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M9078, M9086, M9094 Tractors

Service - Training Manual Sva 7-96101

Table of Contents

	Section	Pub. No.
2 ENGINE		
Workshop Manual to Ser.No. 04517 / DBD0010601	2004	7-69860
Workshop Manual post DBD0055001	2007	7-98510
3 FUEL SYSTEM		
How it works - Injection System post DBD0055001	3	7-97340
4 ELECTRICAL		
How it works and Troubelshooting - Combi Instrument	4A	7-95391
How it works - ECCU (Electronic Central Control Unit) from DBD0057135 onwards	4B	7-99220
Circuit Diagram up to Veh. No. 04517 / up to DBD0010601	4001	7-96680
Circuit Diagram post DBD0055001	4002	7-97390
Circuit Diagram post DBD0057135	4003	7-98691
5 STEERING SYSTEM		
Workshop Manual - Front Axle 20.16 (German/English)	5001	7-70620
6 TRANSMISSION		
Troubleshooting 4-Wheel Drive – Differential lock – Management post DBD 0055001	6003	7-97150
Workshop Manual TW557	6005	7-99240
8 HYDRAULIC SYSTEM		
How it works and Troubleshooting - Electronic Hitch Control EHR-D	8B	7-95350
Functional description and troubleshooting Electronic lifting gear control system (EHR-B) from DBD0057135 onwards	8C	7-99420
Functional description and Troubleshooting - Electronic front hitch control (EFH)	8E	6-50640

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Kapitel

2004

WERKSTATTHANDBUCH MOTOR
WORKSHOP-MANUAL ENGINE

955 / 964 / 970
C55 / C64 / C70

M968/M975	**bis/to Ser.No. 04938**
CS68/CS75	**bis/to Ser.No. DBD0023065**
M9078/M9086/M9094	**bis/to Ser.No. 04517**
CS78/CS86/CS94	**bis/to Ser.No. DBD0010601**

2004

CASE STEYR Landmaschinentechnik GmbH
Technische Dokumentation
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Sva 7-69860 GE/EN

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WERKSTATTHANDBUCH
WORKSHOP MANUAL

MOTOR-ENGINE

STEYR 955/955a - **WD 301.42/43**
964/964a - **WD 301.82/83** TURBO
M 968a - **WD 301.89** TURBO
970a - **WD 301.87** TURBO
M 975a - **WD 301.88** TURBO

STEYR 9078/9078a - **WD 401.80/81** TURBO
M 9083a - **WD 401.89** TURBO
9086/9086a - **WD 401.82/83** TURBO
9094a - **WD 401.85** TURBO

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Montage - Anweisungen

Dieses Handbuch ist vorwiegend zum Gebrauch in den Werkstätten bestimmt.

Es enthält nützliche Hinweise für das Zerlegen und Zusammenbauen des Motors.

Die Arbeiten sind gemäß der Arbeitsfolge stufenweise beschrieben und mit Bildern erläutert.

Für die Verschleißteile sind Grenzmaße angegeben, um die notwendige Erneuerung solcher Teile bestimmen zu können.

Für die Benutzung dieses Werkstatt-Handbuches dient die Betriebsanleitung als Ergänzung.

Zur Ersatzteile-Bestellung ist die jeweilige Ersatzteilliste zugrunde zu legen.

Verwenden Sie nur STEYR Original Wartungs- und Ersatzteile.

Assembly Instructions

This Manual is primarily designed for workshop use and contains useful information on engine disassembly and assembly.

The tasks involved are described and illustrated in the specified sequence.

Go/no go dimensions are stated for parts subject to wear, showing when these items need replacing.

The Operating Instructions serve as a supplement to this Repair Manual.

Please do not hesitate to get in touch with our Service Department should you require additional information pertaining to this Manual.

For spare parts orders the respective spare parts catalogue should be referred to.

Use genuine STEYR maintenance and spare parts only!

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Diesem Werkstatt-Handbuch liegt der techn. Stand bei der Drucklegung zugrunde. Nachträgliche Änderungen können Abweichung gegenüber der gelieferten Motorausführung verursachen. Rechtliche oder sonstige Ansprüche sind daher ausgeschlossen.

This workshop manual reflects the state of the art at the time of going to print. Subsequent alterations may give rise to differences as compared with the model actually delivered. They do not entitle the purchaser to legal claims or others.

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INHALTSVERZEICHNIS

Dieses Werkstatthandbuch enthält: **Seite**

1. Spezialwerkzeuge und Vorrichtungen 3
2. Motorschnittbilder mit Baugruppen 6
3. Montagefolge, Tabelle (alphabetisch) 7
   Montagefolgen, Tabelle (numerisch) 8

4. Zerlegen des Motors 9

1. Schmieröl ablassen 9
2. Kühlflüssigkeits ablassen 9
3. Wasser/Luftsammler abbauen 10
4. Turbolader abbauen 10
5. Auspuffkrümmer 10
6. Zylinderkopfhaube 11
7. Kipphebelbock . 11
8. Einspritzventil ausbauen 11
9. Einspritzventil zerlegen 11
10. Kraftstoffdruckleitung 12
11. Zylinderkopf abbauen 12
12. Ventile ausbauen 12
13. Ölwanne abbauen 13
14. Schmierölsaugleitung 13
15. Maussenausgleich 13
16. Kolben mit Pleuelstange 13
17. Zylinderlaufbüchse 14
18. Düse zur Kolbenkühlung 15
19. Drehstromgenerator 15
20. Lüfterflügel 15
21. Wasserpumpe 16
22. - ..... -
23. - ..... -
24. Nabe auf Kurbelwelle 16
25. Stirnwanddeckel (Räderseite) 17
26. Ölpumpe 17
27. Einspritzpumpe 17
28. Schwungrad 18
29. Gehäuse für Schwungrad 18
30. Stirnwanddeckel 18
31. Nockenwelle 18
32. Pilzstößel 19
33. Kurbelwelle 19

5. Grenzmaße für Verschleißteile 21

1. Allgemeine Hinweise 21
2. Tabelle für Genzmaße der Verschleißteile 22
3. Reparatur-Schleifmaße 34

6. Zusammenbau des Motors 37
1. Allgemeine Hinweise 37
2. Anzugsmomente f. Schraubverbindungen 38
3. Lagerspiel prüfen 41
4. Zahnräder einstellen 41
5. Verdrehflankenspiel prüfen 42
6. Düse zur Kolbenkühlung ausrichten 43
7. Zylinderbüchsenüberstand kontrollieren 44
8. Kolbenüberstand kontrollieren 44
9. Zylinderköpfe montieren 44
10. Anziehvorschrift der Zylinderköpfe 45
11. Förderbeginn prüfen 47
12. Verdichtungsdruck prüfen 47
13. Wellendichtringe erneuern 48

TABLE OF CONTENTS

Contents: **Page**

1. Special tools and devices 3
2. Engine section view showing assembly 6
3. Dismantl./assembly sequences, table (aphab.) 7
   Dismantl./assembly sequences, table (numeric.) .. 8

4. Dismanteling the engine 9

1. Draining lube oil 9
2. Draining coolant 9
3. Removing water/air collector 10
4. Removing turbocharger 10
5. Exhaust manifold 10
6. Cylinder-head cover 11
7. Rocker-arm bracket 11
8. Removing injection valve 11
9. Dismantling injection valve 11
10. Fuel-delivery lines 12
11. Cylinder head 12
12. Removing valves 12
13. Removing oil pan 13
14. Oil-suction line 13
15. Balance weight 13
16. Piston and connect. rod 13
17. Cylinder liner 14
18. Nozzle for piston cooling 15
19. Three-phase generator 15
20. Fan blades 15
21. Water pump 16
22. - ..... -
23. - ..... -
24. Hub from crankshaft 16
25. Front-wall cover (Timing gear end) 17
26. Oil pump 17
27. Injection pump 17
28. Flywheel 18
29. Flywheel housing 18
30. Front-wall cover 18
31. Camshaft 18
32. Mushroom-head tappet 19
33. Crankshaft 19

5. Limit dimension for wearing parts 21

1. General remarks 21
2. Table of limit dimensions for wearing parts 22
3. Refurbishing grades 34

6. Engine assembly 37
1. General remarks 37
2. Screw and bolt tightening torques 38
3. Checking bearing play 41
4. Setting timing 41
5. Adjusting backlash 42
6. Adjusting nozzle for piston cooling 43
7. Checking cylinder-liner projection 44
8. Checking piston projection 44
9. Mounting cylinder heads 44
10. Order of tightening the cylinder heads 45
11. Checking commencement of delivery 47
12. Checking compression pressure 47
13. Renewing shaft seals 48

https://truckmanualshub.com/

7. Technische Daten Baureihe 301. 52

7.1 Technische Daten Baureihe 401. 53

2. Abspritzdruck am Einspritzventil 56
3. Schmieröldruck 57

8. Aufladung 59

1. Schnittbild mit Legende 59
3. Mögl. Störungen an aufgeladenen Motoren 60
3. Betriebs- und Wartungsempfehlungen 60
4. Ermittlung der Lagerspiele 62

9. Kupplung WD 301. 64
WD 401. 65

10. Dichtwerkstoffe - Tabelle 66

7. Technical data, series 301. 52

7.1 Technical data, series 401. 53

2. Establishing injection pressure 56
3. Lube-oil pressure 57

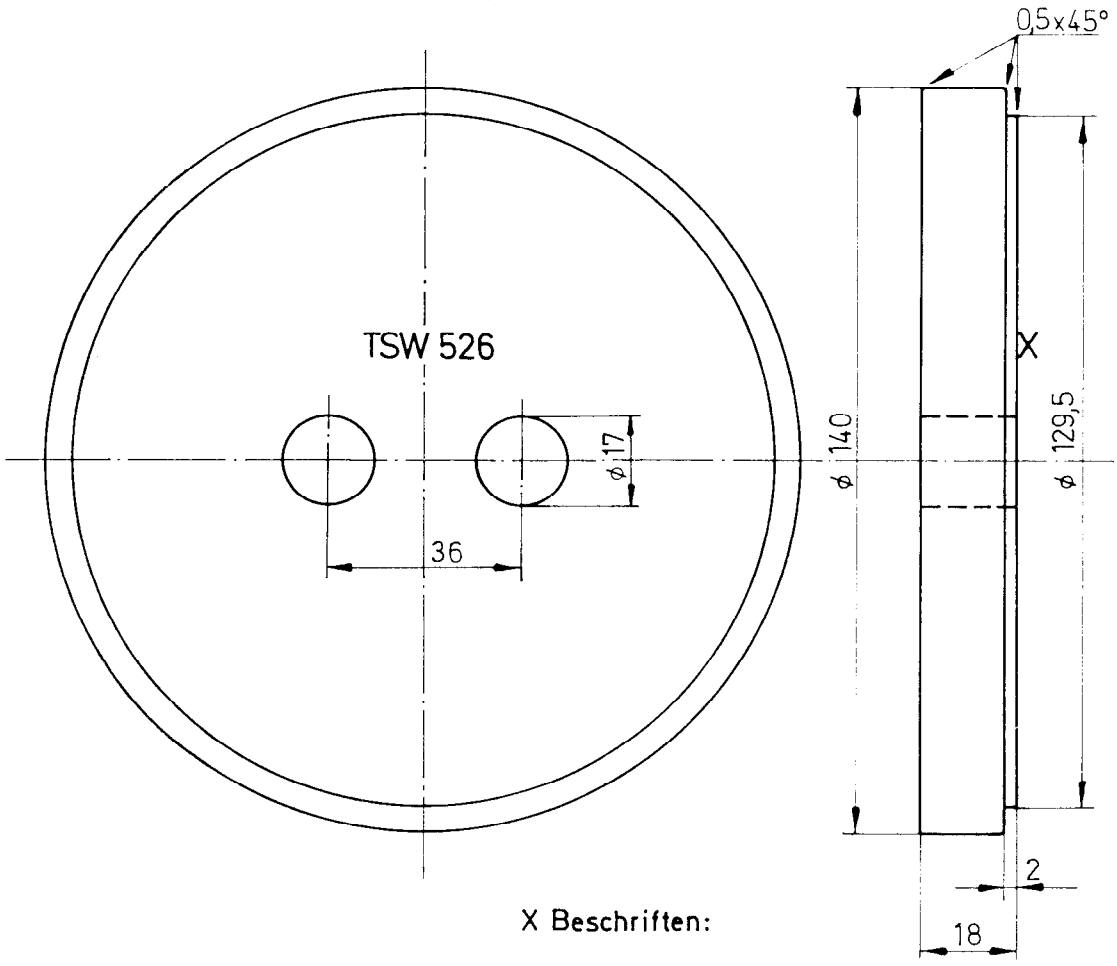
8. Turbocharging 59

1. Sectional drawing with caption 59
3. Possib. disturbances w. supercharged engines . 61
3. Operation and maintenance suggestions 61
4. Determination of bearing clearances 63

9. Clutch WD 301. 64
WD 401. 65

10. Gasket material table 67

https://truckmanualshub.com/



TSW 526 (Pos. 13) Montagescheibe für Radialdichtringe mit 4 Funktionen:

1. RDR Schwungradseite mit der Fläche Ø 140 mm in Deckel plan einpressen.
2. RDR Schwungradseite bei Einlaufrille in Kurbelwelle mit 2 mm Ansatz versetzt in Deckel einpressen (siehe Seite 50).
3. RDR Räderseite bei Räderkasten ausgebaut plan einpressen.
4. RDR Räderseite bei Motor im eingebauten Zustand über die Kurbelwelle mit 2 Schrauben gleichmäßig plan eindrücken. (Innensechskantschrauben von der Nabe dazu verwenden.)

TSW 526 (item 13) mounting disk for radial sealing ring with 4 functions:

1. Press RSR with surface Ø 140 mm plain into cover.
2. Press RSR on flywheel side displaced into cover at run-in groove on crankshaft with 2 mm projection (see page 50).
3. Press RSR on wheel side in plain with wheel case removed.
4. Press in RSR plain on wheel side evenly with two screws over the crankshaft with the engine installed. (Use the hexagon socket screws from the hub).

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1. Spezialwerkzeuge — Special tools

I. Diese Spezialwerkzeuge sind für eine Reparatur unbedingt erforderlich.

I. The following special purpose tools are absolutely necessary for repair.

1	**TSW 125**	Zentrierdorn für Zweifachkupplung	Centralizing mandrel for dual clutch (follow up with existing 15 mm centralizing mandrel)
2	**TSW 014**	Ventilheber	Valve lifter
3	**TSW 510**	Zylinderbüchsen-Auszieher (KUKKO Nr. 16)	Cylinder liner extractor (KUKKO No. 16)
4	**TSW 508**	Ausziehplatte für Zylinderbüchsen	Extractor plate for cylinder liners
5	**TSW 005**	Anschlußstück für Motometer	Connecting part for motometer
6	**TSW 241**	Steigrohr-Förderbeginn-Einstellung-Reihen pumpe	Riser pipe-transport start - adjustment - inline pump
7	**TSW 513**	Haltevorrichtung f. Stophebel-Einspritzpumpe	Holding device for stop lever injection pump
8	**TSW 5610**	Meßuhrhalter + Meßuhr TSW 17049-6	Gauge holder and gauge TSW 17049-6
9	**TSW 220**	(TSW 17996) Motor Aufspannbock siehe Spezialwerkzeugkatalog	(TSW 17996) Mounting trestle for motor see special tool catalog
10	**TSW 514**	Motor-Aufspannplatte siehe Spezialwerkzeug katalog	Mounting plate for motor see special tool catalog

II. Spezialwerkzeuge mit Maßskizzen zur Selbstanfertigung oder im ZED auf Bestellung erhältlich.

II. Special-purpose tools with sketches for self manufacturing or available from the central spare parts service upon request.

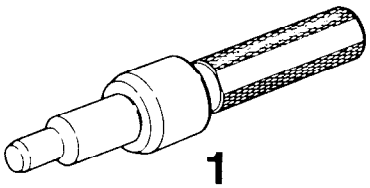
11	---------	Montagebolzen für Massenausgleich WD 401. (Hilfswerkzeug - 2 Stück)	Mounting bolts for mass balancing WD 401. (Auxiliary tools - 2 pieces)
12	**TSW 163**	Einstellvorrichtung für Kupplungshebel (Zeichnung siehe Spezialwerkzeugkatalog TS 225/93)	Adjusting device for clutch lever (drawing see special tool catalog TS 225/93)
13	**TSW 526**	Montagescheibe für Radialdichtring (Schwungrad- und Räderseite , siehe Seite 3)	Mounting device for radial seal, flywheel en and gear end, see page 3)

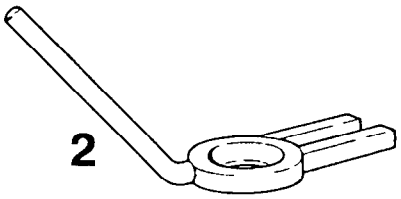
III. Im Fachhandel erhältlich bzw. mit *) auch im ZED (Zentralen Ersatzteile-Dienst) bei STEYR-Landmaschinentechnik erhältlich.

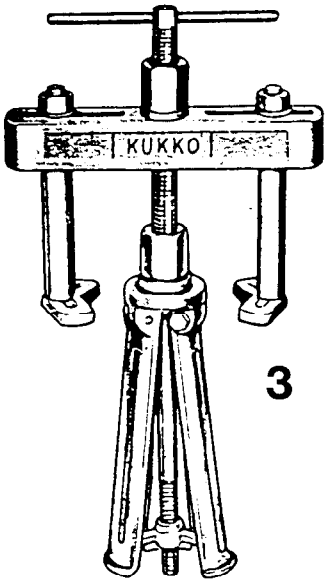
III. Availabel at specialized dealers or with *) also the central spare parts service at STEYR-Landmaschinentechnik

	---------	Ventilsitzbearbeitungsgerät (MIRA, HUNGER, etc.)	Valve seat processing tool (MIRA, HUNGER, etc.)
14	**KUKKO 18-1*)**	Abziehvorrichtung (Einspritzpumpe-Zahnrad)	Extractor (injection pump cog)
15	**HAZET794-2*)**	Kolbenringspannband	Piston ring tension strap
16	**HAZET790-1A**	Kolbenringzange	Piston ring pliers

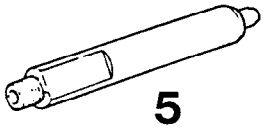
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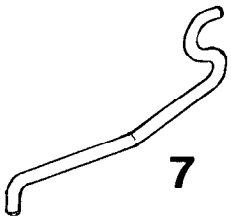

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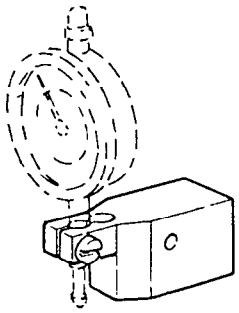

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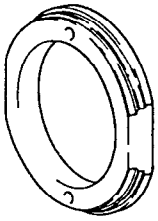


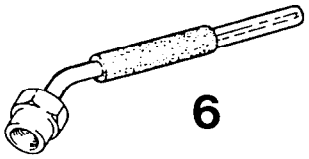
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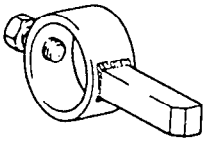

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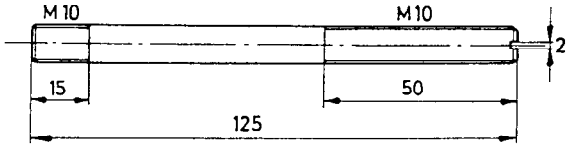

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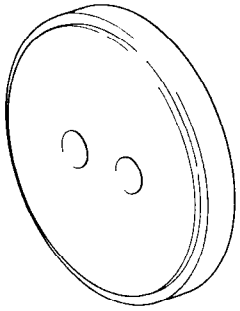

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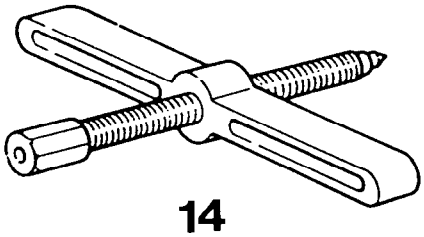

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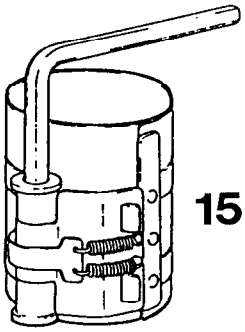

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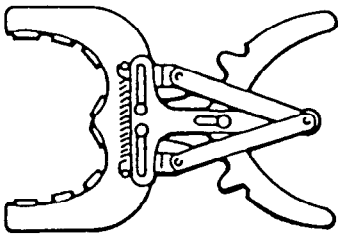


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13

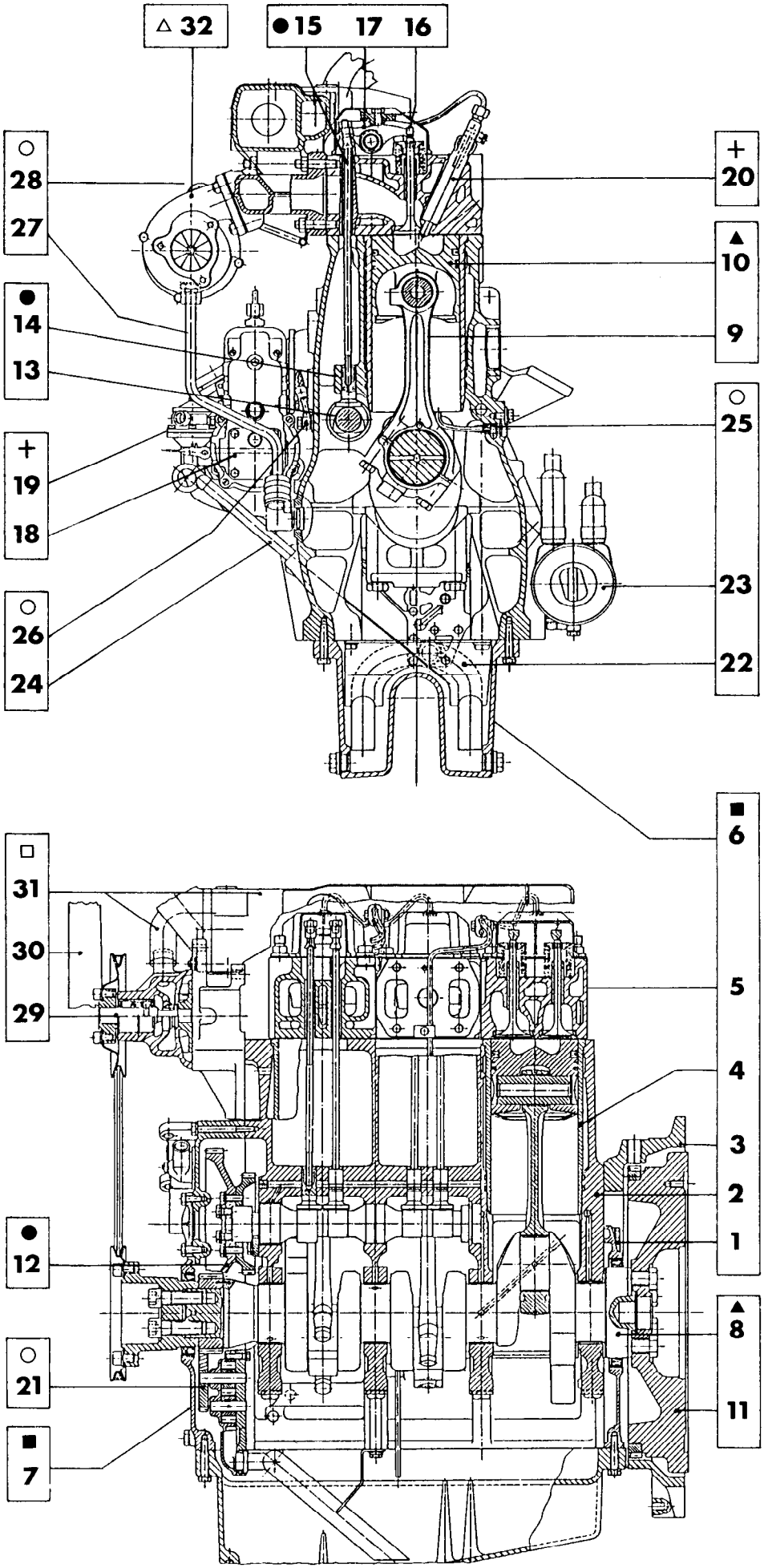

14


15


16

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2. Motorschnittbilder mit Baugruppen
2. Engine section views showing assembly



Baugruppen ■▲●+○□△
Kennzeichen zum leichteren Auffinden.

■ **Gehäuse und Gehäuseteile**
1 Stirnwanddeckel (Schwungrads.)
2 Kurbelgehäuse
3 Schwungradgehäuse
4 Zylinderlaufbuchse
5 Zylinderkopf
6 Ölwanne
7 Stirnwanddeckel (Räderseite)

▲ **Triebwerk**
8 Kurbelwelle
9 Pleuelstange
10 Kolben
11 Schwungrad

● **Rädertrieb und Ventilsteuerung**
12 Zahnräder (Rädertrieb)
13 Nockenwelle
14 Pilzstößel
15 Stoßstange
16 Ein- und Auslaßventil
17 Kipphebel

\+ **Kraftstoffsystem**
18 Einspritzpumpe
19 Förderpumpe
20 Einspritzventil

○ **Schmierölkreislauf**
21 Schmierölpumpe
22 Schmierölsaugleitung
23 Schmierölfilter
24 Ölmeßstab
25 Spritzdüse für Kolbenkühlung
26 Schmierölleitung zur Einspritzpumpe
27 Schmierölrücklaufleitung vom Turbolader
28 Schmierölzulaufleitung zum Turbolader

□ **Kühlsystem**
29 Kühlwasserpumpe
30 Lüfterflügel
31 Kühlwasserleitung

△ **Aufladung**
32 Abgas-Turbolader

Assemblies ■▲●+○□△
Symbols to facilitate identification

■ **Crankcase and crankcase parts**
1 Front wall cover (flywheel end)
2 Crankcase
3 Flywheel housing
4 Cylinder liner
5 Cylinder head
6 Oil pan
7 Front wall cover (timing gear end)

▲ **Crank assembly**
8 Crankshaft
9 Connecting rod
10 Piston
11 Flywheel

● **Gear drive and valve timing**
12 Gears (drive)
13 Camshaft
14 Mushroom-head tappet
15 Pushrod
16 Inlet and exhaust valves
17 Rocker arm

\+ **Fuel system**
18 Injection pump
19 Fuel delivery pump
20 Injection valve

○ **Lubricating-oil system**
21 Lube oil pump
22 Lube oil suction line
23 Lube-oil filter
24 Oil dipstick
25 Injection nozzle for piston-cooling
26 Lube-oil line to injection pump
27 Lube-oil return line from turbocharger
28 Lube-oil supply line to turbocharger

□ **Cooling system**
29 Cooling-water pump
30 Fan blade
31 Cooling-water line

△ **Turbocharging**
32 Exhaust gas turbocharger

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3. Montagefolgen

Die im Abschnitt 4 im einzelnen beschriebenen Arbeitsstufen zum Zerlegen des Motors sind in Tabelle 3.1 alphabetisch aufgeführt und mit der dazugehörigen Nummer versehen. Anhand dieser Nummer kann in der numerisch geordneten Tabelle 3.2 die jeweilige Reihenfolge der vorher durchzuführenden Zerlege-Stufen ermittelt werden. Hierzu sind in der rechten Spalte die Nummern dieser Arbeiten als Montagefolgen angegeben.

3.1 Tabelle, alphabetisch

Arbeitsstufe	siehe N r.
Auspuffkrümmer abbauen	4.5
Drehstromgenerator abbauen	4.19
Düse zur Kolbenkühlung ausbauen	4.18
Einspritzpumpe ausbauen	4.27
Einspritzventil ausbauen	4.8
Einspritzventil zerlegen	4.9
Gehäuse für Schwungrad abbauen	4.29
Kipphebelbock abbauen	4.7
Kolben mit Pleuelstange ausbauen	4.16
Kraftstoffdruckleitungen abbauen	4.10
Kühlflüssigkeit ablassen	4.2
Kühlwasser-Luftsammler abbauen	4.4
Kurbelwelle ausbauen	4.33
Lüfterflügel abbauen	4.20
Massenausgleich ausbauen	4.15
Motoröl ablassen	4.1
Nabe auf Kurbelwelle abbauen	4.24
Nockenwelle ausbauen	4.31
Ölpumpe ausbauen	4.26
Ölwanne abbauen	4.13
Pilzstößel ausbauen	4.32
Schmierölsaugleitung ausbauen	4.14
Schwungrad abbauen	4.28
Stirnwanddeckel (Räderseite) abbauen	4.25
Stirnwanddeckel (Schwungradseite) abbauen	4.30
Turbolader abbauen	4.3
Ventile ausbauen	4.12
Wasserpumpe abbauen	4.21
Zylinderkopf abbauen	4.11
Zylinderkopfhaube abbauen	4.6
Zylinderlaufbuchse ausbauen	4.17

3. Dismantling/assembly sequences

The engine disassembly stages described in detail in Section 4 are listed alphabetically in table 3.1 with their corresponding numbers. Using these numbers in conjunction with the numerically arranged table 3.2, you can quickly find the sequence in which the preceding disassembly stages are to be executed. The numbers of these operations are given as assembly sequence in the right-hand column.

