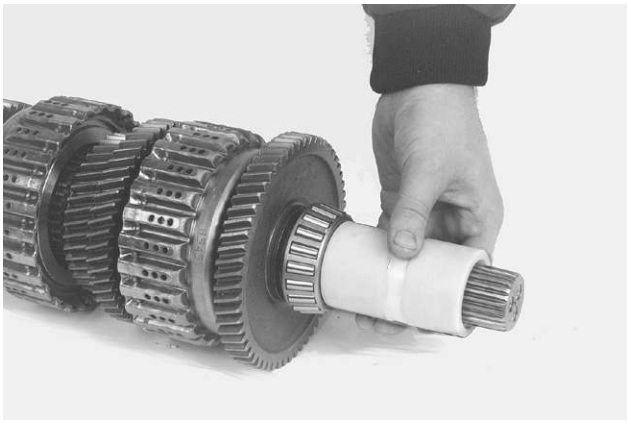
## STEP 36



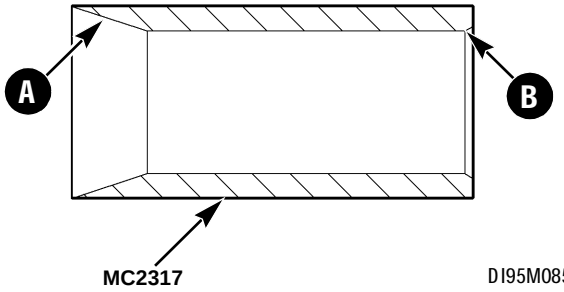

DD96A075

Lubricate a new sealing ring (1) with clean transmission oil. Using the seal expander MC2316, install the sealing ring into the inner groove on the input shaft. Remove the seal expander MC2316.

## STEP 37



DD96A078




DI95M085

Compress and reshape the seal ring (1) by hand. Install the long chamfer end (A) of the seal compressor MC2317, over the input shaft and sealing ring (1). Remove the seal compressor MC2317 then install the short chamfer end (B) of the seal compressor over the sealing ring (1).

**NOTE:** *Only by using the seal compressor can the seals (1) be compressed to the correct working size.*

## STEP 38

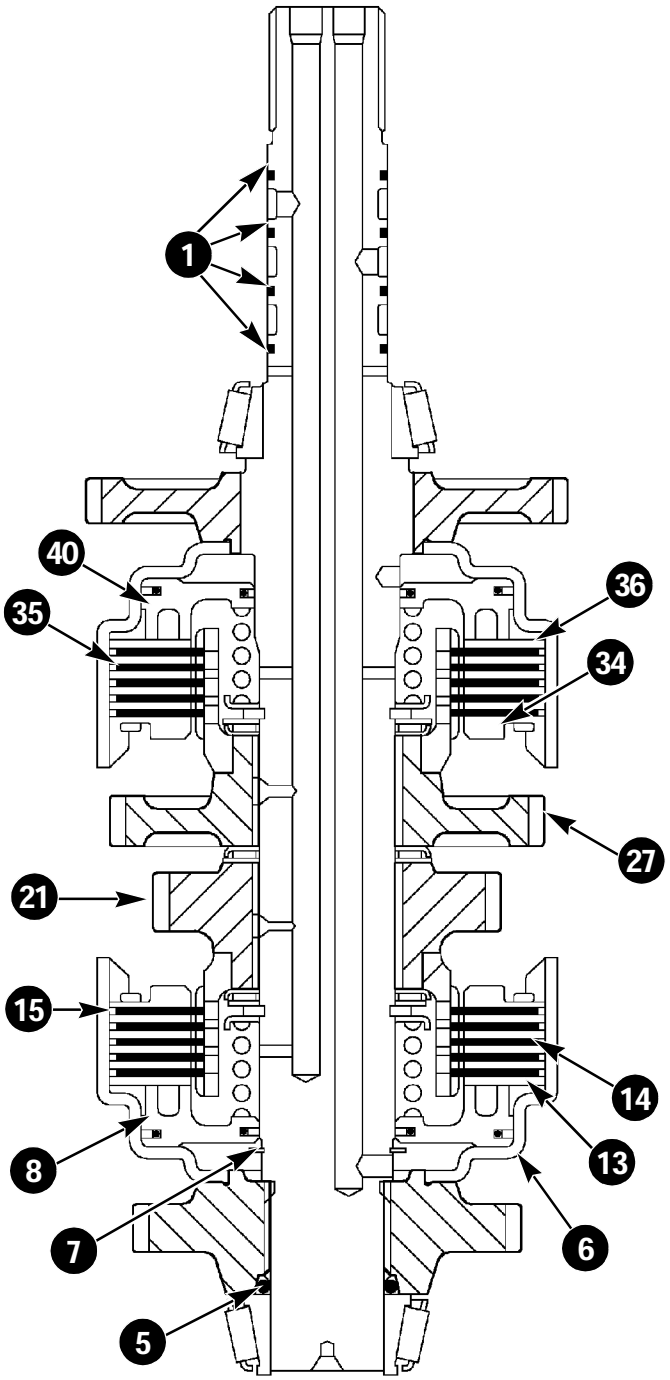
Repeat STEP 36 and STEP 37 for the remaining sealing rings (1).

**NOTE:** *Check the new sealing rings are not twisted or damaged and the sealing rings will turn freely in the grooves.*

https://truckmanualshub.com/



## Cross Sectional Drawing of the Input Shaft




MI05J094

6.1ST GEAR CLUTCH HOUSING
7.SNAP RING
8.PISTON
15.BACKING PLATE
21.1ST GEAR HUB
27.3RDGEAR HUB
36.SEPARATOR PLATES (5)
40.PISTON

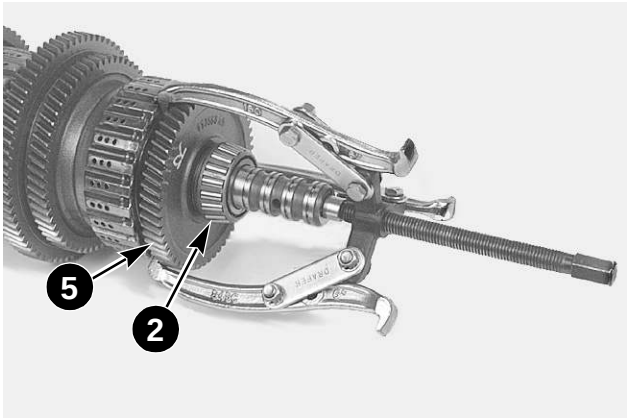
https://truckmanualshub.com/



# DROPSHAFT

## Disassembly

### STEP 39




DD96A085

Remove and discard the sealing rings (1). Use a suitable bearing puller and remove the bearing cone (2), thrust washer (3), thrust bearing (4) and the 4th gear hub (5).

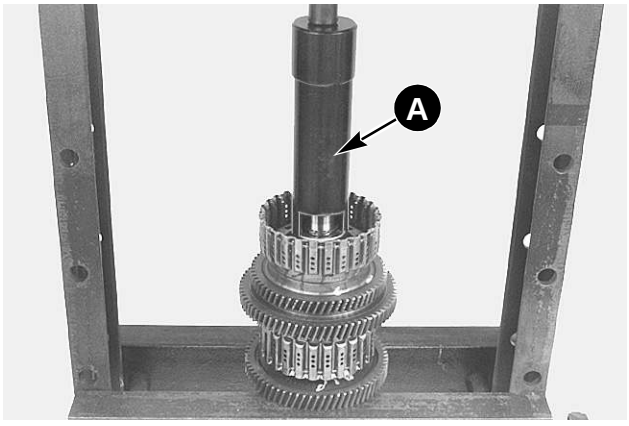
### STEP 40

Remove the bearing cage (6), spacer (7), bearing cage (8) and thrust bearing (9).

### STEP 41

Remove the snap ring (10), backing plate (11), separator plates (12) and friction plates (13).

### STEP 42




DD96A086

Install the dropshaft onto a suitable hydraulic press. Use the spring compressor MC1992 (A) to compress the piston return spring (16). Release the snap ring (14) from the groove in the dropshaft. Release the pressure from the press and remove the spring compressor.

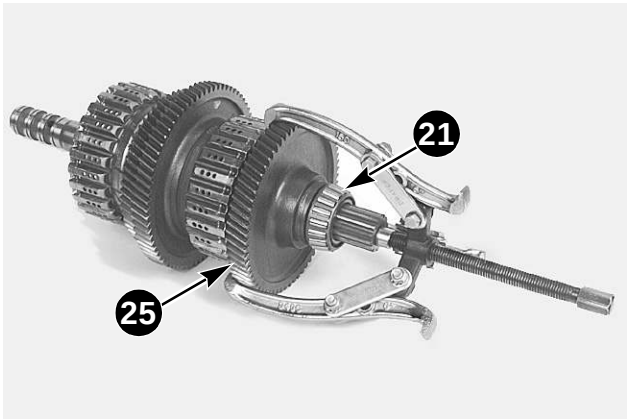
### STEP 43

Remove the snap ring (14), spring retainer (15) and spring (16).

### STEP 44

Remove the piston (17) from the 4th gear clutch housing. Remove and discard the piston sealing ring (19), o-ring (18), sealing ring (20) and o-ring (21).

### STEP 45




DD96A103

Use a suitable bearing puller and remove the bearing cone (22). Remove snap ring (23), thrust washer (24), thrust bearing (25), thrust washer (26) and 2nd gear hub (27).

### STEP 46

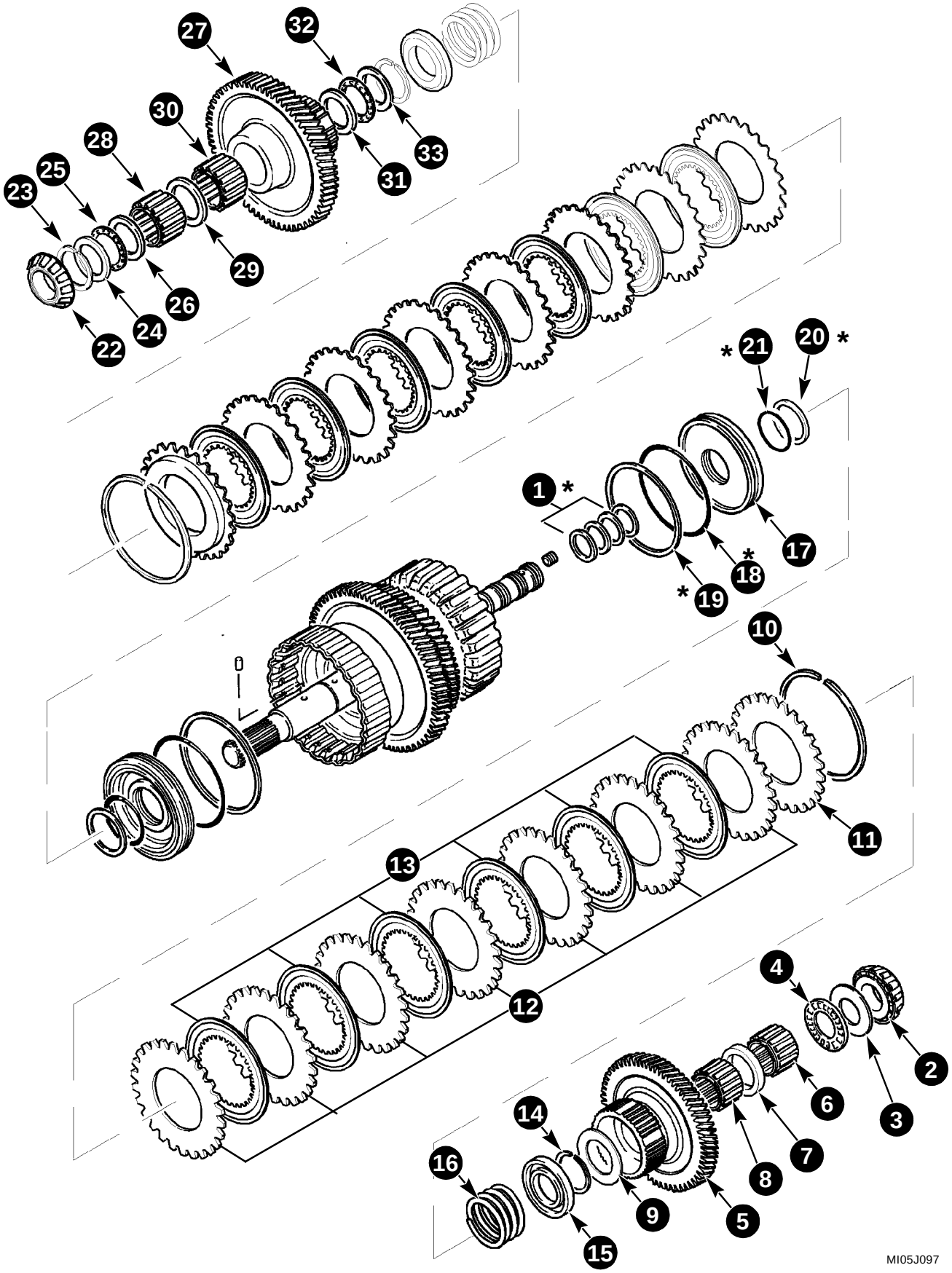
Remove the bearing cage (28), spacer (29) and bearing cage (30).

### STEP 47

Remove the thrust washer (31), thrust bearing (32) and thrust washer (33).

https://truckmanualshub.com/






**NOTE 1:** *Items are numbered in order of Disassembly, items marked* ✱ *must be replaced.*

https://truckmanualshub.com/

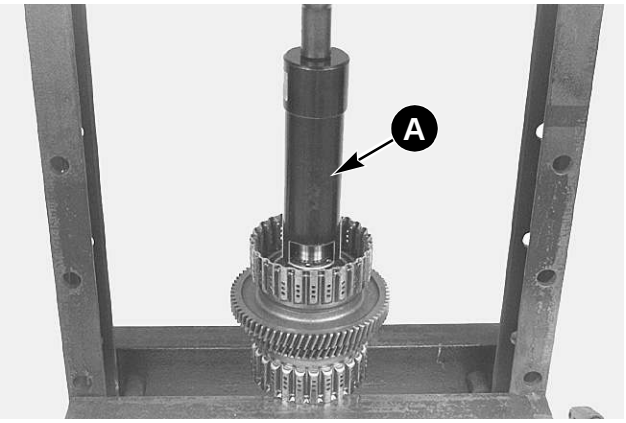


## STEP 48

Remove the snap ring (32), backing plate (33), friction plates (34) and separator plates (35).

**NOTE:** *The 2nd speed clutch pack has 7 friction and 7 metal separator plates.*

## STEP 49




DD96A087

Install the dropshaft onto a suitable hydraulic press. Use the spring compressor MC1992 (A) to compress the piston return spring (38). Release the snap ring (36) from the groove in the dropshaft. Release the pressure from the press and remove the spring compressor.

## STEP 50

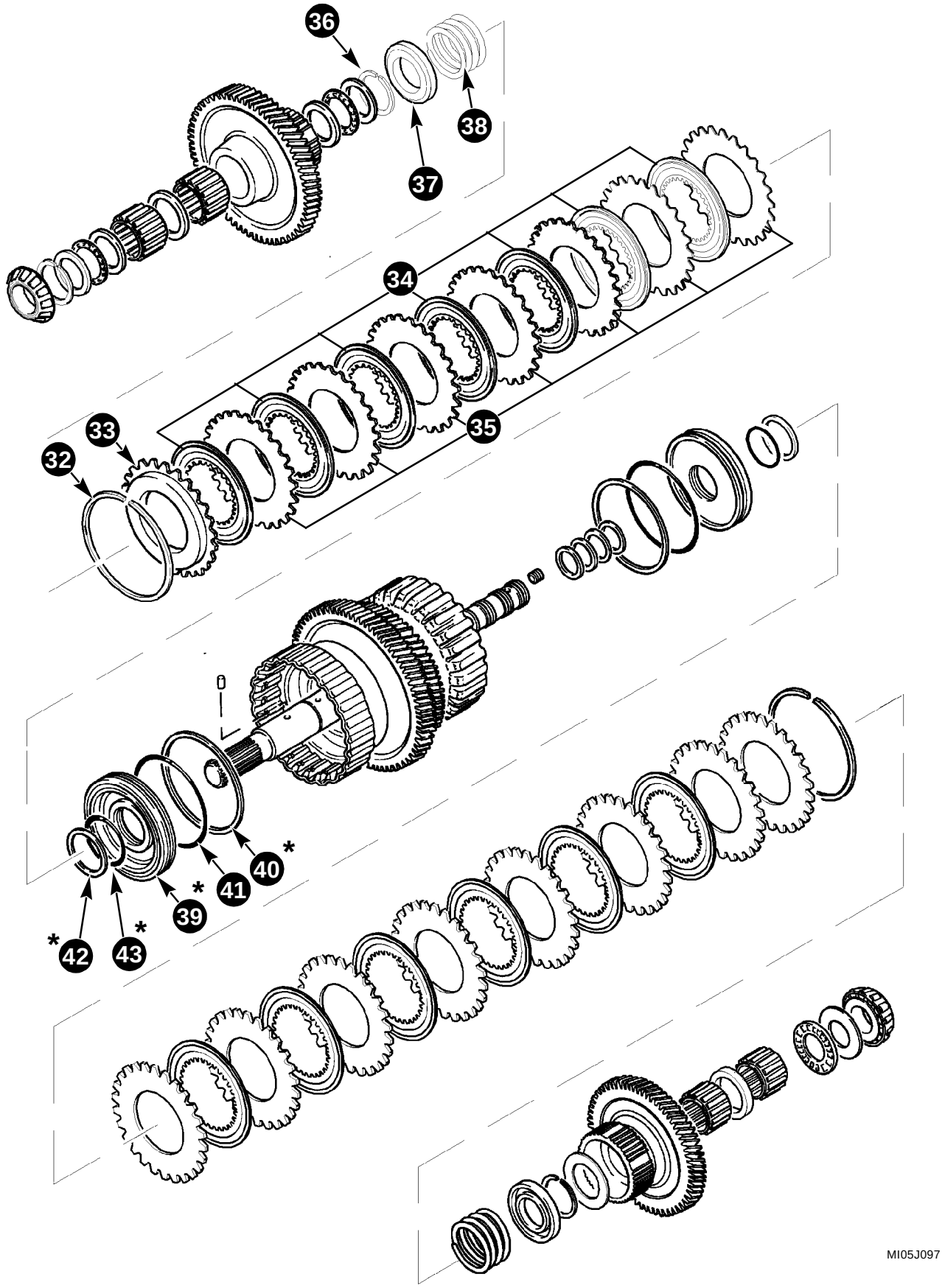
Remove the snap ring (36), spring retainer (37) and spring (38).

## STEP 51

Remove the piston (39) from the 2nd gear clutch housing. Remove and discard the piston sealing ring (40), o-ring (41), sealing ring (42) and o-ring (43).

https://truckmanualshub.com/






**NOTE 1:** *Items are numbered in order of Disassembly, items marked* ✱ *must be replaced.*

https://truckmanualshub.com/



## Assembly

### STEP 52

Lubricate and install a new o-ring (43) and sealing ring (42) into the inner groove of the piston (39). Lubricate and install a new o-ring (41) and sealing ring (40) into the outer groove of the piston (39).

**NOTE:** *Make sure the o-rings are installed before the sealing rings.*

### STEP 53

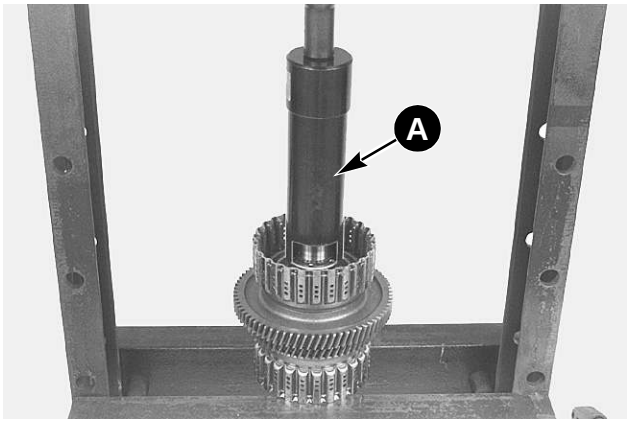
Install the piston (39) into the 2nd gear clutch housing (splined end of the dropshaft). Make sure the grooved side of the piston is facing outward. Carefully push the piston into the housing using even pressure. If the piston locks up during installation, remove the piston and install again.

**IMPORTANT:** *Never use force to correct wrong alignment of the piston.*

### STEP 54

Install the piston return spring (38) and spring retainer (37). Make sure the spring (38) locates correctly into the cup side of the spring retainer (37). Install the snap ring (36) onto the input shaft.

### STEP 55




DD96A087

Install the input shaft onto a suitable hydraulic press. Use the spring compressor MC1992 (A) to compress the piston return spring (38). Install the snap ring (36) into the groove in the input shaft. Release the pressure from the press and remove the spring compressor.

### STEP 56

Install one metal separator plate (35) and one friction plate (34) into the 2nd gear clutch housing. Continue to install one metal separator plate (35) then one friction plate (34), until five metal separator plates and five friction plates have been installed. The last plate installed must be a friction plate.

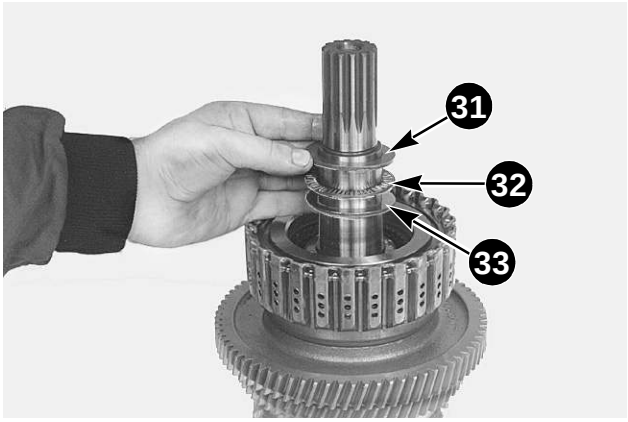
**IMPORTANT:** *The 3rd clutch pack friction plates are different to the 1st, 2nd and 4th clutch pack friction plates. When installing new 2nd clutch pack friction plates make sure the correct plates are installed.*

**IMPORTANT:** *If new friction plates are to be installed, make sure all the friction plates have the same friction material pattern and the friction plates are soaked in clean transmission oil before installation.*

### STEP 57

Install the backing plate (33), make sure the recessed side of the backing plate is facing outward. Install the snap ring (32), make sure the snap ring is located correctly into the groove in the clutch housing.

### STEP 58

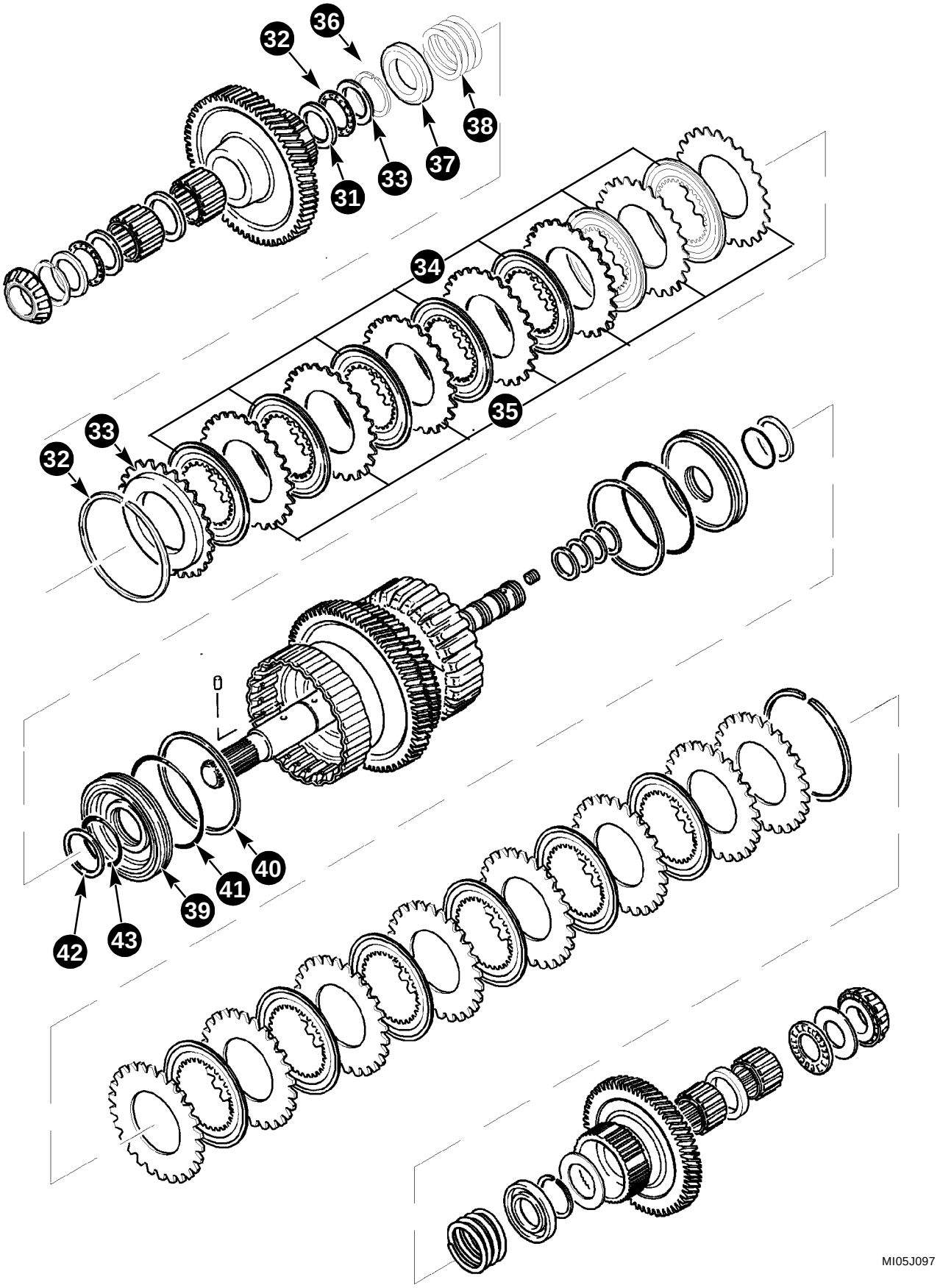



DD96A088

Install the thrust washer (33), thrust bearing (32) and thrust washer (31).

https://truckmanualshub.com/

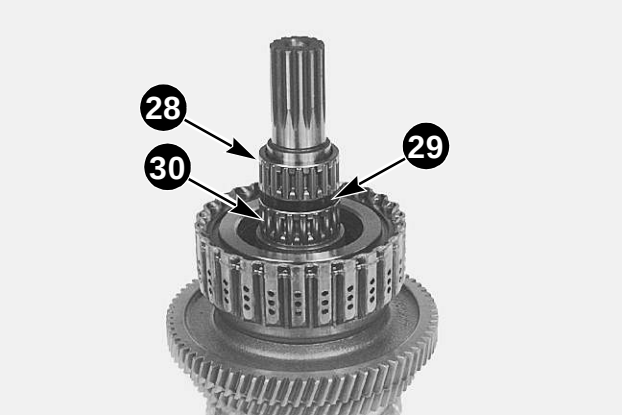




https://truckmanualshub.com/



### STEP 59



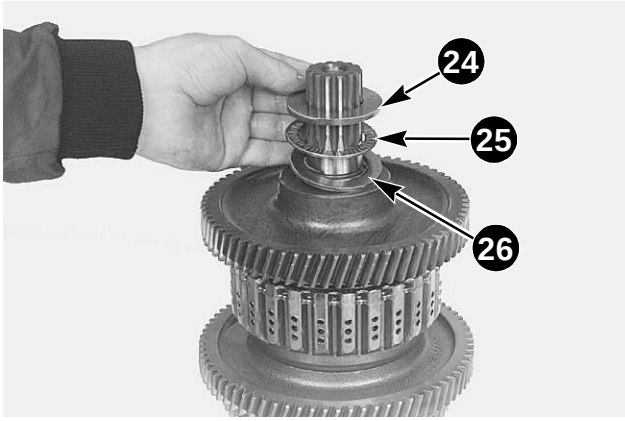

DD96A089

Install the bearing cage (30), spacer (29) and bearing cage (28) onto the dropshaft.

### STEP 60

Align the clutch pack friction plates and install the 2nd gear hub (27). Make sure all the friction plates engage onto the gear hub (27).

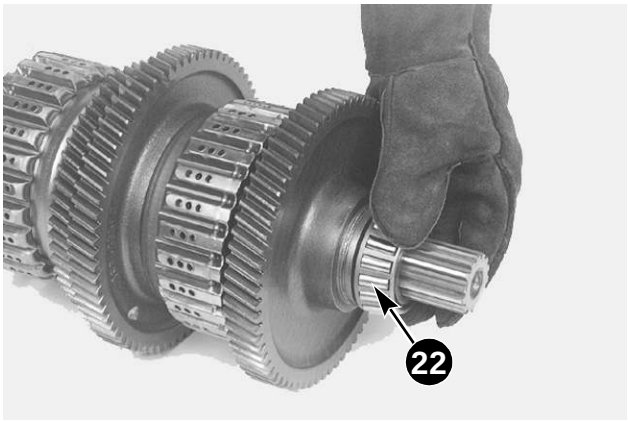
### STEP 61




DD96A088

Install the thrust washer (26), thrust bearing (25) and thrust washer (24). Install snap ring (23).

### STEP 62




DD96A084

Heat the bearing cone (22) in a bearing oven to a temperature of 110℃ (230℉). Install the bearing cone (22) onto the dropshaft. Make sure the bearing cone is against the thrust washer (24).

> ⚠ **WARNING:** ***Always wear heat protective gloves or mittens when handling heated parts.***

### STEP 63

Lubricate and install a new o-ring (21) and sealing ring (20) into the inner groove of the piston (17). Lubricate and install a new o-ring (18) and sealing ring (19) into the outer groove of the piston (17).

**NOTE:** *Make sure the o-rings are installed before the sealing rings.*

### STEP 64

Install the piston (17) into the 4th gear clutch housing. Make sure the grooved side of the piston is facing outward. Carefully push the piston into the housing using even pressure. If the piston locks up during installation, remove the piston and install again.

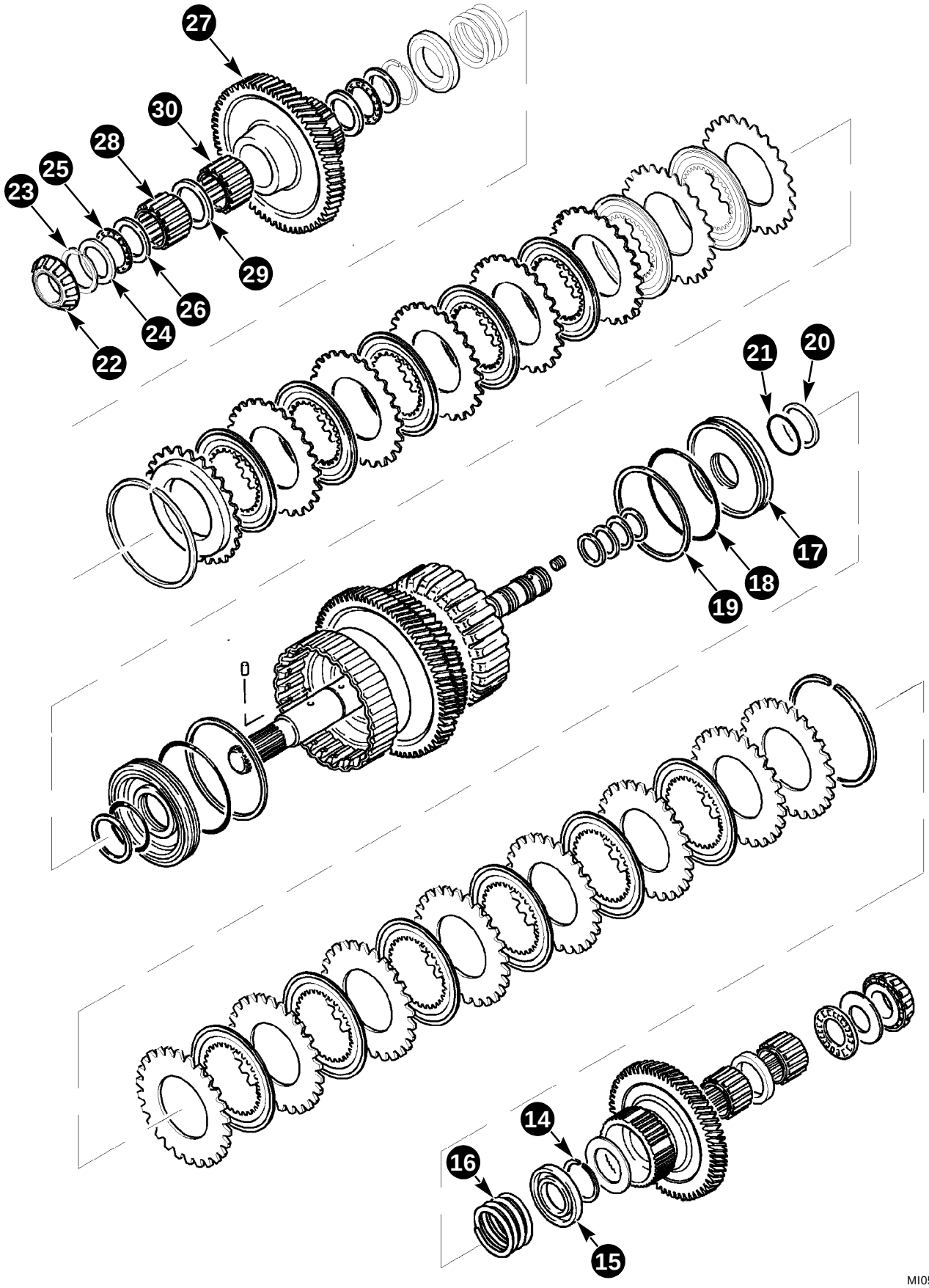
**IMPORTANT:** *Never use force to correct wrong alignment of the piston.*

### STEP 65

Install the piston return spring (16) and spring retainer (15). Make sure the spring (16) locates correctly into the cup side of the spring retainer (15). Install the snap ring (14) onto the dropshaft.

https://truckmanualshub.com/



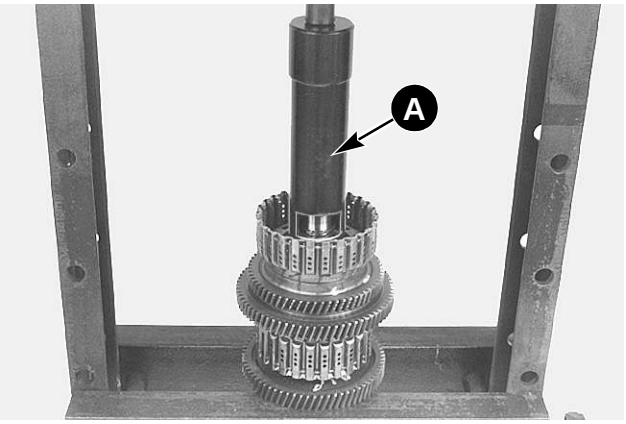



MI05J097

https://truckmanualshub.com/



## STEP 66




DD96A086

Install the input shaft onto a suitable hydraulic press. Use the spring compressor MC1992 (A) to compress the piston return spring (16). Install the snap ring (14) into the groove in the input shaft. Release the pressure from the press and remove the spring compressor.

## STEP 67

Install one metal separator plate (12) and one friction plate (13) into the 4th gear clutch housing. Continue to install one metal separator plate (13) then one friction plate (12), until five metal separator plates and four friction plates have been installed. The last plate installed must be a metal separator plate.

**IMPORTANT:** *The 3rd clutch pack friction plates are different to the 1st, 2nd and 4th clutch pack friction plates. When installing new 4th clutch pack friction plates make sure the correct plates are installed.*

**IMPORTANT:** *If new friction plates are to be installed, make sure all the friction plates have the same friction material pattern and the friction plates are soaked in clean transmission oil before installation.*

## STEP 68

Install the backing plate (11), make sure the recessed side of the backing plate is facing outward. Install the snap ring (10), make sure the snap ring is located correctly into the groove in the clutch housing.

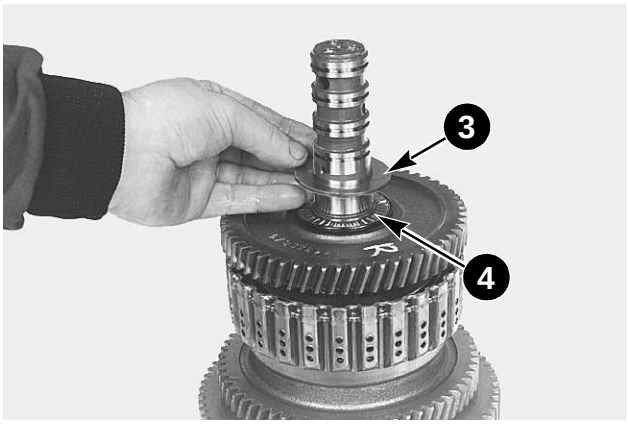
## STEP 69

Install thrust bearing (9), bearing cage (8), spacer (7) and bearing cage (6) onto the dropshaft.

## STEP 70

Align the clutch pack friction plates and install the 4th gear hub (5). Make sure all the friction plates engage onto the gear hub (5).

## STEP 71



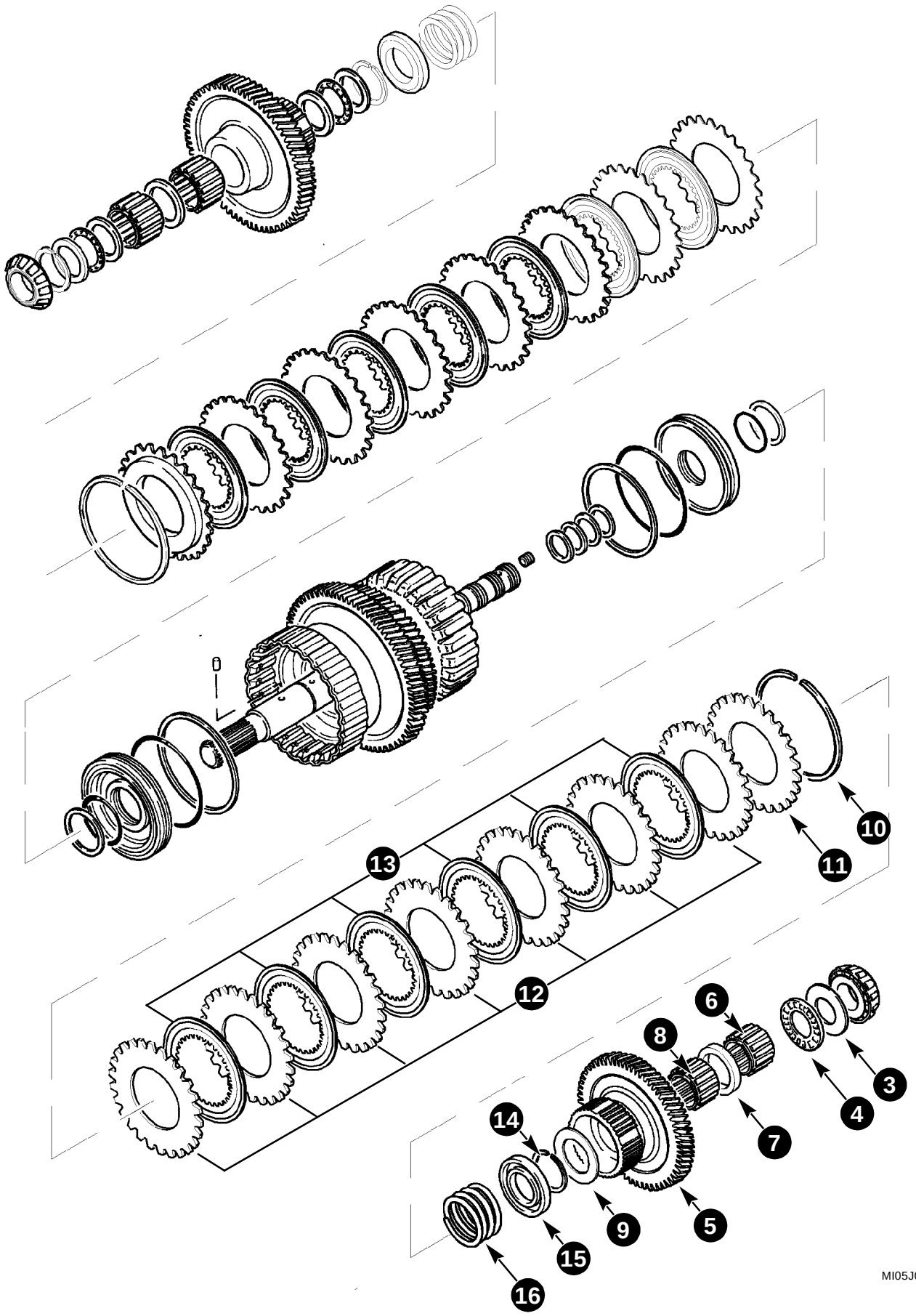

DD96A102

Install the thrust bearing (4) and thrust washer (3).

**IMPORTANT:** *Make sure the open side (needle rollers) of the thrust bearing (4) is towards the thrust washer (3).*

https://truckmanualshub.com/

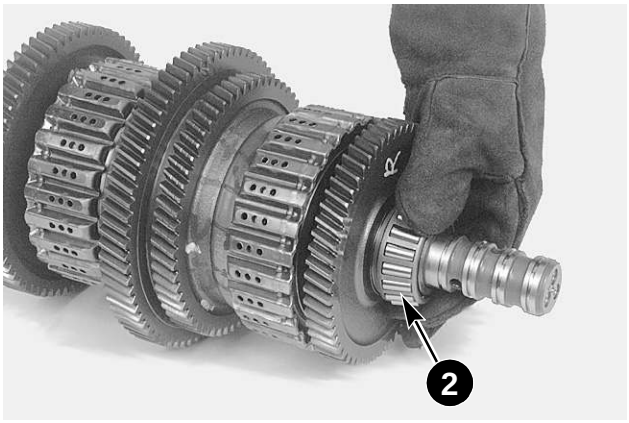




https://truckmanualshub.com/



## STEP 72

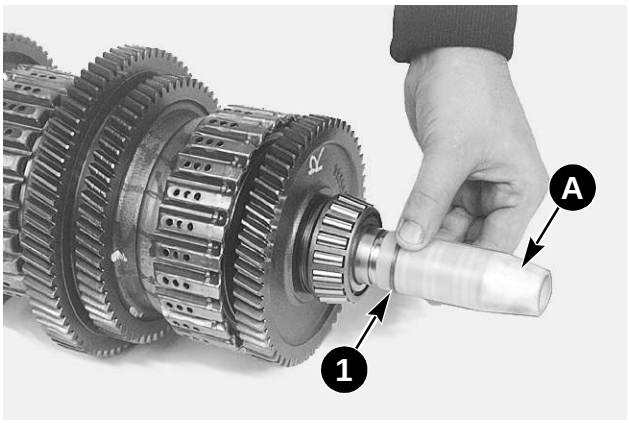



DD96A081

Heat the bearing cone (2) in a bearing oven to a temperature of 110℃ (230℉). Install the bearing cone (2) onto the dropshaft. Make sure the bearing cone is against the thrust washer (3).

**WARNING:** ***Always wear heat protective gloves or mittens when handling heated parts.***

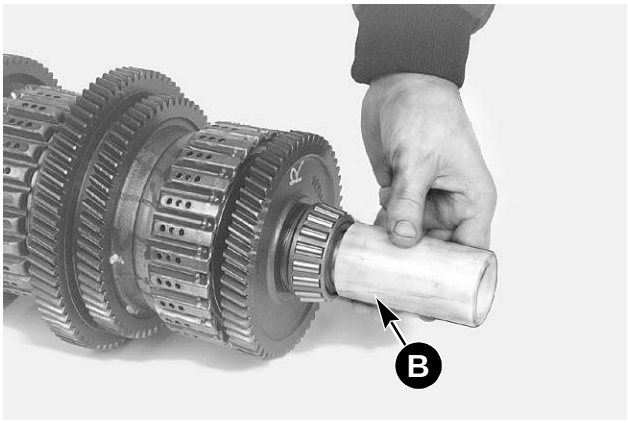
## STEP 73



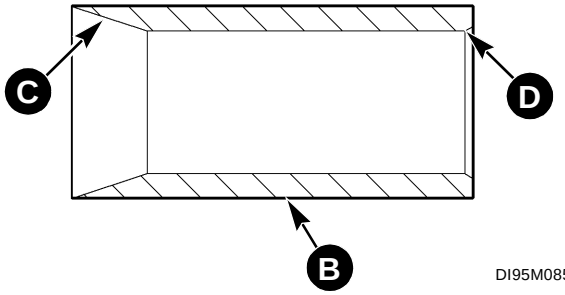

DD96A082

Lubricate a new sealing ring (1) with clean transmission oil. Using the seal expander MC1999A (A), install the sealing ring into the inner groove on the input shaft. Remove the seal expander (A).

## STEP 74




DD96A083




DI95M085

Compress and reshape the seal ring (1) by hand. Install the long chamfer end (C) of the seal compressor MC2005-1 (B) over the dropshaft and sealing ring (1). Remove the seal compressor (B) then install the short chamfer end (D) of the seal compressor over the sealing ring (1).

**NOTE:** *Only by using the seal compressor can the seals (1) be compressed to the correct working size.*

## STEP 75

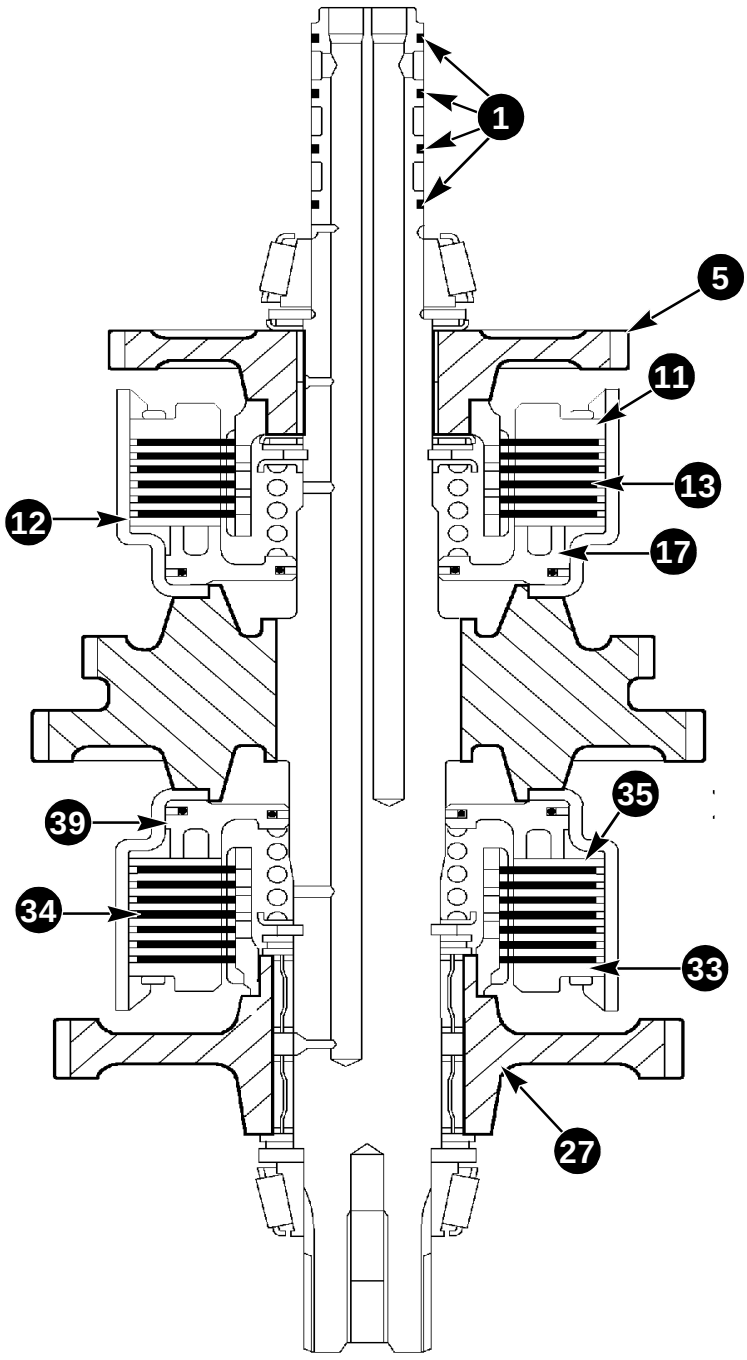
Repeat STEP 73 and STEP 74 the remaining sealing rings (1).

**NOTE:** *Check the new sealing rings are not twisted or damaged and the sealing rings will turn freely in the grooves.*

https://truckmanualshub.com/



## Cross Sectional Drawing of the Dropshaft



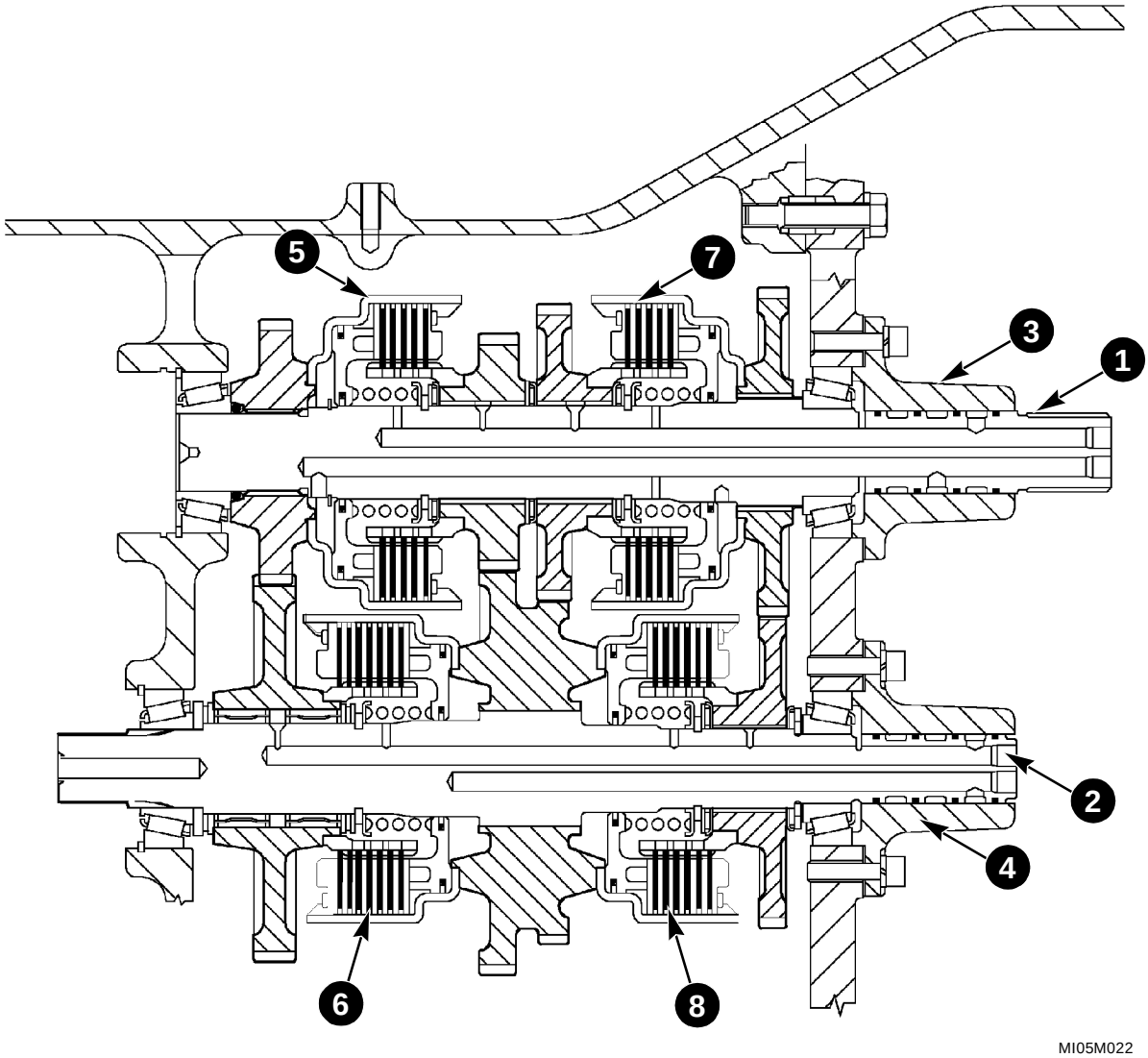

MI05J098

11. BACKING PLATE
12. SEPARATOR PLATES (7)
27. 2ND GEAR HUB
33. BACKING PLATE
39. PISTON

https://truckmanualshub.com/



# Cross Sectional Drawing of the Powershift Transmission




3. INPUT SHAFT OIL DISTRIBUTOR
6. 2ND CLUTCH PACK

https://truckmanualshub.com/



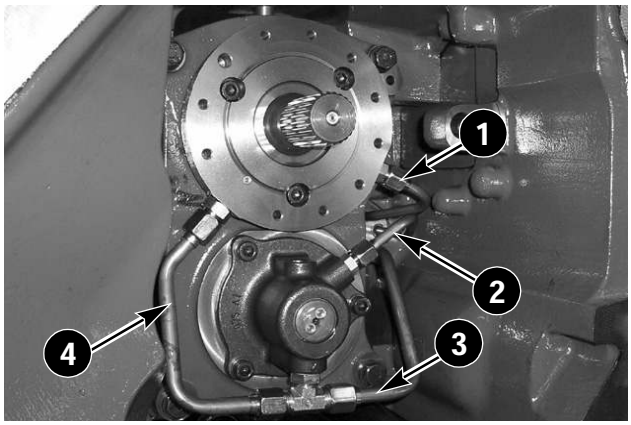
# HIGH AND LOW SPEED CLUTCH SHAFTS

## Removal

### STEP 1

Separate the speed transmission from the range transmission.

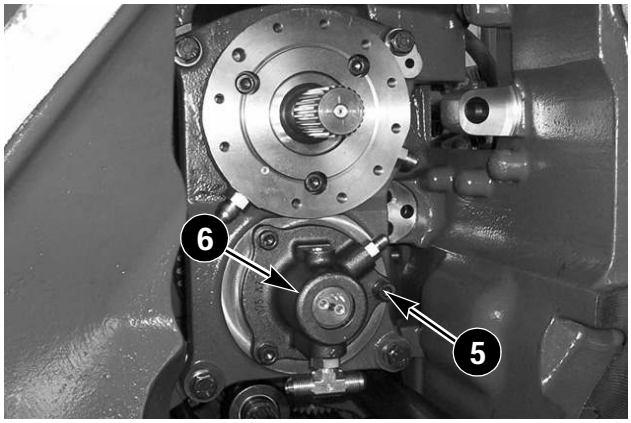
### STEP 2




MD05J047

Remove and cap oil feed tubes (1), (2), (3) and (4).

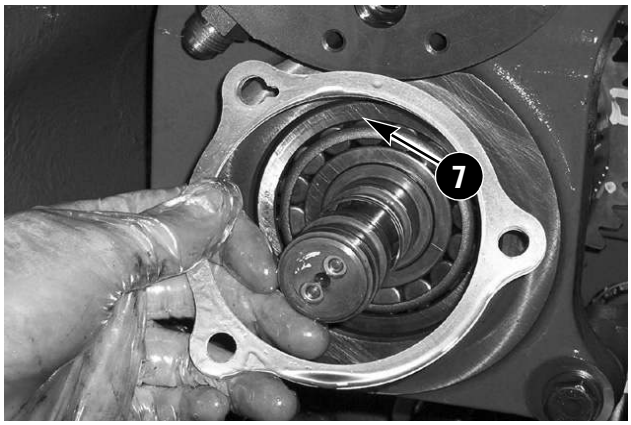
### STEP 3




MD05J050

Remove the three retaining bolts (5) and the low clutch oil distribution manifold (6).

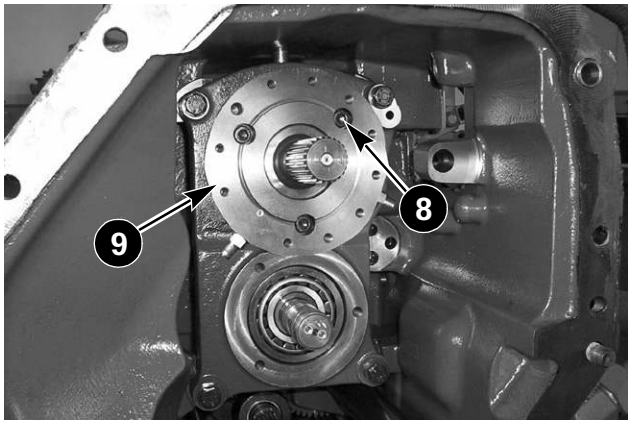
### STEP 4




MD05J048

Remove the low clutch oil distribution manifold shims (7).

### STEP 5




MD05J053

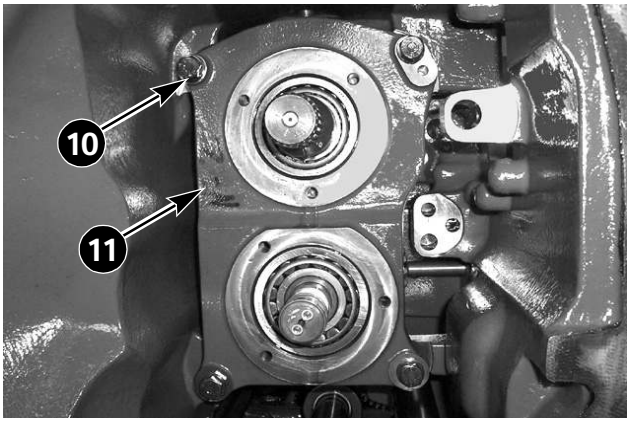
Remove the three retaining bolts (8). Remove the high clutch oil distribution hub and shims (9).

**NOTE:** *Retain shims for assembly.*

https://truckmanualshub.com/



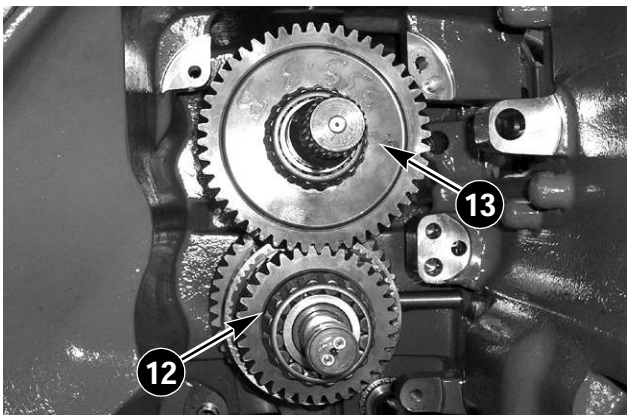
## STEP 6




MD05J049

Remove two of the bearing carrier retaining bolts (10), and Install two alignment studs MC1995A. Remove the two remaining bearing carrier retaining bolts and the bearing carrier (11).

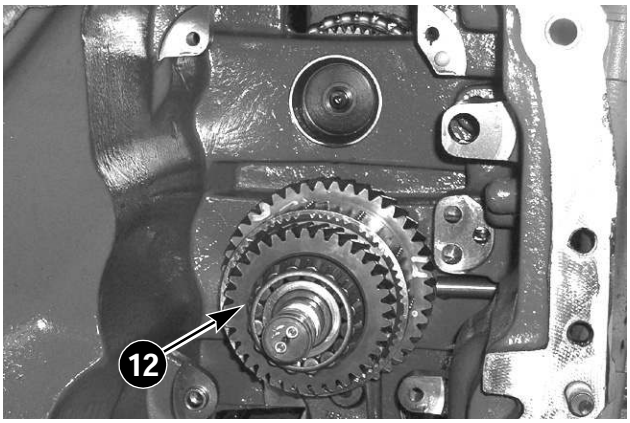
## STEP 7




MD05J056

Support the low clutch assembly (12) and carefully remove the high clutch assembly (13).

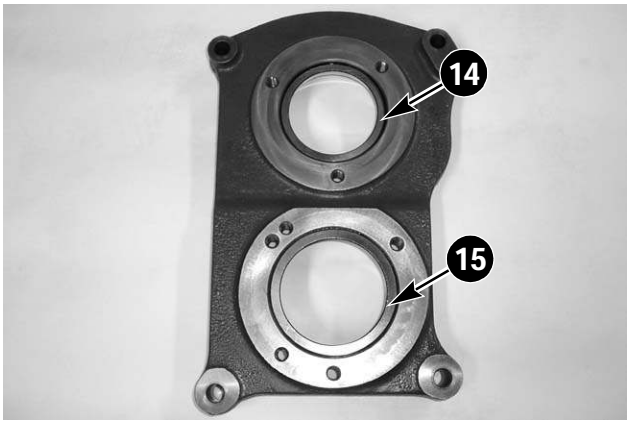
## STEP 8




MD05J057

Remove the low speed clutch assembly (12).

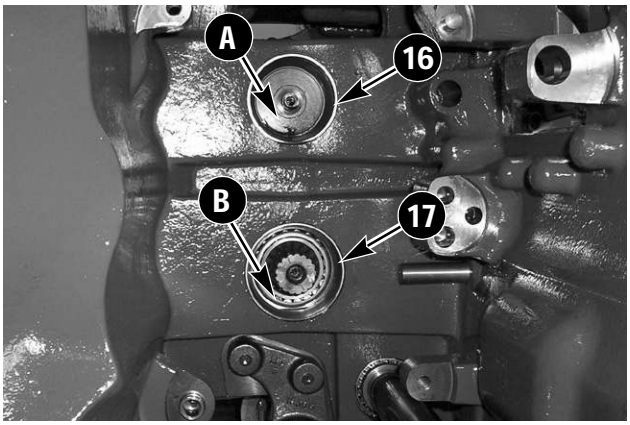
## STEP 9




MD05J058

Use a suitable bearing driver and remove the high clutch shaft bearing cup (14) and the low clutch shaft bearing cup (15) from the bearing carrier.

## STEP 10




MD05J055

Use a suitable puller to remove the high clutch shaft bearing cup (16) and the low clutch shaft bearing cup (17) from the transmission housing.

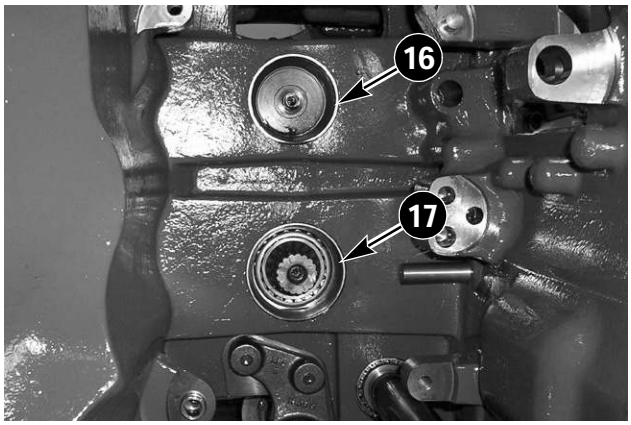
**IMPORTANT:** *Care must be taken not to damage the plastic lubrication disc* (A) *and the retaining ring* (B).

https://truckmanualshub.com/



## Installation

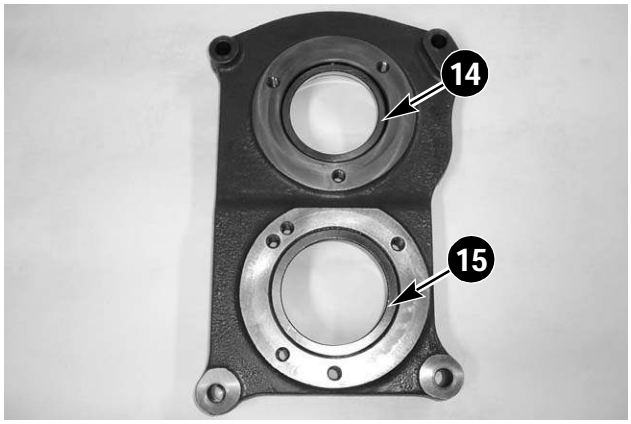
### STEP 11




MD05J055

Use a suitable bearing driver to install the high clutch shaft bearing cup (16) and the low clutch shaft bearing cup (17). Make sure the bearing cups are fully installed and are against the retaining rings in the transmission housing.

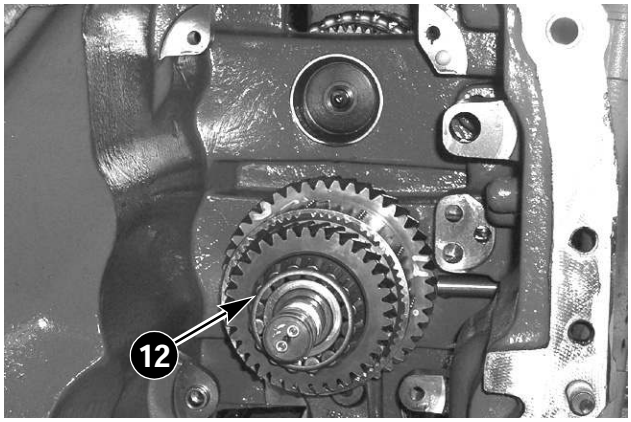
### STEP 12




MD05J058

Use a suitable bearing driver and install the high clutch shaft bearing cup (14) and the low clutch shaft bearing cup (15). Make sure the bearing cups are level with the outer face of the bearing carrier.

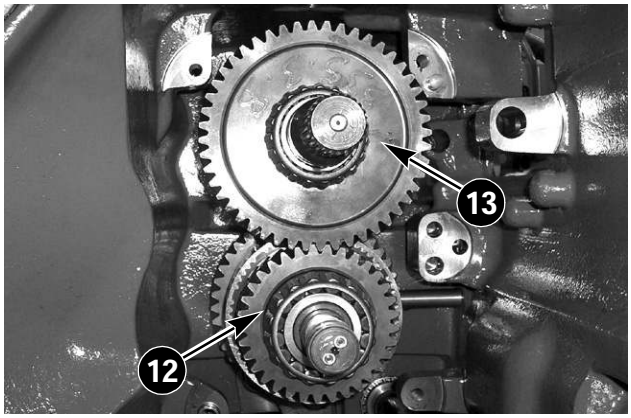
### STEP 13




MD05J057

Carefully install the low speed clutch assembly (12).

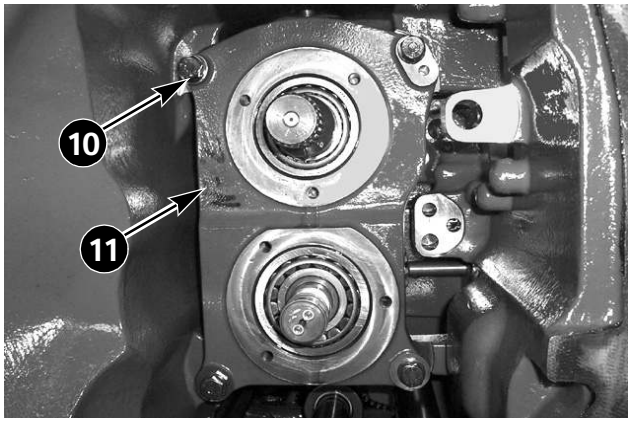
### STEP 14




MD05J056

Support the low clutch assembly (12) and carefully install the high clutch assembly (13).

### STEP 15



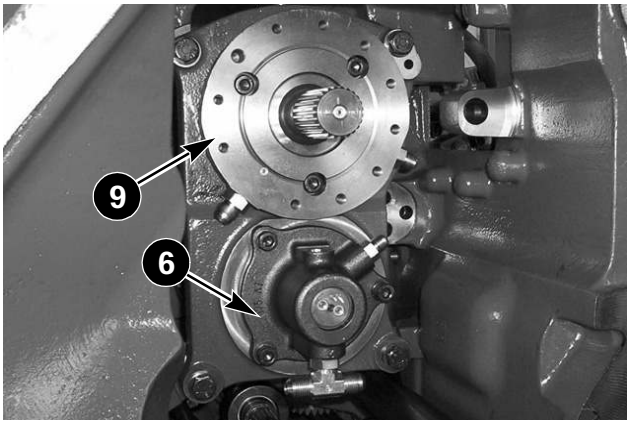

MD05J049

Install the bearing carrier (11) and install two of the retaining bolts (10). Remove the alignment studs MC1995A. and install the remaining two retaining bolts. Tighten the retaining bolts to 101 to 113 Nm (75 to 83 lb ft).

https://truckmanualshub.com/



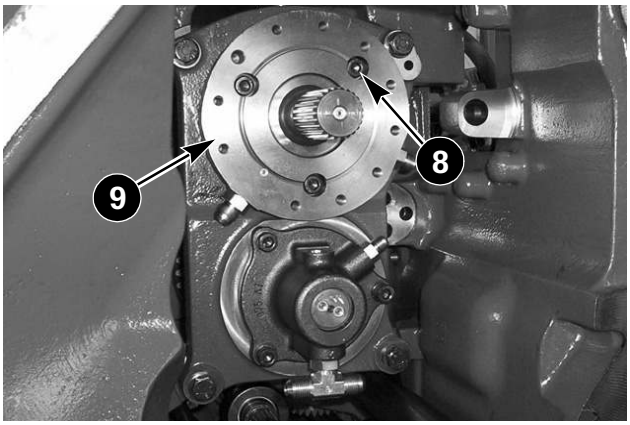
## STEP 16




MD05J053

Install the high clutch oil distribution hub (9) and the low clutch oil distribution manifold (6) without shims. DO NOT tighten the bolts at this stage.

## STEP 17



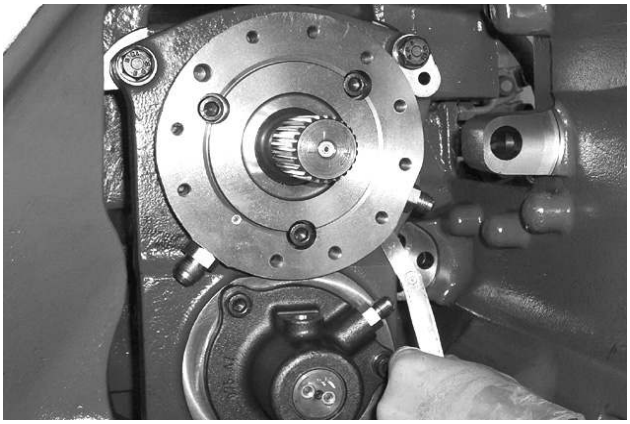

MD05J053

Tighten the high clutch oil distribution hub retaining bolts (8) to a torque of 9 Nm (80 lb in). Rotate the shaft and continue to tighten the retaining bolts until the torque remains constant at 9 Nm (80 lb in).

## STEP 18

Loosen the high clutch oil distribution hub retaining bolts, then tighten the retaining bolts to a torque of 2.8 Nm (25 lb in). Rotate the shaft and continue to tighten the retaining bolts until the torque remains constant at 2.8 Nm (25 lb in).

## STEP 19



MD05J052

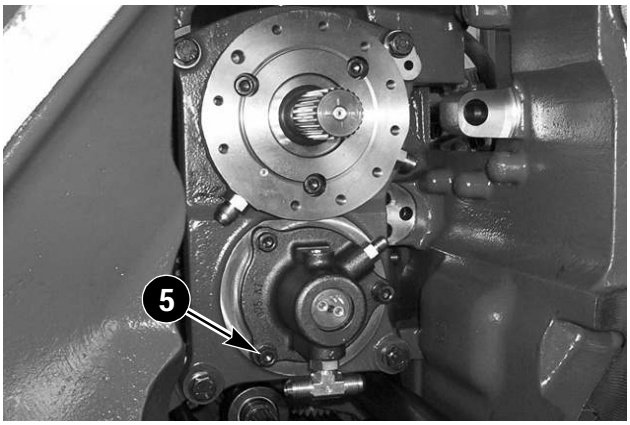
using feeler gauges measure and make a note of the gap between the high clutch oil distribution hub and the bearing carrier next to the three retaining bolts. If the difference between the three measurements is less than 0.05 mm (0.002 inch), use the average of the measurements to calculate the required shim pack refer to STEP 20.

**NOTE:** *If the difference between the three measurements is more than 0.05 mm (0.002 inch), remove the oil distribution hub and check the high clutch shaft bearing and cup for the correct seating.*

## STEP 20

Add 0.36 mm (0.014 inch) to the average measurement noted in STEP 19 to determine the correct shim pack thickness. Make a note of the required shim pack thickness. Loosen the oil distribution hub retaining bolts.

## STEP 21




MD05J053

Tighten the low clutch oil distribution manifold retaining bolts (5) to a torque of 9 Nm (80 lb in). Rotate the shaft and continue to tighten the retaining bolts until the torque remains constant at 9 Nm (80 lb in).

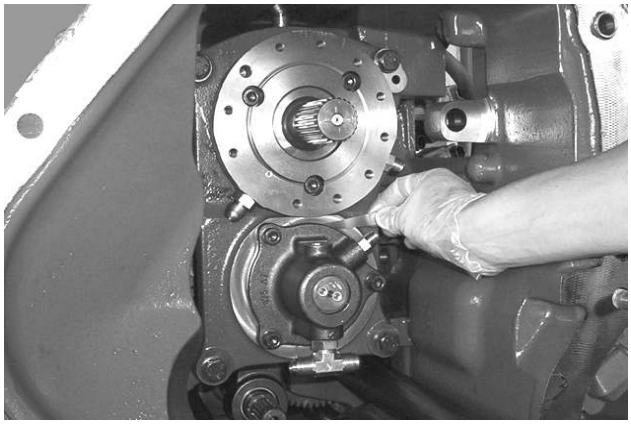
https://truckmanualshub.com/



## STEP 22

Loosen the low clutch oil distribution manifold retaining bolts, then tighten the retaining bolts to a torque of 2.8 Nm (25 lb in). Rotate the shaft and continue to tighten the retaining bolts until the torque remains constant at 2.8 Nm (25 lb in).

## STEP 23



MD05J051

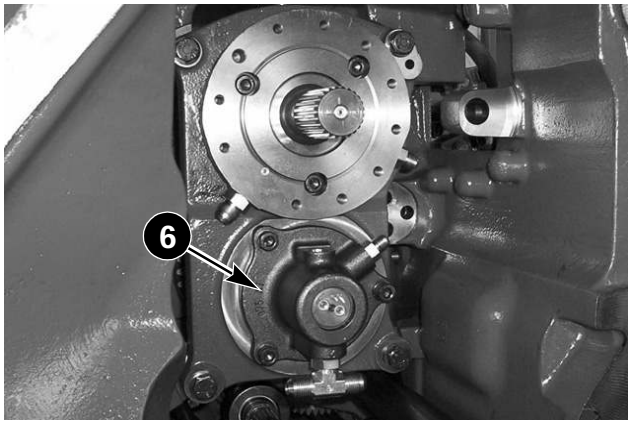
Using feeler gauges measure and make a note of the gap between the low clutch oil distribution manifold and the bearing carrier next to the three retaining bolts. If the difference between the three measurements is less than 0.05 mm (0.002 inch), use the average of the measurements to calculate the required shim pack refer to STEP 24.

**NOTE:** *If the difference between the three measurements is more than 0.05 mm (0.002 inch), remove the oil distribution* manifold *and check the high clutch shaft bearing and cup for the correct seating.*

## STEP 24

Add 0.28 mm (0.011 inch) to the average measurement noted in STEP 23 to determine the correct shim pack thickness. Make a note of the required shim pack thickness.

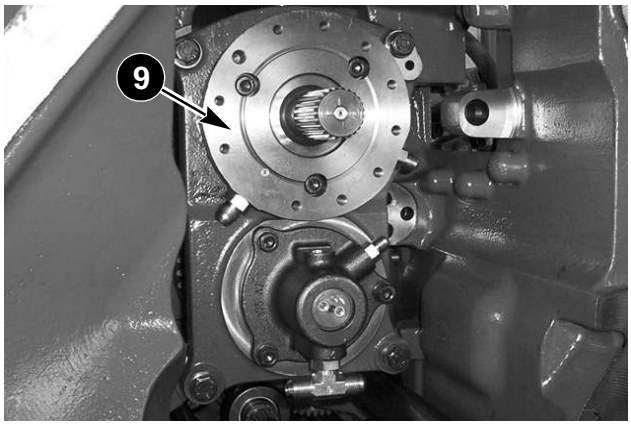
## STEP 25




MD05J053

Remove the low clutch oil distribution manifold retaining bolts and oil distributor (6). install the shims (determined in STEP 24) and the oil distribution manifold (6). Install and tighten the retaining bolts to a torque of 58 to 65 Nm (43 to 48 lb ft). Rotate the low clutch shaft and check the retaining bolt torque.

## STEP 26




MD05J053

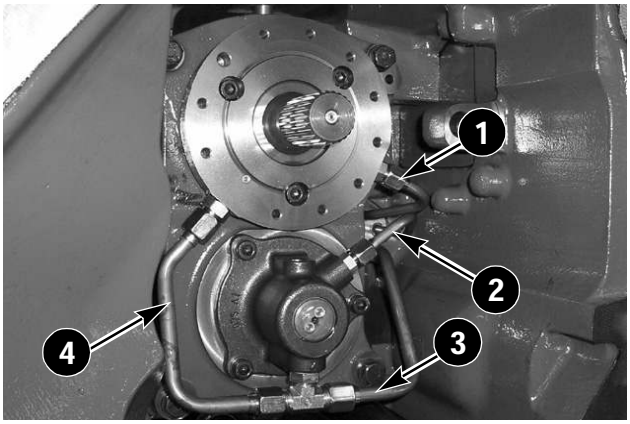
Remove the high clutch oil distribution hub retaining bolts and oil distributor hub (9). install the shims (determined in STEP 20) and the oil distribution hub (9). Install and tighten the retaining bolts to a torque of 58 to 65 Nm (43 to 48 lb ft). Rotate the high clutch shaft and check the retaining bolt torque.

**NOTE:** *As a final check, use a DTI gauge to insure that the high clutch shaft and low clutch shaft have an end play of 0.003 to 0.13 mm (0.001 to 0.005 inch).*

https://truckmanualshub.com/



**STEP 27**




MD05J047

Lubricate and install new o-rings onto the feed tubes (1), (2) and (3). Install and tighten the feed tubes onto the oil distributors.

https://truckmanualshub.com/



This Page Has Been Left Blank

https://truckmanualshub.com/



# LOW SPEED CLUTCH SHAFT

## Disassembly

### STEP 1

Remove and discard the sealing rings (1).

### STEP 2



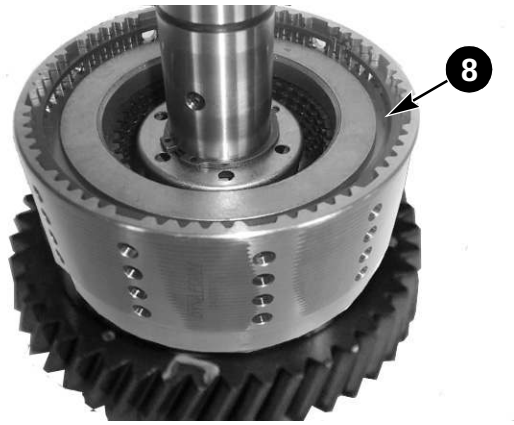

MD05J067

Use a suitable bearing puller and remove the bearing cones (2) and (3).

### STEP 3

Remove retaining ring (4), thrust washer (5) thrust bearing (6) and gear hub (7).

### STEP 4




MD05K001

Release the retaining ring (8) from the clutch housing

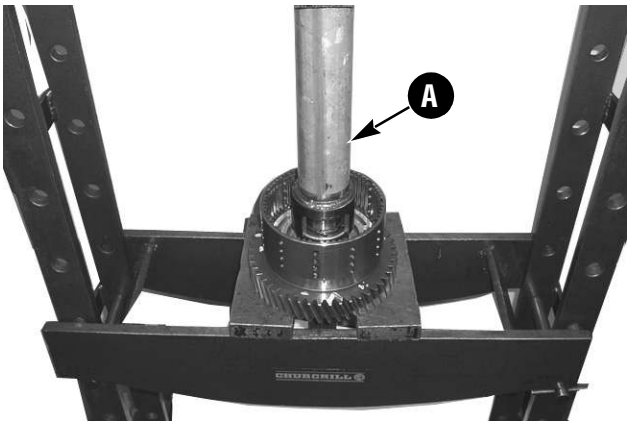
### STEP 5

Remove the backing plate (9) friction plates (10), separator plates (11).

### STEP 6

Remove bearing (12), spacer (13) and bearing (14). Remove thrust bearing (15) and thrust washer (16).

### STEP 7




MD05J070

Install the low speed clutch shaft onto a suitable hydraulic press. Use the spring compressor 1013T1 (A) to compress the piston return spring (19). Release the snap ring (17) from the groove in the input shaft. Release the pressure from the press and remove the spring compressor.

### STEP 8

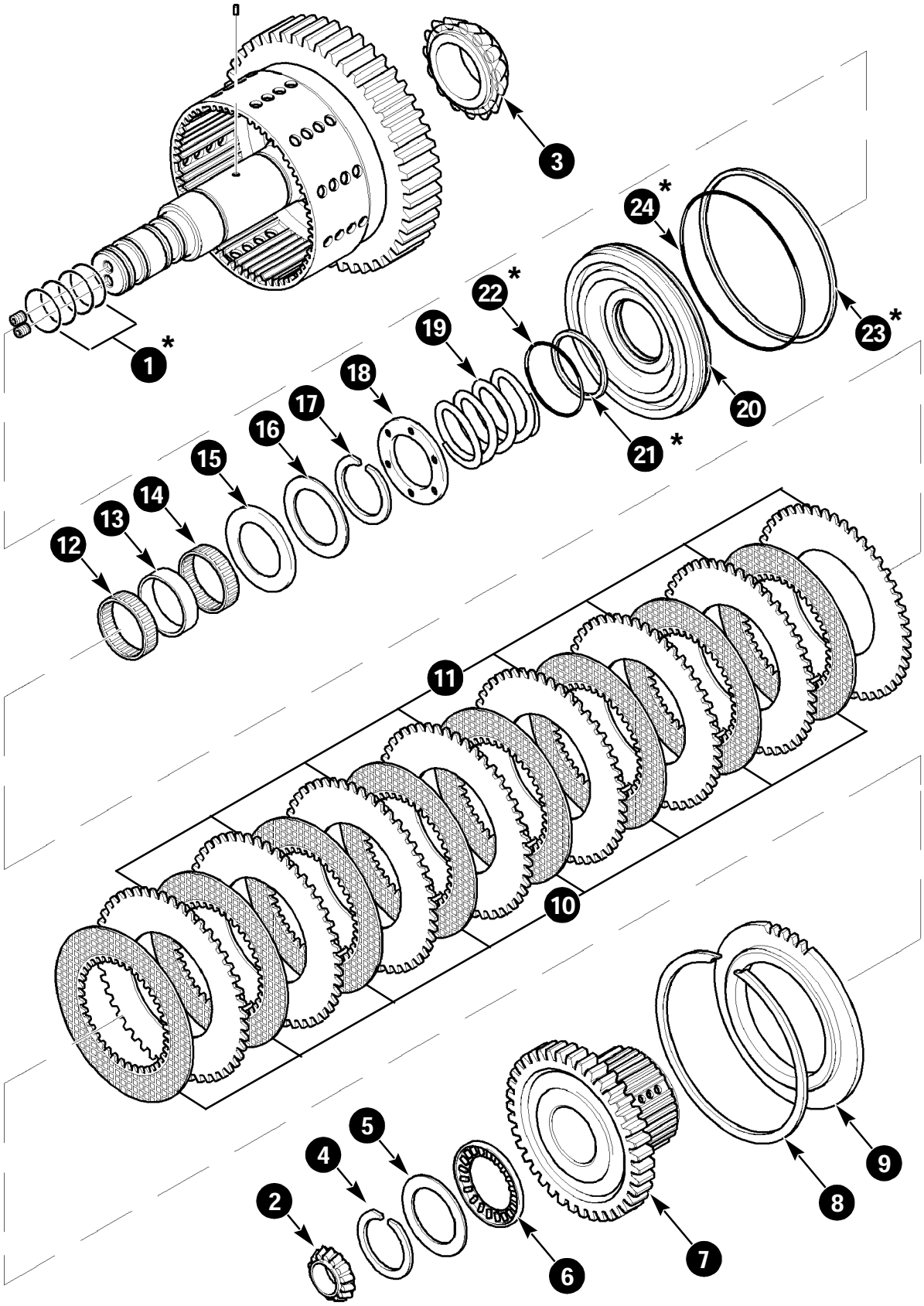
Remove the snap ring (17), retainer (18) spring (19) and piston (20).

### STEP 9

Remove and discard the piston sealing ring (21), o-ring (22), sealing ring (23) and o-ring (24).

https://truckmanualshub.com/






MI05J065

**NOTE:** *Items are numbered in order of Disassembly, items marked ✱ must be replaced.*

https://truckmanualshub.com/



## Assembly

### STEP 10

Lubricate and install a new o-ring (24) and sealing ring (23) into the outer groove of the piston (20). Lubricate and install a new o-ring (21) and sealing ring (22) into the inner groove of the piston (20).

**NOTE:** *Make sure the o-rings are installed before the sealing rings. Check the sealing rings (22) and (23) are not twisted or damaged.*

### STEP 11

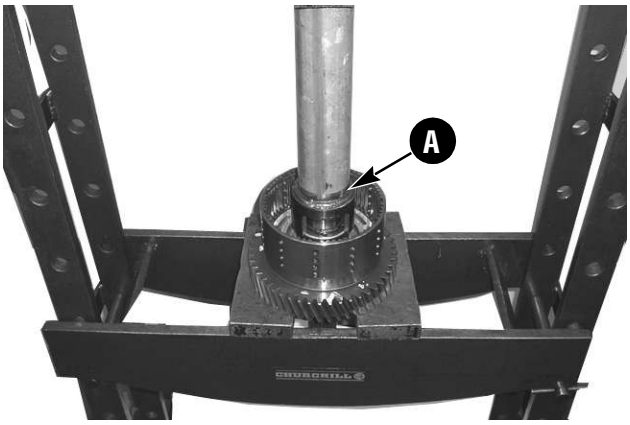
Install the piston (20) into the low speed clutch housing. Make sure the grooved side of the piston is facing outward. Carefully push the piston into the housing using even pressure. If the piston locks up during installation, remove the piston and install again.

**IMPORTANT:** *Never use force to correct wrong alignment of the piston.*

### STEP 12

Install the piston return spring (19) and spring retainer (18). Make sure the spring (19) locates correctly into the cup side of the spring retainer (18). Install the snap ring (17) onto the low speed clutch shaft.

### STEP 13




MD05J070

Install the input shaft onto a suitable hydraulic press. Use the spring compressor 1013T1 (A) to compress the piston return spring (19). Install the snap ring (17) into the groove in the low speed clutch shaft. Release the pressure from the press and remove the spring compressor.

### STEP 14

Install the thrust washer (16), thrust bearing (15), bearing cage (14), narrow spacer (13) and bearing cage (12) onto the low speed clutch shaft.

**IMPORTANT:** *Make sure the open side (needle rollers) of the thrust bearing (15) is towards the thrust washer (16).*

### STEP 15

Install one metal separator plate (11) and one friction plate (10) into the low speed clutch housing. Continue to install one metal separator plate (11) then one friction plate (10), until eight metal separator plates and eight friction plates have been installed. The last plate installed must be a friction plate.

**IMPORTANT:** *If new friction plates are to be installed, make sure all the friction plates have the same friction material pattern and the friction plates have been soaked in clean transmission oil before installation.*

### STEP 16

Install the backing plate (9), make sure the recessed side of the backing plate is facing outward. Install the snap ring (8), make sure the snap ring is located correctly into the groove in the clutch housing.

### STEP 17

Align the clutch pack friction plates and install the low speed gear hub (7). Make sure all the friction plates engage onto the gear hub (7).

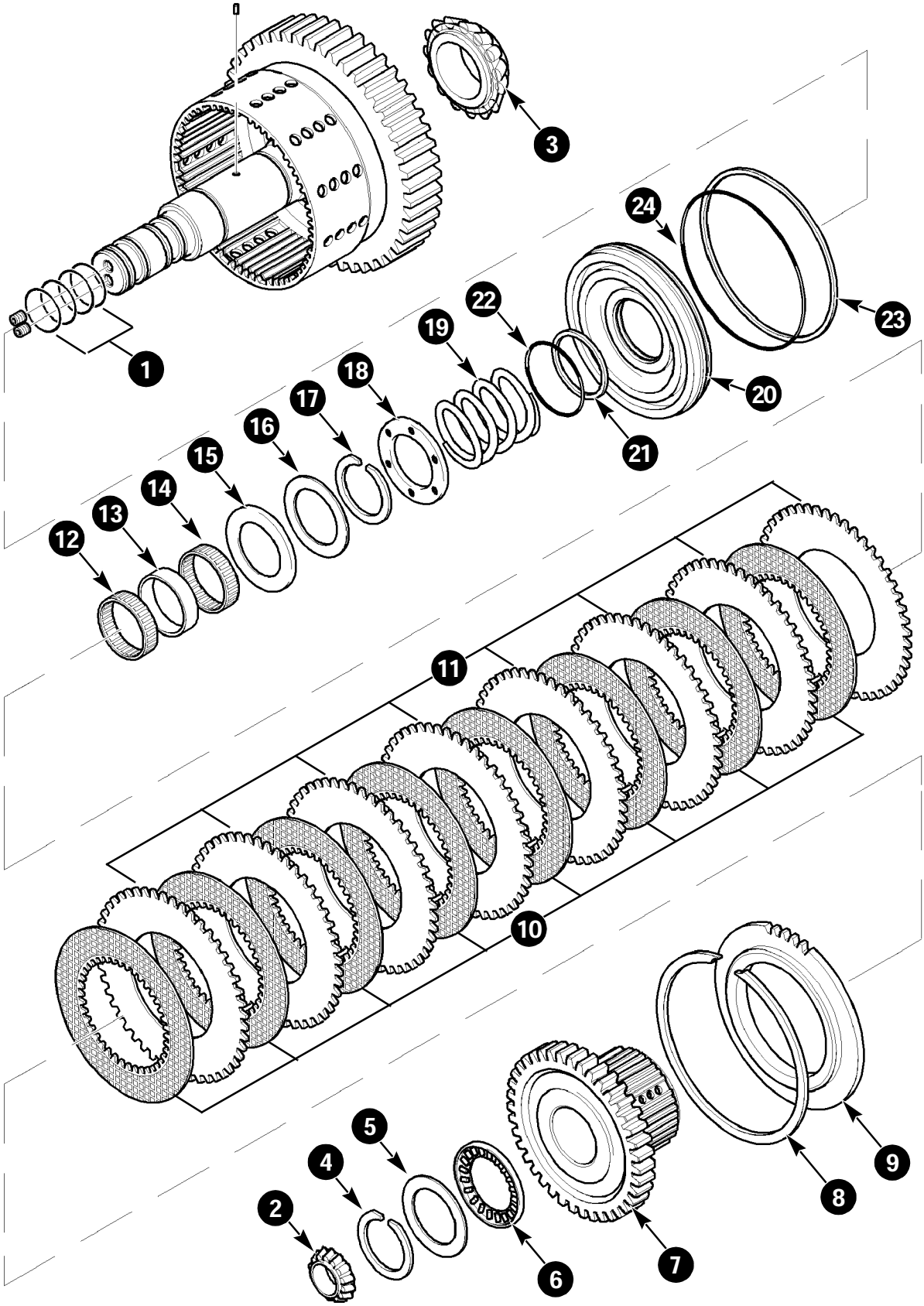
### STEP 18

Install thrust bearing (6) thrust washer (5) and retaining ring (4).

**IMPORTANT:** *Make sure the open side (needle rollers) of the thrust bearing (6) is towards the thrust washer (5).*

https://truckmanualshub.com/






MI05J065

https://truckmanualshub.com/



## STEP 19

Heat the bearing cones (2) and (3) in a bearing oven to a temperature of 110℃ (230℉).

## STEP 20

Install the bearing cone (3) onto the low speed clutch shaft. Make sure the bearing cone is against the gear.

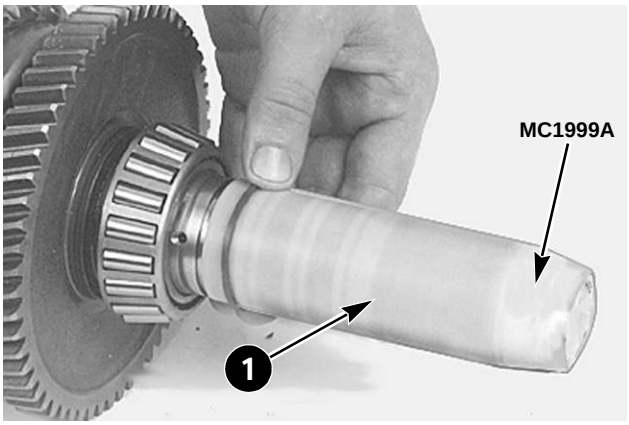
> ⚠ **WARNING:** Always wear heat protective gloves or mittens when handling heated parts.

## STEP 21

Use a suitable hydraulic press onto bearing cone (2) inner race and press into position.

**IMPORTANT:** *Make sure the bearing cone cage does not make contact with the press. Install a suitable spacer between the press and the bearing cone inner race.*

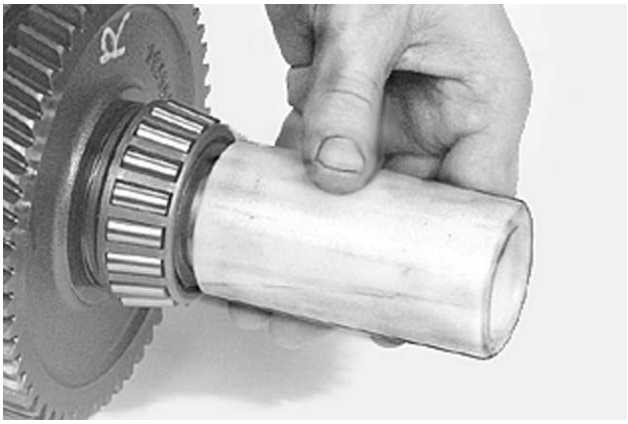
## STEP 22



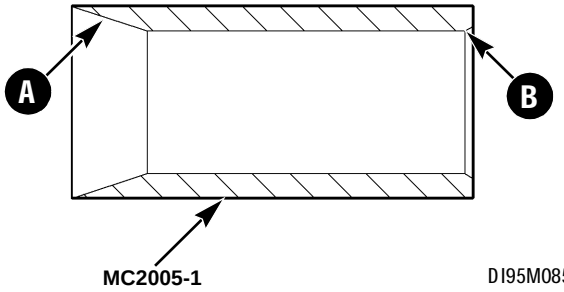

MD05J076

Lubricate a new sealing ring (1) with clean transmission oil. Using the seal expander MC1999A, install the sealing ring into the inner groove on the input shaft. Remove the seal expander MC1999A.

## STEP 23



MD05J075




DI95M085

Compress and reshape the seal ring (1) by hand. Install the long chamfer end (A) of the seal compressor MC2005-1, over the low speed clutch shaft and sealing ring (1). Remove the seal compressor MC2005-1 then install the short chamfer end (B) of the seal compressor over the sealing ring (1).

**NOTE:** *Only by using the seal compressor can the seals (1) be compressed to the correct working size.*

## STEP 24

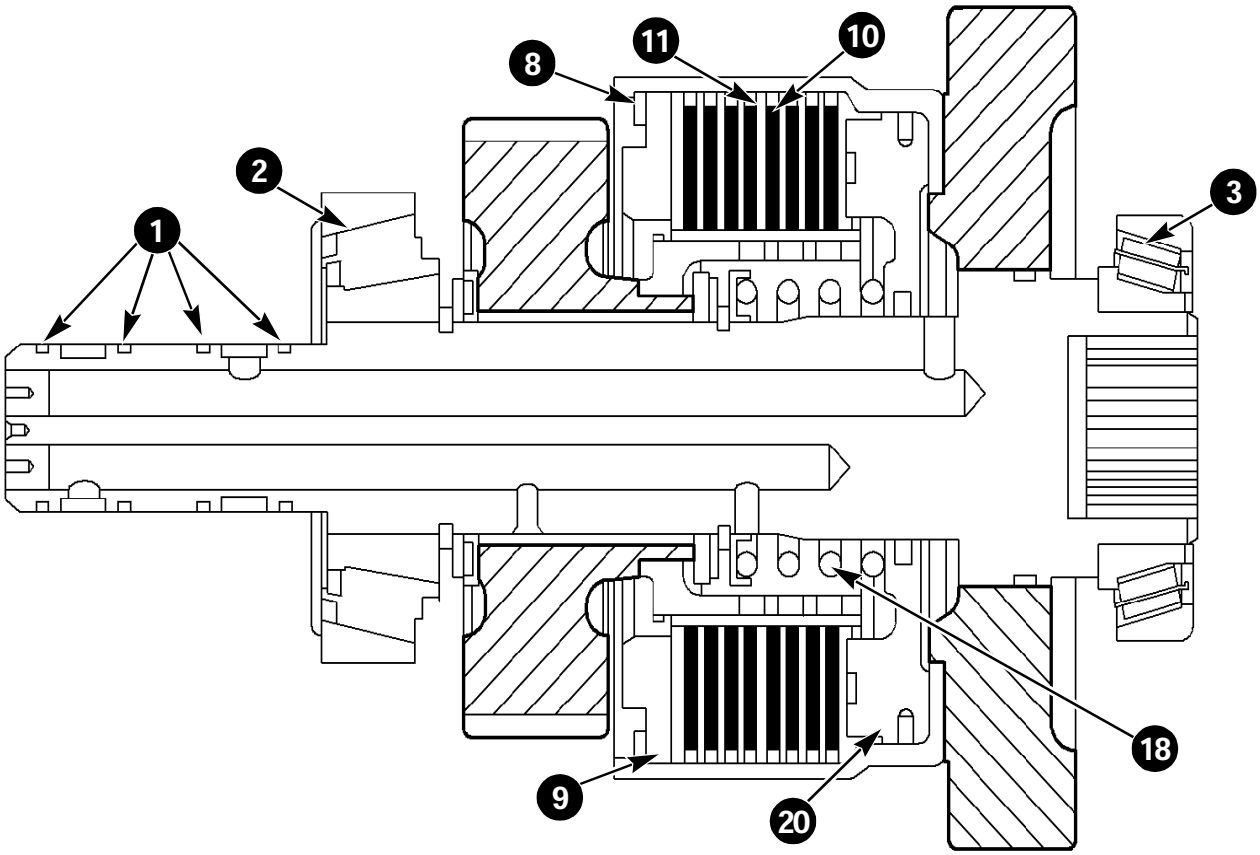
Repeat STEP 22 and STEP 23 for the remaining sealing rings (1).

**NOTE:** *Check the new sealing rings are not twisted or damaged and the sealing rings will turn freely in the grooves.*

https://truckmanualshub.com/



## Cross Sectional Drawing of the Low Speed Clutch Shaft




3.BEARING 10. FRICTION PLATES (8) 20.PISTON

https://truckmanualshub.com/



# HIGH SPEED CLUTCH SHAFT

## Disassembly

### STEP 1

Remove and discard the sealing rings (1).

### STEP 2

Use a suitable bearing puller and remove the bearing cone (2).

### STEP 3




MD05J081

Use a suitable bearing puller and remove bearing cone (3) thrust bearing (4), thrust washer (5) and gear (6).

### STEP 4

Release the retaining ring (7) from the clutch housing

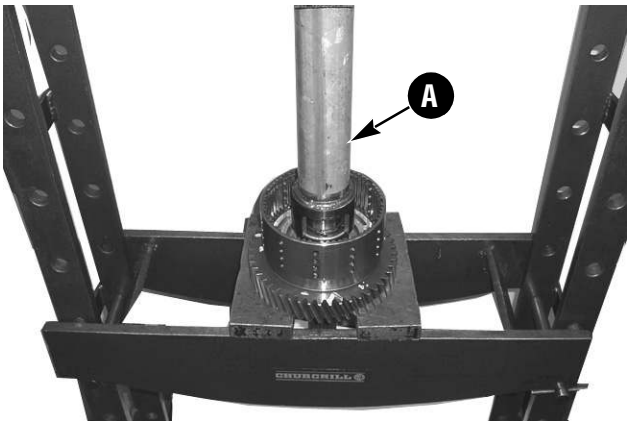
### STEP 5

Remove the backing plate (8) friction plates (9), separator plates 10.

### STEP 6

Remove bearing (11), spacer (12) and bearing (13). Remove thrust bearing (14) and thrust washer (15).

### STEP 7




MD05J070

Install the high speed clutch shaft onto a suitable hydraulic press. Use the spring compressor 1013T1 (A) to compress the piston return spring (18). Release the snap ring (16) from the groove in the input shaft. Release the pressure from the press and remove the spring compressor.

### STEP 8

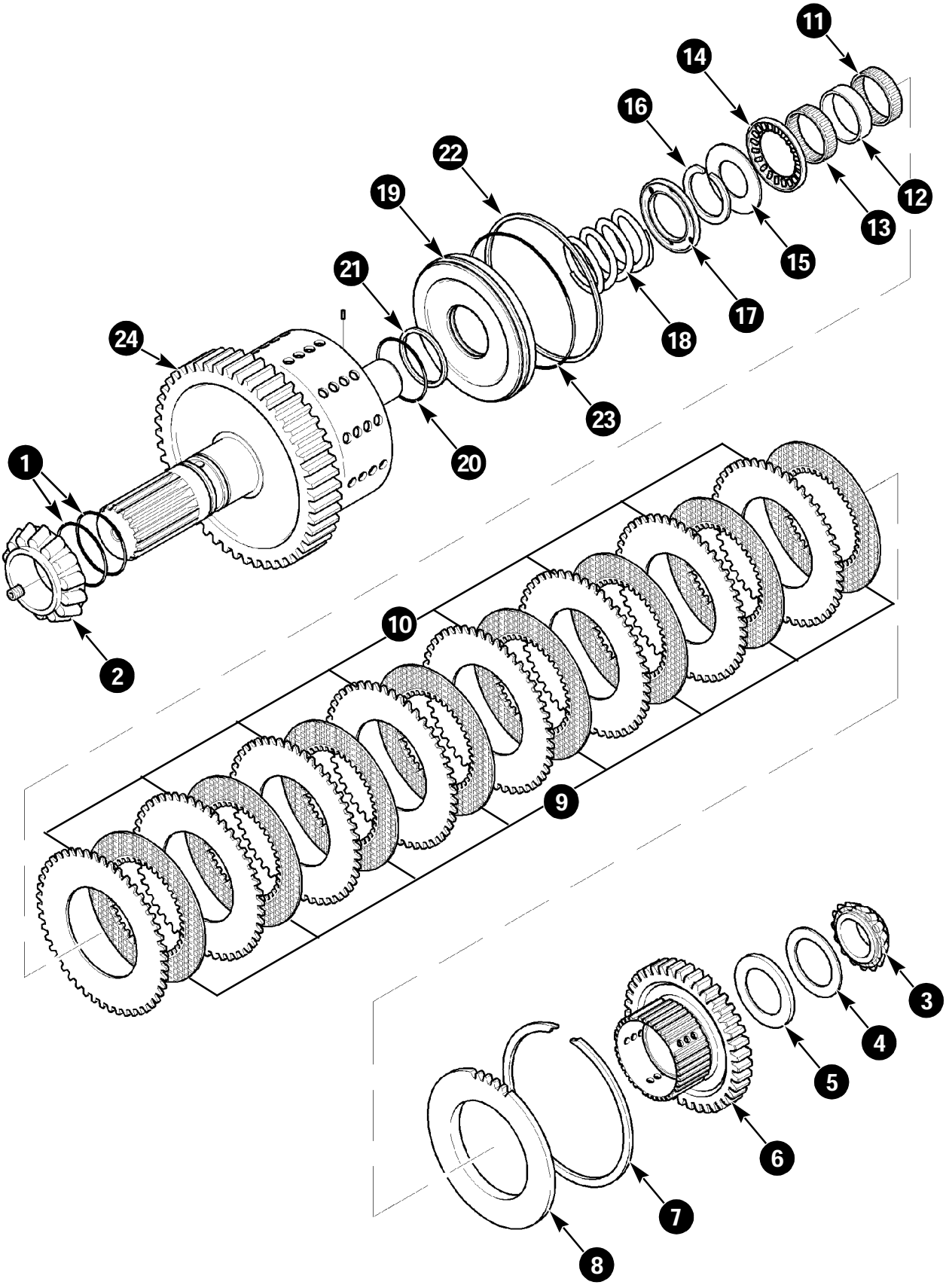
Remove the snap ring (16), retainer (17) spring (18) and piston (19).

### STEP 9

Remove and discard the piston sealing ring (20), o-ring (21), sealing ring (22) and o-ring (23).

https://truckmanualshub.com/





https://truckmanualshub.com/



## Assembly

### STEP 10

Lubricate and install a new o-ring (23) and sealing ring (22) into the outer groove of the piston (19). Lubricate and install a new o-ring (20) and sealing ring (21) into the inner groove of the piston (19).

**NOTE:** *Make sure the o-rings are installed before the sealing rings. Check the sealing rings (21) and (22) are not twisted or damaged.*

### STEP 11

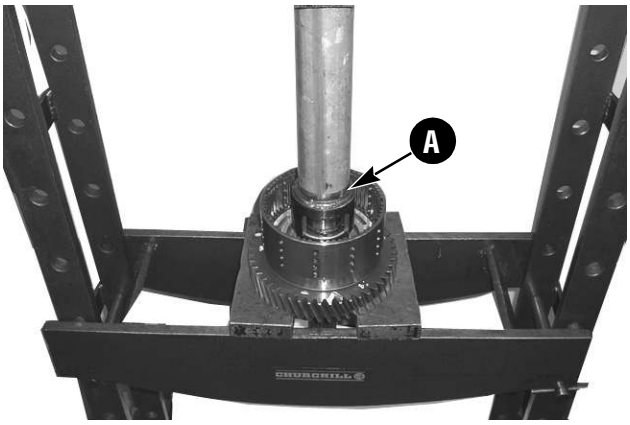
Install the piston (19) into the high speed clutch housing. Make sure the grooved side of the piston is facing outward. Carefully push the piston into the housing using even pressure. If the piston locks up during installation, remove the piston and install again.

**IMPORTANT:** *Never use force to correct wrong alignment of the piston.*

### STEP 12

Install the piston return spring (18) and spring retainer (17). Make sure the spring (18) locates correctly into the cup side of the spring retainer (17). Install the snap ring (16) onto the low speed clutch shaft.

### STEP 13




MD05J070

Install the input shaft onto a suitable hydraulic press. Use the spring compressor 1013T1 (A) to compress the piston return spring (18). Install the snap ring (16) into the groove in the low speed clutch shaft. Release the pressure from the press and remove the spring compressor.

### STEP 14

Install the thrust washer (15), thrust bearing (14), bearing cage (13), narrow spacer (12) and bearing cage (11) onto the high speed clutch shaft.

**IMPORTANT:** *Make sure the open side (needle rollers) of the thrust bearing (14) is towards the thrust washer (15).*

### STEP 15

Install one metal separator plate (10) and one friction plate (11) into the high speed clutch housing. Continue to install one metal separator plate (10) then one friction plate (9), until eight metal separator plates and eight friction plates have been installed. The last plate installed must be a friction plate.

**IMPORTANT:** *If new friction plates are to be installed, make sure all the friction plates have the same friction material pattern and the friction plates have been soaked in clean transmission oil before installation.*

### STEP 16

Install the backing plate (8), make sure the recessed side of the backing plate is facing outward. Install the snap ring (7), make sure the snap ring is located correctly into the groove in the clutch housing.

### STEP 17

Align the clutch pack friction plates and install the high speed gear hub (6). Make sure all the friction plates engage onto the gear hub (6).

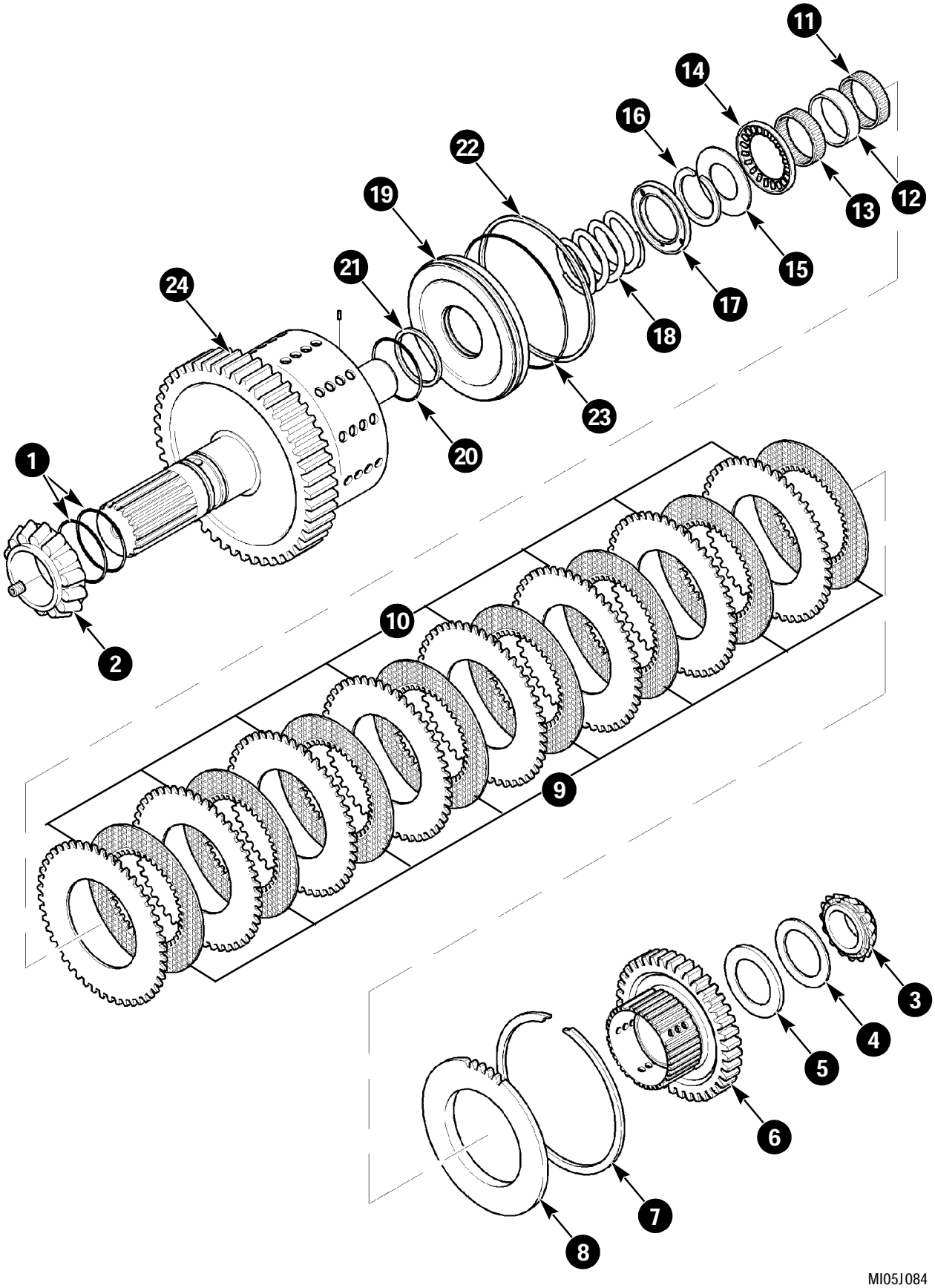
### STEP 18

Install thrust bearing (5) and thrust washer (4).

**IMPORTANT:** *Make sure the open side (needle rollers) of the thrust bearing (5) is towards the thrust washer (4).*

https://truckmanualshub.com/





https://truckmanualshub.com/



## STEP 19

Heat the bearing cones (2) and (3) in a bearing oven to a temperature of 110°C (230°F).

## STEP 20

Install the bearing cone (2) onto the high speed clutch shaft. Make sure the bearing cone is against the gear.

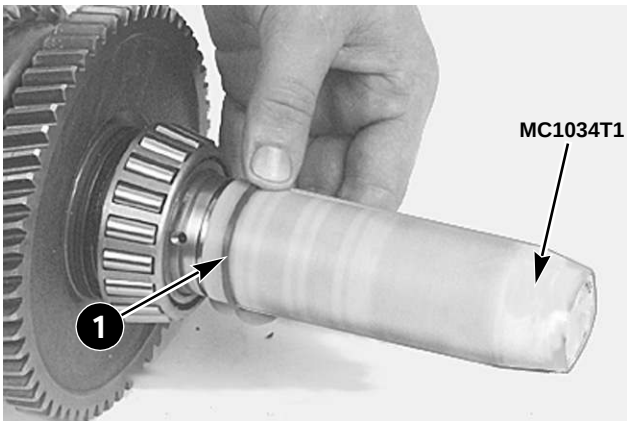
> **WARNING:** Always wear heat protective gloves or mittens when handling heated parts.

## STEP 21

Use a suitable hydraulic press onto bearing cone (3) inner race and press into position.

**IMPORTANT:** *Make sure the bearing cone cage does not make contact with the press. Install a suitable spacer between the press and the bearing cone inner race.*

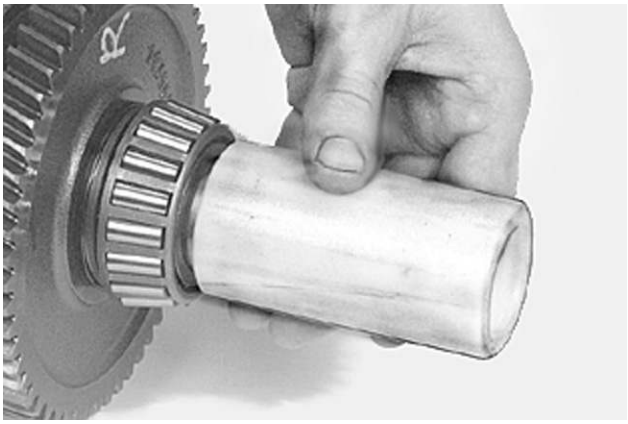
## STEP 22



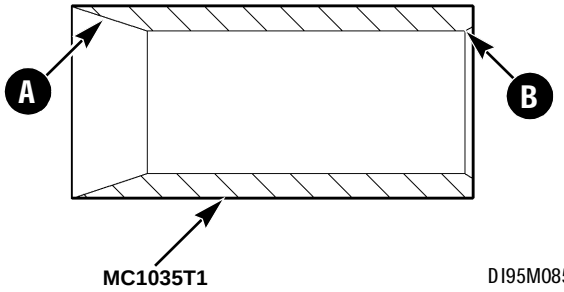

MD05J076

Lubricate a new sealing ring (1) with clean transmission oil. Using the seal expander 1034T1, install the sealing ring into the inner groove on the input shaft. Remove the seal expander 1034T1.

## STEP 23



MD05J075




DI95M085

Compress and reshape the seal ring (1) by hand. Install the long chamfer end (A) of the seal compressor 1035T1, over the high speed clutch shaft and sealing ring (1). Remove the seal compressor 1035T1 then install the short chamfer end (B) of the seal compressor over the sealing ring (1).

**NOTE:** *Only by using the seal compressor can the seals (1) be compressed to the correct working size.*

## STEP 24

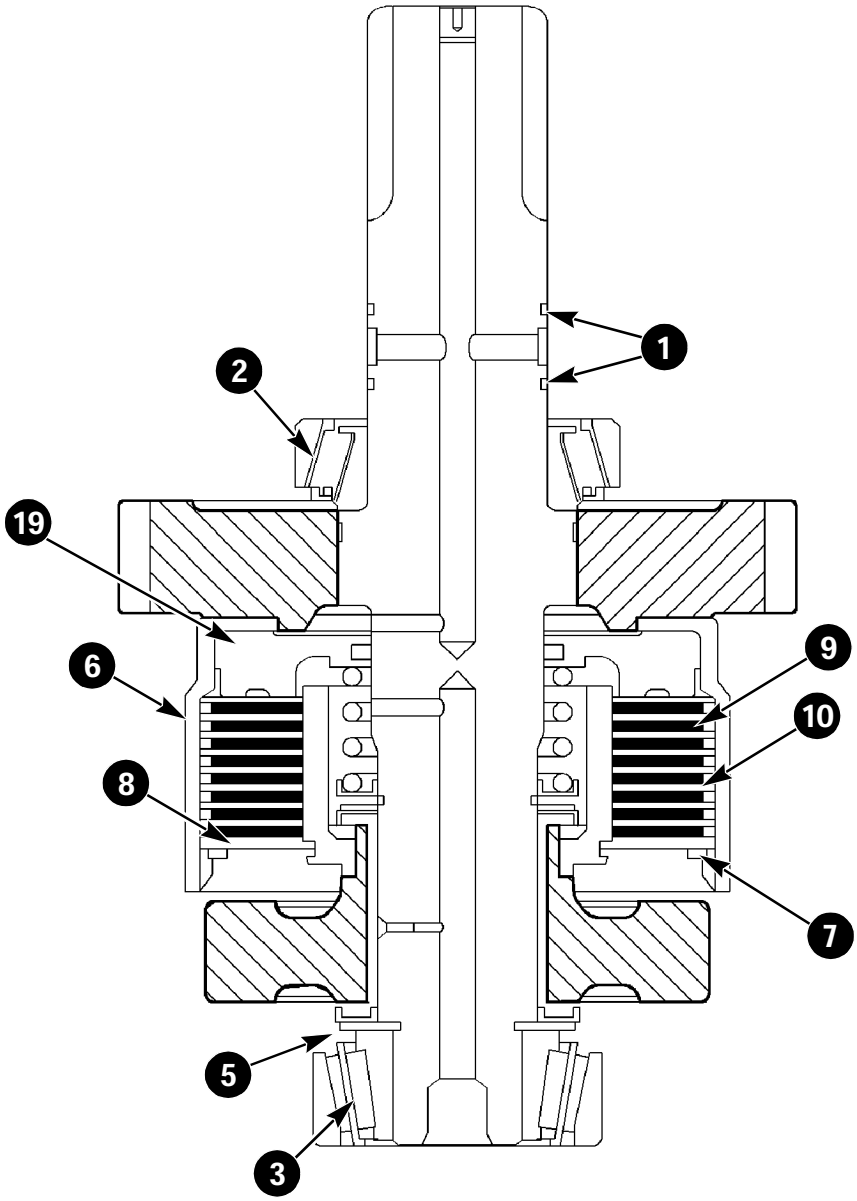
Repeat STEP 22 and STEP 23 for the remaining sealing rings (1).

**NOTE:** *Check the new sealing rings are not twisted or damaged and the sealing rings will turn freely in the grooves.*

https://truckmanualshub.com/



# Cross Sectional Drawing of the High Speed Clutch Shaft



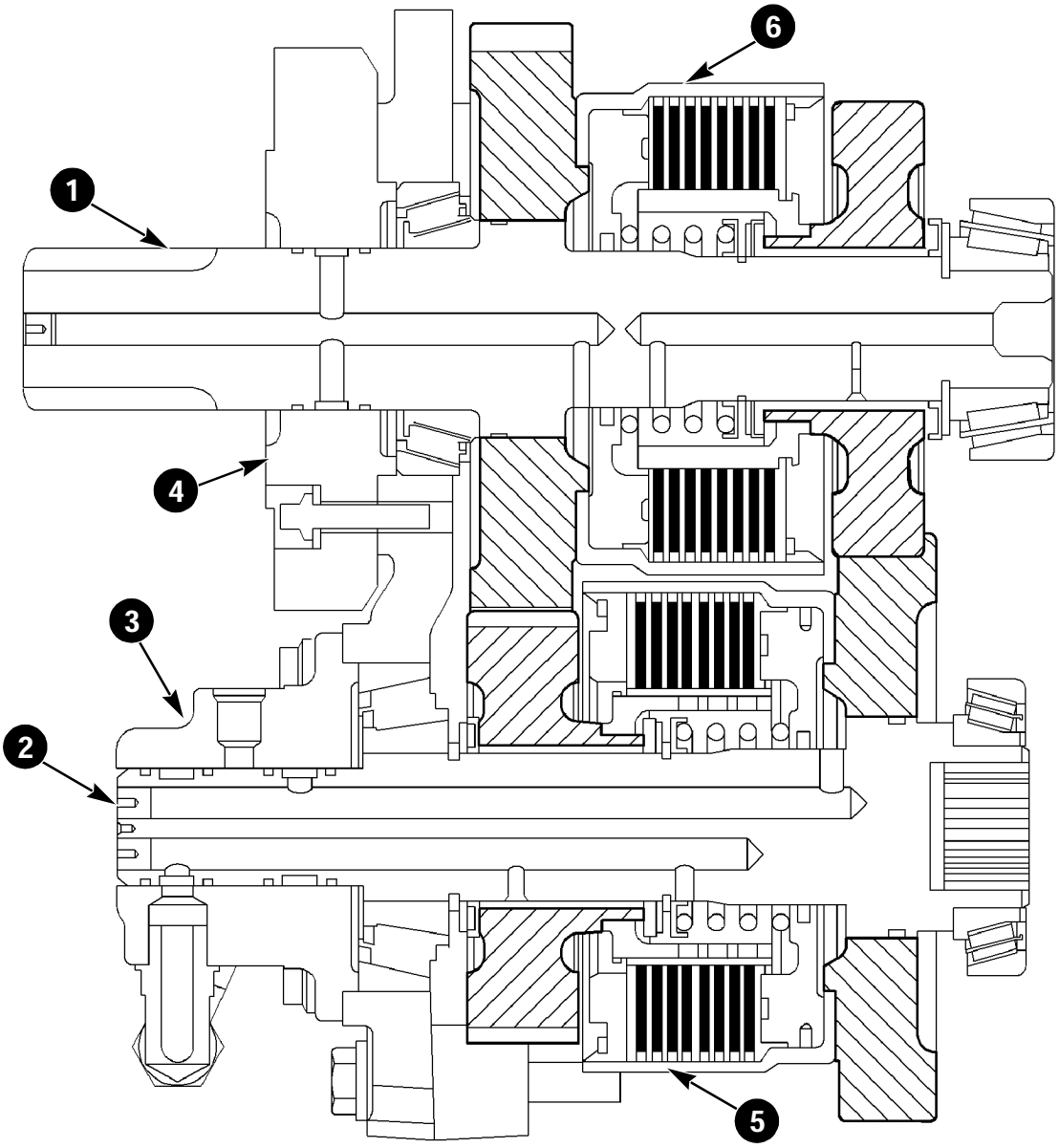

MI05J101

3.BEARING
5.THRUST WASHER
8.BACKING PLATE
9.SEPARATOR PLATES (8)

https://truckmanualshub.com/



# Cross Sectional Drawing of the High and Low Speed Transmission




Mi05J100

3.LOW CLUTCH SHAFT OIL DISTRIBUTOR

6.HIGH CLUTCH PACK

https://truckmanualshub.com/

# Section 6007

## RANGE TRANSMISSION SERVICING

## XTX185, 200 and 215 Tractors



McCORMICK

SM 8-15160

© 2006 McCormick Tractors International Limited.
September 2006

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIFICATIONS .....3

SPECIAL TORQUES .....3

SPECIAL TOOLS .....3

TOOLS TO BE MADE .....4

BEARING CARRIER HOUSING
- Removal .....5
- Installation .....9

PINION AND SHUTTLE SHAFT
- Removal .....17
- Installation .....19

INTERMEDIATE SHAFT
- Disassembly .....21
- Assembly .....22
- Cross Sectional Drawing of the Intermediate Shaft..... 23

SHUTTLE SHAFT
- Disassembly .....24
- Assembly .....28
- Cross Sectional Drawing of the Shuttle Shaft ..... 38

PINION SHAFT
- Disassembly and Assembly .....39
- First Gear Shimming Procedure .....42
- Synchronizer
  - Disassembly and Assembly .....44
- Pinion Shaft Centre Support
  - Disassembly and Assembly .....45
- Cross Sectional Drawing of the Pinion Shaft..... 46

PINION SHAFT SETTINGS
- Pinion Shaft Mounting Distance ..... 47
- Pinion Shaft Bearing Preload Setting ..... 49

https://truckmanualshub.com/



# SPECIFICATIONS

| | | |
|---|---|---|
| Transmission Oil Type | McCormick HTX | |
| Intermediate Shaft End Play | 0.01 to 0.1 mm | 0.001 to 0.0039 inch |
| Shuttle Shaft | | |
| Friction Plate Thickness | 2.825 to 2.975 mm | 0.071 to 0.077 inch |
| Separator Plate Thickness | 1.825 to 1.975 mm | 0.111 to 0.117 inch |
| Backing Plate Thickness | 10.8 to 11.05 mm | 0.425 to 0.435 inch |
| Number of Clutch Plates | | |
| Forward Clutch | | |
| Friction Plates | 10 | |
| Separator Plates | 10 | |
| Reverse Clutch | | |
| Friction Plates | 8 | |
| Separator Plates | 8 | |
| End Play | 0.05 to 0.15 mm | 0.002 to 0.006 inch |
| Pinion Shaft | | |
| 1st Gear End Play | 0.2 to 0.5 mm | 0.008 to 0.02 inch |
| Pinion Bearing Rolling Pull | 1.5 to 4.5 kg/f | 3.3 to 8.8 lb/f |

# SPECIAL TORQUES

| | | |
|---|---|---|
| Bearing Carrier Housing Retaining Bolt | 250 to 280 Nm | 185 to 206 lb.ft |
| Pinion Shaft Rear Bearing Support Retaining Bolt | | |
| With Loctite 638 (680) | 100 to 113 Nm | 74 to 83 lb.ft |
| Pinion Shaft Centre Bearing Carrier Retaining Bolt | | |
| (12 Point Fixing) | 250 to 280 Nm | 185 to 206 lb.ft |
| Gear Selector Housing Retaining Bolts | | |
| (XtraSpeed - E and E Plus Tractors) | 39 to 48 Nm | 29 to 35 lb.ft |

# SPECIAL TOOLS

**1. MC1995A ALIGNMENT STUDS**

**2. MC2572 ALIGNMENT STUDS**

**3. MC2620 INTERMEDIATE SHAFT HOLDER**

**4. MC1999A SEAL RING EXPANDER**

**5. MC2005-1 SEAL RING COMPRESSOR**

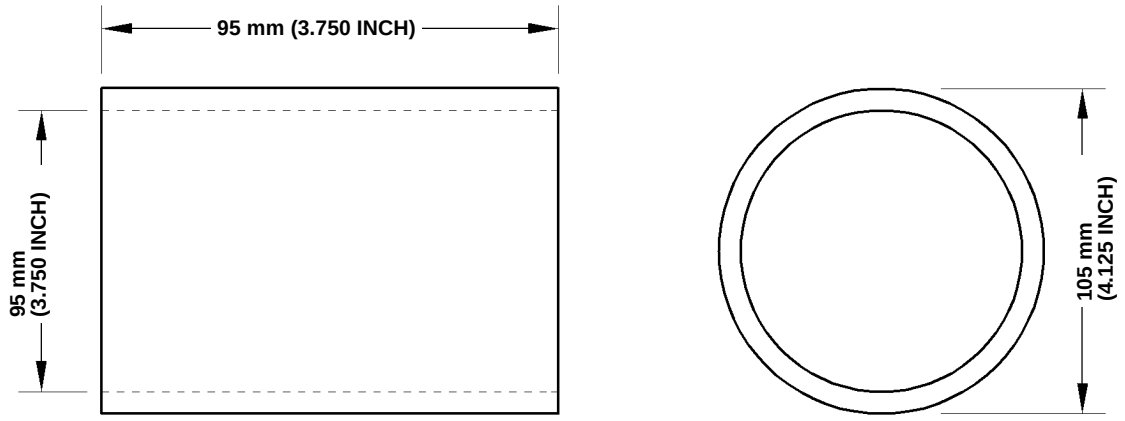
**6. MC2621 PINION SHAFT PULLER ADAPTER (IF REQUIRED)**

**7. 1031T1 CLUTCH PACK SPRING COMPRESSOR**

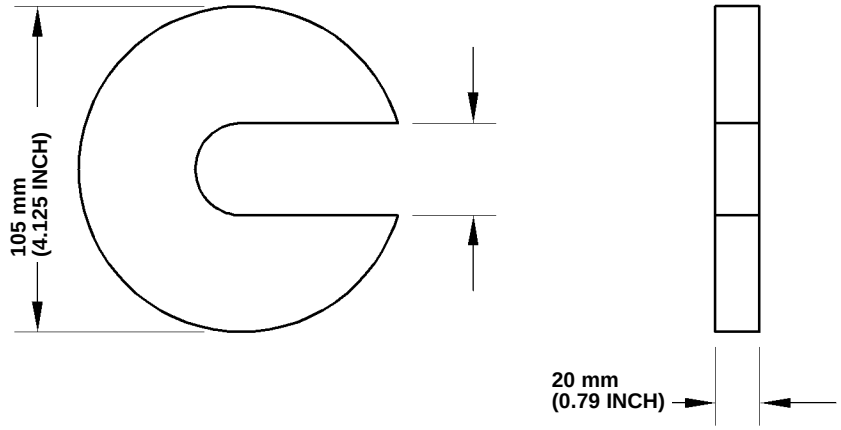
https://truckmanualshub.com/



# TOOLS TO BE MADE




SHUTTLE SHAFT SLEEVE




SHUTTLE SHAFT WASHER

https://truckmanualshub.com/



# BEARING CARRIER HOUSING

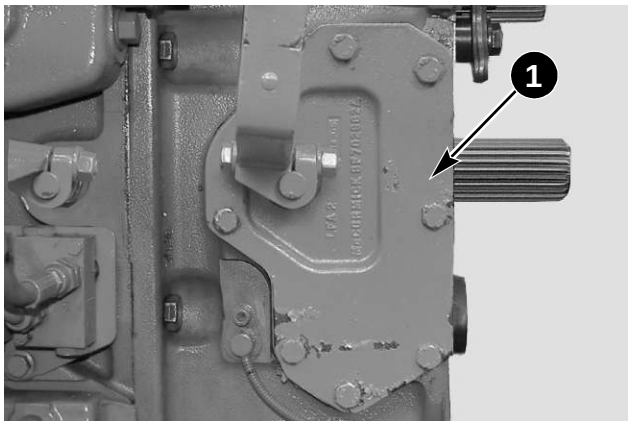
Before removing the bearing carrier housing it will be necessary to carry out the following:

- Remove the cab and separate the speed and range transmission, refer to Section 6003.
- Remove the MFD/Park brake assembly, refer to Section 6017.
- If the pinion shaft or the pinion shaft bearings are to be replaced, remove the rear axles and remove the differential, refer to Section 6012.

**IMPORTANT:** *The pinion shaft and crown wheel ring gears are supplied as a matched set and must be replaced together if necessary. If new pinion shaft and crown wheel ring gears are installed the correct pinion shaft mounting distance and bearing preload must be set and the correct pinion gear and ring gear tooth patterns MUST be set correctly.*

## Removal

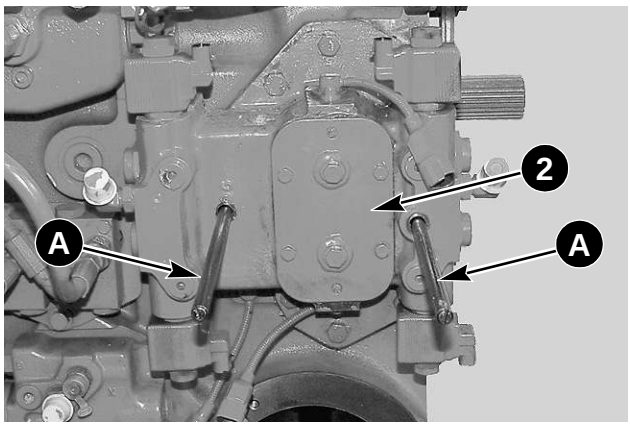
### STEP 1




MD06C106

For XtraSpeed tractors remove the retaining bolts and remove the 3rd/4th gear selector linkage mounting plate (1).

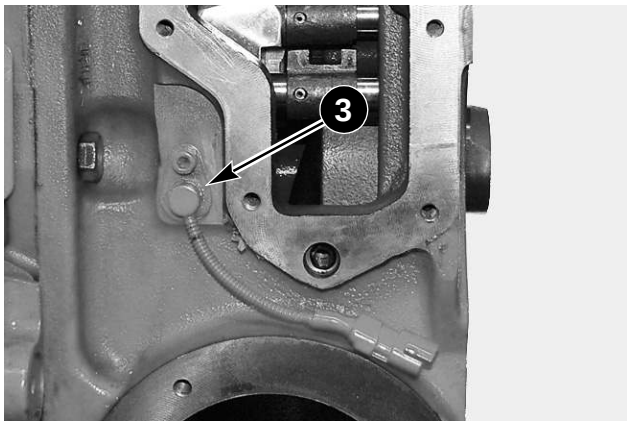
### STEP 2




MD06C109

For XtraSpeed - E and E Plus tractors remove two retaining bolts and install alignment studs (MC1995A) (A) as shown. Remove the remaining retaining bolts and remove the gear selector linkage housing (2).

### STEP 3

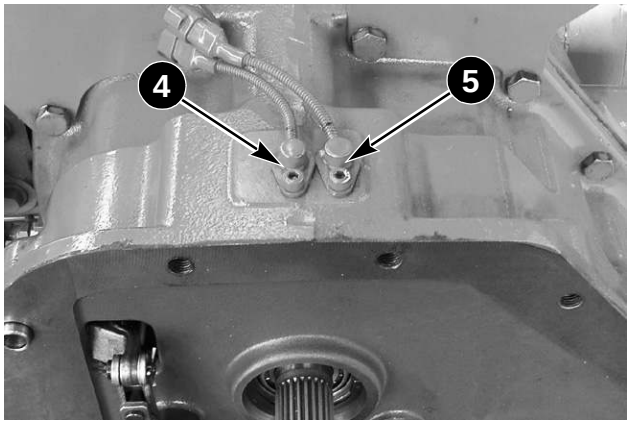



MD06C107

Remove the retaining screw and remove PTO ‘B’ sensor (3) and shim if equipped. Discard the o-ring from the speed sensor.

**NOTE:** *Make sure the shims are retained for installation.*

### STEP 4




MD06C027

Remove the retaining screw and remove the Inter ‘A’ speed sensor (4) and Inter ‘B’ speed sensor (5) (If equipped). Discard the o-ring from the speed sensor.

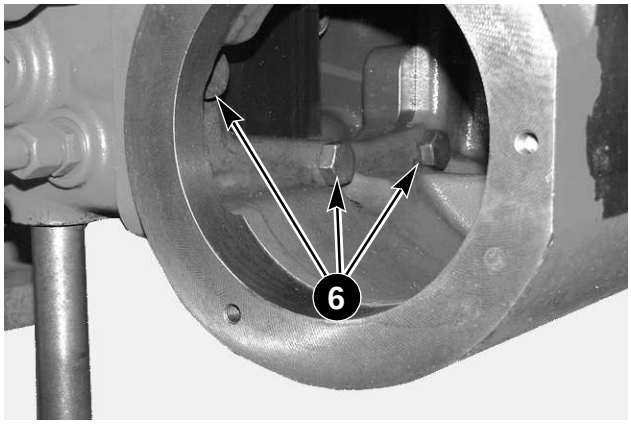
**NOTE:** *Only tractors up to P.I.N JJE350083 are equipped with Inter ‘B’ speed sensors.*

**NOTE:** *Some speed sensors are equipped with shims. Shims must be retained for installation.*

https://truckmanualshub.com/



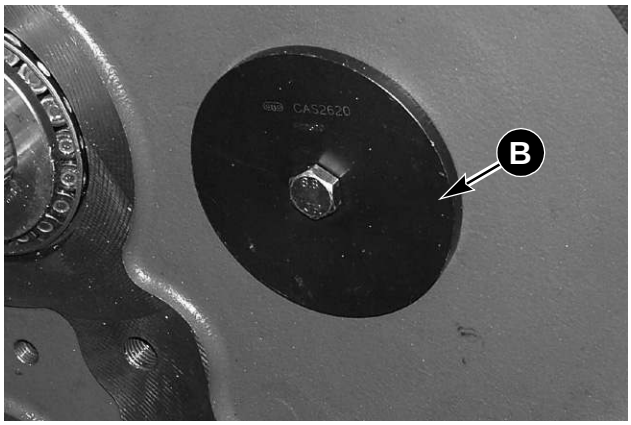
## STEP 5




MD06C065

Gaining access through the filter screen housing, remove the three internal bearing carrier housing housing retaining bolts (6).

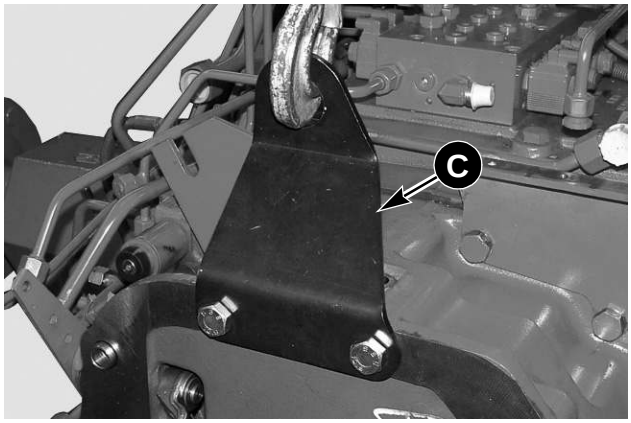
## STEP 6




DI06C028

Install the intermediate shaft holder MC2620 (B) and a 10 x 35 mm bolt onto the intermediate shaft. Tighten the bolt to secure the intermediate shaft to the bearing carrier housing.

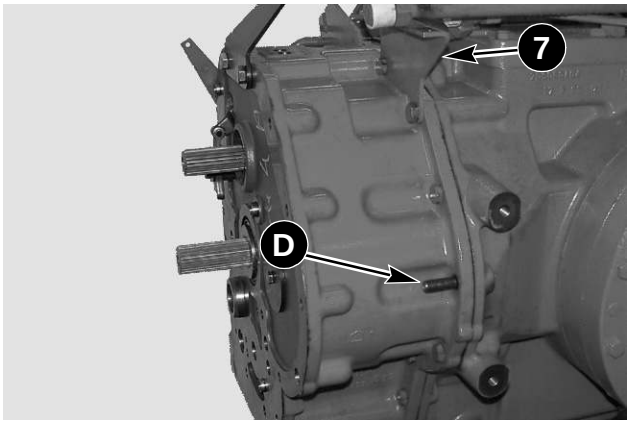
## STEP 7



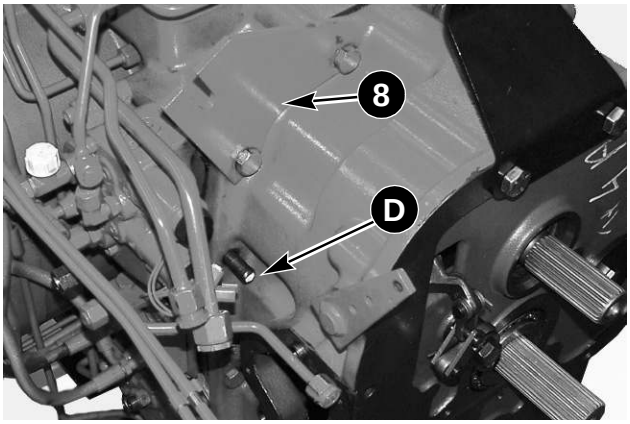

DI06C028

Install the lifting bracket MC2565 (C) using two 16 x 35 mm bolts. Attach suitable lifting equipment to the lifting bracket.

## STEP 8




MI06C086



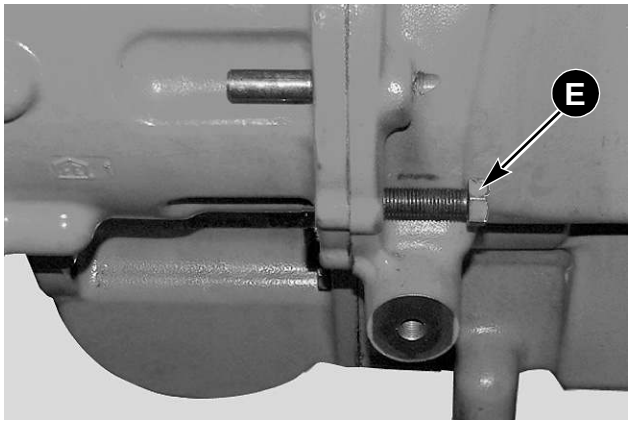

MI06C087

Remove two bearing carrier housing retaining bolts and install two MC2572 alignment studs (D) as shown. Remove the remaining bearing carrier housing retaining bolts and remove the tube support bracket (7) and park brake cable bracket (8). Make sure all bolts have been removed.

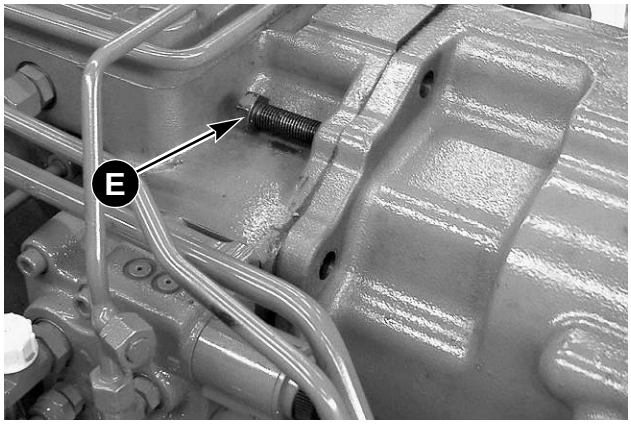
https://truckmanualshub.com/



## STEP 9



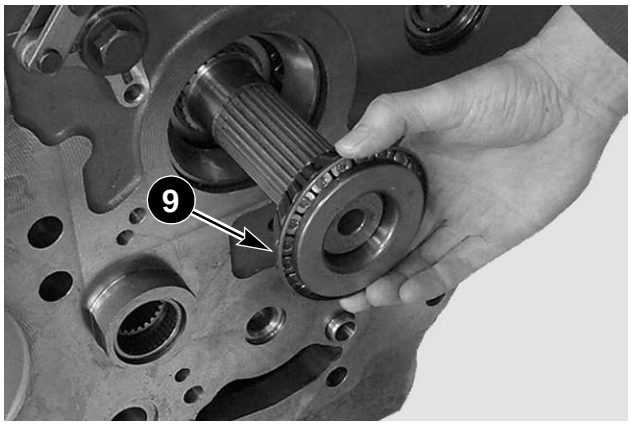

MD06C089




MD06C088

Install two 16 mm jacking bolts (E) with a minimum thread length of 75 mm as shown. Evenly tighten the bolts until the seal between the bearing carrier housing and the range transmission is broken and the pinion bearing begins to be pulled from the pinion shaft.

## STEP 10




MD06C079

Continue tightening the jacking bolts until the pinion bearing is free of the pinion shaft, remove the pinion bearing (9).

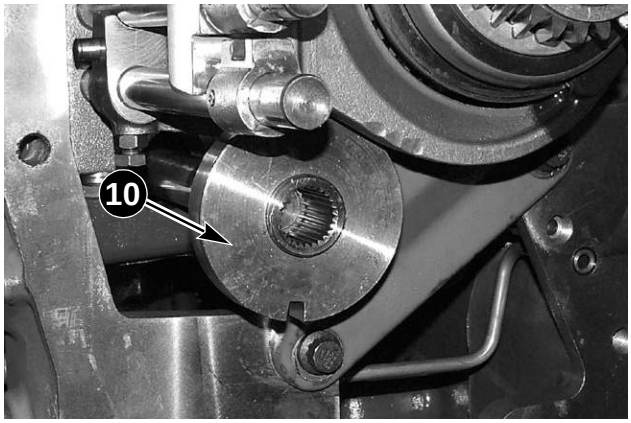
## STEP 11

With the bearing carrier housing supported on the lifting equipment, carefully remove bearing carrier housing and intermediate shaft.

## STEP 12

Support the intermediate shaft and remove the intermediate shaft holder MC2620. Remove the intermediate shaft from the bearing carrier housing.

## STEP 13

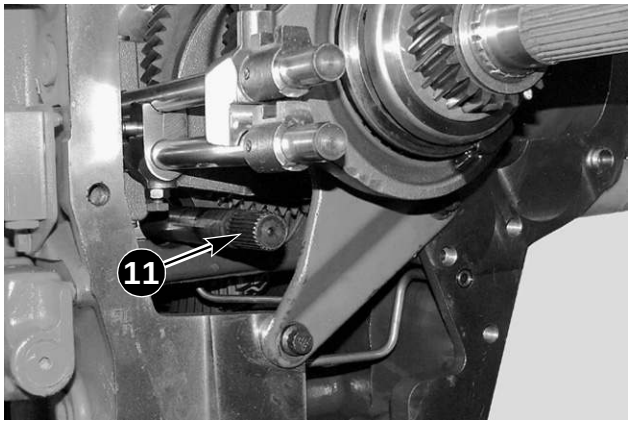



MD06C090

Remove the PTO drive shaft coupler/load sensing wheel (10) from the PTO shaft.

**NOTE:** *It may be necessary to move the 3rd/4th selector fork forward to engage 4th gear to enable the PTO drive shaft coupler/load sensing wheel to be removed.*

## STEP 14



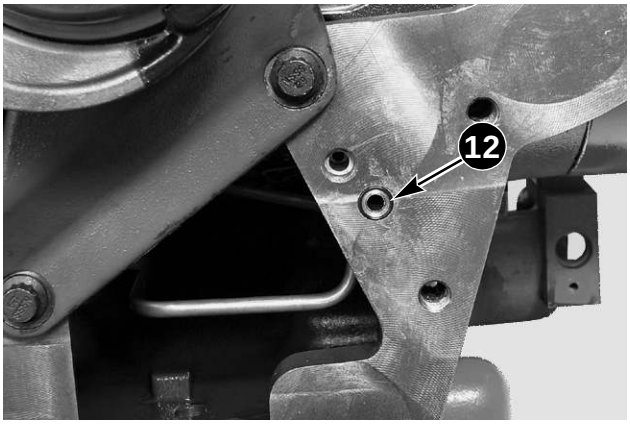

MD06C091

Remove the PTO drive shaft (11).

https://truckmanualshub.com/



## STEP 15




MD06C081

Remove and discard the o-ring (12) from the range transmission housing. Clean the mounting faces of the range transmission and bearing carrier housing.

**NOTE:** *Do not use abrasive materials to clean the transmission mounting faces.*

## STEP 16

Clean the mounting faces of the bearing carrier housing and the 3rd/4th gear selector linkage plate (XtraSpeed tractors) or gear selector linkage housing (XtraSpeed - E and E Plus tractors).

**NOTE:** *Do not use abrasive materials to clean the transmission mounting faces.*

https://truckmanualshub.com/



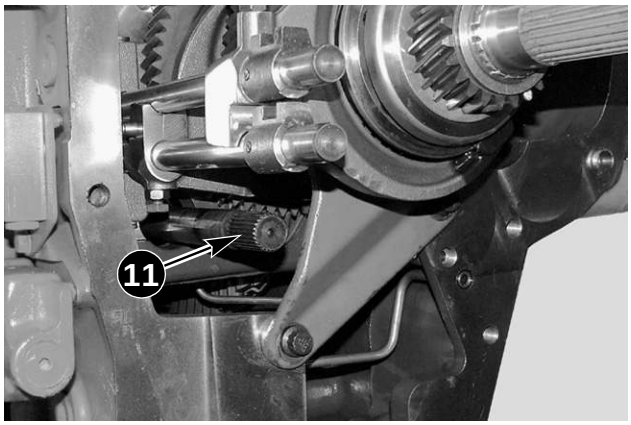
## Installation

**IMPORTANT:** *If a new crown wheel and pinion have been installed or new pinion bearings have been installed, the pinion bearing preload and gear tooth patterns must be set.*

### STEP 17

Make sure the mounting faces of the range transmission and bearing carrier housing are clean.

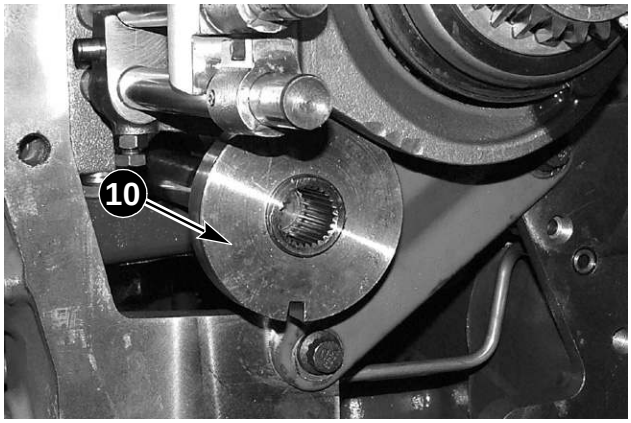
### STEP 18




MD06C091

Install the PTO drive shaft (11). Make sure the drive shaft locates correctly into the PTO clutch hub.

### STEP 19

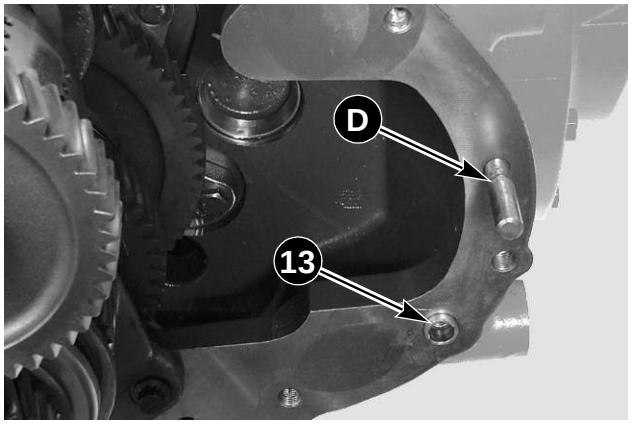



MD06C090

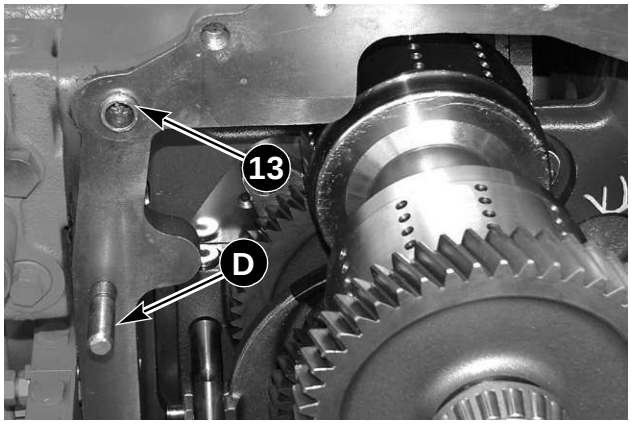
Install the PTO drive shaft coupler/coupler/load sensing wheel (10) onto the PTO shaft.

**NOTE:** *It may be necessary to move the 3rd/4th selector fork forward to engage 4th gear to enable the PTO drive shaft coupler/load sensing wheel to be installed.*

### STEP 20



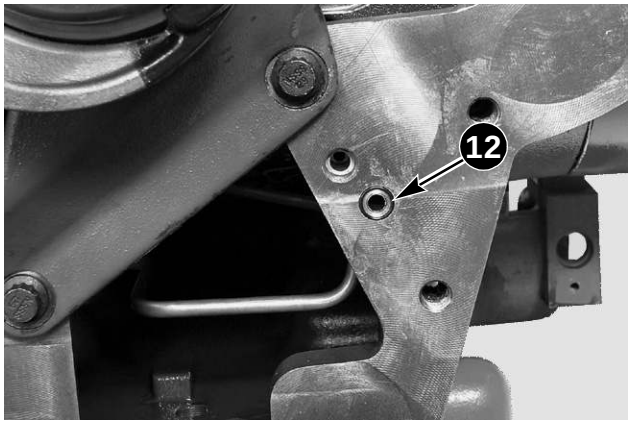

MI06C082




DI96B001

Install two MC2572 alignment studs (D) as shown. Make sure the location dowels (13) are installed into the range transmission in location shown or installed into the bearing carrier housing.

### STEP 21



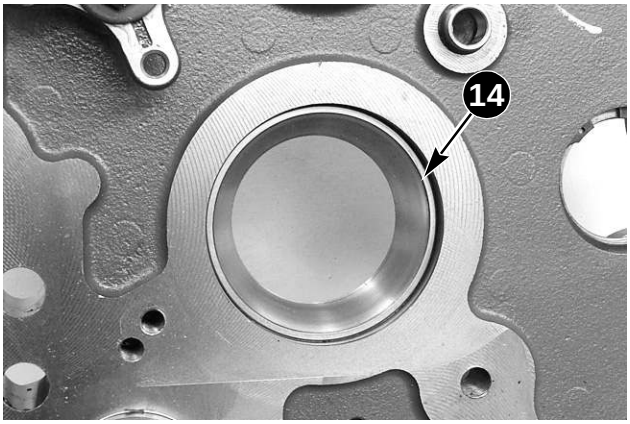

MI06C081

Install a new o-ring (12) and apply a continuous bead of Loctite 515 to the range transmission mounting face.

https://truckmanualshub.com/



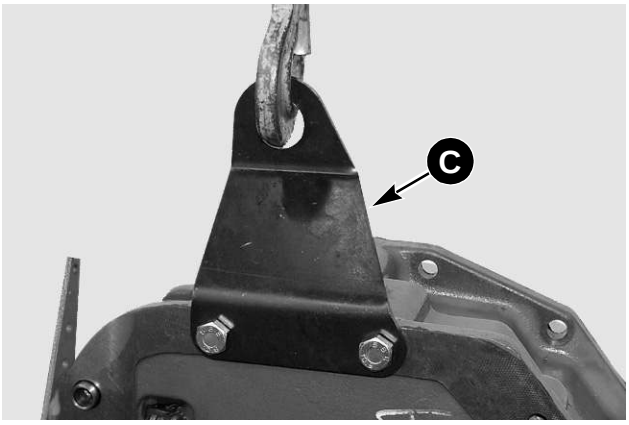
## STEP 22




MD06C061

Make sure the bearing cup (14) is fully installed against the shoulder in the bearing carrier housing.

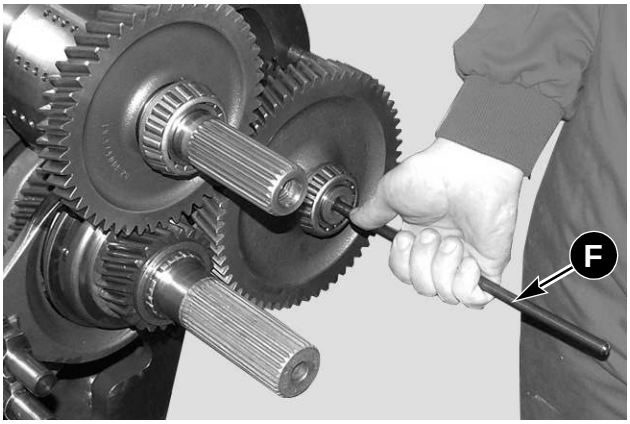
## STEP 23




DI06C028

Install the lifting bracket MC2565 (C) using two 16 x 35 mm bolts.

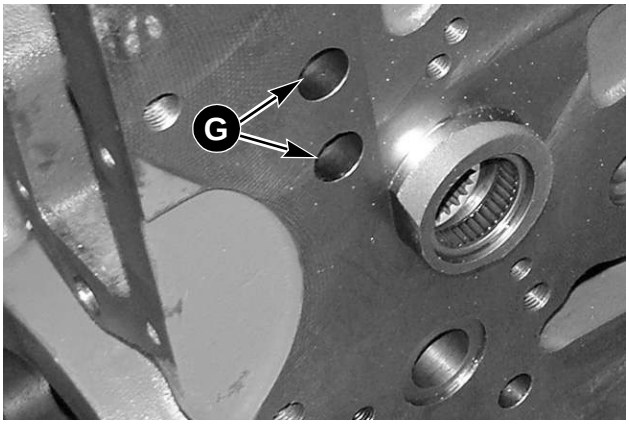
## STEP 24




DI06C028

Install a 10 mm alignment stud MC1995A (F) into the threaded end of the intermediate shaft to use as a handle. Have an assistant install and hold the intermediate shaft into position in the range transmission housing.

## STEP 25



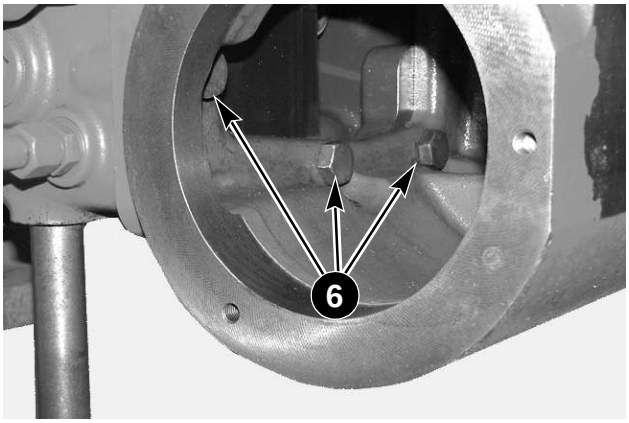

MD06C075

Attach suitable lifting equipment to the lifting bracket and install the bearing carrier housing onto the alignment studs. Slide the bearing carrier housing along the alignment studs. Make sure the shifter rails locate into shifter rail support holes (G) in the bearing carrier housing.

## STEP 26

Continue to fully install the bearing carrier housing, install and tighten bearing carrier housing retaining bolts to a torque of 250 to 280 Nm (185 to 206 lb ft). Remove the alignment studs from the range transmission and intermediate shaft and install and tighten the two remaining external retaining bolts to a torque of 250 to 280 Nm (185 to 206 lb ft).

## STEP 27



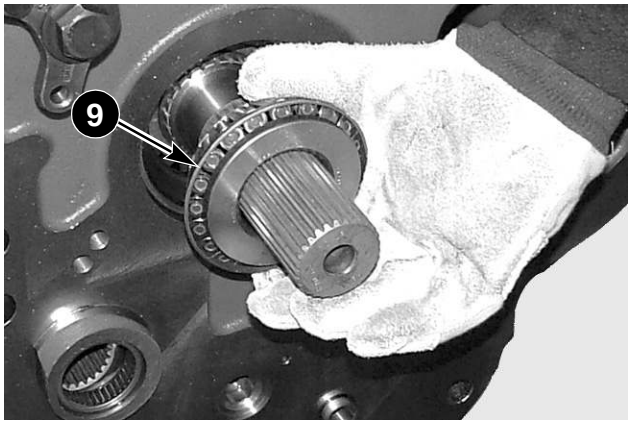

MD06C085

Gaining access through the filter screen housing, Install and tighten the three internal bearing carrier housing retaining bolts (6) to a torque of 250 to 280 Nm (185 to 206 lb ft).

https://truckmanualshub.com/



## STEP 28

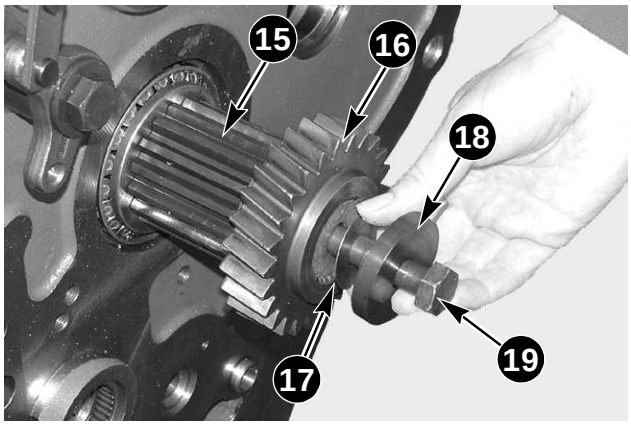



MI06C063

Heat the pinion shaft bearing cone (9) in a bearing oven to a temperature of 110°C (230°F). Install the bearing cone onto the pinion shaft.

> **WARNING:** ***Always wear heat protective gloves or mittens when handling heated parts.***

## STEP 29

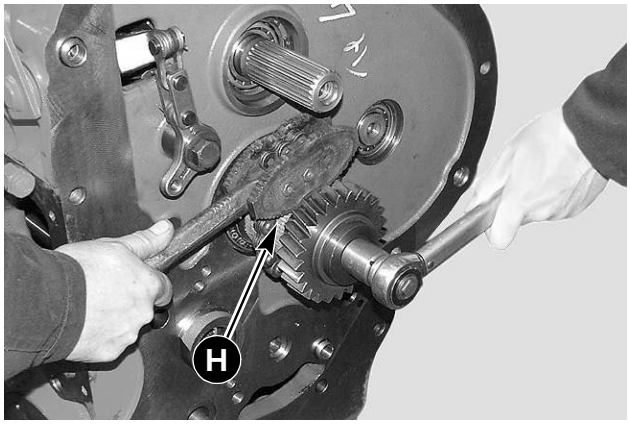



MD06C067

Install the park brake hub (15) and MFD drive gear (16). Install the shims (17) (see Important below), washer (18) and pinion retaining bolt (19).

**IMPORTANT:** *If the pinion shaft has not been serviced install the old shims (17) removed during the MFD clutch removal procedure. If the pinion shaft has been serviced install shims (17) determined during the pinion shaft bearing preload setting procedure.*

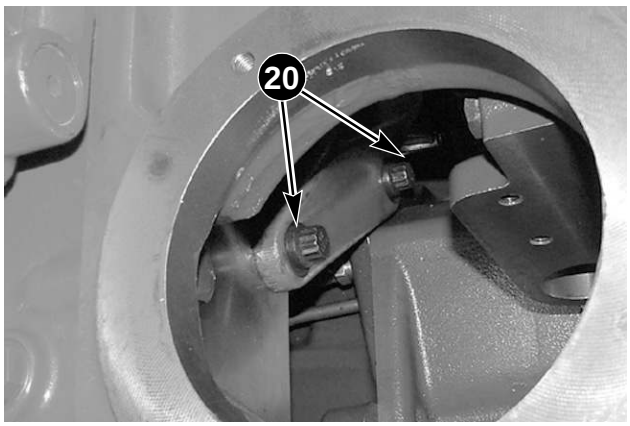
## STEP 30



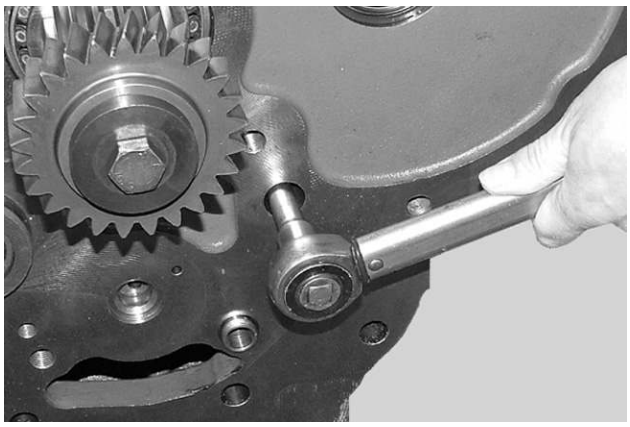

MD06C094

Install protective webbing (H) around the park brake hub. Using a suitable chain wrench, hold the pinion shaft and tighten pinion shaft retaining bolt to a torque of 280 Nm (206 lb ft). Remove the chain wrench.

## STEP 31




MD06C068



MD06C069

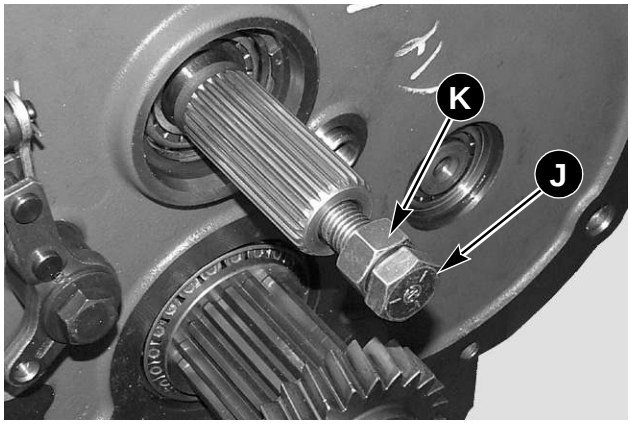
Gaining access through the filter screen housing for the lower centre bearing support bolt and through the bearing carrier housing for the upper centre bearing support bolt, tighten the bolts (20) (installed during pinion shaft installation) to a torque of 250 to 280 Nm (185 to 206 lb ft).

**NOTE:** *The PTO drive shaft and coupler/load sensing wheel have been removed for photographic purposes.*

https://truckmanualshub.com/



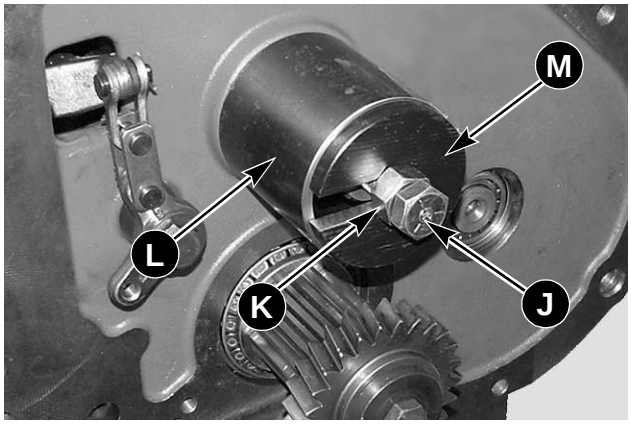
## STEP 32




MD06C095

Install a 3/4-10 x 2 inch UNC bolt (J) and nut (K) into the threaded end of the shuttle shaft as shown.

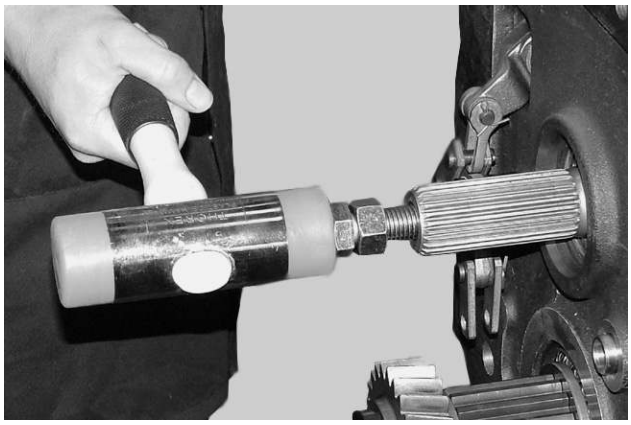
## STEP 33




MD06C096

Install sleeve (L) and washer (M) (refer to tools to be made). Hold bolt (J) and tighten nut (K) to pull the shuttle shaft, bearing cup, shims (if installed) and spacer against the snap ring.

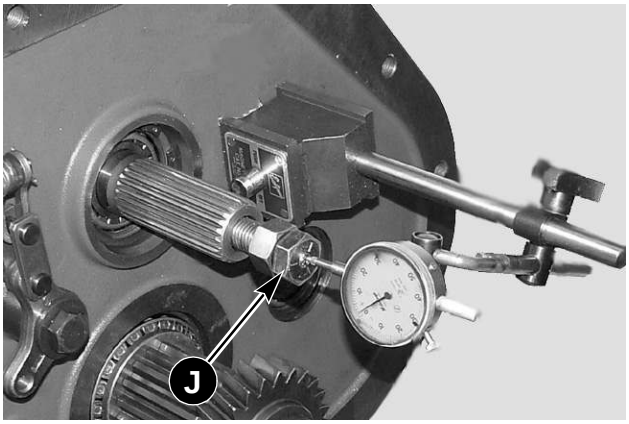
## STEP 34



MD06C097

Use a soft faced hammer and gently drive the shuttle shaft rearward to seat the rear bearing.

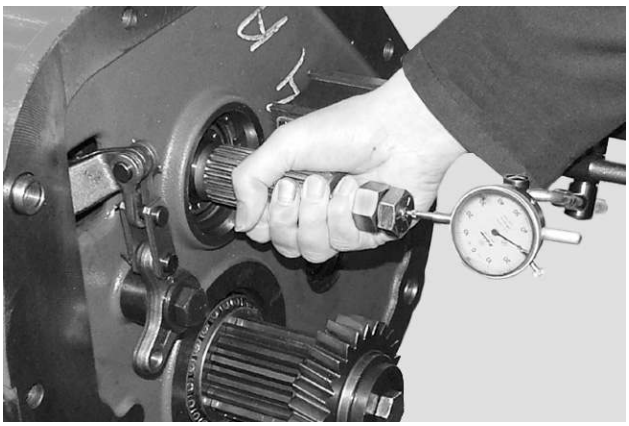
## STEP 35




MD06C097

Remove the sleeve and washer. Install a dial gauge onto the end of bolt (J), rotate the shuttle shaft and push and hold the shaft towards the rear of the transmission. Zero the dial gauge.

## STEP 36



MD06C098

Rotate then pull the shuttle shaft forward and note the end play reading on the dial gauge. Subtract 0.5 mm (0.02 inch) from the noted reading to give the required shim pack thickness to give a correct end play of 0.05 to 0.15 mm (0.002 to 0.006 inch).

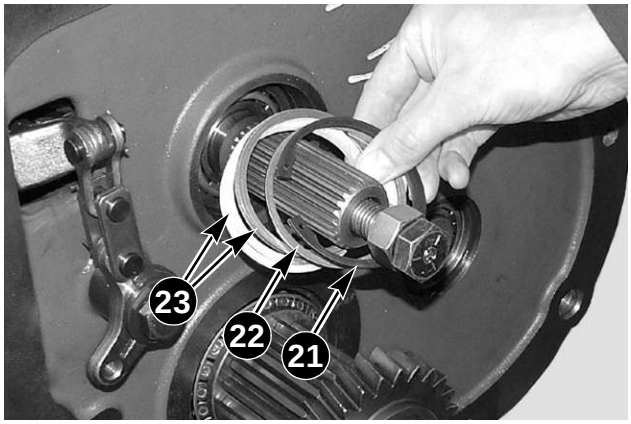
**NOTE:** *If the shuttle shaft bearings have not been replaced and the end play is NOT CORRECT, shims must be added or subtracted to give the correct end play, refer to STEP 37.*

**NOTE:** *If the shuttle shaft bearings have been replaced or the shims have not been installed add shims to give the correct end play, refer to STEP 37.*

https://truckmanualshub.com/



## STEP 37




MD06C099

Remove the snap ring (21) and spacer (22). Install the required shim pack (23) determined in STEP 36, spacer (22) and snap ring (21). Make sure the snap ring locates correctly into the snap ring groove.

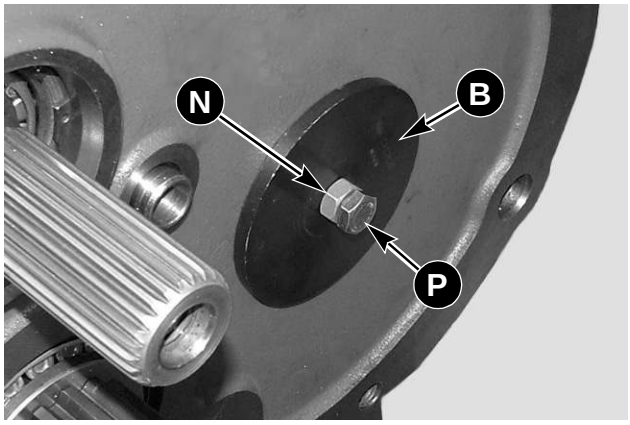
**NOTE:** *Hold the shim pack in position with petroleum jelly to prevent the shims from dropping into the snap ring groove.*

**NOTE:** *It may be necessary to use a bearing driver to install the bearing cup further into the bearing carrier housing to enable the shims to be installed.*

## STEP 38

Repeat STEP 32 to STEP 36 and check the shuttle shaft end play. The correct end play must be 0.05 to 0.015 mm (0.002 to 0.006 inch). Remove the bolt from the shuttle shaft.

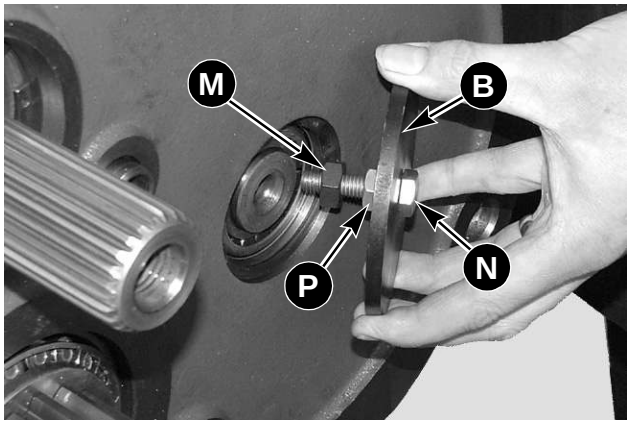
## STEP 39




MD06C100

Install the intermediate shaft holder MC2620 (B), a 10 mm bolt (P) (with a minimum thread length of 50 mm) and 10 mm nut (N) into the threaded end of the intermediate shaft as shown. Make sure the bolt is installed into the intermediate shaft at least 6 full turns. Hold bolt (P) and tighten nut (N) to pull the intermediate shaft, bearing cup, shims (if installed) and spacer against the snap ring.

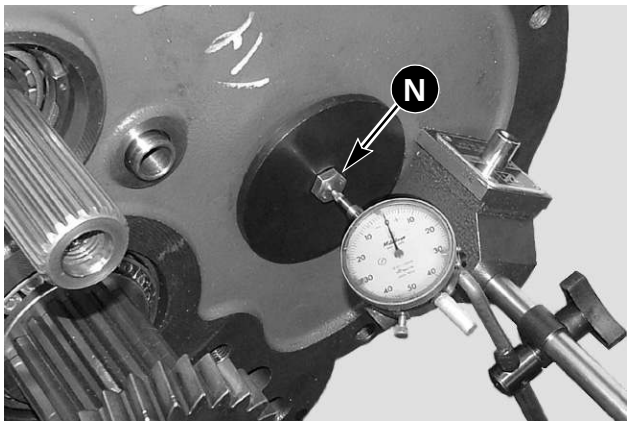
## STEP 40




MD06C101

Remove the intermediate shaft holder MC2620 (B) assembly. Install the intermediate shaft holder MC2620 onto bolt (N) and install and tighten nut (P), install a second nut (P) and install the intermediate shaft holder MC2620 (B) assembly into the intermediate shaft. Lock nut (P) against the intermediate shaft.

## STEP 41



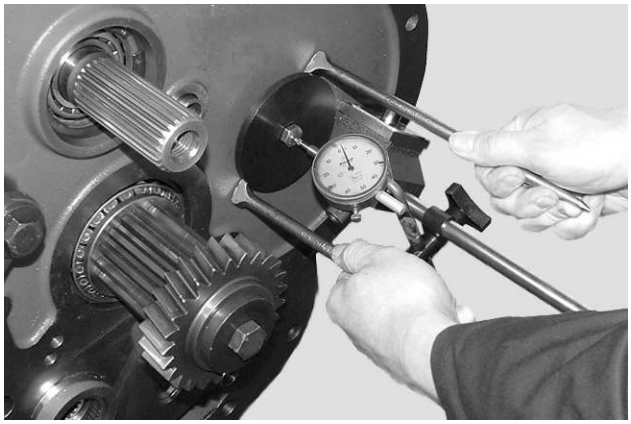

MD0CC102

Rotate the shuttle shaft using a wrench. Install a dial gauge onto the end of bolt (N), push and hold the intermediate shaft towards the rear of the transmission. Zero the dial gauge.

https://truckmanualshub.com/



## STEP 42



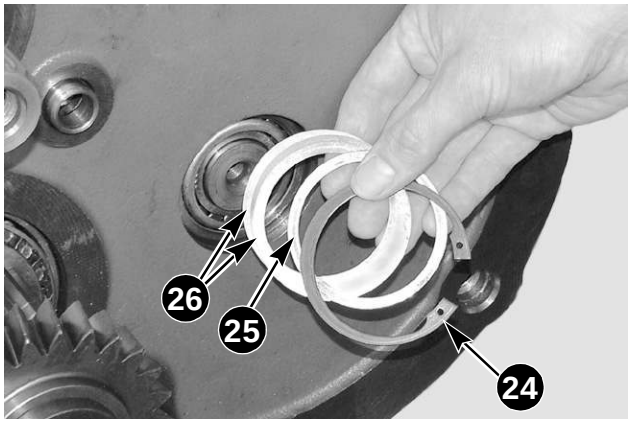
MD06C103

Using levers, pull the intermediate shaft fully forward and note the end play reading on the dial gauge. Subtract 0.5 mm (0.02 inch) from the noted reading to give the required shim pack thickness to give a correct end play of 0.01 to 0.1 mm (0.001 to 0.0039 inch).

**NOTE:** *If the intermediate shaft bearings have not been replaced and the end play is NOT CORRECT, shims must be added or subtracted to give the correct end play, refer to STEP 43.*

**NOTE:** *If the intermediate shaft bearings have been replaced or the shims have not been installed add shims to give the correct end play, refer to STEP 43.*

## STEP 43




MD06C112

Remove the intermediate shaft holder MC2620 and remove the snap ring (24) and spacer (25). Install the required shim pack (26) determined in STEP 43, spacer (25) and snap ring (24). Make sure the snap ring locates correctly into the snap ring groove.

**NOTE:** *Hold the shim pack in position with petroleum jelly to prevent the shims from dropping into the snap ring groove.*

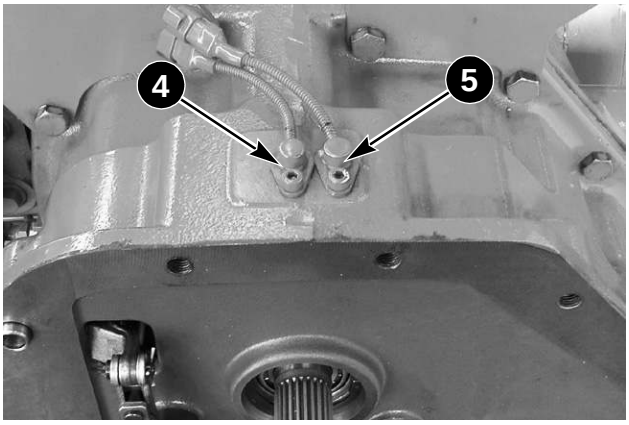
**NOTE:** *It may be necessary to use a bearing driver to install the bearing cup further into the bearing carrier housing to enable the shims to be installed.*

## STEP 44

Repeat STEP 39 to STEP 43 and check the intermediate shaft end play. The correct end play must be 0.01 to 0.1 mm (0.001 to 0.0039 inch).

**IMPORTANT:** *When the end play is correct, remove the intermediate shaft holder MC2620.*

## STEP 45

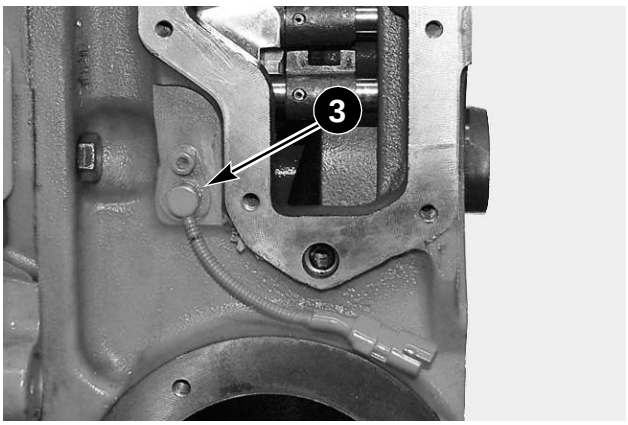



MD06C027

Install a new o-ring onto the Inter ‘A’ speed sensor (4) and Inter ‘B’ speed sensor (5) (If equipped) and install the sensor(s). Install and tighten the retaining screw(s).

**NOTE:** *Only tractors up to P.I.N JJE350083 are equipped with Inter ‘B’ speed sensors.*

## STEP 46




MD06C027

Install a new o-ring onto the PTO ‘B’ sensor (3) and install the PTO ‘B’ sensor (3) and shims if equipped. Install and tighten the retaining screw.

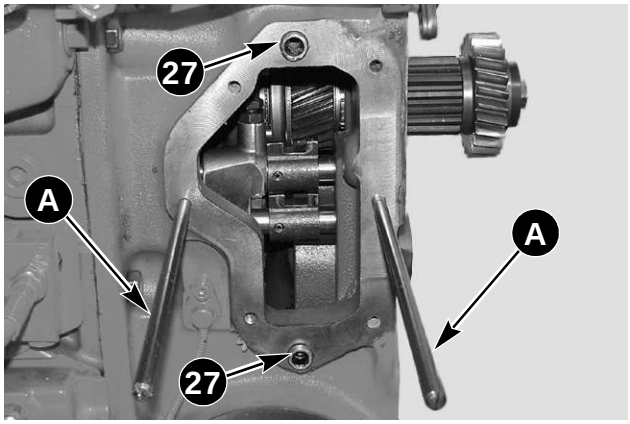
## STEP 47

Make sure the mounting faces of the bearing carrier housing and the 3rd/4th gear selector plate (XtraSpeed tractors) or gear selector linkage housing (XtraSpeed - E and E Plus tractors) are clean.

https://truckmanualshub.com/



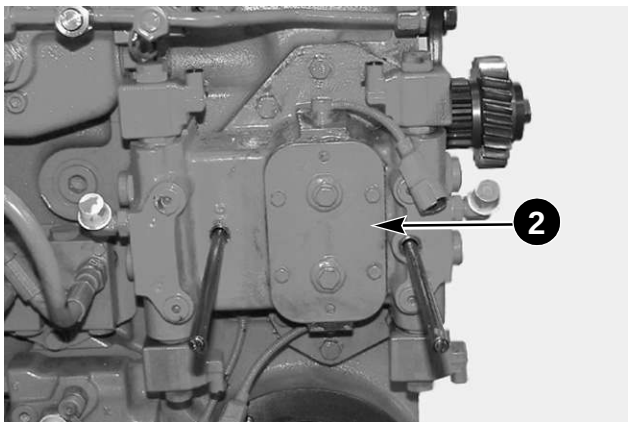
## STEP 48




MD06C110

Make sure the location dowels (27) are installed into the bearing carrier housing. For XtraSpeed - E and E Plus tractors install two alignment studs (MC1995A) (A) as shown.

## STEP 49

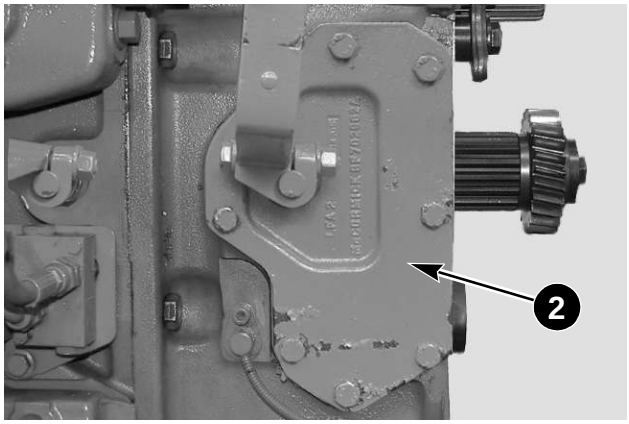



MD06C111

For XtraSpeed - E and E Plus tractors make sure the shifter rails are in Neutral. Apply a continuous bead of Loctite 515 to the bearing carrier housing mounting face and install the gear selector linkage housing (2). Make sure the actuators locate correctly into the shifter rails. Install and tighten the retaining bolts to a torque of 39 to 48 Nm (29 to 35 lb.ft). Remove the alignment studs and install and tighten the two remaining bolts to a torque of 39 to 48 Nm (29 to 35 lb.ft).

Adjust the gear selector linkage, refer to Section 9001.

## STEP 50



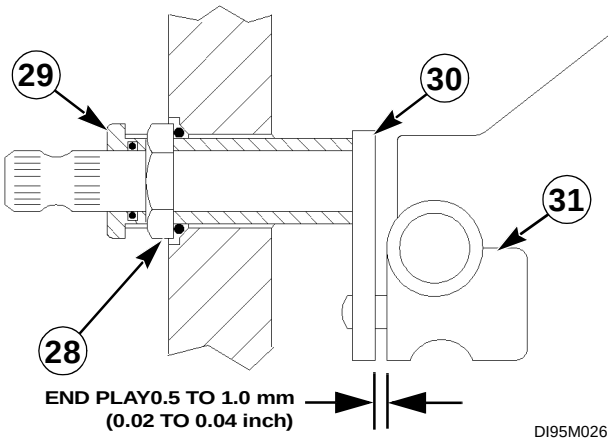

MD06C05

For XtraSpeed tractors make sure the shifter rails are in Neutral. Apply a continuous bead of Loctite 515 to the bearing carrier housing mounting face and install the 3rd/4th gear selector linkage mounting plate (2). Make sure the 3rd/4th gear selector linkage locates correctly into the 3rd/4th gear selector fork bushing. Install and tighten the retaining bolts to a torque of 39 to 48 Nm (29 to 35 lb.ft).

## STEP 51

Adjust the 1st/2nd and 3rd/4th gear selector pivot shafts, refer to STEP 52.

## STEP 52




DI95M026

Loosen the pivot bushing lock nut (28) and turn the pivot bushing clockwise (29) until the pivot shaft linkage (30) contacts the selector fork (31). DO NOT over tighten the bushing (29). Install a dial gauge onto the end of the pivot shaft. Turn the pivot bushing counter clockwise until an end play reading on the dial gauge of 0.5 to 1.0 mm (0.02 to 0.04 inch) is obtained. Tighten the lock nut (28).

https://truckmanualshub.com/



## STEP 53

Remove the pinion retaining bolt, washer, shims, MFD drive gear and park brake hub.

*Make sure the shims remain together for the installation of the MFD clutch.*

## STEP 54

Install the MFD clutch assembly, refer to Section 6017.

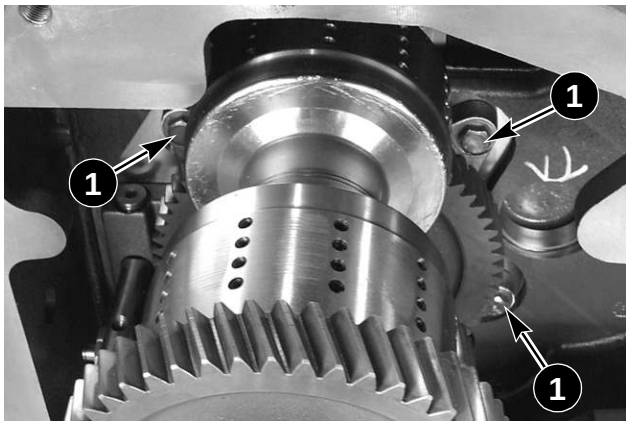
https://truckmanualshub.com/



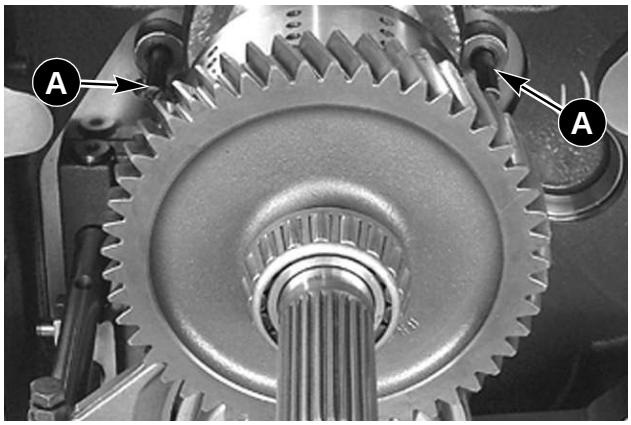
# PINION AND SHUTTLE SHAFT

## Removal

### STEP 1




MD06C050

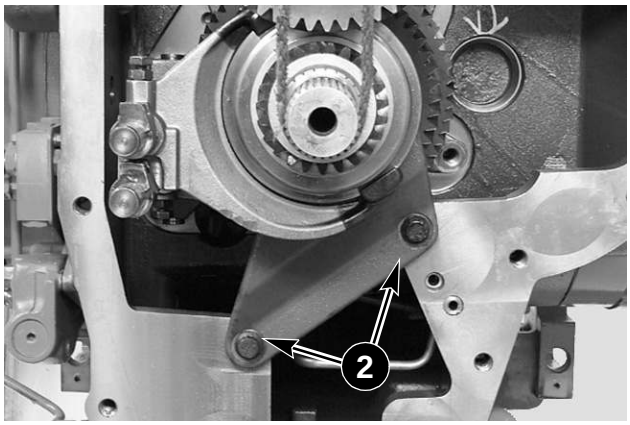



MD06C057

Remove the upper pinion shaft bearing carrier retaining bolts (1) and install two 12 mm alignment studs (A) into the top mounting holes as shown.

**NOTE:** *Make sure the 12 mm* alignment *studs protrude 85 mm from the transmission housing.*

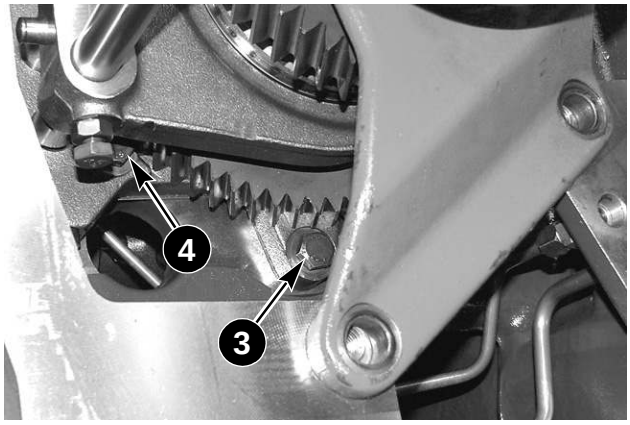
### STEP 2



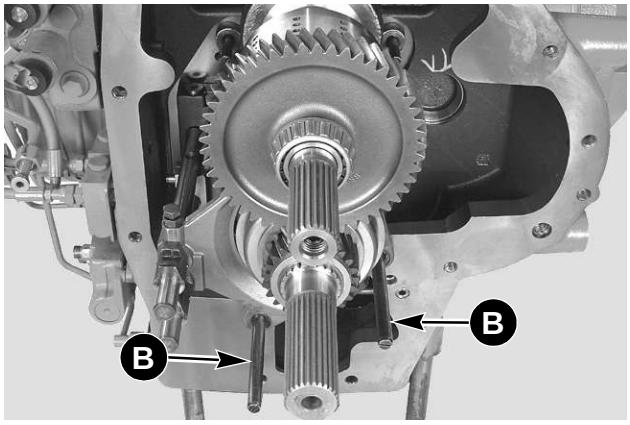

MD06C049

Using suitable lifting equipment, support the front of the pinion shaft and remove the centre support retaining bolts (2).

### STEP 3




MD06C051



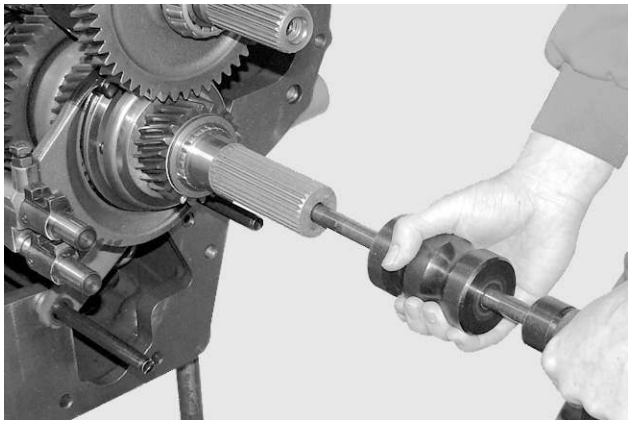

MD06C052

Remove the lower pinion shaft bearing carrier retaining bolts (3) and (4). Install two 16 mm alignment studs MC1995A (B) into the centre bearing support mounting holes as shown.

https://truckmanualshub.com/



## STEP 4



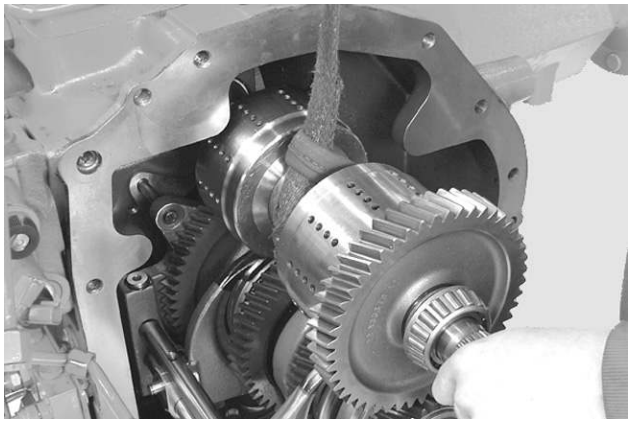
MD06C056

Using a slide hammer (with a 16 x 2 mm thread) installed into the end of the pinion shaft, pull the pinion shaft from the transmission until the bearing carrier is free of the range transmission.

**IMPORTANT:** *Make sure the pinion shaft remains on the 12 mm* alignment *studs.*

**NOTE:** *It may be necessary to use a sliding hammer adaptor MC2621.*

## STEP 5



MD06C053

Remove the slide hammer and attach suitable lifting equipment to the shuttle shaft. Carefully slide the pinion shaft and shuttle shaft along the aliment studs until the shuttle shaft can be removed. Remove the shuttle shaft.

**IMPORTANT:** *Make sure the pinion shaft remains on the 12 mm* alignment *studs.*

## STEP 6

With the shuttle shaft removed, slide the pinion shaft back towards the rear of the transmission on the alignment studs.

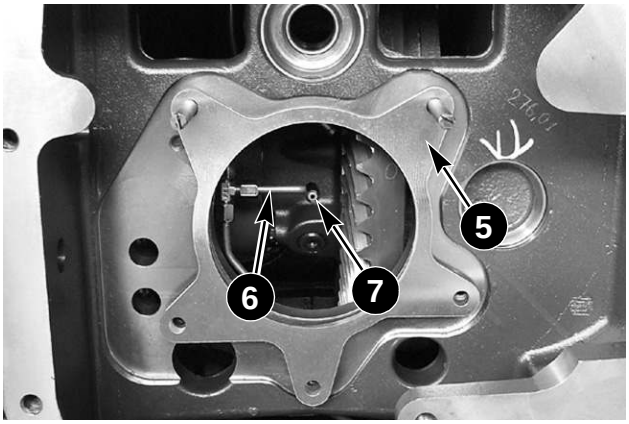
## STEP 7



MD06C054

Support the front of the pinion shaft and remove the 16 mm alignment studs. Attach suitable lifting equipment to the pinion shaft centre bearing support as shown. With the pinion shaft supported on the lifting equipment, remove the pinion shaft.

## STEP 8




MD06C055

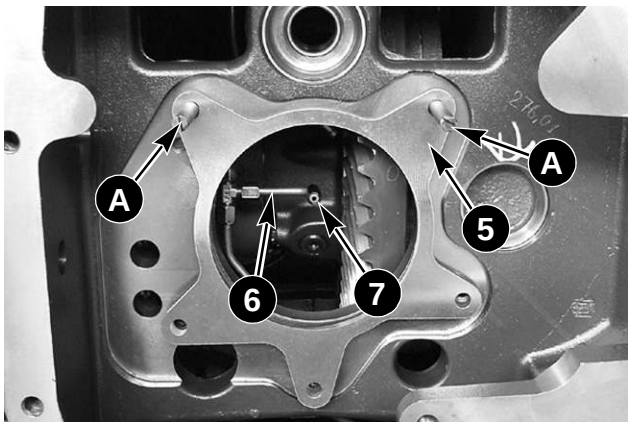
Remove shims (5) and check the pinion shaft lube tube (6) and plastic sleeve (7) and remove if necessary.

https://truckmanualshub.com/



## Installation

### STEP 9




MD06C055

Install two 12 mm alignment studs (A) in the range transmission housing as shown. Install shims (5) removed during removal or determined during the pinion shaft mounting distance procedure (refer to “Pinion Shaft Mounting Distance” on page 47).

Make sure the lube tube (6) and plastic sleeve (7) are correctly installed.

**NOTE:** *Make sure the 12 mm alignment studs protrude 85 mm from the transmission housing.*

### STEP 10.



MD06C054

Attach suitable lifting equipment to the pinion shaft centre support as shown and carefully install the pinion shaft on to the alignment studs.

**NOTE:** *For XtraSpeed tractors make sure the 1st/2nd gear selector pivot shaft locates correctly on to the selector fork bushing.*

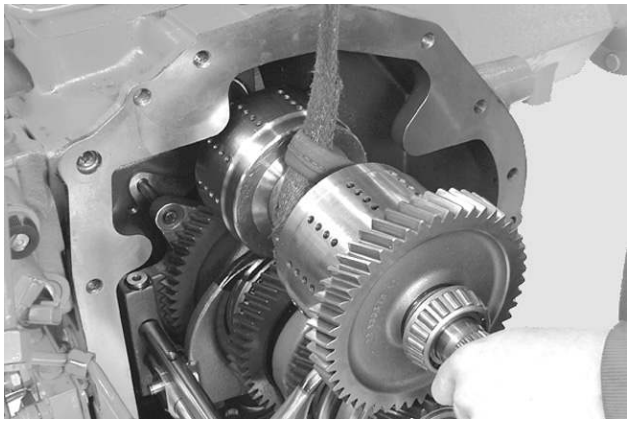
### STEP 11

Support the front of the pinion shaft and remove the lifting equipment. Install two 16 mm alignment studs through the centre bearing support into the range transmission.

### STEP 12

Make sure the shuttle shaft seal rings are installed. Attach suitable lifting equipment to the shuttle shaft

### STEP 13



MD06C053

Using the lifting equipment position the shuttle shaft over the pinion shaft. Slide the pinion shaft on the alignment studs to a position were the shuttle shaft can be installed. Install the shuttle shaft and slide both the pinion shaft and shuttle shaft rewards. It may be necessary to turn the pinion shaft to engage the pinion shaft into the ring gear.

**IMPORTANT:** *Care must be taken not to damage the shuttle shaft seal rings.*

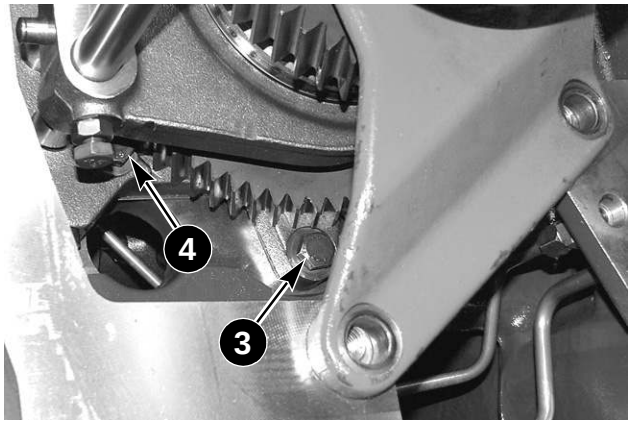
https://truckmanualshub.com/



## STEP 14




MD06C050



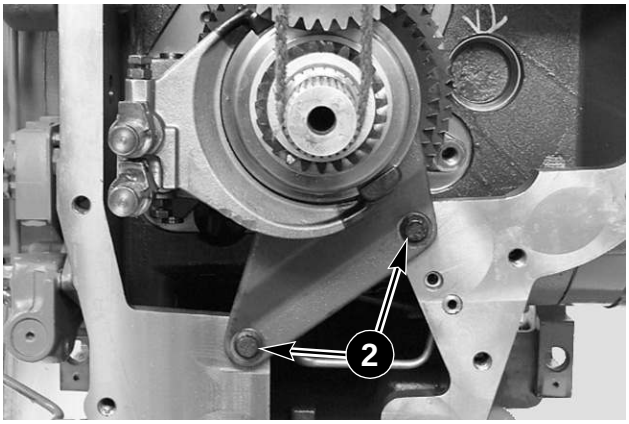

MD06C051

Remove the two 12 mm alignment studs. Apply Loctite 638 (680) to the threads of the pinion shaft rear bearing carrier retaining bolts and install the retaining bolts (1), (3) and (4). Support the front of the pinion shaft on the lifting equipment and remove the 16 mm (MC1995A) alignment studs.

Evenly tighten all the pinion shaft bearing carrier retaining bolts to a torque of 100 to 113 Nm (74 to 83 lb ft).

**NOTE:** *It will be necessary to use a suitable crows foot wrench to tighten the lower retaining bolt (4).*

## STEP 15




MD06C049

Install the two centre support retaining bolts (2). DO NOT tighten at this stage.

**IMPORTANT:** *The centre support retaining bolts must be tightened during the bearing carrier housing installation.*

## STEP 16

Make sure the lube tube sleeve is correctly located into the end of the pinion shaft.

https://truckmanualshub.com/



# INTERMEDIATE SHAFT

## Disassembly

**NOTE:** *Replacement intermediate shafts are available as an assembled unit, consisting of intems 1 to 7 and items 11 and 12.*

### STEP 1

Remove the bearing carrier housing and intermediate shaft, refer to BEARING CARRIER HOUSING on page 5.

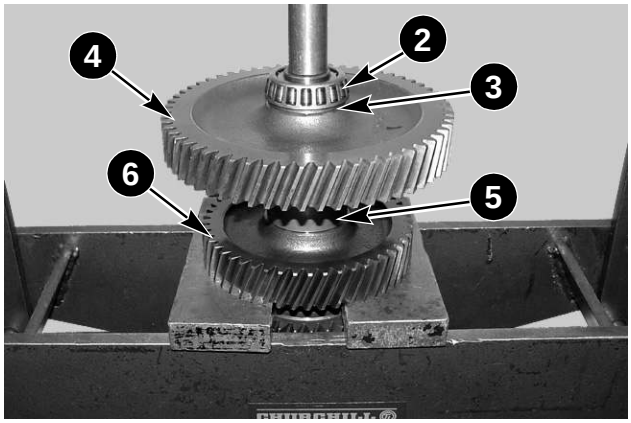
### STEP 2

Use a bearing puller and remove bearing cone (1) from the 1st/2nd gear shaft assembly (7).

### STEP 3

If only the intermediate shaft bearings are to be replaced, use a bearing puller and remove bearing cone (2) from the 1st/2nd gear shaft assembly (7).

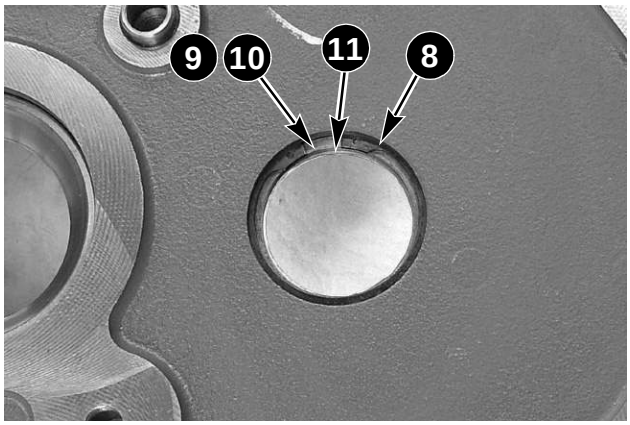
### STEP 4




C12006

If the intermediate gears are to be replaced, use a hydraulic press and remove bearing cone (2), thrust washer (3), 4th gear (4), spacer (5) and 3rd gear (6) 1st/2nd gear shaft assembly (7).

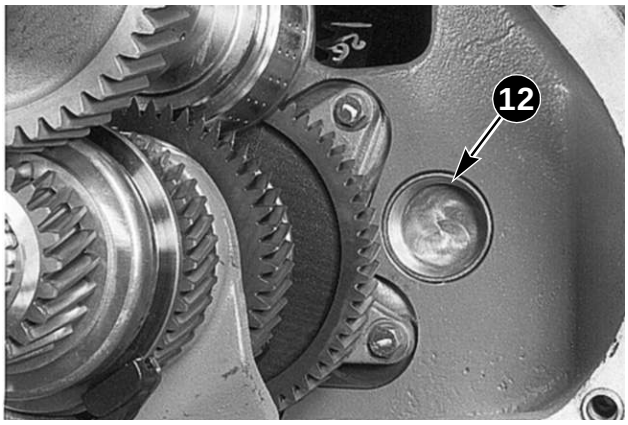
### STEP 5




MI06C005

Check the front bearing cup (11) in the bearing carrier housing. If the bearing cup (11) is worn or damaged or if the bearing cone (2) is to be replaced, remove the snap ring (8), spacer (9) and shims (10). Use a bearing driver and remove the bearing cup (11).

### STEP 6




MI06C017

Check the rear bearing cup (12) in the transmission housing. If the bearing cup (12) is worn or damaged or if the bearing cone (1) is to be replaced, use a blind hole bearing puller and remove the bearing cup (12).

https://truckmanualshub.com/



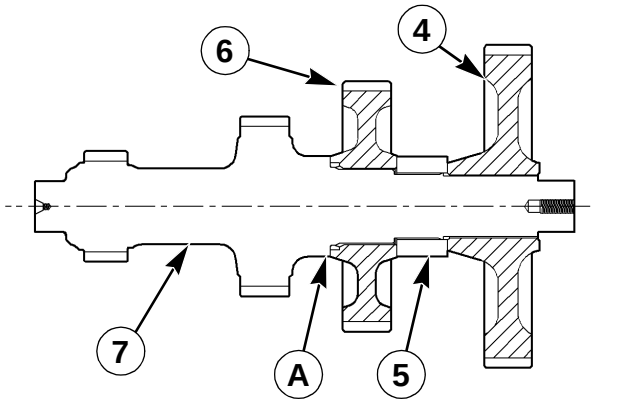
## Assembly

### STEP 7

Heat 4th gear (4), 3rd gear (6), bearing cone (2) in a bearing oven to a temperature of 110℃ (230℉). Keep the 1st/2nd gear shaft assembly (7) as cool as possible.

**WARNING:** ***Always wear heat protective gloves or mittens when handling heated parts.***

### STEP 8

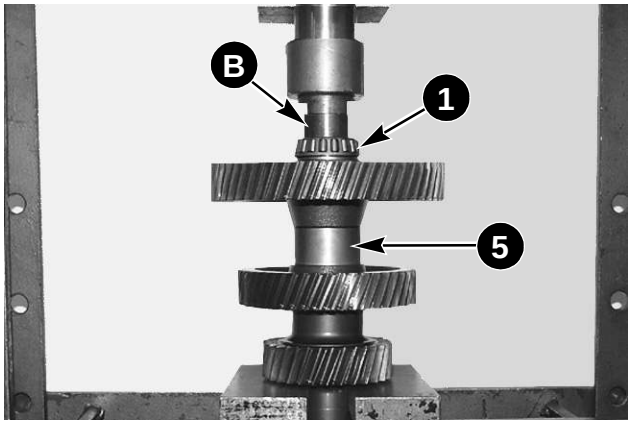



MI06D057

Install the 3rd gear (6) onto the 1st/2nd gear shaft assembly (7). Make sure the recess (A) side of the gear is towards and against the 2nd gear on the 1st/2nd gear shaft assembly (7).

Install spacer (5) and 4th gear (4). Make sure the spacer is fully against the 3rd gear and the 4th gear is fully against the spacer.

### STEP 9




MI06C035

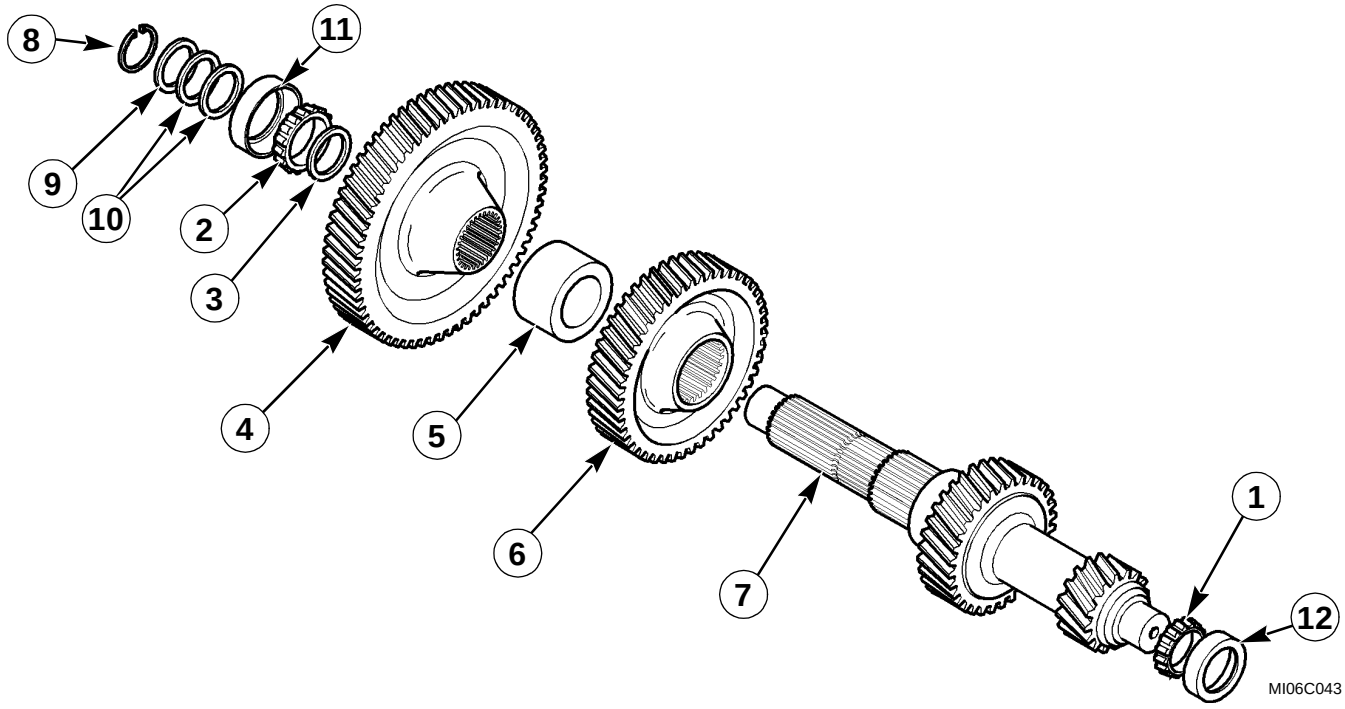
Install the intermediate shaft onto a hydraulic press, install thrust washer (3) and bearing cone (2). Using suitable sleeve (B) on the inner race of bearing cone (2). Apply pressure to the inner race of bearing cone (2), make sure all item are in contact and spacer (5) cannot be turned.

**IMPORTANT:** *Make sure the sleeve (B) does not make contact with the bearing cage or the shaft assembly.*

**WARNING:** ***Always wear heat protective gloves or mittens when handling heated parts.***

### STEP 10

Heat bearing cone (1) in a bearing oven to a temperature of 110℃ (230℉). Install bearing cone (1) onto the 1st/2nd gear shaft assembly (7). Make sure the bearing cone is against the 1st gear.

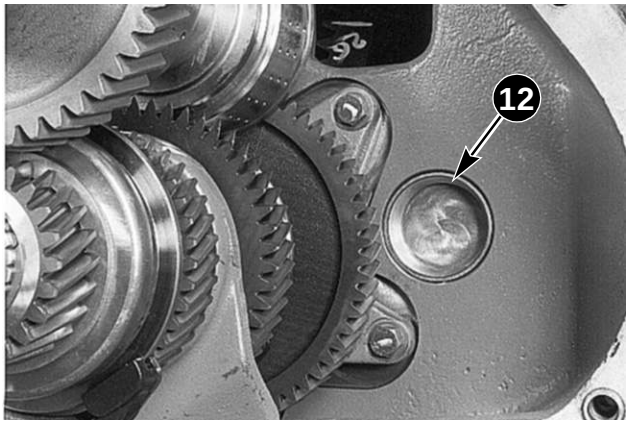



MI06C043

https://truckmanualshub.com/



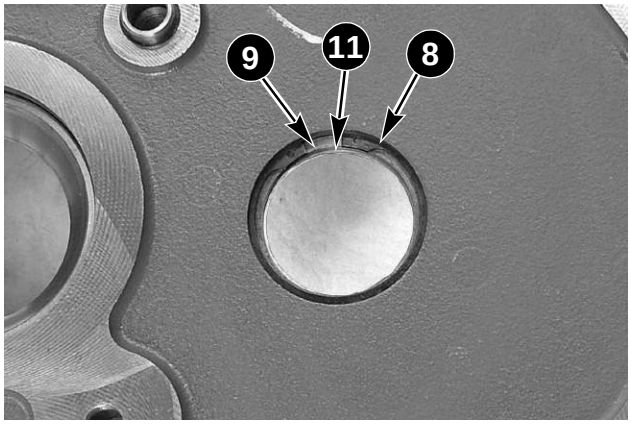
**STEP 11**




MI06C017

If the bearing cup (12) has been removed. Use a bushing/bearing driver to install a new bearing cup (12). Make sure the bearing cup is against the shoulder in the transmission housing.

**STEP 12**

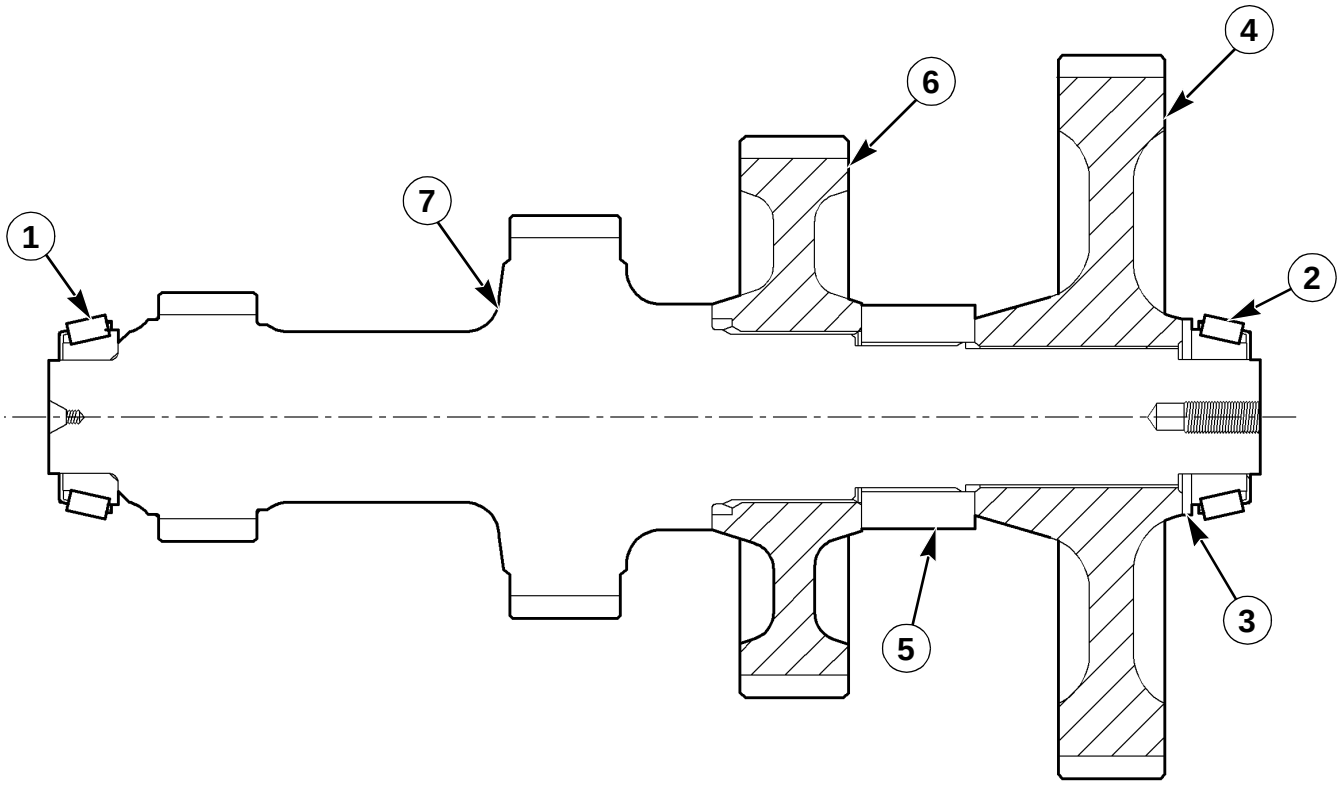



MI06C005

If the front bearing cup (11) has been removed, use a bearing driver and install a new bearing cup into the bearing carrier housing. Install spacer (9) and snap ring (8). DO NOT install shims (10). Make sure the bearing cup (11), spacer (9) and snap ring (8) are in contact.

**IMPORTANT:** *Shims (10) are to be determined and installed during the bearing carrier housing installation.*

## Cross Sectional Drawing of the Intermediate Shaft




MI06C044

1. BEARING CONE
2. BEARING CONE
3. THRUST WASHER
4. 4TH GEAR
5. SPACER
6. 3RD GEAR
7. 1ST/2ND GEAR SHAFT ASSEMBLY

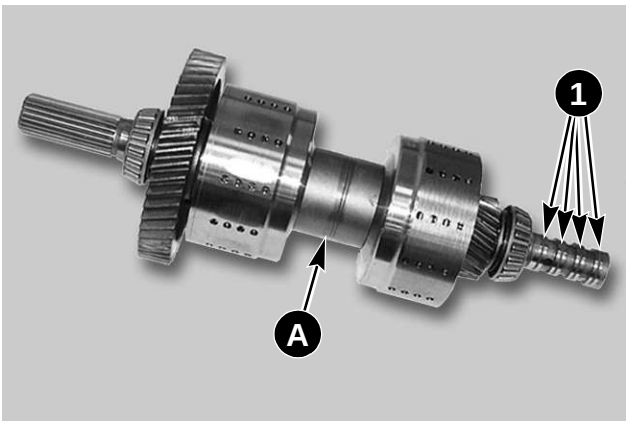
https://truckmanualshub.com/



# SHUTTLE SHAFT

## Disassembly

### STEP 1

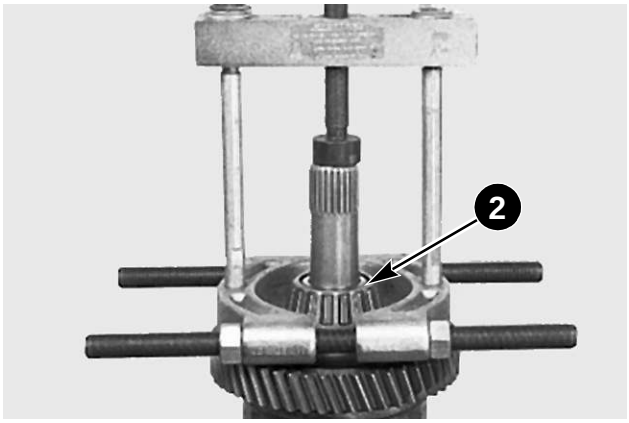



MD06C027

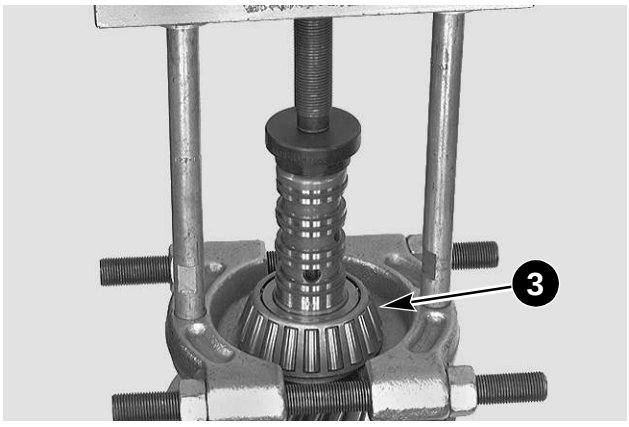
Place the forward/reverse shuttle shaft assembly (A) on a clean work surface and remove and discard the seal rings (1).

**IMPORTANT:** *Care must be taken not to damage the seal groove when removing the seal rings (1).*

### STEP 2




DI06C002




DI06C003

Use a bearing puller and remove bearing cone (2) and (3).

### STEP 3

Remove snap ring (4), thrust washer (5) and thrust bearing (6). Remove forward gear (7), bearing cage (8), spacer (9) and bearing cage (10). Remove and discard seal ring (11) from the forward gear hub.

### STEP 4

Remove thrust bearing (12) and thrust washer (13).

**IMPORTANT:** *Make sure the components for the forward gear remain together.*

### STEP 5

Remove snap ring (14), thrust washer (15) and thrust bearing (16). Remove reverse gear (17), bearing cage (18), spacer (19) and bearing cage (20). Remove and discard the seal ring (21) from the reverse gear hub.

### STEP 6

Remove thrust bearing (22) and thrust washer (23).

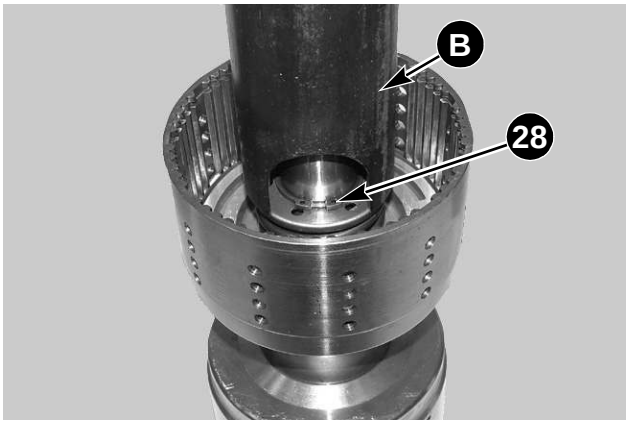
**IMPORTANT:** *Make sure the components for the reverse gear remain together.*

**NOTE:** *The following procedure (STEP 7 to STEP 10) is the same for both the forward and reverse clutch packs.*

### STEP 7

Remove snap ring (24), backing plate (25), friction plates (26) and separator plates (27).

### STEP 8

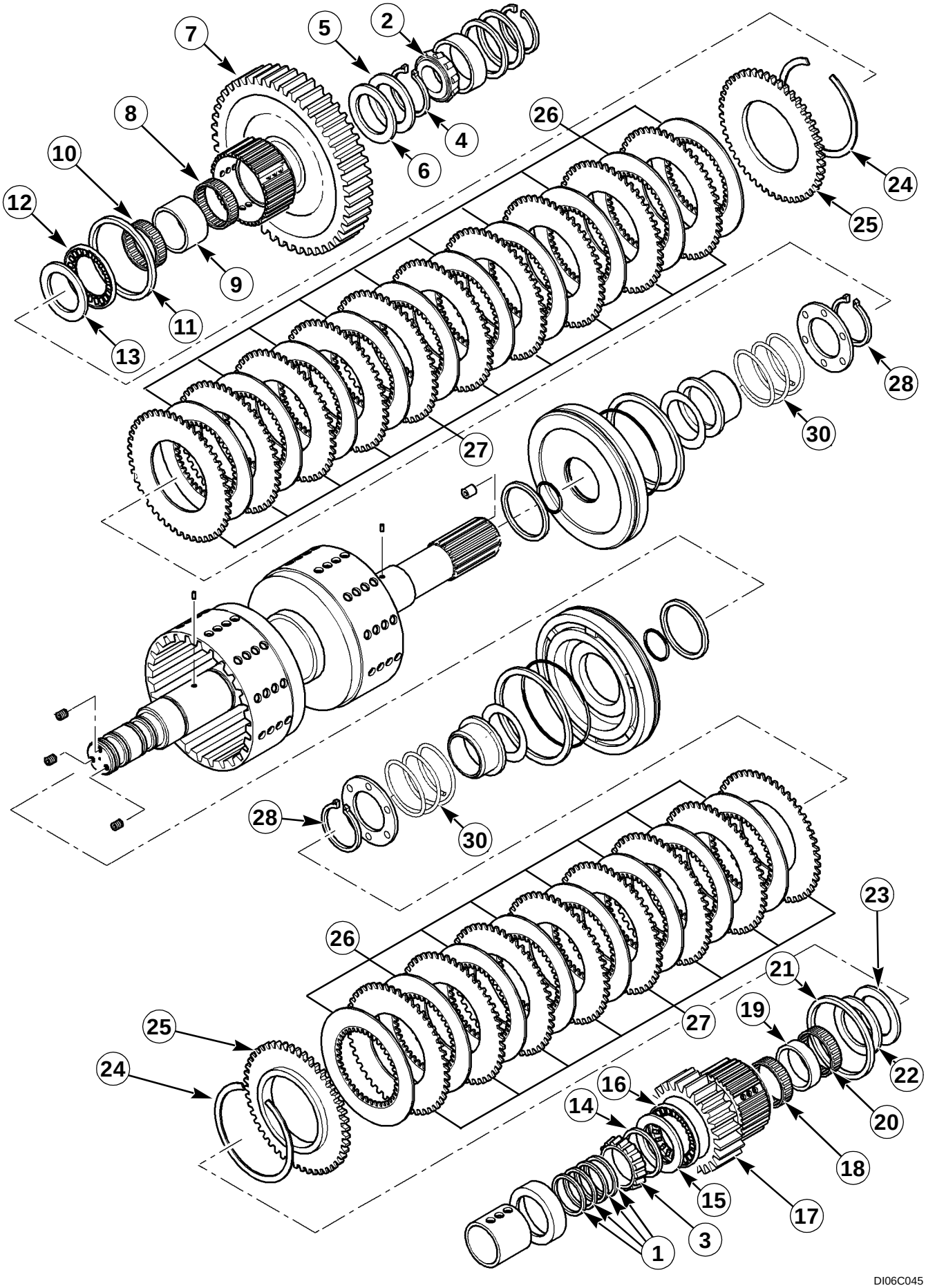



DI06C028

Install the shuttle shaft assembly into a hydraulic press. Using the spring compressor 1013T1 (B), compress spring (30) and remove snap ring (28) from the groove in the shuttle shaft.

https://truckmanualshub.com/






DI06C045

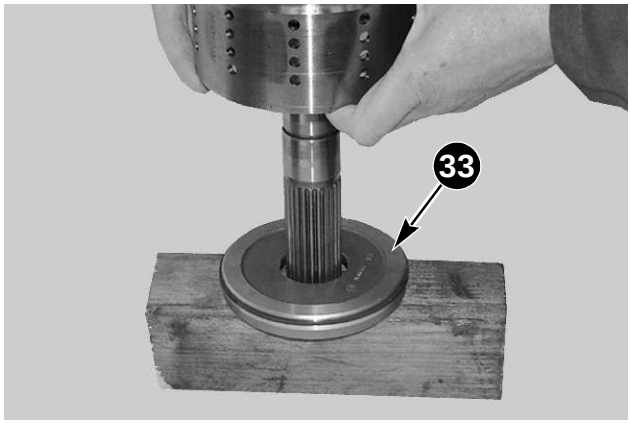
https://truckmanualshub.com/



## STEP 9

Slowly release the pressure on the press and remove the spring compressor 1013T1. Remove snap ring (28), spring retainer (29), spring (30), lubrication sleeve (31) and shims (32).

## STEP 10




DI06C029

Use a suitable block to shock the piston (33) out of the clutch housing. Remove and discard seal ring (34), o-ring (35), seal ring (36) and o-ring (37) from the piston (33).

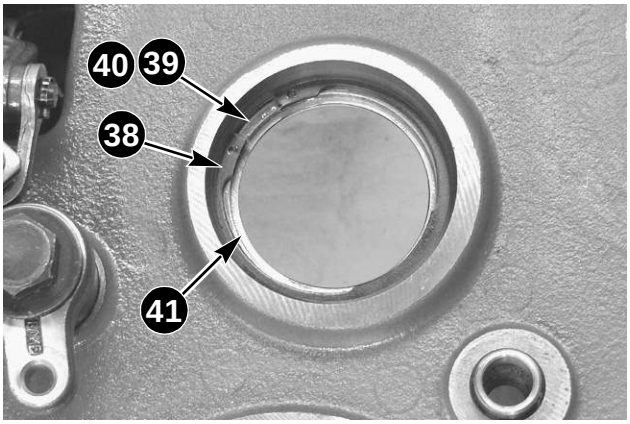
**IMPORTANT:** *Make sure the components for the disassembled clutch pack remain together.*

## STEP 11

Repeat STEP 7 to STEP 10 to remove the remaining clutch pack components.

**IMPORTANT:** *Make sure the components for the disassembled clutch pack remain together.*

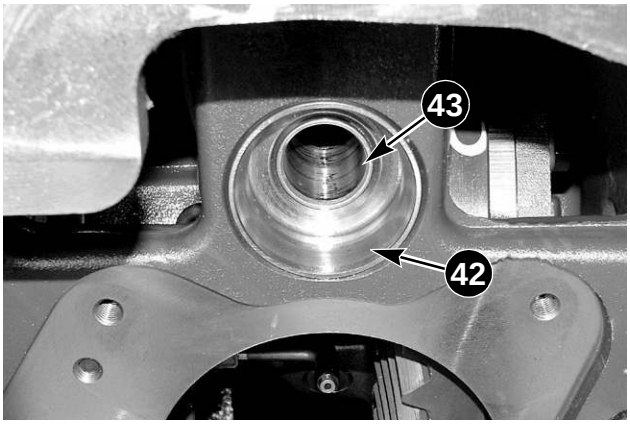
## STEP 12




MD06C019

Check the front bearing cup (41) in the bearing carrier housing. If the bearing cup is worn or damaged or if the bearing cup (2) is to be replaced, remove the snap ring (38). Remove the spacer (39) and shims (40). Use a bearing driver to remove bearing cup (41).

## STEP 13



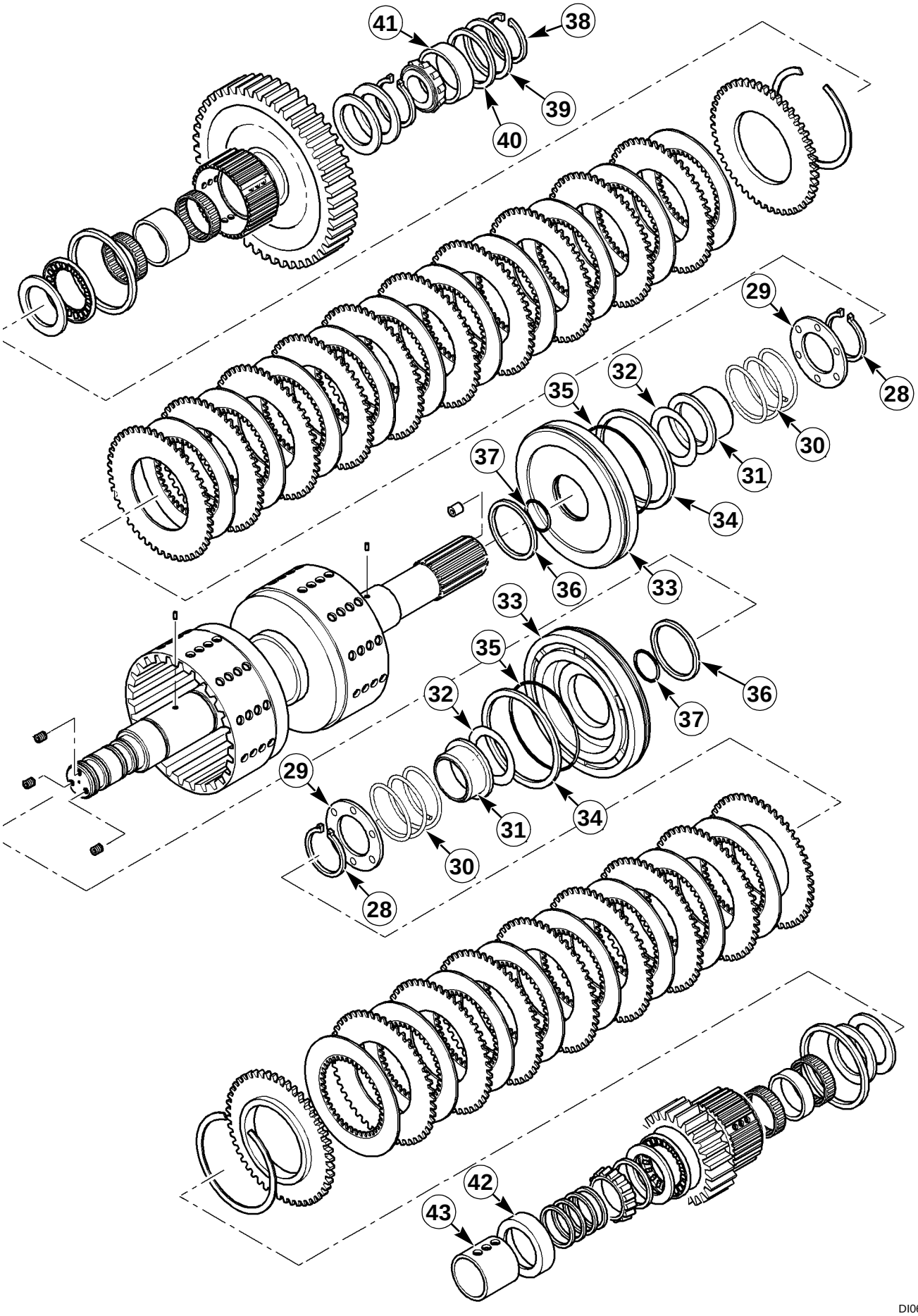

DI06C020

Check the rear bearing cup (42) in the rear of the transmission. If the bearing cup is worn or damaged or if the bearing cup (3) is to be replaced use a blind hole puller and remove bearing cup (42).

Check the wear sleeve (43) in the rear of the transmission. If the wear sleeve is worn or damaged use a blind hole puller and remove wear sleeve (43).

https://truckmanualshub.com/






DI06C045

https://truckmanualshub.com/



## Assembly

**IMPORTANT:** *If a new shuttle shaft is to be installed, make sure the expansion plugs (44) and (45) are installed. Also make sure end plug (46) is installed. If a new plug (46) is to be installed apply Loctite 242 to the threads.*

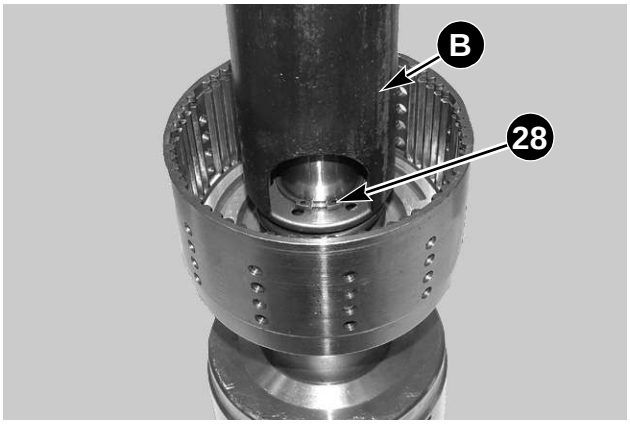
**IMPORTANT:** *Make sure the roll pins (47) are installed to a depth of 0.5 to 1.5 mm below the surface of the shuttle shaft.*

**IMPORTANT:** *If new friction plates are to be installed, make sure all friction plates have the same friction material groove pattern and the plates have been soaked in clean transmission oil before installation.*

### STEP 14

Install the forward piston (33) into the clutch housing, without seals. Install lubrication sleeve (31), spring (30) and spring retainer (29). Install snap ring (28) onto the shuttle shaft.

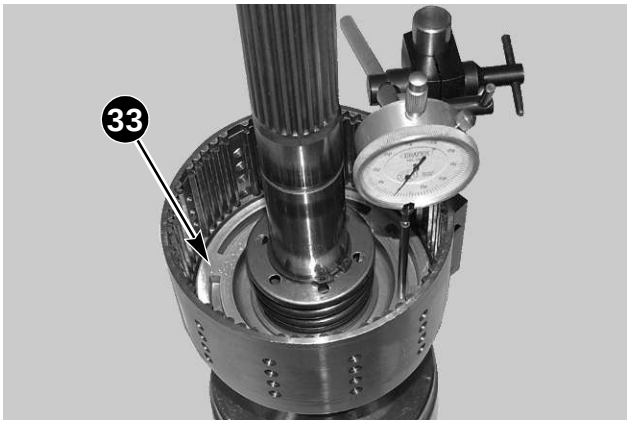
### STEP 15




DI06C028

Install the shuttle shaft onto a hydraulic press. Using the spring compressor 1013T1 (B), compress spring (30) and install snap ring (28) into the groove in the shuttle shaft. Release the pressure from the press and remove the spring compressor.

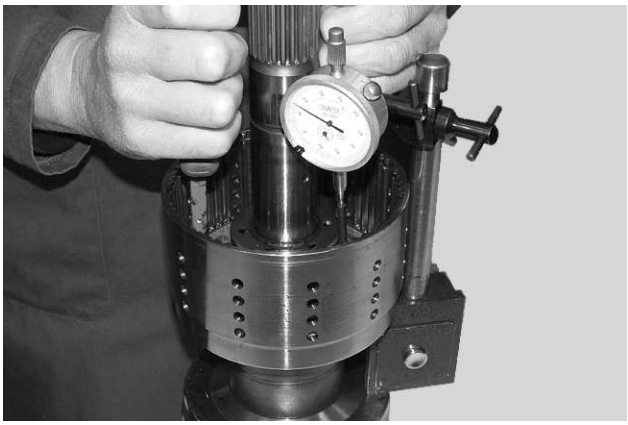
### STEP 16



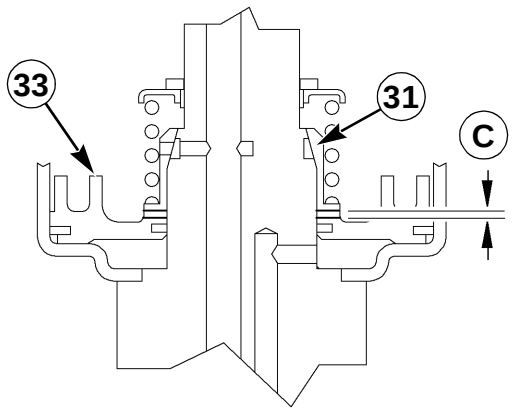

DI06C030

Install a dial gauge onto the face of the piston (33). Making sure the piston is fully down, zero the dial gauge.

### STEP 17



DI06C031

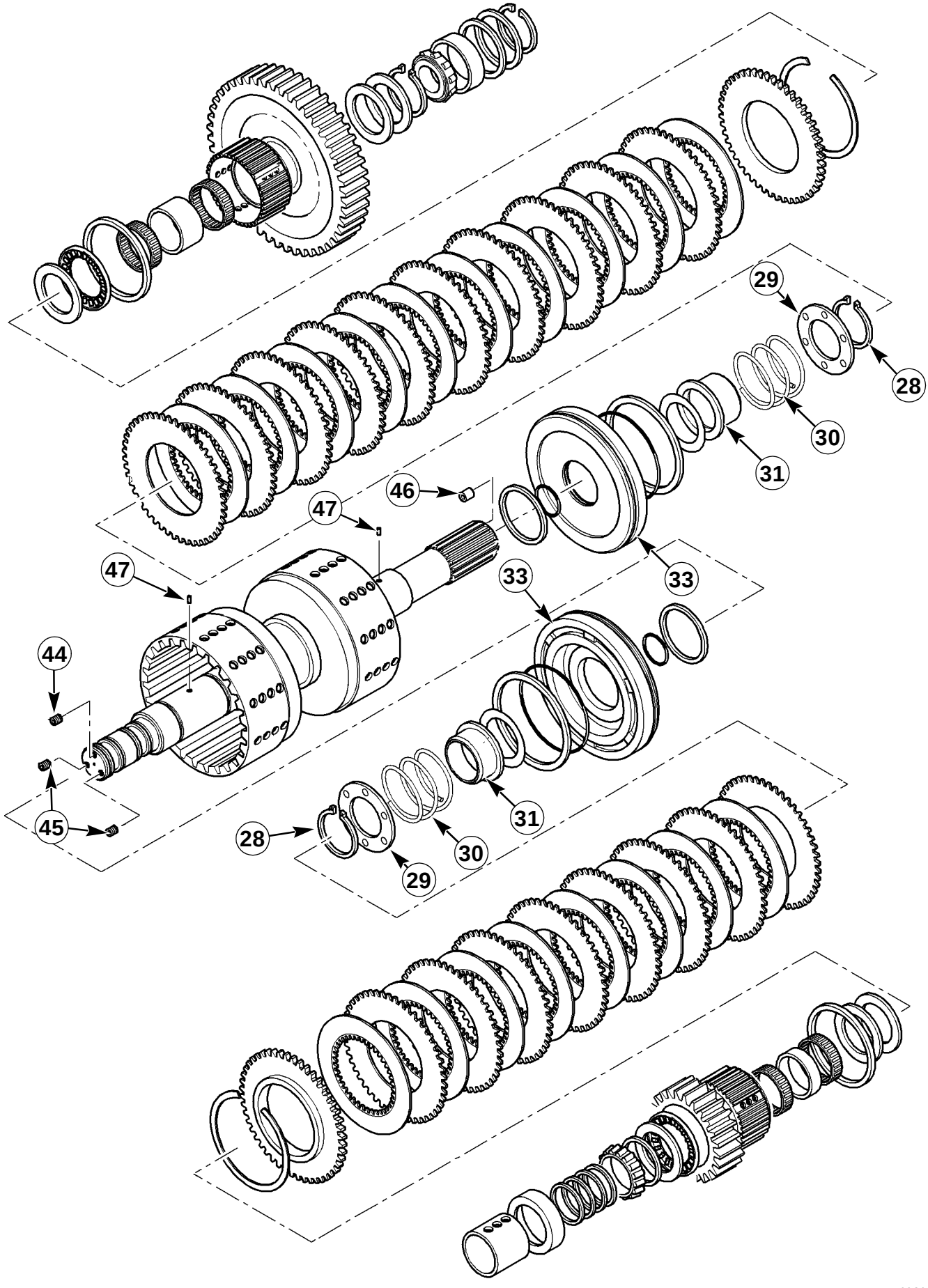



DI96B001

Using two pair of pliers evenly lift the piston (33). Make sure the piston is fully against lubrication sleeve (31). Note the reading on the dial gauge to measure dimension (C), between piston (33) and lubrication sleeve (31).

https://truckmanualshub.com/






DI06C045

https://truckmanualshub.com/



## STEP 18

Subtract 0.3 mm from the reading noted in STEP 17, to determine the correct shim pack (32) thickness to give an end play of 0.18 to 0.4 mm.

## STEP 19

Using the spring compressor 1013T1 and hydraulic press, remove snap ring (28), spring retainer (29), spring (30) and lubrication sleeve (31).

## STEP 20

Install shim pack (32) determined in STEP 17, lubrication sleeve (29), spring (30) and spring retainer (29). Install snap ring (28) onto the shuttle shaft. Make sure the snap ring is located correctly into the groove.

## STEP 21

Repeat STEP 16 and STEP 17 and measure the end play. The end play must be between 0.18 to 0.4 mm.

**NOTE:** *If piston (33) cannot be rotated in the clutch housing too many shims have been installed.*

## STEP 22

Using the spring compressor 1013T1 and hydraulic press, remove snap ring (28), spring retainer (29), spring (30), lubrication sleeve (31) and shims (32). Remove piston (33).

## STEP 23

Repeat STEP 14 to STEP 22 to determine the forward lubrication shim pack.

**NOTE:** *Keep each shim pack together. Make sure the forward clutch shim pack and reverse clutch shim pack are kept separate.*

**NOTE:** *The following procedure (STEP 24 to STEP 29) for assembling the clutch packs is the same for the forward and reverse clutches. When assembling the shuttle shaft, assemble the forward clutch pack first.*

## STEP 24

Lubricate and install a new o-ring (37) and sealing ring (36) into the inner groove of piston (33). Lubricate and install a new o-ring (35) and sealing ring (34) into the outer groove of piston (33).

**NOTE:** *Make sure the o-rings are installed before the sealing rings.*

## STEP 25

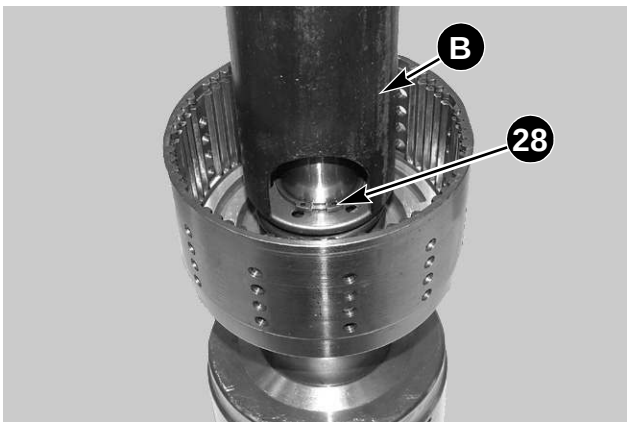
Install piston (33) into the clutch housing. Make sure the grooved side of the piston is facing outward. Carefully push the piston into the housing using even pressure. If the piston locks up during installation, remove the piston and install again. Never use force to correct wrong alignment of the piston.

## STEP 26

Install shims (32), (determined in STEP 18, lubrication sleeve (31), spring (30), spring retainer (29) and snap ring (28) onto the shuttle shaft.

**IMPORTANT:** *Make sure the shim pack determined in STEP 18 for the forward clutch pack is installed into the forward clutch and the shim pack for the reverse clutch pack is installed into the reverse clutch.*

## STEP 27

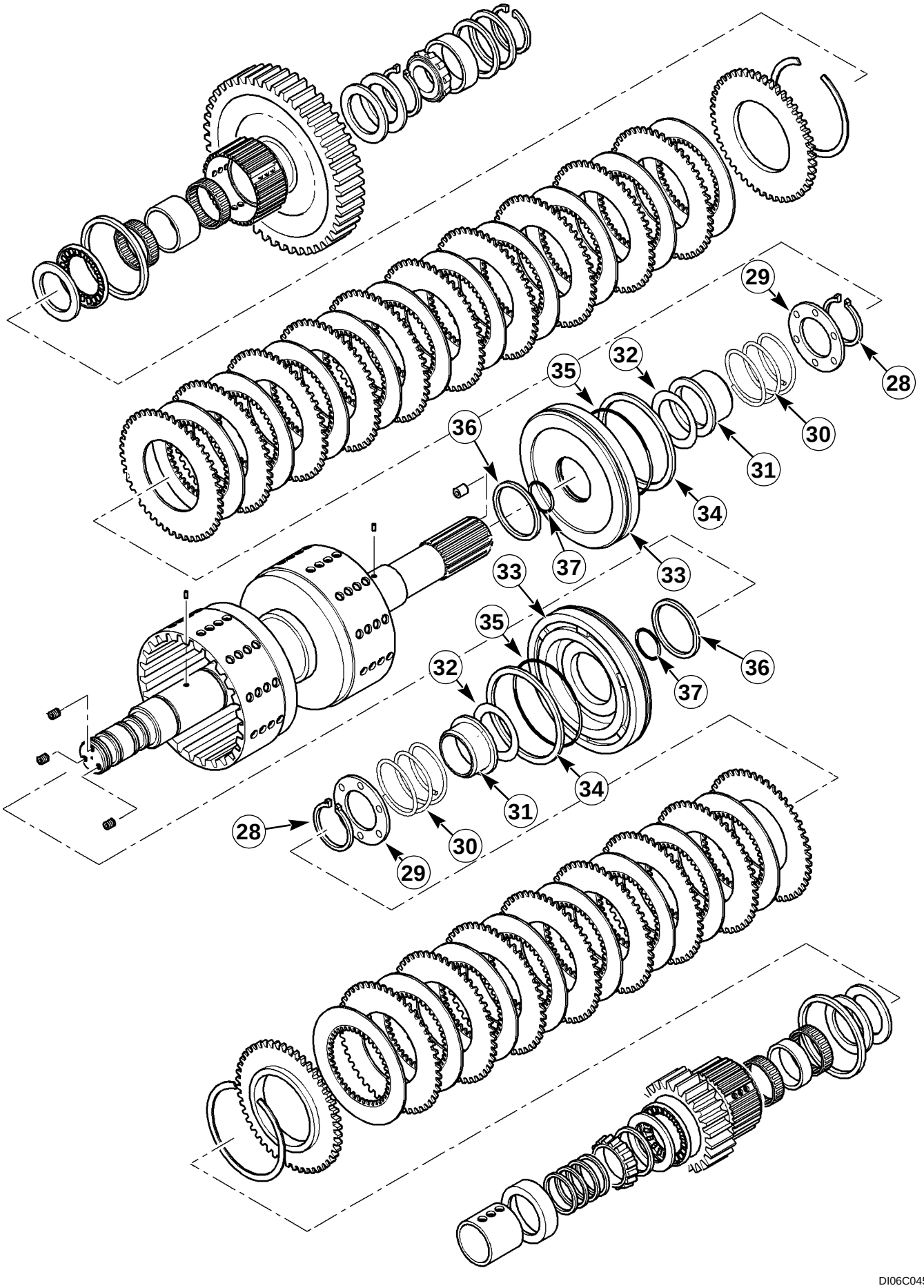



DI06C028

Install the shuttle shaft onto a hydraulic press. Using the spring compressor 1013T1 (B), compress spring (30) and install snap ring (28) into the groove in the shuttle shaft. Make sure the snap ring is located correctly into the groove.

https://truckmanualshub.com/






DI06C04

https://truckmanualshub.com/



## STEP 28

Install one metal separator plate (27) then one friction plate (26) into the forward clutch. Continue to install one metal separator plate (27) then one friction plate (26), until ten metal separator plates and ten friction plates have been installed. The last plate installed must be a friction plate (26).

**IMPORTANT:** *If new friction plates are to be installed, make sure all the friction plates have the same friction material groove pattern and the friction plates are soaked in clean transmission oil before installation.*

## STEP 29

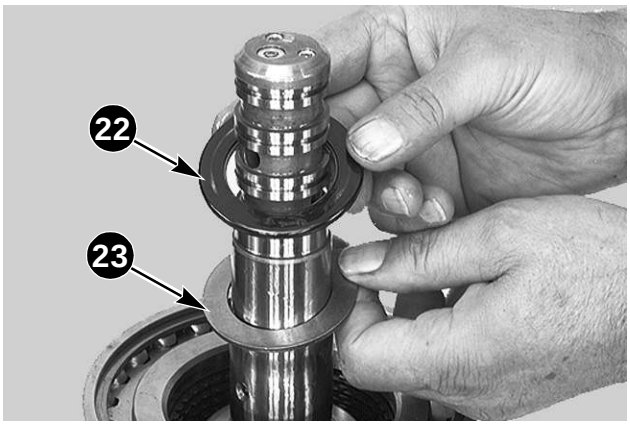
Install backing plate (25), make sure the recessed side of the backing plate is facing outward. Install the snap ring (24), make sure the snap ring is located correctly into the groove.

## STEP 30

Repeat STEP 25 to STEP 29 for the reverse clutch pack, then go to STEP 31.

**IMPORTANT:** *The reverse clutch is only equipped with EIGHT separator plates and EIGHT friction plates.*

## STEP 31

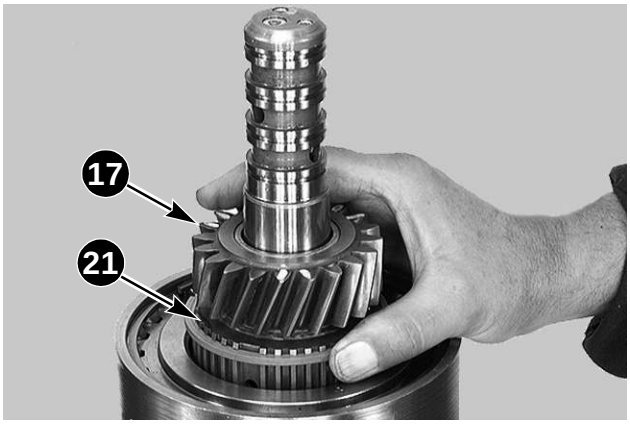



DI06C008

Install thrust washer (23), thrust bearing (22), roller bearing (20), spacer (19) and roller bearing (18).

**NOTE:** *Make sure the needle roller side (open side) of the thrust bearing* (22) *is towards the thrust washer* (23)*.*

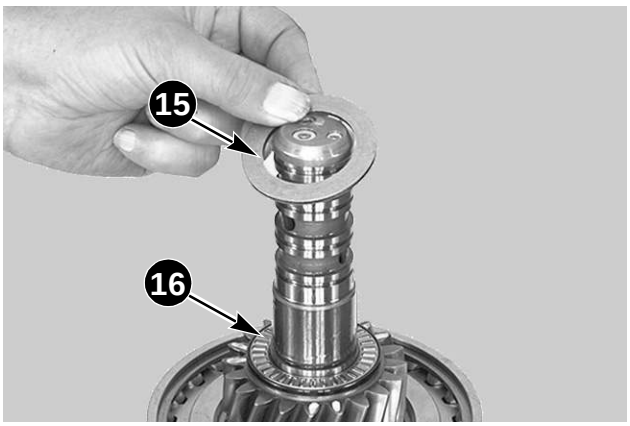
## STEP 32




DI06C009

Install a new seal ring (21) onto the reverse gear hub (17). Align the reverse clutch pack friction plates and install gear hub (17). Make sure all the friction plates engage onto the gear hub (17).

## STEP 33




DI06C010

Install thrust bearing (16) and thrust washer (15).

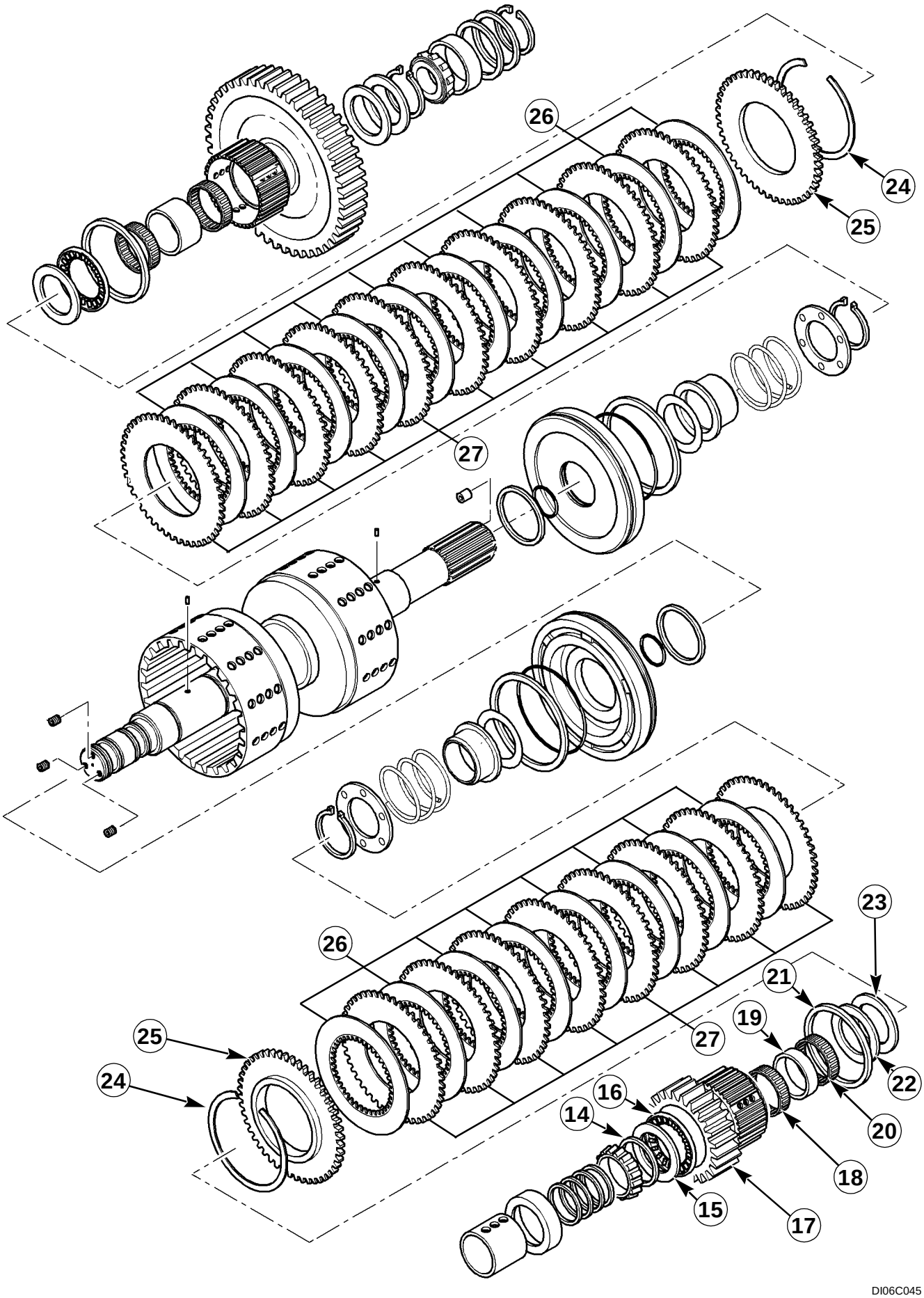
**NOTE:** *Make sure the needle roller side (open side) of the thrust bearing (16) is towards the thrust washer (15).*

## STEP 34

Install snap ring (14), make sure the snap ring is located correctly into the groove.

https://truckmanualshub.com/



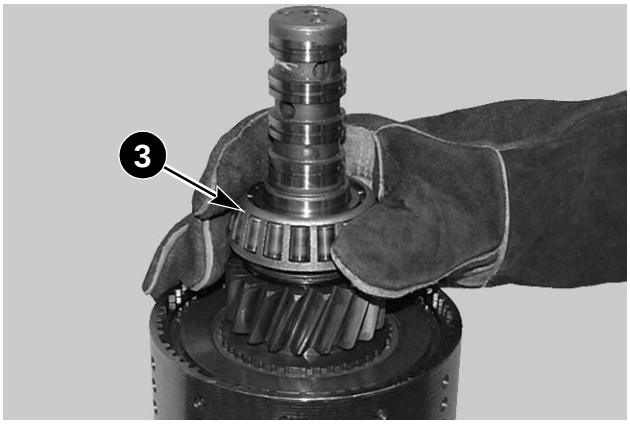



DI06C045

https://truckmanualshub.com/



## STEP 35

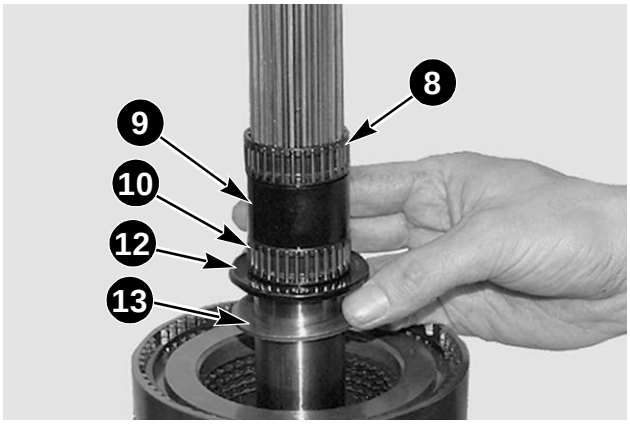



MI06C032

Heat bearing cone (3) in a bearing oven to a temperature of 110℃ (230℉). Install the bearing cone onto the shuttle shaft. Make sure the bearing cone is against the snap ring.

**WARNING:** ***Always wear heat protective gloves or mittens when handling heated parts.***

## STEP 36

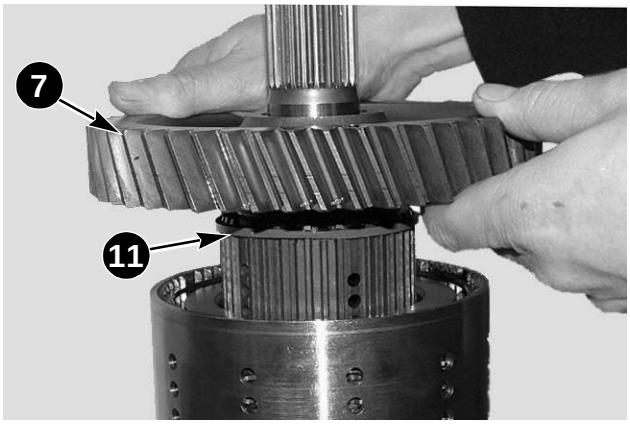



DI06C022

Install thrust washer (13), thrust bearing (12), roller bearing (10), spacer (9) and roller bearing (8).

**NOTE:** *Make sure the needle roller side (open side) of the thrust bearing (12) is towards the thrust washer (13).*

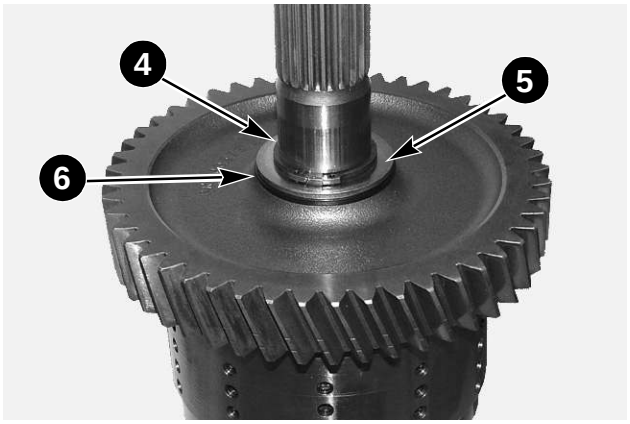
## STEP 37




DI06C023

Install a new seal ring (11) onto the forward gear hub (7). Align the reverse clutch pack friction plates and install gear hub (7). Make sure all the friction plates engage onto the gear hub (7).

## STEP 38




DI06C24

Install thrust bearing (6) and thrust washer (5). Install the snap ring (4).

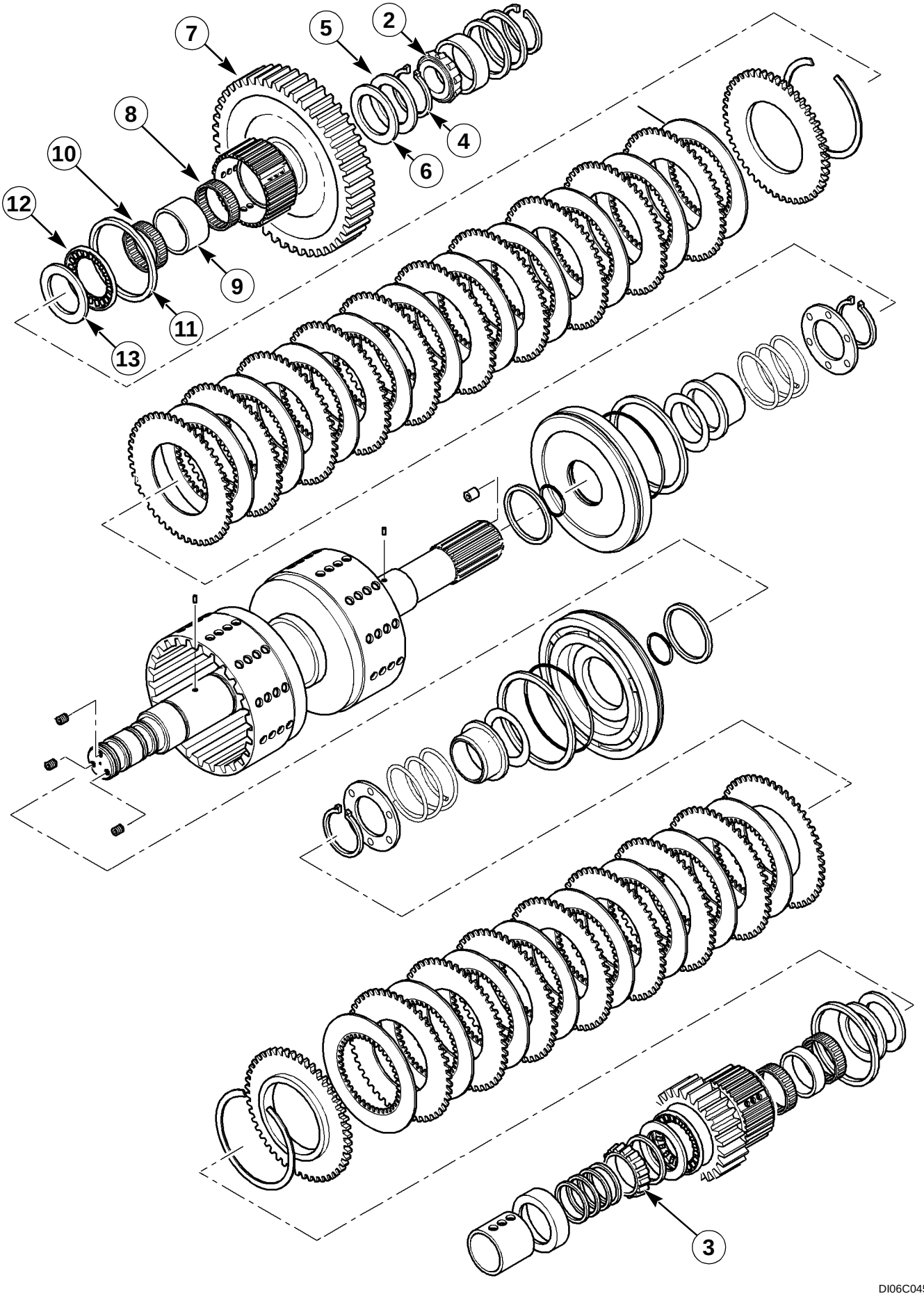
**NOTE:** *Make sure the needle roller side (open side) of the thrust bearing (6) is towards the thrust washer (5).*

## STEP 39

Install the snap ring (4), make sure the snap ring is located correctly into the groove.

https://truckmanualshub.com/



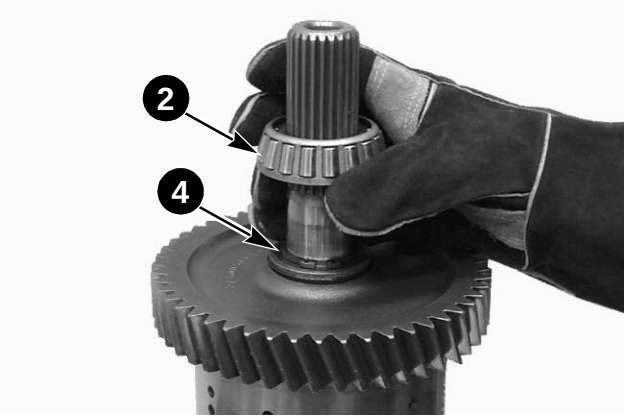



DI06C045

https://truckmanualshub.com/



## STEP 40

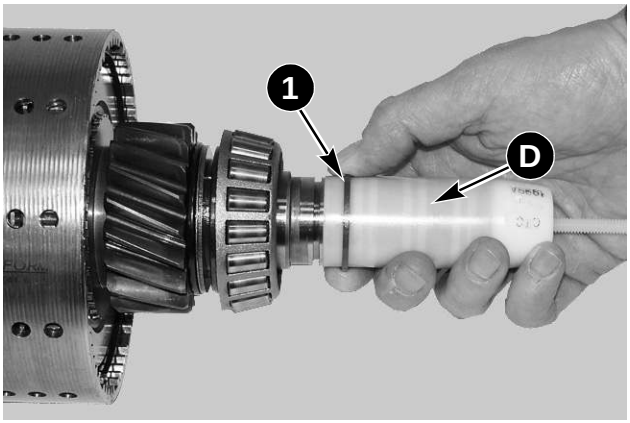



DI06C025

Heat bearing cone (2) in a bearing oven to a temperature of 110℃ (230℉). Install the bearing cone onto the shuttle shaft. Make sure the bearing cone is against the snap ring (4).

**WARNING:** ***Always wear heat protective gloves or mittens when handling heated parts.***

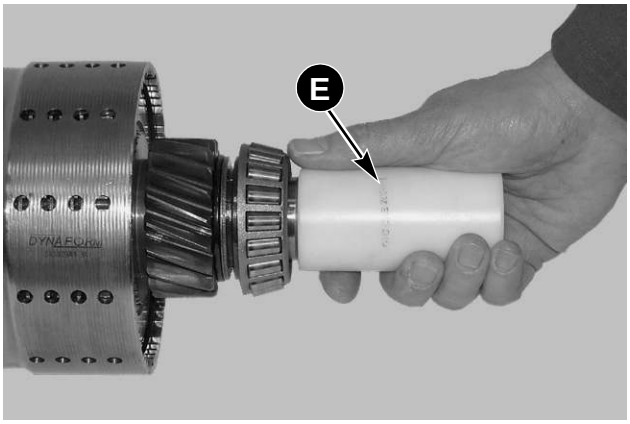
## STEP 41



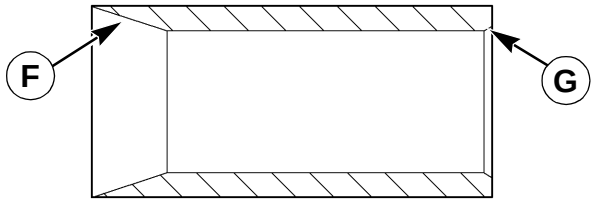

DI06C033

Lubricate a new seal ring (1) with clean transmission oil. Using the seal expander MC1999A (D), install the seal ring into the inner groove in the shuttle shaft. Remove the seal expander MC1999A.

## STEP 42




DI06C034




MI95M085

Compress and reshape seal ring (1) by hand. Install the long chamfer end (F) of seal compressor MC2500-1 (E) over the shuttle shaft and seal ring (1). Remove the seal compressor (E) then install the short chamfer end (G) of the seal compressor over the seal ring (1).

## STEP 43

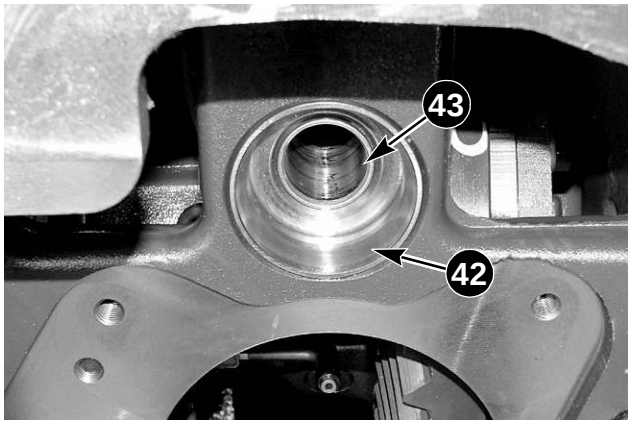
Repeat STEP 41 and STEP 42 for the remaining seal rings (1).

**NOTE:** *Check and make sure the new seal rings are not twisted or damaged and the seal rings will turn freely in the grooves. Replace the seal rings if necessary.*

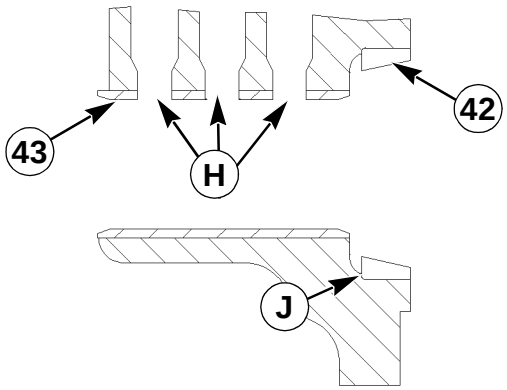
https://truckmanualshub.com/



## STEP 44




DI06C020

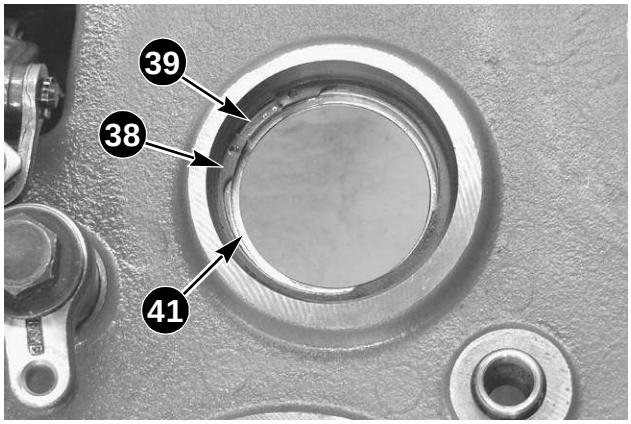



MI06C021

If the wear sleeve (43) and/or bearing cup (42) have been removed. Use a bushing/bearing driver to install a new wear sleeve (43) and bearing cup (42).

Make sure the holes (H) in the wear sleeve (43) are correctly aligned with the oil galleries in the transmission housing and the bearing cup (42) is fully seated against the shoulder (J).

## STEP 45




MD06C019

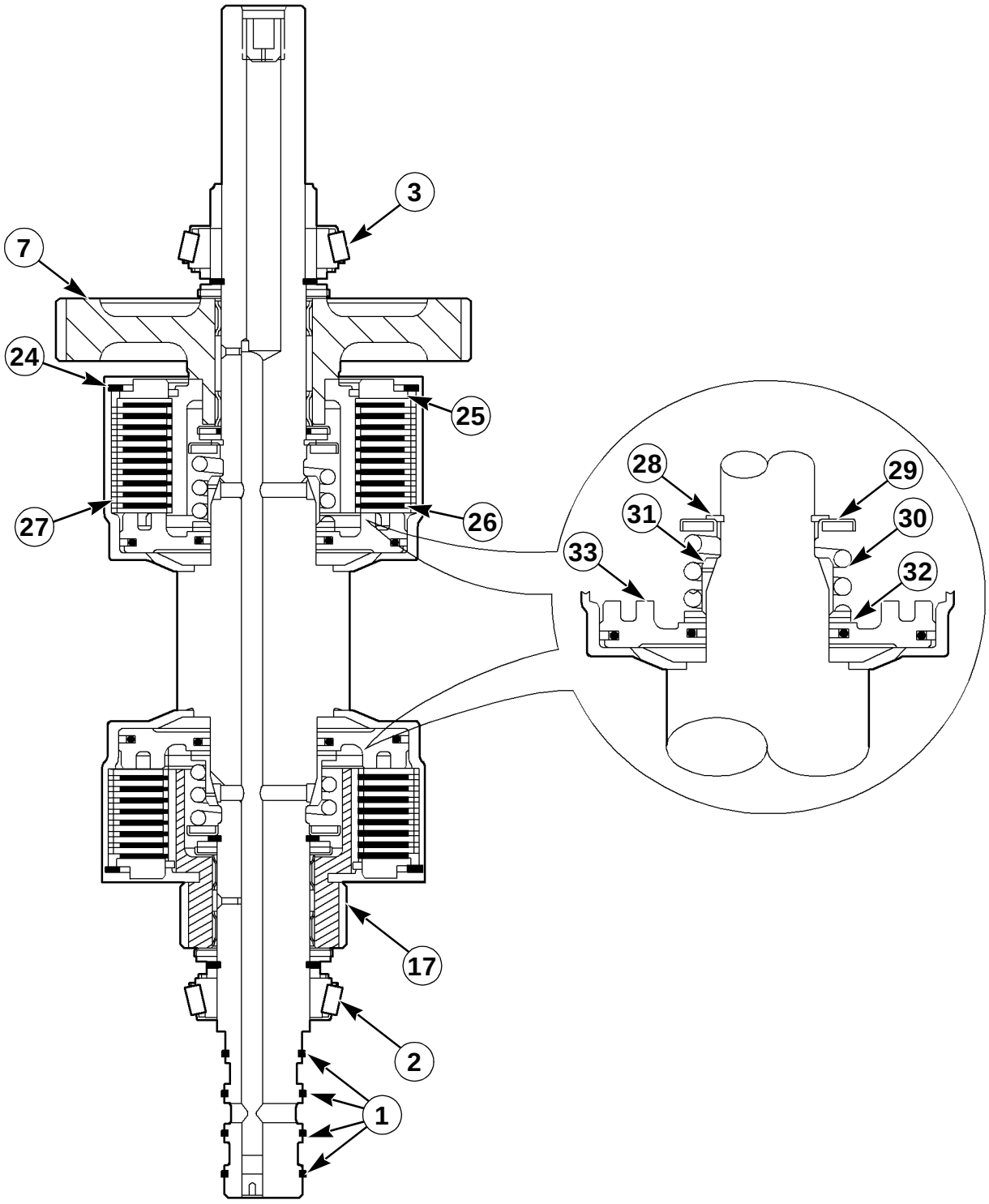
If the front bearing cup (41) has been removed, use a bearing driver and install a new bearing cup (41) into the bearing carrier housing. Install spacer (39) and snap ring. DO NOT install shims (40). Make sure the bearing cup (41), spacer (39) and snap ring (38) are in contact.

**IMPORTANT:** *Shims (40) are to be determined and installed during the bearing carrier housing installation.*

https://truckmanualshub.com/



## Cross Sectional Drawing of the Shuttle Shaft




MI06D058

1. SEAL RINGS
2. BEARING CONE
3. BEARING CONE
7. FORWARD GEAR
17. REVERSE GEAR
24. SNAP RING
25. BACKING PLATE
26. FRICTION PLATE
27. SEPARATOR PLATE
28. SNAP RING
29. SPRING RETAINER
30. SPRING
31. LUBRICATION SLEEVE
32. SHIM
33. PISTON

https://truckmanualshub.com/

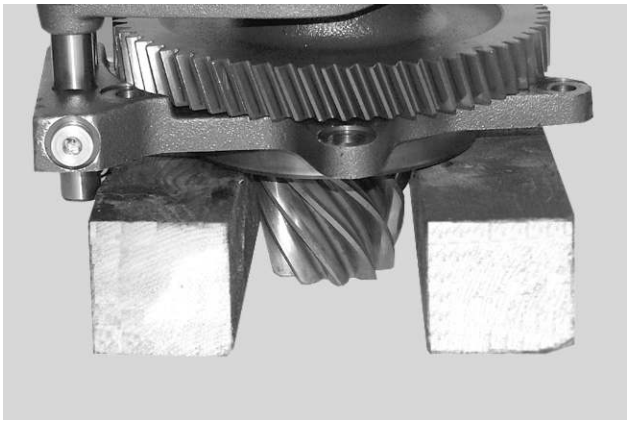


# PINION SHAFT

## Disassembly and Assembly

**NOTE:** *Assembly is in reverse order of disassembly.*

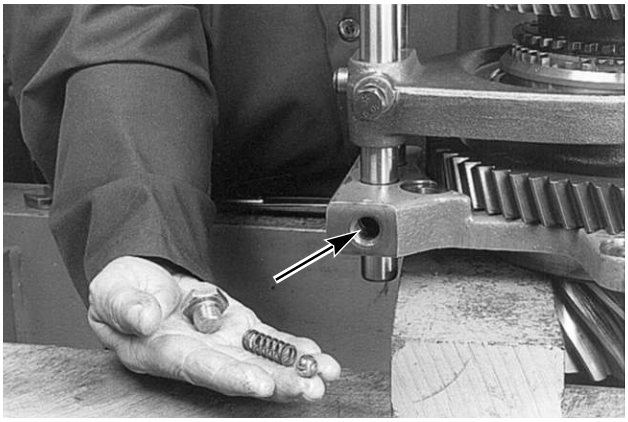
### STEP 1



MD06C048

Place the pinion shaft on a work bench and secure with suitable wooden blocks.

### STEP 2



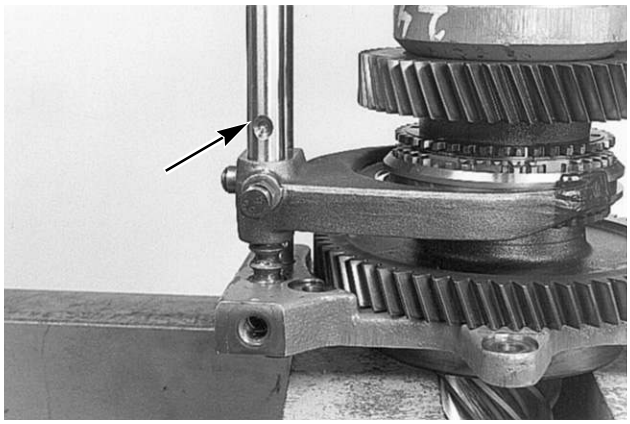
RP98M011

Remove the 1st/2nd range detent plug, spring and ball from the rear support.

### STEP 3

Repeat STEP 2 and remove the 3rd/4th range detent plug, spring and ball.

### STEP 4



RP98M012

Loosen the 1st/2nd selector fork locknut and retaining bolt. Remove the 1st/2nd selector rail and selector fork.

**NOTE:** *For Assembly, make sure the selector fork locates correctly onto the sychronizer and the selector rail retaining bolt detent is aligned with the selector fork retaining bolt.*

**NOTE:** *Apply Loctite 638 (680) to the threads of the selector fork retaining bolt.*

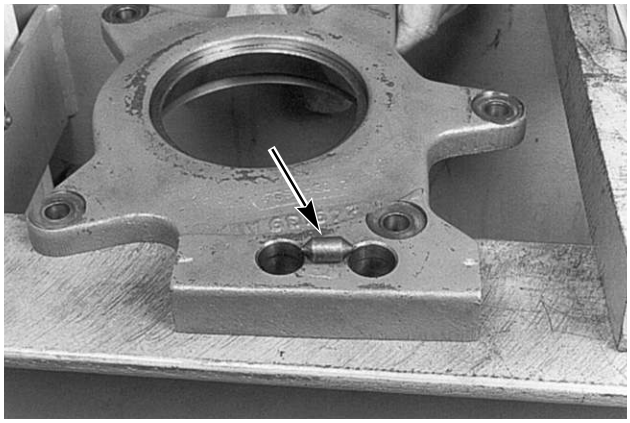
### STEP 5

**NOTE:** Repeat STEP 4 and remove the 3rd/4th range selector rail and selector fork.

**NOTE:** *For Assembly install the 3rd/4th selector fork and selector rail, make sure the selector fork locates correctly onto the sychronizer and the selector rail retaining bolt detent is aligned with the selector fork retaining bolt.*

**NOTE:** *Apply Loctite 638 (680) to the threads of the selector fork retaining bolt.*

### STEP 6



RP98M071

Remove the interlock plunger from the rear support.

https://truckmanualshub.com/



### STEP 7

Remove retaining ring (1), thick thrust washer (2) and thrust bearing (3).

### STEP 8

Remove forth gear (4), washer (5) and thrust bearing (6).

### STEP 9

Remove synchronizer and hub assembly (7).

### STEP 10

Remove retaining ring (8), thick thrust washer (9) and thrust bearing (10).

### STEP 11

Remove third gear (11).

### STEP 12

Remove thrust bearing (12) and thin thrust washer (13).

### STEP 13

Remove the centre support and bearing assembly (14).

**NOTE:** *For Disassembly and Assembly refer to "Pinion Shaft Centre Support" on page 45.*

### STEP 14

Remove retaining ring (15), thin thrust washer (16) and thrust bearing (17).

### STEP 15

Remove second gear (18) and thrust washer (19).

### STEP 16

Remove the synchronizer and hub assembly (20).

### STEP 17

Remove retaining ring (21), thick thrust washer (22), thrust bearing (23) and thin thrust washer (24).

### STEP 18

Remove first gear (25).

### STEP 19

Remove spacer (26), needle rollers (27) spacer (28), needle rollers (29) and spacer (30).

**NOTE:** *There are a total of 76 needle rollers for the first gear.*

### STEP 20

Remove thick thrust washer (31), thrust bearing (32) and thick thrust washer (33).

### STEP 21

Remove bearing support (34) from the pinion shaft and shim (35) if equipped.

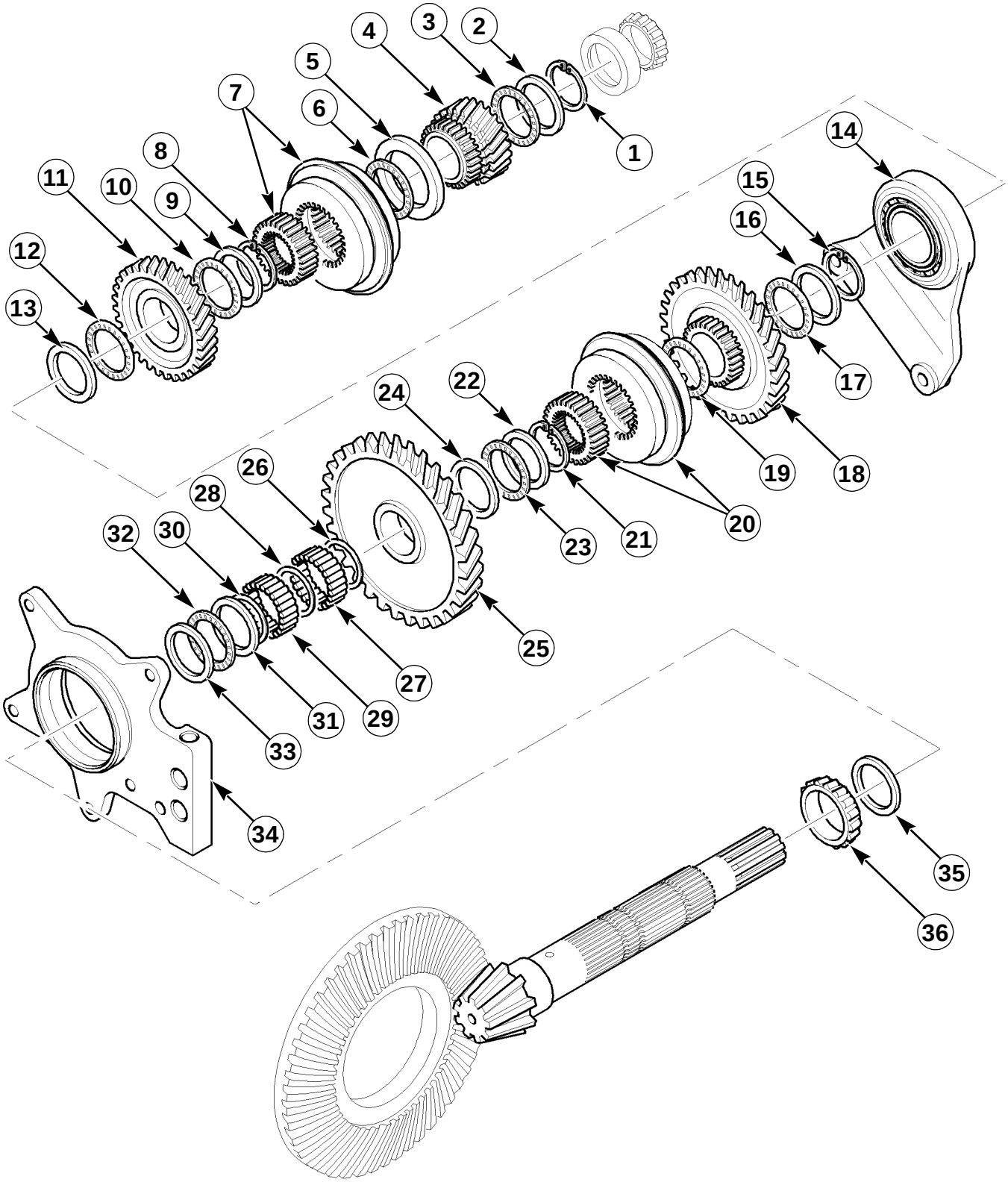
**NOTE:** *For assembly, refer to "First Gear Shimming Procedure" on page 42.*

### STEP 22

Using a press or suitable bearing puller remove bearing (36) from the pinion shaft.

https://truckmanualshub.com/






MD06C037

https://truckmanualshub.com/



## First Gear Shimming Procedure

### STEP 1

Heat bearing cone (36) in a bearing oven to a temperature of 110°C (230°F). Install bearing cone (36) onto the pinion shaft. Make sure the bearing is against pinion gear.

**WARNING:** ***Always wear heat protective gloves or mittens when handling heated parts.***

### STEP 2

Install thrust washer (33), thrust bearing (32) and thrust washer (31)

**NOTE:** *Do not install the needle rollers at this stage.*

### STEP 3

Install first gear (25), thrust washer (24), thrust bearing (23) and thrust washer (22).

### STEP 4

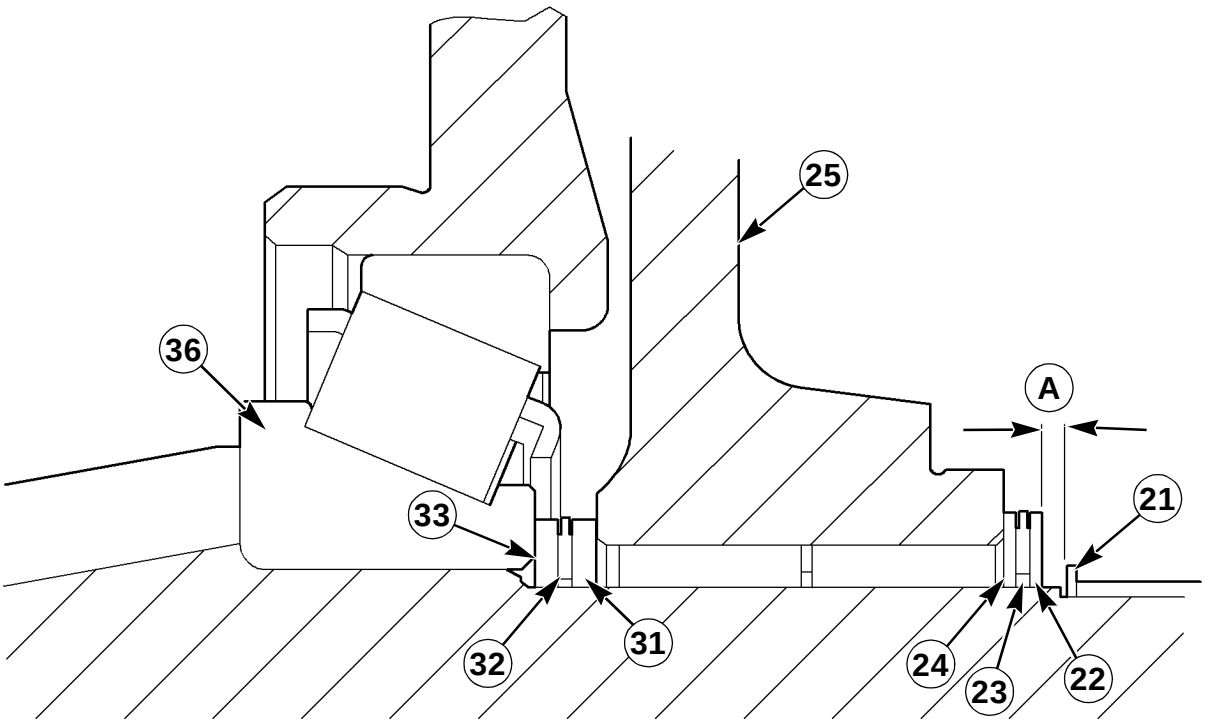
Install retaining ring (21).

### STEP 5

Measure the end play (A) between thrust washer (22) and retaining ring (21).

### STEP 6

Disassemble the first range gear from the pinion shaft. Remove the rear thrust washers and thrust bearing. Select the required shims from the table below based on measurement (A).




MD06C038

| MEASUREMENT A | 0 - 0.5 mm | 0.51 - 0.8 mm | 0.81 - 1.10 mm | 1.11 - 1.40 mm |
|---|---|---|---|---|
| NO OF SHIMS REQUIRED | 0 | 1 | 2 | 3 |

https://truckmanualshub.com/

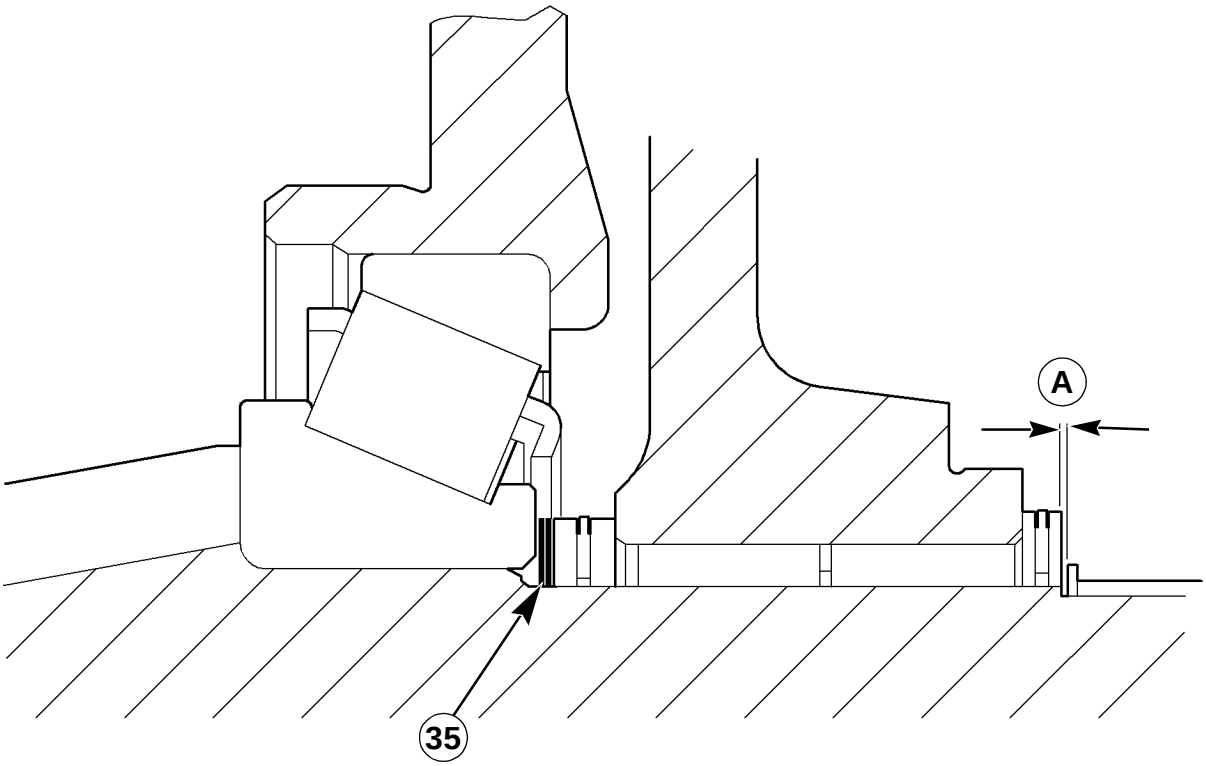


**STEP 7**

Place the selected shim(s) (35) on the pinion shaft bearing cone. Assemble the first range gear including the needle rollers, thrust bearings and thrust washers.

**STEP 8**

Check the end play (A) of the gear. End play should be between 0.20 and 0.50 mm (0.008 to 0.02 inch).




MD06C039

https://truckmanualshub.com/

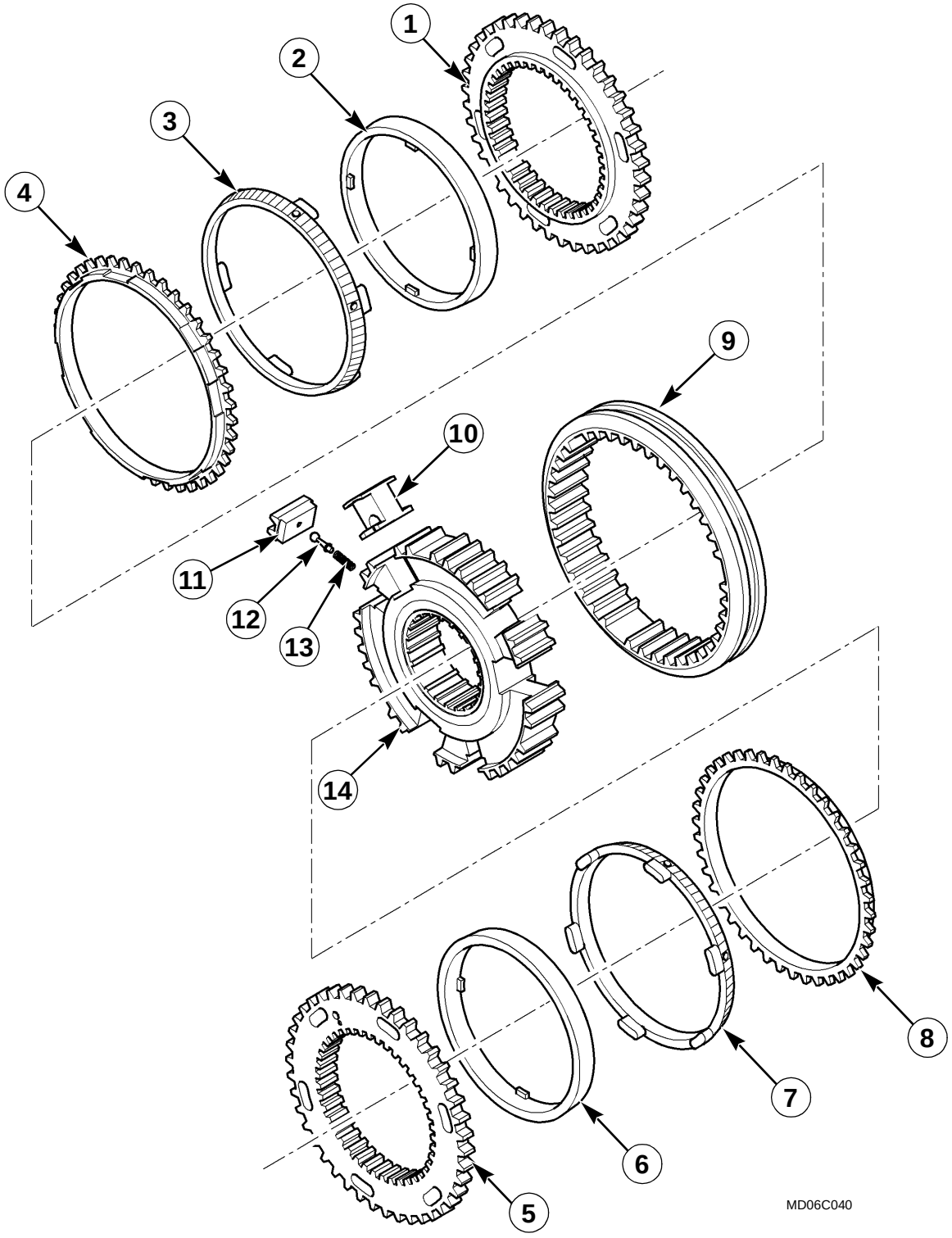


# Synchronizer

## Disassembly and Assembly

**NOTE:** *Items are numbered in order of Disassembly, Assembly is in reverse order of Disassembly.*

**NOTE:** *If any of the parts are worn or damaged the synchronizer must be replaced.*




4.GEAR RING 8. GEAR RING 12.PLUNGER (3)

https://truckmanualshub.com/



# Pinion Shaft Centre Support

## Disassembly and Assembly

**NOTE:** *Items are numbered in order of Disassembly, Assembly is in reverse order of Disassembly.*

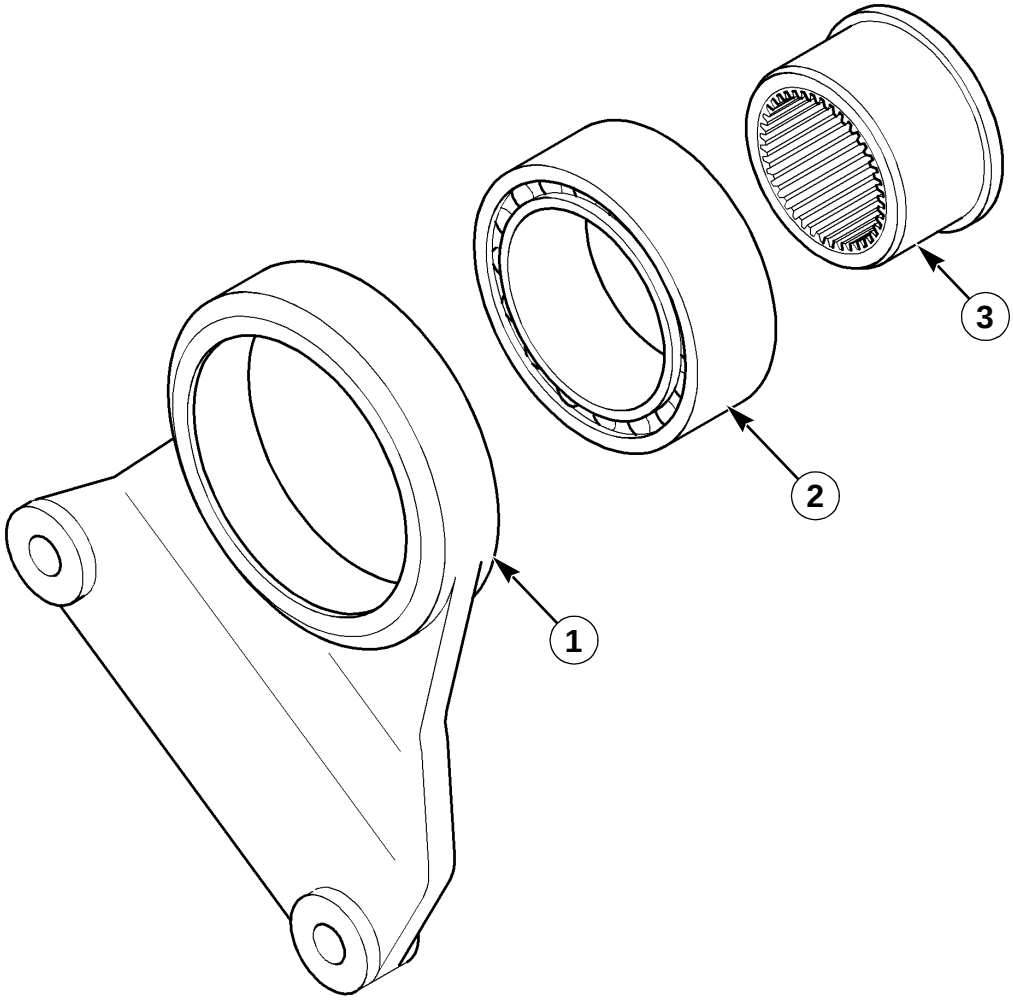
### STEP 1

Place the bearing support housing (1) in a suitable hydraulic press and remove the bearing (2) from the support housing.

### STEP 2

Place the bearing (2) in the hydraulic press and remove the centre hub (3) from the bearing.

**NOTE:** *For assembly, make sure the circlip side of the bearing faces the shoulder in the support housing.*

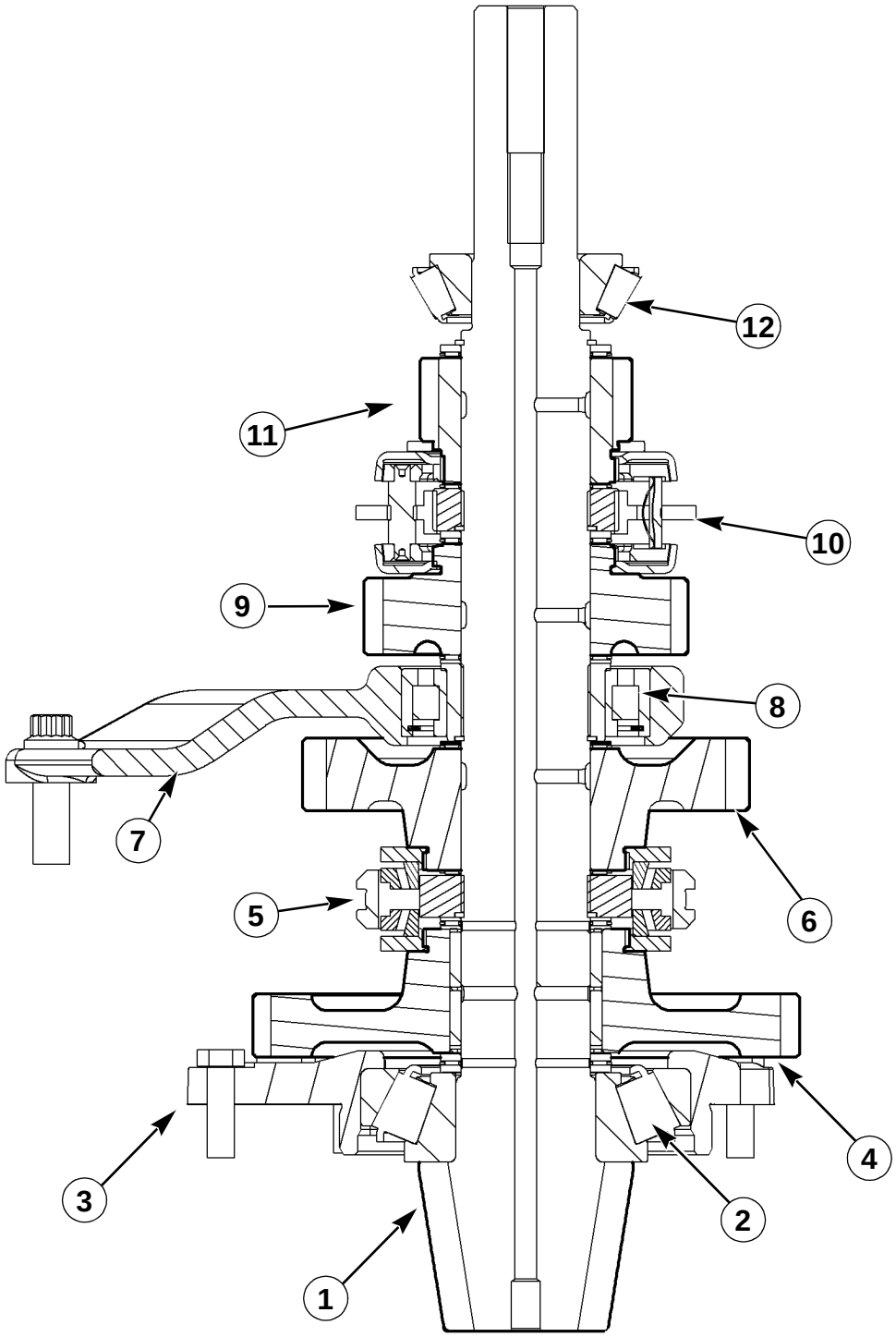



MD06C041

https://truckmanualshub.com/



# Cross Sectional Drawing of the Pinion Shaft




1. PINION SHAFT
2. PINION BEARING
3. PINION BEARING CARRIER
4. 1ST GEAR
5. 1ST/2ND GEAR SYNCHRONIZER ASSEMBLY
6. 2ND GEAR
7. CENTRE BEARING SUPPORT
8. CENTRE SUPPORT BEARING
9. 3RD GEAR
10. 3RD/4TH GEAR SYNCHRONIZER ASSEMBLY
11. 4TH GEAR
12. FRONT PINION BEARING

https://truckmanualshub.com/



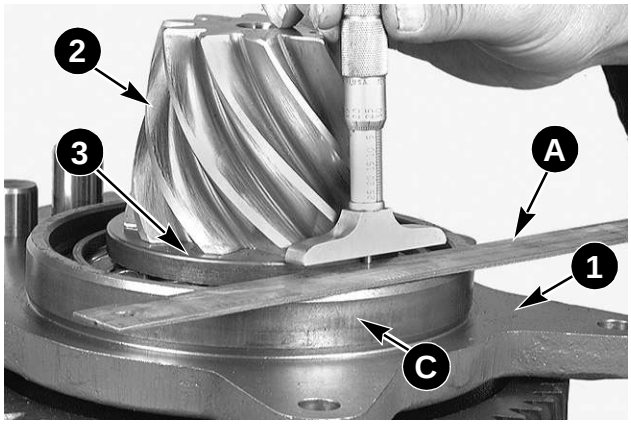
# PINION SHAFT SETTINGS

## Pinion Shaft Mounting Distance

**IMPORTANT:** *If the pinion shaft or pinion shaft bearings have been replaced the pinion shaft mounting distance and pinion bearing preload must be set correctly.*

**IMPORTANT:** *The pinion shaft bearing preload can only be set with the crown wheel ring gear removed. Remove the differential/crown wheel assembly if not already been removed, refer to Section 6012.*

### STEP 1




MD06C074

Support the pinion shaft bearing carrier (1) on suitable supports, make sure the pinion shaft (2) is free to rotate.

Rotate the pinion shaft several times to seat the bearing cone in the bearing cup.

Place a straight edge (A) on top of the bearing carrier shoulder and against the bearing cone (3). Using a micrometer and depth micrometer to measure and note the following:

Thickness of the straight edge (A).

Measurement (B) between the top of the straight edge and the bearing cone (3).

Height of the bearing carrier (1) shoulder (C).

Use the following example to determine dimension (D) between the rear of the bearing cone (3) and the mounting face of the pinion shaft bearing carrier (1).

Measurement (A)
Thickness of straight edge ..... 2.5 mm

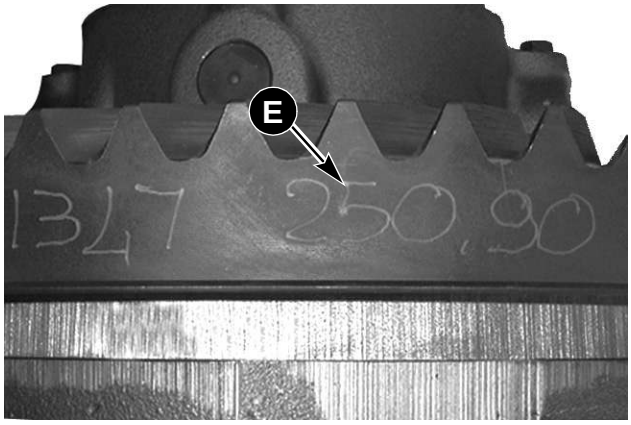
Measurement (B)
Bearing Cone (3) to straight edge ..... 0.83 mm

Measurement (C)
Height of bearing carrier shoulder ..... 22.6 mm

A + B + C = D

Dimension D = ..... 25.93 mm

### STEP 2




MD06C078

Make a note of the dimension (E) etched on the ring gear as shown.

Use the following example to determine pinion shaft mounting distance (G).

Dimension (D) determined in STEP 1 ... 25.93 mm

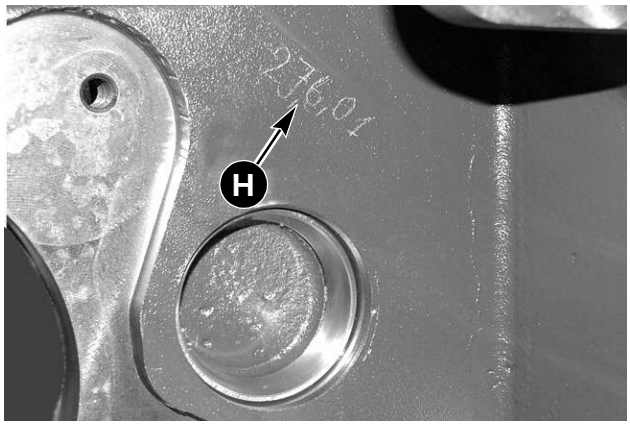
Dimension (E) etched on ring gear ..... 250.90 mm

Dimension (F) constant ..... 0.25 mm

D + E + F = G

Pinion Mounting Distance G = ..... 277.08 mm

### STEP 3




MD06C070

Subtract the dimension (H) etched on the on the range transmission housing from the pinion shaft mounting distance (G) determined in STEP 2 to obtain the correct shim pack thickness to be installed.

Example:

Pinion Mounting Distance,
Determined in STEP 2..... 277.08 mm

Dimension (H),
etched on range transmission ..... 276.01 mm

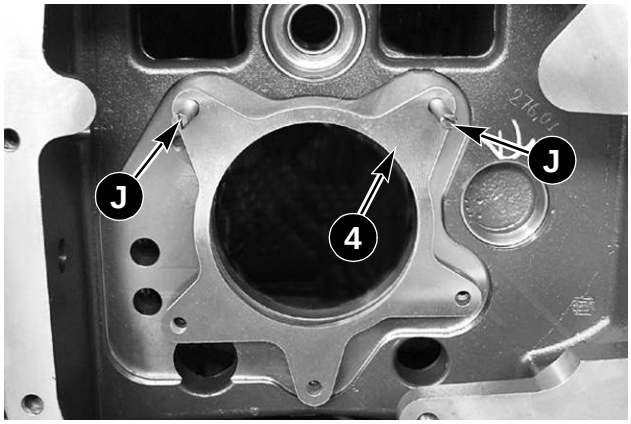
G - H = Shim Pack Thickness

Required Shim Pack = ..... 1.07 mm

https://truckmanualshub.com/



## STEP 4




MD06C055

Install two 12 mm alignment studs (J) in the range transmission housing as shown and install shims (4) Make sure the 12 mm alignment studs protrude 85 mm from the transmission housing.

## STEP 5.



MD06C054

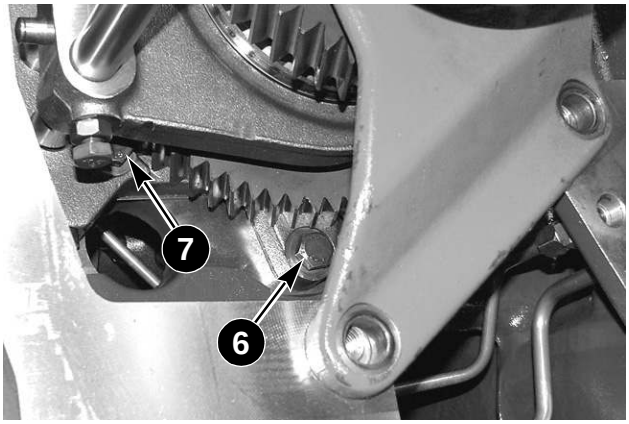
Attach suitable lifting equipment to the pinion shaft centre support as shown and carefully install the pinion shaft on to the alignment studs.

**NOTE:** *For XtraSpeed tractors make sure the 1st/2nd gear selector pivot shaft locates correctly on to the selector fork bushing.*

## STEP 6




MD06C060

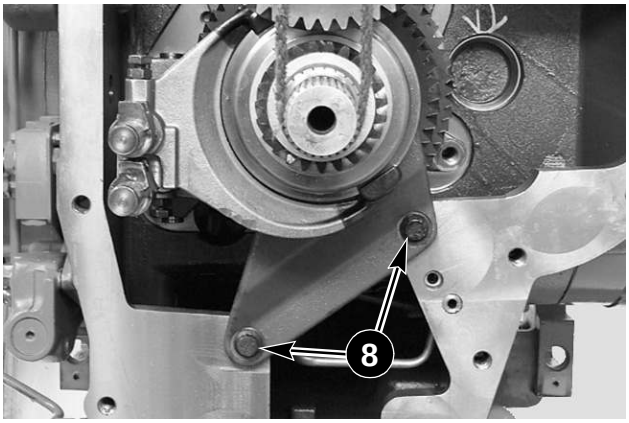



MD06C051

Remove the two 12 mm alignment studs and install the pinion shaft bearing carrier retaining bolts (5), (6) and (7). Evenly tighten all the pinion shaft bearing carrier retaining bolts to a torque of 100 to 113 Nm (74 83 lb ft).

**NOTE:** *It will be necessary to use a suitable crows foot wrench to tighten the lower retaining bolt (7).*

## STEP 7




MD06C049

Remove the lifting equipment from the centre support. Support the front of the pinion shaft on the lifting equipment and install the two centre support retaining bolts (8). DO NOT tighten at this stage, remove the lifting equipment.

https://truckmanualshub.com/



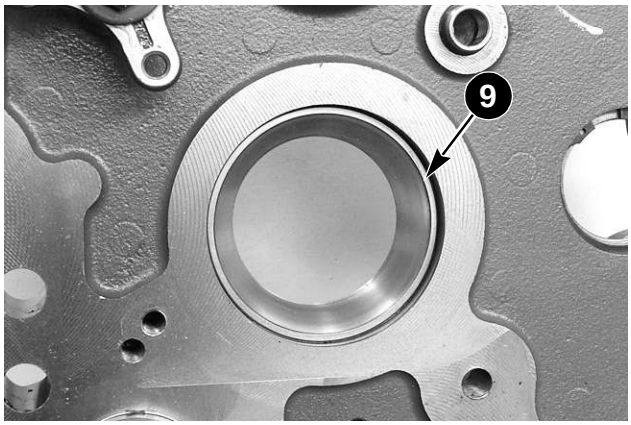
# Pinion Shaft Bearing Preload Setting

**IMPORTANT:** *The pinion shaft bearing preload can only be set with the crown wheel ring gear removed. Remove the differential/crown wheel assembly if not already been removed, refer to Section 6012.*

## STEP 8

Make sure the mounting faces of the range transmission and bearing carrier housing are clean.

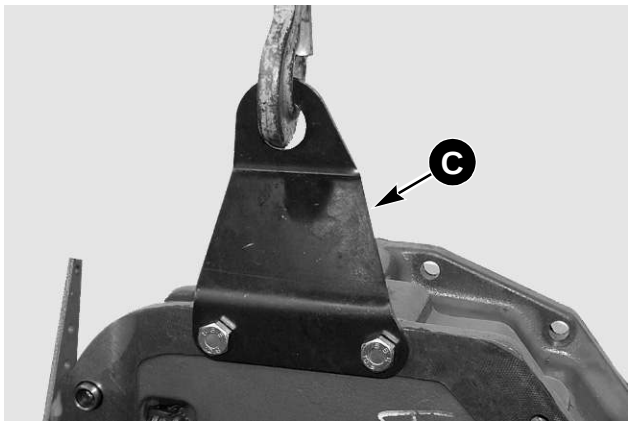
## STEP 9




MD06C061

If the pinion shaft front bearing cup has been removed, use a bearing driver and install the new bearing cup (9). Make sure the bearing cup is fully installed against the shoulder in the bearing carrier housing.

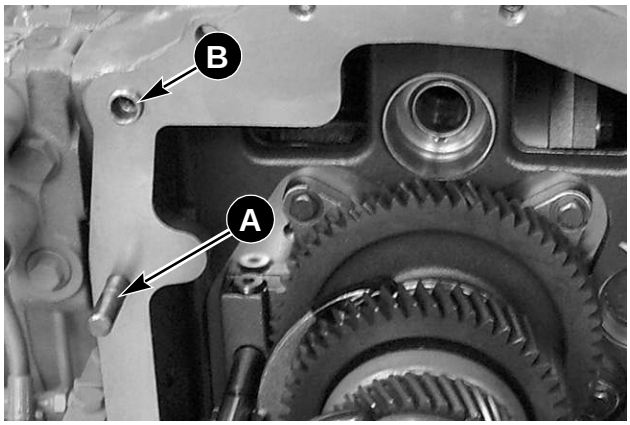
## STEP 10



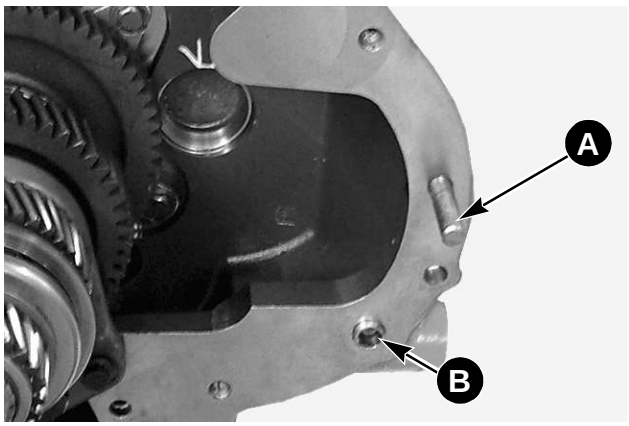

DI06C028

Install the lifting bracket MC2565 (C) using two 16 x 35 mm bolts.

## STEP 11




MD06C077



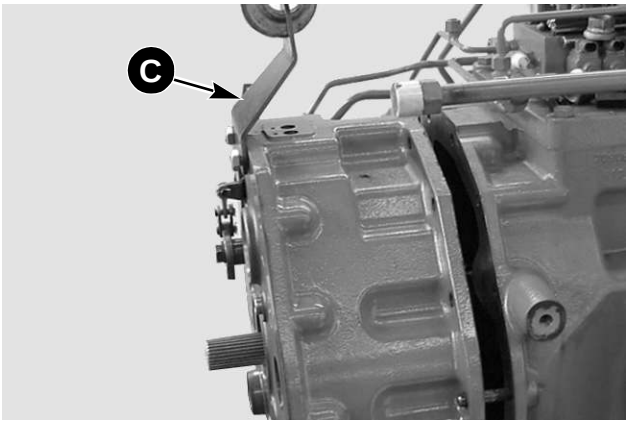

MD06C076

Install two alignment studs (A) (MC2572) as shown. Make sure the location dowels (B) are installed into the range transmission as shown or installed into the bearing carrier housing.

https://truckmanualshub.com/



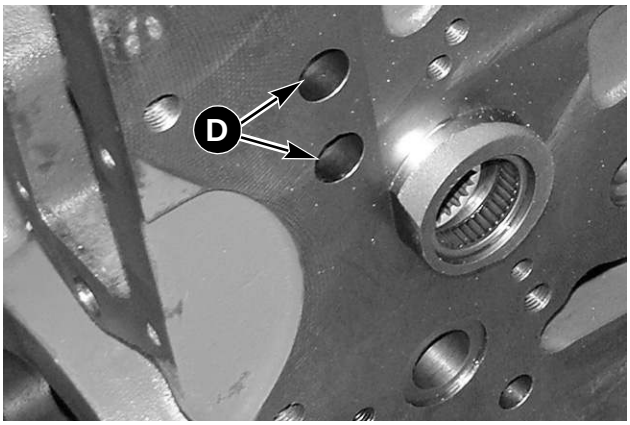
## STEP 12




MI06C073

Attach suitable lifting equipment to the lifting bracket MC2565 (C) and install the bearing carrier housing onto the alignment studs.

## STEP 13




MD06C075

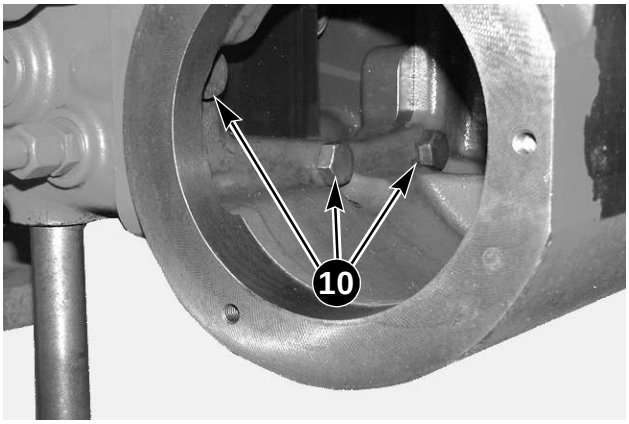
Slide the bearing carrier housing along the alignment studs. Make sure the shifter rails locate into shifter rail support holes (D) in the bearing carrier housing.

## STEP 14

Continue to fully install the bearing carrier housing, Install and tighten 11 bearing carrier housing retaining bolts to a torque of 250 to 280 Nm (185 to 206 lb ft). Remove the alignment studs from the range transmission install and tighten the two remaining external retaining bolts to a torque of 250 to 280 Nm (185 to 206 lb ft).

**IMPORTANT:** *Make sure the longer bolts are installed through the locating dowels (B), refer to STEP 11.*

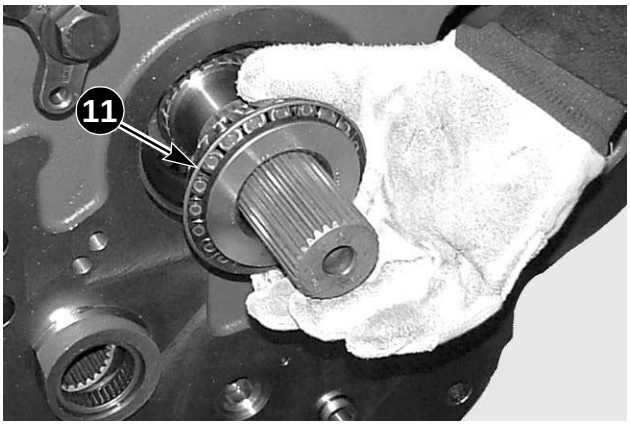
## STEP 15




MD06C065

Gaining access through the filter screen housing, Install and tighten the three internal bearing carrier housing retaining bolts (10) to a torque of 250 to 280 Nm (185 to 206 lb ft).

## STEP 16




MI06C063

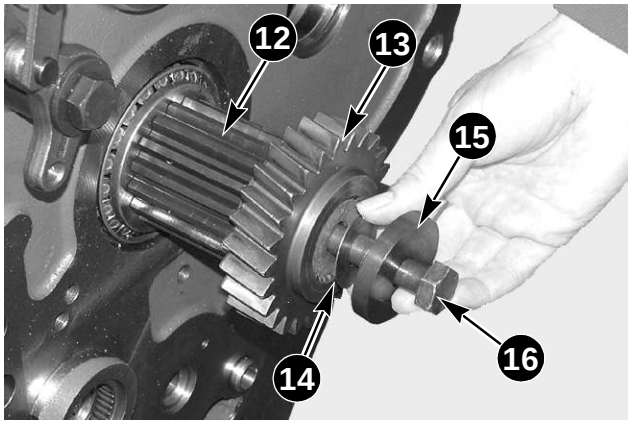
Heat the pinion shaft bearing cone (11) in a bearing oven to a temperature of 110℃ (230℉). Install the bearing cone onto the pinion shaft.

**WARNING:** ***Always wear heat protective gloves or mittens when handling heated parts.***

https://truckmanualshub.com/



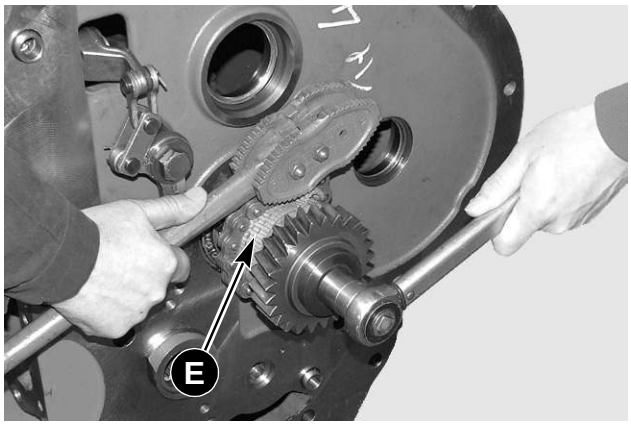
## STEP 17




MD06C064

Install the park brake hub (12) and MFD drive gear (13). Install shims (14) with a nominal thickness of 2.7 mm, washer (15) and pinion retaining bolt (16).

## STEP 18



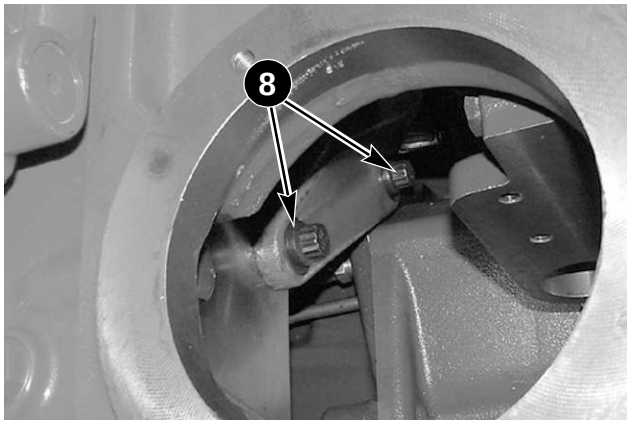

MD06C027

Install protective webbing (E) around the park brake hub and using a suitable chain wrench to hold the pinion shaft. Tighten pinion shaft retaining bolt to a torque of 280 Nm (206 lb ft).

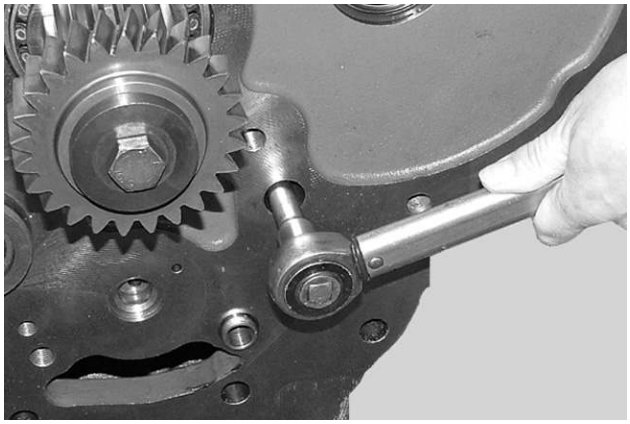
## STEP 19

Rotate the pinion shaft to seat the bearings and check the pinion shaft retaining bolt torque. Repeat STEP 18 until the bolt torque remains constant.

## STEP 20



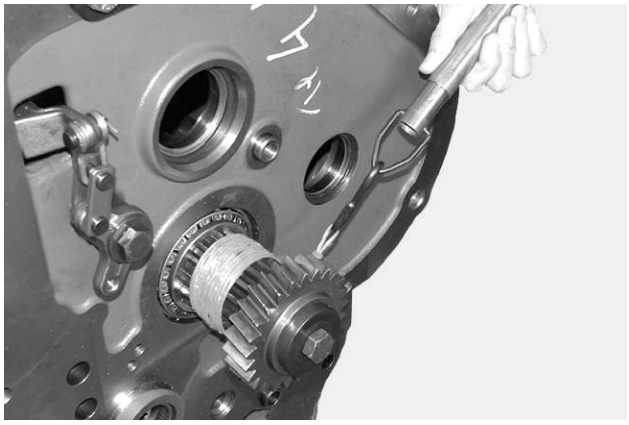

MD06C068



MD06C069

Gaining access through the filter screen housing for the lower centre bearing support bolt and through the bearing carrier housing for the upper centre bearing support bolt, tighten the bolts (8) (installed in STEP 7) to a torque of 250 Nm (185 lb ft).

## STEP 21



MD06C066

Wrap a length of cord around the park brake hub without overlapping the cord. Connect a spring balance to the cord and check the pinion bearing preload. The correct rolling pull must be 1.5 to 4.5 kg/f (3.3 to 8.8 lb/f).

https://truckmanualshub.com/

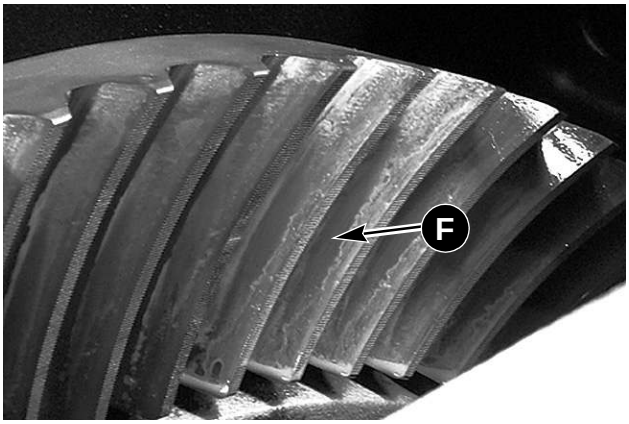


## STEP 22

If the rolling pull is incorrect, remove the pinion shaft retaining bolt and add or remove shims as necessary. Install the retaining bolt and repeat STEP 18 and STEP 19.

**NOTE:** *If shims are to be added It may be necessary to backseat the bearing by lightly tapping the end of the bearing using a soft faced hammer.*

## STEP 23




MD06G054

Install the differential, refer to Section 6012 check and adjust the pinion gear and ring gear backlash and check the pinion/ring gear tooth patterns (F) are correct.

**IMPORTANT:** *The pinion gear and ring gear tooth patterns MUST be set correctly. Failure to set correct the tooth patterns will cause damage the pinion/ring gear.*
*If the tooth patterns are not correct remove the pinion shaft and add or remove the pinion shaft mounting distance shims as required. Repeat STEP 4 to of the Pinion Shaft Setting procedure until the correct tooth patterns are obtained.*

https://truckmanualshub.com/

6012

# Section 6012

## DIFFERENTIAL AND DIFFERENTIAL LOCK SERVICING

## XTX185, 200 and 215 Tractors

McCORMICK

SM 8-15210

© 2006 McCormick Tractors International Limited.
September 2006

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIFICATIONS .....3

SPECIAL TORQUES .....4

SPECIAL TOOLS .....4

DIFFERENTIAL AND DIFFERENTIAL LOCK
GENERAL INFORMATION .....5

DIFFERENTIAL AND DIFFERENTIAL LOCK
Removal ..... 6
Disassembly ..... 8
Assembly ..... 12
Installation ..... 19
Cross Sectional Drawing of the Differential Assembly ..... 22

DIFFERENTIAL ADJUSTMENTS
Differential Bearing Preload Adjustment ..... 23
Pinion/Ring Gear Backlash Adjustment ..... 26

PINION/RING GEAR TOOTH PATTERN
Correct Tooth Pattern ..... 27
Incorrect Tooth Pattern ..... 28

https://truckmanualshub.com/



# SPECIFICATIONS

| | | |
|---|---|---|
| Transmission Oil Type | McCormick HTX | |
| Differential Lock | | |
| Friction Plate Thickness | 4.95 to 5.21 mm | 0.195 to 0.205 inch |
| Separator Plate Thickness | 2.65 to 2.83 mm | 0.104 to 0.111 inch |
| Number of Plates | | |
| Friction Plates | 3 | |
| Separator Plates | 4 | |
| Differential Assembly | | |
| Pinion/Ring Backlash | 0.23 to 0.33 mm | 0.009 to 0.013 inch |
| Differential Bearing Rolling Pull | 2.4 to 4.5 kg | 5.3 to 9.9 lb.f |

https://truckmanualshub.com/



## SPECIAL TORQUES

| | | |
|---|---|---|
| Differential Bearing Carrier Retaining Bolt | 235 to 260 Nm | 173 to 192 lb. ft |
| Ring Gear Retaining Bolt With Loctite 638 (680) | 250 to 280 Nm | 185 to 206 lb. ft |
| Differential Planetary Pin Retaining Bolts With Loctite 638 (680) | 58 to 65 Nm | 43 to 48 lb. ft |

## SPECIAL TOOLS

**1. MC1995A ALIGNMENT STUDS**

**2. MC1952 LIFTING ADAPTER**

https://truckmanualshub.com/



# DIFFERENTIAL AND DIFFERENTIAL LOCK GENERAL INFORMATION

If the pinion shaft and ring gear are to be replaced it will be necessary to carry out the following:

- Remove the cab and separate the speed and range transmission, refer to Section 6003.
- Remove the MFD/Park brake assembly, refer to Section 6017.
- Remove the pinion shaft, refer to Section 6007.

**IMPORTANT:** *The pinion shaft and crown wheel ring gear are supplied as a matched set and must be replaced together. If a new pinion shaft and crown wheel ring gear set are installed the correct pinion shaft mounting distance and bearing preload must be set. Also the pinion/ring gear tooth patterns MUST be correct.*

If the differential or differential lock are to be serviced it will be necessary to carry out the following:

- Park the tractor on hard level ground, apply the park brake and remove the key. Put blocks in front and behind the front wheels.
- Install suitable wedges between the front axle and bolster (both sides).
- Disconnect the battery (Negative Terminal first).
- Remove the seat, floor mat and access plate to gain access to the rockshaft/transmission top cover housing.
- Remove the rear three point linkage and lift cylinders.
- Remove the lift arm retaining bolts and washers, put alignment marks on the rockshaft and lift arms. Remove the lift arms.
- Remove the auxiliary valves/manifold assembly and discard the o-ring.
- Remove all necessary tubes and hoses.
- Remove the rockshaft/transmission top cover housing, remove and discard the gasket and o-rings.
- Install and safely support the rear of the transmission on a suitable tractor splitting stand and remove the axle stands.
- Remove the rear axles refer to Section 6018.
- Remove the service brakes, refer to Section 7002.

**NOTE:** *Put identification marks on all disconnected harness connectors.*

**NOTE:** *Cap all disconnected tubes and hoses.*

https://truckmanualshub.com/

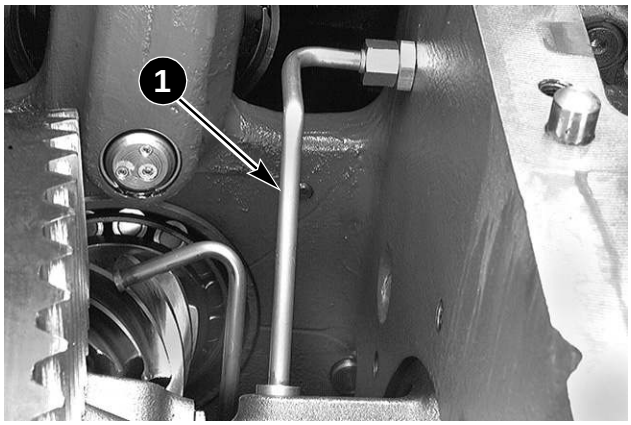


# DIFFERENTIAL AND DIFFERENTIAL LOCK

## Removal

**IMPORTANT:** *The following procedure is to be carried out with the rockshaft/transmission cover and rear axles removed, refer to "DIFFERENTIAL AND DIFFERENTIAL LOCK GENERAL INFORMATION" on page 5.*

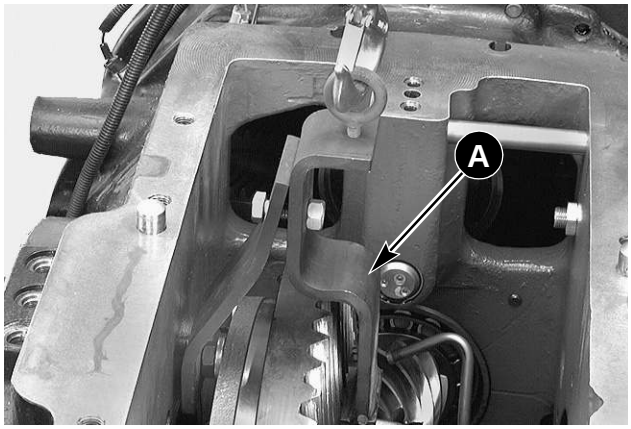
### STEP 1




MH06D025

Remove the differential lock feed tube (1) and discard the o-ring (2) from the tube.

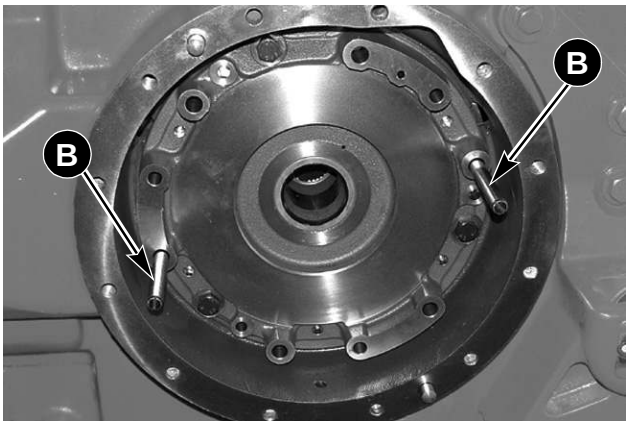
### STEP 2




MH06D026

Install the lifting adapter MC1952 (A) to the differential ring gear and tighten the lifting adapter nut and bolt. Attach suitable lifting equipment onto the lifting adapter MC1952.

### STEP 3




MD06D069

Install two 16 mm alignment studs (MC1995A) (B) through the left hand bearing carrier into the transmission as shown.

### STEP 4

With the differential ring gear supported on the lifting equipment. Remove the retaining bolts (3), left hand differential bearing carrier (4) and shims (5).

**NOTE:** *If the differential carrier bearings are NOT to be replaced, retain the shims for installation. Put identification marks on the shims and keep the shims with the left hand bearing carrier.*

### STEP 5

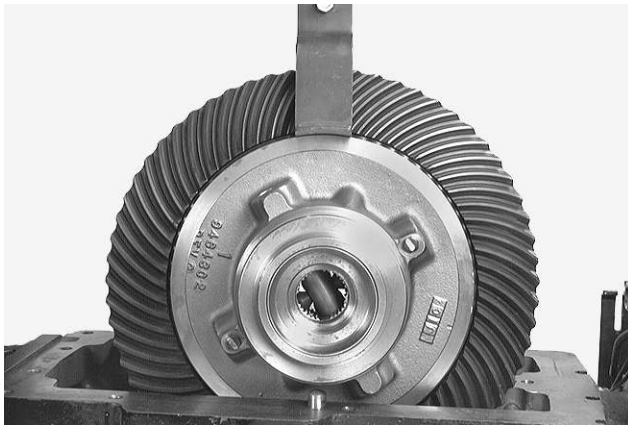
Repeat STEP 3 and STEP 4 and remove the retaining bolts (6), right hand differential carrier (7) and shims (8).

**NOTE:** *If the differential carrier bearings are NOT to be replaced, retain the shims for installation. Put identification marks on the shims and keep the shims with the right hand bearing carrier.*

https://truckmanualshub.com/

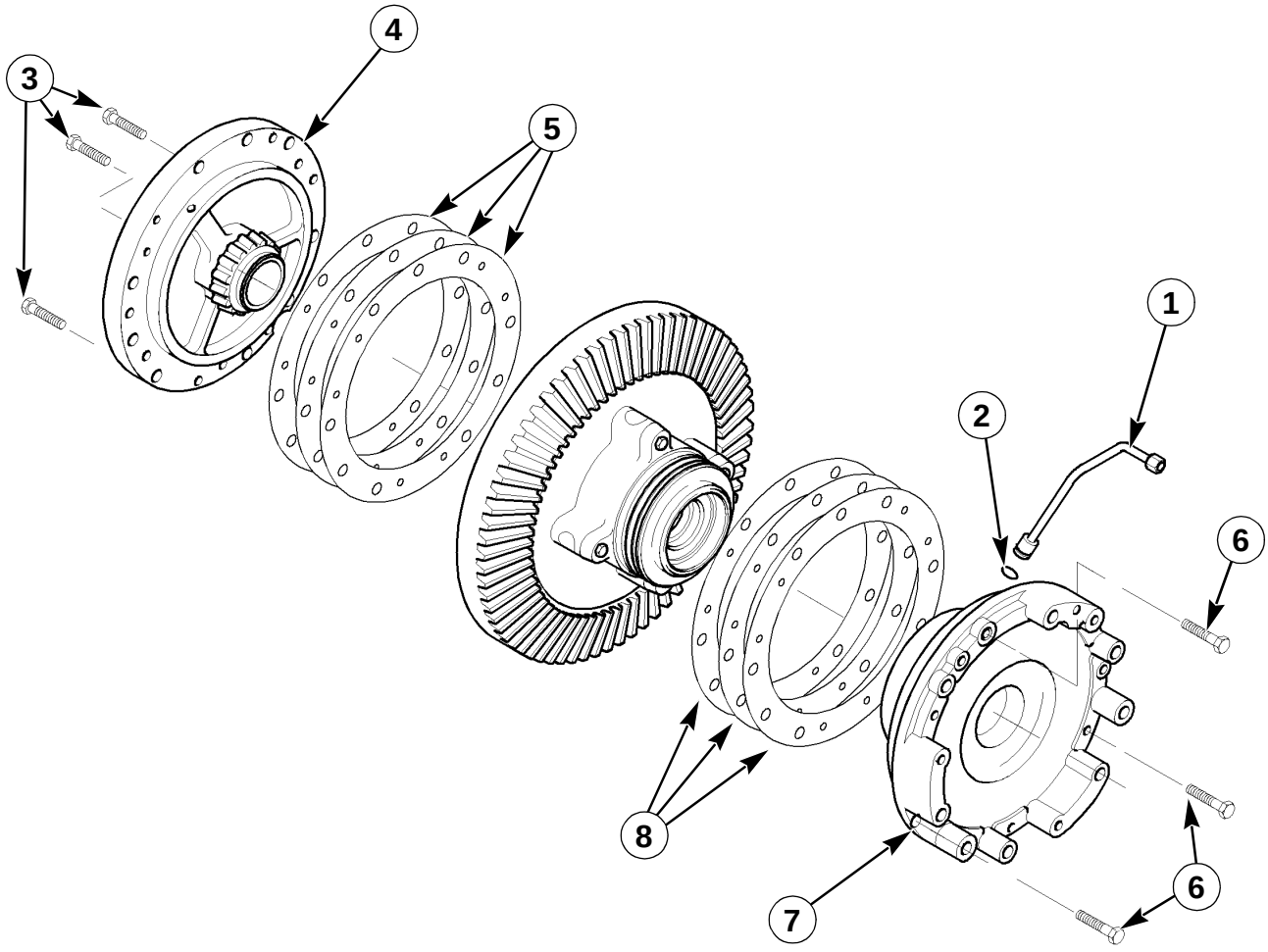


## STEP 6



MH06D027

Remove differential assembly from the range transmission.



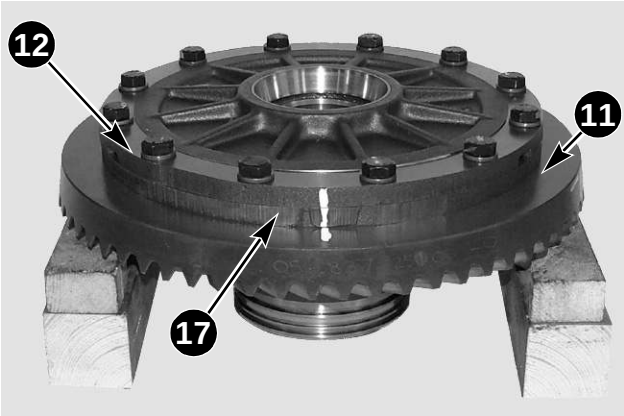

MI06D024

https://truckmanualshub.com/



## Disassembly

### STEP 1




MD06D030

Remove and discard seal rings (9). Position the differential assembly on a clean work surface. Place wooden blocks approximately 25 mm (1.0 inch) below the ring gear as shown. Put alignment marks on the ring gear (11), cover plate (12) and differential housing (17).

### STEP 2

Remove the ring gear retaining bolts and washers (10). Use a soft faced hammer to release the ring gear (11) from the differential housing (17) onto the blocks.

### STEP 3




MD06D032

Attach suitable lifting equipment to the differential assembly. Raise the assembly and remove the ring gear (11) and wooden blocks. Lower the differential assembly onto the work surface and remove the lifting equipment.

### STEP 4

Remove cover plate (12), thrust washer (13), separator plates (14), friction plates (15) and pins (16) from the differential housing (17). Remove the sun gear (18).

**NOTE:** *Put identification marks on the sun gear and thrust washers, make sure the gear and thrust washer remain together for assembly.*

### STEP 5



MD06D031

Using compressed air apply pressure to the differential lock supply port and remove piston (19).

> **WARNING:** *To prevent injury ALWAYS wear face protection and protective gloves when working with compressed air.*

### STEP 6



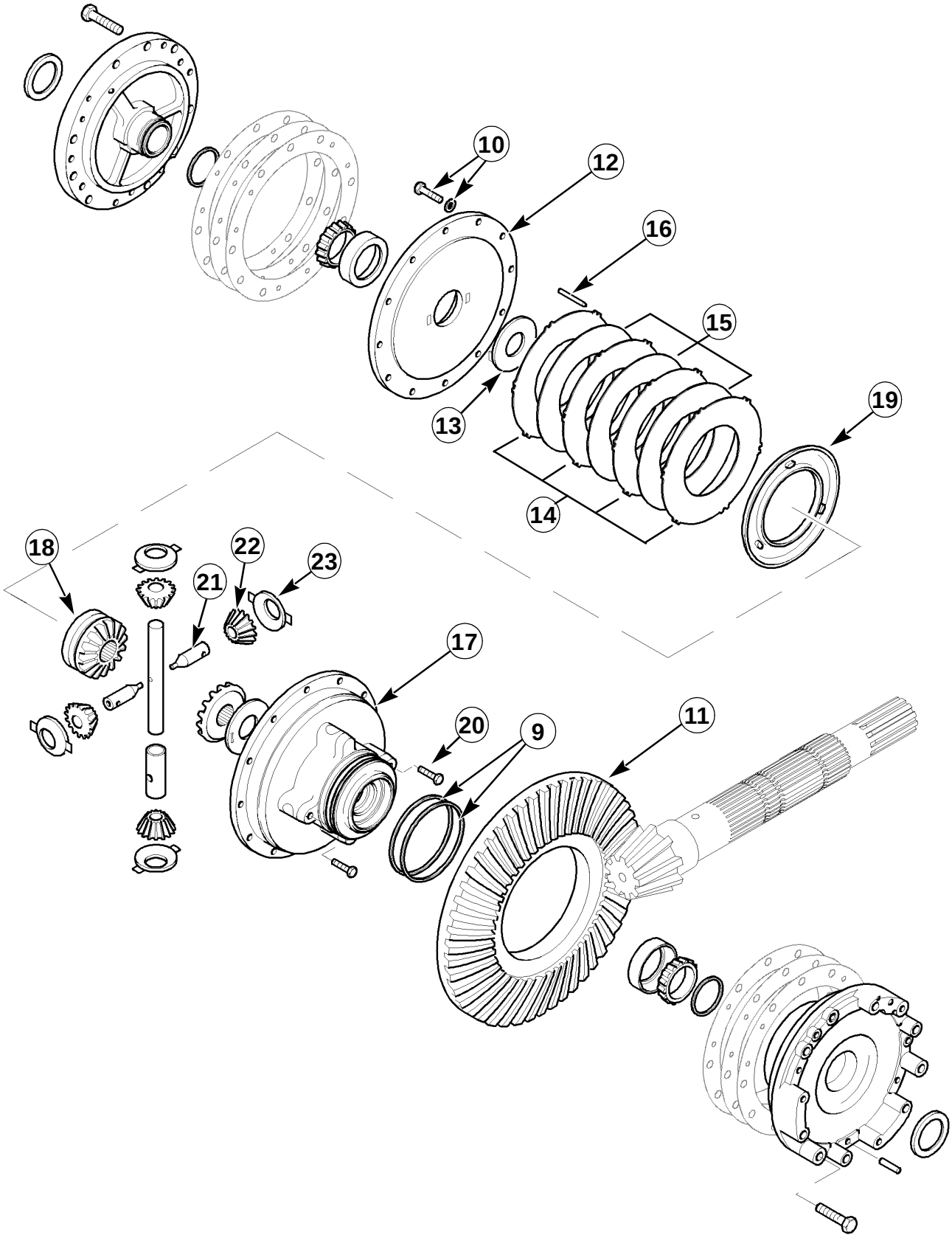

MD06D033

Put identification/alignment marks on the planetary gear pins (21) and (25). Remove the retaining bolt (20). Using an 8 mm bolt installed into the end of the planetary gear pin remove the planetary gear pin (21). Remove the planetary gear (22) and thrust washer (23).

**NOTE:** *Put identification marks on the gears and thrust washers and keep each gear together with its thrust washer for assembly.*

https://truckmanualshub.com/






MI06D001

https://truckmanualshub.com/



## STEP 7

Remove the retaining bolt (24), planetary gear pin (25), planetary gear (26) and thrust washer (27).

**NOTE:** *Put identification marks on the gears and thrust washers and keep each gear together with its thrust washer for assembly.*

## STEP 8

Put alignment marks on the planetary gear pin (28) and remove the pin. Remove spacer (29), planetary gear (30), thrust washer (31), planetary gear (32) and thrust washer (33).

**NOTE:** *Put identification marks on the gears and thrust washers and keep each gear together with its thrust washer for assembly.*

## STEP 9

Remove the sun gear (34) and thrust washer (35).

**NOTE:** *Put identification marks on the sun gear and thrust washers, make sure the gear and thrust washer remain together for assembly.*

## STEP 10

Remove and discard seal ring (36) and seal (37) from the right hand bearing carrier (7).

## STEP 11

Remove and discard the seal ring (38) and seal (39) from the left hand bearing carrier (4).

## STEP 12

If the differential bearings are to be replaced use suitable bearing puller and remove bearing cone (41) from the left hand bearing carrier (4) and bearing cone (42) from the right hand bearing carrier (7).

## STEP 13

If the differential bearings have been removed, use a suitable bearing puller and remove bearing cup (43) from the differential housing (17) and bearing cup (44) from the cover plate (12).

## STEP 14

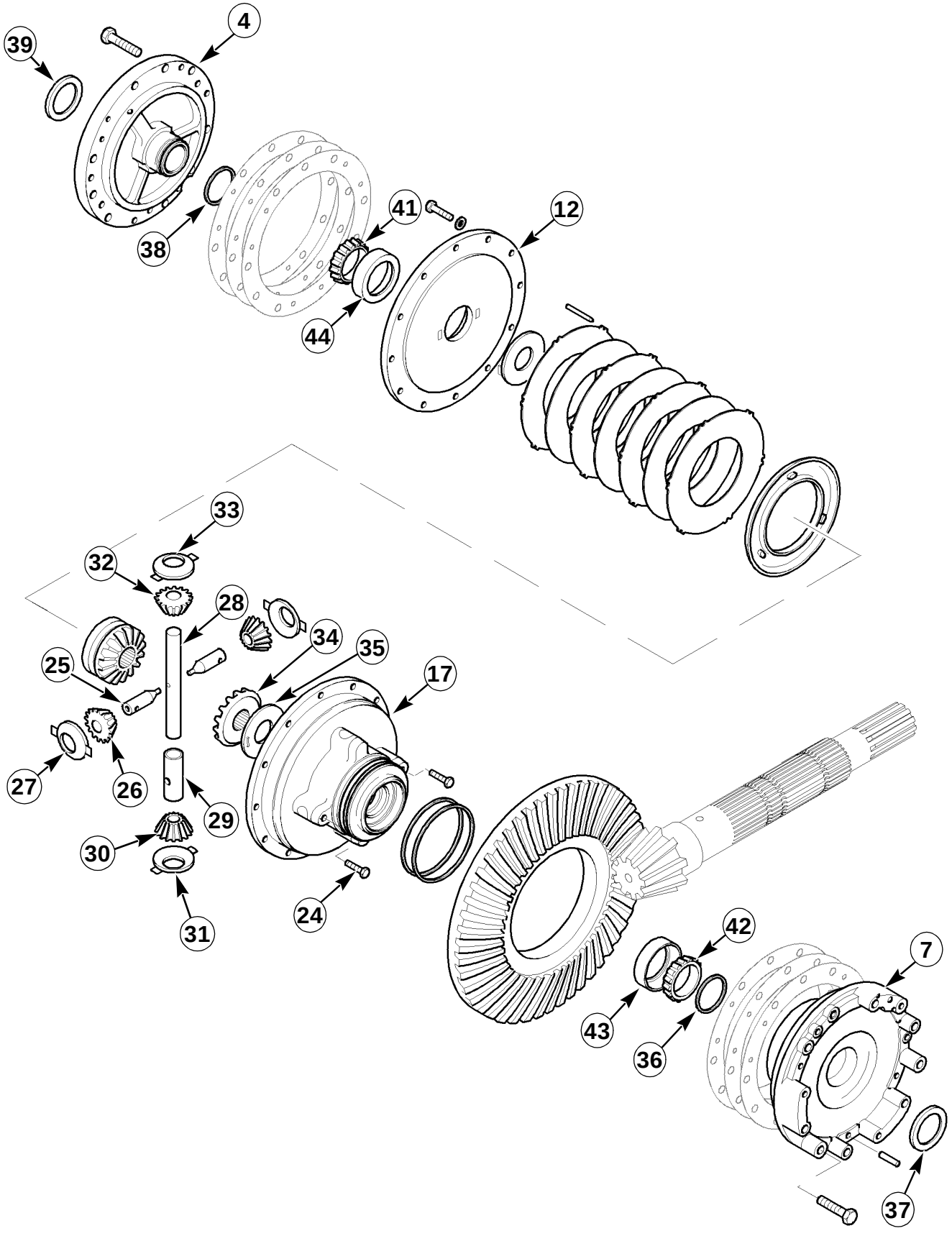
Check all parts for wear or damage and replace as necessary.

**IMPORTANT:** *The pinion shaft and crown wheel ring gear are supplied as a matched set and if necessary must be replaced together. If a new pinion shaft and crown wheel ring gear is to be installed, refer to Section 6007 to remove and install the pinion shaft. Also to set the pinion shaft mounting distance and the bearing preload.*

**IMPORTANT:** *After installation of the pinion shaft and crown wheel ring gear the correct gear tooth patterns MUST be checked and adjustments made if necessary.*

https://truckmanualshub.com/






MI06D001

https://truckmanualshub.com/



## Assembly

**IMPORTANT:** *If new differential bearings are to installed, the differential bearing preload must be set after assembly, refer to "DIFFERENTIAL ADJUSTMENTS" on page 23.*

**IMPORTANT:** *If the pinion shaft and ring gear have to be replaced, the pinion shaft mounting distance and bearing preload must be set, refer to Section 6007.*

### STEP 15

If the differential bearing cup has been removed use a suitable bearing driver to install the bearing cup (43) into the differential housing (17) and bearing cup (44) into the cover plate (12). Make sure the bearing cups are against the shoulders in the cover plate and differential housing.

### STEP 16



MD06D051

Heat bearing cone (42) in a bearing oven to a temperature of 110°C (230°F). Install bearing cone (42) onto the right hand bearing carrier (7). Make sure the bearing cone is against the shoulder on the right hand bearing carrier.

**WARNING:** *Always wear heat protective gloves when handling heated parts.*

### STEP 17



MD06D052

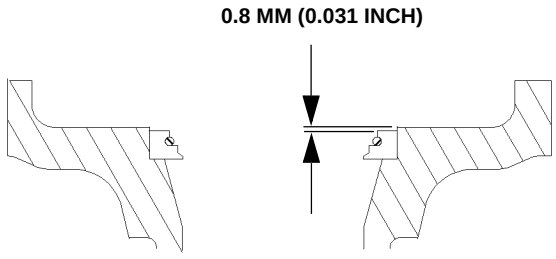
Heat bearing cone (41) in a bearing oven to a temperature of 110°C (230°F). Install bearing cone (41) onto the left hand bearing carrier (4). Make sure the bearing cone is against the shoulder on the left hand bearing carrier.

**WARNING:** *Always wear heat protective gloves when handling heated parts.*

### STEP 18



MI06D053

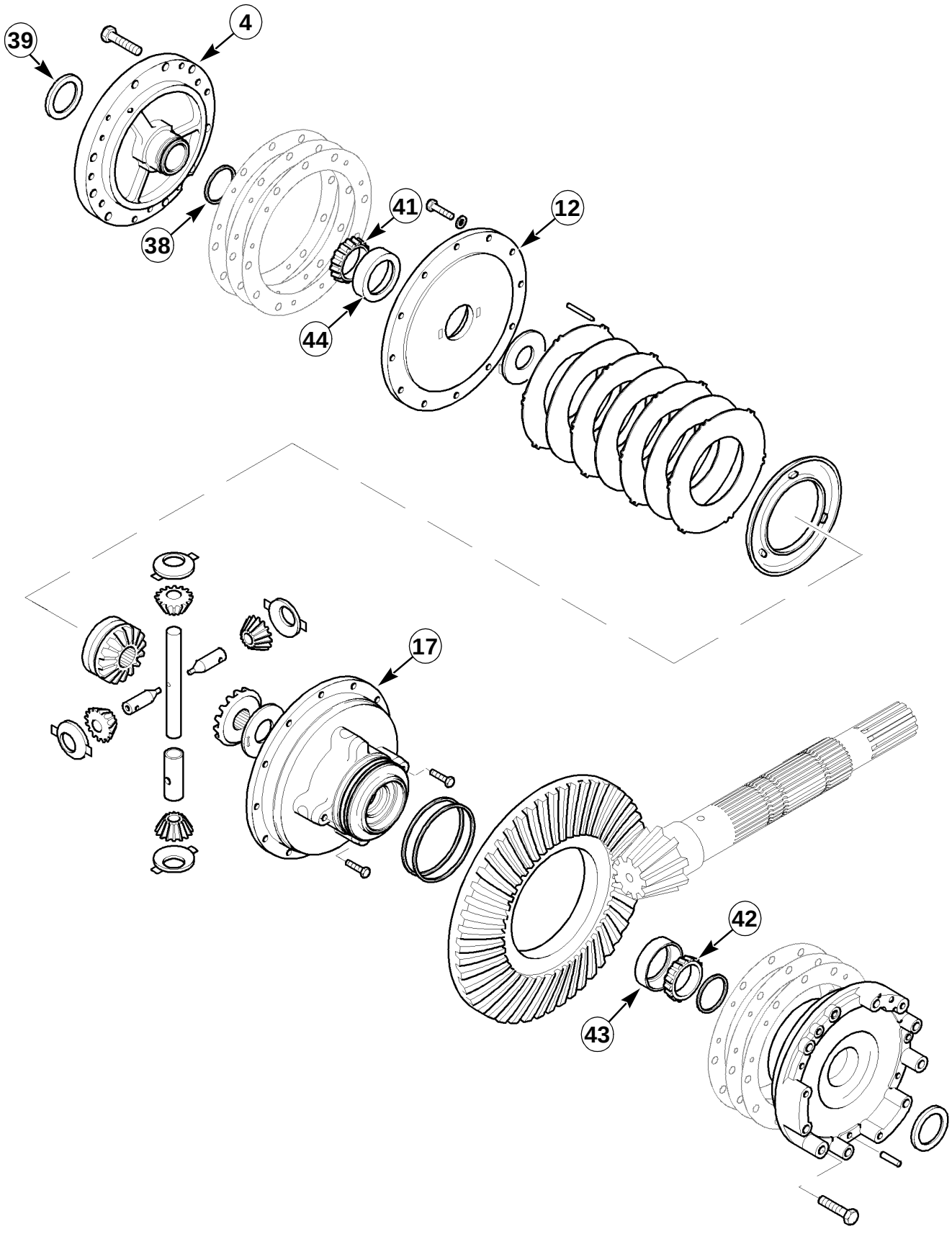



MI06049

Use a suitable seal installer and install a new seal (39) into the left hand bearing carrier (4). Install the seal to a depth of 0.8 mm (0.031 inch) below the face of the bearing carrier. Make sure the lip of the seal is facing towards the inside of the bearing carrier.

https://truckmanualshub.com/






MI06D001

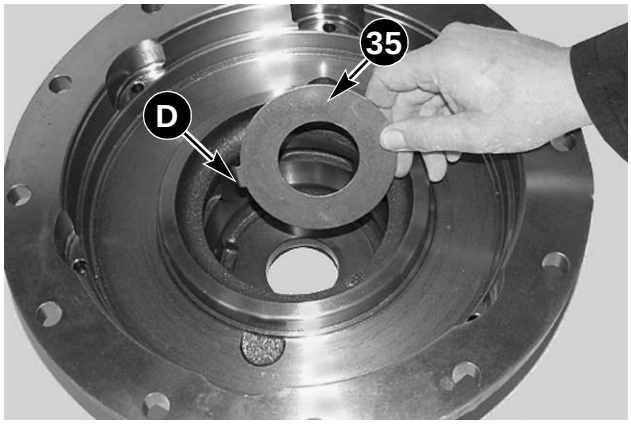
https://truckmanualshub.com/



## STEP 19

Repeat STEP 18 and install a new seal (37) into the right hand bearing carrier (7).

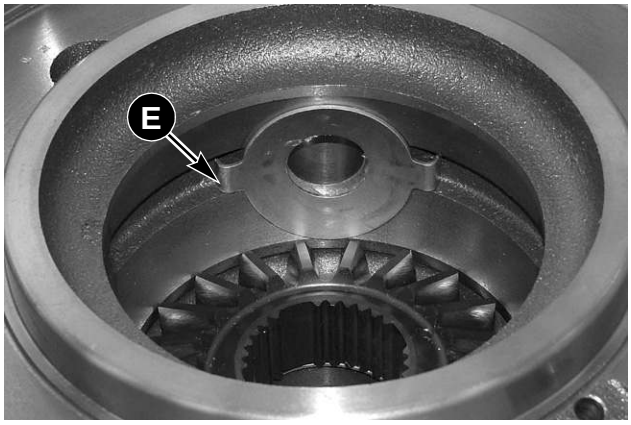
## STEP 20




MD06D34

Install thrust washer (35) into the differential housing (17). Make sure the tabs (D) on the thrust washer locate correctly into the holes in the differential housing (17). Install the sun gear (34).

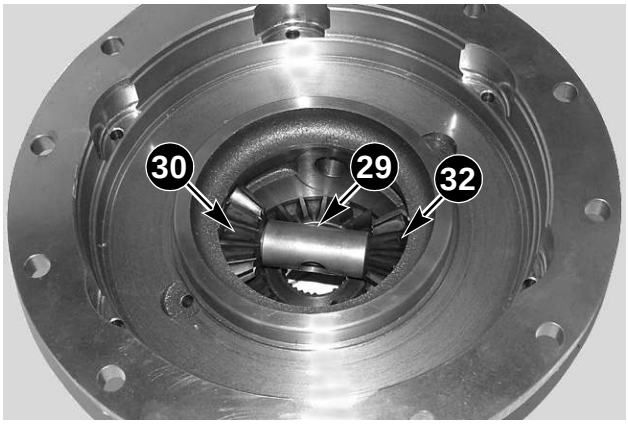
## STEP 21




MD06D040

Lubricate the inner wall and thrust washer tab locating groove of the differential housing with clean transmission oil. Install thrust washers (31) and (33), make sure the tabs (E) on the thrust washer locate correctly into the groove in the differential housing (17) as shown.

## STEP 22




MD06D035

Install planetary gear (30), planetary gear (32) and spacer (29). Install the planetary gear pin (28), make sure the alignment marks made during disassembly are aligned and the holes in the spacer align with the holes in pin (28).

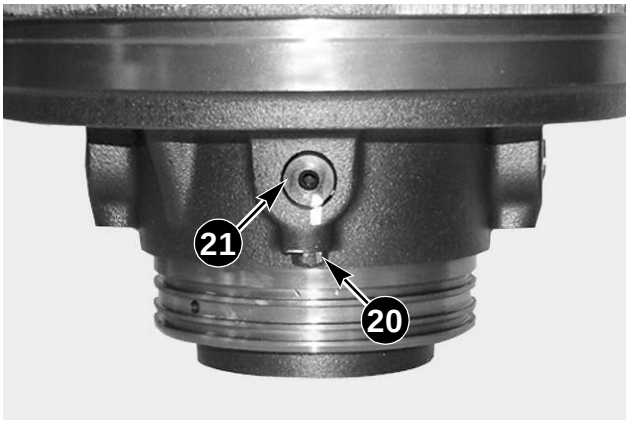
## STEP 23

Install thrust washers (23) and (27), make sure the tabs on the thrust washer locate correctly into the groove in the differential housing (17).

## STEP 24

Install planetary gear (22), planetary gear (26), planetary gear pin (21) and planetary gear pin (25). Make sure the alignment marks made during disassembly are aligned and the pins locate correctly through the spacer (29) into the planetary gear pin (28).

## STEP 25

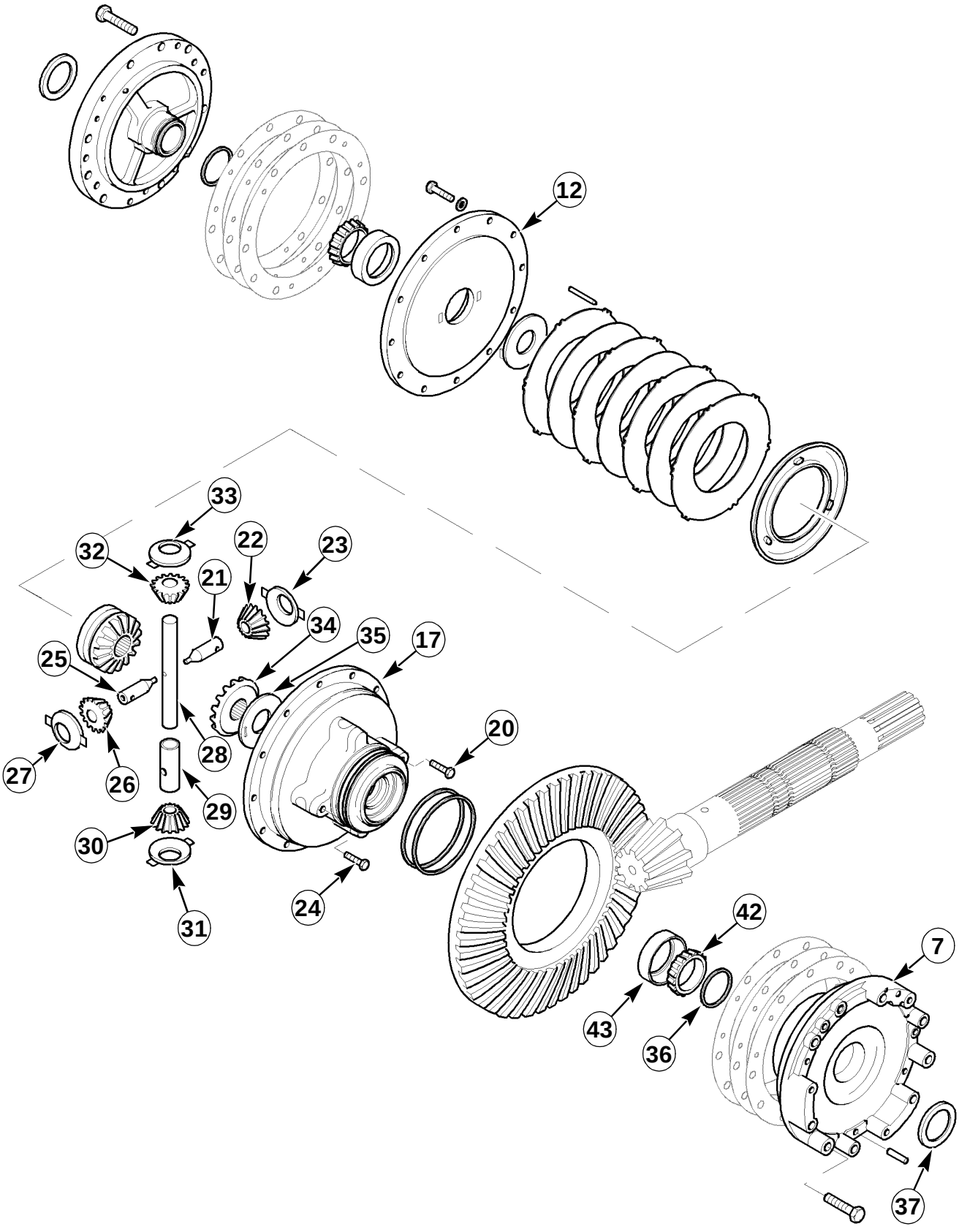



MD06D033

Apply Loctite 638 (680) to the threads of bolts (20) and (24). Install and tighten bolts (20) and (24) to a torque of 58 to 65 Nm (43 to 48 lb. ft). Make sure the bolts locate correctly into the locating holes in planetary gear pins (21) and (25).

https://truckmanualshub.com/



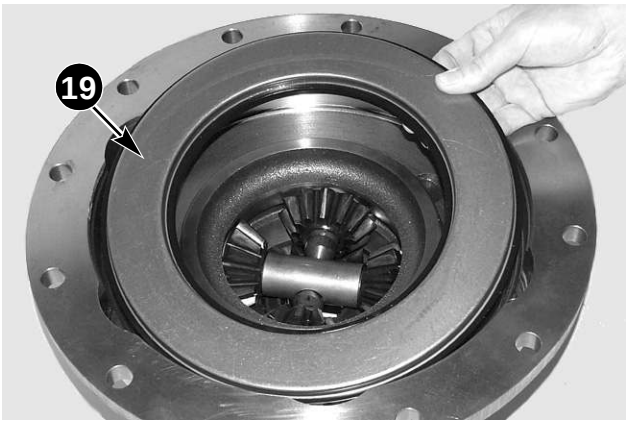



MI06D001

https://truckmanualshub.com/



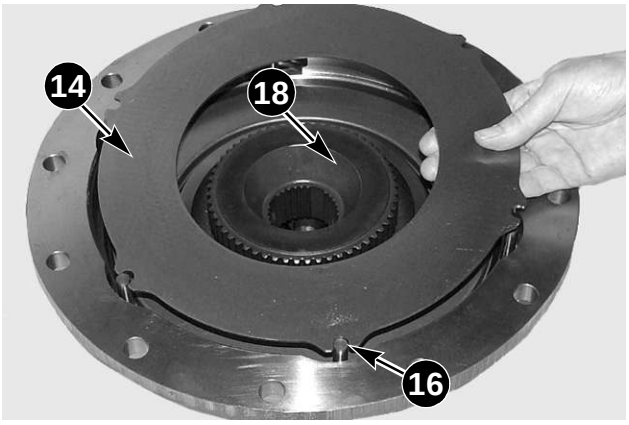
## STEP 26



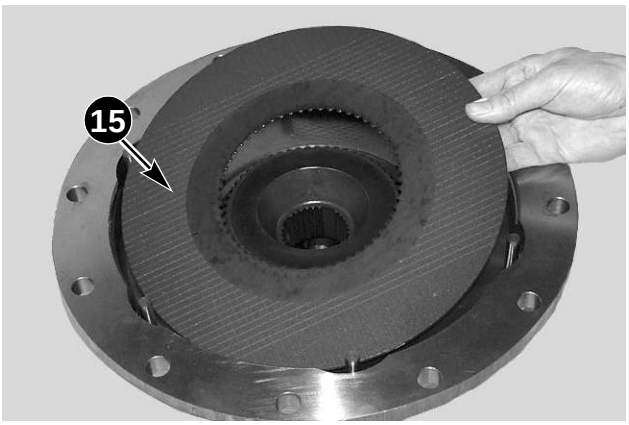

MD06D036

Lubricate the sealing edges of the piston (19) with petroleum jelly. Install the piston (19) into the differential housing (17). Carefully push the piston into the housing using even pressure. Care must be taken not to damage the lip of the seal.

## STEP 27




MD06D037

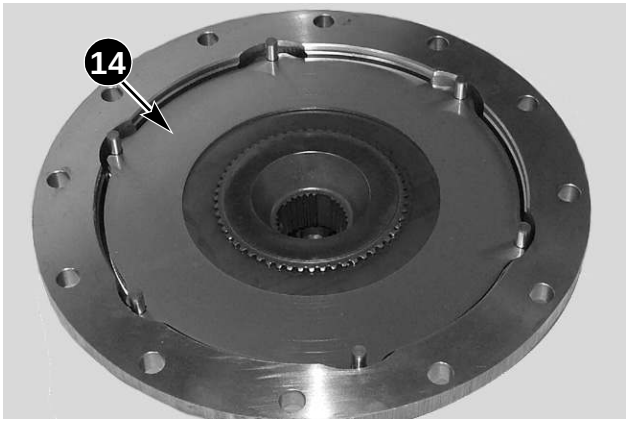



MD06D037

Install sun gear (18) and six locating pins (16). Install one metal separator plate (14) then one friction plate (15).

**IMPORTANT:** *If new friction plates are to be installed, soak the new friction plates in clean transmission oil before installation.*

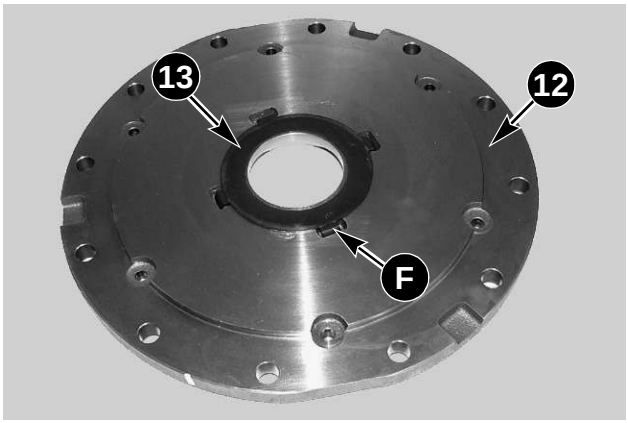
## STEP 28




MD06D039

Continue to install one metal separator plate (14) then one friction plate (15) until four metal separator plates and three friction plates have been installed. The last plate installed must be a metal separator plate (14).

## STEP 29




MD06D041

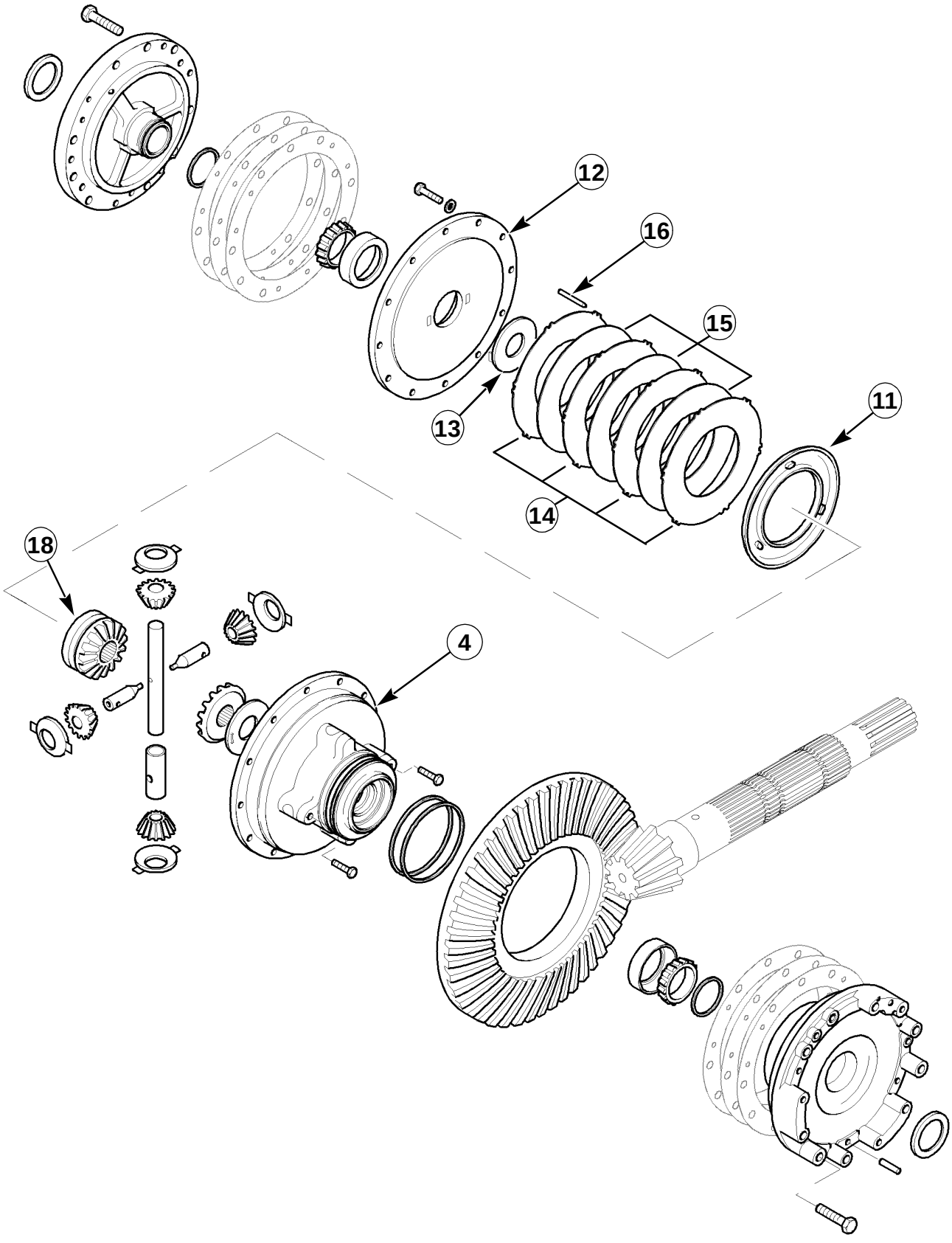
Install thrust washer (13) onto the cover plate (12), make sure tabs (F) locate correctly into the holes in the cover plate (12). Hold the thrust washer in place using petroleum jelly.

## STEP 30

Install the cover plate (12), make sure the alignment marks made during disassembly are aligned and pins (16) locate correctly into the holes in the cover plate.

https://truckmanualshub.com/






MI06D001

https://truckmanualshub.com/



## STEP 31




MD06D028

If new differential bearings have been installed and the pinion shaft has NOT been removed, install a suitable lifting eye (G) and four ring gear retaining bolts (10), insert the lifting eye retaining bolt from the ring gear side of the assembly. Install and tighten four 16 mm nuts to the retaining bolts.

Carry out the differential bearing preload procedure, refer to “DIFFERENTIAL ADJUSTMENTS” on page 23.

**IMPORTANT:** *Seal rings (9), (36) and (38) must be installed after the bearing preload has been determined.*

## STEP 32




MD06D032

If new differential bearings have NOT been installed or the new differential bearing preload has been determined.
Place the ring gear on wooden blocks as shown. Attach suitable lifting equipment to the differential assembly and install the assembly in position over the ring gear (11) onto the work surface. Make sure the alignment marks are aligned. Remove the lifting equipment.

## STEP 33




MD06D042

Apply Loctite 638 (680) to the threads of four new ring gear retaining bolts. Install the four retaining bolts (10) with washer into the ring gear (11). Evenly tighten the retaining bolts (10) to pull the ring gear onto the differential assembly. Make sure the ring gear (11) is against the shoulder on the differential housing (17).

## STEP 34



MD06D030

Apply Loctite 638 (680) to the threads of the remaining eight new ring gear retaining bolts. Install the retaining bolts (10) with washers. Tighten all the ring gear retaining bolts to a torque of 250 to 280 Nm (185 to 206 lb. ft).

Carry out the differential bearing preload procedure, refer to “DIFFERENTIAL ADJUSTMENTS” on page 23.

**IMPORTANT:** *Seal rings (9), (36) and (38) must be installed after the bearing preload has been determined.*

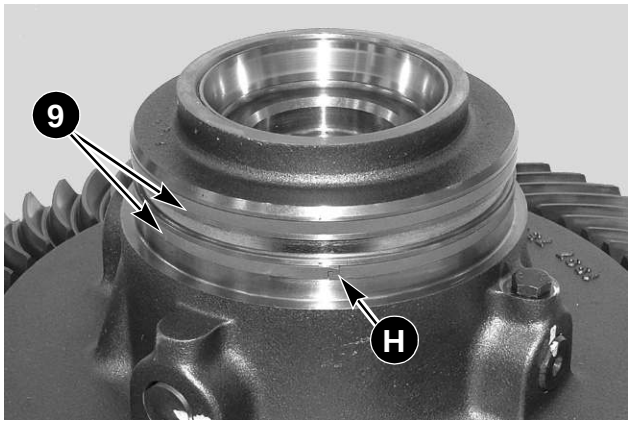
https://truckmanualshub.com/



## Installation

**IMPORTANT:** *If the differential bearings have to be replaced, the differential bearing preload must be set before Installation, refer to "DIFFERENTIAL ADJUSTMENTS" on page 23.*

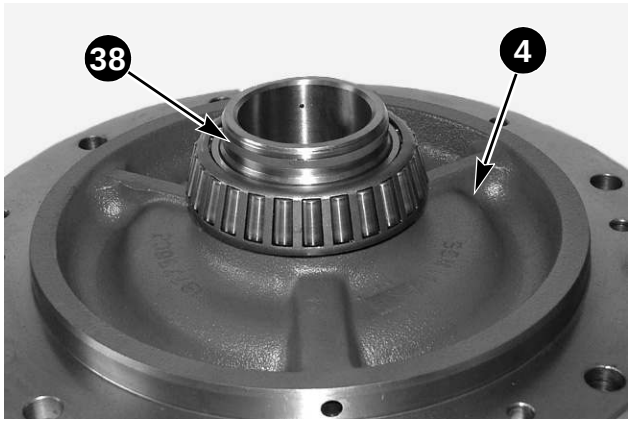
### STEP 1




MD06D050

Lubricate and install new seal rings (9) onto the differential housing. Make sure the ends (H) of the seals interlock correctly and interlocks are positioned 180° apart.

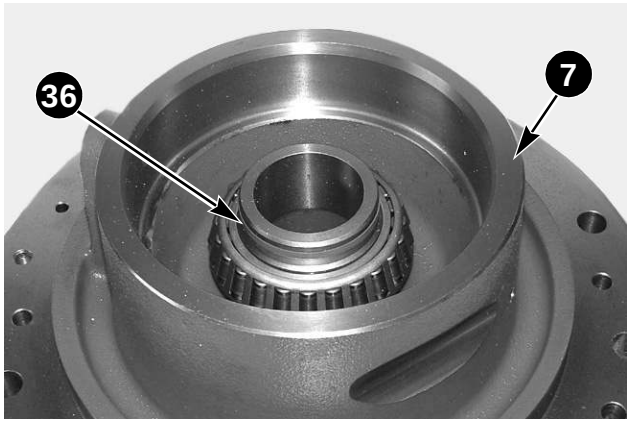
### STEP 2




MD06D054

Lubricate and install a new seal ring (38) onto the left hand bearing carrier (4). Make sure the ends of the seal interlock correctly.

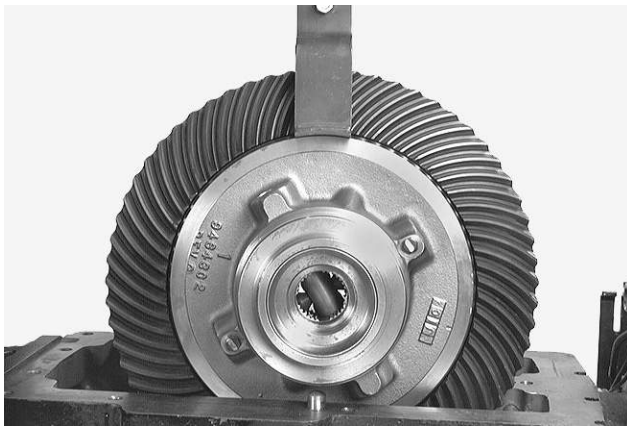
### STEP 3




MD06D055

Lubricate and install a new seal ring (36) onto the right hand bearing carrier (7). Make sure the ends of the seal interlock correctly.

### STEP 4



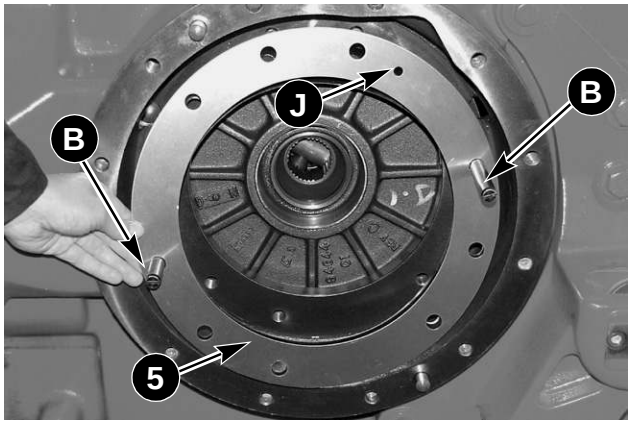
MH06D027

Install the lifting adapter MC1952 (A) to the differential ring gear and tighten the lifting adapter nut and bolt. Attach suitable lifting equipment onto the lifting adapter MC1952. Install differential assembly into position in the range transmission.

https://truckmanualshub.com/



## STEP 5

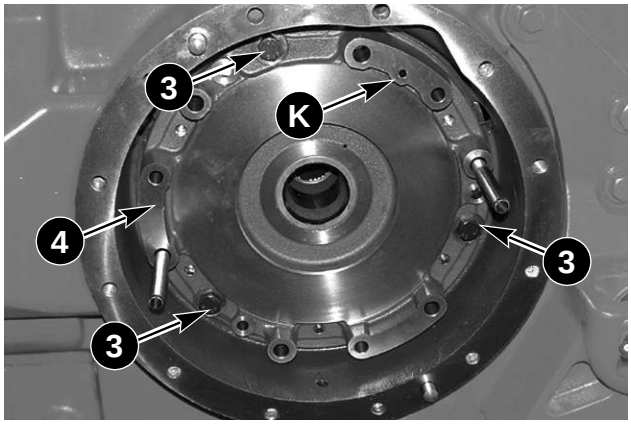



MD06D070

Install two 16 mm alignment studs (MC1995A) (B) into the left hand differential bearing carrier mounting face. Install shims (5) determined during differential bearing preload adjustment. Make sure the lubrication hole (J) is in the position shown and aligned with the lubrication slot in the transmission housing.

**NOTE:** *If the differential bearings have NOT been replaced install shims (5) retained during removal.*

## STEP 6




MD06D069

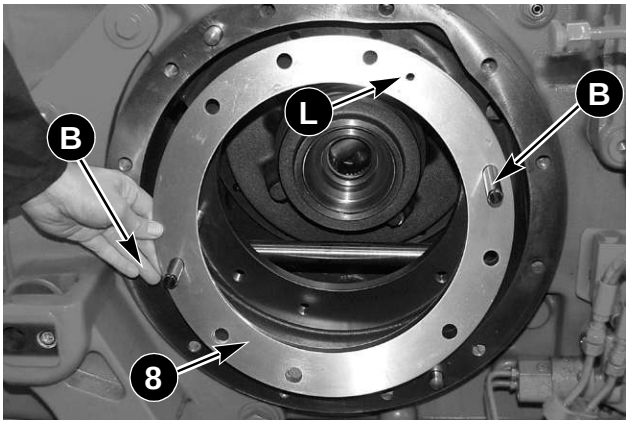
Install differential bearing carrier (4). Make sure the lubrication hole (K) is in the position shown. Install and tighten the three bearing carrier retaining bolts (3) to a torque of 235 to 260 Nm (173 to 192 lb.ft).

**IMPORTANT:** *Care must be taken not to damage the seal ring.*

## STEP 7

Remove the alignment studs. Make sure the left hand differential bearing cone is seated into the bearing carrier bearing cup.

## STEP 8

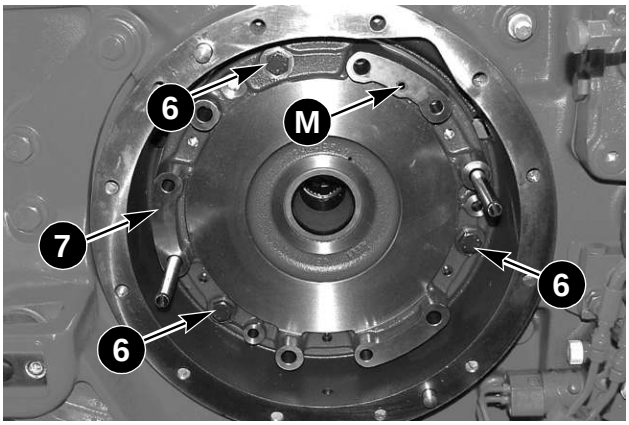



MD06D070

Install two 16 mm alignment studs (MC1995A) (B) into the right hand differential bearing carrier mounting face. Install shims (8) determined during differential bearing preload adjustment. Make sure the lubrication hole (L) is in the position shown and aligned with the lubrication slot in the transmission housing.

**NOTE:** *If the differential bearings have NOT been replaced install shims (8) retained during removal.*

## STEP 9




MD06D071

Install differential bearing carrier (7). Make sure the lubrication hole (M) is in the position shown. Install and tighten the three bearing carrier retaining bolts (6) to a torque of 235 to 260 Nm (173 to 192 lb.ft). Remove the alignment studs.

**IMPORTANT:** *Care must be taken not to damage the seal rings.*

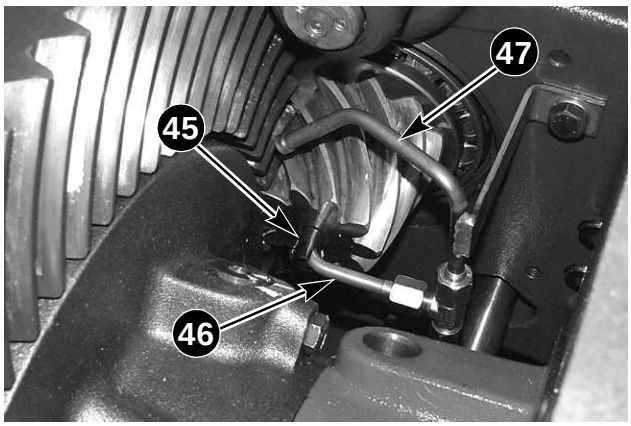
## STEP 10

Remove the lifting adapter MC1952.

https://truckmanualshub.com/



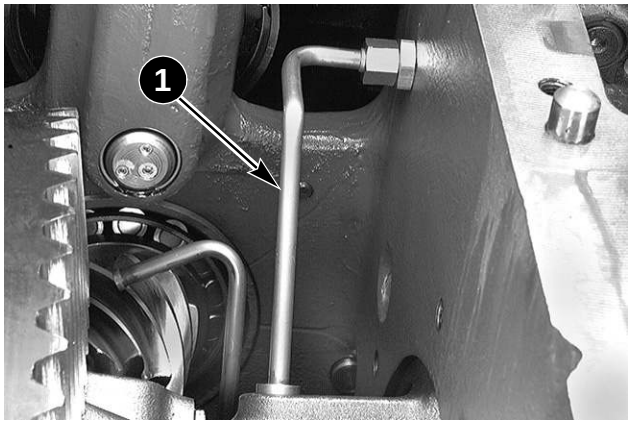
## STEP 11




MH06D025

Make sure the pinion shaft lubrication sleeve (45) and tubes (46) and (47) are installed correctly.

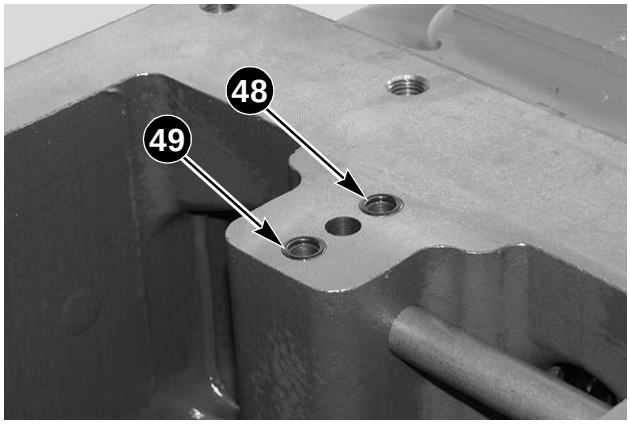
## STEP 12




MH06D025

Lubricate and install a new o-ring (2) onto the differential lock feed tube (1). Install and tighten the feed tube (1).

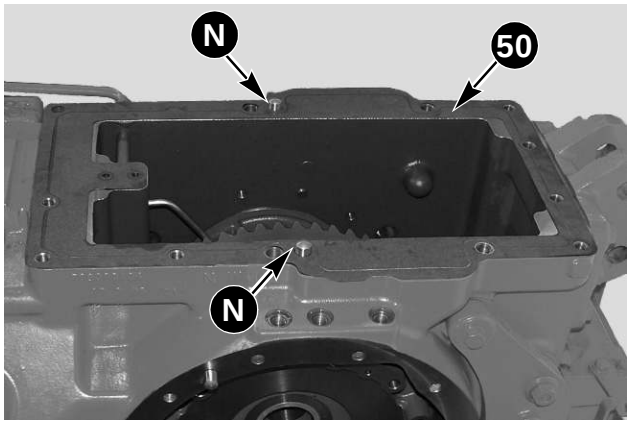
## STEP 13




MD06D084

Lubricate and install new o-rings (48) and (49).

## STEP 14




MD06D092

Make sure the locating dowels (N) are installed into the range transmission. Install a new rockshaft/transmission cover gasket (50) and install the rockshaft/transmission cover housing. Install and tighten the bolts to the following torques.

16 mm bolts ..... 250 to 280 Nm (185 to 206 lb. ft)
20 mm bolts ..... 490 to 580 Nm (362 to 427 lb. ft)

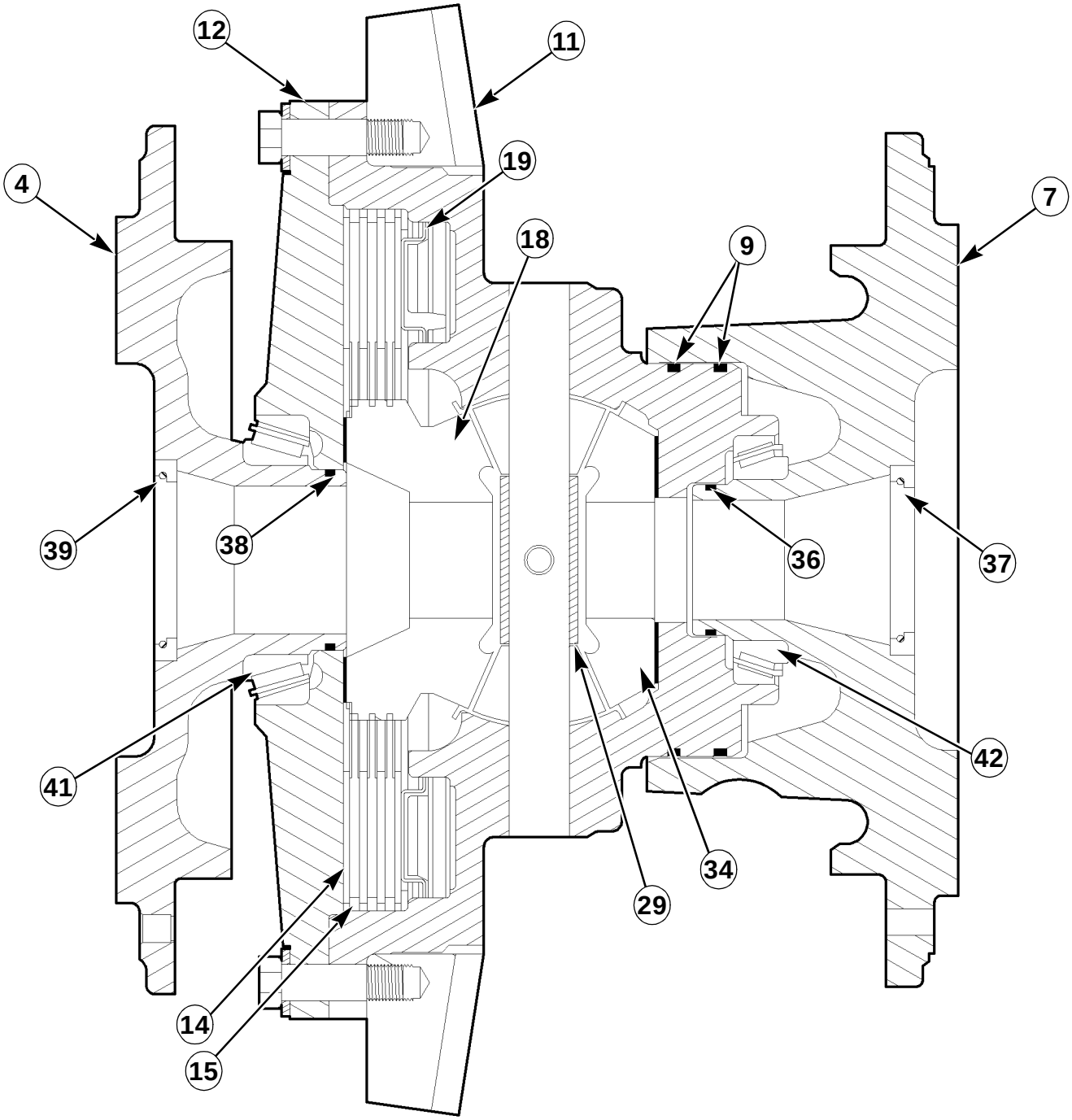
After Installation it will, be necessary to carry out the following:

- Lubricate and install a new auxiliary valves/manifold assembly o-ring and install the auxiliary valves/manifold assembly.
- Lubricate and install new o-rings to all disconnected tube fittings where necessary.
- Connect all disconnected tubes and hoses.
- Install the service brakes, refer to Section 7002.
- Install the rear axles refer to Section 6018.
- Install the access plate, floor mat and seat.
- Install the lift arms, make sure the aliment marks made during removal are aligned.
- Install and tighten the lift arm retaining bolts and washers.
- Install the rear three point linkage and lift cylinders.

https://truckmanualshub.com/



# Cross Sectional Drawing of the Differential Assembly




MI06D002

4. LEFT HAND BEARING CARRIER
7. LEFT HAND BEARING CARRIER
9. SEAL RINGS
11. RING GEAR
12. COVER PLATE
14. SEPARATOR PLATE
15. FRICTION PLATE
18. SUN GEAR
19. PISTON
29. SPACER
34. SUN GEAR
36. SEAL RING
37. SEAL
38. SEAL RING
39. SEAL
41. BEARING CONE
42. BEARING CONE

https://truckmanualshub.com/

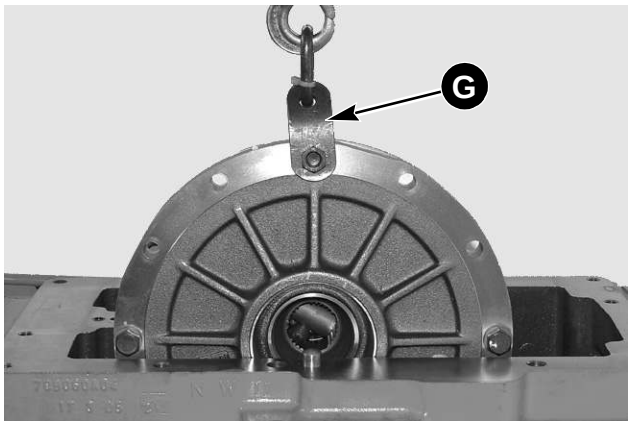


# DIFFERENTIAL ADJUSTMENTS

## Differential Bearing Preload Adjustment

**IMPORTANT:** *If the pinion shaft and ring gear have been replaced the Differential Bearing Preload procedure must be carried out with the pinion shaft removed.*

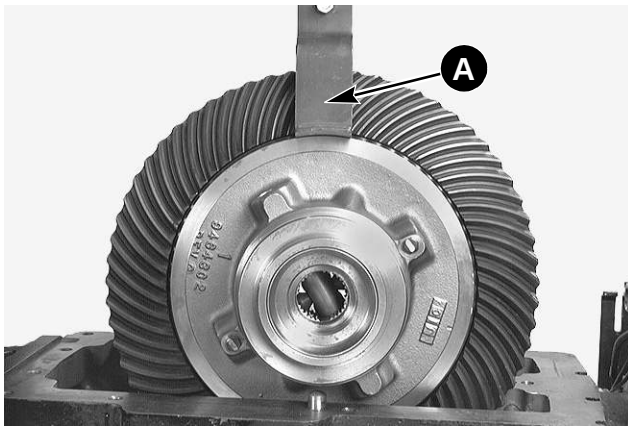
### STEP 1




MD06D073

If the pinion shaft has not been removed, install lifting equipment to the lifting eye (G) installed during assembly of the differential. Install the differential assembly in position into the transmission housing.

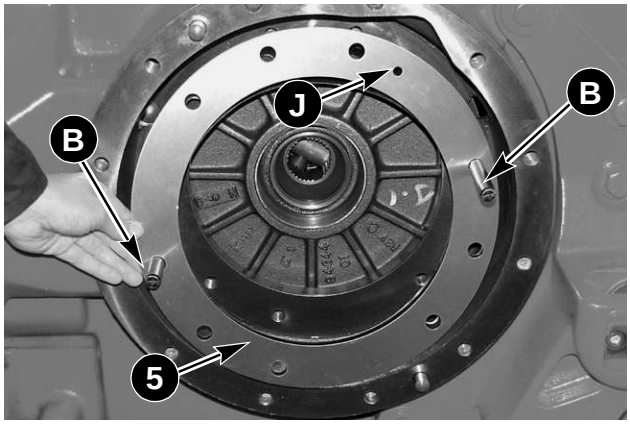
### STEP 2




MH06D027

If the pinion shaft has been removed, install the lifting adapter MC1952 (A) to the differential ring gear and tighten the lifting adapter nut and bolt. Attach suitable lifting equipment onto the lifting adapter MC1952. Install differential assembly into position in the range transmission.

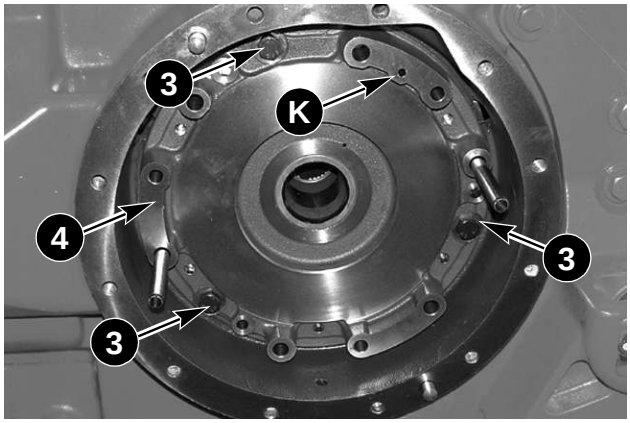
### STEP 3




MD06D070

Install two 16 mm alignment studs (MC1995A) (B) into the left hand differential bearing carrier mounting face as shown. Install shims (5) retained during removal. Make sure the lubrication hole (J) is in the position shown and aligned with the lubrication slot in the transmission housing.

### STEP 4




MD06D069

Install the left hand differential bearing carrier (4) without shims. Make sure the lubrication hole (K) is in the position shown.
Install and tighten the three bearing carrier retaining bolts (3) to a torque of 110 to 150 Nm (81 to 110 lb.ft).

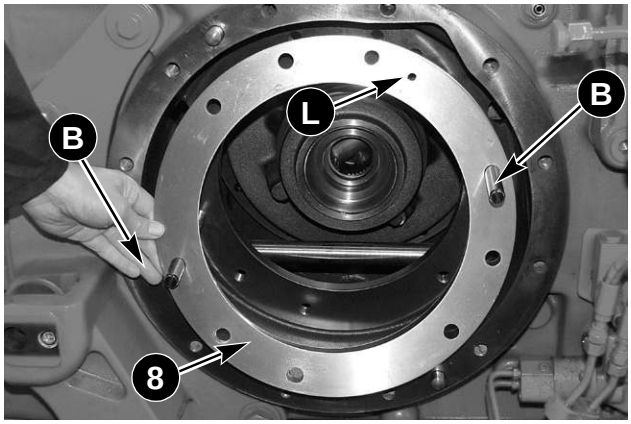
### STEP 5

Remove the alignment studs. Make sure the left hand differential bearing cone is seated into the bearing carrier bearing cup.

https://truckmanualshub.com/



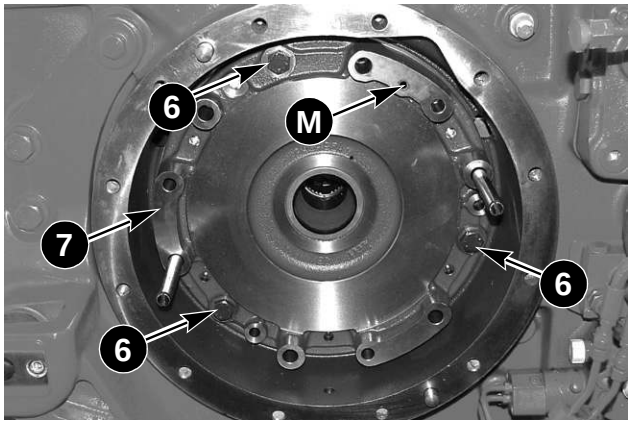
## STEP 6




MD06D070

Install two 16 mm alignment studs (MC1995A) (B) into into the right hand differential bearing carrier mounting face. Install shims (8) retained during removal. Make sure the lubrication hole (L) is in the position shown and aligned with the lubrication slot in the transmission housing.

## STEP 7




MD06D071

Install differential right hand bearing carrier (7). Make sure the lubrication hole (M) is in the position shown.

Install and tighten the three bearing carrier retaining bolts (6) to a torque of 150 Nm (110 lb.ft).

## STEP 8

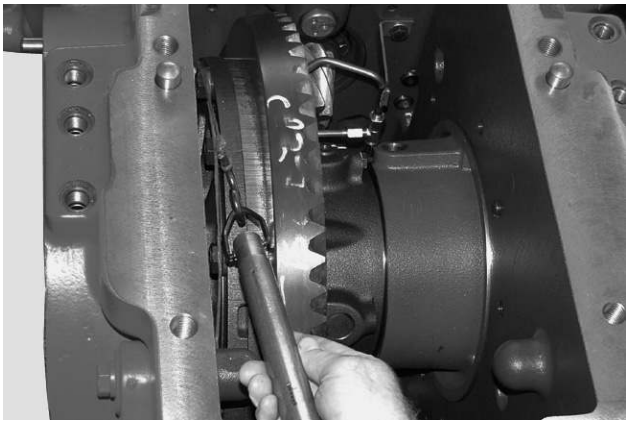
Remove the lifting eye or lifting adaptor MC1952 if installed.

**IMPORTANT:** *Make sure the differential assembly does not make contact with the pinion shaft if installed.*

## STEP 9

Rotating the differential assembly several times to seat the bearings.

## STEP 10



MD06G082

Wrap a length of cord around the differential housing without overlapping the cord. Connect a spring balance to the cord and check the differential bearing preload. The correct rolling pull must be 2.4 to 4.5 kg/f (5.3 to 10 lb/f).

**NOTE:** *If the rolling pull is correct go to STEP 13.*

## STEP 11

If the bearing rolling pull is not correct attach the lifting eye or lifting adaptor MC1952 to the differential assembly and support the assembly on the lifting equipment.
Using the alignment studs remove the left hand or right hand bearing carrier, add or remove shims as necessary. Install the bearing carrier and tighten the three bearing carrier retaining bolts (3) to a torque of 150 Nm (110 lb.ft).

**NOTE:** *To increase the rolling pull remove approximately 0.05 mm (0.002 inch) from the right hand bearing carrier. To decrease the rolling pull add approximately 0.05 mm (0.002 inch) to the left hand bearing carrier.*
*Shims are available in the following thicknesses.*
*0.089 mm (0.0035 inch).*
*0.102 mm (0.004 inch).*
*0.178 mm (0.007 inch).*
*0.305 mm (0.012 inch).*
*0.737 mm (0.029 inch).*

## STEP 12.

Repeat STEP 8 to STEP 11 until the bearing preload is correct.

https://truckmanualshub.com/



## STEP 13

If the bearing preload has been set with the ring gear removed, go to STEP 15.

## STEP 14

If the bearing preload has been set with the pinion shaft removed, install the pinion shaft, refer to Section 6007. Make sure the pinion shaft mounting distance is set correctly. With the pinion shaft correctly installed check the pinion/ring gear backlash, refer to “Pinion/Ring Gear Backlash Adjustment” on page 26.

## STEP 15

If the bearing preload has been set with the ring gear removed, install the lifting eye or lifting to the differential assembly. Attach lifting equipment to the lifting eye and support the differential assembly. Remove the bearing carriers using the alignment studs MC1995.

**IMPORTANT:** *Make sure the new left hand shim pack remains with the left hand bearing carrier and the new right hand shim pack remain with the right hand bearing carrier.*

## STEP 16

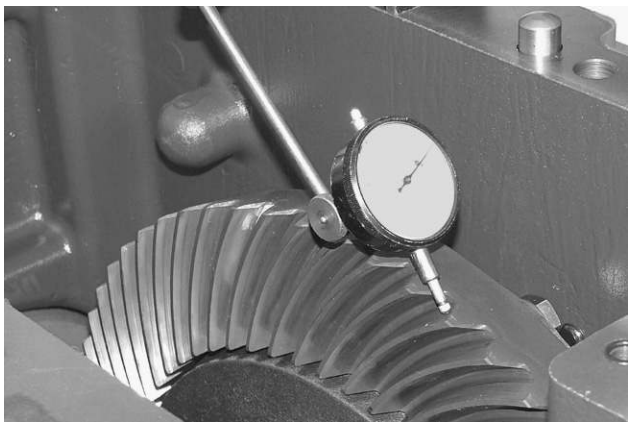
Put the differential assembly on a clean work surface and remove the lifting eye and retaining bolts. Refer to the assembly procedure STEP 32 to STEP 34 on Page 18 and install the ring gear.

https://truckmanualshub.com/



# Pinion/Ring Gear Backlash Adjustment

## STEP 17



MD06D082

Install a dial gauge on the edge of the ring gear tooth. Hold the pinion shaft and move the ring gear in either direction until the pinion gear tooth and ring gear tooth are in full contact. Zero the dial gauge.

With the pinion shaft held check the pinion/ring gear backlash. The backlash must be measured at three places equally spaced around the ring gear.

The backlash must be 0.20 to 0.33 mm (0.007 to 0.013 inch).

Too much backlash move shims from the left hand bearing carrier to the right hand bearing carrier.

Too little backlash move shims from the right hand bearing carrier to the left hand bearing carrier.

**IMPORTANT:** *Moving 0.089 mm (0.0035 inch) of shims from on side to the other will change the backlash approximately 0.051 mm (0.002 inch). The total shim pack thickness MUST NOT change.*

**IMPORTANT:** *Backlash MUST be within 0.23 to 0.33 mm (0.009 to 0.013 inch) to obtain the correct tooth patterns.*

**IMPORTANT:** *When the differential assembly has been installed and the backlash correctly set the pinion/ring gear tooth patterns MUST be checked. Incorrect tooth patterns will result in damage occurring to the pinion and ring gears.*

## STEP 18



MD06D083

Apply a thin coat of yellow ochre or engineers blue on the convex (drive) side of the ring gear teeth at 120° intervals around the ring gear. Rotate the ring gear several times counter-clockwise and clockwise.

## STEP 19

Check the tooth patterns, refer to “PINION/RING GEAR TOOTH PATTERN” on page 27.

## STEP 20

When the tooth patterns are correct. Install the lifting adaptor MC1952 to the differential assembly. Attach lifting equipment to the lifting adaptor MC1952. Support the differential assembly and remove the bearing carriers using the alignment studs MC1995. Remove the differential assembly from the transmission.

## STEP 21

Install the seal rings to the differential assembly and bearing carriers. Install the differential, refer to “Installation” on page 19.

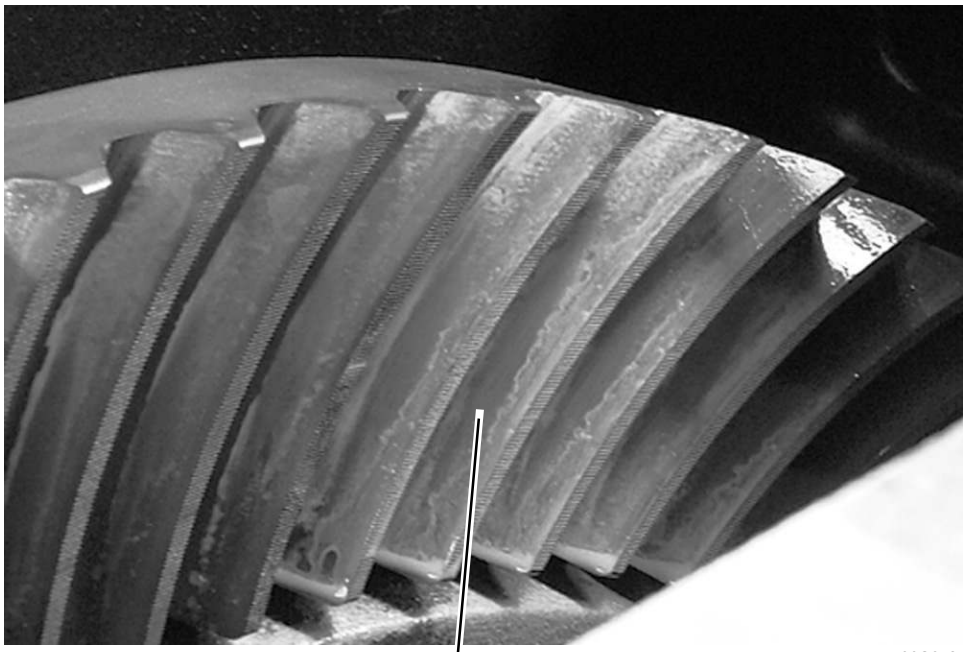
https://truckmanualshub.com/



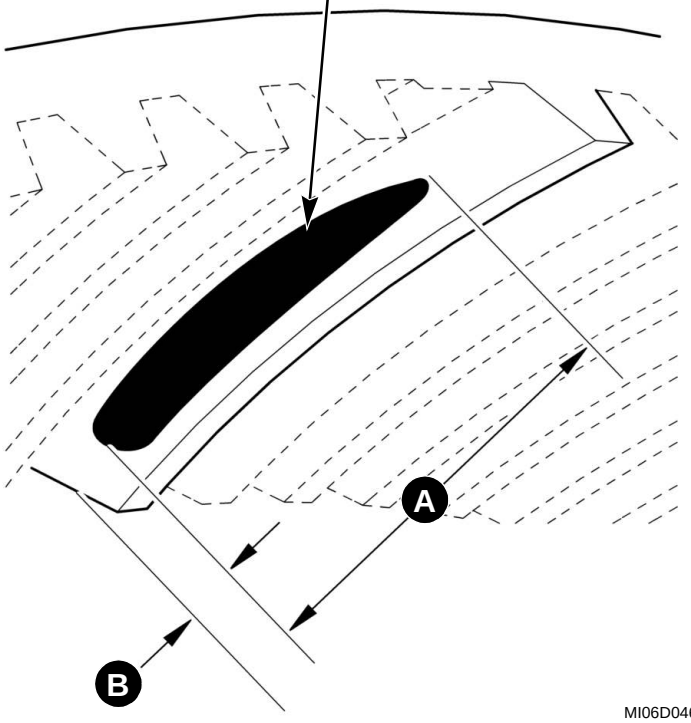
# PINION/RING GEAR TOOTH PATTERN

## Correct Tooth Pattern

**IMPORTANT:** *The correct tooth pattern shown is approximate and shapes may change, however the same general shape must be seen. The position of the tooth pattern on the convex (drive) side of the ring gear must be within the dimensions shown on the illustration below.*



MD06G053




MI06D046

**A. 30 MM MINIMUM**
**35 MM MAXIMUM**

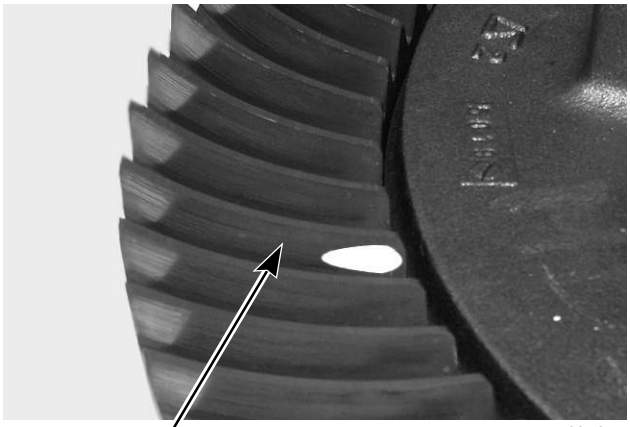
**B. 10 MM MINIMUM**
**15 MM MAXIMUM**

https://truckmanualshub.com/



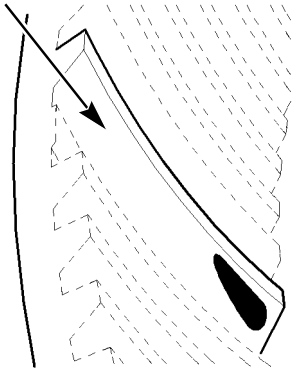
## Incorrect Tooth Pattern

### PINION SHAFT TOO FAR OUT OF ENGAGEMENT



MD06D045

**CONVEX (DRIVE) SIDE**

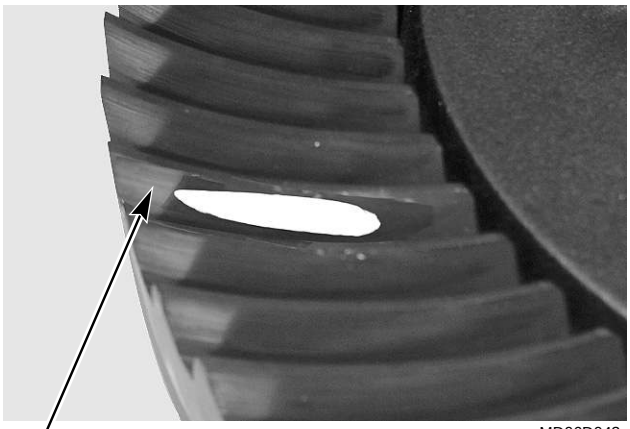


MI06D047

Incorrect tooth pattern shows that the size and position of the pinion shaft contact area is at the outer edge of the ring gear teeth on the convex (drive) side. The pinion shaft is too far out of engagement with the ring gear. The pinion mounting distance must be adjusted, refer to Section 6007 and remove the pinion shaft. **Add 0.08 mm of shims** to the shim pack installed at the rear of the pinion bearing cup in the transmission housing.

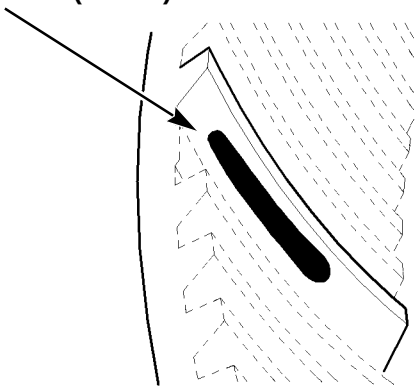
**IMPORTANT:** *When shims have been installed, repeat the differential installation procedure in this section and check the tooth pattern.*

### PINION SHAFT TOO FAR INTO ENGAGEMENT



MD06D043

**CONVEX (DRIVE) SIDE**



MI06D048

Incorrect tooth pattern shows that the size and position of the pinion shaft contact area is too far towards the centre line of the ring gear teeth on the convex (drive) side. The pinion shaft is too far into engagement with the ring gear. The pinion mounting distance must be adjusted, refer to Section 6007 and remove the pinion shaft. **Remove 0.08 mm of shims** from the shim pack installed at the rear of the pinion bearing cup in the transmission housing.

**IMPORTANT:** *When shims have been removed, repeat the differential installation procedure in this section and check the tooth pattern.*

https://truckmanualshub.com/

# Section 6017

## MFD CLUTCH SERVICING

## XTX Series Tractors



McCORMICK

SM 8-15170

© 2006 McCormick Tractors International Limited.
September 2006

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIFICATIONS ..... 3

SPECIAL TORQUES ..... 3

SPECIAL TOOLS ..... 3

MFD CLUTCH SERVICING
- Removal ..... 4
- Disassembly ..... 6
- Assembly ..... 12
- Installation ..... 24
- Cross Sectional Drawing of the Type 1 MFD Clutch ..... 28
- Cross Sectional Drawing of the Type 2 MFD Clutch ..... 29

https://truckmanualshub.com/



# SPECIFICATIONS

| | | |
|---|---|---|
| Number of Clutch Plates | | |
| Type 1 MFD Clutch. | | |
| Friction Plates | 8 | |
| Separator Plates | 8 | |
| Type 2 MFD Clutch. | | |
| Friction Plates | 7 | |
| Separator Plates | 7 | |
| MFD Clutch Friction Plate Thickness | 2.40 to 2.65 mm | 0.096 to 0.102 inch |
| MFD Clutch Separator Plate Thickness | 2.16 to 2.31 mm | 0.085 to 0.091 inch |
| Type 2 MFD Clutch Spacer Plate Thickness (if Equipped) | 2.16 to 2.31 mm | 0.085 to 0.091 inch |
| Type 1 MFD Clutch Backing Plate Thickness | 16.1 to 16.35 | 0.634 to 0.643 inch |
| Type 2 MFD Clutch Spacer Plate Thickness (With Spacer Plates) | 16.1 to 16.35 | 0.634 to 0.643 inch |
| Type 2 MFD Clutch Spacer Plate Thickness (Without Spacer Plates) | 20.65 to 20.85 | 0.813 to 0.821 inch |
| Belleville Washer Free Height | 11 mm | 0.43 inch |
| Type 1 MFD Clutch Assembly End Play | 1.00 to 1.25 mm | 0.039 to 0.049 inch |
| MFD Bearing Housing Bearing End Play | 0.03 to 0.13 mm | 0.001 to 0.005 inch |
| MFD Idler Gear End Play | 0.025 to 0.102 mm | 0.001 to 0.004 inch |

# SPECIAL TORQUES

| | | |
|---|---|---|
| MFD Clutch Assembly Mounting Bolts | | |
| Lower 12 Point Fixing | 280 Nm | 206 lb ft |
| M12 Bolt (With Loctite 242) | 110 Nm | 80 lb ft |
| M16 Bolt (With Loctite 242) | 280 Nm | 206 lb ft |
| MFD Idler Gear Retaining Bolt | | |
| Phosphate Coated 828-16120 - Class 10.9 (With Loctite 242) | 250 Nm | 185 lb ft |
| Pinion Shaft Retaining Bolt | | |
| Phosphate Coated 828-16110 - Class 10.9 (With Loctite 242) | 280 Nm | 206 lb ft |

# SPECIAL TOOLS

**1. 1037T1 BELLEVILLE SPRING COMPRESSOR**

**2. 1038T1 SNAP RING ADAPTER**

**3. MC2000 SEAL RING EXPANDER**

**4. MC2005-2 SEAL RING COMPRESSOR**

**5. MC1995A ALIGNMENT STUDS**

https://truckmanualshub.com/

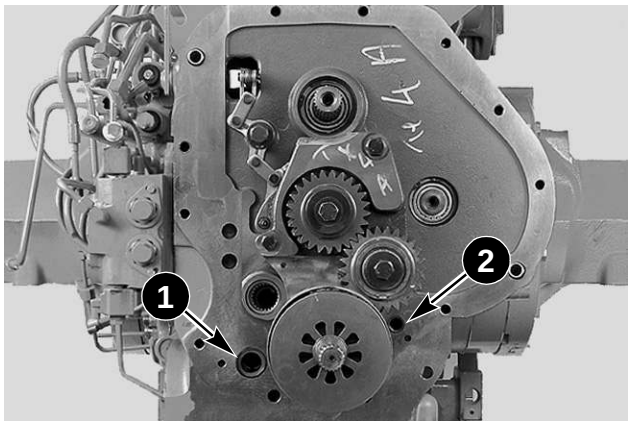


# MFD CLUTCH SERVICING

## Removal

**IMPORTANT:** *The following procedure is carried out with the tractor separated between the Speed and Range transmissions. Follow the guidelines for separating the tractor, refer to Section 6003.*

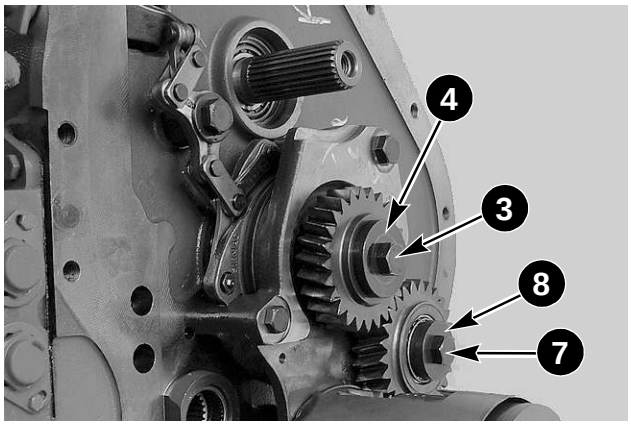
### STEP 1




MI06B069

With the tractor separated between the Speed and Range transmissions, remove and discard the sealing rings (1) and (2). Clean the mounting faces of the transmission housings.

### STEP 2




MI06B070

Remove and discard the pinion shaft drive gear retaining bolt (3). Remove spacer (4), shims (5) and drive gear (6). Remove the MFD idler gear retaining bolt (7), spacer (8) and shims (9).

**NOTE:** *If the pinion shaft is not to be serviced, retain the shims for installation.*

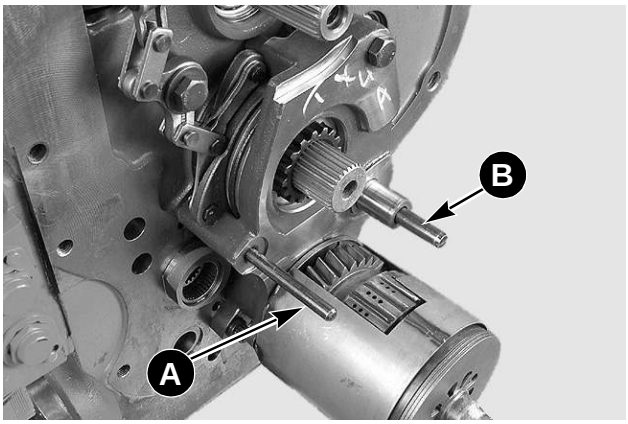
### STEP 3

Remove the outer bearing cone (10), idler gear (11) and inner bearing cone (12).

### STEP 4

If the MFD idler gear bearings are to be replaced, remove the bearing cups (13) and (14).

### STEP 5




MI06B071

Remove the 12 mm MFD bearing housing mounting bolt (16) and install a 12 mm (A) and a 16 mm (B) alignment stud (MC1995A) as shown. Remove the remaining mounting bolts (15) and (17).

**NOTE:** *The MFD shield back plate will prevent bolts (17) from being fully removed.*

### STEP 6

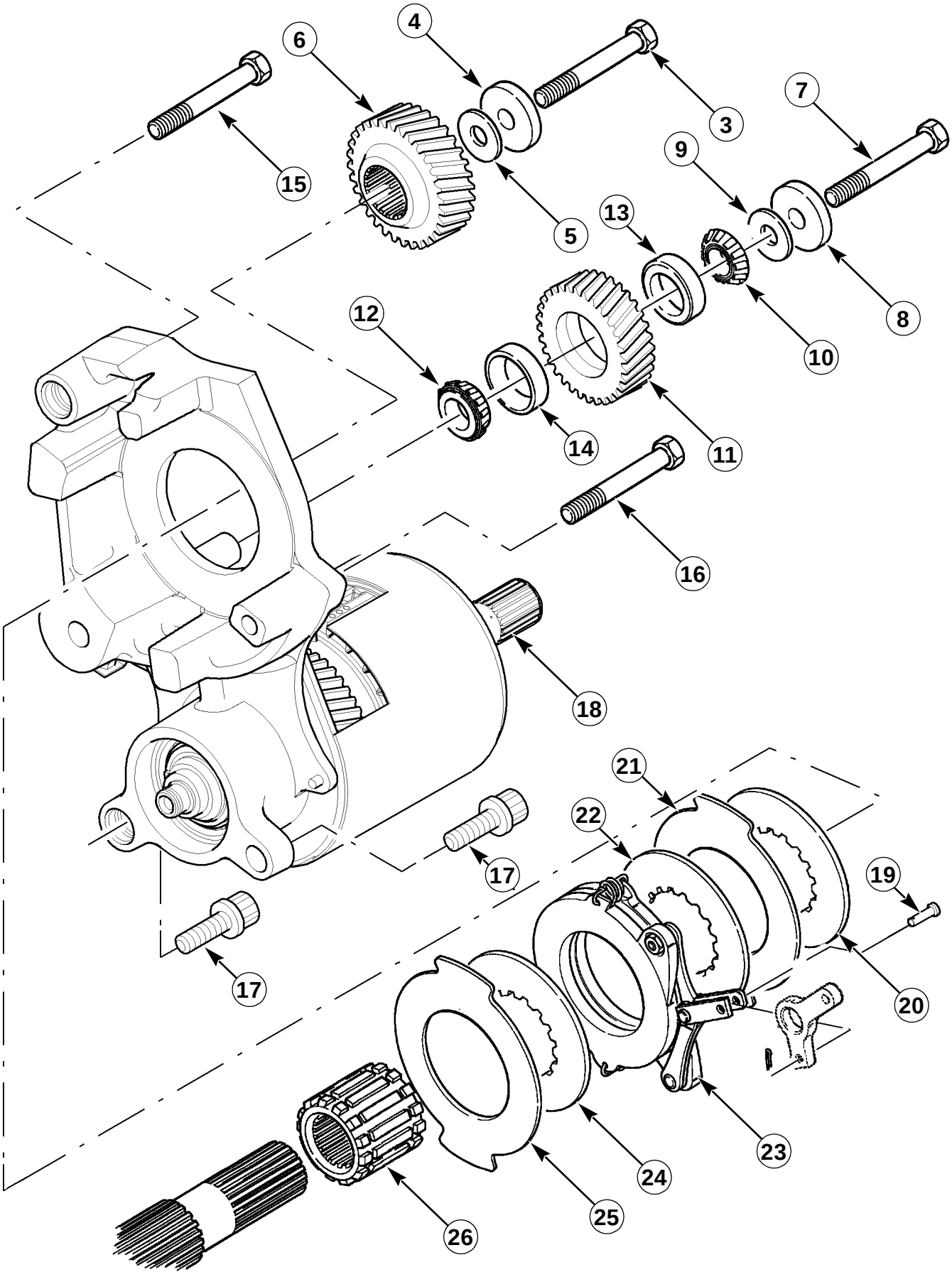
Carefully slide the MFD clutch assembly (18) along the alignment studs. Attach suitable lifting equipment to the assembly and remove the assembly from the transmission.

### STEP 7

Remove and discard the split pin and remove the clevis pin (19). Remove friction plate (20), separator plate (21), friction plate (22). Remove park brake actuator (23), friction plate (24), separator plate (25) and park brake hub (26).

https://truckmanualshub.com/






MI06B058

https://truckmanualshub.com/



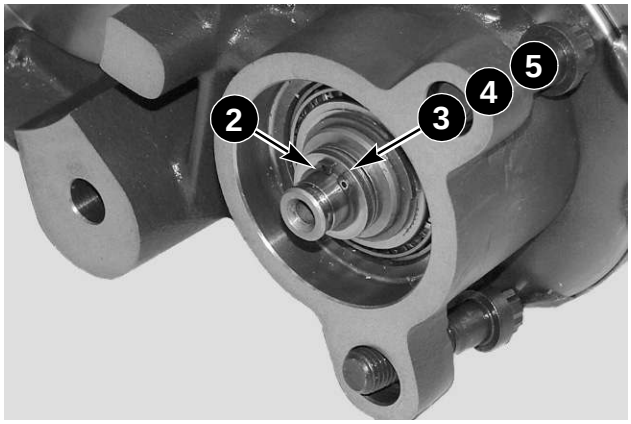
## Disassembly

### STEP 1

Place the MFD clutch assembly on a clean work surface and remove and discard the sealing ring (1).

**IMPORTANT:** *Care must be taken not to damage the seal groove when removing the seal rings (1).*

### STEP 2




MD06E084

Remove snap ring (2), thrust washer (3), thrust bearing (4) and thrust washer (5).

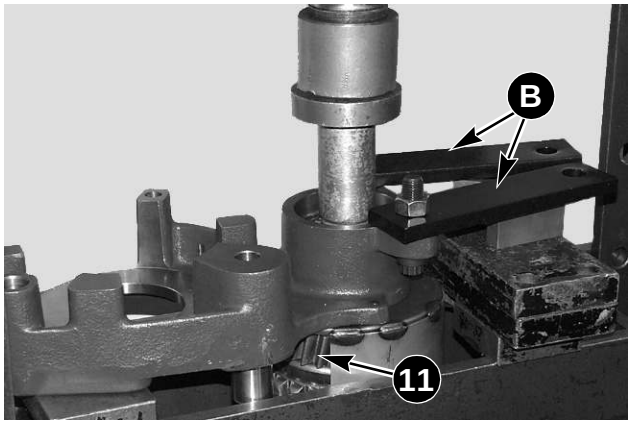
### STEP 3

Remove the clutch pack assembly (A) from the MFD bearing assembly. Remove thrust washer (6), thrust bearing (7) and thrust washer (8).

### STEP 4

Remove the MFD gear hub snap ring (9) and shims (10).

### STEP 5




MD06E084

Attach suitable supports (B) to the MFD bearing housing. Using a hydraulic press carefully remove the MFD gear hub (11) from the bearing housing, remove the bearing cone (12).

**IMPORTANT:** *Support the MFD gear hub (11) while pressing the gear hub from the bearing housing.*

### STEP 6

Remove seal (13), retaining bolts (14), shield (15) and mounting bolts (16).

### STEP 7

If the MFD gear hub bearing are to be replaced, use a suitable bearing puller and remove bearing cone (17) from the gear hub (11).

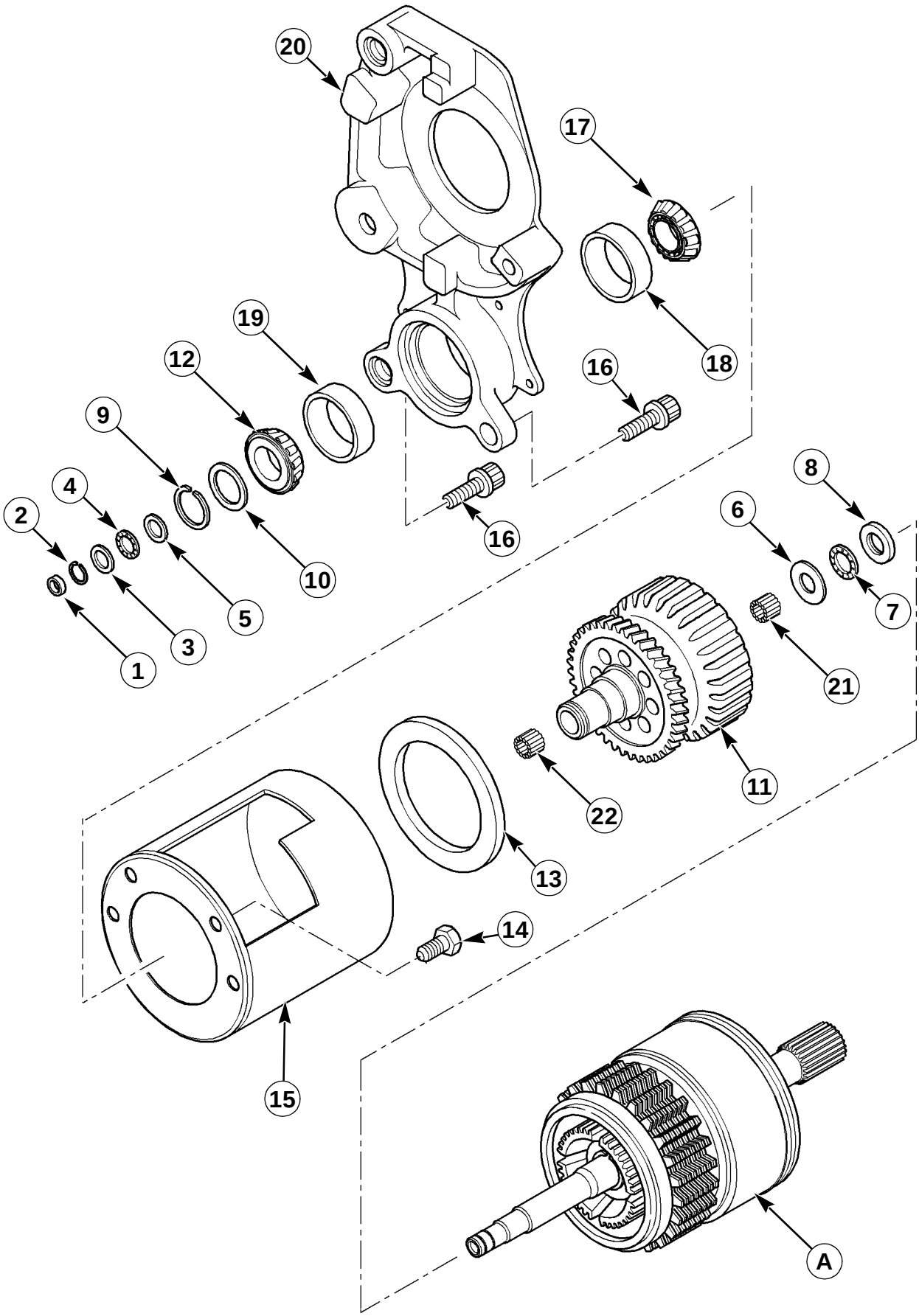
Also remove bearing cups (18) and (19) from the bearing housing (20).

### STEP 8

Check the needle roller bearings (21) and (22) for wear or damage and remove if necessary.

https://truckmanualshub.com/

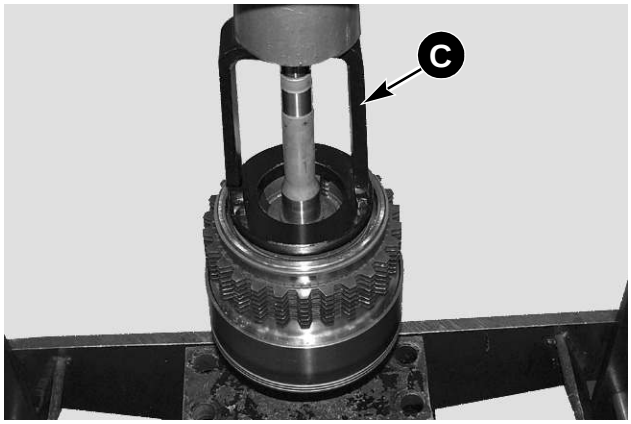




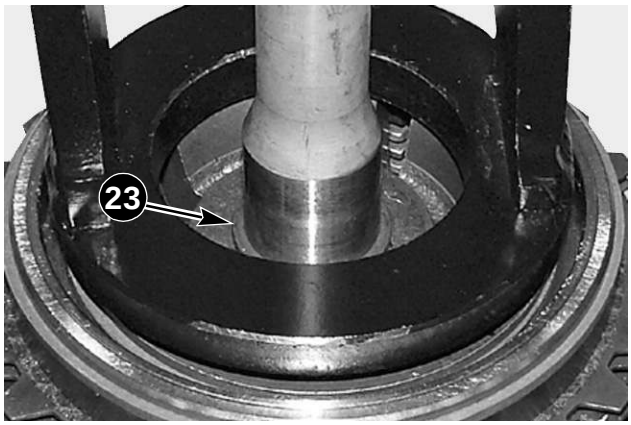
https://truckmanualshub.com/



## STEP 9




MD06E019

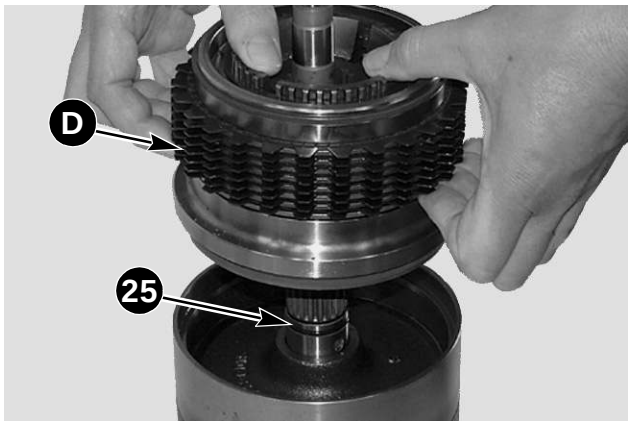



Place the MFD clutch assembly on a hydraulic press. Using the spring compressor 1037T1 (C) apply enough pressure to compress the belleville springs (28). Remove snap ring (23) from the groove in the MFD shaft (29).

## STEP 10

Slowly release the pressure on the hydraulic press and remove the spring compressor 1037T1. Remove snap ring (23) and thrust washer (24).

## STEP 11




MD06E021

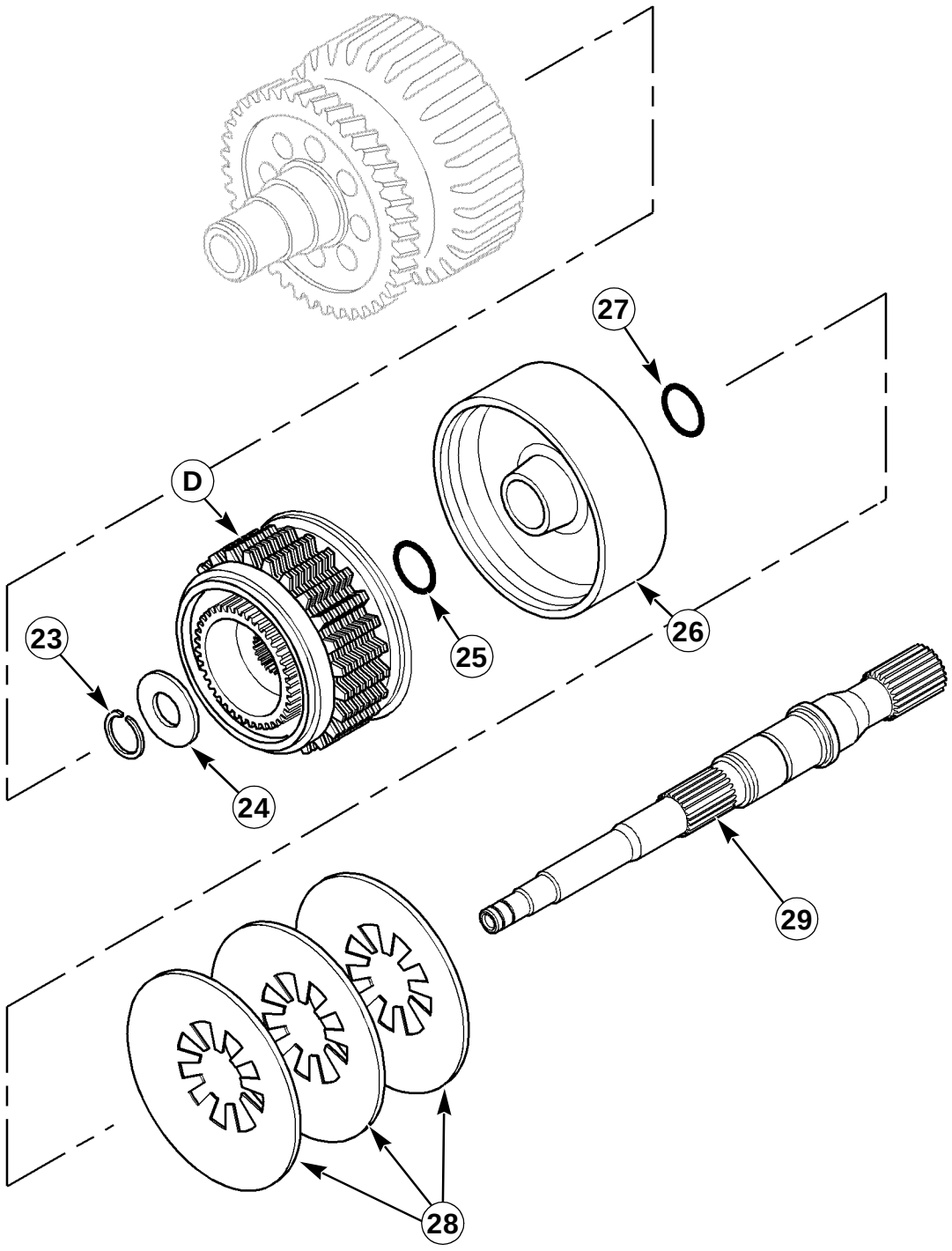
Remove the MFD clutch pack assembly (D) from the MFD shaft (29). Remove and discard o-ring (25).

## STEP 12

Remove piston hub (26), o-ring (27) and belleville springs (28), discard o-ring (27).

https://truckmanualshub.com/





https://truckmanualshub.com/



## Type 1 MFD Clutch Pack

**IMPORTANT:** *Type 1 MFD clutch packs are equipped with 8 friction plates, 8 separator plates (34), and a 16 mm thick backing plate.*

### STEP 13

Remove snap ring (30), shims (31) and backing plate (32).

### STEP 14

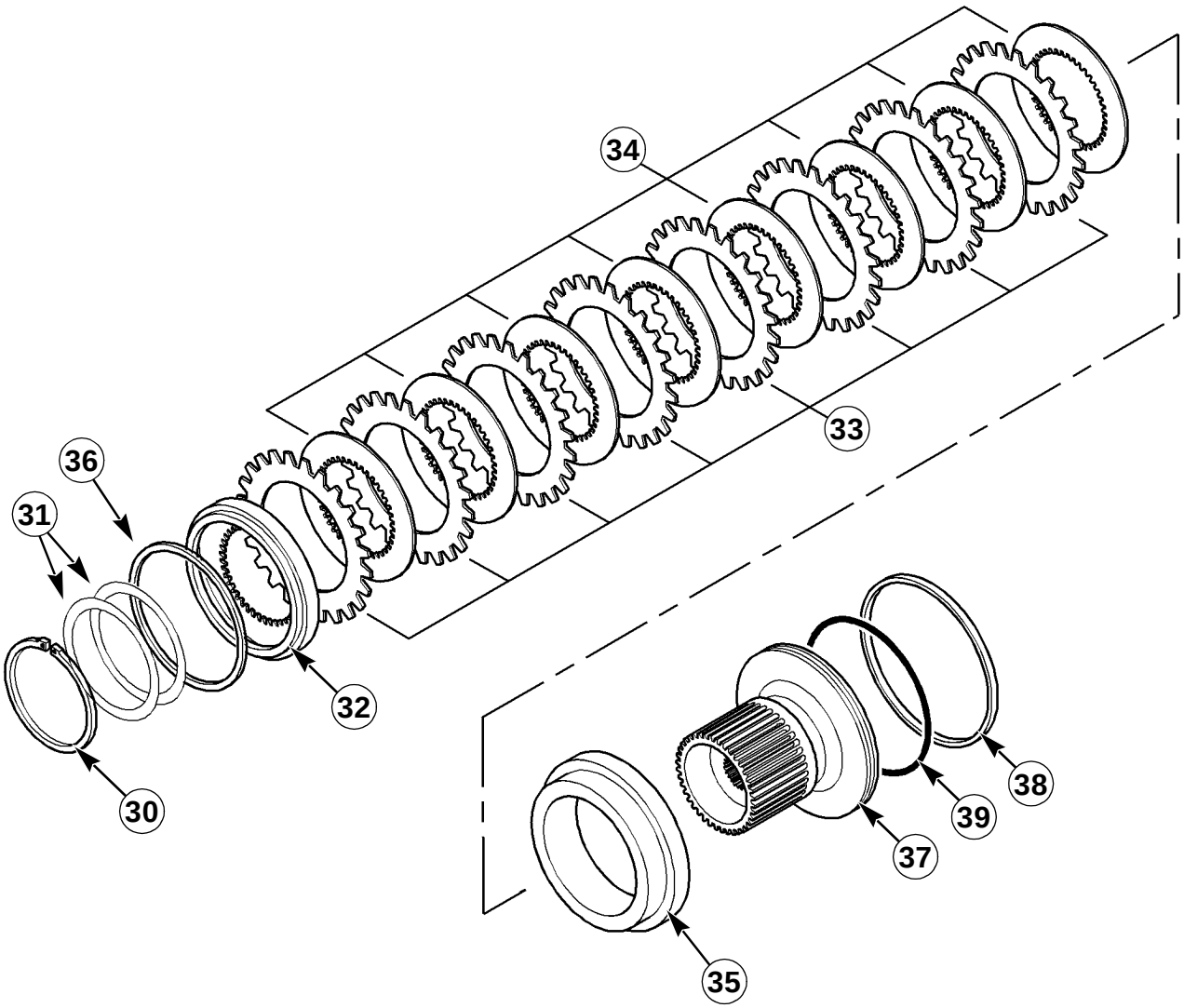
Remove friction plates (33), separator plates (34) and base plate (35).

### STEP 15

Remove and discard the seal ring (36) from the backing plate (37).

### STEP 16

Remove and discard piston seal (38) and o-ring (39) from the piston (37).



https://truckmanualshub.com/



## Type 2 MFD Clutch Pack

**IMPORTANT:** *Type 2 MFD clutch packs are equipped with 7 friction plates (43), 7 separator plates (44) and with either a 16 mm or 20 mm thick backing plate (41).*

### STEP 17

Remove snap ring (40) and backing plate (41). Remove the spacer plates (42) if equipped.

**IMPORTANT:** *Spacer plates (42) are only used with 16 mm thick backing plates (41).*

### STEP 18

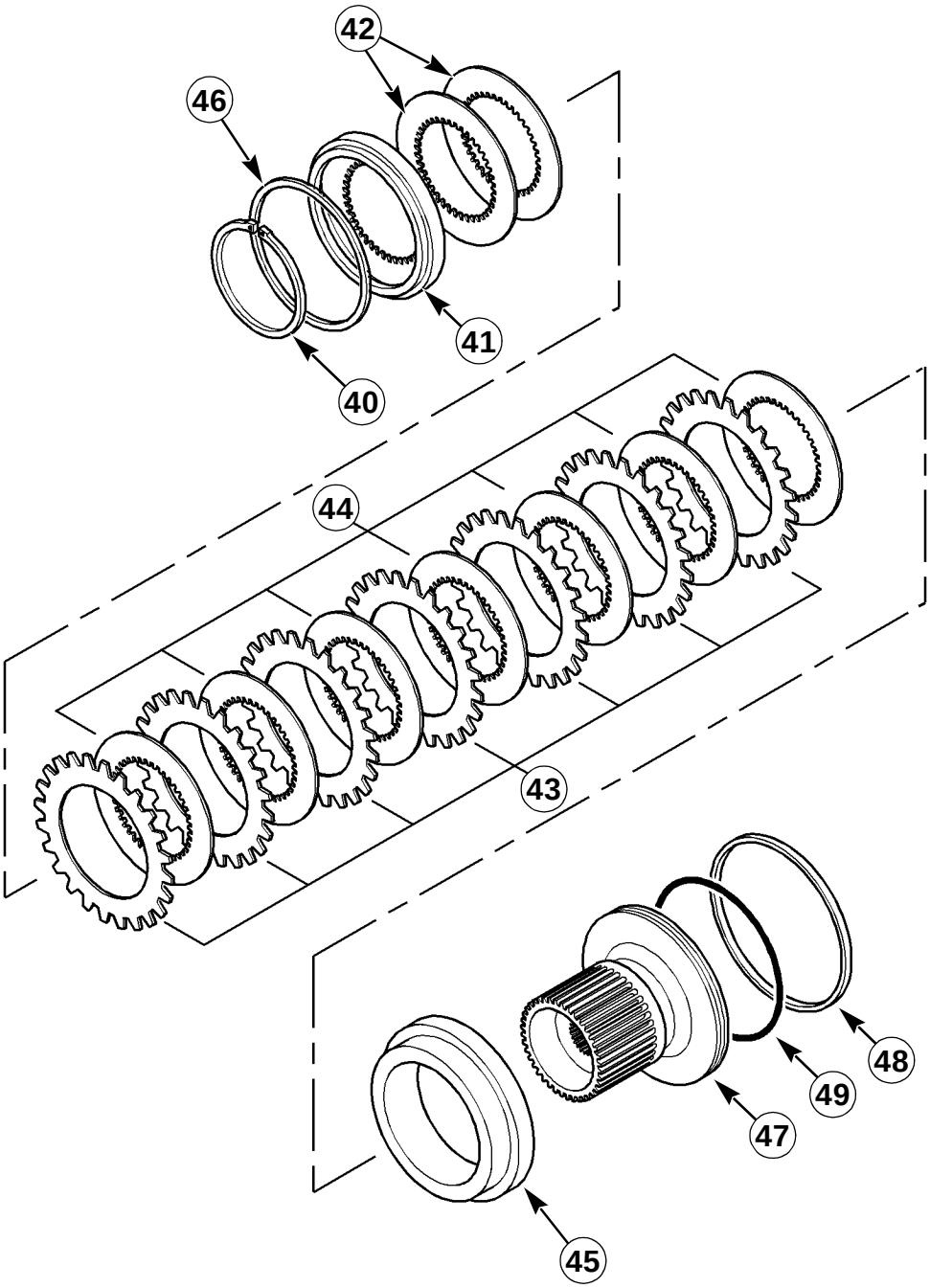
Remove friction plates (43), separator plates (44) and base plate (45).

### STEP 19

Remove and discard the seal ring (46) from the backing plate (41).

### STEP 20

Remove and discard piston seal (48) and o-ring (49) from the piston (47).



https://truckmanualshub.com/

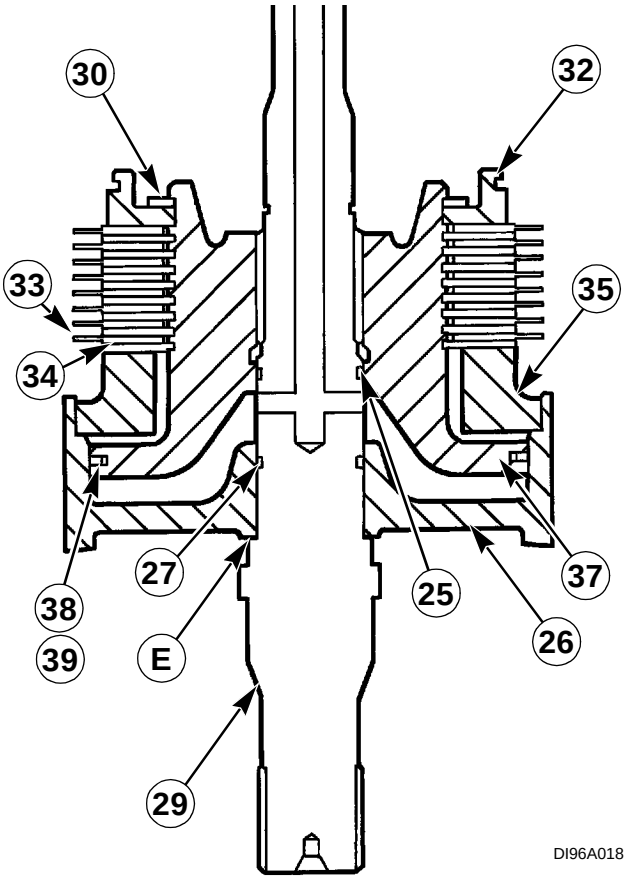


# Assembly

## Type 1 MFD Clutch Pack

**IMPORTANT:** *If new friction plates are to be installed, make sure all friction plates have the same friction material groove pattern and the plates have been soaked in clean transmission oil before installation.*

### STEP 21




Install the piston hub (26) onto the MFD shaft (29), without o-rings (25) and (27). Make sure the piston hub (26) is against the shoulder (E).

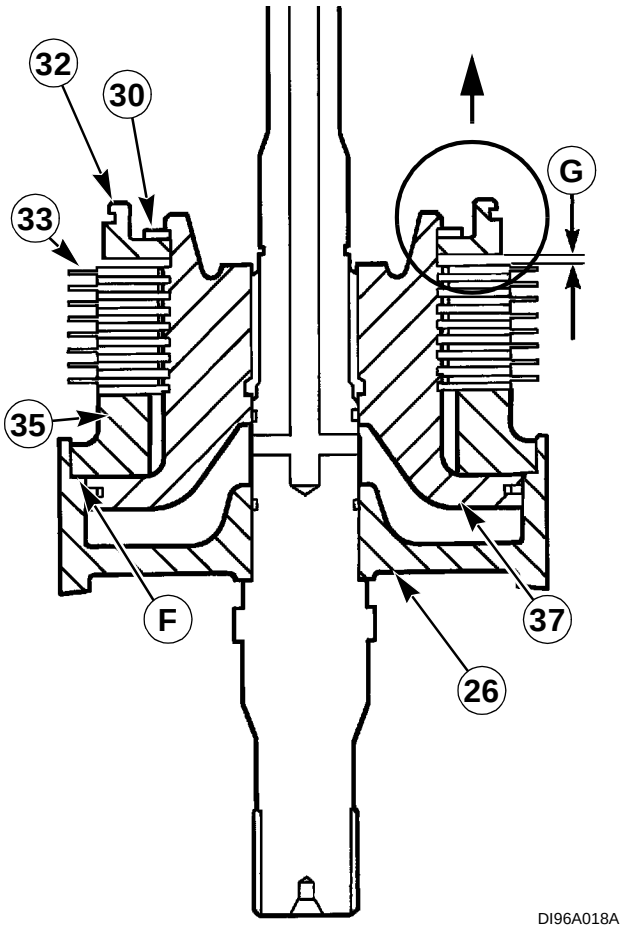
Install piston (37) onto the MFD shaft (29) without o-ring (39) or piston seal (38). Install base plate (35) one separator plate (34) then one friction plate (33).

Continue to install one separator (34) and one friction plate (33) until a total of 8 separator plates and 8 friction plates have been installed.

Install backing plate (32) and snap ring (30), make sure the snap ring locates correctly into the snap ring groove.

**IMPORTANT:** *When installing the separator and friction plates the last plate installed must be a friction plate (33).*

### STEP 22




Lift backing plate (32), snap ring (30) and piston (32) until the piston (37) contacts the base plate (35). Make sure the base plate (35) remains seated against the shoulder (F) in the piston hub (26).

Measure distance (G) between the last friction plate (33) and the backing plate (32).

Subtract 1.0 to 1.25 mm (0.039 to 0.049 inch) from measurement (G) to determine the shim pack thickness to be installed between backing plate (32) and snap ring (30).

### STEP 23

Remove all items installed in STEP 21 from the MFD shaft (29).

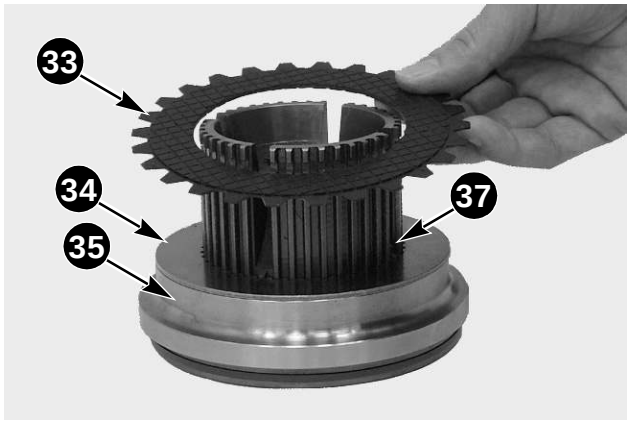
### STEP 24

Lubricate and install a new o-ring (39) and piston seal (38) onto the piston (37).

https://truckmanualshub.com/



## STEP 25




MD06E011

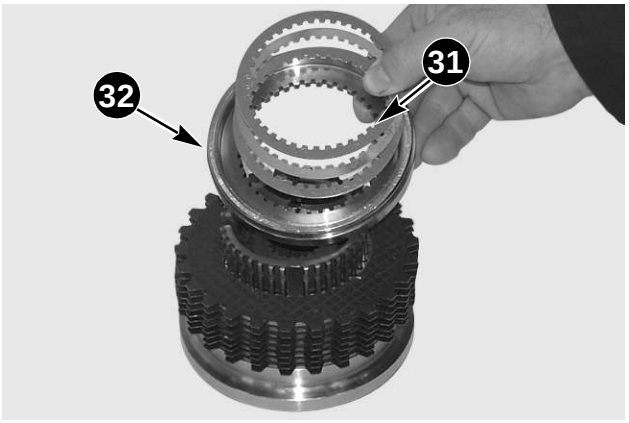
Install base plate (35), one separator plate (34) then one friction plate (33) onto piston (37).

## STEP 26

Continue to install one separator plate (34) and one friction plate (33) until a total of 8 separator plates and 8 friction plates have been installed.

**IMPORTANT:** *When installing the separator plates and friction plates the last plate installed must be a friction plate (33).*

## STEP 27



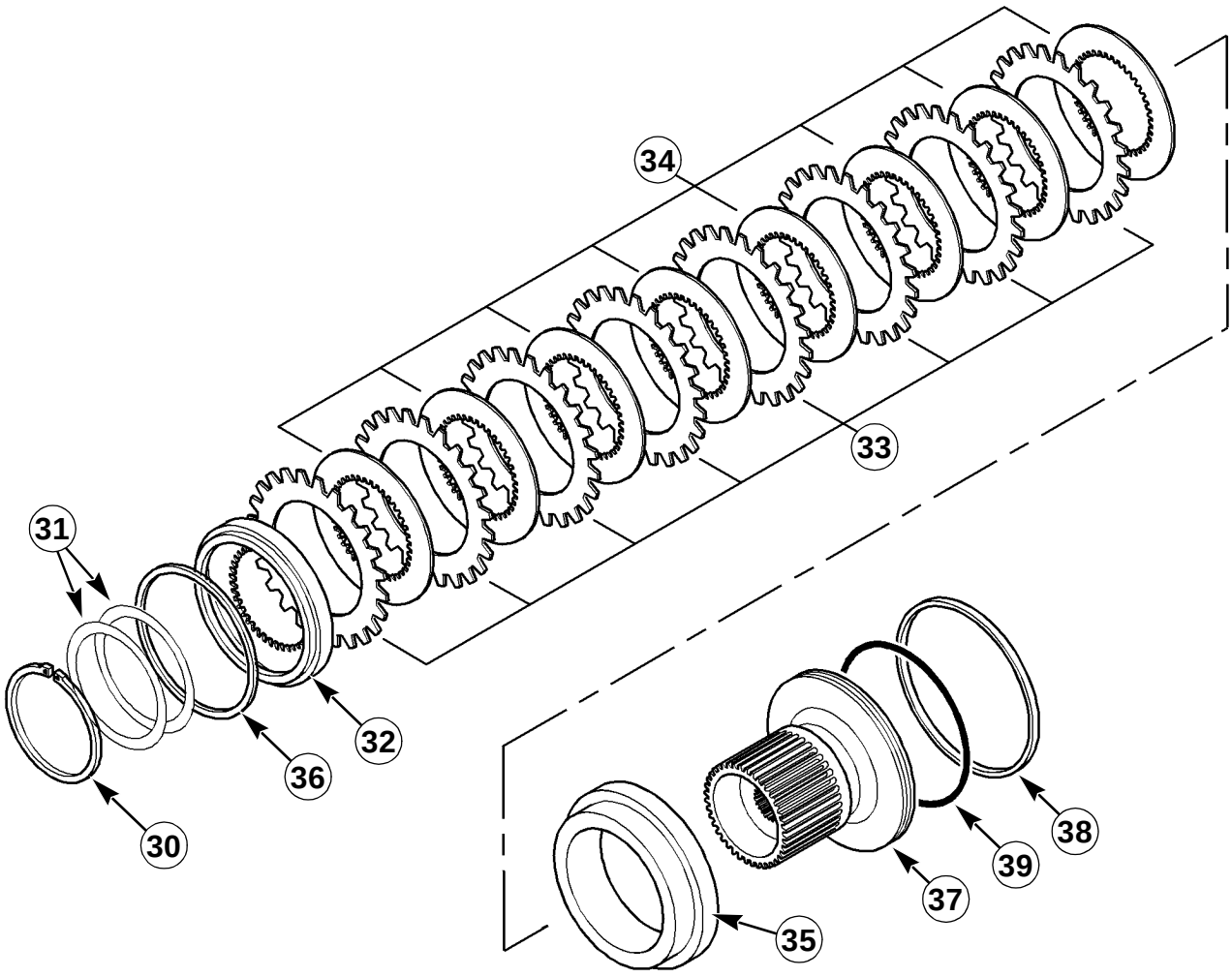

MD06G069

Install backing plate (32), shims (31) (determined in STEP 16).
Install snap ring (30), make sure the snap ring locates correctly into the snap ring groove.

## STEP 28

Lubricate and install a new seal ring (36) into the groove in the backing plate (32).

**NOTE:** *After the assembly of the MFD clutch pack, go to STEP 36.*



https://truckmanualshub.com/



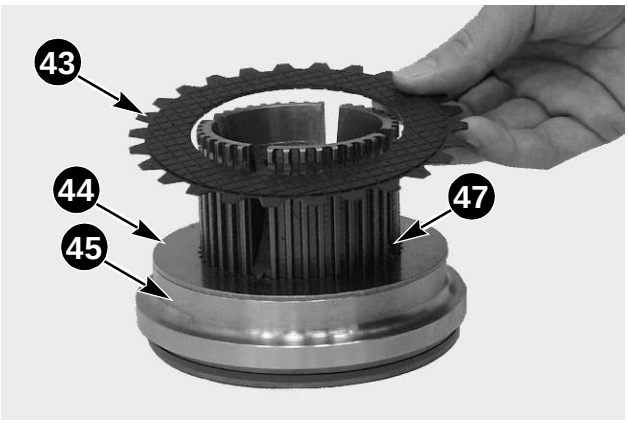
## Type 2 MFD Clutch Packs

**IMPORTANT:** *If new friction plates are to be installed, make sure all friction plates have the same friction material groove pattern and the plates have been soaked in clean transmission oil before installation.*

### STEP 29

Lubricate and install a new o-ring (49) and piston seal (48) onto the piston (47).

### STEP 30




MD06E011

Install base plate (45), one separator plate (44) then one friction plate (43) onto piston (47).

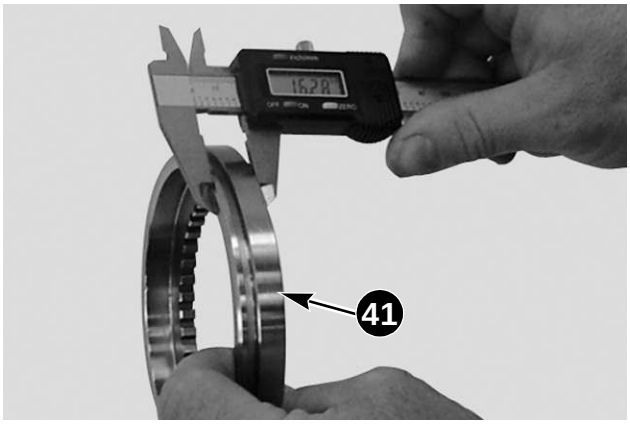
### STEP 31

Continue to install one separator plate (44) and one friction plate (43) until a total of 7 separator plates and 7 friction plates have been installed.

**IMPORTANT:** *Separator plates (44) have an external diameter on 127 mm.*

**IMPORTANT:** *When installing the separator plates and friction plates the last plate installed must be a friction plate (43).*

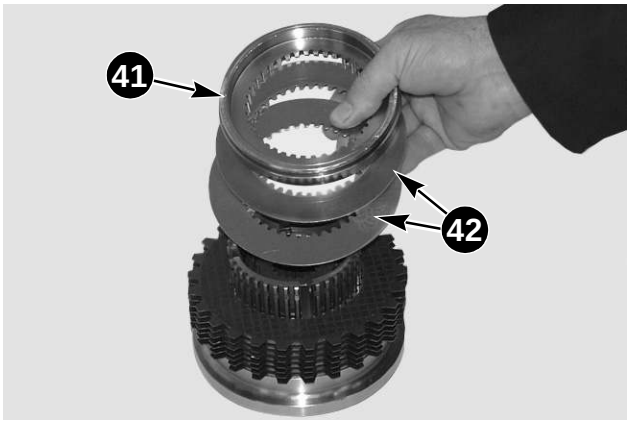
### STEP 32




MD06G068

Measure and make a note of the thickness of the backing plate (41).

### STEP 33




MD06G070

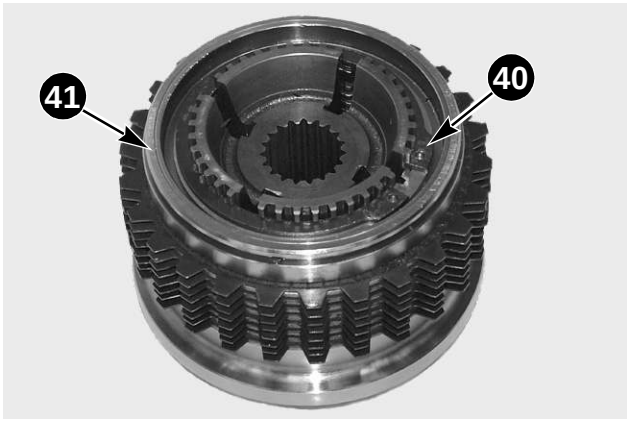
If a 16 mm backing plate (41) is to be installed, install TWO spacer plates (42). Install 16 mm backing plate (41).
Install snap ring (40), make sure the snap ring locates correctly into the snap ring groove.

**IMPORTANT:** *Spacer plates (42) are similar to separator plates (44) but have an external diameter of 121.5 mm. Spacer plates (42) are ONLY to be installed when using a 16 mm thick backing plate.*

https://truckmanualshub.com/



## STEP 34



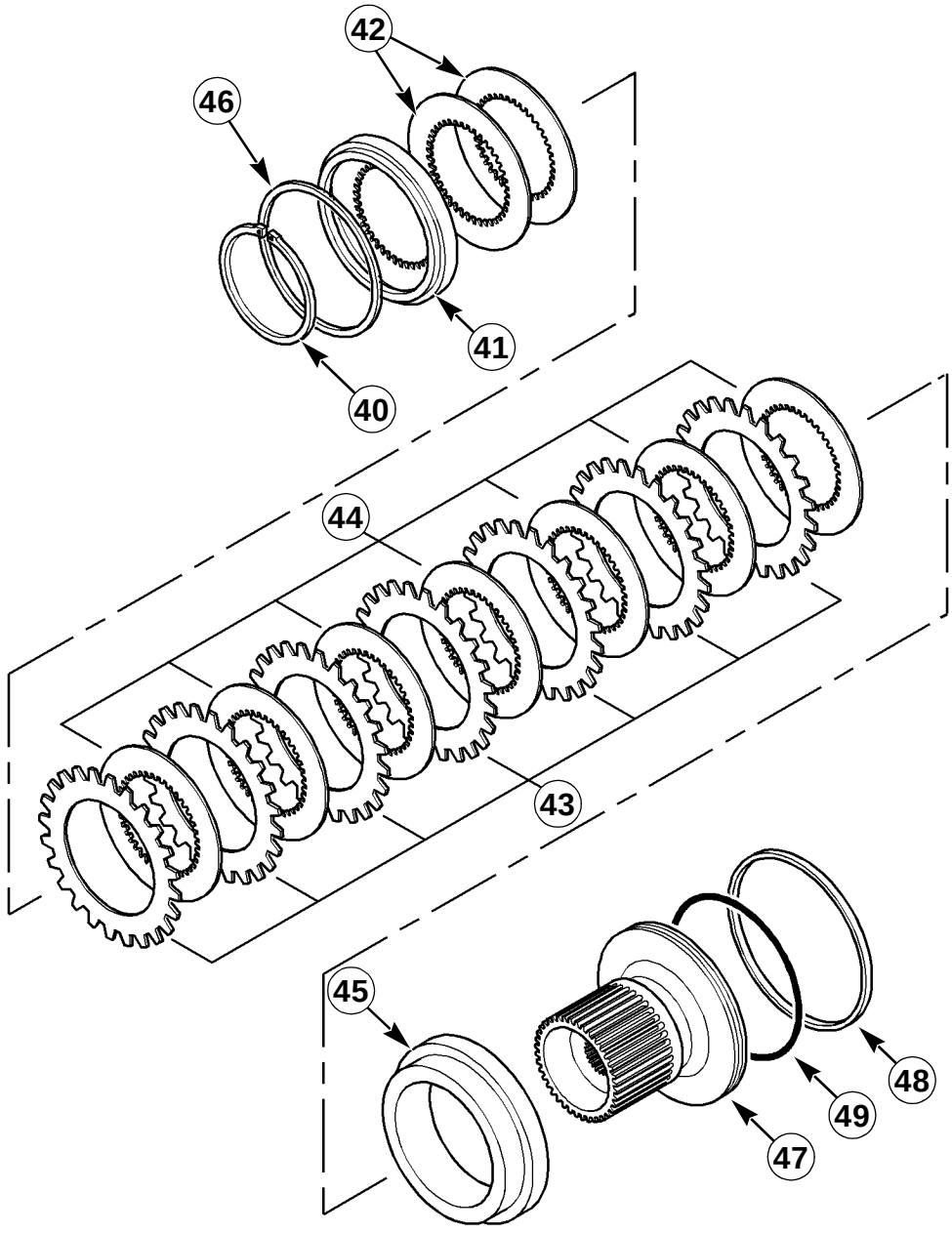

MI06E012

If a 20 mm backing plate (41) is to be installed, install the backing plate (41), and snap ring (40), make sure the snap ring locates correctly into the snap ring groove.

## STEP 35

Lubricate and install a new seal ring (46) into the groove in the backing plate (41).

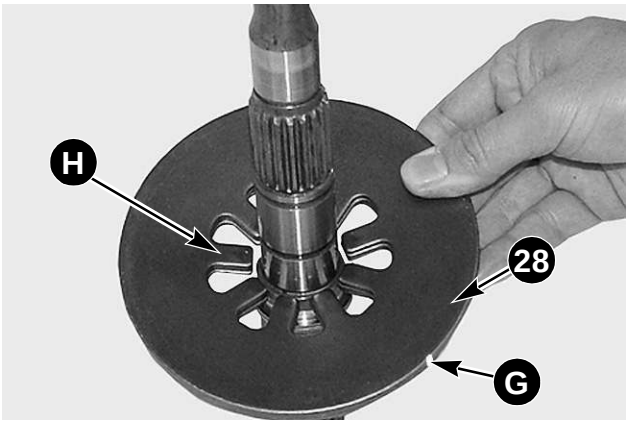
**IMPORTANT:** *When installing a 20 mm thick backing plate (42) DO NOT install spacer plates (42).*



https://truckmanualshub.com/



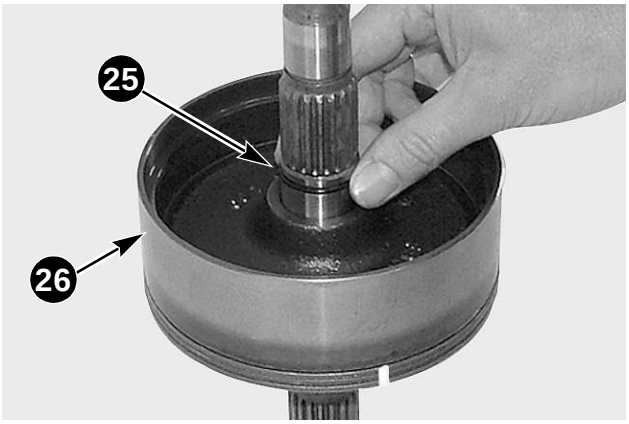
## STEP 36




MI06E014

Install belleville springs (28) onto the MFD shaft (29) with the concave side facing upward towards the piston hub, make sure the fingers (H) align together. Put alignment marks (G) on the belleville springs (28) as shown.

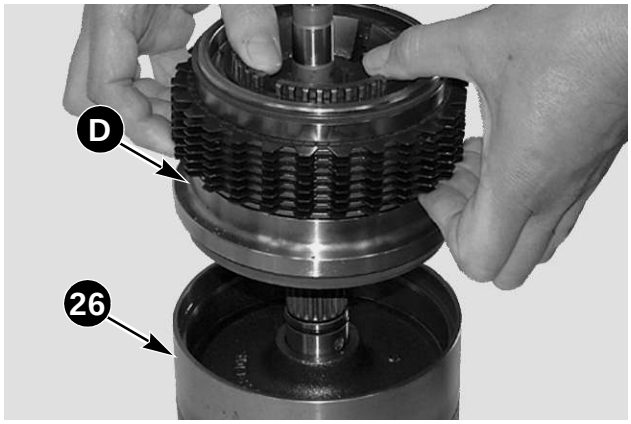
## STEP 37




MI06E015

Lubricate and install a new o-ring (27) into the lower groove in the MFD shaft (29). Install piston hub (26), lubricate and install a new o-ring (25) into the upper groove in the MFD shaft (29).

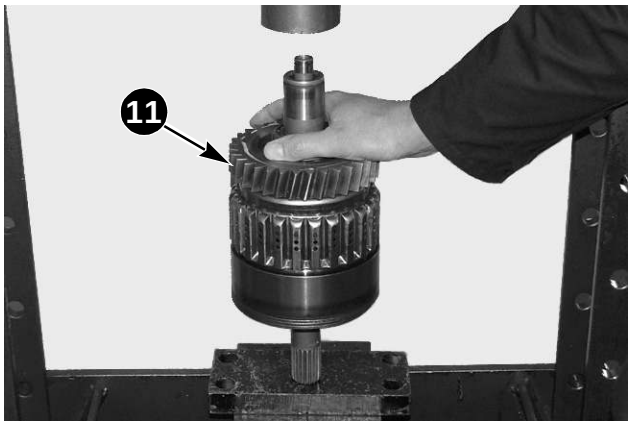
## STEP 38




MD06E021

Carefully Install the MFD clutch assembly (D) onto the MFD shaft. Make sure piston locates into piston hub (26).

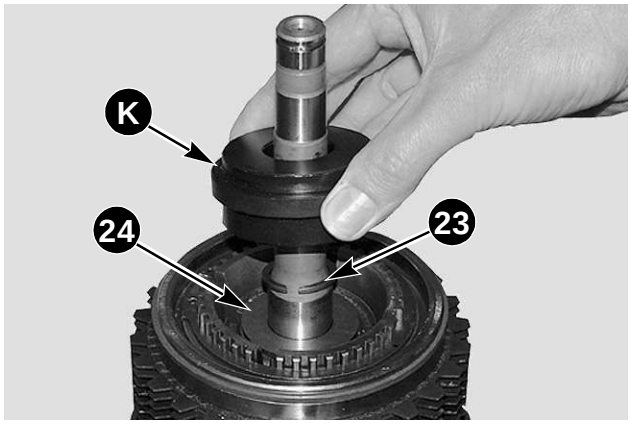
## STEP 39




MI06E086

Use gear hub (11) to align friction plates (33).

## STEP 40



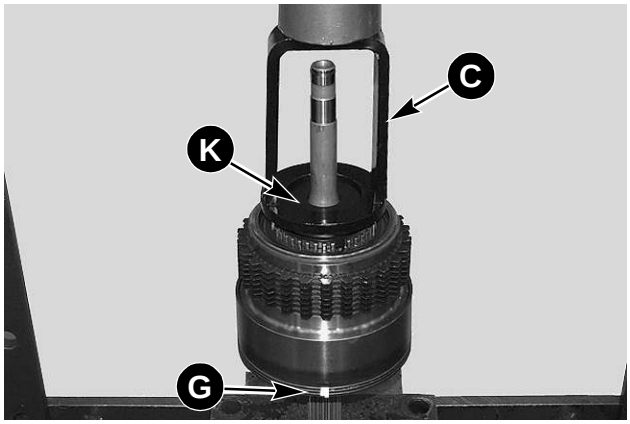

MI06E022

Place the MFD clutch shaft assembly on a hydraulic press. Install thrust washer (24) and a new snap ring (23) onto the MFD shaft.
Install the snap ring adapter 1038T1 (K) over the snap ring (23) make sure the snap ring locates into the recess in the snap ring adapter.

https://truckmanualshub.com/



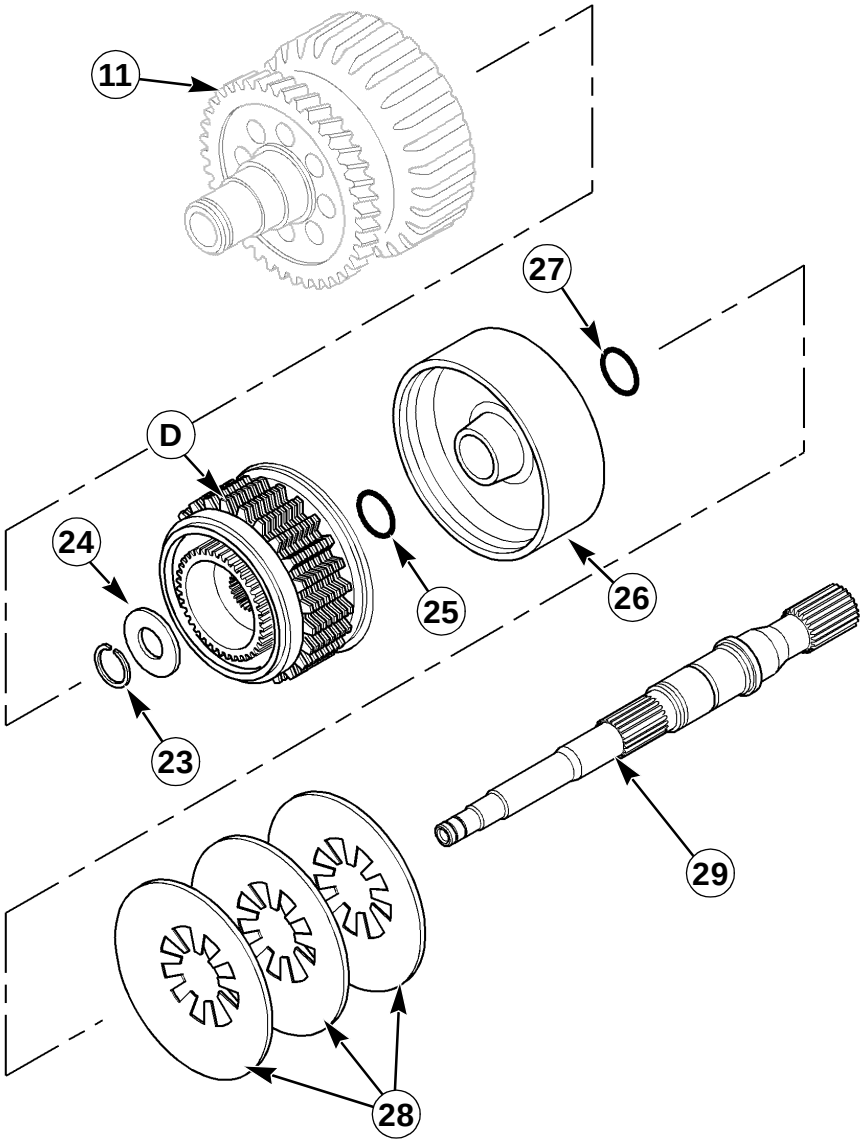
**STEP 41**




MI06E018

Make sure the alignment marks (G) made in STEP 36 are aligned. Using the spring compressor 1037T1 (C), SLOWLY apply pressure to the spring compressor and snap ring adapter 1038T1 (K), press the snap ring (23) onto the MFD shaft. When the snap ring is heard to snap into the snap ring groove, SLOWLY release the pressure on the hydraulic press.

**IMPORTANT:** *Apply pressure to the hydraulic press slowly to avoid damaging the snap ring or snap ring groove.*



https://truckmanualshub.com/



## STEP 42

If the needle roller bearings (21) and (22) have been remove, install new bearings (21) and (22) into the gear hub (11). Make sure the bearings are fully seated against the shoulders in the gear hub (11).

## STEP 43

If bearing cups (18) and (19) have been removed use a hydraulic press and install new bearing cups (18) and (19) into the MFD bearing housing (20). Make sure the bearing cups are fully seated against the shoulders in the MFD bearing housing.

## STEP 44

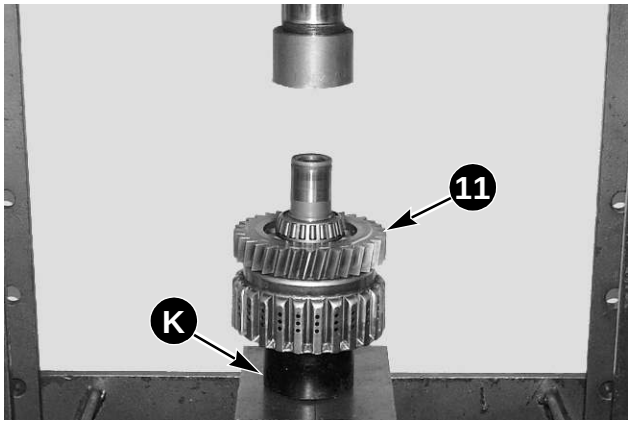
Install mounting bolts (16) into the MFD bearing housing. Install shield (15) and install and tighten retaining bolts (14). Install a new seal (13), make sure the lip of the seal is facing upwards.

## STEP 45

Heat the bearing cone (17) in a bearing oven to a temperature of 110°C (230°F). Install the bearing onto the gear hub (11). Make sure the bearing is fully seated against the shoulder.

**WARNING:** *Always wear heat protective gloves when handling heated parts.*

## STEP 46

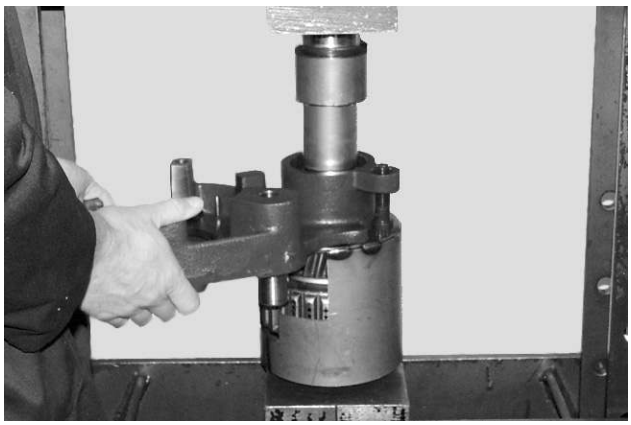



MI06E087

Position the gear hub assembly (11) on a hydraulic press using a suitable 110 mm (4.33 inch) ID tube (K) as shown.

**NOTE:** *It will be necessary to have an assistant support the bearing housing during the following procedure.*

## STEP 47

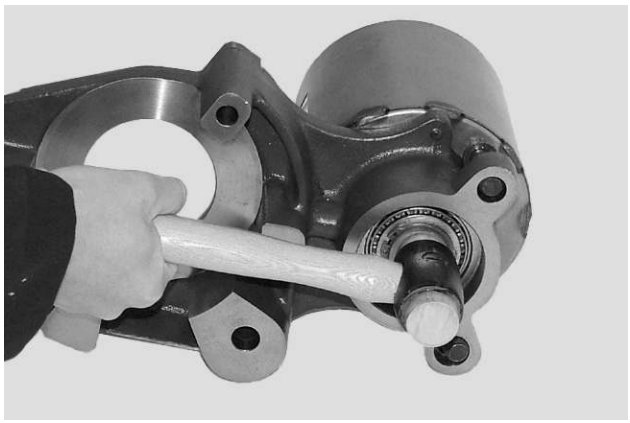


MI06E088

Install the MFD bearing housing (20) onto the gear hub assembly (11). Using a hydraulic press and suitable sleeve install and press bearing cone (12) into position.
Continue to apply pressure to the bearing until all end play is removed from the MFD bearing housing (20). Release the pressure on the hydraulic press.

**IMPORTANT:** *Make sure the sleeve does not make contact with the bearing cage or the MFD gear hub.*

## STEP 48

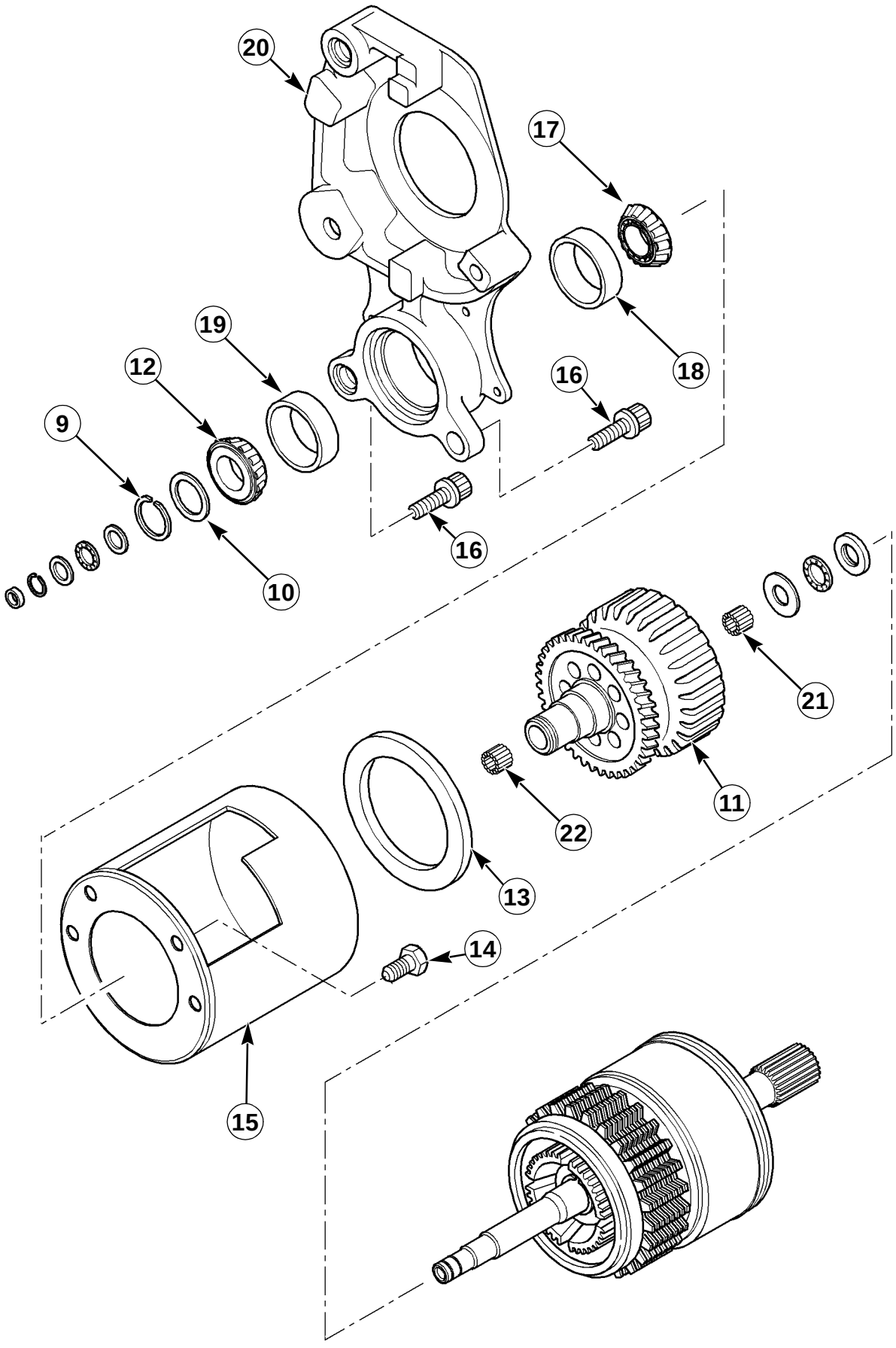


MI06E089

Install snap ring (9). DO NOT install shims (10) at this stage. Using a soft faced hammer seat the snap ring (9) against bearing cone (12).

https://truckmanualshub.com/

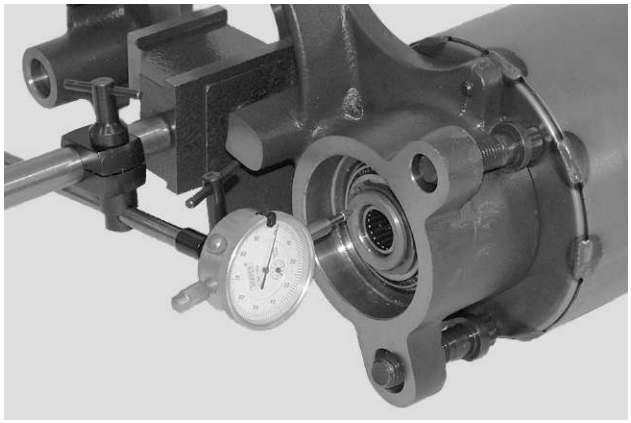




https://truckmanualshub.com/



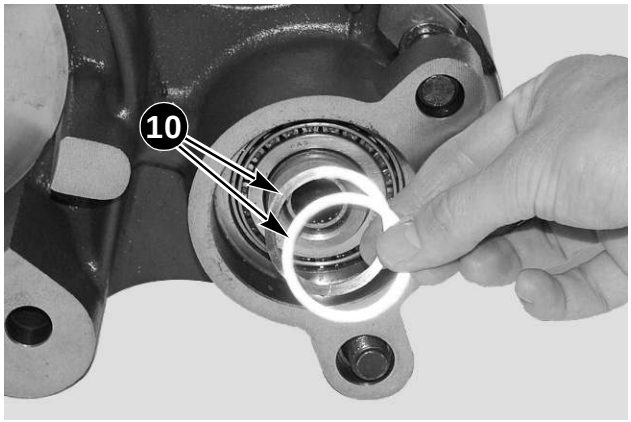
## STEP 49



MI06E090

Using a dial gauge, measure and make a note of the end play of gear hub assembly (11).
Subtract 0.06 mm to the measured end play to determine the initial shim pack to be installed to give a bearing end play of 0.03 to 0.13 mm (0.001 to 0.005 inch).

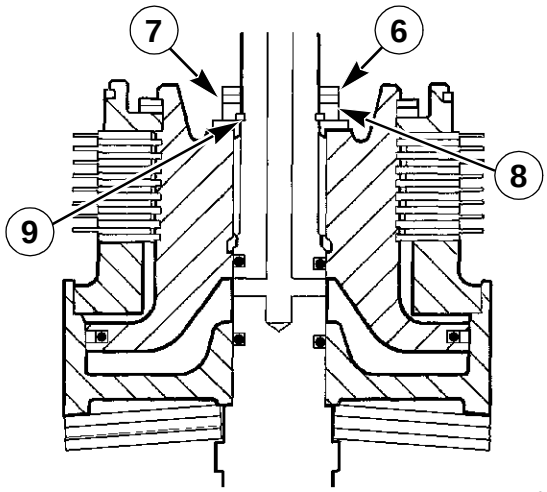
## STEP 50




MI06E091

Remove snap (9). Repeat STEP 47 to remove the end play from MFD bearing housing (20). Install shims (10) (determined in STEP 48) and snap ring (9). Use a soft faced hammer to seat bearing cone (12) against the shims (10) and snap ring (9).

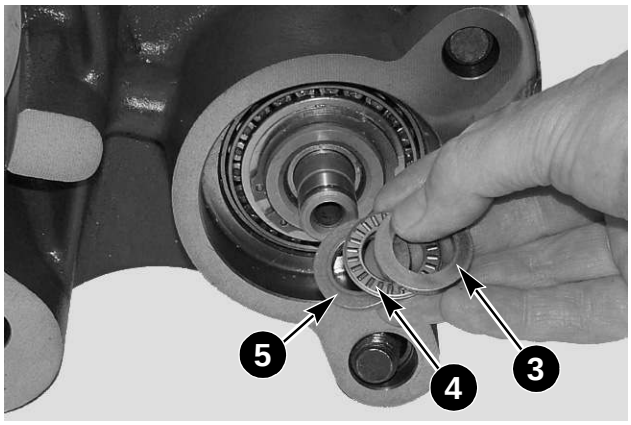
## STEP 51




DI96A020

Install thrust washer (8) onto the MFD shaft assembly (A), make sure the recess in the thrust washer is positioned correctly over the snap ring (9). Install thrust bearing (7) and thrust washer (6).

## STEP 52

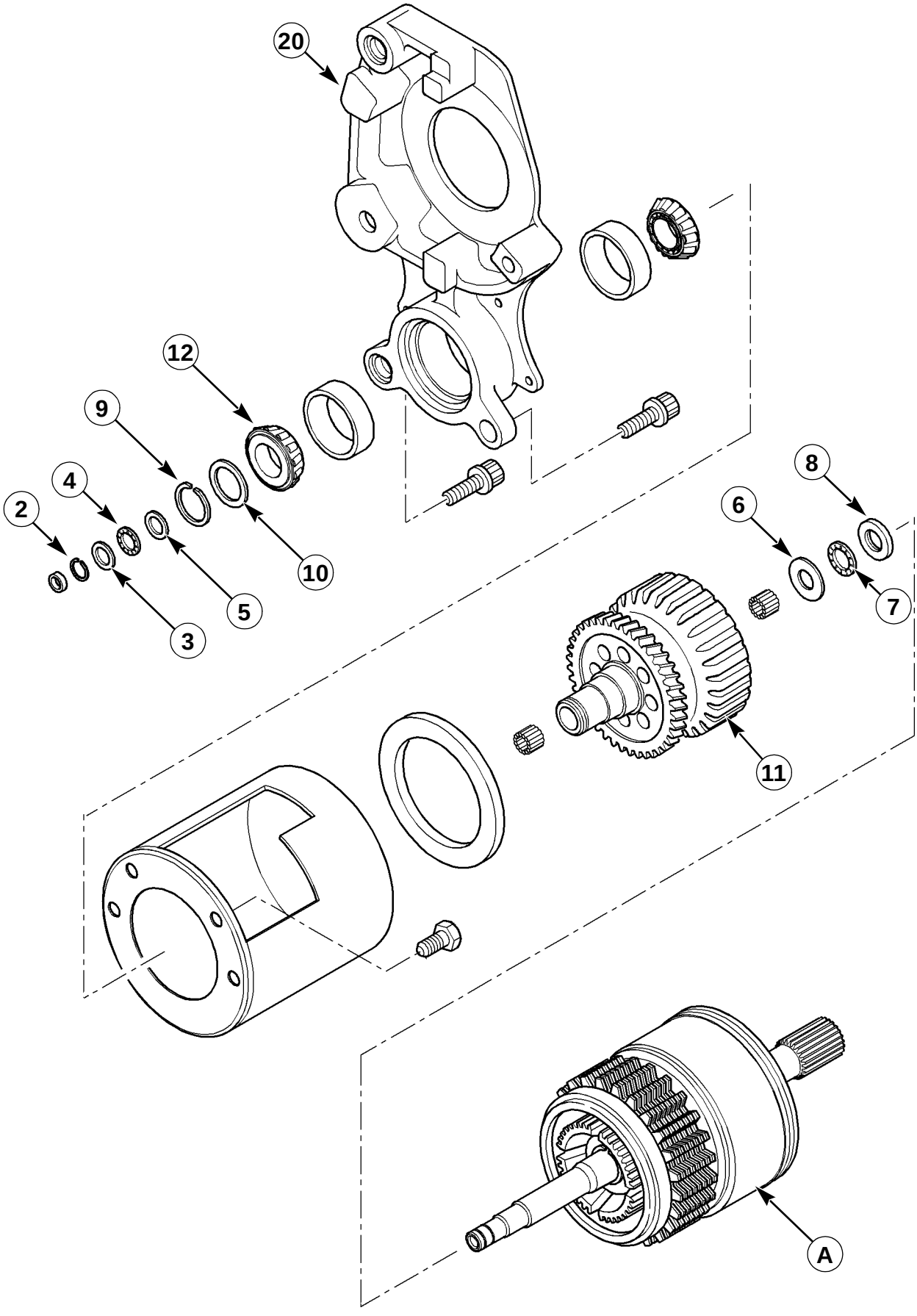



MI06B074

Install the MFD bearing housing assembly onto the MFD shaft assembly (A). Make sure friction plates locate correctly into the MFD gear hub (11). Install thrust washer (5), thrust bearing (4) and thrust washer (3).

https://truckmanualshub.com/

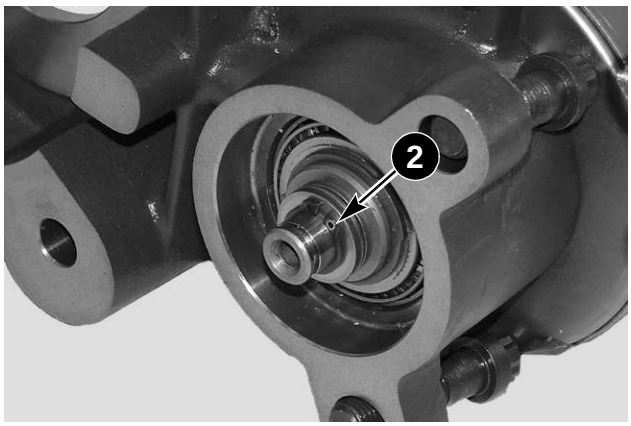




https://truckmanualshub.com/



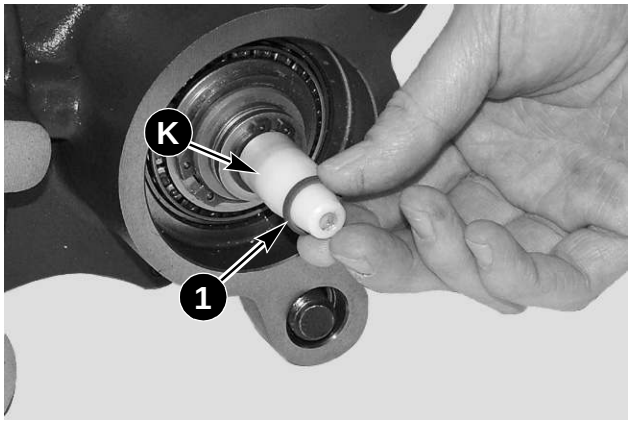
## STEP 53




MI06E094

Install snap ring (2), make sure the snap ring locates correctly into the snap ring groove.

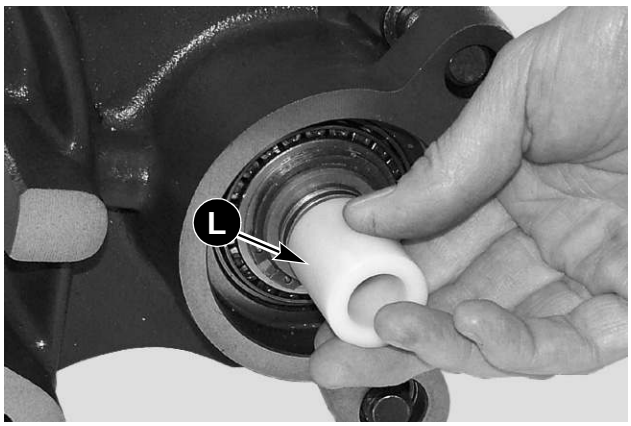
## STEP 54



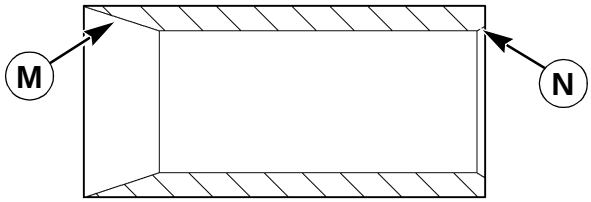

MI06E095

Lubricate a new seal ring (1) with clean transmission oil. Using the seal expander MC2000 (K) install the new seal ring (1) into the groove in the MFD shaft. Remove the seal expander.

## STEP 55




MI06E097




MI95M085

Compress and reshape the seal ring by hand. Install the long chamfer end (M) of the seal compressor MC2005-2 (L) over the MFD shaft and seal ring. Remove the seal compressor then install the short chamfer end (N) of the seal compressor over the seal ring.

**NOTE:** *The seal compressor MC2005-2 will compress the seal ring to its correct working size. Make sure the seal ring has not been twisted or damaged during installation. If the seal ring is twisted or damaged, remove and discard the seal ring and repeat STEP 54 and STEP 55.*

https://truckmanualshub.com/



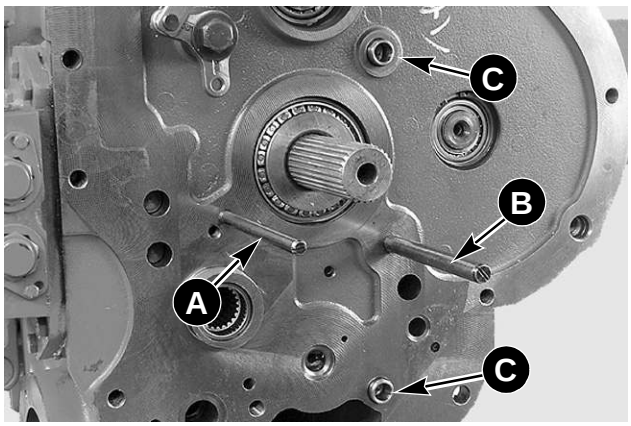
This Page Has Been Left Blank.

https://truckmanualshub.com/



## Installation

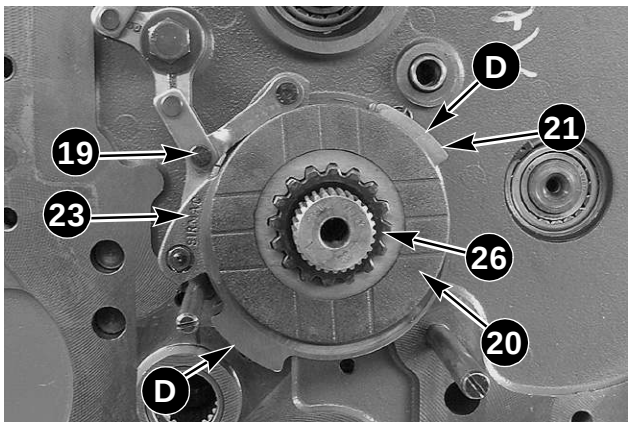
### STEP 56




MI06B072

Install a 12 mm (A) and a 16 mm (B) alignment stud (MC1995A) as shown. Make sure the dowels (C) are installed in the locations shown.

### STEP 57




MI06B073

Install park brake hub (26), separator plate (25), friction plate (24) and park brake actuator (23). Install a second friction plate (22), a second separator plate (21) and final friction plate (20). Install the clevis pin (19) and secure with a new split pin. Make sure the tabs (D) on the separator plates are aligned as shown.

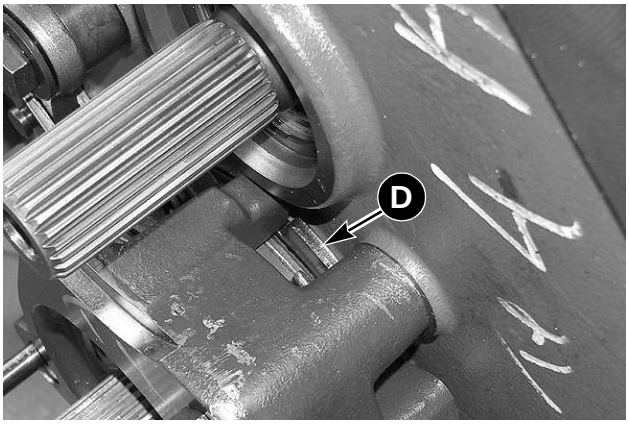
### STEP 58

Apply Loctite 242 to the range transmission bearing carrier threaded holes for the bottom MFD mounting bolts.

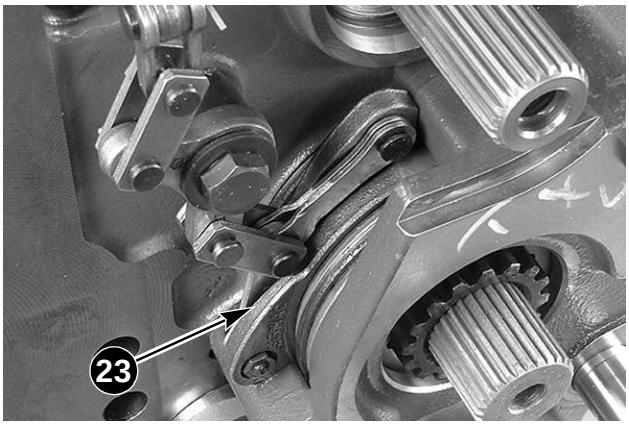
### STEP 59

Install the MFD clutch assembly (18) on to the alignment studs using suitable lifting equipment. Slide the assembly along the alignment studs and remove the lifting equipment.

### STEP 60




MI06B074




MI06B075

Continue to slide the assembly (18) along the alignment studs, making sure the park brake actuator (23) and separator plate tabs (D) locate correctly into the park brake/MFD housing as shown.

### STEP 61

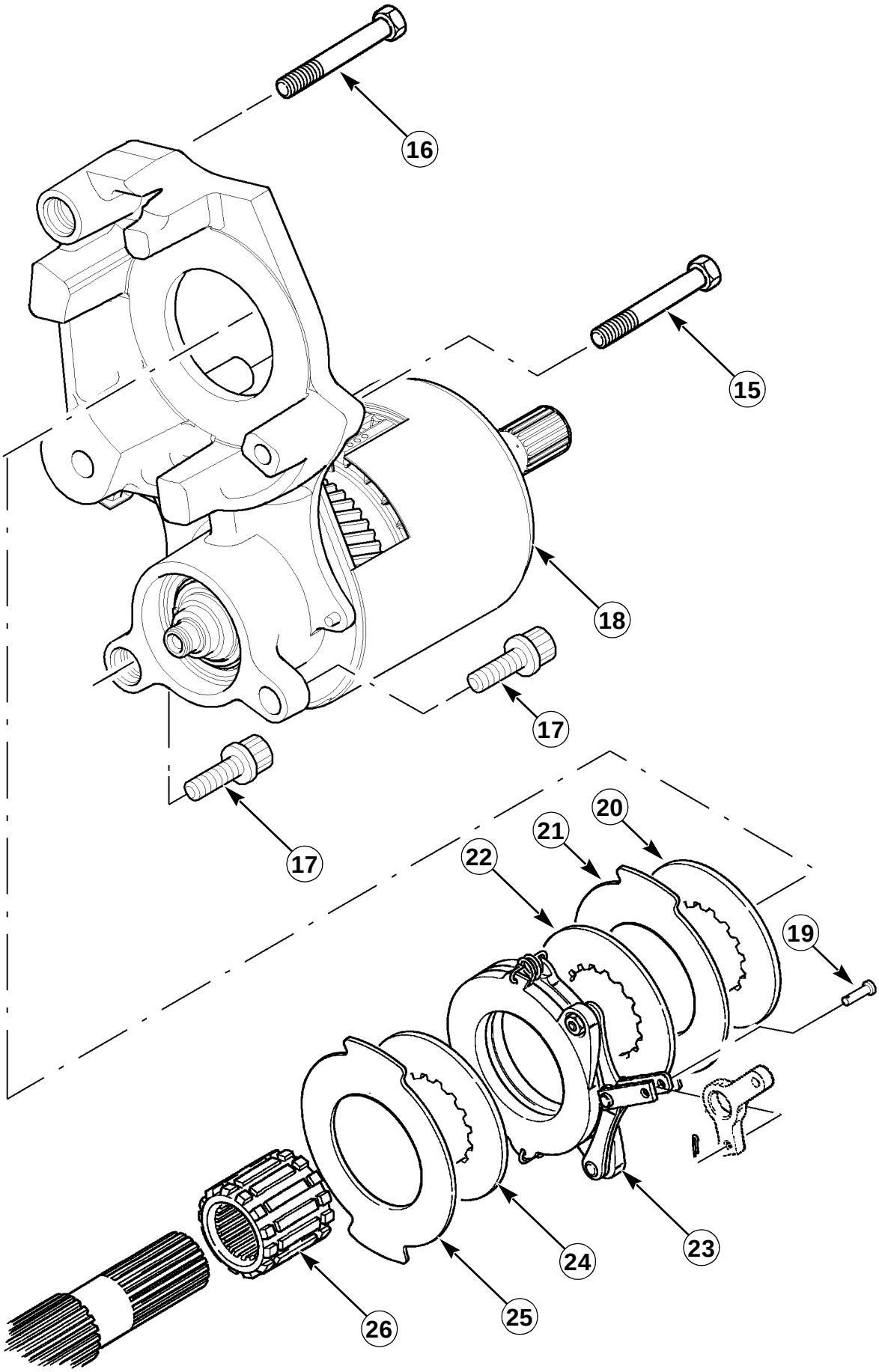
Apply Loctite 242 to the threads of the top MFD bearing housing mounting bolt (16) and install the top mounting bolt (16). Install the bottom mounting bolts (17). Tighten the top and bottom mounting bolts to a torque of 280 Nm (206 lb ft).

### STEP 62

Remove the alignment studs and Loctite 242 to the threads of the 12 mm mounting bolt (15). Install and tighten the 12 mm mounting bolt to a torque of 110 Nm (80 lb ft).

https://truckmanualshub.com/

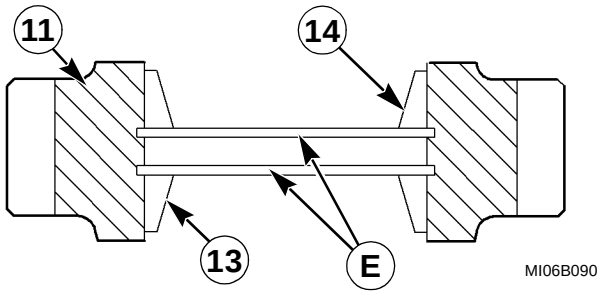




https://truckmanualshub.com/



## STEP 63



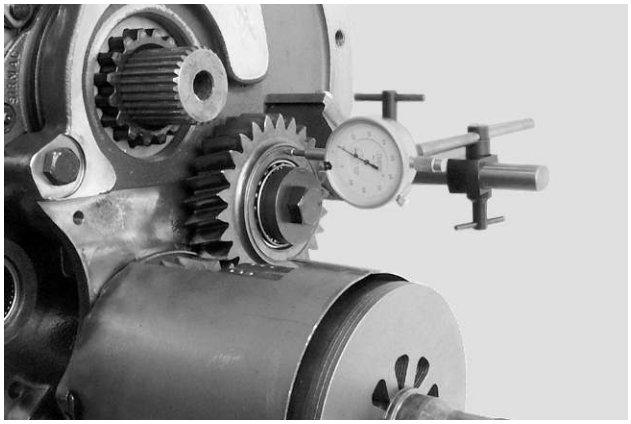

MI06B090

If the MFD idler gear bearing cups have been removed, make sure snap rings (E) are correctly installed into the grooves in the idler gear (11). Using a hydraulic press, install new bearing cups (13) and (14). Make sure the bearing cups are installed against snap rings (E) as shown.

## STEP 64

Install inner bearing cone (12), idler gear (11) and outer bearing cone (10). Install spacer (8) and MFD idler gear retaining bolt (7). Tighten the retaining bolt to a torque of 250 Nm (185 lb ft). DO NOT install shims (9) at this stage.

## STEP 65



MI06B076

Attach a dial gauge to the MFD idler gear (11) as shown. Using even pressure on the idler gear measure the end play of the gear. Subtract 0.06 mm (0.024 inch) from the measured end play to determine the correct shim thickness to be installed.

## STEP 66

Remove the MFD idler gear retaining bolt (7) and spacer (8). Install shims (9) (determined in STEP 65), spacer (8) and retaining bolt (7). Tighten the retaining bolt to a torque of 250 Nm (185 lb ft).

## STEP 67

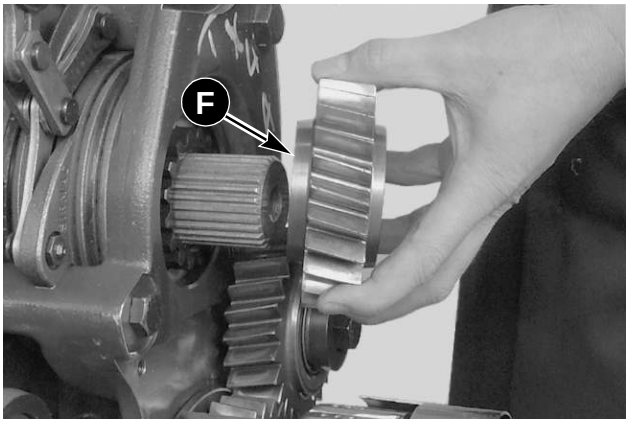
Check for an MFD idler gear end play of 0.025 to 0.102 mm (0.001 to 0.004 inch). If the end play is not correct repeat STEP 65.

## STEP 68

When the MFD idler gear end play set correctly, remove the MFD idler gear retaining bolt (7). Apply Loctite 242 to the threads of the retaining bolt (7) and install and tighten the retaining bolt to a torque of 250 Nm (185 lb ft).

**NOTE:** *If the MFD idler gear bolt is to be replaced a new bolt to the correct specification, (phosphate coated - class 10.9) must be installed.*

## STEP 69

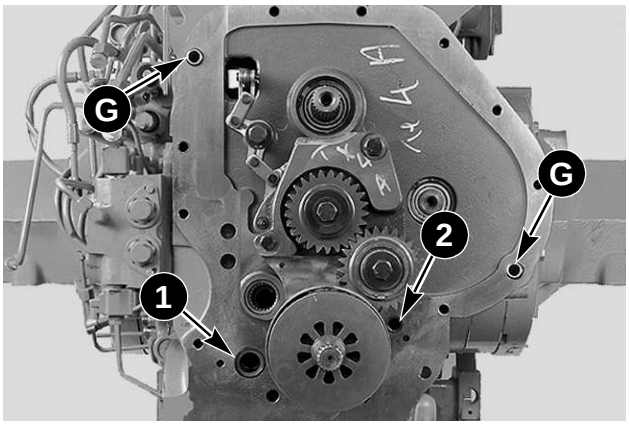



MI06B077

Install drive gear (6), make sure the deeper off set hub (F) is towards the park brake hub as shown. Install shims (5) and spacer (4) onto a new pinion shaft drive gear retaining bolt (3) (phosphate coated - class 10.9). Apply Loctite 242 to the threads of the retaining bolt and tighten the bolt to a torque of 280 Nm (206 lb ft).

**IMPORTANT:** *Install shims (5) retained during removal, or if the pinion shaft has been serviced, install shims determined when carrying out the pinion shaft bearing preload procedure, refer to Section 6007.*

## STEP 70

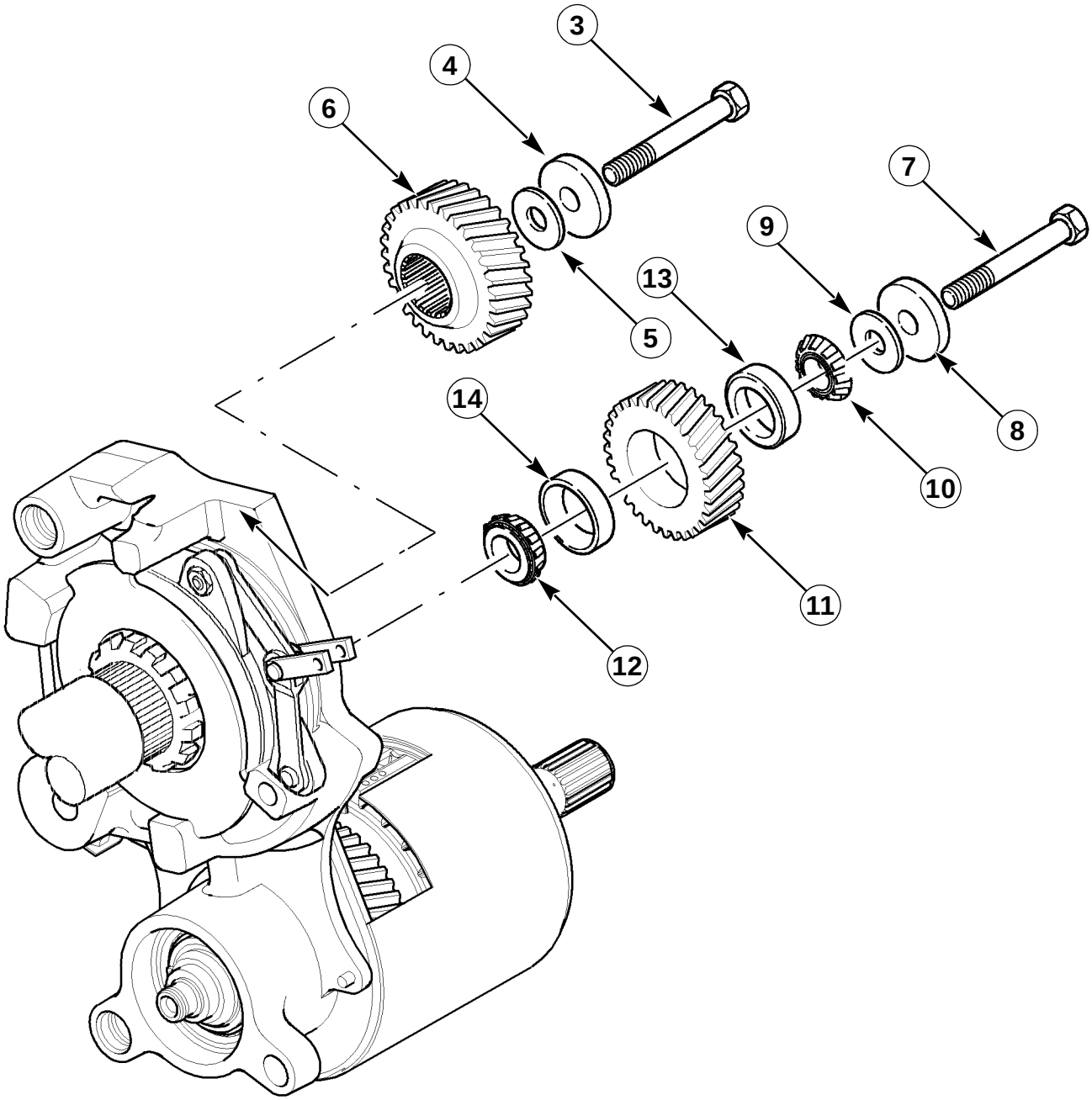



MI06B069

Install new sealing rings (1) and (2). Make sure the locating dowels (G) are correctly installed into the range or speed transmission.

https://truckmanualshub.com/

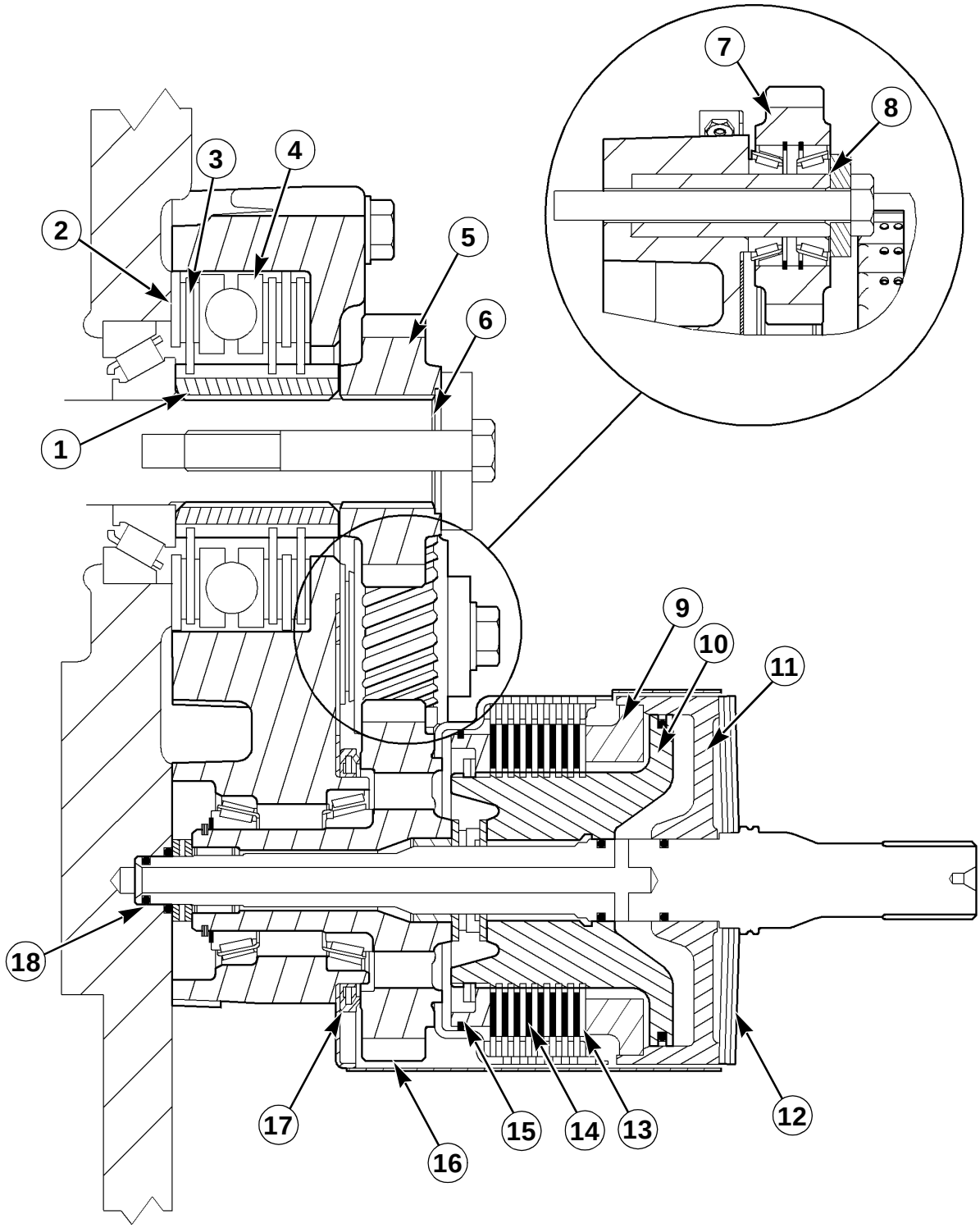




https://truckmanualshub.com/



## Cross Sectional Drawing of the Type 1 MFD Clutch

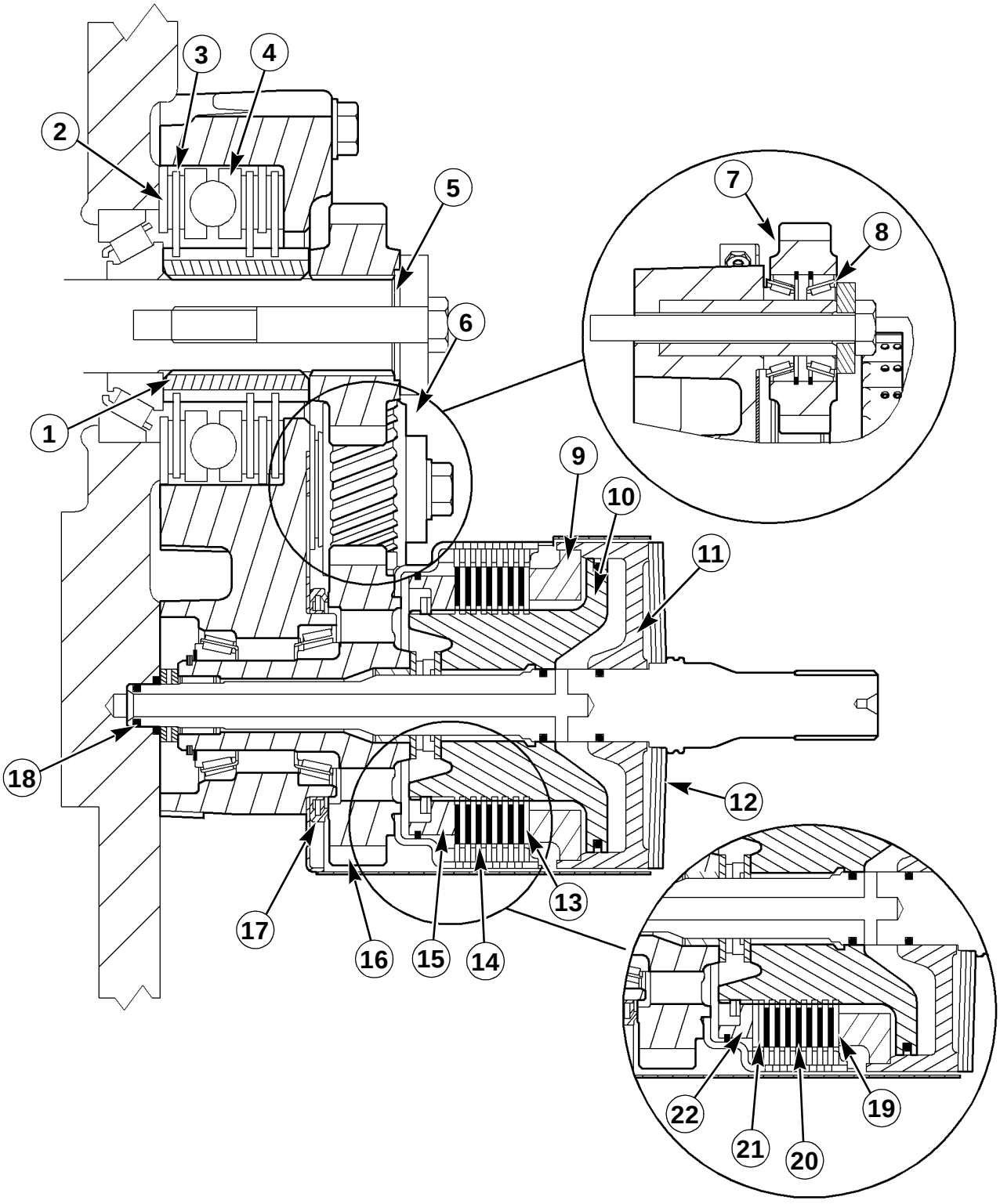



1. PARK BRAKE HUB
2. SEPARATOR PLATES (2)
3. FRICTION PLATES (3)
4. PARK BRAKE ACTUATOR
5. MFD DRIVE GEAR
6. SHIMS
7. MFD IDLER GEAR
8. SHIMS
9. BASE PLATE
10. PISTON
11. PISTON HUB
12. BELLEVILLE SPRINGS (3)
13. SEPARATOR PLATES (8)
14. FRICTION PLATES (8)
15. 16 mm BACKING PLATE
16. MFD GEAR HUB
17. SEAL
18. SEAL RING

https://truckmanualshub.com/



## Cross Sectional Drawing of the Type 2 MFD Clutch




1. PARK BRAKE HUB
2. SEPARATOR PLATES (2)
3. FRICTION PLATES (3)
4. PARK BRAKE ACTUATOR
5. MFD DRIVE GEAR
6. SHIMS
7. MFD IDLER GEAR
8. SHIMS
9. BASE PLATE
10. PISTON
11. PISTON HUB
12. BELLEVILLE SPRINGS (3)
13. SEPARATOR PLATES (7)
14. FRICTION PLATES (7)
15. 20 mm BACKING PLATE
16. MFD GEAR HUB
17. SEAL
18. SEAL RING
19. SEPARATOR PLATES (7)
20. FRICTION PLATES (7)
21. SPACER PLATES (2)
22. 16 mm BACKING PLATE

https://truckmanualshub.com/

# Section 6018

## REAR AXLE REMOVAL

## XTX185, 200 and 215 Tractors



McCORMICK

SM 8-15180

© 2006 McCormick Tractors International Limited.
September 2006

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIAL TORQUES .....3

AXLE REMOVAL
Removal ..... 4
Installation ..... 6

https://truckmanualshub.com/



# SPECIAL TORQUES

| | | |
|---|---|---|
| Flanged Axle | | |
| Rear Wheel Nuts | 485 to 550 Nm | 357 to 405 lb ft |
| Bar Axle | | |
| Rear Wheel to Hub Bolts | 485 to 550 Nm | 357 to 405 lb ft |
| Hub to Axle Clamping Bolts | | |
| Evenly in 50 Nm (36 lb ft) | 244 to 298 Nm | 180 to 220 lb ft |
| After 30 minutes Operation | 244 to 298 Nm | 180 to 220 lb ft |
| Rear Axle Mounting Bolts | 251 to 280 Nm | 185 to 207 lb ft |
| Cab Mounting Bracket to Rear Axle | 310 Nm | 229 lb ft |
| Cab Mounting Nut | 215 Nm | 159 lb ft |
| Stabiliser Bracket Retaining Bolts | 455 Nm | 335 lb ft |

https://truckmanualshub.com/



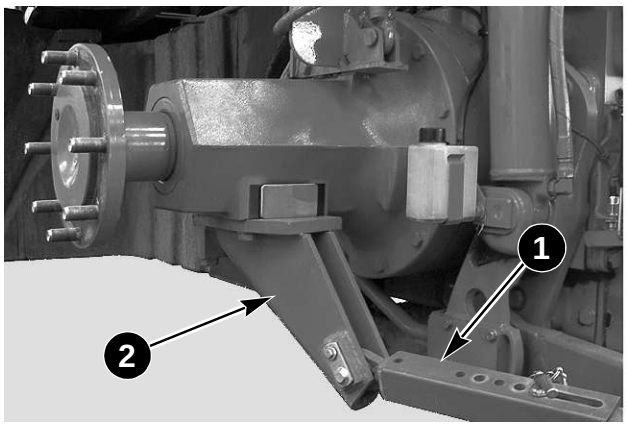
# AXLE REMOVAL

Before removing the axles it will be necessary to carry out the following:

- Park the tractor on hard level ground, apply the park brake and remove the key. Put blocks in front and behind the front wheels.
- For tractors equipped with suspended font axles, fully lower the axle to the bottom mechanical stops.
- Install suitable wedges between the front axle and bolster (both sides).
- Disconnect the battery (Negative Terminal first).
- Raise and support the rear of the tractor on suitable axle stands and remove the rear wheels.
- Place a suitable container with a capacity of at least 115 Litres (30.5 US. Gal) under the transmission and drain the oil from the transmission.
- Place a suitable container with a capacity of at least 25 Litres (6.6 US. Gal) under the each rear axle and drain the oil from the axles. Install and tighten drain plugs.
- Install and safely support the rear of the transmission on a suitable tractor splitting stand and remove the axle stands.
- For tractors equipped with cab suspension, fully lower the cab, refer to Section 10011.

## Removal

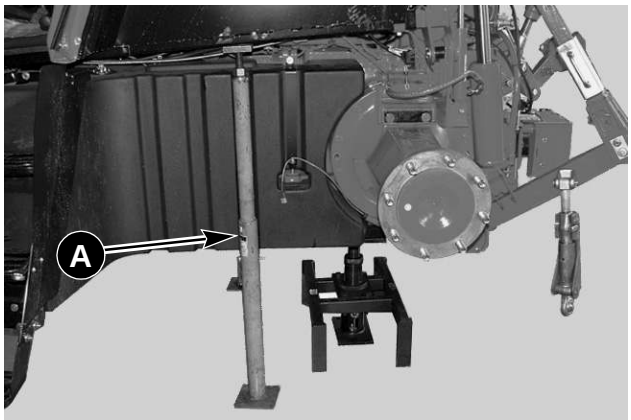
### STEP 1




MD06E001

Disconnect the stabiliser linkage (1), remove the retaining bolts and remove the stabiliser bracket (2).

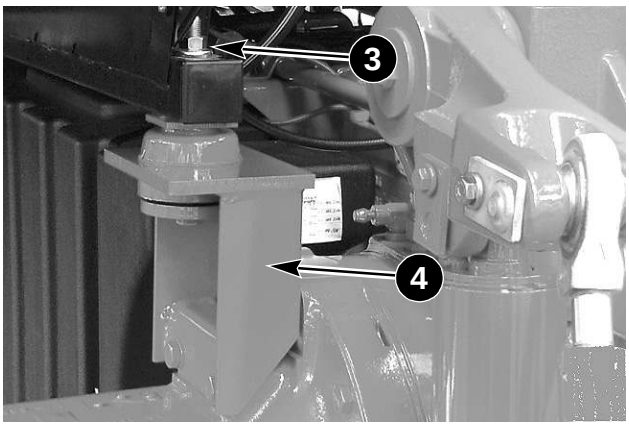
### STEP 2




MD06E077

Support both sides of the cab on cab support stands (A) MC10281 (or equivalent).

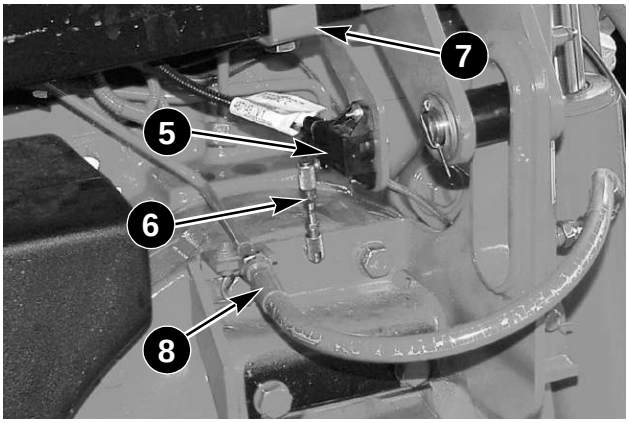
### STEP 3




MDO6F012

For tractor not equipped with cab suspension remove the cab mounting nut and washer (3). Remove the mounting bracket bolts (4) and remove the mounting bracket. Go to STEP 6.

### STEP 4



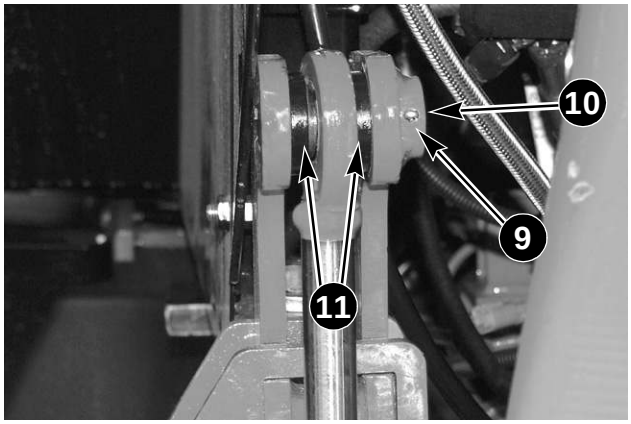

MD06F006

For tractor equipped with cab suspension remove disconnect the potentiometer (5) and linkage (6). Remove the mounting bracket (7). Disconnect and cap hose (8).

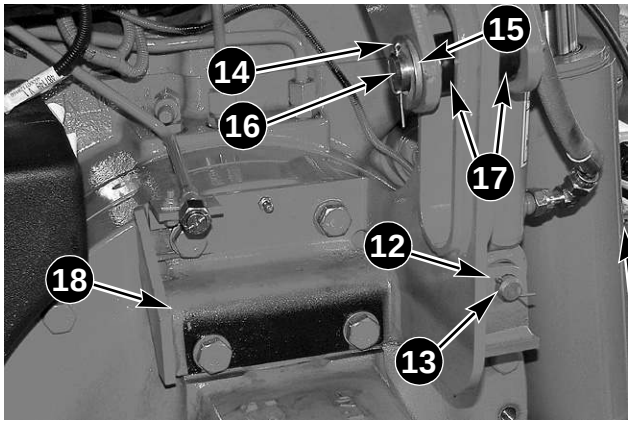
https://truckmanualshub.com/



## STEP 5




MD06F004




MD06F005

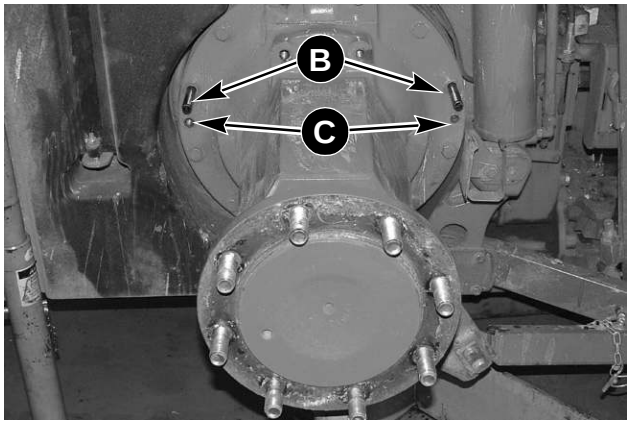
Remove and discard split pin (9). Remove the upper cylinder pin (10) and spacers (11).

Remove and discard split pin (12), support the cab suspension cylinder and remove the lower cylinder retaining pin and plastic washers (13). Remove the cylinder.

Remove and discard split pin (14), remove washer (15), pin (16), and sleeve (17).

Remove the retaining bolts and remove the cab suspension bracket (18).

## STEP 6




MD06E009

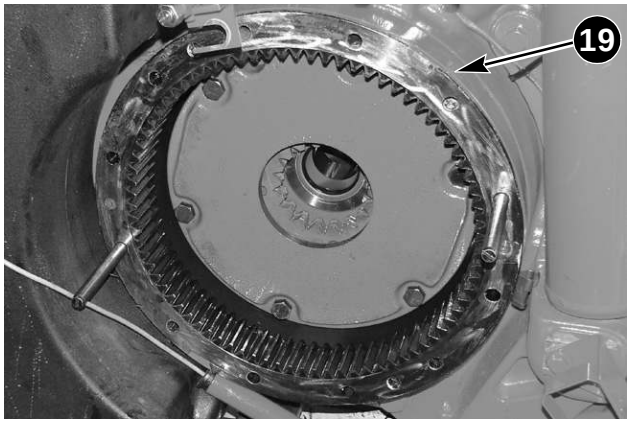
Remove two axle retaining bolts and install two 16 mm alignment studs (B) MC1995A as shown. Install but do not tighten two 16 mm jacking bolts with a minimum length thread of 70 mm into the threaded holes (C). Remove the remaining axle retaining bolts.

**IMPORTANT:** *Before carrying out STEP 7, place a suitable axle stand under the opposite axle (if installed).*

## STEP 7

Attach suitable lifting equipment to the axle and evenly tighten the jacking bolts until the seal between the axle and ring gear is broken carefully remove the axle.

## STEP 8




MD06E008

Put identification marks on the ring gear (19). Using a suitable lever remove the ring gear from the transmission.

https://truckmanualshub.com/



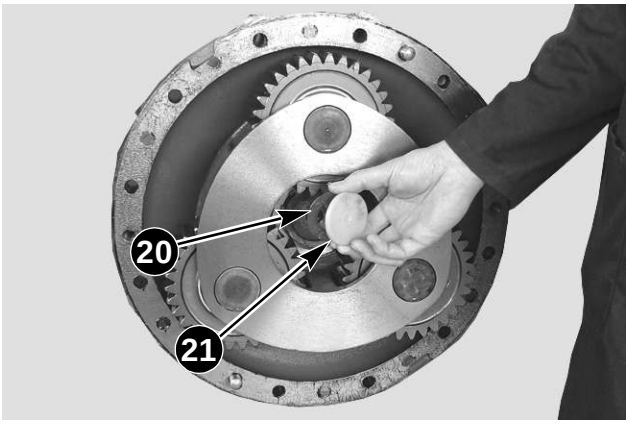
## Installation

### STEP 1

Clean the mounting surfaces of the rear axle, transmission and ring gear.

**NOTE:** *Do not use abrasive materials to clean machined surfaces.*

### STEP 2

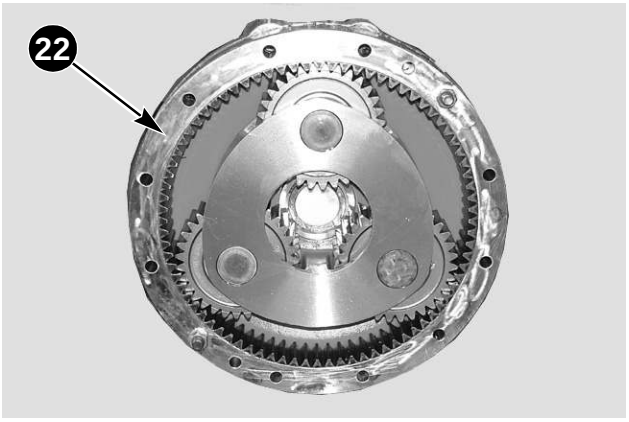



MD06E005

Check the plastic spacer (21) for damage and replace as necessary. For tractors equipped with two brake separator plates make sure washer (20) is installed between the plastic spacer (21) and the axle shaft.

**IMPORTANT:** *Tractors with three brake separator plates do not require washer (20).*

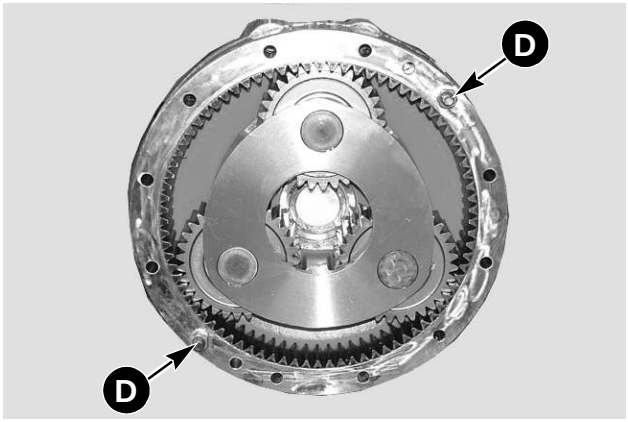
### STEP 3




MD06E006

Apply a continuous bead of Loctite 515 on the axle and install the ring gear (22).

### STEP 4

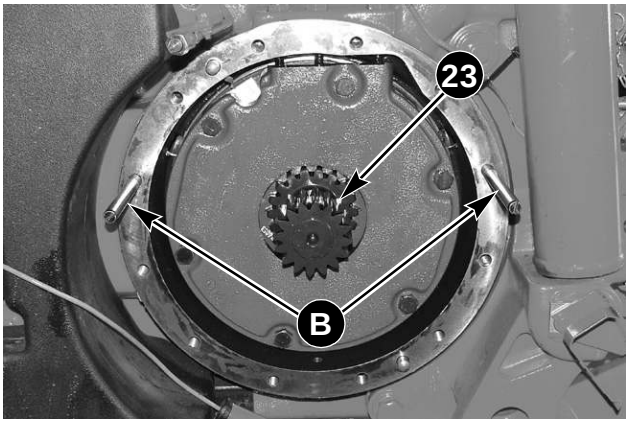



MD06E006

Temporally install two 16 mm bolts (D), flat washers and nuts as shown. Tighten the bolts so the ring gear is sealed and sitting evenly on the axle.

**NOTE:** *The procedure in STEP 4 will allow the Loctite sealant to cure, the temporary nuts, bolts and washers must be removed before the axle is connected to the range housing.*

### STEP 5




MD06E007

Make sure the axle sun gear shaft (23) is installed correctly and the brake friction plates are correctly located onto the splined hub on the axle sun gear shaft (23).

Apply a continuous bead of Loctite 515 to the transmission housing rear axle mounting surface. Install two 16 mm alignment studs (B) MC1995A as shown.

https://truckmanualshub.com/



## STEP 6

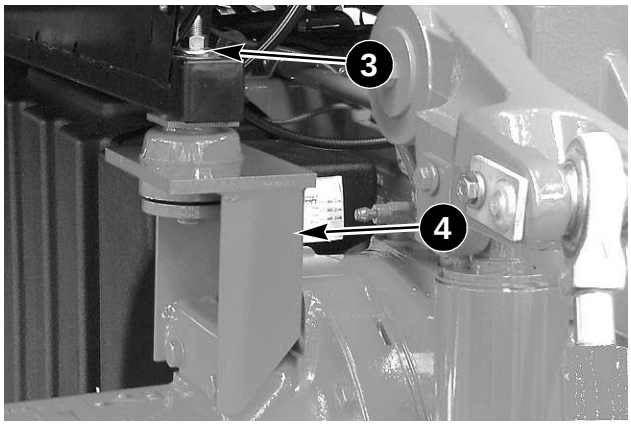
Attach suitable lifting equipment to the rear axle and install the axle onto the alignment studs. Align the planetary gears with the sun gear shaft and fully install the axle onto transmission housing.

Install the mounting bolts, DO NOT install bolts into the top two mounting holes. Remove the alignment studs and install two mounting bolts.

Tighten all mounting bolts to a torque of 251 to 280 Nm (185 to 207 lb ft).

**NOTE:** *For tractor equipped with cab suspension go to STEP 8.*

## STEP 7

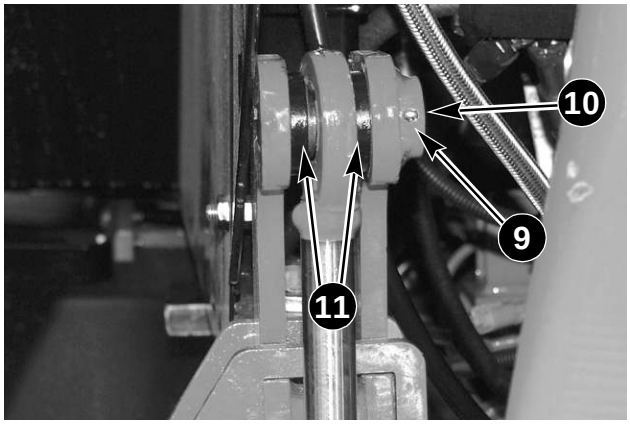



MD06E012

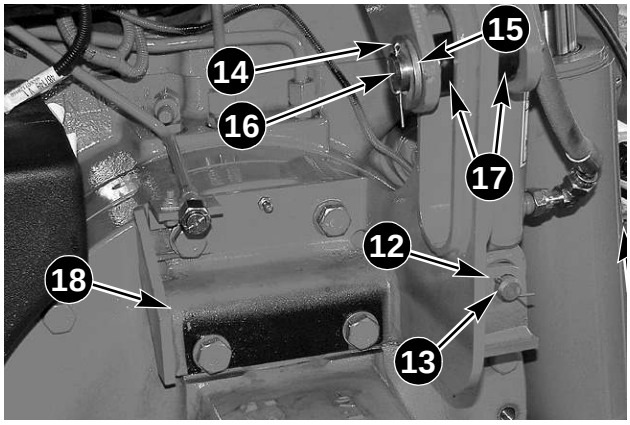
For tractor not equipped with cab suspension Install the cab mounting bracket (4), install and tighten the retaining bolts to a torque of 310 Nm (229 lb ft).

Install the cab mounting nut and washer (3), tighten the nut to a torque of 215 Nm (159 lb ft). Go to STEP 10.

## STEP 8




MD06F004




MD06F005

For tractor equipped with cab suspension install the cab suspension bracket (18), install and tighten the retaining bolts to a torque of 310 Nm (229 lb ft).

Install sleeve (17), pin (16) and washer (15). Install a new split pin (14).

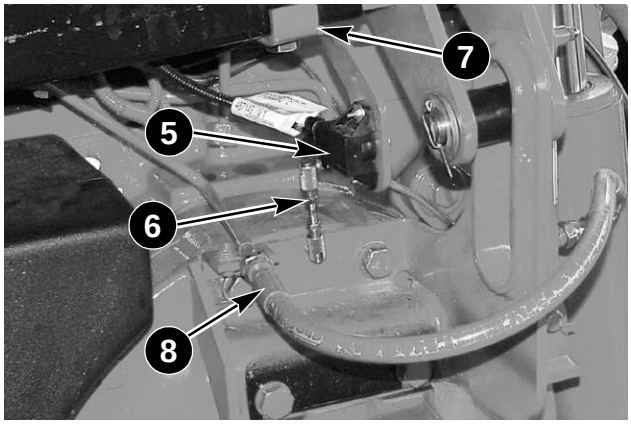
Support the cab suspension cylinder in position and install the lower cylinder pin (13) and washers, install a new split pin (12).

Install spacers (11) and upper cylinder pin (10). Install a new split pin (9).

https://truckmanualshub.com/



## STEP 9




MD06F006

Install the potentiometer mounting bracket (7) and tighten the retaining bolt to a torque of 48 Nm (35 lb ft).

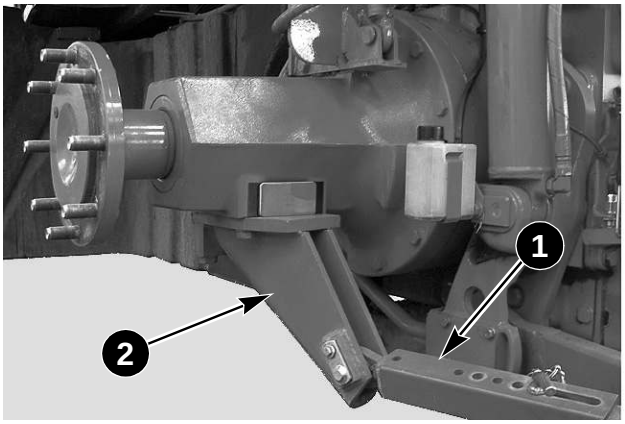
Connect the cab suspension potentiometer (5) and connect and adjust the potentiometer linkage (6).

Lubricate and install a new o-ring to the fitting and connect and tighten hose (8).

## STEP 10

Remove the cab support stands.

## STEP 11




MD06E001

Install the stabiliser bracket (2) and install and tighten the retaining bolts to a torque of 455 Nm (335 lb ft). Connect the stabiliser linkage (1).

After installation of the rear axles it will be necessary to carry out the following

- Support the tractor on suitable axle stands and remove the tractor splitting stand.
- Install the rear wheels and tighten the nuts to the correct torque, refer to SPECIAL TORQUES on Page 3.
- Fill the transmission with clean McCormick HTX transmission oil to the correct level.
- Remove the wedges from between the front axle and bolster (both sides).
- Connect the battery (Positive Terminal first).
- Remove the air from the braking system, refer to Section 9001.
- For cab suspension tractors, remove the air from the cab suspension cylinders and calibrate the cab suspension, refer to Section 10011.

https://truckmanualshub.com/

# Section
# 6019

## PTO SERVICING
## - SHIFTABLE/REVERSIBLE

## XTX185, 200 and 215 Tractors



McCORMICK

SM 8-15290

© 2006 McCormick Tractors International Limited.
September 2006

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIFICATIONS .....3

SPECIAL TORQUES .....3

SPECIAL TOOLS .....3

TOOLS TO BE MADE .....3

PTO HOUSING
- Removal .....4
- Installation .....7

PTO CLUTCH
- Removal and Disassembly .....10
- Assembly and Installation .....12
- Cross Sectional Drawing of the PTO Clutch ..... 18

SHIFTABLE PTO
- Disassembly .....19
- Assembly .....22
- Cross Sectional Drawing of the Shiftable PTO..... 31

REVERSIBLE PTO
- Disassembly .....33
- Assembly .....38
- Cross Sectional Drawing of the Reversible PTO..... 47

https://truckmanualshub.com/



## SPECIFICATIONS

| | | |
|---|---|---|
| PTO Input Shaft End Play | 0.03 to 0.13 mm | 0.001 to 0.005 inch |
| PTO Output Shaft | 0.025 mm | 0.001 to 0.005 inch |
| PTO Clutch | | |
| Number of Friction Plates | | 6 |
| Number of Separator Plates | | 6 |
| PTO Clutch Friction Plate Thickness (New) | 2.45 to 2.6 mm | 0.096 to 0.102 inch |
| PTO Clutch Separator Plate Thickness (New) | 2.16 to 2.31 mm | 0.085 to 0.091 inch |
| PTO Clutch Backing Plate Thickness (New) | 5.58 to 5.71 | 0.219 to 0.225 inch |
| PTO Brake | | |
| Number of Spring Washers (Wave) | | 6 |
| PTO Brake Single Side Friction Plate Thickness (New) | 2.95 to 3.1 mm | 0.116 to 0.122 inch |
| PTO Brake Double Side Friction Plate Thickness (New) | 3.75 to 3.90 mm | 0.147 to 0.118 inch |
| PTO Clutch Separator Plate Thickness (New) | 3.45 to 3.6 mm | 0.136 to 0.142 inch |

## SPECIAL TORQUES

| | | |
|---|---|---|
| PTO Clutch Housing Mounting Bolts M16 Bolts | 250 to 280 Nm | 185 to 206 lb ft |
| PTO Front Cover Retaining Bolts | 100 to 113 Nm | 74 to 83 lb ft |
| PTO Clutch Retaining Bolt | 130 Nm | 95 lb ft |

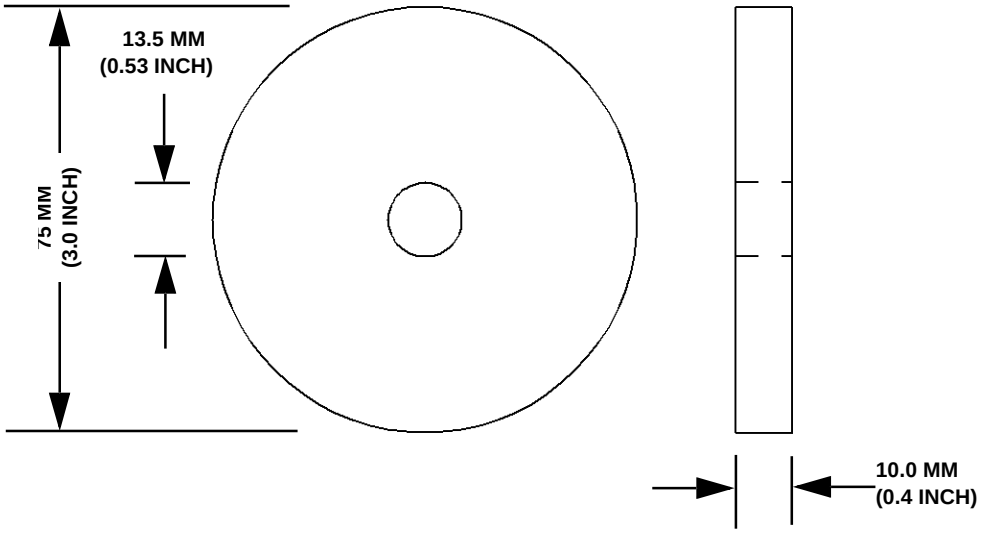
## SPECIAL TOOLS

**1. MC1992 SPRING COMPRESSOR**

**2. MC2001 SEAL RING EXPANDER**

**3. MC2005-3 SEAL RING COMPRESSOR**

## TOOLS TO BE MADE




**WASHER**

https://truckmanualshub.com/



# PTO HOUSING

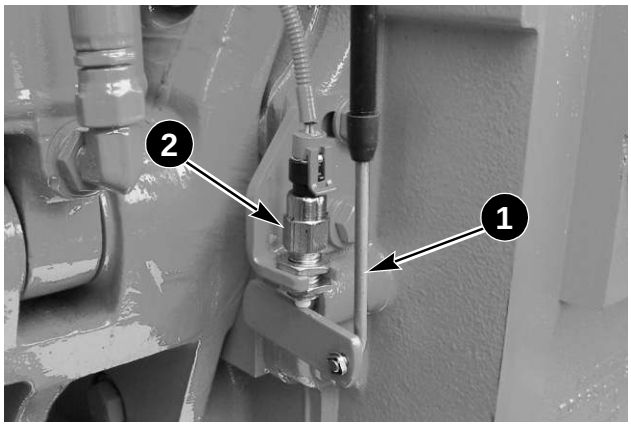
## Removal

Before removing the PTO housing it will be necessary to carry out the following:

- Park the tractor on hard level ground, apply the park brake, lower the three point hitch and remove the key. Put blocks in front and behind the front wheels.
- Disconnect the battery (Negative Terminal first).
- Drain the transmission oil into a suitable container with a capacity of at least 115 Litres (30.5 US. Gal). When the oil has drained install and tighten the drain plug.
- Remove the three point hitch top link.
- Remove the trailer hitch components and PTO guard as necessary to gain access to the PTO housing.

**IMPORTANT:** *Use suitable lifting equipment when removing the trailer hitch components.*

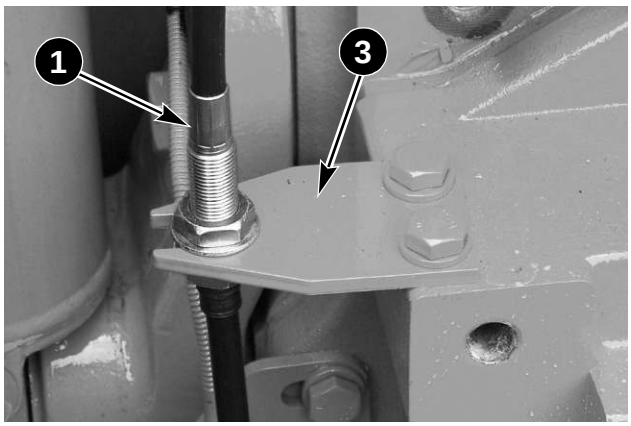
### STEP 1




MD06G029

For tractors equipped with shiftable PTO remove the retaining clip and disconnect the PTO speed selector cable (1) from the PTO selector lever. Disconnect the PTO speed switch (2) from the harness, loosen the lock nuts and remove the PTO speed switch (2) from from the bracket.

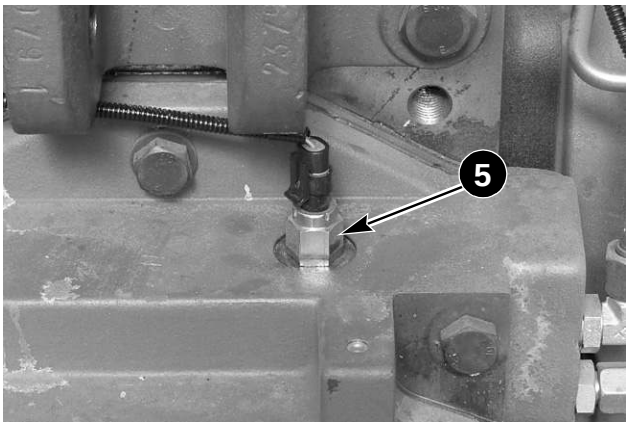
### STEP 2




MH06G030

For tractors equipped with shiftable PTO, loosen the lock nuts and remove the PTO speed selector cable (1) from the support bracket (3). Remove the retaining bolts and remove the support bracket (3).

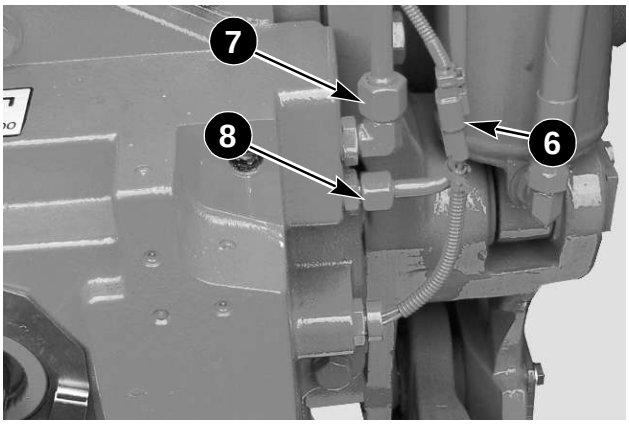
### STEP 3




MH06G080

For tractors equipped with reversible PTO, disconnect the PTO speed switch (5) from the harness and remove the switch.

### STEP 4




MH06G032

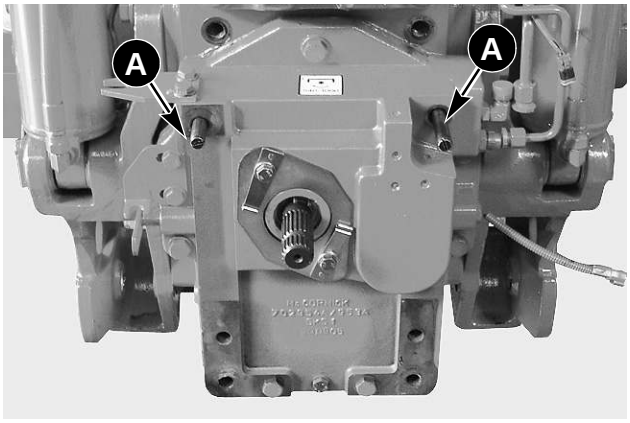
Disconnect the PTO speed sensor connector (6). Disconnect and cap the lubrication tube (7) and PTO clutch feed tube (8).

https://truckmanualshub.com/



**NOTE:** *Depending on the type of trailer hitch installed on the tractor, some PTO housing bolts may have been removed during the removal of the trailer hitch.*

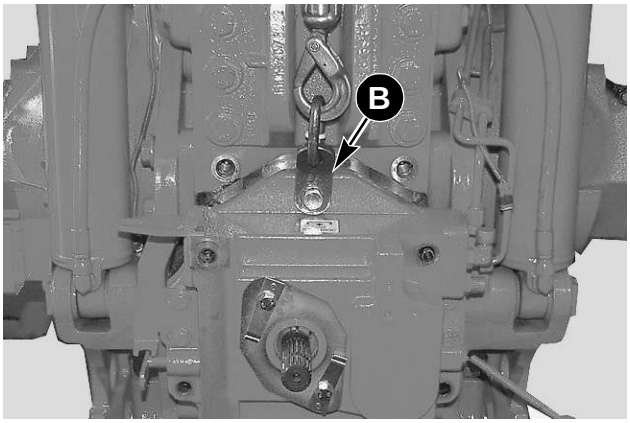
## STEP 5




MD06H049

If not already removed, remove two PTO housing bolts and install two 16 mm alignment studs (MC1995A) (A) through the PTO housing as shown. Remove the remaining PTO housing bolts.

## STEP 6

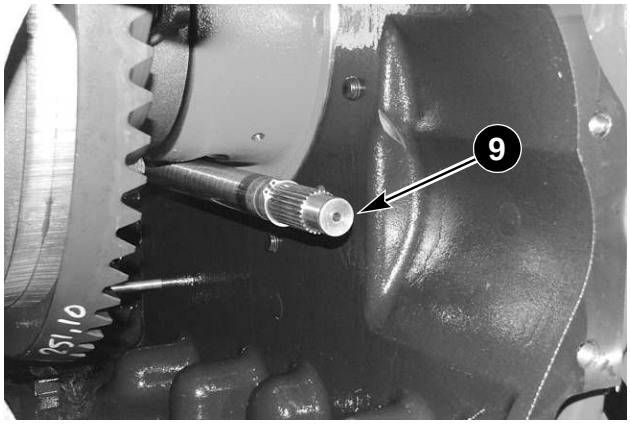



MH06H050

Separate the PTO housing from the range transmission and slide the PTO housing along the alignment studs until a suitable lifting eye (B) can be installed through the top mounting hole as shown.
Attach lifting equipment to the lifting eye (B) and remove the PTO housing.

**IMPORTANT:** *Do not allow the PTO housing to move beyond the end of the alignment studs.*

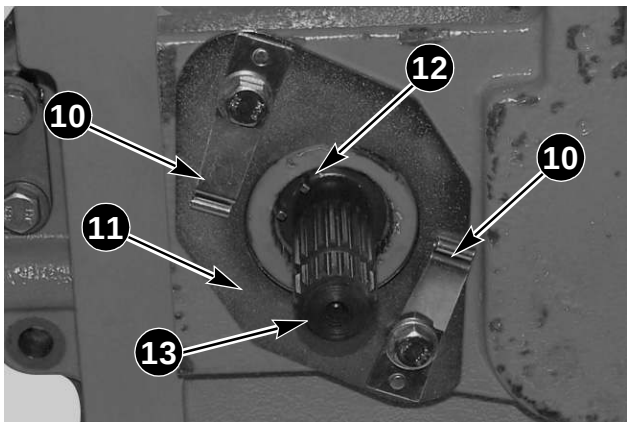
## STEP 7




MH06H051

Remove the PTO shaft (9)

## STEP 8



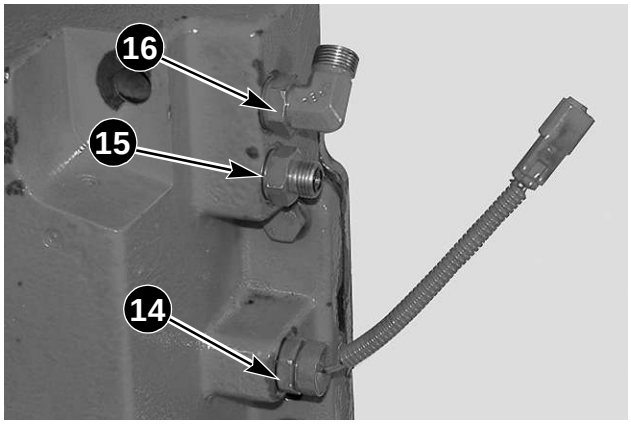

MH06G073

Remove the retaining bolts and remove the PTO cover retaining clips (10) and plate (11). Remove retaining ring (12) and remove the PTO splined output shaft (13).

https://truckmanualshub.com/



## STEP 9




MH06G074

Remove the PTO speed sensor (14) and tube fittings (15) and (16). Discard the o-rings from the fittings.

## STEP 10

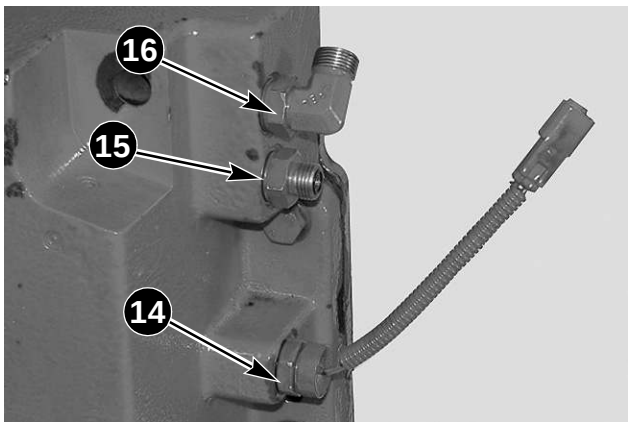
Clean the PTO housing and range transmission mounting faces.

https://truckmanualshub.com/



## Installation

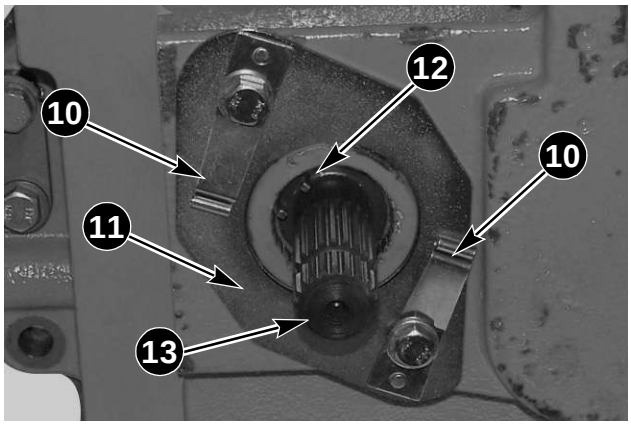
### STEP 11




MH06G074

Lubricate and install new o-ring onto the tube fittings (15) and (16). Install and tighten the fittings. Install and tighten the PTO speed sensor (14) to a torque of 27 Nm (20 b.ft).

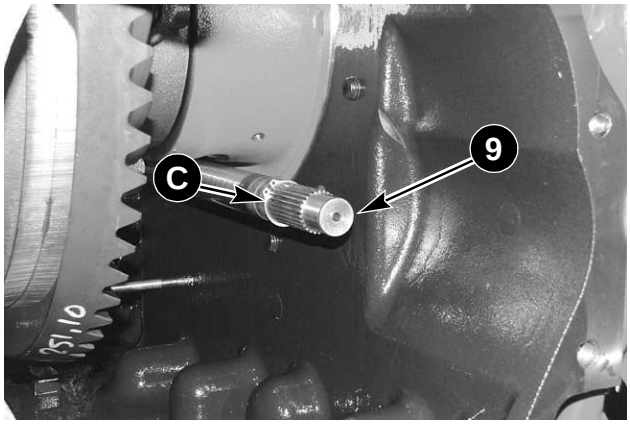
### STEP 12




MH06G073

Install the PTO splined output shaft (13) and retaining ring (12). Make sure the retaining ring locates correctly into the groove in the output sleeve.
Install the PTO cove plate (11) and retaining clips (10), install and tighten the retaining bolts.

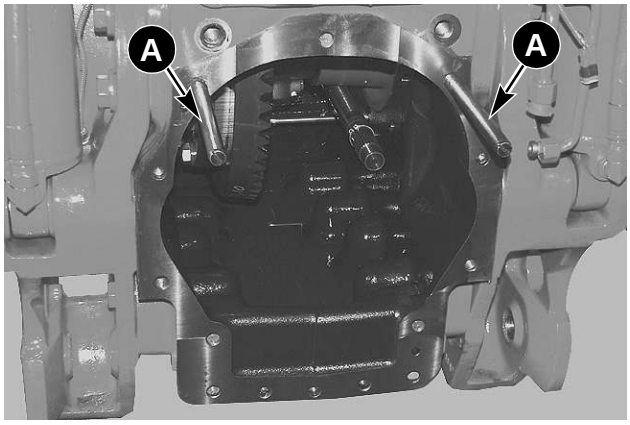
### STEP 13




MH06H051

Install the PTO shaft (9) into the drive coupling. Make sure the snap ring (C) is installed and facing towards the PTO housing.

### STEP 14



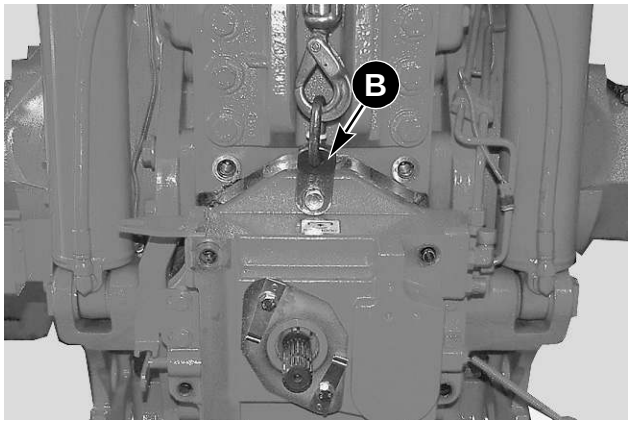

MH06H052

Install two 16 mm alignment studs (MC1995A) (A) into the range transmission as shown. Apply a continuous bead of Loctite 515 to the range transmission mounting face.

https://truckmanualshub.com/



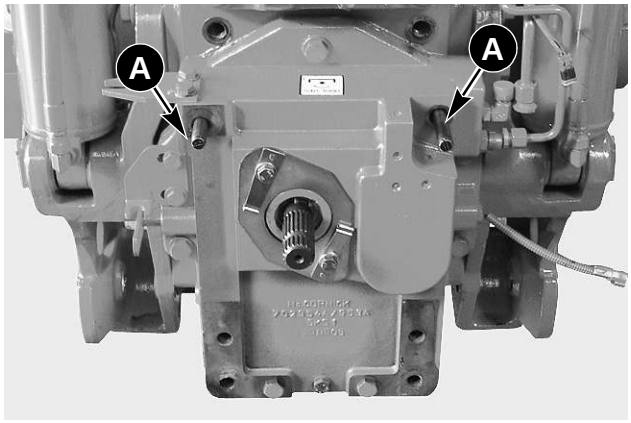
## STEP 15




MH06D027

Attach a suitable lifting eye (B) and lifting equipment to the PTO housing and install the PTO housing onto the alignment studs.
Slide the PTO housing along the alignment studs until the housing is fully supported on the studs. Remove the lifting equipment and lifting eye (B).

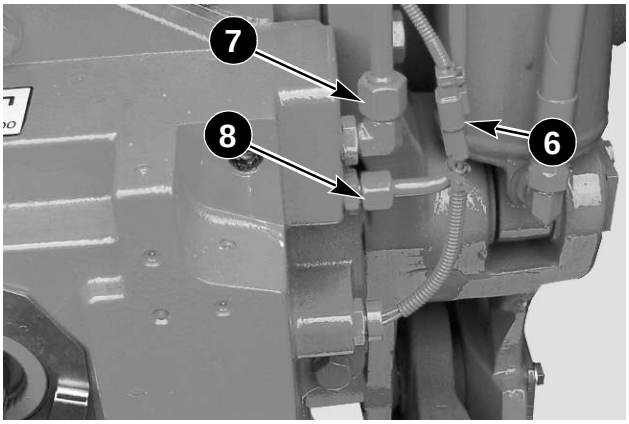
## STEP 16




MD06H049

Continue to slide the PTO housing along the alignment studs to fully installed the PTO housing. Install the bolts, remove the alignment studs (A) and install the two remaining bolts. Tighten all the retaining bolts to a torque of 250 to 280 Nm (185 to 206 lb ft).

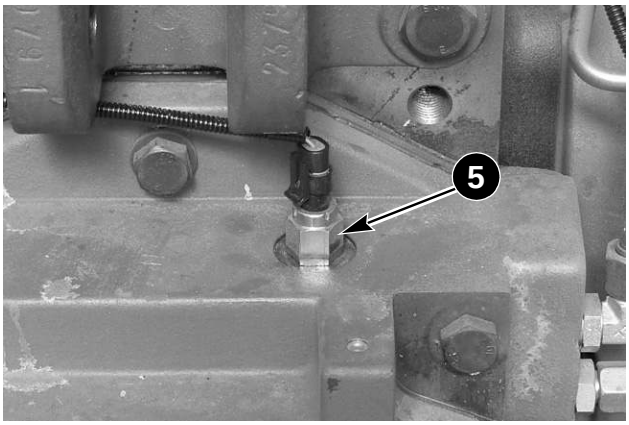
## STEP 17




MH06G032

Lubricate and install new o-rings onto the tube fittings and connect and tighten the PTO clutch feed tube (8) and lubrication tube (7). Connect the PTO speed sensor connector (6).

## STEP 18



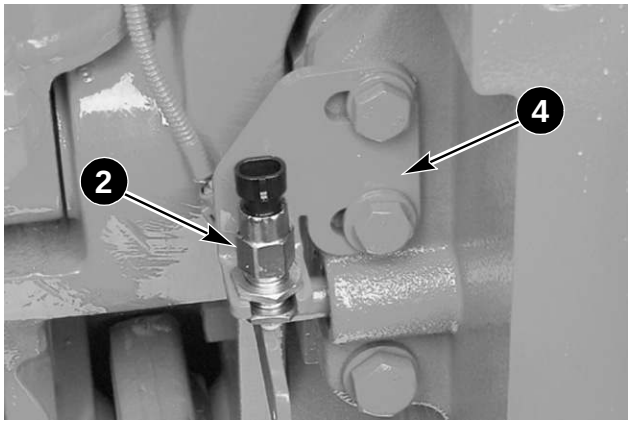

MH06G080

For tractors equipped with reversible PTO, install and tighten the PTO speed switch (5). Connect the switch to the harness.

https://truckmanualshub.com/



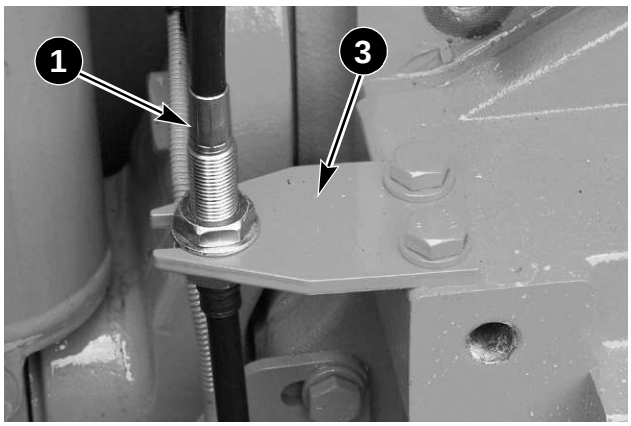
## STEP 19




MH06G031

For tractors equipped with shiftable PTO, install the PTO speed switch (2). If necessary loosen the bracket retaining bolts to position the PTO speed switch (2) in line with the shift lever, tighten the bracket retaining bolts to a torque of 100 to 113 Nm (74 to 84 lb.ft).

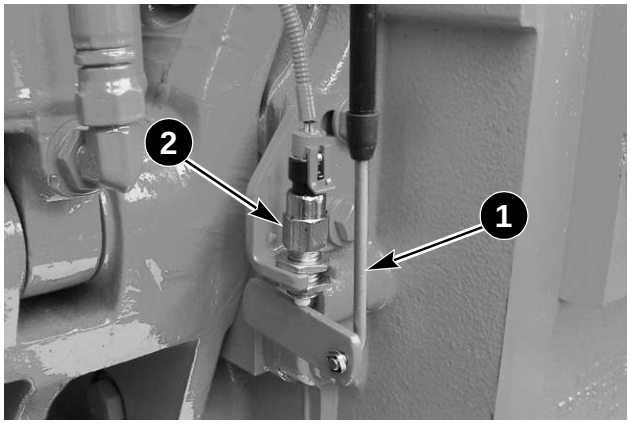
## STEP 20




MH06G030

For tractors equipped with shiftable PTO, install the selector cable (1) into the support bracket (3). Do not tighten the lock nuts at this stage.

## STEP 21




MD06G029

For tractors equipped with shiftable PTO, install PTO speed selector cable (1) into the PTO selector lever and install the retaining clip. Adjust the speed selector cable (1) and PTO speed switch (2), refer to section 9001. Tighten the cable lock nuts and connect the PTO speed switch (2) to the harness.

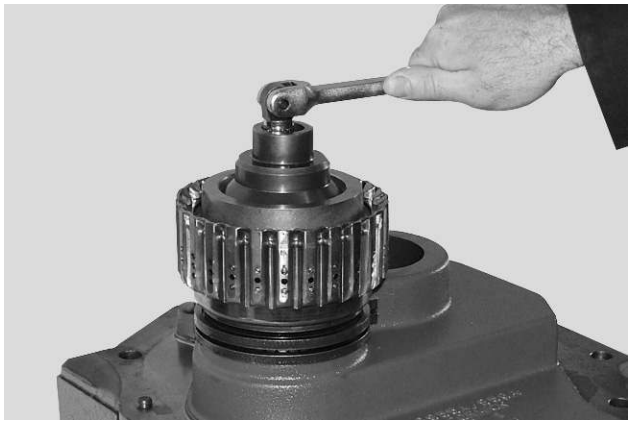
https://truckmanualshub.com/



# PTO CLUTCH

## Removal and Disassembly

### STEP 1

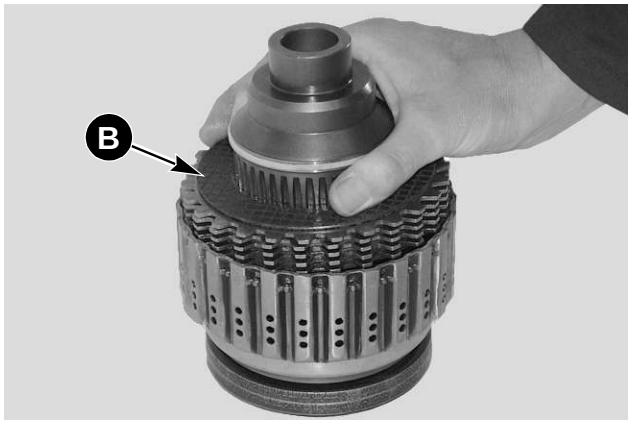


MD06F016

Place the PTO clutch housing on a clean work surface and remove clutch retaining bolt (31) from the PTO input shaft (A). Remove PTO clutch assembly. Remove and discard the o-rings (1) from the PTO input shaft (A).

**NOTE:** *The clutch retaining bolt is prevented from being fully removed from the PTO clutch housing (4) by the needle bearing cage (30).*

### STEP 2



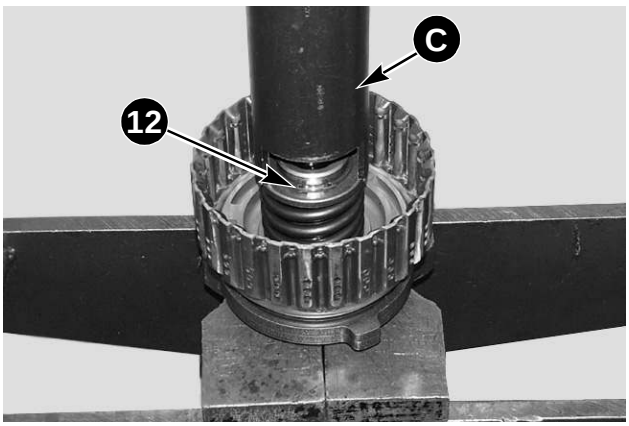

MD06F017

Remove snap ring (2) and backing plate (3). Remove the clutch hub assembly (B) from the PTO clutch housing (4). Remove thrust bearing (5) and thrust bearing (6).

### STEP 3

Remove roll pins (7), friction plates (8) and separator plates (9) from the clutch hub (10). Remove and discard seal ring (11).

### STEP 4



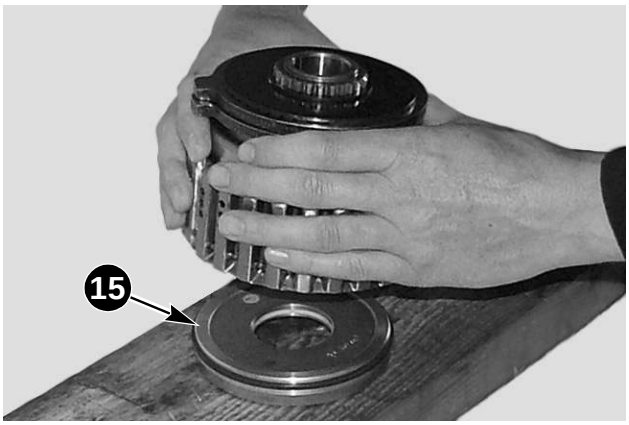

MD06F022

Place the MFD clutch assembly on a hydraulic press. Using the spring compressor MC1992 (C) compress spring (14) and remove snap ring (12).

### STEP 5

Slowly release the pressure on the hydraulic press and remove the spring compressor MC1992. Remove snap ring (12), spring retainer (13) and spring (14).

### STEP 6




MD06F018

Use a suitable block of wood and shock the piston (15) out of the PTO clutch housing (4). Remove and discard seal ring (16), o-ring (17), seal ring (18) and o-ring (19) from the piston (15).

### STEP 7

Remove snap ring (20), single sided brake friction plate (21), recessed separator plate (22) and three spring washers (23).

### STEP 8

Remove double sided friction plate (24), recessed separator plate (25), three spring washers (26) and single sided brake friction plate (27).

https://truckmanualshub.com/

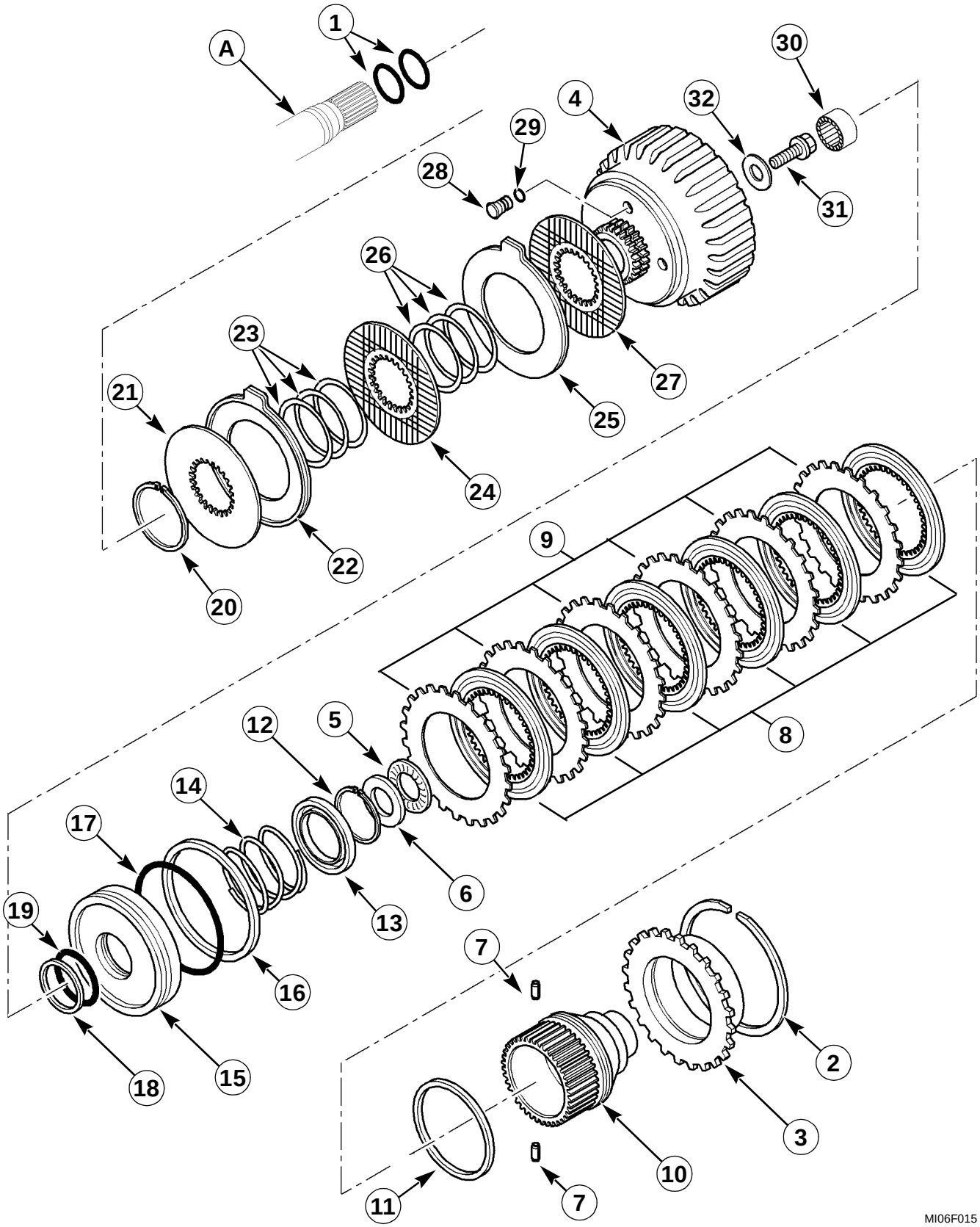


## STEP 9

Remove the piston pins (28) from the PTO clutch housing (4). Remove and discard the o-rings (29) from the brake pins (28).

## STEP 10

Check the needle bearing (30) for wear or damage and remove if necessary. If the needle bearing cage (30) is removed, remove retaining bolt (31) and washer (32).




MI06F015

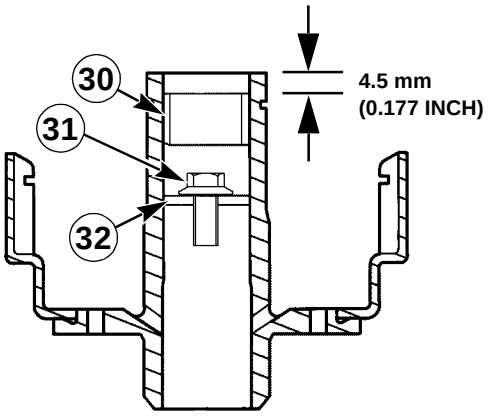
https://truckmanualshub.com/



## Assembly and Installation

**IMPORTANT:** *If new friction plates are to be installed, make sure all friction plates have the same friction material groove pattern and the plates have been soaked in clean transmission oil before installation.*

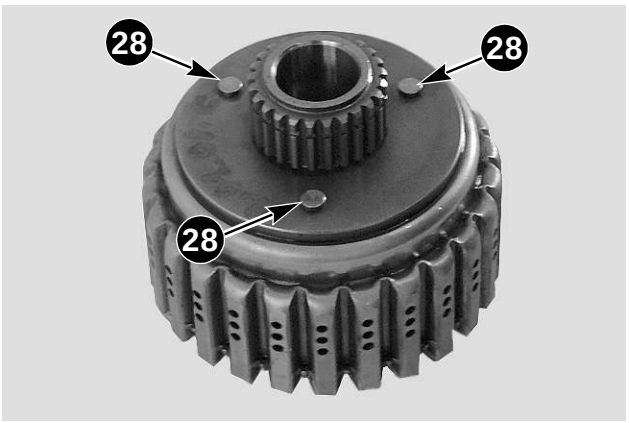
### STEP 11




MI06F013

If the needle bearing (30) has been removed, install washer (32) and retaining bolt (31). Using a suitable bearing driver install needle bearing cage (30) into the PTO clutch housing (4) to a depth of 4.5 mm (0.177 inch) as shown.

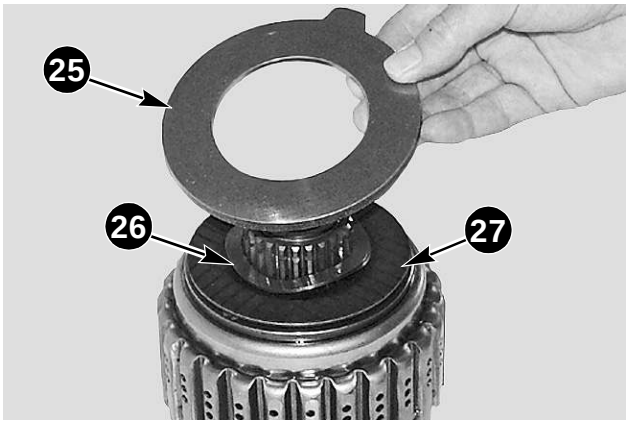
### STEP 12




MD06F019

Lubricate and install new o-rings (29) to the brake pins (28). Install the brake pins into the PTO clutch housing (4). Make sure the pin heads are to the outside of the housing.

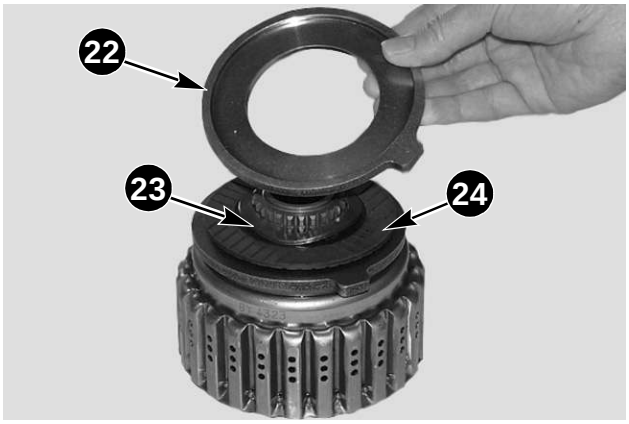
### STEP 13




MD06F020

Install a single sided brake friction plate (27) onto the PTO clutch housing, with the friction side facing upwards.
Install three spring washers (26) and separator plate (25). Make sure the recess in the separator plate is towards the friction plate (27).

### STEP 14

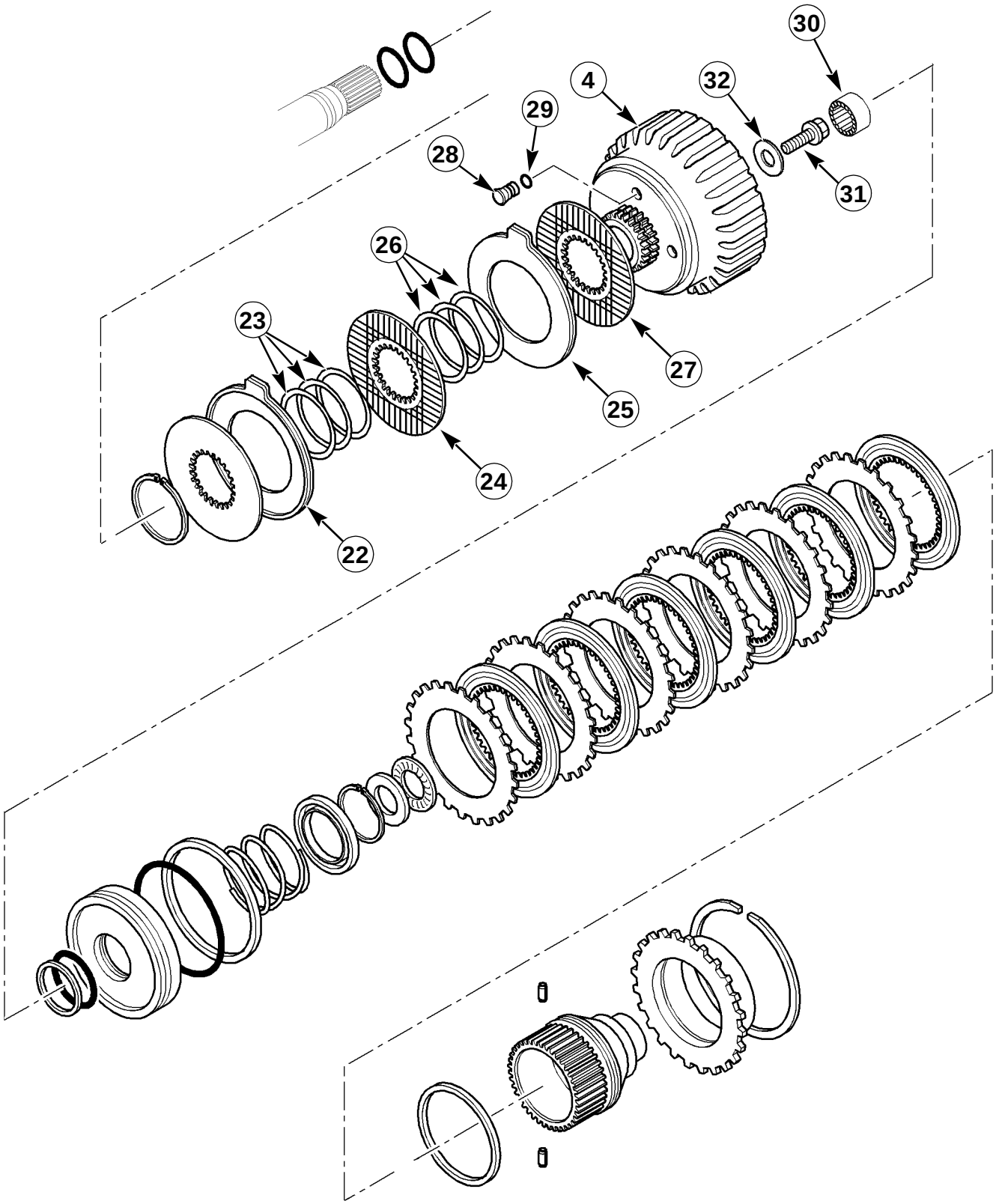



MD06F021

Install the double sided friction plate (24) onto the PTO clutch housing and install three spring washers (23).
Install the second separator plate (22). Make sure the recess in the separator plate is facing upwards.

https://truckmanualshub.com/



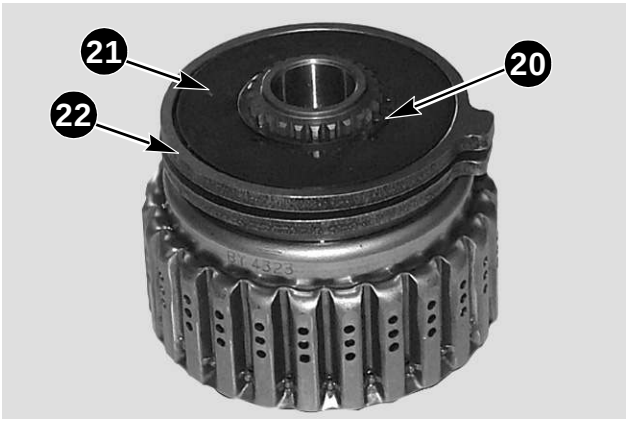



MI06F015

https://truckmanualshub.com/



## STEP 15



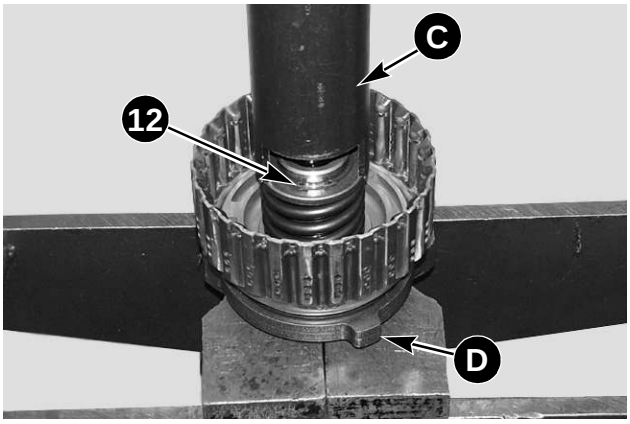

MD06F030

Install the second single sided brake friction plate (21) with the friction side towards the recessed separator plate (22). Install snap ring (20), make sure the snap ring is correctly seated in the snap ring groove.

## STEP 16

Install piston (15) into of the PTO clutch housing (4). Make sure the grooved side of the piston is facing outward. Carefully push the piston into the housing using even pressure. If the piston locks up during installation, remove the piston and install again. Never use force to correct wrong alignment of the piston.

## STEP 17



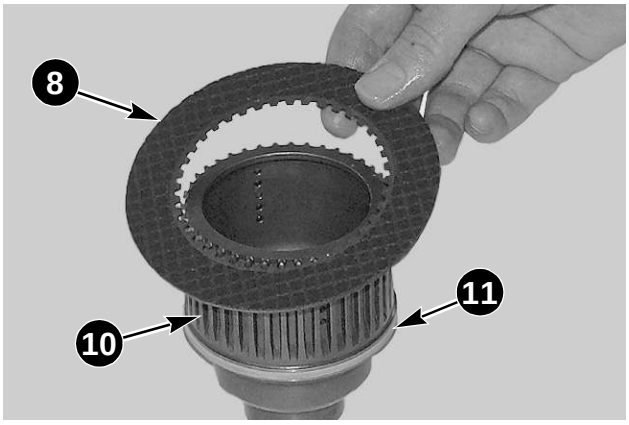

MD06F022

Place the MFD clutch assembly on a hydraulic press and align tabs (D) on the brake separator plates (22) and (25). Install spring (14) and spring retainer (13), using the spring compressor MC1992 (C) compress spring (14) and install snap ring (12). Make sure the snap ring is correctly seated in the snap ring groove.

## STEP 18

Slowly release the pressure on the hydraulic press and remove the spring compressor MC1992.

## STEP 19

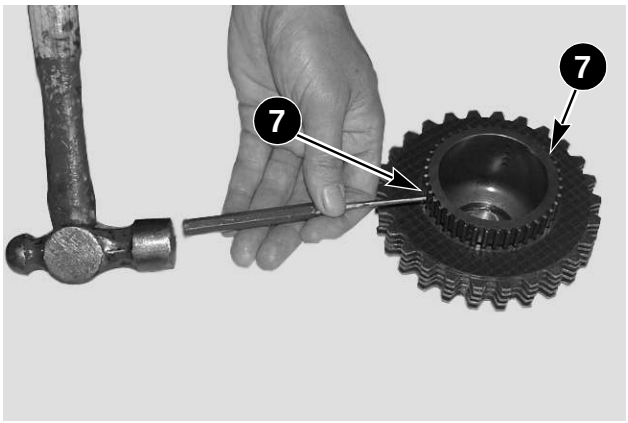



MD06F023

Lubricate and install a new seal ring (11) into the groove in the PTO clutch hub (10). Install one friction plate (8) then one separator plate (9) onto the PTO clutch hub (10).
Continue to install one friction plate (8) then one separator plate (9) until six friction plates and five separator plates have been installed.

**NOTE:** *The last plate install must be a friction plate (8).*

## STEP 20

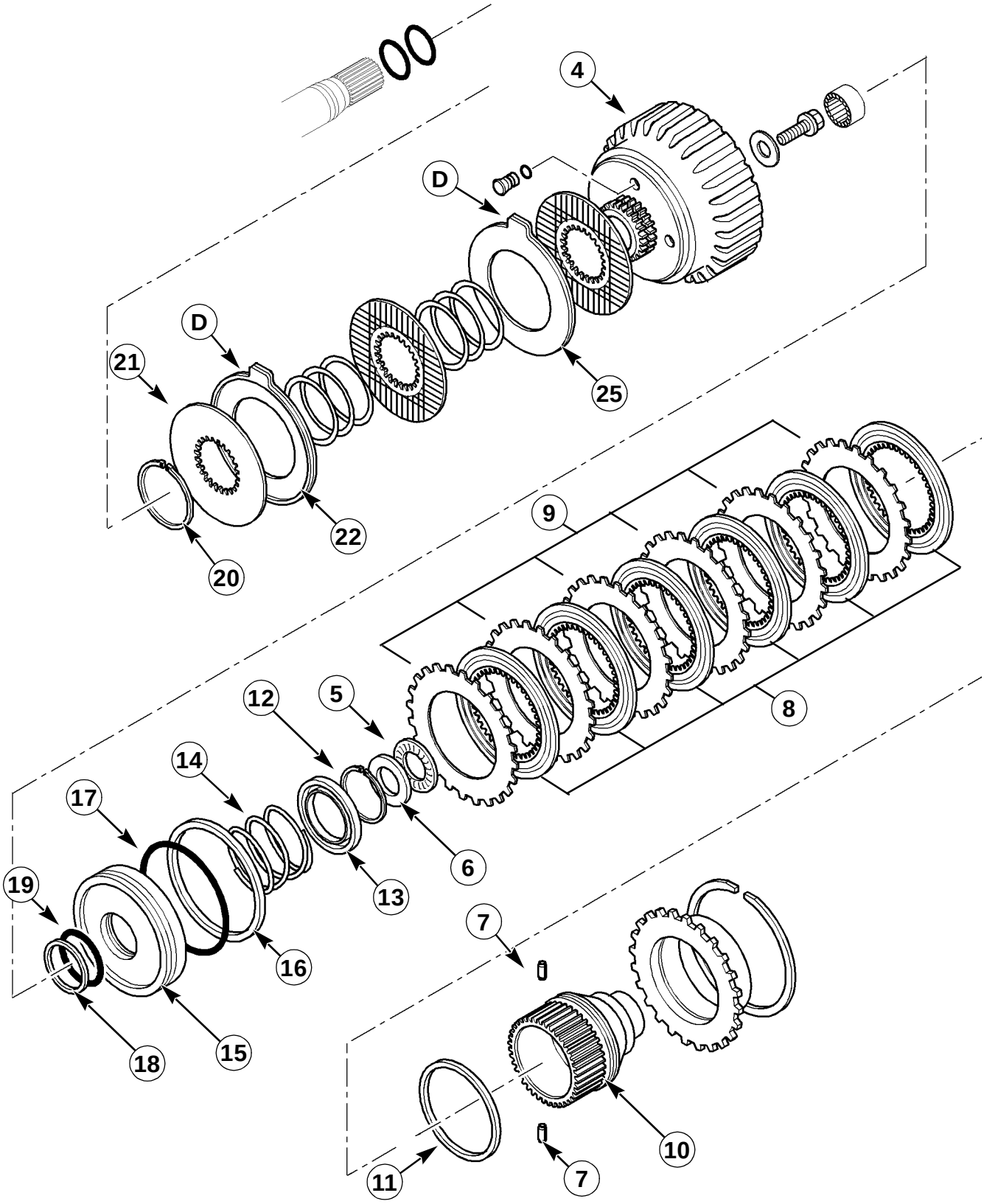



MD06F032

Install new roll pins (7) into the PTO clutch hub (10). Make sure the roll pins are level with the outer splines of the PTO clutch hub (10).

https://truckmanualshub.com/



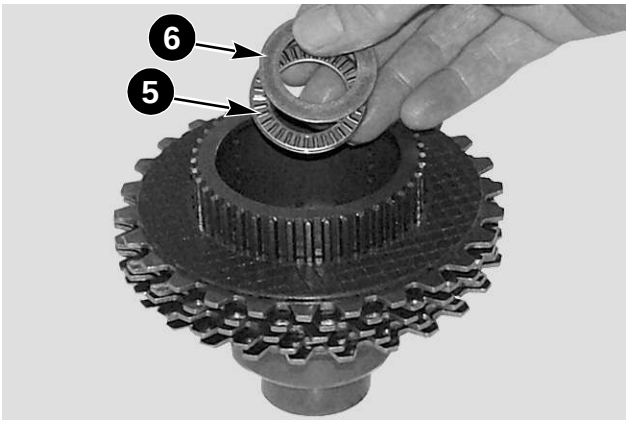



MI06F015

https://truckmanualshub.com/



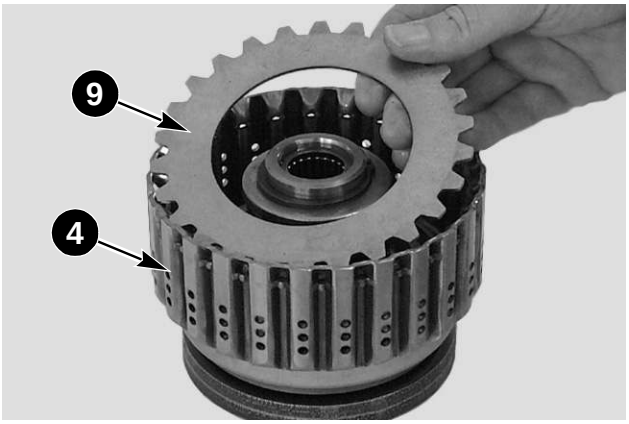
**STEP 21**




MD06E084

Install thrust bearing (5) and thrust washer (6) into the in the PTO clutch hub (10). Apply petroleum jelly to hold the thrust bearing and thrust washer in place.

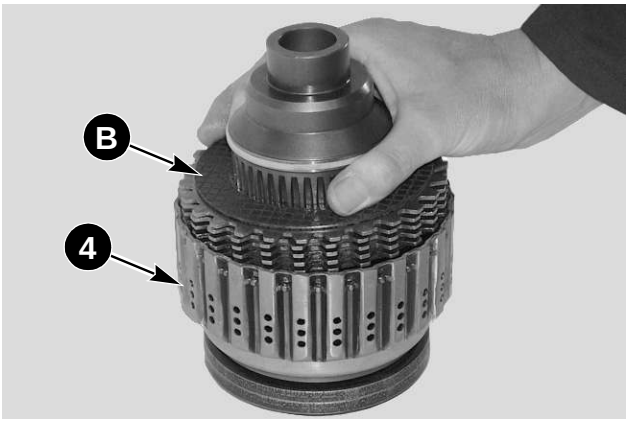
**STEP 22**




MD06F025

Install the remaining separator plate (9) into the PTO clutch housing (4).

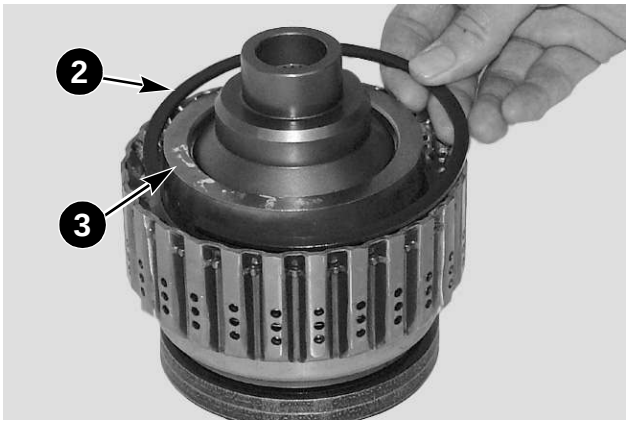
**STEP 23**




MD06F017

Install the clutch hub assembly (B) into the PTO clutch housing (4).

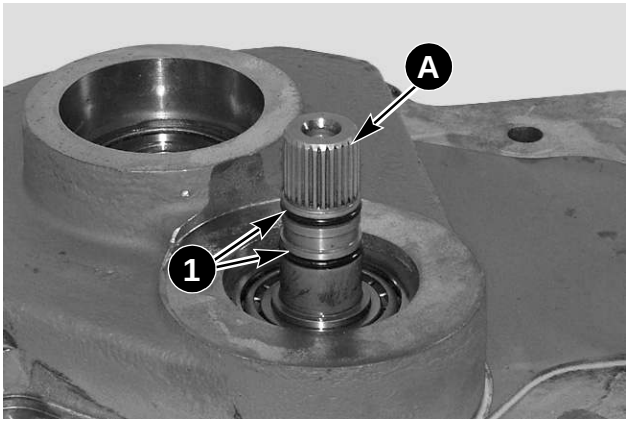
**STEP 24**




MD06F027

Install backing plate (3) and snap ring (2). Make sure the snap ring is correctly seated in the snap ring groove.

**STEP 25**



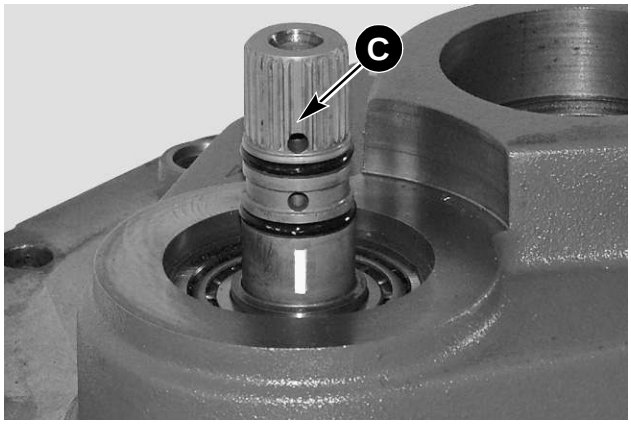

MD06F028

Lubricate and install new o-rings (1) into the grooves in the PTO input shaft (A).

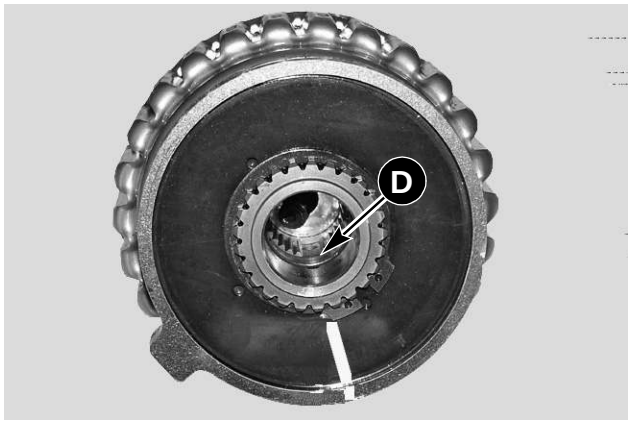
https://truckmanualshub.com/



## STEP 26



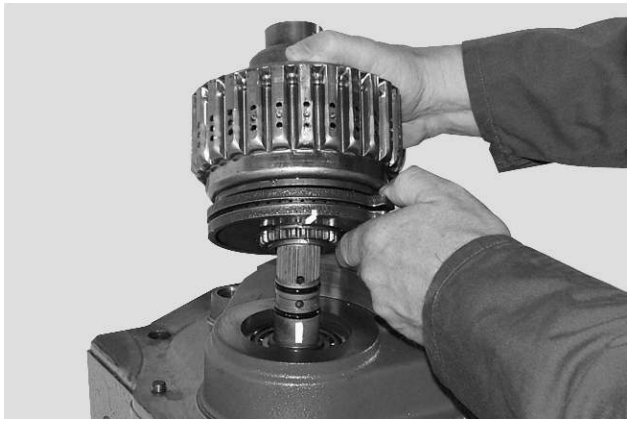

MD06G026




MD06G027

Put alignment marks on the input shaft and PTO clutch assembly in line with the double splines (C) and (D) as shown.

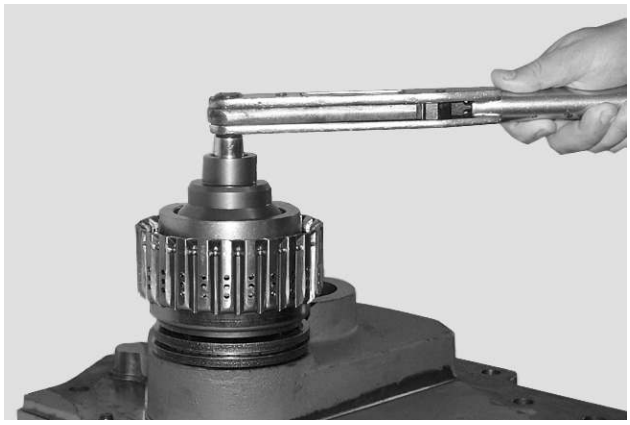
## STEP 27



MD06G028

Align the marks made in Step 26 and install the PTO clutch assembly onto the input shaft.

## STEP 28



MD06G081

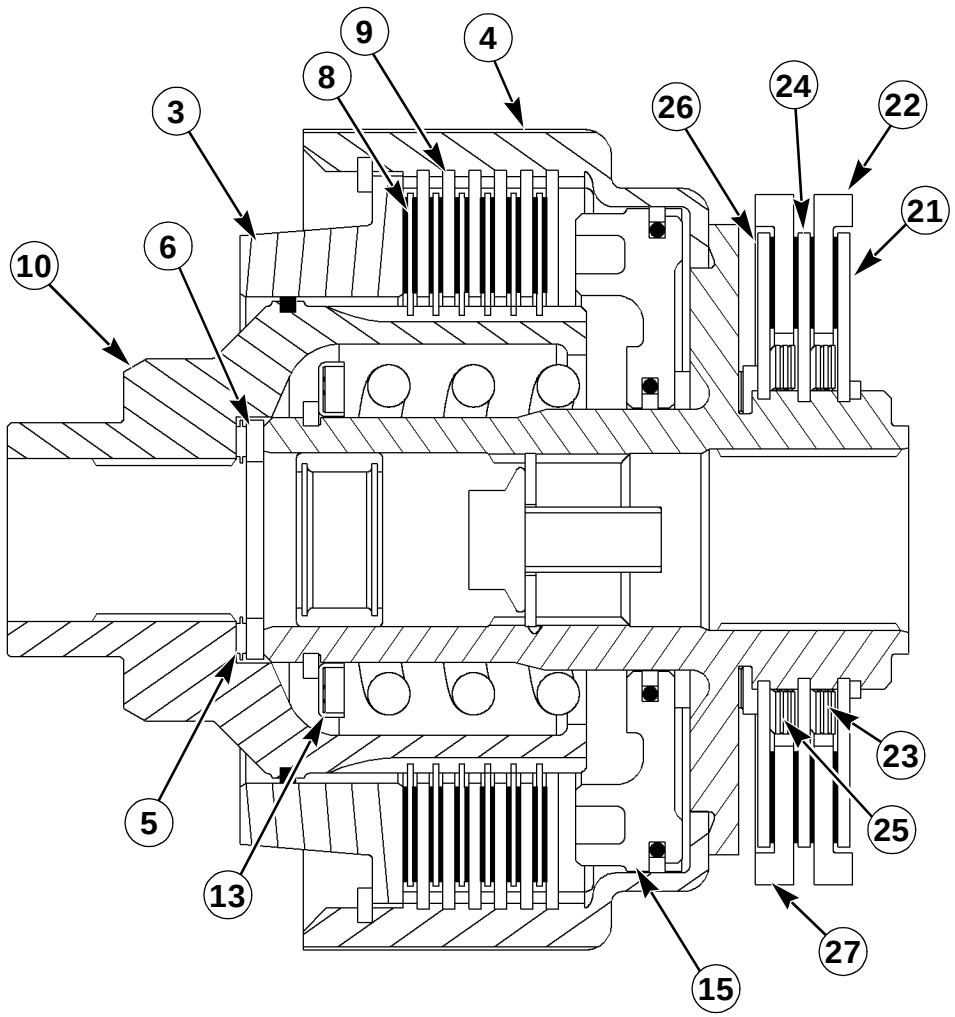
Tighten the clutch retaining bolt to a torque of 130 Nm (95 lb ft).

https://truckmanualshub.com/



**STEP 1**

## Cross Sectional Drawing of the PTO Clutch




MI06F014

3. BACKING PLATE
4. CLUTCH HOUSING
5. THRUST BEARING
6. THRUST WASHER
8. FRICTION PLATES (6)
9. SEPARATOR PLATES (8
10. CLUTCH HUB
13. SPRING RETAINER)
15. PISTON
21. SINGLE SIDED BRAKE FRICTION PLATE
22. RECESSED SEPARATOR PLATE
23. SPRING WASHERS (3)
24. DOUBLE SIDED BRAKE FRICTION PLATE
25. SPRING WASHERS (3)
26. SINGLE SIDED BRAKE FRICTION PLATE
27. RECESSED SEPARATOR PLATE

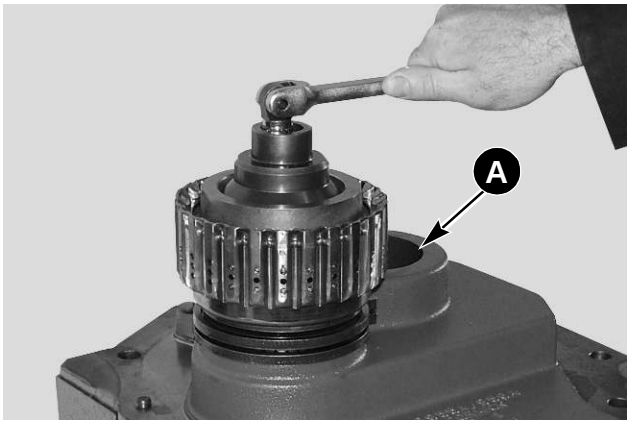
https://truckmanualshub.com/



# SHIFTABLE PTO

## Disassembly

### STEP 2



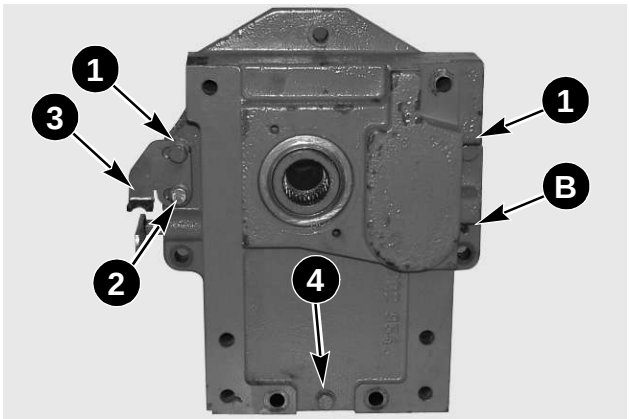

MD06F016

Use lifting equipment and place the PTO clutch housing on a clean work surface and remove the clutch retaining bolt from the PTO input shaft (A). Remove PTO the clutch assembly.

**NOTE:** *The clutch retaining bolt is prevented from being fully removed from the PTO clutch housing by the needle bearing cage.*

**NOTE:** *The following Step shows the PTO housing raised into the vertical position, this is for photographic purposes only. It is not necessary to raise the PTO housing to carry out the procedure.*

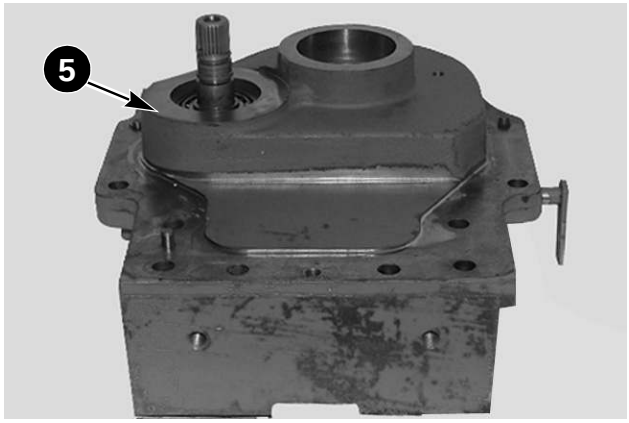
### STEP 3




MD06G075

Remove the two upper front plate retaining bolts (1). Remove the retaining bolt (2) and switch bracket (3). Remove the lower retaining bolt (4).
Install two 10 mm jacking bolts into the threaded hole (B) and lower switch bracket hole. Do not tighten the jacking bolts at this stage.

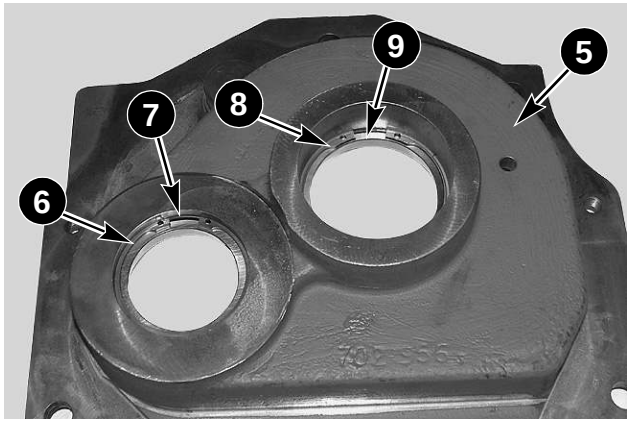
### STEP 4




MD06F088

Support the PTO clutch housing on a suitable blocks so the PTO output shaft sleeve is clear of the work surface. Evenly tighten the jacking bolts until the seal between the PTO housing and the front cover is broken. Remove the front cover (5).

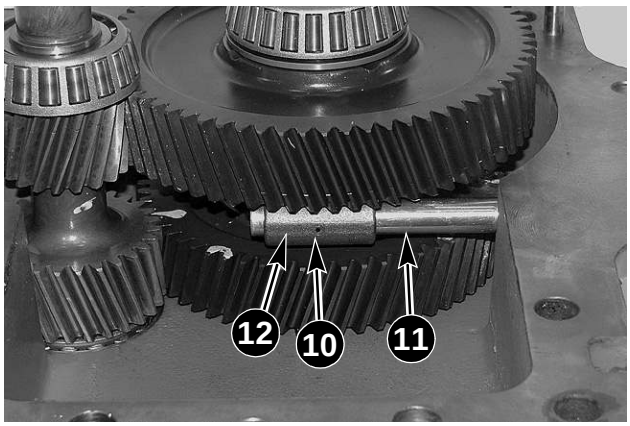
### STEP 5




MD06F040

Remove snap ring (6), bearing cup (7), snap ring (8) and bearing cup (9) from the front cover (5).

### STEP 6



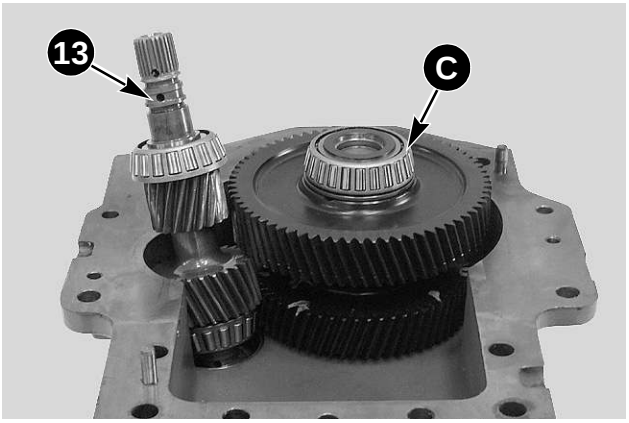

MD06F41

Remove the roll pin (10), selector rod (11) and selector fork (12).

https://truckmanualshub.com/



## STEP 7




MD06F042

Lift the input shaft (13) clear of the oil distribution gallery and remove the output shaft assembly (C) from the PTO housing. Remove the input shaft (13).

## STEP 8

Remove and discard the seal rings (14) and o-rings (15) from the input shaft (13). Use a bearing puller to remove bearing cones (16) and (15).

## STEP 9



MD06F043

Use a bearing puller to remove bearing cone (17), thrust washer (18) and gear (19).

## STEP 10

Remove the shift collar (20), make sure hub (23) remains on the output shaft (26).

## STEP 11

Remove balls (21), springs (22), hub (23) and gear (24) from the output shaft (26).

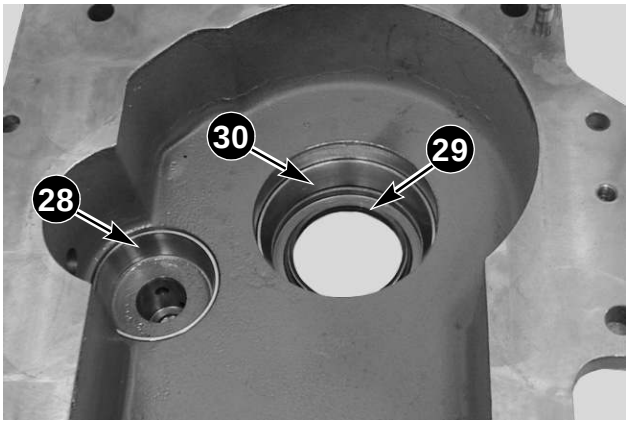
## STEP 12

Check the core plug (27) for damage and remove as necessary.

## STEP 13

Use a bearing puller and remove bearing cone (25) from the output shaft (26).

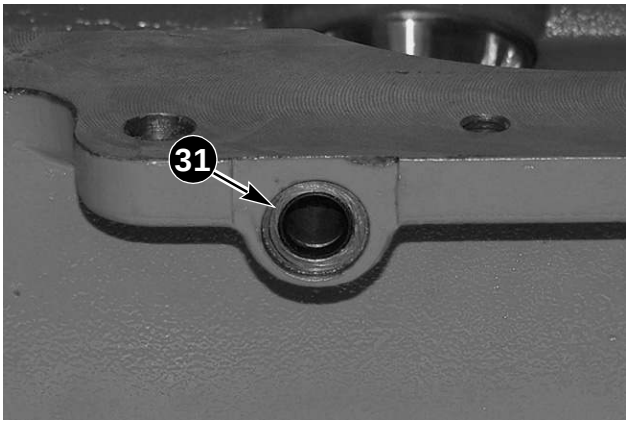
## STEP 14




MD06F046

Use a blind hole puller to remove bearing cup (28) from the PTO housing. Remove the output shaft seal (29) and bearing cup (30) from the PTO housing.

## STEP 15

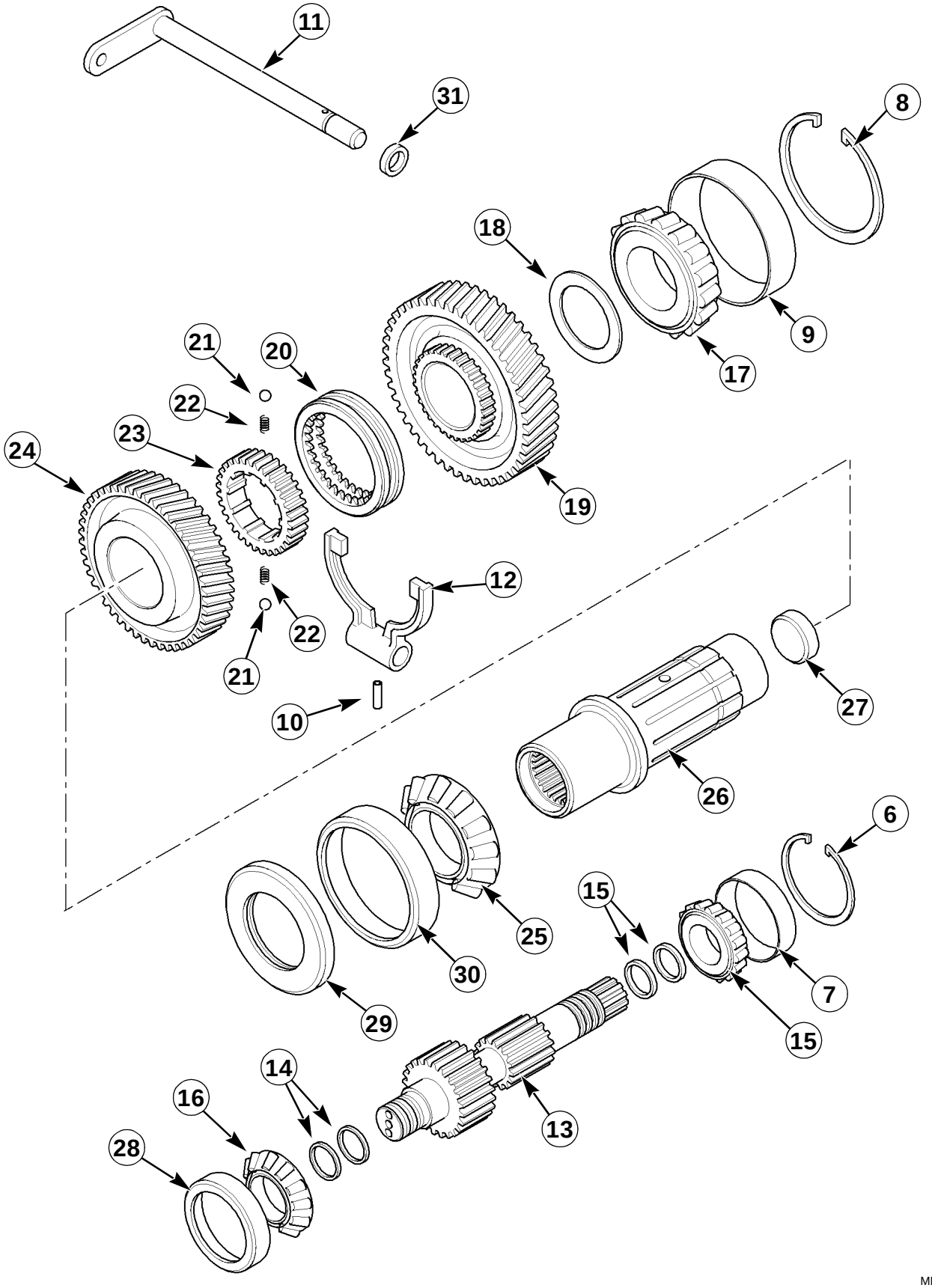



MD06F087

Remove the selector shaft seal (31) from the PTO housing.

https://truckmanualshub.com/






MI06F033

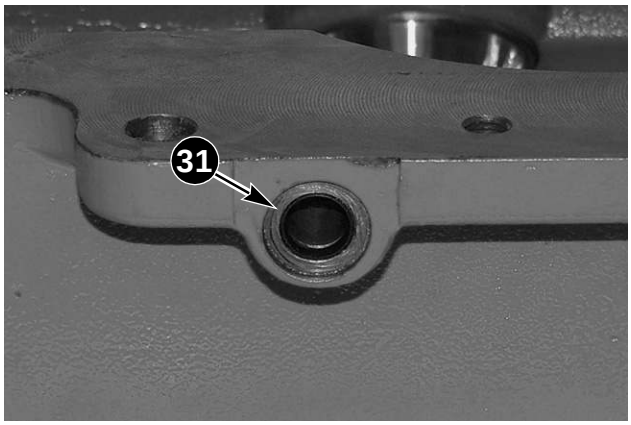
https://truckmanualshub.com/



## Assembly

**IMPORTANT:** *Check the PTO housing oil distribution gallery for wear or damage. If the oil gallery is worn or damaged replace the housing.*

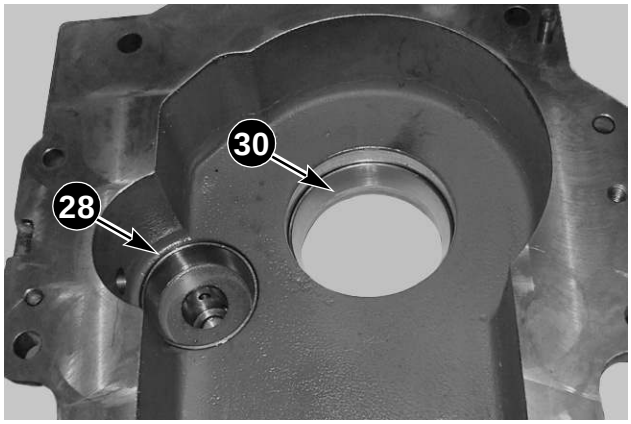
### STEP 16




MD06F087

Using a suitable driver to install a new selector shaft seal (31) into the PTO housing. Make sure the seal is against the shoulder in the housing.

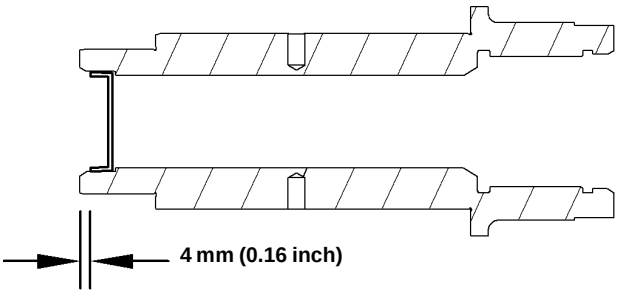
### STEP 17




MD06F044

Install bearing cups (28) and (30) into the PTO housing, make sure the bearing cups are against the shoulders in the housing.

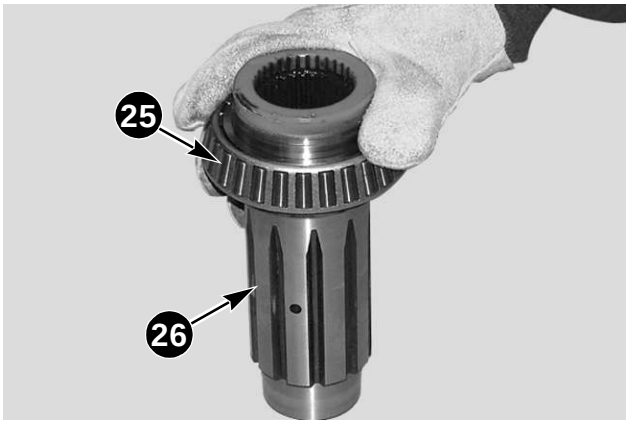
### STEP 18




MI06F035

If core plug (27) has been remove. Make sure the plug mounting surface of the output shaft (26) is clean. Apply Loctite 747 primer and adhesive 680 to the mounting surface of a new core plug (27). Using a suitable driver install the core plug (27) into the output shaft (26) to a depth of 4 mm (0.16 inch) as shown.

### STEP 19



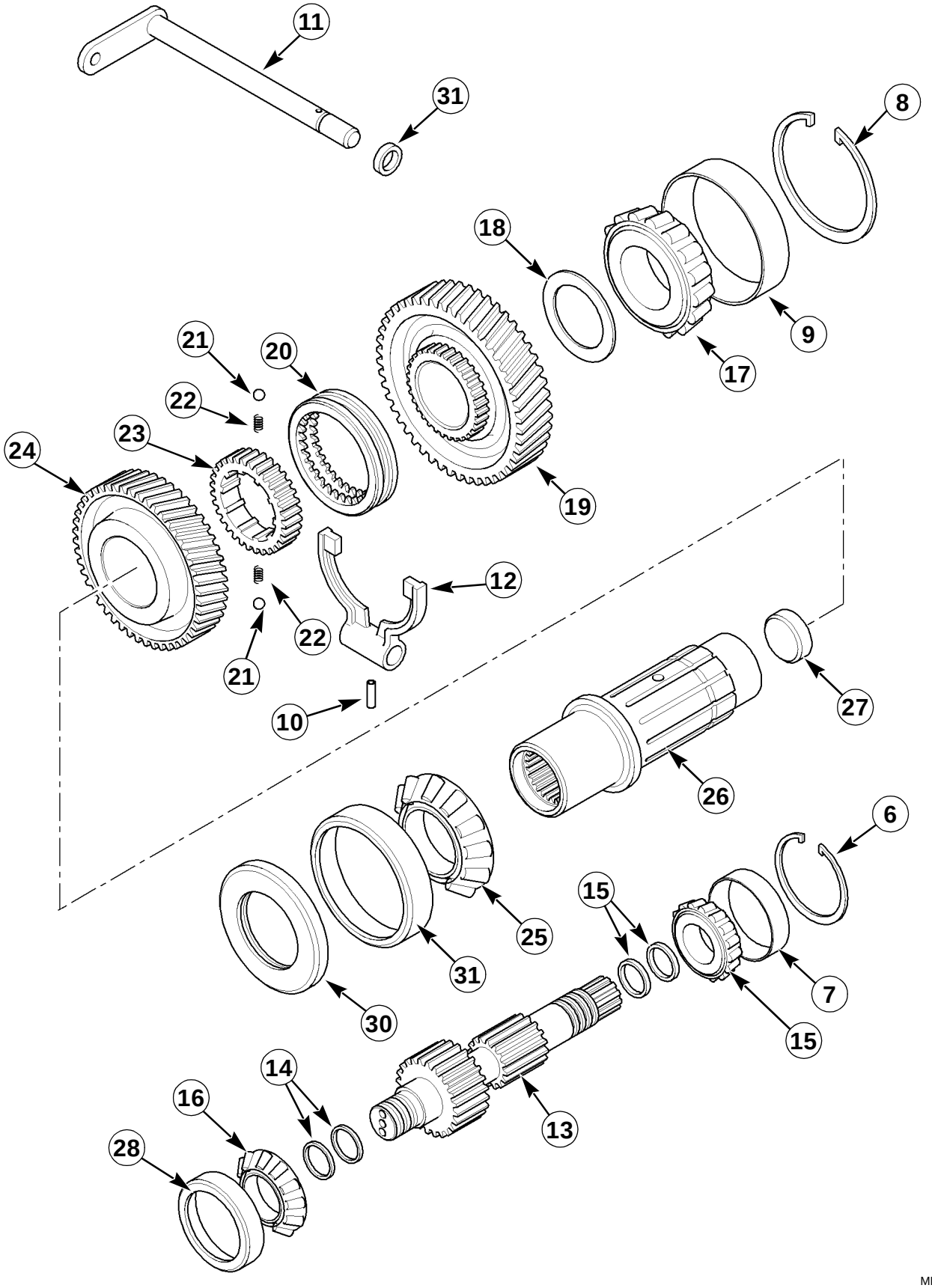

MD06F047

Heat bearing cone (25) in a bearing oven to a temperature of 110℃ (230℉). Install bearing cone (25) onto the output shaft (26). Make sure the bearing is fully installed against the shoulder on the output shaft.

**WARNING:** ***Always wear heat protective gloves or mittens when handling heated parts.***

https://truckmanualshub.com/



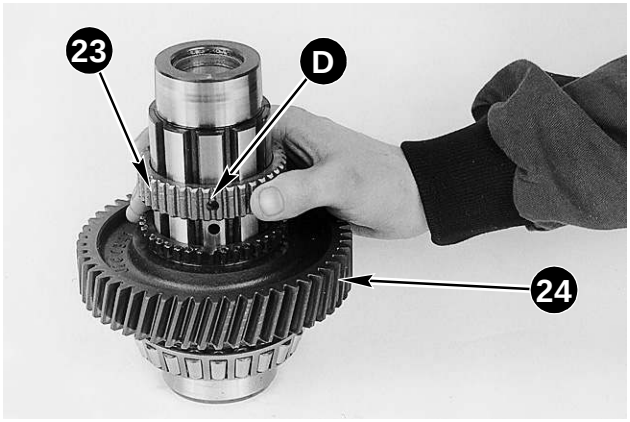



MI06F033

https://truckmanualshub.com/



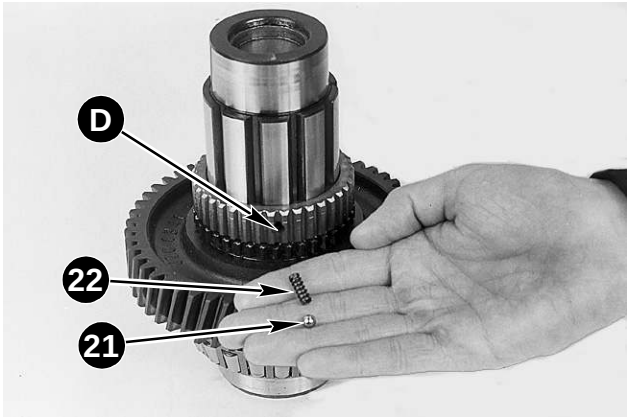
## STEP 20




DP97A314

Install gear (24) and hub (23), align detent holes (D) in the hub with the holes in the PTO output shaft (26).

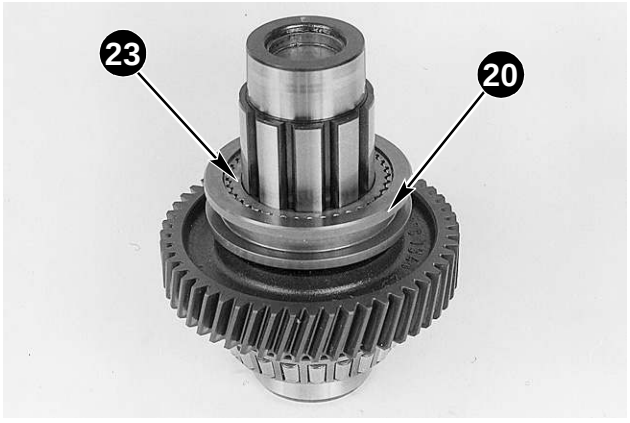
## STEP 21




DP97A3157

Make sure detent hole (D) in the hub is aligned with the hole in the PTO output shaft. Install springs (22) and balls (21) into holes (D) (both sides). Use petroleum jelly to hold the springs and balls in position.

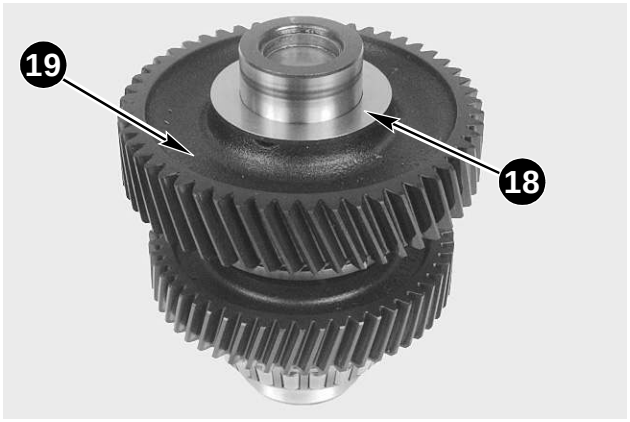
## STEP 22




DP97A318

Install shift collar (20), firmly press the shift collar onto hub (23) until the detent balls hold shift collar (20) in the neutral position as shown.

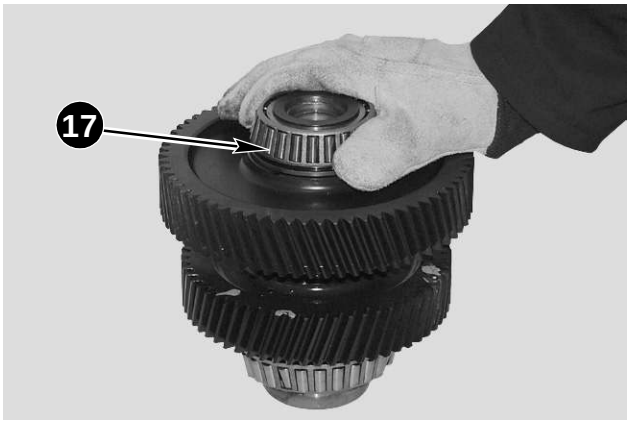
## STEP 23




DD96N177

Install gear (19) and thrust washer (18).

## STEP 24



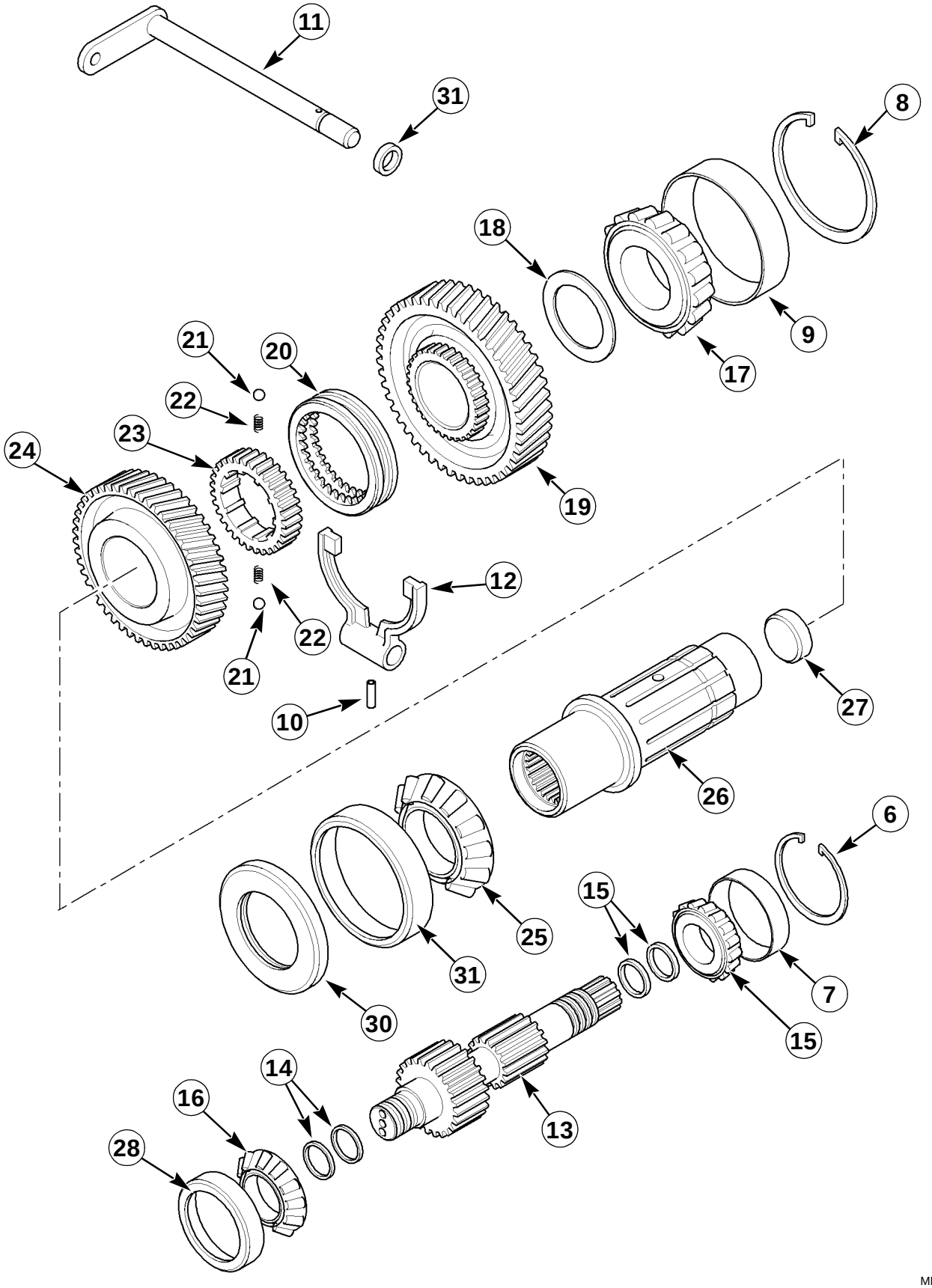

MD06F048

Heat bearing cone (17) in a bearing oven to a temperature of 110℃ (230℉). Install the bearing cone onto the PTO output shaft. Make sure the bearing is against the thrust washer.

**WARNING:** ***Always wear heat protective gloves or mittens when handling heated parts.***

https://truckmanualshub.com/





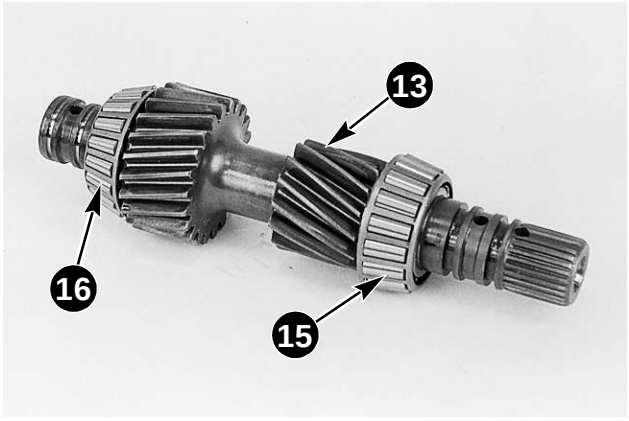

MI06F033

https://truckmanualshub.com/



**NOTE:** *One end plug is installed into the PTO input shaft (13) at the factory. The plug is installed into the PTO clutch oil pressure gallery, the lubrication gallery is not plugged.*

## STEP 25

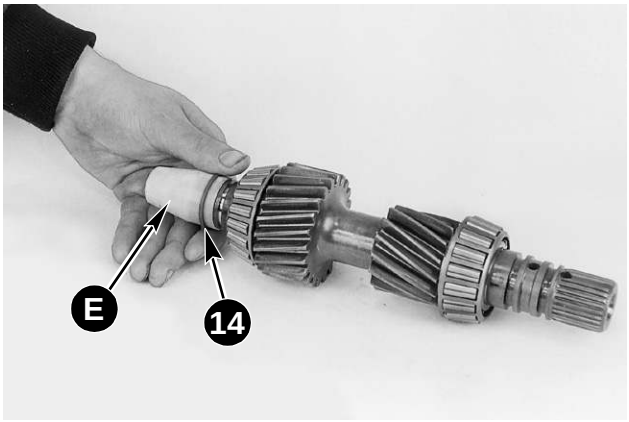



DP97A310

Heat the PTO input shaft bearing cones (15) and (16) in a bearing oven to a temperature of 110℃ (230℉) . Install the bearing cones onto the PTO input shaft (13). Make sure the bearings are against the shoulders on the PTO input shaft.

> ⚠ ***WARNING: Always wear heat protective gloves or mittens when handling hot parts.***

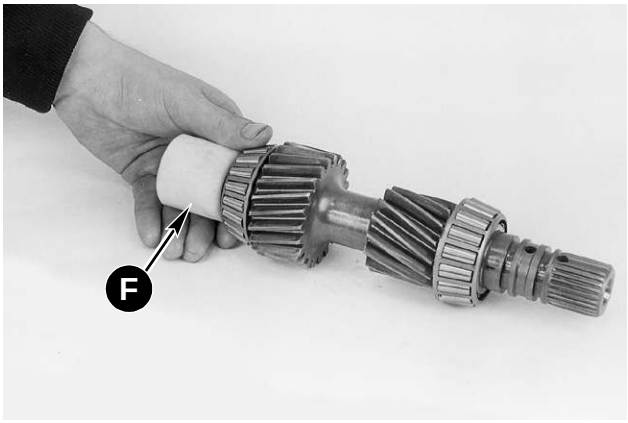
## STEP 26




DP97A311

Lubricate new seal ring (14) with clean transmission oil. Using seal expander (E) MC2001, install the seal ring into the inner groove on the PTO input shaft (13). Remove the seal expander (E).

## STEP 27




DP97A312

Compress and reshape the seal ring by hand. Install the long chamfer end of the seal compressor (F) MC2005-3 over the PTO input shaft (13) and seal ring (14). Remove the seal compressor (F) and install the short chamfer end over the seal ring.

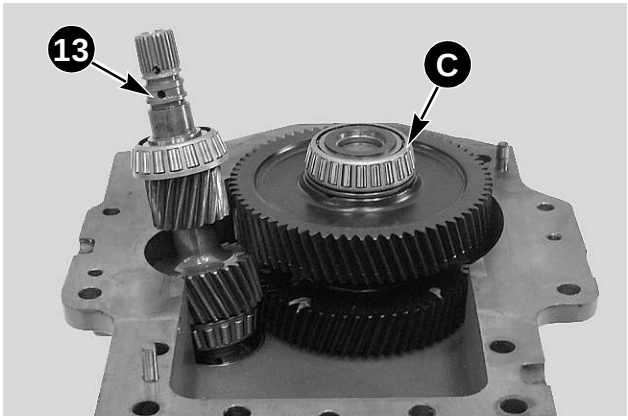
**IMPORTANT:** *Only by using the seal compressor MC2005-3 can the seal rings be compressed to their correct working size.*

## STEP 28

Repeat Step 26 and Step 27 for the remaining seal ring (14).

**NOTE:** *Check the new seal rings are not twisted or damaged and the seal rings will turn freely in the grooves.*

## STEP 29



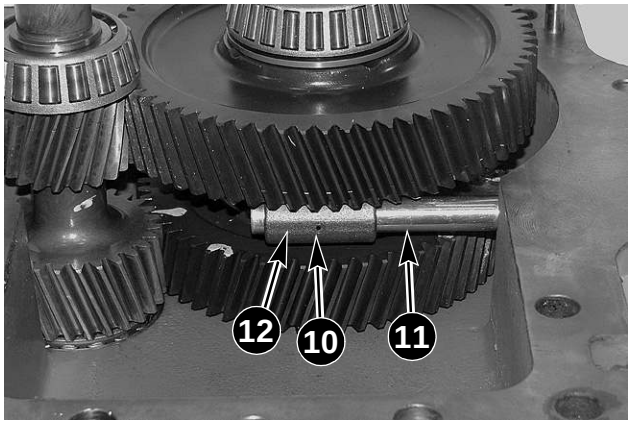

MD06F042

With the PTO housing supported on blocks, partially install the PTO input shaft (13) into the PTO housing. Install the PTO output shaft assembly (C). As the PTO output shaft assembly is being installed, install the input shaft (13) into the lower bearing cup. Care must be taken not to damage the input shaft seal rings. Make sure the shaft assembly (C) is clear of the work surface

https://truckmanualshub.com/



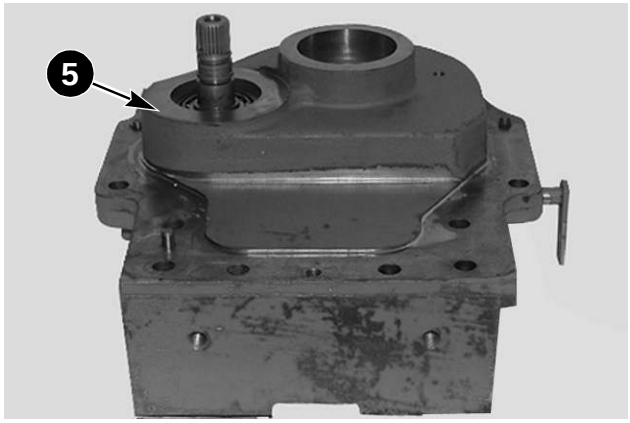
## STEP 30




MD06F41

Install selector fork (12) and selector rod (11). Make sure the selector rod (11) lever is facing downward. Align the roll pin holes and install roll pin (10). Make sure the end of the roll pin is level with the surface of the selector fork.

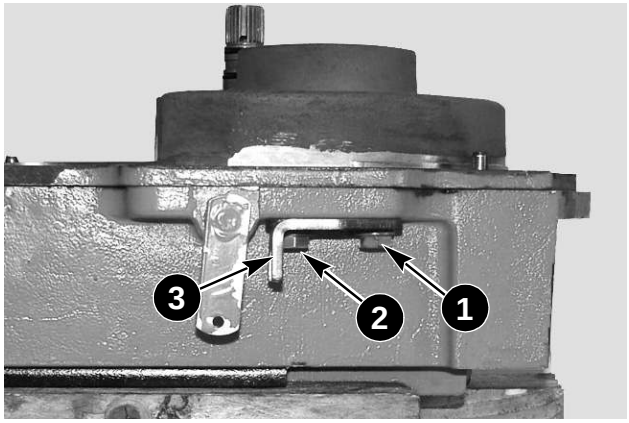
## STEP 31



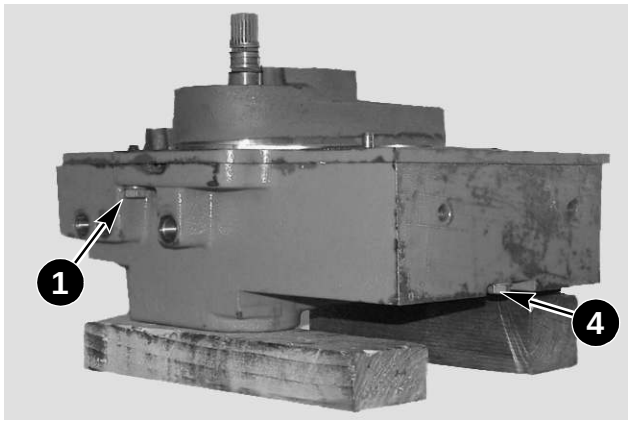

MD06F088

Apply a continuous bead of Loctite 515 to the PTO housing front cover mounting face. Make sure the dowels are in place and install the front cover (5).

## STEP 32



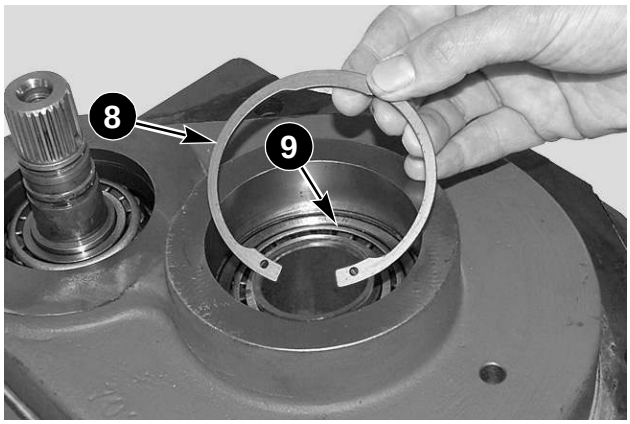

MD06G077




MD06G076

Install switch bracket (3) and retaining bolt (2). Install the two upper front plate retaining bolts (1) and lower retaining bolt (4). Tighten all the bolts to a torque of 100 to 113 Nm (74 to 83 lb ft)

## STEP 33




MD06F096

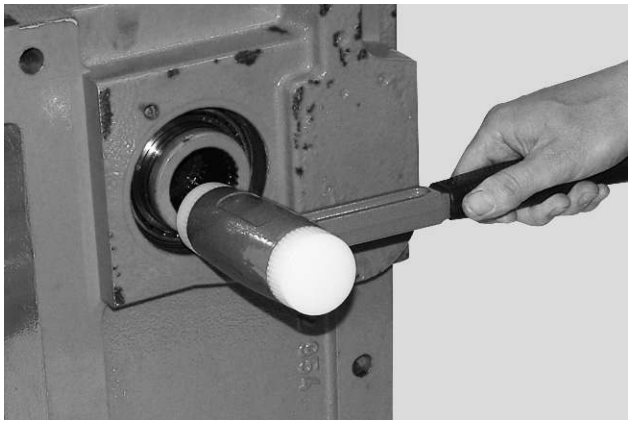
Install bearing cup (9) into the front cover, select and install the thickest snap ring (8) that can be installed correctly into the snap ring groove.

**NOTE:** *Snap rings (8) are available in the following thicknesses, 2.56 mm, 2.66 mm, 2.76 mm, 2.86 mm, 2.96 mm, 3.06 mm, 3.16 mm, 3.26 mm and 3.36 mm.*

https://truckmanualshub.com/



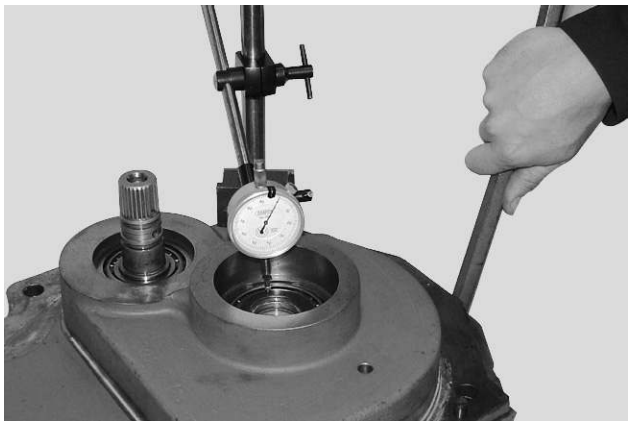
## STEP 34



MD06F090

Use lifting equipment and raise the PTO housing into the vertical position. Use the lifting equipment Use a soft faced hammed on the output shaft to seat the bearing cup (9) against the snap ring (8).

## STEP 35



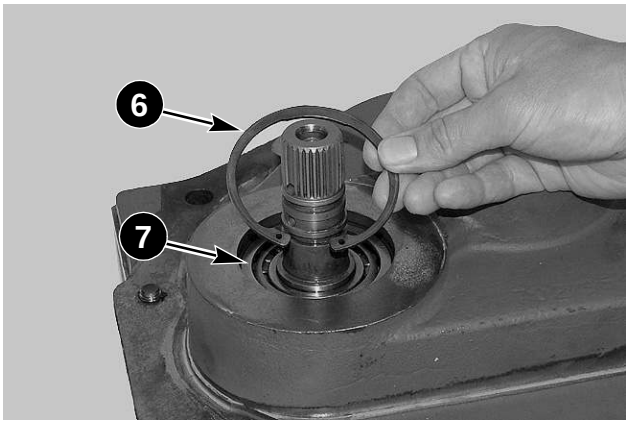
MD06F056

Rotate the output shaft several times to seat the bearings by rotating the input shaft.
Install a dial gauge onto the PTO output shaft, zero the gauge. Using a lever against the rear of the output shaft, lift the output shaft and note the end play reading. The end play must be 0.025 to 0.125 mm (0.001 to 0.005 inch).

## STEP 36

If the end play is not correct remove snap ring (8) and repeat Step 33 to Step 35.

## STEP 37

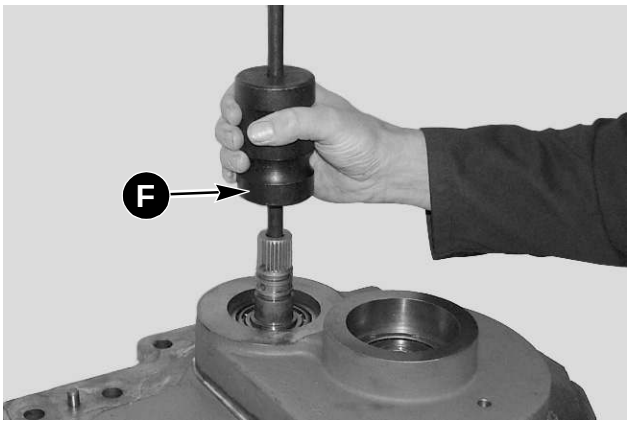



MD06F017

Install bearing cup (7) into the front cover, select and install the thickest snap ring (6) that can be installed correctly into the snap ring groove.

**NOTE:** *Snap ring (6) are available in the following thicknesses, 2.065 mm, 2.165 mm, 2.265 mm, 2.365 mm, 2.465 mm, 2.565 mm, 2.665 mm, 2.765 mm and 2.865 mm.*

## STEP 38



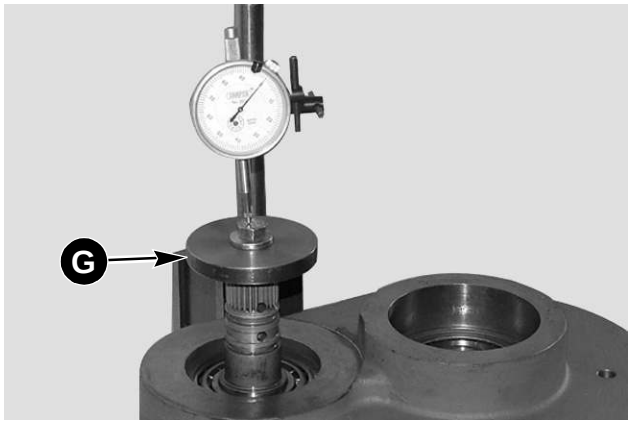

MD06F093

Using a slide hammer (F) (with a 12 mm x 1.75 mm thread) installed into the end of the input shaft, seat the bearing cup (7) against the snap ring (6).

https://truckmanualshub.com/



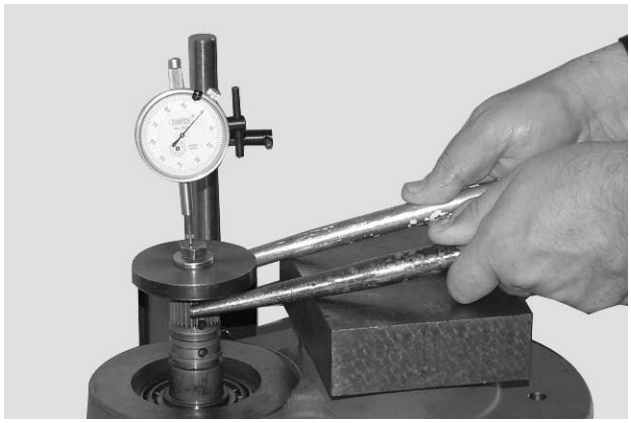
## STEP 39




MD06G078

Install washer (G) (refer to Tools to be Made), into the end of the input shaft using a 12 mm x 25 mm bolt. Install dial gauge onto end of the input shaft, zero the dial gauge. Rotate the input shaft several times to seat the bearings.

## STEP 40



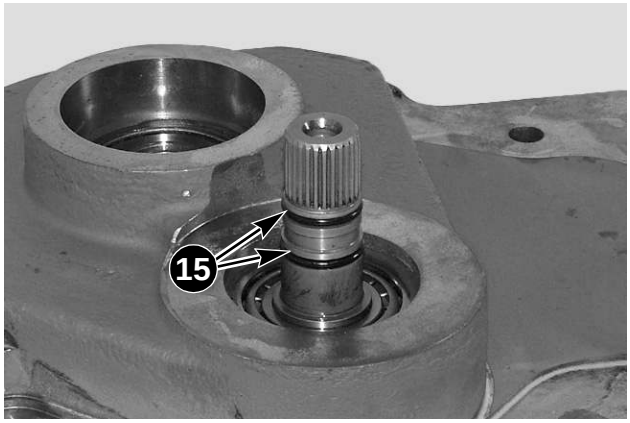
MD06G079

Using a suitable block and two levers under washer (G) lift the input shaft and note the end play reading. The end play must be 0.025 to 0.125 mm (0.001 to 0.005 inch).

## STEP 41

If the end play is not correct remove snap ring (8) and repeat Step 37 to Step 40.

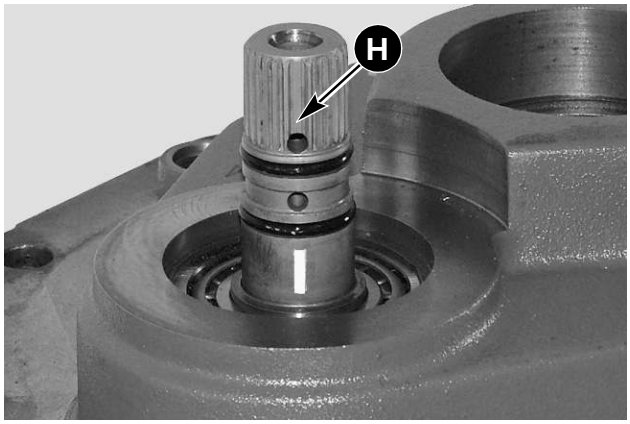
## STEP 42



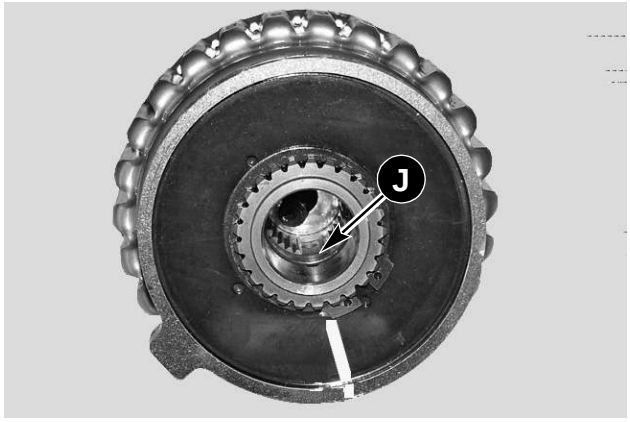

MD06F028

Lubricate and install new o-rings (15) into the grooves in the PTO input shaft.

## STEP 43




MD06G026



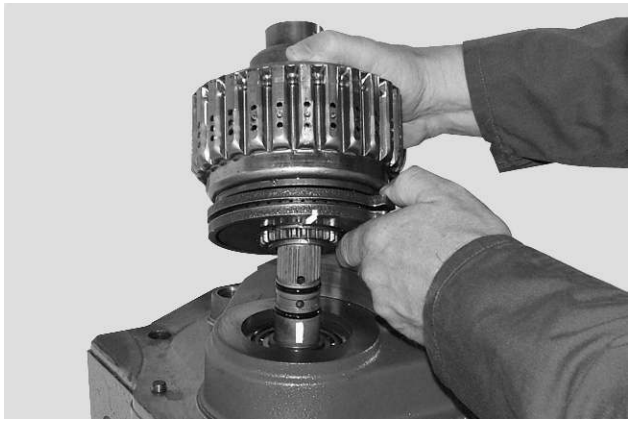

MD06G027

Put alignment marks on the input shaft and PTO clutch assembly in line with the double splines (H) on the shaft and (J) on the clutch assembly as shown.

https://truckmanualshub.com/



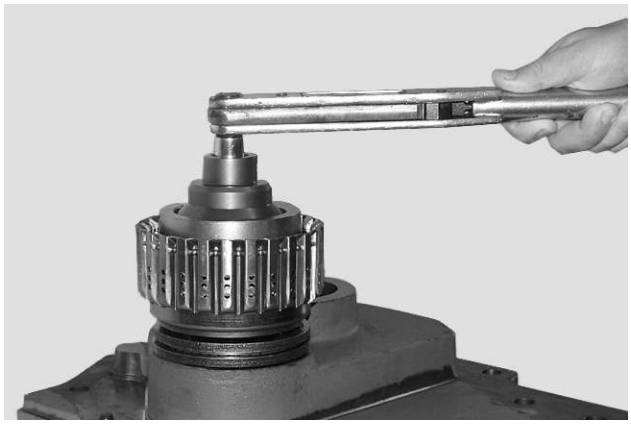
## STEP 44



MD06G028

Align the marks made in Step 43 and install the PTO clutch assembly onto the input shaft.

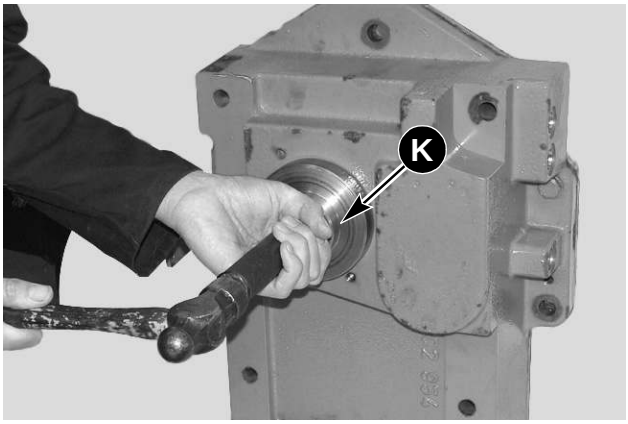
## STEP 45



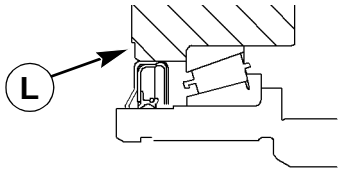
MD06G081

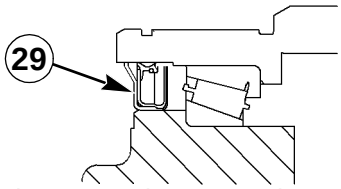
Tighten the clutch retaining bolt to a torque of 130 Nm (95 lb ft).

## STEP 46




MD06F095



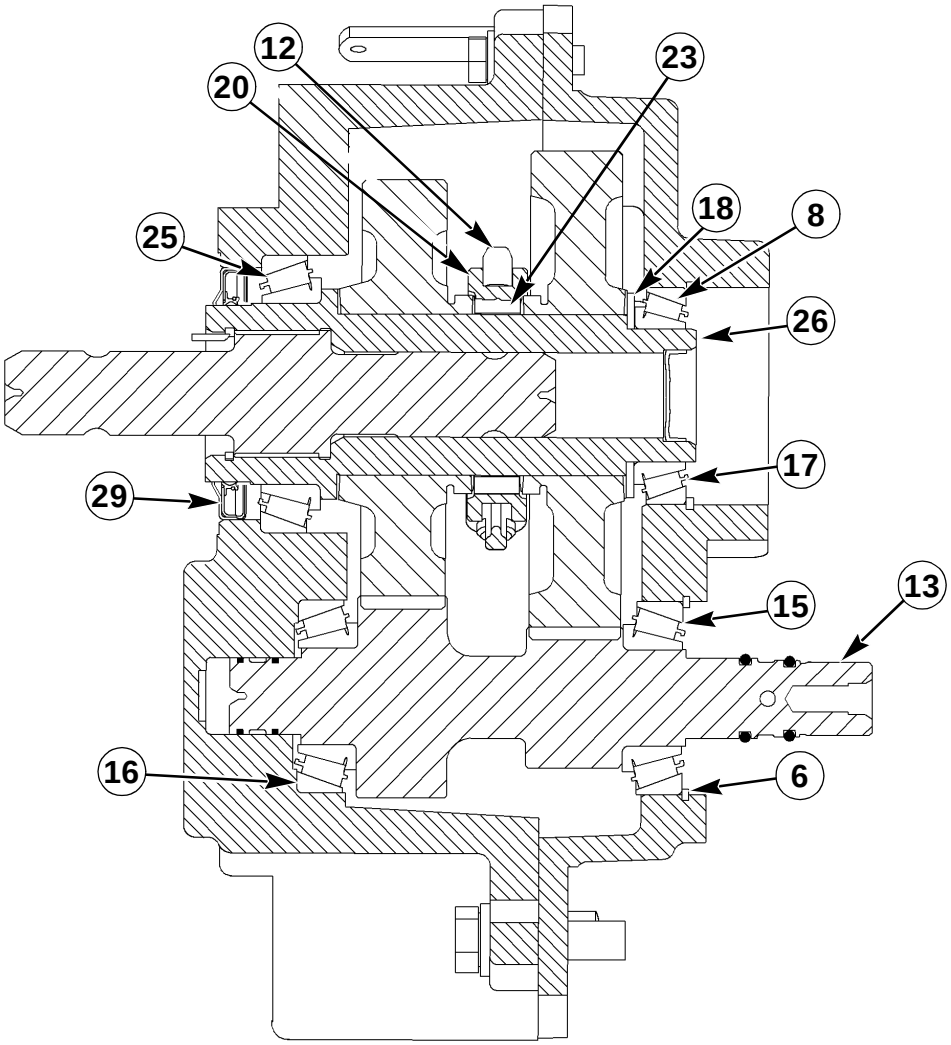




Apply Loctite 609 to the outer edge of a new output shaft seal (29). Use a suitable seal installer (K) and install the output shaft seal (29). Make sure the seal is level with the machined face (L) of the PTO housing.

https://truckmanualshub.com/



# Cross Sectional Drawing of the Shiftable PTO




| | |
|---|---|
| 6. SNAP RING | 17. BEARING CONE |
| 8. BEARING CONE | 18. THRUST WASHER |
| 12. SELECTOR FORK | 20. SHIFT COLLAR |
| 13. INPUT SHAFT | 23. HUB |
| 16. BEARING CONE | 25. BEARING CONE |
| 15. BEARING CONE | 29. SEAL |

https://truckmanualshub.com/



This Page Has Been Left Blank

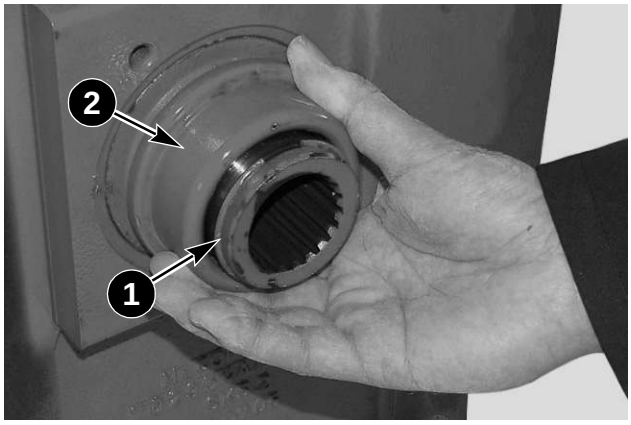
https://truckmanualshub.com/



# REVERSIBLE PTO

## Disassembly

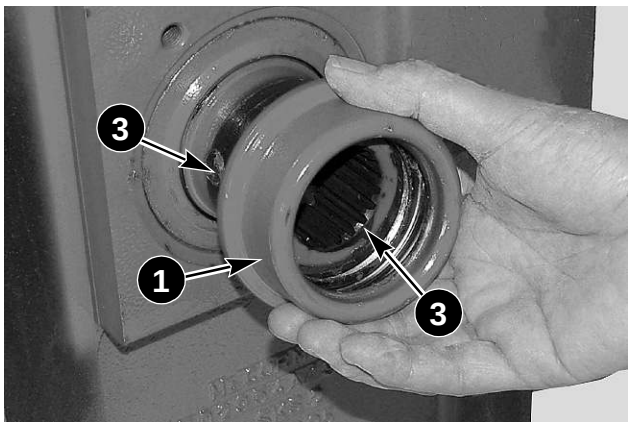
### STEP 1




MD06F113

Use lifting equipment to place the PTO clutch housing on a clean work surface. Push and hold the PTO output shaft retaining sleeve (2) towards the PTO housing and remove the retaining ring (1).

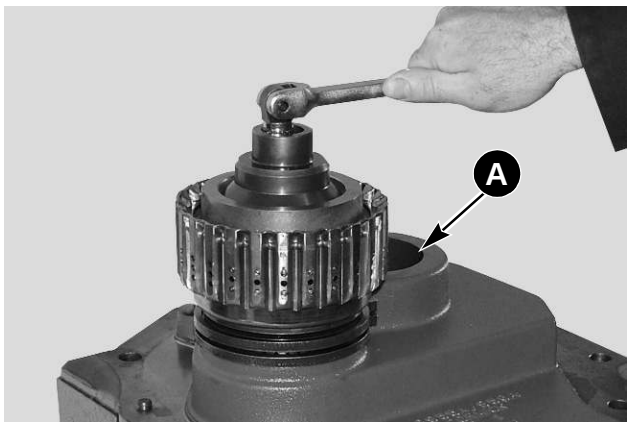
### STEP 2




MD06F114

Remove the PTO output shaft retaining sleeve (2) and retaining balls (3) from the PTO output shaft.

### STEP 3

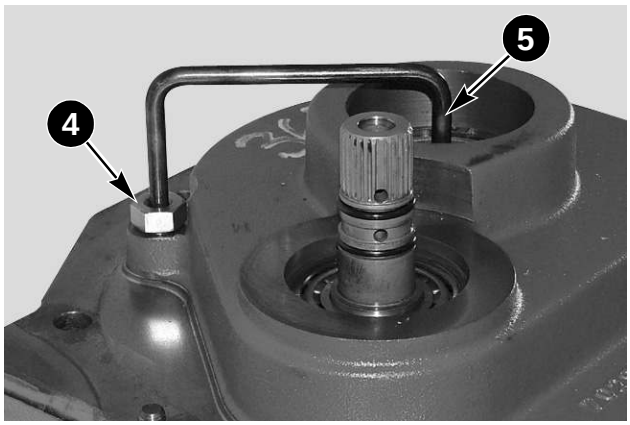



MD06F016

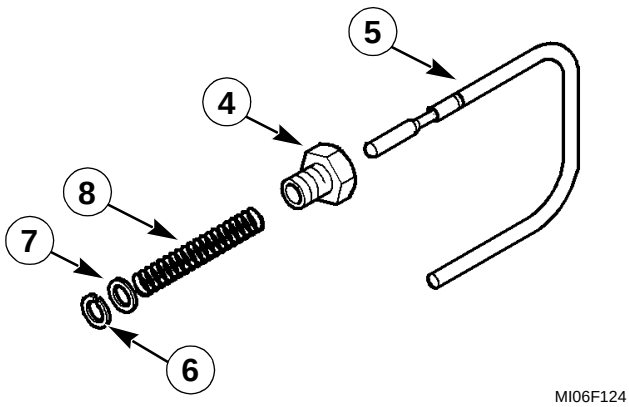
Use lifting equipment to lower the PTO clutch housing. Support the housing on suitable blocks. Remove the clutch retaining bolt from the PTO input shaft (A) and remove PTO the clutch assembly.

**NOTE:** *The clutch retaining bolt is prevented from being fully removed from the PTO clutch housing by the needle bearing cage.*

### STEP 4




MD06F115




MI06F124

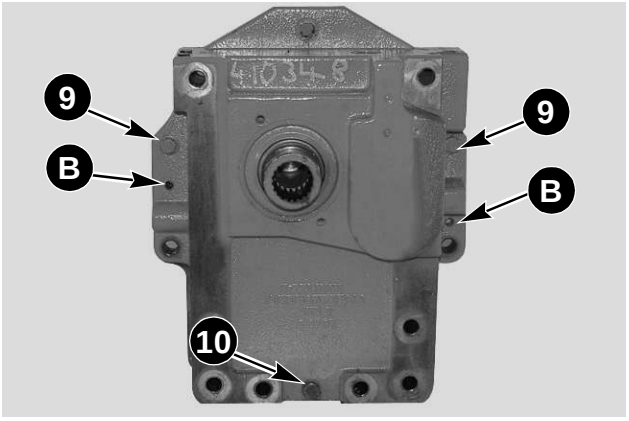
Remove the sleeve fitting (4) and rod assembly (5). If necessary remove the retaining ring (6), washer (7) and spring (8).

https://truckmanualshub.com/



**NOTE:** *The following Step shows the PTO housing raised into the vertical position, this is for photographic purposes only. It is not necessary to raise the PTO housing to carry out the procedure.*

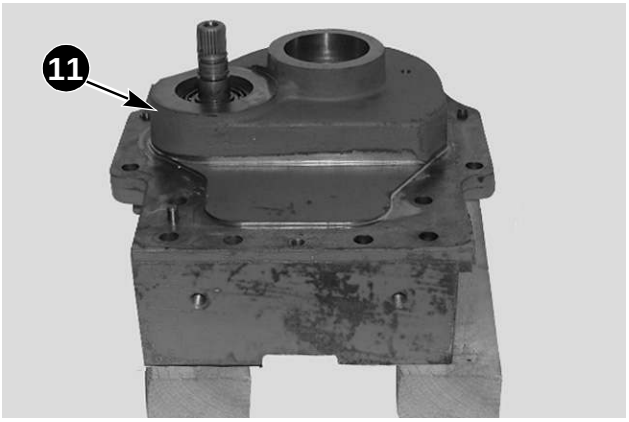
## STEP 5




MD06F089

Remove the two upper front plate retaining bolts (9) and lower retaining bolt (10). Install two 10 mm jacking bolts into the threaded holes (B). Do not tighten the jacking bolts at this stage.

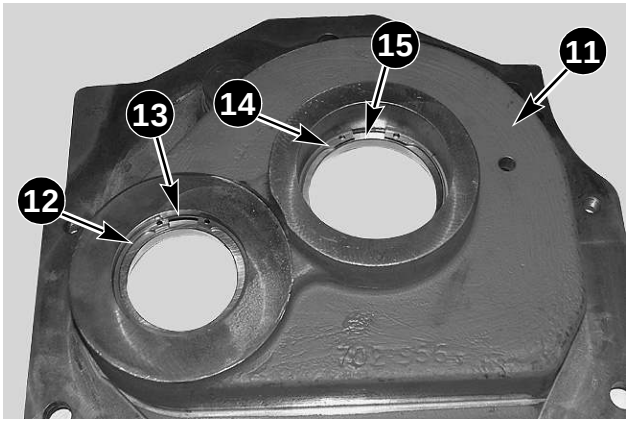
## STEP 6




MD06F088

Evenly tighten the jacking bolts until the seal between the PTO housing and the front cover is broken. Remove the front cover (11).

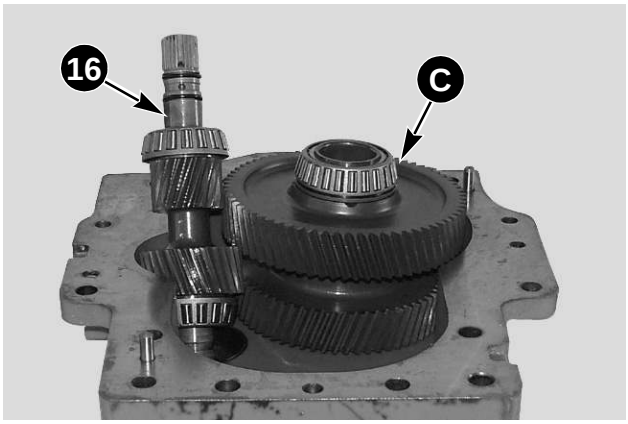
## STEP 7




MD06F040

Remove snap ring (12), bearing cup (13), snap ring (14) and bearing cup (15) from the front cover (11).

## STEP 8




MD06F117

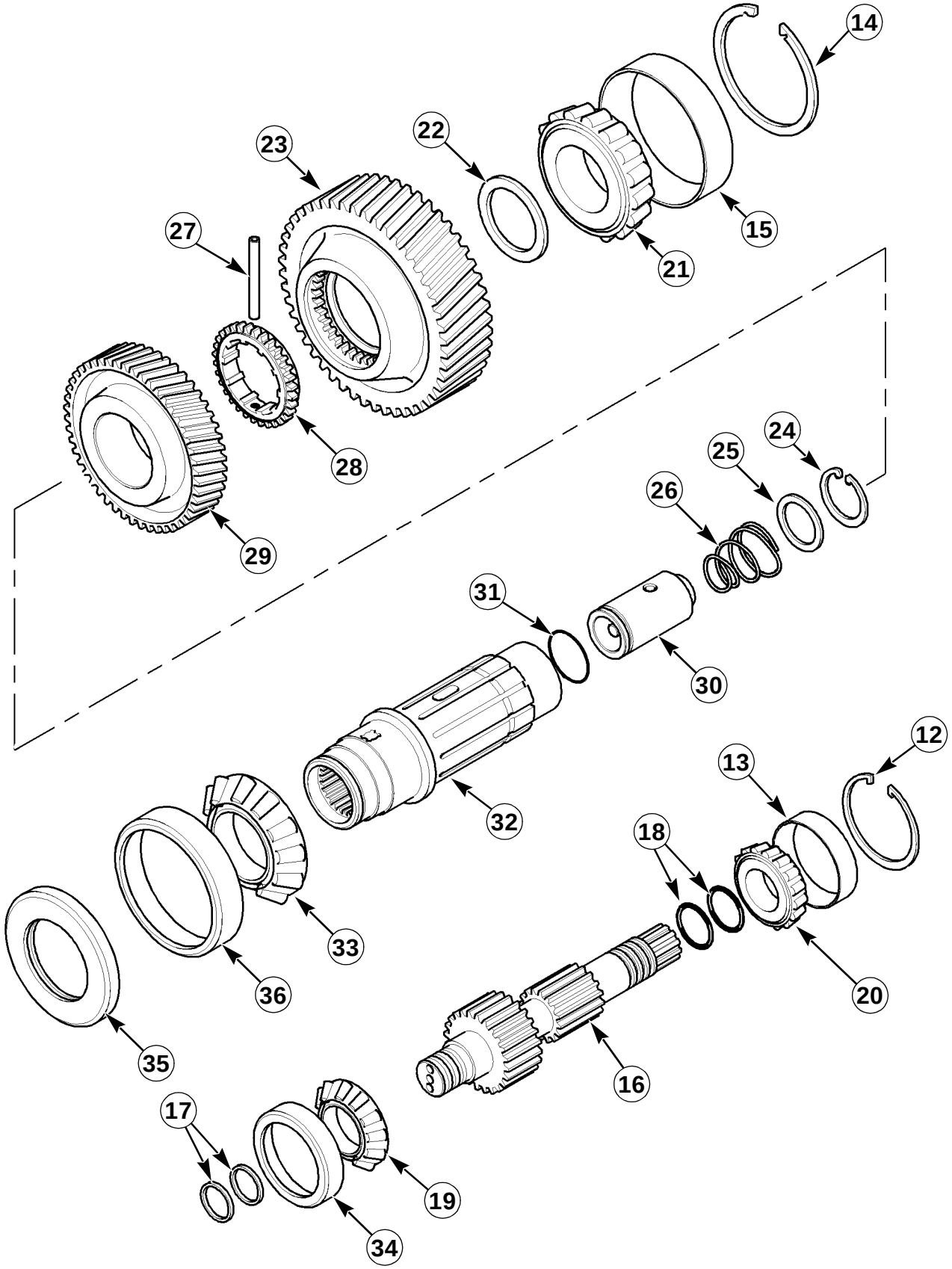
Lift the input shaft (16) clear of the oil distribution gallery and remove the output shaft assembly (C) from the PTO housing. Remove the input shaft (16).

## STEP 9

Remove and discard the seal rings (17) and o-rings (18) from the input shaft (16). Use a bearing puller to remove bearing cones (19) and (20).

https://truckmanualshub.com/



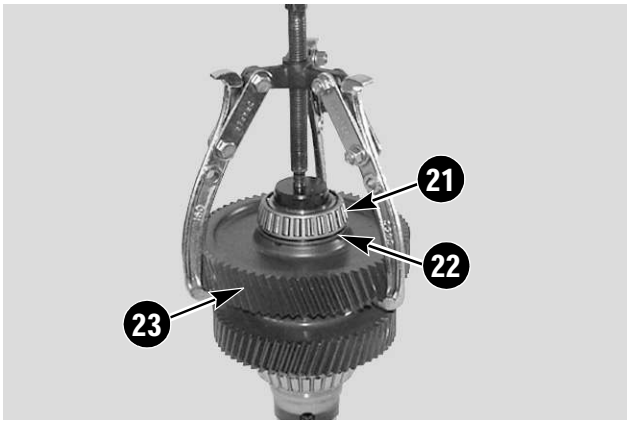



MI06F023

https://truckmanualshub.com/



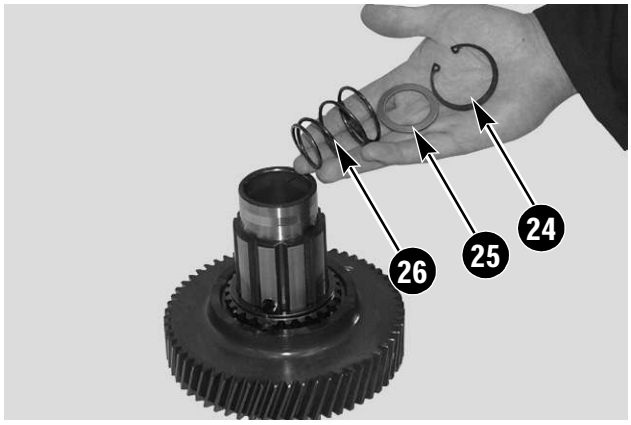
## STEP 10




MD06F119

Use a bearing puller to remove bearing cone (21), thrust washer (22), and gear (23).

## STEP 11




MD06F111

Carefully remove the retaining ring (24) from the internal bore of the output shaft (32). Remove washer (25) and spring (26).

**IMPORTANT:** *The retaining ring (24) is under spring tension. Care must be taken when removing the retaining ring (24).*

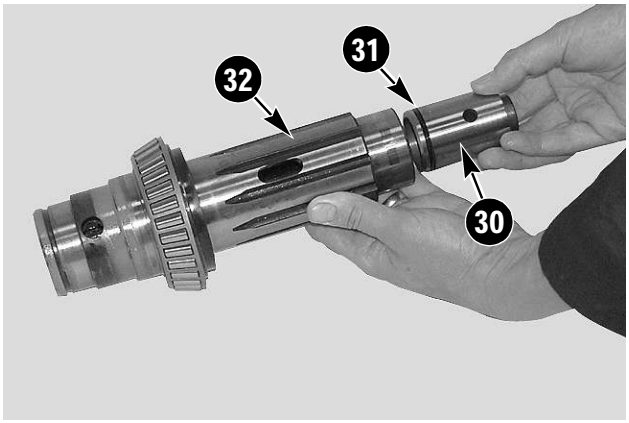
## STEP 12



MD06F118

For access to the shift collar (28), raise, then lower gear (29). Remove the retaining pin (27), shift collar (28) and gear (29).

## STEP 13



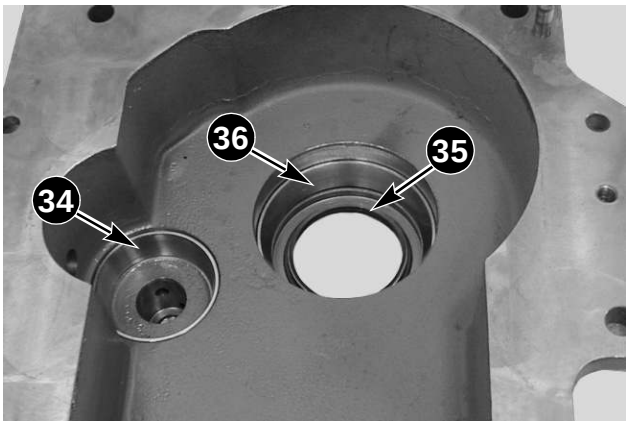

MD06F112

Remove inner sleeve (30) from the output shaft (32). Remove and discard the o-ring (31).

## STEP 14

Use a bearing puller to remove bearing cone (33) from the output shaft (32).

## STEP 15

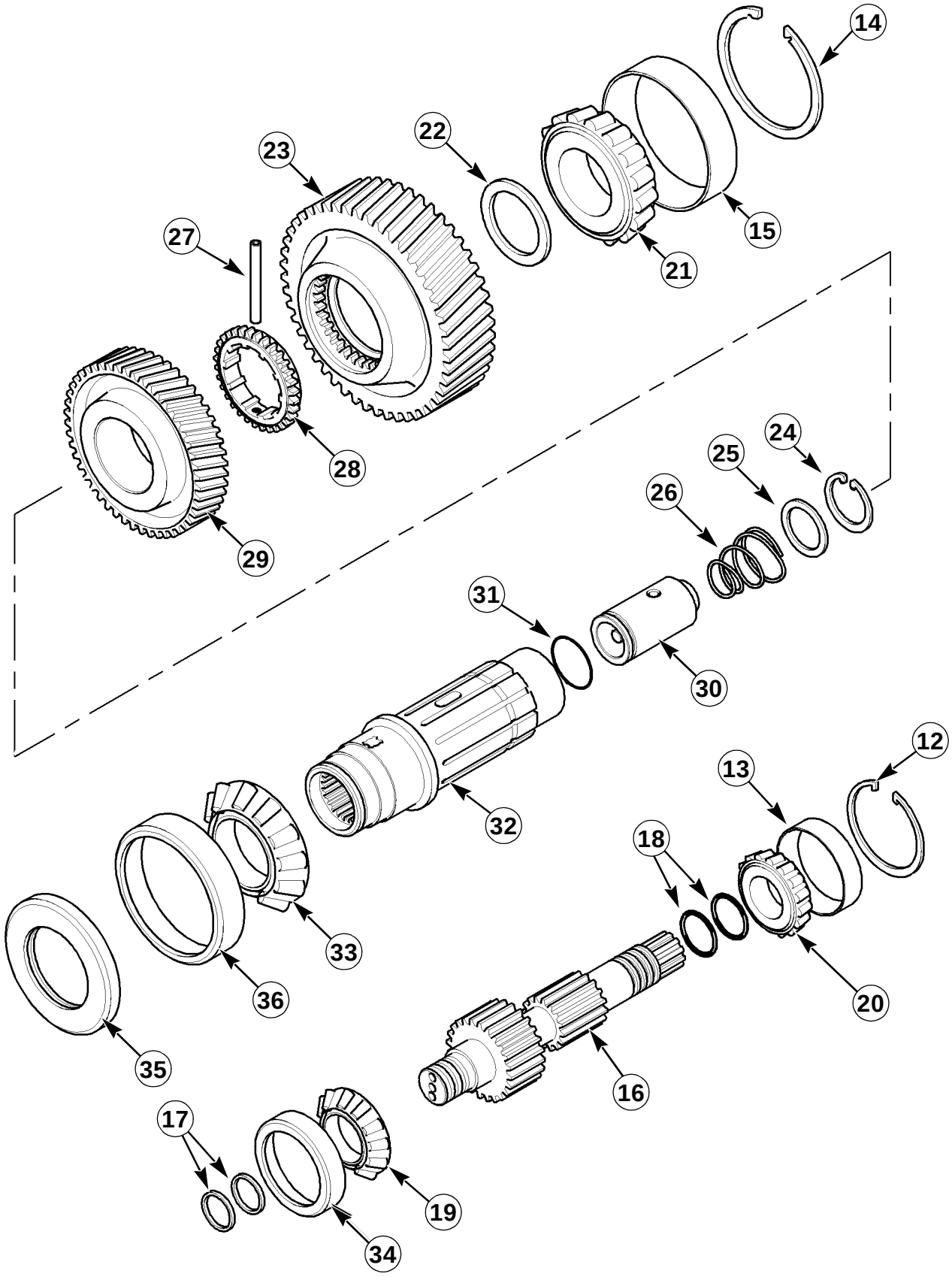



MD06F046

Use a blind hole puller to remove bearing cup (34) from the PTO housing. Remove the output shaft seal (35) and bearing cup (36) from the PTO housing.

https://truckmanualshub.com/



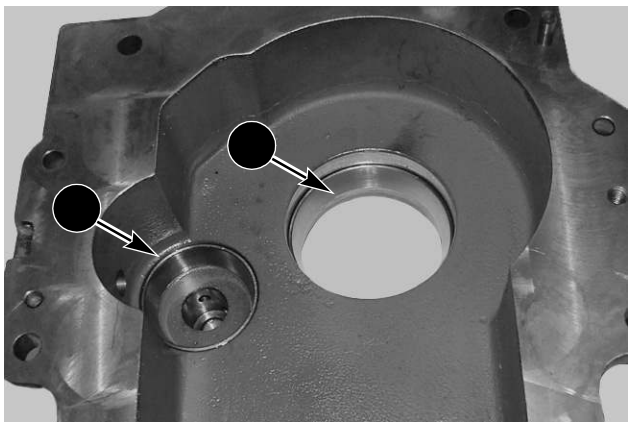


https://truckmanualshub.com/



## Assembly

### STEP 16



MD06F044

Install bearing cups (34) and (36) into the PTO housing, make sure the bearing cups are against the shoulders in the housing.

### STEP 17

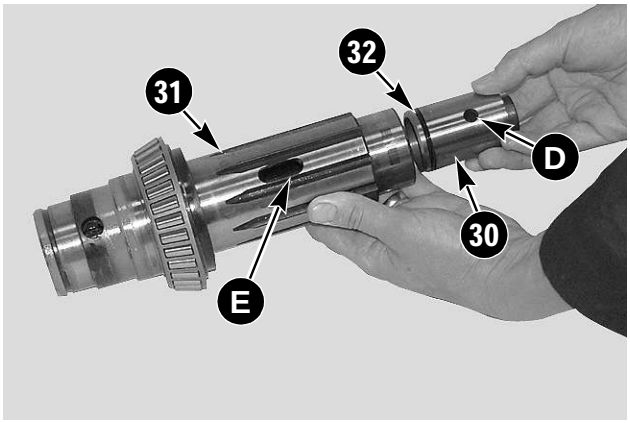


MD06F120

Heat bearing cone (33) in a bearing oven to a temperature of 110℃ (230℉). Install bearing cone (33) onto the output shaft (32). Make sure the bearing is fully installed against the shoulder on the output shaft.

> **WARNING:** ***Always wear heat protective gloves or mittens when handling heated parts.***

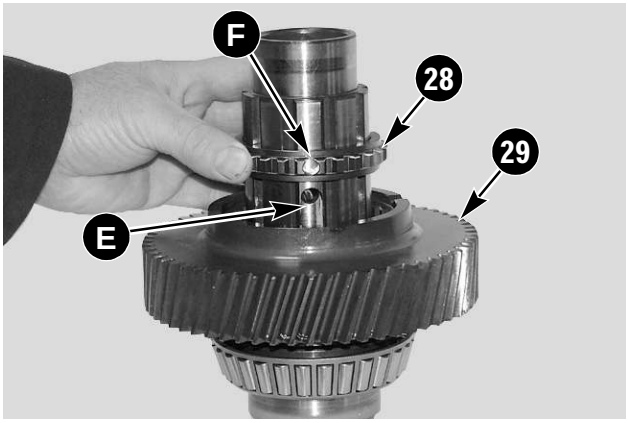
### STEP 18




MD06F112

Lubricate and install a new o-ring (31) onto sleeve (30). Install sleeve (30) into the output shaft (32) (o-ring side towards the bearing). Make sure hole (D) in sleeve (31) is aligned with the top of the slot (E) in the output shaft (32).

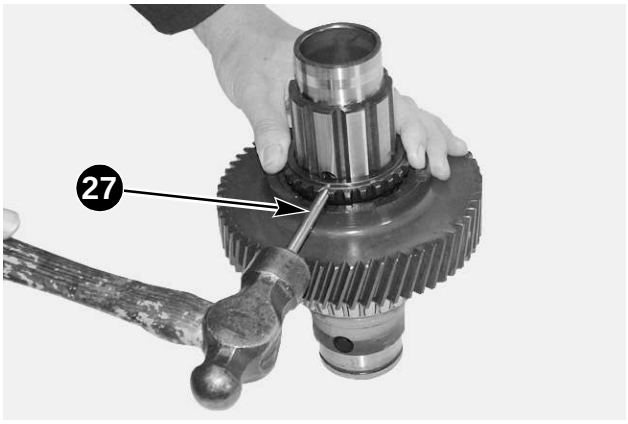
### STEP 19




MD06F121

Install gear (29) and shift collar (28) onto the output shaft (32). Make sure align hole (F) in the shift collar (28) is aligned with slot (E) in the output shaft and (32).

### STEP 20

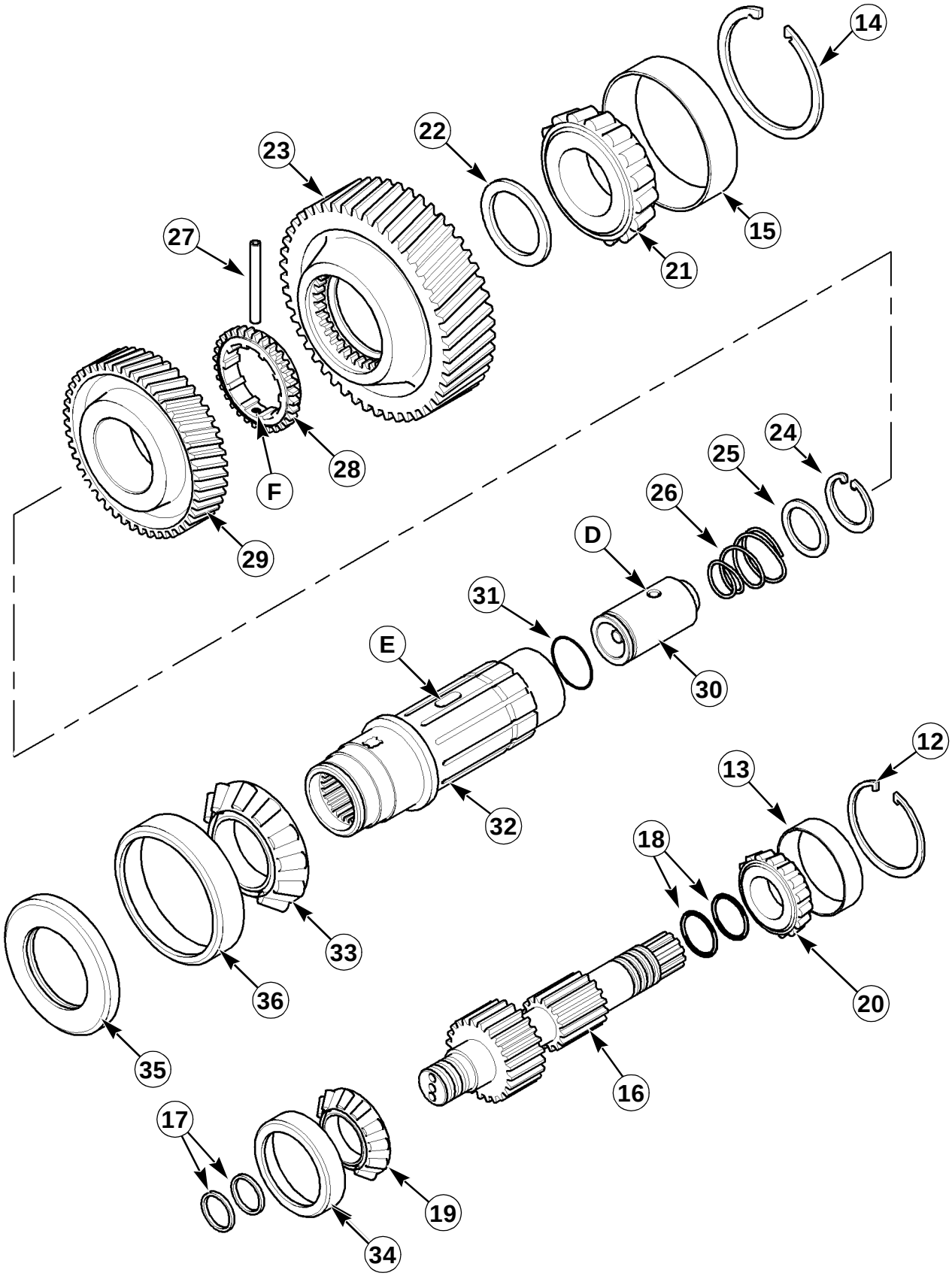



MD06F122

Align the hole (F) in the shift collar (28) with hole (D) in sleeve (30). Partially install retaining pin (27) into the shift collar (28) and sleeve (30).

https://truckmanualshub.com/





https://truckmanualshub.com/



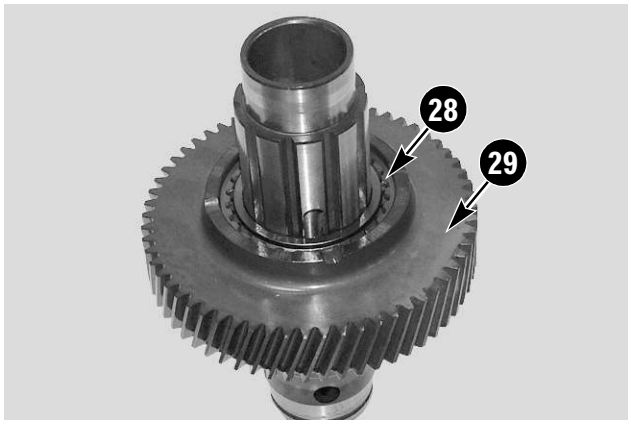
## STEP 21



MD06F118

Continue to install the retaining pin (27) until the retaining pin is installed an equal distance into each side of the shift collar (28).

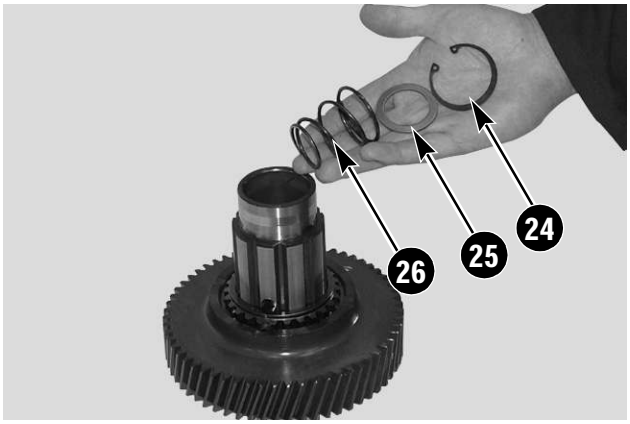
## STEP 22




MD06F118

Push sleeve (30) down until the teeth of shift collar (28) locate into the gear (29).

## STEP 23

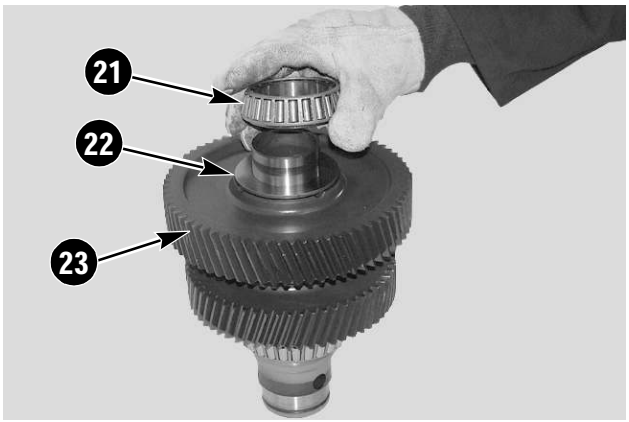



MD06F111

Install spring (26), washer (25), and retaining ring (24). Make sure the smaller diameter of the spring is positioned over the boss in the sleeve (30) and the snap ring (24) locates correctly into the snap ring groove in the output shaft (32).

**IMPORTANT:** *The retaining ring (24) is spring loaded. Care must be taken when installing the retaining ring.*

## STEP 24



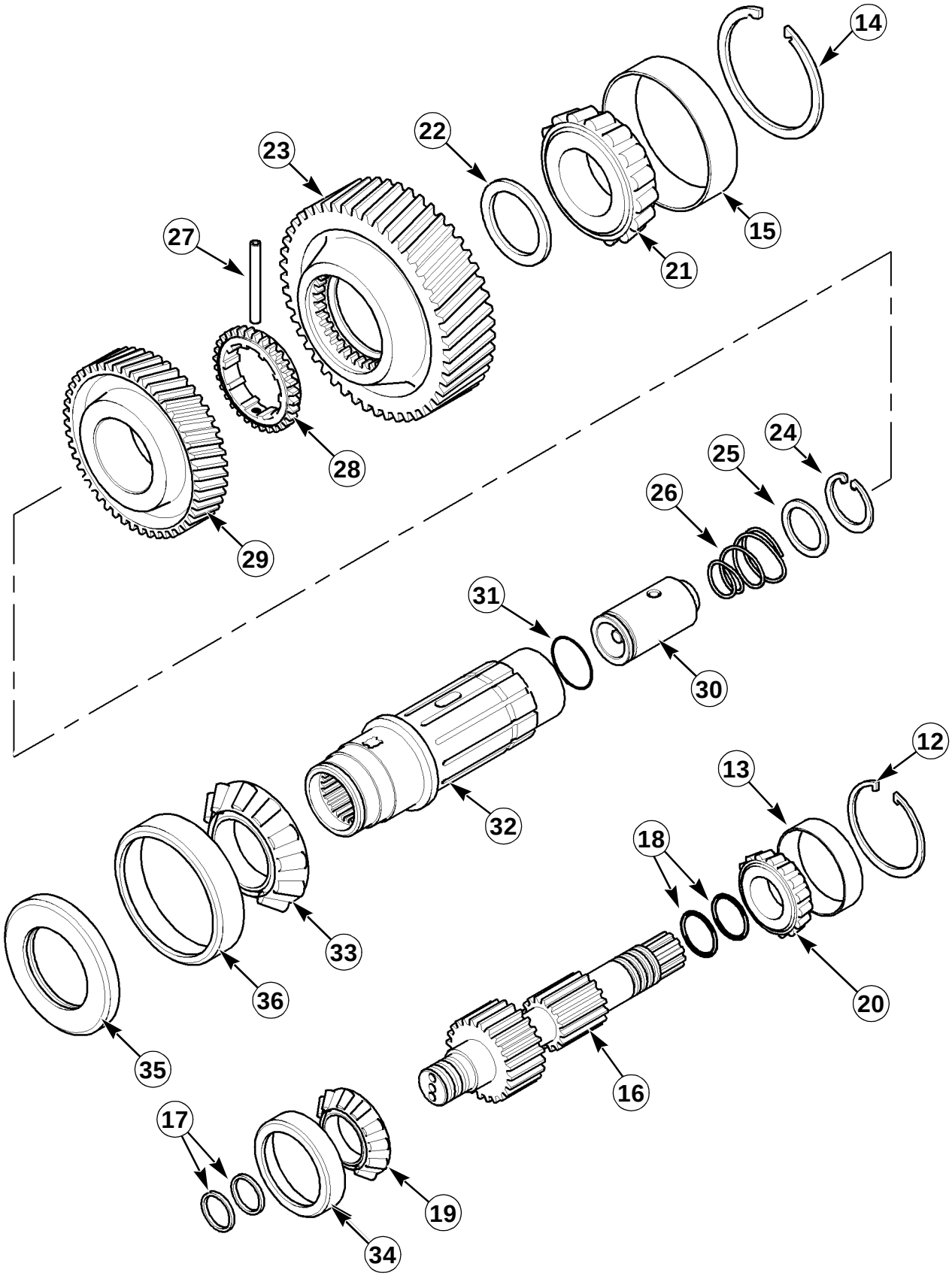

MD06F111

Install gear (23) and thrust washer (22). Heat bearing cone (21) in a bearing oven to a temperature of 110℃ (230℉). Install bearing cone (21) onto the output shaft (31). Make sure the bearing is fully installed against the thrust washer (22).

**WARNING:** ***Always wear heat protective gloves or mittens when handling heated parts.***

https://truckmanualshub.com/



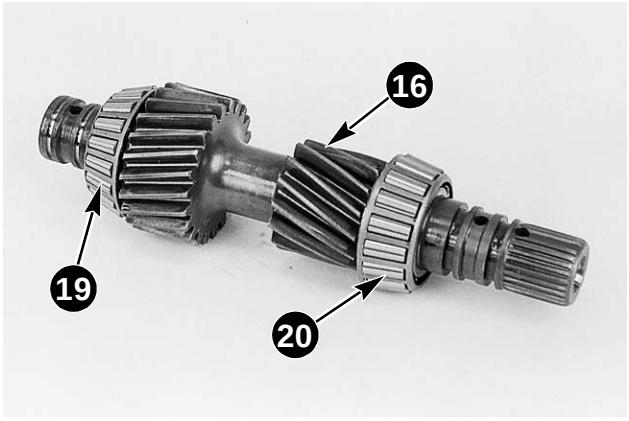


https://truckmanualshub.com/



**IMPORTANT:** *One end plug is installed into the PTO input shaft (16) at the factory. The plug is installed into the PTO clutch oil pressure gallery, the lubrication gallery is not plugged.*

## STEP 25

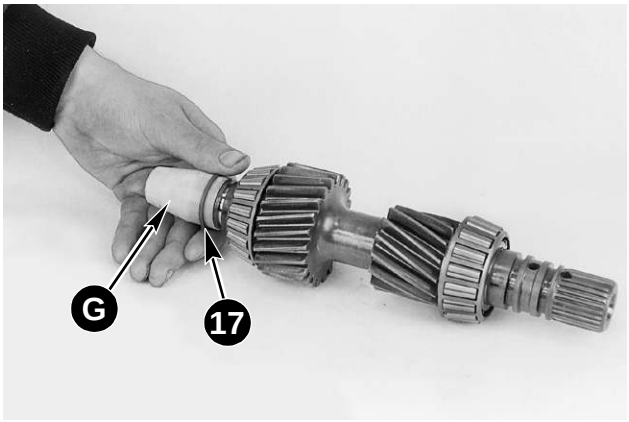



DP97A310

Heat the PTO input shaft bearing cones (19) and (20) in a bearing oven to a temperature of 110℃ (230℉) . Install the bearing cones onto the PTO input shaft (16). Make sure the bearings are against the shoulders on the PTO input shaft.

> ⚠ ***WARNING: Always wear heat protective gloves or mittens when handling hot parts.***

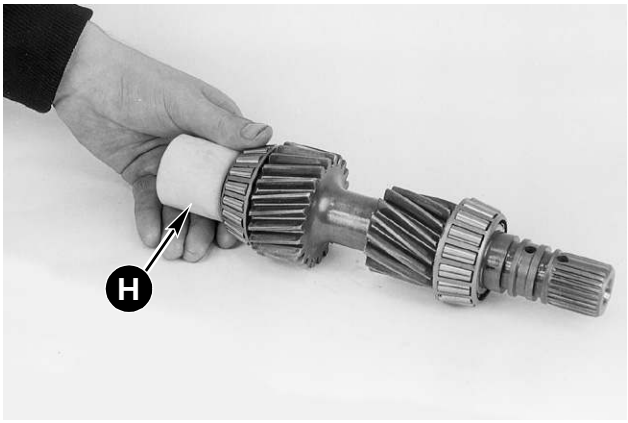
## STEP 26




DP97A311

Lubricate new seal ring (17) with clean transmission oil. Using seal expander (G) MC2001, install the seal ring into the inner groove on the PTO input shaft (16). Remove the seal expander (G).

## STEP 27




DP97A312

Compress and reshape the seal ring by hand. Install the long chamfer end of the seal compressor (H) MC2005-3 over the PTO input shaft (16) and seal ring (17). Remove the seal compressor (H) and install the short chamfer end over the seal ring.

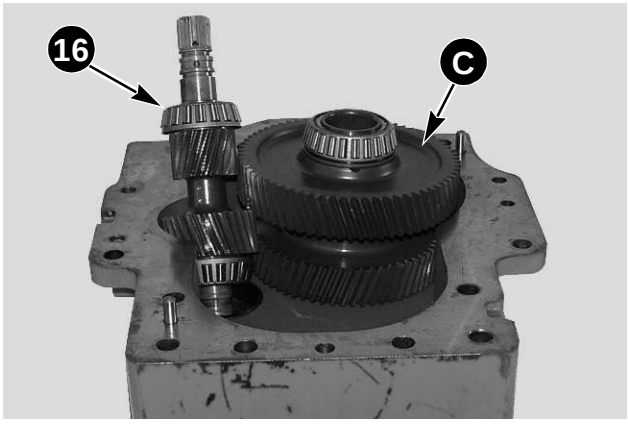
**IMPORTANT:** *Only by using the seal compressor MC2005-3 can the seal rings be compressed to their correct working size.*

## STEP 28

Repeat Step 26 and Step 27 for the remaining seal ring (17).

**IMPORTANT:** *Check the new seal rings are not twisted or damaged and the seal rings will turn freely in the grooves.*

## STEP 29



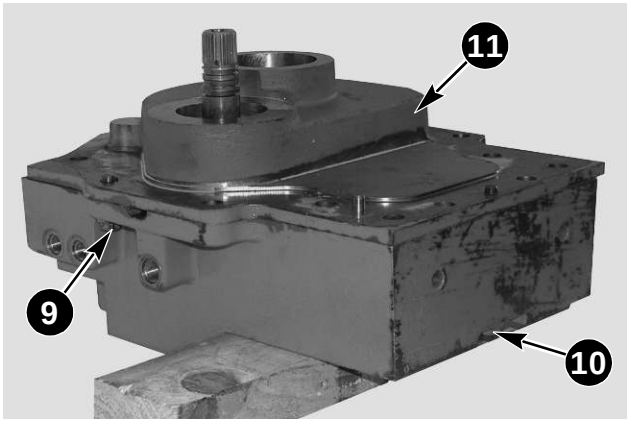

MD06G020

Partially install the PTO input shaft (16) into the PTO housing. Install the PTO output shaft assembly (C). As the PTO output shaft assembly is being installed, install the input shaft (16) into the lower bearing cup. Care must be taken not to damage the input shaft seal rings.

https://truckmanualshub.com/



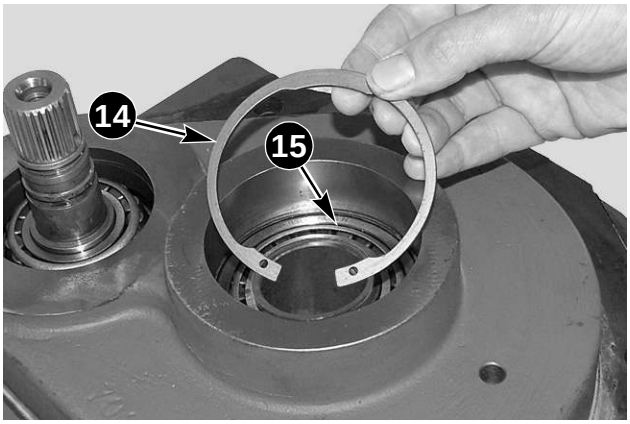
## STEP 30




MD06F049

Apply a continuous bead of Loctite 515 to the PTO housing front cover mounting face. Make sure the dowels are in place and install the front cover (11). Install the lower retaining bolt (10) and upper retaining bolts (9) (both sides). Tighten the bolts to a torque of 100 to 113 Nm (74 to 83 lb ft).

## STEP 31

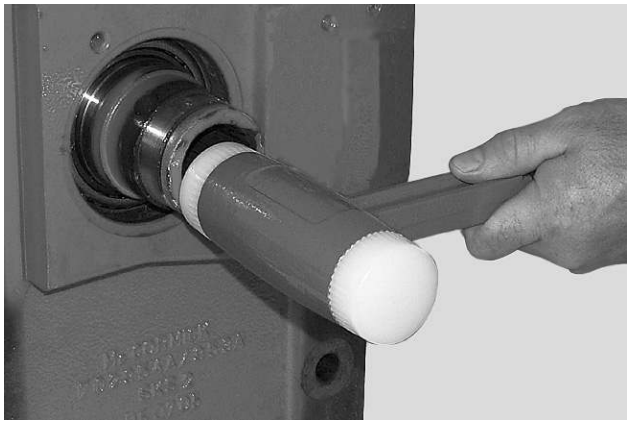



MD06G014

Install bearing cup (15) into the front cover, select and install the thickest snap ring (14) that can be installed correctly into the snap ring groove.

**NOTE:** *Snap rings (14) are available in the following thicknesses, 2.56 mm, 2.66 mm, 2.76 mm, 2.86 mm, 2.96 mm, 3.06 mm, 3.16 mm, 3.26 mm and 3.36 mm.*

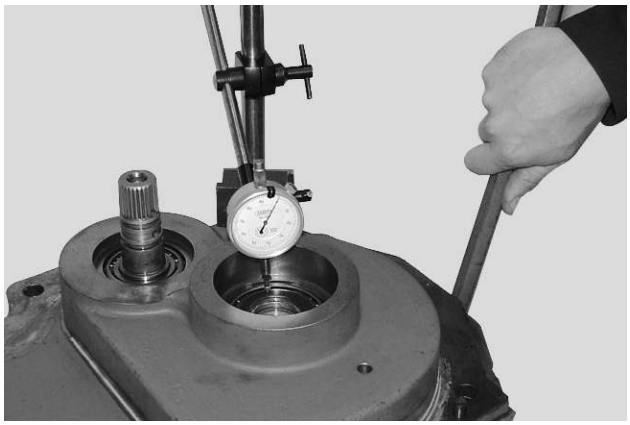
## STEP 32



MD06F121

Use lifting equipment and raise the PTO housing into the vertical position. Use a soft faced hammed on the output shaft to seat the bearing cup (15) against the snap ring (14).

## STEP 33



MD06F056

Lower the PTO housing and rotate the output shaft several times to seat the bearings by rotating the input shaft.

Install a dial gauge onto the PTO output shaft, zero the gauge. Using a lever against the rear of the output shaft, lift the output shaft and note the end play reading. The end play must be 0.025 to 0.125 mm (0.001 to 0.005 inch).

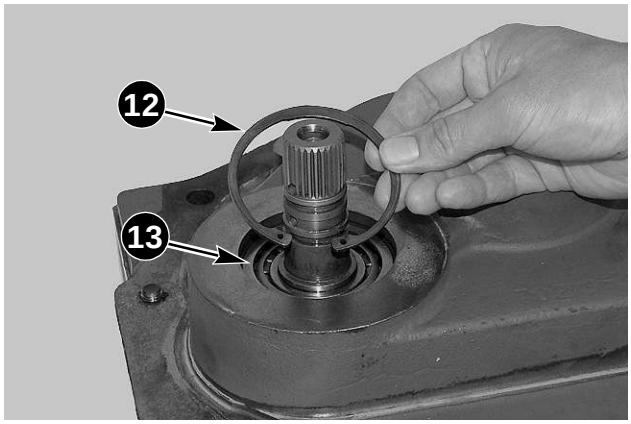
## STEP 34

If the end play is not correct remove snap ring (14) and repeat Step 31 to Step 33.

https://truckmanualshub.com/



## STEP 35

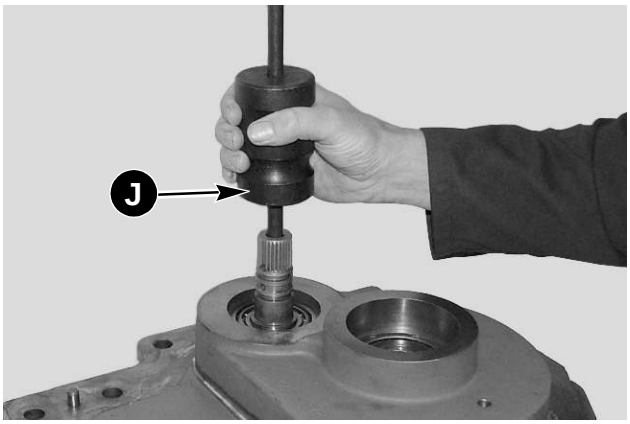



MD06F017

Install bearing cup (13) into the front cover, select and install the thickest snap ring (12) that can be installed correctly into the snap ring groove.

**NOTE:** *Snap ring (12) are available in the following thicknesses, 2.065 mm, 2.165 mm, 2.265 mm, 2.365 mm, 2.465 mm, 2.565 mm, 2.665 mm, 2.765 mm and 2.865 mm.*

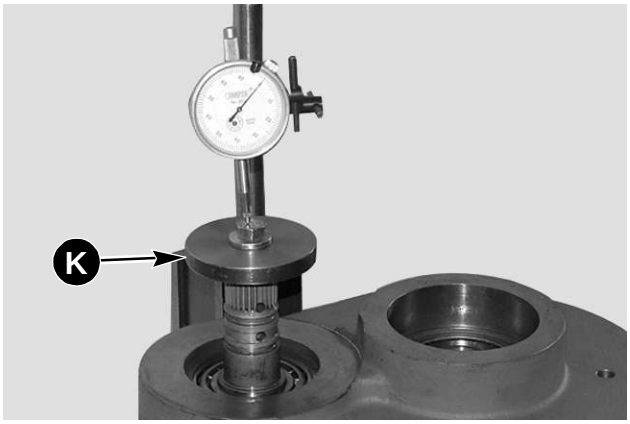
## STEP 36




MD06F093

Using a slide hammer (J) (with a 12 mm x 1.75 mm thread) installed into the end of the input shaft, seat the bearing cup (13) against the snap ring (12).

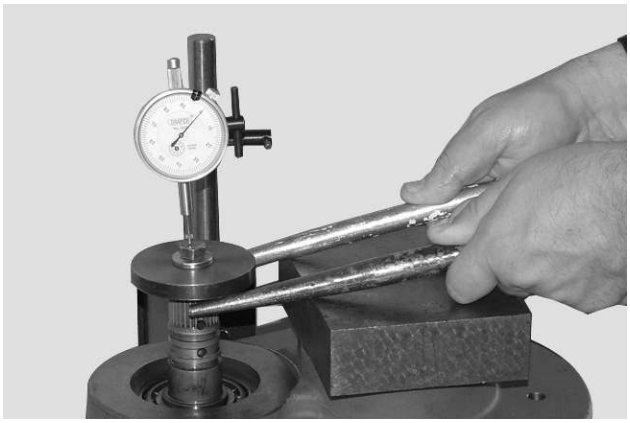
## STEP 37




MD06G078

Install washer (K) (refer to Tools to be Made), into the end of the input shaft using a 12 mm x 25 mm bolt. Install dial gauge onto end of the input shaft, zero the dial gauge. Rotate the input shaft several times to seat the bearings.

## STEP 38



MD06G079

Using a suitable block and two levers under washer (K) lift the input shaft and note the end play reading. The end play must be 0.025 to 0.125 mm (0.001 to 0.005 inch).

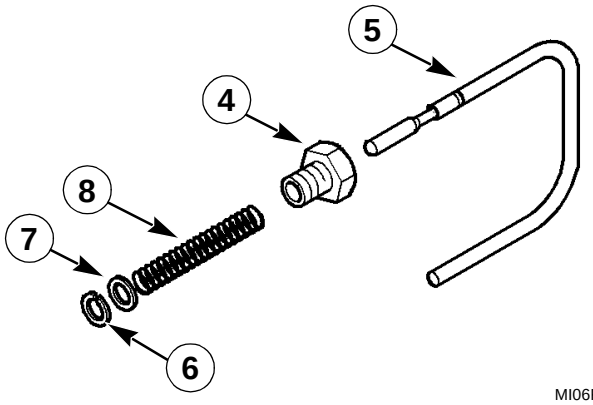
## STEP 39

If the end play is not correct remove snap ring (14) and repeat Step 35 to Step 38.

https://truckmanualshub.com/



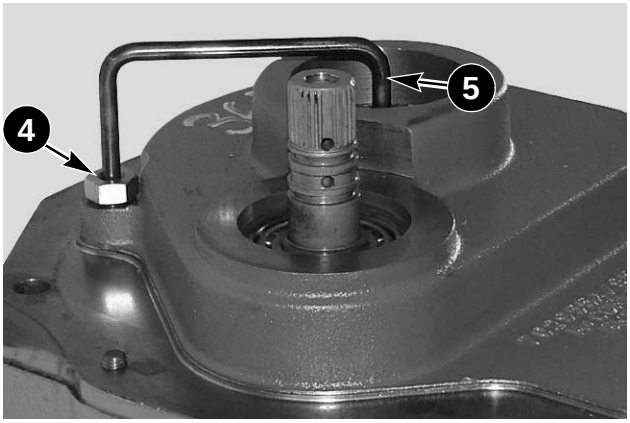
## STEP 40




MI06F124

Lubricate and install a new o-ring onto fitting (4). Install fitting (4), spring (8) and washer (7) onto rod (5). Compress spring (8) and install retaining ring (6). Make sure the retaining ring locates correctly into the groove in rod (5).

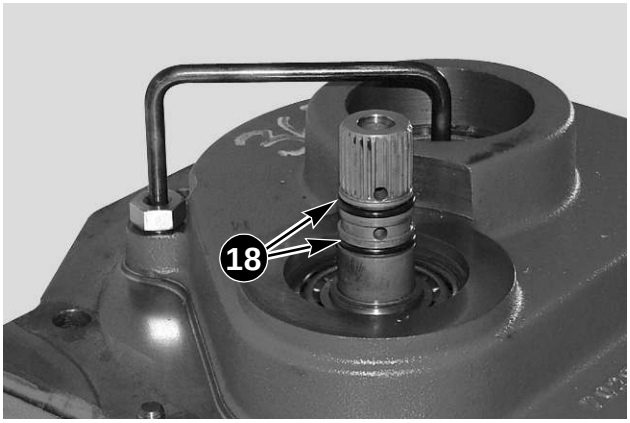
## STEP 41




MD06F016

Install rod assembly and install and tighten fitting.

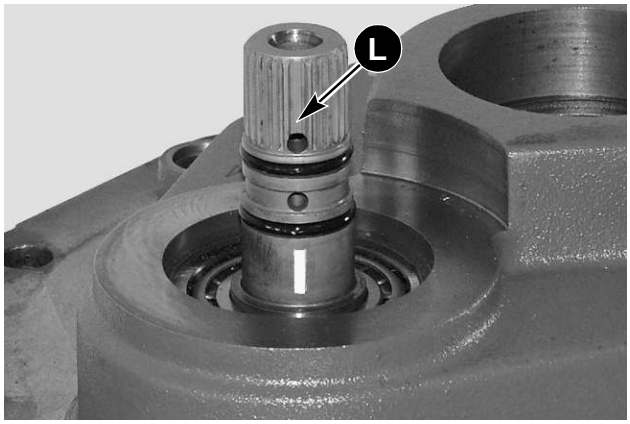
## STEP 42



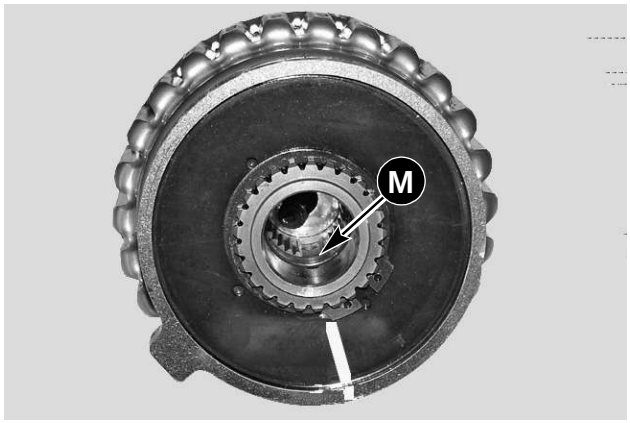

MD06F028

Lubricate and install new o-rings (18) into the grooves in the PTO input shaft.

## STEP 43



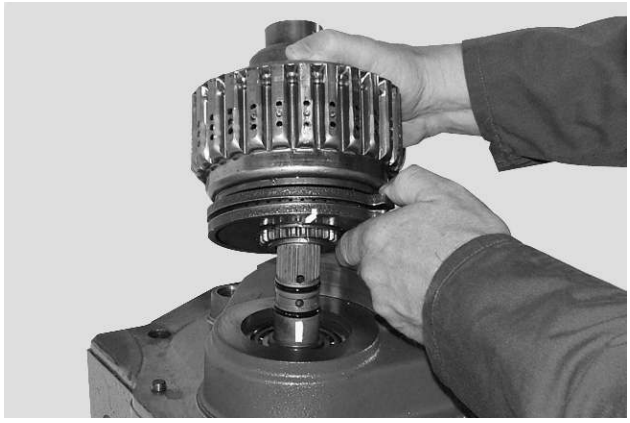

MD06G026




MD06G027

Put alignment marks on the input shaft and PTO clutch assembly in line with the double splines (L) on the input shaft and on the clutch assembly (M) as shown.

## STEP 44



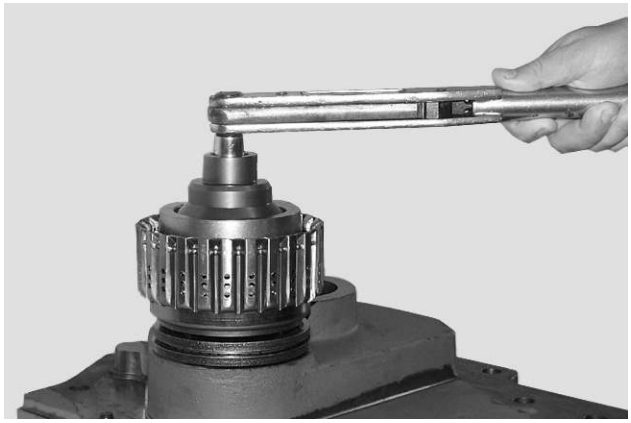
MD06G028

Align the marks made in Step 43 and install the PTO clutch assembly onto the input shaft.

https://truckmanualshub.com/



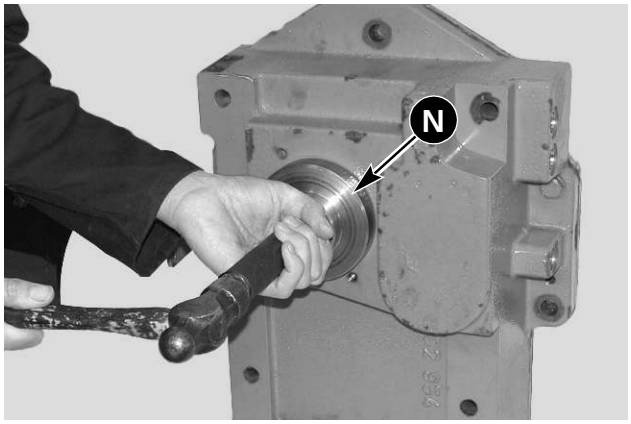
## STEP 45



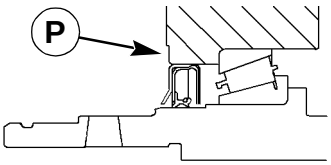
MD06G081

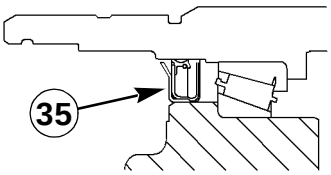
Tighten the clutch retaining bolt to a torque of 130 Nm (95 lb ft).

## STEP 46



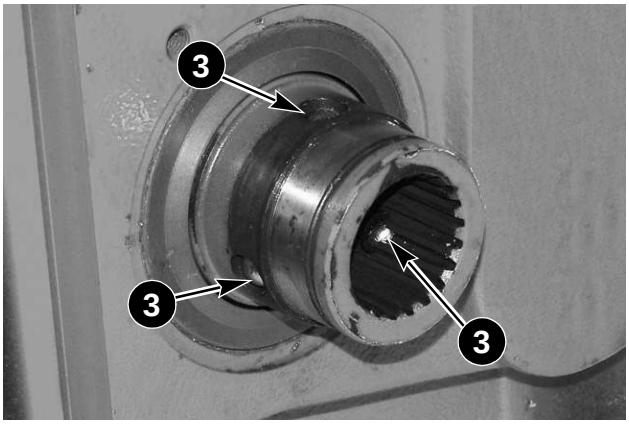

MD06F095




Apply Loctite 609 to the outer edge of a new output shaft seal (35). Use a suitable seal installer (N) and install the output shaft seal (35). Make sure the seal is level with the machined face (P) of the PTO housing.

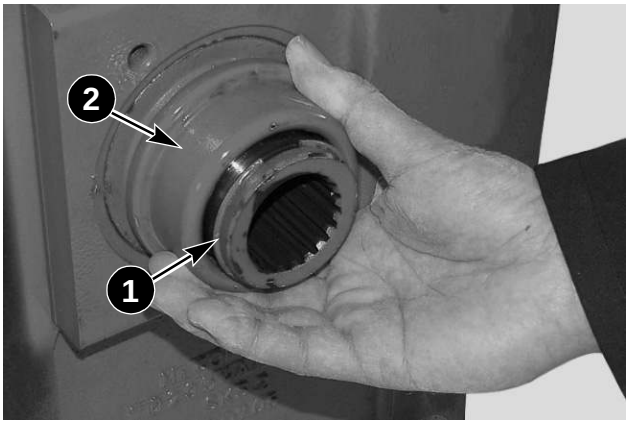
## STEP 47




MD06F122

Install the three retaining balls (3) into the PTO output shaft.

## STEP 48



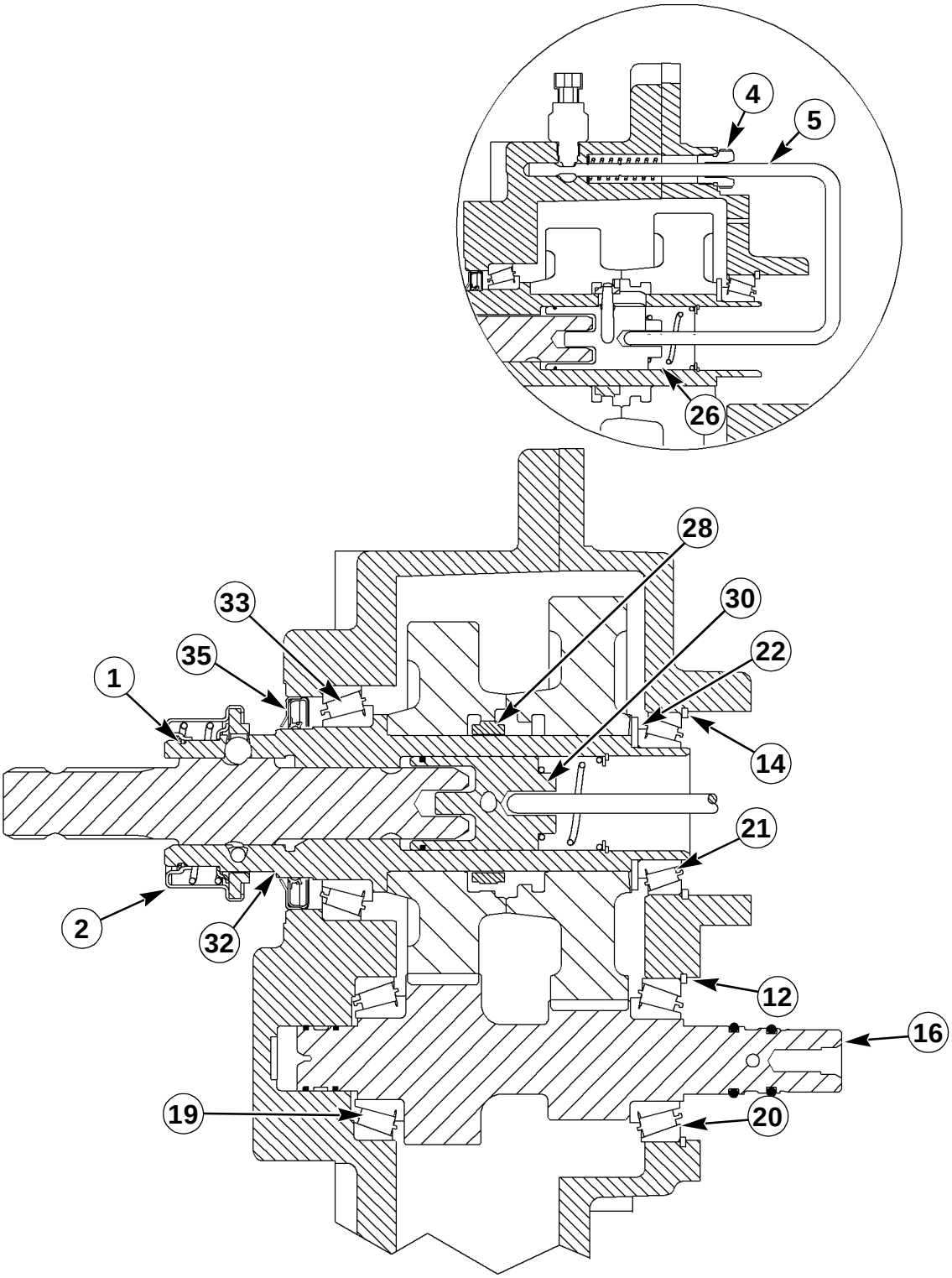

MD06F113

Install PTO output shaft retaining sleeve (2) onto the output shaft. Push and hold the retaining sleeve (1) towards the PTO housing and install the retaining ring (1). Make sure the retaining ring locates correctly into the groove in the output shaft.

https://truckmanualshub.com/



## Cross Sectional Drawing of the Reversible PTO




1. RETAINING RING
2. OUTPUT SHAFT RETAINING SLEEVE
4. FITTING
5. ROD ASSEMBLY
12. SNAP RING
14. SNAP RING
16. INPUT SHAFT
19. BEARING CONE
20. BEARING CONE
21. BEARING CONE
22. THRUST WASHER
26. SPRING
28. SHIFT COLLAR
30. INNER SLEEVE
32. OUTPUT SHAFT
33. BEARING CONE
35. SEAL

https://truckmanualshub.com/



# Section 6021

## MFD FRONT AXLE

## XTX Series Tractors

## 20.29 Axles

McCORMICK

SM 8-15250

© 2006 McCormick Tractors International Limited.
September 2006

Whilst every effort is made to ensure that the specifications, desciptions, photographs and illustrations in this publication are correct at the time of going to print, they may not be up to date as a result of modifications adopted by the Manufacturer at any time.
All information within this publications has been provided by Carraro SpA.

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIFICATIONS ..... 3

SPECIAL TORQUES ..... 4

SPECIAL TOOLS ..... 5

DISASSEMBLY OPERATIONS ..... 9

- Steering cylinder group ..... 10
- Epicyclic reduction gear ..... 11
- Wheel hub group ..... 12
- Axle beam group ..... 15
- Differential support group ..... 17
- Pinion group ..... 19
- Differential group ..... 21

ASSEMBLY OPERATIONS ..... 23

- Pinion group ..... 24
- Differential group ..... 27
- Differential carrier group ..... 29
- Axle beam group ..... 34
- Wheel hub group ..... 35
- Epicyclic reduction gear ..... 39
- Steering cylinders group ..... 40
- Toe-in adjustment ..... 42
- Steering angle adjustment ..... 44
- Testing after assembly ..... 45

https://truckmanualshub.com/



# SPECIFICATIONS

| | | |
|---|---|---|
| DIFFERENTIAL | | |
| Pinion Bearing Pre-load | 92 to 139 N | 20 to 31 lb f |
| Pinion Bearing and Differential Bearing Total Pre-load | 92 (+ 92) to 139 (+ 107) N | 20 (+ 20) to 31 (+ 24) lb f |
| Bevel Gear Backlash | 0.18 to 0.23 mm | 0.007 to 0.009 inch |
| Shim Thickness for Pinion Height Setting | 2.5 (min.) to 3.4 mm (max.) | 0.098 (min.) to 0.134 inch (max.) |

| | |
|---|---|
| LUBRICANTS | |
| Grease | McCormick LX Multi-purpose EP2 Grease |
| MFD Axle Pivot Pin | Loctite Anti Seize Compound |
| MFD Axle Capacities | |
| Type | SAE 85W-140 EP Gear Oil |
| Planetary | 1.5 Litres |
| Differential | 6 Litres |

https://truckmanualshub.com/



# SPECIAL TORQUES

| | | |
|---|---|---|
| Pinion Shaft Nut | Refer to SPECIFICATIONS for Pre-load | |
| Differential Housing to Axle Bolt | 169 Nm | 125 lb ft |
| Locking Plate Bolt | 13 Nm | 10 lb ft |
| Ring Gear to Differential Housing Bolt with Loctite 270 | 70 Nm | 52 lb ft |
| Breather Plug | 10 Nm | 7 lb ft |
| Oil Fill/Level Plugs | 60 Nm | 44 lb ft |
| Differential Bearing Cap Bolt | 266 Nm | 196 lb ft |
| King Pin Retaining Bolt | 180 Nm | 140 lb ft |
| Steering Stop Locknut | 150 Nm | 111 lb ft |
| Steering Cylinder to Differential Support Bolt | 120 Nm | 89 lb ft |
| Ball Joint on Steering Cylinder | 300 Nm | 221 lb ft |
| Track Rod Locknut | 250 Nm | 185 lb ft |
| Ball Joint to Swivel Housing Locknut | 220 Nm | 162 lb ft |
| Planetary Gear to Swivel Housing Bolt | 230 Nm | 169 lb ft |
| Wheel Stud with Loctite 270 | 70 Nm | 52 lb ft |
| Planetary Gear Carrier to Wheel Hub Screw | 25 Nm | 18 lb ft |
| Front Weight Frame Bolts | 425 Nm | 314 lb ft |
| Front Wheel Nuts | 530 to 570 Nm | 391 to 420 lb ft |
| MFD Axle Retaining Bolts | 570 to 645 Nm | 420 to 475 lb ft |
| Planetary Gear Retaining Bolt | 79 Nm | 58 lb ft |
| Grease Fittings | 8 Nm | 6 lb ft |

https://truckmanualshub.com/

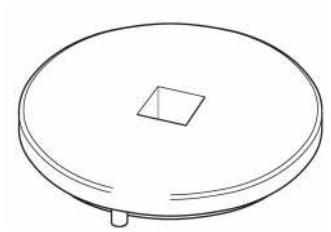


# SPECIAL TOOLS

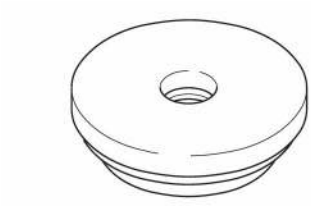
https://truckmanualshub.com/



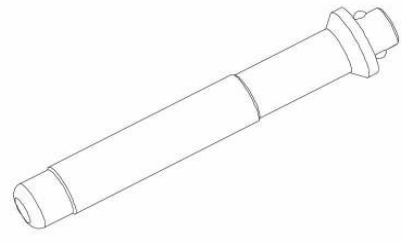
The special tools used to fit seals, bearings and bushes should always be used with the interchangeable handle CA119033 and a suitable safety handle to protect the hands.



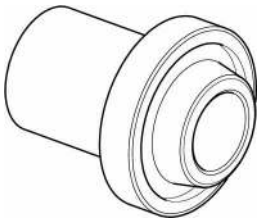
CA119030



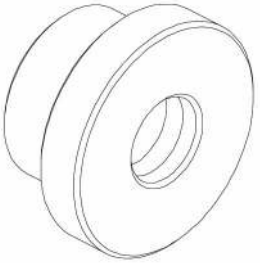
CA119143



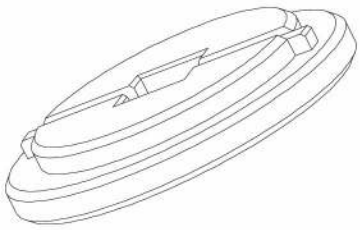
CA119033



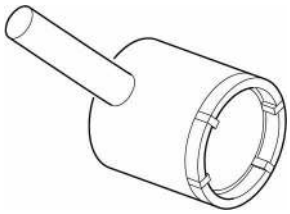
CA119148



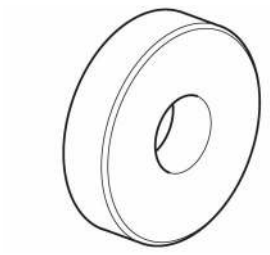
CA119055



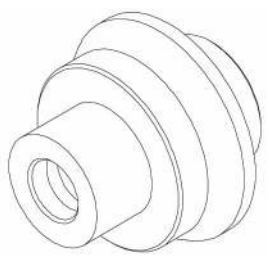
CA119149



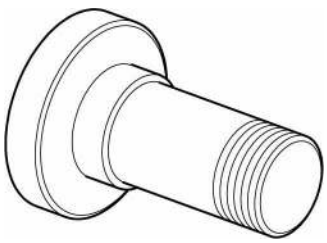
CA119099



CA7119182



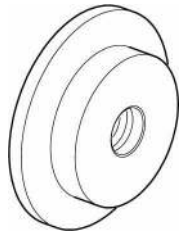
CA119139



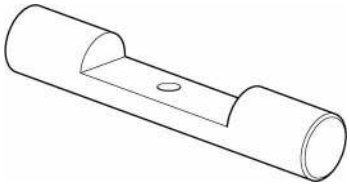
CA119202

https://truckmanualshub.com/

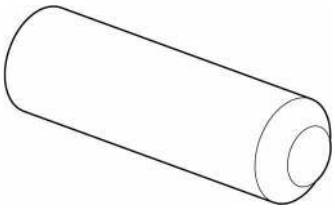




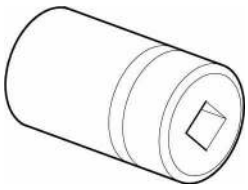
CA119225



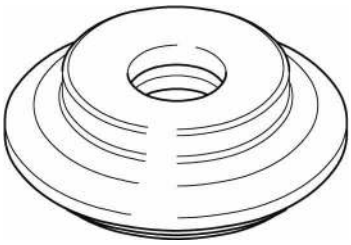
CA119228



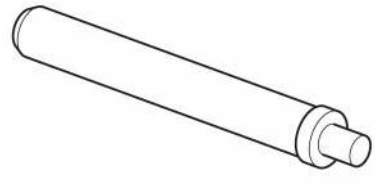
CA715004



CA715022



CA715026



CA715027



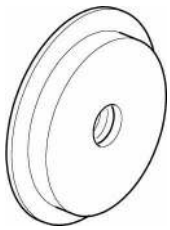
CA715034



CA715035



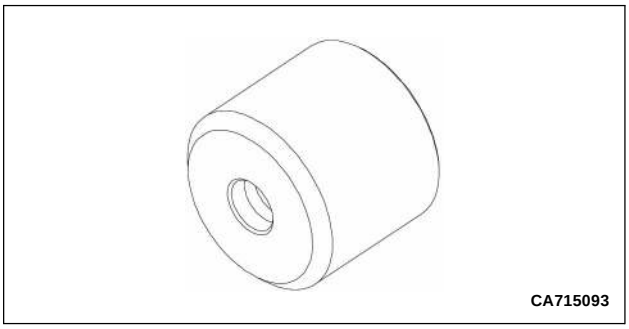
CA715036

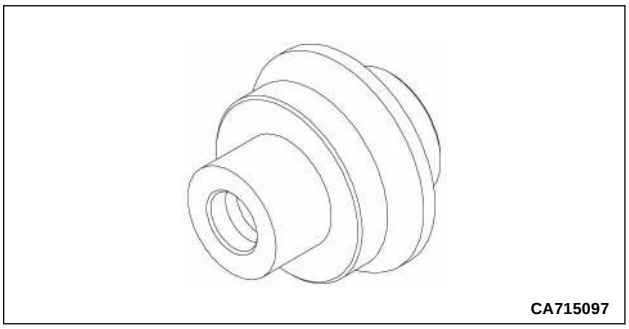


CA715092

https://truckmanualshub.com/




CA715093


CA715097

https://truckmanualshub.com/



# DISASSEMBLY OPERATIONS

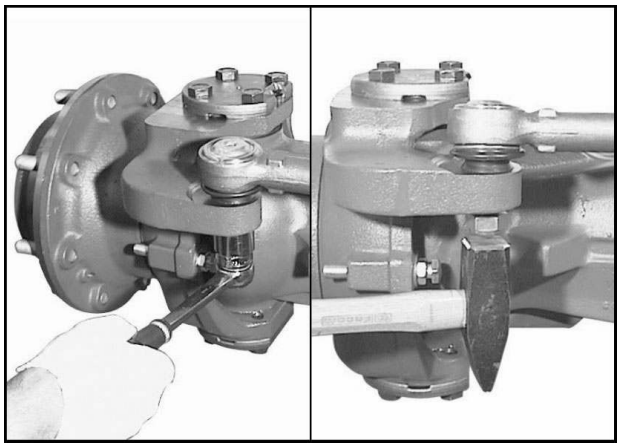
https://truckmanualshub.com/



# STEERING CYLINDER UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



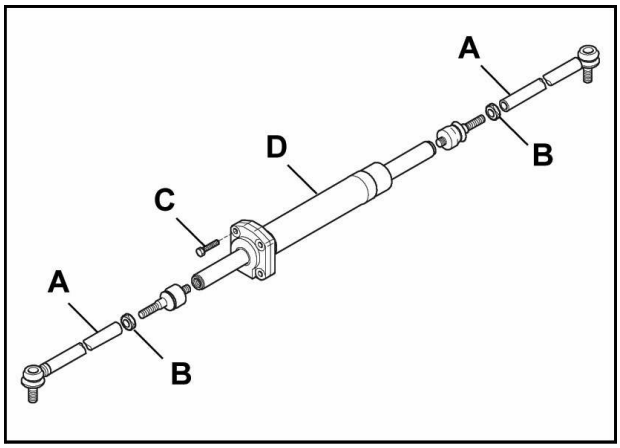
Loosen the guide rod locknut until it is over the end of the threaded pin.

Tap the nut with a hammer to separate the guide rod from the swivel housing.

**ATTENTION:** *Be careful not to hit the end of the threaded pin.*

**NOTE:** *This is a destructive operation for the nut.*

## STEP 2

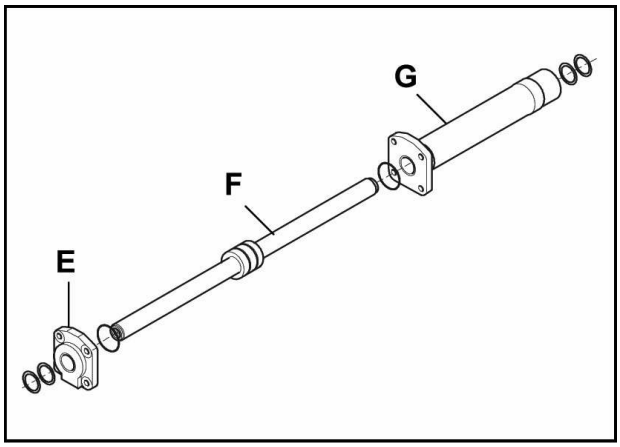



Remove the guide rod link (A) by loosening the nut (B) with a spanner. Check the condition of the parts.

Undo the cylinder securing screws (C), then ease the cylinder (D) out of its housing. If necessary, use a rubber hammer.

Remove only that parts that need to be overhauled and/or replaced.

## STEP 3




Detach the cylinder head (E) from the cylinder case (G).

Remove all the seals and O-Rings, from both the cylinder head and rod.

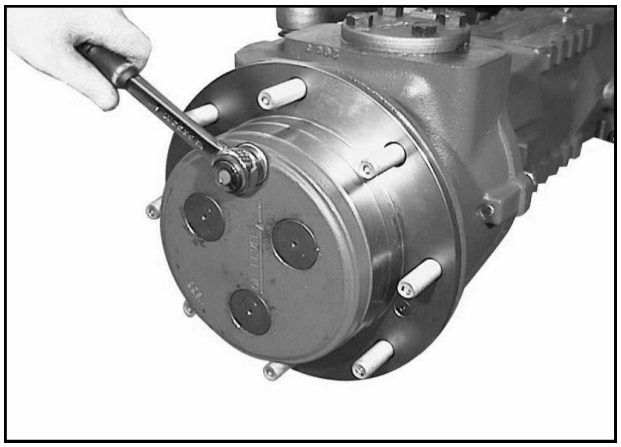
https://truckmanualshub.com/



# EPICYCLIC REDUCTION UNIT

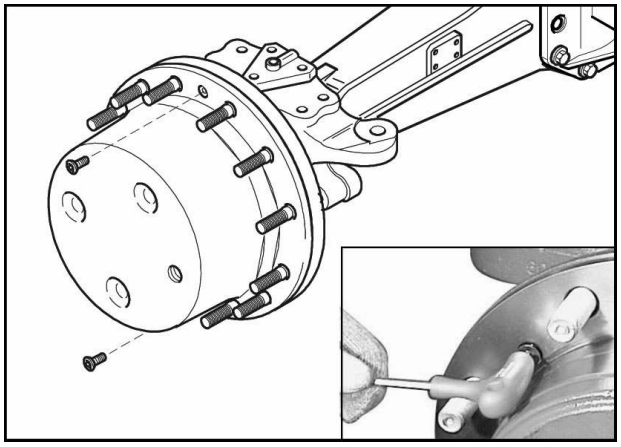
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



Before draining the oil, position the wheel hub with the plug at the top and loosen it to release any possible inner pressure, then remove it completely. Turn the wheel hub upside-down with the hole in the lowest point and drain the oil completely.

## STEP 2

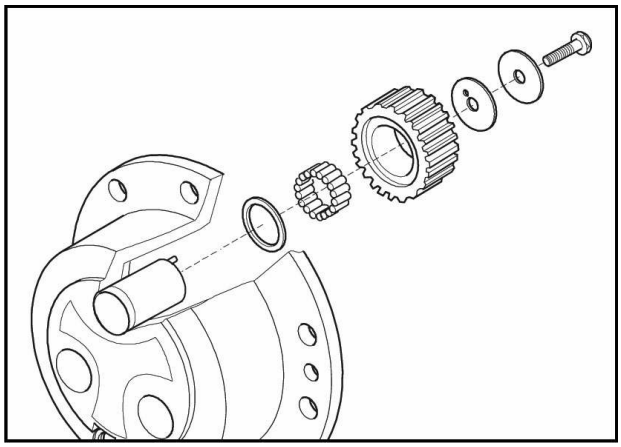


Unscrew and remove both securing screws from the planetary carrier.

Remove the planetary carrier from the wheel hub.

Position the planetary carrier on a workbench and check condition for wear.

## STEP 3



To carry out possible replacements of the planetary gears:

- remove the planetary gear securing screws.
- remove the washers.
- lift the planetary gears from the pin.
- collect the roller bearings and check condition.
- remove the thrust washers.

**NOTE:** *When replacing planetary gears, it is advisable to fit new roller bearings.*

https://truckmanualshub.com/

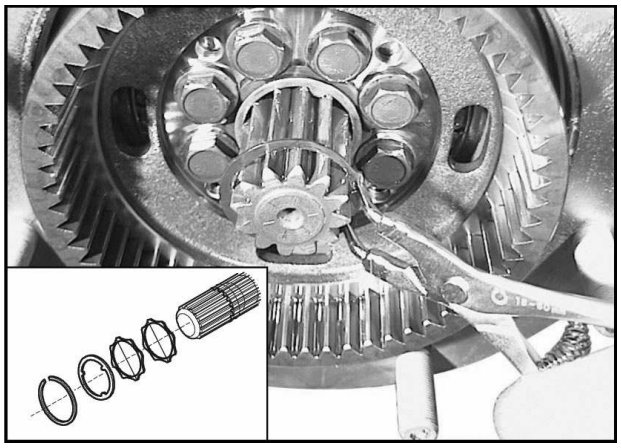


# WHEEL HUB UNIT

To avoid an accident that could damage either the operator or the wheel hub group, before disassembling the wheel hub, it is advisable to secure it with a harness on a hoist or other supporting device.

Some of the following pictures may not show your axle, but the procedure is the same.

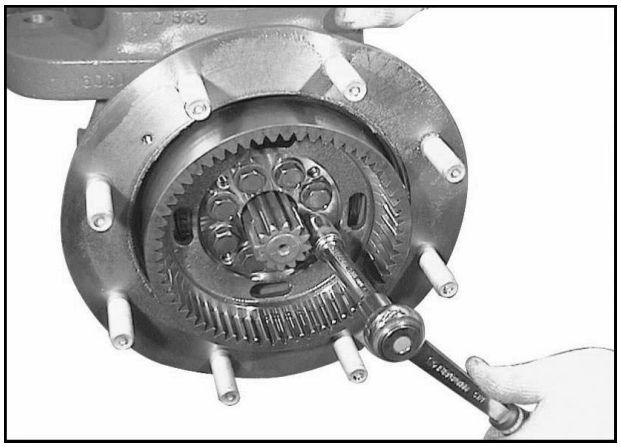
## STEP 1



Remove the steel lock ring from the U-Joint shaft using suitable pliers.

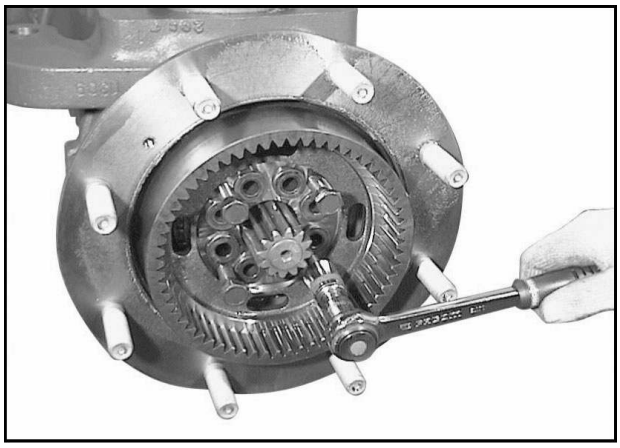
Remove and save the axle shaft washers.

## STEP 2



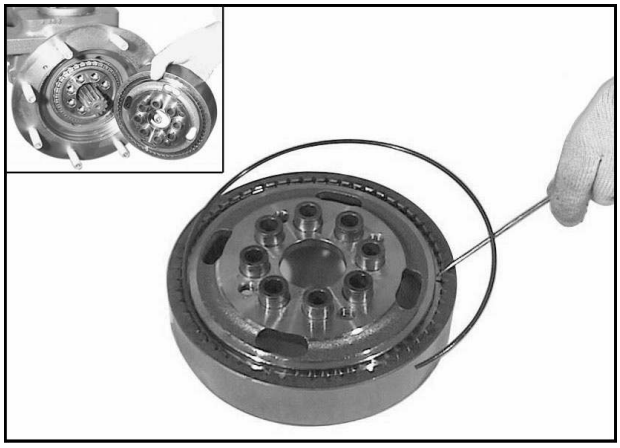
Unscrew and remove the fastening screws from the wheel carrier group.

## STEP 3



To remove the wheel carrier group from its housing, refit at least two of the just removed screws into the threaded extraction holes.

## STEP 4



Extract and remove the wheel carrier, together with the epicyclic ring gear.

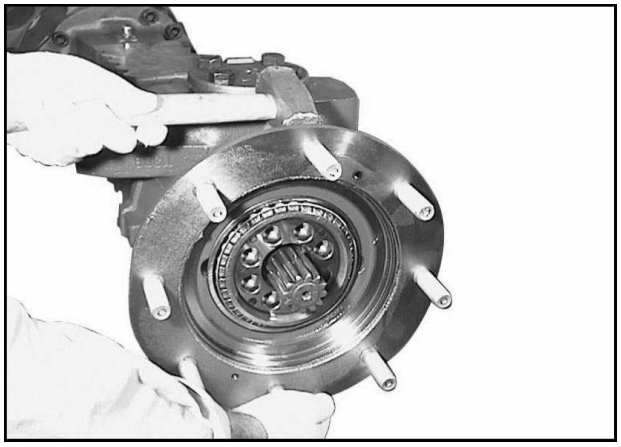
Remove the steel lock ring and separate the wheel carrier from the epicyclic ring gear. Check the condition of the components for wear.

If necessary, remove the centering bushes of the hub lock ring gear with special tool CA715027 and a hammer.

https://truckmanualshub.com/



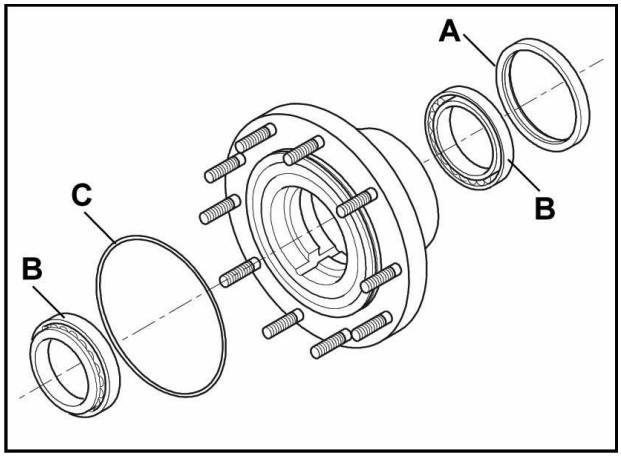
## STEP 5



Remove the wheel hub, using levers and a hammer to facilitate the operation.

**NOTE:** *Retrieve the bearing cone.*

## STEP 6




Place the wheel hub on a flat surface and, with a lever, remove the seal ring (A).

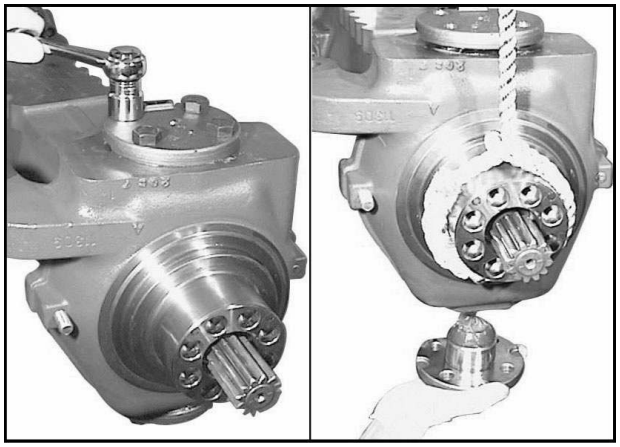
**NOTE:** *This is a destructive operation for the seal ring.*

Remove the bearing cups (B), on both sides of the hub, using a hammer and a suitable drift.

Using a suitable extractor, remove the bearing cone from the swivel housing end.

Remove the O-Ring (C) from the wheel hub.

## STEP 7



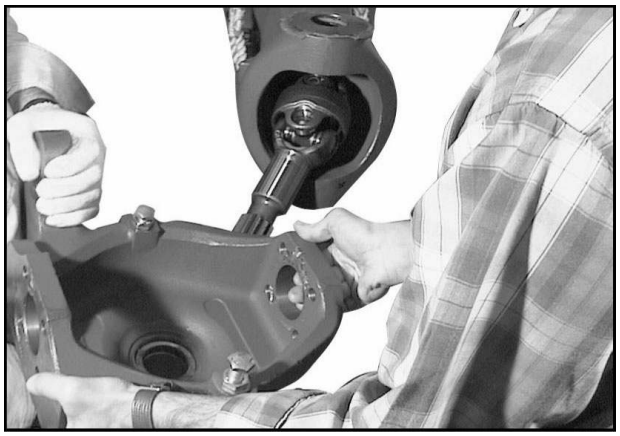
Remove the securing screws from the upper and lower king pins.

**ATTENTION:** ***B****efore removing the king pins, secure the swivel housing with a belt or a rope to a hoist or other supporting device.*

Remove the king pins.

**NOTE:** *Retrieve the Belleville washers.*

## STEP 8

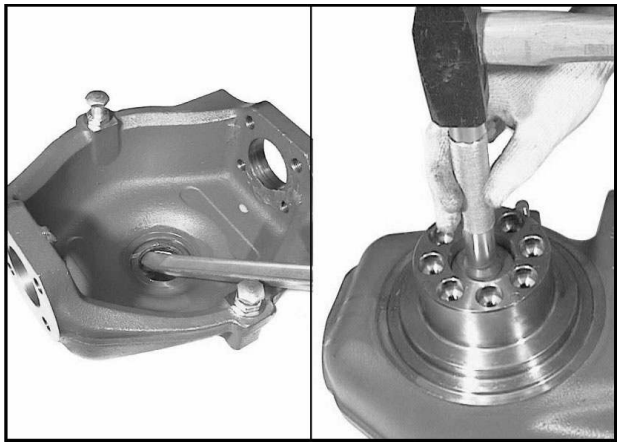


Remove the swivel housing from the axle beam and from the U-Joint short shaft.

https://truckmanualshub.com/



## STEP 9



Place the swivel housing on a flat surface and with a lever, lift out the seal ring.

**NOTE:** *This is a destructive operation for the seal ring.*

Turn the swivel housing and using a drift and hammer, take out the bush.

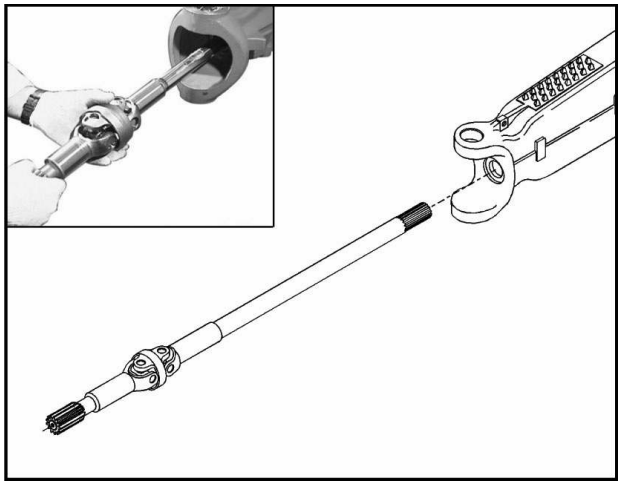
https://truckmanualshub.com/



# AXLE BEAM GROUP UNIT

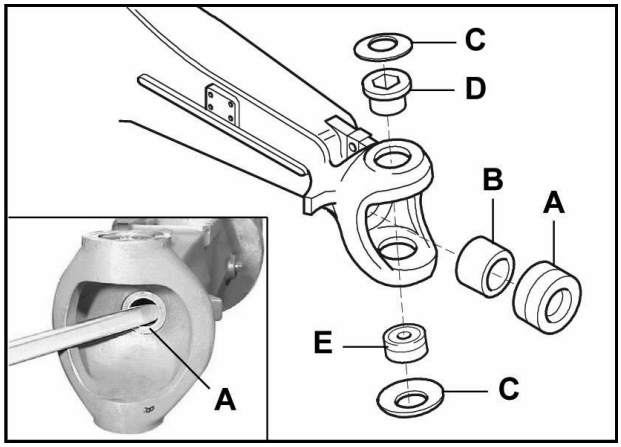
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



Remove the U-Joint from the axle beam.

## STEP 2




Lever the seal ring (A) out of the axle beam.

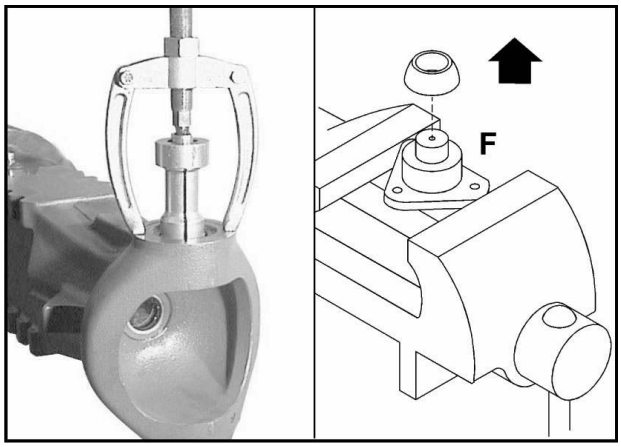
Remove the cup springs (C) from the king pin housings in the axle beam.

**NOTE:** *This is a destructive operation for the seal ring.*

Using a suitable extractor, remove the bush (B) from the beam.

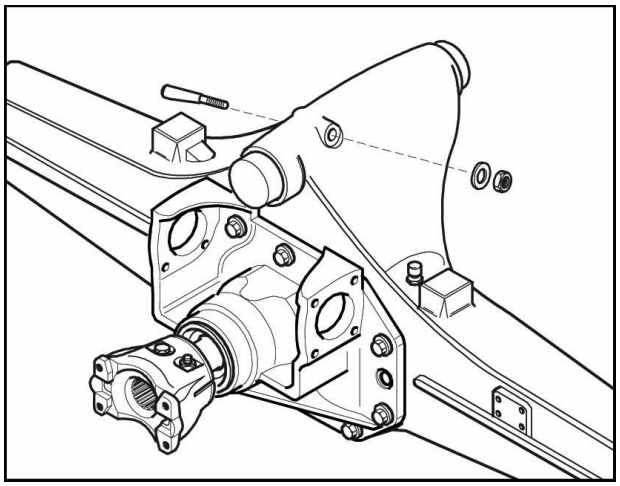
**NOTE:** *Examine the bush before removal and only replace if required.*

## STEP 3




Take the upper (D) and lower (E) bushes out of the king pin housings (F) and extract the king pin.

## STEP 4



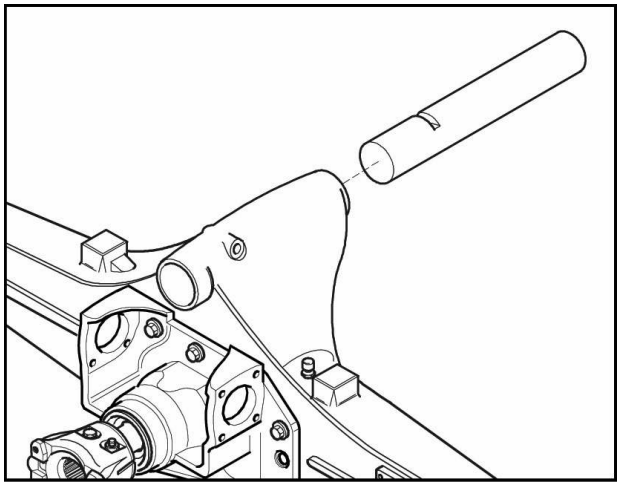
Remove the pivot lock pin retaining nut and the related washer.

Using a punch and hammer, push out the pivot lock pin from the axle beam.

https://truckmanualshub.com/



**STEP 5**



If necessary using suitable drift and a hammer, remove the pivot from the axle beam.

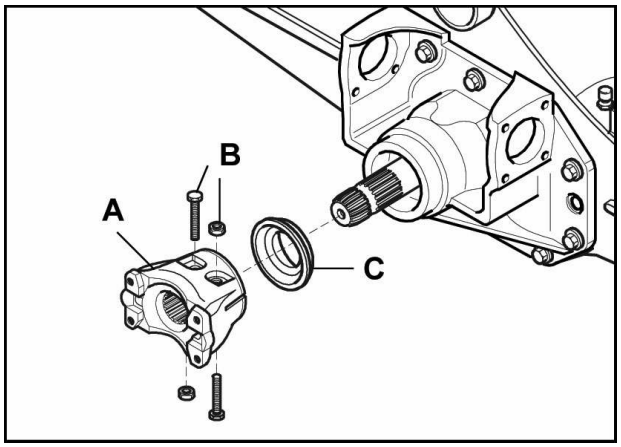
https://truckmanualshub.com/



# DIFFERENTIAL SUPPORT

Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1

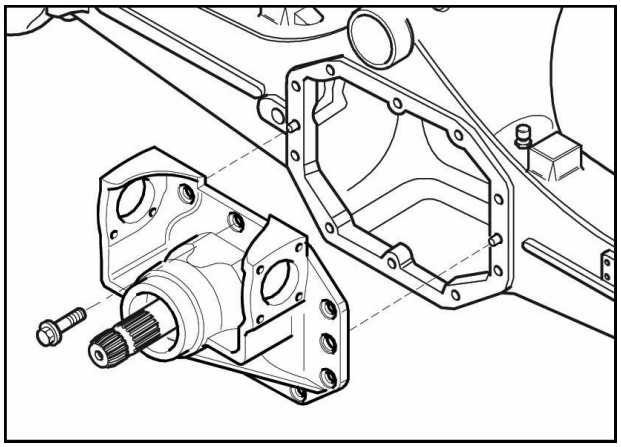



Remove the securing bolt and nut (B) from the flange (A).

Take the flange out, then remove the seal ring (C).

**NOTE:** *This is a destructive operation for the seal ring.*

## STEP 2

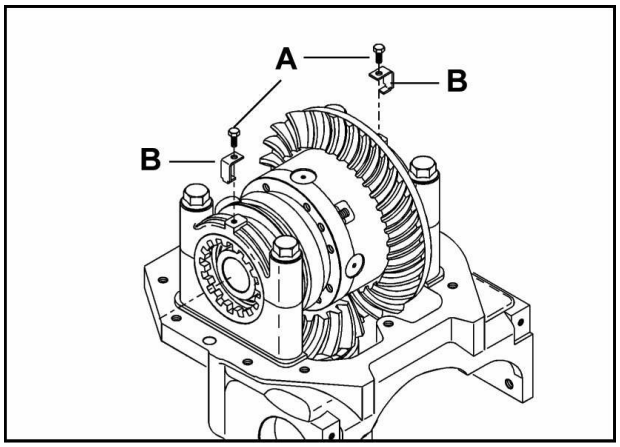


Loosen and remove the screws on the differential support.

Remove the differential carrier.

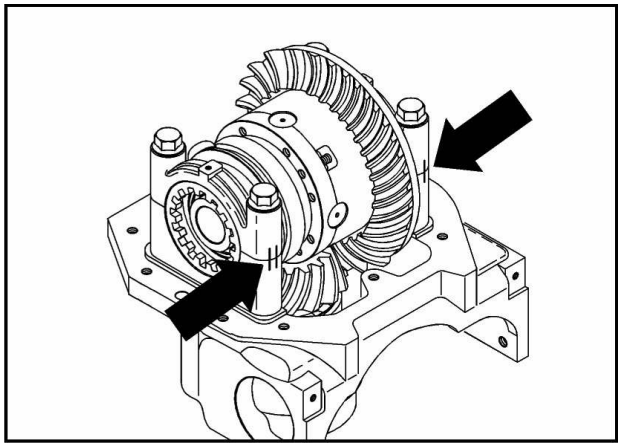
**ATTENTION:** *Support the differential carrier with a rope or other appropriate means.*

## STEP 3




Loosen and remove the screws (A) to take out the two ring nut retainers (B).

## STEP 4

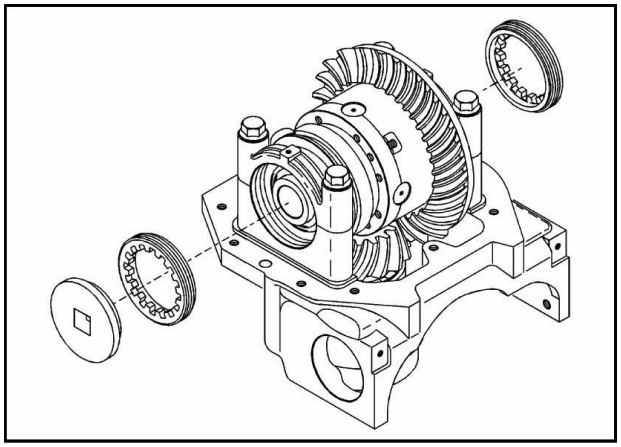


Before removing the bolts, mark both half-collars and the differential carrier with permanent reference marks to avoid inverting them during re-assembly. Mark the area between the ring nuts and the differential carrier as well.

https://truckmanualshub.com/



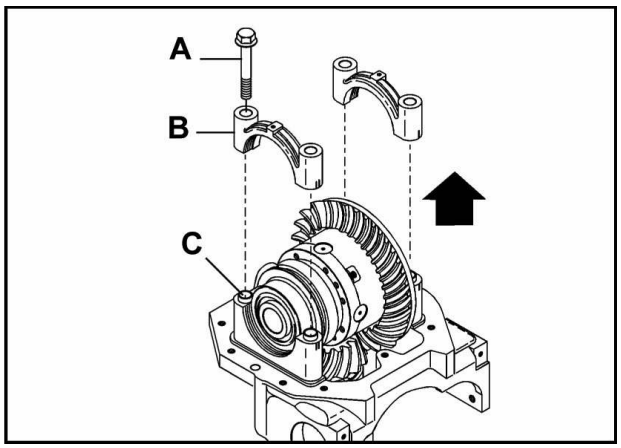
## STEP 5



Remove the adjuster ring nuts using special tools CA119030 and CA119049.

**NOTE:** *The two ring nuts are different, so take note of their position with regard to the bevel crown gear.*

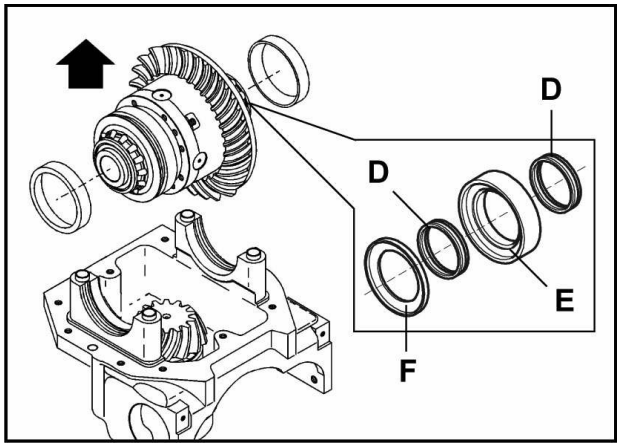
## STEP 6




Undo the 4 screws (A) and remove both half-collars (B).

**NOTE:** *Check that the bushes (C) remain in their housings.*

## STEP 7

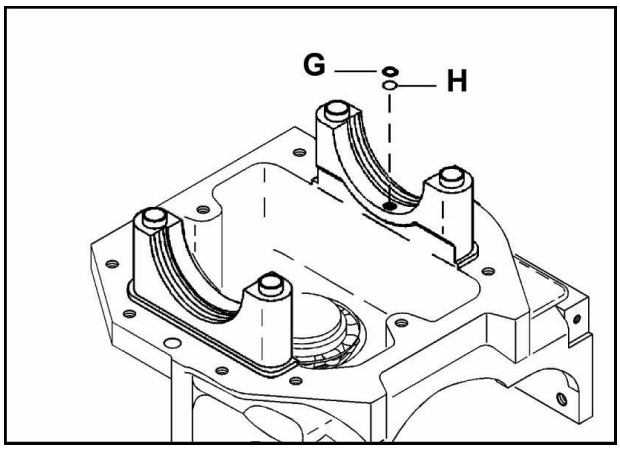



Lift the differential gear out of the casing.

Remove and collect from ring gear side, the spacer (E) with its seal rings (D) assembled, the washer (F) and the cup bearings.

**ATTENTION:** *Do not mismatch the cup bearings if they are not to be replaced.*

## STEP 8




Collect the washer (G) and the O-Ring (H) from the bearing seat on the ring gear side.

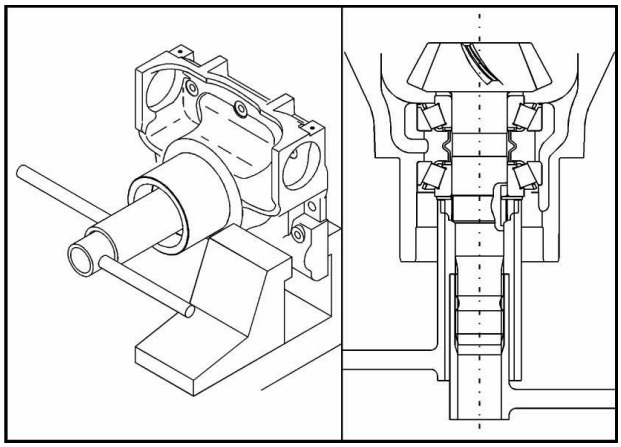
https://truckmanualshub.com/



# PINION GROUP DISASSEMBLY

Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1

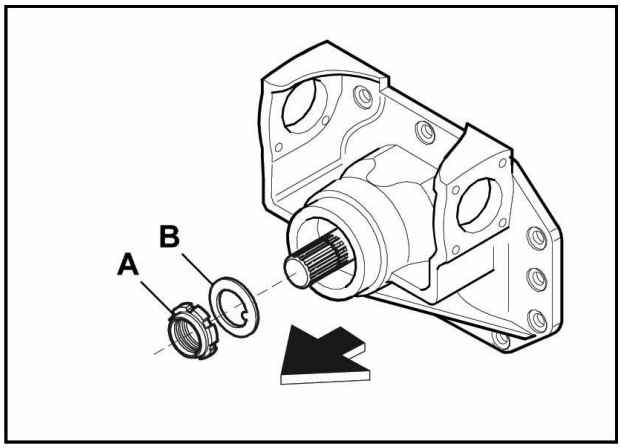


Fit the differential carrier in a vice.

Release the lock nut, using special tools CA119099 and CA715022.

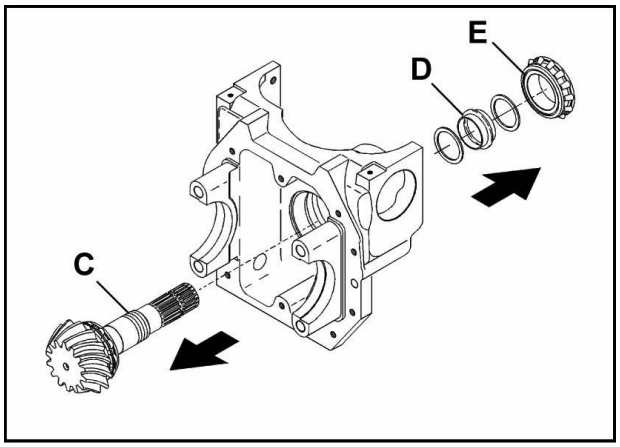
**NOTE:** *This operation will irretrievably damage the ring nut.*

## STEP 2




Remove the ring nut (A) retaining washer (B).

## STEP 3

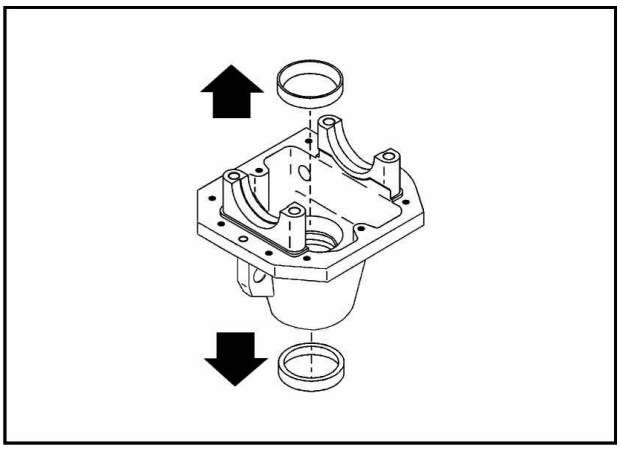



Tap the shaft with a soft hammer to remove the bevel pinion (C).

**ATTENTION:** *Take care not to drop the pinion.*

Collect the washers, the collapsible spacer (D) and the inner cone (E) of the tapered roller bearing.

## STEP 4

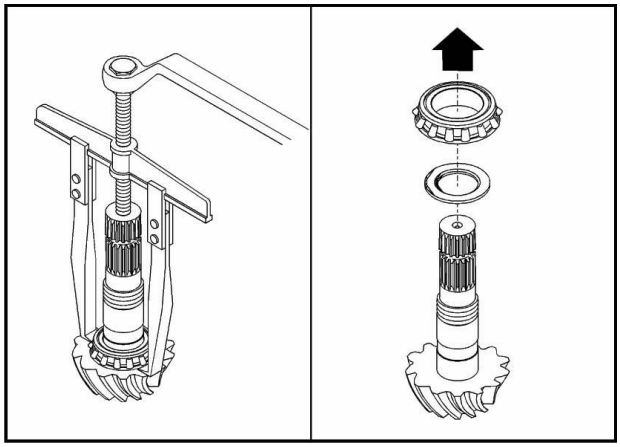


Place the differential carrier on a flat surface as shown in the figure and, using a drift and a hammer, remove the outer cups of the taper roller bearing.

https://truckmanualshub.com/



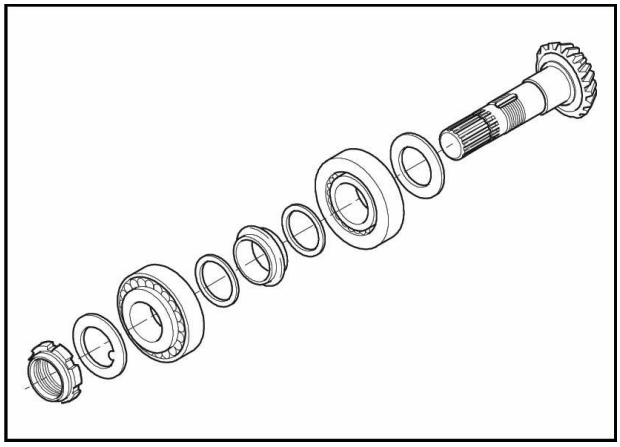
**STEP 5**



Use a standard extractor to remove the inner cone of the tapered roller bearing of the pinion.

Collect the bearing cone and the underlying shim.

**STEP 6**



Check all pinion components for wear.

The ring nut and the collapsible spacer must be replaced when reassembling the unit.

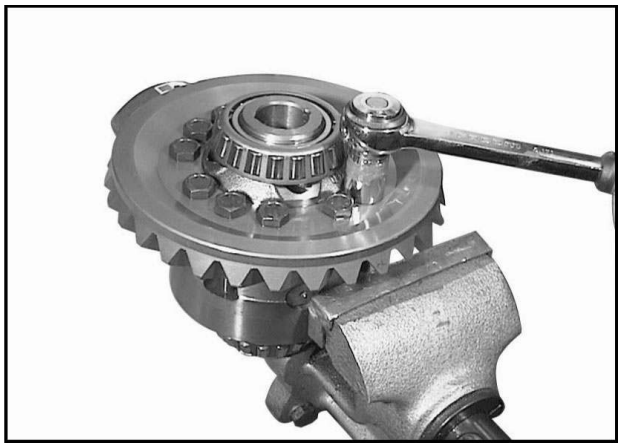
https://truckmanualshub.com/



# DIFFERENTIAL UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1

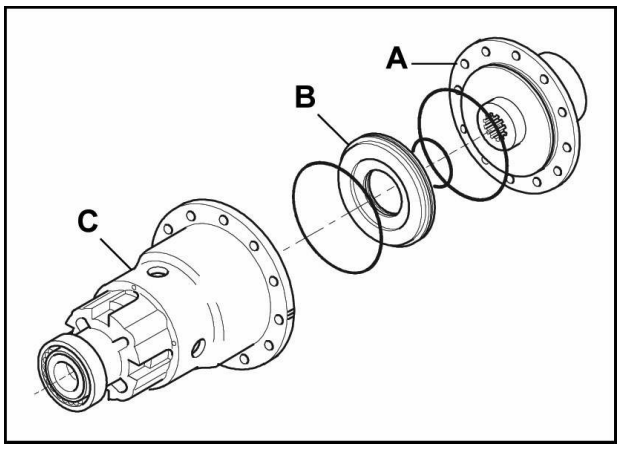


Clamp the differential in a soft jaw vice.

Undo the securing screws and remove the bevel gear crown.

**ATTENTION:** *This will free both differential half boxes. Take care not to drop the internal components.*

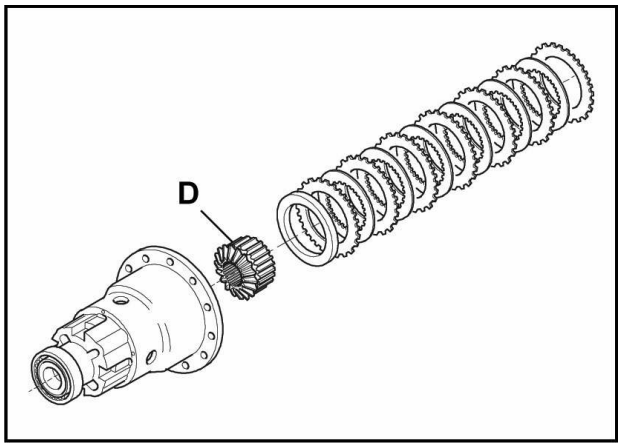
## STEP 2




Disassemble the cover (A) from the differential box (C), then remove the piston (B).

Retrieve the O-Rings from the cover and from the differential lock piston (inner and outer housings).

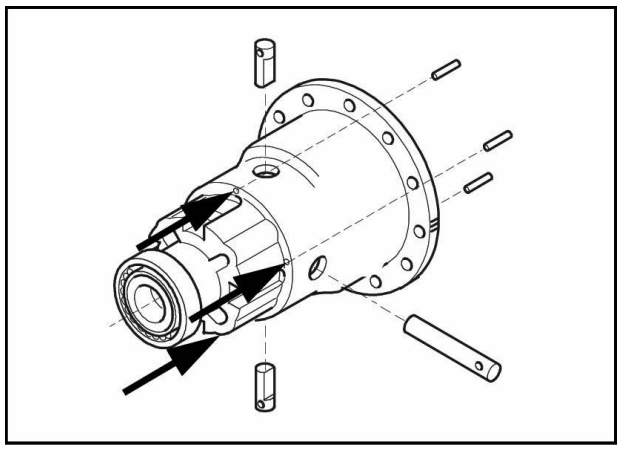
## STEP 3




Disassemble and remove the plates, drive-plates and planetary gear (D) from the differential box.

**NOTE:** *Separate, carefully clean and examine the removed components, checking for wear and operating suitability.*

## STEP 4

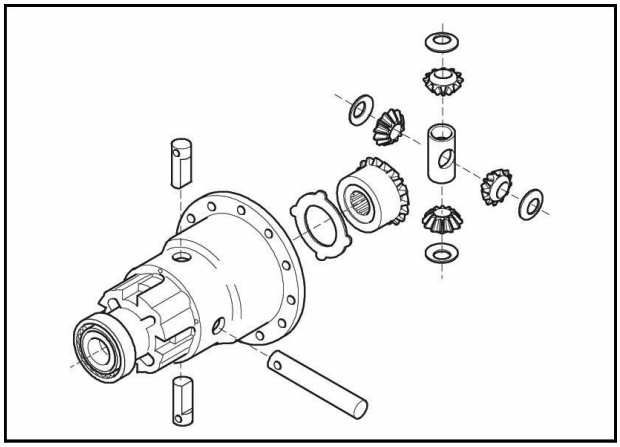


Using a thin punch, push out the three locking pins in order to take out the short and the long planetary securing pins.

https://truckmanualshub.com/



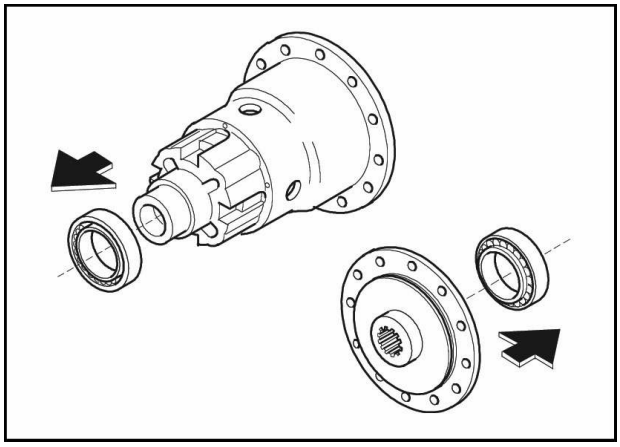
## STEP 5



Disassemble the planetary carrier and collect all the components from inside the differential box: sun gears, thrust washers, spider, planetary gear.

**NOTE:** *Check for wear and operating condition of all the components.*

## STEP 6



Using a three-hold extractor, take the bearings out of the differential half boxes and from the cover.

https://truckmanualshub.com/



# ASSEMBLY OPERATIONS

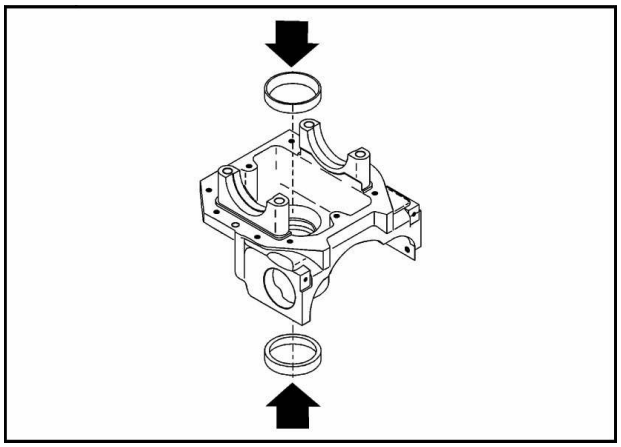
https://truckmanualshub.com/



# PINION UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

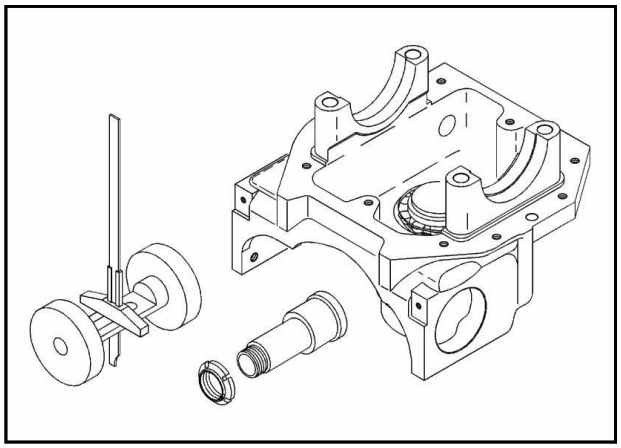
## STEP 1



Place the differential support on a workbench.

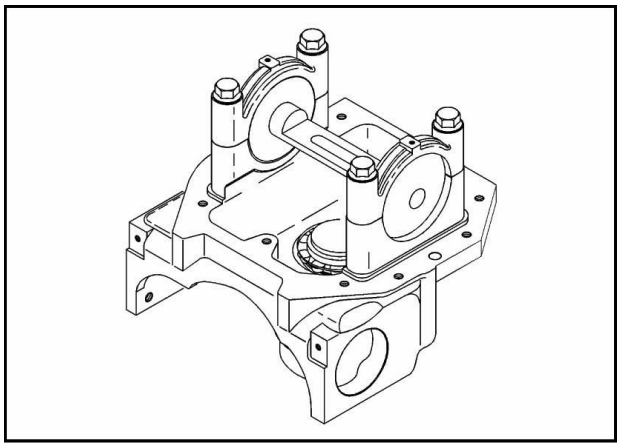
Fit the outer cups of the new bearings using special tools CA119225, CA715092 and a hammer.

## STEP 2



To measure the distance, use the “false pinion” CA119202 and “false differential box” CA119182 and CA119228.

## STEP 3

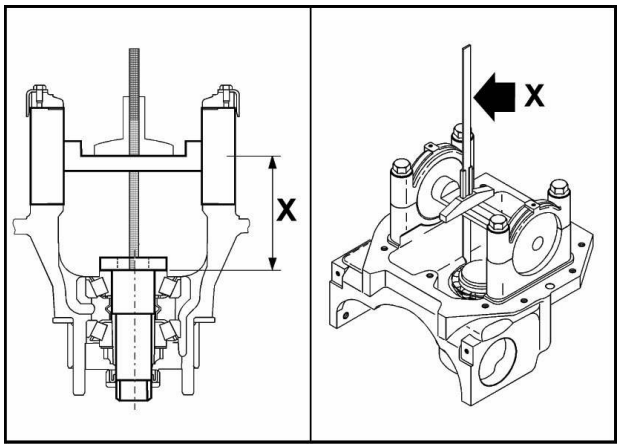


Insert the false pinion tool CA119202, together with its bearings and ring nut, into the bearing housings.

Tighten until the backlash is eliminated. Do not overtighten.

Install special tools CA119182 and CA119228 into the differential group supports and screw in the half collar bolts (see figure).

## STEP 4



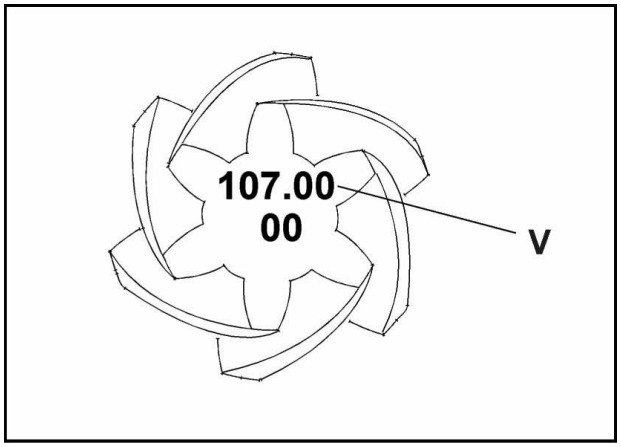

Assembly diagram of the tools CA119182 and CA119228 on the bearing differential carrier seats.

Use a depth gauge to measure distance “X” (distance between the axis of the differential bearings and the point at which the pinion head is supported, or base of the bearing).

https://truckmanualshub.com/



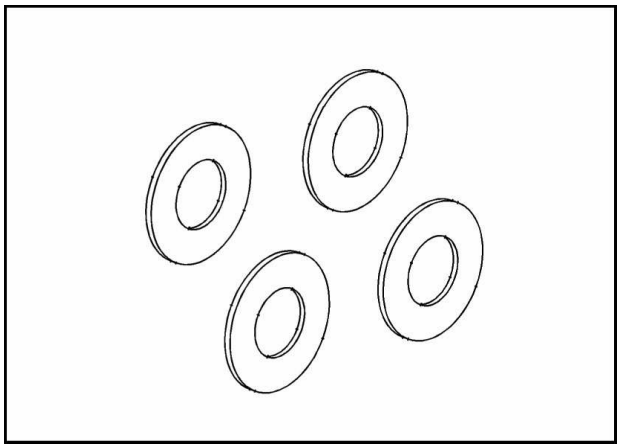
## STEP 5




**S=X-V**

In order to determine the necessary thickness (S) between the pinion and the bearing, subtract the value (V), stamped on the pinion head (V=requested conical distance), from the measured value (X).

## STEP 6

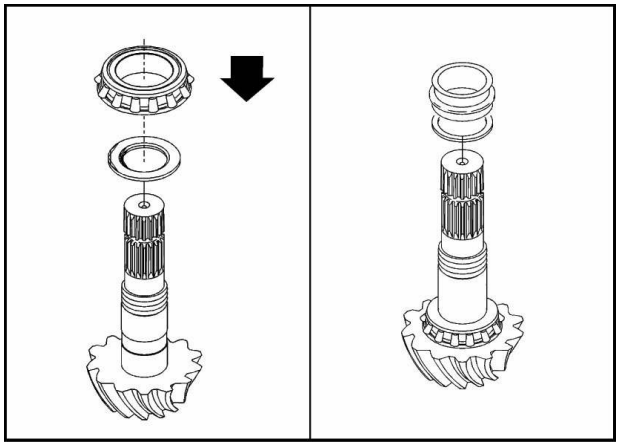


| Shim Range S | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 |

Select the thickness (S) from the range of available shims, and fit to the shaft under the pinion head.

**NOTE:** *Take care to assemble correctly.*

## STEP 7

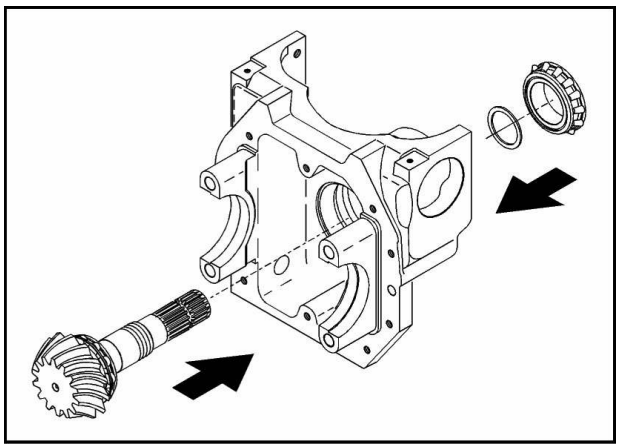


Once you have chosen and inserted the suitable shim with the chamfer against the gear, force the bearing into the pinion shaft end with special tool CA715004 under a press, making sure that it is well set.

Fit the shims and a new elastic spacer.

**NOTE:** *Use always a new elastic spacer.*

## STEP 8



Insert the bevel pinion unit into the differential support housing (from the internal axle side) and the second bearing cone into the pinion end, from the opposite side.

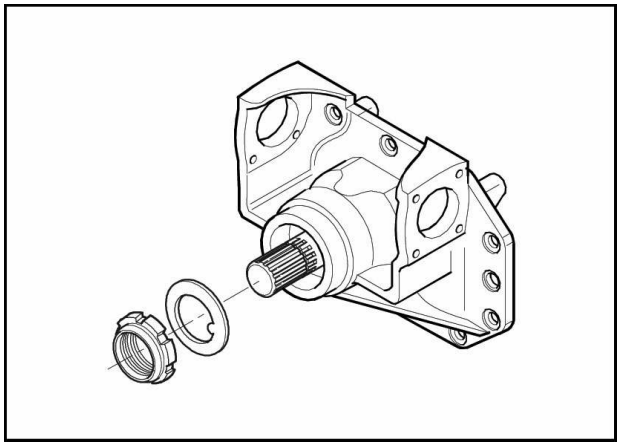
In order to force the second bearing into position, use the special tool CA715004 and a hammer.

It is advisable to offer resistance to the beating force, for example, a sledge hammer.

https://truckmanualshub.com/

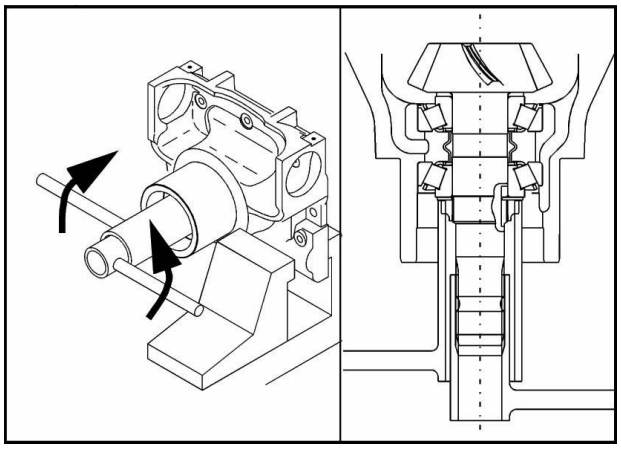


## STEP 9



Insert a ring nut washer and screw a new lock ring nut onto the pinion end.

## STEP 10

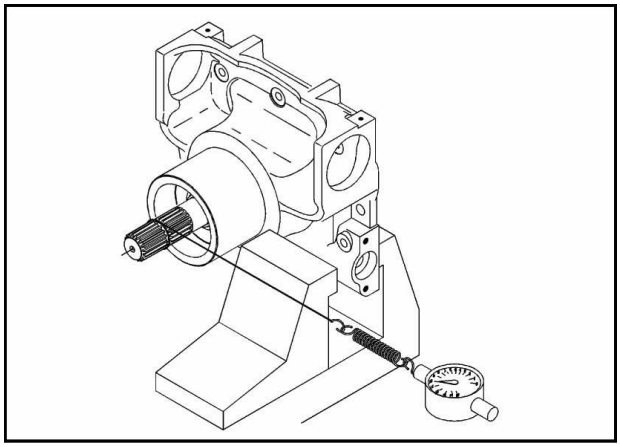


Screw in the ring nut, using special tool CA119099 and, for the pinion retainer use special tool CA715022.

**ATTENTION:** *The torque setting is given by the preloading measurement on the bearings. Tighten the ring nut gradually.*

**NOTE:** *If the tightening is excessive, the elastic spacer will need to be replaced and the procedure repeated. When checking the preloading, it is advisable to gently beat both pinion ends with a soft hammer, to help the bearings seat correctly.*

## STEP 11



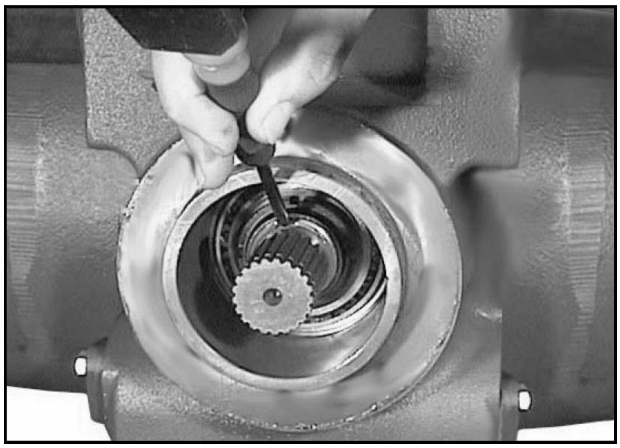
**P=9.2÷13.9 daN**

Measure the preloading of the pinion taper roller bearings, using a dynamometer with the cord wound around the end of the pinion spline.

Adjustment is carried out by gradually tightening the ring nut, taking care not to exceed the prescribed torque.

**ATTENTION:** *All preloadings must be measured without the seal ring.*

## STEP 12



Once the prescribed preloading value is achieved, lock the ring nut, using a hammer and chisel.

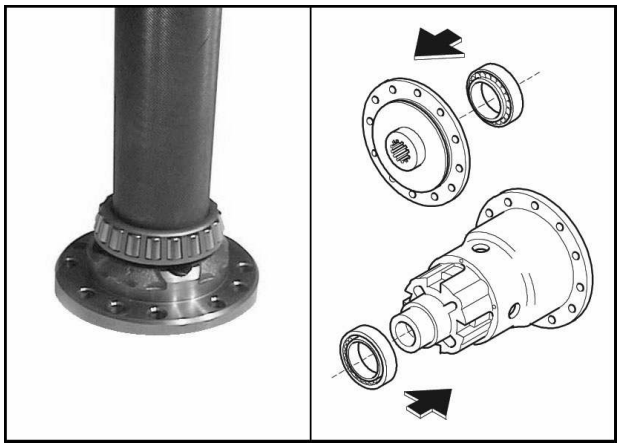
https://truckmanualshub.com/



# DIFFERENTIAL UNIT

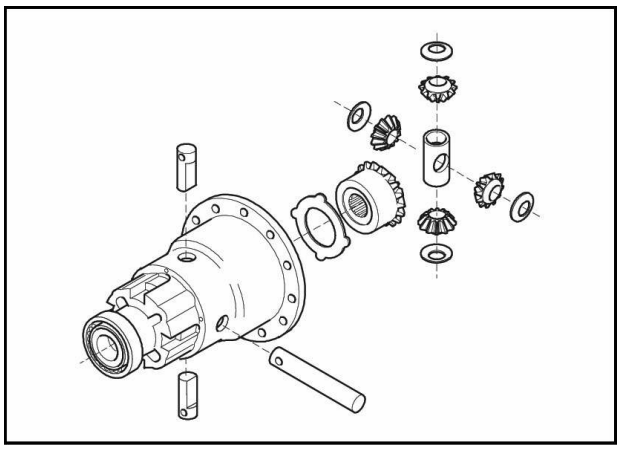
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



Assemble the cones of the new taper roller bearings onto the half boxes, using special tool CA715093 and a hammer.

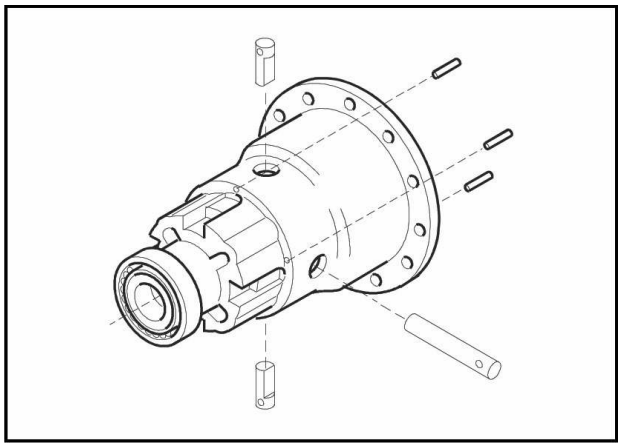
## STEP 2



Place the half box on a workbench and assemble all its inner components (thrust washer, planetary gears, sun gears, thrust washers, spider), as shown in figure.

Insert the short pins and the long pin in their housings to constrain the planetary gears and spider.

## STEP 3

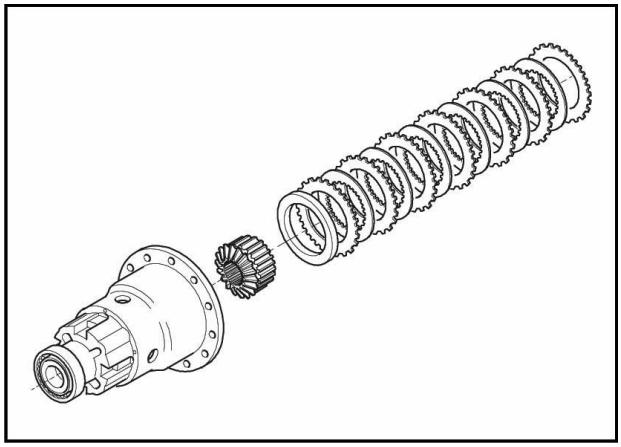


Lock the just assembled securing pins by inserting the correct locking pins through the box into the securing pins.

To align the locking pin holes with those on the box, rotate the securing pins by hand.

**NOTE:** *Completely insert the locking pins.*

## STEP 4

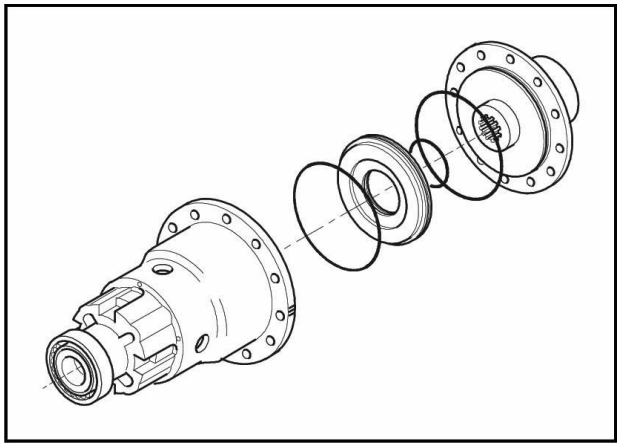


Install all of the inner components into the box; sun gear, discs and counterdiscs, as shown in figure.

https://truckmanualshub.com/



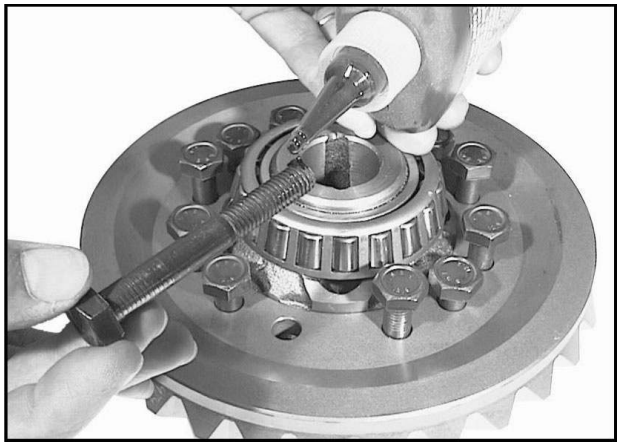
**STEP 5**



Fit new well lubricated O-Rings into their relative housings on the piston and differential box cover.

Insert the piston and refit the differential box cover.

**STEP 6**



Spread a film of Loctite 496 onto the contact surface between the bevel crown gear and the differential box.

Fit the bevel crown gear into the differential box.

Apply Loctite 270 to the threads and tighten the screws to the prescribed torque.

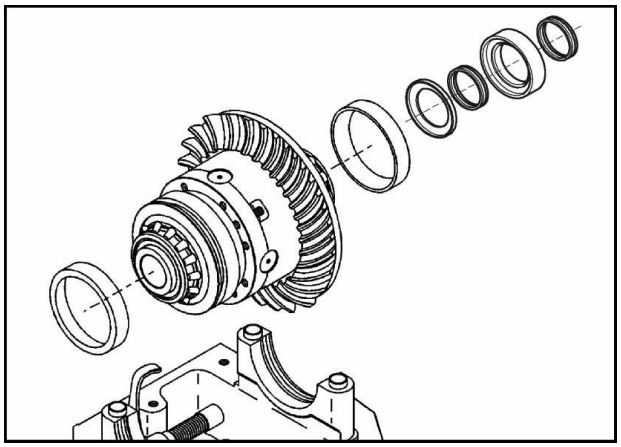
https://truckmanualshub.com/



# DIFFERENTIAL CARRIER UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

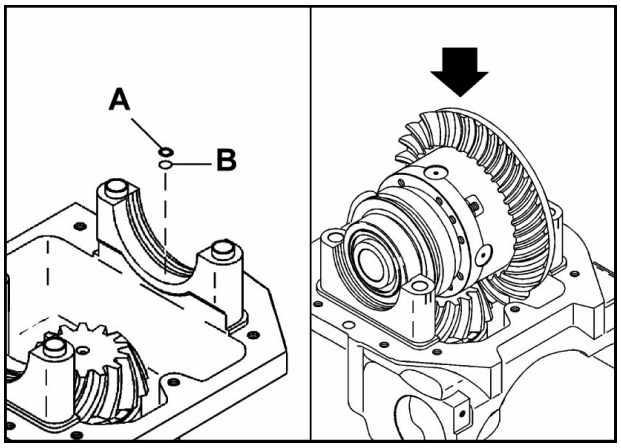
## STEP 1



Fit the outer cups of the taper roller bearings onto both differential box bearings.

On the bevel gear side, pre-assemble the washer and spacer with new seal rings with a light layer of grease and install.

## STEP 2

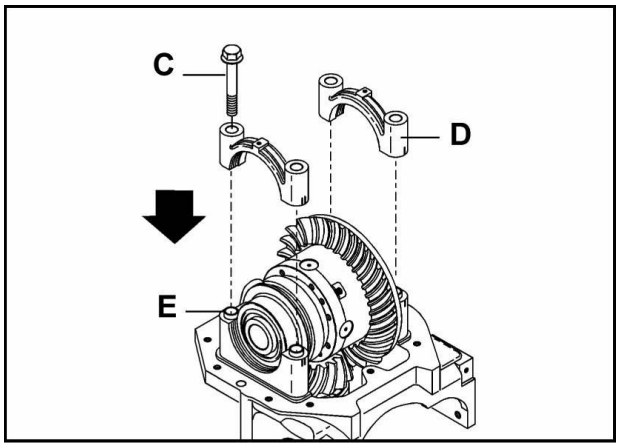



Before positioning the differential box onto the differential carrier, insert a new O-ring (B) and washer (A) into the bearing seat on the bevel crown side, over the hydraulic oil hole.

Position the complete differential box onto the differential carrier.

**ATTENTION:** *Take care not to invert the outer cups of the taper roller bearings. Check they are fitted to the right side of the bevel crown assembly.*

## STEP 3

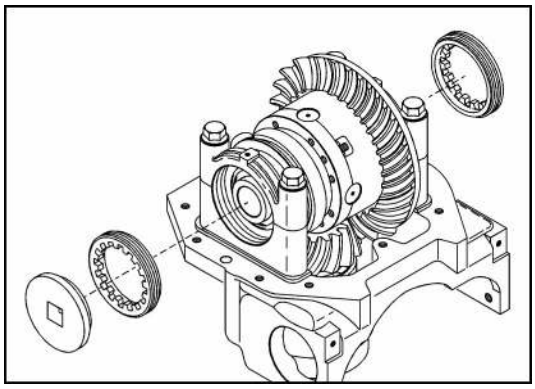



Place the differential unit with the bevel crown gear onto the pinion.

Check that all bushes (E) are correctly seated and correctly place both half collars (D) using the previously marked references.

Secure both collars with the fastening bolts (C).

## STEP 4



Assemble and tighten both adjustment ring nuts in the differential support with special tools CA119030 and CA119149, until the backlash is eliminated and the differential bearings are slightly preloaded.

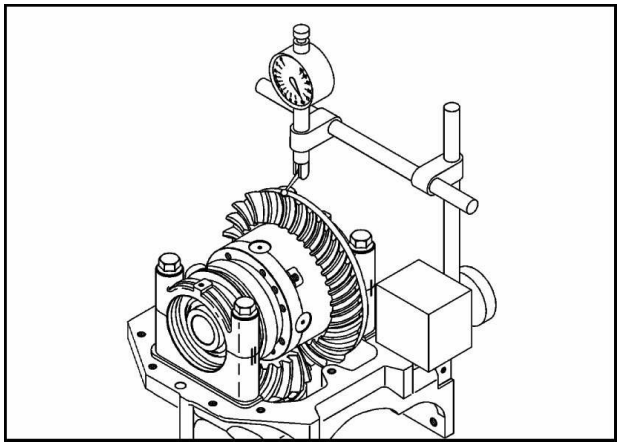
**NOTE:** *The 2 ring nuts are different. Take care not to invert their position with regard to the bevel crown gear.*

Check that the differential bearings are well seated. If necessary, tap lightly with a soft hammer to properly seat the bearings.

https://truckmanualshub.com/



## STEP 5

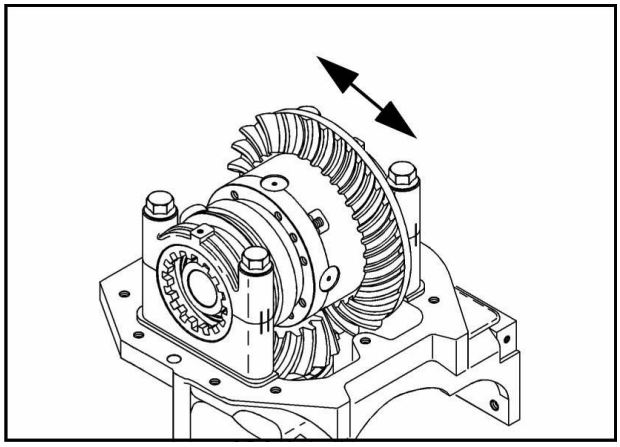


Position a dial gauge on the differential carrier, so that the feeler stylus touches the surface of one tooth of the crown gear at a 90° angle.

Lock the pinion and move the crown gear in each direction, noting the pinion-ring gear backlash - measured with the gauge.

Repeat the operation on 2 or more teeth, rotating the crown gear, to obtain an average value.

## STEP 6

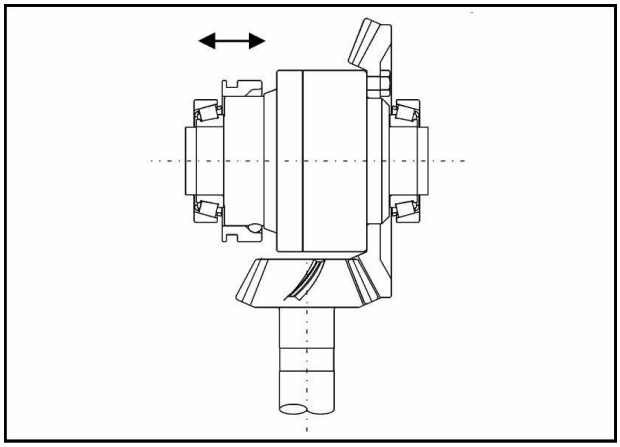


Check that the measured backlash value is within the prescribed range:

**0.18÷0.23**

Carry out any adjustment on the 2 ring nuts using special tools CA119030 and CA119149.

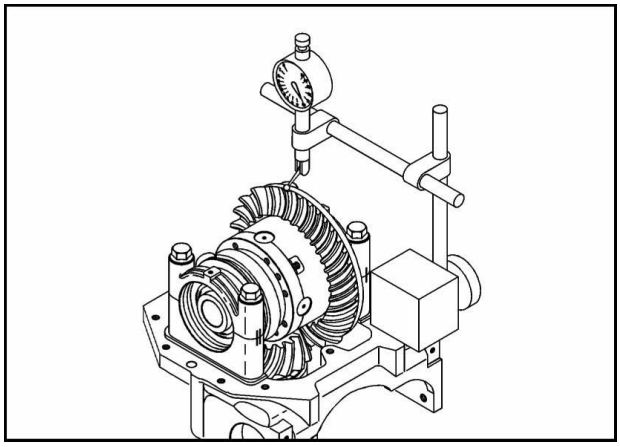
## STEP 7



If the measured backlash is less than the given tolerance range, unscrew the ring nut on the bevel crown gear side and screw in the opposite one by the same amount.

If the measured backlash is greater than the given tolerance range, unscrew the ring nut on the side opposite to the bevel crown gear, and screw in the other one by the same amount.

## STEP 8



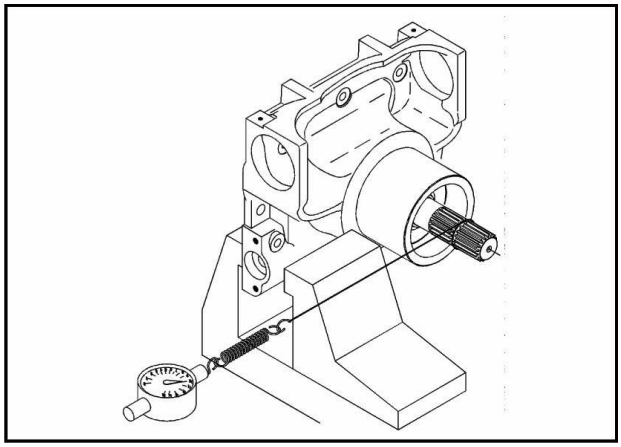
Once the pinion-ring gear backlash has been adjusted, check also that there is a minimum preloading on the differential box bearings.

Repeat the above operations until the prescribed settings are achieved.

https://truckmanualshub.com/



## STEP 9



Once the pinion-ring gear backlash has been established, measure the total preloading (T) of the bearings (pinion-crown bevel gear system), using a dynamometer with the cord wound around the pinion splined end. The measured value should be within the following range:

**T=(P+9.2)÷(P+10.7) daN**

where P is the effectively measured pinion preloading (see “Pinion assembly”).

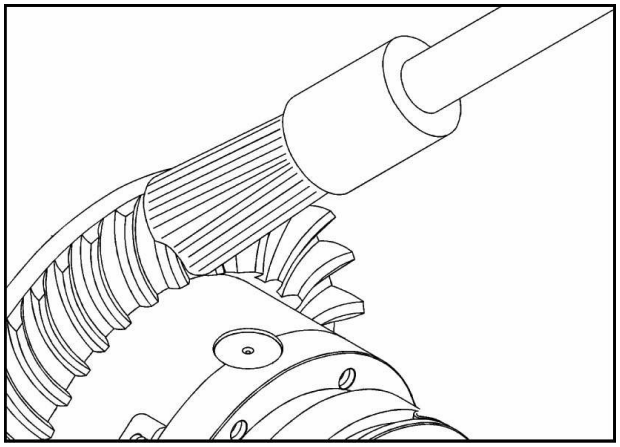
**ATTENTION:** *All preloadings must be measured without the seal ring.*

If the measurement is not within the prescribed range, check carefully the assembly of each component and adjust the differential support ring nuts:

If the total preloading is less than the given range, screw in both ring nuts by the same amount, keeping the pinion-ring gear backlash value unchanged.

If the total preloading is greater than the given range, unscrew both ring nuts by the same amount, keeping the pinion-ring gear backlash value unchanged.

## STEP 10

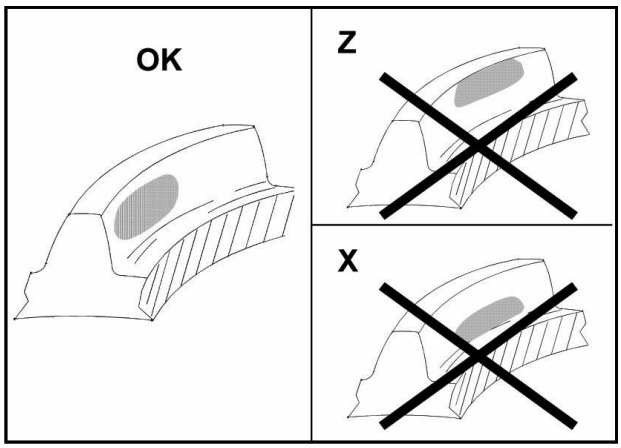


GENERIC INFORMATION

To test the marks of the bevel gear teeth, paint the ring gear with engineering blue.

The marking test should be always carried out on the ring bevel gear teeth and on both sides.

## STEP 11




OK - Correct tooth contact.

Z - Excessive contact on the tooth tip.

The pinion shaft is too much out of engagement. Re-set the mounting distance and repeat the differential adjustment procedure.

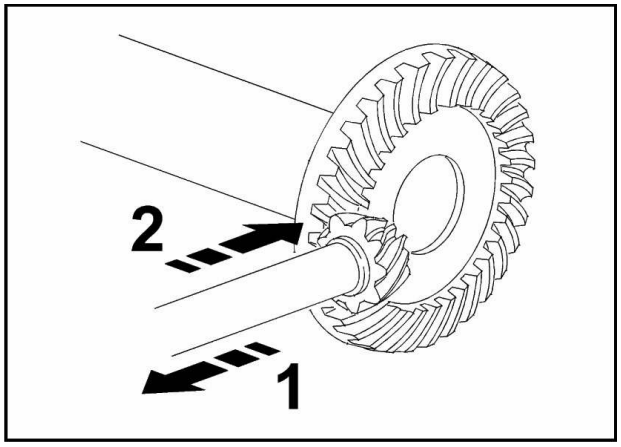
X - Excessive contact at the tooth base.

The pinion shaft is too much into engagement. Re-set the mounting distance and repeat the differential adjustment procedure.

https://truckmanualshub.com/



## STEP 12

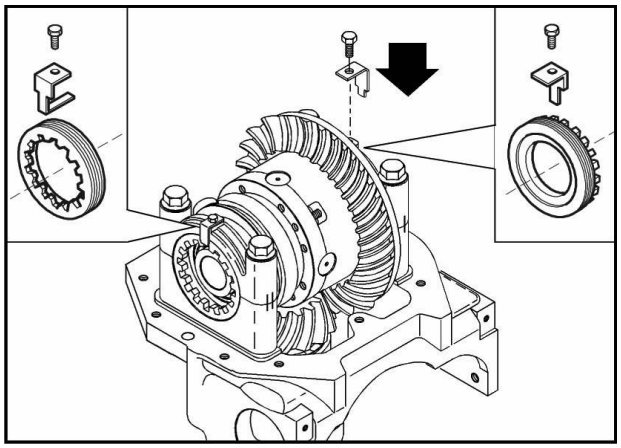



Movements to correct, pinion.

1 - Direction to move the pinion for type X contact adjustment;

2 - Direction to move the pinion for type Z contact adjustment.

## STEP 13

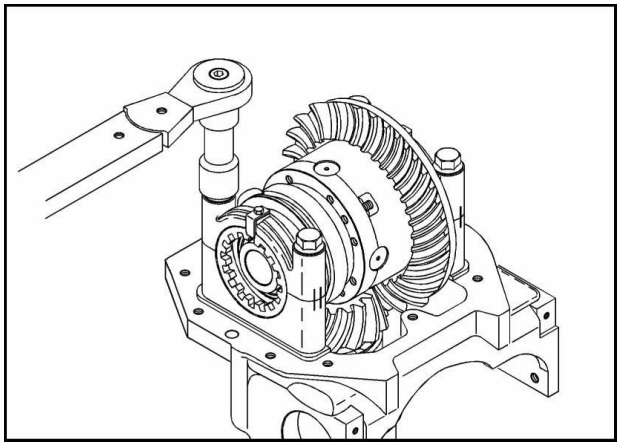


Once all adjustment operations have been completed, fit the adjuster ring nut retainers and their respective screws. Tighten to the prescribed torque.

**ATTENTION:** *The ring nut and the related locking plate on the crown side are different from those on the differential box.*

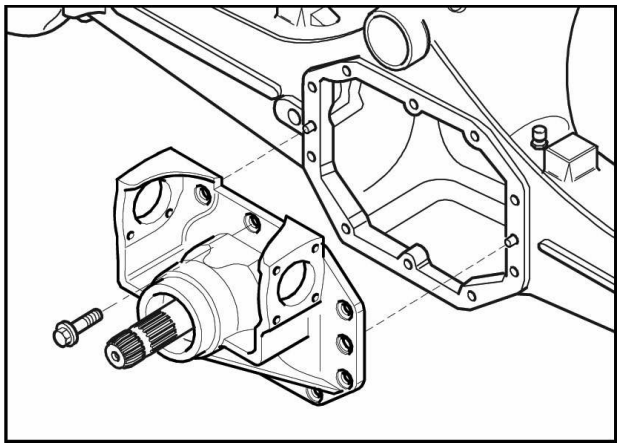
**NOTE:** *Turn the ring nuts slightly in order to align them.*

## STEP 14



Tighten the bolts for both half collars to the prescribed torque.

## STEP 15



**ATTENTION:** *Before mating 2 surfaces, make sure they are perfectly clean. Degrease and clean them with appropriate detergents.*

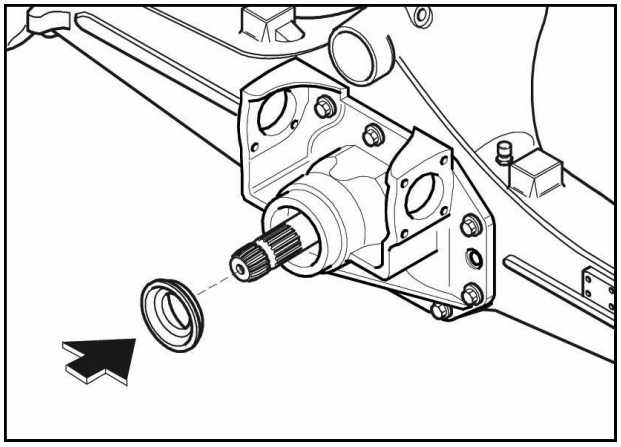
Spread a film of Loctite 510 onto the contact surface between the axle beam and the differential carrier.

Position the differential carrier on the axle housing, and tighten the retaining screws to the prescribed torque.

https://truckmanualshub.com/

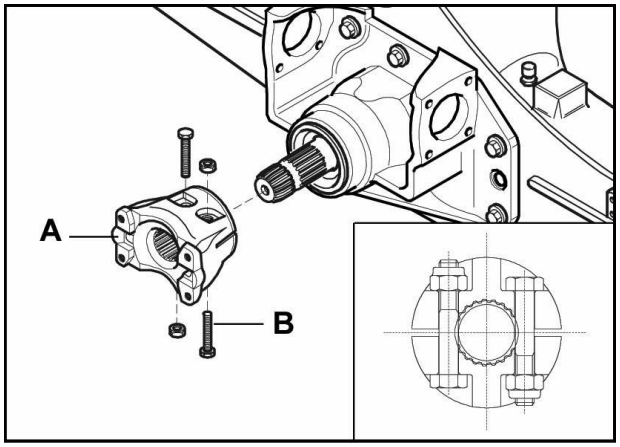


**STEP 16**



Fit a new well lubricated seal ring onto the pinion end using the special tool CA119148, then install the flange.

**STEP 17**




Loosely fit both flange securing bolts (B) and nuts.

Tighten bolts and nuts to the prescribed torque.

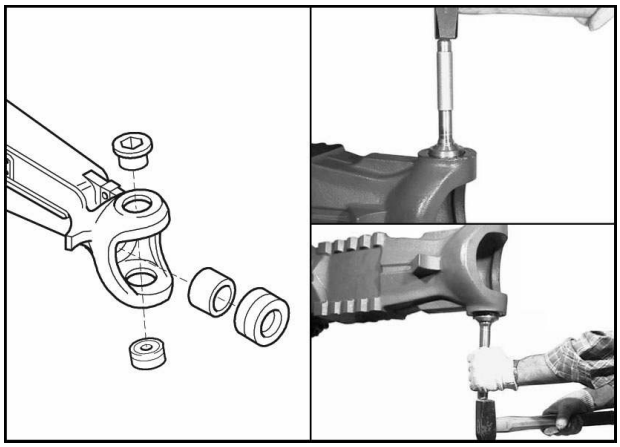
https://truckmanualshub.com/



# AXLE BEAM UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



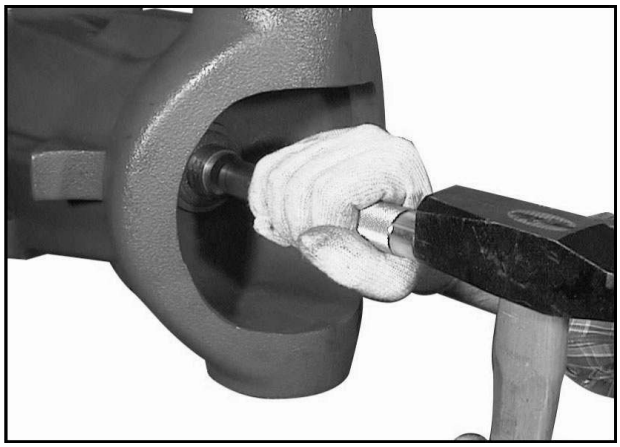
Assemble the upper king pin bush on the axle beam using special tool CA715034 and a hammer.

Insert the cup of the ball bearing onto the lower part of the axle beam using special tool CA715035 and a hammer

**NOTE:** *To facilitate assembly, cool the cup of the ball bearing to a temperature lower than -100°C.*

**ATTENTION:** *Wear safety gloves.*

## STEP 2

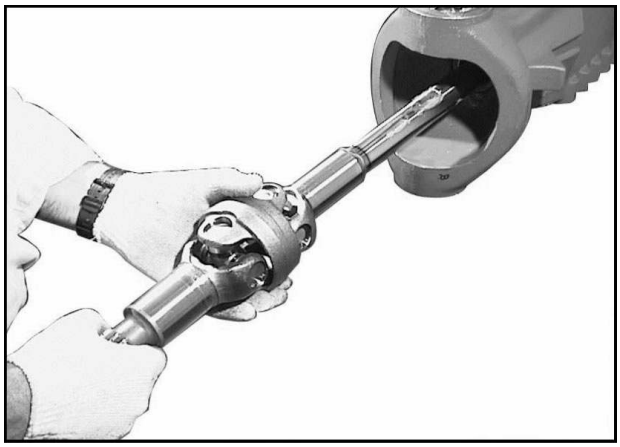


Assemble the bush onto the axle beam using special tool CA119055 and a hammer.

Assemble the seal ring onto the beam using special tool CA119139 and a hammer.

3/4 fill the seal ring cavity with grease.

## STEP 3



Lubricate the bush and the seal ring lip.

Insert the U-Joint inside the axle beam.

**ATTENTION:** *Be careful not to damage the seal.*

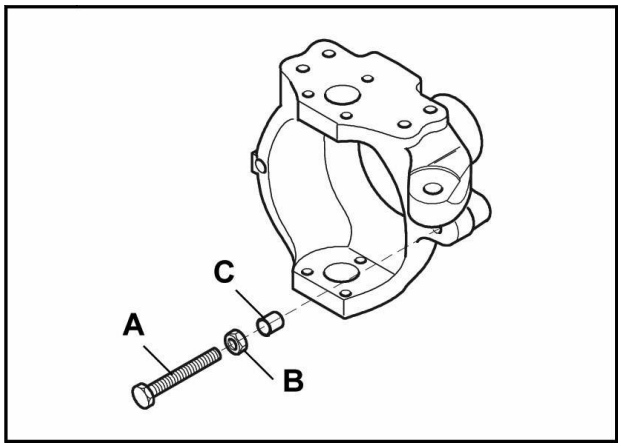
https://truckmanualshub.com/



# WHEEL HUB UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

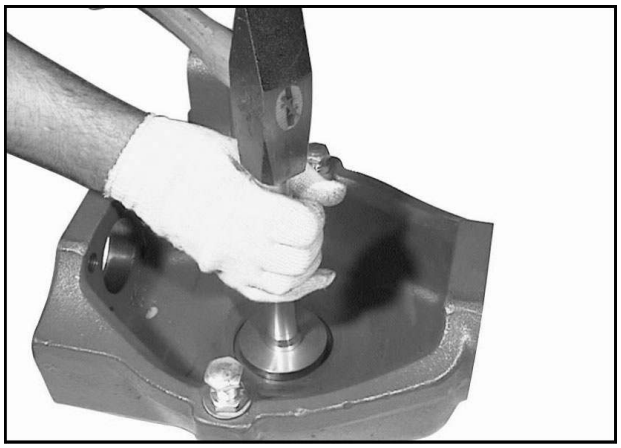
## STEP 1




If disconnected, reassemble the steering mechanical retainer: screw (A), nut (B) and spacer (C).

**ATTENTION:** *Insert the spacer bush (C) onto the screw between the nut and swivel housing (as in figure); lack of this spacer may cause damage to the axle.*

## STEP 2

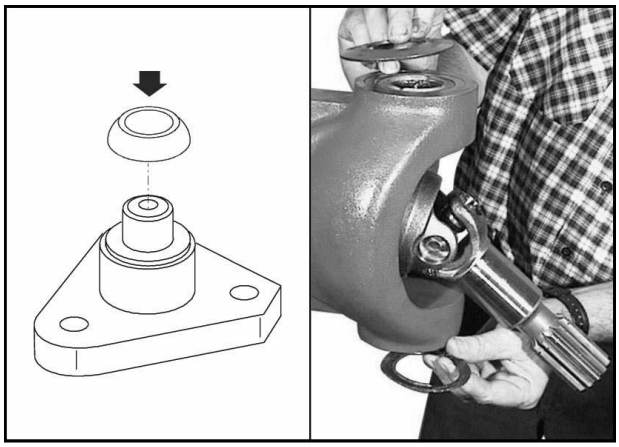


Force the bush into the swivel housing using special tool CA715036 and a hammer or a press.

Assemble the seal ring on the swivel housing using special tool CA715097 and a hammer.

3/4 fill the gasket cavity with grease.

## STEP 3



Position the lower king pin on a workbench and assemble the cone of the spherical joint using special tool CA715035 under a press.

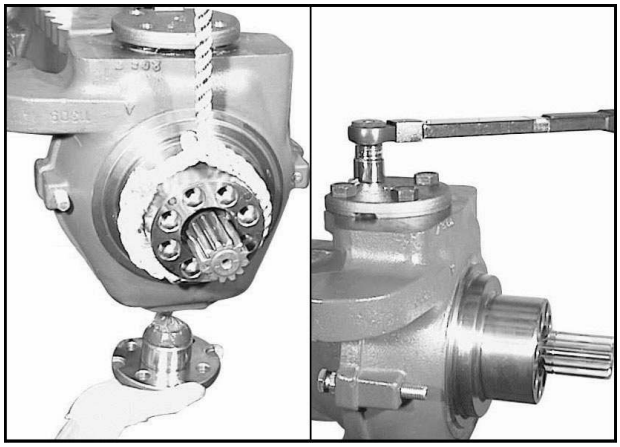
Grease the king pin housings well with the specified grease.

Position the Belleville washers onto the king pin housings.

https://truckmanualshub.com/



## STEP 4



**ATTENTION:** *Secure the swivel housing group with a rope or harness.*

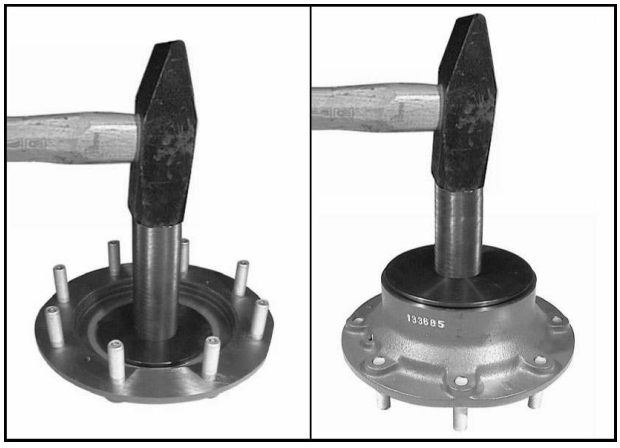
Lubricate the seal ring lip and to avoid damage to the seal rings; protect the splined end of the axle shaft by wrapping it with thin adhesive tape. (After assembly, completely remove the adhesive tape.)

Install the swivel housing onto the axle beam.

Fit the upper and lower king pins and tighten the retaining screws to the prescribed torque.

**NOTE:** *Make sure that the Belleville washers remain in position.*

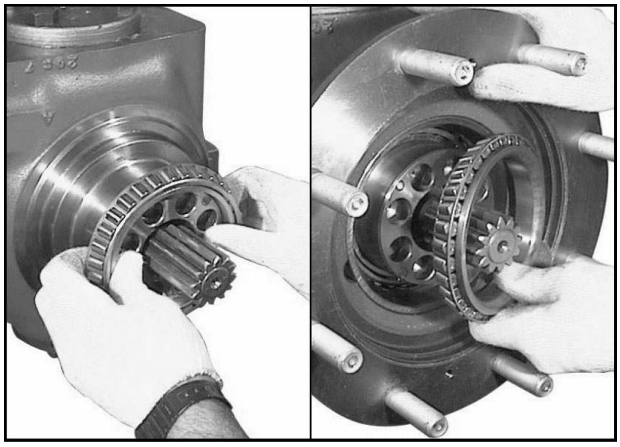
## STEP 5



Place the wheel hub on a workbench and force both cups of the taper roller bearings into position using special tool CA715026 under a press or with a hammer.

Insert the seal ring into the wheel hub using special tool CA119143 and a hammer.

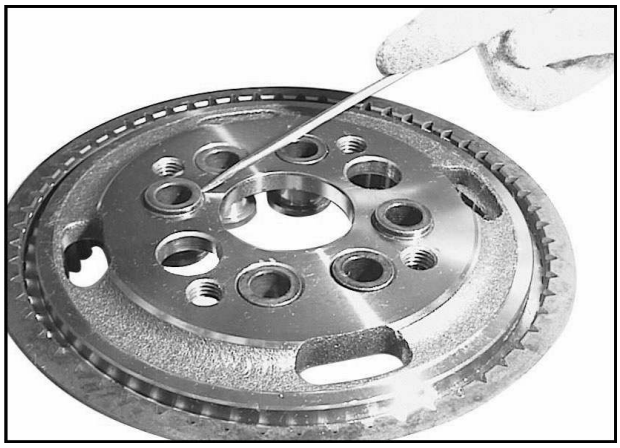
## STEP 6



Fit the cone of the taper roller bearing onto the swivel housing end.

Install the wheel hub onto the swivel housing and fit the other cone of the taper roller bearing into position.