3.1 Table, alphabetical

Working stage	see No.
Removing Alternator	4.19
Removing Balance weight	4.15
Removing Camshaft	4.31
Removing Coolant	4.2
Removing Cooling-water pipe	4.4
Removing Crankshaft	4.33
Removing Cylinder head	4.11
Removing Cylinder-head cover	4.6
Removing Cylinder liner	4.17
Removing Exhaust and intake pipe	4.5
Removing Fan blades	4.20
Removing Flywheel	4.28
Removing Flywheel housing	4.29
Removing Front-wall cover (flywheel end)	4.30
Removing Front-wall cover (timing gear end)	4.25
Removing Fuel-delivery line	4.10
Removing Hub from crankshaft	4.24
Removing Injection pump	4.27
Dismantle Injection valve	4.9
Removing Injection valve	4.8
Draining Lube oil	4.1
Removing Mushroom-head tappet	4.32
Removing Nozzle for piston cooling	4.18
Removing Oil pan	4.13
Remvoing Oil pump	4.26
Removing Oil-suction line	4.14
Removing Piston a. connecting rod	4.16
Removing Rocker-arm bracket	4.7
Removing Turbocharger	4.3
Removing Valve	4.12
Removing Water pump	4.21

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3.2 Tabelle, numerisch

Nr.	Arbeiten	Nummern der vorher durchzuführenden Arbeits-Stufen (Montagefolgen)
4.1	Motoröl ablassen	
4.2	Kühlflüssigkeit ablassen	
4.3	Turbolader abbauen	
4.4	Kühlwasser-Luftsammler abbauen	4.2
4.5	Auspuffkrümmer abbauen	
4.6	Zylinderkopfhaube abbauen	
4.7	Kipphebelbock abbauen	4.6
4.8	Einspritzventil ausbauen	
4.9	Einspritzventil zerlegen	4.8
4.10	Kraftstoffdruckleitungen abbauen	
4.11	Zylinderkopf abbauen	4.2 - 4.7 / 4.10 /
4.12	Ventile ausbauen	4.2 - 4.7 / 4.10 / 4.11
4.13	Ölwanne abbauen	4.1
4.14	Schmierölsaugleitung ausbauen	4.1 / 4.13
4.15	Massenausgleich ausbauen (nur WD 401.)	4.1 / 4.13
4.16	Kolben mit Pleuelstange ausbauen	4.1 - 4.7 / 4.10 / 4.11 / 4.13 - 4.15
4.17	Zylinderlaufbuchse ausbauen	4.1 - 4.7 / 4.10 / 4.11 / 4.13 - 4-16
4.18	Düse zur Kolbenkühlung ausbauen	
4.19	Drehstromgenerator abbauen	
4.20	Lüfterflügel abbauen	
4.21	Wasserpumpe abbauen	4.2 / 4.20
4.22	----------	
4.23	----------	
4.24	Nabe auf Kurbelweile abbauen	
4.25	Stirnwanddeckel (Räderseite) abbauen	4.1 / 4.2 / 4.13 / 4.19 / 4.20 / 4.24
4.26	Ölpumpe ausbauen	4.1 / 4.2 / 4.13 / 4.19 / 4.20 / 4.25
4.27	Einspritzpumpe ausbauen	4.10
4.28	Schwungrad abbauen	
4.29	Gehäuse für Schwungrad abbauen	4.28
4.30	Stirnwanddeckel (Schwungradseite) abbauen	4.1 / 4.13 / 4.28 / 4.29
4.31	Nockenwelle ausbauen	4.1 / 4.2 / 4.6 / 4.7 / 4.13 / 4.19 / 4.20 / 4.24 / 4.25
4.32	Pilzstößel ausbauen	4.1 / 4.2 / 4.6 / 4.7 / 4.13 / 4.19 / 4.20 / 4.24 / 4.25 / 4.31
4.33	Kurbelwelle ausbauen	4.1 / 4.2 / 4.13 - 4.16 / 4.19 / 4.20 / 4.24 - 4.26 / 4.28 - 4.30

3.2 Table, numerical

No.	Operations	Numbers of working stages required beforehand (assembly sequence)
4.1	Draining engine oil	
4.2	Draining coolant	
4.3	Removing turbo charger	
4.4	Removing cooling water-air collector	4.2
4.5	Removing exhaust manifold	
4.6	Removing cylinder-head cover	
4.7	Removing rocker-arm bracket	4.6
4.8	Removing injection valve	
4.9	Dismantle injection valve	4.8
4.10	Removing fuel-delivery line	
4.11	Removing cylinder head	4.2 - 4.7 / 4.10 /
4.12	Removing valves	4.2 - 4.7 / 4.10 / 4.11
4.13	Removing oil pan	4.1
4.14	Removing oil-suction line	4.1. / 4.13
4.15	Removing balance weight (only WD 401.)	4.1. / 4.13
4.16	Removing piston and connecting rod	4.1 - 4.7 / 4.10 / 4.11 / 4.13 - 4.15
4.17	Removing cylinder liner	4.1 - 4.7 / 4.10 / 4.11 / 4.13 - 4.16
4.18	Removing nozzle for piston cooling	
4.19	Removing alternator	
4.20	Removing fan blades	
4.21	Removing water pump	4.2 / 4.20
4.22	----------	
4.23	----------	
4.24	Removing hub from crankshaft	
4.25	Removing front-wall cover (timing-gear end)	4.1 / 4.2 / 4.13 / 4.19 / 4.20 / 4.24
4.26	Removing oil pump	4.1 / 4.2 / 4.13 / 4.19 / 4.20 / 4.25
4.27	Removing injectio pump	4.10
4.28	Removing flywheel	
4.29	Removing flywheel housing	4.28
4.30	Removing front-wall cover (flywheel end)	4.1 / 4.13 / 4.28 / 4.29
4.31	Removing camshaft	4.1 / 4.2 / 4.6 / 4./ /4.13 / 4.19 / 4.20 / 4.24 - 4.25
4.32	Removing mushroom-head tappet	4.1 / 4.2 / 4.6 / 4./ /4.13 / 4.19 / 4.20 / 4.24 - 4.25 / 4.31
4.33	Removing crankshaft	4.1 / 4.2 / 4.13 - 4.16 / 4.19 / 4.20 / 4.24 - 4.26 / 4.28 - 4.30

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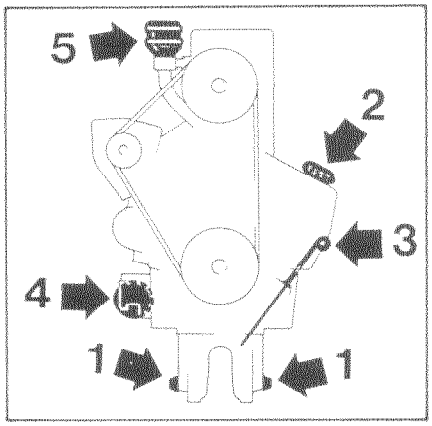
4. Zerlegen des Motors

- Vor dem Zerlegen Motor außen gründlich reinigen.
- Arbeitsplatz (Werkbank) hell, unbeengt und frei von Schmutz und Spänen.
- Benötigte Werkzeuge und Vorrichtungen bereitlegen.
- Als Orientierungshinweis für die Arbeitsstufen dient das alphabetische Inhaltsverzeichnis Seite 7.
- Die darin aufgeführten Arbeiten sind in folgendem stufenweise beschrieben und mit Bildern verdeutlicht.
- Lesen Sie bitte vor Arbeitsbeginn die entsprechenden Arbeitsbeschreibungen ganz durch, damit Sie schon zu Beginn den Arbeitsumfang ganz erfassen.

Dismantling the engine

- Clean engine exterior thoroughly prior to dismantling.
- Select well lit location (workbench) providing for unrestircted movement and free of dirt and swarf.
- Place tools and devices in readiness.
- Refer to alphabetical table of contents on page 7 for guidelines dealing with the working stages involved.
- The operations listed in this table are to be carried out step-by-step in the sequence shown and as illustrated.
- Please read the corresponding descriptions of the jobs involved prior to starting work, so that you are fully familar with the scope involved.

4.1



Motoröl ablassen

1 = 2 Ablaßschrauben bei Allrad-Motor
2 = Öleinfüllstuten
3 = Ölmeßstab
4 = Ölfilter
5 = Motorentlüftung - wartungsfrei

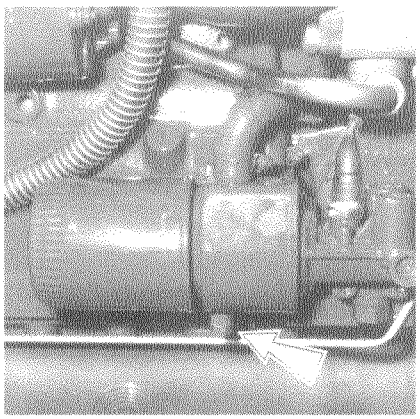
Ölmenge und Ölqualität siehe Technische Daten bzw. Betriebsanleitung

Draining engine oil

1 = Drain plug
2 = Oil filler neck
3 = Oil dipstick
4 = Oil filter
5 = Engine ventilation - maintenance-free

For oil quantity and oil quality, see technical data or operation manual

4.2



Kühlflüssigkeit ablassen

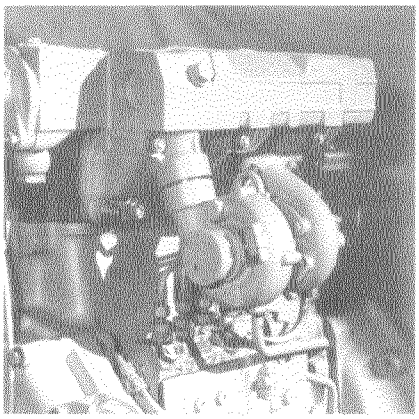
1. Auffanggefäß für abzulassendes Kühlmittel bereitstellen.
2. Ablaßschraube öffnen.
3. Kühlerverschlußdeckel öffnen.
4. Abgelassenes Kühlmittel (kalkarm) durch Tuch seien und wiederverwenden.

Draining coolant

1. Place suitable can in readiness to collect coolant.
2. Open drain plug 1.
3. Open radiator closing cover.
4. Filter drained coolant (low lime content) through a cloth and use again.

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4.3 (WD 301.)



Turbolader abbauen

1. Auspuff und Ansaugschlauch abbauen
2. Schmierölzulaufleitung und Schmierölrücklaufleitung abschrauben. Auf Formdichtung achten.
3. Turbolader abflanschen
4. Reparaturanleitung für Turbolader siehe Abschnitt 8.

Removing turbocharger

1. Dismount exhaust and intake tube
2. Remove lubricating-oil supply pipe and lubricating-oil return pipe. Note schaped gasket.
3. Disflange turbocharger
4. Repair instruction for turbocharger see section 8.

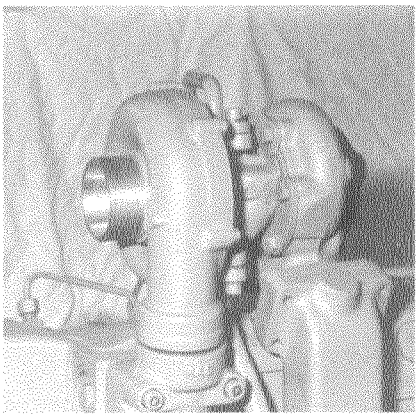
Achtung beim Zusammenbau!

Zulässiger Mittigkeitsversatz zwischen Ansaugrohr und Verdichterstutzen des Turboladers am Ø 3 mm

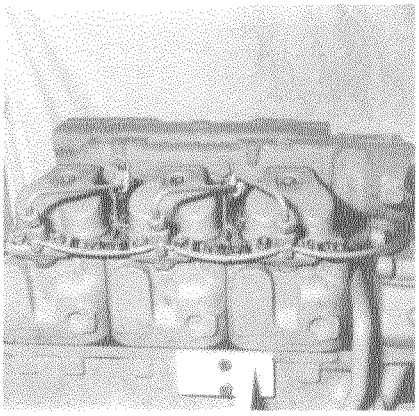
Note when assembling!

Permissible eccentricity between intake pipe and compressor sochekt of turbo-charger at Ø 3 mm

4.3.1 (WD 401.)



4.4
4.5



Kühlwasser-Luftsammler Auspuffkrümmer

Hinweis: (WD 301.)
Nur gemeinsamer Abbau von Kühlwasser-Luftsammler und Auspuffkrümmer möglich.

Achtung beim Zusammenbau!

Die Erhöhung der Stahlsickendichtung zwischen Ansaug-/Abgasrohr und Zylinderkopf in Richtung Zylinderkopf montieren.
Anziehreihenfolge für Ansaugrohr mit integrierter Kühlwasserführung.
Zylinderweise beginnend von Mitte Motor:
1. Sechskantmutter oben
2. Sechskantmutter unten rechts
3. Sechskantmutter unten links

Cooling water-air collector Exhaust manifold

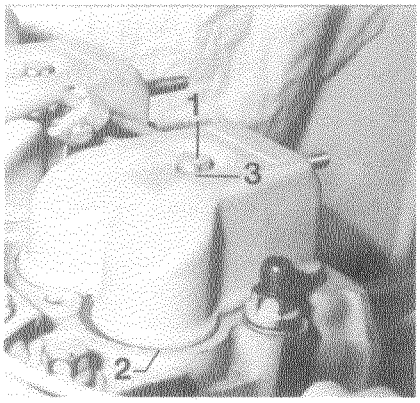
Comment: (WD 301.)
Only combined dismount of cooling water-air collector and exhaust manifold possible.

Note when assembling!

Mount the steel beaded seal between intake/exhaust-gas pipe and cylinder head so that the raised part is facing the cylinder head.
Tightening sequence for intake pipe with integrated cooling water guide, cylinder by cylinder, beginning from the centre of the engine:
1. Hexagonal nut at top
2. Hexagonal nut at bottom right
3. Hexagonal nut at bottom left

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4.6



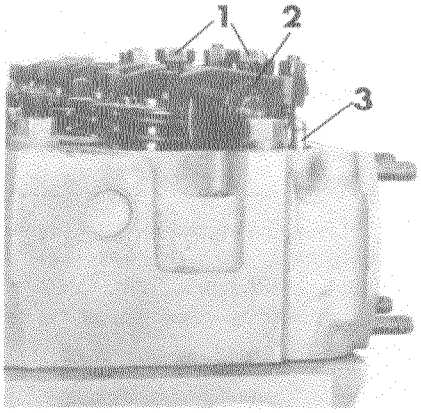
Zylinderkopfhaube abbauen

1. Sechskantschraube 1 herausdrehen.
2. Zylinderkopfhaube abnehmen.
3. Auf Formdichtung 2 und Dichtring 3 achten.

Removing cylinder-head cover

1. Unscrew hexagon screw 1.
2. Remove cylinder-head cover.
3. Take due note of shaped gasket 2 and sealing ring 3.

4.7



Kipphebelbock abbauen

1. Sechskantschrauben 1 herausdrehen.
2. Kipphebelbock 2 abheben.
3. Stoßstangen 3 herausnehmen.

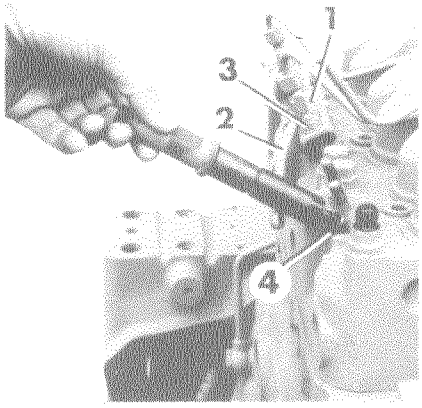
Einbauhinweis:
Stopstangenbohrung auf freien Durchgang (Kopphebelschmierung) überprüfen.

Removing rocker-arm bracket

1. Remove hexagon screw 1.
2. Lift rocker-arm bracket 2.
3. Take pushrods 3 out.

Assembly note:
Check pushrod bore for free passage (check rocker-arm lubrication).

4.8



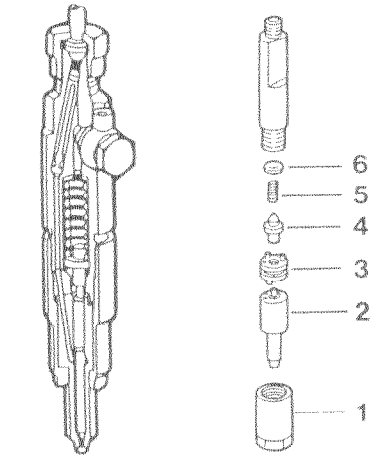
Einspritzventil ausbauen

1. Oberwurfmutter 1 von Kraftstoffdruckleitung abschrauben (am Einspritzventil mit einem Schlüssel gegenhalten).
2. Leckölleitung 2 abschrauben.
3. Muttern 3 am Befestigungsbügel abschrauben.
4. Scheiben und Befestigungsbügel abnehmen.
5. Einspritzventil herausnehmen.
6. Auf Dichtscheibe 4 achten.
   Einbauhinweise:
   Leckölleitung 2 muß immer außenliegend (vom Motor weg) angebaut werden.

Removing injection valve

1. Unscrew cap nut 1 on fuel delivery line (hold up at injection valve using a wrench).
2. Unscrew leak-oil line 2.
3. Unscrew nuts 3 on mounting bracket.
4. Remove washers and mounting bracket.
5. Take injection valve out.
6. Take care of sealing washers 4.
   Assembly note:
   Leak-oil line 2 must always be attached outside (i.e. away from engine).

4.9



Einspritzventil zerlegen

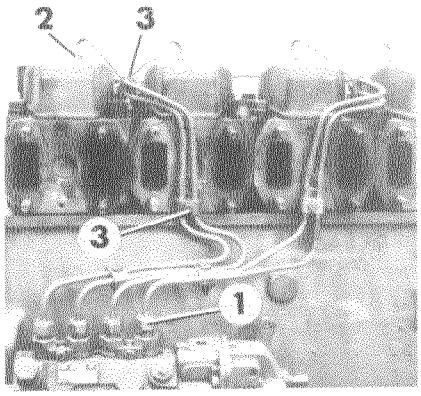
1. Einspritzventil einspannen.
2. Oberwurfmutter 1 abschrauben.
3. Einspritzdüse 2 herausnehmen (Falls erforderlich erneuern).
4. Zwischenscheibe 3, Druckbolzen 4, Druckfeder 5 und Einstellscheiben 6 herausnehmen. Siehe auch Abschnitt 7.2.

Dismantle injection valve

1. Clamp injection valve in vice.
2. Unscrew union nut 1.
3. Remove multiple-hole nozzle 2 (renew, if required).
4. Remove washer 3, pressure pin 4, pressure spring 5 and shims 6. See also section 7.2.

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4.10



Kraftstoffdruckleitungen abbauen

1. Überwurfmutter 1 an der Einspritzpumpe abschrauben.
2. Überwurfmutter 2 am Einspritzventil abschrauben. Am Einspritzventil mit einem Schlüssel gegenhalten.
3. Rohrschellenhälften 3 am Zylinderkopf abschrauben.
4. Kraftstoffdruckleitungen kompl. abnehmen.

Hinweis: Einspritzleitungen gehen ohne Abbau des Wasser-Luftsammlers und Auspuffkrümmers nicht heraus.

Einbauhinweis:
Anzugsvorschriften Abs. 6.2 beachten.

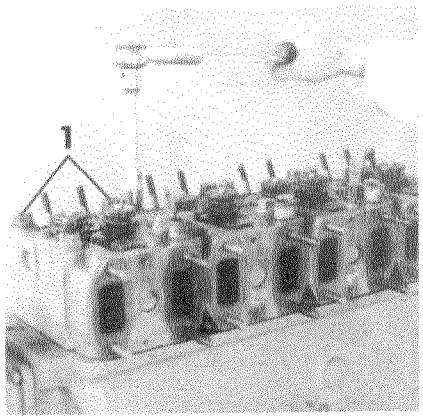
Removing fuel-delivery lines

1. Unscrew cap nut 1 on injection pump.
2. Unscrew union nut 2 on injector. Hold up at injector using an open-jawed spanner.
3. Unscrew pipe-clamp halves 3 on cylinder head.
4. Remove fuel-delivery lines all together.

Note: Injection pipes can only taken off water-air collector and exhaust manifold have been dismounted.

Assembly note:
Observe tightening specifica-tions, section 6.2.

4.11



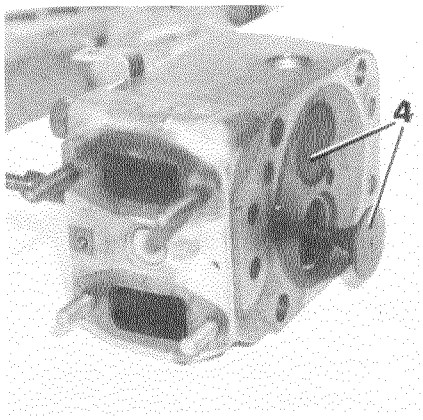
Zylinderkopf abbauen

1. Sechskantschrauben 1 (4 Stück pro Zylinder) mit Steckschlüssel herausschrauben.
2. Zylinderköpfe einzeln abheben.
3. Bei Montage auf peinlichste Sauberkeit an den Dichtflächen achten (siehe auch Abs. 6.9).

Removing cylinder head

1. Unscrew hexagon screws 1 (4 per cylinder) using a socket wrench.
2. Lift cylinder heads off individually.
3. Be sure to keep sealing surfaces absolutely clean (see also section 6.9).

4.12



Ventile ausbauen

1. Mit Ventilheber TSW 014 Feder niederdrücken und Ventilkeile herausnehmen.
2. Ventile 4 nach unten herausziehen.

Einbauhinweis:
Zusammenbau in umgekehrter Reihenfolge.
Im Reparaturfall siehe Abs. 5.3.4 Ventilkegel erneuern.

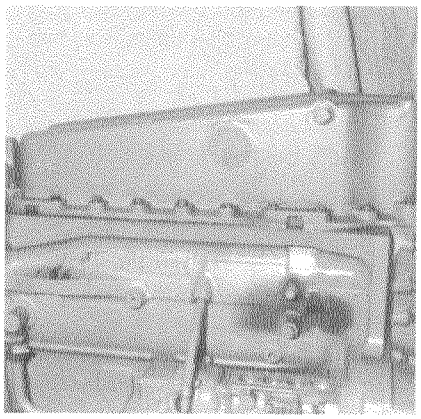
Removing valves

1. Press spring by means of valve lifter TSW 014 and remove valve spring cotters.
2. Take valve 4 out from bottom.

Assembly note:
Assembly in the reverse sequence. in case of repairs, see section 5.3.4 replace valve cone.

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4.13



Ölwanne abbauen

1. Alle Schrauben an der Ölwanne herausschrauben.
2. Mit Schraubendreher oder Hebeeisen Ölwanne von Dichtung lösen und abheben.
3. Bei Montage auf peinlichste Sauberkeit an den Dichtflächen achten.

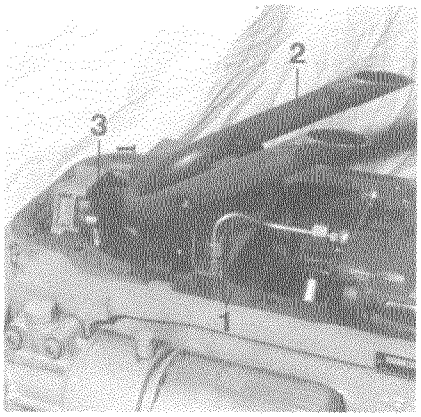
Einbauhinweis:
Die Ölwannendichtung entfällt, Ölwanne mit Dichtungsmaße abdichten.

Removing oil pan

1. Unscrew all bolts holding oil pan.
2. Using screwdriver or lever, release oil pan from gasket and lift off.
3. Be sure to keep sealing surfaces absolutely clean during assembly.

Assembly note:
Oil sump gasket not applicable, seal oil sump by means of a sealing compound.

4.14



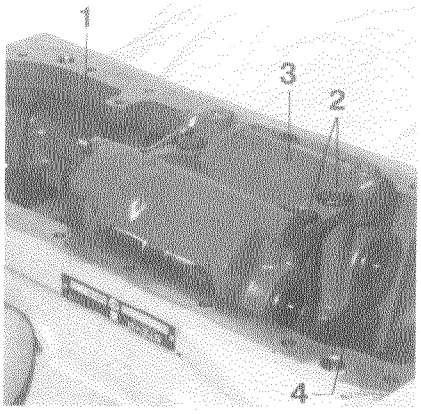
Schmierölsaugleitung ausbauen

1. Sechskantschrauben 1 herausschrauben.
2. Schmierölleitung 2 abnehmen.
3. Auf Runddichtring 3 achten.

Remove oil-suction line

1. Remove hexagon screws 1.
2. Take down oil-intake line 2.
3. Note O-ring 3.

4.15



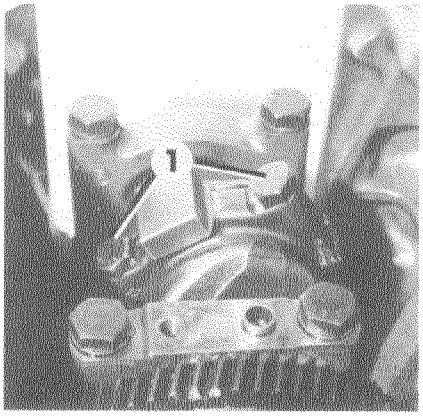
Massenausgleich ausbauen

1. Schmierölleitung 1 zum Massenausgleich an den Überwurf-muttern abschrauben.
2. Sechskantschrauben 2 herausschrauben.
3. Massenausgleich 3 heraushe-ben. Auf Beilagebleche 4 unter dem Massenausgleich achten. Siehe auch Abs. 6.4. und 6.5.

Removing balance weight

1. Unscrew at cap nuts, on lubeoil line 1, leading to balance weight.
2. Remove hexagon screws 2.
3. Lift out balance weight 3. Take care of shims 4 beneath balance weight. Also see sections 6.4 and 6.5.

4.16



Kolben mit Pleuelstange ausbauen

1. Pleuelschrauben 1 mit Steckschlüssel abschrauben.

   Hinweis: Die Zuordnung zum Zylinder ist serienmäßig nicht markiert!
   (Markierungen anbringen!)

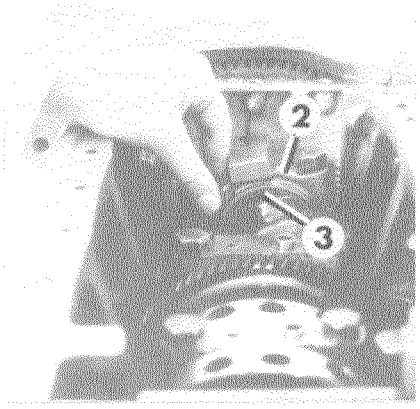
Removing piston and connecting rod

1. Unscrew connecting-rod bolts 1, using a box spanner.

   Note: The assignation of cylinders is not marked by standard!
   (Put on marking!)

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4.16.1



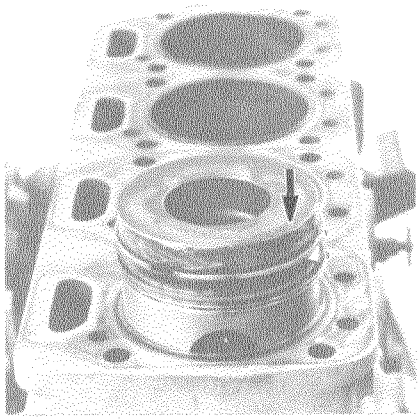
2. Schrauben mit Pleueldeckel 2 herausnehmen.
3. Auf Pleuellagerschalen 3 achten.

Einbauhinweis:
Lagerschalen unter Beachtung des Fixierstiftes einsetzen.
Pleuelstange und Pleueldeckel sind mit gleicher Nummer gekennzeichnet. Nicht vertauschen. Anzugsvorschriften Abs. 6.2 beachten. Axialspiel Abs. 6.3 kontrollieren.

2. Remove bolts together with connecting-rod bearing cap 2.
3. Do not lose connecting-rod bearing shells 3.

Assembly note:
Insert bearing shells noting the locating pin.
The connecting rod and connecting-rod cover are marked with the same number. Do not mix them up. Observe tightening specifications, section 6.2. Check axial clearance, section 6.3.

4.16.2



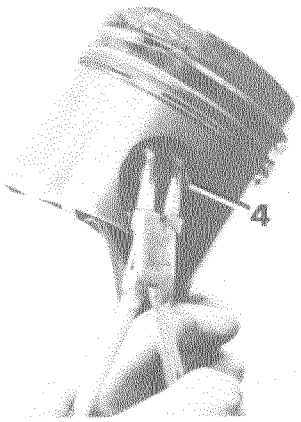
4. Kolben mit Pleuelstange nach oben herausdrücken.

Einbauhinweis:
Der Pfeil auf dem Kolbenboden muß zum Schwungrad zeigen. Stoßfugen der Kolbenringe um 180° versetzen (nacheinander gegenüberliegend).

4. Press piston and connecting rod upwards and out.

Assembly note.
Arrow on piston head must be pointing towards flywheel. Butting joints of the piston rings must be staggered 180° each (i.e. opposing in sequence).

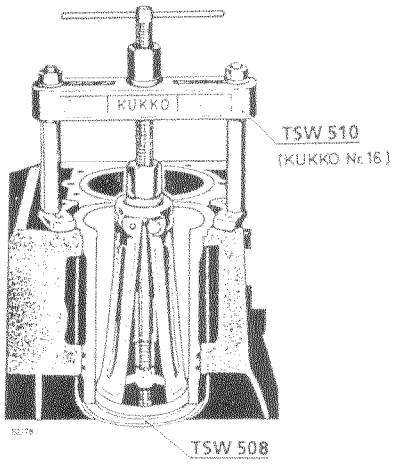
4 16.3



5. Sicherungsring 4 mit Sicherungsringzange entfernen.
6. Kolbenbolzen herausdrücken.
7. Kolben abnehmen.
8. Zum Auswechseln der Kolbenringe, Kolbenringzange verwenden.

5. Use circlip pliers to remove circlip 4.
6. Force gudgeon pin out.
7. Remove piston.
8. To exchange piston rings, use piston-ring pliers.