## STEP 7



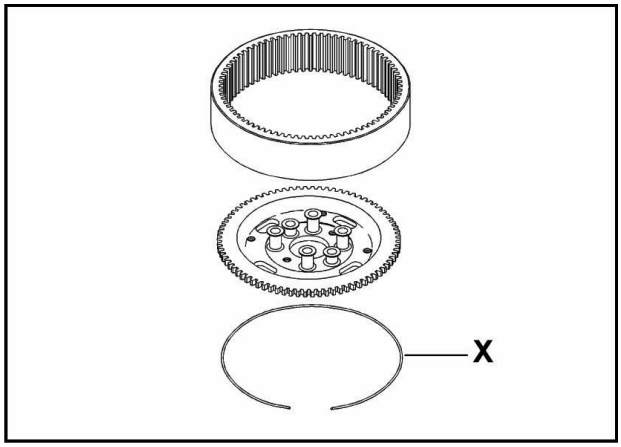
Place the wheel carrier on a workbench and force the bushes. Lever with the carrier surface using special tool CA715027.

At least two bushes (diametrically-opposed) should be set slightly higher than the carrier surface level to be used as dowel pins.

https://truckmanualshub.com/

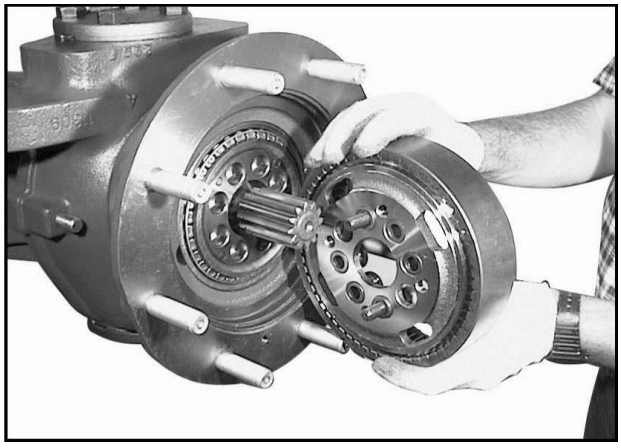


## STEP 8



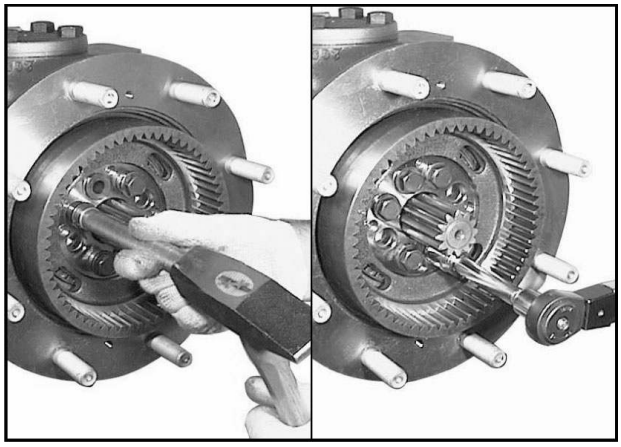

Pre-assemble the wheel carrier-epicyclic ring gear group with the special locking ring (X) as shown.

## STEP 9



Fit the wheel carrier group to the wheel hub using the two projecting bushes as dowel pins. Tighten the securing screws in order to locate the ring bevel gear with the wheel hub.

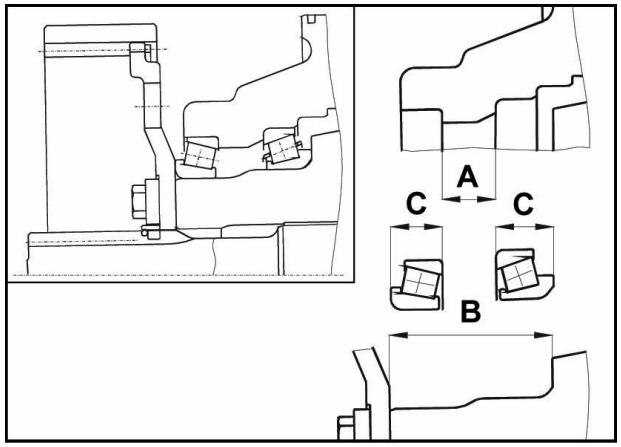
## STEP 10



Insert all the hub dowel bushes completely using special tool CA715027 and a hammer.

Assemble the wheel carrier fastening screws and tighten to the prescribed torque.

## STEP 11




**A= 17.950 ÷ 18.000**

**B= 64.275 ÷ 64.325**

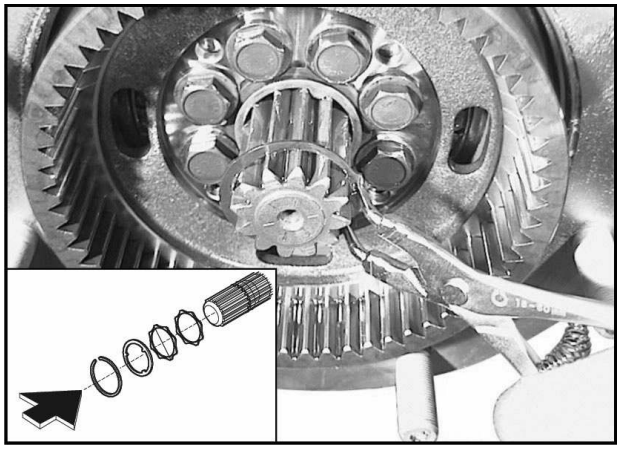
**C= 23.070 ÷ 23.172**

The bearings do not require preload or backlash adjustment. However, before assembling new components, check the dimensions as indicated above.

https://truckmanualshub.com/



**STEP 12**



Slide the washers onto the U-Joint shaft and lock with the retaining ring. Insert the assembly at the end of the splined hub and push into its housing.

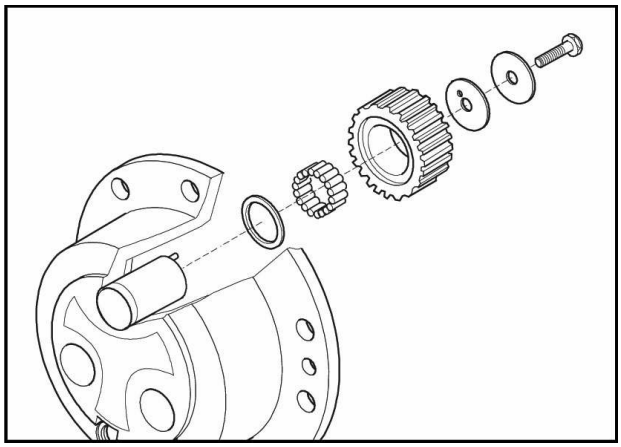
https://truckmanualshub.com/



# EPICYCLIC REDUCTION GEAR ASSEMBLY

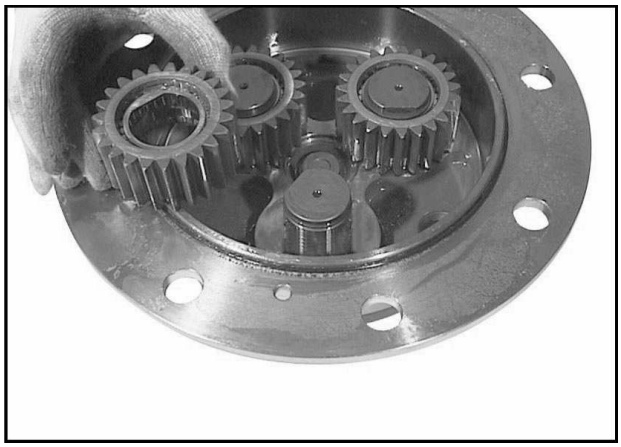
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



Collect all the components of the epicyclic reduction gear.

## STEP 2



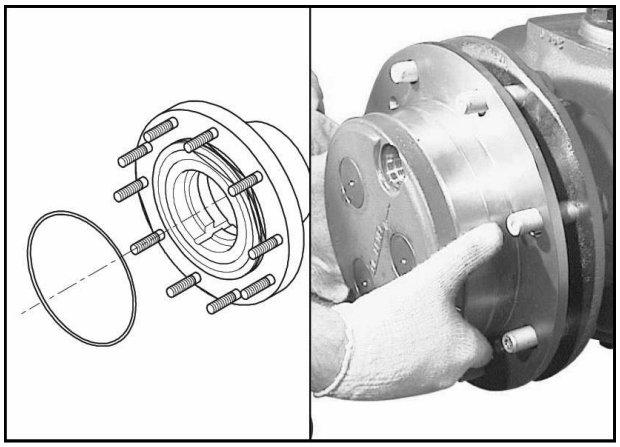
Place the planetary carrier on a workbench.

Insert the thrust washer, the planetary gear, the roller bearings and the two upper trust washers onto the planetary carrier pins.

**NOTE:** *Check correct positioning of first upper trust washer on the lock pin.*

Assemble the retaining screw, then tighten the screws to the prescribed torque.

## STEP 3



Fit a new O-ring onto the wheel hub.

Install the epicyclic reduction gear onto the wheel hub.

Insert the securing screws and tighten to the prescribed torque.

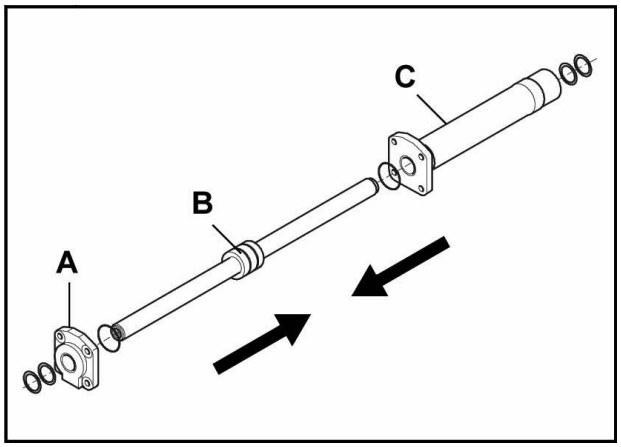
https://truckmanualshub.com/



# STEERING CYLINDERS UNIT

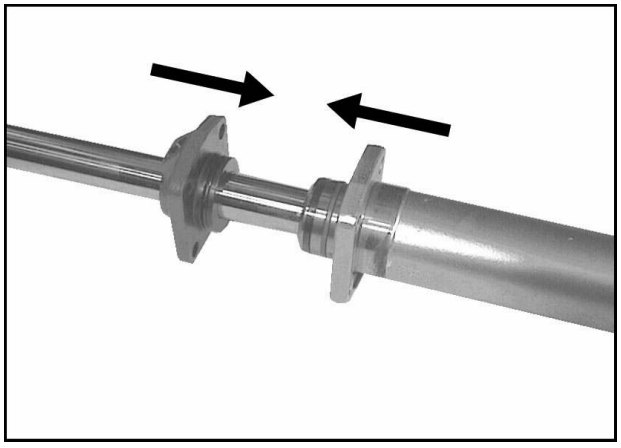
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



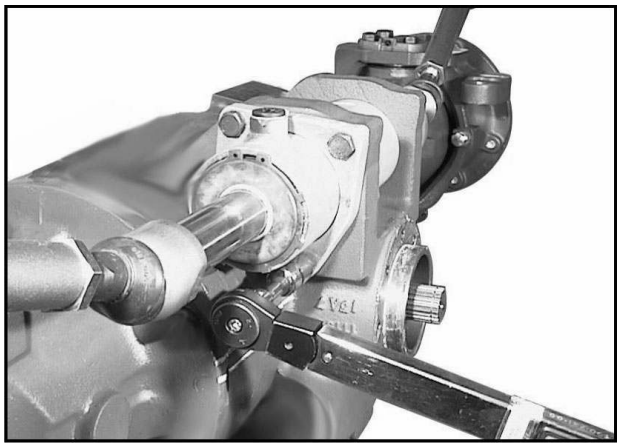

Fit new seal rings to the cylinder head (A), piston (B) and cylinder body (C).

## STEP 2



Slide the pre-assembled rod into the cylinder body.

## STEP 3



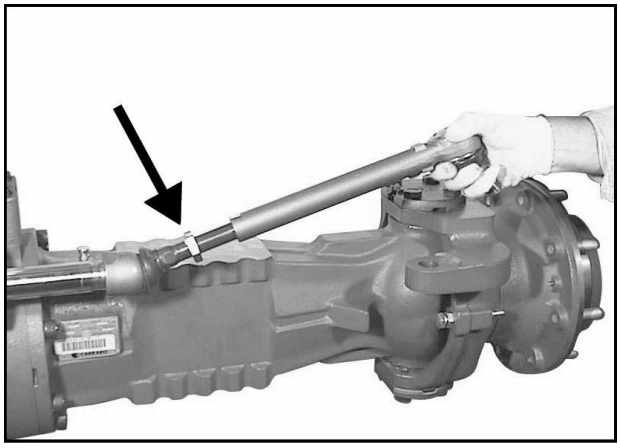
Fit the guide rods to the ends of the cylinder rod and tighten to the prescribed torque.

With guide rods already assembled on the stem fit the steering cylinder to the central body.

**NOTE:** *Install the spacer flange.*

Insert the steering cylinder securing screws and tighten to the prescribed torque.

## STEP 4



Align the swivel housings with the axle (parallel wheel hub).

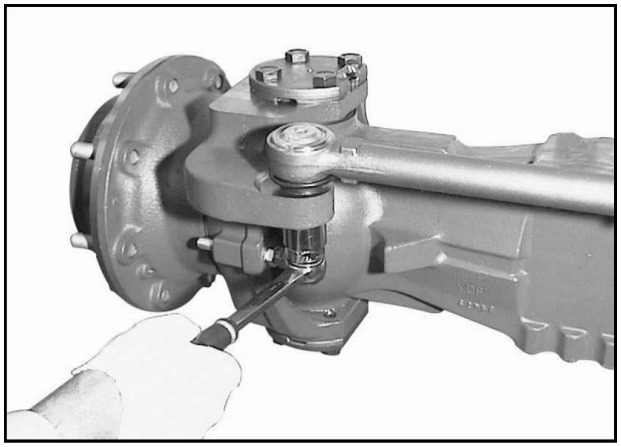
Rotate the guide rod so that the ball joint can be inserted into the swivel housing arm.

**NOTE:** *It is necessary to unscrew the locking nut to carry out this operation.*

https://truckmanualshub.com/



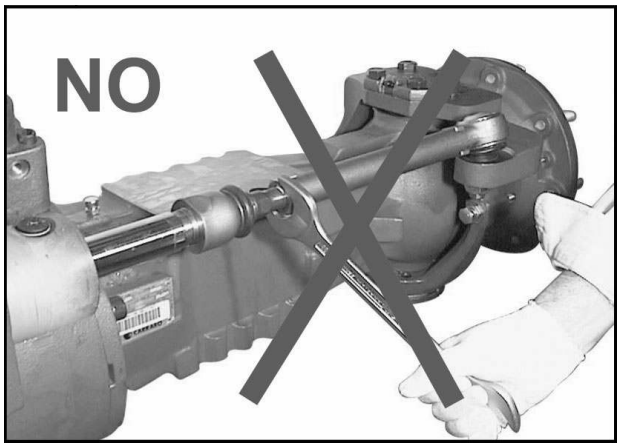
**STEP 5**



Insert the ball joint into its own housing on the swivel housing.

Fit the lock nut and tighten to the prescribed torque.

**STEP 6**




Do not tighten the guide lock nut until the toe-in has been correctly adjusted.

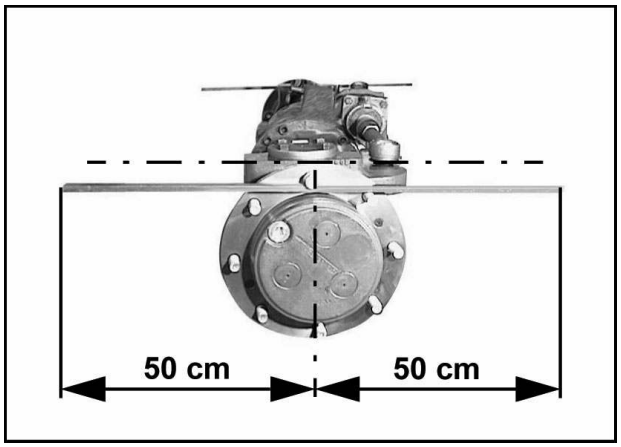
https://truckmanualshub.com/



# TOE-IN ADJUSTMENT

Some of the following pictures may not show your axle, but the procedure is the same.

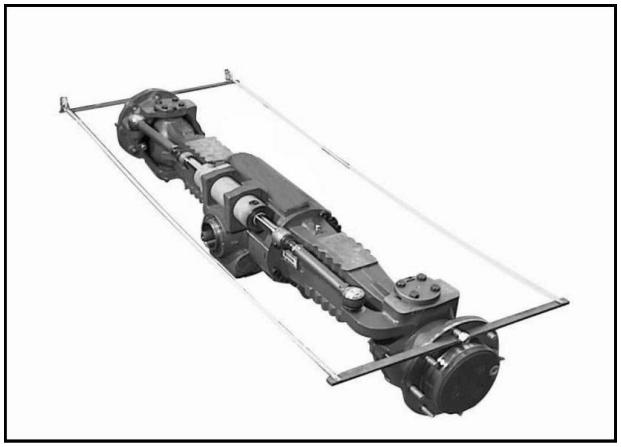
## STEP 1




Put two equal one-meter-long linear bars on the wheel sides and lock them with two nuts on the wheel hub stud bolt.

**ATTENTION:** *The two bars should be fixed at their centre so that they are perpendicular to the supporting surface and parallel to the pinion shaft axis. Align the two bars.*

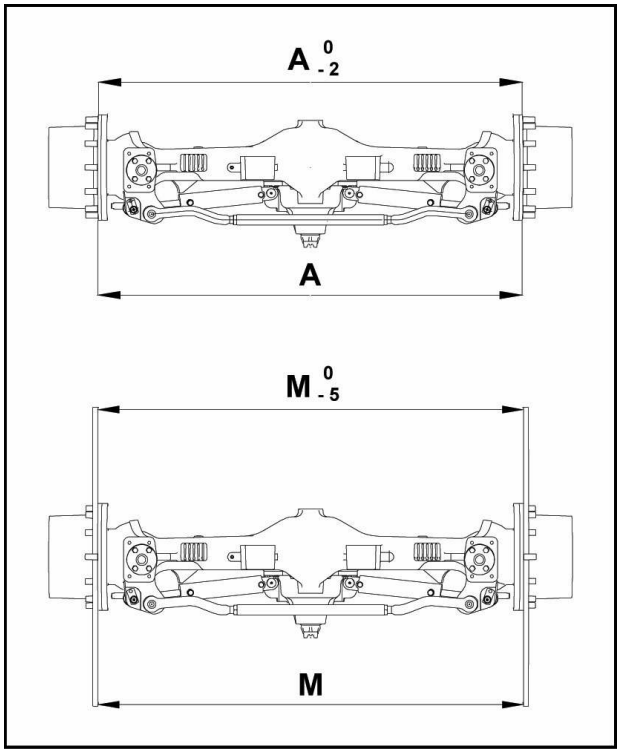
## STEP 2



Measure the distance in mm (M) between the bar ends with a tape line.

**NOTE:** *Obtain the minimum value, swinging the measurement point.*

## STEP 3




Check that the difference in the measurements between the wheel hub diameter ends is within the prescribed tolerance range.

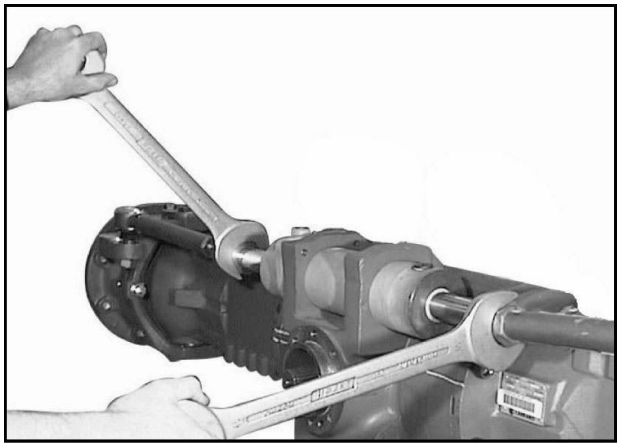
The nominal toe-in value (A) refers to the external diameter of the wheel hubs flange, therefore measured value (M) at the bar ends must be related to the ratio between the length of the bar and flange diameter.

**nominal toe-in = A o / -2 —> measured toe-in = M 0 / -5**

https://truckmanualshub.com/

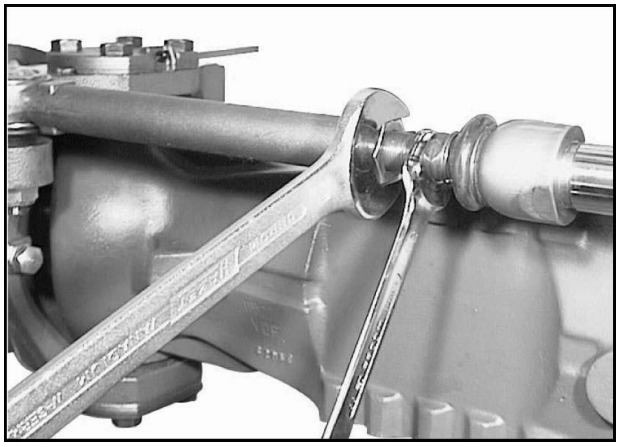


**STEP 4**



If toe-in is incorrect, use two spanners on the guide rods (1), adjusting both rods equally until the toe-in is within the prescribed tolerance.

**STEP 5**



After adjusting, tighten the lock nuts on the guide rods to the prescribed torque.

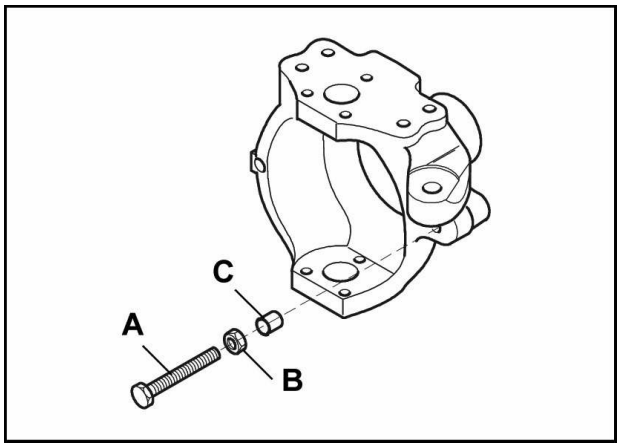
https://truckmanualshub.com/



# STEERING ANGLE ADJUSTMENT

Some of the following pictures may not show your axle, but the procedure is the same.

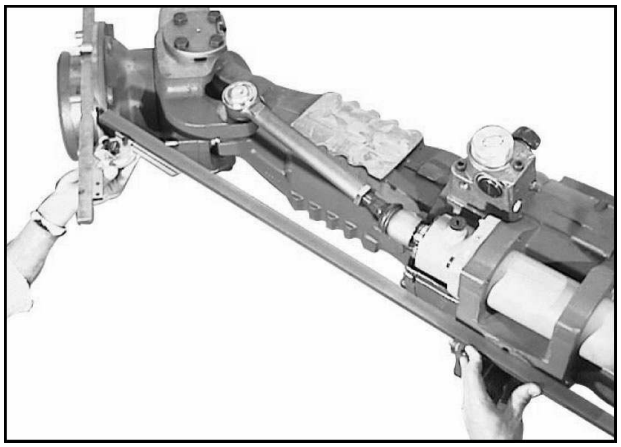
## STEP 1




Check screw (A), nut (B) and spacer (C) are correctly assembled.

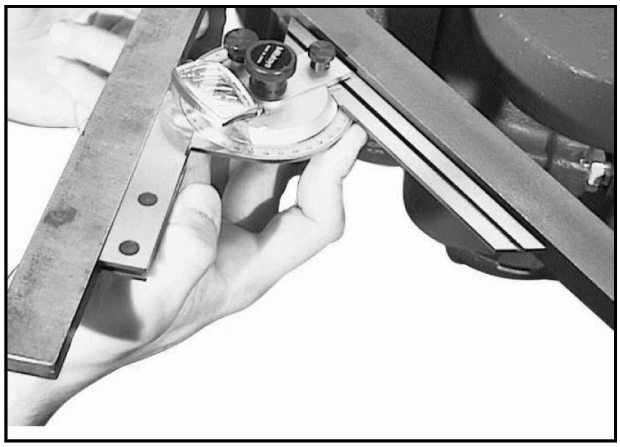
**ATTENTION:** *The spacer bush (C) must be fitted on the screw between the nut and the swivel housing. Incorrect fitting of the spacer may damage the axle.*

## STEP 2



Use the same bars used for the toe-in adjustment together with a long bar aligned with the machined part of the central body (pinion side), so that the two bars and the hub form an acute angle at the maximum steering angle.

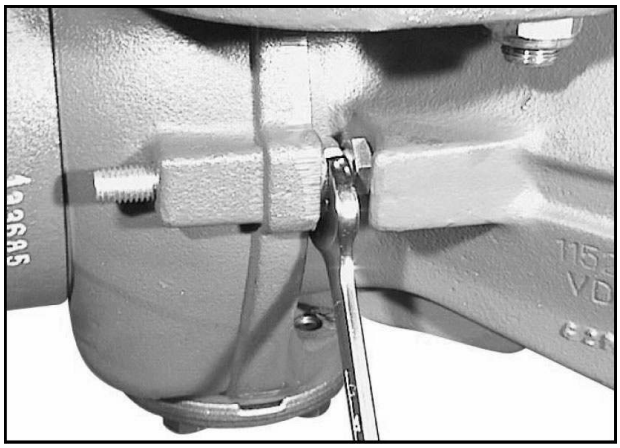
## STEP 3



Adjust a protractor to the prescribed angle and position it on the long bar.

Move a wheel hub until the bar is aligned with the angle fixed by the protractor.

## STEP 4



Adjust the steering retainer nuts and fix them with the locknut to the prescribed torque.

Steer completely towards the opposite lock and repeat the operation.

https://truckmanualshub.com/



# Section 6021-A

## MFD FRONT AXLE

## XTX Series Tractors

## 20.43 Axles

McCORMICK

SM 8-15230

© 2006 McCormick Tractors International Limited.
September 2006

Whilst every effort is made to ensure that the specifications, desciptions, photographs and illustrations in this publication are correct at the time of going to print, they may not be up to date as a result of modifications adopted by the Manufacturer at any time.
All information within this publications has been provided by Carraro SpA.

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIFICATIONS ..... 3

SPECIAL TORQUES ..... 4

SPECIAL TOOLS ..... 5

DISASSEMBLY OPERATIONS ..... 10
- Steering cylinder group ..... 11
- Epicyclic reduction gear group ..... 12
- Wheel hub group ..... 13
- Axle beam group ..... 16
- Differential support group ..... 17
- Differential group ..... 19
- Pinion group ..... 21

ASSEMBLY OPERATIONS ..... 23
- Pinion group ..... 24
- Differential group ..... 28
- Differential support group ..... 30
- Axle beam group ..... 35
- Wheel hub group ..... 36
- Epicyclic reduction gear group ..... 40
- Steering cylinder group ..... 42
- Toe-in adjustment ..... 44
- Steering angle adjustment ..... 46
- Testing after assembly ..... 47

https://truckmanualshub.com/



# SPECIFICATIONS

| | | |
|---|---|---|
| DIFFERENTIAL | | |
| Pinion Bearing Pre-load | 92.7 to 150.7 N | 21 to 34 lb f |
| Pinion Bearing and Differential Bearing Total Pre-load | 92.7 (+ 29.9) to 150.7 (+ 48.6) N | 21 (+ 6.7) to 34 (+ 11) lb f |
| Bevel Gear Backlash | 0.20 to 0.28 mm | 0.007 to 0.011 inch |
| Shim Thickness for Pinion Height Setting | 2.5 (min.) to 3.4 mm (max.) | 0.098 (min.) to 0.134 inch (max.) |

| | |
|---|---|
| LUBRICANTS | |
| Grease | McCormick LX Multi-Purpose EP2 Grease |
| MFD Axle Pivot Pin | Loctite Anti Seize Compound |
| MFD Axle Capacities | |
| Type | SAE 85W-140 EP Gear Oil |
| Planetary | 1.5 Litres |
| Differential | 6 Litres |

https://truckmanualshub.com/



# SPECIAL TORQUES

| | | |
|---|---|---|
| Pinion Shaft Nut | Refer to SPECIFICATIONS for Pre-load | |
| Differential Housing to Axle Bolt | 169 Nm | 125 lb ft |
| Locking Plate Bolt | 13 Nm | 10 lb ft |
| Ring Gear to Differential Housing Bolt with Loctite 270 | 190 Nm | 52 lb ft |
| Breather Plug | 10 Nm | 7 lb ft |
| Oil Fill/Level Plugs | 60 Nm | 44 lb ft |
| Differential Bearing Cap Bolt | 266 Nm | 196 lb ft |
| King Pin Retaining Bolt | 190 Nm | 140 lb ft |
| Steering Stop Locknut | 150 Nm | 111 lb ft |
| Steering Cylinder to Differential Support Bolt | 120 Nm | 89 lb ft |
| Ball Joint on Steering Cylinder | 300 Nm | 221 lb ft |
| Track Rod Locknut | 250 Nm | 185 lb ft |
| Ball Joint to Swivel Housing Locknut | 220 Nm | 162 lb ft |
| Planetary Gear to Swivel Housing Bolt | 230 Nm | 169 lb ft |
| Wheel Stud with Loctite 270 | 70 Nm | 52 lb ft |
| Planetary Gear Carrier to Wheel Hub Screw | 25 Nm | 18 lb ft |
| Front Weight Frame Bolts | 425 Nm | 314 lb ft |
| Front Wheel Nuts | 530 to 570 Nm | 391 to 420 lb ft |
| MFD Axle Retaining Bolts | 570 to 645 Nm | 420 to 475 lb ft |
| Planetary Gear Retaining Bolt | 79 Nm | 58 lb ft |
| Grease Fittings | 8 Nm | 6 lb ft |

https://truckmanualshub.com/

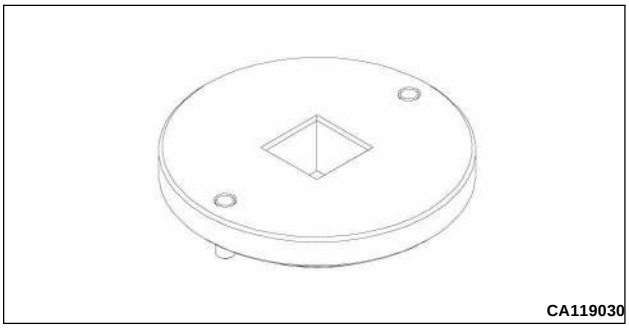


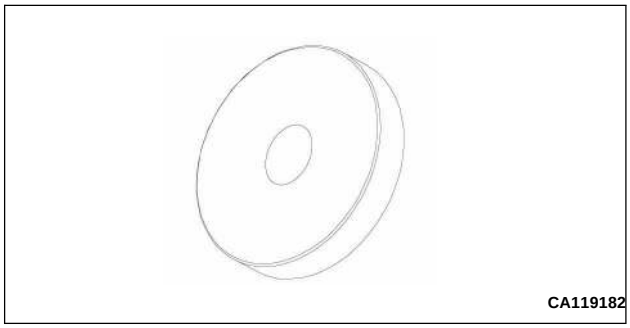
# SPECIAL TOOLS

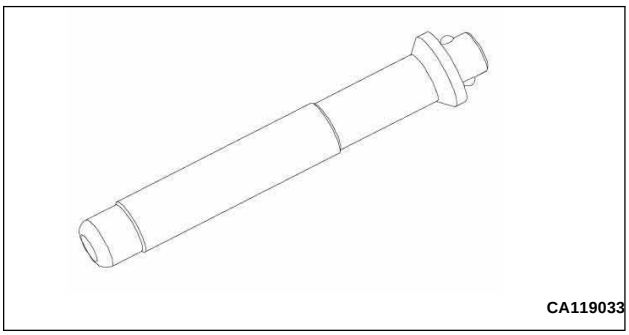
https://truckmanualshub.com/

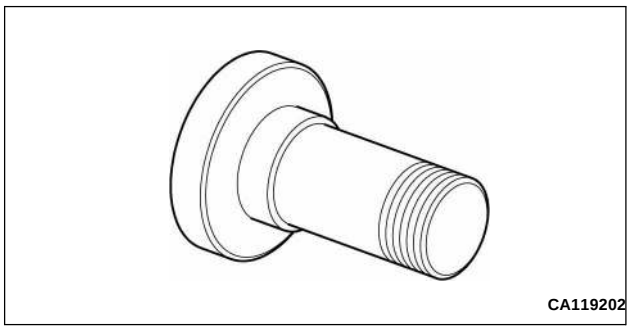


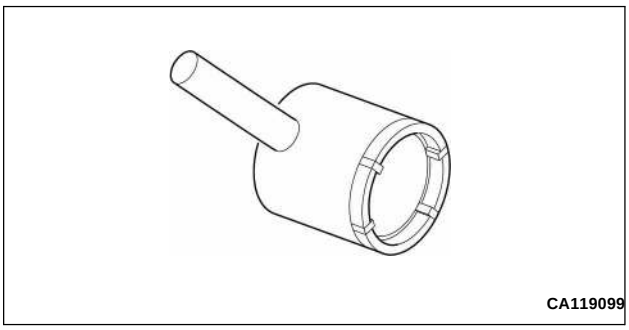
The special tools used to fit seals, bearings and bushes should always be used with the interchangeable handle CA119033 and a suitable safety handle to protect the hands.

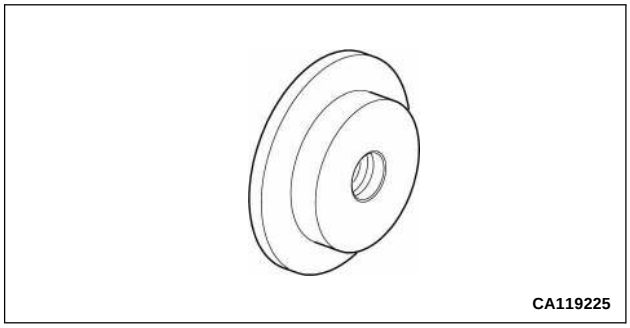

CA119030

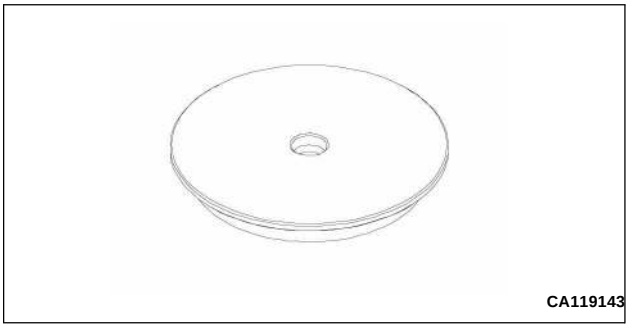

CA119182

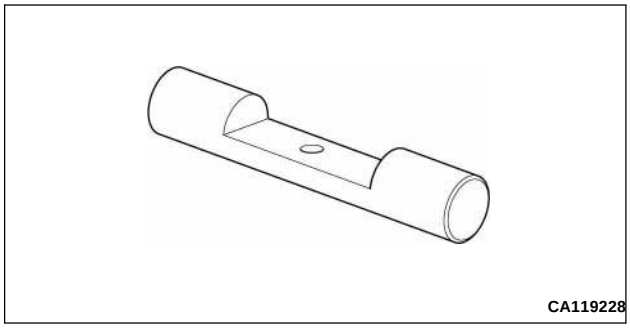

CA119033

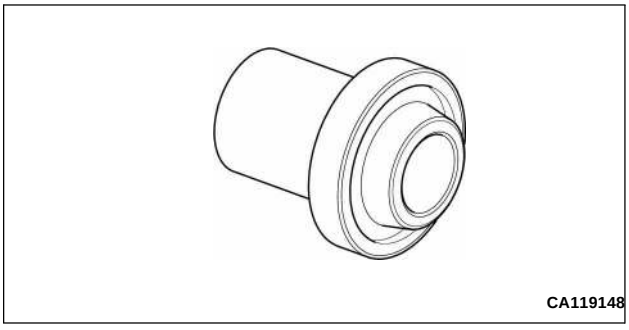

CA119202

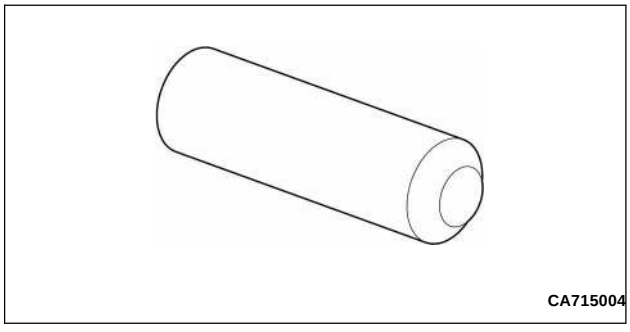

CA119099


CA119225


CA119143

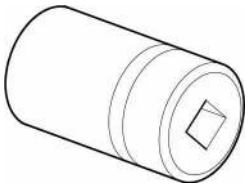

CA119228


CA119148


CA715004

https://truckmanualshub.com/

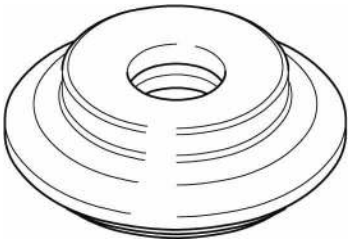




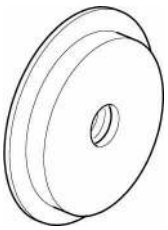
CA715022



CA715036



CA715026



CA715092



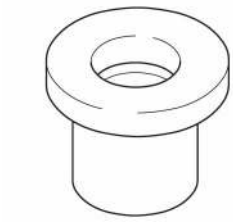
CA715027



CA715093



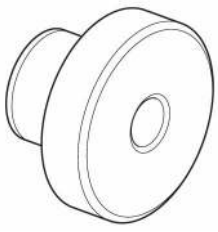
CA715034



CA715163



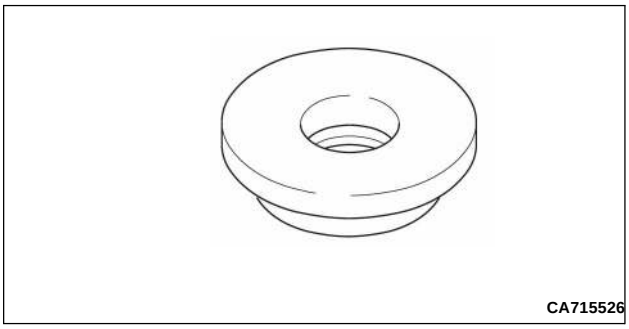
CA715035

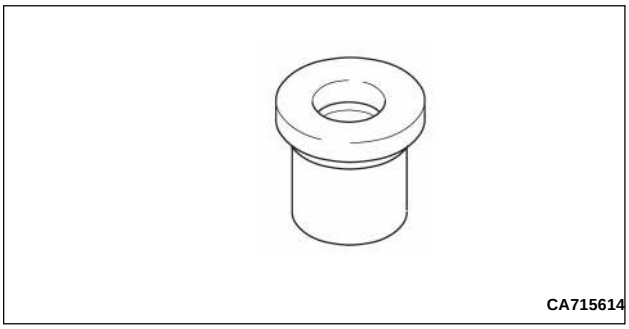


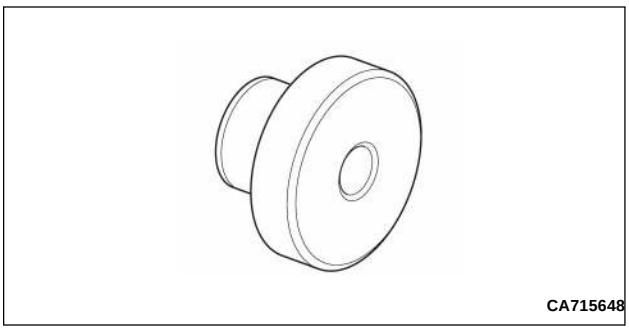
CA715164

https://truckmanualshub.com/




CA715526


CA715614


CA715648

https://truckmanualshub.com/

https://truckmanualshub.com/



# DISASSEMBLY OPERATIONS

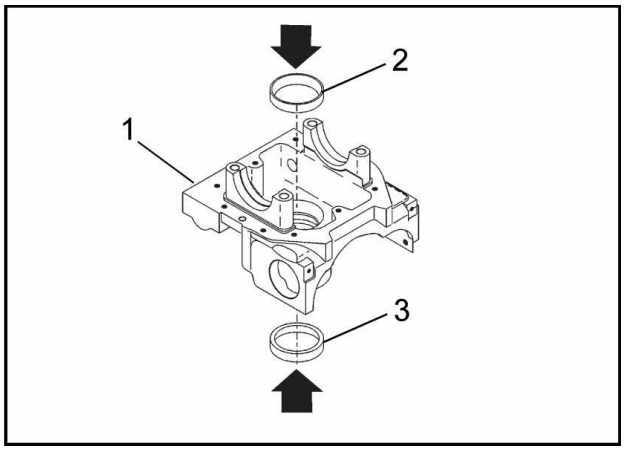
https://truckmanualshub.com/



# STEERING CYLINDER UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



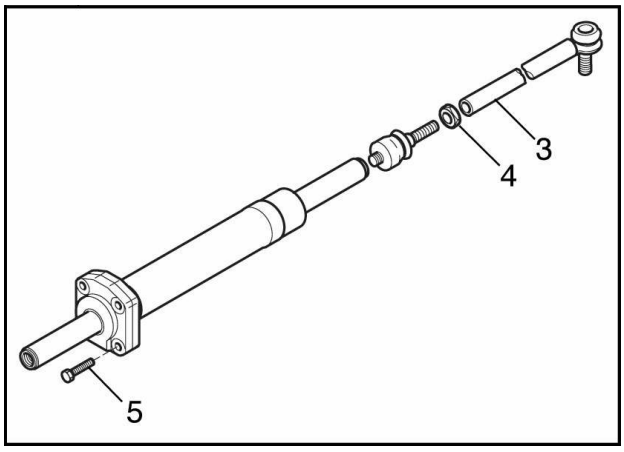

Loosen the guide rod (1) locknut (2) with a few turns until it clears the end of the threaded pin.

Use a hammer to release the guide rod from the swivel housing.

**ATTENTION:** *Do not use the hammer on the end of the threaded pin.*

**NOTE:** *This is a destructive operation for the nut.*

## STEP 2

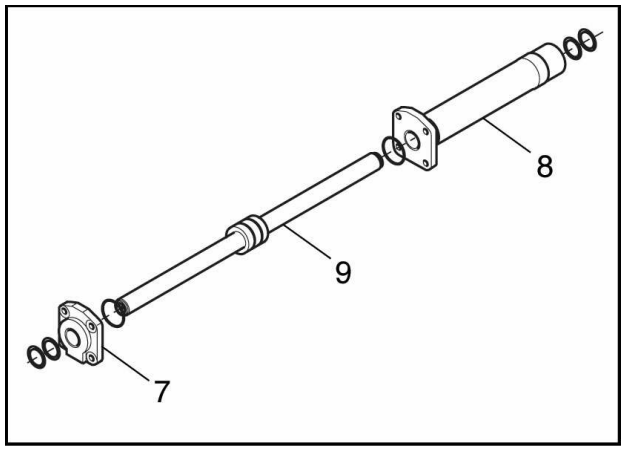



Remove the guide rod link (3) by loosening the nut (4) using a suitable wrench. Check its conditions.

Undo the cylinder fastening screws (5), then take the cylinder (6) out of its seat. If necessary, use a rubber hammer.

Remove only parts that need to be overhauled and/or replaced.

## STEP 3




Detach the cylinder head (7) from the cylinder case (8).

Remove the cylinder head and rod (9) from the cylinder case.

Remove all the seals.

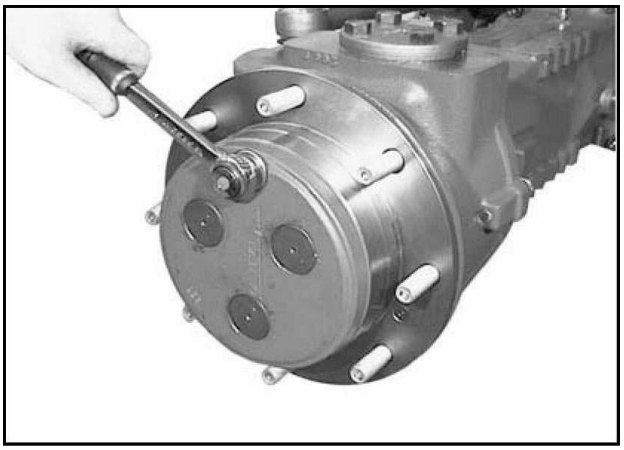
https://truckmanualshub.com/



# EPICYCLIC REDUCTION GEAR

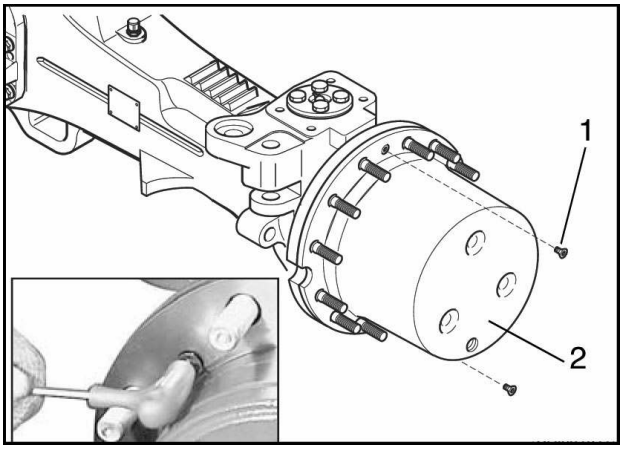
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



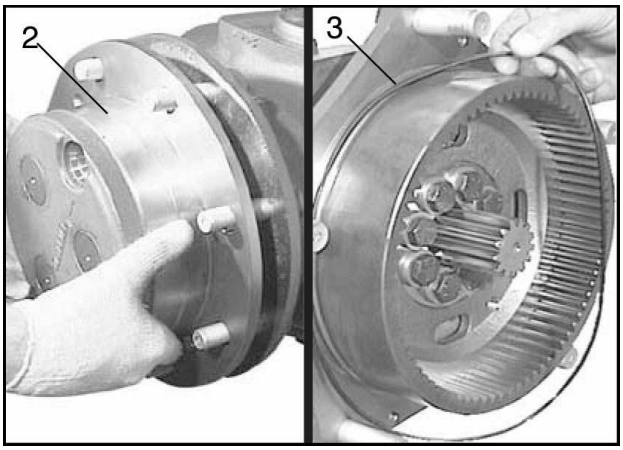
Drain the oil from the epicyclic reduction gear.

## STEP 2



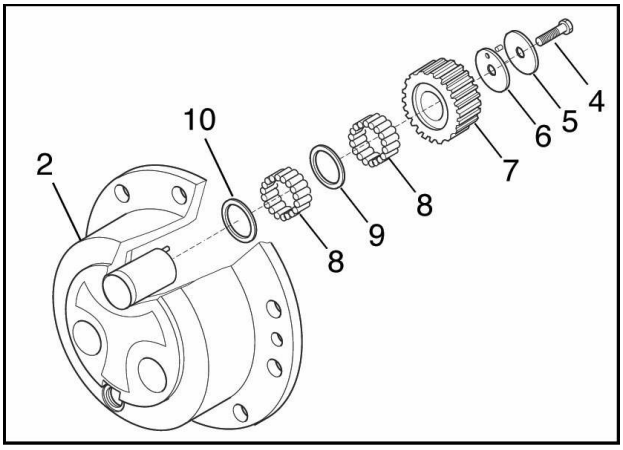

Remove both retaining screws (1) from the planetary carrier (2) using a wrench.

## STEP 3




Remove the planetary carrier (2) from the wheel hub and save the O-Ring (3).

Check the condition of the planetary carrier (2) on a bench.




If required replace the planetary gears as follow:

- remove retaining screws (4);
- remove washers (5, 6);
- remove planetary gears (7) from the pins;
- collect needle bearings (8), and check condition;
- collect the washers (9);
- remove the thrust washers (10).

**NOTE:** *With new planetary gears it is advisable to install new needle bearings.*

https://truckmanualshub.com/

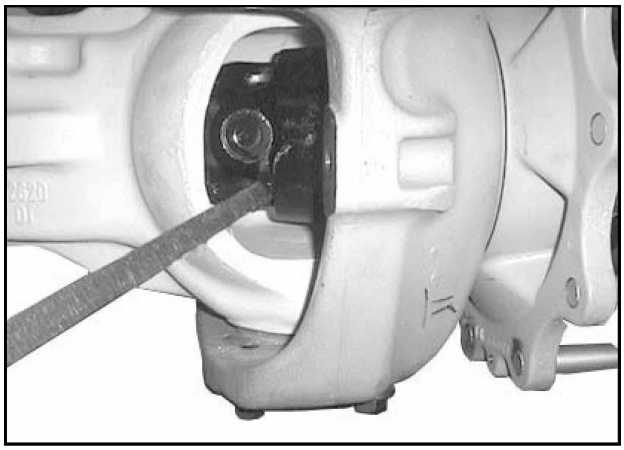


# WHEEL HUB UNIT

To avoid damaging either the operator or the wheel hub group, before disassembling the wheel hub, it is advisable to secure it with a harness on a hoist or other supporting device,

Some of the following pictures may not show your axle, but the procedure is the same.

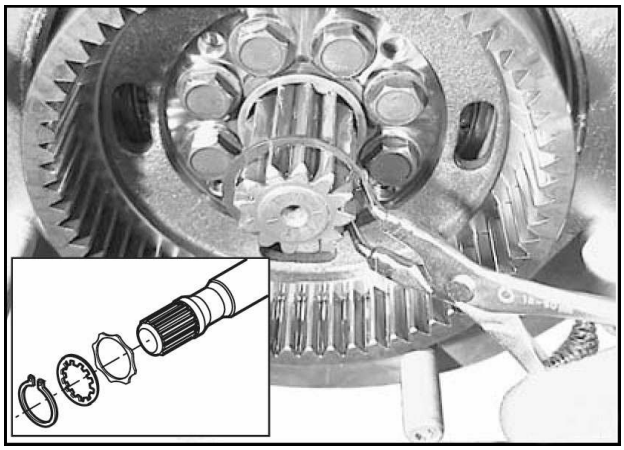
## STEP 1



Insert a lever between the swivel housing and the axle beam, fitting it into the double U-joint and being careful not to damage it.

With the lever, push the double U-joint towards the wheel hub to make ease removal of the snap ring.

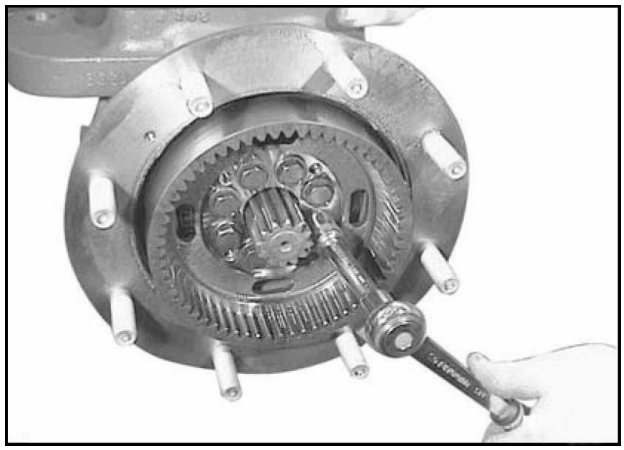
## STEP 2



Remove the snap ring from the double U-Joint shaft using suitable pliers.

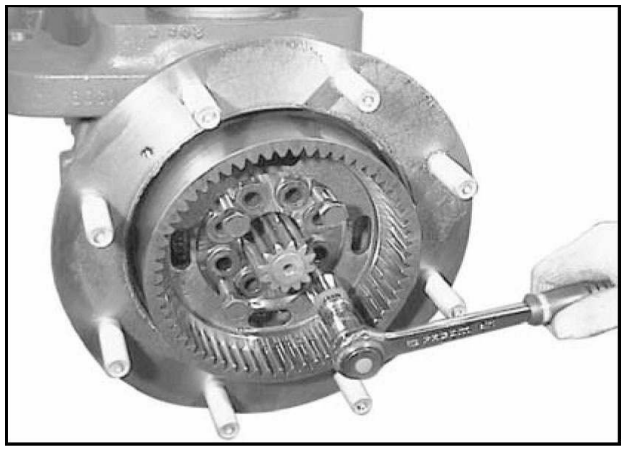
Collect the washers.

## STEP 3



Unscrew and remove the retaining bolts from the wheel carrier group.

## STEP 4

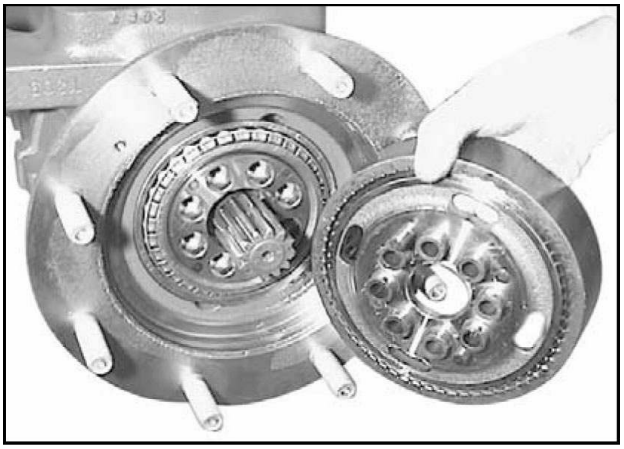


To remove the wheel carrier, screw two of the just removed bolts into the two threaded holes.

https://truckmanualshub.com/



## STEP 5



Remove the wheel carrier together with the ring gear.

## STEP 6

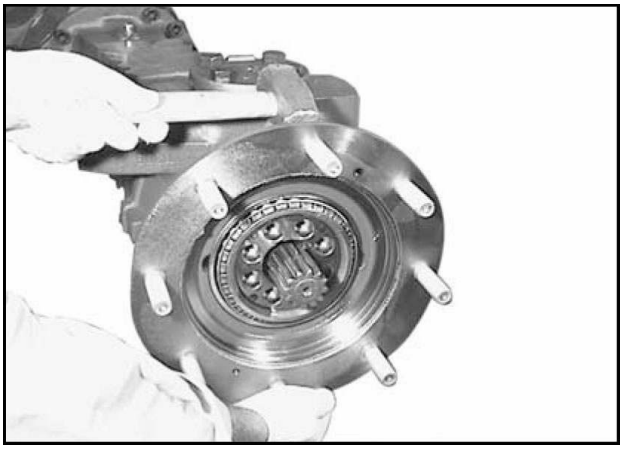


Remove the snap ring.

Check the condition of the components.

Only if necessary, remove the centering bushes of the hub snap ring gear, using special tool CA715027 and a hammer.

## STEP 7

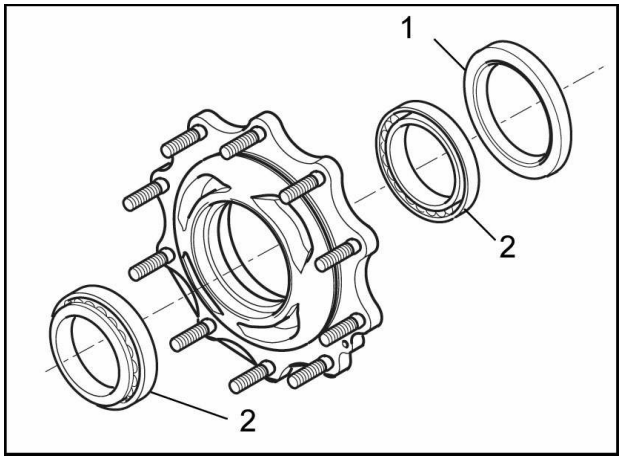


Remove the wheel hub using levers and a hammer.

**ATTENTION:** *Be careful not to damage the bearings.*

**NOTE:** *Check the condition of the bearing cone.*

## STEP 8




Position the wheel hub on a flat surface and lever out the seal (1).

**NOTE:** *This is a destructive operation for the seal.*

Remove the bearing cups (2) from both sides of the hub, using a hammer and a suitable drift.

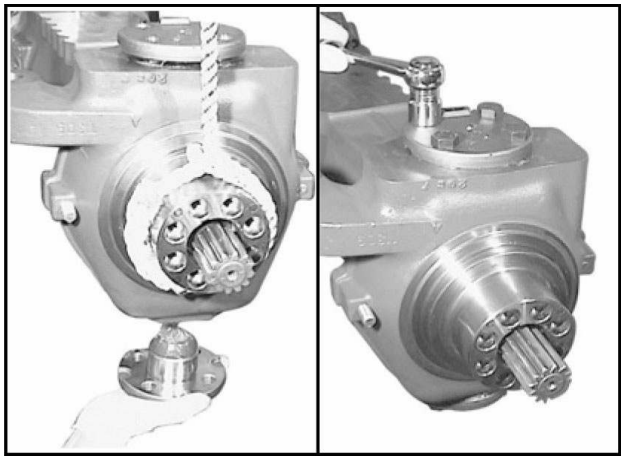
Remove the bearing cone from the swivel housing end, using a suitable extractor.

**ATTENTION:** *Be careful not to damage the bearing cone.*

https://truckmanualshub.com/



## STEP 9

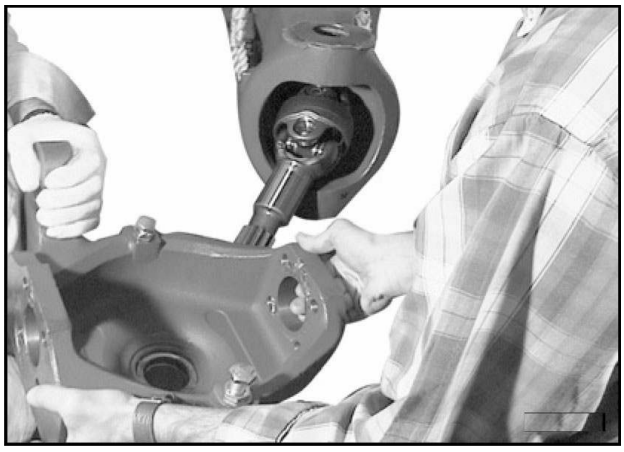


**ATTENTION:** *Before removing the king pins, secure the swivel housing with a harness fitted to a hoist or other supporting device.*

Unscrew and remove the fastening screws from the upper and lower king pin.

Remove the king pins.

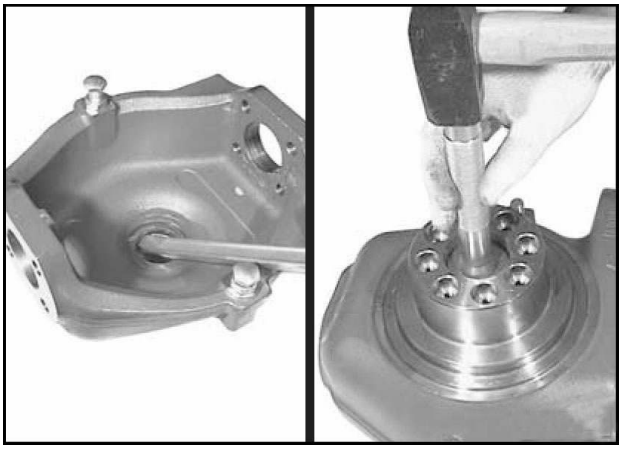
## STEP 10



Remove the swivel housing from the axle beam and the double U-Joint.

Collect the Belleville washers.

## STEP 11



Position the swivel housing on a flat surface and remove the seal with a lever.

**NOTE:** *This is a destructive operation for the seal.*

Turn the swivel housing and remove the bush, using a suitable drift and a hammer.

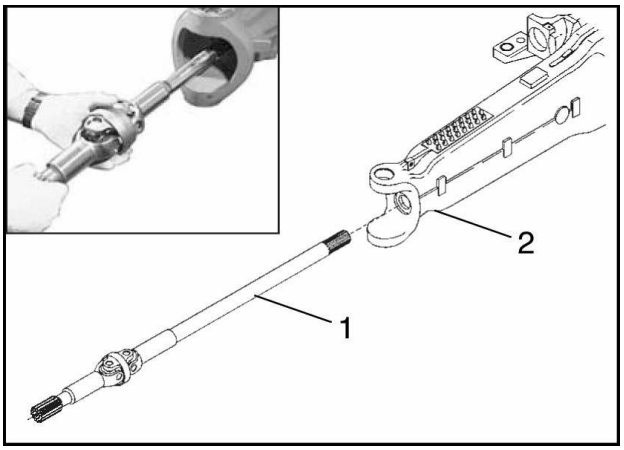
https://truckmanualshub.com/



# AXLE BEAM

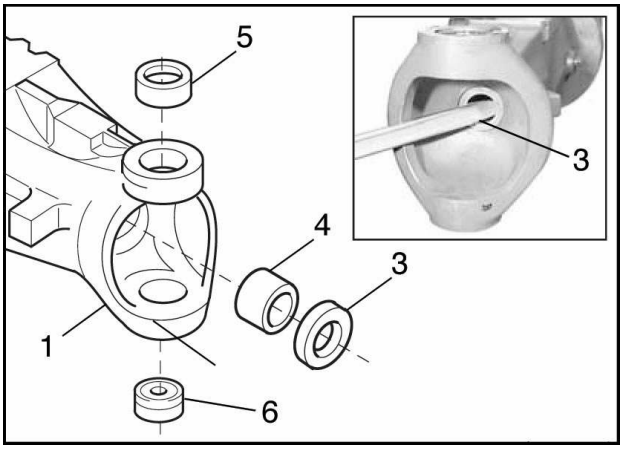
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1




Remove the double U-Joint (1) from the axle beam (2).

## STEP 2




Remove the seal (3) from of the axle beam (1) using a lever.

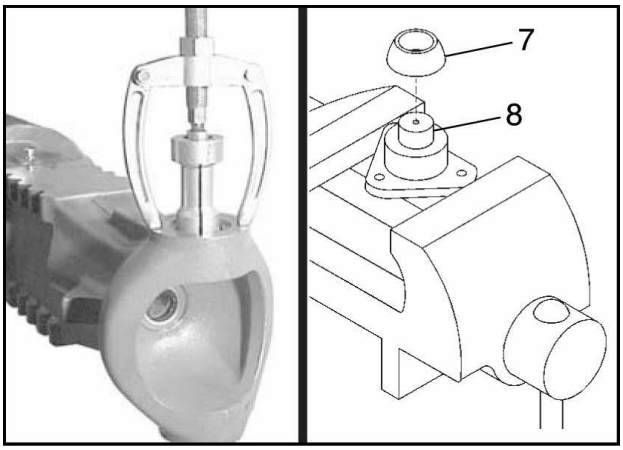
**NOTE:** *This is a destructive operation for the seal.*

Remove the bush (4) from the beam with a suitable extractor.

**NOTE:** *Examine the bush for wear before removal and only replace if necessary.*

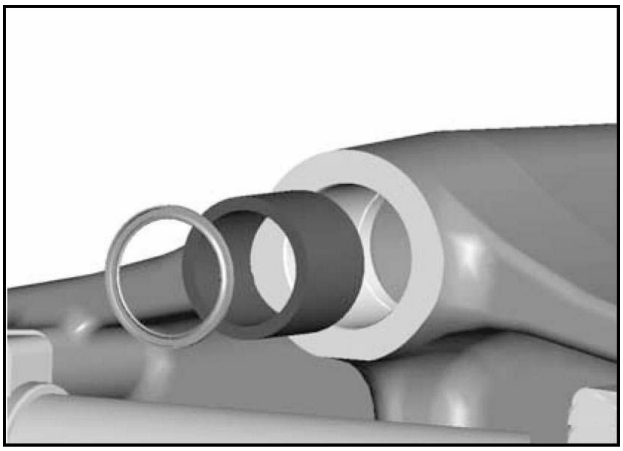
**ATTENTION:** *do not damage the bush seating.*

## STEP 3




Remove the upper (5) and lower (6, 7) bushes from the king pin seats (8) and from the king pin, using a suitable extractor.

## STEP 4



Using a suitable tool, remove the rear and front seals from the pivot.

**NOTE:** *This is a destructive operation for the seals.*

Using a suitable extractor, remove the rear and front bushes from the axle beam pivot.

**NOTE:** *This is a destructive operation for the bushes.*

https://truckmanualshub.com/

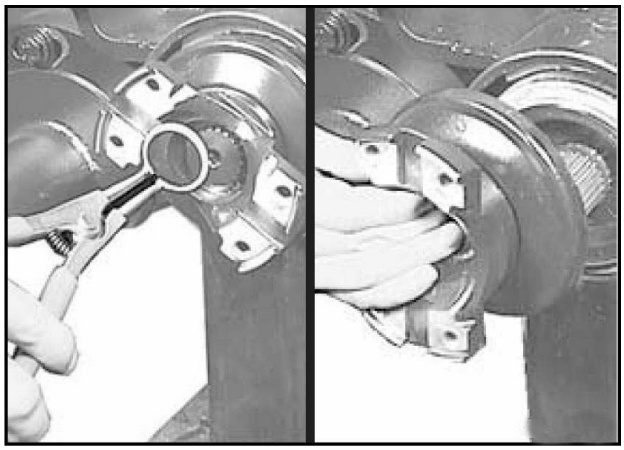


# DIFFERENTIAL SUPPORT UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before disassembling the differential support group, it is necessary to remove both universal joint units.*

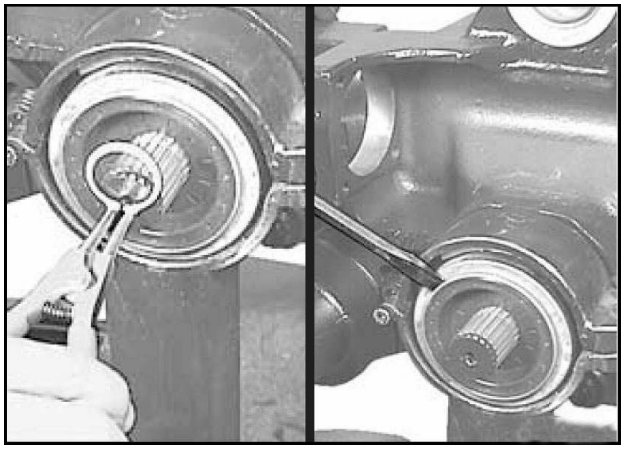
## STEP 1



Remove the snap ring.

Remove the flange with cover.

## STEP 2

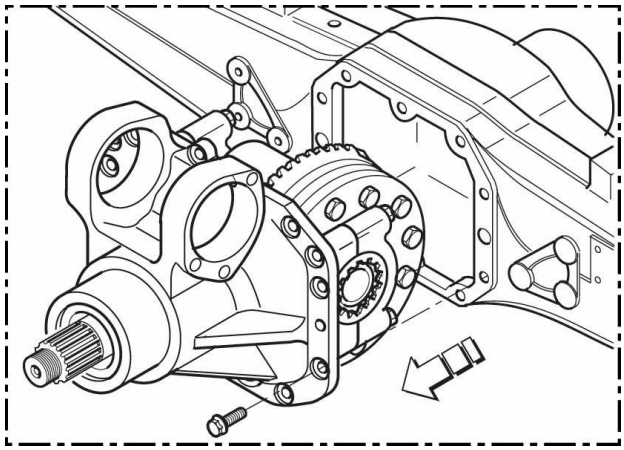


Remove the other snap ring.

Using a lever, extract the seal ring from the differential support.

**NOTE:** *This is a destructive operation for the seal.*

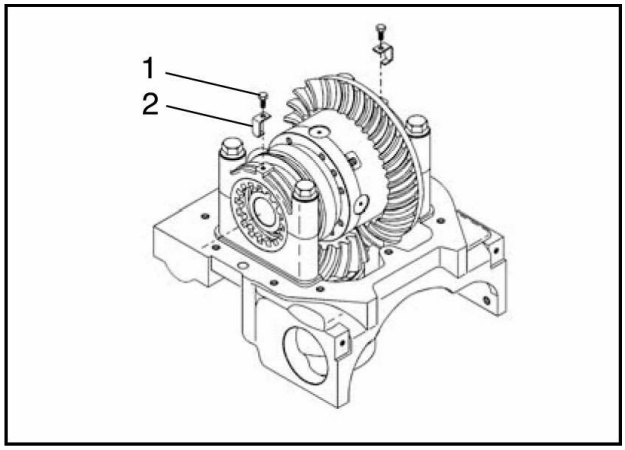
## STEP 3



**ATTENTION:** *Before disassembly, support the differential with a suitable harness and hoist.*

Remove the fixing bolts and remove the differential support from the central body.

## STEP 4

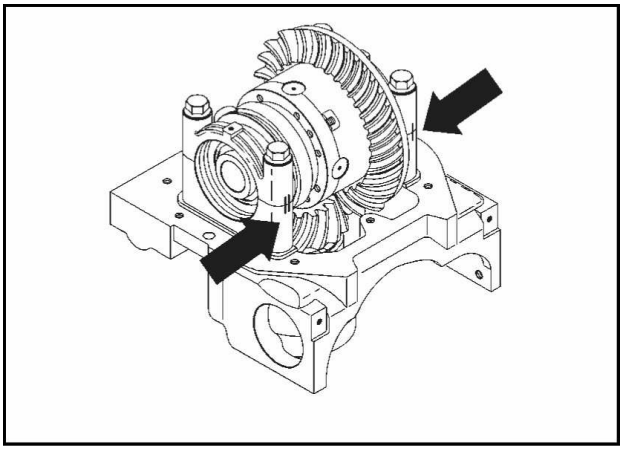



Unscrew bolts (1) to remove the ring nut locks (2).

https://truckmanualshub.com/

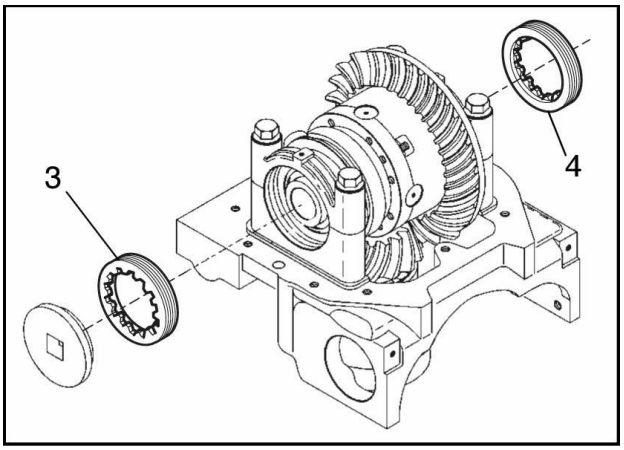


**STEP 5**



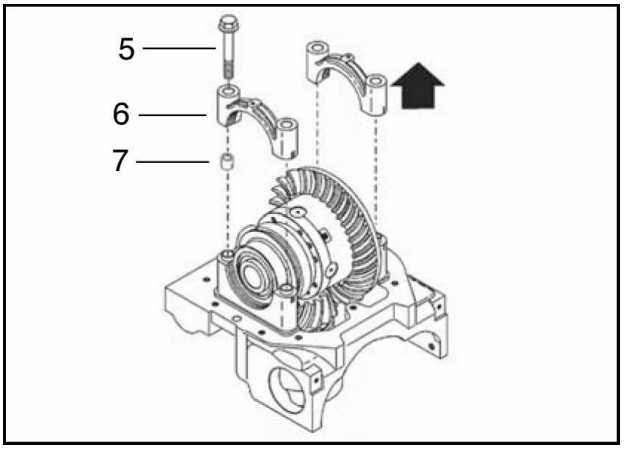
Before removing bearing cup bolts, mark bearing cups and the differential carrier with permanent reference marks to avoid incorrect assembly.

**STEP 6**




Unscrew the adjuster rings nuts (3) and (4), using special tool CA119030.

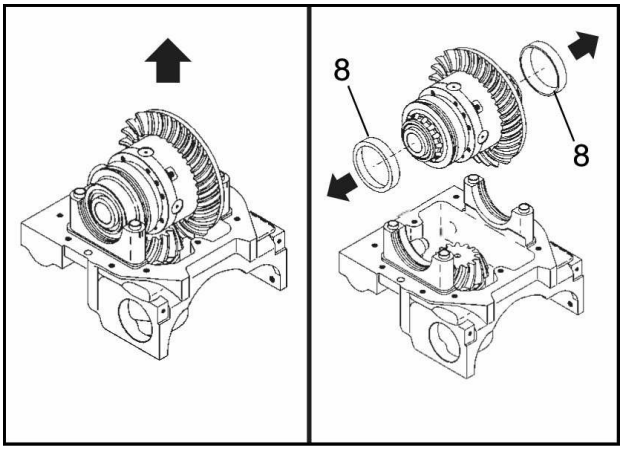
**STEP 7**




Unscrew the four screws (5) and remove the two half-collars (6).

Retain the four locating dowels (7).

**STEP 8**




Remove the differential unit.

**ATTENTION:** *Do not mismatch the bearing cups cups if they are not to be replaced.*

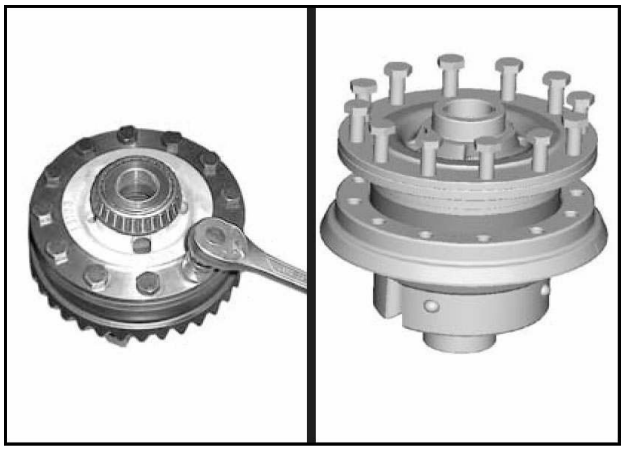
https://truckmanualshub.com/



# DIFFERENTIAL UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

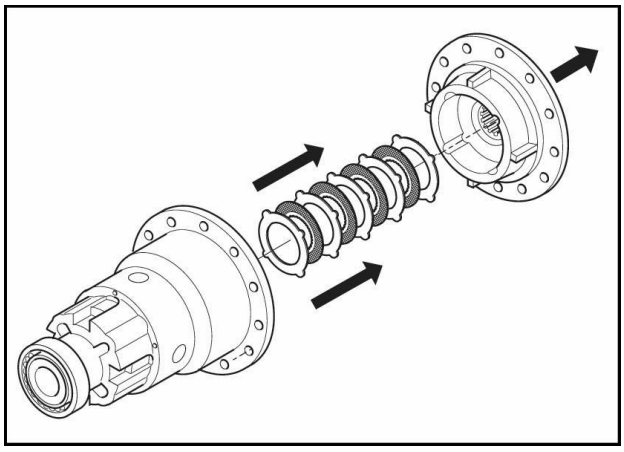
## STEP 1



Secure the differential in a soft jaw vice.

Remove the crown wheel retaining bolts and the crown wheel.

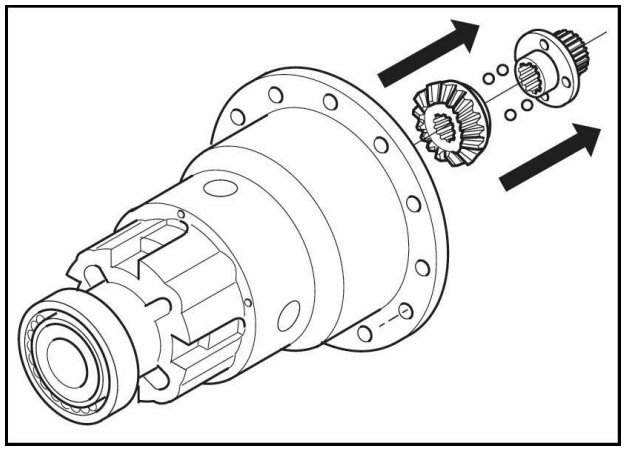
## STEP 2



Remove the cover from the differential housing.

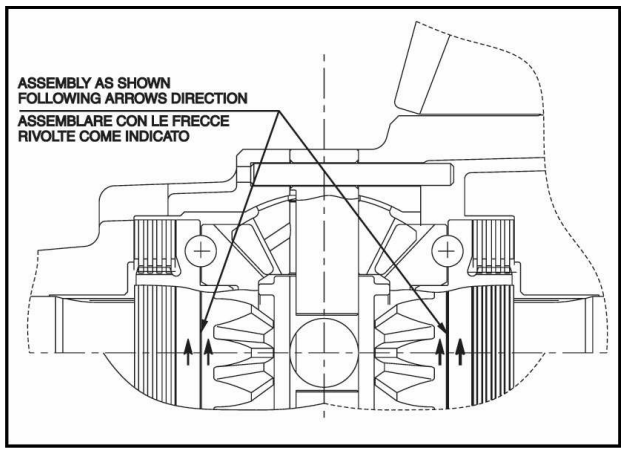
Remove plates and counterplates.

## STEP 3



Carefully separate the left sleeve, the balls and the right planetary gear.

## STEP 4

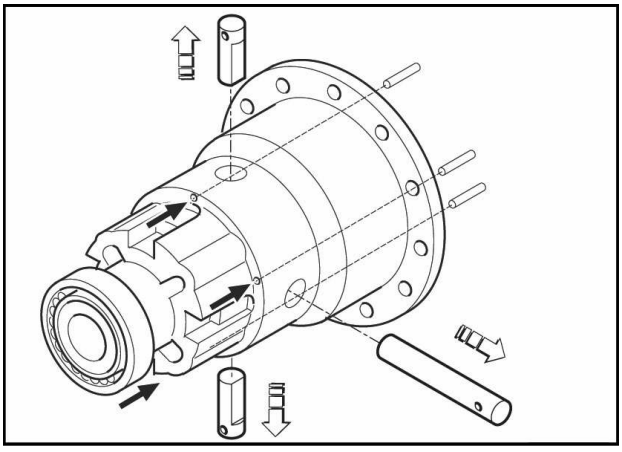



**ATTENTION:** *The two components of the left and right planetary are a matched set and must be re-assembled as shown.*

https://truckmanualshub.com/



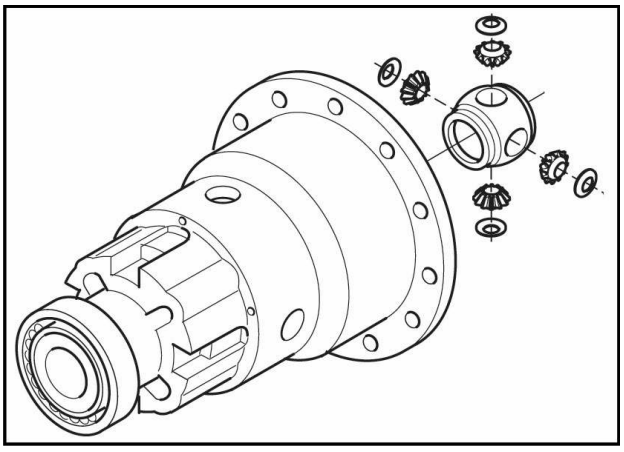
**STEP 5**



Using an appropriate punch, push out the three locking pins from the planetary shaft.

Slide the three pins out of the differential.

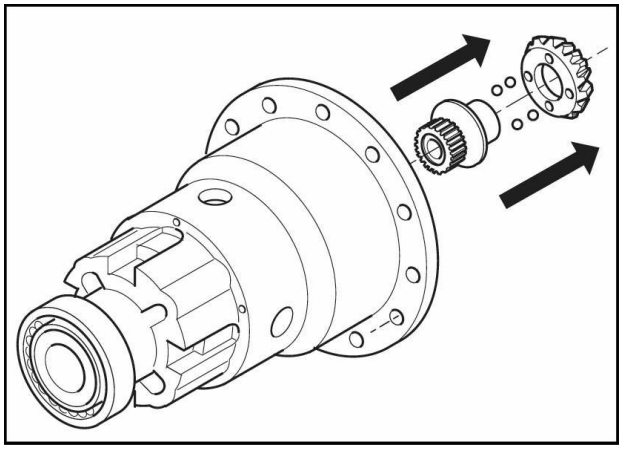
**STEP 6**



Disassemble all the components (washers, planetary gears and spider).

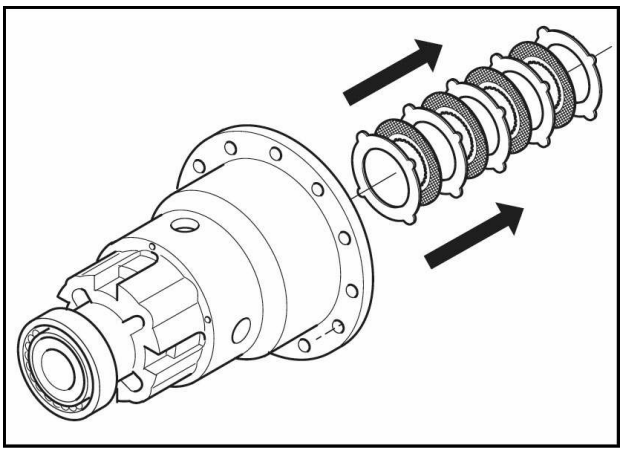
Carefully clean the components and check for wear.

**STEP 7**



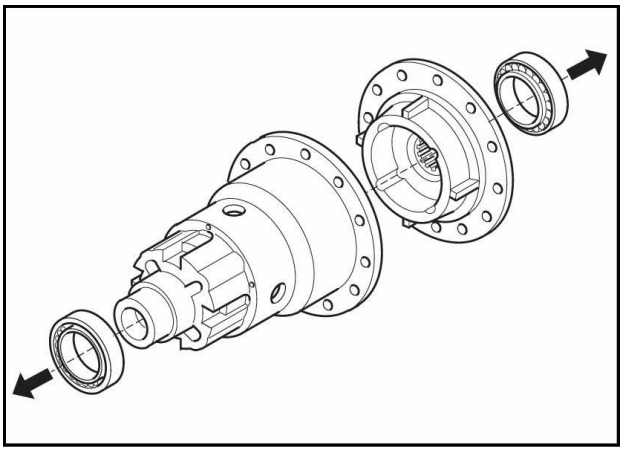
Remove the left planetary gear, the balls and the left sleeve.

**STEP 8**



Remove the left hand side friction and separate plates.

**STEP 9**



Using a suitable extractor. remove the bearings from the differential housing and cover.

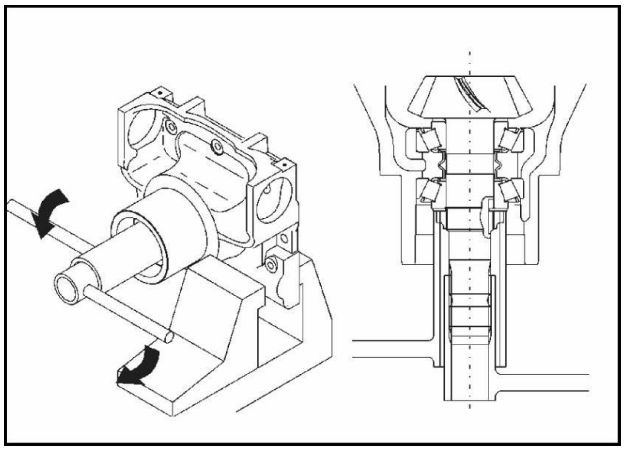
https://truckmanualshub.com/



# PINION UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1

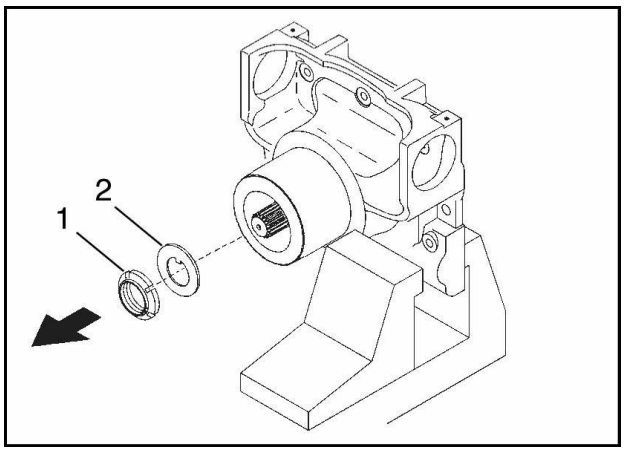


Lock the differential carrier in a vice.

Remove the ring nut using special tools CA119099 and CA715022.

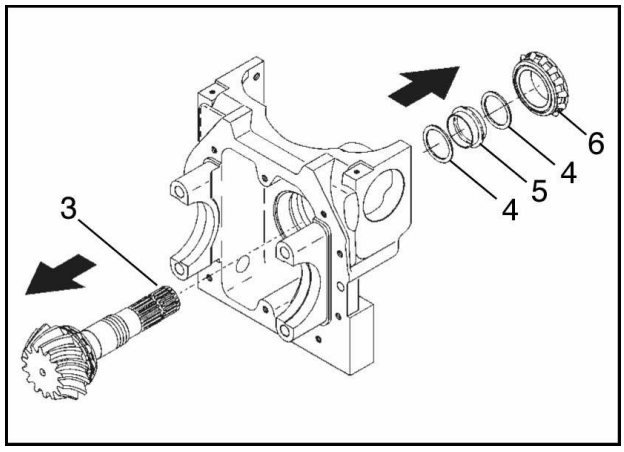
**NOTE:** *This is a destructive operation for the ring nut.*

## STEP 2




Remove the ring nut (1) and retaining washer (2).

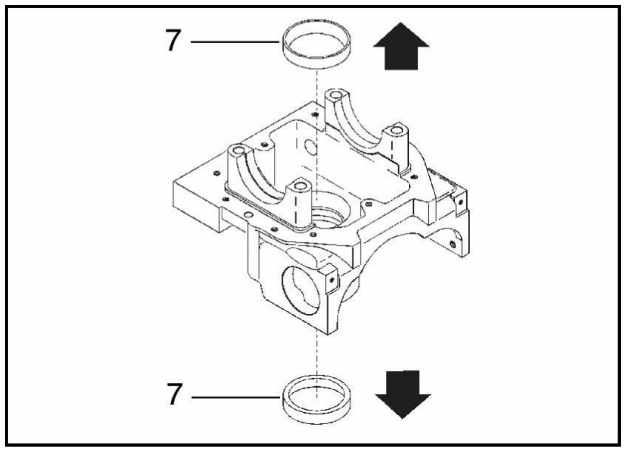
## STEP 3




Tap the shaft with a soft hammer to remove the bevel gear (3).

Collect the washers (4) the collapsible spacer (5) and the bearing cone (6).

## STEP 4

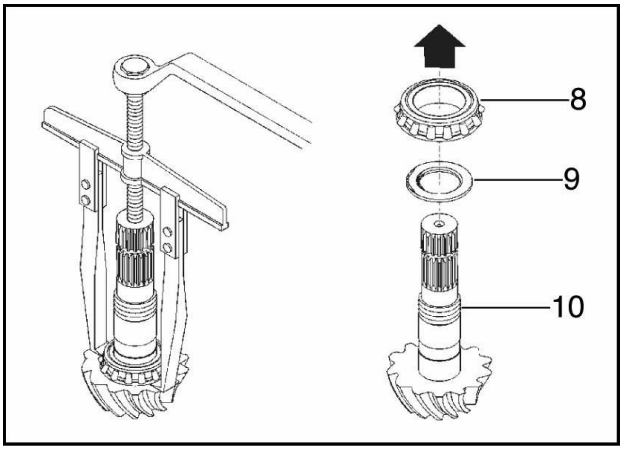



Remove the bearing cups (7) from the differential carrier using a drift and hammer.

https://truckmanualshub.com/



**STEP 5**




Remove the bearing cone (8) from the pinion (10), using a standard extractor.

Remove the underlying shim (9).

**STEP 6**



Check all pinion components for wear.

**NOTE:** *The ring nut and the collapsible spacer must be replaced when reassembling the group.*

https://truckmanualshub.com/



# ASSEMBLY OPERATIONS

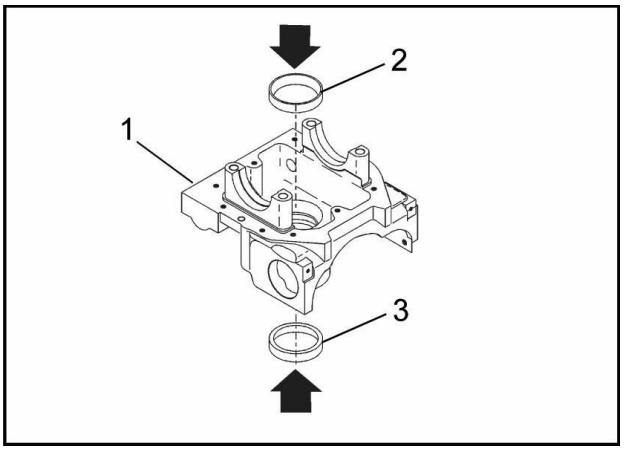
https://truckmanualshub.com/



# PINION UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

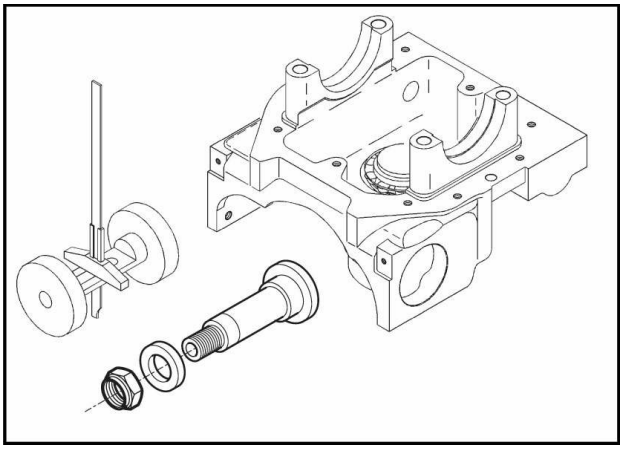
## STEP 1




Place the differential support (1) on a workbench.

Fit the bearing cups (2, 3) using the special tools CA751092, CA119225 and a hammer.

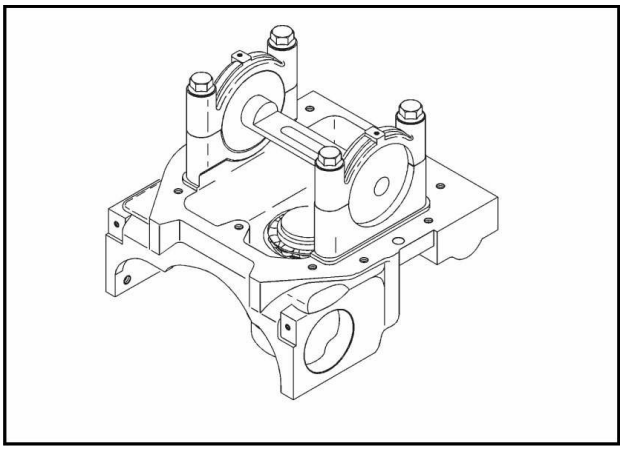
## STEP 2



Prepare the “false pinion” CA119202 and “false differential housing” CA119182 and CA119228.

A depth gauge is also required for this procedure.

## STEP 3



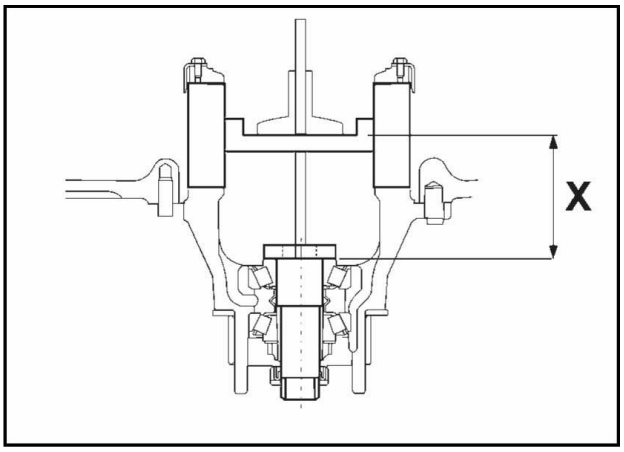
Insert the bearing cups in their seats.

Assemble the false pinion CA119202 and its ring nut.

Tighten until the backlash is eliminated, without exceeding the ring nut.

Install special tools CA119182 and CA119228 to the differential group supports and screw in the half collar bolts (see figure).

## STEP 4



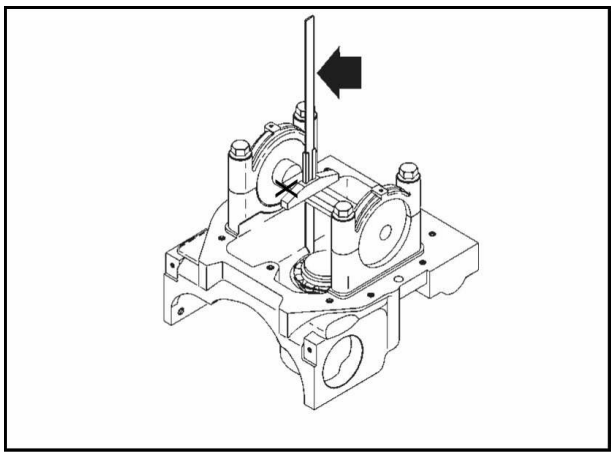

Use the depth gauge to measure the distance “X”.

See also step 5.

https://truckmanualshub.com/

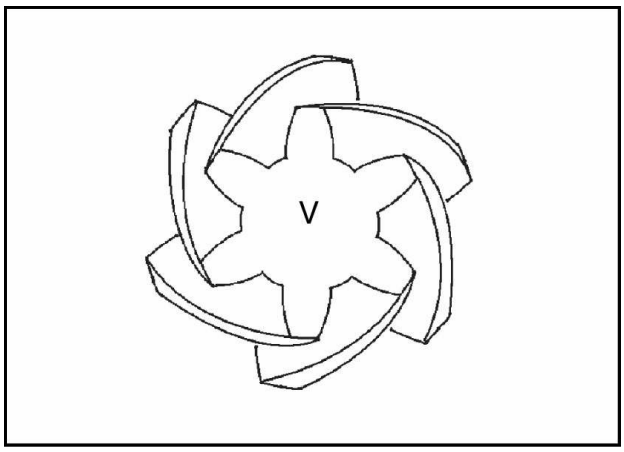


## STEP 5



Use the depth gauge to measure the distance between the axis of the differential bearings and the point at which the pinion head is supported, or the base of the bearing.

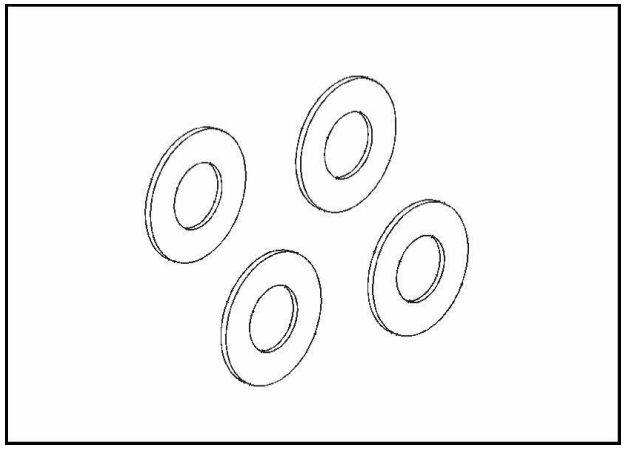
## STEP 6




From the value “X” deduct the value “V” (stamped on the pinion head) to get the value “S”.

**S (Shim thickness) = X - V mm**

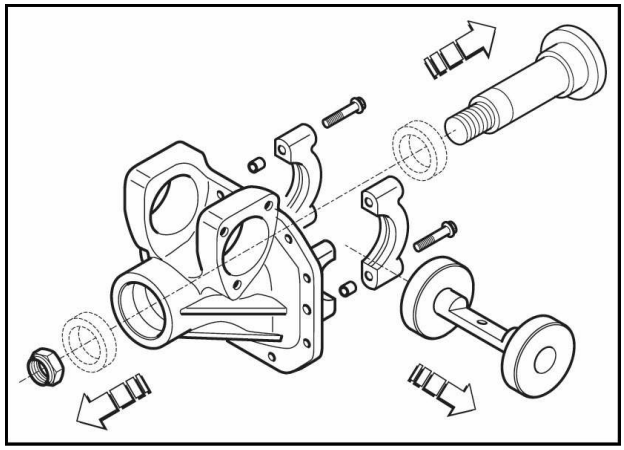
## STEP 7



| Shim Range S | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 |

Choose the shim with the thickness value (S) from the range of available shims, and fit it on the shaft under the pinion head.

## STEP 8



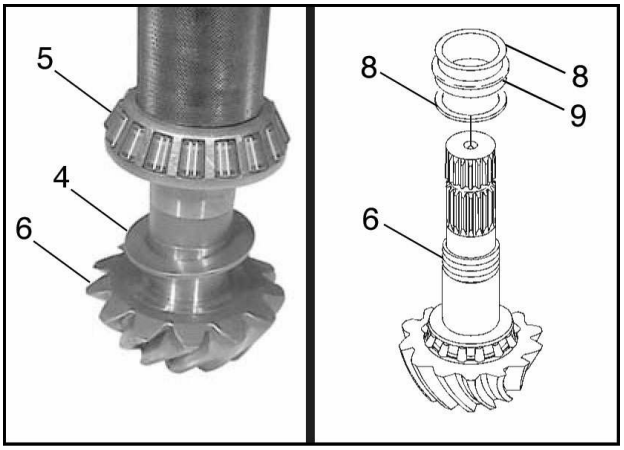
Remove the false differential housing.

Remove the ring nut, false pinion CA119202 and bearing cones.

https://truckmanualshub.com/



## STEP 9

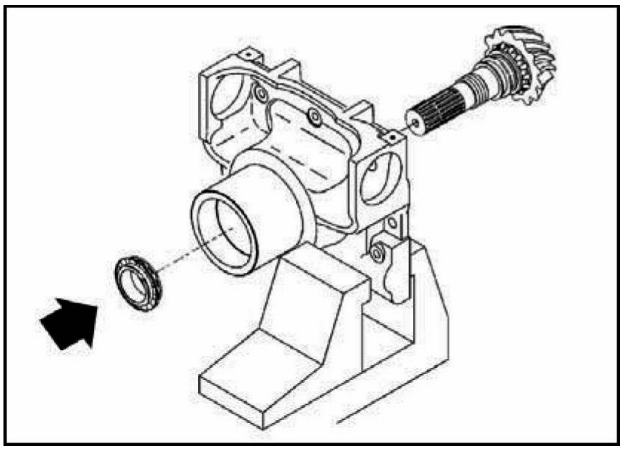



Insert the suitable shim (4) with chamfer against the gear onto the pinion shaft.

Force the bearing into the pinion shaft using CA715004 special tool under a press, making sure that it is well set. Insert the shims (8) and the new collapsible spacer onto the shaft (6).

**NOTE:** *Always use a new collapsible spacer (9).*

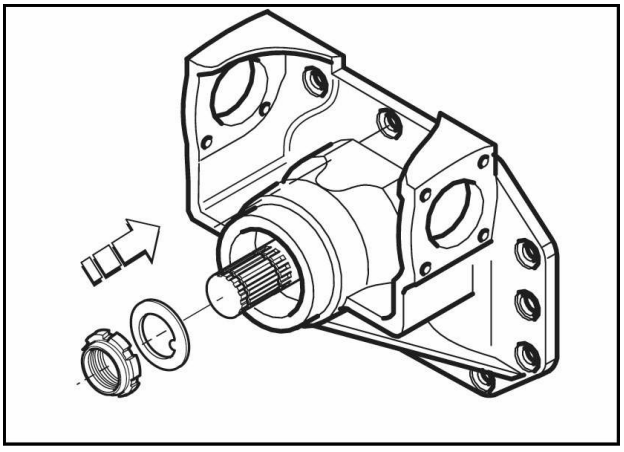
## STEP 10



Insert the bevel pinion shaft into the differential carrier seat and bearing cone onto the pinion shaft.

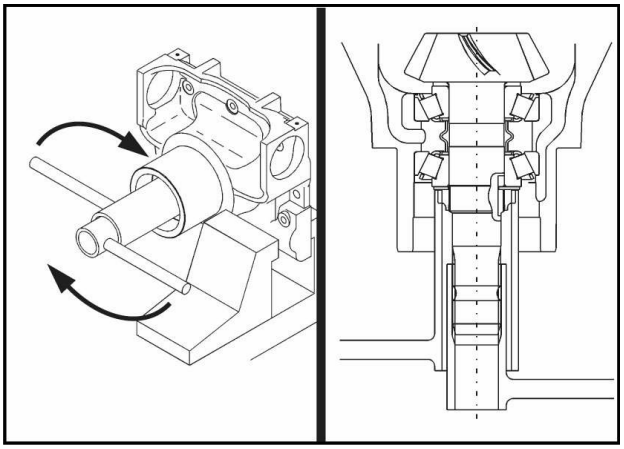
Force the bearing into position using the special tool CA715004 and a hammer.

## STEP 11



Insert a new ring nut washer and refit the locking ring nut.

## STEP 12



Use tool CA119099 to fit the ring nut and tool CA715022 to fit the pinion retainer.

**ATTENTION:** *The torque setting is given by the preloading measurement on bearings. Tighten the ring nut gradually.*

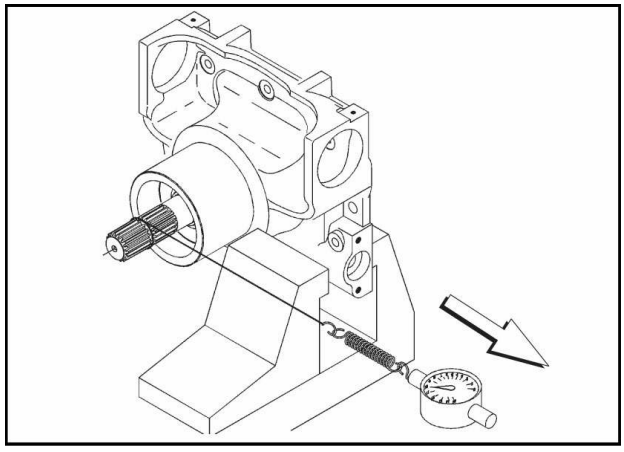
**NOTE:** *If the tightening is excessive, the elastic spacer will need to be replaced and the procedure repeated.*

When checking the preloading, it is advisable to tap both pinion ends with a soft hammer. This will help to reseat the bearings.

https://truckmanualshub.com/



## STEP 13



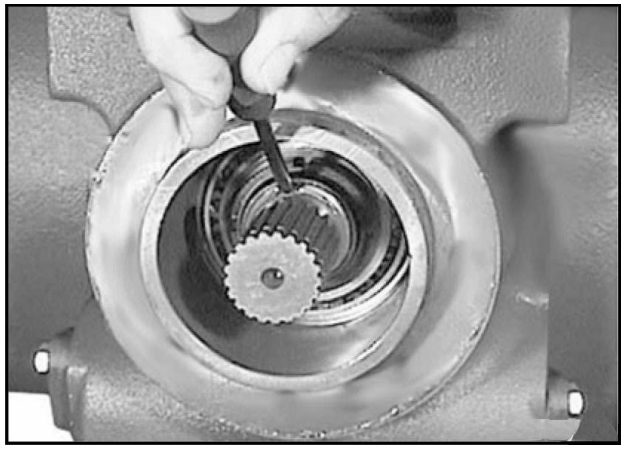
**P=92.7÷150.7 N**

Set the preloading measurement (P) of the pinion taper roller bearings, using a dynamometer with the cord wound around the pinion splined end.

Adjustment is carried out by gradually increasing the ring nut torque, taking care not to exceed the measurement.

**ATTENTION:** *All preloadings must be measured without the seal.*

## STEP 14



Once the requested preloading value is achieved, caulk the ring nut, using a hammer and a chisel.

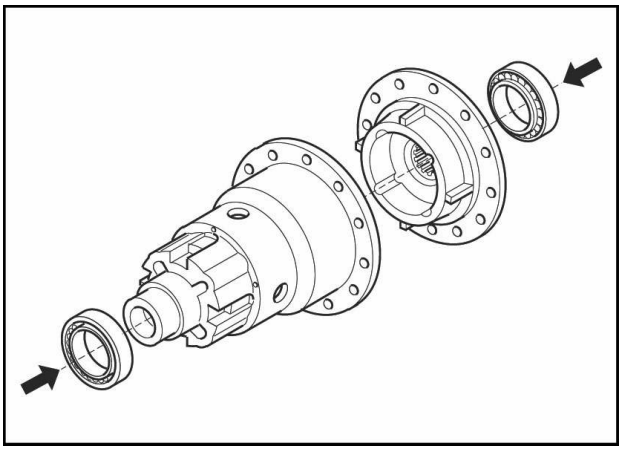
https://truckmanualshub.com/



# DIFFERENTIAL UNIT

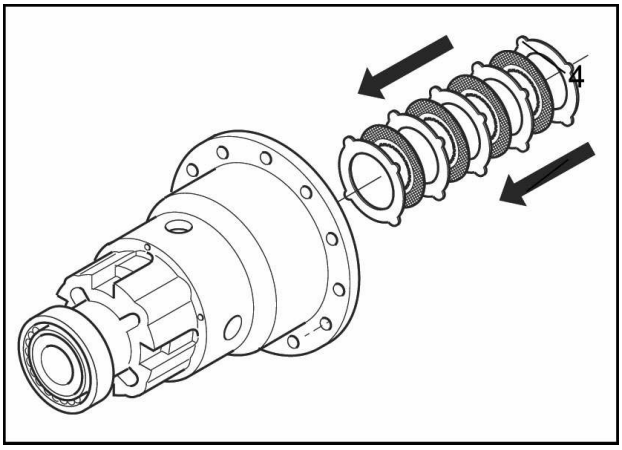
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



Assemble the bearing cones on the differential housing and cover, using the special tool CA715093 and a hammer.

## STEP 2

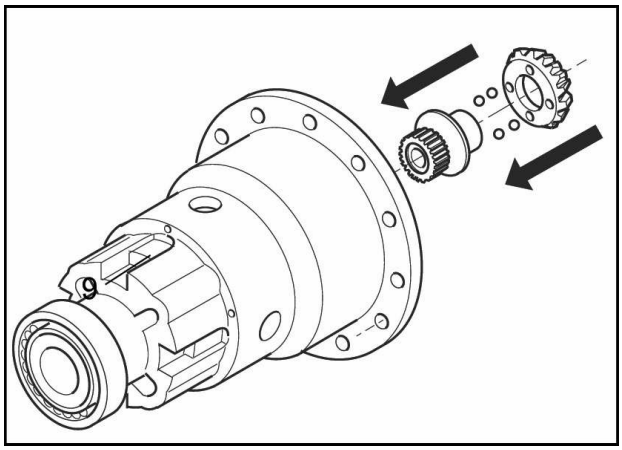



Position the differential housing on a workbench.

Install one separator plate and one friction plate into the differential housing. Continue until 5 separator plates and 4 friction plates have been installed.

**NOTE:** *The last plate installed must be a separator plate.*

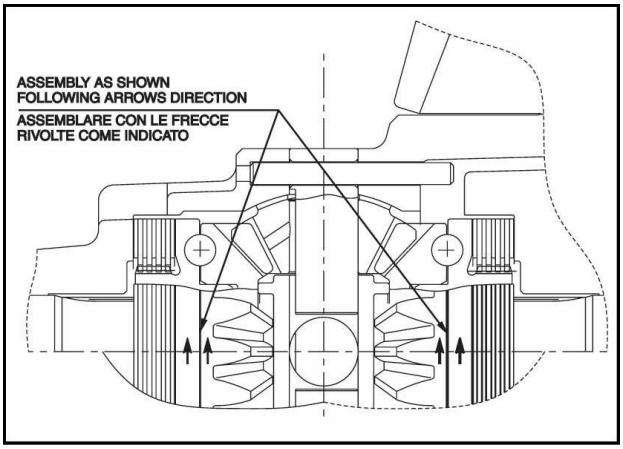
## STEP 3




Install balls into the left hub. Align the marks on side gear and hub making sure the arrows etched on the side gear and hub face in the direction shown. Install hub and gear as an assembly, making sure the hub splines are correctly located into the separator and friction plates.

Install thrust washer.

## STEP 4

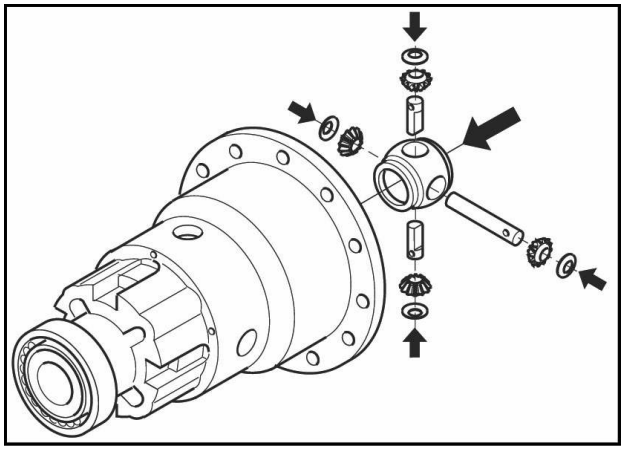



**ATTENTION:** *The two components of the left and right planetary are a matched set and must be assembled as shown.*

https://truckmanualshub.com/

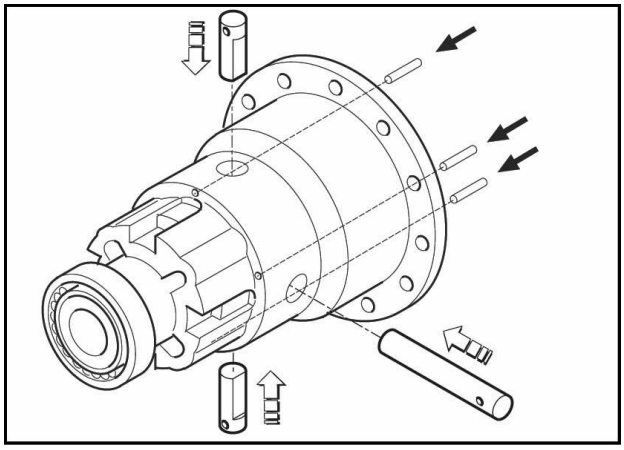


**STEP 5**



Install the spider, the washers and planetary gears.

**STEP 6**

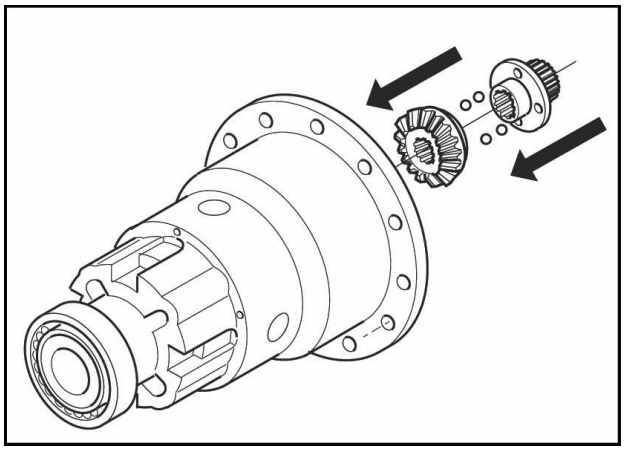


Install the long planetary pin through the planetary gears, thrust washer and spider.

Install the two short pins in the same way.

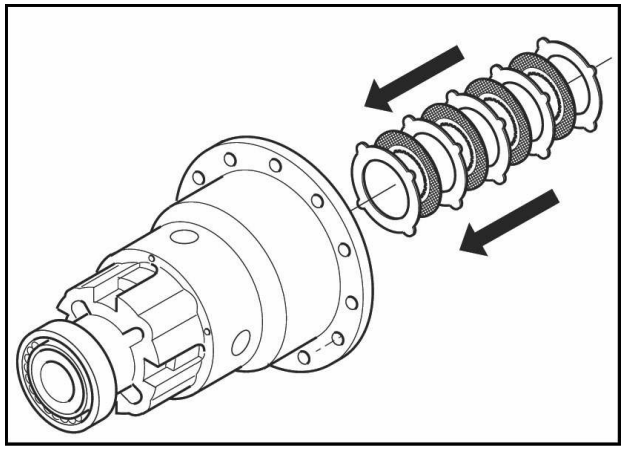
**NOTE:** *Completely insert the locking pins (11).*

**STEP 7**



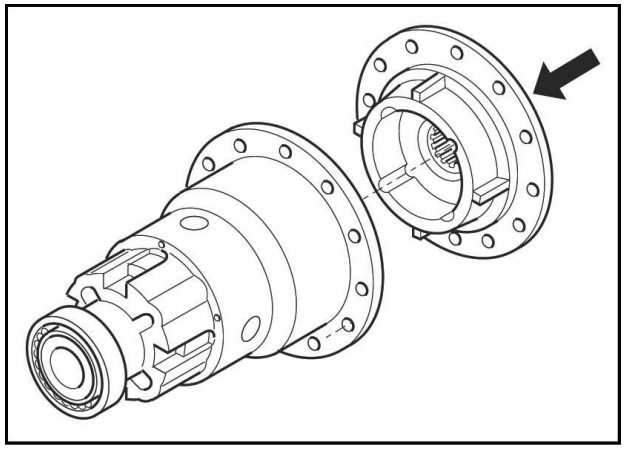
Insert the right planetary gear, the balls and the right sleeve.

**STEP 8**



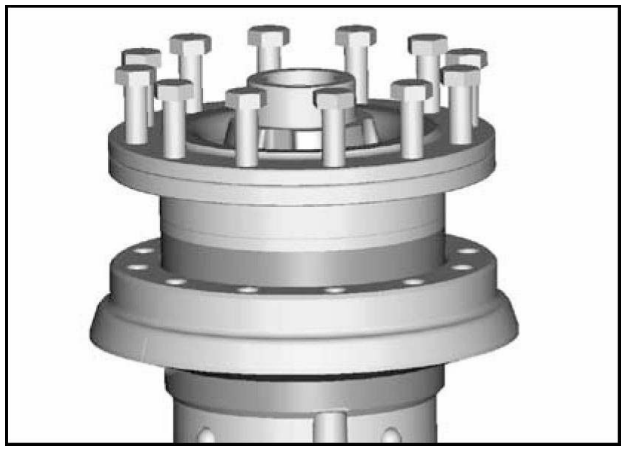
Insert the other group of plates and counterplates.

**STEP 9**



Refit the differential housing cover.

**STEP 10**



Install the crown wheel onto the differential housing.

Install the retaining bolt with LOCTITE 270 and tighten to the prescribed torque.

https://truckmanualshub.com/

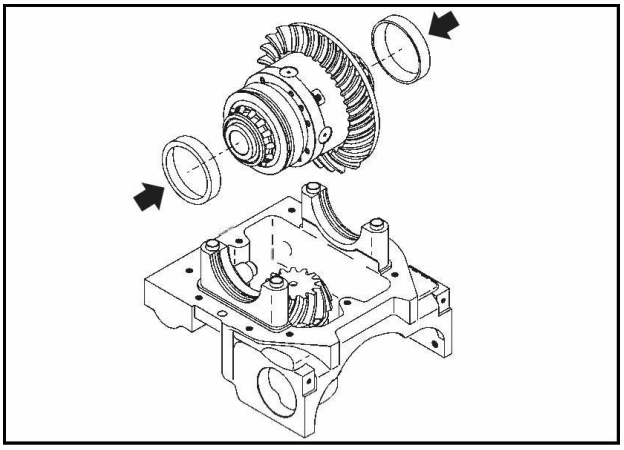


# DIFFERENTIAL UNIT SUPPORT

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before assembling the differential support group, it is necessary to assemble the pinion group.*

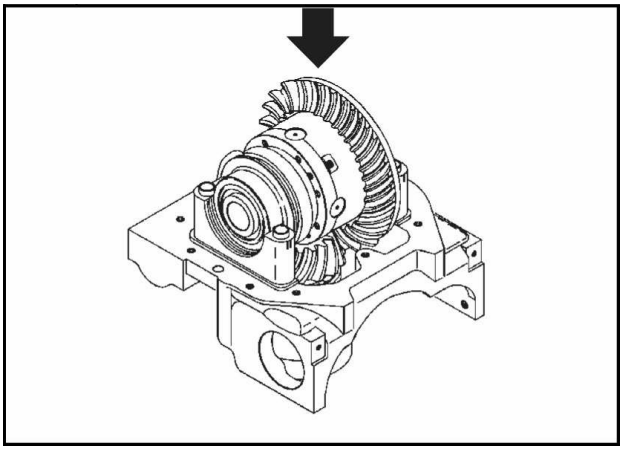
## STEP 1



Position the bearing cups on the differential unit.

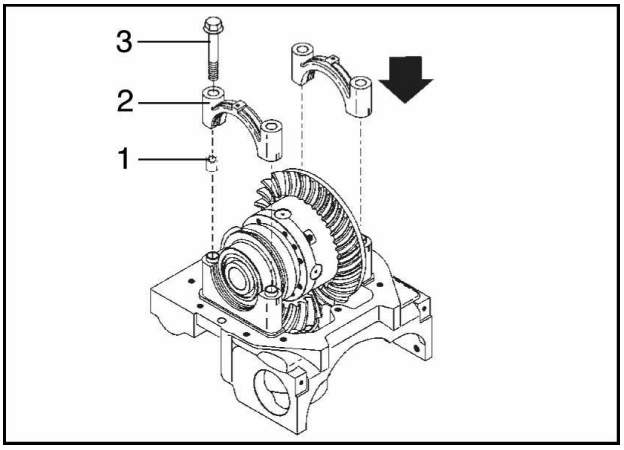
**ATTENTION:** *Do not mismatch the bearing cups if the bearings are not replaced.*

## STEP 2



Position the complete differential housing, with the bearing cups already assembled, onto the differential carrier.

## STEP 3

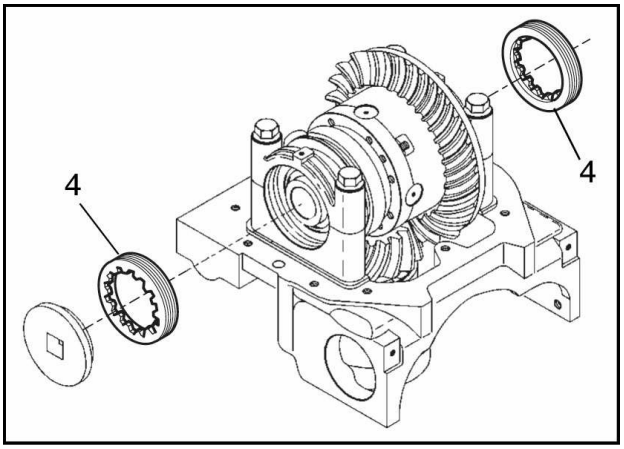



Move the differential group so to place the bevel crown gear on the pinion.

Install bushes (1) and bearing caps (2) with identification marks aligned.

Install retaining bolts (3) and tighten by hand.

## STEP 4



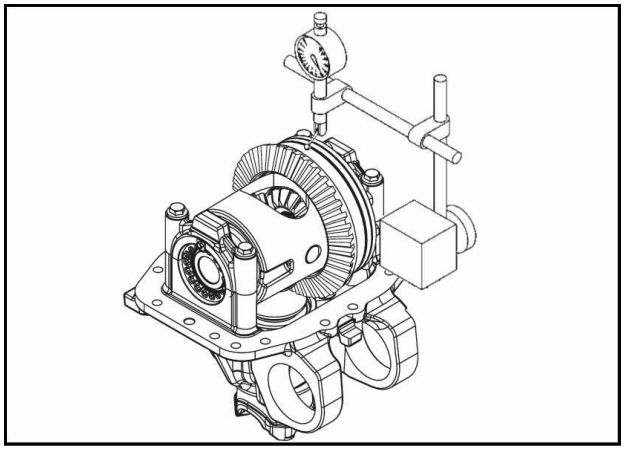

Assemble and install ring nuts (4) on the differential support. Using special tool CA119030, tighten the ring nuts to eliminate the slack and slightly preload the differential bearings.

If necessary, knock gently with a soft hammer to properly seat the bearings.

https://truckmanualshub.com/

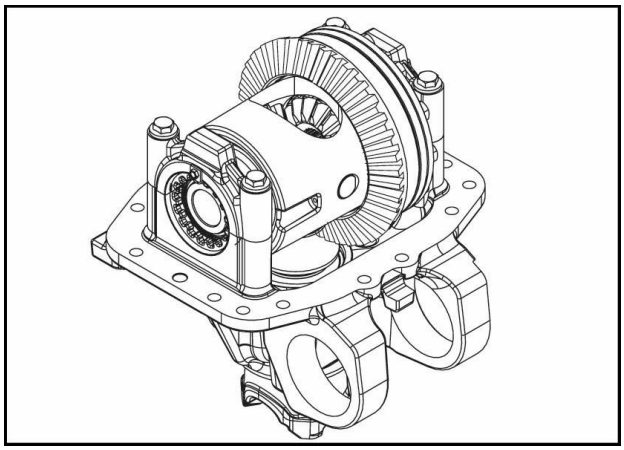


## STEP 5



Position a dial gauge on the differential support so that the feeler stylus touches the surface of one tooth of the crown gear with a 90° angle.

## STEP 6



Lock the pinion and move the crown wheel to measure the backlash.

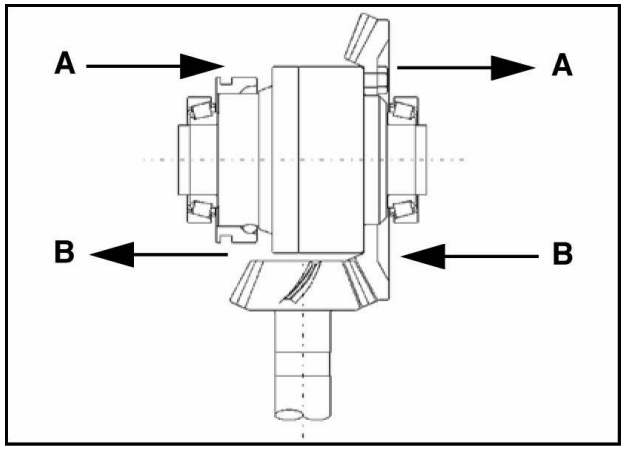
Repeat the operation on 2 or more points, rotating the crown gear, to obtain an average value.

The backlash should be within the range

**0.20÷0.28 mm**

Adjust by turning the two ring nuts with special tool CA119030.

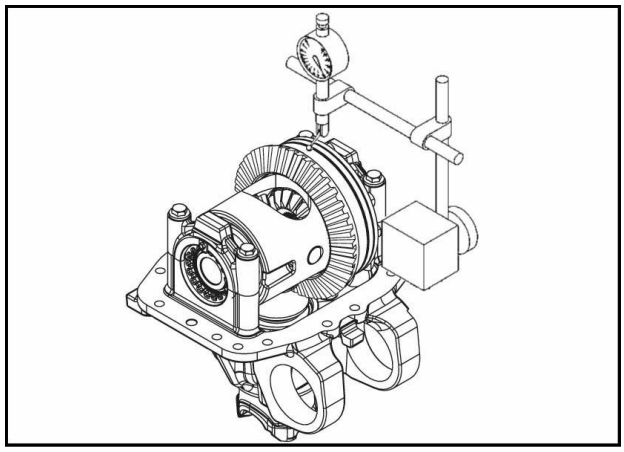
## STEP 7




If the measured backlash is less than the given tolerance range, unscrew the ring nut on the bevel crown gear side and screw in the opposite one by the same amount (A).

If the measured backlash is greater than the given tolerance range, unscrew the ring nut on the side opposite to the bevel crown wheel, and screw in the other one by the same amount (B).

## STEP 8



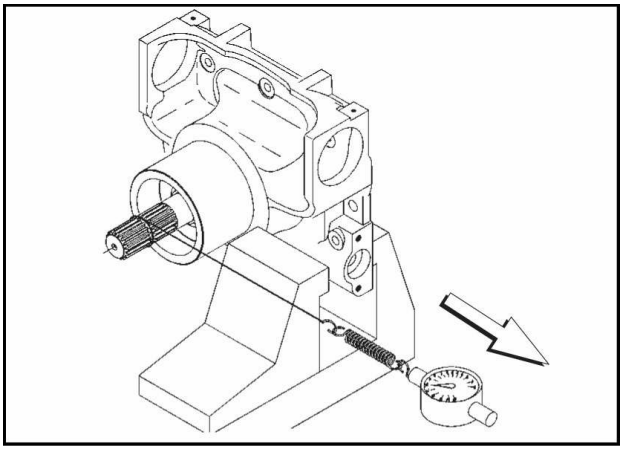
Once the pinion-ring gear backlash adjustment has been carried out, check also that there is a minimum preloading on the differential housing bearings.

Repeat the sequence until the correct backlash is reached.

https://truckmanualshub.com/



## STEP 9



Once the backlash has been established, measure the total preloading (T) of the bearing. Use a dynamometer, wind the cord around the pinion splined end and check the rolling pull.

The measured value should be within the following range:

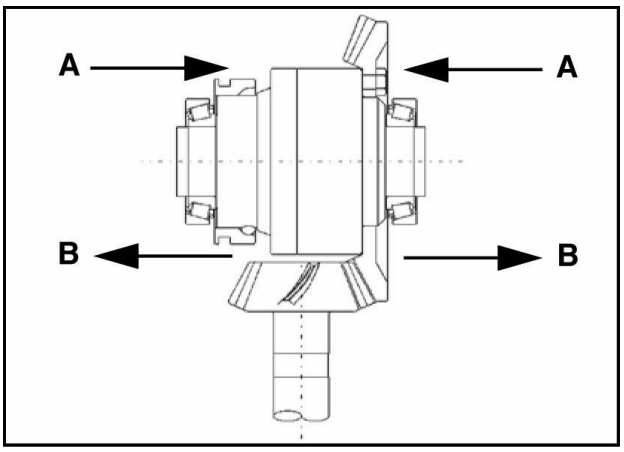
**T=(P+29.9)÷(P+48.6) N**

where P is the effectively measured pinion preloading.

See: “Pinion assembly”.

**ATTENTION:** *All preloadings must be measured without seal ring.*

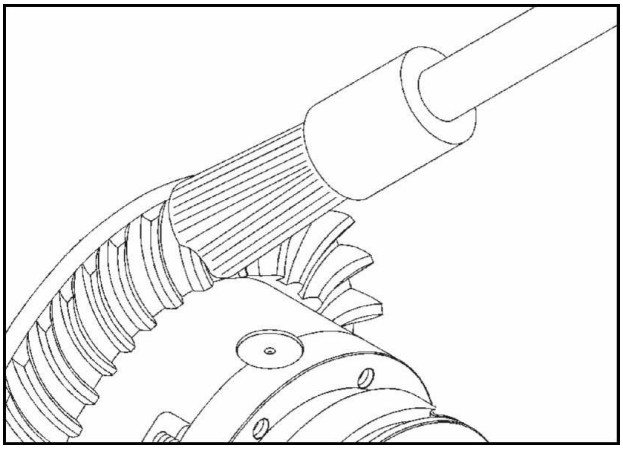
## STEP 10




If the total preloading is less than the given range, screw in both ring nuts by the same amount (A), keeping the pinion-ring gear backlash value unchanged;

If the total preloading is greater than the given range, unscrew both ring nuts by the same amount (B), keeping the pinion-ring gear backlash value unchanged.

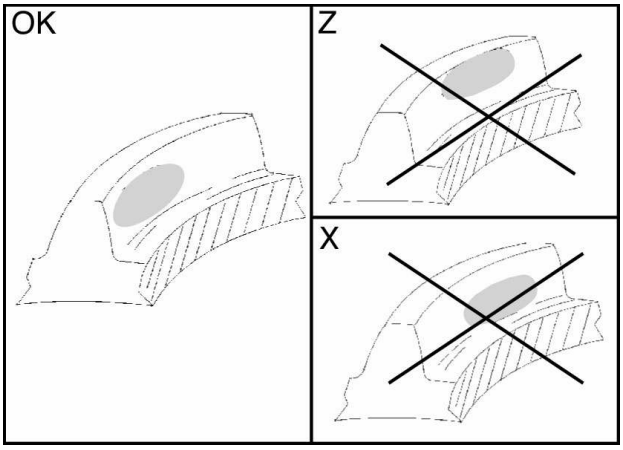
## STEP 11



**NOTE:** *To check the tooth pattern of the crown wheel and pinion, paint the ring gear with engineering blue.*

The marking test should be always carried out on the ring bevel gear teeth and on both sides.

## STEP 12




OK - Correct tooth contact.

Z - Excessive contact on the tooth tip.

The pinion shaft is too far out of engagement. Re-set the mounting distance and repeat the differential adjustment procedure.

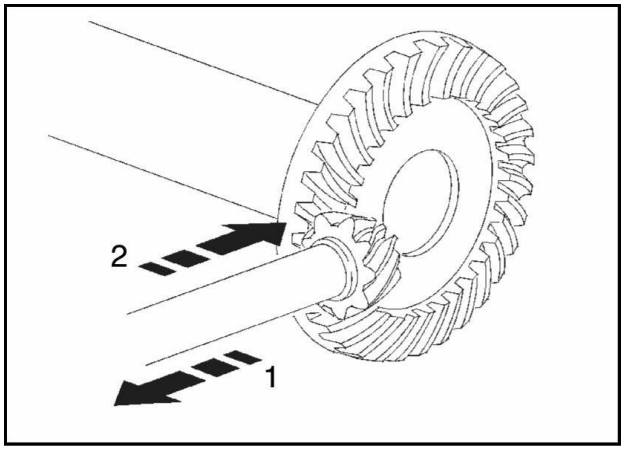
X - Excessive contact at the tooth base.

The pinion shaft is too far into engagement. Re-set the mounting distance and repeat the differential adjustment procedure.

https://truckmanualshub.com/



## STEP 13

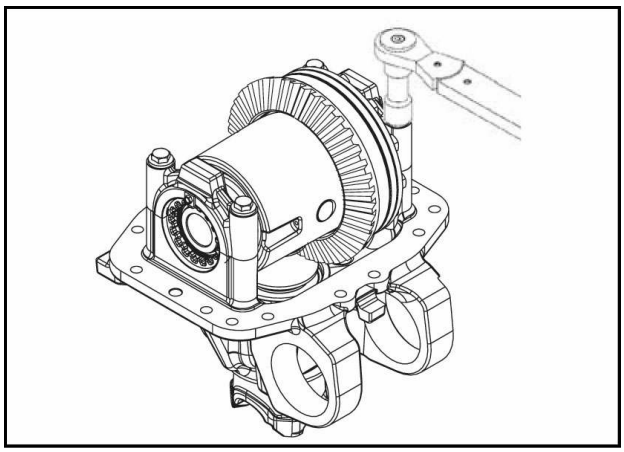



Movements to correct, pinion.

1 - Direction to move the pinion for type X contact adjustment;

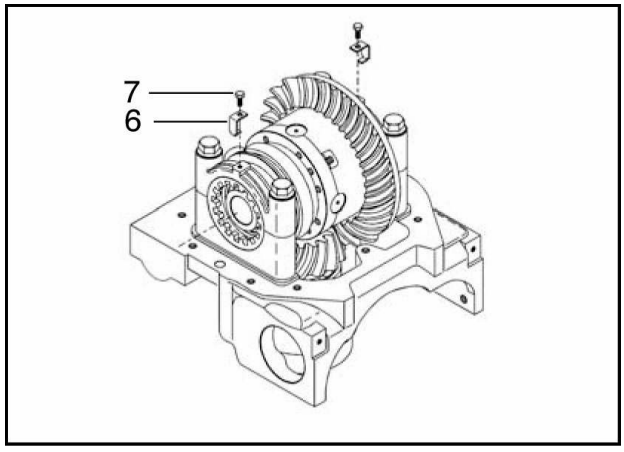
2 - Direction to move the pinion for type Z contact adjustment.

## STEP 14



Tighten the bearing cap retaining bolts to the prescribed torque.

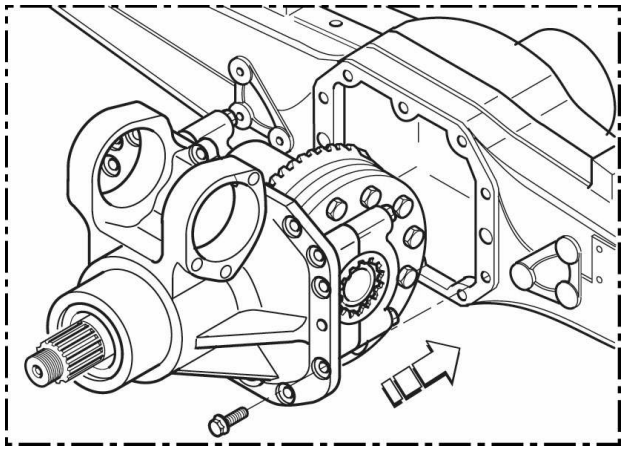
## STEP 15




Once all the adjusting operations have been performed, fit the ring nut retainers (6) and respective screws (7), tightening them to the prescribed torque.

**NOTE:** *Align the retainer correctly.*

## STEP 16



**ATTENTION:** *Before matching surfaces, make sure they are perfectly clean; degrease and clean with an appropriate cleaner.*

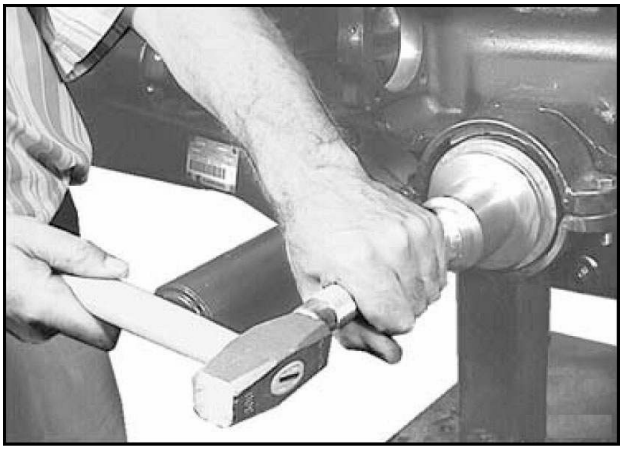
Spread a film of LOCTITE 510 on the contact surface between the axle beam and the differential carrier.

Position the differential carrier on the axle housing and tighten the bolts to the prescribed torque.

https://truckmanualshub.com/

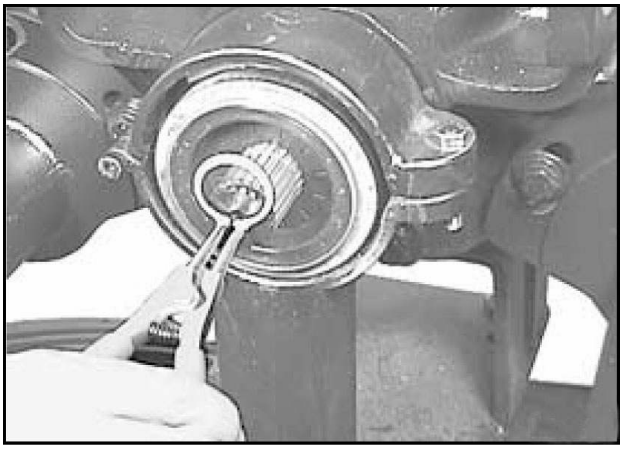


**STEP 17**



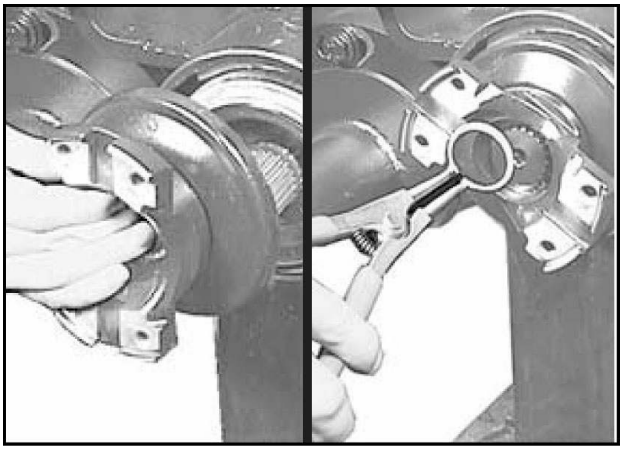
Tap a new seal onto the central beam assembly, using special tool CA119148 and a hammer.

**STEP 18**



Fit the flange support snap ring onto the pinion shaft.

**STEP 19**



Fit the flange with cover onto the pinion end.

Fit the other snap ring onto the pinion shaft.

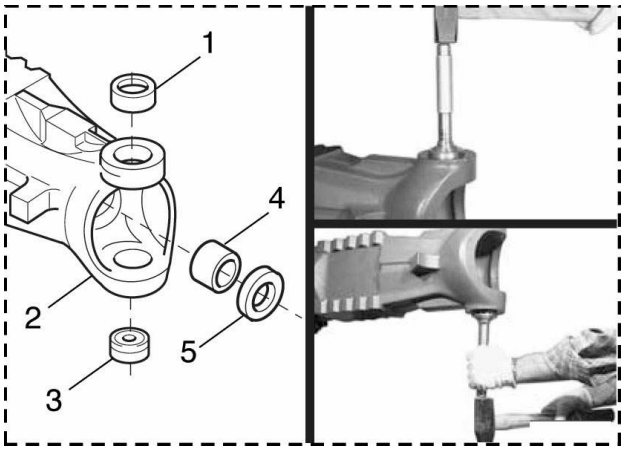
https://truckmanualshub.com/



# AXLE BEAM UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



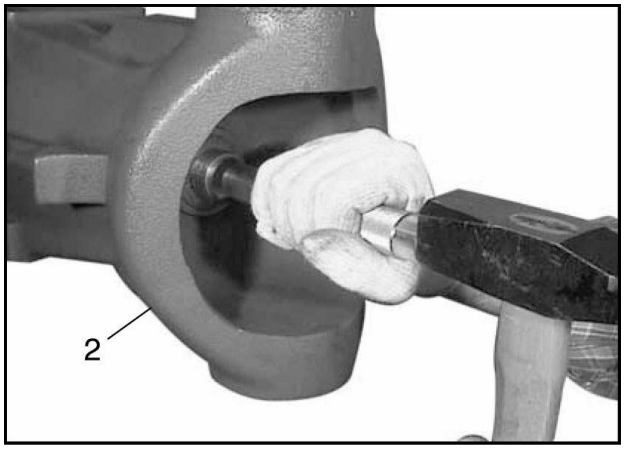

Assemble the upper king pin bush (1) onto the axle beam (2) using special tool CA715034 and a hammer.

Insert the ball bearing cup (3) onto the lower part of the axle beam using special tool CA715034 and a hammer

**NOTE:** *To make the assembly easier, cool the bush (1) and ball race cup (3) to a temperature lower than -100°C.*

**ATTENTION:** *Wear safety gloves.*

## STEP 2

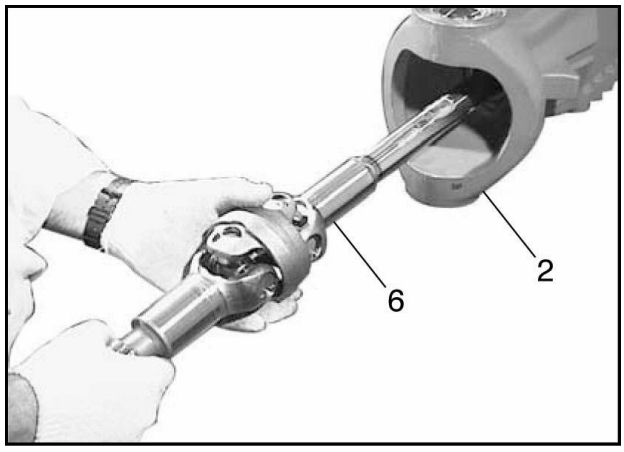



Assemble the bush (4) on the axle beam (2) using special tool CA715614 and a hammer.

Assemble the seal (5) on the beam using special tool CA715526 and a hammer.

Grease carefully the seal lip.

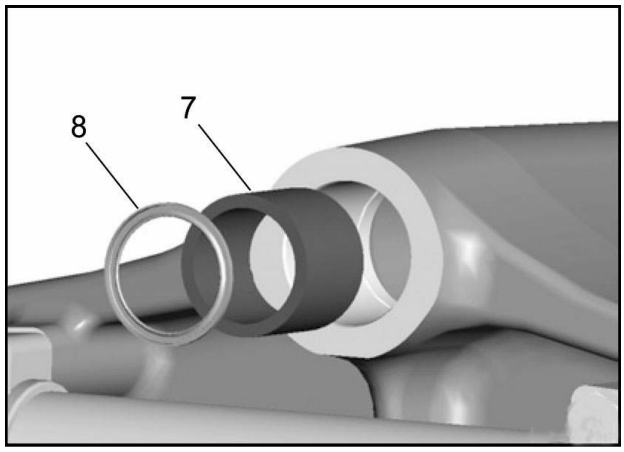
## STEP 3




Insert the double U-Joint (6) inside the axle beam (2).

**ATTENTION:** *Be careful not to damage the seal.*

## STEP 4




**NOTE:** *To make the assembly easier, cool the bushes to a temperature lower than -100 °C.*

Install two new bushes (7) and two new seals (8) in the pivot on the axle beam, using special tools CA715163 and CA715164.

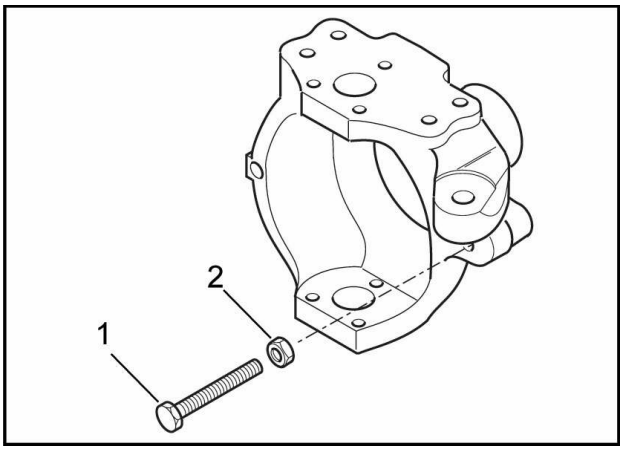
https://truckmanualshub.com/



# WHEEL HUB GROUP

Some of the following pictures may not show your axle, but the procedure is the same.

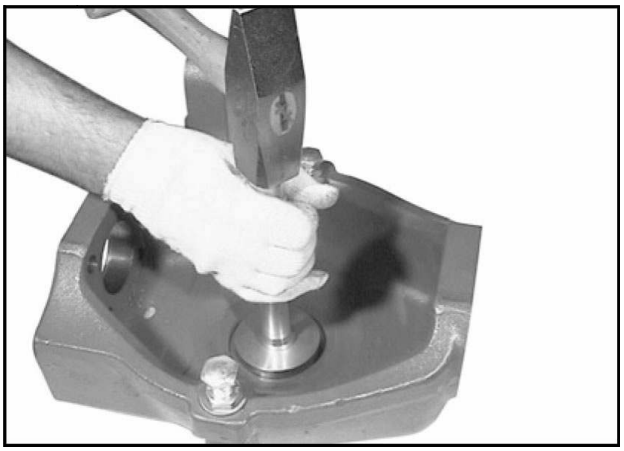
## STEP 1




If previously removed, reassemble the steering stop assembly bolt (1) and nut (2) onto to the swivel housing.

**NOTE:** *Do not tighten the nut (2) until the steering angle has been adjusted.*

## STEP 2

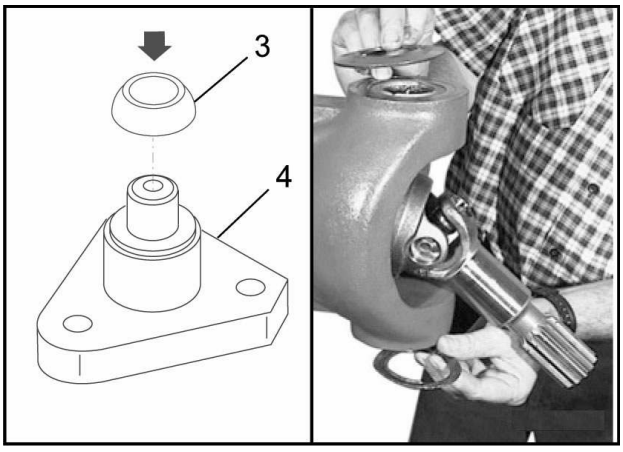


Force the bush into the swivel housing using special tool CA715036 and a hammer or press.

Carefully grease the seal.

Assemble the seal onto the swivel housing using special tool CA715468 and a hammer.

## STEP 3

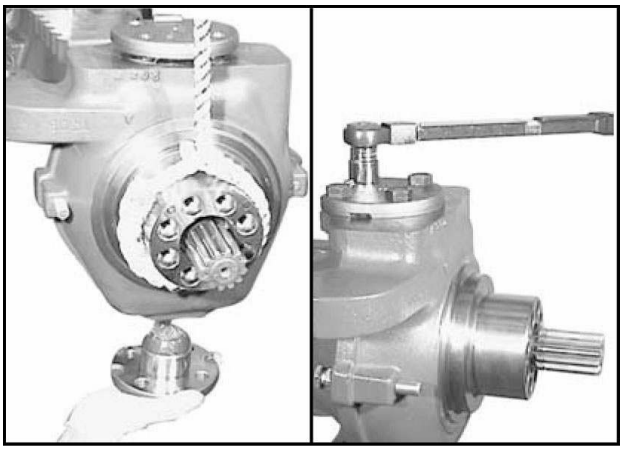



On a workbench, position the lower king pin (4) and assemble the spherical joint cone (3) using special tool CA715035 under a press.

Grease the king pin seats with specified grease.

Position the Belleville washers onto the king pin seats.

## STEP 4



**ATTENTION:** *Secure the swivel housing using a harness supported by a hoist.*

To avoid damaging the seal, protect the splined end of the axle shaft by wrapping with adhesive tape.

Assemble the swivel housing onto the axle beam trumpet and completely remove the adhesive tape, after assembly.

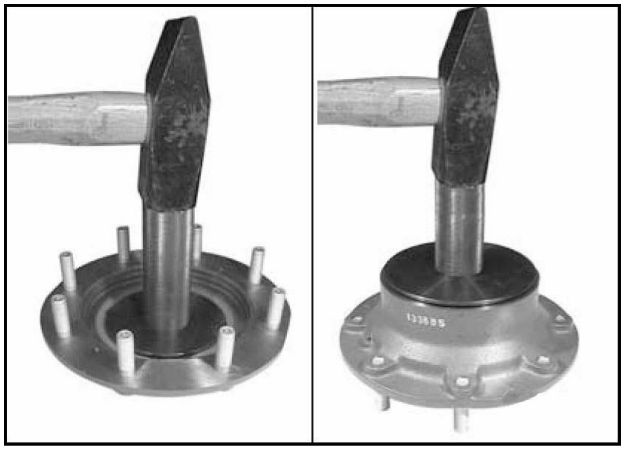
Assemble the lower and upper king pins, and tighten the retaining screws to the prescribed torque.

**NOTE:** *Make sure that the Belleville washers remain in position.*

https://truckmanualshub.com/



## STEP 5

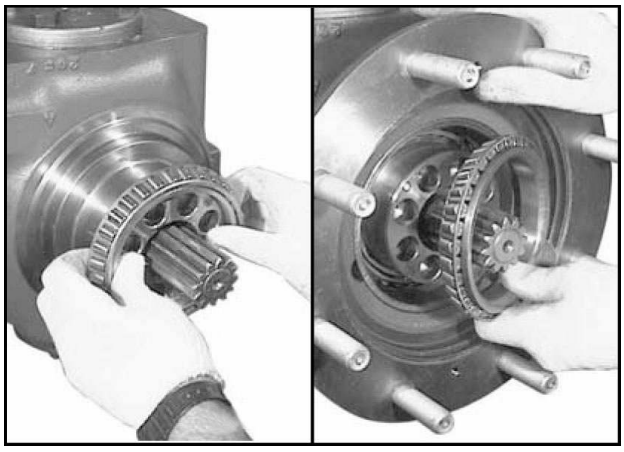


Place the wheel hub on a workbench and force both bearing cups into position using special tool CA715026 under a press or with a hammer.

**NOTE:** *Do not lubricate the seal.*

Insert a new seal into the wheel hub using special tool CA119143 and a hammer.

## STEP 6



Fit the bearing cone onto the swivel housing end.

Fit the wheel hub onto the swivel housing and fit the other bearing cone.

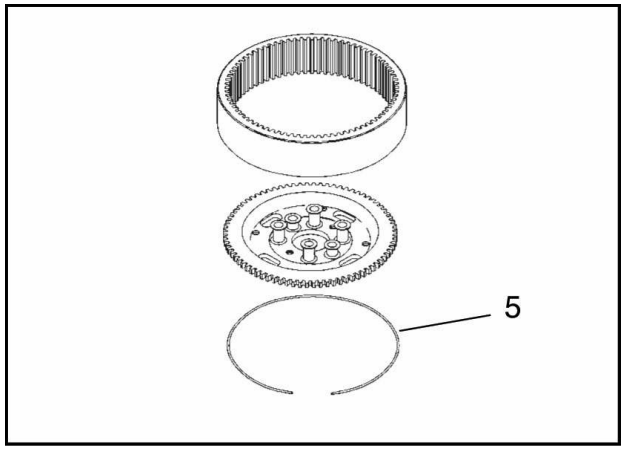
## STEP 7



On a workbench, force the bushes into the wheel carrier surface until flush, using special tool CA715027.

**NOTE:** *At least two bushes (diametrically-opposed) should be set slightly higher than the carrier surface to be used as dowel pins.*

## STEP 8

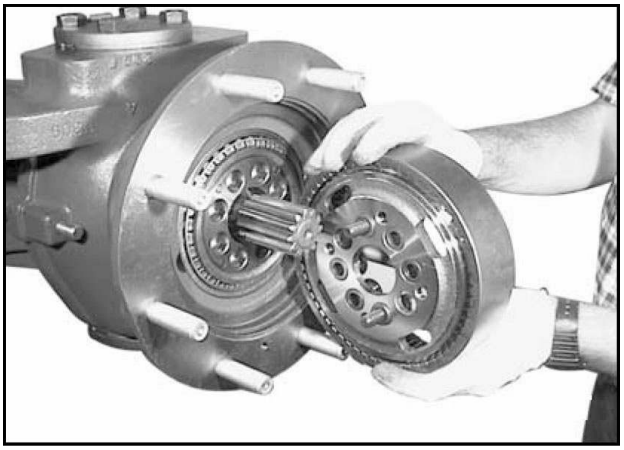



Pre-assemble the wheel carrier-epicyclic ring gear group with the special locking ring (5).

https://truckmanualshub.com/

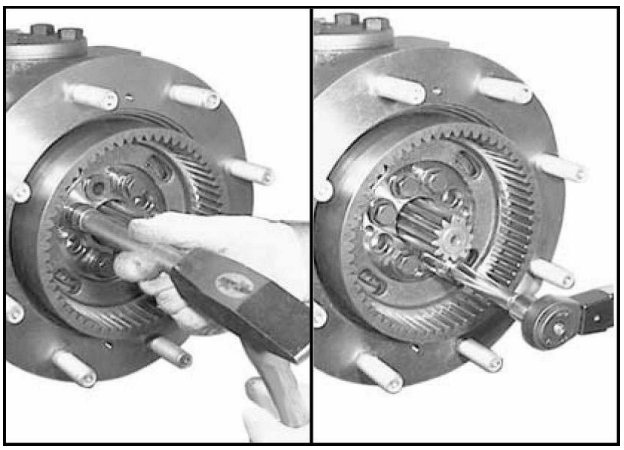


## STEP 9



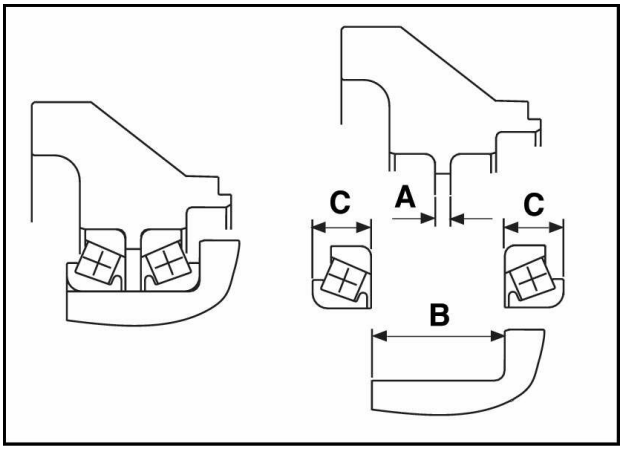
Assemble the wheel carrier group onto the wheel hub using the two projecting bushes as dowel pins and tighten the relative screws in order to correctly align the wheel carrier with the wheel hub.

## STEP 10



Insert all the hub dowel bushes completely using special tool CA715027 and a hammer. Fit the bolts and tighten to the prescribed torque.

## STEP 11



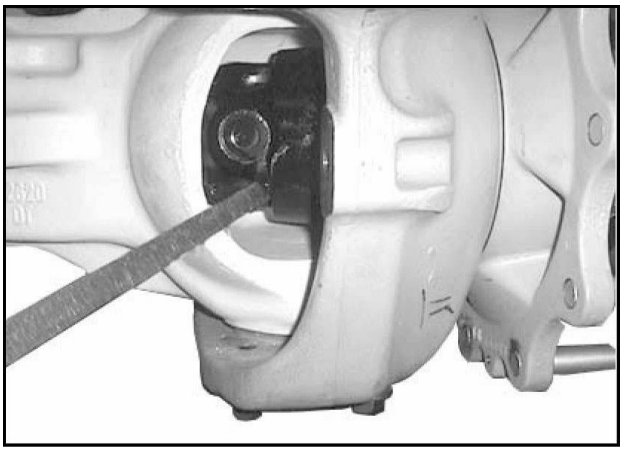

**A= 17.950 ÷ 18.000 (mm)**

**B= 64.275 ÷ 64.325 (mm)**

**C= 23.070 ÷ 23.172 (mm)**

The bearings do not require preload or backlash adjustment. However, before assembling new components, check the dimensions as indicated above.

## STEP 12



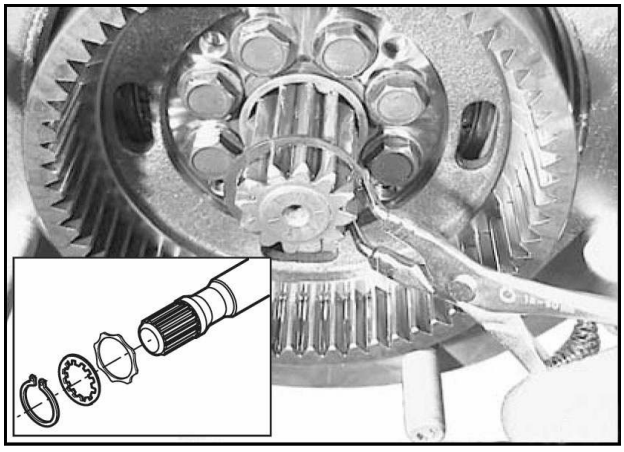
Insert a lever between the swivel housing and the axle beam and fit it into the double U-joint being careful not to damage it.

Using the lever, push the double U-joint in the direction of the wheel hub to facilitate the snap ring insertion.

https://truckmanualshub.com/



**STEP 13**



Slide the thrust washers onto the double U-Joint shaft and lock with the lock ring by inserting at the end of the splined hub and seating correctly.

Push the double U-Joint into position and check the lock ring is correctly fitted.

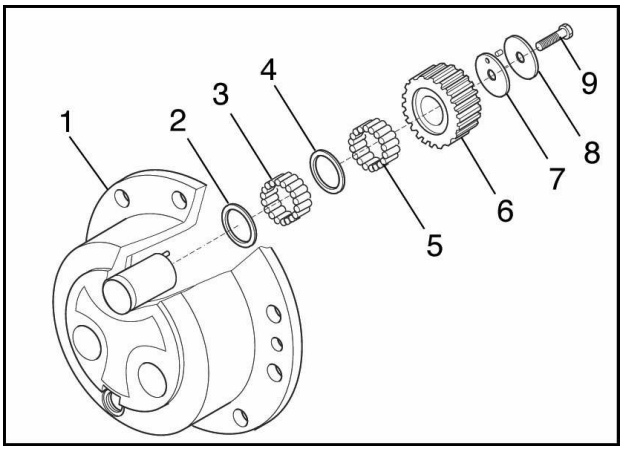
https://truckmanualshub.com/



# EPICYCLIC REDUCTION GEAR UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

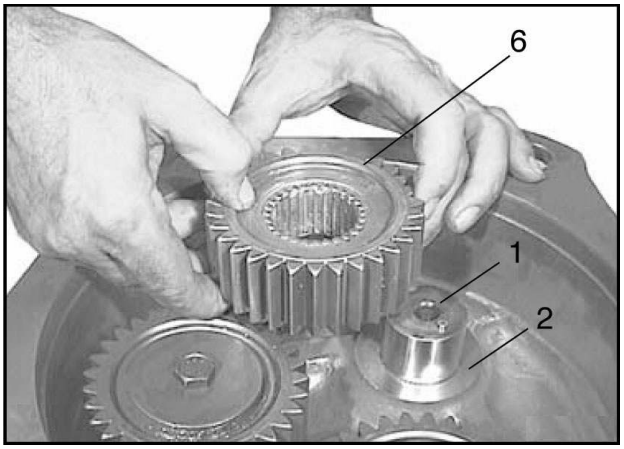
## STEP 1




Collect all the epicyclic reduction gear parts: the spider carrier (1), the thrust washers (2, 4), the planetary gear (6) with the roller bearings (3, 5), the washers (7, 8) and the fixing screw (6) of every planetary carrier pin.

**NOTE:** *When installing new planetary gears (6) it is advisable to fit new roller bearings (3, 5).*

## STEP 2



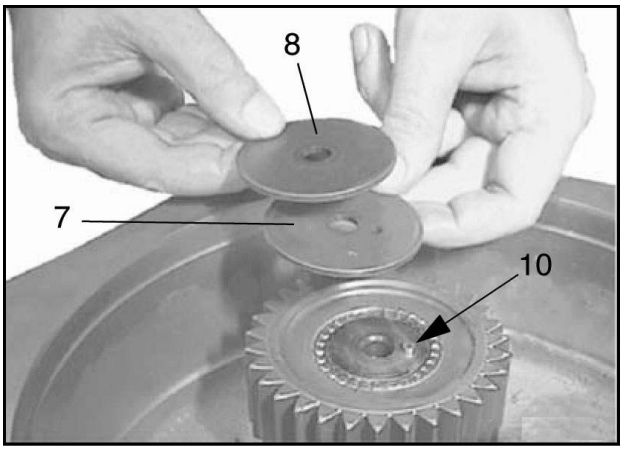

Place the planetary carrier on a workbench.

Insert the roller bearings (3, 5) and the thrust washer (4) into the epicyclic gears (6).

**NOTE:** *Grease the roller bearings (3, 5).*

Insert the thrust washers (2) and the assembled epicyclic gears onto the planetary carrier pins (1).

## STEP 3

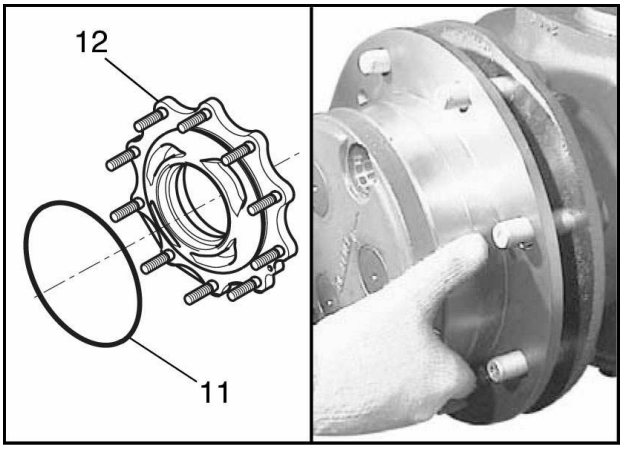



Fit the washers (7, 8).

**NOTE:** *The intermediate washer (7) has a hole for centering with the dowel pin (10) fitted on the planetary carrier pin.*

Insert the retaining screw (9) and tighten to the prescribed torque.

## STEP 4




Fit a new O-Ring (11) on the wheel hub (12).

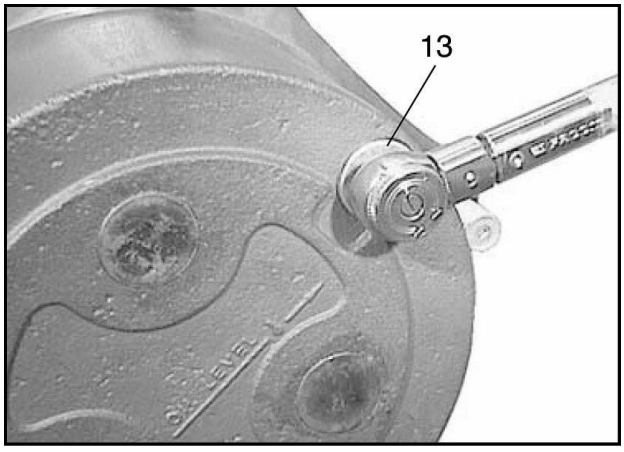
Fit the epicyclic reduction gear assembly onto the wheel hub.

Tighten the fastening bolts to the prescribed torque.

https://truckmanualshub.com/



**STEP 5**




Top up the wheel hub with oil.

Fit the drain plug (13) and tighten to the prescribed torque.

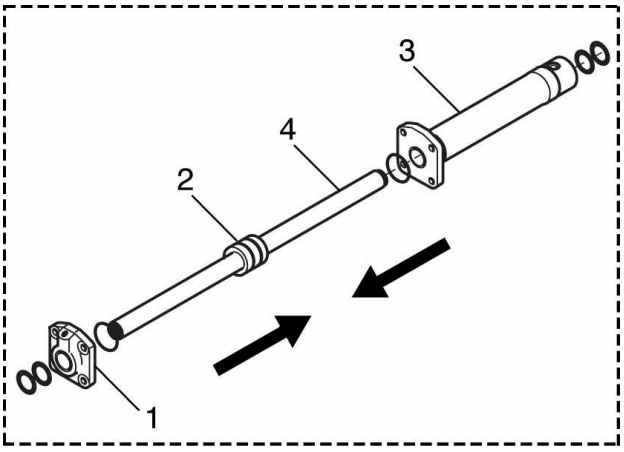
https://truckmanualshub.com/



# STEERING CYLINDER UNIT

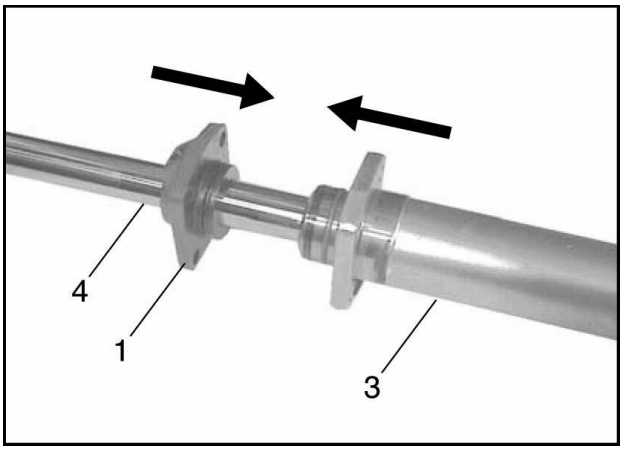
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



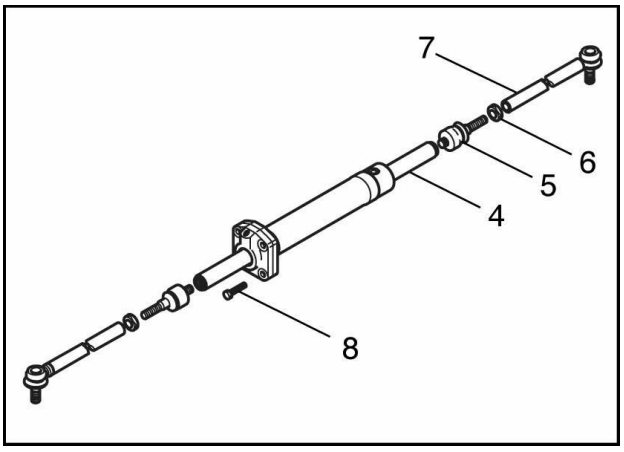

Fit new seals on the cylinder head (1), on the piston (2) and on the cylinder body (3).

## STEP 2



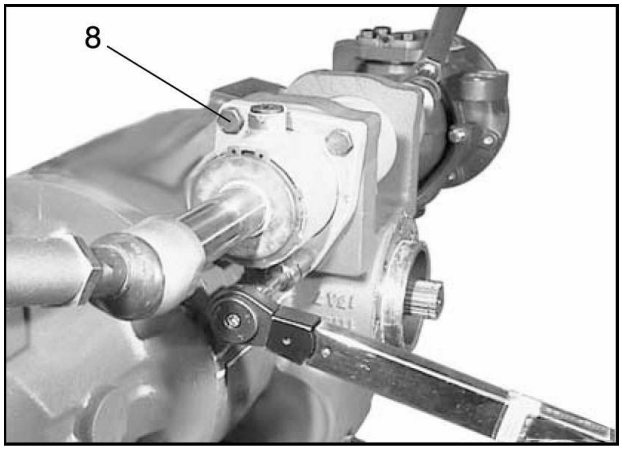

Slide the pre-assembled rod (4) and cylinder head (1) into the cylinder body (3).

## STEP 3




Fit the tie rod (7), the spherical joint (5) and the nut (6) onto the ends of the cylinder rod (4) and tighten to the prescribed torque.

## STEP 4



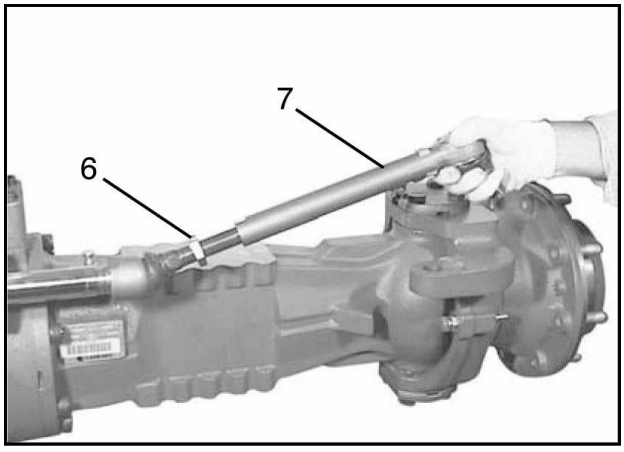

With guide rods already assembled on the stem, install the steering cylinder onto the central body.

Install and tighten the steering cylinder securing bolts to the prescribed torque.

https://truckmanualshub.com/



## STEP 5

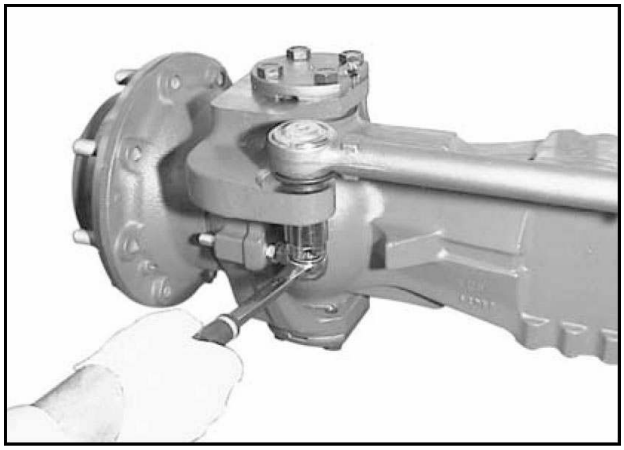



Align the swivel housings with the axle (parallel wheel hub).

Screw the tie rod (7) so that the ball joint can be inserted into the swivel housing arm.

**NOTE:** *It is important to unscrew the locking nut (6) to carry out this operation.*

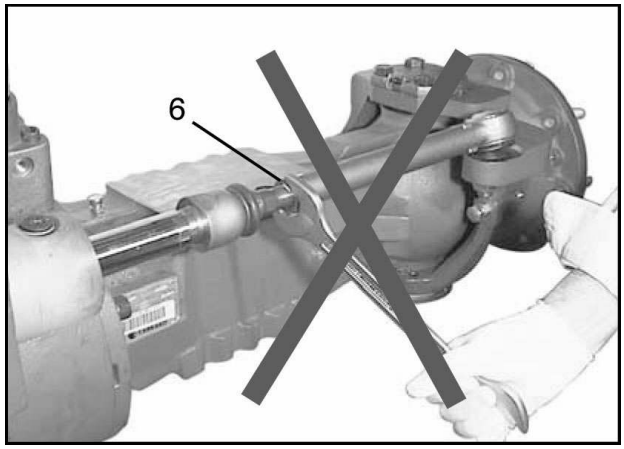
## STEP 6



Insert the ball joint into its own seat on the swivel housing.

Assemble and tighten the lock nut to the prescribed torque.

## STEP 7




Screw in the lock nut (6) of the tie rod only when the toe-in adjustment has been carried out.

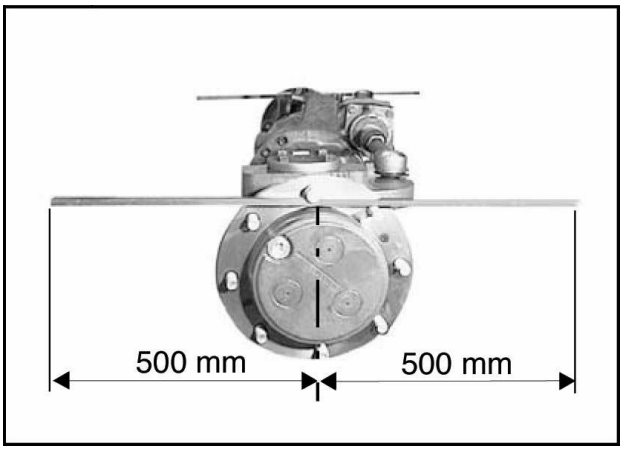
https://truckmanualshub.com/



# TOE-IN ADJUSTMENT

Some of the following pictures may not show your axle, but the procedure is the same.

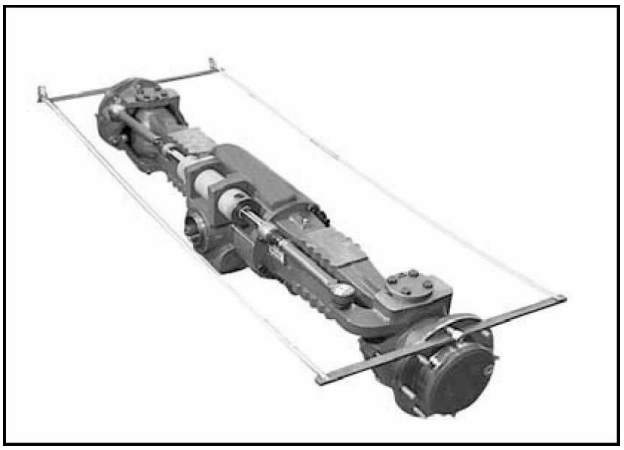
## STEP 1




Put two equal one-meter-long linear bars onto the wheel sides and secure them using two nuts fitted to the wheel hub studs.

**NOTE:** *The two bars should be perpendicular to the supporting surface and parallel to the pinion shaft axis. Align the two bars.*

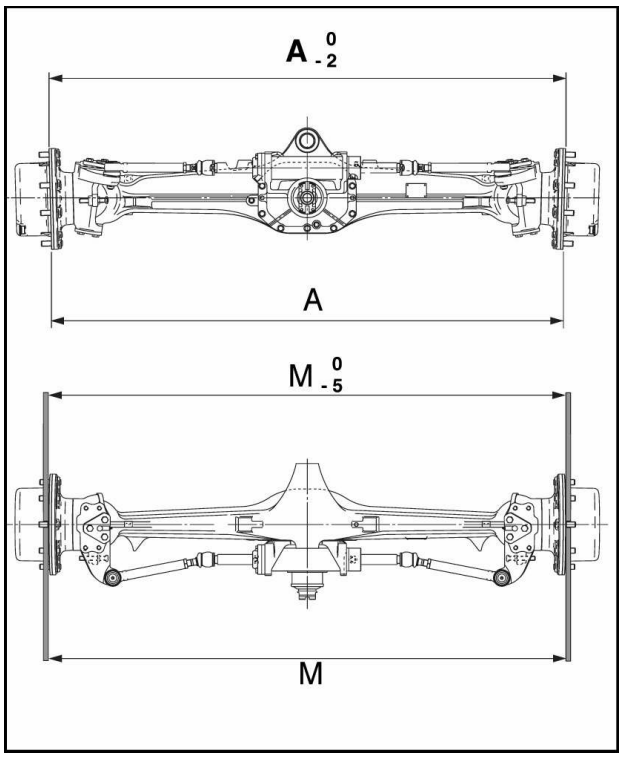
## STEP 2



Measure the distance in mm between the bars ends with a tape line.

**NOTE:** *Set to the minimum distance values.*

## STEP 3




Check that the difference of the measurements between the bar ends is within the prescribed tolerance range.

Nominal toe-in value (A) applies to the external diameter of the wheel hubs flange, therefore measured value (M) at the bars ends must be relative to the ratio between the bar length and flange diameter:

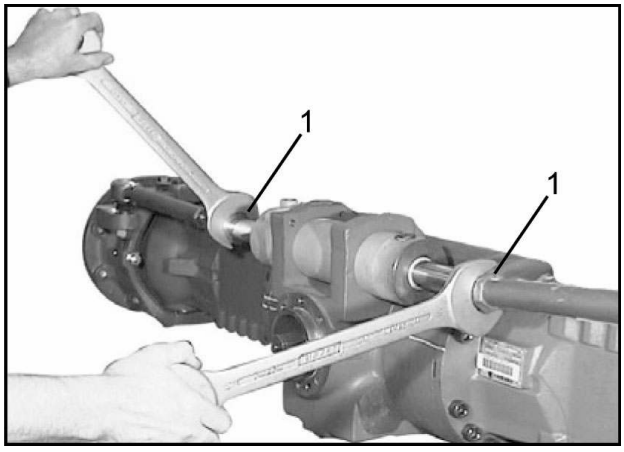
**nominal toe-in = A 0 / -2**

**measured toe-in = M 0 / -5**

https://truckmanualshub.com/

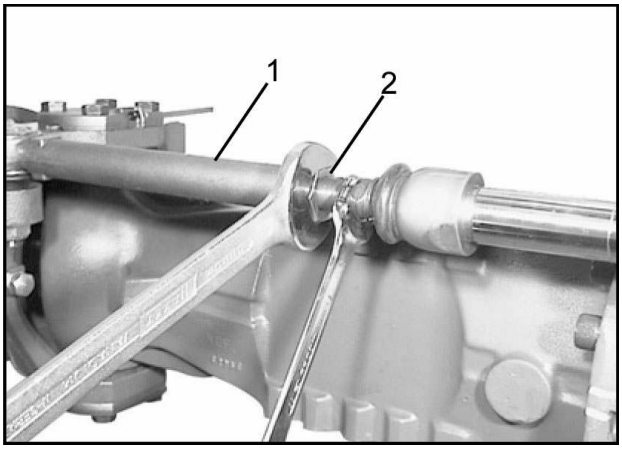


**STEP 4**




If toe-in is incorrect, use two spanners on the guide rods (1) adjusting both rods equally until the toe-in is within the prescribed tolerance.

**STEP 5**




After adjusting, tighten the lock nuts (2) to the prescribed torque.

https://truckmanualshub.com/

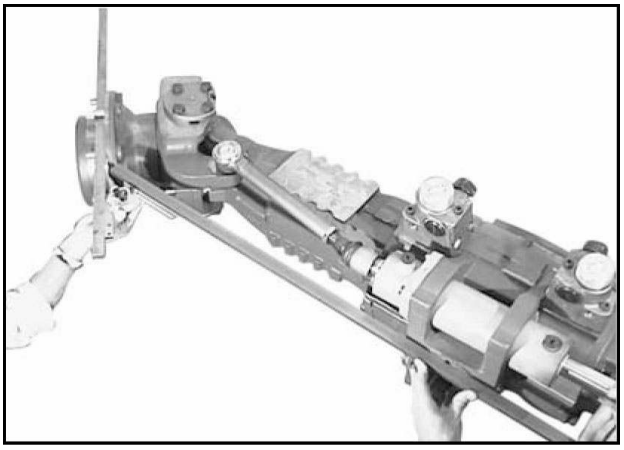


# STEERING ANGLE ADJUSTMENT

Some of the following pictures may not show your axle, but the procedure is the same.

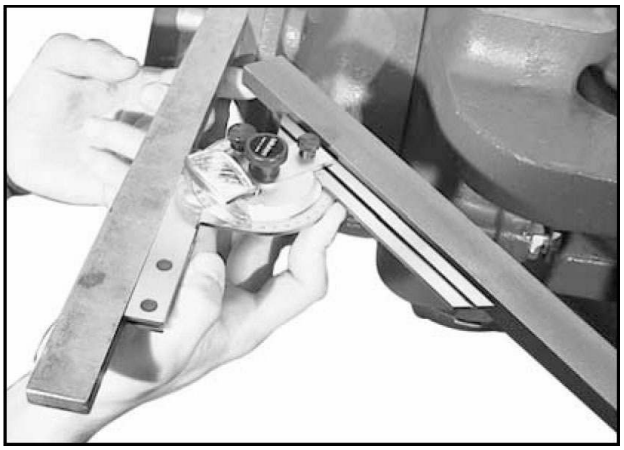
**NOTE:** *Before adjusting the steering angle see the procedure described in "Toe-in adjustment".*

## STEP 1



Use the same bars used for the toe-in adjustment together with a long bar aligned with the machined part of the central body (pinion side), so that the two bars and the hub form an acute angle at the maximum steering angle.

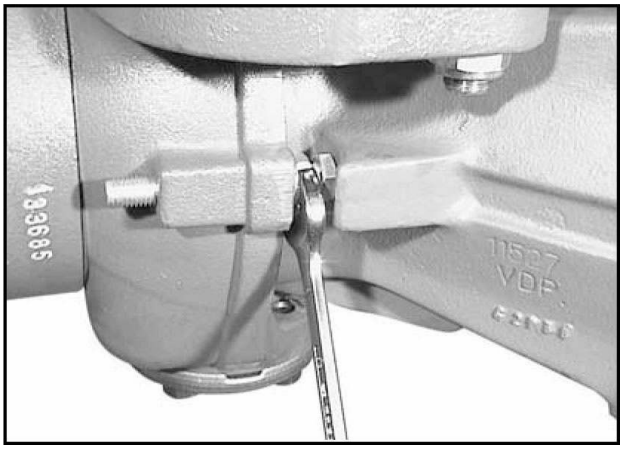
## STEP 2



Adjust a protractor to the prescribed angle and position it on the long bar.

Move a wheel hub until the bar is aligned with the angle fixed by the protractor.

## STEP 3



Adjust the steering retainer nuts and fix them with the locknut to the prescribed torque.

Steer completely to the opposite lock and repeat the operation.

https://truckmanualshub.com/



# Section 6022

## FRONT SUSPENDED AXLE

## XTX Series Tractors

## 20.29 Axles

McCORMICK

SM 8-15240

© 2006 McCormick Tractors International Limited.

September 2006

Whilst every effort is made to ensure that the specifications, desciptions, photographs and illustrations in this publication are correct at the time of going to print, they may not be up to date as a result of modifications adopted by the Manufacturer at any time.
All information within this publications has been provided by Carraro SpA.

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIFICATIONS ..... 3

SPECIAL TORQUES ..... 4

SPECIAL TOOLS ..... 5

DISASSEMBLY OPERATIONS ..... 11
- Potentiometer ..... 12
- Steering cylinder unit ..... 14
- Epicyclic reduction gear ..... 16
- Wheel hub unit ..... 18
- Torsion bar unit ..... 20
- Swivel housing unit ..... 23
- Universal joints ..... 27
- Suspension cylinder ..... 30
- Upper arm ..... 31
- Lower arm ..... 34
- Differential support unit ..... 36
- Pinion unit ..... 38
- Differential unit ..... 40

ASSEMBLY OPERATIONS ..... 43
- Differential unit ..... 44
- Pinion unit ..... 47
- Differential unit support ..... 50
- Lower arm ..... 55
- Upper arm ..... 57
- Suspension cylinder ..... 61
- Universal Joint ..... 62
- Swivel housing unit ..... 66
- Torsion bar unit ..... 70
- Torsion bar preload adjustment ..... 73
- Wheel hub unit ..... 75
- Epicyclic reduction gear unit ..... 78
- Steering cylinder unit ..... 80
- Toe-in and steering angle adjustment ..... 82
- Arms sensor ..... 84

https://truckmanualshub.com/



# SPECIFICATIONS

| | | |
|---|---|---|
| DIFFERENTIAL | | |
| Pinion Bearing Pre-load | 92 to 138 N | 20 to 31 lb f |
| Pinion Bearing and Differential Bearing Total Pre-load | 92 (+ 29) to 138 (+ 44) N | 20 (+ 6.5) to 31 (+ 9.8) lb f |
| Bevel Gear Backlash | 0.20 to 0.28 mm | 0.007 to 0.011 inch |
| Shim Thickness for Pinion Height Setting | 2.5 (min.) to 3.4 mm (max.) | 0.098 (min.) to 0.134 inch (max.) |
| LUBRICANTS | | |
| Grease | McCormick LX Multi-purpose EP2 Grease | |
| MFD Axle Pivot Pin | Loctite Anti Seize Compound | |
| MFD Axle Capacities | | |
| Type | SAE 85W-140 EP Gear Oil | |
| Planetary | 1.5 Litres | |
| Differential | 5.5 Litres | |

https://truckmanualshub.com/



# SPECIAL TORQUES

| | | |
|---|---|---|
| Pinion Shaft Nut | Refer to SPECIFICATIONS for Pre-load | |
| Differential Housing to Axle Bolt | 169 Nm | 125 lb ft |
| Locking Plate Bolt | 13 Nm | 10 lb ft |
| Ring Gear to Differential Housing Bolt with Loctite 270 | 70 Nm | 51 lb ft |
| Breather Plug | 10 Nm | 7 lb ft |
| Oil Fill/Level Plugs | 60 Nm | 44 lb ft |
| Differential Bearing Cap Bolt | 226 Nm | 196 lb ft |
| King Pin Retaining Bolt | 169 Nm | 124 lb ft |
| Steering Stop Locknut | 150 Nm | 111 lb ft |
| Steering Cylinder to Differential Support Bolt | 120 Nm | 89 lb ft |
| Ball Joint on Steering Cylinder | 300 Nm | 221 lb ft |
| Track Rod Locknut | 250 Nm | 185 lb ft |
| Ball Joint to Swivel Housing Locknut | 220 Nm | 162 lb ft |
| Planetary Gear to Swivel Housing Bolt | 230 Nm | 169 lb ft |
| Wheel Stud with Loctite 270 | 70 Nm | 52 lb ft |
| Planetary Gear Carrier to Wheel Hub Screw | 25 Nm | 18 lb ft |
| Front Weight Frame Bolts | 425 Nm | 314 lb ft |
| Front Wheel Nuts | 530 to 570 Nm | 391 to 420 lb ft |
| MFD Axle Retaining Bolts | 570 to 645 Nm | 420 to 475 lb ft |
| Planetary Gear Retaining Bolt | 79 Nm | 58 lb ft |
| Potentiometer Cover Retaining Bolt | 13 Nm | 9 lb ft |
| Potentiometer Support Retaining Bolts | 13 Nm | 9 lb ft |
| Grease Fittings | 8 Nm | 6 lb ft |
| Suspension cylinder, lower Pin Retaining Bolts | 95 Nm | 70 lb ft |
| Upper Arm Pin, Retaining Bolt | 135 Nm | 99 lb ft |
| Upper Arm Pin, Lock Nut | 70 Nm | 51 lb ft |
| Sensor retaining Nut | 4 Nm | 3 lb ft |
| Steering Lock Plate, Retaining Bolt | 60 Nm | 44 lb ft |
| Sensor retaining Nut | 4 Nm | 3 lb ft |
| Lower ball joint Ring Nut, M27x1.5 | 170 Nm | 125 lb ft |
| Upper ball joint Ring Nut, M22x1.5 | 140 Nm | 103 lb ft |
| Half Shaft Protection, Retaining Bolts | 135 Nm | 99 lb ft |
| Half Shaft Protection, Lock Nut | 70 Nm | 51 lb ft |
| Front Flange, Retaining Bolts | 95 Nm | 70 lb ft |
| Rear Torsion Bar Preload Flange, Retaining Bolts | 169 Nm | 124 lb ft |
| Torsion Bar Preload, Lock Nut | 45 Nm | 33 lb ft |
| Lower Arm Pin, Retaining Nut | 600 Nm | 442 lb ft |
| Universal Joint, Centering Grub Screw | 30 Nm | 22 lb ft |
| Universal Joint, Centering Grub Screw Lock Nut | 80 Nm | 59 lb ft |
| Upper Pin Cover Retaining Bolts | 50 Nm | 37 lb ft |

https://truckmanualshub.com/

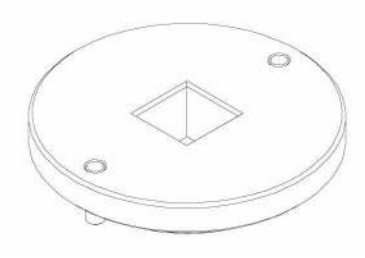


# SPECIAL TOOLS

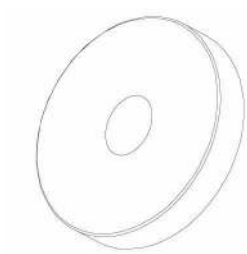
https://truckmanualshub.com/



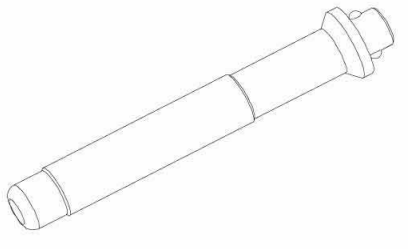
The special tools used to fit seals, bearings and bushes should always be used with the interchangeable handle CA119033 and a suitable safety handle to protect the hands.



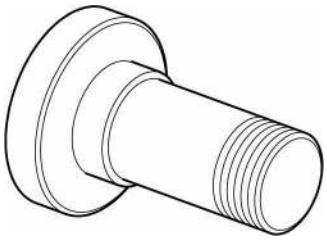
CA119030



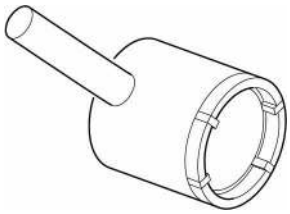
CA119182



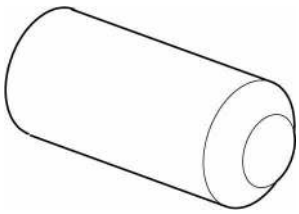
CA119033



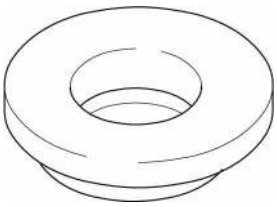
CA119202



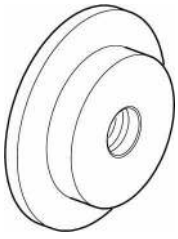
CA715099



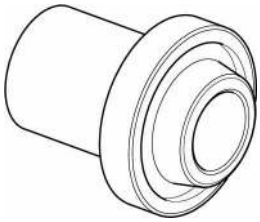
CA119215



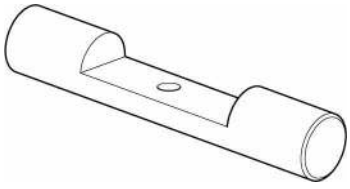
CA119103



CA119225



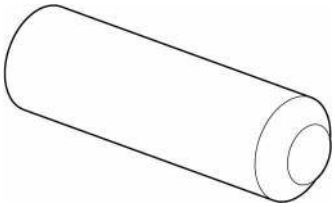
CA119148



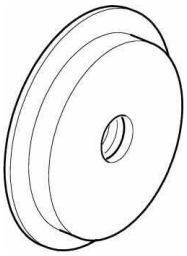
CA119228

https://truckmanualshub.com/

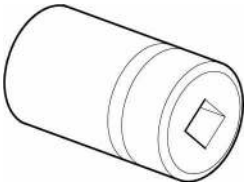




CA715004



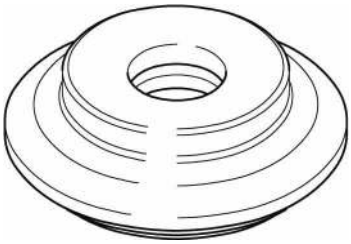
CA715092



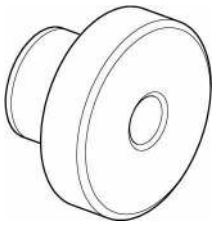
CA715022



CA715093



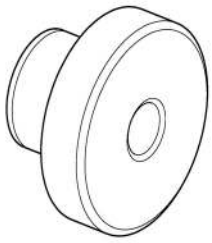
CA715026



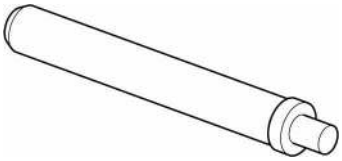
CA715097



CA715027



CA715098



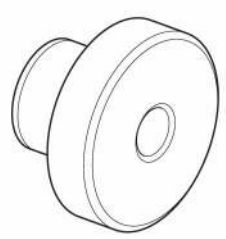
CA715086

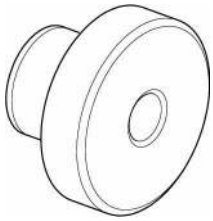


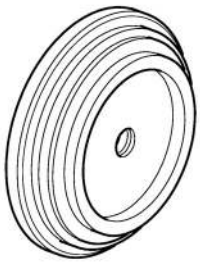
CA715108

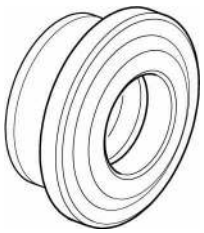
https://truckmanualshub.com/

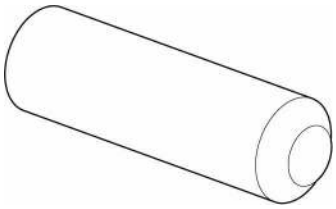


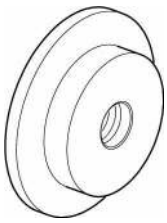

CA715164

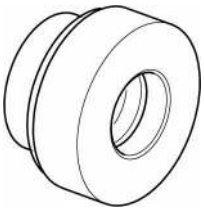

CA715323

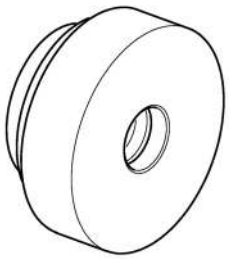

CA715175

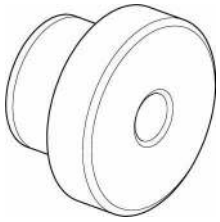

CA715324

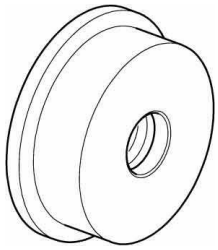

CA715179


CA715325


CA715321


CA715326


CA715322


CA715327

https://truckmanualshub.com/

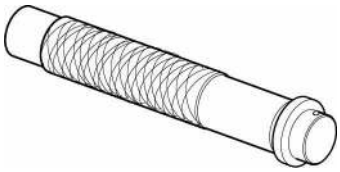




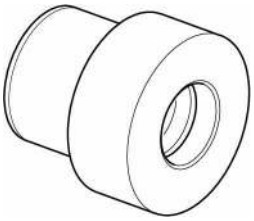
CA715328



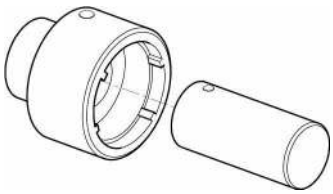
CA715333



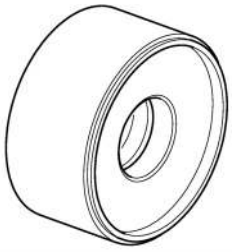
CA715329



CA715334



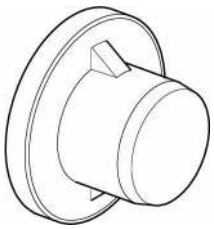
CA715330



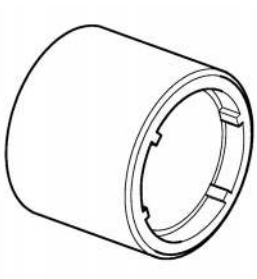
CA715335



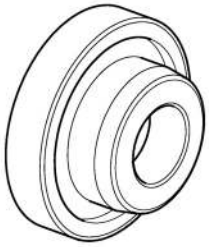
CA715331



CA715336



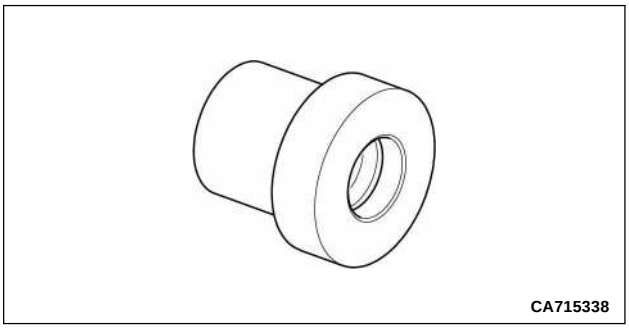
CA715332



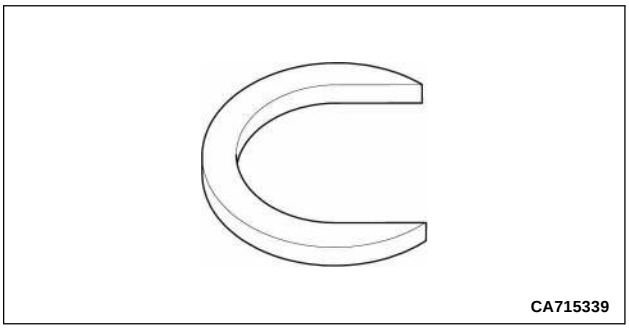
CA715337

https://truckmanualshub.com/

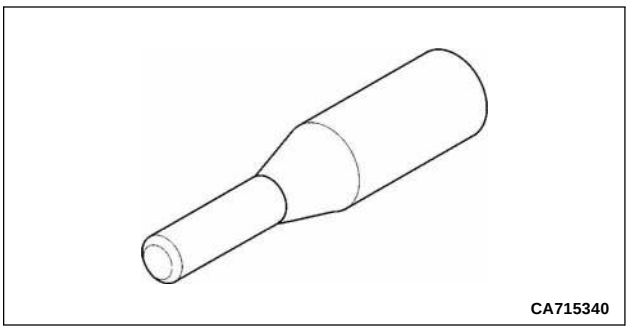




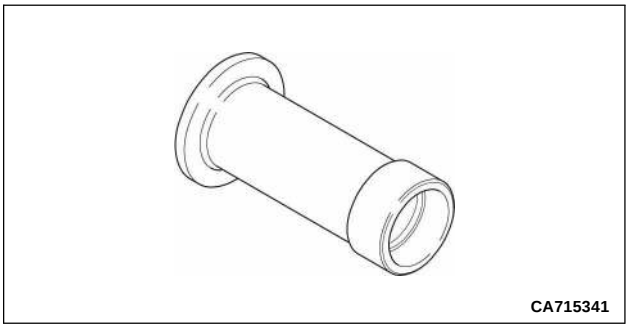
CA715338



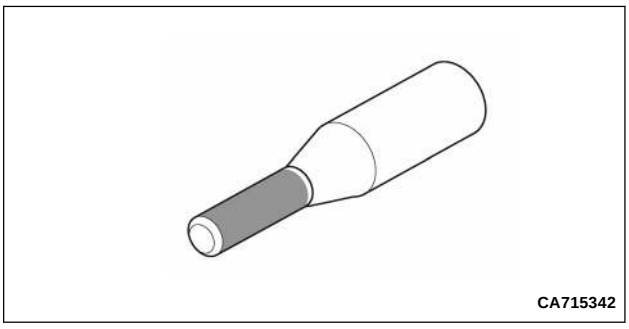
CA715339



CA715340



CA715341



CA715342

https://truckmanualshub.com/



# DISASSEMBLY OPERATIONS

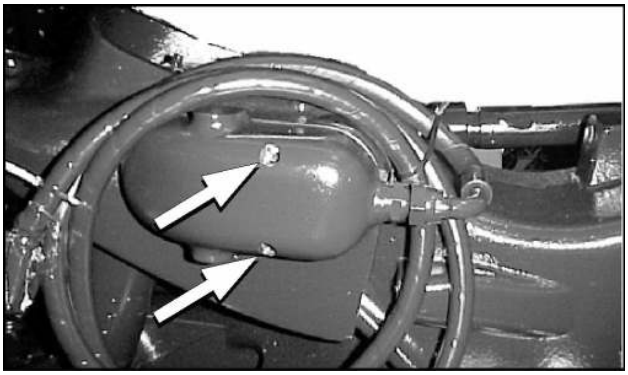
https://truckmanualshub.com/



# POTENTIOMETER

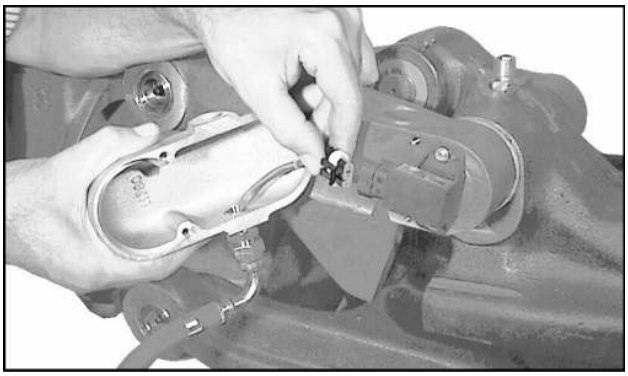
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



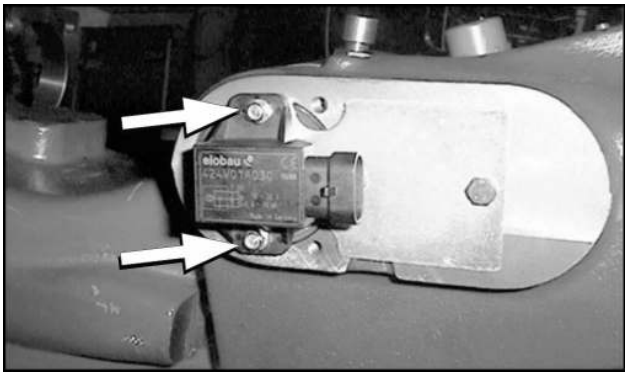
Remove the screws from the cover of the sensor wiring harness kit.

## STEP 2



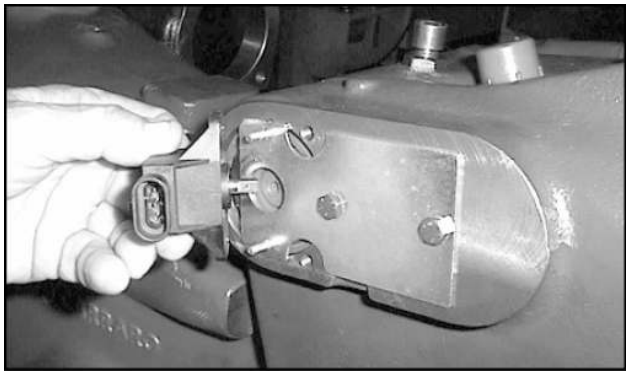
Before removing the sensor harness kit, disconnect the electric connector.

## STEP 3



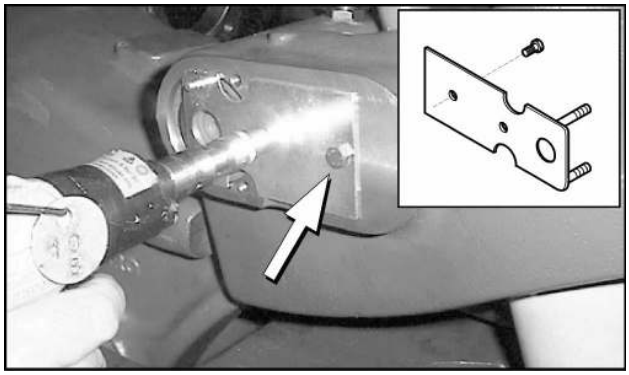
Unscrew and remove the sensor retaining nuts and retrieve the washers.

## STEP 4



Remove the sensor.

## STEP 5



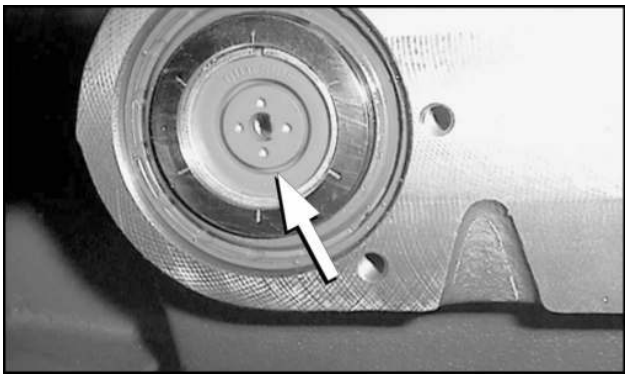
Unscrew and remove the sensor support retaining screws.

Remove the sensor support.

https://truckmanualshub.com/



## STEP 6



**NOTE:** *Using an indelible felt-tip pen, mark the position of the washer ring, in order to be able to correctly position the ring upon re-assembly.*

Using a suitable lever, remove the rubber washer and the washer holding ring.

**NOTE:** *This is a destructive operation for the rubber washer.*

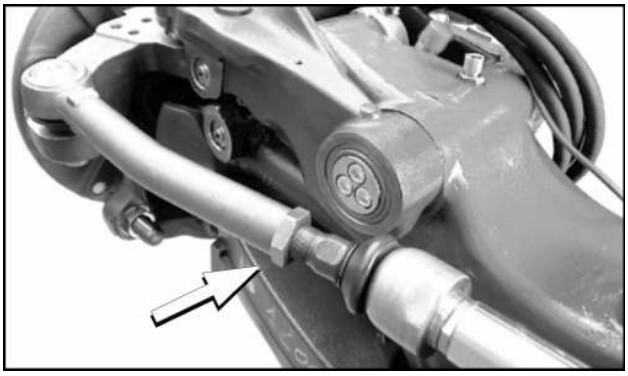
https://truckmanualshub.com/



# STEERING CYLINDER UNIT

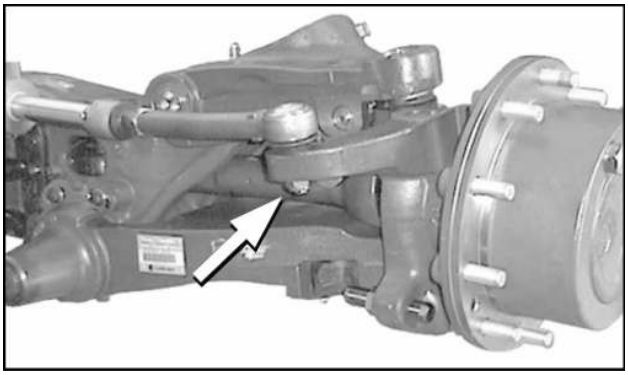
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



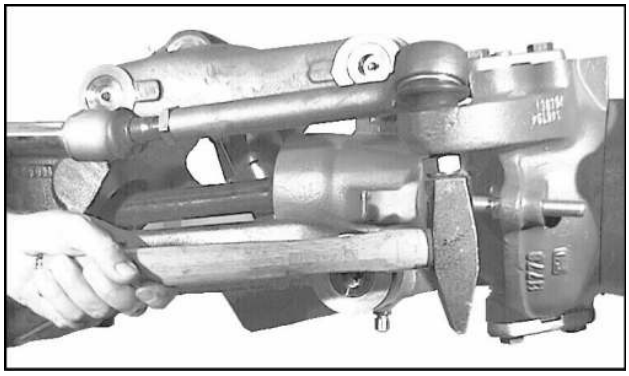
Loosen the lock nut on the tie rod a few turns.

## STEP 2



Loosen the fastening nut of the steering arm unit ball joint by giving it a few turns, until it reaches the level of the threaded pin.

## STEP 3

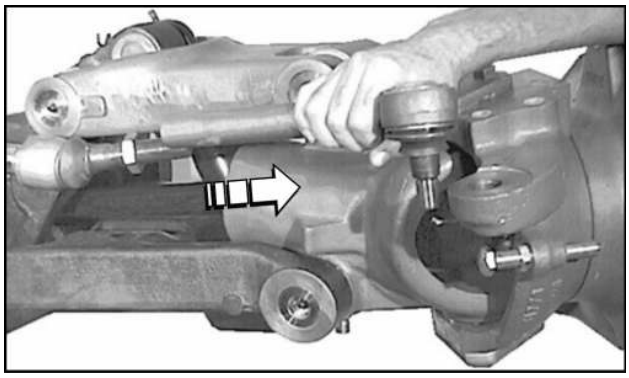


Using a soft hammer, hit the nut to detach the steering arm unit from the swivel housing.

**ATTENTION:** *The positioning of the nut serves to prevent the thread of the steering arm unit ball joint from being damaged.*

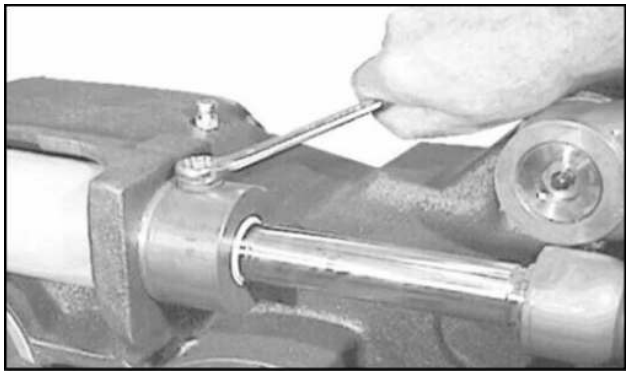
**NOTE:** *this is a destructive operation for the nut.*

## STEP 4



Unscrew and completely remove the two tie rods.

## STEP 5

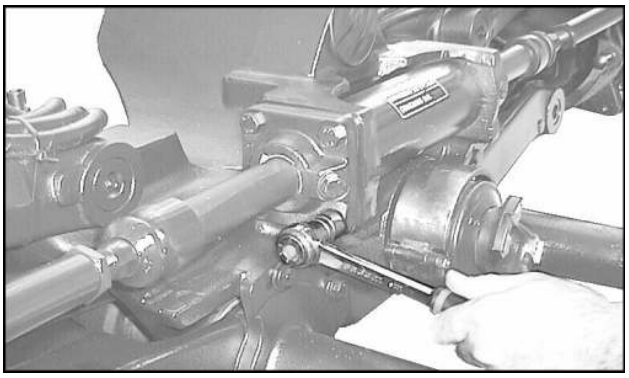


Remove the cylinder connections.

https://truckmanualshub.com/

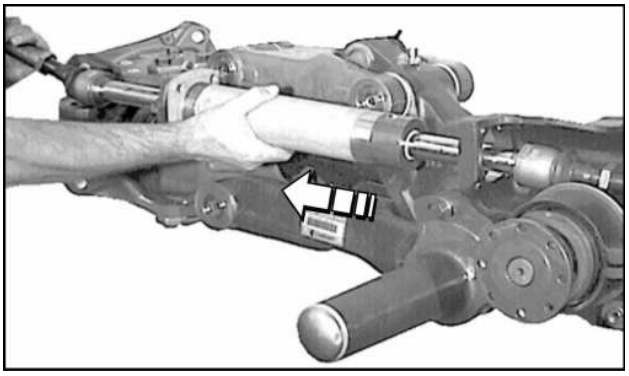


## STEP 6



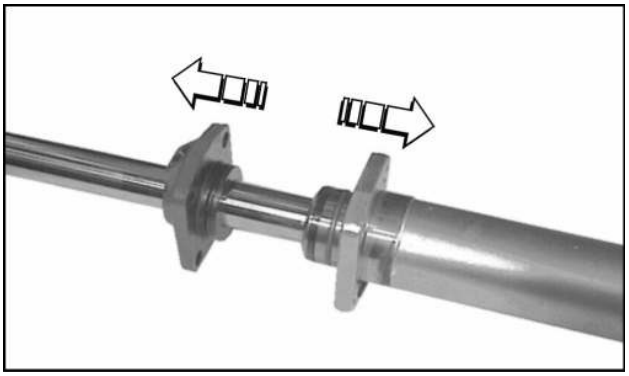
Unscrew and remove the screws from the cylinder.

## STEP 7



Remove the cylinder from the differential support.

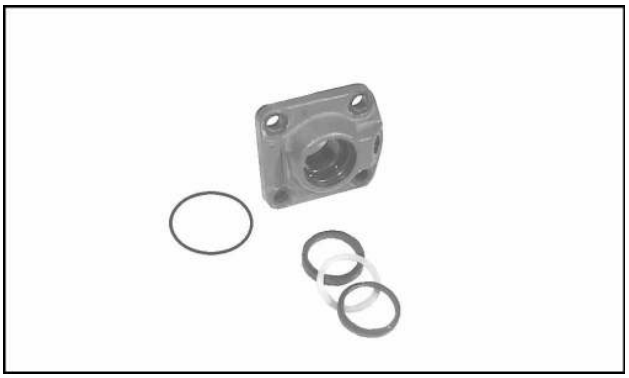
## STEP 8



After removing the steering cylinder, check the condition of the components.

Detach the cylinder head from the cylinder case and remove the rod.

## STEP 9



Remove the cylinder head from the rod and inspect the O.ring and all seals.

Replace if necessary.

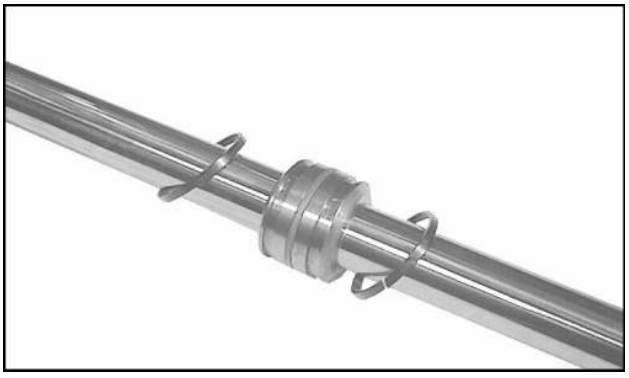
## STEP 10



Inspect all the cylinder case gaskets.

Replace if necessary.

## STEP 11



Inspect all the rod sealing rings.

Replace if necessary.

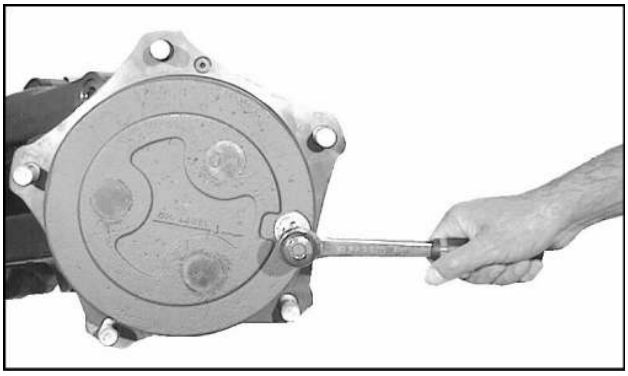
https://truckmanualshub.com/



# EPICYCLIC REDUCTION GEAR

Some of the following pictures may not show your axle, but the procedure is the same.

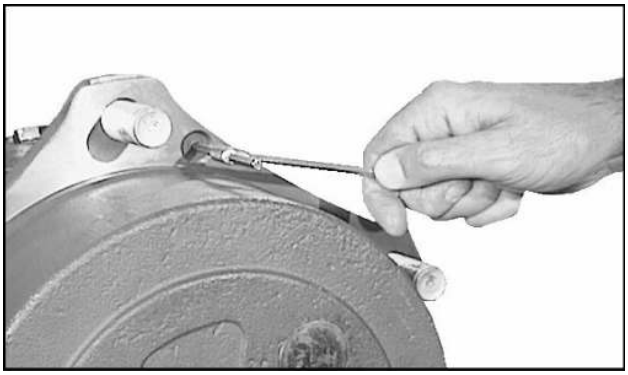
## STEP 1



Remove the plug and drain the oil before disassembling.

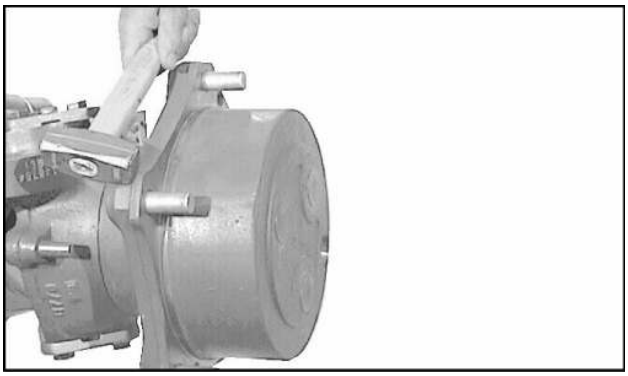
When removing, keep the plug uppermost in order to avoid oil jet, then gradually rotate the hub to lower the drain hole.

## STEP 2



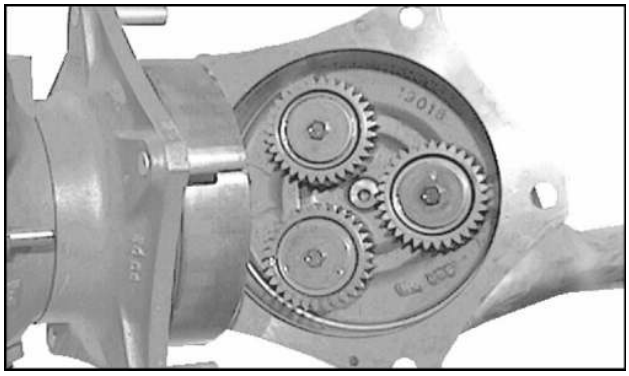
Remove the retaining screws from the epicyclic reduction gear assembly.

## STEP 3



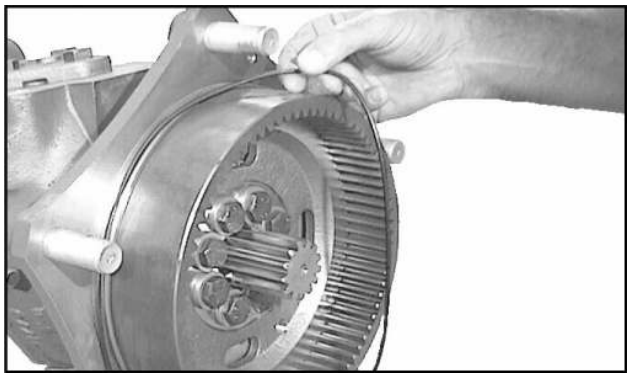
Detach the epicyclic reduction gear assembly by tapping lightly whit a soft hammer.

## STEP 4



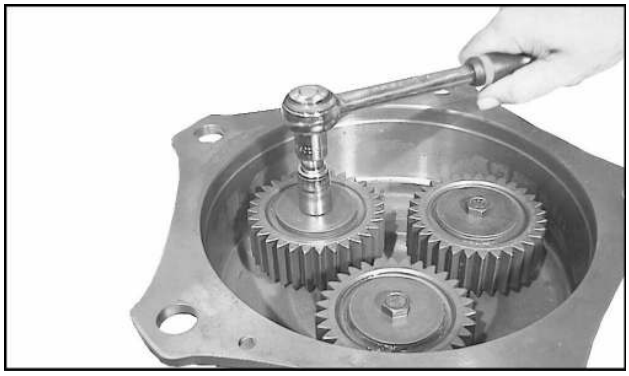
Remove the entire epicyclic reduction gear assembly.

## STEP 5



Retrieve the ‘O’.ring from the wheel hub.

## STEP 6

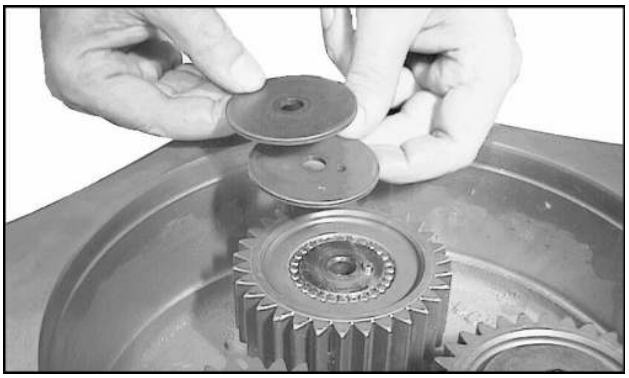


Remove planetary gear retaining bolts.

https://truckmanualshub.com/

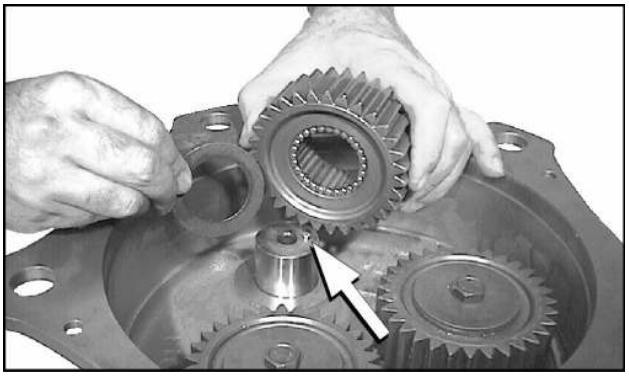


**STEP 7**



Remove the two thrust washers.

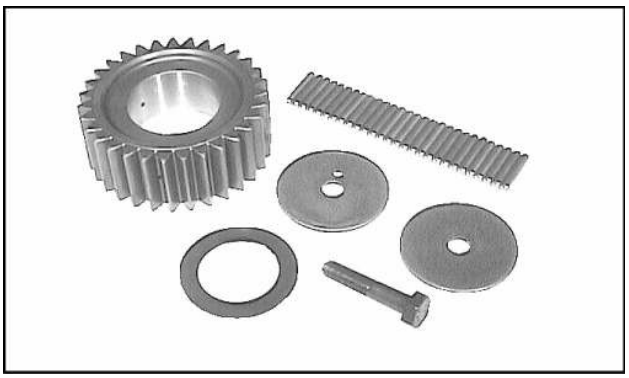
**STEP 8**



Remove the planetary gear complete with needle bearings and the lower thrust washer.

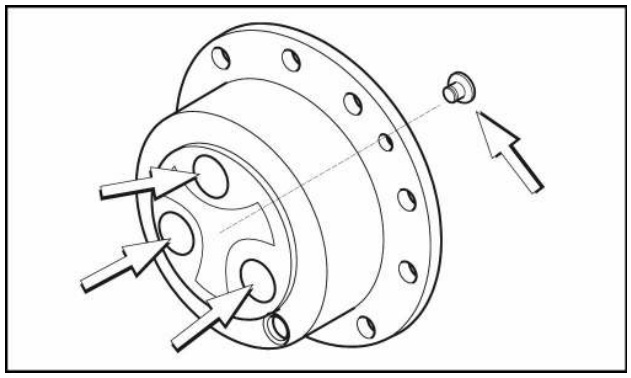
Remove the locating pin shown.

**STEP 9**



Inspect the conditions of the planetary gear components.

**STEP 10**



If the planetary gear pins or the half-shaft stop pad are damaged, replace the whole planetary carrier.

https://truckmanualshub.com/

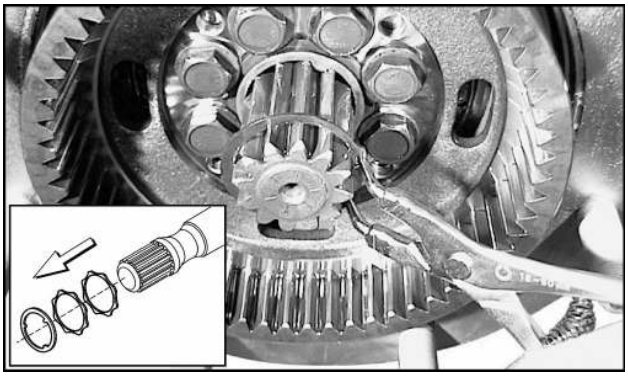


# WHEEL HUB UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before disassembling the wheel hub unit, it is necessary to remove the epicyclic reduction gear unit.*

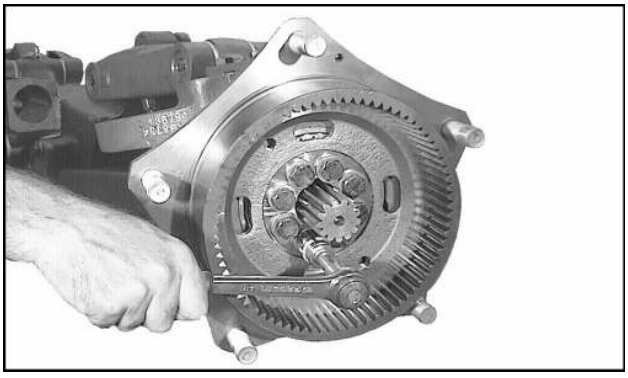
## STEP 1



Remove the snap ring from the half-shaft using suitable pliers.

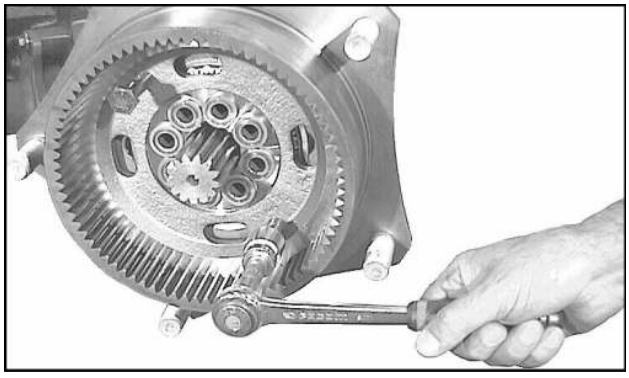
Remove the washer and thrust washers from the half-shaft.

## STEP 2



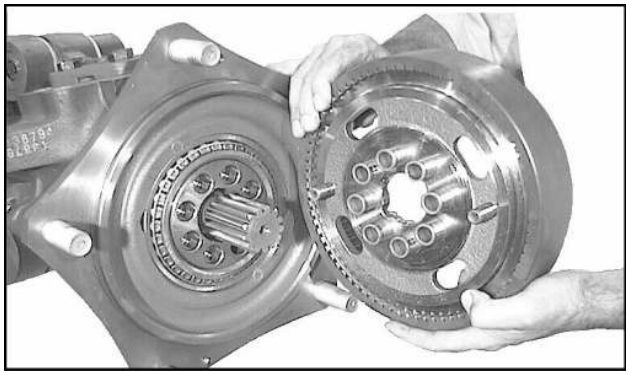
Unscrew and remove the retaining screws from the wheel carrier group.

## STEP 3



To remove the wheel carrier, use two of the screws just removed and screw into the threaded lift-off holes.

## STEP 4

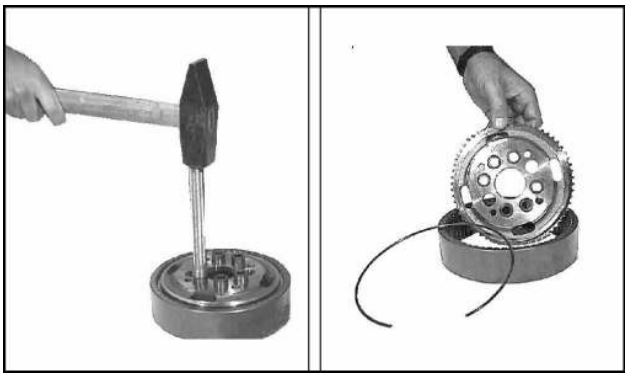


Remove the wheel carrier.

https://truckmanualshub.com/



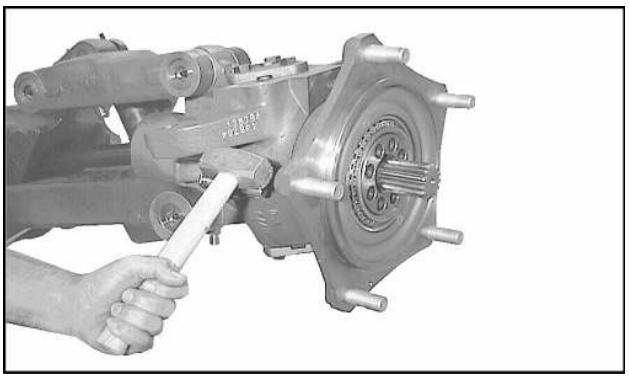
## STEP 5



Place the wheel carrier on a work bench, and remove all centering bushes using special tool CA715027.

Remove the stop-ring and disassemble the wheel carrier assembly.

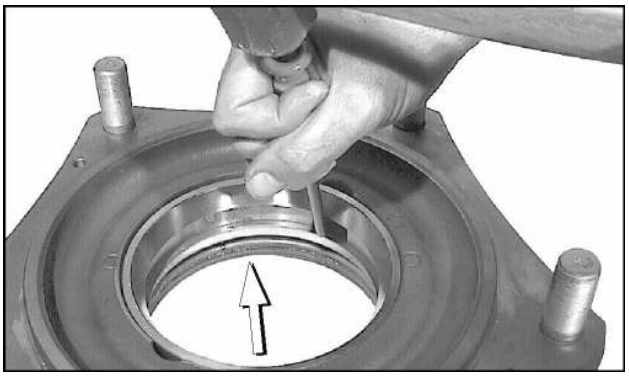
## STEP 6



Withdraw the wheel hub using a suitable lever and a soft hammer.

**NOTE:** *Remove the bearing cone.*

## STEP 7



**ATTENTION:** *during the operation the seal ring is also withdrawn and may be damaged.*

Place the wheel hub on a flat surface and using a drilling tool, push out the bearing outer races from both sides.

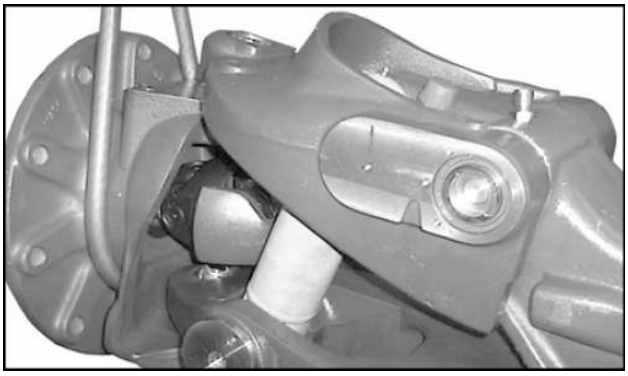
https://truckmanualshub.com/



# TORSION BAR UNIT

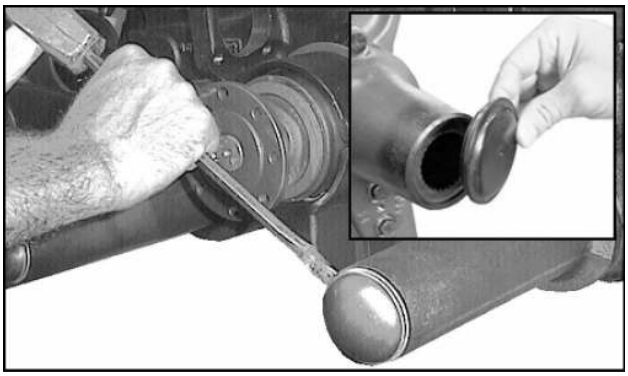
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



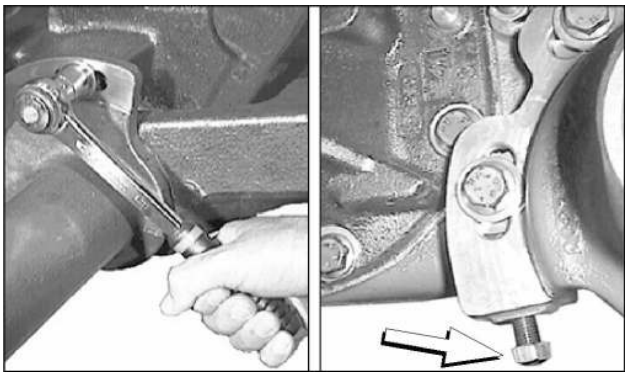
Lift the swivel housing unit up to the end of its stroke by means of a rope attached to a hoist.

## STEP 2



Remove the cover from the rear torsion bar flange.

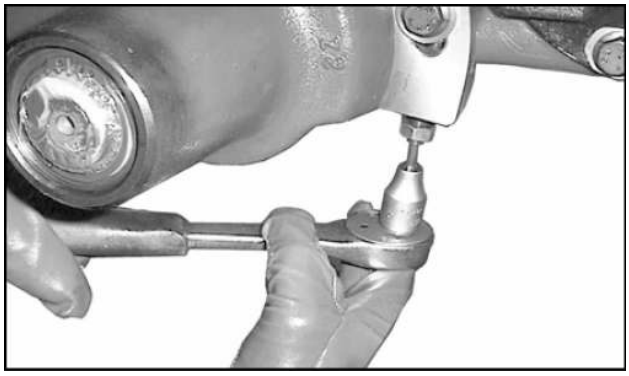
## STEP 3



Partially loosen the three retaining bolts from the rear flange.

Loosen the locking nut on the rear flange grub screw.

## STEP 4



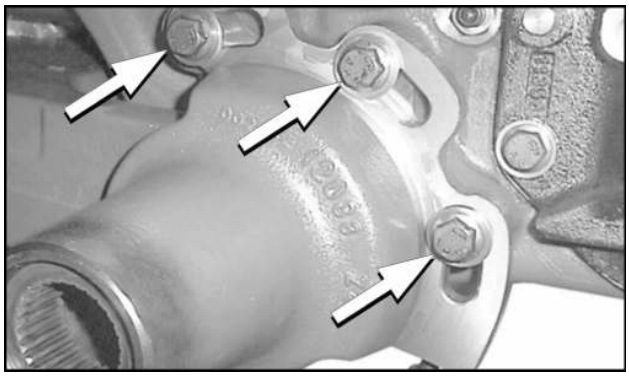
Slowly unscrew the grab screw to eliminate the torsion bar preload.

## STEP 5



Remove the torsion bar snap ring from the rear flange.

## STEP 6



Remove the three retaining bolts from the rear flange and retrieve the washers.

https://truckmanualshub.com/



**STEP 7**



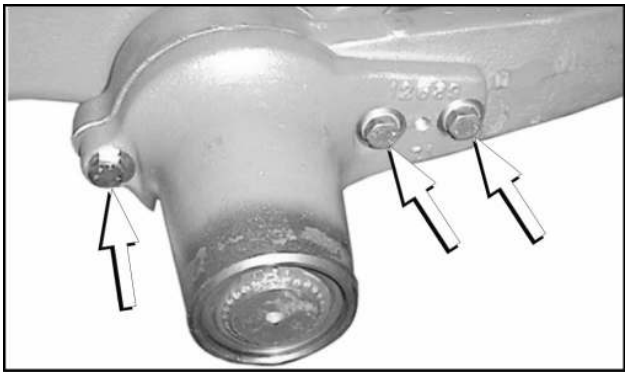
Detach the rear flange by tapping with a soft hammer.

**STEP 8**



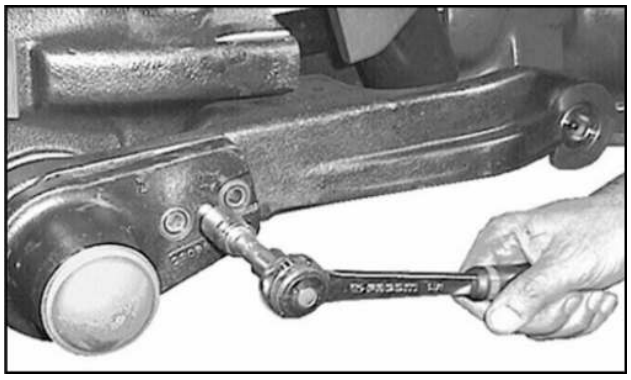
Check the rear flange ‘O’ ring and if necessary replace it.

**STEP 9**



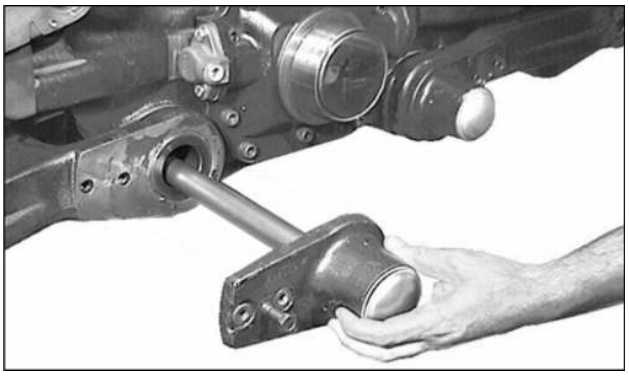
Remove the three retaining bolts from the front torsion bar flange.

**STEP 10**



Remove the front flange, by placing one of the screws in the threaded hole designed for removal.

**STEP 11**



Slide the front flange unit away from the central beam and torsion bar.

**STEP 12**

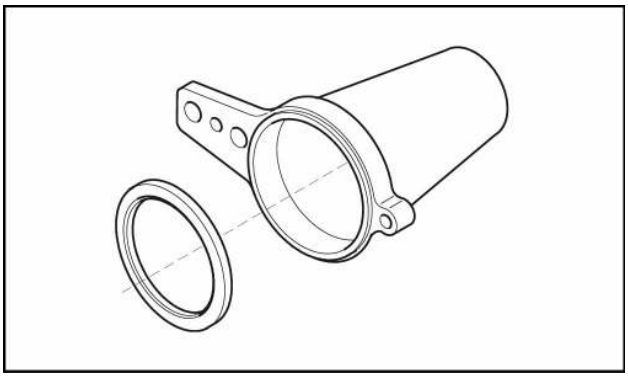


Slide the torsion bar from the front flange by tapping the ends of the bar with a soft hammer; simultaneously removing the protective cover.

https://truckmanualshub.com/



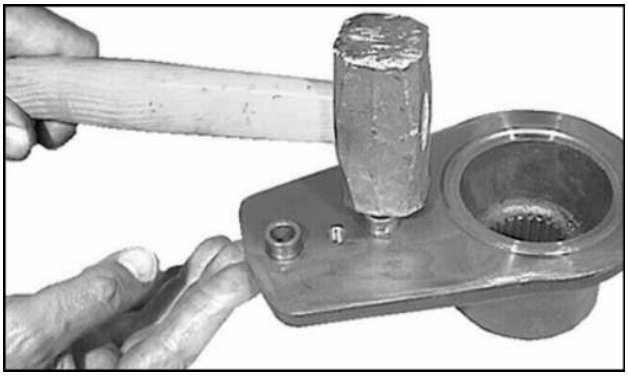
## STEP 13



Remove the seal ring from the front flange.

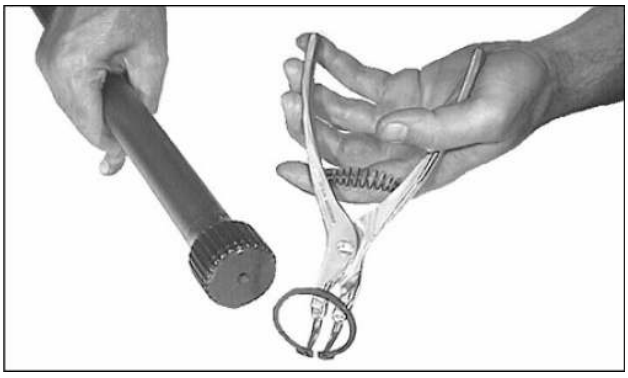
**NOTE:** *This is a destructive operation for the seal ring.*

## STEP 14



If necessary, remove the two centering bushes from the front flange with a soft hammer.

## STEP 15



Remove the lock ring from the torsion bar.

https://truckmanualshub.com/

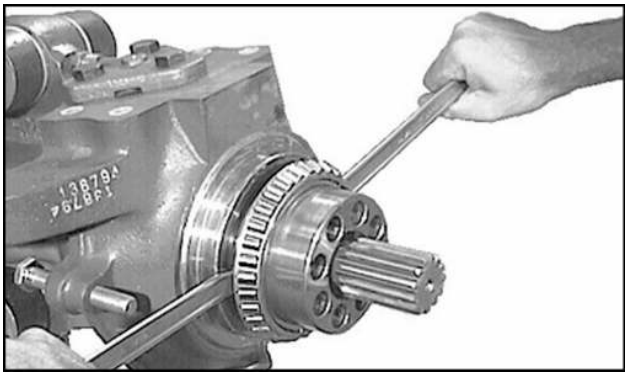


# SWIVEL HOUSING UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

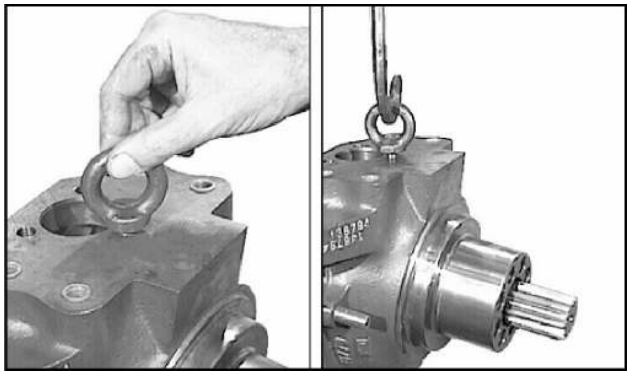
**NOTE:** *Before disassembling the swivel housing unit, it is necessary to remove the steering cylinder unit, the wheel hub unit and to eliminate the preload from the torsion bar.*

## STEP 1



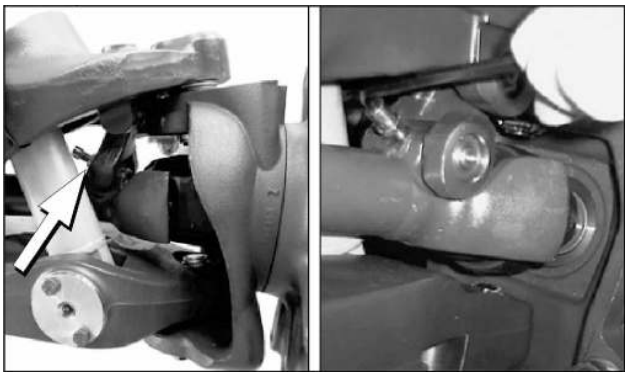
Using two levers, remove the bearing cone from the swivel housing.

## STEP 2



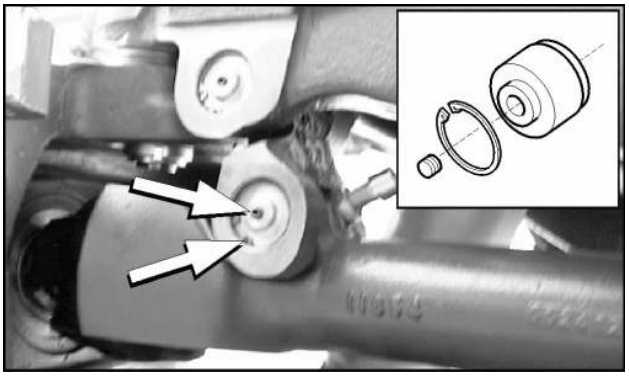
Screw an eye bolt into one of the threaded holes of the swivel housing and support the swivel housing with a suitable harness and hoist.

## STEP 3



Loosen the lock nut and unscrew the retaining bolt of the universal joint housing support fork pin by giving it a few turns.

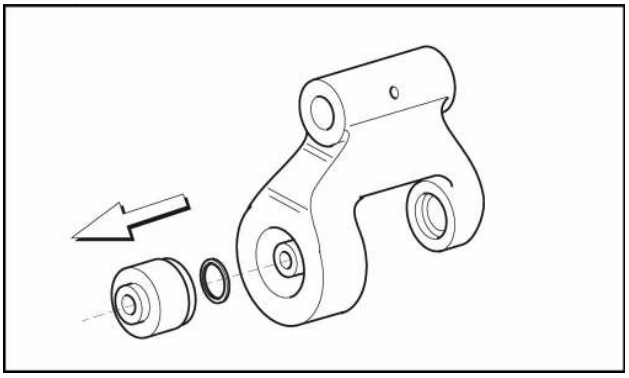
## STEP 4



Remove the lower lock ring from the universal joint housing support fork.

Unscrew and remove the grub screw from the centering bush.

## STEP 5



Using a suitable extractor, remove the centering bush and seal rings from the support fork.

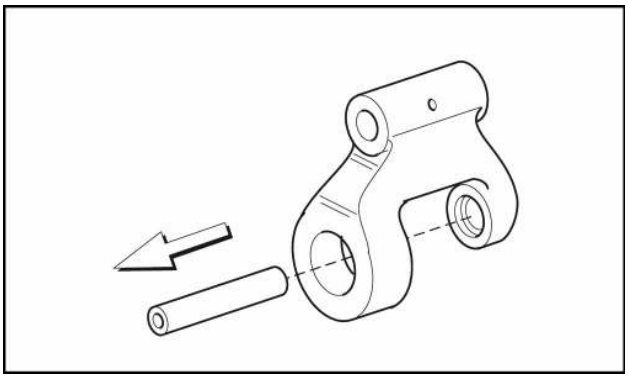
Check the conditions of seal ring and replace if necessary.

**NOTE:** *this is a destructive operation for the seal ring.*

https://truckmanualshub.com/



## STEP 6

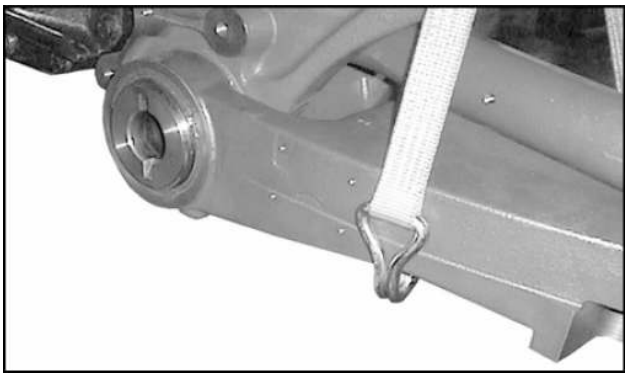


Using a suitable extractor remove the fork pin.

**NOTE:** *if necessary, slightly raise the joint unit to facilitate the extraction of the pin.*

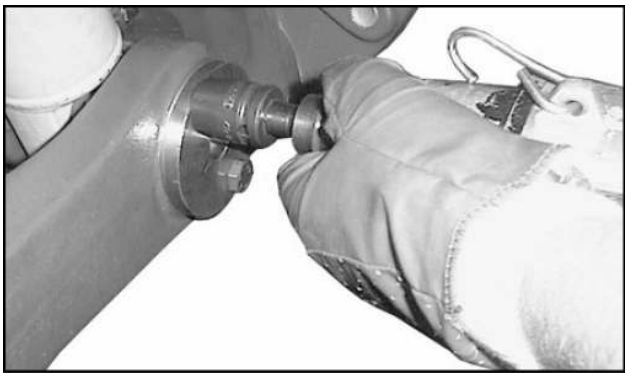
**ATTENTION:** *Check all removed components and replace if necessary.*

## STEP 7



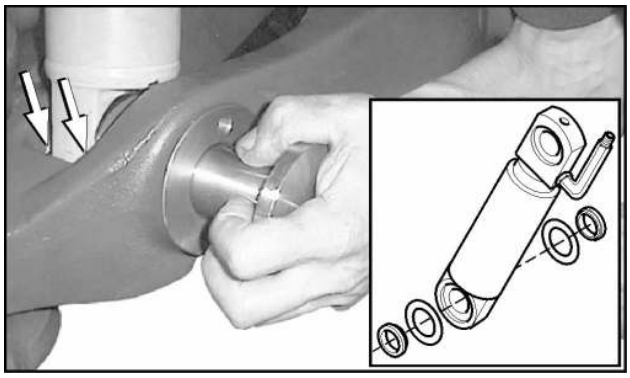
With a harness attached to a hoist, secure and support the lower arm.

## STEP 8



Remove the two retaining bolts from the suspension cylinder lower pin.

## STEP 9

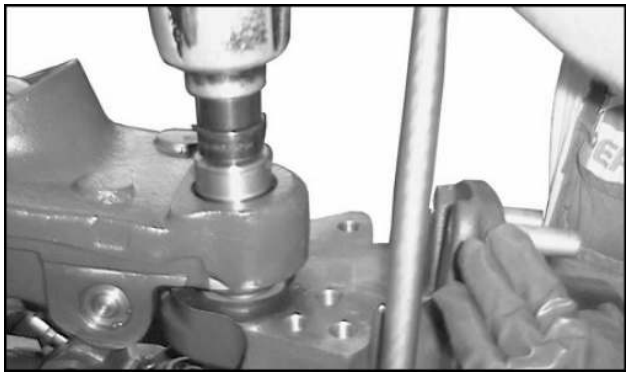


Remove the suspension cylinder lower pin.

If necessary, slightly raise the lower arm to facilitate withdrawal of the pin.

**NOTE:** *Retrieve the spacers and Belleville washers from the lower part of the suspension cylinder.*

## STEP 10



Using special tool CA715332, remove the retaining nut of the upper arm on the swivel housing.

## STEP 11

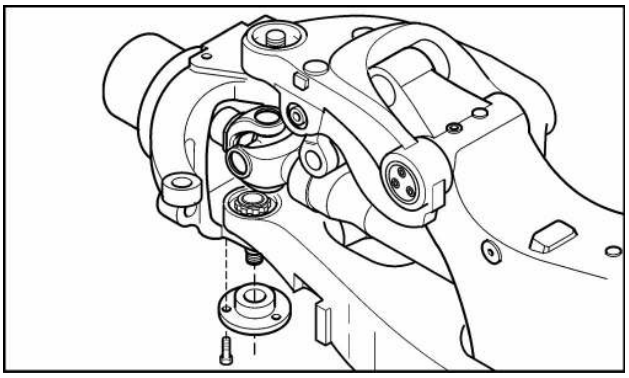


Using special tool CA715331, remove the retaining nut of the lower arm on the swivel housing.

https://truckmanualshub.com/

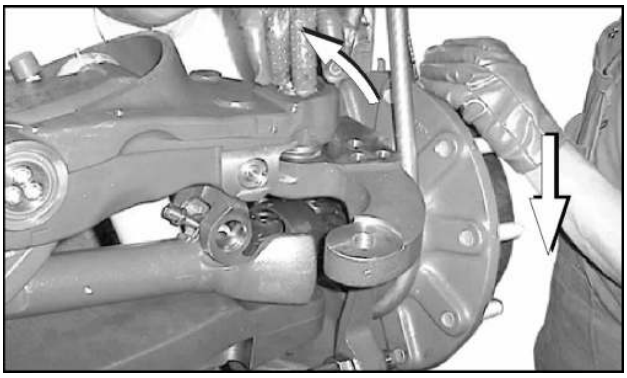


## STEP 12



Before removing the swivel housing remove the retaining bolts and detach the lower flange.

## STEP 13



**ATTENTION:** .B*e careful not to damage the thread of the ball joint.*

Lower the swivel housing slightly and slowly and at the same time rotate the upper arm upwards.

**NOTE:** *It is necessary to use slight vertical combined movements, when trying to find the best position to make it easier to withdraw the upper arm from the ball joint.*

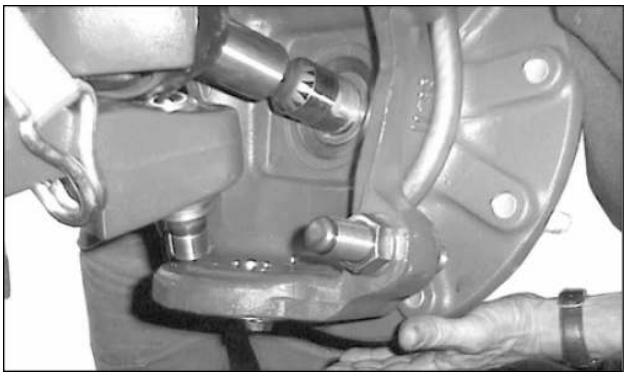
## STEP 14



Withdraw the swivel housing from the upper ball joint.

Rotate the upper arm and support fork until it reaches the end of stroke.

## STEP 15



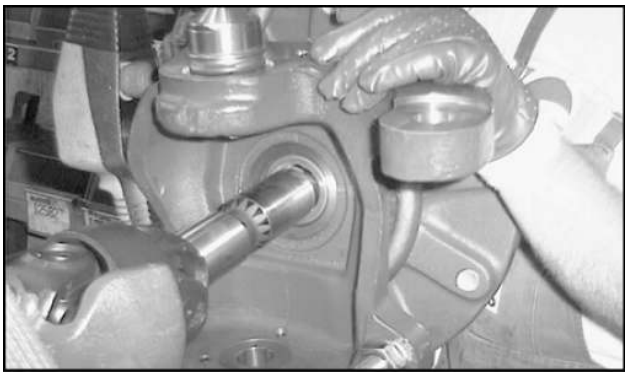
Slide the swivel housing from the lower ball joint.

**ATTENTION:** *Be careful not to damage the thread of the ball joint.*

Lower the swivel housing slowly, rotating its upper part slightly outwards and downwards.

**NOTE:** *It is necessary to use slight combined movements, when trying to find the best position to make it easier to withdraw the swivel housing from the lower arm ball joint.*

## STEP 16



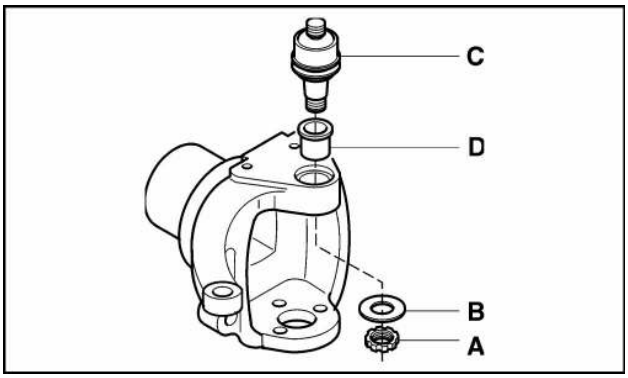
Slide the swivel housing from the half-shaft.

**ATTENTION:** *Take care not to damage the swivel housing bush and seal.*

https://truckmanualshub.com/



## STEP 17




If necessary:

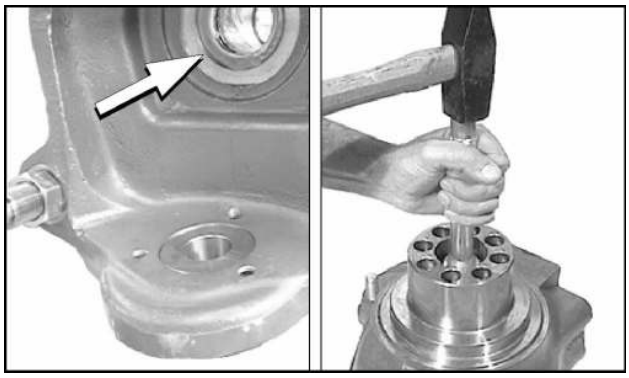
Using special tool CA715331, remove the retaining nut “A” and washer ‘B’ from the upper ball joint.

Withdraw the upper ball joint “C”.

**NOTE:** *It is not advisable to change the bush “D”.*

Only if necessary, push out the upper flange “D” using a driving tool and hammer.

## STEP 18



Place the swivel housing on a flat surface and using a suitable lever, extract the seal ring.

**NOTE:** *This is a destructive operation for the seal ring.*

If necessary, turn the swivel housing and extract the bush using special tool CA715108 and a hammer.

https://truckmanualshub.com/

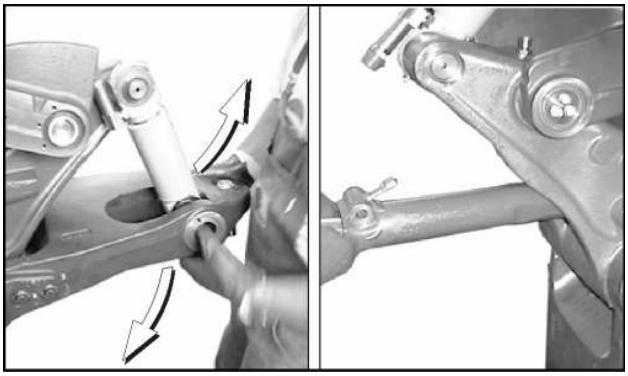


# UNIVERSAL JOINTS

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before disassembling the universal joints, it is necessary to remove the swivel housing unit.*

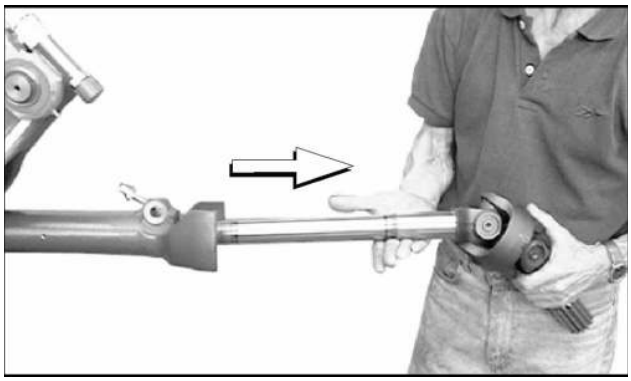
## STEP 1



Release the lower arm from the support harness and rotate it downwards.

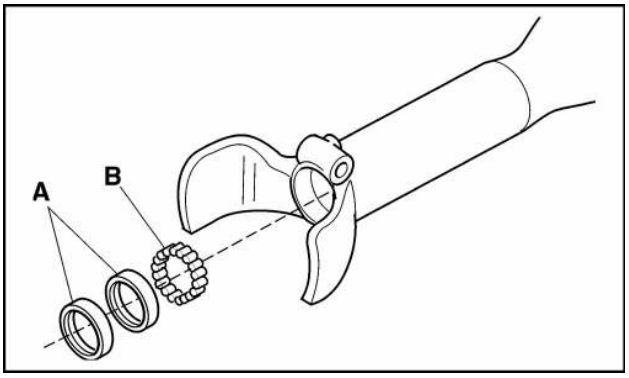
Rotate the suspension cylinder upwards, until it reaches the end of stroke.

## STEP 2



Using reasonable force, extract the universal joint from its housing.

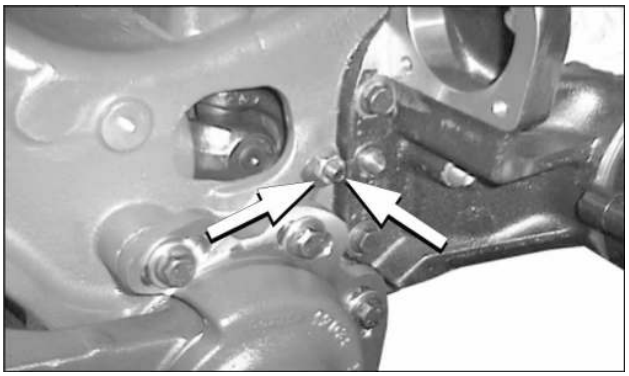
## STEP 3




Remove the two seal rings “A” and the needle bearings “B” from the universal joint housing.

**NOTE:** *This is a destructive operation for the seal rings.*

## STEP 4



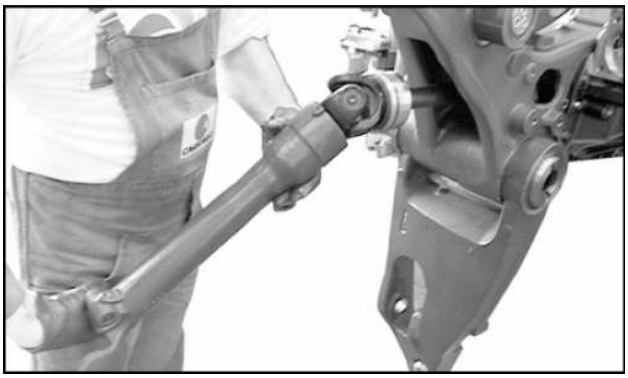
Loosen the lock nut and unscrew the grub screw a few turns.

**NOTE:** *Repeat the operation on the other two grub screws positioned on the front side of the axle body.*

https://truckmanualshub.com/

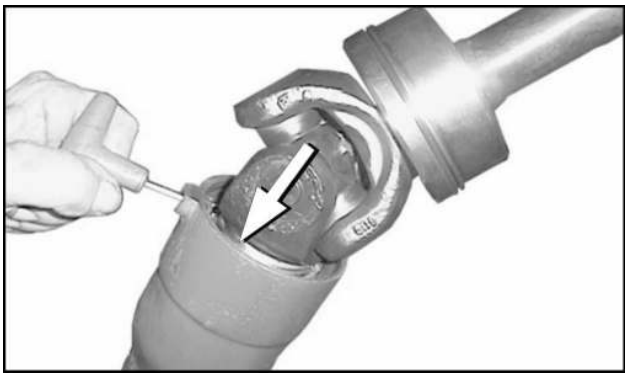


## STEP 5



Using reasonable force, remove the universal joint housing and inner universal joint from the differential unit.

## STEP 6

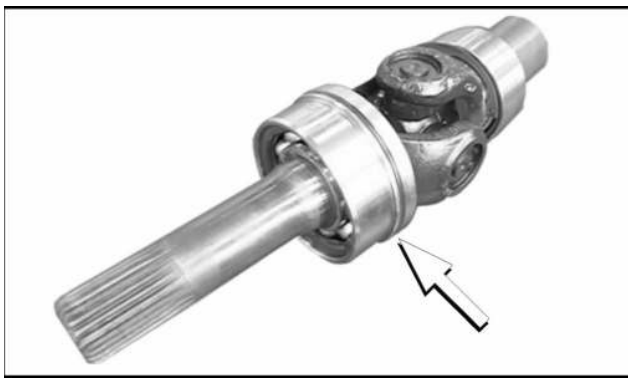


If necessary, remove the inner components.

Loosen the grub screw a few turns.

Remove the snap ring positioned on the inner side of the universal joint.

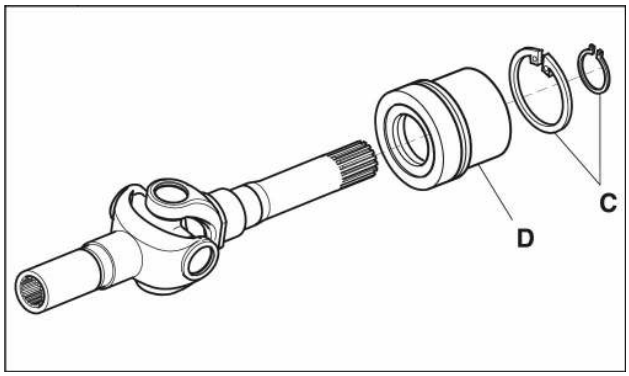
## STEP 7



Slide the universal joint complete with bearing and seal rings, from the universal joint housing.

Remove and discard the ‘O’ Ring.

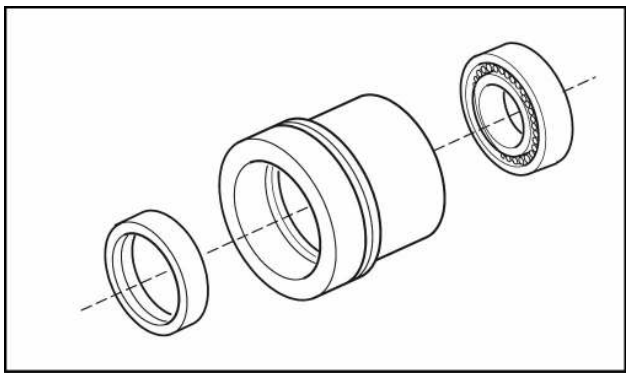
## STEP 8




Remove the two snap rings “C” from the half-shaft, on the differential side of the universal joint.

Using a standard extractor tool, extract the centering bush “D” complete with bearing and seal ring.

## STEP 9



Remove the seal ring from the centering bush.

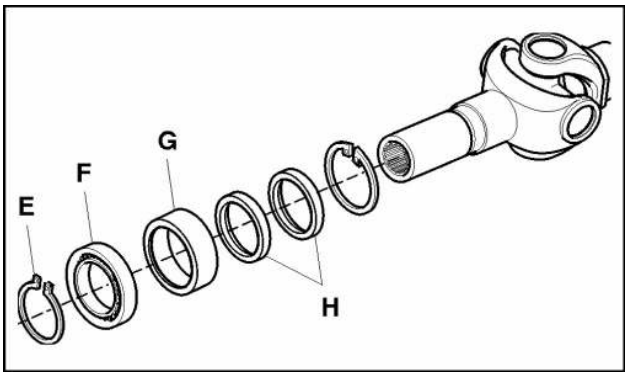
**NOTE:** *This is a destructive operation for the seal ring.*

Remove the bearing from the centering bush with a suitable driving tool.

https://truckmanualshub.com/



## STEP 10




Remove the snap ring “E” from the half-shaft, on the wheel side of the universal joint.

Using a standard extractor tool, extract the bearing “F”.

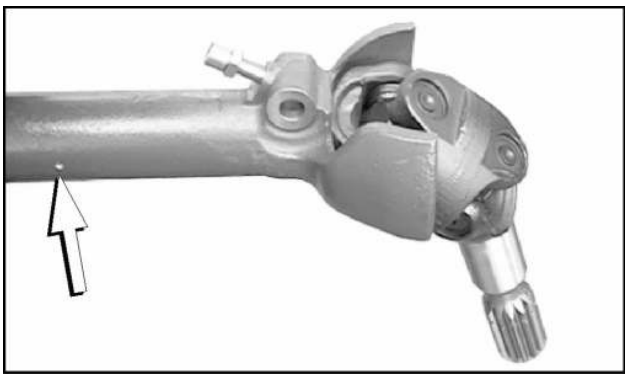
Extract the bush “G” complete with the two seal rings “H”.

Remove the two seal rings from the bush.

**NOTE:** *This is a destructive operation for the seal rings “H”.*

Carefully check all the components and replace them if necessary.

## STEP 11



Unscrew and remove the grub screw from the sealing hole.

https://truckmanualshub.com/

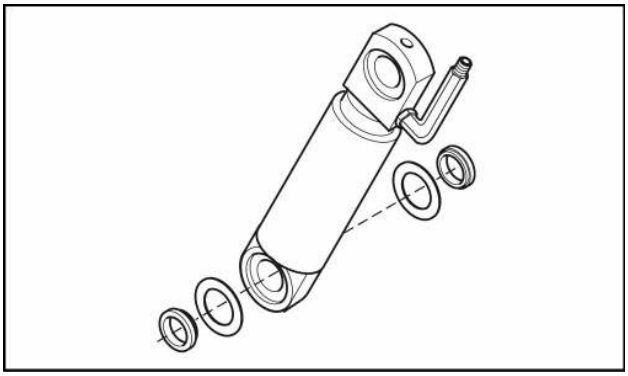


# SUSPENSION CYLINDER

Some of the following pictures may not show your axle, but the procedure is the same.

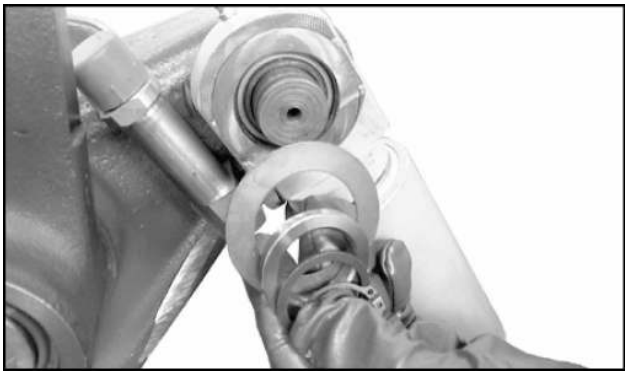
**NOTE:** B*efore disassembling the suspension cylinder, it is necessary to remove the swivel housing unit.*

## STEP 1



If not already disassembled, remove the two spacers and the two Belleville washers from the suspension cylinder base.

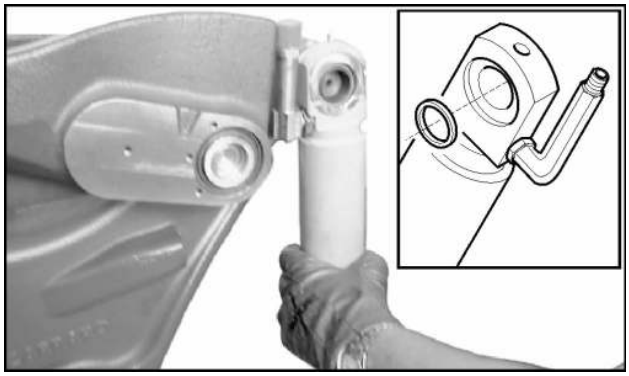
## STEP 2



Remove the snap ring on the upper part of the suspension cylinder.

Remove the washer, spacer and Belleville washer from the upper fixing pin.

## STEP 3



Slide the suspension cylinder from the upper fixing pin and the inner spacer.

https://truckmanualshub.com/

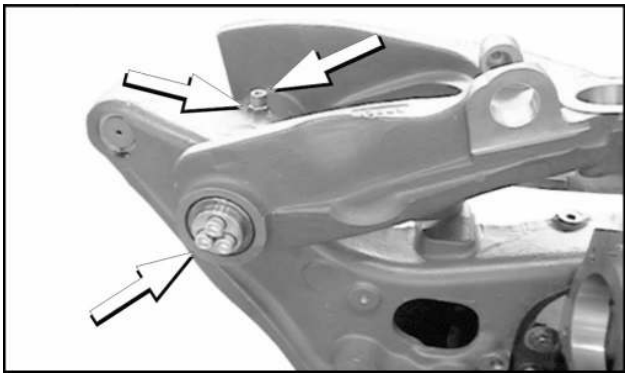


# UPPER ARM

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before disassembling the upper arm, it is necessary to remove the sensor kit and the swivel housing unit.*

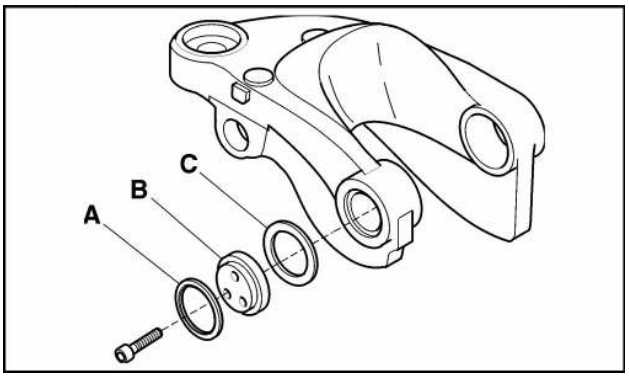
## STEP 1



Loosen the locking nut and unscrew the upper arm pin retaining bolt.

Remove the three cover fixing screws.

## STEP 2

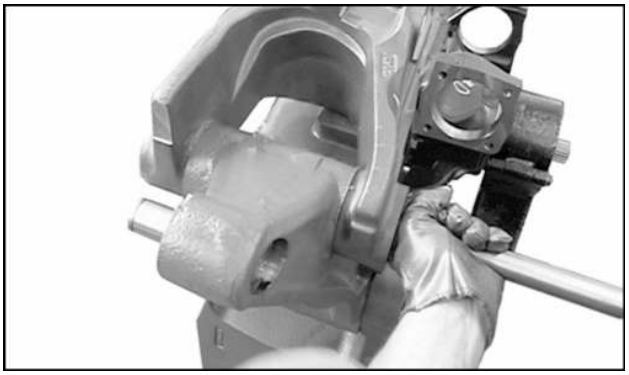



Remove the seal ring “A” from the cover “B”.

**NOTE:** *This is a destructive operation for the seal ring.*

Slide the cover and remove the lower thrust washer “C”.

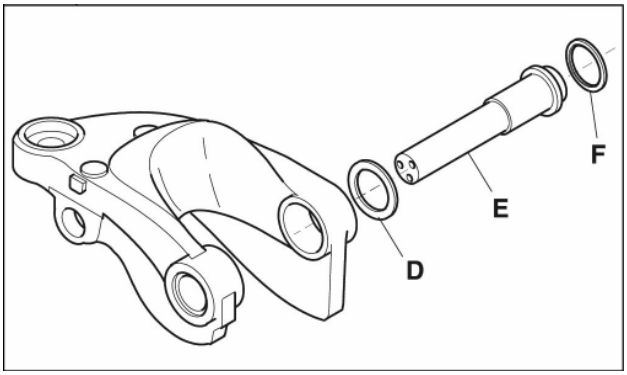
## STEP 3



**ATTENTION:** *Before removing the retaining pin, support the upper arm with a harness.*

Push out the upper arm retaining pin using a suitable driving tool.

## STEP 4



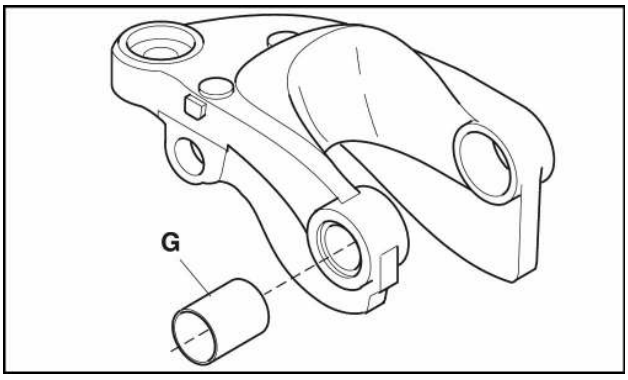

From the pin head “E” remove the seal ring “F” and the thrust washer “D”.

**NOTE:** *This is a destructive operation for the seal ring.*

https://truckmanualshub.com/

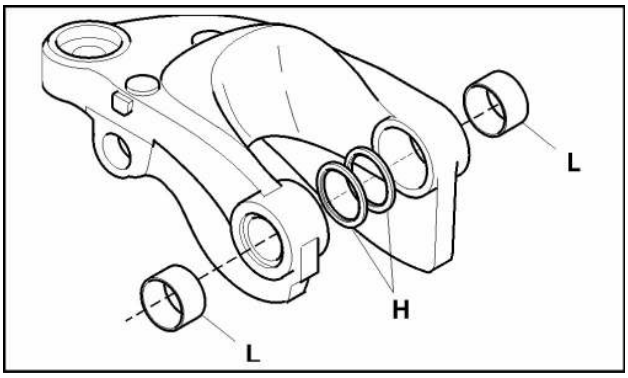


### STEP 5




Slide the bush “G” from the pin seat and remove the upper arm.

### STEP 6

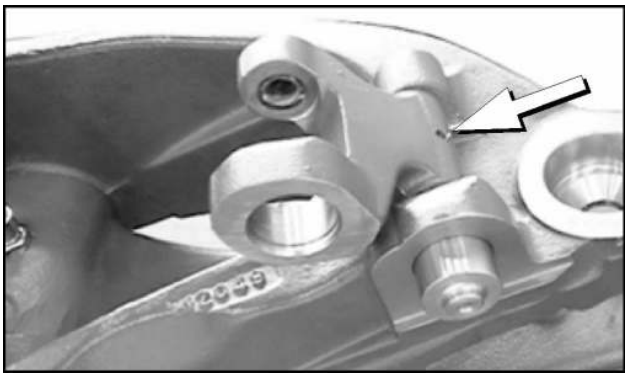



Place the upper arm on a work surface and remove the two seal rings “H”.

**NOTE:** *This is a destructive operation for the seal rings.*

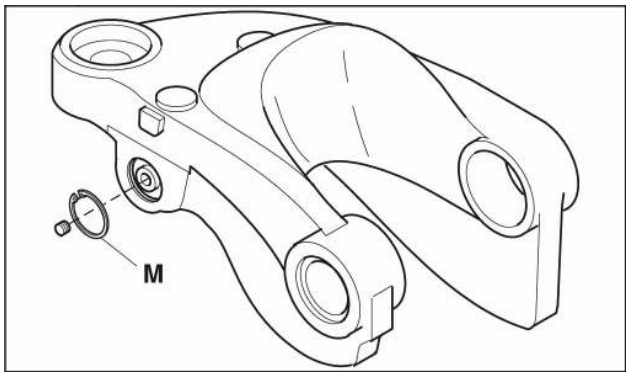
If necessary, push out the two bushes “L” using a suitable driving tool.

### STEP 7



If necessary to remove the universal joint support fork, push out the roll pin using a suitable punch.

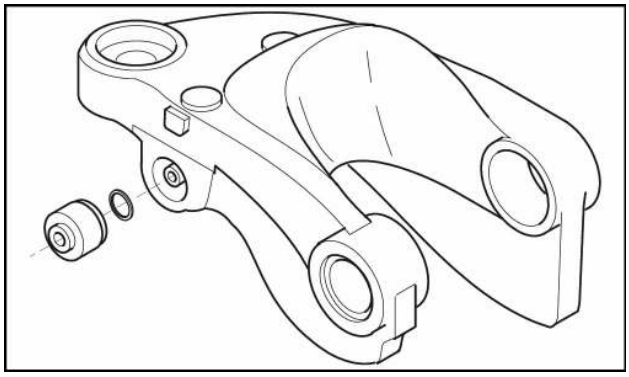
### STEP 8




Remove the snap ring “M”.

Unscrew and remove the grub screw from the centering bush.

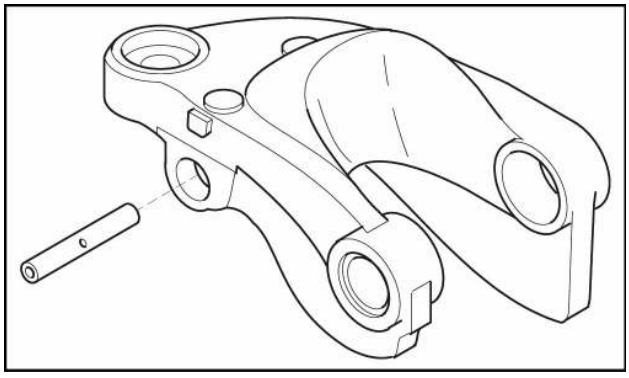
### STEP 9



Using a suitable extractor tool, remove the centering bush and seal ring from the upper arm.

**NOTE:** *This is a destructive operation for the seal ring.*

### STEP 10

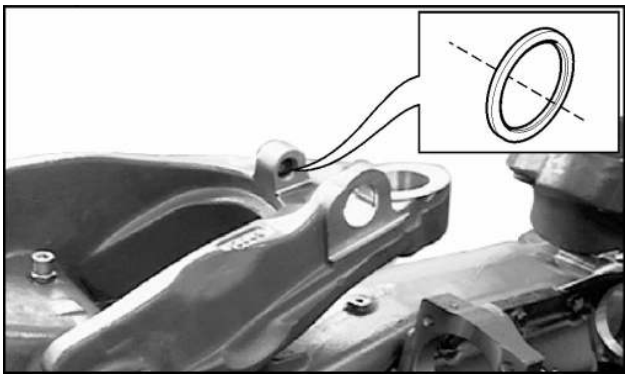


Using a suitable extractor tool, remove the support fork retaining pin.

https://truckmanualshub.com/



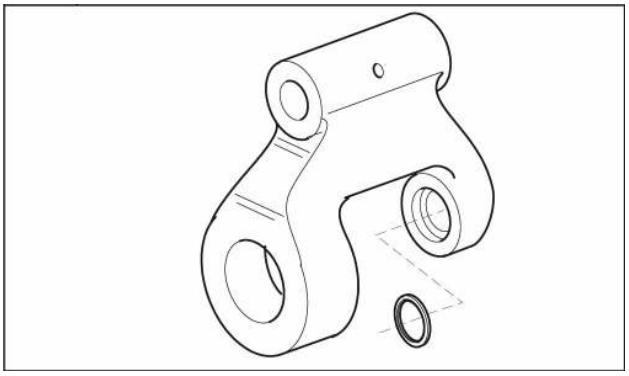
## STEP 11



If necessary, remove the seal ring from the upper arm.

**NOTE:** *This is a destructive operation for the seal ring.*

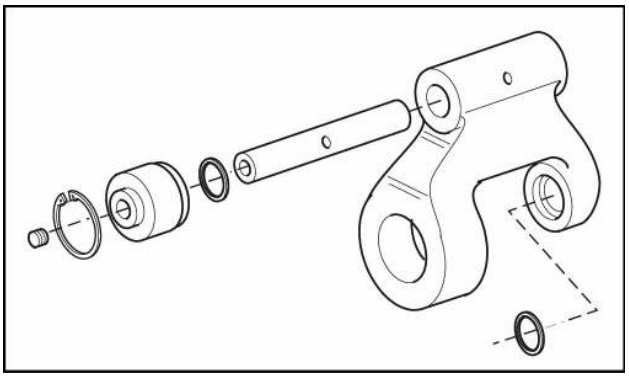
## STEP 12



If necessary, remove the seal ring from the support fork.

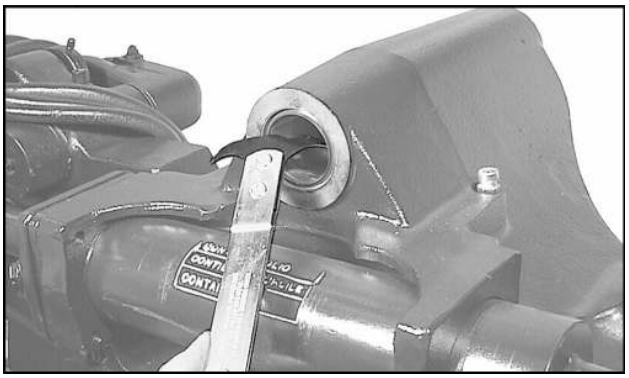
**NOTE:** *this is a destructive operation for the seal ring.*

## STEP 13



Carefully check all the components and replace them if necessary.

## STEP 14



Remove the pivot seal ring with a suitable tool.

**NOTE:** *This is a destructive operation for the pivot seal ring.*

https://truckmanualshub.com/

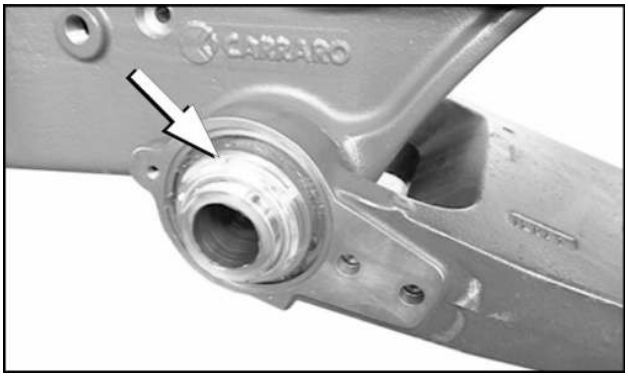


# LOWER ARM

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before disassembling the lower arm, it is necessary to remove the swivel housing unit.*

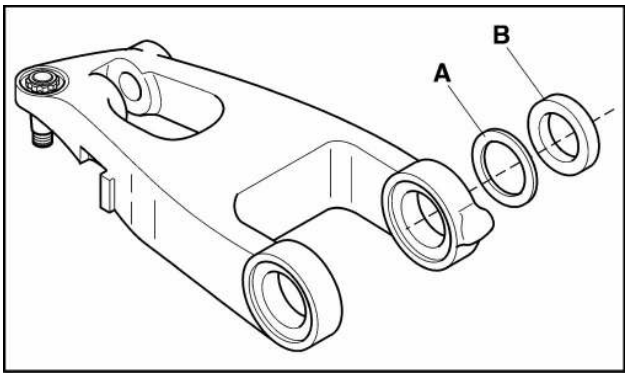
## STEP 1




Support the lower arm using a suitable harness and hoist.

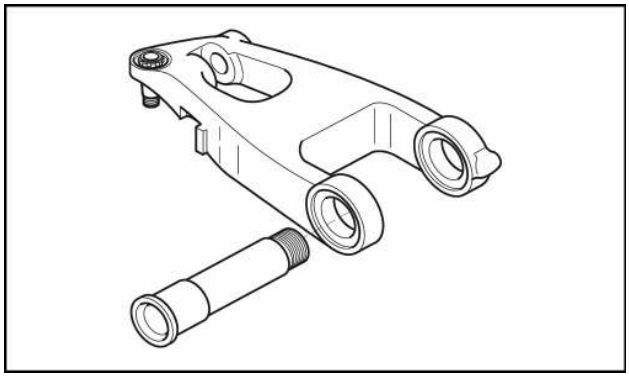
Using the special tool CA715330 and the pin locking tool CA715336, remove the locking ring nut from the lower arm pin.

## STEP 2




Remove the thrust washer “B” and the thrust ring “A”.

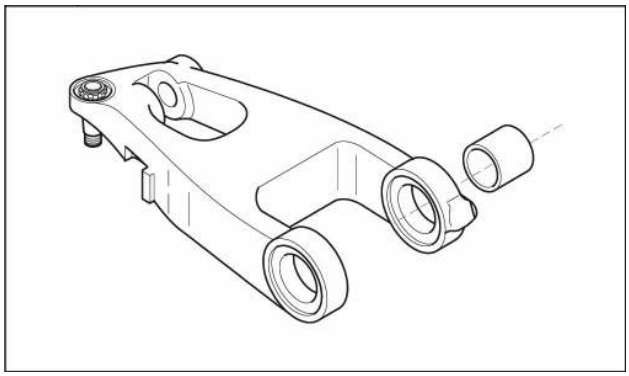
## STEP 3



**ATTENTION:** *make sure that the lower arm is firmly secured by the harness.*

Push out the lower arm pin using a suitable driving tool.

## STEP 4

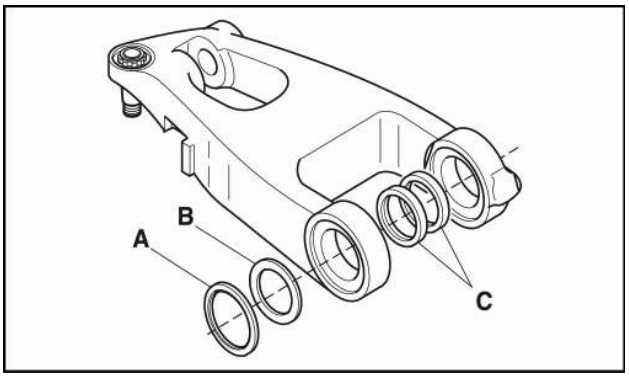


Slide out the bush and remove the complete lower arm from the central axle body.

https://truckmanualshub.com/



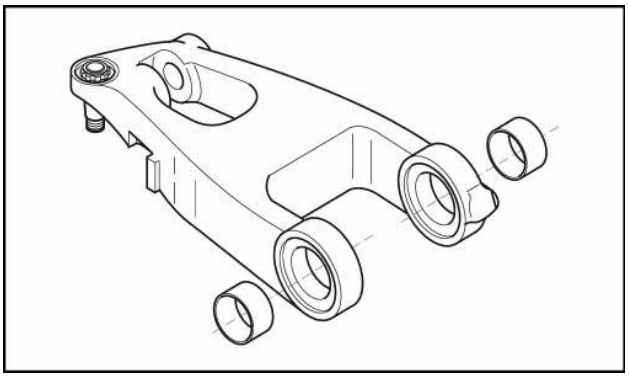
## STEP 5




Place the lower arm on a work surface and remove the seal rings “A” and “C” and the shim ring “B”.

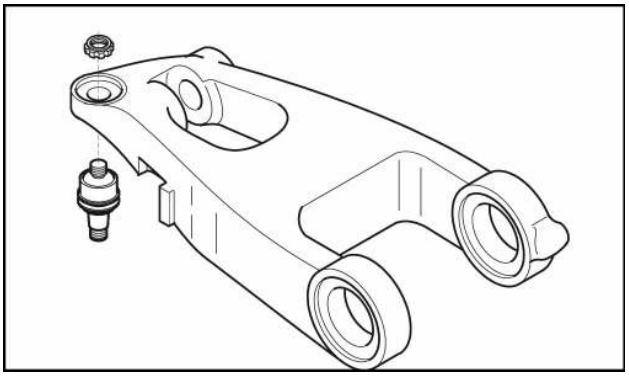
**NOTE:** *This is a destructive operation for the seal rings.*

## STEP 6



If necessary, extract the two bushes from the lower arm using a suitable driving tool.

## STEP 7



Using the special tool CA715332, remove the fastening ring nut from the lower ball joint.

Slide the ball joint from the lower arm.

https://truckmanualshub.com/

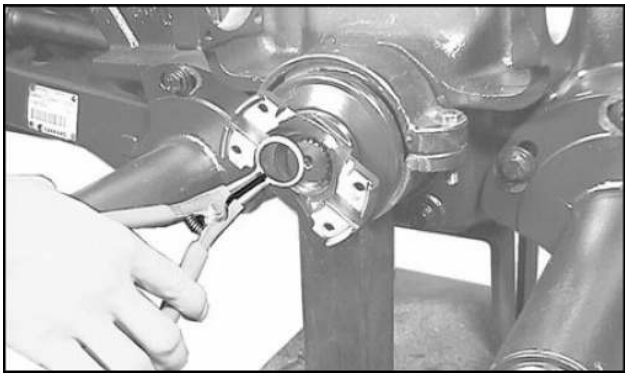


# DIFFERENTIAL SUPPORT UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

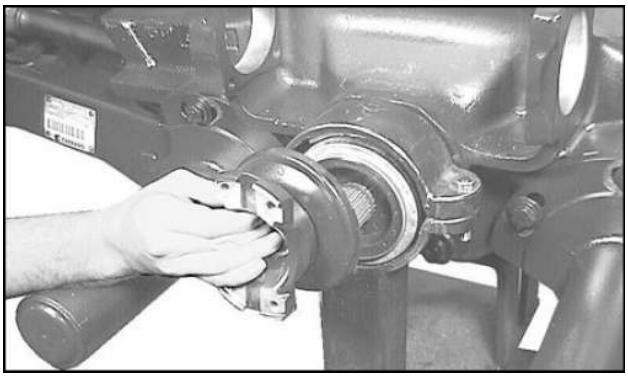
**NOTE:** B*efore disassembling the differential support unit, it is necessary to remove both universal joint units.*

## STEP 1



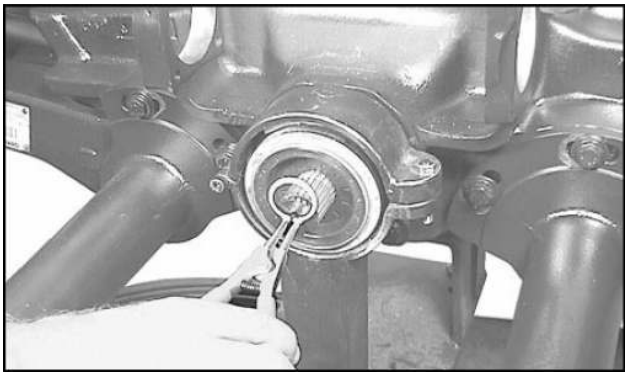
Remove the snap ring.

## STEP 2



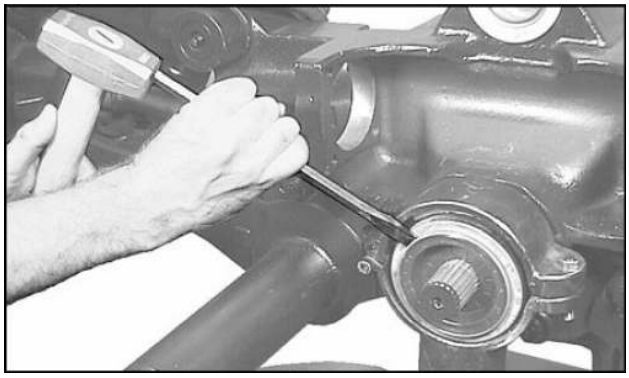
Remove the pinion flange.

## STEP 3



Remove the snap ring from the pinion.

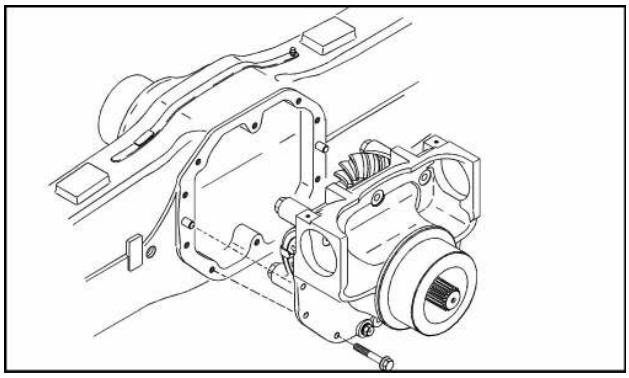
## STEP 4



Remove the seal ring with a suitable tool.

**NOTE:** *This is a destructive operation for the seal ring.*

## STEP 5



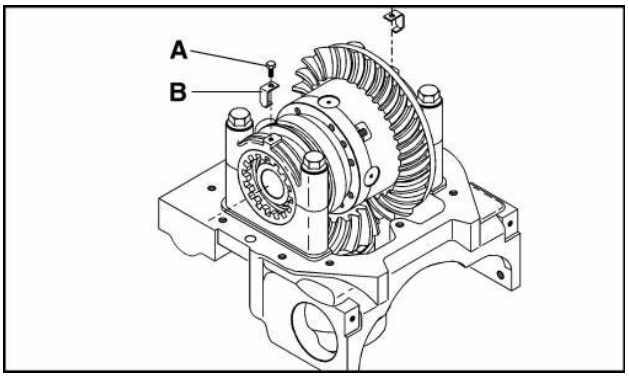
**ATTENTION:** *Before disassembly, support the differential carrier with a suitable harness.*

Remove the retaining bolts from the differential carrier.

https://truckmanualshub.com/

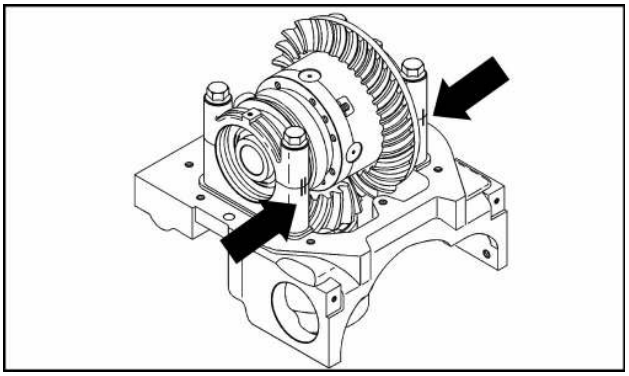


## STEP 6




Remove bolts “A” and locking clamps “B”.

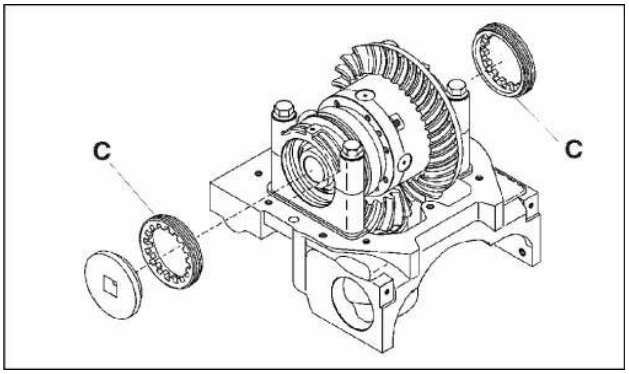
## STEP 7



Before removing bolts, mark bearing cups and the differential carrier with permanent reference marks to avoid incorrect re-assembly.

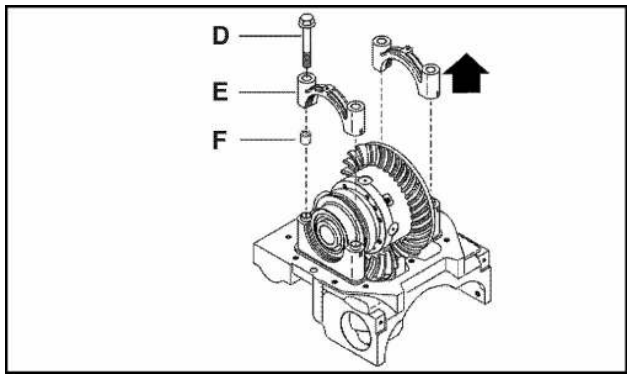
Also mark the area between the ring buts and the differential carrier.

## STEP 8




Remove the left and right adjuster rings nuts “C” using special tool CA119030.

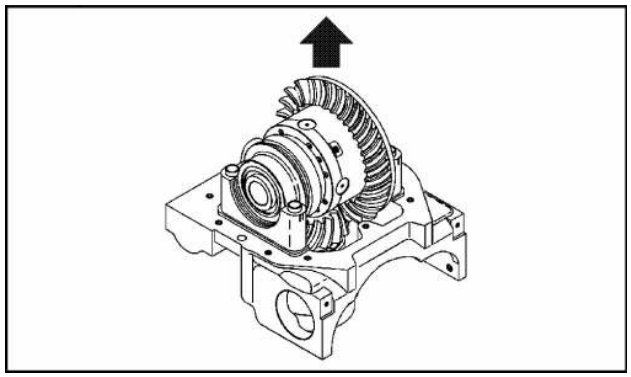
## STEP 9




Remove the four retaining screws “D” and remove the bearing caps “E”.

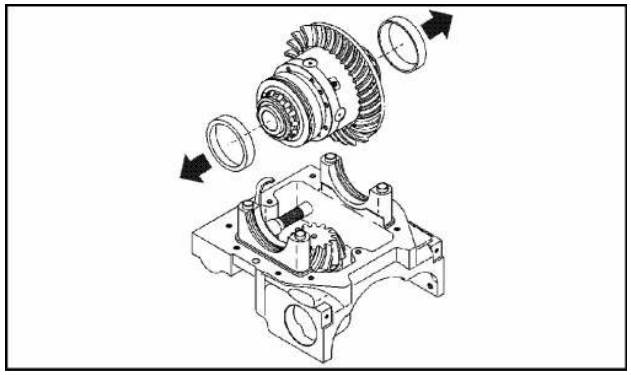
Remove the four locating dowels “F”.

## STEP 10



Remove the differential unit.

## STEP 11



**NOTE:** *Mark the differential unit and carrier to avoid incorrect reassembly.*

**ATTENTION:** *Do not mismatch the bearing cups if they are not to be replaced.*

Remove the bearing cups that were removed with the differential unit.

https://truckmanualshub.com/

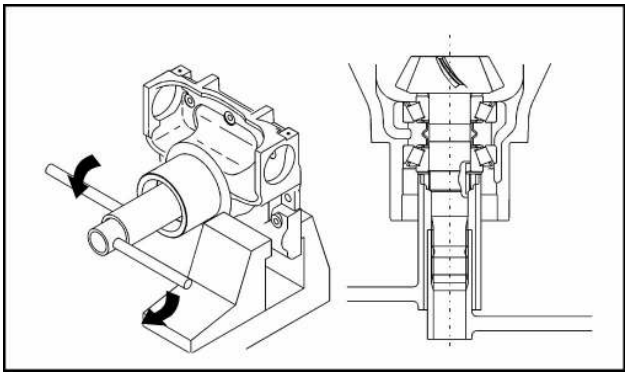


# PINION UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before disassembling the pinion unit, it is necessary to remove the differential unit.*

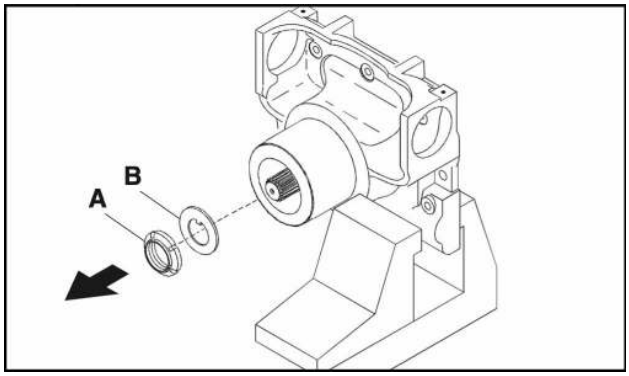
## STEP 1



Remove the ring nut using special tools CA119099 and CA715022.

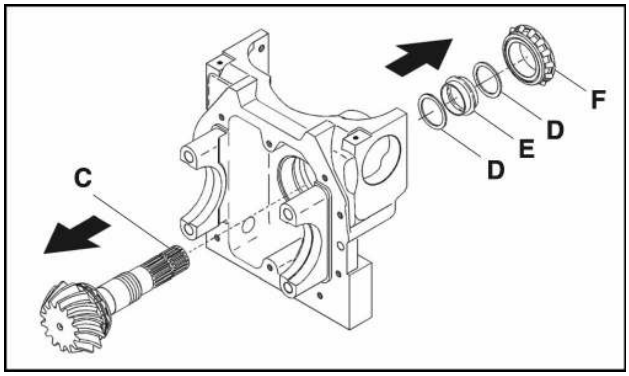
**NOTE:** *This is a destructive operation for the ring nut.*

## STEP 2




Remove the ring nut “A” and the locking washer “B”.

## STEP 3

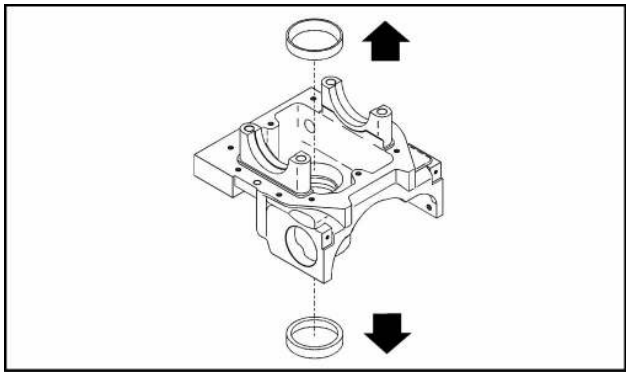



**ATTENTION:** *take care not to drop the pinion.*

Tap the pinion shaft with a soft hammer to remove the bevel gear “C”.

Remove the washers “D”, collapsible spacer “E” and the inner bearing cone “F”.

## STEP 4

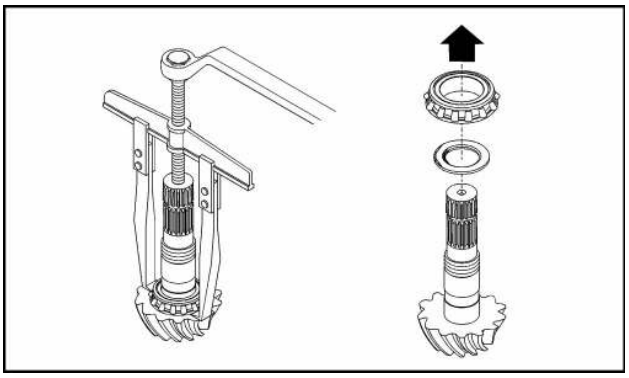


Place the differential carrier on a flat surface and remove the outer bearing cups using a suitable driving tool and a hammer.

https://truckmanualshub.com/



## STEP 5



Remove the inner bearing cone from the pinion shaft using a standard extractor.

Remove the underlying shim.

## STEP 6



Check all pinion components for wear.

**NOTE:** *The ring nut, locking washer and collapsible spacer must be replaced when reassembling the unit.*

https://truckmanualshub.com/

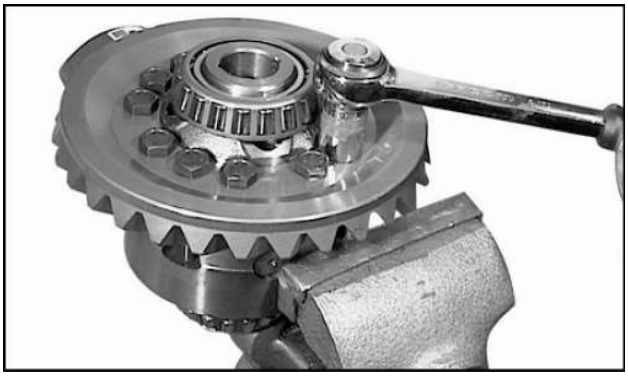


# DIFFERENTIAL UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before disassembling the differential unit, it is necessary to remove the differential support unit.*

## STEP 1

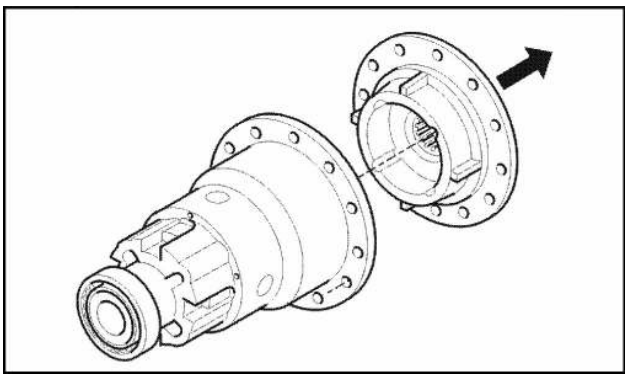


Remove the differential and secure it in a soft jaw vice.

Remove the crown wheel retaining bolts and crown wheel.

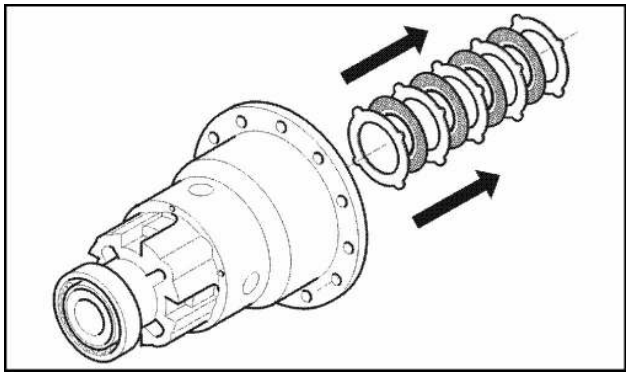
**ATTENTION:** *This operation separates the two parts of the differential housing. Take care not to lose the components.*

## STEP 2



Remove the cover from the differential housing.

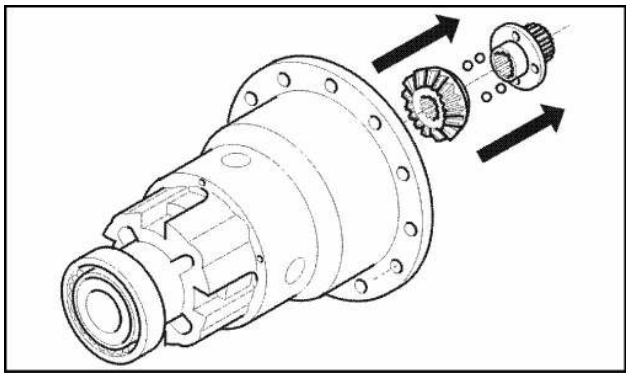
## STEP 3



**NOTE:** *Keep all components in order of not being replaced.*

Remove the right hand side friction plates and separator plates.

## STEP 4



Carefully remove the right hand hub and side gear as an assembly. Mark the side gear and hub for re-alignment.

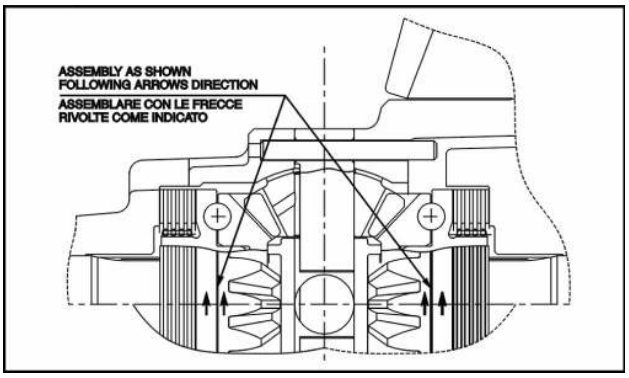
Separate side gear and hub.

Remove the balls.

https://truckmanualshub.com/

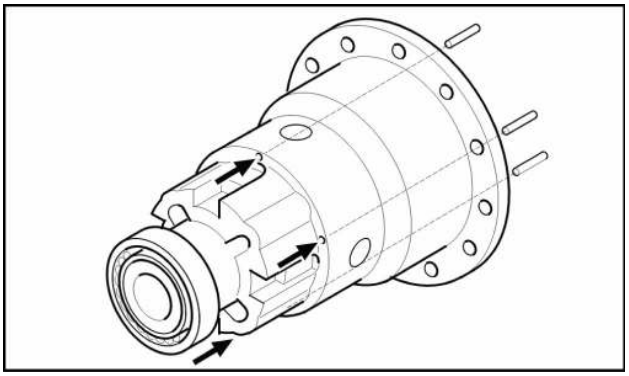


## STEP 5



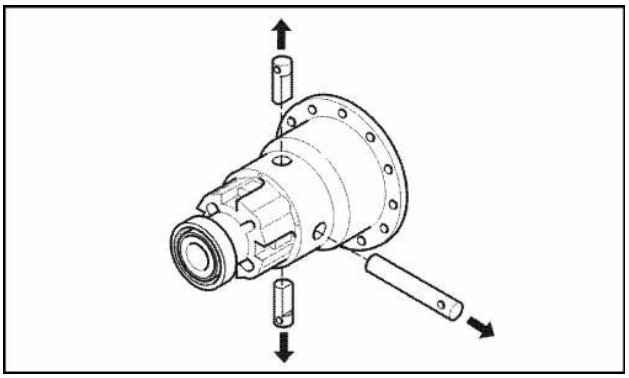

**ATTENTION:** *The two components of the left and right planetary are a matched set and must be assembled as shown.*

## STEP 6



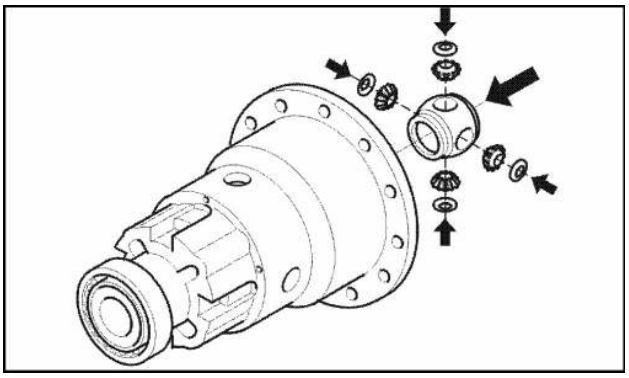
Using a suitable punch, push out the three locking pins.

## STEP 7



Remove the three planetary pins from the differential unit.

## STEP 8

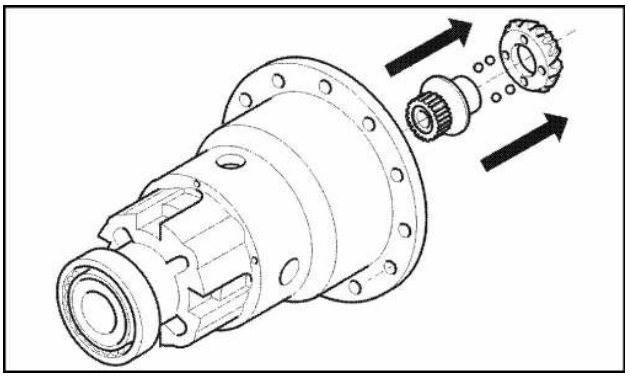


**NOTE:** *Keep the components in order, to facilitate re-assembly.*

Disassemble all the components (washers, planetary gears and spider).

Carefully clean the components and check their conditions for wear.

## STEP 9



Carefully remove the left hand hub and side gear as an assembly. Mark the side gear and hub for re-alignement.

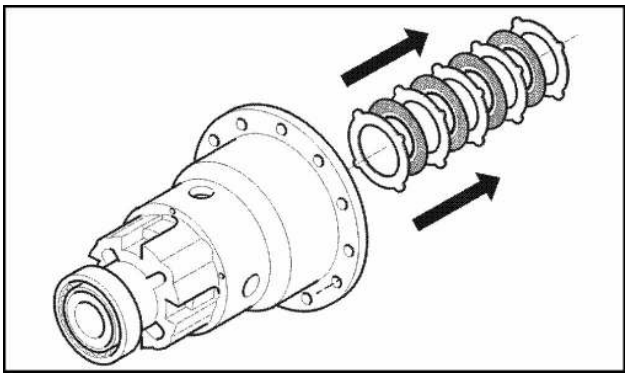
Separate side gear and hub.

Remove the balls.

https://truckmanualshub.com/



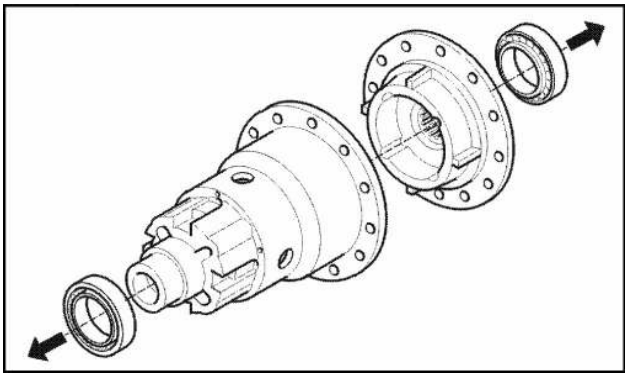
## STEP 10



**NOTE:** *Keep all components in order if not being replaced.*

Remove the left hand side friction plates and separator plates.

## STEP 11



Using a suitable extraction tool, remove the bearings from the differential housing and cover.

https://truckmanualshub.com/



# ASSEMBLY OPERATIONS

https://truckmanualshub.com/



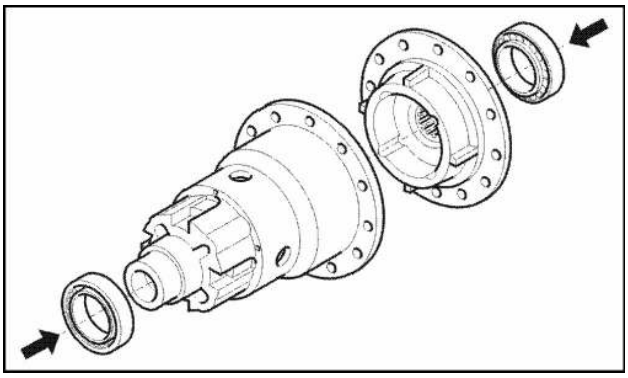
# DIFFERENTIAL UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

After cleaning the components carefully and checking their functionality and wear conditions, proceed to the assembly of the differential parts, as indicated in the figures.

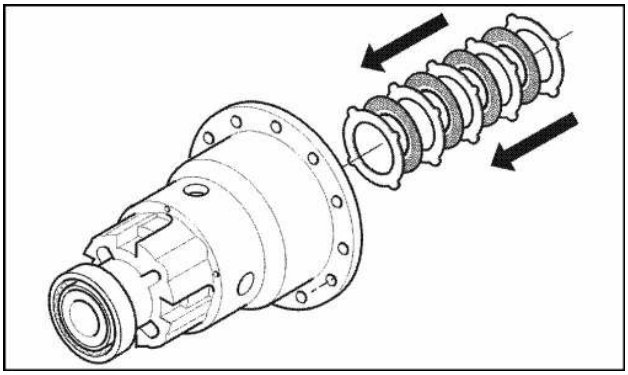
**NOTE:** *Carry out the assembly with great care.*

## STEP 1



Assemble the cones of the new taper roller bearings on the differential housing and cover, using special tool CA715093 and a hammer.

## STEP 2

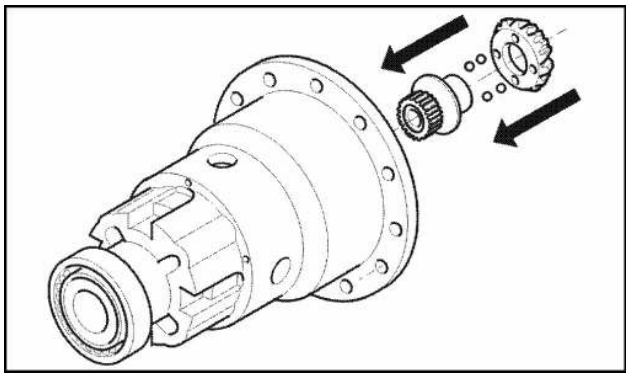


Install one separator plate and one friction plate into the differential housing.

Continue to install one separator plate and one friction plate until a total of 5 separate plates and 4 friction plates have been installed.

**NOTE:** *The last plate installed must be a separator plate.*

## STEP 3

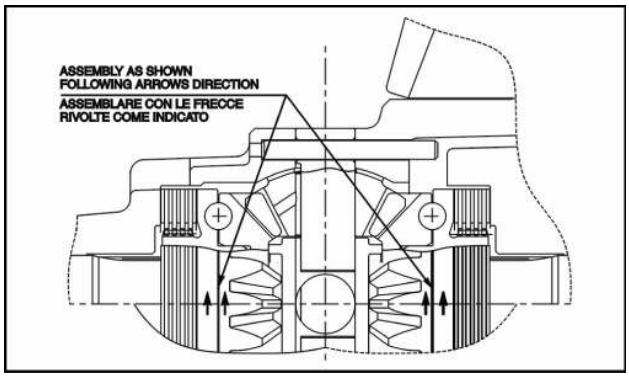


Install balls into the left hub, align the marks on side gear and hub. Make sure arrows etched on side gear and hub are facing in the direction shown in STEP 4.

Install hub and side gear as an assembly, making sure the splines of the hub are correctly located into separator plates and friction plates.

Install thrust washer.

## STEP 4

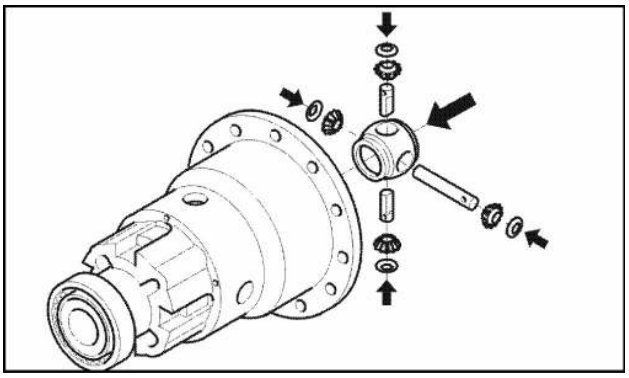



**ATTENTION:** *The two components of the left and right planetary are a matched set and must be assembled as shown.*

https://truckmanualshub.com/

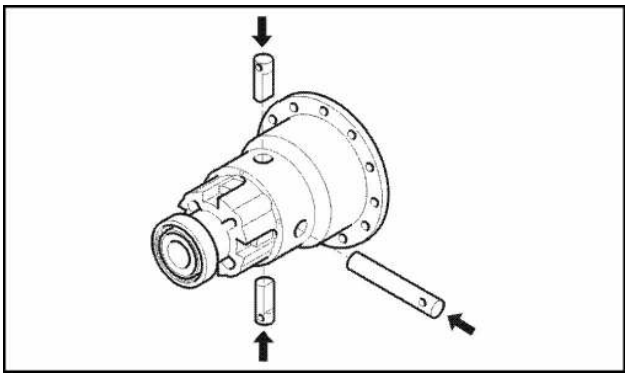


## STEP 5



Install the spider, the washers and the planetary gears.

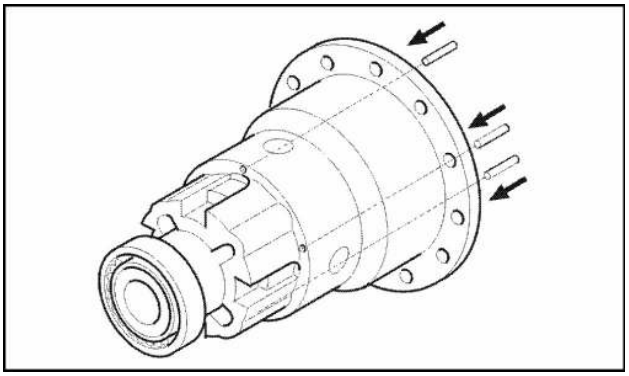
## STEP 6



Install the long planetary pin, through the planetary gears, thrust washers and spider.

Install the two short pins in the same way.

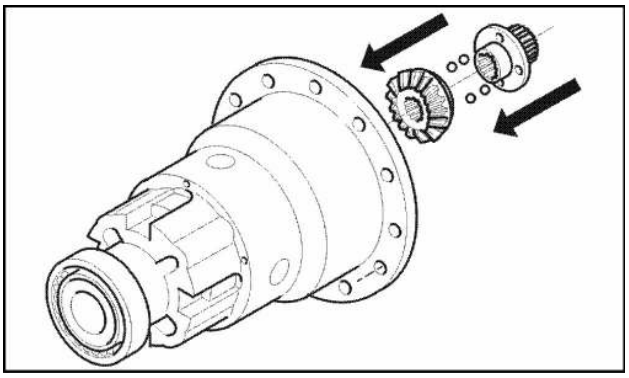
## STEP 7



Manually rotate the planetary pins to align the locking pin holes with the corresponding holes in the housing.

Install the three locking pins.

## STEP 8

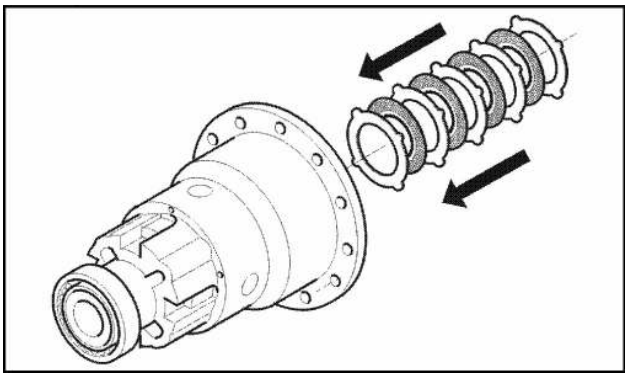


Install balls into the right hub, aligning the marks on the side gear and hub.

**NOTE:** *Make sure arrows etched on side gear and hub are facing in the direction shown in STEP 4.*

Install hub and side gears as an assembly.

## STEP 9

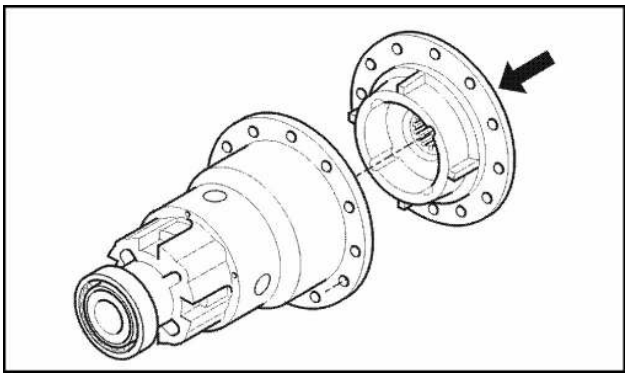


Install one separator plate and one friction plate into the differential housing.

Continue to install one separator plate and one friction plate until a total of 5 separate plates and 4 friction plates have been installed.

**NOTE:** *The last plate installed must be a separator plate.*

## STEP 10

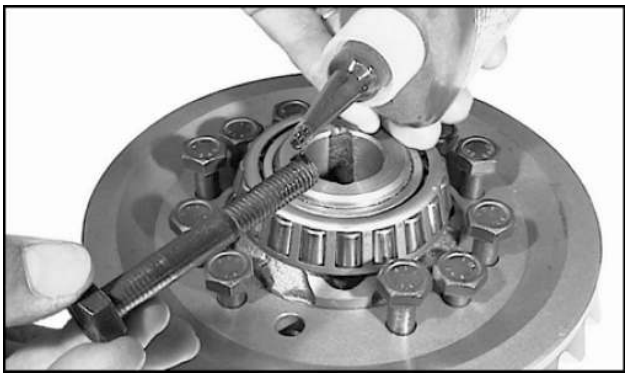


Install the cover onto the differential housing.

https://truckmanualshub.com/



**STEP 11**



Install the crown wheel onto the differential housing.

Install the retaining bolts with LOCTITE 270 and tighten to the prescribed torque.

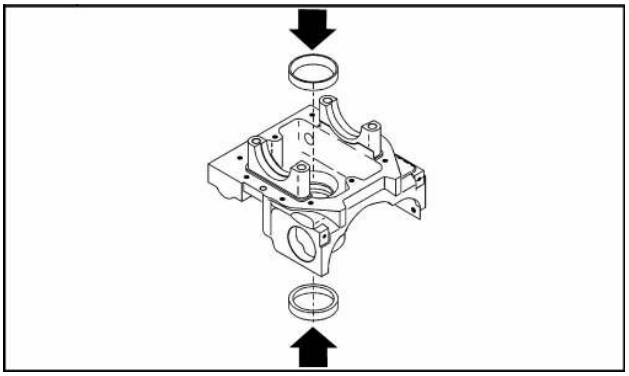
https://truckmanualshub.com/



# PINION UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

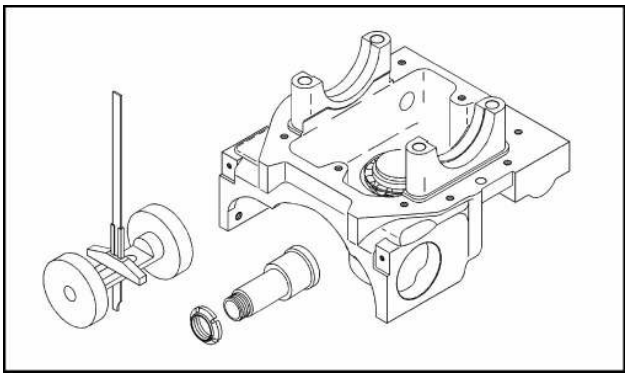
## STEP 1



Place the differential carrier on a workbench.

Fit the bearing cups using special tools CA119225, CA715092 and a hammer.

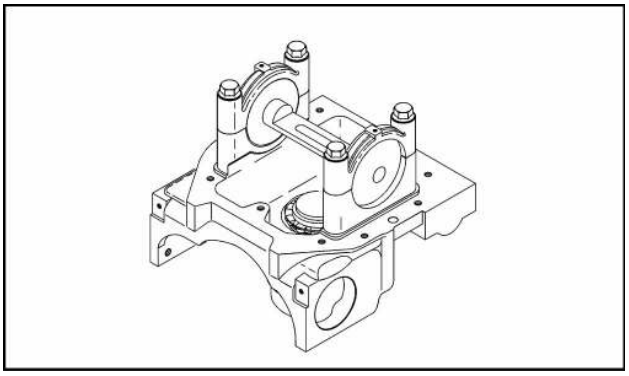
## STEP 2



Prepare the “false pinion” CA119202 and “false differential box” CA119182 and CA119228.

**NOTE:** *A depth gauge is also required for this procedure.*

## STEP 3



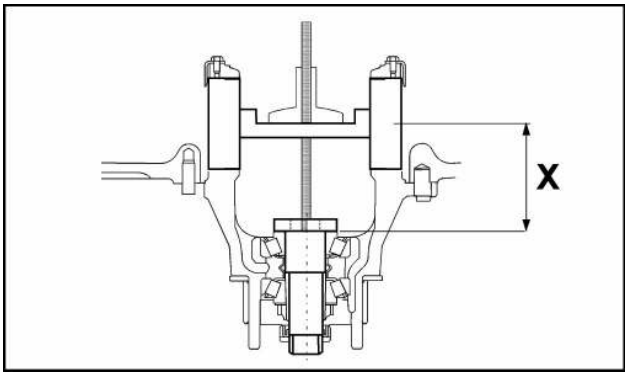
Install the false pinion CA119202, together with its bearings and ring nut and bearing housings.

Tighten the ring nut until the backlash is eliminated.

Install the false differential box CA119182 and CA119228, and bearing cups.

Tighten retaining bolts to the prescribed torque.

## STEP 4

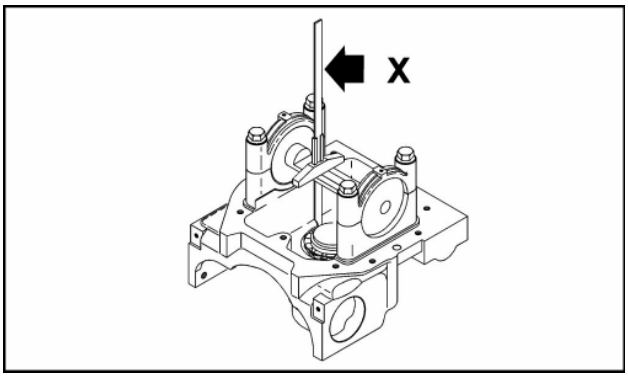



Measure distance “X” using a depth gauge.

https://truckmanualshub.com/

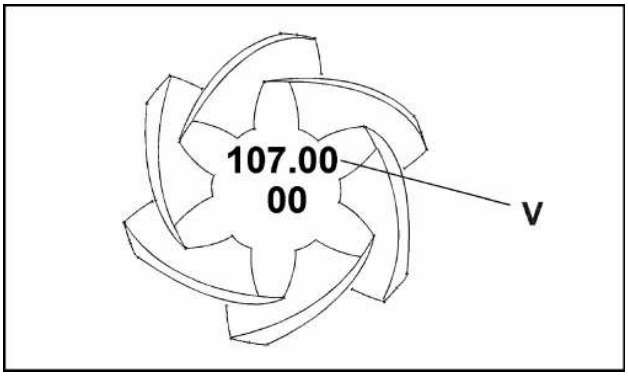


## STEP 5




Distance “X” is the distance between the axis of the differential bearings and the point at which the pinion head is supported or the base of the bearing.

## STEP 6

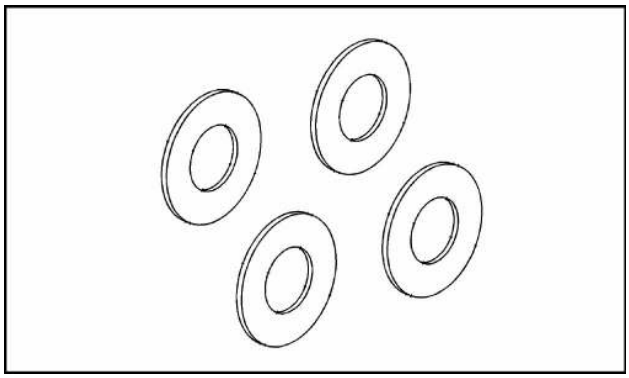



**S=X-V**

To determine the correct shim thickness (S) to be installed between the pinion and bearing; subtract value V (stamped at the pinion head) from the measured distance (X).

**NOTE:** *V = prescribed distance.*

## STEP 7

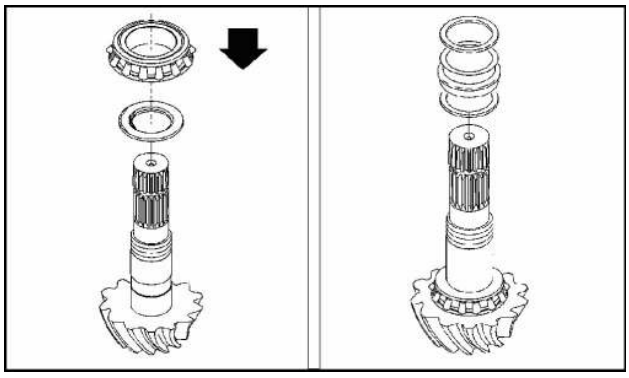


| Shim Range S | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 |

Select the thickness “S” from the range of available shims, and fit to shaft under the pinion head.

Take care to assemble correctly.

## STEP 8



Install selected shim with chamfer against the gear, into the pinion shaft and using special tool CA715004 under a press, make sure that it is well seated.

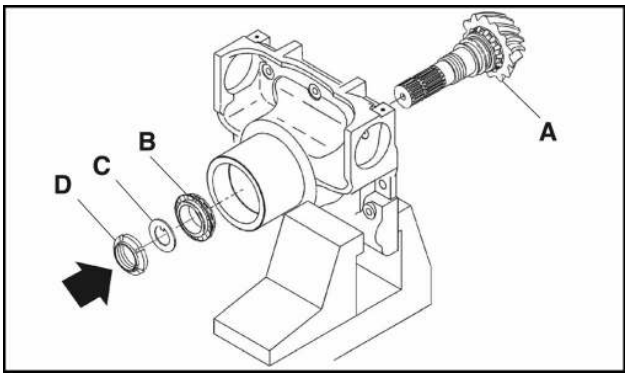
Insert the shims and a new collapsible spacer.

**NOTE:** *Always use a new collapsible spacer.*

https://truckmanualshub.com/



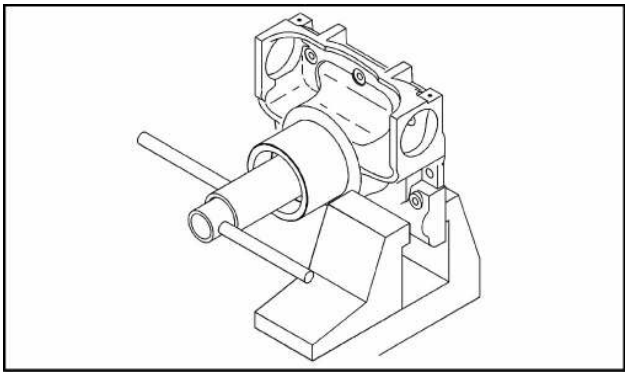
## STEP 9




Install pinion shaft “A” into the differential support carrier and the second bearing cone “B” into the pinion shaft, using special tool CA715004 and a hammer.

It is advisable to offer resistance to the beating force with, for example, a sledge hammer.

## STEP 10



Insert washer “C” and ring nut “D” onto the pinion shaft.

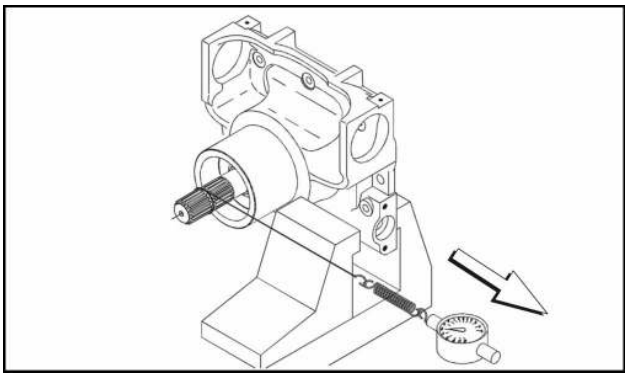
Use special tool CA119099 and pinion retainer CA715022 to tighten the ring nut.

**ATTENTION:** *The torque setting is determined by the preloading measurement on the bearings.*

Tighten the ring nut gradually and lightly tap both pinion ends with a soft hammer to seat the bearings.

**NOTE:** *If the collapsible spacer is over tightened, it will have to be replaced and the procedure repeated.*

## STEP 11



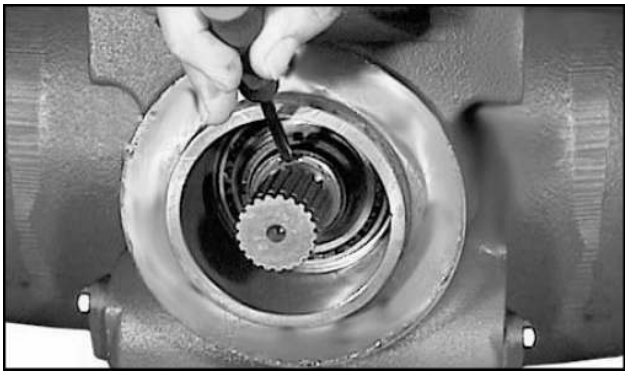
**P=9.2÷13.8 daN**

**ATTENTION:** *All preloadings should be measured without the seal ring.*

Carry out the preloading measurement “P” of the pinion taper roller bearings, using a dynamometer with the cord wound around the pinion end.

Adjustment is carried out by increasing the ring nut torque setting gradually, taking care not to exceed the prescribed rolling pull.

## STEP 12



Once the prescribed preloading value is achieved, lock the ring nut, using a suitable drift and hammer.

https://truckmanualshub.com/

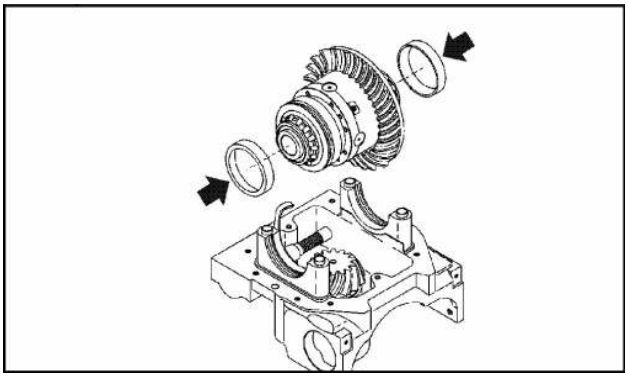


# DIFFERENTIAL UNIT SUPPORT

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** B*efore assembling the differential support unit, it is necessary to assemble the pinion unit.*

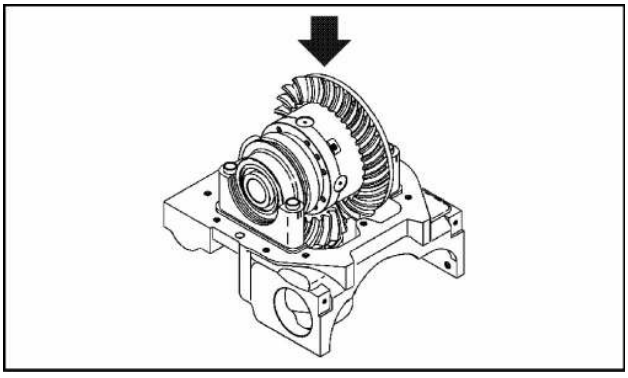
## STEP 1



Position the bearing cups on the differential unit.

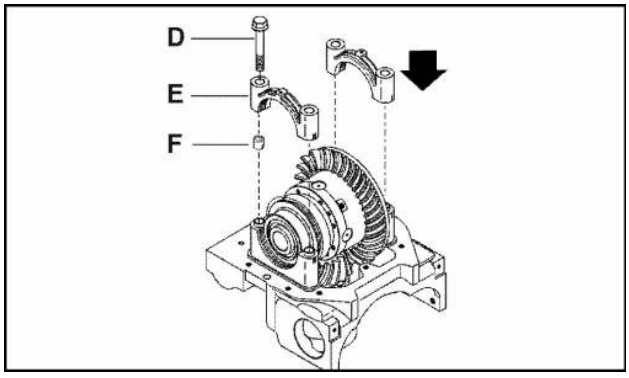
**ATTENTION:** *Do not mismatch the bearing cups if the bearings are not replaced.*

## STEP 2



Position the complete differential housing, with the bearing cups already assembled, onto the differential carrier.

## STEP 3

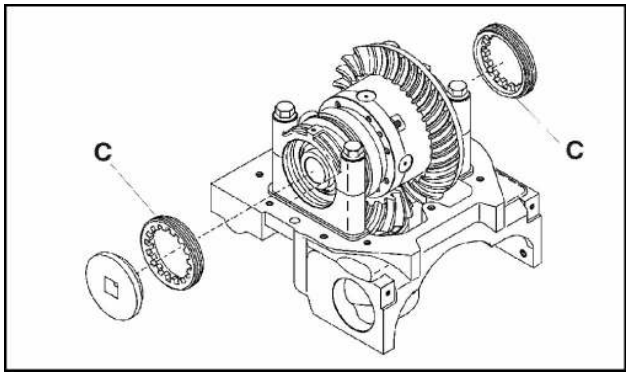



Move the differential group so to place the bevel crown gear on the pinion.

Install bushes “F” and bearing cups “E” with identification marks aligned.

Install retaining bolts “D” and tighten by hand.

## STEP 4



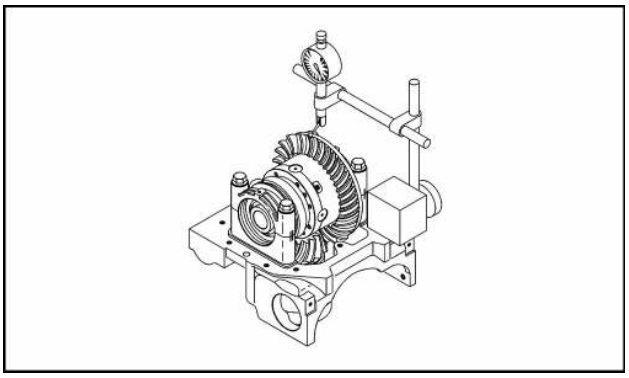

Assemble and install ring nuts “C” on the differential support. With the special wrench CA119030, tighten the ring nuts to eliminate the slack and slightly preload the differential bearings.

If necessary, tap gently with a soft hammer to properly seat the bearings.

https://truckmanualshub.com/

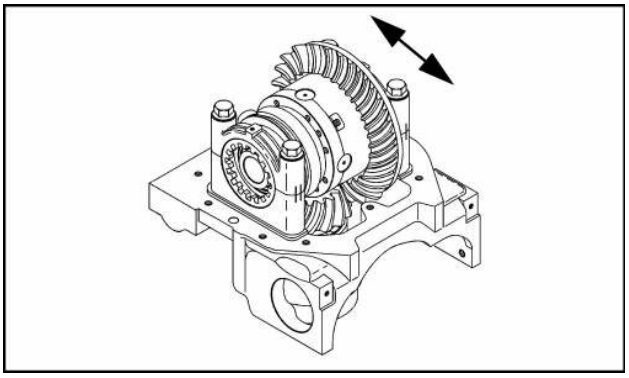


## STEP 5



Position a dial gauge on the differential support so that the feeler stylus touches the surface of one tooth of the crown gear with a 90° angle.

## STEP 6



Lock the pinion and move the crown wheel to measure the backlash.

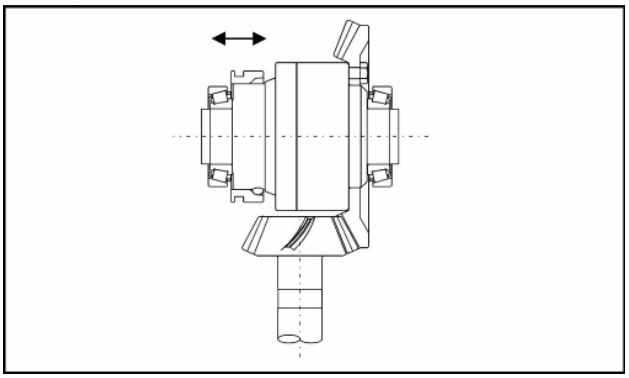
Repeat the operation on 2 or more points, rotating the crown gear, to obtain an average value.

The backlash should be within the range

**0.20÷0.28 mm**

Adjust by turning the two ring nuts using special tool CA119030.

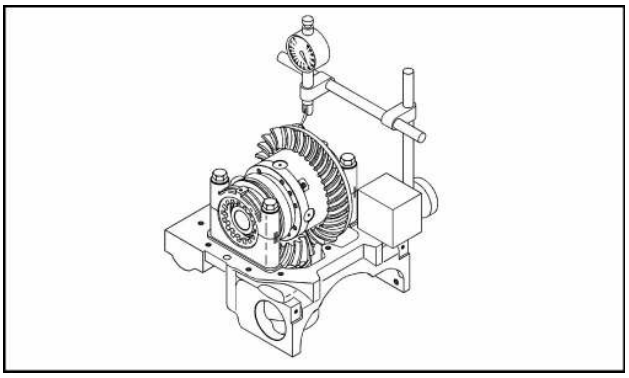
## STEP 7



If the measured backlash is less than the given tolerance range, unscrew the ring nut on the bevel crown gear side and screw in the opposite one by the same amount.

If the measured backlash is greater than the given tolerance range, unscrew the ring nut on the side opposite to the bevel crown gear, and screw in the other one by the same amount.

## STEP 8



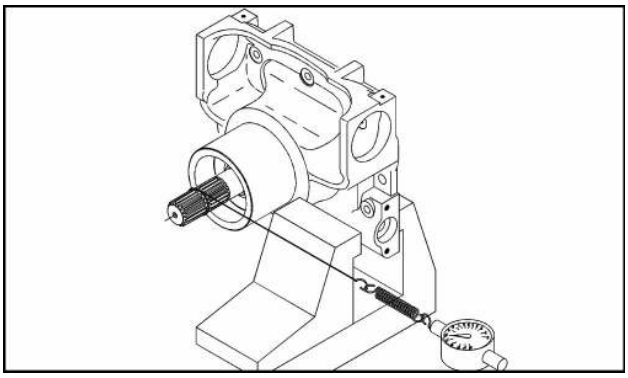
Once the pinion-ring gear backlash adjustment has been carried out, check also that there is a minimum preloading on the differential housing bearings.

Repeat the procedure until the correct backlash is reached.

https://truckmanualshub.com/



## STEP 9



Once the backlash has been established, measure the total preloading (T) of the bearing., Use a dynamometer, wind the cord around the pinion splined end and check the rolling pull.

The measured value should be within the following range:

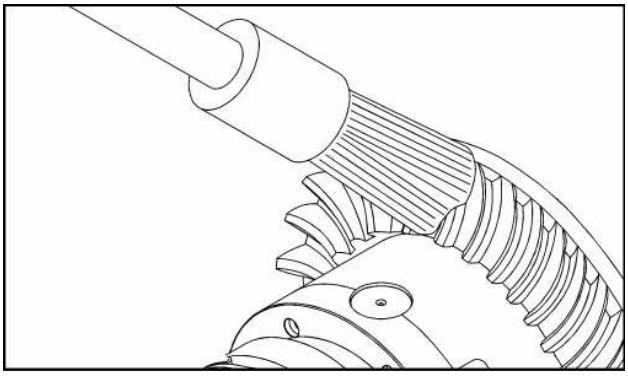
**T=(P+2.99)÷(P+4.86) daN**

where P is the effectively measured pinion preloading.

See: “Pinion assembly”.

**NOTE:** *All preloadings must be measured without the seal ring.*

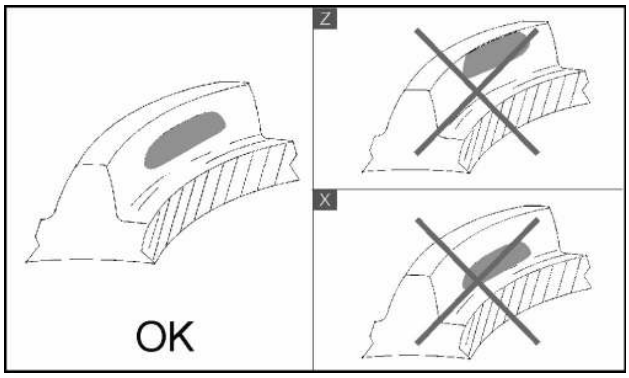
## STEP 10



If the total preloading is less than the given range, screw in both ring nuts by the same amount, keeping the pinion-ring gear backlash value unchanged;

If the total preloading is greater than the given range, unscrew both ring nuts by the same amount, keeping the pinion-ring gear backlash value unchanged.

## STEP 11




OK - Correct tooth contact.

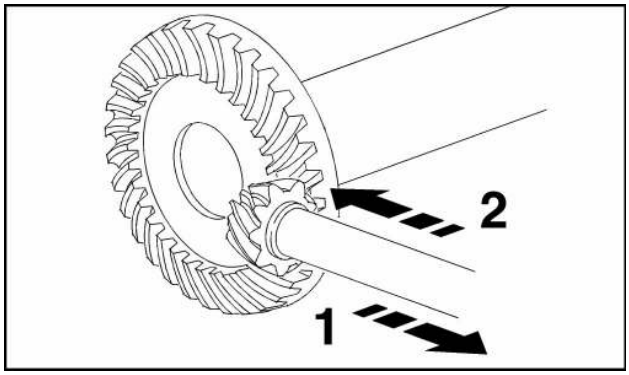
Z - Excessive contact on the tooth tip.

The pinion shaft is too much out of engagement. Re-set the mounting distance and repeat the differential adjustment procedure.

X - Excessive contact at the tooth base.

The pinion shaft is too much into engagement. Re-set the mounting distance and repeat the differential adjustment procedure.

## STEP 12




Movements to correct, pinion.

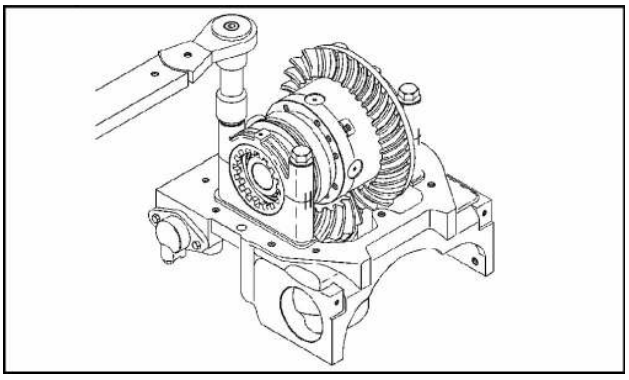
1 - Direction to move the pinion for type X contact adjustment;

2 - Direction to move the pinion for type Z contact adjustment.

https://truckmanualshub.com/

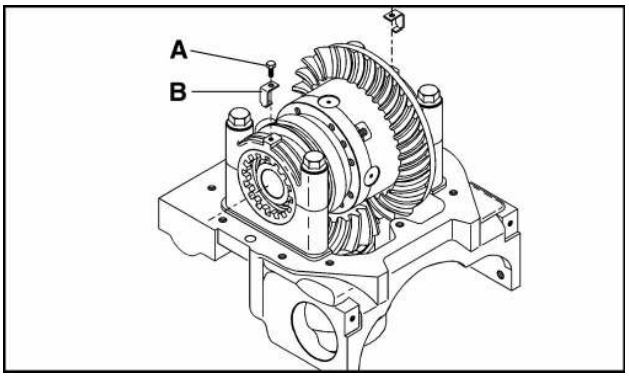


## STEP 13



Tighten the bearing cap retaining bolts to the prescribed torque.

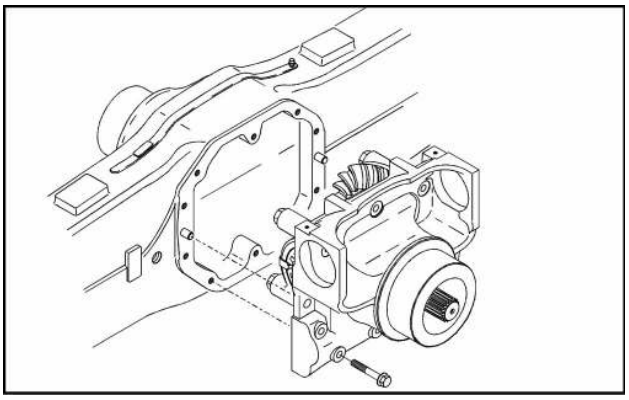
## STEP 14




Once all the adjusting operations have been performed, fit the right and left ring nut retainers “B” and screws “A”, tightening them to the prescribed torque.

**NOTE:** *Align the retainers correctly.*

## STEP 15



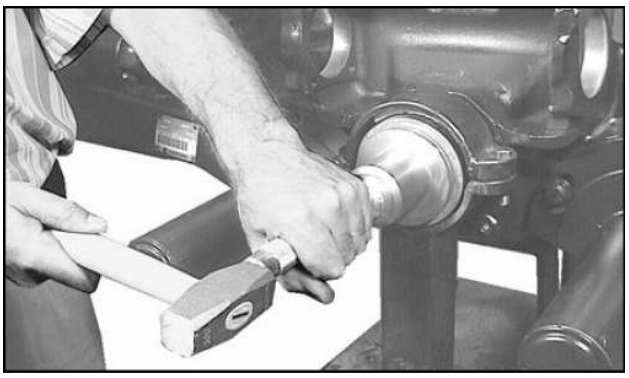
**ATTENTION:** *Before matching two surfaces make sure they are perfectly clean; degrease and clean with the appropriate cleaner.*

Spread a film of LOCTITE 510 on the contact surface between the axle beam and the differential carrier.

Position the differential carrier on the axle housing.

Insert and tighten retaining screws to the prescribed torque.

## STEP 16

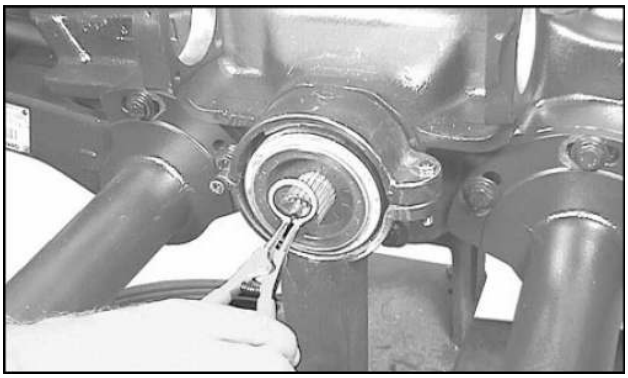


Tap a new seal ring onto the central beam assembly, using special tool CA119148 and a hammer.

https://truckmanualshub.com/

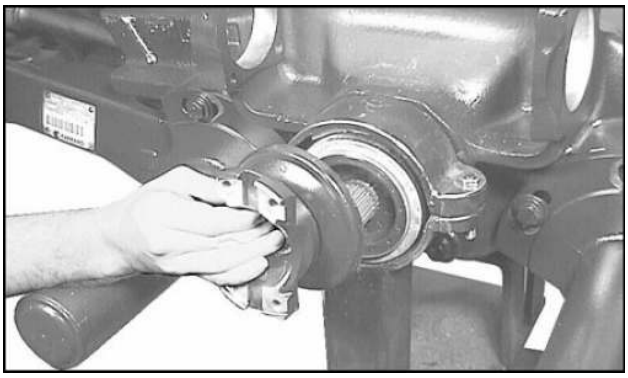


**STEP 17**



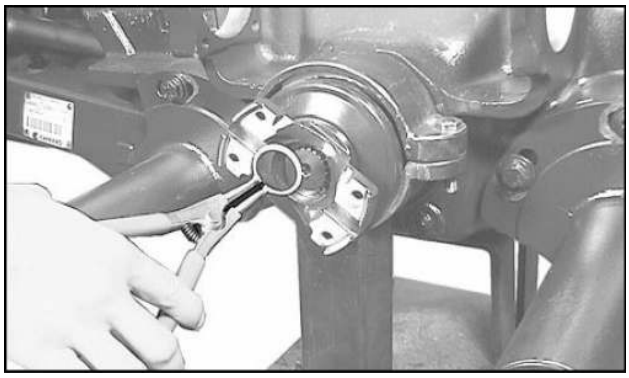
Fit the flange support snap ring onto the pinion shaft.

**STEP 18**



Fit the flange onto the pinion end.

**STEP 19**



Fit the retaining snap ring onto to the pinion end.

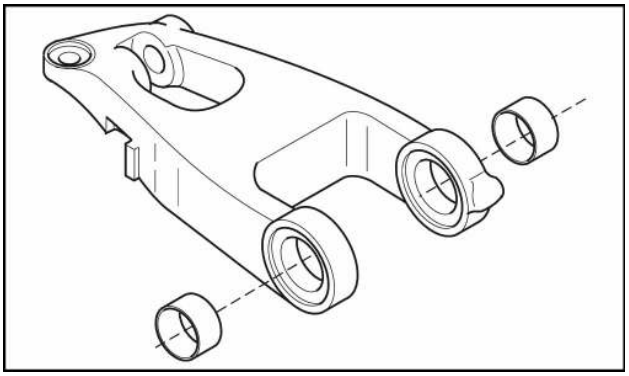
https://truckmanualshub.com/



# LOWER ARM

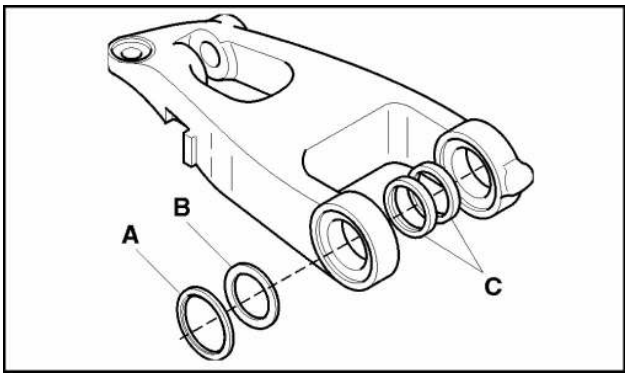
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



Place the lower arm on a workbench and insert the two bushes using special tool CA715327.

## STEP 2



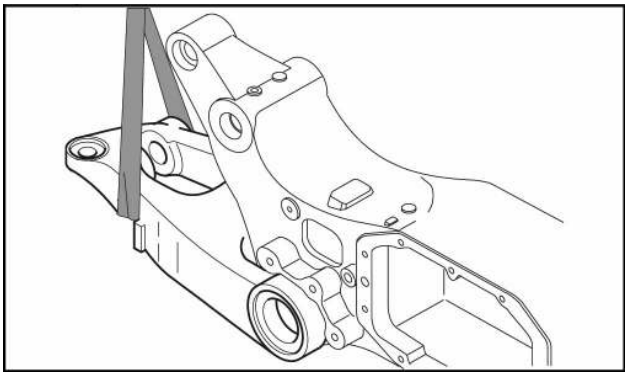

Grease the new seal rings (C) and the thrust ring (A) with McCormick LX Multi-Purpose EP2 Grease.

Insert the two seal rings “C” on the inside seats of lower arm using special tool CA715325.

Place the thrust ring “B” on the outward rear seat of the lower arm, with the pitted side facing outwards.

Insert the seal ring “A” on the rear outward seat of the lower arm using special tool CA715326.

## STEP 3

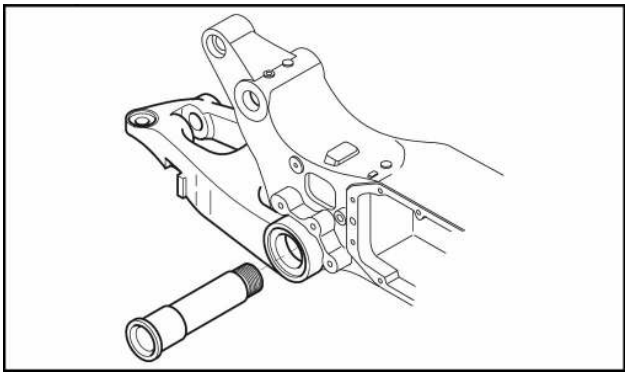


Using a harness and a suitable hoist, support the lower arm.

Position the lower arm to align with the mounting hole on the axle housing body.

**ATTENTION:** *The holes in the lower arm and in the axle housing body must be perfectly aligned.*

## STEP 4



Insert the lower arm pin from the rear side.

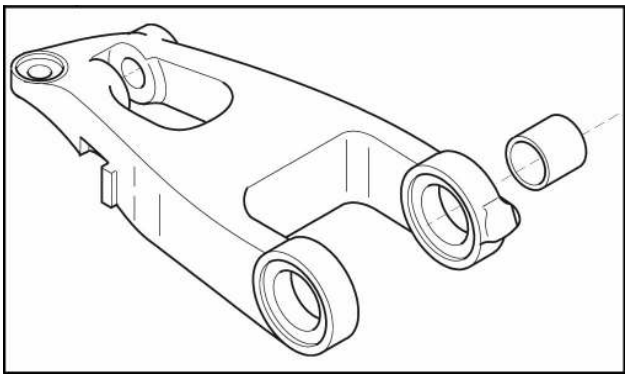
**NOTE:** *If necessary, tap the pin head with a soft hammer.*

**ATTENTION:** *Insert the pin with care to avoid damaging the seal rings.*

https://truckmanualshub.com/



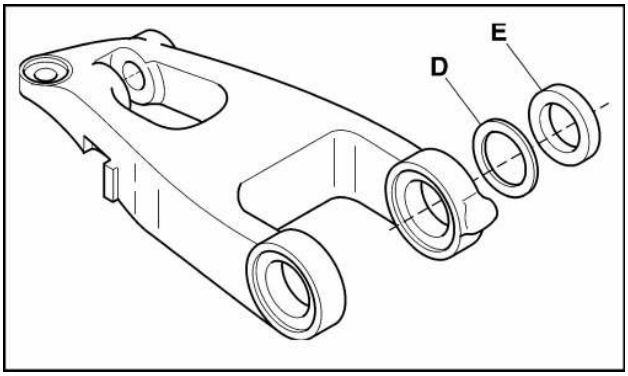
## STEP 5



Insert the bush on the lower arm and central body using special tool CA715326.

**ATTENTION:** *The bush must be fully inserted and rest against the axle body.*

## STEP 6

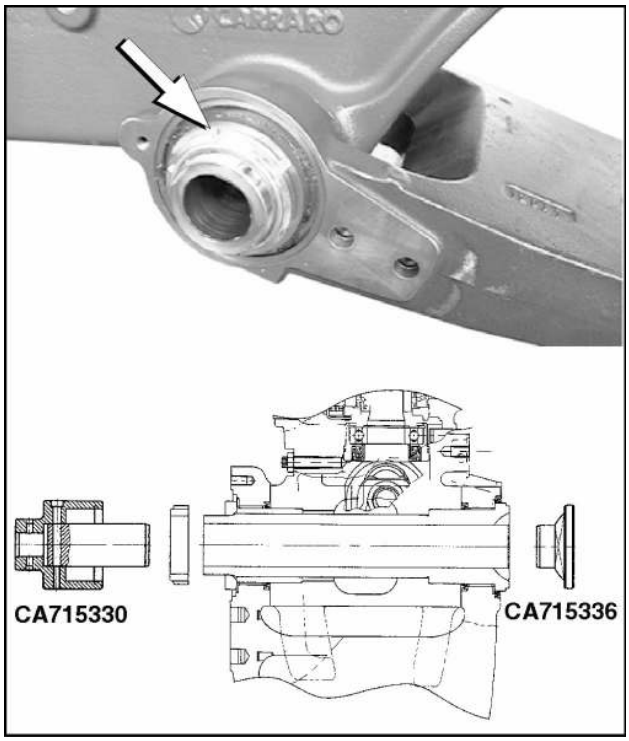



Grease the thrust washer “E” and thrust ring “D”.

Place the thrust ring “D” on the outward rear seat of the lower arm with the pitted side facing outwards.

Insert the thrust washer “E”.

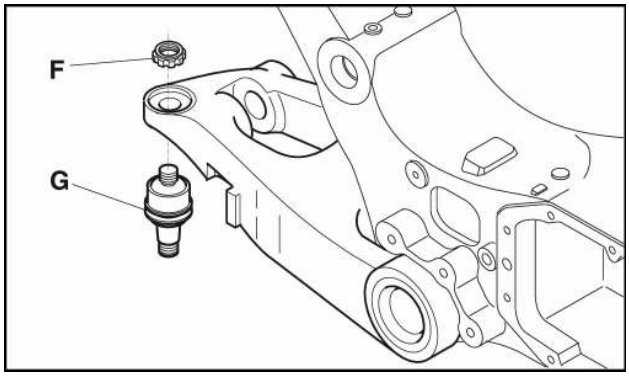
## STEP 7




Manually screw on the ring nut and then tighten it to the prescribed torque using special tools CA715330, CA715336 and a torque wrench.

**ATTENTION:** *The arm must rotate smoothly.*

## STEP 8




Install the swivel housing ball joint (G) in the seat provided on the lower arm

Fit the nut and tighten it to the prescribed torque using special tool CA715332.

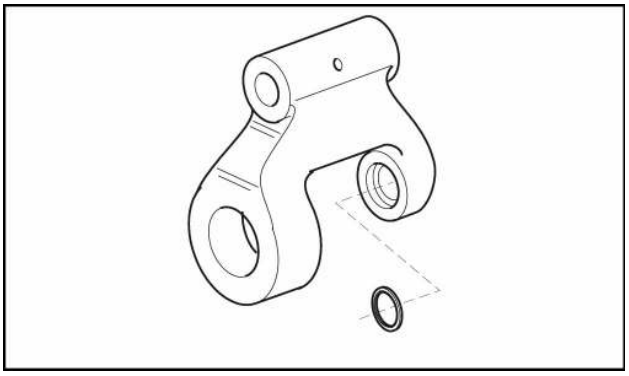
https://truckmanualshub.com/



# UPPER ARM

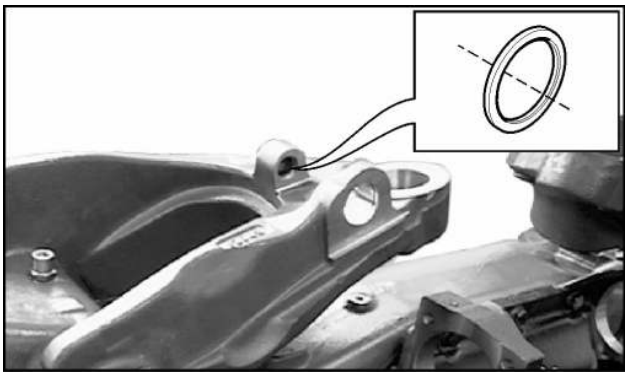
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



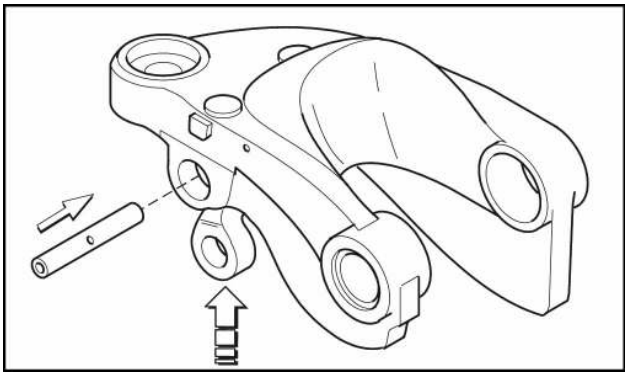
Grease the new seal ring with McCormick Multi-purpose EP2 Grease and install into the fork using special tool CA715329.

## STEP 2



Grease the new seal ring with McCormick Multi-purpose EP2 Grease and insert the seal ring into the upper arm using special tool CA715329.

## STEP 3



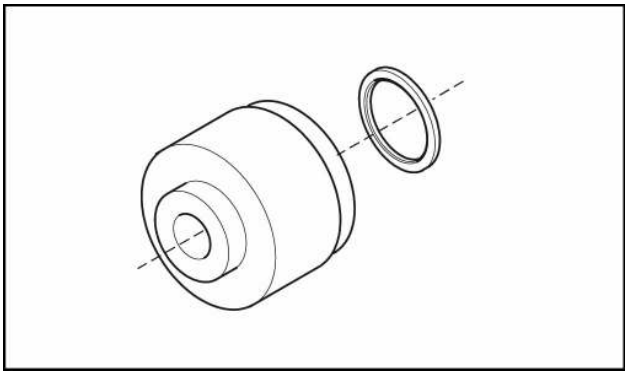
Install the support fork into the upper arm seat.

**ATTENTION:** *The hole in the fork must be perfectly aligned with the holes in the upper arm.*

Grease the support fork upper pin and insert into the upper arm and support fork.

**ATTENTION:** *The pin must be fully inserted.*

## STEP 4

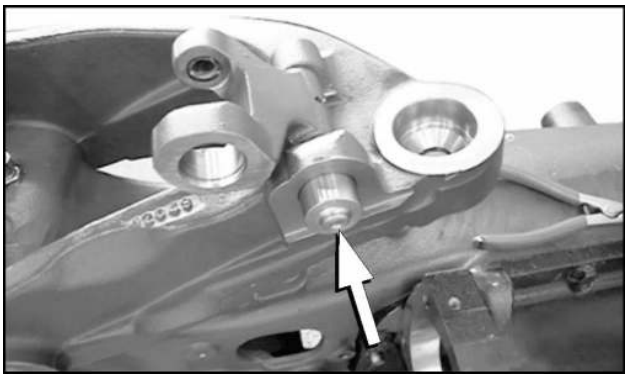


Grease the new seal ring and install the centering bush using special tool CA715329 and a hammer.

https://truckmanualshub.com/



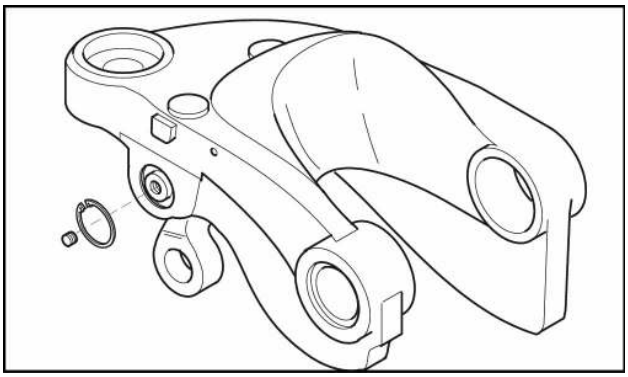
### STEP 5



install the complete centering bush onto the support fork upper pin.

**ATTENTION:** *The bush must be fully inserted.*

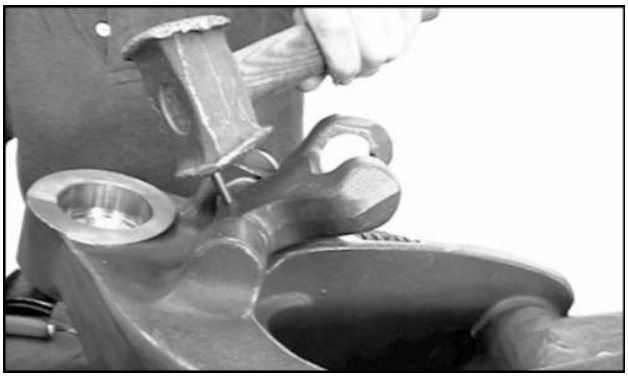
### STEP 6



Install the lock ring to secure the centering bush.

Apply LOCTITE 542 onto the thread of the grub screw and screw into the extraction hole on the fork pin.

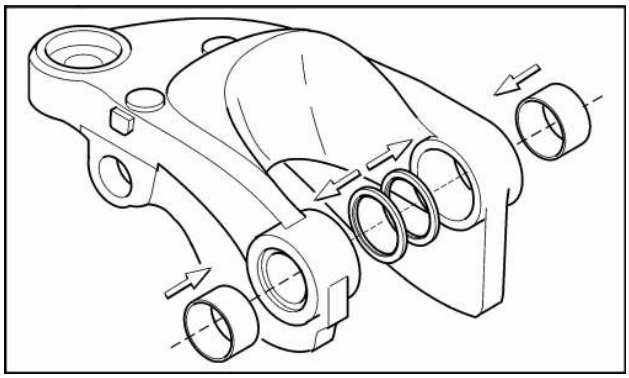
### STEP 7



Rotate the support fork until the hole for the split pin is perfectly aligned with the hole in the fork pin.

Install the split pin.

### STEP 8

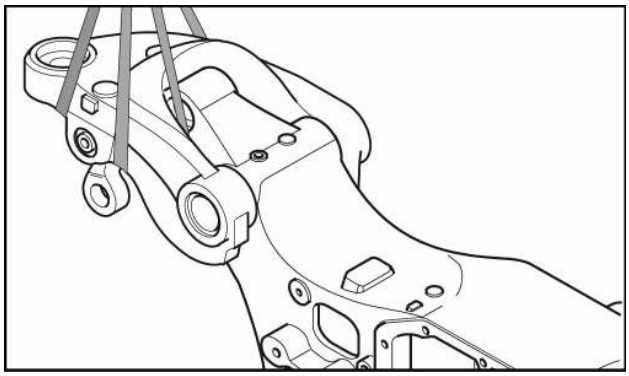


install the two bushes to the upper arm outward seats using special tool CA715324.

Carefully grease the new seal rings.

Install the two seal rings onto the inner seats of the upper arm using special tool CA715337.

### STEP 9



Use a harness and suitable hoist to support the upper arm.

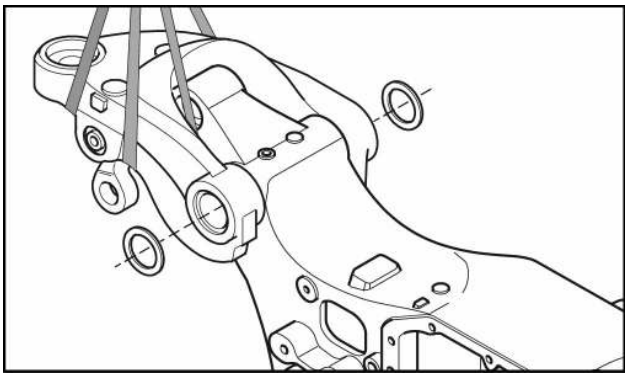
Position the upper arm to align with the relevant mounting hole in the axle housing body.

**ATTENTION:** *The holes in the upper arm and the holes in the axle housing body must be perfectly aligned.*

https://truckmanualshub.com/



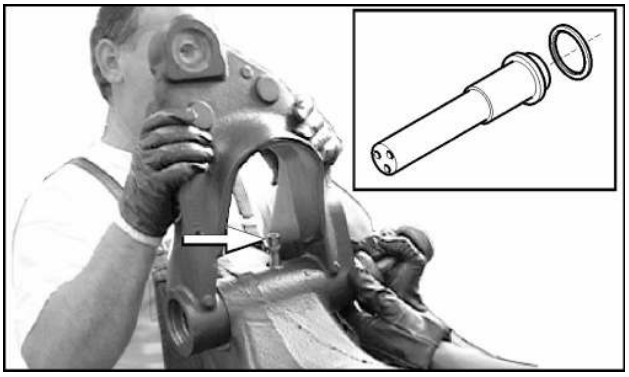
## STEP 10



Carefully grease the thrust rings.

Install the thrust rings on the front and rear of the upper arm with the pitted side facing outwards.

## STEP 11



Drive the seal ring onto the pin head using special tool CA715337.

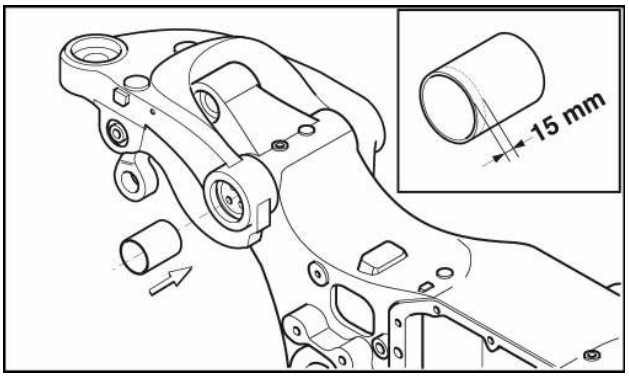
Insert the upper arm pin from the front of the axle.

**NOTE:** *If necessary, tap the pin head using special tool CA715337.*

**ATTENTION:** *The pin must be fully inserted.*

Tighten the screw (indicated by the arrow) to lock the pin.

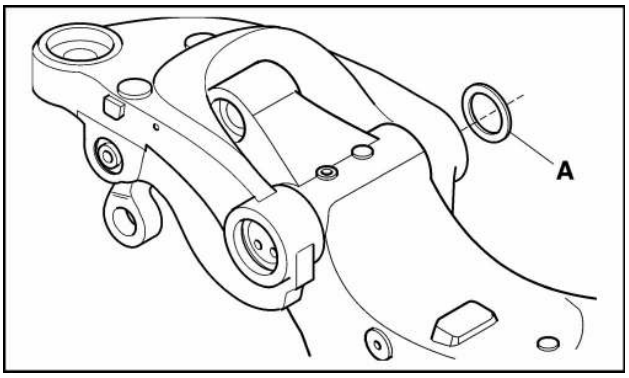
## STEP 12




**ATTENTION:** *The bush must not touch the axle body. It should protrude at least 15 mm.*

Partially insert the bush from the side opposite the pin.

## STEP 13



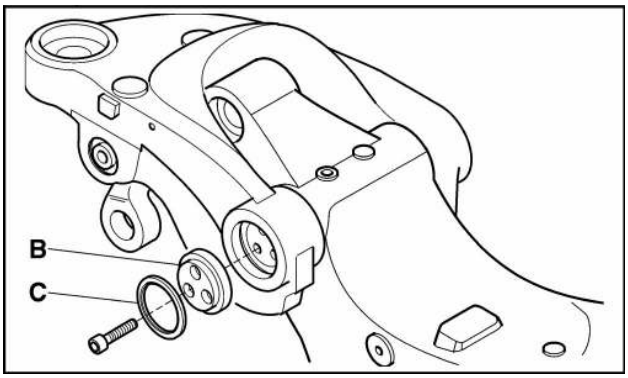

Carefully grease the new front and rear seal rings.

Install the front seal ring “A” using special tool CA715335.

https://truckmanualshub.com/



## STEP 14




install the seal ring (C) onto the flange (B) using special tool CA715335.

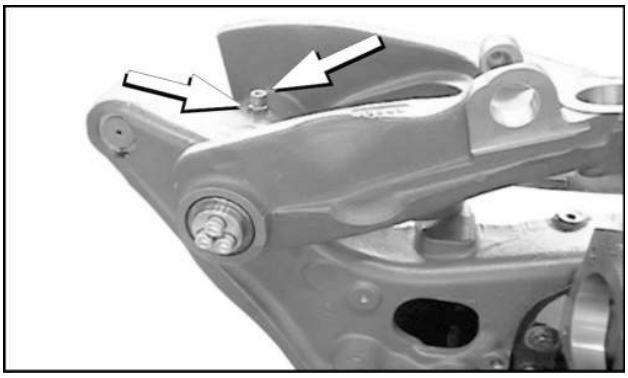
Place the cover onto the protruding bush.

Rotate the arm until the three holes in the pin are perfectly aligned with the three holes in the cover.

Using driving tool CA715335 and a hammer, hit the cover and protruding bush until they are fully inserted.

Insert and tighten the three fastening screws to the prescribed torque.

## STEP 15

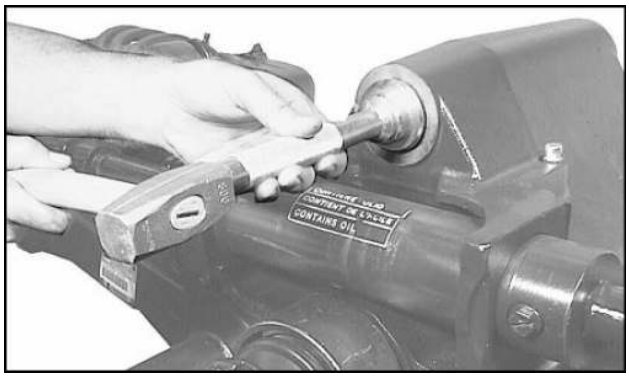


Insert the fastening screw and lock nut.

Tighten the screw and lock nut to the prescribed torque.

**ATTENTION:** *The arm must rotate freely.*

## STEP 16



Fit a new seal ring into the central beam assembly pivot using special tool CA715164.

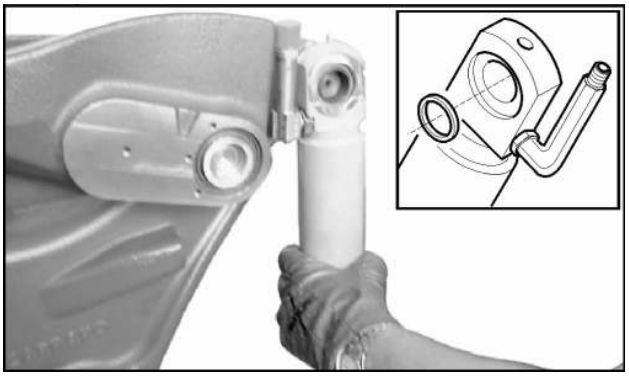
https://truckmanualshub.com/



# SUSPENSION CYLINDER

Some of the following pictures may not show your axle, but the procedure is the same.

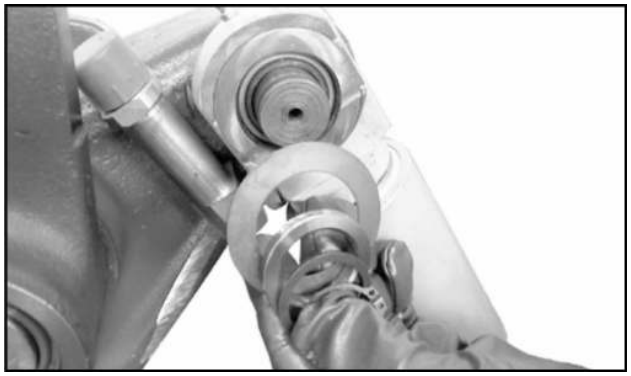
## STEP 1



Place the spacer onto the upper mounting pin of suspension cylinder.

Install the suspension cylinder on the upper pin using special tool CA715333 and a hammer.

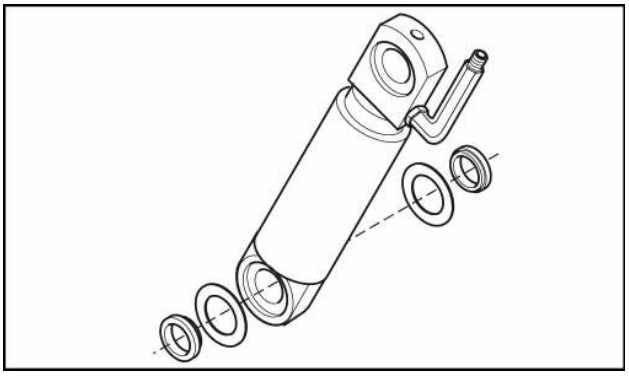
## STEP 2



Place the Belleville washer, spacer and washer on the upper pin.

Fit the snap ring to secure.

## STEP 3



Install the two Belleville washers and two spacers into the suspension cylinder base.

Grease the seat of the lower pin so the spacer and the Belleville washers do not separate.

https://truckmanualshub.com/

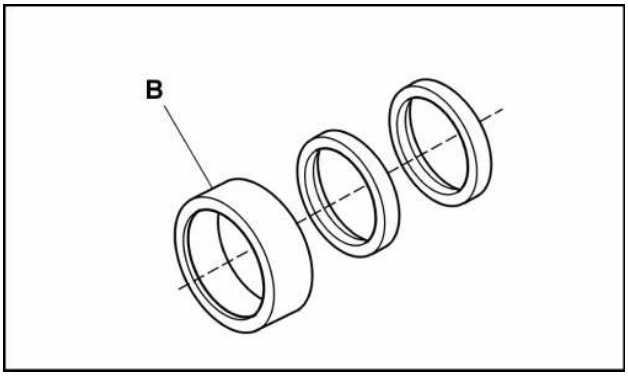


# UNIVERSAL JOINT

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** B*efore assembling the double universal joint unit, it is necessary to assemble the differential support unit.*

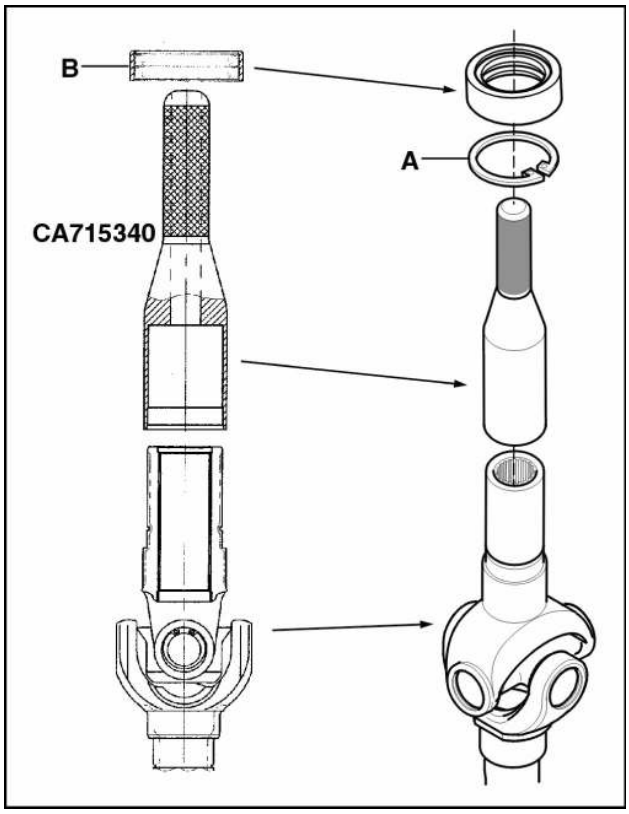
## STEP 1




Carefully grease the two new seal rings.

Using special tool CA715323, insert the two new seal rings into the bush “B” to be installed on the universal joint (wheel side).

## STEP 2




Insert the snap ring “A”, which will be used later, in the universal joint (wheel side).

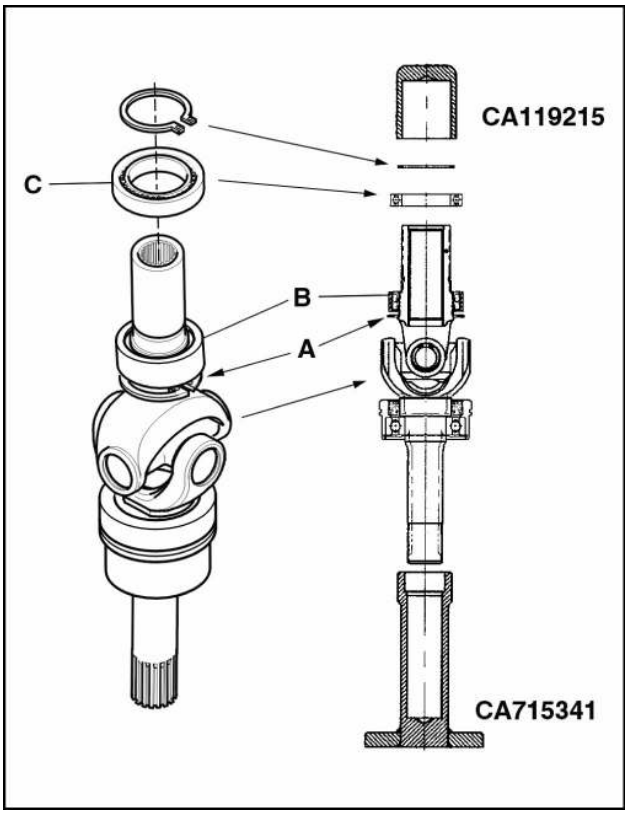
Install the special tool CA715340 onto the universal joint, to protect the seal rings during assembly.

Insert the bush “B”, complete with the two seal rings, onto the universal joint.

https://truckmanualshub.com/



## STEP 3



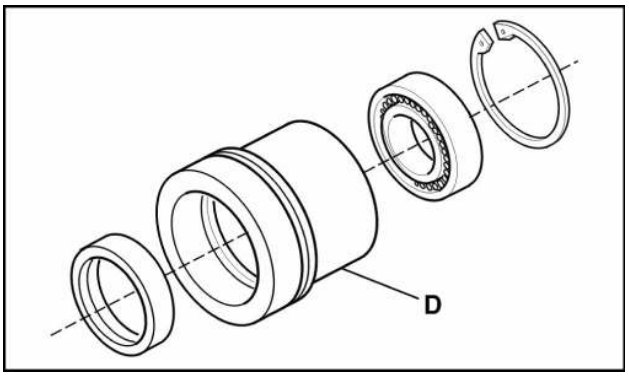

To install bearing “C”, use special tool CA715341.

Seat bearing “C” using special tool CA119215.

**ATTENTION:** *The bearing must be fully inserted.*

Install the snap ring to secure.

## STEP 4

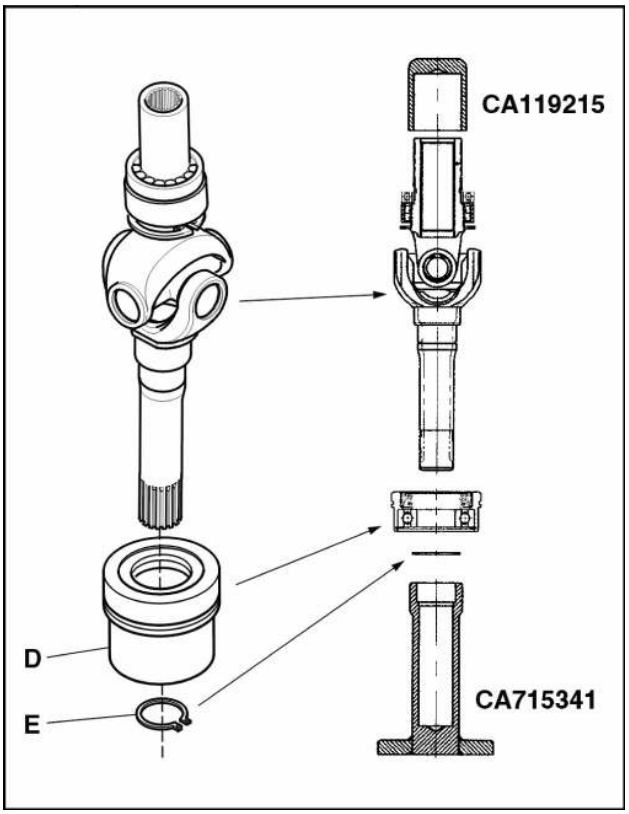



Using special tools CA715097 and CA715179, insert a new seal ring and the bearing into the universal joint centering bush “D”.

**ATTENTION:** *The bearing must be fully inserted.*

Install the snap ring to secure.

## STEP 5

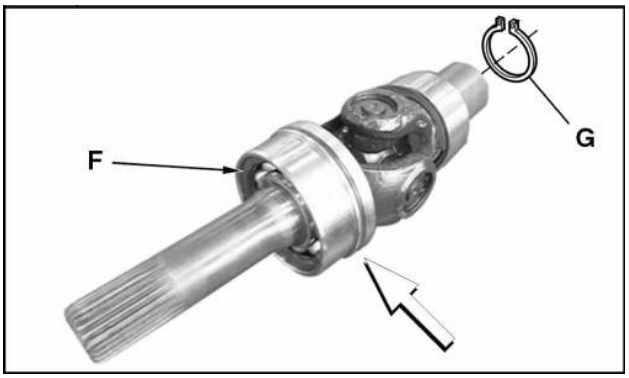



Install the complete centering bush onto the universal joint using special tools CA715341 and CA119215.

**ATTENTION:** *The centering bush must be fully inserted in the universal joint.*

Install the snap ring “E” in its seat using special tools CA715341 and CA119215 to secure.

## STEP 6



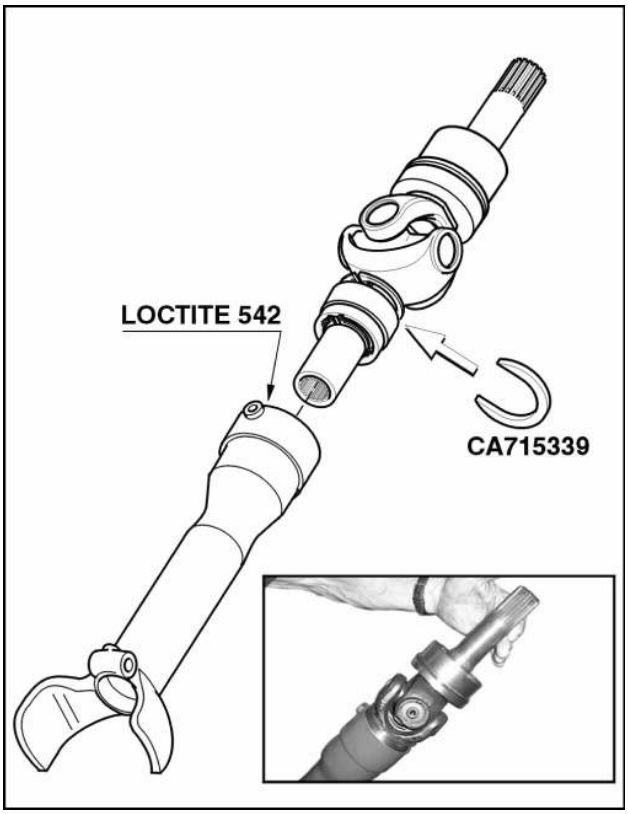

Install the two snap rings “F” and “G”, in the appropriate seats, with suitable pliers.

Fit a new ‘O’.ring onto the centering bush.

https://truckmanualshub.com/



## STEP 7




Place the universal joint housing in a vice.

Apply LOCTITE 542 to the inside where the seal ring holding bush will be inserted

Insert the complete universal joint into the housing using special tool CA715339.

**ATTENTION:** *The universal joint must be inserted completely, with the bearing resting against the housing.*

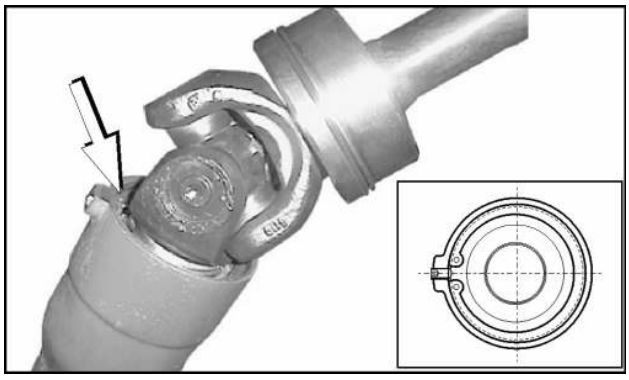
Insert the support rings bush as follows:

Fit special tool CA715339 between the snap ring and bearing.

Install U-joint into the housing and drive, with a soft hammer, until stopped by special tool CA715339.

Remove special tool and continue driving into position until the snap ring seats correctly.

## STEP 8



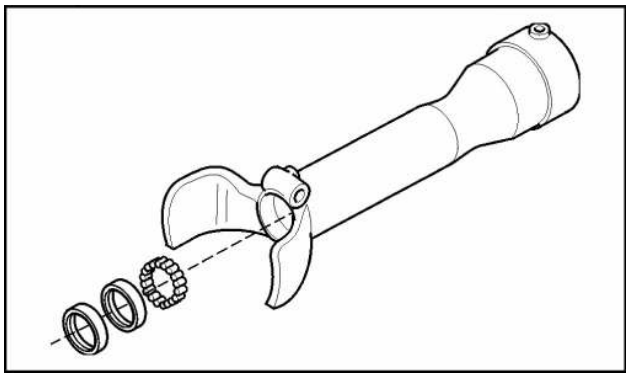
**ATTENTION:** *The snap ring must be inserted with the opening in alignment with the grub screw as shown.*

## STEP 9



Apply LOCTITE 542 on the thread of the grub screw, insert and tighten.

## STEP 10



Place the needle bearing inside the universal joint housing, using special tool CA715334.

Insert a two new seal rings into the housing using special tool CA119103.

https://truckmanualshub.com/

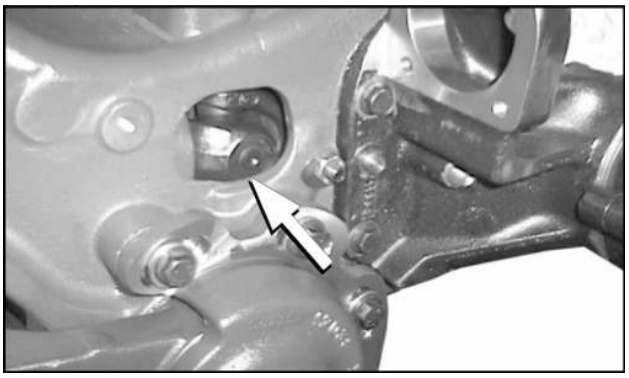


## STEP 11



Install the universal joint into the axle housing body.

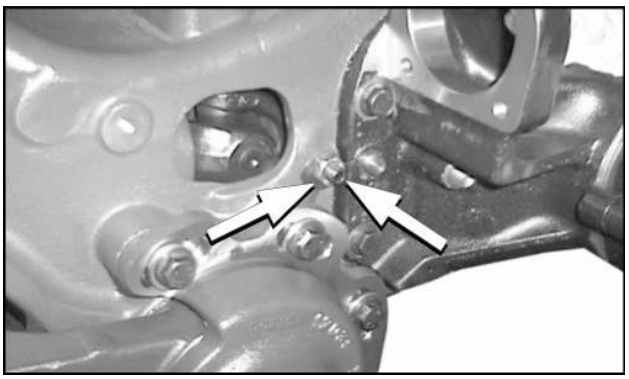
## STEP 12



Support the universal joint while inserting it in the differential unit through the appropriate opening on the axle housing body.

**NOTE:** *The universal joint must be fully inserted, with the centering bush resting against the seat in the axle housing body.*

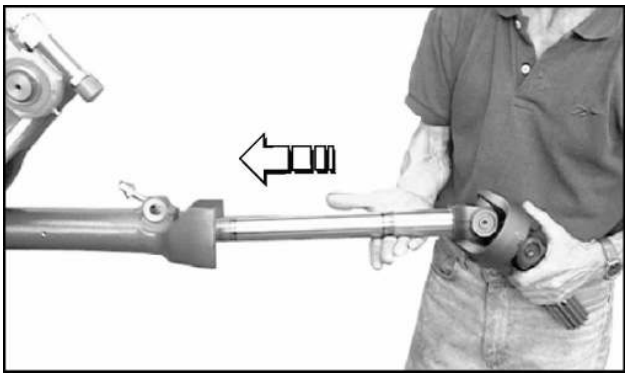
## STEP 13



Insert and tighten the grub screw and the lock nut (in order) to their respective prescribed torques.

**NOTE:** *Repeat the operation on the other grub screw and nut positioned on the front side of the axle body.*

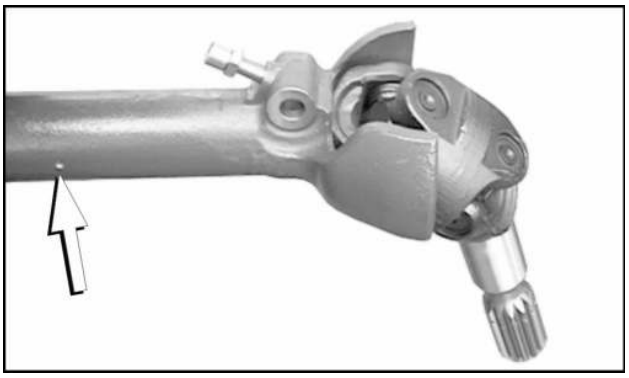
## STEP 14



**ATTENTION:** *proceed with care; the spline shaft end of the double universal joint must not damage the seal rings during assembly.*

Install the double universal joint.

## STEP 15



Apply McCormick LX Multi-Purpose EP2 Grease through the indicated hole, until it starts leaking out of the seal rings at the ends of the universal joint housing.

Apply LOCTITE 542 on the thread of the grub screw, insert and screw into the hole.

**ATTENTION:** *The grub screw should not be screwed beyond the surface of the universal joint housing.*

https://truckmanualshub.com/

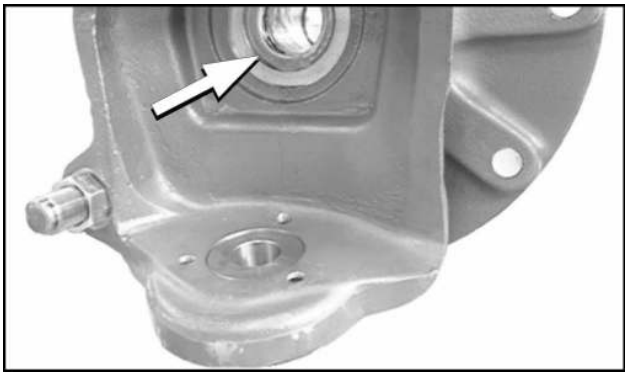


# SWIVEL HOUSING UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

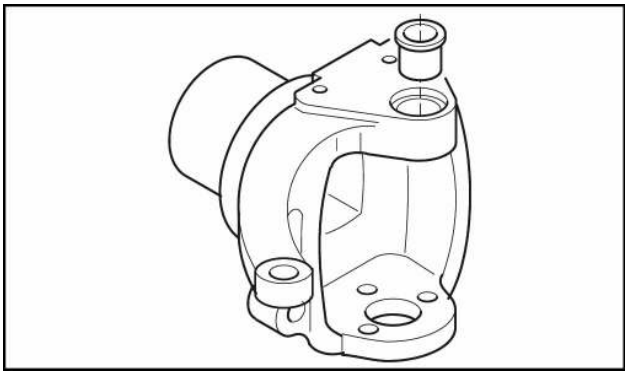
**NOTE:** *Before assembling the swivel housing unit, it is necessary to assemble the double universal joint unit, the lower arm, the upper arm and the suspension cylinder.*

## STEP 1



Place the swivel housing on a workbench and install a new bush using special tool CA715108 and a new seal ring using special tool CA715321.

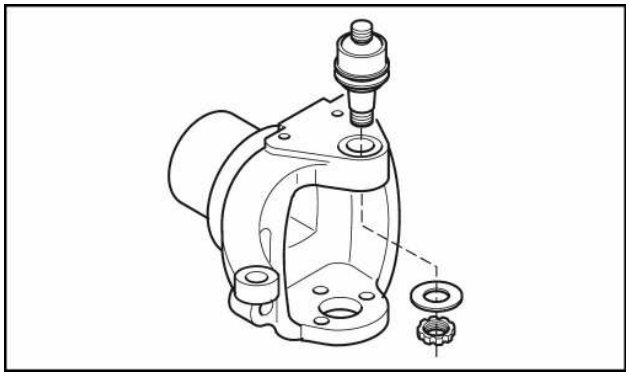
## STEP 2



If previously removed, insert the upper flange into the swivel housing using special tool CA715338.

**NOTE:** *To facilitate assembly, cool the parts to a temperature lower than -100 degrees C.*

## STEP 3

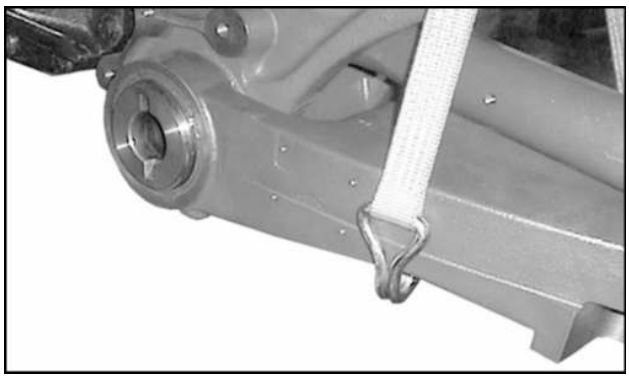


Install the ball joint onto the upper part of swivel housing.

Insert the washer and manually screw the fastening ring nut.

Tighten the ring nut to the prescribed torque using special tool CA715331.

## STEP 4

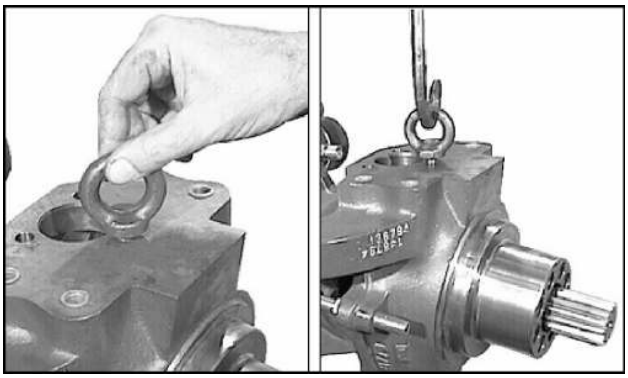


Support the lower arm with a harness attached to a hoist.

https://truckmanualshub.com/

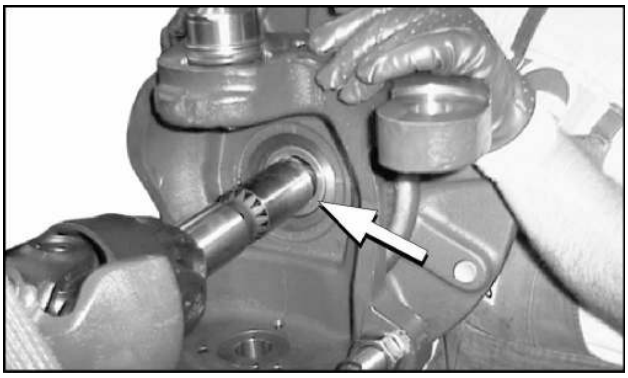


## STEP 5



Screw a eyebolt in the one of threaded holes on the swivel housing and support it using suitable lifting equipment.

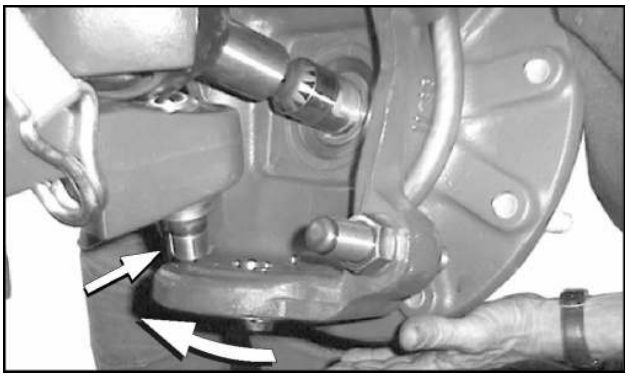
## STEP 6



Install special tool CA715342 into the grooved end of the double universal joint to avoid damaging the seal ring in the swivel housing.

Lift the swivel housing and insert the end of the double universal joint.

## STEP 7

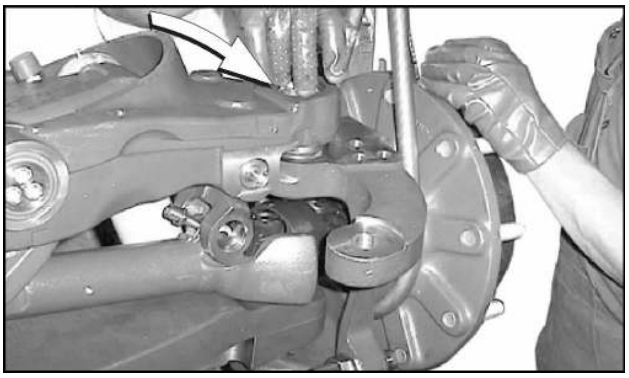


Insert the ball joint of the lower arm into the swivel housing.

Lift the swivel housing slowly and use slight combined movements to find the best position to facilitate the introduction of the lower arm ball joint into the swivel housing.

**ATTENTION:** *Be extremely careful not to damage the threads of the ball joint.*

## STEP 8



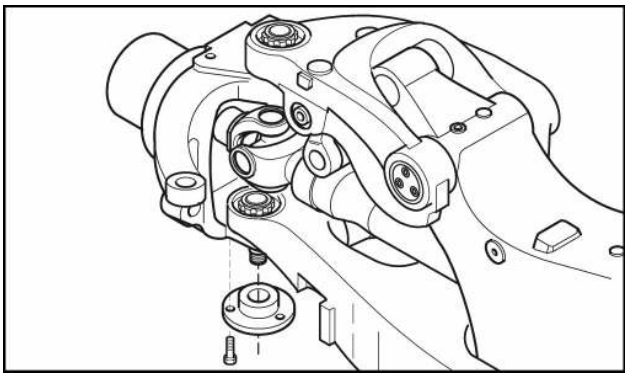
Slowly lower the upper arm and use slight vertical combined movements to find the best position to facilitate the introduction of the upper arm in the ball joint.

**ATTENTION:** *Be extremely careful not to damage the threads of the ball joint.*

https://truckmanualshub.com/



**STEP 9**



Install the lower flange into the lower part of swivel housing.

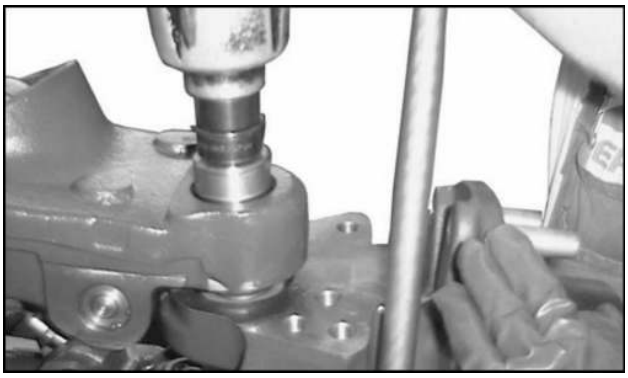
Insert and tighten the three retaining bolts to the prescribed torque.

**STEP 10**



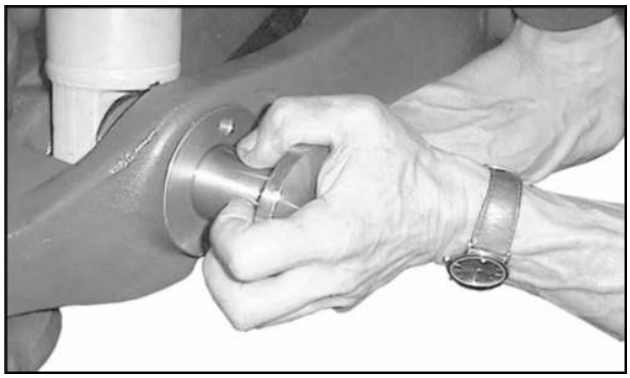
Using special tool CA715331, fit a new lower arm fastening ring nut onto the lower joint and tighten to the prescribed torque.

**STEP 11**



Using special tool CA715332, fit a new upper arm fastening ring nut onto the upper joint and tighten to the prescribed torque.

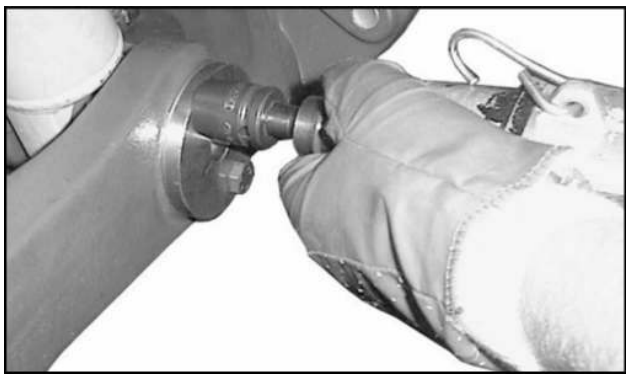
**STEP 12**



Align the hole in the lower arm with the hole in the suspension cylinder and insert the pin.

**NOTE:** *If necessary, slightly raise or lower the lower arm to facilitate the insertion of the pin.*

**STEP 13**

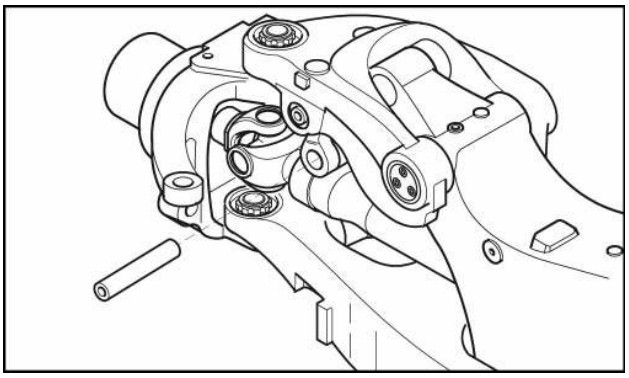


Install the retaining bolts for the suspension cylinder lower pin and tighten them to the prescribed torque.

https://truckmanualshub.com/



## STEP 14



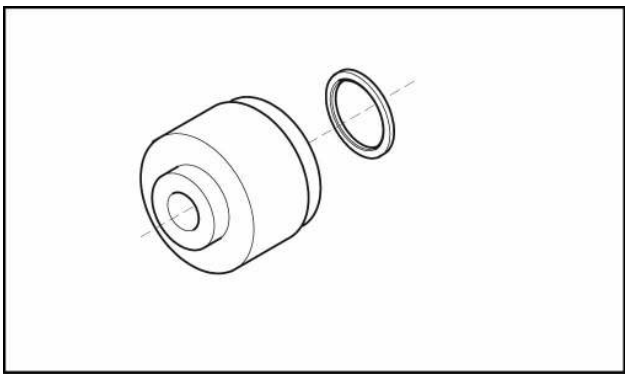
Insert the lock pin.

**ATTENTION:** *The holes in the joint support fork and the hole in the joint protection element must be perfectly aligned.*

Rotate the pin until the slot on the pin is correctly aligned with the hole in the universal joint housing.

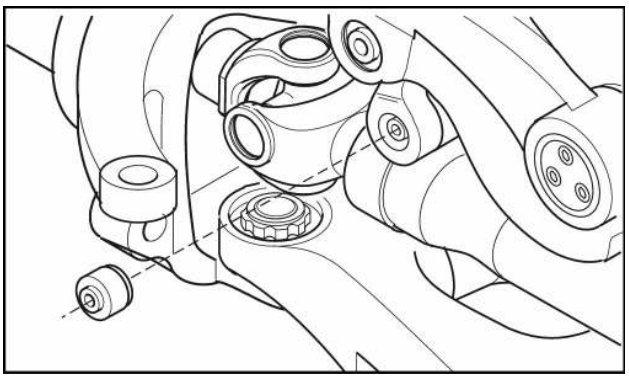
**NOTE:** *If necessary, slightly raise the housing to facilitate the introduction of the pin.*

## STEP 15



Carefully grease the new seal ring and fit onto the centering bush using special tool CA715329.

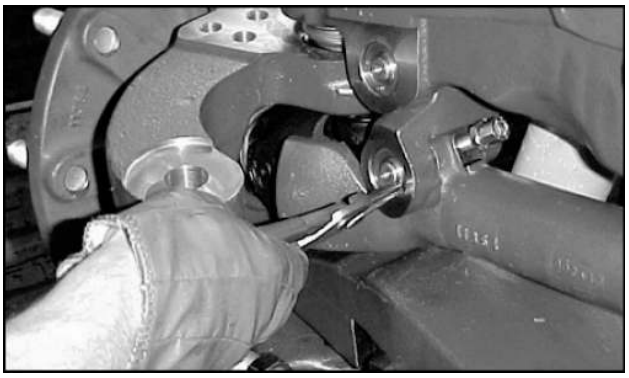
## STEP 16



Install the complete centering bush on the support fork lower pin.

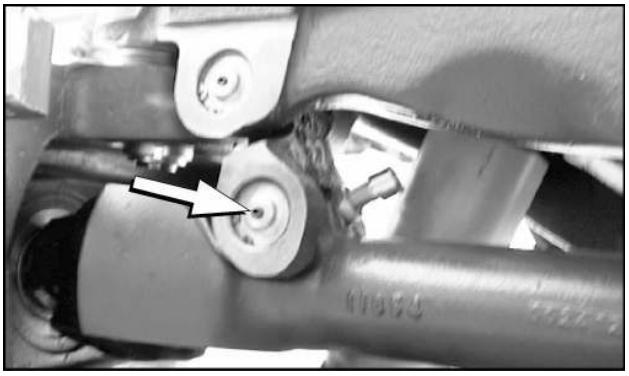
**ATTENTION:** *The bush must be fully inserted.*

## STEP 17



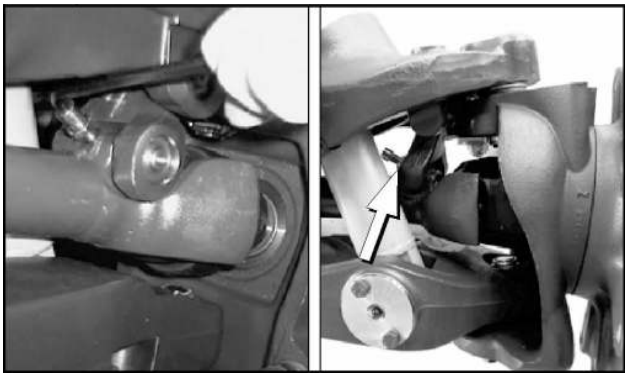
Install the snap ring to secure the centering bush.

## STEP 18



Apply LOCTITE 542 on the thread of the grub screw and screw into the hole used for fork pin extraction.

## STEP 19



Lock the lower pin of the joint support fork.

Screw in the retaining bolt and then the lock nut, tightening to their respective prescribed torque.

https://truckmanualshub.com/

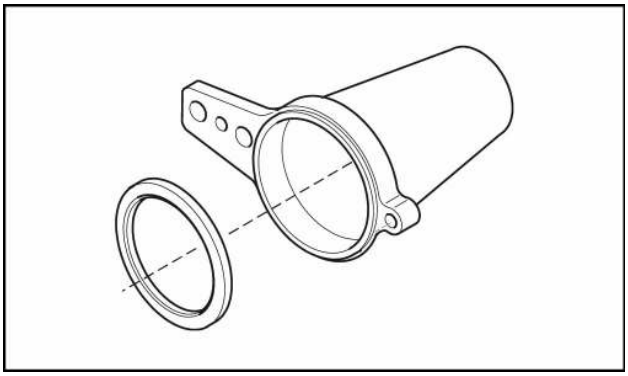


# TORSION BAR UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before assembling the torsion bar unit, it is necessary to assemble the lower arm*

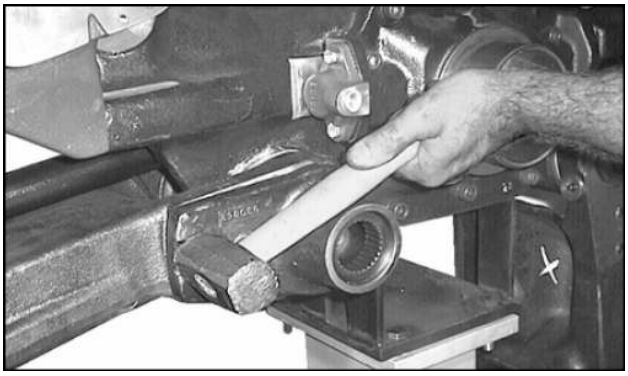
## STEP 1



Lubricate the new seal ring with McCormick LX Multi-Purpose EP2 Grease.

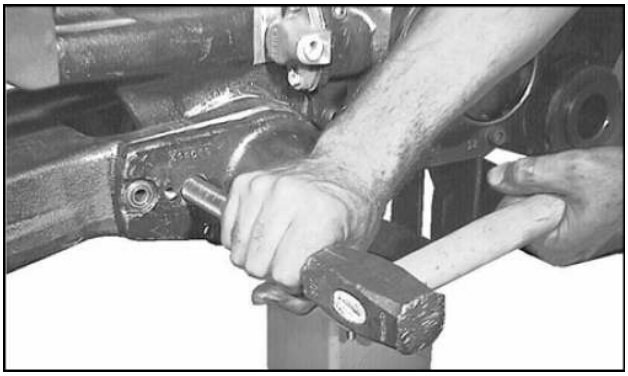
Insert the seal ring on the front flange using special tool CA715326.

## STEP 2



Place the front flange into its seat in the lower arm and tap with a soft hammer.

## STEP 3



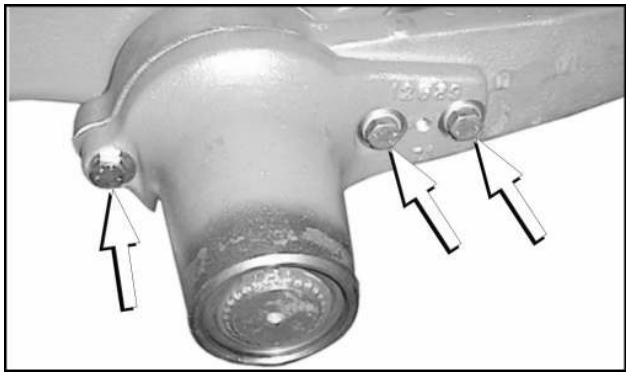
Tap the centering bush into the front flange, using special tool CA715086 and a hammer.

## STEP 4



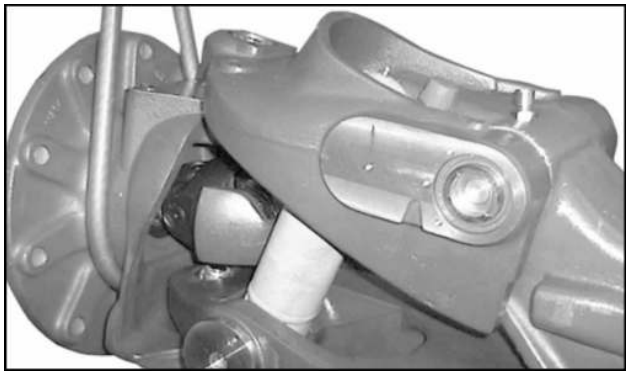
Apply a thin coat of LOCTITE 542 onto the front flange retaining bolts.

## STEP 5



Insert and tighten the front flange retaining bolts to the prescribed torque.

## STEP 6



Use a harness and suitable hoist to raise the axle suspension to the end of its stroke.

https://truckmanualshub.com/



**STEP 7**



Grease the inner teeth of the front flange.

**STEP 8**



Before inserting the torsion bar, check the marks stamped on the end:

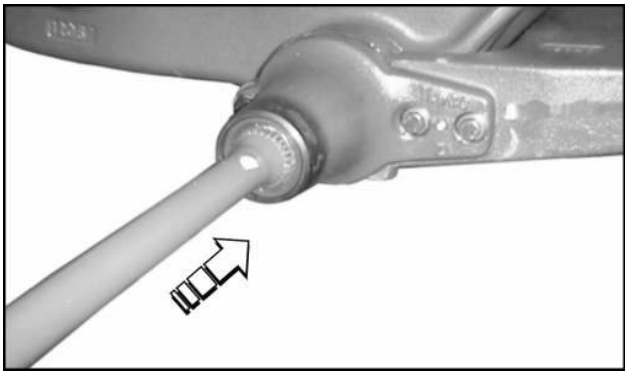
- sx = left torsion bar;

- dx = right torsion bar.

**NOTE:** *The arrow indicates the rotation direction of the bar during the preload.*

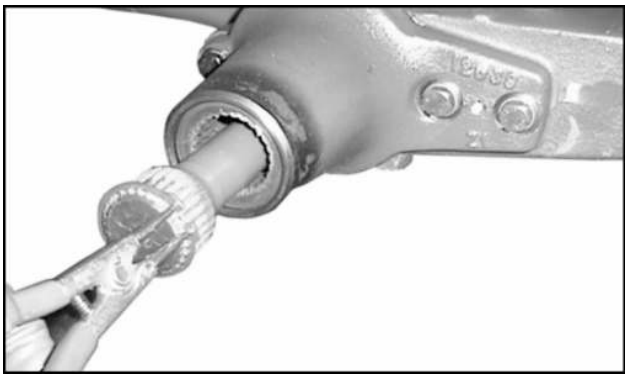
**NOTE:** *The "dx" and "sx" sides are as viewed from the pinion flange side.*

**STEP 9**



Install the torsion bar in its seat.

**STEP 10**



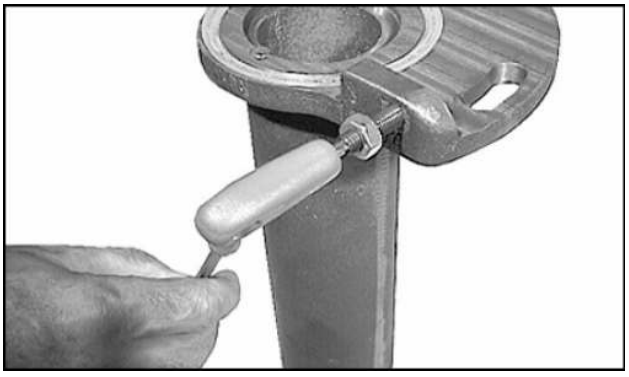
Fit the torsion bar snap ring (front flange side).

**STEP 11**



Fit a new O-ring to the rear flange.

**STEP 12**



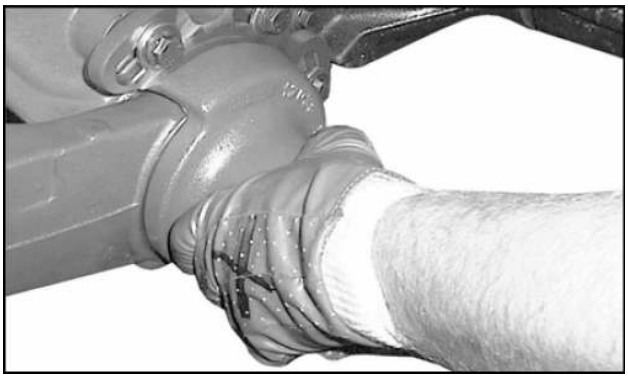
Pre-assemble the grub screw and lock nut and fit to the rear flange.

**NOTE:** *Do not screw in beyond the support base.*

https://truckmanualshub.com/



**STEP 13**



Install the rear flange on the seat of the lower arm.

Rotate so the three rear flange slot holes align with the threaded holes.

Insert the three retaining bolts, but do not tighten.

https://truckmanualshub.com/

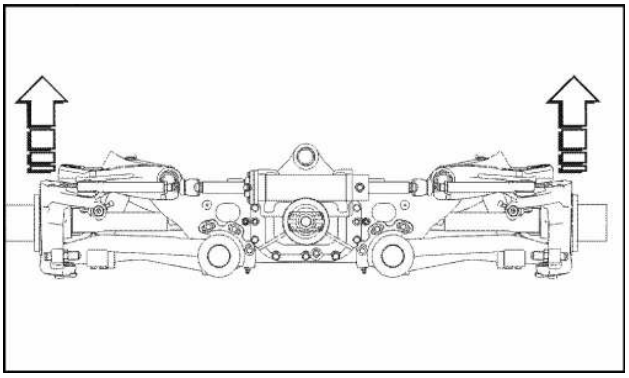


# TORSION BAR PRELOAD ADJUSTMENT

Some of the following pictures may not show your axle, but the procedure is the same.

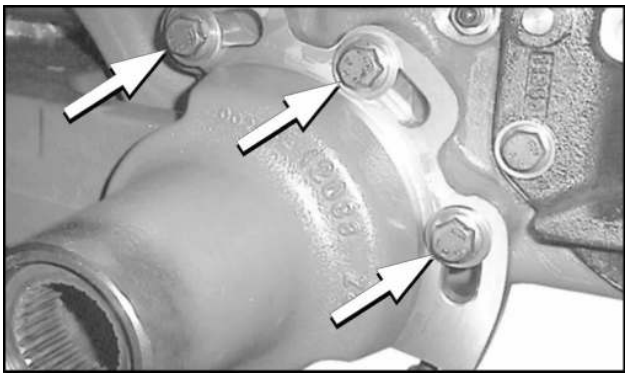
**NOTE:** *The adjustment of the torsion bar preload must be performed when the axle is complete with all its components.*

## STEP 1



Fully raise both sides of the axle suspension.

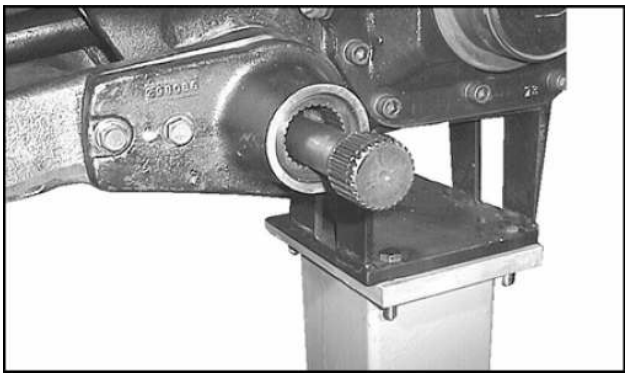
## STEP 2



Rotate the left hand flange counterclockwise to position the retaining bolts at the right of the slots.

Rotate the right hand flange clockwise to position the retaining bolts at the left of the slots.

## STEP 3



Fully insert the torsion bar.

## STEP 4



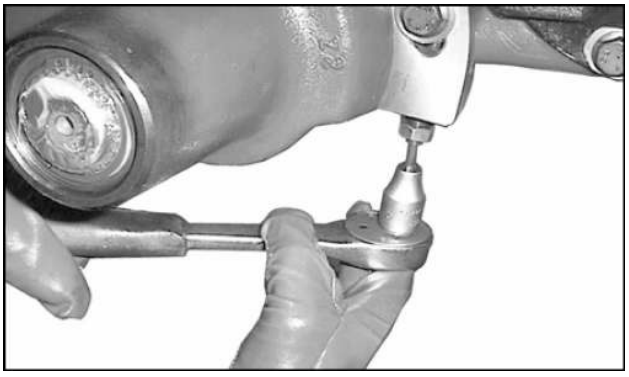
Using a soft driving tool, tap the front end of the torsion bar until perfectly engaged in the flange and resting against the snap ring.

## STEP 5



Fit the snap ring using suitable pliers.

## STEP 6

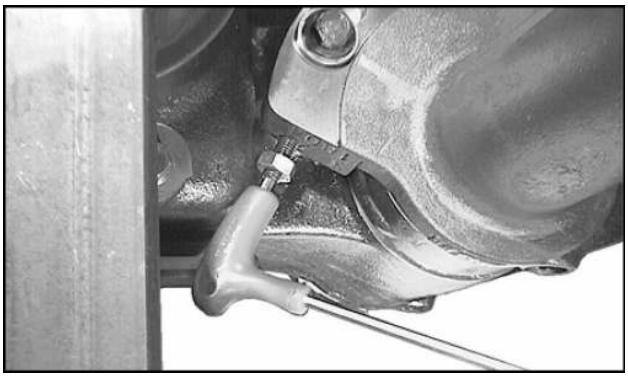


Screw the grub screw into the rear flange with your fingers, until it touches the central body.

https://truckmanualshub.com/



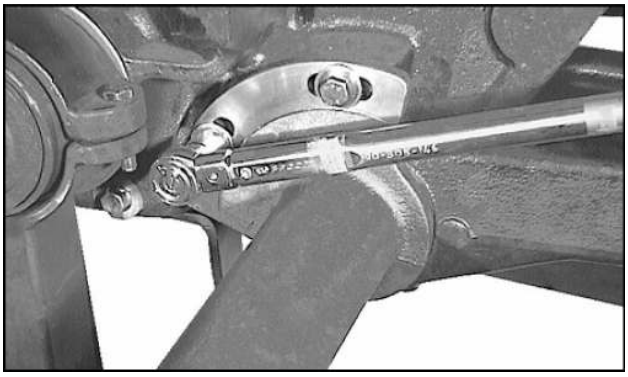
### STEP 7



**ATTENTION:** *During this operation, the flange will rotate to preload the torsion bar. If the adjusting screw is difficult to turn, make sure that the retaining bolts have not been overtightened.*

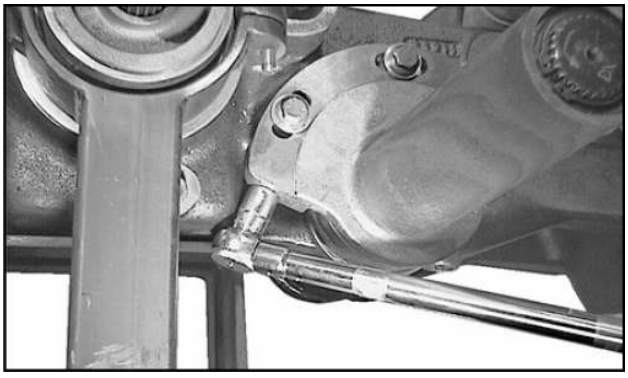
Preload the torsion bar by giving the rear flange grub screw 7.5 turns with a wrench.