4.17



Zylinderlaufbüchse ausbauen

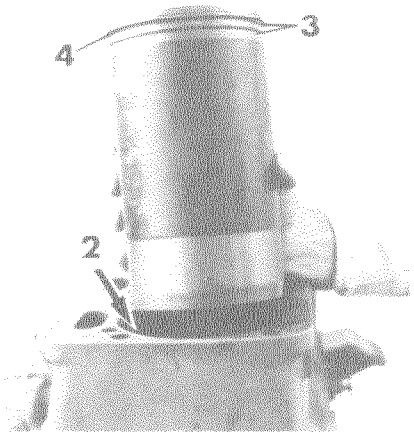
1. Mit Zylinderbüchsen-Auszieher TSW 510 und Ausziehplatte TSW 508 Zylinderbüchsen herausziehen.
2. Runddichtringe aus dem Kurbelgehäuse herausnehmen.
3. Runddichtringe unter dem Buchsenbund entfernen.

Removing cylinderliner

1. Pull out cylinder liner by means of cylinder liner extractor TSW 510 and extractor plate TSW 508.
2. Take rubber O-rings out of crankcase.
3. Remove O-rings below liner collar.

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4.17.1



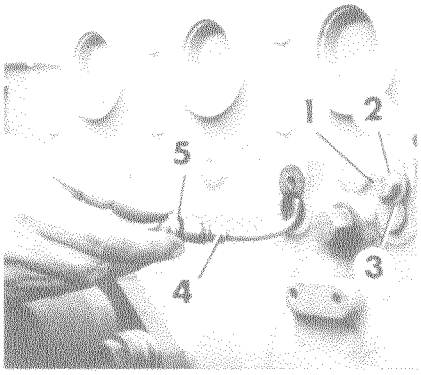
Einbauhinweis.
Auflageflächenam Bund 4 reinigen und Zylinderbüchsenüber-stand messen. Siehe auch Abs. 6.7. (eventuell einschleifen)
Neue Runddichtringe einfetten. Ringe 2 sorgfältig in das Kurbelgehäuse einlegen. Ringe 3 einseitig unter dem Buchsenbund ansetzen und mit geringer Dehnung über den Buchsenbund ziehen. Beim Herunterstreifen Ringe nicht verdrillen.
Zylinderlaufbuchse von Hand

Assembly note:
Clean supporting surfaces on collar 4 and measure cylinder-liner projection. See also section 6.7.

Grease new rubber O-rings. Place rings 2 carefully into crankcase. place rings 3 at one end below liner collar and pull them over lines collar by stretching slightly. Be careful that rings are not twisted when mounted.

Press cylinder liner manually.

4.18



Düse zur Kolbenkühlung ausbauen

1. Sechskantschraube 1 herausschrauben und Federring 2 mit Scheibe 3 abnehmen.
2. Düse 4 herausziehen. Auf Runddichtung 5 achten.

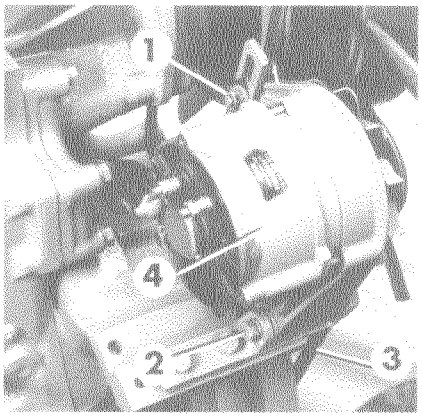
Einbauhinweis:
Ausrichten der Düse Abs. 6.7 beachten.

Removing nozzle for piston cooling

1. Remove hexagon bolt 1 and take down spring lock washer 2 with shim 3.
2. Pull out nozzle 4. Note 0-ring 5.

Assembly note.
Observe nozzle adjustment, section 6.7.

4.19



Drehstromgenerator abbauen

1. Elektrische Leitungen kennzeichnen und abziehen bzw. abschrauben.
2. Sechskantschrauben 1 und 2 abschrauben.
3. Drehstromgenerator 4 aus Keilriemen 3 aushängen und abnehmen.

Remove alternator

1. Mark electric cables and pull out or unscrew.
2. Unscrew hexagon screws 1 and 2.
3. Remove alternator 4 from V-belt pulley 3 and take it down.

4.20

Lüfterflügel abbauen

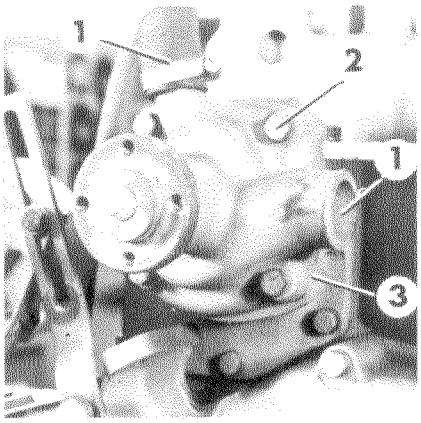
1. Sechskantschrauben mit Federring abschrauben.
2. Lüfterflügel und Keilriemenscheibe anehmen.

Removing fan blades

1. Unscrew hexagon screws to-gether with spring washer.
2. Take down fan blades and V-belt pulley,.

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4.21



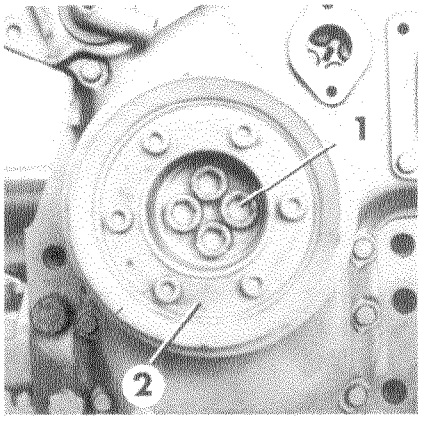
Wasserpumpe abbauen

1. Schlauchverbindungen 1zur Wasserpumpe entfernen.
2. Sechskantschrauben 2 abschrauben (4 Stück) und Wasserpumpe abnehmen.
3. Auf Formdichtung 3 achten.

Removing water pump

1. Remove hose connection 1 with water pump.
2. Unscrew hexagon screws 2 (4 pieces) and take down water pump.
3. Note shaped gasket 3.

4.24



Nabe auf Kurbelwelle abbauen

1. Keilriemen entspannen.
2. Befestigungsschrauben 1 mit Steckschlüssel herausschrauben.
3. Nabe mit angeflanschter Keilriemenscheibe 2 von der Kurbelwelle ziehen.

Einbauhinweis:
Anzugsvorschriften Abs. 6.2 beachten.

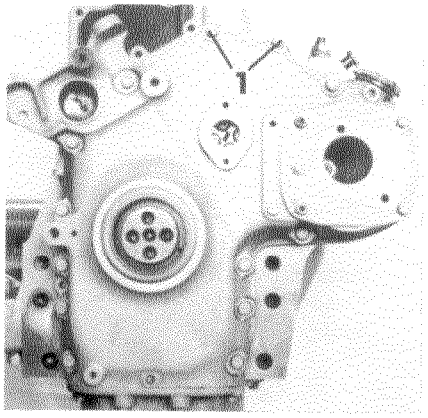
Removing hub from crankshaft

1. Relieve tension of V-belt.
2. Unscrew fastening screws 1 using a socket wrench.
3. Draw hub with attached pulley 2 off crankshaft.

Assembly note:
Observe tightening specifications, section 6.2.

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4.25



Stirnwanddeckel abbauen

1. Alle Sechskantschrauben 1 herausschrauben.
2. Festsitzenden Stirnwanddeckel durch seitliches, leichtes Klopfen lösen und abnehmen.

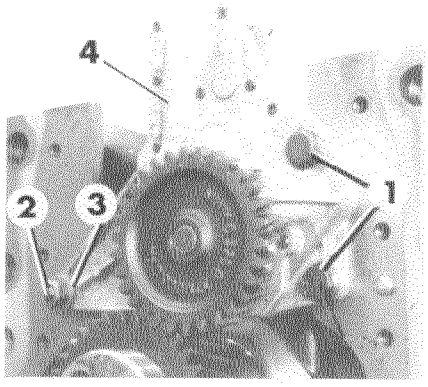
Einbauhinweis.
Beschädigte Formdichtung erneuern.
Anzugsvorschriften Abs. 6.2 beachten.

Removing front-wall cover

1. Unscrew all hexagon bolts 1.
2. Loosen and remove front-wall cover by knocking gently and laterally.

Assembly note:
Replace damaged shaped gasket.
Observe tightening specifications section 6.2.

4.26



Ölpumpe ausbauen

1. Sechskantschrauben 1 herausschrauben.
2. Midrip-Mutter 2 abschrauben und Scheibe 3 abnehmen.
3. Ölpumpe 4 abnehmen.

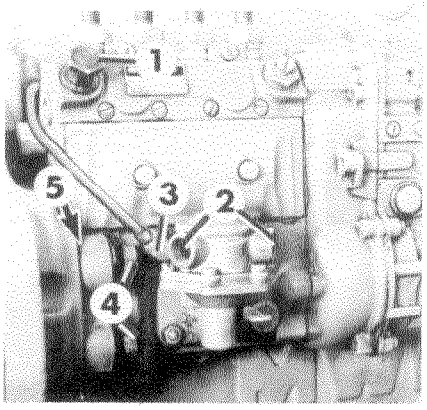
Einbauhinweis:
Verdrehflankenspiel Abs. 6.5 beachten.
Anzugsvorschriften Abs. 6.2 beachten.

Removing oil pump

1. Unscrew hexagon bolts 1.
2. Unscrew midrip-nut 2 and take down washer 3.
3. Take down oil pump 4.

Assembly note.
Backlash: note section 6.5.
Observe tightening specifications section 6.2.

4.27



Einspritzpumpe ausbauen

1. Gestänge für Drehzahlverstel-lung und Abstellung an der Einspritzpumpe entfernen.
2. Alle Kraftstoffleitungen an der Einspritz- und Förderpumpe abschrauben (Stellen 1 und 2).
3. Schmierölleitung 3 abschrauben. Auf Dichtringe achten.
4. Sechskantmutter 6 am Einspritzpumpen - Antriebsrad 7 abschrauben.
   (Bild 4.27.1)
5. Einspritzpumpen-Antriebsrad 7 mit Abziehvorrichtung abziehen.
   (KUKKO 18-1)
   ACHTUNG! Keine Abdruckschrauben verwenden.
6. Sechskantmuttern 4 abschrauben. Zahnscheiben und Scheiben abnehmen.
7. Einspritzpumpe abnehmen. Runddichtring 5 überprüfen.

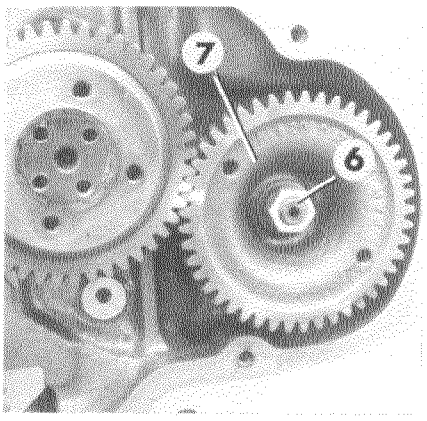
Einbauhinweis.
Auf Scheibenfeder in der Einspritzpumpen-Nockenwelle achten. Eingriffe der markierten Zahnräder überprüfen. Kraftstoffsystem entlüften. Förderbeginn prüfen (siehe Abs. 6.11).
Anzugsvorschriften Abs. 6.2 beachten.

Removing injection pump

1. Detach speed control and engine stopping linkage at injection pump.
2. Unscrew all fuel lines at injection and feed pumps (Positions 1 and 2).
3. Unscrew lube-oil line 3. Take care of sealing rings.
4. Remove hexagon nut 6 on injection-pump driving gear 7.
   (Fig. 4.27.1)
5. Pull out injection-pump driving gear 7 using an extractor.
   (KUKKO 18-1)
   ATTENTION! Note with puller screw!
6. Remove hexagon nuts 4. Take down toothed lock washers and shims.
7. Take down injection pump. Checking O-ring 5.

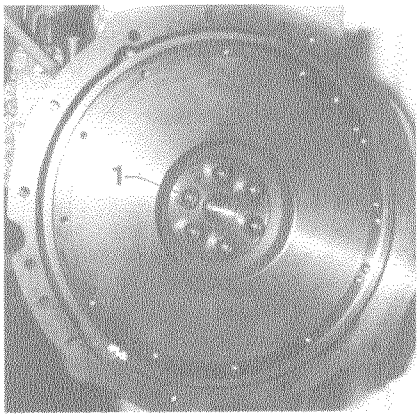
Assembly note:
Note woodruff key in injection pump camshaft.
Check engagements of the marked gear wheels.
Vent fuel lines.
Checking start of delivery. (See section 6.11).
Observe tightening specifications section 6.2.

4.27.1



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4.28



Schwungrad abbauen

1. Kurbelwelle festhalten.

   Achtung:
   Oberfläche der Pleuelzapfen nicht beschädigen.
2. Befestigungsschrauben 1 mit Steckschlüssel abschrauben.
3. Schwungrad von der Kurbelwelle heben.

   Einbauhinweis.
   Anzugsvorschriften Abs. 6.2 beachten.

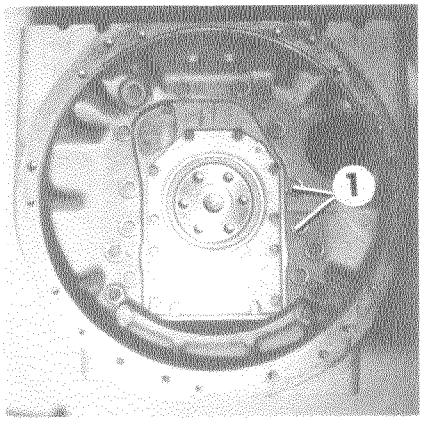
Removal flywheel

1. Hold crankshaft.

   Caution:
   Do not damage crankpin surface.
2. Unscrew fastening bolts 1 using a boxer spanner.
3. Lift flywheel from crankshaft.

   Assembly note:
   Observe tightening specifications, section 6.2.

4.29



Gehäuse für Schwungrad abbauen

1. Alle Befestigungsschrauben 1 am Gehäuse für Schwungrad abschrauben.
2. Festsitzendes Gehäuse durch leichtes Klopfen lösen und abnehmen.

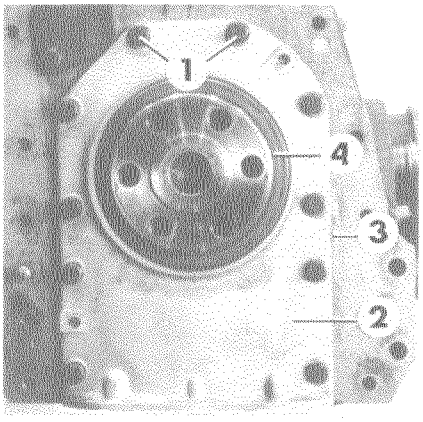
   Einbauhinweis:
   Anzugsvorschriften Abs. 6.2 beachten.

Removing flywheel housing

1. Unscrew all fastening bolts 1 on flywheel housing.
2. Loosen and take down stuck housing by knocking gently.

   Assembly:
   Observe tightening specifications, section 6.2.

4.30



Stirnwanddeckel abbauen

1. Alle Befestigungsschrauben 1 am Stirnwanddeckel herausschrauben.
2. Stirnwanddeckel 2 abnehmen.
3. Auf Formdichtung 3 achten.

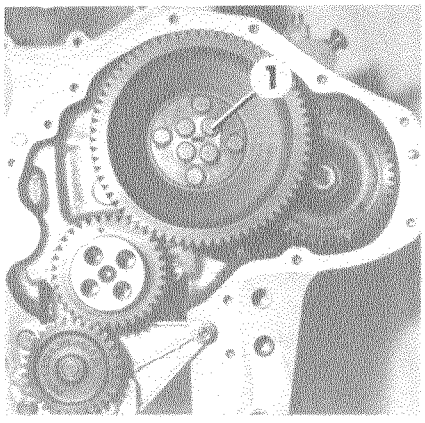
   Einbauhinweis:
   Dichtlippe am Radialdichtring 4 leicht einfetten.

Removing front-wall cover

1. Unscrew all fastening bolts 1 on front-wall cover.
2. Take down front-wall cover 2.
3. Note shaped gasket 3.

   Assembly note:
   Slightly coat sealing lip on radial seal 4 with grease.

4.31



Nockenwelle ausbauen

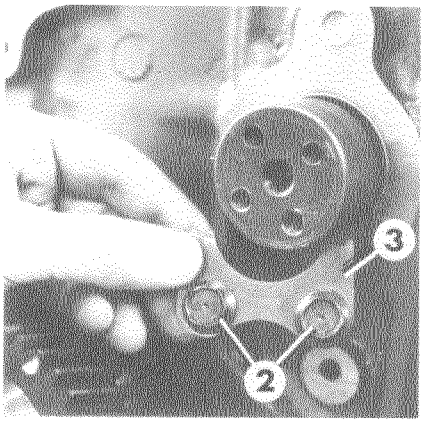
1. Befestigungsschrauben 1 herausschrauben und Stirnzahnräder von der Nockenwelle abnehmen.

Remove camshaft

1. Unscrew fastening bolts 1 and take down front-gear wheels from camshaft.

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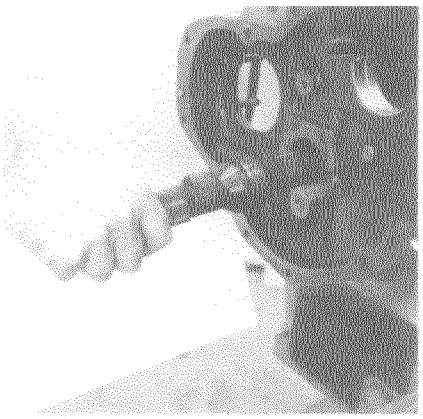
4.31.1



2. Sechskantschrauben 2 abschrauben.
3. Segment 3 für Nockenwellenfixierung abnehmen.

2. Unscrew hexagon bolts 2.
3. Remove segment 3 for locating camshaft.

4.31.2



4. Motor in kopfstehende Lage bringen. *)
5. Alle Pilzstößel nach unten (in Richtung Zylinder) drücken.
6. Nockenwelle bei kopfstehendem Motor vorsichtig herausziehen. Beim Herausziehen Nockenwelle drehen.

Einbauhinweis:
Lagerspiel Abs. 6.3 beachten.

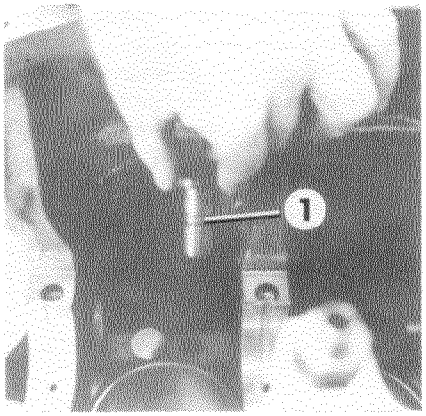
*) Wenn dazu die Möglichkeit nicht besteht, müssen die Stößel mit Drahthaken hochgehängt werden.

4. Place engine on head.
5. Press all mushroom-head tappets downwards (in direction of cylinder).
6. Carefully withdraw camshaft with engine standing on head. Turn camshaft during removal.

Assembly note:
Note bearing play section 6.3.

*) If this possiblility does not exist, the tappets have to be suspended by means of a wire bar.

4.32



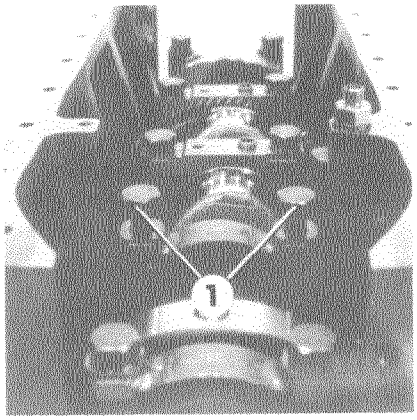
Pilzstößel ausbauen

1. Pilzstößel 1 aus Kurbelgehäusebohrung nehmen.

Removing mushroom-head tappet

1. Take mushroom-head tappets 1 out of crankcase bore.

4.33



Kurbelwelle ausbauen

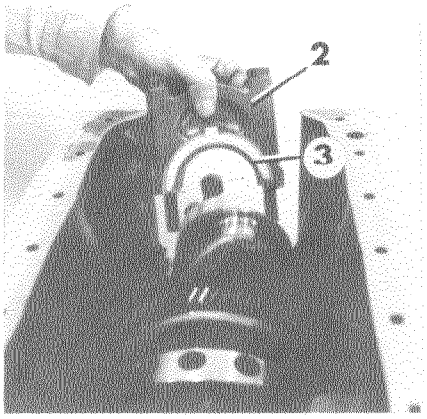
1. Hauptlagerschrauben 1 abschrauben

Removing crankshaft

1. Remove main-bearing bolts 1.

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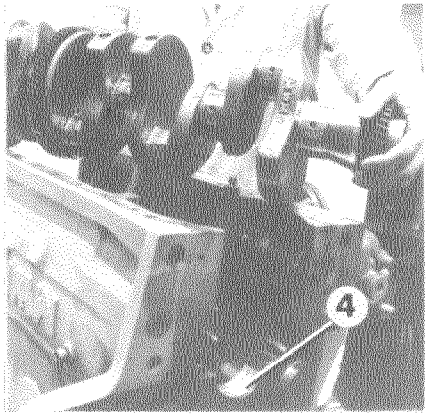
4.33.1



2. Lagerdeckel 2 abheben. Lagerdeckel sind numeriert.
3. Auf Lagerschalen und Anlaufringe 3 am schwungradseitigem Lager achten.

2. Lift off bearing covers 2. Bearing covers are numbered.
3. Note bearing shells and ring halves 3 on flywheel-end bearing.

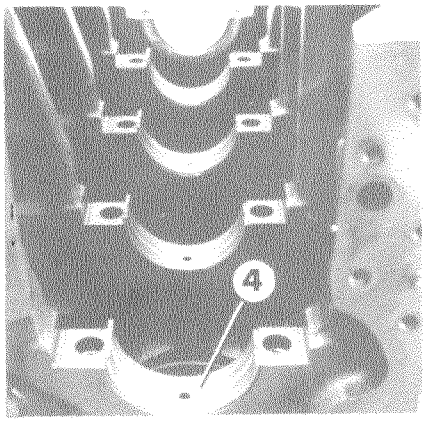
4.33.2



4. Kurbelwelle aus dem Gehäuse heben und auf Lagerschalen 4 achten.

4. Lift crankshaft from crankcase and note bearing shells 4.

4.33.3



Einbauhinweis:
Lagerschalen und Lagerdeckel nicht vertauschen.
Lagerschalen 4 unter Beachtung des Fixierstiftes im Lagerdeckel einsetzen.
Anlaufringe so einlegen, daß die Laufschichtseiten mit den Öltaschen immer in Richtung Kurbelwange bzw. Kurbelwellenflansch zeigen.
Axialspiel Abs. 6.3 beachten.
Anzugsvorschriften Abs. 6.2 beachten.

Assembly note:
Do not confuse bearing shells and bearing covers. Insert bearing shells 4 noting locating pin in bearing cover.
Ring halves are to be fitted in such a way that coated sides with oil pockets always point in direction of crankweb or crankshaft flange.
Observe axial clearance, section 6.3.
Observe tightening specifications, section 6.2.

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5. Grenzmaße für Verschleißteile

1. Allgemeine Hinweise

- Nach dem Zerlegen des Motors alle Einzelteile sorgfältig reinigen und trocknen.
- Alle Teile, die aufgrund ihrer Laufzeit einer gewissen Abnutzung unterliegen, sind in folgender Zusammenstellung mit den Neu-Abmessungen und maximal zulässigen Verschleißmaßen aufgeführt.
- Teile genau vermessen (zylindrische Teile am ganzen Umfang) und Oberfläche prüfen (Mikrometer, Meßtemperatur ca. 20°C).
- Bei Meß- und Prüfergebnissen, deren Werte außerhalb oder in der Nähe der Verschleißmaßgrenzen liegen, sind die betreffenden Teile auszutauschen bzw. nachzuarbeiten.

Für folgende Teile sind Verschleißmaße angegeben:

1. Kurbelwelle
2. Zahnkranz auf Kurbelwelle für Motoren mit Massenausgleich
3. Hauptlagerschale
4. Pleuellagerschale
5. Anlaufring (Kurbelwelle)
6. Pleuelstange
7. Kolbenbolzen
8. Kolben, komplett
9. Zylinderlaufbuchse
10. Ventilrückstand / Ventilkegel - Turbo-Motor
11. Ventilsitzring / Ventilführung - Turbo-Motor
12. Ventilrückstand / Ventilkegel - Saug-Motor
13. Ventilsitzring / Ventilführung - Saug-Motor
14. Kipphebelbock
15. Kipphebel
16. Nockenwelle
17. Nockenwelle- und Stößelbohrungen im Kurbelgehäuse
18. Segment für Nockenwellenfixierung
19. Pilzstößel
20. Stirnzahnrad zum Nockenwellen- und Einspritzpumpenantrieb
21. Stirnzahnrad auf Einspritzpumpenwelle
22. -----
23. Zahnkranz auf Schwungrad
24. Welle für Massenausgleich
25. Lagerbuchse für Massenausgleich
26. Lagerring für Massenausgleich
27. Wasserpumpenlager, Wasserpumpen-Reparatursatz
28. Zylinderkopfschrauben

Diese Nummern sind unter Abschnitt 5.2. in der ersten Spalte, - lfd.Nr. - angegeben.

5. Limit dimensions for wearing parts

1. General remarks

- After having dismantled the engine carefully clean and dry all components.
- All parts subject to wear and tear after a certain time are listed in the following along with their dimensions when new and their maximum permissible wear rates.
- Carefully gauge the items and check the whole circumference and surface of the cylindrical parts (micrometer, measuring temperature: approx. 20° C).
- If the measuring and test results show values exceeding or reaching the wear limiting values, the parts involved must be replaced and/or reworked.

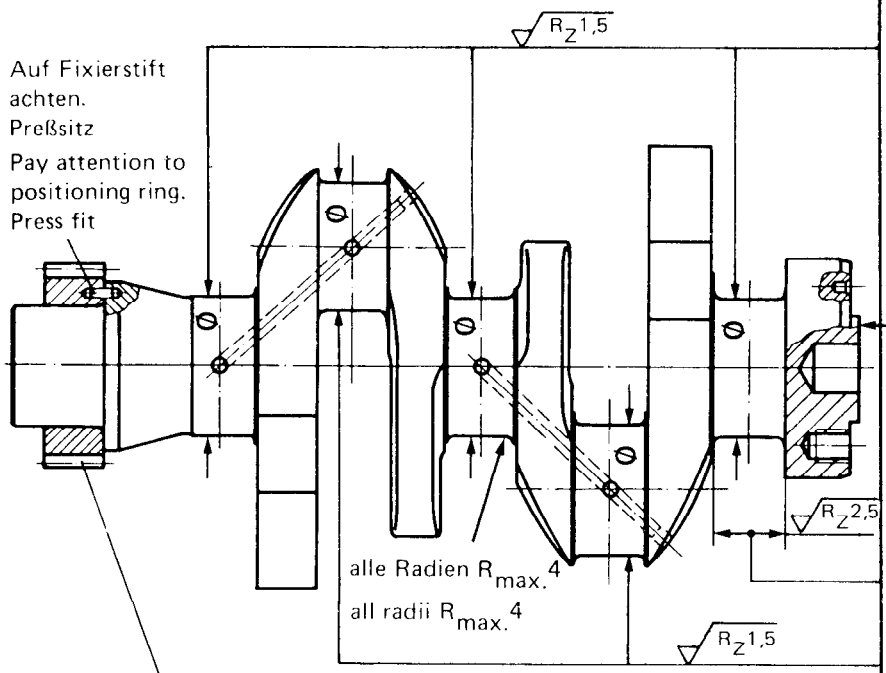
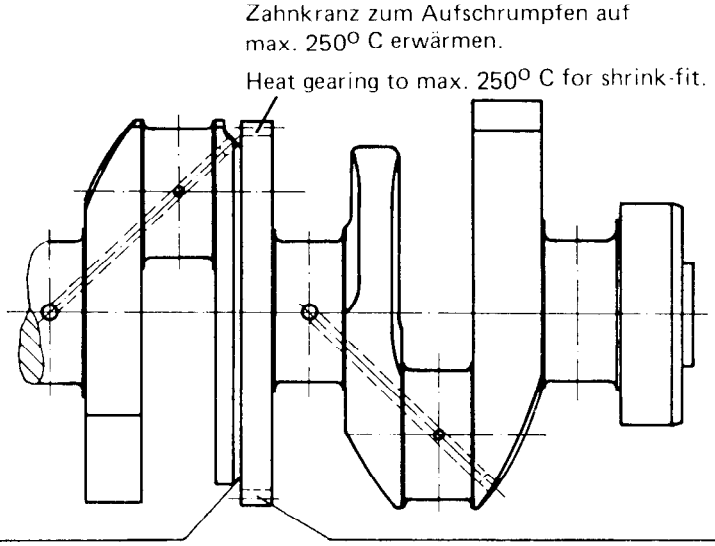
Wear dimensions are given for the following parts:

1. Crankshaft
2. Gear ring on crankshaft for engines with mass balancing
3. Main-bearing shell
4. Big-end bearing shell
5. Ring halves (crankshaft)
6. Connecting rod
7. Piston pin
8. Piston, compl.
9. Cylinder liner
10. Valve recess / Valve cones - Turbo-engine
11. Valve seat ring / Valve guide - Turbo-engine
12. Valve recess / Valve cones - Suction-engine
13. Valve seat ring / Valve guide - Suction-engine
14. Rocker bracket
15. Rocker arm
16. Camshaft
17. Camshaft and tappet holes in crankcase
18. Key to fix camshaft
19. Mushroom-head tappet
20. Spur gear for camshaft and injection pump drive
21. Spur gear on injection pump shaft
22. -----
23. Ring gear on flywheel
24. Mass balancing shaft
25. Bearing bush for balance weight
26. Bearing ring for balance weight
27. Water-pump bearing, water pump repair kit
28. Cylinder head screws

These numbers are the serial numbers given in the first column of section 5.2.