### STEP 8



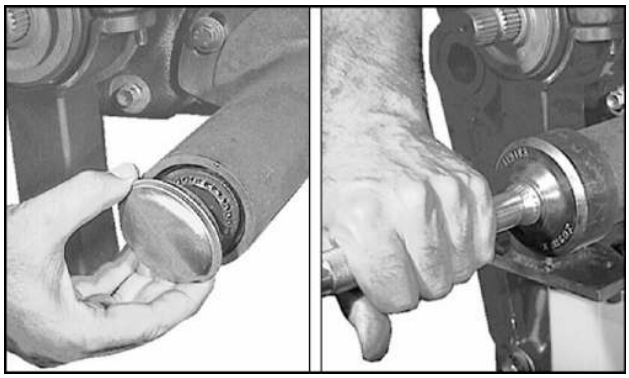
Tighten the retaining bolts to the prescribed torque.

### STEP 9



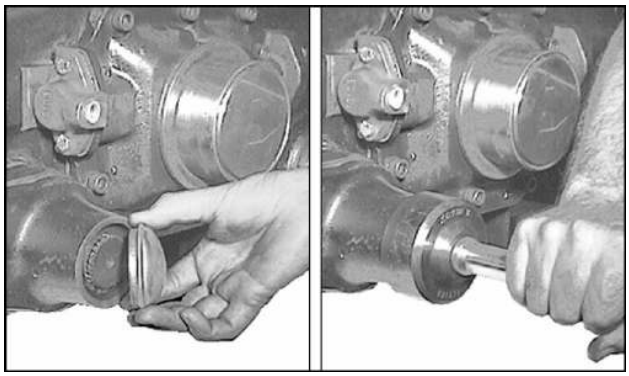
Tighten the grub screw lock nut to the prescribed torque, using a torque wrench.

### STEP 10



Place the cover on the rear flange and tap in using special tool CA715328 and a hammer.

### STEP 11



Place the cover on the front flange and tap in using special tool CA715328 and a hammer.

https://truckmanualshub.com/



# WHEEL HUB UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before assembling the wheel hub unit, it is necessary to assemble the swivel housing unit.*

## STEP 1



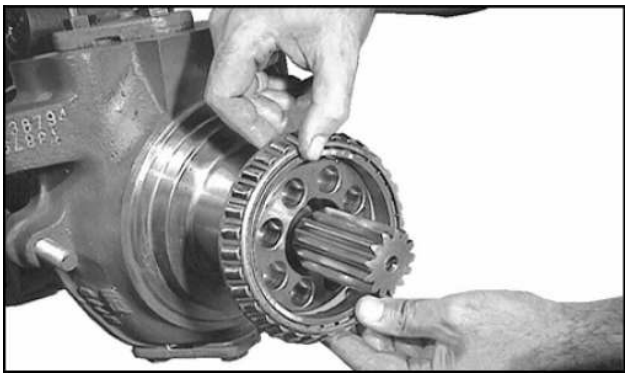
Place the wheel hub on a workbench and fit the two outer bearing cups using special tool CA715026.

## STEP 2



Turn the wheel hub upside down and fit a new lubricated seal ring, using special tool CA715175.

## STEP 3



Slide the inner bearing cone onto the swivel housing end.

**NOTE:** *If necessary, use a rubber hammer.*

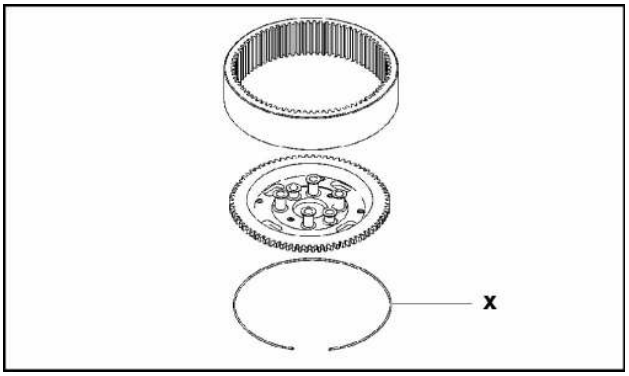
## STEP 4



Position the wheel carrier on a work bench and introduce the bushes until they are at the level of the bench using special tool CA715027.

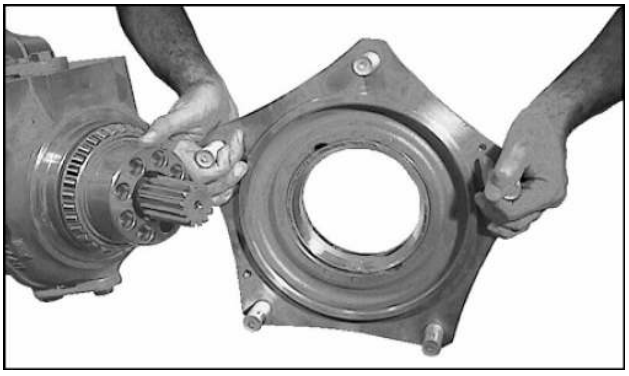
Leave two diametrically opposed bushes higher than the carrier surface, to use as dowel pins.

## STEP 5




Pre-assemble the epicyclic crown gear and wheel carrier, with the special stop ring.

## STEP 6

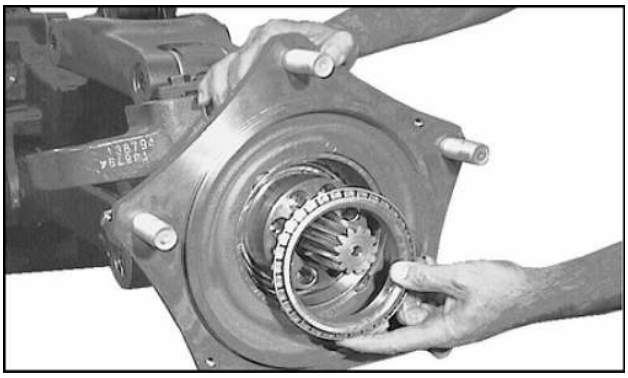


Fit the wheel hub onto the swivel housing.

https://truckmanualshub.com/

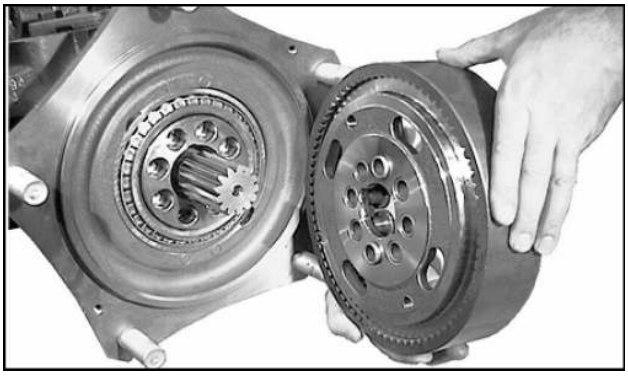


## STEP 7



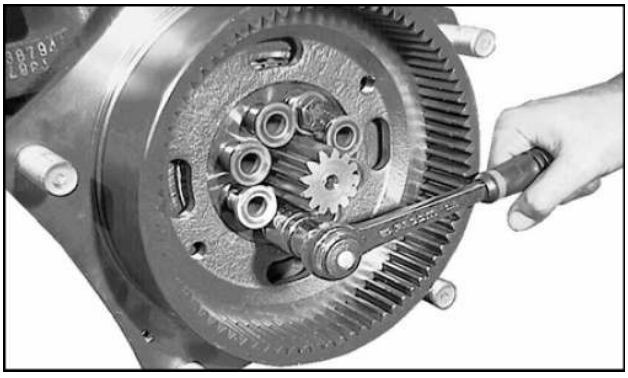
Place the outer bearing cone into the wheel hub.

## STEP 8



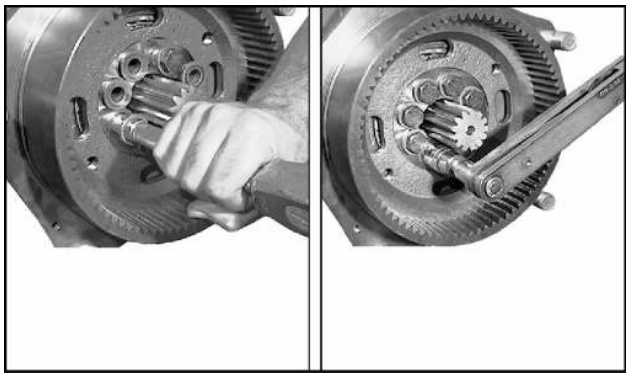
Using the two protruding bushes as dowel pins, locate the wheel carrier on the swivel housing.

## STEP 9



Insert and tighten two retaining bolts into the centering bushes to secure the wheel carrier assembly.

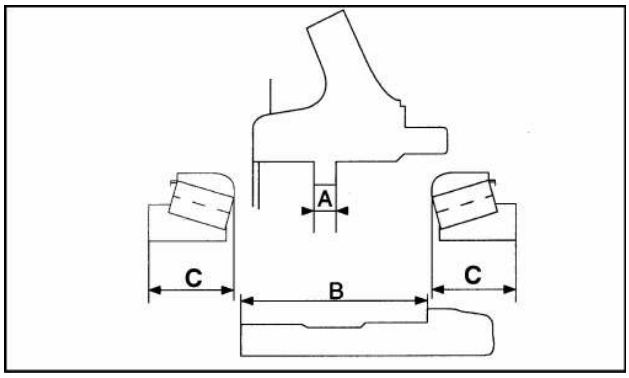
## STEP 10



Seat the bushes used as dowels using special tool CA715027 and a hammer.

Insert and tighten all retaining bolts for the wheel carrier assembly to the prescribed torque.

## STEP 11




**A = 17.950 - 18.000**

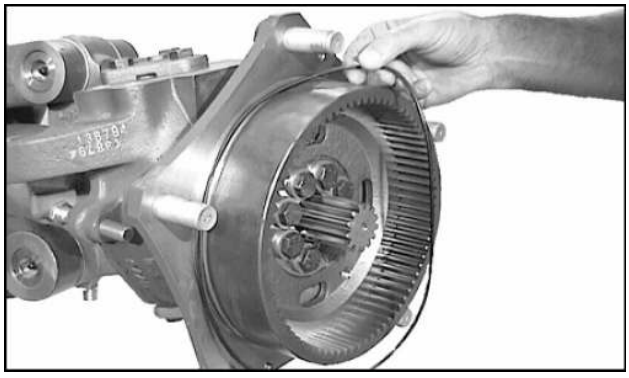
**B = 64.275 - 64.325**

**C = 23.070 - 23.172**

Bearings do not require preloading or backlash.

Check they are within the parameters above.

## STEP 12

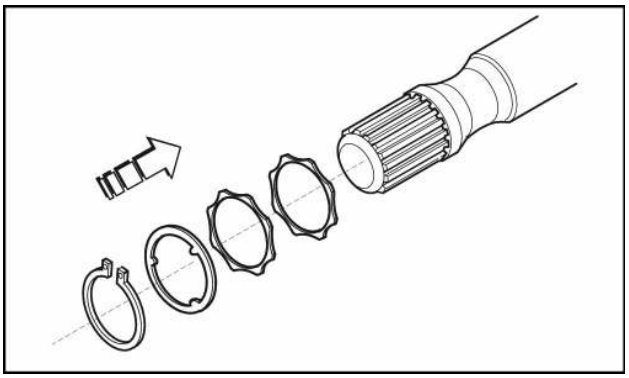


Fit the new O-ring to the outer diameter of the wheel hub.

https://truckmanualshub.com/



## STEP 13



Insert the thrust washers onto the U-Joint shaft and lock with the retaining ring.

**NOTE:** *Make sure the lock ring is correctly seated.*

https://truckmanualshub.com/

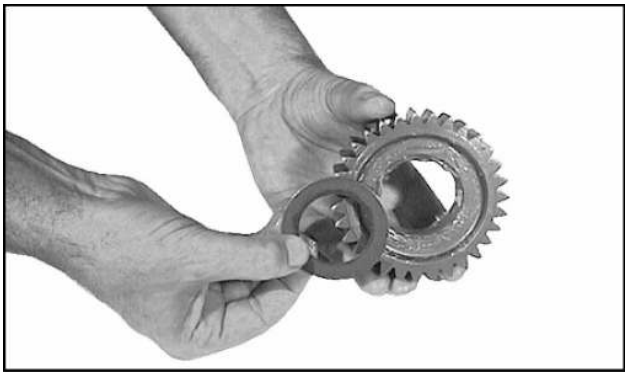


# EPICYCLIC REDUCTION GEAR UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

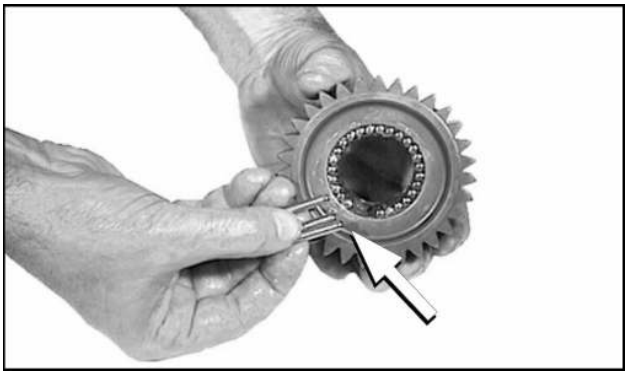
**NOTE:** *Before assembling the epicyclic reduction gear unit, it is necessary to assemble the wheel hub unit.*

## STEP 1



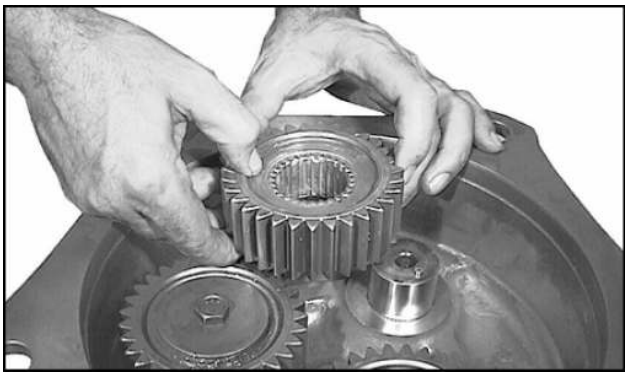
Apply a thin coat of grease to the sides and inner part of the planetary gear and place the thrust washer in position.

## STEP 2



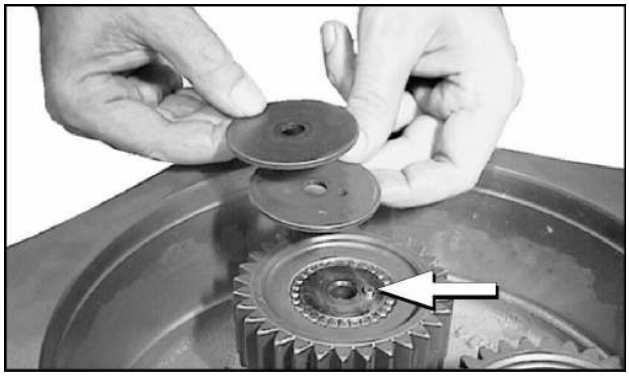
Place all bearing needles (twenty-eight for each gear) into the planetary gear.

## STEP 3



Slide the pre-assembled planetary gears onto the pin of epicyclic reduction gear.

## STEP 4

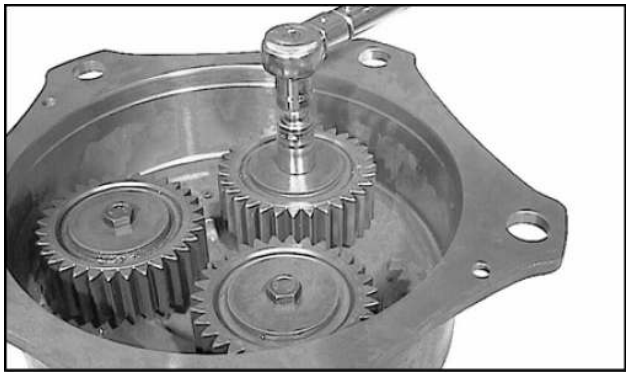


Place the pins on the planetary carrier pins.

Fit the two thrust washers to the planetary gears.

**NOTE:** *Make sure the thrust washer is correctly positioned on the lock pin.*

## STEP 5

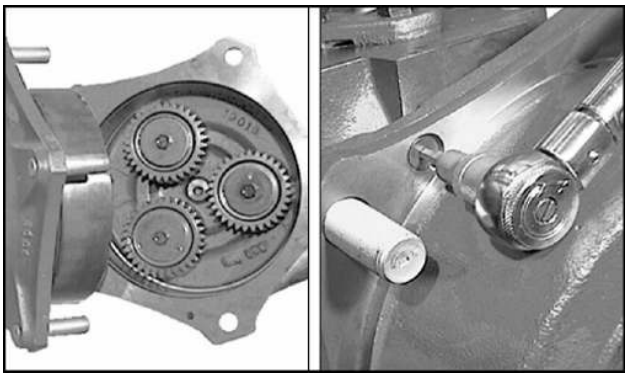


Insert and tighten the retaining bolts for the planetary gear to the prescribed torque.

https://truckmanualshub.com/



## STEP 6

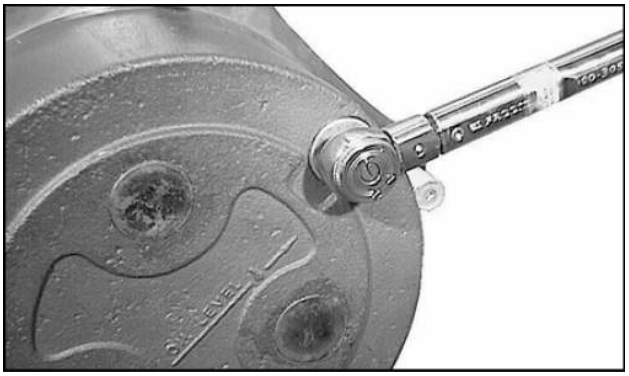


Fit O-ring to the wheel hub.

Install the epicyclic reduction gear assembly onto the wheel hub.

Apply LOCTITE 542 to threads, insert and tighten the retaining screws to the prescribed torque.

## STEP 7



Top up the oil in the wheel hub.

Insert the drain plug and tighten to the prescribed torque.

https://truckmanualshub.com/



# STEERING CYLINDER UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before assembling the cylinder, it is necessary to assemble the differential support unit and the swivel housing unit.*

## STEP 1



Fit the new seal rings to the cylinder head.

## STEP 2



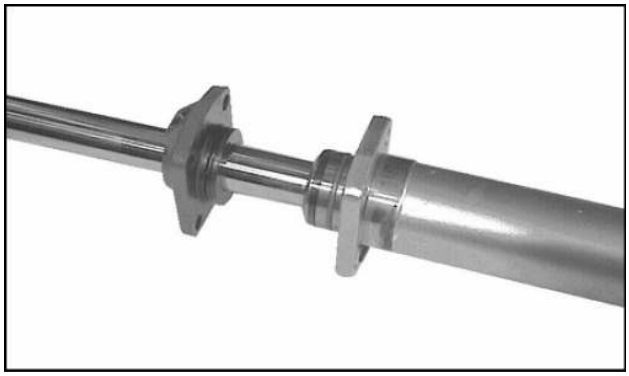
Fit the new seal rings to the cylinder body.

## STEP 3



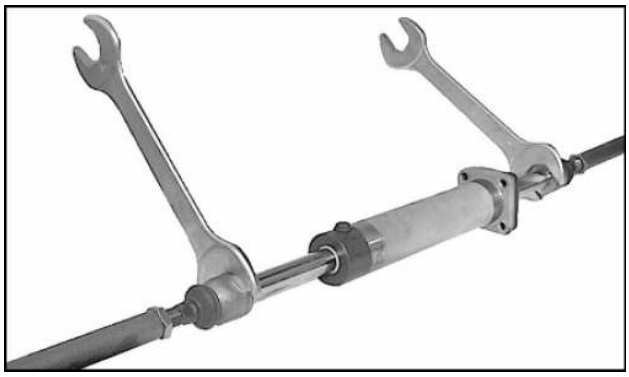
Fit the new seal rings to the cylinder rod.

## STEP 4



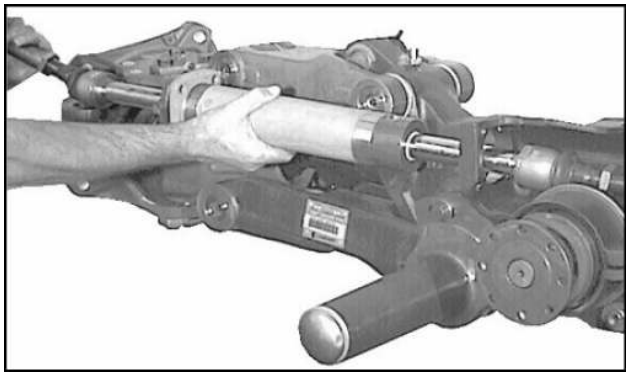
Slide the pre-assembled rod into the cylinder body.

## STEP 5



Fit the tie rods to the ends of the cylinder rod and tighten to the prescribed torque.

## STEP 6

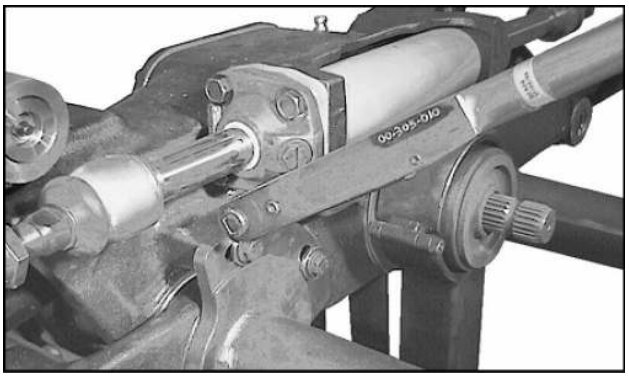


Fit the steering cylinder to the central beam assembly, temporarily removing the end part of a tie rod to seat the assembly correctly.

https://truckmanualshub.com/

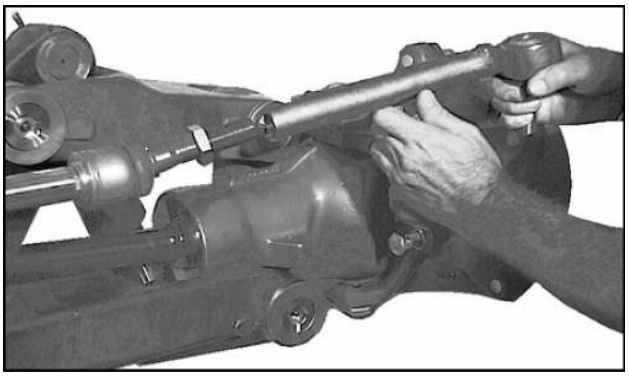


**STEP 7**



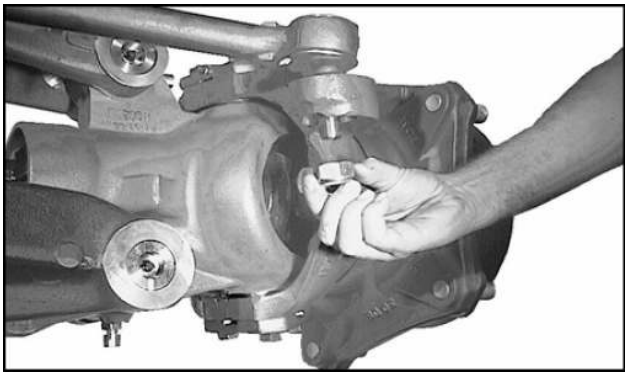
Insert and tighten the steering cylinder retaining bolts to the prescribed torque.

**STEP 8**



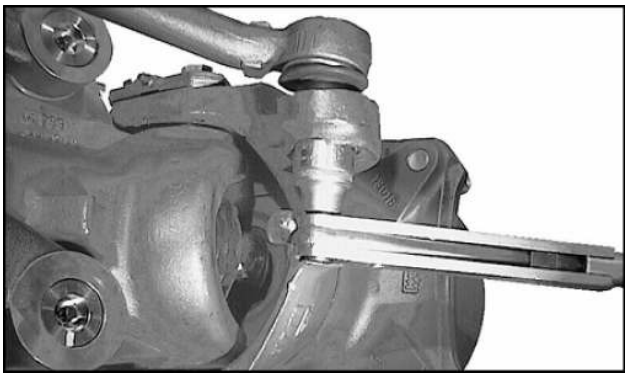
Re-install the steering rod end onto the tie rod.

**STEP 9**



Insert the tie rod ball joint onto the swivel housing bracket and secure it with a self-locking nut.

**STEP 10**



Tighten the self-locking nut to the prescribed torque.

https://truckmanualshub.com/

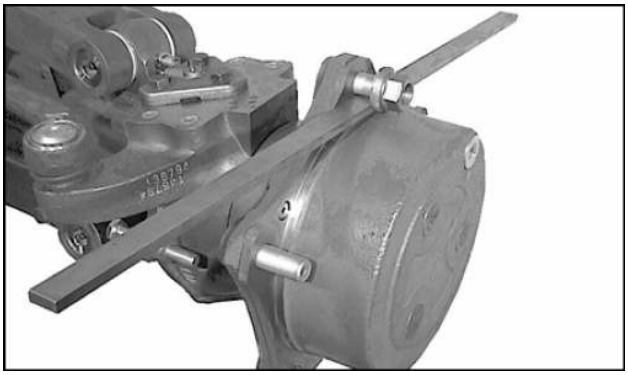


# TOE-IN AND STEERING ANGLE ADJUSTMENT

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *For the toe-in and steering angle adjustment, it is necessary to work with the axle complete of all components.*

## STEP 1



The adjustment of the toe-in must be undertaken with the axle in three different positions: medium, low, high.

Adjust the toe-in:

Position the steering cylinder rod in the centre of its stroke, measure the exposed rod length on both sides and check they are equal.

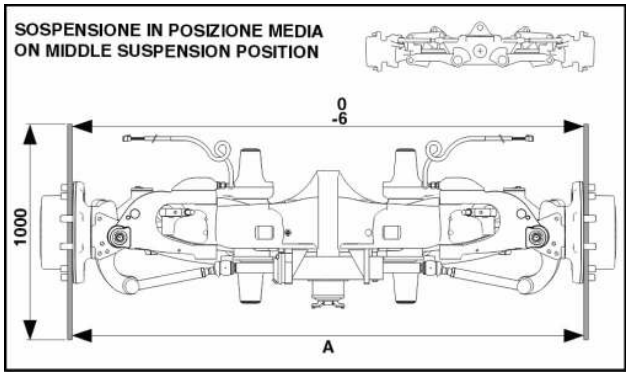
Install two identical straight bars, 1m in length, on the wheel sides, and secure them with two nuts on the wheel hub stub bolts.

**NOTE:** *The two bars must be fixed so that the centre of each bar is perpendicular to the centre line of the hub and parallel to the pinion shaft axis.*

**ATTENTION:** *Toe-in values are rating values. Therefore they relate to the major diameter of the wheel hub.*

Employing the method described below, it is important to recognise that the toe-in values must be proportional to the length of the mounted straight bars.

## STEP 2



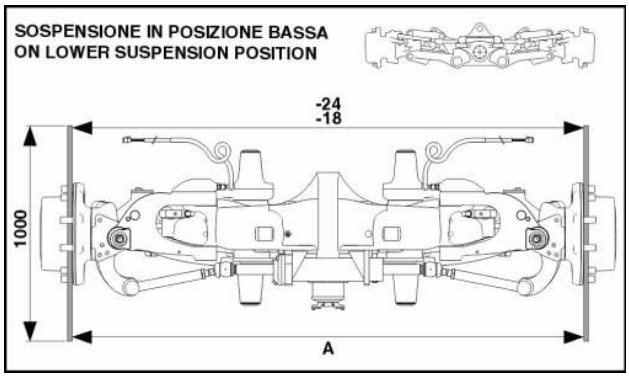

Middle position:

Place the axle into the intermediate position and check that the difference between the two measurements is within tolerance: A

Measure the distance in millimetres between the ends of the two bars, using a tape line.

**ATTENTION:** *Take the minimum value, by pivoting the measuring point.*

## STEP 3



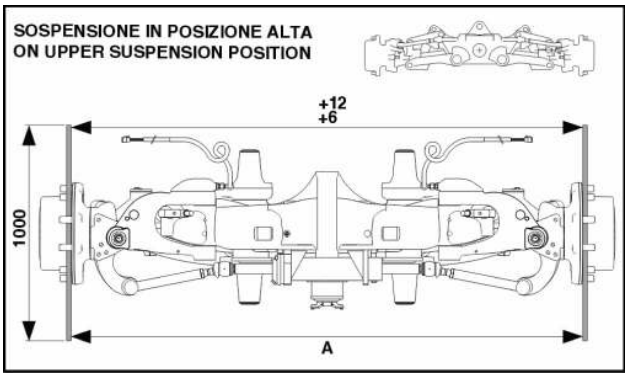

Lower position:

Place the axle into the lower position and check that the difference between the two measurements is within tolerance: A

https://truckmanualshub.com/



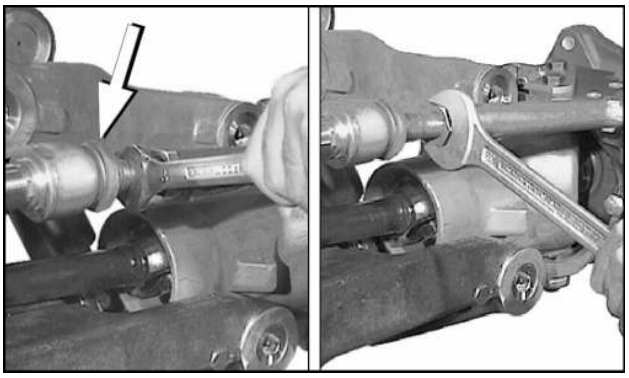
## STEP 4




Upper position:

Place the axle into the upper position and check that the difference between the two measurements is within tolerance: A

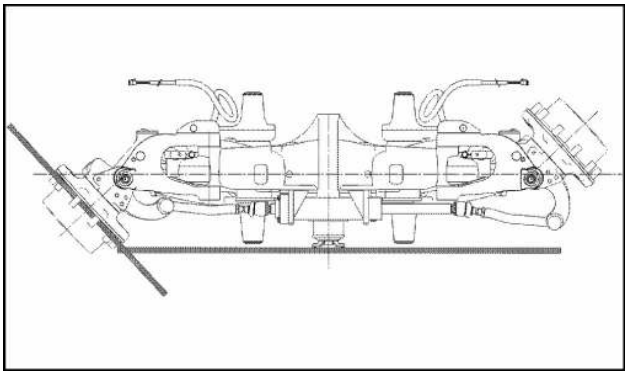
## STEP 5



If toe-in is incorrect, using two spanners, screw the tie rods in or out equally until the toe-in is within the prescribed tolerance.

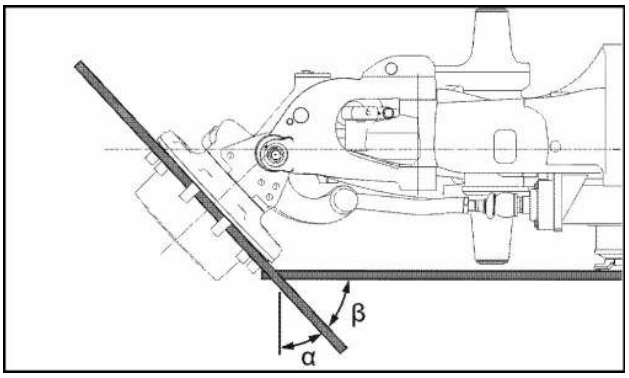
After adjusting the toe-in, tighten the lock nuts to the prescribed torque

## STEP 6



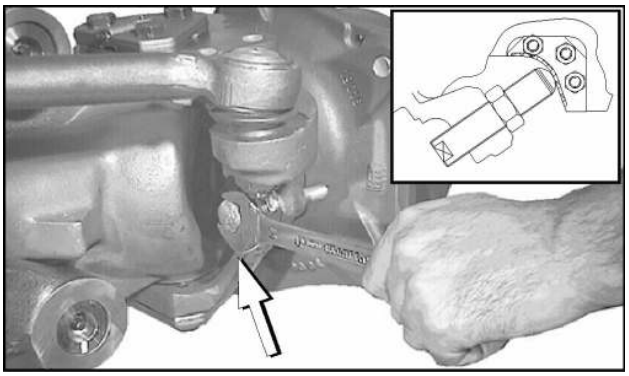
Use the same bars used for the adjustment of the steering angle and a long bar, resting on the machined part of the central body (pinion side), so that the two bars form an acute angle at the maximum turning point.

## STEP 7




Rotate the wheel side unit until it forms the prescribed steering angle.

## STEP 8



Adjust the steering stop by tightening or loosening the special bolt before tightening the lock nut to the prescribed torque.

Turn steering to the opposite lock and repeat the procedure.

https://truckmanualshub.com/

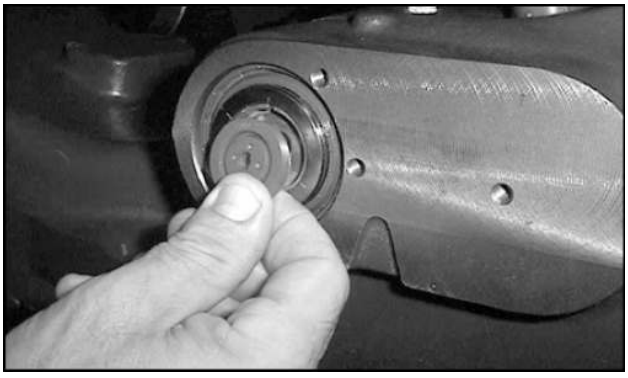


# ARMS SENSOR

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before assembling the sensor harness kit, it is necessary to assemble all the other components of the axle.*

## STEP 1



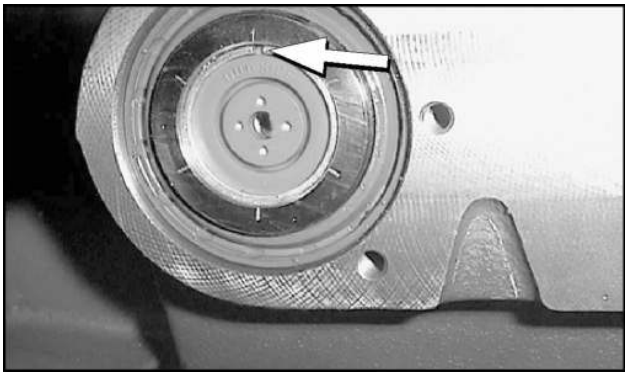
If the rubber washer ring has been removed, reseat it after applying LOCTITE 542 on its outer side.

**ATTENTION:** *For the assembly, refer to the marks made during disassembly.*

Fit the sensor rubber pad into the washer ring

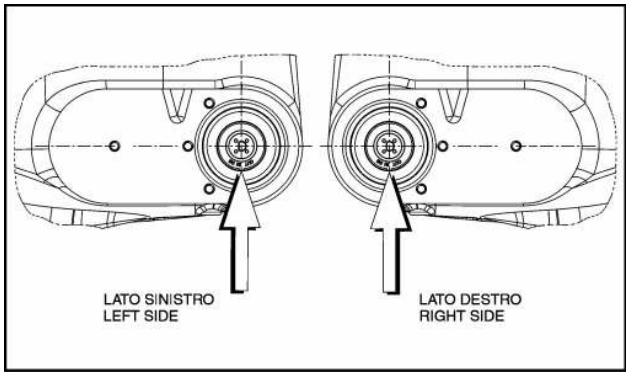
**NOTE:** *On the rubber washer, the word "OUTSIDE" must be facing outwards.*

## STEP 2



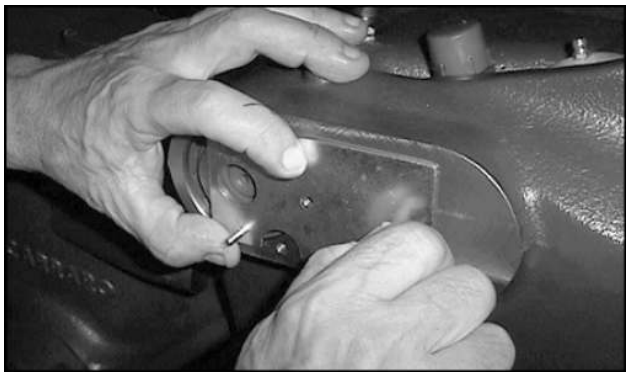
The outer protrusion of the sensor rubber washer must be inserted in the slot on the ring.

## STEP 3




Rubber pad assembly position.

## STEP 4



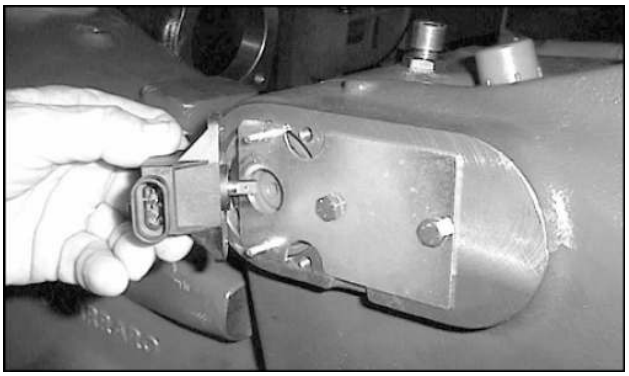
Position the sensor support on the upper arm, centering it as much as possible with respect to the hole in the rubber washer.

Insert the sensor retaining screws and tighten to the prescribed torque.

https://truckmanualshub.com/



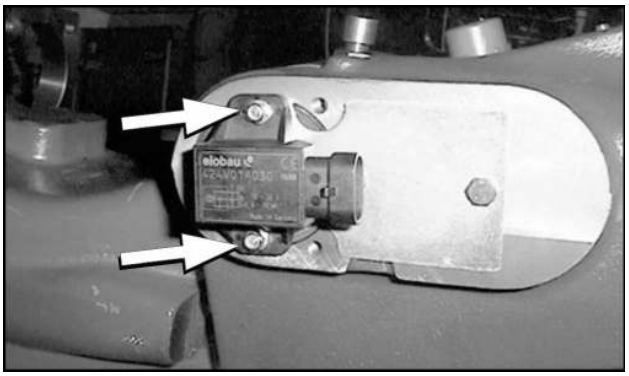
## STEP 5



Install the sensor onto the rubber washer in the upper arm.

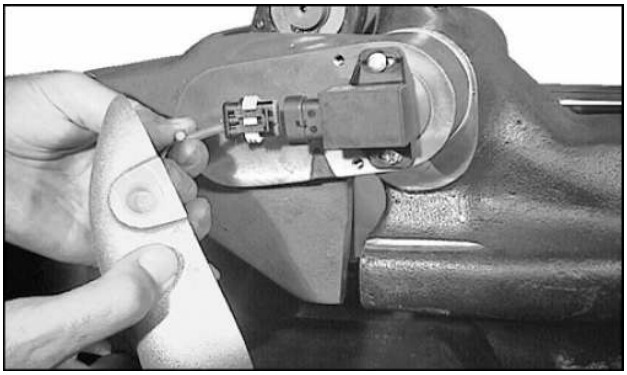
**ATTENTION:** *Be careful to the correct assembly position.*

## STEP 6



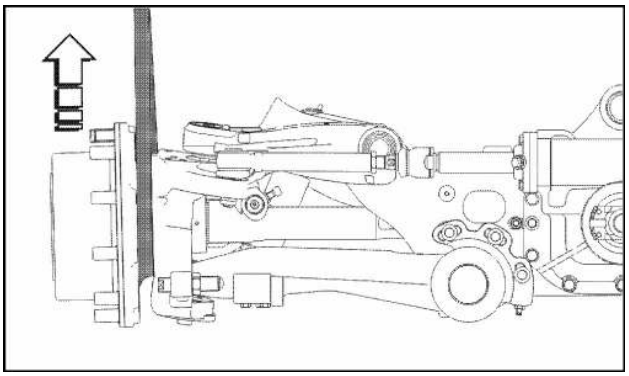
Fit the washers and sensor retaining nuts and tighten provisionally.

## STEP 7



Connect the sensor to the harness kit in order to power it and adjust the angular position.

## STEP 8



ADJUSTMENT ANGLE SENSOR:

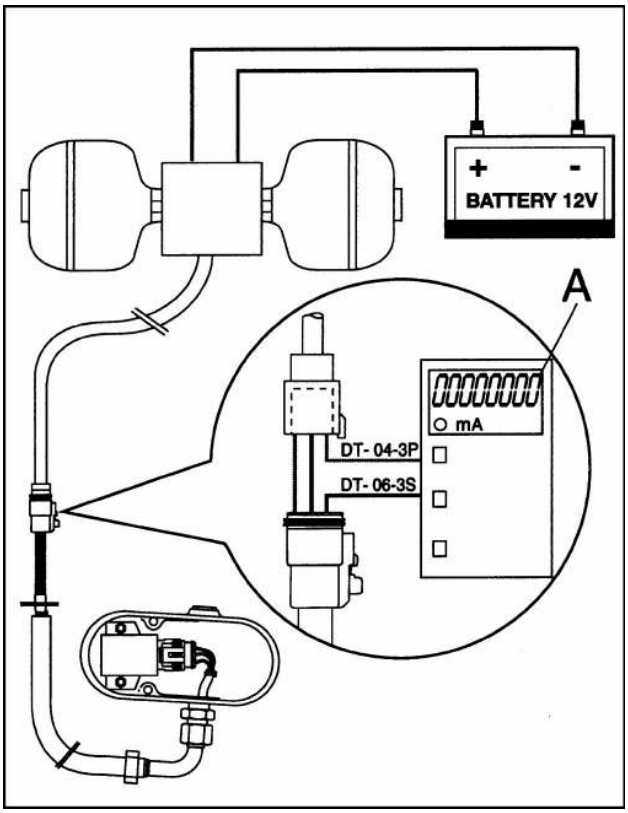
Set the angle sensor in order to find the ideal work position for the axle.

Use a harness and suitable hoist and raise the axle to the end of its stroke.

https://truckmanualshub.com/



## STEP 9




If the axle and all its parts, including the battery, have been connected to the vehicle, detach the connector between the sensor and the suspension control unit, and connect a multi-meter, to measure the electric current, which should be:

With the wheel sides fully raised:

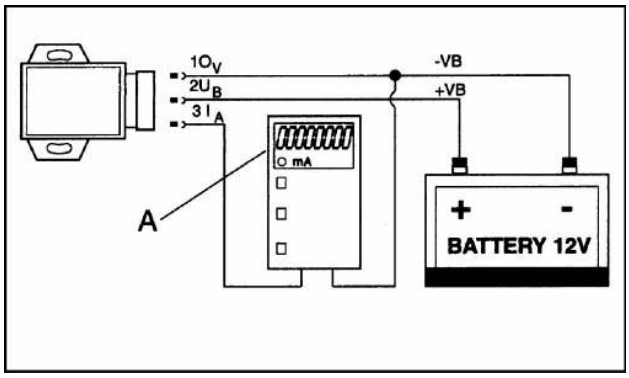
**A = 7.8 mA ± 0.5**

With the wheel sides fully lowered:

**A = 15.963 mA ± 0.5**

**ATTENTION:** *measurements should be taken with the ignition switched on.*

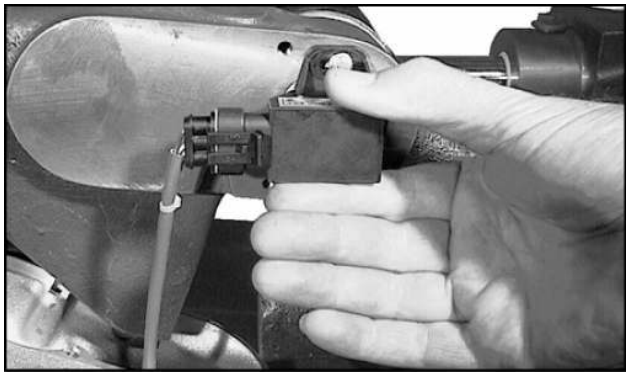
## STEP 10




If the axle has not been fitted and is on a work bench, lift the wheel sides until to end of stroke with a rope.

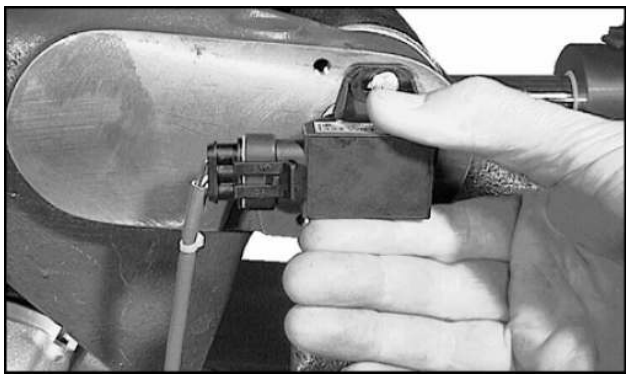
With equipment comprising a 12V battery and a multi-meter connected to the angle sensors, measure the electric current which should be the same as in STEP 9.

## STEP 11



Adjust the value of the electric current by loosening the nuts and slowly rotating the sensor by hand until the prescribed value is shown on the multi-meter.

## STEP 12

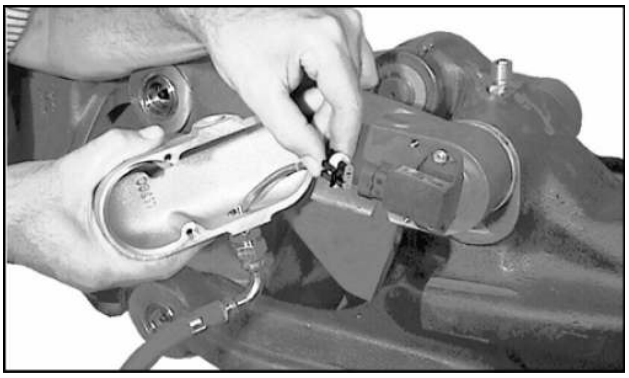


Tighten the sensor fixing nuts to the prescribed torque.

https://truckmanualshub.com/

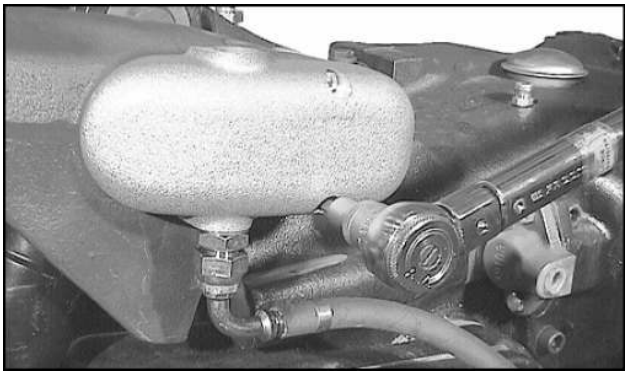


**STEP 13**



Connect the harness kit/sensor cables.

**STEP 14**



Fit the wiring harness kit cover and tighten the fixing screws to the prescribed torque.

https://truckmanualshub.com/



# Section 6022-A

## FRONT SUSPENDED AXLE

## XTX Series Tractors

## 20.43 Axles

McCORMICK

SM 8-14010

© 2006 McCormick Tractors International Limited.
September 2006

Whilst every effort is made to ensure that the specifications, desciptions, photographs and illustrations in this publication are correct at the time of going to print, they may not be up to date as a result of modifications adopted by the Manufacturer at any time.
All information within this publications has been provided by Carraro SpA.

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIFICATIONS ..... 3

SPECIAL TORQUES ..... 4

SPECIAL TOOLS ..... 5

DISASSEMBLY OPERATIONS ..... 10
- potentiometer ..... 11
- Steering cylinder unit ..... 12
- Epicyclic reduction gear ..... 13
- Wheel hub unit ..... 15
- Torsion bar unit ..... 17
- Swivel housing unit ..... 19
- Universal joints ..... 23
- Suspension cylinder ..... 26
- Upper arm ..... 27
- Lower arm ..... 30
- Differential support unit ..... 32
- Pinion unit ..... 34
- Differential unit ..... 35

ASSEMBLY OPERATIONS ..... 37
- Differential unit ..... 38
- Pinion unit assembly ..... 41
- Differential unit support ..... 44
- Lower arm ..... 49
- Upper arm ..... 52
- Suspension cylinder ..... 56
- Universal Joint ..... 57
- Swivel housing unit ..... 62
- Torsion bar unit ..... 68
- Torsion bar preload adjustment ..... 71
- Wheel hub unit ..... 73
- Epicyclic reduction gear unit ..... 76
- Steering cylinder unit ..... 78
- Toe-in and steering angle adjustment ..... 80
- Arms sensor group ..... 82

https://truckmanualshub.com/



# SPECIFICATIONS

| | | |
|---|---|---|
| DIFFERENTIAL | | |
| Pinion Bearing Pre-load | 92.7 to 150.7 N | 21 to 34 lb f |
| Pinion Bearing and Differential Bearing Total Pre-load | 92.7 to 150.7(+29.8 to 48.6) N | 21 to 34 (+6.6 to 11) lb f |
| Bevel Gear Backlash | 0.20 to 0.28 mm | 0.007 to 0.011 inch |
| Shim Thickness for Pinion Height Setting | 2.5 (min.) to 3.4 mm (max.) | 0.098 (min.) to 0.134 inch (max.) |

| | |
|---|---|
| LUBRICANTS | |
| Grease | McCormick LX Multi-purpose EP2 Grease |
| MFD Axle Pivot Pin | Loctite Anti Seize Compound |
| MFD Axle Capacities | |
| Type | SAE 85W-140 EP Gear Oil |
| Planetary | 1.5 Litres |
| Differential | 5.5 Litres |

https://truckmanualshub.com/



# SPECIAL TORQUES

| | | |
|---|---|---|
| Pinion Shaft Nut | Refer to SPECIFICATIONS for Pre-load | |
| Differential Housing to Axle Bolt | 169 Nm | 125 lb ft |
| Locking Plate Bolt | 13 Nm | 10 lb ft |
| Ring Gear to Differential Housing Bolt with Loctite 270 | 70 Nm | 52 lb ft |
| Breather Plug | 10 Nm | 7 lb ft |
| Oil Fill/Level Plugs | 60 Nm | 44 lb ft |
| Differential Bearing Cap Bolt | 266 Nm | 196 lb ft |
| King Pin Retaining Bolt | 300 Nm | 221 lb ft |
| Steering Stop Locknut | 450 Nm | 332 lb ft |
| Steering Cylinder to Differential Support Bolt | 120 Nm | 89 lb ft |
| Ball Joint on Steering Cylinder | 300 Nm | 221 lb ft |
| Track Rod Locknut | 250 Nm | 185 lb ft |
| Ball Joint to Swivel Housing Locknut | 220 Nm | 162 lb ft |
| Planetary Gear to Swivel Housing Bolt | 230 Nm | 169 lb ft |
| Wheel Stud with Loctite 542 | 70 Nm | 52 lb ft |
| Planetary Gear Carrier to Wheel Hub Screw | 25 Nm | 18 lb ft |
| Front Weight Frame Bolts | 425 Nm | 314 lb ft |
| Front Wheel Nuts | 530 to 570 Nm | 391 to 420 lb ft |
| MFD Axle Retaining Bolts | 570 to 645 Nm | 420 to 475 lb ft |
| Planetary Gear Retaining Bolt | 75 Nm | 55 lb ft |
| Potentiometer Cover Retaining Bolt | 13 Nm | 10 lb ft |
| Potentiometer Retaining Bolts | 4 Nm | 3 lb ft |
| Axle Suspension Pin Cover Bolts | 60 Nm | 44 lb ft |

https://truckmanualshub.com/

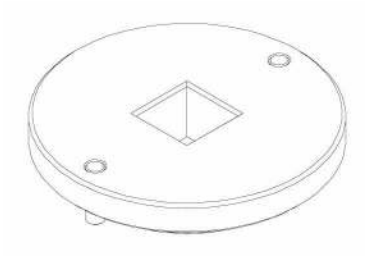


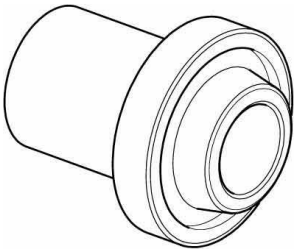
# SPECIAL TOOLS

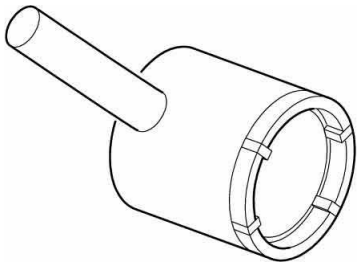
https://truckmanualshub.com/

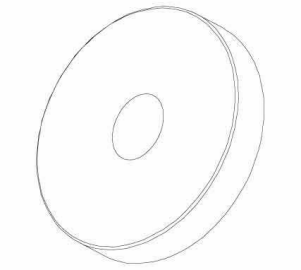


The special tools used to fit seals, bearings and bushes should always be used with the interchangeable handle CA119033 and a suitable safety handle to protect the hands.

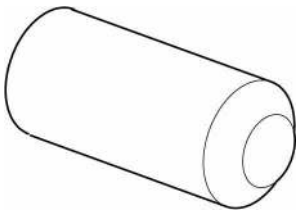

CA119030

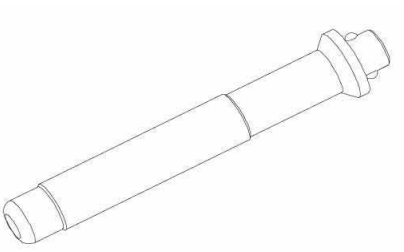

CA119148

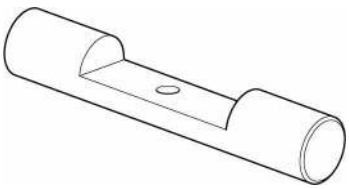

CA119099

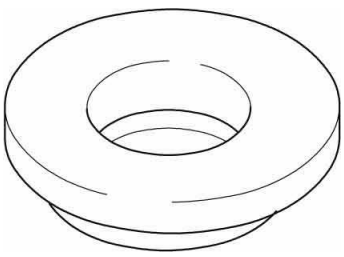

CA119182

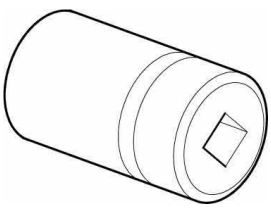

CA119143


CA119215


CA119033

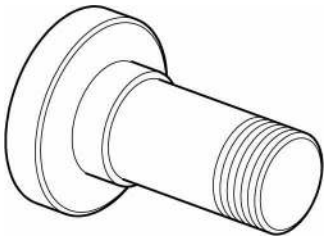

CA119228

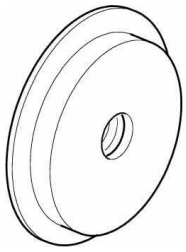

CA119103

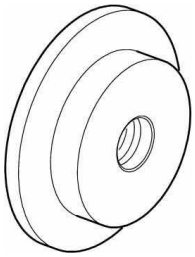

CA715022

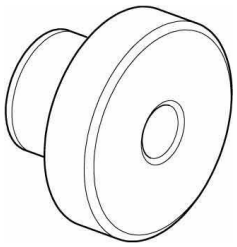
https://truckmanualshub.com/

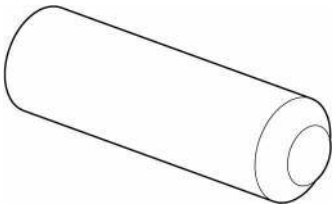


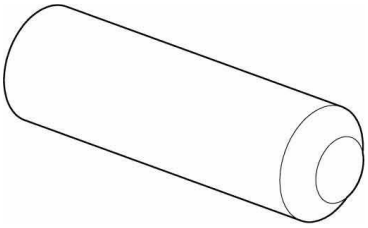

CA119202

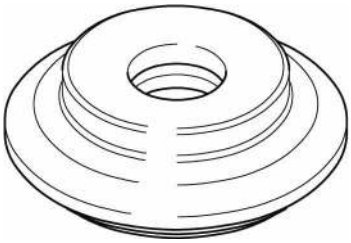

CA715092

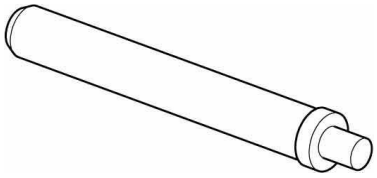

CA119225


CA715097

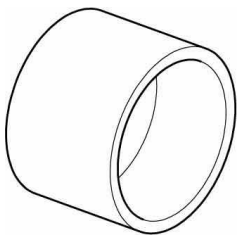

CA715004


CA715179


CA715026


CA715086

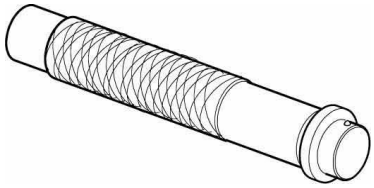

CA715027

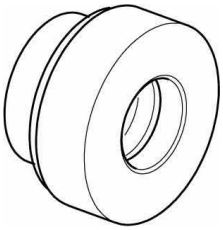

CA715093

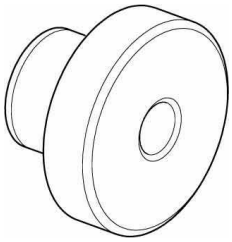
https://truckmanualshub.com/

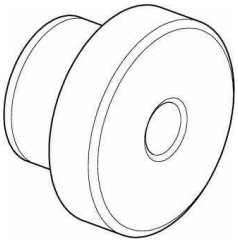


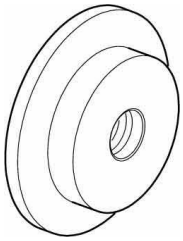

CA715108

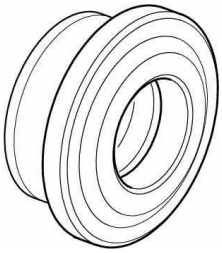

CA715329

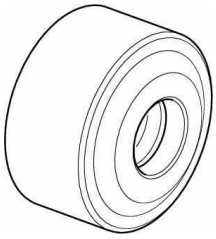

CA715321

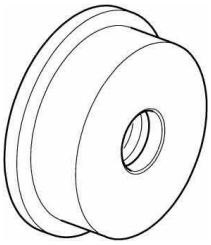

CA715323

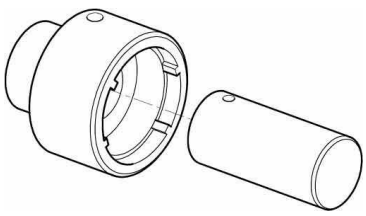

CA715322


CA715325


CA715324

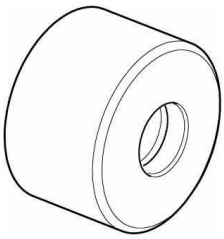

CA715328

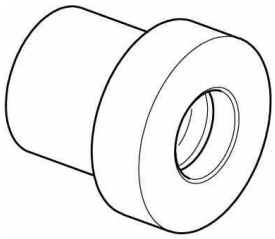

CA715327

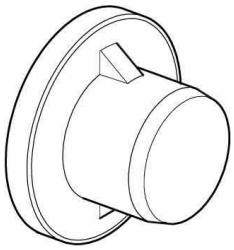

CA715330

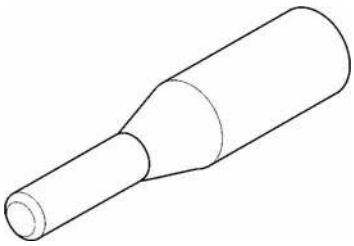
https://truckmanualshub.com/

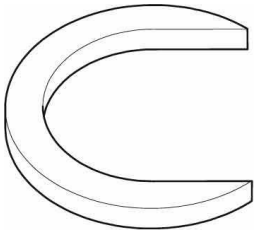


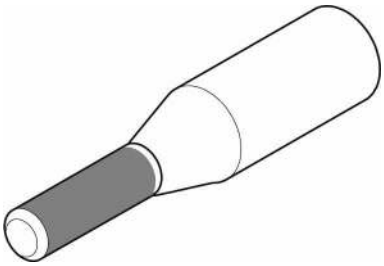

CA715333

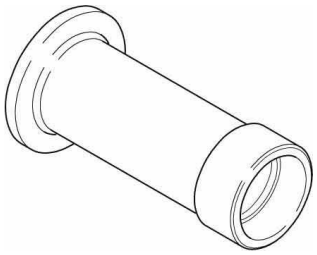

CA715338

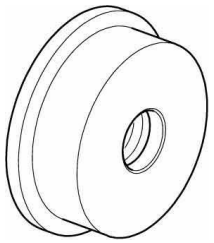

CA715336

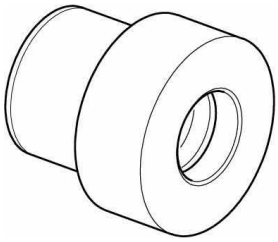

CA715340

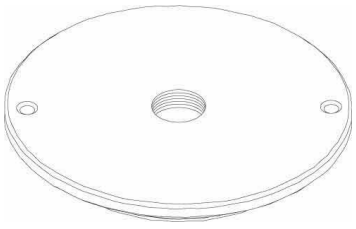

CA715339


CA715399


CA715341


CA715677


CA715334


CA715713

https://truckmanualshub.com/



# DISASSEMBLY OPERATIONS

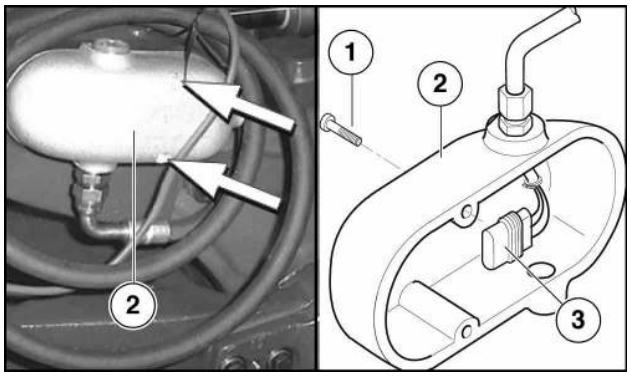
https://truckmanualshub.com/



# POTENTIOMETER

Some of the following pictures may not show your axle, but the procedure is the same.

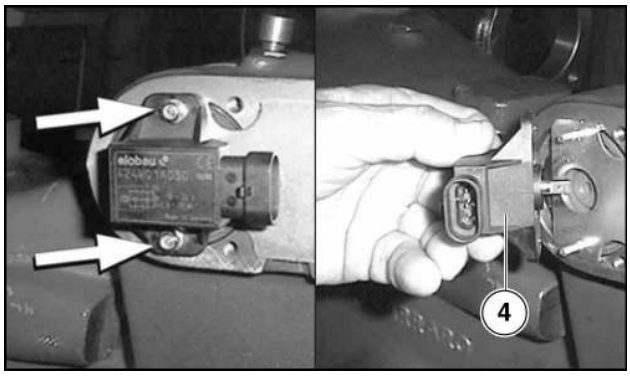
## STEP 1




Remove the screws (1) from the cover of the sensor wiring harness kit (2). Before removing the sensor harness kit, disconnect the electric connector (3).

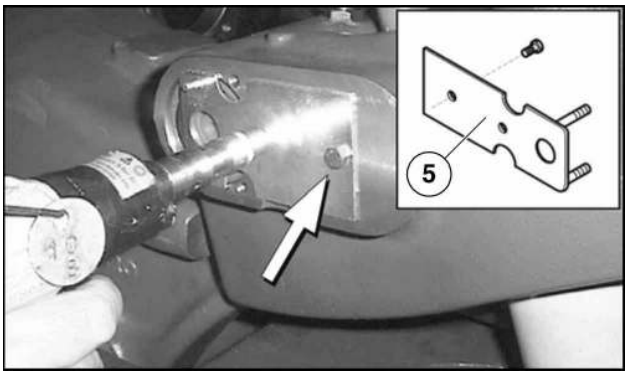
**NOTE:** *Do not damage the electrical wires.*

## STEP 2



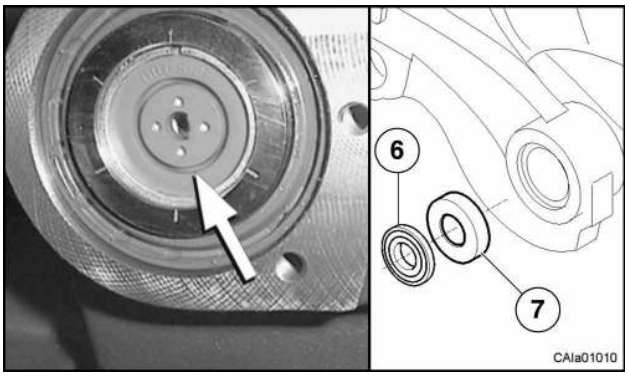

Remove the sensor retaining nuts and washers. Remove the sensor (4).

## STEP 3




Unscrew and remove the sensor support retaining screws. Remove the sensor support (5).

## STEP 4




Mark the position of the rubber washer (6) and the washer holding ring (7). Remove the rubber washer and the washer holding ring with a suitable lever.

**NOTE:** *This is a destructive operation for the rubber washer.*

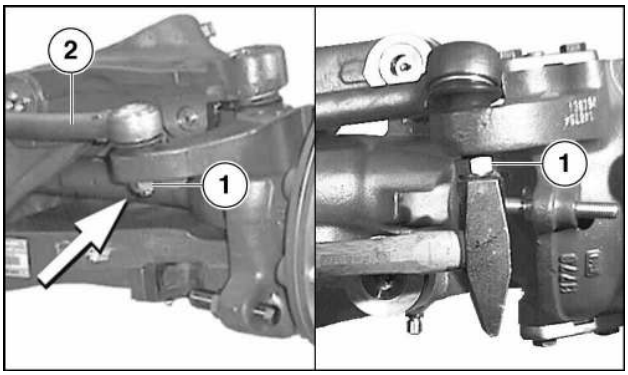
https://truckmanualshub.com/



# STEERING CYLINDER UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1

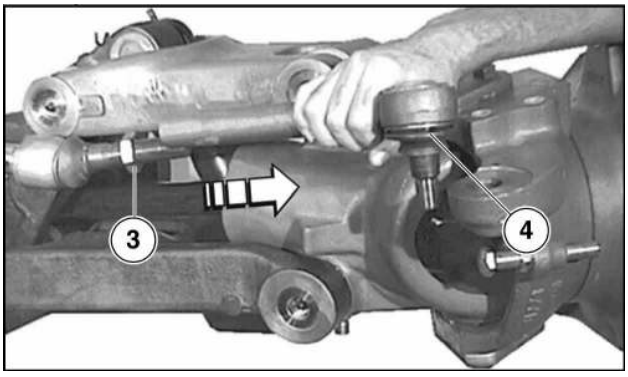



Remove lock nuts (1) and extract the ball joints (2) from the swivel housing.

**NOTE:** *If necessary use a hammer.*

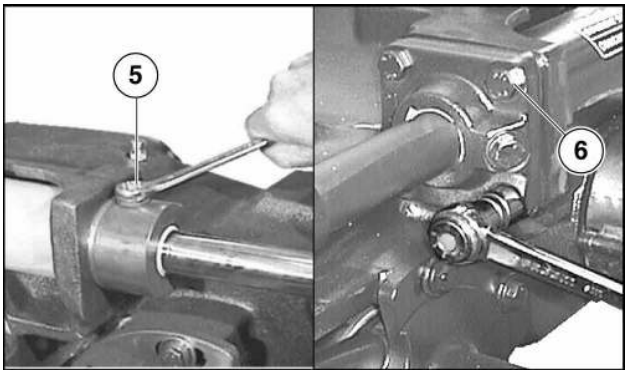
**ATTENTION:** *take care not to damage the threads. For assembly, replace the lock nuts (1).*

## STEP 2



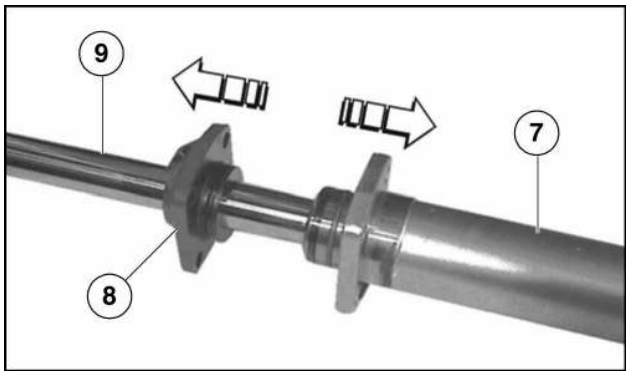

Loosen the lock nut (3) on the tie rod a few turns. Remove the two tie rods (4).

## STEP 3




Remove the hydraulic connections (5).
Remove the cylinder retaining bolts (6) and slide the cylinder from the differential support.

## STEP 4




Detach the cylinder head (8) from the cylinder (7) and remove the rod (9).

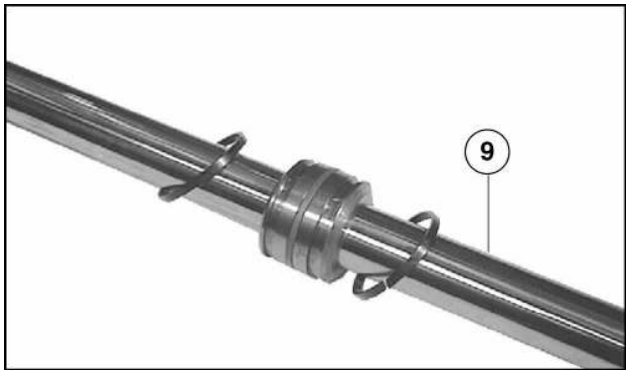
## STEP 5




Remove the cylinder head (8) from the rod (9).

Remove and discard the seals and O-Rings from the cylinder head (8) and cylinder (7).

## STEP 6




Remove and discard the seal rings from the steering rod (9).

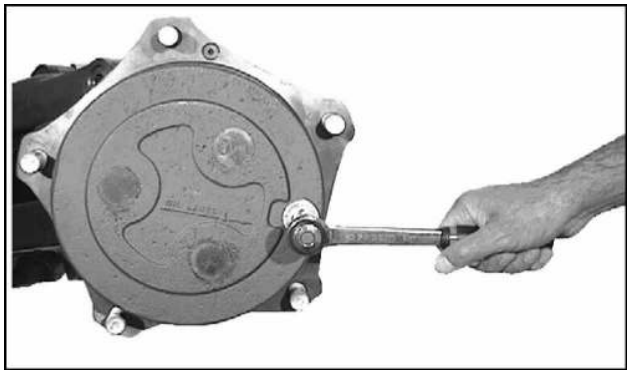
https://truckmanualshub.com/



# EPICYCLIC REDUCTION GEAR

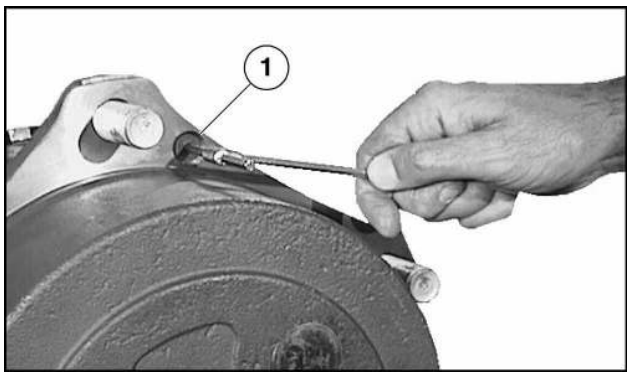
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



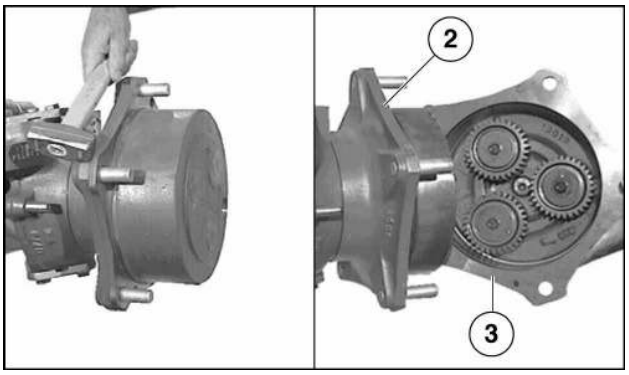
Drain the oil from the epicyclic reduction gear.

## STEP 2



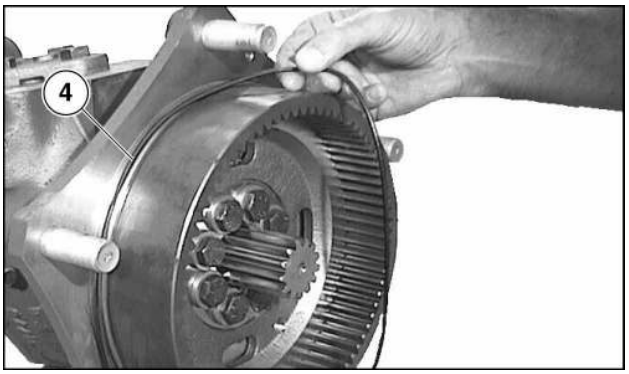

Remove the retaining screws (1) from the epicyclic reduction gear assembly.

## STEP 3




Remove the epicyclic reduction gear assembly (3) from the wheel hub (2) by tapping lightly with a hammer.

## STEP 4

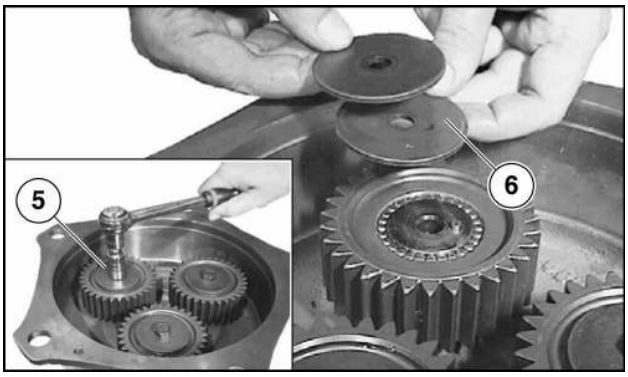



Remove and discard the O-ring (4) from the wheel hub.

https://truckmanualshub.com/

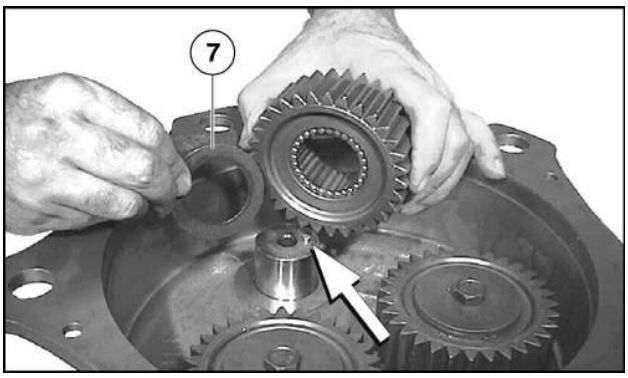


## STEP 5




Remove the retaining bolts (5) and the thrust washers (6).

## STEP 6




Remove the planetary gear with needle bearings and the lower thrust washer (7). Remove the locating pin shown.

## STEP 7



**NOTE:** *Inspect the condition of the planetary gear components.*

https://truckmanualshub.com/



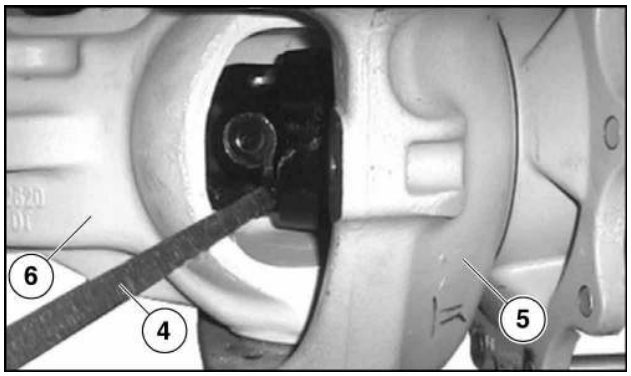
# WHEEL HUB UNIT

Before disassembling the wheel hub, it is advisable to secure it with a suitable hoist or any other supporting device, in order to avoid its accidental fall that could damage either the operator or the wheel hub group.

Some of the following pictures may not show your axle, but the procedure is the same.

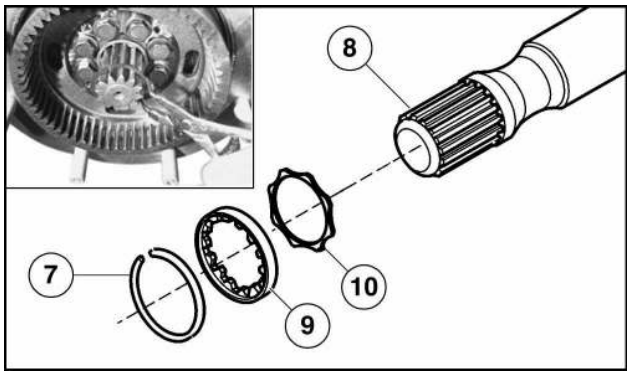
**NOTE:** *Before disassembling the wheel hub unit, it is necessary to remove the epicyclic reduction gear unit.*

## STEP 1



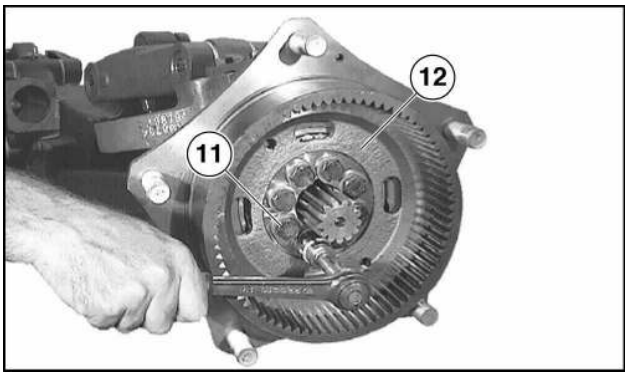

Insert a lever (4) between the swivel housing (5) and the axle beam (6) and push the double U-Joint in the direction of the final drive to allow the lock ring (7) removal.

## STEP 2



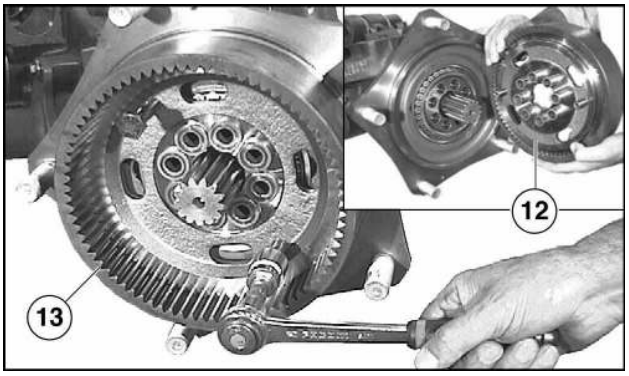

Remove the snap ring (7) from the U-Joint shaft (8). Remove washer (9) and thrust washer (10).

## STEP 3




Unscrew and remove the fastening screws (11) from the wheel carrier group (12).

## STEP 4




Extract and remove the wheel carrier together with the epicyclic ring gear (13).

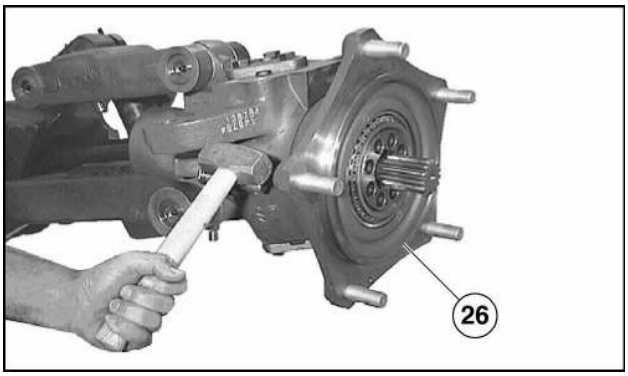
To remove the wheel carrier, screw two of the just removed bolts in the threaded holes.

Remove the wheel carrier.

https://truckmanualshub.com/



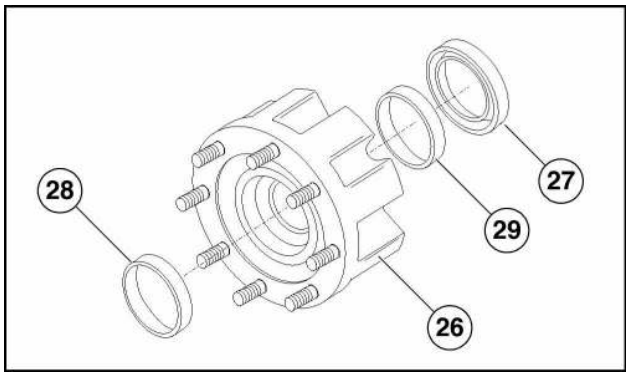
## STEP 5




Remove the wheel hub (26), using a suitable lever and hammer.

**NOTE:** *Remove the bearing cone.*

## STEP 6




Position the wheel hub (26) on a flat surface and remove the seal ring (27) using a suitable lever.

**NOTE:** *This is a destructive operation for the seal ring.*

Remove the bearing cups (28, 29), using a hammer and a suitable drift or using a suitable extractor.

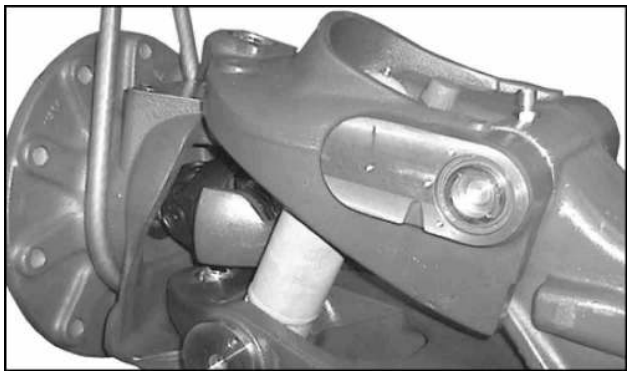
https://truckmanualshub.com/



# TORSION BAR UNIT

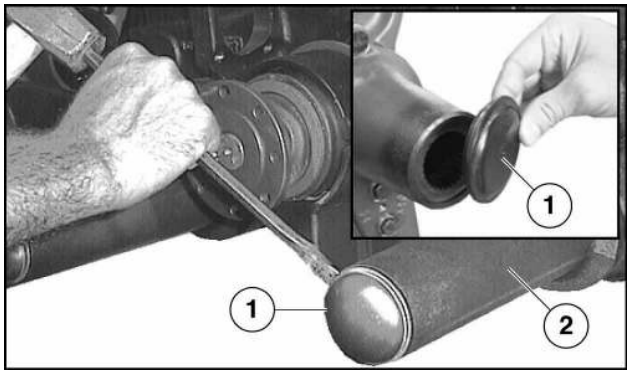
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



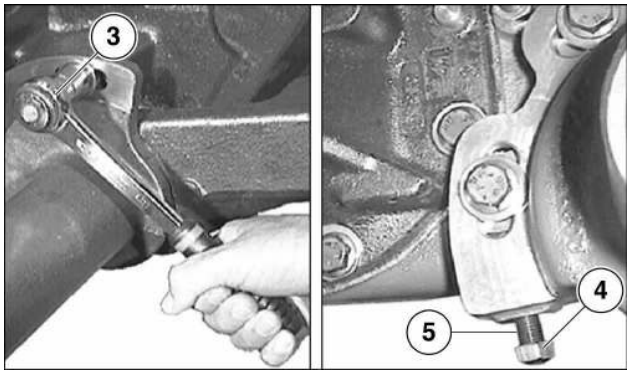
Lift the swivel housing unit up to the end of its stroke by means of a rope attached to a hoist.

## STEP 2



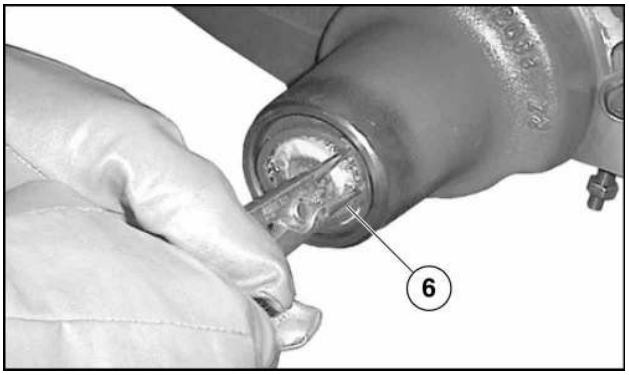

Remove the cover (1) from the rear torsion bar flange (2).

## STEP 3



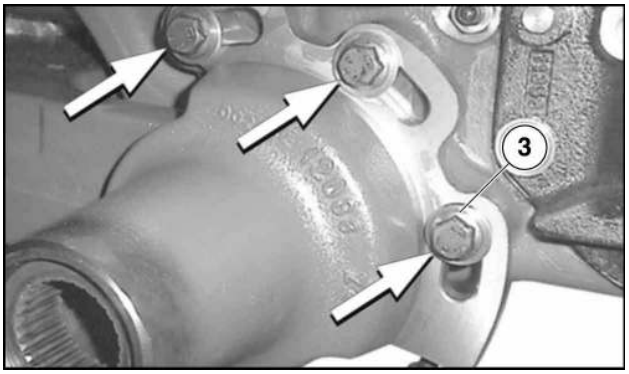

Loosen partially the three retaining bolts (3) from the rear flange. Loosen the locking nut (4) on the rear flange grub screw. Unscrew the grab screw (5) to eliminate the torsion bar preload.

## STEP 4



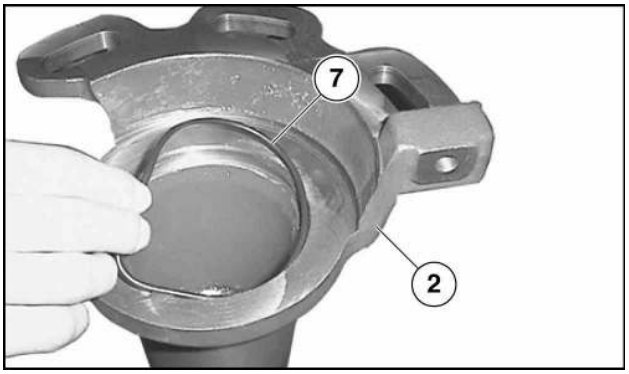

Remove the torsion bar's snap ring (6) from the rear flange.

## STEP 5




Remove the three retaining bolts (3) from the rear flange. Remove the centering bush.

## STEP 6

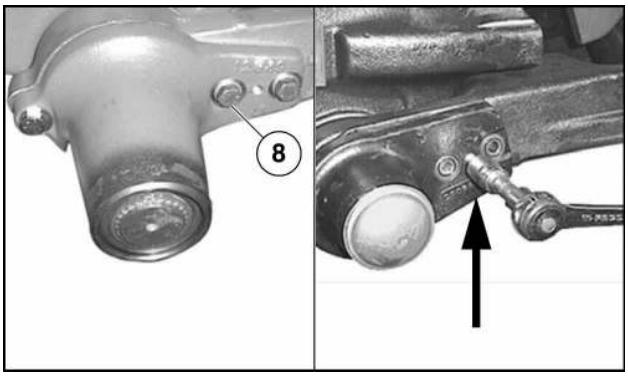



Slide the rear flange (2) by tapping with a soft hammer. Remove and discard the rear flange O-Ring (7).

https://truckmanualshub.com/



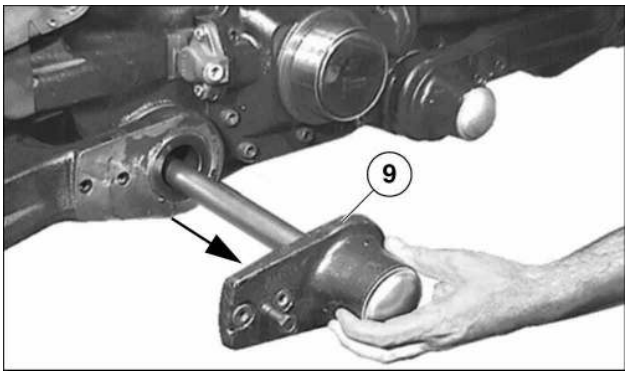
### STEP 7




Remove the three retaining bolts (8) from the front torsion bar flange.

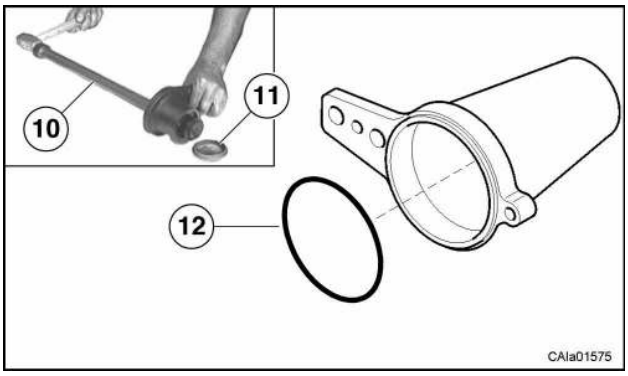
**NOTE:** *To remove the front flange, place one of the bolts in the threaded hole (as shown) designed for removal.*

### STEP 8




Slide from the central beam the front flange unit and torsion bar (9).

### STEP 9

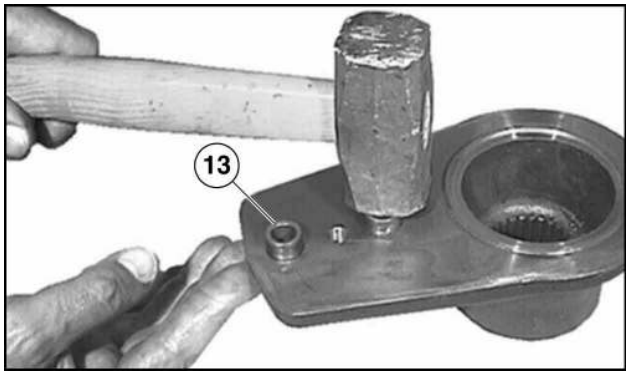



Slide the torsion bar (10) from the front flange by tapping the ends of the bar with a soft hammer; simultaneously removing the protective cover (11).

Remove and discard the O-Ring (12) from the front flange.

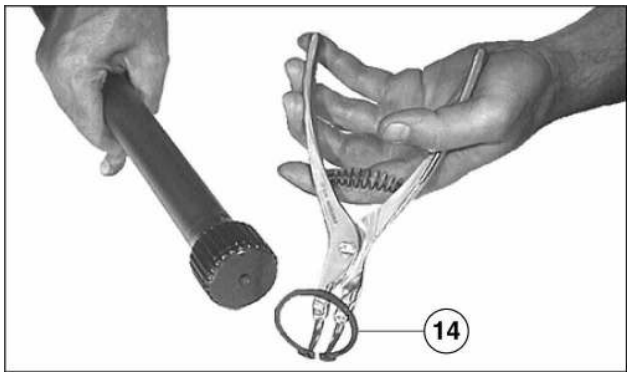
**NOTE:** *This is a destructive operation for the O-Ring.*

### STEP 10




If necessary, remove the two centering bushes (13) from the front flange with a soft hammer.

### STEP 11




Remove the lock ring (14) from on the torsion bar.

https://truckmanualshub.com/

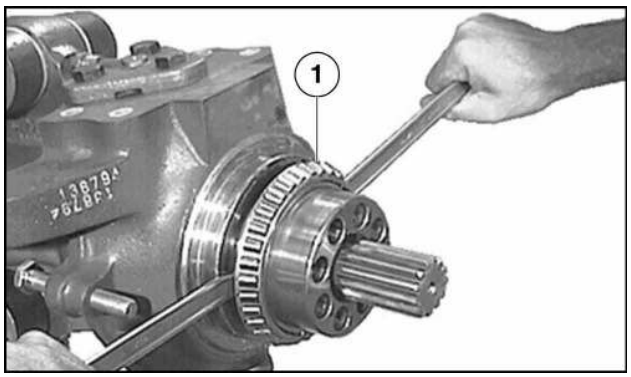


# SWIVEL HOUSING UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before disassembling the swivel housing unit, it is necessary to remove the steering cylinder unit, the wheel hub unit and to eliminate the preload from the torsion bar.*

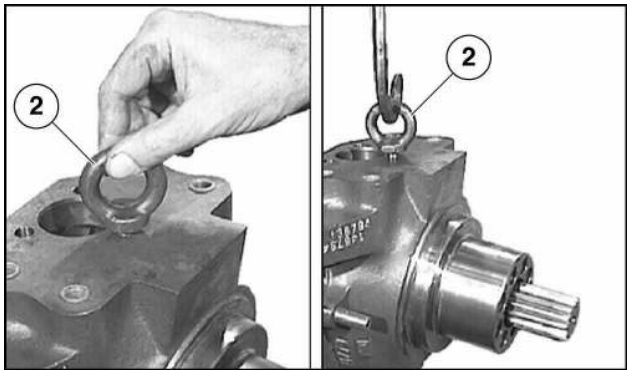
## STEP 1




Using two levers remove the bearing cone (1) from the swivel housing.

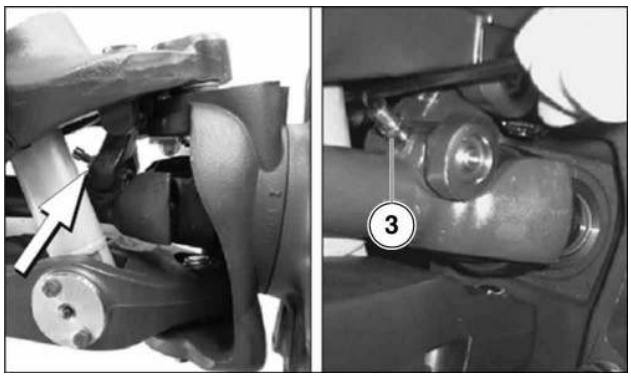
**ATTENTION:** *Do not damage the bearing seat.*

## STEP 2



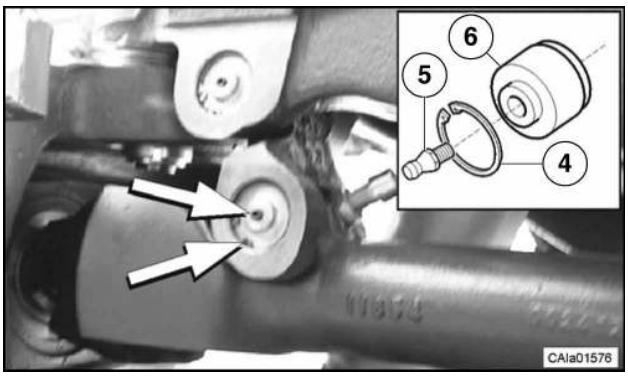

**ATTENTION:** *Screw an eyebolt (2) onto one of the threaded holes of the swivel housing. Using a suitable harness and hoist, support the swivel housing.*

## STEP 3




Loosen the lock nut and unscrew the retaining bolt (3) of the universal joint housing support fork pin by giving it a few turns.

## STEP 4

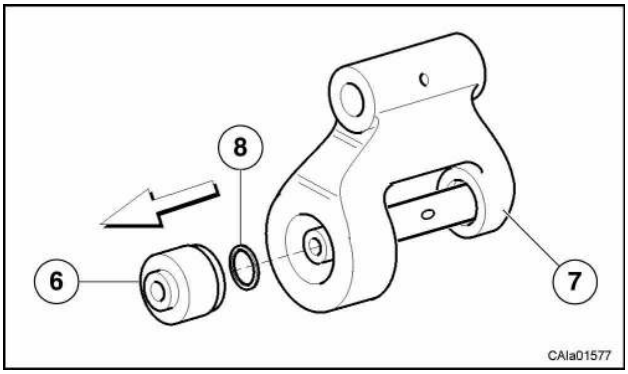



Remove the lower lock ring (4) from the universal joint housing support fork. Unscrew and remove the greaser nipple (5) from the centering bush (6).

https://truckmanualshub.com/

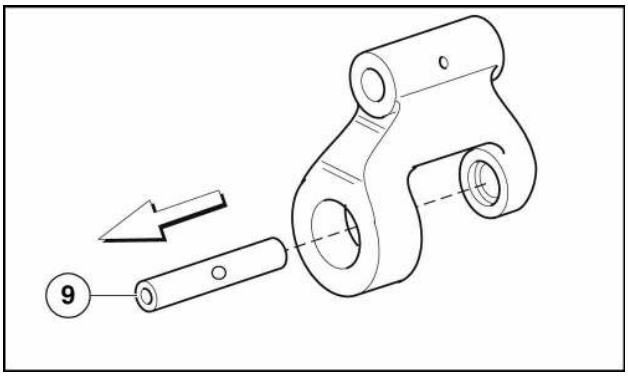


## STEP 5




Using a suitable extractor, remove the centering bush (6) from the support fork (7) and the seal rings (8).

## STEP 6

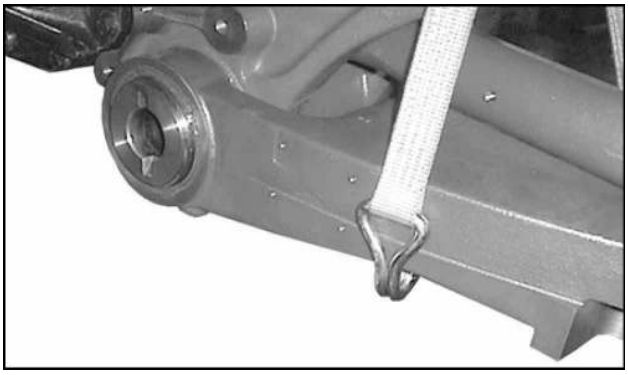



Using a suitable extractor, remove the fork pin (9).

**NOTE:** *If necessary, slightly raise the joint unit to facilitate the extraction of the pin.*

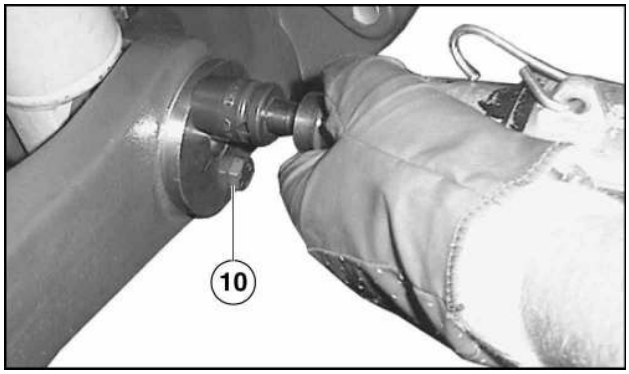
**ATTENTION:** *Check all components and replace as necessary.*

## STEP 7



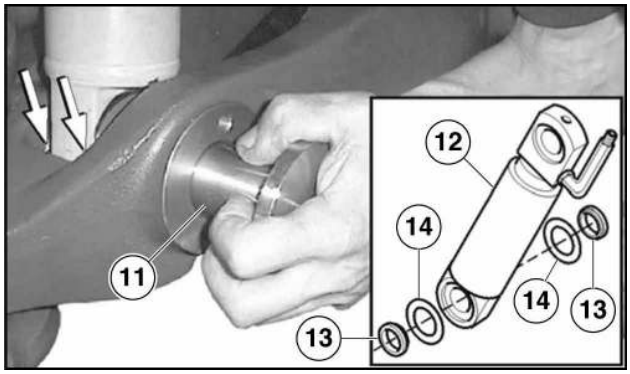
**ATTENTION:** *With a harness, attached to a hoist, secure and support the lower arm.*

## STEP 8




Unscrew and remove the two retaining bolts (10) from the suspension cylinder lower pin.

## STEP 9

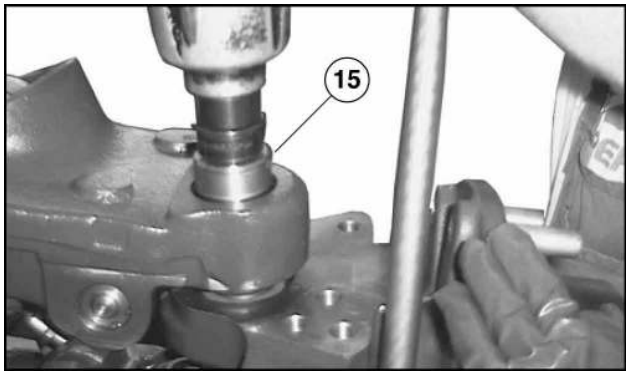



Remove the suspension cylinder lower pin (11).

**NOTE:** *If necessary, slightly raise the lower arm, to facilitate the removal of the pin.*

**ATTENTION:** *Remove the spacers (13) and belleville washers (14) from the lower part of the suspension cylinder (12).*

## STEP 10




Remove the retaining nut (15) of the upper arm on the swivel housing.

https://truckmanualshub.com/

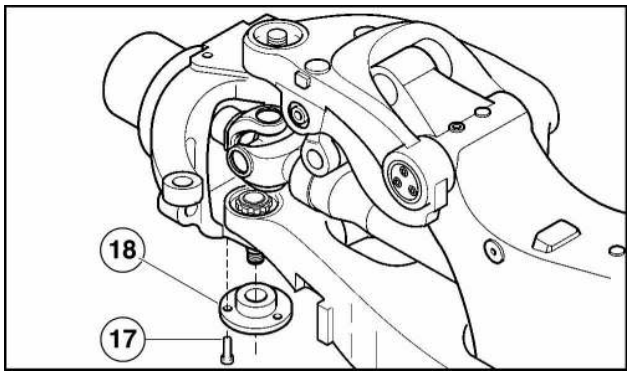


## STEP 11



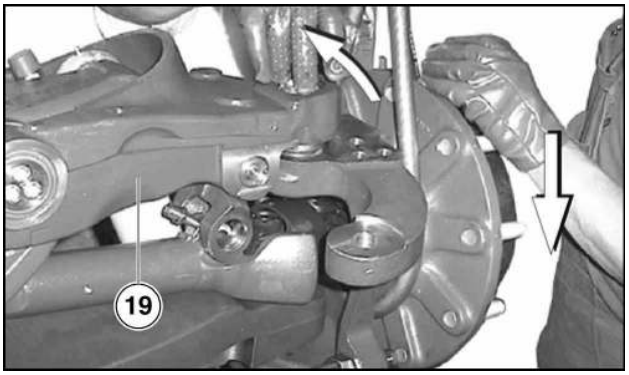

Remove the retaining nut (16) of the lower arm on the swivel housing.

## STEP 12




**NOTE:** *Before removing the swivel housing, unscrew and remove the retaining bolts (17) and the lower flange (18).*

## STEP 13

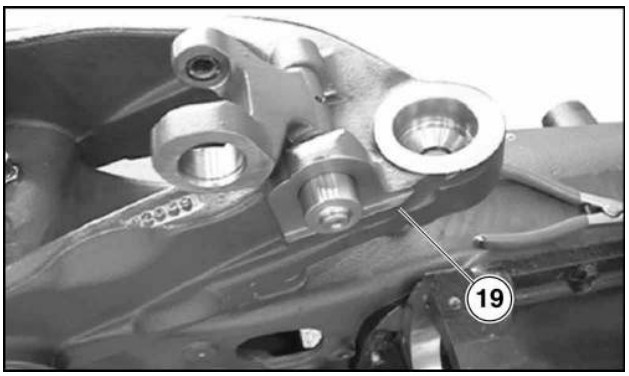



**ATTENTION:** *Be careful not to damage the thread of the ball joint.*

Lower the swivel housing slightly and slowly and at the same time rotate the upper arm (19) upwards.

**NOTE:** *It is necessary to proceed with slight vertical combined movements, trying to find the best position in order to make it easier to slide the upper arm from the ball joint.*

## STEP 14



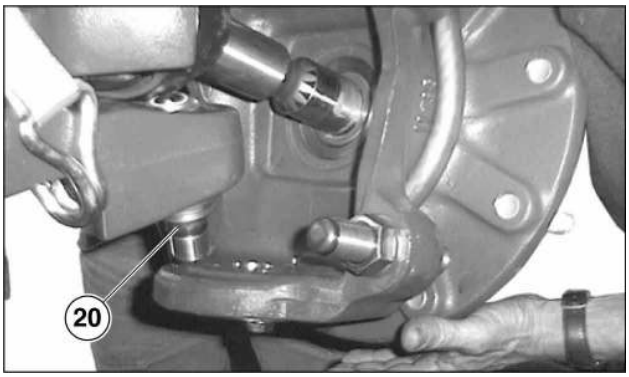

Slide the swivel housing from the upper ball joint.

Rotate the upper arm (19), and support fork, until it reaches the end of its stroke.

https://truckmanualshub.com/



## STEP 15



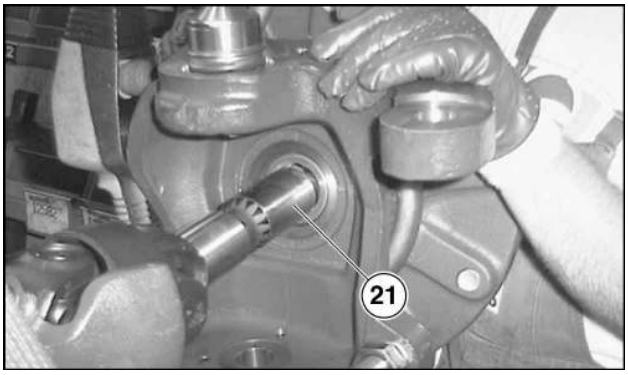

Slide the swivel housing from the lower ball joint (20).

**ATTENTION:** *Be careful not to damage the thread of the ball joint.*

Lower the swivel housing slowly, rotating its upper part slightly outwards and downwards.

**NOTE:** *It is necessary to proceed with slight combined movements, trying to find the best position in order to make it easier to slide the swivel housing from the lower arm ball joint.*

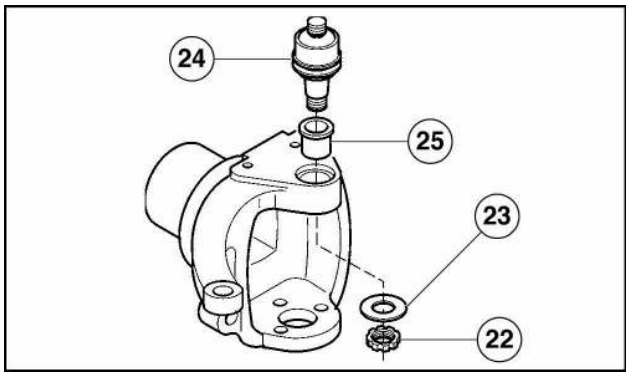
## STEP 16




Slide the swivel housing from the half-shaft (21).

**ATTENTION:** *Take care not damage the swivel housing bush and seal.*

## STEP 17

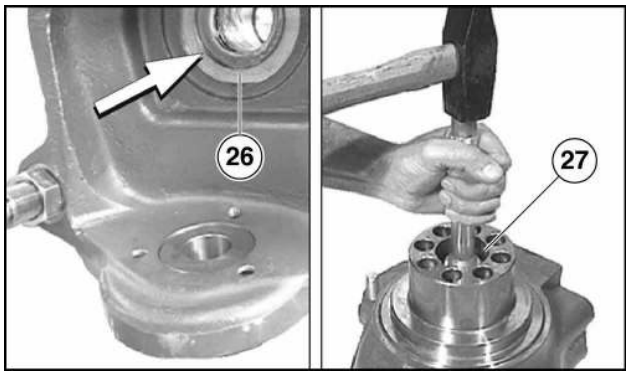



If necessary: remove the retaining nut (22) and washer (23) from the upper ball joint. Remove the upper ball joint (24).

**NOTE:** *It is not advisable to change the bush (25).*

Only if necessary, push out the bush (25) by means of a hammer and a driving tool.

## STEP 18




Position the swivel housing on a flat surface and extract the seal ring (26) using a suitable lever.

**NOTE:** *This is a destructive operation for the seal ring.*

If necessary, turn the swivel housing and remove the bushing (27) using a suitable driving tool and a hammer.

https://truckmanualshub.com/

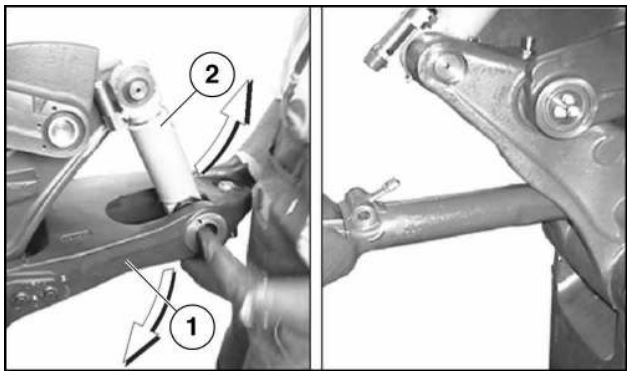


# UNIVERSAL JOINTS

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before disassembling the joints, it is necessary to remove the swivel housing unit.*

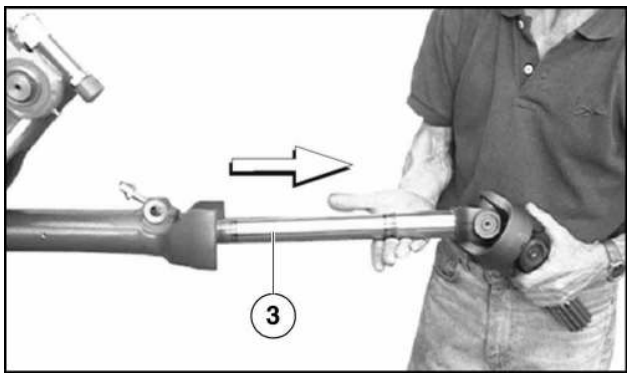
## STEP 1




Release the lower arm (1) from the support harness and rotate it downwards.

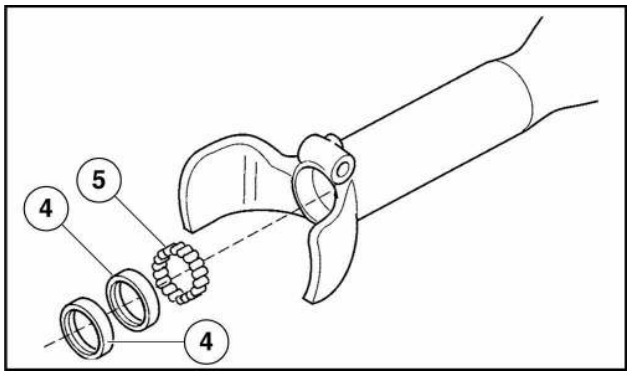
Rotate the suspension cylinder (2) upwards until it reaches the end of its stroke.

## STEP 2




Using reasonable force, remove the universal joint (3) from its housing.

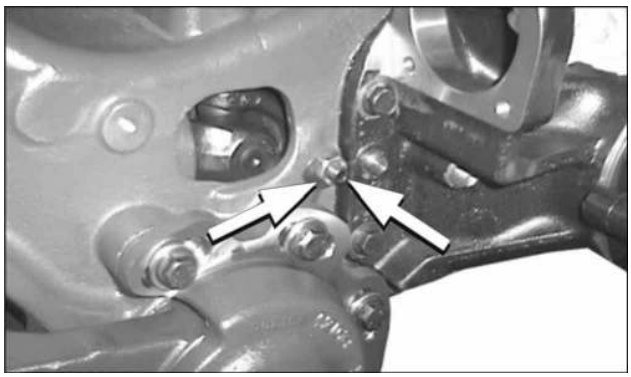
## STEP 3




Remove the two seal rings (4) and the needle bearings (5).from the universal joints housing.

**NOTE:** *This is a destructive operation for the seal rings.*

## STEP 4



Loosen the lock nut and unscrew the grub screw a few turns from the universal joint unit.

**NOTE:** *Repeat the operation on the other two grub screws positioned on the front side of the axle body.*

https://truckmanualshub.com/

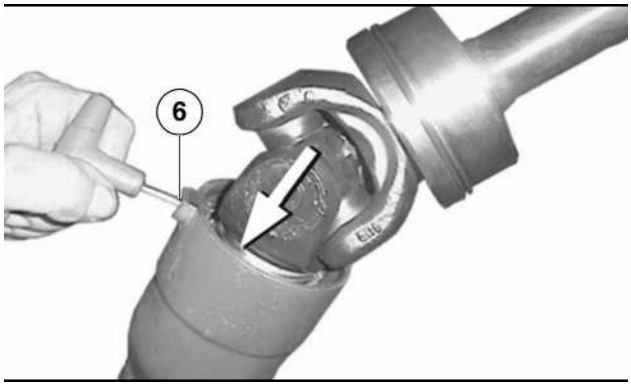


## STEP 5



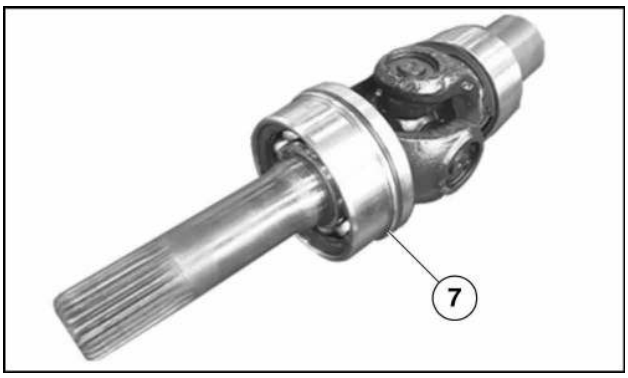
Using reasonable force, remove the universal joint housing and inner universal joint from the differential unit.

## STEP 6




If necessary, remove the inner components. Loosen the grub screw (6) a few turns.
Remove the snap ring positioned on the inner side of the universal joint (as shown).

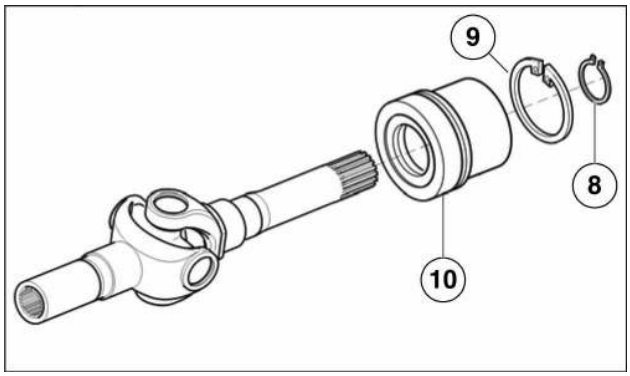
## STEP 7




Slide the universal joint complete with bearing and seal rings from the universal joint housing.

Remove and discard the O-Ring (7).

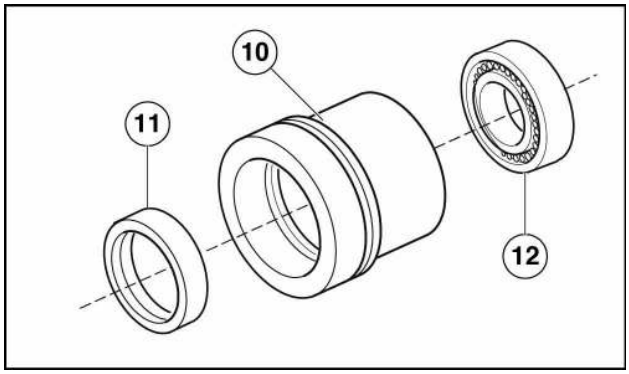
## STEP 8




Remove the two snap rings (8) and (9) from the half-shaft, on the differential side of the universal joint.

Using a standard extractor, extract the centering bush (10) with bearing and seal ring.

## STEP 9




Remove the seal ring (11) from the centering bush.

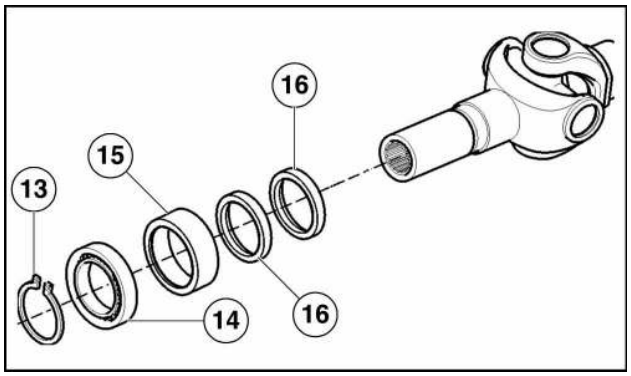
**NOTE:** *This is a destructive operation for the seal ring.*

Remove the bearing (12) from the centering bush with a suitable driving tool.

https://truckmanualshub.com/



## STEP 10




Remove the snap ring (13) from the half-shaft, on the wheel side of the universal joint.

Using a standard extractor, extract the bearing (14) bush (15) and the two seal rings (16).

**NOTE:** *This is a destructive operation for the seal rings.*

https://truckmanualshub.com/

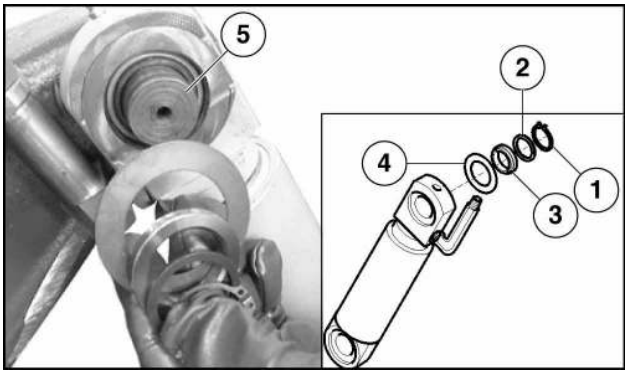


# SUSPENSION CYLINDER

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before disassembling the suspension cylinder, it is necessary to remove the swivel housing unit.*

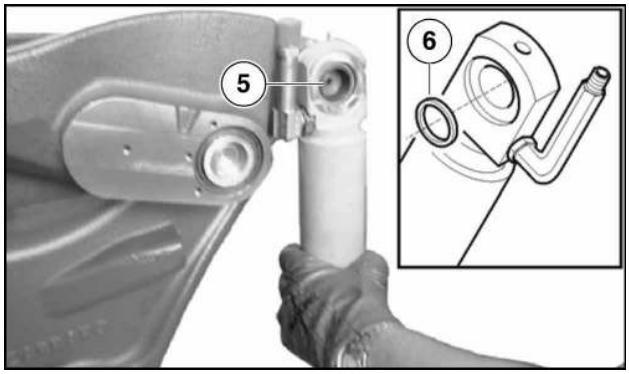
## STEP 1




Remove the snap ring (1) on the upper part of suspension cylinder.

Remove the washer (2), spacer (3) and belleville washer (4) from the upper fixing pin (5).

## STEP 2




Slide the suspension cylinder from the upper fixing pin (5) and the inner spacer (6).

https://truckmanualshub.com/

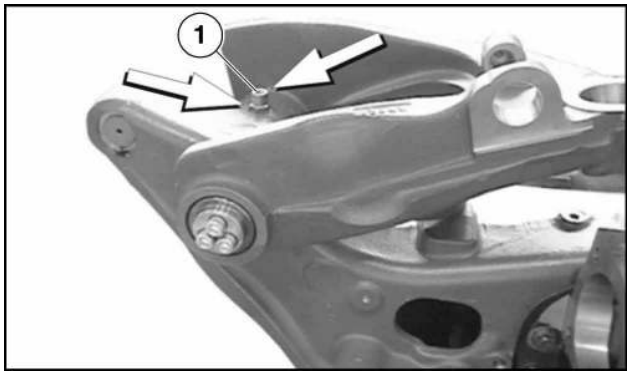


# UPPER ARM

Some of the following pictures may not show your axle, but the procedure is the same.

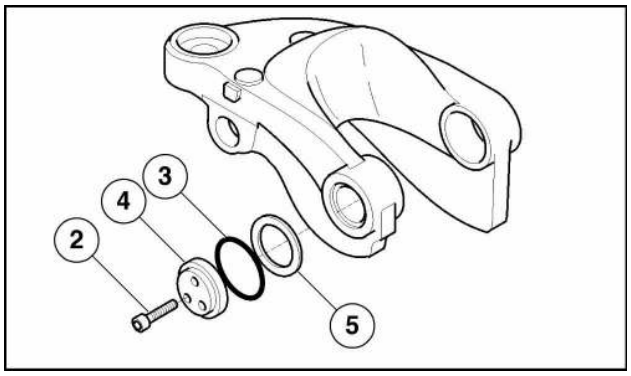
**NOTE:** *Before disassembling the upper arm, it is necessary to remove the sensor kit and the swivel housing unit.*

## STEP 1



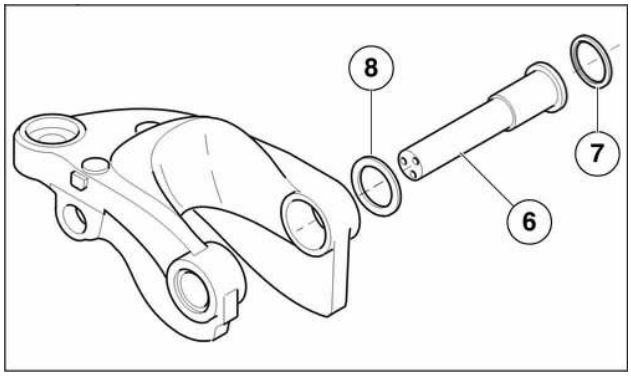

Loosen the locking nut and unscrew the retaining bolt (1).

## STEP 2




Remove the three retaining bolts (2) flange (4) and lower thrust washer (5). Remove and discard the O-Ring (3) from the flange (4).

## STEP 3



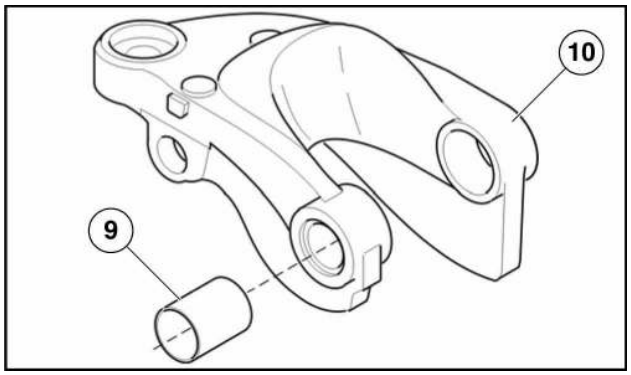

Push out the upper arm retaining pin (6) using a suitable driving tool.

**ATTENTION:** *Before removing the retaining pin, support the upper arm with a harness.*

Remove the O-Ring (7) and thrust washer (8) from the retaining pin (6).

**NOTE:** *This is a destructive operation for the O-Ring.*

## STEP 4

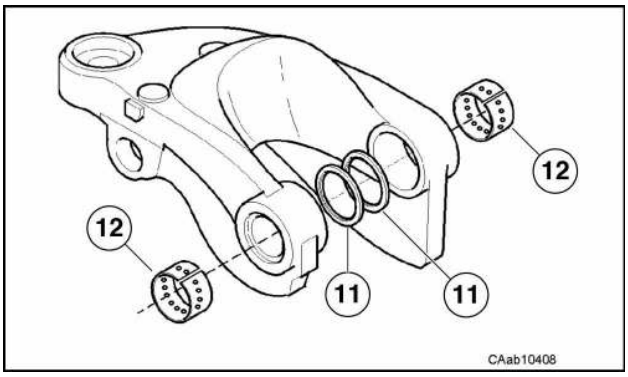



Slide the bush (9) from the pin seat and remove the upper arm (10).

https://truckmanualshub.com/



## STEP 5

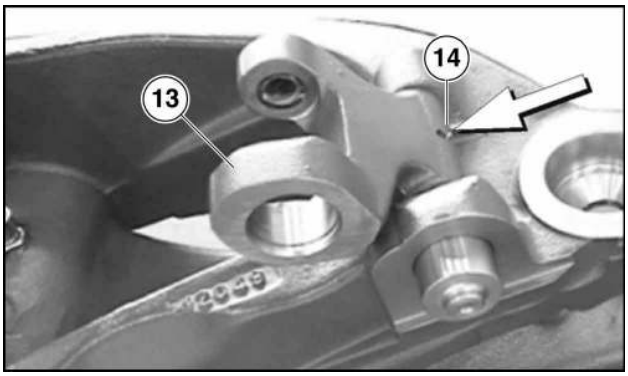



Position the upper arm on a work surface and remove the two seal rings (11).

**NOTE:** *This is a destructive operation for the seal rings.*

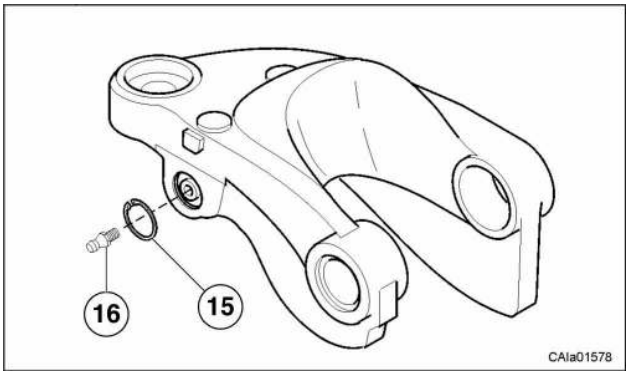
If necessary, push out the two bushes (12) using a suitable driving tool.

## STEP 6



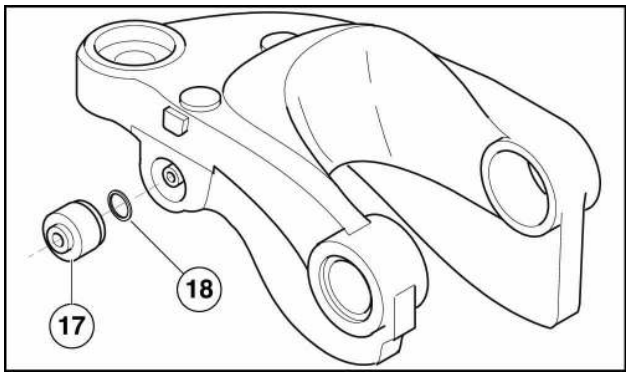

If necessary, remove the universal joint support fork (13). Remove the roll pin (14) with a suitable punch.

## STEP 7




Remove the snap ring (15). Unscrew and remove the greaser nipple (16) from the centering bush.

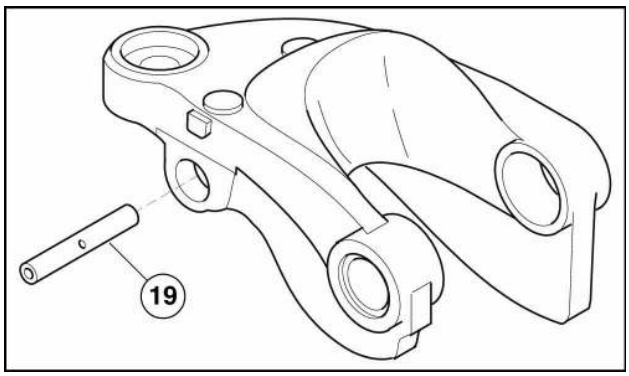
## STEP 8




Remove the centering bush (17) and seal ring (18) from the upper arm using a suitable extractor.

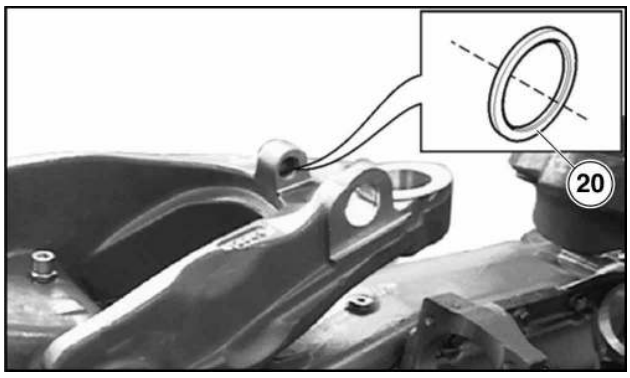
**NOTE:** *This is a destructive operation for the seal ring.*

## STEP 9




Using a suitable extractor remove the support fork retaining pin (19).

## STEP 10



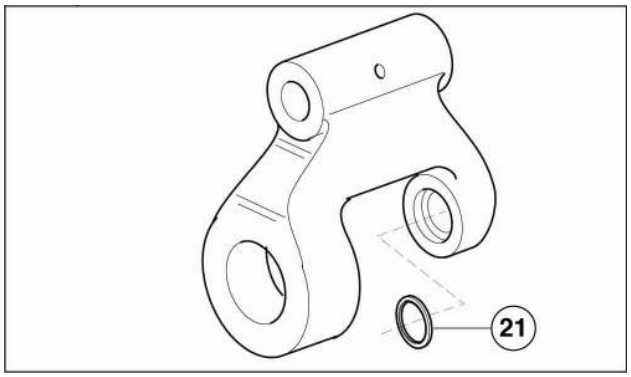

If necessary, remove the seal ring (20) from the upper arm.

**NOTE:** *This is a destructive operation for the seal ring.*

https://truckmanualshub.com/



## STEP 11




If necessary, remove the seal ring (21) from the support fork.

**NOTE:** *This is a destructive operation for the seal ring.*

https://truckmanualshub.com/

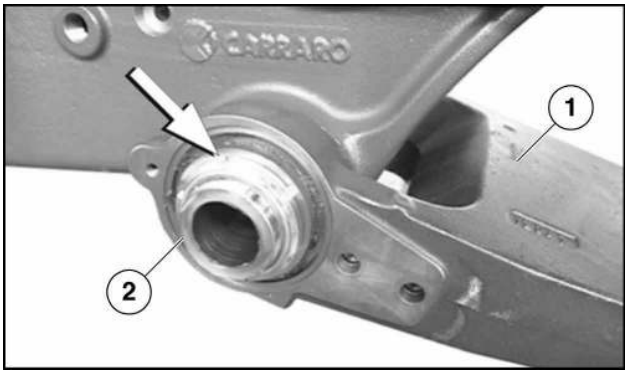


# LOWER ARM

Some of the following pictures may not show your axle, but the procedure is the same.

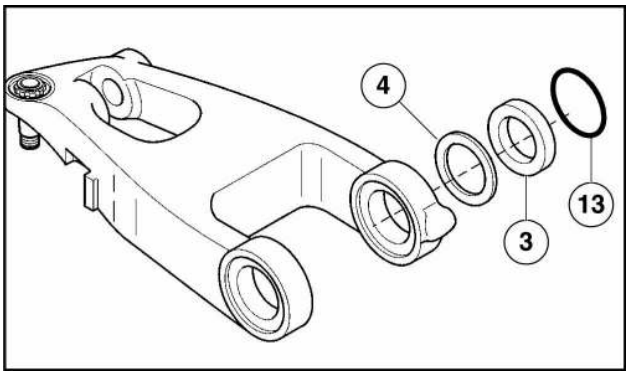
**NOTE:** *Before disassembling the lower arm, it is necessary to remove the swivel housing unit.*

## STEP 1



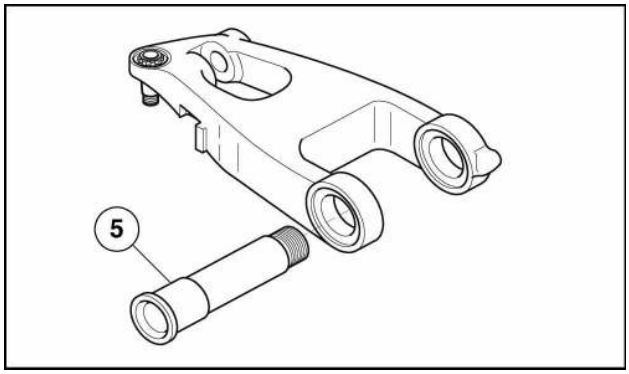

Before removal, support the lower arm (1) using a suitable harness and hoist. Remove the locking nut (2) using special tools CA715330 and CA715336,

## STEP 2



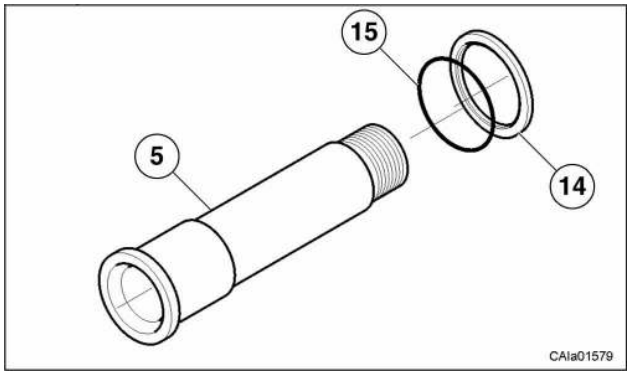

Remove thrust washer (3), thrust ring (4) and O-Ring (13).

## STEP 3




Push out the lower arm retaining pin (5) using a suitable driving tool.

## STEP 4

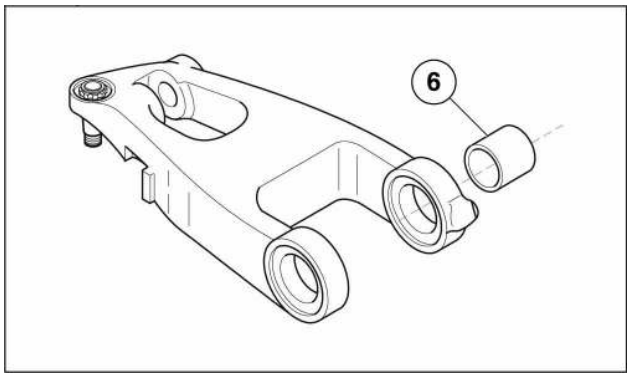



Remove thrust washer (14) and O-Ring (15).

https://truckmanualshub.com/

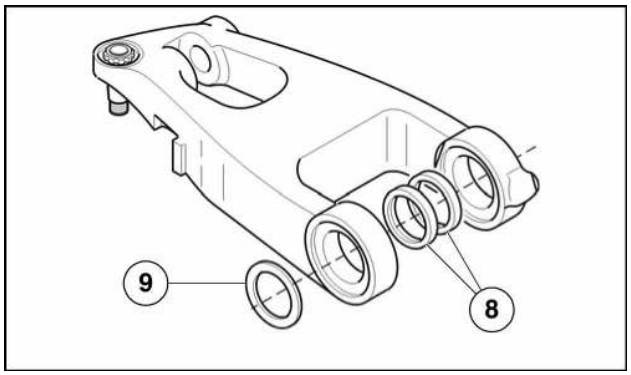


## STEP 5




Slide out bush (6) and remove the lower arm from the central axle body.

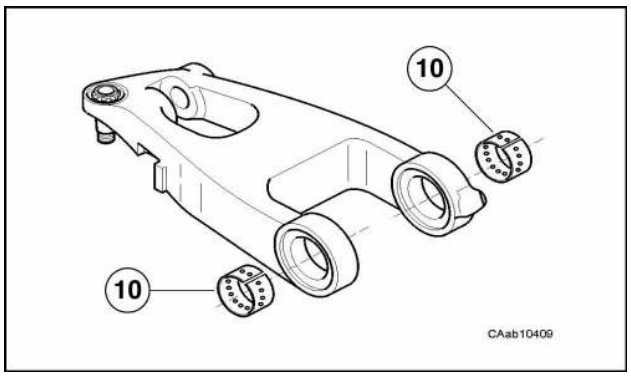
## STEP 6




Position the lower arm on a work surface and remove the seal rings (8) and the shim ring (9).

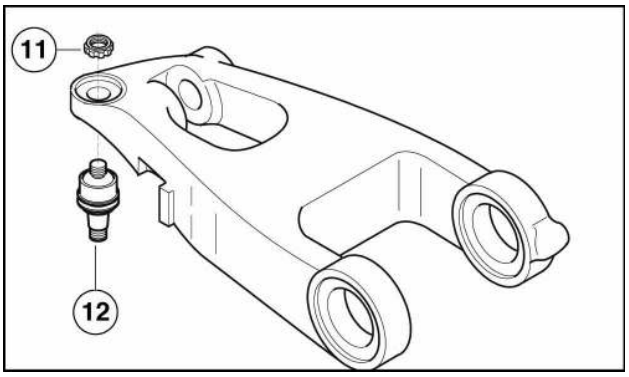
**NOTE:** *This is a destructive operation for the seal rings.*

## STEP 7




If necessary, extract the two bushes (10) from the lower arm using a suitable driving tool.

## STEP 8




Remove the retaining nut (11) from the lower ball joint. Slide the ball joint (12) from the lower arm.

https://truckmanualshub.com/

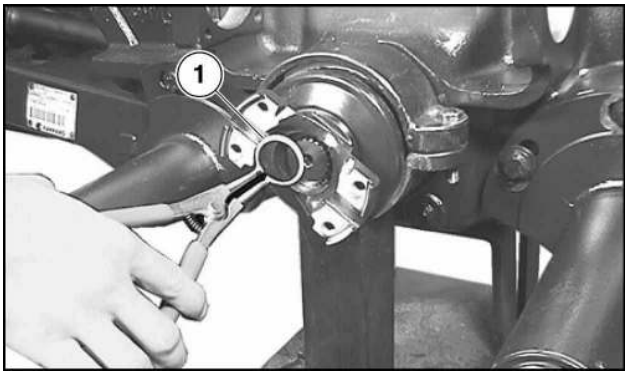


# DIFFERENTIAL SUPPORT UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

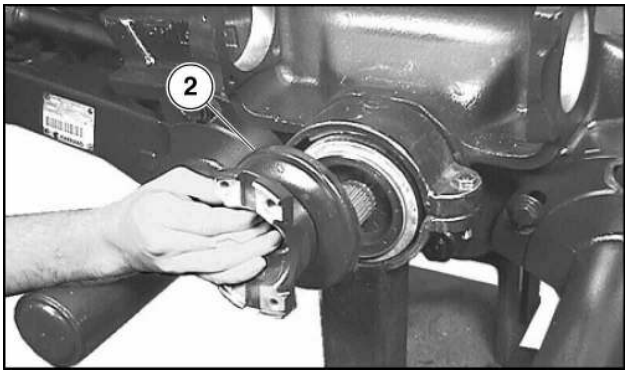
**NOTE:** *Before disassembling the differential support unit, it is necessary to remove both universal joint units.*

## STEP 1



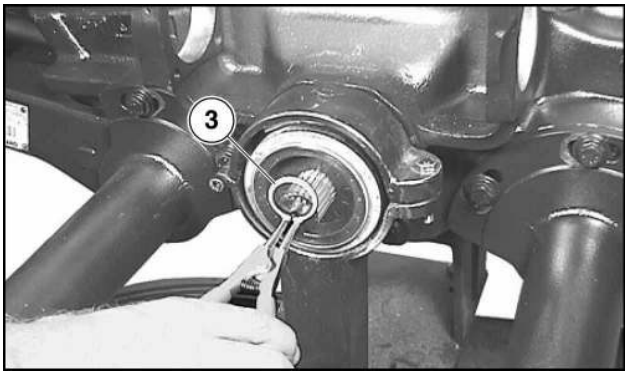

Remove the snap ring (1).

## STEP 2




Remove the flange (2).

## STEP 3




Remove the snap ring (3).

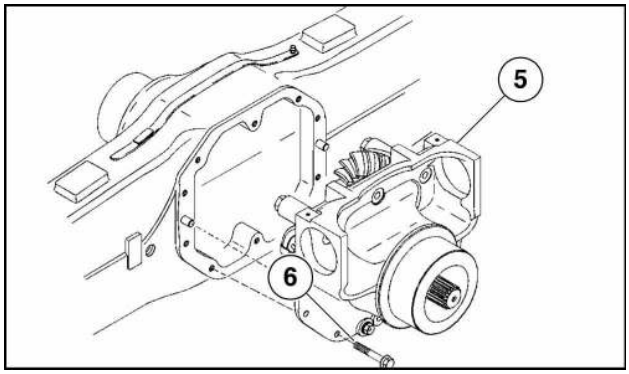
## STEP 4




Remove the seal ring (4) with a suitable lever.

**NOTE:** *This is a destructive operation for the seal.*

## STEP 5



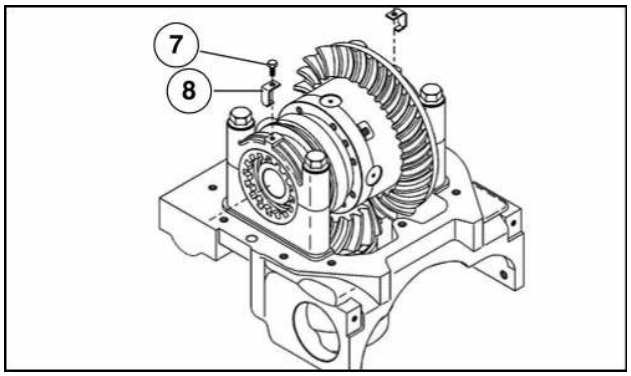

**ATTENTION:** *Before disassembly, support the differential carrier (5) with a suitable harness and hoist.*

Remove the retaining bolts (6) and the differential carrier (5).

https://truckmanualshub.com/

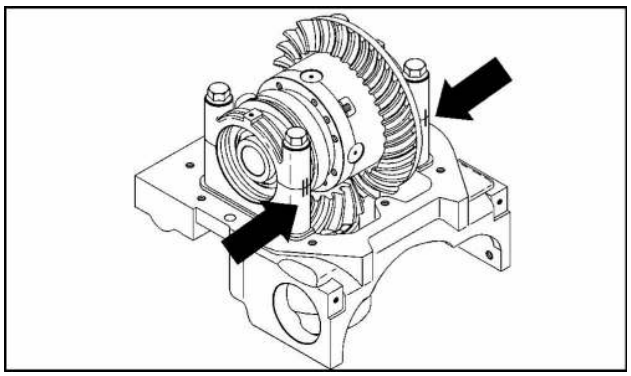


**STEP 6**



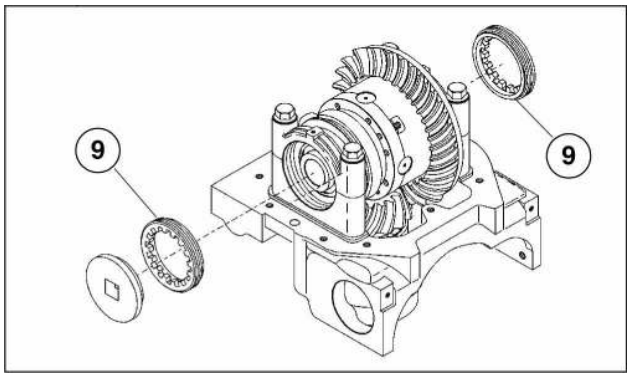

Remove bolts (7) and locking clamps (8).

**STEP 7**



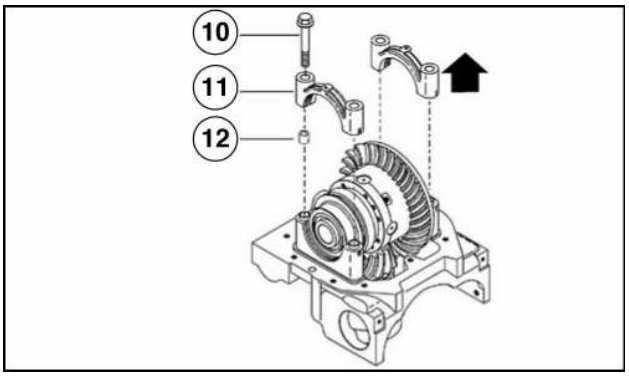
Before removing the bearing cap bolts, mark the bearing caps and the differential *carrier* with permanent reference marks to avoid incorrect replacement.

**STEP 8**




Remove the left and right adjuster rings nuts (9) using special tool CA119030.

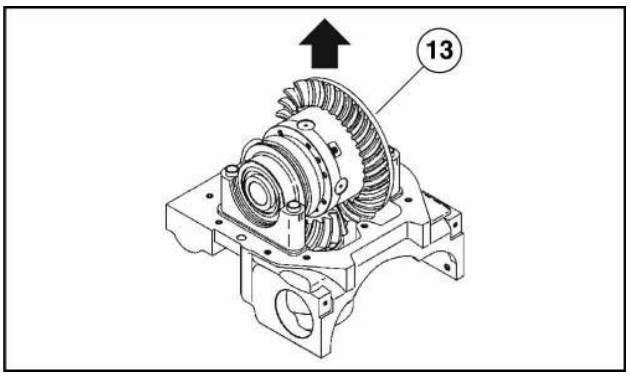
**STEP 9**




Remove the bearing cap retaining bolts (10), bearing caps (11) and locating dowels (12).

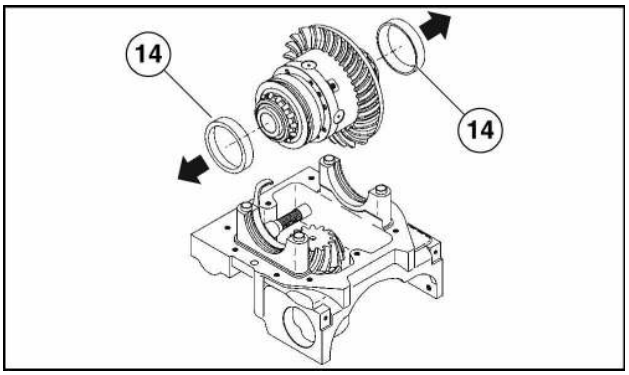
**NOTE:** *Mark the differential unit and carrier, to avoid incorrect assembly.*

**STEP 10**




Remove the differential unit (13).

**STEP 11**




**ATTENTION:** *Do not mismatch the bearing cups (14) if they are not to be replaced.*

https://truckmanualshub.com/

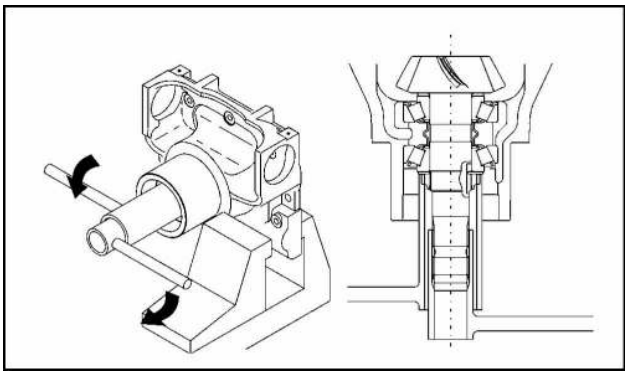


# PINION UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before disassembling the pinion unit, it is necessary to remove the differential support unit.*

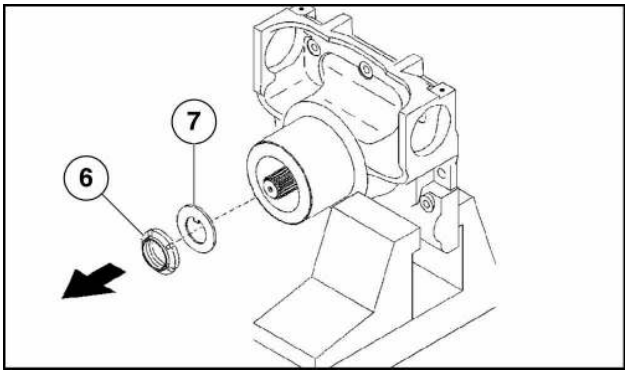
## STEP 1



Remove the ring nut using special tools CA119099 and CA715022.

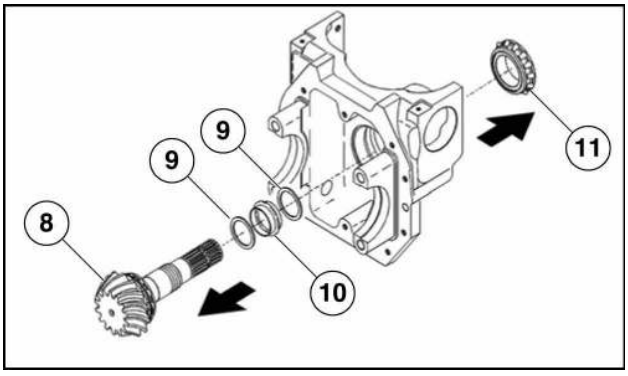
**NOTE:** *This is a destructive operation for the ring nut.*

## STEP 2



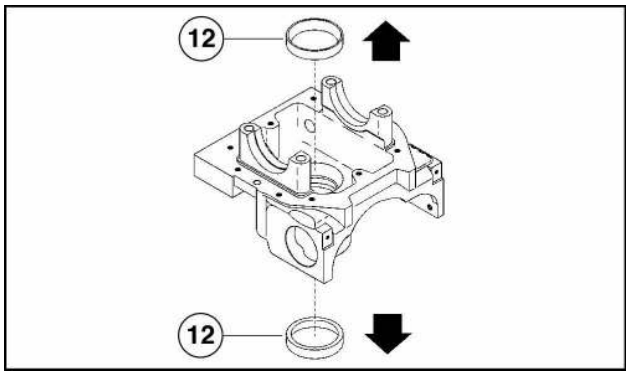

Remove ring nut (6) and locking washer (7).

## STEP 3



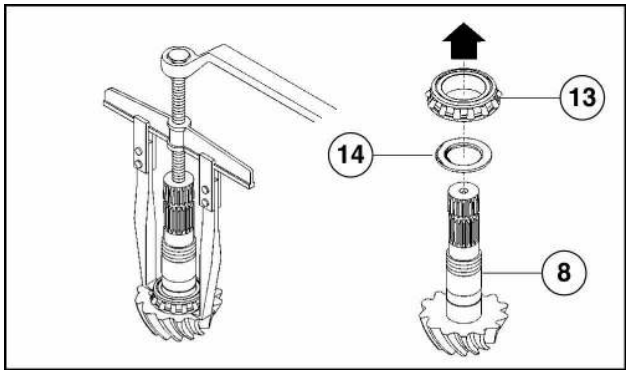

Tap the pinion shaft (8) with a soft hammer to remove. Remove washers (9), collapsible spacer (10) and the inner bearing cone (11).

## STEP 4




Place the differential carrier (1) on a flat surface and remove the outer bearing cups (12) using a hammer and suitable driving tool.

## STEP 5




Remove the inner bearing cone (13) from the pinion Shaft (8), using a suitable extractor. Remove the underlying shim (14).

## STEP 6



Check all pinion components for wear.

https://truckmanualshub.com/

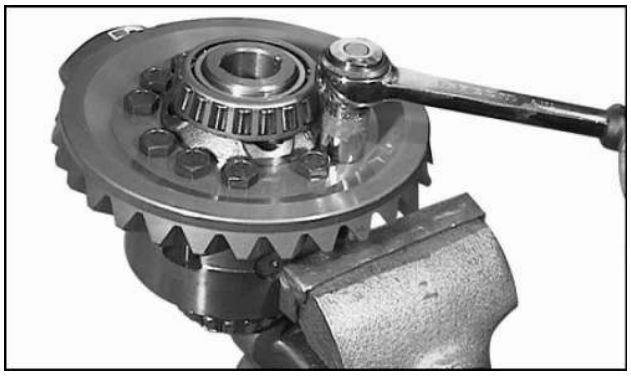


# DIFFERENTIAL UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

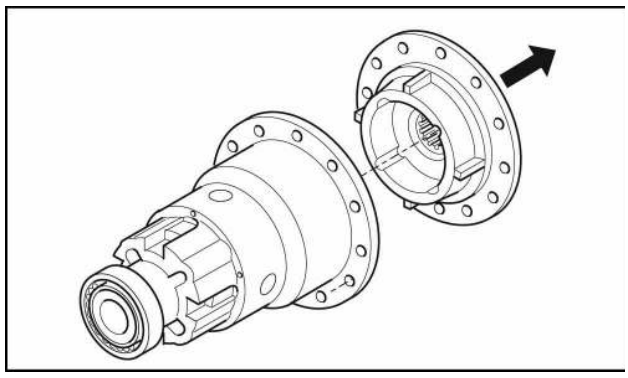
**NOTE:** *Before disassembling the differential unit, it is necessary to remove the differential support unit.*

## STEP 1



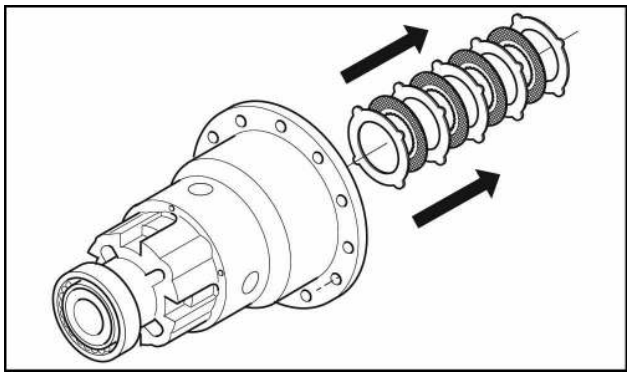
Secure the differential unit in a soft jaw vice. Remove the crown wheel retaining bolts and the crown wheel.

## STEP 2



Remove the cover from the differential housing.

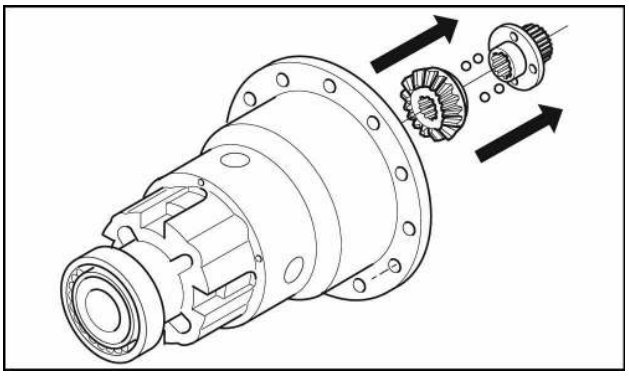
## STEP 3



**NOTE:** *Keep all components in order, if not being replaced*

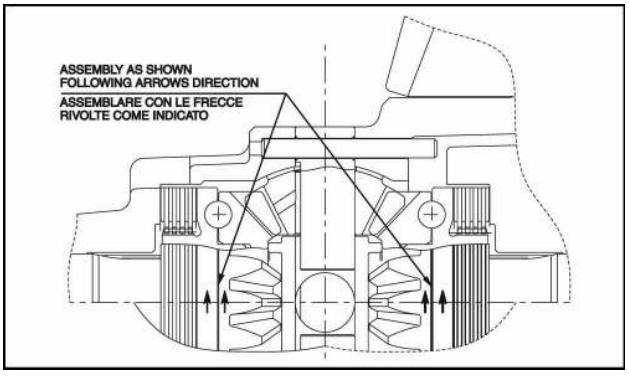
Remove the right hand side friction plates and separator plates.

## STEP 4



Carefully remove the right hand hub and side gear as an assembly. Put alignment marks on the side gear and hub. Separate side gear and hub. Remove the balls.

## STEP 5

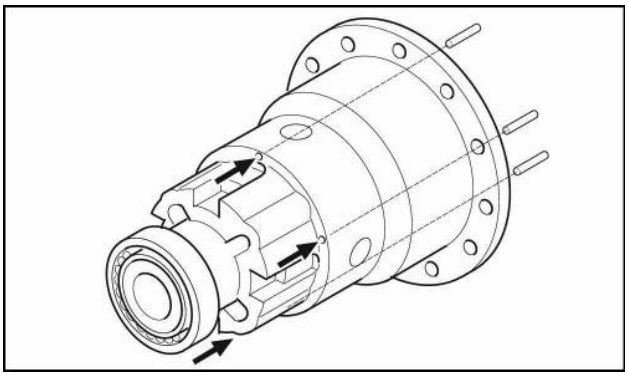



**ATTENTION:** *The two components of the left and right planetary are a matched set and must be assembled as shown.*

https://truckmanualshub.com/

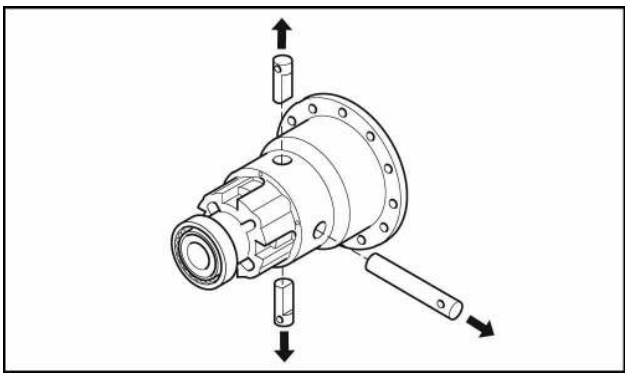


### STEP 6



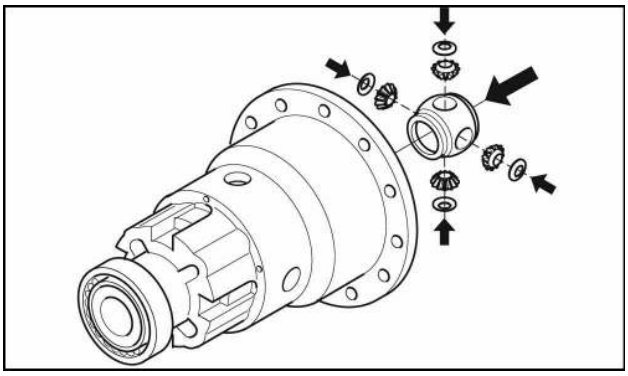
Using a suitable punch, push out the three locking pins.

### STEP 7



Remove the three planetary pins from the differential unit.

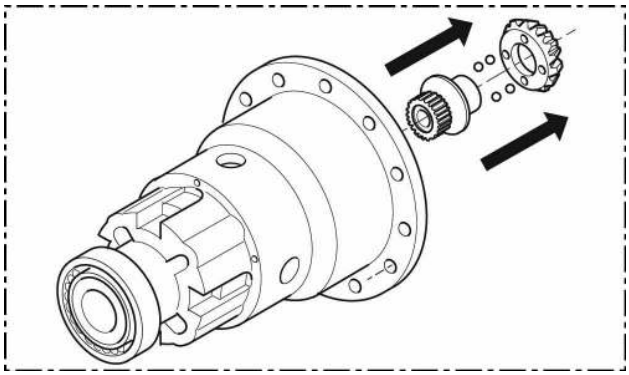
### STEP 8



**NOTE:** *Keep the components in order to facilitate assembly.*

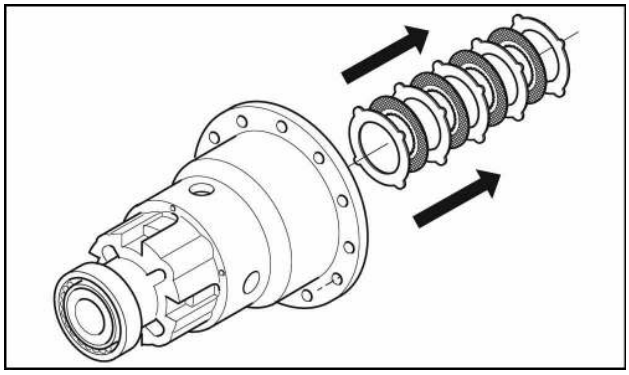
Disassemble all the components (washers, planetary gears and spider).

### STEP 9



Carefully remove the left hand hub and side gear as an assembly. Put alignment marks on the side gear and hub. Separate side gear and hub. Remove the balls.

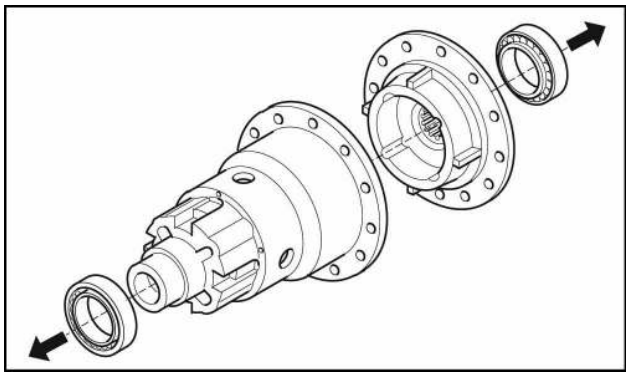
### STEP 10



**NOTE:** *Keep all components in order, if not being replaced*

Remove the left hand side friction plates and separator plates.

### STEP 11



Using a suitable extractor, remove the bearings from the differential housing and cover.

https://truckmanualshub.com/



# ASSEMBLY OPERATIONS

https://truckmanualshub.com/

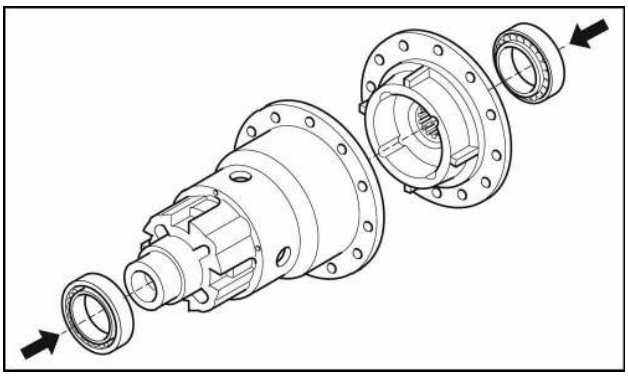


# DIFFERENTIAL UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

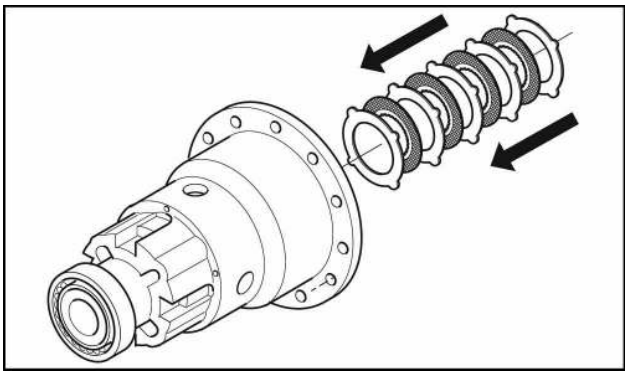
Before assembly, check the condition of all components and replace as necessary.

## STEP 1



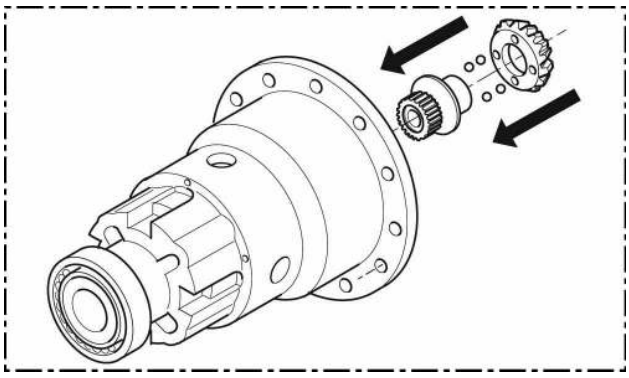
Assemble the bearing cones on the differential housing and cover, using special tool CA715093 and a hammer.

## STEP 2



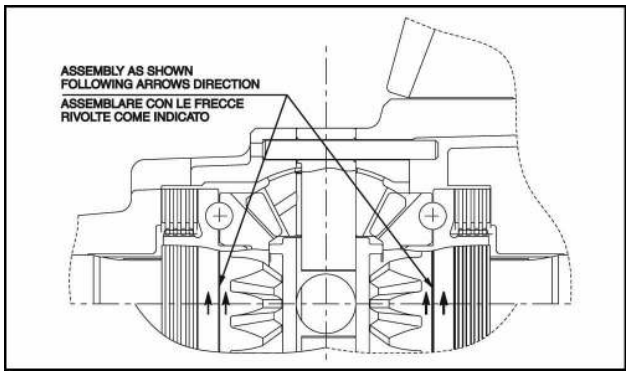
Install one separator plate and one friction plate into differential housing. Continue to install one separator plate and one friction plate until a total of 5 separator plates and 4 friction plates have been installed. The last plate installed must be a separator plate.

## STEP 3



Install balls into the left hub, align the marks on side gear and hub. Make sure the arrows etched on side gear and hub are facing in the direction shown in STEP 4. Install hub and side gear as an assembly, make sure the splines of the hub are correctly located into separator plates and friction plates. Install thrust washer.

## STEP 4

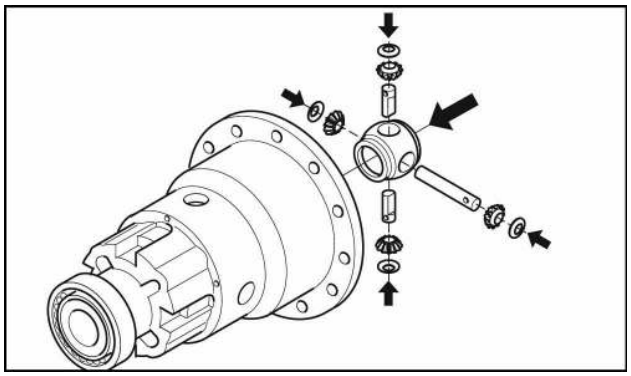



**ATTENTION:** *The two components of the left and right planetary are a matched set and must be assembled as shown.*

https://truckmanualshub.com/

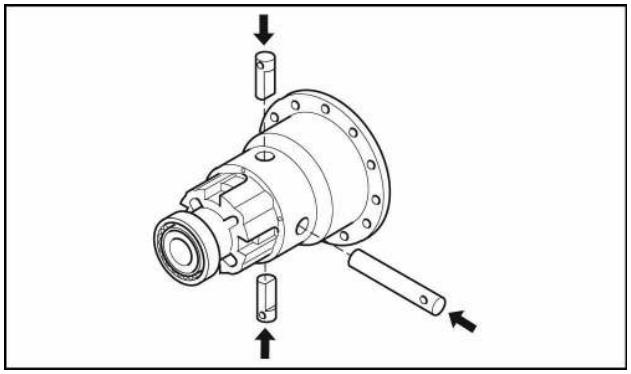


**STEP 5**



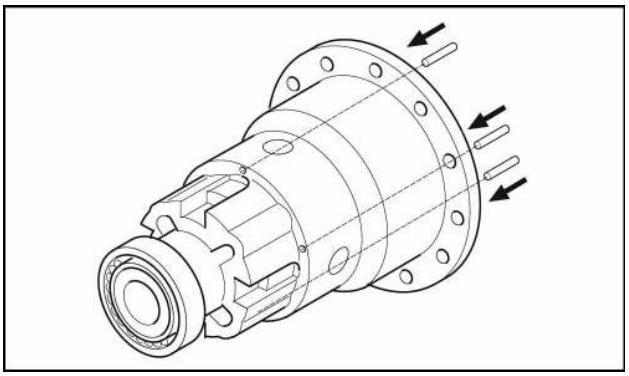
Install the spider, washers and planetary gears.

**STEP 6**



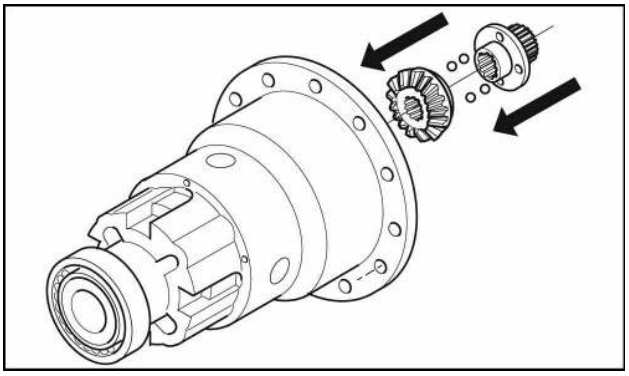
Install the long planetary pin, through the planetary gears, thrust washers and spider. Install the two short pins in the same way.

**STEP 7**



Rotate the planetary pins to align the locking pin holes with the corresponding holes in the housing. Install the three locking pins.

**STEP 8**

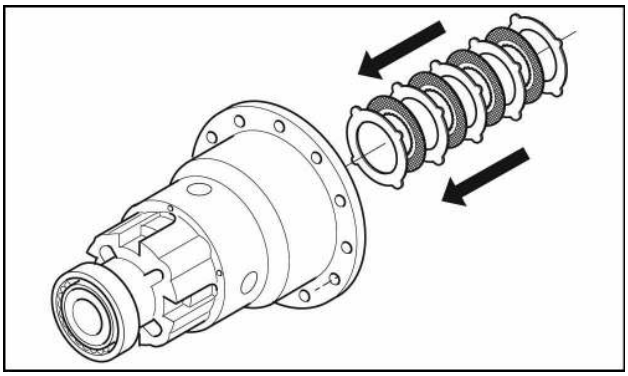


Install balls into the right hub, align the marks on side gear and hub. Make sure the arrows etched on side gear and hub are facing in the direction shown in STEP 4. Install hub and side gear as an assembly.

https://truckmanualshub.com/

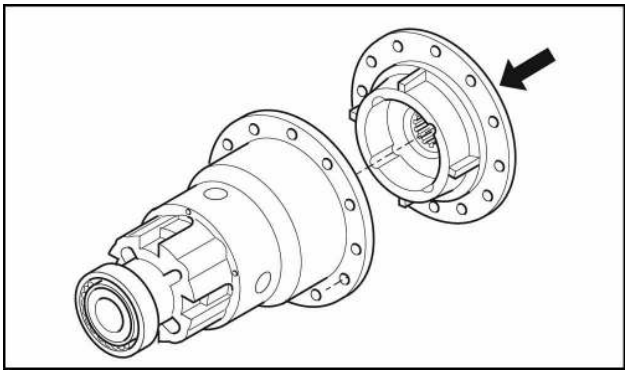


**STEP 9**



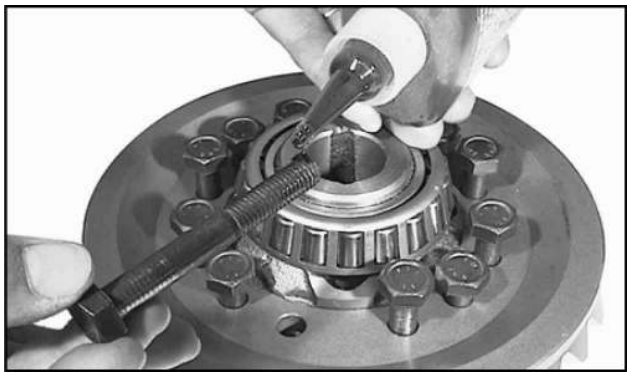
Install one separator plate and one friction plate into differential housing. Continue to install one separator plate and one friction plate until a total of 5 separator plates and 4 friction plates have been installed. The last plate installed must be a separator plate.

**STEP 10**



Install the cover onto the differential housing.

**STEP 11**



Install the crown wheel onto the differential housing. Install the retaining bolts with Loctite 270 and tighten to a torque of 70 Nm (51 lb ft).

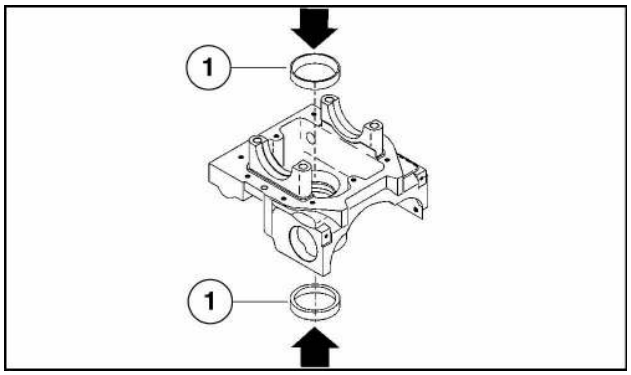
https://truckmanualshub.com/



# PINION UNIT ASSEMBLY

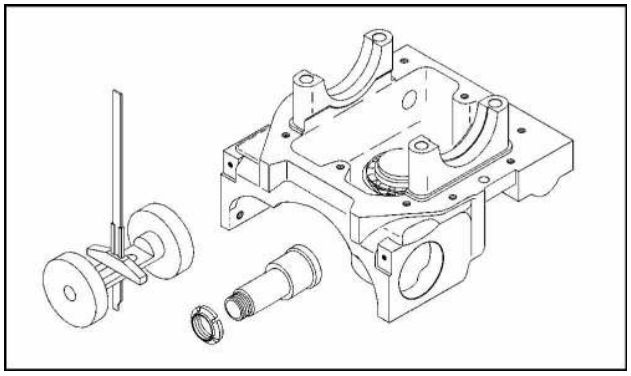
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



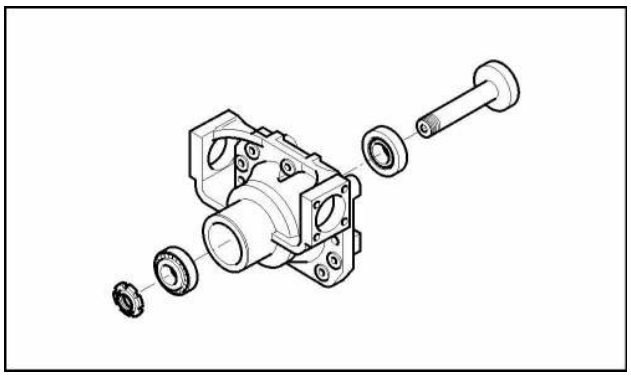

Place the differential carrier on a workbench. Fit the bearing cups (1) using special tools CA119225, CA715092 and a hammer.

## STEP 2



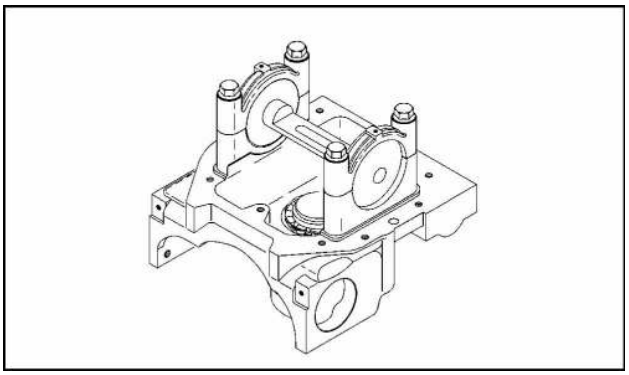
Prepare the “false pinion” CA119202, “false differential box” CA119182 and CA119228. A depth gauge is also required for this procedure.

## STEP 3



Install the bearing cones into the differential carrier with the “false pinion” and its ring nut. Tighten the ring nut, until the backlash is eliminated.

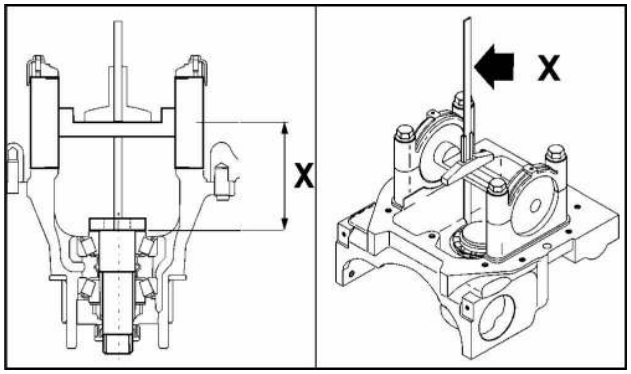
## STEP 4



Install the “false differential box” CA119182, CA119228 and the bearing caps. Install the retaining bolts and tighten evenly to a torque of 266 Nm (196 lb ft).

**NOTE:** *Make sure the identification marks made during disassembly are correctly aligned.*

## STEP 5

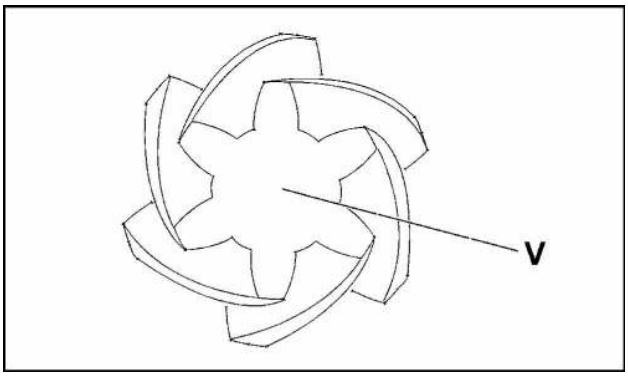



Use a depth gauge to measure distance “X” (distance between the axis of the differential bearings and the point at which the pinion head is supported, or base of the bearing).

https://truckmanualshub.com/



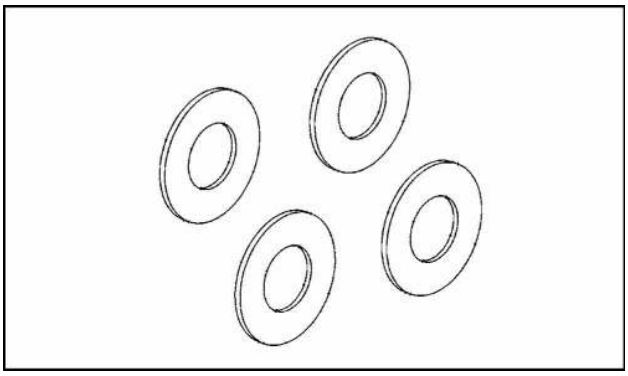
## STEP 6




To determine the correct shim pack thickness (S) to be installed between the pinion and bearing, subtract value (V) stamped on the pinion head (V = requested distance) from the measured distance (X).

**S (Shim Thickness) = X - V**

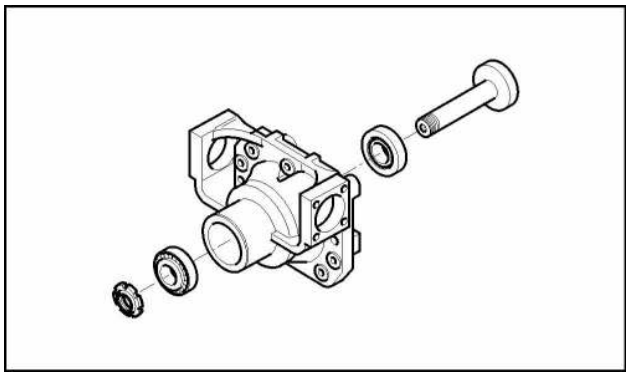
## STEP 7



| Shim Range S | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 |

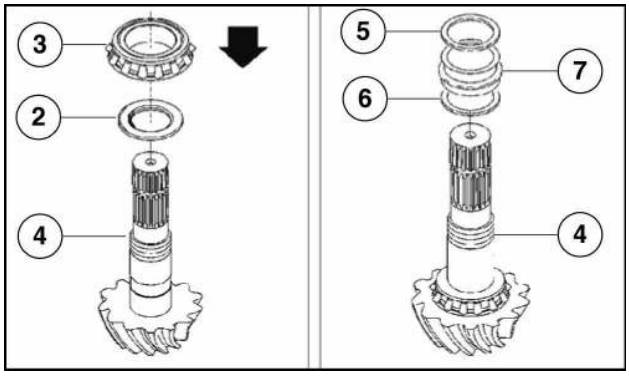
**IMPORTANT:** *There must always be minimum shim thickness of 2.5 mm. If the calculated shim thickness (S) is less than 2.5 mm, repeat STEP 1 to STEP 6. If the calculated shim thickness (S) is still less than 2.5 mm it may be necessary to replace bearings (3) and (9) and cups (1).*

## STEP 8



Remove the “false differential box” special tool from the differential carrier. Remove the ring nut, “false pinion” and the bearing cones.

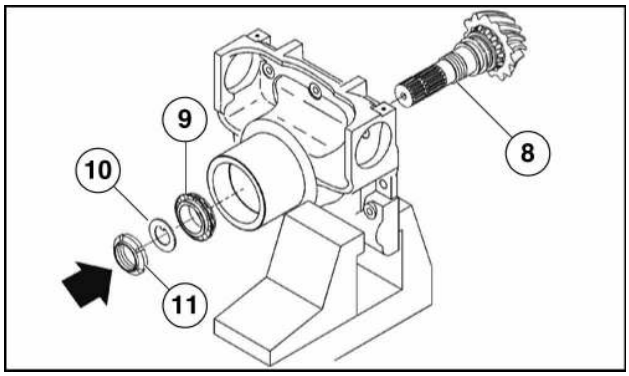
## STEP 9




Install the chosen shim (2) with the chamfer against the gear onto the pinion shaft (4). Using a suitable press and special tool CA715004 Install the bearing (3) onto the pinion shaft (4) making sure that it is well seated. Install shims (5), (6) and a new collapsible spacer (7).

**NOTE:** *Always use a new collapsible spacer (7).*

## STEP 10

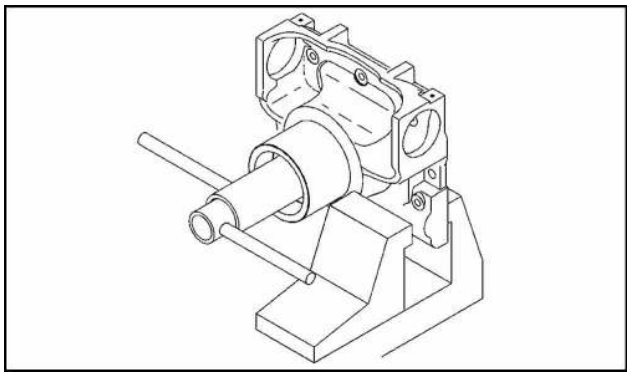



Install the pinion shaft (8) into the differential carrier and the bearing cone (9) onto the pinion shaft using special tool CA715004 and a hammer. Install washer (10) and ring nut (11) onto the pinion shaft.

https://truckmanualshub.com/



## STEP 11



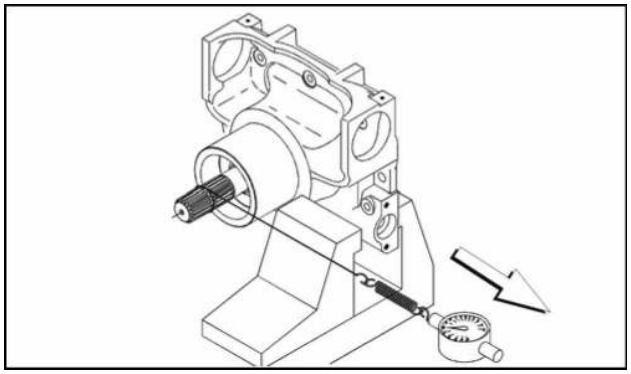
Use wrench CA119099 and pinion retainer CA715022 to tighten the ring nut.

**ATTENTION:** *The torque setting is determined by the preload measurement on the bearings.*

Tighten the ring nut gradually and slightly tap both pinion ends with a soft hammer, to seat the bearings.

**NOTE:** *If the collapsible spacer is over tightened, it must be replaced and the procedure repeated.*

## STEP 12

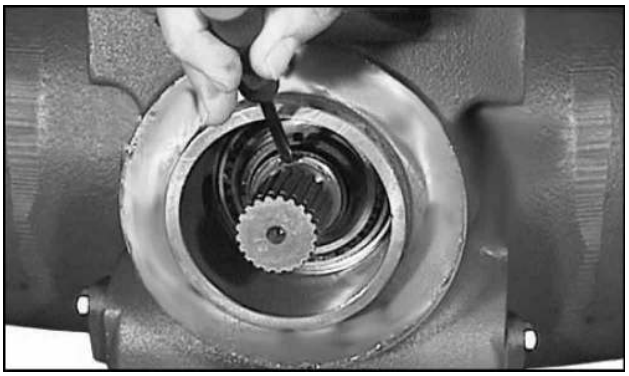


To carry out the preloading measurement of the pinion shaft roller bearings, attach a length of cord to pinion shaft, wrap the cord around the pinion shaft without overlapping. Attach a spring balance to the end of the cord and check the pinion shaft rolling pull. The correct rolling pull must be 92.7 to 150.7 N (21to 34 lb/f).

The adjustment is carried out by increasing the ring nut torque gradually, taking care not to exceed the required rolling pull.

**ATTENTION:** *All preloadings must be measured without the seal ring.*

## STEP 13



Once the requested preloading value is achieved, lock the ring nut into the groove on the pinion shaft using a hammer and a suitable drift.

https://truckmanualshub.com/

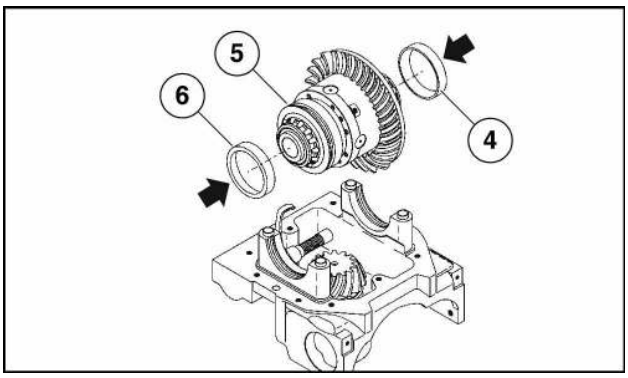


# DIFFERENTIAL UNIT SUPPORT

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before assembling the differential support unit, it is necessary to assemble the pinion unit.*

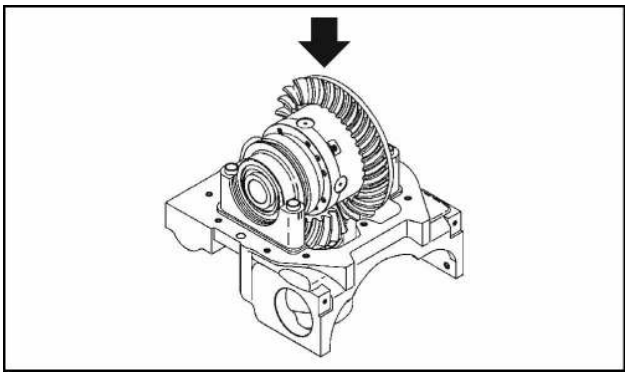
## STEP 1




Install the bearing cups on the differential unit.

**ATTENTION:** *Do not mismatch the bearing cups if the bearings are not replaced.*

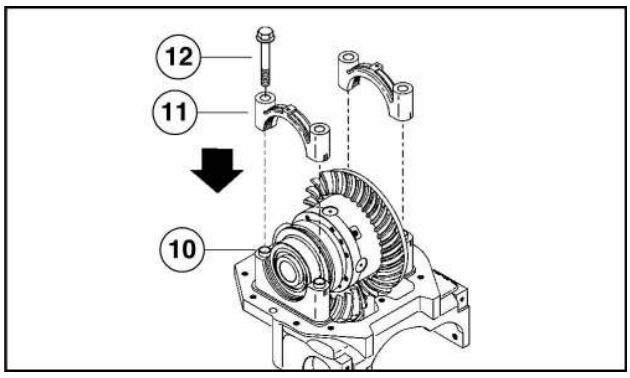
## STEP 2



Position the differential unit, with the bearing cups on to the differential carrier.

**ATTENTION:** *Using the marks made during disassembly. Make sure the differential unit is positioned correctly.*

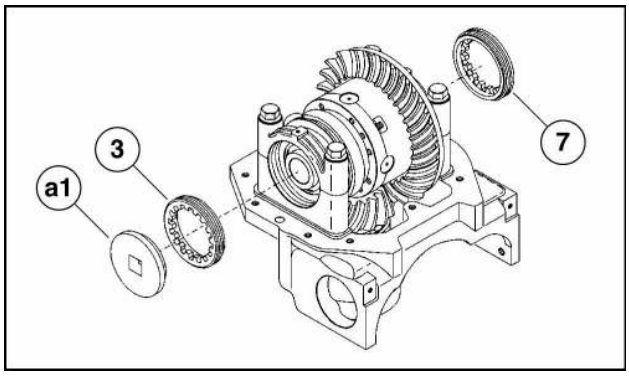
## STEP 3




Install bushes (10) and bearing caps (11) with the identification marks aligned.

Install retaining bolts (12) and tighten by hand.

## STEP 4

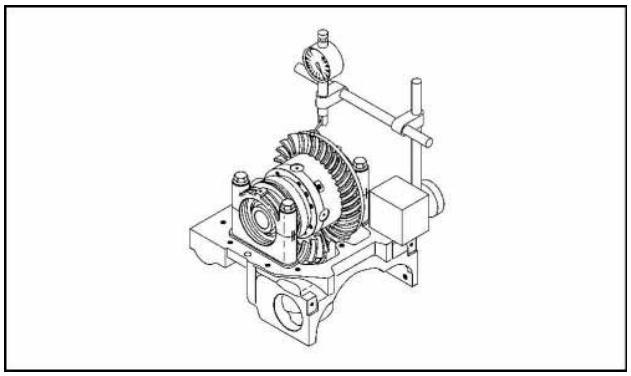



Install ring nuts (3) and (7) to the differential carrier. Tighten both ring nuts (3) and (7) with special tools CA119030 (a1), till the backlash is eliminated and the differential bearings are slightly preloaded. Check that the differential bearings are well seated; if necessary, knock slightly with a soft hammer.

https://truckmanualshub.com/

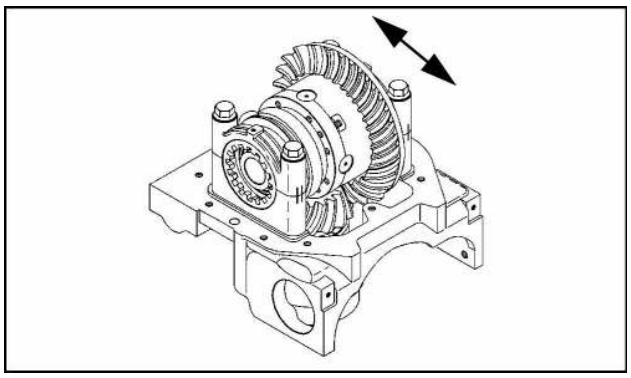


## STEP 5



Position a dial gauge on the differential carrier, so that the feeler stylus touches the surface of one tooth with a 90 degree angle.

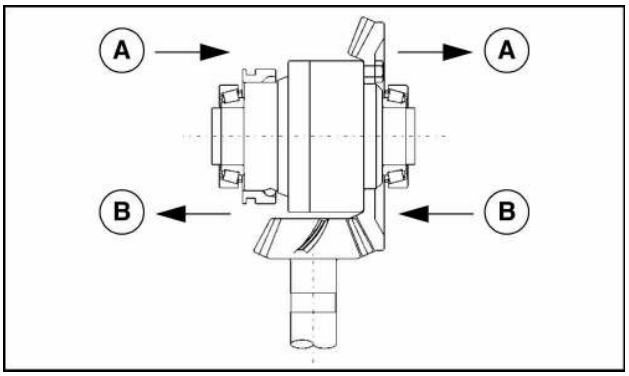
## STEP 6



Lock the pinion and move the crown Wheel to measure the backlash. Repeat the operation on 3 or more points, rotating the crown wheel to obtain an average value. The backlash must be between 0.20 to 0.28 mm (0.007 to 0.011 inch)

Set the crown wheel and pinion backlash by turning adjusting rings (3) and (7) with special tool CA119030.

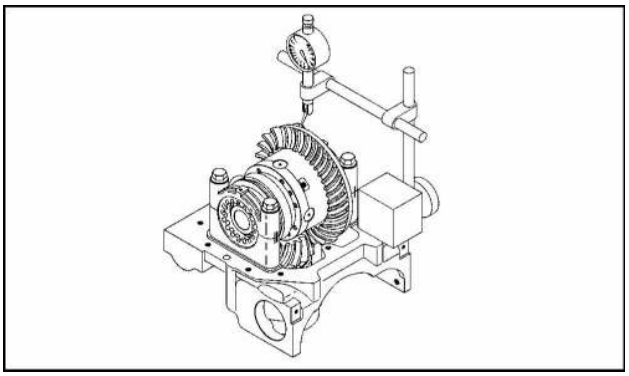
## STEP 7




If the backlash is less than the given tolerance range, unscrew the ring nut on the crown wheel side and screw in the opposite one by the same amount (A);

If the backlash is greater than the given tolerance range: unscrew the ring nut on the side opposite to the crown wheel, and screw in the other one by the same amount (B).

## STEP 8

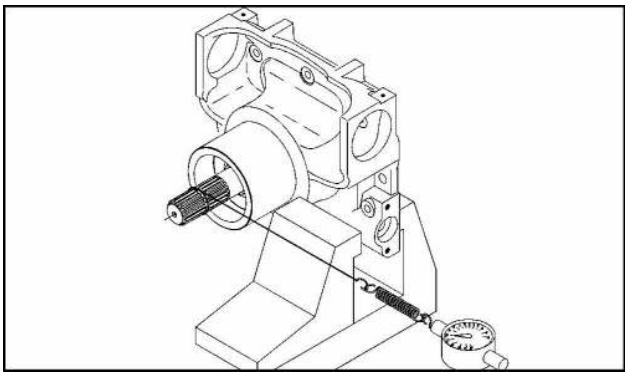


Once you have carried out the adjustment of the crown wheel and pinion backlash, check also that there is a minimum preloading on the differential housing bearing. Repeat the sequence until the correct backlash is reached.

https://truckmanualshub.com/



## STEP 9



Once the backlash has been established, measure the total preloading (T) of the bearings. Attach a length of cord to the pinion shaft, wrap the cord around the pinion shaft without overlapping. Attach a spring balance to the end of the cord and check the rolling pull.

The measured value should be within the following range:

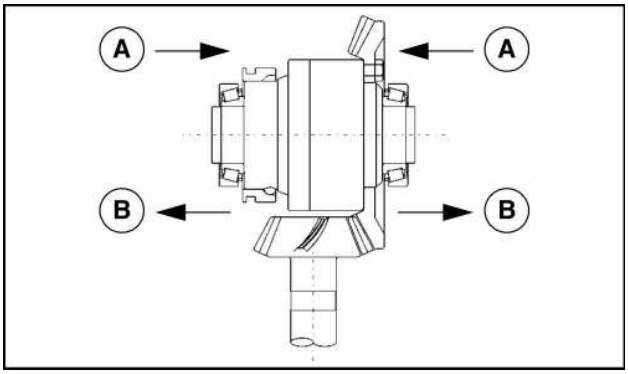
T=(P+2.99)

where P is the measured pinion preload.

See: sec. “Pinion assembly”.

**ATTENTION:** *All preloades must be measured without seal ring.*

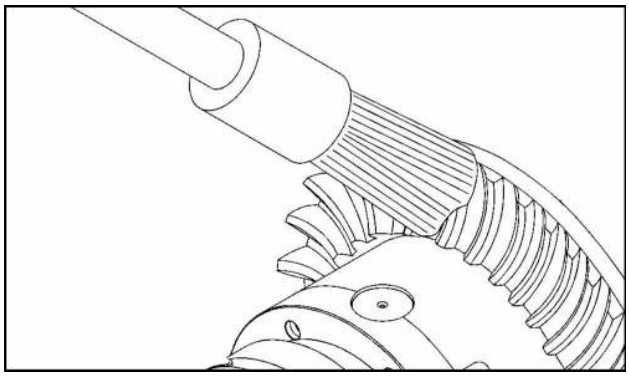
## STEP 10




If the total preload is less than the given range, screw in both ring nuts by the same amount (A), keeping the crown wheel and pinion backlash value unchanged.

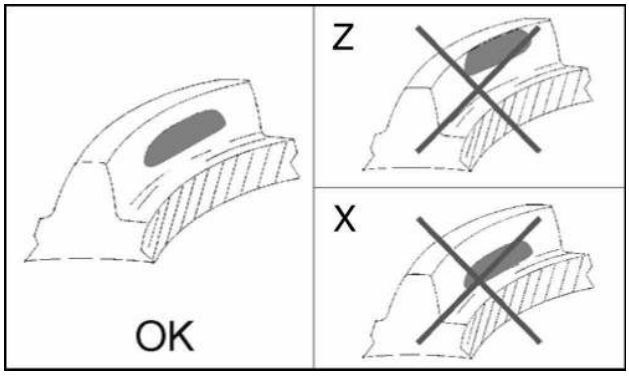
If the total preload is greater than the given range, unscrew both ring nuts by the same amount (B), keeping the crown wheel and pinion backlash value unchanged.

## STEP 11



**NOTE:** *To check the tooth pattern of the crown wheel and pinion, paint the crown wheel with engineering blue.*

## STEP 12




OK - Correct tooth contact.

Z - Excessive contact on the tooth tip.

The pinion shaft is to far out of engagement. The mounting distance must be adjusted and the differential adjustment procedure must be repeated.

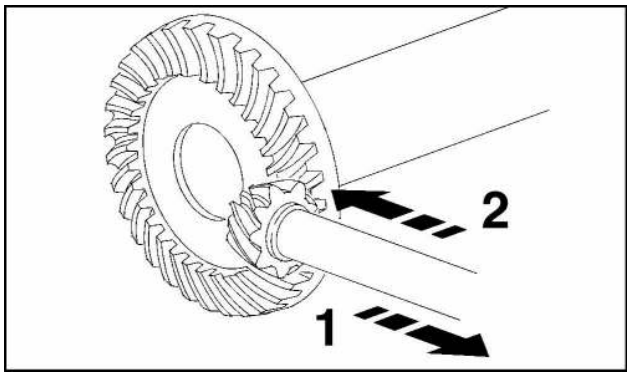
X - Excessive contact at the tooth base.

The pinion shaft is to far into engagement. The mounting distance must be adjusted and the differential adjustment procedure must be repeated.

https://truckmanualshub.com/



## STEP 13

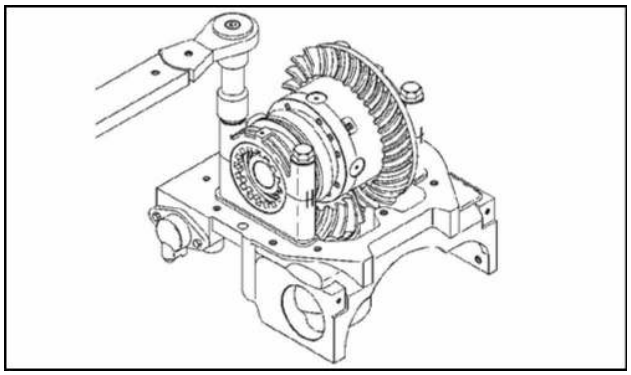



Movements to correct pinion

1 - Direction to move pinion for example “X”.

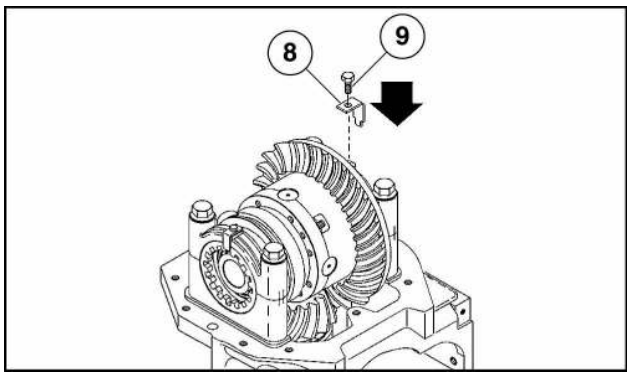
2 - Direction to move pinion for example “Z”.

## STEP 14



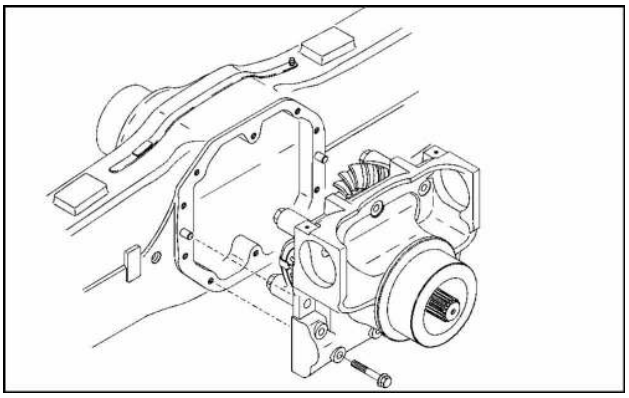
Tighten the retaining bolts of the bearing caps to a torque of 266 Nm (196 lb ft).

## STEP 15



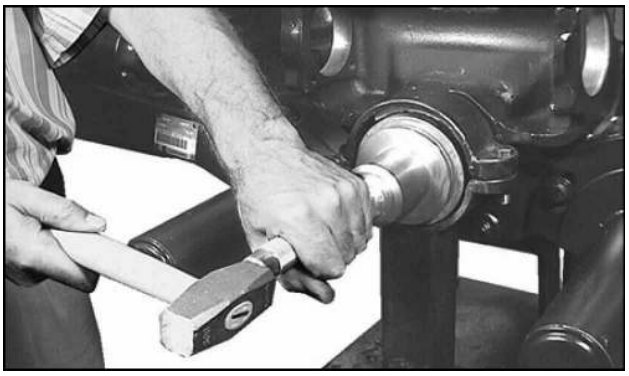

Once all the adjustment operations have been completed, install the retaining clamps (8) and tighten the retaining bolts (9) to a torque of 13 Nm (10 lb ft).

## STEP 16



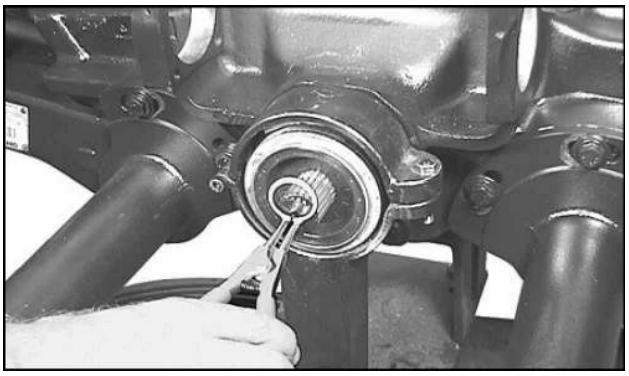
Clean the mounting surfaces of the differential unit. Apply a continuous bead of Loctite 510 and position the differential carrier on the axle housing. Install the retaining bolts and tighten to a torque of 169 Nm (125 lb ft).

## STEP 17



Install a new seal ring on the central beam assembly, using special tool CA119148.

## STEP 18

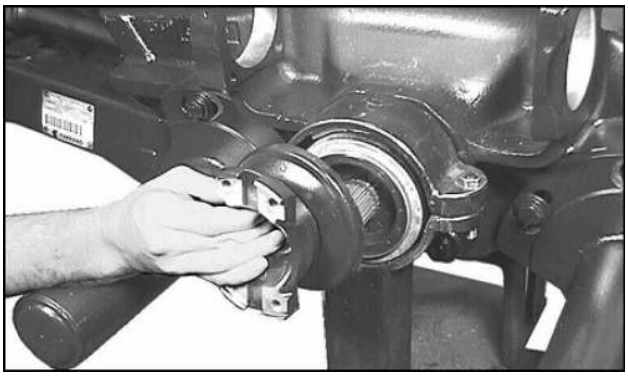


Install the snap ring on the pinion shaft.

https://truckmanualshub.com/

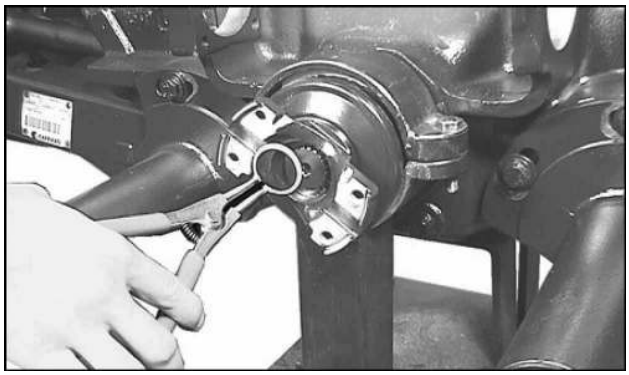


**STEP 19**



Install the flange on the pinion end.

**STEP 20**



Install the snap ring on the pinion end.

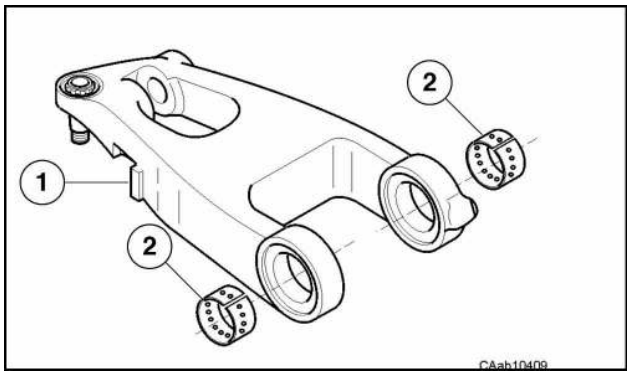
https://truckmanualshub.com/



# LOWER ARM

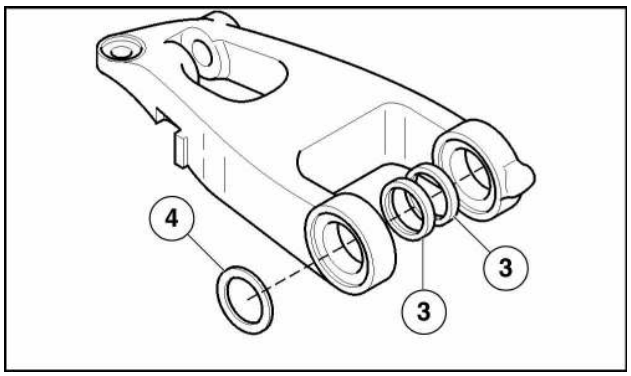
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



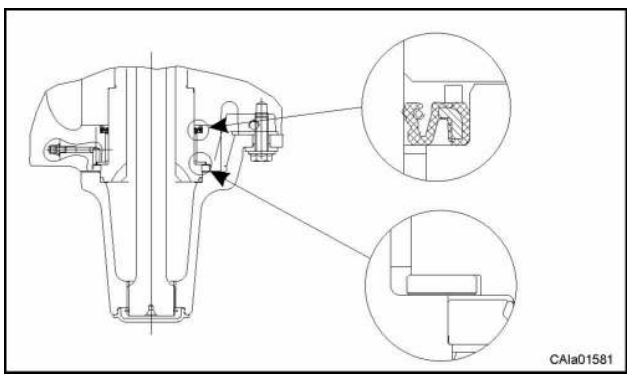

Place the lower arm (1) on a workbench and insert the bushes (2) using special tool CA715327.

## STEP 2




Grease the new seal rings (3) and the thrust ring (4) with McCormick LX Mulit-Purpose EP2 Grease. Insert the two seal rings (3) on the inside seats of lower arm with the special tool CA715325. Place the thrust ring (4) on the outward rear seat of lower arm with the pitted side facing outwards.

## STEP 3




**ATTENTION:** *Assemble the seal rings (3) and the washer (4), as shown.*

## STEP 4




Heat the washer for 5 minutes at 120°C.

**ATTENTION:** *Always wear heat protective gloves when handling hot parts.*

## STEP 5




Apply Loctite 638 (680) on the contact surface between the lower arm pin (6) and the washer.

## STEP 6




Assemble the washer on the pin as shown.

**ATTENTION:** *Always wear heat protective gloves when handling hot parts.*

https://truckmanualshub.com/

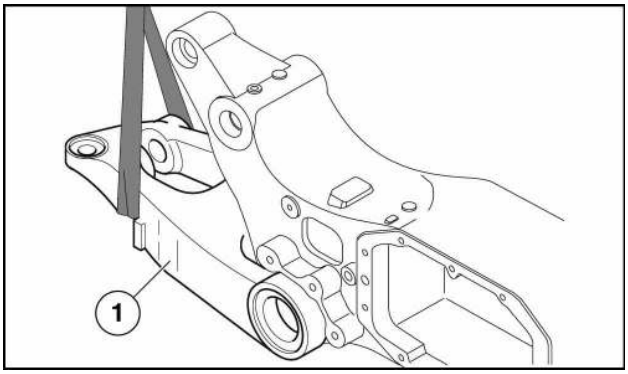


## STEP 7



Install the O-Ring on the washer's seat.

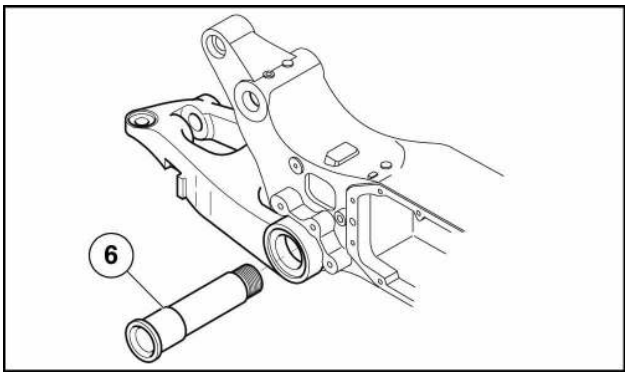
## STEP 8




Using a harness and suitable hoist support the lower arm (1). Position the lower arm in correspondence with the mounting hole on the axle housing body.

**ATTENTION:** *The holes in the lower arm and in the axle housing body must be perfectly aligned.*

## STEP 9

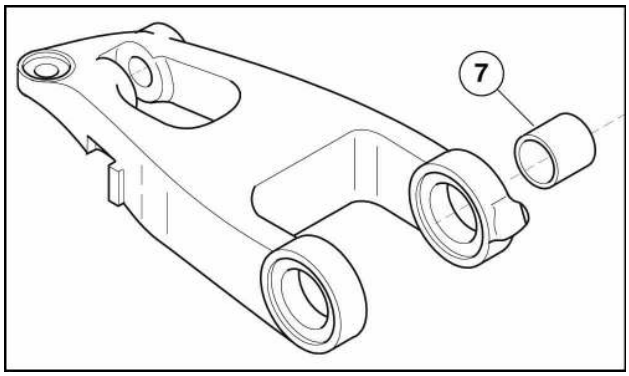



Insert the lower arm pin (6) from the rear, with the washer and O-Ring assembled.

**NOTE:** *If necessary, tap the pin head with a soft Hammer, in order to facilitate the introduction.*

**ATTENTION:** *Insert the pin with care, in order to avoid damaging the seals.*

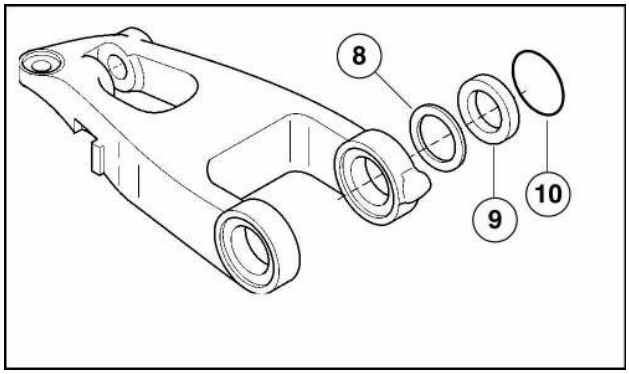
## STEP 10




Install the bush (7) on the lower arm and central body from the front side, with the special tool CA715325.

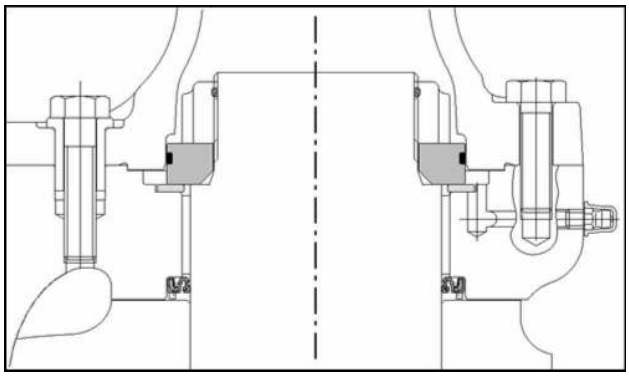
**ATTENTION:** *The bush must be fully inserted and rest against the axle body.*

## STEP 11




Assemble a new O-ring (10) on the thrust ring (9). Grease the thrust washer (8) and thrust ring (9) with McCormick LX Mulit-Purpose EP2 Grease. Place the thrust ring (4) on the outward rear seat of the lower arm with the pitted side facing outwards.

## STEP 12



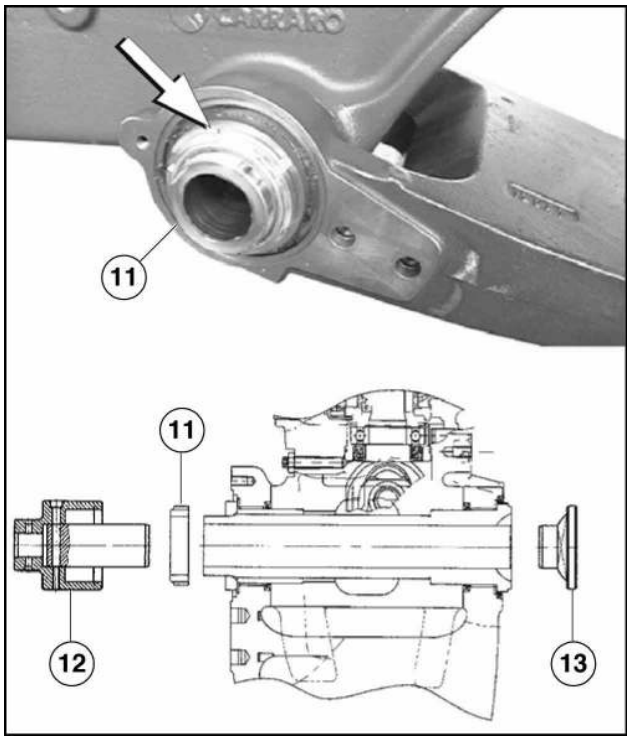
Place the thrust ring (8) and the thrust washer (9) on the lower arm pin (6) (threaded end).

**ATTENTION:** *Assemble the parts as shown.*

https://truckmanualshub.com/



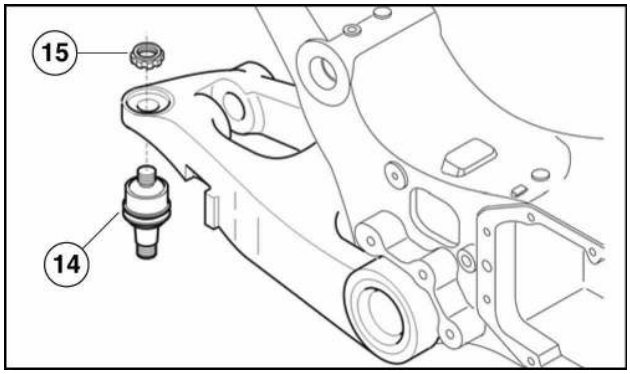
## STEP 13




Install the ring nut (11) and tighten to a torque of 600 Nm (442 lb ft) using special tool CA715330 (12), and pin locking tool CA715336 (13).

**ATTENTION:** *The arm must rotate smoothly.*

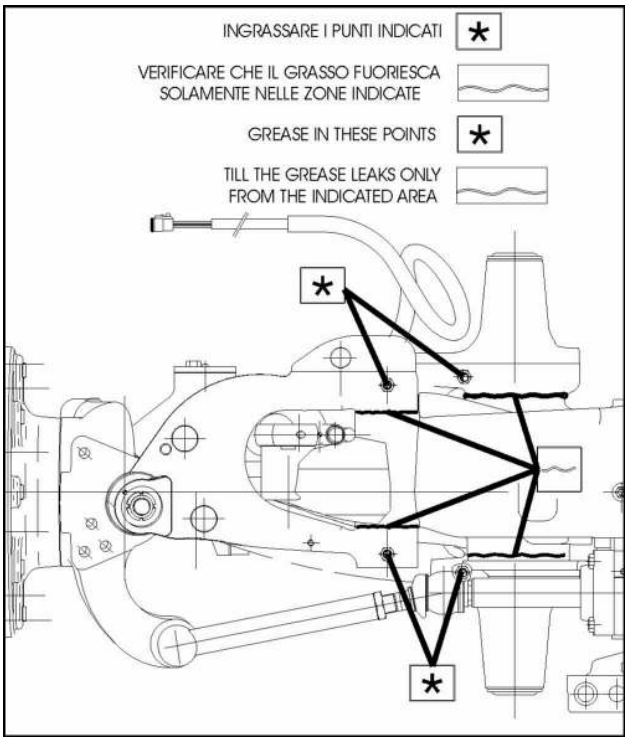
## STEP 14




Install the swivel housing ball joint (14) with a new nut (15).

Tighten the new nut (15) to a torque of 250 Nm (184 lb ft).

## STEP 15




Grease the arms with McCormick LX Mulit-Purpose EP2 Grease as shown.

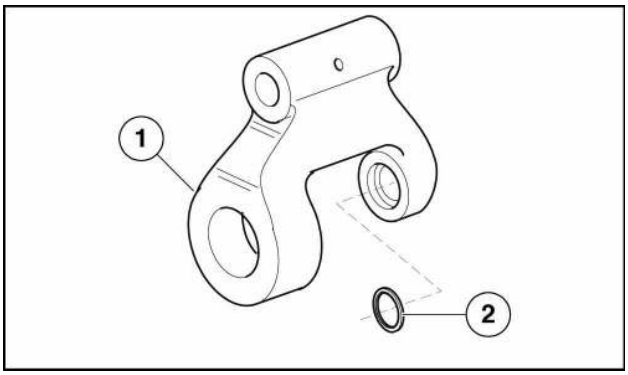
https://truckmanualshub.com/



# UPPER ARM

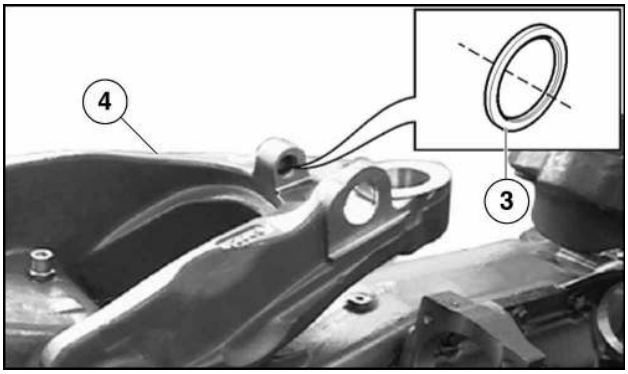
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



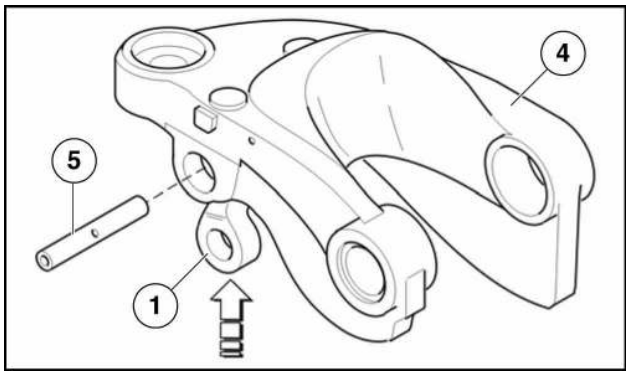

Lubricate a the new seal ring (2) with McCormick LX Mulit-Purpose EP2 Grease and install it into the support fork (1) with special tool CA715329.

## STEP 2




Lubricate a the new seal ring (3) with McCormick LX Mulit-Purpose EP2 Grease and install it into the upper arm (4) with special tool CA715329.

## STEP 3



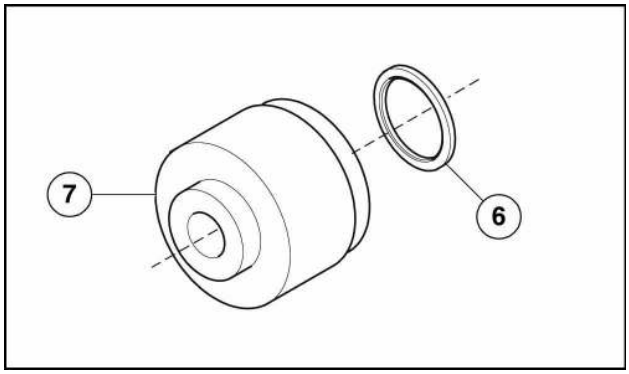

Install the support fork (1) into the upper arm seat (4).

**NOTE:** *The hole in the fork must be perfectly aligned with the holes in the upper arm.*

Grease the support fork upper pin (5) with McCormick LX Mulit-Purpose EP2 Grease and insert it into the upper arm and support fork.

**NOTE:** *The pin must be fully inserted.*

## STEP 4

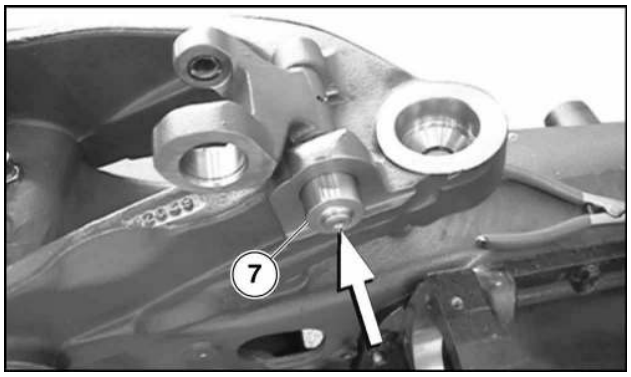



Lubricate a the new seal ring (6) with McCormick LX Mulit-Purpose EP2 Grease and install onto the centering bush (7) with special tool CA715329 and a hammer.

https://truckmanualshub.com/



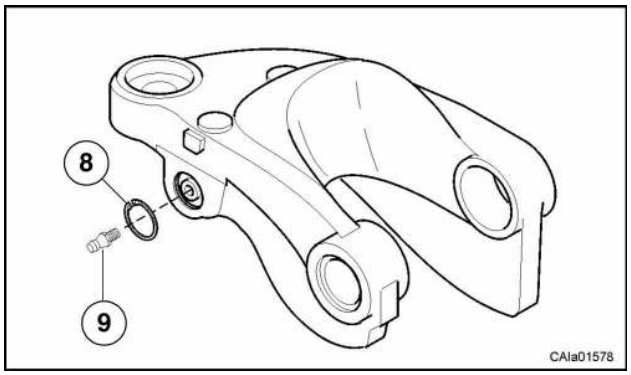
## STEP 5




Install the complete centering bush (7) on the support fork upper pin (5).

**ATTENTION:** *The bush must be fully inserted.*

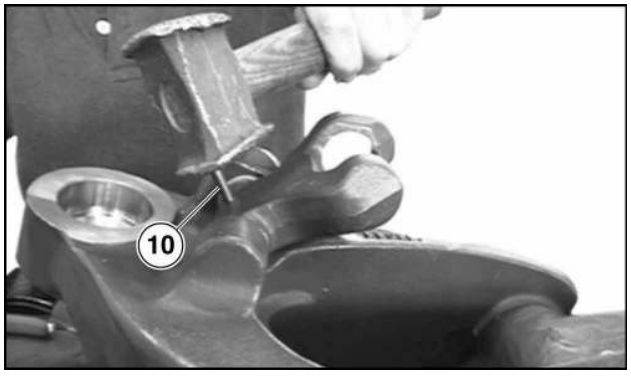
## STEP 6




Install the lock ring (8) to lock the centering bush.

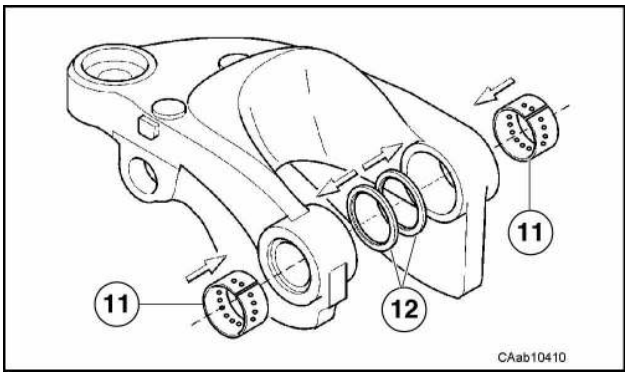
Screw the greaser nipple (9) into the extraction hole on the support fork pin.

## STEP 7



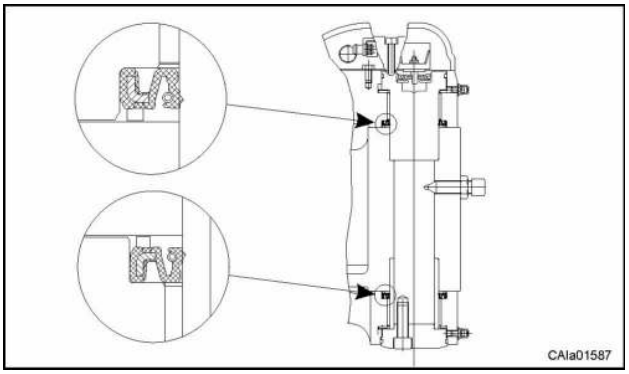

Rotate the support fork (1) until the hole for the split pin is aligned with the hole in the pin (5). Install the split pin (10).

## STEP 8



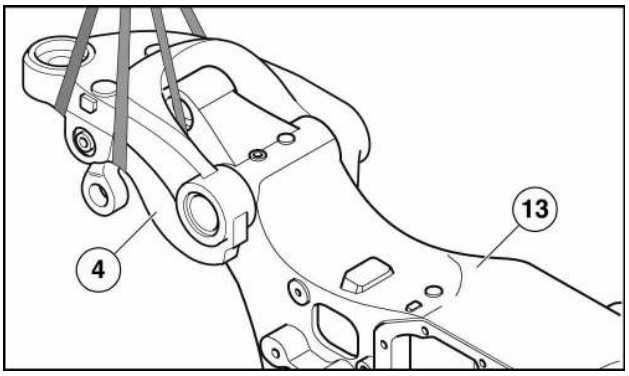

Grease the bushes (11) and the new seal rings (12) with McCormick LX Mulit-Purpose EP2 Grease. Install the two bushes (11) on the upper arm outward seats with special tool CA715324. Install the two seal rings (12) on the inner seats of the upper arm with special tool CA715677.

## STEP 9




**ATTENTION:** *Assemble the seal rings (12) as shown*

## STEP 10



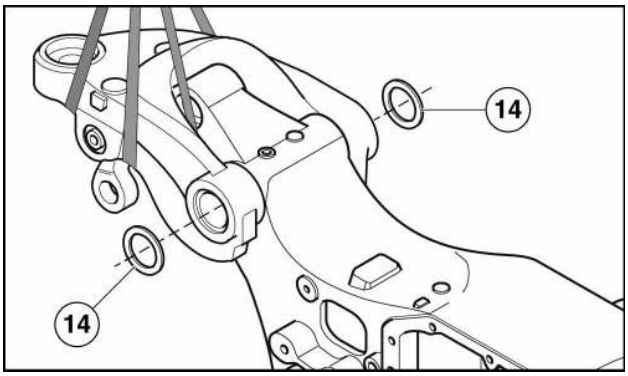

Using a harness and suitable hoist, position the upper arm (4) in correspondence with the relevant mounting hole in the axle housing body (13).

**ATTENTION:** *The holes in the upper arm and the axle housing body must be perfectly aligned.*

https://truckmanualshub.com/



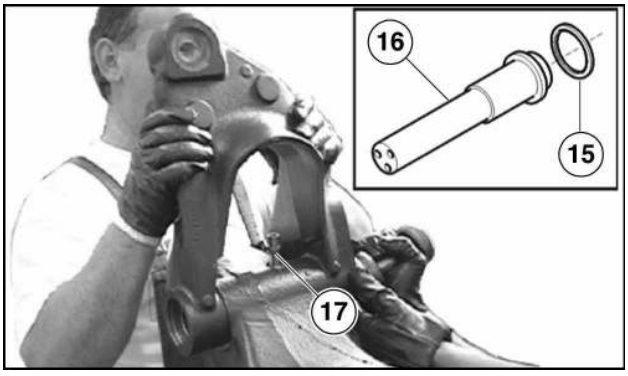
## STEP 11




Install thrust ring's (14) on the front and rear of the upper arm with the pitted side facing outwards

**NOTE:** *Lubricate the thrust rings with* McCormick LX Mulit-Purpose EP2 Grease.

## STEP 12



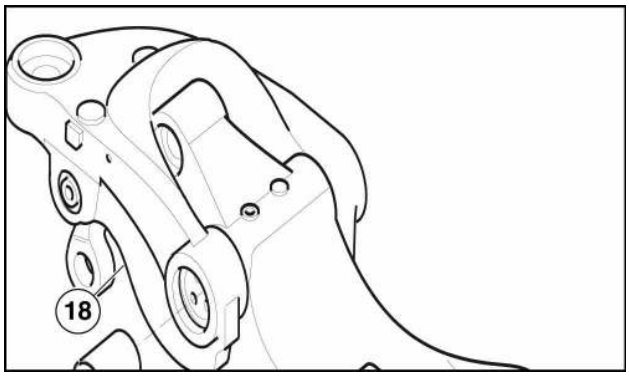

Grease the new O-Ring (15) and install it onto the pin head (16).

Insert the upper arm pin (16) from the front of the axle.

**NOTE:** *If necessary, tap the pin head with special tool CA715677.*

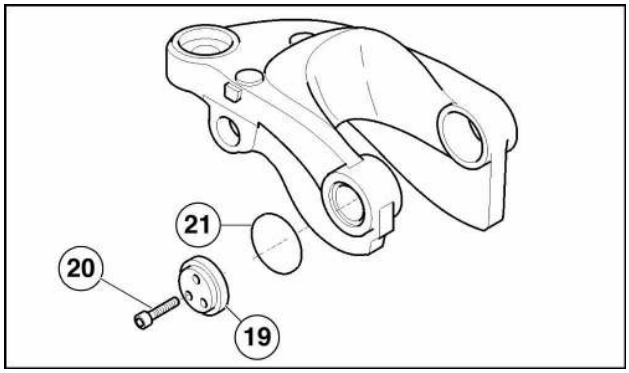
Tighten the bolt (17) in order to lock the upper arm pin.

## STEP 13




Partially insert the bush (18) from the opposite side of the pin.

## STEP 14




Install the O-Ring (21) on the flange (19). Position the flange (19) on the protruding bush (18).

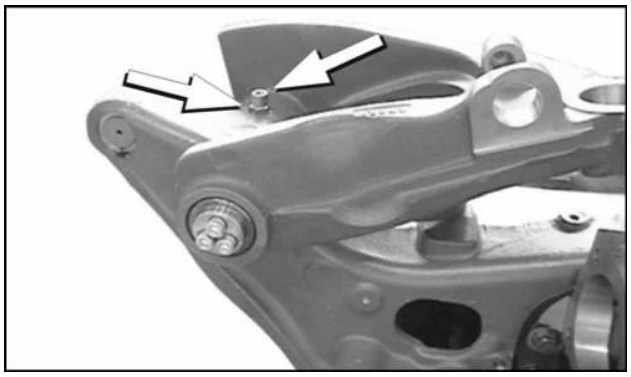
**ATTENTION:** *The three holes in the flange (19) must be perfectly aligned with the three holes in the pin (16).*

Using Special tool CA715677 and a hammer, hit the flange(19) with the protruding bush (18) until they are fully installed. Tighten the three retaining bolts (20) to a torque of 50 Nm (37 lb ft).

https://truckmanualshub.com/



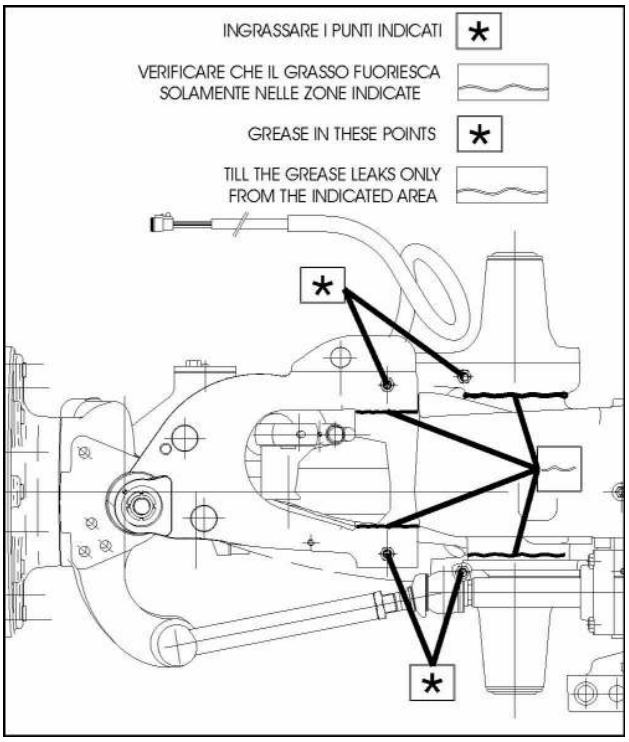
## STEP 15



Tighten the bolt show, to a torque of 135 Nm (99 lb ft) and then the lock nut to a torque of 70 Nm (52 lb ft).

**ATTENTION:** *The arm must rotate freely.*

## STEP 16




Grease the arms with McCormick LX Mulit-Purpose EP2 Grease as shown.

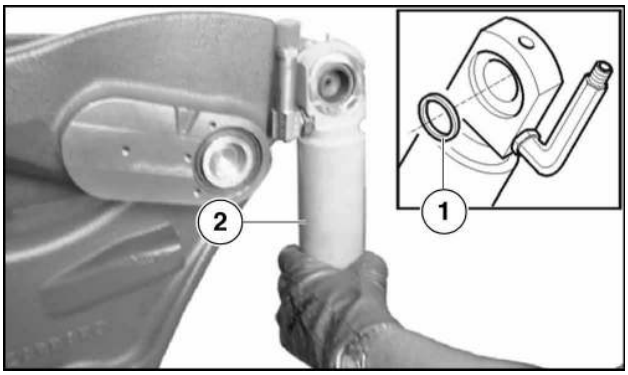
https://truckmanualshub.com/



# SUSPENSION CYLINDER

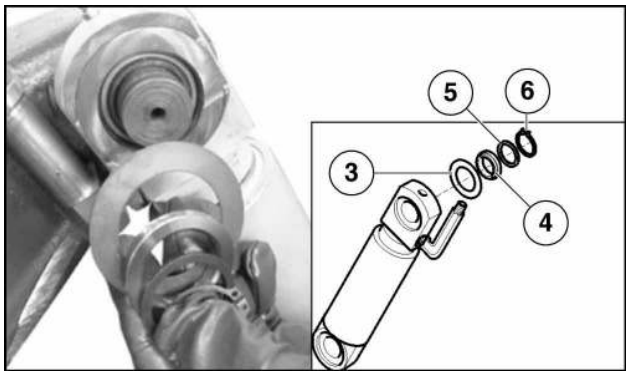
Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1




Install spacer (1) on the upper mounting pin of the suspension cylinder. Install the suspension cylinder (2) on the upper pin, using special tool CA715333 and a hammer.

## STEP 2




Place the belleville washer (3), spacer (4) and the washer (5) on the upper pin. Install the snap ring (6) to lock.

https://truckmanualshub.com/

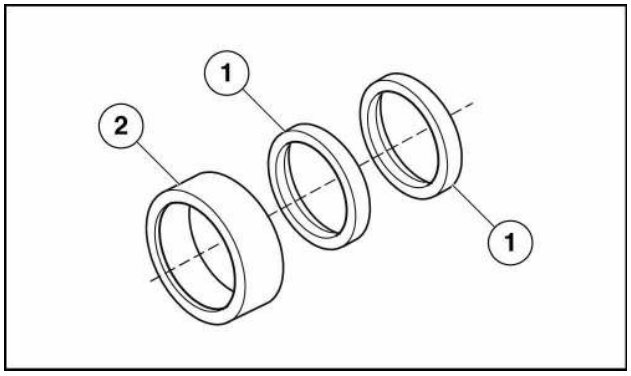


# UNIVERSAL JOINT

Some of the following pictures may not show your axle, but the procedure is the same.

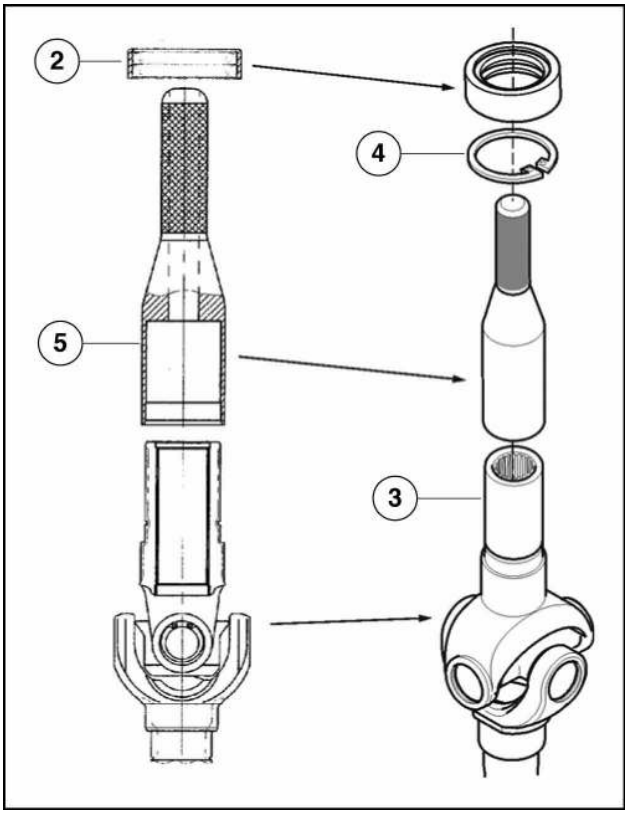
**NOTE:** *Before assembling the double universal joint unit, it is necessary to assemble the differential support unit.*

## STEP 1




Grease two new seal rings (1) with McCormick LX Mulit-Purpose EP2 Grease. Using special tool CA715323 and a hammer, install the seal rings in the bush (2) to be installed on the universal joint (wheel side).

## STEP 2




Insert the snap ring (4), which will be used later, in the universal joint (3) (wheel side).

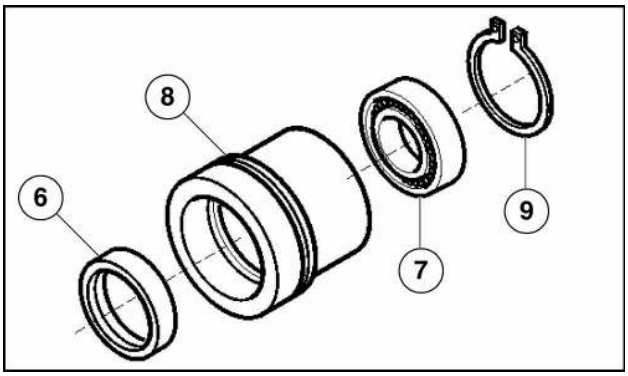
Install the special tool CA715340 (5) on the universal joint, in order to protect the seal rings during assembly.

Insert the bush (2), complete with the two seal rings, on the universal joint.

https://truckmanualshub.com/



## STEP 3

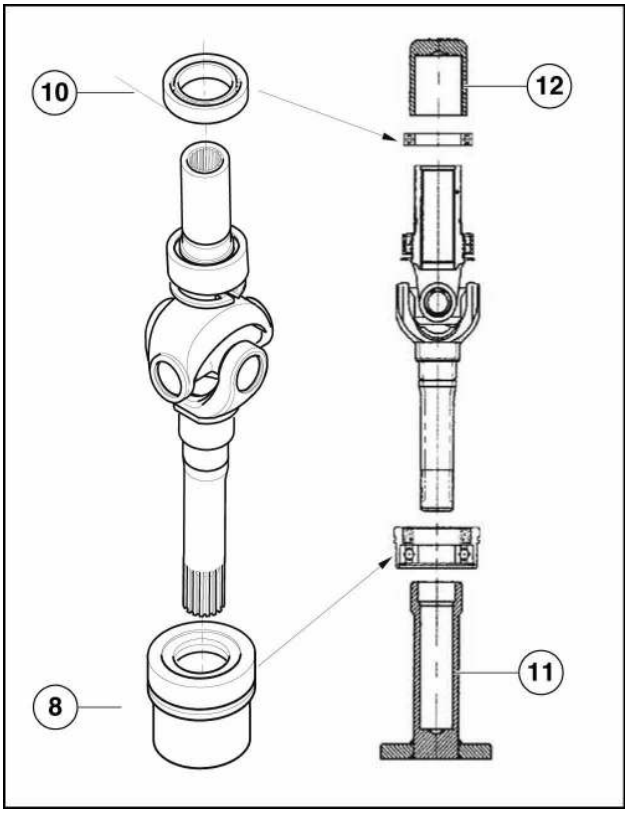



Using special tools CA715097 and CA715179, grease and insert a new seal ring (6) and bearing (7) in the centering bush (8) of the universal joint (differential side).

**ATTENTION:** *The bearing must be fully inserted.*

Install the snap ring (9).

## STEP 4

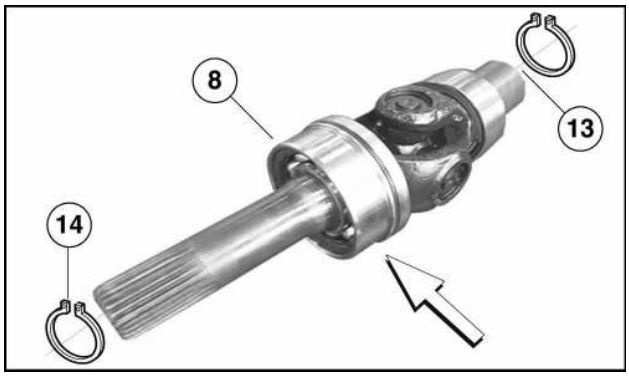



In order to assemble the bearing (10) and the centering bush(8) use the special tool CA715341 (11).

Install all the components on their seats with special tool CA119215 (12).

**ATTENTION:** *The bearings must be fully inserted.*

## STEP 5

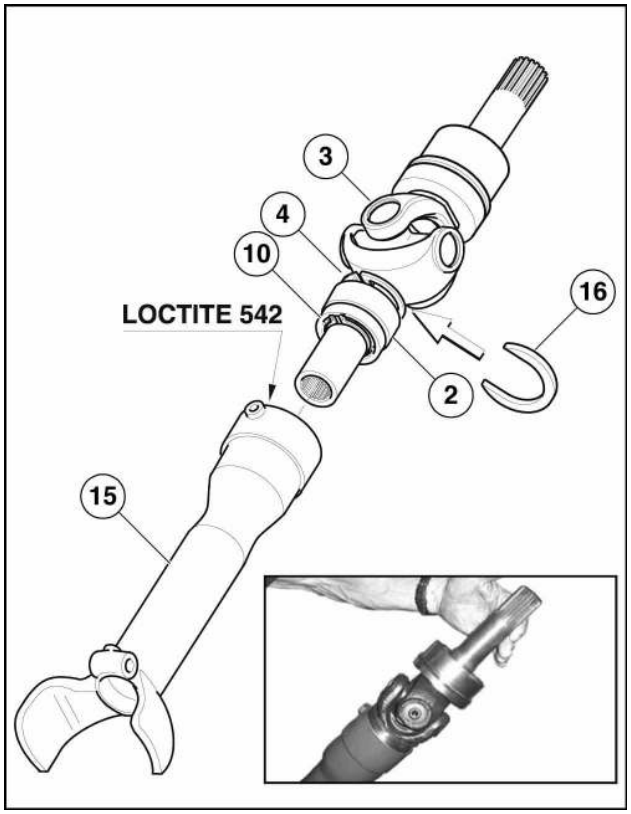



Install snap rings (13 and 14) in their seats. Install a new O-Ring on the centering bush (8).

https://truckmanualshub.com/



## STEP 6




Place the universal joint housing (15) in a vice.

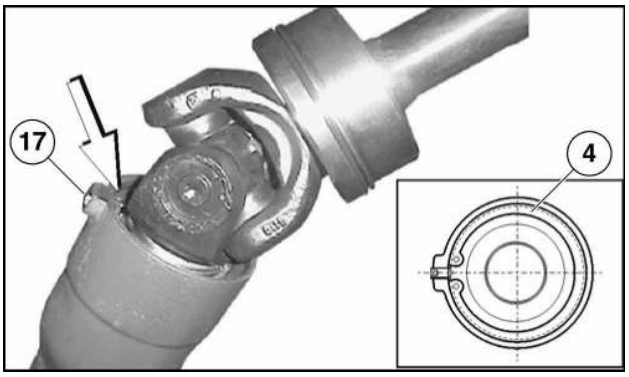
Apply Loctite 542 on the seal ring holding bush of the universal joint housing.

Insert the complete universal joint (3) in the housing (15) using the special tool CA715339 (16).

**ATTENTION:** *The universal joint (3) must be inserted completely, with the bearing resting against the* housing.

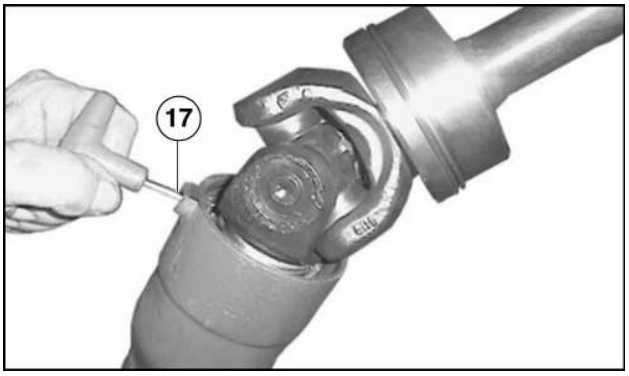
Insert the special tool CA715339 (16) between the snap ring (4) and the universal joint spider (as shown). Insert the universal joint (3) into the housing (15). With a soft hammer tap the universal joint (3) until it is possible to extract the special tool CA715339 (16) and install snap ring (4).

## STEP 7



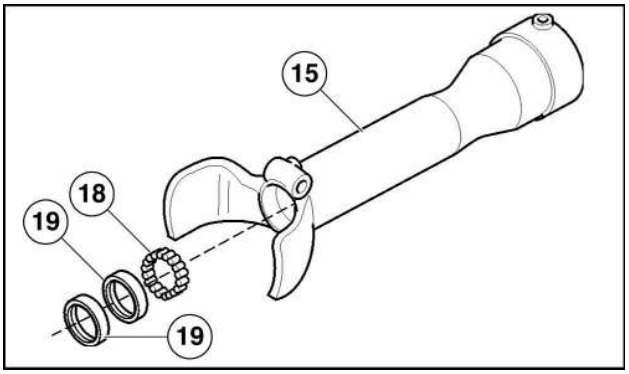

**ATTENTION:** *The snap ring (4) must be installed with the opening in correspondence with the grub screw (17) (as shown).*

## STEP 8




Apply Loctite 524 on the threads of grub screw (17) and tighten.

## STEP 9




Position the needle bearing (18) inside the universal joint housing (15), using special tool CA715334.

Apply McCormick LX Mulit-Purpose EP2 Grease to the new seal rings (19) and install in to the housing (15) using the special tool CA119103.

https://truckmanualshub.com/

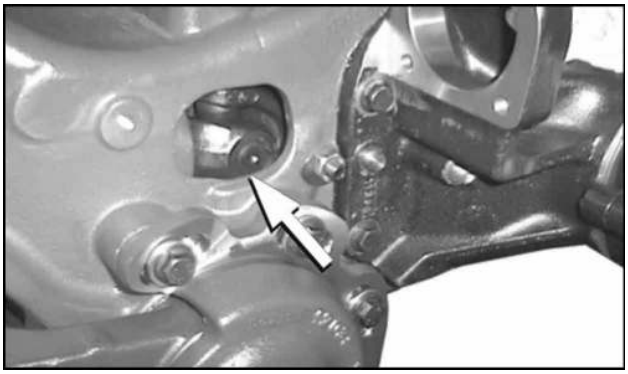


## STEP 10



Install the universal joint into the axle housing body.

## STEP 11

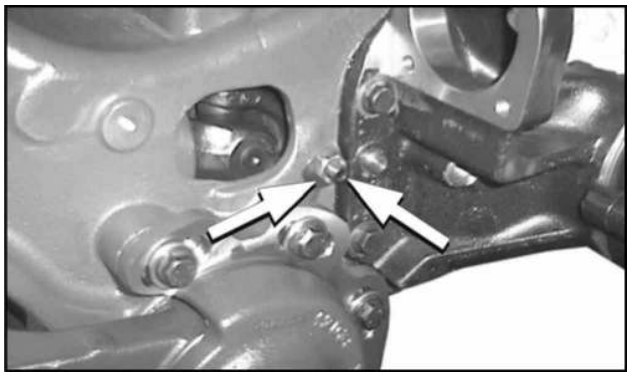


Support the universal joint while inserting it in the differential unit through the appropriate opening on the axle housing body.

The universal joint must be fully inserted with the centering bush (8) resting against the seat in the axle housing body.

**ATTENTION:** *Do not damage the O-Ring during assembly.*

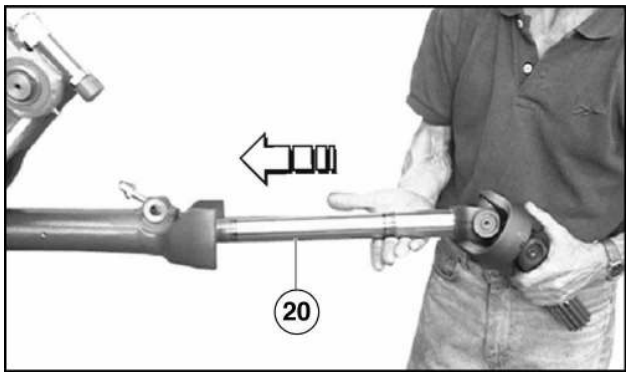
## STEP 12



Tighten the grub screw to a torque of 30 Nm (22 lb ft) and the lock nut to 80 Nm (59 lb ft).

**NOTE:** *Repeat the operation on the other grub screw and nut positioned on the front side of the axle body.*

## STEP 13



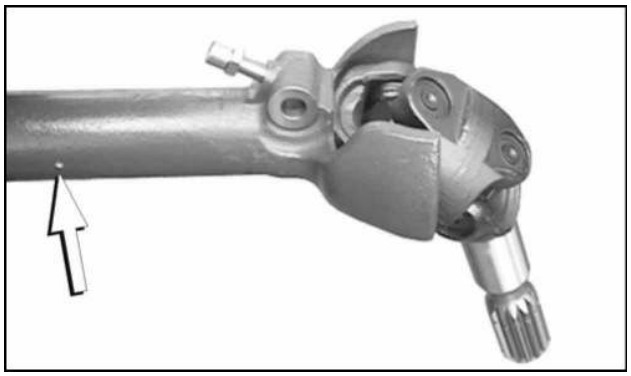

Install the double universal joint (20).

**ATTENTION:** *Proceed with care; the spline shaft end of the double universal joint must not damage the seal rings (19) during assembly.*

https://truckmanualshub.com/



**STEP 14**



Apply McCormick LX Mulit-Purpose EP2 Grease, through the indicated hole, until it leaks out of the seal rings at the ends of the universal joint housing.

**NOTE:** *The grub screw must not be screwed beyond the surface of the housing.*

https://truckmanualshub.com/

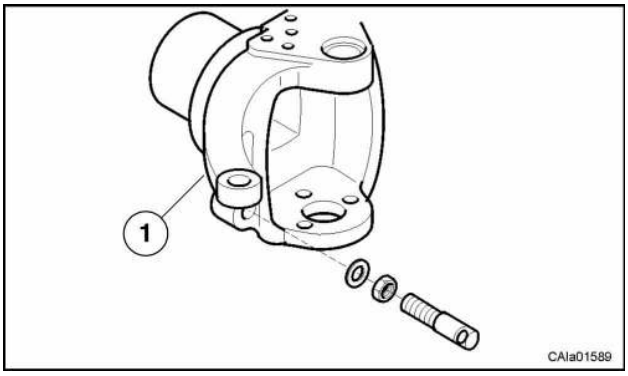


# SWIVEL HOUSING UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before assembling the swivel housing unit, it is necessary to assemble the double universal joint unit, the lower arm, the upper arm and the suspension cylinder.*

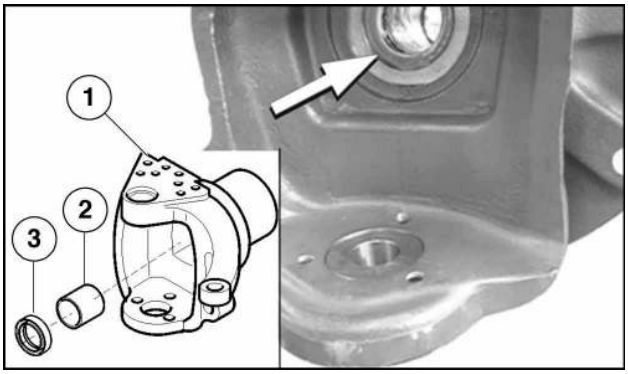
## STEP 1




Install the steering lock bolt, nut and washer to the swivel housing (1).

**NOTE:** *Do not tighten the nut until the steering angle is set.*

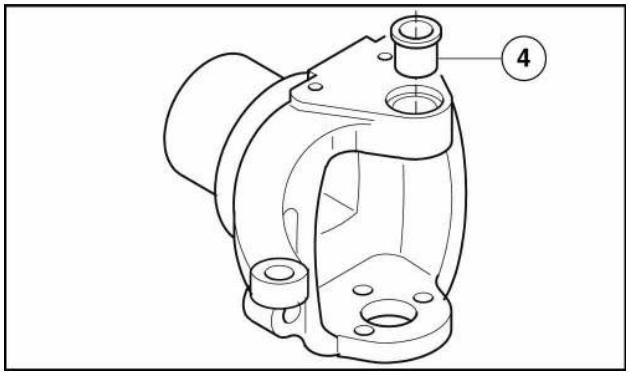
## STEP 2




Place the swivel housing (1) on a workbench and Install a new bush (2) using special tool CA715108, and a new seal ring (3) with special tool CA715321.

**NOTE:** *Grease the bush (2) and seal ring (3) with McCormick LX Mulit-Purpose EP2 Grease.*

## STEP 3

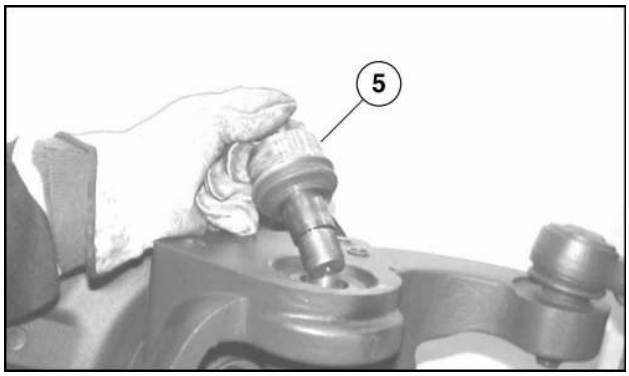



Install the bush (4) into the swivel housing using special tool CA715338 and a hammer.

**NOTE:** *To make the assembly easier, it is advisable to cool the bushes to a temperature lower than -100℃*

**ATTENTION:** *Always wear safety gloves when handling frozen parts.*

## STEP 4

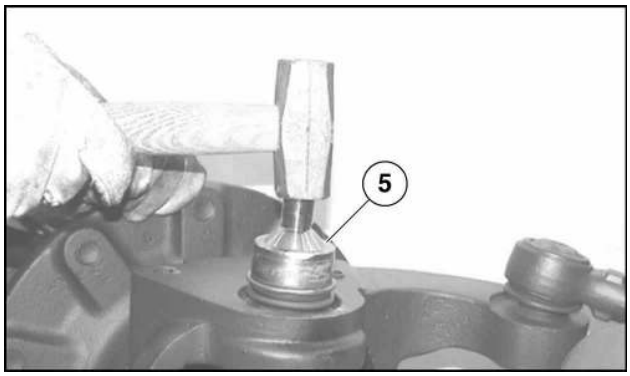



Insert a new ball joint (5) on the upper part of the swivel housing.

https://truckmanualshub.com/

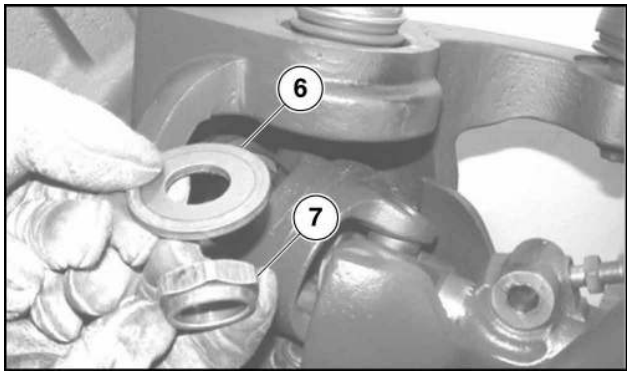


## STEP 5



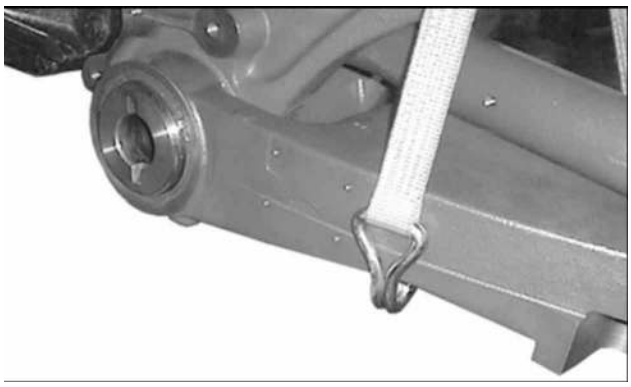

Use a soft material hammer to seat the ball joint (5).

## STEP 6



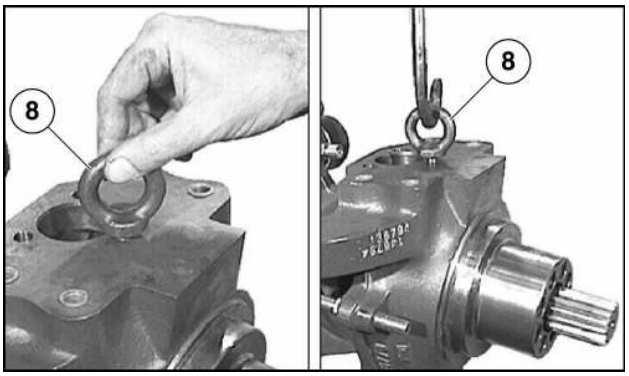

Install the washer (6),retaining nut (7) and tighten to a torque of 250 Nm (184 lb ft).

## STEP 7



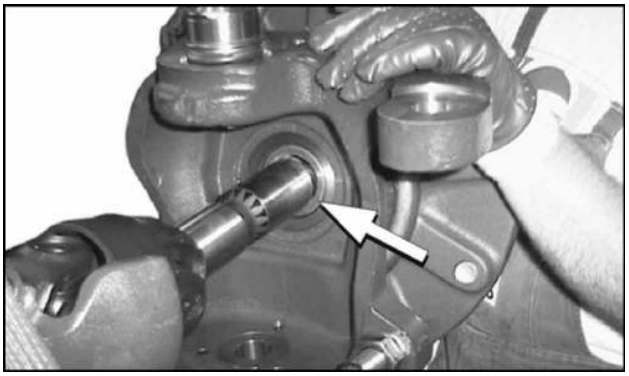
**ATTENTION:** *Using a harness and suitable hoist, support the lower arm*

## STEP 8




**ATTENTION:** *Screw an eyebolt (8) into one of the threaded holes in the swivel housing and support it using suitable lifting equipment.*

## STEP 9



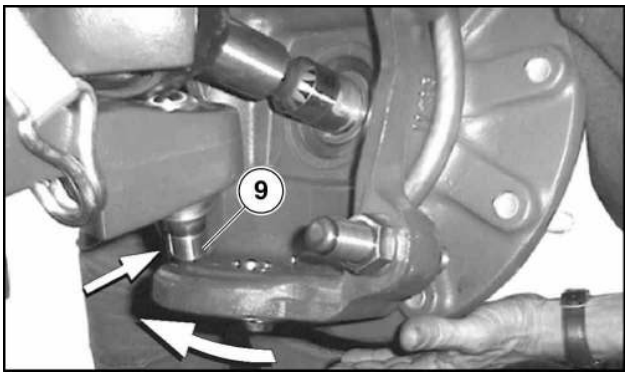
**ATTENTION:** *Install special tool CA715399 in the splined end of the double universal joint, to avoid damaging the seal ring in the swivel housing.*

Lift the swivel housing and insert the end of the double universal joint.

https://truckmanualshub.com/



## STEP 10

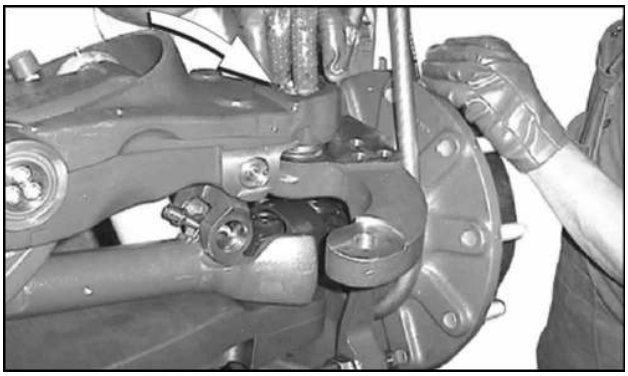



Insert the ball joint of the lower arm into the swivel housing.

Lift the swivel housing slowly *an proceed with slight combined movements, trying to find the best position to facilitate the introduction of the lower arm ball joint into the swivel housing*.

**ATTENTION:** *Be careful not to damage the threads of the ball joint (9).*

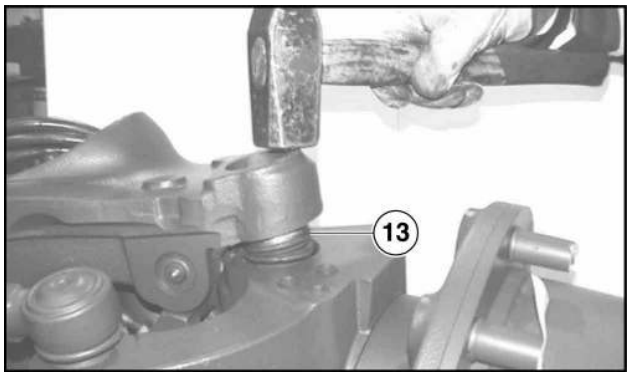
## STEP 11



Slowly lower the upper arm, *and proceed with slight combined movements, trying to find the best position to facilitate the introduction of the upper arm ball joint into the swivel housing*.

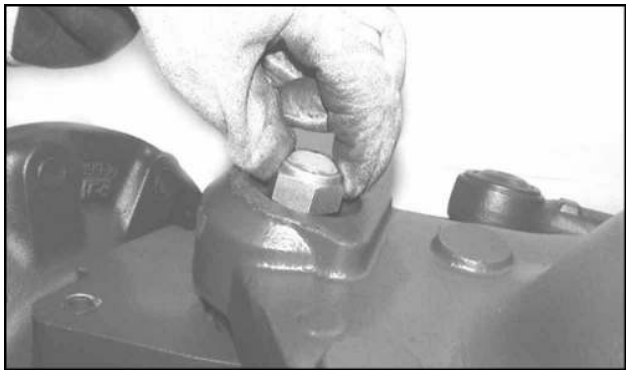
**ATTENTION:** *Be careful not to damage the threads of the ball joint.*

## STEP 12



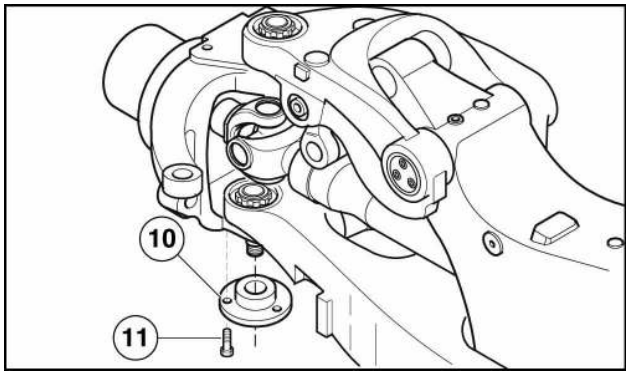

Tap the upper arm onto the upper king pin (13).

## STEP 13



Install a new retaining nut to the upper king pin (13).

## STEP 14




Install the flange (10) to the lower part of the swivel housing. Tighten the three retaining bolts (11) to a torque of 169 Nm (125 lb ft).

https://truckmanualshub.com/

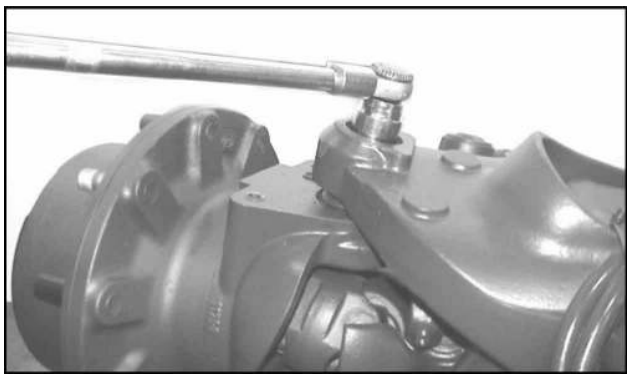


## STEP 15



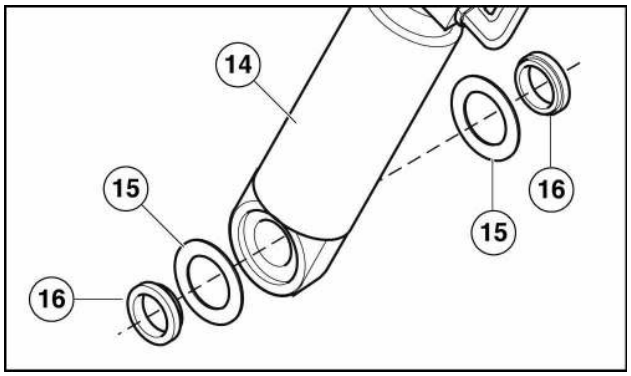

Install a new retaining nut on the lower joint (12) and tighten to a torque of 250 Nm (184 lb ft).

## STEP 16



Tighten the upper joint (13) retaining nut to a torque of 250 Nm (184 lb ft).

## STEP 17




Position the two belleville washers (15) and the two spacers (16) on the suspension cylinder (14).

**NOTE:** *Apply McCormick LX Mulit-Purpose EP2 Grease to the washers and spacers*.

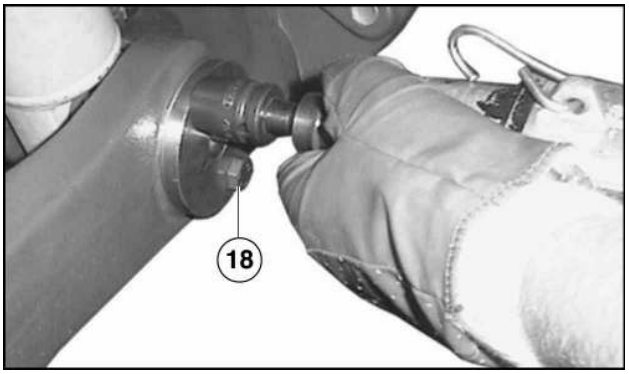
## STEP 18




Align the hole in the lower arm with the hole in the suspension cylinder and install the pin (17).

**NOTE:** *If necessary, slightly raise or lower the lower arm to facilitate the introduction of the pin.*

## STEP 19

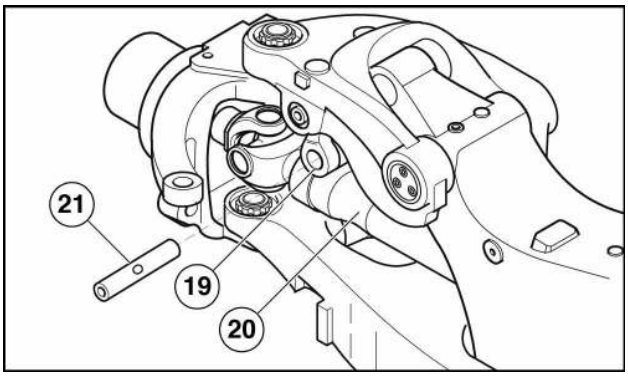



Install the two retaining bolts (18) of the suspension cylinder lower pin, and tighten them to a torque of 50 Nm (37 lb ft).

https://truckmanualshub.com/



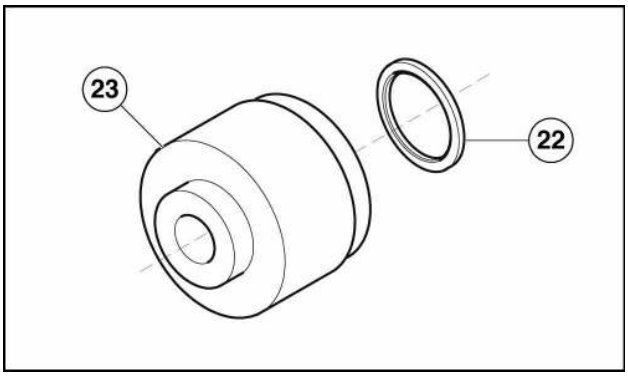
## STEP 20




Grease the pin (21) with McCormick LX Mulit-Purpose EP2 Grease. Align the holes in the universal joint support fork and the hole in the universal joint housing and install pin (21). Rotate the pin until the hole in the pin is aligned with the hole in the universal joint housing and install the retaining bolt.

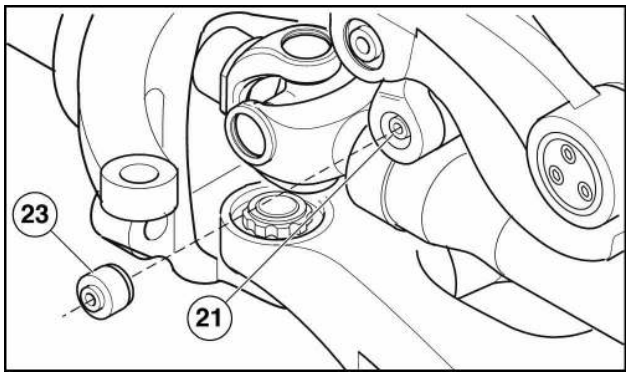
**NOTE:** *If necessary, slightly raise the universal joint unit to facilitate the introduction of the pin.*

## STEP 21




Lubricate the new seal ring (22) with McCormick LX Mulit-Purpose EP2 Grease. Install the seal ring on the centering bush (23) with special tool CA715329 and a hammer.

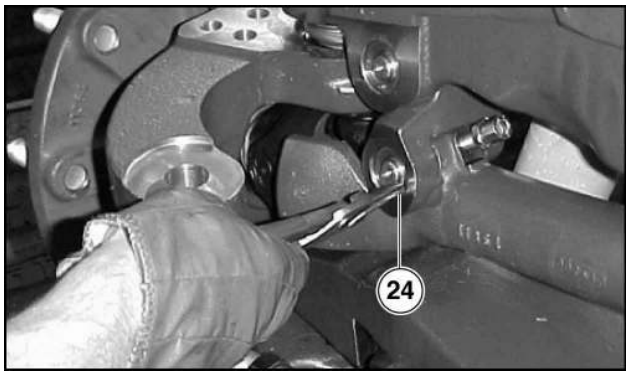
## STEP 22




Install the complete centering bush (23) on the support fork lower pin (21).

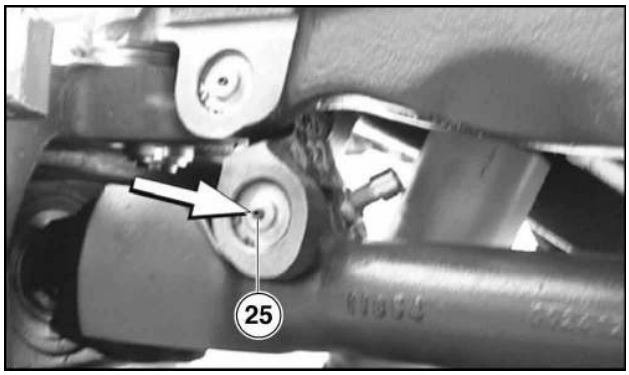
**NOTE:** *The bush must be fully inserted.*

## STEP 23




Install the snap ring (24) to lock the centering bush (23).

## STEP 24

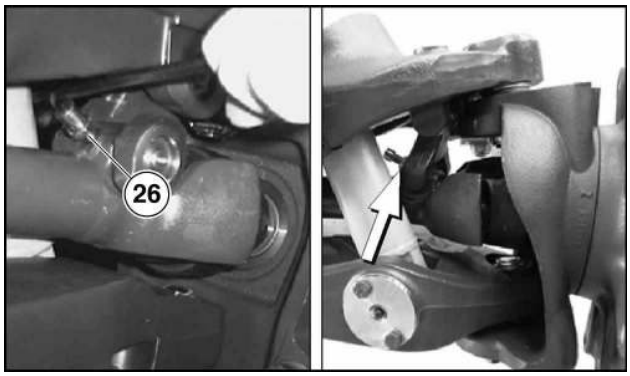



Install the greaser nipple (25) into the support fork pin extraction hole, and tighten to a torque of 8 Nm (6 lb ft).

https://truckmanualshub.com/



## STEP 25




To lock the lower pin of the universal joint support fork, Tighten the retaining bolt to a torque of 135 Nm (99 lb ft) and the lock nut (26) to a torque of 70 Nm (52 lb ft).

https://truckmanualshub.com/

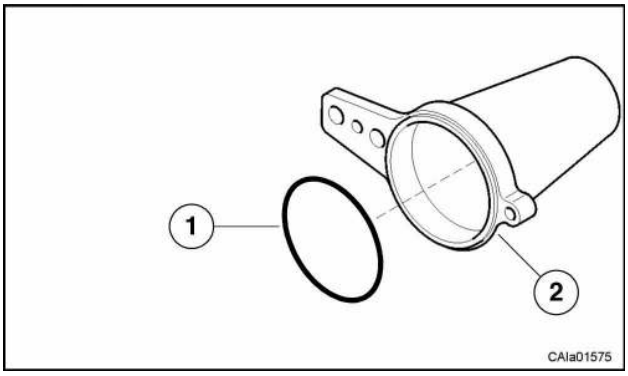


# TORSION BAR UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before assembling the torsion bar unit, it is necessary to assemble the lower arm.*

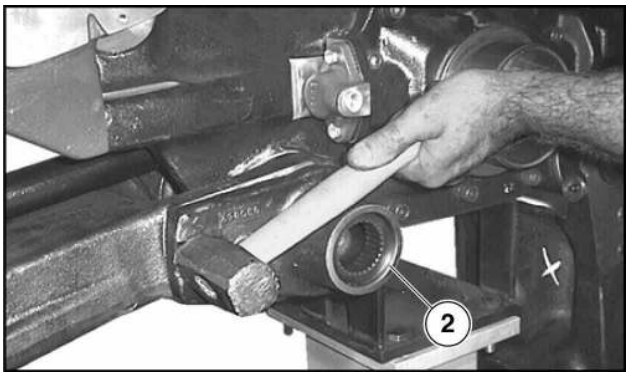
## STEP 1




Lubricate the new O-Ring (1) with McCormick LX Mulit-Purpose EP2 Grease.

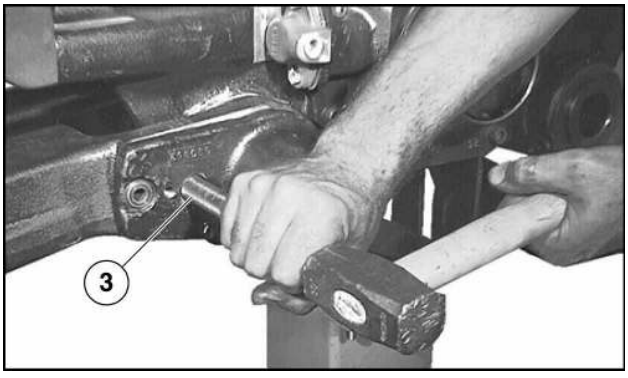
Install the O-Ring onto the flange (2).

## STEP 2



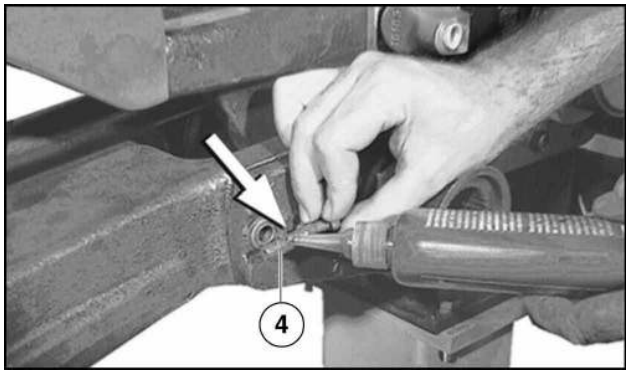

Install the front flange (2) onto the lower arm and tap with a soft material hammer.

## STEP 3



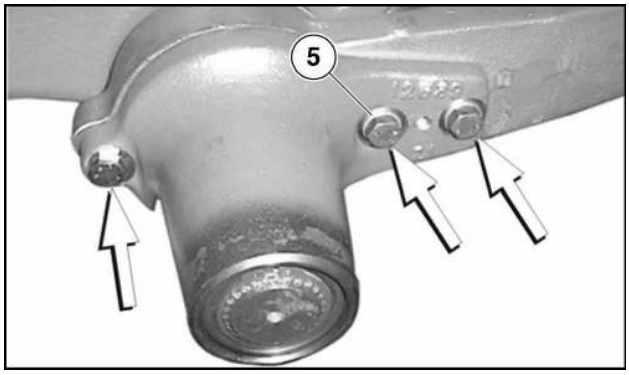

Tap the centering bush (3) into the front flange, using the special tool CA715086 and a hammer.

## STEP 4



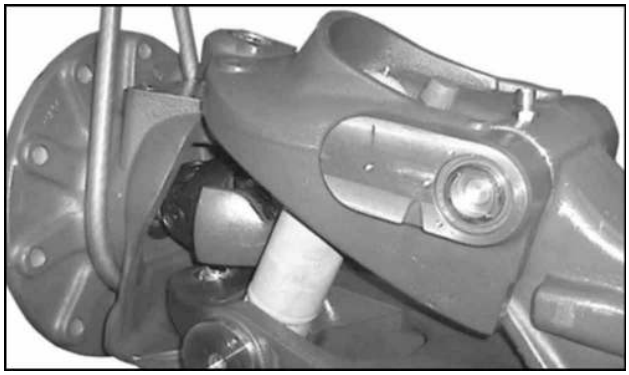

Apply a thin coat of Loctite 542 onto the front flange retaining bolts (4).

## STEP 5




Tighten the front flange retaining bolts (5) to a torque of 95 Nm (70 lb ft).

## STEP 6

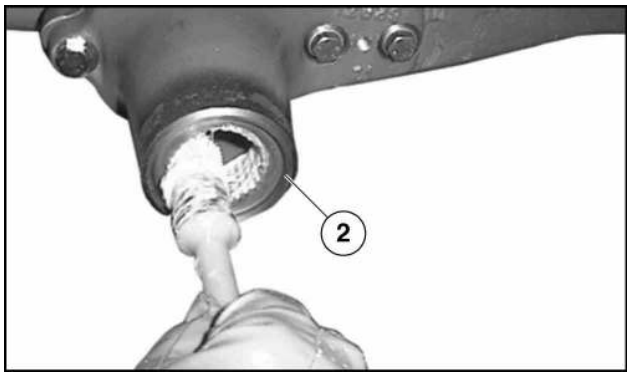


Using a harness and suitable hoist, raise the axle suspension to the end of its stroke.

https://truckmanualshub.com/

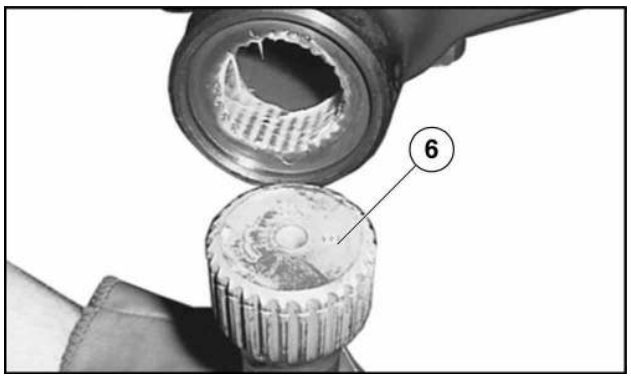


## STEP 7




Lubricate with McCormick LX Mulit-Purpose EP2 Grease, the inner teeth of the front flange (2).

## STEP 8




Before introducing the torsion bar (6), check the marks stamped on the end:

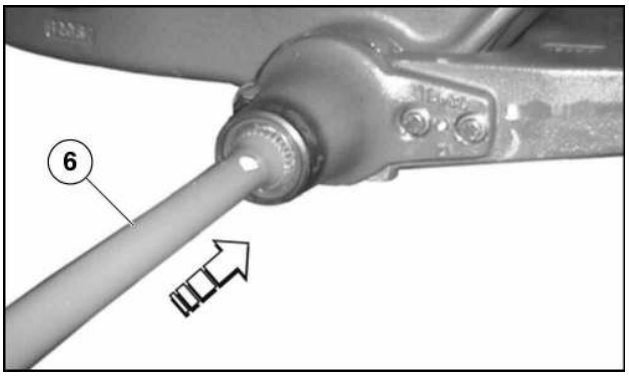
-sx = left torsion bar;

-dx = right torsion bar.

**NOTE:** *The arrow indicates the direction of rotation during preload.*

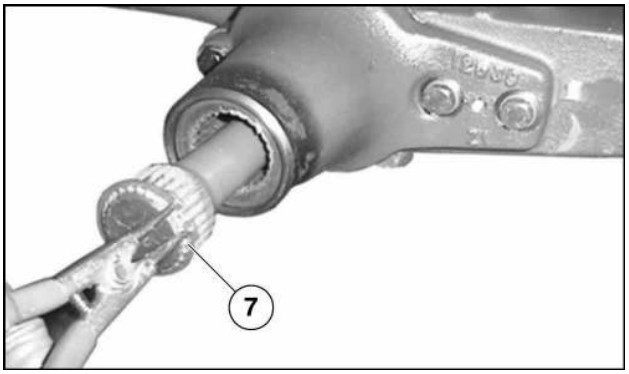
**NOTE:** *The "dx" and "sx" sides must be viewed from the pinion flange side.*

## STEP 9



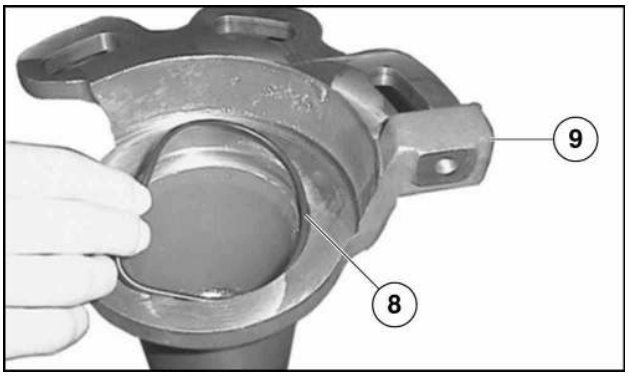

Install the torsion bar (6) in its seat.

## STEP 10




Install the torsion bar snap ring (7) (front flange side).

## STEP 11

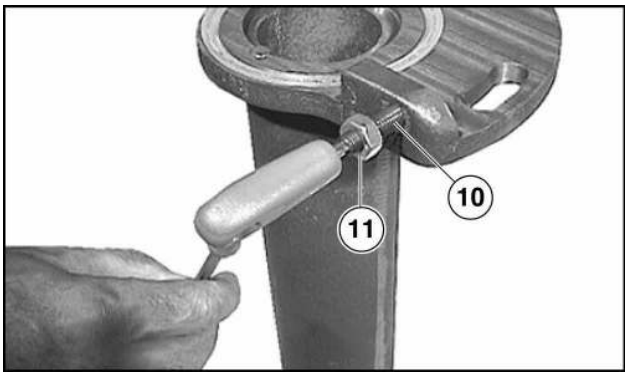



Install a new O-Ring (8) to the rear flange (9).

https://truckmanualshub.com/



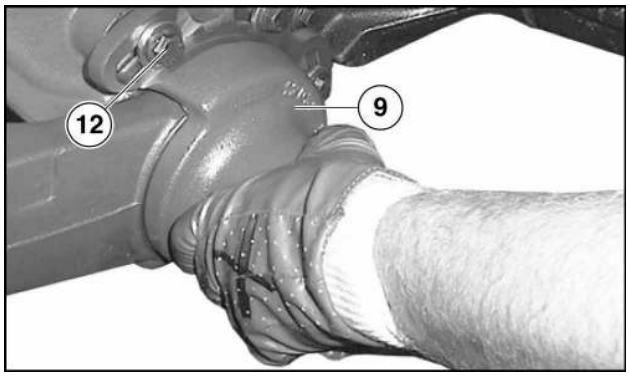
## STEP 12




Pre-assembly the grub screw (10) and the lock nut (11) to the rear flange.

**NOTE:** *Do not screw it beyond the support base.*

## STEP 13




Install the rear flange (9) on the seat of the lower arm. Install the three retaining bolts (12), but do not tighten.

https://truckmanualshub.com/

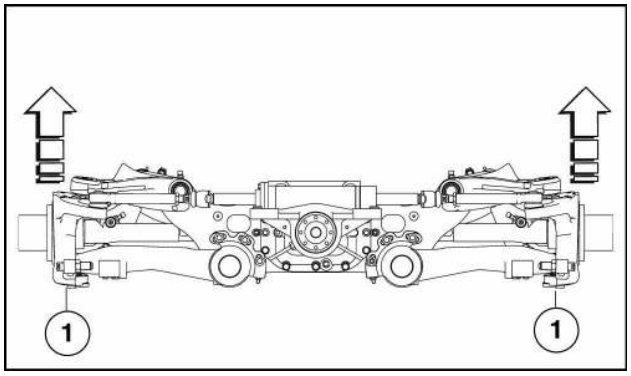


# TORSION BAR PRELOAD ADJUSTMENT

Some of the following pictures may not show your axle, but the procedure is the same.

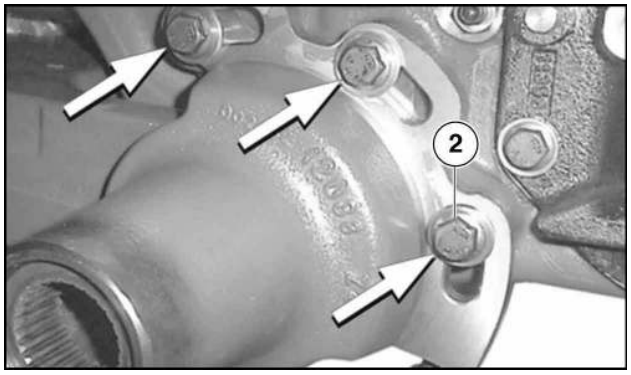
**NOTE:** *The adjustment of the torsion bar preload must be performed when the axle is complete with all its components.*

## STEP 1




Fully raise both sides of the axle supension(1).

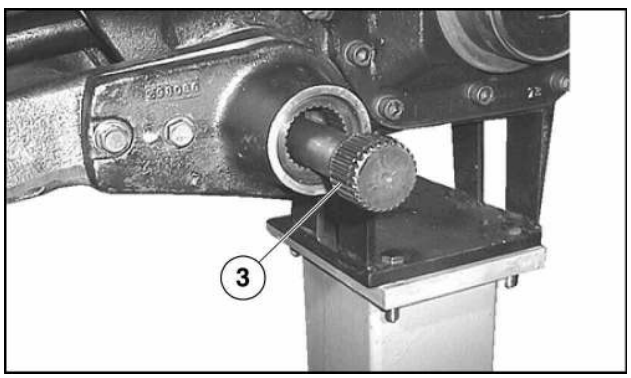
## STEP 2




Rotate the L/H flange counterclockwise to position the retaining bolts (2) at the right of the slot.

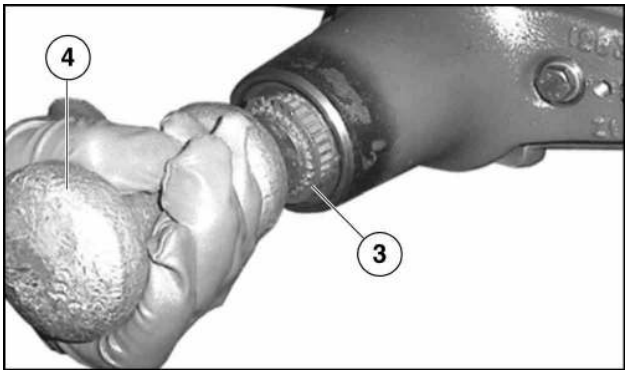
Rotate the R/H flange clockwise to position the retaining bolts (2) at the left of the slot.

## STEP 3



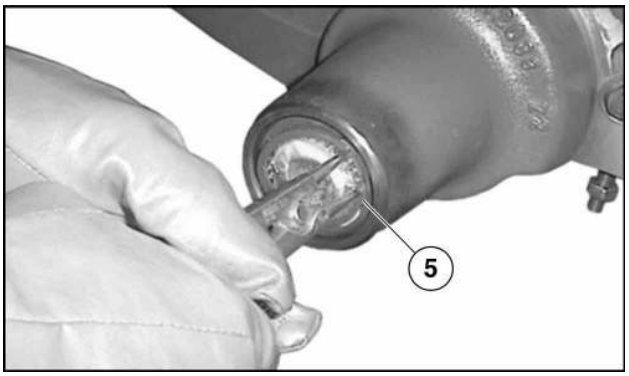

Fully Insert the torsion bar (3).

## STEP 4




Using a soft driving tool (4) and a hammer, tap the front end of the torsion bar (3), until it is fully engaged in the flanges and resting against the snap ring.

## STEP 5

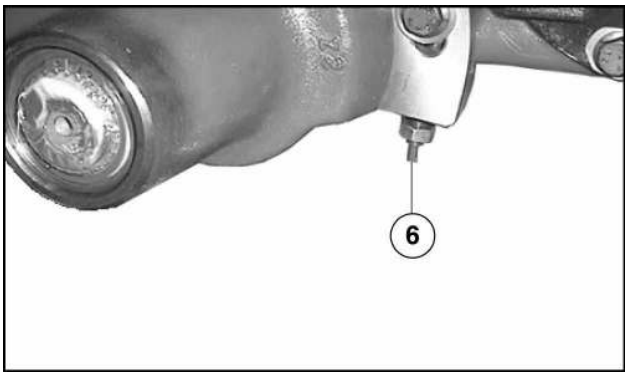



Install the snap ring (5) from the rear flange side.

https://truckmanualshub.com/

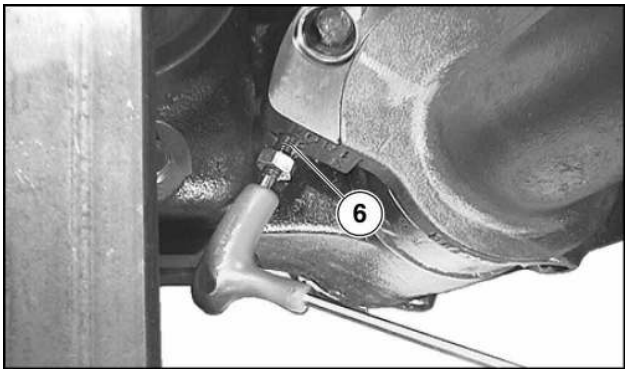


### STEP 6




Screw the grub screw (6) into the rear flange until it touches the central body.

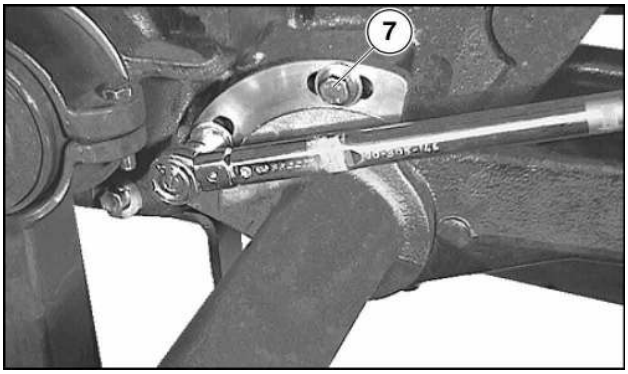
### STEP 7




To preload the torsion bar give the rear flange grub screw (6) 7.5 turns.

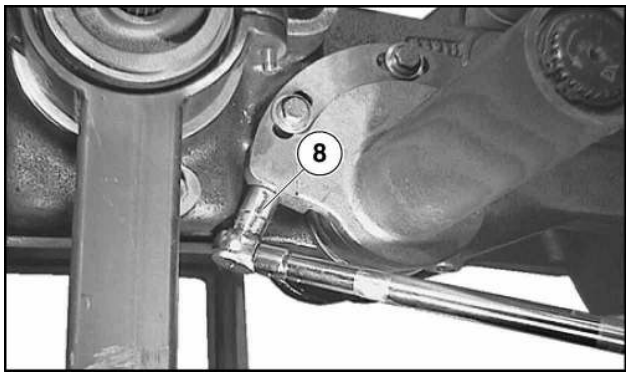
**NOTE:** *During this operation flange will rotate to preload the torsion bar. If the adjusting screw (6) is difficult to turn, make sure the retaining bolts are not overtightened.*

### STEP 8



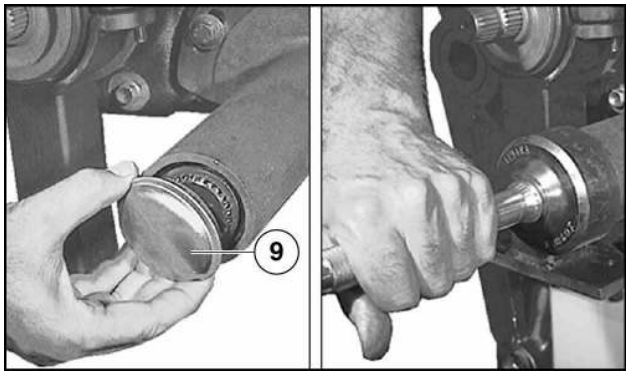

Tighten the retaining bolts (7) to a torque of 169 Nm (125 lb ft).

### STEP 9



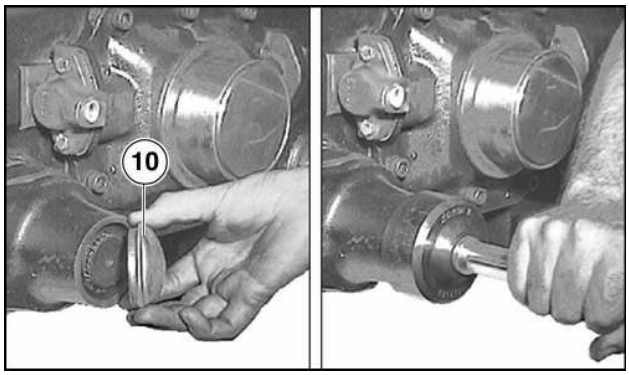

Tighten the grub screw lock nut (8) to a torque of 45 Nm (33 lb ft).

### STEP 10




Install the cover (9) on the rear flange using special tool CA715328 and a hammer.

### STEP 11




Install the cover (10) on the front flange using special tool CA715328 and a hammer.

https://truckmanualshub.com/



# WHEEL HUB UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *Before assembling the wheel hub unit, it is necessary to assemble the swivel housing unit.*

## STEP 1




Place the wheel hub (1) on a workbench and install the two taper roller bearing cups using the special tool CA715026 under a press or with a hammer.

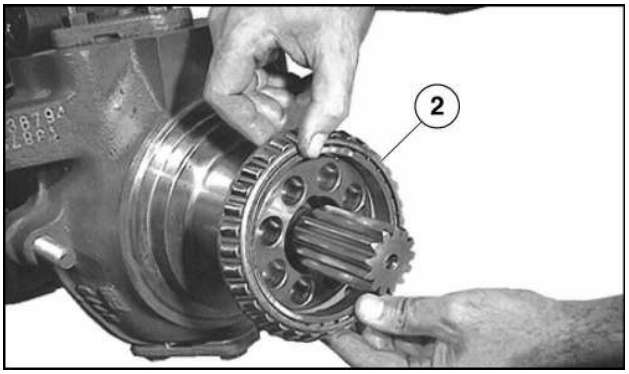
## STEP 2



Turn the wheel hub upside down and install a new seal ring special tool CA119143 and a hammer.

**NOTE:** *Before installation lubricate the seal with McCormick LX Multi-Purpose Grease.*

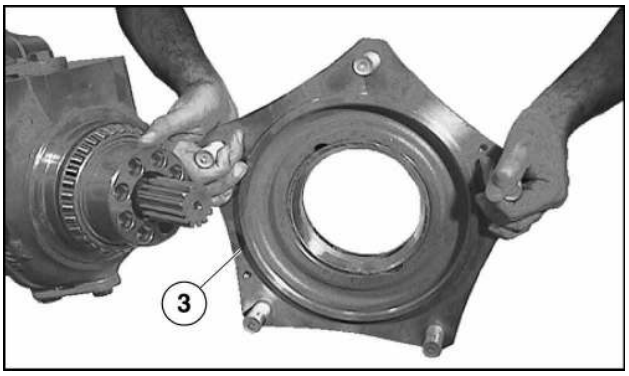
## STEP 3




Install the inner bearing cone (2) onto the swivel housing.

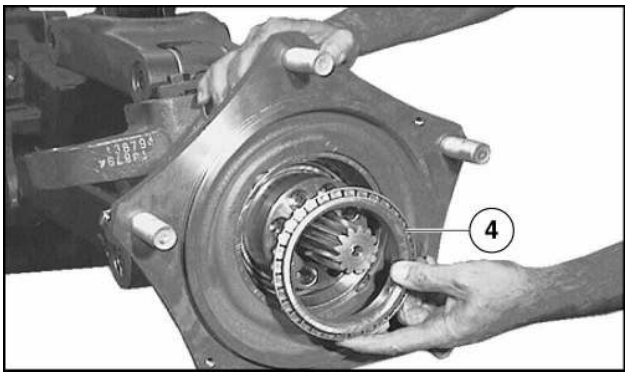
**NOTE:** *If necessary, use a rubber hammer.*

## STEP 4




Install the wheel hub (3) onto the swivel housing.

## STEP 5

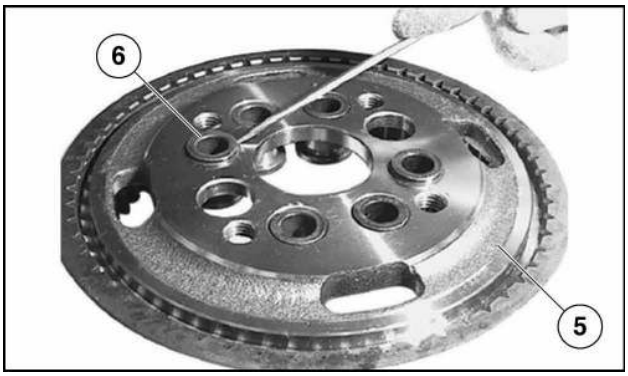



Install the outer bearing cone (4) onto the wheel hub (3).

https://truckmanualshub.com/



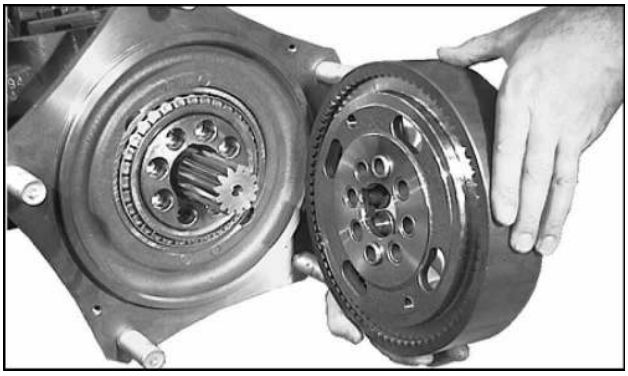
## STEP 6




Position the wheel carrier (5) on a workbench and install the bushes (6) to the carrier surface level with the special tool CA715027.

**NOTE:** *Leave two bushes opposed to each other, slightly higher than the carrier surface to be used as dowel pins.*

## STEP 7

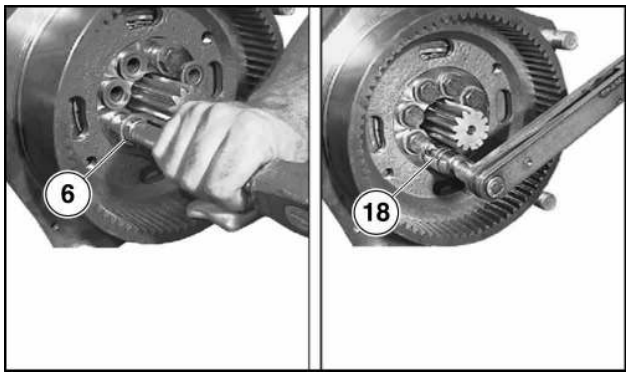


**NOTE:** *Check O-Rings (17) position.*

Only for 20.43SI FR axle model.

**NOTE:** *Check O-Rings (17) position.*

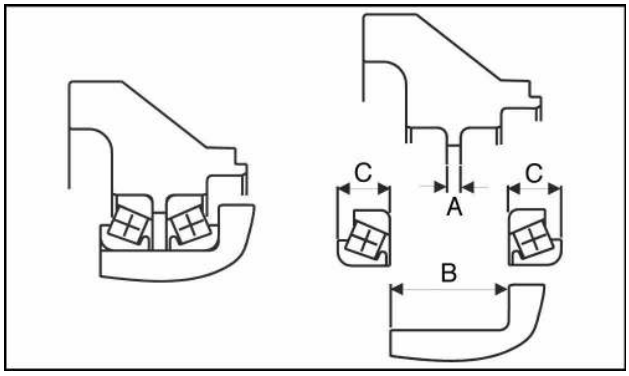
## STEP 8




Install the wheel carrier onto the wheel hub using the two projecting bushes as dowel pins. Install the bushes (6) used as dowels with special tool CA715027 and a hammer.

Install the wheel carrier retaining bolts (18) and tighten to a torque of 230 Nm (169 lb ft).

## STEP 9




A= 17.950

B= 64.275

C= 23.070

The bearings do not require preloading or backlash, only the dimensions shown above.

https://truckmanualshub.com/

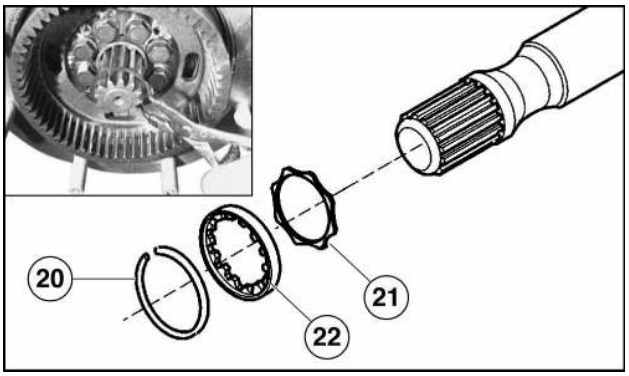


## STEP 10




Using a lever (19) push the double U-Joint in the direction of the final drive to allow the lock ring (20) to be installed.

## STEP 11




Install washer (21) and thrust washer (22) onto the U-Joint shaft and lock them with the snap ring (20).

**NOTE:** *Make sure the lock ring (20) is correctly seated.*

https://truckmanualshub.com/

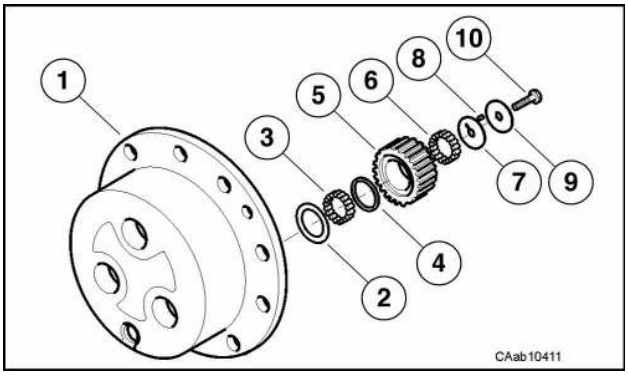


# EPICYCLIC REDUCTION GEAR UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

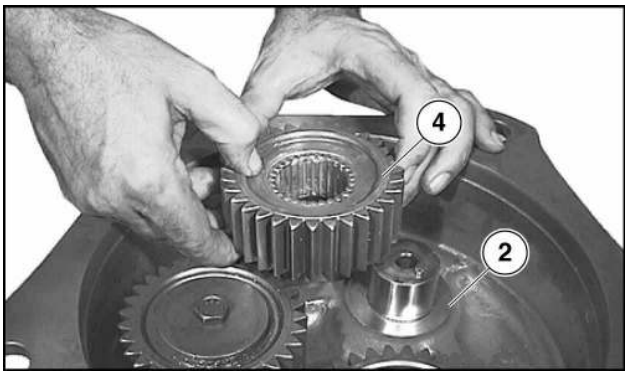
**NOTE:** *Before assembling the epicyclic reduction gear unit, it is necessary to assemble the wheel hub unit.*

## STEP 1




**NOTE:** *With new planetary gears it is advisable to install new needle bearings.*

## STEP 2

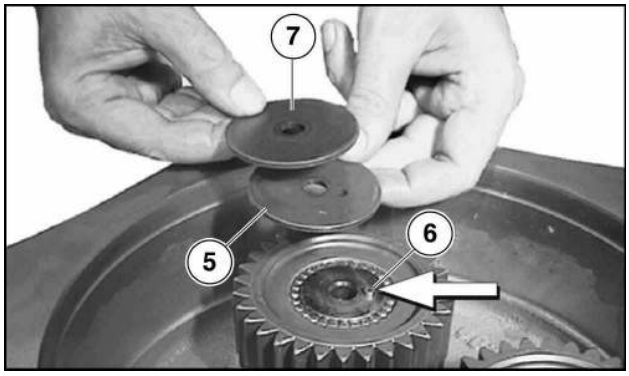



Position the planetary carrier on a workbench. Install the washer (4) and the needle bearings (3, 6) into the epicyclic gears (5).

**NOTE:** *Apply Mccormick LX Multi-Purpose Grease to the needles.*

Install the thrust washers (2) and the epicyclic gears (5) onto the planetary carrier pins.

## STEP 3

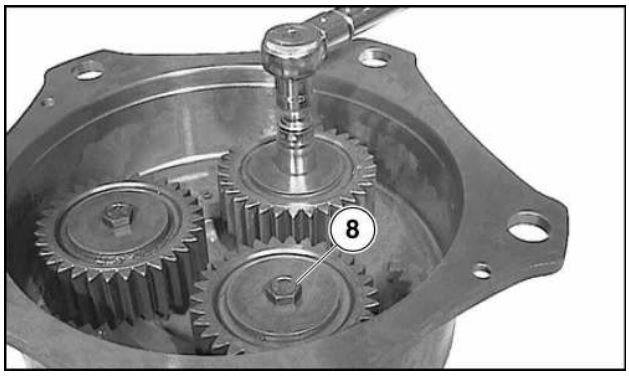



Place the pins (8) on the planetary carrier pins.

Install the two thrust washers (7) and (9) to the planetary gears.

**NOTE:** *Make sure the thrust washer (7) is correctly positioned on the lock pin.*

## STEP 4

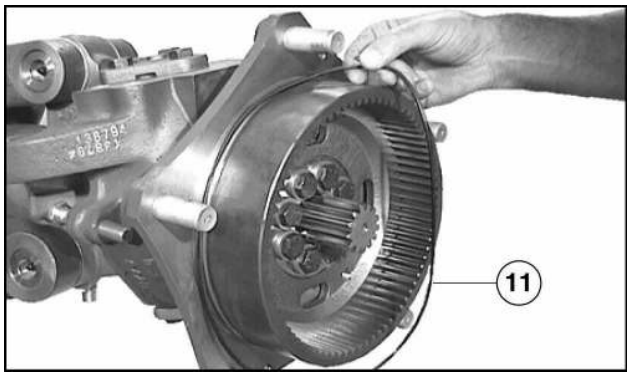



Install the retaining bolts (10) and tighten to a torque of 79 Nm (58 lb ft).

https://truckmanualshub.com/

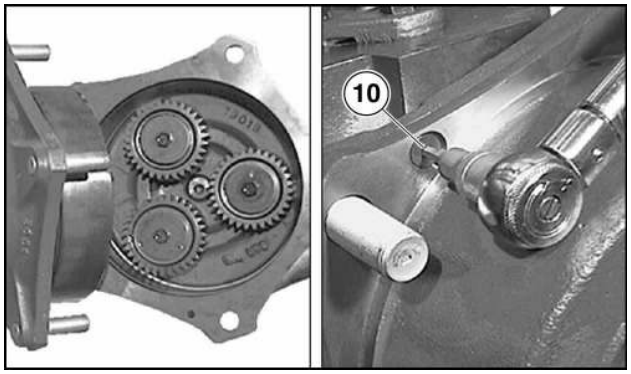


## STEP 5



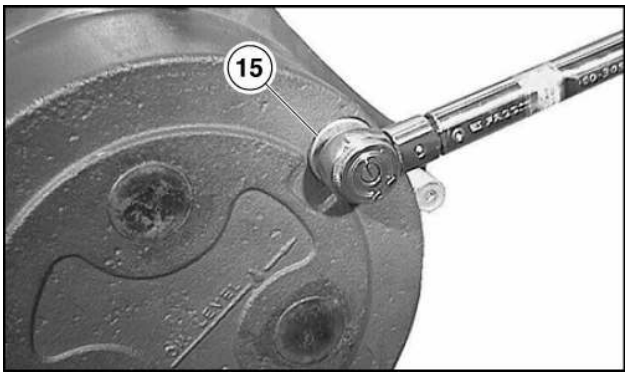

Install a new O-Ring (11) on the wheel hub (13).

## STEP 6




Install the epicyclic reduction gear assembly to the wheel hub (13). Install the retaining screws (14) and tighten to a torque of 25 Nm (18 lb ft).

## STEP 7




Top up the oil on the wheel hub.

Install the drain plug (15) and tighten to a torque 60 Nm (44 lb ft).

https://truckmanualshub.com/

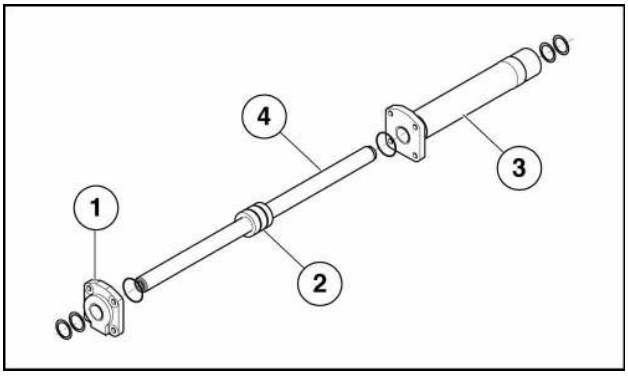


# STEERING CYLINDER UNIT

Some of the following pictures may not show your axle, but the procedure is the same.

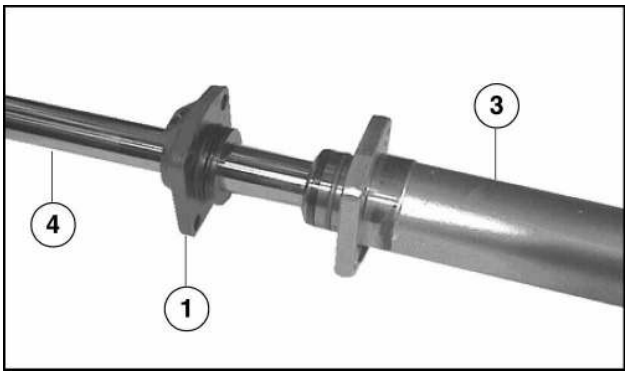
**NOTE:** *Before assembling the cylinder, it is necessary to assemble the differential support unit and the swivel housing unit.*

## STEP 1



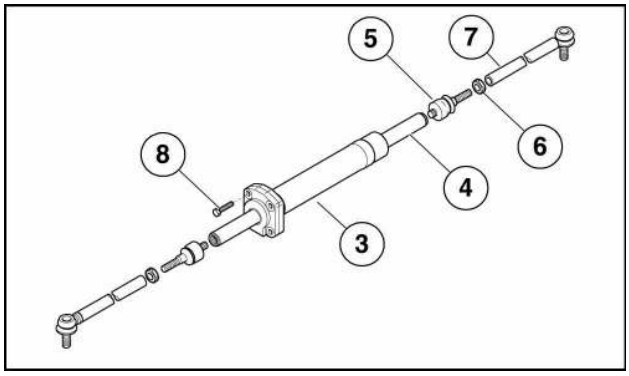

Install new seal rings on the cylinder head (1), the piston (2), and on the cylinder body (3).

## STEP 2



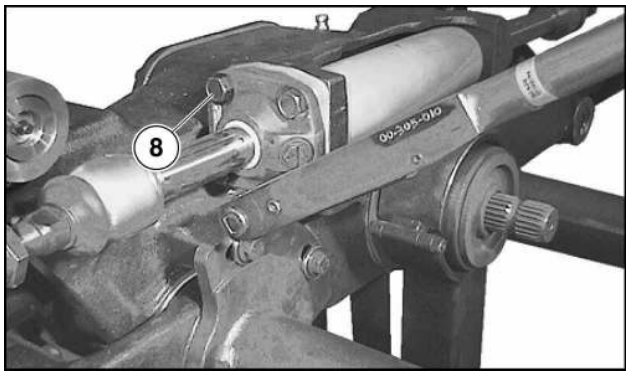

Slide the cylinder rod (4) into the cylinder body (3).

## STEP 3




Install the steering rods (7), ball joint (5) and lock nut (6) to the ends of the cylinder rod (4). Tighten the ball joint (5) to a torque of 300 Nm (221 lb ft).

## STEP 4

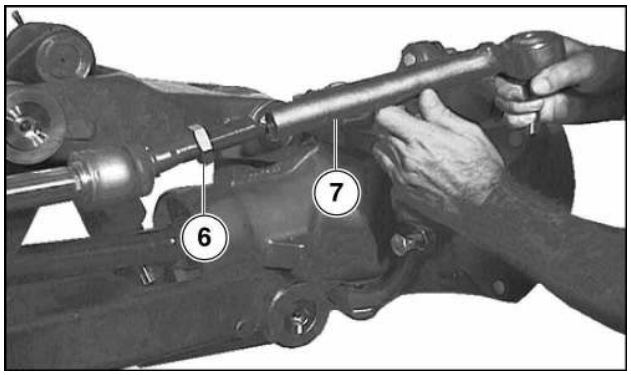



Install the steering cylinder onto the axle, and tighten the steering cylinder retaining bolts (8) to a torque of 120 Nm (88 lb ft).

https://truckmanualshub.com/



## STEP 5

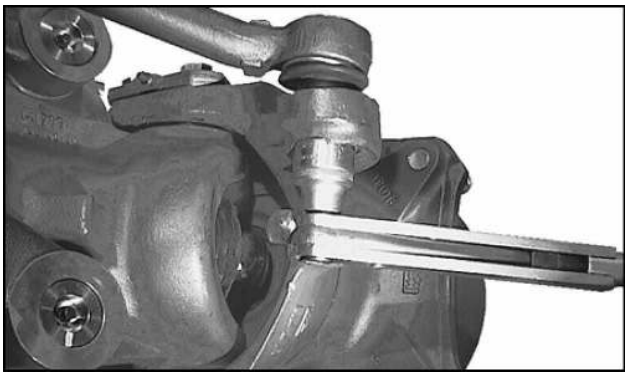



Align the swivel housings with the axle.

Screw the steering rod (7) so that the ball joint can be inserted into the swivel housing arm.

**NOTE:** *It is important to unscrew the locking nut (6) to carry out this operation.*

## STEP 6



Install the ball joint into the swivel housing. Install a new retaining nut and tighten to a torque of 220 Nm (162 lb ft).

**ATTENTION:** *Tighten the lock nut (6) when the toe-in adjustment has been carried out.*

https://truckmanualshub.com/

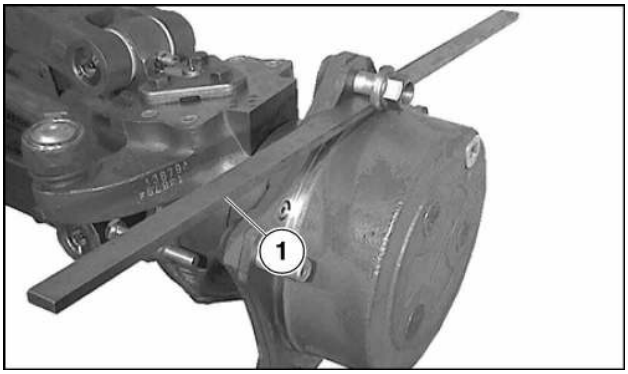


# TOE-IN AND STEERING ANGLE ADJUSTMENT

Some of the following pictures may not show your axle, but the procedure is the same.

**NOTE:** *For the toe-in and steering angle adjustment, it is necessary to work with the axle complete of all components.*

## STEP 1



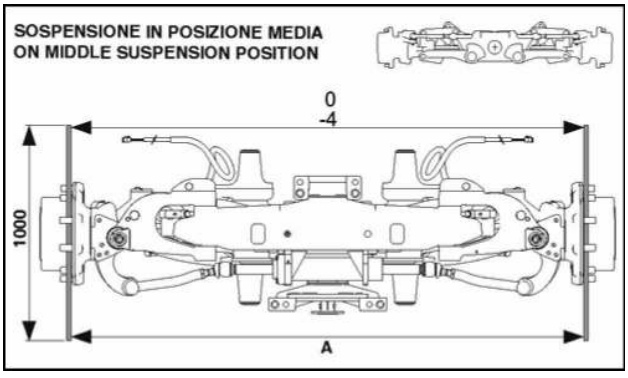

The adjustment of the toe-in must be made with the axle in three different positions: medium, low, high.

Position the steering cylinder rod in the centre of stroke and measure the exposed rod length on both sides and check that they are equal;

Install two straight bars (1), 1m in length, on the wheel sides, and secure them with two nuts on the wheel stubs.

**NOTE:** *The two bars must be fixed so the centre of each bar is perpendicular to centre line of the hub and parallel to the pinion shaft axis.*

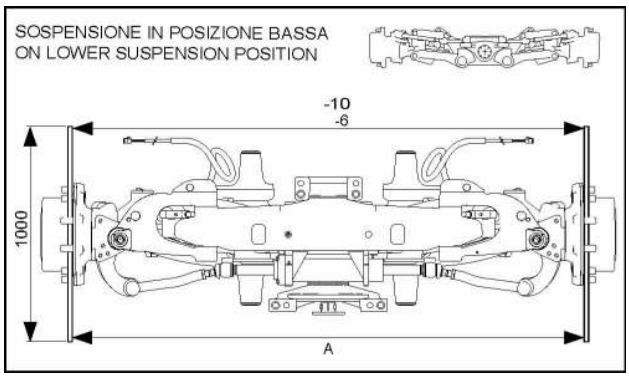
## STEP 2




Place the axle in the intermediate position and check that the difference between the two measurements is within tolerance: A

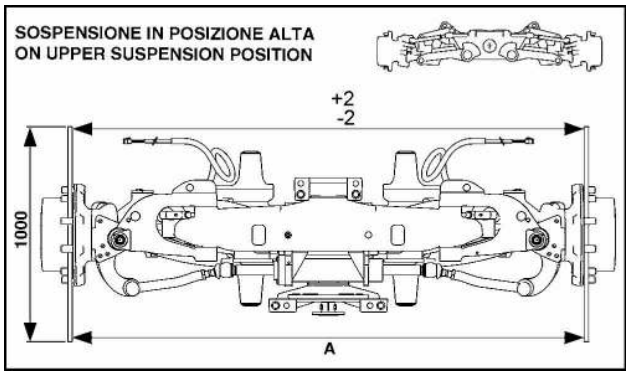
Measure the distance in millimetres between the ends of the two bars, using a tape measure.

## STEP 3




Place the axle in the lower position and check that the difference between the two measurements is within tolerance: A

## STEP 4

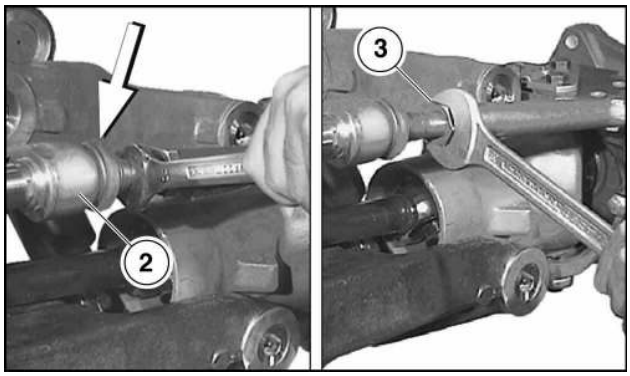



Place the axle in the upper position and check that the difference between the two measurements is within tolerance: A

https://truckmanualshub.com/



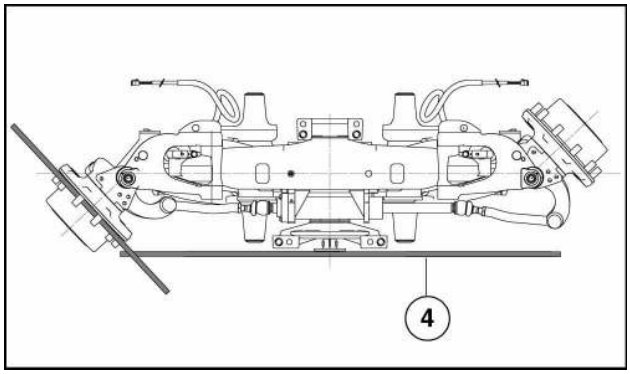
## STEP 5




If toe-in is incorrect, screw in or out the tie rods (2) equally until the toe-in is within the requested tolerance.

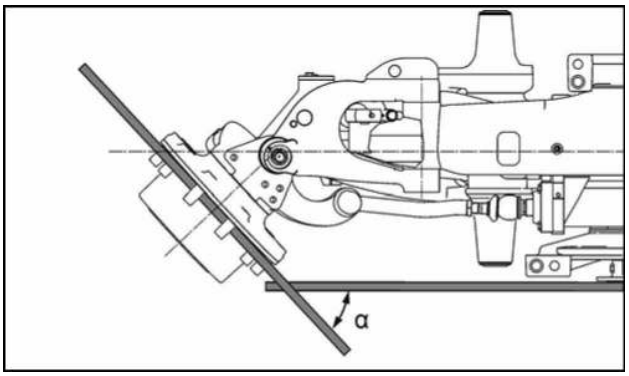
After adjusting the toe-in, tighten the lock nuts (3) to a torque of 250 Nm (185 lb ft).

## STEP 6



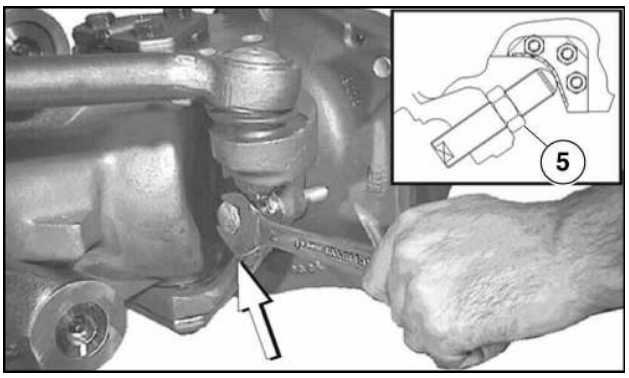

Use the same bars for the adjustment of the steering angle and a long bar (4), resting on the machined part of the central body (pinion side), so that the two bars form an acute angle at the maximum turning point.

## STEP 7




Move the wheel side unit until it forms an angle of 35° “a”.

## STEP 8




Adjust the steering stop by tightening or loosening the special bolts before tightening it with the locknut (5) to a torque of 150 Nm (111 lb ft).

Turn steering to the opposite side and repeat the operation.

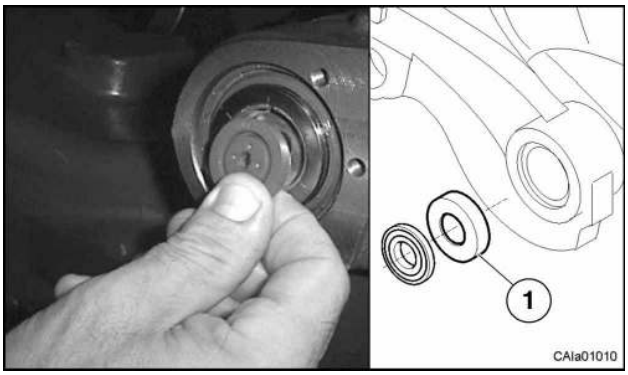
https://truckmanualshub.com/



# ARMS SENSOR GROUP

Some of the following pictures may not show your axle, but the procedure is the same.

## STEP 1



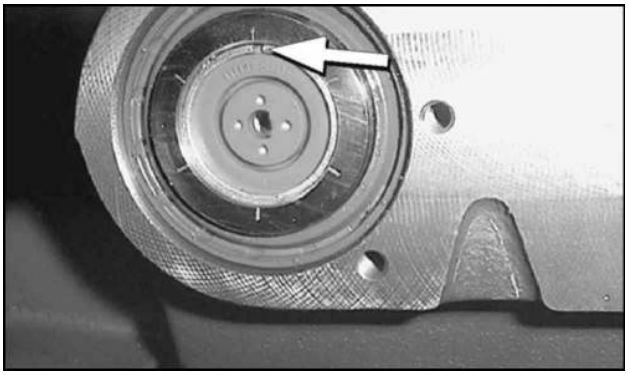

Install the rubber washer ring (1) in its seat after applying Loctite 542 on its outer edge.

**ATTENTION:** *For the assembly, refer to the marks made during disassembly.*

Install the sensor rubber washer (2) into the washer ring (1).

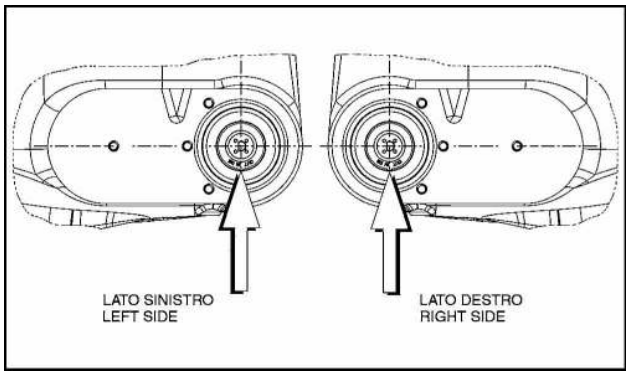
**NOTE:** *The word "OUTSIDE" on the rubber washer must be facing outwards.*

## STEP 2



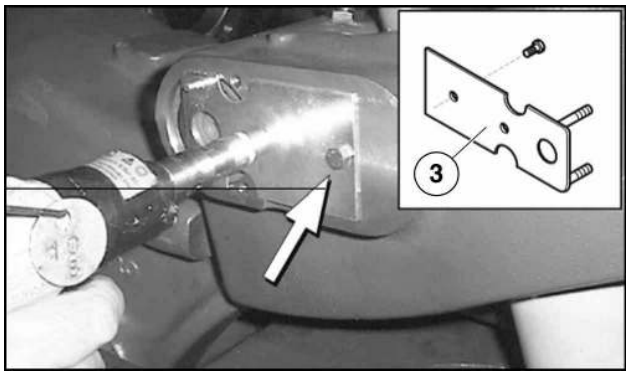
The outer protrusion of the sensor rubber washer (2) must be inserted in the slot on the ring (1).

## STEP 3




Assemble as shown.

## STEP 4



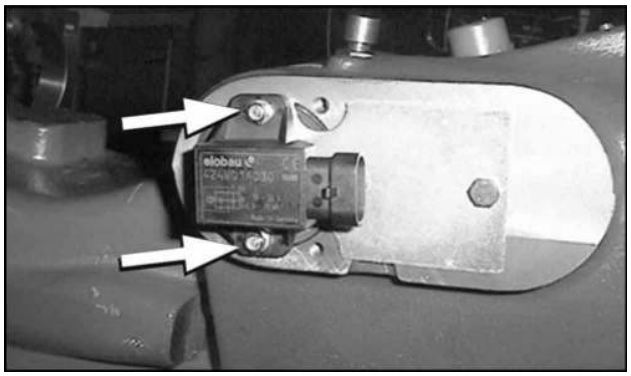

Install the sensor support (3) on the upper arm.

Tighten sensor support bolts to a torque of 13 Nm (10 lb ft).

https://truckmanualshub.com/



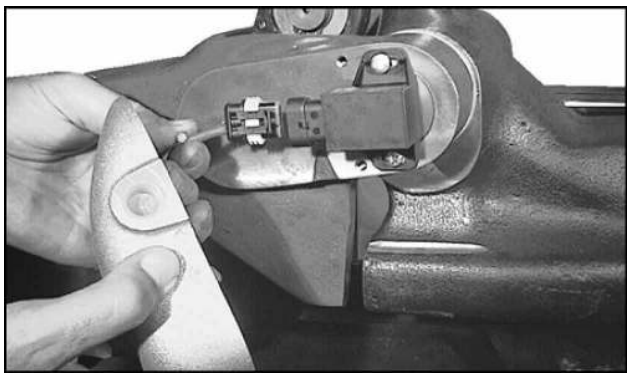
## STEP 5



Install the sensor onto the rubber washer in the upper arm.

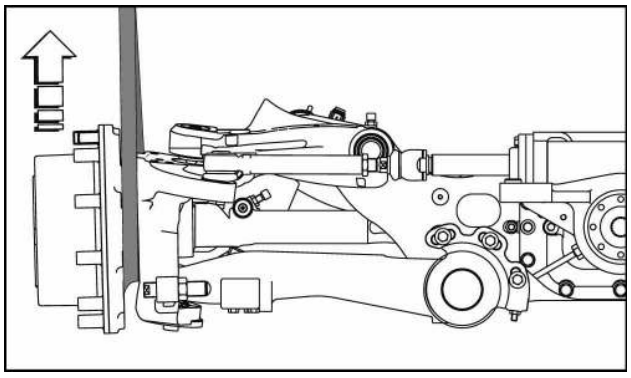
Install the washers and sensor retaining nuts and tighten provisionally.

## STEP 6



Connect the sensor to the harness kit in order to power it and adjust the angular position.

## STEP 7

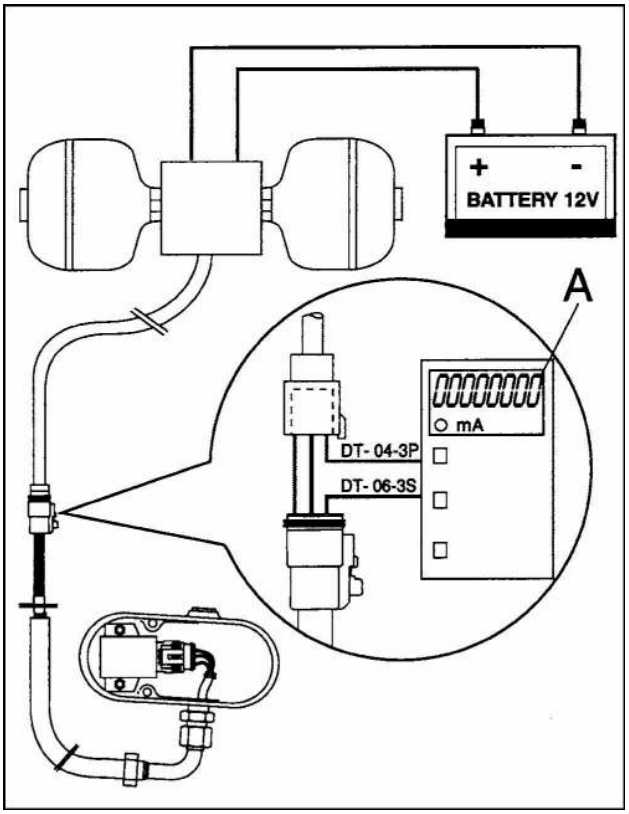


SENSOR ANGLE ADJUSTMENT:

Set the sensor angle in order to find the ideal work position for the axle.

Using a harness and suitable hoist, raise the axle to the end of its stroke.

## STEP 8




If the axle and all its parts, including the battery, have been connected to the tractor, disconnect the connector between the sensor and the suspension control unit, and connect a multi meter to measure the electric current which must be:

With the wheel sides fully raise.

A = 7.8 mA ± 0.5

With the wheel sides fully lowered.

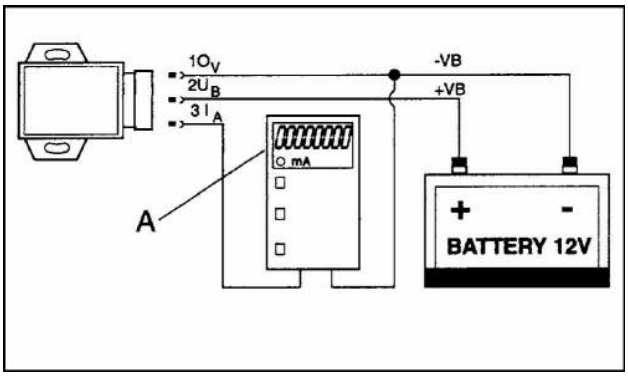
A = 15.963 mA ± 0.5

**ATTENTION:** *Measurements should be taken with the ignition on.*

https://truckmanualshub.com/



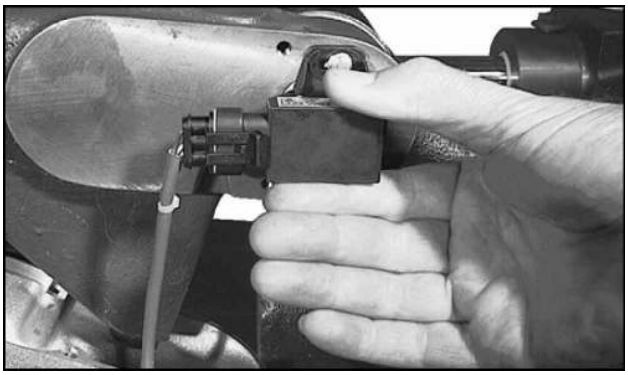
## STEP 9




If the axle has not been fitted and is on a work bench, lift the wheel sides until to end of stroke with a rope.

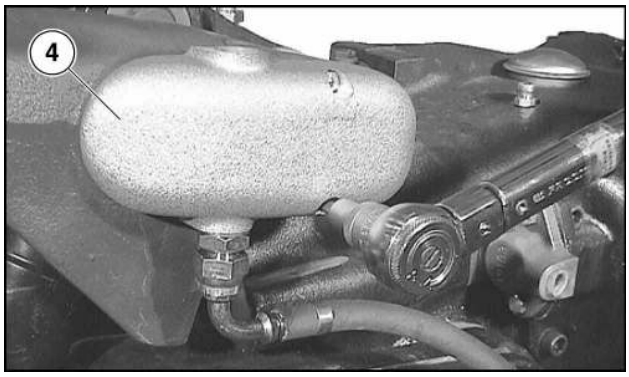
With a equipment consisting of a 12V battery and a multi meter connected to the angle sensors, (as shown), measure the electric current which must be the same as in STEP 8.

## STEP 10



To adjust the value of the electric current, loosen the nuts and rotate the sensor slowly by hand until the prescribed value is shown on the multi meter. Tighten the sensor fixing nuts to t a torque of 4 Nm (3 lb ft).

## STEP 11




Install the wiring harness kit cover (4), and tighten the fixing screws to a torque of 13 Nm (10 lb ft).

https://truckmanualshub.com/

# Table of Contents

## XTX Series Tractors
## Service/Diagnostic Manual SM 8-15002

## Volume 1 Contains Tabs 1 to 6
## Volume 2 Contains Tabs 7 to 10


| | Section | Pub. No. |
|---|---|---|
| **1 GENERAL** | | |
| Safety Rules, General Information and Torque Specifications | 1001 | SM 8-10080 |
| **2 ENGINE** | | |
| **NOTE:** *For Service and Overhaul procedures refer to your Engine Service Manual.* | | |
| **3 FUEL** | | |
| **NOTE:** *For Service and Overhaul procedures refer to your Engine Service Manual.* | | |
| **4 ELECTRICAL** | | |
| Electrical Troubleshooting and Schematics | 4001 | SM 8-15150 |
| Instrument Cluster Programming | 4002 | SM 8-15121 |
| Battery Servicing and Testing | 4004 | SM 8-10160 |
| **5 STEERING** | | |
| Steering Column and Steering Hand Pump Removal | 5001 | SM 8-15270 |
| Rexroth Steering Hand Pump | 5002 | SM 8-15260 |
| **6 TRANSMISSION** | | |
| Transmission How it Works | 6 | DT50-50501 |
| Guidelines for Separating the Speed and Range Transmissions | 6003 | SM 8-15190 |
| 8 Speed Powershift Transmission Servicing | 6006 | SM 8-15031 |
| Range Transmission Servicing | 6007 | SM 8-15160 |
| Differential and Differential Lock Servicing | 6012 | SM 8-15210 |
| MFD Clutch Servicing | 6017 | SM 8-15170 |
| Rear Axle Removal | 6018 | SM 8-15180 |
| PTO Servicing - shiftable/reversible | 6019 | SM 8-15290 |
| MFD Front Axle (20.29 Rigid Axle) | 6021 | SM 8-15250 |
| MFD Front Axle (20.43 Rigid Axle) | 6021-A | SM 8-15230 |
| MFD Front Axle (20.29 Suspended Axle) | 6022 | SM 8-15240 |
| MFD Front Axle (20.43 Suspended Axle) | 6022-A | SM 8-14010 |


© 2006 McCormick Tractors International Limited.
Printed in England
SM 8-15012
July 2005 (Revised November 2006)

https://truckmanualshub.com/

# Table of Contents


**7 BRAKES**

| | | |
|---|---|---|
| Brakes How it Works | 7 | DT50-50700 |
| Service Brakes | 7002 | SM 8-15220 |

**8 HYDRAULICS**

| | | |
|---|---|---|
| Hydraulics How it Works | 8 | DT30-10203 |
| Hydraulic Troubleshooting and Schematic | 8001 | SM 8-15021 |
| Charge/Lubrication Pump | 8003 | SM 8-15200 |
| Remote Valves | 8008 | SM 8-15130 |

**9 CHASSIS**

| | | |
|---|---|---|
| Pedal, Lever and Switch Adjustments | 9001 | SM 8-15041 |

**10 CONTROLLER SYSTEMS**

| | | |
|---|---|---|
| Electrical Controllers How it Works | 10 | DT50-50611 |
| Auxiliary/Remote Valve Controller - Error Codes, Troubleshooting and Schematics | 10001 | SM 8-15051 |
| Hitch/PTO Controller - Error Codes, Troubleshooting and Schematics | 10002 | SM 8-15061 |
| Independent Front Suspension Axle Controller - Calibration, Error Codes, Troubleshooting and Schematics | 10003 | SM 8-15070 |
| Transmission and Cab Controller - Calibration, Error Codes, Troubleshooting and Schematics | 10006 | SM 8-15081 |
| Instrument Cluster Controller - Error Codes, Troubleshooting and Schematics | 10009 | SM 8-15091 |
| Controller Reprogramming (Using The McCormick Diagnostic Centre) | 10010 | SM 8-15101 |
| Cab Suspension Controller - Calibration, Error Codes, Troubleshooting and Schematics | 10011 | SM 8-15140 |
| Automatic Temperature Control - Error Codes, Troubleshooting and Schematics | 10012 | SM 8-15110 |


**NOTE:** *Information contained in this manual may cover features that are not available in all markets worldwide.*

**NOTE:** *References throughout this manual may be made to sections currently not available. These Sections will be made available at a later date.*

https://truckmanualshub.com/

# Section 7

## XTX BRAKES

## How It Works



McCORMICK

DT 50-50701

© 2006 McCormick Tractors International Limited.
August 2007

https://truckmanualshub.com/



# TABLE OF CONTENTS

BRAKE SYSTEM
Service Brakes General ..... 5
Park Brake ..... 5
Optional Park Lock ..... 5
Brake Disc Housing ..... 5

BRAKE ACTUATION
General Description ..... 7

SERVICE BRAKES
General Description ..... 9
Brake Application ..... 9
Self Adjusting Mechanism ..... 9

PARKING BRAKE
General Description ..... 11
Operation ..... 11
Optional Mechanical Parking Lock ..... 11

HYDRAULIC TRAILER BRAKE
General Description ..... 12

REXROTH VALVE
Brakes Off ..... 12
Brakes Applied ..... 13
Maximum Trailer Brake Pressure ..... 14
Rexroth Hydraulic Trailer Brake Valve Schematic ..... 15

HUSCO HYDRAULIC TRAILER BRAKE VALVE
General Description ..... 16
Brakes in Off Position ..... 16
Brakes Applied ..... 17
Brakes at Maximum Pressure ..... 18
Husco Hydraulic Trailer Brake Valve Schematic ..... 19

SLANZI TRAILER BRAKE VALVE
General Description ..... 20
Trailer brakes connected and tractor brakes not applied ..... 21
Trailer brakes connected and tractor brakes applied ..... 22
Schematic Drawing Of Slanzi Hydraulic Trailer Brake Valve ..... 23

REMOVING AIR FROM THE TRACTOR SERVICE BRAKES ..... 24

PNEUMATIC (AIR) TRAILER BRAKING SYSTEM
General Description ..... 25
Inshot System ..... 25

https://truckmanualshub.com/



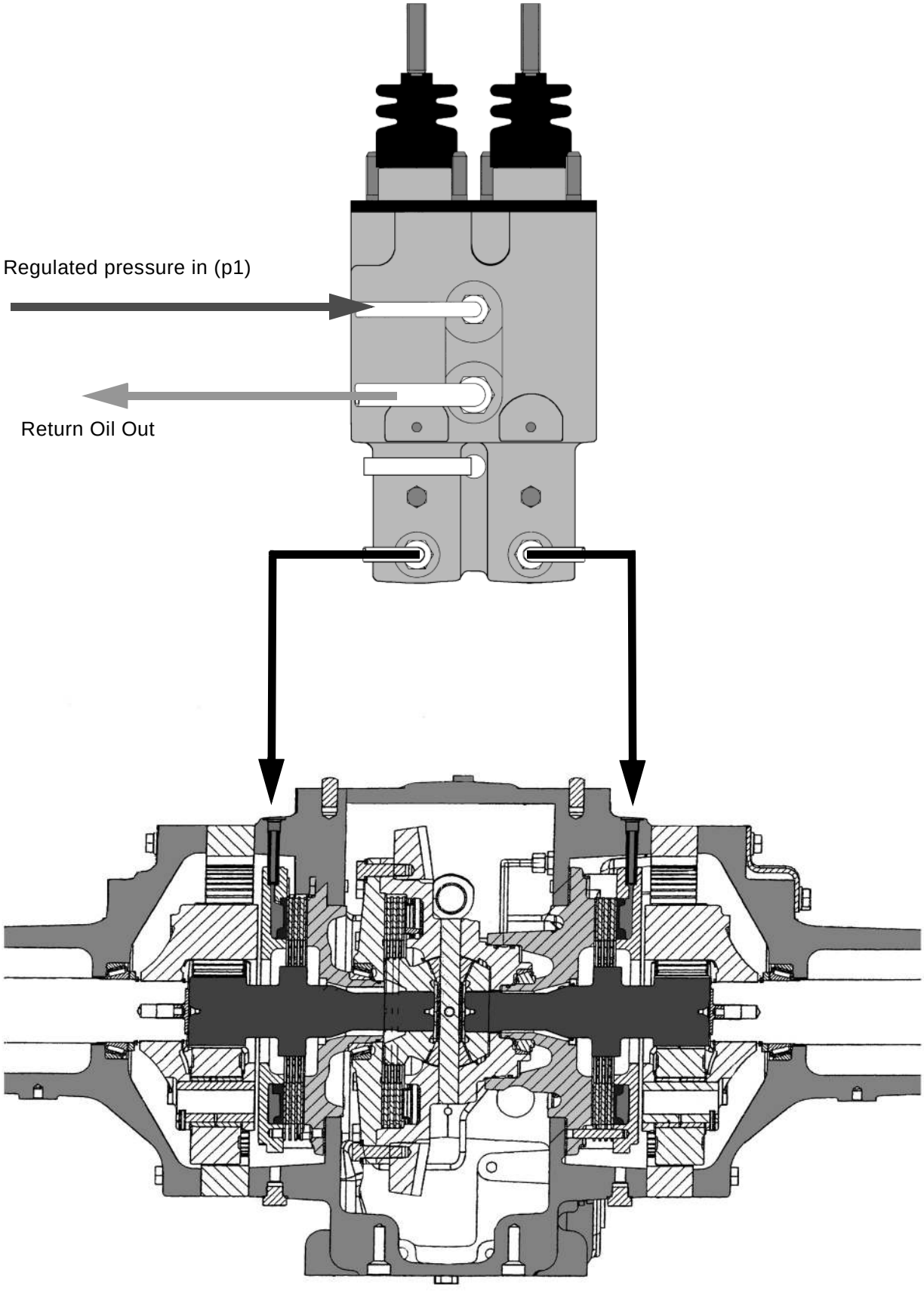
SYSTEM LAYOUT
- Compressor ..... 27
- Pressure Control Valve ..... 27
- Air Storage ..... 27
- Air Pressure Warning ..... 28
- Fluid Reaction Valves ..... 28
- Trailer Park Brake Operation ..... 28
- Activation of the Air Trailer Brakes ..... 28
- Single Line System ..... 29

AIR TRAILER BRAKE SCHEMATIC ..... 30

https://truckmanualshub.com/



# BRAKE SYSTEM



https://truckmanualshub.com/



## Service Brakes General

The braking system consists of inboard oil immersed multi plate disc brakes which are hydraulically operated and are self adjusting.

To apply the service brakes, the operator uses a “power boosted master cylinder” system which has a regulated pressure (P1) supply from the tractor hydraulic system to give hydraulic servo assistance to the brake application, therefore requiring less pedal effort from the operator to stop the tractor.

**NOTE:** *Tractors built from approximately May 2006 and all 50 kph models incorporate an accumulator on the brake circuit, to provide a supply of regulated pressure (P1) in the event of engine shutdown whilst the tractor is in motion.*

The brake master cylinder valve uses self equalising master cylinders with an internal balance line which connects the L/H and R/H circuits together when both brakes are applied ensuring equal braking.

Both hydraulic trailer brakes and pneumatic trailer brakes are available as an option individually or together. The trailer brake valves are controlled by a connection to both the service brake circuits. The brake pedals must be latched together for actuation of the trailer brakes. There are two types of hydraulic trailer brake valve that could be fitted to the tractor, depending on its age. Both valves are covered in latter pages of this section.

## Park Brake

The parking brake of the tractor is a multi plate disc brake that is cable operated and mounted on the end of the pinion shaft. The park brake discs and counter plates are compressed by an expanding ball and ramp mechanism that is mounted between the discs, between the transmission centre housing and the MFD support housing.

## Optional Park Lock

An optional mechanical park lock can be specified. This unit is electro hydraulically operated, by the shuttle lever, and is sprung to the engaged position and regulated pressure (P1) is used to disengage the locking pawl from a gear on the MFD drive shaft within the speed housing of the transmission, whenever the forward reverse lever is moved out of the park position the lock will disengage.

## Brake Disc Housing

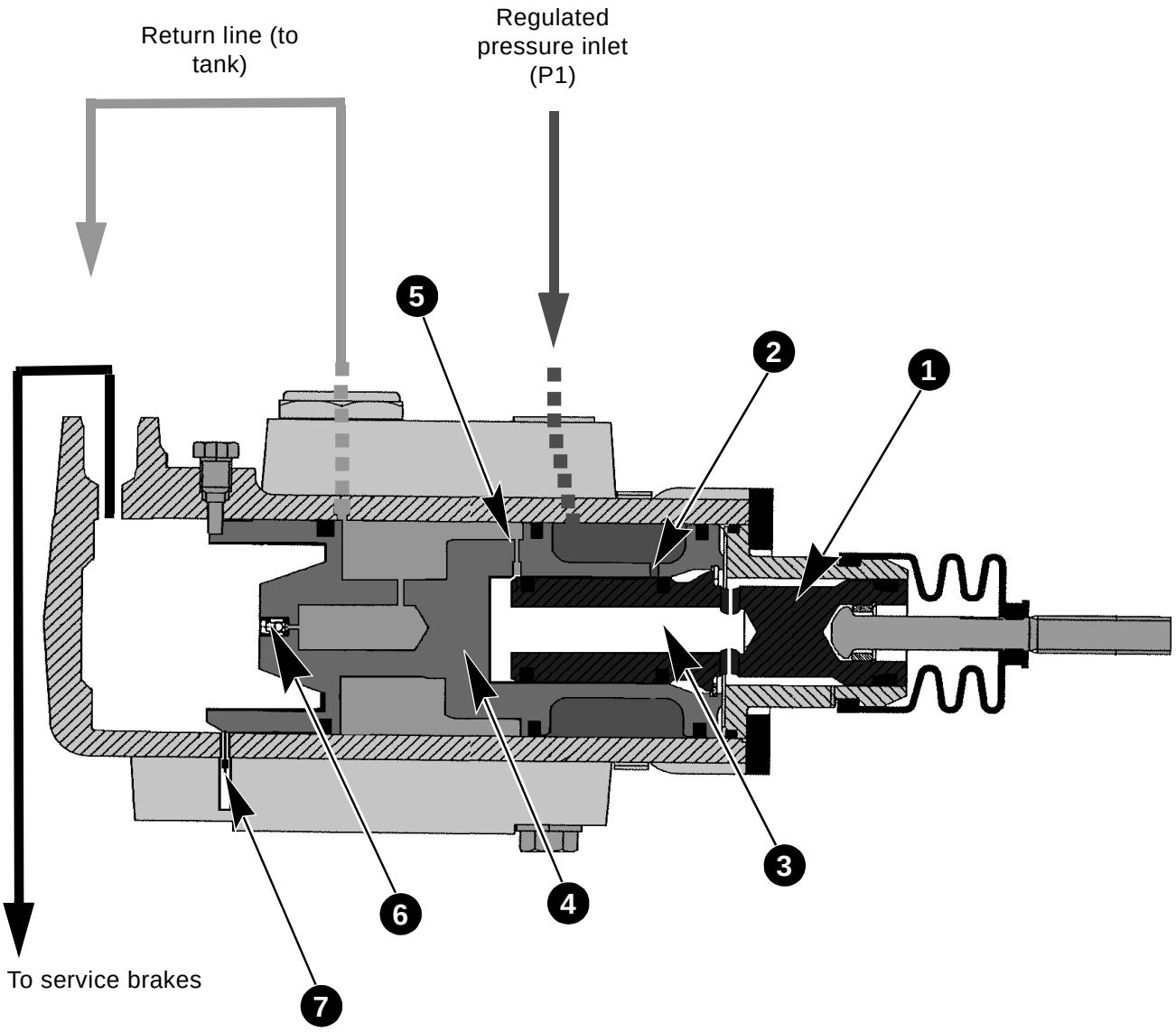
When a brake pedal is depressed by the operator, oil is directed from the master cylinder through a steel tube to the oil inlet fitting on top of the rear transmission housing. The brakes are mounted inside a special housing between the outer face of the differential housing of the tractor and the axle planetary reduction unit. A small plastic tube that is sealed into both the transmission housing and the brake housing then delivers oil to the brake piston. This causes the friction plates to be clamped between the piston and the counter plates.

The friction plates are splined on to the sun shaft of the differential. The piston is mounted in the end of the brake housing and compresses the friction discs and counter plates towards the differential of the tractor.

https://truckmanualshub.com/



# BRAKE ACTUATION



https://truckmanualshub.com/



## General Description

When the operator applies either the left or right brake pedal, the linkage connected to the pedal pushes on an internal piston (1) in the first stage of the master cylinder.

If the engine is running there is a supply of regulated pressure oil (P1) to the brake master cylinder. As the first stage piston moves across in the master cylinder it opens a port (2) in the valve allowing regulated pressure (P1) to enter into the cavity (3) inside the piston and assist with the movement of the second piston (4).

Should the engine be turned off, or there is no regulated oil pressure supply (P1) then the first stage piston (2) will be mechanically pushed against the second piston (4) to allow brake actuation, but much more pedal effort will be required from the operator.

If the operator does not increase the pedal travel, the regulated pressure (P1) will move the second piston (4) a small amount, applying some pressure to the lines of the service brakes, and also shutting the supply of regulated pressure oil (P1) to the brake master cylinder. The pedal effort supplied by the operator is then sufficient to maintain the braking effort off the tractor.

Any reduction in pedal effort or travel will then allow the piston to return a small amount and opening port (5), allowing the regulated pressure (P1) behind the first stage piston to escape to tank, releasing the service brakes.

Should the operator continue to press the brake pedal the “power boost” will continue to be applied and the second piston inside the master cylinder will move to the maximum amount of travel possible. This will be limited by either the maximum stroke of the cylinder or the amount of oil required to apply the brakes.

If the amount of oil supplied to the brakes in one stroke of the master cylinder is insufficient to engage the service brakes, then as the pedal is released there is a one way valve (6) in the centre of the second piston that will allow oil from the tank gallery of the master cylinder to enter into the bore of the cylinder connected to the service brakes. As the pedal is re-applied by the operator the one way valve (6) closes allowing the new supply of oil to be pumped to the brake pistons.

Once the pedal is released, and pressure in the service brakes falls, the ball inside the one way valve (6) will fall from its seat and allow any excess oil flow from the piston to return to the tank gallery (so that the piston is full but not held under pressure).

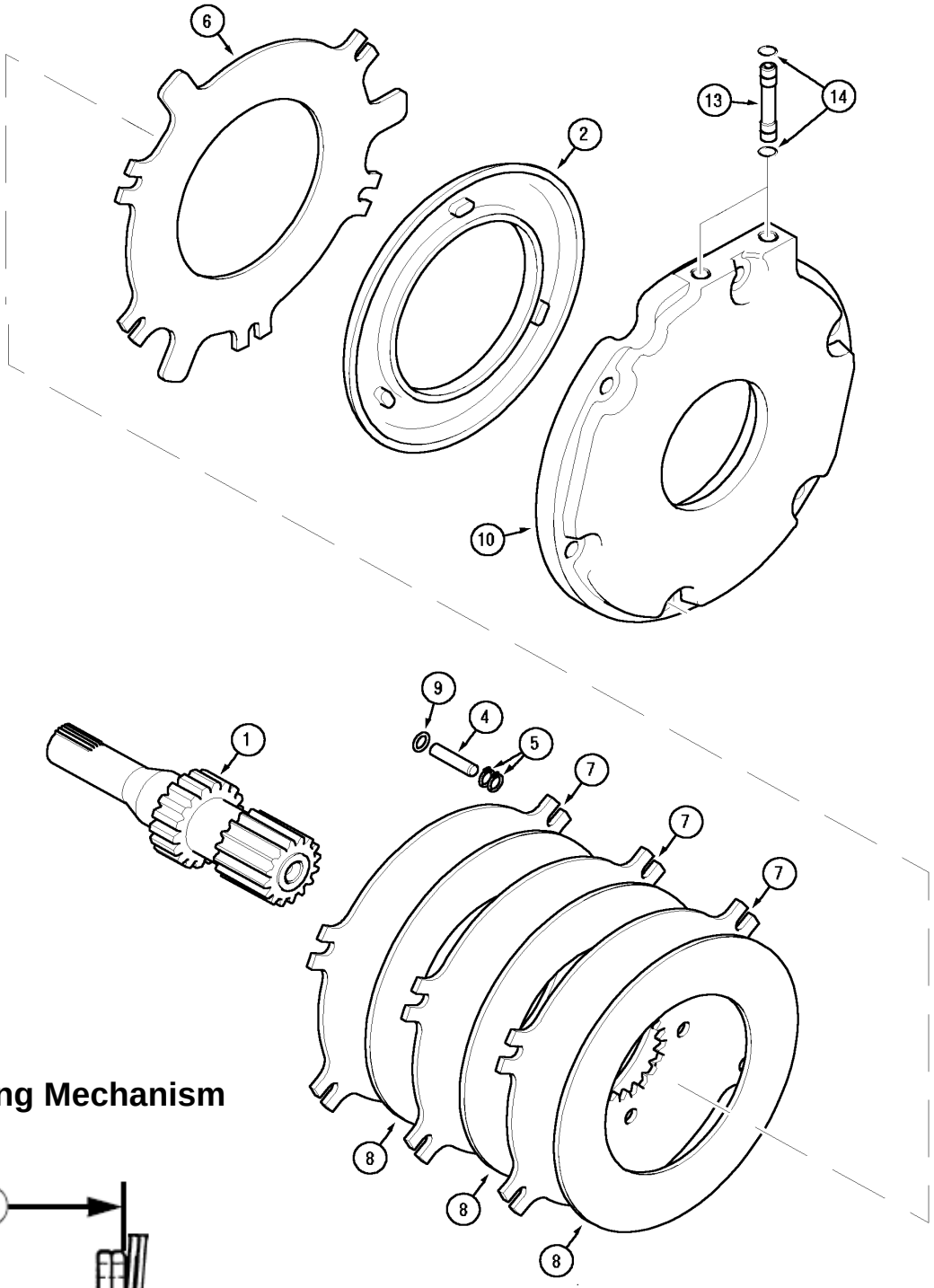
When both the pedals are pressed together there is an internal gallery (7) between the left and right cylinder of the valve that will allow the oil pressure between both sides of the cylinder to equalize and stop the tractor safely in a straight line.

As the brake valve is regarded as a safety related item no service parts are available from McCormick to repair the unit. Should the valve start to leak or fail it must be replaced as a complete unit.

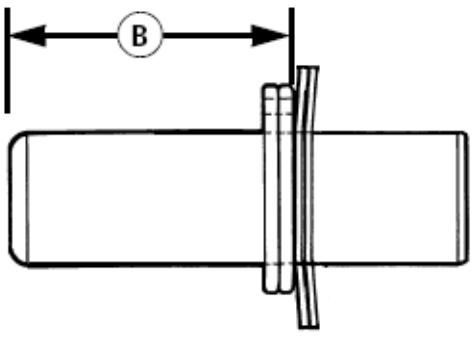
https://truckmanualshub.com/



# SERVICE BRAKES




## Self Adjusting Mechanism



https://truckmanualshub.com/



## General Description

As previously described the tractor service brakes are mounted inside the rear axle housing of the tractor between the differential and the axle planetary reduction units. The rear differential bearing housing also acts as the main housing for the brake friction discs (8) and the counter plates (7).

The brake piston (2) is mounted into the outer end plate of the brake housing (10). Oil is supplied through the rear frame of the tractor from the power boosted master cylinder by plastic tubes (13) that are sealed to the brake housing and the rear frame of the transmission by o-ring seals (14). The seals for the brake piston are bonded onto the metal centre section of the piston making it a one piece unit.

The brake friction discs are mounted on course splines to the differential output shafts (1), the counter plates are held into the brake housing by large locating lugs on their outer circumference. At three points on the counter plates there are also special locating pins that contain two circlips and two belville washers that act as self adjusters and push off devices to ensure the correct running clearance is set between the friction and counter plates when the brakes are released. The brake counter plate nearest to the brake piston (6) is also of slightly different design to enable this push off process to take place.

Cooling and lubrication of the service brakes is achieved by a flow of oil entering into the brake housing through a second plastic tube. Oil passes through an internal passage in the brake housing to an orifice, that allows a controlled flow of oil into the area close to the centre of the brake discs. This lubrication flow has been set to give as much flow as possible without the risk of the brake piston being pushed back, which would then increase pedal travel and give poor brake performance.

## Brake Application

When the operator presses the brake pedal, the power boosted master cylinder supplys oil through a steel tube to the rear frame of the transmission where it is diverted through the plastic tube into the endplate of the brake housing (into the area behind the piston). As the flow of oil increases the brake piston is compressed towards the friction and counter plates, applying the brakes.

When the operator releases the pedal the belville washers on the adjuster pins will push against the lugs on the counter plate closest to the piston returning the piston back into its housing and leaving the correct clearance between the brake friction discs and counter plates releasing the brakes.

## Self Adjusting Mechanism

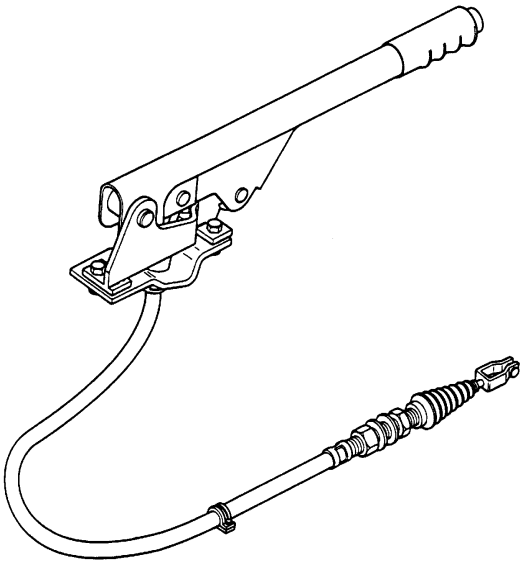
When servicing the brakes of the tractor it is imperative that the self adjuster mechanism is reset correctly and that the belville washers are placed on the pins in the correct way (see illustration opposite). Upon assembly the circlips should be moved closest to the inner end (differential side) of the pin and the belville washers set as per illustration and dimension “B” should be 26 to 29 mm.

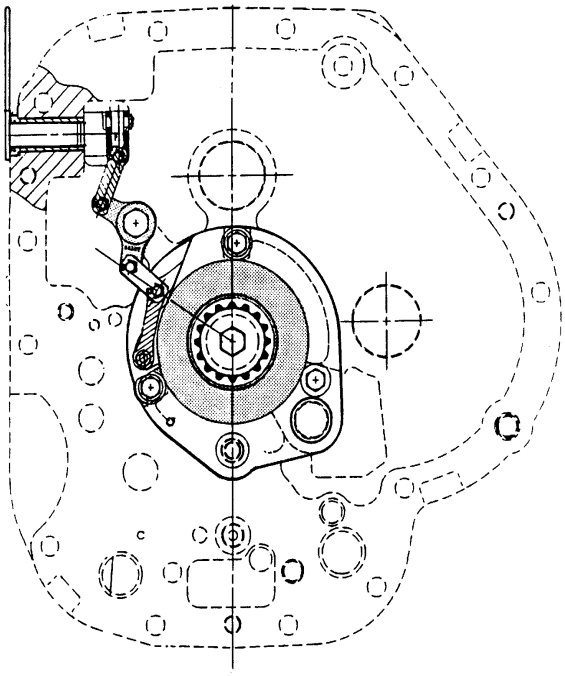
**IMPORTANT:** *To coincide with the release of 50KPH tractors in May 2006 a new style brake disc and counter plate have been introduced to cope with the 25% increase in operating force that 50KPH generates. Also, the lubrication oil flow was increased, and an accumulator added to the regulated pressure supply line to the brake boost valve in order to meet the dead engine braking legislation. These plates use different friction material and incorporate a teardrop style of lubrication hole in the friction disc. The counter plates are thicker and one less is used making the differential bearing carrier now a breaking surface. It is imperative that on assembly the differential bearing carrier has the same surface finish on it as a standard brake counter plate and that the lubrication holes in the friction discs are all in line. The operation of these brakes is identical to those described above, but if repair to one side of the tractor is carried out, then the other side must use the same components, therefore equal braking efficiency is achieved on both sides of the tractor.*

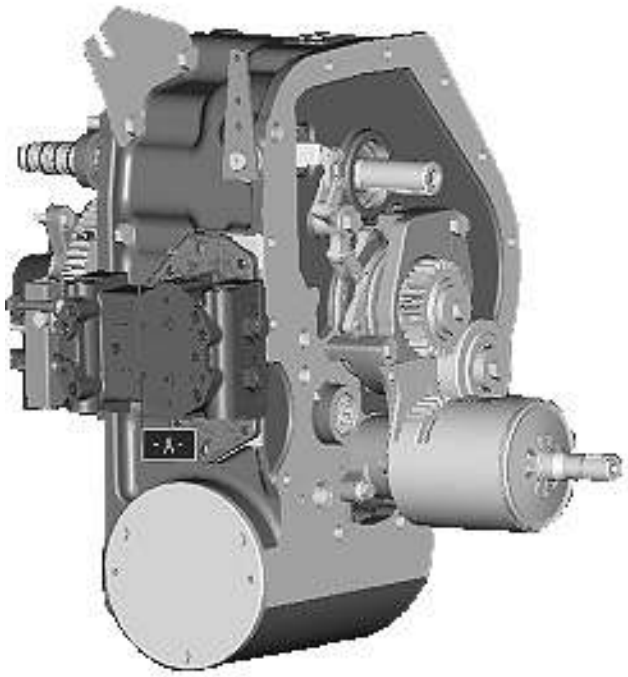
https://truckmanualshub.com/

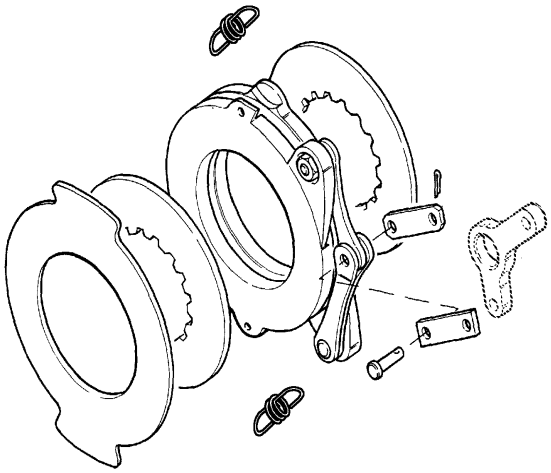


# PARKING BRAKE









https://truckmanualshub.com/



## General Description

The parking brake, is a multi plate wet disc type brake, mounted on the end of the pinion shaft between the pinion bearing and the MFD drop gear. Fitted between the counter plates and park brake discs is an expanding ball and ramp mechanism that when engaged compresses the friction and counterplates together applying the parking brake and preventing the pinion shaft from rotating. The brake disks are located onto the pinion shaft on a special gear, and the counter plates locate against the side of the MFD clutch mounting inside the transmission.

## Operation

When the operator applies the park brake lever, a cable below the cab floor pulls on the linkage in the top of the sandwich plate of the transmission. This linkage is connected to a crank arm inside the transmission that is connected to the ball and ramp actuator unit fitted between the brake discs and the counterplates. As the linkage pulls on the two halves of the actuator they rotate against each other on the ball bearings between them and as these balls are fitted into ramps, in the two halves of the actuator the counterplates and the friction discs are then compressed between the sandwich plate of the transmission and the MFD clutch mounting housing. When released there are springs fitted to the actuator to return it to its off position.

## Optional Mechanical Parking Lock

For markets that require so, there is an optional electro-hydraulically controlled mechanical parking lock available, that prevents the MFD output drive shaft of the tractor from being rotated whilst engaged.

The forward and reverse lever assembly incorporates a console with an extra position for park (P). To start the engine of all machines equipped with parking lock, the forward reverse lever must be in the park position.

**NOTE:** *For more information about the mechanical components of the parking lock please refer to section 6.*



https://truckmanualshub.com/



# HYDRAULIC TRAILER BRAKE

## General Description

Hydraulic trailer brakes is a factory fitted option for most markets but is also available as a field kit for markets where trailer brakes are not a legal requirement.

There are 3 different types of trailer brake valve that have been used in production and can be identified by the manufacturers of the valve assembly. The first valve used was a Rexroth valve, and the latter valve a Husco, and the third valve a Slanzi. Both the Rexroth and Husco valves function in a similar way and mount in the same position (on the lower right side of the range transmission housing), although they look very different. The Slanzi valve is of a completely different design and is mounted at the side of the Auxiliary valves, at the rear of the tractor.

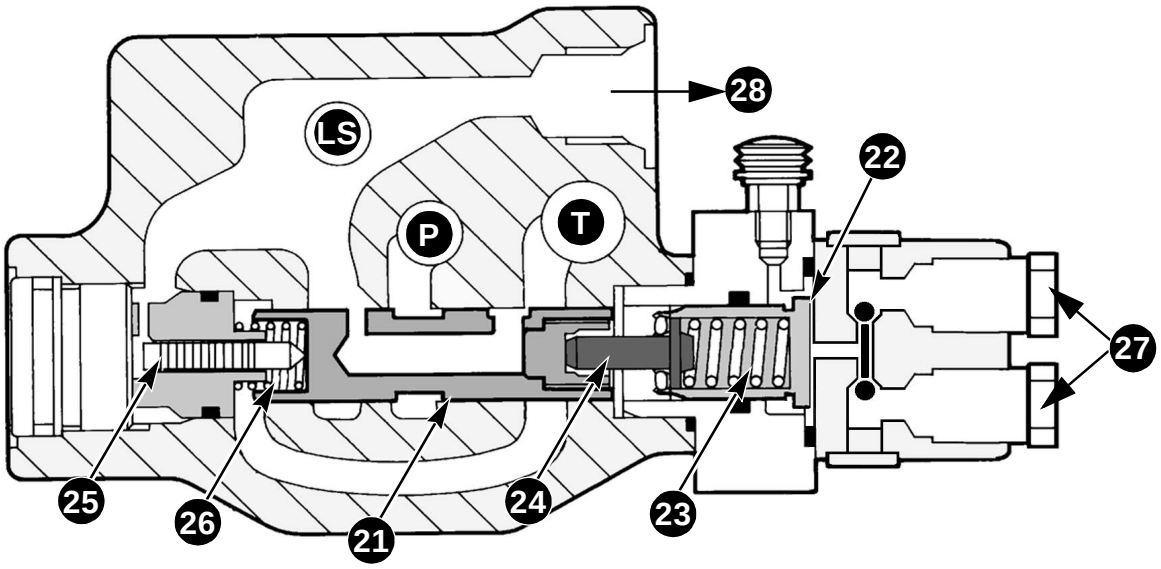
For the trailer brake valve to be activated, hydraulic pressure from both the left and right tractor service brake supply lines must be received into the pilot head of the trailer brake valve. This hydraulic pressure acts upon a balance type valve in the pilot head, and if pressure is felt in both left and right lines oil is allowed to pass to the actuating piston in the trailer brake valve

**NOTE:** *The balence valve is external on slanzi valve, and not part of the pilot head. There is a hose supllying oil to the pilot head from the ballence valve*

Should pressure only be felt in the left or right brake circuit a ball bearing is pushed onto a seat by the oil pressure closing the flow of oil from passing to the actuating piston in the trailer brake valve. When there is pressure in both sides a steel pin holds the balls in both sides away from there seats, allowing oil to pass to the pilot head to activate the valve.

On the Slanzi brake valve the balance valve is an external system completely independent of the brake valve.

## REXROTH VALVE




## Brakes Off

The tractor service brake circuits are connected to the trailer brake valve at (27).

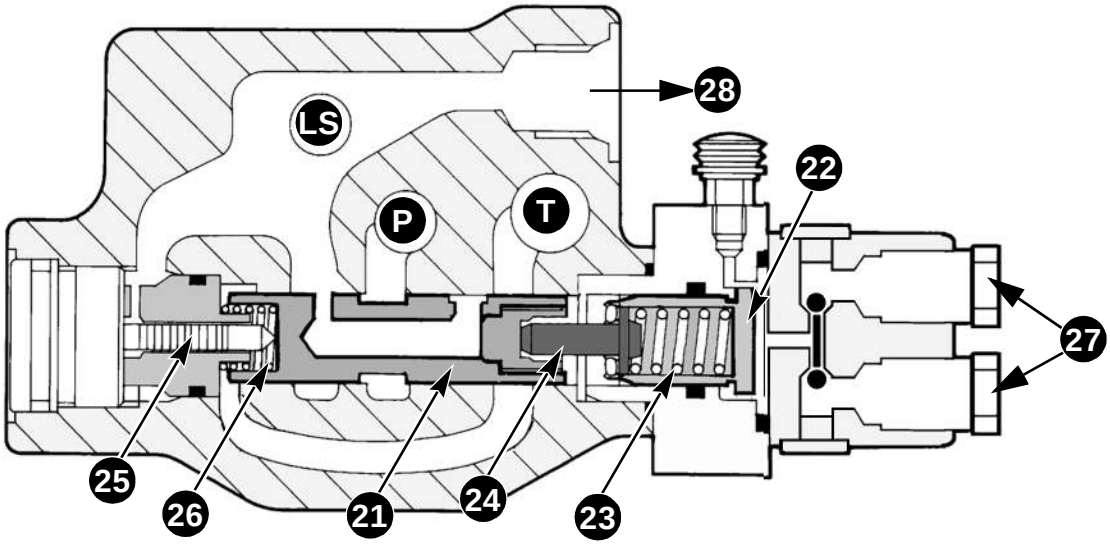
With the brakes OFF there is no pressure at (27) and the spring (26) holds the main spool (21) with the pilot piston

https://truckmanualshub.com/



(22) to the right.

In this position the supply at port (P) is closed and the trailer brake port (28) is vented to tank (T) through the spool.




## Brakes Applied

When the tractor service brakes are applied, pressure is supplied to (27). This pressure moves the pilot piston (22) and main spool (21) against the spring (26). The oil supply at (P) flows past the main spool (21) to port (28) and then to the trailer brakes.

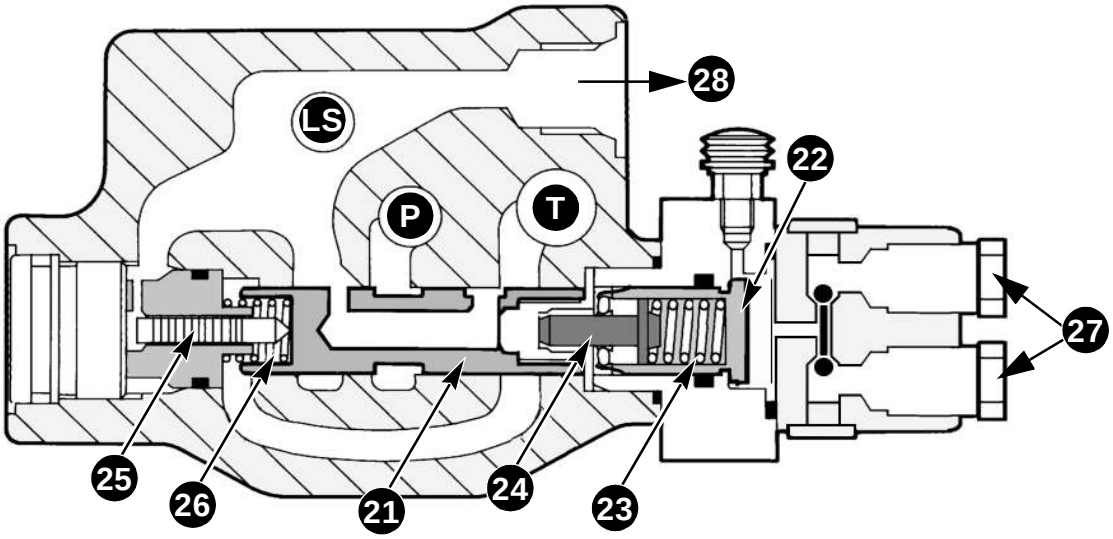
The pressure in port (28) also has access to the left end of the reaction pin (25) and to the signal circuit through port (LS).

This pressure will increase until it can overcome the tractor brake pressure applied to the pilot piston (22) and then move the main spool (21) towards the right. The spool will move to a position where the supply into the valve at port (P) is restricted and the pressure in port (28) is stabilized.

The actual pressure of the supply to the trailer brakes will therefore be proportional to the pressure in the tractor tractor service brakes.

https://truckmanualshub.com/






## Maximum Trailer Brake Pressure

The maximum pressure from the trailer brake valve is limited to 150 bar. This is an international standard common to all hydraulic trailer braking systems to ensure compatibility when attached to the braking system of any trailer.

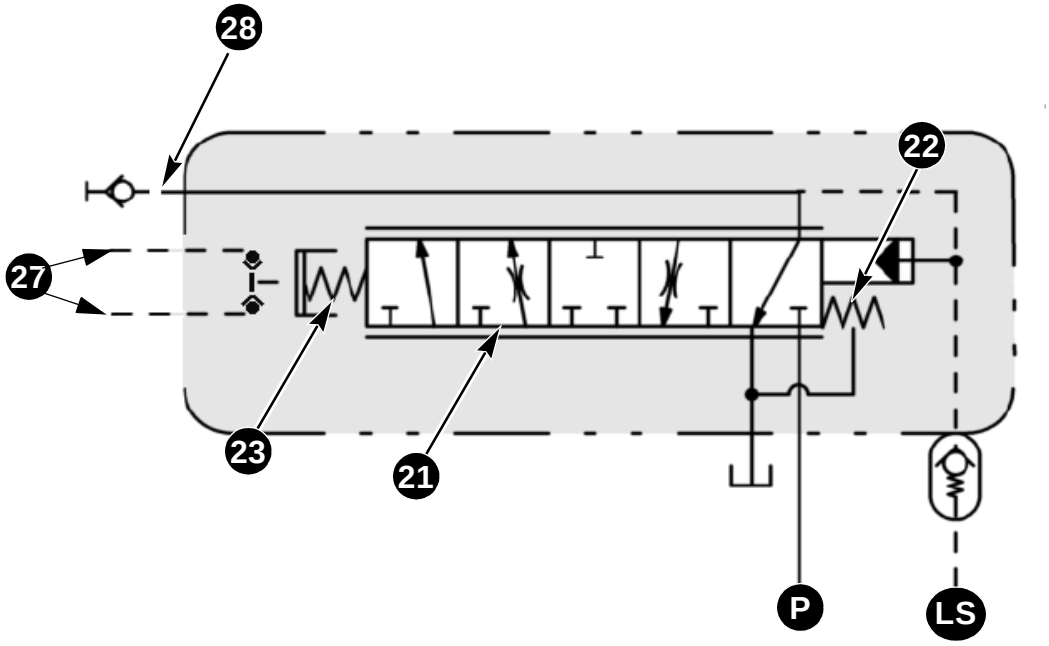
If excessive pressure from the tractor is applied, the trailer brake pressure will increase up to a maximum of 150 bar.

At this pressure, the pilot piston internal spring (23) will collapse and allow the main spool to move towards the right to a position where the supply at port (P) is restricted and the pressure in port (28) to the trailer brakes is stabilized, or opened to tank to relieve the pressure.

https://truckmanualshub.com/



## Rexroth Hydraulic Trailer Brake Valve Schematic



https://truckmanualshub.com/



# HUSCO HYDRAULIC TRAILER BRAKE VALVE

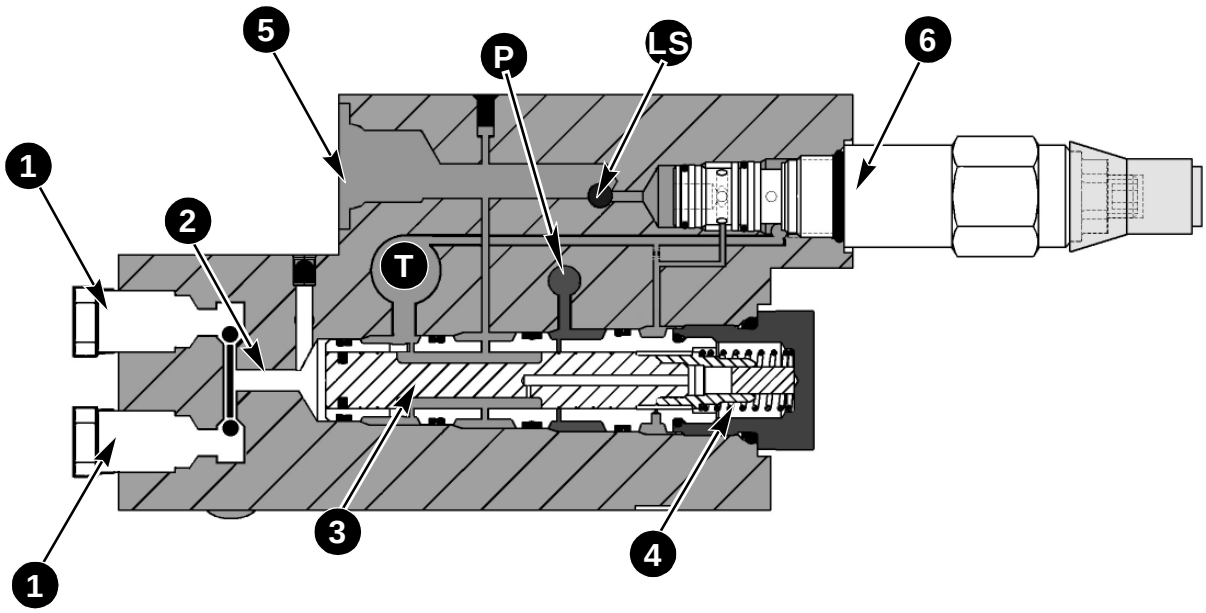
## General Description

A second type of hydraulic trailer brake valve was introduced in late autumn 2005 and is produced by Husco. Although the function of the valve is similar to the previous valve, the way that it is manufactured is totally different. The valve consists of a main housing containing two factory set and sealed cartridge units for the actuation of the valve. The only service parts that are available for the unit are complete cartridges, including seals.

The valve uses a pilot signal from both the left and right tractor service brakes and requires both pedals to be pressed to actuate the trailer brakes, as it is fitted with a balance valve within its pilot head that then allows the tractors independent brakes to be used without the operation of the trailer brake.

## Brakes in Off Position

The left and right tractor service brakes are connected to the trailer brake valve at (1). Without the tractor brakes applied there is no hydraulic pressure in the pilot head of the valve (2) and so the main spool (3) is held to the left by spring (4). With the main spool in this position the pressure port (P) is closed and the trailer brake port (5) is open to tank, so there is no hydraulic pressure sent to the trailer brakes and if required, oil can return into the tractor to stop any pressure build up if trailer brake temperature should change.



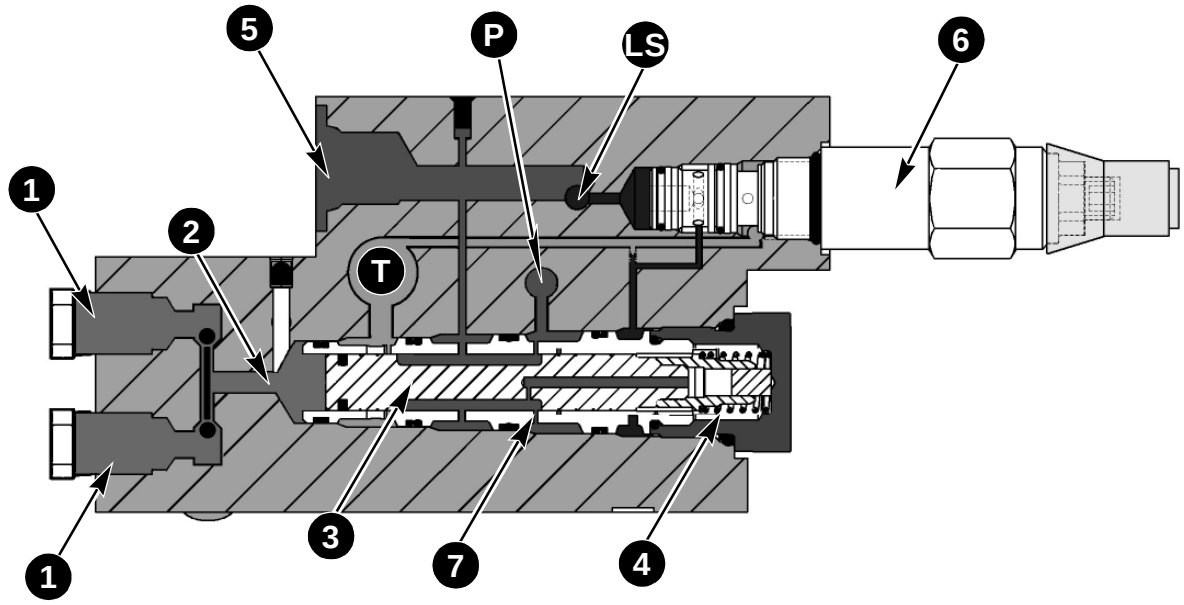
https://truckmanualshub.com/



## Brakes Applied

When both the left and right tractor brakes are applied, hydraulic pressure is sent to the trailer brake valve at ports (1) passing through into the pilot head (2), to push the main spool (3) to the right against spring (4).

This action has closed the trailer brake port (5) to the tank port (T) and now opens the valve across the valley of the main spool (3) to the pressure port (P). The oil pressure in the trailer brake valve outlet port is also connected to the signal line of the tractor at port (LS) passing out of the valve through a 1mm orifice and then a signal line check valve. When the signal pressure is felt at the hydraulic pump it is brought on stroke and continues to build pressure until it reaches approximately 120 to150 Bar.



https://truckmanualshub.com/



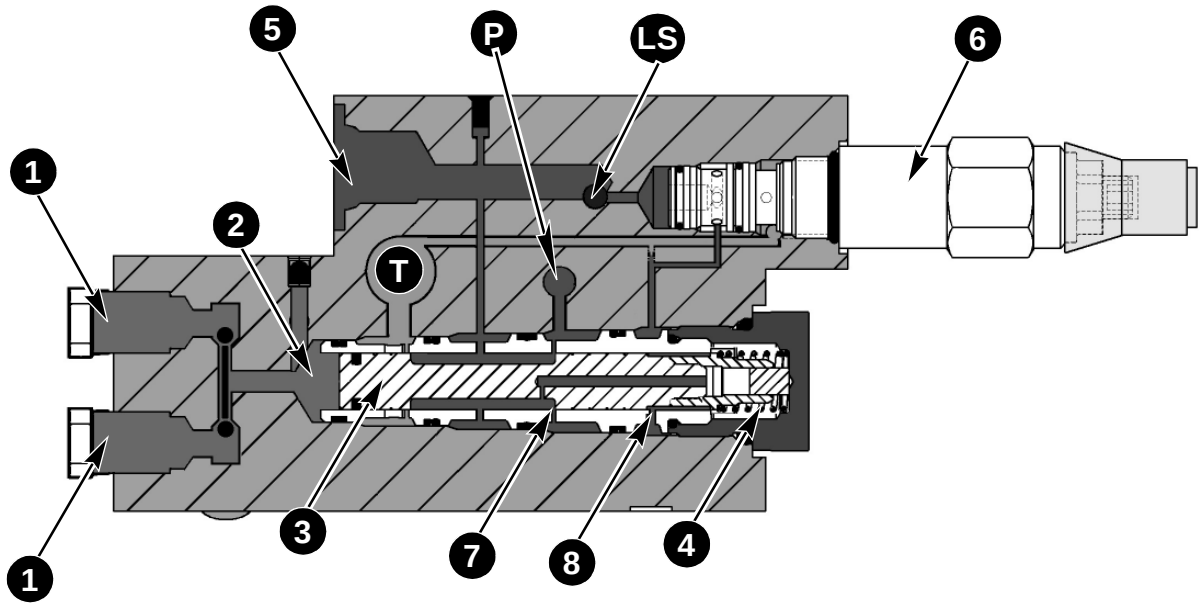
## Brakes at Maximum Pressure

The industry standard for hydraulic trailer brake systems has a limit of 150 Bar maximum working pressure. To control the maximum pressure within the husco valve there is a sealed relief valve cartridge that limits the signal line pressure that is created by the valve, but there is also hydraulic damping of the main spool to stop the valve from constantly shuttling the spool between the on and off position.

With the tractor service brakes fully applied as described on previous page, hydraulic pressure in the pilot head (2) is maintained keeping the main spool (3) pushed against its return spring (4) and held in the open position. A small flow of oil can also pass through an orifice in the side of the spool (7) to give a dampening effect to stop erratic movement of the main spool.

The hydraulic pressure in the working port (5) will steadily build up until the trailer brakes are applied and then pressure will build very quickly in the working port until it is sufficient to open the relief valve cartridge (6) and allow some oil to pass to tank through an orifice and also allow a small amount of oil to pass through a second orifice (8) to act on the rear of the main spool (3).

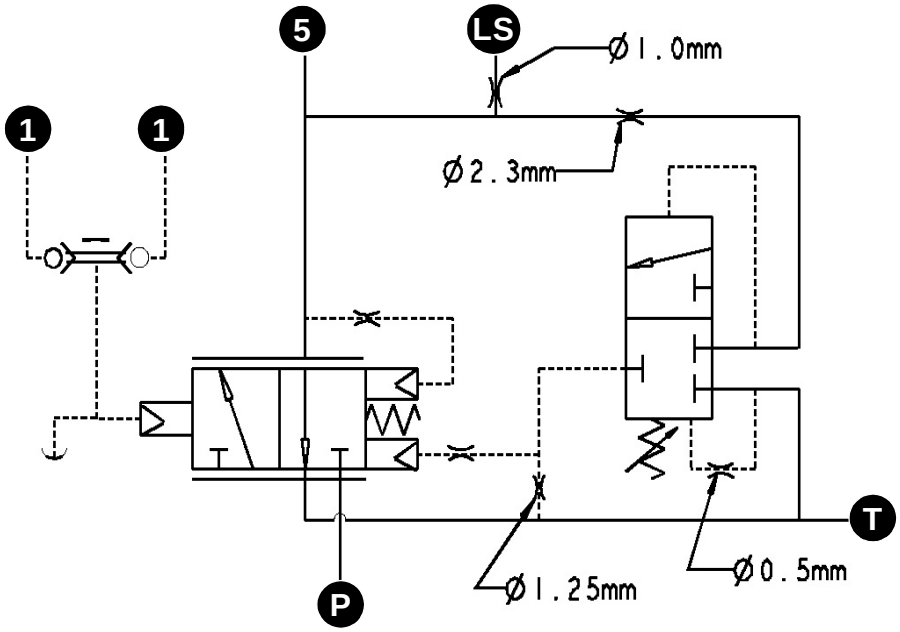
As the main spool (3) now has equal oil pressure acting on both ends plus spring pressure it is returned towards the off position, to maintain 150 bar until the operator releases the pilot pressure in the service brake circuit. Because there is also a second orifice (9) connecting the back face of the main spool (3) and the relief valve cartridge (6) to tank, leakage will occur constantly shuttling the main spool to maintain a consistent maximum pressure.



https://truckmanualshub.com/



## Husco Hydraulic Trailer Brake Valve Schematic



https://truckmanualshub.com/

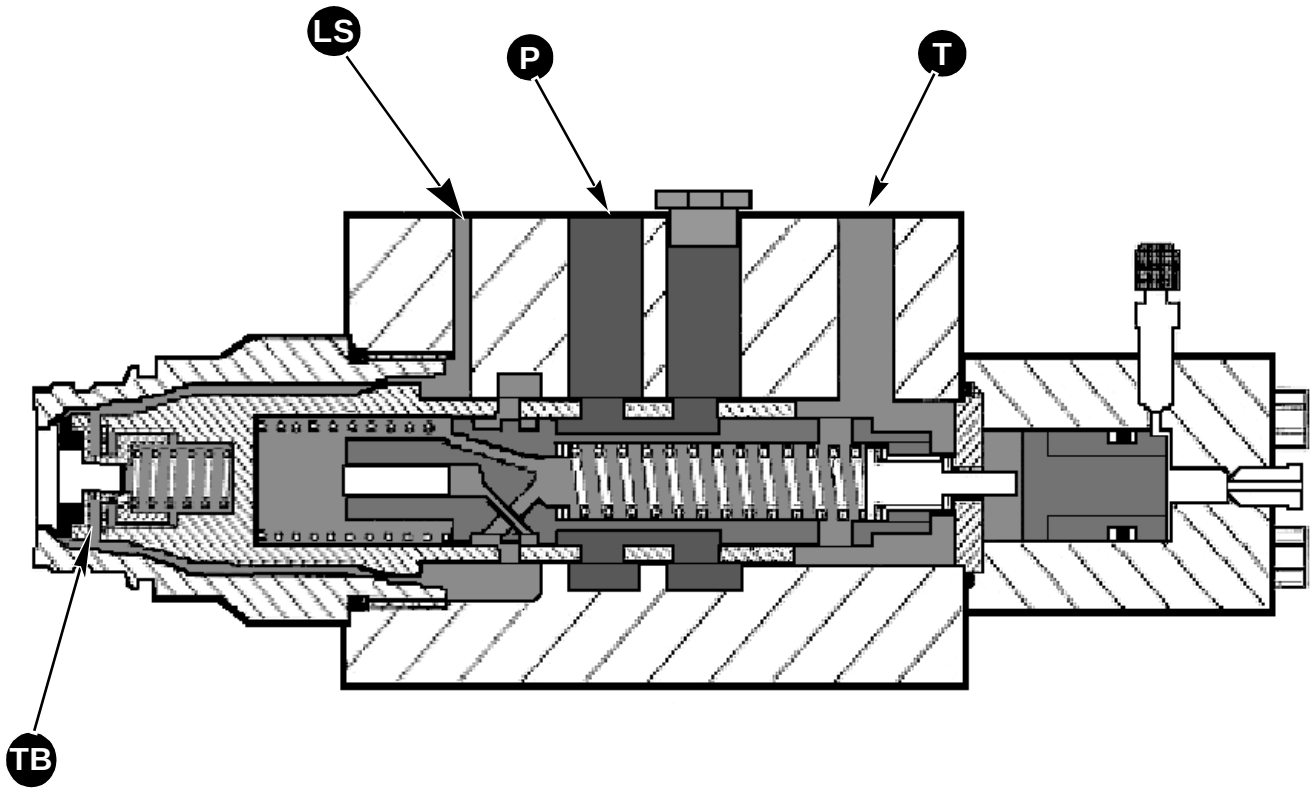


# SLANZI TRAILER BRAKE VALVE

## General Description

From approximately January 2007 a hydraulic trailer brake valve was introduced manufactured by a company called Slanzi. The purpose of this valve was to standardise valves for all Northern European tractors and the Swiss market, as the previous two options of valve would not meet the stringent new tests for the Swiss market that required proportional operation of the trailer brakes, compared with the operation pressure of the tractor brakes all the way across the braking range at approximately a 2:1 ratio, i.e. tractor brakes 2 bar hydraulic pressure, would mean approximately 4 bars of trailer brake pressure.

The new valve has the capability to be used on an open or closed centre hydraulic system depending on which ports are connected. For XTX tractors one of the large ports is closed off using a blanking plug to enable the valve to be used in closed centre format, and the small port (LS) that is connected internal to the trailer coupling outlet (TB) is connected to the signal line of the tractor through a one way valve (one way valve not shown). Port (T) is connected directly to the hydraulic resevior of the tractor.

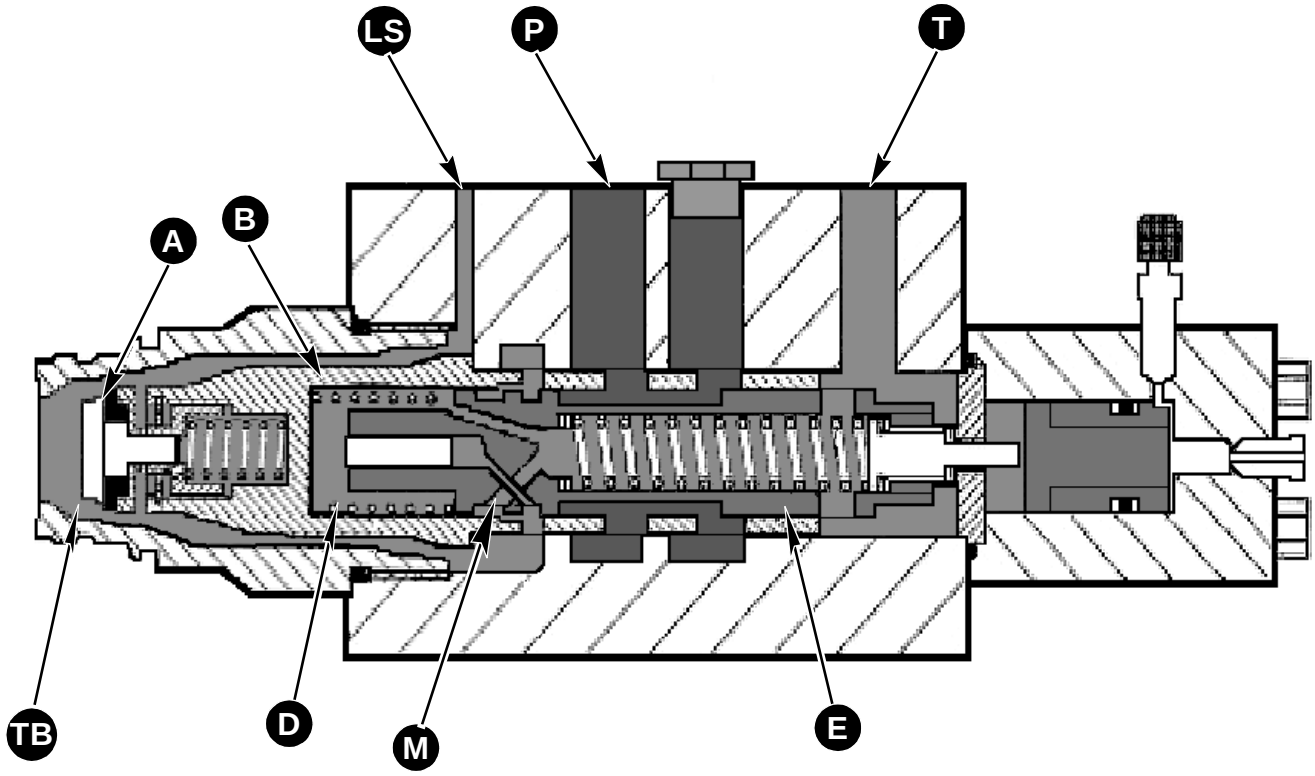


https://truckmanualshub.com/



## Trailer brakes connected and tractor brakes not applied

When the trailer brake coupling is connected to the tractor, the self sealing coupling (A) and internal spool (B) of the hydraulic trailer brake valve are pushed backwards against spring (D), to connect the brake cylinders of the trailer to tank (T) through an orifice (F) and oil passage in the centre of the main control spool (E).Therefore no pressure is present in the trailer brakes.



https://truckmanualshub.com/



## Trailer brakes connected and tractor brakes applied

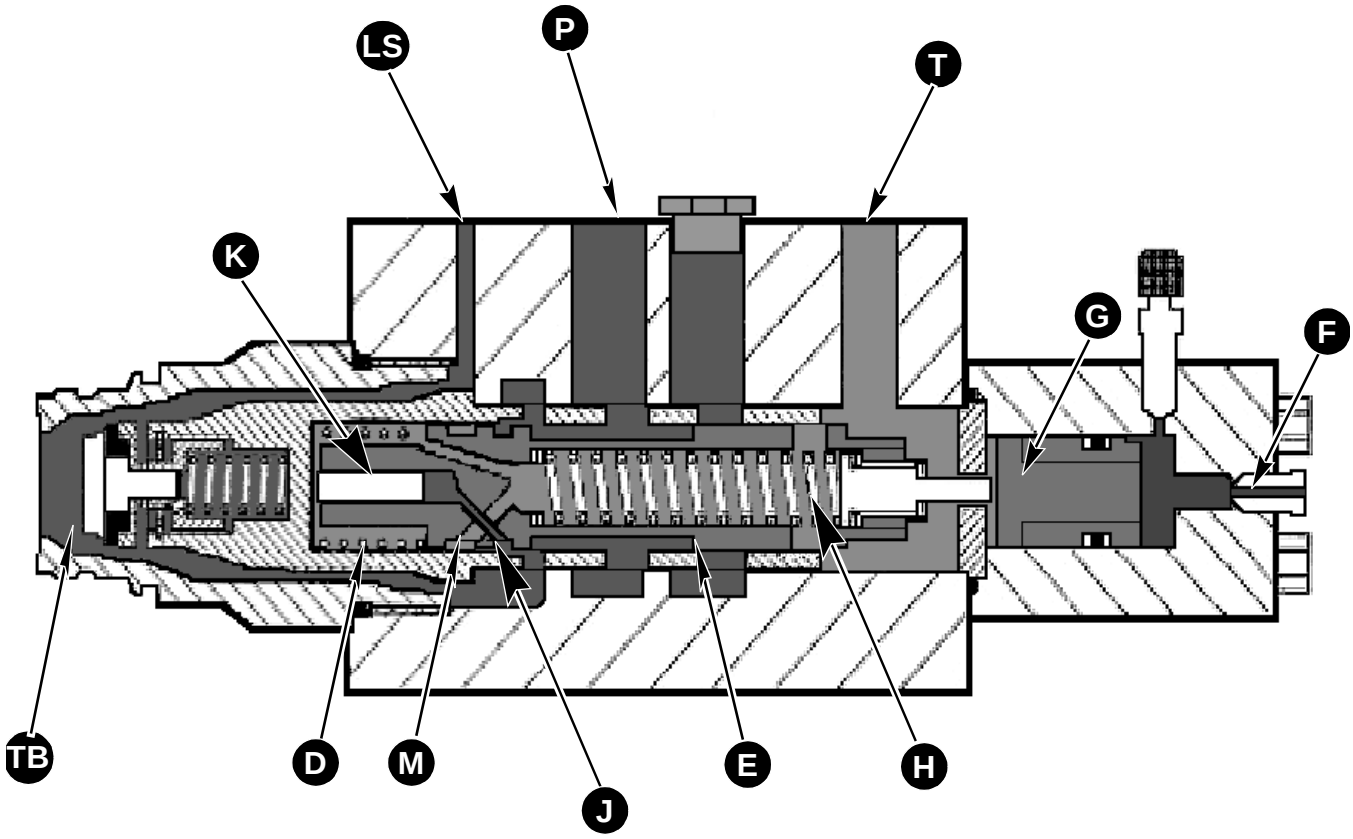
When the operator presses down the brake pedals of the tractor together hydraulic fluid is sent from the master cylinders of the tractor to a balance valve. This balance valve will only allow fluid to reach the trailer brake valve to actuate it if both pedals are pressed. If only one pedal is pressed the balance valve will seal off the fluid from the tractor and allow only the tractors independent brakes to be applied, not the trailer.

Fluid from the balance valve will then enter into the hydraulic trailer brake valve through port (F) to push against a two piece piston assembly (G), that will then push the plunger inside the main spool (E) against spring (H) to compress the main spool against spring (D) and open port (P) to port (TB) across the main spool.

At the same time oil from port (TB) can pass into the load sensing line (LS) to produce signal pressure, and bring the hydraulic pump on stroke to create pressure and flow. Pressure and flow in port (TB) will continue to rise until there is sufficient oil pressure at orifice (J) to allow the main spool to be pushed to the closed position by reaction pin (K), against spring (H) and piston (G), in this position the valve will deliver oil to the trailer brakes at proportional pressure to the tractor brake pressure as there is proportional oil pressure on both ends of the spool plus spring pressure from spring (D) returning the main spool to a centre position maintaining pressure in (TB) but not allowing further pressure into the circuit.

The maximum pressure the valve creates will be limited to 140 bar at which point spring (H) will compress allowing spool (E) to be returned to the closed position.

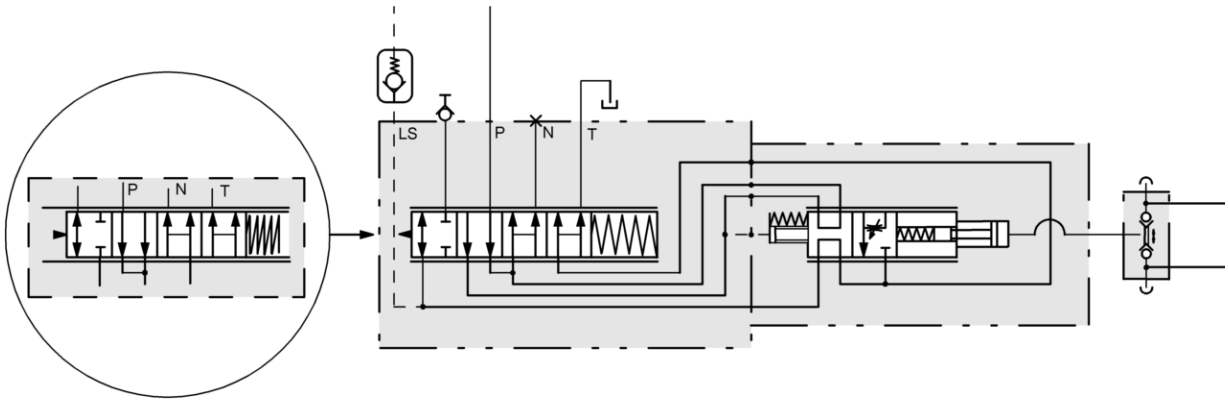
When the tractor brakes are released the hydraulic pressure from behind piston (G) is also released and spring (D) will push back the main spool (E) and the piston (G) to open the port (TB) to tank through orifice (M) and the centre of the main spool, releasing the hydraulic pressure from the trailer brakes. The one way valve in the load sensing line will also close allowing all internal pressure in port LS to return to zero through the centre of the main spool.



https://truckmanualshub.com/



## Schematic Drawing Of Slanzi Hydraulic Trailer Brake Valve



https://truckmanualshub.com/



# REMOVING AIR FROM THE TRACTOR SERVICE BRAKES

In order for the tractor brakes to function correctly it is very important that all air is properly removed from both the service brakes of the tractor and the pilot head of the trailer brake valve. If the air is not removed properly this can result in anything from a spongy brake pedal, with extremely long travel, to inoperative hydraulic trailer brakes, and generally very poor or uneven brake performance, which is not only dangerous to the operator but to all other highway users.

The correct procedure for air removal is as follows:-
Check that the pedal adjustment and free play is correct to specification See section 9001 of the service manual.

Start the tractor and ensure it is running at 1500 ERPM with the park brake applied and the F/R lever in the neutral position and unlatch the brake pedals.

Fit clear plastic tube to axle brake bleed nipples, and return clear tube into transmission oil filler.

Loosen L/H bleed nipple and slowly pump L/H pedal until oil visible, pressing pedal down firmly and slowly releasing pedal to allow master cylinder to refill. Press L/H pedal and hold down and lock off bleed nipple. Slowly release L/H pedal.
Loosen L/H bleed nipple and press L/H pedal and hold down lock off bleed nipple.
Repeat steps until no air visible in tube.

Loosen R/H bleed nipple and pump R/H pedal until oil visible. Press R/H pedal and hold down, lock off bleed nipple release R/H pedal loosen R/H bleed nipple and press R/H pedal and hold down, lock off bleed nipple and slowly release pedal. Repeat steps until no air visible in tube.

In order to bleed the balance pipe between the left and right master cylinder loosen the left bleed nipple, and press the left pedal halfway down and hold, and then press the right pedal to the floor and then press the left pedal fully down also. Lock of the left bleed nipple, and release both pedals very slowly.
Repeat steps until no air visible in the tube.

Place a suitable oil tight container under the hydraulic trailer brake valve, and loosen L/H brake pilot supply tube at the trailer brake valve.Press down L/H pedal and hold down, lock off L/H brake pilot supply tube at trailer brake valve. Release L/H pedal, and loosen L/H brake pilot supply tube at trailer brake valve, press L/H pedal and hold down lock off L/H brake pilot supply tube at brake valve repeat steps until no air is visible.

Loosen R/H brake pilot supply tube at trailer brake valve, and press R/H pedal and hold down. Lock off R/H brake pilot supply tube at trailer brake valve, and release R/H pedal. Loosen R/H brake pilot supply tube at trailer brake valve, and press R/H pedal and hold down lock off R/H brake pilot supply tube at trailer brake valve.Repeat steps until no air is visible.

Join both brake pedals together and open trailer brake valve bleed nipple. Press both pedals full down and lock off trailer brake valve bleed nipple, and release brake pedals slowly.Repeat steps until no air is visible.

Leave tractor to stand for 10 Minutes and repeat steps, until a firm pedal is achieved and you are confident all air is removed.

https://truckmanualshub.com/



# PNEUMATIC (AIR) TRAILER BRAKING SYSTEM

## General Description

Pneumatic (air) trailer brakes are available on McCormick tractors as a factory fitted option or a field installed package.

All 50KPH tractors and certain other European markets have a legal requirement for air trailer brakes and therefore tractors for these markets will be fitted with air brakes as standard.

The components used to fit air trailer brakes to McCormick tractors are designed and supplied by one of the leading European tractor air trailer brake specialists “Tractair”.

There are two different systems:-
1. A conventional twin line system using a red emergency line (R), and a yellow brake signal line (Y), as is fitted to most trucks.

2. An Inverse single line (B) which is blue in colour, when this system is fitted the tractor will also have the twin line system fitted as well as the single line. This system is not used in the UK and is mainly for the Eastern European countries.

The type of air couplers fitted to the back of the tractor will vary according to the market, but will always be of a self sealing type.

## Inshot System

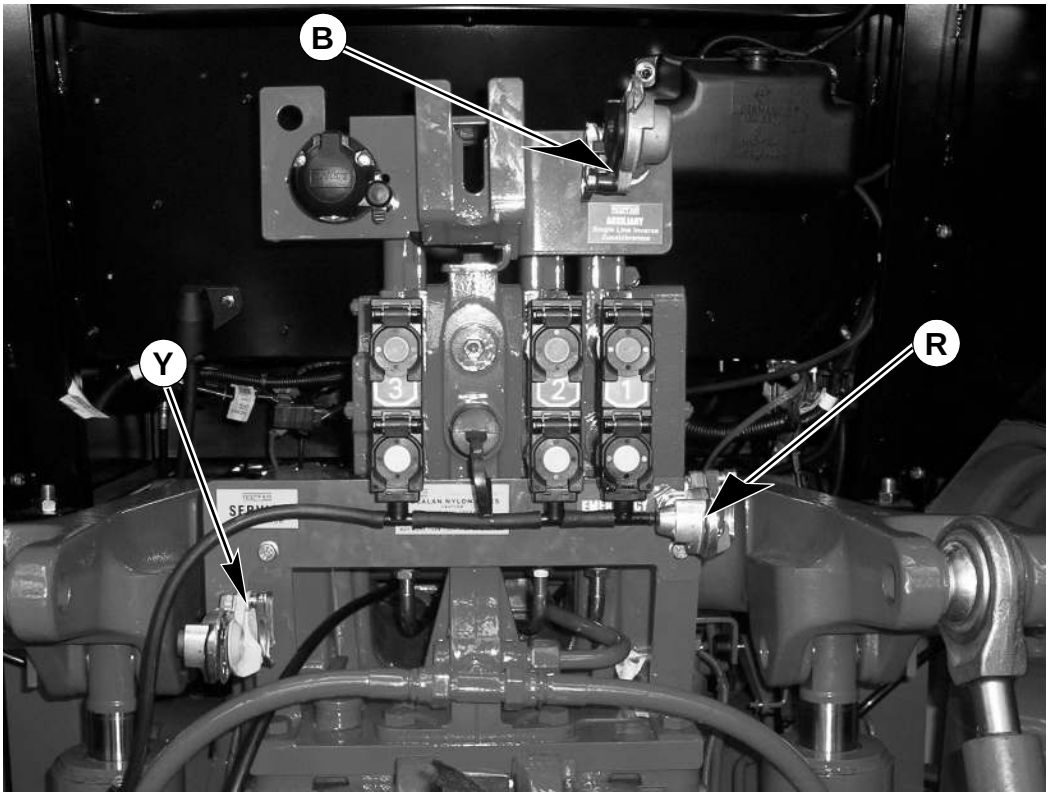
Due to the size and weight of trailers in some areas of the world now, and the high capacity of their air systems used, an additional system has been introduced on McCormick tractors called “Inshot”.

This system allows a small amount of air to be passed through the systems fluid reaction valves directly into the trailer brake signal circuit to pre-charge the system with air. This “Inshot” of air into the system reduces any time delay and prevents the possibility of the tractor brakes locking before the trailer brakes have been applied.

There is an electrical signal taken from the brake light circuit of the tractor to a solenoid valve that will supply air directly from the air tank to a regulator valve that will reduce its pressure. This air is then fed into the fluid reaction valves where it acts as servo pressure assisting the opening of the fluid reaction valves to allow air into the yellow signal line quickly and activate the trailers brakes sooner giving more efficient braking.

https://truckmanualshub.com/





https://truckmanualshub.com/



# SYSTEM LAYOUT

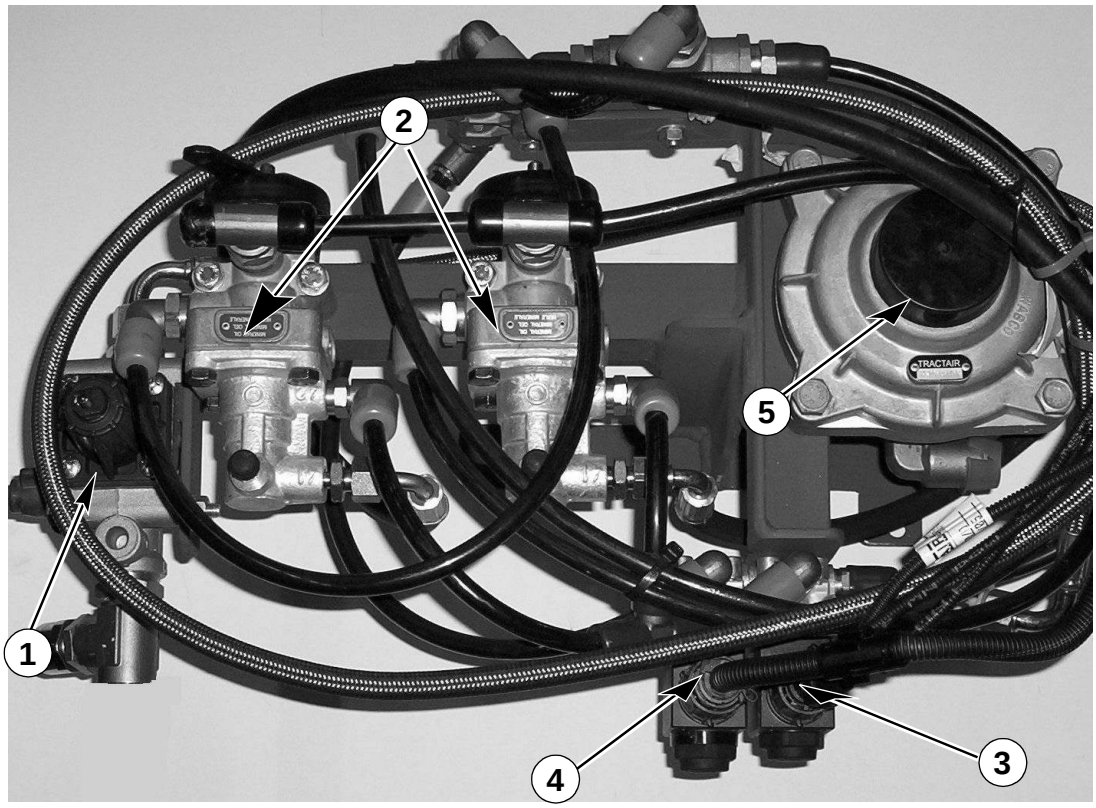
## Compressor

An engine mounted air compressor is fitted that takes its air supply from the engines main air filter, the compressor is lubricated by a supply of oil from the engines pressure gallery and is returned back to the sump. Depending on the tractor model, the compressor will either be belt driven from the fan pulley or it will be gear driven from the engine timing case at the front or rear of the engine.

## Pressure Control Valve

Air is supplied via a steel braided heat resistant, thermoplastic hose from the compressor to a pressure control valve (1), which is sometimes called an unloader valve. If the tractor is for a cold climate market an anti-freeze pump, may be fitted between the compressor and the pressure control valve.

The pressure control valve will open when the air system is full to capacity and exhaust all air from the compressor to atmosphere, this will close again as the system pressure reduces if air is used. This keeps the system at a set pressure regardless of engine speed. However if the air compressor cannot maintain a safe working pressure the gauge fitted in the cab will indicate there is a problem alerting the operator.




## Air Storage

Air from the pressure control valve is fed into 2 storage tanks fitted behind each rear axle housing. Fitted to the base of these tanks is a drain valve that will allow the operator to periodically drain any water and condensation out of the storage tanks that may have formed.

The red emergency air line is connected directly to the tractors air tanks. The purpose of this line is to supply air to the trailers air tank or tanks that operate the trailers brakes.

If an operator requires to take an air supply from the tractor to inflate the tractor tyres or operate air tools then he can plug into the red line, as it is always open to the systems working pressure.

https://truckmanualshub.com/



## Air Pressure Warning

If air pressure in the storage tanks drops below approximately 4 bar air pressure, the instrument cluster will illuminate the lamp on the air gauge and turn on the cluster alarm to warn the operator. The sensor for the gauge and the lamp is fitted next to the unloader valve. With 6 bar air pressure the sensor should have approximately 124 Ohms resistance between pins.

## Fluid Reaction Valves

There are two fluid reaction valves (2) linked into the tractor service brake lines and the air system of the tractor. When the operator presses the brake pedal(s), not only are the tractor brakes applied, but a signal is felt at the fluid reaction valve. This signal then operates the spool in the fluid reaction valve opening the flow of air into the yellow trailer signal line, that is connected to the trailers relay valve. Air from the trailers tank is then sent to the brake chambers of the trailer to apply the brakes.

When the brake pedal(s) is released, the spool in the fluid reaction valve is returned to its rest position by a spring, thus allowing air in the yellow line to be released. Releasing the air in the signal line will then allow the trailer relay valve to release the air from the trailer chambers.The rating of the return spring in the fluid reaction valves will affect the sensitivity of the air trailer brake operation, however it is set for the optimum level of safe trailer braking.

## Trailer Park Brake Operation

When the tractor park brake is applied a switch connected into the air trailer brake electrical harness switches a relay turning off the power to the solenoid on the hand brake valve (3), this opens the valve and allows air into the yellow brake signal line applying the trailer brakes. If the tractor is turned off the power to the solenoid is also turned off allowing the park brake also to be applied as the valve is sprung open and closed electrically. There is also a shuttle valve fitted between the park brake valve and the fluid reaction valves to prevent interference between circuits.

## Activation of the Air Trailer Brakes

Oil is taken from the tractor service brake system from both the left and right supply lines and is fed to the fluid reaction valves. These valves have a direct air supply also from the air tanks on the tractor.

When the tractor foot brakes are applied the fluid reaction valve spool is moved by the tractors brake hydraulic oil pressure, air is directed from the reaction valve into the yellow signal line activating the trailer brakes. Using this method can sometimes cause a delay in the trailer brake being activated because sufficient oil pressure has to build in the tractor service brakes to overcome the return springs in the fluid reaction valves, so a system called inshot is used to overcome this problem and bring the tractor and trailer brakes on in the correct phase.

With the inshot braking system, there are individual fluid reaction valves fitted for each rear wheel brake circuit of the tractor, and an electro solenoid valve (4) that supplies air into the fluid reaction valves to give servo assistance to the movement of the fluid reaction valves spool, to increase the speed at which the air trailer brake is activated.

A shuttle valve is fitted to the line from both valves where it tee’s off to the yellow line. It will close the air supply off to either valve should only one brake pedal be applied, or its signal pressure be lower, or there be a failure in a reaction valve, or its pipe work to ensure air trailer braking works correctly. There is also another shuttle valve fitted to the pipework between the park brake valve and the fluid reaction valves for the same reason.

When the brake pedal is released the spool in the fluid reaction valve is returned to its rest position by a spring, allowing air in the yellow line to be released, and therefore also releasing the trailer brakes.

https://truckmanualshub.com/



## Single Line System

A single line air brake system is also available as a special option. The tractor will come equipped with the twin line system as already described above, plus a third blue line and an inverse relay valve (5).

The blue third line, will supply air to the trailers brakes all the time when the tractors brakes are not applied, as the brake actuators on the trailer are sprung loaded to the on position, and need an air supply to release them.

When the operator applies the tractors brakes the inverse relay valve will dump the air from the trailer brake actuators engaging the trailer brakes, and as the pedal is released the inverse valve will send air back to the trailer to remove the brakes.

https://truckmanualshub.com/



# AIR TRAILER BRAKE SCHEMATIC

## Key

1. Engine air filter
2. Air compressor
3. Anti freeze pump
4. Pressure regulator
5. Air receiver
6. Water drain
7. Air pressure gauge sender unit
8. Air pressure test point – tire inflation point
9. Emergency line coupling – red
10. Hydraulic oil input from tractor brakes
11. Shuttle valve
12. Fluid reaction valve
13. Park brake valve
14. Trailer brake signal line coupling – yellow
15. Relay valve (not part of standard kit, this is for high air flow options)
16. Inverse trailer control valve (single line brakes only) – blue line if equipped
17. Single line brakes coupling – blue
18. Inshot solenoid valve
19. Inshot pressure regulator

**NOTE:** *For electrical schematic refer to Brake Lights and Air Trailer Brake in Section 4001 of this Service Manual.*

https://truckmanualshub.com/



# Section 7002

## SERVICE BRAKES

## XTX185, 200 and 215 Tractors

McCORMICK

SM 8-15220

© 2006 McCormick Tractors International Limited.
September 2006

https://truckmanualshub.com/



# TABLE OF CONTENTS

SERVICE BRAKES
Tractors With Three Separator Plates
Removal ....4
Installation ....6
Tractors With Two Separator Plates
Removal ....10
Installation ....12

https://truckmanualshub.com/



This Page Has Been Left Blank

https://truckmanualshub.com/



# SERVICE BRAKES

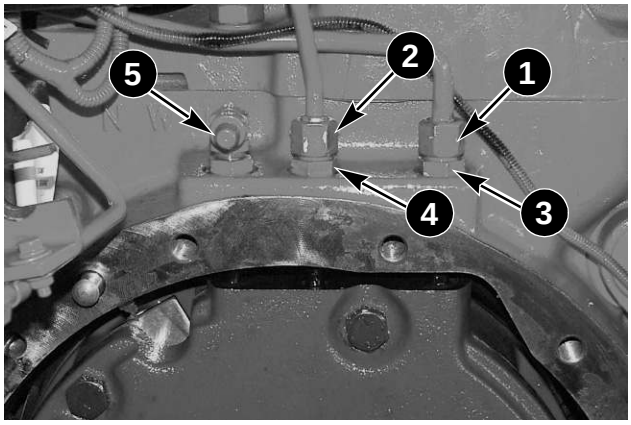
## Tractors With Three Separator Plates

## Removal

### STEP 1

Remove the rear axles, refer to Section 6018.

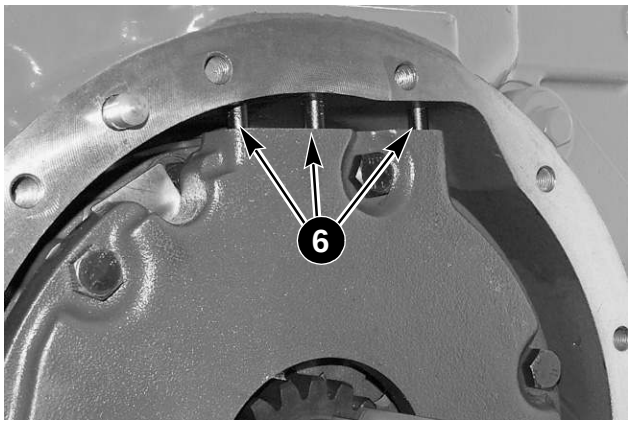
### STEP 2




MD06D104

Disconnect and cap the lubrication tube (1) and brake tube (2), remove the tube fittings (3) and (4). Remove the brake bleed fitting (5), discard the o-rings from the fittings.

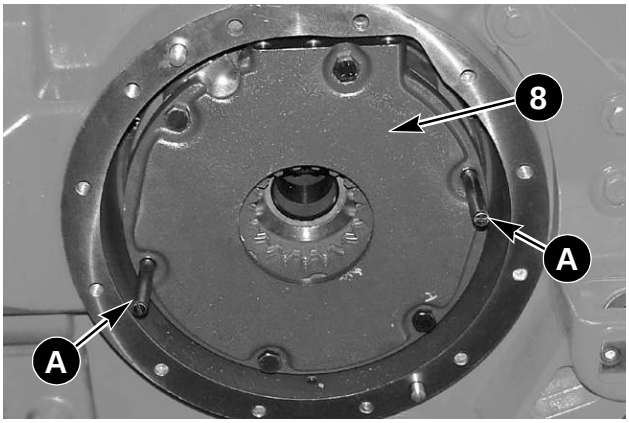
### STEP 3




MD06E007

Remove the plastic feed tubes (6), remove and discard the o-rings (7) from the tubes.

### STEP 4




MD06D093

Remove two left hand brake piston housing retaining bolts and install two 16 mm alignment studs (A) MC1995A as shown. Remove the remaining retaining bolts and remove the left hand brake piston housing (8).

### STEP 5

Remove the adjuster return plate (9).

### STEP 6

Remove the three brake friction plates (10) and three separator plates (11). Remove the three brake reaction pins (13) and the five locating pins (14).

### STEP 7

Remove sun gear shaft seal (15) from the differential bearing carrier (16).

https://truckmanualshub.com/



## STEP 8

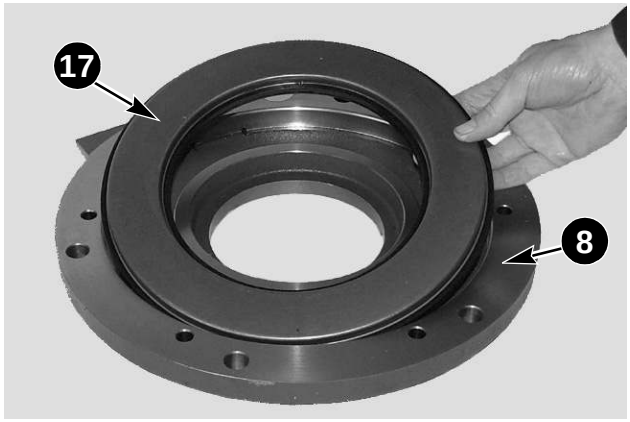
Inspect the friction plates (10) and separator plates (11) for damage or heavy wear. Replace as necessary.

**IMPORTANT:** *Replace both friction plates and separator plates if the friction plate thickness is less than 3.45 mm (0.136 inch).*

## STEP 9

Repeat STEP 2 to STEP 6 and remove the right hand brake components.

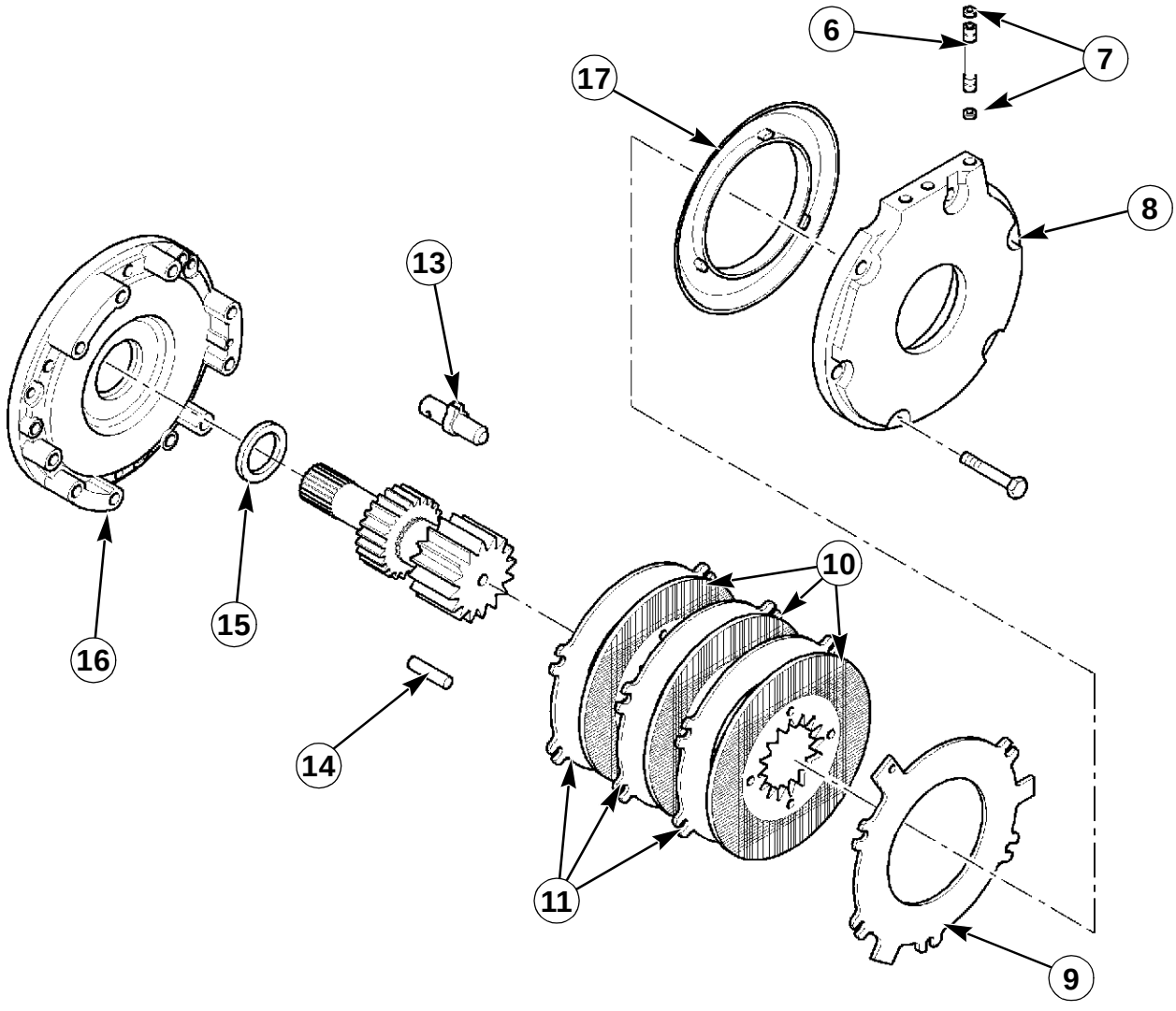
## STEP 10




MD06D094

Carefully remove piston (17) from the brake piston housing (8) using compressed air.

> **WARNING:** ***To prevent injury, always wear eye protection when working with compressed air.***



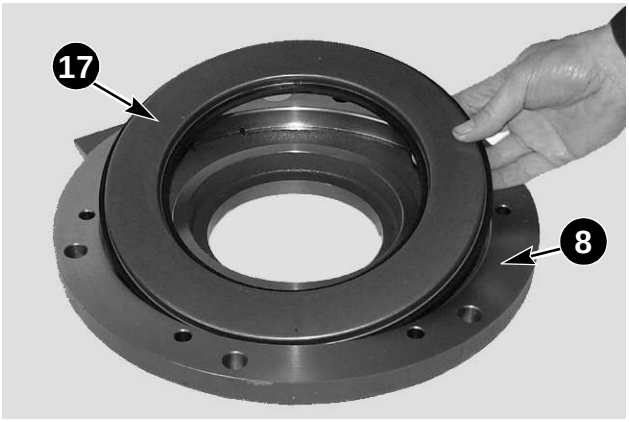

MI06D044

https://truckmanualshub.com/



## Installation

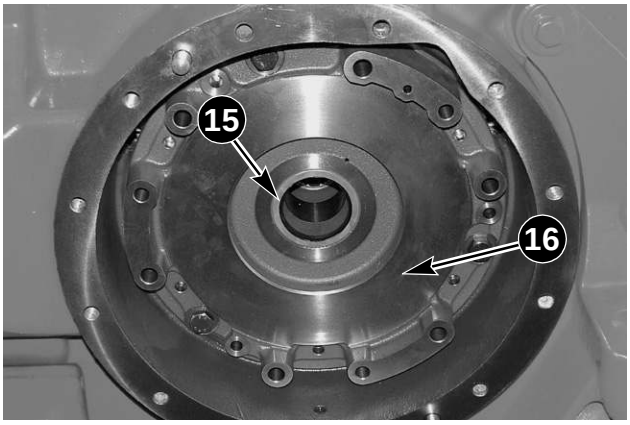
### STEP 11




MD06D094

Lubricate the inner and outer piston seals of the brake piston (17) with petroleum jelly. Carefully install piston (17) into the brake piston housing (8). Gently tap with a soft faced hammer until the piston is fully seated.

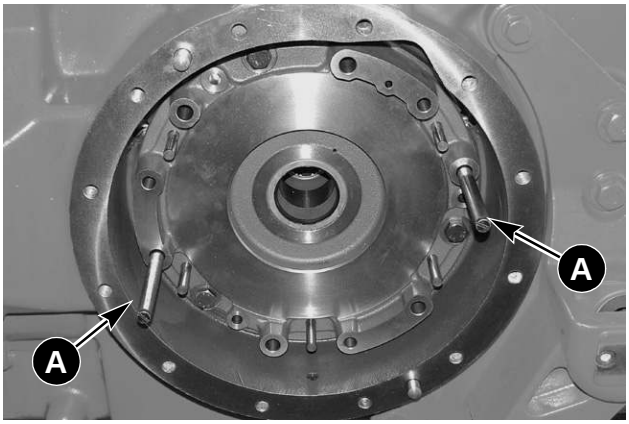
### STEP 12




MD06D095

Using a suitable driver install a new sun gear shaft seal (15) into the differential bearing carrier (16). Lubricate the lip of the seal with clean transmission oil.

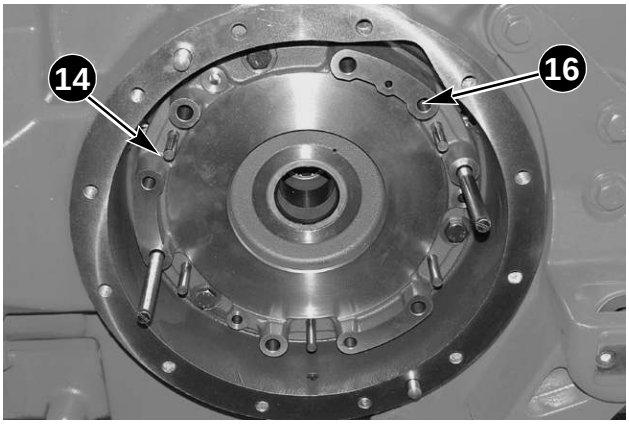
### STEP 13




MD06D096

Install alignment studs (A) MC1995A in the differential carrier.

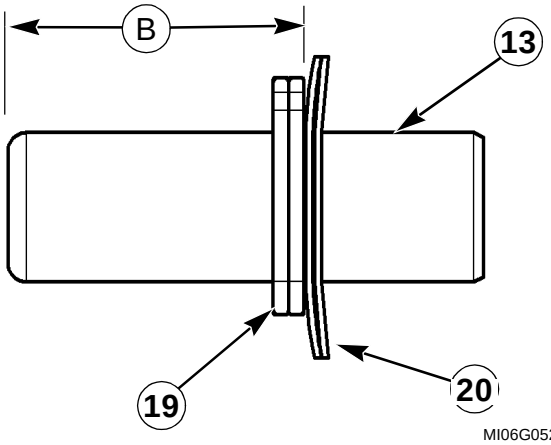
### STEP 14




MD06D096

Install the five locating pins (14) into the differential bearing carrier (16).

### STEP 15



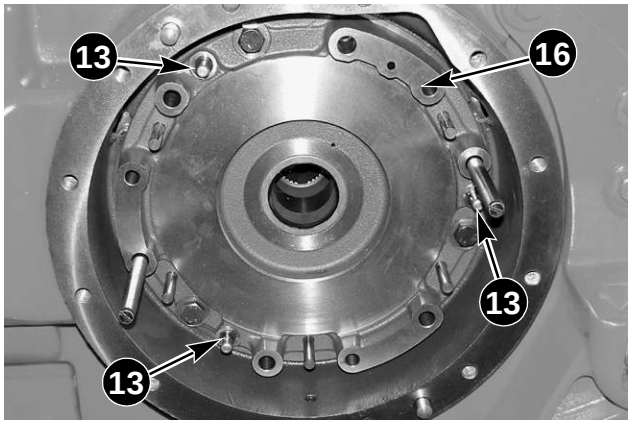

MI06G052

If new brake plates are to be installed, brake reaction pins (13) must be reset. Adjust the depth (B) of retaining rings (19) 26 to 29 mm. Make sure the belleville washers (20) are positioned against retaining rings (19), as shown. If the original plates are to be installed, do not reset the brake adjusters.

https://truckmanualshub.com/



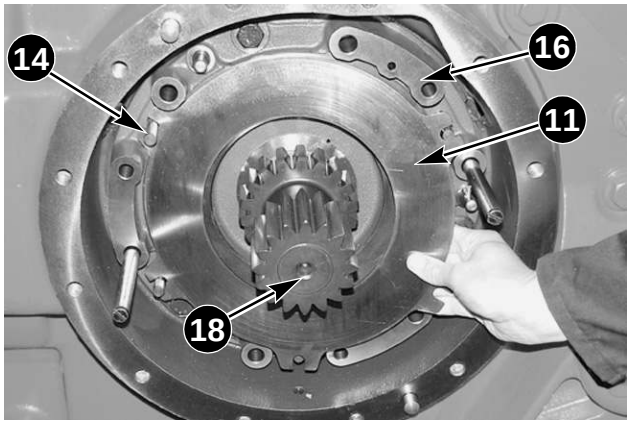
**STEP 16**




MD06E008

Install the brake adjusters (13) into the differential bearing carrier (16). Make sure the belleville washers are towards the differential bearing carrier.

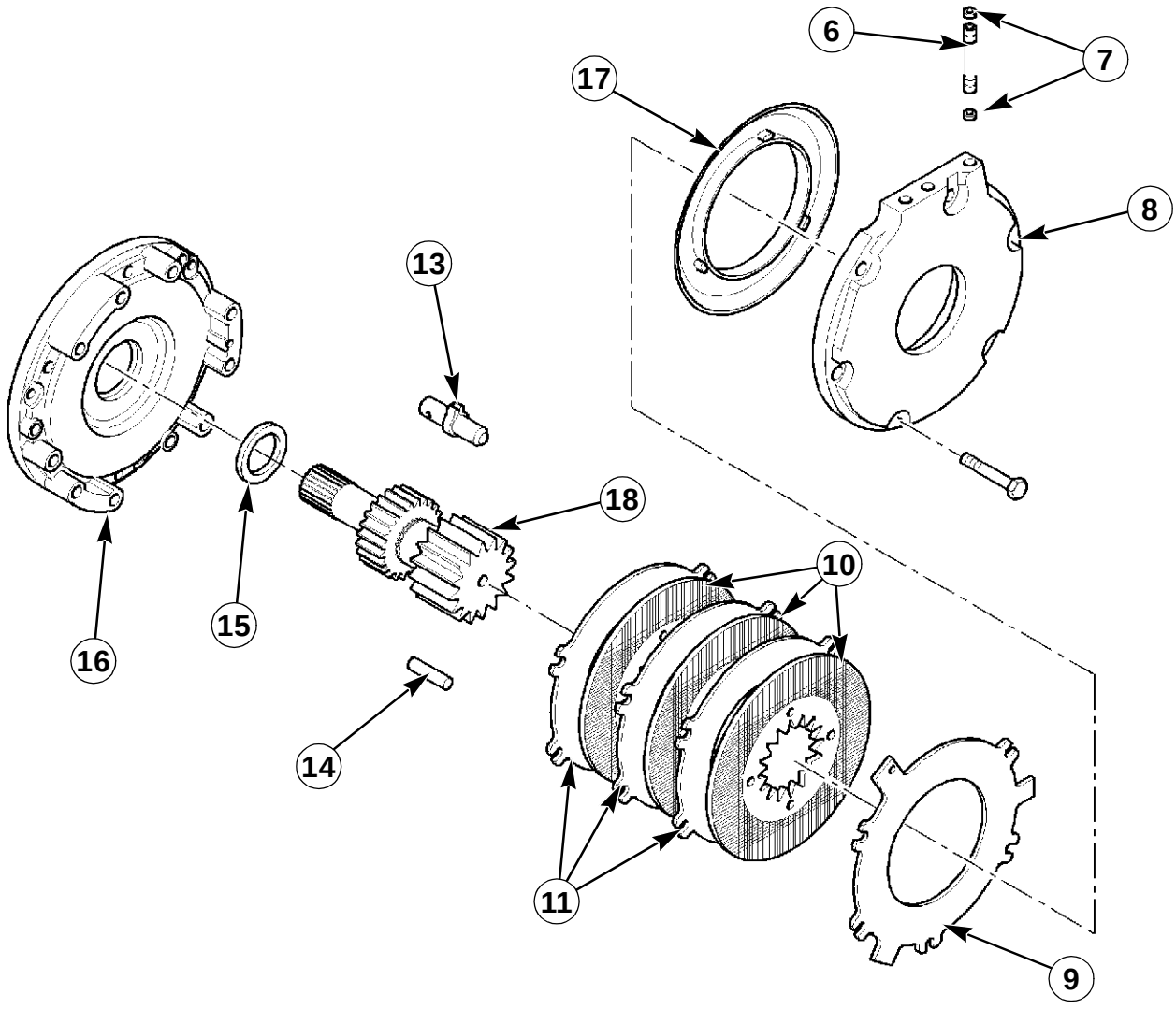
**STEP 17**




MD06D010

Install sun gear shaft (18), make sure the sun gear shaft locates correctly into the differential splines.
Install one separator plate (11) into the differential bearing carrier (16), make sure separator plate locates correctly onto the locating pins (14).

**IMPORTANT:** *The separator plate thickness for tractors equipped with three separator plates is 2.7 mm.*

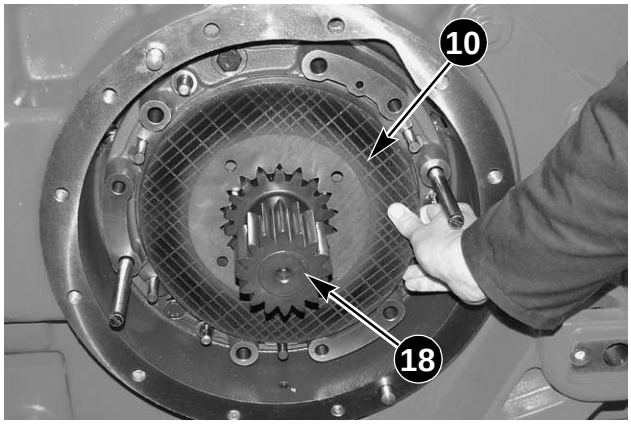



MI06D044

https://truckmanualshub.com/



## STEP 18




MD06D099

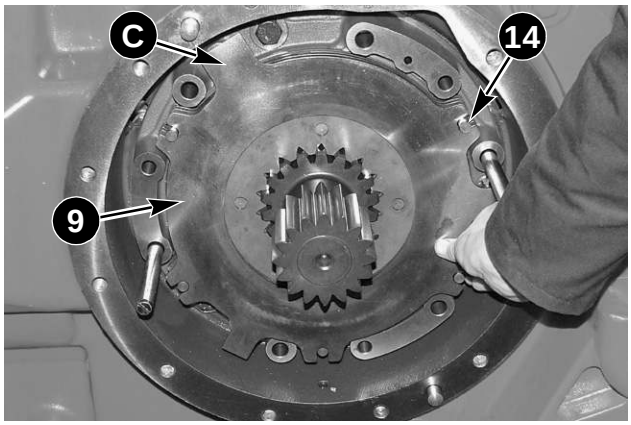
Install one friction plate (10) onto the sun gear shaft (18).

## STEP 19

Continue to install one separator plate (11) and one friction plate (10) until three separator plates and three friction plates have been installed.

**IMPORTANT:** *The last plate installed must be a friction plate.*

## STEP 20

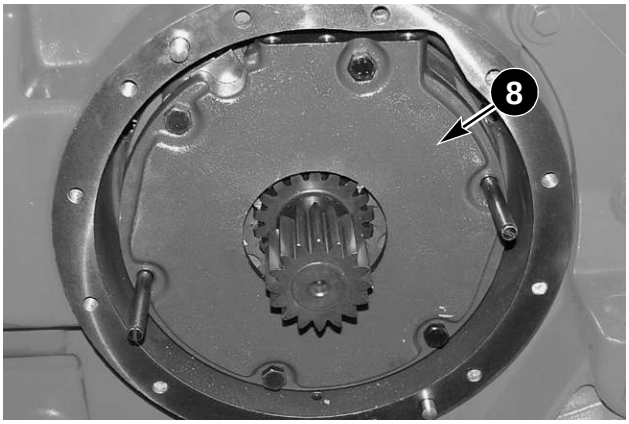



MD06D103

Install the adjuster return plate (9), make sure adjuster return plate locates correctly onto the locating pins (14).

**IMPORTANT:** *Make sure tabs (C) are in contact with the brake adjusters (13).*

## STEP 21

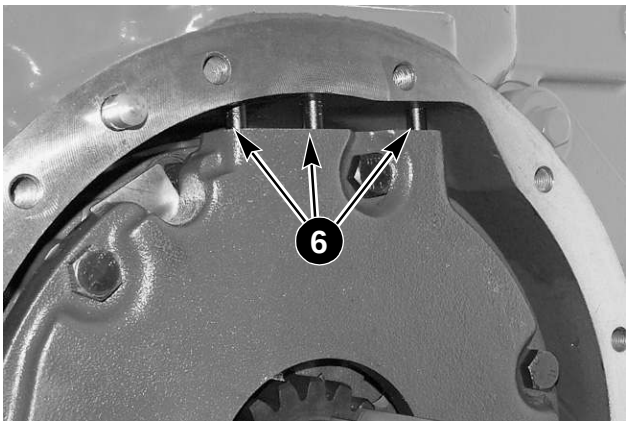



MD06D101

Install the brake piston housing (8) and install four housing retaining bolts. Remove the two alignment studs and install the two remaining retaining bolts.

Tighten all the retaining bolts to a torque of 235 to 260 Nm (173 to 192 lb ft).

## STEP 22



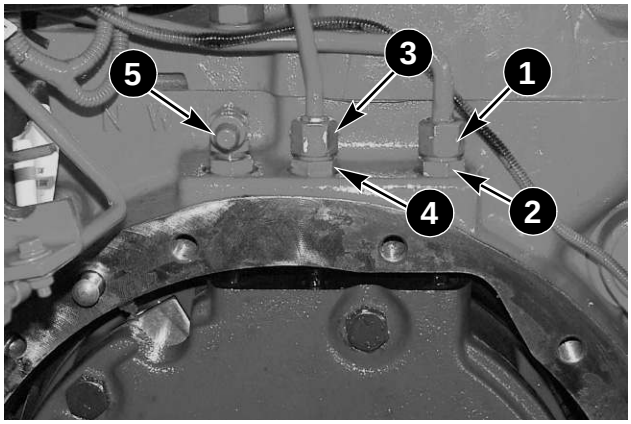

MD06E007

Lubricate and install new o-rings (7) onto the plastic feed tubes (6). Install the feed tubes through the transmission housing into the brake piston housing.

https://truckmanualshub.com/



## STEP 23

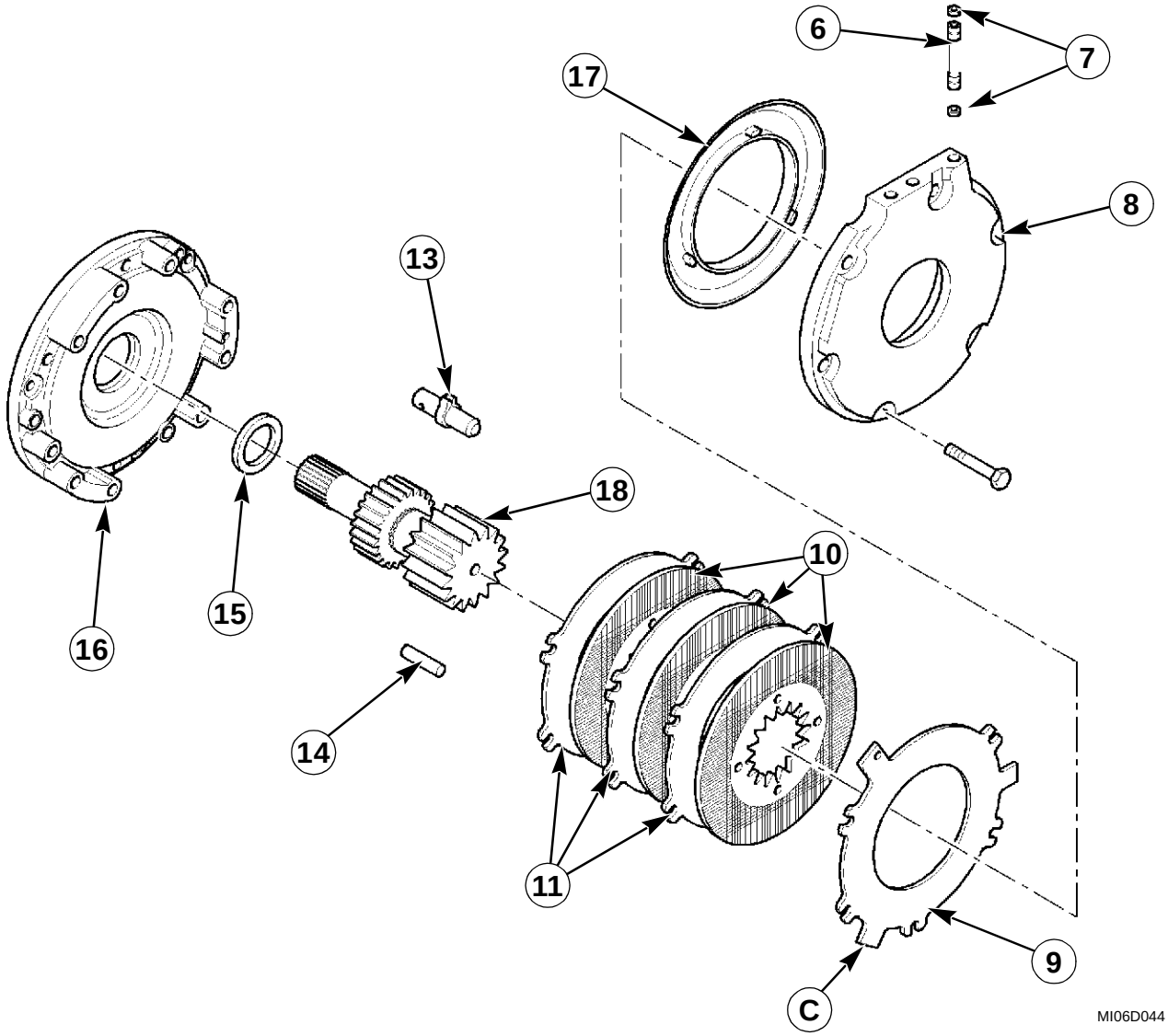



MD06D104

Lubricate and install new o-rings to the tube and bleed fittings. Install and tighten the bleed fitting (5), tube fitting (4) and tube fitting (3). Connect and tighten the brake tube (2) and lubrication tube (1).

## STEP 24

Install the rear axles, refer to Section 6018.




MI06D044

https://truckmanualshub.com/



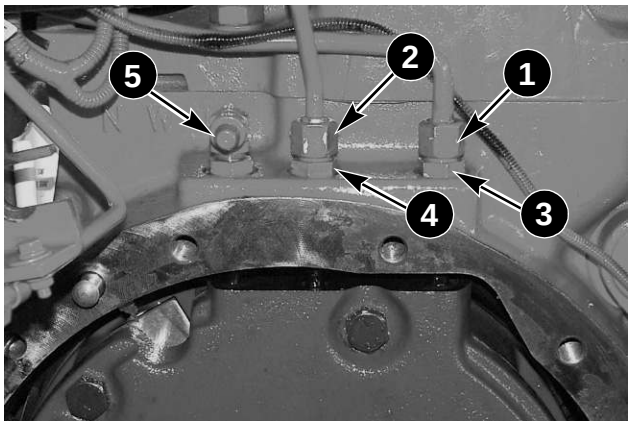
# Tractors With Two Separator Plates

## Removal

### STEP 25

Remove the rear axles, refer to Section 6018.

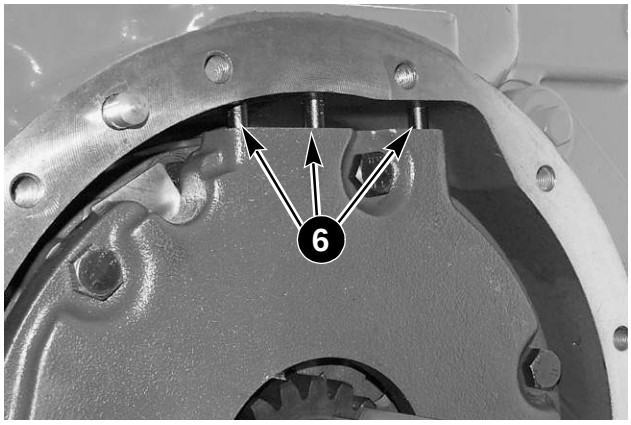
### STEP 26




MD06D104

Disconnect and cap the lubrication tube (1) and brake tube (2), remove the tube fittings (3) and (4). Remove the brake bleed fitting (5), discard the o-rings from the fittings.

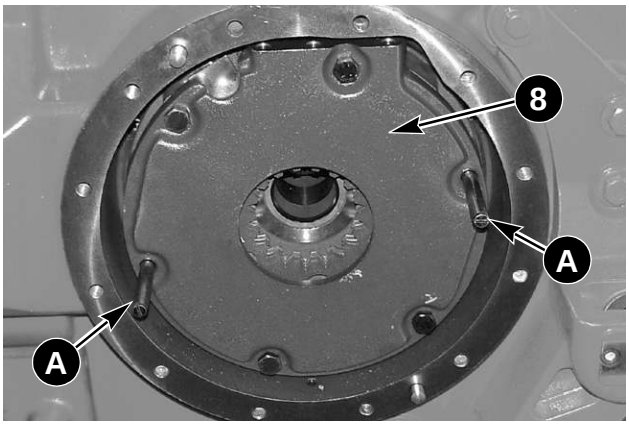
### STEP 27




MD06E007

Remove the plastic feed tubes (6), remove and discard the o-rings (7) from the tubes.

### STEP 28




MD06D093

Remove two left hand brake piston housing retaining bolts and install two 16 mm alignment studs (A) MC1995A as shown. Remove the remaining retaining bolts and remove the left hand brake piston housing (8).

### STEP 29

Remove the adjuster return plate (9).

### STEP 30

Remove the three brake friction plates (10) and two separator plates (11). Remove the three brake reaction pins (13) and the five locating pins (14).

### STEP 31

Remove sun gear shaft seal (15) from the differential bearing carrier (16).

https://truckmanualshub.com/



## STEP 32

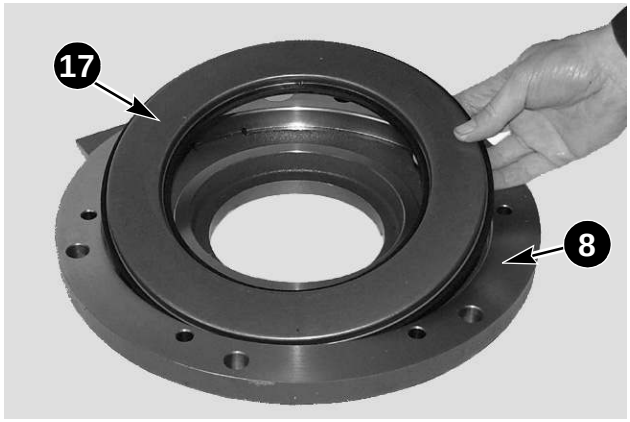
Inspect friction plate (10) and separator plate (11) for damage or heavy wear. Replace as necessary.

**IMPORTANT:** *Replace both the friction plates and separator plates if the friction plate thickness is less than 3.45 mm (0.136 inch).*

## STEP 33

Repeat STEP 2 to STEP 6 and remove the right hand brake components.

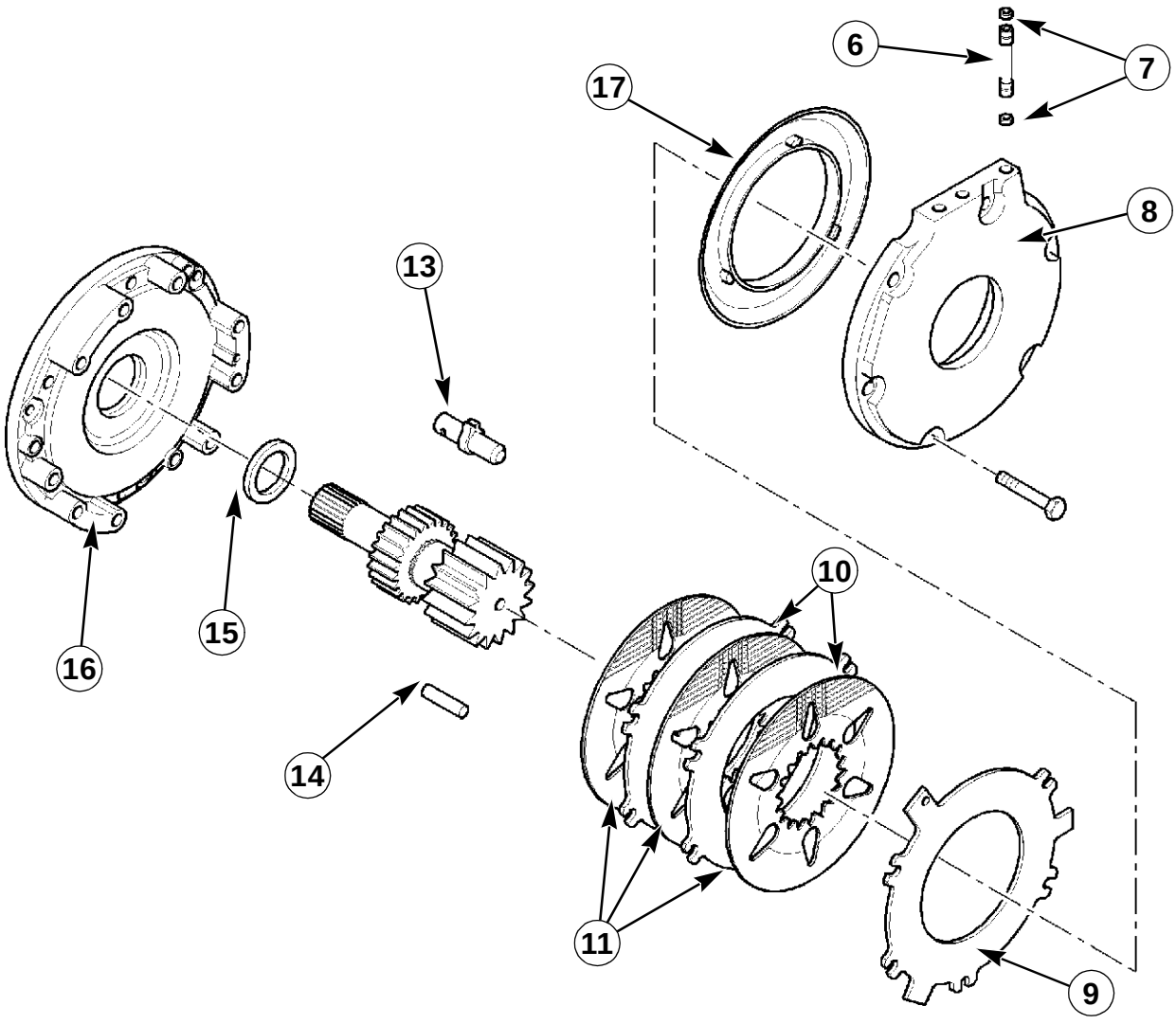
## STEP 34




MD06D094

Carefully remove piston (17) from the brake piston housing (8) using compressed air.

> **WARNING:** ***To prevent injury, always wear eye protection when working with compressed air.***



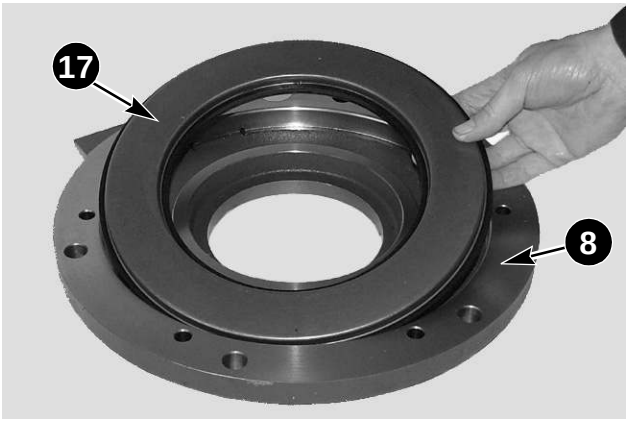

MI06D105

https://truckmanualshub.com/



## Installation

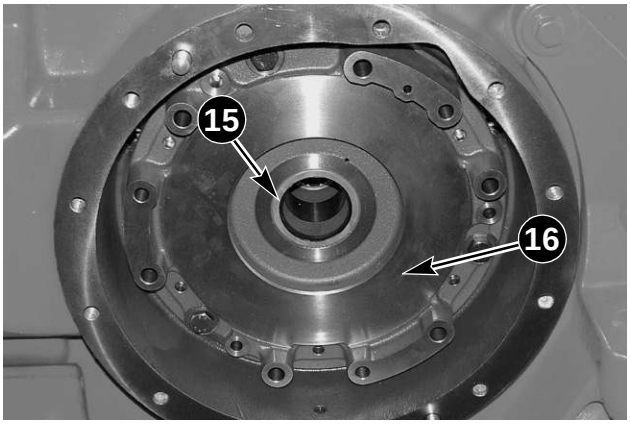
### STEP 35




MD06D094

Lubricate the inner and outer piston seals of the brake piston (17) with petroleum jelly. Carefully install piston (17) into the brake piston housing (8). Gently tap with a soft faced hammer until the piston is fully seated.

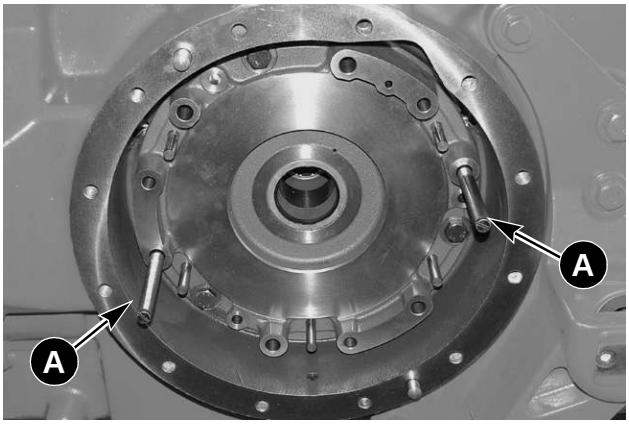
### STEP 36




MD06D095

Using a suitable driver install a new sun gear shaft seal (15) into the differential bearing carrier (16). Lubricate the lip of the seal with clean transmission oil.

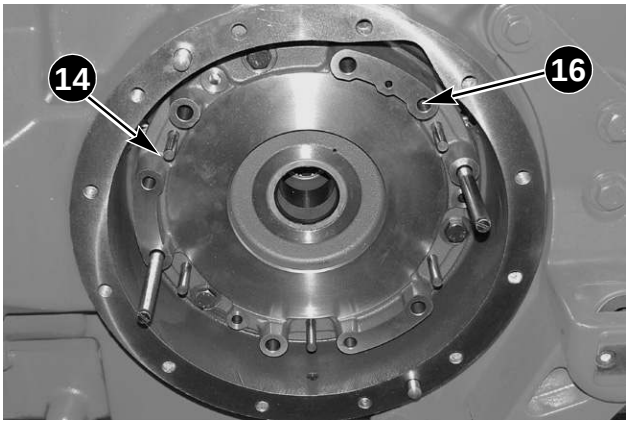
### STEP 37




MD06D096

Install alignment studs (A) MC1995A in the differential carrier.

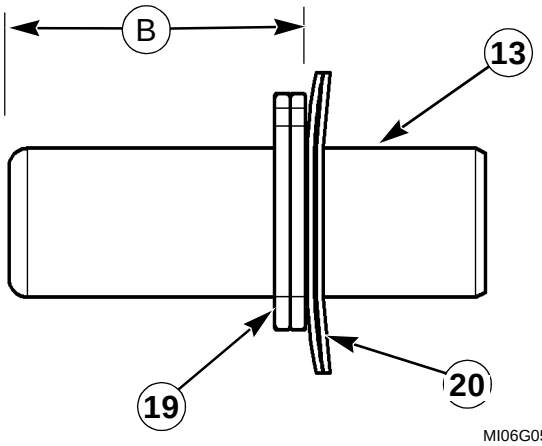
### STEP 38




MD06D096

Install the five locating pins (14) into the differential bearing carrier (16).

### STEP 39



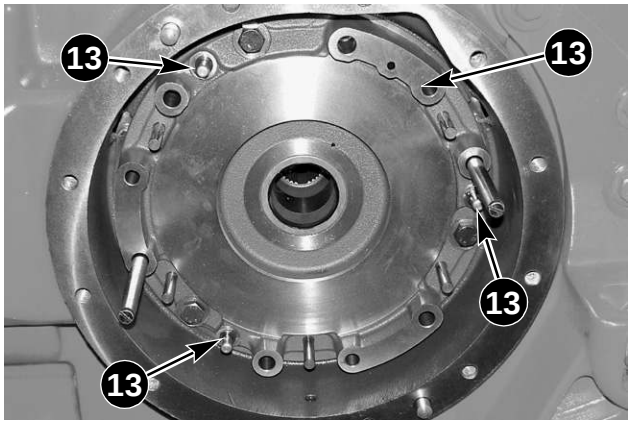

MI06G052

If new brake plates are to be installed, brake reaction pins (13) must be reset. Adjust the depth (B) of retaining rings (19) 26 to 29 mm. Make sure the belleville washers (20) are positioned against retaining rings (19), as shown. If the original plates are to be installed, do not reset the brake adjusters.

https://truckmanualshub.com/



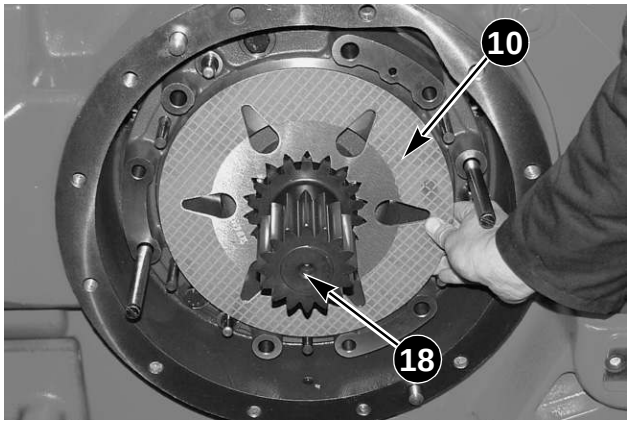
**STEP 40**




MD06E008

Install the brake adjusters (13) into the differential bearing carrier (16). Make sure the belleville washers are towards the differential bearing carrier.

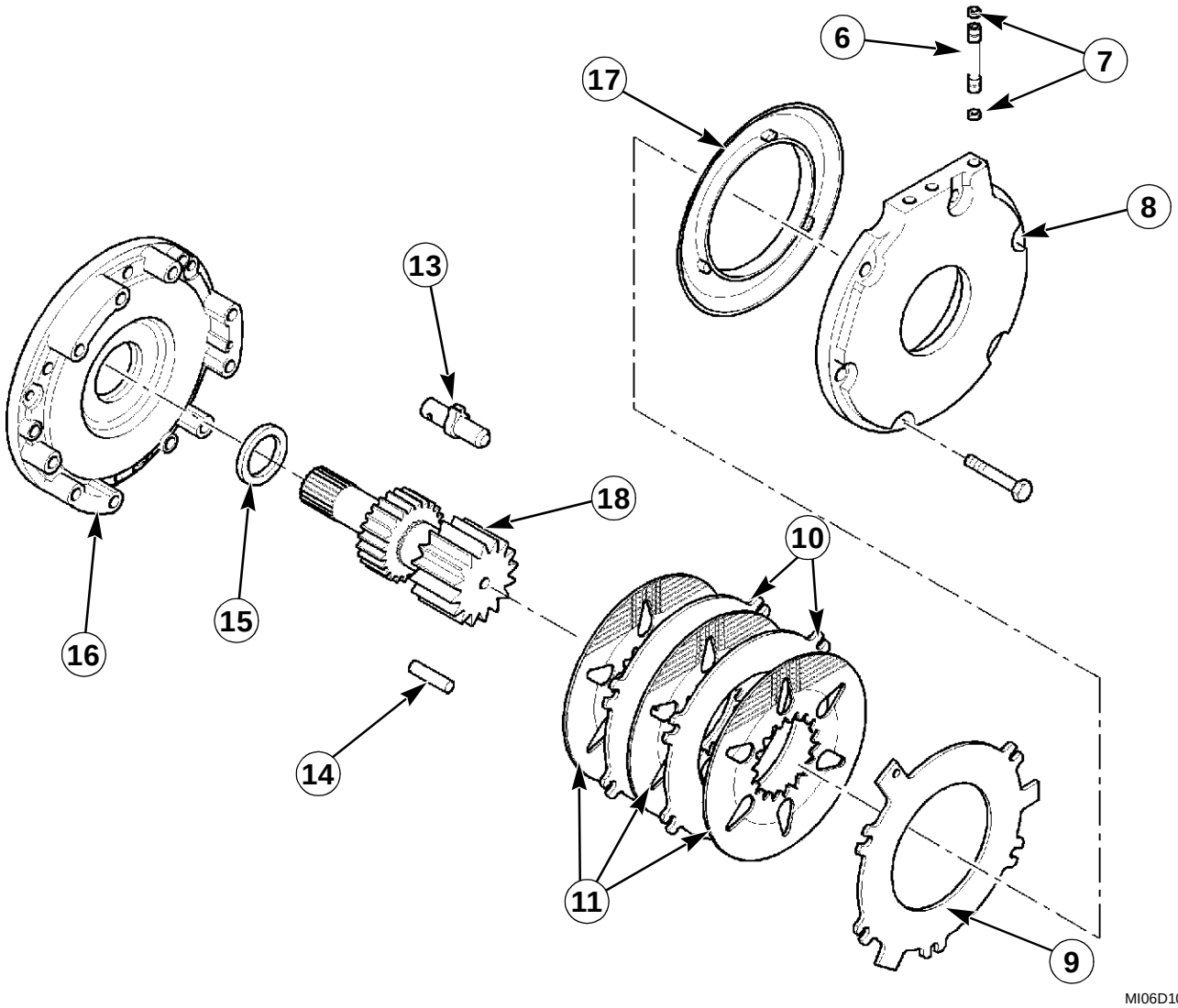
**STEP 41**




MD06D099

Install sun gear shaft (18), make sure the sun gear shaft locates correctly into the differential splines.
Install one friction plate (10) onto the sun gear shaft (18).

**IMPORTANT:** *The separator plate thickness for tractors equipped with two separator plates is 4.0 mm.*

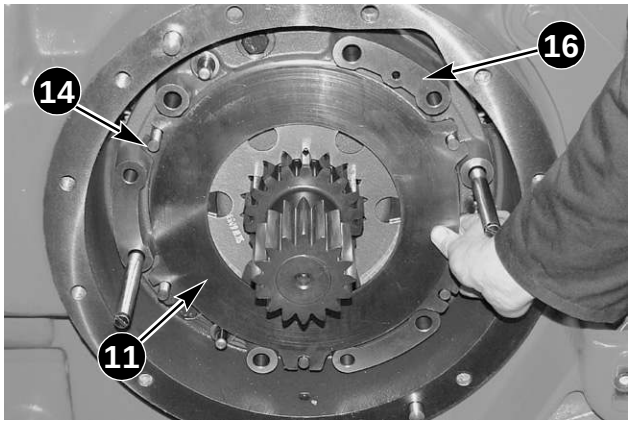



MI06D105

https://truckmanualshub.com/



## STEP 42




MD06D099

Install one separator plate (11) into the differential bearing carrier (16), make sure separator plate locates correctly onto the locating pins (14).

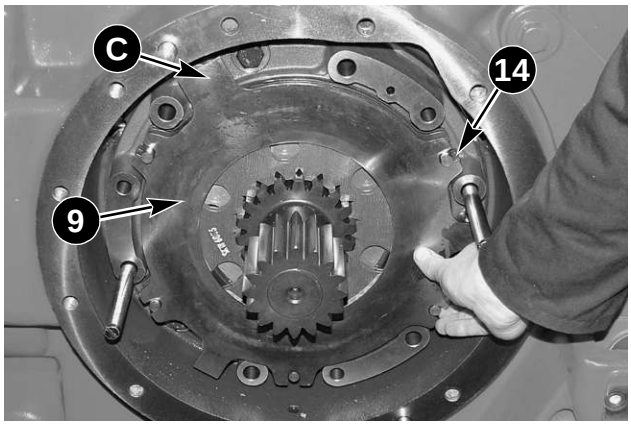
## STEP 43

Continue to install one separator plate (11) and one friction plate (10) until two separator plates and three friction plates have been installed.

**NOTE:** *The friction plates must be installed with the elongated holes in line.*

**IMPORTANT:** *The last plate installed must be a friction plate.*

## STEP 44

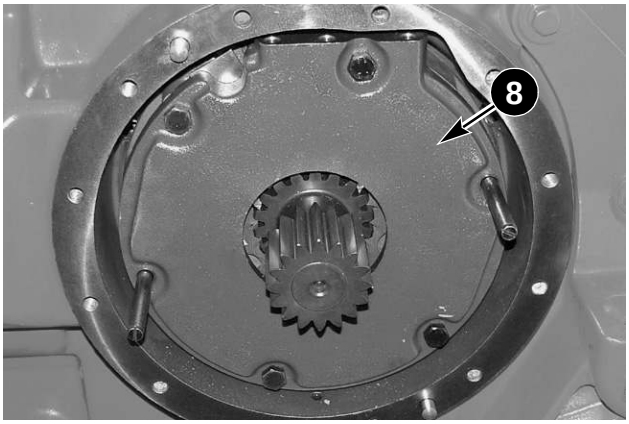



MD06D103

Install the adjuster return plate (9) make sure adjuster return plate locates correctly onto the locating pins (14).

**IMPORTANT:** *Make sure tabs (C) are in contact with the brake adjusters (13).*

## STEP 45

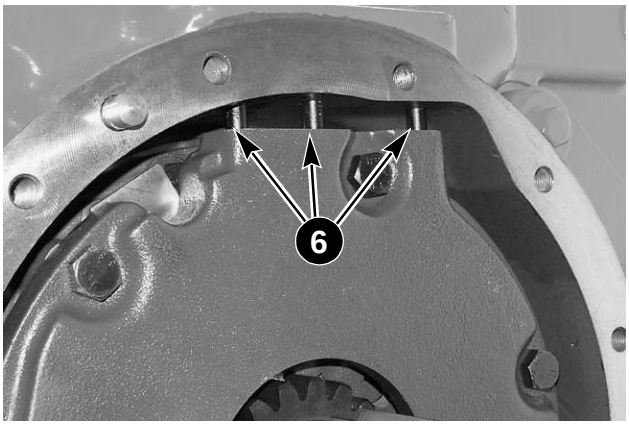



MD06D101

Install the brake piston housing (8) and install four housing retaining bolts. Remove the two alignment studs and install the two remaining retaining bolts.

Tighten all the retaining bolts to a torque of 235 to 260 Nm (173 to 192 lb ft).

## STEP 46



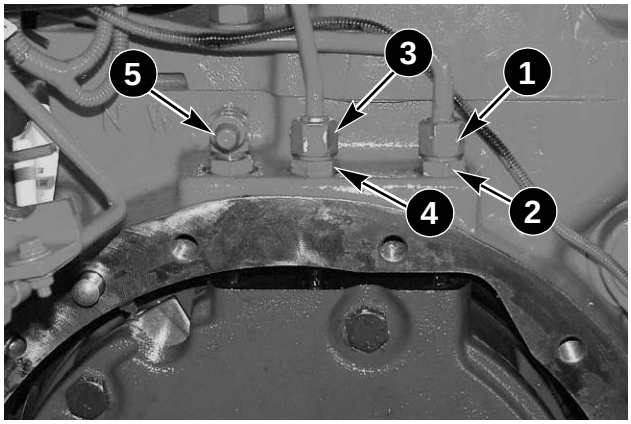

MD06E007

Lubricate and install new o-rings (7) onto the plastic feed tubes (6). Install the feed tubes through the transmission housing into the brake piston housing.

https://truckmanualshub.com/



## STEP 47

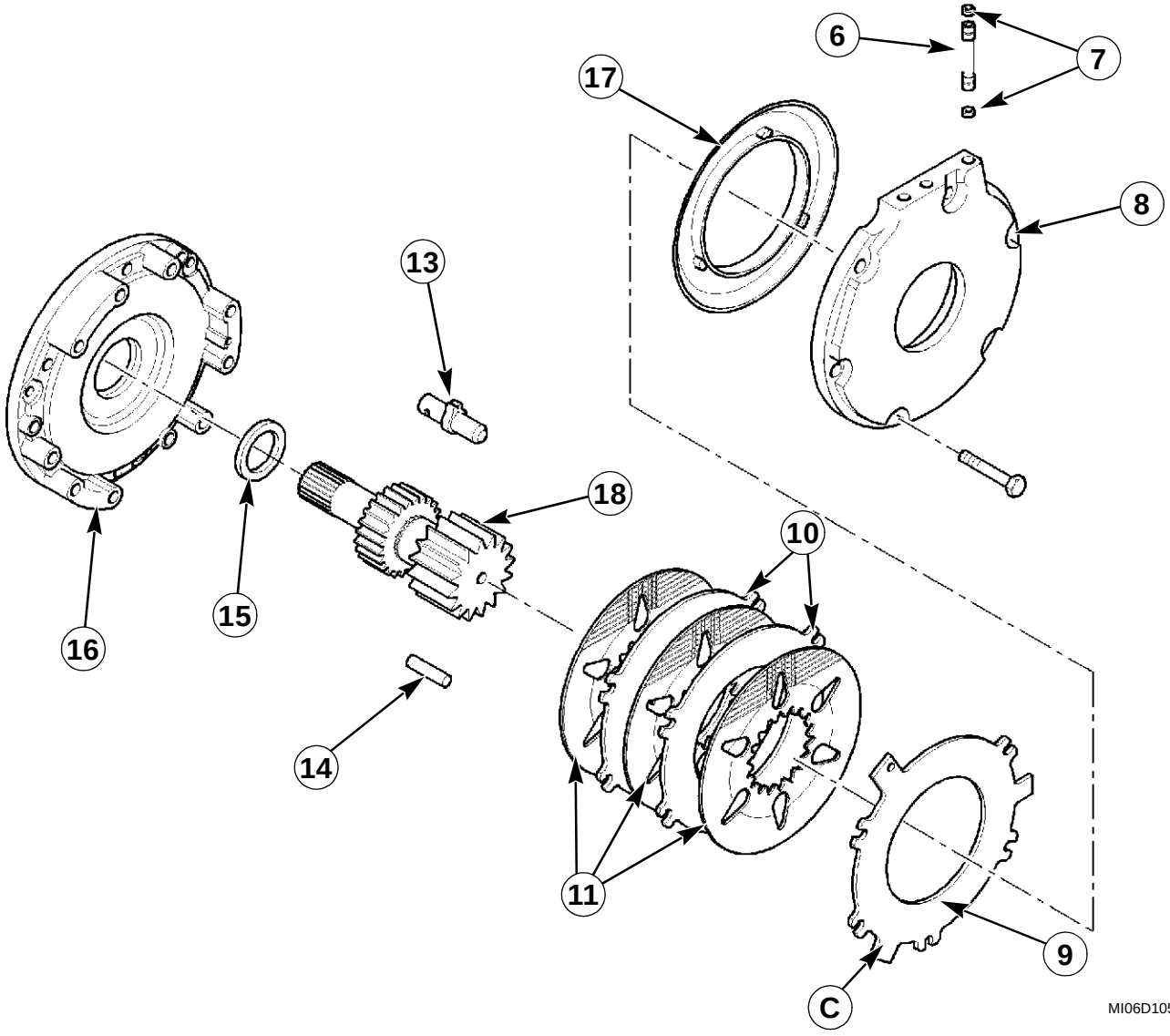



MD06D104

Lubricate and install new o-rings to the tube and bleed fittings. Install and tighten the bleed fitting (5), tube fitting (4) and tube fitting (3). Connect and tighten the brake tube (2) and lubrication tube (1).

## STEP 48

Install the rear axles, refer to Section 6018.




MI06D105

https://truckmanualshub.com/

# Section 8

## XTX HYDRAULICS

### How it Works



McCORMICK

DT30-10203

© 2006 McCormick Tractors International Limited.
July 2005 (Revised September 2006)

https://truckmanualshub.com/



# TABLE OF CONTENTS

INTRODUCTION
General Information ..... 6
Hydraulic Circuits ..... 6
Hydraulic Pumps ..... 7
Hydraulic Pipe Seals ..... 7

XTX185 to 215 HYDRAULIC SYSTEM - BASIC LAYOUT
General Description ..... 8
Specifications ..... 8

HYDRAULIC SCHEMATIC
Legend ..... 10
XTX Hydraulic Schematic (Rexroth PFC Pump) ..... 11

TRANSMISSION LUBRICATION CIRCUIT AND PFC PUMP SUPPLY
General Description ..... 13
Oil Inlet Suction Screen ..... 15
Charge/lubrication Pump ..... 15
Pump Location and Drive ..... 15
Charge/Lubrication Pump flow and pressure. ..... 15
Main Filter Housing ..... 17
Main Filter Specifications ..... 17
Filter By-pass ..... 17
Differential Pressure Switch ..... 17
Lubrication Pressure Relief Valve ..... 19

PFC HYDRAULIC PUMP
Rexroth PFC Pump ..... 20
PFC Axle Piston Pump ..... 21
PFC Piston Pump Signal Circuit ..... 22

PFC PUMP SIGNAL CIRCUIT
General Description ..... 23
Operating Modes ..... 23
Low Pressure Stand-by - (at engine start up) ..... 25
Pressure and Flow Supply ..... 27
Increased Flow Demand ..... 27
Decreased Flow Demand ..... 27
Maximum Pressure Limitation ..... 29
Return to Low Pressure Stand-by ..... 29

PRIORITY AND REGULATOR VALVE
General Description ..... 31
Steering Priority Spool ..... 31
Steering Main Relief Valve ..... 31
Dynamic Orifice ..... 31

REGULATED PRESSURE CONTROL CIRCUIT (P1)
General Description ..... 33
Regulated Pressure Control Spool ..... 33
Circuit description ..... 33

https://truckmanualshub.com/



POWERSHIFT CONTROL VALVE
- General Description ..... 35
- Solenoids ..... 35
- Electronic Control Module (ECM) ..... 35
- Pulse Width Modulation (PWM) ..... 35

FORWARD/REVERSE MANIFOLD
- General Description ..... 37
- Electronic Control System ..... 37

FORWARD/REVERSE SOLENOID OPERATION
- Solenoid Off - Diagram 1 ..... 39
- Solenoid On - Diagram 2 ..... 39

FORWARD AND REVERSE CONTROL
- General description ..... 41
- Automatic Clutch Control ..... 41
- Forward Drive Engaged ..... 41
- Reverse Drive Engaged ..... 41
- Direction Change Without using the Clutch Pedal ..... 41

PTO CONTROL
- General Description ..... 43
- Pulse Width Modulation (PWM) ..... 43
- PTO OFF - Diagram 1 ..... 45
- PTO ON - Diagram 2 ..... 45

DIFFERENTIAL LOCK & MFD CONTROL
- Differential Lock General Description ..... 47
- Differential Lock OFF ..... 47
- Differential Lock ON ..... 47
- MFD Control General Description ..... 47
- MFD Off ..... 47
- MFD On ..... 47

SERVO POWER RANGE SELECTOR ..... 48

RANGE SELECTION (XtraSpeed-E & XtraSpeed-Eplus Tractors)
- General Description ..... 49
- Control ..... 49

CREEP SPEED SELECTION
- General Description ..... 51
- Creeper Disengaged ..... 51
- Creeper Engaged ..... 51

PARK LOCK
- General Description ..... 53
- Park Lock Disengaged ..... 53
- Park Lock Engaged ..... 53
- Manual Operation Of The Park Lock ..... 53

REMOTE AUXILIARY VALVES
- General Description ..... 55
- High Pressure Main Circuit ..... 55

https://truckmanualshub.com/



MECHANICALLY OPERATED AUXILIARY REMOTE VALVES
Raise position (Diagram 1) ..... 57
Lower Position (Diagram 2) ..... 57
Float Position (Diagram 3) ..... 57
Signal Check Valves ..... 57
Operation of the Priority Flow Control Spool (21h) ..... 59
Operation of the Detent mechanism ..... 59

MECHANICALLY OPERATED AUXILIARY REMOTE VALVES (Non Priority)
General Description ..... 61
Operation of the flow control spool (22i) ..... 61
Operating more than one remote valve ..... 61

ELECTRICALLY OPERATED AUXILIARY REMOTE VALVES
General Description ..... 63
Auxiliary Solenoid Valve(23p) ..... 63
XtraSpeed & XtraSpeed-E 4th valve ..... 63
Neutral Position ..... 63
Raise Position ..... 63
Lower Position ..... 63
XtraSpeed-Eplus Valves Position 1 to 4 ..... 65
Valve operation (raise) ..... 65
Valve operation (lower) ..... 65
Valve operation (float) ..... 67
Motor Remote Spool Operation ..... 67

HYDRAULIC POWER BEYOND
General Description ..... 69
Hydraulic Test points ..... 69

ELECTRONIC HITCH AND PTO CONTROLLER (EHC)
General Description ..... 71
Pulse Width Modulation (PWM) ..... 71
Operator Control of the Hitch ..... 73
Operating in Position Control ..... 77
Operating in Load Control (Lower Link Sensing) ..... 77

HITCH HYDRAULIC CIRCUIT
General Description ..... 79
Hitch in Neutral ..... 79
Hitch Raising ..... 81
Hitch Lowering ..... 83

https://truckmanualshub.com/



This Page Has Been Left Blank.

https://truckmanualshub.com/



# INTRODUCTION

## General Information

The XTX Series tractors use an extremely efficient load sensing hydraulic system which incorporates four circuits to provide the main hydraulic requirements of the tractor.

1. Low pressure transmission lubrication circuit
2. Priority safety circuits
3. Regulated pressure transmission control circuit
4. High pressure main circuit

## Hydraulic Circuits

### 1 Lubrication Circuit

The lubrication circuit provides a low pressure flow of oil to lubricate and cool the following transmission components:-

Powershift, Shuttle, Differential Lock, MFD and PTO Clutches
Synchromesh Units
Brakes
Gears
Bearings
Splines
Hitch Rock Shaft

### 2 Priority Safety Circuit

The priority safety circuit gives priority to the steering and optional trailer brake (Europe only) circuits before supplying the regulated pressure and high pressure circuits.

### 3 Regulated Pressure Circuit

The regulated pressure circuit supplies the following transmission components:-

Powershift clutches
Forward/reverse shuttle clutches
Range cylinders (Auto speed only
Differential Lock clutch
Four Wheel Drive clutch
Power Take Off clutch
Front PTO clutch (option)
Brake booster

The same regulated pressure circuit also provides the pilot pressure for the control circuits of the hitch and electronic remote valves.

### 4 High Pressure Main Circuit

The high pressure circuit supplies all the remote valve and hitch work circuits, front axle suspension and cab suspension, it is also used as a source for a power beyond supply.

This circuit is supplied by an efficient, pressure flow compensated (PFC) pump. This pump matches its hydraulic power output to the actual load requirements of the tractor to ensure the maximum efficiency and the minimum use of fuel.

https://truckmanualshub.com/



## Hydraulic Pumps

### 1 Charge/Lubrication Pump

The charge/lubrication pump is used to supply the main PFC pump to prevent cavitation. This pump also supplies all the lubrication and cooling requirements of the transmission.

The pump draws oil from the transmission housing through a 30 micron suction screen and delivers it to the main pressure filter.

Pump flow rate at 2200 rpm is 190-210 litres/minute (tractors built prior to 01/01/2006).

Pump flow rate at 2200 rpm is 140-166 litres/minute (tractors built after 01/01/2006).

### 2 Pressure and Flow Compensation (PFC) Pump Unit

This unit includes an axial piston pump which has a variable flow output and can operate at a variable pressure. A pump control valve automatically controls the PFC pump flow and pressure.

Pump flow rate at 2200 rpm is:113-123 litres/minute (Rexroth).

150-160 litres/minute (Sauer Sunstrand) optional high flow pump.

## Hydraulic Pipe Seals

All hydraulic lines are equipped with o-ring face seals to ensure reliable, vibration resistant connections.

https://truckmanualshub.com/



# XTX185 to 215 HYDRAULIC SYSTEM - BASIC LAYOUT

## General Description

There are two pumps in the XTX 185 to 215 hydraulic system as shown in the diagram on page 9.

The charge/lubrication pump (2) supplies oil at low pressure through the main filter (6) to both the PFC (pressure and flow compensation) axial piston pump (8) and the transmission lubrication system (TL).

The PFC axial piston pump (8) delivers oil to the priority/regulator valve (10) which ensures that the steering (25) has first priority. Depending on tractor build, second priority is given to the trailer brake valve (31) and front axle brakes (40). Regulated pressure (P1) has third priority and the high pressure systems which include the hitch (15), auxiliary valves (21), brake booster (39) and power beyond (19) will have fourth priority. Options which may also take an oil feed from the 4th priority are cab suspension (43) and front axle suspension (41).

## Specifications

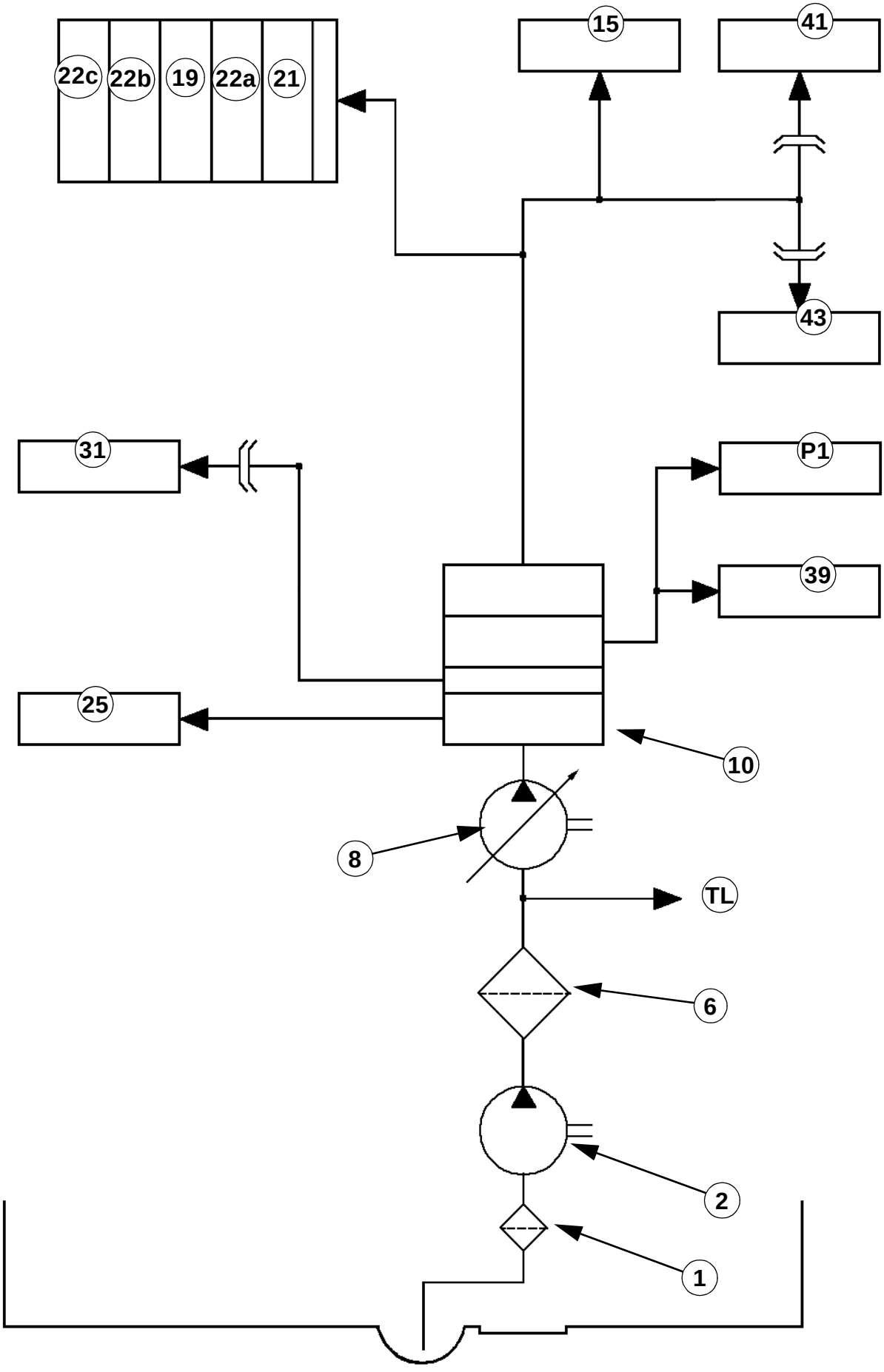
| COMPONENT | FLOW<br>Tractors built prior to 01/01/2006 | FLOW<br>Tractor built after 01/01/2006 |
|---|---|---|
| Charge/Lubrication Pump | 190 - 210 L/Min.<br>(50 - 55.2 US gpm) | 140 - 166 L/Min.<br>(36.96 - 43.8 US gpm) |
| Rexroth PFC Axial Piston Pump | 113 - 123 L/Min.<br>(34 US gpm) | 113 - 123 L/Min<br>(34 US gpm) |
| Sauer Sunstrand PFC Axial Piston Pump | 150 - 160 L/Min.<br>(43 US gpm) | 150 - 160 L/Min<br>(43 US gpm) |

| COMPONENT | REXROTH | SAUER SUNSTRAND |
|---|---|---|
| Power Steering Hand Control Unit | 177 to 185 Bar<br>(2575 - 2683 PSI) | 177 to 185 Bar<br>(2575 - 2683 PSI) |
| Pilot Pressure Regulator | 22 to 24 Bar<br>(319 - 348 PSI) | 22 to 24 Bar<br>(319 - 348PSI) |
| Low Pressure Stand-by | 27 to 40 Bar<br>(391 to 580 PSI) | 27 to 40 Bar<br>(391 to 580 PSI) |
| Hitch Valve Working Pressure | 199 to 209 Bar<br>(2886 - 3031 PSI) | 202 Bar<br>(2930 PSI) |
| Remote Valves | 199 to 209 Bar<br>(2886 - 3031 PSI) | 202 Bar<br>(2930 PSI) |
| Power Beyond Supply | 199 to 209 Bar<br>(2886 - 3031 PSI) | 202 Bar<br>(2930 PSI) |
| Cab Suspension | 199 to 209 Bar<br>(2886 - 3031 PSI) | 202 Bar<br>(2930 PSI) |
| Front Axle Suspension | 199 to 209 Bar<br>(2886 - 3031 PSI) | 202 Bar<br>(2930 PSI) |
| Cylinder Shock Valve (Cushion Valve) | 224 Bar<br>(3250 PSI) | 224 Bar<br>(3250 PSI) |
| Trailer Brake | 150 Bar<br>(2175 PSI) | 150 Bar<br>(2175 PSI) |

https://truckmanualshub.com/



## Basic Hydraulic Schematic



https://truckmanualshub.com/



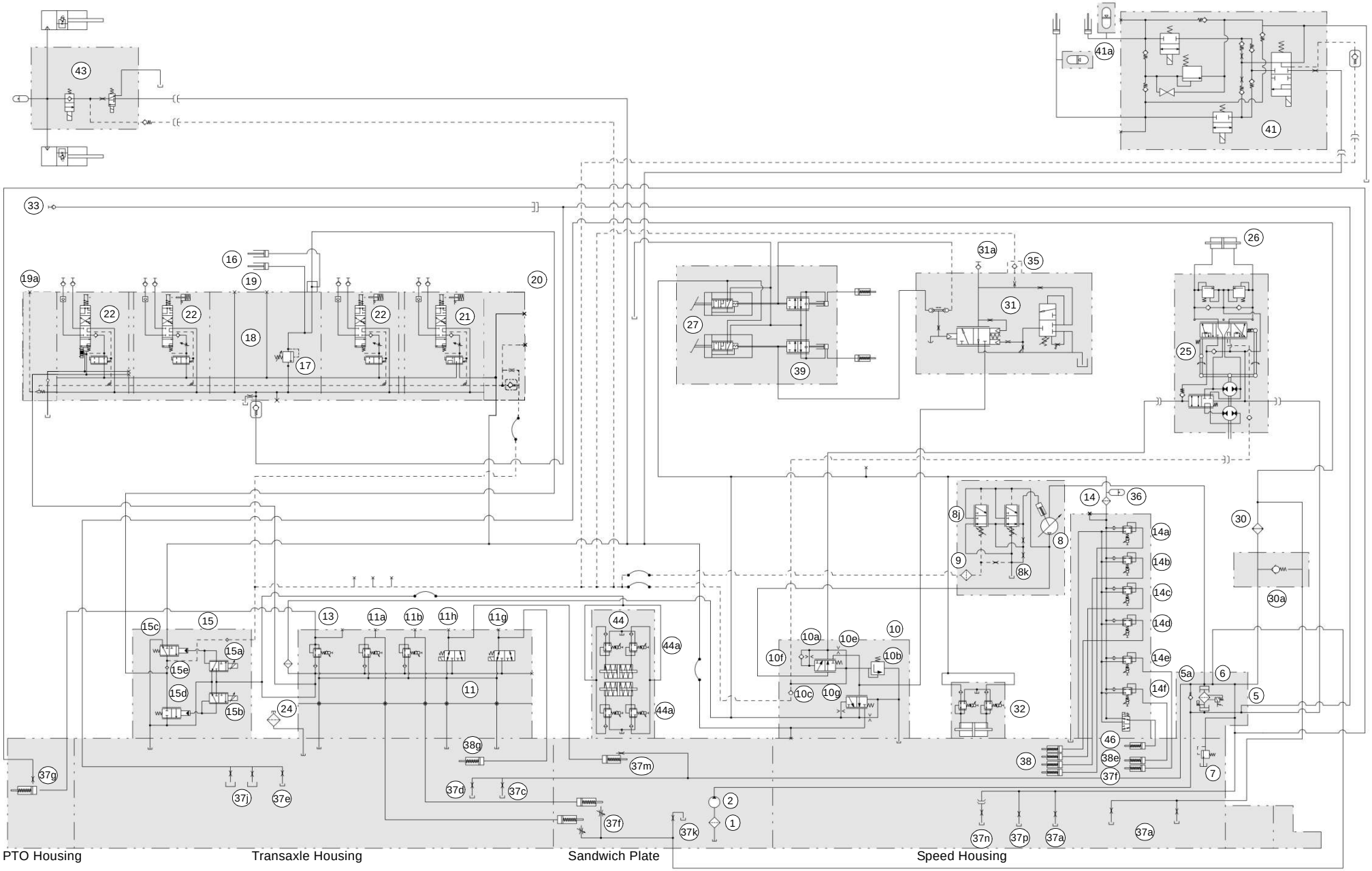
# HYDRAULIC SCHEMATIC

## Legend

1. Main Suction Screen
2. Lubrication/charge Pump
5. Main Filter Housing
5a. Filter by-pass valve 3 bar
5b. Lubrication Priority Valve
5c. Orifice 4.25 mm
6. Main Filter
7. Lubrication Pressure Relief Valve 4.5 bar
8. PFC pump
8j. Compensator Spool
8k. Main Relief Valve
9. Signal Screen
10. Priority/Regulator valve
10a. Steering Priority Valve
10b. Steering Main Relief Valve
10c. Steering Signal Check Valve
10e. Signal Dynamic Orifice (0.8 mm)
10f. Signal Dampening orifice (1.0 mm)
10g. Regulated Pressure Regulator Spool
11. Forward/Reverse Manifold
11a. Forward Solenoid Valve
11b. Reverse Solenoid Valve
11g. Differential Solenoid Valve
11h. MFD Solenoid Valve
13. PTO Solenoid Valve
14. Powershift Manifold
14a. Powershift Solenoid Valve 1
14b. Powershift Solenoid Valve 2
14c. Powershift Solenoid Valve 3
14d. Powershift Solenoid Valve 4
14e. High Clutch Solenoid Valve
14f. Low Clutch Solenoid Valve
14g. Park Lock Solenoid Valve
15. Hitch Control Valve
15a Raise Solenoid
15b. Lower Solenoid
15c. Raise Secondary Control Spool
15d. Lower Secondary Control Spool
15e. Check Valve
16. Hitch Cylinders
17. Hitch Cushion Relief Valve 228 -242 bar
18. Remote Auxiliary Valve Mounting Plate
19. Hydraulic Power Beyond (Flow and Return)
19a Hydraulic Power Beyond Signal line
20. Remote Auxiliary Valve End Plate
21. 1st Remote Auxiliary Valve
22. Additional Remote Auxiliary Valve
24. Transmission Housing Breather
25. Steering Hand Control Unit
26. Steering Cylinder
27. Brake Master Cylinders
30. Oil Cooler
30a Oil Cooler By-Pass Valve 2.75 Bar
31. Trailer Brake Valve (if equipped)
31a Trailer Brake Coupling (if equipped)
32. Creeper Selector Valve (If Fitted)
33. Hydraulic Motor Low Pressure Return Coupling
34. Front Hitch Cylinders (if equipped)
35. Trailer Brake Signal Check Valve
36. Powershift Supply Accumulator
37. Transmission Lubrication
37a Powershift Lubrication
37b. Powershift Main Shaft Bearing Lubrication
37c. Pinion/Bevel Gear Lubrication
37d. Pinion Shaft Gear Lubrication
37e. Differential Housing Lubrication
37f. Forward/Reverse Clutches Lubrication
37g. PTO Clutch Lubrication
37j. Brake Disc Lubrication
37k. Forward/Reverse Bearing Lubrication
37m. MFD Clutch Lubrication
37n Creeper Lubrication (If Fitted)
37p Powershift High/Low Clutch Lubrication
38. Powershift Clutches
38e. High Clutch
38f. Low Clutch
38g Differential Lock Clutch
39 Brake Booster
40 Front Axle Brakes
41 Front Axle Suspension Valve
41a Front Axle Suspension Accumulators
43 Cab Suspension
44 Power Range Selector (PRS)
44a Range Solenoids
45 Front PTO
46 Park Lock

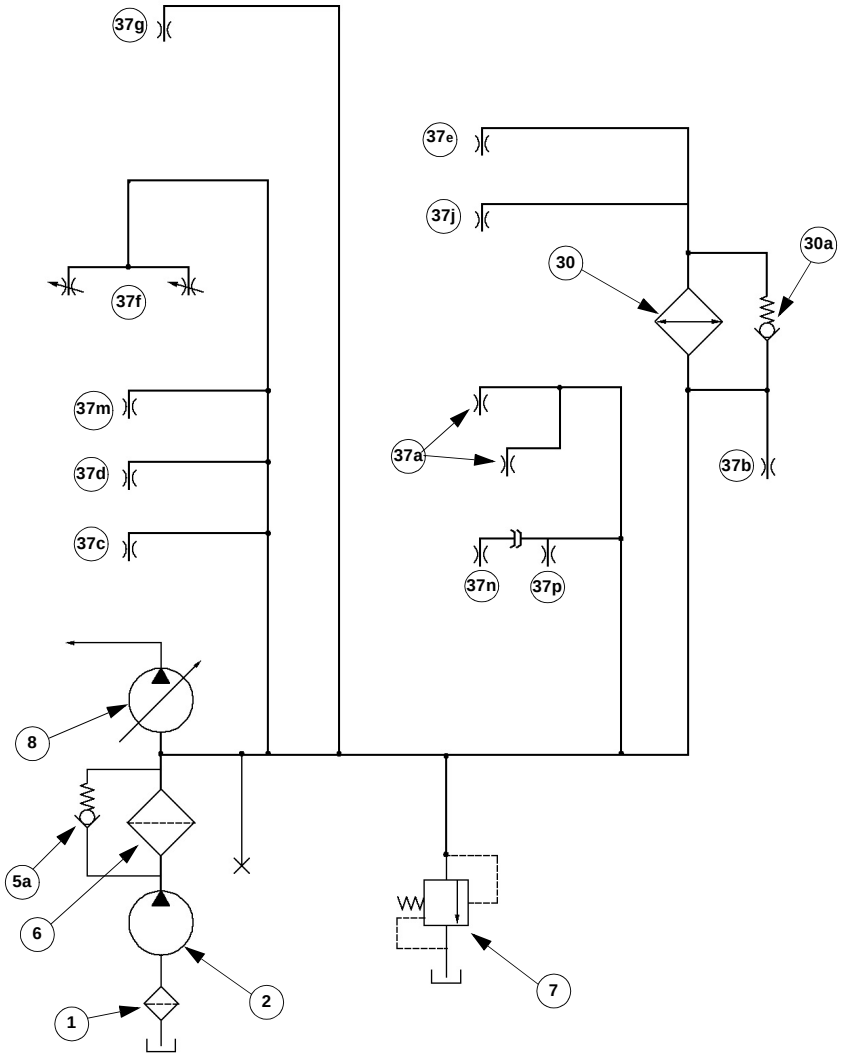
https://truckmanualshub.com/


## XTX Hydraulic Schematic (Rexroth PFC Pump)

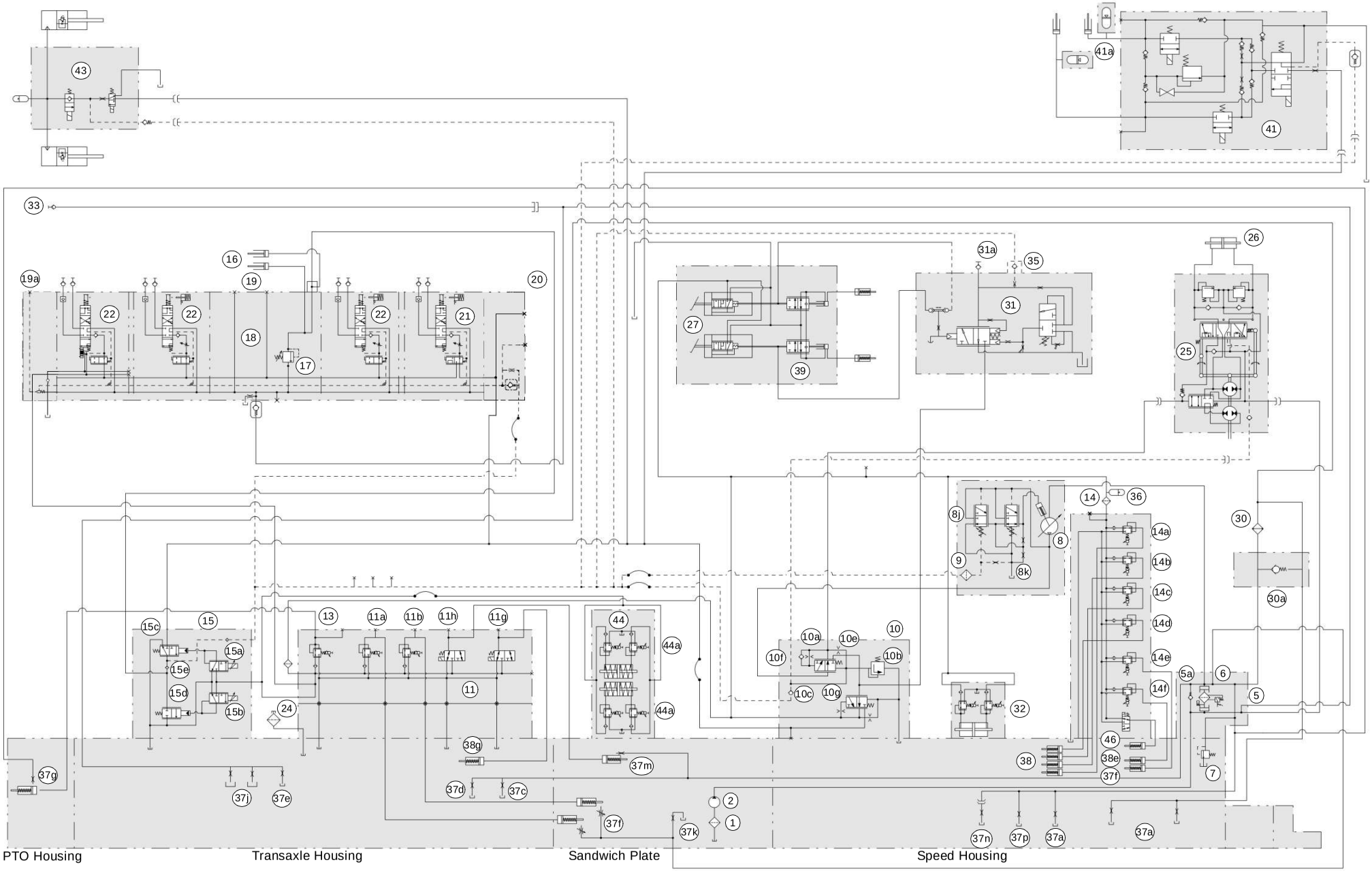


https://truckmanualshub.com/

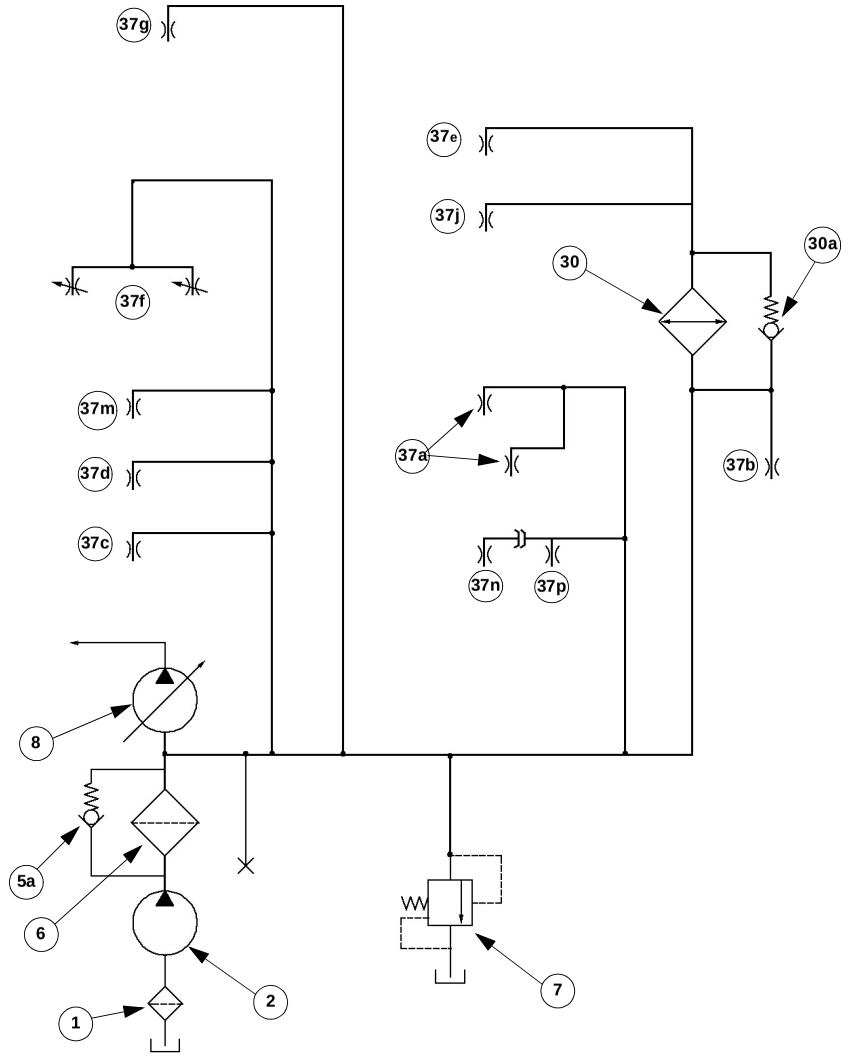




## XTX Hydraulic Schematic (Rexroth PFC Pump)




https://truckmanualshub.com/




https://truckmanualshub.com/

https://truckmanualshub.com/



# TRANSMISSION LUBRICATION CIRCUIT AND PFC PUMP SUPPLY

## General Description

The transmission lubrication circuit is supplied from the charge/lubrication pump (2) and operates at low pressure to lubricate and cool all transmission components. The pressure in the lubrication circuit is influenced very little by the demand for flow from the PFC axial piston pump. When the PFC pump is operating at high flow rates, it will draw oil away from the lubrication circuit, however return oil from the remote auxiliary valves, power beyond and power steering returns to the lubrication circuit at the filter mounting plate.

Because of the large flow of oil from the charge pump on the XTX 185 to 215 transmission it is not necessary to have a primary and secondary lubrication circuit.

A lubrication pressure relief valve (7) opens when the lubrication pressure rises to 4.1 - 4.9 bar and allows the excess flow to return to the transmission housing.

The lubrication orifices, for all the circuits, are designed to allow the oil flows listed below, when the engine is running at maximum speed.

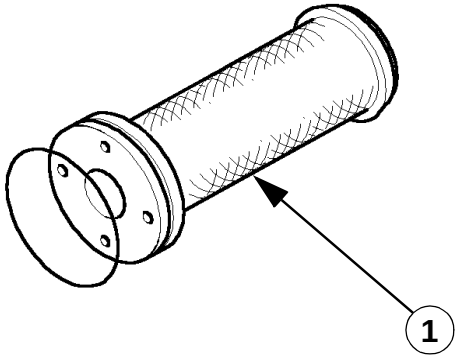
| **Pump Flow Specifications** | | **litre/min.** |
|---|---|---|
| 2 | Lubrication/charge pump | 190 - 210 (tractors prior to (01/01/2006) |
| 2 | Lubrication/Charge pump | 140 - 166 (tractors after (01/01/2006) |
| 8 | PFC axial piston pump | 113 - 123 (Rexroth) |
| | | 150 - 163 (Sauer) |
| **Lubrication circuit** | | |
| 37a | Powershift clutch lubrication | 15.5 |
| 37b | Powershift main shaft bearing lubrication | 4.0 |
| 37c | Bevel gear/pinion lubrication | 4.0 |
| 37d | Pinion shaft lubrication | 8.0 |
| 37e | Differential housing lubrication | 8.0 |
| 37f | Forward/reverse shuttle control valve | |
| | (clutch engaged) | 25.0 |
| | (clutch disengaged) | 10.0 |
| 37g | PTO clutch lubrication | 16.0 |
| 37j | Brake lubrication | 8.0 |
| | Per axle (total tractor flow 16 litres) | |
| 37m | MFD clutch & bearing lubrication | 12.0 |
| 37n | Creeper lubrication (if fitted) | |
| 37p | Powershift High/Low clutch lubrication | |
| **Additional Component** | | |
| 30a | Oil cooler bypass valve | 2.75 bar (40PSI) |

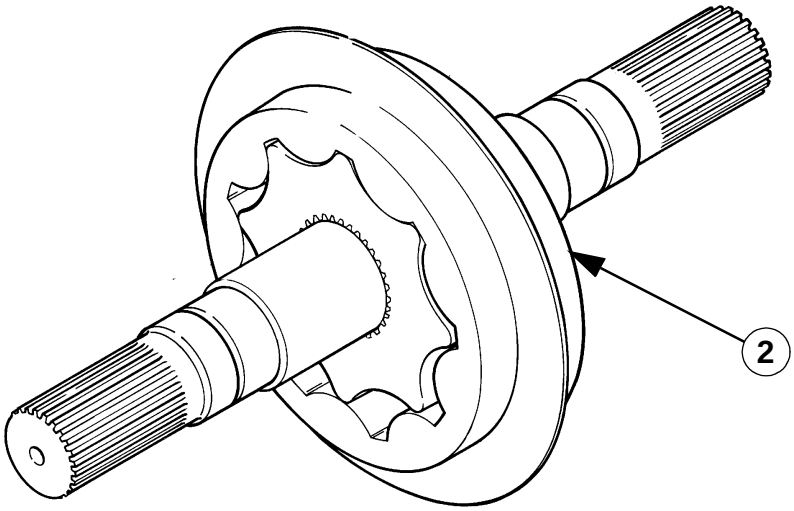
**NOTE:** *After assembling the transmission, all lubrication orifices must be clean and free of contamination.*

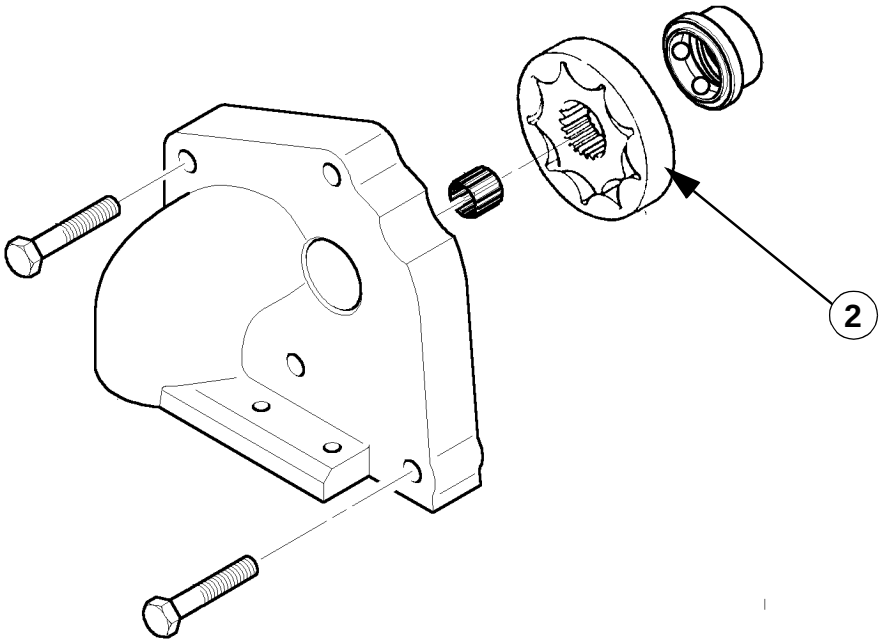
**NOTE:** *Refer to section 8001 of the workshop manual for correct testing procedure.*

https://truckmanualshub.com/





https://truckmanualshub.com/



## Oil Inlet Suction Screen

The oil inlet suction screen (1) is located in the bottom of the transmission housing and has a 30 micron nylon filter. All the oil flowing from the transmission to the charge/lubrication pump passes through this suction screen.

The screen is accessible from the right hand side of the transmission and requires the oil to be drained before it is removed.

Screen service interval and oil change interval - 1000 hours.

## Charge/lubrication Pump

The charge/lubrication pump (2) is of the gyrotor type and provides a low pressure high flow supply which is used for the following purposes:-

A. Transmission lubrication and cooling of all clutch friction discs.

B. Circulation through the oil cooler.

C. PFC (Pressure and Flow Compensation) axial piston pump supply to prevent cavitation.

This pump absorbs only 0.73 kW (0.98 HP) approximately. This power consumption is much less than the power wasted by oil drag in a transmission system that relies on a high oil level for splash lubrication. A pressure lubrication system is more reliable and effective than a splash system, because it is not affected by the inclination of the tractor when operating on hill sides.

## Pump Location and Drive

The pump is located in the transmission sandwich plate between the range housing and the speed transmission housing.

To gain access to the pump the tractor must be split between the range transmission and the sandwich plate.

## Charge/Lubrication Pump flow and pressure.

XTX 185 to 215 tractors built prior to 01/01/2006 have a maximum flow of 190 - 210 L/min.

XTX 185 to 215 tractors built after 01/01/2006 have a maximum flow of 140 - 166 L/min.

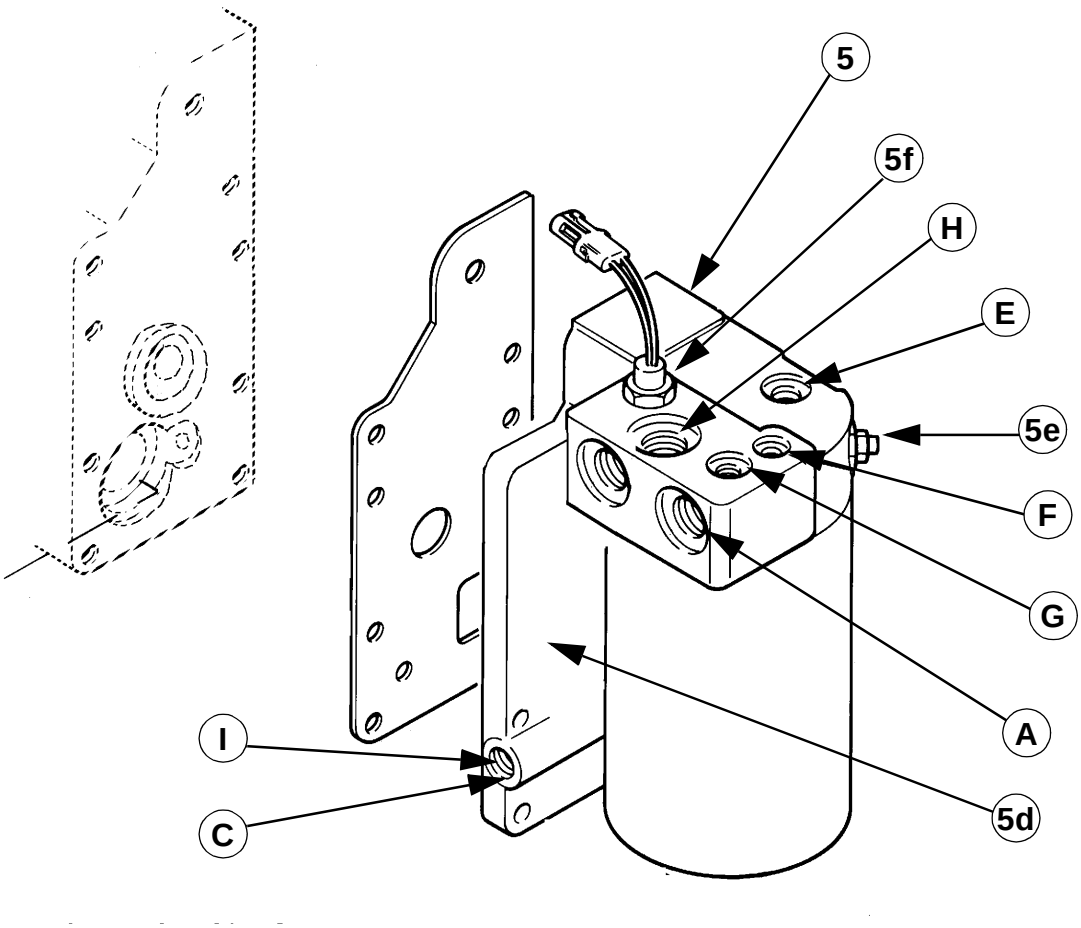
Minimum pressure 1.4 Bar at 1000 erpm & 3.8 Bar at 2200 erpm.

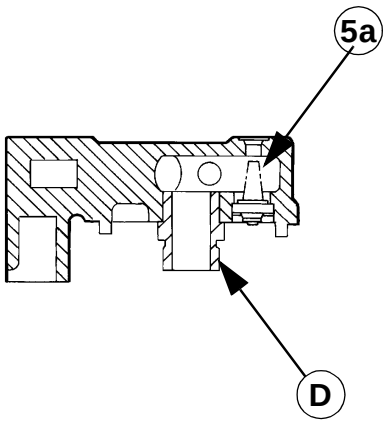
Maximum pressure 4.9 bar at 2200 erpm.

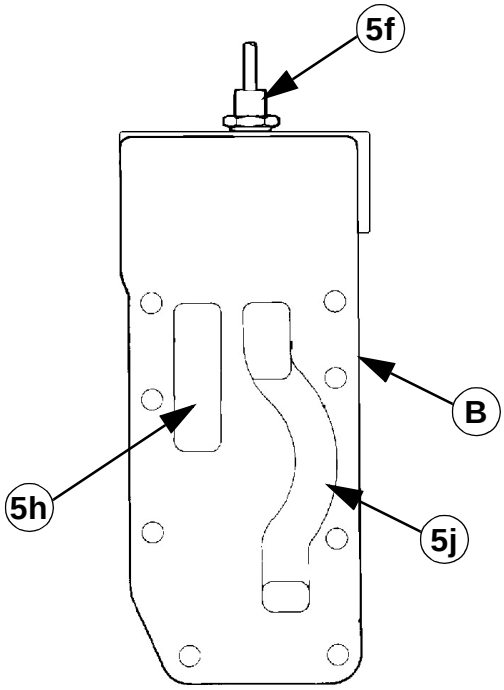
**NOTE:** *Refer to Section 8001 for the correct testing procedure.*

https://truckmanualshub.com/





https://truckmanualshub.com/



## Main Filter Housing

The Main Filter Housing is located on the right hand side of the speed transmission housing behind the battery box.

5a. Filter bypass valve.
5e. Differential pressure switch.
5f. Oil Temperature switch.
5h. Oil inlet passage.
5j. Lubrication passage.
A. PFC pump supply port.
B. Oil Cooler supply port.
C. Lubrication supply to powershift.
D. Filter connector.
E. Steering circuit return port.
F. Lubrication pressure test port.
G. Lubrication supply port to PTO clutch and hitch rockshaft.
H. Remote valve return port.
I. Creeper speed or main shaft lubrication supply port.

## Main Filter Specifications

| | |
|---|---|
| Type | Spin on/off |
| Filter change interval | 1000 hours |
| Grade of filtration | 95% at 10 micron |
| Filter element pore size | 10 micron |
| Capacity (to JSO 4572 - Multi-pass test) | 75gm |
| Pressure drop at 90 litre/min | 0.2 bar |

## Filter By-pass

On the XTX 185 to 215 transmission the oil from the charge/lubrication pump flows through the internal passage (5h) to the filter head, the oil then joins the return flow from the steering (E) and remote valves (H).

The oil flows either through the filter element or through the filter bypass valve (5a). The bypass valve will open if the differential pressure across the filter reaches 3.0 bar. This prevents excessive pressure in the filter which could result from either cold oil operation or a blocked filter element.

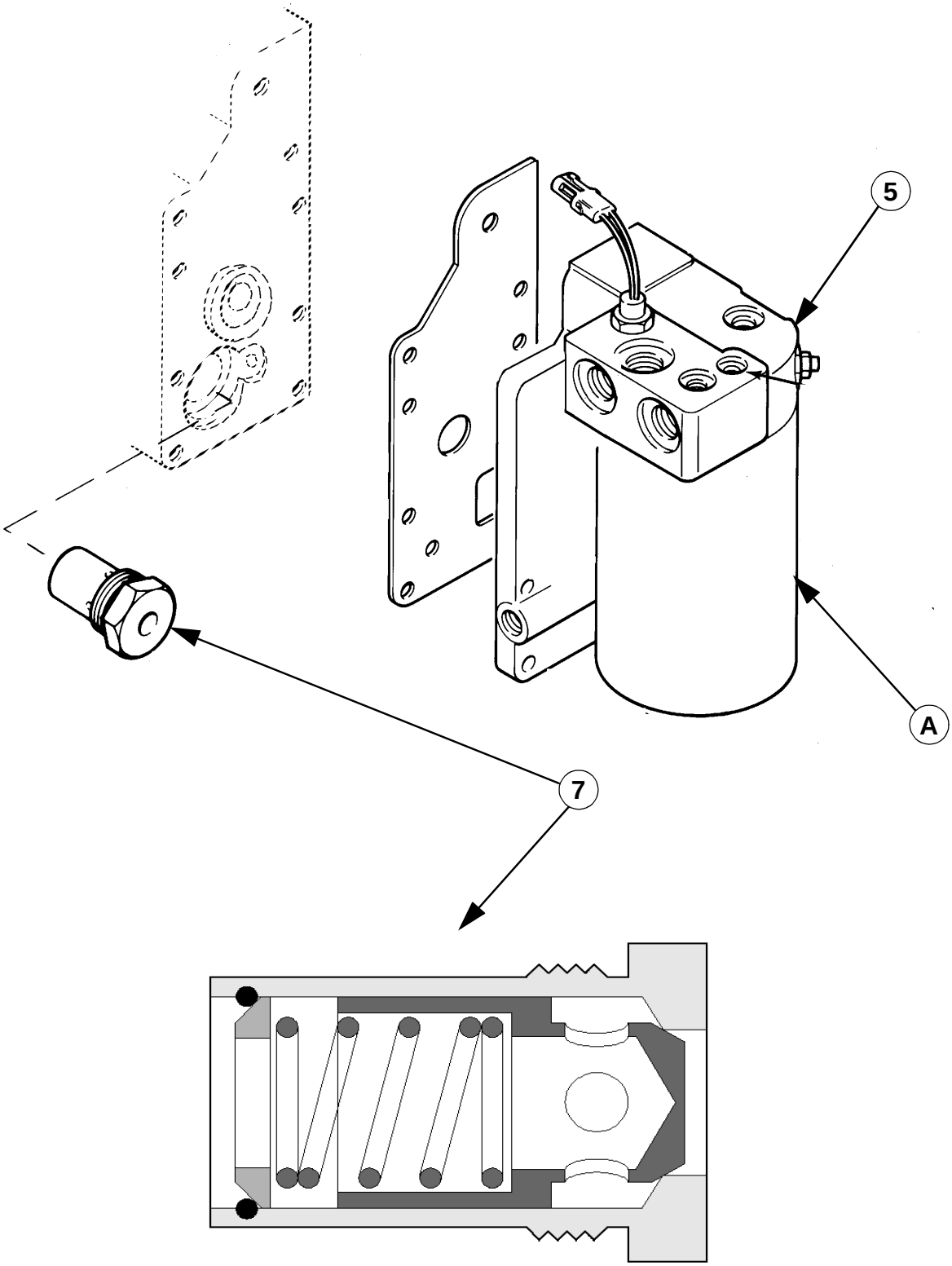
**NOTE:** *The filter bypass valve (5a) is located in the filter housing above the filter. It is accessible after the filter is removed.*

## Differential Pressure Switch

The differential pressure switch (5e), which is set at 2.5 to 3.0 bar, will activate an indicator light in the instrument cluster before the bypass valve opens to alert the operator of the need to service the filter. A temperature switch (5f) is connected to the instrument cluster and prevents the indicator light from being activated if the oil temperature is below 38°C.

https://truckmanualshub.com/





https://truckmanualshub.com/



## Lubrication Pressure Relief Valve

The lubrication pressure relief valve (7) is a simple non-adjustable poppet valve. It is located in the speed transmission housing, covered by the oil filter mounting plate (5).

The lubrication pressure relief valve will only open when the pressure in the lubrication system reaches 4.5 bar. If the valve opens the excess oil will be returned to the transmission housing.

Although this relief valve is set to open at 4.5 bar, the actual lubrication pressure at 2200 engine rpm and working temperature will be in the range of 5.50 bar for a charge/lubrication system in good condition.

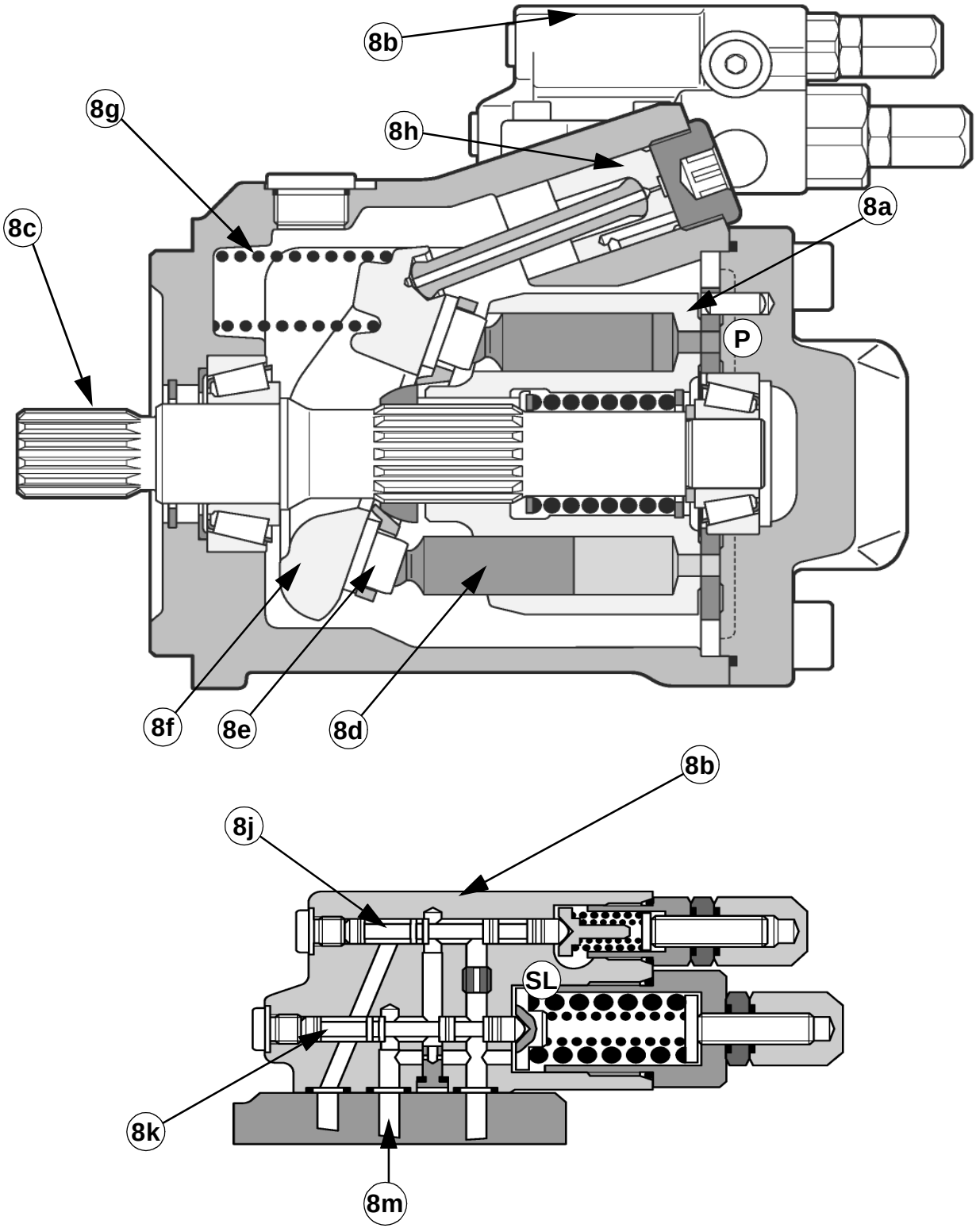
**NOTE:** *Refer to Service Manual Section 8001 for the correct testing procedure.*

https://truckmanualshub.com/



# PFC HYDRAULIC PUMP

## Rexroth PFC Pump



https://truckmanualshub.com/


# PFC AXIAL PISTON PUMP

## Introduction

The pump consists of a 9 piston cylinder block (8a) and a control block (8b) which located at the end of the pump.

The cylinder block is fixed to the drive shaft (8c) which is driven from the transmission gears and both cylinder block and drive shaft rotate together.

The cylinder block has 9 cylinder bores with a piston (8d) in each one. One end of the piston has a ball joint and a slipper (8e) which is designed to run against the machined surface of the swash plate (8f). Lubricating oil between the slipper and the swash plate prevents the slipper and piston from moving away from the swash plate surface during operation.

The swash plate (8f) can be tilted from a zero position to a maximum angle of 17°. When moved from the zero position, the pistons follow the incline of the swash plate.

## Operation

When the pump is driven the pistons rotate with the cylinders and as they follow the incline of the swash plate they will move in and out of the cylinder block. As the pistons move out of the cylinder block they draw oil into the cylinder bores from the inlet port (not shown) through a kidney shaped hole in the manifold plate.

When the pistons move into the cylinder block, they push oil out of the bores through another kidney shaped hole to the pump outlet port (P).

As the swash plate angle is increased, so the stroke of the pistons is increased which increases the flow from the pump.

The maximum flow rate of the pump at rated engine speed is 129 L/min. (Rexroth) and 163 L/min. (Sauer Sunstrand).

The angle of the swash plate is biased to the 17° p osition by the control spring (8g). This allows the pump to be ready to provide full output on demand as soon as the engine is started, giving an almost instant response from the hydraulic system.

When the pump is operating the swash plate angle is controlled by the control piston (8h).

## Pump Control Block

The control block houses a flow compensator spool (8j) and a main relief valve (8k).

The compensator spool (8j) responds to the pump output pressure at (P) and signals (SL) from the hydraulic system, and controls the pump swash plate angle and therefore the pump output flow and pressure.

The main relief valve (8k) reacts to high pump output pressure and will control the pump swash plate angle thus limiting the pump maximum pressure.

**NOTE:** *Refer to Section 8001 for the correct testing procedure*

# PFC AXIAL PISTON PUMP

## Introduction

The pump consists of a 9 piston cylinder block (8a) and a control block (8b) which located at the end of the pump.

The cylinder block is fixed to the drive shaft (8c) which is driven from the transmission gears and both cylinder block and drive shaft rotate together.

The cylinder block has 9 cylinder bores with a piston (8d) in each one. One end of the piston has a ball joint and a slipper (8e) which is designed to run against the machined surface of the swash plate (8f). Lubricating oil between the slipper and the swash plate prevents the slipper and piston from moving away from the swash plate surface during operation.

The swash plate (8f) can be tilted from a zero position to a maximum angle of 17°. When moved from the zero position, the pistons follow the incline of the swash plate.

## Operation

When the pump is driven the pistons rotate with the cylinders and as they follow the incline of the swash plate they will move in and out of the cylinder block. As the pistons move out of the cylinder block they draw oil into the cylinder bores from the inlet port (not shown) through a kidney shaped hole in the manifold plate.

When the pistons move into the cylinder block, they push oil out of the bores through another kidney shaped hole to the pump outlet port (P).

As the swash plate angle is increased, so the stroke of the pistons is increased which increases the flow from the pump.

The maximum flow rate of the pump at rated engine speed is 129 L/min. (Rexroth) and 163 L/min. (Sauer Sunstrand).

The angle of the swash plate is biased to the 17° p osition by the control spring (8g). This allows the pump to be ready to provide full output on demand as soon as the engine is started, giving an almost instant response from the hydraulic system.

When the pump is operating the swash plate angle is controlled by the control piston (8h).

## Pump Control Block

The control block houses a flow compensator spool (8j) and a main relief valve (8k).

The compensator spool (8j) responds to the pump output pressure at (P) and signals (SL) from the hydraulic system, and controls the pump swash plate angle and therefore the pump output flow and pressure.

The main relief valve (8k) reacts to high pump output pressure and will control the pump swash plate angle thus limiting the pump maximum pressure.

**NOTE:** *Refer to Section 8001 for the correct testing procedure*

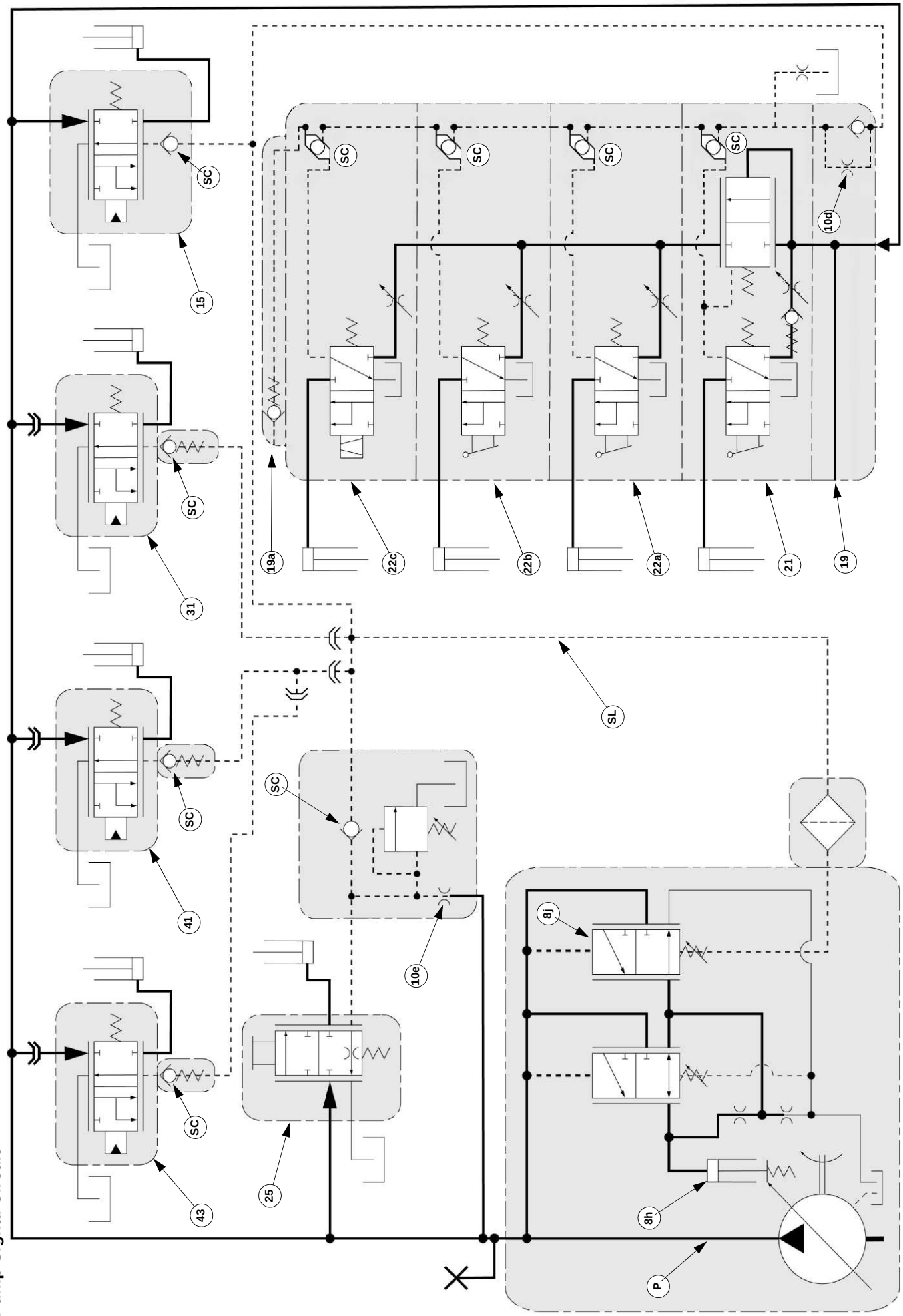


https://truckmanualshub.com/

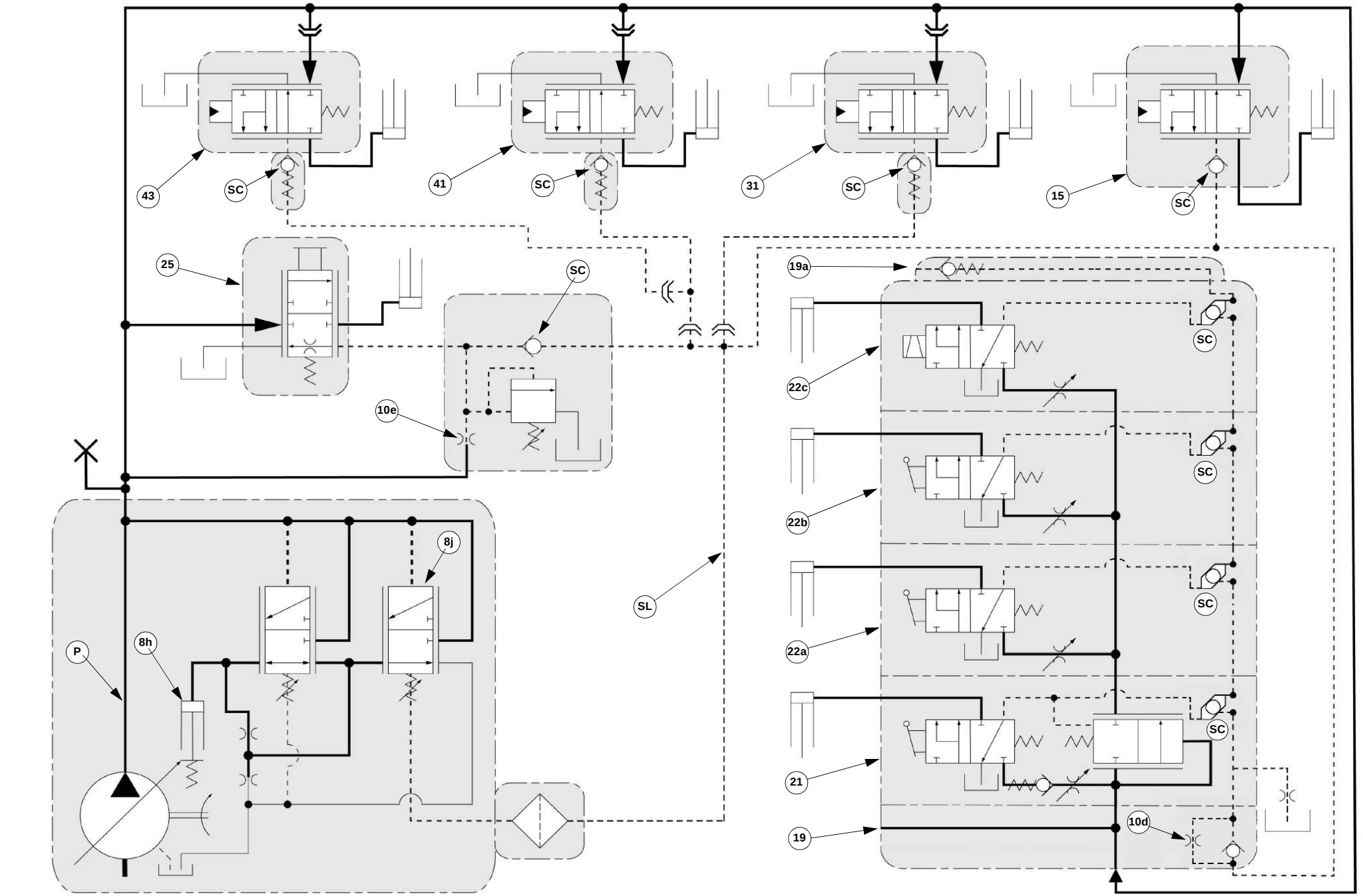
https://truckmanualshub.com/



## PFC Pump Signal Circuit



## PFC Pump Signal Circuit



https://truckmanualshub.com/



# PFC PUMP SIGNAL CIRCUIT

## General Description

The remote valves (21, 22a, 22b and 22c), the hitch control valve (15), the steering control valve (25), the optional trailer brake valve (31) and power beyond plate (19) each have a signal port. Each signal port directs a signal pressure through the signal circuit (SL) to the compensator spool (8j).

A single check valve (SC) is located in each signal line connection between the control valve and the compensator spool (8j). When several control valves are operated together, the signal at the higher pressure will cause the check valves in the control valves at the lower pressures to close. This prevents back pressure acting on other control valves and ensures that the highest signal pressure will act on the compensator spool (8j).

The compensator spool (8j) controls the angle of the pump swash plate by supplying the control piston (8h) with oil under pressure, or allowing the oil pressure acting on the control piston to vent to tank.

The spool responds to both pump output pressure (P) and pressure in the signal circuit (SL).

## Operating Modes

The pump is designed to operate in two different modes according to the demand for flow and pressure placed upon it. These modes are as follows:-

1. Low pressure stand-by

When there is no demand for flow or pressure, the pump provides just enough flow to maintain a low system pressure and compensate for any internal leakage in the system. In this mode the pump requires very little power to drive it.

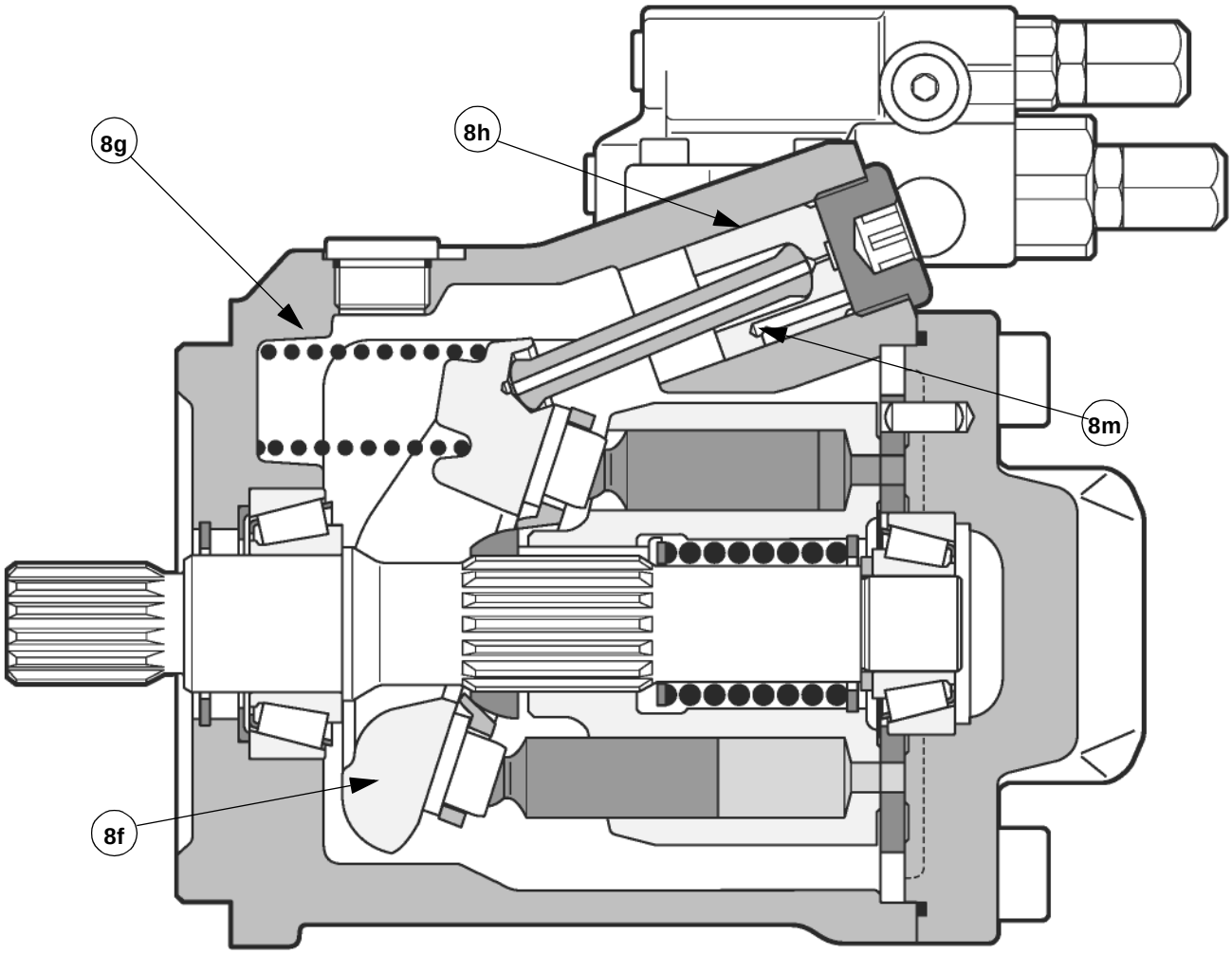
2. Pressure and Flow Supply

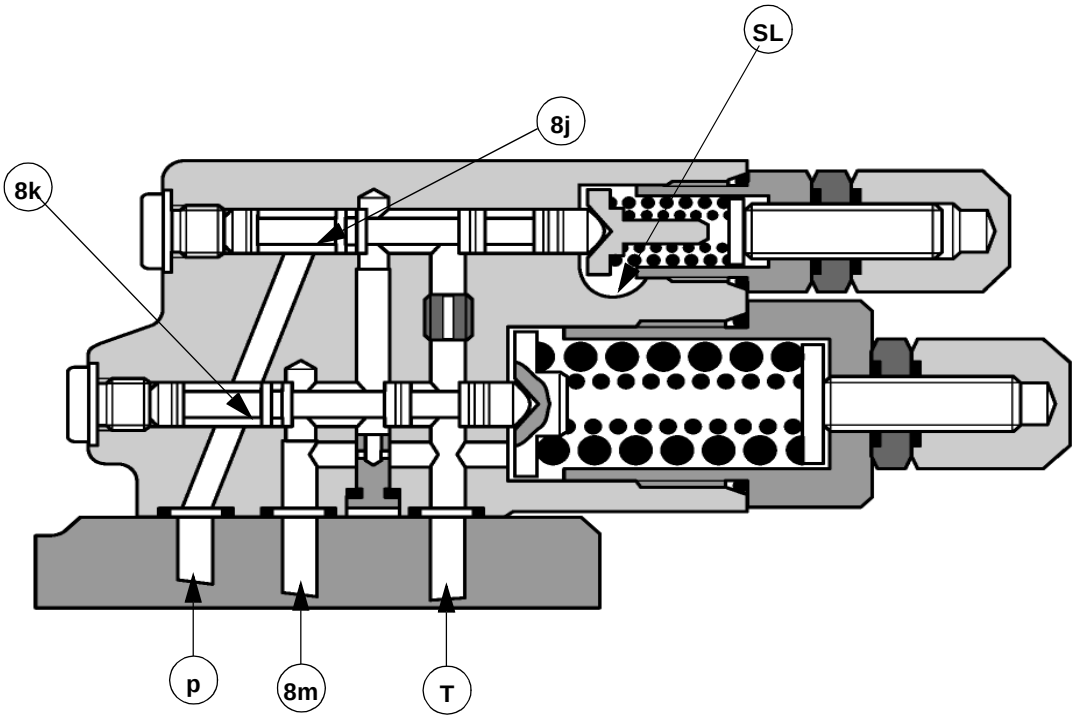
When there is a demand for flow and pressure from the hydraulic system, the pump responds to provide just the flow/pressure that is required. When the pump output reaches the required pressure, the pump will maintain that pressure with the correct flow to satisfy the hydraulic system.

**NOTE:** *Use the signal circuit schematic along with the following pages (which describe in detail the operation of the signal circuit).*

https://truckmanualshub.com/





https://truckmanualshub.com/



## Low Pressure Stand-by - (at engine start up)

The compensator spool (8j) is moved by its spring, which is equal to (Rexroth) 26 to 28 Bar (377 to 406 PSI). (Sauer) 25 Bar (363 PSI)

The pump swash plate (8f) is moved to the maximum demand position of $17^{o}$ by its spring.

When the engine is started the flow from the pump will begin to increase to maximum. Because all the control valves supplied by this pump are closed (switched OFF), the oil pressure will also increase rapidly.

A small flow enters the signal system through the dynamic orifice (10e) which is located in the steering priority spool and fills the signal system, however a portion of this small flow is vented to tank through an orifice (25a) in the steering control valve (25) and limits the pressure in the signal circuit (SL) to approximately 13 bar.

This low signal circuit pressure combines with the spring pressure to move the compensator spool (8j) away from the spring end.

When the pump output pressure increases to 27 to 40 Bar (391 to 580 PSI) (Rexroth), 29 to 39 Bar (421 to 566 PSI) (Sauer) it will overcome the combined spring and signal circuit pressures and move the compensator spool (8j) against the spring. This allows a small flow from the pump output to flow across the spool to passage (8m), then to the pump control piston (8h). The control piston moved by hydraulic pressure adjusts the swash plate angle until the pump output flow has reduced enough to stabilise the output pressure to 27 to 40 bar (391 to 580 PSI) for Rexroth or Sauer pumps.

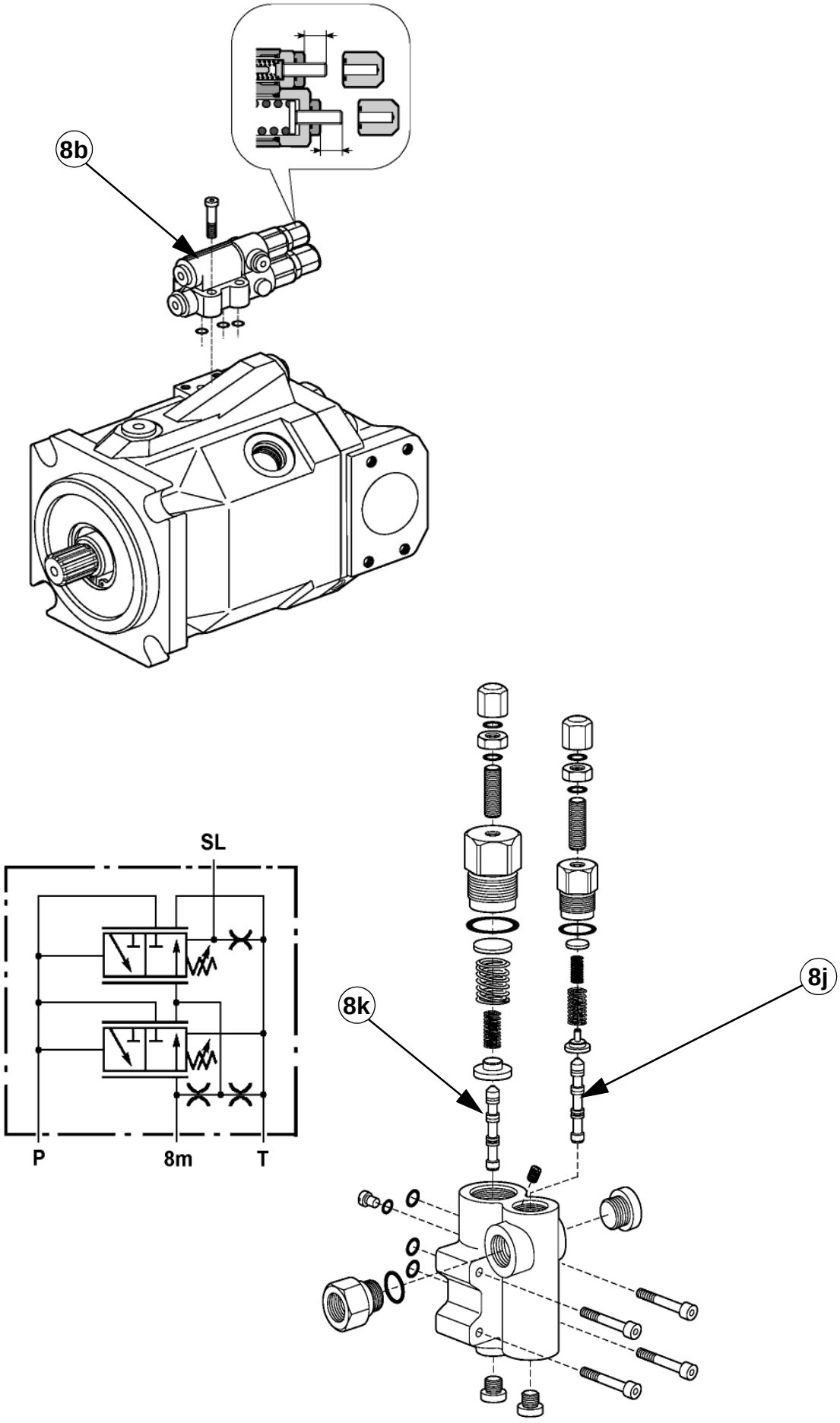
If the pump output pressure reduces below 27 to 40 Bar (391 to 580 PSI) (Rexroth), 29 to 39 Bar (421 to 566 PSI) (Sauer) the compensator spool will be moved away from the spring end and passage (8m) is vented to tank (T). The swash plate angle will be increased by spring (8g) resulting in increased pump flow and pressure until the pressure returns to 27 to 40 Bar (391 to 580 PSI) (Rexroth), 29 to 39 Bar (421 to 566 PSI) (Sauer).

The compensator spool (8j) will modulate in the middle position controlling the position of both the pump control piston and the swash plate angle, and maintaining the pump output pressure at 27 to 40 Bar (391 to 580 PSI) (Rexroth), 29 to 39 Bar (421 to 566 PSI) (Sauer). The pump output flow will be just enough to compensate for internal leakage.

**NOTE:** *The compensator spool spring is screw adjustable. Refer to Section 8001 for the correct testing procedure.*

https://truckmanualshub.com/





https://truckmanualshub.com/



## Pressure and Flow Supply

When oil flow is required in the system, the flow is controlled by the difference in pressure at the opposite ends of the compensator spool (8j).

When a control valve e.g. hitch (15) is operated the pump pressure (P) is connected to the signal circuit (SL). The combined spring and signal circuit pressures will cause the compensator spool (8j) to move away from the spring end, and allow oil from the control piston (8h) to flow past the spool to tank (T).

As the oil pressure reduces behind the control piston (8h), the swash plate angle will increase and the pump flow will increase until the flow demand has been satisfied.

The actual flow required from the pump is determined by an orifice in the control valve which is being operated. This orifice can be created either by limiting spool travel or by a flow control spool within the control valve.

When a control valve is operated, the oil pressure in the controlled circuit being supplied will increase to its operating pressure. This pressure is also transmitted through the signal circuit (SL) to the spring end of the compensator spool (8j). The combined force of this pressure and the spring will be acting on the spring end of the compensator spool.

If the pump output flow is higher than the flow required by the control valve being operated, the pump output pressure (P) will continue to increase until it overcomes the combined signal and spring pressure at the spring end of the compensator spool (8j). The compensator spool will then move towards the spring allowing a small flow of oil across the spool to the pump control piston (8h). The control piston moved by hydraulic pressure will adjust the swash plate angle until the pump output is reduced enough to stabilise the output pressure to 26 to 28 bar (377 to 406 PSI) for Rexroth pumps or 25 bar (363 PSI) for Sauer pumps above the operating pressure of the control valve. This difference in pressure is created by the compensator spool spring.

## Increased Flow Demand

When an additional control valve is operated and extra flow is required, the pump pressure (P) is connected to the signal circuit (SL). This will cause the compensator spool (8j) to move away from the spring end and allow the oil behind the piston (8h) to vent to tank (T). The swash plate will move and the pump flow will be increased until the extra demand for flow has been satisfied.

When satisfied, the pressure of the supply from the pump (P) will increase until it is 26 to 28 bar (377 to 406 PSI) for Rexroth pumps or 25 bar (363 PSI) for Sauer pumps above the signal circuit pressure (SL), then move the compensator spool towards the spring to control the pump flow as previously described.

## Decreased Flow Demand

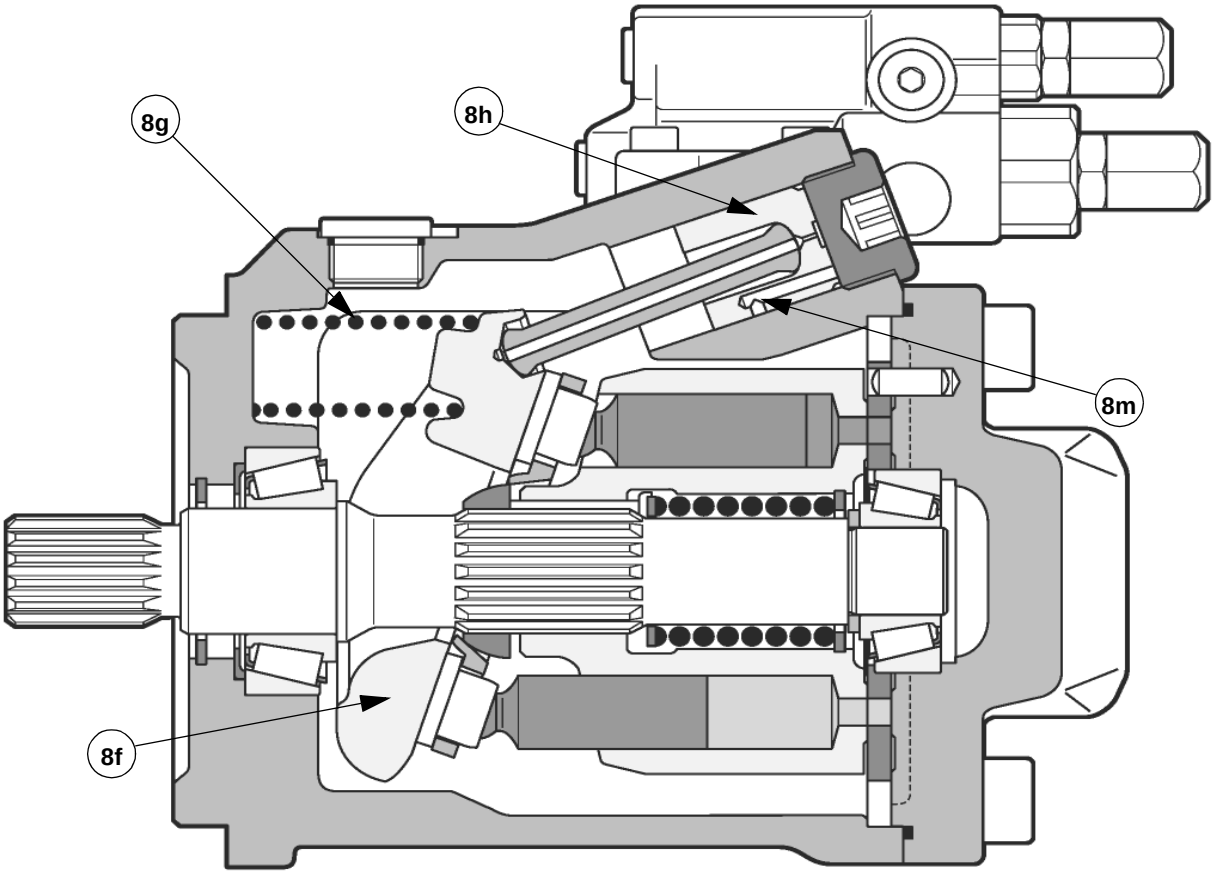
If there is a reduction in the demand for flow, the pump pressure (P) will exceed the signal circuit pressure (SL) by more than 26 to 28 bar (377 to 406 PSI) (Rexroth) 25 bar (363 PSI) (Sauer). This will cause the compensator spool (8j) to move against the spring to allow some oil to flow to the pump control piston (8h). This will move the swash plate against the spring and reduce the pump flow.

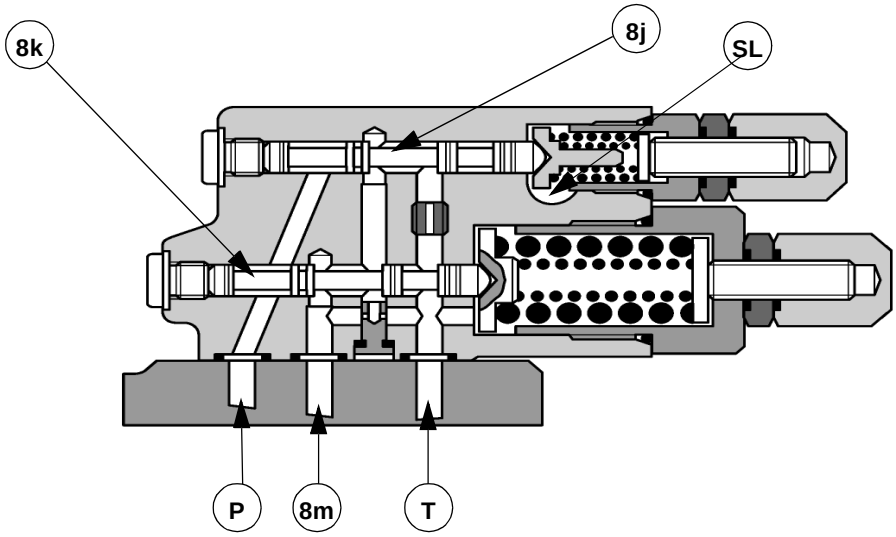
When the pump flow has reduced to the system requirement, the difference in pressure at each end of the compensator spool will return to 26 to 28 bar (377 to 406 PSI) (Rexroth) 25 bar (363 PSI) (Sauer) and the compensator spool will move by spring pressure to close the supply to the control piston. This will hold the swash plate at that pumping angle.

**NOTE:** *Refer to Section 8001 for the correct testing procedure.*

https://truckmanualshub.com/





https://truckmanualshub.com/



## Maximum Pressure Limitation

If for instance, a hydraulic cylinder reaches the end of its travel or an unconnected remote valve is operated, the pressure in the hydraulic system could reach an excessively high value. The hydraulic system is protected by limiting its maximum pressure to 199 to 209 bar (2887 to 3031 PSI) for Rexroth pumps or 202 bar (2930 PSI) for Sauer pumps.

When the pressure in the system reaches the setting of the main relief valve (8k) it will move the spool against the spring. This allows a small flow from the pump output to flow around the spool to passage (8m), then to the pump control piston (8h). The control piston moved by hydraulic pressure adjusts the swash plate angle until the pump output is reduced enough to stabilise the output pressure to 199 to 209 bar (2887 to 3031 PSI) for Rexroth pumps or 202 bar (2930 PSI) for Sauer pumps.

Because the movement of the main relief valve (8k) allows the full pump supply pressure to be applied to the pump control piston (8h), the swash plate will very rapidly reduce the pump flow from full output to almost zero within 8 to 10 milliseconds.

## Return to Low Pressure Stand-by

The pump will remain at maximum operating pressure until the valve in operation is returned to neutral. When this occurs the connection between pump pressure (P) and the signal line (SL) is blocked. The signal circuit pressure will reduce because of a vent to tank through the bleed orifice (10d) in the Bosch auxiliary remote valves.

The high pump supply pressure acting on the compensator spool (8j) will cause the spool to move against its spring and allow the full supply pressure to be applied to the pump control piston (8h). The swash plate will adjust the pump output until the pump supply pressure is reduced and then maintained at the low stand-by pressure of 30 to 40 Bar (391 to 580 PSI) (Rexroth), 29 to 39 Bar (421 to 566 PSI) (Sauer).

**NOTE:** *The main relief valve is screw adjustable. Refer to Service Manual Section 8001 for the correct testing procedure.*

https://truckmanualshub.com/



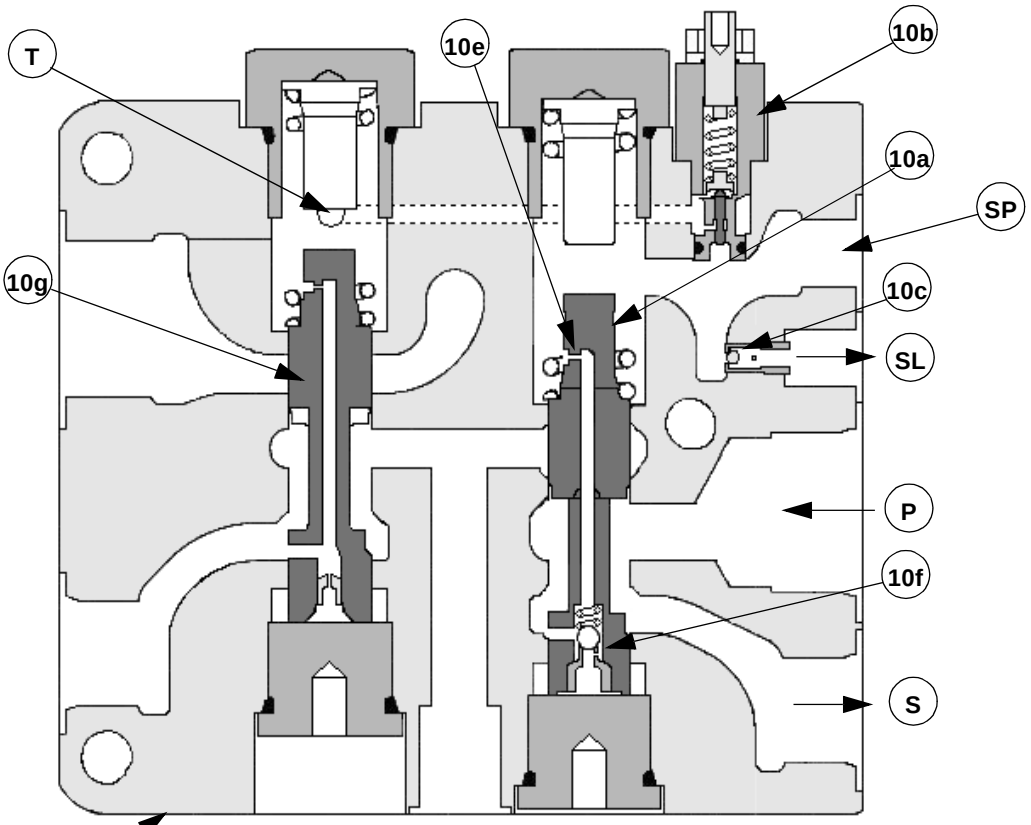



Diagram 1

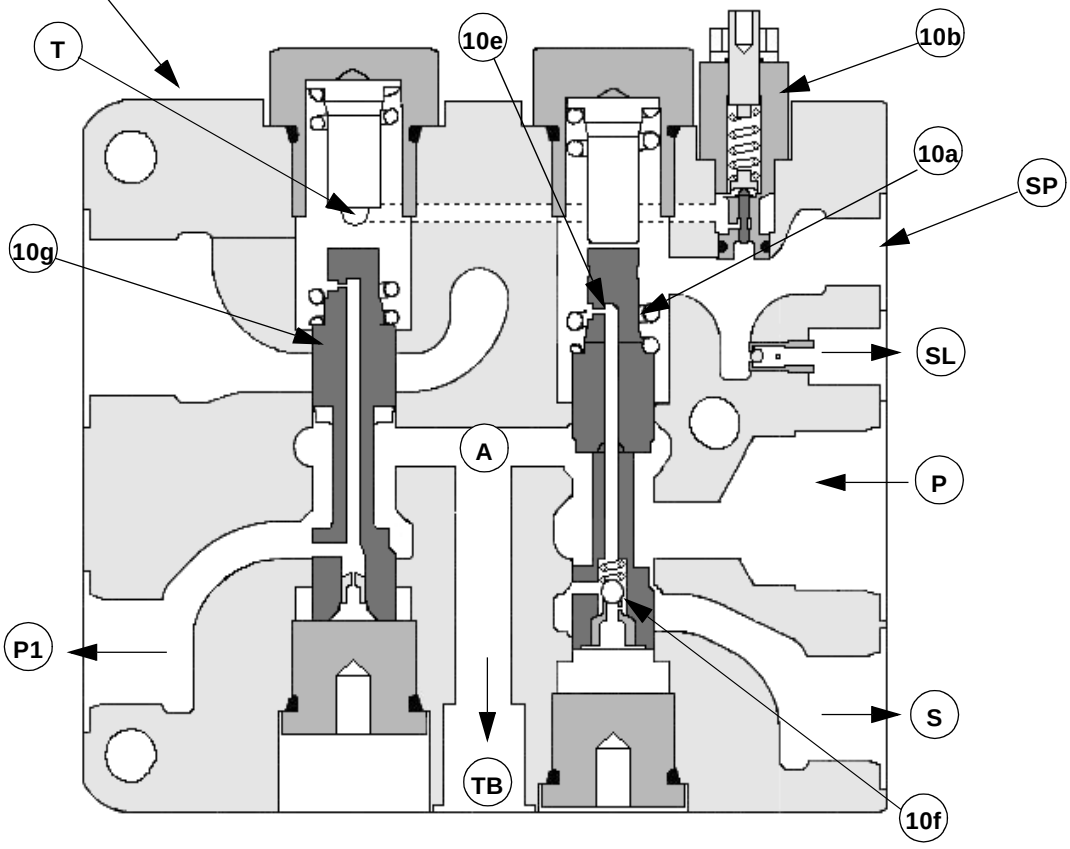



Diagram 2

https://truckmanualshub.com/



# PRIORITY AND REGULATOR VALVE

## General Description

The Priority/Regulator Valve is located on the top of the speed transmission. This valve consists of the following components: priority spool (10a), steering main relief valve (10b), signal check valve (10c), dynamic sensing orifice (10e), dampening orifice (10f) and regulator spool (10g).

## Steering Priority Spool

When the tractor is started, the PFC pump supplies oil to the Priority/Regulator Valve at port (P). The flow is directed to the steering priority spool (10a) which is held down by its spring. This allows flow past the spool to the steering supply port (S) and also through the dampening orifice (10f) to the lower end of the spool (10a).

The steering control valve is a closed centre type valve, so there is no flow through it until the steering wheel is rotated. With the steering in neutral, the pump supply pressure increases until it moves the steering priority spool against its spring (diagram 2). In this position the pump flow is redirected past the spool to the passage (A) which is connected to the P1 pressure regulator spool (10g) and also to the optional trailer brake at port (TB).

The steering priority spool (10a) also allows a small flow to the steering supply port (S) to maintain the pressure differential across the spool (10a).

When the steering wheel is rotated, the steering control valve spool directs the pump supply (P) to the steering cylinder (26) and also through the steering signal port (SP) into the signal circuit (SL). This signal pressure is connected to the PFC pump compensator spool (8j) and also to the spring end of the steering priority spool (10a).

Initially the steering signal pressure will be the same as the pump supply pressure acting on the lower end of the spool (10a), so the spring will hold the spool down to give priority flow to the steering (diagram 1). The pressure in the steering circuit and signal circuit will increase to operating pressure and then stabilize at that pressure by the operation of the steering control valve spool. The pump supply pressure will continue to increase and will move the steering priority spool against the spring enough to allow the remaining flow to the P1 pressure regulator spool (10g) and port (TB) for the optional trailer brake valve (diagram 2).

**NOTE:** *The dampening orifice (10f) is fitted into the lower end of the steering priority spool (10a). The dampening orifice dampens the movement of the steering priority spool (10a), however when the steering is operated the ball above the dampening orifice will lift off it's seat so that oil can escape from the end of the spool allowing the spool to move downwards quickly to give steering priority.*

## Steering Main Relief Valve

The steering signal line (SP) is connected to the spring end of the steering priority spool (10a), the steering relief valve (10b) and past the steering check valve (10c) to the signal circuit (SL).

If the steering signal pressure rises to 177 to 185 bar (2575 to 2730 PSI), the steering relief valve (10b) will open to tank (T) and prevent any further increase in steering signal pressure. The PFC pump supply pressure will continue to increase and will move the steering priority valve spool (10a) against its spring to reduce flow to the steering system while maintaining a maximum pressure of 177 to 185 bar (2575 to 2730 PSI) in the steering circuit.

**NOTE:** *The steering main relief valve (10b) is screw adjustable. Refer to Section 8001 for the correct testing procedure.*

## Dynamic Orifice

The dynamic orifice (10e) is located in the spring end of the steering priority spool (10a) and directs a small flow from the pump output into the signal circuit (SL) to fill the circuit.

https://truckmanualshub.com/



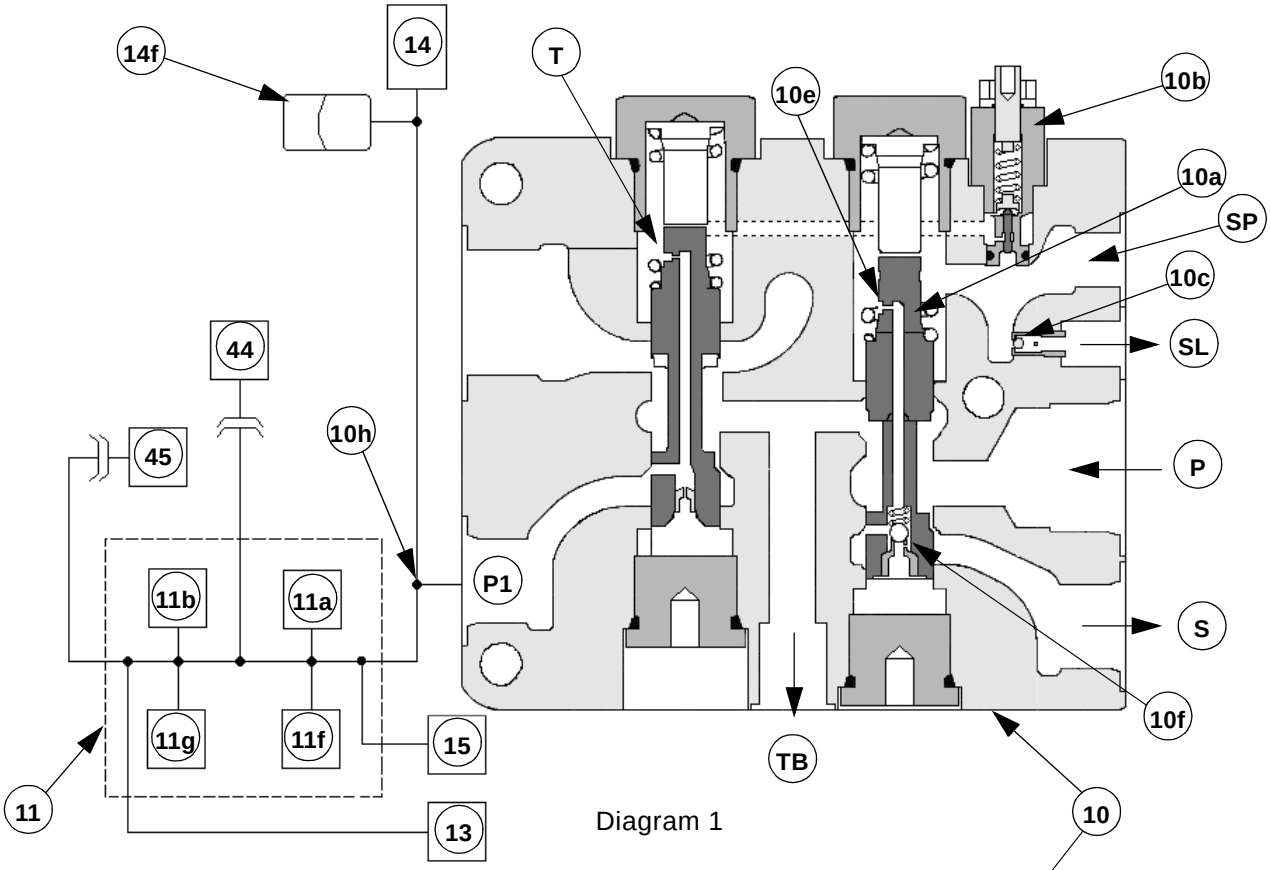



Diagram 1

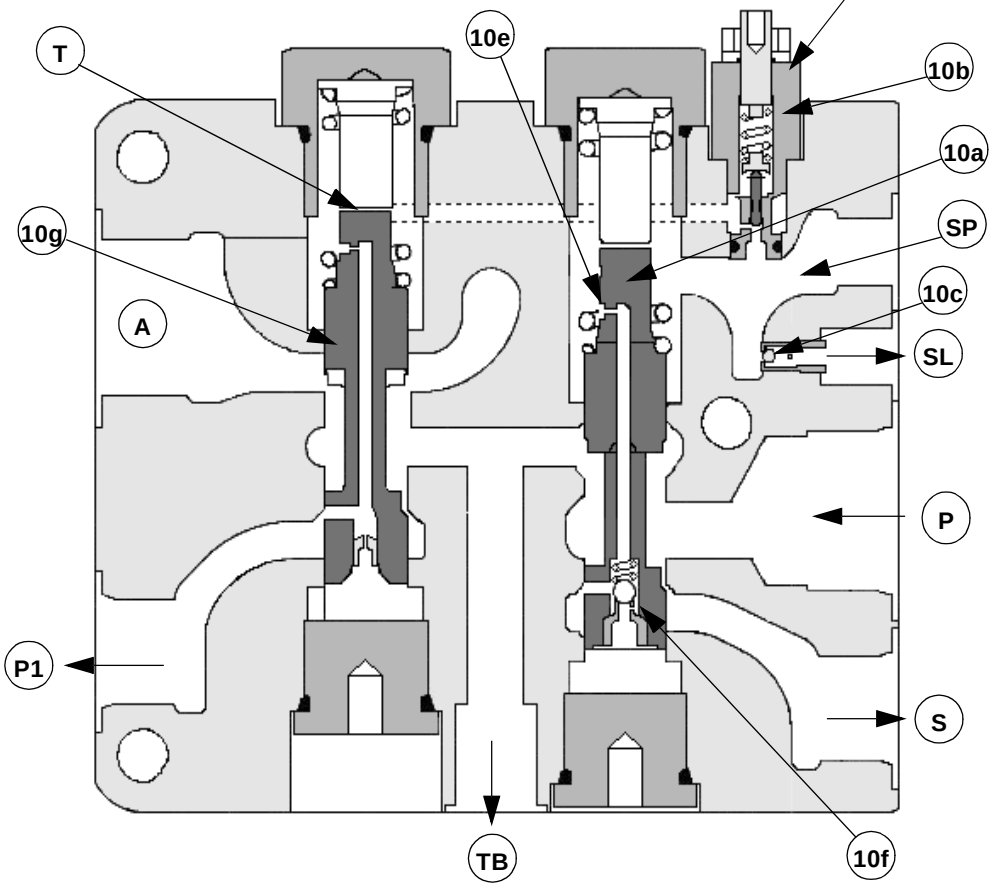



Diagram 2

https://truckmanualshub.com/



# REGULATED PRESSURE CONTROL CIRCUIT (P1)

## General Description

The regulated pressure circuit provides the supply for all the transmission control circuits, hitch and electronic auxiliary remote pilot systems.

This circuit is supplied from the PFC pump (8) through the steering priority spool (10a) and is controlled at regulated pressure 22 to 24 bar (319 to 348 PSI) by the regulator pressure control spool (10g).

An accumulator (14f) is connected into the supply to the powershift (14) to maintain a constant supply pressure to the powershift when other regulated services are operated.

## Regulated Pressure Control Spool

Pump pressure moves the steering priority spool (10a) against it's spring to supply oil to the regulated and work circuits. Oil flows across the regulator spool (10g) to the regulated circuits (P1) and also through an orifice to the bottom of the regulator spool. When the regulated circuits fill with oil the pressure increases to 22 to 24 bar (319 to 348 PSI) and moves the spool up against its spring until the flow is reduced and the regulated pressure is stabilised.

As the regulator spool moves up (diagram 2) it also opens passage (A) to the hitch, remote auxiliary valves and other high pressure circuits.

When a regulated circuit is activated, the regulator spool senses a momentary drop in pressure. The spring will move the spool down to allow for an increase in flow of oil to meet the demand. As the demand is met, pressure again builds on the bottom of the spool and moves the spool up to maintain regulated pressure.

**NOTE:** *The regulated pressure control spool spring is Shim adjustable. Refer to Section 8001 for the correct testing procedure.*

## Circuit description

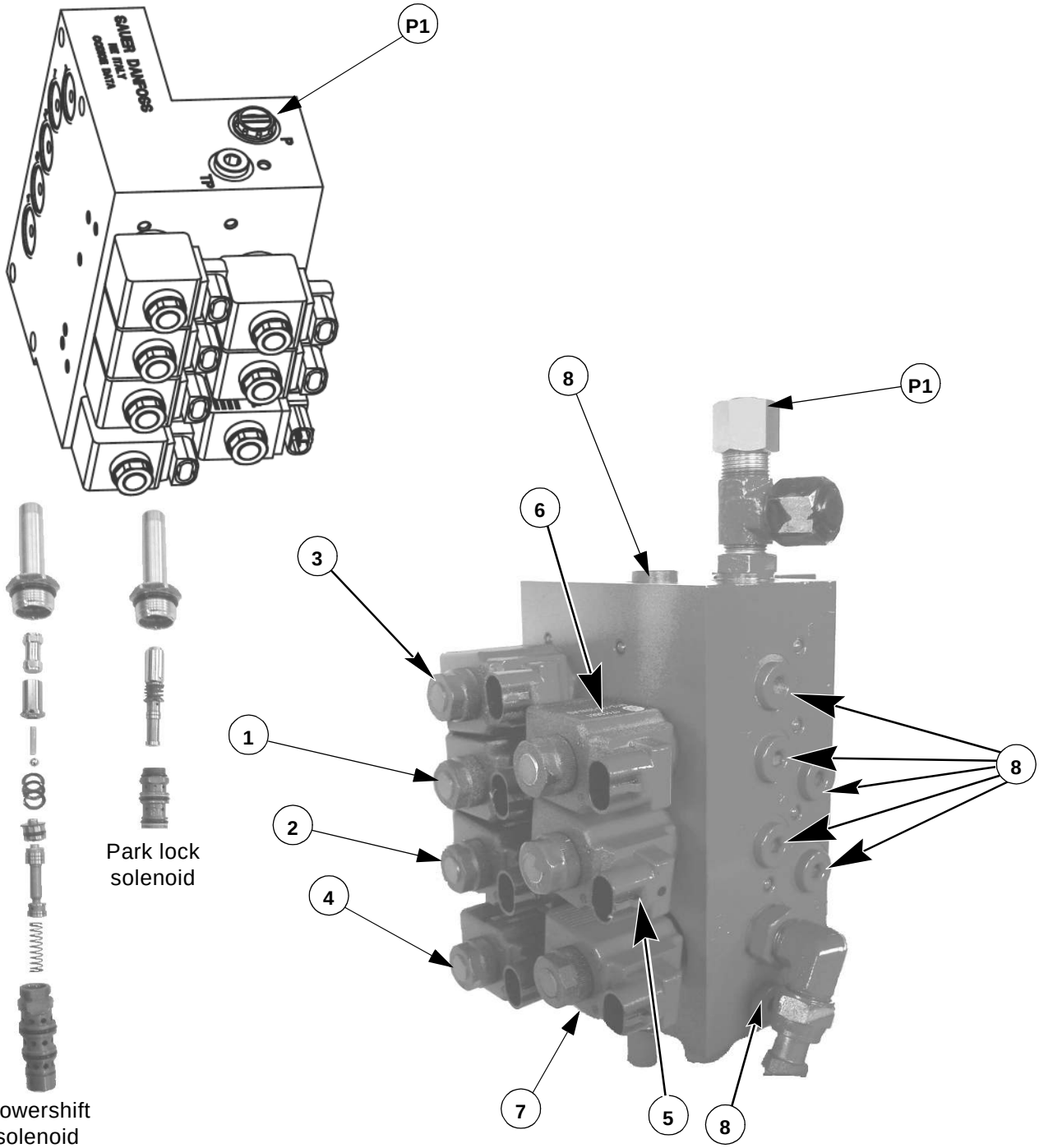
The regulated supply flows out at the top of the priority/regulator valve (10) to a 'T'-piece fitting (10h). From this point there is a connection to the powershift valve (14) and the F/R manifold (11). This regulated pressure supplies the forward and reverse clutches (11a and 11b) as required, differential lock solenoid valve (11f), MFD solenoid valve (11g) and PTO solenoid valve (13) which are located in the F/R shuttle manifold.

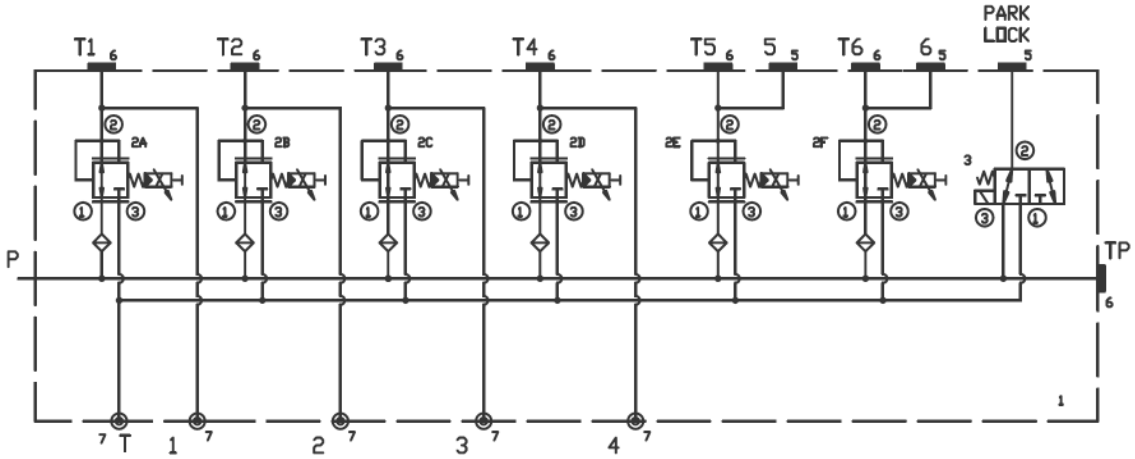
If an optional front PTO is installed there is a regulated supply from the top of the F/R manifold block (11).

https://truckmanualshub.com/



# POWERSHIFT CONTROL VALVE



https://truckmanualshub.com/



## General Description

The powershift control valve is mounted on the front right hand side of the speed transmission housing. It consists of an aluminium manifold block, 4 powershift clutch solenoids (1-4), a low clutch solenoid (5), a high clutch solenoid (6), a park lock solenoid (7) and test ports (8) adjacent to each hydraulic solenoid.

## Solenoids

The solenoids are controlled electronically by the transmission Electronic Control Module (ECM) using Pulse Width Modulation (PWM), this allows the operator to simply select the power shift required for the given speed and operating load. Selection of the powershift is made by using the switches mounted on the range/multi function lever. Operating the switches sends the required signal to the cab ECM. The cab ECM sends a signal to the transmission ECM via the CAN BUS, on receiving the signal from the cab ECM the transmission ECM starts to modulate the selected powershift solenoid.

## Electronic Control Module (ECM)

The transmission Electronic Control Module (ECM) controls both the powershift and the forward/reverse solenoids. This control module self checks both systems at engine start-up and during operation. If an error occurs, a fault code will be recorded in the computer memory and is accessible to assist fault diagnosis and rectification.

## Pulse Width Modulation (PWM)

When a powershift is selected the control module sends a 12 volt supply to the selected solenoid, the ground return wire from the solenoid is connected to the ECM then to ground via the circuitry of the ECM.

The control module uses varying Pulse Width Modulation (PWM) to control the ground circuit of the solenoid. The control module repeatedly switches the ground circuit on and off at a rate of 500Hz (500 times/second).

The length of time in milliseconds that the earth circuit stays closed causes the solenoid to be ON. The length of time in milliseconds that the earth circuit stays open causes the solenoid to be OFF.

For example the solenoid may cycle ON for 75% of the time, then OFF for 25% of the time. This will give an average voltage of approximately 9 volts across the solenoid coil. This cycle can be repeated continually or changed to give longer ON/OFF periods by the ECM. By changing the average voltage across the solenoid the ECM can control the powershift clutch oil supply pressure.

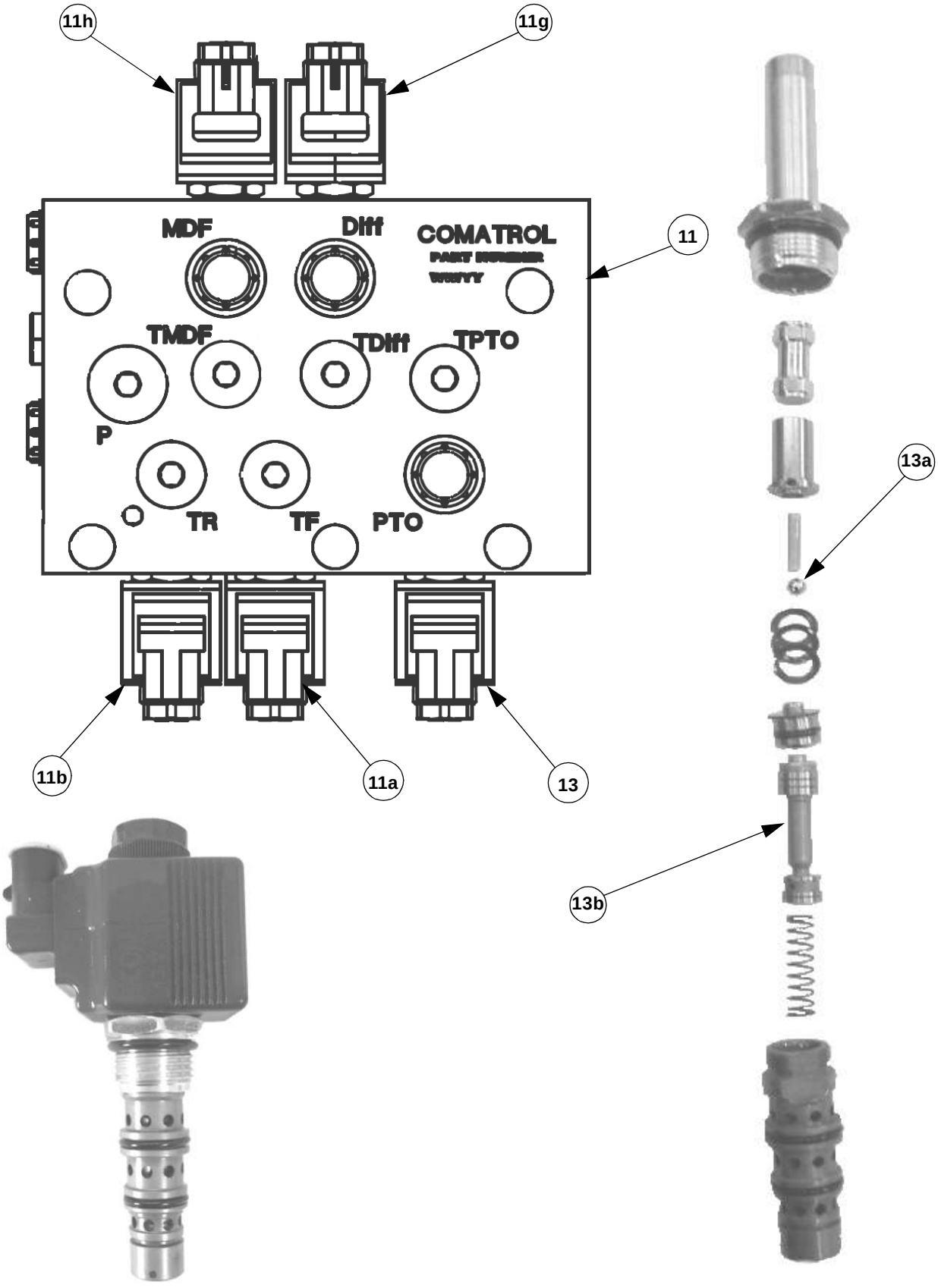
By increasing the PWM ON and reducing the PWM OFF periods the average voltage is increased across the solenoid. This causes the solenoid spool valve to increase the powershift clutch supply pressure.

By reducing the PWM ON and increasing the PWM OFF periods the average voltage is reduced across the solenoid. This causes the solenoid spool valve to reduce the powershift clutch supply pressure.

https://truckmanualshub.com/



# FORWARD/REVERSE MANIFOLD



https://truckmanualshub.com/



## General Description

The F/R shuttle control allows the operator to change the direction of the tractor by moving a lever, without the need to use the clutch pedal. This manoeuvre should be carried out at low tractor and engine speed.

The F/R shuttle solenoids are fitted in the forward/reverse manifold which is mounted on top of the rear transmission housing. The solenoids are operated electronically by the transmission ECM using Pulse Width Modulation (PWM).

The operator can select forward or reverse drive by moving the column mounted Forward/Neutral/Reverse (F/N/R) lever from the park or neutral position into the forward or reverse position. The movement of the F/N/R lever sends a given voltage to the cab ECM. The cab ECM sends a signal to the transmission ECM via the CAN BUS, on receiving the signal from the cab ECM the transmission ECM starts to modulate either the forward solenoid (11a) or reverse solenoid (11b).

The Mechanical Four wheel Drive (MFD), Differential lock and Park lock solenoids are also fitted in the forward/reverse manifold.

## Electronic Control System

This system has overall control of the following functions:

Forward / Neutral / Reverse clutch engagement.

Forward / Reverse clutch modulation.

Park lock engagement / dis-engagement.

Powershift speed control.

Powershift clutch modulation.

Creeper engagement / dis-engagement.

Range gear selection (E and E-plus models only).

https://truckmanualshub.com/



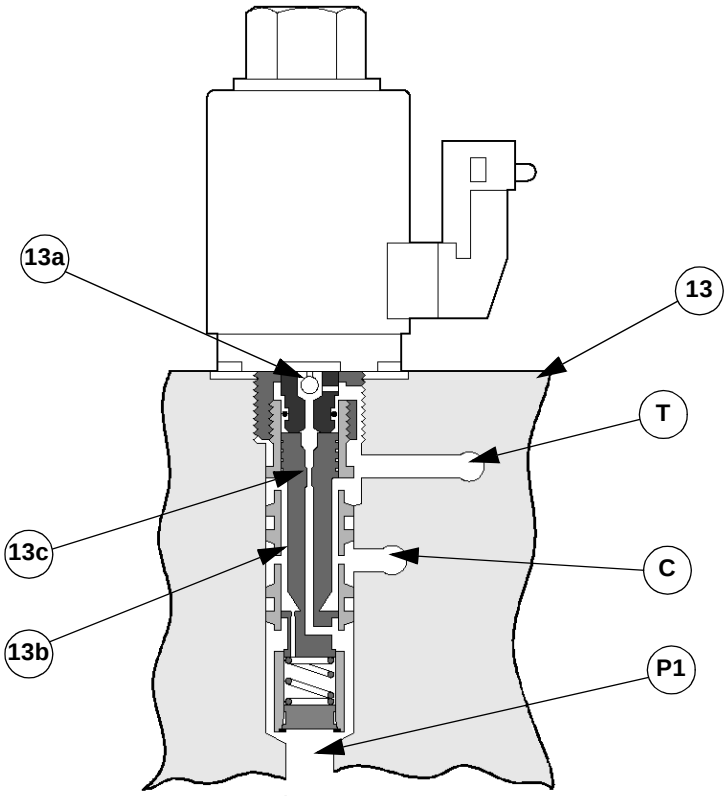



Diagram 1

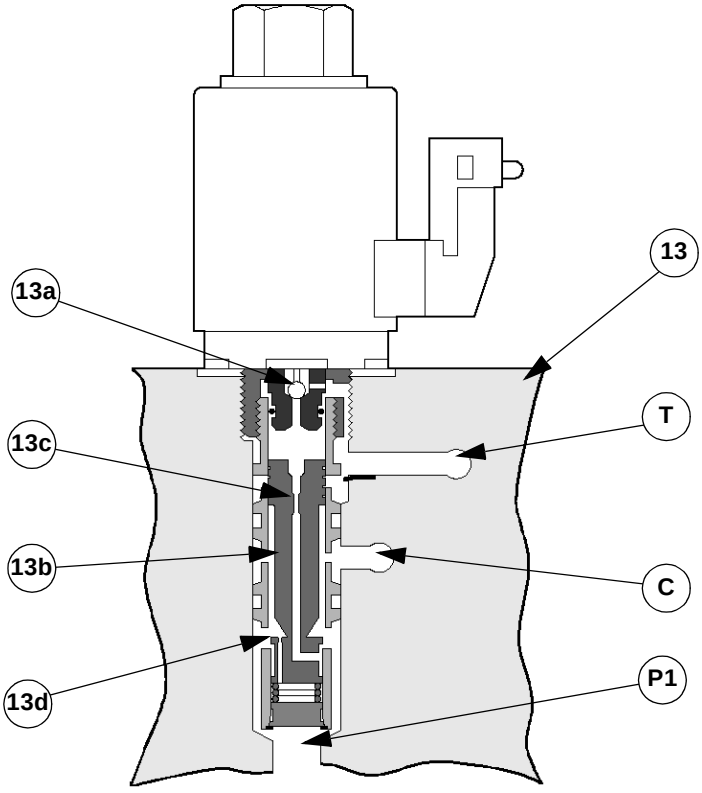



Diagram 2

https://truckmanualshub.com/



# FORWARD/REVERSE SOLENOID OPERATION

## Solenoid Off - Diagram 1

When the solenoid valve is de-energised the solenoid ball (13a) is unseated. P1 supply flows through the centre of the solenoid spool (13b) then through an orifice (13c) and past the unseated solenoid ball (13a) to tank (T). The orifice (13c) reduces oil flow from the P1 circuit. Any oil above the solenoid spool (13b) is connected to tank (T) creating a lower pressure above the spool. Because of the low pressure on top of the spool the solenoid spool is moved up by its spring and connects the forward or reverse clutch port (C) to tank (T).

## Solenoid On - Diagram 2

When the solenoid valve is energised the solenoid ball is initially seated. Regulated pressure supply at (P1) flows through to the centre of the solenoid spool (13b), to the top end of the spool. The oil pressure above the spool increases, overcomes the spool spring and moves the spool down.

When the spool is moved down the connection between the tank port (T) is closed and the connection between the regulated supply port (P1) and the forward or reverse clutch (C) is opened.

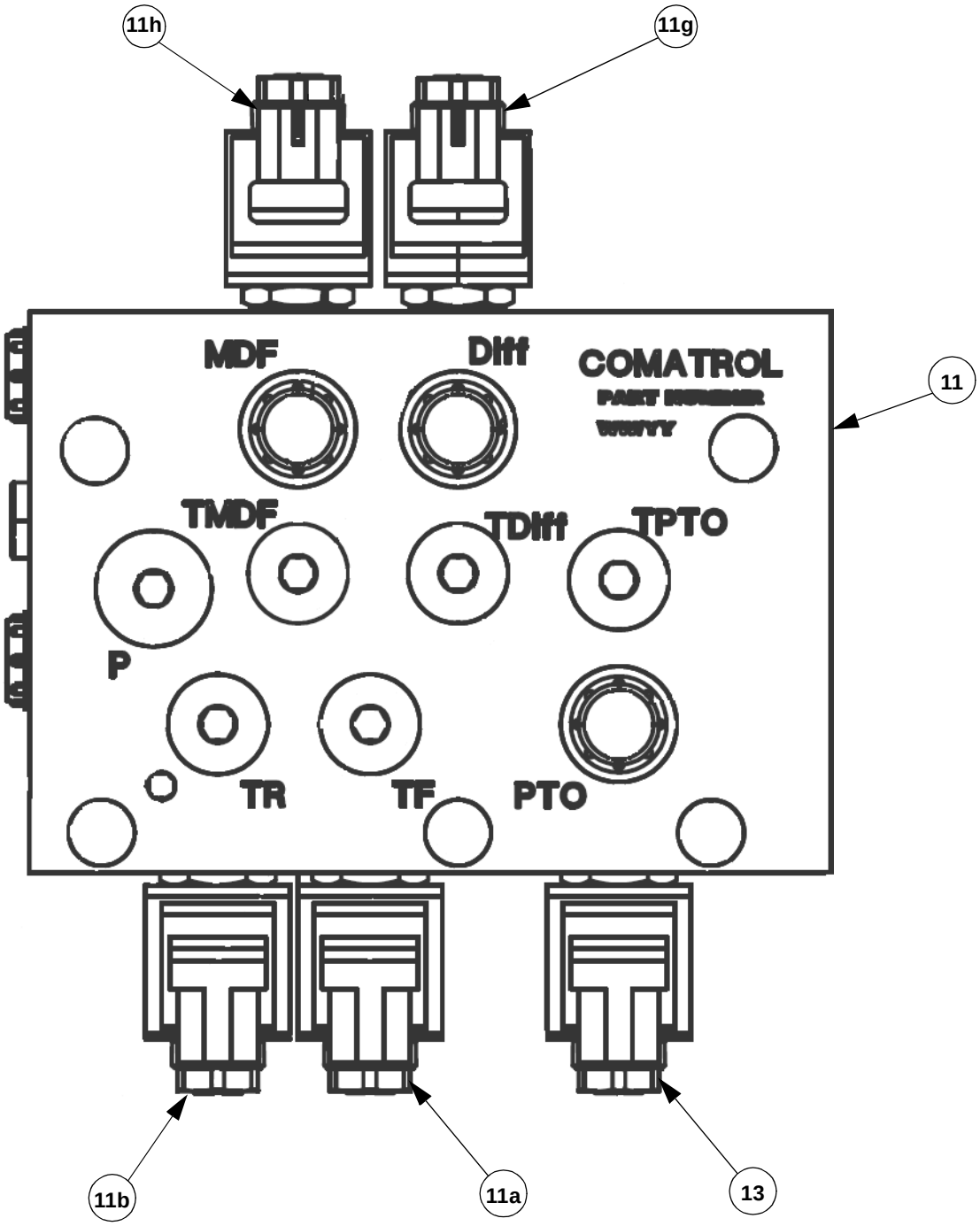
Once the selected clutch begins engagement the electronic control module (ECM) will monitor the speed of engagement by comparing the engine and gearbox output shaft speeds.

If required the control module will change the PWM setting and allow the ball (13a) to be partially unseated. This will reduce the oil pressure above the spool and allow the spool to be moved up slightly limiting the supply to the clutch.

A dampening orifice (13d) allows oil movement at the spring end of the spool so that the spool can move without hydraulic locking, but limits the speed of oil flow to provide a dampening effect of the spool.

https://truckmanualshub.com/





https://truckmanualshub.com/



# FORWARD AND REVERSE CONTROL

## General description

To start the engine, the F/N/R lever must be placed in the neutral or park position. When the engine is started, regulated pressure enters the F/R manifold at port (P) from the priority/regulator valve. From this port oil flows to the forward solenoid (TF), reverse solenoid (TR), four wheel drive solenoid (TMFD), differential lock solenoid (TDIFF) and power take off solenoid (TPTO). When any of the solenoids are activated the oil is directed around the solenoid spool to the relevant clutch.

With the clutch pedal in the UP position, the engine running and a range gear selected any movement of the F/N/R lever to forward or reverse will cause the tractor to drive. Take up of drive will be controlled by the transmission ECM using PWM.

Depressing the clutch to the bottom of it's travel will signal the transmission ECM via the clutch potetiometer to cut the power to the forward or reverse solenoid, disengaging the appropriate clutch and stopping drive.

Holding the clutch pedal in any position between fully up and fully down will signal the transmission ECM via the clutch potetiometer. The transmission ECM will vary the PWM according to clutch position giving the operator control over the forward or reverse clutch pressures therefore controlling the take up of drive.

## Automatic Clutch Control

When the operator changes the direction of the tractor using the F/N/R lever and without using the clutch pedal, the system is designed to release one clutch and modulate the engagement of the oncoming clutch. This is all controlled by the transmission ECM.

## Forward Drive Engaged

When the F/N/R lever is moved to the forward position, the forward solenoid (11a) is energised and oil is directed from the solenoid valve through internal drillings in the transmission to the forward clutch. Modulation of the clutch is controlled by the transmission controller using PWM.

The reverse solenoid remains off and therefore the oil passage to the reverse clutch is open to tank.

## Reverse Drive Engaged

When the F/N/R lever is moved to the reverse position, the reverse solenoid (11b) is energised and oil is directed from the solenoid valve through internal drillings in the transmission to the reverse clutch. Modulation of the clutch is controlled by the transmission controller using PWM.

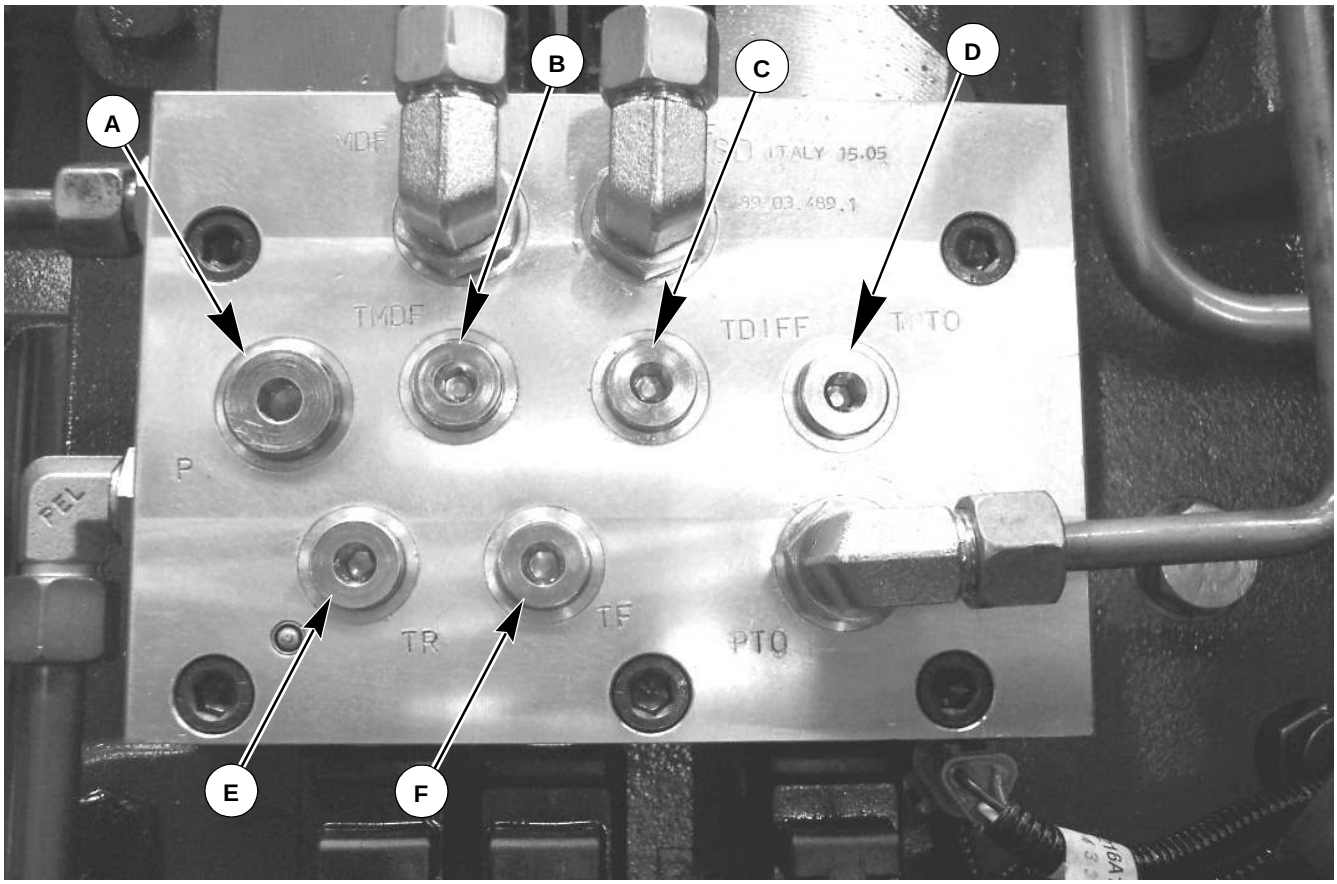
The forward solenoid remains off and therefore the oil passage to the forward clutch is open to tank.

## Direction Change Without using the Clutch Pedal

When the F/N/R lever is moved to change direction (e.g. forward to reverse), the solenoid (11a) is de-energised, allowing oil from the forward clutch to return to tank. Solenoid (11b) is energised and regulated pressure is directed from the solenoid valve through internal drillings in the transmission to the reverse clutch. Modulation of the clutch is controlled by the transmission controller using PWM.

https://truckmanualshub.com/





https://truckmanualshub.com/



# PTO CONTROL

## General Description

The rear PTO is controlled electronically by the Hitch ECM using PWM. It allows the operator to select the PTO by simply moving the switch to the ON position. The Hitch ECM will gradually increase the oil pressure to the PTO clutch according to the speed selected and the load on the PTO shaft.

**NOTE:** *The PTO clutch supply pressure is controlled to a lower pressure by the ECM (Electronic Control Module) when 540 rpm speed is selected.*

## Pulse Width Modulation (PWM)

When the PTO switch is in the ON position the hitch ECM sends a 12 volt supply to the PTO solenoid, the ground return wire from the solenoid is connected to the ECM then to ground via the cicuitry of the ECM.

The control module uses varying Pulse Width Modulation (PWM) to control the ground circuit of the solenoid. The control module repeatedly switches the ground circuit on and off at a rate of 500Hz (500 times/second).

The length of time in milliseconds that the earth circuit stays closed causes the solenoid to be ON. The length of time in milliseconds that the earth circuit stays open causes the solenoid to be OFF.

For example the solenoid may cycle ON for 75% of the time, then OFF for 25% of the time. This will give an average voltage of approximately 9 volts across the solenoid coil. This cycle can be repeated continually or changed to give longer ON/OFF periods by the ECM. By changing the average voltage across the solenoid the ECM can control the PTO clutch oil supply pressure.

By increasing the PWM ON and reducing the PWM OFF periods the average voltage is increased across the solenoid. This causes the solenoid spool valve to increase the PTO clutch supply pressure.

By reducing the PWM ON and increasing the PWM OFF periods the average voltage is reduced across the solenoid. This causes the solenoid spool valve to reduce the PTO clutch supply pressure.

### Forward/Reverse Manifold Test Points

**A**.....(P) Regulated Pressure (22 - 24 Bar)
**B**.....(TMFD) Four Wheel Drive
**C**.....(TDIFF) Differential lock
**D**.....(TPTP) Independent Power Take Off
**E**.....(TR) Reverse Clutch
**F**.....(TF) Forward Clutch

https://truckmanualshub.com/



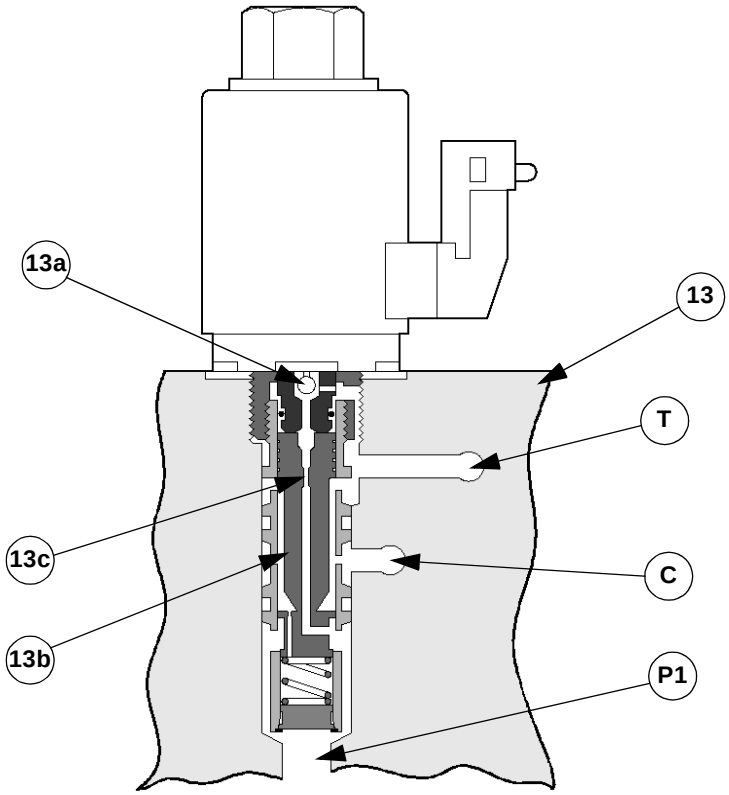



Diagram 1

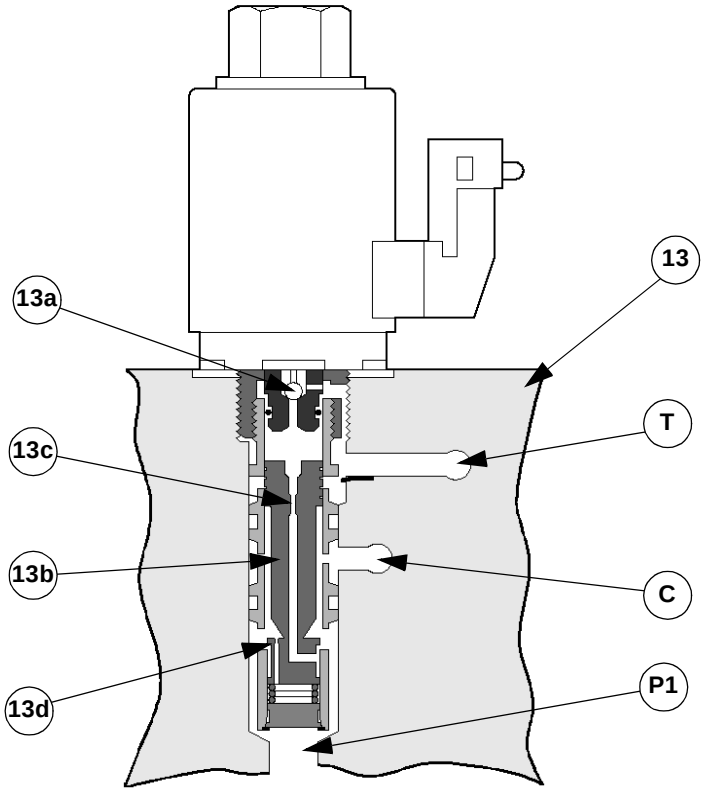



Diagram 2

https://truckmanualshub.com/



## PTO OFF - Diagram 1

When the solenoid valve is de-energised the solenoid ball (13a) is unseated. P1 supply flows through the centre of the spool (13b) then through an orifice (13c) and past the unseated solenoid ball (13a) to tank (T). The orifice (13c) reduces oil flow from the P1 circuit. Any oil pressure above the solenoid spool (13b) is connected to tank (T). The solenoid spool is moved up by its spring and connects the PTO clutch port (C) to tank (T).

## PTO ON - Diagram 2

When the solenoid valve is energised the solenoid ball is initially seated. Regulated pressure supply at (P1) flows through to the centre of the solenoid spool (13b), to the top end of the spool. The oil pressure above the spool increases, overcomes the spool spring and moves the spool down.

When the spool is moved down the connection between the tank port (T) is closed and the connection between the regulated supply port (P1) and the PTO clutch (C) is opened.

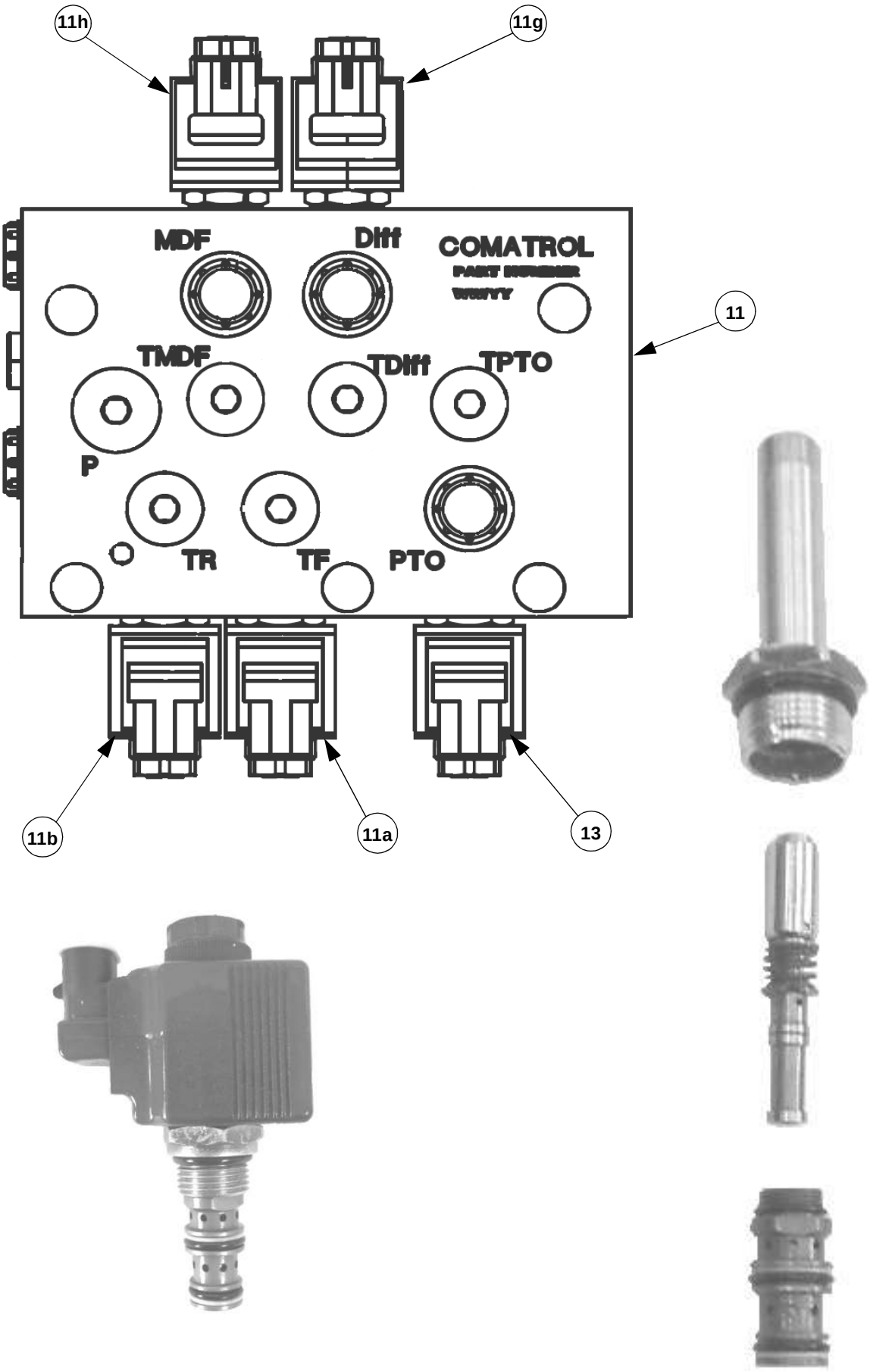
Once the PTO begins engagement the electronic control module will monitor the speed of engagement by comparing the engine and PTO shaft speeds.

If required the control module will change the PWM setting and allow the ball (13a) to be partially unseated. This will reduce the oil pressure above the spool and allow the spool to be moved up slightly limiting the supply to the clutch.

A dampening orifice (13d) allows oil movement at the spring end of the spool so that the spool can move without hydraulic locking, but limits the speed of oil flow to provide a dampening effect of the spool.

https://truckmanualshub.com/





https://truckmanualshub.com/



# DIFFERENTIAL LOCK & MFD CONTROL

## Differential Lock General Description

The hydraulic differential lock clutch is controlled by a combined electrical and electronic system. The differential lock solenoid valve (11g) is located in the F/R manifold (11).

The electrical system includes a safety feature which switches off the differential lock if one or both brakes are operated. The differential lock switch will then have to be re-engaged after the brakes are released.

The electronic control provides an automatic function controlled by the hitch Electronic Control Module (ECM). When this function is selected it will engage and disengage the differential lock automatically according to the tractor speed, hitch position, wheel slippage (if equipped with radar) and brake operation.

**NOTE:** *Refer to the Service Manual Section 10002 for further information about the electrical and electronic control.*

## Differential Lock OFF

when solenoid (11g) is de-energised the solenoid spool is moved onto it's seat by it's spring preventing regulated pressure from engaging the clutch. When the solenoid spool is in this position oil from the clutch port (C) is connected to tank allowing any oil behind the differential lock clutch piston to drain to tank and disengage the differential clutch.

## Differential Lock ON

When the differential lock solenoid (11g) is energised the solenoid spool is moved against it's spring. In this position the solenoid tank port is blocked and the regulated pressure supply flows to port (C), through pipe work and internal drillings to the differential lock clutch piston. This pressure clamps the friction plates to the separator plates to lock the differential.

**NOTE:** *Refer to Service Manual Section 8001 for the correct testing procedure.*

## MFD Control General Description

The hydraulic MFD clutch is controlled by a combined electrical and electronic system. The MFD solenoid valve (11h) is located in the F/R manifold (11).

The electrical system includes a safety feature which switches on the MFD if both brakes are operated. This provides four wheel braking at all times regardless of the position of the MFD switch.

The electronic control provides an automatic function controlled by the hitch Electronic Control Module (ECM). When this function is selected it will engage and disengage the MFD automatically according to the tractor speed, hitch position, wheel slippage (if equipped with radar) and brake operation.

**NOTE:** *Refer to the Service Manual Section 10002 for further information about the electrical and electronic control.*

## MFD Off

When the MFD solenoid is energised the Solenoid spool is moved against it's spring. In this position the solenoid tank port is blocked and the regulated pressure supply flows to port (M), through pipe work and internal drillings to the MFD clutch piston. This pressure moves the piston against the MFD belleville springs and releases the clutch which disengages the MFD drive.

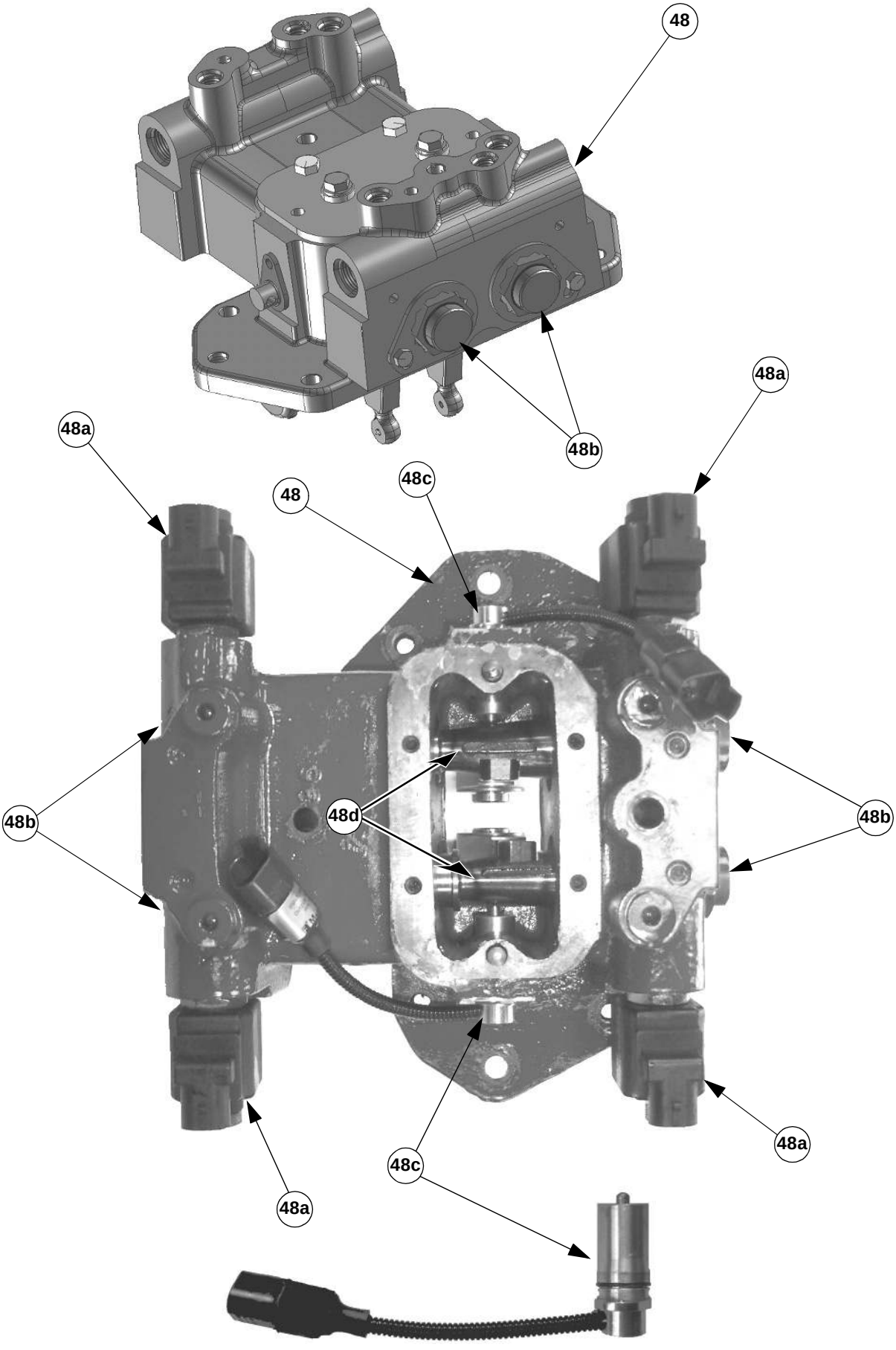
## MFD On

When the MFD solenoid is de-energised the solenoid spool is moved onto it's seat by its spring preventing regulated pressure from engaging the MFD clutch. When the solenoid spool is in this position oil from the clutch port (M) is connected to tank allowing any oil behind the MFD clutch piston to drain to tank and disengage the MFD clutch.

https://truckmanualshub.com/



# SERVO POWER RANGE SELECTOR



https://truckmanualshub.com/



# RANGE SELECTION (XtraSpeed-E & XtraSpeed-E*plus* Tractors)

## General Description

The range gears on the XtraSpeed-E and XtraSpeed-E*plus* tractor are controlled electronically by the transmission ECM using PWM. This allows the operator to change up and down the full range of gears by simply pressing the appropriate switches on the multi function lever. As the operator changes up or down the gears and it becomes necessary for the transmission to change a range gear, the transmission ECM will select neutral on forward/reverse clutches, then power the appropriate solenoid on the Power Range Selector (PRS) to select the required range gear, the transmission ECM will then re-energies the forward/reverse clutch.

The Power Range Selector (PRS) (48) consists of 4 solenoids (48a), 2 double acting cylinders (48b) and 2 position sensors (48c).

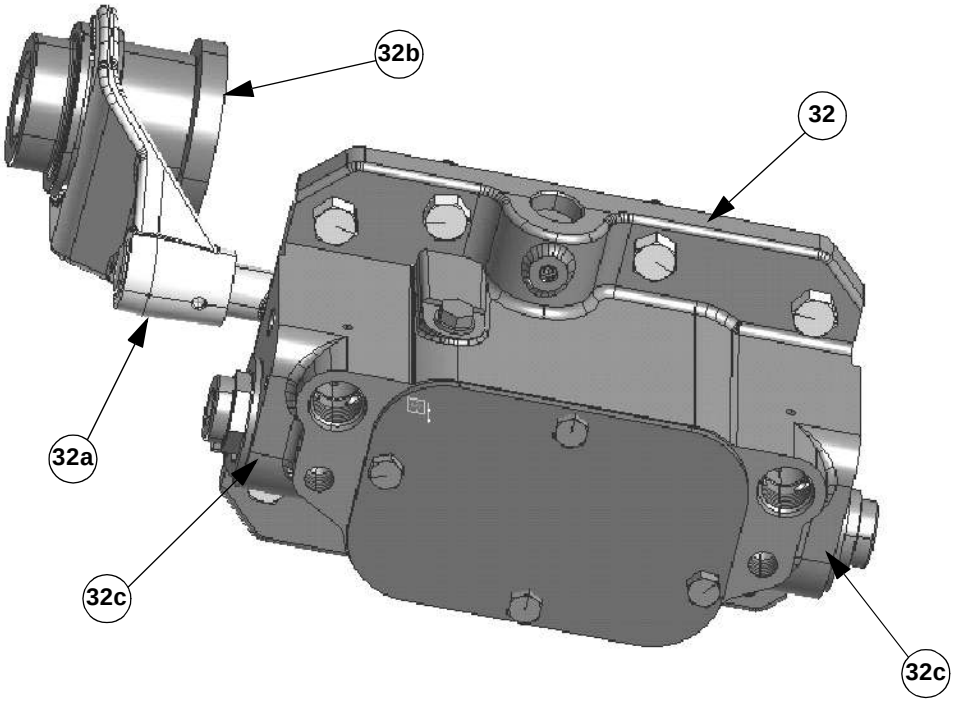
## Control

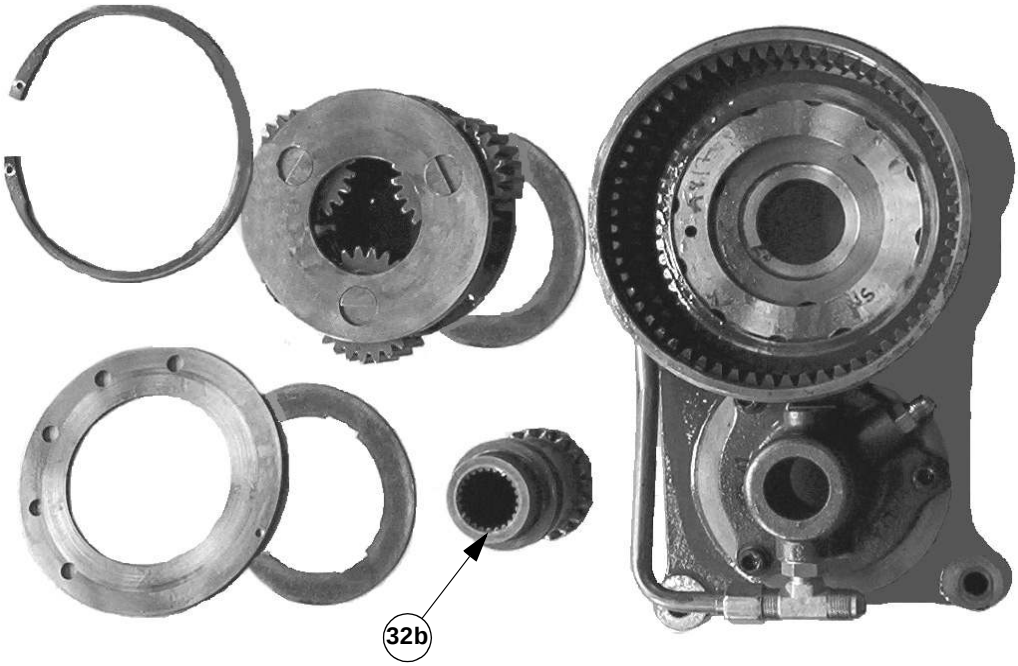
The solenoids are controlled by the transmission ECM using PWM. If one of the solenoids is energised regulated pressure is directed to one of the cylinders, this moves one of the selector rods (48d) either left or right selecting a new range gear.

As one of the selector rods (48d) moves, it's position is sensed by a position sensors (48c), the sensor signals the position of the selector rod to the transmission ECM.

https://truckmanualshub.com/





https://truckmanualshub.com/



# CREEP SPEED SELECTION

## General Description

When creep speed is engaged the transmission speed is reduced by 20%.

Creep speed should only be engaged when the engine is at low idle, the FNR lever is in the neutral position and either range 1 or range 2 are selected.

The creep speed engagement is controlled electronically by the transmission ECM, this allows the operator to engage or disengage creeper by simply pressing a switch.

The creep selector valve (32) consist of a double acting piston (32c) and 2 solenoids, as the piston is moved in one direction or the other, a fork (32a) connected to the piston (32C) moves a gear inside the transmission which selects or de-selects creep speed.

## Creeper Disengaged

When the solenoid to disengage creep speed is energised the solenoid spool is moved against it's spring. In this position the solenoid tank port is blocked and the regulated pressure supply flows through pipe work to one end of the creep speed unit double acting piston (32c). This pressure moves the piston, fork (32a) and gear (32b) disengaging the creep speed. Once creep speed has been disengaged the solenoid is turned off, allowing any pressure on the end of the piston to return to tank. The piston is held in position by a detent.

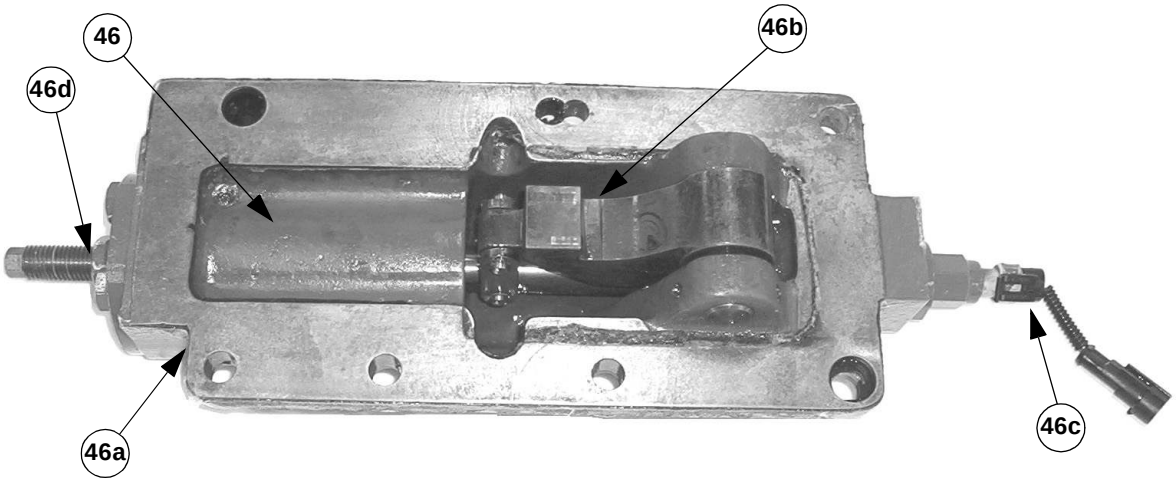
## Creeper Engaged

When the solenoid to engage creep speed is energised the solenoid spool is moved against it's spring. In this position the solenoid tank port is blocked and the regulated pressure supply flows through pipe work to one end of the creep speed unit double acting piston (32c). This pressure moves the piston, fork (32a) and gear (32b) engaging the creep speed. Once creep speed has been engaged the solenoid is turned off, allowing any pressure on the end of the piston to return to tank. The piston is held in position by a detent.

**NOTE:** *To engage and disengage creep speed the tractor must be stationary, the engine speed below 1000 RPM and the FNR lever is in the neutral position, and park brake off.*

https://truckmanualshub.com/





https://truckmanualshub.com/



# PARK LOCK

## General Description

The park lock is a hydraulically operated mechanical lock, when engaged a pawl (46b) is held into a toothed wheel on the MFD shaft by a spring, locking the transmission. When the park lock is disengaged the pawl (46b) is removed from the toothed wheel hydraulically and the transmission is free to rotate.

Regulated pressure is supplied to the park lock unit (46a) by a solenoid mounted on the power shift manifold. A switch (46c) is mounted on the park lock unit to signal to the operator when the park lock is engaged or disengaged.

The park lock is controlled by the Cab Controller and the Transmission controller.

## Park Lock Disengaged

When the operator moves the FNRP lever from the Park (P) position to the Forward (F), Neutral (N), or Reverse (R) position power is supplied to the solenoid by both the Cab and Transmission controllers and the solenoid spool is moved against it's spring. In this position the solenoid tank port is blocked and the regulated pressure supply flows through pipes to the park lock piston (46).

As the piston (46) is moved by the regulated pressure, it pulls against the engagement spring and retracts the pawl (46b) from the toothed wheel. When the pawl (46b) has been fully removed from the toothed wheel the transmission is free to rotate.

## Park Lock Engaged

When the operator moves the FNRP lever from the Forward (F), Neutral (N), or Reverse (R) position to the Park (P) position, and the tractor is travelling at more than 3 kph the power supply to the solenoid is removed by both the Cab and Transmission controllers, the solenoid spool is moved onto it's seat by it's spring, stopping the supply of regulated pressure to the piston (46). In this position the solenoid tank port is open and the in the piston cylinder is allowed to return to tank.

The piston (46) is now pulled by the engagement spring and the pawl (46b) engages into the toothed wheel. When pawl (46b) is engaged in the toothed wheel the transmission is mechanically locked.

## Manual Operation Of The Park Lock

In the event of an electrical or hydraulic failure it may be necessary to manually disengage the park lock. This can be done by fully screwing in the manual release bolt (46d) on the park lock unit.

To re-engage the park lock, screw the manual release bolt (46d) fully out.

**NOTE:** *The park lock is controller by both the cab and transmission controller, the reason for this if either of the controllers should fail whilst the tractor is moving, the other controller will maintain the park lock in the off position.*

https://truckmanualshub.com/



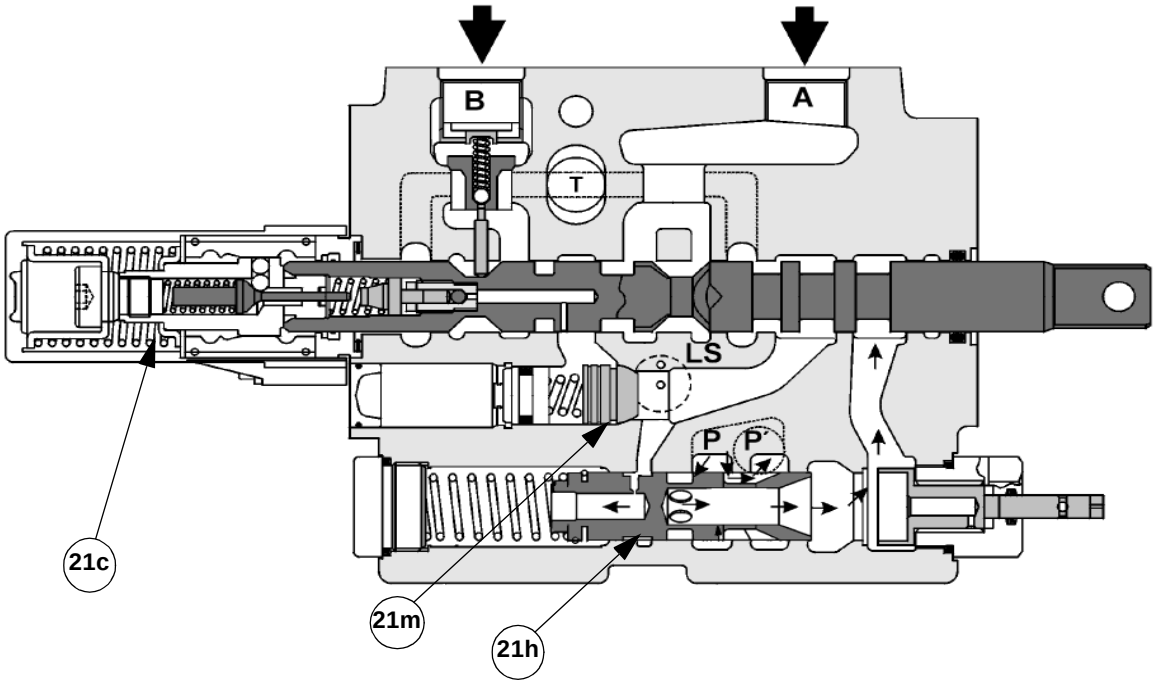



Diagram 1

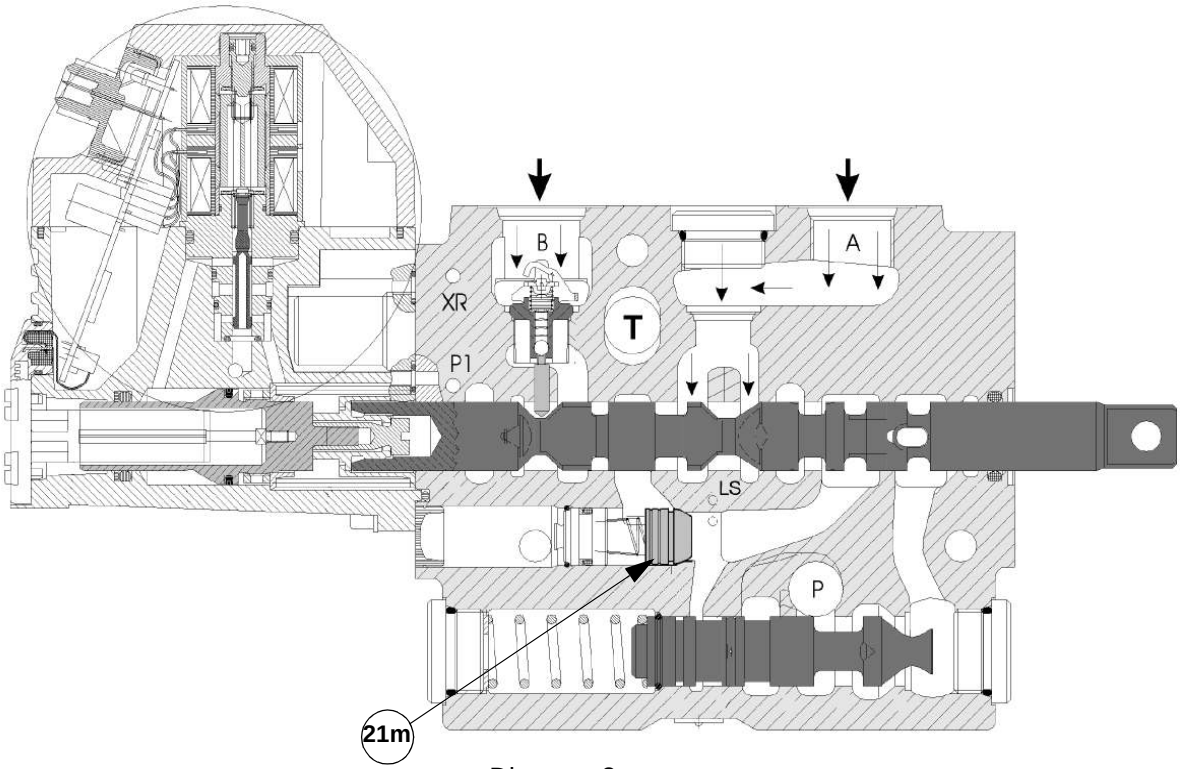



Diagram 2

https://truckmanualshub.com/



# REMOTE AUXILIARY VALVES

## General Description

Two types of Bosch remote auxiliary valves are used on the XTX series tractors, mechanical (diagram 1) and electronic (diagram 2). The remote auxiliary valves are of high specification with several variations to suit all applications. These valves are mounted on the remote valve block which is located above the PTO housing.

The main features are:-

A. Closed centre design - to reduce oil flow wastage.

B. Double acting, (Three or four position), double acting valves incorporate a float position and can be used as a single acting valve if required.

C. Load check valves (21m) available, these are located in the outlet ports and prevent any leak back through the valve spools.

D. Neutral return mechanism (21c), to return the main spool to neutral if the valve maximum operating pressure is exceeded.

E. Flow control facility (21h), the flow available at each remote valve can be adjusted to meet the requirement of the equipment supplied.

F. Priority remote valve on the first remote only, allowing uninterrupted supply to hydraulic motors, etc.

G. Simultaneous operation, all remote valves can be operated at the same time once the priority valve is satisfied.

H. Up to three mechanically operated and one electrically operated remote valves can be installed on XtraSpeed and XtraSpeed-E tractors.

I. All Remote valves on XtraSpeed-E*plus* tractors are electrically operated.

**NOTE:** *A zero pressure return is fitted as standard to the remote valve mounting plate which will allow a return flow of up to 9 L/min. Any equipment requiring a larger return flow than this will be subjected to a back pressure equal to charge/lubrication pressure.*

## High Pressure Main Circuit

The high pressure circuit is supplied by the PFC pump (8) after the demands of the steering (25), optional trailer brake (31) optional front axle brakes and regulated circuits (P1) have been satisfied. This circuit supplies the remote valves (21 & 22), power beyond facility (19), the working circuit of the hitch (15), optional cab suspension and optional front axle suspension.

The PFC pump supplies all high pressure circuits at the same time, even if their flow and pressure requirements are different.

**NOTE:** *The maximum pressure available in the high pressure circuit is 199 to 209 bar. This is controlled by the main relief valve in the PFC pump control valve assembly (8k).*

https://truckmanualshub.com/



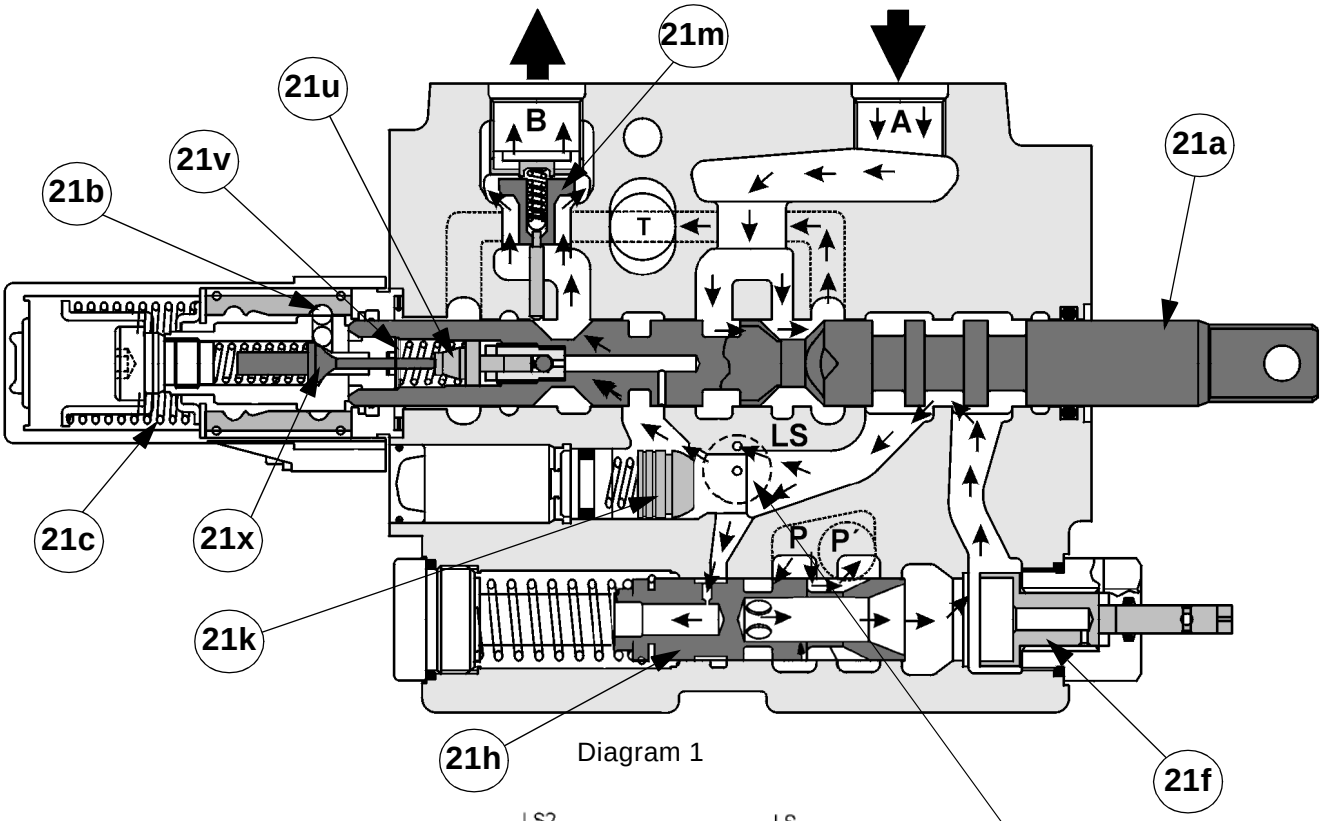
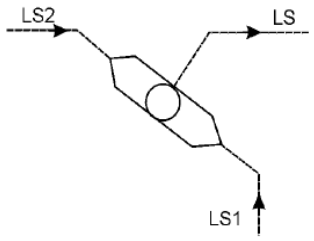



Diagram 1



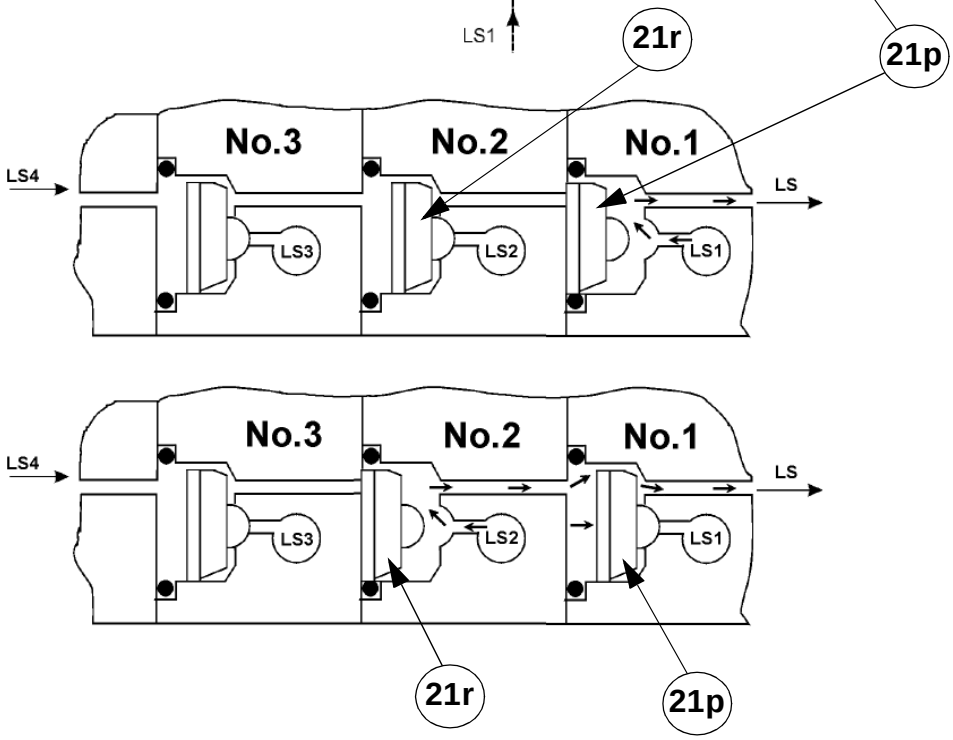




Diagram A

Diagram B

https://truckmanualshub.com/



# MECHANICALLY OPERATED AUXILIARY REMOTE VALVES

## Raise position (Diagram 1)

When the control lever is moved to the raise position, the main control spool (21a) is pulled out of the valve bore. This spool movement compresses the centring spring (21c) and also engages the detent balls (21b) into a detent, which mechanically holds the spool in this position.

Oil flows past the main control spool and pushes open the load check valve (21m), then flows out from the raise port (B) to the couplers. The amount of flow is determined by the setting of the adjustable flow control valve (21f) from 0 to 95 litre/min. The pressure of this flow at the raise port is also exposed to the spring end of the priority flow control spool (21h) ensuring that the no.1 priority valve always receives the pre selected flow of oil. Oil also flows past the signal check valve (LS) into the signal line for the pump to increase its flow.

Return oil from the couplers is directed into the lower port (A) and past the main control spool to the tank port (T). From here it is directed to the inlet side of the filter housing.

## Lower Position (Diagram 2)

When the control lever is moved to the lower position, the main control spool (21a) is pushed into the valve bore, engaging the detent balls (21b) into their detents.

Oil flows past the main spool to the lower port (A) to the quick release coupling. As the main control spool is pushed into the valve bore the load check valve pin (21n) is forced up the ramp of the main spool (21a) unseating the load check valve (21m) to allow the return oil at port (B) to flow to tank (T).

The pressure at the lower port (A) is also directed to the spring end of the priority flow control spool (21h) and to the signal check valve (LS) to signal the pump to increase its flow. This pressure is also exposed to the detent kickout mechanism (21u) which will control the maximum operating pressure in the lower port (A) in exactly the same way as explained for raise position.

## Float Position (Diagram 3)

When the control lever is moved to the float position, the main control spool (21a) is moved to its maximum travel into the valve bore, engaging the detent balls (21b) into their detents.

The spool blocks oil supply to the ports (A and (B) and both of these ports are now open to tank (T). The check valve pin (21n) has been pushed upwards by the main spool (21a) opening the load check valve (21m). This valve will now allow a double acting or single acting cylinder to float.

The detent kickout mechanism does not function in the float position and the main control spool (21a) must be manually returned to neutral.

## Signal Check Valves

When the main control spool (21a) of valve number 1 is moved to the raise or lower position pump pressure enters the signal line (LS1) moving the signal check valve (21p) to the left closing the signal port to the next valve and allowing the oil to flow down the signal line (LS) to the pump, this increases the pump flow to meet the demand of the valve. see diagram A.

If two remote valves are operated at the same time the valve requiring the highest pressure will control the pump. If remote valve two is operated, diagram B, the pump pressure at (LS2) moves the signal check valve (21r) to the left closing the signal port to remote valve three but flowing to remote valve one, if remote valve one is operating at a lower pressure the signal line pressure from remote valve two will hold the signal check valve (21p) to the right closing the signal port to remote valve one. The oil will then flow around the check valve (21p) and on to the pump.

https://truckmanualshub.com/



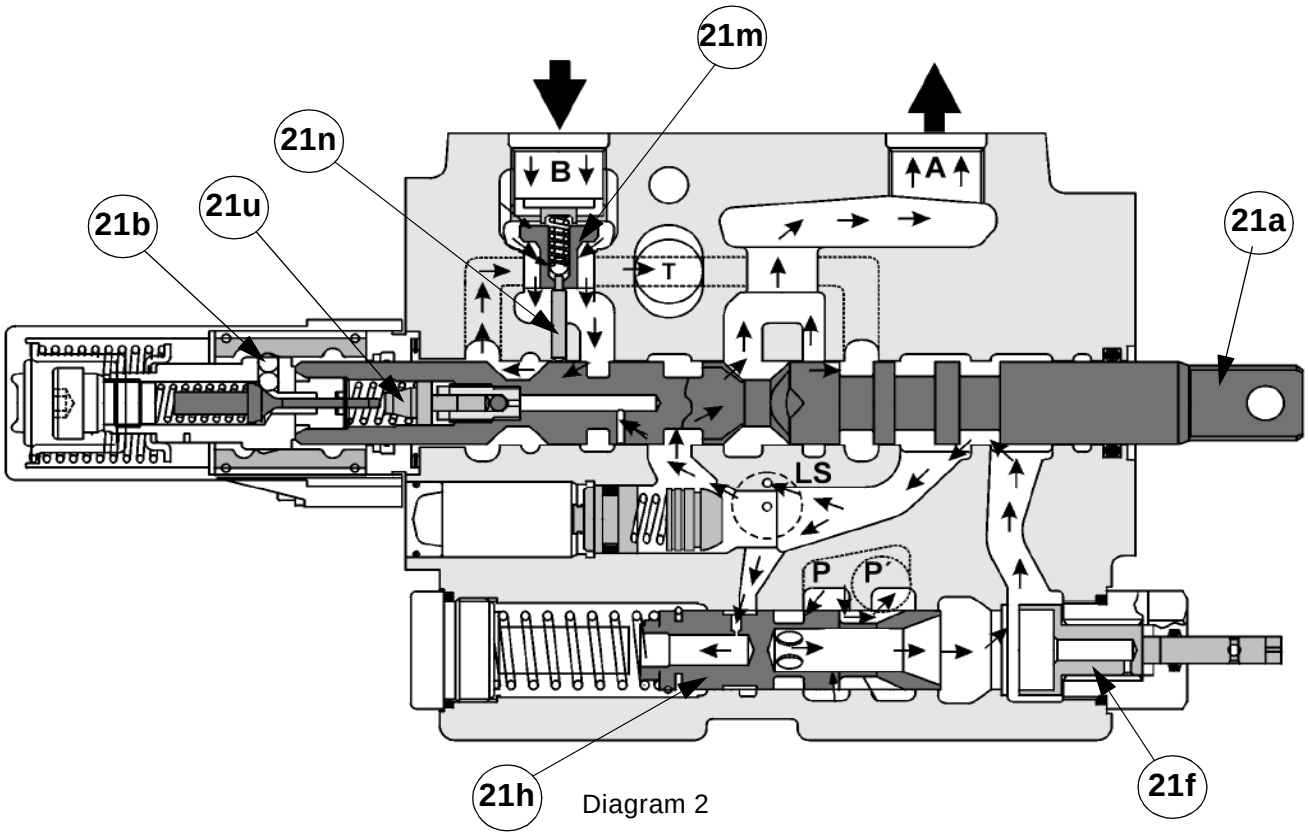



Diagram 2

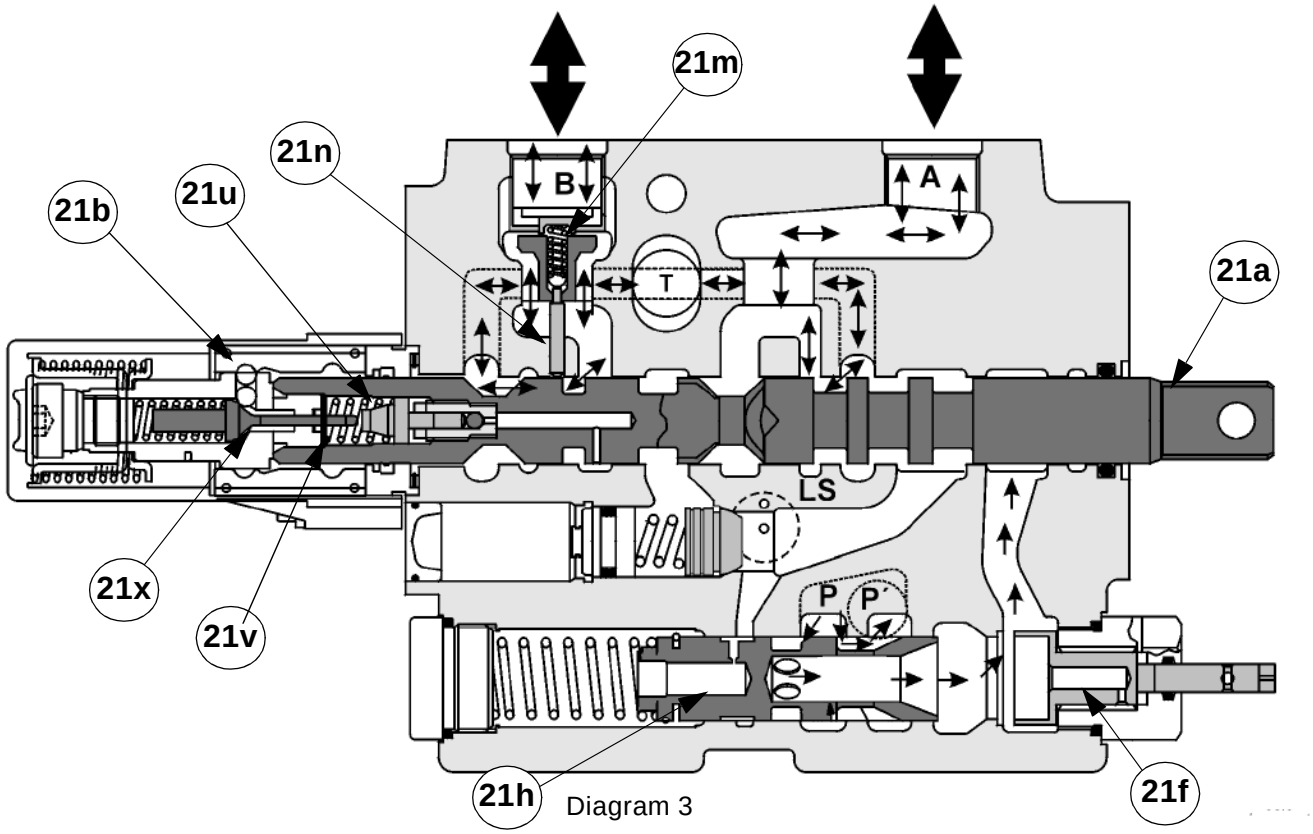



Diagram 3

https://truckmanualshub.com/



## Operation of the Priority Flow Control Spool (21h)

With the first remote valve in the raise or lower position, the pump will provide enough flow to meet the valve demand, this is determined by the setting of the flow control valve (21f).

The pressure of the oil supply (P) has access to the right end of the priority flow control spool (21h), and signal pressure plus spring pressure has access to the spring end of the spool (21h). This combined signal and spring pressure will move the spool (21h) to the right allowing oil from (P) to flow through the centre of the spool, past the flow control valve(21f) to the main control spool (21a), ensuring priority flow to this remote valve.

If the flow from the pump is greater than the flow required by the first valve the pump supply oil pressure acting on the right end of the priority flow control spool (21h) will become greater than the combined signal and spring pressure acting on the spring end of the spool. This will cause the spool to move against the spring and allow the excess oil flow to be directed through port (P') to the other remote valves.

Should another remote valve or the hitch control valve be operated, requiring the same or a lower pressure, the flow demand will signal the pump to increase its flow to meet the demand. The pump supply pressure will remain constant and the priority flow control spool (21h) will maintain its position. This means that the supply pressure and flow to the main control spool (21a) on the first remote valve (priority valve) will remain constant.

Should another remote valve or the hitch valve be activated requiring a higher pressure, the pressure and flow demand will signal the pump to increase flow to meet the increased demand. The higher supply pressure acting on the right end of the priority flow control spool (21h) will overcome the combined signal and spring pressure acting on the spring end of the spool and cause it to move to the left. This will cause a restriction at the spool centre land and compensate for the higher supply pressure therefore maintaining the same flow and pressure available to the main control spool (21a).

## Operation of the Detent mechanism

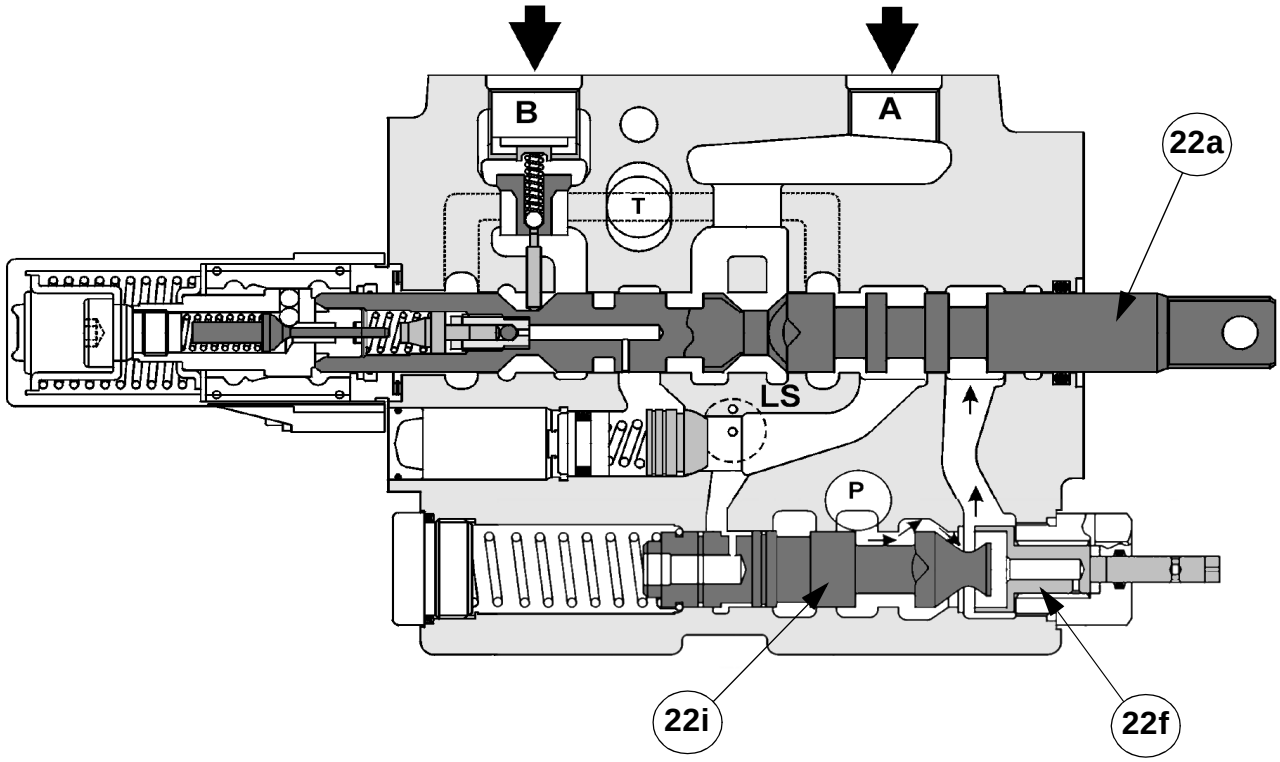
The pressure at the raise port (B) is also exposed to the detent kickout mechanism (21u). The detent mechanism pin and ball are held on their seat by a spring. When the pressure acting against the ball exceeds the setting of the spring, the ball and pin will move to the left off their seat, the pin will come into contact with the detent ball release pin (21x) and move the pin to the left against it's spring freeing the detent balls (21b) from their detents. This allows the centring spring (21c) to return the spool to neutral.

The detent poppet spring tension is shim adjustable at (21v). The factory setting for this pressure is 170 - 180 Bar (2465 - 2610 PSI) The remote valve kick out pressure should be less than the maximum pressure setting of the PFC piston pump.

**NOTE:** *Excessively low detent pressure settings will reduce the flow available to the remote couplers due to the operation of the detent mechanism.*

https://truckmanualshub.com/





https://truckmanualshub.com/



# MECHANICALLY OPERATED AUXILIARY REMOTE VALVES (Non Priority)

## General Description

Valves 2,3 and 4 are non priority and are available as double acting (four position) valves with one raise check valve.

The supply from the pump is available to the supply port (P) of all additional remote valves once the number 1 priority remote valve has sufficient flow.

Apart from the priority spool the operation of the additional remote valves is the same as the priority remote valve.

## Operation of the flow control spool (22i)

PFC pump supply (P) passes around the flow control spool (22i), past the flow control valve (22f) and onto the main control spool (22a). The oil pressure will force the flow control spool (22i) against its spring, restricting the amount of oil available to the main control spool (22a). With the remote valve in the raise or lower position, the pump will increase the flow to meet the valve demand which is determined by the setting of the flow control valve (22f). At the same time oil pressure will have access to the spring end of the flow control spool (22i). The increased supply pressure acting on the spring end of the flow control spool (22i) will move the spool to the right until the flow demand of the valve is met.

## Operating more than one remote valve

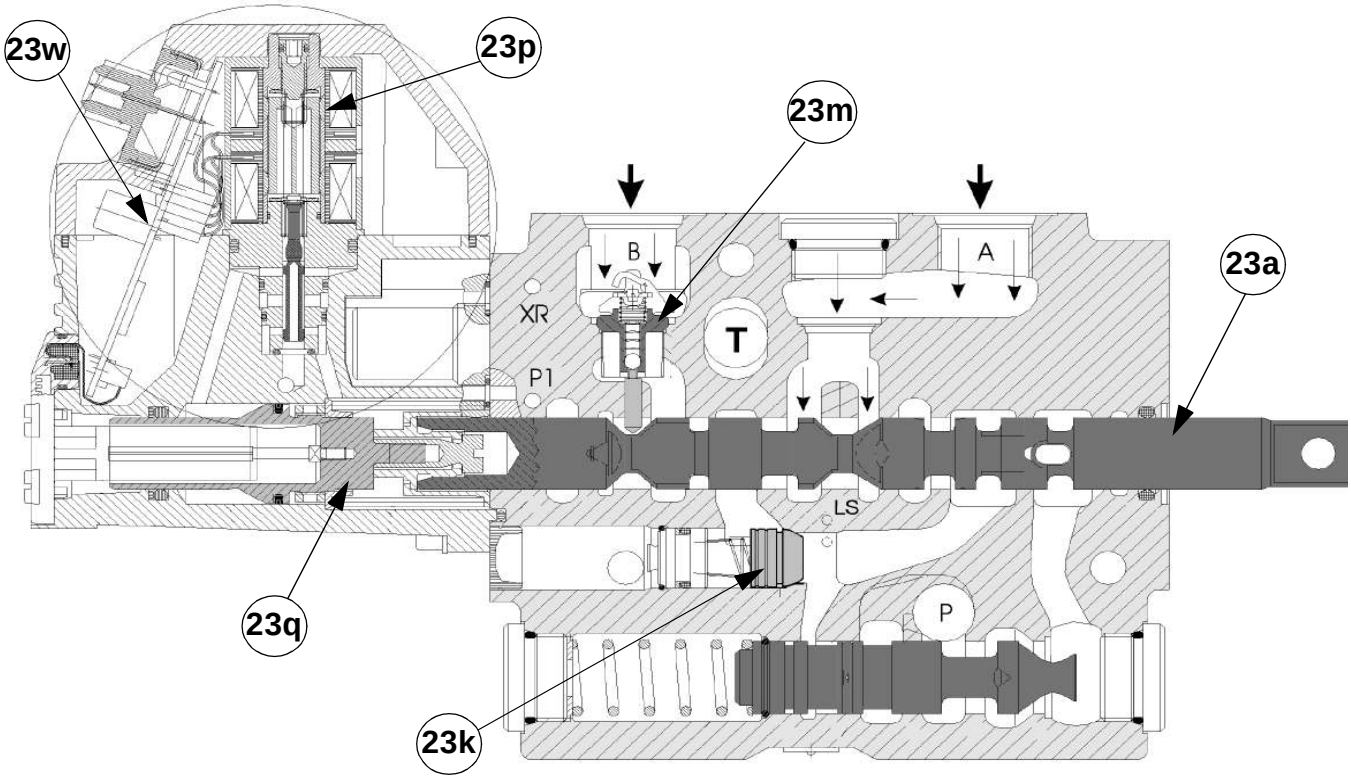
Should another remote valve or the hitch control valve be operated, requiring the same or a lower pressure, that pressure and flow demand will signal the pump to increase its flow to meet the increased demand. The pump supply pressure will remain constant and the flow control spool (22i) will maintain its position. This means that the supply pressure and flow to the main control spool (22a) will remain constant.

Should another remote valve or the hitch valve be activated requiring a higher pressure, that pressure and flow demand will signal the pump to increase flow to meet the increased demand. The higher supply pressure acting on the right end of the flow control spool (22i) will overcome the combined signal and spring pressure acting on the spring end of the spool and cause it to move further against the spring to limit the flow and compensate for the increased supply pressure.

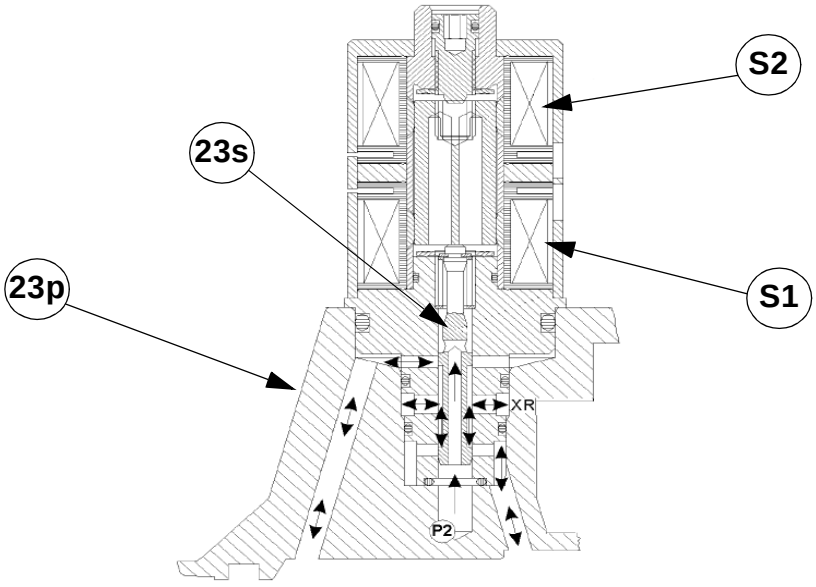
This means that the flow control spool will maintain the flow and pressure available to the remote valve main spool (22a).

https://truckmanualshub.com/






**NEUTRAL**



https://truckmanualshub.com/



# ELECTRICALLY OPERATED AUXILIARY REMOTE VALVES

## General Description

Electro-hydraulically controlled remote valves are available as the fourth remote auxiliary valve on the XtraSpeed and XtraSpeed-E series tractors or up to 5 electro-hydraulically controlled remote valves can be fitted on the XtraSpeed-E*plus* tractors.

If the valve is fitted as the 4th electric remote valve on the XtraSpeed and XtraSpeed-E tractors, it is double acting three position (raise, neutral and lower), it has a load hold check valve (23m) in the raise port (B).These valves are also controlled by signal voltage from a rocker switch directed through a resistor pack.

The electric remote valves fitted to XtraSpeed-E*plus* tractors are four position valves (raise, neutral, lower and float) controlled from the seat armrest via CAN bus. A load hold check valve (23) is fitted in the raise port (B), but as the 5th valve has no joystick to operate it only 3 positions are available.

The main spool (23a) is held in the neutral position by a spring and the valve has no detents.The valve includes a drop check valve (23k) and a signal check valve.

The valve is operated by oil pressure from tractor P1 regulated pressure circuit. The oil is supplied to either side of a piston (23q) which is attached to the main spool (23a). Supplying oil to one side of the piston (23q) or the other will have the effect of moving the main control spool to the left or right.

The internal operation of the remote auxiliary valve is the same as the mechanically operated non priority valves.

## Auxiliary Solenoid Valve(23p)

This valve has a bi-directional solenoid valve which is located on the end of the electrically operated auxiliary valve. It is supplied with oil from the tractor P1 regulated circuit. There is also a connection to tank at port (XR).

## XtraSpeed & XtraSpeed-E 4th valve

The solenoids are operated by a three position rocker switch which is located in the cab on the right hand console at the rear of the remote auxiliary control levers. Operating the switch sends a voltage to the circuit board (23w) mounted next to the solenoid valve. the circuit board receives the signal from the switch and powers the appropriate solenoid to move the main control spool (23a)

## Neutral Position

With the rocker switch in the neutral position both solenoids (S1 and S2) are de-energised. Both side of the main spool piston (23q) are connected to tank (XR) allowing any oil at each side of the auxiliary valve main spool piston (23q) to drain to tank. This allows the main spool (23a) to return to neutral by it’s spring.

## Raise Position

When the rocker switch is moved to the Forwards position (spring return to neutral), solenoid (S2) is energised.

With the solenoid (S2) energised the solenoid spool (23s) is pulled upwards. In this position the regulated pressure supply (P2) flows up the centre of the solenoid spool to the left side of the main spool piston (23q). The right side of the main spool piston is connected to tank (XR). This moves the main spool (23a) against it’s spring to the raise position.

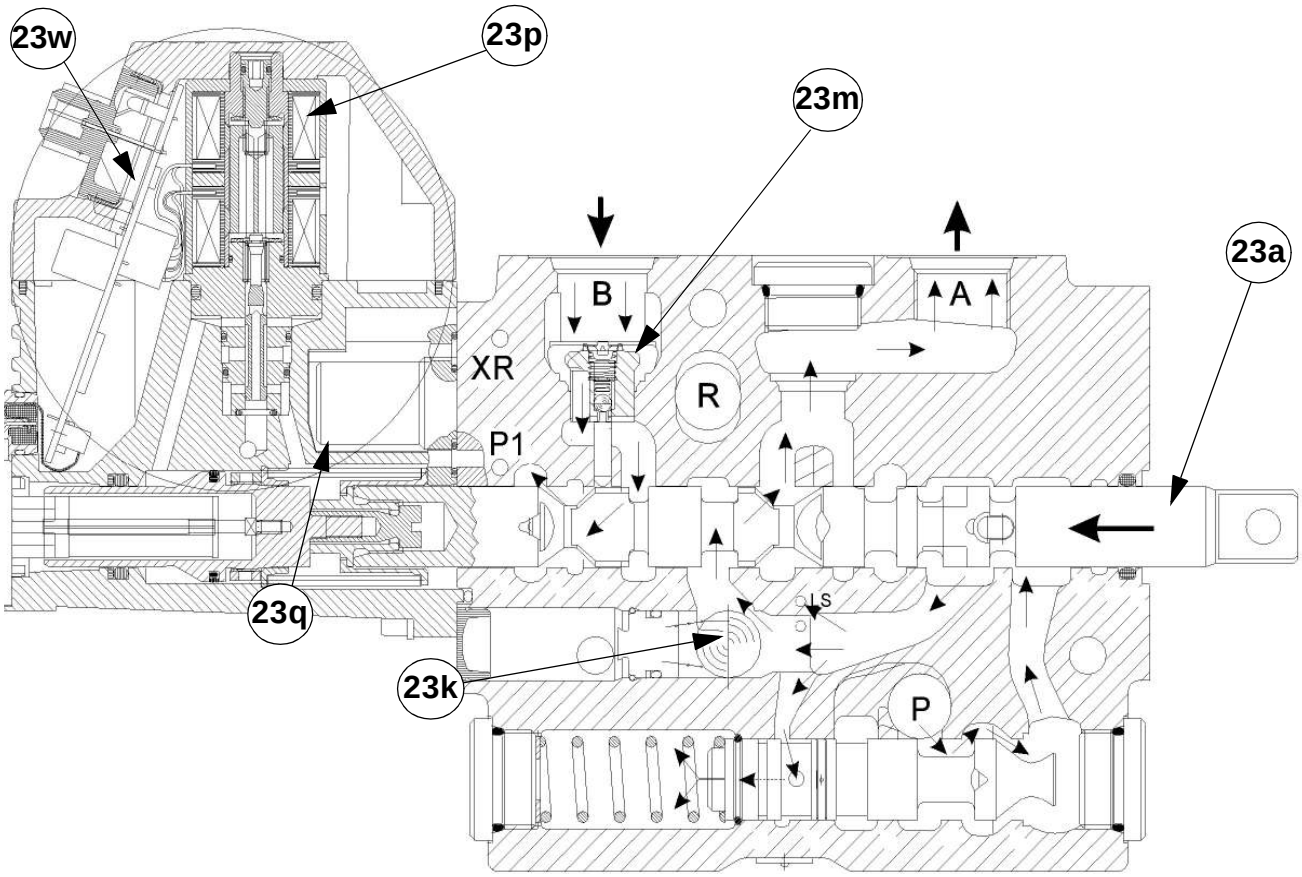
## Lower Position

When the rocker switch is moved to the rear position (spring return to neutral) the solenoid (S1) is energised.

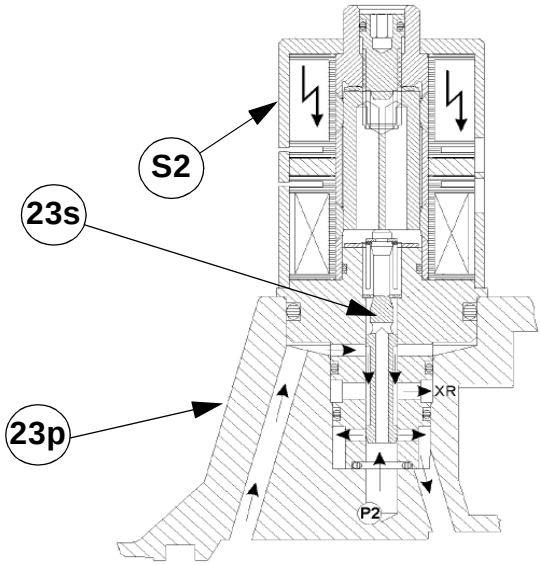
With the solenoid (S1) energised the solenoid spool (23s) is pushed downwards. In this position the regulated pressure supply (P1) flows around the bottom of the solenoid spool to the right side of the main spool piston (23q). The left side of the main spool piston is connected to tank (XR). This moves the main spool (23a) against it’s spring to the lower position.

https://truckmanualshub.com/






**POWER A**



https://truckmanualshub.com/



## XtraSpeed-E*plus* Valves Position 1 to 4

There can be up to four CAN BUS controlled valves fitted to XtraSpeed-E*plus* tractors, each valve is made up of the following components:-

- A remote valve Electronic Control Module (ECM).
- A CAN BUS operated electro hydraulic pilot control valve.
- An inductive position transducer/sensor, which transmits information to the auxiliary valve ECM regarding main spool position.
- A diagnostic LED.
- A main spool valve block.
- A main spool.
- A load hold check valve.
- A signal line check valve.

## Valve operation (raise)

When the operator selects raise the selected remote valve receives a signal from the auxiliary valve ECM via the CAN BUS, the remote valve responds accordingly, powering the pilot valve block to direct pilot pressure (P1) into the main spool control piston gallery (7).

As oil enters gallery (7) the main spool moves to the right allowing main PFC pump stand-by oil pressure to flow from gallery (P).

The oil from gallery (P) passes around the compensator spool (10) and main spool (8). Oil passing around the main spool enters the signal line circuit increasing the PFC pump oil pressure.

When the PFC pump oil pressure increases enough to lift the load check valve off it’s seat oil will flow past the check valve, around the main spool, around the load drop check valve and out of port B.

## Valve operation (lower)

When the operator selects lower the selected remote valve receives a signal from the auxiliary valve ECM via the CAN BUS, the remote valve responds accordingly, powering the pilot valve block to direct pilot pressure (P1) into the main spool control piston gallery (6).

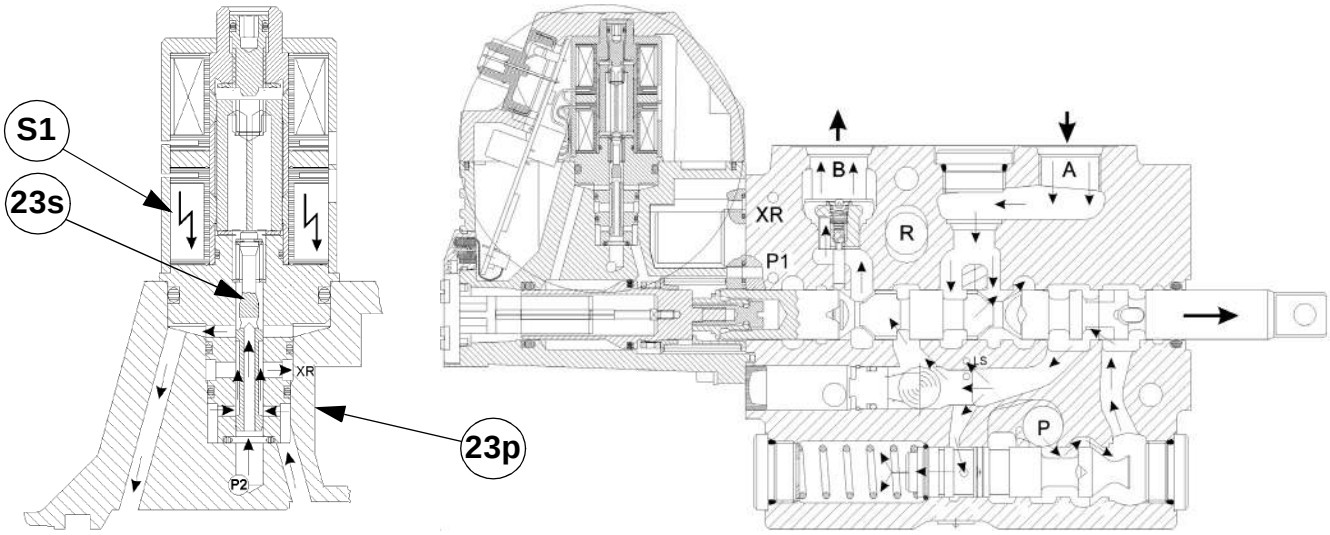
As oil enters gallery (6) the main spool moves to the left allowing main PFC pump stand-by oil pressure to flow from gallery (P).

The oil from gallery (P) passes around the compensator spool (10) and main spool (8). Oil passing around the main spool enters the signal line circuit increasing the PFC pump oil pressure.

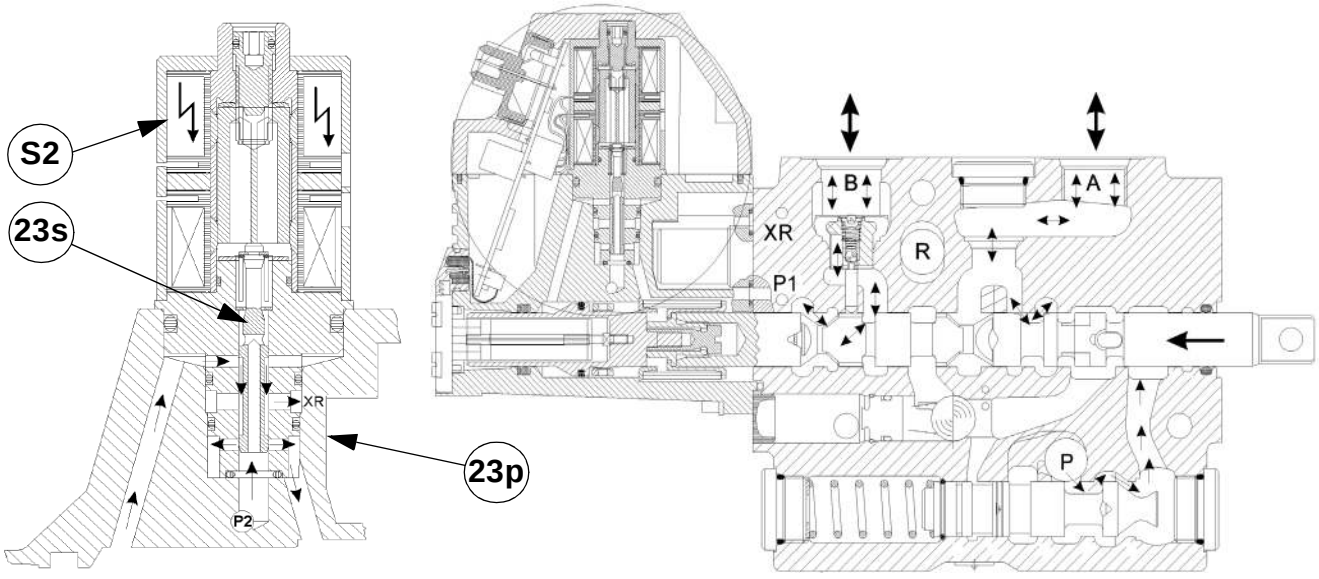
When the PFC pump oil pressure increases enough to lift the load check valve off it’s seat oil will flow past the check valve, around the main spool and out of port A.

https://truckmanualshub.com/






**POWER B**




**FLOAT**

https://truckmanualshub.com/



## Valve operation (float)

When the operator selects float the selected remote valve responds to the signal sent via the CAN BUS from the auxiliary valve ECM, powering the pilot valve block to direct pilot pressure (P1) into the main spool control piston gallery (7).

When the spool valves on the tractor are required to go into the float position the operation is the same as the raise mode except the spool travel is 110% of normal operation.

When the main spool moves in to the float position both A and B ports are connected to the return port.

**NOTE:** *the float position is only available on the valves that are joystick operated.*

## Motor Remote Spool Operation

A hydraulic motor can be operated from any of the XTX series tractor remote valves, however it is not advisable to operate a motor from the electric 4th remote valve on XtraSpeed and XtraSpeed-E tractors or the 5th remote on XtraSpeed-E*plus* tractors. This is because these remote valves do not have a float position, turning the operating switch to neutral will stop the motor immediately possibly causing damage to the motor.

https://truckmanualshub.com/



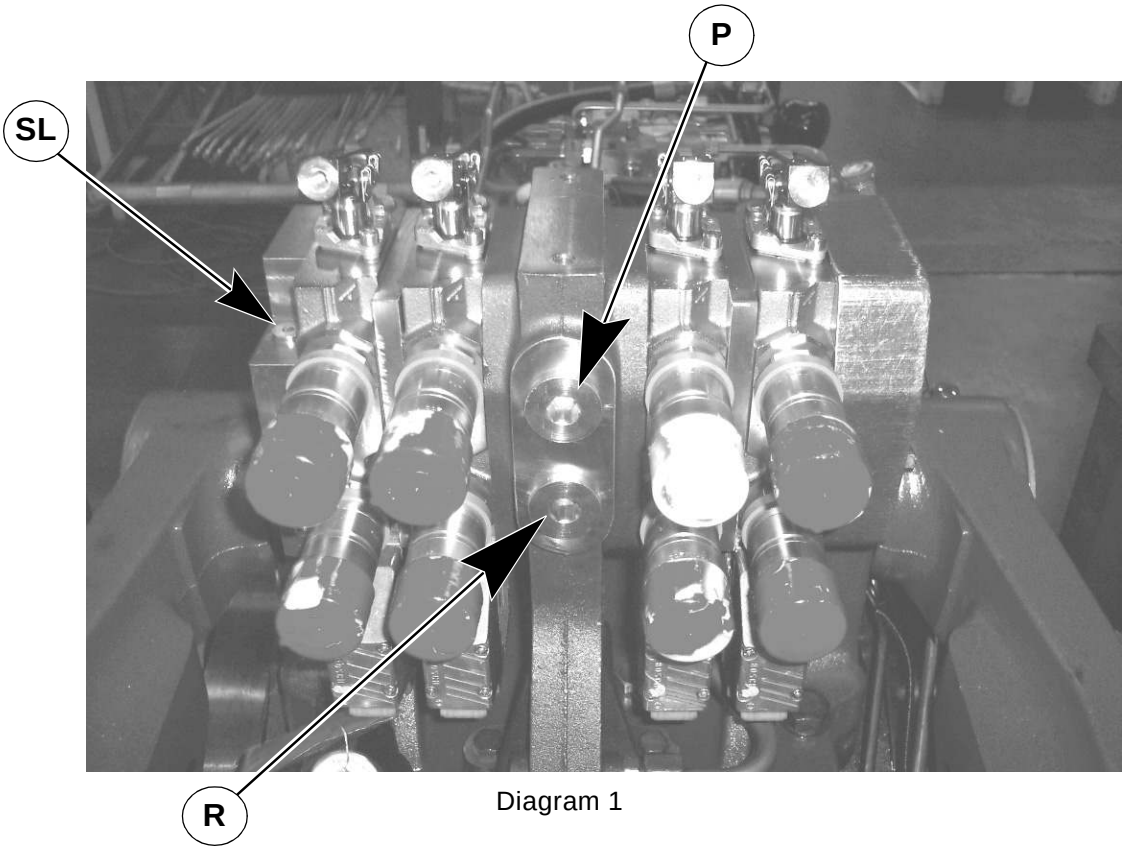



Diagram 1

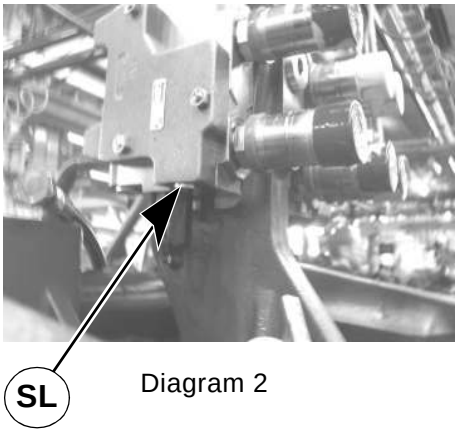



Diagram 2

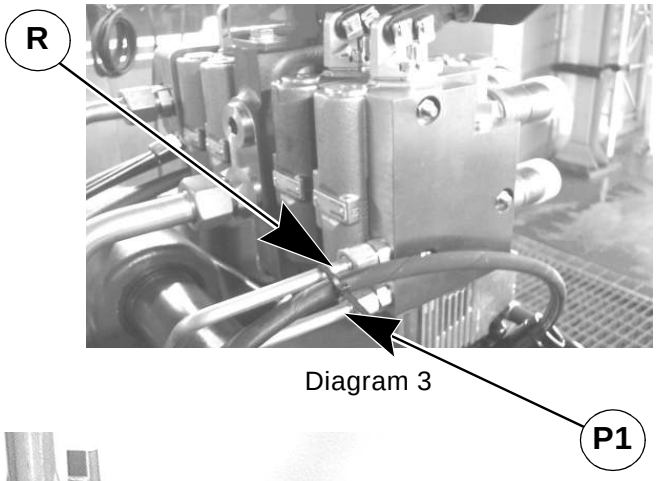



Diagram 3

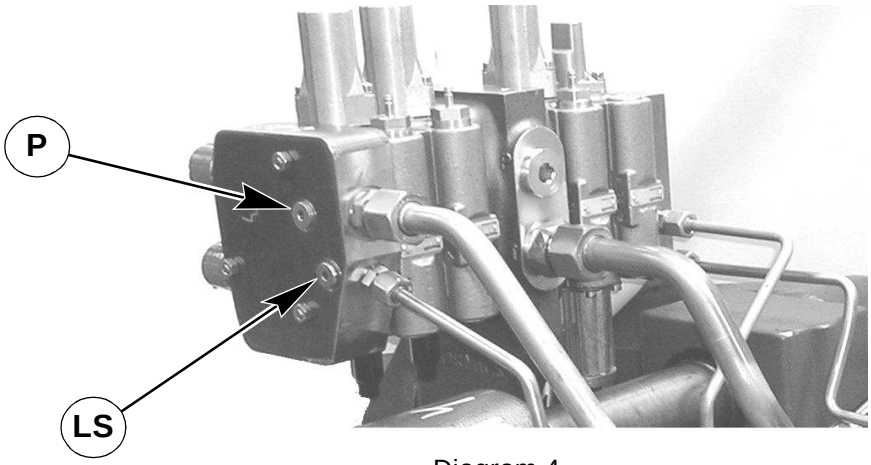



Diagram 4

https://truckmanualshub.com/



# HYDRAULIC POWER BEYOND

## General Description

The power beyond facility is fitted as standard and can be used to supply oil to additional equipment.

The power beyond facility has an outlet port (P) which supplies the implement and a return ports (R). The return port is connected to the return circuit of the remote valves, therefore all return oil is returned to the main hydraulic filter.

There is also a signal port (SL) which requires a signal connection from the implement valve block or service. This is required to signal the PFC pump to increase flow and meet the required demand.

If the tractor has only mechanical remote valves the signal line connection is located on the underside of the end plate (diagram 2).

If the tractor is equipped with one or more electric remote valves the signal line connection is located on top of the end plate (diagram 1).

If the tractor has any number of electronic remote valves a regulated feed (P1) and return (R) are connected to the remote valve end plate (diagram 3)

**NOTE:** *The outlet, return and signal ports are all plugged if the power beyond facility is not being used. A signal check valve is installed as standard under the signal line plug (SL), therefore it is not necessary to install one in the signal line of the additional equipment. This check valve prevents interaction from the other hydraulic valves.*

## Hydraulic Test points

Two M14 test points have been provided on the hydraulic input plate of the remote valves for checking stand-by pressure, main hydraulic pressure and steering pressure.

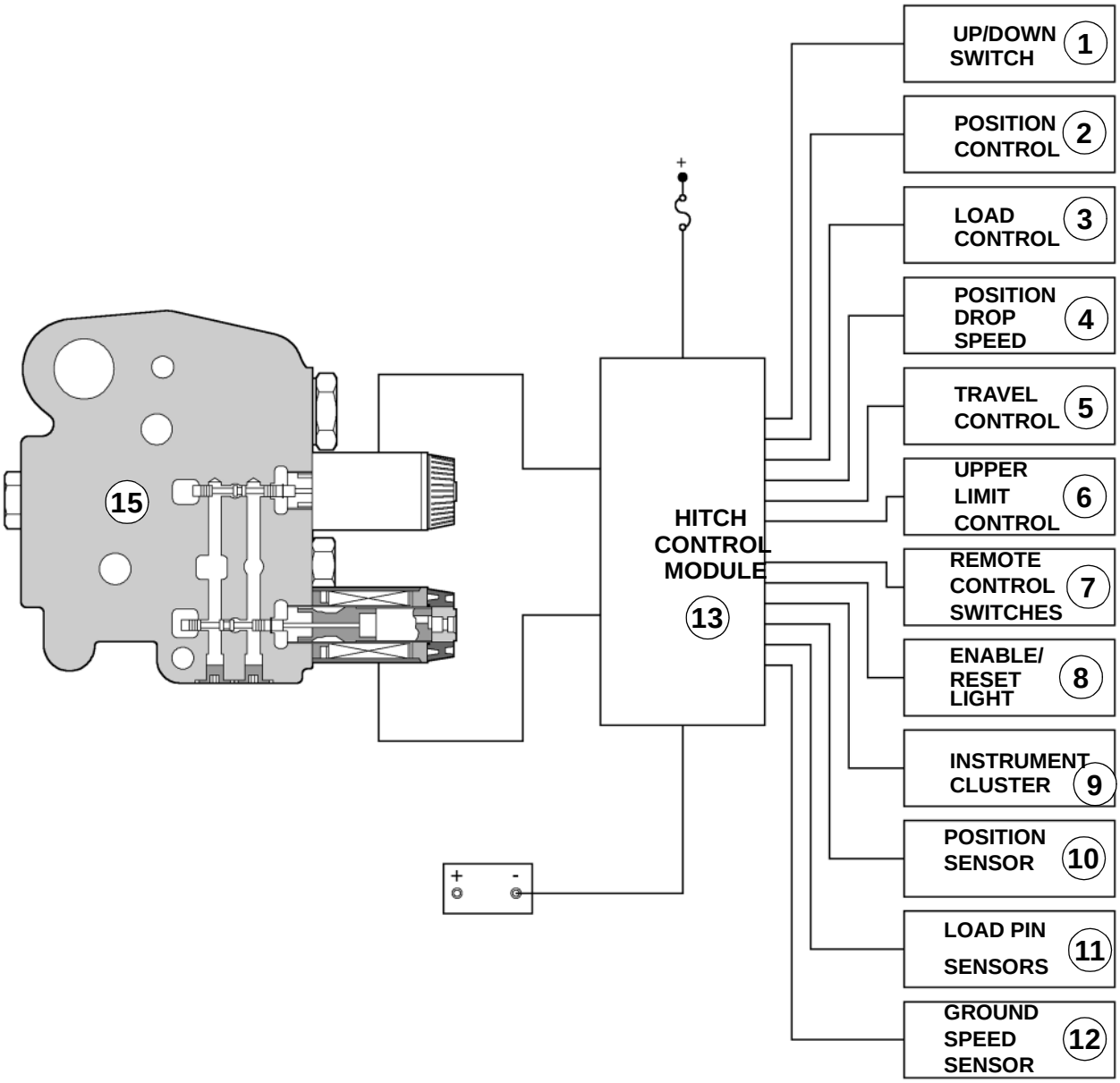
Stand-by, main hydraulic and steering pressure can be checked by installing a suitable fitting into test point (P).

**NOTE:** *Although a test point is provided on the end plate of the auxiliary valves for easy access, it should be noted that any readings found are after the priority valve, and if a fault is present within the priority valve then false readings could be obtained from this point. For full test procedure please refer to section 8001 of this manual*

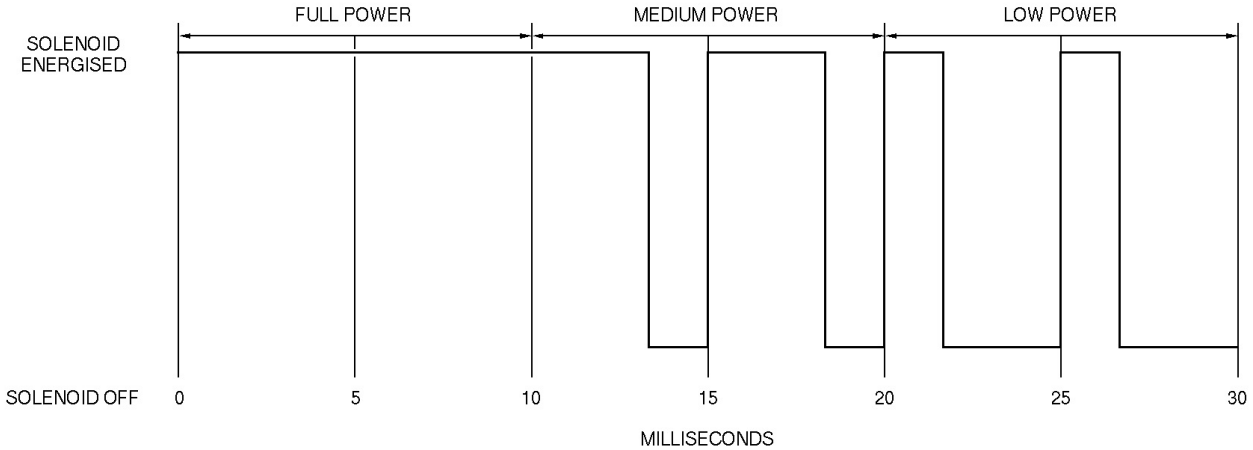
Signal line pressure can be checked by installing a suitable fitting into test point (LS).

https://truckmanualshub.com/






SOLENOID PULSE WITH MODULATION (PWM) CONTROL



https://truckmanualshub.com/



# ELECTRONIC HITCH AND PTO CONTROLLER (EHC)

## General Description

The electronic hitch control (EHC) system consists of:-

A. One up/down switch (1), 5 control knobs (2,3,4,5,6), one enable/reset warning lamp (8).

B. 4 remote switches (7) mounted to the rear of the rear fenders (optional).

C. One hitch position sensor (10) located on the top of the rear PTO housing.

D. Two load pin sensors (11) which are also the lower link pins.

E. One ground speed sensor (12) located on the top of the rear transmission housing.

F. A control module (13) located below the R/H console.

G. The hitch hydraulic control valve (15) located on R.H. side of the rear transmission housing.

The 5 control knobs are connected to potentiometers, the position sensor is also a potentiometer.

The control module is supplied with switched power and also connected to a clean ground.

When the key switch is moved to ON the control module self checks the EHC system. If a fault occurs with the EHC system a fault code will appear on the digital instrument cluster which can be used to determine the location and type of fault to be rectified. For further information refer to Hitch Calibration and Troubleshooting section 10002.

The control module will send electrical supplies to all the potentiometers and sensors. Voltage signals will return from the potentiometers and sensors to the control module according to their current operating settings. The control module will then process this information and according to the preset programming of the module will send an electrical supply to the raise or lower solenoids of the hitch hydraulic control valve to raise or lower the hitch.

## Pulse Width Modulation (PWM)

The control module sends a 12 volt supply to each solenoid, the ground return wire for each solenoid is connected to the control module then to ground according to the operation of the control module.

The control module uses a varying Pulse Width Modulation (PWM) method to control the ground circuit for each solenoid. The control module repeatedly switches the ground circuit on and off very rapidly. This controls the average voltage across the solenoid and controls the speed of raise or lower of the hitch.

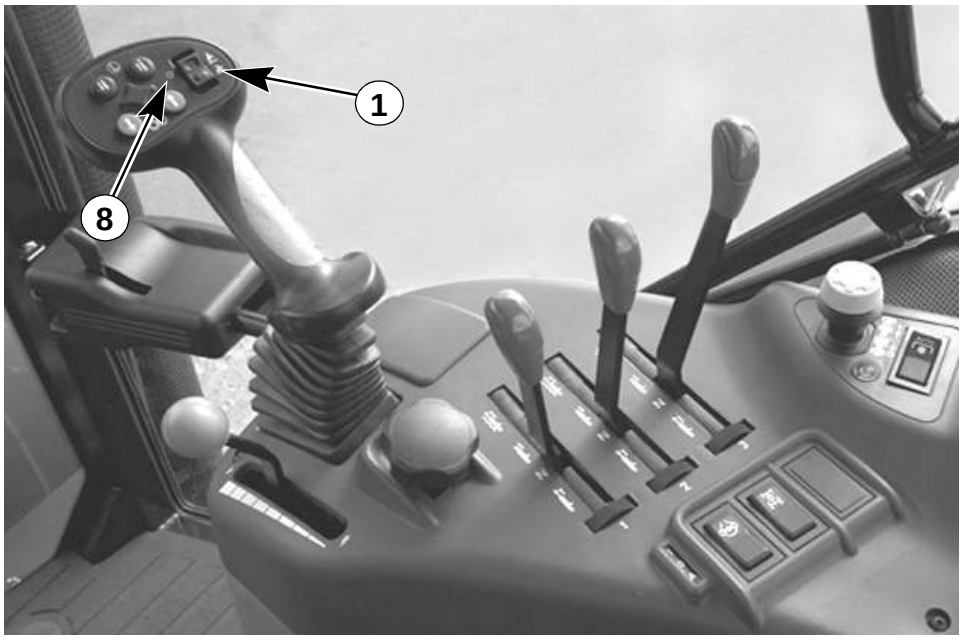
PWM is the length of time (usually in milliseconds) that the earth circuit stays closed which causes the solenoid to be ON. For example the solenoid may cycle ON for 3 milliseconds, then OFF for 2 milliseconds. This cycle can be repeated continually or changed by the control module as required.

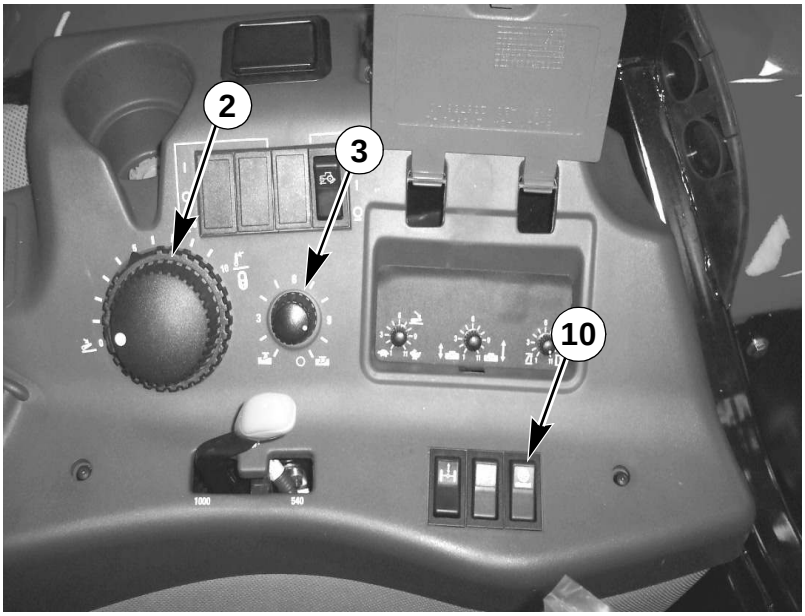
By increasing the PWM ON and reducing the PWM OFF periods the average voltage is increased at the solenoid. This causes the internal spools of the hitch hydraulic control valve to increase the raise or lower speed of the hitch.

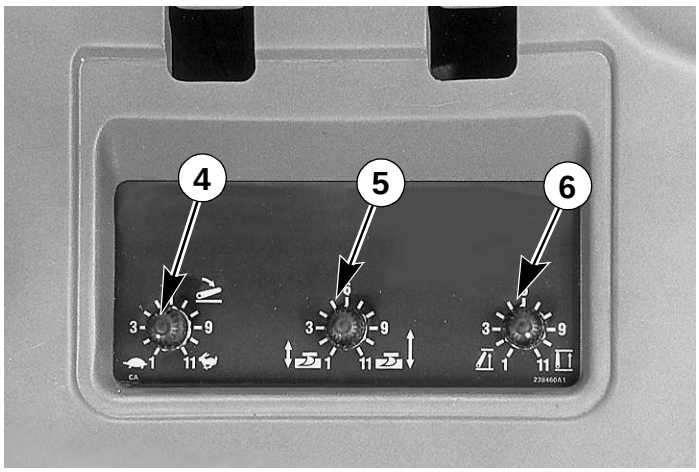
By reducing the PWM ON and increasing the PWM OFF periods the average voltage is increased at the solenoid. This causes the internal spools of the hitch hydraulic control valve to increase the raise or lower speed of the hitch.

https://truckmanualshub.com/





https://truckmanualshub.com/



## Operator Control of the Hitch

The Electronic Hitch Control (EHC) can be operated in one of two modes POSITION CONTROL or LOAD CONTROL.

In position control the hitch moves with the rotation of the position control knob. In load control the EHC moves the hitch to maintain a constant implement load on the tractor in changing soil conditions and terrain.

The operator controls for the EHC system consists of an up/down switch (1), 5 control knobs (2,3,4,5 and 6), an enable/reset light (8), a diagnostic display (9), a ride control switch (10), and 4 remote switches (if equipped).

**Operator Controls**

1. UP/DOWN SWITCH - This switch is used to lower or fully raise the hitch. It has 3 working positions: UP, DOWN, MOMENTARY.

   **UP** - The back of the switch pushed down. This fully raises the hitch from the working position to the transport position (controlled by the UPPER LIMIT STOP). The speed is not adjustable.

   **DOWN** - The switch is in the centre position. This lowers the hitch from the transport position to the working position or the position set with the Position Control Knob. The speed is controlled by the DROP SPEED CONTROL.

   **MOMENTARY** - Double click and hold the switch by pushing the front of the switch into the MOMENTARY position. This will by-pass the DROP SPEED CONTROL setting allowing the hitch to drop at maximum speed. As long as the momentary switch is held, the hitch will continue to drop and will by-pass the “Working Position” setting. This function is beneficial in getting ploughs to penetrate in some soil conditions. When the momentary switch is released, the hitch will automatically return to the “Working or Position” setting. This function is only active when the position control is set in the bottom half of its range.

2. POSITION CONTROL -The control consists of an inner knob and an outer ring. This control is used to;
   A. Enable the EHC System.
   B. Precisely control the position of the hitch.
   C. Set a “Bottom” limit.
   D. Provide Hitch transport lock.

   INNER KNOB - Used to precisely control the position of the hitch. Turning the knob clockwise will raise the hitch or counter-clockwise will lower the hitch.

   Press the PUSH-BUTTON in on the side of the knob, to bypass the “Bottom” limit without changing the setting on the Outer Ring. The PUSH -BUTTON is also used when the knob is turned fully clockwise to lock the knob in the TRANSPORT position.

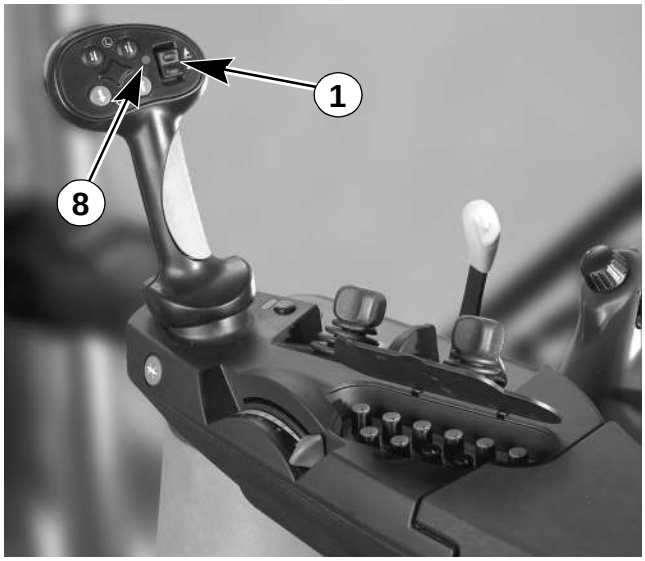
   OUTER RING - This is an adjustable mechanical stop for the inner knob. The setting can be bypassed with the push-button on the inner knob.

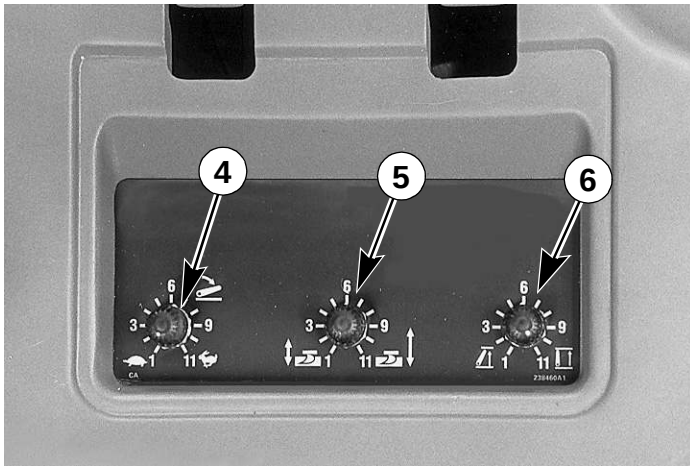
3. LOAD CONTROL - This knob is used to set the load on the tractor or implement depth. Turning the knob clockwise will increase the load and implement depth. Turning the knob counter-clockwise will reduce the load and implement depth. Turning the knob fully clockwise to the stop (11) sets the EHC System in the POSITION CONTROL MODE. This (11) position is used to prevent unwanted hitch movement when the tractor is moving at more than 0.8km/h (0.5 m.p.h.).

4. DROP SPEED CONTROL - This knob is used to adjust the lowering speed of the hitch when using either the UP/DOWN SWITCH or the POSITION CONTROL knob. Set the DROP SPEED according to the implement weight and operating requirement. This control can be over-ridden by double clicking and holding the UP/DOWN SWITCH in the MOMENTARY position.

https://truckmanualshub.com/








https://truckmanualshub.com/



5. TRAVEL CONTROL - This knob is used to adjust the amount of hitch movement (depth variation) allowed in the LOAD CONTROL MODE. Turning the knob clockwise will increase the hitch movement. This allows closer control of the load on the tractor and enables the hitch to follow soil contours better. Turning the knob counter-clockwise will decrease the amount of hitch movement. Set the control in the lower range when using semi-mounted implements or on flat terrain where the amount of hitch movement can be restricted without affecting performance.
6. UPPER LIMIT CONTROL - This knob is used to adjust the maximum transport height of the hitch. It limits the transport height when using either the UP/DOWN SWITCH or POSITION CONTROL knob. A setting of "1" allows the hitch to raise only half the way, while a setting of "11" allows full transport height to be reached. This control can be used to limit hitch height with fully-mounted PTO driven implements where the angle of the Implement Input Driveline (IID) joints need to be limited to prevent noise, chatter and damage due to excessive angles. Turning the knob clockwise increases the transport height. Turning the knob counter-clockwise decreases the transport height.

**IMPORTANT:** *When using the Automatic Hitch the UPPER LIMIT STOP* ***MUST ALWAYS*** *be rotated fully clockwise to the stop position (position "11").*

7. HITCH REMOTE SWITCHES (If Equipped) - The remote switches can be used to raise or lower the hitch from the rear of the tractor. This can be useful for making small adjustments when connecting implements to the three point hitch. Press the top switch (1) to raise the hitch. Press the bottom switch (2) to lower the hitch.

   When the switches are released, the hitch will stop at the selected position until the hitch controls on the right hand side console inside the cab are used to operate the hitch. The hitch will have to be enabled with the position control knob.

   If both switches are pressed together the hitch will stop. When the switches are released, the EHC system will reset in approximately one second. The hitch switches can then be used in the normal manner.

**NOTE:** *The EHC system must be enabled with the hitch position control knob after each use of the remote hitch control switches.*

> ⚠ **WARNING:** *Stand well clear of the linkage or implement when operating the external controls or injury can result from contact with moving parts.*

8. ENABLE/RESET LIGHT- This lamp is located in the UP/DOWN SWITCH and is used to indicate the condition of the EHC SYSTEM. It will stay ON for 2 seconds after the engine has started for a bulb check. The indicator has 2 functions:

   FLASHING - The hitch needs to be enabled. The actual position of the hitch is not the same as the setting of the POSITION CONTROL knob.

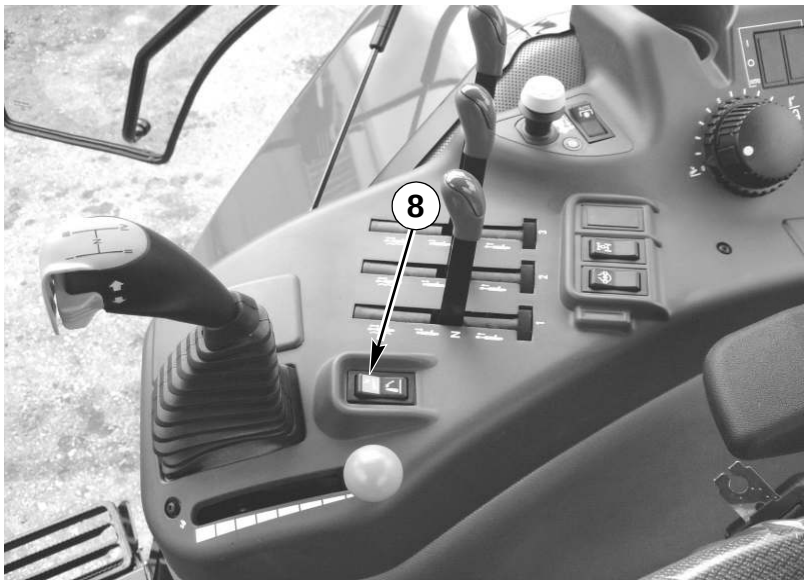
   **To enable the EHC system:** Set the UP/DOWN switch to DOWN. Rotate the POSITION CONTROL knob until the control knob and the actual position of the hitch are the same. When the indicator lamp stops flashing the EHC system is enabled. The hitch will follow the movement of the POSITION CONTROL knob, when the hitch UP/DOWN switch is in the DOWN position.

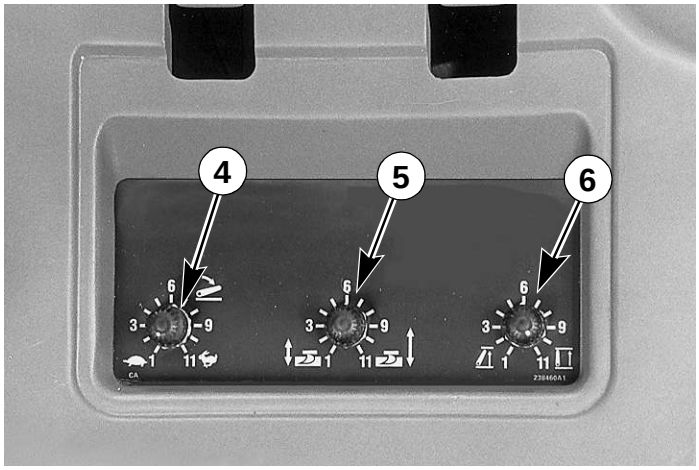
   CONTINUOUSLY ON - Look for the diagnostic code showing in the Diagnostic Display (9), under the cover on the right console. Refer to Hitch Calibration and Troubleshooting Section 10002.

9 RIDE CONTROL SWITCH - This switch has 3 positions ON, OFF and MOMENTARY. In the OFF (centre) position ride control is off. In the ON three-point hitch mounted implement bounce is reduced by the electronic controller counteracting the shock loading by raising or lowering the three-point hitch. in the MOMENTARY position the hitch upper limit setting is overridden and the hitch will lift to it's maximum height. The MOMENTARY position should be used when latching and unlatching the automatic pick-up hitch.

https://truckmanualshub.com/





https://truckmanualshub.com/



## Operating in Position Control

The tractor and implement must be operated in the field to select the correct position of the hitch. Do the following steps:

Set the Position Control Knob (2) to the transport lock position. Set the Drop Speed Control (4) to “6” and the Upper Limit Control (6) to “1”. Set the Travel Control (5) to the maximum setting “11”.

Set the Load Control (3) to “11”.

**IMPORTANT:** *If the Load Control is set to any other position the hitch may raise when the tractor speed is increased to more than 0.8 km/h (0.5 m.p.h.)*

Set the UP/DOWN switch (1) in the DOWN position. If the enable/reset lamp (8) on the switch flashes, move the hitch POSITION CONTROL KNOB (2) to match the actual hitch position.

Adjust the UPPER LIMIT CONTROL (6) to set the desired hitch raised position. A setting of “11” corresponds to the hitch being fully up.

Operate the tractor and implement in the field. Set the implement depth with the POSITON CONTROL KNOB (2). The rate of hitch movement is determined by the amount the knob is moved. If the knob is moved slowly a precision control mode is provided to move the hitch slowly to match the knob.

If the position control knob is moved quickly the hitch will lower at the set drop rate. Move the outer ring to set bottom or lowest hitch position desired. This will provide a reference point for returning the knob to the original implement depth position each time the knob is moved and also to maintain the same depth.

Use the UP/DOWN switch (1) in the UP position to temporarily raise the implement without changing any of the hitch position adjustments. Use the DOWN position to return the implement to its original position.

Adjust the DROP SPEED (4) until the implement lowers at the speed desired.

**IMPORTANT:** *Always use the Hitch position control knob (2) to raise the hitch for road transport put the control knob in the transport lock position and the up/down switch (1) in the up position.*

## Operating in Load Control (Lower Link Sensing)

The EHC system will automatically adjust the hitch position to maintain a constant implement load on the tractor as the implement travels through varying soil conditions and terrain. If an implement travels through heavy soil the increased load is sensed at the lower links and the hitch will raise the implement in small increments.

**NOTE:** *The tractor must be moving at a speed of more than 0.8 km/h (0.5 m.p.h.) for the load controls to function.*

**NOTE:** *If the implement has gauge wheels, move the Hitch Position Control Knob (2) fully counter-clockwise.*

Turn the LOAD CONTROL Knob (3) counter-clockwise to decrease the load setting until the hitch begins to raise.

*The load control is OFF at the (0) position and the hitch will operate in the position control mode.*

Move the hitch POSITON CONTROL knob (2) fully counter-clockwise.

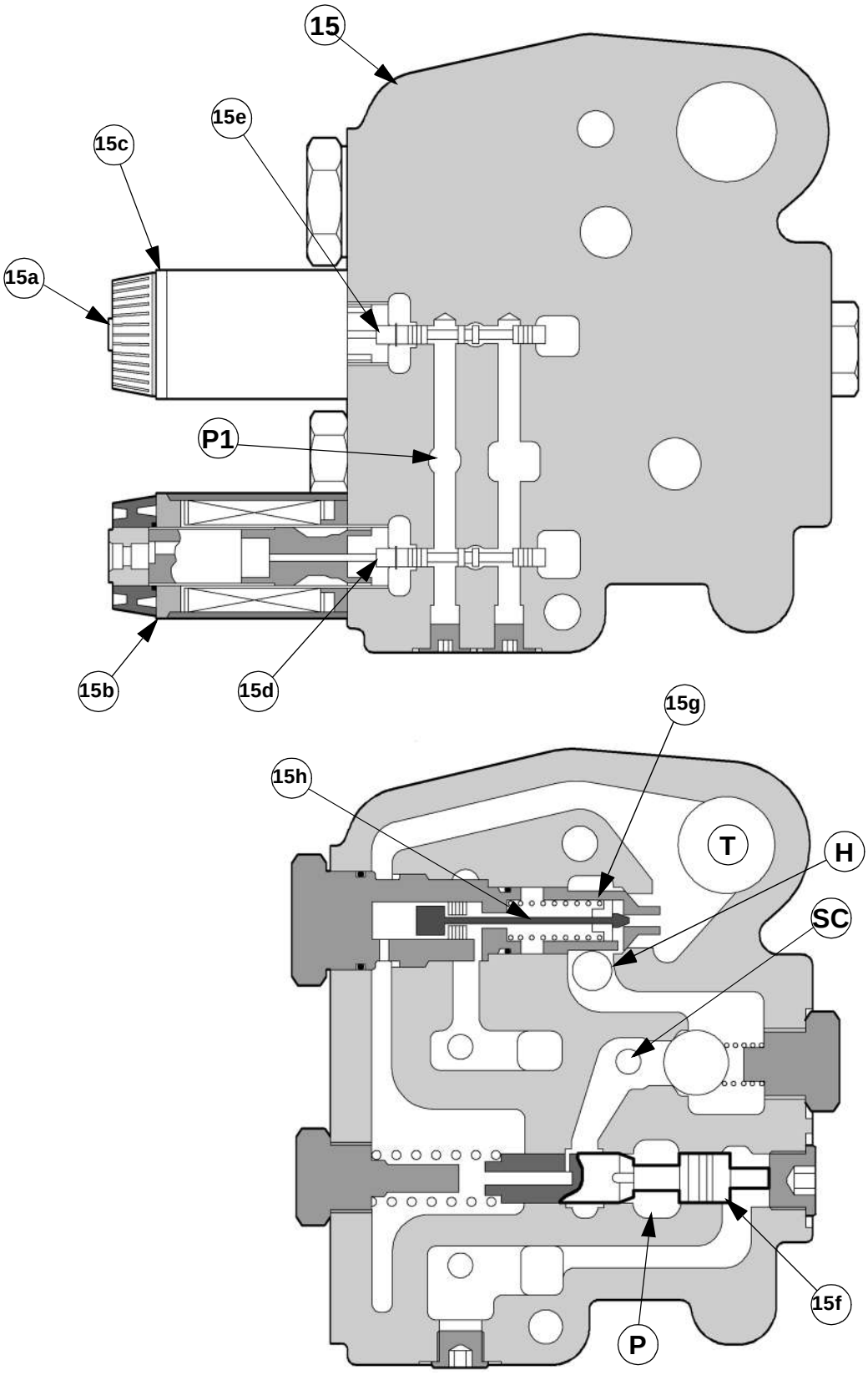
**NOTE:** *In fields with intermittent hard and soft soil conditions, a “Bottom” depth may be set by moving the Hitch Position Control knob to the lowest implement operating depth.*

Turn the TRAVEL CONTROL knob (5) counter-clockwise to reduce the changes in working depth with changing loads.

**NOTE:** *A typical operation for a fully mounted implement is a setting of “7” to “10”.*

https://truckmanualshub.com/





https://truckmanualshub.com/



# HITCH HYDRAULIC CIRCUIT

## General Description

The hitch hydraulic circuit consists of the hitch control valve (15) located on the right hand side of the rear transmission housing, the internal lift cylinder (16), a hitch relief valve (17) located in the internal lift cylinder base plate and an external assistor cylinder (if equipped).

The hitch valve is supplied at port (P1) with oil flow from the regulated circuit at 19 to 21 bar and also a supply at port (P) with oil flow from the PFC pump.

When the hitch is lifting the working pressure of the hitch is transmitted through a signal check valve located in port (SC), into the signal line (SL) to the signal the PFC pump.

The hitch control valve includes the following components:

**Raise and Lower Solenoids (15a and 15b)**

These solenoids when energized by the hitch electronic controller will move the raise or lower primary spools (15d and 15e) and allow oil at regulated pressure to move the raise or lower secondary spools (15f and 15g).

The solenoids are operated by Pulse Width Modulation (PWM) electrical supply. This allows accurate control of the how quick and how far the primary spools are moved and enables precise control of the hitch movement.

**Primary Raise and lower spools (15d and 15e)**

These spools are controlled and operated by the raise and lower solenoids. When a primary spool is moved it will allow a controlled oil flow of up to 19 to 21 bar to be directed to the raise or lower secondary spool. This will cause the raise or lower secondary spool to move and allow oil flow to or from the hitch lift cylinder/s.

**Secondary Raise Spool (15f)**

This spool is controlled and moved to the left against spring pressure by oil pressure from the primary spool. When moved it will direct oil flow from the PFC pump at port (P) to the hitch cylinder/s at port (H) to raise the hitch.

**Secondary Lower Spool (15g)**

The secondary lowering spool is pilot operated. The pilot poppet (15h) is controlled and unseated against spring pressure by oil pressure from the primary spool. When the pilot poppet is unseated it allows a pressure differential at each end of the secondary lowering spool (15g) which unseats to the left. This allows the oil in the hitch cylinder/s flow to through the hitch control valve from port (H) to tank at port (T).

**Manual Raise or Lower Control**

Should it become necessary to manually raise or lower the hitch, this can be accomplished by inserting a small drift punch into the centre of the hitch Raise or Lower solenoid at (15a), while the engine is running. This will cause the appropriate pilot spool to move and cause the hitch to raise or lower.

## Hitch in Neutral

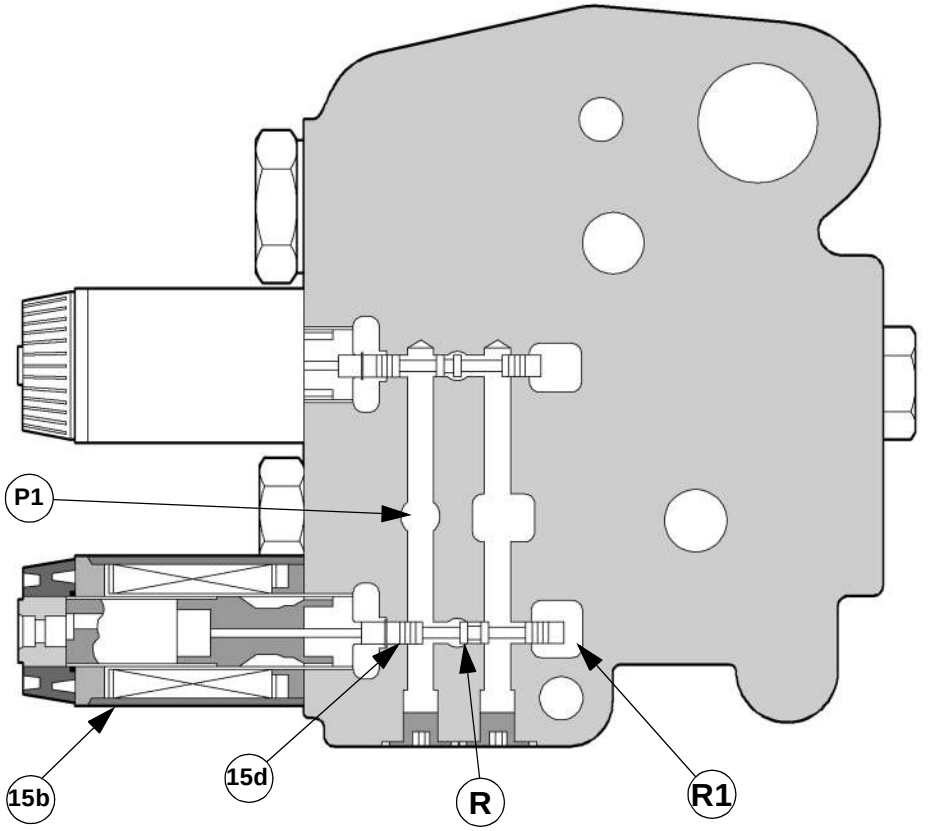
The hitch control valve is a closed centre valve. With no power at both solenoids the primary spools are in their neutral position and there is no regulated pressure to the secondary raise or lower spools.

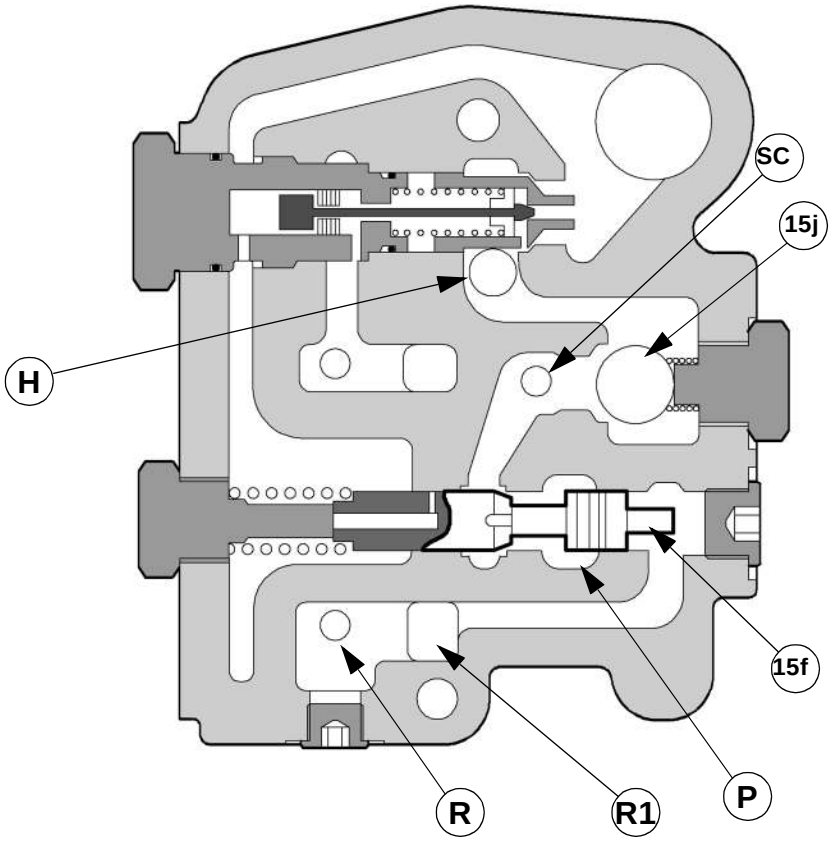
The lowering spool spring holds the spool on its seat. There is equal lift cylinder pressure at both ends of the spool due to access through an orifice in the left side of the spool. This prevents the hitch lowering.

The raise spool spring holds the spool to the right preventing flow from the PFC pump to the hitch lift cylinder.

https://truckmanualshub.com/





https://truckmanualshub.com/



## Hitch Raising

When the hitch is moved to raise, an electrical signal is sent to the hitch controller. The hitch controller will send power (PWM) to the raise solenoid (15b) energizing the solenoid.

With the raise solenoid energized, the primary raise spool (15d) is moved to the right by magnetic force. Regulated pressure supply at port (P1) is directed past the spool to port (R) then to the right end of the raise secondary spool (15f) and also through port (R1) to the right end of the primary raise spool (15d). When this pressure increases to equal the magnetic force of the solenoid the primary raise spool will move to the left sufficient to stabilise the hydraulic pressure.

This hydraulic pressure acting on the right end of the secondary spool (15f) moves the spool to the left against spring pressure and allows oil supply from the main pump at port (P) to flow past the spool to the signal line check valve (SC) and also to the check valve (15j).

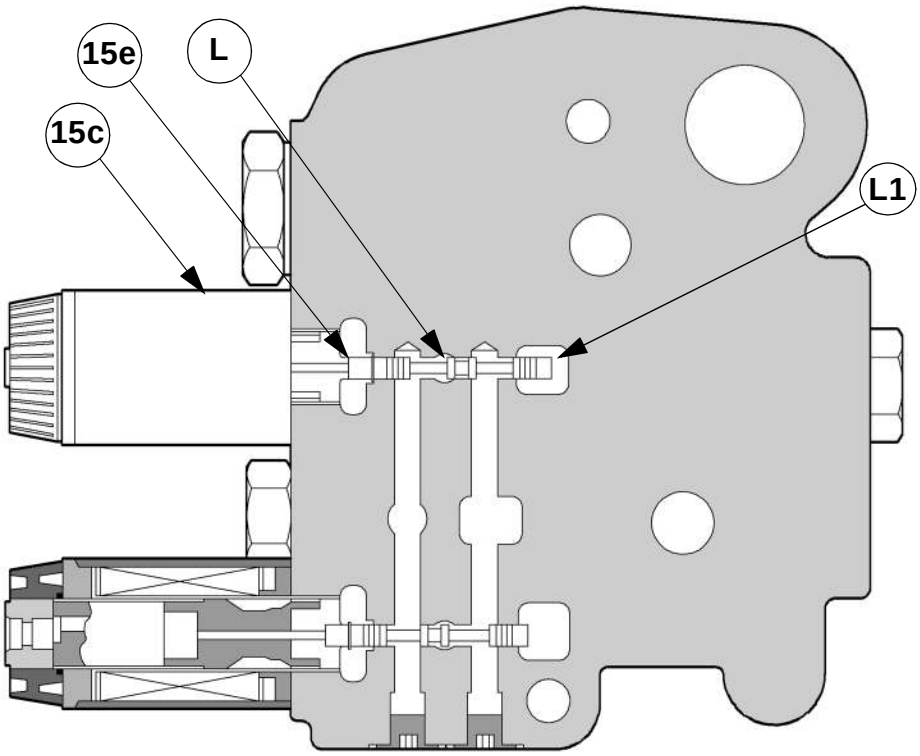
Oil flows through the signal line to signal the PFC pump to increase flow to meet the demand.

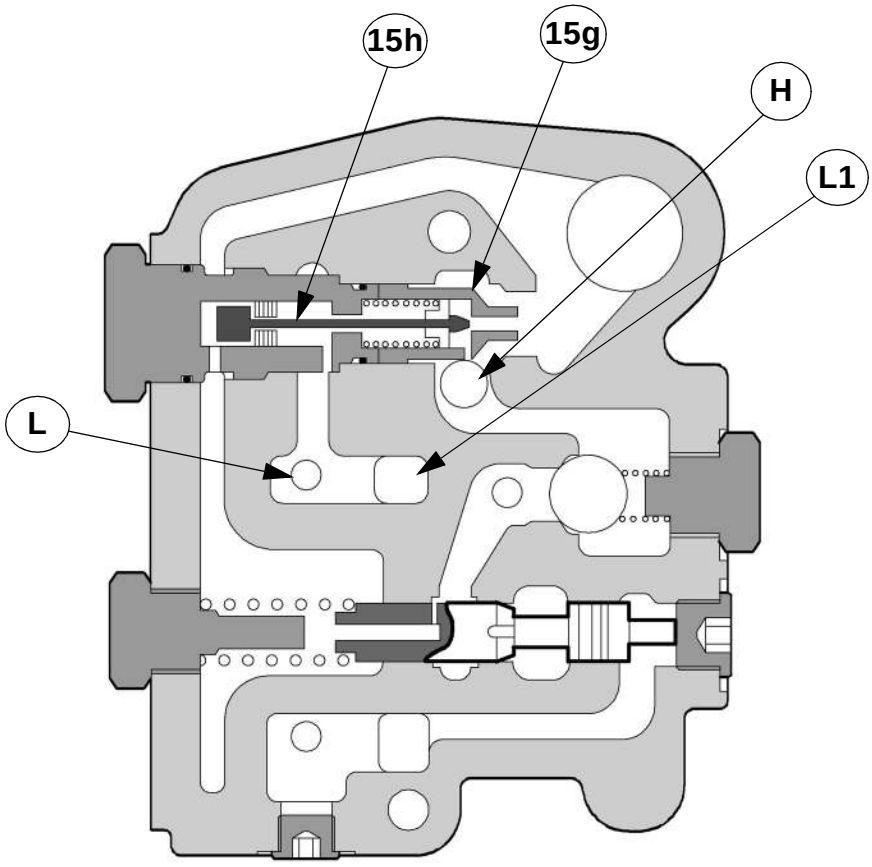
When the supply pressure at the check valve (15j) increases to above the hitch cylinder pressure, the check valve will open and allow flow through port (H) to the hitch cylinder/s.

The raise speed of the hitch is controlled by the PWM of the raise solenoid which then controls the oil pressure acting on the right end of the secondary spool. This controls the distance the secondary raise spool moves against its spring and therefore the amount of flow past the spool to the hitch cylinder/s.

https://truckmanualshub.com/





https://truckmanualshub.com/



## Hitch Lowering

When the hitch is moved to lower, an electrical signal is sent to the hitch controller. The hitch controller will send power (PWM) to the lower solenoid (15c) energizing the solenoid.

With the lower solenoid energized, the primary lower spool (15e) is moved to the right by magnetic force. Regulated pressure supply at port (P1) is directed past the spool to port (L) then to the right end of the pilot poppet piston (15h) in the lowering secondary spool and also through port (L1) to the right end of the primary lowering spool (15e). When this pressure increases to equal the magnetic force of the solenoid the primary spool will move to the left sufficient to stabilise the hydraulic pressure.

This hydraulic pressure acting on the right end of the pilot poppet piston (15h) moves the piston and poppet to the left unseating the pilot poppet against spring pressure. Oil flows to tank (T) past the unseated pilot poppet and due to the orifice in the side of the lowering secondary spool (15g) the oil pressure drops at the spring end of this spool. The lift cylinder hydraulic pressure acting around the right of the lowering secondary spool moves the spool to the left and allows oil flow from the lift cylinder through port (H) to tank (T).

The lowering speed of the hitch is controlled by the PWM of the lowering solenoid which then controls the oil pressure acting on the right end of the pilot poppet. This controls the distance the pilot poppet moves against its spring and therefore the amount of flow past the secondary lowering spool to tank.

https://truckmanualshub.com/



# Section 8001

## HYDRAULIC TROUBLESHOOTING AND SCHEMATICS

## XTX Series Tractors

McCORMICK

SM 8-15021

© 2005 McCormick Tractors International Limited.
April 2005 (Revised September 2006)

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIAL TOOLS ..... 3

HYDRAULIC SYSTEM TROUBLESHOOTING
- PFC Pump Problems ..... 4
- Rear Hitch Problems ..... 6
- Signal Circuit Problems ..... 8
- Remote Valve Circuit Problems ..... 9
- Steering Problems ..... 12
- Brake Problems ..... 14
- Hydraulic Trailer Brake Problems (If Equipped) ..... 15
- PTO Problems ..... 15
- Differential Lock Problems ..... 16
- MFD Problems ..... 16
- Hydraulic System Cooling Problems ..... 17
- Independent Front Suspension Axle Problems ..... 17

HYDRAULIC SYSTEM DIAGNOSTIC TESTING
- Test 1 - Regulated Circuit Leakage Test ..... 20
- Test 2 - Charge Pump Pressure Test ..... 24
- Test 3 - Charge Pump Flow Test ..... 26
- Test 4 - Low Pressure Standby Test ..... 28
- Test 5 - Maximum Pressure Test ..... 32
- Test 6 - Pump Flow Test ..... 34
- Test 7 - Steering Function and Pressure Test ..... 36
- Test 8 - Regulated Pressure Test ..... 38
- Test 9 - Powershift Valve Pressure Test ..... 40
- Test 10 - MFD Pressure Test ..... 42
- Test 11 - PTO Supply Pressure Test ..... 44
- Test 12 - Differential Lock Pressure Test ..... 46
- Test 13 - Forward and Reverse Clutch Pressure Test ..... 48
- Test 14 - Rear Hitch Pressure Test ..... 50

HYDRAULIC SCHEMATIC (XTX Tractors) ..... 52
- Hydraulic Circuit Components ..... 52

https://truckmanualshub.com/



# SPECIAL TOOLS

**FLOWMETER, 0-300 L/MIN (0-75 US GPM) OR EQUIVALENT**

**1002T2 HYDRAULIC DIAGNOSTIC AND PRESSURE TEST KIT**

**MC2545 1-7/16” M33 ADAPTER**
**(SAUER SUNSTRAND PUMP)**

**1039T1 1-7/16” M33 ELBOW ADAPTER**
**(REXROTH PUMP)**

https://truckmanualshub.com/



# HYDRAULIC SYSTEM TROUBLESHOOTING

When troubleshooting an electro-hydraulic system problem check for electrical power to the solenoid coils as they are activated. This will isolate hydraulic system problems from electrical problems. Use a high impedance multimeter for any electrical checks.

Before making any hydraulic system tests, make sure transmission is filled to correct level, hydraulic filters are clean and the hydraulic oil temperature is above 49℃.

## PFC Pump Problems

### PROBLEM: Poor overall hydraulic performance (low flow).

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Low hydraulic oil level in transmission. | A. Fill transmission to correct level. |
| B. Blocked main hydraulic filter. | B. Change main hydraulic filter. |
| C. Blocked suction screen. | C. Check and clean suction screen. |
| D. Low lubrication circuit pressure. | D. Carry out Test 2 - Charge Pump Pressure Test. |
| E. Low charge pump flow. | E. Carry out Test 3 - Charge Pump Flow Test. |
| F. PFC pump has internal wear or damage. | F. Inspect and correct problem as necessary. Carry out Test 6 - Pump Flow Test |
| G. Pump compensator spool stuck or binding. | G. Inspect and correct problem as necessary. Carry out Test 4 - Low Pressure Standby Test |
| H. Pump main relief spool stuck or binding. | H. Inspect and correct problem as necessary. Carry out Test 5 - Maximum Pressure Test |
| I. Signal line filters blocked. | I. Inspect and correct problem as necessary. |
| J. Signal line fault | J. Check the hitch, remote valve, trailer brake and suspension check valves.<br>Check the priority valve 0.8 mm dynamic sensing orifice. |
| K. Defective pump drive. | K. Refer to PTO Pump Drive Shaft and Hydraulic Pump Drive Gear, Section 6023. |

### PROBLEM: P.F.C. pump remains on high pressure standby

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Steering hand pump is not centered. | A. Center steering hand pump. |
| B. Faulty steering hand pump. | B. Check the steering hand pump, refer to Section 5002. |
| C. Blocked steering 0.5mm bleed orifice. | C. Check the remote auxiliary valve 0.5 mm bleed orifice. |
| D. Blocked steering valve signal hose. | D. Inspect and correct problem as necessary. |
| E. Blocked steering valve return tube or adaptors. | E. Inspect and correct problem as necessary. |
| F. Remote lever(s) not in full neutral position. | F. Correct remote lever position. |
| G. Trailer Brake valve not in neutral position. | G. Inspect and correct problem as necessary. |
| H. Hitch valve not in neutral position. | H. Inspect and correct problem as necessary. |
| I. Suspension axle control valve not in neutral position. | I. Inspect and correct problem as necessary. |
| J. Pump compensator spool is binding. | J. Remove compensator repair/replace as necessary. Carry out Test 4 - Low Pressure Standby Test |
| K. PFC pump has internal wear or damage. | K. Inspect and correct problem as necessary. |

https://truckmanualshub.com/



## PROBLEM: PFC pump emits excessive noise.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Low hydraulic oil level in transmission. | A. Fill transmission to correct level. |
| B. Blocked suction screen. | B. Check and clean suction screen. |
| C. Blocked main hydraulic filter. | C. Change main hydraulic filter. |
| D. Aerated oil. | D. Check condition of oil. Check the charge pump inlet for air infiltration. |
| E. Low lubrication pressure. | E. Carry out Test 2 - Charge Pump Pressure Test. |
| F. Low charge pump flow. | F. Carry out Test 3 - Charge Pump Flow Test. |
| G. Cables contacting on hydraulic pipework. | G. Check all cables and re-route cables or secure as necessary. |
| H. .Pump remains on high pressure standby | H. Refer to P.F.C. pump remains on high pressure standby on Page 4. |
| I. PFC Pump has internal wear or damage. | I. Carry out the following:<br>Test 4 - Low Pressure Standby Test,<br>Test 5 - Maximum Pressure Test and<br>Test 6 - Pump Flow Test. |
| J. Defective pump drive. | J. Refer to PTO Pump Drive Shaft and Hydraulic Pump Drive Gear, Section 6023. |

## PROBLEM: P.F.C. pump will not develop high pressure standby condition, but will run at reduced pressure levels.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Pump main relief valve spool stuck or binding out of adjustment. | A. Inspect, correct problem and adjust as necessary. Carry out Test 5 - Maximum Pressure Test |
| B. Leaking signal check valve. | B. Carry out Test 5 - Maximum Pressure Test. |
| C. Blocked signal line filter. | C. Check and clean signal line filter. |
| D. Pump compensator spool stuck or binding. | D. Inspect and correct problem as necessary. Carry out Test 4 - Low Pressure Standby Test |
| E. Remote valve cables out of adjustment. | E. Adjust remote valve cables, refer to Section 9001. |
| F. Internal pump problem. | F. Inspect and correct problem as necessary. |

https://truckmanualshub.com/



# Rear Hitch Problems

**NOTE:** *Always check the Hitch diagnostic error codes. Refer to Section 10002.*

## PROBLEM: Hitch will not raise (Remotes function correctly)

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Check hitch valve pilot pressure. | A. Carry out Test 8 - Regulated Pressure Test. |
| B. Hitch valve raise pilot spool is binding. | B. Manually override pilot spool. Attempt to shift spool by pushing with a small Parallel Pin Punch through the hole in the end of raise solenoid assembly - do not apply excessive force. |
| C. Hitch valve raise spool is stuck or binding. | C. Service the hitch valve, refer to Section 8006 Hydraulic Valves. |
| D. Hitch valve lower pilot spool is binding. | D. Manually override pilot spool. Attempt to shift spool by pushing with a small Parallel Pin Punch through the hole in the end of raise solenoid assembly - do not apply excessive force. |
| E. Hitch valve lower spool is stuck open. | E. Service the hitch valve, refer to Section 8006 Hydraulic Valves. |
| F. Hitch check valve blocked. | F. Inspect and correct problem as necessary, refer to Section 8006 Hydraulic Valves |
| G. Hitch lift cylinder seals leaking | G. Service the hitch cylinder. |
| H. Hitch cross shaft seized | H. Service the hitch cross shaft. |
| I. Hitch lift cylinder(s) seized | I. Service the hitch cylinder. |
| J. Leakage in hitch cylinder/cushion relief. | J. Fully lower the hitch. Place a suitable clean oil container under the cushion relief valve mounting block.<br><br>Inspect the cushion relief valve and hitch cylinder, repair or replace as necessary. |

https://truckmanualshub.com/



## PROBLEM: Hitch will not lower.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Check hitch valve pilot pressure. | A. Carry out Test 8 - Regulated Pressure Test. |
| B. Hitch valve raise spool is stuck or binding. | B. Service the hitch valve, refer to Section 8006 Hydraulic Valves. |
| C. Hitch valve lower pilot spool is stuck or binding. | C. Manually override pilot spool. Attempt to shift spool by pushing with a small Allen head wrench through the hole in the end of raise solenoid assembly - do not apply excessive force. |
| D. Hitch valve raise spool is stuck or binding. | D. Service the hitch valve, refer to Section 8006 Hydraulic Valves. |
| E. Hitch cross shaft seized | E. Service the hitch cross shaft. |
| F. Hitch lift cylinder(s) seized | F. Service the hitch cylinder. |

## PROBLEM: Hitch leaks down.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Leakage in hitch cylinder/cushion relief, or leakage in hitch valve. | A. Determine whether leakage is hitch cylinder, or hitch valve.<br>Raise the hitch along with a sufficient load to duplicate the problem. Support the hitch with correct lifting equipment in the fully raised position.<br>Disconnect both ends of the upper hitch supply tube(s). Cap the hitch valve supply port and the lower hitch supply tube. Remove the hitch support.<br>If the hitch continues to leak down the problem is in the hitch cylinder, or cushion relief. Continue with possible cause B.<br>If the hitch no longer leaks down the problem is in the hitch valve. Continue with possible cause C. |
| B. Leakage in hitch cylinder/cushion relief. | B. Fully lower the hitch. Place a suitable clean oil container under the cushion relief valve mounting block.<br>Inspect the cushion relief valve and hitch cylinder, repair or replace as necessary. |

continued....

https://truckmanualshub.com/



| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| C. Leakage is in the hitch valve. | C. Support the hitch with correct lifting equipment in the fully raised position. Connect the upper hitch supply tube. Remove the hitch support and fully lower the hitch.<br><br>Service the hitch valve, refer to Section 8006 Hydraulic Valves.<br><br>Remove the load check plug, spring and ball. Inspect the load check seat within the valve body. If the load check seat is damaged the hitch valve must be replaced.<br><br>Next remove the lower secondary spool assembly. The secondary spool assembly must be replaced as a unit. |

## Signal Circuit Problems

### PROBLEM: System performance is poor for all main PFC pump high pressure circuits:

A. Only one remote section is operating correctly.

B. Only the rear hitch is operating correctly.

C. Only the trailer brake is operating correctly.

D. Only the independent front suspension axle is operating correctly.

- Disconnect the signal line for the operating circuit and plug/cap the connectors. Check system performance. If the system performance has improved continue with Possible Causes/Procedure below.

**NOTE 1:** *If only the steering system is operating correctly the steering priority spool in the priority/regulator valve is probably binding, or the steering priority spool pilot orifice is blocked.*

**NOTE 2:** *If only the steering system is NOT operating correctly disconnect and cap all the signal line tubes and hoses, EXCEPT the pump and steering signal lines. Check the operation of the steering, if the steering now operates correctly, the problem is with one of the disconnected circuits. Connect and check the operation of the steering for each of the disconnected circuits in turn until the circuit with the problem is identified.*

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Faulty signal check valve in the functioning remote section. | A. Service the remote valve section, refer to Section 8008 Remote Valves. |
| B. Faulty signal check valve in the hitch valve. | B. Service the hitch valve, refer to Section 8006 Hydraulic Valves. |
| C. Faulty signal check valve in the trailer brake valve (If equipped). | C. Service the hydraulic trailer brake valve, refer to Section 7004 Hydraulic Trailer Brake Valve. |
| D. Faulty signal check valve in the Suspension axle control valve (if equipped). | D. Clean or replace the signal check valve connector in the Suspension axle control valve body. |
| E. Faulty signal check valve in the priority valve. | E. Service the priority regulator valve, refer to Section 8006 Hydraulic Valves. |
| F. Faulty signal check valve in cab suspension (If fitted). | F. Clean or replace the signal check valve in cab suspension. |

https://truckmanualshub.com/



# Remote Valve Circuit Problems

**NOTE:** *Always check a remote circuit problem by switching remote sections couplers (if equipped). If another remote section works the hydraulic system is operating correctly. Check the signal check on the remote section that works.*

## PROBLEM: Low remote valve pressure and flow at all but one remote valve section.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Faulty signal check in good remote valve section. | A. Service the remote valve section, refer to Section 8008 Remote Valves. |

## PROBLEM: Remote valve lever(s) will not automatically return to neutral.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Mechanical interference on valve linkage. | A. Inspect and correct problem as necessary. |
| B. Low maximum pressure setting on PFC pump. | B. Carry out Test 5 - Maximum Pressure Test. |
| C. Faulty detent assembly. | C. Service the remote valve section, refer to Section 8008 Remote Valves. |
| D. Bent/damaged remote valve spool. | D. Service the remote valve section, refer to Section 8008 Remote Valves. |
| E. Excessive torque on valve mounting bolts. | E. Check bolt torque. |
| F. Sticking or excessive mounting torque on operating cables. | F. Check cable mounting nut torque, free off or replace cable as necessary. |

## PROBLEM: Remote valve lever(s) will not go into, or stay in detent.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Remote valve detent setting is adjusted too low. | A. Adjust detent setting. |
| B. Mechanical interference on valve linkage. | B. Check the linkage and correct as necessary. |
| C. Faulty detent assembly. | C. Service the remote valve section, refer to Section 8008 Remote Valves. |
| D. Incorrectly adjusted remote valve cables. | D. Adjust remote valve cables, refer to Section 9001 |

## PROBLEM: Implement will not raise.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Couplers are not connected correctly. | A. Check coupler connections. |
| B. Excessive load. | B. Reduce load. |
| C. Remote valve supply problem. | C. Carry out the following tests<br>Test 4 - Low Pressure Standby Test<br>Test 5 - Maximum Pressure Test |
| D. Faulty load check valve. | D. Service the remote valve section, refer to Section 8008 Remote Valves. |
| E. Broken or incorrectly adjusted remote valve cable. | E. Adjust or replace cable as necessary, refer to Section 9001. |

## PROBLEM: Implement raises but too slowly (low flow).

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Flow control is incorrectly adjusted or sticking. | A. Adjust or repair flow control as necessary. |

https://truckmanualshub.com/



| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| B. Excessive load. | B. Reduce load. |
| C. Low supply flow to remote valve. | C. Carry out the following tests<br>Test 4 - Low Pressure Standby Test<br>Test 5 - Maximum Pressure Test |
| D. Faulty load check valve causing excessive back pressure. | D. Service the remote valve section, refer to Section 8008 Remote Valves. |
| E. Incorrectly adjusted remote valve cables. | E. Adjust remote valve cables, refer to Section 9001 |

## PROBLEM: Implement will not lower.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Couplers are not connected correctly. | A. Check coupler connections. |
| B. Implement couplers are not compatible with tractor couplers. | B. Check implement coupler type. |
| C. Faulty load check valve. | C. Service the remote valve section, refer to Section 8008 Remote Valves. |
| D. Incorrectly adjusted remote valve cables. | D. Adjust remote valve cables, refer to Section 9001 |
| E. High back pressure in return circuit. | E. Carry out Test 2 - Charge Pump Pressure Test. |

## PROBLEM: Hydraulic system chatter when implement lowering and/or raising.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Faulty load check valve. | A. Service the remote valve section, refer to Section 8008 Remote Valves. |
| B. Low pressure/high pressure compensator settings need to be adjusted. | B. Carry out Test 4 - Low Pressure Standby Test and Test 5 - Maximum Pressure Test. |
| C. Faulty flow control in remote section. | C. Service the remote valve section, refer to Section 8008 Remote Valves. |
| D. Unstable steering priority valve. | D. Service the priority/regulator valve, refer to Section 8006 Hydraulic Valves. |

https://truckmanualshub.com/



## PROBLEM: Implement leaks down - engine off.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Faulty remote check in that remote section. | A. Service the remote valve section, refer to Section 8008 Remote Valves. |
| B. Mechanical interference on valve linkage. | B. Inspect and correct problem as necessary. |
| C. Faulty detent assembly. | C. Service the remote valve section, refer to Section 8008 Remote Valves. |
| D. Bent/damaged remote valve spool. | D. Service the remote valve section, refer to Section 8008 Remote Valves. |
| E. Excessive torque on valve mounting bolts. | E. Check bolt torque. |
| F. Sticking or excessive mounting torque on operating cables. | F. Check cable mounting nut torque, free off or replace cable as necessary. |
| G. Cracked or damaged remote valve casting. | G. Replace the remote valve as necessary. |

## PROBLEM: Fluctuation of flow to priority remote (No. 1) when operating one or more other remote circuits.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Faulty remote valve signal check. | A. Service the remote valve section, refer to Section 8008 Remote Valves. |
| B. Faulty remote valve flow control | B. Service the remote valve section, refer to Section 8008 Remote Valves. |

## PROBLEM: Implement creeps up while simultaneously operating another remote.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Faulty remote valve signal check. | A. Service the remote valve section, refer to Section 8008 Remote Valves. |
| B. Incorrectly adjusted or faulty remote valve cable. | B. Adjust or replace the remote valve cable as necessary. |
| C. Bent/damaged remote valve spool. | C. Service the remote valve section, refer to Section 8008 Remote Valves. |
| D. Faulty detent assembly. | D. Service the remote valve section, refer to Section 8008 Remote Valves. |
| E. Cracked or damaged remote valve casting. | E. Replace the remote valve as necessary. |

## PROBLEM: Excessive effort required to shift remote lever.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Mechanical interference on valve linkage. | A. Check for interference and correct as necessary. |
| B. Excessive torque on valve retaining nuts. | B. Check the nut torque, refer to Section 8008 Remote Valves. |
| C. Bent/damaged remote valve spool. | C. Service the remote valve section, refer to Section 8008 Remote Valves. |
| D. Faulty detent assembly. | D. Service the remote valve section, refer to Section 8008 Remote Valves. |
| E. Faulty remote valve cables or linkage. | E. Repair or replace as necessary. |

https://truckmanualshub.com/



### PROBLEM: Excessive flow control efforts.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Flow control compression nut is over torqued. | A. Check the nut torque, refer to Section 8008 Remote Valves. |
| B. Faulty flow control assembly. | B. Service the remote valve section, refer to Section 8008 Remote Valves. |
| C. Excessive torque on valve retaining nuts. | C. Check the nut torque, refer to Section 8008 Remote Valves. |
| D. Faulty remote valve flow control linkage. | D. Repair or replace as necessary. |

### PROBLEM: Flow control will not remain at set point.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Flow control compression nut is not torqued to specification. | A. Check the nut torque, refer to Section 8008 Remote Valves. |

## Steering Problems

### PROBLEM: Excessive effort required for steering.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Poor hydraulic system performance. | A. Carry out the following tests:<br>Test 4 - Low Pressure Standby Test<br>Test 5 - Maximum Pressure Test<br>See Poor Overall Hydraulic Performance on Page 4.<br>See Signal Circuit Problems on Page 8. |
| B. Incorrectly adjusted steering relief pressure. | B. Carry out Test 7 - Steering Function and Pressure Test. |
| C. Steering priority spool is stuck. | C. Service the priority/regulator valve, refer to Section 8006 Hydraulic Valves. |
| D. 0.8 mm dynamic sensing orifice blocked | D. Service the priority/regulator valve, refer to Section 8006 Hydraulic Valves. |
| E. 'P' port 90° hydraulic fitting screwed too far in to steering hand pump body. | E. Fully install the 90° hydraulic fitting into the hand pump body by hand, turn the fitting one complete turn anticlockwise and secure with the locknut. |
| F. Faulty steering hand pump. | F. Service the steering hand pump, refer to Section 5002 Steering Hand Pump. |
| G. Mechanical interference in steering column. | G. Service the steering column, refer to Section 5002 Steering Hand Pump. |
| H. Excessive load on front axle. | H. Reduce load. |

https://truckmanualshub.com/



## PROBLEM: Slow or inadequate steering

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Poor hydraulic system performance. | A. Carry out the following tests:<br>Test 4 - Low Pressure Standby Test<br>Test 5 - Maximum Pressure Test |
| B. Excessive load on front axle. | B. Reduce load. |
| C. Mechanical interference in steering column. | C. Inspect and correct problem as necessary. |
| D. Incorrectly adjusted steering relief pressure. | D. Carry out Test 7 - Steering Function and Pressure Test. |
| E. Priority regulator valve 0.8 mm orifice is plugged. | E. Service the priority/regulator valve, refer to Section 8006 Hydraulic Valves. |
| F. Steering priority spool is stuck. | F. Service the priority/regulator valve, refer to Section 8006 Hydraulic Valves. |
| G. Excessive leakage past steering cylinder seals. | G. Perform steering cylinder leakage test. |
| H. Faulty steering hand pump. | H. Service the steering hand pump, refer to Section 5002 Steering Hand Pump. |

## PROBLEM: No power steering

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Poor hydraulic system performance. | A. Carry out the following tests:<br>Test 4 - Low Pressure Standby Test<br>Test 5 - Maximum Pressure Test |
| B. Incorrectly adjusted steering relief pressure. | B. Carry out Test 7 - Steering Function and Pressure Test. |
| C. Priority regulator valve 0.8 mm orifice is plugged. | C. Service the priority/regulator valve, refer to Section 8006 Hydraulic Valves. |
| D. Steering priority spool is stuck. | D. Service the priority/regulator valve, refer to Section 8006 Hydraulic Valves. |
| E. Faulty steering hand pump. | E. Service the steering hand pump, refer to Section 5002 Steering Hand Pump. |
| F. Excessive leakage past steering cylinder seals. | F. Perform steering cylinder leakage test. |
| G. Mechanical interference in steering column. | G. Inspect and correct problem as necessary. |
| H. Excessive load on front axle. | H. Reduce load. |

## PROBLEM: Excessive number of wheel turns lock to lock.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Faulty steering hand pump. | A. Service the steering hand pump, refer to Section 5002 Steering Hand Pump. |
| B. Excessive leakage past steering cylinder seals. | B. Perform steering cylinder leakage test. |
| C. Wrong combination of steering hand pump and front axle. | C. Determine if correct parts were installed. |

https://truckmanualshub.com/



### PROBLEM: Steering at lock - wheel continues to rotate (slippage) with effort applied.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Faulty steering hand pump. | A. Service the steering hand pump, refer to Section 5002 Steering Hand Pump. |
| B. Excessive leakage past steering cylinder seals. | B. Perform steering cylinder leakage test. |

### PROBLEM: Inadequate manual steering.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Faulty steering hand pump. | A. Service the steering hand pump, refer to Section 5002 Steering Hand Pump. |
| B. Excessive leakage past steering cylinder seals. | B. Perform steering cylinder leakage test. |

### PROBLEM: Steering effected when operating hitch and or remote valve.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Priority/regulator valve steering priority spool is not functioning correctly. | A. Service the priority/regulator valve, refer to Section 8006 Hydraulic Valves. |

## Brake Problems

### PROBLEM: Poor brake response.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Air in brake system. | A. Bleed brake system of air, refer to Section 9001. |
| B. Faulty brake valve (master cylinder). | B. Service the brake master cylinder, refer to Section 7002 Service Brakes. |
| C. Excessive leakage past brake pistons. | C. Service the brake pistons, refer to Section 7002 Service Brakes. |
| D. Worn or distorted brake components | D. Check and replace worn or damaged brake components as necessary, refer to Section 7002. |
| E. Poor regulated pressure (Booster brakes only) | E. Carry out Test 8 - Regulated Pressure Test |
| F. Faulty check valve and accumulator (MTX110/120/125/135/140/150 tractors only) | F. Clean or replace check valve as necessary. |
| G. Poor pump performance | G. Carry out the following tests:<br>Test 4 - Low Pressure Standby Test<br>Test 5 - Maximum Pressure Test |
| H. Incorrect pedal adjustment | H. Adjust brake pedals, refer to Section 9001 Pedal, Lever and Switch Adjustments. |
| I. Brakes spongy. | I. Bleed brakes. |

https://truckmanualshub.com/



### PROBLEM: Brakes dragging.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Brake pedal out of adjustment. | A. Adjust brake pedals, refer to Section 9001 Pedal, Lever and Switch Adjustments. |
| B. Blocked or restricted tank hose from brake valve (Booster brakes only) | B. Clean or replace tank hose as necessary. |
| C. Damaged or distorted brake components | C. Check and replace worn or damaged brake components as necessary, refer to Section 7002. |

## Hydraulic Trailer Brake Problems (If Equipped)

### PROBLEM: Trailer brakes are NOT operating (other hydraulic systems operating).

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Brake pedal out of adjustment. | A. Adjust the brakes, refer to Section 9001 Pedal, Lever and Switch Adjustments. |
| B. Trailer brake valve spool is binding. | B. Service hydraulic trailer brake valve, refer to Section 7004 Hydraulic Trailer Brake Valve. |
| C. Poor pump performance | C. Carry out the following tests:<br>Test 4 - Low Pressure Standby Test<br>Test 5 - Maximum Pressure Test |
| D. Signal circuit problem | D. See Signal Circuit Problems on Page 8. |

## PTO Problems

**NOTE:** *Always check the diagnostic error codes for the PTO/FNR Controller. Refer to Section 10002, PTO/FNR Controller and Powershift.*

### PROBLEM: PTO is inoperative.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Low regulated pressure setting. | A. Carry out Test 8 - Regulated Pressure Test. |
| B. Blocked supply filter in shuttle valve | B. Clean or replace shuttle valve supply filter as necessary. |
| C. PTO solenoid valve is not functioning. | C. Carry out Test 11 - PTO Supply Pressure Test. |
| D. Leaking PTO shaft seals | D. Service the PTO, refer to Section 6019. |
| E. Leaking PTO clutch seals | E. Service the PTO, refer to Section 6019. |
| F. PTO shaft cross drilling plugs missing | F. Service the PTO, refer to Section 6019. |
| G. Worn PTO clutch | G. Service the PTO, refer to Section 6019. |
| H. Leaking shuttle valve o-rings | H. Replace the shuttle valve o-rings, refer to Section 8003. |

https://truckmanualshub.com/



## Differential Lock Problems

**NOTE:** *Always check the diagnostic error codes for the Hitch/MFD/Differential Lock Controller. Refer to Section 10002, Hitch/MFD/Differential Lock Controller.*

### PROBLEM: Differential lock is inoperative.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Low regulated pressure setting. | A. Carry out Test 8 - Regulated Pressure Test. |
| B. Blocked supply filter in shuttle valve | B. Clean or replace shuttle valve supply filter as necessary. |
| C. Blocked supply filter in differential solenoid | C. Clean or replace differential solenoid filter as necessary. |
| D. Differential lock solenoid valve is not functioning. | D. Carry out Test 12 - Differential Lock Pressure Test. |
| E. Leaking shuttle valve o-rings | E. Replace the shuttle valve gasket, refer to Section 8003. |
| F. Right hand differential carrier seals leaking seals | F. Service the differential, refer to Section 6012. |
| G. Leaking differential lock piston seals | G. Service the differential, refer to Section 6012. |
| H. Worn differential clutch | H. Service the differential, refer to Section 6012. |

## MFD Problems

**NOTE:** *Always check the diagnostic error codes for the Hitch/MFD/Differential Lock Controller. Refer to Section 10002, Hitch/MFD/Differential Lock Controller.*

### PROBLEM: MFD is inoperative (will not disengage).

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Low regulated pressure setting. | A. Carry out Test 8 - Regulated Pressure Test. |
| B. Blocked supply filter in shuttle valve | B. Clean or replace shuttle valve supply filter as necessary. |
| C. Blocked supply filter in MFD solenoid | C. Clean or replace MFD solenoid filter as necessary. |
| D. MFD solenoid valve is not functioning. | D. Carry out Test 10 - MFD Pressure Test. |
| E. Leaking shuttle valve o-rings | E. Replace the shuttle valve gasket, refer to Section 8003. |
| F. Leaking internal supply tube | F. Service the range transmission, refer to Section 6007. |
| G. Leaking MFD piston seals | G. Service the MFD, refer to Section 6017. |
| H. Worn or damaged MFD clutch | H. Service the MFD, refer to Section 6017. |

https://truckmanualshub.com/



## Hydraulic System Cooling Problems

### PROBLEM: Hydraulic system overheats.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Air flow through oil cooler is blocked. | A. Inspect/clean oil cooler fins. |
| B. Faulty lube priority valve. | B. Inspect lube priority valve in the main hydraulic filter housing and correct problem as necessary. |
| C. Faulty charge pump. | C. Carry out Test 2 - Charge Pump Pressure Test. |
| D. High case drain flow on PFC pump. | D. Use flowmeter to check case drain flow. |

## Independent Front Suspension Axle Problems

**WARNING:** *Before carrying out any servicing or repairs on tractors equipped with Independent Front Suspension make sure the key switch is in the OFF position, the suspension mode switch is in the OFF position and the axle is fully lowered to the bottom mechanical stop. Failure to do this may result in serious injury.* M753

**NOTE:** *Always check the diagnostic error codes for the axle controller. Refer to Section 10003, Independent Front Suspension Axle Calibration, Error Codes, Troubleshooting and Schematics.*

### PROBLEM: Axle will not raise (or raises one side only).

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Suspension control valve pilot spool is stuck closed. | A. Service the pilot spool. |
| B. Suspension control valve pilot solenoid faulty | B. Check or replace the pilot solenoid as necessary. |
| C. Suspension solenoid spool is stuck closed on the axle side which will not raise. | C. Service the solenoid spool. |
| D. Manual shut-off valve is open. | D. Close or service the manual shut-off valve. |
| E. Faulty valve assembly | E. Clean or replace the valve as necessary. |
| F. Excessive load on front axle. | F. Reduce load. |
| G. Poor pump performance | G. Carry out the following tests:<br>Test 4 - Low Pressure Standby Test<br>Test 5 - Maximum Pressure Test |
| H. Signal circuit problem | H. See Signal Circuit Problems on Page 8. |
| I. Suspension cushion valve faulty. | I. Clean or replace the cushion valve as necessary. |

https://truckmanualshub.com/



## PROBLEM: Axle will not lower (or lowers one side only).

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Suspension control valve pilot spool is stuck open. | A. Service the pilot spool. |
| B. Suspension control valve pilot solenoid faulty | B. Check or replace the pilot solenoid as necessary. |
| C. Suspension solenoid spool is stuck closed on the axle side which will not lower. | C. Service the solenoid spool. |
| D. Faulty valve assembly | D. Clean or replace the valve as necessary. |

## PROBLEM: Axle leaks down with the engine off.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. Left or right Suspension solenoid spools are stuck open. | A. Service the solenoid spools. |
| B. Manual shut-off valve is open. | B. Close or service the manual shut-off valve. |
| C. Suspension check valve is leaking. | C. Service the Suspension control valve. |
| D. Suspension cushion relief valve is leaking. | D. Service the Suspension control valve. |
| E. Faulty valve assembly | E. Clean or replace the valve as necessary. |

## PROBLEM: Axle will not remain at highest operating position in manual override mode.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. No error code is recorded but right hand potentiometer has moved out of adjustment (above upper limit). | A. Refer to Section 10003, Suspension Axle Calibration, Error Codes, Troubleshooting and Schematics. |

## PROBLEM: Axle will not remain at lowest operating position in manual override mode.

| POSSIBLE CAUSE | PROCEDURE |
|---|---|
| A. No error code is recorded but left hand potentiometer has moved out of adjustment (above upper limit). | A. Refer to Section 10003, Suspension Axle Calibration, Error Codes, Troubleshooting and Schematics. |

https://truckmanualshub.com/



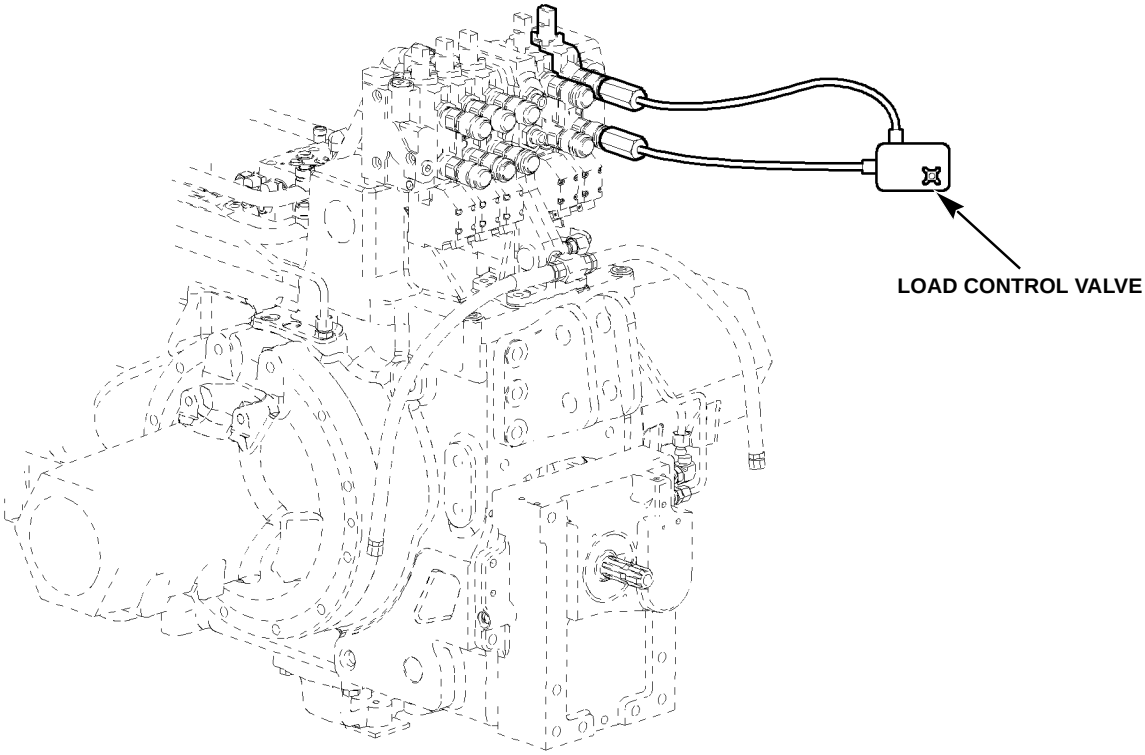
This Page Has Been Left Blank

https://truckmanualshub.com/



# HYDRAULIC SYSTEM DIAGNOSTIC TESTING

## Test 1 - Regulated Circuit Leakage Test




MI05D007

**NOTE:** *The flowmeter load control valve must fully open before starting test.*

## TOOLS REQUIRED

Two male couplers, quick disconnect (part no. 1272399C2).
Two flowmeter connectors, (7/8-14 JIC male onto quick disconnect couplers).
One flowmeter 0-300 L/min. (0-75 US gpm) or equivalent.

## TEST CONNECTIONS

Install the flowmeter into the number 1 remote valve couplers.

## TEST REQUIREMENTS

- Place the tractor in neutral. Apply the parking brake.
- The flowmeter load control valve must be fully open to allow full flow.
- Set the number 1 priority remote valve flow control to the maximum flow setting.
- Place the MFD switch into the “ON” position.
- Start and run engine.
- Heat the hydraulic oil to a temperature of 49°C.
- Run engine at 1000 rpm.
- Actuate the number 1 remote lever and turn the load valve on the flowmeter to restrict the flow until 69 bar (1000 psi) load is read at the flowmeter. Record the flow reading. This is your baseline reading. All future readings will be compared to this baseline reading.

Continued.....

https://truckmanualshub.com/


**IMPORTANT:** *If at least 19 L/min. (5.0 US gpm) is not read on the flowmeter, it must be determined that the tractor has a hydraulic pump problem or a leak in the regulated circuit (refer to Page 23).*

- Operate each feature of the regulated circuit individually and observe the drop in flow readings. When a feature is operated, the flow should drop momentarily and then return to the baseline reading. Record the flow readings using the table below.

**NOTE:** *When a powershift speed is selected, two clutches are engaged for each speed operation. Speeds 1 to 4 will also engage low clutch 5 and speeds 5 to 8 will also engage high clutch 6. If a problem occurs in all speeds from 1 to 4, it is possible that low clutch 5 is at fault, and if a problem occurs in all speeds from 5 to 8, it is possible that high clutch 6 is at fault.*

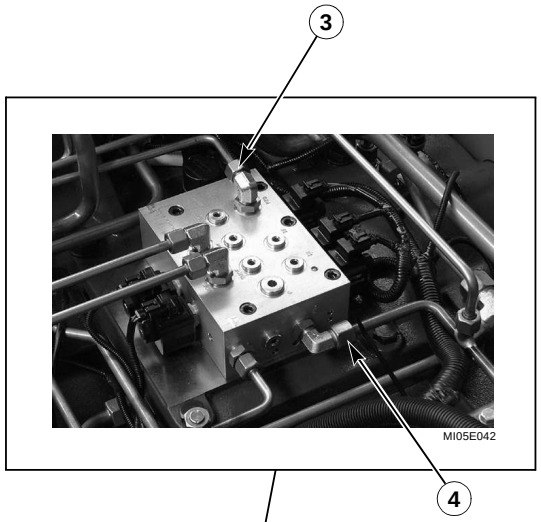
**COUPLER FLOW AT 69 BAR (1000 PSI) 1000 ENGINE RPM**

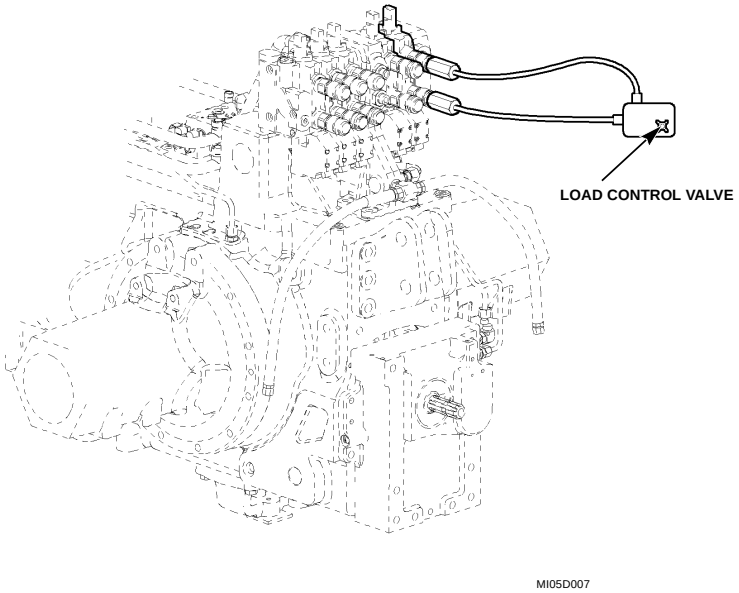
| FLOW TEST | FLOW DROP | FLOW RECORDED |
|---|---|---|
| Baseline reading - F-N-R in neutral - Powershift speed 1 | | |
| Engage Forward Clutch (return to neutral) | YES/NO | |
| Engage Reverse Clutch (return to neutral) | YES/NO | |
| Shift powershift to speed 2 | YES/NO | |
| Shift powershift to speed 3 | YES/NO | |
| Shift powershift to speed 4 | YES/NO | |
| Shift powershift to speed 5 | YES/NO | |
| Shift powershift to speed 6 | YES/NO | |
| Shift powershift to speed 7 | YES/NO | |
| Shift powershift to speed 8 (return to speed 1) | YES/NO | |
| PRS (Power Range Selector) | YES/NO | |
| Creep | YES/NO | |
| Park Lock ON/OFF | YES/NO | |
| Differential lock ON/ OFF | YES/NO | |
| Rear PTO ON/OFF | YES/NO | |
| Front PTO ON/OFF | YES/NO | |
| MFD OFF/ON | YES/NO | |

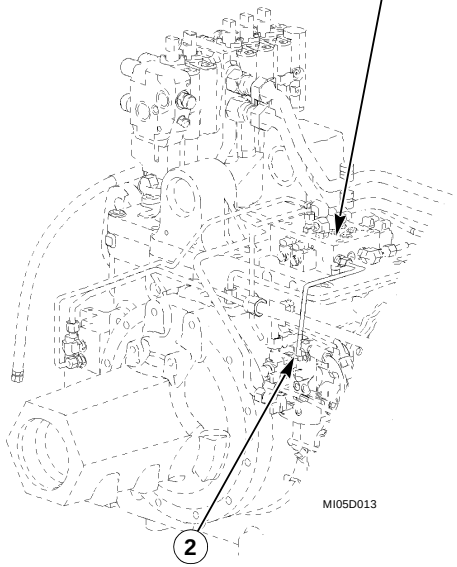
- When a feature is operated constant flow drop below the baseline reading indicates a leak in that particular circuit. The leakage amount is the baseline reading minus the reading of the regulated circuit feature during operation.

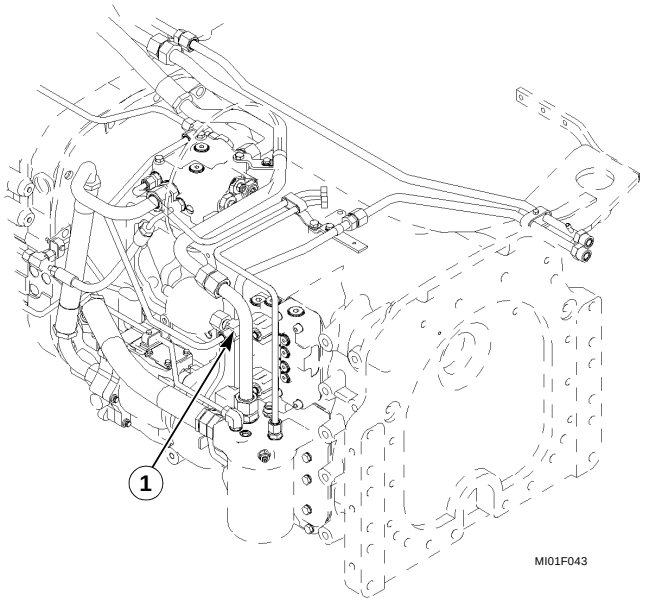
**NOTE:** *Leakage of 1.9 to 3.8 L/min. (0.5 to 1.0 US gpm) is moderate leakage. Leakage greater than 3.8 L/min. (1.0 US gpm) is excessive leakage, inspect and correct the problem as necessary.*

- If the flow reading DOES NOT drop when regulated circuit feature is operated, this indicates that circuit is not operating. When troubleshooting an electro-hydraulic system problem check for electrical power to the solenoid coils as they are activated. This will isolate hydraulic system problems from electrical problems. Use a high impedance multimeter for any electrical checks. Refer to Sections 4001,10002 and 10006.


3
MI05E042
4


LOAD CONTROL VALVE
MI05D007


MI05D013
2


1
MI01F043

https://truckmanualshub.com/



To find a regulated circuit leak, sections of the circuit must be disconnected and capped off. Before disconnecting any hydraulic lines thoroughly clean the area.

1. Disconnect the powershift supply tube (1). Plug the open tube connections and cap the open fittings. Repeat Test 1 - Regulated Circuit Leakage Test.

   If the flow readings have increased to 19 L/min. (5.0 US gpm) or more, the leak is in the powershift circuit. If the flow readings are unchanged install the tube and go to step 2.

2. Disconnect the hitch valve pilot pressure supply tube (2). Plug the open tube connections and cap the open fittings. Repeat Test 1 - Regulated Circuit Leakage Test.

   If the flow readings have increased to 19 L/min. (5.0 US gpm) or more, the leak is in the hitch pilot pressure circuit. If the flow readings are unchanged install the tube and go to step 3.

3. Disconnect the rear PTO supply tube (3). Plug the open tube connections and cap the open fittings. Repeat Test 1 - Regulated Circuit Leakage Test.

   If the flow readings have increased to 19 L/min. (5.0 US gpm) or more, the leak is in the rear PTO circuit. If the flow readings are unchanged install the tube and go to Step 4.

   **NOTE:** *The above check will only test the PTO clutch circuit, to test the PTO supply circuit carry the following checks.*

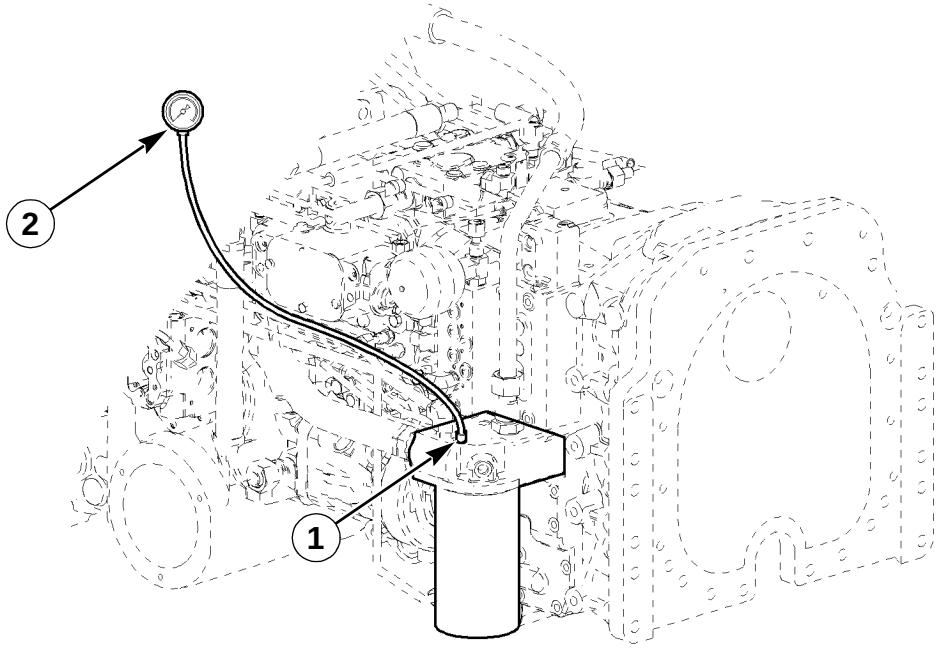
4. Disconnect the shuttle valve supply tube (4). Plug the open tube connections and cap the open fittings. Repeat Test 1 - Regulated Circuit Leakage Test.

   If the flow readings have increased to 19 L/min. (5.0 US gpm) or more, the leak is in the shuttle valve circuit. Check the individual shuttle valve circuits. If the flow readings are unchanged install the tube.

https://truckmanualshub.com/



# Test 2 - Charge Pump Pressure Test




MI05D012

https://truckmanualshub.com/



## TOOLS REQUIRED

HYDRAULIC TEST 1002T2
One M14 Minimess test point MC2541
One high pressure hose (part no. 8172694)
One 10 bar (150 psi) gauge (part no. FT5274-1)

## TEST CONNECTIONS

Remove the blanking plug (1) from the filter head test port, install a M14 test point and pressure gauge (2).

## TEST REQUIREMENTS

- Place the tractor in neutral. Apply the parking brake.
- Start and run engine.
- Heat the hydraulic oil to a temperature of 49℃.
- Run the engine at 1000 and 2200 rpm.
- Minimum charge pump pressure must be 1.4 bar (20 psi) at 1000 rpm and 3.8 bar (55 psi) at 2200 rpm. Maximum charge pump pressure is 4.8 bar (70 psi).
- If the pressure is not correct, refer to POSSIBLE CAUSES.

## POSSIBLE CAUSES

Pressure readings below specification:

- Hydraulic oil level is low.
- Suction screen is blocked.
- Excessive lube flow (lube orifices too large or missing).
- Lube pressure relief valve is stuck open.
- Lubrication collar in Forward and/or Reverse clutches not seated correctly. Service the forward and reverse clutches, refer to Section 6007 Servicing the Range Transmission.

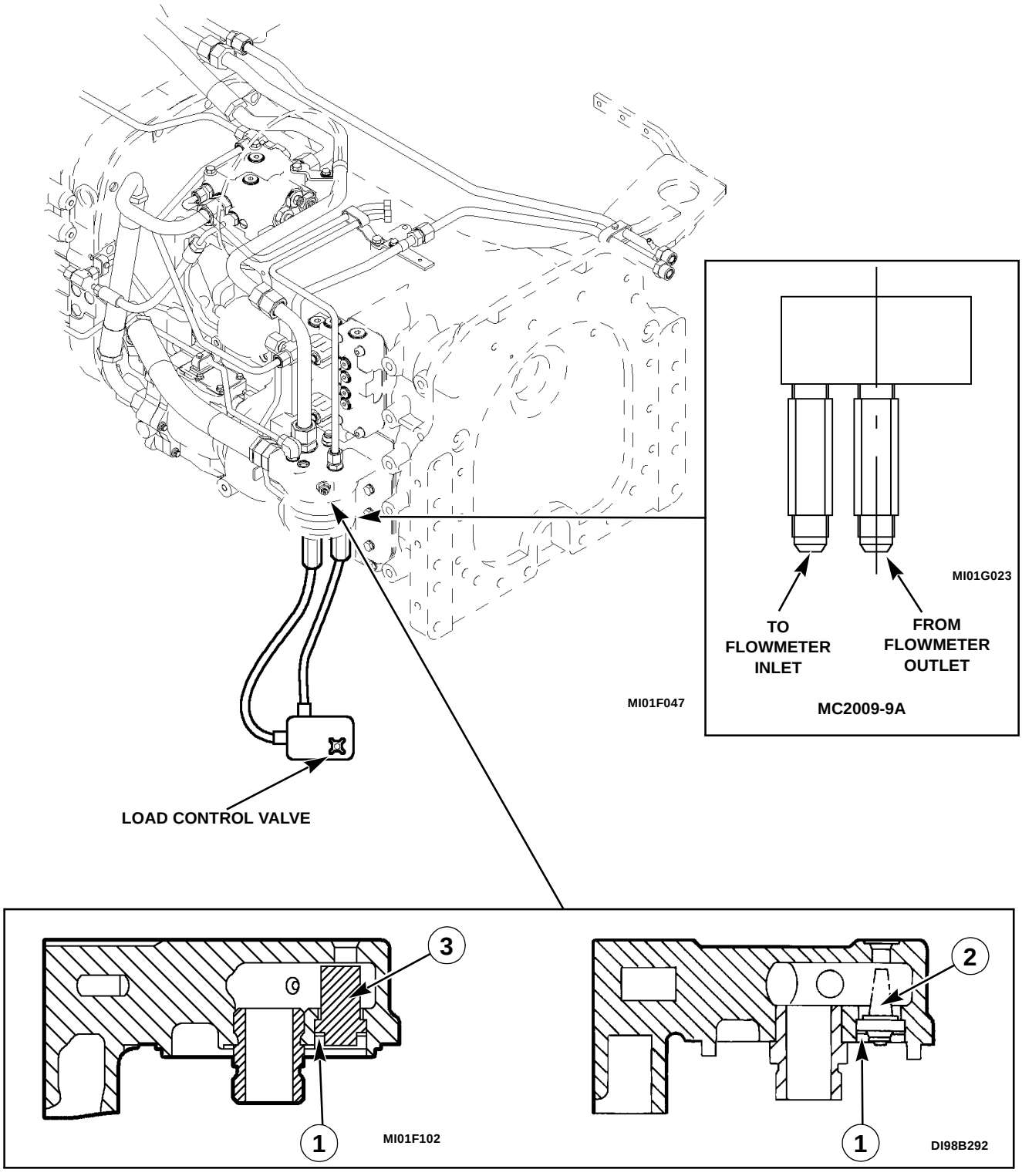
Pressure readings above specifications:

- Lube pressure relief valve is faulty. Inspect lube pressure relief valve in the transmission at the main hydraulic filter mounting and correct problem as necessary.
- There is a restriction in the oil cooler or oil cooler circuit.
- There is a restriction in the lubrication circuit.
- Oil cooler by-pass valve stuck closed and cooler circuit blocked.

https://truckmanualshub.com/



## Test 3 - Charge Pump Flow Test




**IMPORTANT:** *The flowmeter load control valve must fully open before starting test. Connect the flowmeter to the flow adaptor using hydraulic hose and adaptors with a minimum internal diameter of 16 mm (5/8 inch) for the charge pump flow test.*

**IMPORTANT:** *Remove retaining ring (1) and bypass valve (2). Install MC2009-10 flowmeter test adapter pin (3) and retaining ring (1). Care must be taken not to damage the retaining ring (1).*

**IMPORTANT:** *Make sure the flowmeter hoses are connected to the test adaptor MC2009-9A as shown. Failure to do so will cause damage to the charge lubrication pump.*

https://truckmanualshub.com/


## TOOLS REQUIRED

One flowmeter 0-300 L/min. (0-75 US gpm) or equivalent.

HYDRAULIC TEST KITS MC2482 AND MC30006
Flowmeter test adaptor MC2009-9
Flowmeter test adaptor pin MC2009-10

## TEST CONNECTIONS

Remove the hydraulic filter element, retaining ring (1) and bypass valve (2) from the filter head. Install the flowmeter adapter pin (3) in place of the bypass valve (2) and install retaining ring (1). Install flowmeter test adapter and adaptor ring onto the filter head in place of the filter element. Install the inlet hose of the flowmeter to the outer port of the adaptor. Install the return hose of the flowmeter to the center port of the adaptor.

**NOTE:** *For Installation, care must be taken not to damage the retaining ring (1).*

## TEST REQUIREMENTS

**IMPORTANT:** *The load valve on the flowmeter must be fully open before starting the tractor.*

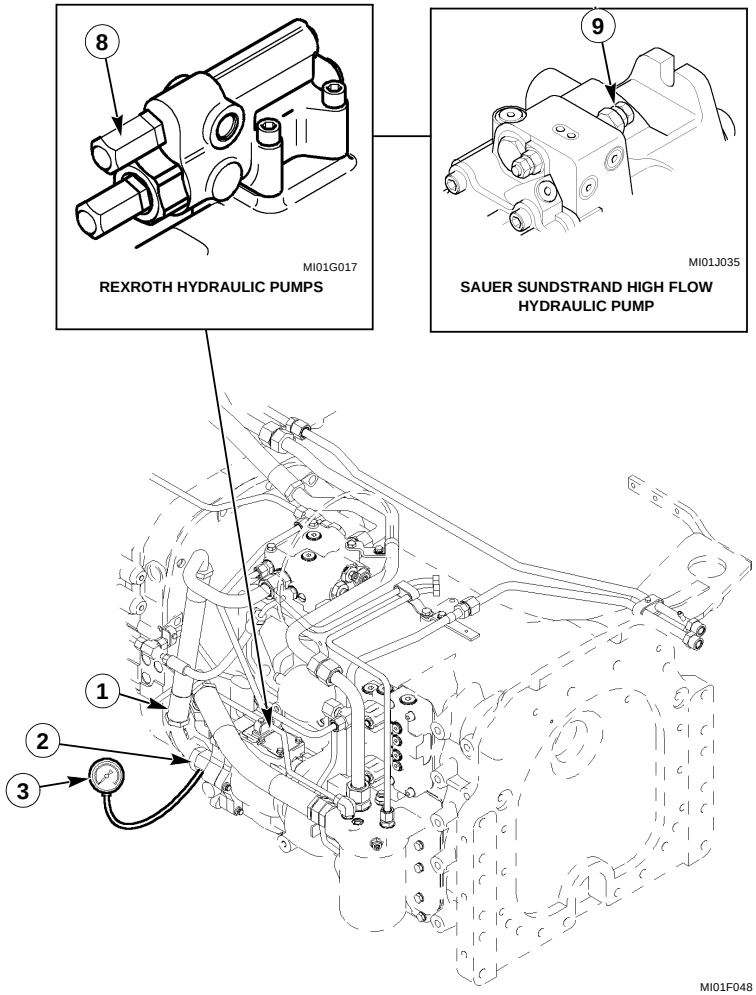
- DO NOT operate the remote valves or damage to the charge pump will occur.
- Start and run engine.
- Place the tractor in neutral. Apply the parking brake.
- Heat the hydraulic oil to a temperature of 49℃.
- Run the engine at 2200 rpm.

**IMPORTANT:** *If the flow begins to increase but stops increasing before the engine reaches 2200 rpm there is a restriction in the flowmeter hoses or adaptors. STOP THE ENGINE AND CHECK FOR THE CAUSE or damage to the charge pump will occur.*

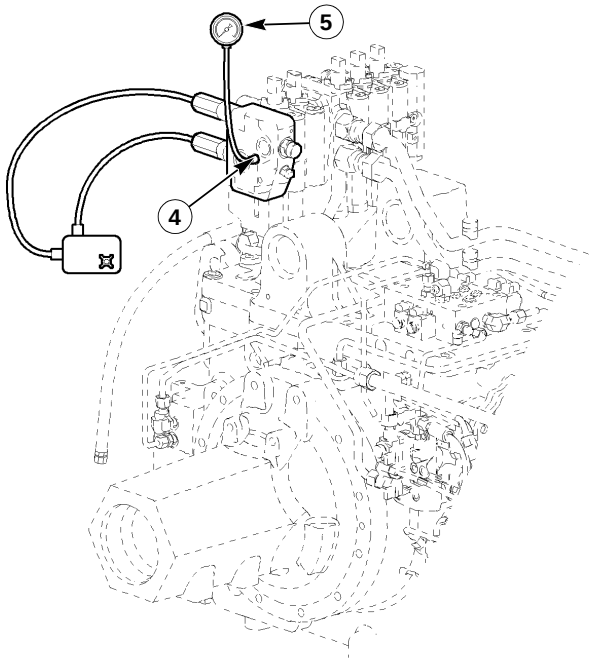
- The flow must be 190 to 210 L/min. (50 to 55.5 US gpm).
- If the flow is not within specifications refer to POSSIBLE CAUSES.

## POSSIBLE CAUSES

- Hydraulic oil level is low.
- Suction screen is blocked.
- The charge pump is worn. Service the charge pump, refer to Section 8003 Charge/Lubrication Pump
- Internal tube leakage (charge pump to filter head).
- Bad Filter Manifold Gasket.
- Bad Filter Manifold
- Charge pump drive has failed. Refer to Section 8003 Charge/Lubrication Pump.




## Test 4 - Low Pressure Standby Test



https://truckmanualshub.com/


## TOOLS REQUIRED

Two male couplers, quick disconnect (part no. 1272399C2).
Two flowmeter connectors, (7/8-14 JIC male onto quick disconnect couplers).
One flowmeter 0-300 L/min. (0-75 US gpm) or equivalent.
One 1 7/16 inch - M33 adaptor MC2545 (Sauer Sunstrand Pump)
One 1 7/16 inch - M33 elbow adaptor 1039T1 (RexrothPump)

HYDRAULIC TEST KITS MC2482 and MC30020
- One 11/16 - M14 adaptor MC2543
- One M14 Minimess test point MC2541
- One M12 Minimess test point MC2540
- Two high pressure hoses (part no. 8172694)
- Two 350 bar (5000 psi) gauges (part no. FT5274-12)

## LOW PRESSURE STANDBY PRESSURE TEST

Disconnect the PFC pump outlet hose (1) and remove the fitting at the pump outlet. Install a 1 7/16 inch - M33 adaptor (2) MC2545 (Sauer Sunstrand Pump) or a 1 7/16 inch - M33 elbow adaptor (2) 1039T1 (Rexroth Pump) , connect the outlet hose (1) to adaptor (2). Install the M12 test point and pressure gauge (3) into adaptor (2).

- The hitch and remote levers must remain in neutral during this test.
- Do not operate the steering, hitch, trailer brake or independent front suspension (if equipped) during this test.
- Place the tractor in neutral. Apply the parking brake.
- Start and run the engine.
- Heat the hydraulic oil to a temperature of 49℃.
- Run the engine at 2200 rpm.
- The pressure reading should be as follows:

  Rexroth hydraulic pumps .....27 to 40 bar (391 to 580 psi).
  Sauer Sundstrand optional high flow hydraulic pump .....27 to 40 bar (391 to 580 psi).

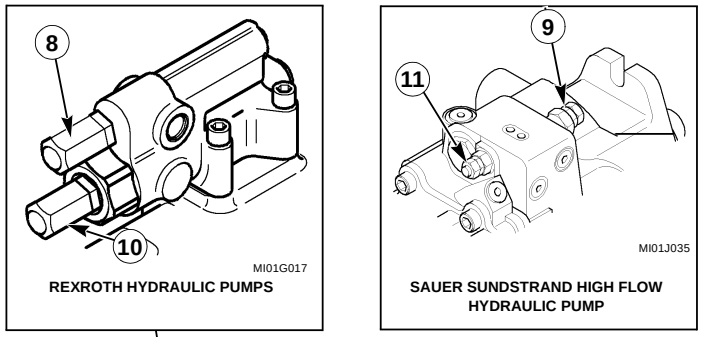
## LOW PRESSURE STANDBY ADJUSTMENT

To ensure stable pump compensation a pressure differential must be maintained between the piston pump outlet pressure and the compensator signal line pressure as follows.

Rexroth hydraulic pumps .....26 to 28 bar (377 to 406 psi).
Sauer Sundstrand optional high flow hydraulic pump ..... 25 bar (363 psi)

Disconnect the PFC pump outlet hose (1) and remove the fitting at the pump outlet. Install a 1 7/16 inch - M33 adaptor (2) MC2545 (Sauer Sunstrand Pump) or a 1 7/16 inch - M33 elbow adaptor (2) 1039T1 (Rexroth Pump). Install the M12 test point and pressure gauge (3) into the adaptor (2).

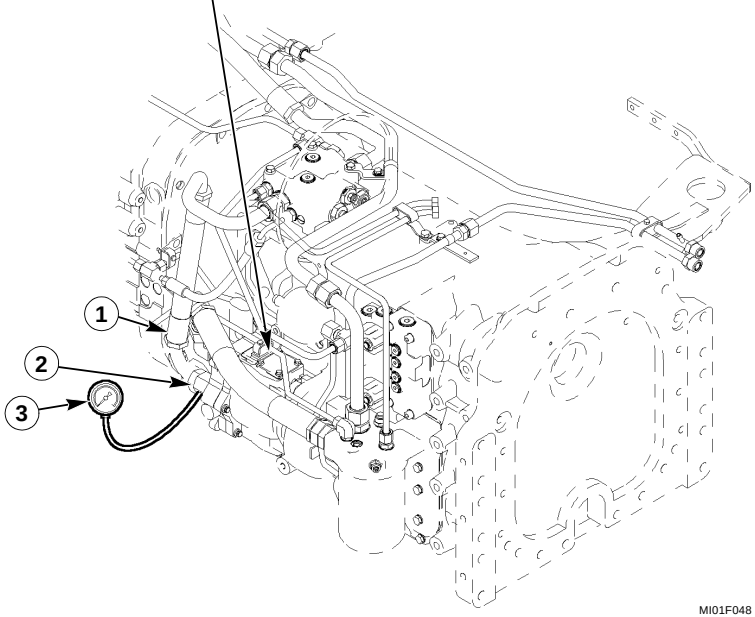
Continued.....

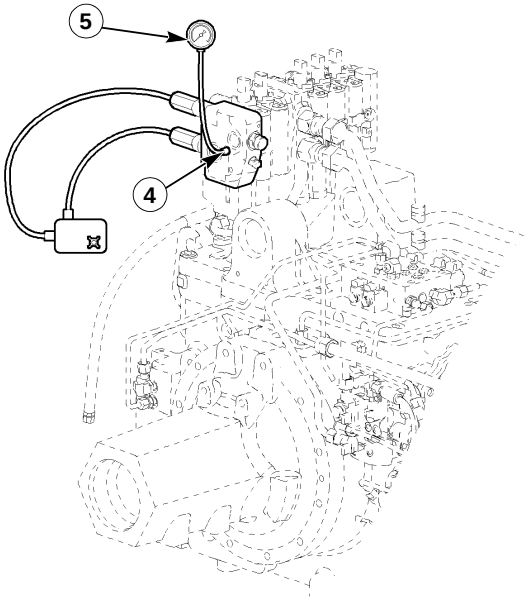



REXROTH HYDRAULIC PUMPS




SAUER SUNDSTRAND HIGH FLOW HYDRAULIC PUMP



https://truckmanualshub.com/



Remove the blanking plug (4) from the remote valve manifold. Install the M14 test fitting and pressure gauge (5). Install flowmeter into the number 1 remote valve couplers. The load valve on the flowmeter must be fully open.

- Start and run the engine.
- Heat the hydraulic oil to a temperature of 49℃.
- Run the engine at 2200 rpm.
- Move the number 1 remote lever to the work position. The flowmeter load valve must be fully open. Adjust the flow control valve on the number 1 remote valve to read 47 L/min. (12.5 US gpm).
- Close the load control valve on the flowmeter until 70 bar (1015 psi) is read on the signal line gauge. The pressure reading at the PFC pump outlet gauge must be as follows:

  Rexroth hydraulic pumps 96 to 98 bar (1377 to 1406 psi).
  Sauer Sundstrand optional high flow hydraulic pump95 bar (1378 psi).

  The difference between the two pressure readings must be as follows:
  Rexroth hydraulic pumps 26 to 28 bar (377 to 406 psi)
  for Sauer Sundstrand option high flow hydraulic pump 25 bar (363 psi).

- For Rexroth hydraulic pumps adjust the low pressure standby at the flow compensator spool (8) if the pressure differential is not between 26 to 28 bar (377 to 406 psi).
- For Sauer Sundstrand optional high flow hydraulic pumps adjust the low pressure standby at the flow compensator spool (9) if the pressure differential is not 25 bar (363 psi).

## POSSIBLE CAUSES

Pressure readings below specification:

- Compensator signal line screen is blocked.
- Charge pump flow is low, carry out Test 3 - Charge Pump Flow Test.
- Broken spring, seized or misadjusted compensator spool (8) or (9). Repair or adjust compensator spool.
- Broken spring, seized or misadjusted main relief valve spool (10) or (11). Repair or adjust main relief valve spool.
- Worn PFC pump, replace as necessary.
- Faulty signal circuit check valves

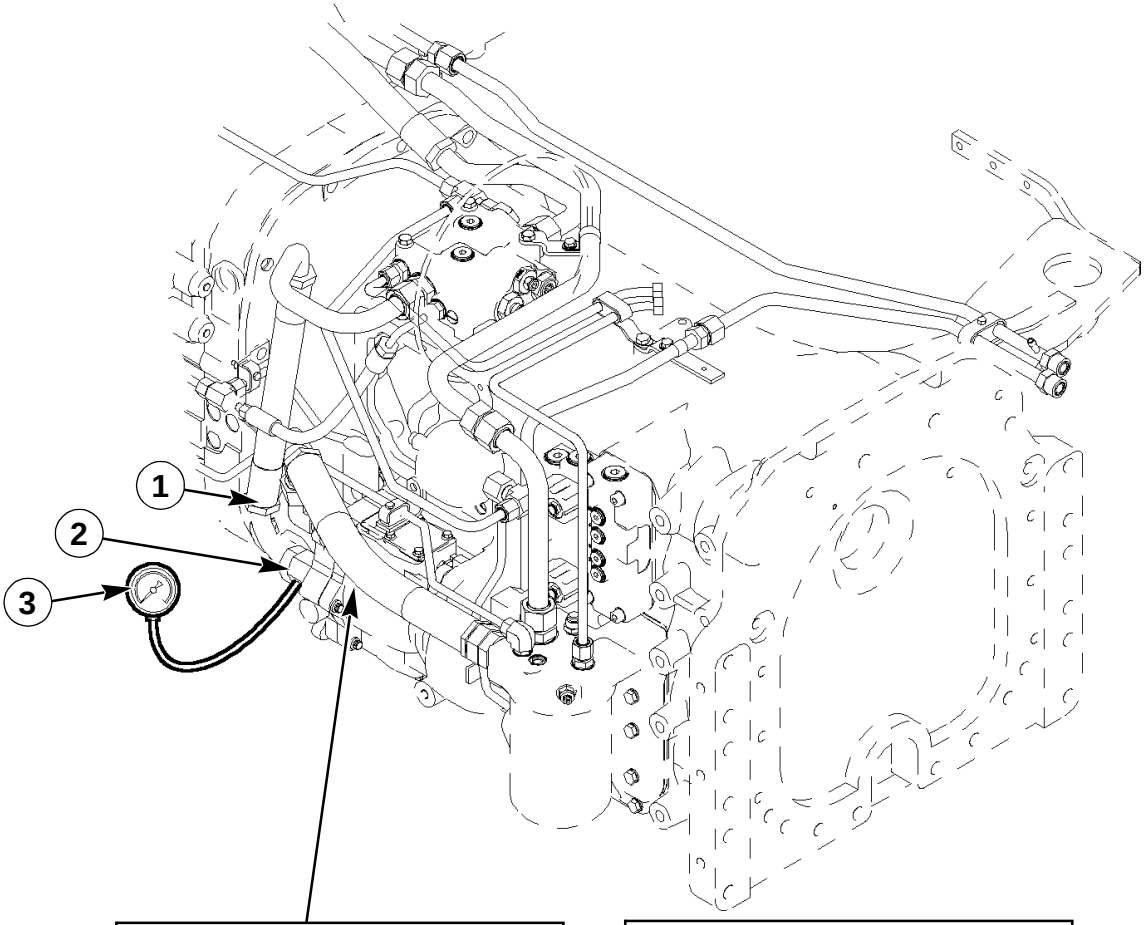
Pressure readings above specification:

- Seized or misadjusted compensator spool (8) or (9). Repair or adjust compensator spool.
- Blocked 0.5 mm bleed orifice in remote auxiliary valve end plate.
- Blocked signal hose to steering valve.
- Faulty steering valve.
- Blocked return tube or adaptor from steering valve to lubrication filter manifold.

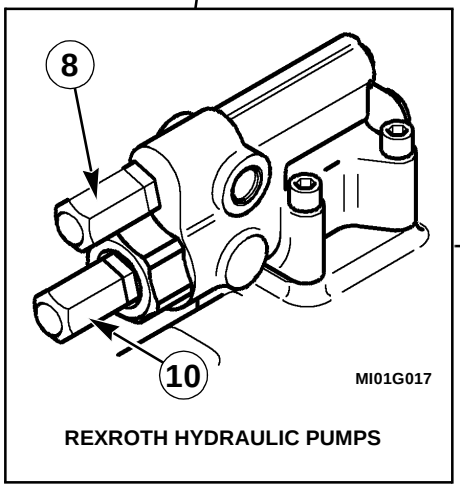
https://truckmanualshub.com/



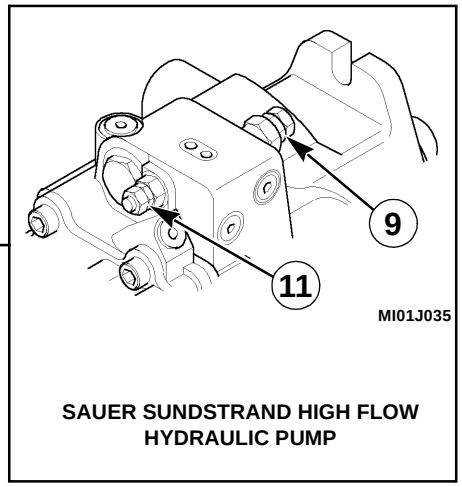
# Test 5 - Maximum Pressure Test




MI01F048




REXROTH HYDRAULIC PUMPS




SAUER SUNDSTRAND HIGH FLOW HYDRAULIC PUMP

https://truckmanualshub.com/



## TOOLS REQUIRED

HYDRAULIC TEST KIT 1002T2
- One high pressure hose (part no. 8172694)
- One M12 Minimess test point MC2540
- One 350 bar (5000 psi) gauge (part no. FT5274-12)
- One 1 7/16 inch - M33 adaptor MC2545 (Sauer Sunstrand Pump)
- One 1 7/16 inch - M33 elbow adaptor 1039T1 (Rexroth Pump)

## TEST CONNECTIONS

Disconnect the PFC pump outlet hose (1) and remove the fitting at the pump outlet. Install a 1 7/16 inch - M33 adaptor (2) MC2545 (Sauer Sunstrand Pump) or a 1 7/16 inch - M33 elbow adaptor (2) 1039T1 (Rexroth Pump), connect the outlet hose (1). Install the M12 test point and pressure gauge (3) into adaptor (2).

## TEST REQUIREMENTS

- Place the tractor in neutral. Apply the parking brake.
- Start and run engine.
- Heat the hydraulic oil to a temperature of 49℃.
- Run engine at 2200 rpm.
- Operate each remote valve lever in turn in both directions, and observe and record the highest pressure reading.
- All pressure readings should be as follows:

  Rexroth hydraulic pumps between .....199 to 209 bar (2887 to 3031 psi) (relief valve pressure).
  Sauer Sundstrand optional high flow hydraulic pump .....202 bar (2930 psi) (relief valve pressure).

- If the pressure is not correct refer to POSSIBLE CAUSES.

## POSSIBLE CAUSES

If pressure readings are equal for each remote section, but not to specification:

- Hydraulic oil level is low.
- Suction screen is blocked.
- Main hydraulic filter blocked.
- Compensator signal line screen is blocked.
- Broken spring, seized or misadjusted compensator spool (8) or (9). Repair or adjust compensator spool as necessary.
- Broken spring, seized or misadjusted main relief valve (10) or (11). Repair or adjust main relief valve as necessary.
- Leaking signal check valve at the priority regulator valve, hitch valve, independent front suspension axle control valve (if equipped) or hydraulic trailer brake valve (if equipped). Cab suspension (if equipped). Refer to Section 8006 Hydraulic Valves or Section 7004 Hydraulic Trailer Brake Valve.
- Leaking or faulty remote signal line check valves.
- Worn PFC pump. Replace as necessary.
- Pump drive has failed. Refer to Section 6023 PTO Front Drive Shaft and Hydraulic Pump Drive Gear.

Pressure is below specification on all but one remote section:

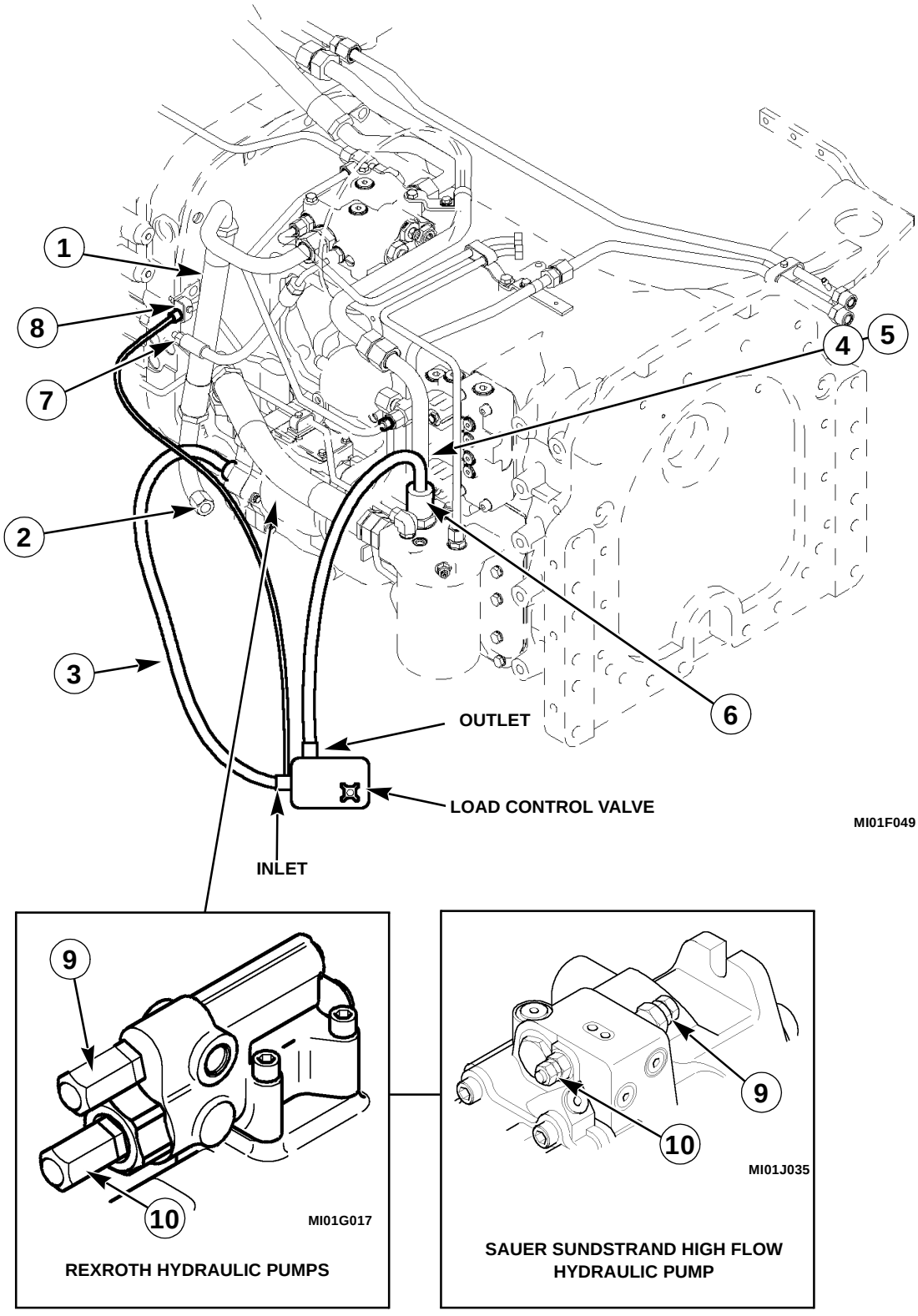
- Misadjusted remote valve cables, refer to Section 9001 Pedal and Lever Adjustments.
- Leaking or faulty remote signal line check valve in remote section that maintained specification pressure. Service the remote valve section, refer to Section 8008 Remote Valves.

**IMPORTANT:** *The pressure at the remote couplers will be approximately 10 bar (150 psi) less than the pressure at the pump outlet. Do not adjust the pressure to read 209 bar (3031 psi) for Rexroth hydraulic pumps or 202 (2930 psi) for Sauer Sundstrand hydraulic pumps at the remotes.*

https://truckmanualshub.com/



# Test 6 - Pump Flow Test







REXROTH HYDRAULIC PUMPS




SAUER SUNDSTRAND HIGH FLOW HYDRAULIC PUMP

https://truckmanualshub.com/



## TOOLS REQUIRED

One flowmeter 0-300 L/min. (0-75 US gpm) or equivalent.

HYDRAULIC TEST KIT 1002T2
Two 1 7/16 inch plugs MC2544

## TEST CONNECTIONS

Disconnect the PFC piston pump outlet hose (1) and install the 1 7/16 inch plug (2) in the hose end swivel connector.

Connect the flowmeter inlet hose to the piston pump outlet port (3), (Provide a tee at the pump outlet for the signal line connection).

Disconnect the remote return flow tube (4) at the filter head. Install the 1 7/16 inch plug in the tube end swivel connector (5).

Connect the flowmeter outlet hose to the open port (6) on top of the filter head.

Disconnect the compensator signal line at the tee or four way connector, cap the tee or four way connector (7). Connect a hose into the compensator signal line tube (8) and connect the other end of the hose at the pump outlet tee.

## TEST REQUIREMENTS

- The load valve on the flowmeter must be fully open.
- Place the tractor in neutral. Apply the parking brake.
- Start and run engine.
- Heat the hydraulic oil to a temperature of 49℃.
- Run engine at 2200 rpm.
- Adjust the flowmeter load valve to 50 bar (725 psi) and record flow reading.
- The PFC piston pump outlet flow must be as follows:

| Model | Pump Type | Flow (New Pump) | Minimum Flow |
|---|---|---|---|
| XTX185/200/215 | Rexroth | 113 - 123L/min. (329.8 - 32.5 US gpm) | 100 L/min. (26.4 US gpm) |
| XTX185/200/215 | Sauer Sundstrand High Flow (Optional) | 150 - 160L/min. (39.6 - 42.2 US gpm) | 140 L/min. (37 US gpm) |

- If the flow is not correct refer to POSSIBLE CAUSES.

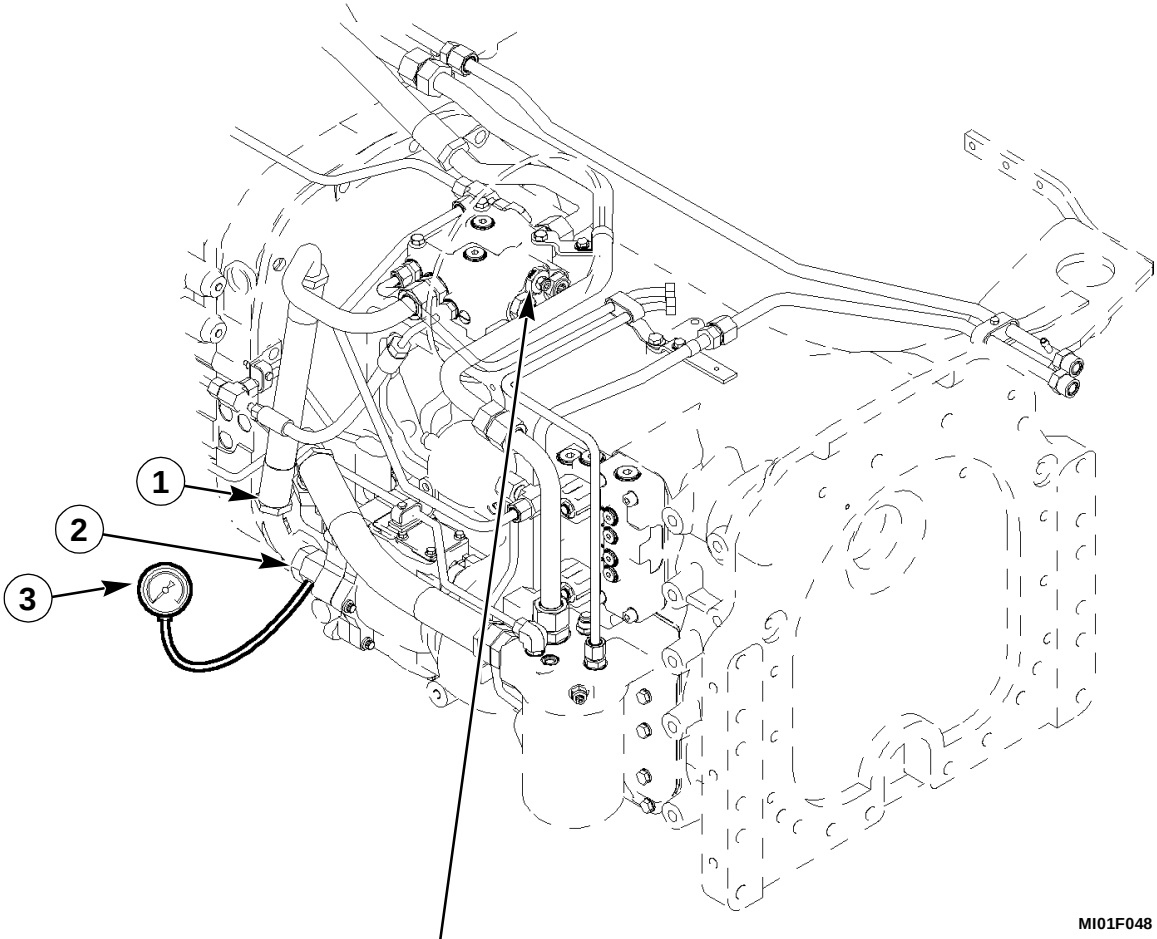
## POSSIBLE CAUSES

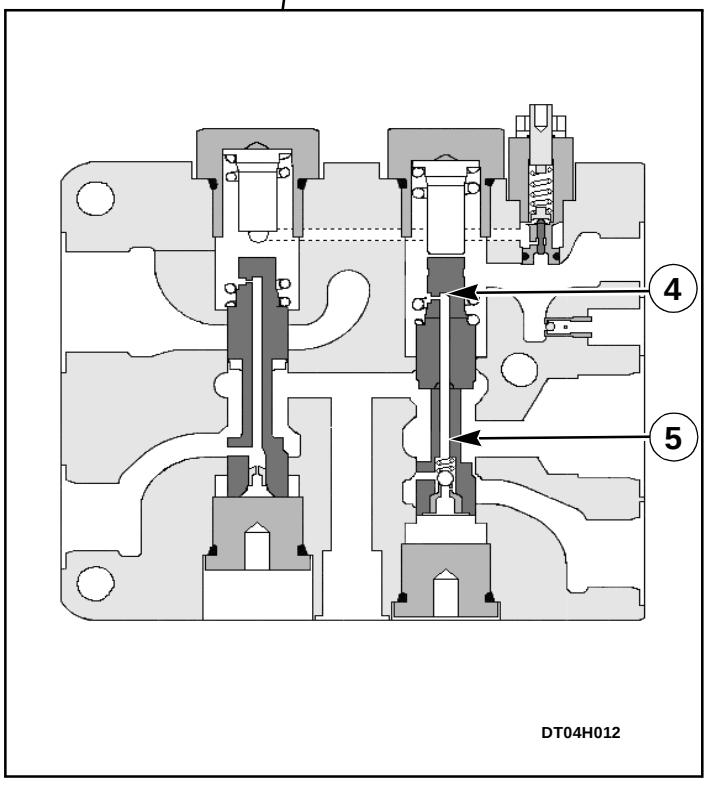
- Charge pump pressure or flow is low, carry out Test 2 - Charge Pump Pressure Test and Test 3 - Charge Pump Flow Test.
- Worn PFC pump. Replace as necessary, refer to Section 8002 Hydraulic Pump.
- Compensator signal line screen is blocked.
- Broken spring, seized or misadjusted compensator spool (9). Repair or adjust compensator spool as necessary.
- Broken spring, seized or misadjusted main relief valve (10). Repair or adjust Main relief valve as necessary.

https://truckmanualshub.com/



## Test 7 - Steering Function and Pressure Test



https://truckmanualshub.com/


## TOOLS REQUIRED

HYDRAULIC TEST KITS MC2482 AND MC30020
One 1 7/16 inch - M33 adaptor MC2545 (Sauer Sunstrand Pump)
One 1 7/16 inch - M33 elbow adaptor 1039T1 (Rexroth Pump)
One M12 Minimess test point MC2540
One high pressure hose (part no. 8172694)
One 350 bar (5000 psi) gauge (part no. FT5274-12)

## TEST CONNECTIONS

Disconnect the PFC pump outlet hose (1) and remove the fitting at the pump outlet. Install a 1 7/16 inch - M33 adaptor (2) MC2545 (Sauer Sunstrand Pump) or a 1 7/16 inch - M33 elbow adaptor (2) 1039T1 (Rexroth Pump), connect the outlet hose (1) to adaptor (2). Install the M12 test point and pressure gauge (3) into adaptor (2).

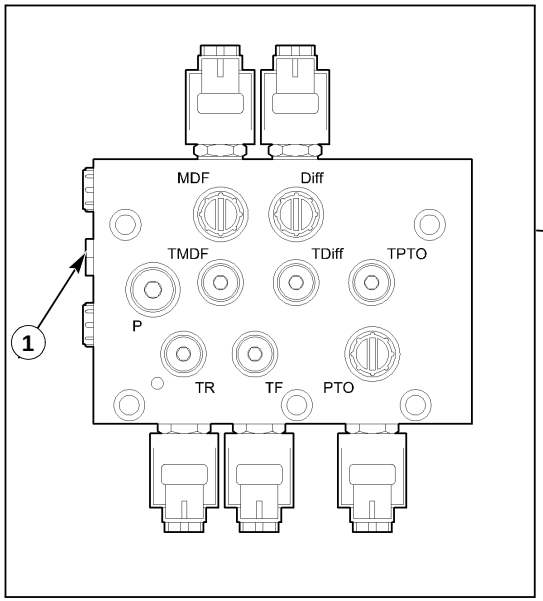
## TEST REQUIREMENTS

- Place the tractor in neutral. Apply the parking brake.
- Start and run engine.
- Heat the hydraulic oil to a temperature of 49℃.
- Run the engine at 1500 rpm.
- Turn and hold the steering wheel on full lock. DO NOT use force to hold the steering in full lock.
- The steering system pressure must be 177.5 to 188.5 bar (2575 to 2730 psi).
- If the pressure is not correct refer to POSSIBLE CAUSES.

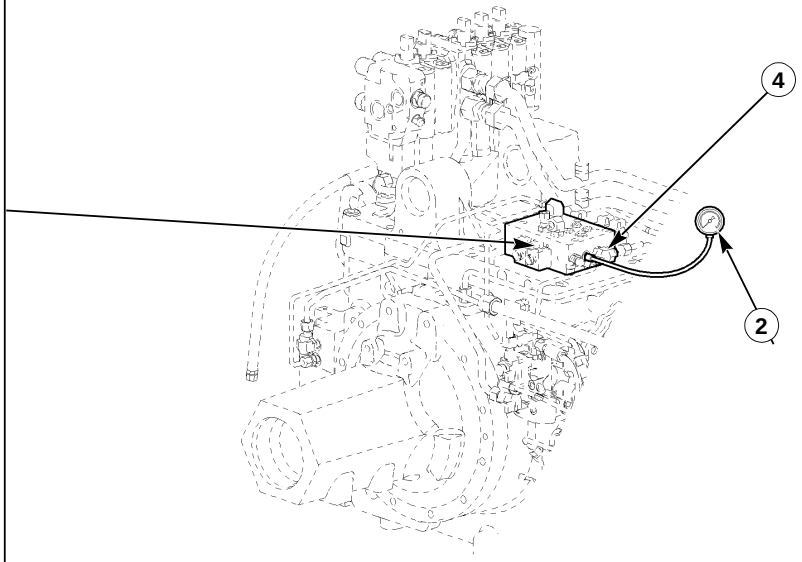
## POSSIBLE CAUSES

- 0.8 mm (0.031 inch) dynamic sensing orifice (4) in the priority regulator valve is plugged.
- Steering priority spool (5) is sticking. Service the priority/regulator valve, refer to Section 8006 Hydraulic Valves.
- Compensator signal line screen is blocked.
- Broken spring, seized or misadjusted compensator spool. Repair or adjust compensator spool as necessary. See Test 4 - Low Pressure Standby Test.
- Broken spring, seized or misadjusted main relief valve. Repair or adjust Main relief valve as necessary. See Test 5 - Maximum Pressure Test.
- Leaking or faulty remote signal line check valves in remote couplers, hitch valve, independent front suspension control valve (if equipped) or hydraulic trailer brake valve (if equipped). Refer to the following:
  Section 8008 Remote Valves,
  Section 8006 Hydraulic Valves
  Section 7004 Hydraulic Trailer Brake Valve.
- Faulty steering valve.
- Faulty steering ram seals.

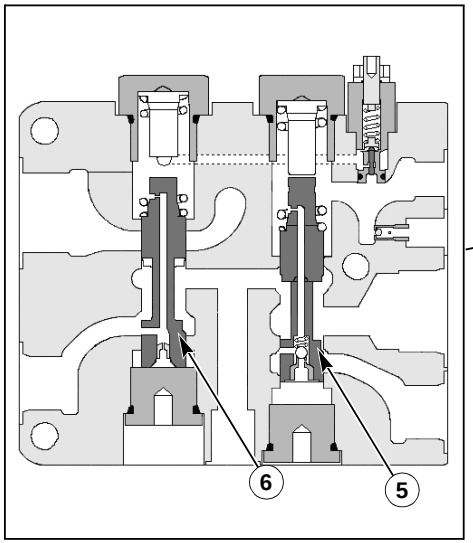
## Test 8 - Regulated Pressure Test



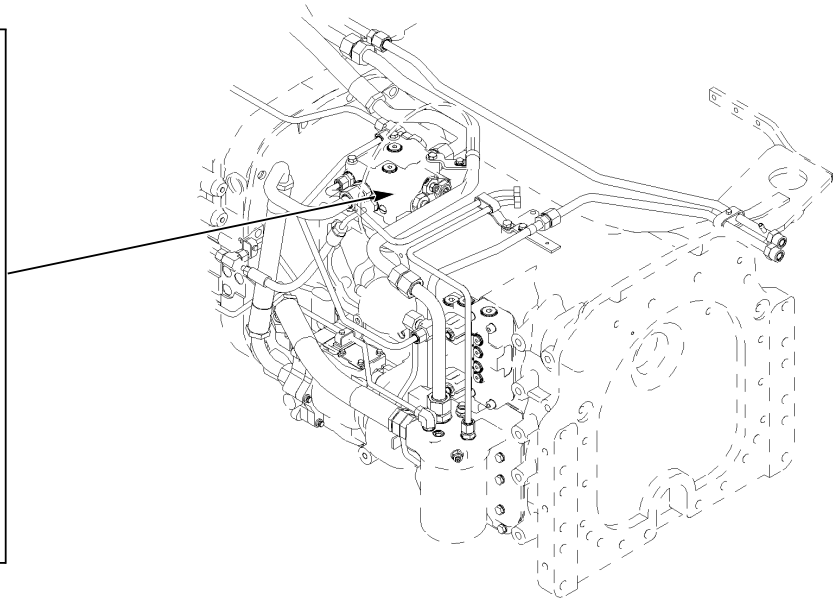

MI05D014




MI05D010




DI04H012



MI01F043

https://truckmanualshub.com/



## TOOLS REQUIRED

HYDRAULIC TEST KIT 1002T2
One M14 Minimess test point MC2541
One high pressure hose (part no. 8172694)
One 35 bar (500 psi) gauge (part no. FT5274-16)

## TEST CONNECTIONS

Remove the blanking plug (1) from the shuttle valve test port, install M14 test point and pressure gauge (2).

## TEST REQUIREMENTS

- Place the tractor in neutral. Apply the parking brake.
- Start and run engine.
- Heat the hydraulic oil to a temperature of 49℃.
- Run engine at 1500 rpm.
- DO NOT operate any of the regulated circuit features.
- The regulated pressure must be 22 to 24 bar (319 to 348 psi).
- If the pressure is not correct refer to POSSIBLE CAUSES.

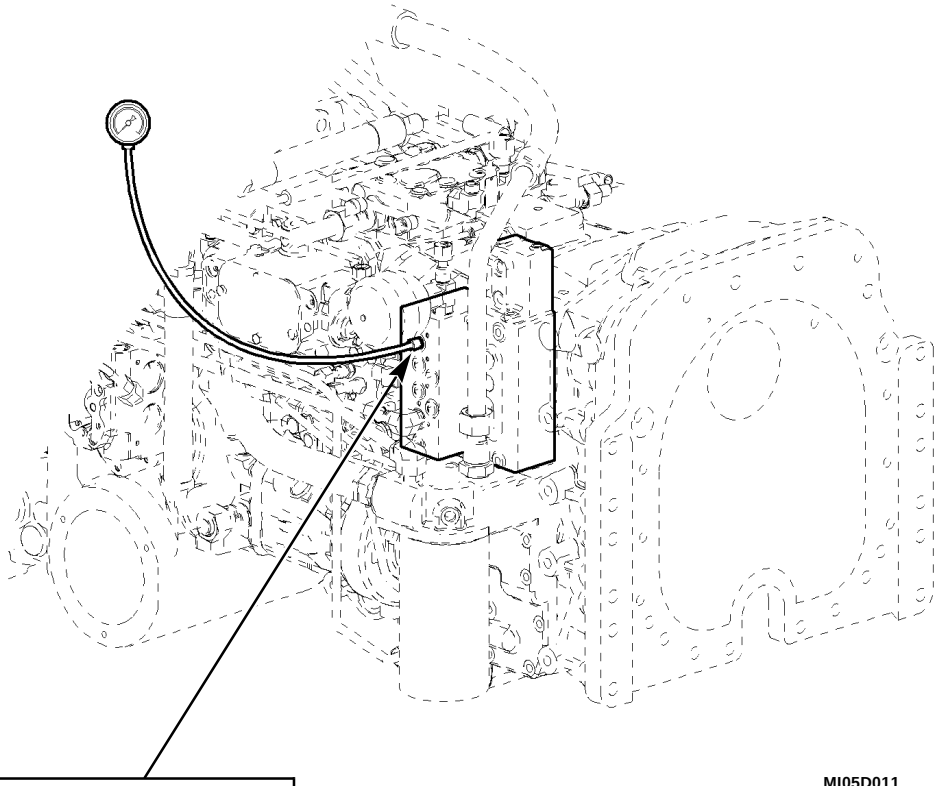
## POSSIBLE CAUSES

- Excessive leakage in the regulated circuit. Carry out Test 1 - Regulated Circuit Leakage Test.
- Blocked supply filter in supply port connector (4).
- Priority spool (5) is seized or has a broken spring. Service the priority/regulator valve, refer to Section 8006 Hydraulic Valves.
- Regulator spool (6) is seized or has a broken spring. Service the priority/regulator valve, refer to Section 8006 Hydraulic Valves.
- PFC pump is worn or faulty, carry out Test 4 - Low Pressure Standby Test.
- Steering relief valve pressure too high. Carry out Test 7 - Steering Function and Pressure Test.
- Incorrect charge pump pressure or flow. Carry out Test 2 - Charge Pump Pressure Test and Test 3 - Charge Pump Flow Test.

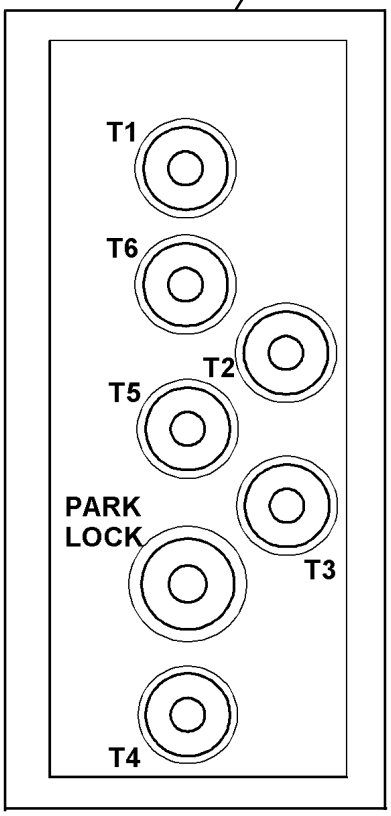
https://truckmanualshub.com/



# Test 9 - Powershift Valve Pressure Test



MI05D011




MI05E041

https://truckmanualshub.com/



## TOOLS REQUIRED

HYDRAULIC TEST KIT 1002T2
One M14 Minimess test point MC2541
One high pressure hose (part no. 8172694)
One 35 bar (500 psi) gauge (part no. FT5274-16)

## TEST CONNECTIONS

Remove the blanking plug from powershift valve test port (T1), install the pressure gauge. When the pressure has been recorded, repeat the procedure for each of the five remaining powershift valve test ports (T2), (T3) (T4) (T5) and (T6).

## TEST REQUIREMENTS

- Place the tractor in neutral. Apply the parking brake.
- Start and run engine.
- Heat the hydraulic oil to a temperature of 49℃.
- Run engine at 1500 rpm.
- Select a powershift speed and record the pressure. Repeat this procedure for each powershift speed, recording the pressure reading.

**NOTE:** *When a powershift speed is selected, two clutches are engaged for each speed operation. Speeds 1 to 4 will also engage low clutch 5 and speeds 5 to 8 will also engage high clutch 6.*

- Minimum pressure 1.5 bar (21.7 psi) below the regulated pressure. Maximum pressure same as regulated pressure recorded in Test 8 - Regulated Pressure Test.
- If the pressure readings are not correct refer to POSSIBLE CAUSES.

## POSSIBLE CAUSES

- Internal tubes, seals, or shafts are leaking, refer to Test 1 - Regulated Circuit Leakage Test.
- Regulator circuit pressure low, refer to Test 8 - Regulated Pressure Test.
- Powershift solenoid spool is not shifting correctly.
  Remove solenoid valve assembly. Inspect seals and check for operation. Replace as necessary.
  Carry out Powershift Circuit Tests, refer to Section 10002 PTO/FNR Controller and Powershift.
- Powershift Valve supply filter blocked.
- Powershift Valve o-rings leaking.
- Powershift Valve body cracked.
- Powershift clutch pack has failed. Service the powershift clutch, refer to Section 6006 Servicing the Powershift Transmission.

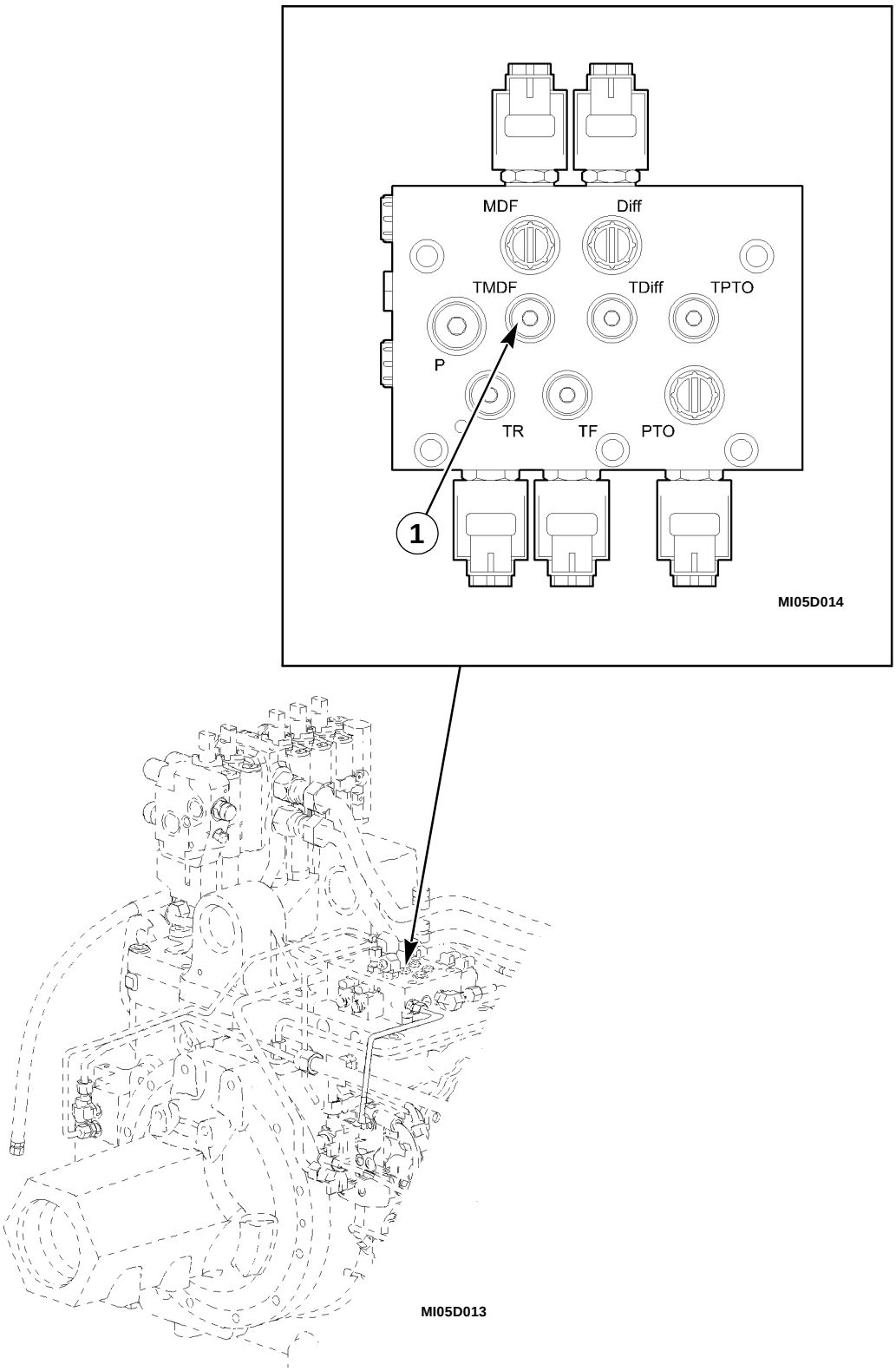
https://truckmanualshub.com/



# Test 10 - MFD Pressure Test

**NOTE:** *Always check the diagnostic error codes for the Hitch/MFD/Differential Lock Controller. Refer to Section 10002, Hitch/MFD/Differential Lock Controller.*

**NOTE:** *The MFD is engaged by pressure applied from belleville springs in the MFD clutch. Hydraulic oil supplied at regulated pressure disengages the MFD. This test is a check of regulated supply to the MFD only. It does not check the operation of the MFD clutch.*



https://truckmanualshub.com/



## TOOLS REQUIRED

HYDRAULIC TEST KIT 1002T2
One M14 - M18 adaptor MC2542
One M14 Minimess test point MC2541
One high pressure hose (part no. 8172694)
One 35 bar (500 psi) gauge (part no. FT5274-16)

## TEST CONNECTIONS

Remove the MFD test point blanking plug (1) from the shuttle valve, install a M14 test point and pressure gauge.

## TEST REQUIREMENTS

- Place the tractor in neutral. Apply the parking brake.
- Start and run engine.
- Heat the hydraulic oil to a temperature of 49℃.
- Run engine at 1500 rpm.
- With the MFD switch in the OFF position and the brakes disengaged (pedals released). Minimum pressure 0.7 bar (10 psi) below the regulated pressure. Maximum pressure same as regulated pressure recorded in Test 8 - Regulated Pressure Test.
- With the MFD switched in the ON position or the brakes engaged (pedals held down): No pressure should be recorded.
- If the pressures are not correct, refer to POSSIBLE CAUSES.