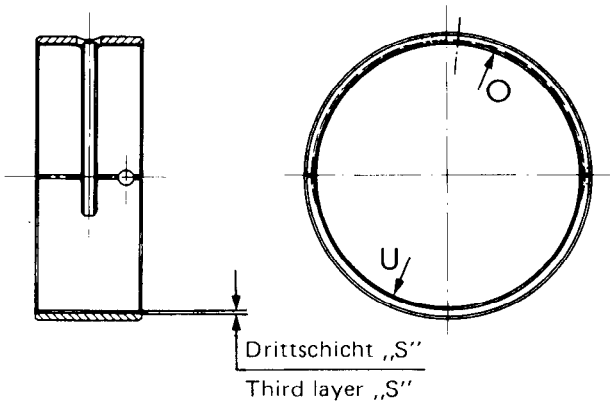
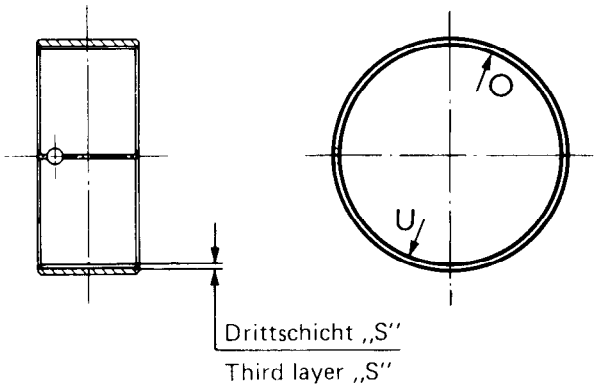
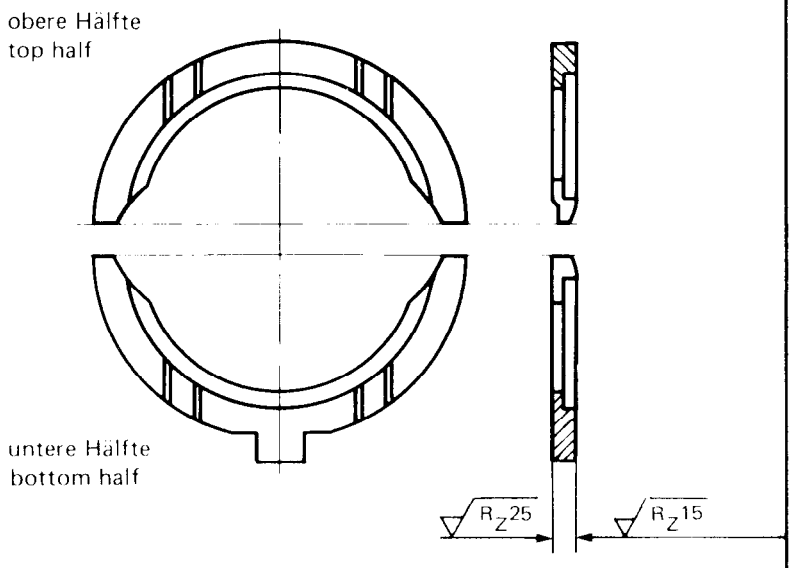
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Tabelle für Grenzmaße der Verschleißteile 5.2.1 – 5.2.2
Table of limit dimensions for wearing parts

lfd. Nr. / Serial No.	Teil, Benennung / Part, Denomination	Abmessungen / Dimensions		
		Neuzustand / New state max. mm	Neuzustand / New state min. mm	Verschleißgrenze / Wear limit max. mm
1	**Kurbelwelle / Crankshaft**			
		69,97	69,951	69,93
				Axialspiel im eingebauten Zustand gemessen: 0,4 mm Axial clearance measured when installed: 0.4 mm
		36,05	36,00	36,07
		62,97	62,951	62,93
				Falls Verschleißspuren: erneuern. Replace if wear marks are visible.
	Reparatur-Schleifmaße siehe 5.3.1 Refurbishing grades see 5.3.1			
2	**Zahnkranz auf Kurbelwelle für Motoren mit Massenausgleich** **Gear ring on crankshaft for engine with mass balancing**			
				Falls Verschleißspuren: erneuern. Replace if wear marks are visible.

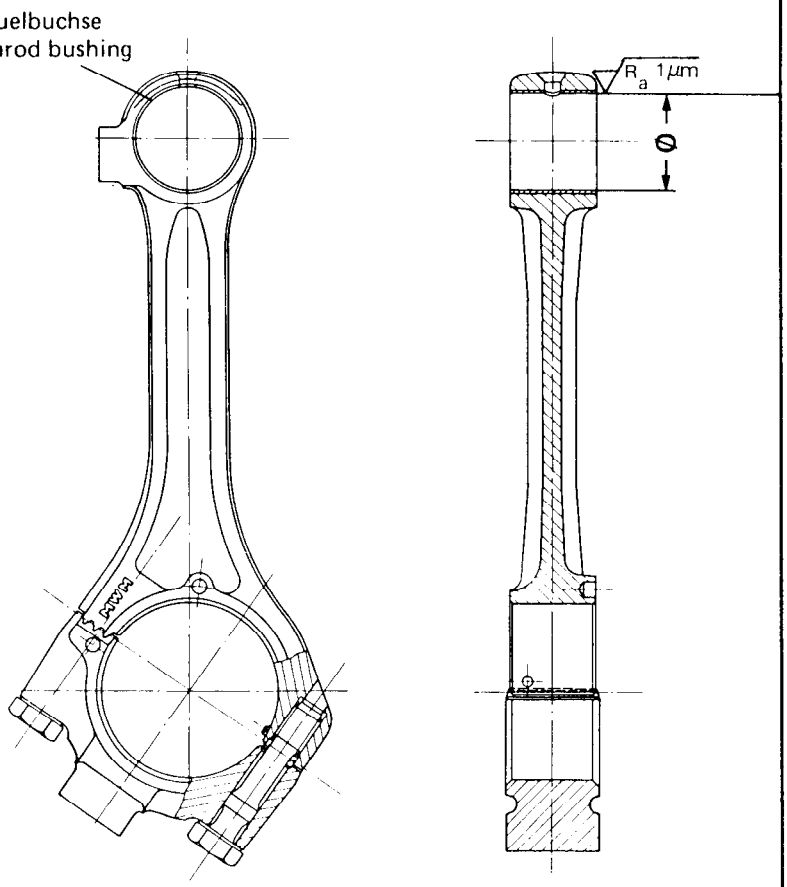
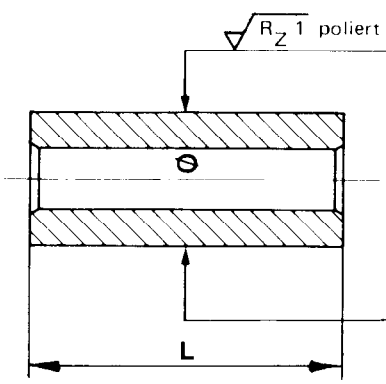
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Tabelle für Grenzmaße der Verschleißteile 5.2.3 — 5.2.5
Table of limit dimensions for wearing parts

lfd. Nr. / Serial No.	Teil, Benennung / Part, Denomination	Abmessungen / Dimensions		
		Neuzustand / New state		Verschleißgrenze / Wear limit
		max. mm	min. mm	max. mm
3	**Hauptlagerschale** **Main-bearing shell** 			Wenn die galvanisch aufgebrachte Drittschicht „S" abgenutzt ist, erkenntlich an bronze-goldglänzendem Laufbild an den Stellen O und U, oder/und bei über den ganzen Umfang verlaufenden Riefen an der Lauffläche, müssen beide Lagerschalen erneuert werden. **Achtung:** Neue Lagerschalen auf Wellenzapfen außerhalb zulässiger Verschleißgrenze sind zwecklos.
4	**Pleuellagerschale** **Big-end bearing shell** 			Both shell bearings will have to be renewed when the galvanically applied third coat „S" wears off (indicated by shiny bronze/gold contact pattern at points O and U, and/or when scoring appears around entire circumference). **Important:** There is no point in fitting new shell bearings on shaft journals with no-go dimensions.
				Untermaßlager siehe 5.3.1 Undersize bearing see 5.3.1
5	**Anlaufring (Kurbelwelle)** **Ring halves (crankshaft)** 	3,47	3,42	Bis Axialspiel 0,25 mm siehe auch Abs. 6.3 Up to axial clearance 0.25 mm see also section 6.3

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Tabelle für Grenzmaße der Verschleißteile 5.2.6 – 5.2.7
Table of limit dimensions for wearing parts

lfd. Nr. / Serial No.	Teil, Benennung / Part, Denomination	Abmessungen / Dimensions		
		Neuzustand / New state		Verschleißgrenze / Wear limit
		max. mm	min. mm	max. mm
6	**Pleuelstange / Connecting rod** Pleuelbuchse / Conrod bushing 	35,08	35,03	35,15
7	**Kolbenbolzen / Piston pin** Saug-Motor / Suction-engine L = 82 mm Turbo-Motor / Turbo-engine L = 88 mm 	35,00	34,994	34,990 Falls riefig: erneuern / Renew if scored

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Tabelle für Grenzmaße der Verschleißteile 5.2.8
Table of limit dimensions for wearing parts

lfd. Nr. / Serial No.	Teil, Benennung / Part, Denomination	Abmessungen / Dimensions		
		Neuzustand / New state max. mm	Neuzustand / New state min. mm	Verschleißgrenze / Wear limit max. mm
8	**Kolben, kompl. TURBO-Motor** **Piston, compl. TURBO-engine**			
	Nenndurchmesser / Nominal diameter — 105			Falls Verschleißspuren: erneuern Replace if wear marks are visible.
		2,07	2,05	2,11
		4,06	4,04	4,11
	Tragbild / Contact surface			Falls fühlbares Spiel: erneuern In case of perceptible clearance: replace
				Falls Längsriefen: erneuern Renew if longitudinally scored.
	Pfeil zeigt auf Schwungradseite Arrow pointing to flywheel end			
	Stoßspiel für alle Ringe Butt clearance on all rings			2 mm
	Ringpartie / Ring section			Falls Verschleißspuren: erneuern. Replace if wear marks are visible.
				0,20
				0,15

Stoßspiel ist durch Kolbenringabnutzung **und** durch Abnutzung der Lauffläche in der Zylinderlaufbuchse verursacht.
Butt clearance caused by piston-ring wear **and** wear of cylinder liner surface.

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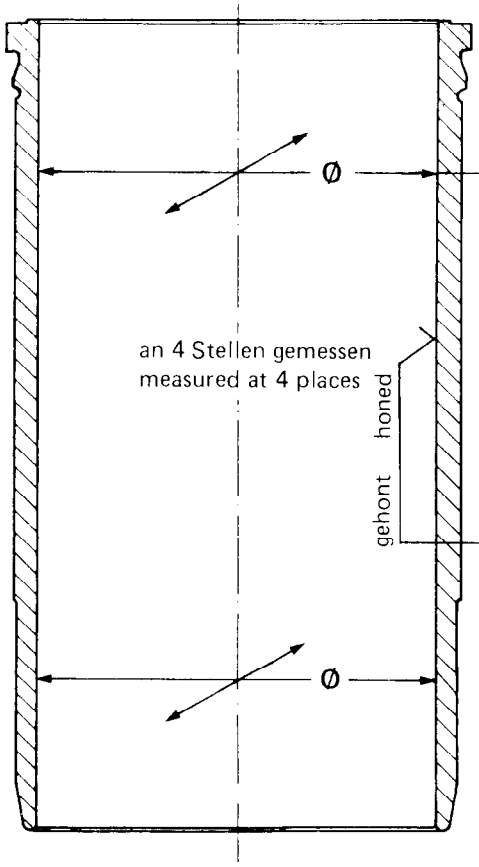
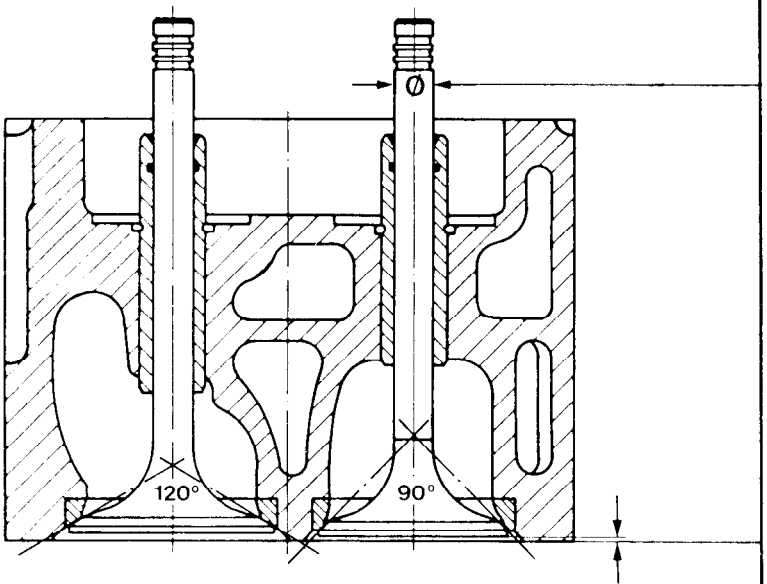
Tabelle für Grenzmaße der Verschleißteile **5.2.8a**
Table of limit dimensions for wearing parts

lfd. Nr.	Teil, Benennung Part, Denomination Serial No.	Abmessungen / Dimensions Neuzustand / New state max. mm	Neuzustand / New state min. mm	Verschleißgrenze / Wear limit max. mm
8a	**Kolben kompl. Saug-Motor** **Piston compl. Suction-engine**			
	Nenndurchmesser / Nominal diameter 105			Falls Verschleißspuren: erneuern Replace if wear marks are visible.
		2,06	2,04	2,10
		4,06	4,04	4.11
	Tragbild Contact surface			Falls fühlbares Spiel: erneuern In case of perceptible clearance: replace Falls Längsriefen: erneuern Renew if longitudinally scored.
	Pfeil zeigt auf Schwungradseite Arrow pointing to flywheel end			
	Stoßspiel für alle Ringe Butt clearance on all rings			2 mm
	Ringpartie Ring section			Falls Verschleißspuren: erneuern. Replace if wear marks are visible.
				0,20
				0,15

Stoßspiel ist durch Kolbenringabnutzung **und** durch Abnutzung der Lauffläche in der Zylinderlaufbuchse verursacht.
Butt clearance caused by piston-ring wear **and** wear of cylinder liner surface.

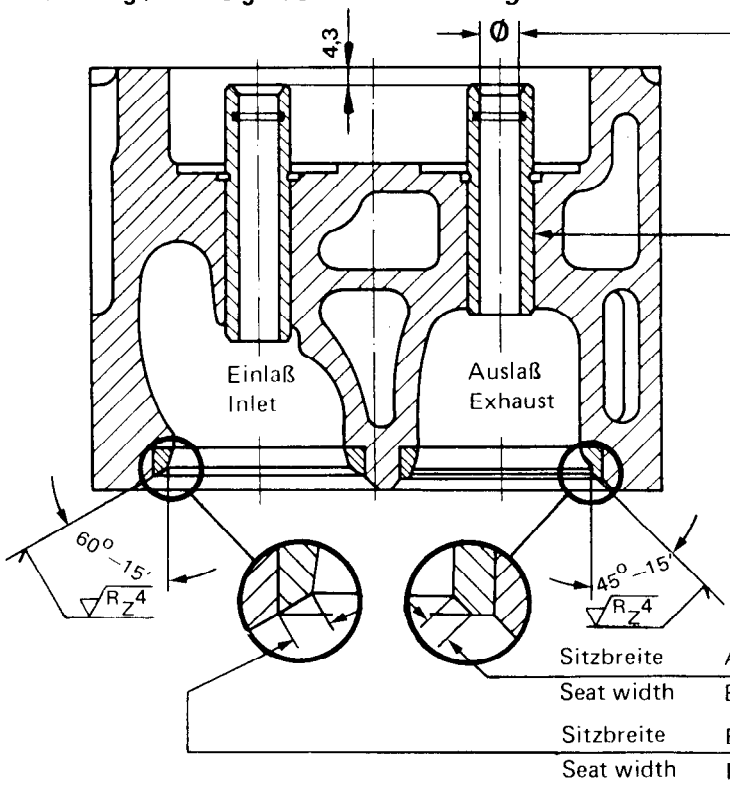
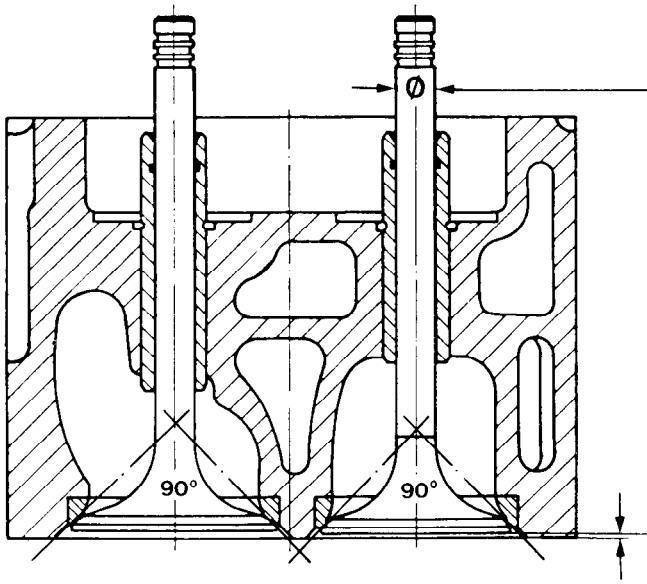
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Tabelle für Grenzmaße der Verschleißteile 5.2.9 – 5.2.10
Table of limit dimensions for wearing parts

lfd. Nr. / Serial No.	Teil, Benennung / Part, Denomination	Abmessungen / Dimensions		
		Neuzustand / New state max. mm	Neuzustand / New state min. mm	Verschleißgrenze / Wear limit max. mm
9	**Zylinderlaufbuchse / Cylinder liner**			
		105,022	105,00	105,250 Falls Längsriefen über 0,05 mm Tiefe: erneuern Longitudinal marks with a depth over 0.05 mm: replace
10	**Ventilrückstand / Ventilkegel TURBO-Motor** **Valve recess / Valve cones TURBO-engine**			
		8,970	8,952	8,945
		1,45	1,0	1,80
		Reparaturstufe siehe 5.3.4 Refurbishing grade see 5.3.4		

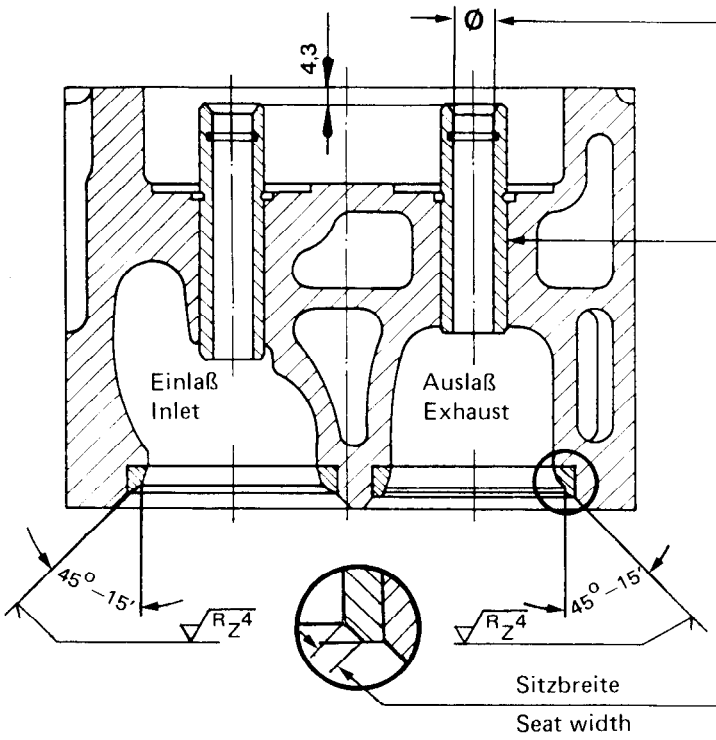
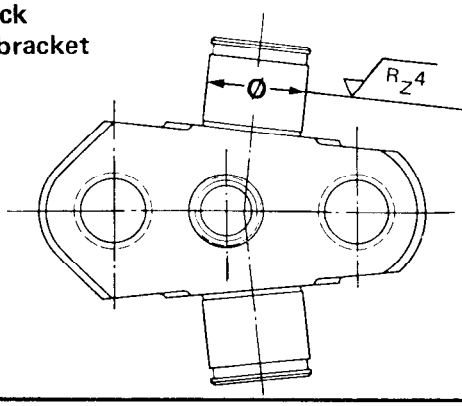
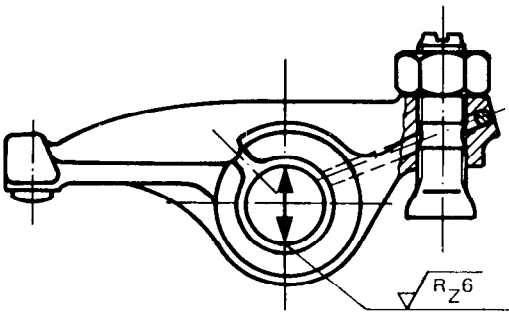
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Tabelle für Grenzmaße der Verschleißteile **5.2.11 – 5.2.12**
Table of limit dimensions for wearing parts

lfd. Nr. / Serial No.	Teil, Benennung / Part, Denomination	Abmessungen / Dimensions		
		Neuzustand / New state max. mm	Neuzustand / New state min. mm	Verschleißgrenze / Wear limit max. mm
11	**Ventilsitzring / Ventilführung** **TURBO-Motor** **Valve seat ring / Valve guide** **TURBO-engine**			
		9,015	9,000	9,060
				Preßsitz Press fit
	Sitzbreite Auslaß Seat width Exhaust	2,7	2,0	3,2
	Sitzbreite Einlaß Seat width Inlet	2,0	1,4	2,4
	Reparaturstufe siehe 5.3.4 Refurbishing grade see 5.3.4			
12	**Ventilrückstand / Ventilkegel** **Saug-Motor** **Valve recess / Valve cones** **Suction-engine**			
		8,970	8,952	8,945
		1,45	1,0	1,80
	Reparaturstufe siehe 5.3.4			

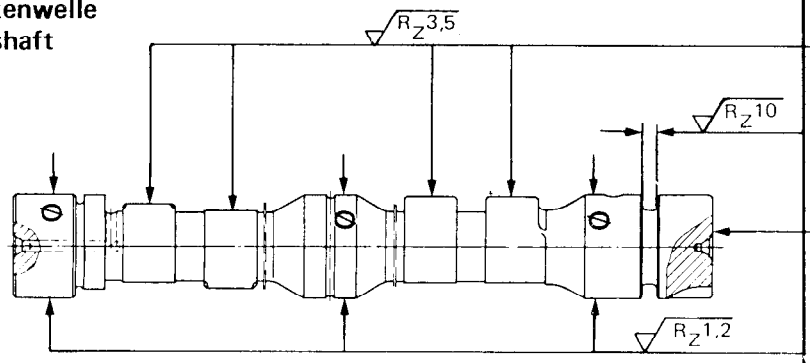
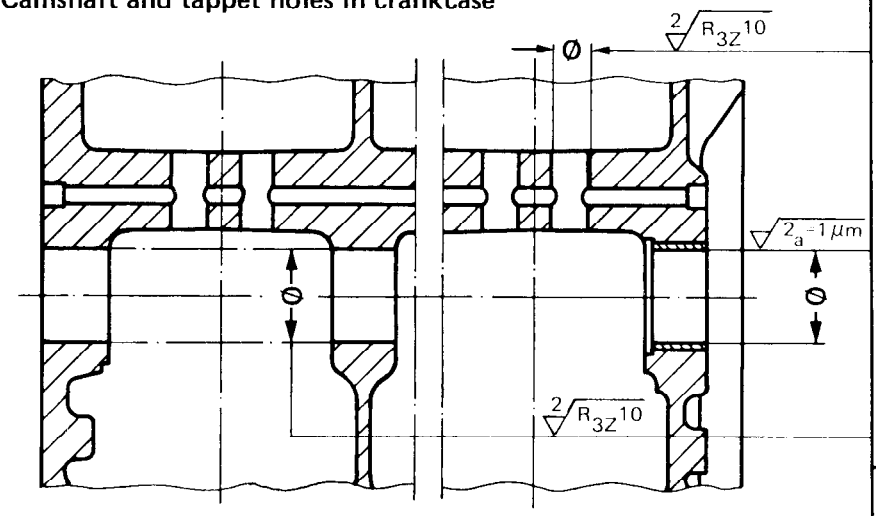
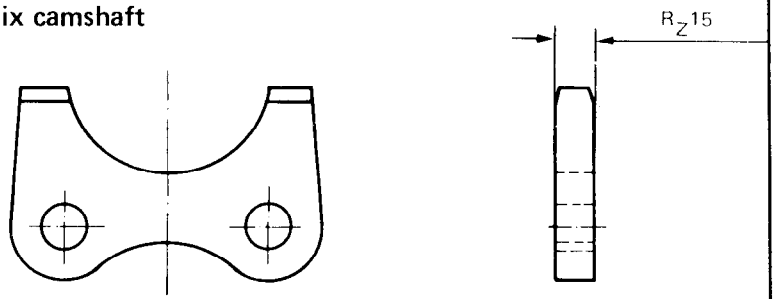
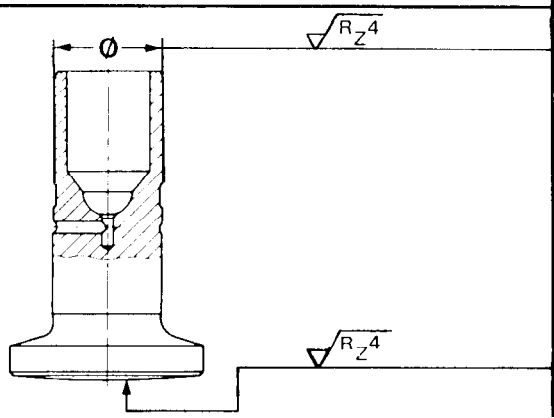
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Tabelle für Grenzmaße der Verschleißteile 5.2.13. – 5.2.15
Table of limit dimensions for wearing parts

lfd. Nr. / Serial No.	Teil, Benennung / Part, Denomination	Abmessungen / Dimensions		
		Neuzustand / New state		Verschleißgrenze / Wear limit
		max. mm	min. mm	max. mm
13	**Ventilsitzring / Ventilführung** **Saug-Motor** **Valve seat ring / Valve guide** **Suction-engine**			
		9,015	9,000	9,060 Preßsitz Press fit
		2,0	1,4	2,4
	Reparaturstufe siehe 5.3.4 Refurbishing grade see 5.3.4			
14	**Kipphebelbock** **Rocker-arm bracket**			
		15,984	15,966	15,950
15	**Kipphebel** **Rocker arm**			
		16,018	16,000	16,040

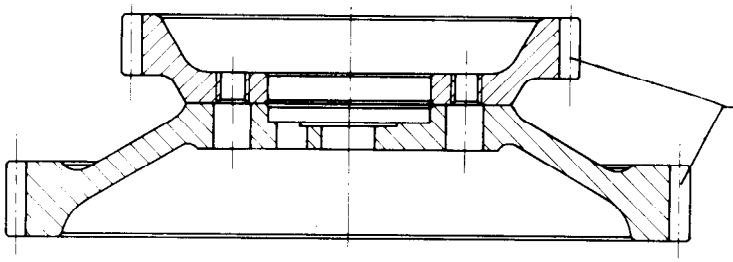
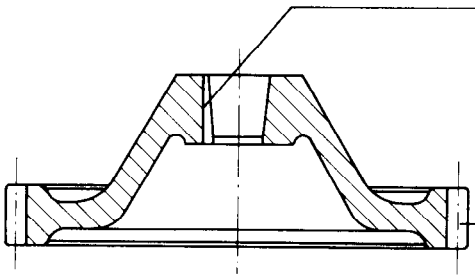
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Tabelle für Grenzmaße der Verschleißteile 5.2.16 – 5.2.19
Table of limit dimensions for wearing parts

lfd. Nr. / Serial No.	Teil, Benennung / Part, Denomination	Abmessungen / Dimensions		
		Neuzustand / New state max. mm	Neuzustand / New state min. mm	Verschleißgrenze / Wear limit max. mm
16	**Nockenwelle / Camshaft** 			Falls Verschleißspuren: erneuern / Replace if wear marks are visible.
		7,190	7,100	7,220
				Axialspiel in eingebautem Zustand gemessen: 0,4 mm / Axial clearance measured when installed: 0.4 mm
		46,960	46,940	46,920
	Reparaturstufe siehe 5.3.2 / Refurbishing grade see 5.3.2			
17	**Nockenwelle-und Stößelbohrungen im Kurbelgehäuse / Camshaft and tappet holes in crankcase** 			
		17,518	17,500	17,530
		47,045	46,990	47,060
		47,025	47,000	47,050
	Reparaturstufe siehe 5.3.3 / Refurbishing grade see 5.3.3			
18	**Segment für Nockenwellenfixierung / Key to fix camshaft** 	7,005	6,850	6,750
19	**Pilzstößel / Mushroom-head tappet** 	17,494	17,483	17,475
				Bei Pittingbildung: erneuern / Replace if pitting marks are visible.

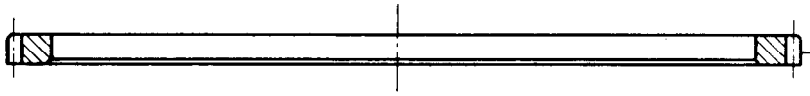
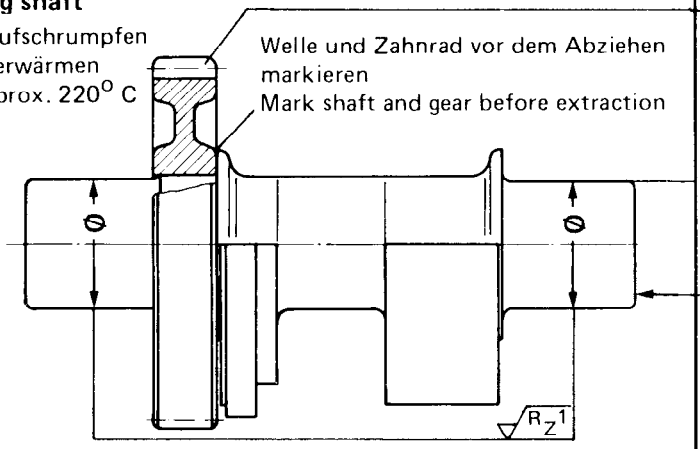
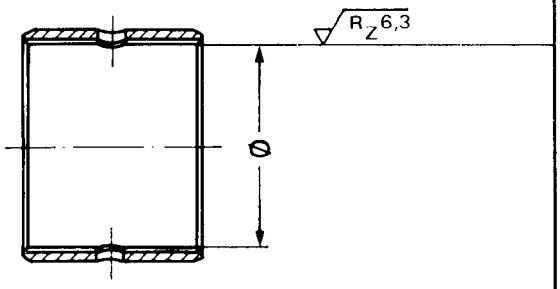
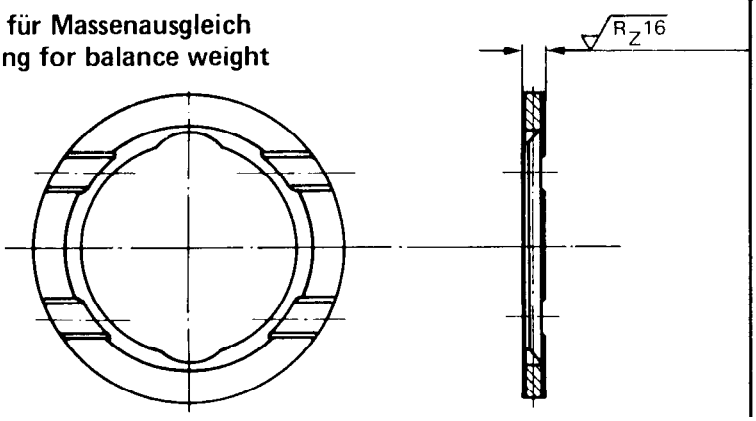
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Tabelle für Grenzmaße der Verschleißteile 5.2.20 – 5.2.22
Table of limit dimensions for wearing parts

lfd. Nr. / Serial No.	Teil, Benennung / Part, Denomination	Abmessungen / Dimensions		
		Neuzustand / New state		Verschleißgrenze / Wear limit
		max. mm	min. mm	max. mm
20	**Stirnzahnrad zum Nockenwellen- und Einspritzpumpenantrieb** **Spur gear for camshaft and injection pump drive** 			Falls Verschleißspuren: erneuern Replace if wear marks are visible.
21	**Stirnzahnrad auf Einspritzpumpenwelle** **Spur gear on injection pump shaft** 			Falls Nute oder Kegel beschädigt: erneuern Replace if groove or taper damaged Falls Verschleißspuren: erneuern. Replace if wear marks are visible.
22				

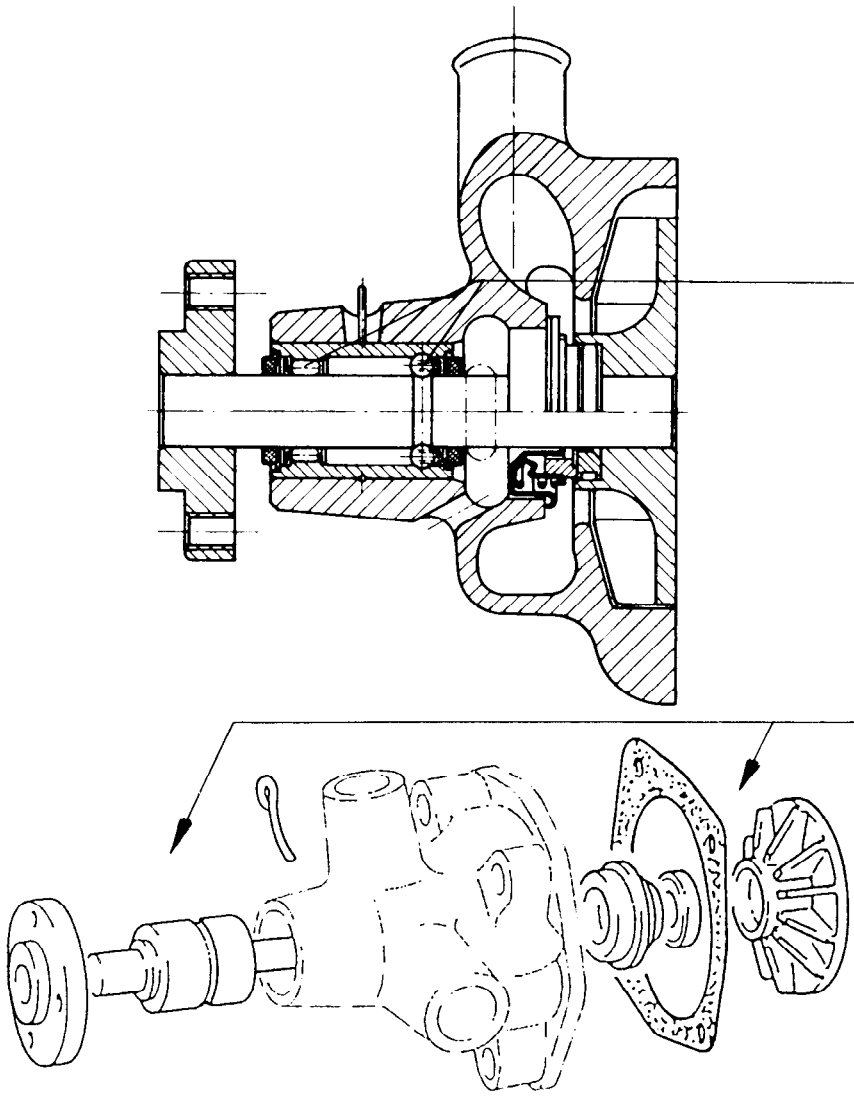
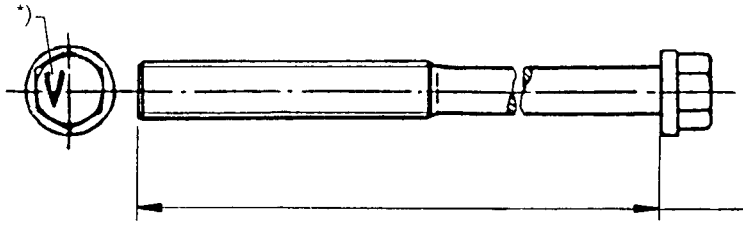
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Tabelle für Grenzmaße der Verschleißteile 5.2.23 – 5.2.26
Table of limit dimensions for wearing parts

lfd. Nr. / Serial No.	Teil, Benennung / Part, Denomination	Abmessungen / Dimensions		
		Neuzustand / New state		Verschleißgrenze / Wear limit
		max. mm	min. mm	max. mm
23	**Zahnkranz auf Schwungrad** **Ring gear on flywheel**  Zahnkranz zum Aufschrumpfen gleichmäßig auf 200 bis 250° C erwärmen. Heat rim gear uniformly up to 200 - 250° C for shrink-fit.			Bei beschädigten Zähnen und bei verschlissenen Zahnflanken: Zahnkranz erneuern. If the toothing is damaged or the tooth flanks worn: replace ring gear .
24	**Welle für Massenausgleich** **Mass balancing shaft** Zahnrad zum Aufschrumpfen auf ca. 220° C erwärmen Heat gear to approx. 220° C for shrink-fit  	33,975	33,950	33,940 Falls Verschleißspuren: erneuern Replace if wear marks are visible Axialspiel im eingebauten Zustand gemessen: 0,5 mm Axial clearance measured when installed: 0.5 mm
25	**Lagerbuchse für Massenausgleich** **Bearing bush for balance weight**  	34,050	34,010	34,080 in eingebautem Zustand gemessen measured when installed
26	**Lagerring für Massenausgleich** **Bearing ring for balance weight**  	3,55	3,45	3,35

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Tabelle für Grenzmaße der Verschleißteile **5.2.27 – 5.2.28**
Table of limit dimensions for wearing parts

lfd. Nr. / Serial No.	Teil, Benennung / Part, Denomination	Abmessungen / Dimensions		
		Neuzustand / New state		Verschleißgrenze / Wear limit
		max. mm	min. mm	max. mm
27	**Wasserpumpenlager, Wasserpumpen-Reparatursatz** **Water-pump bearing, Water-pump repair kit**			Falls fühlbare Lagerluft oder Undichtheit: If bearing shows signs of play or leaking:
				"Reparatursatz" "Repair kit"
28	**Zylinderkopfschrauben** **Cylinder head screws**			Vor jeder Wiederverwendung messen gegebenenfalls erneuern (siehe Seite 45) Measure before reuse - if necessary renew (see page 45)
		158,5	158,0	160,5

*) Symbol für Drehwinkel-Anziehmethode
*) Symbol for angel-rotation-tightening method

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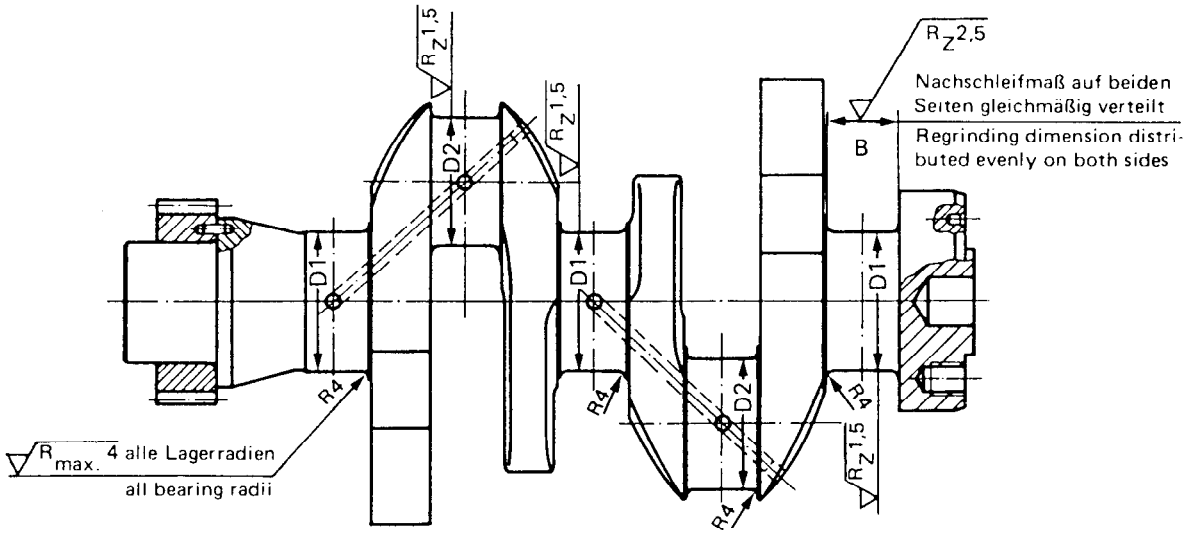
5.3 Reparatur - Schleifmaße

Einige Motorteile, die das zulässige Verschleißmaß erreicht haben, können zur Weiterverwendung nachgearbeitet werden.
Diese Nacharbeit erfolgt gemäß der nachstehenden Maßtabellen. Die jeweils erforderlichen Einbauteile sind bei den entsprechenden Reparaturstufen aufgeführt.

5.3 Refurbishing gracles

Some engine components, which have already reached the no-go dimension, can be refurbished for further use. Refurbishing must be made in accordance with the following dimensions tables, the necessary items being listed according to the corresponding refurbishinggrades.

5.3.1 Kurbelwelle
Crankshaft



Wir empfehlen
die Lagerzapfen (D 1 und D 2) der Kurbelwelle jeweils auf gleiche Reparaturstufe nachzuschleifen, um den Einbau von falschen Lagerschalen zu vermeiden.

Maß B entsprechend der untenstehenden Tabelle nachschleifen.

It is recommended:
To prevent wrong bearing shells from being mounted to regrind each crankshaft journal (i. e. D 1 and D 2) to the same repair stage.

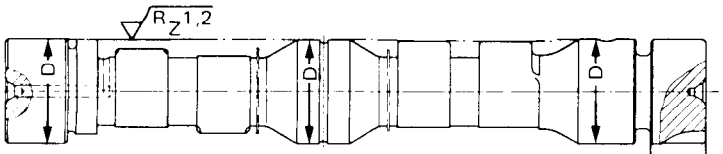
Regrind dimension B in accordance with the following table.

Stufe Grade	D 1	dazugehörige Hauptlager corresponding main bearings	B	dazugehörige Anlaufringe corresponding ring halves
neu new	69,97 - 69,951	301 00 01 0755	36,00 - 36,05	s = 3,43 301 00 01 0754
1	69,72 - 69,701	301 00 01 0737	36,20 - 36,25	s = 3,53 301 00 01 0701
2	69,47 - 69,451	301 00 01 0738	36,40 - 36,45	s = 3,63 301 00 01 0702
3	69,22 - 69,201	301 00 01 0739		
4	68,97 - 68,951	301 00 01 0740	36,60 - 36,65	s = 3,73 301 00 01 0711

Stufe Grade	D 2	dazugehörige Pleuellager corresponding big-end bearings
neu new	62,97 - 62,951	301 00 03 0714
1	62,72 - 62,701	301 00 03 0709
2	62,47 - 62,451	301 00 03 0710
3	62,22 - 62,201	301 00 03 0711
4	61,97 - 61,951	301 00 03 0712

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5.3.2 Nockenwelle
Camshaft



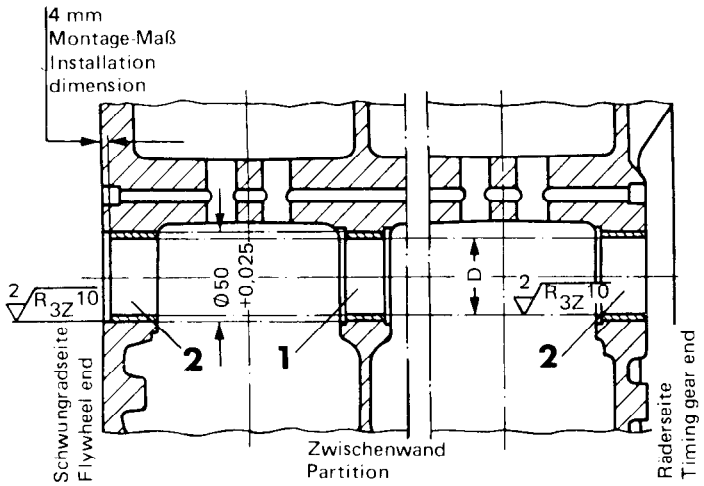
Hier nicht nachschleifen, da der Durchmesser als Sitz für Nockenwellen- und Einspritzpumpenantriebsrad erhalten bleiben muß.

Do not grind here because diameter is to be maintained as seating for camshaft and injection pump drive gears.

Stufe Grade	D
Standardmaß Standard dimension	46,96 - 46,94
Untermaßstufe Undersize stage	46,66 - 46,64

5.3.3 Kurbelgehäuse-Nockenwellenbohrung
Camshaft bore in crankcase

Pos.	Stückzahl Quantity		dazugehörige Lagerbüchsen corresponding bearing bushes
1	2	3	301 00 05 0716
2	2	2	301 00 05 0715
	3-Zyl.	4-Zyl.	



1. Nockenwellenbohrungen aufbohren

1. Verschlußdeckel am schwungradseitigen Lager abbauen.
2. Lagerbuchse auf der Räderseite ausdrücken.
3. Außer Räderseite alle Lagerbohrungen auf Maß Ø 50 $^{+0,025}$ aufbohren. Oberflächengüte beachten.
4. Scharfe Bohrungskanten entgraten max. 0,5 x 45°.

2. Lagerbuchsen einbauen

1. Lagerbuchsen einpressen. Darauf achten, daß sich die Schmierölbohrungen in Kurbelgehäuse und Lagerbuchse decken. Montagemaß 4 mm bei Pos. 2 beachten.
2. Lagerbuchsen feinbohren. Oberflächengüte be achten.

Stufe	D
Standardmaß	47 $^{+0,025}$
Untermaßstufe	46,70 $^{+0,025}$

Zulässige Unparallelität der Nockenwellenbohrung zur Kurbelwellenachse auf Gehäuselänge 0,05 mm.

3. Scharfe Bohrungskanten entgraten max. 0,5 x 45° Ölbohrungen durchspülen und Lagerbohrungen reinigen.

1. Reboring camshaft bores

1. Remove closing cover on bearing attached at flywheel end.
2. Press out bushing at gear end.
3. Except at gear end, all bearing bores must have a dia. of 50 $^{+0,025}$. Observe surface quality.
4. Burr sharp bore edges max. 0.5 x 45°.

2. Installing bushings

1. Press in bushings. Be careful that the lubricating-oil bores inside the crankcase and bushing coincide with one another. Observe installation dimension of 4 mm for Pos. 2.
2. Finebore bushings. Observe surface quality.

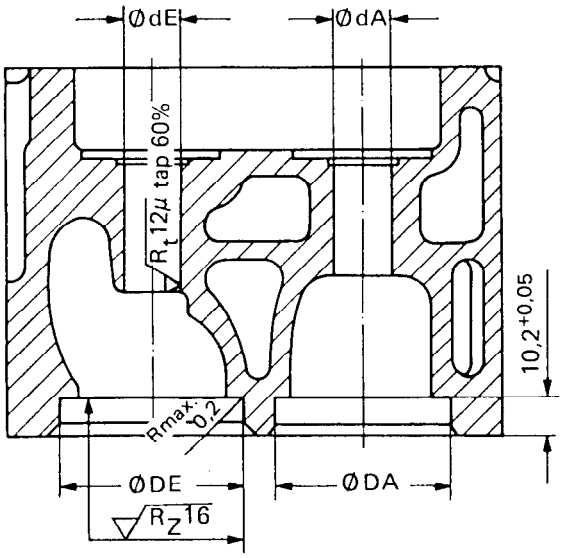
Grade	D
Standard dimension	47 $^{+0.025}$
Undersize stage	46,70 $^{+0.025}$

Permissible deviation of camshaft bores from crankshaft axis on crankcase length 0.05 mm.

3. Burr sharp bore edges max. 0.5 x 45°. Flush oil bores and clean bearing bores.

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5.3.4 Zylinderkopf, Ventilführungen und Ventilsitzringe Saug-Motor
Cylinder head, valve guides and valve seat rings suction engine



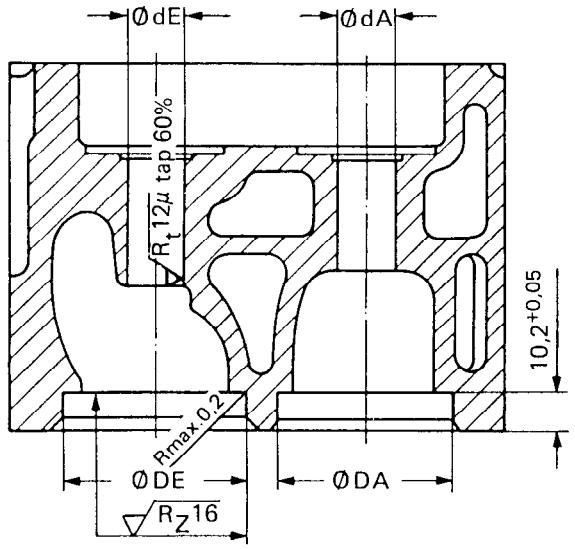
Stufe Grade	d E	dazugehörige Ventilführung Einlaß corresponding valve guides inlet
neu/new	15,010 - 15,021	301 00 04 0707
1	15,110 - 15,121	301 00 04 0714
2	15,210 - 15,221	301 00 04 0712

Stufe Grade	d A	dazugehörige Ventilführung Auslaß corresponding valve guides exhaust
neu/new	15,010 - 15,021	301 00 04 0706
1	15,110 - 15,121	301 00 04 0713
2	15,210 - 15,221	301 00 04 0715

Stufe Grade	DE	dazugehöriger Ventilsitzring Einlaß corresponding valve seat ring inlet
neu/new	48,00 - 48,016	301 42 04 0701
1	48,20 - 48,216	302 00 04 0719

Stufe Grade	DA	dazugehöriger Ventilsitz Auslaß corresponding valve seat ring exhaust
neu/new	45,00 - 45,016	301 00 04 0716
1	45,20 - 45,216	301 00 04 0720

5.3.4.1 Zylinderkopf, Ventilführungen und Ventilsitzringe Turbo-Motor
Cylinder head, valve guides and valve seat rings turbo-engine



Stufe Grade	dE	dazugehörige Ventilführung Einlaß corresponding valve guides inlet
neu/new	15,010 - 15,021	301 00 04 0707
1	15,110 - 15,121	301 00 04 0714
2	15,210 - 15,221	301 00 04 0712

Stufe Grade	dA	dazugehörige Ventilführung Auslaß corresponding valve guides exhaust
neu/new	15,010 - 15,021	301 00 04 0706
1	15,110 - 15,121	301 00 04 0713
2	15,210 - 15,221	301 00 04 0715

Stufe Grade	DE	dazugehörige Ventilsitzringe Einlaß corresponding valve seating inlet
neu/new	48,00 - 48,016	301 82 04 0702
1	48,20 - 48,216	301 00 04 0719

Stufe Grade	DA	dazugehöriger Ventilsitzring Auslaß corresponding valve seat ring exhaust
neu/new	45,00 - 45,016	301 00 04 0716
1	45,20 - 45,216	301 00 04 0720

Reparaturfolge:

1. Ventilsitzringe an einer Stelle auf geringe Wanddicke ausschleifen bis Vorspannung abgebaut und Ventilsitzringe aushebeln.
   Achtung: Auflagebund im Zylinderkopf nicht beschädigen.
2. Ventilführungen mit Ausschlagdorn austreiben.
3. Aufnahmebohrungen für Ventilsitzringe und Ventilführungen gegebenenfalls entsprechend Reparaturstufe nacharbeiten.
4. Ventilführungen bis zur Auflage des Sprengringes in den Zylinderkopf einpressen.
5. Ventilsitzringe in flüssigem Stickstoff unterkühlt in den Zylinderkopf einlegen und nachpressen.
6. Ventilsitzringe (nur Stufe 1) fertig bearbeiten. Siehe Abschnitt 5.2.10 bis 5.2.13.

Repair sequence.

1. Drill out valve-seat rings at one thin-walled point until pretension is reduced and lift off valve-seat rings.

   Caution: The supporting collar inside the cylinder head should not get damaged.
2. Eject valve guides using a mandrel.
3. Regrind supporting bores for valve-seat rings and valve guides to the appropriate repair stage, if necessary.
4. Press in the valve guides into the cylinder head as far as the contact area of the circlip.
5. Insert valve seat rings supercooled in liquid nitrogen into the cylinder head, and press them in hard.
6. Finish griunding in valve seat rings (only for Stage 1). See Sections 5.2.10 to 5.2.13.

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6. Zusammenbau des Motors

6.1 Allgemeine Hinweise

- Verschleißteile erneuern, Ersatzteilnummern für die Nachbestellung aus Ersatzteilliste entnehmen.
- Beim Zusammenbau auf peinliche Sauberkeit achten.
- Alle Gleitflächen an Lagern, Wellen, Zahnrädern, Hebeln, sowie Kolben und Zylinderlaufbuchse (innen) mit sauberem Motoröl einölen.
- Der Zusammenbau erfolgt sinngemäß in umgekehrter Reihenfolge wie das Zerlegen.
- Folgende weitere Punkte hierbei beachten.

6.2 Anzugsmomente für Schraubverbindungen

6.3 Lagerspiel prüfen

6.4 Zahnräder einstellen

6.5 Verdrehflankenspiel prüfen

6.6 Düse zur Kolbenkühlung ausrichten

6.7 Zylinderbuchsenüberstand kontrollieren

6.8 Kolbenüberstand kontrollieren

6.9 Zylinderköpfe montieren

6.10 Anziehvorschrift der Zylinderköpfe-Drehwinkelmethode

6.11 Förderbeginn prüfen

6.12 Verdichtungsdruck prüfen

6.13 Wellendichtringe erneuern

6. Engine assembly

6.1 General remarks

- Replace worn parts, referring to spare-parts list for order numbers (spare-part numbers).
- Take care to ensure maximum cleanliness when assembling.
- Lubricate all sliding surfaces on bearings, shafts, gears, levers, as well as piston and cylinder liner (inside) with clean engine oil.
- Assembly is carried out in the reverse sequence to that of dismantling.
- Following procedures are described in more detail in the following.

6.2 Screw and bolt tightening torques

6.3 Checking bearing play

6.4 Setting timing

6.5 Adjusting backlash

6.6 Adjust nozzle for piston cooling

6.7 Checking cylinder-liner projection

6.8 Checking piston projection

6.9 Mounted cylinder heads

6.10 Order of tightening the cylinder heads - angle-rotation method

6.11 Checking commencement of delivery

6.12 Checking compression pressure

6.13 Renewing shaft seals

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6.2 Anzugsmomente für Schraubverbindungen

Nur mit richtigem Drehmoment angezogene Schraubverbindungen gewährleisten sichere Befestigung der Bauteile, sowie zulässige Beanspruchung der Schrauben. Deshalb Schrauben sorgfältig nach dieser Vorschrift anziehen.