## POSSIBLE CAUSES

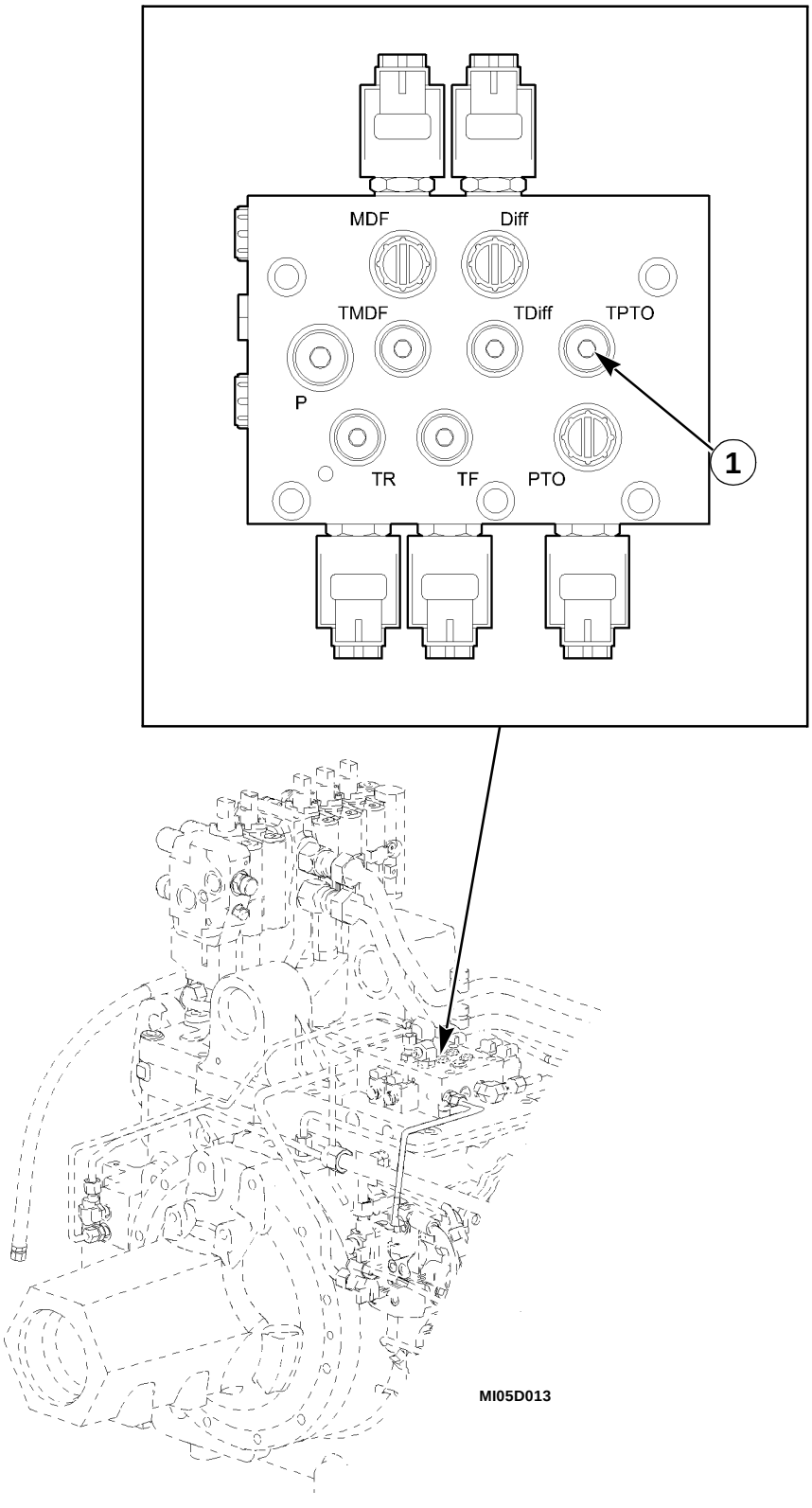
- MFD solenoid spool is not shifting correctly.
  Remove solenoid valve assembly. Inspect seals and check for operation. Replace as necessary.
  Carry out MFD Solenoid Test, refer to Section 10002 Hitch/MFD/Differential Lock Controller.
- MFD solenoid filter blocked.
- Shuttle valve supply filter blocked.
- Shuttle valve gasket leaking.
- MFD internal supply tube leaking.
- MFD clutch shaft seals leaking. Service the MFD clutch, refer to Test 1 - Regulated Circuit Leakage Test. Also refer to Section 6017 MFD Clutch.
- Piston seals leaking in MFD clutch pack. Service the MFD clutch, refer to Test 1 - Regulated Circuit Leakage Test. Also refer to Section 6017 MFD Clutch.

https://truckmanualshub.com/



# Test 11 - PTO Supply Pressure Test

**NOTE:** *Always check the diagnostic error codes for the PTO/FNR Controller. Refer to Section 10002, PTO/FNR Controller and Powershift.*



https://truckmanualshub.com/



## TOOLS REQUIRED

HYDRAULIC TEST KIT 1002T2
One M14 Minimess test point MC2541
One high pressure hose (part no. 8172694)
One 35 bar (500 psi) gauge (part no. FT5274-16)

## TEST CONNECTIONS

Remove the PTO test point plug (1) from the shuttle valve, install M14 test point and pressure gauge.

## TEST REQUIREMENTS

- Place the tractor in neutral. Apply the parking brake.
- Start and run engine.
- Heat the hydraulic oil to a temperature of 49℃.
- Run engine at 1500 rpm.
- Engage the PTO.

**540 PTO RPM OPERATION:**

- Engage 540 PTO rpm, pressure must not exceed 8.0 to 12 bar (116 to 174 psi). The pressure to the PTO clutch is limited by the PTO controller.

**1000 PTO RPM OPERATION:**

- Engage 1000 PTO rpm, pressure must be 22 to 24 bar (319 to 348 psi).
- Disengage the PTO.
- The pressure must drop to zero.
- If the pressures are not correct see POSSIBLE CAUSES.

## POSSIBLE CAUSES

Pressure too low in 540 or 1000 PTO speed.

- PTO solenoid spool is not shifting correctly.
  Remove solenoid valve assembly. Inspect seals and check for operation. Replace as necessary.
  Carry out PTO Circuit Tests, refer to Section 10002 PTO/FNR Controller and Powershift.
- Regulator circuit pressure low, refer to Test 8 - Regulated Pressure Test.
- Shuttle valve supply filter blocked.
- Shuttle valve o-rings leaking.
- Shuttle valve body cracked.
- PTO input shaft seal leaking, service the PTO, refer to Section 6019.
- PTO input shaft blanking plugs missing, service the PTO, refer to Section 6019.
- PTO clutch seals leaking, service the PTO, refer to Section 6019.

Pressure correct in 1000 PTO speed but incorrect in 540 PTO speed.

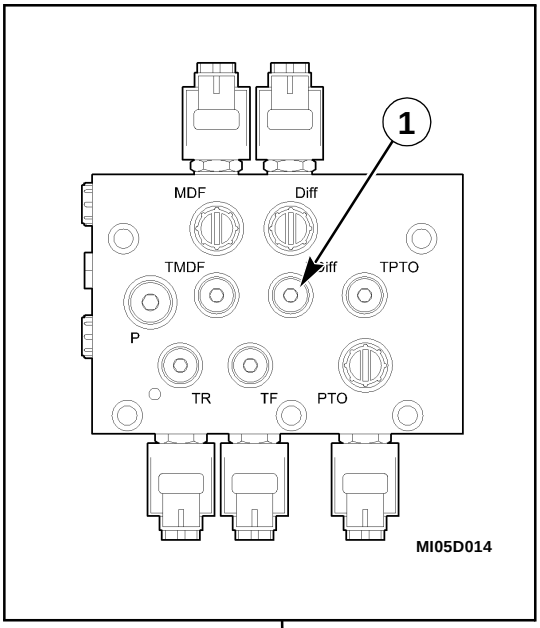
- PTO solenoid spool is not shifting correctly.
  Remove solenoid valve assembly. Inspect seals and check for operation. Replace as necessary.
  Carry out PTO Circuit Tests, refer to Section 10002 PTO/FNR Controller and Powershift.
- 540/1000 PTO speed switch circuit faulty, refer to Section 10002 PTO/FNR Controller and Powershift.
- PTO controller failure, refer to Section 10002 PTO/FNR Controller and Powershift.

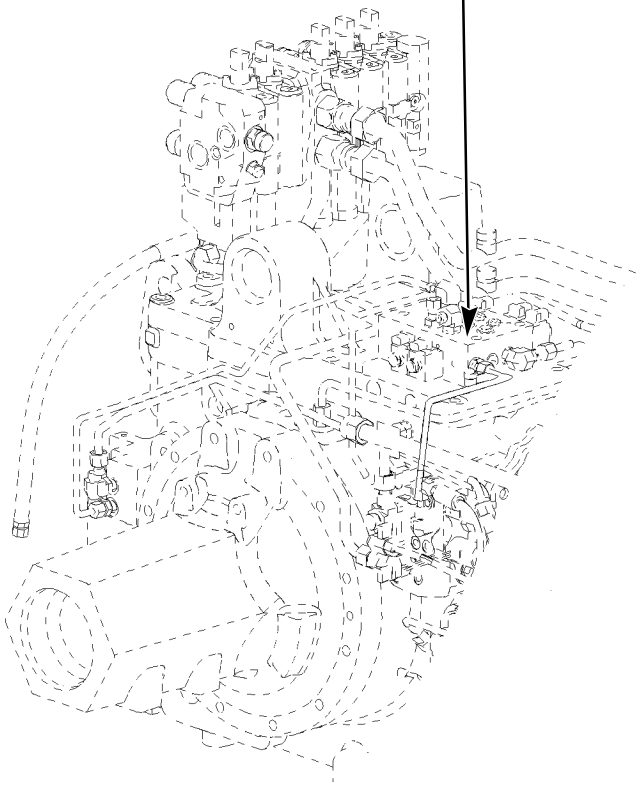
https://truckmanualshub.com/



# Test 12 - Differential Lock Pressure Test

**NOTE:** *Always check the diagnostic error codes for the Hitch/MFD/Differential Lock Controller. Refer to Section 10002, Hitch/MFD/Differential Lock Controller.*



https://truckmanualshub.com/



## TOOLS REQUIRED

HYDRAULIC TEST KITS MC2482 AND MC30020
One M14 Minimess test point MC2541
One high pressure hose (part no. 8172694)
One 35 bar (500 psi) gauge (part no. FT5274-16)

## TEST CONNECTIONS

Remove the differential lock test point plug (1) from the shuttle valve, install M14 test point and pressure gauge.

## TEST REQUIREMENTS

- Place the tractor in neutral. Apply the parking brake.
- Start and run engine.
- Heat the hydraulic oil to a temperature of 49℃.
- Run engine at 1500 rpm.
- Engage differential lock.
- Minimum pressure 0.7 bar (10 psi) below the regulated pressure. Maximum pressure same as regulated pressure recorded in Test 8 - Regulated Pressure Test.
- Disengage the differential lock.
- The pressure must drop to zero.
- If the pressure is not correct refer to POSSIBLE CAUSES.

## POSSIBLE CAUSES

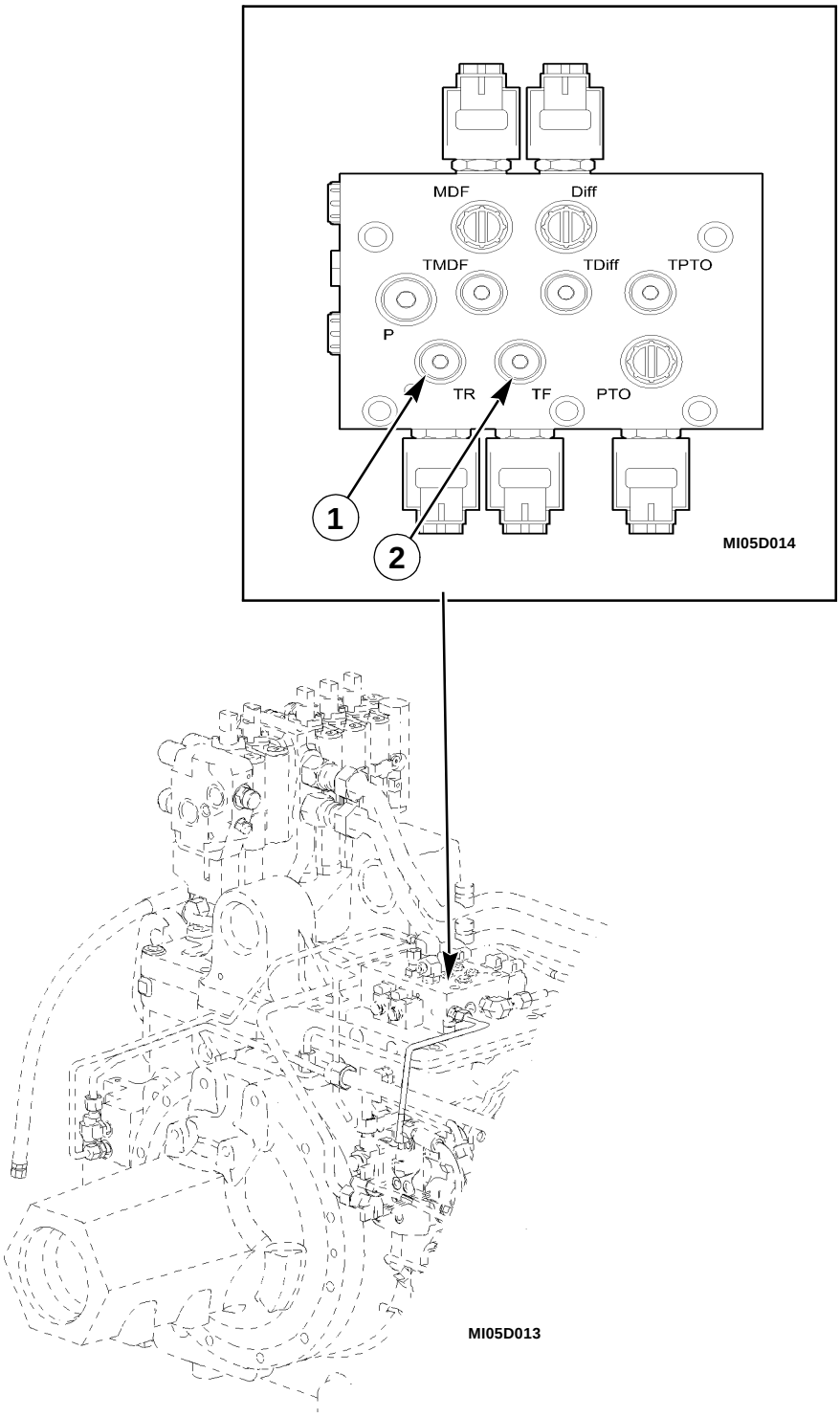
- Differential solenoid spool is not shifting correctly.
  Carry out Differential Lock Circuit Tests, refer to Section 10002 Hitch/MFD/Differential Lock Controller.
- Shuttle valve supply filter blocked.
- Shuttle valve o-rings leaking.
- Leakage in differential lock circuit - Carry out Test 1 - Regulated Circuit Leakage Test.
  O-rings leaking on differential lock solenoid.
  Piston seals leaking in differential lock clutch pack. Service the differential lock, refer to Section 6012 Differential and Differential Lock.
  Seals leaking on R/H differential bearing carrier. Service the differential, refer to Section 6012 Differential and Differential Lock.

https://truckmanualshub.com/



# Test 13 - Forward and Reverse Clutch Pressure Test

**NOTE:** *Always check the diagnostic error codes for the PTO/FNR Controller. Refer to Section 10002, PTO/FNR Controller and Powershift.*



https://truckmanualshub.com/



## TOOLS REQUIRED

HYDRAULIC TEST KIT 1002T!
Two M14 Minimess test points MC2541
Two high pressure hoses (part no. 8172694)
Two 35 bar (500 psi) gauges (part no. FT5274-16)

## TEST CONNECTIONS

Remove the forward clutch test point (1) and reverse clutch test point (2) from the shuttle valve test ports, install two M14 test points and pressure gauges.

## TEST REQUIREMENTS

- Place the F/N/R or F/N/R/P lever in the neutral position. Apply the parking brake.
- Place range lever in the neutral position (XtraSpeed tractors only).
- Set gear selection to 01 (XtraSpeed-E and XtraSpeed-E Plus tractors only).

**WARNING:** *If the tractor is keyed off at any time during the test, reset the gear selection to 01.* M753

- Disengage the creep speed.
- Start and run engine.
- Heat the hydraulic oil to a temperature of 49℃.
- Run engine at 1500 rpm.
- Select Forward then Reverse and record the pressure readings. Return the F/N/R or F/N/R/P lever to the neutral position.
- The pressure readings for both Forward and Reverse must be within 0.7 bar (10 psi) of regulated pressure recorded in Test 8 - Regulated Pressure Test.
- The pressure reading in Neutral must be zero
- If the pressure readings are not correct refer to POSSIBLE CAUSES.

**NOTE:** *When creep speed is selected the pressure to the forward and reverse clutch packs is reduced to 10.3 bar (150 psi).*

## POSSIBLE CAUSES

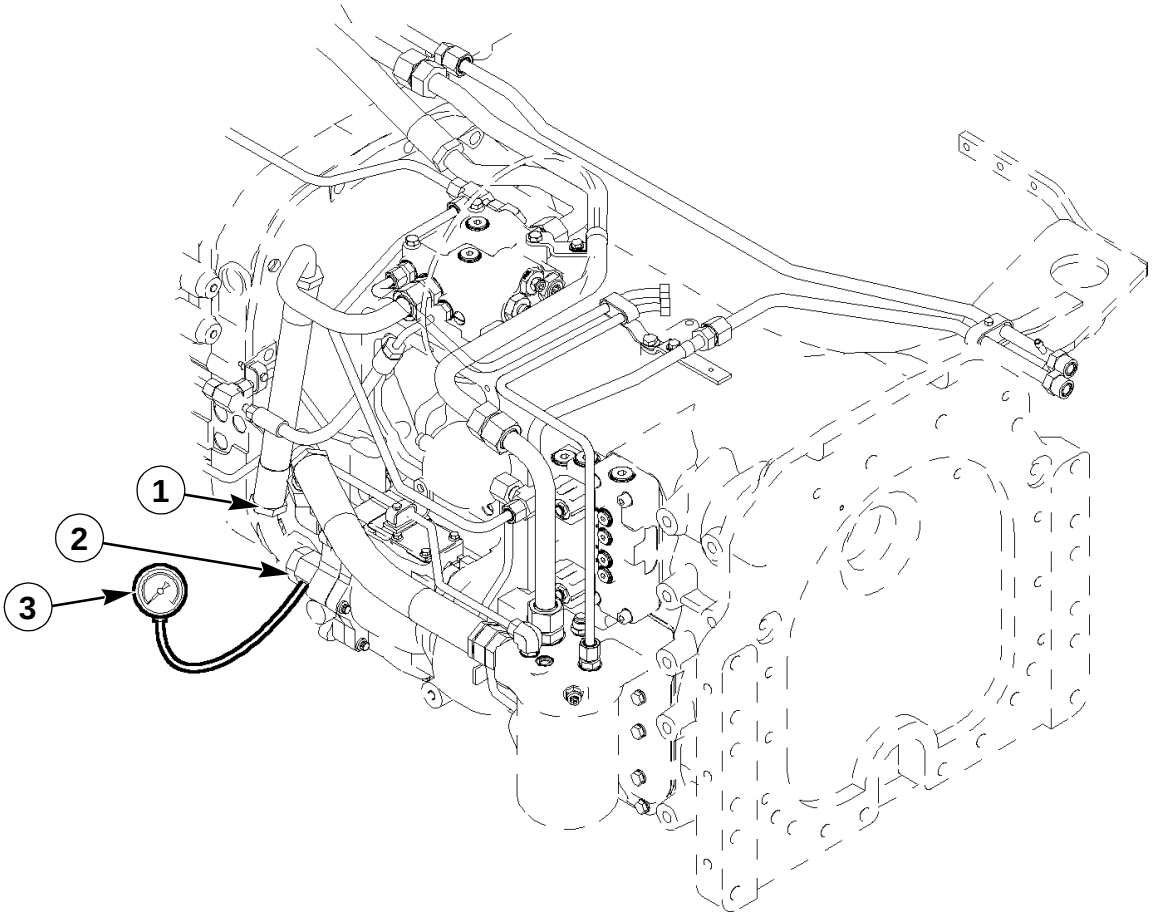
- Both forward and reverse clutch pressure readings are out of specification:
  Incorrect regulated pressure, carry out Test 8 - Regulated Pressure Test.
- Clutch pressure reading is normal for only one of the clutches:
  Excessive leakage in clutch with low pressure reading, carry out Test 1 - Regulated Circuit Leakage Test.
- Clutch pressure reading is zero when selecting Forward or Reverse:
  Both forward and reverse solenoids are being energized at the same time giving a neutral condition. Carry out Forward/Neutral/Reverse Circuit Test, refer to Section 10002 PTO/FNR Controller and Powershift.
- Shuttle valve supply filter blocked.
- Forward and/or reverse solenoid filter blocked.
- Forward and/or Reverse solenoid spool is not shifting correctly.
  Remove solenoid valve assembly. Inspect seals and check for operation. Replace as necessary.
  Carry out Forward/Neutral/Reverse Circuit Test, refer to Section 10002 PTO/FNR Controller and Powershift.
- Shuttle valve o-rings leaking.
- Shuttle valve body cracked.

https://truckmanualshub.com/



## Test 14 - Rear Hitch Pressure Test

**NOTE:** *Always check the diagnostic error codes for the Hitch/MFD/Differential Lock Controller. Refer to Section 10002, Hitch/MFD/Differential Lock Controller.*




MI01F048

https://truckmanualshub.com/



## TOOLS REQUIRED

HYDRAULIC TEST KIT 1002T2

One M12 Minimess test point MC2540
One high pressure hose (part no. 8172694)
One 350 bar (5000 psi) gauge (part no. FT5274-12)
One 1 7/16 inch - M33 adaptor MC2545 (Sauer Sunstrand Pump)
One 1 7/16 inch - M33 elbow adaptor 1039T1 (Rexroth Pump)

## TEST CONNECTIONS

Disconnect the PFC pump outlet hose (1) and remove the fitting at the pump outlet. Install a 1 7/16 inch - M33 adaptor (2) MC2545 (Sauer Sunstrand Pump) or a 1 7/16 inch - M33 elbow adaptor (2) 1039T1 (Rexroth Pump), connect the outlet hose (1). Install the M12 test point and pressure gauge (3) into the adaptor (2).

## TEST REQUIREMENTS

- Place the tractor in neutral. Apply the parking brake.
- Start and run engine.
- Heat the hydraulic oil to a temperature of 49℃.
- Run engine at 1500 rpm.
- The hitch should be unloaded and fully lowered.
- Raise the hitch. The hitch should raise at low pressure standby pressure as follows:

  Rexroth hydraulic pumps

  27 to 40 bar (391 to 580 psi).
  Sauer Sundstrand optional high flow hydraulic pump

  27 to 40 bar (391 to 580 psi).

## POSSIBLE CAUSES

Refer to Rear Hitch Problems on page 6.

https://truckmanualshub.com/



# HYDRAULIC SCHEMATIC (XTX Tractors)

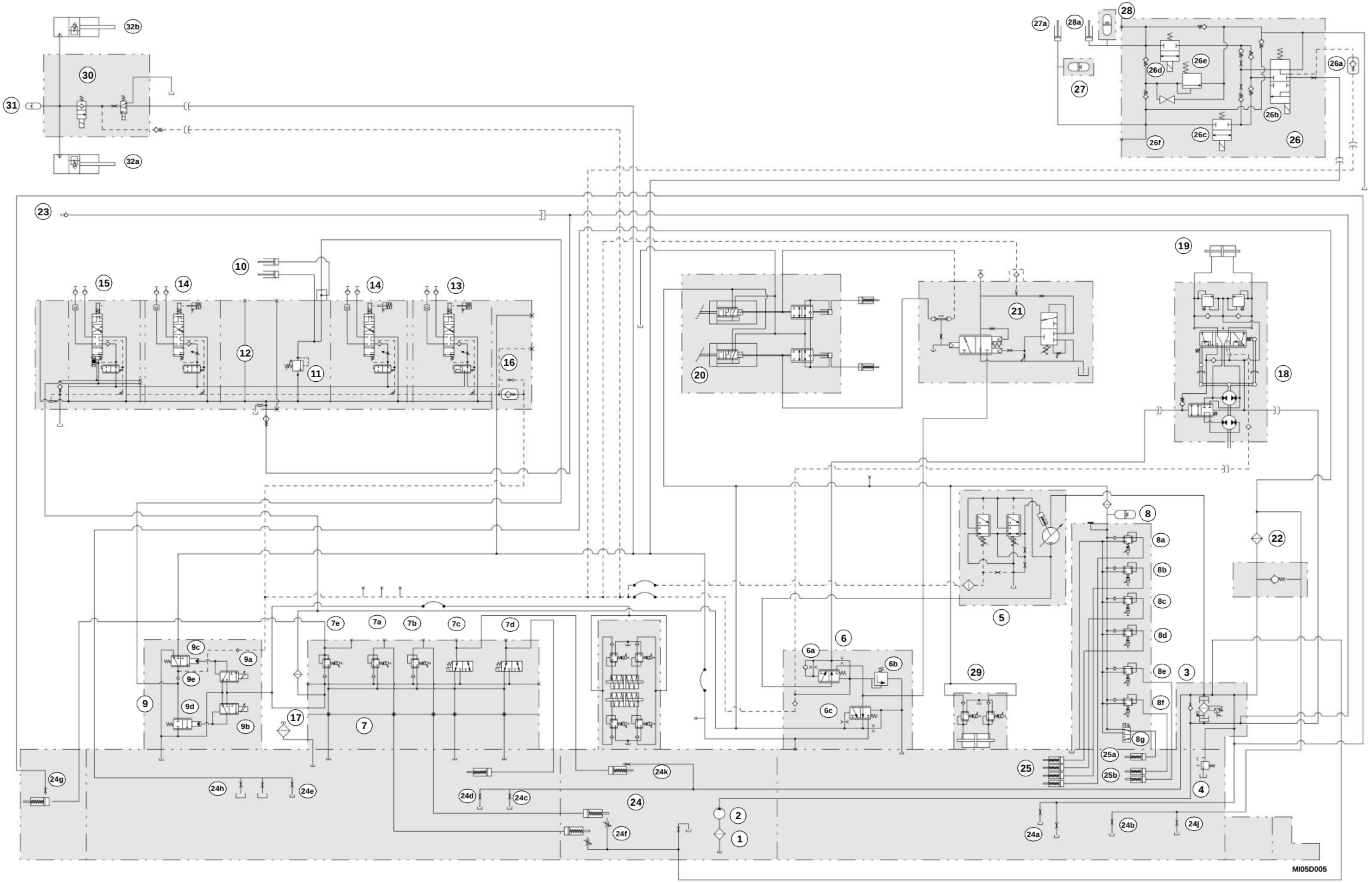
## Hydraulic Circuit Components

| |
|---|
| 1.MAIN SUCTION SCREEN |
| 2.CHARGE/LUBRICATION PUMP |
| 3.MAIN FILTER |
| 4.LUBRICATION PRESSURE RELIEF VALVE 4.8 BAR (70 PSI) |
| 5.PFC PUMP MAXIMUM PRESSURE REXROTH 199 TO 209 BAR (2886 TO 3031 PSI) SAUER 202BAR (2929 PSI) |
| 6.PRIORITY REGULATOR VALVE |
| 6A.STEERING PRIORITY SPOOL |
| 6B.STEERING MAXIMUM PRESSURE VALVE 177 TO 185 BAR (2567 TO 2683 PSI) |
| 6C.REGULATED PRESSURE CONTROL SPOOL 22 TO 24 BAR (319 TO 348 PSI) |
| 7.F-N-R SHUTTLE VALVE (WITH FILTER SCREEN AT SUPPLY PORT) |
| 7A.FORWARD SOLENOID VALVE (WITH FILTER SCREEN) |
| 7B.REVERSE SOLENOID VALVE (WITH FILTER SCREEN) |
| 7C.MFD SOLENOID VALVE |
| 7D.DIFFERENTIAL SOLENOID VALVE |
| 7E.PTO SOLENOID VALVE |
| 8.POWERSHIFT VALVE (WITH FILTER SCREEN AT SUPPLY PORT) |
| 8A.S1 SOLENOID VALVE |
| 8B.S2 SOLENOID VALVE |
| 8C.S3 SOLENOID VALVE |
| 8D.S4 SOLENOID VALVE |
| 8E.S5 SOLENOID VALVE (LOW) |
| 8F.S6 SOLENOID VALVE (HIGH) |
| 8G.SOLENOID VALVE PARK LOCK |
| 9.HITCH CONTROL VALVE |
| 9A.RAISE SOLENOID PILOT VALVE |
| 9B.LOWER SOLENOID PILOT VALVE |
| 9C.RAISE SECONDARY CONTROL SPOOL |
| 9D.LOWER SECONDARY CONTROL SPOOL |
| 9E.CHECK VALVE |
| 10.HITCH CYLINDERS |
| 11.HITCH CUSHION RELIEF VALVE 217 TO 231 BAR (3147 TO 3350 PSI) |
| 12.HYDRAULIC POWER BEYOND PLATE |
| 13.1ST REMOTE AUXILIARY VALVE WITH PRIORITY |
| 14.ADDITIONAL REMOTE AUXILIARY VALVE |
| 15.ELECTRONIC REMOTE VALVE |
| 16.RETURN OIL CHECK VALVE |
| 17.TRANSMISSION HOUSING BREATHER |
| 18.STEERING HAND CONTROL UNIT - EUROPEAN TRACTORS |
| 18A.STEERING HAND CONTROL UNIT - NORTH AMERICAN TRACTORS (REFER TO PAGE 54) |
| 19.STEERING CYLINDER |
| 20.BOOSTER BRAKE VALVE (IF EQUIPPED) |
| 21.BRAKE VALVE |

| |
|---|
| 22.OIL COOLER |
| 23.HYDRAULIC MOTOR LOW PRESSURE RETURN COUPLING |
| 24.TRANSMISSION LUBRICATION |
| 24A.POWERSHIFT LUBRICATION, CLUTCHES 1,2,3,4 15.5 L/MIN. (4 US GPM) |
| 24B.MAINSHAFT/POWERSHIFT CLUTCH 5 LUBRICATION 7 L/MIN. (1.8 US GPM) |
| 24C.PINION/BEVEL GEAR LUBRICATION 4 L/MIN. (1 US GPM) |
| 24D.PINION SHAFT GEAR LUBRICATION 8 L/MIN. (2 US GPM) |
| 24E.DIFFERENTIAL HOUSING LUBRICATION 8 L/MIN. (2 US GPM) |
| 24F.FORWARD AND REVERSE CLUTCH LUBRICATION ENGAGED - 25 L/MIN. (6.6 US GPM) DISENGAGED - 10 L/MIN. (2.6 US GPM) |
| 29.CREEPER VALVE (OPTIONAL) |
| 30.CAB SUSPENSION (OPTIONAL) |
| 31.CAB SUSPENSION ACCUMULATOR 40 BAR (580 PSI) |
| 32A.CAB SUSPENSION RIGHT CYLINDER |
| 32B.CAB SUSPENSION LEFT CYLINDER |
| 33.SCHEMATIC FOR 5 ELECTRONIC REMOTE VALVES (REFER TO PAGE 54) |

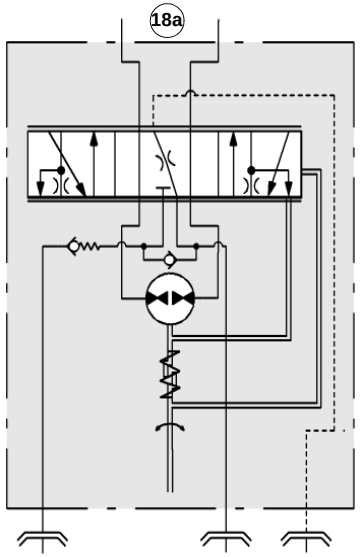
https://truckmanualshub.com/


## SCHEMATIC CIRCUIT XTX TRACTORS

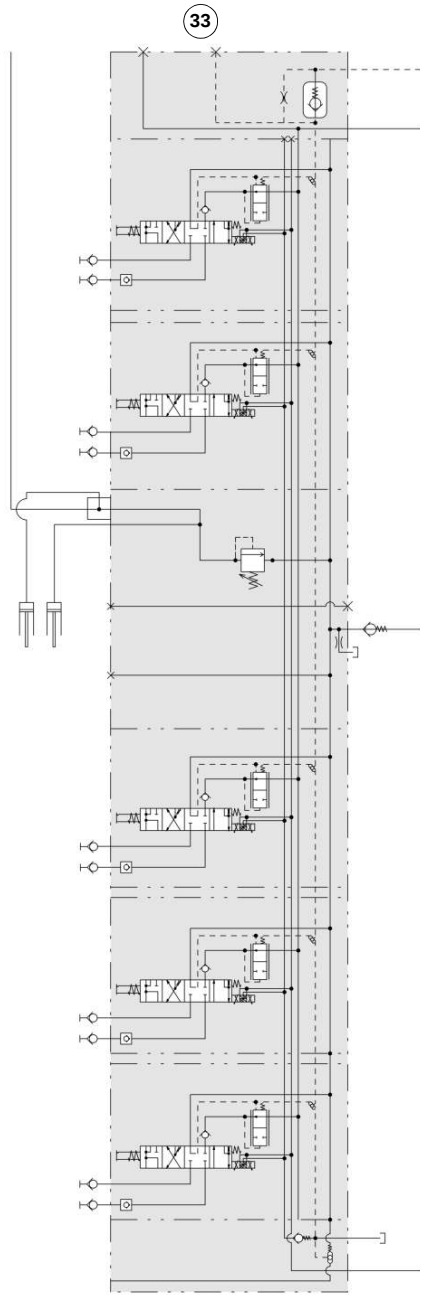


https://truckmanualshub.com/






MI01F021




MI05D006

https://truckmanualshub.com/

# Section 8003



## CHARGE/LUBRICATION PUMP

## XTX185, 200 and 215 Tractors

McCORMICK

SM 8-15200

© 2006 McCormick Tractors International Limited.
September 2006

https://truckmanualshub.com/



# TABLE OF CONTENTS

CHARGE/LUBRICATION PUMP
Removal ..... 3
Installation ..... 4

https://truckmanualshub.com/



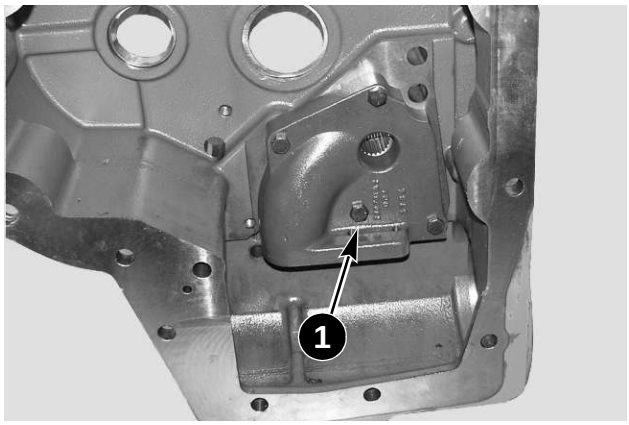
# CHARGE/LUBRICATION PUMP

Before removing the charge/lubrication pump, it will be necessary to carrying out the following:

- Remove the cab and separate the speed and range transmission, refer to Section 6003.
- Remove the MFD/Park brake assembly, refer to Section 6017.
- Remove the bearing carrier housing, refer to Section 6007.

## Removal

### STEP 1

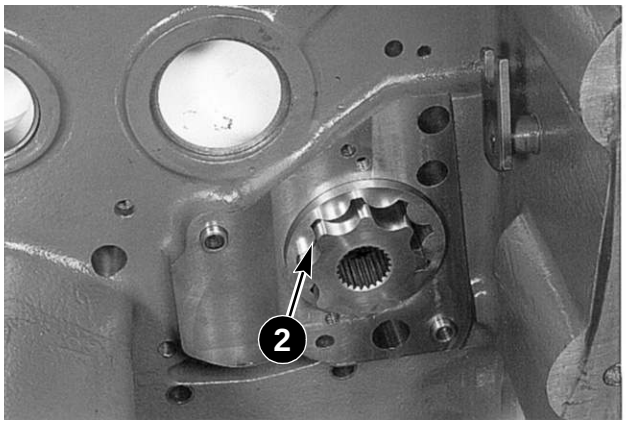



MD06C104

Remove the four charge/lubrication pump retaining bolts (1) and remove the charge/lubrication pump housing.

**NOTE:** *The two longer bolts are installed through the charge/lubrication pump housing locating dowels.*

### STEP 2

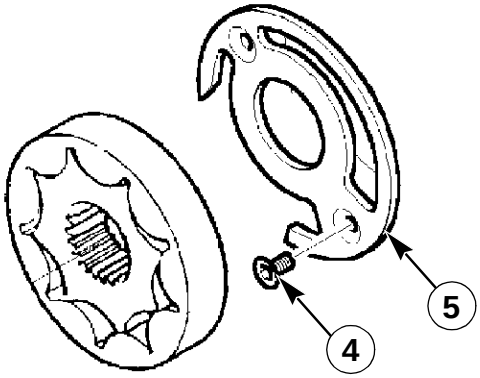



RP98J063

Remove the gerotor gear set (2)

**NOTE:** *Some early transmissions are equipped with different gerotor gear sets and bearing carrier housing, refer to STEP 3.*

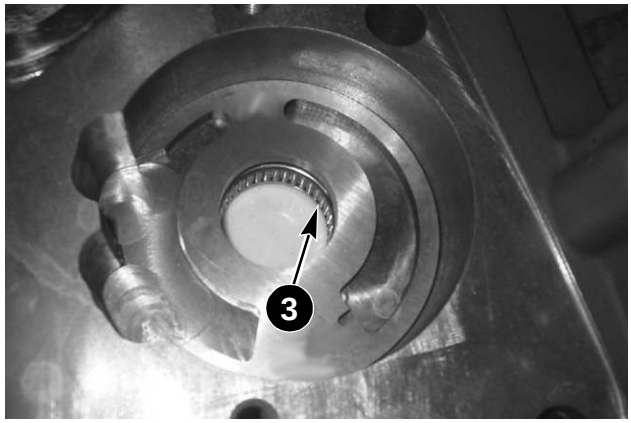
### STEP 3




MI06D003

Remove the two retaining screws (4) and wear plate (5) if equipped.

### STEP 4




MD06D020

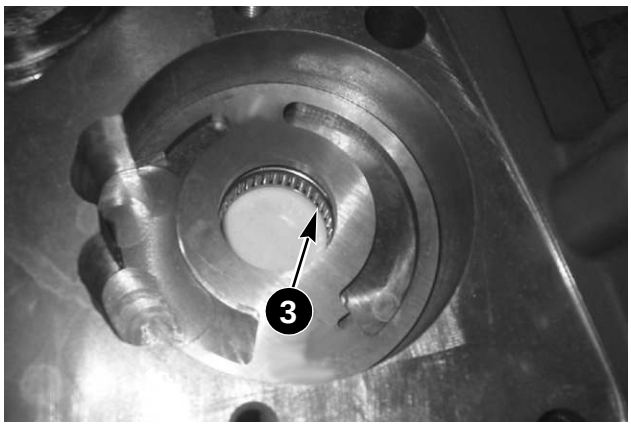
Check needle bearing (3) for wear or damage and remove as necessary.

https://truckmanualshub.com/



## Installation

### STEP 5

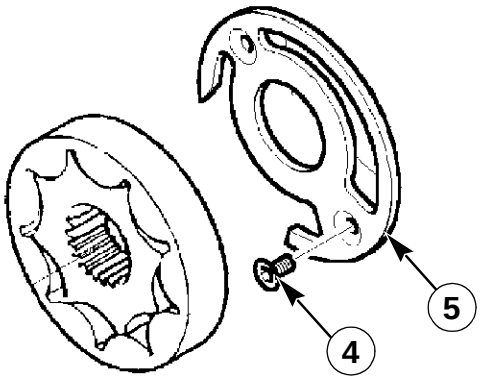



MD06D020

If the needle bearing (3) has been removed, install a new needle bearing using a suitable bearing driver against the outside diameter of the bearing. Install the bearing to a depth of 3.5 mm (0.14 inch) from the charge/lubrication pump side of the bearing carrier housing.

**NOTE:** *Make sure the flat surface of the bearing is towards the front.*

### STEP 6



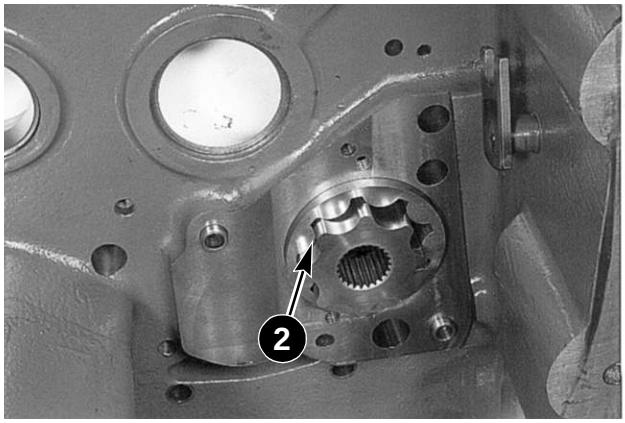

MI06D003

Install the wear plate (5) and the two retaining screws (4) if equipped. Place a small bead of Loctite 638 (680) on the screws and tighten to a torque of 12 Nm (8 lb ft).

### STEP 7

Using a micrometer, measure the outer diameter of the gerotor gear set. Replace the gerotor gear set if outer diameter is not between 114.211 mm (4.4967 inches) and 114.249 mm (4.4982 inches).

### STEP 8

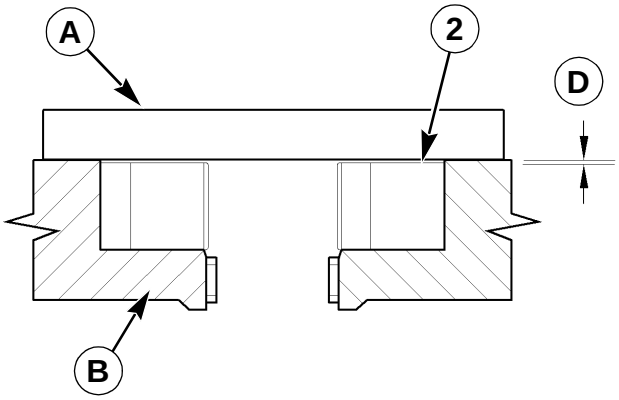



RP98J063

Install the gerotor gear set (2) in the bearing carrier housing.

**NOTE:** *The marks on the gerotor set (2) must be together, Faced up or down.*

### STEP 9




MD06D022

Put a straight edge (A) across the bearing carrier housing (B) and the gerotor gear set (2). Using feeler gauges, measure clearance (D) between the straight edge and the gerotor gear set.

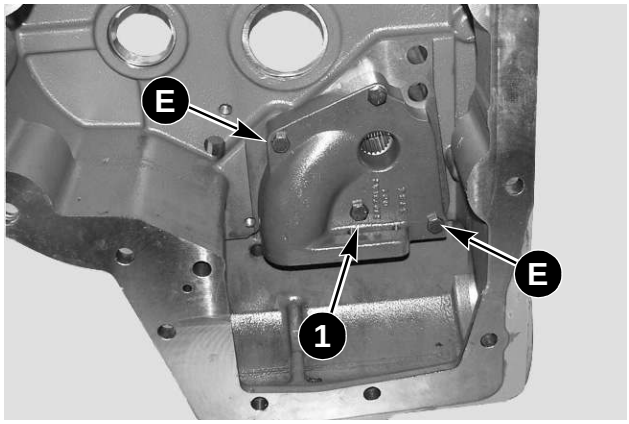
Clearance (D) must be 0.04 to 0.13 mm (0.001 to (0.005 inch). If end clearance is below 0.04 mm (0.001 inch) check for foreign matter between gerotor gear set and bearing carrier housing.

If clearance (D) is more than 0.13 mm (0.005 inch) replace gerotor gear set and repeat this step to check the clearance.

https://truckmanualshub.com/



## STEP 10




MD06C104

Install the charge/lubrication pump housing and install the four housing retaining bolts (1). Make sure the 70 mm long bolts are install through the locating dowels at location (E). Tighten all the bolts to a torque of 100 to 113 Nm (73 to 83 lb ft).

## STEP 11

Install the bearing carrier housing, refer to Section 6007 for procedure.

https://truckmanualshub.com/

# Section 8008

## BOSCH REMOTE VALVES

## XTX Series Tractors



McCORMICK

SM 8-15130

© 2005 McCormick Tractors International Limited.
September 2005

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIAL TORQUES ..... 3

REMOTE VALVES
Removal and Installation ..... 4

REMOTE VALVE
Disassembly and Assembly ..... 6

REMOTE VALVE (ELECTRONIC)
Disassembly and Assembly ..... 8

CHECK VALVE
Disassembly and Assembly ..... 10
Check valve pin ..... 11

REMOTE VALVE END PLATE
Disassembly and Assembly ..... 12

REMOTE VALVE END PLATE WITH FORTH REMOTE VALVE
Disassembly and Assembly ..... 13

REMOTE VALVE END PLATE MANIFOLD
Disassembly and Assembly ..... 14

https://truckmanualshub.com/



# SPECIAL TORQUES

| | | |
|---|---|---|
| Mounting Nuts | 30 to 33 Nm | 22 to 24 lb ft |

https://truckmanualshub.com/



# REMOTE VALVES

## Removal and Installation

**NOTE:** *Steps are numbered in order of Removal, for Installation follow the procedure in reverse order.*

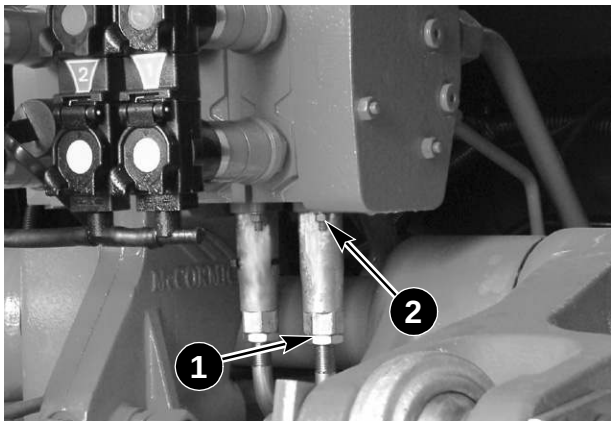
Before removing the Remote Valves it will be necessary to carry out the following:
- Park the tractor on hard level ground and apply the parking brake.
- Stop the engine and remove the key.
- Put blocks in front of and behind the rear wheels.
- Clean the area around the remote valves.

### STEP 1

Disconnect the battery, negative (-) terminal(s) first.

**NOTE:** *For Installation, connect the positive (+) terminal(s) first.*

### STEP 2




MD05G141

Loosen the lock nuts (1) on the remote valve cables. Remove the retaining nuts (2) and remove the cables.

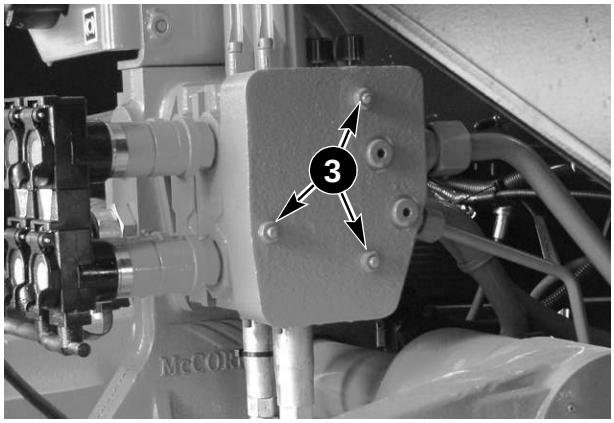
### STEP 3

Disconnect the front hitch hoses, if equipped, from the remote valve couplers.

### STEP 4

Disconnect and plug, all pipes from the remote valves.

### STEP 5




MD05G140

Remove the three remote valve retaining nuts (3). Remove the end cover manifold and the remote valves, as equipped, remove and discard all o-rings.

**NOTE:** *For Installation, refer to Section 9001 for Remote Valve Cable Adjustment.*

**NOTE:** *For Installation, lubricate and install new o-rings. Tighten the retaining nuts to a torque of 30 to 33 Nm (22 to 24 lb ft).*

https://truckmanualshub.com/



THIS PAGE HAS BEEN LEFT BLANK

https://truckmanualshub.com/

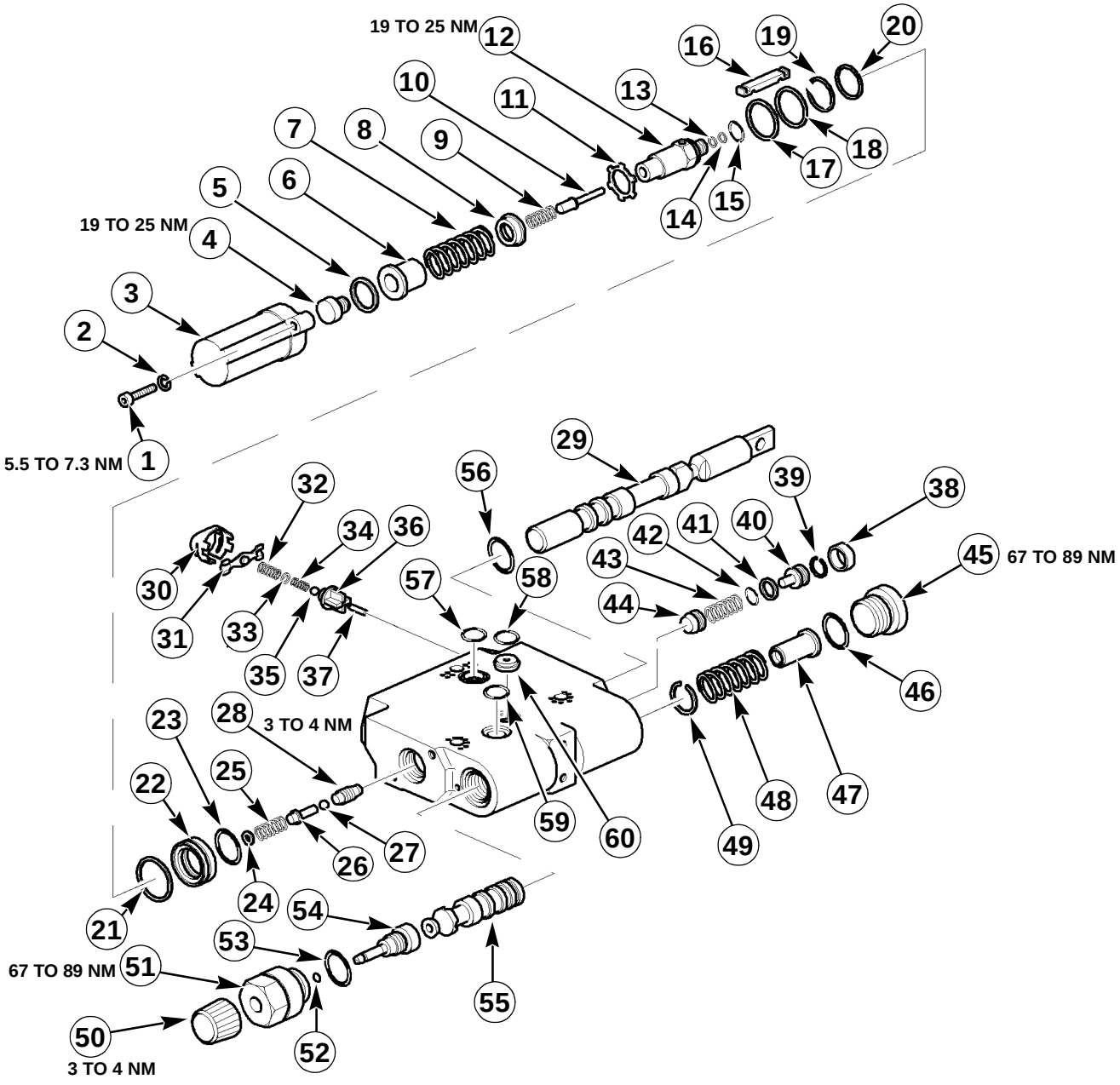


# REMOTE VALVE

## Disassembly and Assembly

**NOTE:** *Items are numbered in order of Disassembly, for Assembly follow the procedure in reverse order.*

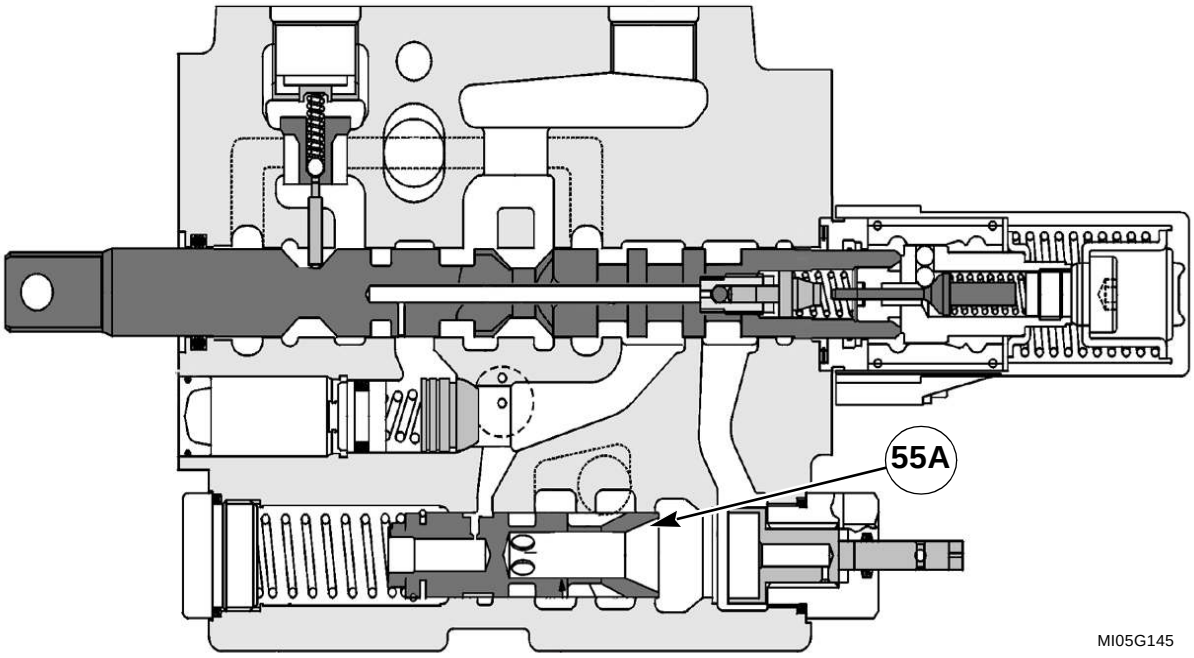
**IMPORTANT:** *The remote valve equipped with Priority Flow Control Spool must always be installed in the number 1 position.*



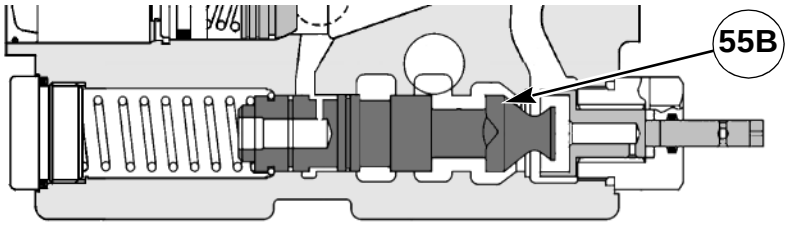

MI05G154

https://truckmanualshub.com/






MI05G145




MI04M089

1. SCREW
2. WASHER
3. DETENT COVER
4. PLUG
5. SHIM
6. SPRING SEAT
7. SPRING
8. SPRING SEAT
9. SPRING
10. SPOOL
11. RETAINING WASHER
12. INLET UNION
13. SUPPORT RING
14. O-RING
15. O-RING
16. STOP BAR
17. RETAINING RING
18. RETAINING RING
19. RING
20. O-RING
21. O-RING
22. SPACER RING
23. O-RING
24. SHIM
25. SPRING
26. THRUST PIN
27. BALL
28. VALVE INSERT
29. SPOOL
30. RETAINER
31. CLAMPING PLATE
32. SPRING)
33. WASHER
34. SPRING
35. BALL
36. VALVE CONE
37. THRUST PIN
38. PLUG
39. RETAINER
40. PLUG
41. SUPPORT RING
42. O-RING
43. SPRING
44. VALVE CONE
45. PLUG
46. O-RING
47. GUIDE PIN
48. SPRING
49. RETAINER
50. ROTARY KNOB
51. PLUG
52. O-RING
53. O-RING
54. THROTTLE SCREW
55A. VALVE SPOOL (PRIORITY)
55B. VALVE SPOOL (NON PRIORITY)
56. O-RING
57. O-RING
58. O-RING
59. O-RING
60. SHUTTLE VALVE

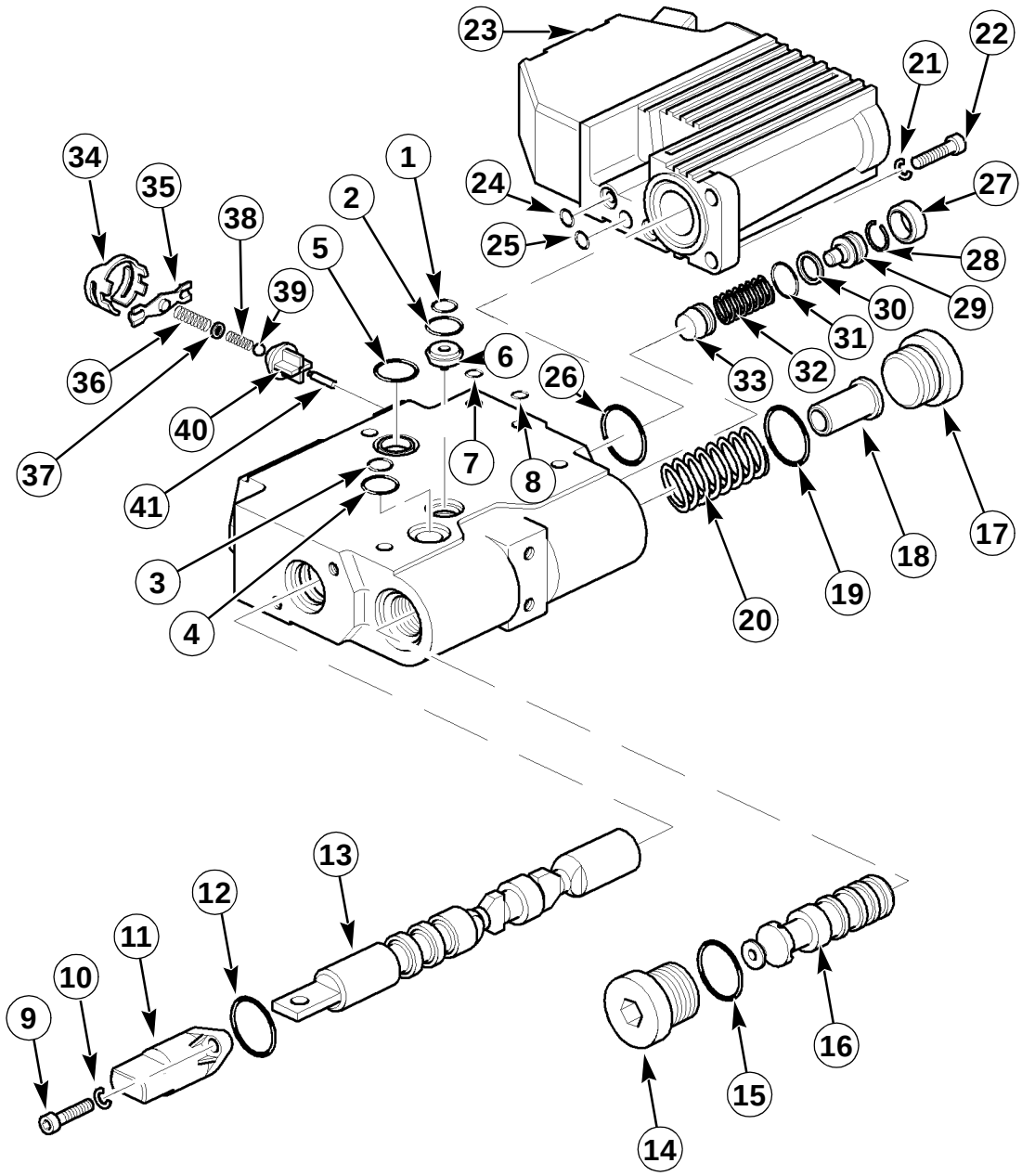
https://truckmanualshub.com/



# REMOTE VALVE (ELECTRONIC)

## Disassembly and Assembly

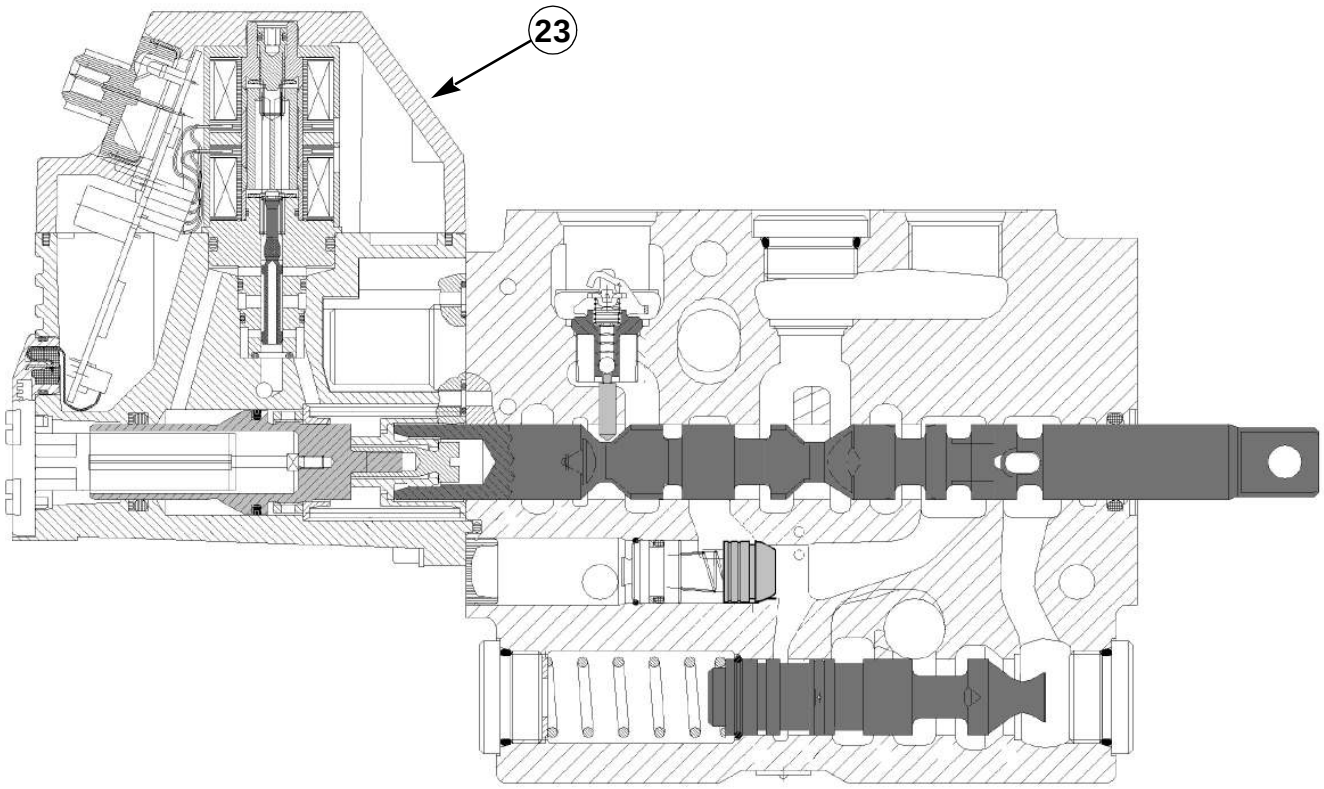
**NOTE:** *Items are numbered in order of Disassembly, for Assembly follow the procedure in reverse order.*




MI04M092

https://truckmanualshub.com/






MI04M099

14. PLUG

28. RETAINER

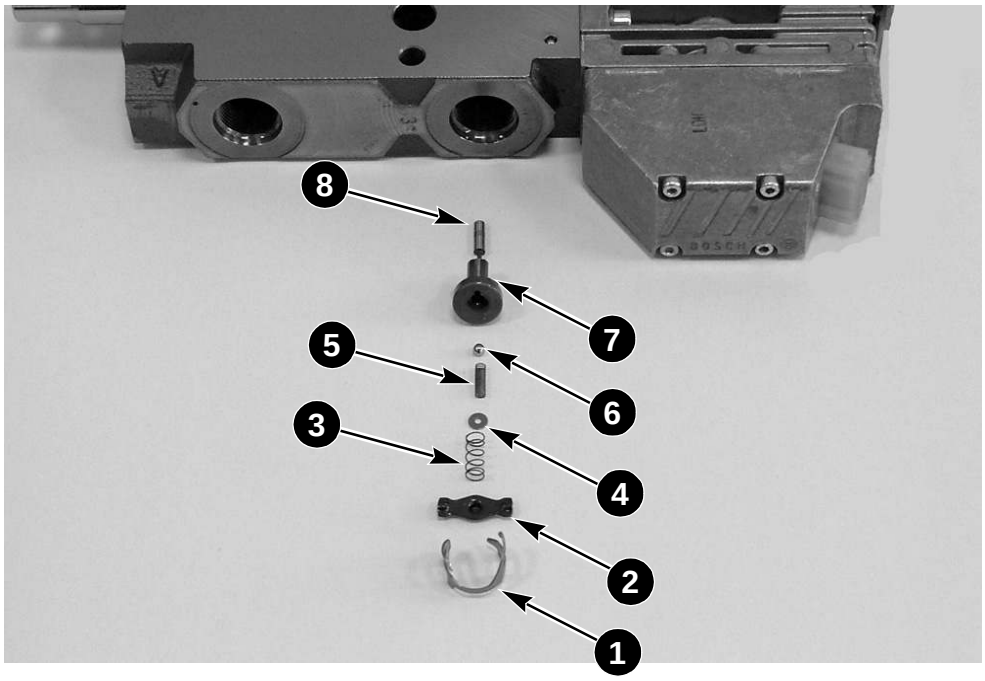
https://truckmanualshub.com/



# CHECK VALVE

## Disassembly and Assembly

**NOTE:** *Items are numbered in order of Disassembly, for Assembly follow the procedure in reverse order.*




MD04N054

1. RETAINING CLIP
2. VALVE RETAINER
3. SPRING
4. WASHER
5. SPRING
6. BALL
7. CHECK VALVE
8. PIN

### STEP 1

Move remote valve spool to neutral position.

### STEP 2

Bend both ends of the retaining clip (1) inwards and turn clockwise

**NOTE:** *For installation, turn the retaining clip (1) counter clockwise and bend the ends outwards.*

### STEP 3

Push down on the valve retainer (2) and turn it counter clockwise 90 degrees, remove the valve retainer (2).

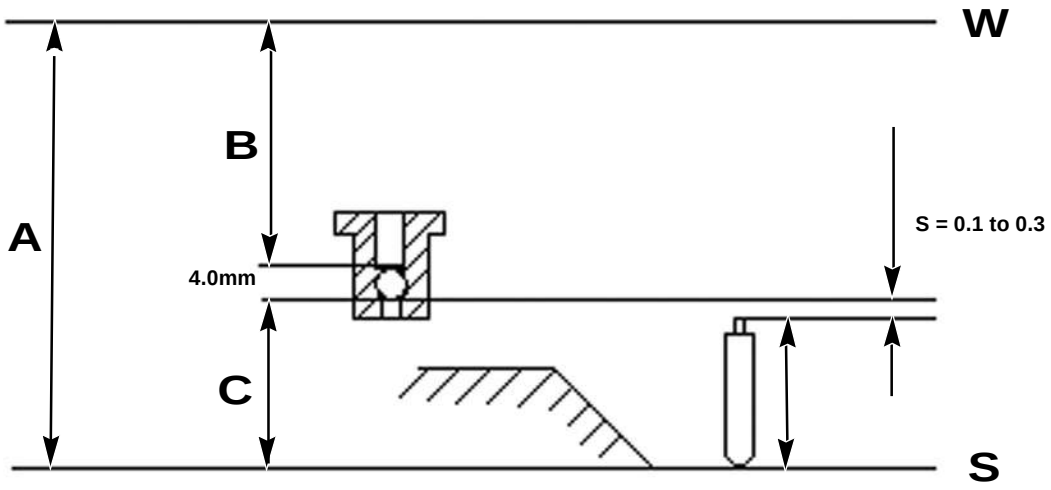
**NOTE:** *For installation, install the valve retainer (2) into the large grooves of the remote valves body, push down and turn 90 degrees clockwise so the valve retainer (2) is seated in the smaller grooves.*

**ATTENTION:** *The correct length of pin 8 is calculated by using the formula shown on Page 11*

https://truckmanualshub.com/



## Check valve pin




MH04N061

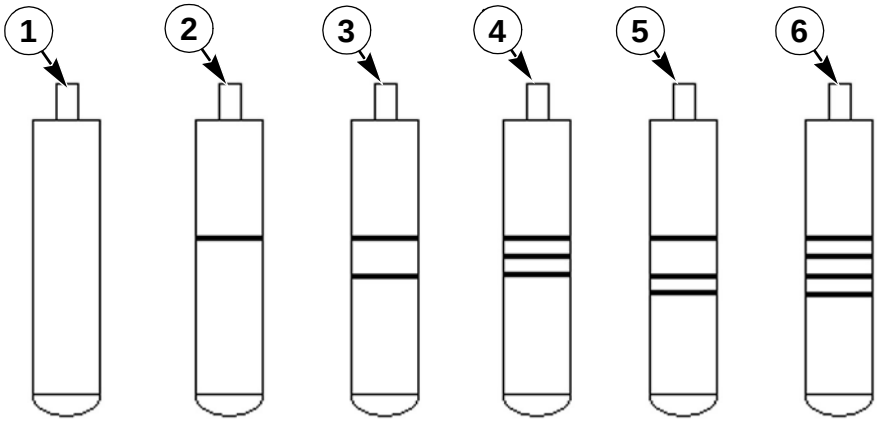
**W** = Top edge of remote valve

**S** = Top edge of remote valve spool

- Remote valve is neutral position
- Measure distance **A** (from top edge of remote valve to spool).
- Insert check valve with ball (diameter = 4mm) into housing.
- Measure distance **B** (from top edge of check valve ball).
- Determine length of pin **Y**.

Fitting space: **C = A - (B + 4mm)**

Pin length: **Y = C - (0.1mm to 0.3mm)**




MH04N062

| | LENGTH OF PIN | MARKING |
|---|---|---|
| 1. PIN | 15.55 mm | NO GROOVE |
| 2. PIN | 15.70 mm | ONE GROOVE |
| 3. PIN | 15.85 mm | TWO GROOVES |
| 4. PIN | 16.00 mm | THREE GROOVES |
| 5. PIN | 16.15 mm | THREE GROOVES |
| 6. PIN | 16.30 mm | FOUR GROOVES |

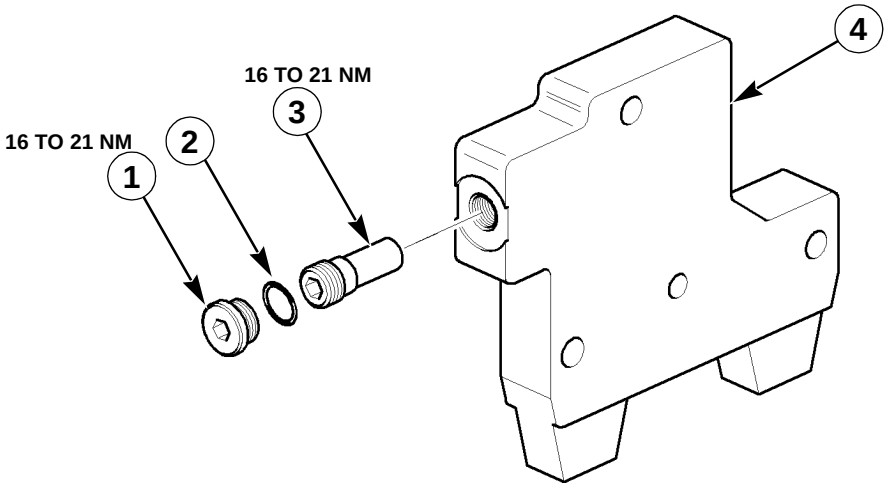
https://truckmanualshub.com/



# REMOTE VALVE END PLATE

## Disassembly and Assembly

**NOTE:** *Items are numbered in order of Disassembly, for Assembly follow the procedure in reverse order.*




MI04M071

1. PLUG
2. O-RING
3. PLUG
4. BODY

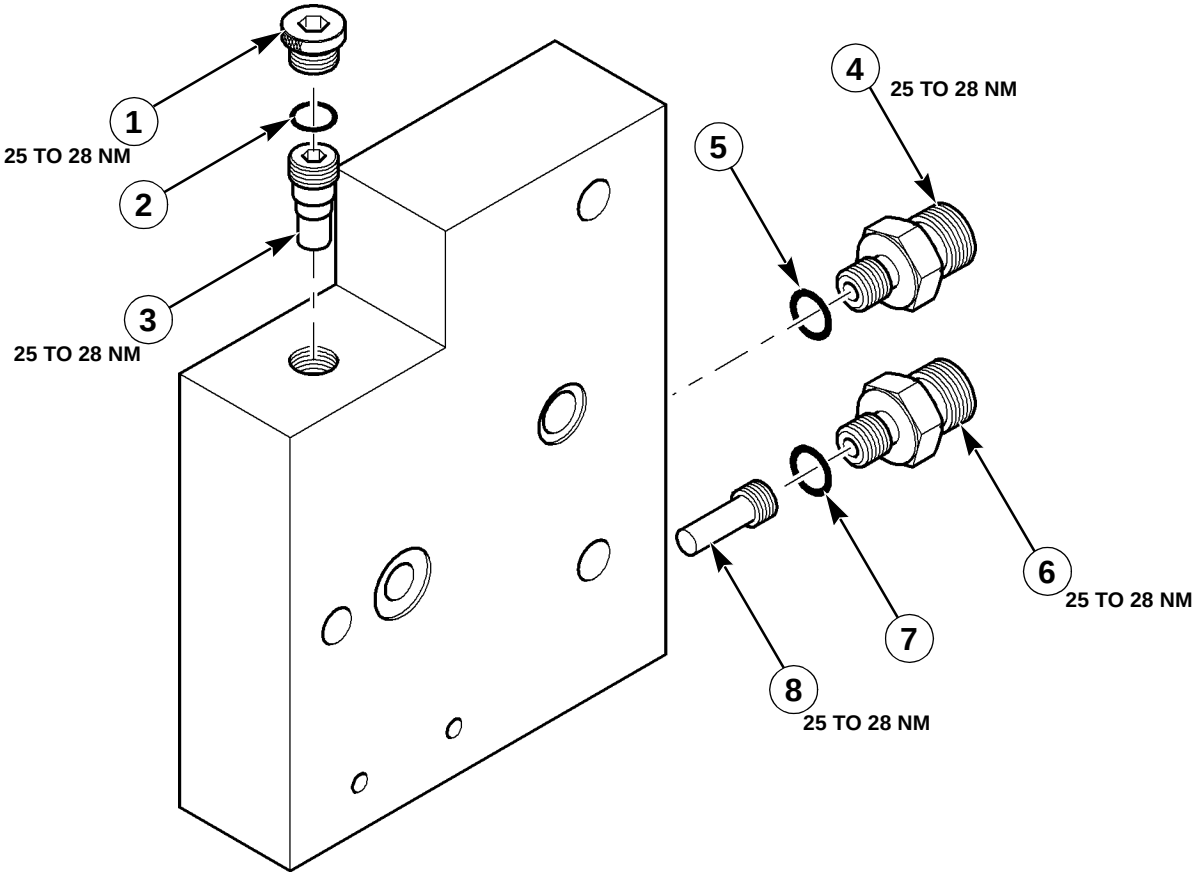
https://truckmanualshub.com/



# REMOTE VALVE END PLATE WITH FORTH REMOTE VALVE

## Disassembly and Assembly

**NOTE:** *Items are numbered in order of Disassembly, for Assembly follow the procedure in reverse order.*




MI05H023

1. PLUG
2. O-RING
3. CHECK VALVE
4. UNION
5. O-RING
6. UNION
7. O-RING
8. FILTER

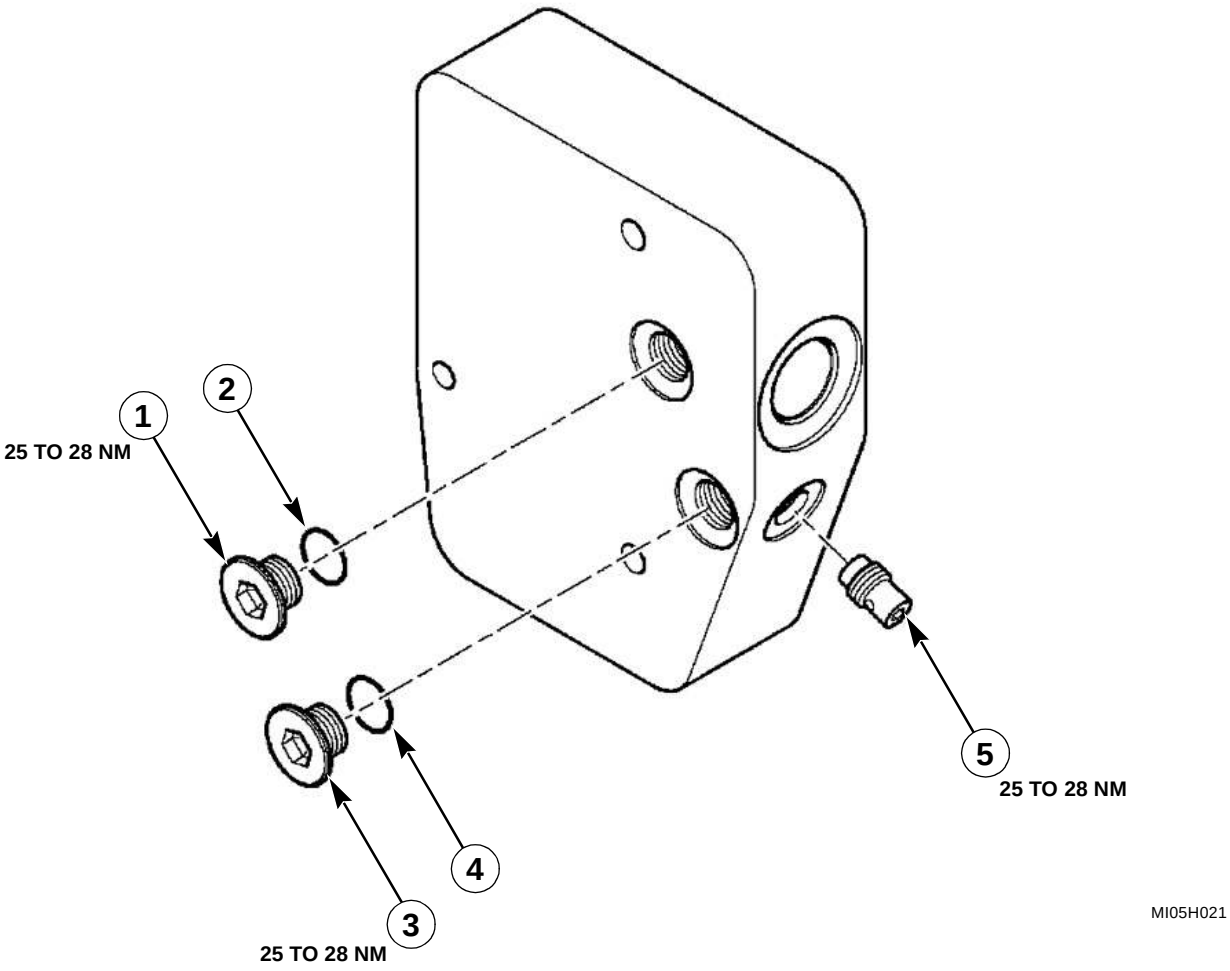
https://truckmanualshub.com/



# REMOTE VALVE END PLATE MANIFOLD

## Disassembly and Assembly

**NOTE:** *Items are numbered in order of Disassembly, for Assembly follow the procedure in reverse order.*




1. PLUG
2. O-RING
3. PLUG
4. O-RING
5. CHECK VALVE

https://truckmanualshub.com/



# Section 9001

## PEDAL, LEVER AND SWITCH ADJUSTMENTS

## XTX Series Tractors

McCORMICK

SM 8-15041

© 2005 McCormick Tractors International Limited.
November 2005

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIAL TORQUES....3

SPECIAL TOOLS....3

HAND AND FOOT THROTTLE ADJUSTMENT....4

PARKING BRAKE ADJUSTMENT....5

BRAKE PEDAL
- Brake Pedal Stop Adjustment....6
- Master Cylinder Rod Adjustment....6
- Brake Pedal Maximum Travel Adjustment....6
- Brake Light Switch Adjustment....6

DROMONE AUTO HITCH ADJUSTMENT (if Equipped)
- Cable Adjustment....8
- Lift Rod Adjustment....8

CBM AXLA AUTO HITCH ADJUSTMENT (if Equipped)
- Cable Adjustment....10
- Lift Rod Adjustment....10

SHIFTABLE PTO ADJUSTMENT....12

REMOTE CONTROL VALVE LINKAGE....13

RANGE SELECTOR LINKAGE
(XtraSpeed Tractors)....14

RANGE SELECTOR SWITCHES
(XtraSpeed Tractors)....15

RANGE SELECTOR LINKAGE
(XtraSpeed - E and XtraSpeed - E Plus Tractors)....16

REMOVING AIR FROM THE BRAKE SYSTEM....18

https://truckmanualshub.com/



# SPECIAL TORQUES

| | | |
|---|---|---|
| Rear Wheel Nuts | | |
| Flange Type Axles | 550 Nm | 405 lb. ft |
| Bar Type Axles | | |
| Wheel Hub to Tapered Bushing | | |
| Evenly in 50 Nm (36 lb. ft) intervals to | 244 to 298 Nm | 179 to 219 lb. ft |
| Wheel to Wheel Hub | 485 to 550 Nm | 357 to 405 lb. ft |

# SPECIAL TOOLS

**HYDRAULIC TEST KIT**
**1002T2**

**MULTIMETER, MC2616**

https://truckmanualshub.com/



# HAND AND FOOT THROTTLE ADJUSTMENT

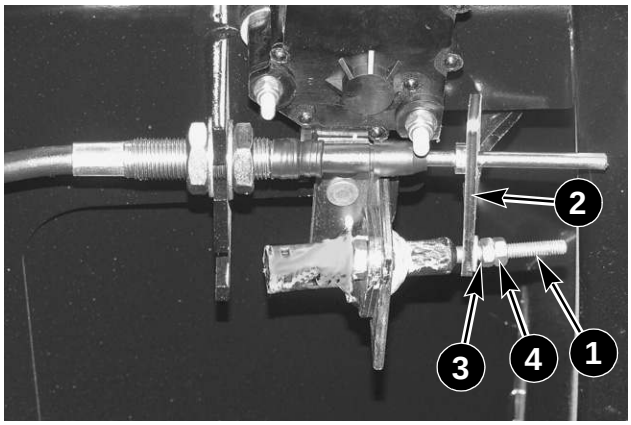
Before any adjustments are made carry out the following:

- Park the tractor on hard level ground and apply the parking brake.
- Stop the engine and remove the key.
- Put blocks in front of and behind the rear wheels.

## STEP 1

Put the hand throttle lever in the low idle position (fully to the rear of the slot in the console cover).

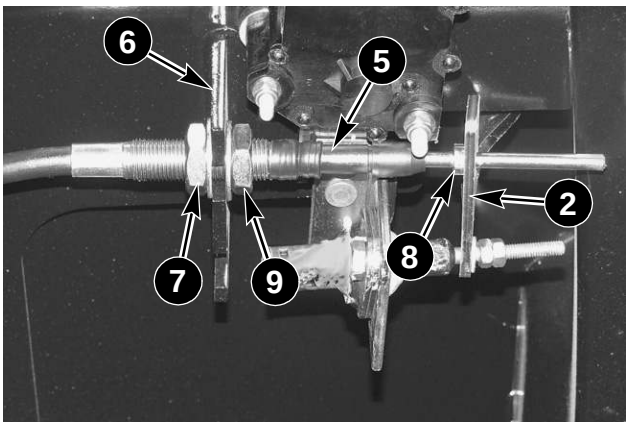
## STEP 2




MD05F081

Install the potentiometer (1) into the pivot assembly (2). Adjust lock nut (3) until flush with the end of the threads. Tighten locknut (4).

## STEP 3




MD05F081

Install the throttle cable (5) into pivot assembly (2) and bracket (6). Adjust nut (7) until bush (8) makes contact with pivot assembly (2). Tighten lock nut (9).

## STEP 4

Make sure low idle and high idle can be obtained on the foot throttle and hand throttle.

https://truckmanualshub.com/

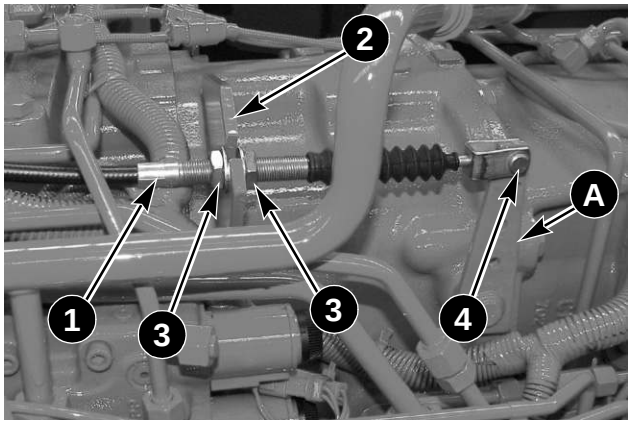


# PARKING BRAKE ADJUSTMENT

Before any adjustments are made carry out the following:

- Park the tractor on hard level ground.
- Stop the engine and remove the key.
- Put blocks in front of and behind the rear wheels.

## STEP 1




MD05F087

Move lever (A) fully forward. Install parking brake cable (1) into bracket (2). Adjust cable (1) using lock nuts (3) until pin (4) can be easily installed. Tighten lock nuts (3).

## STEP 2

Operate the parking brake lever, the parking brake should be fully applied when it has travelled between 4 and 5 notches, adjust lock nuts (3) if necessary and install a new cotter pin into pin (4).

https://truckmanualshub.com/



# BRAKE PEDAL

Before any adjustments are made carry out the following:
- Park the tractor on hard level ground and apply the parking brake.
- Stop the engine and remove the key.
- Put blocks in front of and behind the rear wheels.
- Remove the RH and LH instrument panel side covers.

**NOTE:** *Disconnect the harness from the auxiliary power socket on the RH side cover.*

**NOTE:** *All adjustments must be carried out before connection of brake tubes and hoses.*

## Brake Pedal Stop Adjustment

### STEP 1

Engage the brake pedal latch to lock both brake pedals together.

### STEP 2

Make sure one of the brake pedals is in contact with surface (1). Adjust bolts (2) until they are in contact with both brake pedals and the latch can be removed without moving the other brake pedal, tighten lock nuts (3).

## Master Cylinder Rod Adjustment

### STEP 3

Adjust clevis (4) so that the cylinder is fully extended and there is 1.0 mm (0.04 inch) clearance between the cylinder rod and piston when the brake pedals are fully against bolts (2), tighten locknut (5).

## Brake Pedal Maximum Travel Adjustment

### STEP 4

Fully depress the RH brake pedal, adjust bolt (6) until it is in contact with the brake pedal. Release the brake pedal and turn bolt (6) one full turn clockwise, tighten locknut (7).

**NOTE:** *The master brake cylinder will be damaged if excessive force is used to depress the brake cylinder.*

### STEP 5

Repeat Step 4 for the LH brake pedal.

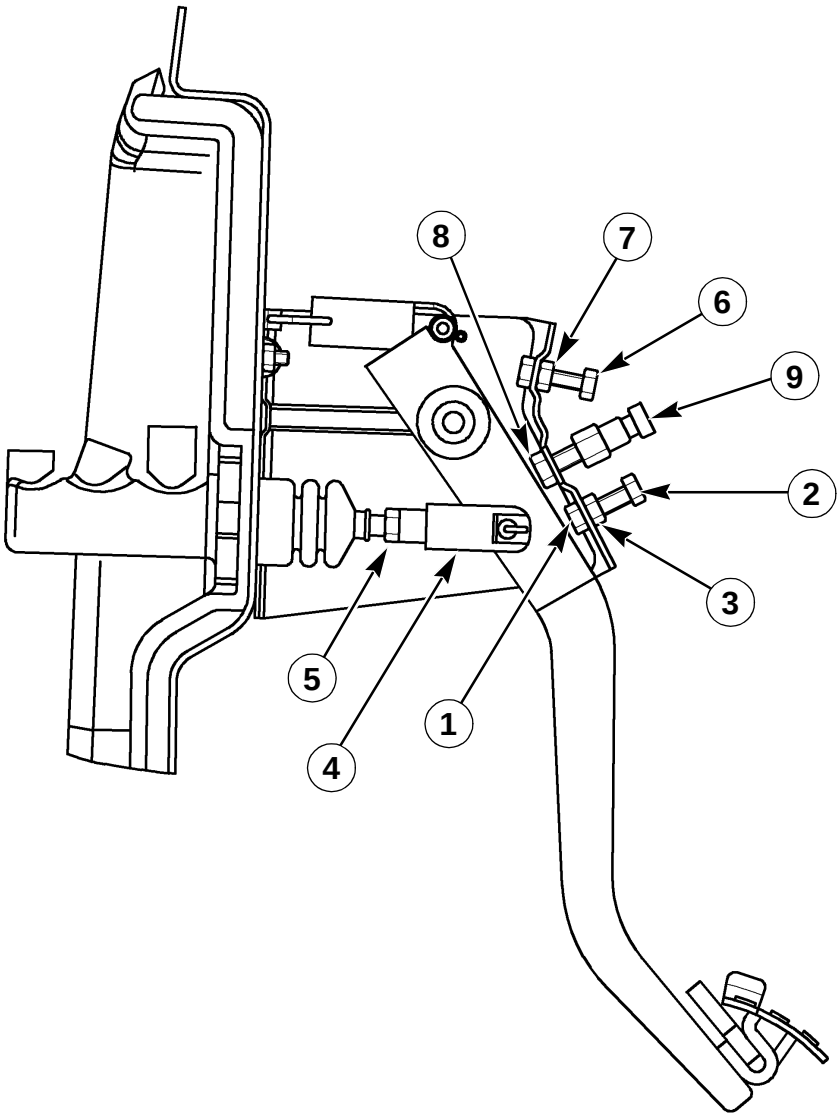
## Brake Light Switch Adjustment

### STEP 6

Loosen locknut (8) and adjust switch (9) until the plunger is fully depressed by the brake pedal when the brake pedal is against stop bolt (2). Turn switch (9) half to one turn counter clockwise so the locating tabs on the switches are facing away from each other.

https://truckmanualshub.com/






DI97J179

**NOTE:** *The above illustration shows the standard brake master cylinder, the brake pedal adjustment procedure is the same for tractors equipped with booster brakes.*

https://truckmanualshub.com/

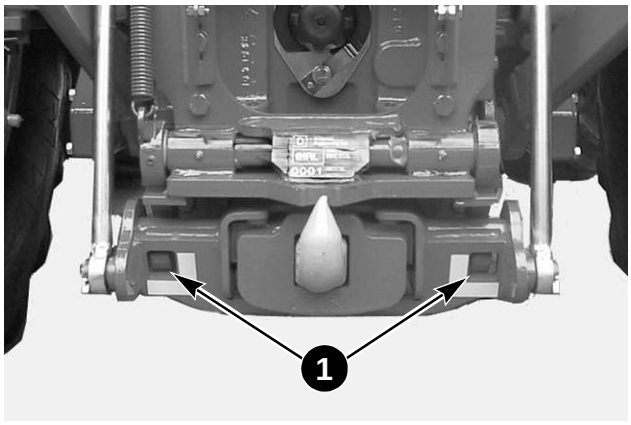


# DROMONE AUTO HITCH ADJUSTMENT (if Equipped)

Before any adjustments are made carry out the following:
- Park the tractor on hard level ground and apply the parking brake.
- Stop the engine and remove the key.
- Put blocks in front of and behind the front wheels.

## Cable Adjustment

### STEP 1

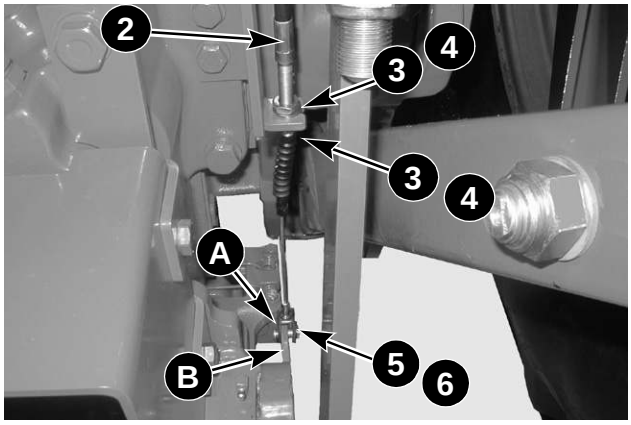



DP00A071

Make sure the auto hitch is in the raised position with latches (1) in the locked position.

**IMPORTANT:** *If the hitch latch fails to lock in the raised position, raise the hitch using the hydraulic jack until the hitch locks correctly.*

### STEP 2




MD01F095

Make sure the auto hitch release control is pushed fully down. Install cable (2) into the bracket with an adjusting nut (3) and washer (4) on either side. Adjust nuts (3) until pin (5) can be installed through the cable clevis (A) and hitch lever (B). Install clip (6) and tighten the adjust nuts (3).

## Lift Rod Adjustment

### STEP 3

Start the engine and press the ride control switch to override the hitch upper limit stop and raise the hitch to the mechanical upper limit stop. While holding the switch down, STOP the engine and remove the key.

> **WARNING:** *Never operate the engine in a closed building. Proper ventilation is required under all circumstances.*

**IMPORTANT:** *Position a suitable hydraulic jack under the hitch until the jack just touches the hitch to support the weight of the hitch. DO NOT raise the hitch using the jack.*

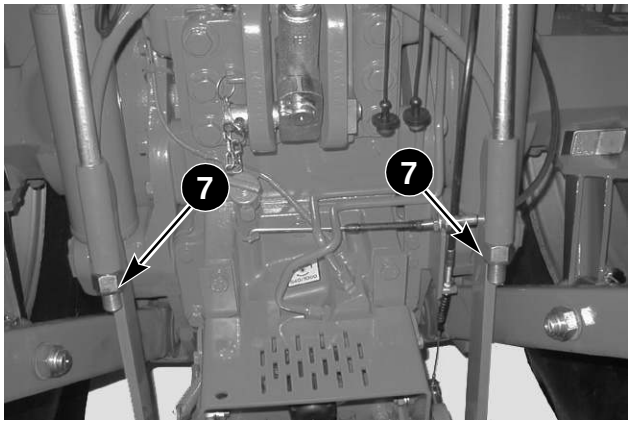
### STEP 4

Pull the auto hitch release control to unlock the locking latches (1). Check the clearance between the latch (1) and the lock bar (C), this should be 3 mm (0.1 inch), if necessary adjust the LH and RH lift rods, refer to Step 7.

https://truckmanualshub.com/



## STEP 5




DD00A075

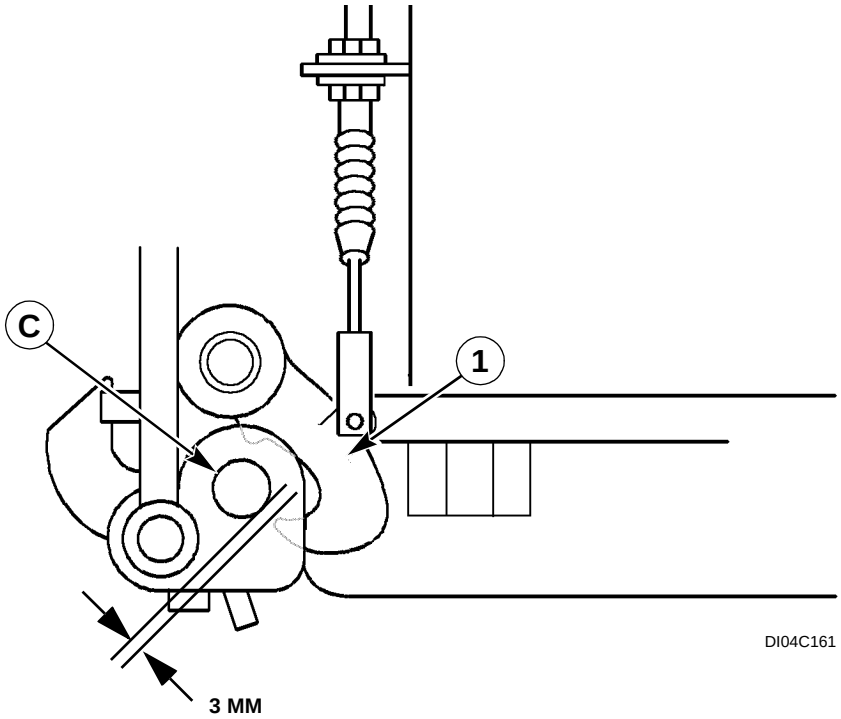
Adjust nuts (7) equally until the correct clearance between the latch (1) and the lock bar (C) is obtained.

**NOTE:** *If the lift rods require lengthening it may be necessary to slightly lower the hydraulic jack.*

## STEP 6

Remove the hydraulic jack and start the engine and lower then raise the hitch to the upper limit to check the operation of the locking latches.

> ⚠ **WARNING:** *Never operate the engine in a closed building. Proper ventilation is required under all circumstances.*




DI04C161

https://truckmanualshub.com/

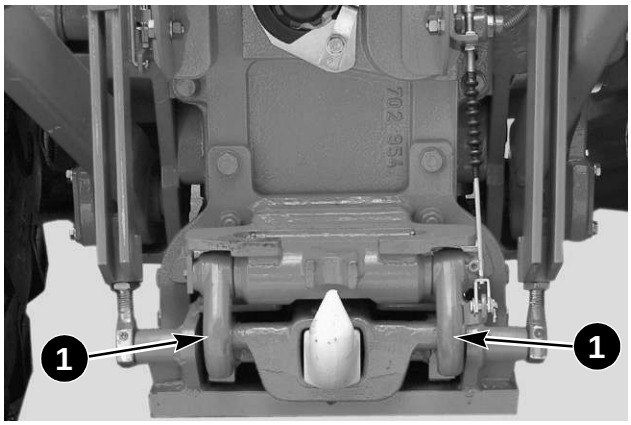


# CBM AXLA AUTO HITCH ADJUSTMENT (if Equipped)

Before any adjustments are made carry out the following:
- Park the tractor on hard level ground and apply the parking brake.
- Stop the engine and remove the key.
- Put blocks in front of and behind the front wheels.

## Cable Adjustment

### STEP 1

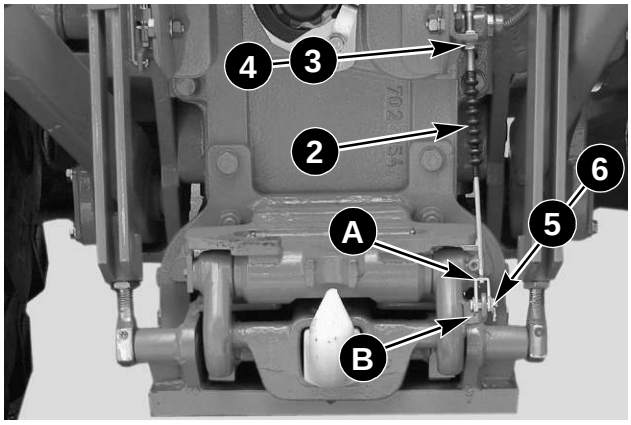



MD05F096

Make sure the auto hitch is in the raised position with latches (1) in the locked position.

**IMPORTANT:** *If the hitch latch fails to lock in the raised position, raise the hitch using the hydraulic jack until the hitch locks correctly.*

### STEP 2




MD05F096

Make sure the auto hitch release control is pushed fully down. Install cable (2) into the bracket with an adjusting nut (3) and washer (4) on either side. Adjust nuts (3) until pin (5) can be installed through the cable clevis (A) and hitch lever (B). Install clip (6) and tighten the adjusting nuts (3).

## Lift Rod Adjustment

### STEP 3

Start the engine and press the ride control switch to override the hitch upper limit stop and raise the hitch to the mechanical upper limit stop. While holding the switch down, STOP the engine and remove the key.

> ⚠ **WARNING:** *Never operate the engine in a closed building. Proper ventilation is required under all circumstances.*

**IMPORTANT:** *Position a suitable hydraulic jack under the hitch until the jack just touches the hitch to support the weight of the hitch. DO NOT raise the hitch using the jack.*

### STEP 4

Pull the auto hitch release control to unlock the locking latches (1). Check the clearance between the latch (1) and the lock bar (9), this should be 3 mm, if necessary adjust the lift rod adjusting nuts (8) to obtain the correct clearance, refer to Step 5.

### STEP 5

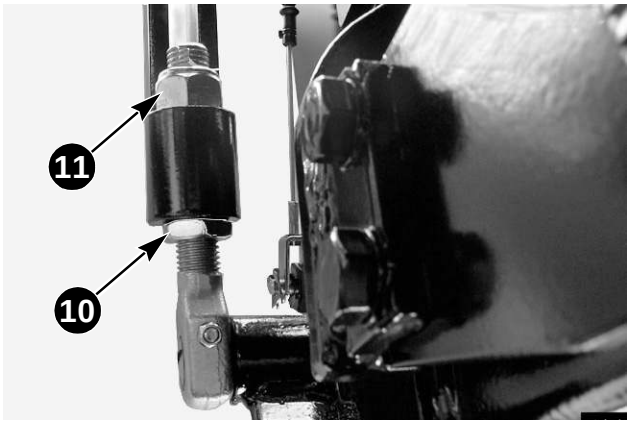
Push auto hitch latch handle fully down to the hitch locked position. Start the engine and lower the hitch approximately 100 mm (4 inch). Make sure the hitch is locked in the raised position.

**IMPORTANT:** *If the hitch latch fails to lock in the raised position, raise the hitch using the hydraulic jack until the hitch locks correctly. DO NOT remove the hydraulic jack.*

https://truckmanualshub.com/



## STEP 6




MD01G021

Loosen lock nuts (7), adjust nuts (8) equally on both lift rods until the correct clearance between the latch (1) and the lock bar (9) is obtained. Tighten the lock nuts (7).

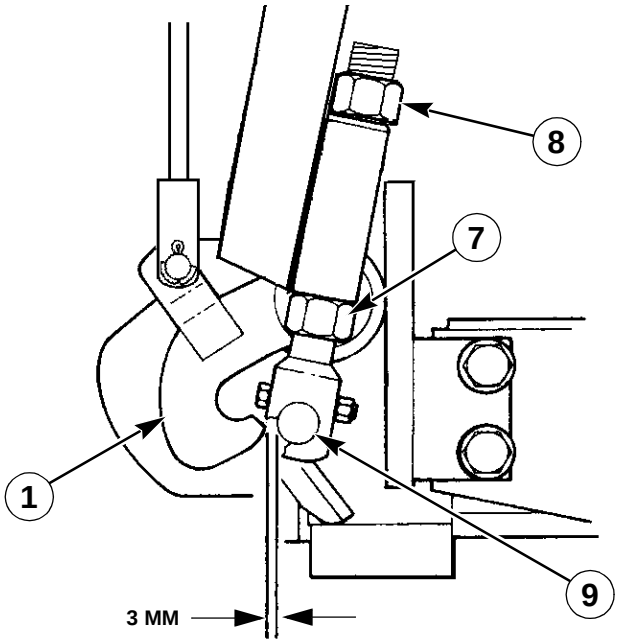
## STEP 7

Remove the jack and start the engine and lower then raise the hitch to the upper limit to check the operation of the locking latches.

**WARNING:** *Never operate the engine in a closed building. Proper ventilation is required under all circumstances.*

https://truckmanualshub.com/





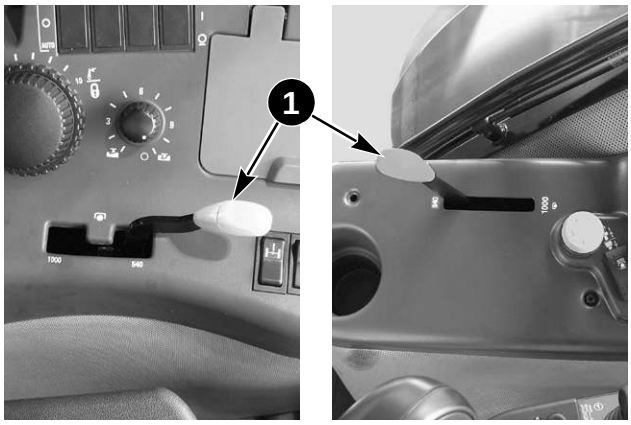

DI05F172

## SHIFTABLE PTO ADJUSTMENT

Before any adjustments are made carry out the following:

- Park the tractor on hard level ground and apply the parking brake.
- Stop the engine and remove the key.
- Put blocks in front of and behind the rear wheels.

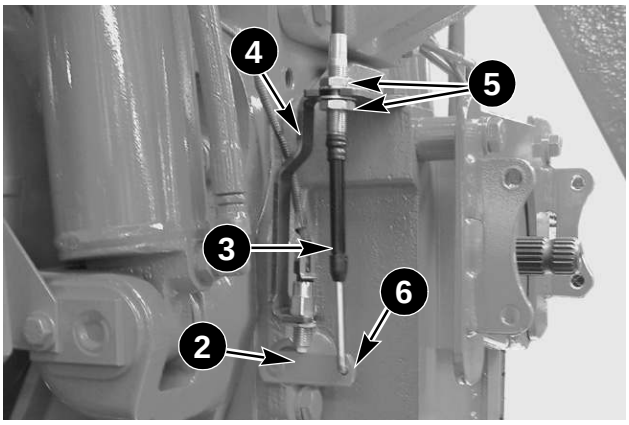
### STEP 1




MD05F164/5

Put the PTO lever (1) in the 540/540E position.

### STEP 2




MD05F163

Put lever (2) in the fully upward position. Install cable (3) into bracket (4) and adjust nuts (5) until the end of cable (3) can be easily installed into lever (2), tighten nuts (5) and install a new cotter pin (6) into cable (3).

https://truckmanualshub.com/



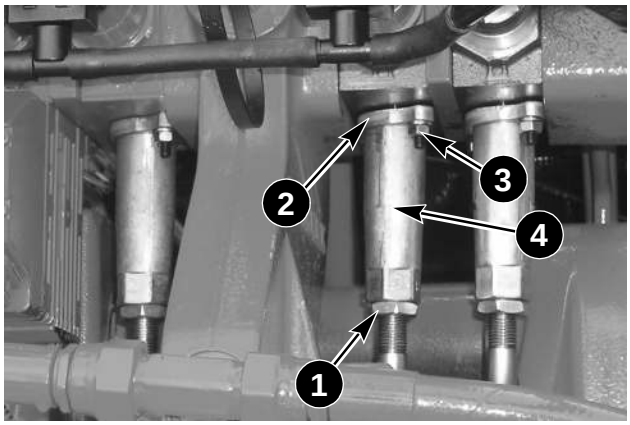
# REMOTE CONTROL VALVE LINKAGE

Before any adjustments are made carry out the following:
- Park the tractor on hard level ground and apply the parking brake.
- Stop the engine and remove the key.
- Put blocks in front of and behind the rear wheels.

## STEP 1

Put the remote control lever(s) in the neutral position.

## STEP 2




MD05G099

Fully loosen the locknut (1) and remove the flange (2) retaining nuts (3), turn cover (4) counter clockwise until there is clearance between cover (4) and the valve body. Make sure the valve spool is in the neutral detent position.

## STEP 3

Install the flange (2) and retaining nuts (3), DO NOT tighten the nuts. Turn cover (4) clockwise until the cover contacts the valve body, continue to turn the cover an additional 1/4 clockwise. Tighten the flange (2) retaining nuts (3) and check the operation of the remote control linkage.

https://truckmanualshub.com/



# RANGE SELECTOR LINKAGE (XtraSpeed Tractors)

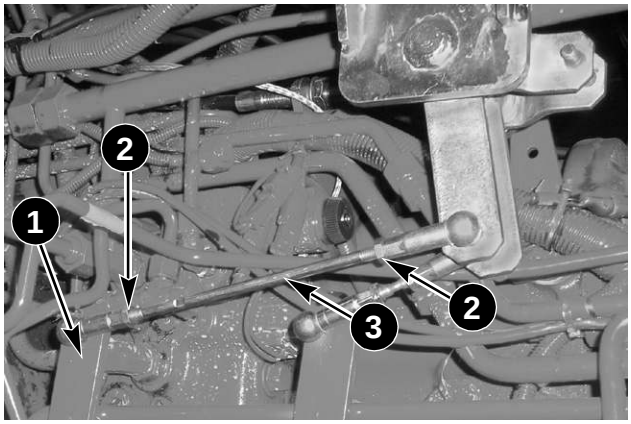
Before any adjustments are made carry out the following:
- Park the tractor on hard level ground and apply the parking brake.
- Stop the engine and remove the key.
- Put blocks in front of and behind the front wheels.

## STEP 1

Raise the rear of the tractor, support the RH rear axle on a suitable axle stand and remove the rear wheel.

**NOTE:** *For Installation, evenly tighten the rear wheel nuts to the correct torque, refer to Page 3.*

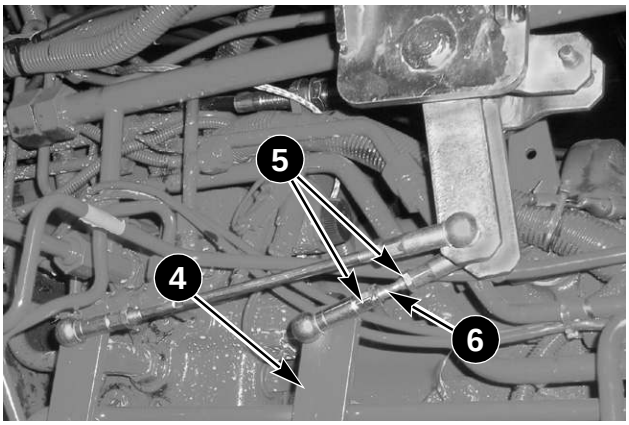
## STEP 2




MD05G011

Put the 1st/2nd range lever (1) in the neutral position. Loosen lock nuts (2) and adjust the 1st/2nd selector rod (3) until it can be easily installed onto lever (1), tighten lock nuts (2).

## STEP 3




MD05G011

Put the 3rd/4th range lever (4) in the neutral position. Loosen lock nuts (5) and adjust the 3rd/4th selector rod (6) until it can be easily installed onto lever (4), tighten lock nuts (5).

## STEP 4

Check the operation of the range selector lever.

https://truckmanualshub.com/



# RANGE SELECTOR SWITCHES (XtraSpeed Tractors)

Before any adjustments are made carry out the following:

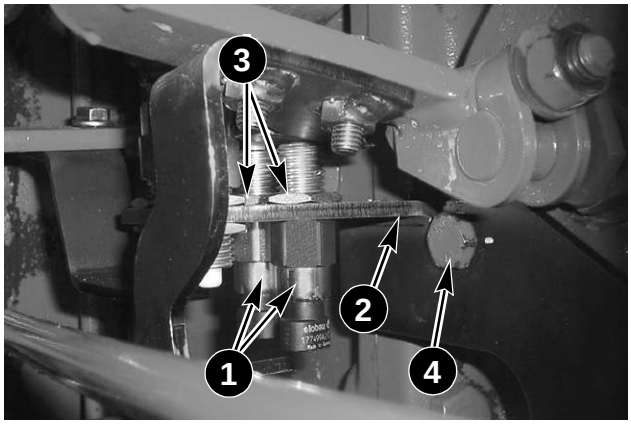
- Park the tractor on hard level ground and apply the parking brake.
- Stop the engine and remove the key.
- Put blocks in front of and behind the front wheels.

## STEP 1

Raise the rear of the tractor, support the RH rear axle on a suitable axle stand and remove the rear wheel.

**NOTE:** *For Installation, evenly tighten the rear wheel nuts to the correct torque, refer to Page 3.*

## STEP 2



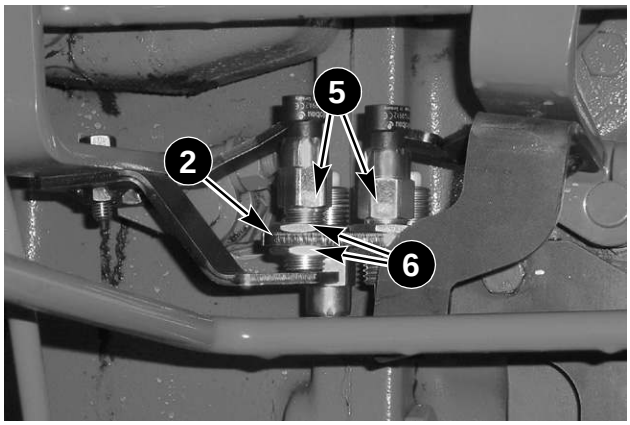

MD05G010

Install the 1st and 3rd range switches (1) into mounting bracket (2), fully tighten lock nuts (3). Loosen the three mounting bracket bolts (4) to adjust the mounting bracket (2).

The mounting bracket should be adjusted so the 1st range switch plunger is depressed when 1st range is selected and the 3rd range switch plunger is depressed when 3rd range is selected. Tighten mounting bracket bolts (4).

**NOTE:** *Make sure that the selector brackets do not make contact with the threaded part of the switch.*

## STEP 3




MD05G012

Install the switches (5) for 2nd and 4th range in mounting bracket (2).

**NOTE:** *The 2nd and 4th range switches have two lock nuts (6), one either side of mounting bracket (2).*

## STEP 4

Select second range and adjust the appropriate switch (5) until the plunger is depressed. Carry out this procedure in 4th range. Tighten lock nuts (6).

**NOTE:** *Make sure that the selector brackets do not make contact with the threaded part of the switch.*

https://truckmanualshub.com/



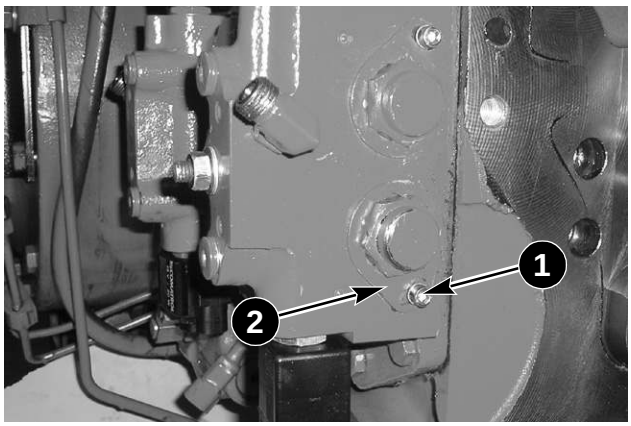
# RANGE SELECTOR LINKAGE
# (XtraSpeed - E and XtraSpeed - E Plus Tractors)

Before any adjustments are made carry out the following:
- Park the tractor on hard level ground and apply the parking brake.
- Stop the engine and remove the key.
- Put blocks in front of and behind the front wheels.

**NOTE:** *The following adjustments can be made on the tractor and it is not necessary to strip the transmission.*

**NOTE:** *Items are numbered in order of removal. For installation, follow the removal procedure in reverse order.*

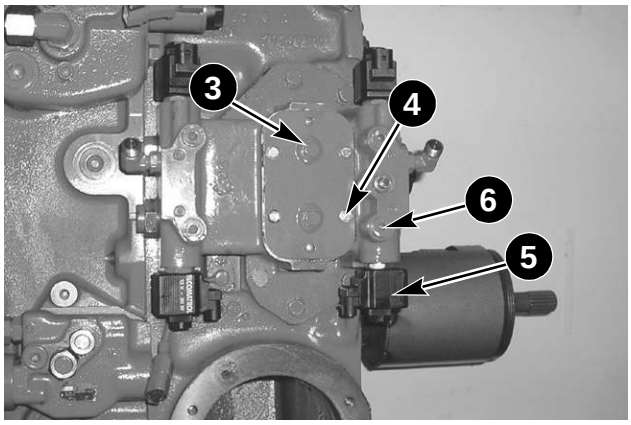
## STEP 1




MD05K028

Remove the four retaining bolts (1) and locking plates (2).

## STEP 2

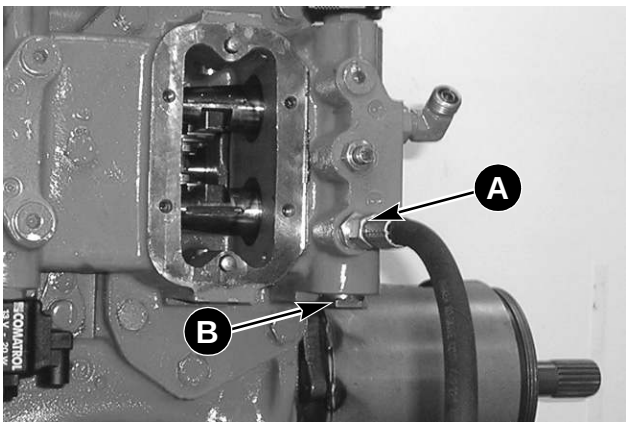



MD05K026

Remove the two locking bolts (3) and the four retaining bolts (4). Remove 2nd range solenoid (5) and oil gallery plug (6).

**NOTE:** *Do not use force when installing* locking bolts *(3)*, make sure they are located correctly in the machined grooves of the range selector pistons.

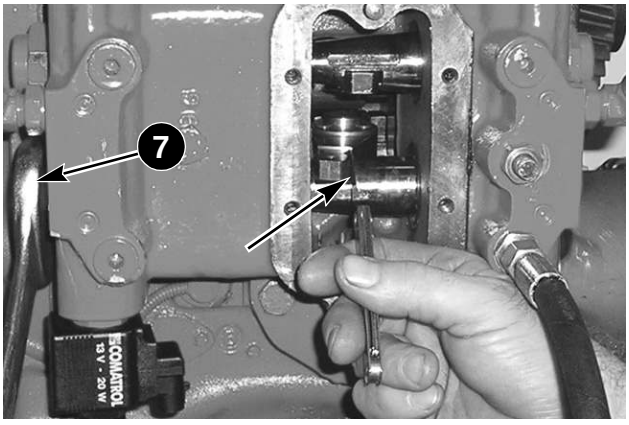
## STEP 3




MD05K027

Connect hose (A) from the portable oil pump to the 2nd range oil gallery using a 14mm connector. Screw special tool 1033T1 (B) into the 2nd range solenoid housing.

## STEP 4




MD05K027

Unscrew adjusting plug (7) until approximately 5mm of thread is showing. Using the portable oil pump add a pressure of 24 bar to the system which will engage 2nd range. screw in the adjusting plug (7) until a clearance of 0.05 mm (0.002 inch) is obtained between the selector lever and piston rod.

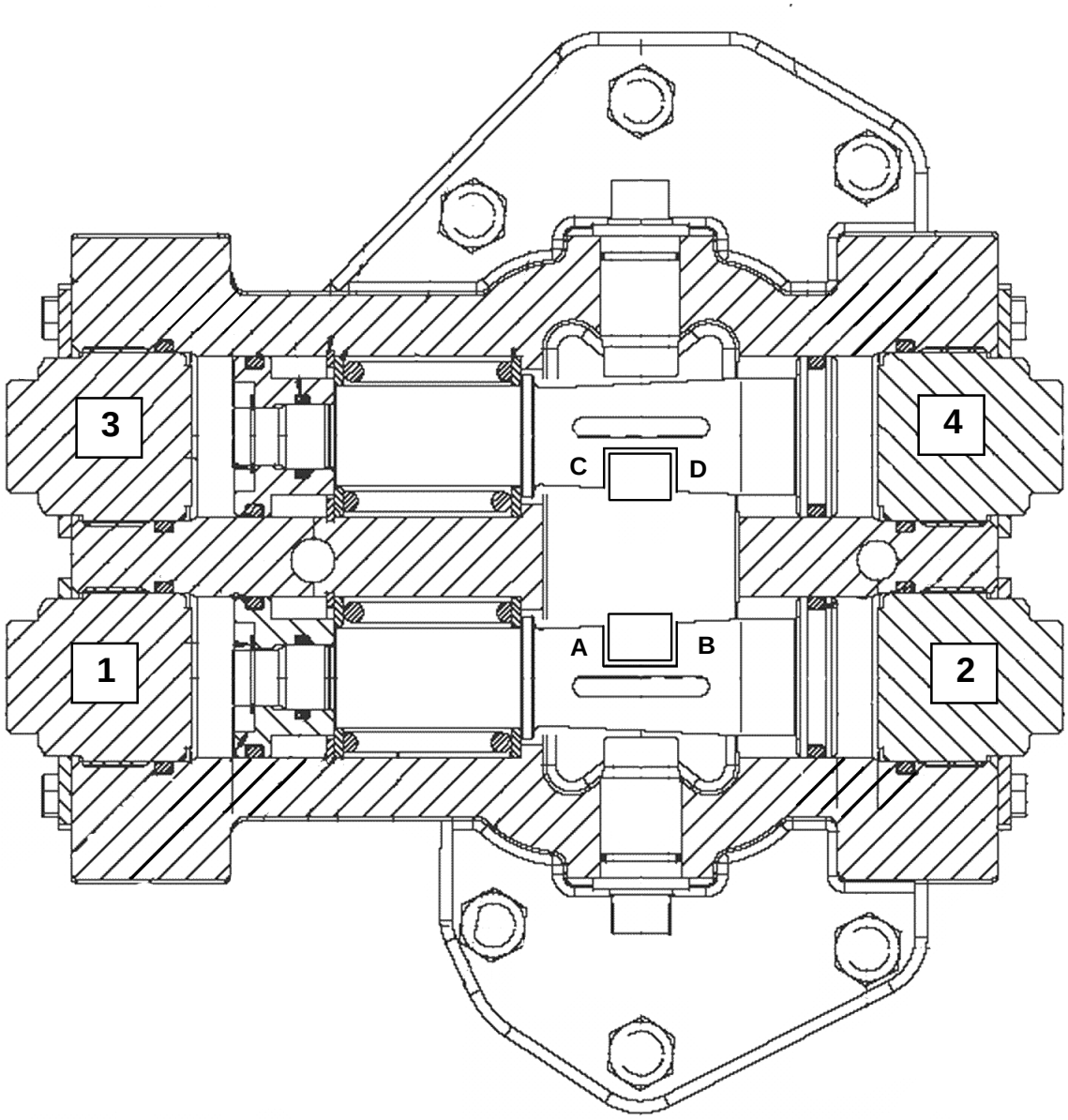
**IMPORTANT:** *when screwing in the adjusting plugs the oil pressure will increase. Slowly release the pressure so that 24 bar is maintained during this procedure.*

https://truckmanualshub.com/



## STEP 5

Repeat STEP 1 to STEP 4 using the relevant oil gallery and adjusting plug for ranges 1, 3 and 4. See table below.




| Pressurise | Adjust | Set Gap |
|---|---|---|
| 1 | 2 | A |
| 2 | 1 | B |
| 3 | 4 | C |
| 4 | 3 | D |

https://truckmanualshub.com/



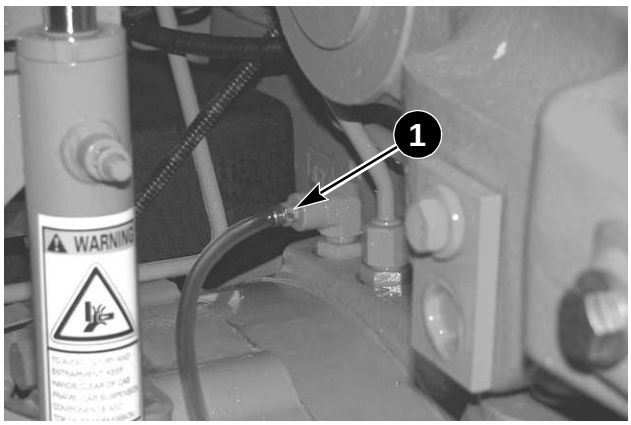
# REMOVING AIR FROM THE BRAKE SYSTEM

Before any adjustments are made carry out the following:

- Park the tractor on hard level ground and apply the parking brake.
- Stop the engine and remove the key.
- Put blocks in front of and behind the front wheels.
- Place suitable containers under the rear axles. Clear all dirt and debris away from the brake bleed valves on the rear axle.

**WARNING:** *Before carrying out any servicing, repairs or troubleshooting procedures make sure the tractor is in NEUTRAL. Failure to do this may result in serious injury.*

## STEP 1




MD05F186

Attach a length of 5 mm (0.2 inch) ID clear plastic tube onto the LH bleed valve (1) and put the other end of the tube in the transmission oil fill tube. Open the LH bleed valve 1 turn counter clockwise.

## STEP 2

Start and run the engine at 1200 to 1500 rpm.

**WARNING:** *Never operate the engine in a closed building. Proper ventilation is required under all circumstances.*

## STEP 3

Slowly and smoothly depress the left brake pedal to its full extent, then tighten the supply tube fitting.

## STEP 4

Slowly release the pedal.

## STEP 5

Repeat STEPS 3 and 4 as many times as necessary until all air has been removed.

## STEP 6

Repeat STEPS 1 to 5 for the right hand brake supply hose using the right brake pedal.

**NOTE:** *To remove air in the master cylinder balance pipe, repeat the procedure with the opposite brake pedal held half way down.*

## STEP 7

Clean any residual hydraulic fluid from the transmission and test the function of the brake system.

## STEP 8 TRAILER BRAKE ONLY

Place a suitable container under hydraulic trailer brake valve. Clear all dirt and debris away from the trailer brake inlet pipes.

## STEP 9

Loosen the left hand trailer brake inlet supply tube fitting (lower fitting at the rear of the hyrdaulic trailer brake valve).

## STEP 10

Start and run the engine at 1200 to 1500 rpm.

**WARNING:** *Never operate the engine in a closed building. Proper ventilation is required under all circumstances.*

## STEP 11

Slowly and smoothly depress the left brake pedal to its full extent, then tighten the supply tube fitting.

## STEP 12

Slowly release the pedal.

## STEP 13

Repeat STEPS 11 and 12 as many times as necessary until all air has been removed.

## STEP 14

Repeat STEPS 9 to 13 for the right hand supply tube fitting (upper fitting at the rear of the hyrdaulic trailer brake valve), using the right brake pedal.

https://truckmanualshub.com/



# Section 10

## XTX ELECTRONIC CONTROLLER

### How It Works

McCORMICK

DT50-50611

© 2005 McCormick Tractors International Limited.
Revised July 2005

https://truckmanualshub.com/



# TABLE OF CONTENTS

INTRODUCTION
XTX Tractor electrical system ..... 4
What is CAN BUS ..... 4

XTX TRACTOR CAN BUS LAYOUT
General Description ..... 5
Control modules ..... 5

CONTROLLER LOCATIONS
Engine Controller ..... 6
Transmission Controller ..... 6
Hitch/PTO and Cab Controllers (XtraSpeed and XtraSpeed-E) ..... 7
Hitch/PTO Controller, Cab Controller and Auxiliary Valve Controller (XtraSpeed-Eplus) ..... 7
Instrument Cluster ..... 8
Automatic Temperature Control (ATC) - (If Equipped) ..... 8
Cab Suspension Controller- (If Equipped) ..... 9
Independent Front Suspension (IFS) Controller - (If Equipped) ..... 9

INSTRUMENT CLUSTER
General Description ..... 10

ERROR CODES
General Description ..... 11
Instrument cluster displayed error codes ..... 11

“McCORMICK DIAGNOSTIC CENTRE” (MDC) ELECTRONIC SERVICE TOOL ..... 12

CONTROLLER LOGIC ..... 13

CAN MESSAGES FOR CAB CONTROLLER (CC 4) ..... 14

CAB CONTROLLER (CC4) LOGIC CHART ..... 15

CAN MESSAGES FOR TRANSMISSION CONTROLLER (TC 4) ..... 16

TRANSMISSION CONTROLLER (TC 4) LOGIC CHART ..... 17

ENGINE CONTROLLER CAN MESSAGES ..... 18

ENGINE ELECTRONIC CONTROLLER LOGIC CHART XTX185 & 200 ONLY ..... 19

ENGINE CONTROLLER CAN MESSAGES ..... 20

ENGINE ELECTRONIC CONTROLLER LOGIC CHART XTX215 ONLY ..... 21

CAN MESSAGES FOR INSTRUMENT CLUSTER ..... 22

XTX TRACTOR INSTRUMENT CLUSTER LOGIC CHART ..... 23

CAN MESSAGES FOR HITCH & PTO CONTROLLER ..... 24

COMBINED HITCH & PTO CONTROLLER LOGIC CHART ..... 25

CAN MESSAGES FOR AUXILIARY VALVE CONTROLLER (E-Plus only) ..... 26

AUXILIARY VALVE CONTROLLER AND VALVE SLICE LOGIC CHART (E-Plus only) ..... 27

https://truckmanualshub.com/



This Page Has Been Left Blank

https://truckmanualshub.com/



# INTRODUCTION

## XTX Tractor electrical system

The electrical system used on XTX is a J1939 CAN BUS system. Using this system has allowed McCormick tractors to fully integrate all the different areas of the tractor and bring them together to work as one.

It has also allowed the total number of wires running around the tractor to be cut down for maximum reliability and the time it takes for messages to be passed from component to component has been vastly reduced and therefore smoother operation and greater productivity can be achieved.

The J1939 CAN standard is the internationally recognized truck and bus standard that all industrial and agricultural machinery manufacturers are aiming to work towards, to eventually enable implement manufacturers to interface their machines to the tractor also.

## What is CAN BUS

CAN BUS is the name that is given to the method of data transfer, on many types of machinery now. Its name comes from the computer industry, and stands for;

Computer Area Network

This term simply means the networking of components and controllers and within this network the exchange of data between components via a data bus system.

CAN BUS in very basic terms is a pair of insulated wires twisted together that run around the tractor between each control module and some components and are joined at each end by a terminal resistor. These wires therefore are the communication link for the whole of the tractor. The engineering name for these wires is CAN High and CAN Low. These wires are very often green and yellow colours.

This means that ultimately each component controlled by a CAN BUS link only needs 4 wires to it. These are CAN High, CAN Low, B+ (power) and Ground (earth).

Electrical messages are then sent out around the CAN BUS system as digital pulses, and are seen by all the components linked to the CAN BUS. Depending on the type of messages sent on the CAN BUS there can be up to approximately 1500 messages per second transmitted.

Although all components see all the messages they will only act on the messages that are relevant at the time to themselves. This is because each message has an identifier (address) attached to it.

This means that all the control modules are constantly linked and as soon as one sends out a signal that all other modules need to act on, they can do so immediately.

There is however a priority system in place that will allow more important messages to be transferred before non important ones.

Because of this most of the wires found on the tractor will actually be connecting sensors, switches, solenoids, potentiometers and lights to the control modules.

In order to cut back on the length of the wires used between controllers and components it is now common practice to locate the controllers as close as possible to the component it is controlling. In order to do this the electrical controllers are manufactured to IP 67 standards to ensure that they are water and weather resistant.

https://truckmanualshub.com/

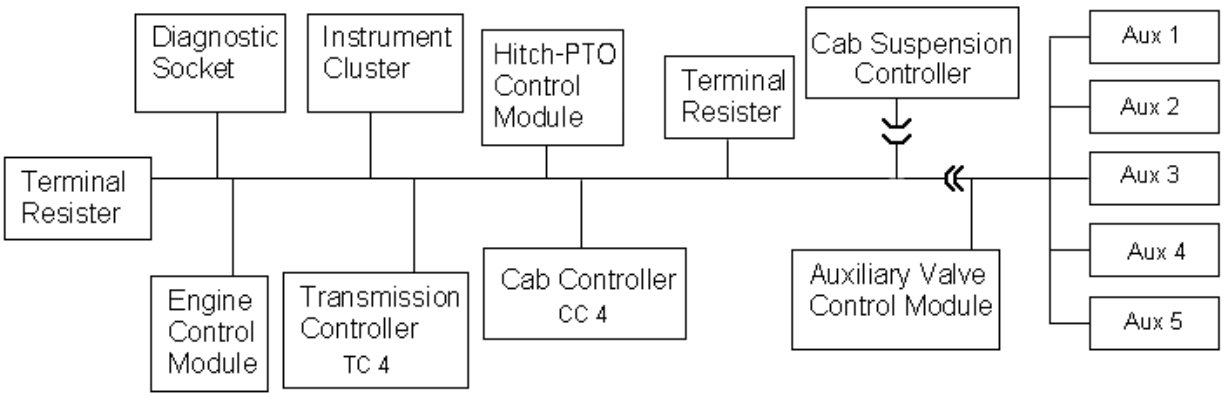


# XTX TRACTOR CAN BUS LAYOUT

## General Description

The XTX tractor uses a CAN BUS electrical system to control its functions of all the major components. The diagram below shows the components connected to the CAN BUS.

**NOTE:** *There are auxiliary valves and auxiliary valve controller fitted to XTX Eplus tractors only. The diagram below shows all options.*




## Control modules

There are up to 9 separate control modules located around the tractor, to control its functions depending on the options that are fitted. These are as follows:

- Engine Control Module.
- Transmission Control Module.
- Cab Control Module.
- Hitch Control Module.
- Instrument Cluster.
- Auxiliary Valve Control Module (Only XtraSpeed E*plus* Tractors).
- Automatic Temperature Control Module (Not Connected To The CAN) - (Optional).
- Cab Suspension Control Module - (Optional).
- Independent Front Axle Suspension Control Module (Not Connected To The CAN) - (Optional).

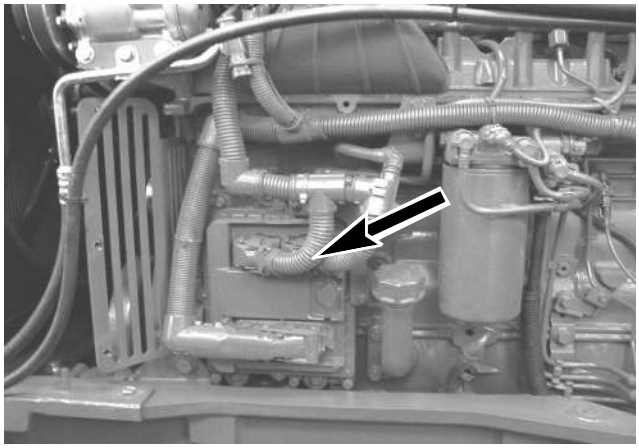
https://truckmanualshub.com/



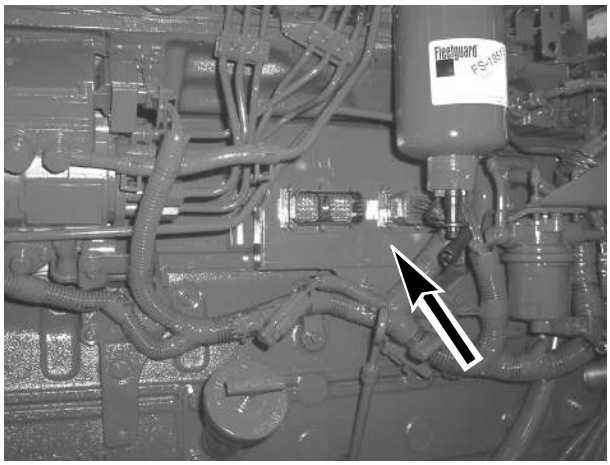
# CONTROLLER LOCATIONS

The controllers for all models are located around the tractors as indicated on the following pages. Controller locations vary between XtraSpeed, XtraSpeed-E and E*plus* models.

## Engine Controller



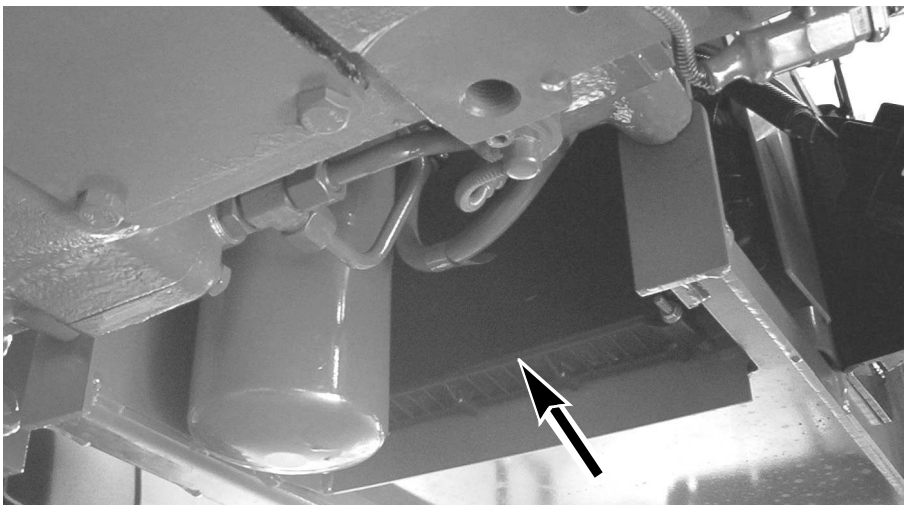
**XTX185/200 ENGINE CONTROLLER (B-POWER)**




**XTX215 ENGINE CONTROLLER (CUMMINS QSB)**

## Transmission Controller

The Transmission Controller is located on the rear face of the battery box.



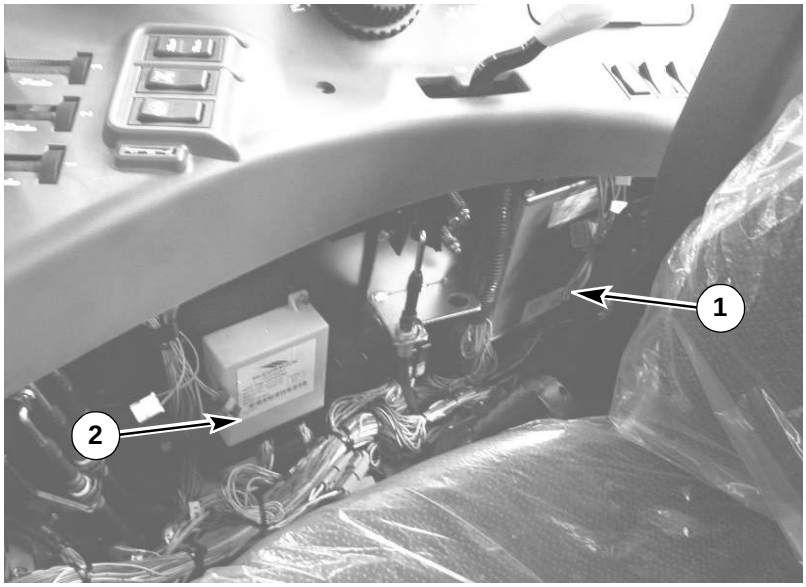
**TRANSMISSION CONTROLLER**

https://truckmanualshub.com/

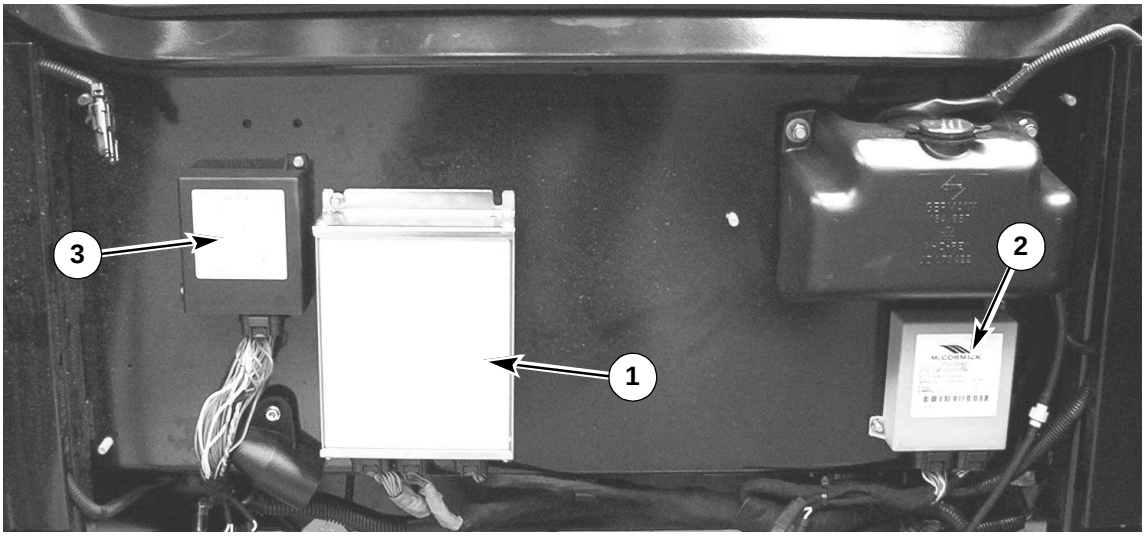


## Hitch/PTO and Cab Controllers (XtraSpeed and XtraSpeed-E)

1. HITCH AND PTO CONTROLLER
2. CAB CONTROLLER




## Hitch/PTO Controller, Cab Controller and Auxiliary Valve Controller (XtraSpeed-E*plus*)




1. HITCH AND PTO CONTROLLER
2. CAB CONTROLLER
3. AUXILIARY VALVE CONTROLLER

https://truckmanualshub.com/



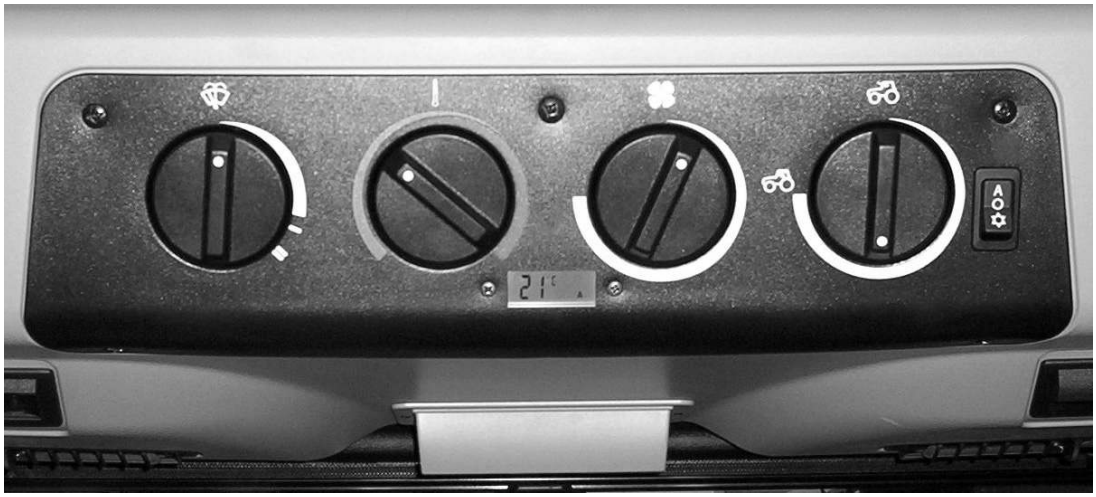
## Instrument Cluster

As well as a visual aid for all necessary operator displays the instrument cluster is also a controller.




## Automatic Temperature Control (ATC) - (If Equipped)

The ATC controller is mounted inside the cab roof behind the control panel.

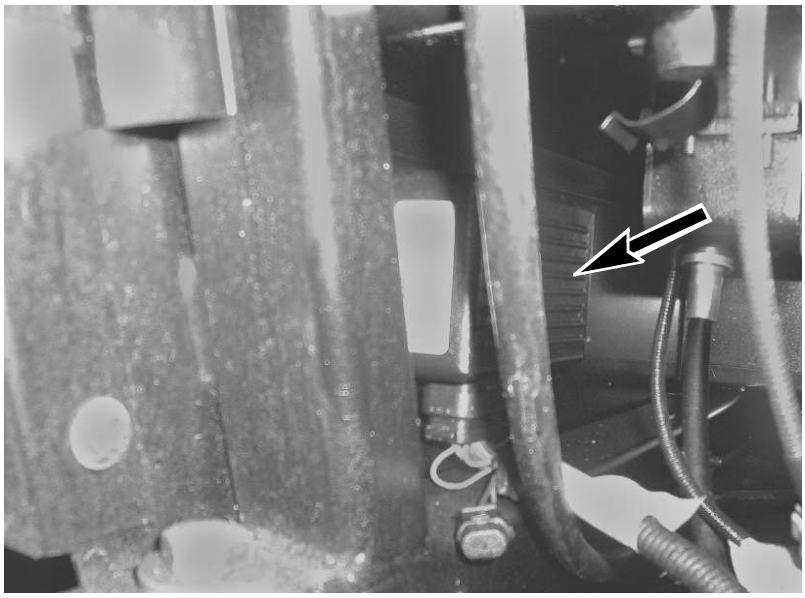


https://truckmanualshub.com/



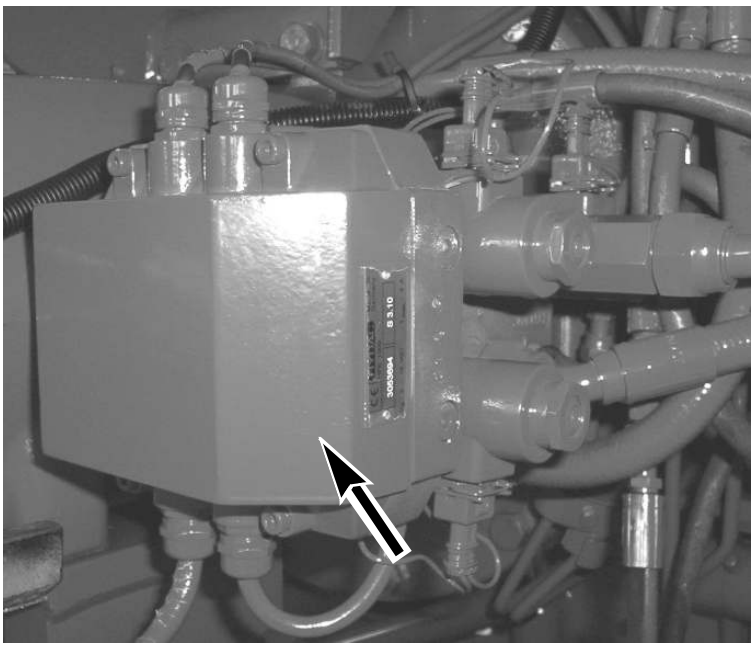
## Cab Suspension Controller- (If Equipped)

The cab suspension controller is located under the left rear corner of the cab base.



## Independent Front Suspension (IFS) Controller - (If Equipped)

The IFS axle controller is located infront of the right hand rear axle, on a mounting bracket with the axle control valve.



https://truckmanualshub.com/



# INSTRUMENT CLUSTER

## General Description

The XTX Instrument Cluster can be split into 4 main sections:

- Warning Lamps
- Analogue Type Gauges
- Touch Sensitive Buttons
- Main Digital Display.

The main digital display is made up using a dot matrix display and uses LED`s (Light Emitting Diodes) to show the symbols and digits on its display screen. This feature allows the Instrument panel contrast to be changed and thus allowing all necessary information to be seen regardless of light conditions.

The 2 rows of touch sensitive buttons enable the operator to programme the Instrument Cluster, Calibrate Speed, view total area and distance worked, carry out any necessary calibrations and also extract any relevant stored information.

The analogue gauges display fuel level, water temperature, and pneumatic trailer brake system pressure (centre gauge - McCormick logo replaced with air pressure gauge), The gauges are all stepper motor type gauges.




1. TOUCH SENSITIVE BUTTONS
2. ANALOGUE GAUGES
3. WARNING LAMPS
4. MAIN DIGITAL DISPLAY

Refer to the operators manual for a detailed explanation of the instrument cluster.

https://truckmanualshub.com/



# ERROR CODES

## General Description

The tractor has the ability to display active error codes on the instrument cluster. These codes are split into different categories depending on the controller that they are generated from. The codes can be used to help diagnose and repair problems with the tractor.

There are 2 ways that error codes can be read:

- Directly from the Instrument panel. (Active codes only).
- Using the McCormick Diagnostic Centre electronic service tool.

**NOTE:** *Not all the error codes can be read from the instrument cluster. The only way to retrieve ALL error codes is via the McCormick Diagnostic Centre.*

## Instrument cluster displayed error codes

The codes displayed on the Instrument cluster are shown on the left hand side of the screen. There will be an exclamation mark (1) shown on the display to indicate that an error has occurred.




1. ERROR DETECTED

By pressing the menu key on the panel the error sub menu will be shown showing the error count for the individual controllers, then by pressing the menu key again the Failure Mode Identifier (FMI) or Suspect Parameter Number (SPN), or both will be shown with the error code.

The error code(s) can then be translated by referring to the relevant service manual section(s).

https://truckmanualshub.com/



# “McCORMICK DIAGNOSTIC CENTRE” (MDC) ELECTRONIC SERVICE TOOL

A laptop based service tool is available to carry out several procedures on the tractor:

- The down loading of control modules with new software.
- The setting up of the tractors functions.
- The setting of some default values.
- The set up of extra or replacement auxiliary valves.
- The retrieval and erasing of error codes.

Without the MDC it will be impossible to fully support the XTX series tractors, it is therefore mandatory that this specialized service tool is made available to service technicians.




In order to connect the laptop to the tractor you must use an AVG interface between the laptop and the tractor, this basically allows the J1939 CAN messages from the tractor to be converted into hexi-decimal computer messages and the computer messages back to J1939.

The CD - Rom containing the McCormick Diagnostic Centre is ordered from the spare parts system:

McCormick Diagnostic Centre = part number 1025T2.

AVG = part number 1014T1.

The laptop then plugs into the AVG via its USB port (a USB A to B connector lead will also be required - This is the type of lead commonly used to connect a PC to a printer via its USB port) and the AVG interface box plugs into the diagnostic socket located under the right hand side of the instrument panel.

**For more information of the McCormick Diagnostic Centre refer to service bulletin DBT1021/3.**

https://truckmanualshub.com/



# CONTROLLER LOGIC

The following pages contain block diagrams of the switch inputs, outputs and CAN messages from the various controllers located on the tractor and are designed to give quick reference to which controllers control or influence features on the tractor. For further wiring information please refer to the relevant service manual section(s).

**NOTE:** *Although all messages transmitted between controllers are listed in the following pages some of the messages are for diagnostic purposes only and are only available to the McCormick Diagnostic Centre upon request.*

https://truckmanualshub.com/



# CAN MESSAGES FOR CAB CONTROLLER (CC 4)

## CHART A

The following CAN messages are transmitted by the CC 4 cab controller.
Creeper switch status
Skip shift switch status
Up shift switch status
Down shift switch status
Operator present switch status
FNRP - FORWARD status
FNRP – NEUTRAL status
FNRP – REVERSE status
FNRP – PARK status
Bottom of clutch pedal switch status
Hand throttle%
Hand throttle voltage
Foot throttle%
Foot throttle voltage
Range 1 switch status (XtraSpeed only)
Range 2 switch status (XtraSpeed only)
Range 3 switch status (XtraSpeed only)
Range 4 switch status (XtraSpeed only)
F/R relay enable input
Ref output voltage – 5V REF
Ref output voltage 12 volt

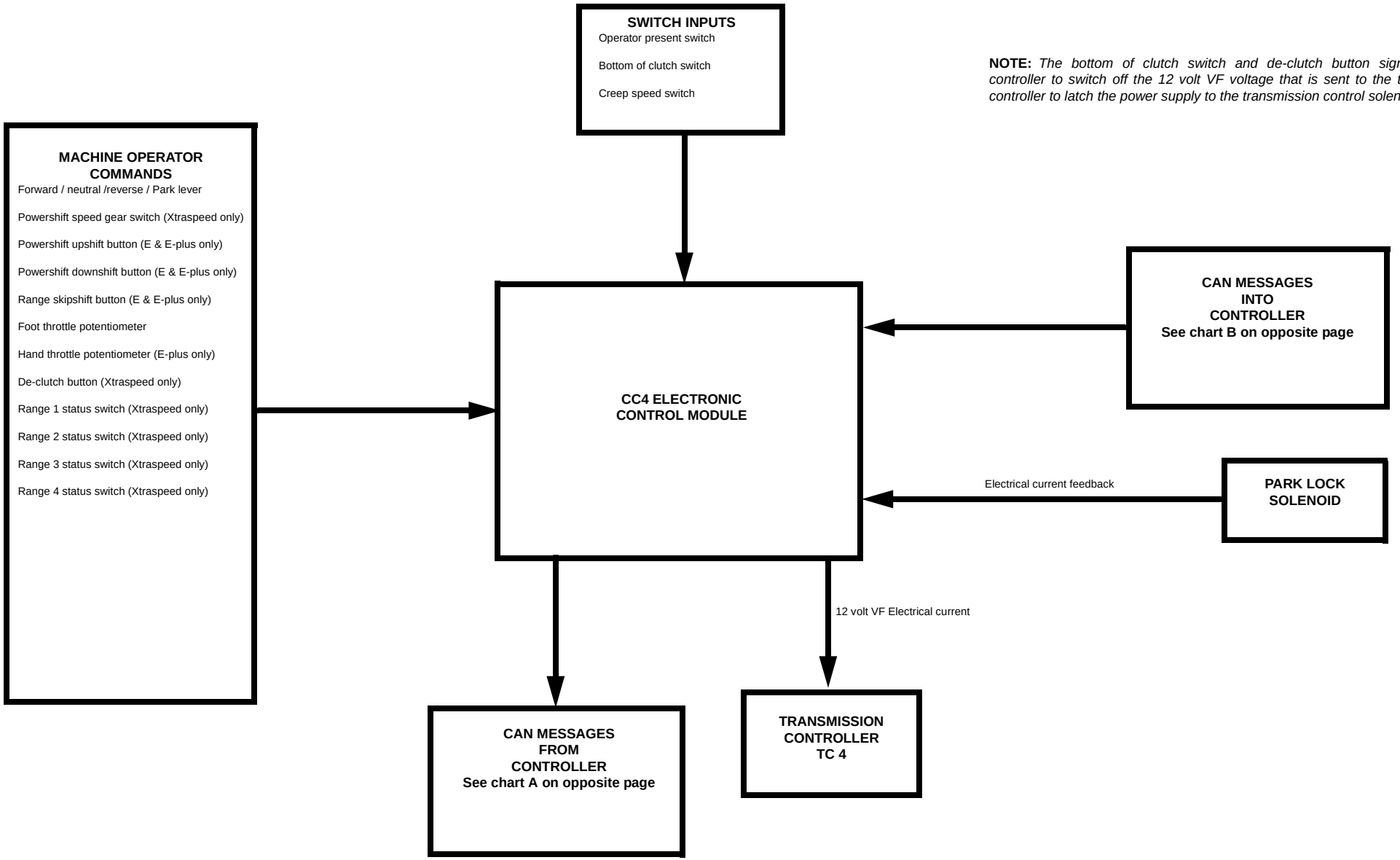
## CHART B

The following CAN message is received into the CC 4 cab controller.

Forward/Reverse relay enable input

https://truckmanualshub.com/


# CAB CONTROLLER (CC4) LOGIC CHART




**NOTE:** *The bottom of clutch switch and de-clutch button signal the cab controller to switch off the 12 volt VF voltage that is sent to the transmission controller to latch the power supply to the transmission control solenoids.*

# CAN MESSAGES FOR TRANSMISSION CONTROLLER (TC 4)

## CHART A

The following list of CAN messages are transmitted from the TC 4 electronic control module.

Range 1-2 Sensor Voltage
Range 3-4 Sensor Voltage
Range 1 Calibration Voltage
Range 2 Calibration Voltage
Range 3 Calibration Voltage
Range 4 Calibration Voltage
Range 1-2 Neutral Calibration Voltage
Range 3-4 Neutral Calibration Voltage
Transmission oil temp sender voltage
Transmission oil temp
MFD On request
Switched bat potential
Ref output voltage 5v
Ref output voltage 12v
F/R relay enable input
Clutch Sensor %
Clutch Sensor Voltage
Range 4 Output Current
Range 3 Output Current
Range 2 Output Current
Range 1 Output Curren
Park lock output
Direct drive output
Creeper Output
Creeper out switch
Creeper in switch
Reverse Ouput curren
PS4 4 Output Current
PS4 3 Output Current
PS4 2 Output Current
PS4 1 Output Current
PS2 2 Output Current
PS2 1 Output Current
Forward Output Current
PTO B Freq
PTO A Freq
PS4 Output Freq
PS2 Output Freq
Inter B Freq - not used
Inter A Freq
Engine Speed Sensor Freq - not used
Axle Freq
Engine torque/power Curve
PTO sensor Phase Difference
Zero Torque Phase Difference
Calculated Torque

Hardware serial no
Variant
Revision
Part No
Software version
Software ID
Hardware ID
Boot Software Version Number
Boot Software Part Number
Application Software Version Number
Application Software Part Number

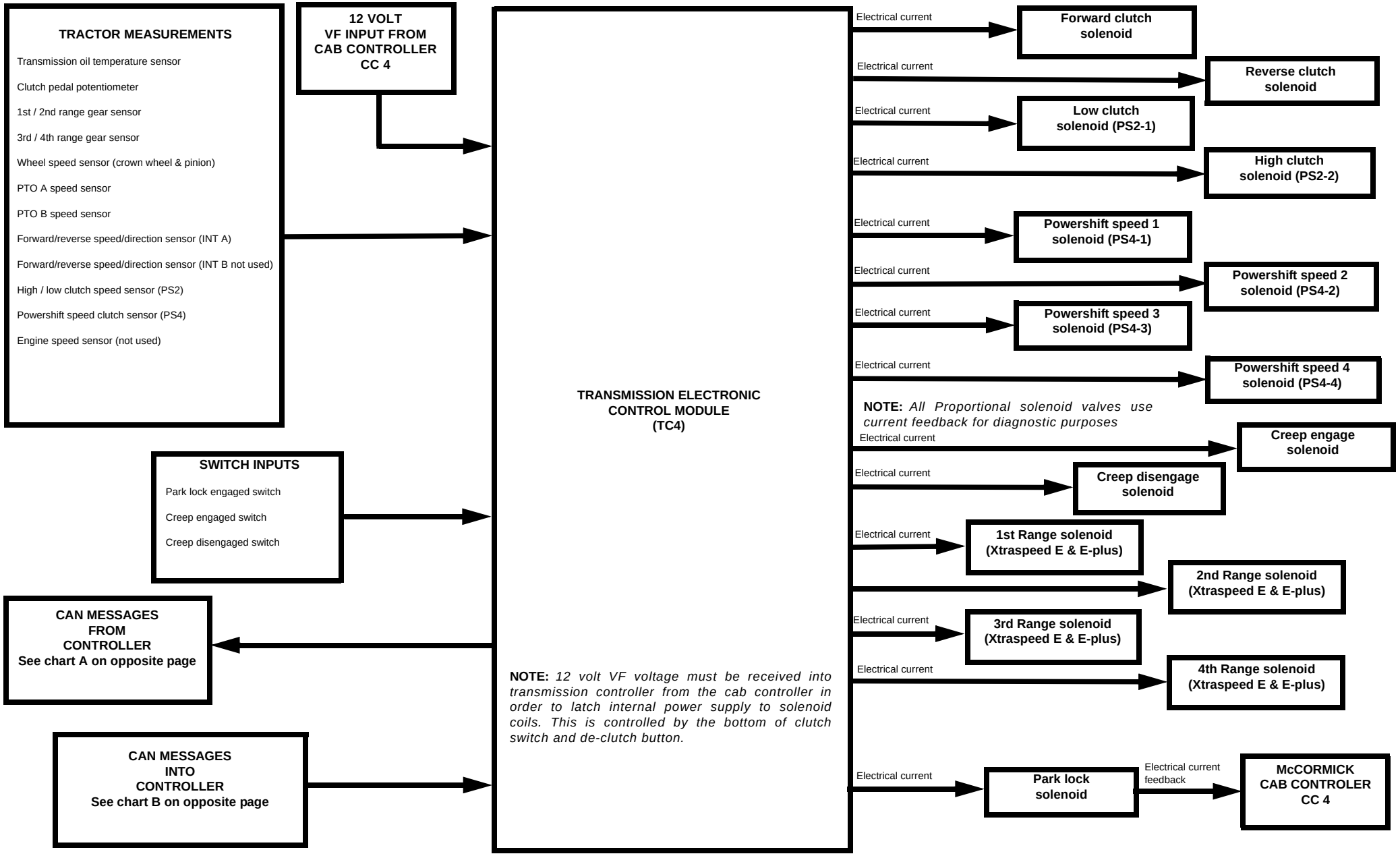
## CHART B

The following list of CAN messages are received by the TC 4 electronic control module.

Creeper switch status
Skip shift switch status
Up shift switch status
Down shift switch status
Op present switch status
FNRP - FORWARD status
FNRP – NEUTRAL status
FNRP – REVERSE status
FNRP – PARK status
Bottom of clutch pedal switch status
Hand throttle %
Hand throttle voltage
Foot throttle %
Foot throttle voltage
Range 1 switch status (XtraSpeed only)
Range 2 switch status (XtraSpeed only)
Range 3 switch status (XtraSpeed only)
Range 4 switch status (XtraSpeed only)
F/R relay enable input
Ref output voltage – 5V RE
PTO output status
Actual Engine % Torque
Engine speed
Engine coolant temperature
Park brake status

https://truckmanualshub.com/


# TRANSMISSION CONTROLLER (TC4) LOGIC CHART



# ENGINE CONTROLLER CAN MESSAGES

## CHART A

The following list of CAN messages are transmitted by the engine electronic control module.

Barometric Pressure
Actual Engine% Torque
Drivers Demand Engine% Torque
Engine Speed
Load At Current Speed
Nominal Friction% Torque
Engine Oil Pressure
Total Engine Hours
Engine Coolant Temperature
Fuel Temperature Fuel Rate
Air Inlet Pressure
Boost Pressure
Intake Manifold Temperature
Wait To Start Lamp
Switched Battery Potential
Battery Potential
Water In Fuel Indicator

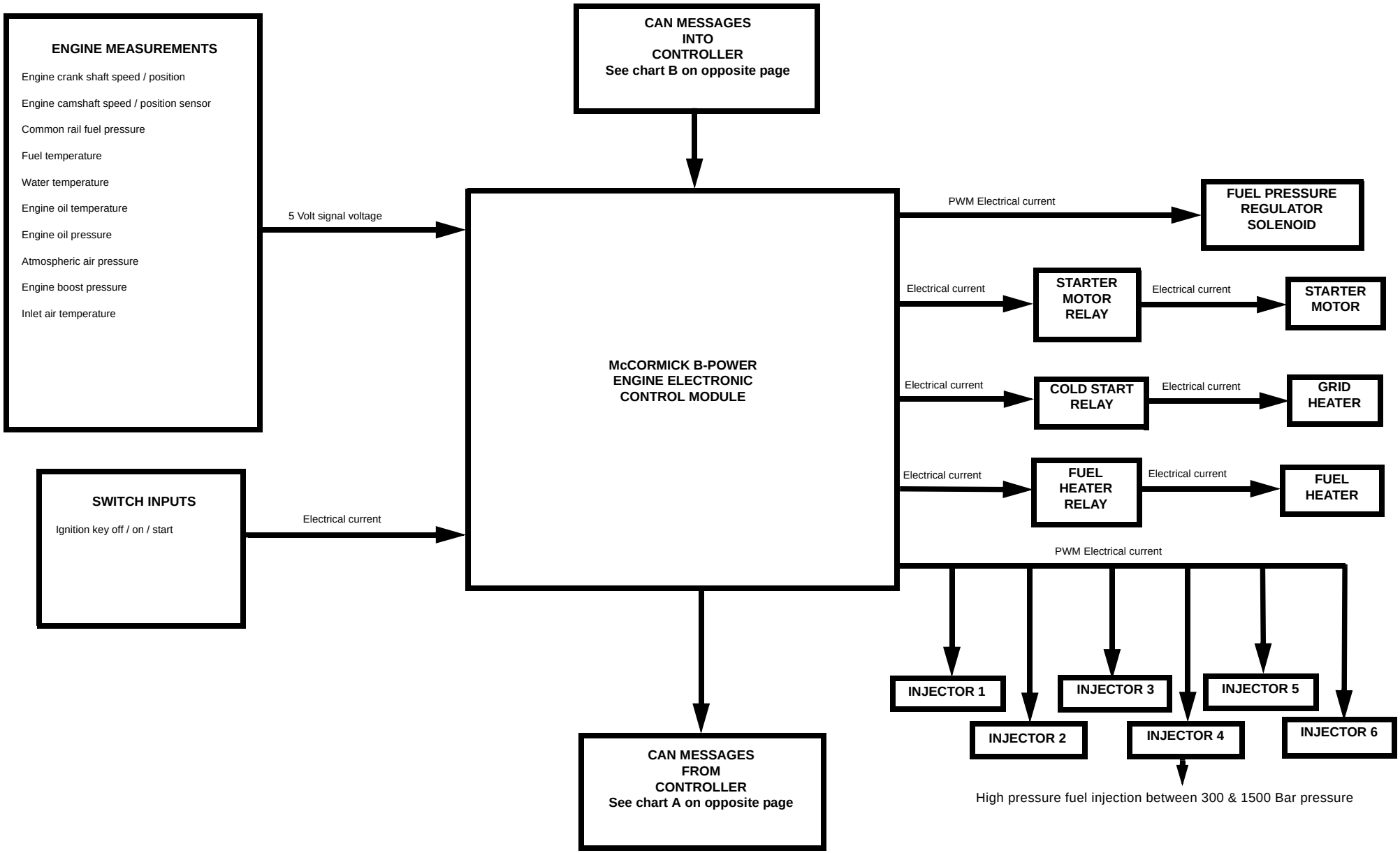
## CHART B

The following list of CAN messages are received by the engine electronic control module.

Requested engine speed
Requested engine power/torque curve

https://truckmanualshub.com/


# ENGINE ELECTRONIC CONTROLLER LOGIC CHART XTX185 & 200 ONLY



https://truckmanualshub.com/

# ENGINE CONTROLLER CAN MESSAGES

## CHART A

The following list of CAN messages are transmitted by the engine electronic control module.

Barometric Pressure
Actual Engine% Torque
Drivers Demand Engine% Torque
Engine Speed
Load At Current Speed
Nominal Friction% Torque
Engine Oil Pressure
Total Engine Hours
Engine Coolant Temperature
Fuel Temperature Fuel Rate
Air Inlet Pressure
Boost Pressure
Intake Manifold Temperature
Wait To Start Lamp
Switched Battery Potential
Battery Potential
Water In Fuel Indicator

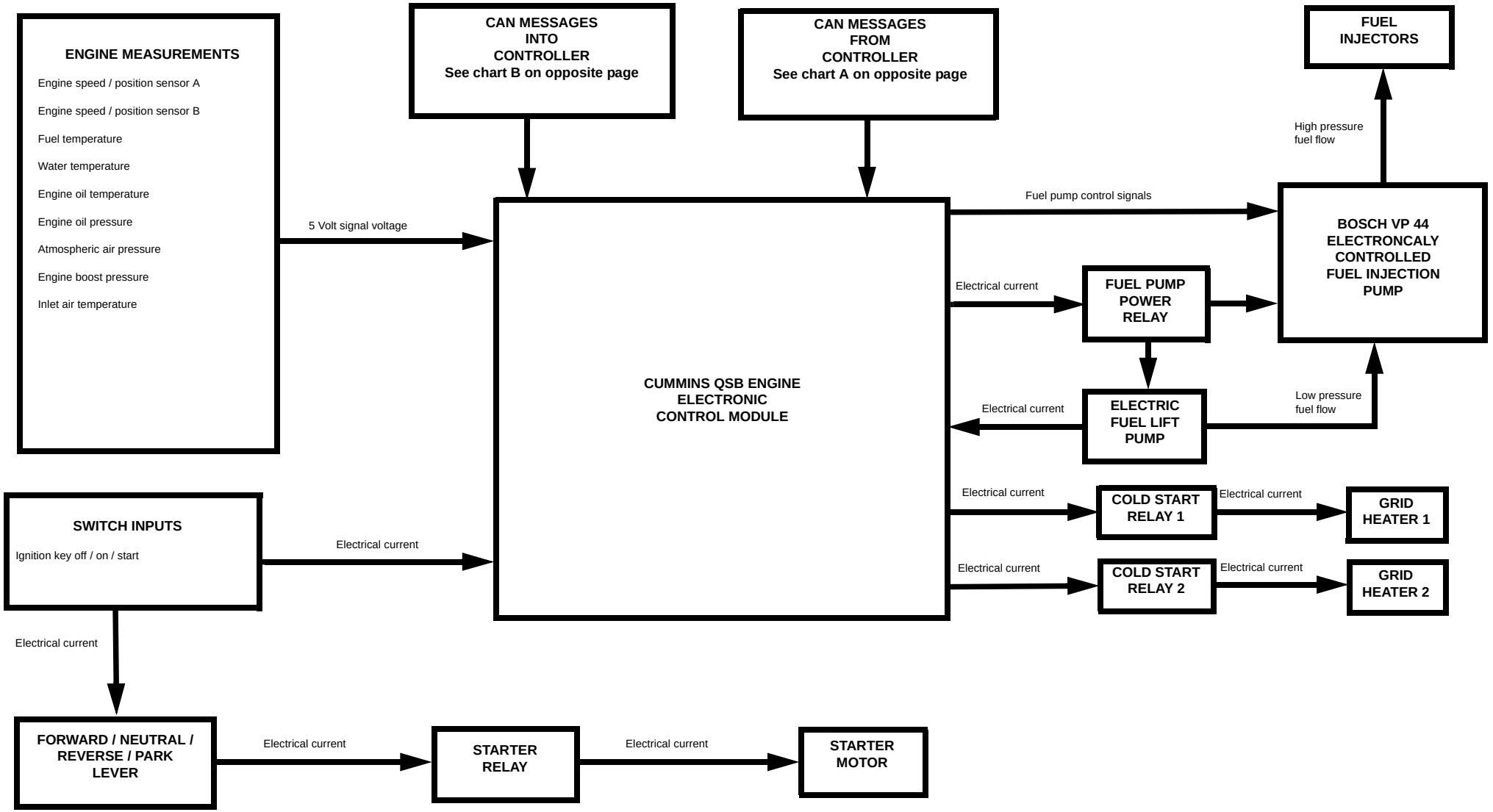
## CHART B

The following list of CAN messages are received by the engine electronic control module.

Requested engine speed
Requested engine power/torque curve

https://truckmanualshub.com/


# ENGINE ELECTRONIC CONTROLLER LOGIC CHART XTX215 ONLY



# CAN MESSAGES FOR INSTRUMENT CLUSTER

## CHART A

The following list of CAN messages transmitted by the instrument cluster.

Park Brake Status
Trip Fuel
Total Fuel Used
Requested PTO Cal Mode
Requested Hitch Cal Mode
Tyre rolling Circumference
Max Slip%

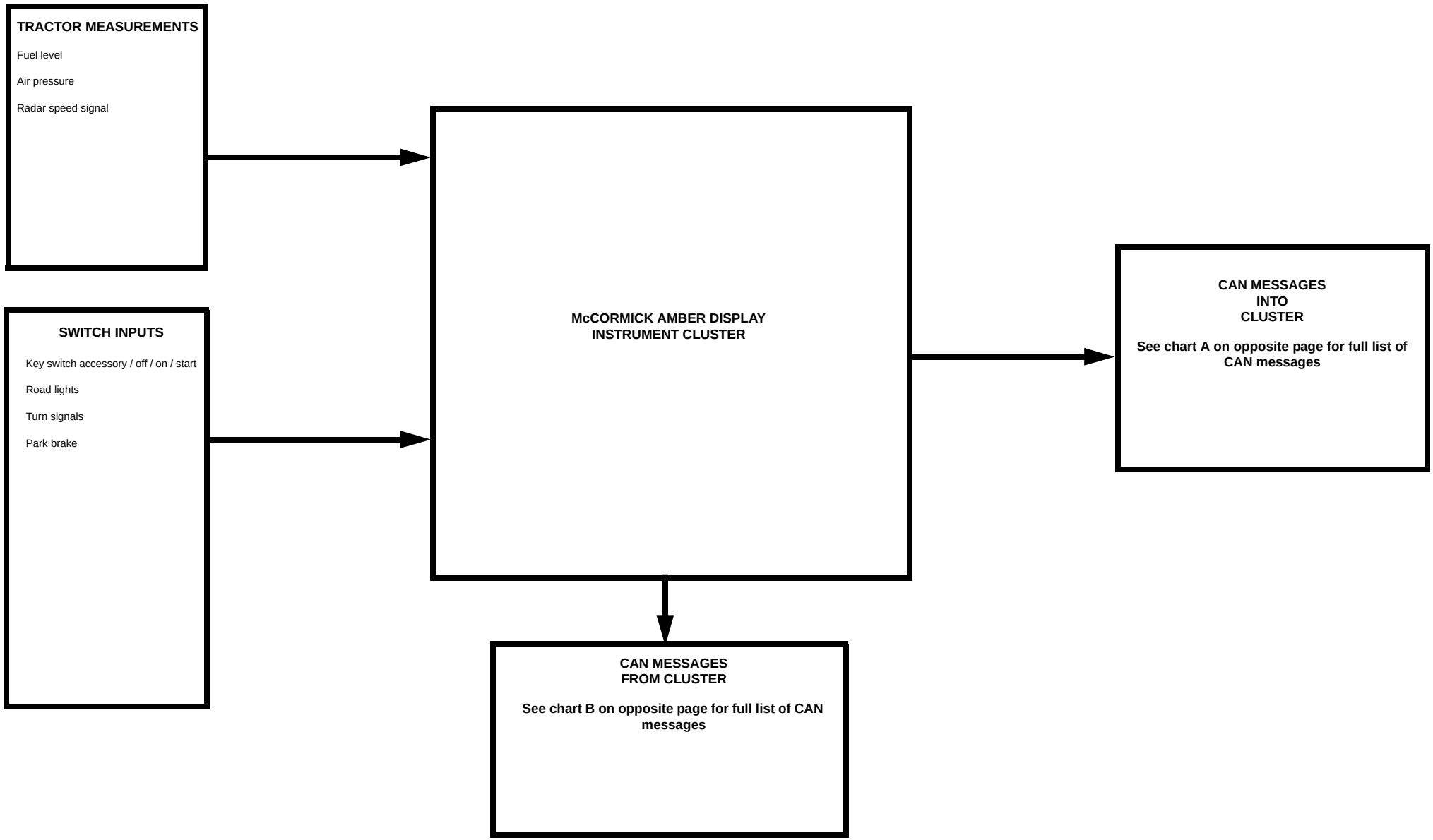
## CHART B

The following list of CAN messages are received by the instrument cluster.

Switched Battery Potential
Battery Potential
Diagnosis Fault Code (Valve 1 E-plus only)
Diagnosis Fault Code (Valve 2 E-plus only)
Diagnosis Fault Code (Valve 3 E-plus only)
Diagnosis Fault Code (Valve 4 E-plus only)
Diagnosis Fault Code (Valve 5 E-plus only)
Auxiliary valve state (all valves E-plus only)
PTO speed selector switch state
PTO clutch output speed
Hitch raise signal
Hitch lower signal
Pto Calibration state
Hitch calibration state
Audible alarm on request
Actual wheel slip
Transmission oil temp
Creeper engaged switch on

https://truckmanualshub.com/


# XTX TRACTOR INSTRUMENT CLUSTER LOGIC CHART



# CAN MESSAGES FOR HITCH & PTO CONTROLLER

## CHART A

The following list of CAN messages are transmitted by the hitch and PTO controller.

Slip Lamp
Seat Switch
Right Brake Switch
Remote PTO ON Switch
Remote PTO OFF Switch
Remote Implement Switch
Radar Present Switch
MFD ON Switch
Left Brake Switch
Hitch Enable Lamp
Diff ON Switch
Auto PTO SET Switch
Auto PTO ON Switch
Auto PTO OFF Switch
Auto PTO Lamp
Auto MFD Switch
Auto Diff Switch
Auto Diff Lamp
PTO Clutch Output speed
PTO Valve Current
Hitch System State
Raise PWM Duty Cycle
Lower PWM Duty Cycle
PTO Output
PTO Duty Cycle
PTO Cal State
PTO Auto Active
MFD Output Command
Hitch Cal State
Diff Output Command
Alarm Horn Request
Upper Limit Override Switch
Upper Lim Voltage
Hitch Switch - Up
Travel Sensor Voltage
Slip On Switch
Ride Control On Switch
Remote Up Switch
Remote Down Switch
Position Command
Load Command Voltage
Drop Rate Voltage
Hitch Switch Momentary Down
Hitch Switch Down Supply Voltage
Right Draft Pin Signal
Raise Valve Current
Hitch position Sensor Voltage
Position Command Voltage
Lower Valve Current
Left Draft Pin Signal
PTO Lamp
PTO OFF Switch
PTO ON Switch
PTO Speed Select Switch
PTO Speed Ratio
PTO Period
Peak Current Feedback
Cal Battery Voltage
Position Range Command Range Ratio
Position Range
Position Min.
Position Command Min.
Right Draft Offset
Raise PWM Threshold
Lower PWM Threshold
Left Draft Offset
Wheel Speed
Radar Speed
Axle RPM
Act Slip%

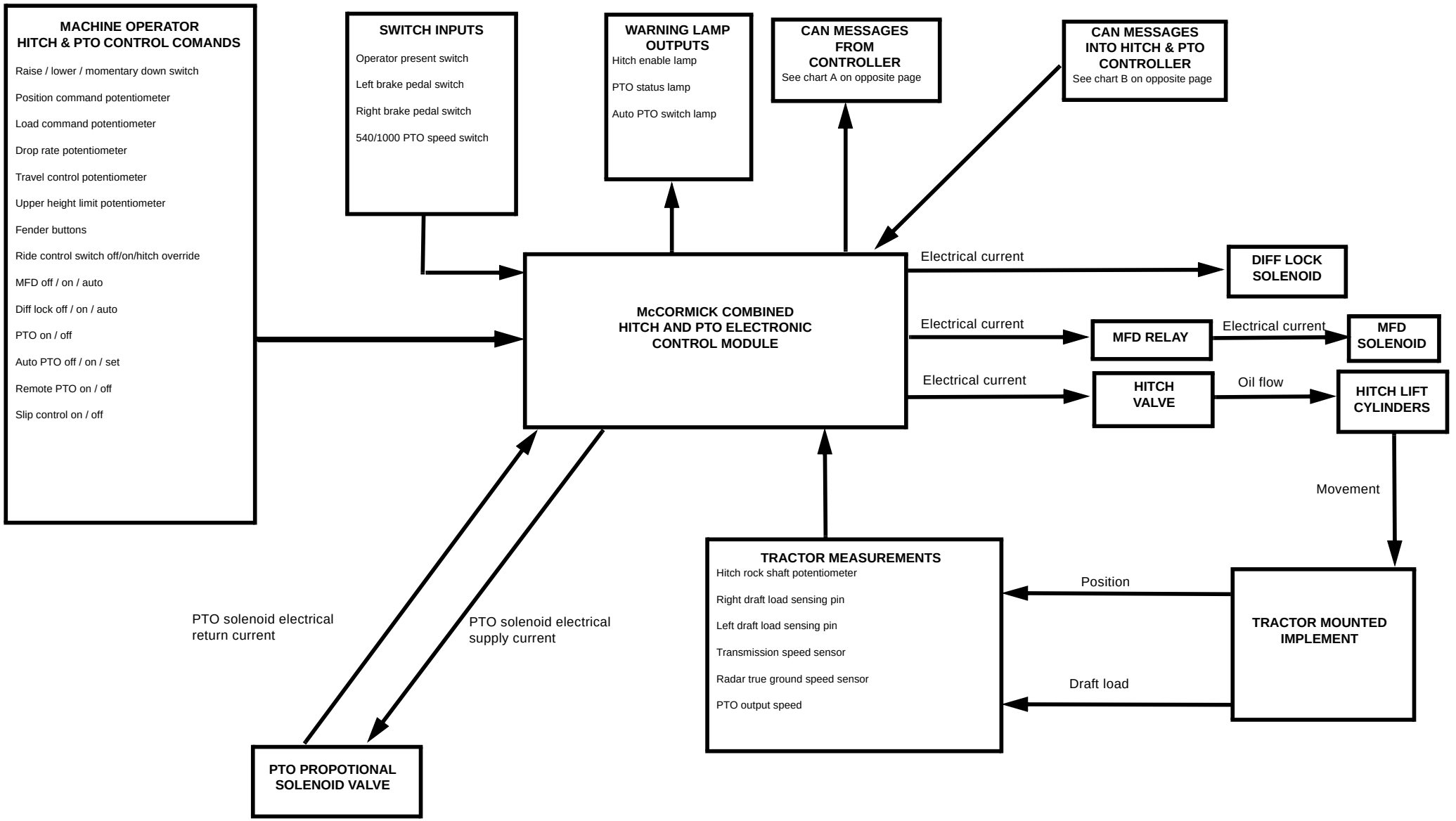
## CHART B

The following list of CAN messages are received by the hitch and PTO controller.

Rqst PTO Cal Mode
Rqst Hitch Cal Mode
Rolling Circumference
Max Slip
MFD on request
Operator present switch

https://truckmanualshub.com/


# COMBINED HITCH & PTO CONTROLLER LOGIC CHART



## CAN MESSAGES FOR AUXILIARY VALVE CONTROLLER (E*plus* only)

The following list of CAN messages are sent from the auxiliary valve controller.

Raise (Valve 1)
Open Centre (Valve 1)
Oil Flow Setpoint (Valve 1)
Lower (Valve 1)
Neutral (Valve 1)
Curve Shape Raise (Valve 1)
Curve Shape Lower (Valve 1)
Curve Gradient Raising (Valve 1)
Curve Gradient Lowering (Valve 1)

Raise (Valve 2)
Open Centre (Valve 2)
Oil Flow Setpoint (Valve 2)
Lower (Valve 2)
Neutral (Valve 2)
Curve Shape Raise (Valve 2)
Curve Shape Lower (Valve 2)
Curve Gradient Raising (Valve 2)
Curve Gradient Lowering (Valve 2)

Raise (Valve 3)
Open Centre (Valve 3)
Oil Flow Setpoint (Valve 3)
Lower (Valve 3)
Neutral (Valve 3)
Curve Shape Raise (Valve 3)
Curve Shape Lower (Valve 3)
Curve Gradient Raising (Valve 3)
Curve Gradient Lowering (Valve 3)

Raise (Valve 4)
Open Centre (Valve 4)
Oil Flow Setpoint (Valve 4)
Lower (Valve 4)
Neutral (Valve 4)
Curve Shape Raise (Valve 4)
Curve Shape Lower (Valve 4)
Curve Gradient Raising (Valve 4)
Curve Gradient Lowering (Valve 4)

Raise (Valve 5)
Open Centre (Valve 5)
Oil Flow Setpoint (Valve 5)
Lower (Valve 5)
Neutral (Valve 5)
Curve Shape Raise (Valve 5)
Curve Shape Lower (Valve 5)
Curve Gradient Raising (Valve 5)
Curve Gradient Lowering (Valve 5)

Error messages for all valves

The following list of CAN messages are received into the auxiliary valve controller.

Error messages valve 1
Valve Temperature (valve 1)
Spool Travel (valve 1)

Error messages valve 2
Valve Temperature (valve 2)
Spool Travel (valve 2)

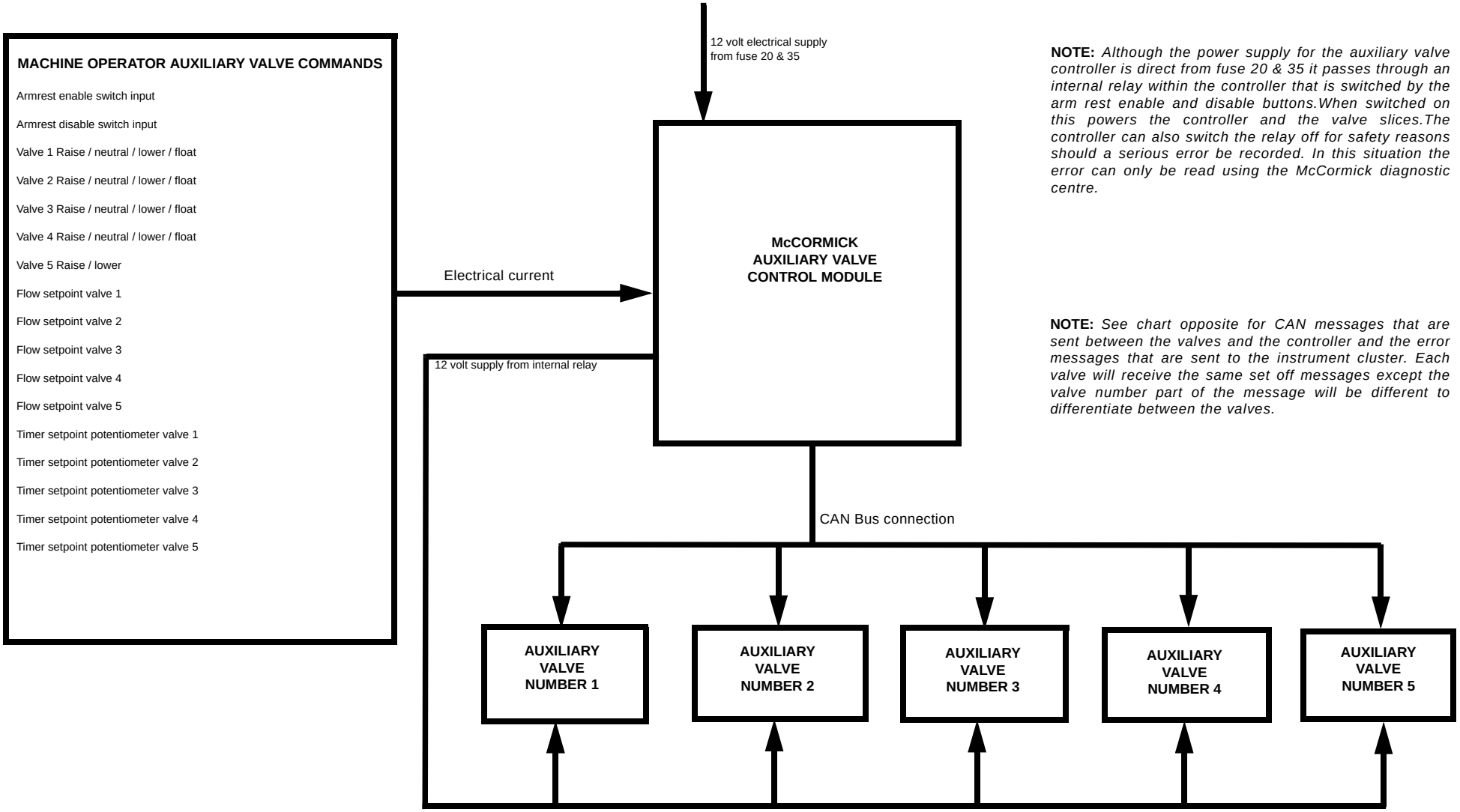
Error messages valve 3
Valve Temperature (valve 3)
Spool Travel (valve 1)

Error messages valve 4
Valve Temperature (valve41)
Spool Travel (valve 1)

Error messages valve 5
Valve Temperature (valve 5)
Spool Travel (valve 5)

https://truckmanualshub.com/


# AUXILIARY VALVE CONTROLLER AND VALVE SLICE LOGIC CHART (E*plus* only)




**NOTE:** *Although the power supply for the auxiliary valve controller is direct from fuse 20 & 35 it passes through an internal relay within the controller that is switched by the arm rest enable and disable buttons.When switched on this powers the controller and the valve slices.The controller can also switch the relay off for safety reasons should a serious error be recorded. In this situation the error can only be read using the McCormick diagnostic centre.*

**NOTE:** *See chart opposite for CAN messages that are sent between the valves and the controller and the error messages that are sent to the instrument cluster. Each valve will receive the same set off messages except the valve number part of the message will be different to differentiate between the valves.*

https://truckmanualshub.com/



# Section 10001

## AUXILIARY/REMOTE VALVE CONTROLLER

### Error Codes, Troubleshooting and Schematics

### XTX185, 200 and 215 XtraSpeed - E Plus Tractors

McCORMICK

SM 8-15051

© 2006 McCormick Tractors International Limited.
July 2005 (Revised September 2006)

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIAL TOOLS ..... 4

GENERAL INFORMATION FOR ELECTRONIC
AUXILIARY/REMOTE VALVE CONTROL ..... 5
Auxiliary/Remote Valve Operation ..... 5
CAN Bus Communication ..... 5

ERROR CODES GENERAL INFORMATION ..... 6
Retrieving Instrument Cluster Displayed Active Error Codes. ..... 6

AUXILIARY/REMOTE VALVE MANUAL OPERATION ..... 7

CIRCUIT TESTING
General Information ..... 8

ERROR CODE TROUBLESHOOTING GUIDE

Auxiliary/Remote Valve Controller Error Codes
No Auxiliary/Remote Valve Controller Error
(No Power to Auxiliary/Remote Valve Controller) ..... 9
Controller Error Code 10 ..... 11
Controller Error Code 11 ..... 12
Controller Error Code 12 ..... 12
Controller Error Code 13 ..... 13
Controller Error Code 14 ..... 13
Controller Error Code 15 ..... 14
Controller Error Code 16 ..... 14
Controller Error Code 17 ..... 15
Controller Error Code 20 ..... 15
Controller Error Code 21 ..... 16
Controller Error Code 22 ..... 16
Controller Error Code 23 ..... 17
Controller Error Code 24 ..... 17
Controller Error Code 25 ..... 18
Controller Error Code 26 ..... 18
Controller Error Code 27 ..... 19
Controller Error Code 30 ..... 19
Controller Error Code 31 ..... 20
Controller Error Code 32 ..... 21
Controller Error Code 33 ..... 21
Controller Error Code 34 ..... 22
Controller Error Code 35 ..... 23
Controller Error Code 36 ..... 23
Controller Error Code 37 ..... 24
Controller Error Code 40 ..... 25
Controller Error Code 41 ..... 26
Controller Error Code 42 ..... 27
Controller Error Code 43 ..... 28
Controller Error Code 44 ..... 29
Controller Error Code 45 ..... 30
Controller Error Code 46 ..... 31
Controller Error Code 47 ..... 32
Controller Error Code 50 ..... 33

https://truckmanualshub.com/



Controller Error Code 51 ..... 34
Controller Error Code 52 ..... 35
Controller Error Code 53 ..... 36
Controller Error Code 54 ..... 37
Controller Error Code 55 ..... 38
Controller Error Code 56 ..... 39
Controller Error Code 57 ..... 40
Controller Error Code 60 ..... 41
Controller Error Code 61 ..... 42
Controller Error Code 62 ..... 43
Controller Error Code 63 ..... 44
Controller Error Code 64 ..... 45
Controller Error Code 65 ..... 45
Controller Error Code 73 ..... 46
Controller Error Code 74 ..... 46
Controller Error Code 75 ..... 47
Controller Error Code 76 ..... 48
Controller Error Code 77 ..... 48
Multiple Controller Potentiometer Low Signal Error Codes ..... 49
Multiple Controller Potentiometer High Signal Error Codes ..... 50

Auxiliary/Remote Valve Error Codes
Valve Error Code 17 and 18 ..... 51
Valve Error Code 19 and 20 ..... 52
Valve Error Code 21 ..... 52
Valve Error Code 22 ..... 52
Valve Error Code 23 ..... 53
Valve Error Code 33 ..... 53
Valve Error Code 34 ..... 54
Valve Error Code 35 ..... 54
Valve Error Code 36 ..... 55
Valve Error Code 37 ..... 55
Valve Error Code 38 ..... 56
Valve Error Code 65 ..... 56
Valve Error Code 66 ..... 57
Valve Error Code 67 ..... 57
Valve Error Code 129 ..... 58
Valve Error Code 130 ..... 58
Valve Error Code 131 ..... 59

COMPONENT IDENTIFICATION
Right Hand Console and Armrest Components ..... 60
Rear Fender and Transmission Components ..... 61

SCHEMATIC CIRCUIT ..... 62

MAIN CONNECTORS ..... 65

https://truckmanualshub.com/



# SPECIAL TOOLS



DD98H120

**MC2616 MULTIMETER KIT includes:**
**MC2616-1 MULTIMETER ONLY**
**MC2616-2 TEST LEADS**
**MC2616-3 TEMPERATURE PROBE**




**1025T1 MCCORMICK DIAGNOSTIC CENTRE**
**1014T1 COMMUNICATIONS ADAPTER**
**1004T2 DOWNLOAD HARNESS**
**1029T1 ADAPTER HARNESS**



DD99A051

**MC2656 TEST PROBE KIT**



DD97E383

**MC31000B HARNESS REPAIR KIT**

https://truckmanualshub.com/



# GENERAL INFORMATION FOR ELECTRONIC AUXILIARY/REMOTE VALVE CONTROL

The electronic Auxiliary/Remote valve system comprises of an Auxiliary/Remote valve controller and up to five individual Auxiliary/Remote valves. Each Auxiliary/Remote valve is directly controlled by a control unit incorporated within the valve.

## Auxiliary/Remote Valve Operation

When the key is turned on the auxiliary/remote valve controller will carry out a self test, during the self test procedure the enable light (LED) in the enable switch will be illuminated momentarily.

The Auxiliary/Remote valves system will only operate when the self test has been completed (enable light off) and the system has been enabled. The system is enabled by momentarily pressing the enable switch; the system enable light in the switch will illuminate when the system is enabled.

In the case of an emergency or to prevent accidental operation of the Auxiliary/Remote valves the system can be disabled by pressing the stop switch.

The Auxiliary/Remote valve controller controls the correct operation of each Auxiliary/Remote valve by processing and monitoring signals directly from the following switches and potentiometers.

- Auxiliary/Remote valve enable switch.
- Auxiliary/Remote valve emergency stop switch.
- Auxiliary/Remote valve control levers (joysticks).
- Auxiliary/Remote valve flow potentiometers.
- Auxiliary/Remote valve timer potentiometers.
- Auxiliary/Remote valve multi function lever auxiliary/remote buttons.

The Auxiliary/Remote valve controller processes and transmits information to the control unit of each Auxiliary/Remote valve. If the operation of a valve is required, information received by the valve control unit is processed and the control unit controls the activation of the spool solenoid within the valve. The valve control unit also monitors oil temperature and spool movement and transmits the information to the Auxiliary/Remote valve controller over the CAN bus.

If an error occurs within Auxiliary/Remote valve controller or any of the Auxiliary/Remote valves during normal operation the valve spools will return to their neutral positions and an error code will be generated. When an error occurs the error warning will be displayed on the instrument cluster.

**NOTE:** *Always check for the same error code in each of the auxiliary/remote valves. The same error in all valves may be an indication of a auxiliary/remote valve controller error. Before troubleshooting the auxiliary/remote valve error codes, first check and correct any auxiliary/remote valve controller error codes that may be present.*

Faults in the Auxiliary/Remote valve units are classified into four categories and the reaction of the Auxiliary/Remote valve varies according to the severity of the fault.

Category 1 - Control Section Faults.

Category 2 - Minor Faults.

Category 3 - Serious faults with internal safety shut-down.

Category 4 - Serious faults requiring external safety shut-down.

> ⚠ **WARNING:** *If category 4 error codes 81, 82 or 83 are displayed STOP the engine immediately.*

## CAN Bus Communication

The CAN Bus circuit comprises of a twisted pair of wires, CAN High (Yellow) and CAN Low (Green), with a termination 120 Ohm resistor at each end. It is important that these wires remain twisted together and the termination resistors are connected to reduce any electrical interference that may disrupt the CAN messages.

https://truckmanualshub.com/



# ERROR CODES GENERAL INFORMATION

Each controller on the tractor continually monitors the control systems for errors. If an error is detected a error message will be transmitted over the CAN circuit to the instrument cluster, which will display an error warning to alert the operator to a problem. Depending on the nature of the fault the instrument cluster may display the Red engine STOP and or the Amber main warning light, also the audible alarm may sound.

**NOTE:** *The instrument cluster will only display current (active) error codes apart from the auxiliary/ remote valve controller error codes; 11, 12, 13 and 15. These codes will only be displayed using the 'McCormick Diagnostic Centre'.*

Each controller will store all error codes that have been detected in the controller memory. These stored error codes can be viewed and cleared using the 'McCormick Diagnostic Centre'.

**IMPORTANT:** *When faults occur in the Auxiliary/Remote Valve system always check for both AVC (Auxiliary Valve Controller) and AV1 to AV5 (Auxiliary Valves) error codes.*

## Retrieving Instrument Cluster Displayed Active Error Codes.

If an error occurs during normal operation in one of the tractor controller systems the ! symbol will appear on the instrument cluster.

If the error warning symbol appears park the tractor on hard level ground, put the F/N/R/P lever in PARK and apply the park brake. Turn the key to the OFF position.

> ⚠ **WARNING:** *Some errors will only be active when the tractor is operated, the codes for these errors will be stored in the relevant controller and MUST only be retrieved using the 'McCormick Diagnostic Centre'. DO NOT retrieve error codes when driving the tractor.*

To read the error codes carry out the following procedure:

Turn the key to the on position and press the menu button.

Each controller will be identified on the Universal Data Display as follows:

| | |
|---|---|
| **ENG** | - ENGINE |
| **IC** | - INSTRUMENT CLUSTER |
| **MCC** | - CAB CONTROLLER OR TRANSMISSION CONTROLLER |
| **EHR** | - ELECTRONIC HITCH |
| **AVC** | - AUXILIARY VALVE CONTROLS |
| **AV1 to AV5** | - AUXILIARY VALVES |

The displayed controller will also display the number of active error codes.

Example:

**ENG** = ENGINE
**0** = No Active Errors

Press the button to scroll through each controller until MCC is display Universal Data Display.

**AV1** = Auxiliary Valve 1
**1** = 1 Active Error

To view the error code, press the menu button.

**25** = Error Code 25

If more than one AV1 error has been detected, press the button to identify the remaining errors.

For AV1 to AV5 and AVC Error Codes refer to the Error Code Troubleshooting Guide in this section.

https://truckmanualshub.com/



# AUXILIARY/REMOTE VALVE MANUAL OPERATION

**IMPORTANT:** *Manual operation of the auxiliary/ remote vales MUST ONLY be used if the valve develops a fault, where the valve can not be operated using the normal cab controls.*

> **WARNING:** *Keep everybody clear of the tractor and implement when manually operating the auxiliary/remote valves.*

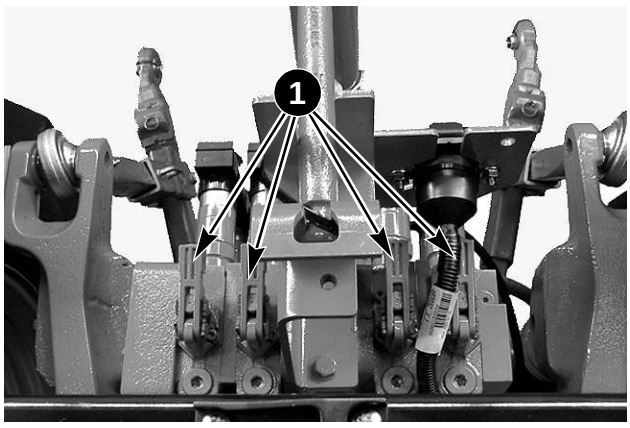
> **WARNING:** *MAKE SURE the area around the implement is clear of obstructions and there is enough space for the implement to be lowered into its working/transport position if necessary. Disconnect the implement from the tractor according to the implement manufactures instructions.*

> **WARNING:** *To prevent injury ONLY operate the auxiliary/remote valve mechanical linkage from inside the cab.*

## STEP 1

If possible, park the tractor on hard level ground, apply the parking brake, turn the key to the OFF position and remove the key. Put blocks in front and behind the rear wheels.

## STEP 2




MD05E043

Manually push the mechanical linkage (1) of the faulty valve fully down into the FLOAT position to lower the implement where it can be safely disconnected from the tractor. It may be necessary to use a suitable bar to operate the linkage.

**IMPORTANT:** *Access to the auxiliary/remote valve mechanical linkage is through the cab rear window. CARE must be taken when operating the linkage.*

## STEP 3

When the implement is fully lowered, disconnect the implement from the tractor according to the implement manufactures instructions.

https://truckmanualshub.com/



# CIRCUIT TESTING

## General Information

**WARNING:** *Never operate the engine in a closed building. Proper ventilation is required under all circumstances.*

**WARNING:** *Before carrying out any checks on the auxiliary/remote valves, disconnect any attached implements from auxiliary/remote valve hydraulic couplers and the rear hitch. If the implement can not be operated using the normal cab controls to relieve the pressure in the system the implement can be operated using the valve manual linkage, refer to "AUXILIARY/REMOTE VALVE MANUAL OPERATION" on page 7.*

**IMPORTANT:** *A single fault in the system may cause several different error codes to be recorded. Make a note of all active error codes for each controller before carrying out the troubleshooting procedure.*

**IMPORTANT:** *Replace the controller if the fault remains only after all necessary checks have been made.*

**IMPORTANT:** *All electrical checks must be made with the tractor parked on hard level ground with park brake engaged, the Forward/Reverse shuttle lever in Neutral or Park and the engine OFF, unless otherwise stated.*

**IMPORTANT:** *Put blocks in front of and behind the rear wheels.*

**IMPORTANT:** *The battery must be at full charge and all connections must be clean and tight before testing. Only use a HIGH IMPEDANCE multimeter for the tests. Do not use a test lamp or damage to the switches may occur.*

**IMPORTANT:** *Use MC2656 test probe kit when making electrical checks at connectors to avoid the risk of shorting between the connector pins or terminals.*

**IMPORTANT:** *When disconnecting harness connectors, always check the connector pins and terminals for damage and alignment.*

**NOTE:** *When measuring resistance values, always measure the resistance of the multimeter leads before testing components. Subtract the resistance of the multimeter leads from the component resistance to obtain a true resistance value.*

**NOTE:** *When testing diodes and diode modules use the multimeter diode test function.*

**NOTE:** *All components, wires and connectors disconnected during any electrical checks must be connected when the checks are completed.*

https://truckmanualshub.com/



# ERROR CODE TROUBLESHOOTING GUIDE

## Auxiliary/Remote Valve Controller Error Codes

## No Auxiliary/Remote Valve Controller Error (No Power to Auxiliary/Remote Valve Controller)

**IMPORTANT:** *If the auxiliary/remote valve controller power circuit fails an instrument cluster error code 304 will be displayed.*

**Fault Description.**

Auxiliary/remote valve controller will not power up.

**System Response.**

The auxiliary/remote valve system will not enable.

**Possible Cause.**

1. Blown fuse 20 or fuse 35.
2. Auxiliary/remote valve controller valve power (VP in) short to ground.
3. Auxiliary/remote valve controller switched power (VF in) open circuit or short to ground.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. Check fuses 20 and 35.
   - If fuses 20 and 35 are OK go to check 2.
   - If fuse 20 has blown go to check 8
   - If fuse 35 has blown go to check 11.

**Fuse 20 and 35 OK.**

2. Turn the key to the ON position and check for a voltage reading at terminal 1 of the auxiliary/remote valve diagnostic connector 1 for wire (VP) Red.
   - If 12 volts is detected go to check 3.
   - If 12 volts is not detected check the following:
     - Wire 146 Red between the switch power stud and fuse 35.
     - The switched power stud connection.
     - Wire 161 Red between fuse 35 and splice IP-SP12.
3. Turn the key to the OFF position and disconnect the auxiliary/remote valve controller at connector 44. Check for continuity between ground and connector 44 pin 6 for the Brown/White clean ground wire.
   - If continuity is not detected check the Brown/White clean ground wire between connector 44 and the battery negative terminal. Also check connector 44 and the battery negative terminal connection.
4. Disconnect connector 53 (fender harness to right hand console harness). Check for continuity between connector 44 pin 3 and connector 53 pin 33 for wire 161 Red.
   - If continuity is not detected check wire 161 Red between connector 44 and connector 53.
5. Disconnect connector 51 (fender harness to right hand console harness). Check for continuity between connector 44 pin 4 and connector 51 pin 23 for wire 160 Red.
   - If continuity is not detected check wire 160 Red between connector 44 and connector 51.
6. Turn the key to the ON position and check the voltage at the right hand console harness side of connector 29 pin F (instrument panel harness to right hand console harness) for wire 161 Red.
   - If 12 volts is not detected check wire 161 between connector 29 and splice IP-SP12. Also check connector 29.
   - If 12 volts is detected check the right hand console harness wire 161 Red between connector 29 and connector 53. Also check connector 53.

continued.....

https://truckmanualshub.com/



7. Check the voltage at the right hand console harness side of connector 29 pin V (instrument panel harness to right hand console harness) for wire 160 Red.
   - If 12 volts is not detected check the following:
     - Wire 160 Red between connector 29 and fuse 20.
     - Connector 29.
     - Wire 160 Red between the battery power stud and fuse 20.
     - The battery power stud connection.
   - If 12 volts is detected check the right hand console harness wire 160 Red between connector 29 and connector 51. Also check connector 51.

**Fuse 20 Blown.**

8. Disconnect the auxiliary/remote valve controller at connector 44 and disconnect connector 51 (fender harness to right hand console harness). Check for continuity between ground and connector 44 pin 4 for wire 160 Red.
   - If continuity is detected check wire 160 Red between connector 44 and connector 51.
9. Disconnect connector 29 (instrument panel harness to right hand console harness). Check for continuity between ground and connector 29 pin V (right hand console harness side) for wire 160 Red.
   - If continuity is detected check the right hand console harness wire 160 Red between connector 29 and connector 51. Also check connector 51.
10. Remove fuse 20 and check for continuity between ground and connector 29 pin V (instrument panel harness side) for wire 160 Red.
    - If continuity is detected check wire 160 Red between fuse 20 and connector 29.

**Fuse 35 Blown.**

11. If the tractor is not equipped with five auxiliary/remote valves, check the spare auxiliary/remote valve connector(s) for corrosion or damage. Make sure the protective plug is installed.
12. Disconnect the auxiliary/remote valve controller at connector 44 and disconnect connector 53 (fender harness to right hand console harness). Check for continuity between ground and connector 44 pin 3 for wire 161 Red.
    - If continuity is detected check wire 161 Red between connector 44 and connector 53.
13. Disconnect connector 51 (fender harness to right hand console harness). Check for continuity between ground and connector 44 pin 17 for wire (VP) Red.
    - If continuity is detected check the following:
      - Wire (VP) Red between connector 44 and splice F-SP16
      - Wire (VP) Red between connector 51 and splice F-SP16.
      - Wire (VP) Red between the auxiliary/remote valve controller diagnostic connector 1 and splice F-SP16.
14. Disconnect connector 40 (fender harness to transmission harness) and check for continuity between ground and connector 44 pin 9 for wire (VP) Red.
    - If continuity is detected check wire (VP) Red between connector 40 and connector 44. Also check connector 40.
15. Put identification marks on all the auxiliary/remote valve connectors and disconnect the auxiliary/remote valves from the harness. Check for continuity between ground and connector 40 pin H (transmission harness side) for wire (VP) Red.
    - If continuity is detected check the following wires for damage.
      - Wire VP Red between valve AV1 and splice T-SP10.
      - Wire VP Red between valve AV2 and splice T-SP10.
      - Wire VP Red between valve AV3 and splice T-SP10.
      - Wire VP Red between valve AV4 and splice T-SP10.
      - Wire VP Red between valve AV5 and splice T-SP10.
      - Wire VP Red between connector 40 pin H and splice T-SP10.

    Also check connector 40.
16. Disconnect connector 50 (fender harness to armrest harness). Check for continuity between ground and connector 50 pin 35 for wire (ARM) Red.
    - If continuity is detected check the following:
      - Wire (ARM) Red between connector 50 pin 35 and splice F-SP24.
      - Wire (ARM) Red between connector 50 pin 18 and splice F-SP24.
      - Wire (ARM) Red between connector 50 pin 20 and splice F-SP24.
      - Wire (ARM) Red between connector 51 pin 28 and splice F-SP24.

continued.....

https://truckmanualshub.com/



17. Disconnect connectors 26 and 29 (instrument panel harness to right hand console harness). Check for continuity between ground and connector 26 pin Z (right hand console harness side) for wire (VP) Red.
    - If continuity is detected check the right hand console harness wire (ARM) Red between connector 26 and connector 51. Also check connector 51.
18. Check for continuity between ground and connector 29 pin Y (right hand console harness side) for wire (ARM) Red.
    - If continuity is detected check the right hand console harness wire (ARM) Red between connector 29 and connector 51. Also check connector 51.
19. Check for continuity between ground and connector 29 pin F (right hand console harness side) for wire 161 Red.
    - If continuity is detected check the right hand console harness wire 161 Red between connector 29 and connector 51. Also check connector 51.
20. Remove fuse 35 and check for continuity between ground and connector 29 pin F (instrument panel harness side) for wire 161 Red.
    - If continuity is detected check the following:
      - Wire 161 Red between splice IP-SP12 and connector 29.
      - Wire (ARM) Red between splice IP-SP12 and connector 29.
      - Wire (VP) Red between splice IP-SP12 and connector 26.
      - Wire 161 Red between splice IP-SP12 and fuse 35.

## Controller Error Code 10

**Fault Description.**

Auxiliary/remote valve controller input (VP IN) voltage is too low or (VP IN) voltage not detected.

**System Response.**

The auxiliary/remote valve system will not enable.

**Possible Cause.**

1. Alternator output too low or poor battery condition.
2. Auxiliary/remote valve controller valve power (VP IN) open circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. Check for controller error codes 11 and 12 using the ‘McCormick Diagnostic Centre’.
   - if error code 11 is present go to Controller Error Code 11.
   - if error code 12 is present go to check 2.
2. Check the battery condition.
3. Check the alternator.
4. Check the following connectors:
   - Connector 51 right hand console harness to fender harness.
   - Connector 53 right hand console harness to fender harness.
   - Connector 10 engine harness to instrument panel harness.
   - Connector 26 instrument panel harness to right hand console harness.
   - Connector 29 instrument panel harness to right hand console harness.

https://truckmanualshub.com/



## Controller Error Code 11

**NOTE:** *Controller error code 11 can only be read using the 'McCormick Diagnostic Centre'.*

**Fault Description.**

Auxiliary/remote valve controller does not detect valve power (VP IN).

**System Response.**

The auxiliary/remote valve system will not enable.

**Possible Cause.**

1. Auxiliary/remote valve controller valve power (VP IN) open circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. Turn the key to the ON position and check for a voltage reading at terminal 1 of the auxiliary/remote valve diagnostic connector 1 for wire (VP) Red.
   - If 12 volts is detected check wire (VP) red between the auxiliary/remote valve connector 44 and splice F-SP16. Also check connector 44.
   - If 12 volts is not detected check go to check 2.
2. Turn the key to the OFF position and disconnect the connector 51 (fender harness to right hand console harness). Check for continuity between connector 51 pin 27 and terminal 1 of the auxiliary/remote valve controller diagnostic connector for wire (VP) Red.
   - If continuity is not detected check wire (VP) Red between connector 51 and splice F-SP16.
3. Connect connector 51, turn the key to the ON position and check for 12 volts at connector 26 pin Z (right hand console side) for wire (VP) Red.
   - If 12 volts is not detected check the instrument panel harness wire (VP) Red between connector 26 and splice IP-12. Also check connector 26.
   - If 12 volts is detected check the right hand console harness wire (VP) Red between connector 26 and connector 51. Also check connectors 26 and 51.

## Controller Error Code 12

**NOTE:** *Controller error code 12 can only be read using the 'McCormick Diagnostic Centre'.*

**Fault Description.**

Auxiliary/remote valve controller valve power (VP out) voltage is too low.

**System Response.**

The auxiliary/remote valve system will not enable.

**Possible Cause.**

1. Low valve power in (VP in) voltage.
2. Bad auxiliary/remote valve controller.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. Check for controller error code 10 and repair as necessary.
2. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



## Controller Error Code 13

**NOTE:** *Controller error code 13 can only be read using the 'McCormick Diagnostic Centre'.*

**Fault Description.**

Auxiliary/remote valve controller does not detect valve power (VP out) voltage.

**System Response.**

The auxiliary/remote valve system will not enable.

**Possible Cause.**

1. Bad valve power in (VP in) circuit.
2. Bad auxiliary/remote valve controller.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. Check for controller error code 11 and repair as necessary.
2. Replace the auxiliary/remote valve controller.

## Controller Error Code 14

**Fault Description.**

Auxiliary/remote valve controller switched power (VF) is too low.

**System Response.**

The auxiliary/remote valve system will not enable.

**Possible Cause.**

1. Alternator output too low or poor battery condition.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. Check the battery condition.
2. Check the alternator.
3. Check the following connectors:
   - Connector 53 right hand console harness to fender harness.
   - Connector 10 engine harness to instrument panel harness.
   - Connector 29 instrument panel harness to right hand console harness.

https://truckmanualshub.com/



## Controller Error Code 15

**NOTE:** *Controller error code 15 can only be read using the 'McCormick diagnostic Centre'.*

**Fault Description.**

Auxiliary/remote valve controller does not detect switched power (VF).

**System Response.**

The auxiliary/remote valve system will not enable.

**Possible Cause.**

1. Bad auxiliary/remote valve controller valve power (VF in) circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. Check for controller error code 14 and repair as necessary.
2. Disconnect connector 53 (fender harness to right hand console harness) and disconnect the auxiliary/remote valve controller at connector 44. Check for continuity between connector 44 pin 3 and connector 53 pin 33 for wire 161 Red.
   - If continuity is not detected check wire 161 Red between connector 44 and connector 53. Also check connector 53.
3. Connect connector 53 and disconnect the connector 29 (instrument panel harness to right hand console harness). Check for continuity between connector 44 pin 3 and connector 29 pin F (right hand console side) for wire 161 Red.
   - If continuity is not detected check wire 161 Red between connector 29 and connector 53. Also check connector 53.
4. Turn the key to the ON position and check for 12 volts at connector 29 pin F (instrument panel harness side).
   - If 12 volts is not detected check wire 161 Red between connector 29 and splice IP-SP12. Also check connector 29.

## Controller Error Code 16

**Fault Description.**

Supply voltage to the flow, timer and joystick controls is too low.

**System Response.**

The auxiliary/remote valve system will not enable.

**Possible Cause.**

1. 5 volt supply circuit to the armrest control potentiometers short circuit to ground.
2. Bad auxiliary/remote valve controller.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. Disconnect connector 50 (fender harness to armrest harness) and disconnect the auxiliary/remote valve controller from the harness at connector 44. Check for continuity between ground and connector 44 pin 10 for wire 540 Red.
   - If continuity is detected check wire 540 Red between connector 44 and connector 50. Also check connector 50.
   - If continuity is not detected check the armrest controls and harness.
2. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connector X2.
3. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



## Controller Error Code 17

**Fault Description.**

Supply voltage to the flow, timer and joystick controls is too high.

**System Response.**

The auxiliary/remote valve system will not enable.

**Possible Cause.**

1. Supply to the armrest controller short circuit to a voltage above 5 volts.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. Disconnect the auxiliary/remote valve controller from the harness at connector 44. Turn the key to the ON position and check for a voltage reading at connector 44 pin 10 for wire 540 Red.
   - If a voltage reading is not detected go to check 2.
   - If a voltage reading is detected go to check 3.
2. Press and hold the following switches in turn while checking for a voltage reading at connector 44 pin 10 for wire 540 Red.
   - Auxiliary/remote valve enable switch.
   - The multi function lever auxiliary/remote valve raise switch.
   - The multi function auxiliary/remote valve lower switch.
     - If a voltage reading is detected check the following:
     - Wire 501 Dark Blue between connector 50 and connector 44.
     - Wire 518 Dark Blue between connector 50 and connector 44.
     - Wire 517 Dark Blue between connector 50 and connector 44.
3. Turn the key to the OFF position and disconnect connector 50 (fender harness to armrest harness). Turn the key to the ON position and check for a voltage reading at connector 44 pin 10 for wire 540 Red.
   - If a voltage reading is detected check wire 540 Red between the connector 44 and connector 50.
4. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connectors X2 and X3.
   - Armrest printed circuit board and connectors X1 and X2.
5. Replace the auxiliary/remote valve controller.

## Controller Error Code 20

**Fault Description.**

Auxiliary/Remote valve controller has detected a stop signal on power up.

**System Response.**

The auxiliary/remote valve system will not enable.

**Possible Cause.**

1. Stop button held in when the key is turned to the ON position.
2. Stop switch open circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. Make sure the stop button is release before turning the key to the ON position.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Check for continuity between connector 44 pin 25 and connector 50 pin 16 for wire 502 Dark Blue.
   - If continuity is not detected check wire 502 Dark Blue between connector 44 and connector 50 for damage.
3. Check for continuity between connector 44 pin 27 and connector 50 pin 17 for wire 503 Dark Blue.
   - If continuity is not detected check wire 503 Dark Blue between connector 44 and connector 50 for damage.
4. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X1.
   - Armrest printed circuit board and connectors X1 and X12.
5. Disconnect the stop switch from the printed circuit board at connector X12 and check for continuity between the terminals of connector X12 (Black wires).
   - If continuity is not detected check the switch wires and replace the stop switch as necessary.

continued.....

https://truckmanualshub.com/



6. Press and hold the stop switch button IN and check for continuity between the terminals of connector X12 (Black wires).
   - If continuity is detected replace the stop switch.
7. Replace the auxiliary/remote valve controller.

## Controller Error Code 21

**Fault Description.**

Auxiliary/Remote valve controller has detected a system enable signal on power up.

**System Response.**

The auxiliary/remote valve system will not enable.

**Possible Cause.**

1. Enable switch button held in when the key is turned to the ON position.
2. Enable switch button held in before the auxiliary/remote valve system self test has been completed.
3. Enable switch circuit shorted to 12 volts.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. Make sure the enable switch is released before turning the key to the ON position.
2. Wait for the system self test to be completed before enabling the system.
3. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Turn the key to the ON position and check for a voltage reading at connector 44 pin 11 for wire 501 Dark Blue.
   - If a voltage reading is detected check wire 501 Dark Blue between connector 44 and connector 50.
4. Turn the key to the OFF position and remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X1.
   - Armrest printed circuit board and connectors X1 and X14.
5. Disconnect the enable switch from the printed circuit board at connector X14 and check for continuity between terminals 1 and 2 (Black wires) of connector X14.
   - If continuity is detected check the switch wires and replace the enable switch as necessary.
6. Press and hold the enable switch button IN and check for continuity between the terminals 1 and 2 (Black wires) of connector X14.
   - If continuity is not detected replace the enable switch.
7. Replace the auxiliary/remote valve controller.

## Controller Error Code 22

**Fault Description.**

Auxiliary/Remote valve controller internal relay coil high short (energised) at power up.

**System Response.**

The auxiliary/remote valve system will not enable.

**Possible Cause.**

1. Stop circuit shorted to 12 volts.
2. Bad auxiliary/remote valve controller.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Turn the key to the ON position and check for a voltage reading at connector 44 pin 25 for wire 502 Dark Blue.
   - If a voltage reading is detected check wire 502 Dark Blue between connector 44 and connector 50.
2. Check for a voltage reading at connector 44 pin 27 for wire 502 Dark Blue.
   - If a voltage reading is detected check wire 503 Dark Blue between connector 44 and connector 50.
3. Turn the key to the OFF position and remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X1.
   - Armrest printed circuit board and connector X1.
4. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



## Controller Error Code 23

**Fault Description.**

Auxiliary/Remote valve controller has detected VP out voltage at power up.

**System Response.**

The auxiliary/remote valve controller does not transmit CAN bus messages to the auxiliary/remote valves. All the auxiliary/remote valves will display valve error code 17.

**Possible Cause.**

1. VP out circuit shorted to 12 volts.
2. Bad auxiliary/remote valve controller.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 40 (fender harness to transmission harness). Turn the key to the ON position and check for a voltage reading at connector 44 pin 9 for wire (VP) Red.
   - If a voltage reading is detected check wire (VP) Red between connector 40 and connector 44.
2. Turn the key to the OFF position and connect connector 40 (fender harness to transmission harness). Turn the key to the ON position and check for voltage reading at connector 44 pin 9 for wire (VP) Red.
   - If a voltage reading is detected check the transmission harness.
3. Replace the auxiliary/remote valve controller.

## Controller Error Code 24

**Fault Description.**

Auxiliary/Remote valve controller has detected a stop signal fault.

**System Response.**

The auxiliary/remote valve system will not enable.

**Possible Cause.**

1. Stop switch circuit shorted to ground.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Check for continuity between ground and connector 44 pin 25 for wire 502 Dark Blue.
   - If continuity is detected check wire 502 Dark Blue between connector 44 and connector 50.
2. Check for continuity between ground and connector 44 pin 27 for wire 503 Dark Blue.
   - If continuity is detected check wire 503 Dark Blue between connector 44 and connector 50. Also check connector 50.
3. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X1.
   - Armrest printed circuit board and connectors X1 and X12.
4. Disconnect the stop switch from the printed circuit board at connector X12 and check for continuity between the terminals of connector X12 (Black wires).
   - If continuity is not detected check the switch wires and replace the stop switch as necessary.
5. Press and hold the stop switch button IN and check for continuity between the terminals of connector X12 (Black wires).
   - If continuity is detected replace the stop switch.
6. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



## Controller Error Code 25

**Fault Description.**

Auxiliary/Remote valve controller internal relay coil high short.

**System Response.**

The auxiliary/remote valve system will not enable.

**Possible Cause.**

1. Stop circuit short to 12 volts.
2. Bad auxiliary/remote valve controller.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Turn the key to the ON position and check for a voltage reading at connector 44 pin 25 for wire 502 Dark Blue.
   - If a voltage reading is detected check wire 502 Dark Blue between connector 44 and connector 50.
2. Check for a voltage reading at connector 44 pin 27 for wire 502 Dark Blue.
   - If a voltage reading is detected check wire 503 Dark Blue between connector 44 and connector 50.
3. Turn the key to the OFF position and remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X1.
4. - Armrest printed circuit board and connector X1.

## Controller Error Code 26

**Fault Description.**

Auxiliary/Remote valve controller has detected a signal on power up from the multi function lever auxiliary/remote valve raise switch.

**System Response.**

The multi function lever auxiliary/remote raise switch will not operate. If the tractor is equipped with five auxiliary/remote valves, valve AV5 will display valve error code 17.

**Possible Cause.**

1. The multi function lever auxiliary/remote raise switch held on when the key is turned to the ON position.
2. The multi function lever auxiliary/remote raise switch operated before the auxiliary/remote valve system self test has been completed.
3. The multi function lever auxiliary/remote raise switch circuit shorted to 12 volts.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. Make sure the multi function lever auxiliary/remote raise switch is release before turning the key to the ON position.
2. Wait for the system self test to be completed before operating the multi function lever auxiliary/remote raise switch.
3. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Turn the key to the ON position and check for a voltage reading at connector 44 pin 21 for wire 518 Dark Blue.
   - If a voltage reading is detected check wire 518 Dark Blue between connector 44 and connector 50.
4. Turn the key to the OFF position and remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X1.
   - Armrest printed circuit board and connectors X1 and X19.
5. Disconnect the auxiliary/remote raise switch from the printed circuit board at connector X19 and check for continuity between the terminals of connector X19 (Black wires).
   - If continuity is detected check the switch wires and replace the multi function lever as necessary.
6. Press and hold in the auxiliary/remote raise switch button and check for continuity between the terminals of connector X19 (Black wires).
   - If continuity is not detected check the switch wires and replace the multi function lever as necessary.
7. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



## Controller Error Code 27

**Fault Description.**

Auxiliary/Remote valve controller has detected a signal on power up from the multi function lever auxiliary/remote valve lower switch.

**System Response.**

The multi function lever auxiliary/remote lower switch will not operate. If the tractor is equipped with five auxiliary/remote valves, valve AV5 will display valve error code 17.

**Possible Cause.**

1. The multi function lever auxiliary/remote lower switch held on when the key is turned to the ON position.
2. The multi function lever auxiliary/remote lower switch operated before the auxiliary/remote valve system self test has been completed.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. Make sure the multi function lever auxiliary/remote lower switch is release before turning the key to the ON position.
2. Wait for the system self test to be completed before operating the multi function lever auxiliary/remote lower switch.
3. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Turn the key to the ON position and check for a voltage reading at connector 44 pin 18 for wire 517 Dark Blue.
   - If a voltage reading is detected check wire 517 Dark Blue between connector 44 and connector 50.
4. Turn the key to the OFF position and remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X1.
   - Armrest printed circuit board and connectors X1 and X18.
5. Disconnect the auxiliary/remote lower switch from the printed circuit board at connector X18 and check for continuity between the terminals of connector X18 (White wires).
   - If continuity is detected check the switch wires and replace the multi function lever as necessary.
6. Press and hold in the auxiliary/remote lower switch button and check for continuity between the terminals of connector X18 (White wires).
   - If continuity is not detected check the switch wires and replace the multi function lever as necessary.
7. Replace the auxiliary/remote valve controller.

## Controller Error Code 30

**Fault Description.**

The signal from the 1st/2nd auxiliary/remote valve joystick AV1 control potentiometer is too low.

**System Response.**

The auxiliary/remote valve controller does not transmit CAN bus messages to valve AV1. Valve AV1 will display valve error code 17.

**Possible Cause.**

1. Valve AV1 control potentiometer signal circuit, open or short circuit to ground.
2. Valve AV1 control potentiometer 5 volt reference open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. If a low potentiometer signal error code is present for all control, flow and timer potentiometers, refer to "Multiple Controller Potentiometer Low Signal Error Codes" on page 49.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Check for continuity between connector 44 pin 22 and connector 50 pin 27 for wire 515 Dark Blue.
   - If continuity is not detected check wire 515 Dark Blue between connector 44 and connector 50.

continued.....

https://truckmanualshub.com/



3. Check for continuity between ground and connector 44 pin 22 for wire 515 Dark Blue.
   - If continuity is detected check wire 515 Dark Blue between connector 44 and connector 50.
4. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X3.
   - Armrest printed circuit board and connectors X3 and X16.
5. Disconnect the 1st/2nd and 3rd/4th auxiliary/remote valve joystick units from the printed circuit board at connectors X16 and X17. Connect the 1st/2nd auxiliary/remote valve joystick unit to connector X17 and the 3rd/4th auxiliary/remote valve joystick unit to connector X16 and check the operation of the auxiliary/remote valve system.
   - If error code 30 is still present, replace the auxiliary/remote valve controller.
   - If error code 34 appears, replace the 1st/2nd auxiliary/remote valve joystick unit.

**IMPORTANT:** *When all checks are complete or a new auxiliary/remote joystick has been installed, make sure the 1st/2nd auxiliary/remote joystick unit is connected to the printed circuit board connector X16 and the 3rd/4th auxiliary/remote joystick unit is connected to connector X17.*

## Controller Error Code 31

**Fault Description.**

The signal from the 1st/2nd auxiliary/remote valve joystick AV1 control potentiometer is too high.

**System Response.**

The auxiliary/remote valve controller does not transmit CAN bus messages to valve AV1. Valve AV1 will display valve error code 17.

**Possible Cause.**

1. Valve AV1 control potentiometer signal circuit shorted to another circuit.
2. Valve AV1 control potentiometer ground open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. If a high potentiometer signal error code is present for all control, flow and timer potentiometers, refer to “Multiple Controller Potentiometer High Signal Error Codes” on page 50.
2. Disconnect the connector 50 (fender harness to armrest harness). Turn the key to the ON position, enable the auxiliary valve system and check for a voltage reading at connector 50 pin 27 for wire 515 Dark Blue.
   - If a voltage reading is detected check wire 515 Dark Blue between connector 44 and connector 50.
   - If a voltage reading is not detected check the armrest harness and the valve AV1 control potentiometer.
3. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X3.
   - Armrest printed circuit board and connectors X3 and X16.
4. Disconnect the 1st/2nd and 3rd/4th auxiliary/remote valve joystick units from the printed circuit board at connectors X16 and X17. Connect the 1st/2nd auxiliary/remote valve joystick unit to connector X17 and the 3rd/4th auxiliary/remote valve joystick unit to connector X16 and check the operation of the auxiliary/remote valve system.
   - If error code 31 is still present, replace the auxiliary/remote valve controller.
   - If error code 35 appears, replace the 1st/2nd auxiliary/remote valve joystick unit.

**IMPORTANT:** *When all checks are complete or a new auxiliary/remote joystick has been installed, make sure the 1st/2nd auxiliary/remote valve joystick unit is connected to the printed circuit board connector X16 and the 3rd/4th auxiliary/remote valve joystick unit is connected to connector X17.*

https://truckmanualshub.com/



## Controller Error Code 32

**Fault Description.**

The signal from the 1st/2nd auxiliary/remote valve joystick AV2 control potentiometer is too low.

**System Response.**

The auxiliary/remote valve controller does not transmit CAN bus messages to valve AV2. Valve AV2 will display valve error code 17.

**Possible Cause.**

1. Valve AV2 control potentiometer signal circuit, open or short circuit to ground.
2. Valve AV2 control potentiometer 5 volt reference open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. If a low potentiometer signal error code is present for all control, flow and timer potentiometers, refer to "Multiple Controller Potentiometer Low Signal Error Codes" on page 49.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Check for continuity between connector 44 pin 5 and connector 50 pin 28 for wire 516 Dark Blue.
   - If continuity is not detected check wire 516 Dark Blue between connector 44 and connector 50.
3. Check for continuity between ground and connector 44 pin 5 for wire 516 Dark Blue.
   - If continuity is detected check wire 516 Dark Blue between connector 44 and connector 50.
4. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X3.
   - Armrest printed circuit board and connectors X3 and X16.
5. Disconnect the 1st/2nd and 3rd/4th auxiliary/remote valve joystick units from the printed circuit board at connectors X16 and X17. Connect the 1st/2nd auxiliary/remote valve joystick unit to connector X17 and the 3rd/4th auxiliary/remote valve joystick unit to connector X16 and check the operation of the auxiliary/remote valve system.
   - If error code 32 is still present, replace the auxiliary/remote valve controller.
   - If error code 36 appears, replace the 1st/2nd auxiliary/remote valve joystick unit.

   **IMPORTANT:** *When all checks are complete or a new auxiliary/remote joystick has been installed, make sure the 1st/2nd auxiliary/remote valve joystick unit is connected to the printed circuit board connector X16 and the 3rd/4th auxiliary/remote valve joystick unit is connected to connector X17.*

## Controller Error Code 33

**Fault Description.**

The signal from the 1st/2nd auxiliary/remote valve joystick AV2 control potentiometer is too high.

**System Response.**

The auxiliary/remote valve controller does not transmit CAN bus messages to valve AV2. Valve AV2 will display valve error code 17.

**Possible Cause.**

1. Valve AV2 control potentiometer signal circuit shorted to another circuit.
2. Valve AV2 control potentiometer ground open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. If a high potentiometer signal error code is present for all control, flow and timer potentiometers, refer to "Multiple Controller Potentiometer High Signal Error Codes" on page 50.
2. Disconnect the connector 50 (fender harness to armrest harness). Turn the key to the ON position, enable the auxiliary valve system and check for a voltage reading at connector 50 pin 28 for wire 516 Dark Blue.
   - If a voltage reading is detected check wire 516 Dark Blue between connector 44 and connector 50.
   - If a voltage reading is not detected check the armrest harness and the valve AV2 control potentiometer.

continued.....

https://truckmanualshub.com/



3. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X3.
   - Armrest printed circuit board and connectors X3 and X16.
4. Disconnect the 1st/2nd and 3rd/4th auxiliary/remote valve joystick units from the printed circuit board at connectors X16 and X17. Connect the 1st/2nd auxiliary/remote valve joystick unit to connector X17 and the 3rd/4th auxiliary/remote valve joystick unit to connector X16 and check the operation of the auxiliary/remote valve system.
   - If error code 33 is still present, replace the auxiliary/remote valve controller.
   - If error code 37 appears, replace the 1st/2nd auxiliary/remote valve joystick unit.

**IMPORTANT:** *When all checks are complete or a new auxiliary/remote joystick has been installed, make sure the 1st/2nd auxiliary/remote valve joystick unit is connected to the printed circuit board connector X16 and the 3rd/4th auxiliary/remote valve joystick unit is connected to connector X17.*

## Controller Error Code 34

**Fault Description.**

The signal from the 3rd/4th auxiliary/remote valve joystick AV3 control potentiometer is too low.

**System Response.**

The auxiliary/remote valve controller does not transmit CAN bus messages to valve AV3. Valve AV3 will display valve error code 17.

**Possible Cause.**

1. Valve AV3 control potentiometer signal circuit, open or short circuit to ground.
2. Valve AV3 control potentiometer 5 volt reference open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. If a low potentiometer signal error code is present for all control, flow and timer potentiometers, refer to “Multiple Controller Potentiometer Low Signal Error Codes” on page 49.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Check for continuity between connector 44 pin 7 and connector 50 pin 29 for wire 514 Dark Blue.
   - If continuity is not detected check wire 514 Dark Blue between connector 44 and connector 50.
3. Check for continuity between ground and connector 44 pin 7 for wire 514 Dark Blue.
   - If continuity is detected check wire 514 Dark Blue between connector 44 and connector 50.
4. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X3.
   - Armrest printed circuit board and connectors X3 and X16.
5. Disconnect the 1st/2nd and 3rd/4th auxiliary/remote valve joystick units from the printed circuit board at connectors X16 and X17. Connect the 1st/2nd auxiliary/remote valve joystick unit to connector X17 and the 3rd/4th auxiliary/remote valve joystick unit to connector X16 and check the operation of the auxiliary/remote valve system.
   - If error code 34 is still present, replace the auxiliary/remote valve controller.
   - If error code 30 appears, replace the 3rd/4th auxiliary/remote valve joystick unit.

**IMPORTANT:** *When all checks are complete or a new auxiliary/remote joystick has been installed, make sure the 1st/2nd auxiliary/remote valve joystick unit is connected to the printed circuit board connector X16 and the 3rd/4th auxiliary/remote valve joystick unit is connected to connector X17.*

https://truckmanualshub.com/



## Controller Error Code 35

**Fault Description.**

The signal from the 3rd/4th auxiliary/remote valve joystick AV3 control potentiometer is too high.

**System Response.**

The auxiliary/remote valve controller does not transmit CAN bus messages to valve AV3. Valve AV3 will display valve error code 17.

**Possible Cause.**

1. Valve AV3 control potentiometer signal circuit shorted to another circuit.
2. Valve AV3 control potentiometer ground open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad control potentiometer

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. If a high potentiometer signal error code is present for all control, flow and timer potentiometers, refer to "Multiple Controller Potentiometer High Signal Error Codes" on page 50.
2. Disconnect the connector 50 (fender harness to armrest harness). Turn the key to the ON position, enable the auxiliary valve system and check for a voltage reading at connector 50 pin 29 for wire 514 Dark Blue.
   - If a voltage reading is detected check wire 514 Dark Blue between connector 44 and connector 50.
   - If a voltage reading is not detected check the armrest harness and the valve AV3 control potentiometer.
3. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X3.
   - Armrest printed circuit board and connectors X3 and X16.
4. Disconnect the 1st/2nd and 3rd/4th auxiliary/remote valve joystick units from the printed circuit board at connectors X16 and X17. Connect the 1st/2nd auxiliary/remote valve joystick unit to connector X17 and the 3rd/4th auxiliary/remote valve joystick unit to connector X16 and check the operation of the auxiliary/remote valve system.
   - If error code 35 is still present, replace the auxiliary/remote valve controller.
   - If error code 31 appears, replace the 3rd/4th auxiliary/remote valve joystick unit.

   **IMPORTANT:** *When all checks are complete or a new auxiliary/remote joystick has been installed, make sure the 1st/2nd auxiliary/remote valve joystick unit is connected to the printed circuit board connector X16 and the 3rd/4th auxiliary/remote valve joystick unit is connected to connector X17.*

## Controller Error Code 36

**Fault Description.**

The signal from the 3rd/4th auxiliary/remote valve joystick AV4 control potentiometer is too low.

**System Response.**

The auxiliary/remote valve controller does not transmit CAN bus messages to valve AV4. Valve AV4 will display valve error code 17.

**Possible Cause.**

1. Valve AV4 control potentiometer signal circuit, open or short circuit to ground.
2. Valve AV4 control potentiometer 5 volt reference open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

**Circuit Checks/Corrective Action.**

1. If a low potentiometer signal error code is present for all control, flow and timer potentiometers, refer to "Multiple Controller Potentiometer Low Signal Error Codes" on page 49.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Check for continuity between connector 44 pin 15 and connector 50 pin 30 for wire 532 Dark Blue.
   - If continuity is not detected check wire 532 Dark Blue between connector 44 and connector 50.

continued.....

https://truckmanualshub.com/



3. Check for continuity between ground and connector 44 pin 15 for wire 532 Dark Blue.
4. - If continuity is detected check wire 532 Dark Blue between connector 44 and connector 50.
5. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X3.
   - Armrest printed circuit board and connectors X3 and X16.
6. Disconnect the 1st/2nd and 3rd/4th auxiliary/remote valve joystick units from the printed circuit board at connectors X16 and X17. Connect the 1st/2nd auxiliary/remote valve joystick unit to connector X17 and the 3rd/4th auxiliary/remote valve joystick unit to connector X16 and check the operation of the auxiliary/remote valve system.
   - If error code 36 is still present, replace the auxiliary/remote valve controller.
   - If error code 32 appears, replace the 3rd/4th auxiliary/remote valve joystick unit.

**IMPORTANT:** *When all checks are complete or a new auxiliary/remote joystick has been installed, make sure the 1st/2nd auxiliary/remote valve joystick unit is connected to the printed circuit board connector X16 and the 3rd/4th auxiliary/remote valve joystick unit is connected to connector X17.*

## Controller Error Code 37

**Fault Description.**

The signal from the 3rd/4th auxiliary/remote valve joystick AV4 control potentiometer is too high.

**System Response.**

The auxiliary/remote valve controller does not transmit CAN bus messages to valve AV4. Valve AV4 will display valve error code 17.

**Possible Cause.**

1. Valve AV4 control potentiometer signal circuit shorted to another circuit.
2. Valve AV4 control potentiometer ground open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. If a high potentiometer signal error code is present for all control, flow and timer potentiometers, refer to “Multiple Controller Potentiometer High Signal Error Codes” on page 50.
2. Disconnect the connector 50 (fender harness to armrest harness). Turn the key to the ON position, enable the auxiliary valve system and check for a voltage reading at connector 50 pin 30 for wire 532 Dark Blue.
   - If a voltage reading is detected check wire 532 Dark Blue between connector 44 and connector 50.
   - If a voltage reading is not detected check the armrest harness and the valve AV4 control potentiometer.
3. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X3.
   - Armrest printed circuit board and connectors X3 and X16.
4. Disconnect the 1st/2nd and 3rd/4th auxiliary/remote valve joystick units from the printed circuit board at connectors X16 and X17. Connect the 1st/2nd auxiliary/remote valve joystick unit to connector X17 and the 3rd/4th auxiliary/remote valve joystick unit to connector X16 and check the operation of the auxiliary/remote valve system.
   - If error code 37 is still present, replace the auxiliary/remote valve controller.
   - If error code 33 appears, replace the 3rd/4th auxiliary/remote valve joystick unit.

**IMPORTANT:** *When all checks are complete or a new auxiliary/remote joystick has been installed, make sure the 1st/2nd auxiliary/remote valve joystick unit is connected to the printed circuit board connector X16 and the 3rd/4th auxiliary/remote valve joystick unit is connected to connector X17.*

https://truckmanualshub.com/



# Controller Error Code 40

**Fault Description.**

The signal from the AV1 flow control potentiometer is too low.

**System Response.**

The auxiliary/remote valve controller does not transmit CAN bus messages to valve AV1. Valve AV1 will display valve error code 17.

**Possible Cause.**

1. Valve AV1 flow control potentiometer signal circuit, open or short circuit to ground.
2. Valve AV1 flow control potentiometer 5 volt reference open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV1 flow control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. If a low potentiometer signal error code is present for all, control, flow and timer potentiometer, refer to “Multiple Controller Potentiometer Low Signal Error Codes” on page 49.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Check for continuity between connector 44 pin 23 and connector 50 pin 8 for wire 511 Dark Blue.
   - If continuity is not detected check wire 511 Dark Blue between connector 44 and connector 50.
3. Check for continuity between ground and connector 44 pin 8 for wire 511 Dark Blue.
   - If continuity is detected check wire 511 Dark Blue between connector 44 and connector 50 for damage.
4. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X5.
5. Disconnect the auxiliary/remote valve AV1 flow control and timer control potentiometers from the printed circuit board at connector X5. Check the resistance reading between terminals 1 and 3 (Red and Brown wires) of connector X5.
   - If a reading of approximately 5000 Ohms is not detected replace the AV1 flow control and timer control potentiometer assembly.
6. Turn the flow potentiometer knob to the 0% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X5.
   - If a reading of approximately 5000 Ohms is not detected replace the AV1 flow control and timer control potentiometer assembly.
7. Slowly turn the flow potentiometer knob from the 0% position to the 100% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X5.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV1 flow control and timer control potentiometer assembly.
8. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Controller Error Code 41

**Fault Description.**

The signal from the auxiliary/remote valve AV1 flow control potentiometer is too high.

**System Response.**

The auxiliary/remote valve controller does not transmit CAN bus messages to valve AV1. Valve AV1 will display valve error code 17.

**Possible Cause.**

1. Valve AV1 flow control potentiometer signal circuit shorted to another circuit.
2. Valve AV1 flow control potentiometer ground open circuit open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV1 flow control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. If a high potentiometer signal error code is present for all control, flow and timer potentiometers, refer to “Multiple Controller Potentiometer High Signal Error Codes” on page 50.
2. Disconnect the connector 50 (fender harness to armrest harness). Turn the key to the ON position, enable the auxiliary valve system and check for a voltage reading at connector 50 pin 8 for wire 511 Dark Blue.
   - If a voltage reading is detected check wire 511 Dark Blue between connector 44 and connector 50.
3. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X5.
4. Disconnect the auxiliary/remote valve AV1 flow control and timer control potentiometers from the printed circuit board at connector X5. Check the resistance reading between terminals 1 and 3 (Red and Brown wires) of connector X5.
   - If a reading of approximately 5000 Ohms is not detected replace the AV1 flow control and timer control potentiometer assembly.
5. Turn the AV1 flow potentiometer knob to the 0% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X5.
   - If a reading of approximately 5000 Ohms is not detected replace the AV1 flow control and timer control potentiometer assembly.
6. Slowly turn the AV1 flow potentiometer knob from the 0% position to the 100% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X5.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV1 flow control and timer control potentiometer assembly.
7. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Controller Error Code 42

**Fault Description.**

The signal from the auxiliary/remote valve AV2 flow control potentiometer is too low.

**System Response.**

The auxiliary/remote valve controller does not transmit CAN bus messages to valve AV2. Valve AV2 will display valve error code 17.

**Possible Cause.**

1. Valve AV2 flow control potentiometer signal circuit, open or short circuit to ground.
2. Valve AV2 flow control potentiometer 5 volt reference open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV2 flow control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. If a low potentiometer signal error code is present for all, control, flow and timer potentiometer, refer to "Multiple Controller Potentiometer Low Signal Error Codes" on page 49.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Check for continuity between connector 44 pin 26 and connector 50 pin 8 for wire 512 Dark Blue.
   - If continuity is not detected check wire 51 Dark Blue between connector 44 and connector 50.
3. Check for continuity between ground and connector 44 pin 26 for wire 512 Dark Blue.
   - If continuity is detected check wire 512 Dark Blue between connector 44 and connector 50.
4. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X6.
5. Disconnect the auxiliary/remote valve AV2 flow control and timer control potentiometers from the printed circuit board at connector X6. Check the resistance reading between terminals 1 and 3 (Red and Brown wires) of connector X6.
   - If a reading of approximately 5000 Ohms is not detected replace the AV2 flow control and timer control potentiometer assembly.
6. Turn the AV2 flow potentiometer knob to the 0% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X6.
   - If a reading of approximately 5000 Ohms is not detected replace the AV2 flow control and timer control potentiometer assembly.
7. Slowly turn the AV2 flow potentiometer knob from the 0% position to the 100% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X6.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV2 flow control and timer control potentiometer assembly.
8. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Controller Error Code 43

**Fault Description.**

The signal from the auxiliary/remote valve AV2 flow control potentiometer is too high.

**System Response.**

The auxiliary/remote valve controller does not transmit CAN bus messages to valve AV2. Valve AV2 will display valve error code 17

**Possible Cause.**

1. Valve AV2 flow control potentiometer signal circuit shorted to another circuit.
2. Valve AV2 flow control potentiometer ground open circuit open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV2 flow control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. If a high potentiometer signal error code is present for all control, flow and timer potentiometers, refer to “Multiple Controller Potentiometer High Signal Error Codes” on page 50.
2. Disconnect the connector 50 (fender harness to armrest harness). Turn the key to the ON position, enable the auxiliary valve system and check for a voltage reading at connector 50 pin 9 for wire 512 Dark Blue.
   - If a voltage reading is detected check wire 512 Dark Blue between connector 44 and connector 50.
3. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X6.
4. Disconnect the auxiliary/remote valve AV2 flow control and timer control potentiometers from the printed circuit board at connector X6. Check the resistance reading between terminals 1 and 3 (Red and Brown wires) of connector X6.
   - If a reading of approximately 5000 Ohms is not detected replace the AV2 flow control and timer control potentiometer assembly.
5. Turn the AV2 flow potentiometer knob to the 0% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X6.
   - If a reading of approximately 5000 Ohms is not detected replace the AV2 flow control and timer control potentiometer assembly.
6. Slowly turn the AV2 flow potentiometer knob from the 0% position to the 100% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X6.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV2 flow control and timer control potentiometer assembly.
7. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Controller Error Code 44

**Fault Description.**

The signal from the auxiliary/remote valve AV3 flow control potentiometer is too low.

**System Response.**

The auxiliary/remote valve controller does not transmit CAN bus messages to valve AV3. Valve AV3 will display valve error code 17.

**Possible Cause.**

1. Valve AV3 flow control potentiometer signal circuit, open or short circuit to ground.
2. Valve AV3 flow control potentiometer 5 volt reference open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV3 flow control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. If a low potentiometer signal error code is present for all, control, flow and timer potentiometer, refer to "Multiple Controller Potentiometer Low Signal Error Codes" on page 49.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Check for continuity between connector 44 pin 8 and connector 50 pin 10 for wire 513 Dark Blue.
   - If continuity is not detected check wire 513 Dark Blue between connector 44 and connector 50.
3. Check for continuity between ground and connector 44 pin 8 for wire 513 Dark Blue.
   - If continuity is detected check wire 513 Dark Blue between connector 44 and connector 50.
4. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X7.
5. Disconnect the auxiliary/remote valve AV3 flow control and timer control potentiometers from the printed circuit board at connector X7. Check the resistance reading between terminals 1 and 3 (Red and Brown wires) of connector X7.
   - If a reading of approximately 5000 Ohms is not detected replace the AV3 flow control and timer control potentiometer assembly.
6. Turn the AV3 flow potentiometer knob to the 0% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X7.
   - If a reading of approximately 5000 Ohms is not detected replace the AV3 flow control and timer control potentiometer assembly.
7. Slowly turn the AV3 flow potentiometer knob from the 0% position to the 100% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X7.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV3 flow control and timer control potentiometer assembly.
8. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Controller Error Code 45

**Fault Description.**

The signal from the auxiliary/remote valve AV3 flow control potentiometer is too high.

**System Response.**

The auxiliary/remote valve controller does not transmit CAN bus messages to valve AV3. Valve AV3 will display valve error code 17.

**Possible Cause.**

1. Valve AV3 flow control potentiometer signal circuit shorted to another circuit.
2. Valve AV3 flow control potentiometer ground open circuit open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV3 flow control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. If a high potentiometer signal error code is present for all control, flow and timer potentiometers, refer to “Multiple Controller Potentiometer High Signal Error Codes” on page 50.
2. Disconnect the connector 50 (fender harness to armrest harness). Turn the key to the ON position, enable the auxiliary valve system and check for a voltage reading at connector 50 pin 10 for wire 513 Dark Blue.
   - If a voltage reading is detected check wire 513 Dark Blue between connector 44 and connector 50.
3. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X7.
4. Disconnect the auxiliary/remote valve AV3 flow control and timer control potentiometers from the printed circuit board at connector X7. Check the resistance reading between terminals 1 and 3 (Red and Brown wires) of connector X7.
   - If a reading of approximately 5000 Ohms is not detected replace the AV3 flow control and timer control potentiometer assembly.
5. Turn the AV3 flow potentiometer knob to the 0% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X7.
   - If a reading of approximately 5000 Ohms is not detected replace the AV3 flow control and timer control potentiometer assembly.
6. Slowly turn the AV3 flow potentiometer knob from the 0% position to the 100% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X7.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV3 flow control and timer control potentiometer assembly.
7. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Controller Error Code 46

**Fault Description.**

The signal from the auxiliary/remote valve AV4 flow control potentiometer is too low.

**System Response.**

The auxiliary/remote valve controller does not transmit CAN bus messages to valve AV4. Valve AV4 will display valve error code 17.

**Possible Cause.**

1. Valve AV4 flow control potentiometer signal circuit, open or short circuit to ground.
2. Valve AV4 flow control potentiometer 5 volt reference open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV4 flow control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. If a low potentiometer signal error code is present for all, control, flow and timer potentiometer, refer to "Multiple Controller Potentiometer Low Signal Error Codes" on page 49.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Check for continuity between connector 44 pin 16 and connector 50 pin 11 for wire 530 Dark Blue.
   - If continuity is not detected check wire 530 Dark Blue between connector 44 and connector 50.
3. Check for continuity between ground and connector 44 pin 16 for wire 530 Dark Blue.
   - If continuity is detected check wire 530 Dark Blue between connector 44 and connector 50.
4. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X8.
5. Disconnect the auxiliary/remote valve AV4 flow control and timer control potentiometers from the printed circuit board at connector X8. Check the resistance reading between terminals 1 and 3 (Red and Brown wires) of connector X8.
   - If a reading of approximately 5000 Ohms is not detected replace the AV4 flow control and timer control potentiometer assembly.
6. Turn the AV4 flow potentiometer knob to the 0% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X8.
   - If a reading of approximately 5000 Ohms is not detected replace the AV4 flow control and timer control potentiometer assembly.
7. Slowly turn the AV4 flow potentiometer knob from the 0% position to the 100% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X8.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV4 flow control and timer control potentiometer assembly.
8. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Controller Error Code 47

**Fault Description.**

The signal from the auxiliary/remote valve AV4 flow control potentiometer is too high.

**System Response.**

The auxiliary/remote valve controller does not transmit CAN bus messages to valve AV4. Valve AV4 will display valve error code 17.

**Possible Cause.**

1. Valve AV4 flow control potentiometer signal circuit shorted to another circuit.
2. Valve AV4 flow control potentiometer ground open circuit open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV4 flow control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. If a high potentiometer signal error code is present for all control, flow and timer potentiometers, refer to “Multiple Controller Potentiometer High Signal Error Codes” on page 50.
2. Disconnect the connector 50 (fender harness to armrest harness). Turn the key to the ON position, enable the auxiliary valve system and check for a voltage reading at connector 50 pin 11 for wire 530 Dark Blue.
   - If a voltage reading is detected check wire 530 Dark Blue between connector 44 and connector 50.
3. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X8.
4. Disconnect the auxiliary/remote valve AV4 flow control and timer control potentiometers from the printed circuit board at connector X8. Check the resistance reading between terminals 1 and 3 (Red and Brown wires) of connector X8.
   - If a reading of approximately 5000 Ohms is not detected replace the AV4 flow control and timer control potentiometer assembly.
5. Turn the AV4 flow potentiometer knob to the 0% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X8.
   - If a reading of approximately 5000 Ohms is not detected replace the AV4 flow control and timer control potentiometer assembly.
6. Slowly turn the AV4 flow potentiometer knob from the 0% position to the 100% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X8.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV4 flow control and timer control potentiometer assembly.
7. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Controller Error Code 50

**Fault Description.**

The signal from the auxiliary/remote valve AV5 flow control potentiometer is too low.

**System Response.**

The auxiliary/remote valve controller does not transmit CAN bus messages to valve AV5. Valve AV5 will display valve error code 17.

**Possible Cause.**

1. Valve AV5 flow control potentiometer signal circuit, open or short circuit to ground.
2. Valve AV5 flow control potentiometer 5 volt reference open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV5 flow control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. If a low potentiometer signal error code is present for all, control, flow and timer potentiometer, refer to "Multiple Controller Potentiometer Low Signal Error Codes" on page 49.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Check for continuity between connector 44 pin 24 and connector 50 pin 12 for wire 531 Dark Blue.
   - If continuity is not detected check wire 531 Dark Blue between connector 44 and connector 50.
3. Check for continuity between ground and connector 44 pin 24 for wire 531 Dark Blue.
   - If continuity is detected check wire 531 Dark Blue between connector 44 and connector 50.
4. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X9.
5. Disconnect the auxiliary/remote valve AV5 flow control and timer control potentiometers from the printed circuit board at connector X9. Check the resistance reading between terminals 1 and 3 (Red and Brown wires) of connector X8.
   - If a reading of approximately 5000 Ohms is not detected replace the AV5 flow control and timer control potentiometer assembly.
6. Turn the AV5 flow potentiometer knob to the 0% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X9.
   - If a reading of approximately 5000 Ohms is not detected replace the AV5 flow control and timer control potentiometer assembly.
7. Slowly turn the AV5 flow potentiometer knob from the 0% position to the 100% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X9.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV5 flow control and timer control potentiometer assembly.
8. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Controller Error Code 51

**Fault Description.**

The signal from the auxiliary/remote valve AV5 flow control potentiometer is too high.

**System Response.**

The auxiliary/remote valve controller does not transmit CAN bus messages to valve AV5. Valve AV5 will display valve error code 17.

**Possible Cause.**

1. Valve AV5 flow control potentiometer signal circuit shorted to another circuit.
2. Valve AV5 flow control potentiometer ground open circuit open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV5 flow control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. If a high potentiometer signal error code is present for all control, flow and timer potentiometers, refer to “Multiple Controller Potentiometer High Signal Error Codes” on page 50.
2. Disconnect the connector 50 (fender harness to armrest harness). Turn the key to the ON position, enable the auxiliary valve system and check for a voltage reading at connector 50 pin 12 for wire 531 Dark Blue.
   - If a voltage reading is detected check wire 531 Dark Blue between connector 44 and connector 50.
3. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X9.
4. Disconnect the auxiliary/remote valve AV5 flow control and timer control potentiometers from the printed circuit board at connector X9. Check the resistance reading between terminals 1 and 3 (Red and Brown wires) of connector X8.
   - If a reading of approximately 5000 Ohms is not detected replace the AV5 flow control and timer control potentiometer assembly.
5. Turn the AV5 flow potentiometer knob to the 0% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X9.
   - If a reading of approximately 5000 Ohms is not detected replace the AV5 flow control and timer control potentiometer assembly.
6. Slowly turn the AV5 flow potentiometer knob from the 0% position to the 100% position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X9.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV5 flow control and timer control potentiometer assembly.
7. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Controller Error Code 52

**Fault Description.**

The signal from the auxiliary/remote valve AV1 timer control potentiometer is too low.

**System Response.**

Valve AV1 will not operate in timer mode.

**Possible Cause.**

1. Valve AV1 timer control potentiometer signal circuit, open or short circuit to ground.
2. Valve AV1 timer control potentiometer 5 volt reference open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV1 timer control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. If a low potentiometer signal error code is present for all, control, flow and timer potentiometer, refer to "Multiple Controller Potentiometer Low Signal Error Codes" on page 49.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Check for continuity between connector 44 pin 32 and connector 50 pin 3 for wire 508 Dark Blue.
   - If continuity is not detected check wire 508 Dark Blue between connector 44 and connector 50.
3. Check for continuity between ground and connector 44 pin 32 for wire 508 Dark Blue.
   - If continuity is detected check wire 508 Dark Blue between connector 44 and connector 50.
4. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X5.
5. Disconnect the auxiliary/remote valve AV1 flow control and timer control potentiometers from the printed circuit board at connector X5. Check the resistance reading between terminals 4 and 6 (Red and Brown wires) of connector X5.
   - If a reading of approximately 5000 Ohms is not detected replace the AV1 flow control and timer control potentiometer assembly.
6. Turn the AV1 timer potentiometer knob to the 0 second position and check the resistance reading between terminals 4 and 5 (Red and White wires) of connector X5.
   - If a reading of approximately 5000 Ohms is not detected replace the AV1 flow control and timer control potentiometer assembly.
7. Slowly turn the AV1 timer potentiometer knob from the 0 second position to the 30 second position and check the resistance reading between terminals 4 and 5 (Red and White wires) of connector X5.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV1 flow control and timer control potentiometer assembly.
8. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Controller Error Code 53

**Fault Description.**

The signal from the auxiliary/remote valve AV1 timer control potentiometer is too high.

**System Response.**

Valve AV1 will not operate in timer mode.

**Possible Cause.**

1. Valve AV2 timer control potentiometer signal circuit, open or short circuit to ground.
2. Valve AV2 timer control potentiometer ground open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV2 timer control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. If a high potentiometer signal error code is present for all control, flow and timer potentiometers, refer to “Multiple Controller Potentiometer High Signal Error Codes” on page 50.
2. Disconnect the connector 50 (fender harness to armrest harness). Turn the key to the ON position, enable the auxiliary valve system and check for a voltage reading at connector 50 pin 3 for wire 508 Dark Blue.
   - If a voltage reading is detected check wire 508 Dark Blue between connector 44 and connector 50.
3. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X5.
4. Disconnect the auxiliary/remote valve AV1 flow control and timer control potentiometers from the printed circuit board at connector X5. Check the resistance reading between terminals 1 and 3 (Red and Brown wires) of connector X5.
   - If a reading of approximately 5000 Ohms is not detected replace the AV1 flow control and timer control potentiometer assembly.
5. Turn the AV1 flow potentiometer knob to the 0 second position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X5.
   - If a reading of approximately 5000 Ohms is not detected replace the AV1 flow control and timer control potentiometer assembly.
6. Slowly turn the AV1 flow potentiometer knob from the 0 second position to the 30 second position and check the resistance reading between terminals 1 and 2 (Red and White wires) of connector X9.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV1 flow control and timer control potentiometer assembly.
7. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Controller Error Code 54

**Fault Description.**

The signal from the auxiliary/remote valve AV2 timer control potentiometer is too low.

**System Response.**

Valve AV2 will not operate in timer mode.

**Possible Cause.**

1. Valve AV2 timer control potentiometer signal circuit, open or short circuit to ground.
2. Valve AV2 timer control potentiometer 5 volt reference open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV2 timer control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. If a low potentiometer signal error code is present for all, control, flow and timer potentiometer, refer to "Multiple Controller Potentiometer Low Signal Error Codes" on page 49.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Check for continuity between connector 44 pin 33 and connector 50 pin 4 for wire 509 Dark Blue.
   - If continuity is not detected check wire 509 Dark Blue between connector 44 and connector 50.
3. Check for continuity between ground and connector 44 pin 33 for wire 509 Dark Blue.
   - If continuity is detected check wire 509 Dark Blue between connector 44 and connector 50.
4. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X6.
5. Disconnect the auxiliary/remote valve AV2 flow control and timer control potentiometers from the printed circuit board at connector X6. Check the resistance reading between terminals 4 and 6 (Red and Brown wires) of connector X6.
   - If a reading of approximately 5000 Ohms is not detected replace the AV2 flow control and timer control potentiometer assembly.
6. Turn the AV2 timer potentiometer knob to the 0 second position and check the resistance reading between terminals 4 and 5 (Red and White wires) of connector X6.
   - If a reading of approximately 5000 Ohms is not detected replace the AV2 flow control and timer control potentiometer assembly.
7. Slowly turn the AV2 timer potentiometer knob from the 0 second position to the 30 second position and check the resistance reading between terminals 4 and 5 (Red and White wires) of connector X6.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV2 flow control and timer control potentiometer assembly.
8. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Controller Error Code 55

**Fault Description.**

The signal from the auxiliary/remote valve AV2 timer control potentiometer is too high.

**System Response.**

Valve AV2 will not operate in timer mode.

**Possible Cause.**

1. Valve AV2 timer control potentiometer signal circuit, open or short circuit to ground.
2. Valve AV2 timer control potentiometer ground open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV2 timer control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. If a high potentiometer signal error code is present for all control, flow and timer potentiometers, refer to “Multiple Controller Potentiometer High Signal Error Codes” on page 50.
2. Disconnect the connector 50 (fender harness to armrest harness). Turn the key to the ON position, enable the auxiliary valve system and check for a voltage reading at connector 50 pin 4 for wire 509 Dark Blue.
   - If a voltage reading is detected check wire 509 Dark Blue between connector 44 and connector 50.
3. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X6.
4. Disconnect the auxiliary/remote valve AV2 flow control and timer control potentiometers from the printed circuit board at connector X6. Check the resistance reading between terminals 4 and 6 (Red and Brown wires) of connector X6.
5. - If a reading of approximately 5000 Ohms is not detected replace the AV2 flow control and timer control potentiometer assembly.
6. Turn the AV2 timer potentiometer knob to the 0 second position and check the resistance reading between terminals 4 and 5 (Red and White wires) of connector X6.
   - If a reading of approximately 5000 Ohms is not detected replace the AV2 flow control and timer control potentiometer assembly.
7. Slowly turn the AV2 timer potentiometer knob from the 0 second position to the 30 second position and check the resistance reading between terminals 4 and 5 (Red and White wires) of connector X6.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV2 flow control and timer control potentiometer assembly.
8. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Controller Error Code 56

**Fault Description.**

The signal from the auxiliary/remote valve AV3 timer control potentiometer is too low.

**System Response.**

Valve AV3 will not operate in timer mode.

**Possible Cause.**

1. Valve AV3 timer control potentiometer signal circuit, open or short circuit to ground.
2. Valve AV3 timer control potentiometer 5 volt reference open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV3 timer control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. If a low potentiometer signal error code is present for all, control, flow and timer potentiometer, refer to "Multiple Controller Potentiometer Low Signal Error Codes" on page 49.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Check for continuity between connector 44 pin 34 and connector 50 pin 5 for wire 510 Dark Blue.
   - If continuity is not detected check wire 510 Dark Blue between connector 44 and connector 50.
3. Check for continuity between ground and connector 44 pin 34 for wire 510 Dark Blue.
   - If continuity is detected check wire 510 Dark Blue between connector 44 and connector 50.
4. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X7.
5. Disconnect the auxiliary/remote valve AV3 flow control and timer control potentiometers from the printed circuit board at connector X7. Check the resistance reading between terminals 4 and 6 (Red and Brown wires) of connector X7.
   - If a reading of approximately 5000 Ohms is not detected replace the AV3 flow control and timer control potentiometer assembly.
6. Turn the AV3 timer potentiometer knob to the 0 second position and check the resistance reading between terminals 4 and 5 (Red and White wires) of connector X7.
   - If a reading of approximately 5000 Ohms is not detected replace the AV3 flow control and timer control potentiometer assembly.
7. Slowly turn the AV3 timer potentiometer knob from the 0 second position to the 30 second position and check the resistance reading between terminals 4 and 5 (Red and White wires) of connector X7.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV3 flow control and timer control potentiometer assembly.
8. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Controller Error Code 57

**Fault Description.**

The signal from the auxiliary/remote valve AV3 timer control potentiometer is too high.

**System Response.**

Valve AV3 will not operate in timer mode.

**Possible Cause.**

1. Valve AV3 timer control potentiometer signal circuit, open or short circuit to ground.
2. Valve AV3 timer control potentiometer ground open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV3 timer control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. If a high potentiometer signal error code is present for all control, flow and timer potentiometers, refer to “Multiple Controller Potentiometer High Signal Error Codes” on page 50.
2. Disconnect the connector 50 (fender harness to armrest harness). Turn the key to the ON position, enable the auxiliary valve system and check for a voltage reading at connector 50 pin 5 for wire 510 Dark Blue.
   - If a voltage reading is detected check wire 510 Dark Blue between connector 44 and connector 50.
3. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X7.
4. Disconnect the auxiliary/remote valve AV3 flow control and timer control potentiometers from the printed circuit board at connector X7. Check the resistance reading between terminals 4 and 6 (Red and Brown wires) of connector X7.
   - If a reading of approximately 5000 Ohms is not detected replace the AV3 flow control and timer control potentiometer assembly.
5. Turn the AV3 timer potentiometer knob to the 0 second position and check the resistance reading between terminals 4 and 5 (Red and White wires) of connector X7.
   - If a reading of approximately 5000 Ohms is not detected replace the AV3 flow control and timer control potentiometer assembly.
6. Slowly turn the AV3 timer potentiometer knob from the 0 second position to the 30 second position and check the resistance reading between terminals 4 and 5 (Red and White wires) of connector X7.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV3 flow control and timer control potentiometer assembly.
7. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Controller Error Code 60

**Fault Description.**

The signal from the auxiliary/remote valve AV4 timer control potentiometer too low.

**System Response.**

Valve AV4 will not operate in timer mode.

**Possible Cause.**

1. Valve AV4 timer control potentiometer signal circuit, open or short circuit to ground.
2. Valve AV4 timer control potentiometer 5 volt reference open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV4 timer control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. If a low potentiometer signal error code is present for all, control, flow and timer potentiometer, refer to "Multiple Controller Potentiometer Low Signal Error Codes" on page 49.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Check for continuity between connector 44 pin 28 and connector 50 pin 6 for wire 528 Dark Blue.
   - If continuity is not detected check wire 528 Dark Blue between connector 44 and connector 50.
3. Check for continuity between ground and connector 44 pin 28 for wire 528 Dark Blue.
   - If continuity is detected check wire 528 Dark Blue between connector 44 and connector 50.
4. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X8.
5. Disconnect the auxiliary/remote valve AV4 flow control and timer control potentiometers from the printed circuit board at connector X8. Check the resistance reading between terminals 4 and 6 (Red and Brown wires) of connector X8.
   - If a reading of approximately 5000 Ohms is not detected replace the AV4 flow control and timer control potentiometer assembly.
6. Turn the AV4 timer potentiometer knob to the 0 second position and check the resistance reading between terminals 4 and 5 (Red and White wires) of connector X8.
   - If a reading of approximately 5000 Ohms is not detected replace the AV4 flow control and timer control potentiometer assembly.
7. Slowly turn the AV4 timer potentiometer knob from the 0 second position to the 30 second position and check the resistance reading between terminals 4 and 5 (Red and White wires) of connector X8.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV4 flow control and timer control potentiometer assembly.
8. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Controller Error Code 61

**Fault Description.**

The signal from the auxiliary/remote valve AV4 timer control potentiometer is too high.

**System Response.**

Valve AV4 will not operate in timer mode.

**Possible Cause.**

1. Valve AV4 timer control potentiometer signal circuit, open or short circuit to ground.
2. Valve AV4 timer control potentiometer ground open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV4 timer control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. If a high potentiometer signal error code is present for all control, flow and timer potentiometers, refer to “Multiple Controller Potentiometer High Signal Error Codes” on page 50.
2. Disconnect the connector 50 (fender harness to armrest harness). Turn the key to the ON position, enable the auxiliary valve system and check for a voltage reading at connector 50 pin 6 for wire 528 Dark Blue.
   - If a voltage reading is detected check wire 528 Dark Blue between connector 44 and connector 50.
3. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X8.
4. Disconnect the auxiliary/remote valve AV4 flow control and timer control potentiometers from the printed circuit board at connector X8. Check the resistance reading between terminals 4 and 6 (Red and Brown wires) of connector X8.
   - If a reading of approximately 5000 Ohms is not detected replace the AV4 flow control and timer control potentiometer assembly.
5. Turn the AV4 timer potentiometer knob to the 0 second position and check the resistance reading between terminals 4 and 5 (Red and White wires) of connector X8.
   - If a reading of approximately 5000 Ohms is not detected replace the AV4 flow control and timer control potentiometer assembly.
6. Slowly turn the AV4 timer potentiometer knob from the 0 second position to the 30 second position and check the resistance reading between terminals 4 and 5 (Red and White wires) of connector X8.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV4 flow control and timer control potentiometer assembly.
7. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Controller Error Code 62

**Fault Description.**

The signal from the auxiliary/remote valve AV5 timer control potentiometer is too low.

**System Response.**

Valve AV5 will not operate in timer mode.

**Possible Cause.**

1. Valve AV5 timer control potentiometer signal circuit, open or short circuit to ground.
2. Valve AV5 timer control potentiometer 5 volt reference open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV5 timer control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. If a low potentiometer signal error code is present for all, control, flow and timer potentiometer, refer to "Multiple Controller Potentiometer Low Signal Error Codes" on page 49.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Check for continuity between connector 44 pin 2 and connector 50 pin 7 for wire 529 Dark Blue.
   - If continuity is not detected check wire 529 Dark Blue between connector 44 and connector 50.
3. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X8
4. Check for continuity between ground and connector 44 pin 2 for wire 529 Dark Blue.
   - If continuity is detected check wire 529 Dark Blue between connector 44 and connector 50.
5. Disconnect the auxiliary/remote valve AV5 flow control and timer control potentiometers from the printed circuit board at connector X9. Check the resistance reading between terminals 4 and 6 (Red and Brown wires) of connector X8.
   - If a reading of approximately 5000 Ohms is not detected replace the AV5 flow control and timer control potentiometer assembly.
6. Turn the AV5 timer potentiometer knob to the 0 second position and check the resistance reading between terminals 4 and 5 (Red and White wires) of connector X9.
   - If a reading of approximately 5000 Ohms is not detected replace the AV4 flow control and timer control potentiometer assembly.
7. Slowly turn the AV5 timer potentiometer knob from the 0 second position to the 30 second position and check the resistance reading between terminals 4 and 5 (Red and White wires) of connector X9.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV5 flow control and timer control potentiometer assembly.
8. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Controller Error Code 63

**Fault Description.**

The signal from the auxiliary/remote valve AV5 timer control potentiometer is too high.

**System Response.**

Valve AV5 will not operate in timer mode.

**Possible Cause.**

1. Valve AV5 timer control potentiometer signal circuit, open or short circuit to ground.
2. Valve AV5 timer control potentiometer ground open circuit.
3. Damaged armrest harness or printed circuit board.
4. Bad AV5 timer control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. If a high potentiometer signal error code is present for all control, flow and timer potentiometers, refer to “Multiple Controller Potentiometer High Signal Error Codes” on page 50.
2. Disconnect the connector 50 (fender harness to armrest harness). Turn the key to the ON position, enable the auxiliary valve system and check for a voltage reading at connector 50 pin 7 for wire 529 Dark Blue.
   - If a voltage reading is detected check wire 529 Dark Blue between connector 44 and connector 50.
3. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X9.
4. Disconnect the auxiliary/remote valve AV5 flow control and timer control potentiometers from the printed circuit board at connector X9. Check the resistance reading between terminals 4 and 6 (Red and Brown wires) of connector X9.
   - If a reading of approximately 5000 Ohms is not detected replace the AV5 flow control and timer control potentiometer assembly.
5. Turn the AV5 timer potentiometer knob to the 0 second position and check the resistance reading between terminals 4 and 5 (Red and White wires) of connector X9.
   - If a reading of approximately 5000 Ohms is not detected replace the AV5 flow control and timer control potentiometer assembly.
6. Slowly turn the AV5 timer potentiometer knob from the 0 second position to the 30 second position and check the resistance reading between terminals 4 and 5 (Red and White wires) of connector X9.
   - A steadily reducing Ohms reading from approximately 5000 Ohms to approximately 1.5 Ohms should be observed. If the readings are incorrect or an intermittent reading is detected replace the AV5 flow control and timer control potentiometer assembly.
7. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



## Controller Error Code 64

**Fault Description.**

Auxiliary/Remote valve controller has not detected a signal from the auxiliary/remote valve system enable light (LED).

**System Response.**

The auxiliary/remote valve system will not enable.

**Possible Cause.**

1. Auxiliary/remote valve system enable light open circuit.
2. Damaged armrest harness or printed circuit board.
3. Bad auxiliary/remote valve enable switch.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect connector 50 (fender harness to armrest harness). Check for continuity between connector 44 pin 29 and connector 50 pin 23 for wire 522 Dark Blue.
   - If continuity is not detected check wire 522 Dark Blue between connector 44 and connector 50.
2. Remove the armrest lower cover and check the following:
   - The armrest harness between connector 50 and printed circuit board connector X2.
   - Armrest printed circuit board and connectors X2 and X14.
3. Disconnect connector X14 from the printed circuit board. Using the multimeter Diode Test Function check for continuity between the terminals 3 and 4 (Grey and Brown wires) of connector X14. Make sure the positive lead of the multimeter is connected to terminal 3 (Grey wire).
   - If continuity is not detected replace the auxiliary/remote valve enable switch.
4. Replace the auxiliary/remote valve controller.

## Controller Error Code 65

**Fault Description.**

Auxiliary/remote valve controller has detected a configuration error.

**System Response.**

The auxiliary/remote valve system will not enable.

**Possible Cause.**

1. Auxiliary/remote valve controller configuration data is corrupt.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

1. Reconfigure the auxiliary/remote valve controller, refer to Section 10010.
2. Reprogramme the auxiliary/remote valve controller, refer to Section 10010.

https://truckmanualshub.com/



## Controller Error Code 73

**Fault Description.**
Auxiliary/Remote valve controller has not received a CAN message from the auxiliary/remote valve AV1.

**System Response.**
Valve AV1 fails to operate.

**Possible Cause.**
1. Valve AV1 CAN bus open circuit.
2. Valve AV1 feed or ground wires open circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**
1. If a CAN message error code is present for all auxiliary/remote valves, check the following:
   - Wire 900 Yellow between the transmission harness splice T-SP6 and splice T-SP11.
   - Wire 900 Light Green between the transmission harness splice T-SP7 and splice T-SP12.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect valve AV1 from the harness. Check for continuity between connector 44 pin 9 and terminal 1 of the valve AV1 connector for wire (VP) Red.
   - If continuity is not detected check wire (VP) Red between the valve AV1 connector and transmission harness splice T-SP10.
3. Check for continuity between connector 44 pin 13 and terminal 3 of the valve AV1 connector for wire 900 Yellow.
   - If continuity is not detected check wire 900 Yellow between the valve AV1 connector and transmission harness splice T-SP11.
4. Check for continuity between connector 44 pin 12 and terminal 3 of the valve AV1 connector for wire 900 Light Green.
   - If continuity is not detected check wire 900 Light Green between the valve AV1 connector and transmission harness splice T-SP12.
5. Check for continuity between ground and the valve AV1 connector terminal 4 for wire (GND) Brown/White.
   - If continuity is not detected check wire (GND) Brown/White between the valve AV1 connector and the battery negative terminal.

## Controller Error Code 74

**Fault Description.**
Auxiliary/Remote valve controller has not received a CAN message from the auxiliary/remote valve AV2.

**System Response.**
Valve AV2 fails to operate.

**Possible Cause.**
1. Valve AV2 CAN bus open circuit.
2. Valve AV2 feed or ground wires open circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**
1. If a CAN message error code is present for all auxiliary/remote valves, check the following:
   - Wire 900 Yellow between the transmission harness splice T-SP6 and splice T-SP11.
   - Wire 900 Light Green between the transmission harness splice T-SP7 and splice T-SP12.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect valve AV2 from the harness. Check for continuity between connector 44 pin 9 and terminal 1 of the valve AV2 connector for wire (VP) Red.
   - If continuity is not detected check wire (VP) Red between the valve AV2 connector and transmission harness splice T-SP10.
3. Check for continuity between connector 44 pin 13 and terminal 3 of the valve AV2 connector for wire 900 Yellow.
   - If continuity is not detected check wire 900 Yellow between the valve AV2 connector and transmission harness splice T-SP11.

continued.....

https://truckmanualshub.com/



4. Check for continuity between connector 44 pin 12 and terminal 3 of the valve AV2 connector for wire 900 Light Green.
   - If continuity is not detected check wire 900 Light Green between the valve AV2 connector and transmission harness splice T-SP12.
5. Check for continuity between ground and the valve AV2 connector terminal 4 for wire (GND) Brown/White.
   - If continuity is not detected check wire (GND) Brown/White between the valve AV2 connector and the battery negative terminal.

## Controller Error Code 75

**Fault Description.**

Auxiliary/Remote valve controller has not received a CAN message from the auxiliary/remote valve AV3.

**System Response.**

Valve AV3 fails to operate.

**Possible Cause.**

1. Valve AV3 CAN bus open circuit.
2. Valve AV3 feed or ground wires open circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. If a CAN message error code is present for all auxiliary/remote valves, check the following:
   - Wire 900 Yellow between the transmission harness splice T-SP6 and splice T-SP11.
   - Wire 900 Light Green between the transmission harness splice T-SP7 and splice T-SP12.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect valve AV3 from the harness. Check for continuity between connector 44 pin 9 and terminal 1 of the valve AV3 connector for wire (VP) Red.
   - If continuity is not detected check wire (VP) Red between the valve AV3 connector and transmission harness splice T-SP10.
3. Check for continuity between connector 44 pin 13 and terminal 3 of the valve AV3 connector for wire 900 Yellow.
   - If continuity is not detected check wire 900 Yellow between the valve AV3 connector and transmission harness splice T-SP11.
4. Check for continuity between connector 44 pin 12 and terminal 3 of the valve AV3 connector for wire 900 Light Green.
   - If continuity is not detected check wire 900 Light Green between the valve AV3 connector and transmission harness splice T-SP12.
5. Check for continuity between ground and the valve AV3 connector terminal 4 for wire (GND) Brown/White.
   - If continuity is not detected check wire (GND) Brown/White between the valve AV3 connector and the battery negative terminal.

https://truckmanualshub.com/



## Controller Error Code 76

**Fault Description.**
Auxiliary/Remote valve controller has not received a CAN message from the auxiliary/remote valve AV4.

**System Response.**
Valve AV4 fails to operate.

**Possible Cause.**
1. Valve AV4 CAN bus open circuit.
2. Valve AV4 feed or ground wires open circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**
1. If a CAN message error code is present for all auxiliary/remote valves, check the following:
   - Wire 900 Yellow between the transmission harness splice T-SP6 and splice T-SP11.
   - Wire 900 Light Green between the transmission harness splice T-SP7 and splice T-SP12.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect valve AV4 from the harness. Check for continuity between connector 44 pin 9 and terminal 1 of the valve AV4 connector for wire (VP) Red.
   - If continuity is not detected check wire (VP) Red between the valve AV4 connector and transmission harness splice T-SP10.
3. Check for continuity between connector 44 pin 13 and terminal 3 of the valve AV4 connector for wire 900 Yellow.
   - If continuity is not detected check wire 900 Yellow between the valve AV4 connector and transmission harness splice T-SP11.
4. Check for continuity between connector 44 pin 12 and terminal 3 of the valve AV4 connector for wire 900 Light Green.
   - If continuity is not detected check wire 900 Light Green between the valve AV4 connector and transmission harness splice T-SP12.
5. Check for continuity between ground and the valve AV4 connector terminal 4 for wire (GND) Brown/White.
   - If continuity is not detected check wire (GND) Brown/White between the valve AV4 connector and the battery negative terminal.

## Controller Error Code 77

**Fault Description.**
Auxiliary/Remote valve controller has not received a CAN message from the auxiliary/remote valve AV5.

**System Response.**
Valve AV5 fails to operate.

**Possible Cause.**
1. Valve AV5 CAN bus open circuit.
2. Valve AV5 feed or ground wires open circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**
1. If a CAN message error code is present for all auxiliary/remote valves, check the following:
   - Wire 900 Yellow between the transmission harness splice T-SP6 and splice T-SP11.
   - Wire 900 Light Green between the transmission harness splice T-SP7 and splice T-SP12.
2. Disconnect the auxiliary/remote valve controller from the harness at connector 44 and disconnect valve AV5 from the harness. Check for continuity between connector 44 pin 9 and terminal 1 of the valve AV5 connector for wire (VP) Red.
   - If continuity is not detected check wire (VP) Red between the valve AV5 connector and transmission harness splice T-SP10.
3. Check for continuity between connector 44 pin 13 and terminal 3 of the valve AV5 connector for wire 900 Yellow.
   - If continuity is not detected check wire 900 Yellow between the valve AV5 connector and transmission harness splice T-SP11.

continued.....

https://truckmanualshub.com/



4. Check for continuity between connector 44 pin 12 and terminal 3 of the valve AV5 connector for wire 900 Light Green.
   - If continuity is not detected check wire 900 Light Green between the valve AV5 connector and transmission harness splice T-SP12.
5. Check for continuity between ground and the valve AV5 connector terminal 4 for wire (GND) Brown/White.
   - If continuity is not detected check wire (GND) Brown/White between the valve AV5 connector and the battery negative terminal.

## Multiple Controller Potentiometer Low Signal Error Codes

**NOTE:** *Multiple controller potentiometer low signal error codes are as follows:*
- *Joystick control potentiometers 30, 32, 34, and 36.*
- *Flow control potentiometers 40, 42, 46, 48, 50.*
- *Timer control potentiometers 52, 54, 56, 60, and 62.*

**Fault Description.**

Auxiliary/Remote valve controller has detected a multiple low potentiometer signal error code on all the armrest control, flow and timer potentiometers.

**System Response.**

All the auxiliary/remote vales fail to operate.

**Possible Cause.**

1. Armrest control, 5 volt supply open circuit.
2. Damaged armrest harness.
3. Bad armrest control unit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. Turn the key to the OFF position and disconnect the auxiliary/remote valve controller from the harness at connector 44. Check for continuity between connector 44 pin 10 and connector 50 pin 1 for wire 540 Red
   - If continuity is not detected check wire 540 Red between connector 44 and connector 50.
2. Remove the armrest lower cover and check the armrest harness between connector 50 and printed circuit board connector X2. Also check the printed circuit board and connector X2.
3. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Multiple Controller Potentiometer High Signal Error Codes

**NOTE:** *Multiple controller potentiometer low signal error codes are as follows:*
*- Joystick control potentiometers 31, 33, 35, and 37.*
*- Flow control potentiometers 41, 43, 45, 47, 51.*
*- Timer control potentiometers 53, 55, 57, 61, and 63.*

**Fault Description.**

Auxiliary/Remote valve controller has detected a multiple high potentiometer signal error code on all the armrest control, flow and timer potentiometers.

**System Response.**

All the auxiliary/remote vales fail to operate.

**Possible Cause.**

1. Armrest control ground open circuit.
2. Damaged armrest harness.
3. Bad armrest control unit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. Turn the key to the OFF position and disconnect the auxiliary/remote valve controller from the harness at connector 44. Check for continuity between connector 44 pin 1 and connector 50 pin 2 for wire 540 Brown - If continuity is not detected check wire 540 Brown between connector 44 and connector 50.
2. Remove the armrest lower cover and check the armrest harness between connector 50 and printed circuit board connector X2. Also check the printed circuit board and connector X2.
3. Replace the auxiliary/remote valve controller.

https://truckmanualshub.com/



# Auxiliary/Remote Valve Error Codes

## Valve Error Code 17 and 18

**Fault Description.**

The auxiliary/remote valve has not received a CAN message from the auxiliary valve controller.

**Fault Category.**

Category 1 - Control Section Fault.

**System Response.**

Auxiliary/remote valve returns to neutral.
Auxiliary/remote valve diagnostic LED will flash Blink Code 11 or 12.

**Possible Cause.**

1. Auxiliary/remote valve control circuit short to 12 volts.
2. CAN bus open circuit or disconnected.
3. Auxiliary/remote valves receiving power prior to auxiliary valves being enabled.
4. Bad auxiliary/remote valve.
5. Bad auxiliary/remote valve controller.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. If the error is detected on all the auxiliary/remote valves, go to check 4.
2. Check for auxiliary/remote valve controller error codes and repair as necessary.
3. Put identification marks on the auxiliary/remote valve connectors and swop the connector of a good valve with the connector of the valve with the detected error. Check the operation of the auxiliary/remote valve.
   - If the previously good valve now fails to operate go to check 4.
   - If the same valve fails to operate, replace the valve.
4. Disconnect one of the auxiliary/remote valves from the harness, turn the key to the ON position (DO NOT enable auxiliary/remote valve system). Check for 12 volts at terminal 1 of the auxiliary/remote valve connector for wire VP Red.
   - If 12 volts is detected check the following wires for damage:
   - Wire VP Red between valve AV1 and splice T-SP10.
   - Wire VP Red between valve AV2 and splice T-SP10.
   - Wire VP Red between valve AV3 and splice T-SP10.
   - Wire VP Red between valve AV4 and splice T-SP10.
   - Wire VP Red between valve AV5 and splice T-SP10.
   - Wire VP Red between connector 40 pin H and splice T-SP10.
   - Wire VP Red between connector 40 pin H and the auxiliary/remote valve controller connector pin 9. Also check connector 40.
   - If 12 volts is not detected check the following wires for damage:
   - Wire 900 Yellow between the connector 44 and the fender harness splice F-SP17.
   - Wire 900 Light Green between the connector 44 and the fender harness splice F-SP18.

https://truckmanualshub.com/



## Valve Error Code 19 and 20

**Fault Description.**
The auxiliary/remote valve has received an incorrect CAN bus message.

**Fault Category.**
Category 1 - Control Section Fault.

**System Response.**
Auxiliary/remote valve returns to neutral.
Auxiliary/remote valve diagnostic LED will flash Blink Code 13 or 14.

**Possible Cause.**
1. Auxiliary/remote valve control circuit failed.
2. CAN bus open circuit or disconnected.
3. Bad auxiliary/remote valve.
4. Bad auxiliary/remote valve controller.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**
1. If the error is detected on all the auxiliary/remote valves, go to check 4.
2. Check for auxiliary valve controller error codes and repair as necessary.
3. Put identification marks on the auxiliary/remote valve connectors and swop the connector of a good valve with the connector of the valve with the detected error. Check the operation of the auxiliary/remote valve.
   - If the previously good valve now fails to operate, check the following wires:
     - Wire 900 Yellow between the connector 44 and the fender harness splice F-SP17.
     - Wire 900 Light Green between the connector 44 and the fender harness splice F-SP18.
   - If the same valve fails to operate, replace the valve.

## Valve Error Code 21

**Fault Description.**
The auxiliary/remote valve has not detected a spool position potentiometer signal.

**Fault Category.**
Category 1 - Control Section Fault.

**System Response.**
Auxiliary/remote valve returns to neutral.
Auxiliary/remote valve diagnostic LED will flash Blink Code 15.

**Possible Cause.**
1. Incorrect auxiliary/remote valve installed.
2. Bad auxiliary/remote valve.

**Circuit Checks/Corrective Action.**
1. Check the correct auxiliary/remote valve installation and replace as necessary.

## Valve Error Code 22

**Fault Description.**
The auxiliary/remote valve EEPROM is inconsistent during self test.

**Fault Category.**
Category 1 - Control Section Fault.

**System Response.**
Auxiliary/remote valve returns to neutral.
Auxiliary/remote valve diagnostic LED will flash Blink Code 16.

**Possible Cause.**
1. Auxiliary/remote valve incorrectly programmed.

**Circuit Checks/Corrective Action.**
1. Replace the auxiliary/remote valve.

https://truckmanualshub.com/



## Valve Error Code 23

**Fault Description.**

No fault, the auxiliary/remote valve control unit is waiting for a neutral signal form the auxiliary/remote valve controller.

> **NOTE:** *If faults have occurred in the auxiliary/remote valve system which are no longer active a valve error code 23 may be displayed. This error code will continued to be displayed until the auxiliary/remote valve controls are placed in the neutral position. When the valve receives a CAN bus, neutral message from the auxiliary/remote valve controller the error code will no longer be displayed and the valves will operate normally.*

**Fault Category.**

Category 1 - Control Section Fault.

**System Response.**

Auxiliary/remote valve returns to neutral.
Auxiliary/remote valve diagnostic LED will flash Blink Code 17.

**Possible Cause.**

1. Joystick not in the neutral position.

**Circuit Checks/Corrective Action.**

1. Make sure the joystick control is in neutral.
2. Check for auxiliary/remote valve controller error codes and correct as necessary.

## Valve Error Code 33

**Fault Description.**

The battery signal is below specified limits.

**Fault Category.**

Category 2 - Minor Fault.

**System Response.**

Auxiliary/remote valve will not operate in the timer mode.
Auxiliary/remote valve diagnostic LED will flash Blink Code 21.

**Possible Cause.**

1. Supply Voltage to the auxiliary/remote valve is below specified limits.
2. Bad auxiliary/remote valve feed or ground circuit.
3. Alternator output too low or poor battery condition.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

> **NOTE:** *If the error is detected on one valve only follow Steps 1 and 2. If the error is detected on all the valves follow Steps 3 to 5.*

1. Disconnect the auxiliary/remote valve with the detected error from the harness. Turn the key to the ON position and enable the auxiliary/remote valve system. Check the voltage reading at terminal 1 of the valve connector for wire VP Red.
   - If the reading is less than 12 volts check wire VP Red between the valve connector and splice T-SP10.
2. Turn the key to the OFF position and check the resistance reading between ground and terminal 2 of the valve connector for wire GND Brown/White.
   - If the resistance reading is high check wire GND Brown/White between the valve connector and the battery negative terminal.
3. Check the alternator.
4. Check the battery condition.
5. Disconnect one of the auxiliary/remote valves from the harness. Turn the key to the ON position and enable the auxiliary/remote valve system. Check the voltage reading at terminal 1 of the valve connector for wire VP Red.
   - If the reading is less than 12 volts check wire VP Red between the auxiliary/remote valve controller connector 44 pin 9 and splice T-SP10. Also check connector 40.

https://truckmanualshub.com/



## Valve Error Code 34

**Fault Description.**
The battery signal is above specified limits.

**Fault Category.**
Category 2 - Minor Fault.

**System Response.**
Auxiliary/remote valve will not operate in the timer mode.
Auxiliary/remote valve diagnostic LED will flash Blink Code 22.

**Possible Cause.**
1. Alternator output is too high.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**
1. Check the alternator.

## Valve Error Code 35

**Fault Description.**
The auxiliary/remote valve spool has not reached the set point position within the specified time limit.

**Fault Category.**
Category 2 - Minor Fault.

**System Response.**
Auxiliary/remote valve will not operate in the timer mode.
Auxiliary/remote valve diagnostic LED will flash Blink Code 23.

**Possible Cause.**
1. Oil temperature too low.
2. Low pilot pressure.
3. Blocked hydraulic filter.
4. Auxiliary/remote valve spool is stuck.
5. Auxiliary/remote valve external linkage seized.
6. Bad auxiliary/remote valve control unit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

**NOTE:** *If the error is detected on one valve only follow Steps 1 to 4. If the error is detected on all valves follow Steps 5 to 9.*

1. Check for auxiliary valve controller errors and correct as necessary.
2. Check the auxiliary/remote valve spool external linkage.
3. Check the auxiliary/remote valve spool and replace the valve as necessary.
4. Check the auxiliary/remote valve control unit connections.
5. Check the operation of the auxiliary/remote valves with the oil at normal operating temperature.
6. Check the operation of other hydraulic functions, if other function fail to operate check the hydraulic filter and replace as necessary.

https://truckmanualshub.com/



## Valve Error Code 36

**Fault Description.**
The auxiliary/remote valve spool has travelled beyond the set point position.

**Fault Category.**
Category 2 - Minor Fault.

**System Response.**
Auxiliary/remote valve returns to neutral.
Auxiliary/remote valve diagnostic LED will flash Blink Code 24.

**Possible Cause.**
1. Auxiliary/remote valve spool is stuck.
2. Bad auxiliary/remote valve control unit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

**NOTE:** *If the error is detected on one valve only follow Steps 1 and 2. If the error is detected on all the valves follow Step 3.*

1. Check the auxiliary/remote valve spool and replace the valve as necessary.
2. Check the auxiliary/remote valve control unit connections.

## Valve Error Code 37

**Fault Description.**
The auxiliary/remote valve spool has not reached the open centre position (float) within the specified time limit.

**Fault Category.**
Category 2 - Minor Fault.

**System Response.**
Auxiliary/remote valve returns to neutral. When the fault has been corrected the joystick must be returned to neutral and then back to float before the valve will operate, error code 23 will be displayed.
Auxiliary/remote valve diagnostic LED will flash Blink Code 25.

**Possible Cause.**
1. Oil temperature too low.
2. Low pilot pressure.
3. Auxiliary/remote valve spool is stuck.
4. Bad auxiliary/remote valve control unit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**

**NOTE:** *If the error is detected on one valve only follow Steps 1 and 2. If the error is detected on all the valves follow Steps 3 to 5.*

1. Check the auxiliary/remote valve spool and replace the valve as necessary.
2. Check the auxiliary/remote valve control unit connections.
3. Check the operation of the auxiliary/remote valves with the oil at normal operating temperature.
4. Check the operation of other hydraulic functions, if other function fail to operate check the hydraulic filter and replace as necessary.

https://truckmanualshub.com/



## Valve Error Code 38

**Fault Description.**

The auxiliary/remote valve spool has been operated manually when both the valve spool and control joystick are in neutral.

**Fault Category.**

Category 2 - Minor Fault.

**System Response.**

Manual operation of the auxiliary/remote valve when the valve spool and control joystick are in neutral will display error 38. When the valve spool returns to neutral the error code will no longer be displayed.

> ⚠ **WARNING:** *Manually operating the auxiliary/remote valve spool at the same time as the joystick or multifuntion lever switches may result in injury.*

Auxiliary/remote valve diagnostic LED will flash Blink Code 26.

**Possible Cause.**

1. Manual deflection of the auxiliary/remote valve spool.
2. Auxiliary/remote valve external linkage seized.
3. Bad auxiliary/remote valve control unit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. Make sure the auxiliary/remote valve spool external linkage is not being held out of neutral accidentally.
2. Check the auxiliary/remote valve spool external linkage.

## Valve Error Code 65

**Fault Description.**

The battery signal excessively high.

**Fault Category.**

Category 3 - Serious Fault With Internal Safety Shut-down.

**System Response.**

Auxiliary/remote valve immediately returns to neutral and the internal safety transistor switches off.
Auxiliary/remote valve diagnostic LED will flash Blink Code 41.

**Possible Cause.**

1. Alternator output too high.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action.**

1. Check the alternator.

https://truckmanualshub.com/



## Valve Error Code 66

**Fault Description.**
The auxiliary/remote valve control unit solenoid circuit has failed.

**Fault Category.**
Category 3 - Serious Fault With Internal Safety Shut-down.

**System Response.**
Auxiliary/remote valve returns to neutral, the internal safety transistor switches off.
Auxiliary/remote valve diagnostic LED will flash Blink Code 42.

**Possible Cause.**
1. Bad auxiliary/remote valve control unit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**
1. Replace the auxiliary/remote valve.

## Valve Error Code 67

**Fault Description.**
The auxiliary/remote valve control unit spool position sensor circuit has failed.

**Fault Category.**
Category 3 - Serious Fault With Internal Safety Shut-down.

**System Response.**
Auxiliary/remote valve returns to neutral, the internal safety transistor switches off.
Auxiliary/remote valve diagnostic LED will flash Blink Code 43.

**Possible Cause.**
1. Bad auxiliary/remote valve control unit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action.**
1. Replace the auxiliary/remote valve.

https://truckmanualshub.com/



## Valve Error Code 129

**Fault Description.**

The auxiliary/remote valve spool can not return to neutral.

**Fault Category.**

Category 4 - Serious Fault requiring external Safety Shut-down.

> ⚠ **WARNING:** *If category 4 error codes 129, 130 or 131 are displayed STOP the engine immediately.*

**System Response.**

The internal safety transistor switches off and the auxiliary valve controller safety relay activates.
Auxiliary/remote valve diagnostic LED will flash Blink Code 81.

**Possible Cause.**

1. Manual deflection of the auxiliary/remote valve spool.
2. Auxiliary/remote valve external linkage seized.
3. Bad auxiliary/remote valve control unit.

> ⚠ **WARNING:** *Before carrying out any checks or repairs on the auxiliary/remote valve system, manually relieve the pressure in the auxiliary/remote valve system and disconnect any attached implements from auxiliary/remote valve hydraulic couplers (refer to "AUXILIARY/REMOTE VALVE MANUAL OPERATION" on page 7). Disconnect any attached implements from the rear hitch according to the implement manufactures instructions.*

**Circuit Checks/Corrective Action.**

1. Make sure the auxiliary/remote valve spool external linkage is not being held out of neutral accidentally.
2. Check the auxiliary/remote valve spool external linkage.
3. Replace the auxiliary/remote valve.

## Valve Error Code 130

**Fault Description.**

The auxiliary/remote valve spool is not in neutral when the auxiliary/remote valve system is enabled.

**Fault Category.**

Category 4 - Serious Fault requiring external Safety Shut-down.

> ⚠ **WARNING:** *If category 4 error codes 129, 130 or 131 are displayed STOP the engine immediately.*

**System Response.**

The internal safety transistor switches off and the auxiliary valve controller safety relay activates.
Auxiliary/remote valve diagnostic LED will flash Blink Code 82.

Continued.....

https://truckmanualshub.com/



**Possible Cause.**

1. Manual deflection of the auxiliary/remote valve spool.
2. Auxiliary/remote valve external linkage seized.
3. Bad auxiliary/remote valve control unit.

> **WARNING:** *Before carrying out any checks or repairs on the auxiliary/remote valve system, manually relieve the pressure in the auxiliary/remote valve system and disconnect any attached implements from auxiliary/remote valve hydraulic couplers (refer to "AUXILIARY/REMOTE VALVE MANUAL OPERATION" on page 7). Disconnect any attached implements from the rear hitch according to the implement manufactures instructions.*

**Circuit Checks/Corrective Action.**

1. Make sure the auxiliary/remote valve spool external linkage is not being held out of neutral accidentally.
2. Check the auxiliary/remote valve spool external linkage.
3. Replace the auxiliary/remote valve.

## Valve Error Code 131

**Fault Description.**

The auxiliary/remote valve has detected a software error during self test and is unable to control the operation of the valve.

**Fault Category.**

Category 4 - Serious Fault requiring external Safety Shut-down.

> **WARNING:** *If category 4 error codes 129, 130 or 131 are displayed STOP the engine immediately.*

**System Response.**

The internal safety transistor switches off and the auxiliary valve controller safety relay activates. Auxiliary/remote valve diagnostic LED will flash Blink Code 83.

**Possible Cause.**

1. Bad auxiliary/remote valve control unit.

> **WARNING:** *Before carrying out any checks or repairs on the auxiliary/remote valve system, manually relieve the pressure in the auxiliary/remote valve system and disconnect any attached implements from auxiliary/remote valve hydraulic couplers (refer to "AUXILIARY/REMOTE VALVE MANUAL OPERATION" on page 7). Disconnect any attached implements from the rear hitch according to the implement manufactures instructions.*

**Circuit Checks/Corrective Action.**

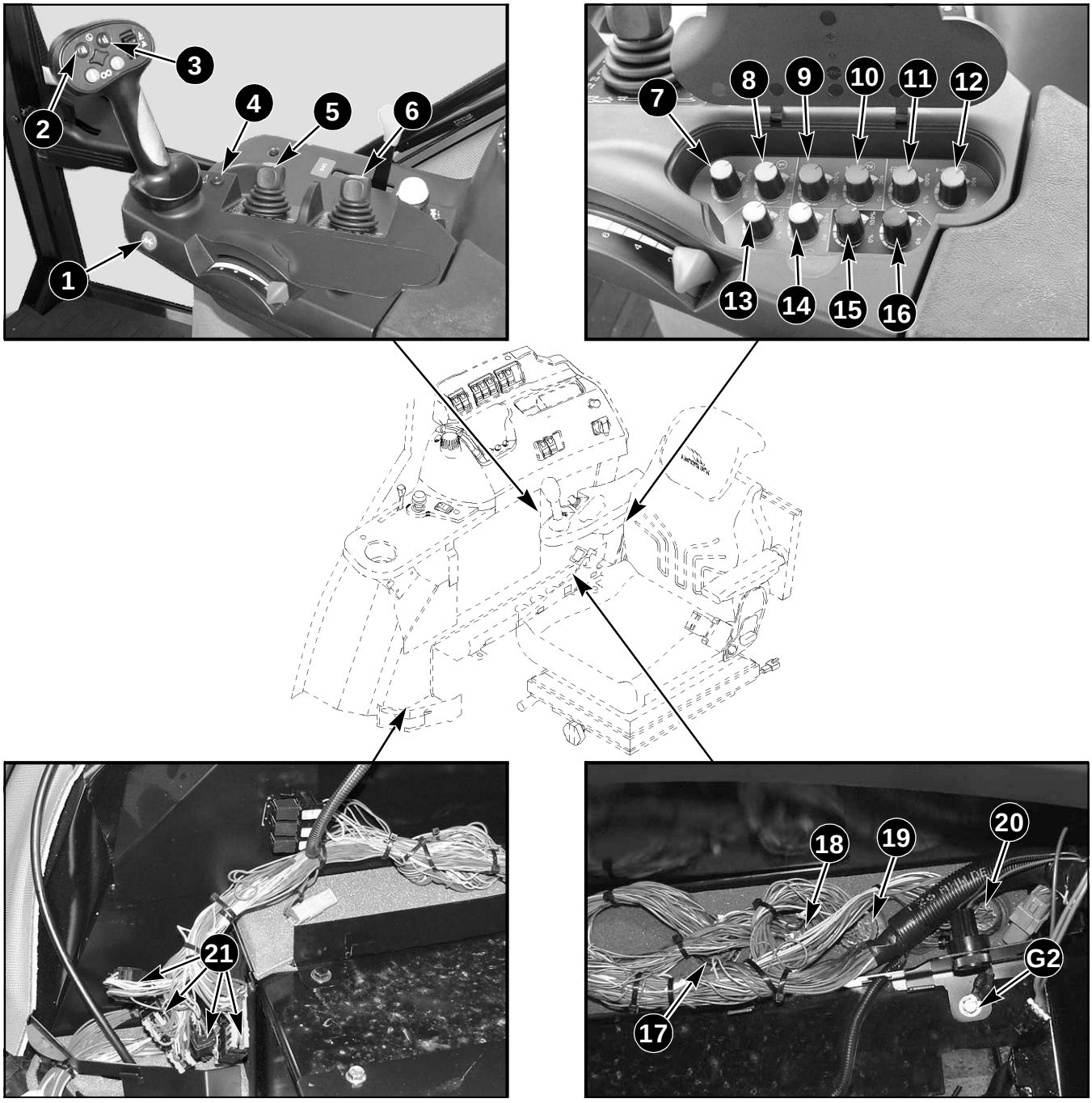
1. Replace the auxiliary/remote valve.

https://truckmanualshub.com/



# COMPONENT IDENTIFICATION

## Right Hand Console and Armrest Components



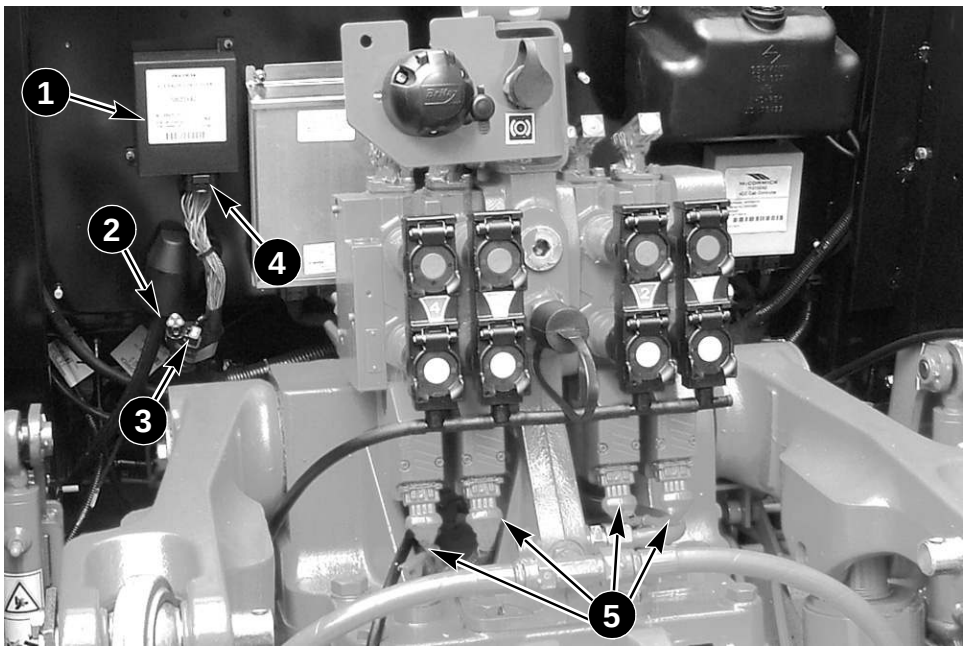

1. AUXILIARY/REMOTE VALVE EMERGENCY STOP SWITCH
2. MULTI FUNCTION LEVER AUXILIARY/REMOTE VALVE LOWER SWITCH
3. MULTI FUNCTION LEVER AUXILIARY/REMOTE VALVE RAISE SWITCH
4. AUXILIARY/REMOTE VALVE ENABLE LIGHT AND SWITCH
5. AUXILIARY/REMOTE VALVE JOYSTICK (VALVES 1 AND 2)
6. AUXILIARY/REMOTE VALVE JOYSTICK (VALVES 3 AND 4)
7. AUXILIARY/REMOTE VALVE FLOW CONTROL (VALVE 1)
8. AUXILIARY/REMOTE VALVE TIMER CONTROL (VALVE 1)
9. AUXILIARY/REMOTE VALVE FLOW CONTROL (VALVE 2)
10. AUXILIARY/REMOTE VALVE TIMER CONTROL (VALVE 2)
11. AUXILIARY/REMOTE VALVE FLOW CONTROL (VALVE 3)
12. AUXILIARY/REMOTE VALVE TIMER CONTROL (VALVE 3)
13. AUXILIARY/REMOTE VALVE FLOW CONTROL (VALVE 4)
14. AUXILIARY/REMOTE VALVE TIMER CONTROL (VALVE 4)
15. AUXILIARY/REMOTE VALVE FLOW CONTROL (VALVE 4)
16. AUXILIARY/REMOTE VALVE TIMER CONTROL (VALVE 4)
17. CONNECTOR 40
18. CONNECTOR 51
19. CONNECTOR 52
20. CONNECTOR 53
21. CONNECTORS 26, 27, 28, 29

G2. CHASSIS GROUND CONNECTION G2

https://truckmanualshub.com/



## Rear Fender and Transmission Components




1. AUXILIARY/REMOTE VALVE CONTROLLER
2. AUXILIARY/REMOTE VALVE CONTROLLER DIAGNOSTIC CONNECTOR 2 (3 PIN)
3. AUXILIARY/REMOTE VALVE CONTROLLER DIAGNOSTIC CONNECTOR 1 (2 PIN)
4. CONNECTOR 44
5. AUXILIARY/REMOTE VALVES

https://truckmanualshub.com/

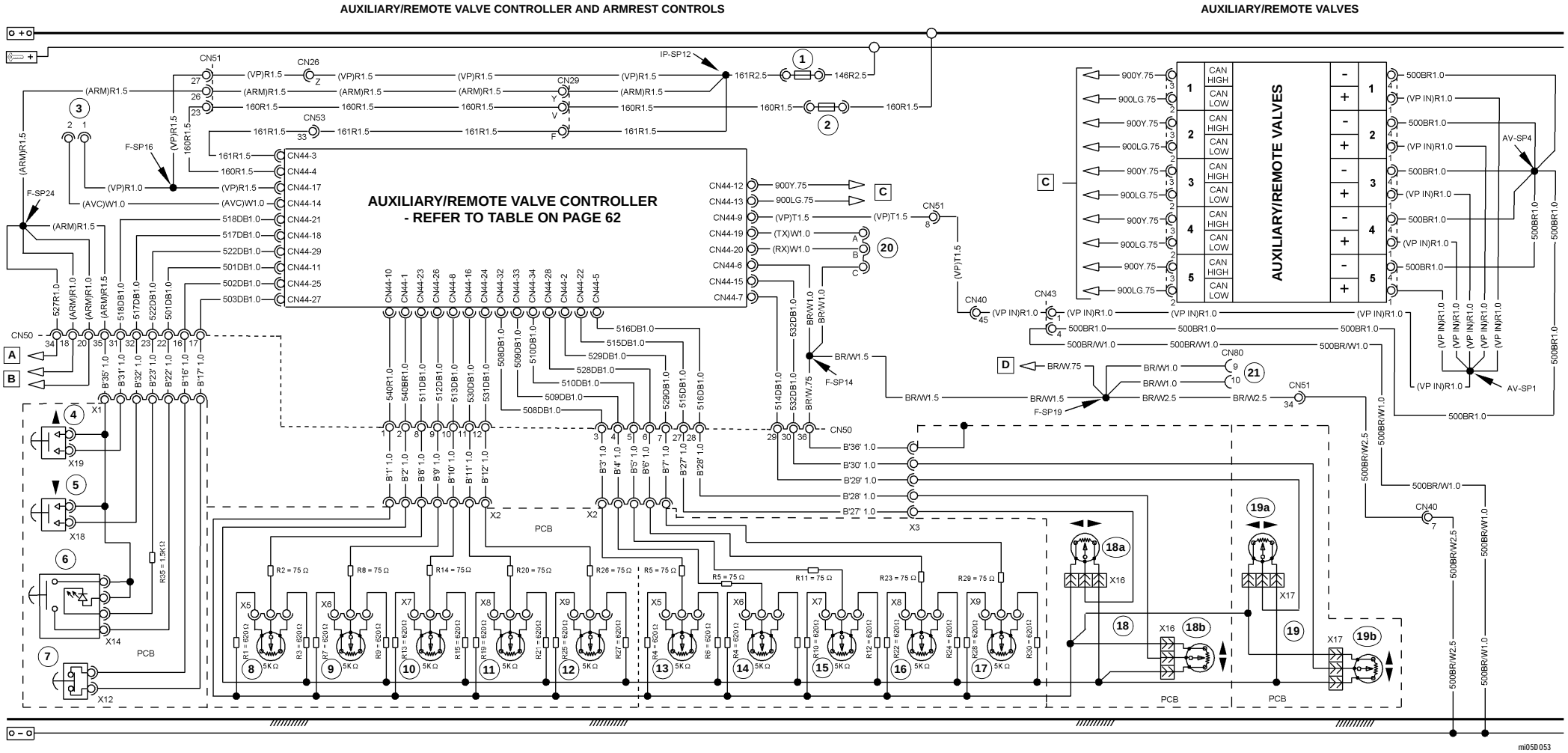


# SCHEMATIC CIRCUIT

| Auxiliary/Remote Valve Controller Connector Pin Identification | |
|---|---|
| 1 | ARMREST CONTROL GROUND SIGNAL (0 VOLTS) |
| 2 | AUXILIARY/REMOTE VALVE 5 TIMER POTENTIOMETER SIGNAL |
| 3 | SWITCHED POWER (VF IN) |
| 4 | UNSWITCHED BATTERY POWER |
| 5 | AUXILIARY/REMOTE VALVE AV2 JOYSTICK POTENTIOMETER SIGNAL |
| 6 | CLEAN GROUND (BATTERY NEGATIVE TERMINAL) |
| 7 | AUXILIARY/REMOTE VALVE AV3 JOYSTICK POTENTIOMETER SIGNAL |
| 8 | AUXILIARY/REMOTE VALVE AV3 FLOW POTENTIOMETER SIGNAL |
| 9 | AUXILIARY/REMOTE VALVE POWER (VP OUT) |
| 10 | ARMREST CONTROL 5 VOLT SUPPLY (REFERENCE) |
| 11 | AUXILIARY/REMOTE VALVE ENABLE SIGNAL |
| 12 | CAN HIGH |
| 13 | CAN LOW |
| 14 | AUXILIARY/REMOTE VALVE CONTROLLER PROGRAMMING |
| 15 | AUXILIARY/REMOTE VALVE AV4 JOYSTICK POTENTIOMETER SIGNAL |
| 16 | AUXILIARY/REMOTE VALVE AV4 FLOW POTENTIOMETER SIGNAL |
| 17 | SWITCHED POWER (VP IN) |
| 18 | MULTI FUNCTION LEVER AUXILIARY/REMOTE SWITCH LOWER SIGNAL |
| 19 | RS232 IN (PROGRAMMING) |
| 20 | RS232 OUT (PROGRAMMING) |
| 21 | MULTI FUNCTION LEVER AUXILIARY/REMOTE SWITCH RAISE SIGNAL |
| 22 | AUXILIARY/REMOTE VALVE AV1 JOYSTICK POTENTIOMETER SIGNAL |
| 23 | AUXILIARY/REMOTE VALVE AV1 FLOW POTENTIOMETER SIGNAL |
| 24 | AUXILIARY/REMOTE VALVE AV5 FLOW POTENTIOMETER SIGNAL |
| 25 | AUXILIARY/REMOTE VALVE STOP SWITCH |
| 26 | AUXILIARY/REMOTE VALVE AV2 FLOW POTENTIOMETER SIGNAL |
| 27 | AUXILIARY/REMOTE VALVE STOP SIGNAL |
| 28 | AUXILIARY/REMOTE VALVE AV4 TIMER POTENTIOMETER SIGNAL |
| 29 | AUXILIARY/REMOTE VALVE ENABLE LIGHT |
| 30 | NOT USED |
| 31 | NOT USED |
| 32 | AUXILIARY/REMOTE VALVE 1 TIMER POTENTIOMETER SIGNAL |
| 33 | AUXILIARY/REMOTE VALVE 2 TIMER POTENTIOMETER SIGNAL |
| 34 | AUXILIARY/REMOTE VALVE 3 TIMER POTENTIOMETER SIGNAL |

https://truckmanualshub.com/


## Auxiliary/Remote Valve Controller Schematic Circuit (For XTX Series XtraSpeed - E Plus Tractors)

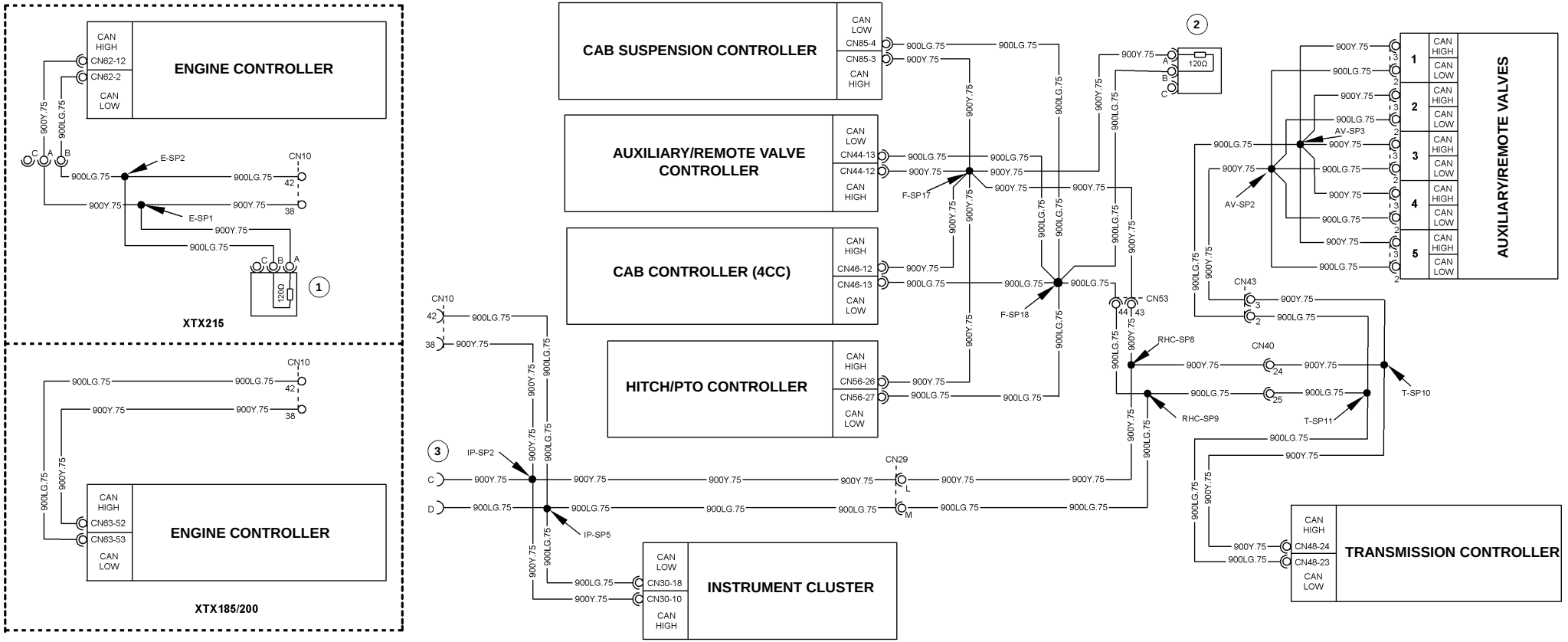



### Key

1. FUSE 35 (7.5 AMP)
2. FUSE 20 (7.5 AMP)
3. AUXILIARY/REMOTE VALVE CONTROLLER DIAGNOSTIC CONNECTOR 1
4. MULTIFUNCTION LEVER AUXILIARY/REMOTE VALVE RAISE SWITCH
5. MULTIFUNCTION LEVER AUXILIARY/REMOTE VALVE LOWER SWITCH
6. AUXILIARY/REMOTE VALVE ENABLE SWITCH
7. AUXILIARY/REMOTE VALVE STOP SWITCH
8. AUXILIARY/REMOTE VALVE AV1 FLOW CONTROL POTENTIOMETER
9. AUXILIARY/REMOTE VALVE AV2 FLOW CONTROL POTENTIOMETER
10. AUXILIARY/REMOTE VALVE AV3 FLOW CONTROL POTENTIOMETER
11. AUXILIARY/REMOTE VALVE AV4 FLOW CONTROL POTENTIOMETER
12. AUXILIARY/REMOTE VALVE AV5 FLOW CONTROL POTENTIOMETER
13. AUXILIARY/REMOTE VALVE AV1 TIMER CONTROL POTENTIOMETER
14. AUXILIARY/REMOTE VALVE AV2 TIMER CONTROL POTENTIOMETER
15. AUXILIARY/REMOTE VALVE AV3 TIMER CONTROL POTENTIOMETER
16. AUXILIARY/REMOTE VALVE AV4 TIMER CONTROL POTENTIOMETER
17. AUXILIARY/REMOTE VALVE AV5 TIMER CONTROL POTENTIOMETER
18. 1ST/2ND AUXILIARY/REMOTE VALVE CONTROL JOYSTICK
18a. AUXILIARY/REMOTE VALVE AV1 CONTROL POTENTIOMETER
18b. AUXILIARY/REMOTE VALVE AV2 CONTROL POTENTIOMETER
19. 3RD/4TH AUXILIARY/REMOTE VALVE CONTROL JOYSTICK
19a. AUXILIARY/REMOTE VALVEAV3 CONTROL POTENTIOMETER
19b. AUXILIARY/REMOTE VALVE AV4 CONTROL POTENTIOMETER
20. AUXILIARY/REMOTE VALVE CONTROLLER DIAGNOSTIC CONNECTOR 2
21. SUSPENDED FRONT AXLE CONTROLLER CONNECTOR

A. TO RANGE SKIP SWITCH (MULTIFUNCTION LEVER)
B. TO HITCH UP/DOWN SWITCH (MULTIFUNCTION LEVER)
C. TO CAN BUS CIRCUIT
D. FROM SPLICE RC-SP5 (REFER TO CAB CONTROLLER CIRCUIT SECTION 10006)

## CAN Bus Schematic Circuit (For XTX Series XtraSpeed - E Plus Tractors)




MI05H030

### Key

1. ENGINE HARNESS TERMINATION RESISTOR (XTX215 TRACTORS ONLY)
2. TRANSMISSION HARNESS TERMINATION RESISTOR
3. DIAGNOSTIC CONNECTOR (9 PIN)

**NOTE:** *For XTX185 and XTX200 tractors the engine harness termination resistor is located within the engine controller.*

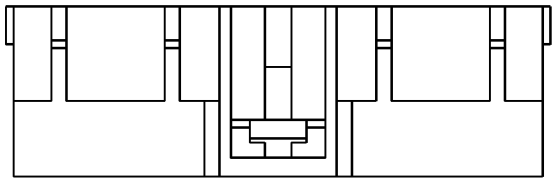
https://truckmanualshub.com/



# MAIN CONNECTORS

## Connector 26

**Location: Right Hand Console**



477I96

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

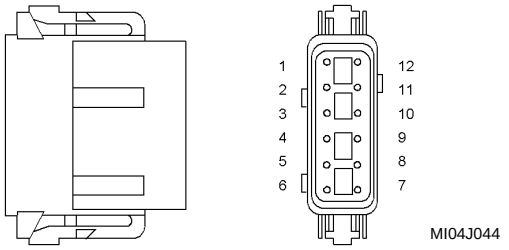
| Cavity | Wire No | Circuit |
|---|---|---|
| A | 590 BR | AUDIBLE ALARM |
| B | 707 P | LH TAIL/POSITION LIGHT |
| C | 708 P | RH TAIL/POSITION LIGHT |
| D | - - - - - | OPEN |
| E | 590 R | CAB CONTROLLER SWITCHED B+ |
| F | 501 R | HITCH/PTO CONTROLLER SWITCHED B+ |
| G | 784 V | REAR FENDER WORK LIGHTS |
| H | 810 R | SEAT B+ |
| J | 530 R | MFD AND DIFF LOCK B+ |
| K | 134 R | AUXILIARY POWER CONNECTOR SWITCHED B+ |
| L | 756 P | RH TURN SIGNAL |
| M | 757 P | LH TURN SIGNAL |
| N | (IIC) R | IIC UNSWITCHED POWER B+ |
| P | 133 R | AUXILIARY POWER FENDER HARNESS CONNECTOR (*)<br>7 PIN CONNECTOR (**) |
| R | 135 R | RH CONSOLE AUXILIARY POWER UNSWITCHED B+ |
| S | 817 R | CIGAR LIGHTER |
| T | 269 Y | PARK BRAKE WARNING LIGHT |
| U | 702 R | BRAKE RELAY B+ |
| V | - - - - - | OPEN |
| W | 785 V | REAR FOG LIGHTS (EUR) |
| X | 254 Y | PARK LOCK SIGNAL |
| Y | 276 LB | 1000 RPM PTO SWITCH |
| Z | (VP) R | AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ (XTRASPEED - E PLUS ONLY) |

*(*) European Specification Tractors Only.*

*(**) American Specification Tractors Only.*

## Connector 27

**Location: Right Hand Console**




**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

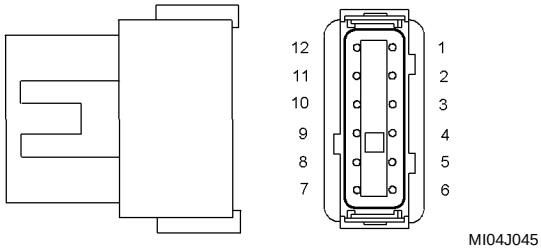
| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 240 Y | AIR TRAILER BRAKE PRESSURE |
| 2 | 515 R | LOADER CONTROLS B+ |
| 3 | 656 Y | CLUTCH POSITION SIGNAL |
| 4 | - - - - - | OPEN |
| 5 | 660 Y | BOTTOM OF CLUTCH SIGNAL |
| 6 | 233 Y | FUEL LEVEL SENDER |
| 7 | 656 BR | CLUTCH POSITION RETURN |
| 8 | 656 R | CLUTCH POSITION B+ |
| 9 | 536 LB | LH BRAKE SIGNAL |
| 10 | 267 Y | HYDRAULIC FILTER RESTRICTION SWITCH |
| 11 | - - - - - | OPEN |
| 12 | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 28

**Location: Right Hand Console**



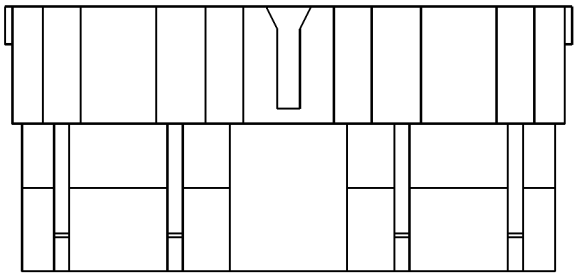

MI04J045

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 2 | 511 T | FORWARD SIGNAL |
| 3 | 562 R | F/N/R, F/N/R/P 12V SUPPLY |
| 4 | 606 W | IIC SWITCHED POWER SENSING |
| 5 | - - - - - | OPEN |
| 6 | 513 T | REVERSE SIGNAL |
| 7 | 531 LB | RH BRAKE SIGNAL |
| 8 | 514 T | NEUTRAL SIGNAL |
| 9 | - - - - - | OPEN |
| 10 | 281 Y | RADAR SIGNAL (HITCH) |
| 11 | 282 Y | RADAR PRESENT (IIC) |
| 12 | 563 LB | IMPLEMENT DOWN SWITCH |
| 2 | 511 T | FORWARD SIGNAL |

## Connector 29

**Location: Right Hand Console**



478I96

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

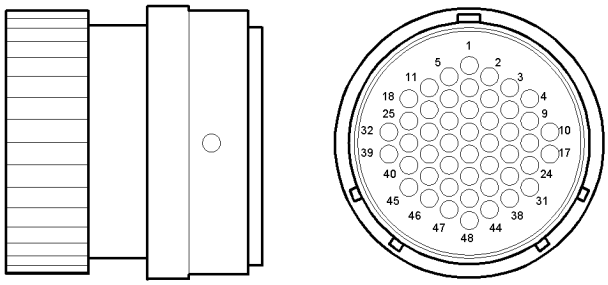
| Cavity | Wire No | Circuit |
|---|---|---|
| A | 835 O | FRONT WINDSCREEN WASHER |
| B | 845 O | REAR WINDSHIELD WASHER |
| C | 550 R | FRONT PTO B+ |
| D | 551 LB | FRONT PTO SIGNAL |
| E | 590 R | REAR PTO SWITCHED B+ |
| F | 161 R | AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ |
| G | 134 R | IIIC SWITCHED POWER |
| H | 776 P | ROTARY BEACON LIGHT |
| J | 531 R | MFD AXLE SUSPENSION UNSWITCHED POWER |
| K | 530 R | MFD AXLE SUSPENSION SWITCHED POWER |
| L | 900 Y | CAN HIGH |
| M | 900 LG | CAN LOW |
| N | - - - - - | OPEN |
| P | 500B R | CAB CONTROLLER UNSWITCHED B+ |
| R | 550 R | TRANSMISSION CONTROLLER SWITCHED B+ |
| S | 400 R | TRANSMISSION CONTROLLER UNSWITCHED B+ |
| T | 643 Y | FOOT THROTTLE SIGNAL |
| U | 643 BR | FOOT THROTTLE 0V RETURN |
| V | 160 R | AUXILIARY/REMOTE VALVE CONTROLLER UNSWITCHED B+ |
| W | - - - - - | OPEN |
| X | 660 R | CAB SUSPENSION CONTROLLER SWITCHED B+ |
| Y | (ARM) R | ARMREST SWITCHED B+ |
| Z | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 40

**Location: Cab Floor (Right Hand Console)**




MI05F174

**RIGHT HAND CONSOLE HARNESS TO TRANSMISSION HARNESS (TRANSMISSION HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 543 LB | MFD SOLENOID B+ |
| 2 | 233 Y | FUEL LEVEL SENDER |
| 3 | 507 R | +8 V POSITION POTENTIOMETER |
| 4 | 507 LB | POSITION SIGNAL |
| 5 | 507 BR | POSITION POTENTIOMETER LOW |
| 6 | (LINK) R | TRANSMISSION CONTROLLER TO CAB CONTROLLER LINK |
| 7 | 500 BR/W | HITCH CONTROLLER CLEAN GROUND |
| 8 | 269 Y | PARK BRAKE WARNING LIGHT |
| 9 | 539 LB | DIFF LOCK SOLENOID B+ |
| 10 | 511 R | HITCH SOLENOID B+ |
| 11 | 513 LB | HITCH RAISE SOLENOID |
| 12 | 514 R | HITCH PIN +8 VOLTS |
| 13 | 515 LB | LH HITCH PIN SIGNAL |
| 14 | 514 BR | HITCH PINS LOW |
| 15 | 514 LB | RH HITCH PIN SIGNAL |
| 16 | 540 R | 4TH AUXILIARY VALVE |
| 17 | 512 LB | HITCH LOWER SOLENOID |
| 18 | 215 Y | WHEEL SPEED SIGNAL |
| 19 | 597 LB | PTO SOLENOID B+ |
| 20 | 597 BR | PTO SOLENOID GROUND |
| 21 | 267 Y | HYDRAULIC FILTER SIGNAL |
| 22 | 280 BR/W | PARK LOCK RETURN |
| 23 | - - - - - | OPEN |
| 24 | 900 Y | CAN HIGH |
| 25 | 900 LG | CAN LOW |
| 26 | 224 Y | PTO SPEED SIGNAL |

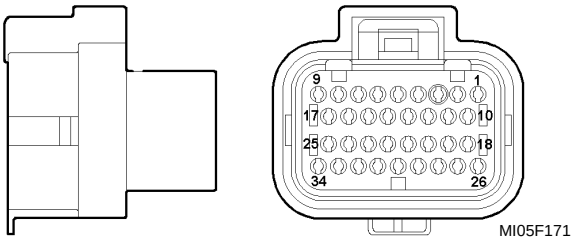
| Cavity | Wire No | Circuit |
|---|---|---|
| 27 | (4TH) Y | XTRASPEED TRACTORS FROM PIN JJE3500646 - NOT USED |
| 28 | - - - - - | OPEN |
| 29 | - - - - - | OPEN |
| 30 | 276 T | 540/1000 PTO SWITCH B+ |
| 31 | 240 Y | TRAILER BRAKE PRESSURE |
| 32 | 276 T | 540/1000 PTO SWITCH |
| 33 | 551 O | FRONT PTO SOLENOID |
| 34 | 500 BR/W | IIC CLEAN GROUND |
| 35 | (1ST) Y | XTRASPEED TRACTORS FROM PIN JJE3500646 - NOT USED |
| 36 | 542 T | 4TH AUXILIARY VALVE RAISE |
| 37 | 541 T | 4TH AUXILIARY VALVE LOWER |
| 38 | 400 R | TRANSMISSION CONTROLLER UNSWITCHED B+ |
| 39 | 516 T | LOADER SOLENOID RAISE |
| 40 | 515 T | LOADER SOLENOID LOWER |
| 41 | 550 R | TRANSMISSION CONTROLLER SWITCHED B+ |
| 42 | (2ND) Y | XTRASPEED TRACTORS FROM PIN JJE3500646 - NOT USED |
| 43 | (3RD) Y | XTRASPEED TRACTORS FROM PIN JJE3500646 - NOT USED |
| 44 | 500 BR/W | CAB CONTROLLER CLEAN GROUND |
| 45 | (VP IN) R | AUXILIARY/REMOTE VALVES B+ (XTRASPEED - E PLUS ONLY) |
| 46 | 656 R | CLUTCH POSITION B+ |
| 47 | 656 Y | CLUTCH POSITION SIGNAL |
| 48 | 656 BR | CLUTCH POSITION RETURN |

https://truckmanualshub.com/



## Connector 44

**Location: Auxiliary/Remote Valve Controller**




MI05F171

**FENDER HARNESS TO AUXILIARY/REMOTE VALVE CONTROLLER**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 540 BR | ARMREST CONTROL GROUND |
| 2 | 529 DB | VALVE 5 TIMER SIGNAL |
| 3 | 161 R | SWITCHED POWER |
| 4 | 160 R | UNSWITCHED POWER |
| 5 | 516 DB | VALVE 2 CONTROL SIGNAL |
| 6 | BR/W | CLEAN GROUND |
| 7 | 514 DB | VALVE 3 CONTROL SIGNAL |
| 8 | 513 DB | VALVE 3 FLOW SIGNAL |
| 9 | (VP) T | VALVE POWER (VP OUT) |
| 10 | 540 R | ARMREST CONTROL 5 VOLT |
| 11 | 501 DB | ENABLE SIGNAL |
| 12 | 900 Y | CAN HIGH |
| 13 | 900 LG | CAN LOW |
| 14 | (AVC) W | CONTROLLER PROGRAMMING |
| 15 | 532 DB | VALVE 4 CONTROL SIGNAL |
| 16 | 530 DB | VALVE 4 FLOW SIGNAL |
| 17 | (VP) R | VP SWITCHED POWER |

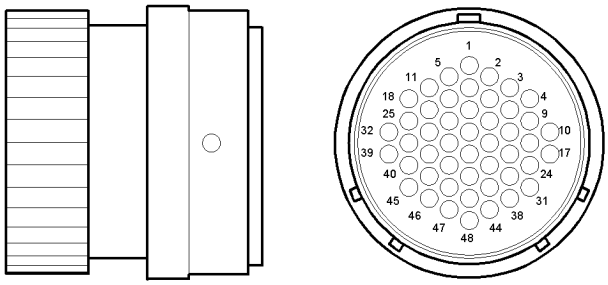
| Cavity | Wire No | Circuit |
|---|---|---|
| 18 | 517 DB | VALVE 5 LOWER SIGNAL |
| 19 | (TX) W | RS232 IN (PROGRAMMING) |
| 20 | (RX) W | RS232 OUT (PROGRAMMING) |
| 21 | 518 DB | VALVE 5 RAISE SIGNAL |
| 22 | 515 DB | VALVE 1 CONTROL SIGNAL |
| 23 | 511 DB | VALVE 1 FLOW SIGNAL |
| 24 | 531 Db | VALVE 5 FLOW SIGNAL |
| 25 | 502 Db | STOP SWITCH |
| 26 | 512 DB | VALVE 2 FLOW SIGNAL |
| 27 | 503 DB | STOP SIGNAL |
| 28 | 528 DB | VALVE 4 TIMER SIGNAL |
| 29 | 522 DB | ENABLE LIGHT RETURN |
| 30 | - - - - - | NOT USED |
| 31 | - - - - - | NOT USED |
| 32 | 508 DB | VALVE 1 TIMER SIGNAL |
| 33 | 509 DB | VALVE 2 TIMER SIGNAL |
| 34 | 510 DB | VALVE 3 TIMER SIGNAL |

https://truckmanualshub.com/



## Connector 50

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO ARMREST HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 540 R | POTENTIOMETER REFERENCE 5V |
| 2 | 540 BR | ARM REST 0V |
| 3 | 508 DB | AUXILIARY VALVE TIMER 1 SIGNAL |
| 4 | 509 DB | AUXILIARY VALVE TIMER 2 SIGNAL |
| 5 | 510 DB | AUXILIARY VALVE TIMER 3 SIGNAL |
| 6 | 528 DB | AUXILIARY VALVE TIMER 4 SIGNAL |
| 7 | 529 DB | AUXILIARY VALVE TIMER 5 SIGNAL |
| 8 | 511DB | AUXILIARY VALVE FLOW 1 SIGNAL |
| 9 | 512 DB | AUXILIARY VALVE FLOW 2 SIGNAL |
| 10 | 513 DB | AUXILIARY VALVE FLOW 3 SIGNAL |
| 11 | 530 DB | AUXILIARY VALVE FLOW 4 SIGNAL |
| 12 | 531 DB | AUXILIARY VALVE FLOW 5 SIGNAL |
| 13 | 644 R | REMOTE THROTTLE (5V) |
| 14 | 644Y | REMOTE THROTTLE SIGNAL |
| 15 | 644 BR | REMOTE THROTTLE (0V) |
| 16 | 502 DB | STOP SWITCH |
| 17 | 503 DB | STOP SWITCH |
| 18 | (ARM) R | GEAR UP SHIFT SWITCHED B+ |
| 19 | 525 DB | GEAR UP SHIFT SIGNAL |
| 20 | (ARM) R | GEAR DOWN SHIFT SWITCHED B+ |
| 21 | 524 DB | GEAR UP SHIFT SIGNAL |
| 22 | 501 DB | AUXILIARY VALVE ENABLE LIGHT SIGNAL |
| 23 | 522 DB | AUXILIARY VALVE ENABLE LIGHT GROUND |
| 24 | 510 LB | HITCH RAISE SIGNAL |
| 25 | 509 LB | HITCH LOWER SIGNAL |
| 26 | 562 LB | HITCH FAST LOWER SIGNAL |

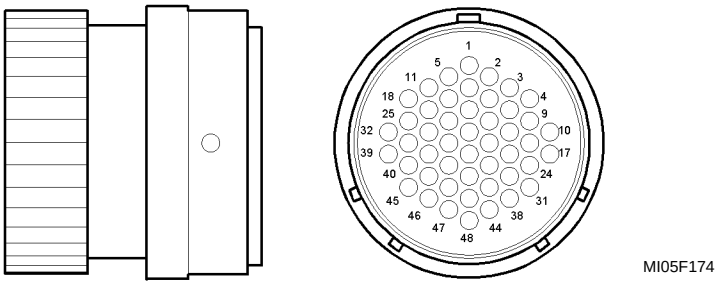
| Cavity | Wire No | Circuit |
|---|---|---|
| 27 | 515 DB | AUXILIARY VALVE JOYSTICK 1A SIGNAL |
| 28 | 516 DB | AUXILIARY VALVE JOYSTICK 1B SIGNAL |
| 29 | 514 DB | AUXILIARY VALVE JOYSTICK 2A SIGNAL |
| 30 | 532 DB | AUXILIARY VALVE JOYSTICK 2B SIGNAL |
| 31 | 518 DB | 5TH AUXILIARY VALVE RAISE |
| 32 | 517 DB | 5TH AUXILIARY VALVE LOWER |
| 33 | 527 DB | RANGE SKIP SWITCH SIGNAL |
| 34 | 527 R | RANGE SKIP SIGNAL |
| 35 | (ARM) R | ARMREST CONTROL SWITCHED B+ |
| 36 | BR/W | ARMREST CONTROL CLEAN GROUND |
| 37 | 501 R | HITCH CONTROL SWITCH B+ |
| 38 | 508 LB | HITCH ENABLE LIGHT |
| 39 | - - - - - | OPEN |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | - - - - - | OPEN |
| 44 | - - - - - | OPEN |
| 45 | - - - - - | OPEN |
| 46 | - - - - - | OPEN |
| 47 | - - - - - | OPEN |
| 48 | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 51

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 757 P | LEFT HAND TURN SIGNAL |
| 2 | 756 P | RIGHT HAND TURN SIGNAL |
| 3 | 507 R | HITCH POSITION POTENTIOMETER B+ |
| 4 | 707 P | LEFT HAND REAR SIDE/POSITION LIGHT |
| 5 | 708 P | RIGHT HAND REAR SIDE/ POSITION LIGHT |
| 6 | 785 V | REAR FOG LIGHT |
| 7 | 702 P | STOP LIGHTS |
| 8 | (VP) T | AUXILIARY/REMOTE VALVE VP OUT |
| 9 | 591 DB | DIFFERENTIAL LOCK SOLENOID B+ |
| 10 | 511 R | HITCH SOLENOID B+ |
| 11 | 835 O | FRONT WINDSCREEN WASHER |
| 12 | 845 O | REAR WINDSCREEN WASHER |
| 13 | 776 P | BEACON LIGHT (EUROPEAN SPECIFICATION TRACTORS ONLY) |
| 14 | 514 BR | LOAD PIN RETURN |
| 15 | 514 LB | RIGHT HAND LOAD PIN SIGNAL |
| 16 | 512 LB | HITCH LOWER SOLENOID |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | - - - - - | OPEN |
| 22 | - - - - - | OPEN |
| 23 | 224 Y | PTO SPEED SIGNAL |
| 24 | 850 R | CAB SUSPENSION CONTROLLER SWITCHED B+ |

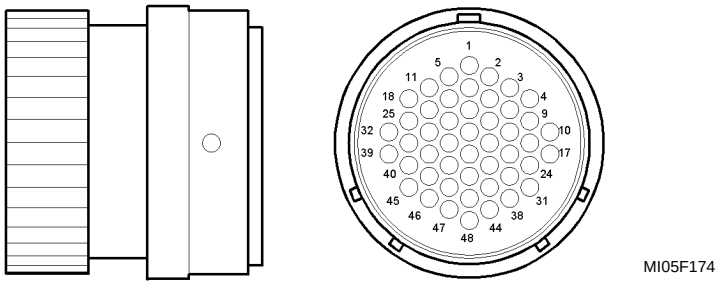
| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 513 LB | HITCH LOWER SOLENOID |
| 26 | 514 R | LOAD PIN 8V SUPPLY |
| 27 | 515 LB | LEFT HAND LOAD PIN SIGNAL |
| 28 | - - - - - | OPEN |
| 29 | 133 R | AUXILIARY POWER SWITCHED B+ |
| 30 | 784 P | REAR WORK LIGHTS |
| 31 | 507 LB | HITCH POSITION POTENTIOMETER SIGNAL |
| 32 | 507 BR | HITCH POSITION POTENTIOMETER RETURN |
| 33 | (LINK) R | CAB CONTROLLER/ TRANSMISSION CONTROLLER LINK |
| 34 | BR/W | HITCH CONTROLLER CLEAN GROUND |
| 35 | BR/W | CLEAN GROUND |
| 36 | 597 LB | PTO SOLENOID B+ |
| 37 | 597 BR | PTO SOLENOID RETURN |
| 38 | - - - - - | OPEN |
| 39 | - - - - - | OPEN |
| 40 | 542 LB | MFD RELAY SUPPLY |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | - - - - - | OPEN |
| 44 | - - - - - | OPEN |
| 45 | - - - - - | OPEN |
| 46 | - - - - - | OPEN |
| 47 | - - - - - | OPEN |
| 48 | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 52

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 560 R | HITCH UPPER LIMIT POTENTIOMETER SUPPLY |
| 2 | 560 LB | HITCH UPPER LIMIT POTENTIOMETER SIGNAL |
| 3 | 560 BR | HITCH UPPER LIMIT POTENTIOMETER RETURN |
| 4 | 502 R | HITCH DROP SPEED POTENTIOMETER SUPPLY |
| 5 | 502 LB | HITCH DROP SPEED POTENTIOMETER SIGNAL |
| 6 | 502 BR | HITCH DROP SPEED POTENTIOMETER RETURN |
| 7 | 504 LB | HITCH POSITION COMMAND POTENTIOMETER SIGNAL |
| 8 | 504 R | HITCH POSITION COMMAND POTENTIOMETER SUPPLY |
| 9 | 504 BR | HITCH POSITION COMMAND POTENTIOMETER RETURN |
| 10 | 505 R | HITCH LOAD COMMAND POTENTIOMETER SUPPLY |
| 11 | 505 LB | HITCH LOAD COMMAND POTENTIOMETER SIGNAL |
| 12 | 505 BR | HITCH LOAD COMMAND POTENTIOMETER RETURN |
| 13 | - - - - - | OPEN |
| 14 | - - - - - | OPEN |
| 15 | - - - - - | OPEN |
| 16 | - - - - - | OPEN |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | 570 LB | SLIP CONTROL LIGHT SUPPLY |
| 22 | 567 LB | SLIP CONTROL ON SIGNAL |
| 23 | - - - - - | OPEN |
| 24 | 593 DB | AUTO PTO OFF SIGNAL |

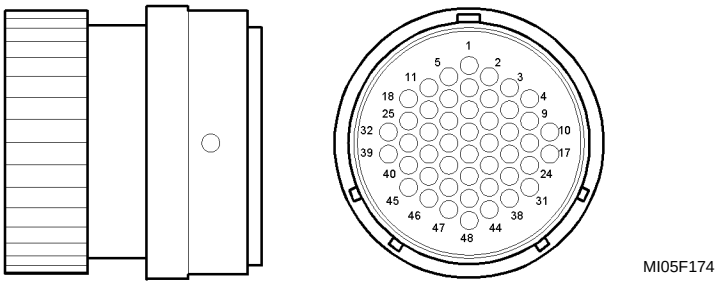
| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 531 R | MFD AXLE SUSPENSION CONTROLLER UNSWITCHED B+ |
| 26 | 643 Y | FOOT THROTTLE SIGNAL |
| 27 | 281 Y | RADAR SIGNAL |
| 28 | 506 R | HITCH TRAVEL POTENTIOMETER SUPPLY |
| 29 | 506 LB | HITCH TRAVEL POTENTIOMETER SIGNAL |
| 30 | 506 BR | HITCH TRAVEL POTENTIOMETER RETURN |
| 31 | 590 R | REMOTE PTO SWITCH B+ |
| 32 | - - - - - | OPEN |
| 33 | 161 R | AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ |
| 34 | - - - - - | OPEN |
| 35 | 500B R | CAB CONTROLLER UNSWITCHED B+ |
| 36 | 572 LB | RIDE CONTROL ON SIGNAL |
| 37 | 573 LB | RIDE CONTROL OVERRIDE SIGNAL |
| 38 | - - - - - | OPEN |
| 39 | 282 Y | RADAR PRESENT SIGNAL |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | 534 DB | FRONT AXLE SUSPENSION UP SIGNAL |
| 44 | 535 DB | MFD AXLE SUSPENSION DOWN SIGNAL |
| 45 | 533 DB | MFD AXLE SUSPENSION REGULATION ON |
| 46 | 542 DB | MFD AXLE SUSPENSION UNSWITCHED UP SIGNAL |
| 47 | 563 DB | MFD AXLE SUSPENSION INDICATOR LIGHT |
| 48 | 530 R | MFD AXLE SUSPENSION SWITCHED B+ |

https://truckmanualshub.com/



## Connector 53

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 532 LB | DIFFERENTIAL LOCK ON SIGNAL |
| 2 | 280 BR | PARK LOCK SOLENOID RETURN |
| 3 | 591 LB | PTO ON SIGNAL |
| 4 | 592 LB | PTO OFF SIGNAL |
| 5 | 592 DB | AUTO PTO ON SIGNAL |
| 6 | 501 R | HITCH/PTO CONTROLLER SWITCHED B+ |
| 7 | 541 LB | MFD ON SIGNAL |
| 8 | 254 Y | PARK LOCK ON SIGNAL |
| 9 | 272 Y | CREEP ON SIGNAL |
| 10 | 590 BR | PTO INDICATOR LIGHT |
| 11 | 563 LB | TRAILER IMPLEMENT SIGNAL (INSTRUMENT CLUSTER) |
| 12 | 594 DB | AUTO PTO SET SIGNAL |
| 13 | 562 R | SHUTTLE SWITCH 12V SUPPLY |
| 14 | 511 T | FORWARD SIGNAL |
| 15 | - - - - - | OPEN |
| 16 | 595 DB | AUTO PTO LIGHT |
| 17 | - - - - - | OPEN |
| 18 | 215 Y | WHEEL SPEED SIGNAL |
| 19 | 539 LB | AUTO DIFFERENTIAL LOCK LIGHT |
| 20 | - - - - - | OPEN |
| 21 | - - - - - | OPEN |
| 22 | 590 R | CAB CONTROLLER SWITCHED B+ |
| 23 | 160 R | AUXILIARY/REMOTE VALVE CONTROLLER UNSWITCHED B+ |
| 24 | 276 LB | 540/1000 PTO SELECTOR SWITCH SIGNAL |

| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 513 T | REVERSE SIGNAL |
| 26 | (ARM) R | ARMREST CONTROL SWITCHED B+ |
| 27 | (vp) R | AUXILIARY/REMOTE VALVE CONTROLLER VP IN |
| 28 | 514 T | NEUTRAL SIGNAL |
| 29 | 303 T | OPERATOR PRESENCE SWITCH SIGNAL |
| 30 | - - - - - | OPEN |
| 31 | - - - - - | OPEN |
| 32 | - - - - - | OPEN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |
| 35 | 565 LB | AUTO MFD ON SIGNAL |
| 36 | 546 LB | AUTO DIFFERENTIAL LOCK ON SIGNAL |
| 37 | 536 LB | LEFT HAND BRAKE SIGNAL |
| 38 | 531 LB | RIGHT HAND BRAKE SIGNAL |
| 39 | - - - - - | OPEN |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | 900 Y | CAN HIGH |
| 44 | 900 LG | CAN LOW |
| 45 | 660 Y | CAB CONTROLLER BOTTOM OF CLUTCH SIGNAL |
| 46 | 510 T | F/N/R, FOOT THROTTLE 5V REF |
| 47 | - - - - - | OPEN |
| 48 | 643 BR | FOOT THROTTLE 0V REF |

https://truckmanualshub.com/



# Section 10002

## HITCH/PTO CONTROLLER (Hitch, PTO, MFD and Differential Lock)

## Calibration, Error Codes, Troubleshooting and Schematics

## XTX Series Tractors

McCORMICK

SM 8-15061

© 2006 McCormick Tractors International Limited.
July 2005 (Revised September 2006)

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIAL TOOLS ..... 5

ELECTRONIC HITCH AND PTO CONTROL GENERAL INFORMATION
- CAN Bus Communication ..... 6
- Hitch Operation ..... 7
- PTO Control Operation ..... 7
- Operators Seat Switch Monitor and Alarm ..... 7

ERROR CODES GENERAL INFORMATION ..... 8
- Retrieving Instrument Cluster Displayed Active Error Codes. ..... 8

HITCH CALIBRATION ..... 9

PTO CALIBRATION ..... 13

CIRCUIT TESTING
- General Information ..... 16

CONTROLLER ERROR CODE TROUBLESHOOTING GUIDE
- PTO Error Codes ..... 17
  - PTO Error Code 1104 ..... 17
  - PTO Error Code 1105 ..... 17
  - PTO Error Code 1106 ..... 18
  - PTO Error Code 1201 ..... 18
  - PTO Error Code 1202 ..... 18
  - PTO Error Code 1204 ..... 19
  - PTO Error Code 1205 ..... 19
  - PTO Error Code 1206 ..... 19
  - PTO Error Code 1303 ..... 20
  - PTO Error Code 1304 ..... 20
  - PTO Error Code 1401 ..... 20
  - PTO Error Code 1402 ..... 21
  - PTO Error Code 1501 ..... 21
  - PTO Error Code 1502 ..... 21
  - PTO Error Code 1503 ..... 22
  - PTO Error Code 1601 ..... 22
  - PTO Error Code 1602 ..... 23
  - PTO Error Code 1603 ..... 23
  - PTO Error Code 1604 ..... 23
  - PTO Error Code 1605 ..... 24
  - PTO Error Code 1606 ..... 24
  - PTO Error Code 1607 ..... 24
  - PTO Error Code 1608 ..... 25
  - PTO Error Code 1609 ..... 25
  - PTO Error Code 1701 ..... 25
  - PTO Error Code 1702 ..... 26
  - PTO Error Code 1703 ..... 26
  - PTO Error Code 1704 ..... 26
  - PTO Error Code 1706 ..... 27

https://truckmanualshub.com/



PTO Error Code 1707 ....27
PTO Error Code 1801 ....27
PTO Error Code 1803 ....28
PTO Error Code 1804 ....28
PTO Error Code 1805 ....28
PTO Error Code 1806 ....29
PTO Error Code 1807 ....29
PTO Error Code 1808 ....29
PTO Error Code 1809 ....30
PTO Error Code 1810 ....30
PTO Error Code 1811 ....30
Hitch Error Codes ....31
Hitch Error Code 2164 ....31
Hitch Error Code 2165 ....31
Hitch Error Code 2166 ....31
Hitch Error Code 2167 ....32
Hitch Error Code 2168 ....32
Hitch Error Code 2169 ....32
Hitch Error Code 2170 ....33
Hitch Error Code 2171 ....33
Hitch Error Code 2173 ....33
Hitch Error Code 2174 ....34
Hitch Error Code 2175 ....34
Hitch Error Code 2176 ....34
Hitch Error Code 2177 ....35
Hitch Error Code 2178 ....35
Hitch Error Code 2201 ....35
Hitch Error Code 2202 ....36
Hitch Error Code 2203 ....36
Hitch Error Code 2206 ....36
Hitch Error Code 2207 ....37
Hitch Error Code 2208 ....37
Hitch Error Code 2209 ....38
Hitch Error Code 2210 ....38
Hitch Error Code 2211 ....38
Hitch Error Code 2212 ....39
Hitch Error Code 2213 ....39
Hitch Error Code 2214 ....39
Hitch Error Code 2215 ....40
Hitch Error Code 2300 ....40
Hitch Error Code 2301 ....40
Hitch Error Code 2302 ....41
Hitch Error Code 2303 ....41
Hitch Error Code 2304 ....41
Hitch Error Code 2305 ....42
Hitch Error Code 2306 ....42
Hitch Error Code 2307 ....42
Hitch Error Code 2308 ....43
Hitch Error Code 2309 ....43
Hitch Error Code 2310 ....44
Hitch Error Code 2311 ....44
Hitch Error Code 2313 ....45
Hitch Error Code 2314 ....45

https://truckmanualshub.com/



Hitch Error Code 2401 ..... 45
Hitch Error Code 2402 ..... 46
Hitch Error Code 2403 ..... 46
Hitch Error Code 2404 ..... 46
Hitch Error Code 2405 ..... 47
Hitch Error Code 2406 ..... 47
Hitch Error Code 2407 ..... 47
Hitch Error Code 2408 ..... 48
Hitch Error Code 2409 ..... 48
Hitch Error Code 2410 ..... 49
Hitch Error Code 2411 ..... 49
Hitch Error Code 2412 ..... 50

COMPONENT IDENTIFICATION
Instrument Panel Components ..... 51
Right Hand Console Components (XtraSpeed Tractors Only) ..... 52
Right Hand Console Components (XtraSpeed - E Tractors Only) ..... 53
Right Hand Console and Armrest Components
(XtraSpeed - E Plus Tractors Only) ..... 54
Rear Fender Components (XtraSpeed - E Plus Tractors Only) ..... 55
Transmission Components (European Specification Tractors) ..... 56
Transmission Components (American Specification Tractors) ..... 57

HITCH/PTO CONTROLLER SCHEMATIC CIRCUITS
Hitch/PTO Controller Pin Identification ..... 59
Hitch/PTO Schematic Circuit (For XtraSpeed Tractors) ..... 60
Hitch/PTO Schematic Circuit (For XtraSpeed - E Tractors) ..... 62
Hitch/PTO Schematic Circuit (For XtraSpeed - E Plus Tractors) ..... 64
Differential and MFD Schematic Circuit (For XtraSpeed and XtraSpeed - E Tractors) ..... 66
Differential and MFD Schematic Circuit (For XtraSpeed - E Plus Tractors) ..... 67

CAN BUS SCHEMATIC CIRCUITS ..... 68
CAN Bus Schematic Circuit (For XtraSpeed and XtraSpeed - E Tractors) ..... 68
CAN Bus Schematic Circuit (For XtraSpeed - E Plus Tractors) ..... 69

MAIN CONNECTORS ..... 71

https://truckmanualshub.com/



# SPECIAL TOOLS



DD98H120

**MC2616 MULTIMETER KIT includes:**
**MC2616-1 MULTIMETER ONLY**
**MC2616-2 TEST LEADS**
**MC2616-3 TEMPERATURE PROBE**




**1025T1 McCORMICK DIAGNOSTIC CENTRE**
**1014T1 COMMUNICATIONS ADAPTER**



**MC2656 TEST PROBE KIT**




**MC31000B HARNESS REPAIR KIT (EUROPE)**

https://truckmanualshub.com/



# ELECTRONIC HITCH AND PTO CONTROL GENERAL INFORMATION

The hitch/PTO controller controls the correct operation of the rear hitch by processing and monitoring signals directly from the following switches and sensors.

- Hitch up/down switch.
- Hitch position command potentiometer.
- Hitch load command potentiometer.
- Hitch upper limit potentiometer.
- Hitch drop speed potentiometer.
- Hitch travel potentiometer.
- Slip and ride control switches.
- Hitch remote switches.
- Hitch position potentiometer.
- Load pin sensors.
- Wheel speed sensor.
- Ground speed radar.

The hitch/PTO controller also controls the correct operation of the rear PTO, MFD and differential lock by processing and monitoring signals directly from the following switches and sensors.

- PTO switch.
- Auto PTO switch.
- PTO speed sensor.
- 540/1000 rpm speed selector switch.
- PTO remote switches.
- Operator presence switch.
- MFD switch (on/auto)
- Differential lock switch (on/auto).

The hitch controller also transmits and receives information over the CAN Bus circuit for the following:

- Diagnostics and configuration through the McCormick Diagnostic Centre.
- Slip control setting from the instrument cluster.
- MFD engagement when park lock is engaged from the transmission controller (tractors equipped with park lock only).
- PTO status for engine power management control to the transmission controller.

## CAN Bus Communication

The CAN Bus circuit comprises of a twisted pair of wires, CAN High (Yellow) and CAN Low (Green), with a termination 120 Ohm resistor at each end. It is important that these wires remain twisted together and the termination resistors are connected to reduce any electrical interference that may disrupt the CAN messages.

https://truckmanualshub.com/



## Hitch Operation

The hitch will only operate when the system has been enabled. When the engine is started the hitch diagnostic light will illuminate to indicate the hitch is 'LOCKED' and needs to be enabled.

To enable the hitch, the hitch command control knob has to be moved to the position that corresponds with the position of the hitch.

If an error occurs during normal operation the hitch diagnostic light will begin to flash to indicate a fault. Faults in the hitch system are classified into four categories and the reaction of the hitch varies according to the severity of the fault.

1. HALT - Hitch is totally disabled and no electronic actuation is possible. The hitch enable lamp will be illuminated.
2. LIMP - Hitch can only be actuated by repeated operation of the hitch up/down switch or the hitch remote switch. The hitch will operate for 1.5 seconds. The tractor must be stationary. The hitch enable lamp will be illuminated and an error code will be displayed.
3. DEGRADED 2 - Due to a failure, the draft control is not operational. The hitch enable lamp will be illuminated and an error code will be displayed.
4. DEGRADED 1 - The hitch enable lamp is illuminated, hitch is operational and an error code will be displayed. Default hitch settings have replaced the operators hitch settings due to component failure.

Most DEGRADED 1 settings are intermittent and will clear. If errors continue corrective action must be taken.

## PTO Control Operation

The hitch/PTO controller provides automatic electro-hydraulic control of the 540 RPM and 1000 RPM Power Take Off (PTO) shafts.

A. Pulse Width Modulate (PWM) the electro-hydraulic PTO solenoid for controlled PTO clutch engagement and protection of the PTO shaft and implement driveline from damage due to excessive torque loads.
B. Automatically adjust the Pulse Width Modulation (Duty Cycle) of the PTO solenoid for 540 or 1000 rpm PTO operation.
C. Controls the PTO brake which is mechanically interlocked to the PTO clutch and does not require independent electrical control.
D. Monitor the PTO driveline to determine PTO RPM and initial motion.
E. Monitor engine speed and compare to PTO RPM to determine PTO clutch slippage.
F. Monitor PTO ON and OFF operator control switches, seat switch and EURO PTO 540/1000 RPM selector switch.
G. Monitor REMOTE PTO ON and OFF switches and AUTO PTO ON/OFF/SET switch.
H. Store starting PWM values, plus system configuration speed ratios for determining input frequency vs. speed relationships.

## Operators Seat Switch Monitor and Alarm

If the PTO is engaged and the seat switch indicates that the operator is not seated for 2 seconds continuously an audible alarm will sound for 7 seconds or until the operator is seated. If the seat switch does not change position for 25 hours the PTO controller will assume the seat switch is faulty. The NEUTRAL lamp will flash and an error code will be stored. The PTO controller will continue to accumulate hours until the seat switch changes position.

https://truckmanualshub.com/



# ERROR CODES GENERAL INFORMATION

Each controller on the tractor continually monitors the control systems for errors. If an error is detected a error message will be transmitted over the CAN circuit to the instrument cluster, which will display an error warning to alert the operator to a problem. Depending on the nature of the fault the instrument cluster may display the Red STOP and or the Amber main warning light, also the audible alarm may sound.

**NOTE:** *The instrument cluster can only display current (active) error codes.*

Each controller will store all error codes that have been detected in the controller memory. These stored error codes can be viewed and cleared using the 'McCormick Diagnostic Centre'.

## Retrieving Instrument Cluster Displayed Active Error Codes.

If an error occurs during normal operation in one of the tractor controller systems the ! symbol will appear on the instrument cluster.

If the error warning symbol appears park the tractor on hard level ground. For tractors equipped with a F/N/R lever put the lever in neutral. For tractors equipped with a F/N/R/P lever the ever in PARK. Apply the park brake and turn the key to the OFF position.

> ⚠ **WARNING:** *Some errors will only be active when the tractor is operated, the codes for these errors will be stored in the relevant controller and MUST only be retrieved using the 'McCormick Diagnostic Centre'. DO NOT retrieve error codes when driving the tractor.*

To read the error codes carry out the following procedure:

Turn the key to the on position and press the menu button.

Each controller will be identified on the Universal Data Display as follows:

| | |
|---|---|
| **ENG** | - ENGINE |
| **IC** | - INSTRUMENT CLUSTER |
| **CC** | - CAB CONTROLLER |
| **TC** | - TRANSMISSION CONTROLLER |
| **CS** | - CAB SUSPENSION CONTROLLER |
| **EHR** | - HITCH/PTO CONTROLLER |
| **AVC** | - AUXILIARY VALVE CONTROLS |
| **AV1 to AV5** | - AUXILIARY VALVES |

The displayed controller will also display the number of active error codes.
Example:

**ENG** = ENGINE
**0** = No Active Errors

Press the button to scroll through each controller until EHR is displayed on the Universal Data Display (dot matrix).

**EHR** = ELECTRONIC HITCH CONTROLLER
**1** = 1 Active Error

To view the error code, press the menu button.

**16** = Error Code 2175

If more than one EHR error has been detected, press the button to identify the remaining errors.

For EHR Error Codes refer to the Error Code Troubleshooting Guide in this section.

https://truckmanualshub.com/



# HITCH CALIBRATION

**IMPORTANT:** *If the Hitch/PTO controller has been replaced the new controller must be configured prior to calibration. Refer to Section 10010.*

**IMPORTANT:** *Any implement connected to the tractor, hitch or PTO, MUST be removed from the tractor (in accordance to the implement manufactures instructions) prior to calibrating the Hitch/PTO controller.*

**IMPORTANT:** *The Hitch and PTO calibration procedure MUST be carried out with the right hand door CLOSED.*

## STEP 1

Park the tractor on hard level ground, apply the park brake. For tractors equipped with an F/N/R lever put the lever in neutral. For tractors equipped with an F/N/R/P lever put the lever in park. Stop the engine and remove the key.

## STEP 2

For tractors equipped with auto hitch, remove the auto hitch lift rods.

## STEP 3

Using suitable lifting equipment attach a suitable 90 kg (200 lb.) weight to the rear hitch. Make sure the the weight is clear of the ground when the hitch is fully lowered.

**IMPORTANT:** *The calibration procedure can be exited at any time by toggling the hitch up/down switch from the hitch DOWN to the hitch UP position.*

**NOTE:** *If the calibration procedure is exited before the procedure has been completed a error status message will appear on the instrument cluster, refer to "Hitch Calibration Error Status Messages:" on page 12.*

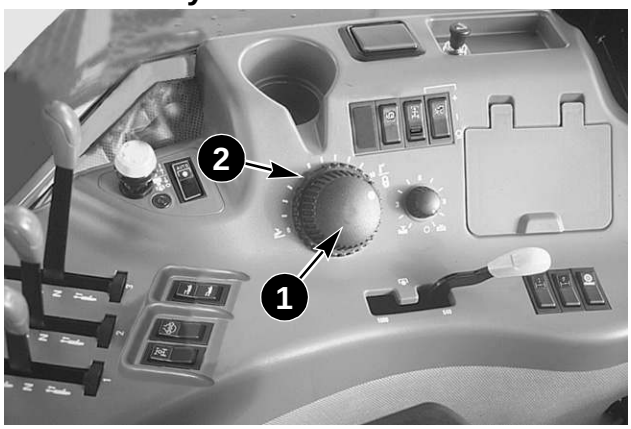
## To enter the Hitch Calibration Mode:

## STEP 4

Press and hold the hitch up/down switch in the down momentary position and start the engine. Release the hitch up/down switch 5 seconds after the engine has started.

> **WARNING:** *Never operate the engine in a closed building, proper ventilation is required under all circumstances.*

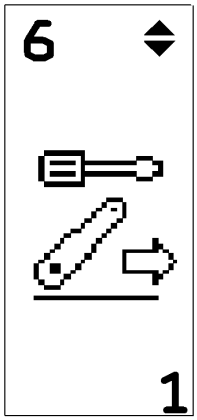
## STEP 5 XtraSpeed and XtraSpeed-E Tractors only




MD5C041

For XtraSpeed and XtraSpeed-E tractors turn the position control knob (1) outer locking ring (2) to position 5.

## STEP 6




MI05C025

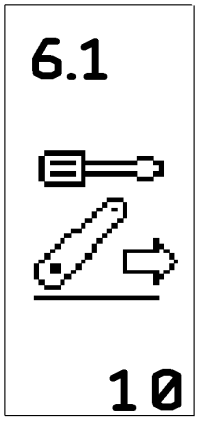
Press the menu button. Using the buttons scroll through the menu to enter the hitch calibration mode. When the hitch calibration mode has been selected the above icon will be displayed on the instrument cluster Universal Data Display. Press the menu button.

**IMPORTANT:** If '0' appears on the Universal display *the controller has not entered the calibration mode, repeat STEP 4.*

https://truckmanualshub.com/



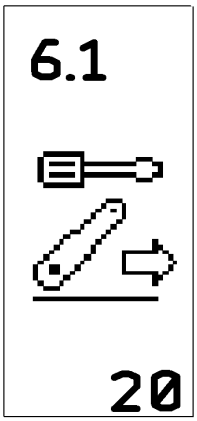
## STEP 7




MI05C026

When ‘10’ appears in the Universal Data Display, press and hold the hitch up/down switch in the down momentary position. When the hitch is fully lowered release the switch.

## STEP 8




MI05C033

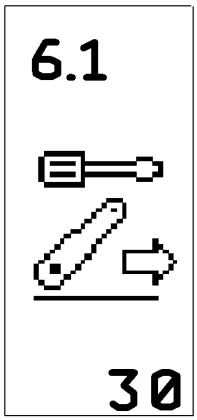
When ‘20’ appears in the Universal Data Display, move the hitch position control to the full raise position. For Xtraspeed and Xtraspeed - E tractors make sure the hitch position control does not move to the transport position.

**NOTE:** *For XtraSpeed and XtraSpeed-E tractors it will be necessary to press the button on the position control knob to move the control knob past position 5 the outer locking ring. When the control knob has past position 5 release the button to prevent the control knob moving into the transport position.*

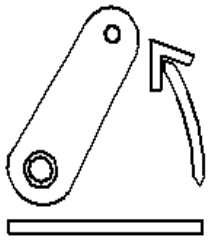
## STEP 9

Push the hitch up/down switch, into the down momentary position then release.

## STEP 10




MI05C027



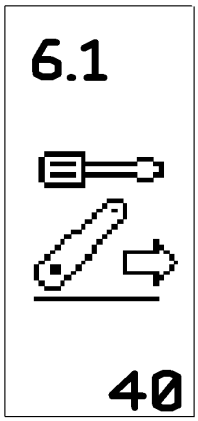
When ‘30’ appears in the Universal Data Display, the hitch will begin the hitch raise sequence.

During the hitch raise sequence the hitch position raise arrow on the right hand side of the instrument cluster will flash on and off.

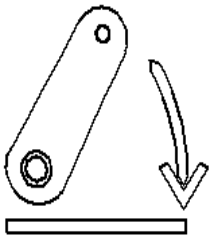
**IMPORTANT:** *DO NOT press hitch up/down switch at this stage.*

**NOTE:** *The hitch raise sequence may take several minutes to complete.*

## STEP 11




MI05C028



When ‘40’ in the Universal Data Display, move the hitch position control to the full lower position.

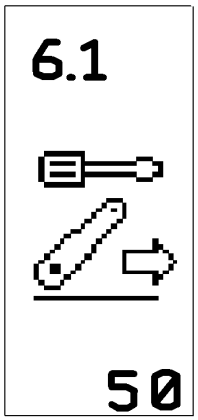
For XtraSpeed and XtraSpeed-E tractors press the button on the position control knob to by-pass the outer locking ring

Push the hitch up/down switch, into the down momentary position then release.

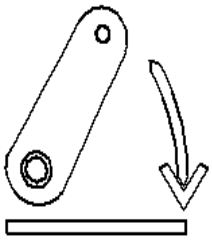
https://truckmanualshub.com/



**STEP 12**




MI05C029

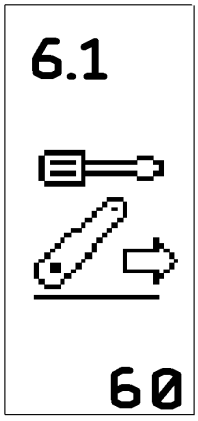


When ‘50’ in the Universal Data Display, the hitch will begin the hitch lower sequence.

During the hitch raise sequence the hitch position lower arrow on the right hand side of the instrument cluster will flash on and off.

**IMPORTANT:** *DO NOT press hitch up/down switch at this stage.*

**STEP 13**

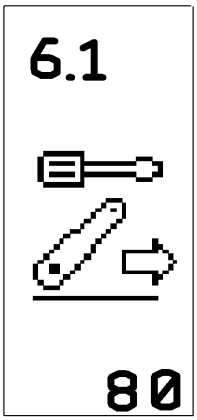



MI05C030

When ‘60’ appears in the Universal Data Display, the hitch will move to the full lower position.

When the hitch reaches the full lower position, push the hitch up/down switch, into the down momentary position then release.

**STEP 14**

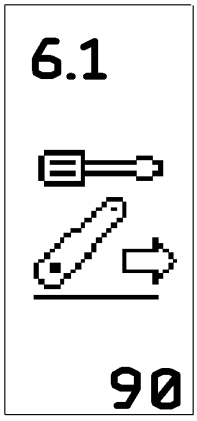



MI05C031

When ‘80’ appears on the instrument cluster the hitch /PTO controller EEPROM is being updated.

**NOTE:** *The calibration sequence number ‘80’ will only appear on the Universal Data Display very briefly.*

**STEP 15**




MI05C030

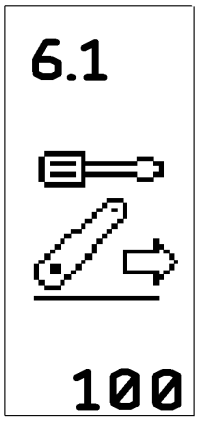
When ‘90’ Universal Data Display, the calibration procedure is complete. Stop the engine.

https://truckmanualshub.com/



## Hitch Calibration Error Status Messages:

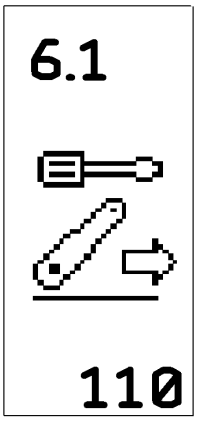
### STEP 16




MI05C037

If ‘100’ appears Universal Data Display, the hitch up/down switch has not been pressed into the down momentary position within 6 minutes of the hitch reaching the fully lower position (refer to STEP 13).

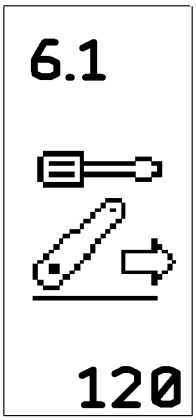
### STEP 17




MI05C038

If ‘110’ Universal Data Display, the calibration procedure has been exited by toggling the hitch up/down switch from the hitch up to the hitch down position or the controller has detected tractor movement during the calibration procedure.

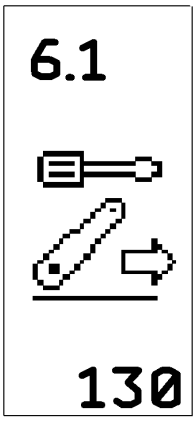
### STEP 18




MI05C039

If ‘120’ appears Universal Data Display, the controller has not been configured. Configure the Hitch/PTO controller, refer to Section 10010.

### STEP 19




MI05C040

If ‘130’ Universal Data Display, the hitch up/down switch has been pressed into down momentary position during STEP 10 or STEP 12 or the controller has detected a calibration error. The controller will record a calibration error code.

If the hitch up/down switch has not been pressed, check the calibration error codes, refer to “Retrieving Instrument Cluster Displayed Active Error Codes.” on page 8.

https://truckmanualshub.com/



# PTO CALIBRATION

**IMPORTANT:** *If the Hitch/PTO controller has been replaced the new controller must be configured prior to calibration. Refer to Section 10010.*

**IMPORTANT:** *Any implement connected to the tractor, hitch or PTO, MUST be removed from the tractor (in accordance to the implement manufactures instructions) prior to calibrating the Hitch/PTO controller.*

**IMPORTANT:** *The Hitch and PTO calibration procedure MUST be carried out with the right hand door CLOSED.*

## STEP 1

Park the tractor on hard level ground, apply the park brake. For tractors equipped with an F/N/R lever put the lever in neutral. For tractors equipped with an F/N/R/P lever put the lever in park. Stop the engine and remove the key.

**IMPORTANT:** *The calibration procedure can be exited at any time turning the PTO switch to the OFF position.*

**NOTE:** *If the calibration procedure is exited before the procedure has been completed a error status message will appear on the instrument cluster, refer to "PTO Calibration Error Status Messages:" on page 15.*

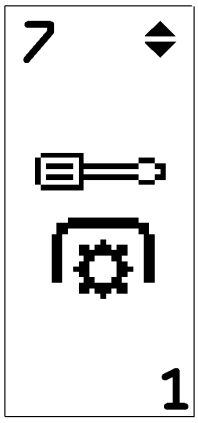
## To enter the PTO Calibration Mode:

## STEP 2

Put the PTO switch in the OFF position. Press and hold the HITCH up/down switch in the down momentary position and start the engine. Release the hitch up/down switch 5 seconds after the engine has started.

> **WARNING:** *Never operate the engine in a closed building, proper ventilation is required under all circumstances.*

## STEP 3

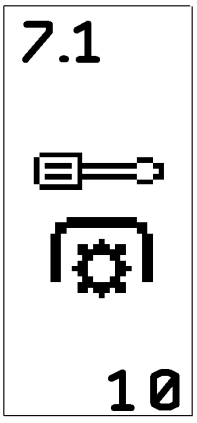



MI05C042

Press the menu button. Using the buttons scroll through the menu to enter the hitch calibration mode. When the PTO calibration mode has been selected the above icon will be displayed on the instrument cluster Universal Data Display. Press the menu button.

**IMPORTANT:** *If '0' appears on the Universal display the controller has not entered the calibration mode, repeat STEP 2.*

## STEP 4



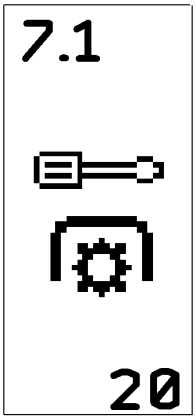

MI05C043

When '10' appears in the Universal Data Display, set the engine speed to 1000 rpm using the hand throttle.

https://truckmanualshub.com/



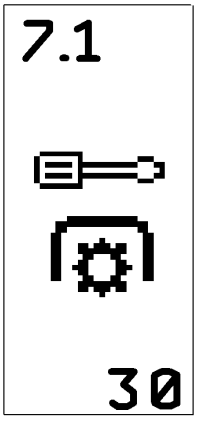
**STEP 5**




MI05C044

When ‘20’ appears in the Universal Data Display, move the PTO switch to the ON position.

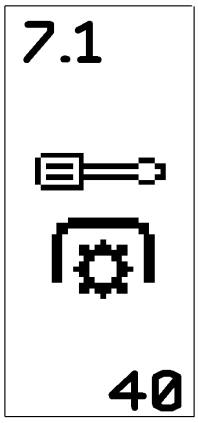
**STEP 6**



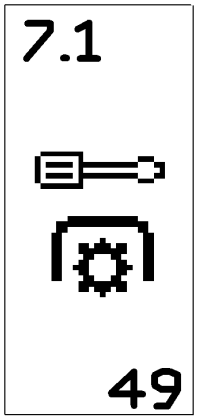

MI05C045

When ‘30’ appears in the Universal Data Display, the PTO shaft will start to turn.

**STEP 7**



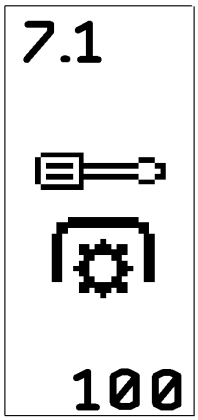

MI05C046




MI05C047

The Universal Data Display will then count up from ‘40’ to ‘49’ in quick succession with the PTO shaft turning.

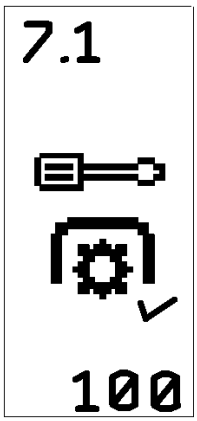
**STEP 8**



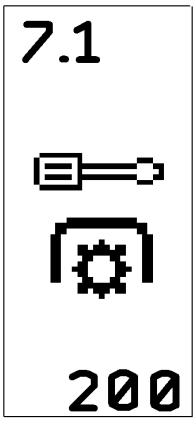

MI05C048

When ‘100’ appears in the Universal Data Display the calibration procedure is complete. Turn the PTO switch to the OFF position.

**STEP 9**




MI06M008




MI05C049

When ‘100’ and a ‘✓’ or ‘200’ (depending on downloaded software) appears in the Universal Data Display, the calibration is complete and controller has exited the calibration mode. Stop the engine.

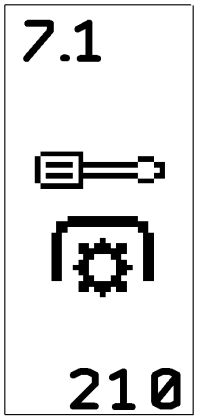
**NOTE:** *If ‘200’ appears in the Universal Data Display during the calibration procedure before ‘100’ (calibration complete) the calibration has been mode has been terminated. Repeat the calibration procedure.*

https://truckmanualshub.com/



## PTO Calibration Error Status Messages:

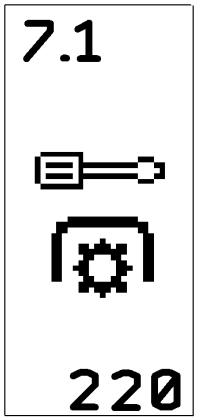
### STEP 10




MI05C050

If ‘210’ appears in the Universal Data Display, the engine speed is incorrect. Set the engine speed at 1000 rpm and repeat the calibration procedure.

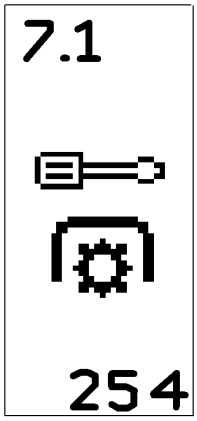
### STEP 11




MI05C051

If ‘220’ appears Universal Data Display, the PTO calibration has been exited. Repeat the calibration procedure.

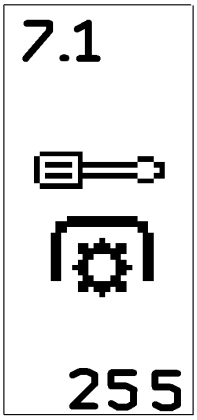
### STEP 12




MI05C052

If ‘254’ appears in the Universal Data Display, the PTO controller has detected a calibration error. The controller will record a calibration error code refer to “Retrieving Instrument Cluster Displayed Active Error Codes.” on page 8.

### STEP 13




MI05C053

If ‘255’ appears in the Universal Data Display, the controller has not been configured. The controller will record a calibration error code refer to “Retrieving Instrument Cluster Displayed Active Error Codes.” on page 8.

https://truckmanualshub.com/



# CIRCUIT TESTING

## General Information

> **WARNING:** *Never operate the engine in a closed building. Proper ventilation is required under all circumstances.*

**IMPORTANT:** *A single fault in the system may cause several different error codes to be recorded. Make a note of all active error codes for each controller before carrying out the troubleshooting procedure.*

**IMPORTANT:** *Replace the controller if the fault remains only after all necessary checks have been made.*

**IMPORTANT:** *For tractors equipped with cab suspension, all checks must be carried out with the cab fully lowered or with the cab supported with suitable cab supports. To lower the cab refer to Section 10011.*

**IMPORTANT:** *All electrical checks must be made with the tractor parked on hard level ground with park brake engaged, the shuttle lever in Neutral or Park and the engine OFF, unless otherwise stated.*

**IMPORTANT:** *Put blocks in front of and behind the rear wheels.*

**IMPORTANT:** *The battery must be at full charge and all connections must be clean and tight before testing. Only use a HIGH IMPEDANCE multimeter for the tests. Do not use a test lamp or damage to the switches may occur.*

**IMPORTANT:** *Use MC2656 test probe kit when making electrical checks at connectors to avoid the risk of shorting between the connector pins or terminals.*

**IMPORTANT:** *When disconnecting harness connectors, always check the connector pins and terminals for damage and alignment.*

**NOTE:** *When measuring resistance values, always measure the resistance of the multimeter leads before testing components. Subtract the resistance of the multimeter leads from the component resistance to obtain a true resistance value.*

**NOTE:** *When testing diodes and diode modules use the multimeter diode test function.*

**NOTE:** *All components, wires and connectors disconnected during any electrical checks must be connected when the checks are completed.*

https://truckmanualshub.com/



# CONTROLLER ERROR CODE TROUBLESHOOTING GUIDE

## PTO Error Codes

## PTO Error Code 1104

**Fault Description.**
The controller has detected a momentary drop in engine speed when PTO is engaged but does not detect a PTO output speed.

**Response.**
PTO light flashes continually (0.5 seconds on and 0.5 seconds off).

**Possible Cause.**
1. Mechanical failure of connected implement.
2. Mechanical failure of PTO.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. STOP the engine and disconnect the implement from the tractor. Start the engine and check the operation of the PTO.
   - If the PTO shaft turns and the error code is no longer present, check the implement.
   - If the PTO operates but is noisy, check for mechanical PTO failures.
2. Reconfigure the hitch/PTO controller (refer to section 10010) then calibrate the PTO.
3. Check the operation of the PTO.
   - If the PTO fails to operate, reprogramme and reconfigure the hitch/PTO controller (refer to section 10010) then calibrate the hitch and PTO.

## PTO Error Code 1105

**Fault Description.**
The controller has detected an interrupted ON signal from the PTO control switch.

**Response.**
PTO light flashes continually (0.5 seconds on and 0.5 seconds off). The remote PTO function will be lock out.

**Possible Cause.**
1. PTO switch has been knocked out of the ON or OFF position.
2. Bad PTO control switch.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Cycle the PTO control switch from ON to OFF and back to ON and check the operation of the PTO.
2. Check the PTO control switch.
3. Check the PTO control switch circuit.

https://truckmanualshub.com/



## PTO Error Code 1106

**Fault Description.**
The controller has detected a drop in the controller supply voltage to below 9.3 volts.

**Response.**
PTO light flashes continually (0.5 seconds on and 0.5 seconds off). The PTO will not operate.

**Possible Cause.**
1. Bad alternator.
2. Poor battery condition.
3. Bad controller power circuit.
4. Bad controller clean ground circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the switched power stud connection.
2. Check the battery condition.
3. Check the alternator output.
4. Check the controller power circuit.
5. Check the controller clean ground circuit.

## PTO Error Code 1201

**Fault Description.**
The controller has not detected either an ON or OFF signal from the PTO control switch.

**Response.**
PTO light flashes continually (0.5 seconds on and 0.5 seconds off). The PTO will not operate.

**Possible Cause.**
1. PTO switch disconnected from the harness.
2. Bad PTO control switch.
3. Bad PTO control switch circuit (open circuit).

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the PTO control switch.
2. Check the PTO control switch circuit.

## PTO Error Code 1202

**Fault Description.**
The controller has detected an ON and OFF signal from the PTO control switch at the same time.

**Response.**
PTO light flashes continually (0.5 seconds on and 0.5 seconds off). The PTO will not operate.

**Possible Cause.**
1. Bad PTO control switch.
2. Bad PTO control switch circuit (shorted to 12 volts).

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the PTO control switch.
2. Check the PTO control switch circuit.

https://truckmanualshub.com/



## PTO Error Code 1204

**Fault Description.**
The controller has not detected a return signal from the PTO indicator light.

**Response.**
PTO operates but the PTO light does not illuminate.

**Possible Cause.**
1. Bad PTO indicator light.
2. Bad PTO indicator light circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the PTO indicator bulb and replace as necessary.
2. Check the PTO indicator light circuit.

## PTO Error Code 1205

**Fault Description.**
The controller has detected a short to 12 volts in the PTO indicator light return circuit.

**Response.**
PTO operates but the PTO light does not illuminate.

**Possible Cause.**
1. Bad PTO indicator light.
2. Bad PTO indicator light circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the PTO indicator bulb and replace as necessary.
2. Check the PTO indicator light circuit.

## PTO Error Code 1206

**Fault Description.**
The controller PTO indicator light driver has failed.

**Response.**
PTO operates but the PTO light does not illuminate.

**Possible Cause.**
1. Bad PTO indicator light.
2. Wrong PTO indicator light bulb installed.
3. Bad PTO indicator light circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the PTO indicator bulb and replace as necessary.
   - The PTO indicator light bulb must be replaced with a bulb with the correct power rating (1.2 Watt).
2. Check the PTO indicator light circuit.

https://truckmanualshub.com/



## PTO Error Code 1303

**Fault Description.**
The controller does not detect continuity across the PTO solenoid.

**NOTE:** *This error may be caused by cycling the PTO control switch too quickly from ON to OFF and back to ON.*

**Response.**
PTO light flashes continually (0.5 seconds on and 0.5 seconds off). The PTO will not operate.

**Possible Cause.**
1. Bad PTO solenoid.
2. Bad PTO solenoid circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the PTO solenoid.
2. Check the PTO solenoid circuit.

## PTO Error Code 1304

**Fault Description.**
The controller has detected a short to 12 volts in the PTO solenoid return circuit.

**Response.**
PTO light flashes continually (0.5 seconds on and 0.5 seconds off). The PTO will not operate.

**Possible Cause.**
1. Bad PTO solenoid.
2. Bad PTO solenoid circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the PTO solenoid.
2. Check the PTO solenoid circuit.

## PTO Error Code 1401

**Fault Description.**
The controller has detected a short to ground in the auto PTO indicator light circuit.

**Response.**
PTO operates but the Auto PTO light does not illuminate.

**Possible Cause.**
1. Bad Auto PTO indicator light.
2. Bad Auto PTO indicator light circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. For XtraSpeed and XtraSpeed-E tractors, check the Auto PTO indicator bulb and replace as necessary.
   - The Auto PTO indicator light bulb must be replaced with a bulb with the correct power rating (1.2 Watt).
2. Check the Auto PTO indicator light circuit.

https://truckmanualshub.com/



## PTO Error Code 1402

**Fault Description.**
The controller has detected a short to 12 volts in the auto PTO indicator light circuit.

**Response.**
PTO operates but the auto PTO light does not illuminate.

**Possible Cause.**
1. Bad auto PTO indicator light circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the auto PTO indicator light circuit.

## PTO Error Code 1501

**Fault Description.**
The controller has not detected an OFF signal from the operator presence switch for 25 hours.

**Response.**
PTO operates OK.

**Possible Cause.**
1. Bad operator presence switch.
2. Bad operator presence circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the operator presence switch.
2. Check the operator presence circuit.

## PTO Error Code 1502

**Fault Description.**
The controller has detected a EEPROM check sum error.

**Response.**
The PTO will not operate.

**Possible Cause.**
1. Controller software problem.
2. Controller hardware problem.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Reprogramme and configure the hitch/PTO controller (refer to section 10010) then calibrate the hitch and PTO.
2. If the fault still remains replace the Hitch/PTO controller.
3. Programme and configure the new hitch/PTO controller (refer to section 10010) then calibrate the hitch and PTO.

https://truckmanualshub.com/



## PTO Error Code 1503

**Fault Description.**
The controller has detected a loss of power or a constant power supply to the PTO solenoid.

**Response.**
PTO light flashes continually (0.5 seconds on and 0.5 seconds off). The PTO will not operate.

**Possible Cause.**
1. PTO solenoid supply circuit shorted to 12 volts.
2. PTO solenoid supply circuit shorted to ground.
3. PTO solenoid supply open circuit.
4. Controller software problem.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the PTO solenoid circuit.
2. Reprogramme and reconfigure the hitch/PTO controller (refer to section 10010) then calibrate the hitch and PTO.
3. If the fault still remains replace the hitch/PTO controller.
4. Programme and configure the new hitch/PTO controller (refer to section 10010) then calibrate the hitch and PTO.

## PTO Error Code 1601

**Fault Description.**
The controller has detected an overspeed of the PTO output shaft for more than 2 seconds.

**Response.**
The PTO will disengage and the PTO light flashes continually (0.5 seconds on and 0.5 seconds off).

**Possible Cause.**
1. Engine high idle speed too high.
2. Bad PTO speed sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the engine high idle speed without load.
2. Check the PTO speed sensor.

https://truckmanualshub.com/



## PTO Error Code 1602

**Fault Description.**
The controller has detected PTO slip above specified limits.

**Response.**
The PTO will disengage and the PTO light flashes continually (0.5 seconds on and 0.5 seconds off).

**Possible Cause.**
1. Excessive load on PTO.
2. PTO configuration incorrect.
3. Low regulated pressure.
4. Bad PTO speed sensor.
5. Bad PTO solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. STOP the engine and disconnect the implement from the tractor. Start the engine and check the operation of the PTO.
   - If the PTO shaft turns and the error code is no longer present, check the implement.
   - If the PTO operates but is noisy, check for mechanical PTO failures.
2. Reconfigure and calibrate the controller.
   - If the PTO fails to operate, reprogramme the controller and reconfigure and calibrate the Hitch and PTO.
3. Carry out the regulated pressure and PTO supply pressure tests, refer to Section 8001.
4. Check the PTO speed sensor circuit.
5. Check the PTO solenoid circuit.

## PTO Error Code 1603

**Fault Description.**
The controller has not detected a signal from the PTO speed sensor for more than 6 seconds after the PTO is engaged.

**Response.**
The PTO will disengage and the PTO light flashes continually (0.5 seconds on and 0.5 seconds off).

**Possible Cause.**
1. PTO speed sensor over tightened.
2. Bad PTO speed sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Loosen the PTO speed sensor and tighten to 27 Nm (20 lb. ft) and check the operation of the PTO.
2. Check the PTO speed sensor circuit.

## PTO Error Code 1604

**Fault Description.**
The controller is detecting a signal from the PTO speed sensor but is not detected an engine speed CAN message.

**Response.**
The PTO will disengage and the PTO light flashes continually (0.5 seconds on and 0.5 seconds off).

**Possible Cause.**
1. Bad engine speed signal.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check for engine controller error codes and repair as necessary.

https://truckmanualshub.com/



## PTO Error Code 1605

**Fault Description.**
The controller has detected a signal from the PTO speed sensor when the PTO switch is in the OFF position for more than 45 seconds.

**Response.**
The PTO light flashes continually (0.5 seconds on and 0.5 seconds off).

**Possible Cause.**
1. Worn PTO brake.
2. Incorrect clearance between the PTO piston and plates.
3. Burnt out PTO clutch (plates sticking).

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the PTO clutch for mechanical failure.

## PTO Error Code 1606

**Fault Description.**
The controller does not detected an engine speed CAN message during PTO operation.

**Response.**
The PTO will disengage and the PTO light flashes continually (0.5 seconds on and 0.5 seconds off).

**Possible Cause.**
1. Bad engine speed signal.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check for engine controller error codes and repair as necessary.

## PTO Error Code 1607

**Fault Description.**
The controller detects the PTO and engine speeds do not match 6 seconds after manual engagement of the PTO or 3 seconds after auto engagement of the PTO.

**Response.**
The PTO will disengage and the PTO light flashes continually (0.5 seconds on and 0.5 seconds off).

**Possible Cause.**
1. Bad engine speed signal.
2. PTO speed sensor over tightened.
3. Bad PTO speed sensor.
4. Bad PTO solenoid.
5. Low regulated or PTO supply pressure.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check for engine controller error codes and repair as necessary
2. Loosen the PTO speed sensor and tighten to 27 Nm (20 lb. ft) and check the operation of the PTO.
3. Check the PTO speed sensor circuit.
4. Check the PTO solenoid circuit.
5. Check the regulated and PTO supply pressure and carry out repairs as necessary, refer to Section 8001.

https://truckmanualshub.com/



## PTO Error Code 1608

**Fault Description.**
The controller has detected the engine speed is too low when the PTO is engaged.

**Response.**
The PTO will disengage.

**Possible Cause.**
1. Engine speed is below 750 rpm when the PTO is engaged.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Increase the engine speed prior to PTO engagement.
2. Check the engine low idle speed.
3. Check for engine controller error codes and repair as necessary.

## PTO Error Code 1609

**Fault Description.**
The controller has not been calibrated.

**Response.**
The PTO will not operate.

**Possible Cause.**
1. The controller has not been calibrated.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Reconfigure the hitch/PTO controller (refer to section 10010) then calibrate the hitch and PTO.

## PTO Error Code 1701

**Fault Description.**
The controller has detected a PTO ON signal from the PTO remote switch for more than 30 seconds.

**Response.**
The PTO light flashes continually (0.5 seconds on and 0.5 seconds off). The remote PTO function will be lock out.

**Possible Cause.**
1. The remote PTO ON switch has been held in for more than 30 seconds.
2. Bad remote PTO switch.
3. Bad remote PTO switch circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Stop the engine, turn the key to the OFF position. Start the engine and check the operation of the remote PTO ON switch, DO NOT operate the switch for more than 30 seconds.
2. Check remote PTO switch.
3. Check remote PTO switch circuit.

https://truckmanualshub.com/



## PTO Error Code 1702

**Fault Description.**
The controller has detected a PTO STOP signal from the PTO remote switch for more than 30 seconds.

**Response.**
The PTO light flashes continually (0.5 seconds on and 0.5 seconds off). The PTO remote function will be lock out.

**Possible Cause.**
1. The PTO remote STOP switch has been held in for more than 30 seconds.
2. Bad PTO remote switch.
3. Bad PTO remote switch circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Stop the engine, turn the key to the OFF position. Start the engine and check the operation of the PTO remote STOP switch, DO NOT operate the PTO remote STOP switch for more than 30 seconds.
2. Check PTO remote switch.
3. Check PTO remote switch circuit.

## PTO Error Code 1703

**Fault Description.**
The controller has detected a PTO ON signal from the PTO remote switch when the tractor is moving.

**Response.**
The PTO will disengage and the PTO light flashes continually (0.5 seconds on and 0.5 seconds off).

**Possible Cause.**
1. The PTO remote ON switch has been activated while the tractor is moving.
2. Bad PTO remote switch.
3. Bad PTO remote switch circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Stop the engine, turn the key to the OFF position. Start the engine and check the operation of the PTO remote switches.
2. Check PTO remote switch.
3. Check PTO remote switch circuit.

## PTO Error Code 1704

**Fault Description.**
The controller has detected a PTO STOP signal from the PTO remote switch when the tractor is moving.

**Response.**
The PTO will disengage and the PTO light flashes continually (0.5 seconds on and 0.5 seconds off).

**Possible Cause.**
1. The PTO remote STOP switch has been activated while the tractor is moving.
2. Bad PTO remote switch.
3. Bad PTO remote switch circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Stop the engine, turn the key to the OFF position. Start the engine and check the operation of the PTO remote OFF switch.
2. Check PTO remote switch.
3. Check PTO remote switch circuit.

https://truckmanualshub.com/



## PTO Error Code 1706

**Fault Description.**
The controller has detected a PTO ON and STOP signal from the PTO remote switches at the same time.

**Response.**
The PTO light flashes continually (0.5 seconds on and 0.5 seconds off). The PTO remote function will be lock out.

**Possible Cause.**
1. Both the PTO remote ON and STOP switches have been held in at the same time.
2. Bad PTO remote switch.
3. Bad PTO remote switch circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Stop the engine, turn the key to the OFF position. Start the engine and check the operation of the PTO remote switches, DO NOT operate both switches at the same time.
2. Check PTO remote switch.
3. Check PTO remote switch circuit.

## PTO Error Code 1707

**Fault Description.**
The controller has detected a PTO ON signal from the PTO remote switch during PTO operation.

**Response.**
The PTO will disengage and the PTO light flashes continually (0.5 seconds on and 0.5 seconds off).

**Possible Cause.**
1. The PTO remote ON switch has been held in during PTO operation.
2. Bad PTO remote switch.
3. Bad PTO remote switch circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Stop the engine, turn the key to the OFF position. Start the engine and check the operation of the PTO remote ON switch, DO NOT operate the switch while the PTO is operating.
2. Check remote PTO switch.
3. Check remote PTO switch circuit.

## PTO Error Code 1801

**Fault Description.**
The controller has not detected an ON or OFF signal from the auto PTO switch for more than 2.5 seconds.

**Response.**
The Auto PTO function will lock out.

**Possible Cause.**
1. The auto PTO switch has been held between the auto PTO on and auto PTO off position for more than 2.5 seconds.
2. Bad auto PTO switch.
3. Bad auto PTO switch circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the operation of the auto PTO switch, make sure the switch is moved between switch states within 2.5 seconds.
2. Check auto PTO switch.
3. Check auto PTO switch circuit.

https://truckmanualshub.com/



## PTO Error Code 1803

**Fault Description.**
The controller has detected more than one signal (ON, OFF or SET) from the auto PTO switch at the same time.

**Response.**
The Auto PTO function will lock out.

**Possible Cause.**
1. The auto PTO switch circuit has shorted between auto PTO on, auto PTO off or auto PTO set.
2. The auto PTO switch circuit has shorted to 12 volts.
3. Bad auto PTO switch.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check auto PTO switch.
2. Check auto PTO switch circuit.

## PTO Error Code 1804

**Fault Description.**
Operator error, with the auto PTO selected the controller has detected an OFF signal from the auto PTO switch, when the hitch is above the PTO off set point.

**Response.**
The PTO will disengage and the PTO light and auto PTO lights will flash continually (0.5 seconds on and 0.5 seconds off).

**Possible Cause.**
1. The auto PTO switch has been turned from the ON to OFF position with the hitch raised above the PTO off set point before the PTO control switch has been turned to the OFF position.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Cycle the PTO switch from ON to OFF and back to ON.

## PTO Error Code 1805

**Fault Description.**
Operator error, with the auto PTO selected the controller has not detected a change in hitch position, when the hitch is above the OFF set point for more than 2 minutes.

**Response.**
The PTO will disengage and the PTO light and auto PTO lights will flash continually (0.5 seconds on and 0.5 seconds off).

**Possible Cause.**
1. The hitch has not been lowered below the PTO on set point within 2 minutes.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Cycle the PTO switch from ON to OFF and back to ON.

https://truckmanualshub.com/



## PTO Error Code 1806

**Fault Description.**
Operator error, with the auto PTO selected the controller has not detected a signal from the wheel speed sensor when hitch is above the OFF set point for more than 10 seconds.

**Response.**
The PTO will disengage and the PTO light and auto PTO light swill flash continually (0.5 seconds on and 0.5 seconds off).

**Possible Cause.**
1. The tractor has not moved within for 10 seconds with the auto PTO switch ON and the hitch position above the off set point.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Cycle the PTO switch from ON to OFF and back to ON.

## PTO Error Code 1807

**Fault Description.**
Operator error, with the auto PTO selected the controller has detected a signal from either the PTO on or PTO off remote switch.

**Response.**
The PTO will disengage and the PTO light and auto PTO light swill flash continually (0.5 seconds on and 0.5 seconds off).

**Possible Cause.**
1. A remote PTO on or off switch has been activated with the auto PTO switch in the ON position.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Cycle the PTO switch from ON to OFF and back to ON.

## PTO Error Code 1808

**Fault Description.**
Operator error, with the auto PTO selected the controller has not detected a signal from the operator presence switch for more than 5 seconds.

**Response.**
The PTO will disengage and the PTO light and auto PTO lights will flash continually (0.5 seconds on and 0.5 seconds off).

**Possible Cause.**
1. The operator moved out of the seat for more than 5 seconds.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Cycle the PTO switch from ON to OFF and back to ON while sitting in the seat.

https://truckmanualshub.com/



## PTO Error Code 1809

**Fault Description.**
Operator error, with the auto PTO selected the controller has detected an invalid auto PTO set point signal.

**Response.**
The PTO will disengage and the PTO light and auto PTO lights will flash continually (0.5 seconds on and 0.5 seconds off).

**Possible Cause.**
1. The auto PTO set points have been set incorrectly.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Cycle the PTO switch from ON to OFF and back to ON.
2. Reset the auto PTO set points.

## PTO Error Code 1810

**Fault Description.**
Operator error, with the auto PTO selected the controller has detected a signal from either the hitch raise or hitch lower remote switch.

**Response.**
The PTO will disengage and the PTO light and auto PTO lights will flash continually (0.5 seconds on and 0.5 seconds off).

**Possible Cause.**
1. A remote hitch raise or lower switch has been activated with the auto PTO switch in the ON position.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Cycle the PTO switch from ON to OFF and back to ON.

## PTO Error Code 1811

**Fault Description.**
Operator error, with the auto PTO selected the controller has detected an ON signal from ride control switch for more than 2 minutes.

**Response.**
The PTO will disengage and the PTO light and auto PTO lights will flash continually (0.5 seconds on and 0.5 seconds off).

**Possible Cause.**
1. The Ride Control switch has been activated with the Auto PTO switch in ON position.
2. The Auto PTO switch has been activated with the Ride Control switch in ON position.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. If operating in ride control mode turn the PTO switch and auto PTO switches to the OFF position.
2. If operating in Auto PTO mode, turn the Ride control switch to thew OFF position and cycle the PTO switch from ON to OFF and back to ON.

https://truckmanualshub.com/



# Hitch Error Codes

## Hitch Error Code 2164

**Fault Description.**
Hitch up/down switch has failed.

**Response.**
Fault Category - DEGRADED 1. Hitch enable light will illuminate and the hitch will operate under default settings only.

**Possible Cause.**
1. Bad Hitch up/down switch.
2. Bad Hitch up/down switch circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check Hitch up/down switch.
2. Bad Hitch up/down switch circuit.

## Hitch Error Code 2165

**Fault Description.**
Left hand load pin sensor circuit failed.

**Response.**
Fault Category - DEGRADED 1. Hitch enable light will illuminate and the hitch will operate under default settings only.

**Possible Cause.**
1. Bad left hand load pin.
2. Bad left hand load pin circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the left hand load pin sensor.
2. Check the left hand load pin sensor circuit.

## Hitch Error Code 2166

**Fault Description.**
Right hand load pin sensor circuit failed.

**Response.**
Fault Category - DEGRADED 1. Hitch enable light will illuminate and the hitch will operate under default settings only.

**Possible Cause.**
1. Bad right hand load pin sensor.
2. Bad right hand load pin sensor circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the right hand load pin sensor.
2. Check the right hand load pin sensor circuit.

https://truckmanualshub.com/



## Hitch Error Code 2167

**Fault Description.**
Both load pin sensor circuits have failed if configured for two load pins.

**Response.**
Fault Category - DEGRADED 2. Hitch enable light will illuminate and the hitch draft control will not operate.

**Possible Cause.**
1. Bad left and right hand load pin sensors.
2. Bad load pin sensor circuits.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the left and right hand load pin sensors.
2. Check the load pin sensor circuits.

## Hitch Error Code 2168

**Fault Description.**
Load pin sensor circuit failed for tractors calibrated for one load pin sensor.

**Response.**
Fault Category - DEGRADED 2. Hitch enable light will illuminate and the hitch draft control will not operate.

**Possible Cause.**
1. Bad load pin sensor.
2. Bad load pin sensor circuits.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the load pin sensor.
2. Check the load pin sensor circuit.

## Hitch Error Code 2169

**Fault Description.**
Load control (Draft) circuit failed., load control potentiometer signal voltage outside the 0.2 to 4.96 volt limit.

**Response.**
Fault Category - DEGRADED 2. Hitch enable light will illuminate and the hitch draft control will not operate.

**Possible Cause.**
1. Bad load command potentiometer.
2. Bad load command potentiometer circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the load command potentiometer.
2. Check the load command potentiometer circuit.

https://truckmanualshub.com/



## Hitch Error Code 2170

**Fault Description.**
Hitch drop speed circuit failed, drop speed potentiometer signal voltage outside the 0.2 to 4.96 volt limit.

**Response.**
Fault Category - DEGRADED 1. Hitch enable light will illuminate and the hitch will operate under default settings only.

**Possible Cause.**
1. Bad hitch drop speed potentiometer.
2. Bad hitch drop speed potentiometer circuit short to voltage above 5 volts.
3. Bad hitch drop speed potentiometer circuit short to ground.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the hitch drop speed potentiometer.
2. Check the drop speed potentiometer circuit.

## Hitch Error Code 2171

**Fault Description.**
Hitch travel circuit failed, travel potentiometer signal voltage outside the 0.2 to 4.96 volt limit.

**Response.**
Fault Category - DEGRADED 1. Hitch enable light will illuminate and the hitch will operate under default settings only.

**Possible Cause.**
1. Bad hitch travel potentiometer.
2. Bad hitch travel potentiometer circuit short to voltage above 5 volts.
3. Bad hitch travel potentiometer circuit short to ground.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the hitch travel potentiometer.
2. Check the hitch travel potentiometer circuit.

## Hitch Error Code 2173

**Fault Description.**
Hitch upper limit circuit failed, upper limit potentiometer signal voltage outside the 0.2 to 4.96 volt limit.

**Response.**
Fault Category - LIMP. Hitch enable light will illuminate and the hitch will only operate for 1.5 seconds using the hitch up/down switch or hitch remote switches repeatedly.

**Possible Cause.**
1. Bad hitch upper limit potentiometer.
2. Bad hitch upper limit potentiometer circuit short to voltage above 5 volts.
3. Bad hitch upper limit potentiometer circuit short to ground.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the hitch upper limit potentiometer.
2. Check the hitch upper limit potentiometer circuit.

https://truckmanualshub.com/



## Hitch Error Code 2174

**Fault Description.**
Hitch position (lift arm) potentiometer circuit failed, position potentiometer signal voltage outside the 0.3 to 5.0 volt limit.

**Response.**
Fault Category - LIMP. Hitch enable light will illuminate and the hitch will only operate for 1.5 seconds using the hitch up/down switch or hitch remote switches repeatedly.

**Possible Cause.**
1. Bad hitch position potentiometer.
2. Bad hitch position potentiometer circuit short to voltage above 5 volts.
3. Bad hitch position potentiometer circuit short to ground.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the hitch position potentiometer is located correctly into the mounting bracket and the retaining nut is tight. Also check the potentiometer link arm located correctly retaining allen screw is tight.
2. Check the hitch position potentiometer.
3. Check the hitch position potentiometer circuit.

## Hitch Error Code 2175

**Fault Description.**
Hitch position command (cab) circuit failed, position command potentiometer signal voltage outside the 0.3 to 5 volt limit.

**Response.**
Fault Category - LIMP. Hitch enable light will illuminate and the hitch will only operate for 1.5 seconds using the hitch up/down switch or hitch remote switches repeatedly.

**Possible Cause.**
1. Bad hitch position command potentiometer.
2. Bad hitch position command potentiometer circuit short to voltage above 5 volts.
3. Bad hitch position command potentiometer circuit short to ground.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the hitch position command potentiometer is located correctly into the right hand console and the retaining nut is tight.
2. Check the hitch position command potentiometer.
3. Check the hitch position command potentiometer circuit.

## Hitch Error Code 2176

**Fault Description.**
Battery voltage above 18 volts.

**Response.**
Fault Category - LIMP. Hitch enable light will illuminate and the hitch will only operate for 1.5 seconds using the hitch up/down switch or hitch remote switches repeatedly.

**Possible Cause.**
1. Bad alternator.
2. Bad battery.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the alternator output. Repair or replace the alternator as necessary.
2. Check the battery, refer to Section 4004 Battery Servicing and Testing.

https://truckmanualshub.com/



## Hitch Error Code 2177

**Fault Description.**
The controller does not detect a voltage on the lower solenoid return circuit.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate.

**Possible Cause.**
1. Lower solenoid return open circuit.
2. Lower solenoid return circuit shorted to ground.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the lower solenoid return circuit.

## Hitch Error Code 2178

**Fault Description.**
The controller does not detect a voltage on the raise solenoid return circuit.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate.

**Possible Cause.**
1. Raise solenoid return open circuit.
2. Raise solenoid return circuit shorted to ground.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the raise solenoid return circuit.

## Hitch Error Code 2201

**Fault Description.**
The controller has detected a voltage on the solenoid supply circuit when the high side driver is OFF.

**Response.**
Fault Category - LIMP. Hitch enable light will illuminate and the hitch will only operate for 1.5 seconds using the hitch up/down switch or hitch remote switches repeatedly.

**Possible Cause.**
1. Solenoid supply circuit shorted to a voltage.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the solenoid supply circuit.

https://truckmanualshub.com/



## Hitch Error Code 2202

**Fault Description.**
The Hitch enable light circuit has failed.

**Response.**
Fault Category - DEGRADED 1. Hitch enable light will illuminate and the hitch will operate under default settings only.

**Possible Cause.**
1. Bad hitch enable light bulb.
2. Bad hitch enable light circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the hitch enable light circuit.

## Hitch Error Code 2203

**Fault Description.**
The Hitch position is above the upper limit.

**Response.**
Fault Category - DEGRADED 1. Hitch enable light will illuminate and the hitch will operate under default settings only.

**Possible Cause.**
1. Hitch position command (cab) potentiometer moved during power down.
2. Bad hitch position command (cab) potentiometer.
3. Bad hitch position command (cab) potentiometer circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Press and hold the hitch up/down switch in the momentary position or the hitch remote down switch down switch until the hitch upper limit is reached.
2. Check the hitch position command potentiometer.
3. Check the hitch position command potentiometer circuit.

## Hitch Error Code 2206

**Fault Description.**
The controller does not detect a voltage on the raise or lower solenoid return circuits.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate.

**Possible Cause.**
1. Raise and lower solenoid 12 volt supply open circuit.
2. Raise and lower solenoid return circuits shorted to ground.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the raise and lower solenoid 12 volt supply circuit.
2. Check the raise and lower solenoid return circuits.

https://truckmanualshub.com/



## Hitch Error Code 2207

**Fault Description.**
The hitch remote switch circuit failed.

**Response.**
Fault Category - DEGRADED 1. Hitch enable light will illuminate and the hitch will operate under default settings only.

**Possible Cause.**
1. Both raise and lower hitch remote switches held in at the same time.
2. Hitch remote switch held in during tractor start up.
3. Hitch remote switch held in while the tractor is moving.
4. Hitch lower remote switch held in with the hitch at its lower travel limit.
5. Hitch raise remote switch held in with the hitch at its upper limit.
6. Bad hitch remote switch.
7. Bad hitch remote switch circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Only operate one hitch remote switch.
2. Make sure the hitch remote switches are released prior to tractor start up.
3. Do not operate the hitch remote switches while the tractor is moving.
4. Set the hitch raise upper limit and hitch lower travel limit using the cab hitch controls prior to operating the hitch remote switches.
5. Check the hitch remote switches.
6. Check the hitch remote switch circuit.

## Hitch Error Code 2208

**Fault Description.**
Battery voltage below 9.312 volts.

**Response.**
Fault Category - LIMP. Hitch enable light will illuminate and the hitch will only operate for 1.5 seconds using the hitch up/down switch or hitch remote switches repeatedly.

**Possible Cause.**
1. Bad alternator.
2. Bad battery.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the alternator output. Repair or replace the alternator as necessary.
2. Check the battery, refer to Section 4004 Battery Servicing and Testing.
3. Check the Hitch/PTO controller connector.

https://truckmanualshub.com/



## Hitch Error Code 2209

**Fault Description.**
The hitch enable switch momentary down circuit failed.

**Response.**
Fault Category - DEGRADED 1. Hitch enable light will illuminate and the hitch will operate under default settings only.

**Possible Cause.**
1. Hitch enable switch held in the momentary position during tractor start up.
2. Hitch in LIMP mode with the hitch is being lowered using the hitch enable switch and the hitch has reached its lower limit.
3. Bad hitch enable switch.
4. Bad hitch enable switch circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Make sure the hitch enable switch is released prior to tractor start up.
2. Check the hitch enable switch.
3. Check the hitch enable switch circuit.

## Hitch Error Code 2210

**Fault Description.**
The controller EEPROM check sum error.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate.

**Possible Cause.**
1. Controller software problem.
2. Controller hardware problem.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Reprogramme and configure the hitch/PTO controller (refer to section 10010) then calibrate the hitch and PTO.
2. If the fault still remains replace the Hitch/PTO controller.
3. Programme and configure the new hitch/PTO controller (refer to section 10010) then calibrate the hitch and PTO.

## Hitch Error Code 2211

**Fault Description.**
The controller Firmware error.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate.

**Possible Cause.**
1. Controller software problem.
2. Controller hardware problem.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Reprogramme and configure the hitch/PTO controller (refer to section 10010) then calibrate the hitch and PTO.
2. If the fault still remains replace the Hitch/PTO controller.
3. Programme and configure the new hitch/PTO controller (refer to section 10010) then calibrate the hitch and PTO.

https://truckmanualshub.com/



## Hitch Error Code 2212

**Fault Description.**
The controller lower solenoid driver failed.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate.

**Possible Cause.**
1. Controller internal short to 12 volts.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Replace the Hitch/PTO controller.
2. Programme and configure the new hitch/PTO controller (refer to section 10010) then calibrate the hitch and PTO.

## Hitch Error Code 2213

**Fault Description.**
The controller raise solenoid driver failed.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate.

**Possible Cause.**
1. Controller internal short to 12 volts.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Replace the Hitch/PTO controller.
2. Programme and configure the new hitch/PTO controller (refer to section 10010) then calibrate the hitch and PTO.

## Hitch Error Code 2214

**Fault Description.**
The controller has detected a short to 12 volts in the lower solenoid return circuit.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate.

**Possible Cause.**
1. Bad lower solenoid.
2. Lower solenoid return circuit short to 12 volts.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the hitch lower solenoid resistance.
2. Check the hitch lower solenoid return circuit.

https://truckmanualshub.com/



## Hitch Error Code 2215

**Fault Description.**
The controller has detected a short to 12 volts in the raise solenoid return circuit.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate.

**Possible Cause.**
1. Bad raise solenoid.
2. Raise solenoid return circuit short to 12 volts.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the hitch raise solenoid resistance.
2. Check the hitch raise solenoid return circuit.

## Hitch Error Code 2300

**Fault Description.**
Hitch calibration error - The controller has detected the hitch position command (cab) potentiometer voltage is not within range (3.8 to 4.95 volts), with the hitch position command in the full raise position.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate. Hitch calibration procedure will stop.

**Possible Cause.**
1. Hitch position command potentiometer is not at full raise.
2. Bad hitch position command potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Move the hitch position command potentiometer to the fully raised position.
2. Check the hitch position command potentiometer is located correctly into the right hand console and the retaining nut is tight.
3. Check the hitch position command potentiometer.
4. Check the hitch position command potentiometer circuit.

## Hitch Error Code 2301

**Fault Description.**
Hitch calibration error -The current to start raising the hitch is above the specified limit.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate. Hitch calibration procedure will stop.

**Possible Cause.**
1. Battery voltage too low.
2. No power to raise solenoid or solenoid resistance is too high.
3. Hitch raise solenoid power or return open circuit.
4. Hitch raise solenoid stuck closed.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the alternator output. Repair or replace the alternator as necessary.
2. Check the battery, refer to Section 4004 Battery Servicing and Testing.
3. Check the hitch raise solenoid resistance, if the resistance reading is above 12 Ohms replace the solenoid.
4. Check the raise solenoid.

https://truckmanualshub.com/



## Hitch Error Code 2302

**Fault Description.**
Hitch calibration error - The current to start raising the hitch is below the specified limit.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate. Hitch calibration procedure will stop.

**Possible Cause.**
1. Battery voltage too high.
2. Bad raise solenoid or solenoid resistance is too low.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the alternator output. Repair or replace the alternator as necessary.
2. Check the battery, refer to Section 4004 Battery Servicing and Testing.
3. Check the hitch raise solenoid resistance, if the resistance reading is below 5 Ohms replace the solenoid.

## Hitch Error Code 2303

**Fault Description.**
Hitch calibration error - The full raise current detection is out of range, with the hitch position command (cab) potentiometer in the full raise position.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate. Hitch calibration procedure will stop.

**Possible Cause.**
1. Battery voltage too high.
2. Bad raise solenoid or solenoid resistance is too low.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the alternator output. Repair or replace the alternator as necessary.
2. Check the battery, refer to Section 4004 Battery Servicing and Testing.
3. Check the hitch raise solenoid resistance, if the resistance reading is below 5 Ohms replace the solenoid.

## Hitch Error Code 2304

**Fault Description.**
Hitch calibration error - The hitch position (lift arm) potentiometer is not at maximum.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate. Hitch calibration procedure will stop.

**Possible Cause.**
1. Obstruction preventing the hitch from travelling to the maximum position.
2. Bad hitch position (lift arm) potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Check and clear any obstruction from the hitch.
2. For tractors with auto hitch, check the auto hitch lift rod adjustment, refer to section 9001 and correct as necessary.
3. Check the hitch position potentiometer is located correctly into the mounting bracket and the retaining nut is tight. Also check the potentiometer link arm is located correctly and the retaining allen screw is tight.
4. Check the hitch position potentiometer.
5. Check the hitch position potentiometer circuit.

https://truckmanualshub.com/



## Hitch Error Code 2305

**Fault Description.**
Hitch calibration error - The controller has detected the hitch position command (cab) potentiometer voltage is not within range (0.25 to 0.90 volts), with the hitch position command in the full lower position.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate. Hitch calibration procedure will stop.

**Possible Cause.**
1. The hitch position command knob is not at full lower.
2. Bad hitch position (cab) potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Turn the hitch position command knob to the full lower position.
2. Check the hitch position command potentiometer is located correctly into the right hand console and the retaining nut is tight.
3. Check the hitch position command potentiometer.
4. Check the hitch position command potentiometer circuit.

## Hitch Error Code 2306

**Fault Description.**
Hitch calibration error -The current to start lowering the hitch is above the specified limit.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate. Hitch calibration procedure will stop.

**Possible Cause.**
1. Battery voltage too low.
2. No power to lower solenoid or solenoid resistance is too high.
3. Hitch lower solenoid power or return open circuit.
4. Hitch lower solenoid stuck closed.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the alternator output. Repair or replace the alternator as necessary.
2. Check the battery, refer to Section 4004 Battery Servicing and Testing.
3. Check the hitch lower solenoid resistance, if the resistance reading is above 12 Ohms replace the solenoid.
4. Check the lower solenoid.

## Hitch Error Code 2307

**Fault Description.**
Hitch calibration error - The current to start lowering the hitch is below the specified limit.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate. Hitch calibration procedure will stop.

**Possible Cause.**
1. Battery voltage too high.
2. Bad lower solenoid or solenoid resistance is too low.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the alternator output. Repair or replace the alternator as necessary.
2. Check the battery, refer to Section 4004 Battery Servicing and Testing.
3. Check the hitch lower solenoid resistance, if the resistance reading is below 5 Ohms replace the solenoid.

https://truckmanualshub.com/



## Hitch Error Code 2308

**Fault Description.**
Hitch calibration error - The calibration time limit has expired.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate. Hitch calibration procedure will stop.

**Possible Cause.**
1. Operator did not acknowledge when the hitch was fully lower within 6 minutes.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Recommence the hitch calibration procedure.

## Hitch Error Code 2309

**Fault Description.**
Hitch calibration error - The controller has detected the hitch position (lift arm) potentiometer voltage is not within range (0.80 to 1.77 volts), with the hitch in the full lower position.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate. Hitch calibration procedure will stop.

**Possible Cause.**
1. Obstruction preventing the hitch from travelling to the minimum position.
2. Bad hitch position (lift arm) potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Check and clear any obstruction from the hitch.
2. Check the hitch position potentiometer is located correctly into the mounting bracket and the retaining nut is tight. Also check the potentiometer link arm is located correctly and the retaining allen screw is tight.
3. Check the hitch position potentiometer.
4. Check the hitch position potentiometer circuit.

https://truckmanualshub.com/



## Hitch Error Code 2310

**Fault Description.**
Hitch calibration error - The controller has detected the hitch position (lift arm) potentiometer voltage is not within range, with the hitch in the full raise position.

The voltage difference with the hitch fully lowered and hitch fully raised must be between 2.245 to 3.30 volts.

Example:
Voltage with hitch fully lowered ..... = 1.2 Volts.
Voltage with hitch fully raised ..... = 3.445 volts minimum (1.2 + 2.245).
Voltage with hitch fully raised .....= 4.5 volts maximum (1.2 + 3.30).

**IMPORTANT:** *The maximum voltage with the hitch fully raised must not exceed 4.98 volts. Error code 2174 will be recorded if the fully raised voltage is above 5 volts.*

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate. Hitch calibration procedure will stop.

**Possible Cause.**
1. Bad hitch position (lift arm) potentiometer linkage.
2. Bad hitch position (lift arm) potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the hitch position potentiometer is located correctly into the mounting bracket and the retaining nut is tight. Also check the potentiometer link arm is located correctly and the retaining allen screw is tight.
2. Check the hitch position potentiometer linkage.
3. Check the hitch position potentiometer.
4. Check the hitch position potentiometer circuit.

## Hitch Error Code 2311

**Fault Description.**
Hitch calibration error - The hitch position (lift arm) and hitch position command (cab) potentiometers are not aligned.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate. Hitch calibration procedure will stop.

**Possible Cause.**
1. Bad hitch position (lift arm) potentiometer.
2. Bad hitch command position (cab) potentiometer.
3. Both hitch position (lift arm) and hitch command position (cab) potentiometer have failed.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the hitch position potentiometer is located correctly into the mounting bracket and the retaining nut is tight. Also check the potentiometer link arm is located correctly and the retaining allen screw is tight.
2. Check the hitch position command potentiometer is located correctly into the right hand console and the retaining nut is tight.
3. Check the hitch position and hitch position command potentiometers.
4. Check the hitch position and hitch position command potentiometer circuits.

https://truckmanualshub.com/



## Hitch Error Code 2313

**Fault Description.**
The hitch slip light has failed.

**Response.**
Fault Category - DEGRADED 1. Hitch enable light will illuminate and the hitch will operate under default settings only.

**Possible Cause.**
1. Bad hitch slip bulb.
2. Bad hitch slip light circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the hitch slip bulb and replace as necessary.
2. Check the slip light circuit.

## Hitch Error Code 2314

**Fault Description.**
The controller does not detect a ground speed radar signal.

**Response.**
Fault Category - DEGRADED 1. Hitch enable light will illuminate and the hitch will operate under default settings only.

**Possible Cause.**
1. Hitch /PTO controller configured for ground speed radar but radar not connected.
2. Bad ground speed radar circuit.
3. Bad ground speed radar.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the hitch configuration settings.
2. Check the ground speed radar is connected.
3. Check ground speed radar circuit.
4. Check ground speed radar.

## Hitch Error Code 2401

**Fault Description.**
The controller has detected a differential lock on and auto differential lock signal at the same time.

**Response.**
The differential lock is disabled.

**Possible Cause.**
1. Bad differential lock switch.
2. Bad differential lock switch circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the differential lock switch.
2. Check the differential lock switch circuit.

https://truckmanualshub.com/



## Hitch Error Code 2402

**Fault Description.**
The controller has detected the MFD driver (supply) circuit has shorted to ground.

**Response.**
The MFD is disabled.

**Possible Cause.**
1. Bad MFD switch.
2. Bad MFD circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the MFD switch.
2. Check the MFD switch circuit.

## Hitch Error Code 2403

**Fault Description.**
The controller has detected an MFD on and auto MFD signal at the same time.

**Response.**
The MFD is disabled.

**Possible Cause.**
1. Bad MFD switch.
2. Bad MFD switch circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the MFD switch.
2. Check the MFD switch circuit.

## Hitch Error Code 2404

**Fault Description.**
The controller has detected the differential lock driver (supply) circuit has shorted to ground.

**Response.**
The differential lock is disabled.

**Possible Cause.**
1. Bad differential lock switch.
2. Bad differential lock circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the differential lock switch.
2. Check the differential lock switch circuit.

https://truckmanualshub.com/



## Hitch Error Code 2405

**Fault Description.**
The differential lock indicator light has failed.

**Response.**
The differential lock indicator light is disabled.

**Possible Cause.**
1. Bad differential lock indicator bulb.
2. Bad differential lock indicator light circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the differential lock indicator bulb and replace as necessary.
2. Check the differential lock indicator circuit.

## Hitch Error Code 2406

**Fault Description.**
The controller has not been configured.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate.

**Possible Cause.**
1. Controller has not been configured.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Reconfigure the hitch/PTO controller (refer to section 10010) then calibrate the hitch and PTO.

## Hitch Error Code 2407

**Fault Description.**
The controller has been configured but has not been calibrated.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate.

**Possible Cause.**
1. Controller has not been calibrated.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Calibrate the controller.

https://truckmanualshub.com/



## Hitch Error Code 2408

**Fault Description.**
The controller has detected the sensor 1 supply voltage is below 7 volts or is above 9 volts.

**Response.**
Fault Category - LIMP. Hitch enable light will illuminate and the hitch will only operate for 1.5 seconds using the hitch up/down switch or hitch remote switches repeatedly.

**Possible Cause.**
1. The hitch command potentiometer supply has shorted to ground or the resistance in the circuit is too low.
2. The hitch command potentiometer supply has shorted to voltage above 9 volts.
3. The hitch position potentiometer supply has shorted to ground or the resistance in the circuit is too low.
4. The hitch position potentiometer supply has shorted to voltage above 9 volts.
5. The hitch load command potentiometer supply has shorted to ground or the resistance in the circuit is too low.
6. The hitch load command potentiometer supply has shorted to voltage above 9 volts.
7. The hitch travel potentiometer supply has shorted to ground or the resistance in the circuit is too low.
8. The hitch travel potentiometer supply has shorted to voltage above 9 volts.
9. The hitch drop speed potentiometer supply has shorted to ground or the resistance in the circuit is too low.
10. The hitch drop speed potentiometer supply has shorted to voltage above 9 volts.
11. The hitch upper limit speed potentiometer supply has shorted to ground or the resistance in the circuit is too low.
12. The hitch upper limit potentiometer supply has shorted to voltage above 9 volts.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
1. Check the hitch command potentiometer circuit.
2. Check the hitch position potentiometer circuit.
3. Check the hitch load command potentiometer circuit.
4. Check the hitch travel potentiometer circuit.
5. Check the hitch drop speed potentiometer circuit.
6. Check the hitch upper limit potentiometer circuit.

## Hitch Error Code 2409

**Fault Description.**
The controller has detected the sensor 2 supply voltage is below 7 volts or is above 9 volts.

**Response.**
Fault Category - DEGRADED 2. Hitch enable light will illuminate and the hitch draft control will not operate.

**Possible Cause.**
1. The hitch load pin supply has shorted to ground or the resistance in the circuit is too low.
2. The hitch load pin supply has shorted to voltage above 9 volts.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

**Circuit Checks/Corrective Action.**
3. Check the left hand and right hand load pin circuit.

https://truckmanualshub.com/



## Hitch Error Code 2410

**Fault Description.**
The controller has detected the high side driver supply 1 voltage is too low when the battery voltage is correct.