Pos.	Schraubverbindungen	Gewinde / Werkstoff	Anzugsmoment in Nm
1	Schraube für Zylinderkopfbefestigung ◢	Spezialschrauben	1. Schrauben von Hand anlegen 2. mit 30 Nm vorziehen 3. Festspannwinkel 1. Stufe 120 ° 4. Festspannwinkel 2. Stufe 120 ° (2 Sechskant = 120 °)
2	Schraube für Lagerdeckelbefestigung (Hauptlager) ◢	M 14 - 10.9	1. mit 70 Nm vorziehen 2. Festspannwinkel 90 ° (1,5 Sechskant = 90°)
4	Schraube für Schwungradbefestigung auf Kurbelwelle	M16 - 10.9	295
5	Schraube für Nabe auf Kurbelwelle	M16 - 10.9	250
6	Schraube für Keilriemenscheibe auf Nabe	M10 - 10.9	70
8	Schraube für Nockenwellenradbefestigung u. Schraube zwischen Nockenwellen- u. Einspritzpumpenrad	Durlok M 8 - 12.9	60
	Mutter auf Bosch-Einspritzpumpenwelle	M 14 x 1,5	100
10	Pleuelschraube ◢ nur 1 x verwenden	M 12 x 1,5 - 12.9	1. mit 30 Nm vorziehen 2. Festspannwinkel 60 ° (1 Sechskant = 60 °)
11	Schraube für Schwungradgehäusebefestigung	M 12 - 12.9 M 10 - 12.9	145 85
12	Schraube für Ölwannenbefestigung	M 8 - 8.8	25
	Schraube für Massenausgleichsbefestigung	M 10 - 8.8	40
	Schraube für Ölpumpenbefestigung Stiftschraube mit selbstsichernder Mutter	Durlok M 8 - 12.9 M 8 - 8.8	40 25
15	Schraube für Kipphebelbockbefestigung	M 10 - 8.8	45
16	Mutter für Kipphebel-Einstellschraube	M 9 x 1	25
17	Schraube für Zylinderkopfhaube	M 8 - 8.8	15
18	Druckventilhalter in der Einspritzpumpe		37
19	Überwurfmutter an Kraftstoffdruckleitung (am Einspritzventil mit einem Schlüssel gegenhalten).	M 14 x 1,5	25
20	Mutter für Einspritzventilbefestigung	M 8	15
	Schraube für Hydraulikpumpenbefestigung	M10 - 10.9 M 8 - 10.9	65 35
	Mutter für Keilriemenscheibe am Drehstromgenerator	M 14	40

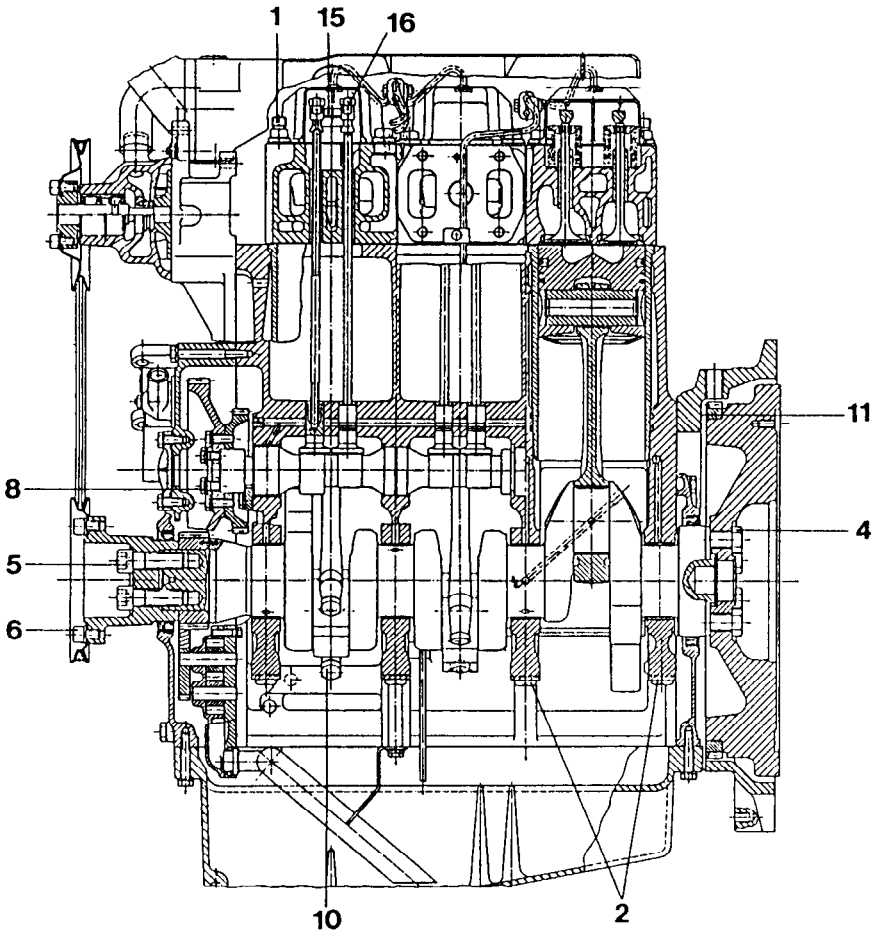
unter diesen Nummern ist in 6.2.1 die Lage der Schraubverbindungen ersichtlich

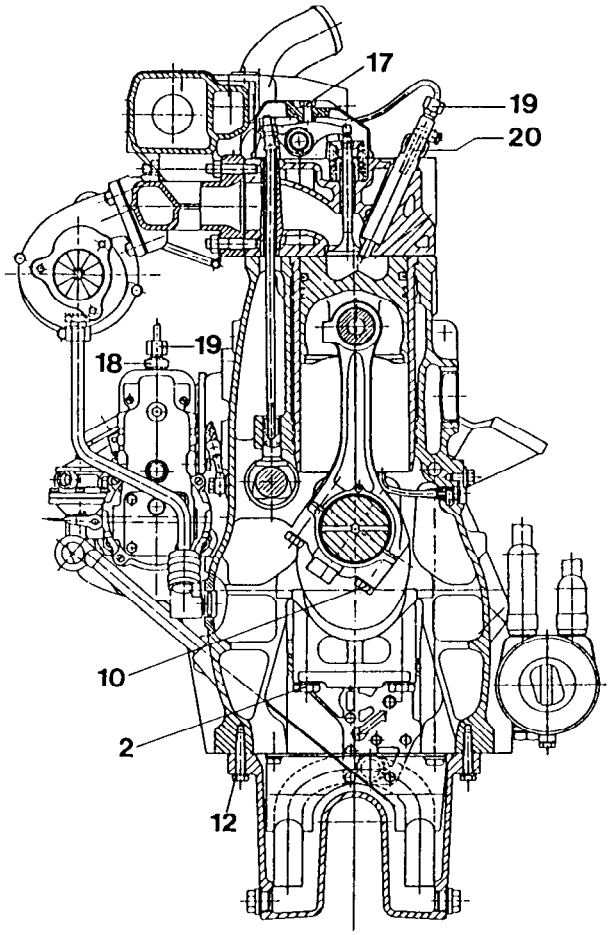
Alle von außen nicht zugänglichen Schraubverbindungen sorgfältig auf festen Anzug prüfen.

◢ = Drehwinkelmehtode (Das Nachziehen der Zylinderkopfschrauben entfällt dadurch - siehe 6.10 - Seite 45)

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6.2.1 Lage der Schraubverbindungen
Locations of screws and bolts





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6.2 Screw and bolt tightening torques

Only screw unions tightened to the correct torque will ensure a safe attachment of the components as well as permissible stresses on the screws. Consequently, the screws should carefully be tightened in accordance with this specification.

Pos.	Screw connections	Thread / material	Tightening torque Nm
1	Screw for head cylinder ◢	Spezialschrauben	1. Put on screws by hand 2. Pretighten to 30 Nm 3. Tightening angle 1st step 120 ° 4. Tightening angle 2nd step 120 ° (2 hexagon = 120 °)
2	Screw for bearing-cover mounting (Hauptlager) ◢	M 14 - 10.9	1. Pretigthen to 70 Nm 2. Tightening angle 90° (1,5 hexagon = 90°)
4	Screw for flywheel mounting on crankshaft	M16 - 10.9	295
5	Screw for hub on crankshaft	M16 - 10.9	250
6	Screw for V-belt pulley on hub	M10 - 10.9	70
8	Screw camshaft-gear mounting and screw between camshaft and injection-pump gear	Durlok M 8 - 12.9	60
	Nut on Bosch injection-pump shaft	M 14 x 1,5	100
10	Connecting-rod bolt ◢ nur 1 x verwenden	M 12 x 1,5 - 12.9	1. Pretighten to 30 Nm 2. Tightening angle 60° (1 hexagon = 60°)
11	Screw on flywheel-housing mounting	M 12 - 12.9 M 10 - 12.9	145 85
12	Screw for oil-pan mounting	M 8 - 8.8	25
	Screw for mounting mass-balancing device	M 10 - 8.8	40
	Screw for oil-pump mounting Stud with self-securing nut	Durlok M 8 - 12.9 M 8 - 8.8	40 25
15	Screw for rocker-arm bracket mounting	M 10 - 8.8	45
16	Nut for rocker-arm adjusting screw	M 9 x 1	25
17	Screw for cylinder-head cover	M 8 - 8.8	15
18	Delivery-valve holder in injection pump		37
19	Union nuts on fuel-delivery line (hold up at injection valve using a wrench).	M 14 x 1,5	25
20	Nut for injection-valve mounting	M 8	15
	Screw for hydraulic pump mounting	M10 - 10.9 M 8 - 10.9	65 35
	Nut for V-belt pully on alternator	M 14	40

the location of these bolted connections is identified by these numbers under 6.2.1.

Carefully check all bolted joints not accessible from outside for tightness.

◢ = Angle-rotation method (Retightening of the cylinder head screws is omitted by it - see 6.10 - page 45)

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6.3 Lagerspiel prüfen (mit Meßuhr bzw. Fühlerlehre)
Checking bearing play (using dial and feeler gauges)

Lagerspiele	Bearing play	radial/radially (mm)	axial/axially (mm)
Hauptlager	Main bearing	0,08 - 0,11	
Anlaufringe	Ring halves		0,04 - 0,25
Pleuellager	Big-end bearing	0,07 - 0,10	0,30 - 0,50
Pleuelbüchse/Kolbenbolzen	Small-end bush/gudgeon pin	0,03 - 0,08	
Nockenwellenlager	Camshaft bearing	0,04 - 0,08	0,10 - 0,29
Massenausgleichslager	Mass balancing bearing	0,03 - 0,07	0,20 - 0,40

6.4. Zahnräder einstellen

Zum einwandfreien Motorbetrieb müssen die Zahnräder auf der Kurbelwelle und den Massenausgleichswellen korrekt montiert und im definierten Eingriff miteinander stehen. Die Montage der Zahnräder auf den Wellen ist in Abschnitten 5.2.1, 5.2.2 und 5.2.24 beschrieben. Das Nockenwellenzahnrad hat ungleiche Lochabstände im Lochkreis zum Anflanschen an der Nockenwelle und kann daher nur in richtiger Lage angeflanscht werden. Das Stirnzahnrad zum Antrieb der Einspritzpumpe auf der Nockenwelle ist hinter dem Nockenwellenrad angeflanscht.

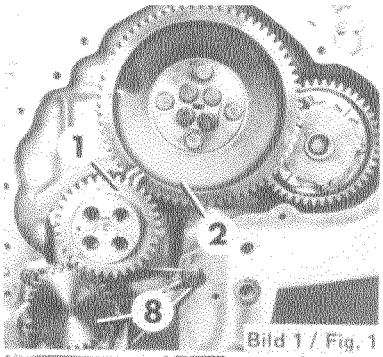


Bild 1 / Fig. 1

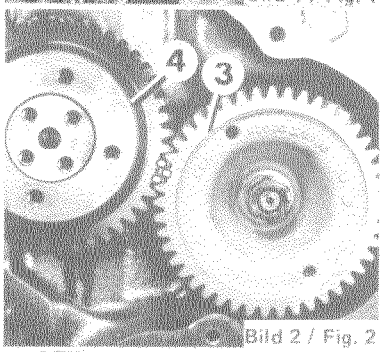


Bild 2 / Fig. 2

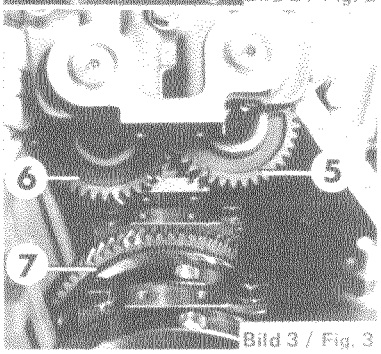


Bild 3 / Fig. 3

Beim Zusammenbau müssen folgende Zahnmarkierungen übereinstimmen:

1. 0-Markierung des Kurbelwellenzahnrades 1 mit 0 - 0 Markierung des Nockenwellenzahnrades 2 (Bild 1).
2. 0-Markierung des Einspritzpumpenrades 3 mit 0-0 Makrierung auf dem Antriebsrad 4 auf der Nockenwelle (Bild 2).

*3. 1-1Markierung auf Ausgleichswellenrad 5 mit der 1-Markierung auf Ausgleichswellenrad 6 (Bild 3).

*4. 0-0 Markierung auf dem Zahnkranz 7 mit 0-Markierung auf Ausgleichswellenrad 6 (Bild 3)

5. Die Stellung des Ölpumpenrades 8 sowie die des Hydraulikpumpenrades sind beliebig (Bild 1).

* Nur bei 4-Zylinder Motoren mit Massenausgleich.

6.4. Setting timing

For proper operation, the gears must correctly be mounted on the crankshaft and mass-balancing shafts and mesh with one another.

Please refer to sections 5.2.1, 5.2.2 and 5.2.24 for attachement of the gears to the shafts. The camshaft gear has different hole separations within the pitch circle to flange it to the camshaft and can, therefore, be mounted in the right position only. The spur gear for driving the injection pump on the camshaft is flanged to the back of the camshaft gear.

The following tooth marks must coincide for assembly:

1. 0-marking on crankshaft gear 1 with 0-0 marking on camshaft gear 2 (Fig. 1).
2. 0-marking on injection-pump gear 3 with 0-0 marking on drive gear 4 on camshaft (Fig. 2).

*3. 1-1 marking on balancing-shaft gear 5 with 1 marking on balancing-shaft gear 6 (Fig. 3).

*4. 0-0 marking on ring gear 7 with 0-marking on balancing-shaft gear 6 (Fig. 3).

5. Arrangement of oil-pump gear 8 as well as of hydraulic pump gear free (Fig. 1).

* On 4-cylinder engines with balancing applianes only.

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6.5. Verdrehflankenspiel prüfen

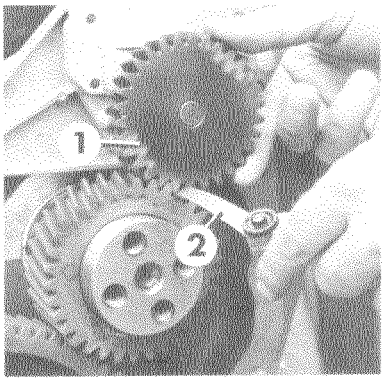
Zahnradpaarung	Flankenspiel (mm)
Ölpumpe/Kurbelwelle	
Betriebslage	0,2
Motor kopfstehend	0,3
Nockenwelle/Kurbelwelle	0,12-0,28 [1]
Nockenwelle/Einspritzpumpe	0,12-0,28 [1]
Nockenwelle/Hydraulikpumpe	0,11-0,27
Massenausgleich/Kurbelwellenrad	
Betriebslage	0,2
Motor kopfstehend	0,3

[1] nur Kontrollmaß, nicht einstellbar

6.5. Adjusting backlash

Gear pairs	Backlash (mm)
Oil pump/crankshaft	
Working position	0,2
Engine on its head	0,3
Camshaft/crankshaft	0,12-0,28 [1]
Camshaft/injection pump	0,12-0,28 [1]
Camshaft/hydraulic pump	0,11-0,27
Balance weight/crankshaft gear	
Working position	0,2
Engine on its head	0,3

[1] reference size only, not adjustable

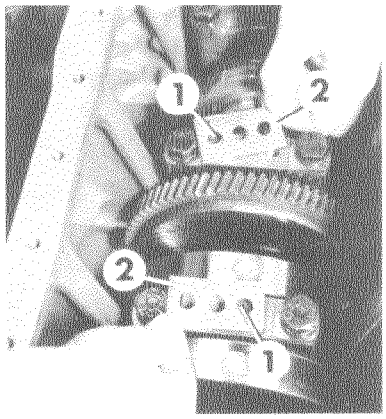


Verdrehflankenspiel einstellen am Ölpumpenzahnrad

1. Befestigungsschrauben an der Ölpumpe (3 Stück) lösen.
2. Verdrehflankenspiel am Ölpumpenzahnrad 1 mit Fühlerlehre 2 einstellen.
3. Nach richtig eingestelltem Flankenspiel Befestigungsschrauben festziehen.
   Anzugsvorschrift Abs. 6.2. beachten.

Adjusting backlash on oil-pump gear

1. Slacken fastening secrews on oil pump (3 screws).
2. Adjust backlash on oil-pump gear 1 using feeler gauge 2.
3. Tighten fastening screws after correct backlash adjustment.
   Observe tightening specification, section 6.2.



am Massenausgleich

1. In die Gewindelöcher 1 über Kreuz 2 Montagebolzen (siehe Spezialwerkzeug 1.11) einschrauben, damit sich die Beilagebleche nicht verschieben.
2. Beidseitig 3 Beilagebleche 2 mit 0,1 mm Dicke auflegen.
3. Massenausgleich in Zahnmarkierungen aufsetzen.
4. Mit 2 Sechskantschrauben festziehen.
5. Verdrehflankenspiel messen.
6. Durch herausnehmen von Beilagebleche wird das Flankenspiel verringert, durch Einlegen vergrößert.
7. Bei richtig eingestelltem Flankenspiel Montagebolzen entfernen und Sechskantschrauben einschrauben.
8. Alle Schrauben mit Drehmomentschlüssel festziehen. Anzugsvorschriften 6.2 beachten

on balance weight

1. Screw two mounting bolts (see special tool 1.11) crosswise into threaded holes 1 so that shims cannot shift.
2. Fit three 0,1 mm thick shims 2 at each side.
3. Position balance weight at tooth marks.
4. Fasten with 2 hexagon bolts.
5. Measure backlash.
6. Remove shims to reduce backlash, and fit more shims to increase it.
7. Remove mounting bolts after setting correct backlash and screw hex. bolts.
8. Tighten all bolts using torque wrench. Observe tightening torque, section 6.2

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6.6

Düse zur Kolbenkühlung ausrichten

1. Gerade gerichteter Stahldraht 1 von 2 mm Ø (Bild 1) in die Öffnung des Düsenrohres 2 (Bild 2) einstecken.
2. An der Oberkante des Kurbelgehäuses Maße nebenstehender Zeichnungen kontrollieren.

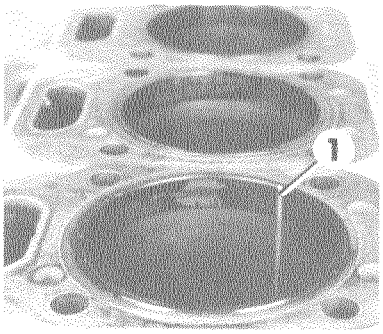


Bild 1
Fig. 1

Düse links von Zylindermitte (Bild 3)

am 3-Zylinder-Motor:
Zylinder 2 und 3

am 4-Zylinder-Motor:
Zylinder 2 und 4

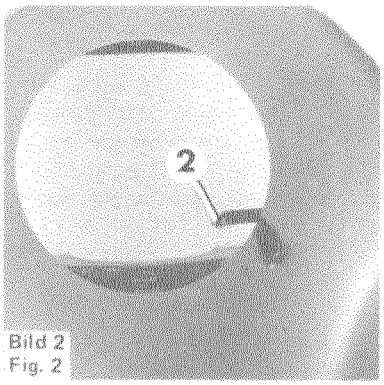


Bild 2
Fig. 2

Düse rechts von Zylindermitte (Bild 4)

am 3-Zylinder-Motor:
Zylinder 1

am 4-Zylinder-Motor:
Zylinder 1 und 3

3. Bei größeren Abweichungen Düsenrohrende vorsichtig mit Zange nachrichten.

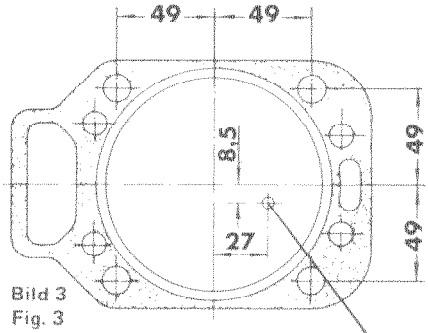


Bild 3
Fig. 3

Düse links von Zylindermitte
Nozzle on lefthand side of cylinder centre

Spritzpunkt an Oberkante Kurbelgehäuse

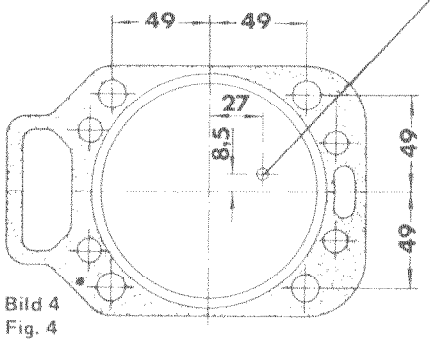


Bild 4
Fig. 4

Düse rechts von Zylindermitte
Nozzle on righthand side of cylinder centre

Adjusting nozzle for piston cooling

1. Insert a straightened steel wire 1 of 2 mm dia. (Fig. 1) into the orifice of nozzle pipe 2 (Fig. 2).
2. Check dimensions mentioned on opposite drawings at upper edge of crankcase.

Nozzle on lefthand side of cylinder centre (Fig. 3)

for 3-cylinder engine:
cylinder 2 and 3

for 4-cylinder engine:
cylinder 2 and 4

Nozzle on righthand side of cylinder centre (Fig. 4)

for 3-cylinder engine:
cylinder 1

for 4-cylinder engine:
cylinder 1 and 3

3. In case of larger deviations, readjust nozzle pipe tip carefully using pliers.

Spraying point at upper edge of crankcase

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6.7

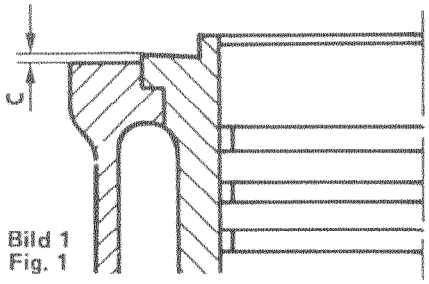


Bild 1
Fig. 1

Zylinderbuchsenüberstand kontrollieren

Der Zylinderbuchsenüberstand ist das Maß zwischen oberer Planfläche des Kurbelgehäuses und der Zylinderlaufbuchse (Bild 1 Maß "c"). Dieses Maß wird mit der Meßuhr und TSW 5610 gemessen und muß betragen:

0,03 bis 0,10 mm

Auflagefläche gereinigt und ohne O-Ringe an der höchsten Stelle der Büchse gemessen.

Checking cylinder-liner projection

The cylinder-liner projection is the amount by which the top face of the cylinder liner projects beyond that of the crankcase (Fig. 1, dimension "c"). This dimension is to be measured with a dial gauge and TSW 5610 and must amount to:

0.03 to 0.10 mm

Base surface cleaned and measured without O-Ring at the highest point of the liner.

6.8

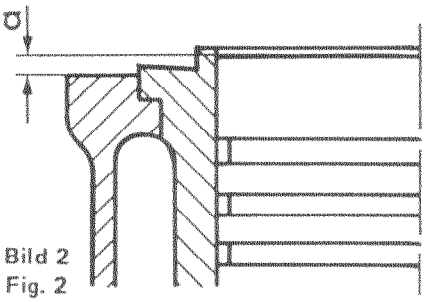


Bild 2
Fig. 2

Kolbenüberstand kontrollieren

Der Kolbenüberstand ist das Maß zwischen oberer Planflache des Kurbelgehäuses und oberer Kolben-fläche (Bild 2 Maß "a"). Dieses Maß wird mit der Meßuhr gemessen und muß betragen:

0,25 bis 0,57 mm

Messen oberhalb vom Kolbenbolzen = Längsachse des Motors (wegen Kippen des Kolbens).

Checking piston projection

The piston projection is the amount by which the top piston face projects beyond the top face of the crankcase (Fig. 1, dimension "a"). This dimension is to be measured with a dial gauge and must amount to:

0.25 to 0.57 mm

Measuring device above piston pin = longitudinal axis of engine (due to tilt of piston).

6.9

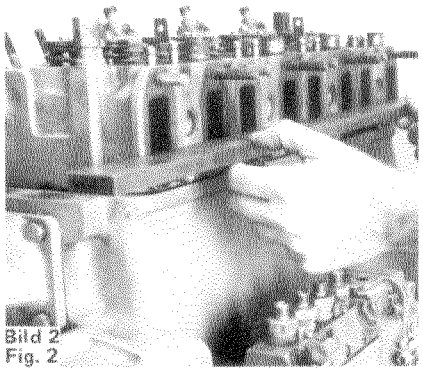


Bild 2
Fig. 2

Zylinderköpfe montieren

1. Alle Zylinderkopfdichtungen (Top = oben) auf das Kurbelgehäuse auflegen.
2. Zylinderköpfe aufsetzen. Schrauben mäßig anziehen. Dabei auf plane Auflage achten.
3. Zylinderköpfe nach den Flächen der Ansaug- und Abgaskanäle ausrichten (Bild 2) bzw. Kühlwasser-Luftsammler und Auspuffkrümmer montieren und dadurch die Zylinderköpfe ausrichten.
4. Zylinderkopfschrauben mit 30 Nm vorziehen.
5. 2 x 120° nachdrehen.

ACHTUNG!
Anziehvorschrift auf der nächsten Seite beachten!

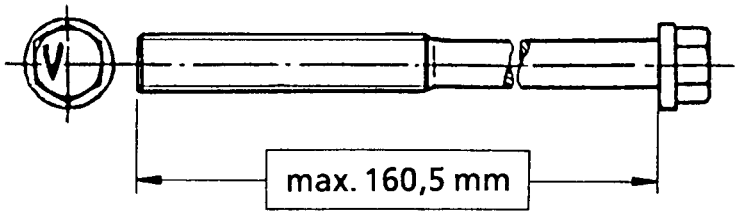
Mounted cylinder heads

1. Slip all cylinder-head gaskets on crankcase .
2. Fit cylinder heads. Screw tighten evenly. Make sure that the supporting surface is perfectly flat.
3. Align cylinder heads with the faces at intake and exhaust ports (Fig. 2) or mount cooling water-air collector and wxhaust manifold and align cylinder head as a result.
4. Pre-tight cylinder head screws with 30 Nm.
5. Turn 2 x 120°.

Attention! Refer to tightening instruction on the next page!

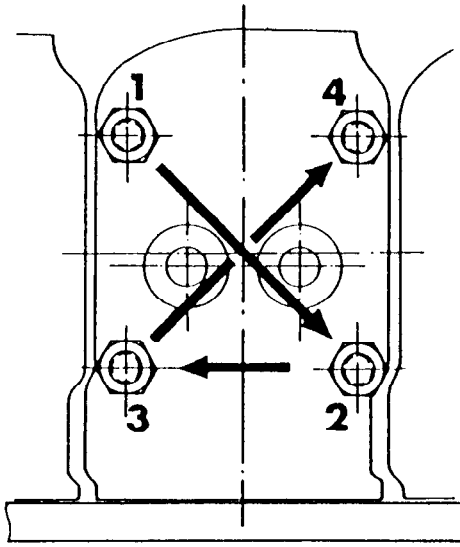
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6.10 Anziehvorschrift der Zylinderköpfe - Drehwinkelmethode / Order of tightening the cylinder heads - angle-rotation method



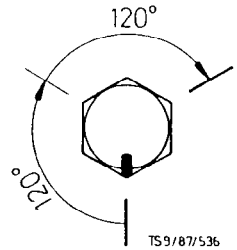
Die Schrauben sind am Kopf mit einem Winkelsymbol markiert. Vor jeder Wiederverwendung Länge messen. Maximal zulässige Schraubenlänge = 160,5 mm (siehe 5.2.28) sind die Schrauben bereits 160,5 mm oder länger, müssen sie wegen Überdehnung erneuert werden.

The screws are labelled at the top with an angular symbol. Measure the length before reuse.
The maximum allowed screw length ist 160,5 mm (see 5.2.28). If the screws measure already 160,5 mm or more, they have to be renewed due to elongation.



1. Schrauben von Hand anlegen
2. mit 30 Nm vorziehen
3. Schraubenköpfe markieren
4. 120° nachdrehen - 1. Stufe
5. 120° nachdrehen - 2. Stufe
   (Schrauben immer nach nebenstehenden Schema anziehen)

1. Put on screws by hand
2. pre-tight with 30 Nm
3. mark screw head
4. tighten by 120° 1st stage
5. tighten by 120° 2nd Stufe
   (tighten screws always according to scheme opposite)



Eine Markierung der Schraubenstellung ist notwendig, um den Drehwinkel von 2 x 120° genau einhalten zu können. Es ist gleichzeitig eine Kontrolle, ob alle Schrauben ordnungsgemäß angezogen sind.

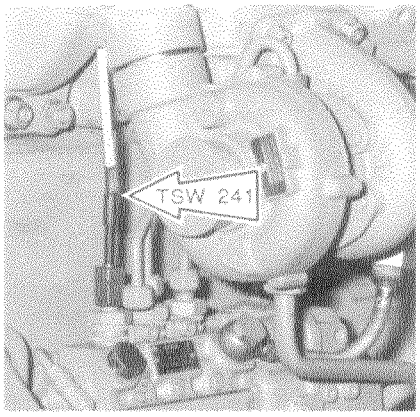
It is necessary to mark the position of the nuts in order to adhere exactly to the angle of rotation of 2 x 90 ° and at the same this enables to check wether or nor all nuts are properly tightened.

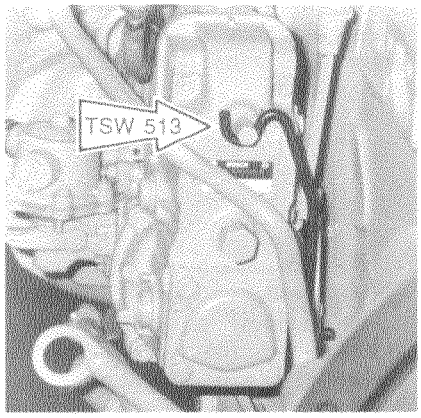
Wichtiger Hinweis:
Bei der Drehwinkelmethode entfällt das spätere Nachziehen der Zylinderkopfschrauben.

Important note:
Retightening of the cylinder head screws is omitted with the angle-rotation method.

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6.11





Förderbeginn prüfen

1. Motor am räderseitigen Zylinder auf Zünd-OT stellen (Ein- u. Auslaßventil geschlossen)
2. Steigrohr TSW 241 an der Einspritzpumpe aufbauen und entlüften.
3. Durch Haltevorrichtung TSW 513 Regelstange der Einspritzpumpe in Mittelstellung fixieren.
4. Motor ca. 30° - 40° zurückdrehen, dann langsam in Drehrichtung vorwärts drehen bis der Kraftstoff im Kapilarrohr zu steigen beginnt.
5. Am Schauloch unter dem Starter (Verschlußpfropfen) die Grade am Schwungrad in Schauloch-Mitte ablesen. (Einstellwerte siehe technische Daten Abs. 7, 7.1)

Korrektur des Förderbeginnes wird durch Schwenken der Einspritzpumpe erreicht.

Anschließend nochmals Kontrolle durchführen.

Checking commencement of delvery

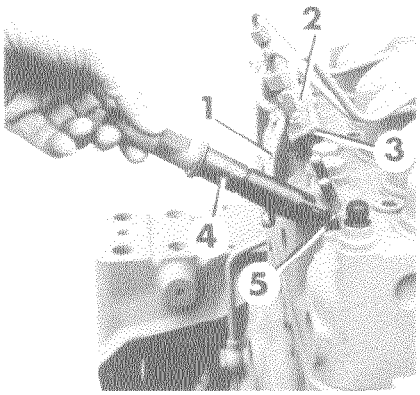
1. Turn piston at wheel-side cylinder to ignition TDC (inlet and outlet valves closed)
2. Mount rising pipe TSW 241 to injection pump and deaerate.
3. Set control rod of injection pump to central position by means of location device TSW 513.
4. Turn back engine about 30° - 40° then slowly forward in direction of rotation until gasoline starts to rise in the capillary tube.
5. Read the degrees on the flywheel at inspection hole centre. The inspection hole is located below the starter (inspection hole cover) (for settings, refer to specifications, paragraph 7, 7.1)

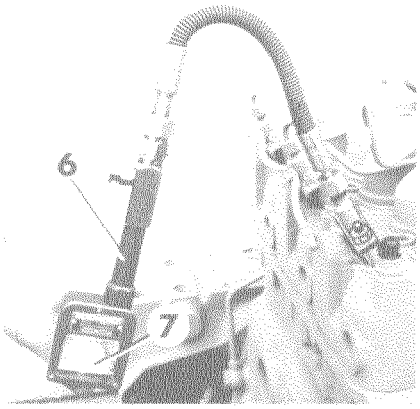
Beginning of injection is corrected by swivelling the injection pump.

Check again afterwards.

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6.12





Verdichtungsdruck prüfen

Der Verdichtungsdruck wird mit dem Verdichtungsprüfer gemessen um festzustellen, ob genügend hoher Verdichtungsdruck vorhanden ist. Das Prüfgerät wird gemäß nebenstehenden Bildern an der Öffnung für das Einspritzventil im Zylinderkopf angeschlossen.

1. Leckölleitung 1 abbauen.
2. Kraftstoffdruckleitung 2 am Einspritzventil abschrauben.
3. Befestigungsbügel 3 abnehmen.
4. Einspritzventil 4 herausziehen. Auf Dichtung 5 achten.
5. Anschlußstück TSW 005 mit Dichtung 5 einstecken und mit Befestigungsbügel 3 festschrauben.

6. Verdichtungsprüfer 6 anbauen.
7. Meßpapier 7 einlegen.
8. Drehzahlverstellhebel auf Stop drücken.
9. Motor kalt mit Anlasser durchdrehen (3 bis 5 Umdrehungen).
10. Verdichtungsdruck muß mind. 22 - 25 bar (kp/cm 2) betragen.
11. Ursachen für zu niedrigen Verdichtungsdruck:
- Ventil undicht
- Kolben undicht
- Zylinderbüchse stark riefig

12. Ursachen beheben.
13. Verdichtungsdruckprüfung wiederholen.

Checking compression pressure

Using compression tester check whether the compression pressure is high enough. Refering to illustrations below, connect tester to injection - valve opening in cylinder head.

1. Detach leak-off line 1.
2. Unscrew fuel-delivery line 2 at injection valve.
3. Remove fastening bracket 3.
4. Withdraw injection valve 4, taking care of seal 5.
5. Insert connecting piece TSW 005 together with gasket - 5 and tighten using fastening bracket 3.
6. Attach compression tester 6.
7. Insert chart 7.
8. Move speed-control lever to stop position.
9. Crank engine cold (3 to 5 revolutions) using the starter.
10. Compression pressure must be not less than 22 - 25 bar (kp/cm 2).
11. Causes fo inadequate compression pressure:
- Valve leaky
- Piston blow-by
- Cylinder liner heavily scored

12. Rectify trouble.
13. Repeat compression check.

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6.13 Wellendichtringe erneuern (Kurbelwelle)

Die Dichtringe in den Kurbelwellenabdichtungen müssen zur Erhaltung ihrer Lebensdauer geschmiert sein. Diese Schmierung hat immer einen, wenn auch geringen Öldurchtritt zur Folge. Eine Leckage von wenigen Tropfen sollte nicht Anlaß zur Reparatur sein.

Stärkerer Ölaustritt an den Kurbelwellenabdichtungen kann auch durch zu hohen Überdruck im Kurbelgehäuse verursacht sein.

Renewing shaft seals (crankshaft)

The sealing rings in the crankshaft seals need lubricating to make them last. Although slight, a certain amount of oil leakage always results from this lubrication but as long as there are only a few drops,there is no need for repair.

Heavy oil leakage at the crankshaft seals may be a sign of exessive pressure in the crankcase.

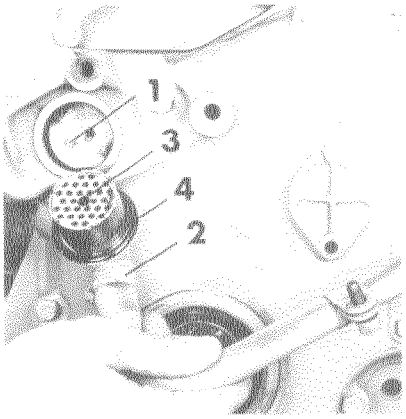


Bild 1/Fig. 1

Daher zuerst Motorentlüftung unteren Teil reinigen

Arbeitsfolgen:

1. Sechskantmutter 1 abschrauben.
2. Schlauchbinder 2 lösen.
3. Entlüftungsgehäuse 3 abnehmen.
4. Auf Runddichtung 4 achten.
5. Entlüftungsgehäuse in Dieselkraftstoff auswaschen.
6. Entlüftungsgehäuse anbauen, falls erforderlich Runddichtung 4 erneuern.
7. Schlauchbinder 2 festziehen.
8. Sechskantmutter 1 anschrauben und festziehen.

Hinweis: Ölabscheider oben von der Motorölentlüftung ist wartungsfrei.

Therefore first clean engine vent lower part

Procedures:

1. Unscrew hexagon nut 1.
2. Release clip 2.
3. Remove breather housing 3.
4. Note O-ring 4.
5. Rinse breather housing in diesel fuel.
6. Attach breather housing, fitting new O-seal 4 if necessary.
7. Tighten clip 2.
8. Screw in hexagon nut 1 and tighten.

Comment: Motor oil vent oil separator on top is maintenance-free.

6.13.1. Allgemein

Tritt auch danach (bei nicht zu hohem Innendruck) Schmieröl an den Kurbelwellenabdichtungen aus, müssen die Wellendichtringe erneuert werden (siehe 6.13.2 udn 6.13.3).

Achtung!
Zur Erneuerung der Abdichtungen nur Ringe mit der eingeprägten Bezeichnung B A F verwenden. Dies sind Silikonringe, die an ihren Dichtlippen sehr kerbempfindlich sind. Daher vorsichtig und sorgfältig einbauen.

Weitere Undichtheiten können unter Umständen durch schadhaften Sitz der Wellendichtringe in den Stirnwanddekkel verursacht sein.

In solchen Fällen müssen die Stirnwanddeckl erneuert werden. (Stirnwanddeckel mit bereits eingebauten Dichtringen).

General

The shaft seals will need renewing (see 6.13.2 and 6.13.3) if lubricating oil still coninues to leak through the crankshaft seals (inside pressure not exessive).

Important!
Replacement shaft seals msut bear the stamped marking B A F . The sealing lips of these silicone rings are of very low impact resistance and must therefore be fitted with extreme care and caution.

Another source of leakage is constituted by damaged shaft seal seating in the end covers.

The end covers themselves will need replacing under these circumstances (with fitted sealing rings).

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6.13.2 Radialdichtring im Stirnwanddeckel (Schwungradseite) erneuern
Replacing radial seal inside front-wall cover (flywheel end)

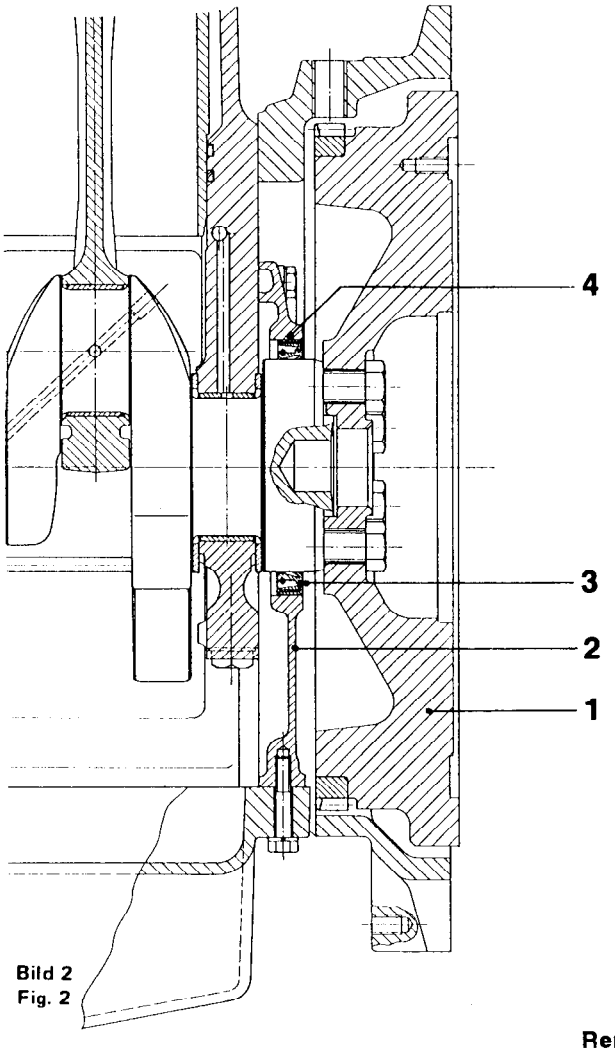


Bild 2
Fig. 2

Ausbau

- Schwungrad 1 abschrauben
- Öl ablassen
- Ölwanne lösen. (Bei beschädigter Dichtung Ölwanne abbauen und Ölwanne mit Dichtungsmasse neu abdichten, Ölwannendichtung entfällt).
- Stirnwanddeckel 2 abbauen.
- Wellendichtring 3 herausdrücken.
  Achtung! Hierbei Dichtfläche 4 im Stirnwanddeckel nicht beschädigen.

Removal

- Unsrew flywheel 1.
- Drain oil.
- Slacken oil pan. (If seal damaged, remove oil pan and seal oil by means of sealing compound, oil sump gasket not applicable).
- Remove front-wall cover 2.
- Press out radial lip.type oil seal 3.
  Caution! Do not damage sealing surface 4 inside front-wall cover.

Kontrolle
Laufspur an Kurbelwellenflansch prüfen:

Prüfergebenis A	**Arbeiten**
nicht spürbar eingelaufen (Fingernagelprobe) Breite unter 1 mm	Lauffläche am Kurbelwellenflansch reinigen und mit feinstem Polierleinen drallfrei polieren.
Prüfergebenis B	
spürbar eingelaufen (Fingernagelprobe) Breite über 1 mm	Lauffläche am Kurbelwellenflansch reinigen und mit feinstem Polierleinen drallfrei polieren. Ring versetzt einbauen

Check
Examining crankshaft flange for wear:

Test result A	**Action**
no appreciable wear (finger-nail check) less than 1 mm wide	Clean running surface of crankshaft flange and polisch with very fine emery cloth to remove rifiling.
Test B	
Appreciable wear (finger-nail check) above 1 mm wide	Clean running surface of crankshaft flange and polish with very fine emery cloth to remove rifling. Fit shaft seal offset from previous position.

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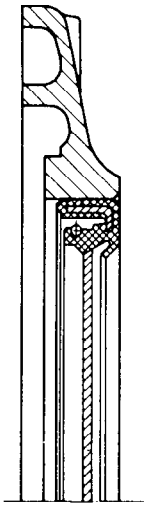


Bild 3 / Fig. 3
normaler Einbau
Normal installation

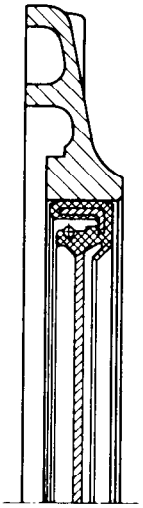


Bild 4 / Fig. 4
versetzter Einbau
Offset installation

Einbau des neuen Radialdichtringes im Stirnwanddekkel (Schwungradseite)

Bei Prüfergebnis A

- Radialdichtring mit Montagescheibe TSW 526 bis zum Anschlagplan eindrücken (Bild 3)

Bei Prüfergebnis B

- Radialdichtring mit Montagescheibe TSW 526 2 mm nach innen versetzt einbauen, damit Dichtlippe an axial verschobener Stelle läuft (Bild 4).

Kurbelwellenflansch am ganzen Umfang leicht einfetten.

Stirnwanddeckel anbauen

- Vorsichtig aufschieben.
- **Achtung!** Hierbei kerbempfindliche Dichtlippe nicht verletzen.
- Stirnwanddeckel festschrauben.
- Schrauben an der Ölwanne festziehen.
- Schwungrad anschrauben.
  Anzugsvorschriften Abs. 6.2 beachten.
- Motoröl einfüllen.

Installing new radial seal inside front-wall cover (flywheel end)

Action for test rsult A

- Using installation plate TSW 526, force radial seal fully home (Fig. 3).

Action for test result B

- Using installation plate TSW 526, install radial seal offset by 2 mm inwards so that contact surface of sealing lip is axially displaced (Fig. 4).

Apply thin film of grease to crankshaft flange on the whole circumstances

Attaching front wall cover

- Fit with extreme caution.
- **Caution!** Be sure not to damage the easily notched sealing lip.
- Tighten front-wall cover.
- Tighten screws on oil pan.
- Screw on flywheel.
  Observe tightening instructions, section 6.2.
- Fill in lubrication oil.

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6.13.3 Radialdichtring im Stirnwanddeckel (Räderseite) erneuern
Replacing radial seal inside front-wall cover (gear end)

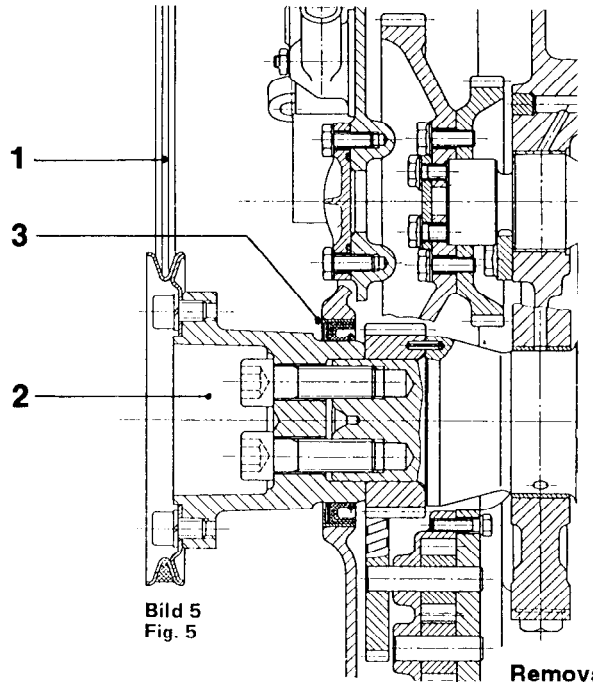


Bild 5
Fig. 5

Ausbau

- Keilriemen 1 entspannen und abnehmen
- Nabe 2 mit Keilriemenscheibe oder mit Schwingungsdämpfer abschrauben.
- Radialdichtring 3 aus dem Stirnwanddeckel mit Schraubendreher oder Montageeisen herausdrücken.
- **Achtung!** Hierbei Sitzfläche am Stirnwanddeckel nicht beschädigen.

Removal

- Release and remove V-belt 1.
- Unscrew hub 2 together with pulley or with vibration damper.
- Force radial seal 3 out of front-wall cover using screwdriver or lever.
- **Caution!** Be sure not to damage seat in front-wall cover.

Laufspur auf der Nabe prüfen:

Prüfergebenis A	**Arbeiten**
nicht spürbar eingelaufen (Fingernagelprobe) Breite unter 1 mm	Lauffläche an der Nabe reinigen und mit feinstem Polierleinen drallfrei polieren.
Prüfergebenis B	**Arbeiten**
spürbar eingelaufen (Fingernagelprobe) Breite über 1 mm	Neue Nabe einbauen.

Checking hub for wear:

Test rsult A	**Action**
no appreciable wear (finger-nail check) less than 1 mm wide	Clean hub running surface and polish with very fine emery cloth to remove rifling.
Test result B	**Action**
Appreciable wear (finger-nail check) above 1 mm wide	Install new hub.

Einbau

- Vor der Montage Radialdichtung außen und an der Dichtlippe leicht einfetten.
- Radialdichtring mit Montagescheibe TSW 526 bis zum Anschlag plan eindrücken (siehe Spezialwerkzeug Seite 3).
- Bei Prüfergebnis B neue Nabe einbauen.
  Nabe am ganzen Umfang leicht einfetten und vorsichtig aufschieben.

  Achtung! Hierbei Kerbempfindliche Dichtlippe nicht verletzen.
  Nabe anschruaben und festziehen.
  Anzugsvorschriften Abs. 6.2 beachten.
  Keilriemen auflegen und spannen.

Attachement

- Before assembly, apply thin film of grease to radial seal and sealing lip.
- Press in radial sealing ring plain with mounting disk TSW 526 to limit (see special tool page 3).
- If test result B is obtained, install new hub.
  Apply thin film of grease to the whole circumference of the hub and slip it on carefully.

  Caution! Do not damage the easily notched sealing lip during this operation.
  Screw on and tighten hub.
  Observe tightening prescriptions, section 6.2.
  Place and stretch V-belt.

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7. Technische Daten - Motor Baureihe **WD 301.**

STEYR Traktor Typ	955/955a	964/964a	970a	M968 / M975a
Motortyp	**WD 301.42/43**	**WD 301.82/83** TURBO	**WD 301.87** TURBO	**WD 301.89 / WD 301.88** TURBO
Motorleistung KW (PS)	41(55)	47 (64)	52 (70)	50(68) / 55(75)
bei Motordrehzahl U/min	2100	2100	2100	2100 / 2200
Motornenndrehzahl U/min	2300	2300	2300	2300
Motor-Leerlaufdrehzahl U/min	650-700	650-700	800-900	650-750 / 850-900
Größtes Drehmoment Nm(kpm)	210(21,5)	247(25,2)	267(27,2)	264(26,9) / 278(28,3)
bei Motordrehzahl U/min	1500	1500	1500	1500
Drehmomentanstieg %	26	26	26	30 / 26
Zylinderzahl	3	3	3	3
Bohrung/Hub mm	105/120	105/120	105/120	105/120
Gesamthubraum ccm	3117	3117	3117	3117
Mittlere Kolbengeschwindigkeit m/sek	9,3	9,2	9,2	9,2
Verdichtungsverhältnis	16,6 : 1	16,0 : 1	16,0 : 1	16,0 : 1
Kompressionsdruck bar	27 *)	30 *)	30 *)	30 *)
Ladedruck bar 1)	-	1,05	1,1	1,15 / 1,30
Arbeitsverfahren	Viertakt-Dieselmotor mit Direkteinspritzung			
Einspritzfolge	1 - 3 - 2			
Drehrichtung der KW von vorne	Rechtslauf			
Motor-Ölfüllmenge mit Filterwechsel Liter	6,6	7,0	7,0	7,0
Motoröl-Qualität API	CC	CD	CD	CD

Steuerzeiten der Ventile
(bei 1mm Kontrollspiel - kaltem Motor)

Einlaß öffnet .....1° nach OT
Einlaß schließt .....8° nach UT
Auslaß öffnet .....33° vor UT
Auslaß schließt .....0° vor OT

Ventilspiel (Motor kalt)

Einlaßventil.....0,2 mm
Auslaßventil.....0,3 mm

Einspritzpumpe	BOSCH-Reiheneinspritzpumpe			
Regler	mechanisch geregelt			
Düsenhalter BOSCH	KBEL 90S 3/13	KBEL 90S3/13	KBEL 90S3/13	KBEL 90S3/13
Einspritzdüse BOSCH	DLLA 152S1180	DLLA 151S972	DLLA 151S972	DLLA 151S972
Düsen-Öffnungsdruck bar	220 + 8	220 + 8	220 + 8	220 + 8
Förderbeginn ° vor OT	**20° ± 1°**	**19° ± 1°**	**19° ± 1°**	**23° ± 1°**

*) unterer Grenzwert: 20 bar
1) bei Vollast und Motornenndrehzahl

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7.1 Technische Daten - Motor Baureihe **WD 401.**

STEYR Traktor Typ	9078/9078a	9086/9086a	9094a	M9083a
Motortyp	**WD 401.80/81** TURBO	**WD 401.82/83** TURBO	**WD 401.85** TURBO	**WD 401.89** TURBO
Motorleistung KW (PS)	57(78)	63(86)	69(94)	61(83)
bei Motordrehzahl U/min	2100	2100	2100	2100
Motornenndrehzahl U/min	2300 **)	2300	2300	2300
Motor-Leerlaufdrehzahl U/min	700 ± 50	710 ± 30	760 ± 30	650 - 750
Größtes Drehmoment Nm(kpm)	298(30,4)	325 (33,1)	353(36,0)	311(31,7)
bei Motordrehzahl U/min	1500	1500	1500	1500
Drehmomentanstieg %	26	26	26	26
Zylinderzahl	4	4	4	4
Bohrung/Hub mm	105/120	105/120	105/120	105/120
Gesamthubraum ccm	4156	4156	4156	4156
Mittlere Kolbengeschwindigkeit m/sek	9,2	9,2	9,2	9,2
Verdichtungsverhältnis	16,0 : 1	16,0 : 1	16,0 : 1	16,0 : 1
Kompressionsdruck bar	30 *)	30 *)	30 *)	30 *)
Ladedruck bar 1)	0,8	0,9	1,0	0,85
Arbeitsverfahren	Viertakt-Dieselmotor mit Direkteinspritzung			
Einspritzfolge	1 - 3 - 4 -2			
Drehrichtung der KW von vorne	Rechtslauf			
Motor-Ölfüllmenge mit Filterwechsel Liter	8,5	8,5	8,5	8,5
Motoröl-Qualität API	CD	CD	CD	CD

Steuerzeiten der Ventile
(bei 1mm Kontrollspiel - kaltem Motor)

Einlaß öffnet .....1° nach OT
Einlaß schließt ..... 8° nach UT
Auslaß öffnet .....33° vor UT
Auslaß schließt ..... 0° vorOT

Ventilspiel (Motor kalt)
Einlaßventil.....0,2 mm
Auslaßventil.....0,3 mm

Einspritzpumpe	BOSCH-Reiheneinspritzpumpe			
Regler	mechanisch geregelt			
Düsenhalter BOSCH	KBEL 90S3/13	KBEL 90S3/13	KBEL 90S3/13	KBEL 90S3/13
Einspritzdüse BOSCH	DLLA 151S972	DLLA 151S972	DLLA 151S972	DLLA 151S972
Düsen-Öffnungsdruck bar	220 + 8	220 + 8	220 + 8	220 + 8
Förderbeginn ° vor OT	**21° ± 1°**	**21° ± 1°**	**21+° ± 1°**	**21+° ± 1°**

**) 2250 U/min bei Getriebeausführung 30 km/h
*) unterer Grenzwert: 20 bar
1) bei Vollast und Motornenndrehzahl

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7. Technical data - Engine serie **WD 301.**

STEYR Traktor Typ	955/955a	964/964a	970a	M968 / M975a
Engine type	**WD 301.42/43**	**WD 301.82/83** TURBO	**WD 301.87** TURBO	**WD 301.89 / WD 301.88** TURBO
Engine output KW (HP)	41(55)	47 (64)	52 (70)	50(68) / 55(75)
at engine speed r.p.m.	2100	2100	2100	2100 / 2200
Rated engine speed r.p.m.	2300	2300	2300	2300
Idling engine speed of r.p.m.	650-700	650-700	800-900	650-750 / 850-900
Max. torque Nm(kpm)	210(21,5)	247(25,2)	267(27,2)	264(26,9) / 278(28,3)
at engine speed U/min	1500	1500	1500	1500
Torque increase amounting %	26	26	26	30 / 26
Number of cylinders	3	3	3	3
Bore/stroke mm	105/120	105/120	105/120	105/120
Total piston displacement ccm	3117	3117	3117	3117
Mean piston speed m/sec	9,3	9,2	9,2	9,2
Compression ratio	16,6 : 1	16,0 : 1	16,0 : 1	16,0 : 1
Compression pressure bar	27 *)	30 *)	30 *)	30 *)
Boost pressure bar 1)	-	1,05	1,1	1,15 / 1,30
Working method	Four-stroke diesel engine with direct injection			
Injection sequence	1 - 3 - 2			
Direction of rotation (crank shaft front)	clockwise rotation			
Eng. oil filling quant. with filter charge litre	6,6	7,0	7,0	7,0
Engine oil - quality API	CC	CD	CD	CD

Valve timing
(control clearance 1mm - cold engine)

Inlet opens .....1° after TDC
Inlet closes .....8° after BDC
Exhaust opens .....33° before BDC
Exhaust closes.....0° before TDC

Valve clearance (engine cold) Intake valve .....0,2 mm
Exhaust valve.....0,3 mm

Injection pump	BOSCH-In-line injection pump			
Regulator	mechan. controlled			
Nozzle holder BOSCH	KBEL 90S 3/13	KBEL 90S3/13	KBEL 90S3/13	KBEL 90S3/13
Injection nozzle BOSCH	DLLA 152S1180	DLLA 151S972	DLLA 151S972	DLLA 151S972
Nozzle opening pressure bar	220 + 8	220 + 8	220 + 8	220 + 8
Commenc. of delivery ° crank shaft before TDC	**20° ± 1°**	**19° ± 1°**	**19° ± 1°**	**23° ± 1°**

*) lower limit: 20 bar
1) at full load and rated engine speed

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7.1 Technical data - Engine serie **WD 401.**

STEYR Traktor Typ	9078/9078a	9086/9086a	9094a	M9083a
Engine type	**WD 401.80/81**	**WD 401.82/83**	**WD 401.85**	**WD 401.89**
	TURBO	TURBO	TURBO	TURBO
Engine output KW (HP)	57(78)	63(86)	69(94)	61(83)
at engine speed r.p.m.	2100	2100	2100	2100
Rated engine speed r.p.m.	2300 **)	2300	2300	2300
Idling engine speed r.p.m.	700 ± 50	710 ± 30	760 ± 30	650 - 750
Max. torque Nm(kpm)	298(30,4)	325 (33,1)	353(36,0)	311(31,7)
at engine speed U/min	1500	1500	1500	1500
Torque increase amounting %	26	26	26	26
Number of cylinders	4	4	4	4
Bore/stroke mm	105/120	105/120	105/120	105/120
Total piston displacement ccm	4156	4156	4156	4156
Mean piston speed m/sec	9,2	9,2	9,2	9,2
Compression ratio	16,0 : 1	16,0 : 1	16,0 : 1	16,0 : 1
Compression pressure bar	30 *)	30 *)	30 *)	30 *)
Boost pressure bar 1)	0,8	0,9	1,0	0,85
Working method	Four-stroke diesel engine with direct injection			
Injection sequence	1 - 3 - 4 -2			
Direction of rotation (crank shaft front)	clockwise rotation			
Eng. oil filling quant. with filter charge litre	8,5	8,5	8,5	8,5
Engine oil - qualityAPI	CD	CD	CD	CD

Valve timing
(control clearance 1 mm - cold engine)

Inlet opens ..... 1° after TDC
Inlet closes ..... 8° after BDC
Exhaust opens ..... 33° before BDC
Exhaust closes .....0° before TDC

Valve clearance (engine cold) Intake valve .....0,2 mm
Exhaust valve.....0,3 mm

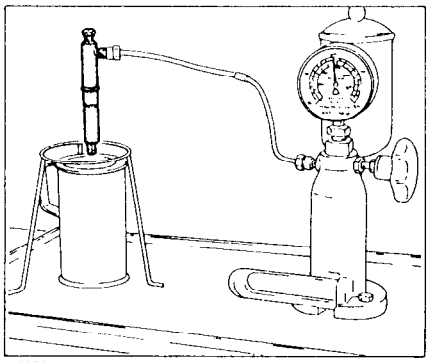
Injection pump	BOSCH-In-line injection pump			
Regulator	mechan. controlled			
Nozzle holder BOSCH	KBEL 90S3/13	KBEL 90S3/13	KBEL 90S3/13	KBEL 90S3/13
Injection nozzle BOSCH	DLLA 151S972	DLLA 151S972	DLLA 151S972	DLLA 151S972
Nozzle opening pressure bar	220 + 8	220 + 8	220 + 8	220 + 8
Commenc. of delivery ° crank shaft before TDC	**21° ± 1°**	**21° ± 1°**	**21+° ± 1°**	**21+° ± 1°**

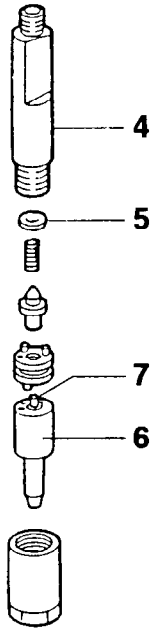
**) 2250 r.p.m. with transmission version 30 km/h
*) lower limit: 20 bar
1) at full load and rated engine speed

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7.2

Abspritzdruck am Einspritzventil
220 bar = Sollwert (siehe auch 4.9)


10356



Arbeitsfolgen:

1. Einspritzventil 1 am Prüfgerät 2 mit Kraftstoffdruckleitung anschließen.
2. Pumpenhebel 3 betätigen. Manometer muß beim Abspritzen 220 bar anzeigen.
3. Abspritzdruck kann nach Entfernen des Düsenhalters 4 durch Auswechseln von Ausgleichscheiben 5 verändert werden.
   Ausgleichscheibe beilegen = Druck erhöhen.
   Ausgleichscheibe herausnehmen Druck verringern.
   0,1 mm = ca. 10 bar
4. Einspritzventil muß an 4 Löchern gleichmäßig fein vernebelt abspritzen und darf nicht nachtropfen.
5. Wenn nicht, Einspritzdüse 6 reinigen.
   Düsenkörper 6 und Düsennadel 7 in sauberem Kraftstoff gut absprühen. Nur mit weicher Bürste (Messing) abbürsten. Düsennadel muß spiegelblank sein und saugend in den Düsenkörper herabgleiten. Sonst: Einspritzdüse erneuern (Nur Teil 6 und 7 gemeinsam).