**Response.**
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate. Hitch calibration procedure will stop.

**Possible Cause.**
1. The controller internal relay has failed.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*

**Circuit Checks/Corrective Action.**
1. Replace the Hitch/PTO controller.
2. Programme and configure the new hitch/PTO controller (refer to section 10010) then calibrate the hitch and PTO

## Hitch Error Code 2411

**Fault Description.**
The controller has detected a EEPROM read error.

**Response.**
The system may respond with any of the following fault categories:
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate.
Fault Category - LIMP. Hitch enable light will illuminate and the hitch will only operate for 1.5 seconds using the hitch up/down switch or hitch remote switches repeatedly.
Fault Category - DEGRADED 1. Hitch enable light will illuminate and the hitch will operate under default settings only.
Fault Category - DEGRADED 2. Hitch enable light will illuminate and the hitch draft control will not operate.

**Possible Cause.**
1. Controller software problem.
2. Bad controller.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 16.*
1. Reprogramme and reconfigure the hitch/PTO controller (refer to section 10010) then calibrate the hitch and PTO.
2. If the fault still remains replace the hitch/PTO controller.
3. Programme and configure the new hitch/PTO controller (refer to section 10010) then calibrate the hitch and PTO.

https://truckmanualshub.com/



# Hitch Error Code 2412

**Fault Description.**
The controller has detected a EEPROM write error

**Response.**
The system may respond with any of the following fault categories:
Fault Category - HALT. Hitch enable light will illuminate and the hitch will not operate.
Fault Category - LIMP. Hitch enable light will illuminate and the hitch will only operate for 1.5 seconds using the hitch up/down switch or hitch remote switches repeatedly.
Fault Category - DEGRADED 1. Hitch enable light will illuminate and the hitch will operate under default settings only.
Fault Category - DEGRADED 2. Hitch enable light will illuminate and the hitch draft control will not operate.

**Possible Cause.**
1. Controller software problem.
2. Bad controller.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 16.*

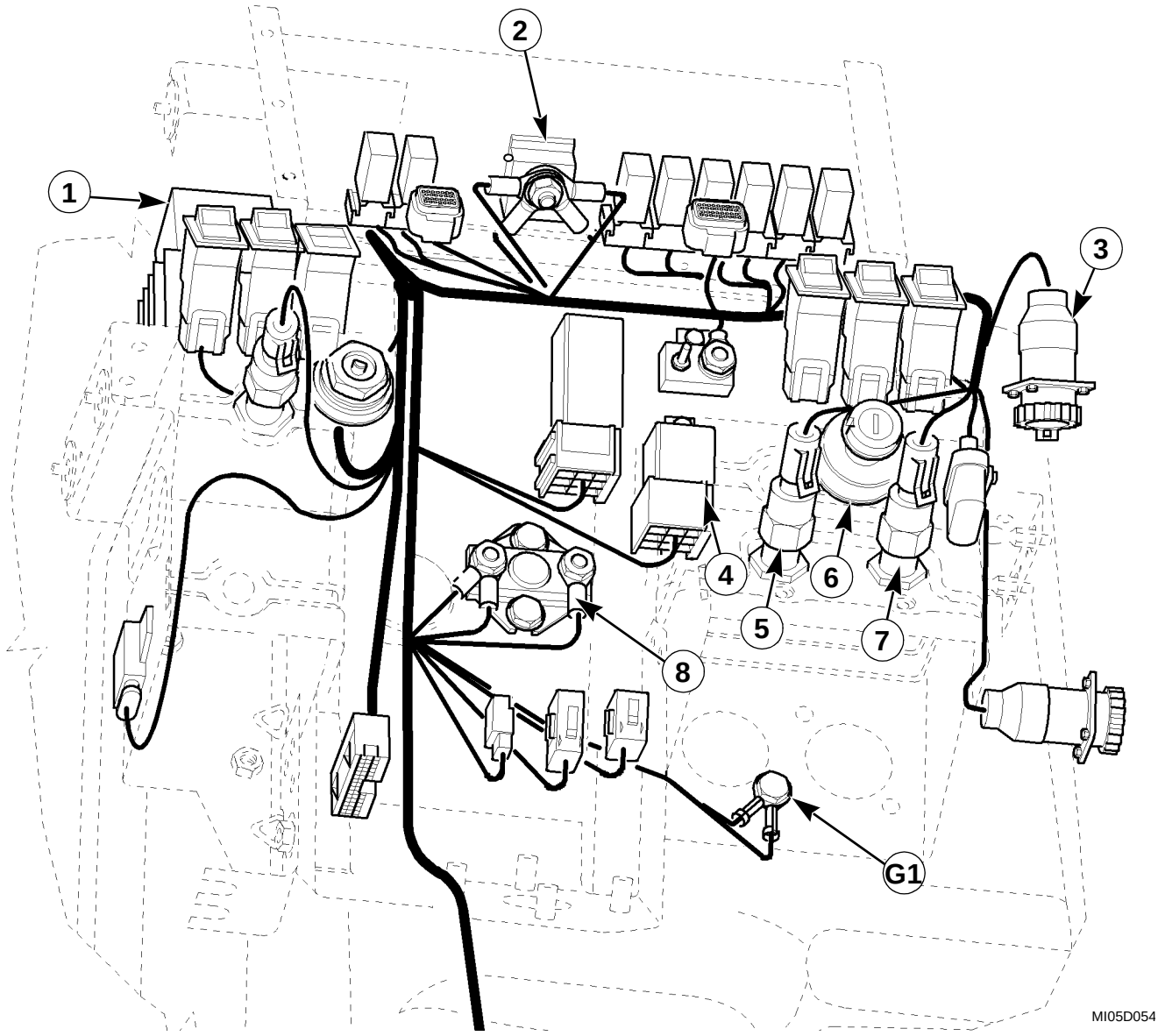
**Circuit Checks/Corrective Action.**
1. Reprogramme and reconfigure the hitch/PTO controller (refer to section 10010) then calibrate the hitch and PTO.
2. If the fault still remains replace the hitch/PTO controller.
3. Programme and configure the new hitch/PTO controller (refer to section 10010) then calibrate the hitch and PTO.

https://truckmanualshub.com/



# COMPONENT IDENTIFICATION

## Instrument Panel Components



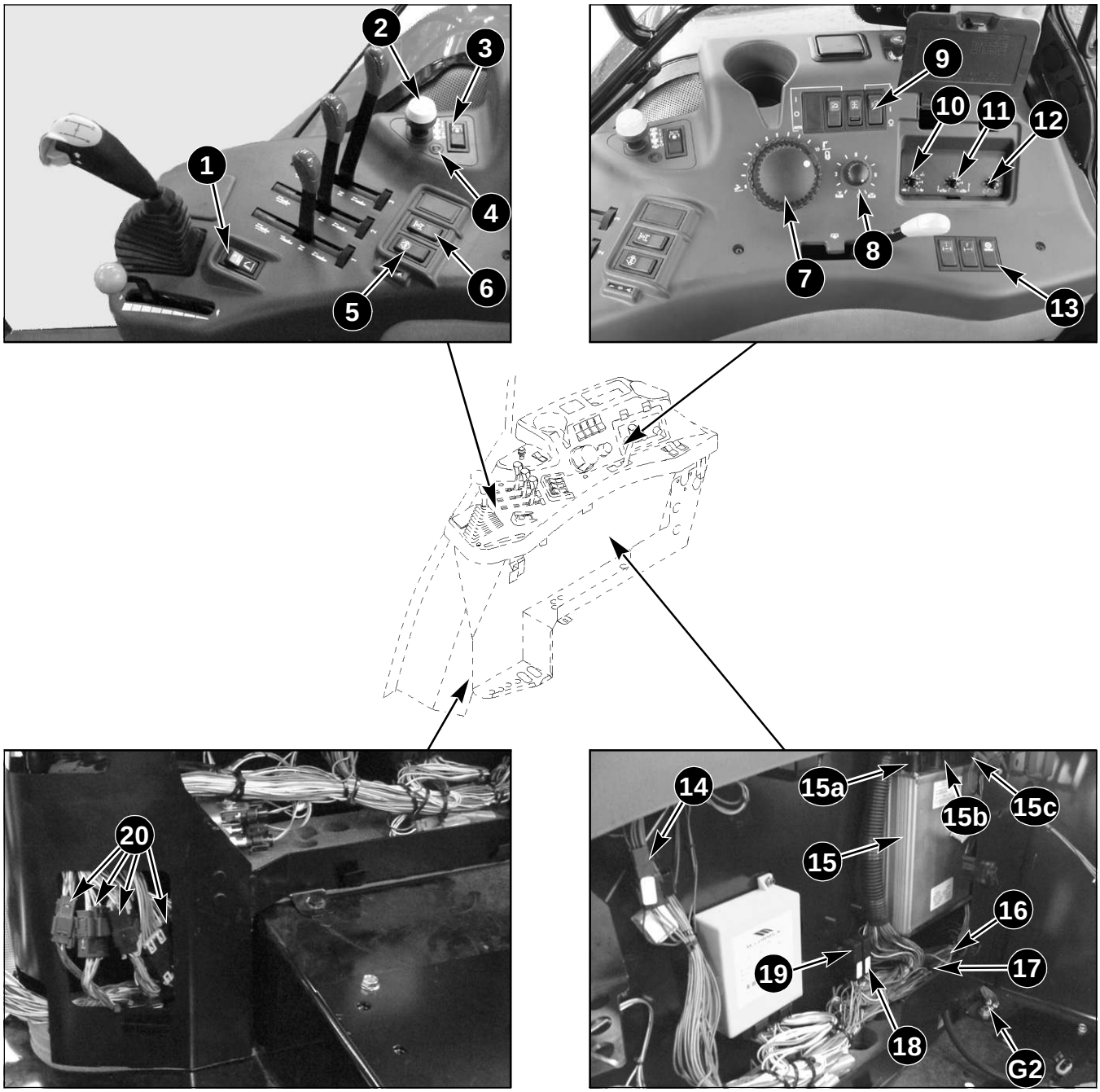

1. FUSE BOX
2. SWITCHED POWER STUD
3. CAN DIAGNOSTIC CONNECTOR
4. CAB POWER RELAY
5. LEFT HAND BRAKE SWITCH
6. KEY SWITCH
7. RIGHT HAND BRAKE SWITCH
8. BATTERY POWER STUD (UNSWITCHED)

G1. CHASSIS GROUND CONNECTION G1

https://truckmanualshub.com/



## Right Hand Console Components (XtraSpeed Tractors Only)



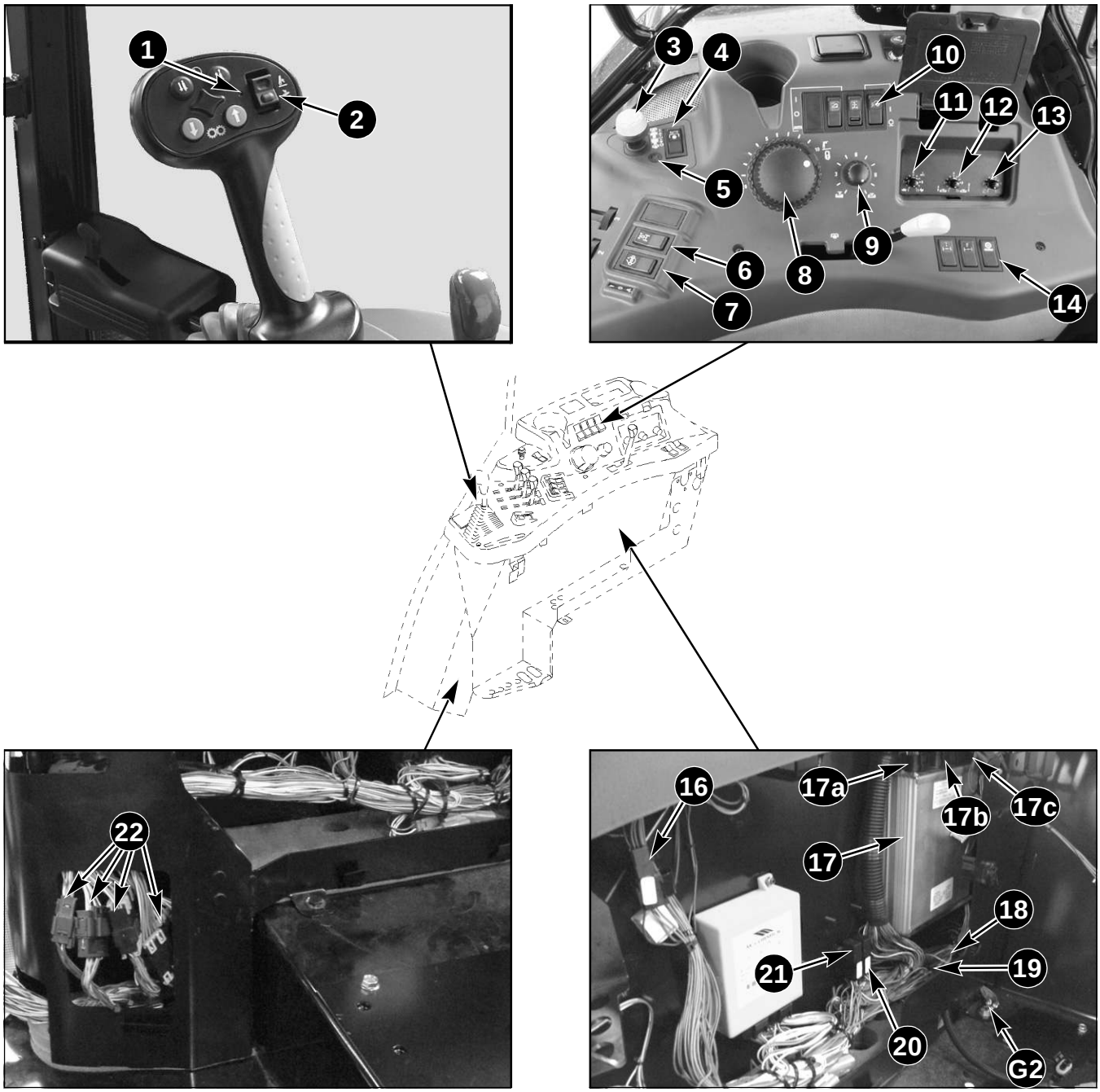

1. HITCH UP/DOWN ENABLE SWITCH
2. PTO SWITCH
3. AUTO PTO SWITCH
4. PTO INDICATOR LIGHT
5. DIFFERENTIAL LOCK SWITCH
6. MFD SWITCH
7. HITCH POSITION POTENTIOMETER
8. HITCH LOAD CONTROL POTENTIOMETER
9. SLIP SWITCH
10. HITCH DROP SPEED POTENTIOMETER
11. HITCH TRAVEL POTENTIOMETER
12. HITCH UPPER LIMIT POTENTIOMETER
13. RIDE CONTROL SWITCH
14. MFD RELAY
15. HITCH CONTROLLER
15a. CONNECTOR 54 (26 PIN)
15b. CONNECTOR 55 (26 PIN)
15c. CONNECTOR 56 (34 PIN)
16. CONNECTOR 52
17. CONNECTOR 40
18. RIGHT HAND BRAKE RELAY
19. LEFT HAND BRAKE RELAY
20. CONNECTORS 26, 27, 28, 29

G2. CHASSIS GROUND CONNECTION G2

https://truckmanualshub.com/



## Right Hand Console Components (XtraSpeed - E Tractors Only)



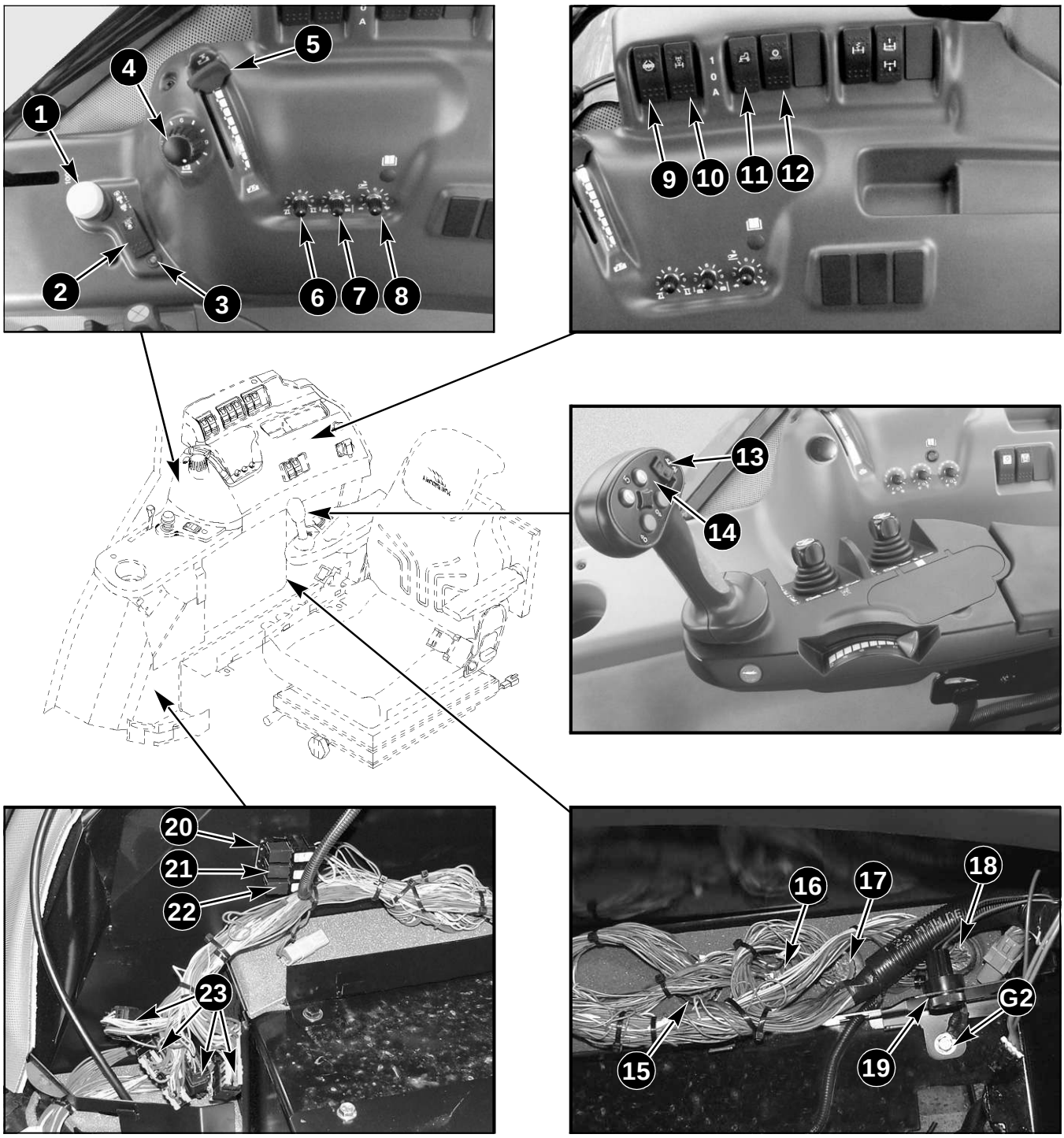

1. HITCH ENABLE LIGHT
2. HITCH UP/DOWN ENABLE SWITCH
3. PTO SWITCH
4. AUTO PTO SWITCH
5. PTO INDICATOR LIGHT
7. DIFFERENTIAL LOCK SWITCH
6. MFD SWITCH
8. HITCH POSITION POTENTIOMETER
9. HITCH LOAD CONTROL POTENTIOMETER
10. SLIP SWITCH
11. HITCH DROP SPEED POTENTIOMETER
12. HITCH TRAVEL POTENTIOMETER
13. HITCH UPPER LIMIT POTENTIOMETER
14. RIDE CONTROL SWITCH
16. MFD RELAY
17. HITCH CONTROLLER
17a. CONNECTOR 54 (26 PIN)
17b. CONNECTOR 55 (26 PIN)
17c. CONNECTOR 56 (34 PIN)
18. CONNECTOR 52
19. CONNECTOR 40
20. RIGHT HAND BRAKE RELAY
21. LEFT HAND BRAKE RELAY
22. CONNECTORS 26, 27, 28, 29

G2. CHASSIS GROUND CONNECTION G2

https://truckmanualshub.com/



# Right Hand Console and Armrest Components (XtraSpeed - E Plus Tractors Only)



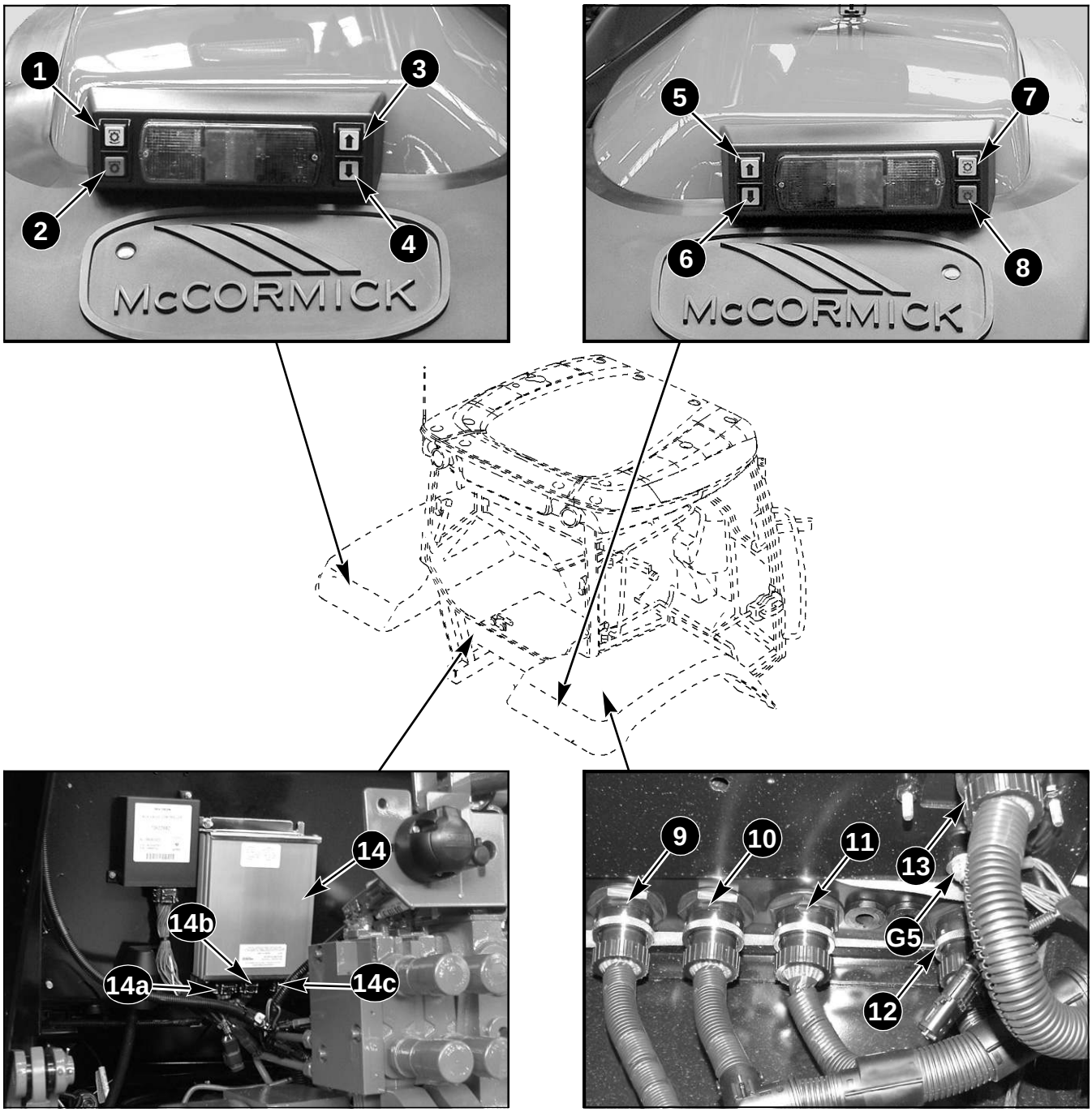

1. PTO SWITCH
2. AUTO PTO SWITCH
3. PTO INDICATOR LIGHT
4. HITCH LOAD CONTROL POTENTIOMETER
5. HITCH POSITION POTENTIOMETER
6. HITCH DROP SPEED POTENTIOMETER
7. HITCH TRAVEL POTENTIOMETER
8. HITCH UPPER LIMIT POTENTIOMETER
9. DIFFERENTIAL LOCK SWITCH
10. MFD SWITCH
11. SLIP SWITCH
12. RIDE CONTROL SWITCH
13. HITCH UP/DOWN SWITCH
14. HITCH ENABLE LIGHT
15. CONNECTOR 40
16. CONNECTOR 51
17. CONNECTOR 52
18. CONNECTOR 53
19. AUDIBLE ALARM
20. RIGHT HAND BRAKE RELAY
21. LEFT HAND RELAY
22. MFD RELAY
23. CONNECTORS 26, 27, 28, 29

G2. CHASSIS GROUND CONNECTION G2

https://truckmanualshub.com/



## Rear Fender Components (XtraSpeed - E Plus Tractors Only)




1. LEFT HAND HITCH REMOTE RAISE SWITCH
2. LEFT HAND HITCH REMOTE LOWER SWITCH
3. LEFT HAND PTO REMOTE ON SWITCH (IF EQUIPPED)
4. LEFT HAND PTO REMOTE STOP SWITCH (IF EQUIPPED)
5. RIGHT HAND HITCH REMOTE RAISE SWITCH
6. RIGHT HAND HITCH REMOTE LOWER SWITCH
7. LEFT HAND PTO REMOTE ON SWITCH (IF EQUIPPED)
8. LEFT HAND PTO REMOTE STOP SWITCH (IF EQUIPPED)
9. CONNECTOR 40 - TRANSMISSION HARNESS
10. CONNECTOR 53 (TRANSMISSION HARNESS)
11. CONNECTOR 52 (FENDER HARNESS)
12. CONNECTOR 51 (FENDER HARNESS)
13. CONNECTOR 50 (FENDER HARNESS)
14. HITCH CONTROLLER

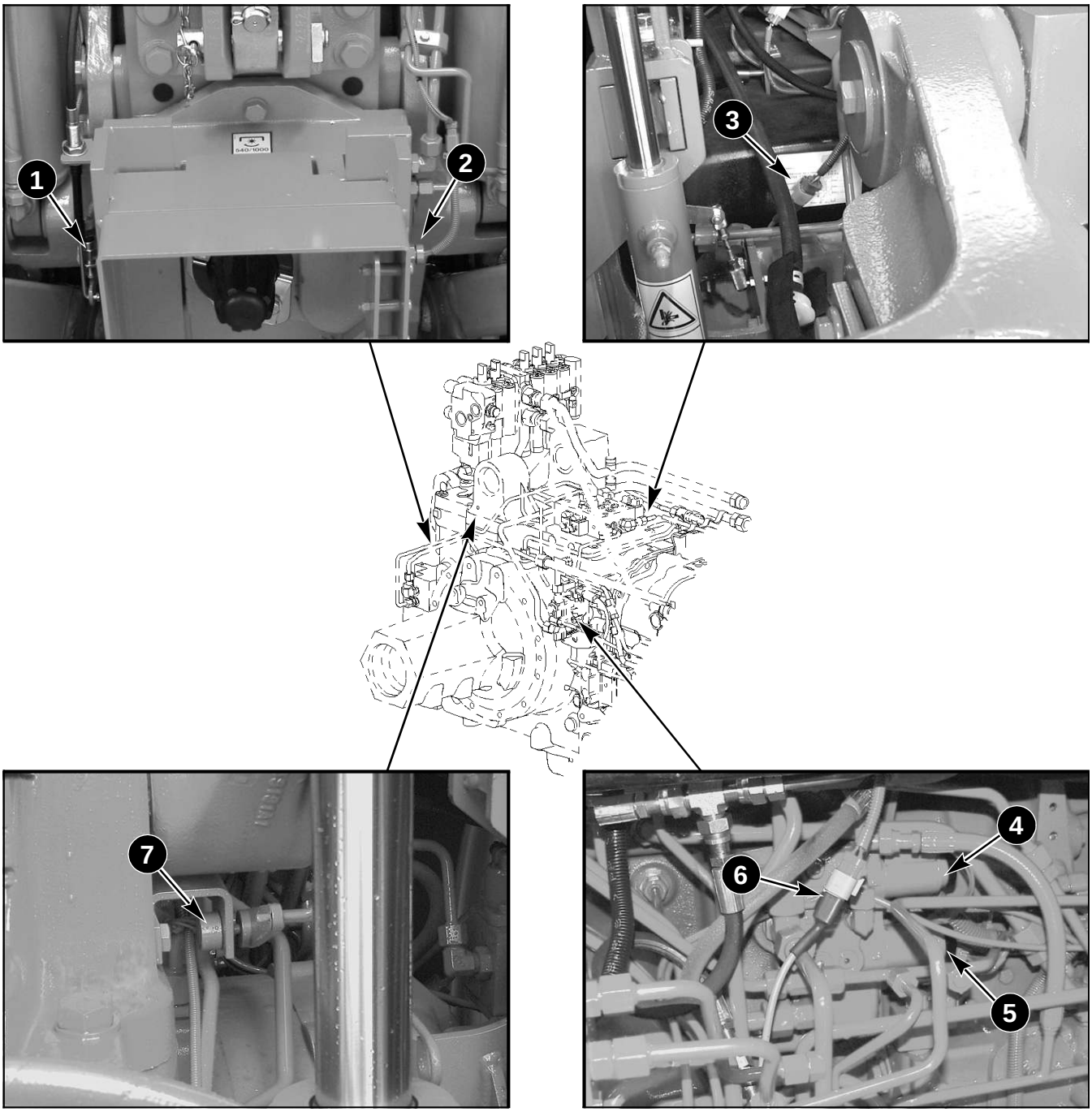
14a. CONNECTOR 56 (34 PIN)
14b. CONNECTOR 55 (26 PIN)
14c. CONNECTOR 54 (26 PIN)

G5. CHASSIS GROUND CONNECTION G5

https://truckmanualshub.com/



# Transmission Components (European Specification Tractors)

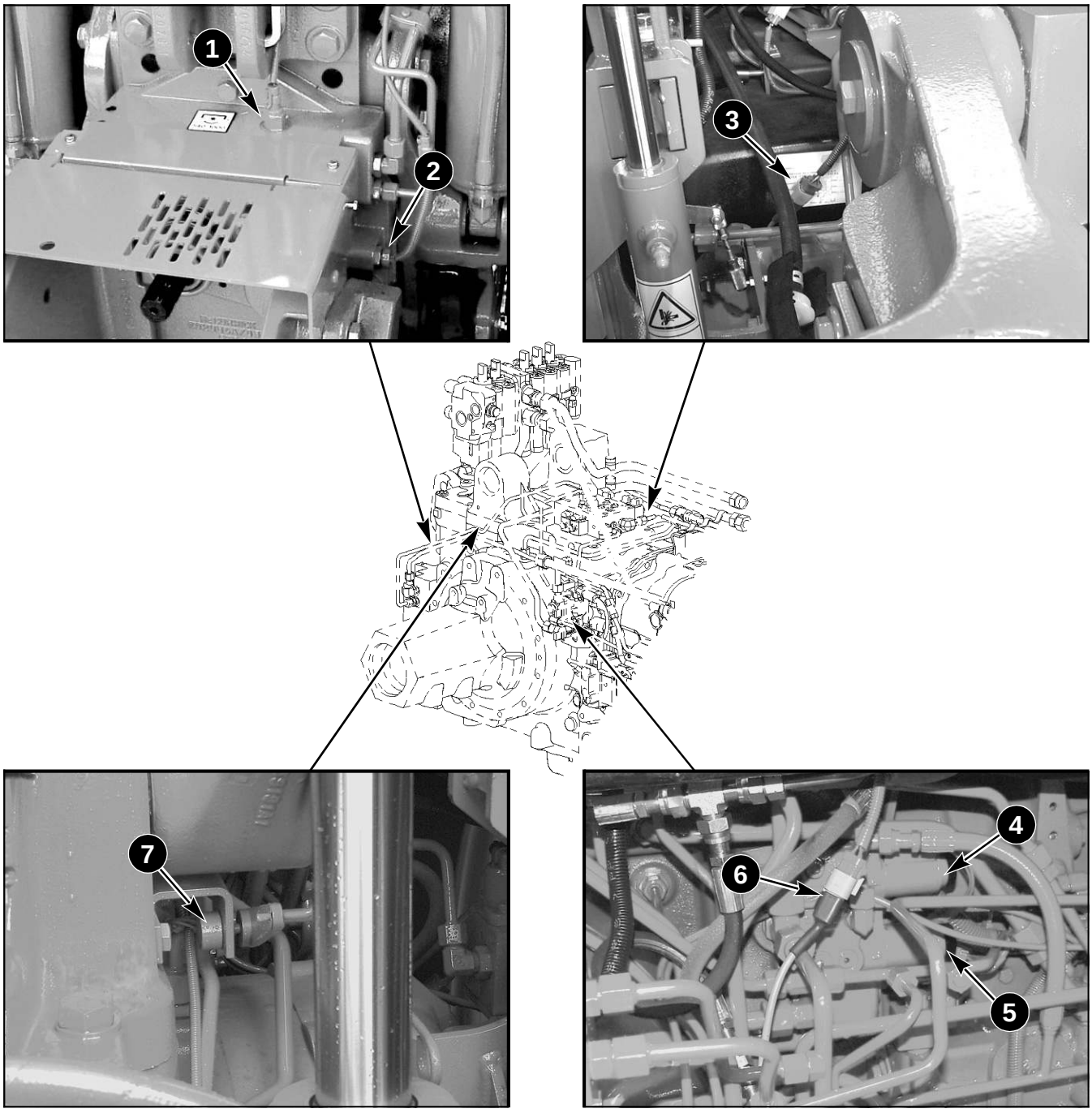



1. PTO SPEED SELECTOR SWITCH
2. PTO SPEED SENSOR
3. LEFT HAND LOAD PIN CONNECTOR)
4. HITCH RAISE SOLENOID
5. HITCH LOWER SOLENOID
6. RIGHT HAND LOAD PIN CONNECTOR
7. HITCH POSITION POTENTIOMETER

https://truckmanualshub.com/



## Transmission Components (American Specification Tractors)




1. PTO SPEED SELECTOR SWITCH
2. PTO SPEED SENSOR
3. LEFT HAND LOAD PIN CONNECTOR)
4. HITCH RAISE SOLENOID
5. HITCH LOWER SOLENOID
6. RIGHT HAND LOAD PIN CONNECTOR
7. HITCH POSITION POTENTIOMETER

https://truckmanualshub.com/



This Page Has Been Left Blank.

https://truckmanualshub.com/

# HITCH/PTO CONTROLLER SCHEMATIC CIRCUITS

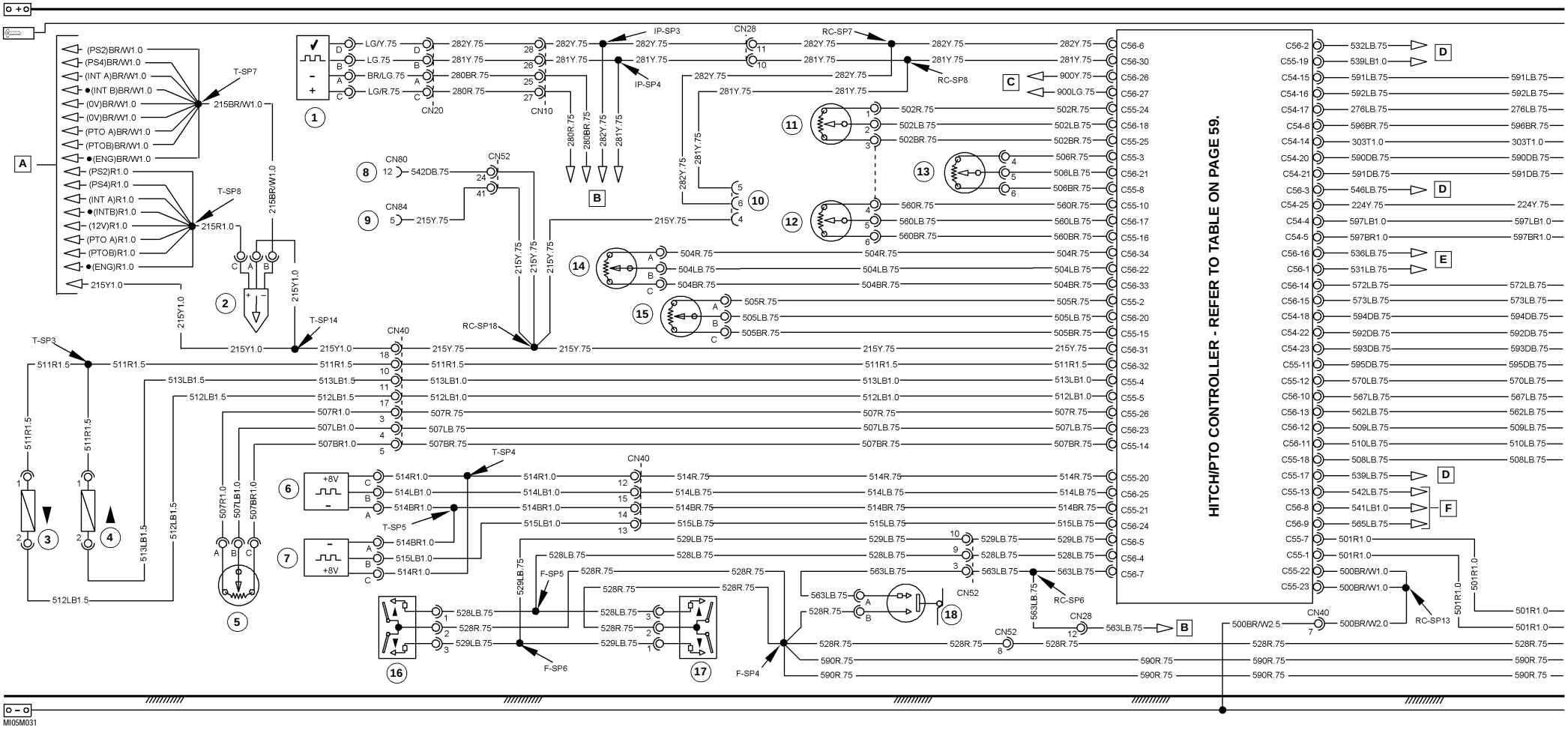
## Hitch/PTO Controller Pin Identification

| CONNECTOR 54 (26 Pin) | | | |
|---|---|---|---|
| 1 | NOT USED | 14 | OPERATOR PRESENCE SIGNAL |
| 2 | NOT USED | 15 | PTO ON SIGNAL |
| 3 | NOT USED | 16 | PTO OFF SIGNAL |
| 4 | PTO SOLENOID RETURN | 17 | 540/1000 PTO SPEED SIGNAL |
| 5 | PTO SOLENOID B+ | 18 | AUTO PTO SET SIGNAL |
| 6 | PTO INDICATOR LIGHT | 19 | NOT USED |
| 7 | NOT USED | 20 | REMOTE PTO ON SIGNAL |
| 8 | NOT USED | 21 | REMOTE PTO OFF SIGNAL |
| 9 | NOT USED | 22 | AUTO PTO ON SIGNAL |
| 10 | NOT USED | 23 | AUTO PTO OFF SIGNAL |
| 11 | NOT USED | 24 | NOT USED |
| 12 | NOT USED | 25 | PTO SPEED SIGNAL |
| 13 | NOT USED | 26 | NOT USED |

| CONNECTOR 55 (26 Pin) | | | |
|---|---|---|---|
| 1 | SWITCHED B+ | 14 | HITCH POSITION (LIFT ARM) LOW |
| 2 | HITCH LOAD CONTROL HIGH | 15 | HITCH LOAD CONTROL LOW |
| 3 | HITCH TRAVEL CONTROL HIGH | 16 | HITCH UPPER HEIGHT CONTROL LOW |
| 4 | HITCH RAISE SOLENOID RETURN | 17 | AUTO DIFFERENTIAL LOCK LIGHT |
| 5 | HITCH LOWER SOLENOID RETURN | 18 | HITCH ENABLE LIGHT |
| 6 | NOT USED | 19 | DIFFERENTIAL LOCK SOLENOID B+ |
| 7 | SWITCHED B+ | 20 | HITCH LOAD PIN 8 VOLT SUPPLY |
| 8 | HITCH TRAVEL CONTROL LOW | 21 | HITCH LOAD PIN 0 VOLT RETURN |
| 9 | NOT USED | 22 | CLEAN GROUND |
| 10 | HITCH UPPER HEIGHT CONTROL HIGH | 23 | CLEAN GROUND |
| 11 | AUTO PTO LIGHT | 24 | HITCH DROP SPEED CONTROL HIGH |
| 12 | SLIP CONTROL LIGHT | 25 | HITCH DROP SPEED CONTROL LOW |
| 13 | MFD CONTROL | 26 | HITCH POSITION (LIFT ARM) HIGH |

| CONNECTOR 56 (34 Pin) | | | |
|---|---|---|---|
| 1 | RIGHT HAND BRAKE SIGNAL | 18 | HITCH DROP SPEED CONTROL SIGNAL |
| 2 | DIFFERENTIAL LOCK ON SIGNAL | 19 | NOT USED |
| 3 | AUTO DIFFERENTIAL LOCK SIGNAL | 20 | HITCH LOAD CONTROL SIGNAL |
| 4 | HITCH REMOTE RAISE SIGNAL | 21 | HITCH TRAVEL CONTROL SIGNAL |
| 5 | HITCH REMOTE LOWER SIGNAL | 22 | HITCH POSITION CONTROL (CAB) SIGNAL |
| 6 | RADAR PRESENT SIGNAL | 23 | HITCH POSITION (LIFT ARM) SIGNAL |
| 7 | TRAILED IMPLEMENT UP SIGNAL | 24 | LEFT HAND LOAD PIN SIGNAL |
| 8 | MFD ON SIGNAL | 25 | RIGHT HAND LOAD PIN SIGNAL |
| 9 | AUTO MFD SIGNAL | 26 | CAN HIGH |
| 10 | SLIP CONTROL ON SIGNAL | 27 | CAN LOW |
| 11 | HITCH RAISE SIGNAL | 28 | NOT USED |
| 12 | HITCH LOWER SIGNAL | 29 | NOT USED |
| 13 | HITCH FAST LOWER SIGNAL | 30 | RADAR SIGNAL |
| 14 | RIDE CONTROL ON SIGNAL | 31 | WHEEL SPEED SIGNAL |
| 15 | RIDE CONTROL OVERRIDE SIGNAL | 32 | HITCH SOLENOID B+ |
| 16 | LEFT HAND BRAKE SIGNAL | 33 | HITCH POSITION CONTROL (CAB) LOW |
| 17 | HITCH UPPER HEIGHT CONTROL SIGNAL | 34 | HITCH POSITION CONTROL (CAB) HIGH |

## Hitch/PTO Schematic Circuit (For XtraSpeed Tractors)




### Key

1. RADAR
2. WHEEL SPEED SENSOR
3. HITCH LOWER SOLENOID
4. HITCH RAISE SOLENOID
5. HITCH POSITION POTENTIOMETER (LIFT ARM)
6. RIGHT HAND LOAD PIN
7. LEFT HAND LOAD PIN
8. CONNECTOR 80 (FRONT SUSPENSION AXLE)
9. CONNECTOR 84 CAB SUSPENSION)
10. IMPLEMENT INTERFACE CONNECTOR
11. HITCH DROP SPEED POTENTIOMETER
12. HITCH UPPER HEIGHT CONTROL POTENTIOMETER
13. HITCH TRAVEL POTENTIOMETER
14. HITCH POSITION CONTROL POTENTIOMETER (CAB)
15. HITCH LOAD CONTROL POTENTIOMETER
16. LEFT HAND HITCH REMOTE SWITCH
17. RIGHT HAND HITCH REMOTE SWITCH
18. TRAILER IMPLEMENT SWITCH (IF EQUIPPED)
19. HITCH UP/DOWN SWITCH
20. SLIP CONTROL SWITCH
21. AUTO PTO SWITCH
22. RIDE CONTROL SWITCH
23. PTO SOLENOID
24. PTO SPEED SENSOR
25. PTO INDICATOR LIGHT
26. PTO SWITCH
27. LEFT HAND REMOTE PTO SWITCH (IF EQUIPPED)
28. RIGHT HAND REMOTE PTO SWITCH (IF EQUIPPED)
29. 540/1000 PTO SPEED SELECTOR SWITCH
30. OPERATOR PRESENCE SWITCH
31. FUSE 33 (7.5 AMP)
32. FUSE 26 (30 AMP)
33. FUSE 27 (7.5 AMP) (TRACTORS UP TO PIN JJE3500311)
34. FUSE 28 (10 AMP)
35. FUSE 43 (7.5 AMP) (TRACTORS FROM PIN JJE3500312)
36. JUMPER LEAD

A. TO TRANSMISSION CONTROLLER
B. TO INSTRUMENT CLUSTER
C. TO CAN BUS CIRCUIT
D. TO DIFFERENTIAL LOCK CIRCUIT
E. TO BRAKE LIGHT SWITCHES
F. TO MFD CIRCUIT
G. TO FRONT SUSPENSION AXLE CONTROLLER
H. TO CREEP SWITCH
J. TO AUDIBLE ALARM
K. TO CAB CONTROLLER
L. TO CAB SUSPENSION CONTROLLER

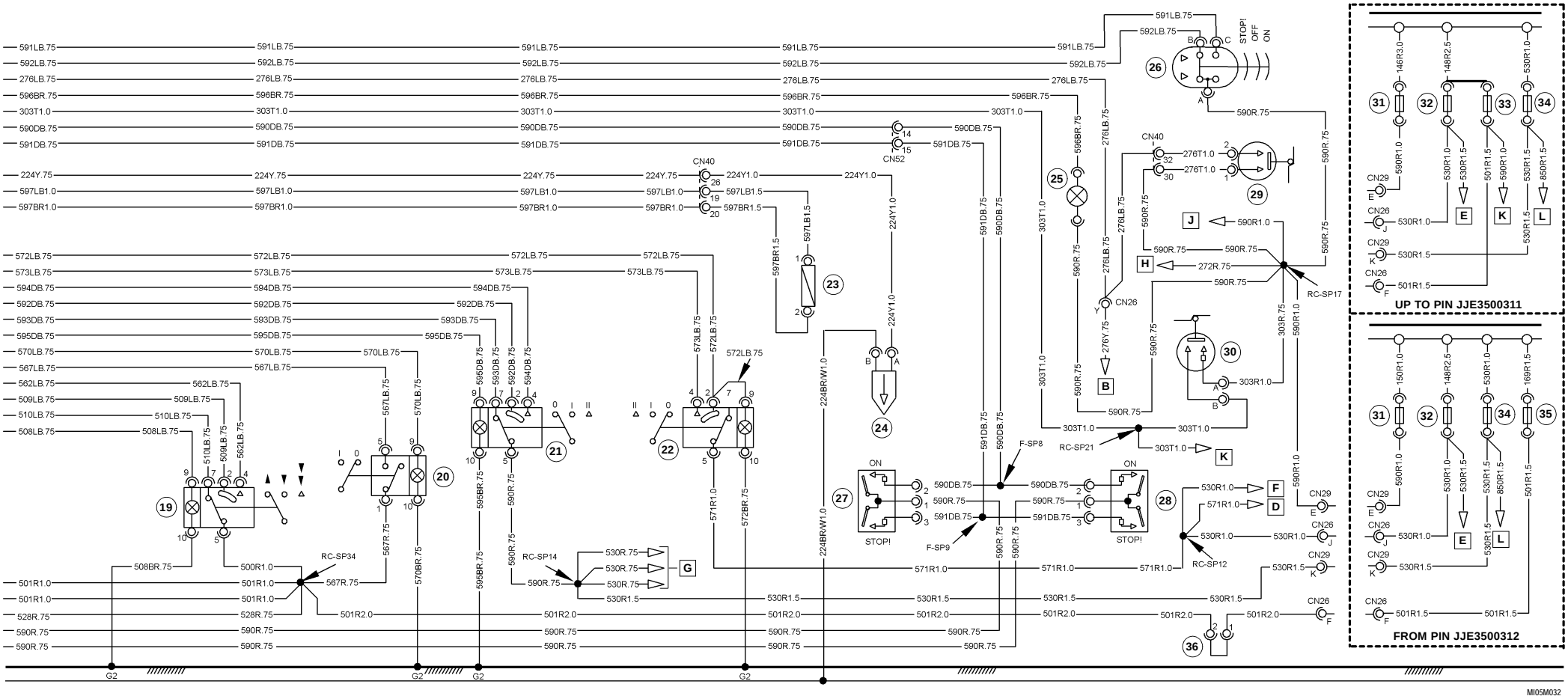
(●) - TRACTORS UP TO PIN JJE3500645 ONLY

**NOTE:** *Only use a HIGH IMPEDANCE multimeter to test the switches and circuits. Do not use a test lamp or damage to the switches may occur.*

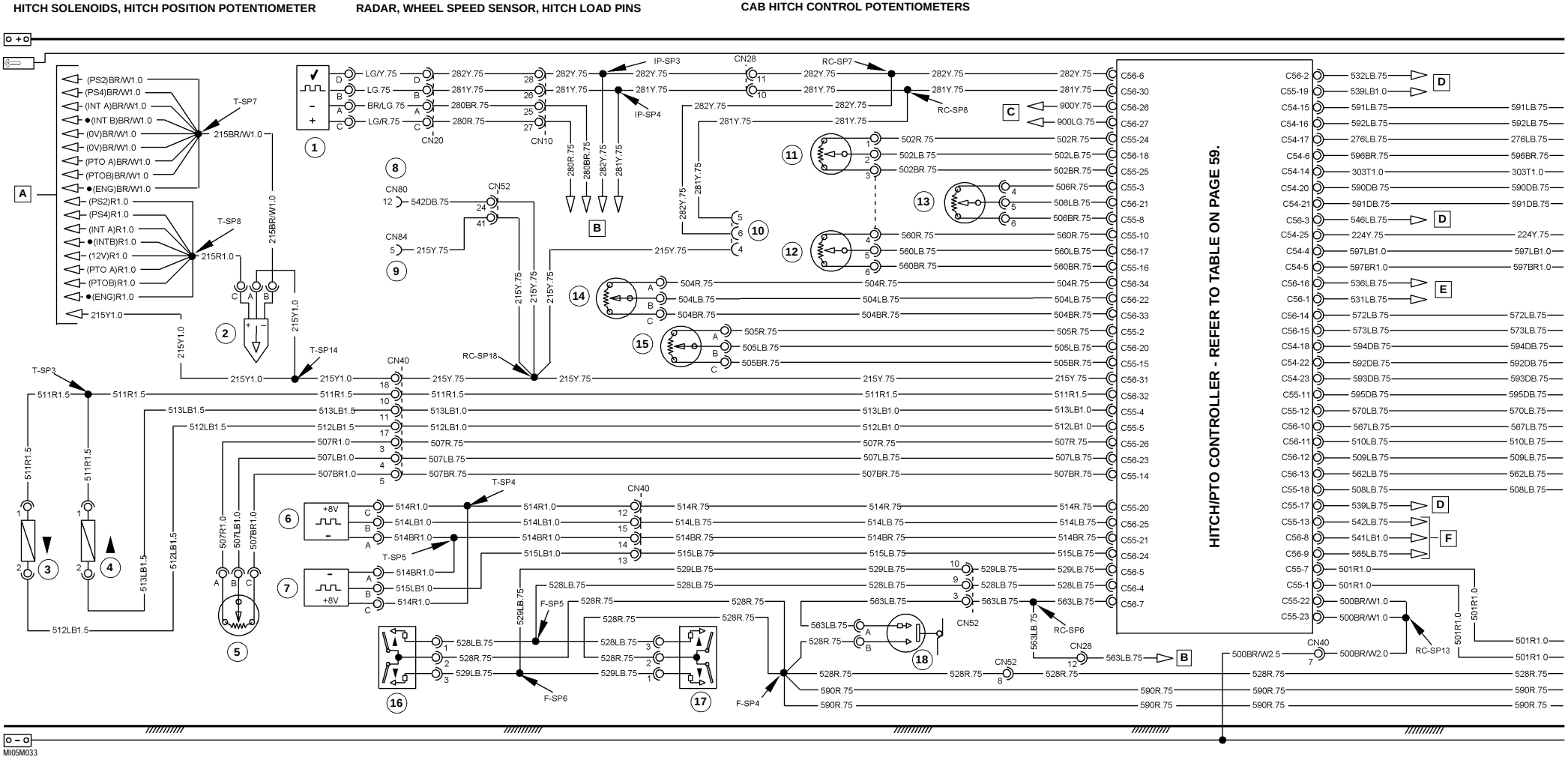
https://truckmanualshub.com/


HITCH UP/DOWN SWITCH, SLIP CONTROL SWITCH, AUTO PTO SWITCH, RIDE CONTROL SWITCH

PTO SOLENOID, PTO CONTROL SWITCHES, 540/1000 PTO SPEED SELECTOR SWITCH, OPERATOR PRESENCE SWITCH



## Hitch/PTO Schematic Circuit (For XTX Series XtraSpeed - E Tractors)




### Key

1. RADAR
2. WHEEL SPEED SENSOR
3. HITCH LOWER SOLENOID
4. HITCH RAISE SOLENOID
5. HITCH POSITION POTENTIOMETER (LIFT ARM)
6. RIGHT HAND LOAD PIN
7. LEFT HAND LOAD PIN
8. CONNECTOR 80 (FRONT SUSPENSION AXLE)
9. CONNECTOR 84 CAB SUSPENSION)
10. IMPLEMENT INTERFACE CONNECTOR
11. HITCH DROP SPEED POTENTIOMETER
12. HITCH UPPER HEIGHT CONTROL POTENTIOMETER
13. HITCH TRAVEL POTENTIOMETER
14. HITCH POSITION CONTROL POTENTIOMETER (CAB)
15. HITCH LOAD CONTROL POTENTIOMETER
16. LEFT HAND HITCH REMOTE SWITCH
17. RIGHT HAND HITCH REMOTE SWITCH
18. TRAILER IMPLEMENT SWITCH (IF EQUIPPED)
19. HITCH UP/DOWN SWITCH
20. SLIP CONTROL SWITCH
21. AUTO PTO SWITCH
22. RIDE CONTROL SWITCH
23. PTO SOLENOID
24. PTO SPEED SENSOR
25. PTO INDICATOR LIGHT
26. PTO SWITCH
27. LEFT HAND REMOTE PTO SWITCH (IF EQUIPPED)
28. RIGHT HAND REMOTE PTO SWITCH (IF EQUIPPED)
29. 540/1000 PTO SPEED SELECTOR SWITCH
30. OPERATOR PRESENCE SWITCH
31. FUSE 33 (7.5 AMP)
32. FUSE 26 (30 AMP)
33. FUSE 27 (7.5 AMP) (TRACTORS UP TO PIN JJE3500311)
34. FUSE 28 (10 AMP)
35. FUSE 43 (7.5 AMP) (TRACTORS FROM PIN JJE3500312)
36. DOOR SWITCH (HITCH CUT-OUT)

A. TO TRANSMISSION CONTROLLER
B. TO INSTRUMENT CLUSTER
C. TO CAN BUS CIRCUIT
D. TO DIFFERENTIAL LOCK SWITCH
E. TO BRAKE LIGHT SWITCHES
F. TO MFD SWITCH
G. TO FRONT SUSPENSION AXLE CONTROLLER
H. TO CREEP SWITCH
J. TO AUDIBLE ALARM
K. TO CAB CONTROLLER
L. TO CAB SUSPENSION CONTROLLER

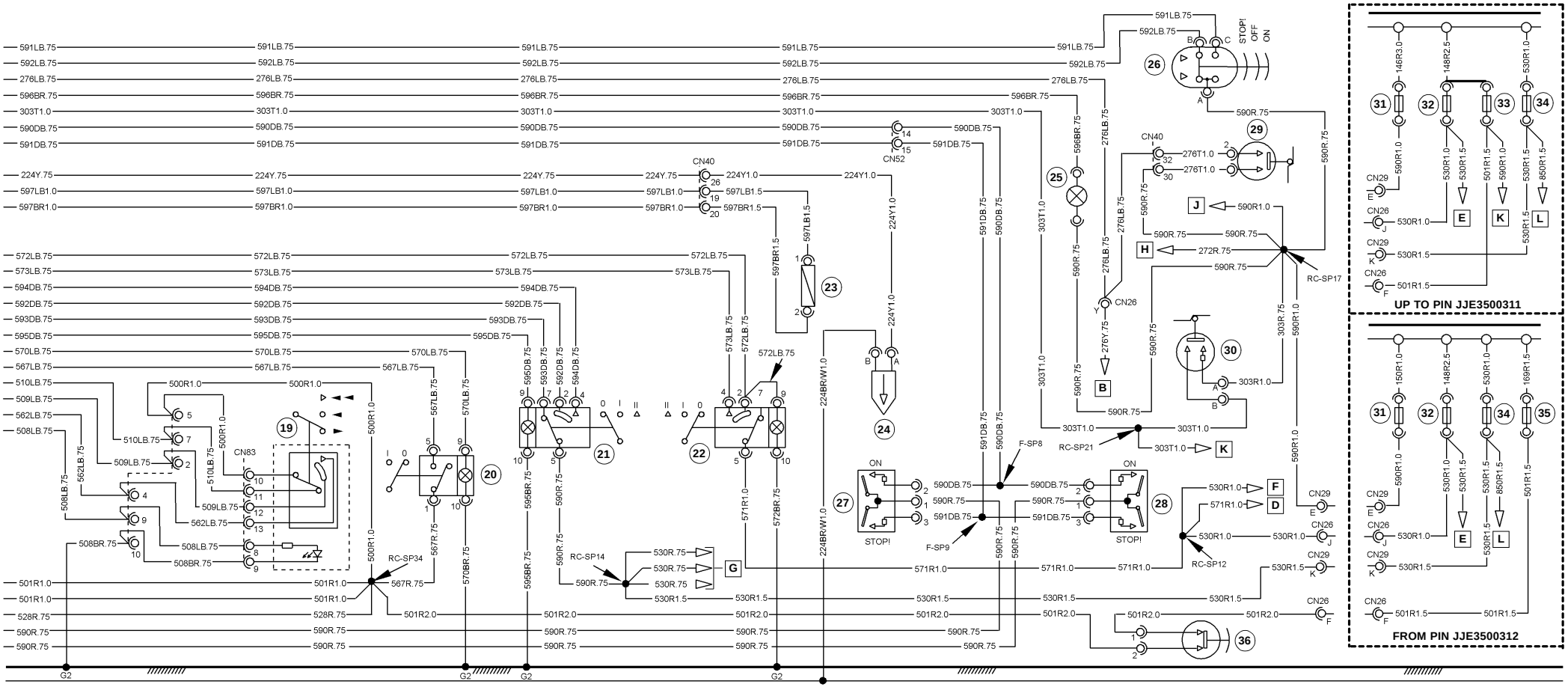
(●) - TRACTORS UP TO PIN JJE3500645 ONLY

**NOTE:** *Only use a HIGH IMPEDANCE multimeter to test the switches and circuits. Do not use a test lamp or damage to the switches may occur.*

https://truckmanualshub.com/

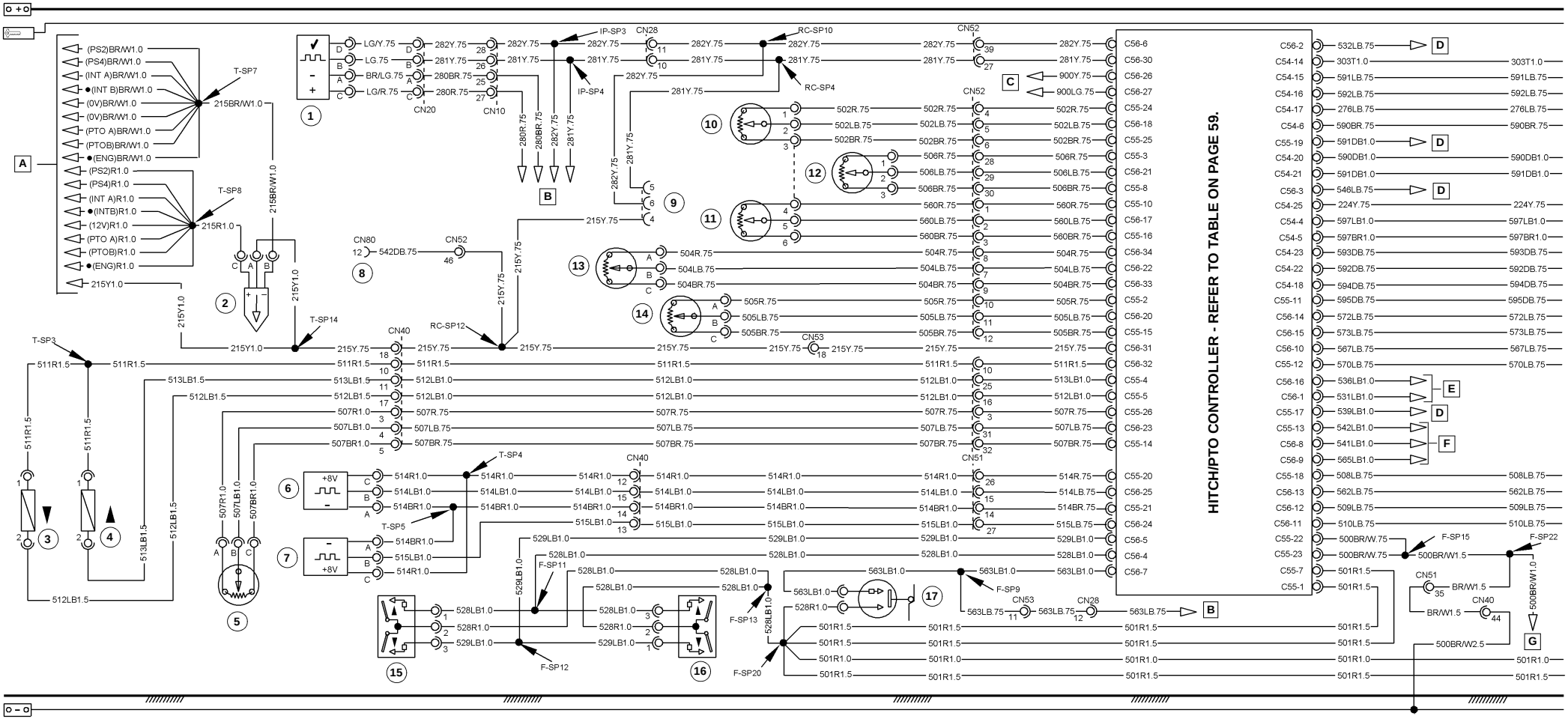

HITCH UP/DOWN SWITCH, SLIP CONTROL SWITCH, AUTO PTO SWITCH, RIDE CONTROL SWITCH

PTO SOLENOID, PTO CONTROL SWITCHES, 540/1000 PTO SPEED SELECTOR SWITCH, OPERATOR PRESENCE SWITCH



## Hitch/PTO Schematic Circuit (For XTX Series XtraSpeed - E Plus Tractors)

**HITCH SOLENOIDS, HITCH POSITION POTENTIOMETER** **RADAR, WHEEL SPEED SENSOR, HITCH LOAD PINS** **CAB HITCH CONTROL POTENTIOMETERS**




## Key

1. RADAR
2. WHEEL SPEED SENSOR
3. HITCH LOWER SOLENOID
4. HITCH RAISE SOLENOID
5. HITCH POSITION POTENTIOMETER (LIFT ARM)
6. RIGHT HAND LOAD PIN
7. LEFT HAND LOAD PIN
8. CONNECTOR 80 (FRONT SUSPENSION AXLE)
9. IMPLEMENT INTERFACE CONNECTOR
10. HITCH DROP SPEED POTENTIOMETER
11. HITCH UPPER HEIGHT CONTROL POTENTIOMETER
12. HITCH TRAVEL POTENTIOMETER
13. HITCH POSITION CONTROL POTENTIOMETER (CAB)
14. HITCH LOAD CONTROL POTENTIOMETER
15. LEFT HAND HITCH REMOTE SWITCH
16. RIGHT HAND HITCH REMOTE SWITCH
17. TRAILER IMPLEMENT SWITCH (IF EQUIPPED)
18. HITCH UP/DOWN SWITCH
19. SLIP CONTROL SWITCH
20. RIDE CONTROL SWITCH
21. AUTO PTO SWITCH
22. PTO SOLENOID
23. PTO SPEED SENSOR
24. PTO INDICATOR LIGHT
25. PTO SWITCH
26. LEFT HAND REMOTE PTO SWITCH (IF EQUIPPED)
27. RIGHT HAND REMOTE PTO SWITCH (IF EQUIPPED)
28. 540/1000 PTO SPEED SELECTOR SWITCH
29. OPERATOR PRESENCE SWITCH
30. FUSE 26 (30 AMP)
31. FUSE 27 (7.5 AMP) (TRACTORS UP TO PIN JJE3500311)
32. FUSE 33 (7.5 AMP)
33. FUSE 43 (7.5 AMP) (TRACTORS FROM PIN JJE3500312)
34. DOOR SWITCH (HITCH CUT-OUT)

A. TO TRANSMISSION CONTROLLER
B. TO INSTRUMENT CLUSTER
C. TO CAN BUS CIRCUIT
D. TO DIFFERENTIAL LOCK CIRCUIT
E. TO BRAKE LIGHT SWITCHES
F. TO MFD CIRCUIT
G. TO CAB CONTROLLER
H. FROM AUXILIARY/REMOTE VALVE CONTROLLER
J. FROM FRONT AXLE SUSPENSION CONTROLLER
K. TO CREEP SWITCH
L. TO AUDIBLE ALARM

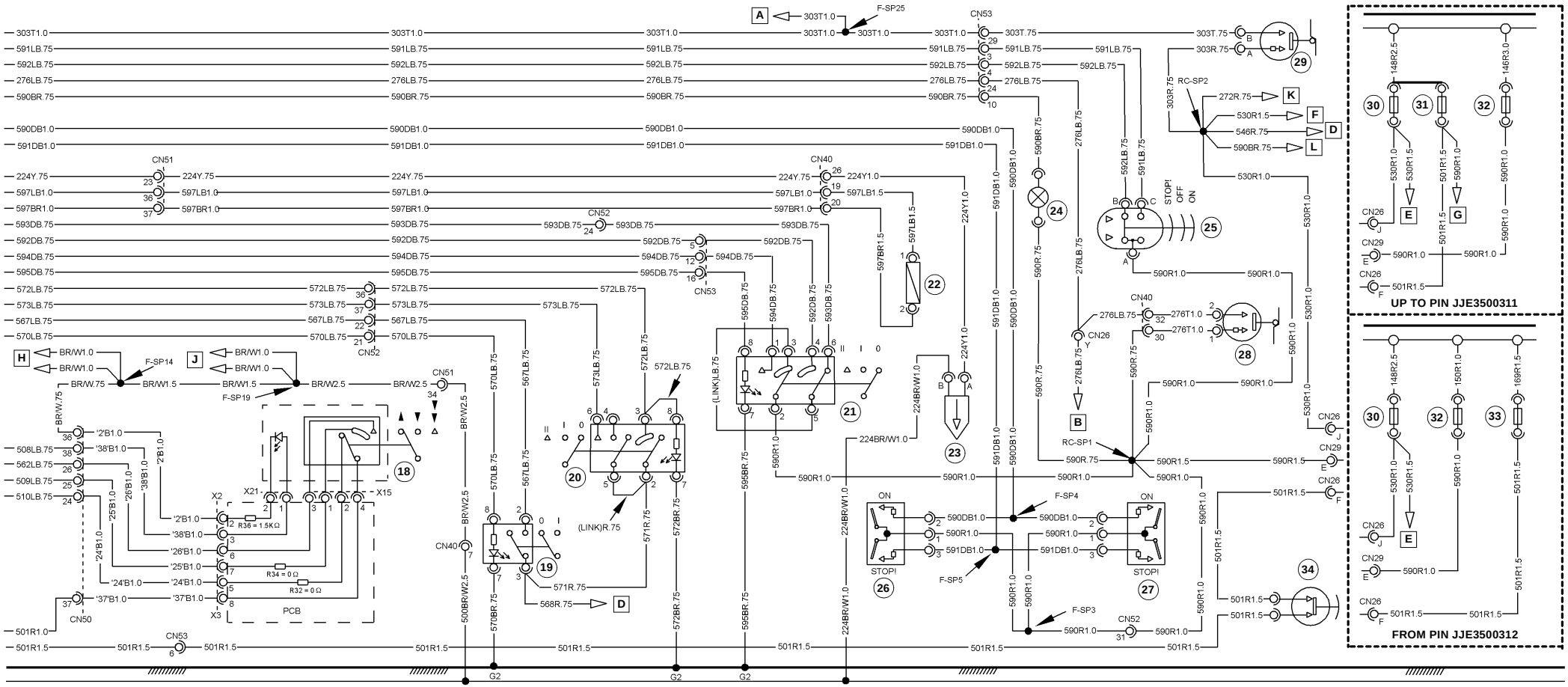
(●) - TRACTORS UP TO PIN JJE3500651 ONLY

**NOTE:** *Only use a HIGH IMPEDANCE multimeter to test the switches and circuits. Do not use a test lamp or damage to the switches may occur.*

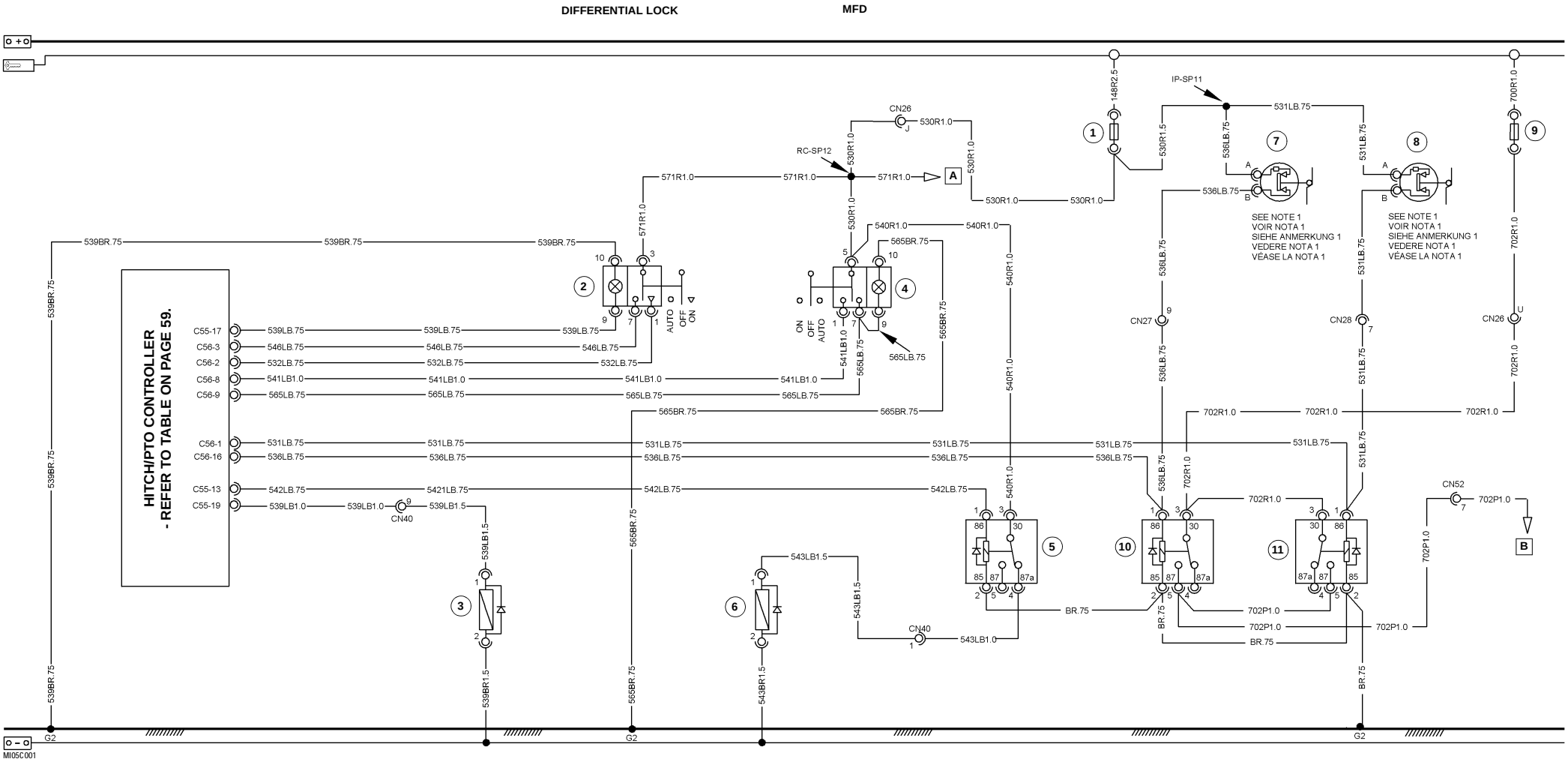
https://truckmanualshub.com/


HITCH UP/DOWN SWITCH, SLIP CONTROL SWITCH, AUTO PTO SWITCH, RIDE CONTROL SWITCH

PTO SOLENOID, PTO CONTROL SWITCHES, 540/1000 PTO SPEED SELECTOR SWITCH, OPERATOR PRESENCE SWITCH



## MFD and Differential Lock Schematic Circuit (For XTX Series XtraSpeed and XtraSpeed - E Tractors)




### Key

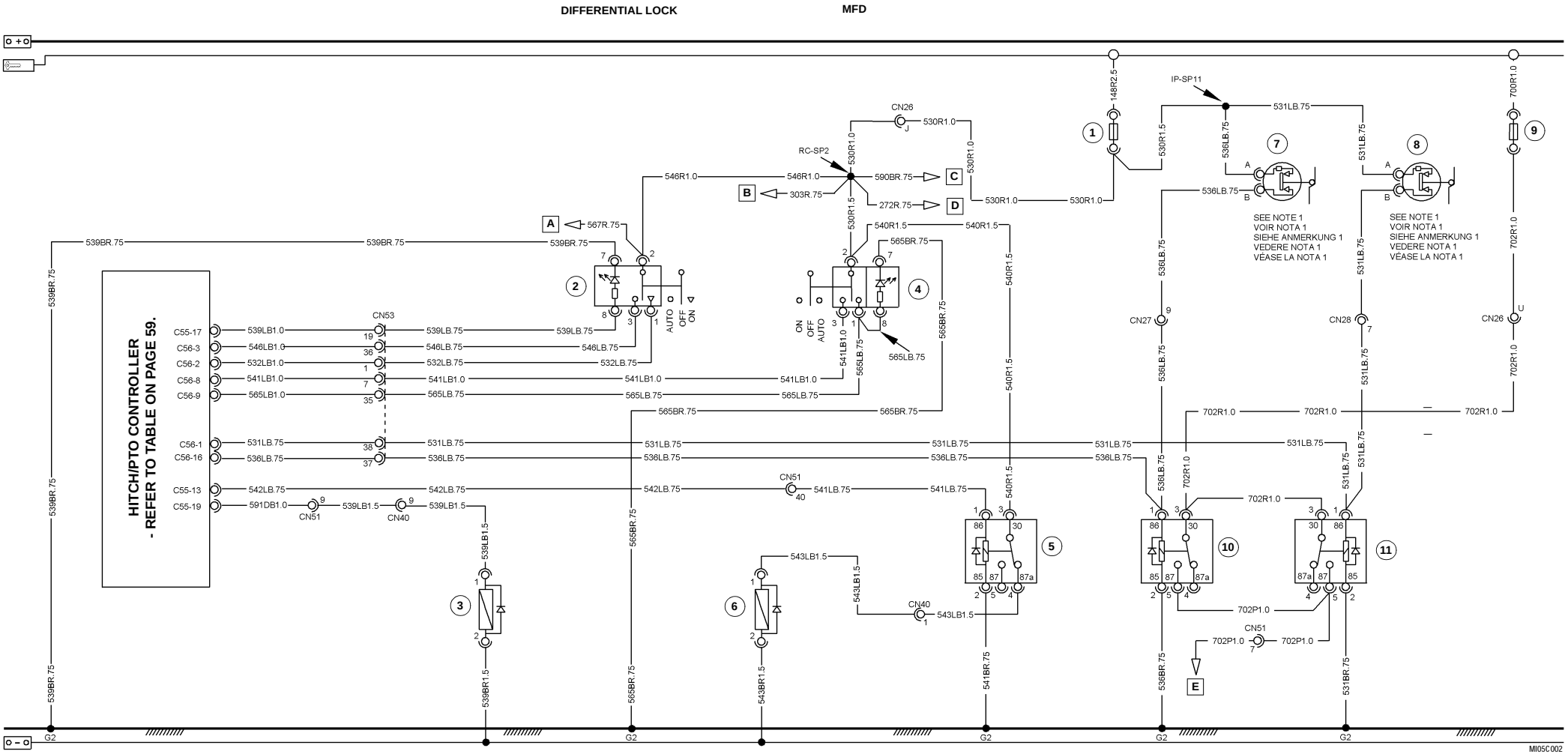
1. FUSE 26 (30 AMP)
2. DIFFERENTIAL LOCK SWITCH
3. DIFFERENTIAL LOCK SOLENOID
4. MFD SWITCH
5. MFD RELAY
6. MFD SOLENOID
7. LEFT HAND BRAKE PEDAL SWITCH
8. RIGHT HAND BRAKE PEDAL SWITCH
9. FUSE 24 (20 AMP)
10. LEFT HAND BRAKE RELAY
11. RIGHT HAND BRAKE RELAY

A. TO RIDE CONTROL SWITCH
B. TO BRAKE LIGHTS

**NOTE:** *Only use a HIGH IMPEDANCE multimeter to test the switches and circuits. Do not use a test lamp or damage to the switches may occur.*

https://truckmanualshub.com/


## MFD and Differential Lock Schematic Circuit (For XTX Series XtraSpeed - E Plus Tractors)




### Key

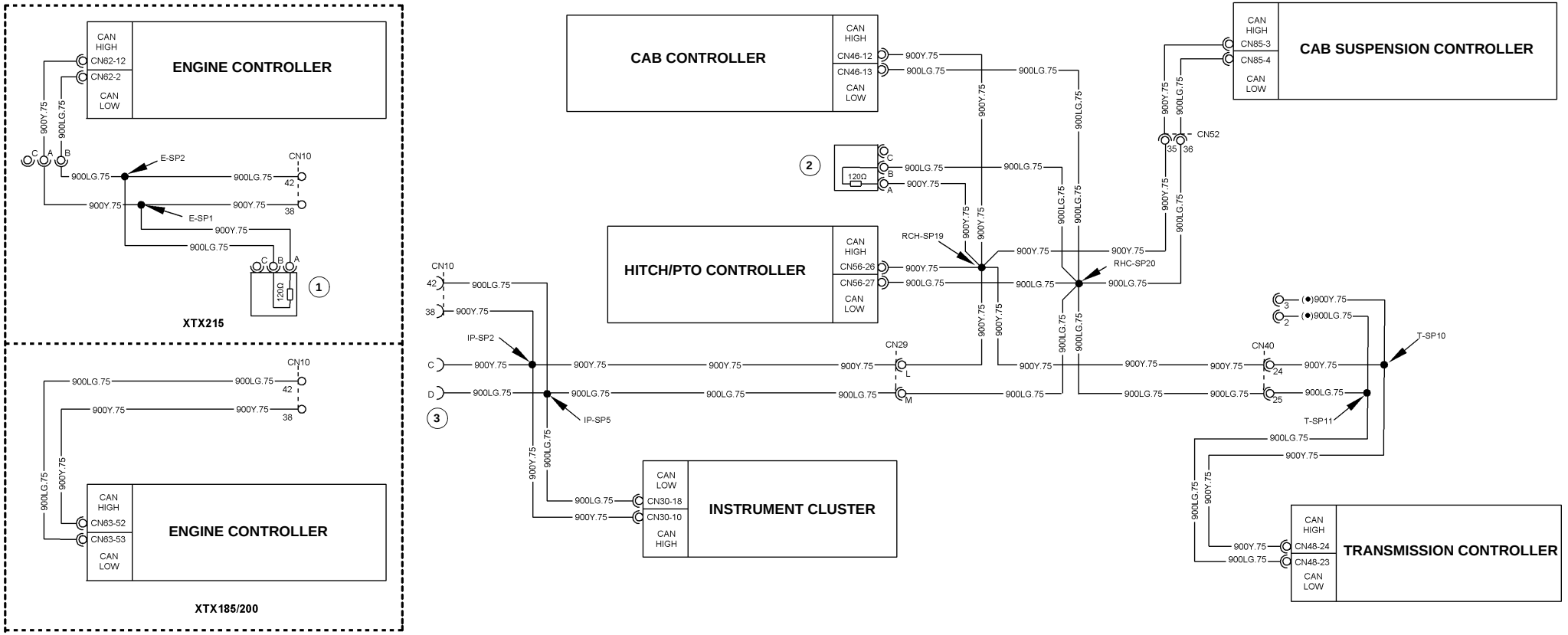
1. FUSE 26 (30 AMP)
2. DIFFERENTIAL LOCK SWITCH
3. DIFFERENTIAL LOCK SOLENOID
4. MFD SWITCH
5. MFD RELAY
6. MFD SOLENOID
7. LEFT HAND BRAKE PEDAL SWITCH
8. RIGHT HAND BRAKE PEDAL SWITCH
9. FUSE 24 (20 AMP)
10. LEFT HAND BRAKE RELAY
11. RIGHT HAND BRAKE RELAY

A. TO RIDE CONTROL SWITCH
B. TO OPERATOR PRESENCE SWITCH
C. TO AUDIBLE ALARM
D. TO CREEP SWITCH
E. TO BRAKE LIGHTS

**NOTE:** *Only use a HIGH IMPEDANCE multimeter to test the switches and circuits. Do not use a test lamp or damage to the switches may occur.*

# CAN BUS SCHEMATIC CIRCUITS

## CAN Bus Schematic Circuit (For XtraSpeed and XtraSpeed - E Tractors)




MI05D049

### Key

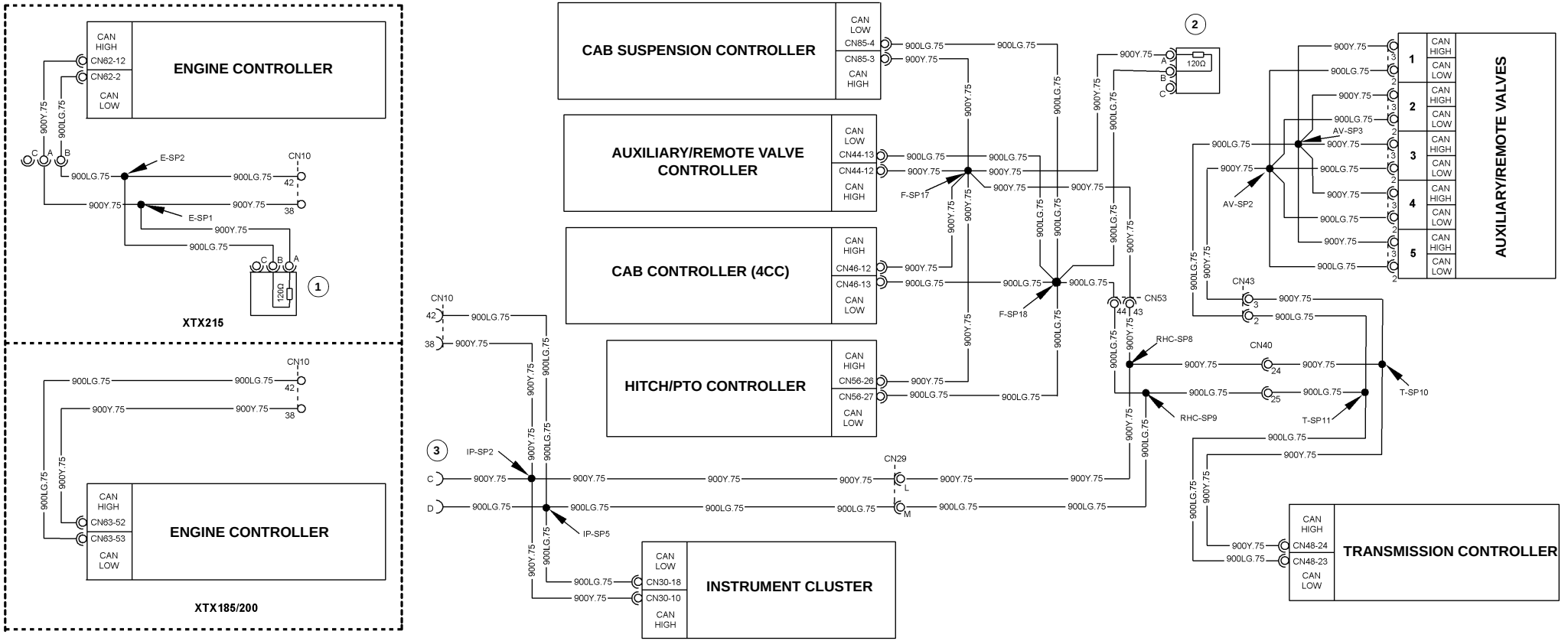
1. ENGINE HARNESS TERMINATION RESISTOR (XTX215 TRACTORS ONLY)
2. TRANSMISSION HARNESS TERMINATION RESISTOR
3. DIAGNOSTIC CONNECTOR (9 PIN)

(●) - TRACTORS UP TO PIN JJE3500645 ONLY

**NOTE:** *For XTX185 and XTX200 tractors the engine harness termination resistor is located within the engine controller.*

https://truckmanualshub.com/


## CAN Bus Schematic Circuit (For XTX Series XtraSpeed - E Plus Tractors)




MI05D049

### Key

1. ENGINE HARNESS TERMINATION RESISTOR (XTX215 TRACTORS ONLY)
2. TRANSMISSION HARNESS TERMINATION RESISTOR
3. DIAGNOSTIC CONNECTOR (9 PIN)

**NOTE:** *For XTX185 and XTX200 tractors the engine harness termination resistor is located within the engine controller.*

https://truckmanualshub.com/


This Page Has Been Left Blank.

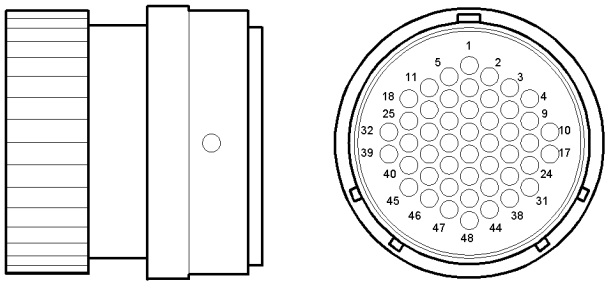
https://truckmanualshub.com/



# MAIN CONNECTORS

## Connector 10 - XTX185 and XTX200 Series Tractors Only

**Location: Cab Firewall**




MI05F174

**ENGINE TO INSTRUMENT PANEL HARNESS (ENGINE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 802 O | A/C HIGH PRESSURE SWITCH |
| 2 | 624 W | ENGINE CONTROLLER NEUTRAL START B+ SUPPLY |
| 3 | 804 O | A/C HIGH PRESSURE SWITCH |
| 4 | 162 R | UNSWITCHED B+ - CLOCK, RADIO AND INSTRUMENT CLUSTER |
| 5 | 200 Y | INSTRUMENT CLUSTER CLEAN GROUND (BATTERY - TERMINAL) |
| 6 | 803 O | A/C COMPRESSOR CLUTCH |
| 7 | - - - - - | OPEN |
| 8 | - - - - - | OPEN |
| 9 | 231 Y | COOLANT LEVEL |
| 10 | - - - - - | OPEN |
| 11 | - - - - - | OPEN |
| 12 | - - - - - | OPEN |
| 13 | 266 Y | AIR FILTER RESTRICTION SWITCH |
| 14 | 121 Y | ALTERNATOR D+ TERMINAL, WARNING LIGHT AND EXCITE |
| 15 | 829 BR/W | ATC CLEAN GROUND |
| 16 | 890 R | HORN B+ |
| 17 | 890 BR | HORN GROUND |
| 18 | 829 BR/W | ATC CLEAN GROUND |
| 19 | 738 P | RH HEADLIGHT - LOW BEAM |
| 20 | 741 P | RH HEADLIGHT - HIGH BEAM |
| 21 | 658 W | WATER IN FUEL |
| 22 | 737 P | LH HEADLIGHT - LOW BEAM |
| 23 | 740 P | LH HEADLIGHT - HIGH BEAM |

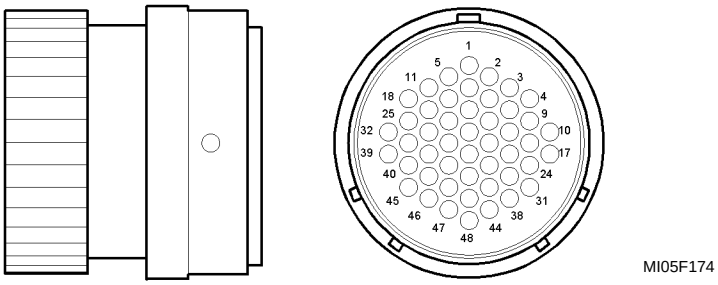
| Cavity | Wire No | Circuit |
|---|---|---|
| 24 | - - - - - | OPEN |
| 25 | 280 BR | RADAR GROUND |
| 26 | 281 Y | RADAR SIGNAL |
| 27 | 280 R | RADAR B+ |
| 28 | 282 Y | RADAR PRESENT |
| 29 | - - - - - | OPEN |
| 30 | - - - - - | OPEN |
| 31 | 784 V | WORK LIGHTS |
| 32 | - - - - - | OPEN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |
| 35 | - - - - - | OPEN |
| 36 | - - - - - | OPEN |
| 37 | - - - - - | OPEN |
| 38 | 900 Y | CAN HIGH |
| 39 | - - - - - | OPEN |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | 900 LG | CAN LOW |
| 43 | - - - - - | OPEN |
| 44 | 643 R | FOOT THROTTLE 5V SUPPLY |
| 45 | 600 W | ENGINE CONTROLLER SWITCHED B+ |
| 46 | 643 Y | FOOT THROTTLE SIGNAL |
| 47 | 900 BR | K - LINE |
| 48 | 643 BR | FOOT THROTTLE 0V RETURN |

https://truckmanualshub.com/



## Connector 10 - XTX215 Series Tractors Only

**Location: Cab Firewall**




MI05F174

**ENGINE TO INSTRUMENT PANEL HARNESS (ENGINE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 802 O | A/C HIGH PRESSURE SWITCH |
| 2 | 625 W | STARTER RELAY NEUTRAL START B+ SUPPLY |
| 3 | 804 O | A/C HIGH PRESSURE SWITCH |
| 4 | 162 R | UNSWITCHED B+ - CLOCK, RADIO AND INSTRUMENT CLUSTER |
| 5 | 200 BR/W | INSTRUMENT CLUSTER CLEAN GROUND (BATTERY - TERMINAL) |
| 6 | 803 O | A/C COMPRESSOR CLUTCH |
| 7 | - - - - - | OPEN |
| 8 | - - - - - | OPEN |
| 9 | 231 Y | COOLANT LEVEL |
| 10 | - - - - - | OPEN |
| 11 | 235 V | NOT USED |
| 12 | 654 W | NOT USED |
| 13 | 266 Y | AIR FILTER RESTRICTION SWITCH |
| 14 | 121 Y | ALTERNATOR D+ TERMINAL, WARNING LIGHT AND EXCITE |
| 15 | 829 BR/W | ATC CLEAN GROUND |
| 16 | 890 R | HORN B+ |
| 17 | 890 BR | HORN GROUND |
| 18 | 828 BR/W | ATC CLEAN GROUND |
| 19 | 738 P | RH HEADLIGHT - LOW BEAM |
| 20 | 741 P | RH HEADLIGHT - HIGH BEAM |
| 21 | - - - - - | OPEN |
| 22 | 737 P | LH HEADLIGHT - LOW BEAM |
| 23 | 740 P | LH HEADLIGHT - HIGH BEAM |

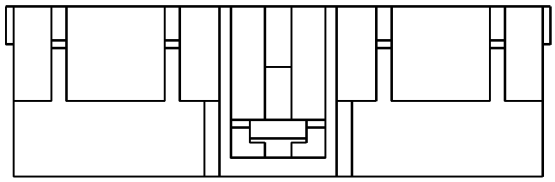
| Cavity | Wire No | Circuit |
|---|---|---|
| 24 | - - - - - | OPEN |
| 25 | 280 BR | RADAR GROUND |
| 26 | 281 Y | RADAR SIGNAL |
| 27 | 280 R | RADAR B+ |
| 28 | 282 Y | RADAR PRESENT |
| 29 | - - - - - | OPEN |
| 30 | - - - - - | OPEN |
| 31 | 784 V | WORK LIGHTS |
| 32 | - - - - - | OPEN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |
| 35 | - - - - - | OPEN |
| 36 | 652 BR | NOT USED |
| 37 | - - - - - | OPEN |
| 38 | 900 Y | CAN HIGH |
| 39 | 653 BR | NOT USED |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | 900 LG | CAN LOW |
| 43 | - - - - - | OPEN |
| 44 | 643 R | FOOT THROTTLE 5V SUPPLY |
| 45 | 132 R | ENGINE CONTROLLER SWITCHED B+ |
| 46 | 643 Y | FOOT THROTTLE SIGNAL |
| 47 | - - - - - | OPEN |
| 48 | 643 BR | FOOT THROTTLE 0V RETURN |

https://truckmanualshub.com/



## Connector 26

**Location: Right Hand Console**



477I96

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

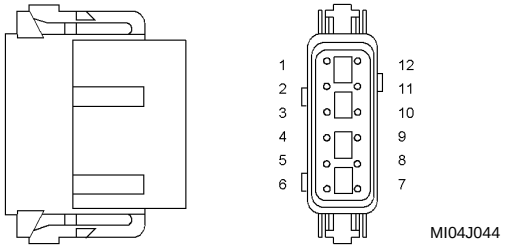
| Cavity | Wire No | Circuit |
|---|---|---|
| A | 590 BR | AUDIBLE ALARM |
| B | 707 P | LH TAIL/POSITION LIGHT |
| C | 708 P | RH TAIL/POSITION LIGHT |
| D | - - - - - | OPEN |
| E | 590 R | CAB CONTROLLER SWITCHED B+ |
| F | 501 R | HITCH/PTO CONTROLLER SWITCHED B+ |
| G | 784 V | REAR FENDER WORK LIGHTS |
| H | 810 R | SEAT B+ |
| J | 530 R | MFD AND DIFF LOCK B+ |
| K | 134 R | AUXILIARY POWER CONNECTOR SWITCHED B+ |
| L | 756 P | RH TURN SIGNAL |
| M | 757 P | LH TURN SIGNAL |
| N | (IIC) R | IIC UNSWITCHED POWER B+ |
| P | 133 R | AUXILIARY POWER FENDER HARNESS CONNECTOR (*)<br>7 PIN CONNECTOR (**) |
| R | 135 R | RH CONSOLE AUXILIARY POWER UNSWITCHED B+ |
| S | 817 R | CIGAR LIGHTER |
| T | 269 Y | PARK BRAKE WARNING LIGHT |
| U | 702 R | BRAKE RELAY B+ |
| V | - - - - - | OPEN |
| W | 785 V | REAR FOG LIGHTS (EUR) |
| X | 254 Y | PARK LOCK SIGNAL |
| Y | 276 LB | 1000 RPM PTO SWITCH |
| Z | (VP) R | AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ (XTRASPEED - E PLUS ONLY) |

*(*) European Specification Tractors Only.*

*(**) American Specification Tractors Only.*

## Connector 27

**Location: Right Hand Console**




**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

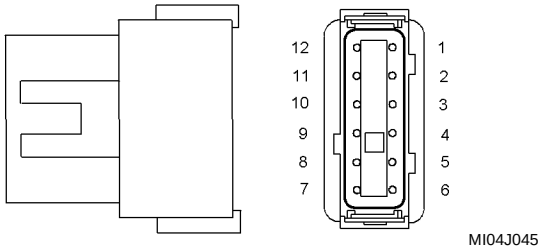
| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 240 Y | AIR TRAILER BRAKE PRESSURE |
| 2 | 515 R | LOADER CONTROLS B+ |
| 3 | 656 Y | CLUTCH POSITION SIGNAL |
| 4 | - - - - - | OPEN |
| 5 | 660 Y | BOTTOM OF CLUTCH SIGNAL |
| 6 | 233 Y | FUEL LEVEL SENDER |
| 7 | 656 BR | CLUTCH POSITION RETURN |
| 8 | 656 R | CLUTCH POSITION B+ |
| 9 | 536 LB | LH BRAKE SIGNAL |
| 10 | 267 Y | HYDRAULIC FILTER RESTRICTION SWITCH |
| 11 | - - - - - | OPEN |
| 12 | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 28

**Location: Right Hand Console**



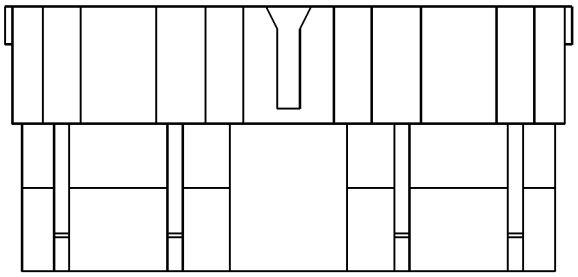

MI04J045

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 2 | 511 T | FORWARD SIGNAL |
| 3 | 562 R | F/N/R, F/N/R/P 12V SUPPLY |
| 4 | 606 W | IIC SWITCHED POWER SENSING |
| 5 | - - - - - | OPEN |
| 6 | 513 T | REVERSE SIGNAL |
| 7 | 531 LB | RH BRAKE SIGNAL |
| 8 | 514 T | NEUTRAL SIGNAL |
| 9 | - - - - - | OPEN |
| 10 | 281 Y | RADAR SIGNAL (HITCH) |
| 11 | 282 Y | RADAR PRESENT (IIC) |
| 12 | 563 LB | IMPLEMENT DOWN SWITCH |
| 2 | 511 T | FORWARD SIGNAL |

## Connector 29

**Location: Right Hand Console**



478I96

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| A | 835 O | FRONT WINDSCREEN WASHER |
| B | 845 O | REAR WINDSHIELD WASHER |
| C | 550 R | FRONT PTO B+ |
| D | 551 LB | FRONT PTO SIGNAL |
| E | 590 R | REAR PTO SWITCHED B+ |
| F | 161 R | (##) AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ |
| G | 134 R | IIIC SWITCHED POWER |
| H | 776 P | ROTARY BEACON LIGHT |
| J | 531 R | MFD AXLE SUSPENSION UNSWITCHED POWER |
| K | 530 R | MFD AXLE SUSPENSION SWITCHED POWER |
| L | 900 Y | CAN HIGH |
| M | 900 LG | CAN LOW |
| N | - - - - - | OPEN |
| P | 500B R | CAB CONTROLLER UNSWITCHED B+ |
| R | 550 R | TRANSMISSION CONTROLLER SWITCHED B+ |
| S | 400 R | TRANSMISSION CONTROLLER UNSWITCHED B+ |
| T | 643 Y | FOOT THROTTLE SIGNAL |
| U | 643 BR | FOOT THROTTLE 0V RETURN |
| V | 160 R | (##) AUXILIARY/REMOTE VALVE CONTROLLER UNSWITCHED B+ |
| W | - - - - - | OPEN |
| X | 660 W | (#) CAB SUSPENSION CONTROLLER SWITCHED B+ |
| | 660 R | (##) CAB SUSPENSION CONTROLLER SWITCHED B+ |
| Y | (ARM) R | (##) ARMREST SWITCHED B+ |
| Z | - - - - - | OPEN |

*(#) XtraSpeed and XtraSpeed - E tractors only.*

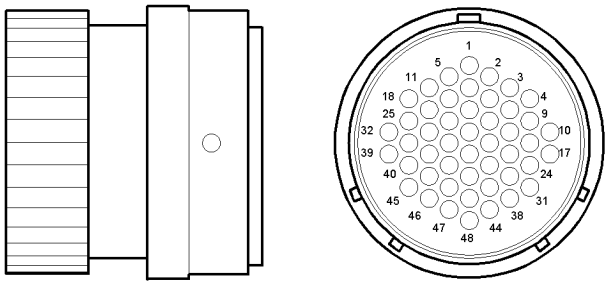
*(#) XtraSpeed - E Plus tractors only.*

https://truckmanualshub.com/



## Connector 40

**Location: Cab Floor (Right Hand Console)**




MI05F174

**RIGHT HAND CONSOLE HARNESS TO TRANSMISSION HARNESS (TRANSMISSION HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 543 LB | MFD SOLENOID B+ |
| 2 | 233 Y | FUEL LEVEL SENDER |
| 3 | 507 R | +8 V POSITION POTENTIOMETER |
| 4 | 507 LB | POSITION SIGNAL |
| 5 | 507 BR | POSITION POTENTIOMETER LOW |
| 6 | (LINK) R | TRANSMISSION CONTROLLER TO CAB CONTROLLER LINK |
| 7 | 500 BR/W | HITCH CONTROLLER CLEAN GROUND |
| 8 | 269 Y | PARK BRAKE WARNING LIGHT |
| 9 | 539 LB | DIFF LOCK SOLENOID B+ |
| 10 | 511 R | HITCH SOLENOID B+ |
| 11 | 513 LB | HITCH RAISE SOLENOID |
| 12 | 514 R | HITCH PIN +8 VOLTS |
| 13 | 515 LB | LH HITCH PIN SIGNAL |
| 14 | 514 BR | HITCH PINS LOW |
| 15 | 514 LB | RH HITCH PIN SIGNAL |
| 16 | 540 R | 4TH AUXILIARY VALVE |
| 17 | 512 LB | HITCH LOWER SOLENOID |
| 18 | 215 Y | WHEEL SPEED SIGNAL |
| 19 | 597 LB | PTO SOLENOID B+ |
| 20 | 597 BR | PTO SOLENOID GROUND |
| 21 | 267 Y | HYDRAULIC FILTER SIGNAL |
| 22 | 280 BR/W | PARK LOCK RETURN |
| 23 | - - - - - | OPEN |
| 24 | 900 Y | CAN HIGH |
| 25 | 900 LG | CAN LOW |
| 26 | 224 Y | PTO SPEED SIGNAL |

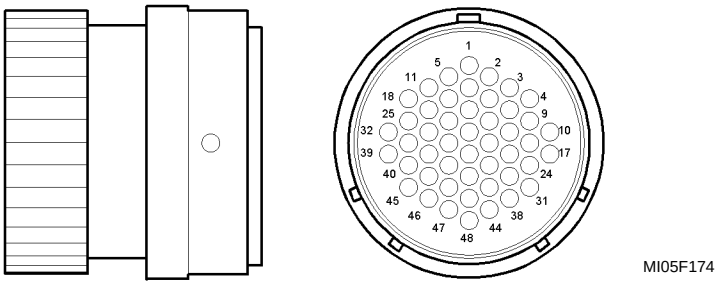
| Cavity | Wire No | Circuit |
|---|---|---|
| 27 | (4TH) Y | XTRASPEED TRACTORS FROM PIN JJE3500646 - NOT USED |
| 28 | - - - - - | OPEN |
| 29 | - - - - - | OPEN |
| 30 | 276 T | 540/1000 PTO SWITCH B+ |
| 31 | 240 Y | TRAILER BRAKE PRESSURE |
| 32 | 276 T | 540/1000 PTO SWITCH |
| 33 | 551 O | FRONT PTO SOLENOID |
| 34 | 500 BR/W | IIC CLEAN GROUND |
| 35 | (1ST) Y | XTRASPEED TRACTORS FROM PIN JJE3500646 - NOT USED |
| 36 | 542 T | 4TH AUXILIARY VALVE RAISE |
| 37 | 541 T | 4TH AUXILIARY VALVE LOWER |
| 38 | 400 R | TRANSMISSION CONTROLLER UNSWITCHED B+ |
| 39 | 516 T | LOADER SOLENOID RAISE |
| 40 | 515 T | LOADER SOLENOID LOWER |
| 41 | 550 R | TRANSMISSION CONTROLLER SWITCHED B+ |
| 42 | (2ND) Y | XTRASPEED TRACTORS FROM PIN JJE3500646 - NOT USED |
| 43 | (3RD) Y | XTRASPEED TRACTORS FROM PIN JJE3500646 - NOT USED |
| 44 | 500 BR/W | CAB CONTROLLER CLEAN GROUND |
| 45 | (VP IN) R | AUXILIARY/REMOTE VALVES B+ (XTRASPEED - E PLUS ONLY) |
| 46 | 656 R | CLUTCH POSITION B+ |
| 47 | 656 Y | CLUTCH POSITION SIGNAL |
| 48 | 656 BR | CLUTCH POSITION RETURN |

https://truckmanualshub.com/



## Connector 50 (XtraSpeed - E Plus Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO ARMREST HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 540 R | POTENTIOMETER REFERENCE 5V |
| 2 | 540 BR | ARM REST 0V |
| 3 | 508 DB | AUXILIARY VALVE TIMER 1 SIGNAL |
| 4 | 509 DB | AUXILIARY VALVE TIMER 2 SIGNAL |
| 5 | 510 DB | AUXILIARY VALVE TIMER 3 SIGNAL |
| 6 | 528 DB | AUXILIARY VALVE TIMER 4 SIGNAL |
| 7 | 529 DB | AUXILIARY VALVE TIMER 5 SIGNAL |
| 8 | 511DB | AUXILIARY VALVE FLOW 1 SIGNAL |
| 9 | 512 DB | AUXILIARY VALVE FLOW 2 SIGNAL |
| 10 | 513 DB | AUXILIARY VALVE FLOW 3 SIGNAL |
| 11 | 530 DB | AUXILIARY VALVE FLOW 4 SIGNAL |
| 12 | 531 DB | AUXILIARY VALVE FLOW 5 SIGNAL |
| 13 | 644 R | REMOTE THROTTLE (5V) |
| 14 | 644Y | REMOTE THROTTLE SIGNAL |
| 15 | 644 BR | REMOTE THROTTLE (0V) |
| 16 | 502 DB | STOP SWITCH |
| 17 | 503 DB | STOP SWITCH |
| 18 | (ARM) R | GEAR UP SHIFT SWITCHED B+ |
| 19 | 525 DB | GEAR UP SHIFT SIGNAL |
| 20 | (ARM) R | GEAR DOWN SHIFT SWITCHED B+ |
| 21 | 524 DB | GEAR UP SHIFT SIGNAL |
| 22 | 501 DB | AUXILIARY VALVE ENABLE LIGHT SIGNAL |
| 23 | 522 DB | AUXILIARY VALVE ENABLE LIGHT GROUND |
| 24 | 510 LB | HITCH RAISE SIGNAL |
| 25 | 509 LB | HITCH LOWER SIGNAL |
| 26 | 562 LB | HITCH FAST LOWER SIGNAL |

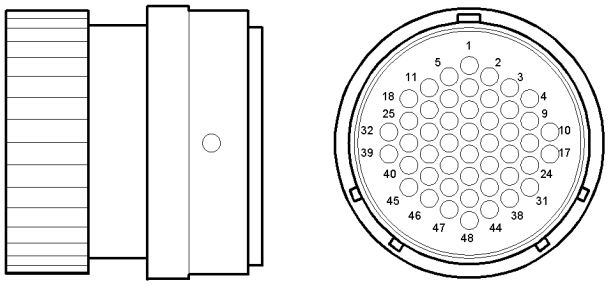
| Cavity | Wire No | Circuit |
|---|---|---|
| 27 | 515 DB | AUXILIARY VALVE JOYSTICK 1A SIGNAL |
| 28 | 516 DB | AUXILIARY VALVE JOYSTICK 1B SIGNAL |
| 29 | 514 DB | AUXILIARY VALVE JOYSTICK 2A SIGNAL |
| 30 | 532 DB | AUXILIARY VALVE JOYSTICK 2B SIGNAL |
| 31 | 518 DB | 5TH AUXILIARY VALVE RAISE |
| 32 | 517 DB | 5TH AUXILIARY VALVE LOWER |
| 33 | 527 DB | RANGE SKIP SWITCH SIGNAL |
| 34 | 527 R | RANGE SKIP SIGNAL |
| 35 | (ARM) R | ARMREST CONTROL SWITCHED B+ |
| 36 | BR/W | ARMREST CONTROL CLEAN GROUND |
| 37 | 501 R | HITCH CONTROL SWITCH B+ |
| 38 | 508 LB | HITCH ENABLE LIGHT |
| 39 | - - - - - | OPEN |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | - - - - - | OPEN |
| 44 | - - - - - | OPEN |
| 45 | - - - - - | OPEN |
| 46 | - - - - - | OPEN |
| 47 | - - - - - | OPEN |
| 48 | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 51 (XtraSpeed - E Plus Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 757 P | LEFT HAND TURN SIGNAL |
| 2 | 756 P | RIGHT HAND TURN SIGNAL |
| 3 | 507 R | HITCH POSITION POTENTIOMETER B+ |
| 4 | 707 P | LEFT HAND REAR SIDE/POSITION LIGHT |
| 5 | 708 P | RIGHT HAND REAR SIDE/ POSITION LIGHT |
| 6 | 785 V | REAR FOG LIGHT |
| 7 | 702 P | STOP LIGHTS |
| 8 | (VP) T | AUXILIARY/REMOTE VALVE VP OUT |
| 9 | 591 DB | DIFFERENTIAL LOCK SOLENOID B+ |
| 10 | 511 R | HITCH SOLENOID B+ |
| 11 | 835 O | FRONT WINDSCREEN WASHER |
| 12 | 845 O | REAR WINDSCREEN WASHER |
| 13 | 776 P | BEACON LIGHT (EUROPEAN SPECIFICATION TRACTORS ONLY) |
| 14 | 514 BR | LOAD PIN RETURN |
| 15 | 514 LB | RIGHT HAND LOAD PIN SIGNAL |
| 16 | 512 LB | HITCH LOWER SOLENOID |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | - - - - - | OPEN |
| 22 | - - - - - | OPEN |
| 23 | 224 Y | PTO SPEED SIGNAL |
| 24 | 850 R | CAB SUSPENSION CONTROLLER SWITCHED B+ |

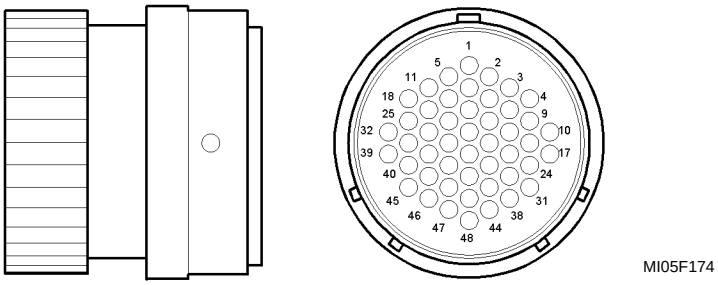
| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 513 LB | HITCH LOWER SOLENOID |
| 26 | 514 R | LOAD PIN 8V SUPPLY |
| 27 | 515 LB | LEFT HAND LOAD PIN SIGNAL |
| 28 | - - - - - | OPEN |
| 29 | 133 R | AUXILIARY POWER SWITCHED B+ |
| 30 | 784 P | REAR WORK LIGHTS |
| 31 | 507 LB | HITCH POSITION POTENTIOMETER SIGNAL |
| 32 | 507 BR | HITCH POSITION POTENTIOMETER RETURN |
| 33 | (LINK) R | CAB CONTROLLER/ TRANSMISSION CONTROLLER LINK |
| 34 | BR/W | HITCH CONTROLLER CLEAN GROUND |
| 35 | BR/W | CLEAN GROUND |
| 36 | 597 LB | PTO SOLENOID B+ |
| 37 | 597 BR | PTO SOLENOID RETURN |
| 38 | - - - - - | OPEN |
| 39 | - - - - - | OPEN |
| 40 | 542 LB | MFD RELAY SUPPLY |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | - - - - - | OPEN |
| 44 | - - - - - | OPEN |
| 45 | - - - - - | OPEN |
| 46 | - - - - - | OPEN |
| 47 | - - - - - | OPEN |
| 48 | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 52 (XtraSpeed and XtraSpeed - E Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 560 R | HITCH UPPER LIMIT POTENTIOMETER SUPPLY |
| 2 | 560 LB | HITCH UPPER LIMIT POTENTIOMETER SIGNAL |
| 3 | 560 BR | HITCH UPPER LIMIT POTENTIOMETER RETURN |
| 4 | 502 R | HITCH DROP SPEED POTENTIOMETER SUPPLY |
| 5 | 502 LB | HITCH DROP SPEED POTENTIOMETER SIGNAL |
| 6 | 502 BR | HITCH DROP SPEED POTENTIOMETER RETURN |
| 7 | 504 LB | HITCH POSITION COMMAND POTENTIOMETER SIGNAL |
| 8 | 504 R | HITCH POSITION COMMAND POTENTIOMETER SUPPLY |
| 9 | 504 BR | HITCH POSITION COMMAND POTENTIOMETER RETURN |
| 10 | 505 R | HITCH LOAD COMMAND POTENTIOMETER SUPPLY |
| 11 | 505 LB | HITCH LOAD COMMAND POTENTIOMETER SIGNAL |
| 12 | 505 BR | HITCH LOAD COMMAND POTENTIOMETER RETURN |
| 13 | - - - - - | OPEN |
| 14 | - - - - - | OPEN |
| 15 | - - - - - | OPEN |
| 16 | - - - - - | OPEN |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | 570 LB | SLIP CONTROL LIGHT SUPPLY |
| 22 | 567 LB | SLIP CONTROL ON SIGNAL |
| 23 | - - - - - | OPEN |
| 24 | 593 DB | AUTO PTO OFF SIGNAL |

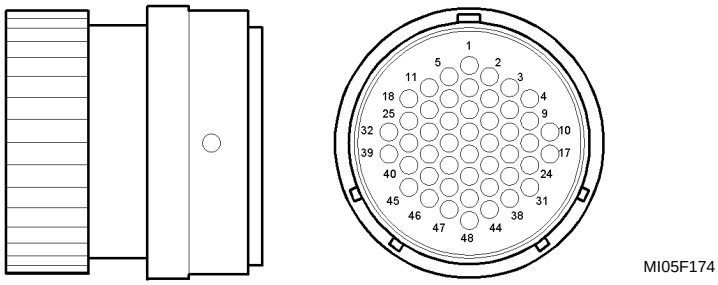
| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 531 R | MFD AXLE SUSPENSION UNSWITCHED B+ |
| 26 | 643 Y | FOOT THROTTLE SIGNAL |
| 27 | 281 Y | RADAR SIGNAL |
| 28 | 506 R | HITCH TRAVEL POTENTIOMETER SUPPLY |
| 29 | 506 LB | HITCH TRAVEL POTENTIOMETER SIGNAL |
| 30 | 506 BR | HITCH TRAVEL POTENTIOMETER RETURN |
| 31 | 590 R | REMOTE PTO SWITCH B+ |
| 32 | - - - - - | OPEN |
| 33 | 161 R | AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ |
| 34 | - - - - - | OPEN |
| 35 | 500B R | CAB CONTROLLER UNSWITCHED B+ |
| 36 | 572 LB | RIDE CONTROL ON SIGNAL |
| 37 | 573 LB | RIDE CONTROL OVERRIDE SIGNAL |
| 38 | - - - - - | OPEN |
| 39 | 282 Y | RADAR PRESENT SIGNAL |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | 534 DB | MFD AXLE SUSPENSION UP SIGNAL |
| 44 | 535 DB | MFD AXLE SUSPENSION DOWN SIGNAL |
| 45 | 533 DB | MFD AXLE SUSPENSION REGULATION ON |
| 46 | 542 DB | MFD AXLE SUSPENSION UNSWITCHED UP SIGNAL |
| 47 | 563 DB | MFD AXLE SUSPENSION INDICATOR LIGHT |
| 48 | 530 R | MFD AXLE SUSPENSION SWITCHED B+ |

https://truckmanualshub.com/



## Connector 52 (XtraSpeed - E Plus Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 560 R | HITCH UPPER LIMIT POTENTIOMETER SUPPLY |
| 2 | 560 LB | HITCH UPPER LIMIT POTENTIOMETER SIGNAL |
| 3 | 560 BR | HITCH UPPER LIMIT POTENTIOMETER RETURN |
| 4 | 502 R | HITCH DROP SPEED POTENTIOMETER SUPPLY |
| 5 | 502 LB | HITCH DROP SPEED POTENTIOMETER SIGNAL |
| 6 | 502 BR | HITCH DROP SPEED POTENTIOMETER RETURN |
| 7 | 504 LB | HITCH POSITION COMMAND POTENTIOMETER SIGNAL |
| 8 | 504 R | HITCH POSITION COMMAND POTENTIOMETER SUPPLY |
| 9 | 504 BR | HITCH POSITION COMMAND POTENTIOMETER RETURN |
| 10 | 505 R | HITCH LOAD COMMAND POTENTIOMETER SUPPLY |
| 11 | 505 LB | HITCH LOAD COMMAND POTENTIOMETER SIGNAL |
| 12 | 505 BR | HITCH LOAD COMMAND POTENTIOMETER RETURN |
| 13 | - - - - - | OPEN |
| 14 | - - - - - | OPEN |
| 15 | - - - - - | OPEN |
| 16 | - - - - - | OPEN |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | 570 LB | SLIP CONTROL LIGHT SUPPLY |
| 22 | 567 LB | SLIP CONTROL ON SIGNAL |
| 23 | - - - - - | OPEN |
| 24 | 593 DB | AUTO PTO OFF SIGNAL |

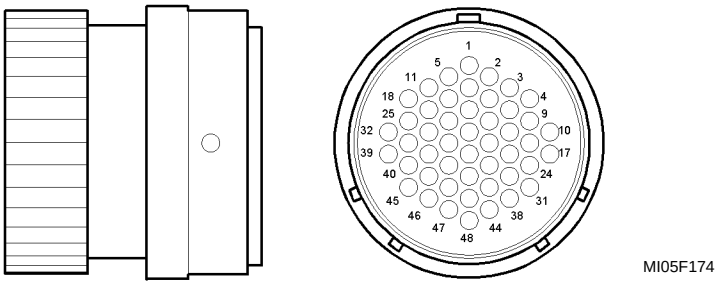
| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 531 R | MFD AXLE SUSPENSION CONTROLLER UNSWITCHED B+ |
| 26 | 643 Y | FOOT THROTTLE SIGNAL |
| 27 | 281 Y | RADAR SIGNAL |
| 28 | 506 R | HITCH TRAVEL POTENTIOMETER SUPPLY |
| 29 | 506 LB | HITCH TRAVEL POTENTIOMETER SIGNAL |
| 30 | 506 BR | HITCH TRAVEL POTENTIOMETER RETURN |
| 31 | 590 R | REMOTE PTO SWITCH B+ |
| 32 | - - - - - | OPEN |
| 33 | 161 R | AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ |
| 34 | - - - - - | OPEN |
| 35 | 500B R | CAB CONTROLLER UNSWITCHED B+ |
| 36 | 572 LB | RIDE CONTROL ON SIGNAL |
| 37 | 573 LB | RIDE CONTROL OVERRIDE SIGNAL |
| 38 | - - - - - | OPEN |
| 39 | 282 Y | RADAR PRESENT SIGNAL |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | 534 DB | FRONT AXLE SUSPENSION UP SIGNAL |
| 44 | 535 DB | MFD AXLE SUSPENSION DOWN SIGNAL |
| 45 | 533 DB | MFD AXLE SUSPENSION REGULATION ON |
| 46 | 542 DB | MFD AXLE SUSPENSION UNSWITCHED UP SIGNAL |
| 47 | 563 DB | MFD AXLE SUSPENSION INDICATOR LIGHT |
| 48 | 530 R | MFD AXLE SUSPENSION SWITCHED B+ |

https://truckmanualshub.com/



## Connector 53 (XtraSpeed - E Plus Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 532 LB | DIFFERENTIAL LOCK ON SIGNAL |
| 2 | 280 BR | PARK LOCK SOLENOID RETURN |
| 3 | 591 LB | PTO ON SIGNAL |
| 4 | 592 LB | PTO OFF SIGNAL |
| 5 | 592 DB | AUTO PTO ON SIGNAL |
| 6 | 501 R | HITCH/PTO CONTROLLER SWITCHED B+ |
| 7 | 541 LB | MFD ON SIGNAL |
| 8 | 254 Y | PARK LOCK ON SIGNAL |
| 9 | 272 Y | CREEP ON SIGNAL |
| 10 | 590 BR | PTO INDICATOR LIGHT |
| 11 | 563 LB | TRAILER IMPLEMENT SIGNAL (INSTRUMENT CLUSTER) |
| 12 | 594 DB | AUTO PTO SET SIGNAL |
| 13 | 562 R | SHUTTLE SWITCH 12V SUPPLY |
| 14 | 511 T | FORWARD SIGNAL |
| 15 | - - - - - | OPEN |
| 16 | 595 DB | AUTO PTO LIGHT |
| 17 | - - - - - | OPEN |
| 18 | 215 Y | WHEEL SPEED SIGNAL |
| 19 | 539 LB | AUTO DIFFERENTIAL LOCK LIGHT |
| 20 | - - - - - | OPEN |
| 21 | - - - - - | OPEN |
| 22 | 590 R | CAB CONTROLLER SWITCHED B+ |
| 23 | 160 R | AUXILIARY/REMOTE VALVE CONTROLLER UNSWITCHED B+ |
| 24 | 276 LB | 540/1000 PTO SELECTOR SWITCH SIGNAL |

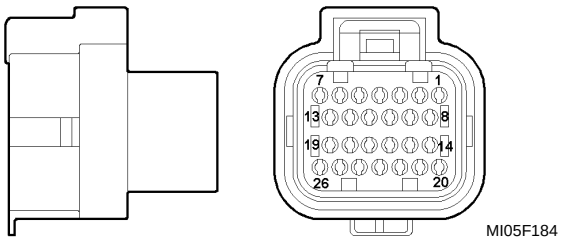
| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 513 T | REVERSE SIGNAL |
| 26 | (ARM) R | ARMREST CONTROL SWITCHED B+ |
| 27 | (vp) R | AUXILIARY/REMOTE VALVE CONTROLLER VP IN |
| 28 | 514 T | NEUTRAL SIGNAL |
| 29 | 303 T | OPERATOR PRESENCE SWITCH SIGNAL |
| 30 | - - - - - | OPEN |
| 31 | - - - - - | OPEN |
| 32 | - - - - - | OPEN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |
| 35 | 565 LB | AUTO MFD ON SIGNAL |
| 36 | 546 LB | AUTO DIFFERENTIAL LOCK ON SIGNAL |
| 37 | 536 LB | LEFT HAND BRAKE SIGNAL |
| 38 | 531 LB | RIGHT HAND BRAKE SIGNAL |
| 39 | - - - - - | OPEN |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | 900 Y | CAN HIGH |
| 44 | 900 LG | CAN LOW |
| 45 | 660 Y | CAB CONTROLLER BOTTOM OF CLUTCH SIGNAL |
| 46 | 510 T | F/N/R, FOOT THROTTLE 5V REF |
| 47 | - - - - - | OPEN |
| 48 | 643 BR | FOOT THROTTLE 0V REF |

https://truckmanualshub.com/



## Connector 54

**Location: Hitch/PTO Controller**




MI05F184

**RIGHT HAND CONSOLE HARNESS TO HITCH/PTO CONTROLLER (XTRASPEED AND XTRASPEED - E TRACTORS) FENDER HARNESS TO HITCH/PTO CONTROLLER (XTRASPEED - E PLUS TRACTORS)**

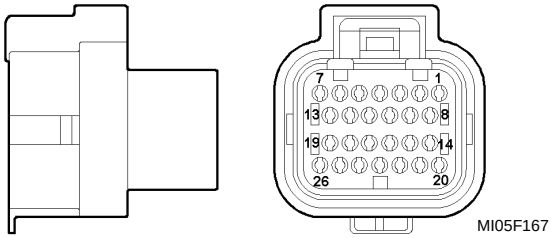
| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | - - - - - | OPEN |
| 2 | - - - - - | OPEN |
| 3 | - - - - - | OPEN |
| 4 | 597 LB | PTO SOLENOID B+ SUPPLY |
| 5 | 597 BR | PTO SOLENOID RETURN |
| 6 | 596 BR | (#) PTO INDICATOR LIGHT |
| | 590 BR | (##) PTO INDICATOR LIGHT |
| 7 | - - - - - | OPEN |
| 8 | - - - - - | OPEN |
| 9 | - - - - - | OPEN |
| 10 | - - - - - | OPEN |
| 11 | - - - - - | OPEN |
| 12 | - - - - - | OPEN |
| 13 | - - - - - | OPEN |
| 14 | 303 T | OPERATOR PRESENCE SWITCH SIGNAL |
| 15 | 591 LB | PTO ON SIGNAL |
| 16 | 592 LB | PTO OFF SIGNAL |
| 17 | 276 LB | 540/1000 PTO SPEED SELECTION SIGNAL |
| 18 | 594 DB | AUTO PTO SET SIGNAL |
| 19 | - - - - - | OPEN |
| 20 | 590 DB | REMOTE PTO SWITCH ON SIGNAL |
| 21 | 591 DB | REMOTE PTO SWITCH OFF SIGNAL |
| 22 | 592 DB | AUTO PTO ON SIGNAL |
| 23 | 593 DB | AUTO PTO OFF SIGNAL |
| 24 | - - - - - | OPEN |
| 25 | 224 Y | PTO SPEED SIGNAL |
| 26 | - - - - - | OPEN |

*(#) XtraSpeed and XtraSpeed - E Tractors Only.*

*(##) XtraSpeed - E Plus Tractors Only.*

## Connector 55

**Location: Hitch/PTO Controller**




MI05F167

**RIGHT HAND CONSOLE HARNESS TO HITCH/PTO CONTROLLER (XTRASPEED AND XTRASPEED - E TRACTORS) FENDER HARNESS TO HITCH/PTO CONTROLLER (XTRASPEED - E PLUS TRACTORS)**

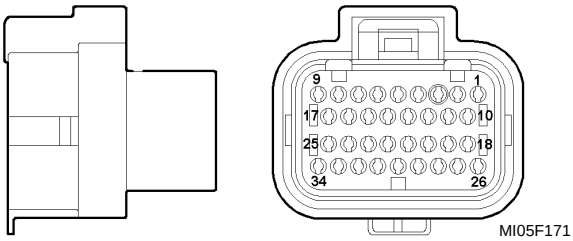
| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 501 R | SWITCHED B+ |
| 2 | 505 R | HITCH LOAD COMMAND POTENTIOMETER SUPPLY |
| 3 | 506 R | HITCH TRAVEL POTENTIOMETER SUPPLY |
| 4 | 513 LB | HITCH RAISE SOLENOID RETURN |
| 5 | 512 LB | HITCH LOWER SOLENOID RETURN |
| 6 | - - - - - | OPEN |
| 7 | 501 R | SWITCHED B+ |
| 8 | 506 BR | HITCH TRAVEL POTENTIOMETER RETURN |
| 9 | - - - - - | OPEN |
| 10 | 560 R | HITCH UPPER LIMIT POTENTIOMETER SUPPLY |
| 11 | 595 DB | AUTO PTO LIGHT |
| 12 | 570 LB | SLIP CONTROL LIGHT SUPPLY |
| 13 | 542 LB | MFD RELAY SUPPLY |
| 14 | 507 BR | HITCH POSITION POTENTIOMETER RETURN |
| 15 | 505 BR | HITCH LOAD COMMAND POTENTIOMETER RETURN |
| 16 | 560 BR | HITCH UPPER LIMIT POTENTIOMETER RETURN |
| 17 | 539 LB | AUTO DIFFERENTIAL LOCK LIGHT |
| 18 | 508 LB | HITCH ENABLE LIGHT |
| 19 | 539 DB | (#) DIFFERENTIAL LOCK SOLENOID B+ |
| | 591 DB | (##) DIFFERENTIAL LOCK SOLENOID B+ |
| 20 | 514 R | LOAD PIN 8V SUPPLY |
| 21 | 514 BR | LOAD PIN RETURN |
| 22 | 500 BR/W | CLEAN GROUND |
| 23 | 500 BR/W | CLEAN GROUND |
| 24 | 502 R | HITCH DROP SPEED POTENTIOMETER SUPPLY |
| 25 | 502 BR | HITCH DROP SPEED POTENTIOMETER RETURN |
| 26 | 507 R | HITCH POSITION POTENTIOMETER SUPPLY |

https://truckmanualshub.com/



## Connector 56

**Location: Hitch/PTO Controller**




MI05F171

**RIGHT HAND CONSOLE HARNESS TO HITCH/PTO CONTROLLER (XTRASPEED AND XTRASPEED - E TRACTORS)**
**FENDER HARNESS TO HITCH/PTO CONTROLLER (XTRASPEED - E PLUS TRACTORS)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 531 LB | RIGHT HAND BRAKE SIGNAL |
| 2 | 532 LB | DIFFERENTIAL LOCK ON SIGNAL |
| 3 | 546 LB | AUTO DIFFERENTIAL LOCK ON SIGNAL |
| 4 | 528 LB | HITCH REMOTE RAISE |
| 5 | 529 LB | HITCH REMOTE LOWER |
| 6 | 282 Y | RADAR PRESENT SIGNAL |
| 7 | 563 LB | IMPLEMENT DOWN SWITCH |
| 8 | 541 LB | MFD ON SIGNAL |
| 9 | 565 LB | AUTO MFD ON SIGNAL |
| 10 | 567 LB | SLIP CONTROL ON SIGNAL |
| 11 | 510 LB | HITCH RAISE SOLENOID |
| 12 | 509 LB | HITCH LOWER SOLENOID |
| 13 | 562 LB | HITCH FAST LOWER SIGNAL |
| 14 | 572 LB | RIDE CONTROL ON SIGNAL |
| 15 | 573 LB | RIDE CONTROL OVERRIDE SIGNAL |
| 16 | 536 LB | LEFT HAND BRAKE SIGNAL |
| 17 | 560 LB | HITCH UPPER LIMIT POTENTIOMETER SIGNAL |
| 18 | 502 LB | HITCH DROP SPEED POTENTIOMETER SIGNAL |

| Cavity | Wire No | Circuit |
|---|---|---|
| 19 | - - - - - | OPEN |
| 20 | 505 LB | HITCH LOAD COMMAND POTENTIOMETER SIGNAL |
| 21 | 506 LB | HITCH TRAVEL POTENTIOMETER SIGNAL |
| 22 | 504 LB | HITCH POSITION COMMAND POTENTIOMETER SIGNAL |
| 23 | 507 LB | HITCH POSITION POTENTIOMETER SIGNAL |
| 24 | 515 LB | LEFT HAND LOAD PIN SIGNAL |
| 25 | 514 LB | RIGHT HAND LOAD PIN SIGNAL |
| 26 | 900 Y | CAN HIGH |
| 27 | 900 LG | CAN LOW |
| 28 | - - - - - | OPEN |
| 29 | - - - - - | OPEN |
| 30 | 281 Y | RADAR SIGNAL |
| 31 | 215 Y | WHEEL SPEED SIGNAL |
| 32 | 511 R | HITCH SOLENOID B+ |
| 33 | 504 BR | HITCH POSITION COMMAND POTENTIOMETER RETURN |
| 34 | 504 R | HITCH POSITION COMMAND POTENTIOMETER SUPPLY |

https://truckmanualshub.com/

# Section 10003



## INDEPENDENT FRONT SUSPENSION AXLE CONTROLLER

## Calibration, Error Codes, Troubleshooting and Schematics

## XTX Series Tractors

McCORMICK

SM 8-15070

© 2005 McCormick Tractors International Limited.
November 2005

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIAL TOOLS ..... 3

GENERAL INFORMATION AXLE CONTROL ..... 4

CALIBRATION
- General Information ..... 6
- Calibration Procedure ..... 6

AXLE POSITION SENSORS
- Position Sensor Check ..... 7
- Axle Position Sensor Adjustment ..... 9

MANUAL LOWERING OF THE FRONT AXLE ..... 11

CIRCUIT TESTING
- General Information ..... 12

ERROR CODE TROUBLESHOOTING GUIDE
- Error Code 21 ..... 13
- Error Code 22 ..... 13
- Error Code 31 ..... 14
- Error Code 32 ..... 15
- No Error Code - Axle Suspension Does Not Operate (XtraSpeed and XtraSpeed - E Tractors Only) ..... 16
- No Error Code - Axle Suspension Does Not Operate (XtraSpeed - E Plus Tractors Only) ..... 17
- No Error Code - Axle Will Not Operate in Manual Mode ..... 18
- No Error Code - Axle Will Not Raise to Mid position in Suspension Mode, Only Right Hand Side of Axle Raises in Manual Mode ..... 19
- No Error Code - Axle Will Not Raise to Mid position in Suspension Mode, Only Left Hand Side of Axle Raises in Manual Mode ..... 19
- No Error Code - Axle Will Not Remain at the Lowest Position in the Manual Mode ..... 20
- No Error Code - Axle Will Not Remain at the Highest Position in the Manual Mode ..... 20
- No Error Code - Axle Will Not Automatically go into Suspension Mode Above 14 Km/h ..... 20

COMPONENT IDENTIFICATION
- Right Hand Console Components (XtraSpeed and XtraSpeed - E Tractors Only) ..... 21
- Right Hand Console Components (XtraSpeed - E Plus Tractors Only) ..... 22
- Transmission Components ..... 23
- Front Axle Components ..... 24
- Front Axle Suspension Controller Schematic Circuit (For XtraSpeed and XtraSpeed - E Tractors) ..... 25
- Front Axle Suspension Controller Schematic Circuit (For XtraSpeed - E Plus Tractors) ..... 26

MAIN CONNECTORS ..... 27

https://truckmanualshub.com/



# SPECIAL TOOLS



DD98H120

**MC2616 MULTIMETER KIT includes:**
**MC2616-1 MULTIMETER ONLY**
**MC2616-2 TEST LEADS**
**MC2616-3 TEMPERATURE PROBE**



MD01G010

**MC3000 SENSOR TEST HARNESS**



DD99A051

**MC2656 TEST PROBE KIT**



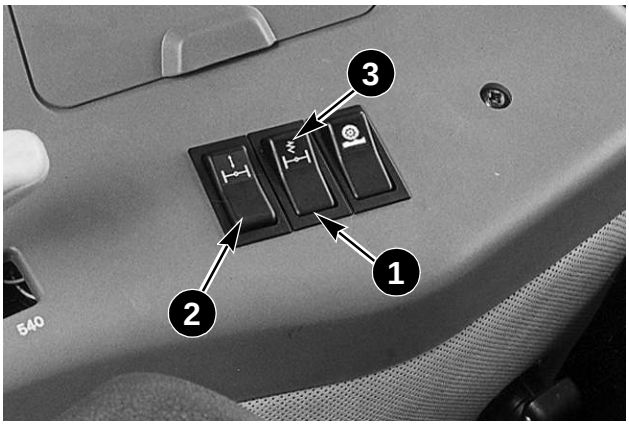
DD97E383

**MC31000B HARNESS REPAIR KIT)**

https://truckmanualshub.com/

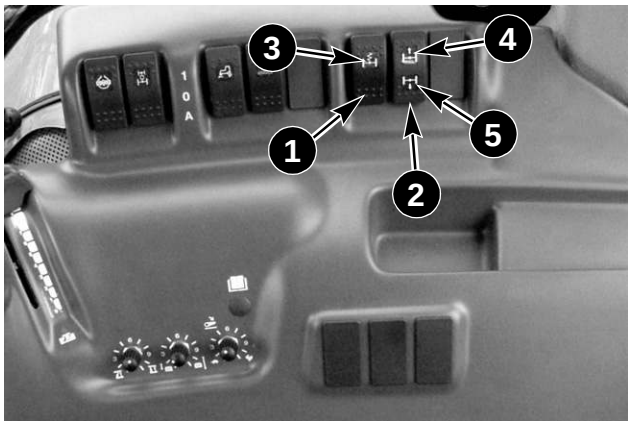


# GENERAL INFORMATION AXLE CONTROL




DP99G057

**XTRASPEED AND XTRASPEED - E TRACTORS**




MD05F073

**XTRASPEED - E PLUS TRACTORS**

1. SUSPENSION MODE SWITCH
2. MANUAL OVERRIDE SWITCH
3. AXLE SUSPENSION INDICATOR LIGHT
4. MANUAL OVERRIDE RAISE INDICATOR LIGHT
5. MANUAL OVERRIDE LOWER INDICATOR LIGHT

The suspended axle has three modes, Off, Axle Suspension and Manual Override and is controlled by two rocker switches on the right hand console.

With the suspension mode switch in the Off position the axle will remain in the last set position.

In the Axle Suspension Mode position the axle has an automatic operating adjustable height range of 90 mm. When the suspension mode is selected the hydraulic accumulators and cylinders become charged with oil and the axle will automatically raise or lower to its mid position. The axle will now have independent suspension travel of +/ - 45 mm.

In the Manual Override mode the axle height can be preset and adjusted up or down by the manual override switch from the lowest position to the maximum travel of 90 mm.

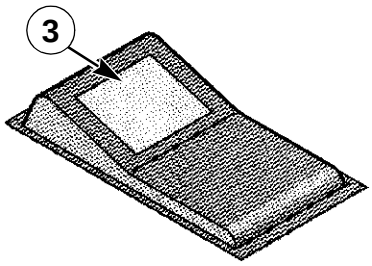
The axle suspension indicator light (located in the suspension mode switch) will illuminate whenever the axle is in the Axle Suspension Mode. The light will also illuminate during the axle calibration procedure and will display error codes when a fault occurs in the system.

https://truckmanualshub.com/



## Suspension Mode Switch

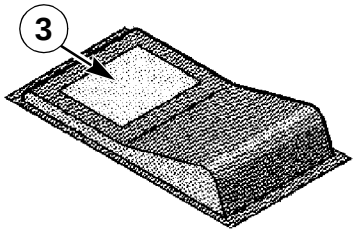
**POSITION 1**




DS98K261

OFF Mode, no axle suspension (axle operates as a rigid axle). The indicator light (3) will not illuminate.

**POSITION 2 (Momentary Position)**




DS98K259

To activate the axle suspension mode press the switch to position 2 then release the switch to position 1. After a short delay the axle will travel to its mid position and will have independent suspension. The indicator light (3) will illuminate.

**NOTE:** *If the switch is held in position 2 for more than 10 seconds the calibration mode will be activated and the indicator lamp will flash continually. To exit the calibration mode turn the key to the OFF position.*

**NOTE:** *If the engine is stopped with the axle in the suspension mode, on start up the axle will be at its mid position and the indicator light will not be illuminate. The axle will not have independent suspension until the switch is operated to position 2 and then release to position 1.*

**NOTE:** *To return the axle to the suspension mode when operating in the manual override mode, operate the switch to position 2 and then release to position 1.*

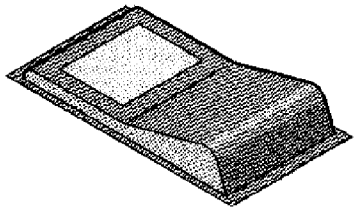
## Manual Override Switch

Manual override will only operate if the Suspension Mode Switch is first turned to Position 2 (Axle Suspension Mode).

Also the manual override will only operate at speeds below 14 km/h (8.7 m.p.h.), above 14km/h (m.p.h. 8.7 m.p.h.) the axle will automatically go into the Axle Suspension Mode and the indicator light (2) in the suspension mode Switch will illuminate.

**NOTE:** *For XtraSpeed and XtraSpeed - E tractors, when the manual override switch is operated the indicator light (2) in the suspension mode switch will not illuminate.*

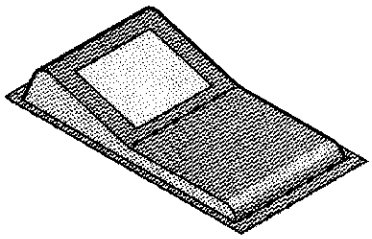
**POSITION 1 (Momentary Position)**



DS98K259

Raises the axle to the required height.

**POSITION 2 (Momentary Position)**



DS98K261

Lowers the axle to the required height.

https://truckmanualshub.com/



# CALIBRATION

## General Information

If any repairs are carried out to the axle suspension system that require the replacement or adjustment of any components, then it will be necessary to calibrate the axle control module.

**IMPORTANT:** *If the axle position sensors have been removed or replaced the adjustment of the position sensor must be set before the axle is calibrated, Refer to “AXLE POSITION SENSORS” on page 7.*

The control module will indicate when the calibration mode has been selected by flashing the axle suspension indicator light (located in the suspension mode switch) at a rate of 1 Hz (1 flash per second).

## Calibration Procedure

1. Start and run the engine at low idle.
1. Hold the suspension mode Switch to momentary position for 10 seconds.
1. Release the switch when the axle suspension indicator light begins to flash at a rate of 1 Hz (1 per second).
1. Calibration Mode has now been entered.
1. Hold the Manual Override Switch in the RAISE position. After a short delay the axle will begin to raise.
1. Release the switch when the axle is at the UPPER mechanical stops.
1. Hold the Manual Override Switch in the LOWER position. The axle will begin to lower.
1. Release the switch when the axle is at the LOWER mechanical stops.
1. Operate the Suspension Mode Switch to the momentary position and release to the ON position.
1. The axle suspension indicator light will stop flashing if the calibration has been accepted.

**NOTE:** *If the indicator light continues to flash, the calibration has not been accepted stop the engine and repeat the calibration procedure. If the calibration still will not be accepted, check the axle position sensor adjustment, refer to Refer to “AXLE POSITION SENSORS” on page 7.*

> ⚠ **WARNING:** *Never operate the engine in a closed building. Proper ventilation is required under all circumstances.*

https://truckmanualshub.com/



# AXLE POSITION SENSORS

## Position Sensor Check

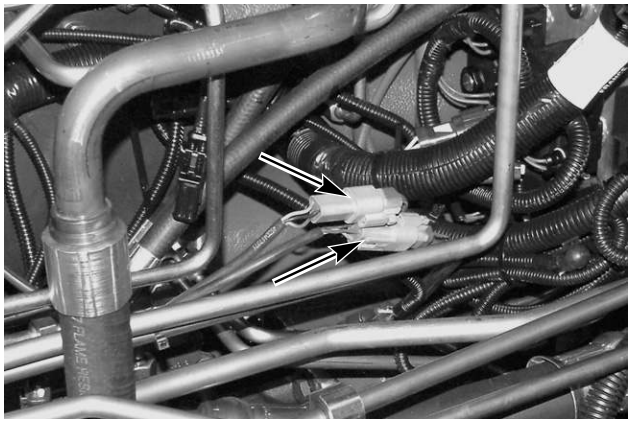
**NOTE:** *The following procedure shows the axle position sensor check being carried out on an XtraSpeed tractor, the procedure is the same for XtraSpeed - E and E Plus tractors.*

**IMPORTANT:** *The position sensor checks are to be carried out from the operators seat.*

### STEP 1

Park the tractor on hard level ground, apply the parking brake, lower the axle to the bottom mechanical stops and STOP the engine. Put blocks in front of and behind the rear wheels.

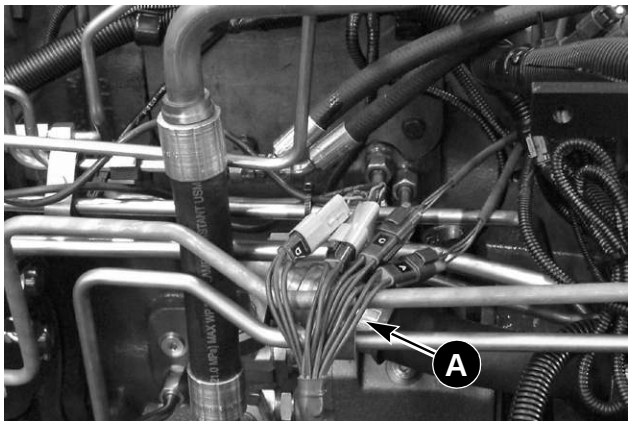
### STEP 2



MD05G146

Disconnect the left and right hand axle position sensor harness connectors.

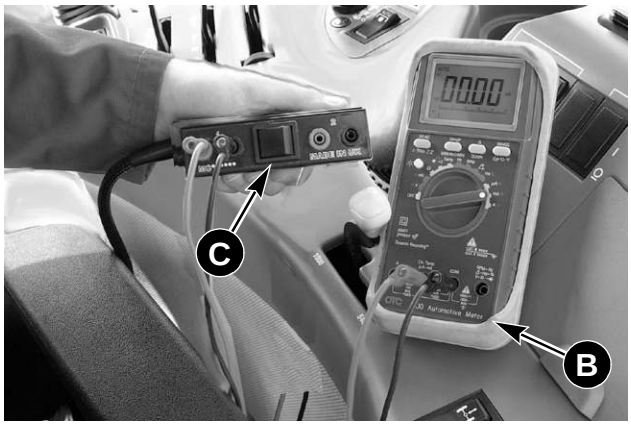
### STEP 3




DD99K047

Connect Blue wedge connectors of the test harness MC3000 (A) to the Blue Wedge connectors of the Left Hand axle position sensor harness. Connect the Green wedge connectors of the test harness to the Orange or Green wedge connectors of the Right Hand axle position sensor harness. Route the test harness through the cab door into the cab.

### STEP 4




MD01G015

Connect the multimeter MC2616 (B) to test points 1 (left Hand) of MC3000. Press the switch (C) towards test point 1. Set the multimeter to read Milliamperes (mA).

**NOTE:** *If two multimeters are available both position sensor readings can be taken at the same time. Connect the second multimeter to test point 2 (Right Hand) and put switch in the CENTRE POSITION.*

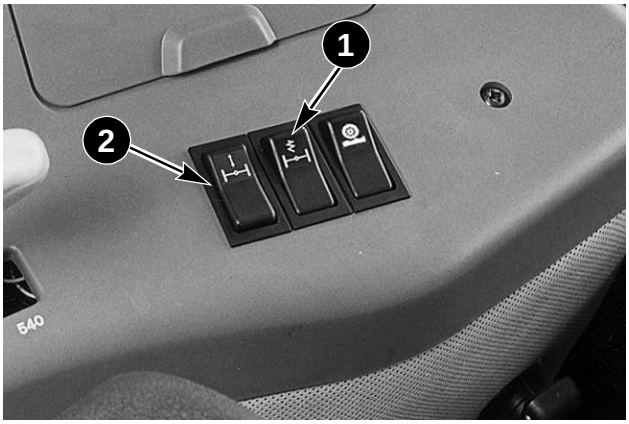
**IMPORTANT:** *If one multimeter is to be used make sure the switch is towards test point 1. Failure to do so will cause an error code to be displayed.*

**IMPORTANT:** *Before starting the engine make sure the multimeter is switched on and set to read milliampere (mA). Failure to do so will cause an error code to be displayed.*

https://truckmanualshub.com/



## STEP 5

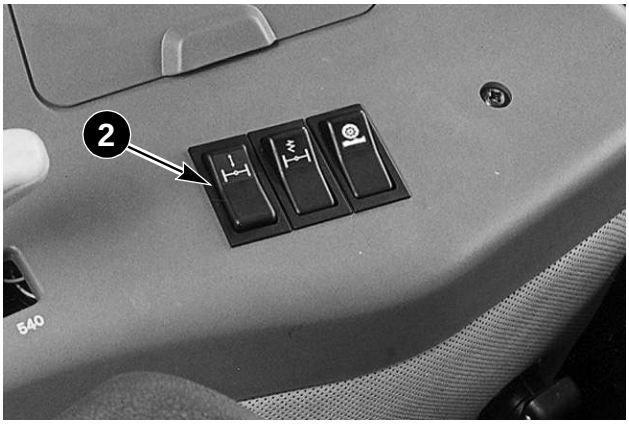



DP99G057

Start and run the engine at low idle. Press the suspension mode switch (1) to the suspension ON position. Wait until the axle has travelled to its mid position then hold the manual override switch (2) in the RAISE position. When the axle reaches upper mechanical stops release the switch and make a note of the multimeter reading.

**WARNING:** *Never operate the engine in a closed building. Proper ventilation is required under all circumstances.*

## STEP 6

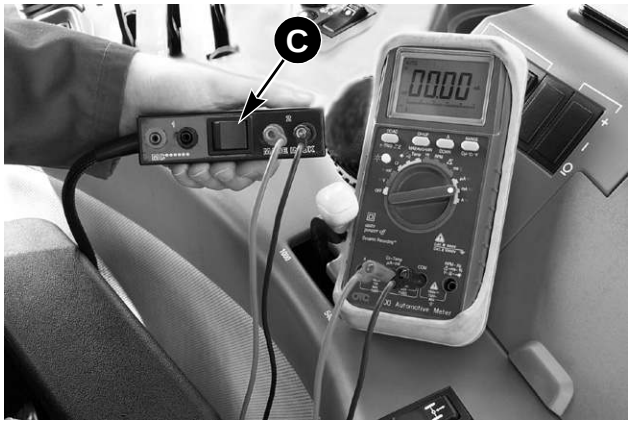



DP99G057

Hold the manual override switch (2) in the LOWER position, when the axle reaches the bottom mechanical stops release the switch and make a note of the multimeter reading.

**NOTE:** *If a second multimeter has been used and both position sensor readings have been taken, Go to STEP 8.*

## STEP 7




MD01G015

If a second multimeter is not available STOP the engine and remove the test leads from test points 1 of MC3000 and install into test points 2. Press the switch (C) towards test point 2. Repeat STEP 5 and STEP 6 to check the right hand position sensor.

## STEP 8

STOP the engine and remove the key.

## STEP 9

The readings should be as follows:-

Bottom Stop .....5.00 mA (minimum)
Upper Stop .....18.86 mA (maximum)

The difference between the upper and bottom stop readings must NOT BE LESS than 9.05 mA.

Example:

Bottom stop reading..... 6.5 mA
Upper reading must not be less than.... 15.55 mA

**IMPORTANT:** *Bottom stop reading of less 4 mA and a upper stop reading of more than 19.68 mA will cause an error code to be displayed.*

## STEP 10

If the readings are not correct adjust the position sensors, Refer to “Axle Position Sensor Adjustment” on page 9.

**NOTE:** *If no reading is obtained check the axle position sensor circuit.*

https://truckmanualshub.com/



## Axle Position Sensor Adjustment

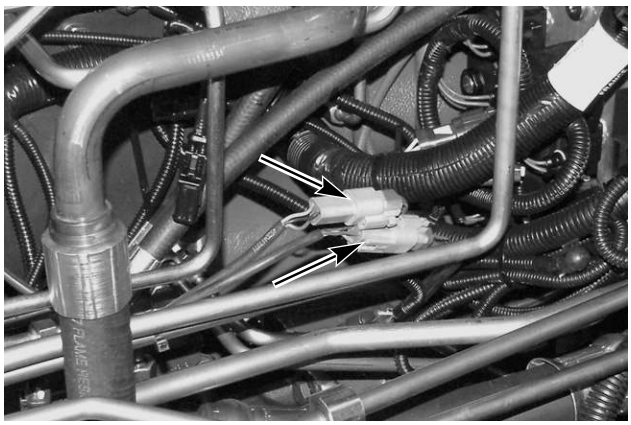
### STEP 1

Park the tractor on hard level ground, apply the parking brake, lower the axle to the bottom mechanical stops and STOP the engine. Put blocks in front of and behind the rear wheels.

> ⚠ **WARNING:** *Before any adjustments are made to the independent front axle position sensors, make sure the axle is fully lowered to the bottom mechanical stop, the engine is not running and the key is in the OFF position. Failure to do this may result in serious injury.*

**IMPORTANT:** *If a fault occurs with the independent front suspension axle the axle suspension will become inoperative and the axle will remain in it's last position. The axle MUST BE lowered manually. Refer to "MANUAL LOWERING OF THE FRONT AXLE" on page 11.*

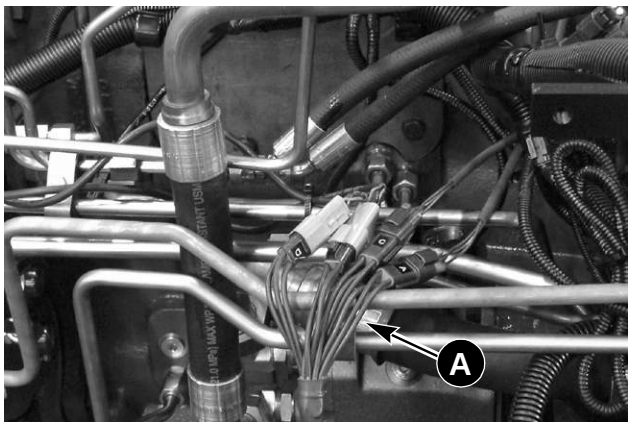
### STEP 2



MD05G146

Disconnect the left and right hand axle position sensor harness connectors.

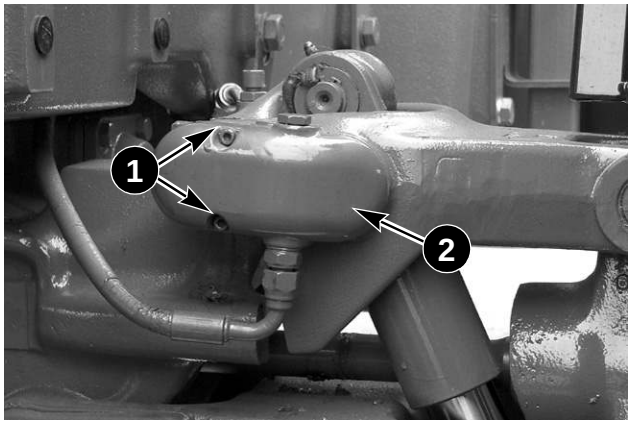
### STEP 3




DD99K047

Connect Blue wedge connectors of the test harness MC3000 (A) to the Blue Wedge connectors of the Left Hand axle position sensor harness. Connect the Green Wedge connectors of the test harness to the Orange or Green wedge connectors of the Right Hand axle position sensor harness.

### STEP 4



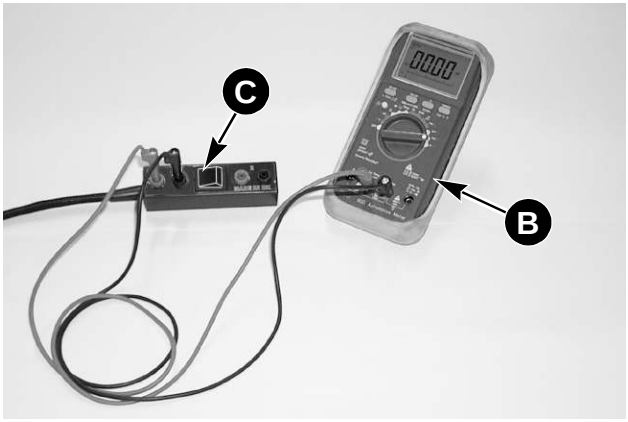

Md05G148

Remove the retaining allen screws (1) and remove covers (2) from the axle position sensor housings (both sides).

https://truckmanualshub.com/



## STEP 5




MD01G015

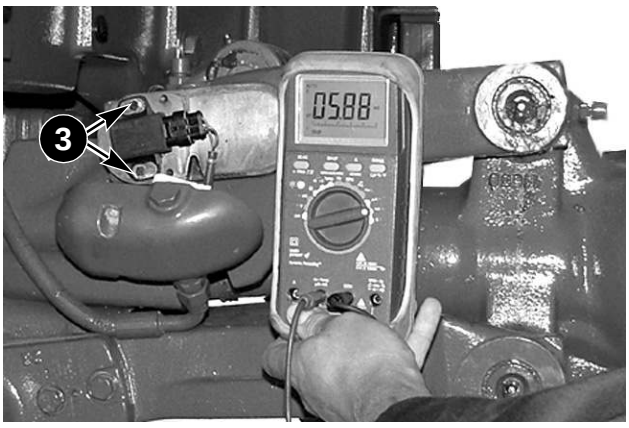
Connect the multimeter MC2616 (B) to test points 1 (left Hand) of MC3000. Press the switch (C) towards test point 1. Set the multimeter to read Milliamperes (mA)

**NOTE:** *If two multimeters are available both position sensor readings can be taken at the same time. Connect the second multimeter to test point 2 (Right Hand) and put switch in the CENTRE POSITION.*

**IMPORTANT:** *If one multimeter is to be used make sure the switch is towards test point 1. Failure to do so will cause an error code to be displayed.*

**IMPORTANT:** *Before turning the key to the ON position make sure the multimeter is switch on and set to read milliampere (mA). Failure to do so will cause an error code to be displayed.*

## STEP 6




MD05G149

Turn the key to the ON position and loosen the left hand position sensor retaining bolts (3), adjust the position sensor until a reading of 6mA (+/- 0.5 mA) is displayed on the multimeter. Tighten the retaining bolts (3) to a torque of 3 Nm.

## STEP 7

Check the multimeter reading and repeat STEP 6 as necessary.

## STEP 8

If a second multimeter is not available STOP the engine and remove the test leads from test points 1 of MC3000 and install into test points 2 and press the switch (C) towards test point 2.

## STEP 9

Repeat STEP 6 and STEP 7 and adjust the right hand position sensor.

## STEP 10

Install the position sensor housing covers (both sides) and tighten the retaining screws to a torque of 13 Nm.

## STEP 11

Check the operation of the position sensors, refer to Position Sensor Check on page 7. Also check the operation of the front axle suspension.

## STEP 12

Remove the test harness and connect the left hand and right hand axle position sensor harness connectors.

https://truckmanualshub.com/

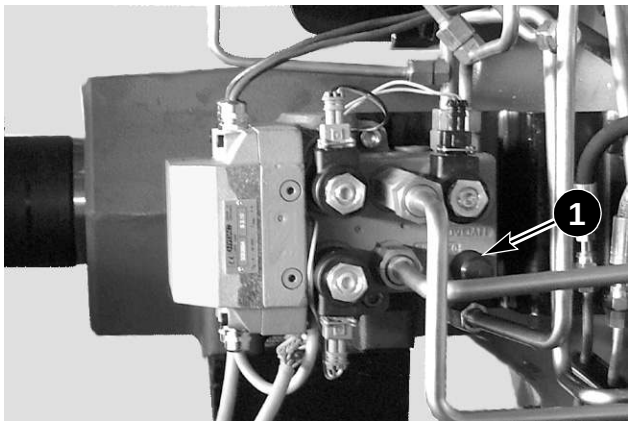


# MANUAL LOWERING OF THE FRONT AXLE

## STEP 1

Park the tractor on hard level ground, apply the parking brake and STOP the engine and remove the key. Put blocks in front of and behind the rear wheels.

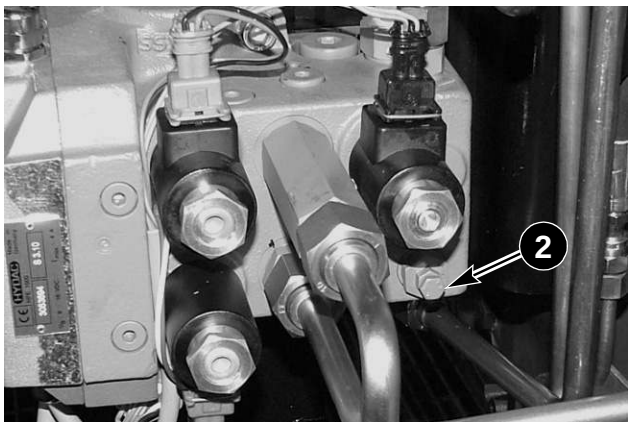
## STEP 2




MD05G150

Clean all dirt and debris from around the control valve block (located on the right hand REAR axle). Remove the plastic cap (1) from the manual shut off valve.

## STEP 3




MD05G151

Loosen the lock nut and slowly loosen screw (2) 1 turn to release the accumulator pressure and to lower the front axle to the bottom mechanical stop.

**IMPORTANT:** *Make sure the area around the front axle is clear during the lowering operation.*

## STEP 4

When the axle is fully lowered tighten screw (2) and tighten the locknut. Install the plastic cap (1).

https://truckmanualshub.com/



# CIRCUIT TESTING

## General Information

> **WARNING:** *Never operate the engine in a closed building. Proper ventilation is required under all circumstances.*

**IMPORTANT:** *All electrical checks must be made with the tractor parked on hard level ground with park brake engaged, the shuttle lever in Neutral or Park and the engine OFF, unless otherwise stated.*

**IMPORTANT:** *Put blocks in front of and behind the rear wheels.*

**IMPORTANT:** *All checks made on the independent front suspension axle are to be made with the axle fully lowered to the bottom mechanical stops. If the axle can not be lowered using the manual override switch, refer to "MANUAL LOWERING OF THE FRONT AXLE" on page 11.*

**IMPORTANT:** *For tractors equipped with cab suspension, all checks must be carried out with the cab fully lowered or with the cab supported with suitable cab supports. To lower the cab refer to Section 10011.*

**IMPORTANT:** *The battery must be at full charge and all connections must be clean and tight before testing. Only use a HIGH IMPEDANCE multimeter for the tests. Do not use a test lamp or damage to the switches may occur.*

**IMPORTANT:** *Use MC2656 test probe kit when making electrical checks at connectors to avoid the risk of shorting between the connector pins or terminals.*

**IMPORTANT:** *Replace the controller if the fault remains only after all necessary checks have been made.*

**IMPORTANT:** *When disconnecting harness connectors, always check the connector pins and terminals for damage and alignment.*

**NOTE:** *When measuring resistance values, always measure the resistance of the multimeter leads before testing components. Subtract the resistance of the multimeter leads from the component resistance to obtain a true resistance value.*

**NOTE:** *When testing diodes and diode modules use the multimeter diode test function.*

**NOTE:** *All components, wires and connectors disconnected during any electrical checks must be connected when the checks are completed.*

https://truckmanualshub.com/



# ERROR CODE TROUBLESHOOTING GUIDE

## Error Code 21

**Fault Description**

The front suspension axle controller does not detect a signal from the left hand axle position sensor.

**System Response.**

The front suspension axle will not operate in either automatic suspension mode or manual override mode. The axle will remain in it's current position.

**Possible Cause**

1. Left hand axle position sensor out of adjustment.
2. Left hand axle position sensor supply open circuit.
3. Left hand axle position sensor return open circuit.
4. Left hand axle position sensor signal.
5. Bad left hand axle position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 12.*

**Circuit Checks/Corrective Action**

1. Check the left hand axle position sensor and adjust if necessary, refer to "Position Sensor Check" on page 7.
2. Disconnect connectors 81 (blue wedge connector) and the left hand axle position sensor, check the following and repair as necessary.
   - Light Blue wire between connector 81 terminal C and the sensor connector terminal 1 for open circuit.
   - Yellow/Dark Green wire between connector 81 terminal A and the sensor connector terminal 2 for open circuit.
   - Brown wire between connector 81 terminal B and the sensor connector terminal 3 for open circuit.
   - The controller harness between connector 81 and the controller for damage.
   - Connector 81 and the axle sensor connector.

## Error Code 22

**Fault Description**

The front suspension axle controller does not detect a signal from the right hand axle position sensor.

**System Response.**

The front suspension axle will not operate in either automatic suspension mode or manual override mode. The axle will remain in it's current position.

**Possible Cause**

1. Right hand axle position sensor out of adjustment.
2. Right hand axle position sensor supply open circuit.
3. Right hand axle position sensor return open circuit.
4. Left hand axle position sensor signal.
5. Bad right hand axle position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 12.*

**Circuit Checks/Corrective Action**

1. Check the right hand axle position sensor and adjust if necessary, refer to "Position Sensor Check" on page 7.
2. Disconnect connectors 81 (orange wedge connector) and the right hand axle position sensor, check the following and repair as necessary.
   - Light Blue wire between connector 82 terminal C and the sensor connector terminal 1 for open circuit.
   - Yellow/Dark Green wire between connector 82 terminal A and the sensor connector terminal 2 for open circuit.
   - Brown wire between connector 82 terminal B and the sensor connector terminal 3 for open circuit.
   - The controller harness between connector 82 and the controller for damage.
   - Connector 82 and the axle sensor connector.

https://truckmanualshub.com/



# Error Code 31

**Fault Description**

The front suspension axle left hand or pilot solenoid fails to operate.

**System Response.**

The front suspension axle will not operate in either automatic suspension mode or manual override mode. The axle will remain in it's current position.

**Possible Cause**

1. Controller unswitched power (battery) circuit open or short to ground.
2. Left hand axle solenoid supply open circuit.
3. Left hand axle solenoid return open circuit.
4. Bad left hand axle solenoid.
5. Axle pilot solenoid supply open circuit.
6. Axle pilot solenoid return open circuit.
7. Bad axle pilot solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 12.*

**Circuit Checks/Corrective Action**

1. If the instrument cluster also fails to power up, go to check 5.
2. Disconnect connectors 80 (axle controller to fender harness). Check the following and repair as necessary.
   - Check for a battery voltage supply at terminal 6 of connector 80 for wire 531 Red.
     - If battery voltage is not detected go to check 3.
     - If battery voltage is detected go to check 9.
3. Disconnect connector 52 (fender harness to right hand console harness). Check the following and repair as necessary.
   - Wire 531 Red between connector 80 terminal 5 and connector 52 pin 21 for open circuit.
   - The controller harness between connector 80 and the controller for damage.
   - Connector 80.
4. Disconnect connector 29 (instrument panel harness to right hand console harness) and check the following and repair as necessary.
   - Wire 531 Red between connector 29 terminal E and fuse 37 for open circuit.
   - Wire 531 Red between connector 29 terminal E and connector 52 pin 21 for open circuit.
5. If the instrument cluster also fails to power up check fuse 37. If the fuse is OK go to check 6, if the fuse has blown go to check 7.
6. If fuse 37 is OK, check the following and repair as necessary.
   - Wires 143 Red and 162 Red between the battery positive terminal or the batter disconnect switch and fuse 37 for open circuit. Also check connector 10 (engine harness to instrument panel harness).
7. If fuse 37 has blown, disconnect connectors 80 (axle controller to fender harness) and 52 (fender harness to right hand console harness. Check the following and repair as necessary.
   - Wire 531 Red between connector 80 terminal 5 and connector 52 pin 21 (for XtraSpeed and XtraSpeed - E tractors) or pin 25 (for XtraSpeed - E Plus tractors) for short to ground.
   - The controller harness between connector 80 and the controller for damage.
   - Connector 80.
8. Disconnect connector 29 (instrument panel harness to right hand console harness) and check the following and repair as necessary.
   - Wire 531 Red between connector 29 terminal E and fuse 37 for short to ground. Also check the instrument cluster circuit.
   - Wire 531 Red between connector 29 terminal E and connector 52 pin 21 (for XtraSpeed and XtraSpeed - E tractors) or pin 25 (for XtraSpeed - E Plus tractors) for short to ground.

Continued.....

https://truckmanualshub.com/



9. Disconnect the left hand axle solenoid SV-L (Blue connector) and check the controller harness between the solenoid connector and the controller for damage and repair as necessary. Also check the solenoid connector.
10. Check the left hand axle solenoid SV-L resistance is approximately 8.5 Ohms at 20℃ (68℉) and repl ace as necessary.
11. Disconnect the axle pilot solenoid WV (Black connector) and check the controller harness between the solenoid connector and the controller for damage and repair as necessary. Also check the solenoid connector.
12. Check the axle pilot solenoid WV resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.

## Error Code 32

**Fault Description**

The front suspension axle right hand solenoid fails to operate.

**System Response.**

The front suspension axle will not operate in either automatic suspension mode or manual override mode. The axle will remain in it's current position.

**Possible Cause**

1. Right hand axle solenoid supply open circuit.
2. Right hand axle solenoid return open circuit.
3. Bad right hand axle solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 12.*

**Circuit Checks/Corrective Action.**

1. Disconnect the left hand axle solenoid SV-R (Green connector) and check the controller harness between the solenoid connector and the controller for damage and repair as necessary. Also check the solenoid connector.
2. Check the left hand axle solenoid SV-R resistance is approximately 8.5 Ohms at 20℃ (68℉) and repla ce as necessary.

https://truckmanualshub.com/



# No Error Code - Axle Suspension Does Not Operate (XtraSpeed and XtraSpeed - E Tractors Only)

**Fault Description**

The front suspension axle controller will not power up.

**System Response.**

The front suspension axle will not operate in either automatic suspension mode or manual override mode. The axle will remain in it's current position.

**Possible Cause**

3. Bad fuse 28.
4. Switched power circuit open or short to ground.
5. Controller ground circuit open circuit.
6. Automatic suspension mode signal circuit short to ground.
7. Manual override raise signal circuit shot to ground.
8. Manual override lower signal circuit shot to ground.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 12.*

**Circuit Checks/Corrective Action.**

1. Check fuse 28, if the fuse has blown, go to check 2 if the fuse is OK go to check 5.
2. Disconnect connectors 80 (axle controller to fender harness) and 52 (fender harness to right hand console harness. Check the following and repair as necessary.
   - Wire 530 Red between connector 80 terminal 8 and connector 52 pin 20 for short to ground.
   - Wire 533 Dark Blue between connector 80 terminal 5 and connector 52 pin 23 for short to ground.
   - Wire 534 Dark Blue between connector 80 terminal 3 and connector 52 pin 17 for short to ground.
   - Wire 535 Dark Blue between connector 80 terminal 2 and connector 52 pin 18 for short to ground.
   - The controller harness between connector 80 and the controller for damage.
   - Connector 80.
3. Disconnect connector 29 (instrument panel harness to right hand console harness) and check the following and repair as necessary.
   - Wire 530 Red between connector 29 terminal K and fuse 28 for short to ground. Also check the cab suspension circuit.

   **NOTE:** *For tractors not equipped with cab suspension the cab suspension wiring is incorporated in the harness and the circuit should still be checked. Refer to Section 10011.*

4. Check the following and repair as necessary.
   - Wire 530 Red between connector 29 terminal K and the right hand console splice RC-SP2 for short to ground.
   - Wire 530 Red between the right hand console splice RC-SP2 and connector 52 pin 20 for short to ground. Also check connector 52.
   - Wire 530 Red between the right hand console splice RC-SP2 and the suspension mode switch terminal 4.
   - Wire 536 Brown between terminal 4 and 9 of the suspension mode switch for short to ground.
   - Wire 530 Red between the right hand console splice RC-SP2 and the suspension manual override switch terminal 3 for short to ground.
   - Wire 590 Red between the right hand console splice RC-SP2 and the auto PTO switch for short to ground. Also check the auto PTO circuit, refer to Section 10002.
   - Wire 533 Dark Blue between the suspension mode switch terminal 2 connector 52 pin 23 for short to ground.
   - Wire 534 Dark Blue between the suspension override switch terminal 1 connector 52 pin 17 for short to ground.
   - Wire 535 Dark Blue between the suspension override switch terminal 7 connector 52 pin 18 for short to ground.
5. If fuse 28 is OK disconnect connectors 80 (axle controller to fender harness) and 52 (fender harness to right hand console harness. Check the following and repair as necessary.
   - Wire 530 Red between connector 80 terminal 8 and connector 52 pin 20 for open circuit.
   - Wires 530 Brown between connector 80 terminals 9 and 10 and ground for open circuit.

Continued.....

https://truckmanualshub.com/



6. Disconnect connector 29 (instrument panel harness to right hand console harness) and check the following and repair as necessary.
   - Wire 530 Red between fuse 28 and connector 29 terminal K for open circuit.
   - Wire 530 Red between the switched power stud and fuse 28 for open circuit.
   - Wire 530 Red between connector 29 terminal K and connector 52 pin 20 for open circuit.

## No Error Code - Axle Suspension Does Not Operate (XtraSpeed - E Plus Tractors Only)

**System Response.**

The front suspension axle will not operate in either automatic suspension mode or manual override mode. The axle will remain in it's current position.

**Possible Cause**

1. Bad fuse 28.
2. Switched power circuit open or short to ground.
3. Controller ground circuit open circuit.
4. Automatic suspension mode signal circuit short to ground.
5. Manual override raise signal circuit shot to ground.
6. Manual override lower signal circuit shot to ground.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 12.*

**Circuit Checks/Corrective Action**

1. Check fuse 28, if the fuse has blown, go to check 3 if the fuse is OK go to check 6.
2. Disconnect connectors 80 (axle controller to fender harness) and 52 (fender harness to right hand console harness. Check the following and repair as necessary.
   - Wire 530 Red between connector 80 terminal 8 and connector 52 pin 48 for short to ground.
   - Wire 533 Dark Blue between connector 80 terminal 5 and connector 52 pin 45 for short to ground.
   - Wire 534 Dark Blue between connector 80 terminal 3 and connector 52 pin 43 for short to ground.
   - Wire 535 Dark Blue between connector 80 terminal 2 and connector 52 pin 44 for short to ground.
   - The controller harness between connector 80 and the controller for damage.
   - Connector 80.
3. Disconnect connector 29 (instrument panel harness to right hand console harness) and check the following and repair as necessary.
   - Wire 530 Red between connector 29 terminal K and fuse 28 for short to ground. Also check the cab suspension circuit.

   **NOTE:** *For tractors not equipped with cab suspension the cab suspension wiring is incorporated in the harness and the circuit should still be checked. Refer to Section 10011.*

4. Check the following and repair as necessary.
   - Wire 530 Red between connector 29 terminal K and the right hand console splice RC-SP6 for short to ground.
   - Wire 530 Red between the right hand console splice RC-SP6 and connector 52 pin 48 for short to ground. Also check connector 52.
   - Wire 530 Red between the right hand console splice RC-SP6 and the suspension mode switch terminal 2.
   - Wire 536 Brown between terminal 2 and 8 of the suspension mode switch for short to ground.
   - Wire 530 Red between the right hand console splice RC-SP6 and the suspension manual override switch terminal 2 for short to ground.
   - Wire 533 Dark Blue between the suspension mode switch terminal 3 connector 52 pin 45 for short to ground.
   - Wire 534 Dark Blue between the suspension override switch terminal 3 connector 52 pin 43 for short to ground.
   - Wire 535 Dark Blue between the suspension override switch terminal 1 connector 52 pin 44 for short to ground.

Continued.....

https://truckmanualshub.com/



5. If fuse 28 is OK disconnect connectors 80 (axle controller to fender harness) and 52 (fender harness to right hand console harness. Check the following and repair as necessary.
   - Wire 530 Red between connector 80 terminal 8 and connector 52 pin 48 for open circuit.
   - Brown/White wires between connector 80 terminals 9 and 10 and the battery negative terminal for open circuit.
6. Disconnect connector 29 (instrument panel harness to right hand console harness) and check the following and repair as necessary.
   - Wire 530 Red between fuse 28 and connector 29 terminal K for open circuit.
   - Wire 530 Red between the switched power stud and fuse 28 for open circuit.
   - Wire 530 Red between connector 29 terminal K and connector 52 pin 48 for open circuit.

## No Error Code - Axle Will Not Operate in Manual Mode

**System Response.**

The front suspension axle will operate in automatic suspension mode but fails to operate in manual override mode in either the raise or lower switch positions or both positions.

**Possible Cause**

1. Manual override switch circuit failed.
2. Bad manual override switch.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 12.*

**Circuit Checks/Corrective Action**

**XtraSpeed and XtraSpeed - E Tractors**

1. Check wire 530 Red between the manual terminal 3 for open circuit.
2. Check the manual override switch and replace as necessary.
3. Disconnect connectors 80 (axle controller to fender harness). Check the following and repair as necessary.
   - Wire 534 Dark Blue between connector 80 terminal 3 and the manual override switch terminal 1 for open circuit.
   - Wire 535 Dark Blue between connector 80 terminal 2 and the manual override switch terminal 7 for open circuit.
   - Connector 52.
   - The controller harness between connector 80 and the controller for damage.
   - Connector 80.

**XtraSpeed - E Plus Tractors**

1. Check wire 530 Red between the manual terminal 2 for open circuit.
2. Check the manual override switch and replace as necessary.
3. Disconnect connectors 80 (axle controller to fender harness). Check the following and repair as necessary.
   - Wire 534 Dark Blue between connector 80 terminal 3 and the manual override switch terminal 3 for open circuit.
   - Wire 535 Dark Blue between connector 80 terminal 2 and the manual override switch terminal 1 for open circuit.
   - Connector 52.
   - The controller harness between connector 80 and the controller for damage.
   - Connector 80.

https://truckmanualshub.com/



## No Error Code - Axle Will Not Raise to Mid position in Suspension Mode, Only Right Hand Side of Axle Raises in Manual Mode

**System Response.**

The front suspension axle will not raise to the mid position when suspension mode switch is operated. Only the right hand side of thew axle will raise when the manual mode switch is in the raise position. The axle will lower when the manual mode switch is in the lower position but automatically raises to the top mechanical stops.

**Possible Cause**

1. Left hand axle position sensor return circuit failed.
2. Bad left hand axle position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 12.*

**Circuit Checks/Corrective Action**

1. Disconnect connectors 81 (blue wedge connector) and the left hand axle position sensor, check the following and repair as necessary.
   - Light Blue wire between connector 81 terminal C and the sensor connector terminal 1 for open circuit.
   - Connector 81 and the axle sensor connector.
2. Replace left hand axle position sensor, adjust the sensor and calibrate the axle.

## No Error Code - Axle Will Not Raise to Mid position in Suspension Mode, Only Left Hand Side of Axle Raises in Manual Mode

**System Response.**

The front suspension axle will not raise to the mid position when suspension mode switch is operated. Only the left hand side of thew axle will raise when the manual mode switch is in the raise position. The axle will lower when the manual mode switch is in the lower position.

**Possible Cause**

1. Right hand axle position sensor return circuit failed.
2. Bad right hand axle position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 12.*

**Circuit Checks/Corrective Action**

1. Disconnect connectors 82 (orange wedge connector) and the right hand axle position sensor, check the following and repair as necessary.
   - Light Blue wire between connector 82 terminal C and the sensor connector terminal 1 for open circuit.
   - Connector 82 and the axle sensor connector.
2. Replace left hand axle position sensor, adjust the sensor and calibrate the axle.

https://truckmanualshub.com/



## No Error Code - Axle Will Not Remain at the Lowest Position in the Manual Mode

**System Response.**

The front suspension axle will not raise off the bottom mechanical stops when the axle is fully lower with the manual override switch.

**Possible Cause**

1. Left hand axle position sensor out of adjustment (above upper limit).

**Circuit Checks/Corrective Action**

1. Check the left hand axle position sensor and adjust if necessary, refer to “Position Sensor Check” on page 7.

## No Error Code - Axle Will Not Remain at the Highest Position in the Manual Mode

**System Response.**

The front suspension axle lowers off the upper mechanical stops when the axle is fully raised with the manual override switch.

**Possible Cause**

1. Right hand axle position sensor out of adjustment (above upper limit).

**Circuit Checks/Corrective Action**

2. Check the Right hand axle position sensor and adjust if necessary, refer to “Position Sensor Check” on page 7.

## No Error Code - Axle Will Not Automatically go into Suspension Mode Above 14 Km/h

**System Response.**

When the tractor is operating in manual override mode and the tractor travels above 14 km/h (8.7 m.p.h) the axle will not automatically go into suspension mode.

**Possible Cause**

1. Bad wheel speed sensor signal.

**Circuit Checks/Corrective Action**

1. Check for transmission controller and Hitch/PTO controller wheel speed sensor error codes and repair as necessary.

**XtraSpeed and XtraSpeed - E Tractors.**

2. Disconnect connectors 80 (axle controller to fender harness) and 52 (fender harness to right hand console harness. Check the following and repair as necessary.
   - Wire 542 Dark Blue between connector 80 terminal 12 and connector 52 pin 24 for open circuit.
   - The controller harness between connector 80 and the controller for damage.
   - Connector 80.
3. Check wire 215 Yellow between the right hand console harness splice RC-SP18 and connector 52 pin 24 for open circuit.

**XtraSpeed - E Plus Tractors.**

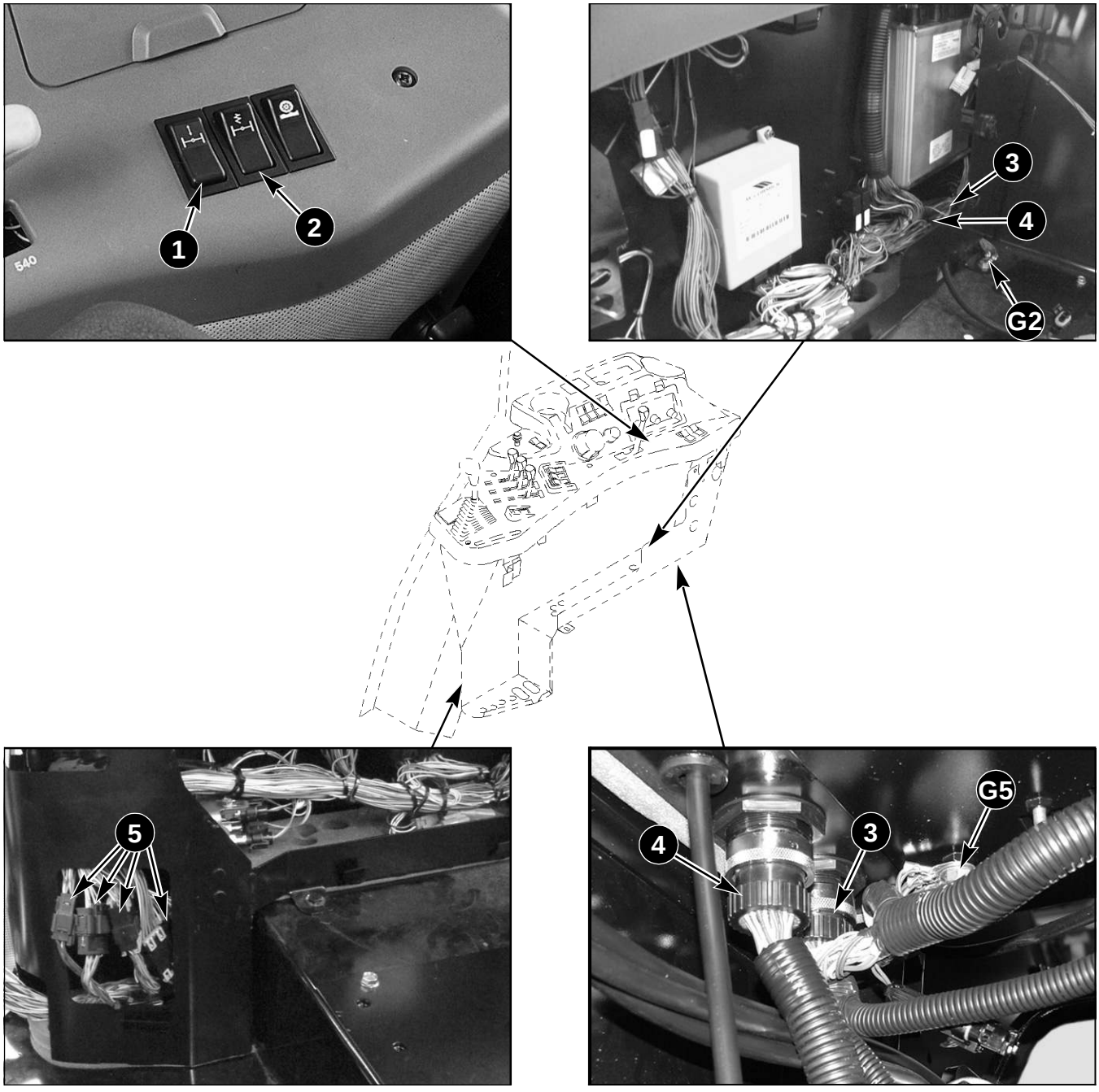
4. Disconnect connectors 80 (axle controller to fender harness) and 52 (fender harness to right hand console harness. Check the following and repair as necessary.
   - Wire 542 Dark Blue between connector 80 terminal 12 and connector 52 pin 46 for open circuit.
   - The controller harness between connector 80 and the controller for damage.
   - Connector 80.
5. Check wire 215 Yellow between the right hand console harness splice RC-SP12 and connector 52 pin 46 for open circuit.

https://truckmanualshub.com/



# COMPONENT IDENTIFICATION

## Right Hand Console Components (XtraSpeed and XtraSpeed - E Tractors Only)



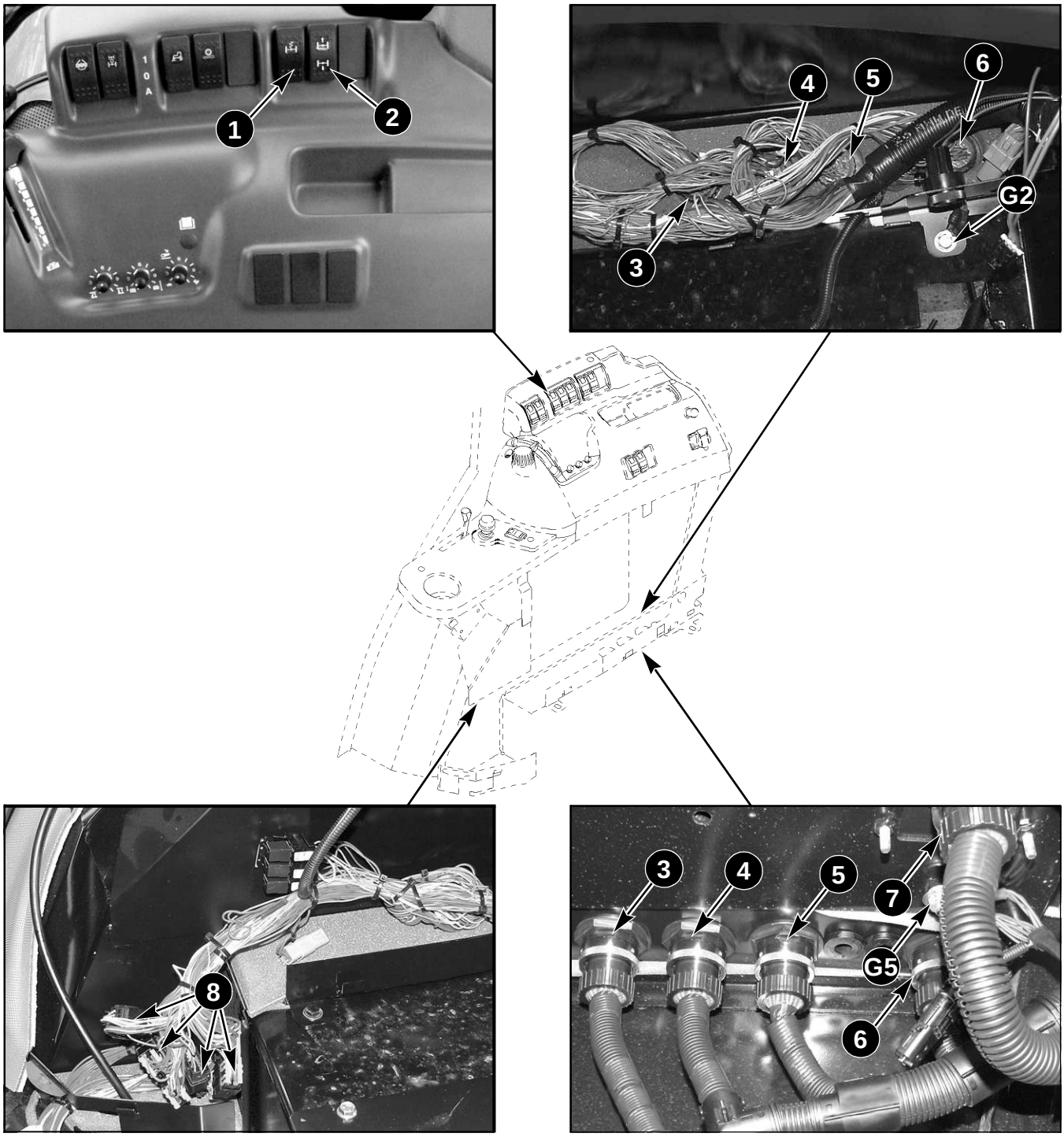

1. FRONT AXLE SUSPENSION OVERRIDE SWITCH
2. FRONT AXLE SUSPENSION MODE SWITCH
3. CONNECTOR 52
4. CONNECTOR 40
5. CONNECTORS 26, 27, 28, 29

G2. CHASSIS GROUND CONNECTION G2
G5. CHASSIS GROUND CONNECTION G2

https://truckmanualshub.com/



# Right Hand Console Components (XtraSpeed - E Plus Tractors Only)



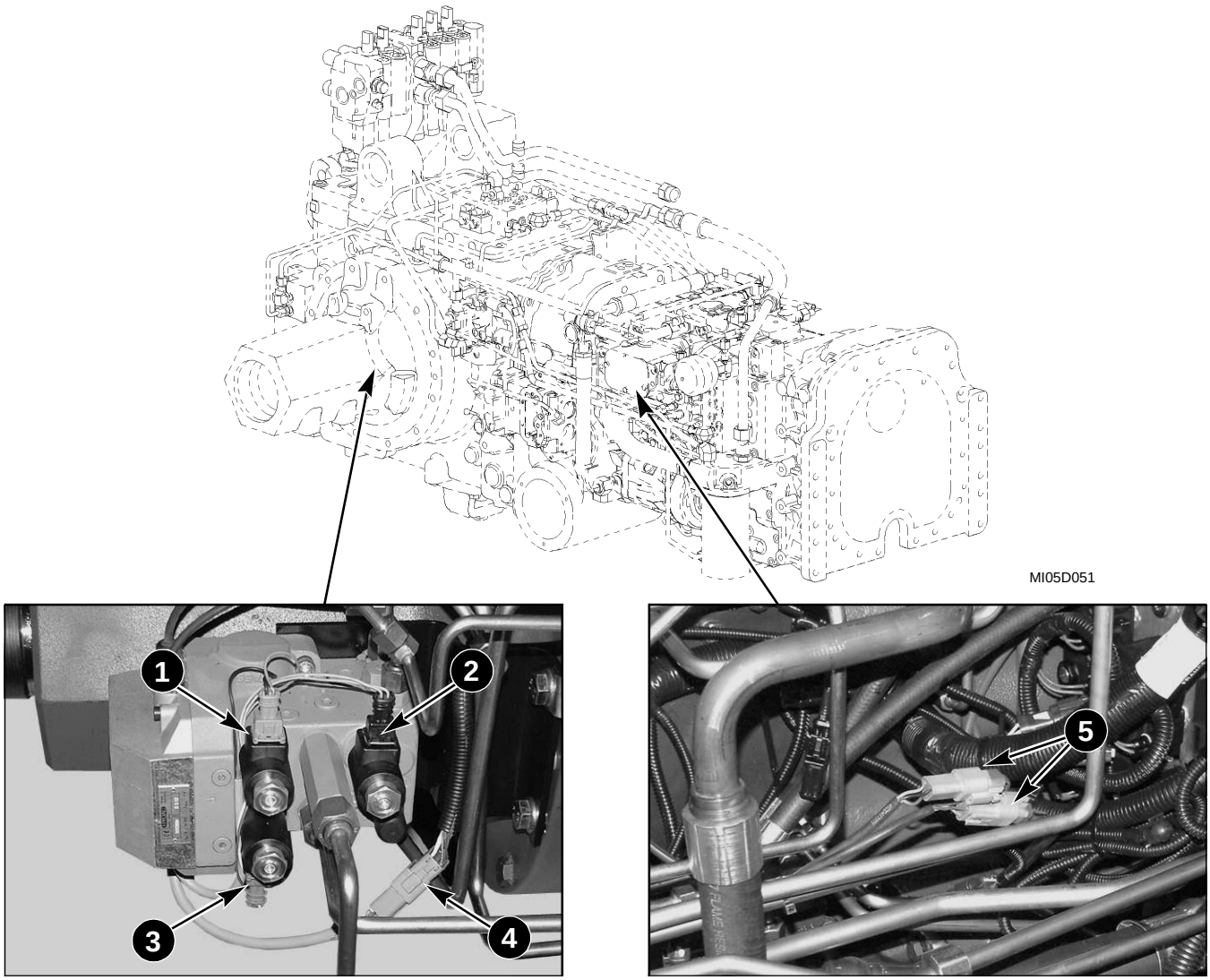

1. FRONT AXLE SUSPENSION MODE SWITCH
2. FRONT AXLE SUSPENSION OVERRIDE SWITCH
3. CONNECTOR 40
4. CONNECTOR 51
5. CONNECTOR 52
6. CONNECTOR 53
7. CONNECTOR 50
8. CONNECTORS 26, 27, 28, 29

G2. CHASSIS GROUND CONNECTION G2

https://truckmanualshub.com/



## Transmission Components

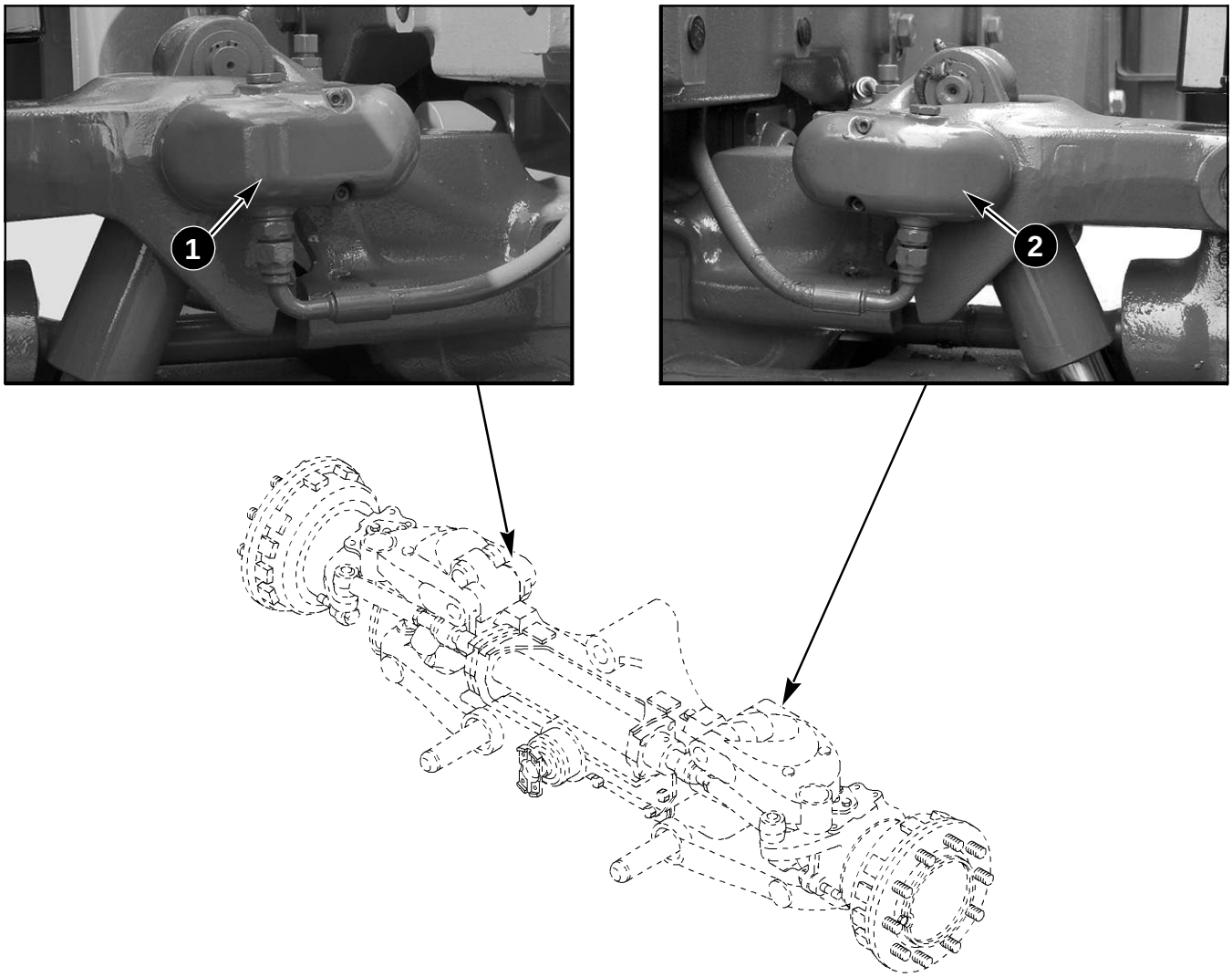



1. RIGHT HAND SOLENOID (GREEN CONNECTOR)
2. PILOT SOLENOID (BLACK CONNECTOR)
3. LEFT HAND SOLENOID (BLUE CONNECTOR)
4. CONNECTOR 80
5. CONNECTOR 81 (BLUE WEDGE) AND CONNECTOR 82 (ORANGE AND GREEN WEDGE)

https://truckmanualshub.com/



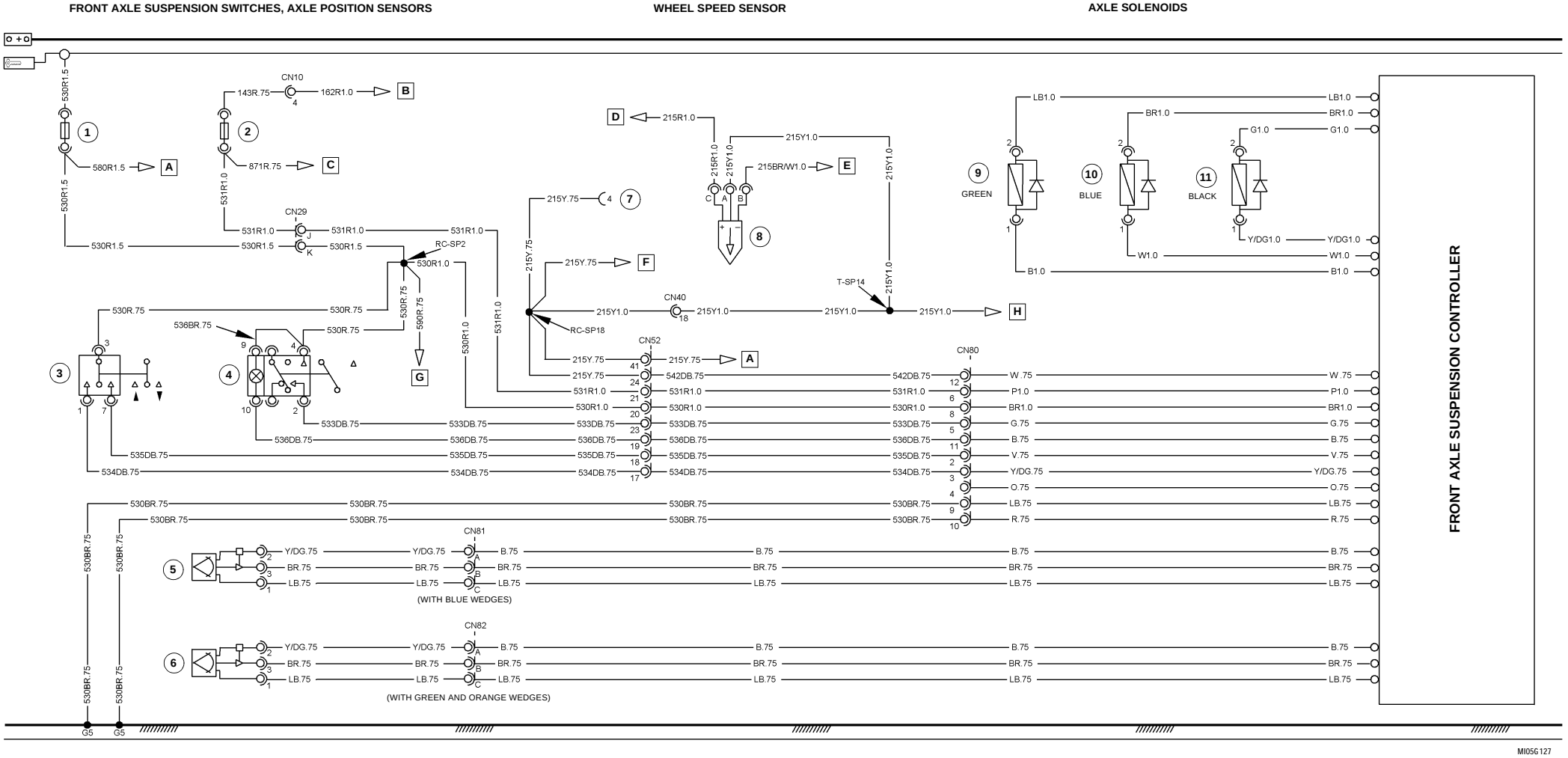
## Front Axle Components




1. LEFT HAND AXLE POSITION SENSOR COVER 2. LEFT HAND AXLE POSITION SENSOR COVER

https://truckmanualshub.com/


# Front Axle Suspension Controller Schematic Circuit (XtraSpeed and XtraSpeed - E Tractors)

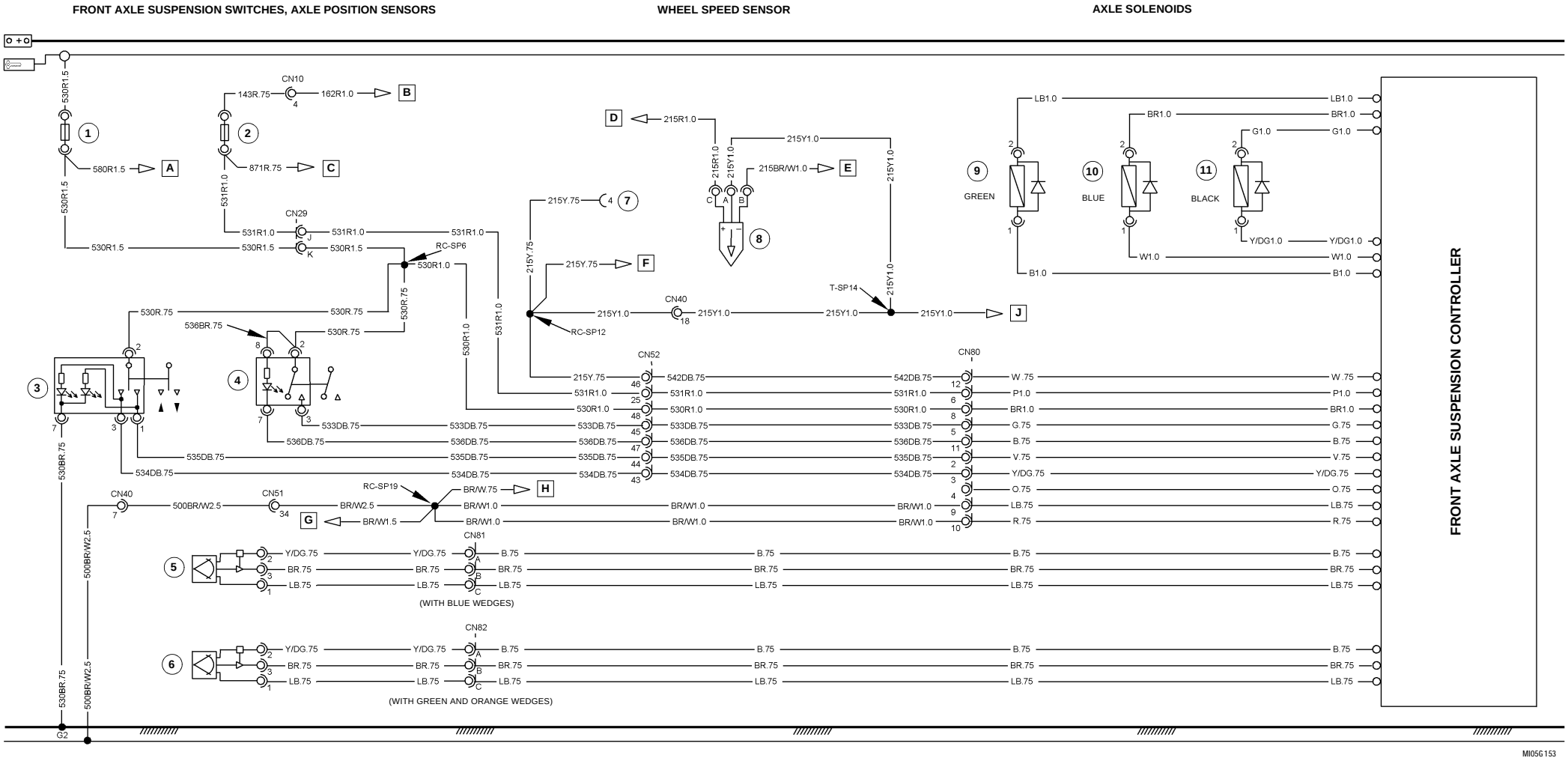



## Key

1. FUSE 28 (10 AMP)
2. FUSE 37 (7.5 AMP)
3. SUSPENSION MANUAL OVERRIDE SWITCH
4. SUSPENSION MODE SWITCH
5. LEFT HAND AXLE POSITION SENSOR
6. RIGHT HAND AXLE POSITION SENSOR
7. IMPLEMENT INTERFACE CONNECTOR
8. WHEEL SPEED SENSOR
9. RIGHT HAND AXLE SOLENOID (SVR)
10. LEFT HAND AXLE SOLENOID (SVL)
11. PILOT SOLENOID (WV)

A. TO CAB SUSPENSION CONTROLLER
B. FROM BATTERY B+ TERMINAL OR MASTER DISCONNECT SWITCH
C. TO INSTRUMENT CLUSTER
D. B+ FROM TRANSMISSION CONTROLLER
E. GROUND TO TRANSMISSION CONTROLLER
F. TO HITCH/PTO CONTROLLER
G. TO AUTO PTO SWITCH
H. TO TRANSMISSION CONTROLLER

# Front Axle Suspension Controller Schematic Circuit (XtraSpeed - E Plus Tractors)




## Key

1. FUSE 28 (10 AMP)
2. FUSE 37 (7.5 AMP)
3. SUSPENSION MANUAL OVERRIDE SWITCH
4. SUSPENSION MODE SWITCH
5. SUSPENSION MODE SWITCH
6. RIGHT HAND AXLE POSITION SENSOR
7. IMPLEMENT INTERFACE CONNECTOR
8. WHEEL SPEED SENSOR
9. RIGHT HAND AXLE SOLENOID (SVR)
10. LEFT HAND AXLE SOLENOID (SVL)
11. PILOT SOLENOID (WV)

A. TO CAB SUSPENSION CONTROLLER
B. FROM BATTERY B+ TERMINAL OR MASTER DISCONNECT SWITCH
C. TO INSTRUMENT CLUSTER
D. B+ FROM TRANSMISSION CONTROLLER
E. GROUND TO TRANSMISSION CONTROLLER
F. TO HITCH/PTO CONTROLLER
G. FROM AUXILIARY/REMOTE VALVE CONTROLLER
H. FROM CAB CONTROLLER
J. TO TRANSMISSION CONTROLLER

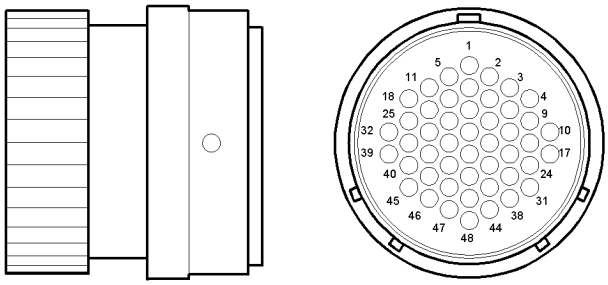
https://truckmanualshub.com/



# MAIN CONNECTORS

## Connector 10 - XTX185 and XTX200 Series Tractors Only

**Location: Cab Firewall**




MI05F174

**ENGINE TO INSTRUMENT PANEL HARNESS (ENGINE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 802 O | A/C HIGH PRESSURE SWITCH |
| 2 | 624 W | ENGINE CONTROLLER NEUTRAL START B+ SUPPLY |
| 3 | 804 O | A/C HIGH PRESSURE SWITCH |
| 4 | 162 R | UNSWITCHED B+ - CLOCK, RADIO AND INSTRUMENT CLUSTER |
| 5 | 200 Y | INSTRUMENT CLUSTER CLEAN GROUND (BATTERY - TERMINAL) |
| 6 | 803 O | A/C COMPRESSOR CLUTCH |
| 7 | - - - - - | OPEN |
| 8 | - - - - - | OPEN |
| 9 | 231 Y | COOLANT LEVEL |
| 10 | - - - - - | OPEN |
| 11 | - - - - - | OPEN |
| 12 | - - - - - | OPEN |
| 13 | 266 Y | AIR FILTER RESTRICTION SWITCH |
| 14 | 121 Y | ALTERNATOR D+ TERMINAL, WARNING LIGHT AND EXCITE |
| 15 | 829 BR/W | ATC CLEAN GROUND |
| 16 | 890 R | HORN B+ |
| 17 | 890 BR | HORN GROUND |
| 18 | 829 BR/W | ATC CLEAN GROUND |
| 19 | 738 P | RH HEADLIGHT - LOW BEAM |
| 20 | 741 P | RH HEADLIGHT - HIGH BEAM |
| 21 | 658 W | WATER IN FUEL |
| 22 | 737 P | LH HEADLIGHT - LOW BEAM |
| 23 | 740 P | LH HEADLIGHT - HIGH BEAM |

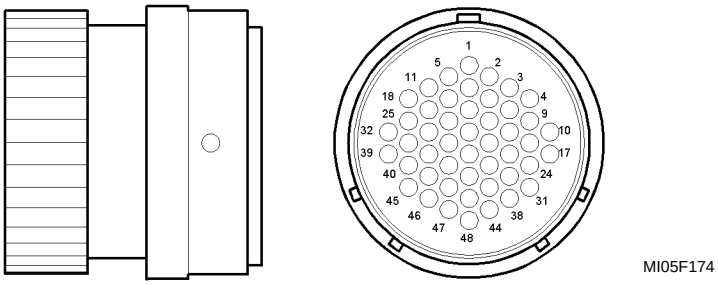
| Cavity | Wire No | Circuit |
|---|---|---|
| 24 | - - - - - | OPEN |
| 25 | 280 BR | RADAR GROUND |
| 26 | 281 Y | RADAR SIGNAL |
| 27 | 280 R | RADAR B+ |
| 28 | 282 Y | RADAR PRESENT |
| 29 | - - - - - | OPEN |
| 30 | - - - - - | OPEN |
| 31 | 784 V | WORK LIGHTS |
| 32 | - - - - - | OPEN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |
| 35 | - - - - - | OPEN |
| 36 | - - - - - | OPEN |
| 37 | - - - - - | OPEN |
| 38 | 900 Y | CAN HIGH |
| 39 | - - - - - | OPEN |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | 900 LG | CAN LOW |
| 43 | - - - - - | OPEN |
| 44 | 643 R | FOOT THROTTLE 5V SUPPLY |
| 45 | 600 W | ENGINE CONTROLLER SWITCHED B+ |
| 46 | 643 Y | FOOT THROTTLE SIGNAL |
| 47 | 900 BR | K - LINE |
| 48 | 643 BR | FOOT THROTTLE 0V RETURN |

https://truckmanualshub.com/



## Connector 10 - XTX215 Series Tractors Only

**Location: Cab Firewall**




MI05F174

**ENGINE TO INSTRUMENT PANEL HARNESS (ENGINE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 802 O | A/C HIGH PRESSURE SWITCH |
| 2 | 625 W | STARTER RELAY NEUTRAL START B+ SUPPLY |
| 3 | 804 O | A/C HIGH PRESSURE SWITCH |
| 4 | 162 R | UNSWITCHED B+ - CLOCK, RADIO AND INSTRUMENT CLUSTER |
| 5 | 200 BR/W | INSTRUMENT CLUSTER CLEAN GROUND (BATTERY - TERMINAL) |
| 6 | 803 O | A/C COMPRESSOR CLUTCH |
| 7 | - - - - - | OPEN |
| 8 | - - - - - | OPEN |
| 9 | 231 Y | COOLANT LEVEL |
| 10 | - - - - - | OPEN |
| 11 | 235 V | NOT USED |
| 12 | 654 W | NOT USED |
| 13 | 266 Y | AIR FILTER RESTRICTION SWITCH |
| 14 | 121 Y | ALTERNATOR D+ TERMINAL, WARNING LIGHT AND EXCITE |
| 15 | 829 BR/W | ATC CLEAN GROUND |
| 16 | 890 R | HORN B+ |
| 17 | 890 BR | HORN GROUND |
| 18 | 828 BR/W | ATC CLEAN GROUND |
| 19 | 738 P | RH HEADLIGHT - LOW BEAM |
| 20 | 741 P | RH HEADLIGHT - HIGH BEAM |
| 21 | - - - - - | OPEN |
| 22 | 737 P | LH HEADLIGHT - LOW BEAM |
| 23 | 740 P | LH HEADLIGHT - HIGH BEAM |

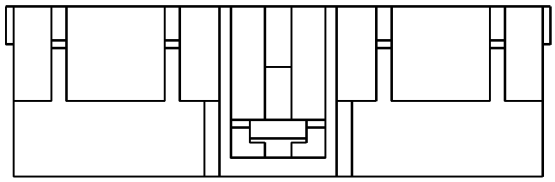
| Cavity | Wire No | Circuit |
|---|---|---|
| 24 | - - - - - | OPEN |
| 25 | 280 BR | RADAR GROUND |
| 26 | 281 Y | RADAR SIGNAL |
| 27 | 280 R | RADAR B+ |
| 28 | 282 Y | RADAR PRESENT |
| 29 | - - - - - | OPEN |
| 30 | - - - - - | OPEN |
| 31 | 784 V | WORK LIGHTS |
| 32 | - - - - - | OPEN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |
| 35 | - - - - - | OPEN |
| 36 | 652 BR | NOT USED |
| 37 | - - - - - | OPEN |
| 38 | 900 Y | CAN HIGH |
| 39 | 653 BR | NOT USED |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | 900 LG | CAN LOW |
| 43 | - - - - - | OPEN |
| 44 | 643 R | FOOT THROTTLE 5V SUPPLY |
| 45 | 132 R | ENGINE CONTROLLER SWITCHED B+ |
| 46 | 643 Y | FOOT THROTTLE SIGNAL |
| 47 | - - - - - | OPEN |
| 48 | 643 BR | FOOT THROTTLE 0V RETURN |

https://truckmanualshub.com/



## Connector 26

**Location: Right Hand Console**



477I96

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

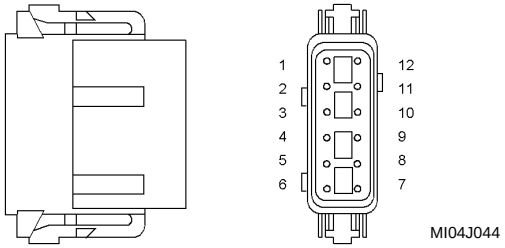
| Cavity | Wire No | Circuit |
|---|---|---|
| A | 590 BR | AUDIBLE ALARM |
| B | 707 P | LH TAIL/POSITION LIGHT |
| C | 708 P | RH TAIL/POSITION LIGHT |
| D | - - - - - | OPEN |
| E | 590 R | CAB CONTROLLER SWITCHED B+ |
| F | 501 R | HITCH/PTO CONTROLLER SWITCHED B+ |
| G | 784 V | REAR FENDER WORK LIGHTS |
| H | 810 R | SEAT B+ |
| J | 530 R | MFD AND DIFF LOCK B+ |
| K | 134 R | AUXILIARY POWER CONNECTOR SWITCHED B+ |
| L | 756 P | RH TURN SIGNAL |
| M | 757 P | LH TURN SIGNAL |
| N | (IIC) R | IIC UNSWITCHED POWER B+ |
| P | 133 R | AUXILIARY POWER FENDER HARNESS CONNECTOR (*)<br>7 PIN CONNECTOR (**) |
| R | 135 R | RH CONSOLE AUXILIARY POWER UNSWITCHED B+ |
| S | 817 R | CIGAR LIGHTER |
| T | 269 Y | PARK BRAKE WARNING LIGHT |
| U | 702 R | BRAKE RELAY B+ |
| V | - - - - - | OPEN |
| W | 785 V | REAR FOG LIGHTS (EUR) |
| X | 254 Y | PARK LOCK SIGNAL |
| Y | 276 LB | 1000 RPM PTO SWITCH |
| Z | (VP) R | AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ (XTRASPEED - E PLUS ONLY) |

*(*) European Specification Tractors Only.*

*(**) American Specification Tractors Only.*

## Connector 27

**Location: Right Hand Console**




**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

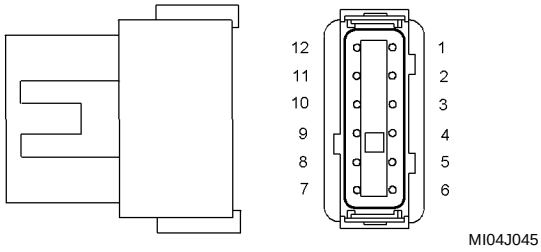
| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 240 Y | AIR TRAILER BRAKE PRESSURE |
| 2 | 515 R | LOADER CONTROLS B+ |
| 3 | 656 Y | CLUTCH POSITION SIGNAL |
| 4 | - - - - - | OPEN |
| 5 | 660 Y | BOTTOM OF CLUTCH SIGNAL |
| 6 | 233 Y | FUEL LEVEL SENDER |
| 7 | 656 BR | CLUTCH POSITION RETURN |
| 8 | 656 R | CLUTCH POSITION B+ |
| 9 | 536 LB | LH BRAKE SIGNAL |
| 10 | 267 Y | HYDRAULIC FILTER RESTRICTION SWITCH |
| 11 | - - - - - | OPEN |
| 12 | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 28

**Location: Right Hand Console**

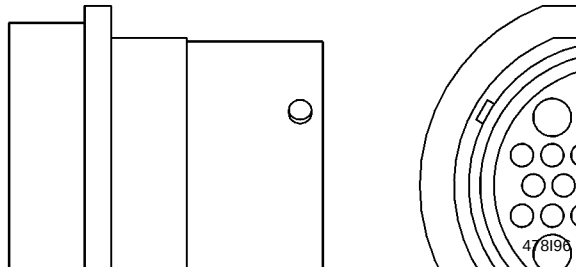



**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 510 T | F/N/R, FOOT THROTTLE 5V REF |
| 2 | 511 T | FORWARD SIGNAL |
| 3 | 562 R | F/N/R, F/N/R/P 12V SUPPLY |
| 4 | 606 W | IIC SWITCHED POWER SENSING |
| 5 | - - - - - | OPEN |
| 6 | 513 T | REVERSE SIGNAL |
| 7 | 531 LB | RH BRAKE SIGNAL |
| 8 | 514 T | NEUTRAL SIGNAL |
| 9 | - - - - - | OPEN |
| 10 | 281 Y | RADAR SIGNAL (HITCH) |
| 11 | 282 Y | RADAR PRESENT (IIC) |
| 12 | 563 LB | IMPLEMENT DOWN SWITCH |

## Connector 29

**Location: Right Hand Console**




**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| A | 835 O | FRONT WINDSCREEN WASHER |
| B | 845 O | REAR WINDSHIELD WASHER |
| C | 550 R | FRONT PTO B+ |
| D | 551 LB | FRONT PTO SIGNAL |
| E | 590 R | REAR PTO SWITCHED B+ |
| F | 161 R | (##) AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ |
| G | 134 R | IIIC SWITCHED POWER |
| H | 776 P | ROTARY BEACON LIGHT |
| J | 531 R | MFD AXLE SUSPENSION UNSWITCHED POWER |
| K | 530 R | MFD AXLE SUSPENSION SWITCHED POWER |
| L | 900 Y | CAN HIGH |
| M | 900 LG | CAN LOW |
| N | - - - - - | OPEN |
| P | 500B R | CAB CONTROLLER UNSWITCHED B+ |
| R | 550 R | TRANSMISSION CONTROLLER SWITCHED B+ |
| S | 400 R | TRANSMISSION CONTROLLER UNSWITCHED B+ |
| T | 643 Y | FOOT THROTTLE SIGNAL |
| U | 643 BR | FOOT THROTTLE 0V RETURN |
| V | 160 R | (##) AUXILIARY/REMOTE VALVE CONTROLLER UNSWITCHED B+ |
| W | - - - - - | OPEN |
| X | 660 W | (#) CAB SUSPENSION CONTROLLER SWITCHED B+ |
| | 660 R | (##) CAB SUSPENSION CONTROLLER SWITCHED B+ |
| Y | (ARM) R | (##) ARMREST SWITCHED B+ |
| Z | - - - - - | OPEN |

*(#) XtraSpeed and XtraSpeed - E tractors only.*

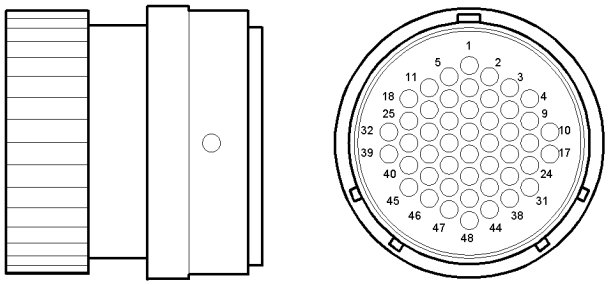
*(##) XtraSpeed - E Plus tractors only.*

https://truckmanualshub.com/



## Connector 40

**Location: Cab Floor (Right Hand Console)**




MI05F174

**RIGHT HAND CONSOLE HARNESS TO TRANSMISSION HARNESS (TRANSMISSION HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 543 LB | MFD SOLENOID B+ |
| 2 | 233 Y | FUEL LEVEL SENDER |
| 3 | 507 R | +8 V POSITION POTENTIOMETER |
| 4 | 507 LB | POSITION SIGNAL |
| 5 | 507 BR | POSITION POTENTIOMETER LOW |
| 6 | (LINK) R | TRANSMISSION CONTROLLER TO CAB CONTROLLER LINK |
| 7 | 500 BR/W | HITCH CONTROLLER CLEAN GROUND |
| 8 | 269 Y | PARK BRAKE WARNING LIGHT |
| 9 | 539 LB | DIFF LOCK SOLENOID B+ |
| 10 | 511 R | HITCH SOLENOID B+ |
| 11 | 513 LB | HITCH RAISE SOLENOID |
| 12 | 514 R | HITCH PIN +8 VOLTS |
| 13 | 515 LB | LH HITCH PIN SIGNAL |
| 14 | 514 BR | HITCH PINS LOW |
| 15 | 514 LB | RH HITCH PIN SIGNAL |
| 16 | 540 R | 4TH AUXILIARY VALVE |
| 17 | 512 LB | HITCH LOWER SOLENOID |
| 18 | 215 Y | WHEEL SPEED SIGNAL |
| 19 | 597 LB | PTO SOLENOID B+ |
| 20 | 597 BR | PTO SOLENOID GROUND |
| 21 | 267 Y | HYDRAULIC FILTER SIGNAL |
| 22 | 280 BR/W | PARK LOCK RETURN |
| 23 | - - - - - | OPEN |
| 24 | 900 Y | CAN HIGH |
| 25 | 900 LG | CAN LOW |

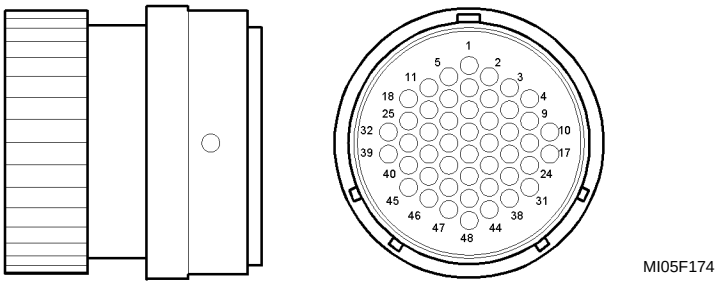
| Cavity | Wire No | Circuit |
|---|---|---|
| 26 | 224 Y | PTO SPEED SIGNAL |
| 27 | - - - - - | OPEN |
| 28 | - - - - - | OPEN |
| 29 | - - - - - | OPEN |
| 30 | 276 T | 540/1000 PTO SWITCH B+ |
| 31 | 240 Y | TRAILER BRAKE PRESSURE |
| 32 | 276 T | 540/1000 PTO SWITCH |
| 33 | 551 O | FRONT PTO SOLENOID |
| 34 | 500 BR/W | IIC CLEAN GROUND |
| 35 | - - - - - | OPEN |
| 36 | 542 T | 4TH AUXILIARY VALVE RAISE |
| 37 | 541 T | 4TH AUXILIARY VALVE LOWER |
| 38 | 400 R | TRANSMISSION CONTROLLER UNSWITCHED B+ |
| 39 | 516 T | LOADER SOLENOID RAISE |
| 40 | 515 T | LOADER SOLENOID LOWER |
| 41 | 550 R | TRANSMISSION CONTROLLER SWITCHED B+ |
| 42 | - - - - - | OPEN |
| 43 | - - - - - | OPEN |
| 44 | 500 BR/W | CAB CONTROLLER CLEAN GROUND |
| 45 | (VP IN) R | AUXILIARY/REMOTE VALVES B+ (XTRASPEED - E PLUS ONLY) |
| 46 | 656 R | CLUTCH POSITION B+ |
| 47 | 656 Y | CLUTCH POSITION SIGNAL |
| 48 | 656 BR | CLUTCH POSITION RETURN |

https://truckmanualshub.com/



## Connector 52 (XtraSpeed and XtraSpeed - E Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 560 R | HITCH UPPER LIMIT POTENTIOMETER SUPPLY |
| 2 | 560 LB | HITCH UPPER LIMIT POTENTIOMETER SIGNAL |
| 3 | 560 BR | HITCH UPPER LIMIT POTENTIOMETER RETURN |
| 4 | 502 R | HITCH DROP SPEED POTENTIOMETER SUPPLY |
| 5 | 502 LB | HITCH DROP SPEED POTENTIOMETER SIGNAL |
| 6 | 502 BR | HITCH DROP SPEED POTENTIOMETER RETURN |
| 7 | 504 LB | HITCH POSITION COMMAND POTENTIOMETER SIGNAL |
| 8 | 504 R | HITCH POSITION COMMAND POTENTIOMETER SUPPLY |
| 9 | 504 BR | HITCH POSITION COMMAND POTENTIOMETER RETURN |
| 10 | 505 R | HITCH LOAD COMMAND POTENTIOMETER SUPPLY |
| 11 | 505 LB | HITCH LOAD COMMAND POTENTIOMETER SIGNAL |
| 12 | 505 BR | HITCH LOAD COMMAND POTENTIOMETER RETURN |
| 13 | - - - - - | OPEN |
| 14 | - - - - - | OPEN |
| 15 | - - - - - | OPEN |
| 16 | - - - - - | OPEN |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | 570 LB | SLIP CONTROL LIGHT SUPPLY |
| 22 | 567 LB | SLIP CONTROL ON SIGNAL |
| 23 | - - - - - | OPEN |
| 24 | 593 DB | AUTO PTO OFF SIGNAL |

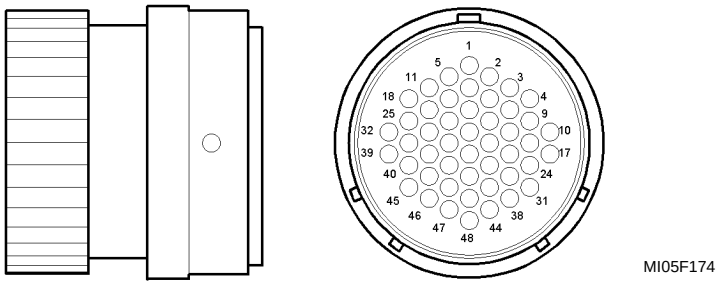
| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 531 R | MFD AXLE SUSPENSION UNSWITCHED B+ |
| 26 | 643 Y | FOOT THROTTLE SIGNAL |
| 27 | 281 Y | RADAR SIGNAL |
| 28 | 506 R | HITCH TRAVEL POTENTIOMETER SUPPLY |
| 29 | 506 LB | HITCH TRAVEL POTENTIOMETER SIGNAL |
| 30 | 506 BR | HITCH TRAVEL POTENTIOMETER RETURN |
| 31 | 590 R | REMOTE PTO SWITCH B+ |
| 32 | - - - - - | OPEN |
| 33 | 161 R | AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ |
| 34 | - - - - - | OPEN |
| 35 | 500B R | CAB CONTROLLER UNSWITCHED B+ |
| 36 | 572 LB | RIDE CONTROL ON SIGNAL |
| 37 | 573 LB | RIDE CONTROL OVERRIDE SIGNAL |
| 38 | - - - - - | OPEN |
| 39 | 282 Y | RADAR PRESENT SIGNAL |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | 534 DB | MFD AXLE SUSPENSION UP SIGNAL |
| 44 | 535 DB | MFD AXLE SUSPENSION DOWN SIGNAL |
| 45 | 533 DB | MFD AXLE SUSPENSION REGULATION ON |
| 46 | 542 DB | MFD AXLE SUSPENSION UNSWITCHED UP SIGNAL |
| 47 | 563 DB | MFD AXLE SUSPENSION INDICATOR LIGHT |
| 48 | 530 R | MFD AXLE SUSPENSION SWITCHED B+ |

https://truckmanualshub.com/



## Connector 52 (XtraSpeed - E Plus Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 560 R | HITCH UPPER LIMIT POTENTIOMETER SUPPLY |
| 2 | 560 LB | HITCH UPPER LIMIT POTENTIOMETER SIGNAL |
| 3 | 560 BR | HITCH UPPER LIMIT POTENTIOMETER RETURN |
| 4 | 502 R | HITCH DROP SPEED POTENTIOMETER SUPPLY |
| 5 | 502 LB | HITCH DROP SPEED POTENTIOMETER SIGNAL |
| 6 | 502 BR | HITCH DROP SPEED POTENTIOMETER RETURN |
| 7 | 504 LB | HITCH POSITION COMMAND POTENTIOMETER SIGNAL |
| 8 | 504 R | HITCH POSITION COMMAND POTENTIOMETER SUPPLY |
| 9 | 504 BR | HITCH POSITION COMMAND POTENTIOMETER RETURN |
| 10 | 505 R | HITCH LOAD COMMAND POTENTIOMETER SUPPLY |
| 11 | 505 LB | HITCH LOAD COMMAND POTENTIOMETER SIGNAL |
| 12 | 505 BR | HITCH LOAD COMMAND POTENTIOMETER RETURN |
| 13 | - - - - - | OPEN |
| 14 | - - - - - | OPEN |
| 15 | - - - - - | OPEN |
| 16 | - - - - - | OPEN |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | 570 LB | SLIP CONTROL LIGHT SUPPLY |
| 22 | 567 LB | SLIP CONTROL ON SIGNAL |
| 23 | - - - - - | OPEN |
| 24 | 593 DB | AUTO PTO OFF SIGNAL |

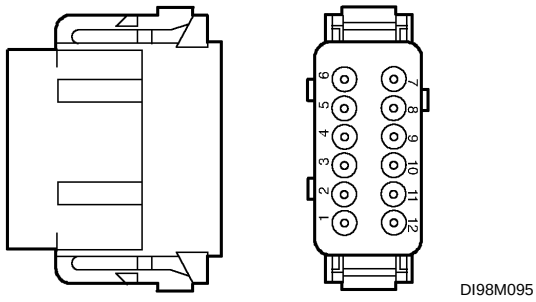
| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 531 R | MFD AXLE SUSPENSION CONTROLLER UNSWITCHED B+ |
| 26 | 643 Y | FOOT THROTTLE SIGNAL |
| 27 | 281 Y | RADAR SIGNAL |
| 28 | 506 R | HITCH TRAVEL POTENTIOMETER SUPPLY |
| 29 | 506 LB | HITCH TRAVEL POTENTIOMETER SIGNAL |
| 30 | 506 BR | HITCH TRAVEL POTENTIOMETER RETURN |
| 31 | 590 R | REMOTE PTO SWITCH B+ |
| 32 | - - - - - | OPEN |
| 33 | 161 R | AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ |
| 34 | - - - - - | OPEN |
| 35 | 500B R | CAB CONTROLLER UNSWITCHED B+ |
| 36 | 572 LB | RIDE CONTROL ON SIGNAL |
| 37 | 573 LB | RIDE CONTROL OVERRIDE SIGNAL |
| 38 | - - - - - | OPEN |
| 39 | 282 Y | RADAR PRESENT SIGNAL |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | 534 DB | FRONT AXLE SUSPENSION UP SIGNAL |
| 44 | 535 DB | MFD AXLE SUSPENSION DOWN SIGNAL |
| 45 | 533 DB | MFD AXLE SUSPENSION REGULATION ON |
| 46 | 542 DB | MFD AXLE SUSPENSION UNSWITCHED UP SIGNAL |
| 47 | 563 DB | MFD AXLE SUSPENSION INDICATOR LIGHT |
| 48 | 530 R | MFD AXLE SUSPENSION SWITCHED B+ |

https://truckmanualshub.com/



## Connector 80

**Location: Right Hand Console**




DI98M095

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | - - - - - | NOT USED |
| 2 | 535 DB | SUSPENSION DOWN |
| 3 | 534 DB | SUSPENSION UP |
| 4 | - - - - - | NOT USED |
| 5 | 533 DB | REGULATION ON |
| 6 | 531 R | UNSWITCHED POWER |
| 7 | - - - - - | NOT USED |
| 8 | 530 R | SWITCHED POWER |
| 9 | 530 BR | # CHASSIS GROUND |
| | BR/W | ## CHASSIS GROUND |
| 10 | 530 BR | # CHASSIS GROUND |
| | BR/W | ## CHASSIS GROUND |
| 11 | 536 DB | INDICATOR LIGHT |
| 12 | 542 DB | WHEEL SPEED SENSOR |

*(#) XtraSpeed and XtraSpeed - E tractors only.*

*(##) XtraSpeed - E Plus tractors only.*

https://truckmanualshub.com/

# Section 10006

## CAB CONTROLLER AND TRANSMISSION CONTROLLER

## Calibration, Error Codes, Troubleshooting and Schematics

## XTX Series Tractors



McCORMICK

SM 8-15081

© 2006 McCormick Tractors International Limited.
July 2005 (Revised October 2006)

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIAL TOOLS ..... 6

SPECIFICATIONS ..... 7

GENERAL INFORMATION FOR ELECTRONIC TRANSMISSION CONTROL ..... 9
- Cab Controller ..... 9
- Transmission Controller ..... 9
- CAN Bus Communication ..... 11

TRANSMISSION CALIBRATION ..... 12
- Transmission Calibration - General Information ..... 13
- Transmission Calibration - Selection Procedure ..... 14
- Transmission Calibration For XtraSpeed Tractors up to PIN JJE3500983 Only ..... 15
- Transmission Calibration For XtraSpeed Tractors From PIN JJE3500983 Only ..... 16
- Transmission Calibration For XtraSpeed - E and E Plus Tractors Only ..... 18
- Transmission Calibration Error Codes ..... 19

ERROR CODES GENERAL INFORMATION ..... 21
- Retrieving Instrument Cluster Displayed Active Error Codes. ..... 21

ERROR CODE TROUBLESHOOTING GUIDE
- Transmission Controller Error Codes ..... 22
  - Transmission Error Code 5000 (XtraSpeed E and XtraSpeed E-Plus Tractors Only) ..... 22
  - Transmission Error Code 5001 (XtraSpeed E and XtraSpeed E-Plus Tractors Only) ..... 22
  - Transmission Error Code 5002 (XtraSpeed E and XtraSpeed E-Plus Tractors Only) ..... 23
  - Transmission Error Code 5003 (XtraSpeed E and XtraSpeed E-Plus Tractors Only) ..... 23
  - Transmission Error Code 5004 (XtraSpeed E and XtraSpeed E-Plus Tractors Only) ..... 24
  - Transmission Error Code 5005 (XtraSpeed E and XtraSpeed E-Plus Tractors Only) ..... 24
  - Transmission Error Code 5006 (XtraSpeed E and XtraSpeed E-Plus Tractors Only) ..... 25
  - Transmission Error Code 5007 (XtraSpeed E and XtraSpeed E-Plus Tractors Only) ..... 25
  - Transmission Error Code 5008 (XtraSpeed E and XtraSpeed E-Plus Tractors Only) ..... 26
  - Transmission Error Code 5009 (XtraSpeed E and XtraSpeed E-Plus Tractors Only) ..... 26
  - Transmission Error Code 5010 (XtraSpeed E and XtraSpeed E-Plus Tractors Only) ..... 27
  - Transmission Error Code 5011 (XtraSpeed E and XtraSpeed E-Plus Tractors Only) ..... 27
  - Transmission Error Code 5012 (XtraSpeed E and XtraSpeed E-Plus Tractors Only) ..... 28
  - Transmission Error Code 5013 (XtraSpeed E and XtraSpeed E-Plus Tractors Only) ..... 28
  - Transmission Error Code 5014 (XtraSpeed E and XtraSpeed E-Plus Tractors Only) ..... 29
  - Transmission Error Code 5015 (XtraSpeed E and XtraSpeed E-Plus Tractors Only) ..... 29

https://truckmanualshub.com/



Transmission Error Code 5016 ..... 30
Transmission Error Code 5017 ..... 30
Transmission Error Code 5018 ..... 31
Transmission Error Code 5019 ..... 31
Transmission Error Code 5020 ..... 32
Transmission Error Code 5021 ..... 32
Transmission Error Code 5022 ..... 33
Transmission Error Code 5023 ..... 33
Transmission Error Code 5024 ..... 34
Transmission Error Code 5025 ..... 34
Transmission Error Code 5026 ..... 35
Transmission Error Code 5027 ..... 35
Transmission Error Code 5028 ..... 36
Transmission Error Code 5029 ..... 36
Transmission Error Code 5030 ..... 37
Transmission Error Code 5031 ..... 37
Transmission Error Code 5032 ..... 38
Transmission Error Code 5033 ..... 38
Transmission Error Code 5034 ..... 39
Transmission Error Code 5035 ..... 39
Transmission Error Code 5036 ..... 40
Transmission Error Code 5037 ..... 40
Transmission Error Code 5038 ..... 41
Transmission Error Code 5039 ..... 41
Transmission Error Code 5040 ..... 42
Transmission Error Code 5041 ..... 42
Transmission Error Code 5042 ..... 43
Transmission Error Code 5043 ..... 43
Transmission Error Code 5044 ..... 44
Transmission Error Code 5045 ..... 44
Transmission Error Code 5046 ..... 45
Transmission Error Code 5047 ..... 45
Transmission Error Code 5048 ..... 46
Transmission Error Code 5049 ..... 46
Transmission Error Code 5050 ..... 47
Transmission Error Code 5051 ..... 47
Transmission Error Code 5052 ..... 48
Transmission Error Code 5053 ..... 48
Transmission Error Code 5062 ..... 49
Transmission Error Code 5063 ..... 49
Transmission Error Code 5064 ..... 50
Transmission Error Code 5065 ..... 50
Transmission Error Code 5066 ..... 51
Transmission Error Code 5067 ..... 51
Transmission Error Code 5068 ..... 52

https://truckmanualshub.com/



Transmission Error Code 5069
(XtraSpeed Tractors from PIN JJE3500983,
XtraSpeed - E and XtraSpeed - E Plus Tractors) ..... 52
Transmission Error Code 5070
(XtraSpeed Tractors from PIN JJE3500983,
XtraSpeed - E and XtraSpeed - E Plus Tractors) ..... 53
Transmission Error Code 5071
(XtraSpeed Tractors from PIN JJE3500983,
XtraSpeed - E and XtraSpeed - E Plus Tractors) ..... 53
Transmission Error Code 5072
(XtraSpeed Tractors from PIN JJE3500983,
XtraSpeed - E and XtraSpeed - E Plus Tractors) ..... 54
Transmission Error Code 5081 ..... 54
Transmission Error Code 5082 ..... 55
Transmission Error Code 5083 ..... 55
Transmission Error Code 5084 ..... 56
Transmission Error Code 5085 ..... 56
Transmission Error Code 5087 ..... 57
Transmission Error Code 5088 ..... 57
Transmission Error Code 5089 ..... 58
Transmission Error Code 5091 ..... 58
Transmission Error Code 5093 ..... 58
Transmission Error Code 5095/5096 ..... 59
Transmission Error Code 5098 ..... 60
Transmission Error Code 5099 ..... 60
Transmission Error Code 5100 ..... 61
Transmission Error Code 5101 ..... 61
Transmission Error Code 5102 ..... 62
Transmission Error Code 5103 ..... 63
Transmission Error Code 5105 ..... 64
Transmission Error Code 5106 ..... 65
Transmission Error Code 5107 ..... 66
Cab Controller Error Codes ..... 67
Cab Error Code 5300 ..... 67
Cab Error Code 5301 ..... 67
Cab Error Code 5302 ..... 68
Cab Error Code 5303 ..... 68
Cab Error Code 5304 ..... 68
Cab Error Code 5305 ..... 69
Cab Error Code 5307 ..... 69
Cab Error Code 5309 ..... 70
Cab Error Code 5311 ..... 70
Cab Error Code 5315 ..... 70
Cab Error Code 5316 ..... 71
Cab Error Code 5317
(XtraSpeed - E Plus Tractors Only) ..... 71
Cab Error Code 5318
(XtraSpeed - E Plus Tractors Only) ..... 72
Cab Error Code 5319 ..... 72
Cab Error Code 5320 ..... 73
Cab Error Code 5321 ..... 73
Cab Error Code 5322 ..... 74
Cab Error Code 5323 ..... 74
Cab Error Code 5324 ..... 75
Cab Error Code 5326 ..... 75
Cab Error Code 5327 ..... 76
Cab Error Code 5328 ..... 76

https://truckmanualshub.com/



CIRCUIT TESTING
General Information ... 77

COMPONENT IDENTIFICATION
Instrument Panel Components ... 78
Right Hand Console Components (XtraSpeed Tractors Only) ... 79
Right Hand Console Components (XtraSpeed - E Tractors Only) ... 80
Right Hand Console Components (XtraSpeed - E Plus Tractors Only) ... 81
Rear Fender Components (XtraSpeed - E Plus Tractors Only) ... 82
Transmission Components ... 84

TRANSMISSION CONTROLLER SCHEMATIC CIRCUITS
Transmission Controller Pin Identification ... 85
Transmission Controller Schematic Circuit (For XtraSpeed and XtraSpeed - E Tractors) ... 86
Transmission Controller Schematic Circuit (For XtraSpeed - E Plus Tractors) ... 88

CAB CONTROLLER SCHEMATIC CIRCUITS
Cab Controller Pin Identification ... 90
Cab Controller Schematic Circuit (For XtraSpeed Tractors up to PIN JJE3500311) ... 91
Cab Controller Schematic Circuit (For XtraSpeed Tractors from PIN JJE3500312 to JJE3500982) ... 92
Cab Controller Schematic Circuit (For XtraSpeed Tractors from PIN JJE3500983) ... 93
Cab Controller Schematic Circuit (For XtraSpeed - E Tractors up to PIN JJE3500311) ... 94
Cab Controller Schematic Circuit (For XtraSpeed - E Tractors from PIN JJE3500312) ... 95
Cab Controller Schematic Circuit (For XtraSpeed - E Plus Tractors up to PIN JJE3500311) ... 96
Cab Controller Schematic Circuit (For XtraSpeed - E Plus Tractors from PIN JJE3500312) ... 97

CAN BUS SCHEMATIC CIRCUITS ... 98
CAN Bus Schematic Circuit (For XtraSpeed and XtraSpeed - E Tractors) ... 98
CAN Bus Schematic Circuit (For XtraSpeed - E Plus Tractors) ... 99

MAIN CONNECTORS ... 100

https://truckmanualshub.com/



# SPECIAL TOOLS



DD98H120

**MC2616 MULTIMETER KIT includes:**
**MC2616-1 MULTIMETER ONLY**
**MC2616-2 TEST LEADS**
**MC2616-3 TEMPERATURE PROBE**




MD04C017

**1025T1 McCORMICK DIAGNOSTIC CENTRE**
**1014T1 COMMUNICATIONS ADAPTER**



DD99A051

**MC2656 TEST PROBE KIT**



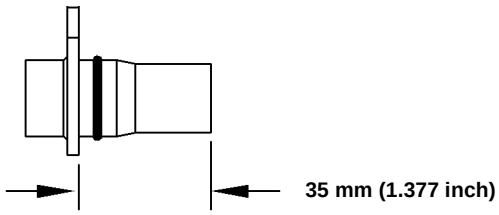
DD97E383

**MC31000B HARNESS REPAIR KIT (EUROPE)**

https://truckmanualshub.com/

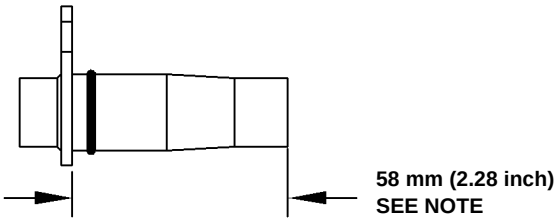


# SPECIFICATIONS




**Powershift (PS2) Speed Sensor and Engine Speed Sensor.**

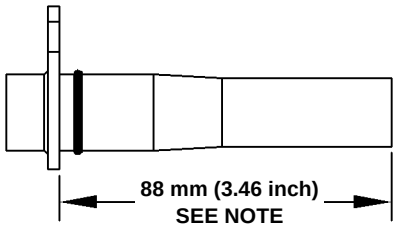
Type ..... Hall Effect
Operating Voltage ..... 12 Volt
Air Gap
- Powershift (PS2) Speed Sensor ..... 0.925 to 1.755 mm (0.036 to 0.069 inch)
- Engine Speed Sensor ..... 0.95 to 2.03 mm (0.037 to 0.080 inch)




**Forward/Reverse Inter A Sensor and PTO B Speed Sensor.**

Type ..... Hall Effect
Operating Voltage ..... 12 Volt
Air Gap
- Forward/Reverse Inter A Sensor ..... 1.8 to 2.45 mm (0.071 to 0.096 inch)
- PTO B Speed Sensor ..... 1.185 to 2.015 mm (0.047 to 0.079 inch)

**NOTE:** *Some transmissions are equipped with 65 mm long Inter A speed sensors and are shimmed to obtain the correct air gap, refer to Service Bulletin DBT4019GB.*



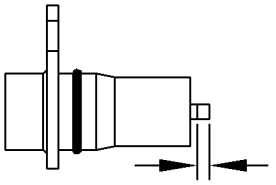

**Powershift (PS4) Speed Sensor and PTO A Speed Sensor.**

Type ..... Hall Effect
Operating Voltage ..... 12 Volt
Air Gap
- Powershift (PS4) Speed Sensor ..... 1.17 to 2.0 mm (0.046 to 0.078 inch)
- PTO A Speed Sensor ..... 1.025 to 1.975 mm (0.040 to 0.077 inch)

**NOTE:** *Some transmissions are equipped with 92 mm long Powershift (PS4) speed sensors and are shimmed to obtain the correct air gap, refer to Service Bulletin DBT4019GB.*

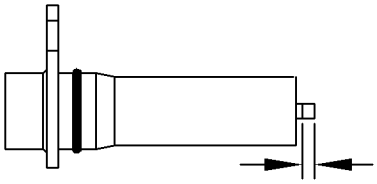
https://truckmanualshub.com/






**Range Position Sensor (XtraSpeed - E and E Plus Tractors Only).**

Type ..... Hall Effect
Operating Voltage ..... 5 Volt
Maximum Plunger Travel ..... 3.2 mm (0.126 inch)




**Range Position Sensor (XtraSpeed Tractors From PIN JJE3500983 Only).**

Type ..... Hall Effect
Operating Voltage ..... 5 Volt
Maximum Plunger Travel ..... 3.2 mm (0.126 inch)

https://truckmanualshub.com/



# GENERAL INFORMATION FOR ELECTRONIC TRANSMISSION CONTROL

The McCormick cab and transmission controllers together control the correct operation of the transmission. The two controllers are part of the CAN Bus network and information is continually passed between the two controllers.

## Cab Controller

The cab controller processes the requests from the operator by monitoring signals directly from the following:

- Forward//Reverse shuttle lever switch (F/N/R or F/N/R/P).
- Gear Up and Down shift switches.
- Clutch pedal switch (bottom of clutch).
- Operator presence switch.
- Declutch switch (XtraSpeed tractors only).
- Range skip switch (XtraSpeed - E and E Plus tractors only).
- Range selection switches (XtraSpeed tractors only).
- Foot throttle position potentiometer.
- Hand throttle position sensor (XtraSpeed - E and E Plus tractors only).
- Creeper switch.

The cab controller also receives the following information transmitted over the CAN Bus network:

- Configuration information from the transmission controller.
- Park brake status information from the instrument cluster.
- Transmission controller status.

The cab controller will process the switch input signals and transmits the information to the transmission controller over the CAN Bus network.

The cab controller and transmission controller are each able to control the engagement of the park lock solenoid (if equipped). If a problem occurs with either the cab or transmission controller the park lock engagement will be controlled by the other active controller.

The cab controller also controls the power supply into the transmission controller for the forward and reverse clutch solenoids. Depending on the information received by the cab controller from the clutch pedal bottom of clutch switch, shuttle lever switch, forward, neutral, reverse or park (if equipped) and the declutch switch (XtraSpeed tractors only) the cab controller will switch on or off the power supply.

## Transmission Controller

The transmission controller monitors information directly from the following sensors.

- Powershift clutch speed sensors.
- Forward and reverse sensor.
- Range position sensors (XtraSpeed - E and E Plus tractors only).
- PTO shaft speed sensors.
- Transmission oil temperature sensor.
- Clutch pedal position sensor.
- Wheel speed sensor.

The transmission controller directly controls the operation of the following:

- Powershift clutch solenoids (PS4).
- Powershift clutch solenoids (PS2).
- Range solenoids (XtraSpeed - E and E Plus only).

The transmission controller processed the above information and will transmit information over the CAN Bus network to other controllers in the system. The transmission controller receives the following information over the CAN Bus network:

- Switch and sensor status from the cab controller.
- Calibration request from the instrument cluster.
- PTO switch status from the hitch/PTO controller (engine power management).
- Engine speed, load and temperature from the engine controller.
- Engine type from the engine controller (for configuration).

https://truckmanualshub.com/



The transmission controller transmits the following information over the CAN Bus network:

- Configuration information to the cab controller.
- Input and output signal information to the cab controller for error checking and monitoring.
- Gear selected, travel direction and error messages to the instrument cluster.
- Audible alarm request to the instrument cluster.
- MFD engagement request the hitch/PTO controller (for park lock operation).
- Engine speed command to the engine controller.
- Engine torque level command to the engine controller.

Depending on the speed selected, transmission oil temperature and the load on the engine the transmission controller will then control the engagement of the correct powershift clutch pack, range solenoids and creep solenoid (if equipped). The transmission controller will then monitor the powershift and forward/reverse clutch speed sensor information to control the level of clutch slip to ensure a smooth gear take up during gear changes.

For tractors equipped with park lock, the transmission controller will control the park lock solenoid engagement along with the cab controller (see “Cab Controller” on page 9).

The transmission controller also transmits and receives information over the CAN Bus network and will process the engine speed and load (torque) information from the engine controller to control the correct gear selection and clutch engagement modulation depending on engine load.

The correct engine torque level is determined by the transmission controller monitoring the PTO shaft speed sensors PTO A and PTO B. During calibration and under no load, the PTO A speed sensor signal pulse is compared with the PTO B speed sensor pulse and the phase at which the signal pulses occur are stored by the controller. When the PTO is engaged and the torque on the shaft increases the PTO shaft speed sensor signal pulses will move out of phase, this allows the controller to measure the amount of torque on the PTO shaft. If the torque level increases to a set level the transmission controller transmits an engine high torque curve request to the engine controller. The engine will remain on the high torque curve until the PTO is disengaged.

There are 4 powershift transmission operating modes for XtraSpeed tractors and 5 operating modes for XtraSpeed - E and E Plus tractors. Each operating mode will be determined by the information received from the Forward/Reverse shuttle lever switch and the gear shift selection switches as follows:

## 1. Pulse Shifting

When the operator presses and releases the Up shift or Down shift switch buttons the transmission will shift up or down a single gear within the selected range. The transmission controller will limit the maximum speed at which the requested Up or Down shift will take place to ensure a smooth gear change.

For XtraSpeed tractors, when a range shift is required the operator must fully depress the clutch pedal or press and hold the declutch switch before selecting the required range change.

For XtraSpeed - E and E Plus tractors when a range change is required an audible alarm will sound. To change the range the operator must release the Up or Down switch button and then press and hold the Up or Down switch button again until the range change is made.

**NOTE:** *The initial configuration of the software will only allow a range change to be made pressing the either the Up or Down gear selection switch for 1 second. It is possible to remove the 1 second delay by pressing both the Range skip switch and the Up gear selection switch while starting the engine. An audible alarm will sound to indicate the 1 second delay has been removed and stored in the controller memory.*

## 2. Sequential Shifting

If the operator holds the Up or Down shift switch continually the transmission will shift up or down one gear change at a time within the selected range until the switch is released. As for pulse shifting the operator must make the range change when required.

Also the transmission controller will limit the maximum speed at which the each gear change will takes place to ensure a smooth gear change.

https://truckmanualshub.com/



### 3. Shuttle Shifting

The operator can change direction (forward to reverse or reverse to forward) without waiting for the tractor to come to a standstill. If the current speed is above that for the correct engagement speed of the preselected gear the transmission controller will select a down shift until the correct speed is achieved.

### 4. Ground Speed Matching (4th Range Only)

If the operator presses the clutch pedal or for XtraSpeed tractors selects neutral or presses the de-clutch button while the tractor is moving the tractor will begin to slow down. When the operator selects forward or reverse or release the clutch pedal the transmission controller will select a gear which matches the speed of the tractor to ensure a smooth gear take up.

### 5. Auto Roading (XtraSpeed - E and E Plus Tractors Only)

Auto shifting mode will only become active when the transmission is in 4th range and both the up shift and range skip switch buttons are pressed. The transmission controller will compare the engine speed information from the engine controller against the cab controller throttle position information. The transmission controller will then process this information to determine the correct gear selection if required.

When auto shifting has been selected the instrument cluster will display an A in place of the range 1 to 4 display. To exit the auto shifting mode one of the following must be carried out:

- A manual powershift request is made (up or down shift switch pressed).
- A manual range skip request is made (range skip switch pressed).
- The shuttle lever selection is changed.
- The key is turned to the OFF position.

### 6. XtraSpeed - E and E Plus Tractor Neutral Selection

**IMPORTANT:** *If you leave the tractor while the engine is running ALWAYS make sure both the forward/ reverse shuttle and the transmission are in NEUTRAL.*

With the tractor parked, put the Forward/Reverse shuttle lever in NEUTRAL or PARK position, as equipped and apply the Park Brake.

Press and hold both Gear Selection Switches (refer to pages 80 and 81) down for approximately 3 seconds to put the transmission into neutral.

**NOTE:** *On certain tractors, the software within the transmission control system will automatically select transmission neutral whenever the shuttle lever is in neutral or park and the operator leaves the seat for more than 5 seconds.*

Once the transmission is in neutral, the Gear Selection Display on the instrument cluster will show 0-1 and the transmission gear selection function will disable. Check and make sure 0-1 is displayed before leaving the operators cab.

To enable the transmission, press and hold the 'UP' gear section switch. An audible alarm will sound and the gear symbol on the instrument cluster will flash to warn the operator when the transmission is about to enable. Once enabled, the transmission will default to gear 1-5 (1st range/5th powershift).

**NOTE:** *If the transmission does not enable, stop and then restart the engine. The transmission will default to the relevant programmed start gear.*

## CAN Bus Communication

The CAN Bus network comprises of a twisted pair of wires, CAN High (Yellow) and CAN Low (Green), with a termination 120 Ohm resistor at each end of the circuit. It is important that these wires remain twisted together and the termination resistors are connected to reduce any electrical interference that may disrupt the CAN messages.

https://truckmanualshub.com/



# TRANSMISSION CALIBRATION

During the transmission calibration the transmission controller will store signal values from the various sensors and solenoids within the system, to enable the controller to control the gear changes of the transmission during normal operation.

The controller will initially monitor and store the voltage signals from the clutch pedal position sensor and throttle sensor(s) activated by the operator.

When the operator moves the clutch pedal from the fully released position to the fully down position and back to the released position the controller will store the minimum and maximum voltage signal values from the clutch pedal position sensor, to determine the voltage range of the sensor.

When the operator moves the foot throttle from low idle position to high idle position the controller will store the minimum and maximum voltage signal values from the foot throttle position sensor to determine the voltage range of the foot throttle sensor. For XtraSpeed - E Plus tractors this procedure is repeated for the hand throttle.

When the clutch and throttle sensor values have been stored the controller will then automatically complete the transmission calibration. The controller will compare the PTO shaft speed sensor signal pulses from the PTO A and PTO B sensors to determine the phase of the signals with the PTO under no load. During normal PTO operation when the PTO is under load the signal phase between the PTO A and PTO B sensors will change, when the phase exceeds a predetermined value the controller will signal the engine to switch to the high torque curve.

For XtraSpeed tractors from PIN JJE3500983 the operator will be requested to select 1st range, 2nd range, 3rd and range 4th range in turn. The controller will monitor and store the voltage signal from the range position sensors in each position.

For XtraSpeed - E and E Plus tractors the controller will then select 1st range, neutral and 2nd range and will monitor and store the voltage signal from the 1st/2nd range position sensor in each position. The 1st range voltage signal will lower than the neutral and 2 range voltage signals. The procedure will be repeated for the 3rd and 4th range selection.

The controller will then engage the powershift PS4, powershift PS2, forward and reverse clutches individually while monitoring the engine load signal from the engine controller over the CAN bus network. The engine load will increase when the clutch pack reaches its initial engagement (bite point), the controller will record the solenoid duty cycle at this point. This recorded duty cycle is then used by the controller to control the gear shifting and direction shuttling operations.

https://truckmanualshub.com/

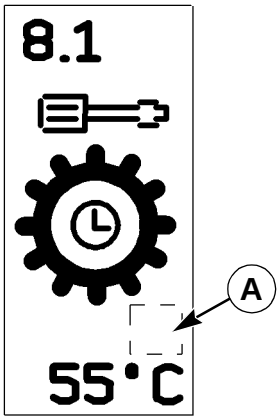


# Transmission Calibration - General Information

**WARNING:** *Only a competent person should carry out the transmission calibration procedure while sat in the operators seat with the tractor parked in a safe area clear of obstructions and any other person(s).*

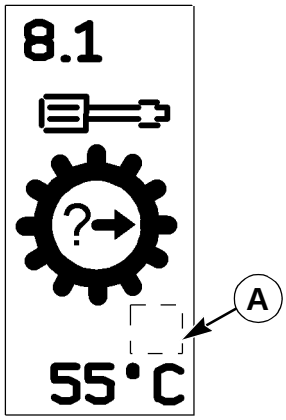
**WARNING:** *BEFORE COMMENCING the calibration procedure carefully read and familiarises yourself with the following general information and the transmission calibration selection and calibration procedures.*

**IMPORTANT:** *If the transmission oil temperature falls below 45°C (113°F) during calibration the an error code will be displayed on the instrument cluster and powershift and forward/reverse clutch calibration will fail.*



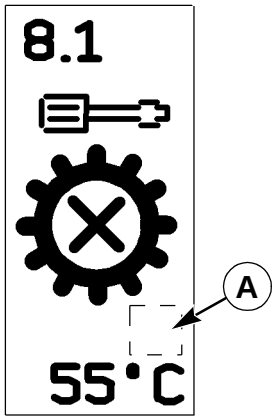
MI05E034

**CALIBRATION WAITING**



MI05E035

**CALIBRATION WAITING CONDITION**



MI05E036

**CALIBRATION FAILED**

During calibration one or more of the above calibration error indicator icons may appear on the instrument cluster with a corresponding error code displayed in area (A), refer to “Transmission Calibration Error Codes” on page 19.

## Calibration Waiting

If the calibration waiting icon appears on the instrument cluster the controller is waiting for an operator action.

Examples:

Code 93 = Park brake not applied.

Code 94 = Operator not sat on the seat.

Code 95= Clutch pedal not depressed.

## Calibration Waiting Condition

If the calibration waiting icon appears on the instrument cluster the controller is waiting for an operator action.

Examples:

Code 80 = Transmission oil temperature too low (below 45 C/113°F).

Code 98 = Forward/Reverse shuttle lever not in Neutral or Park.

## Calibration Failed

If the calibration failed icon appears on the instrument cluster the controller is waiting for an operator action.

Examples:

Code 51 = Foot throttle calibration failed (not activated within the time allowed).

Code 52 = Hand throttle calibration failed (not activated within the time allowed).

https://truckmanualshub.com/



# Transmission Calibration - Selection Procedure

**IMPORTANT:** *Before carrying out the transmission calibration, refer to Transmission Calibration - General Information on page 13.*

> **WARNING:** ***BEFORE COMMENCING the calibration procedure carefully read and familiarises yourself with the following calibration procedure.***

**IMPORTANT:** *As the transmission oil temperature may fall during calibration, it is recommended that the transmission oil temperature is heated to above 55° C (131°F) prior to commencing calibration.*

## STEP 1

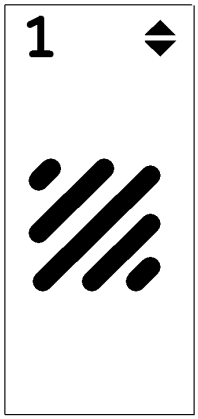
Park the tractor on hard level ground, apply the Park Brake and put the forward/reverse shuttle lever in NEUTRAL or PARK.

Make sure the PTO is disengaged and the Air Conditioning is turned OFF, STOP the engine and remove the key. For XtraSpeed tractors put the range lever in Neutral.

Put blocks in front of and behind the front and rear wheels.

**NOTE:** *For tractors equipped with creeper, make sure direct drive is selected (Creep OFF) before stopping the engine.*

## STEP 2

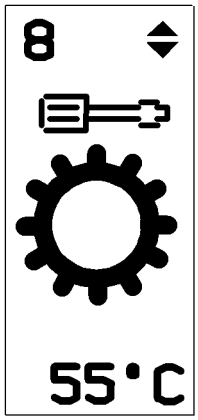



MI05E033

Start the engine and press the instrument cluster menu button to enter the calibration mode. Release the menu button when the above icon appears.

> **WARNING:** *Never operate the engine in a closed building, proper ventilation is required under all circumstances.*

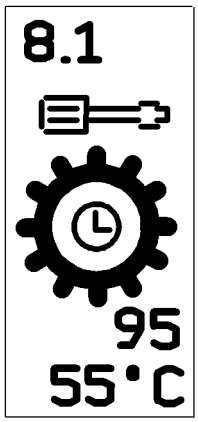
## STEP 3




MI05E037

Using the buttons scroll through the menu to enter the transmission calibration selection. When the transmission calibration has been selected the above icon and the transmission oil temperature will be displayed on the instrument cluster.

## STEP 4




MI05E038

To enter the transmission calibration mode, press the instrument cluster menu button . Release the menu button when the above icon appears

.

> **WARNING:** ***To prevent the tractor from driving DO NOT continue with the calibration procedure unless the 8.1 icon is displayed on the instrument cluster.***

**NOTE:** *During the calibration procedure the engine speed will automatically be set at approximately 1000 r.p.m.*

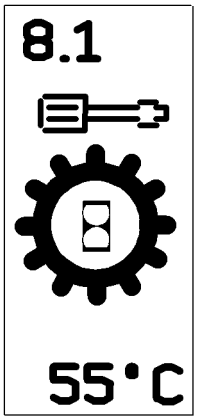
https://truckmanualshub.com/



# Transmission Calibration For XtraSpeed Tractors up to PIN JJE3500983 Only

**IMPORTANT:** *CARRY OUT the transmission Calibration Selection Procedure before carrying out the following. Refer to Transmission Calibration - Selection Procedure on page 14.*

## STEP 1




MI05E039

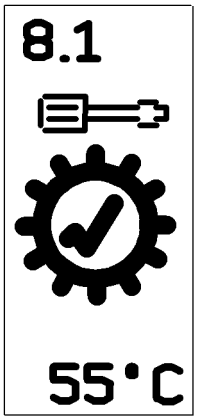
Hold the clutch pedal fully down, select 4th range and put the forward/reverse shuttle lever in forward. Release the clutch pedal and fully depress the foot throttle for 1 second then release.

When the above icon appears on the instrument cluster the transmission calibration will begin.

**WARNING:** ***Only release the clutch pedal when the 8.1 icon is displayed on the instrument cluster.***

**NOTE:** *The audible alarm will sound during the remainder of the calibration procedure.*

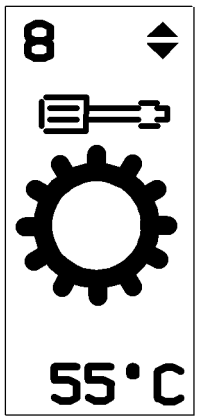
## STEP 2




MI05E040

The calibration procedure will take approximately 10 minutes. Once the calibration is complete the above icon will be displayed on the instrument cluster. Put the forward/reverse shuttle lever in the NEUTRAL or PARK position, STOP the engine and remove the key.

## STEP 3




MI05E037

If a calibration waiting condition or calibration failed icon appears on the instrument cluster before the calibration complete icon appears, put the forward/reverse shuttle lever in NEUTRAL or PARK. Press the menu button on the instrument cluster to return to the calibration selection. When the above icon appears on the instrument cluster repeat he calibration procedure.

**WARNING:** ***To prevent the tractor from driving DO NOT continue with the calibration procedure unless the 8.1 icon is displayed on the instrument cluster.***

**IMPORTANT:** *When the calibration procedure is complete the calibration waiting icon and error code 98 will appear on the instrument cluster if the forward/reverse shuttle lever is not put into NEUTRAL or PARK. This is not an error condition and the calibration has been successful.*

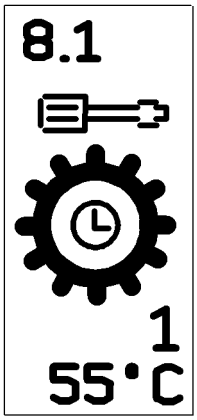
https://truckmanualshub.com/



# Transmission Calibration For XtraSpeed Tractors From PIN JJE3500983 Only

**IMPORTANT:** *CARRY OUT the transmission Calibration Selection Procedure before carrying out the following. Refer to Transmission Calibration - Selection Procedure on page 14.*

## STEP 1



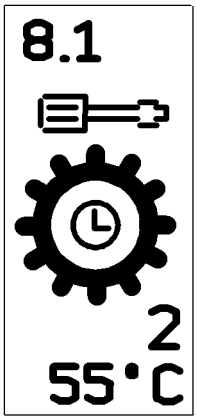

MI06E001

Hold the clutch pedal fully down and put the forward/ reverse shuttle lever in forward.
Release the clutch pedal and fully depress the foot throttle for 1 second then release.

When the above icon appears on the instrument cluster the select 1st range.

**WARNING:** ***Only release the clutch pedal when the 8.1 icon is displayed on the instrument cluster.***

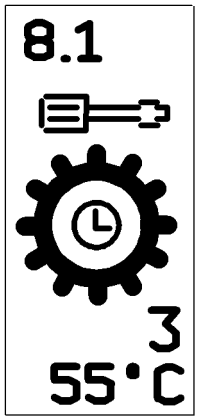
## STEP 2




MI06E002

When the above icon appears on the instrument cluster the select 2nd range.

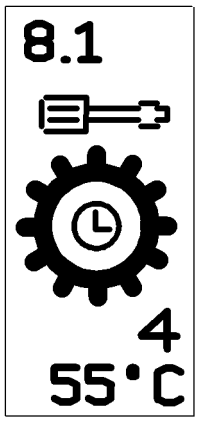
## STEP 3




MI06E003

When the above icon appears on the instrument cluster the select 3rd range.

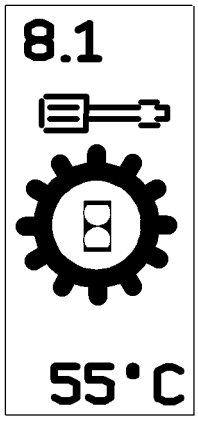
## STEP 4




MI06E004

When the above icon appears on the instrument cluster the select 4th range.

## STEP 5




MI05E039

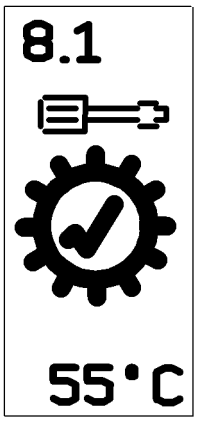
When the above icon appears on the instrument cluster the transmission calibration will begin.

**NOTE:** *The audible alarm will sound during the remainder of the calibration procedure.*

https://truckmanualshub.com/



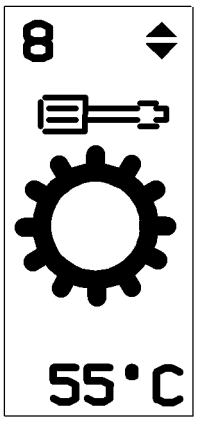
**STEP 6**




MI05E040

The calibration procedure will take approximately 10 minutes. Once the calibration is complete the above icon will be displayed on the instrument cluster. Put the forward/reverse shuttle lever in the NEUTRAL or PARK position, STOP the engine and remove the key.

**STEP 7**




MI05E037

If a calibration waiting condition or calibration failed icon appears on the instrument cluster before the calibration complete icon appears, put the forward/ reverse shuttle lever in NEUTRAL or PARK. Press the menu button on the instrument cluster to return to the calibration selection. When the above icon appears on the instrument cluster repeat he calibration procedure.

**WARNING:** ***To prevent the tractor from driving DO NOT continue with the calibration procedure unless the 8.1 icon is displayed on the instrument cluster.***

**IMPORTANT:** *When the calibration procedure is complete the calibration waiting icon and error code 98 will appear on the instrument cluster if the forward/reverse shuttle lever is not put into NEUTRAL or PARK. This is not an error condition and the calibration has been successful.*

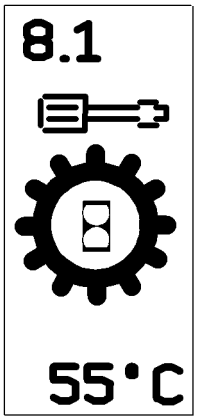
https://truckmanualshub.com/



# Transmission Calibration For XtraSpeed - E and E Plus Tractors Only

**IMPORTANT:** *CARRY OUT the transmission Calibration Selection Procedure before carrying out the following. Refer to Transmission Calibration - Selection Procedure on page 14.*

## STEP 1



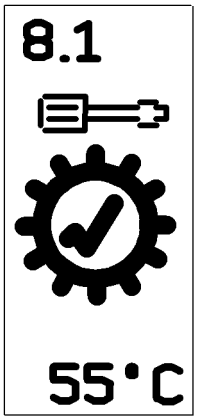

MI05E039

Hold the clutch pedal fully down and put the forward/reverse shuttle lever in forward.
Release the clutch pedal and fully depress the foot throttle for 1 second then release.
For XtraSpeed - E Plus tractors also move the hand throttle to full throttle for 1 second then move the throttle to the low idle position.
When the above icon appears on the instrument cluster the transmission calibration will begin.

**WARNING:** ***ONLY release the clutch pedal when the 8.1 icon is displayed on the instrument cluster.***

**NOTE:** *The audible alarm will sound during the remainder of the calibration procedure.*

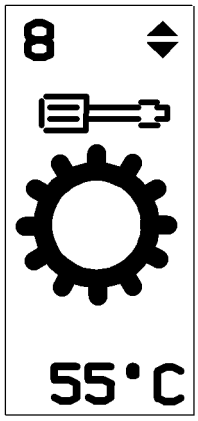
## STEP 2




MI05E040

The calibration procedure will take approximately 10 minutes. Once the calibration is complete the above icon will be displayed on the instrument cluster. Put the forward/reverse shuttle lever in the NEUTRAL or PARK position, STOP the engine and remove the key.

## STEP 3




MI05E037

If a calibration waiting condition or calibration failed icon appears on the instrument cluster before the calibration complete icon appears, put the forward/reverse shuttle lever in NEUTRAL or PARK. Press the menu button on the instrument cluster to return to the calibration selection. When the above icon appears on the instrument cluster repeat he calibration procedure.

**WARNING:** ***To prevent the tractor from driving DO NOT continue with the calibration procedure unless the 8.1 icon is displayed on the instrument cluster.***

**IMPORTANT:** *When the calibration procedure is complete the calibration waiting icon and error code 98 will appear on the instrument cluster if the forward/reverse shuttle lever is not put into NEUTRAL or PARK. This is not an error condition and the calibration has been successful.*

https://truckmanualshub.com/



# Transmission Calibration Error Codes

**IMPORTANT:** *Check for transmission and cab controller active error codes and carry out the necessary repairs before troubleshooting the calibration error codes.*

| CODE | DESCRIPTION | POSSIBLE CAUSE |
|---|---|---|
| 1 | 1st Range Calibration Failed (XtraSpeed - E and E Plus Tractors Only) | 1. The controller incorrectly configured. - Reconfigure the controller.<br>2. 1st and 2nd range solenoids connected incorrectly - Check the solenoid connections.<br>3. Bad 1st/2nd range position sensor. - Check the position sensor.<br>4. 1st/2nd range shifter mechanical problem. - Check for mechanical failures and repair as necessary. |
| 2 | 2nd Range Calibration Failed (XtraSpeed - E and E Plus Tractors Only) | |
| 3 | 3rd Range Calibration Failed (XtraSpeed - E and E Plus Tractors Only) | 1. The controller incorrectly configured. - Reconfigure the controller<br>2. 3rd and 4th range solenoids connected incorrectly. - Check the solenoid connections.<br>3. Bad 3rd/4th range position sensor. - Check the position sensor.<br>4. 3rd/4th range shifter mechanical problem. - Check for mechanical failures and repair as necessary. |
| 4 | 4th Range Calibration Failed (XtraSpeed - E and E Plus Tractors Only) | |
| 5 | 1st/2nd/Neutral Range Calibration Failed (XtraSpeed from PIN JJE3500983 Tractors Only) | 1. The controller incorrectly configured. - Reconfigure the controller.<br>2. Bad 1st/2nd range position sensor. - Check the position sensor.<br>3. 1st/2nd range shifter mechanical problem. - Check for mechanical failures and repair as necessary |
| 6 | 3rd/4th/Neutral Range Calibration Failed (XtraSpeed from PIN JJE3500983 Tractors Only) | 1. The controller incorrectly configured. - Reconfigure the controller.<br>2. Bad 1st/2nd range position sensor. - Check the position sensor.<br>3. 3rd/4th range shifter mechanical problem. - Check for mechanical failures and repair as necessary |
| 10 | Forward Clutch Calibration Failed | 1. Sticking clutch solenoid valve. Bad solenoid valve. - Turn the engine OFF to exit the calibration. If possible drive the tractor in each gear. If the tractor drives in each gear repeat the calibration procedure.<br>**IMPORTANT:** *The tractor can only be driven without the transmission being fully calibrated for short periods.*<br>2. Hydraulic failure refer to Section 8001.<br>3. Clutch pack mechanical failure. - Check for mechanical failures and repair as necessary. |
| 11 | Reverse Clutch Calibration Failed | |
| 21 | Low Powershift Clutch (PS2-1) Calibration Failed | |
| 22 | High Powershift Clutch (PS2-2) Calibration Failed | |
| 41 | 1st Powershift Clutch (PS4-1) Calibration Failed | |
| 42 | 2nd Powershift Clutch (PS4-2) Calibration Failed | |
| 43 | 3rd Powershift Clutch (PS4-3) Calibration Failed | |
| 44 | 4th Powershift Clutch (PS4-4) Calibration Failed | |
| 50 | Clutch Pedal Position Sensor Calibration Failed | 1. Time taken to move the clutch pedal from fully down to fully released is too long. - Repeat the calibration procedure.<br>2. Bad clutch pedal position sensor. or sensor circuit. - Check the clutch pedal position sensor and sensor circuit. |
| 51 | Foot Throttle Calibration Failed | 1. Time taken to move the foot throttle from low idle to high idle and back to low idle is too long. - Repeat the calibration procedure.<br>2. Bad foot throttle position sensor or foot throttle circuit. - Check the clutch foot throttle position sensor and sensor circuit. |

https://truckmanualshub.com/



| | | |
|---|---|---|
| 52 | Hand Throttle Calibration Failed | 1. Time taken to move the hand throttle from low idle to high idle and back to low idle is too long. - Repeat the calibration procedure.<br>2. Bad hand throttle position sensor or hand throttle circuit. - Check the clutch foot throttle position sensor and sensor circuit. |
| 61 | Engine Torque Not Stabilised | 1. Air conditioning operating during calibration. - Make sure the air conditioning is switched OFF.<br>2. Auxiliary/remote valve operated during calibration. - Make sure the auxiliary/remote valve levers or joysticks are in neutral. |
| 80 | Transmission Oil Temperature Too Low | 1. Transmission oil temperature is below 55°C (131°F ) when calibration begins. - Wait for the transmission oil temperature to reach 55°C (131°F) and repeat the calibration proce dure.<br>2. Transmission oil temperature falls below 45°C (11 3°F) during calibration. - Raise transmission oil temperature to a temperature above 55°C (131°F) and repeat the calib ration procedure. |
| 90 | Engine Not Running Correctly | 1. Check for engine error codes and repair as necessary. |
| 93 | Park Brake Not Engaged | 1. Park brake not engaged. - Engage the park brake.<br>2. Bad park brake switch. - Check the park brake switch and the switch circuit.<br>3. Bad CAN Bus park brake signal from the instrument cluster. |
| 94 | Operator Not Present | 1. Operator out of seat. - Remain seated in the operators seat during calibration.<br>2. Bad operator presence switch. - Check the operator presence switch and switch circuit. |
| 95 | Shuttle Lever Not In Forward | 1. Shuttle lever not moved into or moved out of the forward position. - Make sure the shuttle lever is moved into and remains in the forward position during calibration.<br>2. Bad F/N/R or F/N/R/P switch. - Check F/N/R or F/N/R/P switch and switch circuit. |
| 96 | Clutch Pedal Not Fully Down | 1. The clutch pedal has not been held fully down during calibration. - Make sure the clutch pedal is held fully down during calibration.<br>2. Bad bottom of clutch switch. - Check the bottom of clutch switch and switch circuit. |
| 97 | Clutch Pedal Down | 1. A signal has not been detected from the bottom of clutch switch when the clutch pedal is fully released during calibration. - Check the bottom of clutch switch and switch circuit. |
| 98 | Shuttle Lever Not In Neutral or Park | 1. Shuttle lever not moved into the neutral or park position when calibration is completed. - Make sure the shuttle lever is moved into neutral or park when the calibration procedure is complete. |
| 99 | 4th Range Not Engaged (XtraSpeed Tractors only) | 1. 4th range has not been selected during calibration. - Make sure the range lever is moved into and remains in 4th range during calibration.<br>2. Bad 4th range switch. - Check the 4th range switch and switch circuit. |
| 100 | PTO Engaged | 1. The PTO switch is in the ON position during calibration. - Move the PTO switch to the OFF position. |
| 101 | PTO Shaft Calibration Failed (Engine Power Management) | 1. Check for transmission error codes 5095/96 and repair as necessary. |

https://truckmanualshub.com/



# ERROR CODES GENERAL INFORMATION

Each controller on the tractor continually monitors the control systems for errors. If an error is detected a error message will be transmitted over the CAN circuit to the instrument cluster, which will display an error warning to alert the operator to a problem. Depending on the nature of the fault the instrument cluster may display the Red engine STOP and or the Amber main warning light, also the audible alarm may sound.

**NOTE:** *The instrument cluster can only display current (active) error codes.*

Each controller will store all error codes that have been detected in the controller memory. These stored error codes can be viewed and cleared using the 'McCormick Diagnostic Centre'.

## Retrieving Instrument Cluster Displayed Active Error Codes.

If an error occurs during normal operation in one of the tractor controller systems the ! symbol will appear on the instrument cluster.

If the error warning symbol appears park the tractor on hard level ground, put the F/N/R lever in NEUTRAL or the F/N/R/P lever in PARK. Apply the park brake and turn the key to the OFF position.

> ⚠ **WARNING:** *Some errors will only be active when the tractor is operated, the codes for these errors will be stored in the relevant controller and MUST only be retrieved using the 'McCormick Diagnostic Centre'. DO NOT retrieve error codes when driving the tractor.*

To read the error codes carry out the following procedure:

Turn the key to the on position and press the menu button.

Each controller will be identified on the Universal Data Display as follows:

| | |
|---|---|
| **ENG** | - ENGINE |
| **IC** | - INSTRUMENT CLUSTER |
| **CC** | - CAB (4CC) CONTROLLER |
| **TC** | - TRANSMISSION CONTROLLER |
| **CS** | - CAB SUSPENSION CONTROLLER |
| **EHR** | - ELECTRONIC HITCH |
| **AVC** | - AUXILIARY VALVE CONTROLLER |
| **AV1 to AV5** | - AUXILIARY VALVES |

The displayed controller will also display the number of active error codes.

Example:

**ENG** = ENGINE
**0** = No Active Errors

Press the button to scroll through each controller until MCC is display Universal Data Display.

**TC** = TRANSMISSION CONTROLLER
**1** = 1 Active Error

To view the error code, press the menu button.

**5020** = Error Code 5020 (Transmission Controller Error)

If more than one CC error has been detected, press the button to identify the remaining errors.

For CC Error Codes refer to the Error Code Troubleshooting Guide in this section.

**IMPORTANT:** *A single fault in the system may cause several different error codes to be recorded. make a note of all active error codes for each controller before carrying out the troubleshooting procedure.*

https://truckmanualshub.com/



# ERROR CODE TROUBLESHOOTING GUIDE

## Transmission Controller Error Codes

## Transmission Error Code 5000 (XtraSpeed E and XtraSpeed E-Plus Tractors Only)

**Fault Description.**
The controller has detected the voltage to the 1st Range solenoid is too low.

**Response.**
Tractor will not operate in 1st range (gears 1-1 to 1-8).

**Possible Cause.**
1. Supply circuit between the transmission controller and the 1st range solenoid shorted to ground.
2. Bad 1st range solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 580 Red between the transmission controller, connector 49 pin 21 and the 1st range solenoid for short circuit to ground.
2. Check the 1st range solenoid connection.
3. Check the 1st range solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5001 (XtraSpeed E and XtraSpeed E-Plus Tractors Only)

**Fault Description.**
The controller has detected the voltage to the 1st Range solenoid is too high.

**Response.**
During tractor operation the tractor will not shift up out of 1st range after 1st range has been selected.
On power up the tractor may select and remain in 1st range (gears 1-1 to 1-8).
The tractor may not drive.

**Possible Cause.**
1. Supply circuit between the transmission controller and the 1st range solenoid shorted to a voltage supply.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 580 Red between the transmission controller, connector 49 pin 21 and the 1st range solenoid for a short to a voltage supply.
2. Check the 1st range solenoid connection.
3. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5002 (XtraSpeed E and XtraSpeed E-Plus Tractors Only)

**Fault Description.**
The controller has detected the 1st Range solenoid current is too low.

**Response.**
The transmission mechanically selects neutral range when 1st range is selected.

**Possible Cause.**
1. Return circuit between the transmission controller and the 1st range solenoid open circuit or short circuit to ground.
2. Bad 1st range solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 580 Tan between the transmission controller, connector 49 pin 1 and the 1st range solenoid for a short to ground or open circuit.
2. Check the 1st range solenoid connection.
3. Check the 1st range solenoid coil resistance is approximately 8.5 Ohms at 20°C (68°F) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5003 (XtraSpeed E and XtraSpeed E-Plus Tractors Only)

**Fault Description.**
The controller has detected the 1st Range solenoid current is too high.

**Response.**
During tractor operation the tractor will not shift up out of 1st range after 1st range has been selected.
On power up the tractor may select and remain in 1st range (gears 1-1 to 1-8).
The tractor may not drive.

**Possible Cause.**
1. Return circuit between the transmission controller and the 1st range solenoid shorted to a voltage supply.
2. Constant supply to the 1st range solenoid.
3. Bad 1st range solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 580 Tan between the transmission controller, connector 49 pin 1 and the 1st range solenoid for a short to a voltage supply.
2. Check wire 580 Red between the transmission controller, connector 49 pin 21 and the 1st range solenoid for a short to a voltage supply.
3. Check the 1st range solenoid coil resistance is approximately 8.5 Ohms at 20°C (68°F) and replace as necessary.
4. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5004 (XtraSpeed E and XtraSpeed E-Plus Tractors Only)

**Fault Description.**
The controller has detected the voltage to the 2nd Range solenoid is too low.

**Response.**
Tractor will not operate in 2nd range (gears 2-1 to 2-8).

**Possible Cause.**
1. Supply circuit between the transmission controller and the 2nd range solenoid shorted to ground.
2. Bad 2nd range solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 581 Red between the transmission controller, connector 49 pin 15 and the 2nd range solenoid for a short circuit to ground.
2. Check the 2nd range solenoid connection.
3. Check the 2nd range solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5005 (XtraSpeed E and XtraSpeed E-Plus Tractors Only)

**Fault Description.**
The controller has detected the voltage to the 2nd Range solenoid is too high.

**Response.**
During tractor operation the tractor will not shift up out of 2nd range after 2nd range has been selected.
On power up the tractor may select and remain in 2nd range (gears 2-1 to 2-8).
The tractor may not drive.

**Possible Cause.**
1. Supply circuit between the transmission controller and the 2nd range solenoid shorted to a voltage supply.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 581 Red between the transmission controller, connector 49 pin 15 and the 2nd range solenoid for a short to a voltage supply.
2. Check the 2nd range solenoid connection.
3. Check the transmission controller connector.

https://truckmanualshub.com/



# Transmission Error Code 5006 (XtraSpeed E and XtraSpeed E-Plus Tractors Only)

**Fault Description.**
The controller has detected the 2nd Range solenoid current is too low.

**Response.**
The transmission mechanically selects neutral range when 2nd range is selected.

**Possible Cause.**
1. Return circuit between the transmission controller and the 2nd range solenoid open circuit or short circuit to ground.
2. Bad 2nd range solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 581 Tan between the transmission controller, connector 49 pin 2 and the 2nd range solenoid for a short to ground or open circuit.
2. Check the 2nd range solenoid connection.
3. Check the 2nd range solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

# Transmission Error Code 5007 (XtraSpeed E and XtraSpeed E-Plus Tractors Only)

**Fault Description.**
The controller has detected the 2nd Range solenoid current is too high.

**Response.**
During tractor operation the tractor will not shift up out of 2nd range after 2nd range has been selected.
On power up the tractor may select and remain in 2nd range (gears 2-1 to 2-8).
The tractor may not drive.

**Possible Cause.**
1. Return circuit between the transmission controller and the 2nd range solenoid shorted to a voltage supply.
2. Constant supply to the 2nd range solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 581 Tan between the transmission controller, connector 49 pin 2 and the 2nd range solenoid for a short to a voltage supply.
2. Check wire 581 Red between the transmission controller, connector 49 pin 15 and the 2nd range solenoid for a short to a voltage supply.
3. Check the 2nd range solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5008 (XtraSpeed E and XtraSpeed E-Plus Tractors Only)

**Fault Description.**
The controller has detected the voltage to the 3rd Range solenoid is too low.

**Response.**
Tractor will not operate in 3rd range (gears 3-1 to 3-8).

**Possible Cause.**
1. Supply circuit between the transmission controller and the 3rd range solenoid shorted to ground.
2. Bad 3rd range solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 582 Red between the transmission controller, connector 49 pin 18 and the 3rd range solenoid for short circuit to ground.
2. Check the 3rd range solenoid connection.
3. Check the 3rd range solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5009 (XtraSpeed E and XtraSpeed E-Plus Tractors Only)

**Fault Description.**
The controller has detected the voltage to the 3rd Range solenoid is too high.

**Response.**
During tractor operation the tractor will not shift up out of 3rd range after 3rd range has been selected.
On power up the tractor may select and remain in 3rd range (gears 3-1 to 3-8).
The tractor may not drive.

**Possible Cause.**
1. Supply circuit between the transmission controller and the 3rd range solenoid shorted to a voltage supply.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 582 Red between the transmission controller, connector 49 pin 18 and the 3rd range solenoid for short to a voltage supply.
2. Check the 3rd range solenoid connection.
3. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5010 (XtraSpeed E and XtraSpeed E-Plus Tractors Only)

**Fault Description.**
The controller has detected the 3rd Range solenoid current is too low.

**Response.**
The transmission mechanically selects neutral range when 3rd range is selected.

**Possible Cause.**
1. Return circuit between the transmission controller and the 3rd range solenoid open circuit or short circuit to ground.
2. Bad 3rd range solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 582 Tan between the transmission controller, connector 49 pin 3 and the 3rd range solenoid for short to ground or open circuit.
2. Check the 3rd range solenoid connection.
3. Check the 3rd range solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5011 (XtraSpeed E and XtraSpeed E-Plus Tractors Only)

**Fault Description.**
The controller has detected the 3rd Range solenoid current is too high.

**Response.**
During tractor operation the tractor will not shift up out of 3rd range after 3rd range has been selected.
On power up the tractor may select and remain in 3rd range (gears 3-1 to 3-8).
The tractor may not drive.

**Possible Cause.**
1. Return circuit between the transmission controller and the 3rd range solenoid shorted to a voltage supply.
2. Constant supply to the 3rd range solenoid.
3. Bad 3rd range solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 582 Tan between the transmission controller, connector 49 pin 3 and the 3rd range solenoid for a short to a voltage supply.
2. Check wire 582 Red between the transmission controller, connector 49 pin 18 and the 3rd range solenoid for a short to a voltage supply.
3. Check the 3rd range solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the 3rd range solenoid connection.
5. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5012 (XtraSpeed E and XtraSpeed E-Plus Tractors Only)

**Fault Description.**
The controller has detected the voltage to the 4th Range solenoid is too low.

**Response.**
Tractor will not operate in 4th range (gears 4-1 to 4-8).

**Possible Cause.**
6. Supply circuit between the transmission controller and the 4th range solenoid shorted to ground.
7. Bad 4th range solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 583 Red between the transmission controller, connector 49 pin 20 and the 4th range solenoid for a short circuit to ground.
2. Check the 4th range solenoid connection.
3. Check the 4th range solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5013 (XtraSpeed E and XtraSpeed E-Plus Tractors Only)

**Fault Description.**
The controller has detected the voltage to the 4th Range solenoid is too high.

**Response.**
During tractor operation the tractor will not shift up out of 4th range after 4th range has been selected.
On power up the tractor may select and remain in 4th range (gears 4-1 to 4-8).
The tractor may not drive.

**Possible Cause.**
1. Supply circuit between the transmission controller and the 4th range solenoid shorted to a voltage supply

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 583 Red between the transmission controller, connector 49 pin 20 and the 4th range solenoid for a short to a voltage supply.
2. Check the 4th range solenoid connection.
3. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5014 (XtraSpeed E and XtraSpeed E-Plus Tractors Only)

**Fault Description.**
The controller has detected the 4th Range solenoid current is too low.

**Response.**
The transmission mechanically selects neutral range when 4th range is selected.

**Possible Cause.**
1. Return circuit between the transmission controller and the 4th range solenoid open circuit or short circuit to ground.
2. Bad 4th range solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 583 Tan between the transmission controller, connector 49 pin 4 and the 4th range solenoid for a short to ground or open circuit.
2. Check the 4th range solenoid connection.
3. Check the 4th range solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5015 (XtraSpeed E and XtraSpeed E-Plus Tractors Only)

**Fault Description.**
The controller has detected the 4th Range solenoid current is too high.

**Response.**
During tractor operation the tractor will not shift up out of 4th range after 4th range has been selected.
On power up the tractor may select and remain in 4th range (gears 4-1 to 4-8).
The tractor may not drive.

**Possible Cause.**
1. Return circuit between the transmission controller and the 4th range solenoid shorted to a voltage supply.
2. Constant supply to the 4th range solenoid.
3. Bad 4th range solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 583 Tan between the transmission controller, connector 49 pin 4 and the 4th range solenoid for a short to a voltage supply.
2. Check wire 583 Red between the transmission controller, connector 49 pin 20 and the 4th range solenoid for a short to a voltage supply.
3. Check the 4th range solenoid connection.
4. Check the 4th range solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
5. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5016

**Fault Description.**
The controller has detected the voltage to the PS4-1 solenoid is too low.

**Response.**
Tractor will not operate in powershift 1 or 5 (gears 1-1, 1-5, 2-1, 2-5, 3-1, 3-5, 4-1 or 4-5).

**Possible Cause.**
1. Supply circuit between the transmission controller and the PS4-1 solenoid shorted to ground.
2. Bad PS4-1 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS1) Red between the transmission controller, connector 49 pin 22 and the PS4-1 solenoid for short circuit to ground.
2. Check the PS4-1 solenoid connection.
3. Check the PS4-1 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5017

**Fault Description.**
The controller has detected the voltage to the PS4-1 solenoid is too high.

**Response.**
The instrument cluster Red STOP light will illuminate and the tractor will not shift out of powershift 1 or 5.
On power up the tractor may select and remain in powershift 1 or 5 (gears 1-1, 1-5, 2-1, 2-5, 3-1, 3-5, 4-1 or 4-5).
The tractor may not drive.

**Possible Cause.**
1. Supply circuit between the transmission controller and the PS4-1 solenoid shorted to a voltage supply.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS1) Red between the transmission controller, connector 49 pin 22 and the PS4-1 solenoid for a short to a voltage supply.
2. Check the PS4-1 solenoid connection.
3. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5018

**Fault Description.**
The controller has detected the PS4-1 solenoid current is too low.

**Response.**
Tractor will not operate in powershift 1 or 5 (gears 1-1, 1-5, 2-1, 2-5, 3-1, 3-5, 4-1 or 4-5).

**Possible Cause.**
1. Return circuit between the transmission controller and the PS4-1 solenoid open circuit or short circuit to ground.
2. Bad PS4-1 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS1) Tan between the transmission controller, connector 49 pin 5 and the PS4-1 solenoid for a short to ground or open circuit.
2. Check the PS4-1 solenoid connection.
3. Check the PS4-1 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5019

**Fault Description.**
The controller has detected the PS4-1 solenoid current is too high.

**Response.**
The instrument cluster Red STOP light will illuminate and the tractor will not shift up out of powershift 1 or 5.
On power up the tractor may select and remain in powershift 1 or 5 (gears 1-1, 1-5, 2-1, 2-5, 3-1, 3-5, 4-1 or 4-5).
The tractor may not drive.

**Possible Cause.**
1. Return circuit between the transmission controller and the PS4-1 solenoid shorted to a voltage supply.
2. Constant 12 volts supply to the PS4-1 solenoid.
3. Bad PS4-1 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS1) Tan between the transmission controller, connector 49 pin 5 and the PS4-1 solenoid for a short to a voltage supply.
2. Check wire (PS1) Red between the transmission controller, connector 49 pin 22 and the PS4-1 solenoid for a short to a voltage supply.
3. Check the PS4-1 solenoid connection.
4. Check the PS4-1 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
5. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5020

**Fault Description.**
The controller has detected the voltage to the PS4-2 solenoid is too low.

**Response.**
Tractor will not operate in powershift 2 or 6 (gears 1-2, 1-6, 2-2, 2-6, 3-2, 3-6, 4-2 or 4-6).

**Possible Cause.**
1. Supply circuit between the transmission controller and the PS4-2 solenoid shorted to ground.
2. Bad PS4-2 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS2) Red between the transmission controller, connector 49 pin 14 and the PS4-2 solenoid for short circuit to ground.
2. Check the PS4-2 solenoid connection.
3. Check the PS4-2 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5021

**Fault Description.**
The controller has detected the voltage to the PS4-2 solenoid is too high.

**Response.**
The instrument cluster Red STOP light will illuminate and the tractor will not shift up out of powershift 2 or 6.
On power up the tractor may select and remain in powershift 2 or 6 (gears 1-2, 1-6, 2-2, 2-6, 3-2, 3-6, 4-2 or 4-6).
The tractor may not drive.

**Possible Cause.**
1. Supply circuit between the transmission controller, connector 49 pin 14 and the PS4-2 solenoid shorted to a voltage supply

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS2) Red between the transmission controller and the PS4-2 solenoid for a short to a voltage supply.
2. Check the PS4-2 solenoid connection.
3. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5022

**Fault Description.**
The controller has detected the PS4-2 solenoid current is too low.

**Response.**
Tractor will not operate in powershift 2 or 6 (gears 1-2, 1-6, 2-2, 2-6, 3-2, 3-6, 4-2 or 4-6).

**Possible Cause.**
1. Return circuit between the transmission controller and the PS4-2 solenoid open circuit or short circuit to ground.
2. Bad PS4-2 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS2) Tan between the transmission controller, connector 49 pin 6 and the PS4-2 solenoid for a short to ground or open circuit.
2. Check the PS4-2 solenoid connection.
3. Check the PS4-2 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5023

**Fault Description.**
The controller has detected the PS4-2 solenoid current is too high.

**Response.**
The instrument cluster Red STOP light will illuminate and the tractor will not shift out of powershift 2 or 6.
On power up the tractor may select and remain in powershift 2 or 6 (gears 1-2, 1-6, 2-2, 2-6, 3-2, 3-6, 4-2 or 4-6).
The tractor may not drive.

**Possible Cause.**
1. Return circuit between the transmission controller and the PS4-2 solenoid shorted to a voltage supply.
2. Constant 12 volts supply to the PS4-2 solenoid.
3. Bad PS4-2 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS2) Tan between the transmission controller, connector 49 pin 6 and the PS4-2 solenoid for a short to a voltage supply.
2. Check wire (PS2) Red between the transmission controller, connector 49 pin 14 and the PS4-2 solenoid for a short to a voltage supply.
3. Check the PS4-2 solenoid connection.
4. Check the PS4-2 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
5. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5024

**Fault Description.**
The controller has detected the voltage to the PS4-3 solenoid is too low.

**Response.**
Tractor will not operate in powershift 3 or 7 (gears 1-3, 1-7, 2-3, 2-7, 3-3, 3-7, 4-3 or 4-7).

**Possible Cause.**
1. Supply circuit between the transmission controller and the PS4-3 solenoid shorted to ground.
2. Bad PS4-3 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS3) Red between the transmission controller, connector 49 pin 10 and the PS4-3 solenoid for short circuit to ground.
2. Check the PS4-3 solenoid connection.
3. Check the PS4-3 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5025

**Fault Description.**
The controller has detected the voltage to the PS4-3 solenoid is too high.

**Response.**
The instrument cluster Red STOP light will illuminate and the tractor will not shift out of powershift 3 or 7.
On power up the tractor may select and remain in powershift 3 or 7 (gears 1-3, 1-7, 2-3, 2-7, 3-3, 3-7, 4-3 or 4-7).
The tractor may not drive.

**Possible Cause.**
1. Supply circuit between the transmission controller and the PS4-3 solenoid shorted to a voltage supply

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS3) Red between the transmission controller, connector 49 pin 10 and the PS4-3 solenoid for a short to a voltage supply.
2. Check the PS4-3 solenoid connection.
3. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5026

**Fault Description.**
The controller has detected the PS4-3 solenoid current is too low.

**Response.**
Tractor will not operate in powershift 3 or 7 (gears 1-3, 1-7, 2-3, 2-7, 3-3, 3-7, 4-3 or 4-7).

**Possible Cause.**
1. Return circuit between the transmission controller and the PS4-3 solenoid open circuit or short circuit to ground.
2. Bad PS4-3 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS3) Tan between the transmission controller, connector 49 pin 7 and the PS4-3 solenoid for a short to ground or open circuit.
2. Check the PS4-3 solenoid connection.
3. Check the PS4-3 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5027

**Fault Description.**
The controller has detected the PS4-3 solenoid current is too high.

**Response.**
The instrument cluster Red STOP light will illuminate and the tractor will not shift out of powershift 3 or 7.
On power up the tractor may select and remain in powershift 3 or 7 (gears 1-3, 1-7, 2-3, 2-7, 3-3, 3-7, 4-3 or 4-7).
The tractor may not drive.

**Possible Cause.**
1. Return circuit between the transmission controller and the PS4-3 solenoid shorted to a voltage supply.
2. Constant supply to the PS4-3 solenoid.
3. Bad PS4-3 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS3) Tan between the transmission controller, connector 49 pin 7 and the PS4-3 solenoid for a short to a voltage supply.
2. Check wire (PS3) Red between the transmission controller, connector 49 pin 10 and the PS4-3 solenoid for a short to a voltage supply.
3. Check the PS4-3 solenoid connection.
4. Check the PS4-3 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
5. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5028

**Fault Description.**
The controller has detected the voltage to the PS4-4 solenoid is too low.

**Response.**
Tractor will not operate in powershift 4 or 8 (gears 1-4, 1-8, 2-4, 2-8, 3-4, 3-8, 4-4 or 4-8).

**Possible Cause.**
1. Supply circuit between the transmission controller and the PS4-4 solenoid shorted to ground.
2. Bad PS4-4 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS4) Red between the transmission controller, connector 49 pin 28 and the PS4-4 solenoid for short circuit to ground.
2. Check the PS4-4 solenoid connection.
3. Check the PS4-4 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5029

**Fault Description.**
The controller has detected the voltage to the PS4-4 solenoid is too high.

**Response.**
The instrument cluster Red STOP light will illuminate and the tractor will not shift out of powershift 4 or 8.
On power up the tractor may select and remain in powershift 4 or 8 (gears 1-4, 1-8, 2-4, 2-8, 3-4, 3-8, 4-4 or 4-8).
The tractor may not drive.

**Possible Cause.**
1. Supply circuit between the transmission controller and the PS4-4 solenoid shorted to a voltage supply.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS4) Red between the transmission controller, connector 49 pin 28 and the PS4-4 solenoid for a short to a voltage supply.
2. Check the PS4-4 solenoid connection.
3. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5030

**Fault Description.**
The controller has detected the PS4-4 solenoid current is too low.

**Response.**
Tractor will not operate in powershift 4 or 8 (gears 1-4, 1-8, 2-4, 2-8, 3-4, 3-8, 4-4 or 4-8).

**Possible Cause.**
1. Return circuit between the transmission controller and the PS4-4 solenoid open circuit or short circuit to ground.
2. Bad PS4-4 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS4) Tan between the transmission controller, connector 49 pin 8 and the PS4-4 solenoid for a short to ground or open circuit.
2. Check the PS4-4 solenoid connection.
3. Check the PS4-4 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5031

**Fault Description.**
The controller has detected the PS4-4 solenoid current is too high.

**Response.**
The instrument cluster Red STOP light will illuminate and the tractor will not shift out of powershift 4 or 8.
On power up the tractor may select and remain in powershift 4 or 8 (gears 1-4, 1-8, 2-4, 2-8, 3-4, 3-8, 4-4 or 4-8).
The tractor may not drive.

**Possible Cause.**
1. Return circuit between the transmission controller and the PS4-4 solenoid shorted to a voltage supply.
2. Constant 12 volts supply to the PS4-4 solenoid.
3. Bad PS4-4 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS4) Tan between the transmission controller, connector 49 pin 8 and the PS4-4 solenoid for a short to a voltage supply.
2. Check wire (PS4) Red between the transmission controller, connector 49 pin 28 and the PS4-4 solenoid for a short to a voltage supply.
3. Check the PS4-4 solenoid connection.
4. Check the PS4-4 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
5. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5032

**Fault Description.**
The controller has detected the voltage to the PS2-1 solenoid is too low.

**Response.**
Tractor will not operate in powershifts 1 to 4 (gears 1-1 to 1-4, 2-1 to 2-4, 3-1 to 3-4 and 4-1 to 4-4).

**Possible Cause.**
1. Supply circuit between the transmission controller and the PS2-1 solenoid shorted to ground.
2. Bad PS2-1 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS2-1) Red between the transmission controller, connector 49 pin 11 and the PS2-1 solenoid for short circuit to ground.
2. Check the PS2-1 solenoid connection.
3. Check the PS2-1 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5033

**Fault Description.**
The controller has detected the voltage to the PS2-1 solenoid is too high.

**Response.**
The instrument cluster Red STOP light will illuminate and the tractor will not shift out of powershift 1, 2, 3 or 4. The tractor may not drive.

**Possible Cause.**
1. Supply circuit between the transmission controller and the PS2-1 solenoid shorted to a voltage supply
2. Bad PS2-1 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS2-1) Red between the transmission controller, connector 49 pin 11 and the PS2-1 solenoid for short to a voltage supply.
2. Check the PS2-1 solenoid connection.
3. Check the PS2-1 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5034

**Fault Description.**
The controller has detected the PS2-1 solenoid current is too low.

**Response.**
Tractor will not operate in powershifts 1 to 4 (gears 1-1 to 1-4, 2-1 to 2-4, 3-1 to 3-4 and 4-1 to 4-4).

**Possible Cause.**
1. Return circuit between the transmission controller and the PS2-1 solenoid open circuit or short circuit to ground.
2. Bad PS2-1 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS2-1) Tan between the transmission controller, connector 49 pin 9 and the PS2-1 solenoid or a short to ground or open circuit.
2. Check the PS2-1 solenoid connection.
3. Check the PS2-1 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5035

**Fault Description.**
The controller has detected the PS2-1 solenoid current is above the specified limit.

**Response.**
The instrument cluster Red STOP light will illuminate and the tractor will not shift out of powershift 1, 2, 3 or 4. The tractor may not drive.

**Possible Cause.**
1. Return circuit between the transmission controller and the PS2-1 solenoid shorted to a voltage supply.
2. Constant 12 volts supply to the PS2-1 solenoid.
3. Bad PS2-1 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS2-1) Tan between the transmission controller, connector 49 pin 9 and the PS2-1 solenoid for a short to a voltage supply.
2. Check wire (PS2-1) Red between the transmission controller, connector 49 pin 11 and the PS2-1 solenoid for a short to a voltage supply.
3. Check the PS2-1 solenoid connection.
4. Check the PS2-1 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
5. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5036

**Fault Description.**
The controller has detected the voltage to the PS2-2 solenoid is too low.

**Response.**
Tractor will not operate in powershifts 5 to 8 (gears 1-5 to 1-8, 2-5 to 2-8, 3-5 to 3-8 and 4-5 to 4-8).

**Possible Cause.**
1. Supply circuit between the transmission controller and the PS2-2 solenoid shorted to ground.
2. Bad PS2-2 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS2-2) Red between the transmission controller, connector 49 pin 19 and the PS2-2 solenoid for short circuit to ground.
2. Check the PS2-2 solenoid connection.
3. Check the PS2-2 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5037

**Fault Description.**
The controller has detected the voltage to the PS2-2 solenoid is too high.

**Response.**
The instrument cluster Red STOP light will illuminate and the tractor will not shift out of powershift 5, 6, 7 or 8. The tractor may not drive.

**Possible Cause.**
1. Supply circuit between the transmission controller and the PS2-2 solenoid shorted to a voltage supply
2. Bad PS2-2 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS2-2) Red between the transmission controller, connector 49 pin 19 and the PS2-2 solenoid for short to a voltage supply.
2. Check the PS2-2 solenoid connection.
3. Check the PS2-2 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5038

**Fault Description.**
The controller has detected the PS2-2 solenoid current is too low.

**Response.**
Tractor will not operate in powershifts 5 to 8 (gears 1-5 to 1-8, 2-5 to 2-8, 3-5 to 3-8 and 4-5 to 4-8).

**Possible Cause.**
1. Return circuit between the transmission controller and the PS2-2 solenoid open circuit or short circuit to ground.
2. Bad PS2-2 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS2-2) Tan between the transmission controller, connector 49 pin 17 and the PS2-2 solenoid or a short to ground or open circuit.
2. Check the PS2-2 solenoid connection.
3. Check the PS2-2 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5039

**Fault Description.**
The controller has detected the PS2-2 solenoid current is above the specified limit.

**Response.**
The instrument cluster Red STOP light will illuminate and the tractor will not shift out of powershift 5, 6, 7 or 8. The tractor may not drive.

**Possible Cause.**
1. Return circuit between the transmission controller and the PS2-2 solenoid shorted to a voltage supply.
2. Constant 12 volts supply to the PS2-2 solenoid.
3. Bad PS2-2 solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (PS2-2) Tan between the transmission controller, connector 49 pin 17 and the PS2-2 solenoid for a short to a voltage supply.
2. Check wire (PS2-2) Red between the transmission controller, connector 49 pin 19 and the PS2-2 solenoid for a short to a voltage supply.
3. Check the PS2-2 solenoid connection.
4. Check the PS2-2 solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
5. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5040

**Fault Description.**
The controller has detected the voltage to the forward solenoid is too low.

**Response.**
The instrument cluster Red STOP light will illuminate. The tractor may attempt to drive in gears 1-1 to 2-8 but may only operate in reverse gears 1-1 to 2-8.

**Possible Cause.**
1. Supply or return circuit between the transmission controller and the forward solenoid shorted to ground.
2. Bad forward solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 504 Red between the transmission controller, connector 49 pin 13 and the forward solenoid for short circuit to ground.
2. Check wire 504 Tan between the transmission controller, connector 49 pin 33 and the forward solenoid for short circuit to ground.
3. Check the forward solenoid connection.
4. Check the forward solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
5. Check the transmission controller connector.

## Transmission Error Code 5041

**Fault Description.**
The controller has detected the voltage to the forward solenoid is too high.

**Response.**
The instrument cluster Red STOP light will illuminate. The tractor may attempt to drive in gears 1-1 to 2-8 but may only operate in reverse gears 1-1 to 2-8.

**Possible Cause.**
1. Return circuit between the transmission controller and the forward solenoid shorted to a voltage supply.
2. Constant supply to the forward solenoid.
3. Bad forward solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 504 Tan between the transmission controller, connector 49 pin 33 and the forward solenoid for a short to a voltage supply.
2. Check wire 504 Red between the transmission controller, connector 49 pin 13 and the forward solenoid for a short to a voltage supply.
3. Check the forward solenoid connection.
4. Check the forward solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
5. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5042

**Fault Description.**
The controller has detected the forward solenoid current is too low.

**Response.**
The instrument cluster Red STOP light will illuminate. The tractor may attempt to drive in gears 1-1 to 2-8 but may only operate in reverse gears 1-1 to 2-8.
Error code 5040 may be displayed.

**Possible Cause.**
1. Return circuit between the transmission controller and the forward solenoid open circuit or short circuit to ground.
2. Bad forward solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 504 Tan between the transmission controller, connector 49 pin 33 and the forward solenoid or a short to ground or open circuit.
2. Check the forward solenoid connection.
3. Check the forward solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5043

**Fault Description.**
The controller has detected the forward solenoid current is too high.

**Response.**
The instrument cluster Red STOP light will illuminate and the forward and reverse clutches will be disabled. The tractor will not drive.
Error code 5041 may be displayed.

**Possible Cause.**
1. Return circuit between the transmission controller and the forward solenoid shorted to ground or a voltage supply.
2. Supply circuit between the transmission controller and the forward solenoid shorted to ground.
3. Constant supply to the forward solenoid.
4. Bad forward solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 504 Tan between the transmission controller, connector 49 pin 33 and the forward solenoid for a short circuit to ground.
2. Check wire 504 Tan between the transmission controller, connector 49 pin 33 and the forward solenoid for a short to a voltage supply.
3. Check wire 504 Red between the transmission controller, connector 49 pin 13 and the forward solenoid for a short to a voltage supply.
4. Check wire 504 Red between the transmission controller, connector 49 pin 13 and the forward solenoid for a short circuit to ground.
5. Check the forward solenoid connection.
6. Check the forward solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
7. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5044

**Fault Description.**
The controller has detected the voltage to the reverse solenoid is too low.

**Response.**
The instrument cluster Red STOP light will illuminate. The tractor may attempt to drive in gears 1-1 to 2-8 but may only operate in forward gears 1-1 to 2-8.

**Possible Cause.**
1. Supply or return circuit between the transmission controller and the reverse solenoid shorted to ground.
2. Bad reverse solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 506 Red between the transmission controller, connector 49 pin 12 and the reverse solenoid for short circuit to ground.
2. Check wire 506 Tan between the transmission controller, connector 49 pin 34 and the reverse solenoid for short circuit to ground.
3. Check the reverse solenoid connection.
4. Check the reverse solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
5. Check the transmission controller connector.

## Transmission Error Code 5045

**Fault Description.**
The controller has detected the voltage to the reverse solenoid is too high.

**Response.**
The instrument cluster Red STOP light will illuminate. The tractor may attempt to drive in gears 1-1 to 2-8 but may only operate in forward gears 1-1 to 2-8.

**Possible Cause.**
1. Supply circuit between the transmission controller and the reverse solenoid shorted to a voltage supply.
2. Constant supply to the reverse solenoid.
3. Bad reverse solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 506 Red between the transmission controller, connector 49 pin 12 and the reverse solenoid for a short to a voltage supply.
2. Check the reverse solenoid connection.
3. Check the reverse solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5046

**Fault Description.**
The controller has detected the reverse solenoid current is too low.

**Response.**
The instrument cluster Red STOP light will illuminate. The tractor may attempt to drive in gears 1-1 to 2-8 but may only operate in forward gears 1-1 to 2-8.
Error code 5044 may be displayed.

**Possible Cause.**
1. Return circuit between the transmission controller and the reverse solenoid open circuit or short circuit to ground.
2. Bad reverse solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 506 Tan between the transmission controller, connector 49 pin 34 and the reverse solenoid or a short to ground or open circuit.
2. Check the reverse solenoid connection.
3. Check the reverse solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5047

**Fault Description.**
The controller has detected the reverse solenoid current is too high.

**Response.**
The instrument cluster Red STOP light will illuminate and the forward and reverse clutches will be disabled. The tractor will not drive.
Error code 5045 may be displayed.

**Possible Cause.**
1. Return circuit between the transmission controller and the reverse solenoid shorted to ground or a voltage supply.
2. Supply circuit between the transmission controller and the reverse solenoid shorted to ground.
3. Constant supply to the reverse solenoid.
4. Bad reverse solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 506 Tan between the transmission controller, connector 49 pin 34 and the reverse solenoid for a short circuit to ground.
2. Check wire 506 Tan between the transmission controller, connector 49 pin 34 and the reverse solenoid for a short to a voltage supply.
3. Check wire 506 Red between the transmission controller, connector 49 pin 12 and the reverse solenoid for a short to a voltage supply.
4. Check wire 506 Red between the transmission controller, connector 49 pin 12 and the reverse solenoid for a short circuit to ground.
5. Check the reverse solenoid connection.
6. Check the reverse solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
7. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5048

**Fault Description.**
The controller has detected the voltage to the creeper engage solenoid is too low.

**Response.**
The tractor will not drive in creep speed.

**Possible Cause.**
1. Supply circuit between the transmission controller and the creep engage solenoid shorted to ground.
2. Bad creeper engage solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (CREEP.1) Tan between the transmission controller, connector 49 pin 16 and the creep engage solenoid for a short circuit to ground.
2. Check the creep engage solenoid connection.
3. Check the creep engage solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5049

**Fault Description.**
The controller has detected the voltage to the creep engage solenoid is too high.

**Response.**
The tractor will only drive in creep speed.

**Possible Cause.**
1. Supply circuit between the transmission controller and the creep engage solenoid shorted to a voltage supply.
2. Bad creep engage solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (CREEP.1) Tan between the transmission controller, connector 49 pin 16 and the creep engage solenoid for a short to a voltage supply.
2. Check the creep engage solenoid connection.
3. Check the creep engage solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5050

**Fault Description.**
The controller has detected the voltage to the park lock solenoid is too low.

**Response.**
The instrument cluster Red STOP light will illuminate and the park lock may engage.

**Possible Cause.**
1. Supply circuit between the transmission controller and the park lock solenoid shorted to ground.
2. Return circuit between the cab controller and the park lock solenoid shorted to ground.
3. Bad park lock solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 280 Yellow between the transmission controller, connector 49 pin 27 and the park lock solenoid for a short circuit to ground.
2. Check wires 280 Brown/White and 280 Brown between the cab controller, connector 46 pin 32 and the park lock solenoid for a short circuit to ground.
3. Check the park lock solenoid connection.
4. Check the park lock solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
5. Check the transmission controller connector.
6. Check the cab controller connector and connector 40, for XtraSpeed - E Plus tractors also check connector 53.

## Transmission Error Code 5051

**Fault Description.**
The controller has detected the voltage to the park lock solenoid is too high.

**Response.**
The instrument cluster Red STOP light will illuminate, the park brake and amber warning lights will flash on and off and the audible alarm will sound. The park lock may not engage.

**Possible Cause.**
1. Supply circuit between the transmission controller and the park lock solenoid shorted to a voltage supply.
2. Return circuit between the cab controller and the park lock solenoid shorted to a voltage supply
3. Bad park lock solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 280 Yellow between the transmission controller, connector 49 pin 27 and the park lock solenoid for a short to a voltage supply.
2. Check wires 280 Brown/White and 280 Brown between the cab controller, connector 46 pin 32 and the park lock solenoid for short to a voltage supply.
3. Check the park lock solenoid connection.
4. Check the park lock solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
5. Check the transmission controller connector.
6. Check the cab controller connector.
7. Check the cab controller connector and connector 40, for XtraSpeed - E Plus tractors also check connector 53.

https://truckmanualshub.com/



## Transmission Error Code 5052

**Fault Description.**
The transmission controller has detected the voltage to the creep disengage (direct drive) solenoid is too low.

**Response.**
The tractor may not select creep speed.

**Possible Cause.**
1. Supply circuit between the transmission controller and the creep disengage (direct drive) solenoid shorted to ground.
2. Bad creep disengage (direct drive) solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (CREE.2) Tan between the transmission controller, connector 49 pin 23 and the creep disengage (direct drive) solenoid for short circuit to ground.
2. Check the creep disengage (direct drive) solenoid connection.
3. Check the creep disengage (direct drive) solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
4. Check the transmission controller connector.

## Transmission Error Code 5053

**Fault Description.**
The transmission controller has detected the voltage to the creeper disengage (direct drive) solenoid is too high.

**Response.**
The tractor may not select direct drive after creep has been engaged.

**Possible Cause.**
1. Supply circuit between the transmission controller and the creeper disengage (direct drive) solenoid shorted to a voltage supply.
2. Bad creep disengage (direct drive) solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire (CREE.2) Tan between the transmission controller, connector 49 pin 23 and the creeper disengage (direct drive) solenoid for a short to a voltage supply.
2. Check the creep disengage (direct drive) solenoid connection.
3. Check the creeper disengage (direct drive) solenoid coil resistance is approximately 8.5 Ohms at 20°C (68℉) and replace as necessary.
4. Check the transmission controller connector.

https://truckmanualshub.com/



## Transmission Error Code 5062

**Fault Description.**
The transmission controller has detected the switched power supply voltage is too high.

**Response.**
The instrument cluster Red STOP light will illuminate and the forward and reverse clutches will be disabled. Error code 5301 may also be displayed.

**Possible Cause.**
1. Bad alternator.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check the alternator and replace or repair as necessary.

## Transmission Error Code 5063

**Fault Description.**
The transmission controller has detected the speed sensor supply output voltage is too low.

**Response.**
Powershift changes may become harsh and error codes 5095, 5096, 5103 and 5107 may be displayed.

**Possible Cause.**
1. The speed sensor supply circuit shorted to ground.
2. The speed sensor 0 volt return circuit shorted to a supply voltage.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**

**NOTE:** *Before carrying out the following, disconnect the transmission controller.*

1. Check a speed sensor supply circuit for a short to circuit ground. If continuity is detected check the following:
   - Wire (12V) Red between the transmission controller, connector 48 pin 2 and transmission harness splice T-SP8.
   - Wire 215 Red between the transmission harness splice T-SP8 and the wheel speed sensor.
   - Wire (INT A) Red between the transmission harness splice T-SP8 and the forward/reverse Inter A sensor.
   - Wire (INT B) Red between the transmission harness splice T-SP8 and the forward/reverse Inter B sensor connector (See Note 1 Below).
   - Red wire (See Note 2 Below) between the transmission harness splice T-SP8 and the PTO A speed sensor (front sensor).
   - Red wire (See Note 2 Below) between the transmission harness splice T-SP8 and the PTO B speed sensor (rear sensor).
   - Wire (PS2) Red between the transmission harness splice T-SP8 and the high/low powershift clutch pack (PS2) speed sensor.
   - Wire (PS4) Red between the transmission harness splice T-SP8 and the powershift clutch pack (PS4) speed sensor.
   - Wire (ENG) Red between the transmission harness splice T-SP8 and the engine speed sensor (See Note 1 Below).

   **NOTE 1:** *Tractors from PIN JJE3500084 are not equipped with Inter B speed sensors. However the transmission harness for tractors up to PIN JJE3500645 (XtraSpeed tractors) and PIN JJE3500651 (XtraSpeed - E and E Plus tractors) retain the sensor wiring and connector.*

   **NOTE 2:** *Due to the reallocation of the PTO speed sensors, tractors up to PIN JJE3500645 (XtraSpeed tractors) and PIN JJE3500651 (XtraSpeed - E and E Plus tractors) the PTO A sensor (front sensor) wiring identification is marked PTO B and the PTO B sensor (rear sensor) is marked PTO A. The sensor wiring on tractors after the above PIN are marked with the correct sensor identification.*

Continued.....

https://truckmanualshub.com/



2. Check a speed sensor return circuit for a short to a supply voltage. If a voltage is detected check the following:
   - Wire (0V) Brown/White between the transmission controller, connector 48 pin 5 and transmission harness splice T-SP7.
   - Wire 215 Brown/White between the transmission harness splice T-SP7 and the wheel speed sensor.
   - Wire (INT A) Brown/White between the transmission harness splice T-SP7 and the forward/reverse INT A sensor.
   - Wire (INT B) Brown/White between the transmission harness splice T-SP7 and the forward/reverse Inter B sensor (See Note 1 Below).
   - The Brown/White wire (See Note 2 Below) between the transmission harness splice T-SP7 and the PTO A speed sensor (front sensor).
   - The Brown/White wire (See Note 2 Below) between the transmission harness splice T-SP7 and the PTO B speed sensor (rear sensor).
   - Wire (PS2) Brown/White between the transmission harness splice T-SP7 and the high/low powershift clutch pack (PS2) speed sensor.
   - Wire (PS4) Brown/White between the transmission harness splice T-SP7 and the powershift clutch pack (PS4) speed sensor.
   - Wire (ENG) Brown/White between the transmission harness splice T-SP7 and the engine speed sensor. (See Note 1 Below).
3. Check the transmission controller connectors.

**NOTE 1:** *Tractors from PIN JJE3500084 are not equipped with Inter B speed sensors. However the transmission harness for tractors up to PIN JJE3500645 (XtraSpeed tractors) and PIN JJE3500651 (XtraSpeed - E and E Plus tractors) retain the sensor wiring and connector.*

**NOTE 2:** *Due to the reallocation of the PTO speed sensors, tractors up to PIN JJE3500645 (XtraSpeed tractors) and PIN JJE3500651 (XtraSpeed - E and E Plus tractors) the PTO A sensor (front sensor) wiring identification is marked PTO B and the PTO B sensor (rear sensor) is marked PTO A. The sensor wiring on tractors after the above PIN are marked with the correct sensor identification.*

## Transmission Error Code 5064

**Fault Description.**
The transmission controller has detected the forward/reverse enable voltage is too high.

**Response.**
The forward and reverse clutches will be disabled and the tractor will not drive.

**Possible Cause.**
1. Alternator output voltage above 15.5 volts.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check the alternator and replace or repair as necessary.

## Transmission Error Code 5065

**Fault Description.**
The transmission controller does not detect the forward/reverse enable supply (input) voltage when required.

**Response.**
The forward and reverse clutches will be disabled and the tractor will not drive.

**Possible Cause.**
1. The forward/reverse supply circuit shorted to ground or open circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for cab controller errors and repair as necessary.
2. Check wire (LINK) between the cab controller, connector 46 pin 9 and the transmission controller, connector 48 pin 19 for short to ground or open circuit.
3. Check the cab controller connector 46 and connector 40, for XtraSpeed - E Plus tractors also check connector 53.

https://truckmanualshub.com/



## Transmission Error Code 5066

**Fault Description.**
The transmission controller has detected a forward/reverse enable supply (input) voltage when not required.

**Response.**
The instrument cluster Red STOP light will illuminate and the tractor will only operate in forward gears 1-1 to 2-8.

**Possible Cause.**
1. The transmission controller forward/reverse supply voltage shorted to a voltage supply.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for cab controller errors and repair as necessary.
2. With the connector 48 disconnected from the transmission controller and the shuttle lever in Neutral, check wire (LINK) Red at connector 48 pin 19 for a short to a voltage supply.
   - If a voltage is detected check wire (LINK) Red between the cab controller connector 46 pin 9 and transmission controller connector 48 pin 19.
3. Check the cab controller and transmission controller connectors.

## Transmission Error Code 5067

**Fault Description.**
The transmission controller has detected the 5 volt reference voltage is too low.

**Response.**
Clutch pedal control may not operate correctly, also XtraSpeed - E and E Plus tractor may not change gear between ranges.

**Possible Cause.**
1. The range position sensor and clutch pedal position sensor 5 voltage reference supply voltage shorted to ground.
2. The range position sensor and clutch pedal position sensor 0 volt reference return circuit shorted to a voltage supply.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**

**NOTE:** *Before carrying out the following, disconnect the transmission controller.*

1. Check the clutch pedal position sensor 5 voltage reference supply circuit for a short to circuit ground. If continuity is detected check the following:
   - Wire (5V) Red between the transmission controller, connector 48 pin 3 and transmission harness splice T-S12.
   - Wire (1/2) Red between the transmission harness splice T-SP12 and the 1st/2nd range position sensor.
   - Wire (3/4) Red between the transmission harness splice T-SP12 and the 3rd/4th range position sensor.
   - Wires 656 Red between the transmission harness splice T-SP12 and the clutch pedal position sensor.
   - Connectors 40 and 27.
2. Check the 0 voltage reference return circuit for a short to a supply voltage. If a voltage is detected check the following:
   - Wire 267 Brown between the transmission controller and transmission harness splice T-SP13.
   - Wire 267 Brown between the transmission harness splice T-SP13 and the oil temperature sensor.
   - Wire (1/2) Brown between the transmission harness splice T-SP13 and the 1st/2nd range position sensor.
   - Wire (3/4) Brown between the transmission harness splice T-SP13 and the 3rd/4th range position sensor.
   - Wires 656 Brown between the transmission harness splice T-SP13 and the clutch pedal position sensor.
   - Connectors 40 and 27.
3. Check the 1st/2nd range sensor for damage and correct installation, repair as necessary.
4. Check the 3rd/4th range sensor for damage and correct installation, repair as necessary.
5. Check the transmission controller connectors.

https://truckmanualshub.com/



## Transmission Error Code 5068

**Fault Description.**
The transmission controller has detected the 5 volt reference voltage is too high.

**Response.**
Clutch pedal control may not operate correctly, also XtraSpeed - E and E Plus tractor may not change gear between ranges.

**Possible Cause.**
1. The range position sensor and clutch pedal position sensor 5 voltage reference supply or return shorted to a voltage above 5.2 volts.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check a range position sensor or the clutch pedal position sensor 5 volt supply circuit for a short to a voltage above 5.2 volts. If a voltage above 5.2 volts is detected check the following:
   - Wire (5V) Red between the transmission controller, connector 48 pin 3 and transmission harness splice T-S12.
   - Wire (1/2) Red between the transmission harness splice T-SP12 and the 1st/2nd range position sensor.
   - Wire (3/4) Red between the transmission harness splice T-SP12 and the 3rd/4th range position sensor.
   - Wires 656 Red between the transmission harness splice T-SP12 and the clutch pedal position sensor.
   - Connectors 40 and 27.

## Transmission Error Code 5069 (XtraSpeed Tractors from PIN JJE3500983, XtraSpeed - E and XtraSpeed - E Plus Tractors)

**Fault Description.**
The transmission controller has detected the 1st/2nd range position signal voltage is too low (below 0.2 volts).

**Response.**
XtraSpeed tractors may not select the correct automatic powershift speed and the maximum demanded engine speed may be limited.
XtraSpeed E and E - Plus tractors may not change from range 1 to range 2 (will remain in range 1).

**Possible Cause.**
1. 1st/2nd range position sensor signal circuit open or shorted to ground.
2. 1st/2nd range position sensor supply open circuit.
3. 1st/2nd range position sensor return open circuit.
4. Bad 1st/2nd range position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for error code 5067 and repair as necessary.
2. Check wire (1/2) Yellow between the transmission controller, connector 47 pin 7 and the 1st/2nd range position sensor for open circuit or short circuit to ground.
3. Check wire (1/2) Red between the transmission harness splice T-SP3 and the 1st/2nd range position sensor for open circuit.
4. Check wire (1/2) Brown between the transmission harness splice T-SP13 and the 1st/2nd range position sensor for open circuit.
5. Check the transmission controller connector.
6. Check the 1st/2nd range position sensor connection.
7. Check the 1st/2nd range sensor for damage and correct installation, repair as necessary.

https://truckmanualshub.com/



# Transmission Error Code 5070 (XtraSpeed Tractors from PIN JJE3500983, XtraSpeed - E and XtraSpeed - E Plus Tractors)

**Fault Description.**
The transmission controller has detected the 1st/2nd range position signal voltage is too high (above 4.75 volts).

**Response.**
XtraSpeed tractors may not select the correct automatic powershift speed and the maximum demanded engine speed may be limited.
XtraSpeed E and E - Plus tractors may not change from range 2 to range 1 (will remain in range 2).

**Possible Cause.**
1. 1st/2nd range position sensor signal circuit open or shorted to a voltage supply.
2. Bad 1st/2nd range position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for error code 5068 and repair as necessary.
2. Check wire (1/2) Yellow between the transmission controller, connector 47 pin 7 and the 1st/2nd range position sensor for a short to a voltage supply.
3. Check the transmission controller connector.
4. Check the 1st/2nd range position sensor connection.

# Transmission Error Code 5071 (XtraSpeed Tractors from PIN JJE3500983, XtraSpeed - E and XtraSpeed - E Plus Tractors)

**Fault Description.**
The transmission controller has detected the 3rd/4th range position signal voltage is too low (below 0.2 volts).

**Response.**
XtraSpeed tractors may not select the correct automatic powershift speed and the maximum demanded engine speed may be limited.
XtraSpeed E and E - Plus tractors may not change from range 3 to range 4 (will remain in range 3).

**Possible Cause.**
1. 3rd/4th range position sensor signal circuit open or shorted to ground.
2. 3rd/4th range position sensor supply open circuit.
3. 3rd/4th range position sensor return open circuit.
4. Bad 3rd/4th range position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for error code 5067 and repair as necessary.
2. Check wire (3/4) Yellow between the transmission controller, connector 47 pin 8 and the 3rd/4th range position sensor for open circuit or short circuit to ground.
3. Check wire (3/4) Red between the transmission harness splice T-SP3 and the 3rd/4th range position sensor for open circuit.
4. Check wire (3/4) Brown between the transmission harness splice T-SP13 and the 3rd/4th range position sensor for open circuit.
5. Check the transmission controller connector.
6. Check the 3rd/4th range position sensor connection.
7. Check the 3rd/4th range sensor for damage and correct installation, repair as necessary.

https://truckmanualshub.com/



# Transmission Error Code 5072 (XtraSpeed Tractors from PIN JJE3500983, XtraSpeed - E and XtraSpeed - E Plus Tractors)

**Fault Description.**
The transmission controller has detected the 3rd/4th range position signal voltage is too high (above 4.75 volts).

**Response.**
XtraSpeed tractors may not select the correct automatic powershift speed and the maximum demanded engine speed may be limited.
XtraSpeed E and E - Plus tractors may not change from range 4 to range 3 (will remain in range 4).

**Possible Cause.**
1. 3rd/4th range position sensor signal circuit open or shorted to a voltage supply.
2. Bad 3rd/4th range position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for error code 5068 and repair as necessary.
2. Check wire (3/4) Yellow between the transmission controller, connector 47 pin 8 and the 3rd/4th range position sensor for a short to a voltage supply above.
3. Check the transmission controller connector.
4. Check the 3rd/4th range position sensor connection.
5. Check the 3rd/4th range sensor for damage and correct installation, repair as necessary.

# Transmission Error Code 5081

**Fault Description.**
The transmission controller has detected the transmission oil temperature supply voltage is too low (below 0.2 volts).

**Response.**
The instrument cluster transmission oil temperature reading is above the actual oil temperature. The transmission will not calibrate (calibration error code 50 may appear on the instrument cluster during calibration).

**Possible Cause.**
1. The transmission oil temperature sensor supply circuit open or shorted to ground.
2. The transmission oil temperature sensor return open circuit.
3. Bad transmission oil temperature sender.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for error code 5067 and repair as necessary.
2. Check wire 267 Tan between the transmission controller, connector 47 pin 24 and the transmission oil temperature sensor for open circuit or short circuit to ground.
3. Check wire 267 Brown between the transmission splice T-SP13 and the oil temperature sensor for open circuit.
4. Check the transmission controller connector.
5. Check the transmission oil temperature sensor connection.
6. Check transmission oil temperature sender and replace as necessary.

https://truckmanualshub.com/



## Transmission Error Code 5082

**Fault Description.**
The transmission controller has detected the transmission oil temperature supply voltage is too high (above 4.75 volts).

**Response.**
The instrument cluster transmission oil temperature reading is below the actual oil temperature. The transmission will not calibrate (calibration error code 50 may appear on the instrument cluster during calibration).

**Possible Cause.**
1. The transmission oil temperature sensor supply or return circuit shorted a voltage supply.
2. Bad transmission oil temperature sender.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 267 Tan between the transmission controller, connector 47 pin 24 and the transmission oil temperature sensor for a short to a voltage supply.
2. Check the transmission controller connector.
3. Check the transmission oil temperature sensor connection.
4. Check transmission oil temperature sender and replace as necessary.

## Transmission Error Code 5083

**Fault Description.**
The transmission controller has detected the clutch pedal position signal voltage is too low (below 0.2 volts).

**Response.**
Clutch pedal control may not operate correctly or the tractor may not drive.

**Possible Cause.**
1. The clutch pedal position sensor signal circuit open or shorted to ground.
2. The clutch pedal position sensor supply open circuit.
3. The clutch pedal position sensor return open circuit.
4. Bad clutch pedal position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for error code 5067 and repair as necessary.
2. Check wire 656 Yellow between the transmission controller, connector 47 pin 25 and the clutch pedal position sensor for open circuit or short circuit to ground. Also check connectors 27 and 40.
3. Check wire 656 Red between the transmission harness splice T-SP3 and the clutch pedal position sensor for open circuit.
4. Check wire 656 Brown between the transmission harness splice T-SP13 and the clutch pedal position sensor for open circuit.
5. Check the transmission controller connector.
6. Check the clutch pedal position sensor connection.
7. Check the clutch pedal position sensor installation and pivot arm installation.
8. Check the clutch pedal position sensor.

https://truckmanualshub.com/



## Transmission Error Code 5084

**Fault Description.**
The transmission controller has detected the clutch pedal position signal voltage is too high (above 4.75 volts).

**Response.**
The instrument cluster Amber warning light will illuminate (flash) and the clutch pedal control may not operate correctly.

**Possible Cause.**
1. The clutch pedal position sensor signal circuit open or shorted to a voltage supply.
2. Bad clutch pedal position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for error code 5068 and repair as necessary.
2. Check wire 656 Yellow between the transmission controller, connector 47 pin 25 and the clutch pedal position sensor for a short to a voltage supply above 5 volts. Also check connectors 27 and 40.
3. Check the transmission controller connector.
4. Check the clutch pedal position sensor connection.
5. Check the clutch pedal position sensor installation and pivot arm installation.
6. Check the clutch pedal position sensor.

## Transmission Error Code 5085

**Fault Description.**
The transmission controller has detected an input voltage to the cab controller forward/reverse relay enable circuit when not required.

**Response.**
The instrument cluster Red STOP light will illuminate and the tractor will only operate in forward gears 1-1 to 2-8.

**Possible Cause.**
1. The cab controller forward/reverse relay enable circuit shorted to a voltage supply.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**

For XtraSpeed tractors check the following:
1. Check wire 660 Yellow between the cab controller, connector 46 pin 27 and the declutch switch.
2. Check wire 660 Yellow between the declutch switch and the right hand console harness splice RC-SP9.
3. Check the range lever gear shift/declutch switch harness for damage.
4. Check wire 660 Yellow between the cab controller, connector 45 pin 2 the right hand console harness splice RC-SP9. Also check the jumper lead.
5. Check wire 660 Yellow the right hand console harness splice RC-SP9 and the clutch pedal bottom of clutch switch. Also check connector 27.

For XtraSpeed - E tractors check the following:
1. Check wire 660 Yellow between the cab controller, connector 46 pin 27 and the right hand console harness splice RC-SP9. Also check the declutch switch connector jumper lead (located near the multi function lever connector).
2. Check wire 660 Yellow between the right hand console harness splice RC-SP9 and the jumper lead connector (located near the cab controller).
3. Check wire 660 Yellow between the cab controller, connector 45 pin 2 and the jumper lead connector (located near the cab controller).
4. Check wire 660 Yellow between the right hand console harness splice RC-SP9 and the clutch pedal bottom of clutch switch. Also check connector 27.

For XtraSpeed - E Plus tractors check the following:
1. Check wire 660 Yellow between the cab controller, connector 46 pin 27 and clutch pedal bottom of clutch switch. Also check connectors 27 and 53.

Continued....

https://truckmanualshub.com/



For all tractors check the following:

1. Check wire 567 Red between the clutch pedal bottom of clutch switch and the instrument panel harness splice IP-SP8.
2. Check wire 518 Tan between the connector 33 and the instrument panel harness splice IP-SP8.
3. Check wire 514 Tan between the cab controller the instrument panel harness splice IP-SP8.
4. Check the forward/reverse shuttle lever switch harness.

## Transmission Error Code 5087

**Fault Description.**
The transmission controller does not detect CAN Bus messages from the cab controller.

**Response.**
The instrument cluster Red STOP light will illuminate and the forward and reverse clutches will be disabled. The tractor will not drive.

**Possible Cause.**

1. The CAN Bus circuit between the transmission controller and the cab controller open circuit.
2. The cab controller is not transmitting CAN messages.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**

1. Check for CAN error messages from other controllers in the system and check the CAN Bus circuit accordingly.
   i.e If the instrument cluster also detects a loss of CAN message from the cab controller, check the CAN circuit between the following:
   - The cab controller and right hand console harness splices RC-SP19 and RC-SP20 for XtraSpeed and XtraSpeed - E tractors.
   - The cab controller and fender harness splices F-SP17 and RC-SP18 for XtraSpeed - E Plus tractors.

## Transmission Error Code 5088

**Fault Description.**
The transmission controller has detected the cab controller is not receiving CAN Bus messages.

**Response.**
The instrument cluster Red STOP light will illuminate and the forward and reverse clutches will be disabled. The tractor will not drive.

**Possible Cause.**

1. The CAN Bus circuit between the transmission controller and the cab controller open circuit.
2. The cab controller is not receiving CAN messages.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**

1. Check for CAN error messages from other controller in the system and check the CAN Bus circuit accordingly.
   i.e If the instrument cluster also detects a loss of CAN message from the cab controller, check the CAN circuit between the following:
   - The cab controller and right hand console harness splices RC-SP19 and RC-SP20 for XtraSpeed and XtraSpeed - E tractors.
   - The cab controller and fender harness splices F-SP17 and RC-SP18 for XtraSpeed - E Plus tractors.

https://truckmanualshub.com/



## Transmission Error Code 5089

**Fault Description.**
The transmission controller does not detect CAN Bus messages from the instrument cluster.

**Response.**
The instrument cluster Red STOP light will illuminate and the tractor will only operate in forward gears 1-1 to 2-8.

**Possible Cause.**
1. The CAN Bus circuit between the transmission controller and the instrument cluster open circuit.
2. The instrument cluster is not transmitting CAN messages.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for CAN error messages from other controller in the system and check the CAN Bus circuit accordingly.
   i.e If the cab controller also detects a loss of CAN message from the instrument cluster, check CAN circuit between the instrument cluster and the instrument panel harness splices IP- SP2 and IP- SP5.

## Transmission Error Code 5091

**Fault Description.**
The transmission controller does not detect CAN Bus messages from the engine controller.

**Response.**
The instrument cluster Red STOP light will illuminate and the tractor will not drive.

**Possible Cause.**
1. The CAN Bus circuit between the transmission controller and the engine controller open circuit.
2. The engine controller is not transmitting CAN messages.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for CAN error messages from other controller in the system and check the CAN Bus circuit accordingly.
   i.e If the instrument cluster also detects a loss of CAN message from the engine controller, check CAN circuit between the engine controller and the instrument panel harness splices IP- SP2 and IP- SP5. Also check connector 10.

## Transmission Error Code 5093

**Fault Description.**
The transmission controller does not detect CAN Bus messages from the hitch controller.

**Response.**
The instrument cluster Red STOP light will illuminate, the park lock and amber warning lights will flash on and off and the audible alarm will sound. The park lock may not engage.

**Possible Cause.**
1. Right hand cab door open (XtraSpeed - E and E Plus tractors only).
2. The CAN Bus circuit between the transmission controller and the hitch controller open circuit.
3. The hitch controller is not transmitting CAN messages.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for CAN error messages from other controller in the system and check the CAN Bus circuit accordingly.
   i.e If the instrument cluster also detects a loss of CAN message from the hitch controller, check the CAN circuit between the following:
   - The hitch controller and right hand console harness splices RC-SP19 and RC- SP20 for XtraSpeed and XtraSpeed - E tractors.
   - The hitch controller and fender harness splices F-SP17 and F- SP18 for XtraSpeed - E Plus tractors.

https://truckmanualshub.com/



# Transmission Error Code 5095/5096

**Fault Description.**
The transmission controller detects an incorrect signal from the PTO shaft speed sensors. The signal from one PTO shaft sensor does not correspond with the signal from the other PTO shaft sensor.

**Response.**
The engine will only operate in the normal operating torque mode.

**Possible Cause.**
1. The PTO shaft speed sensor (PTO A or PTO B) supply open circuit.
2. The PTO shaft speed sensor (PTO A or PTO B) return open circuit.
3. The PTO shaft speed sensor (PTO A or PTO B signal open or short circuit to ground.
4. Bad PTO shaft speed sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check the Red wire (See Note Below) between the PTO A speed sensor (front sensor) and the transmission harness splice T-SP8 for open circuit.
2. Check the Red wire (See Note Below) between the PTO B speed sensor (rear sensor) and the transmission harness splice T-SP8 for open circuit.
3. Check the Brown/White wire (See Note Below) between the PTO A speed sensor (front sensor) and the transmission harness splice T-SP7 for open circuit.
4. Check the Brown/White wire (See Note Below) between the PTO B speed sensor (rear sensor) and the transmission harness splice T-SP7 for open circuit.
5. Check the Yellow wire (See Note Below) between the PTO A sensor (front sensor) and the transmission controller, connector 47 pin 26 for a short to ground.
6. Check the Yellow wire (See Note Below) between the PTO B sensor (rear sensor) and the transmission controller, connector 47 pin 27 for a short to ground.
7. Check the Yellow wire (See Note Below) between the PTO A sensor (front sensor) and the transmission controller, connector 47 pin 26 for open circuit.
8. Check the Yellow wire (See Note Below) between the PTO B sensor (rear sensor) and the transmission controller, connector 47 pin 27 for open circuit.

   **NOTE:** *Due to the reallocation of the PTO speed sensors, tractors up to PIN JJE3500645 (XtraSpeed tractors) and PIN JJE3500651 (XtraSpeed - E and E Plus tractors) the PTO A sensor (front sensor) wiring identification is marked PTO B and the PTO B sensor (rear sensor) is marked PTO A. The sensor wiring on tractors after the above PIN are marked with the correct sensor identification.*

https://truckmanualshub.com/



## Transmission Error Code 5098

**Fault Description.**
The transmission controller has detected both a forward and reverse signal at the same time.

**Response.**
The instrument cluster Red STOP light will illuminate and the forward and reverse clutches will be disabled. The tractor will not drive. Error codes 5099, 5320 or 5322 may be displayed.

**Possible Cause.**
1. The forward or reverse signal circuit shorted to a voltage supply.
2. Bad forward/reverse shuttle lever switch.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for transmission error codes 5099 and repair as necessary.
2. Check for cab controller error codes 5320 and 5322.
3. If error code 5320 is present check wire 511 Tan between the cab controller, connector 46 pin 15 and connector 33 for a short to a supply voltage.
4. If error code 5322 is present check wire 513 Tan between the cab controller, connector 46 pin 23 and connector 33 for a short to a supply voltage.
5. Check the forward/reverse shuttle lever switch harness.
6. Check the cab controller connector.
7. Check connector 28 for XtraSpeed - E Plus tractors also check connector 53.

## Transmission Error Code 5099

**Fault Description.**
The transmission controller has detected a forward or reverse signal but does not detect an out of neutral signal or park lock signal (XtraSpeed - E Plus tractors only).

**Response.**
The instrument cluster Red STOP light will illuminate and the forward and reverse clutches will be disabled. The tractor will not drive. Error codes 5098, 5320 or 5022 may be displayed.

**Possible Cause.**
1. The neutral signal circuit open or shorted to ground.
1. The park lock signal circuit open or shorted to ground.
2. The forward or reverse signal circuit shorted to a voltage supply.
3. Bad forward/reverse shuttle lever switch.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for transmission error codes 5098 and repair as necessary.
2. Check for cab controller error codes 5320 and 5322.
3. If error code 5320 is present check wire 511 Tan between the cab controller, connector 46 pin 15 and connector 33 for a short to a supply voltage.
4. If error code 5322 is present check wire 513 Tan between the cab controller, connector 46 pin 23 and connector 33 for a short to a supply voltage.
5. Check the neutral signal circuit wires 518 Tan and 514 Tan between the cab controller, connector 45 pin 3 and connector 33 for open circuit.
6. Check the neutral signal circuit wires 518 Tan and 514 Tan between cab controller, connector 45 pin 3 and connector 33 for a short to ground. Also check wire 657 Red between splice IP-SP9 and the clutch pedal bottom of clutch switch for a short to ground.
7. Check the forward/reverse shuttle lever switch harness.
8. Check the cab controller connector.
9. Check connector 28, for XtraSpeed - E Plus tractors also check connector 53.

https://truckmanualshub.com/



## Transmission Error Code 5100

**Fault Description.**
The transmission controller has detected current in the forward solenoid circuit when forward is not selected.

**Response.**
The instrument cluster Red STOP light will illuminate and the forward and reverse clutches will be disabled. The tractor will not drive.

**Possible Cause.**
1. Return circuit between the transmission controller and the forward solenoid shorted to ground or a voltage supply.
2. Supply circuit between the transmission controller and the forward solenoid shorted to ground.
3. Constant supply to the forward solenoid.
4. Bad forward solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 504 Tan between the transmission controller, connector 49 pin 33 and the forward solenoid for a short circuit to ground.
2. Check wire 504 Tan between the transmission controller, connector 49 pin 33 and the forward solenoid for a short to a voltage supply.
3. Check wire 504 Red between the transmission controller, connector 49 pin 13 and the forward solenoid for a short to a voltage supply.
4. Check wire 504 Red between the transmission controller, connector 49 pin 13 and the forward solenoid for a short circuit to ground.
5. Check the forward solenoid connection.
6. Check the forward solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
7. Check the transmission controller connector.

## Transmission Error Code 5101

**Fault Description.**
The transmission controller has detected current in the reverse solenoid circuit when reverse is not selected.

**Response.**
The instrument cluster Red STOP light will illuminate and the forward and reverse clutches will be disabled. The tractor will not drive.

**Possible Cause.**
1. Return circuit between the transmission controller and the reverse solenoid shorted to ground or a voltage supply.
2. Supply circuit between the transmission controller and the reverse solenoid shorted to ground.
3. Constant supply to the reverse solenoid.
4. Bad reverse solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 506 Tan between the transmission controller, connector 49 pin 34 and the reverse solenoid for a short circuit to ground.
2. Check wire 506 Tan between the transmission controller, connector 49 pin 34 and the reverse solenoid for a short to a voltage supply.
3. Check wire 506 Red between the transmission controller, connector 49 pin 12 and the reverse solenoid for a short to a voltage supply.
4. Check wire 506 Red between the transmission controller, connector 49 pin 12 and the reverse solenoid for a short circuit to ground.
5. Check the reverse solenoid connection.
6. Check the reverse solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.
7. Check the transmission controller connector.

https://truckmanualshub.com/



# Transmission Error Code 5102

**Fault Description.**
The clutch pedal bottom of clutch signal detected by the cab controller does not correspond with the clutch pedal position sensor signal detected by the transmission controller.

**Response.**
The tractor may not drive or the clutch pedal control may not operate correctly.

**Possible Cause.**
1. Tractor incorrectly calibrated/configured.
2. The clutch pedal bottom of clutch circuit jumper lead missing or incorrectly installed (XtraSpeed and XtraSpeed - E tractors only).
3. The clutch pedal bottom of clutch signal open circuit.
4. The clutch pedal bottom of clutch supply open circuit.
5. Bad clutch pedal bottom of clutch switch.
6. Bad clutch pedal sensor circuit.
7. Bad clutch pedal position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for error code 5085 and repair as necessary.
2. Check transmission controller and cab controller configuration settings and calibrate the transmission.

For XtraSpeed tractors check the following:
1. Make sure the declutch switch is connected to the harness.
2. Make sure the jumper lead is correctly installed into the jumper lead connector (located near the cab controller).
3. Check wire 660 Yellow between the cab controller, connector 45 pin 2 and the right hand console harness splice RC-SP9 for open circuit. Also check the jumper lead.
4. Check wire 660 Yellow between right hand console harness splice RC-SP9 and the clutch pedal bottom of clutch switch. Also check connector 27.

For XtraSpeed -E tractors check the following:
1. Make sure the jumper lead is installed correctly into the declutch switch connector (located near the multi function lever connector).
2. Make sure the jumper lead is removed from the jumper lead connector (located near the cab controller).
3. Check wire 660 Yellow between the cab controller, connector 46 pin 27 and the right hand console harness splice RC-SP9 for open circuit. Also check the jumper lead.
4. Check wire 660 Yellow between right hand console harness splice RC-SP9 and the clutch pedal bottom of pedal switch. Also check connector 27.

For XtraSpeed -E Plus tractors check the following:
1. Check wire 660 Yellow between the cab controller, connector 46 pin 27 and the clutch pedal bottom of pedal switch. Also check connectors 53 and 27.

For all tractors check the following:
2. Check wire 567 Red between the clutch pedal bottom of clutch switch and the instrument panel harness splice IP-SP8.
3. Check wire 518 Tan between the connector 33 and the instrument panel harness splice IP-SP8.
4. Check wire 514 Tan between the cab controller, connector 45 pin 3 the instrument panel harness splice IP-SP8.
5. Check the forward/reverse shuttle lever switch harness.
6. Check the clutch pedal position sensor circuit.
7. Check the clutch pedal position sensor installation and pivot arm installation.
8. Check the clutch pedal position sensor.

https://truckmanualshub.com/



# Transmission Error Code 5103

**Fault Description.**
The transmission controller detects an incorrect wheel speed sensor signal. The wheel speed sensor signal does not correspond with the forward/reverse Inter A sensor signal.

**Response.**
Powershift changes may become harsh. The following functions may not operate correctly, park lock (if equipped), creep (if equipped) and speed matching. The transmission will not calibrate.

**Possible Cause.**

Tractor drives.
1. Bad range position sensor.
2. The wheel speed sensor supply open circuit.
3. The wheel speed sensor return open circuit.
4. The wheel speed sensor signal open or short circuit to ground or to a voltage supply.
5. Bad wheel speed sensor signal.

Tractor does not drive.
1. Bad powershift or high/low clutch solenoid.
2. Powershift and high/low clutch pack oil pressure too low.
3. Mechanical or hydraulic failures.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**

Tractor drives.
1. Check for error codes 5069 to 5072 and repair as necessary.
2. Check for error code 5063 and or 5107 and repair as necessary.
3. Check wire 215 Red between the wheel speed sensor and the transmission harness splice T-SP8 for open circuit.
4. Check wire 215 Brown/White between the wheel speed sensor and the transmission harness splice T-SP7 for open circuit.
5. Check 215 Yellow between the wheel speed sensor and the transmission controller, connector 47 pin 1 for an open circuit or a short to ground.
6. Check 215 Yellow between the wheel speed sensor and the transmission controller, connector 47 pin 1 for short to a voltage supply.
7. Check the wheel speed sensor connector.
8. Check the wheel speed sensor, tighten the sensor to a torque of 27 Nm (20 ft lb.).
9. Check the forward/reverse Inter A sensor, refer to error code 5107.

Tractor does not drive.
1. Check for solenoid error codes 5000 to 5039 and repair as necessary.
2. Check for mechanical or hydraulic failures and repair as necessary.

https://truckmanualshub.com/



# Transmission Error Code 5105

**Fault Description.**
The transmission controller detects an incorrect signal from the powershift clutch speed (PS4) sensor.

**Response.**
The powershift gear change may become harsh or the tractor may not drive. Error code 5106 may also be displayed.

**Possible Cause.**

Tractor drives.
1. The powershift clutch speed (PS4) sensor and high/low clutch speed (PS2) sensor incorrectly connected.
2. The powershift clutch speed (PS4) sensor supply open circuit.
3. The powershift clutch speed (PS4) sensor return open circuit.
4. The powershift clutch speed (PS4) sensor signal open or short circuit to ground.
5. The powershift clutch speed (PS4) sensor signal short a supply voltage.

Tractor does not drive.
1. Bad powershift or high/low clutch solenoid.
2. Powershift and high/low clutch pack oil pressure too low.
3. Mechanical or hydraulic failures.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**

Tractor drives.
1. Make sure the powershift clutch speed (PS4) sensor and high/low clutch speed sensor are correctly connected. Wires (PS4) Red and (PS4) Brown/White should be connected to the speed sensor located on the right hand side of the speed housing (refer to Page 84). Wires (PS2) Red and (PS2) Brown/White should be connected to the speed sensor located on the top of the speed housing (refer to Page 84).
2. Check for error code 5063 and repair as necessary.
3. Check wire (PS4) Red between the powershift clutch speed (PS4) sensor and the transmission harness splice T-SP8 for open circuit.
4. Check wire (PS4) Brown/White between the powershift clutch speed (PS4) sensor and the transmission harness splice T-SP7 for open circuit.
5. Check (PS4) Yellow between the powershift clutch speed (PS4) sensor and the transmission controller, connector 47 pin 10 for an open circuit or a short to ground.
6. Check (PS4) Yellow between the powershift clutch speed (PS4) sensor and the transmission controller, connector 47 pin 10 for a short to a supply voltage.

Tractor does not drive
1. Check for solenoid error codes 5000 to 5039 and repair as necessary.
2. Check for mechanical or hydraulic failures and repair as necessary.

https://truckmanualshub.com/



# Transmission Error Code 5106

**Fault Description.**
The transmission controller detects an incorrect signal from the high/low clutch speed (PS2) sensor.

**Response.**
The powershift gear change may become harsh or the tractor may not drive. Error code 5105 may also be displayed.

**Possible Cause.**

Tractor drives.
1. The powershift clutch speed (PS4) sensor and high/low clutch speed (PS2) sensor incorrectly connected.
2. The high/low clutch speed (PS2) sensor supply open circuit.
3. The high/low clutch speed (PS2) sensor return open circuit.
4. The high/low clutch speed (PS2) sensor signal open or short circuit to ground.
5. The high/low clutch speed (PS2) sensor signal short to a voltage supply.

Tractor does not drive.
1. Bad powershift or high/low clutch solenoid.
2. Powershift and high/low clutch pack oil pressure too low.
3. Mechanical failures.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**

Tractor drives.
1. Make sure the powershift clutch speed (PS4) sensor and high/low clutch speed sensor are correctly connected. Wires (PS4) Red and (PS4) Brown/White should be connected to the speed sensor located on the right hand side of the speed housing (refer to Page 84). Wires (PS2) Red and (PS2) Brown/White should be connected to the speed sensor located on the top of the speed housing (refer to Page 84).
2. Check for error code 5063 and repair as necessary.
3. Check wire (PS2) Red between the high/low clutch speed (PS2) sensor and the transmission harness splice T-SP8 for open circuit.
4. Check wire (PS2) Brown/White between the high/low clutch speed (PS2) sensor and the transmission harness splice T-SP7 for open circuit.
5. Check (PS2) Yellow between the high/low clutch speed (PS2) sensor and the transmission controller, connector 47 pin 11 for an open circuit or a short to ground.
6. Check (PS2) Yellow between the high/low clutch speed (PS2) sensor and the transmission controller, connector 47 pin 11 for a short to a supply voltage.

Tractor does not drive
1. Check for solenoid error codes 5000 to 5039 and repair as necessary.
2. Check for mechanical or hydraulic failures and repair as necessary.

https://truckmanualshub.com/



# Transmission Error Code 5107

**Fault Description.**
The transmission controller does not detect a signal from the forward/reverse (Inter A) sensor.

**Response.**
The forward/reverse shuttle change may become harsh or the tractor may not drive.

**Possible Cause.**

Tractor drives.
1. Bad range position sensor.
2. The forward/reverse Inter A sensor and Inter B sensor connectors incorrectly connected (See Note Below).
3. The forward/reverse Inter A sensor supply open circuit.
4. The forward/reverse Inter A sensor return open circuit.
5. The forward/reverse Inter A sensor open or short circuit to ground.
6. The forward/reverse Inter A sensor signal short to a voltage supply.

Tractor does not drive.
1. Bad powershift, forward or reverse solenoid.
2. Powershift and high/low clutch pack oil pressure too low.
3. Forward/reverse clutch pack oil pressure too low
4. Mechanical or hydraulic failures.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**

Tractor drives.
1. Check for error codes 5069 to 5072 and repair as necessary.
2. For tractors equipped with Inter A and Inter B sensors make sure the forward/reverse Inter A sensor and forward/reverse Inter B sensor are correctly connected (See Note Below). The forward/reverse sensors are located on top of the transmission range housing. Wires (INT A) Red and (INT A) Brown/White should be connected to the right hand sensor (refer to Page 84). Wires (INT B) Red and (INT B) Brown/White should be connected to left hand sensor (refer to Page 84).
3. Check for error code 5063 and repair as necessary.
4. Check wire (INT A) Red between the forward/reverse Inter A sensor and the transmission harness splice T-SP8 for open circuit.
5. Check wire (INT A) Brown/White between the forward/reverse Inter A sensor and the transmission harness splice T-SP7 for open circuit.
6. Check wire (INT A) Yellow between the forward/reverse Inter A sensor and the transmission controller, connector 47 pin 18 for a short to ground.
7. Check wire (INT A) Yellow between the forward/reverse Inter A sensor and the transmission controller, connector 47 pin 18 for an open circuit.

   **NOTE:** *Tractors from PIN JJE3500084 are not equipped with Inter B speed sensors. However the transmission harness for tractors up to PIN JJE3500645 (XtraSpeed tractors) and PIN JJE3500651 (XtraSpeed - E and E Plus tractors) retain the sensor wiring and connector.*

Tractor does not drive.
1. Check for solenoid error codes 5000 to 5047 and repair as necessary.
2. Check for mechanical or hydraulic failures and repair as necessary.

https://truckmanualshub.com/



# Cab Controller Error Codes

## Cab Error Code 5300

**Fault Description.**
The cab controller has detected the switched power supply voltage is too low (below 9.8 volts).

**Response.**
The instrument cluster Red STOP light will illuminate and the forward and reverse clutches will be disabled.

**Possible Cause.**
1. Bad alternator.
2. Poor battery condition.
3. Bad cab controller power supply circuit.
4. Bad controller clean ground return circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. For tractors up to PIN JJE3500311 check for Hitch/PTO error code 1106.

For tractors up to PIN JJE3500311 if Hitch/PTO error code 1106 is detected check the following:
1. Check the switched power stud connection.
2. Check the battery condition.
3. Check the alternator output.

For tractors with Hitch/PTO error code 1106 not detected check the following:
1. Check the wire 590 Red between the cab controller, connector 46 pin 3 and fuse 27.
2. Check connector 26, for XtraSpeed - E Plus tractors also check connector 53.

## Cab Error Code 5301

**Fault Description.**
The cab controller has detected the switched power supply voltage is too high.

**Response.**
The instrument cluster Red STOP light will illuminate and the forward and reverse clutches will be disabled. Error code 5062 may also be displayed.

**Possible Cause.**
1. Bad alternator.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check the alternator and replace or repair as necessary.

https://truckmanualshub.com/



## Cab Error Code 5302

**Fault Description.**
The cab controller has detected the forward/reverse enable supply (output) voltage is too low (below 9.8 volts).

**Response.**
The forward and reverse clutches may be disabled and the tractor may not drive.

**Possible Cause.**
1. The forward/reverse enable (output) circuit shorted to ground.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for error code 5300 and repair as necessary.
2. Check wire (LINK) Red between the cab controller connector 46 pin 9 and the transmission controller connector 48 pin 19 for a short to ground.
3. Check connector 40, for XtraSpeed - E Plus tractors also check connector 51.
4. Check the cab and transmission controller connectors 46 and 48.

## Cab Error Code 5303

**Fault Description.**
The cab controller has detected the forward/reverse enable supply (output) voltage is present when not required.

**Response.**
The instrument cluster Amber Warning light will illuminate.

**Possible Cause.**
1. The forward/reverse enable supply (output) circuit shorted to a supply voltage.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. With the forward/reverse shuttle lever in neutral check wire (LINK) Red between the cab controller connector 46 pin 9 and the transmission controller connector 48 pin 19 for a short to a voltage supply.
2. Check connector 40, for XtraSpeed - E Plus tractors also check connector 51.
3. Check the cab and transmission controller connectors 46 and 48.

## Cab Error Code 5304

**Fault Description.**
The controller has detected the 5 volt reference voltage to is too low.

**Response.**
The forward and reverse clutches may be disabled and the tractor may not drive. The throttle may not operate correctly.

**Possible Cause.**
1. The forward/reverse and throttle 5 volt reference circuit shorted to ground.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 643 Red between the foot throttle and connector 10 pin 44 for a short to ground. Also check connector 10 (engine harness side).
2. Check wire 643 Red between the instrument panel harness splice IP-SP16 and connector 10 pin 44 for a short to ground. Also check connector 10 (instrument panel harness side).
3. Check wire 510 Tan between the instrument panel harness splice IP-SP16 and connector 33 for a short to ground. Also check connector 33 and the F/N/R switch or F/N/R/P switch harness.
4. Check wire 510 Tan between the instrument panel harness splice IP-SP16 and the cab controller connector 46 pin 10 for a short to ground.
5. Check connector 28, for XtraSpeed tractors also check connector 53.
6. For XtraSpeed - E Plus tractors check wire 644 Red between the fender harness splice F-SP 23 and connector 50 pin 13 for a short to ground. Also check connector 50 and the armrest control harness.

https://truckmanualshub.com/



## Cab Error Code 5305

**Fault Description.**
The controller has detected the 5 volt reference voltage to is too high.

**Response.**
The instrument cluster Red STOP light will illuminate and the forward and reverse clutches will be disabled. The engine speed will default to low idle.

**Possible Cause.**
1. The forward/reverse and throttle 5 volt reference circuit shorted to a supply voltage.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 643 Red between the foot throttle and connector 10 pin 44 for a short to a voltage supply. Also check connector 10 (engine harness side).
2. Check wire 643 Red between the instrument panel harness splice IP-SP16 and connector 10 pin 44 for a short to a voltage supply. Also check connector 10 (instrument panel harness side).
3. Check wire 510 Tan between the instrument panel harness splice IP-SP16 and connector 33 for a short to a voltage supply. Also check connector 33 and the F/N/R switch or F/N/R/P switch harness.
4. Check wire 510 Tan between the instrument panel harness splice IP-SP16 and the cab controller connector 46 pin 10 for a short to a voltage supply.
5. Check connector 28, for XtraSpeed tractors also check connector 53.
6. For XtraSpeed - E Plus tractors check wire 644 Red between the fender harness splice F-SP23 and connector 50 pin 13 for a short to a voltage supply. Also check connector 50 and the armrest control harness.

## Cab Error Code 5307

**Fault Description.**
The cab controller does not detect CAN Bus messages from the transmission controller.

**Response.**
The instrument cluster Red STOP light will illuminate and the forward and reverse clutches will be disabled.

**Possible Cause.**
1. The CAN Bus circuit between the cab controller and the transmission controller open circuit.
2. The transmission controller is not transmitting CAN messages.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for CAN error messages from other controllers in the system and check the CAN Bus circuit accordingly.
   i.e
   For XtraSpeed and XtraSpeed - E tractors, if the instrument cluster also detects a loss of CAN message from the transmission controller, check CAN circuit between the following:
   - The transmission controller and right hand console harness splices RC-SP19 and RC-SP20.

   For XtraSpeed - E Plus tractors, if the instrument cluster also detects a loss of CAN message from the transmission controller and auxiliary/remote valves, check CAN circuit between the following:
   - The transmission controller and fender harness splices F-SP17 and F-SP18.

   For XtraSpeed - E Plus tractors, if the instrument cluster also detects a loss of CAN message from the transmission controller only, check CAN circuit between the following:
   - The transmission controller and fender transmission splices F-SP10 and F-SP11.

https://truckmanualshub.com/



## Cab Error Code 5309

**Fault Description.**
The cab controller does not detected CAN Bus messages from the instrument cluster.

**Response.**
The instrument cluster Red STOP light will illuminate.

**Possible Cause.**
1. The CAN Bus circuit between the cab controller and the instrument cluster open circuit.
2. The instrument cluster is not transmitting CAN messages.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check the operation of the instrument cluster park brake warning light and repair as necessary.
2. Check for instrument cluster CAN error messages and repair as necessary.

## Cab Error Code 5311

**Fault Description.**
The cab controller does not detected CAN Bus messages from the engine controller.

**Response.**
The instrument cluster Red STOP light will illuminate and the tractor will not drive in any gear.

**Possible Cause.**
1. The CAN Bus circuit between the cab controller and the engine controller open circuit.
2. The engine controller is not transmitting CAN messages.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for CAN error messages from other controller in the system and check the CAN Bus circuit accordingly.
   i.e
   If the instrument cluster also detects a loss of CAN message from the engine controller, check CAN circuit between the engine controller and the instrument panel harness splices IP-SP2 and IP-SP5. Also check connector 10.

## Cab Error Code 5315

**Fault Description.**
The controller has detected the foot throttle signal voltage is too low (below 0.2 volts).

**Response.**
The instrument cluster Amber Warning light will illuminate and the engine foot throttle control will be disabled. For XtraSpeed - E Plus tractors the engine can be controlled with the hand throttle. Error codes 5304 and or 5317 may also be displayed.

**Possible Cause.**
1. The foot throttle signal circuit open or shorted to ground.
2. The foot throttle supply open circuit.
3. Bad foot throttle potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for error code 5304 and repair as necessary.
2. Check wire 643 Yellow between the cab controller, connector 46 pin 22 and the foot throttle for open circuit or short circuit to ground.
3. Check connectors 10 and 29, for XtraSpeed - E Plus tractors also check connector 52.
4. Check wire 643 Red between the instrument panel harness splice IP-SP16 and the foot throttle for open circuit. Also check connector 10.
5. Check the cab controller connector.
6. Check the foot throttle connection.
7. Check the foot throttle potentiometer.

https://truckmanualshub.com/



## Cab Error Code 5316

**Fault Description.**
The controller has detected the foot throttle signal voltage is too high (above 4.75 volts).

**Response.**
The instrument cluster Amber Warning light will illuminate and the engine foot throttle control will be disabled. For XtraSpeed - E Plus tractors the engine can be controlled with the hand throttle. Error code 5305 and or 5318 may also be displayed.

**Possible Cause.**
1. The foot throttle signal circuit shorted to a supply voltage above 5 volts.
2. The foot throttle return open circuit.
3. Bad foot throttle potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for error code 5305 and repair as necessary.
2. Check wire 643 Yellow between the cab controller, connector 46 pin 22 and the foot throttle for a short to a voltage above 5 volts.
3. Check wire 643 Brown between the cab controller, connector 46 pin 1 and the foot throttle for open circuit.
4. Check connectors 10 and 29, for XtraSpeed - E Plus tractors also connectors 52 and 53.
5. Check the cab controller connectors.
6. Check the foot throttle connection.
7. Check the foot throttle potentiometer.

## Cab Error Code 5317 (XtraSpeed - E Plus Tractors Only)

**Fault Description.**
The controller has detected the hand throttle signal voltage is too low (below 0.2 volts).

**Response.**
The instrument cluster Amber Warning light will illuminate and the engine foot throttle control will be disabled. Error code 5315 may also be displayed.

**Possible Cause.**
1. The hand throttle signal circuit open or shorted to ground.
2. The hand throttle supply open circuit.
3. The hand throttle return open circuit.
4. Bad hand throttle position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for error code 5304 and repair as necessary.
2. Check wire 644 Yellow between the cab controller, connector 46 pin 22 and the hand throttle for open circuit or short circuit to ground. Also check connector 50 and the armrest control harness.
3. Check wire 644 Red between the fender harness splice F-SP23 and the connector 50 pin 13 for open circuit. Also check connector 50 and the armrest control harness.
4. Check wire 644 Brown between the fender harness splice F-SP21 and the connector 50 pin 15 for open circuit. Also check connector 50 and the armrest control harness.
5. Check the cab controller connector.
6. Check the hand throttle connection.
7. Check the hand throttle position sensor.

https://truckmanualshub.com/



## Cab Error Code 5318
## (XtraSpeed - E Plus Tractors Only)

**Fault Description.**
The controller has detected the hand throttle signal voltage is too high (above 4.75 volts).

**Response.**
The instrument cluster Amber Warning light will illuminate and the engine foot throttle control will be disabled. Error code 5316 may also be displayed.

**Possible Cause.**
1. The hand throttle signal circuit shorted to a supply voltage.
2. The hand throttle return open circuit.
3. Bad hand throttle position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for error code 5305 and repair as necessary.
2. Check wire 644 Yellow between the cab controller, connector 46 pin 5 and the hand throttle for a short to a voltage above 5 volts. Also check connector 50 and the armrest control harness.
3. Check wires 643 Brown and 644 Brown between the cab controller, connector 46 pin 1 and the hand throttle for open circuit. Also check connector 50 and the armrest control harness.
4. Check the cab controller connector.
5. Check the hand throttle connection.
6. Check the hand throttle position sensor.

## Cab Error Code 5319

**Fault Description.**
The controller has detected the forward signal voltage is too low (below 0.2 volts).

**Response.**
The instrument cluster Amber Warning light will illuminate and the tractor will not drive in forward.

**Possible Cause.**
1. The forward signal open or shorted to ground.
2. The forward/reverse 5 volt reference supply open circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for error code 5304 and repair as necessary.
2. Check for error code 5321. If error code 5321 is present check wire 510 Tan between connector 33 and the instrument panel harness splice IP-SP16 for open circuit. Also check the F/N/R switch or F/N/R/P switch harness.
3. Check wire 511 Tan between the cab controller, connector 46 pin 15 and connector 33 for open circuit or short circuit to ground.
4. Check connectors 33 and 28, for XtraSpeed - E Plus tractors also check connector 53.
5. Check the cab controller connector.

https://truckmanualshub.com/



## Cab Error Code 5320

**Fault Description.**
The controller has detected the forward signal voltage is too high (above 4.75 volts).

**Response.**
The instrument cluster Red STOP light will illuminate the forward clutch will be disabled. For XtraSpeed - E and E Plus tractors the tractor will only operate in reverse gears 1-1 to 2-8.

**Possible Cause.**
1. The forward signal circuit shorted to a supply voltage above 5 volts.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for error code 5305 and repair as necessary.
2. Check wire 511 Tan between the cab controller, connector 46 pin 15 and connector 33 for a short to a voltage supply.
3. Check connectors 33 and 28, for XtraSpeed - E Plus tractors also check connector 53.
4. Check the cab controller connector.

## Cab Error Code 5321

**Fault Description.**
The controller has detected the reverse signal voltage is too low (below 0.2 volts).

**Response.**
The instrument cluster Amber Warning light will illuminate and the tractor will not drive in reverse.

**Possible Cause.**
1. The reverse signal open or shorted to ground.
2. The forward/reverse 5 volt reference supply open circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for error code 5304 and repair as necessary.
2. Check for error code 5319. If error code 5319 is present check wire 510 Tan between connector 33 and the instrument panel harness splice IP-SP16 for open circuit. Also check the forward/reverse shuttle lever switch harness.
3. Check wire 513 Tan between the cab controller, connector 46 pin 23 and connector 33 for open circuit or short circuit to ground.
4. Check connectors 33 and 28, for XtraSpeed - E Plus tractors also check connector 53.
5. Check the cab controller connector.

https://truckmanualshub.com/



## Cab Error Code 5322

**Fault Description.**
The controller has detected the reverse signal voltage is too high (above 4.75 volts).

**Response.**
The instrument cluster Red STOP light will illuminate, the reverse clutch will be disabled. For XtraSpeed - E and E Plus tractors the tractor will only operate in forward gears 1-1 to 2-8.

**Possible Cause.**
1. The reverse signal circuit shorted to a supply voltage above 5 volts.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for error code 5305 and repair as necessary.
2. Check wire 513 Tan between the cab controller, connector 46 pin 23 and connector 33 for a short to a voltage above 5 volts.
3. Check connectors 33 and 28, for XtraSpeed - E Plus tractors also check connector 53.
4. Check the cab controller connector.

## Cab Error Code 5323

**Fault Description.**
The cab controller has detected current in the reverse solenoid circuit when reverse is not selected.

**Response.**
The instrument cluster Red STOP light will illuminate and the forward and reverse clutches will be disabled. The tractor will not drive.

**Possible Cause.**
1. Return circuit between the transmission controller and the reverse solenoid shorted to ground or 12 volts.
2. Supply circuit between the transmission controller and the reverse solenoid shorted to ground.
3. Constant 12 volts supply to the reverse solenoid.
4. Bad reverse solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for error code 5101 and repair as necessary.
2. Check wire 506 Tan between the transmission controller, connector 49 pin 34 and the reverse solenoid for a short circuit to ground.
3. Check wire 506 Tan between the transmission controller, connector 49 pin 34 and the reverse solenoid for a short to a voltage supply.
4. Check wire 506 Red between the transmission controller, connector 49 pin 12 and the reverse solenoid for a short to a voltage supply.
5. Check wire 506 Red between the transmission controller, connector 49 pin 12 and the reverse solenoid for a short circuit to ground.
6. Check the transmission controller connector.
7. Check the reverse solenoid connection.
8. Check the reverse solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.

https://truckmanualshub.com/



## Cab Error Code 5324

**Fault Description.**
The cab controller has detected current in the forward solenoid circuit when forward is not selected.

**Response.**
The instrument cluster Red STOP light will illuminate and the forward and reverse clutches will be disabled. The tractor will not drive.

**Possible Cause.**
1. Return circuit between the transmission controller and the forward solenoid shorted to ground or 12 volts.
2. Supply circuit between the transmission controller and the forward solenoid shorted to ground.
3. Constant 12 volts supply to the forward solenoid.
4. Bad forward solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check for error code 5100 and repair as necessary.
2. Check wire 504 Tan between the transmission controller, connector 49 pin 33 and the forward solenoid for a short circuit to ground.
3. Check wire 504 Tan between the transmission controller, connector 49 pin 33 and the forward solenoid for a short to a voltage supply.
4. Check wire 504 Red between the transmission controller, connector 49 pin 13 and the forward solenoid for a short to a voltage supply.
5. Check wire 504 Red between the transmission controller, connector 49 pin 13 and the forward solenoid for a short circuit to ground.
6. Check the transmission controller connector.
7. Check the forward solenoid connection.
8. Check the forward solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.

## Cab Error Code 5326

**Fault Description.**
The controller has detected the voltage to the park lock solenoid is too low.

**Response.**
The instrument cluster Red STOP light will illuminate, the park brake and Amber Warning lights will flash on and off and the audible alarm will sound. The park lock may not engage.

**Possible Cause.**
1. Supply circuit between the transmission controller and the park lock solenoid open circuit.
2. Return circuit between the cab controller and the park lock solenoid shorted to ground or open circuit.
3. Bad park lock solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 280 Yellow between the transmission controller, connector 49 pin 27 and the park lock solenoid for open circuit.
2. Check wire 280 Brown/White between the cab controller, connector 46 pin 32 and the park lock solenoid for short to ground or open circuit.
3. Check the park lock solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.

https://truckmanualshub.com/



## Cab Error Code 5327

**Fault Description.**
The controller has detected the voltage to the park lock solenoid is too high.

**Response.**
The instrument cluster Red STOP light will illuminate and the forward and reverse clutches will be disabled.

**Possible Cause.**
1. Supply circuit between the transmission controller and the park lock solenoid shorted to a voltage supply.
2. Return circuit between the cab controller and the park lock solenoid shorted to a voltage supply.
3. Bad park lock solenoid.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Check wire 280 Yellow between the transmission controller, connector 49 pin 27 and the park lock solenoid for a short to a voltage supply.
2. Check wire 280 Brown/White between the cab controller, connector 46 pin 32 and the park lock solenoid for short to a voltage supply.
3. Check the park lock solenoid coil resistance is approximately 8.5 Ohms at 20℃ (68℉) and replace as necessary.

## Cab Error Code 5328

**Fault Description.**
The cab controller has detected incorrect data from the transmission controller.

**Response.**
The instrument cluster Red STOP light will illuminate and the forward and reverse clutches will be disabled. The tractor will not drive.

**Possible Cause.**
1. Transmission controller and cab controller software incompatible.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 77.*

**Circuit Checks/Corrective Action.**
1. Using the McCormick Diagnostic Tool check the transmission and cab controller installed software and reprogram and reconfigure transmission and cab controllers as necessary, refer to Section 10010. Calibrate the transmission controller.

https://truckmanualshub.com/



# CIRCUIT TESTING

## General Information

**WARNING:** *Never operate the engine in a closed building. Proper ventilation is required under all circumstances.*

**IMPORTANT:** *A single fault in the system may cause several different error codes to be recorded. Make a note of all active error codes for each controller before carrying out the troubleshooting procedure.*

**IMPORTANT:** *Replace the controller if the fault remains only after all necessary checks have been made.*

**IMPORTANT:** *For tractors equipped with cab suspension, all checks must be carried out with the cab fully lowered or with the cab supported with suitable cab supports. To lower the cab refer to Section 10011.*

**IMPORTANT:** *All electrical checks must be made with the tractor parked on hard level ground with park brake engaged, the shuttle lever in Neutral or Park and the Engine OFF.*

**IMPORTANT:** *Put blocks in front of and behind the rear wheels.*

**IMPORTANT:** *The battery must be at full charge and all connections must be clean and tight before testing. Only use a HIGH IMPEDANCE multimeter for the tests. Do not use a test lamp or damage to the switches may occur.*

**IMPORTANT:** *Use MC2656 test probe kit when making electrical checks at connectors to avoid the risk of shorting between the connector pins or terminals.*

**IMPORTANT:** *When disconnecting harness connectors, always check the connector pins and terminals for damage and alignment.*

**NOTE:** *When measuring resistance values, always measure the resistance of the multimeter leads before testing components. Subtract the resistance of the multimeter leads from the component resistance to obtain a true resistance value.*

**NOTE:** *When testing diodes and diode modules use the multimeter diode test function.*

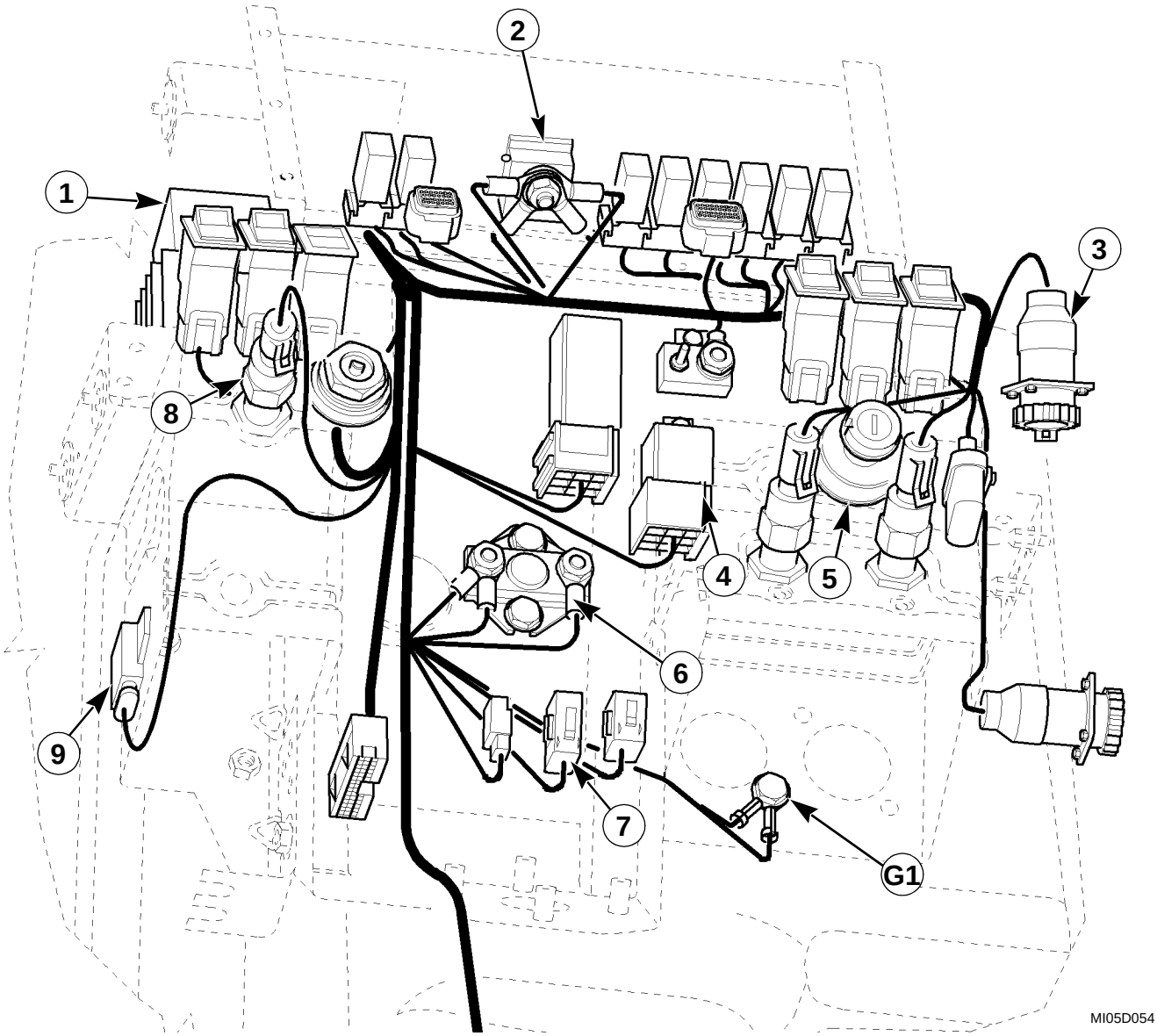
**NOTE:** *All components, wires and connectors disconnected during any electrical checks must be connected when the checks are completed.*

https://truckmanualshub.com/



# COMPONENT IDENTIFICATION

## Instrument Panel Components



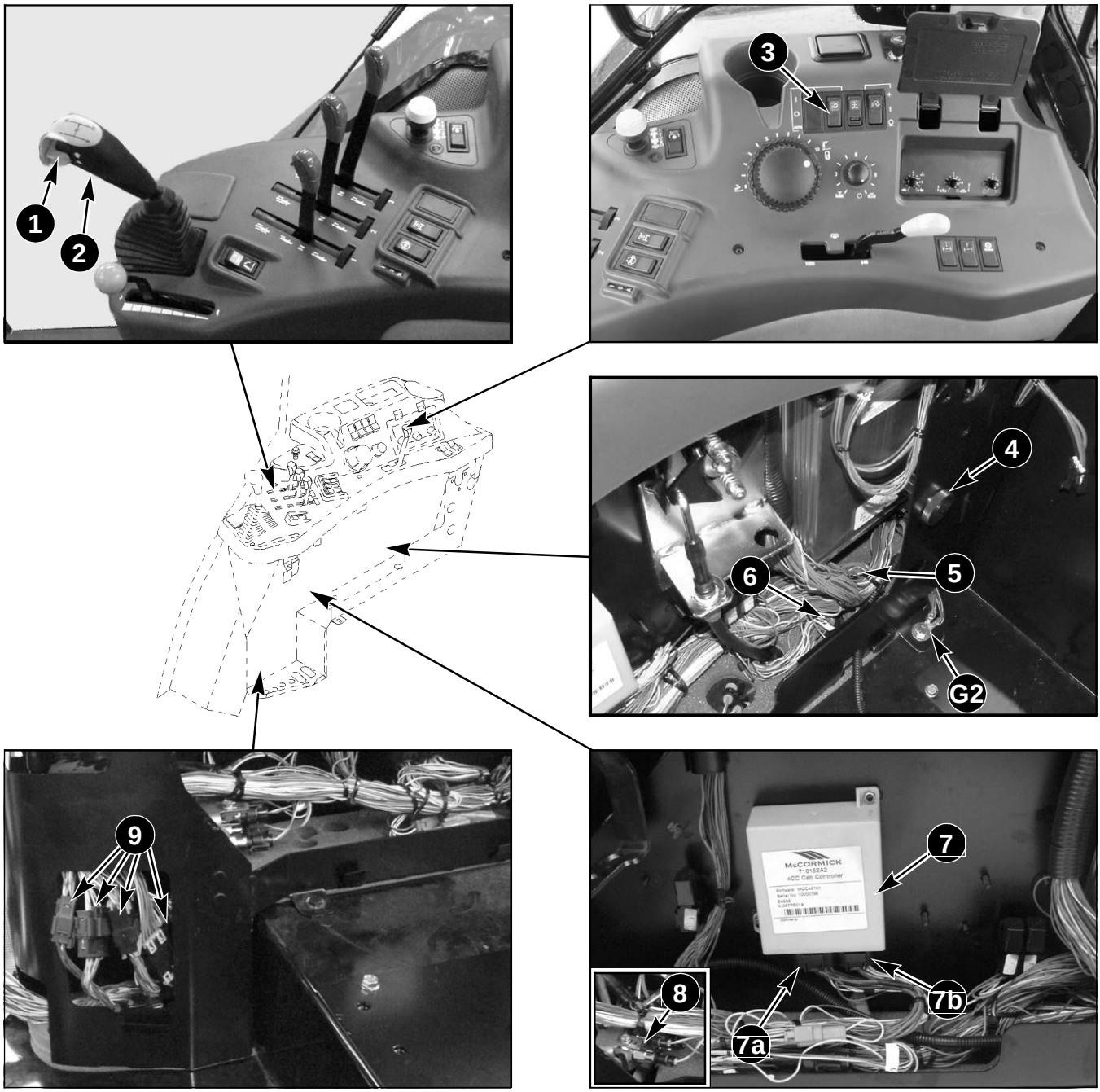

1. FUSE BOX
2. SWITCHED POWER STUD
3. CAN DIAGNOSTIC CONNECTOR
4. CAB POWER RELAY
5. KEY SWITCH
6. BATTERY POWER STUD (UNSWITCHED)
7. CONNECTOR 33 (FORWARD/REVERSE SHUTTLE SWITCH)
8. INCHING PEDAL SWITCH (BOTTOM OF PEDAL)
9. INCHING PEDAL POSITION SENSOR

G1.CHASSIS GROUND CONNECTION G1

https://truckmanualshub.com/



## Right Hand Console Components (XtraSpeed Tractors Only)




1. POWERSHIFT SHIFT SWITCH
2. DECLUTCH SWITCH
3. CREEP SWITCH
4. AUDIBLE ALARM
5. CONNECTOR 52
6. CONNECTOR 40
7. CAB CONTROLLER

7a. CONNECTOR 46 (34 PIN)

7b. CONNECTOR 45 (26 PIN)

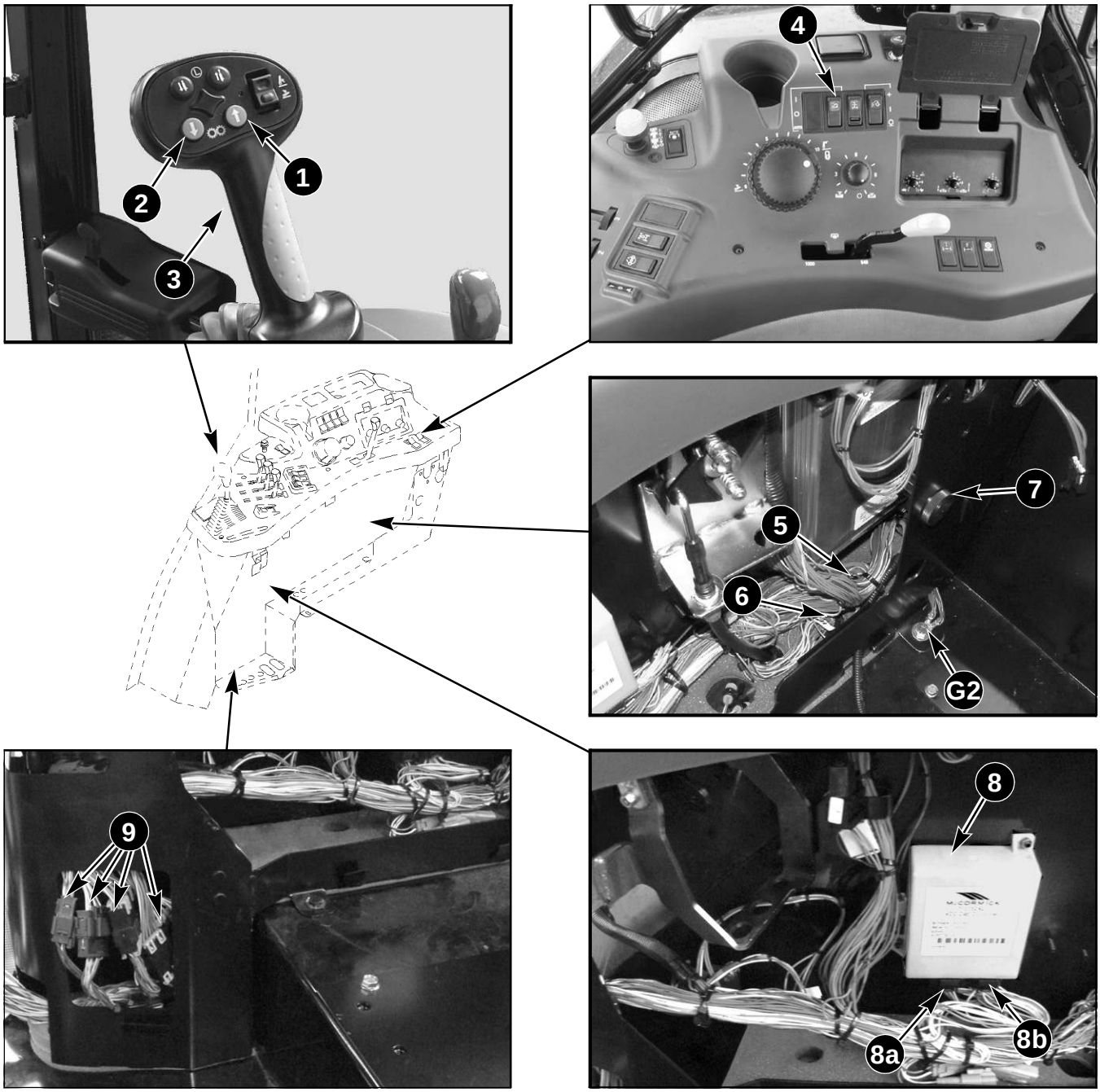
8. RANGE SELECTION SWITCHES
   TRACTOR UP TO PIN JJE3500444
9. CONNECTORS 26, 27, 28, 29

G2. CHASSIS GROUND CONNECTION G2

https://truckmanualshub.com/



## Right Hand Console Components (XtraSpeed - E Tractors Only)




1. POWERSHIFT UP SHIFT SWITCH
2. POWERSHIFT DOWN SHIFT SWITCH
3. RANGE SKIP SWITCH
4. CREEPER SWITCH
5. CONNECTOR 52
6. CONNECTOR 40
7. AUDIBLE ALARM
8. CAB CONTROLLER

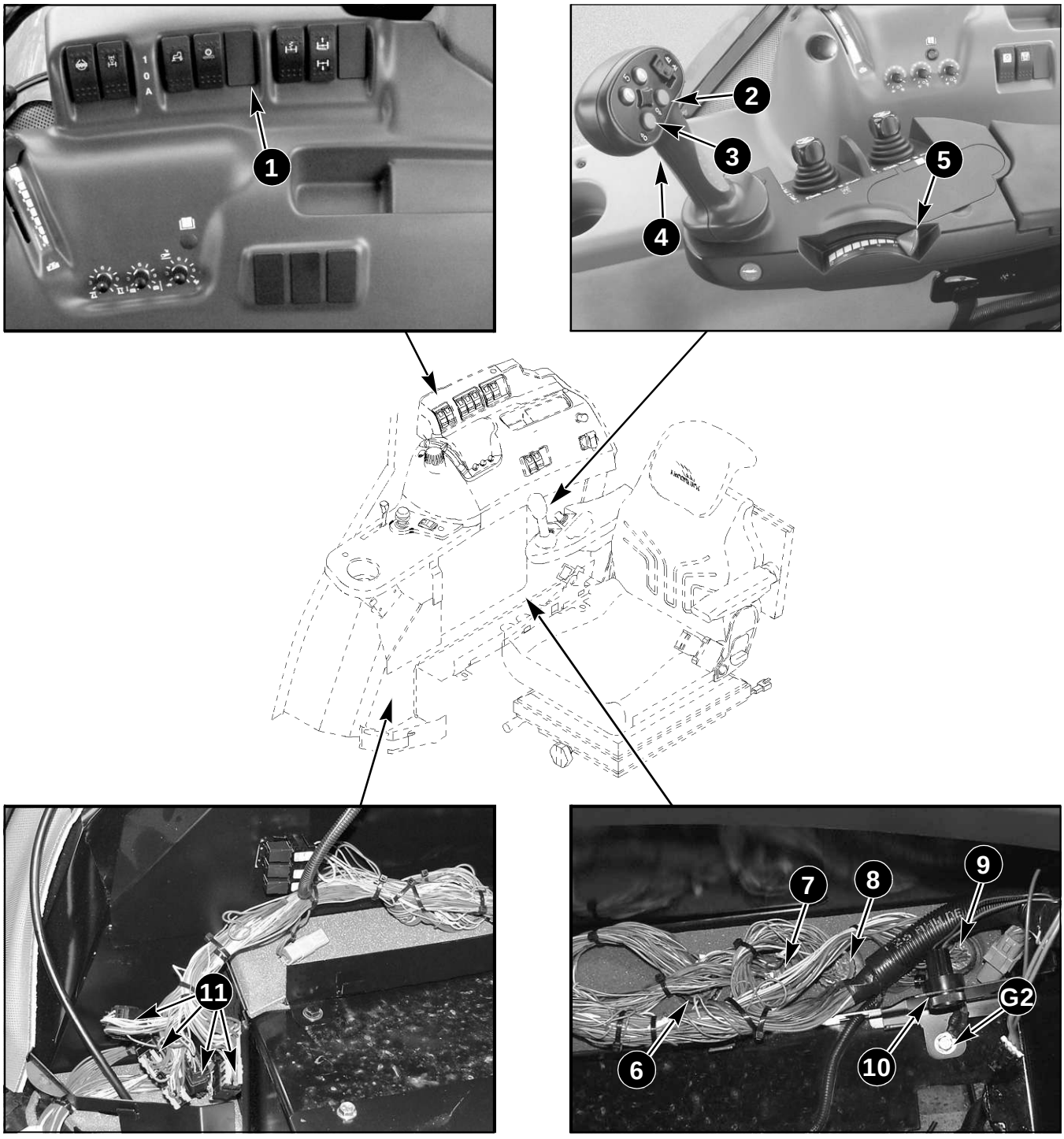
8a. CONNECTOR 46 (34 PIN)
8b. CONNECTOR 45 (26 PIN)
9. CONNECTORS 26, 27, 28, 29

G2. CHASSIS GROUND CONNECTION G2

https://truckmanualshub.com/



## Right Hand Console Components (XtraSpeed - E Plus Tractors Only)



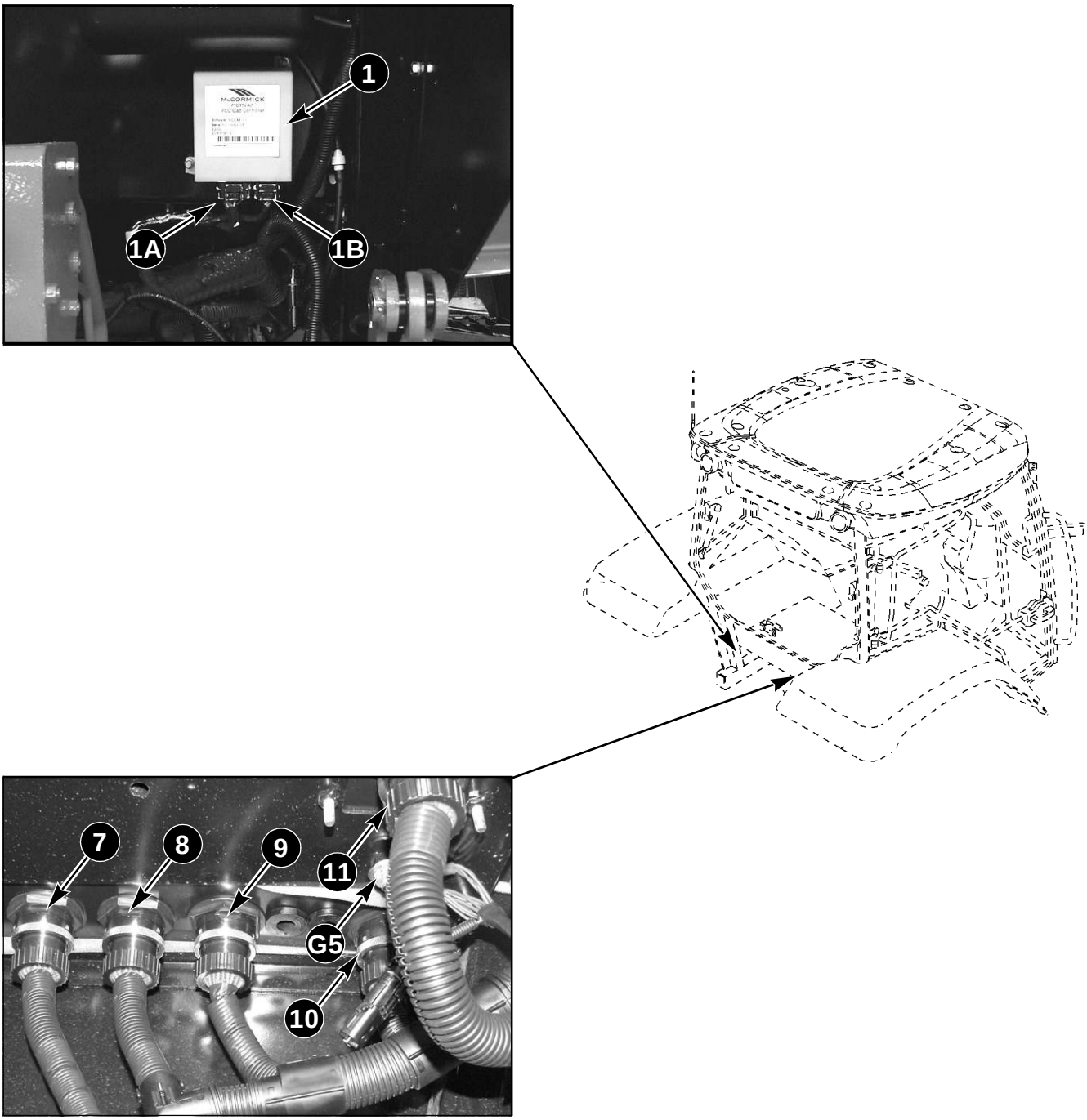

1. CREEPER SWITCH POSITION
2. GEAR UP SHIFT CONTROL
3. GEAR DOWN SHIFT CONTROL
4. RANGE SKIP SWITCH
5. HAND THROTTLE
6. CONNECTOR 40
7. CONNECTOR 51
8. CONNECTOR 52
9. CONNECTOR 53
10. AUDIBLE ALARM
11. CONNECTORS 26, 27, 28, 29

G2. CHASSIS GROUND CONNECTION G2

https://truckmanualshub.com/



# Rear Fender Components (XtraSpeed - E Plus Tractors Only)



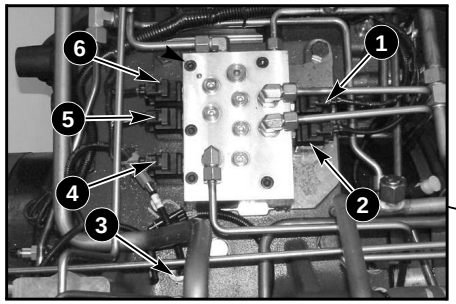

1. CAB CONTROLLER
1A. CONNECTOR 46 (34 PIN)
1B. CONNECTOR 45 (26 PIN)
7. CONNECTOR 40 - TRANSMISSION HARNESS
8. CONNECTOR 53 (TRANSMISSION HARNESS)
9. CONNECTOR 52 (FENDER HARNESS)
10. CONNECTOR 51 (FENDER HARNESS)
11. CONNECTOR 50 (FENDER HARNESS)

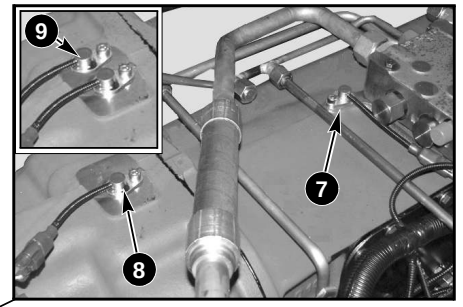
G5. CHASSIS GROUND CONNECTION G5

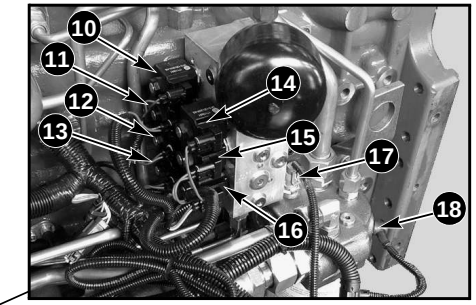
https://truckmanualshub.com/

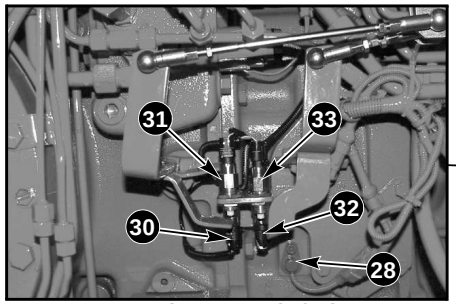
This Page Has Been Left Blank.

## Transmission Components

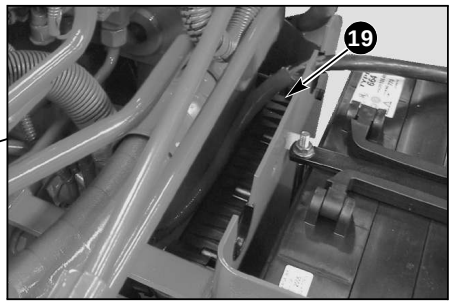


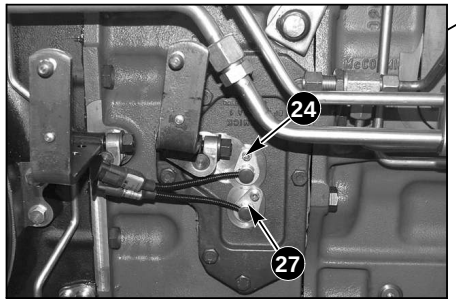



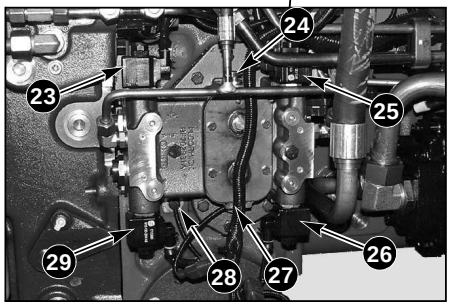




XTRASPEED TRACTORS
FROM PIN JJE3500445 TO JJE3500982 ONLY

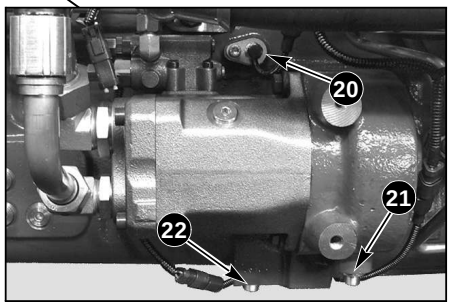



XTRASPEED TRACTORS
FROM PIN JJE3500983 ONLY




XTRASPEED - E AND E PLUS TRACTORS ONLY




1. MFD SOLENOID
2. DIFFERENTIAL LOCK SOLENOID
3. WHEEL SPEED SENSOR
4. REAR PTO SOLENOID
5. FORWARD SOLENOID
6. REVERSE SOLENOID
7. POWERSHIFT PS2 SPEED SENSOR
8. FORWARD/REVERSE INTER A SENSOR
9. FORWARD/REVERSE INTER B SENSOR TRACTORS UP TO PIN JJE3500084 (NOT USED)
10. POWERSHIFT PS4-3 SOLENOID
11. POWERSHIFT PS4-1 SOLENOID
12. POWERSHIFT PS4-2 SOLENOID
13. POWERSHIFT PS4-4 SOLENOID
14. POWERSHIFT PS2-2 SOLENOID
15. POWERSHIFT PS2-1 SOLENOID
16. PARK LOCK SOLENOID (IF EQUIPPED)
17. TRANSMISSION OIL TEMPERATURE SWITCH
18. HYDRAULIC FILTER RESTRICTION SWITCH
19. TRANSMISSION CONTROLLER
20. POWERSHIFT PS4 SPEED SENSOR
21. ENGINE SPEED SENSOR TRACTORS UP TO PIN JJE3500084 (NOT USED)
22. PTO A SPEED SENSOR
23. 3RD RANGE SOLENOID
24. 3RD/4TH RANGE POSITION SENSOR
25. 4TH RANGE SOLENOID
26. 2ND RANGE SOLENOID
27. 1ST/2ND RANGE POSITION SENSOR
28. PTO B SPEED SENSOR
29. 1ST RANGE SOLENOID
30. 1ST RANGE SWITCH
31. 2ND RANGE SWITCH
32. 3RD RANGE SWITCH
33. 4TH RANGE SWITCH

https://truckmanualshub.com/

# TRANSMISSION CONTROLLER SCHEMATIC CIRCUITS

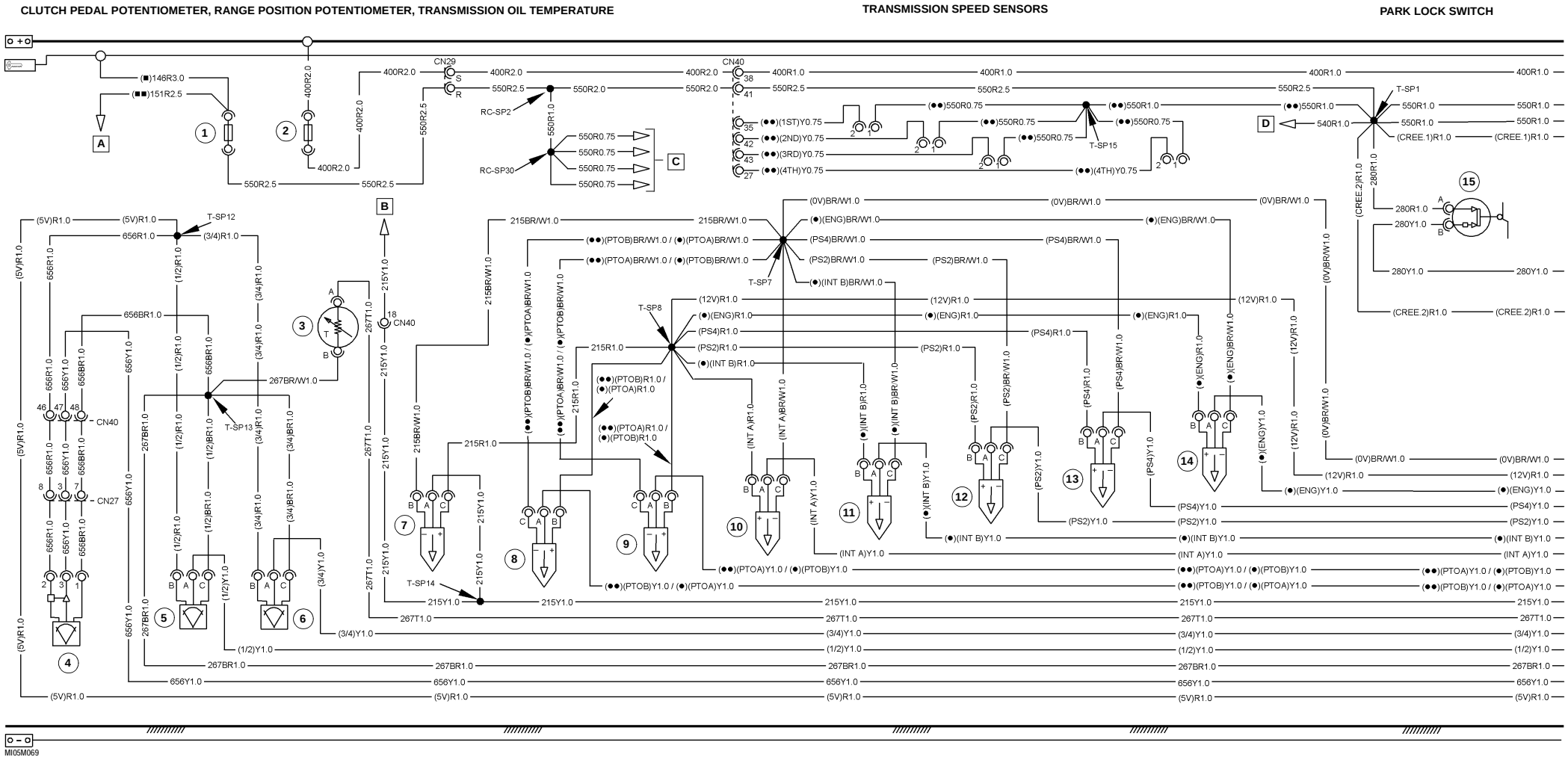
## Transmission Controller Pin Identification

| CONNECTOR 47 (34 Pin) | | | |
|---|---|---|---|
| 1 | WHEEL SPEED SENSOR | 18 | FORWARD/REVERSE INTER A SENSOR |
| 2 | ENGINE SPEED | 19 | FORWARD/REVERSE INTER B SENSOR (NOT USED) |
| 3 | NOT USED | 20 | NOT USED |
| 4 | CREEP ENGAGED SWITCH | 21 | NOT USED |
| 5 | CREEP DISENGAGED SWITCH | 22 | NOT USED |
| 6 | NOT USED | 23 | NOT USED |
| 7 | 1ST/2ND RANGE POSITION SENSOR | 24 | TRANSMISSION OIL TEMPERATURE SWITCH |
| 8 | 3RD/4TH RANGE POSITION SENSOR | 25 | CLUTCH PEDAL POSITION SENSOR SIGNAL |
| 9 | NOT USED | 26 | PTO A SPEED SENSOR (FRONT SENSOR) |
| 10 | POWERSHIFT PS4 SPEED SENSOR | 27 | PTO B SPEED SENSOR (REAR SENSOR) |
| 11 | HIGH/LOW CLUTCH (PS2) SPEED SENSOR | 28 | NOT USED |
| 12 | PARK LOCK SWITCH | 29 | NOT USED |
| 13 | NOT USED | 30 | NOT USED |
| 14 | NOT USED | 31 | NOT USED |
| 15 | NOT USED | 32 | NOT USED |
| 16 | NOT USED | 33 | NOT USED |
| 17 | NOT USED | 34 | NOT USED |

| CONNECTOR 48 (26 Pin) | | | |
|---|---|---|---|
| 1 | NOT USED | 14 | NOT USED |
| 2 | 12 VOLT (BUF) | 15 | NOT USED |
| 3 | 5 VOLT (REFERENCE) | 16 | NOT USED |
| 4 | 0 VOLT (REFERENCE) | 17 | NOT USED |
| 5 | 0 VOLT (SPEED SENSOR GROUND) | 18 | NOT USED |
| 6 | 0 VOLT (CLEAN GROUND) | 19 | FORWARD/REVERSE ENABLE 12 VOLT SUPPLY (INPUT) |
| 7 | 0 VOLT (CLEAN GROUND) | 20 | NOT USED |
| 8 | NOT USED | 21 | NOT USED |
| 9 | NOT USED | 22 | NOT USED |
| 10 | NOT USED | 23 | CAN HIGH |
| 11 | NOT USED | 24 | CAN LOW |
| 12 | NOT USED | 25 | 12 VOLT SWITCHED BATTERY POWER |
| 13 | 12 VOLT UNSWITCHED BATTERY POWER | 26 | 12 VOLT SWITCHED BATTERY POWER |

| CONNECTOR 49 (34 Pin) | | | |
|---|---|---|---|
| 1 | 1ST RANGE SOLENOID RETURN | 18 | 3RD RANGE SOLENOID SUPPLY |
| 2 | 2ND RANGE SOLENOID RETURN | 19 | HIGH SOLENOID PS2-2 SUPPLY |
| 3 | 3RD RANGE SOLENOID RETURN | 20 | 4TH RANGE SOLENOID SUPPLY |
| 4 | 4TH RANGE SOLENOID RETURN | 21 | 1ST RANGE SOLENOID SUPPLY |
| 5 | POWERSHIFT SOLENOID PS4-1 RETURN | 22 | POWERSHIFT SOLENOID PS4-1 SUPPLY |
| 6 | POWERSHIFT SOLENOID PS4-2 RETURN | 23 | CREEP ENGAGE SOLENOID SUPPLY |
| 7 | POWERSHIFT SOLENOID PS4-3 RETURN | 24 | NOT USED |
| 8 | POWERSHIFT SOLENOID PS4-4 RETURN | 25 | NOT USED |
| 9 | LOW SOLENOID PS2-1 RETURN | 26 | NOT USED |
| 10 | POWERSHIFT SOLENOID PS4-3 SUPPLY | 27 | PARK LOCK SOLENOID SUPPLY |
| 11 | LOW SOLENOID PS2-1 SUPPLY | 28 | POWERSHIFT SOLENOID PS4-4 SUPPLY |
| 12 | REVERSE SOLENOID SUPPLY | 29 | NOT USED |
| 13 | FORWARD SOLENOID SUPPLY | 30 | NOT USED |
| 14 | POWERSHIFT SOLENOID PS4-2 SUPPLY | 31 | NOT USED |
| 15 | 2ND RANGE SOLENOID SUPPLY | 32 | NOT USED |
| 16 | CREEP DISENGAGE SOLENOID SUPPLY | 33 | FORWARD SOLENOID RETURN |
| 17 | HIGH SOLENOID PS2-2 RETURN | 34 | REVERSE SOLENOID RETURN |

## Transmission Controller Schematic Circuit (For XtraSpeed and XtraSpeed - E Tractors)




## Key

1. FUSE 34 (7.5 AMP)
2. FUSE 5 (7.5 AMP)
3. TRANSMISSION OIL TEMPERATURE SWITCH
4. CLUTCH PEDAL POSITION SENSOR
5. 1ST/2ND RANGE POSITION SENSOR (XTRASPEED - E TRACTORS AND XTRASPEED TRACTORS FROM JJE3500983 ONLY)
6. 3RD/4TH RANGE POSITION SENSOR (XTRASPEED - E TRACTORS AND XTRASPEED TRACTORS FROM JJE3500983 ONLY)
7. WHEEL SPEED SENSOR
8. PTO B SPEED SENSOR (REAR SENSOR)
9. PTO A SPEED SENSOR (FRONT SENSOR)
10. FORWARD/REVERSE SENSOR (INTER A)
11. FORWARD/REVERSE SENSOR (INTER B) TRACTORS UP TO PIN JJE3500084 (NOT USED)
12. HIGH/LOW CLUTCH SPEED SENSOR (PS2)
13. POWERSHIFT CLUTCH SPEED SENSOR (PS4)
14. ENGINE SPEED SENSOR TRACTORS UP TO PIN JJE3500084 (NOT USED)
15. PARK LOCK ENGAGED SWITCH
16. CREEP ENGAGED SWITCH (CREEP ON)
17. CREEP DISENGAGED SWITCH (CREEP OFF)
18. FORWARD CLUTCH SOLENOID
19. REVERSE CLUTCH SOLENOID
20. LOW CLUTCH SOLENOID (PS2-1)
21. HIGH CLUTCH SOLENOID (PS2-2)
22. PARK LOCK SOLENOID (IF EQUIPPED)
23. CREEP ENGAGE SOLENOID (CREEP ON)
24. CREEP DISENGAGE SOLENOID (CREEP OFF)
25. POWERSHIFT SOLENOID (PS4-1)
26. POWERSHIFT SOLENOID (PS4-2)
27. POWERSHIFT SOLENOID (PS4-3)
28. POWERSHIFT SOLENOID (PS4-4)
29. 1ST RANGE SOLENOID (XTRASPEED - E TRACTORS ONLY)
30. 2ND RANGE SOLENOID (XTRASPEED - E TRACTORS ONLY)
31. 3RD RANGE SOLENOID (XTRASPEED - E TRACTORS ONLY)
32. 4TH RANGE SOLENOID (XTRASPEED - E TRACTORS ONLY)

A. B+ FROM KEY SWITCH TERMINAL 3
B. TO HITCH CONTROLLER
C. TO RANGE SWITCHES (XTRASPEED TRACTORS UP TO JJE3500983ONLY)
D. TO 4TH AUXILIARY VALVE
E. TO CAB CONTROLLER
F. TO CAN BUS CIRCUIT

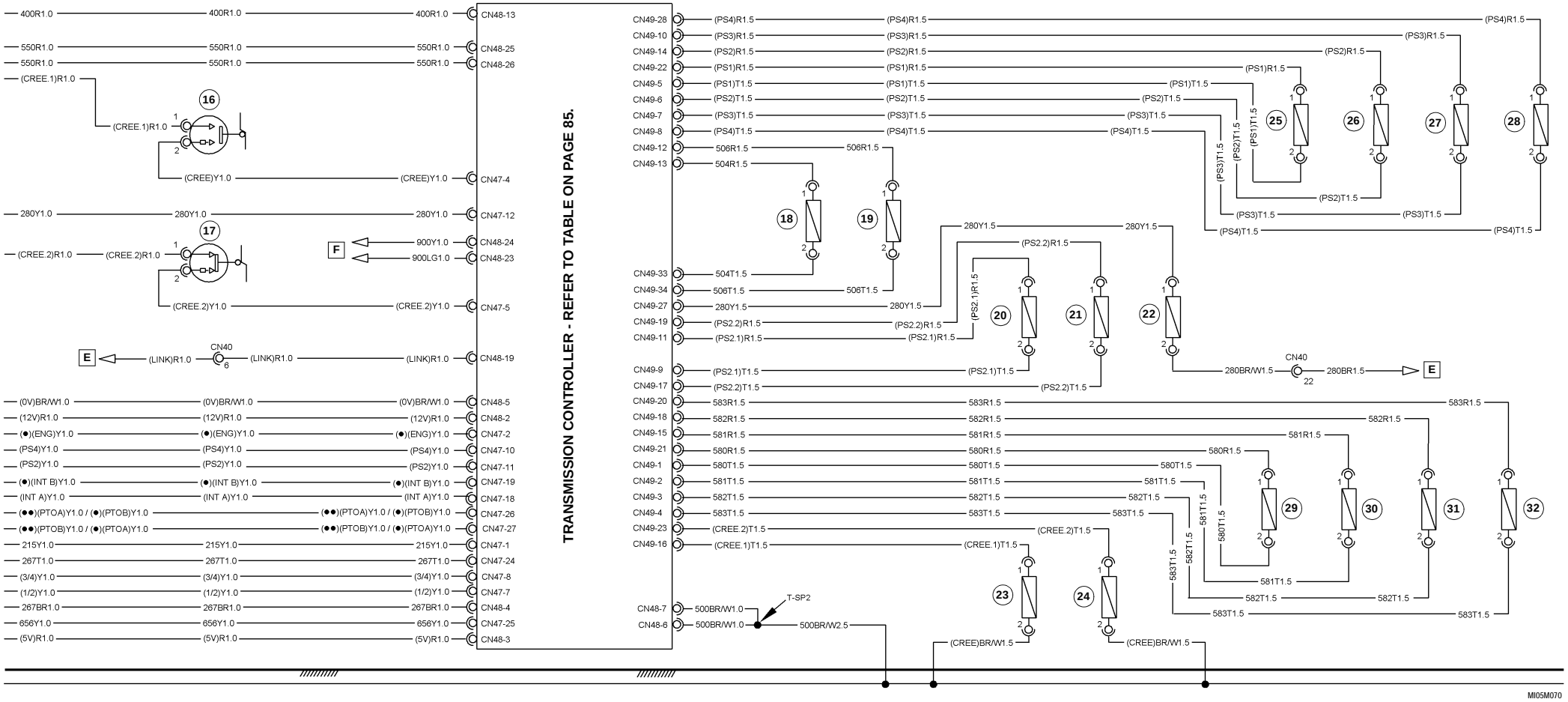
(■)- TRACTORS UP TO PIN JJE3500311
(■■)- TRACTORS FROM PIN JJE3500312
(●)- TRACTORS UP TO PIN JJE3500645
(●●)- TRACTORS FROM PIN JJE3500646

**NOTE:** *Only use a HIGH IMPEDANCE multimeter to test the switches and circuits. Do not use a test lamp or damage to the switches may occur.*

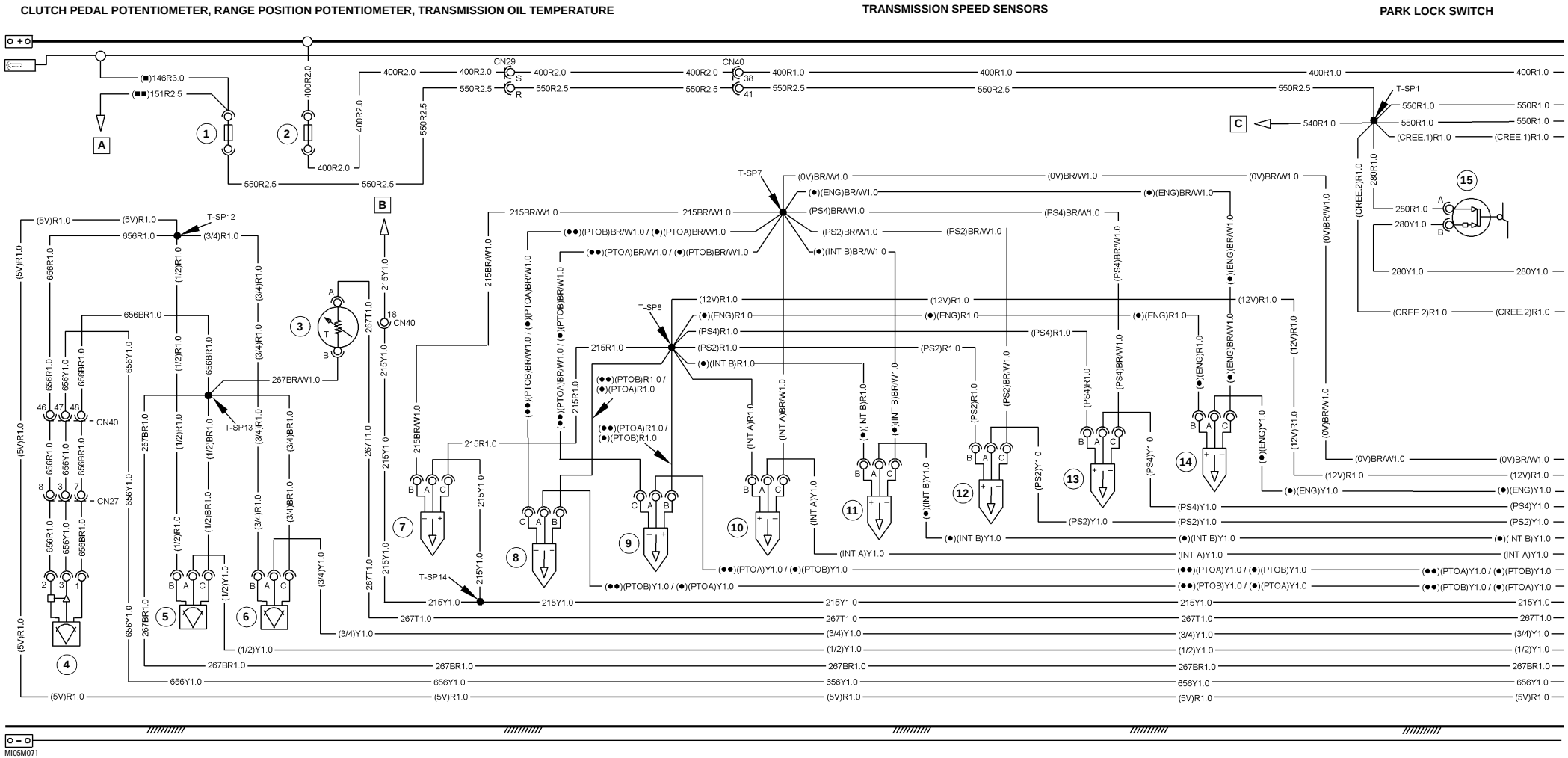
https://truckmanualshub.com/


CREEP SWITCHES

TRANSMISSION CONTROL SOLENOIDS



## Transmission Controller Schematic Circuit (For XtraSpeed - E Plus Tractors)




## Key

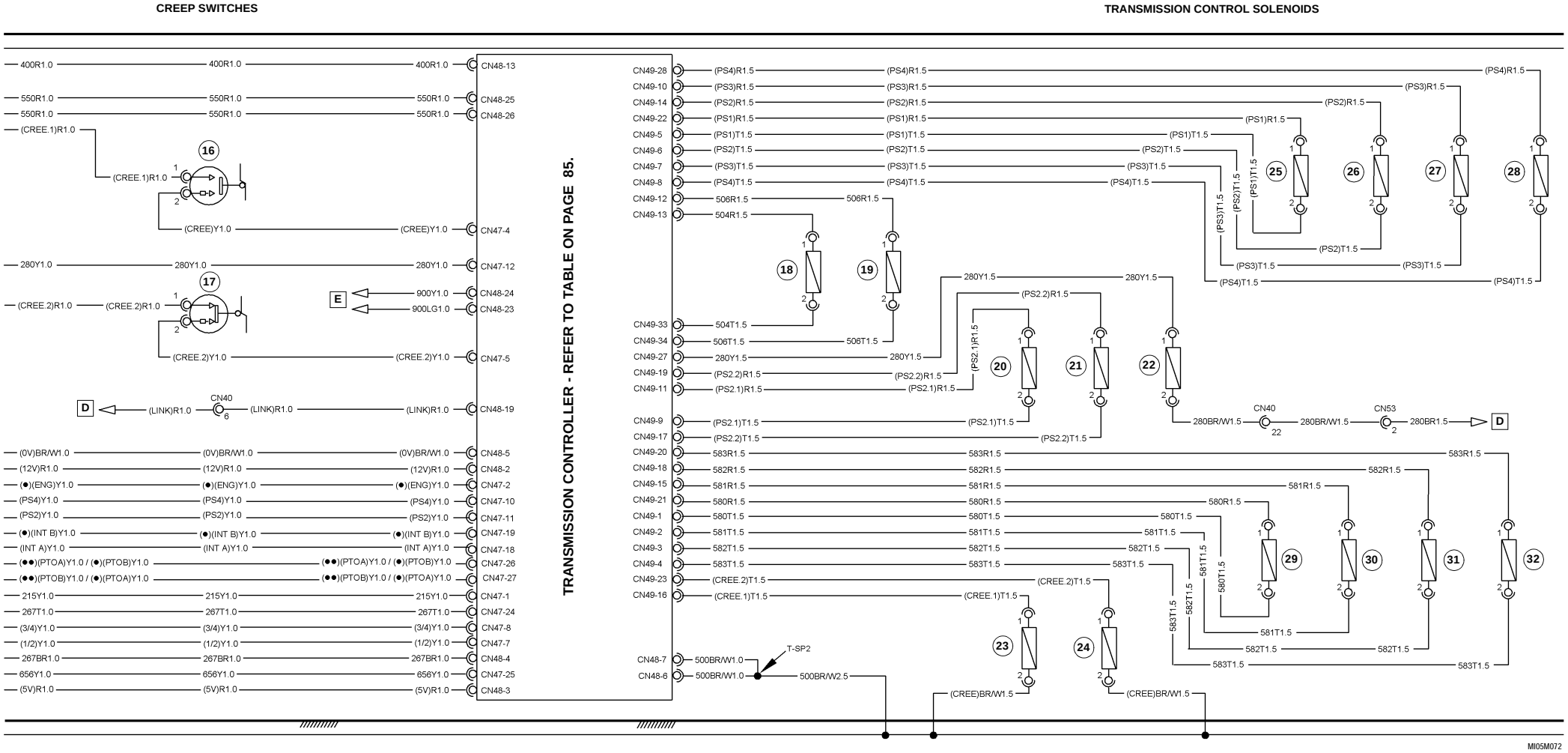
1. FUSE 34 (7.5 AMP)
2. FUSE 5 (7.5 AMP)
3. TRANSMISSION OIL TEMPERATURE SWITCH
4. CLUTCH PEDAL POSITION SENSOR
5. 1ST/2ND RANGE POSITION SENSOR
6. 3RD/4TH RANGE POSITION SENSOR
7. WHEEL SPEED SENSOR
8. PTO B SPEED SENSOR (REAR SENSOR)
9. PTO A SPEED SENSOR (FRONT SENSOR)
10. FORWARD/REVERSE SENSOR (INT A)
11. FORWARD/REVERSE SENSOR (INT B) (NOT USED)
12. HIGH/LOW CLUTCH SPEED SENSOR (PS2)
13. POWERSHIFT CLUTCH SPEED SENSOR (PS4)
14. ENGINE SPEED SENSOR (NOT USED)
15. PARK LOCK SWITCH
16. CREEP ENGAGED SWITCH (CREEP ON)
17. CREEP DISENGAGED SWITCH (CREEP OFF)
18. FORWARD CLUTCH SOLENOID
19. REVERSE CLUTCH SOLENOID
20. LOW CLUTCH SOLENOID (PS2-1)
21. HIGH CLUTCH SOLENOID (PS2-2)
22. PARK LOCK SOLENOID (IF EQUIPPED)
23. CREEP ENGAGE SOLENOID (CREEP ON)
24. CREEP DISENGAGE SOLENOID (CREEP OFF)
25. 1ST SPEED POWERSHIFT CLUTCH (PS4-1)
26. 2ND SPEED POWERSHIFT CLUTCH (PS4-2)
27. 3RD SPEED POWERSHIFT CLUTCH (PS4-3)
28. 4TH SPEED POWERSHIFT CLUTCH (PS4-4)
29. 1ST RANGE SOLENOID
30. 2ND RANGE SOLENOID
31. 3RD RANGE SOLENOID
32. 4TH RANGE SOLENOID

A. B+ FROM KEY SWITCH TERMINAL 3
B. TO HITCH CONTROLLER
C. TO 4TH AUXILIARY VALVE CONNECTOR (NOT USED)
D. TO CAB CONTROLLER
E. TO CAN BUS CIRCUIT

(■)- TRACTORS UP TO PIN JJE3500311
(■■)- TRACTORS FROM PIN JJE3500312
(●)- TRACTORS UP TO PIN JJE3500651
(●●)- TRACTORS FROM PIN JJE3500652

**NOTE:** *Only use a HIGH IMPEDANCE multimeter to test the switches and circuits. Do not use a test lamp or damage to the switches may occur.*

https://truckmanualshub.com/

https://truckmanualshub.com/


# CAB CONTROLLER SCHEMATIC CIRCUITS

## Cab Controller Pin Identification

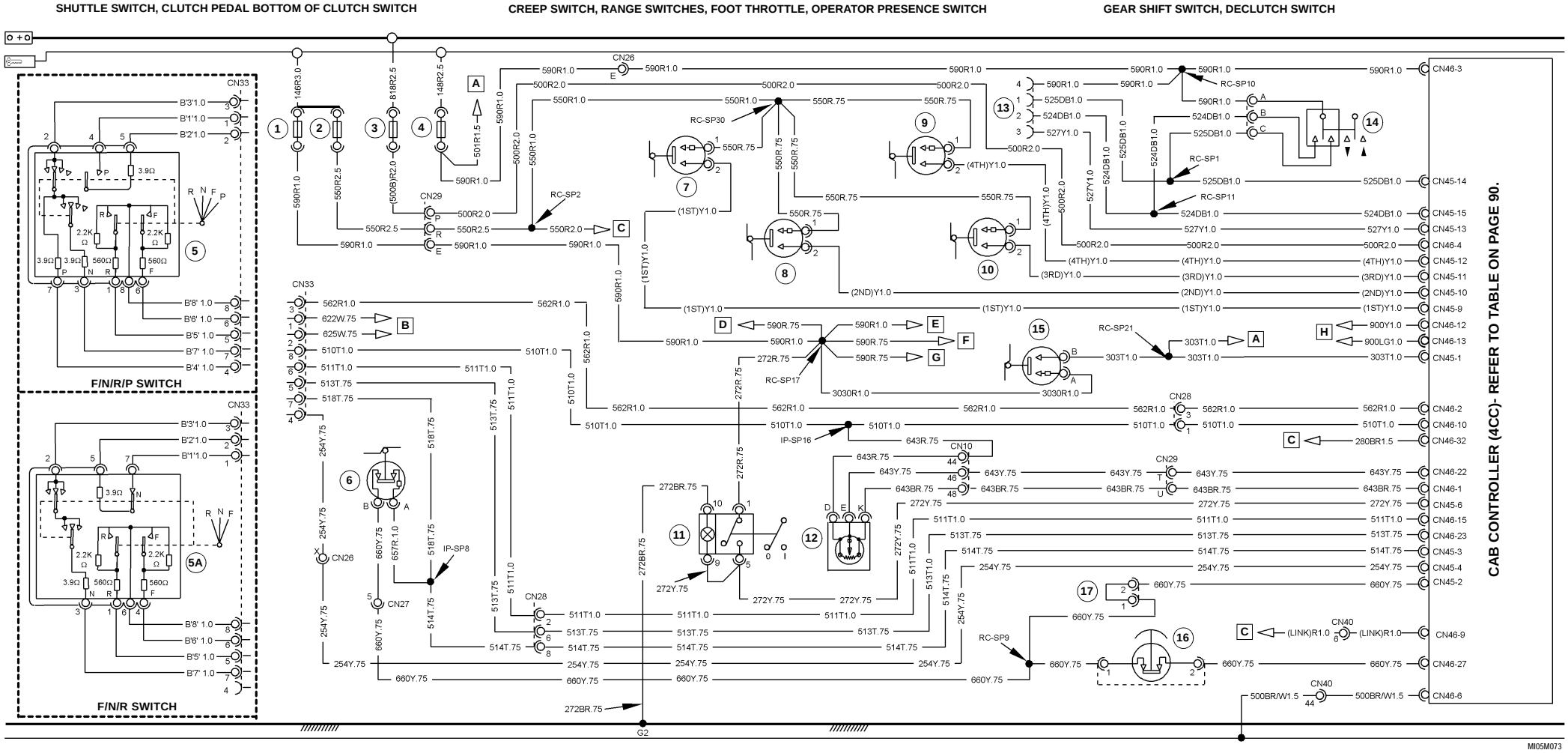
| CONNECTOR 45 (26 Pin) | | | |
|---|---|---|---|
| 1 | OPERATOR PRESENCE SIGNAL | 14 | GEAR SHIFT UP SIGNAL (XTRASPEED TRACTORS ONLY) |
| 2 | CLUTCH PEDAL BOTTOM OF CLUTCH SIGNAL | 15 | GEAR SHIFT DOWN SIGNAL (XTRASPEED TRACTORS ONLY) |
| 3 | NEUTRAL SIGNAL | 16 | NOT USED |
| 4 | PARK LOCK SIGNAL | 17 | NOT USED |
| 5 | NOT USED | 18 | NOT USED |
| 6 | CREEP ON SIGNAL | 19 | NOT USED |
| 7 | NOT USED | 20 | NOT USED |
| 8 | NOT USED | 21 | NOT USED |
| 9 | *1ST RANGE SIGNAL (XTRASPEED TRACTORS ONLY) | 22 | NOT USED |
| 10 | *2ND RANGE SIGNAL (XTRASPEED TRACTORS ONLY) | 23 | NOT USED |
| 11 | *3RD RANGE SIGNAL (XTRASPEED TRACTORS ONLY) | 24 | NOT USED |
| 12 | *4TH RANGE SIGNAL (XTRASPEED TRACTORS ONLY) | 25 | NOT USED |
| 13 | RANGE SKIP SIGNAL (XTRASPEED - E AND E PLUS TRACTORS ONLY) | 26 | NOT USED |

(*) Not Used On Tractors From Pin JJE3500646.

| CONNECTOR 46 (34 Pin) | | | |
|---|---|---|---|
| 1 | THROTTLE 0 VOLT (REFERENCE) | 18 | NOT USED |
| 2 | NEUTRAL OR NEUTRAL/PARK B+ | 19 | NOT USED |
| 3 | 12 VOLT SWITCHED POWER | 20 | NOT USED |
| 4 | 12 VOLT UNSWITCHED BATTERY POWER | 21 | NOT USED |
| 5 | HAND THROTTLE (XTRASPEED - E AND E PLUS TRACTORS ONLY) | 22 | FOOT THROTTLE SIGNAL |
| | | 23 | REVERSE SIGNAL |
| 6 | 0 VOLT (CLEAN GROUND) | 24 | NOT USED |
| 7 | NOT USED | 25 | NOT USED |
| 8 | NOT USED | 26 | NOT USED |
| 9 | FORWARD/REVERSE ENABLE 12 VOLT SUPPLY (OUTPUT) | 27 | FORWARD/REVERSE ENABLE, DECLUTCH SIGNAL |
| 10 | THROTTLE, FORWARD/REVERSE 5 VOLT (REFERENCE) | 28 | NOT USED |
| 11 | NOT USED | 29 | NOT USED |
| 12 | CAN HIGH | 30 | NOT USED |
| 13 | CAN LOW | 31 | NOT USED |
| 14 | NOT USED | 32 | PARK LOCK SOLENOID RETURN |
| 15 | FORWARD SIGNAL | 33 | NOT USED |
| 16 | NOT USED | 34 | NOT USED |
| 17 | NOT USED | | |

https://truckmanualshub.com/


## Cab Controller Schematic Circuit (For XtraSpeed Tractors up to PIN JJE3500311)




### Key

1. FUSE 33 (7.5 AMP)
2. FUSE 34 (7.5 AMP)
3. FUSE 38 (7.5 AMP)
4. FUSE 27 (7.5 AMP)
5. FORWARD/NEUTRAL/REVERSE /PARK SWITCH (IF EQUIPPED)

5A. FORWARD/NEUTRAL/REVERSE SWITCH (IF EQUIPPED)

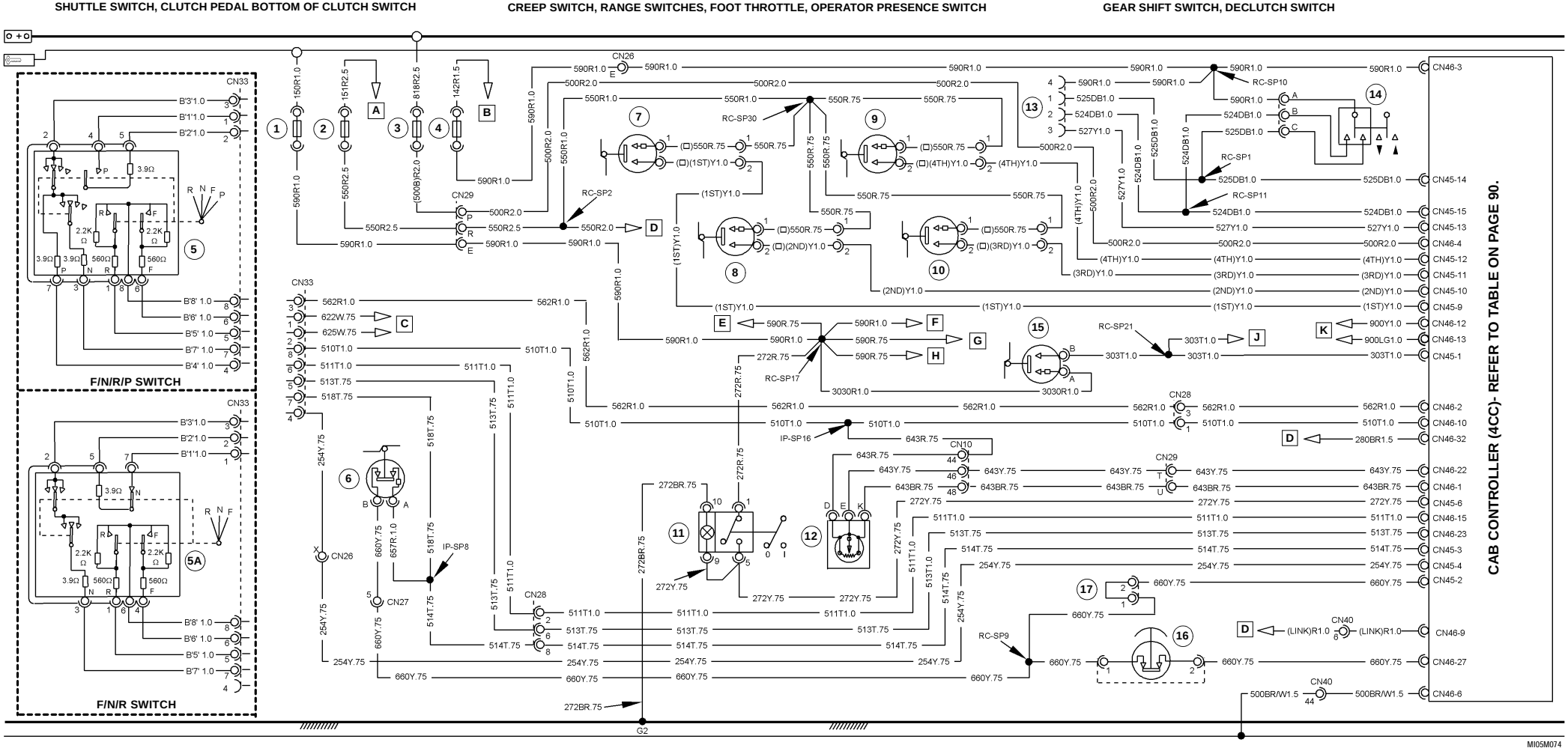
6. CLUTCH PEDAL BOTTOM OF CLUTCH SWITCH
7. 1ST RANGE SWITCH
8. 2ND RANGE SWITCH
9. 3RD RANGE SWITCH
10. 4TH RANGE SWITCH
11. CREEP SWITCH (IF EQUIPPED)
12. FOOT THROTTLE POTENTIOMETER
13. MULTI FUNCTION LEVER CONNECTOR (NOT USED
14. GEAR SHIFT SWITCH
15. OPERATOR PRESENCE SWITCH
16. DECLUTCH SWITCH
17. JUMPER LEAD CONNECTOR (WITH JUMPER LEAD) SEE IMPORTANT

A. TO HITCH CONTROLLER CIRCUIT
B. TO NEUTRAL START CIRCUIT
C. TO TRANSMISSION CONTROLLER CIRCUIT
D. TO PTO SWITCH
E. TO AUDIBLE ALARM
F. TO 540/1000 PTO SWITCH
G. TO PTO INDICATOR LIGHT
H. TO CAN BUS CIRCUIT

**NOTE:** *Only use a HIGH IMPEDANCE multimeter to test the switches and circuits. Do not use a test lamp or damage to the switches may occur.*

**IMPORTANT:** *The same right hand console harness is used for both XtraSpeed and XtraSpeed - E tractors. For XtraSpeed tractors the clutch pedal bottom of clutch signal circuit must be connected to the cab controller at connector 45 pin 2 (through the jumper lead) and to connector 46 pin 27 (through the declutch switch).*

## Cab Controller Schematic Circuit (For XtraSpeed Tractors from PIN JJE3500312 to JJE3500982)




## Key

1. FUSE 33 (7.5 AMP)
2. FUSE 34 (7.5 AMP)
3. FUSE 38 (7.5 AMP)
4. FUSE 27 (7.5 AMP)
5. FORWARD/NEUTRAL/REVERSE /PARK SWITCH (IF EQUIPPED)

5A. FORWARD/NEUTRAL/REVERSE SWITCH (IF EQUIPPED)

6. CLUTCH PEDAL BOTTOM OF CLUTCH SWITCH
7. 1ST RANGE SWITCH
8. 2ND RANGE SWITCH
9. 3RD RANGE SWITCH
10. 4TH RANGE SWITCH
11. CREEP SWITCH (IF EQUIPPED)
12. FOOT THROTTLE POTENTIOMETER
13. MULTI FUNCTION LEVER CONNECTOR (NOT USED)
14. GEAR SHIFT SWITCH
15. OPERATOR PRESENCE SWITCH
16. DECLUTCH SWITCH
17. JUMPER LEAD CONNECTOR (WITH JUMPER LEAD) SEE IMPORTANT

A. B+ FROM KEY SWITCH TERMINAL 3
B. B+ FROM KEY SWITCH TERMINAL 5
C. TO NEUTRAL START CIRCUIT
D. TO TRANSMISSION CONTROLLER CIRCUIT
E. TO PTO SWITCH
F. TO AUDIBLE ALARM
G. TO 540/1000 PTO SWITCH
H. TO PTO INDICATOR LIGHT
J. TO HITCH CONTROLLER CIRCUIT
K. TO CAN BUS CIRCUIT

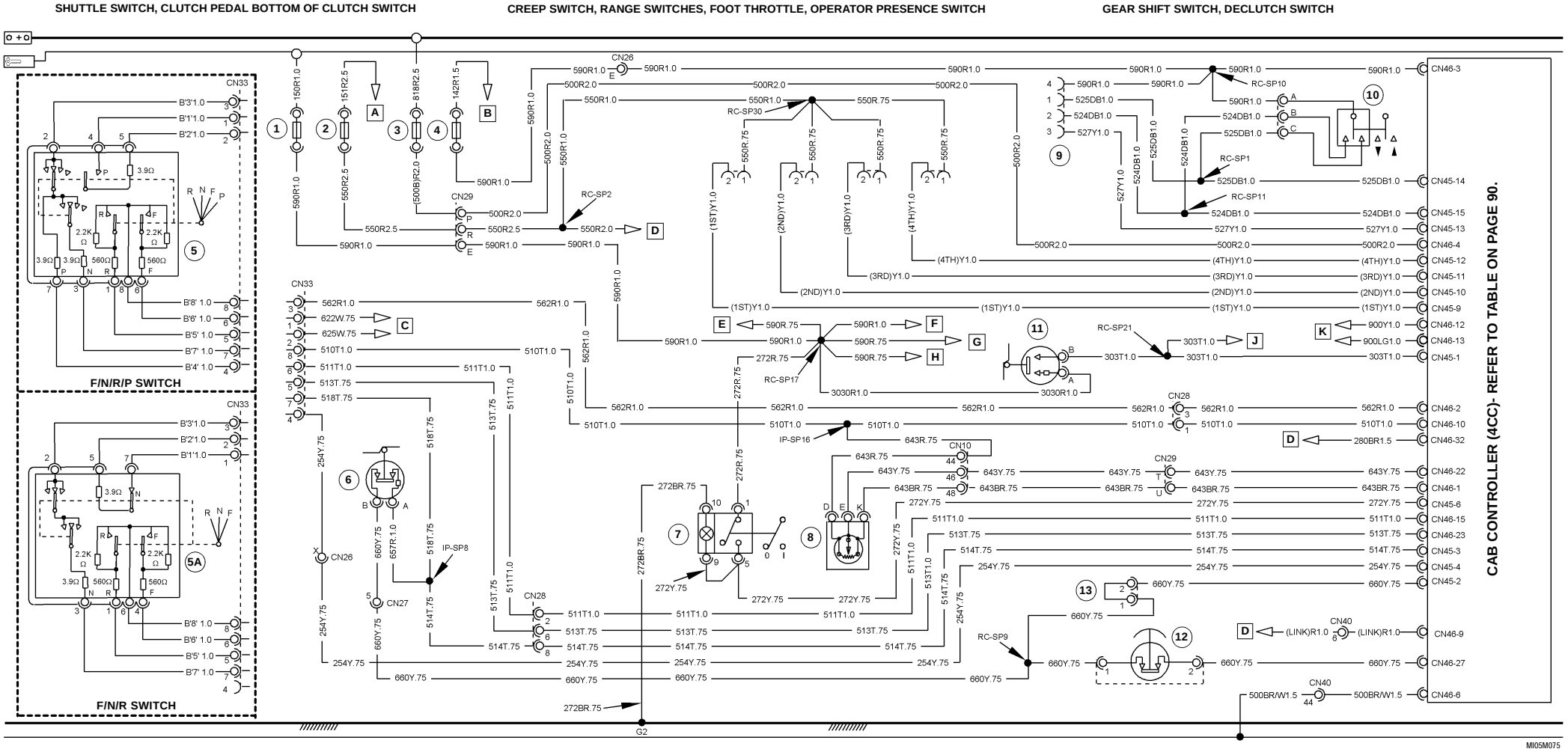
(□)ADAPTER HARNESS - TRACTORS FROM PIN JJE3500445

**NOTE:** *Only use a HIGH IMPEDANCE multimeter to test the switches and circuits. Do not use a test lamp or damage to the switches may occur.*

**IMPORTANT:** *The same right hand console harness is used for both XtraSpeed and XtraSpeed - E tractors. For XtraSpeed tractors the clutch pedal bottom of clutch signal circuit must be connected to the cab controller at connector 45 pin 2 (through the jumper lead) and to connector 46 pin 27 (through the declutch switch).*

https://truckmanualshub.com/


## Cab Controller Schematic Circuit (For XtraSpeed Tractors from PIN JJE3500983)




### Key

1. FUSE 33 (7.5 AMP)
2. FUSE 34 (7.5 AMP)
3. FUSE 38 (7.5 AMP)
4. FUSE 27 (7.5 AMP)
5. FORWARD/NEUTRAL/REVERSE /PARK SWITCH (IF EQUIPPED)

5A. FORWARD/NEUTRAL/REVERSE SWITCH (IF EQUIPPED)

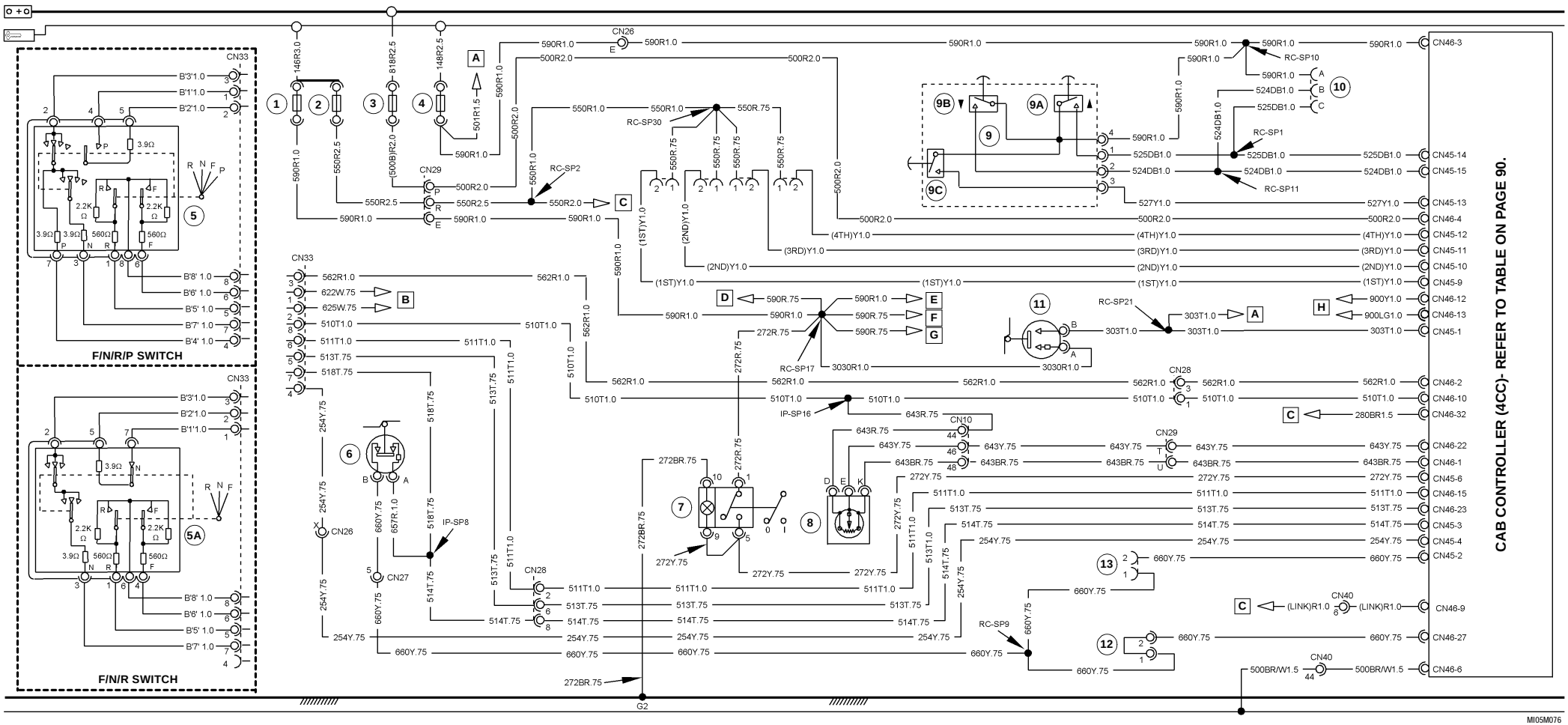
6. CLUTCH PEDAL BOTTOM OF CLUTCH SWITCH
7. CREEP SWITCH (IF EQUIPPED)
8. FOOT THROTTLE POTENTIOMETER
9. MULTI FUNCTION LEVER CONNECTOR (NOT USED
10. GEAR SHIFT SWITCH
11. OPERATOR PRESENCE SWITCH
12. DECLUTCH SWITCH
13. JUMPER LEAD CONNECTOR (WITH JUMPER LEAD) SEE IMPORTANT

A. B+ FROM KEY SWITCH TERMINAL 3
B. B+ FROM KEY SWITCH TERMINAL 5
C. TO NEUTRAL START CIRCUIT
D. TO TRANSMISSION CONTROLLER CIRCUIT
E. TO PTO SWITCH
F. TO AUDIBLE ALARM
G. TO 540/1000 PTO SWITCH
H. TO PTO INDICATOR LIGHT
J. TO HITCH CONTROLLER CIRCUIT
K. TO CAN BUS CIRCUIT

**NOTE:** *Only use a HIGH IMPEDANCE multimeter to test the switches and circuits. Do not use a test lamp or damage to the switches may occur.*

**IMPORTANT:** *The same right hand console harness is used for both XtraSpeed and XtraSpeed - E tractors. For XtraSpeed tractors the clutch pedal bottom of clutch signal circuit must be connected to the cab controller at connector 45 pin 2 (through the jumper lead) and to connector 46 pin 27 (through the declutch switch).*

## Cab Controller Schematic Circuit (For XtraSpeed - E Tractors up to PIN JJE3500311)




### Key

1. FUSE 33 (7.5 AMP)
2. FUSE 34 (7.5 AMP)
3. FUSE 38 (7.5 AMP)
4. FUSE 27 (7.5 AMP)
5. FORWARD/NEUTRAL/REVERSE /PARK SWITCH (IF EQUIPPED)

5A. FORWARD/NEUTRAL/REVERSE SWITCH (IF EQUIPPED)

6. CLUTCH PEDAL BOTTOM OF CLUTCH SWITCH
7. CREEP SWITCH (IF EQUIPPED)
8. FOOT THROTTLE POTENTIOMETER
9. MULTI FUNCTION LEVER

9A. GEAR UP SHIFT SWITCH

9B. GEAR DOWN SHIFT SWITCH

9C. RANGE SKIP SWITCH

10. GEAR SHIFT SWITCH CONNECTOR (NOT USED)
11. OPERATOR PRESENCE SWITCH
12. DECLUTCH SWITCH CONNECTOR (WITH JUMPER LEAD) SEE IMPORTANT
13. JUMPER LEAD CONNECTOR (WITHOUT JUMPER LEAD) SEE IMPORTANT

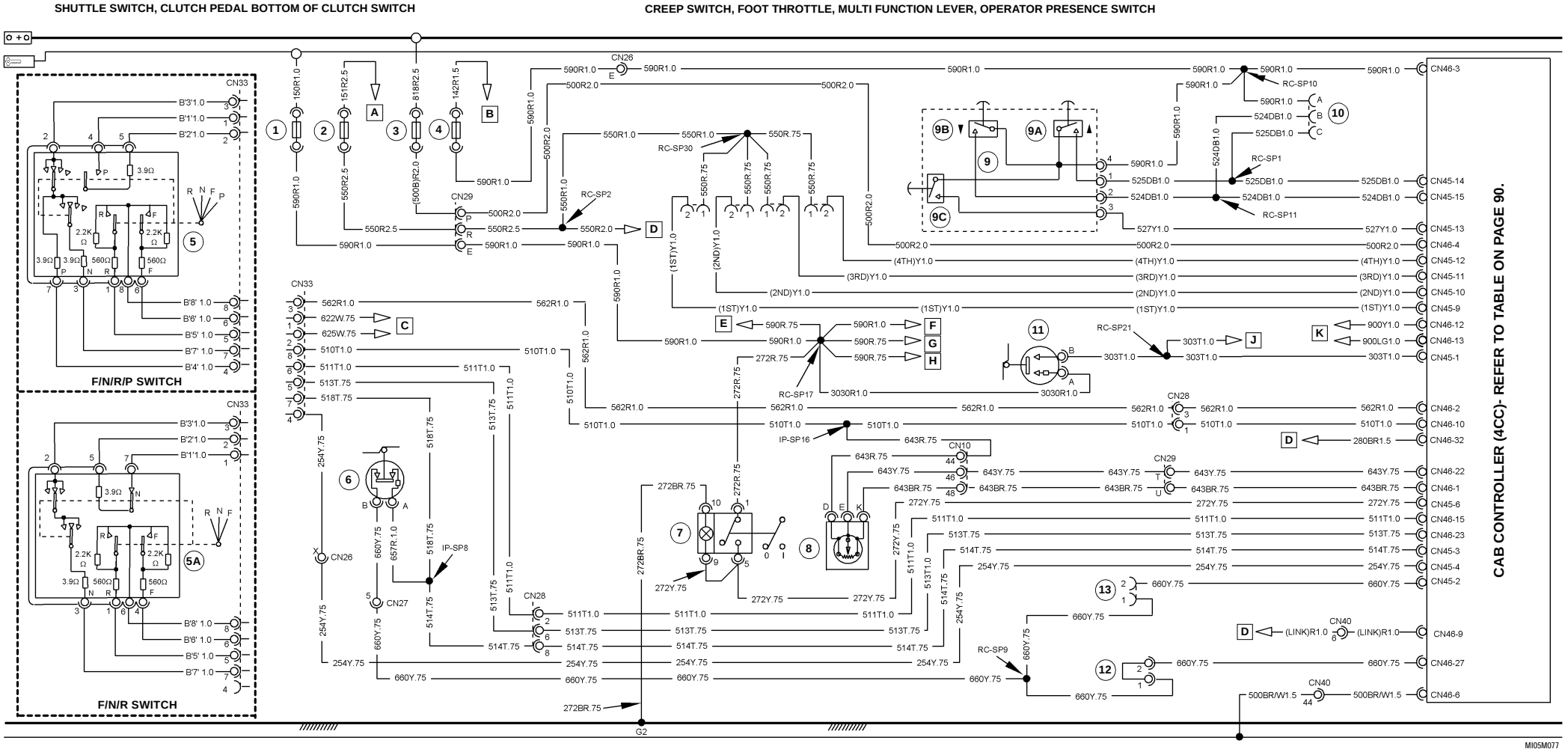
A. TO HITCH CONTROLLER CIRCUIT
B. TO NEUTRAL START CIRCUIT
C. TO TRANSMISSION CONTROLLER CIRCUIT
D. TO PTO SWITCH
E. TO AUDIBLE ALARM
F. TO 540/1000 PTO SWITCH
G. TO PTO INDICATOR LIGHT
H. TO CAN BUS CIRCUIT

**NOTE:** *Only use a HIGH IMPEDANCE multimeter to test the switches and circuits. Do not use a test lamp or damage to the switches may occur.*

**IMPORTANT:** *The same right hand console harness is used for both XtraSpeed and XtraSpeed - E tractors. For XtraSpeed - E tractors the clutch pedal bottom of clutch signal circuit MUST ONLY be connected to the cab controller at connector 46 pin 27 (through the jumper lead connected to the declutch switch connector). The connection to the cab controller at connector 45 pin 2 remains OPEN.*

https://truckmanualshub.com/


## Cab Controller Schematic Circuit (For XtraSpeed - E Tractors from PIN JJE3500312 to JJE3500983)




### Key

1. FUSE 33 (7.5 AMP)
2. FUSE 34 (7.5 AMP)
3. FUSE 38 (7.5 AMP)
4. FUSE 27 (7.5 AMP)
5. FORWARD/NEUTRAL/REVERSE /PARK SWITCH (IF EQUIPPED)

5A. FORWARD/NEUTRAL/REVERSE SWITCH (IF EQUIPPED)

6. CLUTCH PEDAL BOTTOM OF CLUTCH SWITCH
7. CREEP SWITCH (IF EQUIPPED)
8. FOOT THROTTLE POTENTIOMETER
9. MULTI FUNCTION LEVER

9A. GEAR UP SHIFT SWITCH

9B. GEAR DOWN SHIFT SWITCH

9C. RANGE SKIP SWITCH

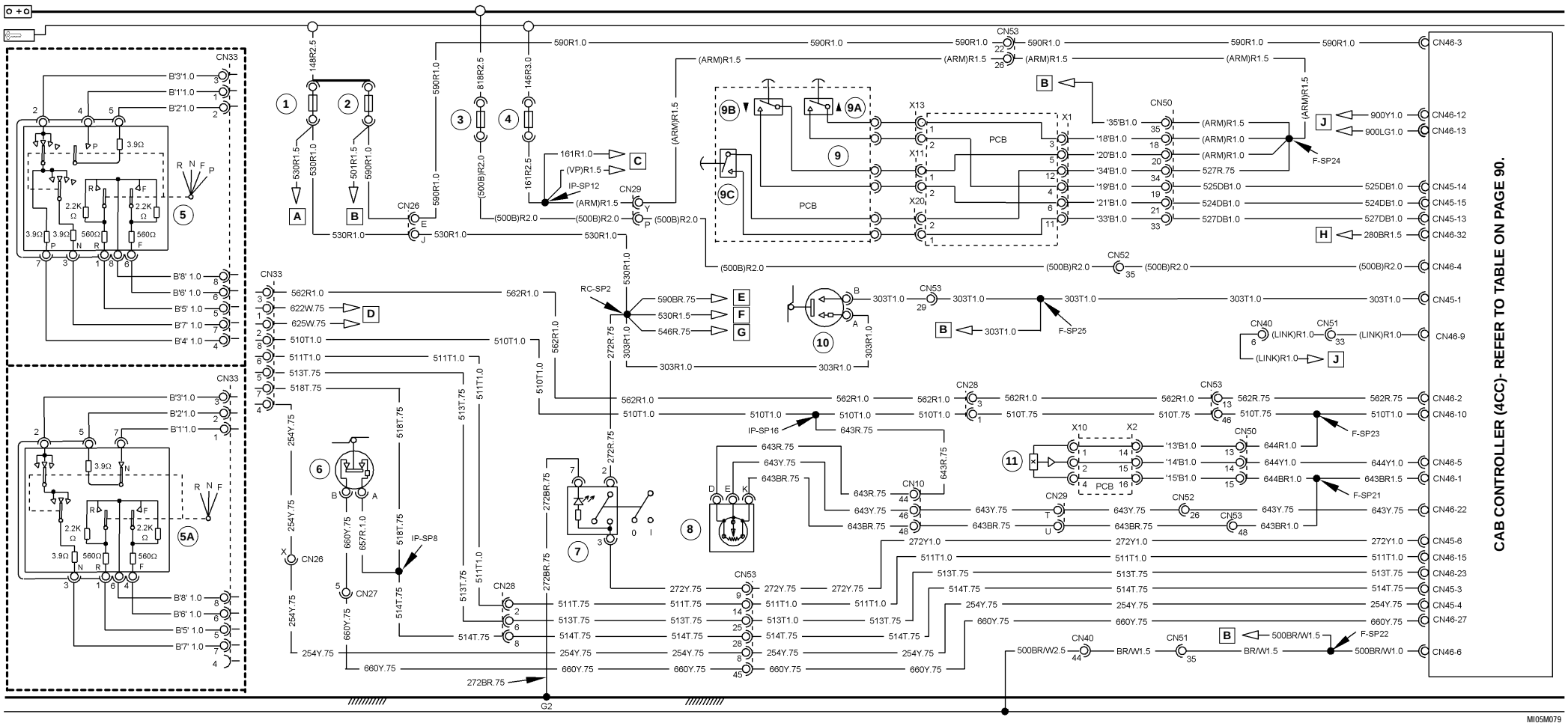
10. GEAR SHIFT SWITCH CONNECTOR (NOT USED)
11. OPERATOR PRESENCE SWITCH
12. DECLUTCH SWITCH CONNECTOR (WITH JUMPER LEAD) SEE IMPORTANT
13. JUMPER LEAD CONNECTOR (WITHOUT JUMPER LEAD) SEE IMPORTANT

A. B+ FROM KEY SWITCH TERMINAL 3
B. B+ FROM KEY SWITCH TERMINAL 5
C. TO NEUTRAL START CIRCUIT
D. TO TRANSMISSION CONTROLLER CIRCUIT
E. TO PTO SWITCH
F. TO AUDIBLE ALARM
G. TO 540/1000 PTO SWITCH
H. TO PTO INDICATOR LIGHT
J. TO HITCH CONTROLLER CIRCUIT
K. TO CAN BUS CIRCUIT

**NOTE:** *Only use a HIGH IMPEDANCE multimeter to test the switches and circuits. Do not use a test lamp or damage to the switches may occur.*

**IMPORTANT:** *The same right hand console harness is used for both XtraSpeed and XtraSpeed - E tractors. For XtraSpeed - E tractors the clutch pedal bottom of clutch signal circuit MUST ONLY be connected to the cab controller at connector 46 pin 27 (through the jumper lead connected to the declutch switch connector). The connection to the cab controller at connector MI04m090 remains OPEN.*

## Cab Controller Schematic Circuit (For XtraSpeed - E Plus Tractors up to PIN JJE3500311)




### Key

1. FUSE 26 (30 AMP)
2. FUSE 27 (7.5 AMP)
3. FUSE 38 (7.5 AMP)
4. FUSE 35 (7.5 AMP)
5. FORWARD/NEUTRAL/REVERSE /PARK SWITCH (IF EQUIPPED)

5A. FORWARD/NEUTRAL/REVERSE SWITCH (IF EQUIPPED)

6. CLUTCH PEDAL BOTTOM OF CLUTCH SWITCH
7. CREEP SWITCH (IF EQUIPPED)
8. FOOT THROTTLE POTENTIOMETER
9. MULTI FUNCTION LEVER

9A. GEAR UP SHIFT SWITCH

9B. GEAR DOWN SHIFT SWITCH

9C. RANGE SKIP SWITCH

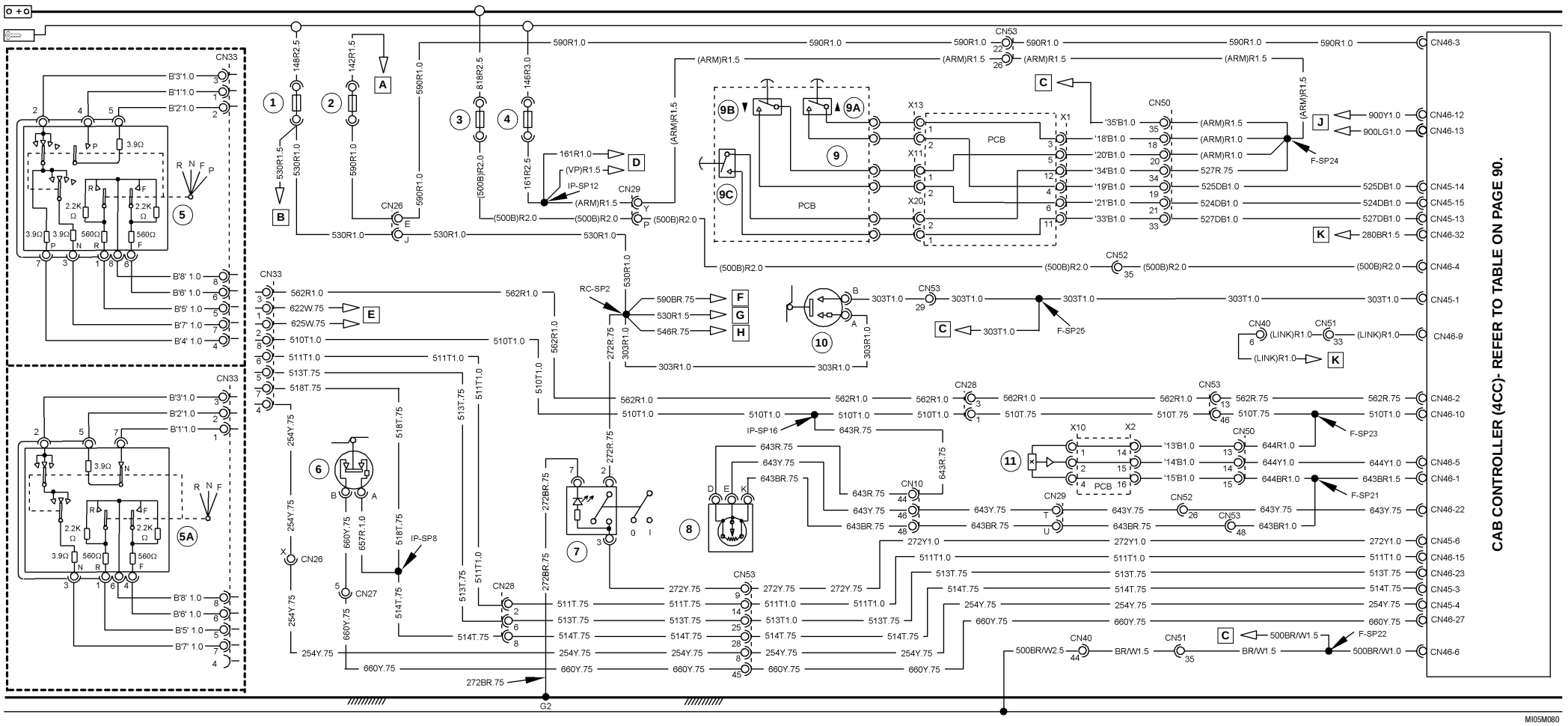
10. OPERATOR PRESENCE SWITCH
11. HAND THROTTLE

A. TO BRAKE PEDAL SWITCHES
B. TO HITCH CONTROLLER
C. TO AUXILIARY/REMOTE VALVE CONTROLLER CIRCUIT
D. TO NEUTRAL START CIRCUIT
E. TO AUDIBLE ALARM
F. TO MFD SWITCH
G. TO DIFFERENTIAL LOCK SWITCH
H. TO CAN BUS CIRCUIT
J. TO TRANSMISSION CONTROLLER

**NOTE:** *Only use a HIGH IMPEDANCE multimeter to test the switches and circuits. Do not use a test lamp or damage to the switches may occur.*

https://truckmanualshub.com/


## Cab Controller Schematic Circuit (For XtraSpeed - E Plus Tractors from PIN JJE3500312)




### Key

1. FUSE 26 (30 AMP)
2. FUSE 27 (7.5 AMP)
3. FUSE 38 (7.5 AMP)
4. FUSE 35 (7.5 AMP)
5. FORWARD/NEUTRAL/REVERSE /PARK SWITCH (IF EQUIPPED)

5A. FORWARD/NEUTRAL/REVERSE SWITCH (IF EQUIPPED)

6. CLUTCH PEDAL BOTTOM OF CLUTCH SWITCH
7. CREEP SWITCH (IF EQUIPPED)
8. FOOT THROTTLE POTENTIOMETER
9. MULTI FUNCTION LEVER

9A. GEAR UP SHIFT SWITCH
9B. GEAR DOWN SHIFT SWITCH
9C. RANGE SKIP SWITCH

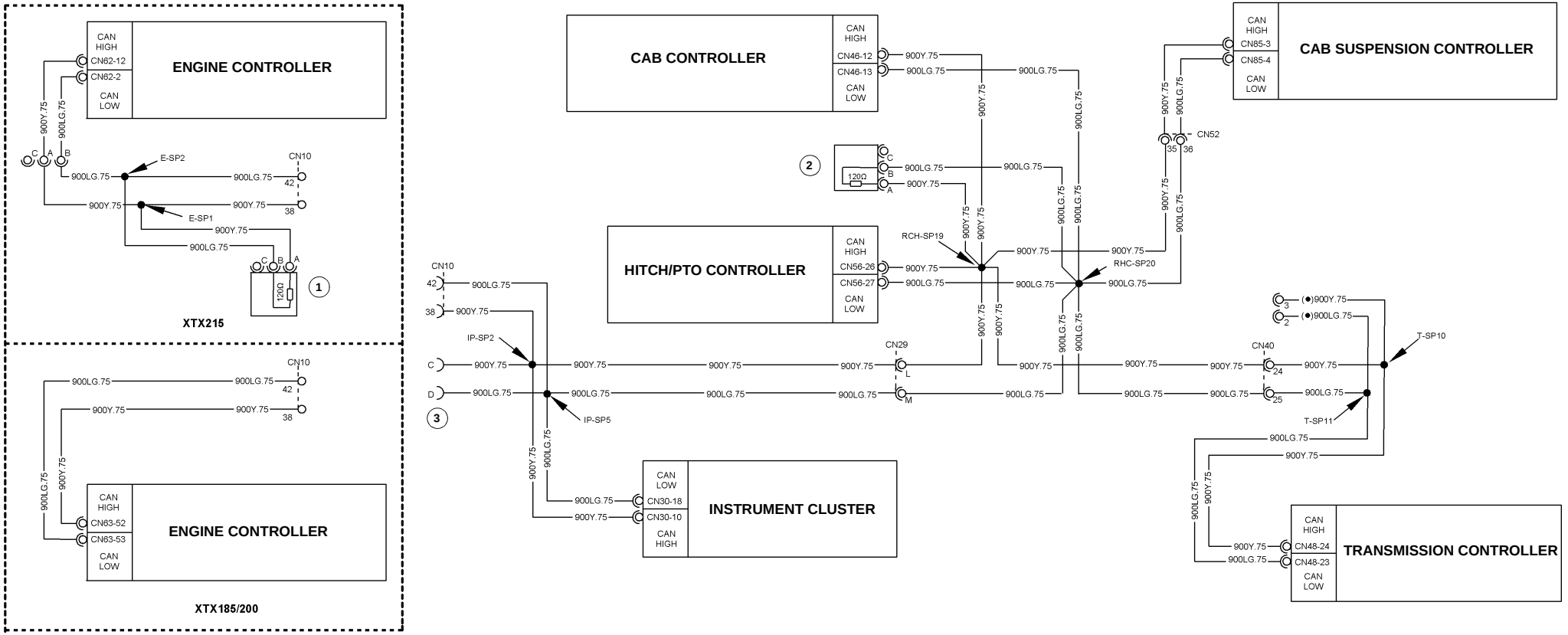
10. OPERATOR PRESENCE SWITCH
11. HAND THROTTLE

A. B+ FROM KEY SWITCH TERMINAL 5
B. TO BRAKE PEDAL SWITCHES
C. TO HITCH CONTROLLER CIRCUIT
D. TO AUXILIARY/REMOTE VALVE CONTROLLER CIRCUIT
E. TO NEUTRAL START CIRCUIT
F. TO AUDIBLE ALARM
G. TO MFD SWITCH
H. TO DIFFERENTIAL LOCK SWITCH
J. TO CAN BUS CIRCUIT
K. TO TRANSMISSION CONTROLLER CIRCUIT

**NOTE:** *Only use a HIGH IMPEDANCE multimeter to test the switches and circuits. Do not use a test lamp or damage to the switches may occur.*

# CAN BUS SCHEMATIC CIRCUITS

## CAN Bus Schematic Circuit (For XtraSpeed and XtraSpeed - E Tractors)




MI05H029

### Key

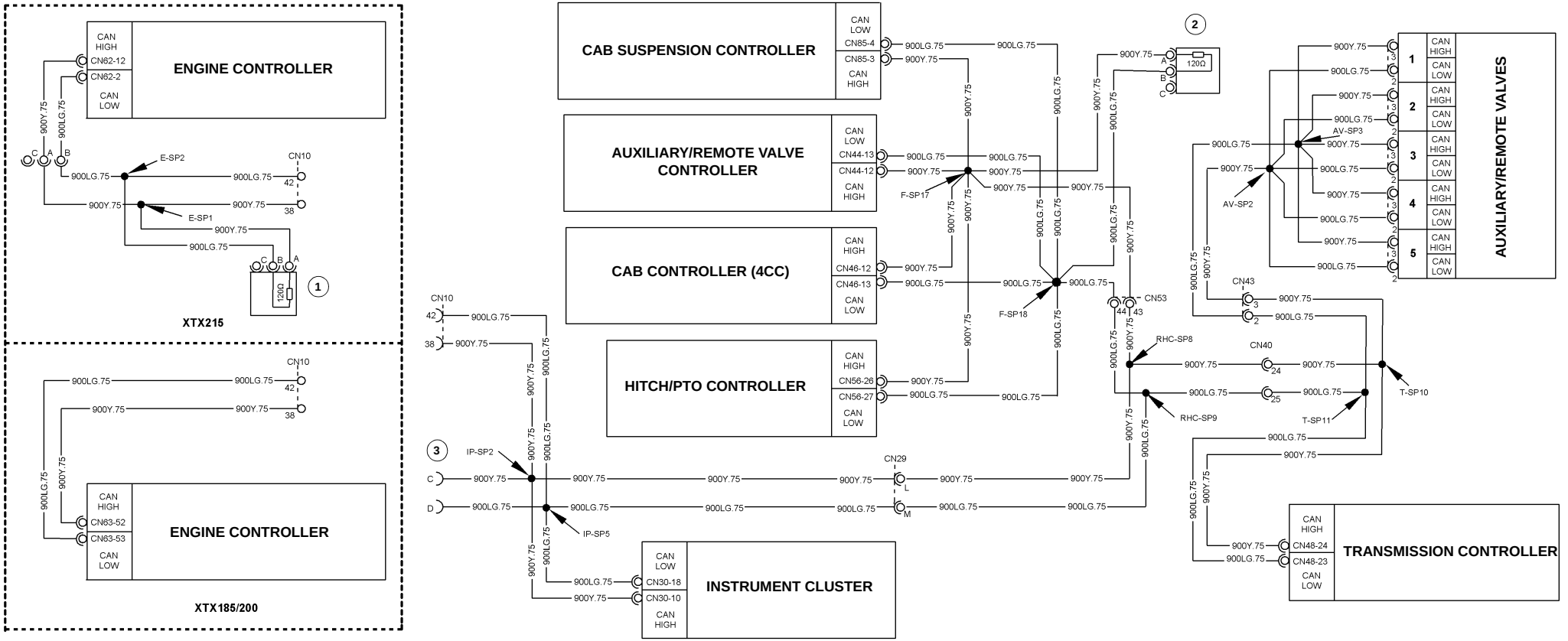
1. ENGINE HARNESS TERMINATION RESISTOR (XTX215 TRACTORS ONLY)
2. TRANSMISSION HARNESS TERMINATION RESISTOR
3. DIAGNOSTIC CONNECTOR (9 PIN)

(●) - TRACTORS UP TO PIN JJE3500646 ONLY

**NOTE:** *For XTX185 and XTX200 tractors the engine harness termination resistor is located within the engine controller.*

https://truckmanualshub.com/


## CAN Bus Schematic Circuit (For XTX Series XtraSpeed - E Plus Tractors)




MI05H0309

### Key

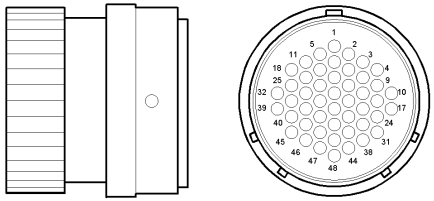
1. ENGINE HARNESS TERMINATION RESISTOR (XTX215 TRACTORS ONLY)
2. TRANSMISSION HARNESS TERMINATION RESISTOR
3. DIAGNOSTIC CONNECTOR (9 PIN)

**NOTE:** *For XTX185 and XTX200 tractors the engine harness termination resistor is located within the engine controller.*

# MAIN CONNECTORS

## Connector 10 - XTX185 and XTX200 Series Tractors Only

**Location: Cab Firewall**




MI05F174

**ENGINE TO INSTRUMENT PANEL HARNESS (ENGINE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 802 O | A/C HIGH PRESSURE SWITCH |
| 2 | 624 W | ENGINE CONTROLLER NEUTRAL START B+ SUPPLY |
| 3 | 804 O | A/C HIGH PRESSURE SWITCH |
| 4 | 162 R | UNSWITCHED B+ - CLOCK, RADIO AND INSTRUMENT CLUSTER |
| 5 | 200 Y | INSTRUMENT CLUSTER CLEAN GROUND (BATTERY - TERMINAL) |
| 6 | 803 O | A/C COMPRESSOR CLUTCH |
| 7 | - - - - - | OPEN |
| 8 | - - - - - | OPEN |
| 9 | 231 Y | COOLANT LEVEL |
| 10 | - - - - - | OPEN |
| 11 | - - - - - | OPEN |
| 12 | - - - - - | OPEN |
| 13 | 266 Y | AIR FILTER RESTRICTION SWITCH |
| 14 | 121 Y | ALTERNATOR D+ TERMINAL, WARNING LIGHT AND EXCITE |
| 15 | 829 BR/W | ATC CLEAN GROUND |
| 16 | 890 R | HORN B+ |
| 17 | 890 BR | HORN GROUND |
| 18 | 829 BR/W | ATC CLEAN GROUND |
| 19 | 738 P | RH HEADLIGHT - LOW BEAM |
| 20 | 741 P | RH HEADLIGHT - HIGH BEAM |
| 21 | 658 W | WATER IN FUEL |
| 22 | 737 P | LH HEADLIGHT - LOW BEAM |
| 23 | 740 P | LH HEADLIGHT - HIGH BEAM |

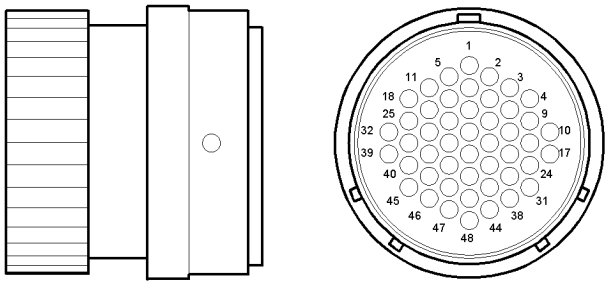
| Cavity | Wire No | Circuit |
|---|---|---|
| 24 | - - - - - | OPEN |
| 25 | 280 BR | RADAR GROUND |
| 26 | 281 Y | RADAR SIGNAL |
| 27 | 280 R | RADAR B+ |
| 28 | 282 Y | RADAR PRESENT |
| 29 | - - - - - | OPEN |
| 30 | - - - - - | OPEN |
| 31 | 784 V | WORK LIGHTS |
| 32 | - - - - - | OPEN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |
| 35 | - - - - - | OPEN |
| 36 | - - - - - | OPEN |
| 37 | - - - - - | OPEN |
| 38 | 900 Y | CAN HIGH |
| 39 | - - - - - | OPEN |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | 900 LG | CAN LOW |
| 43 | - - - - - | OPEN |
| 44 | 643 R | FOOT THROTTLE 5V SUPPLY |
| 45 | 600 W | ENGINE CONTROLLER SWITCHED B+ |
| 46 | 643 Y | FOOT THROTTLE SIGNAL |
| 47 | 900 BR | K - LINE |
| 48 | 643 BR | FOOT THROTTLE 0V RETURN |

https://truckmanualshub.com/



## Connector 10 - XTX215 Series Tractors Only

**Location: Cab Firewall**




MI05F174

**ENGINE TO INSTRUMENT PANEL HARNESS (ENGINE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 802 O | A/C HIGH PRESSURE SWITCH |
| 2 | 625 W | STARTER RELAY NEUTRAL START B+ SUPPLY |
| 3 | 804 O | A/C HIGH PRESSURE SWITCH |
| 4 | 162 R | UNSWITCHED B+ - CLOCK, RADIO AND INSTRUMENT CLUSTER |
| 5 | 200 BR/W | INSTRUMENT CLUSTER CLEAN GROUND (BATTERY - TERMINAL) |
| 6 | 803 O | A/C COMPRESSOR CLUTCH |
| 7 | - - - - - | OPEN |
| 8 | - - - - - | OPEN |
| 9 | 231 Y | COOLANT LEVEL |
| 10 | - - - - - | OPEN |
| 11 | 235 V | NOT USED |
| 12 | 654 W | NOT USED |
| 13 | 266 Y | AIR FILTER RESTRICTION SWITCH |
| 14 | 121 Y | ALTERNATOR D+ TERMINAL, WARNING LIGHT AND EXCITE |
| 15 | 829 BR/W | ATC CLEAN GROUND |
| 16 | 890 R | HORN B+ |
| 17 | 890 BR | HORN GROUND |
| 18 | 828 BR/W | ATC CLEAN GROUND |
| 19 | 738 P | RH HEADLIGHT - LOW BEAM |
| 20 | 741 P | RH HEADLIGHT - HIGH BEAM |
| 21 | - - - - - | OPEN |
| 22 | 737 P | LH HEADLIGHT - LOW BEAM |
| 23 | 740 P | LH HEADLIGHT - HIGH BEAM |

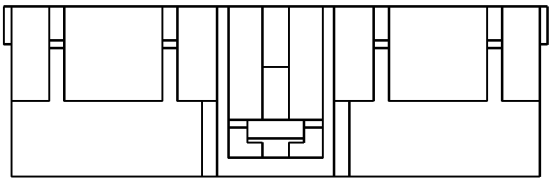
| Cavity | Wire No | Circuit |
|---|---|---|
| 24 | - - - - - | OPEN |
| 25 | 280 BR | RADAR GROUND |
| 26 | 281 Y | RADAR SIGNAL |
| 27 | 280 R | RADAR B+ |
| 28 | 282 Y | RADAR PRESENT |
| 29 | - - - - - | OPEN |
| 30 | - - - - - | OPEN |
| 31 | 784 V | WORK LIGHTS |
| 32 | - - - - - | OPEN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |
| 35 | - - - - - | OPEN |
| 36 | 652 BR | NOT USED |
| 37 | - - - - - | OPEN |
| 38 | 900 Y | CAN HIGH |
| 39 | 653 BR | NOT USED |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | 900 LG | CAN LOW |
| 43 | - - - - - | OPEN |
| 44 | 643 R | FOOT THROTTLE 5V SUPPLY |
| 45 | 132 R | ENGINE CONTROLLER SWITCHED B+ |
| 46 | 643 Y | FOOT THROTTLE SIGNAL |
| 47 | - - - - - | OPEN |
| 48 | 643 BR | FOOT THROTTLE 0V RETURN |

https://truckmanualshub.com/



## Connector 26

**Location: Right Hand Console**



477I96

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

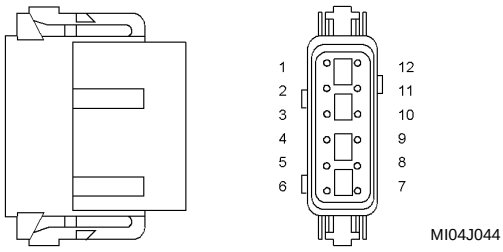
| Cavity | Wire No | Circuit |
|---|---|---|
| A | 590 BR | AUDIBLE ALARM |
| B | 707 P | LH TAIL/POSITION LIGHT |
| C | 708 P | RH TAIL/POSITION LIGHT |
| D | - - - - - | OPEN |
| E | 590 R | CAB CONTROLLER SWITCHED B+ |
| F | 501 R | HITCH/PTO CONTROLLER SWITCHED B+ |
| G | 784 V | REAR FENDER WORK LIGHTS |
| H | 810 R | SEAT B+ |
| J | 530 R | MFD AND DIFF LOCK B+ |
| K | 134 R | AUXILIARY POWER CONNECTOR SWITCHED B+ |
| L | 756 P | RH TURN SIGNAL |
| M | 757 P | LH TURN SIGNAL |
| N | (IIC) R | IIC UNSWITCHED POWER B+ |
| P | 133 R | AUXILIARY POWER FENDER HARNESS CONNECTOR (*)<br>7 PIN CONNECTOR (**) |
| R | 135 R | RH CONSOLE AUXILIARY POWER UNSWITCHED B+ |
| S | 817 R | CIGAR LIGHTER |
| T | 269 Y | PARK BRAKE WARNING LIGHT |
| U | 702 R | BRAKE RELAY B+ |
| V | - - - - - | OPEN |
| W | 785 V | REAR FOG LIGHTS (EUR) |
| X | 254 Y | PARK LOCK SIGNAL |
| Y | 276 LB | 1000 RPM PTO SWITCH |
| Z | (VP) R | AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ (XTRASPEED - E PLUS ONLY) |

*(*) European Specification Tractors Only.*

*(**) American Specification Tractors Only.*

## Connector 27

**Location: Right Hand Console**



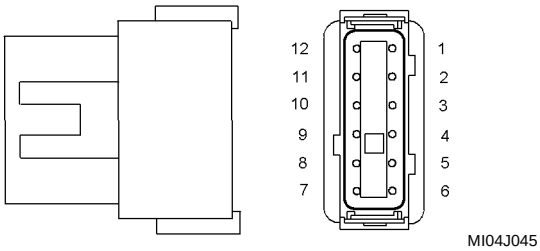

MI04J044

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 240 Y | AIR TRAILER BRAKE PRESSURE |
| 2 | 515 R | LOADER CONTROLS B+ |
| 3 | 656 Y | CLUTCH POSITION SIGNAL |
| 4 | - - - - - | OPEN |
| 5 | 660 Y | BOTTOM OF CLUTCH SIGNAL |
| 6 | 233 Y | FUEL LEVEL SENDER |
| 7 | 656 BR | CLUTCH POSITION RETURN |
| 8 | 656 R | CLUTCH POSITION B+ |
| 9 | 536 LB | LH BRAKE SIGNAL |
| 10 | 267 Y | HYDRAULIC FILTER RESTRICTION SWITCH |
| 11 | - - - - - | OPEN |
| 12 | - - - - - | OPEN |

## Connector 28

**Location: Right Hand Console**




MI04J045

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

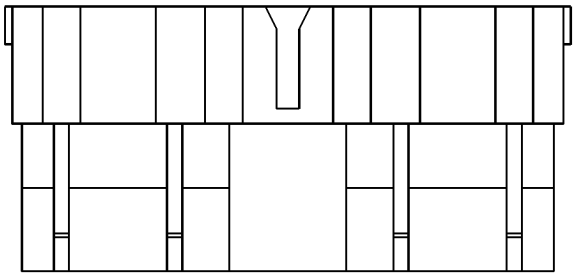
| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 510 T | F/N/R, FOOT THROTTLE 5V REF |
| 2 | 511 T | FORWARD SIGNAL |
| 3 | 562 R | F/N/R, F/N/R/P 12V SUPPLY |
| 4 | 606 W | IIC SWITCHED POWER SENSING |
| 5 | - - - - - | OPEN |
| 6 | 513 T | REVERSE SIGNAL |
| 7 | 531 LB | RH BRAKE SIGNAL |
| 8 | 514 T | NEUTRAL SIGNAL |
| 9 | - - - - - | OPEN |
| 10 | 281 Y | RADAR SIGNAL (HITCH) |
| 11 | 282 Y | RADAR PRESENT (IIC) |
| 12 | 563 LB | IMPLEMENT DOWN SWITCH |

https://truckmanualshub.com/



## Connector 29

### Location: Right Hand Console



478I96

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

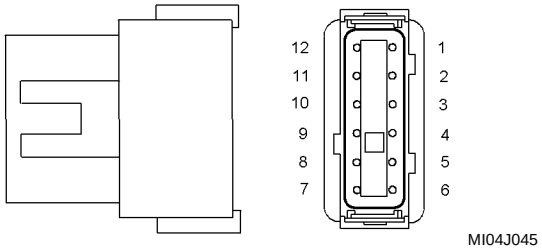
| Cavity | Wire No | Circuit |
|---|---|---|
| A | 835 O | FRONT WINDSCREEN WASHER |
| B | 845 O | REAR WINDSHIELD WASHER |
| C | 550 R | FRONT PTO B+ |
| D | 551 LB | FRONT PTO SIGNAL |
| E | 590 R | REAR PTO SWITCHED B+ |
| F | 161 R | (##) AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ |
| G | 134 R | IIIC SWITCHED POWER |
| H | 776 P | ROTARY BEACON LIGHT |
| J | 531 R | MFD AXLE SUSPENSION UNSWITCHED POWER |
| K | 530 R | MFD AXLE SUSPENSION SWITCHED POWER |
| L | 900 Y | CAN HIGH |
| M | 900 LG | CAN LOW |
| N | - - - - - | OPEN |
| P | 500B R | CAB CONTROLLER UNSWITCHED B+ |
| R | 550 R | TRANSMISSION CONTROLLER SWITCHED B+ |
| S | 400 R | TRANSMISSION CONTROLLER UNSWITCHED B+ |
| T | 643 Y | FOOT THROTTLE SIGNAL |
| U | 643 BR | FOOT THROTTLE 0V RETURN |
| V | 160 R | (##) AUXILIARY/REMOTE VALVE CONTROLLER UNSWITCHED B+ |
| W | - - - - - | OPEN |
| X | 660 W | (#) CAB SUSPENSION CONTROLLER SWITCHED B+ |
| | 660 R | (##) CAB SUSPENSION CONTROLLER SWITCHED B+ |
| Y | (ARM) R | (##) ARMREST SWITCHED B+ |
| Z | - - - - - | OPEN |

*(#) XtraSpeed and XtraSpeed - E tractors only.*

*(#) XtraSpeed - E Plus tractors only.*

## Connector 33

### Location: Instrument Panel




MI04J045

**INSTRUMENT PANEL TO SHUTTLE LEVER SWITCH (INSTRUMENT PANEL HARNESS SIDE)**

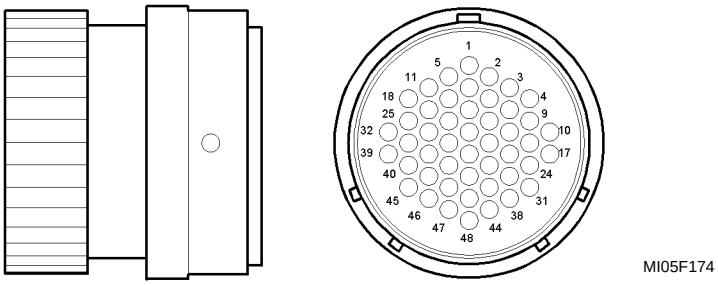
| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 622 W | NEUTRAL START |
| 2 | 625 W | NEUTRAL START |
| 3 | 562 R | F/N/R, F/N/R/P 12V SUPPLY |
| 4 | 254 Y | PARK LOCK SIGNAL |
| 5 | 513 T | REVERSE SIGNAL |
| 6 | 511 T | FORWARD SIGNAL |
| 7 | 518 T | NEUTRAL SIGNAL |
| 8 | 510 T | F/N/R 5V REF |
| 9 | 890 BR | HORN GROUND |
| 10 | 763 P | TURN SIGNAL COMMON |
| 11 | 757 P | RIGHT TURN SIGNAL |
| 12 | 756 P | LEFT TURN SIGNAL |

https://truckmanualshub.com/



## Connector 40

**Location: Cab Floor (Right Hand Console)**




MI05F174

**RIGHT HAND CONSOLE HARNESS TO TRANSMISSION HARNESS (TRANSMISSION HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 543 LB | MFD SOLENOID B+ |
| 2 | 233 Y | FUEL LEVEL SENDER |
| 3 | 507 R | +8 V POSITION POTENTIOMETER |
| 4 | 507 LB | POSITION SIGNAL |
| 5 | 507 BR | POSITION POTENTIOMETER LOW |
| 6 | (LINK) R | TRANSMISSION CONTROLLER TO CAB CONTROLLER LINK |
| 7 | 500 BR/W | HITCH CONTROLLER CLEAN GROUND |
| 8 | 269 Y | PARK BRAKE WARNING LIGHT |
| 9 | 539 LB | DIFF LOCK SOLENOID B+ |
| 10 | 511 R | HITCH SOLENOID B+ |
| 11 | 513 LB | HITCH RAISE SOLENOID |
| 12 | 514 R | HITCH PIN +8 VOLTS |
| 13 | 515 LB | LH HITCH PIN SIGNAL |
| 14 | 514 BR | HITCH PINS LOW |
| 15 | 514 LB | RH HITCH PIN SIGNAL |
| 16 | 540 R | 4TH AUXILIARY VALVE |
| 17 | 512 LB | HITCH LOWER SOLENOID |
| 18 | 215 Y | WHEEL SPEED SIGNAL |
| 19 | 597 LB | PTO SOLENOID B+ |
| 20 | 597 BR | PTO SOLENOID GROUND |
| 21 | 267 Y | HYDRAULIC FILTER SIGNAL |
| 22 | 280 BR/W | PARK LOCK RETURN |
| 23 | - - - - - | OPEN |
| 24 | 900 Y | CAN HIGH |
| 25 | 900 LG | CAN LOW |
| 26 | 224 Y | PTO SPEED SIGNAL |

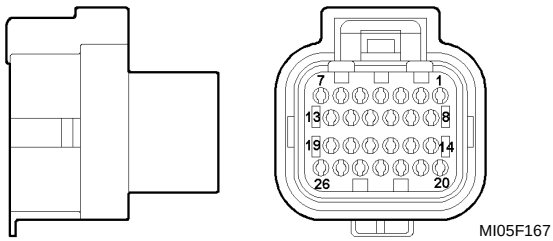
| Cavity | Wire No | Circuit |
|---|---|---|
| 27 | (4TH) Y | XTRASPEED TRACTORS FROM PIN JJE3500646 - NOT USED |
| 28 | - - - - - | OPEN |
| 29 | - - - - - | OPEN |
| 30 | 276 T | 540/1000 PTO SWITCH B+ |
| 31 | 240 Y | TRAILER BRAKE PRESSURE |
| 32 | 276 T | 540/1000 PTO SWITCH |
| 33 | 551 O | FRONT PTO SOLENOID |
| 34 | 500 BR/W | IIC CLEAN GROUND |
| 35 | (1ST) Y | XTRASPEED TRACTORS FROM PIN JJE3500646 - NOT USED |
| 36 | 542 T | 4TH AUXILIARY VALVE RAISE |
| 37 | 541 T | 4TH AUXILIARY VALVE LOWER |
| 38 | 400 R | TRANSMISSION CONTROLLER UNSWITCHED B+ |
| 39 | 516 T | LOADER SOLENOID RAISE |
| 40 | 515 T | LOADER SOLENOID LOWER |
| 41 | 550 R | TRANSMISSION CONTROLLER SWITCHED B+ |
| 42 | (2ND) Y | XTRASPEED TRACTORS FROM PIN JJE3500646 - NOT USED |
| 43 | (3RD) Y | XTRASPEED TRACTORS FROM PIN JJE3500646 - NOT USED |
| 44 | 500 BR/W | CAB CONTROLLER CLEAN GROUND |
| 45 | (VP IN) R | AUXILIARY/REMOTE VALVES B+ (XTRASPEED - E PLUS ONLY) |
| 46 | 656 R | CLUTCH POSITION B+ |
| 47 | 656 Y | CLUTCH POSITION SIGNAL |
| 48 | 656 BR | CLUTCH POSITION RETURN |

https://truckmanualshub.com/



## Connector 45 (XtraSpeed and XtraSpeed - E Tractors Only)

**Location: Cab Controller**




MI05F167

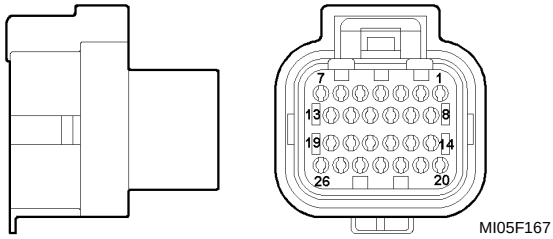
**RIGHT HAND CONSOLE HARNESS TO CAB CONTROLLER**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 303 T | OPERATOR PRESENCE SWITCH |
| 2 | 606 Y | (***) BOTTOM OF CLUTCH SIGNAL |
| 3 | 514 T | NEUTRAL SIGNAL |
| 4 | 254 Y | PARK LOCK SIGNAL |
| 5 | - - - - - | OPEN |
| 6 | 272 Y | CREEP SIGNAL |
| 7 | - - - - - | OPEN |
| 8 | - - - - - | OPEN |
| 9 | (1ST) Y | (***) 1ST RANGE SIGNAL |
| 10 | (2ND) Y | (***) 2ND RANGE SIGNAL |
| 11 | (3RD) Y | (***) 3RD RANGE SIGNAL |
| 12 | (4TH) Y | (***) 4TH RANGE SIGNAL |
| 13 | 527 DB | RANGE SHIFT SIGNAL |
| 14 | 525 DB | SHIFT UP SIGNAL |
| 15 | 524 DB | SHIFT DOWN SIGNAL |
| 16 | - - - - - | OPEN |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | - - - - - | OPEN |
| 22 | - - - - - | OPEN |
| 23 | - - - - - | OPEN |
| 24 | - - - - - | OPEN |
| 25 | - - - - - | OPEN |
| 26 | - - - - - | OPEN |

*(***) Not used for XtraSpeed - E tractors.*

## Connector 45 (XtraSpeed - E Plus Tractors Only)

**Location: Cab Controller**




MI05F167

**FENDER HARNESS TO CAB CONTROLLER**

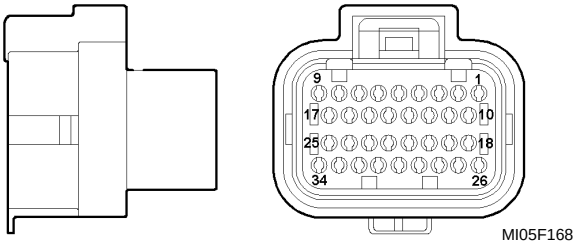
| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 303 T | OPERATOR PRESENCE SWITCH |
| 2 | - - - - - | OPEN |
| 3 | 514 T | NEUTRAL SIGNAL |
| 4 | 254 Y | PARK LOCK SIGNAL |
| 5 | - - - - - | OPEN |
| 6 | 272 Y | CREEP SIGNAL |
| 7 | - - - - - | OPEN |
| 8 | - - - - - | OPEN |
| 9 | - - - - - | OPEN |
| 10 | - - - - - | OPEN |
| 11 | - - - - - | OPEN |
| 12 | - - - - - | OPEN |
| 13 | 527 DB | RANGE SHIFT SIGNAL |
| 14 | 525 DB | SHIFT UP SIGNAL |
| 15 | 524 DB | SHIFT DOWN SIGNAL |
| 16 | - - - - - | OPEN |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | - - - - - | OPEN |
| 22 | - - - - - | OPEN |
| 23 | - - - - - | OPEN |
| 24 | - - - - - | OPEN |
| 25 | - - - - - | OPEN |
| 26 | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 46 (XtraSpeed and XtraSpeed - E Plus Tractors Only)

**Location: Cab Controller**



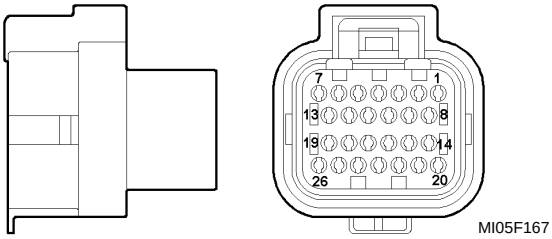

MI05F168

**RIGHT HAND CONSOLE HARNESS TO CAB CONTROLLER**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 643 BR | FOOT THROTTLE 0V RETURN |
| 2 | 562 R | F/N/R, F/N/R/P 12V SUPPLY |
| 3 | 590 R | SWITCHED B+ |
| 4 | 500 R | UNSWITCHED B+ |
| 5 | - - - - - | OPEN |
| 6 | 500 BR/W | CLEAN GROUND |
| 7 | - - - - - | OPEN |
| 8 | - - - - - | OPEN |
| 9 | (LINK) R | TRANSMISSION CONTROLLER LINK |
| 10 | 510 T | FORWARD, REVERSE, THROTTLE 5V REFERENCE |
| 11 | - - - - - | OPEN |
| 12 | 900 Y | CAN HIGH |
| 13 | 900 LG | CAN LOW |
| 14 | - - - - - | OPEN |
| 15 | 511 T | FORWARD SIGNAL |
| 16 | - - - - - | OPEN |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | - - - - - | OPEN |
| 22 | 643 Y | FOOT THROTTLE SIGNAL |
| 23 | 513 T | REVERSE SIGNAL |
| 24 | - - - - - | OPEN |
| 25 | - - - - - | OPEN |
| 26 | - - - - - | OPEN |
| 27 | 660 Y | DECLUTCH SIGNAL (XTRASPEED ONLY) |
| | 660 Y | BOTTOM OF CLUTCH SIGNAL (XTRASPEED - E ONLY) |
| 28 | - - - - - | OPEN |
| 29 | - - - - - | OPEN |
| 30 | - - - - - | OPEN |
| 31 | - - - - - | OPEN |
| 32 | 280 BR | PARK LOCK RETURN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |

## Connector 46 (XtraSpeed - E Plus Tractors Only)

**Location: Cab Controller**




MI05F167

**FENDER HARNESS TO CAB CONTROLLER**

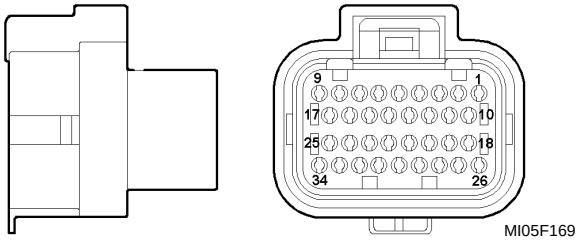
| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 643 BR | THROTTLE 0V RETURN |
| 2 | 562 R | F/N/R, F/N/R/P 12V SUPPLY |
| 3 | 590 R | SWITCHED B+ |
| 4 | 500B R | UNSWITCHED B+ |
| 5 | 644 Y | FOOT THROTTLE SIGNAL |
| 6 | 500 BR/W | CLEAN GROUND |
| 7 | - - - - - | OPEN |
| 8 | - - - - - | OPEN |
| 9 | (LINK) R | TRANSMISSION CONTROLLER LINK |
| 10 | 510 T | FORWARD/REVERSE, THROTTLE 5V REFERENCE |
| 11 | - - - - - | OPEN |
| 12 | 900 Y | CAN HIGH |
| 13 | 900 LG | CAN LOW |
| 14 | - - - - - | OPEN |
| 15 | 511 T | FORWARD SIGNAL |
| 16 | - - - - - | OPEN |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | - - - - - | OPEN |
| 22 | 643 Y | FOOT THROTTLE SIGNAL |
| 23 | 513 T | REVERSE SIGNAL |
| 24 | - - - - - | OPEN |
| 25 | - - - - - | OPEN |
| 26 | - - - - - | OPEN |
| 27 | 660 Y | BOTTOM OF CLUTCH SIGNAL |
| 28 | - - - - - | OPEN |
| 29 | - - - - - | OPEN |
| 30 | - - - - - | OPEN |
| 31 | - - - - - | OPEN |
| 32 | 280 BR | PARK LOCK RETURN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 47

**Location: Transmission Controller**



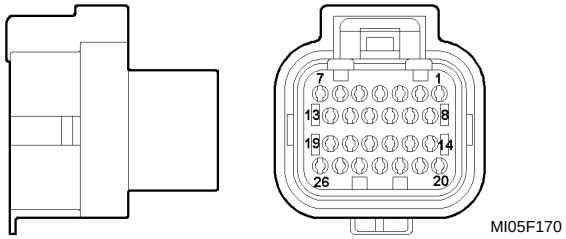

MI05F169

**TRANSMISSION HARNESS TO TRANSMISSION CONTROLLER**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 215 Y | WHEEL SPEED SIGNAL |
| 2 | ENG Y | ENGINE SPEED SIGNAL (NOT USED) |
| 3 | - - - - - | OPEN |
| 4 | (CREE) Y | CREEP DISENGAGED SIGNAL |
| 5 | (CREE.2) Y | CREEP ENGAGED SIGNAL |
| 6 | - - - - - | OPEN |
| 7 | 1/2 Y | (*) 1ST/2ND RANGE SIGNAL |
| 8 | 3/4 Y | (*) 3RD/4TH RANGE SIGNAL |
| 9 | - - - - - | OPEN |
| 10 | (PS4) Y | POWERSHIFT PS4 SPEED SIGNAL |
| 11 | (PS2) Y | POWERSHIFT PS2 SPEED SIGNAL |
| 12 | 280 Y | PARK LOCK DISENGAGED SIGNAL |
| 13 | - - - - - | OPEN |
| 14 | - - - - - | OPEN |
| 15 | - - - - - | OPEN |
| 16 | - - - - - | OPEN |
| 17 | - - - - - | OPEN |
| 18 | (INTA) Y | FORWARD/REVERSE INTER A SIGNAL |
| 19 | (INTB) Y | FORWARD/REVERSE INTER B SIGNAL (NOT USED) |
| 20 | - - - - - | OPEN |
| 21 | - - - - - | OPEN |
| 22 | - - - - - | OPEN |
| 23 | - - - - - | OPEN |
| 24 | 267 T | TRANSMISSION OIL TEMPERATURE SIGNAL |
| 25 | 656 Y | CLUTCH PEDAL POSITION SIGNAL |
| 26 | (PTOA) Y | PTO A SPEED SENSOR |
| 27 | (PTOB) Y | PTO B SPEED SENSOR |
| 28 | - - - - - | OPEN |
| 29 | - - - - - | OPEN |
| 30 | - - - - - | OPEN |
| 31 | - - - - - | OPEN |
| 32 | - - - - - | OPEN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |

## Connector 48

**Location: Transmission Controller**




MI05F170

**TRANSMISSION HARNESS TO TRANSMISSION CONTROLLER**

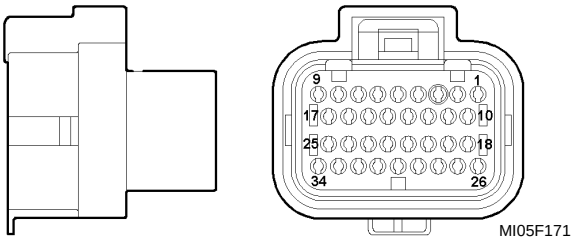
| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | - - - - - | OPEN |
| 2 | (12V) R | SEED SENSOR 12V SUPPLY |
| 3 | (5V) R | 5V SENSOR REFERENCE |
| 4 | 267 BR | 0V SENSOR REFERENCE |
| 5 | (0V) BR/W | SEED SENSOR 0V RETURN |
| 6 | 500 BR/W | CLEAN GROUND |
| 7 | 500 BR/W | CLEAN GROUND |
| 8 | - - - - - | OPEN |
| 9 | - - - - - | OPEN |
| 10 | - - - - - | OPEN |
| 11 | - - - - - | OPEN |
| 12 | - - - - - | OPEN |
| 13 | 400 R | UNSWITCHED B+ |
| 14 | - - - - - | OPEN |
| 15 | - - - - - | OPEN |
| 16 | - - - - - | OPEN |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | (LINK) R | CAB CONTROLLER LINK |
| 20 | - - - - - | OPEN |
| 21 | - - - - - | OPEN |
| 22 | - - - - - | OPEN |
| 23 | 900 LG | CAN LOW |
| 24 | 900 Y | CAN HIGH |
| 25 | 500 R | SWITCHED B+ |
| 26 | 500 R | SWITCHED B+ |

https://truckmanualshub.com/



## Connector 49

**Location: Transmission Controller**




MI05F171

**TRANSMISSION HARNESS TO TRANSMISSION CONTROLLER**

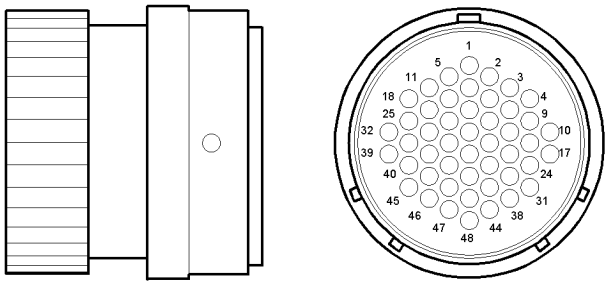
| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 580 T | 1ST RANGE SOLENOID RETURN |
| 2 | 581 T | 2ND RANGE SOLENOID RETURN |
| 3 | 582 T | 3RD RANGE SOLENOID RETURN |
| 4 | 583 T | 4TH RANGE SOLENOID RETURN |
| 5 | (PS1) T | POWERSHIFT SOLENOID PS4-1 RETURN |
| 6 | (PS2) T | POWERSHIFT SOLENOID PS4-2 RETURN |
| 7 | (PS3) T | POWERSHIFT SOLENOID PS4-3 RETURN |
| 8 | (PS4) T | POWERSHIFT SOLENOID PS4-4 RETURN |
| 9 | (PS2.1) T | LOW POWERSHIFT SOLENOID PS2-1 RETURN |
| 10 | (PS3) R | POWERSHIFT SOLENOID PS4-3 SUPPLY |
| 11 | (PS2.1) R | LOW POWERSHIFT SOLENOID PS2-1 SUPPLY |
| 12 | 506 R | REVERSE SOLENOID SUPPLY |
| 13 | 504 R | FORWARD SOLENOID SUPPLY |
| 14 | (PS2) R | POWERSHIFT SOLENOID PS4-2 SUPPLY |
| 15 | 581 R | 2ND RANGE SOLENOID SUPPLY |
| 16 | (CREE.1) T | CREEP ENGAGE SOLENOID SUPPLY (CREEP ON) |
| 17 | (PS2.2) T | HIGH POWERSHIFT SOLENOID PS2-2 RETURN |
| 18 | 582 R | 3RD RANGE SOLENOID SUPPLY |
| 19 | (PS2.2) R | HIGH POWERSHIFT SOLENOID PS2-2 SUPPLY |
| 20 | 583 R | 4TH RANGE SOLENOID SUPPLY |
| 21 | 580 R | 1ST RANGE SOLENOID SUPPLY |
| 22 | (PS1) R | POWERSHIFT SOLENOID PS4-1 SUPPLY |
| 23 | (CREE.2) T | CREEP DISENGAGE SOLENOID SUPPLY (DIRECT DRIVE) |
| 24 | - - - - - | OPEN |
| 25 | - - - - - | OPEN |
| 26 | - - - - - | OPEN |
| 27 | 280 Y | PARK LOCK SOLENOID SUPPLY |
| 28 | (PS4) R | POWERSHIFT SOLENOID PS4-4 SUPPLY |
| 29 | - - - - - | OPEN |
| 30 | - - - - - | OPEN |
| 31 | - - - - - | OPEN |
| 32 | - - - - - | OPEN |
| 33 | 504 T | FORWARD SOLENOID RETURN |
| 34 | 506 T | REVERSE SOLENOID RETURN |

https://truckmanualshub.com/



## Connector 50 (XtraSpeed - E Plus Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO ARMREST HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 540 R | POTENTIOMETER REFERENCE 5V |
| 2 | 540 BR | ARM REST 0V |
| 3 | 508 DB | AUXILIARY VALVE TIMER 1 SIGNAL |
| 4 | 509 DB | AUXILIARY VALVE TIMER 2 SIGNAL |
| 5 | 510 DB | AUXILIARY VALVE TIMER 3 SIGNAL |
| 6 | 528 DB | AUXILIARY VALVE TIMER 4 SIGNAL |
| 7 | 529 DB | AUXILIARY VALVE TIMER 5 SIGNAL |
| 8 | 511DB | AUXILIARY VALVE FLOW 1 SIGNAL |
| 9 | 512 DB | AUXILIARY VALVE FLOW 2 SIGNAL |
| 10 | 513 DB | AUXILIARY VALVE FLOW 3 SIGNAL |
| 11 | 530 DB | AUXILIARY VALVE FLOW 4 SIGNAL |
| 12 | 531 DB | AUXILIARY VALVE FLOW 5 SIGNAL |
| 13 | 644 R | REMOTE THROTTLE (5V) |
| 14 | 644Y | REMOTE THROTTLE SIGNAL |
| 15 | 644 BR | REMOTE THROTTLE (0V) |
| 16 | 502 DB | STOP SWITCH |
| 17 | 503 DB | STOP SWITCH |
| 18 | (ARM) R | GEAR UP SHIFT SWITCHED B+ |
| 19 | 525 DB | GEAR UP SHIFT SIGNAL |
| 20 | (ARM) R | GEAR DOWN SHIFT SWITCHED B+ |
| 21 | 524 DB | GEAR UP SHIFT SIGNAL |
| 22 | 501 DB | AUXILIARY VALVE ENABLE LIGHT SIGNAL |
| 23 | 522 DB | AUXILIARY VALVE ENABLE LIGHT GROUND |
| 24 | 510 LB | HITCH RAISE SIGNAL |
| 25 | 509 LB | HITCH LOWER SIGNAL |
| 26 | 562 LB | HITCH FAST LOWER SIGNAL |

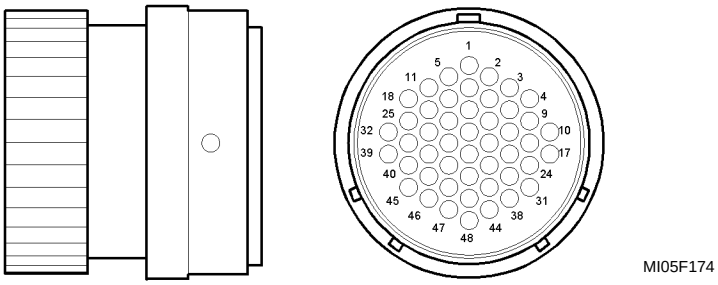
| Cavity | Wire No | Circuit |
|---|---|---|
| 27 | 515 DB | AUXILIARY VALVE JOYSTICK 1A SIGNAL |
| 28 | 516 DB | AUXILIARY VALVE JOYSTICK 1B SIGNAL |
| 29 | 514 DB | AUXILIARY VALVE JOYSTICK 2A SIGNAL |
| 30 | 532 DB | AUXILIARY VALVE JOYSTICK 2B SIGNAL |
| 31 | 518 DB | 5TH AUXILIARY VALVE RAISE |
| 32 | 517 DB | 5TH AUXILIARY VALVE LOWER |
| 33 | 527 DB | RANGE SKIP SWITCH SIGNAL |
| 34 | 527 R | RANGE SKIP SIGNAL |
| 35 | (ARM) R | ARMREST CONTROL SWITCHED B+ |
| 36 | BR/W | ARMREST CONTROL CLEAN GROUND |
| 37 | 501 R | HITCH CONTROL SWITCH B+ |
| 38 | 508 LB | HITCH ENABLE LIGHT |
| 39 | - - - - - | OPEN |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | - - - - - | OPEN |
| 44 | - - - - - | OPEN |
| 45 | - - - - - | OPEN |
| 46 | - - - - - | OPEN |
| 47 | - - - - - | OPEN |
| 48 | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 51 (XtraSpeed - E Plus Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 757 P | LEFT HAND TURN SIGNAL |
| 2 | 756 P | RIGHT HAND TURN SIGNAL |
| 3 | 507 R | HITCH POSITION POTENTIOMETER B+ |
| 4 | 707 P | LEFT HAND REAR SIDE/POSITION LIGHT |
| 5 | 708 P | RIGHT HAND REAR SIDE/ POSITION LIGHT |
| 6 | 785 V | REAR FOG LIGHT |
| 7 | 702 P | STOP LIGHTS |
| 8 | (VP) T | AUXILIARY/REMOTE VALVE VP OUT |
| 9 | 591 DB | DIFFERENTIAL LOCK SOLENOID B+ |
| 10 | 511 R | HITCH SOLENOID B+ |
| 11 | 835 O | FRONT WINDSCREEN WASHER |
| 12 | 845 O | REAR WINDSCREEN WASHER |
| 13 | 776 P | BEACON LIGHT (EUROPEAN SPECIFICATION TRACTORS ONLY) |
| 14 | 514 BR | LOAD PIN RETURN |
| 15 | 514 LB | RIGHT HAND LOAD PIN SIGNAL |
| 16 | 512 LB | HITCH LOWER SOLENOID |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | - - - - - | OPEN |
| 22 | - - - - - | OPEN |
| 23 | 224 Y | PTO SPEED SIGNAL |
| 24 | 850 R | CAB SUSPENSION CONTROLLER SWITCHED B+ |

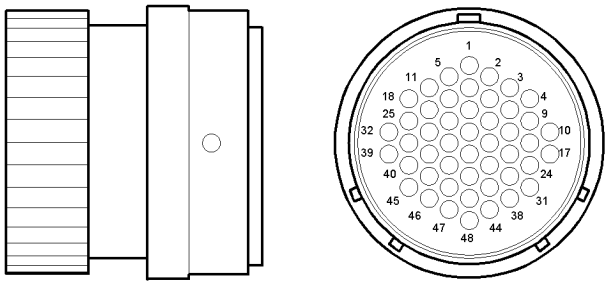
| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 513 LB | HITCH LOWER SOLENOID |
| 26 | 514 R | LOAD PIN 8V SUPPLY |
| 27 | 515 LB | LEFT HAND LOAD PIN SIGNAL |
| 28 | - - - - - | OPEN |
| 29 | 133 R | AUXILIARY POWER SWITCHED B+ |
| 30 | 784 P | REAR WORK LIGHTS |
| 31 | 507 LB | HITCH POSITION POTENTIOMETER SIGNAL |
| 32 | 507 BR | HITCH POSITION POTENTIOMETER RETURN |
| 33 | (LINK) R | CAB CONTROLLER/ TRANSMISSION CONTROLLER LINK |
| 34 | BR/W | HITCH CONTROLLER CLEAN GROUND |
| 35 | BR/W | CLEAN GROUND |
| 36 | 597 LB | PTO SOLENOID B+ |
| 37 | 597 BR | PTO SOLENOID RETURN |
| 38 | - - - - - | OPEN |
| 39 | - - - - - | OPEN |
| 40 | 542 LB | MFD RELAY SUPPLY |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | - - - - - | OPEN |
| 44 | - - - - - | OPEN |
| 45 | - - - - - | OPEN |
| 46 | - - - - - | OPEN |
| 47 | - - - - - | OPEN |
| 48 | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 52 (XtraSpeed - E Plus Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 560 R | HITCH UPPER LIMIT POTENTIOMETER SUPPLY |
| 2 | 560 LB | HITCH UPPER LIMIT POTENTIOMETER SIGNAL |
| 3 | 560 BR | HITCH UPPER LIMIT POTENTIOMETER RETURN |
| 4 | 502 R | HITCH DROP SPEED POTENTIOMETER SUPPLY |
| 5 | 502 LB | HITCH DROP SPEED POTENTIOMETER SIGNAL |
| 6 | 502 BR | HITCH DROP SPEED POTENTIOMETER RETURN |
| 7 | 504 LB | HITCH POSITION COMMAND POTENTIOMETER SIGNAL |
| 8 | 504 R | HITCH POSITION COMMAND POTENTIOMETER SUPPLY |
| 9 | 504 BR | HITCH POSITION COMMAND POTENTIOMETER RETURN |
| 10 | 505 R | HITCH LOAD COMMAND POTENTIOMETER SUPPLY |
| 11 | 505 LB | HITCH LOAD COMMAND POTENTIOMETER SIGNAL |
| 12 | 505 BR | HITCH LOAD COMMAND POTENTIOMETER RETURN |
| 13 | - - - - - | OPEN |
| 14 | - - - - - | OPEN |
| 15 | - - - - - | OPEN |
| 16 | - - - - - | OPEN |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | 570 LB | SLIP CONTROL LIGHT SUPPLY |
| 22 | 567 LB | SLIP CONTROL ON SIGNAL |
| 23 | - - - - - | OPEN |
| 24 | 593 DB | AUTO PTO OFF SIGNAL |

| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 531 R | MFD AXLE SUSPENSION UNSWITCHED B+ |
| 26 | 643 Y | FOOT THROTTLE SIGNAL |
| 27 | 281 Y | RADAR SIGNAL |
| 28 | 506 R | HITCH TRAVEL POTENTIOMETER SUPPLY |
| 29 | 506 LB | HITCH TRAVEL POTENTIOMETER SIGNAL |
| 30 | 506 BR | HITCH TRAVEL POTENTIOMETER RETURN |
| 31 | 590 R | REMOTE PTO SWITCH B+ |
| 32 | - - - - - | OPEN |
| 33 | 161 R | AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ |
| 34 | - - - - - | OPEN |
| 35 | 500B R | CAB CONTROLLER UNSWITCHED B+ |
| 36 | 572 LB | RIDE CONTROL ON SIGNAL |
| 37 | 573 LB | RIDE CONTROL OVERRIDE SIGNAL |
| 38 | - - - - - | OPEN |
| 39 | 282 Y | RADAR PRESENT SIGNAL |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | 534 DB | MFD AXLE SUSPENSION UP SIGNAL |
| 44 | 535 DB | MFD AXLE SUSPENSION DOWN SIGNAL |
| 45 | 533 DB | MFD AXLE SUSPENSION REGULATION ON |
| 46 | 542 DB | MFD AXLE SUSPENSION UNSWITCHED UP SIGNAL |
| 47 | 563 DB | MFD AXLE SUSPENSION INDICATOR LIGHT |
| 48 | 530 R | MFD AXLE SUSPENSION SWITCHED B+ |

https://truckmanualshub.com/

# Section 10009

## INSTRUMENT CLUSTER CONTROLLER

### Error Codes, Troubleshooting and Schematics

### XTX Series Tractors



McCORMICK

SM 8-15091

© 2006 McCormick Tractors International Limited.
November 2005 (Revised September 2006)

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIAL TOOLS ..... 3

INSTRUMENT CLUSTER GENERAL INFORMATION
CAN Bus Communication ..... 5

ERROR CODES GENERAL INFORMATION ..... 6
Retrieving Instrument Cluster Displayed Active Error Codes. ..... 6

CIRCUIT TESTING
General Information ..... 7

ERROR CODE TROUBLESHOOTING GUIDE
Error Code 100 ..... 8
Error Code 101 ..... 8
Error Code 102 ..... 9
Error Code 103 ..... 10
Error Code 106 ..... 11
Error Code 200 ..... 11
Error Code 201 ..... 11
Error Code 202 ..... 11
Error Code 300 ..... 12
Error Code 301 (XTX185 and XTX200 Tractors Only) ..... 12
Error Code 301 (XTX215 Tractors Only) ..... 13
Error Code 302 ..... 13
Error Code 303 ..... 14
Error Code 304 (XtraSpeed - E Plus Tractors Only) ..... 15
Error Code 305 ..... 16

COMPONENT IDENTIFICATION
Instrument Panel Components ..... 17
Right Hand Console Components (XtraSpeed and XtraSpeed - E Tractors Only) ..... 18
Right Hand Console and Armrest Components (XtraSpeed - E Plus Tractors Only) ..... 19
Engine Components - XTX185 and XTX200 Tractors ..... 20
Engine Components - XTX215 Tractors ..... 21
Transmission Components ..... 22

INSTRUMENT CLUSTER SCHEMATIC CIRCUIT ..... 24

CAN BUS SCHEMATIC CIRCUIT
CAN Bus Schematic Circuit (For XtraSpeed and XtraSpeed - E Tractors) ..... 26
CAN Bus Schematic Circuit (For XtraSpeed - E Plus Tractors) ..... 27

MAIN CONNECTORS ..... 29

https://truckmanualshub.com/



# SPECIAL TOOLS




MD04C017

**1025T1 MCCORMICK DIAGNOSTIC CENTRE**



DD99A051

**MC2656 TEST PROBE KIT**



DD98H120

**MC2616 MULTIMETER KIT includes:**
**MC2616-1 MULTIMETER ONLY**
**MC2616-2 TEST LEADS**
**MC2616-3 TEMPERATURE PROBE**



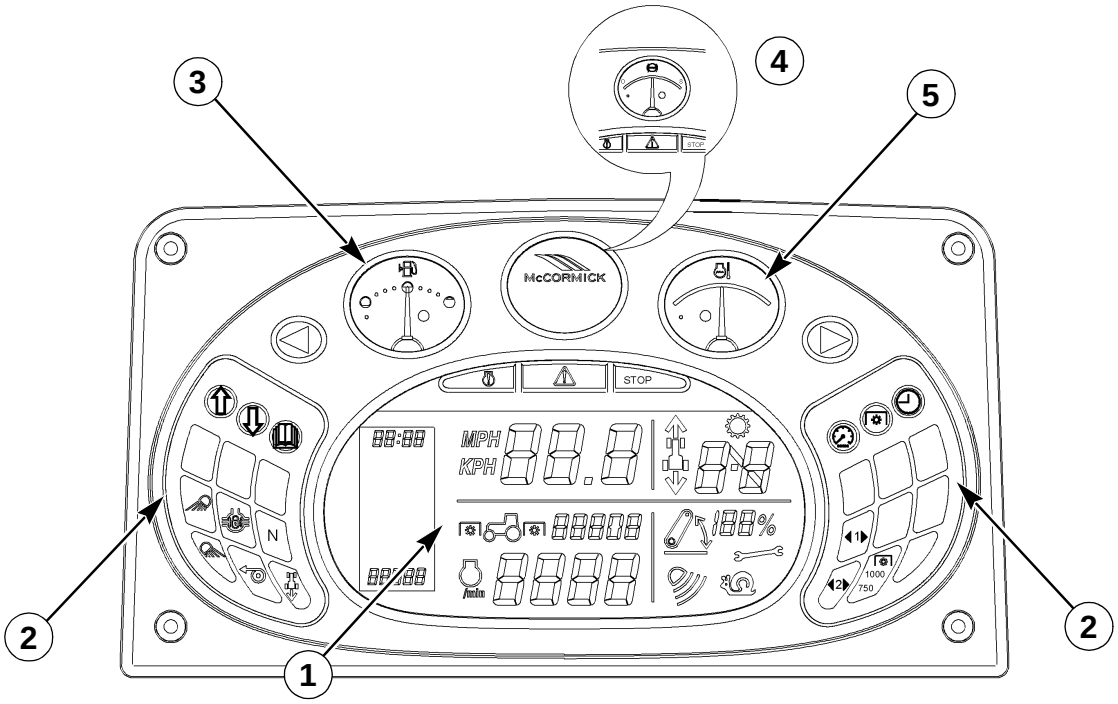
DD97E383

**MC31000B HARNESS REPAIR KIT (EUROPE)**

https://truckmanualshub.com/



# INSTRUMENT CLUSTER GENERAL INFORMATION




1. MAIN DIGITAL DISPLAY
2. INDICATOR WARNING LAMPS
3. FUEL GAUGE
4. MCCORMICK LOGO OR AIR TRAILER BRAKE PRESSURE GAUGE (IF EQUIPPED)
5. ENGINE COOLANT TEMPERATURE GAUGE

The main function of the instrument cluster is to display information to the operator. To enable correct information to be displayed, the cluster processes and monitors signals directly from the following components.

- Alternator (charging).
- Air filter restriction switch.
- Coolant level sender.
- Water in fuel warning (XTX185/200 Tractors Only).
- Hydraulic filter restriction switch.
- Ground speed radar.
- Trailed Implement switch.
- PTO speed selection switch.
- PTO Speed
- Park brake switch.
- Air trailer brake pressure sender.
- Fuel level sender.
- Front PTO switch
- Turn signal switch.
- Light switch (position lights and high beam warning).
- Water in fuel sensor (XTX185/200 tractors).

The instrument cluster also receives information over the CAN bus circuit which includes the following:

- Engine speed.
- Coolant temperature.
- Cold start warning.
- Water in fuel warning (XTX215 Tractors Only).
- Engine stop warning.
- Engine maintenance warning.
- Hydraulic filter temperature switch.
- Wheel speed sensor.
- Hitch position potentiometer.
- Error codes.

In addition to displaying error codes from other controllers in the system and error codes for faults that may occur in the instrument cluster circuit. The instrument cluster also transmits the park brake switch status and calibration requests to over the CAN bus circuit to other controllers connected to the CAN bus.

https://truckmanualshub.com/



## CAN Bus Communication

The CAN Bus circuit comprises of a twisted pair of wires, CAN High (Yellow) and CAN Low (Green), some applications require a termination 120 Ohm resistor to be installed at each end of the circuit. It is important that the CAN wires remain twisted together and the termination resistors are connected to reduce any electrical interference that may disrupt the CAN messages.

**NOTE:** *XTX185 and XTX200 tractors are equipped with one termination resistor externally connected to the transmission harness and one termination resistor located within the engine controller.*

https://truckmanualshub.com/



# ERROR CODES GENERAL INFORMATION

Each controller on the tractor continually monitors the control systems for errors. If an error is detected an error message will be transmitted over the CAN circuit to the instrument cluster, which will display an error warning to alert the operator to a problem. Depending on the nature of the fault the instrument cluster may display the Red engine STOP and or the Amber main warning light, also the audible alarm may sound.

**NOTE:** *The instrument cluster will only display current (active) error codes.*

Each controller will store all error codes that have been detected in the controller memory. These stored error codes can be viewed and cleared using the 'McCormick Diagnostic Centre'.

## Retrieving Instrument Cluster Displayed Active Error Codes.

If an error occurs during normal operation in one of the tractor controller systems the ! symbol will appear on the instrument cluster.

If the error warning symbol appears park the tractor on hard level ground, put the F/N/R lever in NEUTRAL and apply the park brake. Turn the key to the OFF position.

> **WARNING:** *Some errors will only be active when the tractor is operated, the codes for these errors will be stored in the relevant controller and MUST only be retrieved using the 'McCormick Diagnostic Centre. DO NOT retrieve error codes when driving the tractor.*

To read the error codes carry out the following procedure:

Turn the key to the on position and press the menu button.

Each controller will be identified on the Universal Data Display as follows:

| | |
|---|---|
| **ENG** | - ENGINE |
| **IC** | - INSTRUMENT CLUSTER |
| **CS** | - CAB SUSPENSION CONTROLLER |

The displayed controller will also display the number of active error codes.

Example:

**ENG** = ENGINE
**0** = No Active Errors

Press the button to scroll through each controller until MCC is display Universal Data Display.

**IC** = INSTRUMENT CLUSTER
**1** = 1 Active Error

To view the error code, press the menu button.

**104** = Error Code 104

If more than one instrument cluster error has been detected, press the button to identify the remaining errors.

For instrument cluster Error Codes refer to the Error Code Troubleshooting Guide in this section.

https://truckmanualshub.com/



# CIRCUIT TESTING

## General Information

> **WARNING:** *Never operate the engine in a closed building. Proper ventilation is required under all circumstances.*

**IMPORTANT:** *All electrical checks must be made with the tractor parked on hard level ground with park brake engaged, the shuttle lever in Neutral or Park and the engine OFF, unless otherwise stated.*

**IMPORTANT:** *Put blocks in front of and behind the rear wheels.*

**IMPORTANT:** *For tractors equipped with cab suspension, all checks must be carried out with the cab fully lowered or with the cab supported with suitable cab supports. To lower the cab refer to Section 10011.*

**IMPORTANT:** *The battery must be at full charge and all connections must be clean and tight before testing. Only use a HIGH IMPEDANCE multimeter for the tests. Do not use a test lamp or damage to the switches may occur.*

**IMPORTANT:** *Use MC2656 test probe kit when making electrical checks at connectors to avoid the risk of shorting between the connector pins or terminals.*

**IMPORTANT:** *Replace the controller if the fault remains only after all necessary checks have been made.*

**IMPORTANT:** *When disconnecting harness connectors, always check the connector pins and terminals for damage and alignment.*

**NOTE:** *When measuring resistance values, always measure the resistance of the multimeter leads before testing components. Subtract the resistance of the multimeter leads from the component resistance to obtain a true resistance value.*

**NOTE:** *When testing diodes and diode modules use the multimeter diode test function.*

**NOTE:** *All components, wires and connectors disconnected during any electrical checks must be connected when the checks are completed.*

https://truckmanualshub.com/



# ERROR CODE TROUBLESHOOTING GUIDE

## Instrument Cluster Error Codes

## Error Code 100

**Fault Description**

Air trailer brake pressure sender signal short circuit.

**Possible Cause**

1. Air trailer brake pressure sender signal wire short circuit to ground.
2. Bad air trailer brake pressure sender.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 7.*

**Circuit Checks/Corrective Action**

1. Disconnect the air trailer brake pressure sender from the harness and disconnect connector 40 (transmission harness to right hand console harness). Check wire 240 Yellow for continuity between ground and the air trailer brake pressure sender connector terminal B.
   - If continuity is detected check wire 240 Yellow between the air trailer brake pressure sender connector and connector 40 for damage. Also check connector 40.
2. Disconnect connector 27 (instrument panel harness to right hand console harness). Check wire 240 Yellow for continuity between ground and connector 27 pin 1 (right hand console harness side).
   - If continuity is detected check wire 240 Yellow between connector 27 and connector 40 for damage. Also check connectors 27 and 40.
3. Disconnect the instrument cluster from the harness and check wire 240 Yellow for continuity between ground and the connector 30 (instrument cluster) pin 30.
   - If continuity is detected check wire 240 Yellow between the connector 30 and connector 27 for damage. Also check connector 27.
4. Replace the air trailer brake sender.

> ⚠ **WARNING:** *Before removing the air trailer brake pressure sender ALWAYS release the air pressure from the air reservoir using the drain valve.*

## Error Code 101

**Fault Description**

Air trailer brake pressure sender signal open or short circuit.

**Possible Cause**

1. Air trailer brake pressure sender signal wire open circuit.
2. Air trailer brake pressure sender signal wire short circuit to voltage above 5 volts.
3. Bad air trailer brake pressure sender.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 7.*

**Circuit Checks/Corrective Action**

1. Disconnect the air trailer brake pressure sender from the harness. Check wire 240 Brown for continuity between ground and the air trailer brake pressure sender connector terminal A.
   - If continuity is not detected check wire 240 Brown between the air trailer brake pressure sender and the battery negative terminal.
2. Turn the key to the ON position and check the voltage reading at the sender connector terminal B for wire 240 Yellow.
   - If a 0 voltage reading is obtained go to check 3.
   - If a voltage reading above 5 volts is obtained go to check 6.

Continued...

https://truckmanualshub.com/



3. Disconnect connector 40 (transmission harness to right hand console harness). Check wire 240 Yellow for continuity between the air trailer brake pressure sender and connector 40 pin 31 (transmission harness side).
   - If continuity is not detected check wire 240 Yellow between the air trailer brake pressure sender connector and connector 40 for damage. Also check connector 40.
4. Disconnect connector 27 (instrument panel harness to right hand console harness). Turn the key to the ON position and check the voltage reading at connector 27 pin 1 (instrument harness side) for wire 240 Yellow.
   - If a 0 voltage reading is obtained check wire 240 Yellow between connector 30 (instrument cluster) and connector 27.
   - If a 5 volt reading is obtained check wire 240 Yellow between the connector 27 and connector 40.
5. Replace the air trailer brake sender.

> ⚠ **WARNING:** *Before removing the air trailer brake pressure sender ALWAYS release the air pressure from the air reservoir using the drain valve.*

6. Disconnect connector 27 (instrument panel harness to right hand console harness). Turn the key to the ON position and check the voltage reading at connector 27 pin 1 (instrument panel harness side) for wire 240 Yellow.
   - If a voltage reading of 5 volts is obtained check the following:
     - Wire 240 Yellow between connector 27 and connector 40 for damage. Also check connector 27.
     - Wire 240 Yellow between connector 40 and the air trailer brake pressure sender connector for damage. Also check connector 40.
   - If a voltage reading above 5 volts is obtained check wire 240 Yellow between connector 30 (instrument cluster) and connector 27 for damage. Also check connector 27.

## Error Code 102

**Fault Description**

Fuel level sender signal short circuit.

**Possible Cause**

1. Fuel level sender signal wire short circuit to ground.
2. Bad fuel level sender.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 7.*

**Circuit Checks/Corrective Action**

1. Disconnect the fuel level sender from the harness and disconnect connector 40 (transmission harness to right hand console harness). Check wire 233 Yellow for continuity between ground and the fuel level sender connector terminal A.
   - If continuity is detected check wire 233 Yellow between the fuel level sender and connector 40 for damage. Also check connector 40.
2. Disconnect connector 27 (instrument panel harness to right hand console harness). Check wire 233 Yellow for continuity between ground and connector 27 pin 6 (right hand console harness side).
   - If continuity is detected check wire 233 Yellow between connector 27 and connector 40 for damage. Also check connectors 27 and 40.
3. Disconnect the instrument cluster from the harness and check wire 233 Yellow for continuity between ground and connector 30 (instrument cluster) pin 8.
   - If continuity is detected check wire 233 Yellow between connector 30 and connector 27 for damage. Also check connector 27.
4. Check the resistance reading between terminals A and B of the fuel level sender, refer to table below and replace the fuel level sender as necessary.

| | |
|---|---|
| EMPTY | 244 to 250 OHMS |
| FULL | 29 to 33.5 OHMS |

https://truckmanualshub.com/



# Error Code 103

**Fault Description**

Fuel level sender signal open or short circuit.

**Possible Cause**

1. Fuel level sender signal wire open circuit.
2. Fuel level sender signal wire short circuit to voltage above 5 volts.
3. Bad fuel level sender.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 7.*

**Circuit Checks/Corrective Action**

1. Disconnect the fuel level sender from the harness and check wire 233 Brown/White for continuity between ground and the fuel level sender connector terminal B.
   - If continuity is not detected check wire 233 Brown/White between the fuel level sender and the battery negative terminal.
2. Turn the key to the ON position and check the voltage reading at the fuel level sender connector for wire 233 Yellow.
   - If a 0 voltage reading is obtained go to check 3.
   - If a voltage reading above 5 volts is obtained go to check 6.
3. Disconnect connector 40 (transmission harness to right hand console harness). Check wire 233 Yellow for continuity between the fuel level sender connector and connector 40 pin 2 (transmission harness side).
   - If continuity is not detected check wire 233 Yellow between the fuel level sender and connector 40 for damage. Also check connector 40.
4. Disconnect connector 27 (instrument panel harness to right hand console harness). Turn the key to the ON position and check the voltage reading at connector 27 pin 6 (instrument panel harness side) for wire 233 Yellow.
   - If a 0 voltage reading is obtained check wire 233 Yellow between connector 30 (instrument cluster) and connector 27. Also check connector 27.
   - If a 5 volt reading is obtained check wire 233 Yellow between the connector 27 and connector 40 for damage. Also check connector 40.
5. Check the resistance reading between terminals A and B of the fuel level sender, refer to table below and replace the fuel level sender as necessary.

| | |
|---|---|
| EMPTY | 244 to 250 OHMS |
| FULL | 29 to 33.5 OHMS |

6. Disconnect connector 27 (instrument panel harness to right hand console harness). Turn the key to the ON position and check the voltage reading at connector 27 pin 6 (instrument panel harness side) for wire 233 Yellow.
   - If a voltage reading of 5 volts is obtained check wire following:
     - Wire 233 Yellow between connector 27 and connector 40 for damage. Also check connector 27.
     - Wire 233 Yellow between connector 40 and the fuel level sender connector for damage. Also check connector 40.
   - If a voltage reading above 5 volts is obtained check wire 233 Yellow between connector 30 (instrument cluster) and connector 27. Also check connector 27.

https://truckmanualshub.com/



## Error Code 106

**Fault Description**

Hydraulic filter temperature switch short circuit.

**NOTE:** *This error code is NOT USED for XTX Series tractors.*

**Possible Cause**

1. Instrument cluster programmed with the wrong software.

**Circuit Checks/Corrective Action**

1. Reprogram the instrument cluster, refer to Section 10010.

## Error Code 200

**Fault Description**

Flash memory checksum error.

**Possible Cause**

1. Instrument cluster software problem.
2. Bad instrument cluster.

**Circuit Checks/Corrective Action**

1. Reprogram the instrument cluster, refer to Section 10010.
2. If the error remains, replace the instrument cluster.

## Error Code 201

**Fault Description**

EEPROM signature error.

**Possible Cause**

1. Instrument cluster software problem.
2. Bad instrument cluster.

**Circuit Checks/Corrective Action**

1. Reconfigure the instrument cluster, refer to Section 10010.
2. Reprogram the instrument cluster, refer to Section 10010.
3. If the error remains, replace the instrument cluster.

## Error Code 202

**Fault Description**

Power up RAM check error.

**Possible Cause**

1. Instrument cluster software problem.
2. Bad instrument cluster.

**Circuit Checks/Corrective Action**

1. Reprogram the instrument cluster, refer to Section 10010.
2. If the error remains, replace the instrument cluster.

https://truckmanualshub.com/



## Error Code 300

**Fault Description**

The instrument cluster is not transmitting information over the CAN bus.

**Possible Cause**

1. Bad CAN bus circuit.
2. Bad instrument cluster.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 7.*

**Circuit Checks/Corrective Action**

1. Check for error code 301.
   - If error code 301 is present, carry out the checks for error code 31.
   - If error code 301 is not present replace the instrument cluster.

## Error Code 301 (XTX185 and XTX200 Tractors Only)

**Fault Description**

The instrument cluster is not receiving information over the CAN bus from the engine controller.

**Possible Cause**

1. Engine controller not powered up.
2. Bad CAN bus circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 7.*

**Circuit Checks/Corrective Action**

1. Check the engine controller power supply and clean ground circuits.
2. Disconnect the engine harness from the engine controller at connector 63 and disconnect connector 10 (engine harness to instrument panel harness). Check wire 900 Yellow for continuity between connector 10 pin 38 and connector 63 (engine controller) pin 52.
   - If continuity is not detected check wire 900 Yellow between connector 10 and connector 63.
   - If continuity is detected go to check 3.
3. Check wire 900 Light Green for continuity between connector 10 pin 42 and connector 63 (engine controller) pin 53.
   - If continuity is not detected check wire 900 Light Green between connector 10 and connector 63.
   - If continuity is detected go to check 4.
4. Connect connector 10 and disconnect the instrument cluster from the harness. Check wire 900 Yellow for continuity between connector 30 (instrument cluster) pin 10 and connector 63 (engine controller) pin 53.
   - If continuity is not detected check wire 900 Yellow between connector 30 and connector 10. Also check connector 10 and splice IP-SP2.
5. Check wire 900 Light Green for continuity between connector 30 (instrument cluster) pin 18 and connector 63 (engine controller) pin 52.
   - If continuity is not detected check wire 900 Light Green between connector 30 and connector 10. Also check connector 10 splice IP-SP5.

https://truckmanualshub.com/



## Error Code 301 (XTX215 Tractors Only)

**Fault Description**

The instrument cluster is not receiving information over the CAN bus from the engine controller.

**Possible Cause**

1. Engine controller not powered up.
2. Bad CAN bus circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 7.*

**Circuit Checks/Corrective Action**

1. Check the engine controller power supply and clean ground circuits.
2. Disconnect the engine controller CAN connector from the engine controller and disconnect connector 10 (engine harness to instrument panel harness). Check wire 900 Yellow for continuity between connector 10 pin 38 and terminal A of the engine controller CAN connector (engine harness side).
   - If continuity is not detected check wire 900 Yellow between connector 10 and engine controller CAN connector. Also check splice E-SP1.
3. Check wire 900 Light Green for continuity between connector 10 pin 42 and terminal B of the engine controller CAN connector (engine harness side).
   - If continuity is not detected check wire 900 Light Green between connector 10 and engine controller CAN connector. Also check splice E-SP3.
4. Connect connector 10 and disconnect the instrument cluster from the harness. Check for continuity between the connector 30 (instrument cluster) pin 10 and terminal A of the engine controller CAN connector (engine harness side) for wire 900 Yellow.
   - If continuity is not detected check wire 900 Yellow between connector 30 and connector 10. Also check connector 10 and splice IP-SP2.
5. Check for continuity between the instrument cluster connector 30 (instrument cluster) pin 18 and terminal B of the engine controller CAN connector (engine harness side) for wire 900 Light Green.
   - If continuity is not detected check wire 900 Light Green between connector 30 and connector 10. Also check connector 10 splice IP-SP5.

## Error Code 302

**Fault Description**

The instrument cluster is not receiving information over the CAN bus from the cab controller.

**Possible Cause**

1. Cab controller not powered up.
2. Bad CAN bus circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 7.*

**Circuit Checks/Corrective Action**

1. Check the cab controller power supply and clean ground circuits, refer to Section 10006.
2. Check for the presence of instrument cluster error codes 303, 304 and 305.

   **XtraSpeed and XtraSpeed - E Tractors**

   - If error codes 303 and 305 are present check the following:
     - Connector 29.
     - Wire 900 Yellow between the instrument panel harness splice IC-SP2 and connector 29 terminal L.
     - Wire 900 Light Green between the instrument panel harness splice IC-SP5 and connector 29 terminal M.
     - Wire 900 Yellow between connector 29 terminal L and the right hand console harness splice RCH-SP19.
     - Wire 900 Light Green between connector 29 terminal M and the right hand console harness splice RCH-SP20.

Continued.....

https://truckmanualshub.com/



- If error codes 303 and 305 are NOT present check the following:
  - Wire 900 Yellow between the cab controller connector 46 pin 43 and the right hand console harness splice RCH-SP19.
  - Wire 900 Light Green between the cab controller connector 46 pin 44 and the right hand console harness splice RCH-SP20.

**XtraSpeed - E Plus Tractors**

- If error codes 303, 304 and 305 are present check the following:
  - Connector 29.
  - Wire 900 Yellow between the instrument panel harness splice IC-SP2 and connector 29 terminal L.
  - Wire 900 Light Green between the instrument panel harness splice IC-SP5 and connector 29 terminal M.
  - Wire 900 Yellow between connector 29 terminal L and the right hand console harness splice RCH-SP8.
  - Wire 900 Light Green between connector 29 terminal M and the right hand console harness splice RCH-SP9.
- If only error codes 303 and 304 are present check the following:
  - Connector 53.
  - Wire 900 Yellow between connector 53 pin 43 and the fender harness splice F-SP17.
  - Wire 900 Light Green between connector 53 pin 44 the fender harness splice F-SP18.
- If error codes 303, 304 and 305 are NOT present check the following:
  - Wire 900 Yellow between the cab controller connector 46 pin 43 and the fender harness splice F-SP17.
  - Wire 900 Light Green between the cab controller connector 46 pin 44 and the fender harness splice F-SP18.

## Error Code 303

**Fault Description**

The instrument cluster is not receiving information over the CAN bus from the hitch controller.

**Possible Cause**

1. Right hand cab door open (XtraSpeed - E and E Plus tractors only).
2. Hitch controller not powered up.
3. Bad CAN bus circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 7.*

**Circuit Checks/Corrective Action**

1. Make sure the right hand cab door is closed (XtraSpeed - E and E Plus tractors only).
2. Check the hitch controller power supply and clean ground circuits, refer to Section 10002.
3. Check for the presence of instrument cluster error codes 302, 304 and 305.

**XtraSpeed and XtraSpeed - E Tractors**

- If error codes 302 and 305 are present check the following:
  - Connector 29.
  - Wire 900 Yellow between the instrument panel harness splice IC-SP2 and connector 29 terminal L.
  - Wire 900 Light Green between the instrument panel harness splice IC-SP5 and connector 29 terminal M.
  - Wire 900 Yellow between connector 29 terminal L and the right hand console harness splice RCH-SP19.
  - Wire 900 Light Green between connector 29 terminal M and the right hand console harness splice RCH-SP20.
- If error codes 302 and 305 are NOT present check the following:
  - Wire 900 Yellow between the hitch controller connector 56 pin 26 and the right hand console harness splice RCH-SP19.
  - Wire 900 Light Green between the hitch controller connector 56 pin 27 and the right hand console harness splice RCH-SP20.

Continued.....

https://truckmanualshub.com/



**XtraSpeed - E Plus Tractors**

- If error codes 302, 304 and 305 are present check the following:
  - Connector 29.
  - Wire 900 Yellow between the instrument panel harness splice IC-SP2 and connector 29 terminal L.
  - Wire 900 Light Green between the instrument panel harness splice IC-SP5 and connector 29 terminal M.
  - Wire 900 Yellow between connector 29 terminal L and the right hand console harness splice RCH-SP8.
  - Wire 900 Light Green between connector 29 terminal M and the right hand console harness splice RCH-SP9.
- If only error codes 302 and 304 are present check the following:
  - Connector 53.
  - Wire 900 Yellow between connector 53 pin 43 and the fender harness splice F-SP17.
  - Wire 900 Light Green between connector 53 pin 44 the fender harness splice F-SP18.
- If error codes 303, 304 and 305 are NOT present check the following:
  - Wire 900 Yellow between the hitch controller connector 56 pin 26 and the fender harness splice F-SP17.
  - Wire 900 Light Green between the hitch controller connector 56 pin 27 and the fender harness splice F-SP18.

## Error Code 304 (XtraSpeed - E Plus Tractors Only)

**Fault Description**

The instrument cluster is not receiving information over the CAN bus from the auxiliary/remote valve controller.

**Possible Cause**

1. Auxiliary/remote valve controller not powered up.
2. Instrument cluster configuration incorrect.
3. Bad CAN bus circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 7.*

**Circuit Checks/Corrective Action**

1. Check the auxiliary/remote valve controller power supply and clean ground circuits, refer to Section 10001.
2. Check the instrument cluster configuration.
3. Check for the presence of instrument cluster error codes 302, 303 and 305.
   - If error codes 302, 304 and 305 are present check the following:
     - Connector 29.
     - Wire 900 Yellow between the instrument panel harness splice IC-SP2 and connector 29 terminal L.
     - Wire 900 Light Green between the instrument panel harness splice IC-SP5 and connector 29 terminal M.
     - Wire 900 Yellow between connector 29 terminal L and the right hand console harness splice RCH-SP8.
     - Wire 900 Light Green between connector 29 terminal M and the right hand console harness splice RCH-SP9.
   - If error codes 302 and 303 are present check the following:
     - Connector 53.
     - Wire 900 Yellow between connector 53 pin 43 and the fender harness splice F-SP17.
     - Wire 900 Light Green between connector 53 pin 44 the fender harness splice F-SP18.
   - If error codes 303, 304 and 305 are not present check the following:
     - Wire 900 Yellow between the auxiliary/remote valve controller connector 44 pin 12 and the fender harness splice F-SP17.
     - Wire 900 Light Green between the auxiliary/remote valve controller connector 44 pin 13 and the fender harness splice F-SP18.

https://truckmanualshub.com/



# Error Code 305

**Fault Description**

The instrument cluster is not receiving information over the CAN bus from the transmission controller.

**Possible Cause**

1. Transmission controller not powered up.
2. Bad CAN bus circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 7.*

**Circuit Checks/Corrective Action**

1. Check the transmission controller power supply and clean ground circuits, refer to Section 10006.

**XtraSpeed and XtraSpeed - E Tractors**

- If error codes 302 and 303 are present check the following:
  - Connector 29.
  - Wire 900 Yellow between the instrument panel harness splice IC-SP2 and connector 29 terminal L.
  - Wire 900 Light Green between the instrument panel harness splice IC-SP5 and connector 29 terminal M.
  - Wire 900 Yellow between connector 29 terminal L and the right hand console harness splice RCH-SP19.
  - Wire 900 Light Green between connector 29 terminal M and the right hand console harness splice RCH-SP20.

- If error codes 302 and 303 are NOT present check the following:
  - Wire 900 Yellow between connector 40 pin 24 and the right hand console harness splice RCH-SP19.
  - Wire 900 Light Green between connector 40 pin 25 the right hand console harness splice RCH-SP20.
  - Wire 900 Yellow between connector 40 pin 24 and the transmission controller connector 48 pin 24, also check the transmission harness splice T-SP10.
  - Wire 900 Light Green between connector 40 pin 24 and the transmission controller connector 48 pin 23, also check the transmission harness splice T-SP11.

**XtraSpeed - E Plus Tractors**

- If error codes 302, 303 and 304 are present check the following:
  - Connector 29.
  - Wire 900 Yellow between the instrument panel harness splice IC-SP2 and connector 29 terminal L.
  - Wire 900 Light Green between the instrument panel harness splice IC-SP5 and connector 29 terminal M.
  - Wire 900 Yellow between connector 29 terminal L and the right hand console harness splice RCH-SP8.
  - Wire 900 Light Green between connector 29 terminal M and the right hand console harness splice RCH-SP9.

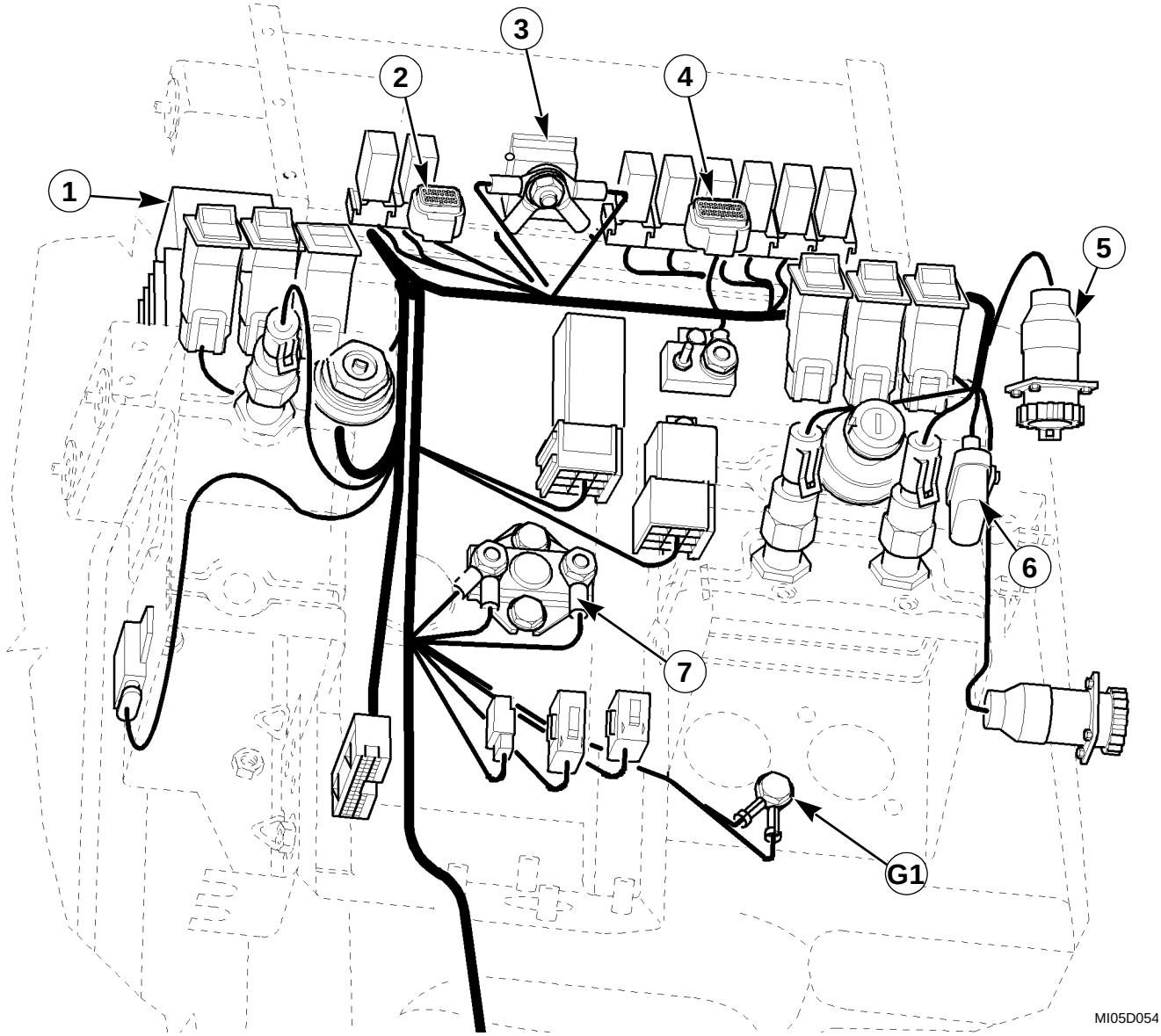
- If error codes 302, 303 and 304 are NOT present check the following:
  - Wire 900 Yellow between connector 40 pin 24 and the right hand console harness splice RCH-SP8.
  - Wire 900 Light Green between connector 40 pin 25 the right hand console harness splice RCH-SP9.
  - Wire 900 Yellow between connector 40 pin 24 and the transmission controller connector 48 pin 24, also check the transmission harness splice T-SP10.
  - Wire 900 Light Green between connector 40 pin 24 and the transmission controller connector 48 pin 23, also check the transmission harness splice T-SP11.

https://truckmanualshub.com/



# COMPONENT IDENTIFICATION

## Instrument Panel Components



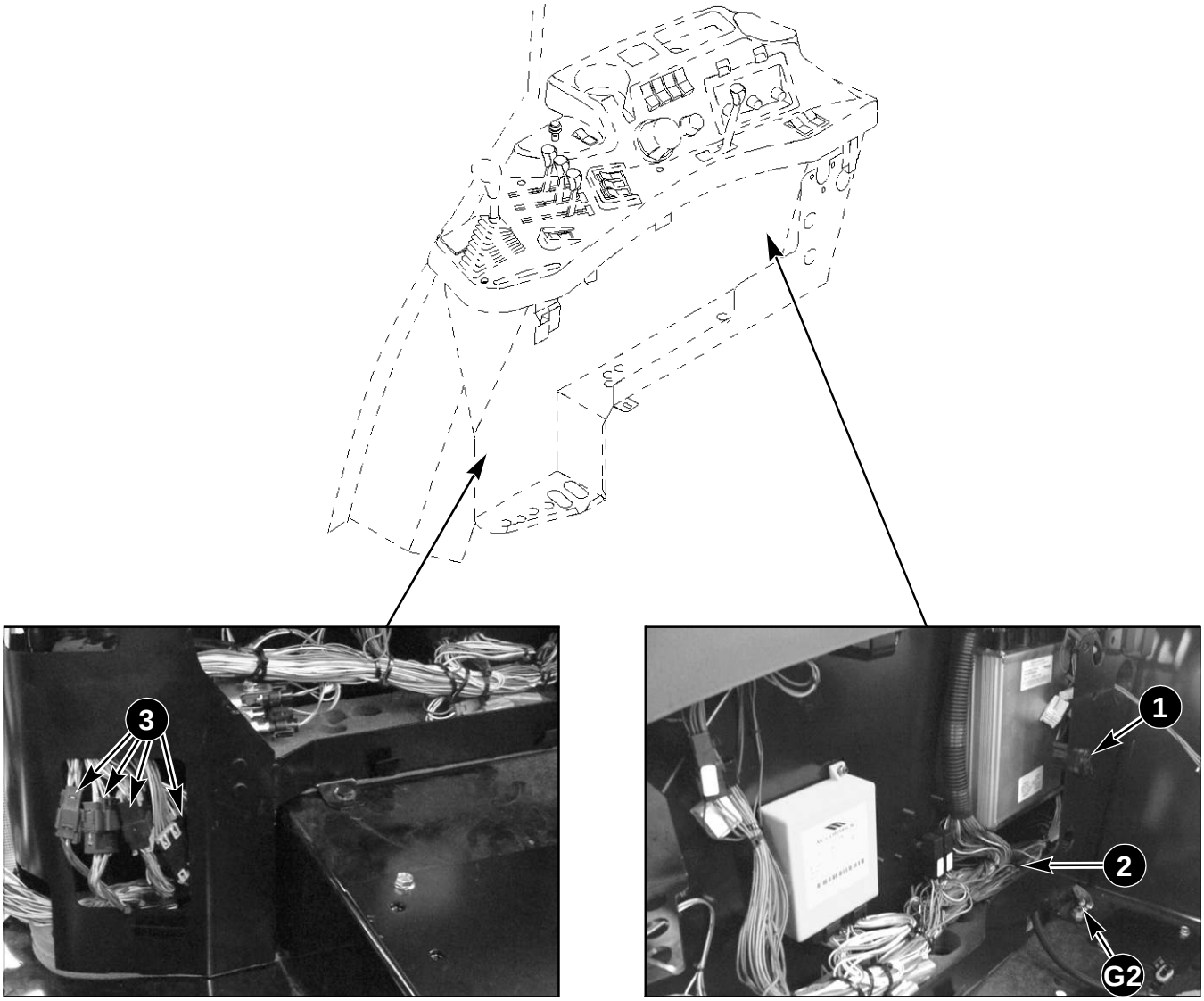

1. FUSE BOX
2. CONNECTOR 31 (26 PIN)
3. SWITCHED POWER STUD
4. CONNECTOR 30 (34 PIN)
5. CAN DIAGNOSTIC CONNECTOR
6. PROGRAMMING CONNECTOR
7. BATTERY POWER STUD (UNSWITCHED)

G1. CHASSIS GROUND CONNECTION G1

https://truckmanualshub.com/



# Right Hand Console Components (XtraSpeed and XtraSpeed - E Tractors Only)

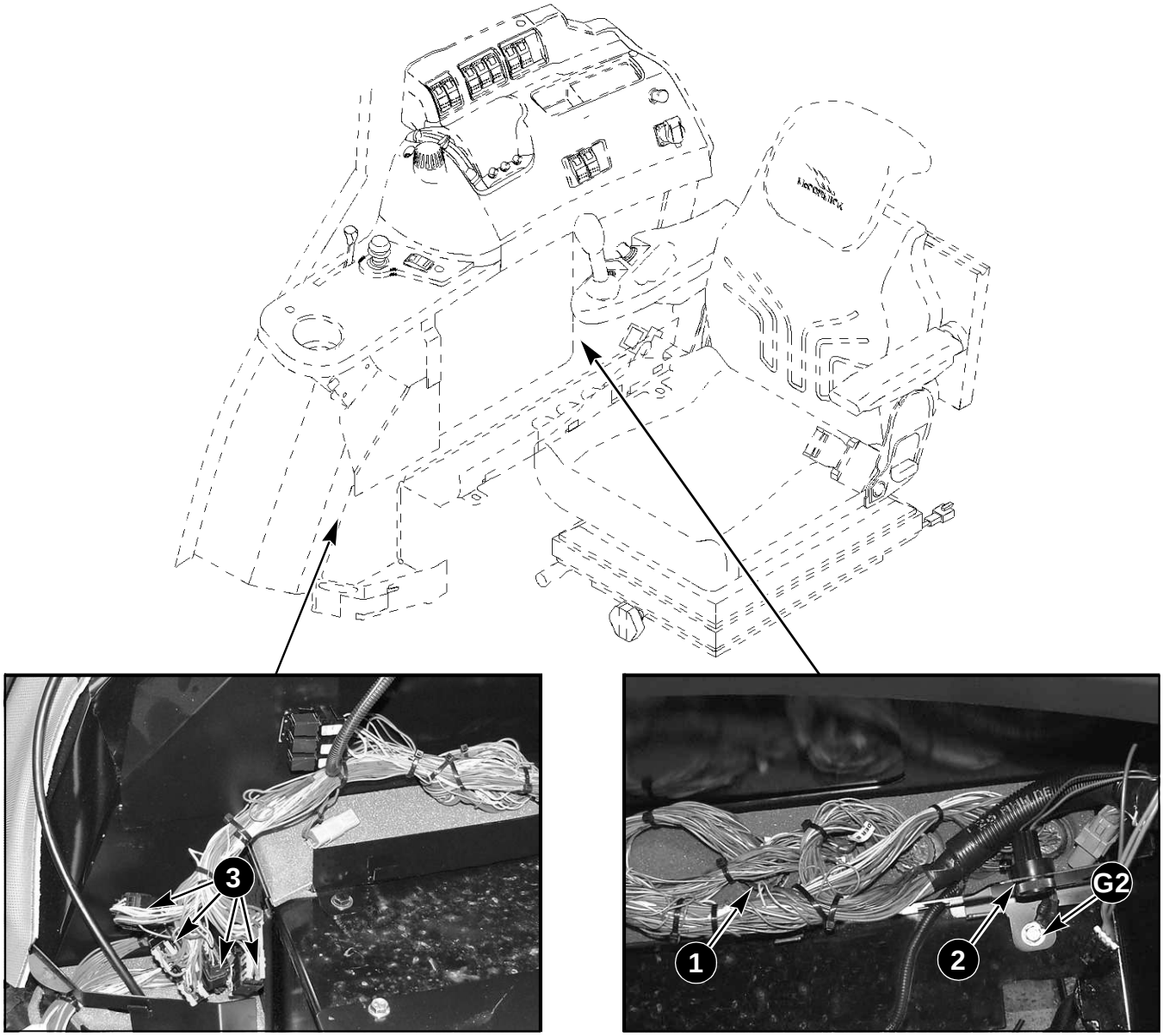



1. AUDIBLE ALARM
2. CONNECTOR 40
3. CONNECTORS 26, 27, 28, 29
G2. CHASSIS GROUND CONNECTION G2

https://truckmanualshub.com/



# Right Hand Console and Armrest Components (XtraSpeed - E Plus Tractors Only)

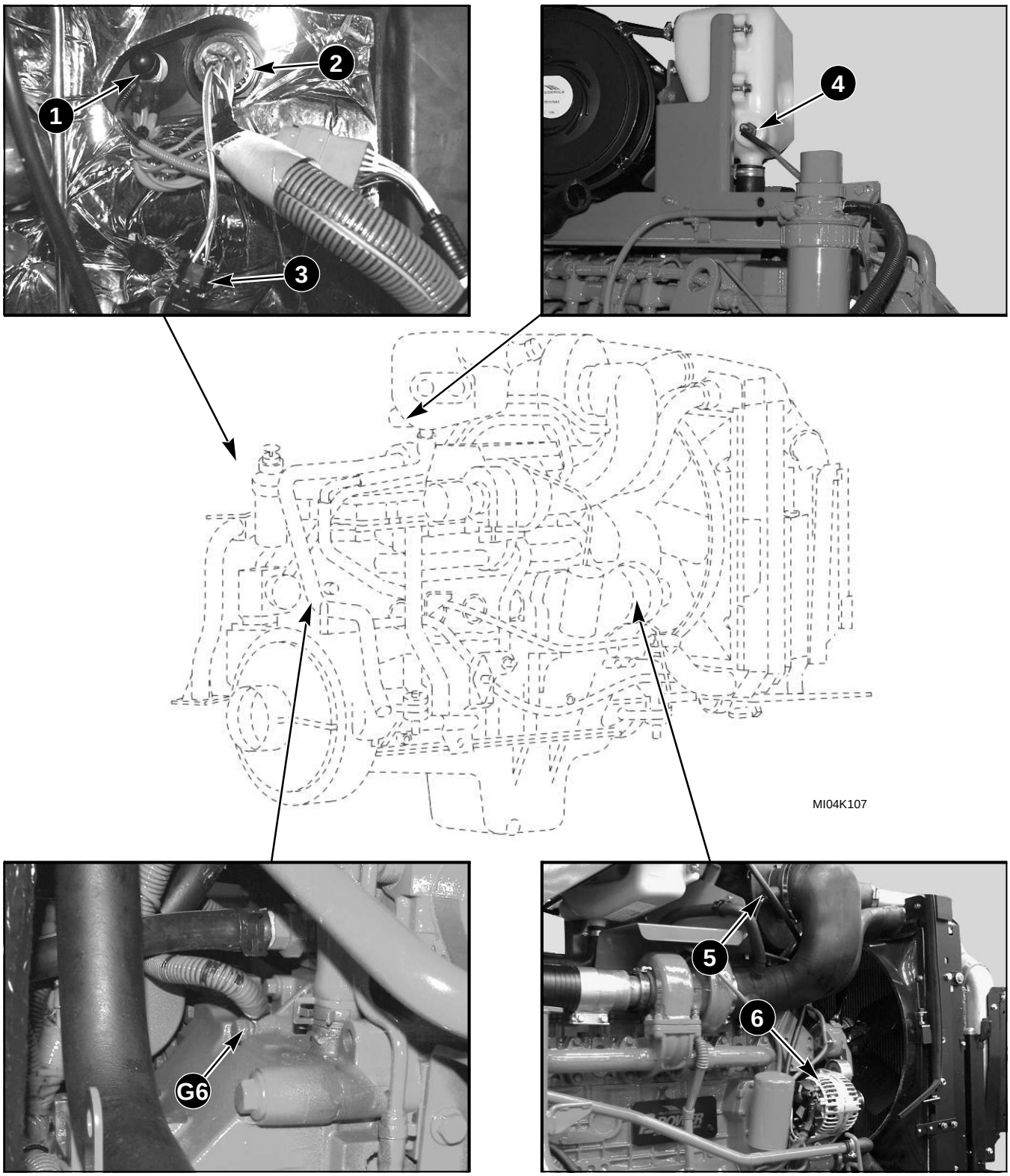



1. CONNECTOR 40
2. AUDIBLE ALARM
3. CONNECTORS 26, 27, 28, 29
G2. CHASSIS GROUND CONNECTION G2

https://truckmanualshub.com/



## Engine Components - XTX185 and XTX200 Tractors



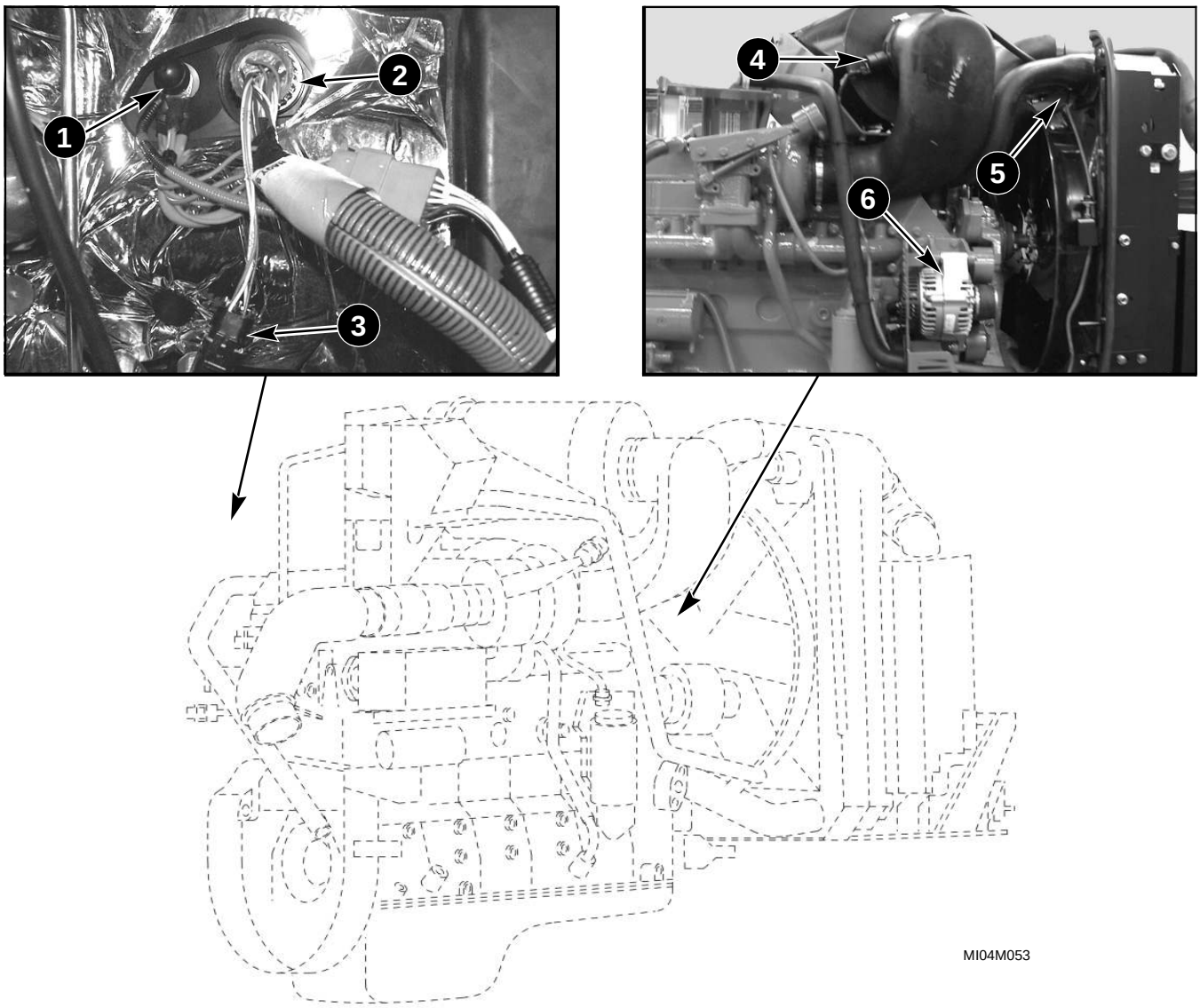

1. UNSWITCHED BATTERY POWER STUD
2. CONNECTOR 10
3. CONNECTOR 20 (RADAR)
4. COOLANT LEVEL SENDER
5. AIR FILTER RESTRICTION SWITCH
6. ALTERNATOR

G6. CHASSIS GROUND CONNECTION G6

https://truckmanualshub.com/



## Engine Components - XTX215 Tractors

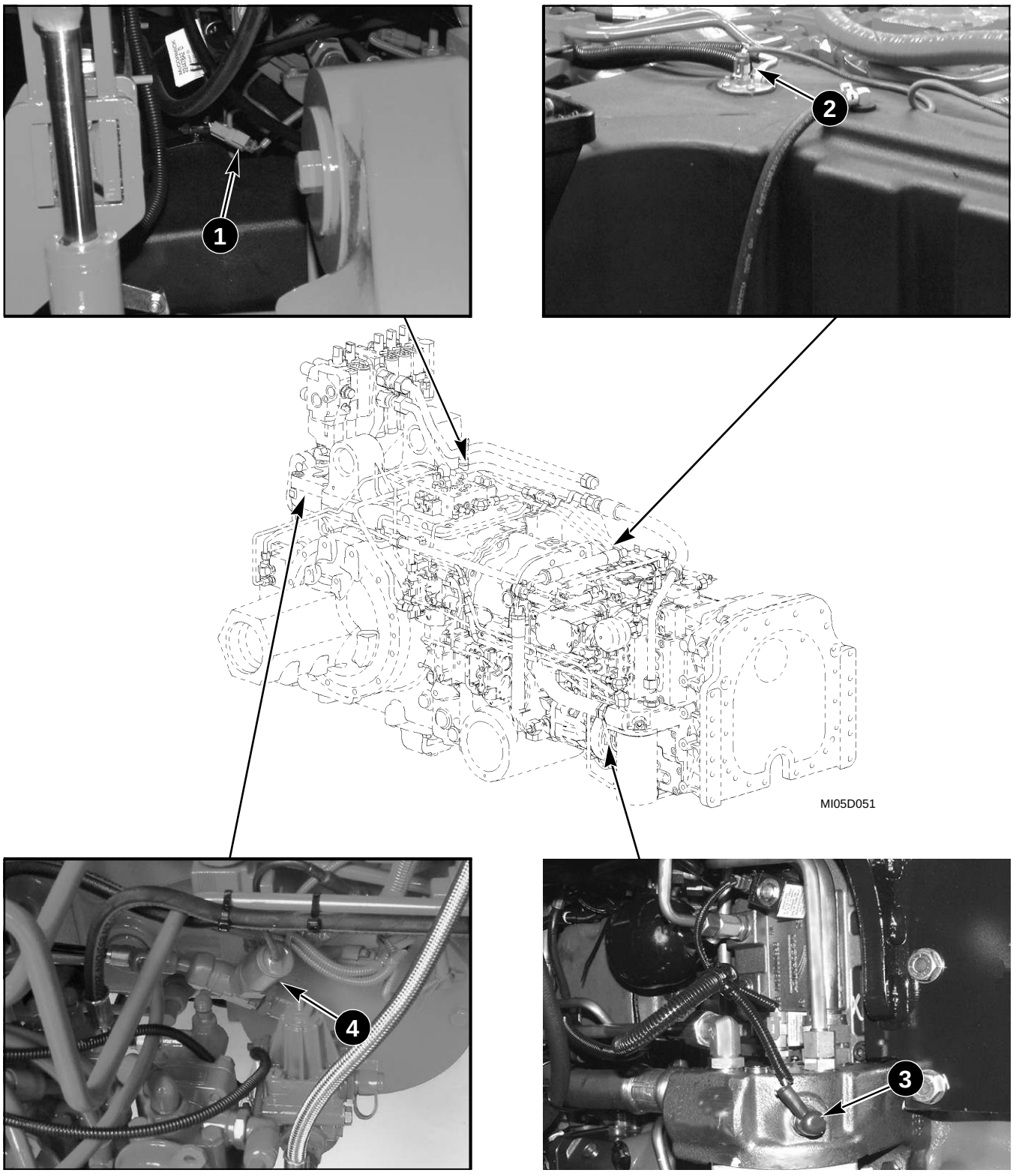



1. UNSWITCHED BATTERY POWER STUD
2. CONNECTOR 10
3. CONNECTOR 20 (RADAR)
4. AIR FILTER RESTRICTION SWITCH
5. COOLANT LEVEL SENDER
6. ALTERNATOR

https://truckmanualshub.com/



## Transmission Components




1. PARK BRAKE SWITCH CONNECTOR
2. FUEL LEVEL SENDER
3. HYDRAULIC FILTER RESTRICTION SWITCH
4. AIR TRAILER BRAKE PRESSURE SENDER

https://truckmanualshub.com/



This Page Has Been Left Blank

https://truckmanualshub.com/



# INSTRUMENT CLUSTER SCHEMATIC CIRCUIT

## Instrument Cluster Connector Pin Identification

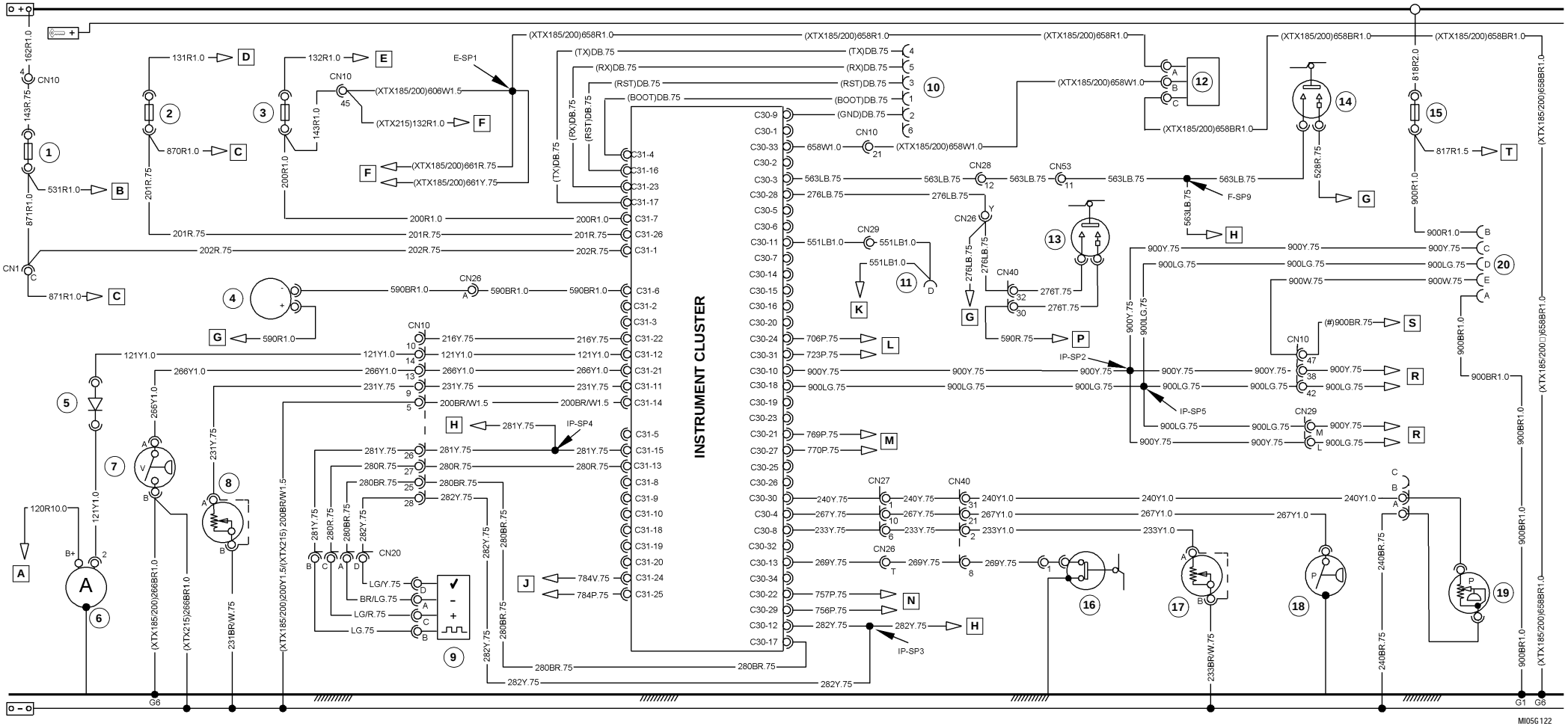
| CONNECTOR 30 (34 Pin) | | | | |
|---|---|---|---|---|
| 1 | OPEN | | 18 | CAN LOW |
| 2 | OPEN | | 19 | OPEN |
| 3 | TRAILED IMPLEMENT SIGNAL | | 20 | OPEN |
| 4 | HYDRAULIC FILTER RESTRICTION SIGNAL | | 21 | 1ST TRAILER TURN SIGNAL |
| 5 | OPEN | | 22 | RIGHT HAND TURN SIGNAL |
| 6 | OPEN | | 23 | OPEN |
| 7 | OPEN | | 24 | SIDE/POSITION LIGHTS |
| 8 | FUEL LEVEL SIGNAL | | 25 | OPEN |
| 9 | BOOTLOAD GROUND | | 26 | OPEN |
| 10 | CAN HIGH | | 27 | 2ND TRAILER TURN SIGNAL |
| 11 | FRONT PTO SIGNAL | | 28 | 540/1000 PTO SIGNAL |
| 12 | RADAR PRESENT SIGNAL | | 29 | LEFT HAND TURN SIGNAL |
| 13 | PARK BRAKE SIGNAL | | 30 | AIR TRAILER BRAKE PRESSURE SIGNAL |
| 14 | OPEN | | 31 | HIGH BEAM |
| 15 | OPEN | | 32 | OPEN |
| 16 | OPEN | | 33 | OPEN |
| 17 | RADAR GROUND | | 34 | OPEN |

| CONNECTOR 31 (26 Pin) | | | | |
|---|---|---|---|---|
| 1 | UNSWITCHED BATTERY POWER (CLOCK) | | 14 | CLEAN GROUND |
| 2 | OPEN | | 15 | RADAR SIGNAL |
| 3 | OPEN | | 16 | BOOTLOAD RESET |
| 4 | BOOTLOAD | | 17 | RS232 TX |
| 5 | OPEN | | 18 | OPEN |
| 6 | AUDIBLE ALARM GROUND | | 19 | OPEN |
| 7 | SWITCHED POWER | | 20 | OPEN |
| 8 | OPEN | | 21 | AIR FILTER RESTRICTION SIGNAL |
| 9 | OPEN | | 22 | NOT USED |
| 10 | OPEN | | 23 | RS232 RX |
| 11 | COOLANT LEVEL SIGNAL | | 24 | FRONT LOWER WORK LIGHTS |
| 12 | ALTERNATOR D+ (EXCITE) | | 25 | REAR LOWER WORK LIGHTS |
| 13 | RADAR B+ | | 26 | ACCESSORY POWER |

https://truckmanualshub.com/


**ALTERNATOR, AIR FILTER RESTRICTION, COOLANT LEVEL AND AUDIBLE RADAR**

**540/1000 PTO SPEED SELECTOR, TRAILED IMPLEMENT, WATER IF FUEL, PARK BRAKE, FUEL LEVEL, HYDRAULIC FILTER RESTRICTION AND AIR BRAKE PRESSURE**



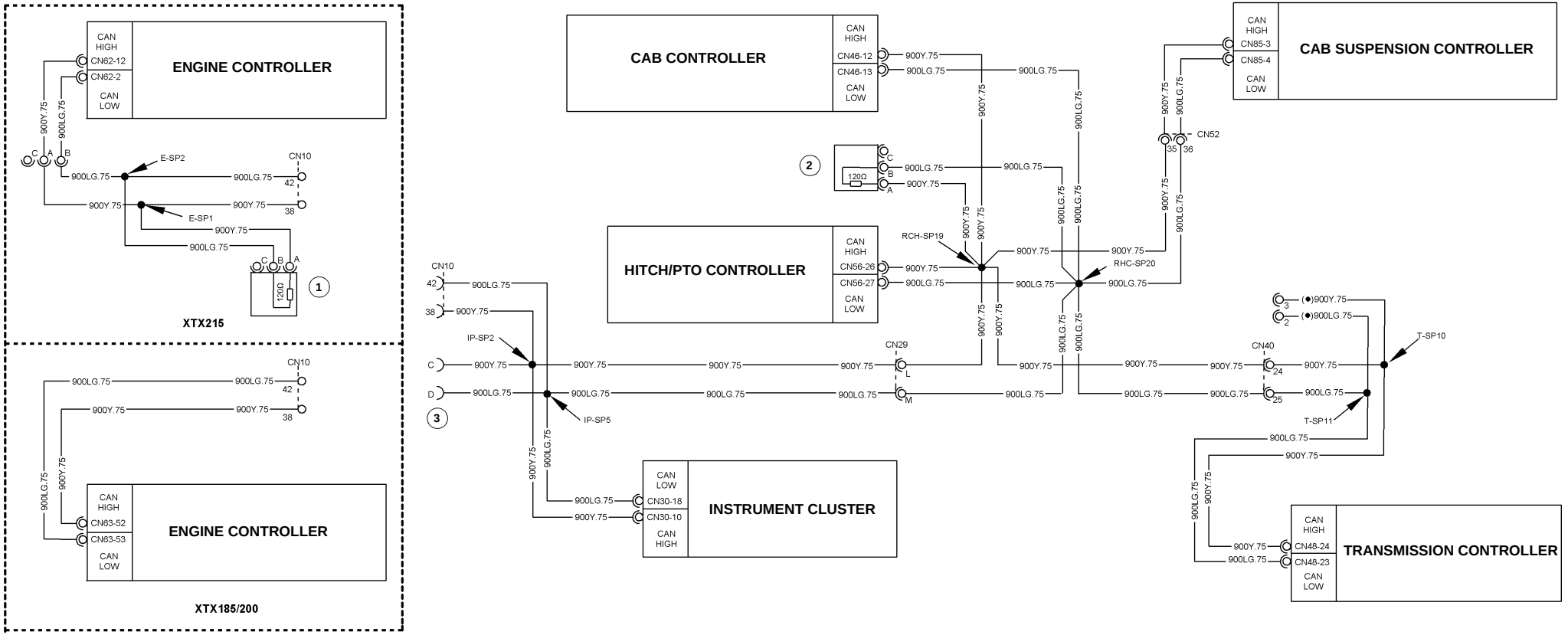

## Key

1. FUSE 37 (7.5 AMP)
2. FUSE 40 (7.5 AMP)
3. FUSE 25 (7.5 AMP)
4. AUDIBLE ALARM
5. DIODE
6. ALTERNATOR
7. AIR FILTER RESTRICTION SWITCH
8. COOLANT LEVEL SENDER
9. RADAR
10. DIAGNOSTIC CONNECTOR (9 PIN)
11. FRONT PTO HARNESS CONNECTOR (3 PIN)
12. WATER IN FUEL SENSOR (XTX185/200)
13. 540/1000 PTO SPEED SELECTOR SWITCH
14. TRAILED IMPLEMENT UP/DOWN SWITCH
15. FUSE 39 (10 AMP)
16. PARK BRAKE SWITCH
17. FUEL LEVEL SENDER
18. HYDRAULIC FILTER RESTRICTION SWITCH
19. AIR TRAILER BRAKE PRESSURE SENDER
20. PROGRAMMING CONNECTOR

A. FROM STARTER MOTOR B+
B. TO SUSPENDED FRONT AXLE CONTROLLER
C. TO RADIO
D. FROM KEY SWITCH TERMINAL 6
E. FROM KEY SWITCH TERMINAL 5
F. TO ENGINE CONTROLLER CIRCUIT
G. SWITCHED B+ FROM HITCH/PTO CIRCUIT
H. FROM HITCH CONTROLLER CIRCUIT
J. FROM WORK LIGHT CIRCUIT
K. TO FRONT PTO SOLENOID
L. FROM HEADLIGHT CIRCUIT
M. FROM TURN SIGNAL CIRCUIT (EUROPEAN SPECIFICATION TRACTORS ONLY)
N. FROM TURN SIGNAL CIRCUIT
P. B+ FROM HITCH/PTO CIRCUIT
R. TO CAN BUS CIRCUIT
S. TO ENGINE CONTROLLER
T. TO CIGAR LIGHTER

# CAN BUS SCHEMATIC CIRCUITS

## CAN Bus Schematic Circuit (For XtraSpeed and XtraSpeed - E Tractors)




MI05H029

### Key

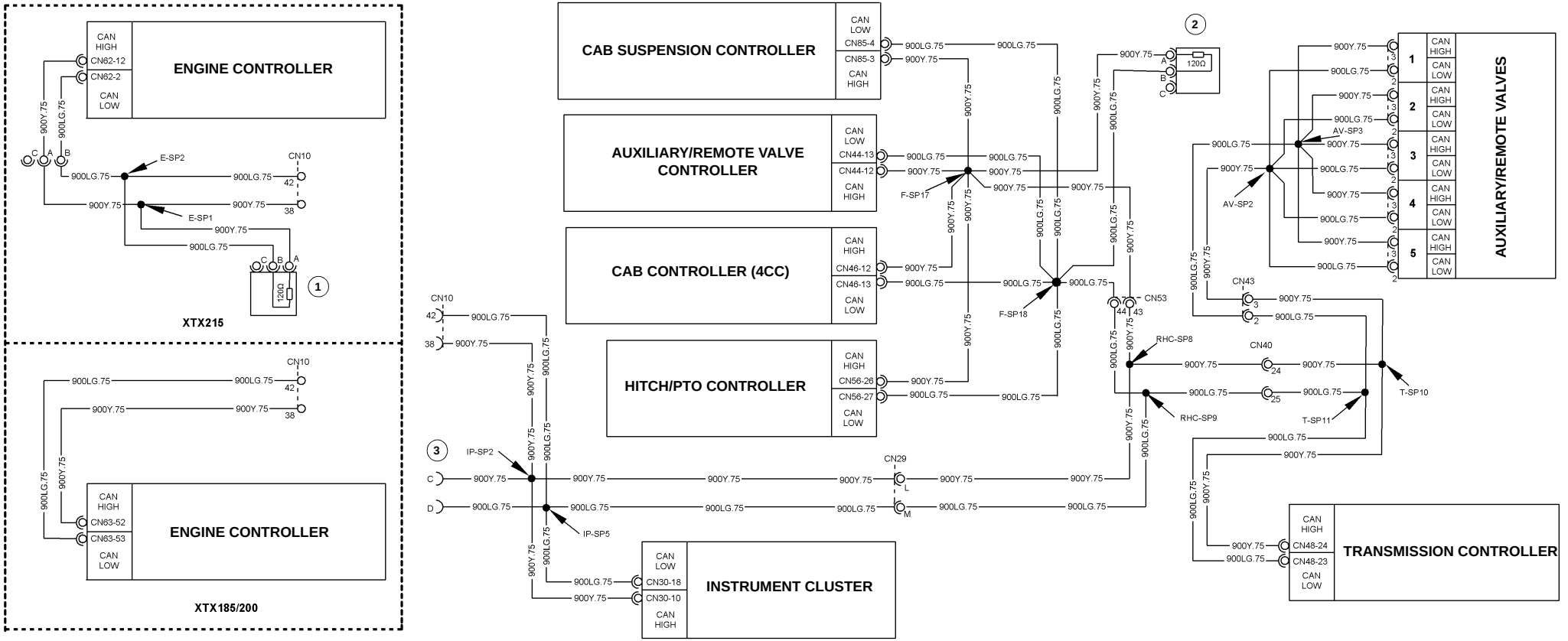
1. ENGINE HARNESS TERMINATION RESISTOR (XTX215 TRACTORS ONLY)
2. TRANSMISSION HARNESS TERMINATION RESISTOR
3. DIAGNOSTIC CONNECTOR (9 PIN)

(●) - TRACTORS UP TO PIN JJE3500645 ONLY

**NOTE:** *For XTX185 and XTX200 tractors the engine harness termination resistor is located within the engine controller.*

https://truckmanualshub.com/


## CAN Bus Schematic Circuit (For XTX Series XtraSpeed - E Plus Tractors)




MI05H030

### Key

1. ENGINE HARNESS TERMINATION RESISTOR (XTX215 TRACTORS ONLY)
2. TRANSMISSION HARNESS TERMINATION RESISTOR
3. DIAGNOSTIC CONNECTOR (9 PIN)

**NOTE:** *For XTX185 and XTX200 tractors the engine harness termination resistor is located within the engine controller.*

https://truckmanualshub.com/


This Page Has Been Left Blank.

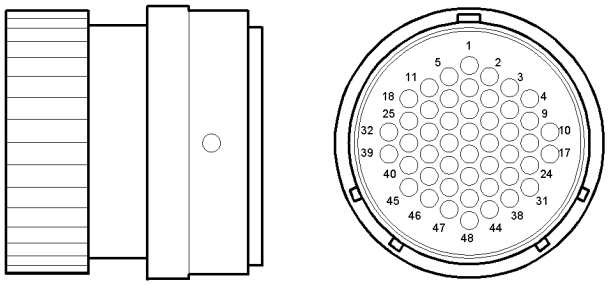
https://truckmanualshub.com/



# MAIN CONNECTORS

## Connector 10 - XTX185 and XTX200 Series Tractors Only

**Location: Cab Firewall**




MI05F174

**ENGINE TO INSTRUMENT PANEL HARNESS (ENGINE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 802 O | A/C HIGH PRESSURE SWITCH |
| 2 | 624 W | ENGINE CONTROLLER NEUTRAL START B+ SUPPLY |
| 3 | 804 O | A/C HIGH PRESSURE SWITCH |
| 4 | 162 R | UNSWITCHED B+ - CLOCK, RADIO AND INSTRUMENT CLUSTER |
| 5 | 200 Y | INSTRUMENT CLUSTER CLEAN GROUND (BATTERY - TERMINAL) |
| 6 | 803 O | A/C COMPRESSOR CLUTCH |
| 7 | - - - - - | OPEN |
| 8 | - - - - - | OPEN |
| 9 | 231 Y | COOLANT LEVEL |
| 10 | - - - - - | OPEN |
| 11 | - - - - - | OPEN |
| 12 | - - - - - | OPEN |
| 13 | 266 Y | AIR FILTER RESTRICTION SWITCH |
| 14 | 121 Y | ALTERNATOR D+ TERMINAL, WARNING LIGHT AND EXCITE |
| 15 | 829 BR/W | ATC CLEAN GROUND |
| 16 | 890 R | HORN B+ |
| 17 | 890 BR | HORN GROUND |
| 18 | 829 BR/W | ATC CLEAN GROUND |
| 19 | 738 P | RH HEADLIGHT - LOW BEAM |
| 20 | 741 P | RH HEADLIGHT - HIGH BEAM |
| 21 | 658 W | WATER IN FUEL |
| 22 | 737 P | LH HEADLIGHT - LOW BEAM |
| 23 | 740 P | LH HEADLIGHT - HIGH BEAM |

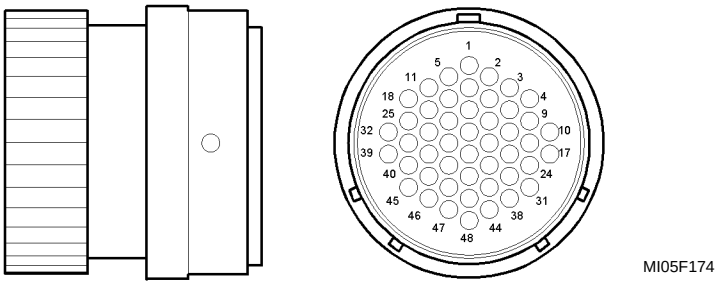
| Cavity | Wire No | Circuit |
|---|---|---|
| 24 | - - - - - | OPEN |
| 25 | 280 BR | RADAR GROUND |
| 26 | 281 Y | RADAR SIGNAL |
| 27 | 280 R | RADAR B+ |
| 28 | 282 Y | RADAR PRESENT |
| 29 | - - - - - | OPEN |
| 30 | - - - - - | OPEN |
| 31 | 784 V | WORK LIGHTS |
| 32 | - - - - - | OPEN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |
| 35 | - - - - - | OPEN |
| 36 | - - - - - | OPEN |
| 37 | - - - - - | OPEN |
| 38 | 900 Y | CAN HIGH |
| 39 | - - - - - | OPEN |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | 900 LG | CAN LOW |
| 43 | - - - - - | OPEN |
| 44 | 643 R | FOOT THROTTLE 5V SUPPLY |
| 45 | 600 W | ENGINE CONTROLLER SWITCHED B+ |
| 46 | 643 Y | FOOT THROTTLE SIGNAL |
| 47 | 900 BR | K - LINE |
| 48 | 643 BR | FOOT THROTTLE 0V RETURN |

https://truckmanualshub.com/



## Connector 10 - XTX215 Series Tractors Only

**Location: Cab Firewall**




MI05F174

**ENGINE TO INSTRUMENT PANEL HARNESS (ENGINE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 802 O | A/C HIGH PRESSURE SWITCH |
| 2 | 625 W | STARTER RELAY NEUTRAL START B+ SUPPLY |
| 3 | 804 O | A/C HIGH PRESSURE SWITCH |
| 4 | 162 R | UNSWITCHED B+ - CLOCK, RADIO AND INSTRUMENT CLUSTER |
| 5 | 200 BR/W | INSTRUMENT CLUSTER CLEAN GROUND (BATTERY - TERMINAL) |
| 6 | 803 O | A/C COMPRESSOR CLUTCH |
| 7 | - - - - - | OPEN |
| 8 | - - - - - | OPEN |
| 9 | 231 Y | COOLANT LEVEL |
| 10 | - - - - - | OPEN |
| 11 | 235 V | NOT USED |
| 12 | 654 W | NOT USED |
| 13 | 266 Y | AIR FILTER RESTRICTION SWITCH |
| 14 | 121 Y | ALTERNATOR D+ TERMINAL, WARNING LIGHT AND EXCITE |
| 15 | 829 BR/W | ATC CLEAN GROUND |
| 16 | 890 R | HORN B+ |
| 17 | 890 BR | HORN GROUND |
| 18 | 828 BR/W | ATC CLEAN GROUND |
| 19 | 738 P | RH HEADLIGHT - LOW BEAM |
| 20 | 741 P | RH HEADLIGHT - HIGH BEAM |
| 21 | - - - - - | OPEN |
| 22 | 737 P | LH HEADLIGHT - LOW BEAM |
| 23 | 740 P | LH HEADLIGHT - HIGH BEAM |

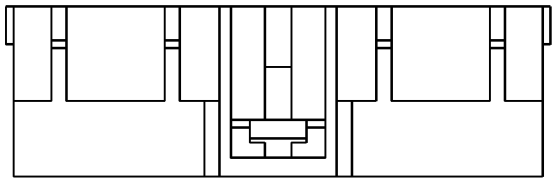
| Cavity | Wire No | Circuit |
|---|---|---|
| 24 | - - - - - | OPEN |
| 25 | 280 BR | RADAR GROUND |
| 26 | 281 Y | RADAR SIGNAL |
| 27 | 280 R | RADAR B+ |
| 28 | 282 Y | RADAR PRESENT |
| 29 | - - - - - | OPEN |
| 30 | - - - - - | OPEN |
| 31 | 784 V | WORK LIGHTS |
| 32 | - - - - - | OPEN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |
| 35 | - - - - - | OPEN |
| 36 | 652 BR | NOT USED |
| 37 | - - - - - | OPEN |
| 38 | 900 Y | CAN HIGH |
| 39 | 653 BR | NOT USED |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | 900 LG | CAN LOW |
| 43 | - - - - - | OPEN |
| 44 | 643 R | FOOT THROTTLE 5V SUPPLY |
| 45 | 132 R | ENGINE CONTROLLER SWITCHED B+ |
| 46 | 643 Y | FOOT THROTTLE SIGNAL |
| 47 | - - - - - | OPEN |
| 48 | 643 BR | FOOT THROTTLE 0V RETURN |

https://truckmanualshub.com/



## Connector 26

**Location: Right Hand Console**



477I96

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

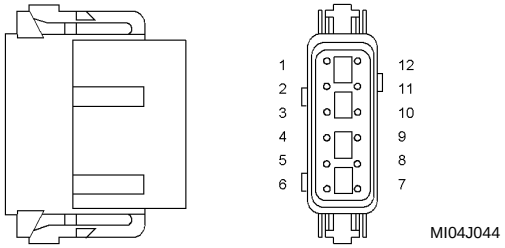
| Cavity | Wire No | Circuit |
|---|---|---|
| A | 590 BR | AUDIBLE ALARM |
| B | 707 P | LH TAIL/POSITION LIGHT |
| C | 708 P | RH TAIL/POSITION LIGHT |
| D | - - - - - | OPEN |
| E | 590 R | CAB CONTROLLER SWITCHED B+ |
| F | 501 R | HITCH/PTO CONTROLLER SWITCHED B+ |
| G | 784 V | REAR FENDER WORK LIGHTS |
| H | 810 R | SEAT B+ |
| J | 530 R | MFD AND DIFF LOCK B+ |
| K | 134 R | AUXILIARY POWER CONNECTOR SWITCHED B+ |
| L | 756 P | RH TURN SIGNAL |
| M | 757 P | LH TURN SIGNAL |
| N | (IIC) R | IIC UNSWITCHED POWER B+ |
| P | 133 R | AUXILIARY POWER FENDER HARNESS CONNECTOR (*)<br>7 PIN CONNECTOR (**) |
| R | 135 R | RH CONSOLE AUXILIARY POWER UNSWITCHED B+ |
| S | 817 R | CIGAR LIGHTER |
| T | 269 Y | PARK BRAKE WARNING LIGHT |
| U | 702 R | BRAKE RELAY B+ |
| V | - - - - - | OPEN |
| W | 785 V | REAR FOG LIGHTS (EUR) |
| X | 254 Y | PARK LOCK SIGNAL |
| Y | 276 LB | 1000 RPM PTO SWITCH |
| Z | (VP) R | AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ (XTRASPEED - E PLUS ONLY) |

*(*) European Specification Tractors Only.*

*(**) American Specification Tractors Only.*

## Connector 27

**Location: Right Hand Console**




**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

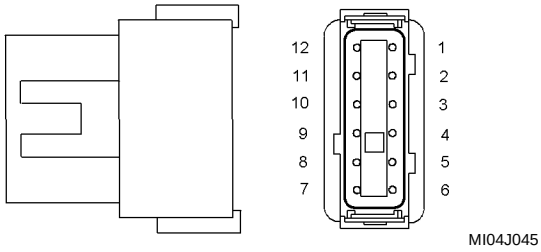
| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 240 Y | AIR TRAILER BRAKE PRESSURE |
| 2 | 515 R | LOADER CONTROLS B+ |
| 3 | 656 Y | CLUTCH POSITION SIGNAL |
| 4 | - - - - - | OPEN |
| 5 | 660 Y | BOTTOM OF CLUTCH SIGNAL |
| 6 | 233 Y | FUEL LEVEL SENDER |
| 7 | 656 BR | CLUTCH POSITION RETURN |
| 8 | 656 R | CLUTCH POSITION B+ |
| 9 | 536 LB | LH BRAKE SIGNAL |
| 10 | 267 Y | HYDRAULIC FILTER RESTRICTION SWITCH |
| 11 | - - - - - | OPEN |
| 12 | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 28

**Location: Right Hand Console**



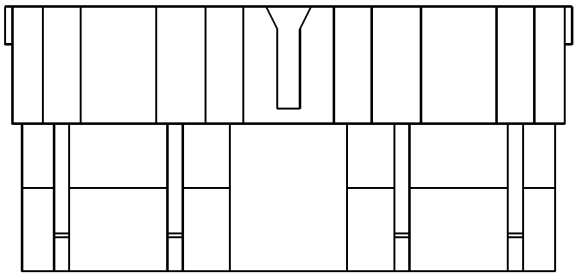

MI04J045

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 510 T | F/N/R, FOOT THROTTLE 5V REF |
| 2 | 511 T | FORWARD SIGNAL |
| 3 | 562 R | F/N/R, F/N/R/P 12V SUPPLY |
| 4 | 606 W | IIC SWITCHED POWER SENSING |
| 5 | - - - - - | OPEN |
| 6 | 513 T | REVERSE SIGNAL |
| 7 | 531 LB | RH BRAKE SIGNAL |
| 8 | 514 T | NEUTRAL SIGNAL |
| 9 | - - - - - | OPEN |
| 10 | 281 Y | RADAR SIGNAL (HITCH) |
| 11 | 282 Y | RADAR PRESENT (IIC) |
| 12 | 563 LB | IMPLEMENT DOWN SWITCH |

## Connector 29

**Location: Right Hand Console**



478I96

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| A | 835 O | FRONT WINDSCREEN WASHER |
| B | 845 O | REAR WINDSHIELD WASHER |
| C | 550 R | FRONT PTO B+ |
| D | 551 LB | FRONT PTO SIGNAL |
| E | 590 R | REAR PTO SWITCHED B+ |
| F | 161 R | (##) AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ |
| G | 134 R | IIIC SWITCHED POWER |
| H | 776 P | ROTARY BEACON LIGHT |
| J | 531 R | MFD AXLE SUSPENSION UNSWITCHED POWER |
| K | 530 R | MFD AXLE SUSPENSION SWITCHED POWER |
| L | 900 Y | CAN HIGH |
| M | 900 LG | CAN LOW |
| N | - - - - - | OPEN |
| P | 500B R | CAB CONTROLLER UNSWITCHED B+ |
| R | 550 R | TRANSMISSION CONTROLLER SWITCHED B+ |
| S | 400 R | TRANSMISSION CONTROLLER UNSWITCHED B+ |
| T | 643 Y | FOOT THROTTLE SIGNAL |
| U | 643 BR | FOOT THROTTLE 0V RETURN |
| V | 160 R | (##) AUXILIARY/REMOTE VALVE CONTROLLER UNSWITCHED B+ |
| W | - - - - - | OPEN |
| X | 660 W | (#) CAB SUSPENSION CONTROLLER SWITCHED B+ |
| | 660 R | (##) CAB SUSPENSION CONTROLLER SWITCHED B+ |
| Y | (ARM) R | (##) ARMREST SWITCHED B+ |
| Z | - - - - - | OPEN |

*(#) XtraSpeed and XtraSpeed - E tractors only.*

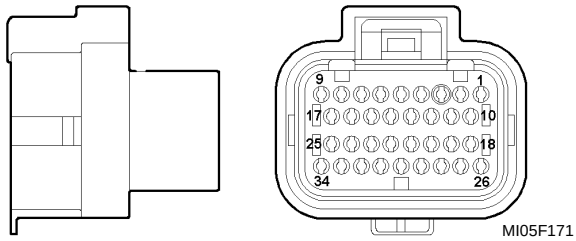
*(##) XtraSpeed - E Plus tractors only.*

https://truckmanualshub.com/



## Connector 30

**Location: Instrument Cluster**



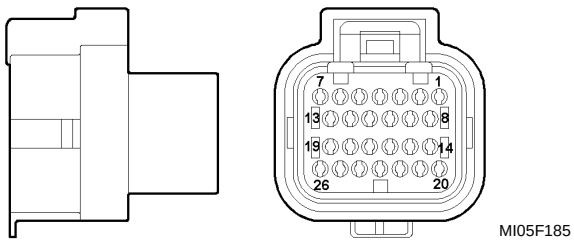

MI05F171

**INSTRUMENT PANEL HARNESS TO INSTRUMENT CLUSTER**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | - - - - - | OPEN |
| 2 | - - - - - | OPEN |
| 3 | 563 LB | TRAILED IMPLEMENT SIGNAL |
| 4 | 267 Y | HYDRAULIC FILTER RESTRICTION SIGNAL |
| 5 | - - - - - | OPEN |
| 6 | - - - - - | OPEN |
| 7 | - - - - - | OPEN |
| 8 | 233 Y | FUEL LEVEL SIGNAL |
| 9 | (GND) DB | BOOTLOAD GROUND |
| 10 | 900 Y | CAN HIGH |
| 11 | 551 LB | FRONT PTO SIGNAL |
| 12 | 282 Y | RADAR PRESENT SIGNAL |
| 13 | 269 Y | PARK BRAKE SIGNAL |
| 14 | - - - - - | OPEN |
| 15 | - - - - - | OPEN |
| 16 | - - - - - | OPEN |
| 17 | 280 BR | RADAR GROUND |
| 18 | 900 LG | CAN LOW |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | 769 P | 1ST TRAILER TURN SIGNAL |
| 22 | 757 P | RIGHT HAND TURN SIGNAL |
| 23 | - - - - - | OPEN |
| 24 | 706 P | SIDE/POSITION LIGHTS |
| 25 | - - - - - | OPEN |
| 26 | - - - - - | OPEN |
| 27 | 770 P | 2ND TRAILER TURN SIGNAL |
| 28 | 276 LB | 540/1000 PRO SPEED SELECTOR SIGNAL |
| 29 | 756 P | LEFT HAND TURN SIGNAL |
| 30 | 240 Y | AIR TRAILER BRAKE PRESSURE SIGNAL |
| 31 | 723 P | HIGH BEAM |
| 32 | - - - - - | OPEN |
| 33 | 658 W | WATER IN FUEL SIGNAL (XTX185/200) |
| 34 | - - - - - | OPEN |

## Connector 31

**Location: Instrument Cluster**




MI05F185

**INSTRUMENT PANEL HARNESS TO INSTRUMENT CLUSTER**

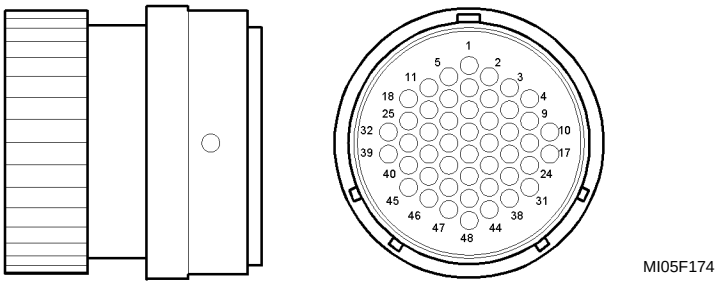
| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 202 R | UNSWITCHED BATTERY POWER |
| 2 | - - - - - | OPEN |
| 3 | - - - - - | OPEN |
| 4 | (BOOT) DB | BOOTLOAD |
| 5 | - - - - - | OPEN |
| 6 | 590 BR | AUDIBLE ALARM GROUND |
| 7 | 200 R | SWITCHED POWER |
| 8 | - - - - - | OPEN |
| 9 | - - - - - | OPEN |
| 10 | - - - - - | OPEN |
| 11 | 231 Y | COOLANT LEVEL SENDER |
| 12 | 121 Y | ALTERNATOR D+ (EXCITE) |
| 13 | 280 R | RADAR B+ |
| 14 | 200 BR/W | CLEAN GROUND |
| 15 | 281 Y | RADAR SIGNAL |
| 16 | (RST) DB | BOOTLOAD RESET |
| 17 | (TX) DB | RS232 TX |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | 266 Y | AIR FILTER RESTRICTION SIGNAL |
| 22 | - - - - - | NOT USED |
| 23 | (RX) DB | RS232 RX |
| 24 | 784 V | FRONT LOWER WORK LIGHTS |
| 25 | 784 P | REAR LOWER WORK LIGHTS |
| 26 | 201 R | ACCESSORY POWER |

https://truckmanualshub.com/



## Connector 40

**Location: Cab Floor (Right Hand Console)**




MI05F174

**RIGHT HAND CONSOLE HARNESS TO TRANSMISSION HARNESS (TRANSMISSION HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 543 LB | MFD SOLENOID B+ |
| 2 | 233 Y | FUEL LEVEL SENDER |
| 3 | 507 R | +8 V POSITION POTENTIOMETER |
| 4 | 507 LB | POSITION SIGNAL |
| 5 | 507 BR | POSITION POTENTIOMETER LOW |
| 6 | (LINK) R | TRANSMISSION CONTROLLER TO CAB CONTROLLER LINK |
| 7 | 500 BR/W | HITCH CONTROLLER CLEAN GROUND |
| 8 | 269 Y | PARK BRAKE WARNING LIGHT |
| 9 | 539 LB | DIFF LOCK SOLENOID B+ |
| 10 | 511 R | HITCH SOLENOID B+ |
| 11 | 513 LB | HITCH RAISE SOLENOID |
| 12 | 514 R | HITCH PIN +8 VOLTS |
| 13 | 515 LB | LH HITCH PIN SIGNAL |
| 14 | 514 BR | HITCH PINS LOW |
| 15 | 514 LB | RH HITCH PIN SIGNAL |
| 16 | 540 R | 4TH AUXILIARY VALVE |
| 17 | 512 LB | HITCH LOWER SOLENOID |
| 18 | 215 Y | WHEEL SPEED SIGNAL |
| 19 | 597 LB | PTO SOLENOID B+ |
| 20 | 597 BR | PTO SOLENOID GROUND |
| 21 | 267 Y | HYDRAULIC FILTER SIGNAL |
| 22 | 280 BR/W | PARK LOCK RETURN |
| 23 | - - - - - | OPEN |
| 24 | 900 Y | CAN HIGH |
| 25 | 900 LG | CAN LOW |
| 26 | 224 Y | PTO SPEED SIGNAL |

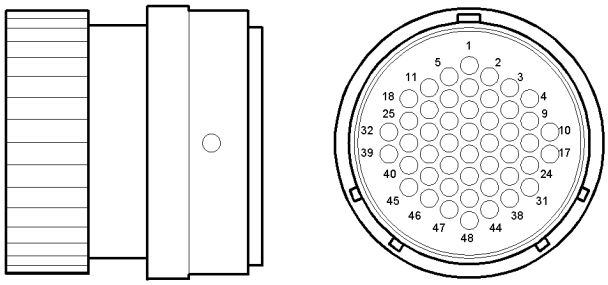
| Cavity | Wire No | Circuit |
|---|---|---|
| 27 | (4TH) Y | XTRASPEED TRACTORS FROM PIN JJE3500646 - NOT USED |
| 28 | - - - - - | OPEN |
| 29 | - - - - - | OPEN |
| 30 | 276 T | 540/1000 PTO SWITCH B+ |
| 31 | 240 Y | TRAILER BRAKE PRESSURE |
| 32 | 276 T | 540/1000 PTO SWITCH |
| 33 | 551 O | FRONT PTO SOLENOID |
| 34 | 500 BR/W | IIC CLEAN GROUND |
| 35 | (1ST) Y | XTRASPEED TRACTORS FROM PIN JJE3500646 - NOT USED |
| 36 | 542 T | 4TH AUXILIARY VALVE RAISE |
| 37 | 541 T | 4TH AUXILIARY VALVE LOWER |
| 38 | 400 R | TRANSMISSION CONTROLLER UNSWITCHED B+ |
| 39 | 516 T | LOADER SOLENOID RAISE |
| 40 | 515 T | LOADER SOLENOID LOWER |
| 41 | 550 R | TRANSMISSION CONTROLLER SWITCHED B+ |
| 42 | (2ND) Y | XTRASPEED TRACTORS FROM PIN JJE3500646 - NOT USED |
| 43 | (3RD) Y | XTRASPEED TRACTORS FROM PIN JJE3500646 - NOT USED |
| 44 | 500 BR/W | CAB CONTROLLER CLEAN GROUND |
| 45 | (VP IN) R | AUXILIARY/REMOTE VALVES B+ (XTRASPEED - E PLUS ONLY) |
| 46 | 656 R | CLUTCH POSITION B+ |
| 47 | 656 Y | CLUTCH POSITION SIGNAL |
| 48 | 656 BR | CLUTCH POSITION RETURN |

https://truckmanualshub.com/



## Connector 51 (XtraSpeed - E Plus Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 757 P | LEFT HAND TURN SIGNAL |
| 2 | 756 P | RIGHT HAND TURN SIGNAL |
| 3 | 507 R | HITCH POSITION POTENTIOMETER B+ |
| 4 | 707 P | LEFT HAND REAR SIDE/POSITION LIGHT |
| 5 | 708 P | RIGHT HAND REAR SIDE/ POSITION LIGHT |
| 6 | 785 V | REAR FOG LIGHT |
| 7 | 702 P | STOP LIGHTS |
| 8 | (VP) T | AUXILIARY/REMOTE VALVE VP OUT |
| 9 | 591 DB | DIFFERENTIAL LOCK SOLENOID B+ |
| 10 | 511 R | HITCH SOLENOID B+ |
| 11 | 835 O | FRONT WINDSCREEN WASHER |
| 12 | 845 O | REAR WINDSCREEN WASHER |
| 13 | 776 P | BEACON LIGHT (EUROPEAN SPECIFICATION TRACTORS ONLY) |
| 14 | 514 BR | LOAD PIN RETURN |
| 15 | 514 LB | RIGHT HAND LOAD PIN SIGNAL |
| 16 | 512 LB | HITCH LOWER SOLENOID |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | - - - - - | OPEN |
| 22 | - - - - - | OPEN |
| 23 | 224 Y | PTO SPEED SIGNAL |
| 24 | 850 R | CAB SUSPENSION CONTROLLER SWITCHED B+ |

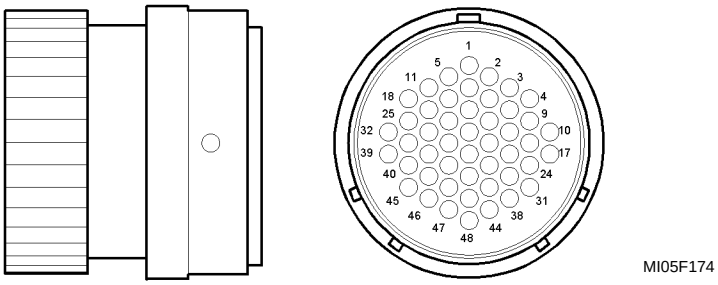
| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 513 LB | HITCH LOWER SOLENOID |
| 26 | 514 R | LOAD PIN 8V SUPPLY |
| 27 | 515 LB | LEFT HAND LOAD PIN SIGNAL |
| 28 | - - - - - | OPEN |
| 29 | 133 R | AUXILIARY POWER SWITCHED B+ |
| 30 | 784 P | REAR WORK LIGHTS |
| 31 | 507 LB | HITCH POSITION POTENTIOMETER SIGNAL |
| 32 | 507 BR | HITCH POSITION POTENTIOMETER RETURN |
| 33 | (LINK) R | CAB CONTROLLER/ TRANSMISSION CONTROLLER LINK |
| 34 | BR/W | HITCH CONTROLLER CLEAN GROUND |
| 35 | BR/W | CLEAN GROUND |
| 36 | 597 LB | PTO SOLENOID B+ |
| 37 | 597 BR | PTO SOLENOID RETURN |
| 38 | - - - - - | OPEN |
| 39 | - - - - - | OPEN |
| 40 | 542 LB | MFD RELAY SUPPLY |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | - - - - - | OPEN |
| 44 | - - - - - | OPEN |
| 45 | - - - - - | OPEN |
| 46 | - - - - - | OPEN |
| 47 | - - - - - | OPEN |
| 48 | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 52 (XtraSpeed and XtraSpeed - E Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 560 R | HITCH UPPER LIMIT POTENTIOMETER SUPPLY |
| 2 | 560 LB | HITCH UPPER LIMIT POTENTIOMETER SIGNAL |
| 3 | 560 BR | HITCH UPPER LIMIT POTENTIOMETER RETURN |
| 4 | 502 R | HITCH DROP SPEED POTENTIOMETER SUPPLY |
| 5 | 502 LB | HITCH DROP SPEED POTENTIOMETER SIGNAL |
| 6 | 502 BR | HITCH DROP SPEED POTENTIOMETER RETURN |
| 7 | 504 LB | HITCH POSITION COMMAND POTENTIOMETER SIGNAL |
| 8 | 504 R | HITCH POSITION COMMAND POTENTIOMETER SUPPLY |
| 9 | 504 BR | HITCH POSITION COMMAND POTENTIOMETER RETURN |
| 10 | 505 R | HITCH LOAD COMMAND POTENTIOMETER SUPPLY |
| 11 | 505 LB | HITCH LOAD COMMAND POTENTIOMETER SIGNAL |
| 12 | 505 BR | HITCH LOAD COMMAND POTENTIOMETER RETURN |
| 13 | - - - - - | OPEN |
| 14 | - - - - - | OPEN |
| 15 | - - - - - | OPEN |
| 16 | - - - - - | OPEN |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | 570 LB | SLIP CONTROL LIGHT SUPPLY |
| 22 | 567 LB | SLIP CONTROL ON SIGNAL |
| 23 | - - - - - | OPEN |
| 24 | 593 DB | AUTO PTO OFF SIGNAL |

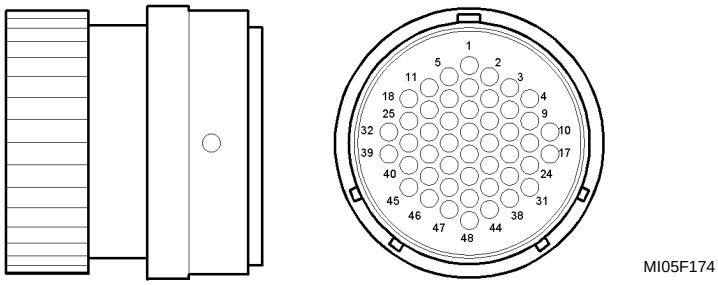
| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 531 R | MFD AXLE SUSPENSION UNSWITCHED B+ |
| 26 | 643 Y | FOOT THROTTLE SIGNAL |
| 27 | 281 Y | RADAR SIGNAL |
| 28 | 506 R | HITCH TRAVEL POTENTIOMETER SUPPLY |
| 29 | 506 LB | HITCH TRAVEL POTENTIOMETER SIGNAL |
| 30 | 506 BR | HITCH TRAVEL POTENTIOMETER RETURN |
| 31 | 590 R | REMOTE PTO SWITCH B+ |
| 32 | - - - - - | OPEN |
| 33 | 161 R | AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ |
| 34 | - - - - - | OPEN |
| 35 | 500B R | CAB CONTROLLER UNSWITCHED B+ |
| 36 | 572 LB | RIDE CONTROL ON SIGNAL |
| 37 | 573 LB | RIDE CONTROL OVERRIDE SIGNAL |
| 38 | - - - - - | OPEN |
| 39 | 282 Y | RADAR PRESENT SIGNAL |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | 534 DB | MFD AXLE SUSPENSION UP SIGNAL |
| 44 | 535 DB | MFD AXLE SUSPENSION DOWN SIGNAL |
| 45 | 533 DB | MFD AXLE SUSPENSION REGULATION ON |
| 46 | 542 DB | MFD AXLE SUSPENSION UNSWITCHED UP SIGNAL |
| 47 | 563 DB | MFD AXLE SUSPENSION INDICATOR LIGHT |
| 48 | 530 R | MFD AXLE SUSPENSION SWITCHED B+ |

https://truckmanualshub.com/



## Connector 52 (XtraSpeed - E Plus Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 560 R | HITCH UPPER LIMIT POTENTIOMETER SUPPLY |
| 2 | 560 LB | HITCH UPPER LIMIT POTENTIOMETER SIGNAL |
| 3 | 560 BR | HITCH UPPER LIMIT POTENTIOMETER RETURN |
| 4 | 502 R | HITCH DROP SPEED POTENTIOMETER SUPPLY |
| 5 | 502 LB | HITCH DROP SPEED POTENTIOMETER SIGNAL |
| 6 | 502 BR | HITCH DROP SPEED POTENTIOMETER RETURN |
| 7 | 504 LB | HITCH POSITION COMMAND POTENTIOMETER SIGNAL |
| 8 | 504 R | HITCH POSITION COMMAND POTENTIOMETER SUPPLY |
| 9 | 504 BR | HITCH POSITION COMMAND POTENTIOMETER RETURN |
| 10 | 505 R | HITCH LOAD COMMAND POTENTIOMETER SUPPLY |
| 11 | 505 LB | HITCH LOAD COMMAND POTENTIOMETER SIGNAL |
| 12 | 505 BR | HITCH LOAD COMMAND POTENTIOMETER RETURN |
| 13 | - - - - - | OPEN |
| 14 | - - - - - | OPEN |
| 15 | - - - - - | OPEN |
| 16 | - - - - - | OPEN |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | 570 LB | SLIP CONTROL LIGHT SUPPLY |
| 22 | 567 LB | SLIP CONTROL ON SIGNAL |
| 23 | - - - - - | OPEN |
| 24 | 593 DB | AUTO PTO OFF SIGNAL |

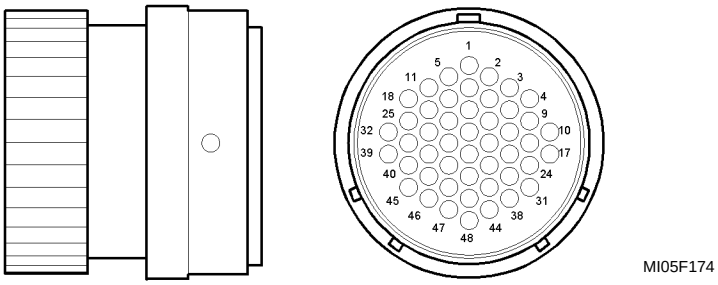
| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 531 R | MFD AXLE SUSPENSION CONTROLLER UNSWITCHED B+ |
| 26 | 643 Y | FOOT THROTTLE SIGNAL |
| 27 | 281 Y | RADAR SIGNAL |
| 28 | 506 R | HITCH TRAVEL POTENTIOMETER SUPPLY |
| 29 | 506 LB | HITCH TRAVEL POTENTIOMETER SIGNAL |
| 30 | 506 BR | HITCH TRAVEL POTENTIOMETER RETURN |
| 31 | 590 R | REMOTE PTO SWITCH B+ |
| 32 | - - - - - | OPEN |
| 33 | 161 R | AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ |
| 34 | - - - - - | OPEN |
| 35 | 500B R | CAB CONTROLLER UNSWITCHED B+ |
| 36 | 572 LB | RIDE CONTROL ON SIGNAL |
| 37 | 573 LB | RIDE CONTROL OVERRIDE SIGNAL |
| 38 | - - - - - | OPEN |
| 39 | 282 Y | RADAR PRESENT SIGNAL |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | 534 DB | FRONT AXLE SUSPENSION UP SIGNAL |
| 44 | 535 DB | MFD AXLE SUSPENSION DOWN SIGNAL |
| 45 | 533 DB | MFD AXLE SUSPENSION REGULATION ON |
| 46 | 542 DB | MFD AXLE SUSPENSION UNSWITCHED UP SIGNAL |
| 47 | 563 DB | MFD AXLE SUSPENSION INDICATOR LIGHT |
| 48 | 530 R | MFD AXLE SUSPENSION SWITCHED B+ |

https://truckmanualshub.com/



## Connector 53 (XtraSpeed - E Plus Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 532 LB | DIFFERENTIAL LOCK ON SIGNAL |
| 2 | 280 BR | PARK LOCK SOLENOID RETURN |
| 3 | 591 LB | PTO ON SIGNAL |
| 4 | 592 LB | PTO OFF SIGNAL |
| 5 | 592 DB | AUTO PTO ON SIGNAL |
| 6 | 501 R | HITCH/PTO CONTROLLER SWITCHED B+ |
| 7 | 541 LB | MFD ON SIGNAL |
| 8 | 254 Y | PARK LOCK ON SIGNAL |
| 9 | 272 Y | CREEP ON SIGNAL |
| 10 | 590 BR | PTO INDICATOR LIGHT |
| 11 | 563 LB | TRAILER IMPLEMENT SIGNAL (INSTRUMENT CLUSTER) |
| 12 | 594 DB | AUTO PTO SET SIGNAL |
| 13 | 562 R | SHUTTLE SWITCH 12V SUPPLY |
| 14 | 511 T | FORWARD SIGNAL |
| 15 | - - - - - | OPEN |
| 16 | 595 DB | AUTO PTO LIGHT |
| 17 | - - - - - | OPEN |
| 18 | 215 Y | WHEEL SPEED SIGNAL |
| 19 | 539 LB | AUTO DIFFERENTIAL LOCK LIGHT |
| 20 | - - - - - | OPEN |
| 21 | - - - - - | OPEN |
| 22 | 590 R | CAB CONTROLLER SWITCHED B+ |
| 23 | 160 R | AUXILIARY/REMOTE VALVE CONTROLLER UNSWITCHED B+ |
| 24 | 276 LB | 540/1000 PTO SELECTOR SWITCH SIGNAL |

| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 513 T | REVERSE SIGNAL |
| 26 | (ARM) R | ARMREST CONTROL SWITCHED B+ |
| 27 | (vp) R | AUXILIARY/REMOTE VALVE CONTROLLER VP IN |
| 28 | 514 T | NEUTRAL SIGNAL |
| 29 | 303 T | OPERATOR PRESENCE SWITCH SIGNAL |
| 30 | - - - - - | OPEN |
| 31 | - - - - - | OPEN |
| 32 | - - - - - | OPEN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |
| 35 | 565 LB | AUTO MFD ON SIGNAL |
| 36 | 546 LB | AUTO DIFFERENTIAL LOCK ON SIGNAL |
| 37 | 536 LB | LEFT HAND BRAKE SIGNAL |
| 38 | 531 LB | RIGHT HAND BRAKE SIGNAL |
| 39 | - - - - - | OPEN |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | 900 Y | CAN HIGH |
| 44 | 900 LG | CAN LOW |
| 45 | 660 Y | CAB CONTROLLER BOTTOM OF CLUTCH SIGNAL |
| 46 | 510 T | F/N/R, FOOT THROTTLE 5V REF |
| 47 | - - - - - | OPEN |
| 48 | 643 BR | FOOT THROTTLE 0V REF |

https://truckmanualshub.com/



# Section 10010

## CONTROLLER AND INSTRUMENT CLUSTER SOFTWARE REPROGRAMMING (Using The McCormick Diagnostic Centre)

## XTX Series Tractors

McCORMICK

SM 8-15101

© 2006 McCormick Tractors International Limited.

July 2005 (Revised September 2006)

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIAL TOOLS ..... 3

GENERAL INFORMATION ..... 4

1014T1 AVG COMMUNICATIONS ADAPTER CONNECTION ..... 5

AUXILIARY/REMOTE VALVE CONTROLLER PROGRAMMING ..... 7

AUXILIARY/REMOTE VALVE CONFIGURATION ..... 10

AUXILIARY/REMOTE VALVE NUMBERING ..... 13

INSTRUMENT CLUSTER PROGRAMMING ..... 16

HITCH, CAB, TRANSMISSION AND CAB SUSPENSION CONTROLLER PROGRAMMING ..... 20

HITCH CONTROLLER CONFIGURATION ..... 23

TRANSMISSION CONTROLLER CONFIGURATION ..... 26

https://truckmanualshub.com/



# SPECIAL TOOLS




MD04C017

**1025T1 MCCORMICK DIAGNOSTIC CENTRE**
**1014T1 AVG COMMUNICATIONS ADAPTER**
**1026T1 USB COMMUNICATIONS LEAD**



MD04E083

**1028T1 CLUSTER PROGRAMMING LEAD**



MD05G098

**1004T2 PROGRAMMING LEAD**

https://truckmanualshub.com/

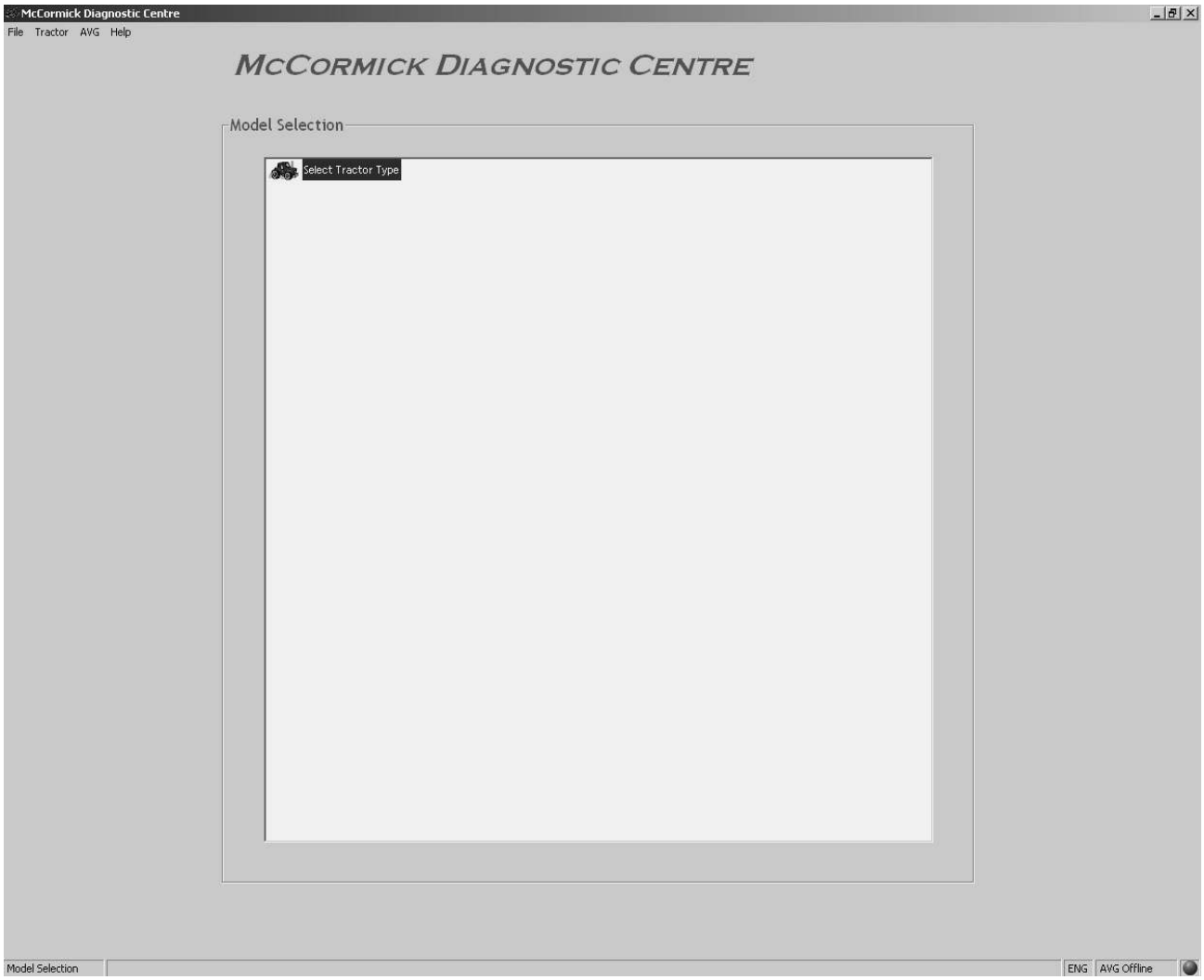


# GENERAL INFORMATION

The tractor control systems may require the controller software to be reprogrammed, also if a new controller (supplied without software) is to be installed it to will have to be programmed with the correct version of software.

The hitch, cab and transmission controllers are programmed using the CAN Bus connection located behind the instrument panel right hand side cover. The instrument cluster and auxiliary valve (AVC) controller are programmed directly using individual download leads.

**IMPORTANT:** *New controller software may be released on the 'McCormick Xchange Portal' prior to the release of updated software versions of the 'McCormick Diagnostic Centre'. Before downloading new software into any controller, check the any relevant Service Bulletins and the "McCormick Xchange Portal". If access to the 'McCormick Xchange Portal' is not available contact your McCormick Distributor.*

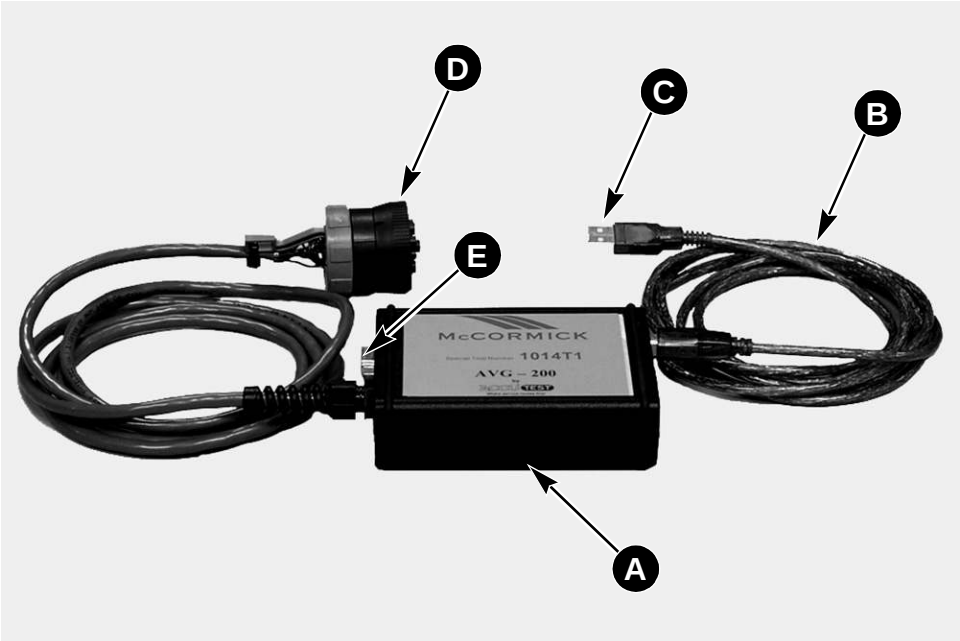



**COMPUTER SCREEN MAIN DIALOGUE WINDOW**

https://truckmanualshub.com/



# 1014T1 AVG COMMUNICATIONS ADAPTER CONNECTION




MD04E001

A.1014T1 AVG COMMUNICATIONS ADAPTER
B.1026T1 USB COMMUNICATIONS LEAD
C.CONNECT TO COMPUTER USB CONNECTION
D.CONNECT TO TRACTOR 9 PIN DIAGNOSTIC CONNECTOR
E.SERIAL CONNECTION (NOT USED)

**IMPORTANT:** *The AVG serial port connection is only used to download software into the AVG. When downloading software into the tractor controllers requiring the AVG communications adapter, the connection MUST BE MADE using the USB communications lead 1026T1.*

The AVG communications adapter 1014T1 provides the interface between the diagnostics software installed on the lap top computer and the tractor. This communication to the tractor is made using 'CAN bus' or 'K Line' systems.

The AVG communications adapter connects to the tractor using 9 pin diagnostics connector. The AVG receives unswitched battery power from the tractor through the 9 pin diagnostics connector to enable the AVG to operate.

## Checking The AVG Connection

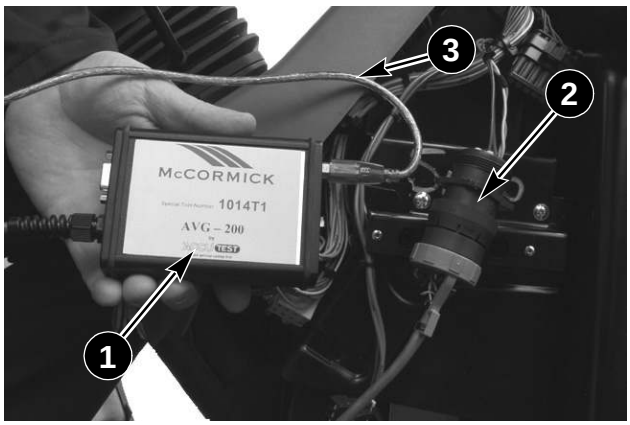
### STEP 1

Park the tractor on hard level ground, apply the parking brake, turn the key to the OFF position and put blocks in front and behind the rear wheels.

### STEP 2

Remove the instrument panel right hand side cover.

### STEP 3




MD04E084

Connect the AVG communications adapter 1014T1 (1) to the CAN bus connector (2). Connect USB communications lead 1026T1 (3) between the USB ports of laptop computer and the AVG communications adapter.

https://truckmanualshub.com/



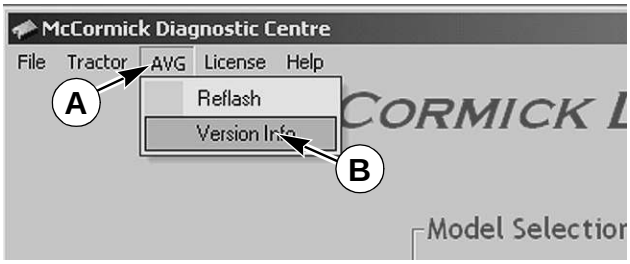
## STEP 4




MH06A057

Turn the computer ON and select the McCormick Diagnostics icon. The main window shown on Page 4 will appear.

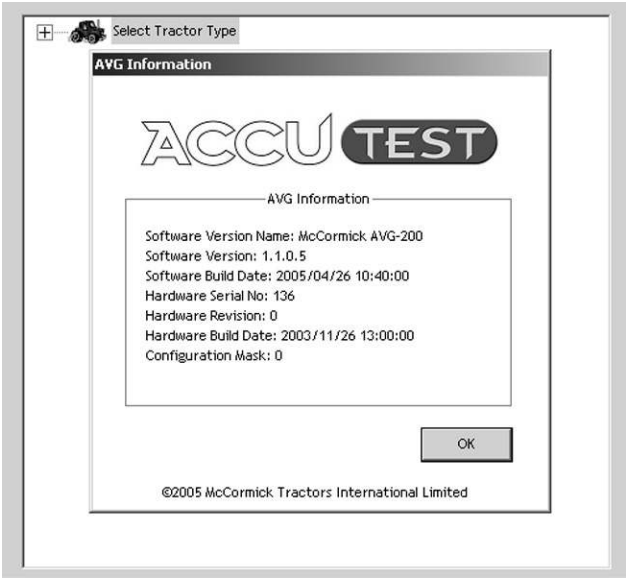
## STEP 5




MH05G028

Click open the ‘AVG’ box (A) on the main window and click open the ‘Version Info’ box (B) as shown.

## STEP 6




MH05G038

If the AVG information appears as shown the AVG communication between the tractor and the lap top computer has been made. Click the ‘OK’ box to return to the main window.

## STEP 7




MH04E027

If the above dialogue box appears the AVG communication between the tractor and the lap top computer has failed. Click ‘OK’ and exit the McCormick Diagnostics program. Shut down the computer and check the following:

1. The 9 pin diagnostic connector.
2. Fuse 39.
3. Wire 900 Red between fuse 39 and the 9 pin diagnostic connector. (Refer to the schematic in Section 10009).
4. Wire 900 Brown between the 9 pin diagnostic connector and chassis ground. (Refer to the schematic in Section 10009).
5. The AVG Driver is not loaded on the computer. Refer to Service Bulletin DBT1019GB.

https://truckmanualshub.com/



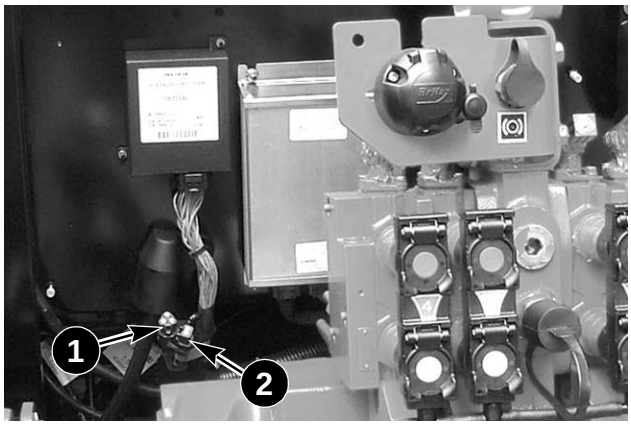
# AUXILIARY/REMOTE VALVE CONTROLLER PROGRAMMING

**IMPORTANT:** *The McCormick Diagnostic Centre will only operate using the correct programming leads, refer to "SPECIAL TOOLS" on page 3. A USB to serial adapter can not be used to programme the Auxiliary Valve controller.*

## STEP 1

Park the tractor on hard level ground, apply the parking brake, turn the key to the OFF position and put blocks in front and behind the rear wheels.

## STEP 2




MD05G013

Remove the retaining nuts and remove cab rear panel. Connect programming lead 1004T2 to the auxiliary/remote valve controller diagnostic connectors (1) and (2).

## STEP 3

Route the programming lead through the cab rear window and connect the programming lead 1004T2 to the laptop computer serial port.

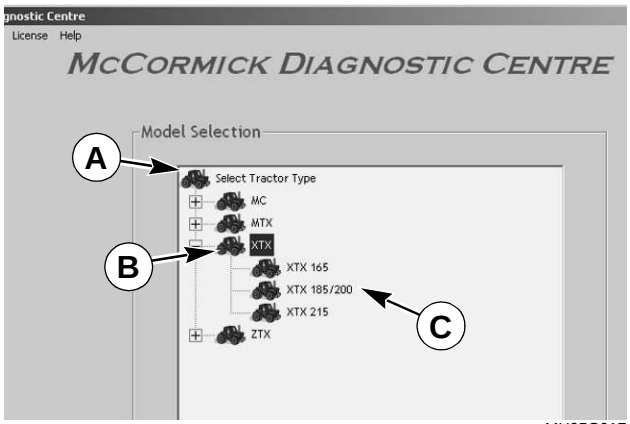
## STEP 4




MH06A057

Turn the computer ON and select the McCormick Diagnostics icon. The main window shown on Page 4 will appear.

## STEP 5




MH05G017

Click open the 'Select Tractor Type' box (A) on the main window to expand the model tree. Click open the XTX box (B) then double click the required XTX model (C) as shown.

## STEP 6

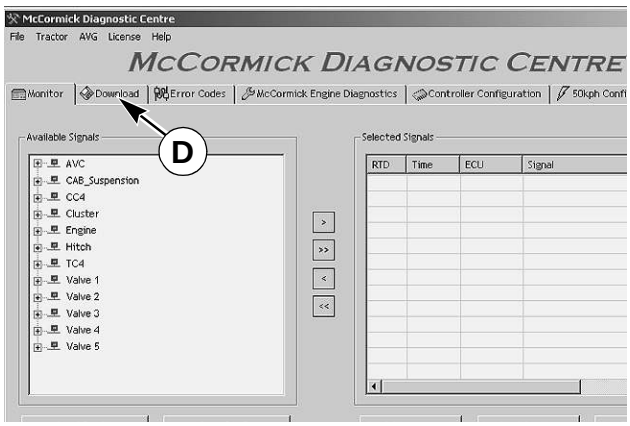



MH05G81

When the above window appears click 'OK' on the dialogue box.

**NOTE:** *The AVG communications adapter is not used when programming the Auxiliary Valve controller.*

## STEP 7



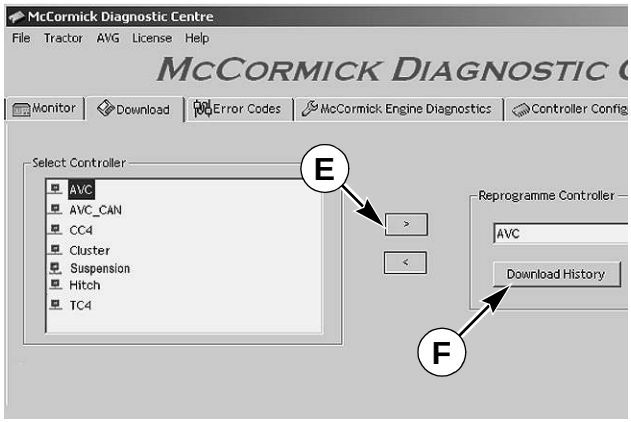

MH06A002

When the above window appears select 'Download' (D) as shown.

https://truckmanualshub.com/



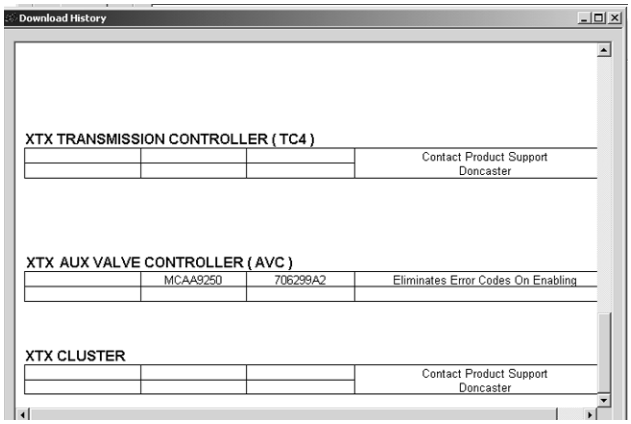
## STEP 8




MH06A0033

Highlight AVC in the select controller window, click on button (E) to enter AVC in the reprogramme controller window. Click the 'Download History' button (F) to open the controller history file.

## STEP 9

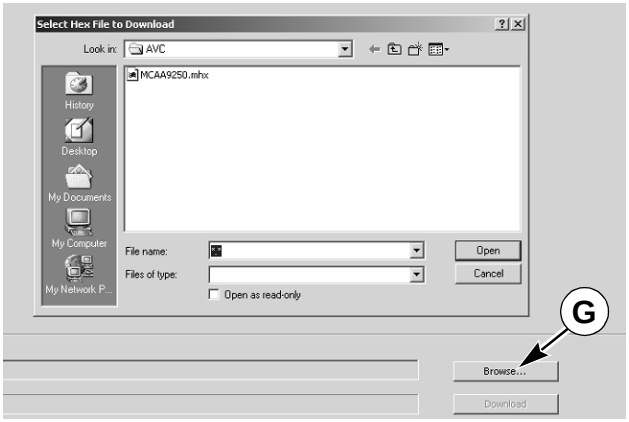



MH05G020

When 'Download History' file opens, scroll through the file to identify the correct software to be downloaded into the selected controller. Make a note of the correct software to be downloaded then close the 'Download History' file.

**IMPORTANT:** *Before selecting software to be downloaded, check any relevant Service Bulletins and the* '*McCormick Xchange portal*'. *If access to the* '*McCormick Xchange portal*' *is not available contact your McCormick distributor.*

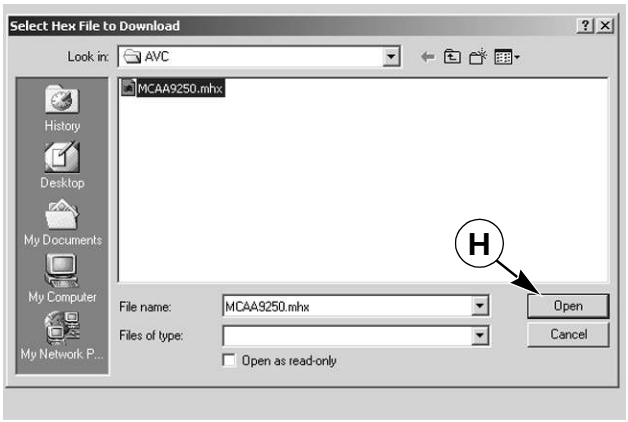
## STEP 10




MH05G021

Click on the 'BROWSE' button (G) to open the 'Select Hex File to Download' window as shown.

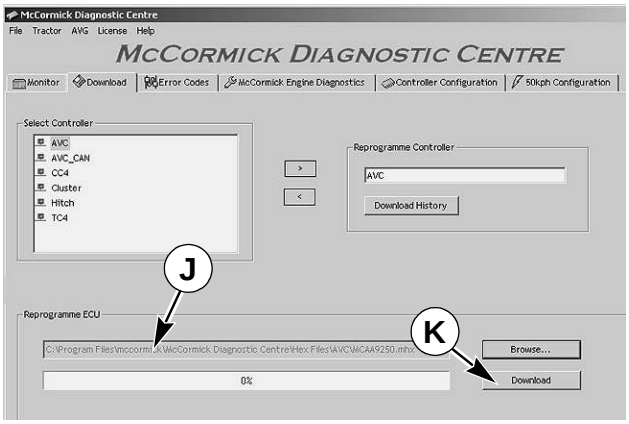
## STEP 11




MH0G022

Highlight the correct software file as noted in STEP 8 and click on the 'Open' button (H).

## STEP 12



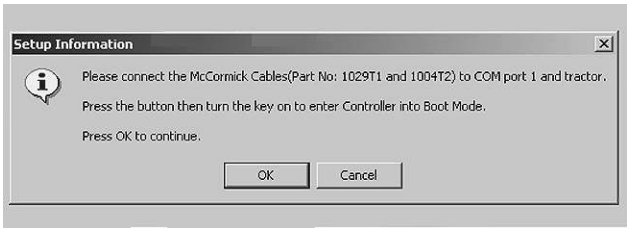

MH04G023

Make sure the correct file is displayed in the 'Reprogramme ECU' window (J) and click the 'Download' button (K).

https://truckmanualshub.com/



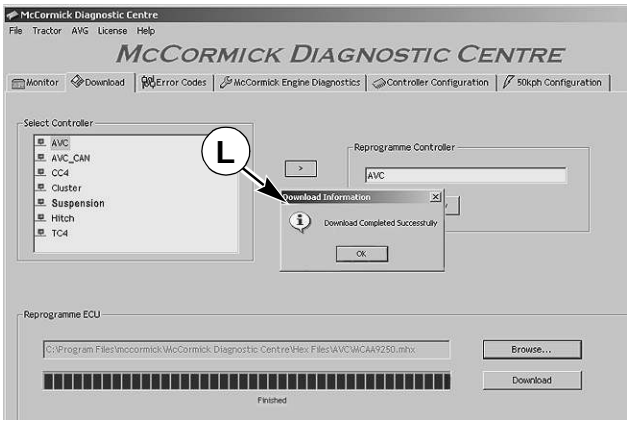
## STEP 13




MH05G024

When the above dialogue box appears, press and hold the push button switch on the programming lead 1004T2. Turn the key to the ON position, release the switch and click on the ‘OK’ button.

## STEP 14




MH05G040

The software will begin to download into the controller. When the software downloading is complete the ‘Download Information’ dialogue box (L) shown will appear, click ‘OK’ on the dialogue box.

## STEP 15

Turn the key to the OFF position, exit the McCormick Diagnostics program, shut down the computer and disconnect the programming lead 1004T2. Install the plugs to the tractor auxiliary/remote valve controller diagnostic connectors.

https://truckmanualshub.com/



# AUXILIARY/REMOTE VALVE CONFIGURATION

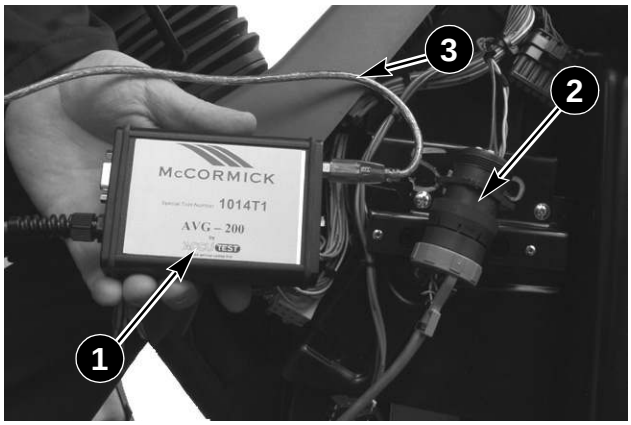
## STEP 1

Park the tractor on hard level ground, apply the parking brake, turn the key to the OFF position and put blocks in front and behind the rear wheels.

## STEP 2

Remove the instrument panel right hand side cover.

## STEP 3




MD04E084

Connect the AVG communications adapter 1014T1 (1) to the CAN bus connector (2). Connect USB communications lead 1026T1 (3) between the USB ports of laptop computer and the AVG communications adapter, refer to Page 5.

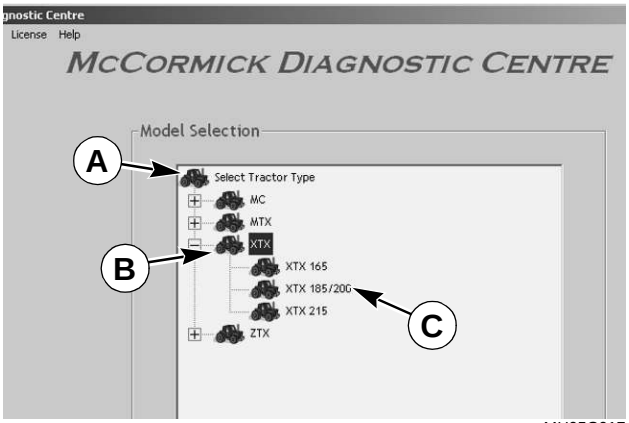
## STEP 4




MH06A057

Turn the computer ON and select the McCormick Diagnostics icon. The main window shown on Page 4 will appear.

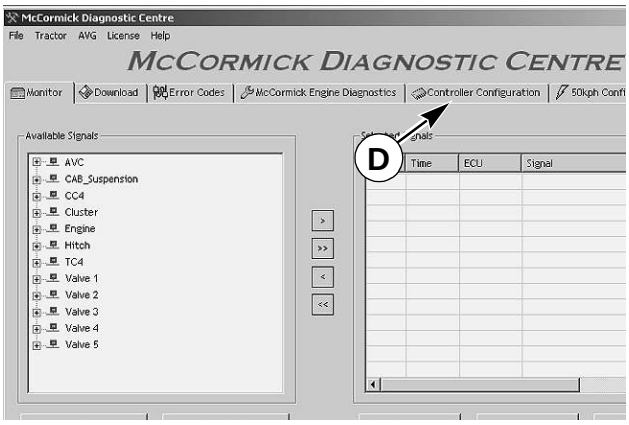
## STEP 5




MH05G017

Click open the ‘Select Tractor Type’ box (A) on the main window to expand the model tree. Click open the XTX box (B) then double click the required XTX model (C) as shown.

## STEP 6




MH06A002

When the above window appears select ‘Controller Configuration’ (D) as shown.

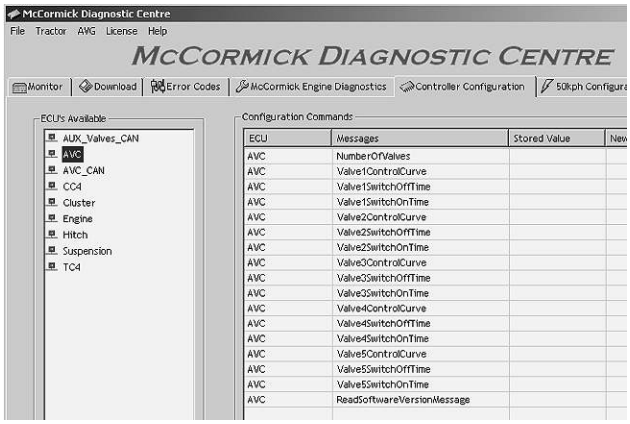
## STEP 7

Turn the key to the ON position.

https://truckmanualshub.com/



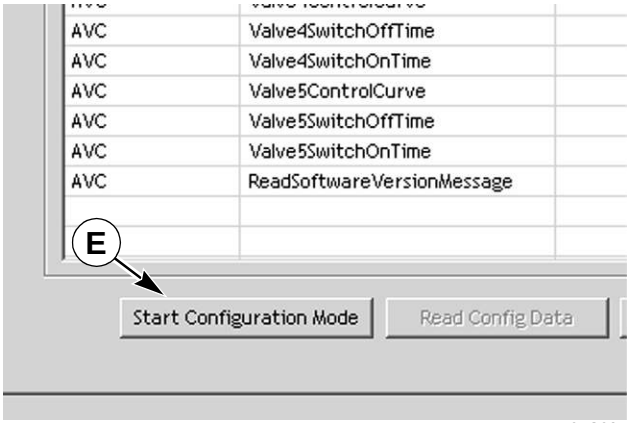
## STEP 8



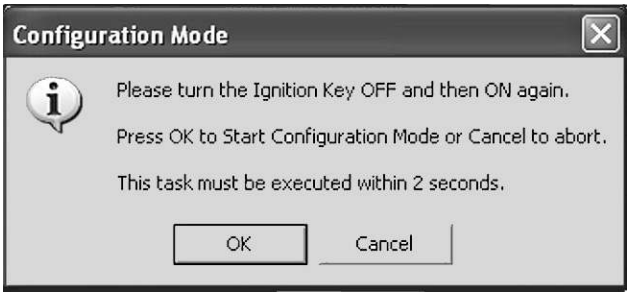

MH05G026

Highlight and double click on AVC in the 'ECU's Available' window. The auxiliary valve configuration information will appear in the Configuration Commands window.

## STEP 9



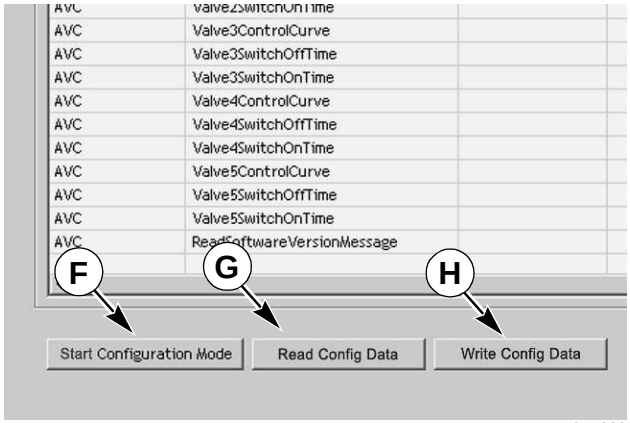

MH04G027




MH04E037

Click on the 'Start Configuration' (E) as shown. When the above information dialogue box appears, follow the instructions as shown.

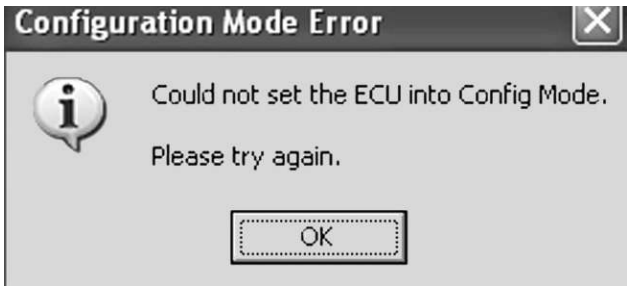
## STEP 10




MH04E038

If the configuration mode has been entered the 'Start Configuration' box will change to the 'Stop Configuration' box (F), the 'Read Configuration' box (G) and the 'Write Configuration' box (H) will become active. Also the auxiliary valve enable light on the armrest will illuminate. Go to Step 12.

## STEP 11



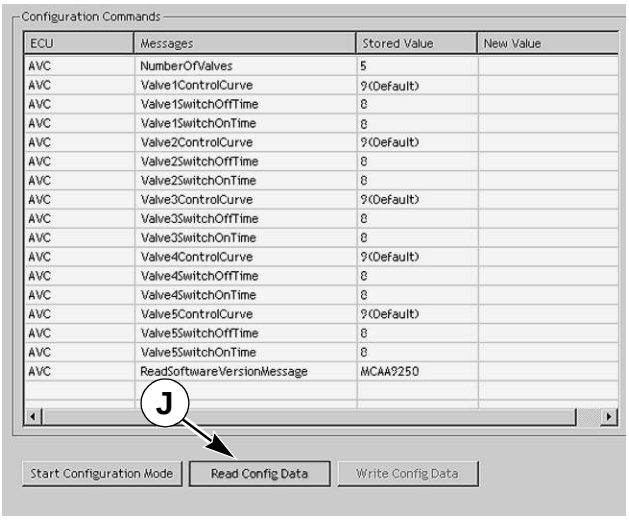

MH04D039

If the above dialogue box appears the configuration mode has failed, click 'OK'. If the configuration mode fails again, check the AVG connection with the key in the OFF and ON positions, refer to "1014T1 AVG COMMUNICATIONS ADAPTER CONNECTION" on page 5.

https://truckmanualshub.com/



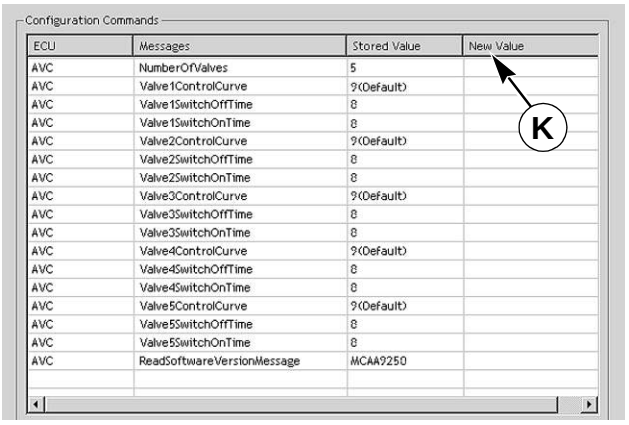
## STEP 12




MH06A004

Click on the ‘Read Configuration’ box (J) as shown and the stored values will appear in the Configuration commands window.

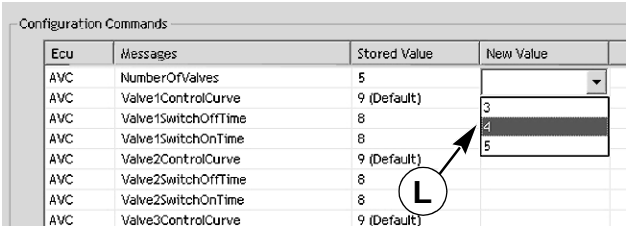
## STEP 13




MH06A005

Click on the number of valves, ‘New Value’ box (K) as shown.

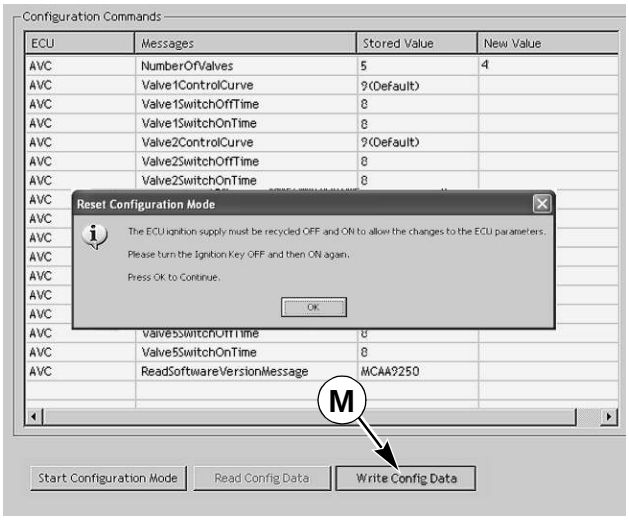
## STEP 14




MH04D042

When the drop down window (L) appears select the number corresponding to the number of auxiliary valves installed on the tractor.

## STEP 15




MH06A006

Click on the ‘Write Configuration’ box (M) and the ‘Reset Configuration Mode’ box will appear as shown. Follow the instructions in the Reset Configuration Mode’ box to store the new values.

## STEP 16

Turn the key to the OFF position, exit the McCormick Diagnostics program, shut down the computer and disconnect the AVG controller interface 1014T1 from the CAN Bus connector.

https://truckmanualshub.com/



# AUXILIARY/REMOTE VALVE NUMBERING

**NOTE:** *Auxiliary/remote valve numbering is used when a new valve has been installed.*

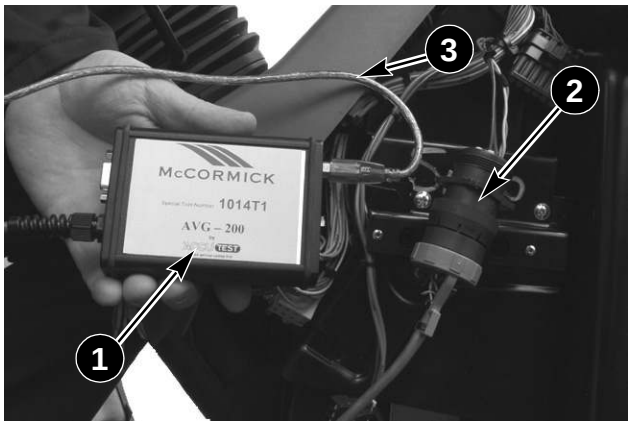
## STEP 1

Park the tractor on hard level ground, apply the parking brake, turn the key to the OFF position and put blocks in front and behind the rear wheels.

## STEP 2

Remove the instrument panel right hand side cover.

## STEP 3




MD04E084

Connect the AVG communications adapter 1014T1 (1) to the CAN bus connector (2). Connect USB communications lead 1026T1 (3) between the USB ports of laptop computer and the AVG communications adapter, refer to Page 5.

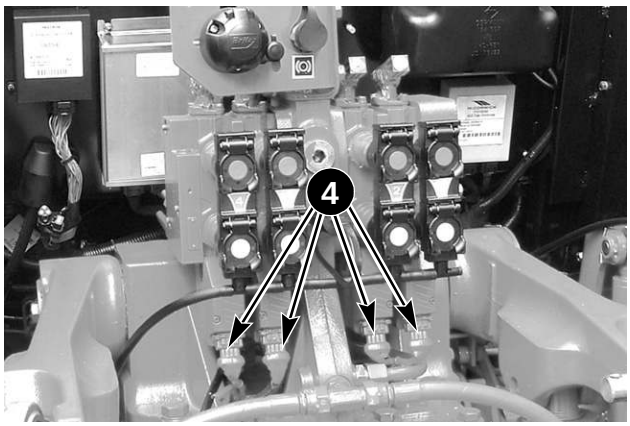
## STEP 4




MH06A057

Turn the computer ON and select the McCormick Diagnostics icon. The main window shown on Page 4 will appear.

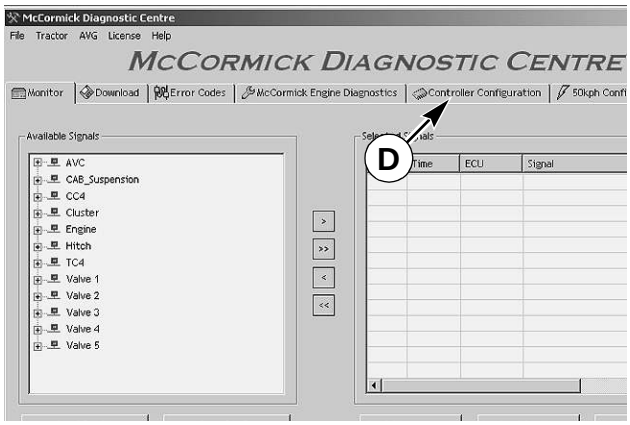
## STEP 5




MD05G097

Disconnect all but the new auxiliary/remote valve from the harness at the valve connectors (4).

## STEP 6



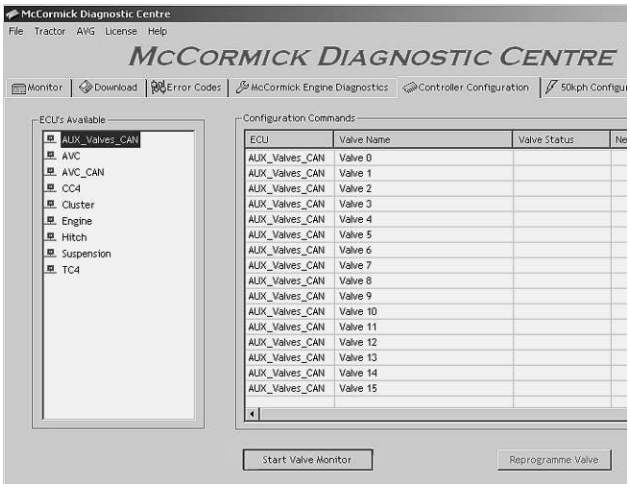

MH06A002

When the above window appears select ‘Controller Configuration’ (D) as shown.

https://truckmanualshub.com/



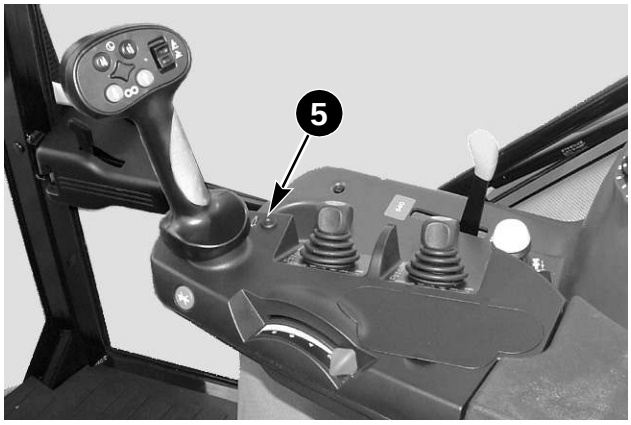
## STEP 7




MH06A036

Highlight and double click on ‘Aux Valves’ in the ‘ECU’s Available’ window. The auxiliary valve information will appear in the Configuration Commands window.

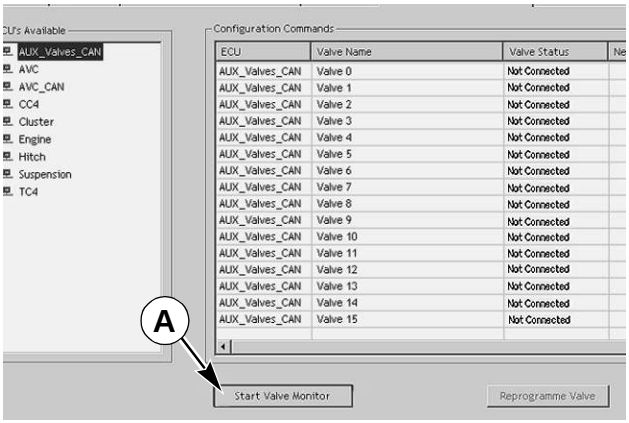
## STEP 8




MD05G097

Turn the key to the ON position wait 5 seconds for the system to carry out the self test then press and release the Auxiliary/Remote valve enable switch (5). Make sure the Auxiliary/Remote valve enable light is illuminated.

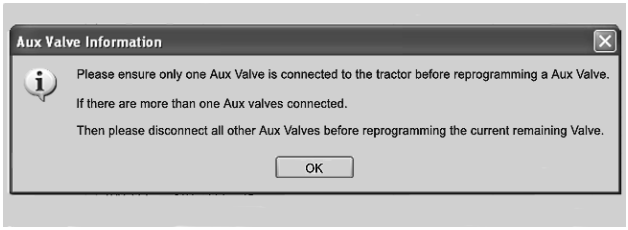
## STEP 9




MH06A037

Click on the ‘Start Valve Monitor’ (A) as shown. The auxiliary valve status information will appear in the Configuration Commands window.

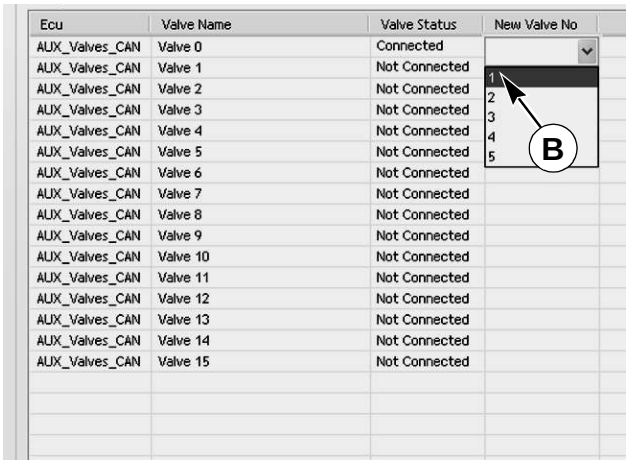
## STEP 10




MH05G098

When the above dialogue box appears click ‘OK’.

## STEP 11



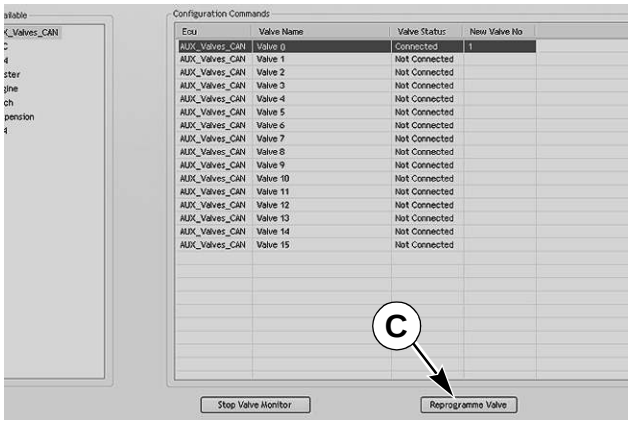

MH05G100

Click on the ‘New Value Number’, when the drop down window (B) appears select the required valve number.

https://truckmanualshub.com/



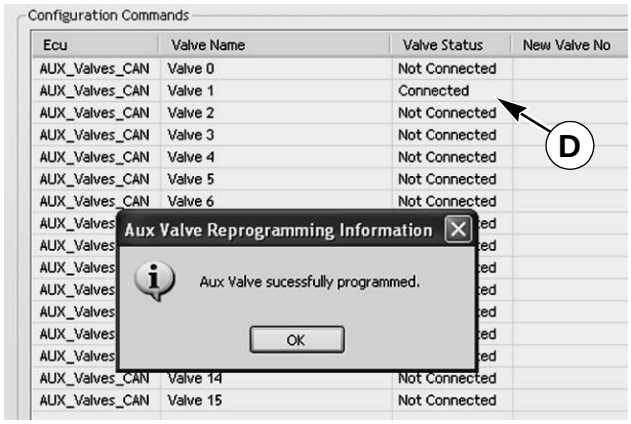
## STEP 12




MH05G101

Click on the ‘Reprogramme Valve’ box (C).

## STEP 13



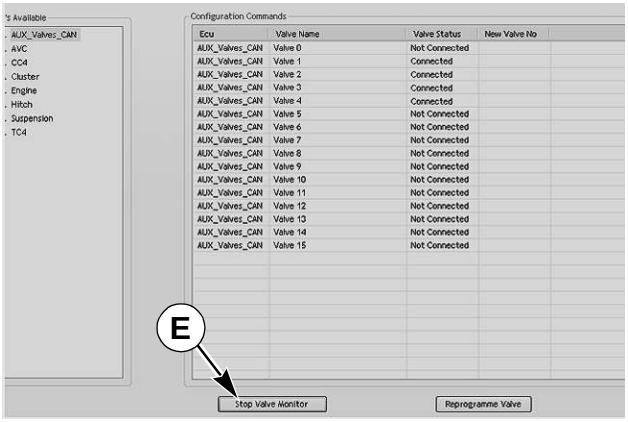

MH05G105

The above dialogue box will appear and the renumbered valve will show as ‘Connected’ as shown at (D). Click ‘OK’ in the Aux Valve Reprogramming Information dialogue box and turn the key to the OFF position.

## STEP 14

If more valves are to be numbered or renumbered, disconnect the connected valve and connect the next valve in the sequence. Repeat the procedure from STEP 8 to STEP 14 for each valve. If no more valves are to be numbered or renumbered go to STEP 15.

## STEP 15




MH05G102

Connect all the valves to the harness. Each connected valve will display ‘Connected’ in the ‘Valve Status’ column. Click on the ‘Stop Valve Monitor’ (E) as shown.

## STEP 16

Turn the key to the OFF position, exit the McCormick Diagnostics program, shut down the computer and disconnect the AVG controller interface 1014T1 from the CAN Bus connector.

https://truckmanualshub.com/



# INSTRUMENT CLUSTER PROGRAMMING

**IMPORTANT:** *The McCormick Diagnostic Centre will only operate using the correct programming leads, refer to "SPECIAL TOOLS" on page 3. A USB to serial adapter can not be used to programme the Instrument Cluster.*

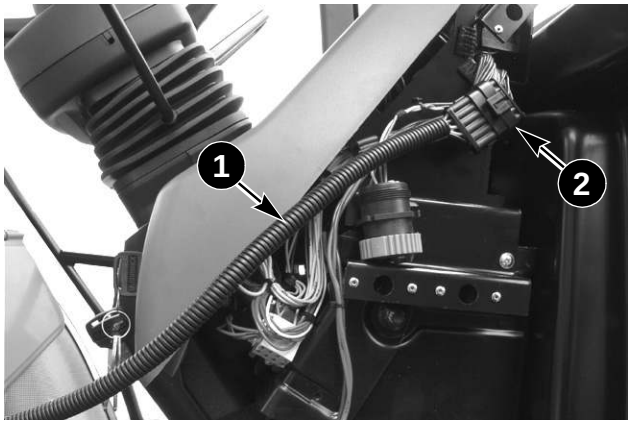
## STEP 1

Park the tractor on hard level ground, apply the parking brake, turn the key to the OFF position and put blocks in front and behind the rear wheels.

## STEP 2

Remove the instrument panel right hand side cover.

## STEP 3




DD00A005

Connect the cluster programming lead 1028T1 (1) to the cluster programming connector (2) and to the laptop computer serial port.

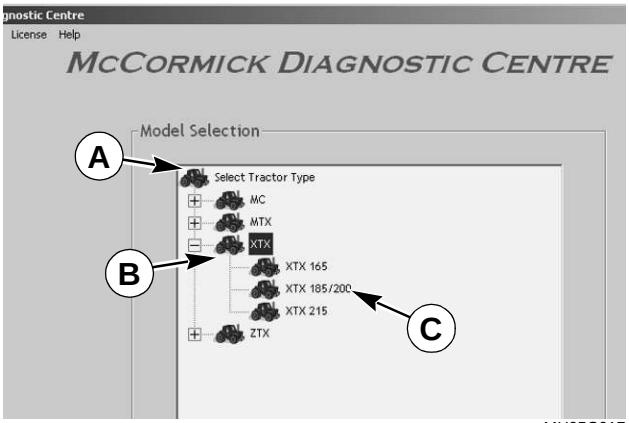
## STEP 4




MH06A057

Turn the computer ON and select the McCormick Diagnostics icon. The main window shown on Page 4 will appear.

## STEP 5




MH05G017

Click open the 'Select Tractor Type' box (A) on the main window to expand the model tree. Click open the XTX box (B) then double the required XTX model (C) as shown.

## STEP 6

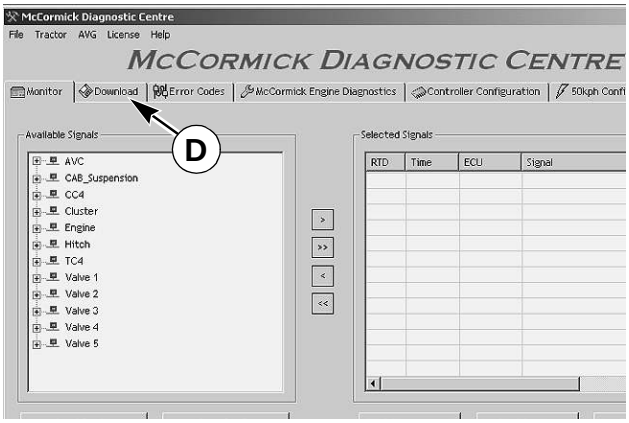



MH05G81

When the above window appears click 'OK' on the dialogue box.

**NOTE:** *The AVG communications adapter is not used when programming instrument cluster.*

## STEP 7



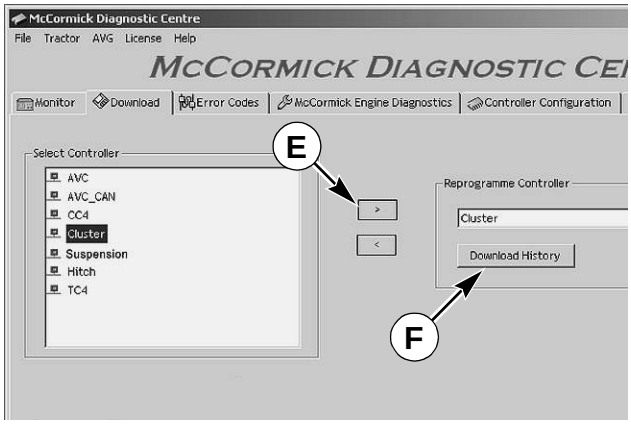

MH06A002

When the above window appears select 'Download' (D) as shown.

https://truckmanualshub.com/



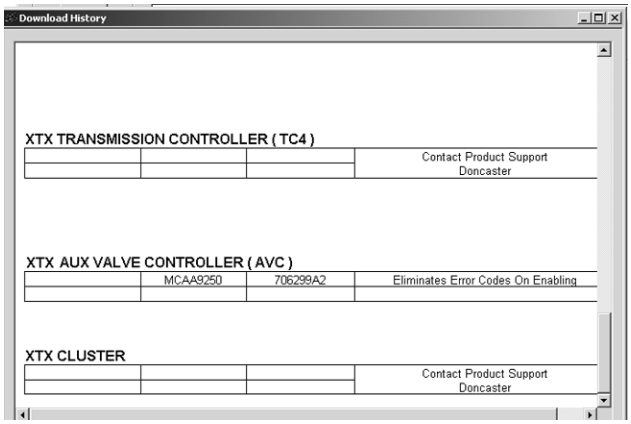
## STEP 8




MH0G029

Highlight 'Cluster' in the select controller window, click on button (E) to enter 'Cluster' in the reprogramme controller window. Click the 'Download History' button (F) to open the controller history file.

## STEP 9

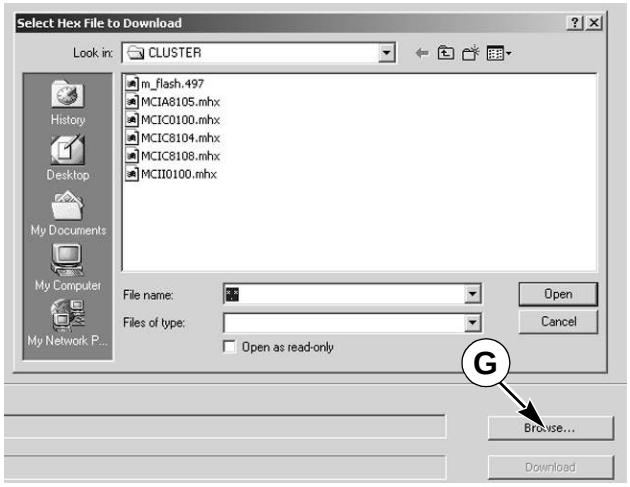



MH05G020

When 'Download History' file opens, scroll through the file to identify the correct software to be downloaded into the selected controller. Make a note of the correct software to be downloaded then close the 'Download History' file.

**IMPORTANT:** *Before selecting software to be downloaded, check any relevant Service Bulletins and the "McCormick Xchange portal". If access to the "McCormick Xchange portal" is not available contact your McCormick distributor.*

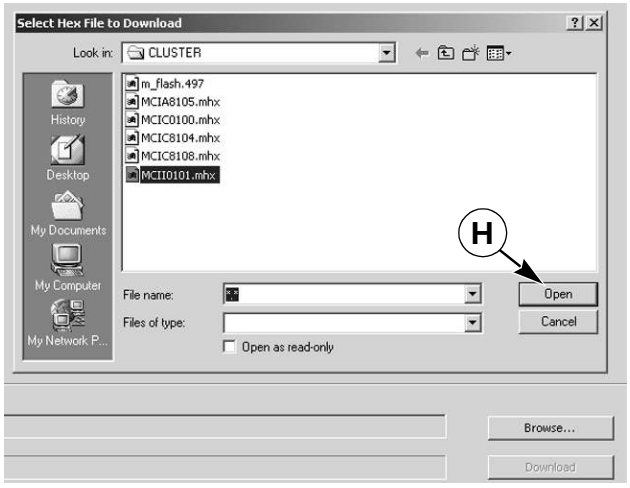
## STEP 10




MH05G030

Click on the 'BROWSE' button (G) to open the 'Select Hex File to Download' window as shown.

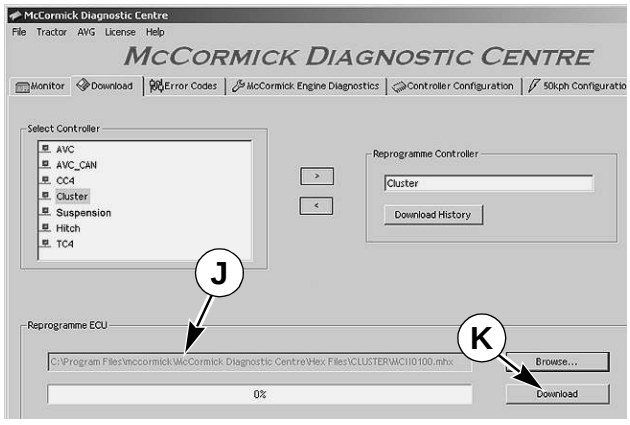
## STEP 11




MH05G079

Highlight the correct software file as noted in STEP 7 and click on the 'Open' button (H).

## STEP 12



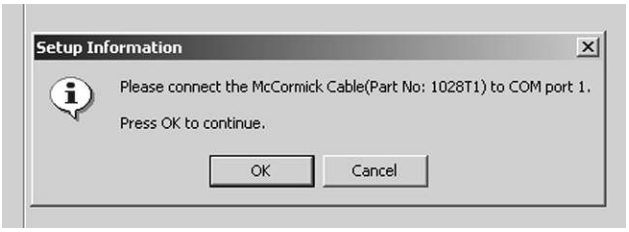

MH05G078

Make sure the correct file is displayed in the 'Reprogramme ECU' window (J) and click the 'Download' button (K).

https://truckmanualshub.com/



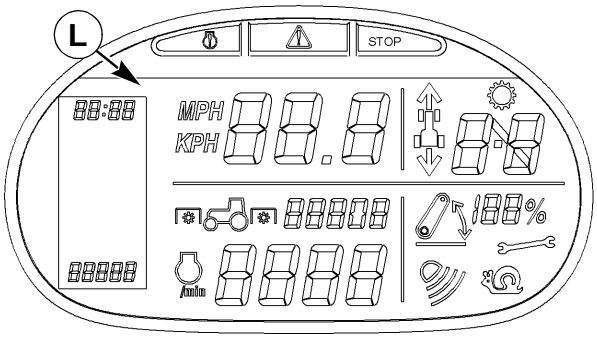
## STEP 13




MH05G077

When the above dialogue box appears turn the key to the ON position.

## STEP 14




MI04E016

If the instrument cluster digital display (L) is displaying information, switch the run/programming toggle switch on the programming lead 1028T1 to the programming position. The digital display (L) will become blank.

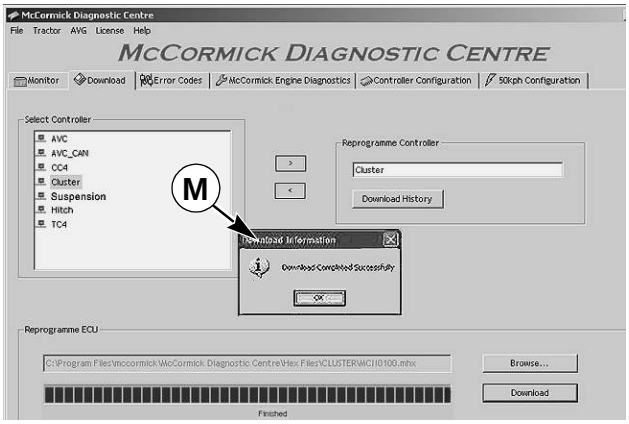
## STEP 15




MH05G080

Momentarily press the reset switch on the programming lead T1028T1 then click the ‘OK’ button.

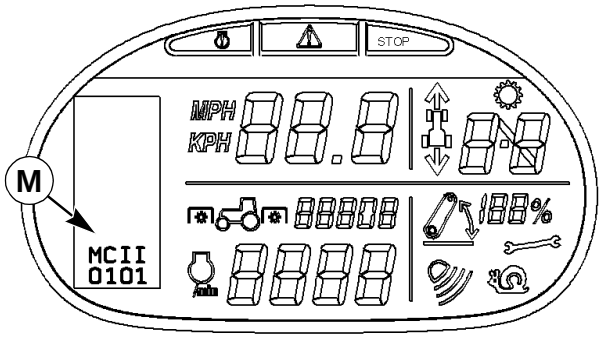
## STEP 16




H06A038

The software will begin to download into the controller. When the software downloading is complete the Download Information dialogue box (M) shown will appear, click ‘OK’ on the dialogue box.

## STEP 17




MI04E017

Switch the run/programming toggle switch on the programming lead 1028T1 to the Run position. Turn the key to the OFF position then to the Accessory position. The instrument cluster digital display will momentarily display the cluster software number (M).

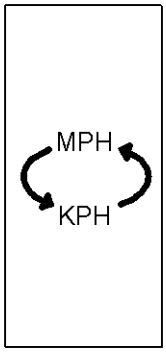
## STEP 18

If the software number is not correct, repeat the programming procedure. If the software number is correct, turn the key to the OFF position, exit the McCormick Diagnostics program, shut down the computer and disconnect the programming lead 1028T2.

https://truckmanualshub.com/



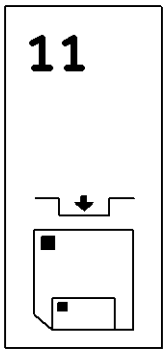
**STEP 19**




MI04D054

Turn the key to the accessory position. When the M.P.H./KPH symbol appears in the centre of instrument cluster main digital display (L) as shown, simultaneously press buttons (N) and (P).

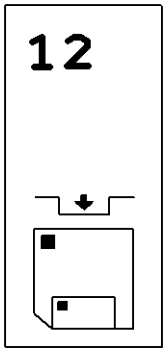
**STEP 20**




MI04D052

When the computer disc symbol and ‘11’ appear in the instrument cluster main digital display, release buttons (N) and (P).

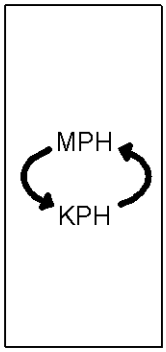
**STEP 21**




MI05G106

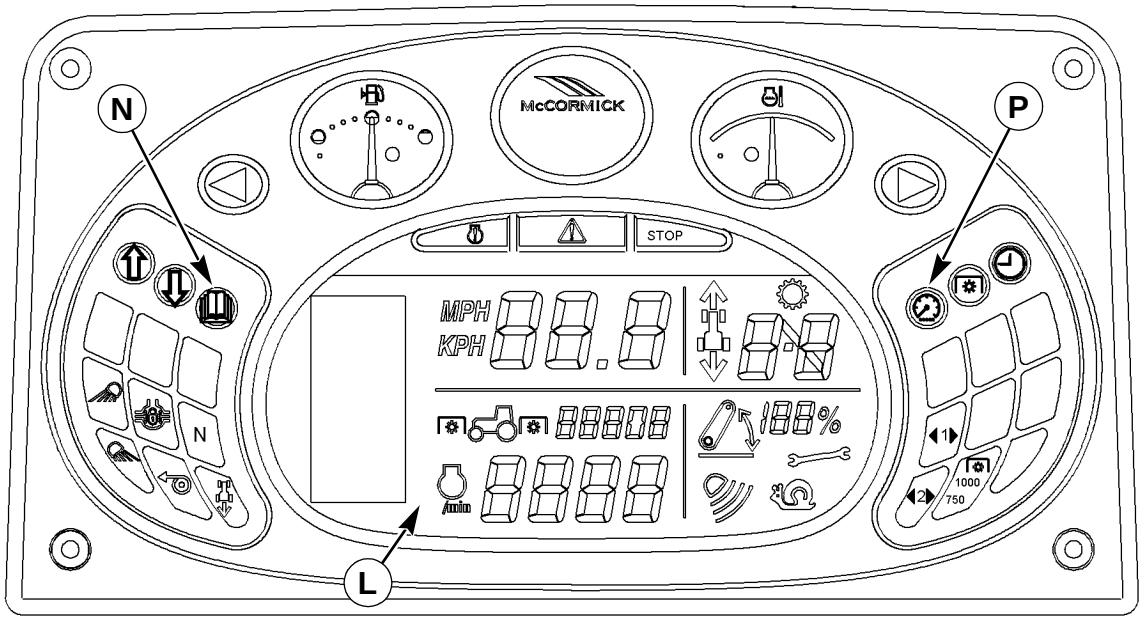
When the computer disc symbol and ‘12’ appear in the instrument cluster main digital display, press and hold the menu button (N) for 2 seconds to store the settings.

**STEP 22**




MI04D054

When the M.P.H./KPH symbol appears in the centre of instrument cluster main digital display (L) as shown, turn the key to the OFF position.




MI04D053

https://truckmanualshub.com/



# HITCH, CAB, TRANSMISSION AND CAB SUSPENSION CONTROLLER PROGRAMMING

**NOTE:** *The illustrations shown in the following procedure are for the Hitch controller programming. The programming procedure is the same for the Hitch, Cab, Transmission and Cab Suspension controllers, unless otherwise stated.*

**IMPORTANT:** *For XtraSpeed - E and E Plus tractors the right hand door must remain CLOSED while the following procedure is being carried out.*

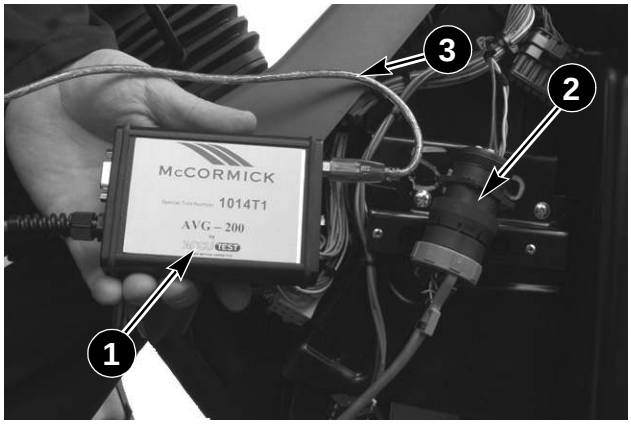
## STEP 1

Park the tractor on hard level ground, apply the parking brake, turn the key to the OFF position and put blocks in front and behind the rear wheels.

## STEP 2

Remove the instrument panel right hand side cover.

## STEP 3




MD04E084

Connect the AVG communications adapter 1014T1 (1) to the CAN bus connector (2). Connect USB communications lead 1026T1 (3) between the USB ports of laptop computer and the AVG communications adapter, refer to Page 5.

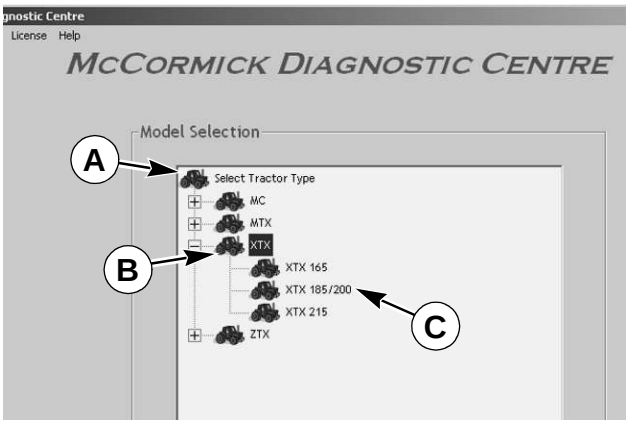
## STEP 4




MH06A057

Turn the computer ON and select the McCormick Diagnostics icon. The main window shown on Page 4 will appear.

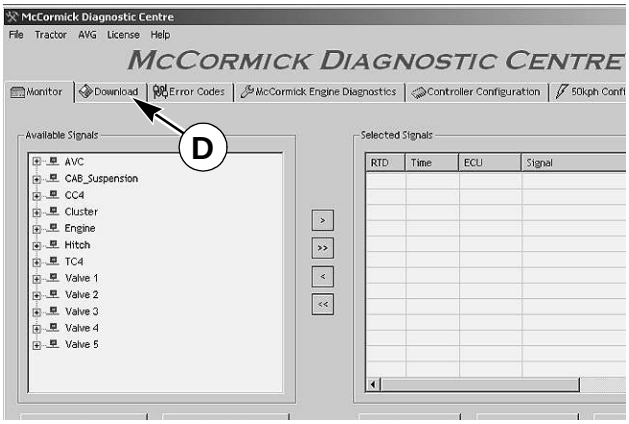
## STEP 5




MH05G017

Click open the ‘Select Tractor Type’ box (A) on the main window to expand the model tree. Click open the XTX box (B) then double the required XTX model (C) as shown.

## STEP 6



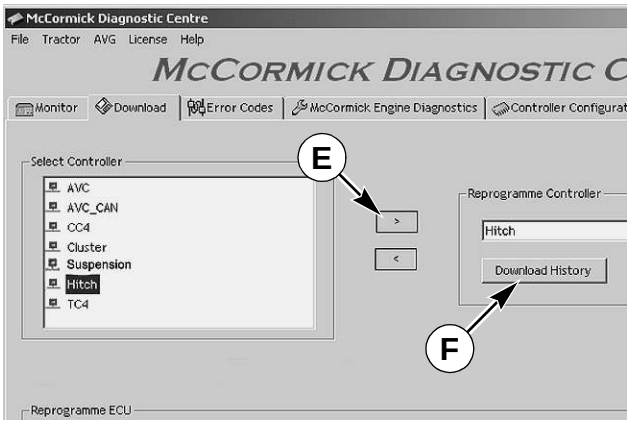

MH06A002

When the above window appears select ‘Download’ (D) as shown.

https://truckmanualshub.com/



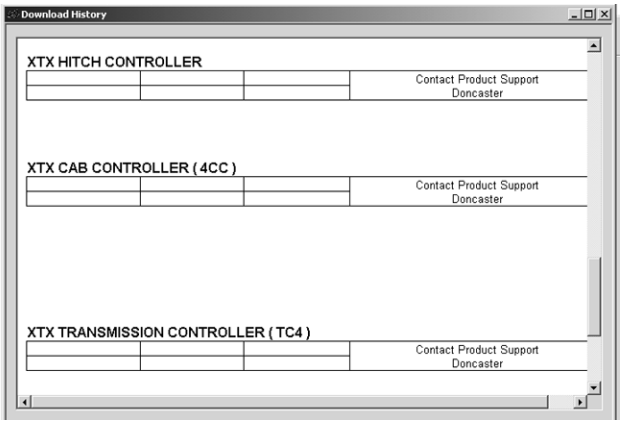
## STEP 7




MH05G032

Highlight the controller to be programmed in the select controller window, click on button (E) to enter selected controller in the reprogramme controller window. Click the 'Download History' button (F) to open the controller history file.

## STEP 8




MH05G033

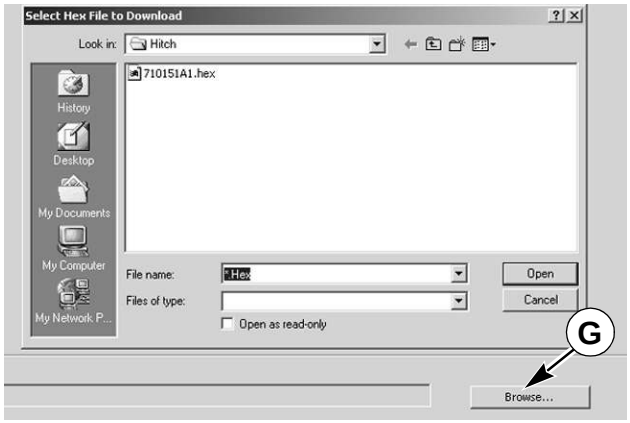
When 'Download History' file opens, scroll through the file to identify the correct software to be downloaded into the selected controller. Make a note of the correct software then close the 'Download History' file.

**IMPORTANT:** *Before selecting software to be downloaded, check any relevant Service Bulletins and the "McCormick Xchange portal". If access to the "McCormick Xchange portal" is not available contact your McCormick distributor.*

## STEP 9

Turn the key to the ON position.

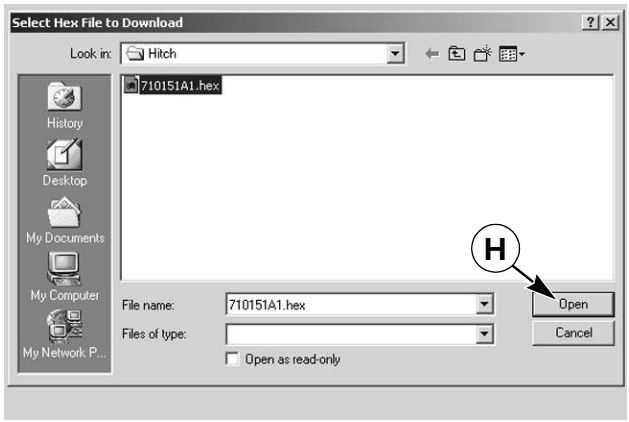
## STEP 10




MH05G034

Click on the 'BROWSE' button (G) to open the 'Select Hex File to Download' window as shown.

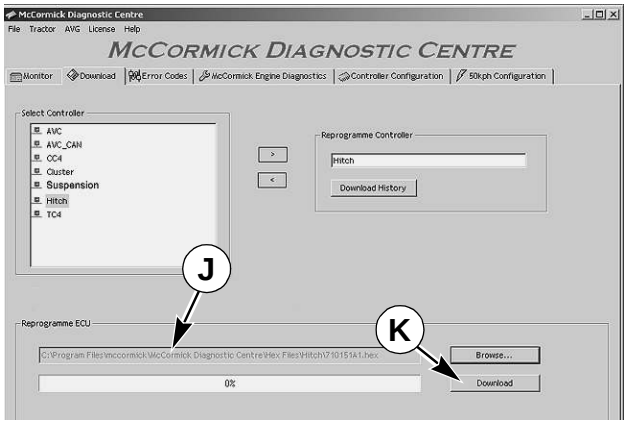
## STEP 11




MH0G035

Highlight the correct software file as noted in STEP 8 and click on the 'Open' button (H).

## STEP 12




MH05G036

Make sure the correct file is displayed in the 'Reprogramme ECU' window (J) and click the 'Download' button (K).

**NOTE:** *When programming the Hitch, or Cab Suspension controllers, go to STEP 14.*

https://truckmanualshub.com/



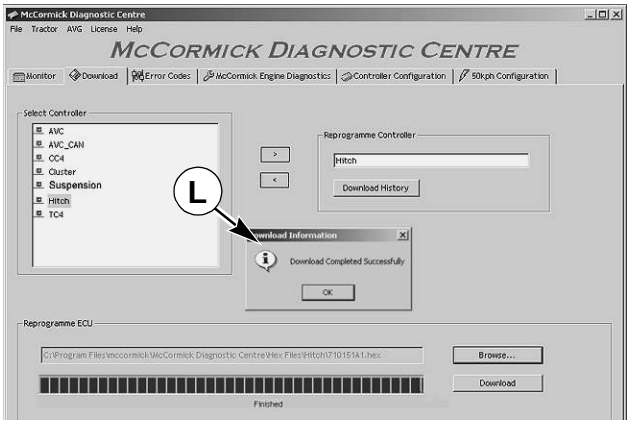
## STEP 13




MH06A039

For Cab and Transmission controller programming, when the above dialogue box appears, turn the key to the OFF position and back to the ON position, then click the ‘OK’ button, as instructed.

## STEP 14




MH05G082

The software will begin to download into the controller. When the software downloading is complete the Download Information dialogue box (L) shown will appear, click ‘OK’ on the dialogue box.

## STEP 15

Turn the key to the OFF position then back to the ON position to store the software in the controller.

## STEP 16

Turn the key to the OFF position, exit the McCormick Diagnostics program, shut down the computer and disconnect the AVG controller interface 1014T1 from the CAN Bus connector.

https://truckmanualshub.com/



# HITCH CONTROLLER CONFIGURATION

**IMPORTANT:** *For XtraSpeed - E and E Plus tractors the right hand door must remain CLOSED while the following procedure is being carried out.*

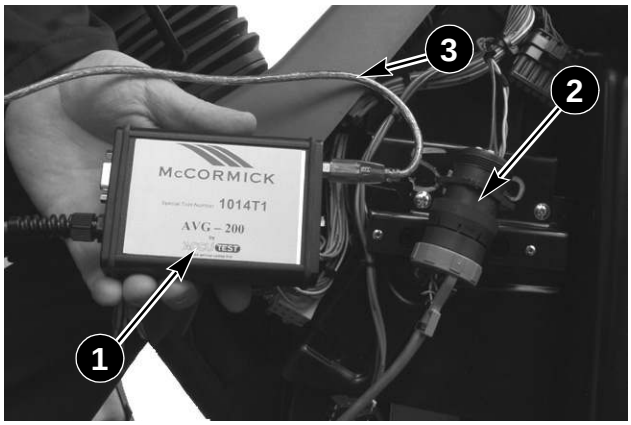
## STEP 1

Park the tractor on hard level ground, apply the parking brake, turn the key to the OFF position and put blocks in front and behind the rear wheels.

## STEP 2

Remove the instrument panel right hand side cover.

## STEP 3




MD04E084

Connect the AVG communications adapter 1014T1 (1) to the CAN bus connector (2). Connect USB communications lead 1026T1 (3) between the USB ports of laptop computer and the AVG communications adapter, refer to Page 5.

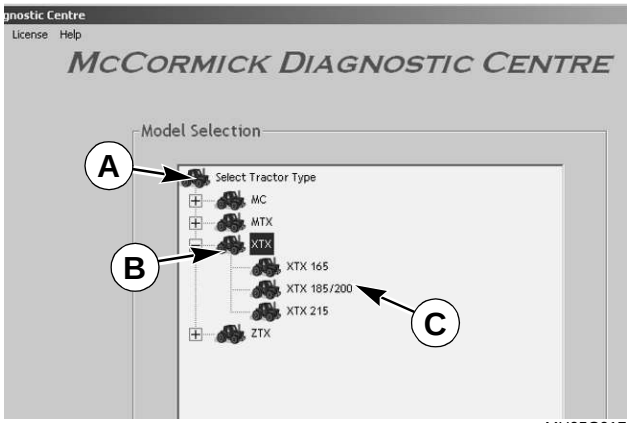
## STEP 4




MH06A057

Turn the computer ON and select the McCormick Diagnostics icon. The main window shown on Page 4 will appear.

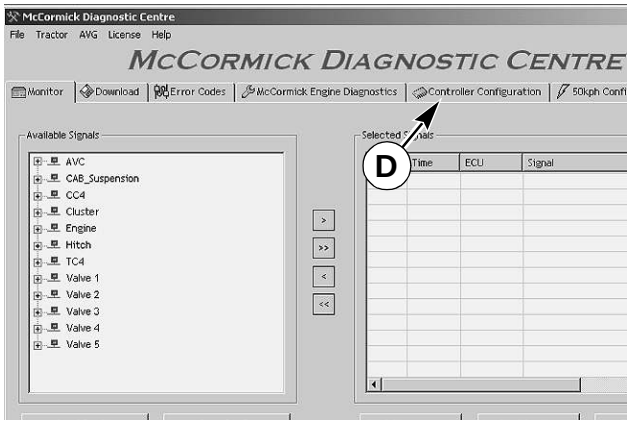
## STEP 5




MH05G017

Click open the ‘Select Tractor Type’ box (A) on the main window to expand the model tree. Click open the XTX box (B) then double click the required XTX model (C) as shown.

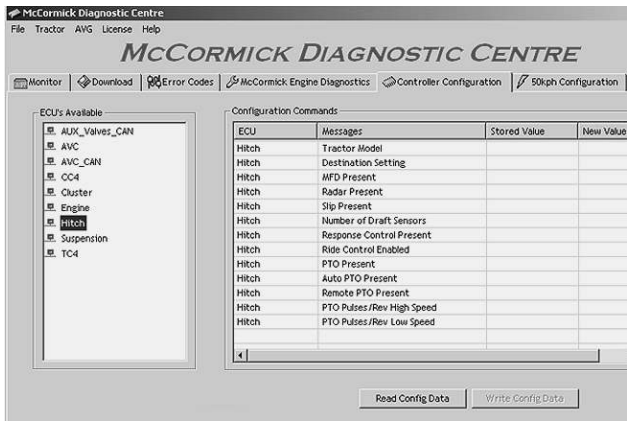
## STEP 6




MH0A002

When the above window appears select ‘Controller Configuration’ (D) as shown.

## STEP 7



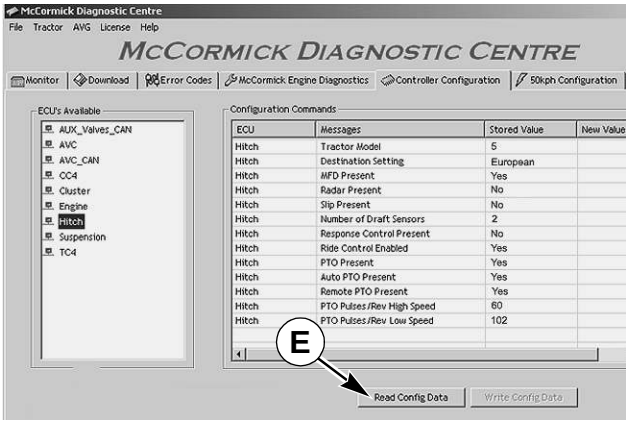

MH05G084

Highlight and double click on ‘Hitch’ in the ‘ECU’s Available’ window. The hitch configuration information will appear in the Configuration Commands window.

https://truckmanualshub.com/



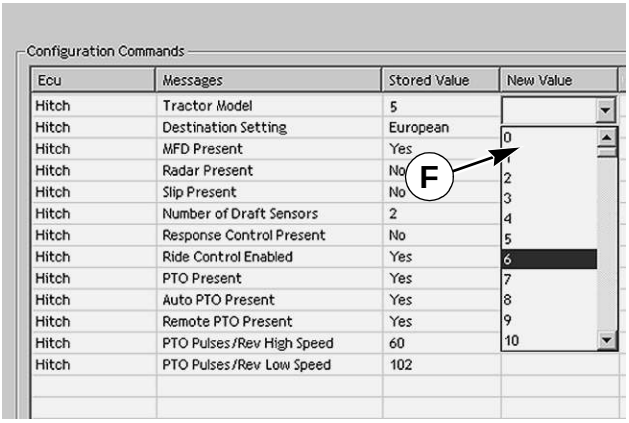
## STEP 8




MH0G083

Turn the key to the On position and click on the ‘Read Configuration’ box (E) as shown. The stored values will appear in the Configuration commands window.

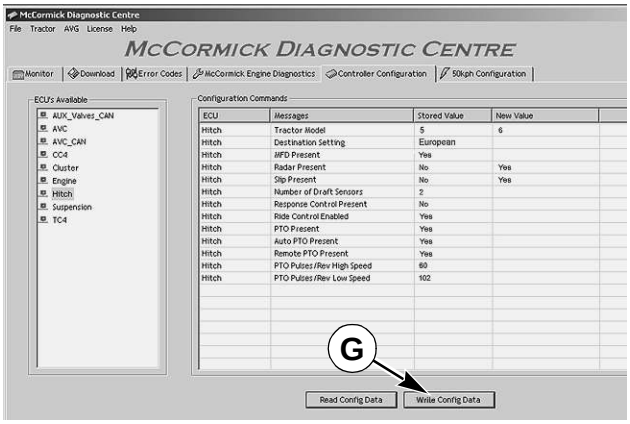
## STEP 9




MH0G087

Click on the ‘New Value’ for the ‘Messages’ to be changed. When the drop down window (F) appears select the new value for the tractor model to be con figured. Repeat the procedure for all ‘Messages’ to be changed as necessary. See “Hitch Controller Configuration Table” on page 25.

## STEP 10




MH0G088

Click on the ‘Write Configuration’ box (G) when all the ‘New Value’ selections have been made.

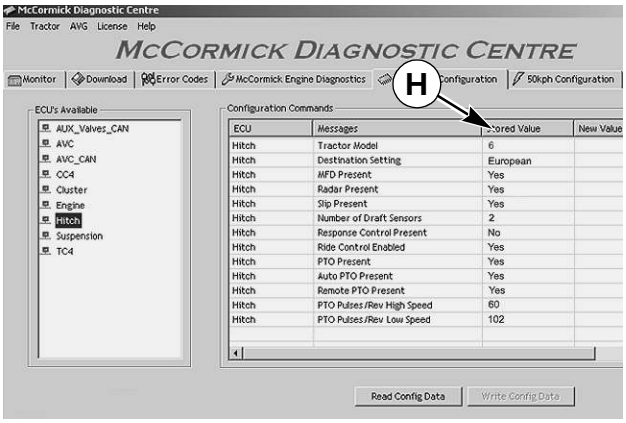
## STEP 11




MH06A044

When the above dialogue box appears, turn the key to the OFF position and back to the ON position then click ‘OK’ to store the new values, as instructed.

## STEP 12




MH0G103

Check the ‘Stored Value’ (H) to make sure the new values have been stored.

## STEP 13

Turn the key to the OFF position, exit the McCormick Diagnostics program, shut down the computer and disconnect the AVG controller interface 1014T1 from the CAN Bus connector.

https://truckmanualshub.com/



# Hitch Controller Configuration Table

| MESSAGES | SPECIFICATION | OPTION | XTRASPEED | XTRASPEED - E | XTRASPEED - E PLUS |
|---|---|---|---|---|---|
| Tractor Model | All | | 6 | 6 | 6 |
| Destination Setting | European | | European | European | European |
| | American | | American | American | American |
| MFD Present | All | With MFD | Yes | Yes | Yes |
| | | Without MFD | No | No | No |
| Radar Present | All | With Radar | Yes | Yes | Yes |
| | | Without Radar | No | No | No |
| Slip Present | All | With Radar | Yes | Yes | Yes |
| | | Without Radar | No | No | No |
| No of Draft Sensors | All | | 2 | 2 | 2 |
| Response Control Present | All | | No | No | No |
| Ride Control Enabled | All | | Yes | Yes | Yes |
| PTO Present | All | | Yes | Yes | Yes |
| Auto PTO Present | All | With Auto PTO | Yes | Yes | Yes |
| | | Without Auto PTO | No | No | No |
| Remote PTO Present | European | | Yes | Yes | Yes |
| | American | | No | No | No |
| PTO Pulses/Rev High Speed | All | | 60 | 60 | 60 |
| PTO Pulses/Rev Low Speed | All | 540 | 102 | 102 | 102 |
| | | 540E | 89 | 89 | 89 |

https://truckmanualshub.com/



# TRANSMISSION CONTROLLER CONFIGURATION

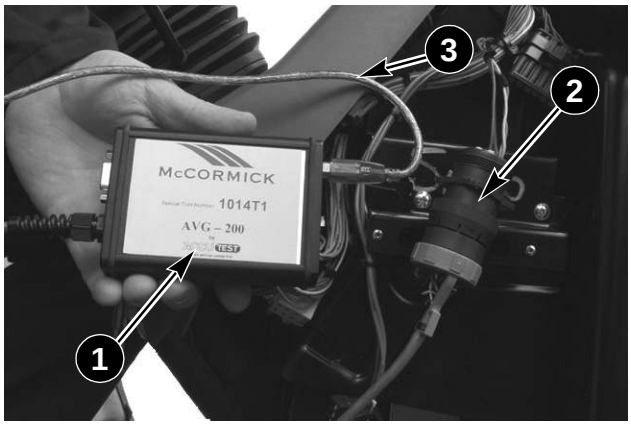
## STEP 1

Park the tractor on hard level ground, apply the parking brake, turn the key to the OFF position and put blocks in front and behind the rear wheels.

## STEP 2

Remove the instrument panel right hand side cover.

## STEP 3




MD04E084

Connect the AVG communications adapter 1014T1 (1) to the CAN bus connector (2). Connect USB communications lead 1026T1 (3) between the USB ports of laptop computer and the AVG communications adapter, refer to Page 5.

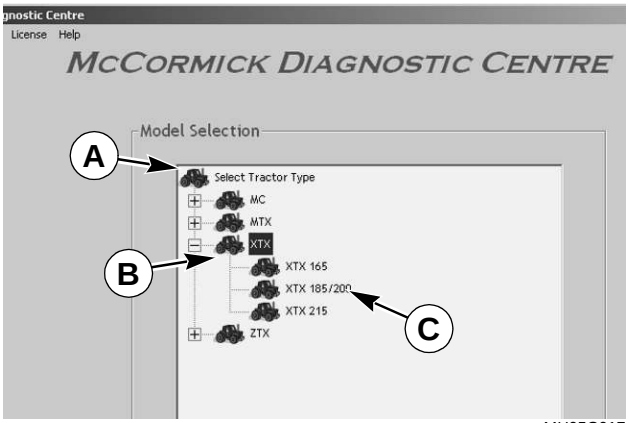
## STEP 4




MH06A057

Turn the computer ON and select the McCormick Diagnostics icon. The main window shown on Page 4 will appear.

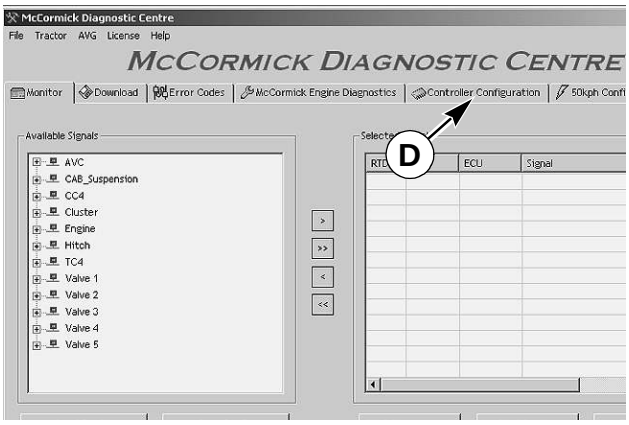
## STEP 5




MH05G017

Click open the ‘Select Tractor Type’ box (A) on the main window to expand the model tree. Click open the XTX box (B) then double click the required XTX model (C) as shown.

## STEP 6



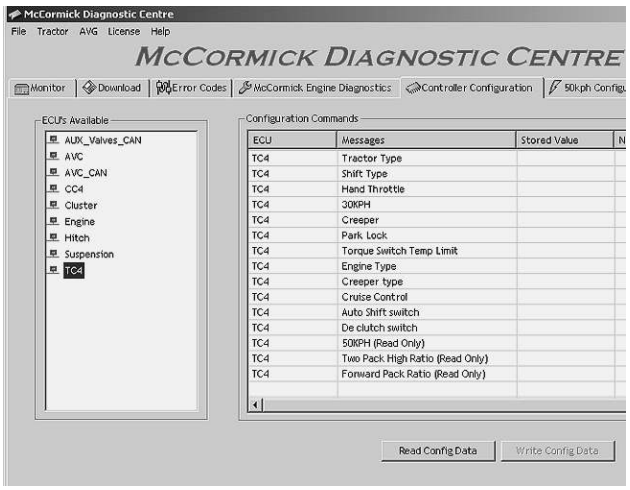

MH06A002

When the above window appears select ‘Controller Configuration’ (D) as shown.

https://truckmanualshub.com/



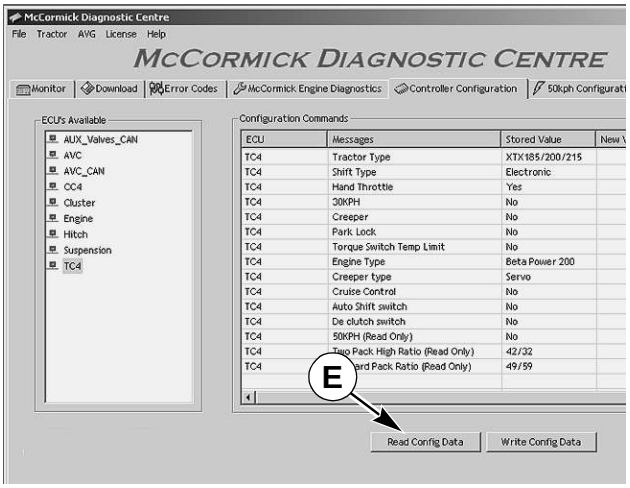
## STEP 7




MH06A040

Highlight and double click on ‘TC4’ in the ‘ECU’s Available’ window. The hitch configuration information will appear in the Configuration Commands window.

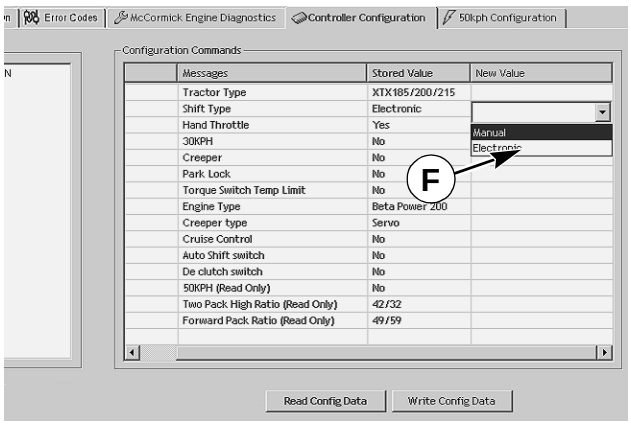
## STEP 8




MH06A041

Turn the Key to the ON position and click on the ‘Read Configuration’ box (E) as shown. The stored values will appear in the Configuration commands window.

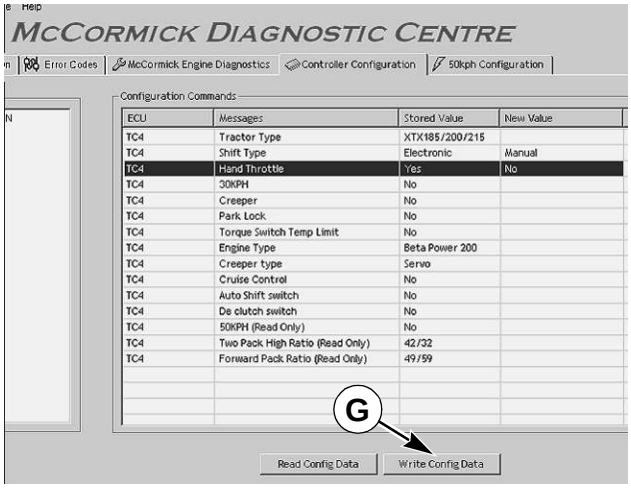
## STEP 9




MH06A042

Click on the ‘New Value’ for the ‘Messages’ to be changed. When the drop down window (F) appears select the new value for the tractor model to be con figured. Repeat the procedure for all ‘Messages’ to be changed as necessary. See “Transmission Controller Configuration Table” on page 28.

## STEP 10




MH06A043

Click on the ‘Write Configuration’ box (G) when all the ‘New Value’ selections have been made.

## STEP 11



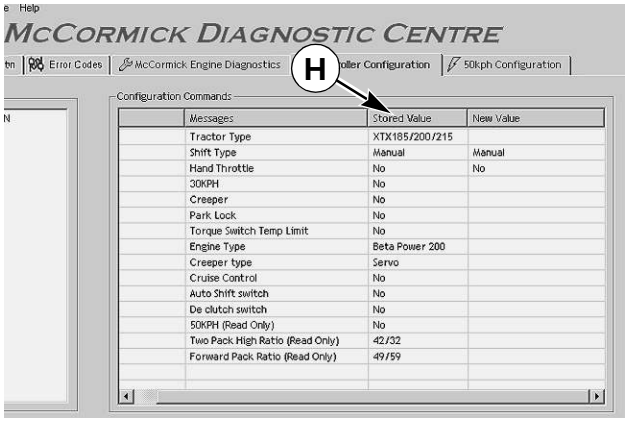

MH06A044

When the above dialogue box appears, turn the key to the OFF position and back to the ON position then click ‘OK’ to store the new values, as instructed.

https://truckmanualshub.com/



## STEP 12




MH0G104

Check the ‘Stored Value’ (H) to make sure the new values have been stored.

## STEP 13

Turn the key to the OFF position, exit the McCormick Diagnostics program, shut down the computer and disconnect the AVG controller interface 1014T1 from the CAN Bus connector.

## Transmission Controller Configuration Table

| MESSAGES | MODEL | OPTION | XTRASPEED | XTRASPEED - E | XTRASPEED - E PLUS |
|---|---|---|---|---|---|
| Tractor Type | | | XTX185/200/215 | XTX185/200/215 | XTX185/200/215 |
| Shift Type | XTX185/200/215 | | Mechanical | Electronic | Electronic |
| Hand Throttle | XTX185/200/215 | | No | No | Yes |
| 30 Kph | XTX185/200/215 | | No | No | No |
| Creeper | XTX185/200/215 | With Creeper | Yes | Yes | Yes |
| | | Without Creeper | No | No | No |
| Park Lock | XTX185/200/215 | With Park Lock | Yes | Yes | Yes |
| | | Without Park Lock | No | No | No |
| Torque Switch Temp Limit | XTX185/200/215 | | No | No | No |
| Engine Type | XTX185 | | Beta Power 185 | Beta Power 185 | Beta Power 185 |
| | XTX200 | | Beta Power 200 | Beta Power 200 | Beta Power 200 |
| | XTX215 | | Cummins 215 | Cummins 215 | Cummins 215 |
| Creeper Type | XTX185/200/215 | | Servo | Servo | Servo |
| Cruise Control | XTX185/200/215 | | No | No | No |
| Auto Shift Switch | XTX185/200/215 | | No | No | No |
| De-Clutch Switch | XTX185/200/215 | | Yes | No | No |
| 50 Kph (Read Only) | XTX185/200/215 | | N/A | N/A | N/A |
| Two Pack High Ratio (Read Only) | XTX185/200/215 | | N/A | N/A | N/A |
| Forward Pack Ratio (Read Only) | XTX185/200/215 | | N/A | N/A | N/A |

https://truckmanualshub.com/



# Section 10011

## CAB SUSPENSION CONTROLLER

## Error Codes, Troubleshooting and Schematics

## XTX Series Tractors

McCORMICK

SM 8-15140

© 2005 McCormick Tractors International Limited.
November 2005

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIAL TOOLS ..... 3

CAB SUSPENSION CONTROLLER GENERAL INFORMATION
- CAN Bus Communication ..... 4

ERROR CODES GENERAL INFORMATION ..... 5
- Retrieving Instrument Cluster Displayed Active Error Codes. ..... 5

CAB SUSPENSION CALIBRATION ..... 6

CAB LOWERING PROCEDURE ..... 7

CIRCUIT TESTING
- General Information ..... 8

ERROR CODE TROUBLESHOOTING GUIDE
- Error Code 65 ..... 9
- Error Code 66 ..... 9
- Error Code 67 ..... 9
- Error Code 68 ..... 10
- Error Code 69 ..... 10
- Error Code 70 ..... 10
- Error Code 71 ..... 11
- Error Code 72 ..... 11
- Error Code 73 ..... 12
- Error Code 74 ..... 12
- Error Code 75 ..... 13
- Error Code 76 ..... 13
- Error Code 77 ..... 13
- Error Code 78 ..... 14

CAB SUSPENSION COMPONENT IDENTIFICATION ..... 15

CAB SUSPENSION SCHEMATIC CIRCUIT ..... 16

CAN BUS SCHEMATIC CIRCUIT
- CAN Bus Schematic Circuit (For XtraSpeed and XtraSpeed - E Tractors) ..... 18
- CAN Bus Schematic Circuit (For XtraSpeed - E Plus Tractors) ..... 19

MAIN CONNECTORS ..... 20

https://truckmanualshub.com/



# SPECIAL TOOLS



DD98H120

**MC2616 MULTIMETER KIT includes:**
**MC2616-1 MULTIMETER ONLY**
**MC2616-2 TEST LEADS**
**MC2616-3 TEMPERATURE PROBE**



DD97E383

**MC31000B HARNESS REPAIR KIT (EUROPE)**



DD99A051

**MC2656 TEST PROBE KIT**

https://truckmanualshub.com/



# CAB SUSPENSION CONTROLLER GENERAL INFORMATION

The cab suspension controller controls the operation of the cab suspension by directly monitoring the position of the cab and by monitoring tractor movement either directly from the wheel speed sensor or over the CAN bus network.

**NOTE:** *XtraSpeed and XtraSpeed - E tractors equipped with 712978A1 cab suspension controllers, detect tractor movement using the wheel speed sensor.*

**NOTE:** *XtraSpeed and XtraSpeed - E tractors equipped with 712978A2 cab suspension controllers and XtraSpeed - E Plus tractors equipped with either A1 or A2 controllers, detect tractor movement over the CAN Bus network from the Hitch/PTO controller.*

When the tractor is stationary the cab suspension will be inactive, the cab will remain in its last set position. When the tractor is travelling at speeds above 1 Kmh (0.62 m.p.h.) the cab suspension will become active and the cab will automatically self level, regardless of the load within the cab.

For tractors with 712978A2 cab suspension controllers, the controller receives information over the CAN Bus network to enable the cab to self level when the engine speed is above 1000 rpm. Also under braking the cab suspension controller will disable the self levelling function to prevent excessive cab movement.

The controller continually controls the movement of the cab by monitoring the signal from the cab suspension position sensor. Depending on the signal from cab suspension position sensor the controller will activate either the cab raise or lower solenoids to make sure the cab remains in the mid position.

If a fault occurs within the cab suspension system the controller will transmit an error code over the CAN bus network to the instrument cluster.

## CAN Bus Communication

The CAN Bus circuit comprises of a twisted pair of wires, CAN High (Yellow) and CAN Low (Green), some applications require a termination 120 Ohm resistor to be installed at each end of the circuit. It is important that the CAN wires remain twisted together and the termination resistors are connected to reduce any electrical interference that may disrupt the CAN messages.

**NOTE:** *XTX185 and XTX200 tractors are equipped with one termination resistor externally connected to the transmission harness and one termination resistor located within the engine controller.*

https://truckmanualshub.com/



# ERROR CODES GENERAL INFORMATION

Each controller on the tractor continually monitors the control systems for errors. If an error is detected an error message will be transmitted over the CAN circuit to the instrument cluster, which will display an error warning to alert the operator to a problem. Depending on the nature of the fault the instrument cluster may display the Red engine STOP and or the Amber main warning light, also the audible alarm may sound.

**NOTE:** *The instrument cluster will only display current (active) error codes.*

## Retrieving Instrument Cluster Displayed Active Error Codes.

If an error occurs during normal operation in one of the tractor controller systems the ! symbol will appear on the instrument cluster.

If the error warning symbol appears park the tractor on hard level ground, put the F/N/R lever in NEUTRAL and apply the park brake. Turn the key to the OFF position.

> **WARNING:** *Some errors will only be active when the tractor is operated, the codes for these errors will be stored in the relevant controller and MUST only be retrieved using the 'McCormick Diagnostic Centre. DO NOT retrieve error codes when driving the tractor.*

To read the error codes carry out the following procedure:

Turn the key to the on position and press the menu button.

Each controller will be identified on the Universal Data Display as follows:

| | |
|---|---|
| **ENG** | - ENGINE |
| **IC** | - INSTRUMENT CLUSTER |
| **CS** | - CAB SUSPENSION CONTROLLER |

The displayed controller will also display the number of active error codes.

Example:

**ENG** = ENGINE
**0** = No Active Errors

Press the button to scroll through each controller until MCC is display Universal Data Display.

**CS** = CAB SUSPENSION CONTROLLER
**1** = 1 Active Error

To view the error code, press the menu button.

**71** = Error Code 71

If more than one instrument cluster error has been detected, press the button to identify the remaining errors.

For instrument cluster Error Codes refer to the Error Code Troubleshooting Guide in this section.

https://truckmanualshub.com/



# CAB SUSPENSION CALIBRATION

**WARNING:** *The following procedure should only be carried while sat in the operators seat. Make sure any other person or persons are clear of the area around the cab.*

## STEP 1

Park the tractor on hard level ground, apply the Park Brake and put the shuttle lever in NEUTRAL or PARK and STOP the engine. Put blocks in front of and behind the front and rear wheels.

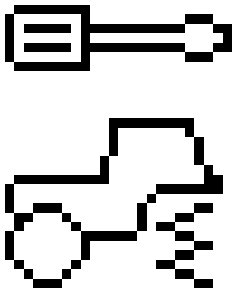
## STEP 2

Start the engine and momentarily press the instrument cluster menu button to enter the sub menu.

**WARNING:** *Never operate the engine in a closed building, proper ventilation is required under all circumstances.*

## STEP 3

Use the UP button to scroll through the sub menu until the cab suspension menu symbol is displayed as shown below.



## STEP 4

Momentarily press the instrument cluster menu button again. The menu number will momentarily advance 0.1 to indicate the cab suspension controller has entered the calibration mode.

## STEP 5

The cab suspension calibration will now begin and the calibration sequence will be as follows.

1. The cab will fully raise.
2. The cab will fully lower.
3. The cab will fully raise.
4. The cab will fully lower.
5. The cab will raise to the mid position.

When the cab calibration is complete turn the key OFF position.

https://truckmanualshub.com/



# CAB LOWERING PROCEDURE

## STEP 1

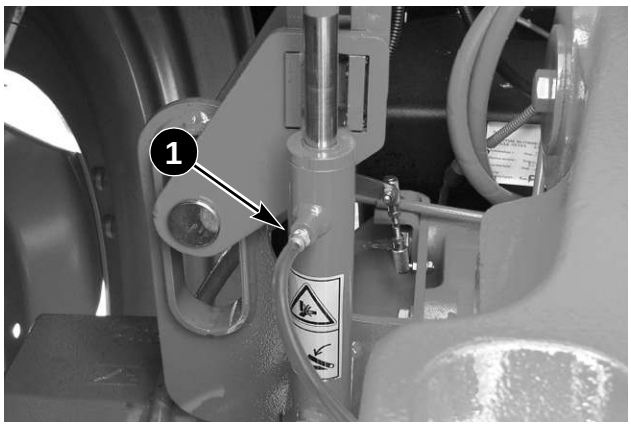
Park the tractor on hard level ground, apply the Park Brake and put the shuttle lever in NEUTRAL or PARK and STOP the engine. Put blocks in front of and behind the front and rear wheels.

## STEP 2

Check and clear the area between the cab and transmission of any obstruction that may prevent the cab from fully lowering.

**WARNING:** *Care must be taken when clearing obstructions between the cab and transmission. DO NOT place yourself or any part of your body between the cab and transmission or wheels as unexpected cab movement may occur, which may cause injury.*

## STEP 3




MI05J069

Remove the dust cap and connect a suitable length of 5mm (0.2 inch) ID plastic tube onto the left hand cab suspension hydraulic cylinder bleed valve (1). Slowly loosen the bleed valve (1) to lower the cab suspension. When the cab is in the fully lowered position tighten the bleed valve, remove the tube and install the dust cap.

**WARNING:** *Watch for pinch points between the cab and transmission as the cab is being lowered.*

https://truckmanualshub.com/



# CIRCUIT TESTING

## General Information

**WARNING:** *Never operate the engine in a closed building. Proper ventilation is required under all circumstances.*

**IMPORTANT:** *All electrical checks must be made with the tractor parked on hard level ground with park brake engaged, the shuttle lever in Neutral or Park and the engine OFF, unless otherwise stated.*

**IMPORTANT:** *Put blocks in front of and behind the rear wheels.*

**IMPORTANT:** *All checks and repairs on the cab suspension system MUST be carried out with the cab suspension fully lowered, refer to “CAB LOWERING PROCEDURE” on page 7.*

**IMPORTANT:** *The battery must be at full charge and all connections must be clean and tight before testing. Only use a HIGH IMPEDANCE multimeter for the tests. Do not use a test lamp or damage to the switches may occur.*

**IMPORTANT:** *Use MC2656 test probe kit when making electrical checks at connectors to avoid the risk of shorting between the connector pins or terminals.*

**IMPORTANT:** *Replace the controller if the fault remains only after all necessary checks have been made.*

**IMPORTANT:** *When disconnecting harness connectors, always check the connector pins and terminals for damage and alignment.*

**NOTE:** *When measuring resistance values, always measure the resistance of the multimeter leads before testing components. Subtract the resistance of the multimeter leads from the component resistance to obtain a true resistance value.*

**NOTE:** *When testing diodes and diode modules use the multimeter diode test function.*

**NOTE:** *All components, wires and connectors disconnected during any electrical checks must be connected when the checks are completed.*

https://truckmanualshub.com/



# ERROR CODE TROUBLESHOOTING GUIDE

## Cab Suspension Controller Error Codes

## Error Code 65

**Fault Description**

Cab suspension position sensor signal short circuit.

**Possible Cause**

1. Cab suspension position sensor signal wire short circuit to ground.
2. Cab suspension position sensor signal wire short circuit to a voltage supply.
3. Bad cab suspension position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action**

1. Check wire 850 Yellow between the cab suspension controller and the position sensor for a short circuit to a voltage supply, repair as necessary.
2. Check wire 850 Yellow between the cab suspension controller and the position sensor for a short circuit to ground, repair as necessary.
3. Replace the position sensor and calibrate the cab suspension.

## Error Code 66

**Fault Description**

Cab suspension position sensor open circuit.

**Possible Cause**

1. Cab suspension position sensor signal wire open circuit.
2. Cab suspension position sensor voltage supply open circuit.
3. Bad cab suspension position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action**

1. Check wire 850 Yellow between the cab suspension controller and the position sensor for open circuit, repair as necessary.
2. Check wire 606 Red between the cab suspension controller and the position sensor for an open circuit, repair as necessary.
3. Replace the position sensor and calibrate the cab suspension.

## Error Code 67

**Fault Description**

Cab suspension position sensor signal voltage below the lower limit during calibration.

**Possible Cause**

1. Bad cab suspension position sensor linkage.
2. Bad cab suspension position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action**

1. Check the position sensor linkage for damage and repair or replace as necessary. Calibrate the cab suspension.
2. Replace the cab suspension position sensor and calibrate the cab suspension.

https://truckmanualshub.com/



## Error Code 68

**Fault Description**

Cab suspension position sensor signal voltage above the upper limit during calibration.

**Possible Cause**

1. Bad cab suspension position sensor linkage.
2. Bad cab suspension position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action**

1. Check the position sensor linkage for damage and repair or replace as necessary. Calibrate the cab suspension.
   Replace the cab suspension controller and the position sensor and calibrate the cab suspension.

## Error Code 69

**Fault Description**

Cab suspension raise actuation timed out during calibration.

**Possible Cause**

1. Cab suspension raise solenoid open circuit.
2. Bad suspension raise solenoid.
3. Mechanical or hydraulic failures.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action**

1. Check wire 851 Orange between the cab suspension controller (connector 86 pin 10) and the raise solenoid connector (terminal 1) for open circuit, repair as necessary.
2. Check wire 851 Orange between the cab suspension controller (connector 86 pin 11) and the raise solenoid connector (terminal 2) for open circuit, repair as necessary.
3. Check the resistance of the raise solenoid is between 10 and 11 Ohms at 20℃ (68℉) and replace as necessary.
4. Check for mechanical or hydraulic failures.

## Error Code 70

**Fault Description**

Cab suspension lower actuation timed out during calibration.

**Possible Cause**

1. Cab suspension lower solenoid open circuit.
2. Bad suspension lower solenoid.
3. Mechanical or hydraulic failures.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action**

1. Check wire 852 Orange between the cab suspension controller (connector 86 pin 8) and the lower solenoid connector (terminal 1) for open circuit, repair as necessary.
2. Check wire 852 Orange between the cab suspension controller (connector 86 pin 7) and the lower solenoid connector (terminal 2) for open circuit, repair as necessary.
3. Check the resistance of the lower solenoid is between 9.3 and 10.3 Ohms at 20℃ (68℉) and replace a s necessary.
4. Check for mechanical or hydraulic failures.

https://truckmanualshub.com/



# Error Code 71

**Fault Description**

Cab suspension raise circuit failed.

**Possible Cause**

1. Cab suspension raise solenoid open circuit.
2. Bad suspension raise solenoid.
3. Mechanical or hydraulic failures.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action**

1. Check wire 851 Orange between the cab suspension controller (connector 86 pin 10) and the raise solenoid connector (terminal 1) for open circuit, repair as necessary.
2. Check wire 851 Orange between the cab suspension controller (connector 86 pin 11) and the raise solenoid connector (terminal 2) for open circuit, repair as necessary.
3. Check the resistance of the raise solenoid is between 10 and 11 Ohms at 20℃ (68℉) and replace as necessary.
4. Check for mechanical or hydraulic failures.

# Error Code 72

**Fault Description**

Cab suspension lower circuit failed.

**Possible Cause**

1. Cab suspension lower solenoid open circuit.
2. Bad suspension lower solenoid.
3. Mechanical or hydraulic failures.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action**

1. Check wire 852 Orange between the cab suspension controller (connector 86 pin 8) and the lower solenoid connector (terminal 1) for open circuit, repair as necessary.
2. Check wire 852 Orange between the cab suspension controller (connector 86 pin 7) and the lower solenoid connector (terminal 2) for open circuit, repair as necessary.
3. Check the resistance of the lower solenoid is between 9.3 and 10.3 Ohms at 20℃ (68℉) and replace a s necessary.
4. Check for obstructions between the cab and the transmission and clear as necessary.

> ⚠ **WARNING:** *Care must be taken when clearing obstructions between the cab and transmission. DO NOT place yourself or any part of your body between the cab and transmission or wheels as unexpected cab movement may occur, which may cause injury.*

5. Check for mechanical or hydraulic failures.

https://truckmanualshub.com/



## Error Code 73

**Fault Description**

Cab suspension controller does not detect a signal, or detects an incorrect signal from the position sensor during calibration.

**Possible Cause**

1. Bad cab suspension position sensor linkage.
2. Cab suspension position sensor signal wire open circuit.
3. Cab suspension position sensor voltage supply open circuit.
4. Cab suspension position sensor voltage return open circuit.
5. Bad cab suspension position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action**

1. Check the position sensor linkage for damage and repair or replace as necessary. Calibrate the cab suspension.
2. Check wire 850 Yellow between the cab suspension controller and the position sensor for open circuit, repair as necessary.
3. Check wire 606 Red between the cab suspension controller and the position sensor for an open circuit, repair as necessary.
4. Check wire (GND) Brown between the cab suspension controller and the position sensor for an open circuit, repair as necessary.
5. Replace the position sensor and calibrate the cab suspension.

## Error Code 74

**Fault Description**

Cab suspension raise actuation timed out during normal operation.

**Possible Cause**

1. Cab suspension raise solenoid open circuit.
2. Bad suspension raise solenoid.
3. Mechanical or hydraulic failures.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 8.*

**Circuit Checks/Corrective Action**

1. Check wire 851 Orange between the cab suspension controller (connector 86 pin 10) and the raise solenoid connector (terminal 1) for open circuit, repair as necessary.
2. Check wire 851 Orange between the cab suspension controller (connector 86 pin 11) and the raise solenoid connector (terminal 2) for open circuit, repair as necessary.
3. Check the resistance of the raise solenoid is between 10 and 11 Ohms at 20℃ (68℉) and replace as necessary.
4. Check for mechanical or hydraulic failures.

https://truckmanualshub.com/



## Error Code 75

**Fault Description**

Cab suspension lower actuation timed out during normal operation.

**Possible Cause**

1. Cab suspension lower solenoid open circuit.
2. Bad suspension lower solenoid.
3. Mechanical or hydraulic failures.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action**

1. Check wire 852 Orange between the cab suspension controller (connector 86 pin 8) and the lower solenoid connector (terminal 1) for open circuit, repair as necessary.
2. Check wire 852 Orange between the cab suspension controller (connector 86 pin 7) and the lower solenoid connector (terminal 2) for open circuit, repair as necessary.
3. Check the resistance of the lower solenoid is between 9.3 and 10.3 Ohms at 20℃ (68℉) and replace a s necessary.
4. Check for mechanical or hydraulic failures.

## Error Code 76

**Fault Description**

Cab suspension position sensor signal voltage is between the lower limit and the calibrated set point.

**Possible Cause**

1. Bad cab suspension position sensor linkage.
2. Bad cab suspension position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action**

1. Check the position sensor linkage for damage and repair or replace as necessary. Calibrate the cab suspension.
2. Replace the cab suspension position sensor and calibrate the cab suspension.

## Error Code 77

**Fault Description**

Cab suspension position sensor signal voltage is between the upper limit and the calibrated set point.

**Possible Cause**

1. Bad cab suspension position sensor linkage.
2. Bad cab suspension position sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action**

1. Check the position sensor linkage for damage and repair or replace as necessary. Calibrate the cab suspension.
2. Replace the cab suspension controller and the position sensor and calibrate the cab suspension.

https://truckmanualshub.com/



# Error Code 78

**Fault Description**

Cab suspension controller is not receiving information over the CAN bus from the engine controller or the hitch/PTO controller.

**Possible Cause**

1. Right hand door open (XtraSpeed - E and E Plus tractors only).
2. Hitch/PTO controller not powered up.
3. Engine controller not powered up.
4. Bad CAN bus circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 8.*

**Circuit Checks/Corrective Action**

1. Make sure the right hand door is closed (XtraSpeed - E and E Plus tractors only).
2. Check for other controller engine CAN message errors. If other controller engine CAN message errors are present, check the engine controller CAN bus circuit.
3. Check for other controller hitch/PTO CAN message errors. If other controller hitch/PTO CAN message errors are present, check the hitch/PTO controller CAN bus circuit.
4. If other controller CAN message errors are not present, check the following:

   **XtraSpeed and XtraSpeed - E Tractors**

   - Wire 900 Yellow between the cab suspension controller and splice RCH-SP19 for open circuit and repair as necessary. Also check connector 52.
   - Wire 900 Light Green between the cab suspension controller and splice RCH-SP20 for open circuit and repair as necessary. Also check connector 52.

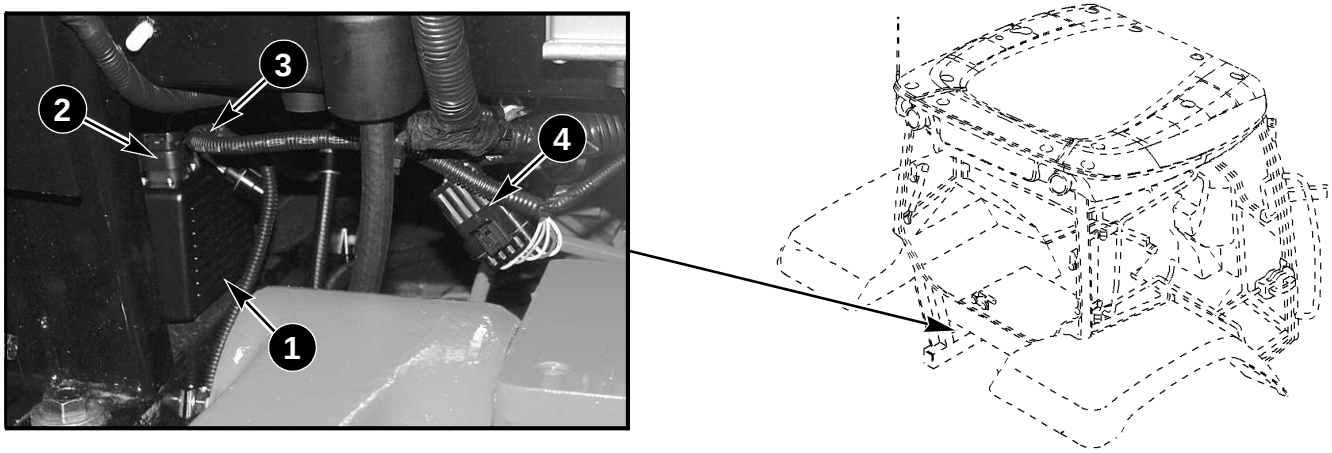
   **XtraSpeed - E Plus Tractors**

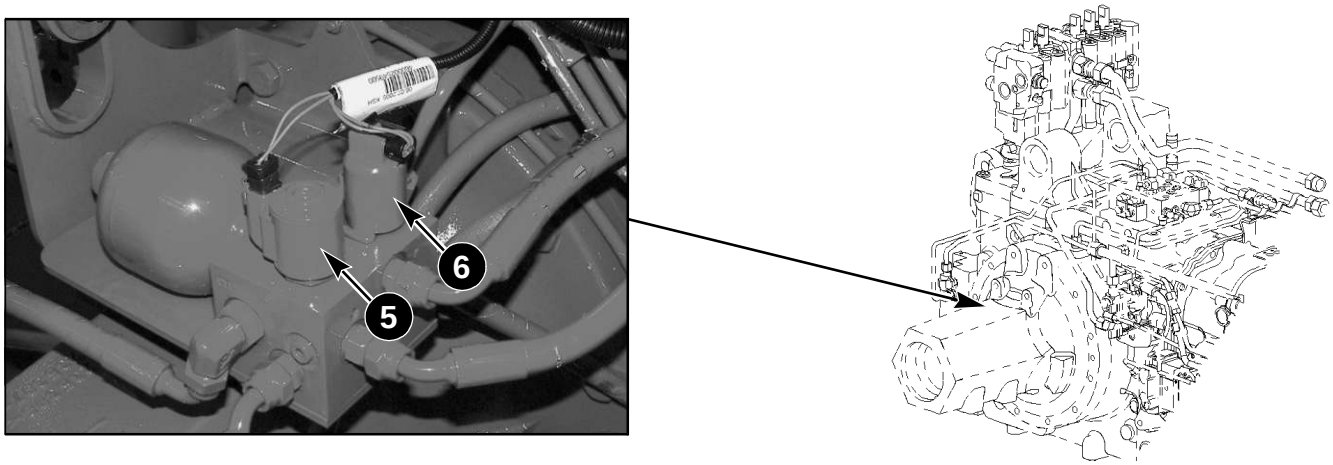
   - Wire 900 Yellow between the cab suspension controller and splice F-SP17 for open circuit and repair as necessary.
   - Wire 900 Light Green between the cab suspension controller and splice F-SP18 for open circuit and repair as necessary.

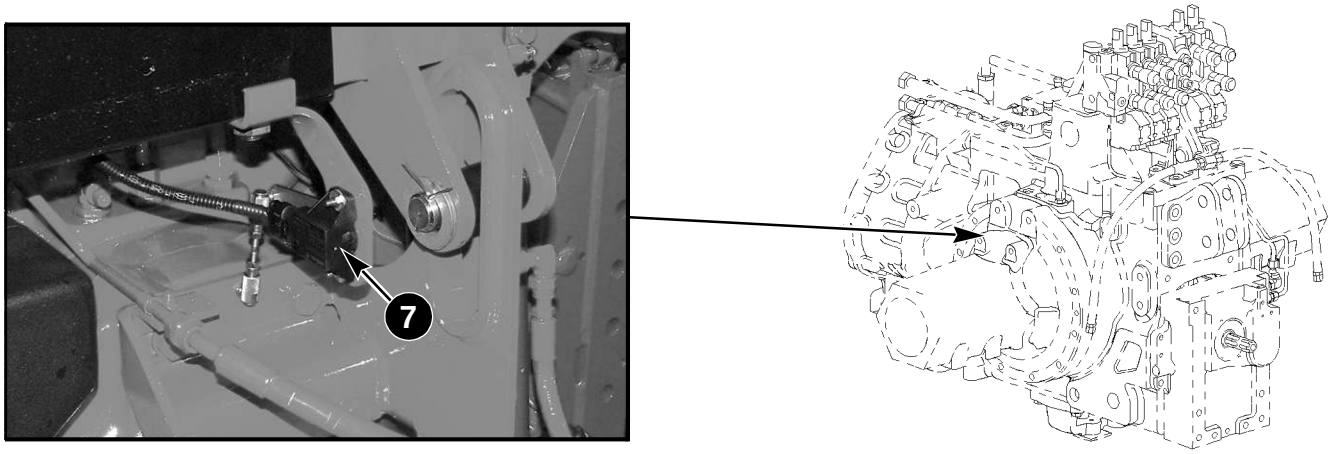
https://truckmanualshub.com/



# CAB SUSPENSION COMPONENT IDENTIFICATION




1. CAB SUSPENSION CONTROLLER
2. CONNECTOR 85
3. CONNECTOR 86
4. CONNECTOR 84
5. CONNECTOR 84
6. CAB RAISE SOLENOID
7. CAB LOWER SOLENOID

https://truckmanualshub.com/



# CAB SUSPENSION SCHEMATIC CIRCUIT

## Cab Suspension Controller Connector Pin Identification

| CONNECTOR 85 (8 Pin) | | | | | |
|---|---|---|---|---|---|
| 1 | CAN LOW | | 5 | OPEN |
| 2 | OPEN | | 6 | OPEN |
| 3 | OPEN | | 7 | CAN HIGH |
| 4 | OPEN | | 8 | OPEN |

| CONNECTOR 86 (23 Pin) | | | | | |
|---|---|---|---|---|---|
| 1 | CHASSIS GROUND | | 13 | OPEN |
| 2 | SWITCHED B+ | | 14 | OPEN |
| 3 | CAB POSITION SENSOR B+ | | 15 | OPEN |
| 4 | OPEN | | 16 | OPEN |
| 5 | OPEN | | 17 | OPEN |
| 6 | OPEN | | 18 | OPEN |
| 7 | CAB LOWER SOLENOID B+ | | 19 | WHEEL SPEED SIGNAL (SEE NOTE) |
| 8 | CAB LOWER SOLENOID RETURN | | 20 | CAB POSITION SENSOR SIGNAL |
| 9 | OPEN | | 21 | CALIBRATION SIGNAL (NOT USED) |
| 10 | CAB RAISE SOLENOID RETURN | | 22 | OPEN |
| 11 | CAB RAISE SOLENOID B+ | | 23 | OPEN |
| 12 | CAB POSITION SENSOR RETURN | | | |

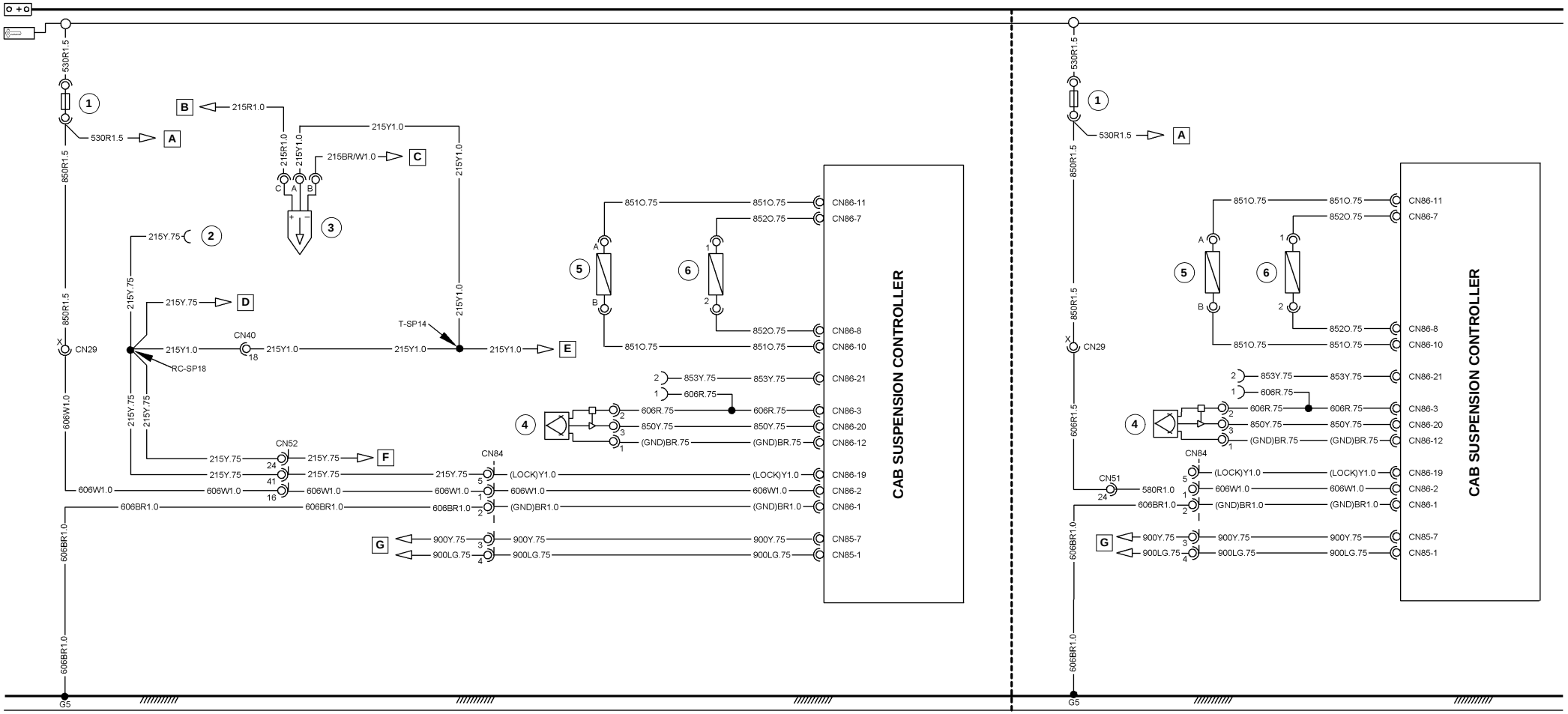
**NOTE:** *XtraSpeed and XtraSpeed - E tractors equipped with 712978A1 cab suspension controllers, detect tractor movement using the wheel speed sensor.*

**NOTE:** *XtraSpeed and XtraSpeed - E tractors equipped with 712978A2 cab suspension controllers and XtraSpeed - E Plus tractors equipped with either A1 or A2 controllers, detect tractor movement over the CAN Bus network from the Hitch/PTO controller.*

https://truckmanualshub.com/


CAB SUSPENSION CIRCUIT FOR XTRASPEED AND XTRASPEED - E TRACTORS

CAB SUSPENSION CIRCUIT FOR XTRASPEED - E PLUS TRACTORS



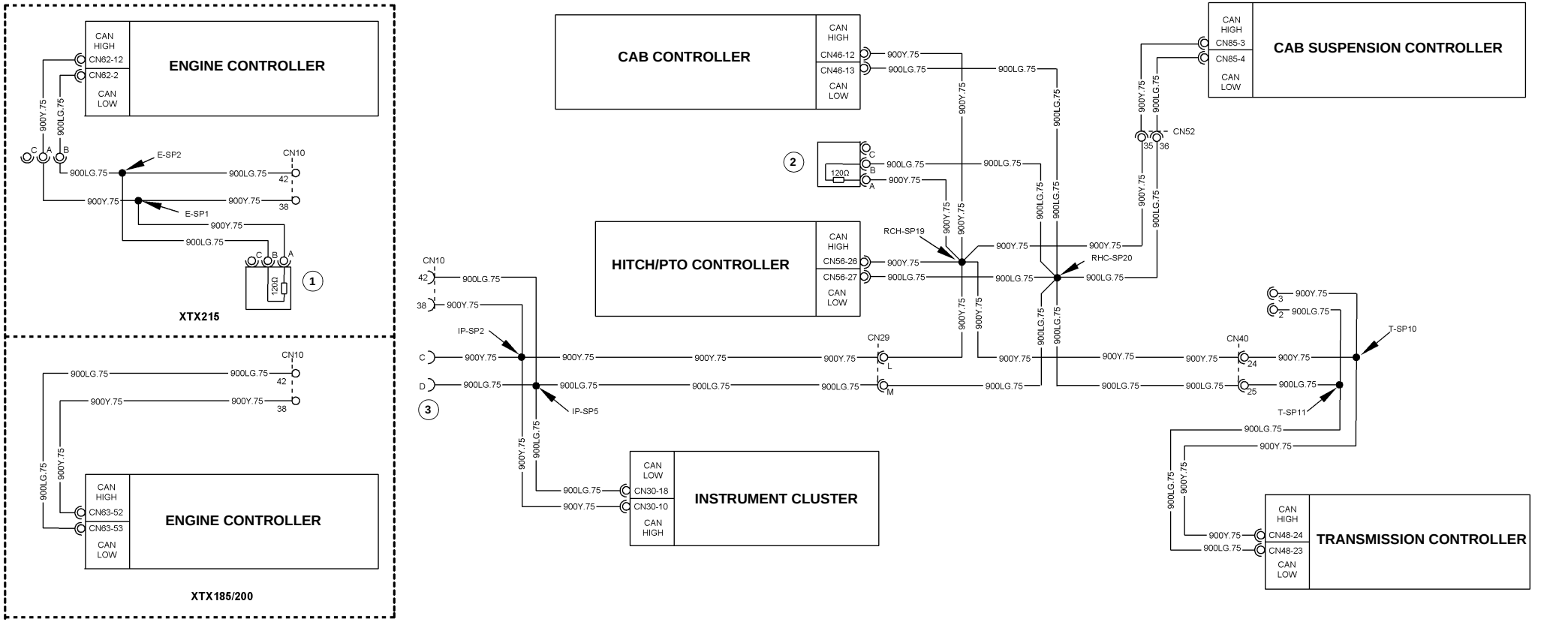

## Key

1. FUSE 28 (10 AMP)
2. IMPLEMENT INTERFACE CONNECTOR
3. WHEEL SPEED SENSOR
4. CAB POSITION SENSOR
5. CAB RAISE SOLENOID
6. CAB LOWER SOLENOID

A. TO FRONT AXLE SUSPENSION CIRCUIT
B. B+ SUPPLY FROM TRANSMISSION CONTROLLER
C. GROUND TO TRANSMISSION CONTROLLER
D. TO HITCH/PTO CONTROLLER
E. TO TRANSMISSION CONTROLLER
F. TO FRONT AXLE SUSPENSION CONTROLLER
G. TO CAN BUS CIRCUIT

# CAN BUS SCHEMATIC CIRCUITS

## CAN Bus Schematic Circuit (For XtraSpeed and XtraSpeed - E Tractors)




MI05D049

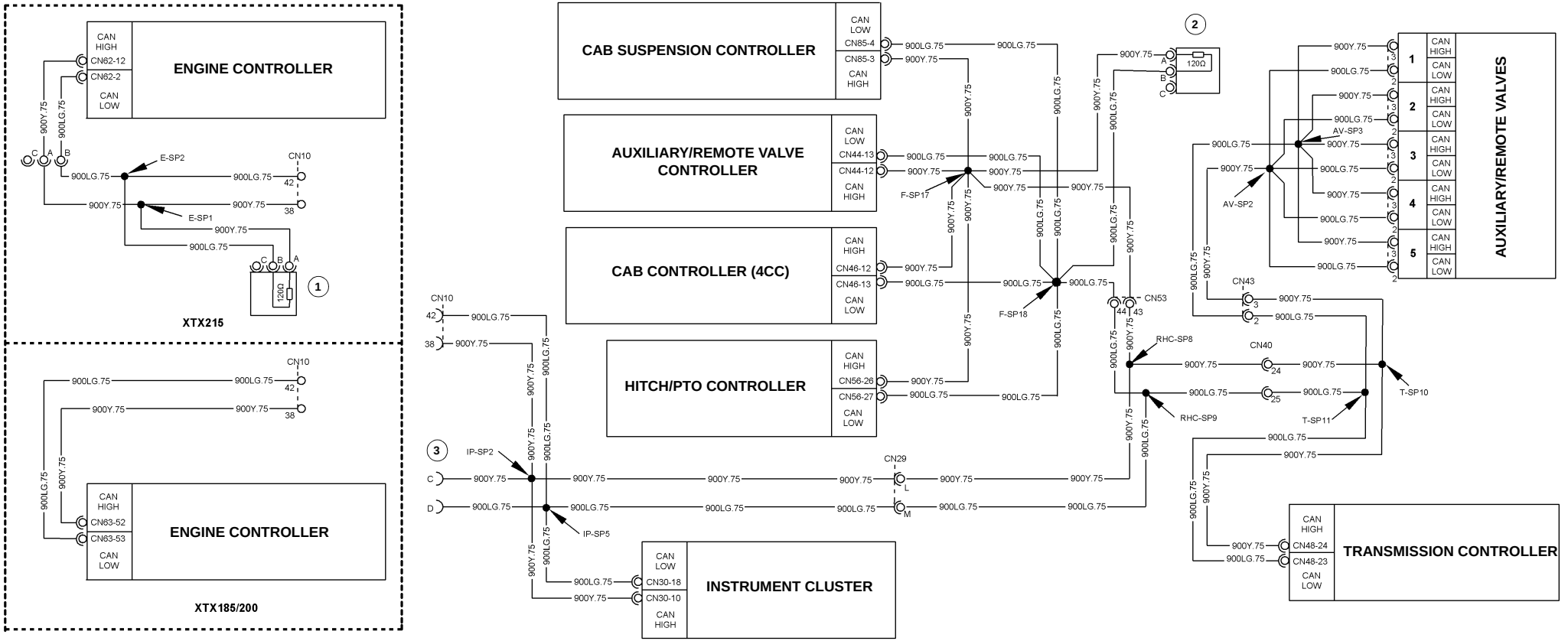
### Key

1. ENGINE HARNESS TERMINATION RESISTOR (XTX215 TRACTORS ONLY)
2. TRANSMISSION HARNESS TERMINATION RESISTOR
3. DIAGNOSTIC CONNECTOR (9 PIN)

**NOTE:** *For XTX185 and XTX200 tractors the engine harness termination resistor is located within the engine controller.*

https://truckmanualshub.com/


## CAN Bus Schematic Circuit (For XtraSpeed - E Plus Tractors)




MI05D049

### Key

1. ENGINE HARNESS TERMINATION RESISTOR (XTX215 TRACTORS ONLY)
2. TRANSMISSION HARNESS TERMINATION RESISTOR
3. DIAGNOSTIC CONNECTOR (9 PIN)

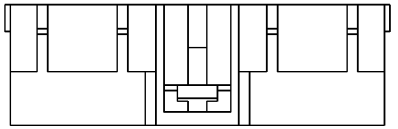
**NOTE:** *For XTX185 and XTX200 tractors the engine harness termination resistor is located within the engine controller.*

https://truckmanualshub.com/


# MAIN CONNECTORS

## Connector 26

**Location: Right Hand Console**



477I96

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

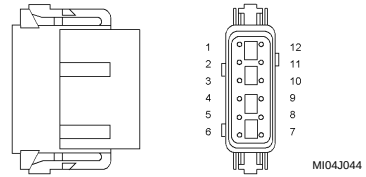
| Cavity | Wire No | Circuit |
|---|---|---|
| A | 590 BR | AUDIBLE ALARM |
| B | 707 P | LH TAIL/POSITION LIGHT |
| C | 708 P | RH TAIL/POSITION LIGHT |
| D | - - - - - | OPEN |
| E | 590 R | CAB CONTROLLER SWITCHED B+ |
| F | 501 R | HITCH/PTO CONTROLLER SWITCHED B+ |
| G | 784 V | REAR FENDER WORK LIGHTS |
| H | 810 R | SEAT B+ |
| J | 530 R | MFD AND DIFF LOCK B+ |
| K | 134 R | AUXILIARY POWER CONNECTOR SWITCHED B+ |
| L | 756 P | RH TURN SIGNAL |
| M | 757 P | LH TURN SIGNAL |
| N | (IIC) R | IIC UNSWITCHED POWER B+ |
| P | 133 R | AUXILIARY POWER FENDER HARNESS CONNECTOR (*)<br>7 PIN CONNECTOR (**) |
| R | 135 R | RH CONSOLE AUXILIARY POWER UNSWITCHED B+ |
| S | 817 R | CIGAR LIGHTER |
| T | 269 Y | PARK BRAKE WARNING LIGHT |
| U | 702 R | BRAKE RELAY B+ |
| V | - - - - - | OPEN |
| W | 785 V | REAR FOG LIGHTS (EUR) |
| X | 254 Y | PARK LOCK SIGNAL |
| Y | 276 LB | 1000 RPM PTO SWITCH |
| Z | (VP) R | AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ (XTRASPEED - E PLUS ONLY) |

*(*) European Specification Tractors Only.*

*(**) American Specification Tractors Only.*

## Connector 27

**Location: Right Hand Console**




MI04J044

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

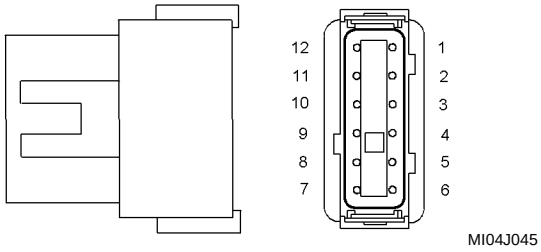
| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 240 Y | AIR TRAILER BRAKE PRESSURE |
| 2 | 515 R | LOADER CONTROLS B+ |
| 3 | 656 Y | CLUTCH POSITION SIGNAL |
| 4 | - - - - - | OPEN |
| 5 | 660 Y | BOTTOM OF CLUTCH SIGNAL |
| 6 | 233 Y | FUEL LEVEL SENDER |
| 7 | 656 BR | CLUTCH POSITION RETURN |
| 8 | 656 R | CLUTCH POSITION B+ |
| 9 | 536 LB | LH BRAKE SIGNAL |
| 10 | 267 Y | HYDRAULIC FILTER RESTRICTION SWITCH |
| 11 | - - - - - | OPEN |
| 12 | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 28

### Location: Right Hand Console



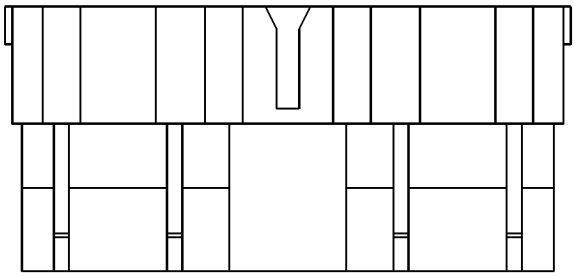

MI04J045

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 510 T | F/N/R, FOOT THROTTLE 5V REF |
| 2 | 511 T | FORWARD SIGNAL |
| 3 | 562 R | F/N/R, F/N/R/P 12V SUPPLY |
| 4 | 606 W | IIC SWITCHED POWER SENSING |
| 5 | - - - - - | OPEN |
| 6 | 513 T | REVERSE SIGNAL |
| 7 | 531 LB | RH BRAKE SIGNAL |
| 8 | 514 T | NEUTRAL SIGNAL |
| 9 | - - - - - | OPEN |
| 10 | 281 Y | RADAR SIGNAL (HITCH) |
| 11 | 282 Y | RADAR PRESENT (IIC) |
| 12 | 563 LB | IMPLEMENT DOWN SWITCH |

## Connector 29

### Location: Right Hand Console



478I96

**INSTRUMENT PANEL TO RIGHT HAND CONSOLE HARNESS (RIGHT HAND CONSOLE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| A | 835 O | FRONT WINDSCREEN WASHER |
| B | 845 O | REAR WINDSHIELD WASHER |
| C | 550 R | FRONT PTO B+ |
| D | 551 LB | FRONT PTO SIGNAL |
| E | 590 R | REAR PTO SWITCHED B+ |
| F | 161 R | (##) AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ |
| G | 134 R | IIIC SWITCHED POWER |
| H | 776 P | ROTARY BEACON LIGHT |
| J | 531 R | MFD AXLE SUSPENSION UNSWITCHED POWER |
| K | 530 R | MFD AXLE SUSPENSION SWITCHED POWER |
| L | 900 Y | CAN HIGH |
| M | 900 LG | CAN LOW |
| N | - - - - - | OPEN |
| P | 500B R | CAB CONTROLLER UNSWITCHED B+ |
| R | 550 R | TRANSMISSION CONTROLLER SWITCHED B+ |
| S | 400 R | TRANSMISSION CONTROLLER UNSWITCHED B+ |
| T | 643 Y | FOOT THROTTLE SIGNAL |
| U | 643 BR | FOOT THROTTLE 0V RETURN |
| V | 160 R | (##) AUXILIARY/REMOTE VALVE CONTROLLER UNSWITCHED B+ |
| W | - - - - - | OPEN |
| X | 606 W | (#) CAB SUSPENSION CONTROLLER SWITCHED B+ |
| | 660 R | (##) CAB SUSPENSION CONTROLLER SWITCHED B+ |
| Y | (ARM) R | (##) ARMREST SWITCHED B+ |
| Z | - - - - - | OPEN |

*(#) XtraSpeed and XtraSpeed - E tractors only.*

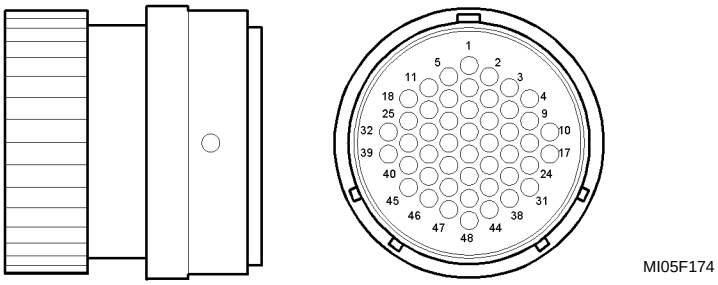
*(##) XtraSpeed - E Plus tractors only.*

https://truckmanualshub.com/



## Connector 51 (XtraSpeed - E Plus Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 757 P | LEFT HAND TURN SIGNAL |
| 2 | 756 P | RIGHT HAND TURN SIGNAL |
| 3 | 507 R | HITCH POSITION POTENTIOMETER B+ |
| 4 | 707 P | LEFT HAND REAR SIDE/POSITION LIGHT |
| 5 | 708 P | RIGHT HAND REAR SIDE/ POSITION LIGHT |
| 6 | 785 V | REAR FOG LIGHT |
| 7 | 702 P | STOP LIGHTS |
| 8 | (VP) T | AUXILIARY/REMOTE VALVE VP OUT |
| 9 | 591 DB | DIFFERENTIAL LOCK SOLENOID B+ |
| 10 | 511 R | HITCH SOLENOID B+ |
| 11 | 835 O | FRONT WINDSCREEN WASHER |
| 12 | 845 O | REAR WINDSCREEN WASHER |
| 13 | 776 P | BEACON LIGHT (EUROPEAN SPECIFICATION TRACTORS ONLY) |
| 14 | 514 BR | LOAD PIN RETURN |
| 15 | 514 LB | RIGHT HAND LOAD PIN SIGNAL |
| 16 | 512 LB | HITCH LOWER SOLENOID |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | - - - - - | OPEN |
| 22 | - - - - - | OPEN |
| 23 | 224 Y | PTO SPEED SIGNAL |
| 24 | 850 R | CAB SUSPENSION CONTROLLER SWITCHED B+ |

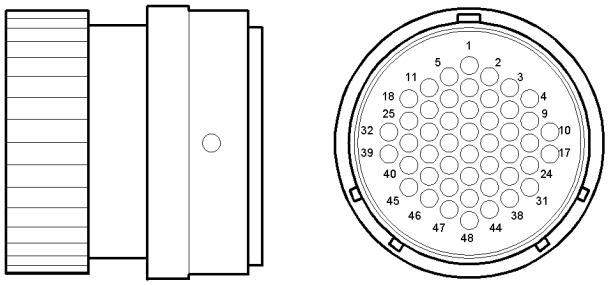
| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 513 LB | HITCH LOWER SOLENOID |
| 26 | 514 R | LOAD PIN 8V SUPPLY |
| 27 | 515 LB | LEFT HAND LOAD PIN SIGNAL |
| 28 | - - - - - | OPEN |
| 29 | 133 R | AUXILIARY POWER SWITCHED B+ |
| 30 | 784 P | REAR WORK LIGHTS |
| 31 | 507 LB | HITCH POSITION POTENTIOMETER SIGNAL |
| 32 | 507 BR | HITCH POSITION POTENTIOMETER RETURN |
| 33 | (LINK) R | CAB CONTROLLER/ TRANSMISSION CONTROLLER LINK |
| 34 | BR/W | HITCH CONTROLLER CLEAN GROUND |
| 35 | BR/W | CLEAN GROUND |
| 36 | 597 LB | PTO SOLENOID B+ |
| 37 | 597 BR | PTO SOLENOID RETURN |
| 38 | - - - - - | OPEN |
| 39 | - - - - - | OPEN |
| 40 | 542 LB | MFD RELAY SUPPLY |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | - - - - - | OPEN |
| 44 | - - - - - | OPEN |
| 45 | - - - - - | OPEN |
| 46 | - - - - - | OPEN |
| 47 | - - - - - | OPEN |
| 48 | - - - - - | OPEN |

https://truckmanualshub.com/



## Connector 52 (XtraSpeed and XtraSpeed - E Tractors Only)

**Location: Cab Floor (Right Hand Console)**




MI05F174

**FENDER HARNESS TO RIGHT HAND CONSOLE HARNESS (FENDER HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 560 R | HITCH UPPER LIMIT POTENTIOMETER SUPPLY |
| 2 | 560 LB | HITCH UPPER LIMIT POTENTIOMETER SIGNAL |
| 3 | 560 BR | HITCH UPPER LIMIT POTENTIOMETER RETURN |
| 4 | 502 R | HITCH DROP SPEED POTENTIOMETER SUPPLY |
| 5 | 502 LB | HITCH DROP SPEED POTENTIOMETER SIGNAL |
| 6 | 502 BR | HITCH DROP SPEED POTENTIOMETER RETURN |
| 7 | 504 LB | HITCH POSITION COMMAND POTENTIOMETER SIGNAL |
| 8 | 504 R | HITCH POSITION COMMAND POTENTIOMETER SUPPLY |
| 9 | 504 BR | HITCH POSITION COMMAND POTENTIOMETER RETURN |
| 10 | 505 R | HITCH LOAD COMMAND POTENTIOMETER SUPPLY |
| 11 | 505 LB | HITCH LOAD COMMAND POTENTIOMETER SIGNAL |
| 12 | 505 BR | HITCH LOAD COMMAND POTENTIOMETER RETURN |
| 13 | - - - - - | OPEN |
| 14 | - - - - - | OPEN |
| 15 | - - - - - | OPEN |
| 16 | - - - - - | OPEN |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | - - - - - | OPEN |
| 20 | - - - - - | OPEN |
| 21 | 570 LB | SLIP CONTROL LIGHT SUPPLY |
| 22 | 567 LB | SLIP CONTROL ON SIGNAL |
| 23 | - - - - - | OPEN |
| 24 | 593 DB | AUTO PTO OFF SIGNAL |

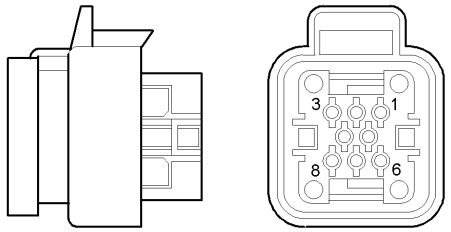
| Cavity | Wire No | Circuit |
|---|---|---|
| 25 | 531 R | MFD AXLE SUSPENSION UNSWITCHED B+ |
| 26 | 643 Y | FOOT THROTTLE SIGNAL |
| 27 | 281 Y | RADAR SIGNAL |
| 28 | 506 R | HITCH TRAVEL POTENTIOMETER SUPPLY |
| 29 | 506 LB | HITCH TRAVEL POTENTIOMETER SIGNAL |
| 30 | 506 BR | HITCH TRAVEL POTENTIOMETER RETURN |
| 31 | 590 R | REMOTE PTO SWITCH B+ |
| 32 | - - - - - | OPEN |
| 33 | 161 R | AUXILIARY/REMOTE VALVE CONTROLLER SWITCHED B+ |
| 34 | - - - - - | OPEN |
| 35 | 500B R | CAB CONTROLLER UNSWITCHED B+ |
| 36 | 572 LB | RIDE CONTROL ON SIGNAL |
| 37 | 573 LB | RIDE CONTROL OVERRIDE SIGNAL |
| 38 | - - - - - | OPEN |
| 39 | 282 Y | RADAR PRESENT SIGNAL |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | - - - - - | OPEN |
| 43 | 534 DB | MFD AXLE SUSPENSION UP SIGNAL |
| 44 | 535 DB | MFD AXLE SUSPENSION DOWN SIGNAL |
| 45 | 533 DB | MFD AXLE SUSPENSION REGULATION ON |
| 46 | 542 DB | MFD AXLE SUSPENSION UNSWITCHED UP SIGNAL |
| 47 | 563 DB | MFD AXLE SUSPENSION INDICATOR LIGHT |
| 48 | 530 R | MFD AXLE SUSPENSION SWITCHED B+ |

https://truckmanualshub.com/



## Connector 85

**Location: Instrument Cluster**



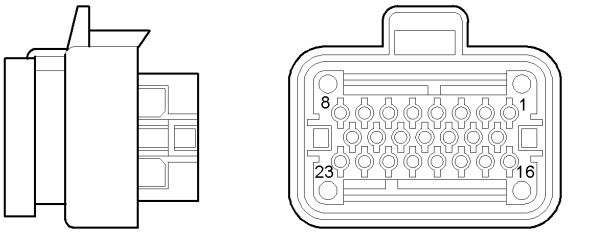

MI05J063

**INSTRUMENT PANEL HARNESS TO INSTRUMENT CLUSTER**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 900 LG | CAN LOW |
| 2 | - - - - - | OPEN |
| 3 | - - - - - | OPEN |
| 4 | - - - - - | OPEN |
| 5 | - - - - - | OPEN |
| 6 | - - - - - | OPEN |
| 7 | 900 Y | CAN HIGH |
| 8 | - - - - - | OPEN |

## Connector 86

**Location: Instrument Cluster**




MI05J062

**INSTRUMENT PANEL HARNESS TO INSTRUMENT CLUSTER**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | (GND) BR | CHASSIS GROUND |
| 2 | 606 W | SWITCHED POWER B+ |
| 3 | 606 R | CAB POSITION SENSOR B+ |
| 4 | - - - - - | OPEN |
| 5 | - - - - - | OPEN |
| 6 | - - - - - | OPEN |
| 7 | 852 O | CAB LOWER SOLENOID B+ |
| 8 | 852 O | CAB LOWER SOLENOID RETURN |
| 9 | - - - - - | OPEN |
| 10 | 851 O | CAB RAISE SOLENOID RETURN |
| 11 | 851 O | CAB RAISE SOLENOID B+ |
| 12 | (GND) BR | CAB POSITION SENSOR RETURN |
| 13 | - - - - - | OPEN |
| 14 | - - - - - | OPEN |
| 15 | - - - - - | OPEN |
| 16 | - - - - - | OPEN |
| 17 | - - - - - | OPEN |
| 18 | - - - - - | OPEN |
| 19 | (LOCK) Y | WHEEL SPEED SENSOR SIGNAL |
| 20 | 850 Y | CAB POSITION SENSOR SIGNAL |
| 21 | 853 Y | CALIBRATION SIGNAL |
| 22 | - - - - - | OPEN |
| 23 | - - - - - | OPEN |

https://truckmanualshub.com/

10012

# Section 10012

## AUTOMATIC TEMPERATURE CONTROL

### Error Codes, Troubleshooting and Schematics

### XTX Series Tractors

McCORMICK

SM 8-15110

© 2005 McCormick Tractors International Limited.
November 2005

https://truckmanualshub.com/



# TABLE OF CONTENTS

SPECIAL TOOLS ..... 3

AUTOMATIC TEMPERATURE CONTROL GENERAL INFORMATION

SYSTEM OPERATION ..... 5

CENTIGRADE/FAHRENHEIT DISPLAY ..... 6

CIRCUIT TESTING
- General Information ..... 7

ERROR CODE TROUBLESHOOTING GUIDE
- Temperature Control Module Error Codes ..... 8
  - Error Code 01 ..... 8
  - Error Code 02 ..... 9
  - Error Code 03 ..... 10
  - Error Code 04 ..... 10
  - Error Code 05 ..... 11
  - Error Code 06 ..... 12
  - Error Code 07 ..... 12
  - Error Code 08 ..... 13
  - Error Code 10 ..... 13

COMPONENT IDENTIFICATION AND SCHEMATIC CIRCUITS
- Air Conditioning Components (Cab Front) ..... 15
- Air Conditioning Components (Rear and Left Hand Side of Cab) ..... 16
- Automatic Temperature Control Schematic Circuit (XTX185 and XTX200 Tractors) ..... 17
- Automatic Temperature Control Schematic Circuit (XTX215 Tractors) ..... 18

MAIN CONNECTORS ..... 19

https://truckmanualshub.com/



# SPECIAL TOOLS



DD98H120

**MC2616 MULTIMETER KIT INCLUDES:**
**MC2616-1 MULTIMETER ONLY**
**MC2616-2 TEST LEADS**
**MC2616-3 TEMPERATURE PROBE**



DD97E383

**MC31000B HARNESS REPAIR KIT (EUROPE)**



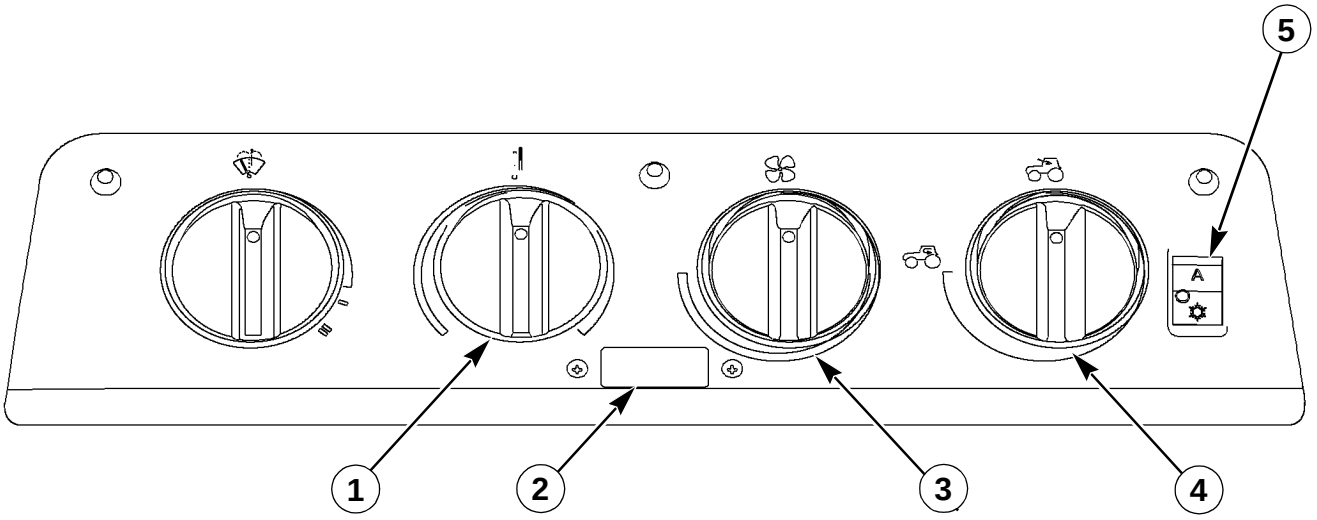
DD99A051

**MC2656 TEST PROBE KIT**

https://truckmanualshub.com/



# AUTOMATIC TEMPERATURE CONTROL GENERAL INFORMATION




MI03C095

1. TEMPERATURE CONTROL
2. DIGITAL DISPLAY
3. BLOWER MOTOR CONTROL
4. RECIRCULATING AIR CONTROL
5. AIR CONDITIONING MODE SWITCH

The function of the automatic temperature control module is to maintain the cab temperature at a level set by the operator. The cab temperature control system operates in three modes, OFF, AUTO and DEFROST. To enable correct operation of the cab temperature control system the controller processes and monitors signals directly from the following components:

- Temperature control potentiometer.
- Recirculating air control potentiometer.
- Blower motor control potentiometer.
- Cab temperature sensor.
- Evaporator freeze control sensor.
- Air conditioning mode switch.
- System high pressure switch.
- System low pressure switch.

The automatic temperature controller directly controls the operation of the following components:

- Blower motors.
- Air conditioning compressor.
- Water control valve motor.
- Air recirculating door control motor.

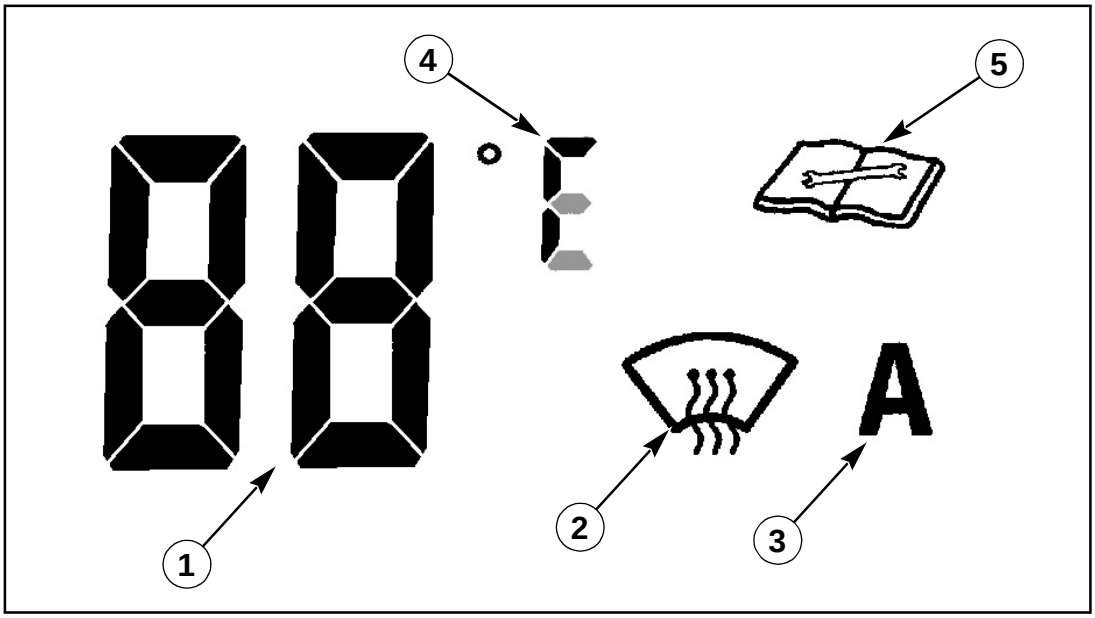
The automatic temperature controller also transmits the following information the digital display:

- Cab temperature setting and scale (Centigrade or Fahrenheit).
- Automatic temperature mode selection (AUTO or DEFROST).
- Service indication and error codes.

https://truckmanualshub.com/



## SYSTEM OPERATION




1.TEMPERATURE SETTING
2.DEFROST MODE INDICATOR
3.AUTO MODE INDICATOR
4.FAHRENHEIT/CENTIGRADE INDICATOR
5.SERVICE INDICATOR

### OFF Mode.

When the air conditioning mode switch is set to the OFF position, the operator can manually operate and control the blower motor speed and recirculating door position by using the blower motor control knob and recirculating air control knob. The cab temperature control will not change the position of the heater valve and the air conditioning compressor will not operate.

### Auto Mode.

When the air conditioning mode switch is set to the AUTO position, the temperature set point (1) and mode indicator A (3) will appear on the digital display, also the temperature centigrade/fahrenheit scale symbol C or F will appear at (4). The operator can adjust the cab temperature set point using the temperature control from a minimum temperature of 16℃ (30℉) to a maximum temperature of 32℃ (90℉).

The automatic temperature control module monitors the cab temperature and automatically adjusts the blower motor speed, air conditioning compressor engagement/disengagement, heater valve and recirculating door position to maintain the cab set point temperature.

If the operator manually adjusts the blower speed or the recirculating air door position the mode indicator A (3) will no longer be displayed. The adjusted feature will no longer be controlled automatically i.e. if the blower motor control is adjusted, the blower motor will not change speeds automatically. To return the system to full auto mode the air conditioning mode switch must be cycled to the OFF position and back to the Auto position.

### Defrost Mode.

When the air conditioning mode switch is set to the DEFROST position the temperature setpoint (1) and mode indicator (2) will appear on the digital display. The recirculating air door will automatically close and the blower motor will go to maximum speed. If the evaporator freeze sensor temperature is above 1.1℃ (34℉) the a ir conditioning compressor will engage. The operator can adjust the cab temperature set point using the temperature control.

### Error Codes.

When an error occurs in the system the service indicator (5) will appear on the digital display, the temperature set point (1) will alternate between displaying the temperature setpoint and the recorded error code.

https://truckmanualshub.com/



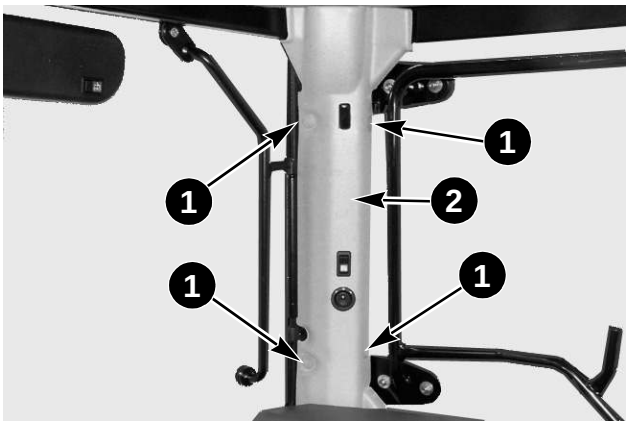
# CENTIGRADE/FAHRENHEIT DISPLAY

**NOTE:** *The temperature display can be set to read the temperature in degrees Centigrade or degrees Fahrenheit. To change the temperature display carry out the following procedure.*

## STEP 1

Park the tractor on hard level ground, apply the park brake and put the F/N/R lever in Neutral or Park. Stop the engine and remove the key.

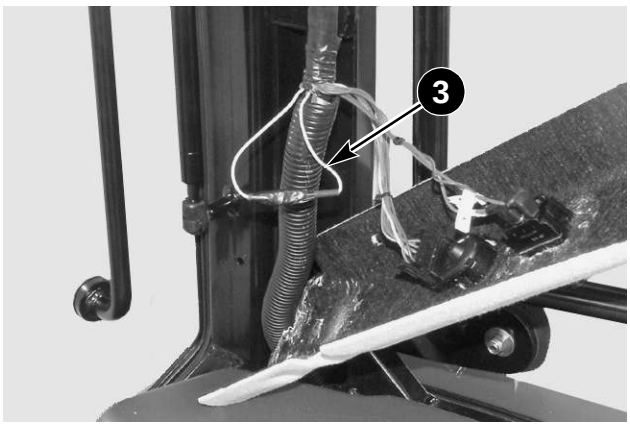
## STEP 2




MD05G130

Remove the four push-in trim retainers (1) and remove cover (2).

## STEP 3




MD05G131

Locate the Centigrade/Fahrenheit connector (3). Disconnect or connect the terminals as required. Cover any exposed terminals with suitable insulation tape.

For Centigrade - connect the terminals.

For Fahrenheit - disconnect the terminals.

## STEP 4

Install the cover and install the push-in trim retainers.

https://truckmanualshub.com/



# CIRCUIT TESTING

## General Information

**WARNING:** *Never operate the engine in a closed building. Proper ventilation is required under all circumstances.*

**IMPORTANT:** *All electrical checks must be made with the tractor parked on hard level ground with park brake engaged, the shuttle lever in Neutral or Park and the engine OFF, unless otherwise stated.*

**IMPORTANT:** *Put blocks in front of and behind the rear wheels.*

**IMPORTANT:** *The battery must be at full charge and all connections must be clean and tight before testing. Only use a HIGH IMPEDANCE multimeter for the tests. Do not use a test lamp or damage to the switches may occur.*

**IMPORTANT:** *Use MC2656 test probe kit when making electrical checks at connectors to avoid the risk of shorting between the connector pins or terminals.*

**IMPORTANT:** *Replace the controller if the fault remains only after all necessary checks have been made.*

**IMPORTANT:** *When disconnecting harness connectors, always check the connector pins and terminals for damage and alignment.*

**NOTE:** *When measuring resistance values, always measure the resistance of the multimeter leads before testing components. Subtract the resistance of the multimeter leads from the component resistance to obtain a true resistance value.*

**NOTE:** *When testing diodes and diode modules use the multimeter diode test function.*

**NOTE:** *All components, wires and connectors disconnected during any electrical checks must be connected when the checks are completed.*

**NOTE:** *For XTX185 and XTX200 tractors refer to the schematic on Page 17, for XTX215 tractors, refer to the schematic on Page 18.*

https://truckmanualshub.com/



# ERROR CODE TROUBLESHOOTING GUIDE

## Temperature Control Module Error Codes

## Error Code 01

**Fault Description**

High pressure switch has cycled twice within 60 seconds.

**System Response.**

The air conditioning compressor will shut down immediately.

**Possible Cause**

1. System pressure too high.
2. High pressure switch open circuit.
3. Bad high pressure switch.
4. Wrong high pressure switch installed.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 7.*

**Circuit Checks/Corrective Action**

**NOTE:** *If the front and rear wipers, interior light, right hand console light, front position lights, lower front work lights and cab mounted headlights fail to operate, check the wire 784 Brown between the main cab chassis ground splice 11 and the chassis ground connection. Also check the chassis ground connection.*

1. Using suitable air conditioning test gauges check the system pressure, refer to gauge manufactures instructions.
   - If the system locks out and error code 01 appears and the system pressure is too high, carry out the necessary repairs to the system.
   - If the system locks out and error code 01 appears and the system pressure is normal, go to check 2.
2. Turn the key to the OFF position and disconnect the high pressure switch from the harness. Check for continuity between terminals A and B of the high pressure switch.
   - If continuity is detected, go to check 3.
   - If continuity is not detected, replace the high pressure switch.

> ⚠ **WARNING:** *Always wear safety goggles when working with liquid refrigerant. Liquid refrigerant in the eyes may cause blindness.*

> ⚠ **WARNING:** *Always wear protective gloves when working with liquid refrigerant. Small amounts of liquid refrigerant on the skin will cause severe and painful frostbite.*

3. Check for continuity between ground and the high pressure switch connector terminal B for wire 804 Orange.
   - If continuity is detected, go to check 6.
4. Disconnect connector 10 (engine harness to instrument panel harness) and check for continuity between connector 10 pin 3 and the high pressure switch connector terminal B for wire 804 Orange.
   - If continuity is not detected check the engine harness wire 804 Orange.
5. Disconnect connector 1 (cab harness to instrument panel harness) and check for continuity between ground and connector 1 pin E (cab harness side) for wire 924 Black.
   - If continuity is not detected check wire 924 Black between connector 1 and the main cab chassis ground splice 11.
6. Disconnect connector 10 (engine harness to instrument panel harness) and check for continuity between connector 10 pin 1 and the high pressure switch connector terminal A for wire 802 Orange.
   - If continuity is not detected check the engine harness wire 802 Orange.

continued.....

https://truckmanualshub.com/



7. Disconnect connector 1 (cab harness to instrument panel harness) and turn the key to the ON position. Check the voltage reading at connector 1 pin D (cab harness side) for wire 923 Orange.
   - If a voltage reading of 5 volts is detected check the instrument panel harness wire 802 Orange between connector 1 and connector 10.
   - If a reading of 5 volts is not detected check cab harness wire 923 Orange between connector 1 and the automatic temperature control module.
8. Replace the automatic temperature control module.

## Error Code 02

**Fault Description**

Low pressure switches cycled four times within 60 seconds.

**System Response.**

The air conditioning compressor will shut down immediately.

**Possible Cause**

1. System pressure too low.
2. Low pressure switch open circuit.
3. Bad low pressure switch.
4. Wrong low pressure switch installed.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 7.*

**Circuit Checks/Corrective Action**

**NOTE:** *If the front and rear turn signal lights, front and rear upper work lights and beacon light fail to operate, check the wire 750 Brown between the main cab chassis ground splice 12 and the chassis ground connection. Also check the chassis ground connection.*

1. Using suitable air conditioning test gauges check the system pressure, refer to gauge manufactures instructions.
   - If the system locks out and error code 02 appears and the system pressure is too low, carry out the necessary repairs to the system.
2. Turn the key to the OFF position and disconnect the low pressure switch from the harness. Check for continuity between terminals A and B of the low pressure switch connector.
   - If continuity is detected, go to check 3.
   - If continuity is not detected, replace the low pressure switch.

> ⚠ **WARNING:** *Always wear safety goggles when working with liquid refrigerant. Liquid refrigerant in the eyes may cause blindness.*

> ⚠ **WARNING:** *Always wear protective gloves when working with liquid refrigerant. Small amounts of liquid refrigerant on the skin will cause severe and painful frostbite.*

3. Check for continuity between ground and the low pressure switch connector terminal A for wire 922 Black.
   - If continuity is detected, go to check 4.
   - If continuity is not detected check wire 922 Black between the low pressure switch connector and the main cab splice 12.
4. Turn the key to the ON position. Check the voltage reading at the low pressure switch connector terminal B for wire 921 Orange.
   - If a reading of 5 volts is not detected check cab harness wire 921 Orange between the low pressure switch connector and the automatic temperature control module.
5. Replace the automatic temperature control module.

https://truckmanualshub.com/



## Error Code 03

**Fault Description**

Blower motor current too high.

**System Response.**

The blower motor control will shut down immediately.

**Possible Cause**

1. Seized blower motor(s).
2. Bad blower motor ground circuit.
3. Bad blower motor PWM control module.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 7.*

**Circuit Checks/Corrective Action**

1. Check for a seized blower motor and replace as necessary.
2. Disconnect the blower motors and blower motor PWM control module from the harness. Check for continuity between terminal B of the left hand blower motor and terminal B of the blower motor PWM connector for wire 945 Black.
   - If continuity is not detected check wire 945 Black between the left hand blower motor and the blower motor PWM control module.
3. Check for continuity between terminal B of the right hand blower motor and terminal G of the blower motor PWM connector for wire 955 Black.
   - If continuity is not detected check wire 955 Black between the right hand blower motor and the blower motor PWM control module.
4. Replace the blower motor PWM control module.

## Error Code 04

**Fault Description**

Blower motor control potentiometer resistance too high (above 11000 Ohms).

**System Response.**

No manual control of the blower motor speed.

**Possible Cause**

1. Blower motor control potentiometer signal open circuit.
2. Blower motor control potentiometer ground open circuit.
3. Bad blower motor control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 7.*

**Circuit Checks/Corrective Action**

1. Check for error codes 05, 06, 08 and 10.
   - If error codes 05 and 06 are present, check wire 964 Black between splice C-SP20 and splice C-SP21.
   - If error codes 08 and 10 are also present, check wire 942 Black between splice C-SP21 and the automatic temperature control module connector terminal F3.
2. Disconnect the blower motor control potentiometer from the harness, turn the blower motor control to the OFF position. Check the resistance reading between terminals B and C of the potentiometer.
   - If a reading of 0 OHMS is not detected, replace the potentiometer.
3. Slowly turn the blower motor control from the OFF position to the maximum blower speed position and check the resistance reading between terminals B and C of the potentiometer.
   - A steadily increasing resistance from 0 Ohms to 10,000 Ohms should be observed. If the reading is incorrect or an intermittent reading is detected replace the potentiometer.

continued.....

https://truckmanualshub.com/



4. Disconnect the automatic temperature control module from the harness and check for continuity between the automatic temperature control module connector terminal E1 and terminal B of the blower motor control potentiometer connector for wire 925 Orange.
   - If continuity is not detected check wire 925 Orange between the automatic temperature control module and the blower motor control potentiometer.
5. Check for continuity between the automatic temperature control module connector terminal F3 and terminal C of the blower motor control potentiometer connector for wires 942 Black and 926 Black.
   - If continuity is not detected check wire 926 Black between the blower motor control potentiometer and splice C-SP20.

## Error Code 05

**Fault Description**

Temperature control potentiometer resistance too high (above 11000 Ohms).

**System Response.**

No manual temperature control cab temperature defaults to 20℃ (68℉).

**Possible Cause**

1. Temperature control potentiometer signal open circuit.
2. Temperature control potentiometer ground open circuit.
3. Temperature control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to “CIRCUIT TESTING” on page 7.*

**Circuit Checks/Corrective Action**

1. Check for error codes 04, 06, 08 and 10.
   - If error codes 04 and 06 are present, check wire 964 Black between splice C-SP20 and splice C-SP21.
   - If error codes 08 and 10 are also present, check wire 942 Black between splice C-SP21 and the automatic temperature control module connector terminal F3.
2. Disconnect the temperature control potentiometer from the harness, turn the temperature control to the maximum cooling position. Check the resistance reading between terminals B and C of the potentiometer.
   - If a reading of 0 OHMS is not detected, replace the potentiometer.
3. Slowly turn the temperature control from maximum cooling to the maximum heat position and check the resistance reading between terminals B and C of the potentiometer.
   - A steadily increasing resistance from 0 Ohms to 10,000 Ohms should be observed. If the reading is incorrect or an intermittent reading is detected replace the potentiometer.
4. Disconnect the automatic temperature control module from the harness and check for continuity between the automatic temperature control module connector terminal D2 and terminal B of the temperature control potentiometer connector for wire 932 Orange.
   - If continuity is not detected check wire 932 Orange between the automatic temperature control module and the temperature control potentiometer.
5. Check for continuity between the automatic temperature control module connector terminal F3 and terminal C of the temperature control potentiometer connector for wires 942 Black and 933 Black.
   - If continuity is not detected check wire 933 Black between the temperature control potentiometer and splice C-SP20.

https://truckmanualshub.com/



## Error Code 06

**Fault Description**

Recirculating air control potentiometer resistance too high (above 11000 Ohms).

**System Response.**

No manual recirculating air control.

**Possible Cause**

1. Recirculating air control potentiometer signal open circuit.
2. Recirculating air control potentiometer ground open circuit.
3. Recirculating air control potentiometer.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 7.*

**Circuit Checks/Corrective Action**

1. Check for error codes 04, 05, 08 and10.
   - If error codes 04 and 05 are present, check wire 964 Black between splice C-SP20 and splice C-SP21.
   - If error codes 08 and 10 are also present, check wire 942 Black between splice C-SP21 and the automatic temperature control module connector terminal F3.
2. Disconnect the recirculating air control potentiometer from the harness, turn the recirculating air control to the maximum fresh air intake position. Check the resistance reading between terminals B and C of the potentiometer.
   - If a reading of 0 OHMS is not detected, replace the potentiometer.
3. Slowly turn the recirculating air control from maximum fresh air intake to the maximum recirculating air position and check the resistance reading between terminals B and C of the potentiometer.
   - A steadily increasing resistance from 0 Ohms to 10,000 Ohms should be observed. If the reading is incorrect or an intermittent reading is detected replace the potentiometer.
4. Disconnect the automatic temperature control module from the harness and check for continuity between the automatic temperature control module connector terminal F2 and terminal B of the recirculating air control potentiometer connector for wire 935 Orange.
   - If continuity is not detected check wire 935 Orange between the automatic temperature control module and the recirculating air control potentiometer.
5. Check for continuity between the automatic temperature control module connector terminal F3 and terminal C of the recirculating air control potentiometer connector for wires 942 Black and 936 Black.
   - If continuity is not detected check wire 936 Black between the recirculating air control potentiometer and splice C-SP20.

## Error Code 07

**Fault Description**

Resistance measured at terminal B3 of the automatic temperature control module too high.

**System Response.**

System operates normally.

**Possible Cause**

1. Ground signal wire from terminal B3 of the automatic temperature control module open circuit.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 7.*

**Circuit Checks/Corrective Action**

1. Check wire 938 Black between splice C-SP21 and the automatic temperature control module connector terminal B3.

https://truckmanualshub.com/



## Error Code 08

**Fault Description**

Cab temperature sensor open circuit or shorted high.

**System Response.**

The automatic temperature control module defaults to 20°C (68°F) setpoint. The automatic temperature c ontrol will not operate.

**NOTE:** *Error code 08 will be displayed if the cab temperature is below -19°C (-2°F), as the cab temperature increases error code 08 will no longer be displayed.*

**Possible Cause**

1. Cab air temperature sensor wiring open circuit.
2. Damaged cab air temperature sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 7.*

**Circuit Checks/Corrective Action**

1. Check for error codes 04, 05, 06 and 10.
   - If error codes 04,05, 06 and 10 are present, check wire 942 Black between splice C-SP21 and the automatic temperature control module connector terminal F3.
2. Check the cab air temperature sensor for damage and replace as necessary.
3. Disconnect the cab air temperature sensor from the harness and check the resistance reading between the terminals of the sensor, refer to "Temperature Sensor Resistance Chart" on page 14.
   - if the readings are incorrect replace the sensor.
4. Disconnect the automatic temperature control module from the harness and check for continuity between terminal A of the cab air temperature sensor connector and terminal C2 of the automatic temperature control module connector for wire 930 Orange.
   - If continuity is not detected check wire 930 Orange between the automatic temperature control module and the cab air temperature sensor.
5. Check for continuity between terminal B of the cab air temperature sensor connector and terminal F3 of the automatic temperature control module connector for wires 924 Black and 931 Black.
   - If continuity is not detected check wire 931 Black between splice C-SP21 and the cab air temperature sensor.

## Error Code 10

**Fault Description**

Evaporator freeze sensor open circuit or shorted high.

**System Response.**

The automatic temperature control will only control the heater valve, the compressor will not operate.

**Possible Cause**

1. Evaporator freeze sensor wiring open circuit.
2. Damaged evaporator freeze sensor.

**IMPORTANT:** *Before carrying out the following tests, refer to "CIRCUIT TESTING" on page 7.*

**Circuit Checks/Corrective Action**

1. Check for error codes 04, 05, 06 and 08.
   - If error codes 04,05, 06 and 08 are present, check wire 942 Black between splice C-SP21 and the automatic temperature control module connector terminal F3.
2. Check the evaporator freeze sensor for damage and replace as necessary. Make sure the freeze sensor is positioned correctly into the evaporator.
3. Disconnect the evaporator freeze sensor from the harness and check the resistance reading between the terminals of the sensor, refer to "Temperature Sensor Resistance Chart" on page 14.
   - If the readings are incorrect replace the sensor.

continued...

https://truckmanualshub.com/



4. Disconnect the automatic temperature control module from the harness and check for continuity between terminal B of the evaporator freeze sensor connector and terminal B1 of the automatic temperature control module connector for wire 920 Orange.
   - If continuity is not detected check wire 920 Orange between the automatic temperature control module and the cab air temperature sensor.
5. Check for continuity between terminal A of the evaporator freeze sensor connector and terminal F3 of the automatic temperature control module connector for wires 924 Black and 959 Black.
   - If continuity is not detected check wire 959 Black between splice C-SP21 and the evaporator freeze sensor.

## Temperature Sensor Resistance Chart

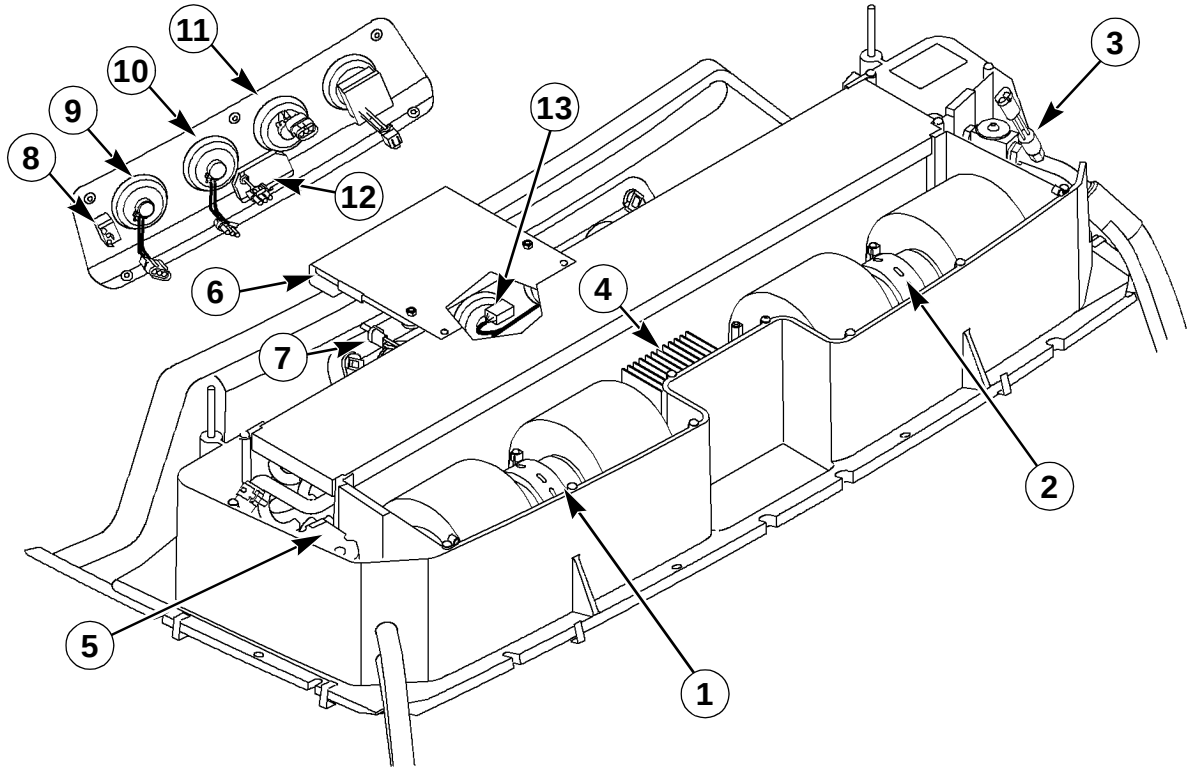
| TEMPERATURE | | RESISTANCE | TEMPERATURE | | RESISTANCE |
|---|---|---|---|---|---|
| ℃ | ℉ | OHMS | ℃ | ℉ | OHMS |
| 0 | 32 | 65300 - 66600 | 13.33 | 56 | 33500 - 34700 |
| 0.56 | 33 | 63500 - 64800 | 13.89 | 57 | 32600 - 33800 |
| 1.11 | 34 | 61700 - 63000 | 14.44 | 58 | 31700 - 32300 |
| 1.67 | 35 | 59900 - 61300 | 15.00 | 59 | 30900 - 32100 |
| 2.22 | 36 | 58200 - 59600 | 15.56 | 60 | 30100 - 31300 |
| 2.78 | 37 | 56600 - 57900 | 16.11 | 61 | 29300 - 30500 |
| 3.33 | 38 | 55000 - 56300 | 16.67 | 62 | 28600 - 29700 |
| 3.89 | 39 | 53400 - 54800 | 17.22 | 63 | 27800 - 29000 |
| 4.44 | 40 | 51900 - 53300 | 17.78 | 64 | 27100 - 28300 |
| 5.00 | 41 | 50500 - 51900 | 18.33 | 65 | 26400 - 27600 |
| 5.56 | 42 | 49100 - 50500 | 18.89 | 66 | 25800 - 26800 |
| 6.11 | 43 | 47800 - 49100 | 19.44 | 67 | 25100 - 26200 |
| 6.67 | 44 | 46400 - 47800 | 20.00 | 68 | 24500 - 25600 |
| 7.22 | 45 | 45200 - 46500 | 20.56 | 69 | 23900 - 24900 |
| 7.78 | 46 | 44300 - 45600 | 21.11 | 70 | 23300 - 24300 |
| 8.33 | 47 | 42700 - 44100 | 21.67 | 71 | 22700 - 23700 |
| 8.89 | 48 | 41600 - 42900 | 22.22 | 72 | 22100 - 23200 |
| 9.44 | 49 | 40500 - 41800 | 22.78 | 73 | 21600 - 22600 |
| 10.00 | 50 | 39400 - 40700 | 23.33 | 74 | 21000 - 22100 |
| 10.56 | 51 | 38300 - 39600 | 23.89 | 75 | 20500 - 21500 |
| 11.11 | 52 | 37300 - 38600 | 24.44 | 76 | 20000 - 21000 |
| 11.67 | 53 | 36300 - 37600 | 25.00 | 77 | 19500 - 20500 |
| 12.22 | 54 | 35300 - 36600 | 25.56 | 78 | 19000 - 20000 |
| 12.78 | 55 | 34400 - 35600 | 26.11 | 79 | 18600 - 19500 |

https://truckmanualshub.com/



# COMPONENT IDENTIFICATION AND SCHEMATIC CIRCUITS

## Air Conditioning Components (Cab Front)



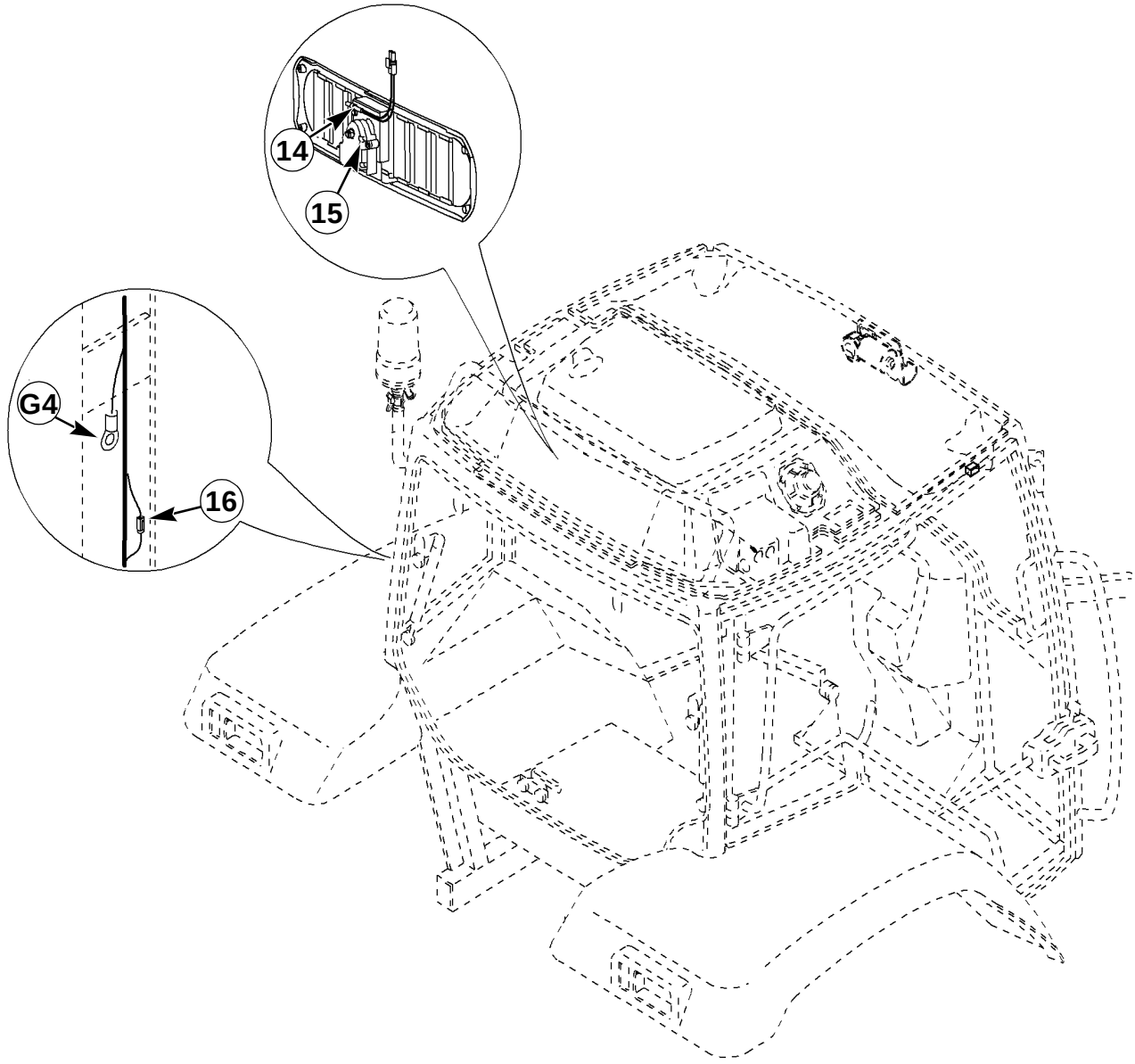

MI04F104

1. RIGHT HAND BLOWER MOTOR
2. LEFT HAND BLOWER MOTOR
3. LOW PRESSURE SWITCH
4. BLOWER MOTOR PWM CONTROLLER
5. HEATER CONTROL VALVE
6. AUTOMATIC TEMPERATURE CONTROL MODULE
7. EVAPORATOR FREEZE SENSOR CONNECTOR
8. AIR CONDITIONING MODE SWITCH
9. RECIRCULATING AIR CONTROL POTENTIOMETER
10. BLOWER MOTOR CONTROL POTENTIOMETER
11. TEMPERATURE CONTROL POTENTIOMETER
12. DIGITAL DISPLAY
13. LOCKOUT RELAY

https://truckmanualshub.com/



## Air Conditioning Components (Rear and Left Hand Side of Cab)



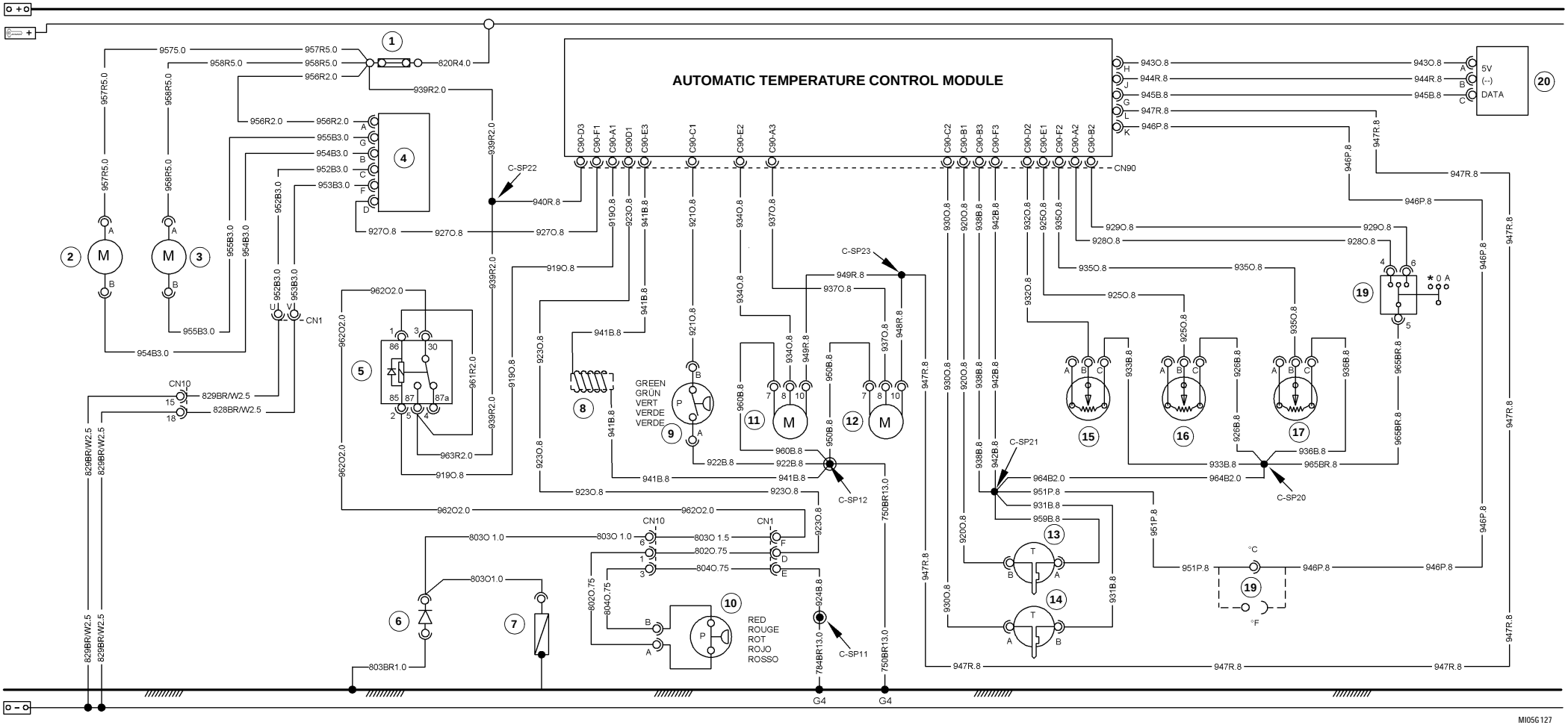

MI05G129

14. RECIRCULATING AIR DOOR MOTOR
15. CAB TEMPERATURE SENSOR
16. CENTIGRADE/FAHRENHEIT CONNECTOR
G4. CHASSIS GROUND CONNECTION G4

https://truckmanualshub.com/


# Automatic Temperature Control Schematic Circuit (XTX185 and XTX200 Tractors)

**BLOWER MOTORS, BLOWER MOTOR PWM CONTROL, LOCKOUT RELAY** | **PRESSURE SWITCHES, HEATER VALVE MOTOR, RECIRCULATING DOOR MOTOR, TEMPERATURE SENSORS** | **CONTROL POTENTIOMETERS, MODE SWITCH, DIGITAL DISPLAY**




## Key

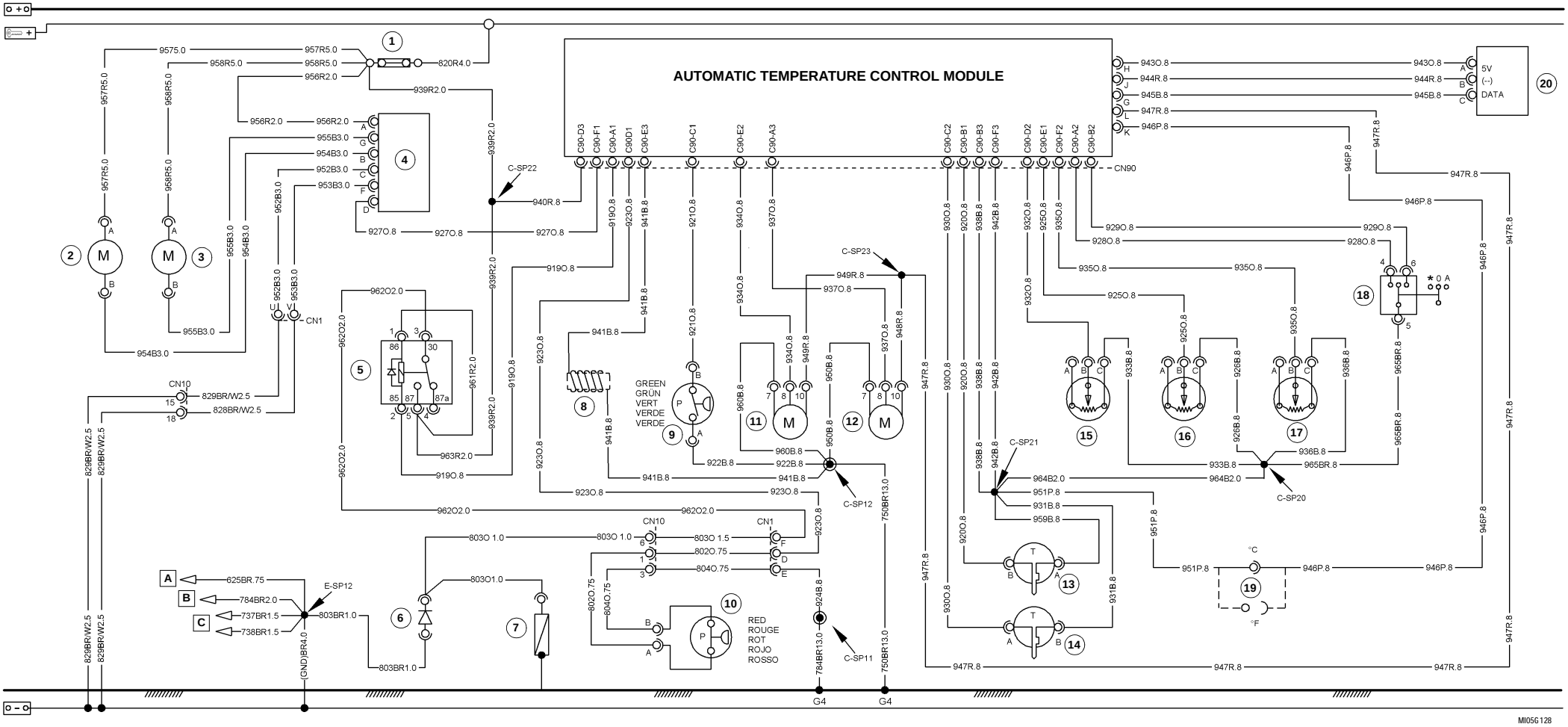
1. CIRCUIT BREAKER
2. LEFT HAND BLOWER MOTOR
3. RIGHT HAND BLOWER MOTOR
4. BLOWER MOTOR PWM CONTROLLER
5. LOCKOUT RELAY
6. SUPPRESSION DIODE
7. AIR CONDITIONING COMPRESSOR
8. FERRITE RING
9. LOW PRESSURE SWITCH
10. HIGH PRESSURE SWITCH
11. HEATER VALVE MOTOR
12. RECIRCULATING AIR DOOR MOTOR
13. EVAPORATOR FREEZE SENSOR
14. CAB TEMPERATURE SENSOR
15. TEMPERATURE CONTROL POTENTIOMETER
16. BLOWER MOTOR CONTROL POTENTIOMETER
17. RECIRCULATING AIR DOOR CONTROL POTENTIOMETER
19. AIR CONDITIONING MODE SWITCH
19. CENTIGRADE/FAHRENHEIT CONNECTOR
20. DIGITAL DISPLAY

**AUTOMATIC TEMPERATURE CONTROL MODULE CONNECTOR PIN IDENTIFICATION**

| | | | |
|---|---|---|---|
| A1 | LOCKOUT RELAY | D1 | HIGH PRESSURE SWITCH SIGNAL |
| A2 | AIR CONDITIONING MODE SWITCH (DEFROST SIGNAL) | D2 | TEMPERATURE CONTROL POTENTIOMETER SIGNAL |
| A3 | RECIRCULATING DOOR CONTROL SIGNAL | D3 | SWITCHED POWER |
| B1 | EVAPORATOR FREEZE SENSOR | E1 | BLOWER MOTOR CONTROL POTENTIOMETER SIGNAL |
| B2 | AIR CONDITIONING MODE SWITCH (AUTO SIGNAL) | E2 | HEATER VALVE CONTROL SIGNAL |
| B3 | GROUND SIGNAL | E3 | GROUND |
| C1 | LOW PRESSURE SWITCH SIGNAL | F1 | BLOWER MOTOR PWM CONTROLLER SIGNAL |
| C2 | CAB TEMPERATURE SENSOR | F2 | RECIRCULATING DOOR CONTROL POTENTIOMETER SIGNAL |
| C3 | OPEN | F3 | CONTROL POTENTIOMETER COMMON GROUND |

# Automatic Temperature Control Schematic Circuit (XTX215 Tractors)

**BLOWER MOTORS, BLOWER MOTOR PWM CONTROL, LOCKOUT RELAY** | **PRESSURE SWITCHES, HEATER VALVE MOTOR, RECIRCULATING DOOR MOTOR, TEMPERATURE SENSORS** | **CONTROL POTENTIOMETERS, MODE SWITCH, DIGITAL DISPLAY**




## Key

1. CIRCUIT BREAKER
2. LEFT HAND BLOWER MOTOR
3. RIGHT HAND BLOWER MOTOR
4. BLOWER MOTOR PWM CONTROLLER
5. LOCKOUT RELAY
6. SUPPRESSION DIODE
7. AIR CONDITIONING COMPRESSOR
8. FERRITE RING
9. LOW PRESSURE SWITCH
10. HIGH PRESSURE SWITCH
11. HEATER VALVE MOTOR
12. RECIRCULATING AIR DOOR MOTOR
13. EVAPORATOR FREEZE SENSOR
14. CAB TEMPERATURE SENSOR
15. TEMPERATURE CONTROL POTENTIOMETER
16. BLOWER MOTOR CONTROL POTENTIOMETER
17. RECIRCULATING AIR DOOR CONTROL POTENTIOMETER
18. AIR CONDITIONING MODE SWITCH
19. CENTIGRADE/FAHRENHEIT CONNECTOR
20. DIGITAL DISPLAY

A. FROM STARTER RELAY
B. FROM FRONT GRILLE WORK LIGHTS
C. FROM HAND HEADLIGHT CIRCUIT

**AUTOMATIC TEMPERATURE CONTROL MODULE CONNECTOR PIN IDENTIFICATION**

| | | | |
|---|---|---|---|
| A1 | LOCKOUT RELAY | D1 | HIGH PRESSURE SWITCH SIGNAL |
| A2 | AIR CONDITIONING MODE SWITCH (DEFROST SIGNAL) | D2 | TEMPERATURE CONTROL POTENTIOMETER SIGNAL |
| A3 | RECIRCULATING DOOR CONTROL SIGNAL | D3 | SWITCHED POWER |
| B1 | EVAPORATOR FREEZE SENSOR | E1 | BLOWER MOTOR CONTROL POTENTIOMETER SIGNAL |
| B2 | AIR CONDITIONING MODE SWITCH (AUTO SIGNAL) | E2 | HEATER VALVE CONTROL SIGNAL |
| B3 | GROUND SIGNAL | E3 | GROUND |
| C1 | LOW PRESSURE SWITCH SIGNAL | F1 | BLOWER MOTOR PWM CONTROLLER SIGNAL |
| C2 | CAB TEMPERATURE SENSOR | F2 | RECIRCULATING DOOR CONTROL POTENTIOMETER SIGNAL |
| C3 | OPEN | F3 | CONTROL POTENTIOMETER COMMON GROUND |

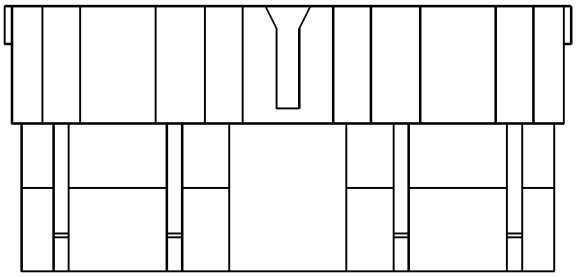
https://truckmanualshub.com/



# MAIN CONNECTORS

## Connector 1

**Location: Instrument panel**



477I96

**INSTRUMENT PANEL TO CAB HARNESS (CAB HARNESS SIDE)**

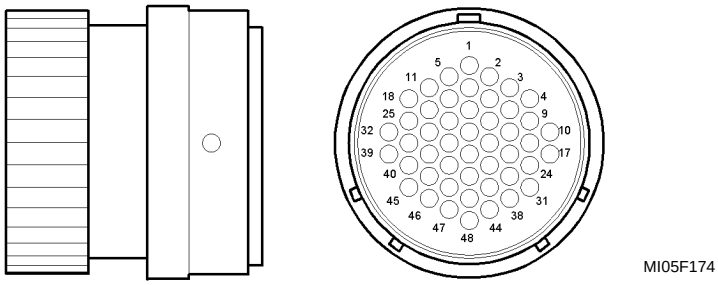
| Cavity | Wire No | Circuit |
|---|---|---|
| A | 830 R | FRONT WIPER MOTOR B+ |
| B | 835 O | FRONT WIPER/WASHER |
| C | 871 R | INTERIOR LIGHT, RADIO |
| D | 923 O | A/C HIGH PRESSURE SWITCH |
| E | 924 O | A/C HIGH PRESSURE SWITCH |
| F | 962 O | A/C COMPRESSOR |
| G | 870 R | RADIO SWITCHED B+ |
| H | 756 P | LH TURN SIGNAL |
| J | 757 P | RH TURN SIGNAL |
| K | 784 V | LOWER CAB WORK LIGHTS |
| L | 776 P | ROTARY BEACON LIGHT |
| M | 794 P | LH REAR CAB WORK LIGHTS |
| N | 794 P | RH REAR CAB WORK LIGHTS |
| P | 726 P | RH POSITION LIGHT/NO PLATE LIGHT |
| R | 707 P | LH POSITION LIGHT |
| S | 840 R | REAR WINDSCREEN WIPER B+ |
| T | 842 O | REAR WINDSCREEN WASHER |
| U | 952 B | BLOWER MOTOR PWM CONTROLLER CLEAN GROUND |
| V | 953 B | BLOWER MOTOR PWM CONTROLLER CLEAN GROUND |
| W | 781 V | RH FRONT CAB WORK LIGHTS |
| X | 791 V | LH FRONT CAB WORK LIGHTS |
| Y | 747 P | CAB HEADLIGHTS (HIGH) |
| Z | 746 P | CAB HEADLIGHTS (LOW) |

https://truckmanualshub.com/



## Connector 10 - XTX185 and XTX200 Series Tractors Only

**Location: Cab Firewall**




MI05F174

**ENGINE TO INSTRUMENT PANEL HARNESS (ENGINE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 802 O | A/C HIGH PRESSURE SWITCH |
| 2 | 624 W | ENGINE CONTROLLER NEUTRAL START B+ SUPPLY |
| 3 | 804 O | A/C HIGH PRESSURE SWITCH |
| 4 | 162 R | UNSWITCHED B+ - CLOCK, RADIO AND INSTRUMENT CLUSTER |
| 5 | 200 Y | INSTRUMENT CLUSTER CLEAN GROUND (BATTERY - TERMINAL) |
| 6 | 803 O | A/C COMPRESSOR CLUTCH |
| 7 | - - - - - | OPEN |
| 8 | - - - - - | OPEN |
| 9 | 231 Y | COOLANT LEVEL |
| 10 | - - - - - | OPEN |
| 11 | - - - - - | OPEN |
| 12 | - - - - - | OPEN |
| 13 | 266 Y | AIR FILTER RESTRICTION SWITCH |
| 14 | 121 Y | ALTERNATOR D+ TERMINAL, WARNING LIGHT AND EXCITE |
| 15 | 829 BR/W | ATC CLEAN GROUND |
| 16 | 890 R | HORN B+ |
| 17 | 890 BR | HORN GROUND |
| 18 | 829 BR/W | ATC CLEAN GROUND |
| 19 | 738 P | RH HEADLIGHT - LOW BEAM |
| 20 | 741 P | RH HEADLIGHT - HIGH BEAM |
| 21 | 658 W | WATER IN FUEL |
| 22 | 737 P | LH HEADLIGHT - LOW BEAM |
| 23 | 740 P | LH HEADLIGHT - HIGH BEAM |

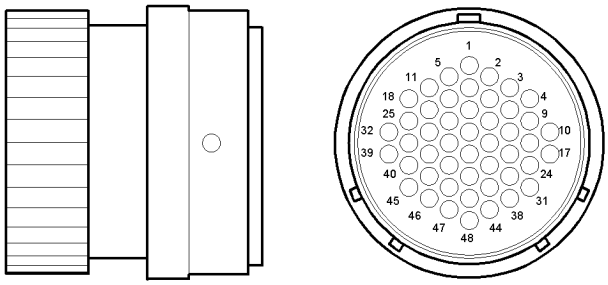
| Cavity | Wire No | Circuit |
|---|---|---|
| 24 | - - - - - | OPEN |
| 25 | 280 BR | RADAR GROUND |
| 26 | 281 Y | RADAR SIGNAL |
| 27 | 280 R | RADAR B+ |
| 28 | 282 Y | RADAR PRESENT |
| 29 | - - - - - | OPEN |
| 30 | - - - - - | OPEN |
| 31 | 784 V | WORK LIGHTS |
| 32 | - - - - - | OPEN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |
| 35 | - - - - - | OPEN |
| 36 | - - - - - | OPEN |
| 37 | - - - - - | OPEN |
| 38 | 900 Y | CAN HIGH |
| 39 | - - - - - | OPEN |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | 900 LG | CAN LOW |
| 43 | - - - - - | OPEN |
| 44 | 643 R | FOOT THROTTLE 5V SUPPLY |
| 45 | 600 W | ENGINE CONTROLLER SWITCHED B+ |
| 46 | 643 Y | FOOT THROTTLE SIGNAL |
| 47 | 900 BR | K - LINE |
| 48 | 643 BR | FOOT THROTTLE 0V RETURN |

https://truckmanualshub.com/



## Connector 10 - XTX215 Series Tractors Only

**Location: Cab Firewall**




MI05F174

**ENGINE TO INSTRUMENT PANEL HARNESS (ENGINE HARNESS SIDE)**

| Cavity | Wire No | Circuit |
|---|---|---|
| 1 | 802 O | A/C HIGH PRESSURE SWITCH |
| 2 | 625 W | STARTER RELAY NEUTRAL START B+ SUPPLY |
| 3 | 804 O | A/C HIGH PRESSURE SWITCH |
| 4 | 162 R | UNSWITCHED B+ - CLOCK, RADIO AND INSTRUMENT CLUSTER |
| 5 | 200 BR/W | INSTRUMENT CLUSTER CLEAN GROUND (BATTERY - TERMINAL) |
| 6 | 803 O | A/C COMPRESSOR CLUTCH |
| 7 | - - - - - | OPEN |
| 8 | - - - - - | OPEN |
| 9 | 231 Y | COOLANT LEVEL |
| 10 | - - - - - | OPEN |
| 11 | 235 V | NOT USED |
| 12 | 654 W | NOT USED |
| 13 | 266 Y | AIR FILTER RESTRICTION SWITCH |
| 14 | 121 Y | ALTERNATOR D+ TERMINAL, WARNING LIGHT AND EXCITE |
| 15 | 829 BR/W | ATC CLEAN GROUND |
| 16 | 890 R | HORN B+ |
| 17 | 890 BR | HORN GROUND |
| 18 | 828 BR/W | ATC CLEAN GROUND |
| 19 | 738 P | RH HEADLIGHT - LOW BEAM |
| 20 | 741 P | RH HEADLIGHT - HIGH BEAM |
| 21 | - - - - - | OPEN |
| 22 | 737 P | LH HEADLIGHT - LOW BEAM |
| 23 | 740 P | LH HEADLIGHT - HIGH BEAM |

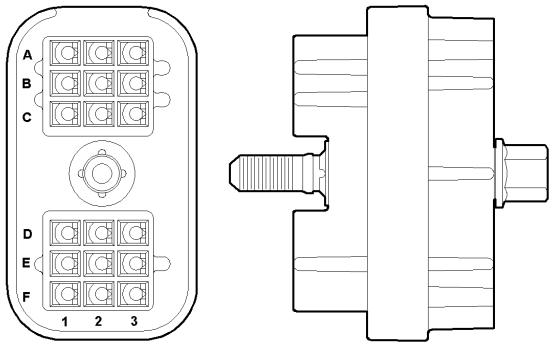
| Cavity | Wire No | Circuit |
|---|---|---|
| 24 | - - - - - | OPEN |
| 25 | 280 BR | RADAR GROUND |
| 26 | 281 Y | RADAR SIGNAL |
| 27 | 280 R | RADAR B+ |
| 28 | 282 Y | RADAR PRESENT |
| 29 | - - - - - | OPEN |
| 30 | - - - - - | OPEN |
| 31 | 784 V | WORK LIGHTS |
| 32 | - - - - - | OPEN |
| 33 | - - - - - | OPEN |
| 34 | - - - - - | OPEN |
| 35 | - - - - - | OPEN |
| 36 | 652 BR | NOT USED |
| 37 | - - - - - | OPEN |
| 38 | 900 Y | CAN HIGH |
| 39 | 653 BR | NOT USED |
| 40 | - - - - - | OPEN |
| 41 | - - - - - | OPEN |
| 42 | 900 LG | CAN LOW |
| 43 | - - - - - | OPEN |
| 44 | 643 R | FOOT THROTTLE 5V SUPPLY |
| 45 | 132 R | ENGINE CONTROLLER SWITCHED B+ |
| 46 | 643 Y | FOOT THROTTLE SIGNAL |
| 47 | - - - - - | OPEN |
| 48 | 643 BR | FOOT THROTTLE 0V RETURN |

https://truckmanualshub.com/



## Connector 90

### Location: Cab Roof




MI04A062

**AUTOMATIC TEMPERATURE CONTROL MODULE CONNECTOR**

| Cavity | Wire No | Circuit |
|---|---|---|
| A1 | 919 O | LOCKOUT RELAY |
| A2 | 928 O | AIR CONDITIONING MODE SWITCH (DEFROST SIGNAL) |
| A3 | 937 O | RECIRCULATING DOOR CONTROL SIGNAL |
| B1 | 920 O | EVAPORATOR FREEZE SENSOR |
| B2 | 929 O | AIR CONDITIONING MODE SWITCH (AUTO SIGNAL) |
| B3 | 938 B | GROUND SIGNAL |
| C1 | 921 O | LOW PRESSURE SWITCH SIGNAL |
| C2 | 930 O | CAB TEMPERATURE SENSOR |
| C3 | - - - - - | OPEN |
| D1 | 923 O | HIGH PRESSURE SWITCH SIGNAL |
| D2 | 932 O | TEMPERATURE CONTROL POTENTIOMETER SIGNAL |
| D3 | 940 R | SWITCHED POWER |
| E1 | 925 O | BLOWER MOTOR CONTROL POTENTIOMETER SIGNAL |
| E2 | 934 O | HEATER VALVE CONTROL SIGNAL |
| E3 | 941 B | GROUND |
| F1 | 927 O | BLOWER MOTOR PWM CONTROLLER SIGNAL |
| F2 | 935 O | RECICULATING DOOR CONTROL POTENTIOMETER SIGNAL |
| F3 | 942 B | CONTROL POTENTIOMETER COMMON GROUND |