Establishing injection pressure of injection valve
220 bar = nominal value (also see 4.9)

Procedures:

1. Connect injection valve 1 to tester 2 using fuel-delivery line.
2. Operate pump lever 3. Pressure gauge must indicate 220 bar on injection.
3. Injection pressure can be altered by exchanging shims 5 after removal of nozzle holder 4.
   Insert shims to raise pressure.
   Remove shims to reduce pressure.
   0.1 mm = approx. 10 bar
4. Injection valve must inject an evenly atomized spray through the four holes without dribbling.
5. If not, clean injection nozzle 6.
   Rinse off nozzle body 6 and needle valve 7 in clean fuel, making sure to use a soft brush only (brass). Needle valve must have a polished finish and fit snugly into the nozzle body. If not, renew injection nozzle (parts 6 and 7 together).

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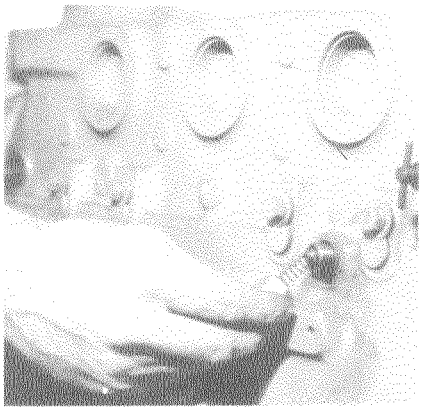
7.3 Schmieröldruck

Bei betriebswarmem Motor:

bei n = 680 min-1 mindestens 0,8 ... 1 bar
bei n = 2300 min-1 3 ... 5 bar

Bei zu niedrigem Öldruck folgende Punkte prüfen:

- Ölstand
- Ölsorte SAE-Wert (siehe Betriebsanleitung)
- Außentemperatur (siehe Betriebsanleitung)
- Sicherheitsventil im Filterkopf sauber ?
- Druckventil für Kolbenkühlung sauber ?



Druckventil für Kolbenkühlung ausgebaut
Pressure valve for piston cooling dismounted

- Druckmeßgerät, Manometer in Ordnung ?
- Ölpumpe arbeitet einwandfrei ?
- Lagerspiele an Kurbelwelle, Nockenwelle und Massenausgleich prüfen.
- Ölbohrungen nicht verstopft ?
- Verschlußstopfen in den Ölbohrungen dicht ?

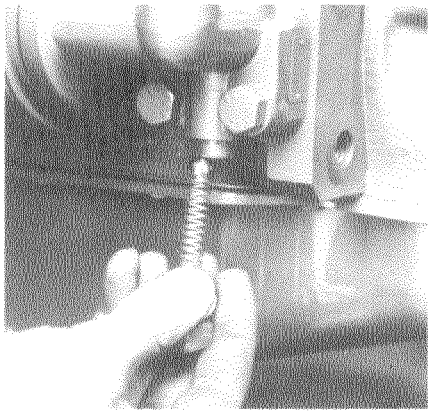
7.3 Lube-oil pressure

With engine warmed up:

at n = 680 min-1 at least 0,8... 1 bar
at n = 2300 min-1 3 ... 5 bar

Check following points if oil pressure is indequate:

- Oil level
- Oil grade SAE value (see Operating instructions)
- Outdoor temperature (see Operating instructions)
- Condition of safety valve in filter head ?
- Condition of pressure valve for piston cooling ?



Schmierölsicherheitsventil ausgebaut
Lube-oil safety valve dismounted

- Is pressure gauge in good working order ?
- Is oil pump working satisfactorily ?
- Check bearing play on crankshaft, camshaft and balance weight.
- Are oil drillings choked ?
- Are plugs in oil drillings leaking ?

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8. Aufladung

Instandsetzungen von Abgasturboladern können nur von autorisierten Fachwerkstätten durchgeführt werden, da Sonderwerkzeuge und Fachkenntnisse erforderlich sind!

Die einzelnen Beschriebungen enthalten:

8.1 Schnittbild mit Legende
8.2 Mögliche Störungen
8.3 Betriebs- und Wartungsempfehlung
8.4 Ermittlung der Lagerspiele

Achtung: Nach jeder Zerlegung des Laders beim Wiedermontieren grundsätzlich die neuen Teile des kleinen Ersatzteilsatzes verwenden.

8. Turbocharging

Turbochargers can only be repaired by specialized work-shops autorizedto do so, as special tools and expert knowledge are required!

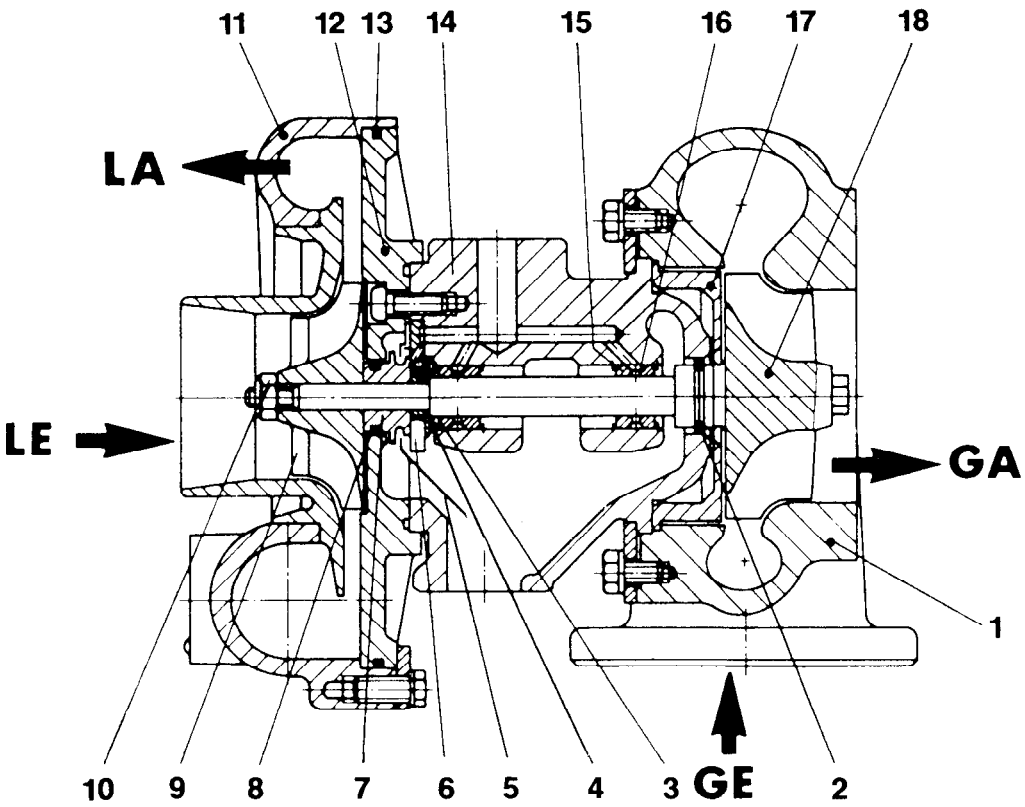
All descriptions consist of:

8.1 Sectional view with legend
8.2 Possible distrubances
8.3 Recommendations for operation and maintenance
8.4 Determination of bearing play

Caution: After each turbocharger dismantling, the new parts of the small spare part set must basically be used for re-assembly.

8.1 Schnittbild mit Legende

8.1 Sectional view with legend



1	Turbinengehäuse	12	Rückwand
2	Kolbenring (Turbinenseite)	13	Runddichtung
3	Lagerbund	14	Lagergehäuse
4	Büchse	15	Sicherungsring
5	Ölabweiser	16	Lagerbüchse
6	Axiallagerscheibe	17	Hitzeschild
7	Dichtungsbüchse	18	Läufer
8	Kolbenring (Verdichterseite)	LE	Lufteintritt
9	Verdichterrad	LA	Luftaustritt
10	Wellenmutter	GE	Gaseintritt
11	Verdichtergehäuse	GA	Gasaustritt

1	turbine housing	12	back wall
2	piston ring (turbine end)	13	O ring
3	bearing collar	14	bearing housing
4	bush	15	circlip
5	oil deflector	16	bearing bush
6	axial bearing disc	17	thermal shield
7	sealing bush	18	rotor
8	piston ring (compressor end)	LE	air inlet
9	impeller	LA	air outlet
10	shaft nut	GE	fas inlet
11	compressor housing	GA	gas outlet

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8.2 Mögliche Störungen an Turboaufgeladenen Dieselmotoren

Art der Störung	Mögliche Ursache	Beseitigung
1. Leistungsmangel Ladedruck zu gering	1.0 Luftfilteranlage verschmutzt, Saug- und Druckleitungen deformiert/undicht	Luftfilteranlage warten, ggf. instandsetzen; Leitungen kontrollieren/abdichten
	1.1 Abgasanlage hat zu hohen Strömungswiderstand/Undichtigkeiten vor Turbine	Auspuffbremse, Rohrleitungen, Dichtungen, Schalldämpfer überprüfen und ggf. instandsetzen
	1.2 Einspritzanlage/Kraftstoffanlage defekt	Einstellwerte, Funktion prüfen, ggf. instandsetzen
	1.3 Kompression zu gering	Ventile, Zylinder, Kolben prüfen, ggf. instandsetzen
	1.4 Ladeluftkühler verschmutzt	Ladeluftkühler reinigen, ggf. tauschen
	1.5 Turbolader defekt Anstreifen der Räder	Turbolader prüfen, ggf. instandsetzen oder tauschen
2. Leistung/Ladedruck zu hoch	2.0 Einspritzanlage defekt	Einstellwerte, Funktion prüfen. ggf. instandsetzen
3. Abgastrübung schwarz	siehe Punkt 1.0, 1.3, 1.4, 1.5, 2.0	
4. Abgastrübung blau	4.0 Ventilführungen, Kolbenringe verschlissen	Gasmenge an Kurbelgehäuseentlüftung prüfen, ggf. Motor überholen
	4.1 verdichterseitige/turbinenseitige Abdichtung im Turbolader defekt	Turbolader prüfen, ggf. instandsetzen oder tauschen
	4.2 Turbolader-Ölablaufleitung verstopft/deformiert	Ölablaufleitung reinigen, ggf. instandsetzen
	4.3 siehe Punkt 1.0	
5. Turbolader ölundicht	5.0 Ölzulauf/Ölablaufleitungen undicht/lose	Turbolader reinigen, Leck suchen und beseitigen
	5.1 Verbindung Verdichter/Lagergehäuse undicht	Turbolader instandsetzen oder tauschen

8.3 Betriebs- und Wartungsempfehlungen

- Den Motor nach dem Anlassen nicht sofort voll belasten. Wir empfehlen, den Motor nach kurzem Leerlaufbetrieb bei mittleren Drehzahlen und mittlerer Last warmzufahren.
- Nach längerem Vollastbetrieb des Motors empfehlen wir vor dem Abstellen einen kurzen Leerlaufbetrieb, um Wärmestaus zu vermeiden.
- Bei Anbau des Turboladers an den Motor sauberes Öl in das Lagergehäuse füllen und unbedingt beachten, daß alle an den Turbolader angeschlossenen Leitungen vor der Montage sorgfältig gereinigt wurden.

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8.2 Possible disturbances in Turbocharged diesel engines

Type of disturbance	Possible cause	Remedy
1. Lack of power boost pressure oo low	1.0 Air filter system dirty. Suction and pressure pipes deformed and/or leaking	Examine filter system, service or replace filter if required. Check and repair or replace pipes, tighten untight joints
	1.1 Too high flow resistance in the exhaust gas system and/or leakages upstreâm of turbine	Check exhaust brake, pipes, gaskets and silencers, carry out repairs required
	1.2 Injection unit and/or fuel system defective	Check setting values and function, correct if required
	1.3 Compression too low	Check valves, cylinders and pistons, sevice or replace defective parts if required
	1.4 Charge air cooler dirty	Clean unit and replace if necessary
	1.5 Turbocharger defective, wheels rubbing on housing walls	Examine turbocharger, repair or replace i necessary
2. Power and/or boost pressure too high	2.0 Injection unit defective	Check setting values and function and correct i required
3. Black exhaust smoke	See points 1.0, 1.3, 1.4, 1.5, 2.	
4. Blue exhaust smoke	4.0 Worn valve guides and/or piston rings	Measure blow-by volume at crankcaseoutlet, overhaul engine if required
	4.1 Compressor-side and/or turbine-side sealing in the turbocharger defective	Examine turbocharger, repair or replace it as required
	4.2 Turbocharger oil drain pipe clogged and/or deformed	Clean oil drain pipe, repair if necessary
	4.3 see point 1.0	
5. Oil leakage at turbocharger	5.0 Oil feed pipe and/or oil drain pipe loose and leaking	Clean turbocharger, check for leakages and rectify
	5.1 Leakage at connection between compressor and bearing housings	Repair or replace turbocharger

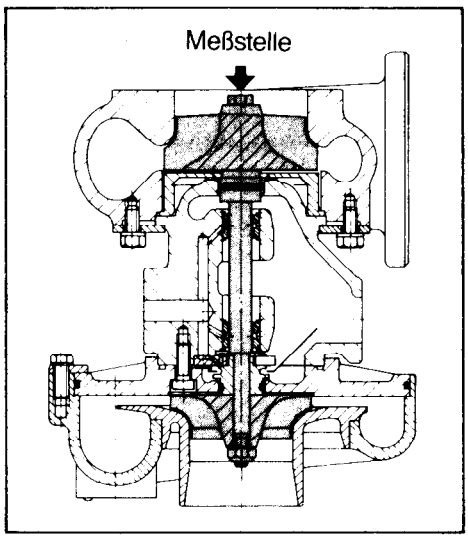
8.3 Operation and maintenance recommendations

- Do not load engine fully shortly after starting. We recommend to warm up the engine after a short period of idling at mean engine speed and mean load.
- After a long period of full load, we recommend to idle for a short period, in order to avoid localization of heat.
- When mounting the turbocharger to the engine, fill clean oil into the bearing housing and make sure, that all lines connected to the turbocharger are meticulously cleaned before assembling.

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8.4 Ermittlung der Lagerspiele

Bauprogramm **K14 - WD 301.**
K24 - WD 401.

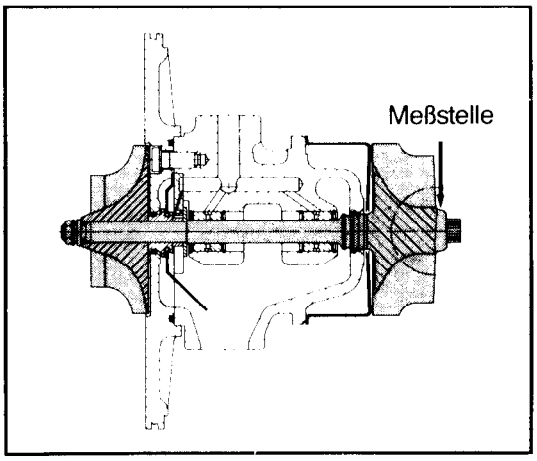


1.1

Bild 1.1

	K14	K24
1. Axialspielmessung	**max. 0,1 mm**	**max. 0,16 mm**

- Meßspitze der Meßuhr stirnseitig auf Turbinenradnabe aufsetzen.
- Läufer nach unten drücken und Meßuhr auf "0" stellen!
- Läufer gegen Meßuhr drücken und Ausschlag des Zeigers notieren.



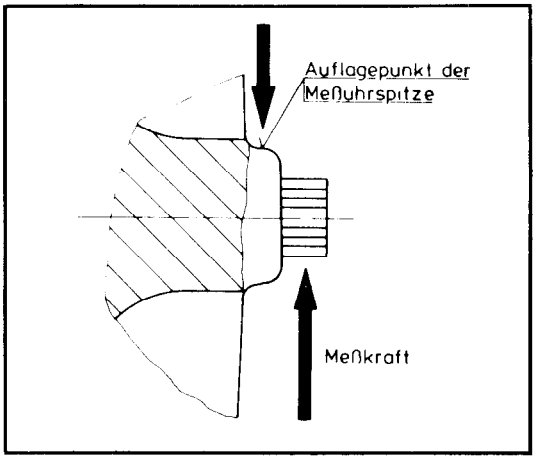
2.1

	K14	K24
2. Radialspielmessung	**max. 0,3 mm**	**max. 0,42 mm**

- Ermittlung des Radialspiels nur turbinenseitig erforderlich.
- Meßspitze der Meßuhr in der Mitte des Aufnahmekonus des Turbinenrades aufsetzen.

Bild 2.1, 2.2

- Turbinenradnabe mittels Federwaage nach unten ziehen. Meßkraft: 50 N. Meßuhr auf "0" stellen!
- Turbinenradnabe mittels Federwaage nach oben ziehen. Meßkraft 50 N
- Ausschlag des Zeigers notieren.
- Diese Messung mindestens an zwei Stellen durchführen.

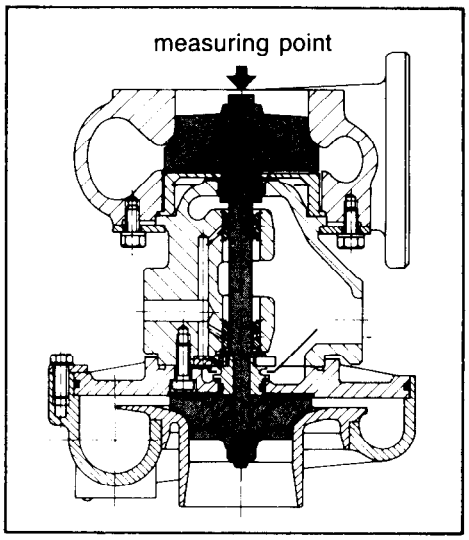


2.2

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8.4 Determination of bearing play

Range **K14 - WD 301.**
K24 - WD 401.



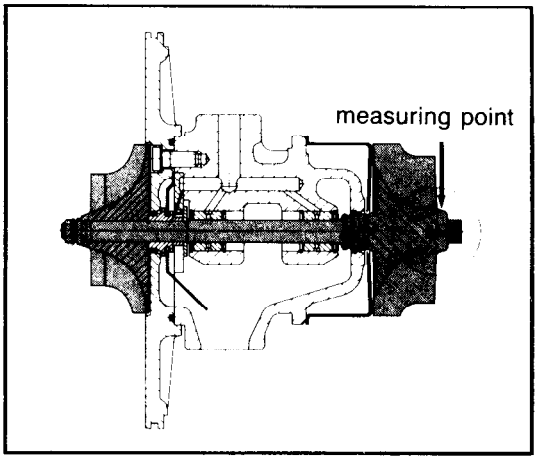
1.1

	K14	K24
1. Measuring the axial play	**max. 0,1 mm**	**max. 0,16 mm**

- Place measuring point of clock gauge on top face of turbine wheel hub.

Illustration 1.1

- Press down shaft and turbine wheel assy. and set the clock gauge at "0".
- Press shaft and turbine wheel assy. against clock gauge and note indicator "throw".

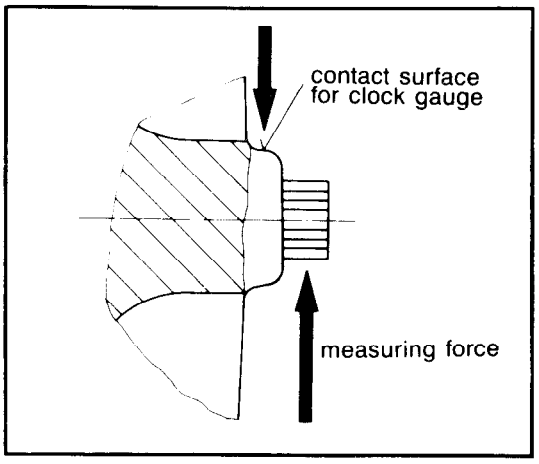


2.1

	K14	K24
2. Measuring the radial play	**max. 0,3 mm**	**max. 0,42 mm**

- Determination of radial play is only necessary at turbine side.
- Place clock gauge measuring point on the centre of the cone on the turbine wheel.

Illustrations 2.1, 2.2



2.2

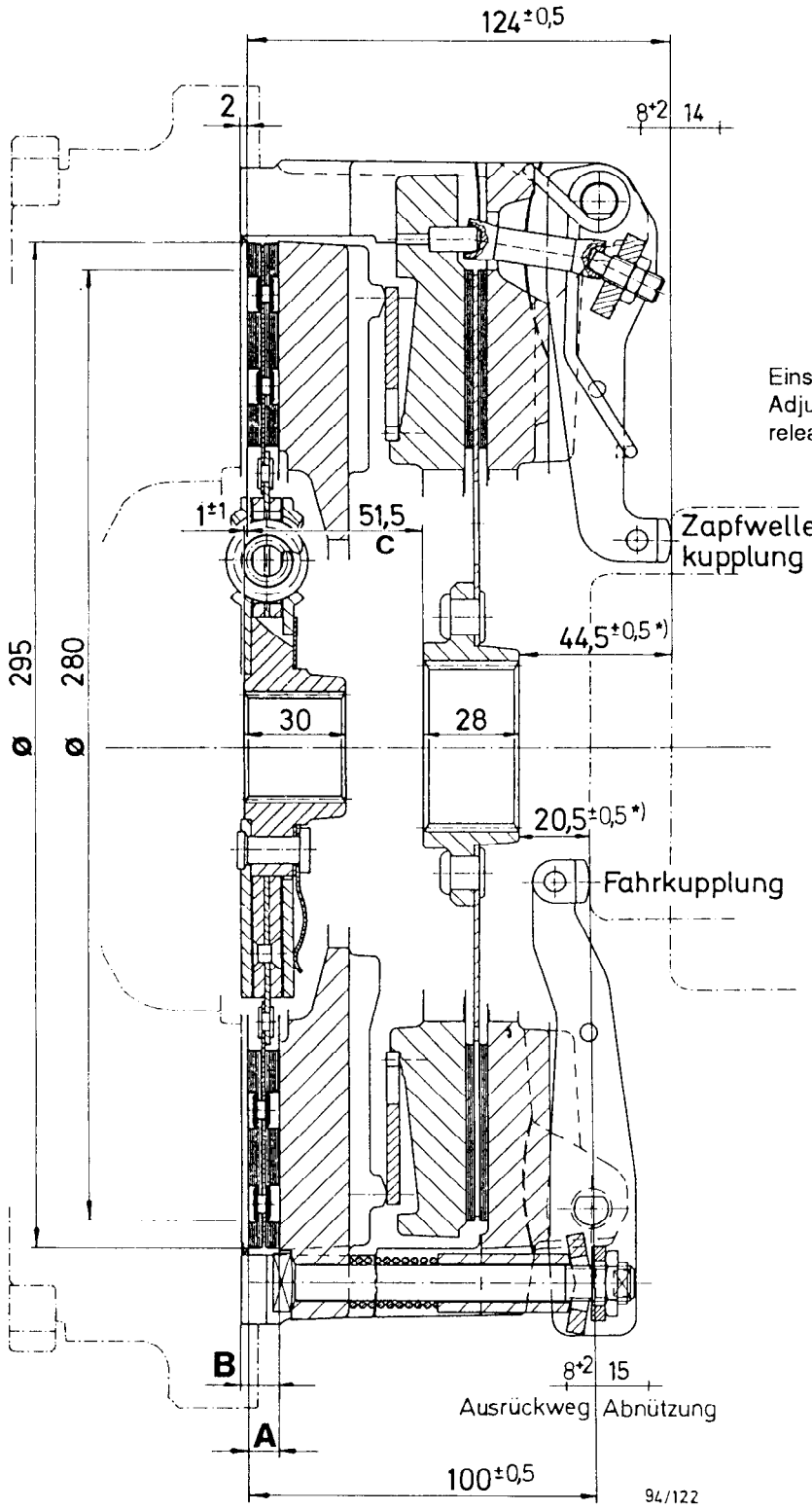
- Pull turbine wheel downwards using spring scale. Measuring force: 50 N. Set clock gauge at "0"!
- Pull turbine wheel upwards using spring scale. Measuring force 50 N.
- Note the clock gauge "throw".
- These measurements are to be taken at, at least, two different positions.

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9. Zweischeiben-Trockenkupplung
Two-stage dry clutch

F & S 295/280 Ø
280/280 Ø

WD 301.



Einstellmaße der Ausrückhebeln
Adjustment measures of the clutch release levers

A = 9,3 ± 0,3 mm
B = 11,3 ± 0,3 mm

Ø 280/280 mm - **WD 301.42/43**
Ø 295/280 mm - **WD 301.82/83, WD 301.87**

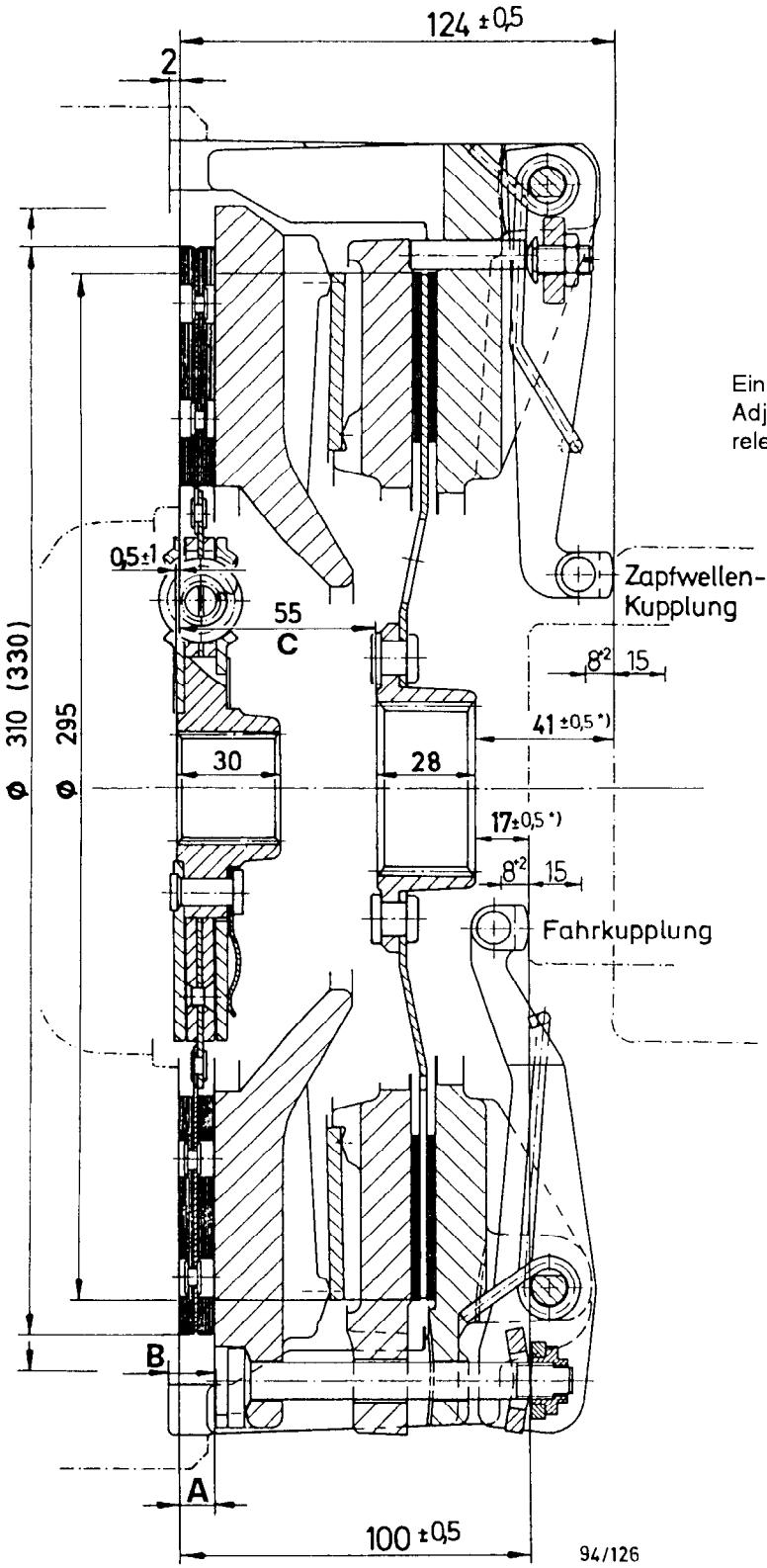
*) Einstellmaße gelten nur bei neuen Kupplungsscheiben.
Adjustment measures are only valid for new clutch disks.

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9. Zweischeiben-Trockenkupplung
Two-stage dry clutch

F & S 310/295 Ø
330/295 Ø

WD 401.



Einstellmaße der Ausrückhebeln
Adjustment measures of the clutch release levers

A = 10 ± 0,3 mm
B = 13 ± 0,3 mm

Ø 310/295 mm - **WD 401.80/81**
Ø 330/295 mm - **WD 401.82/83, WD 401.85**

*) Einstellmaße gelten nur bei neuen Kupplungsscheiben.
Adjustment measures are only valid for new clutch disks.

SICHERN, BEFESTIGEN, DICHTEN

mit Anaeroben - Kunststoffen (AK) *)

*) unter Luftabschluß aushärtend

Verwendung	SICHERN		BEFESTIGEN			DICHTEN	
Klasse	mittelfest	fest	Mehrzweck	mittelfest	fest	Rohrgewinde	Flächen
Kurzzeichen	**SM**	**SF**	**AKM**	**BM**	**BF**	**DR**	**DF**
Handfestigkeit in Minuten	15- 30	15 - 30	15 - 30	15 - 30	5 - 10	15 - 30	sofort
Funktionsfestigkeit in Stunden	1	1	1	1	0,5	0,5	sofort
Endfestigkeit in Stunden	3	3	3	3	4	12 - 24	24
Temperaturbereich °C		- 55 bis +150			- 55 bis +200	-55 bis +150	-55 bis +200
Freigegebene Produkte Fa. LOCTITE	**242**	**262**	**270**	**641**	**648**	**572**	**510/518**
Produktfarbe	blau	rot	grün	gelb	grün	weiß	rot
STEYR-Ersatzteilenummer	900 07 99 1633	900 07 99 1658	900 07 99 0088	900 07 99 1675	900 07 99 0184	900 07 99 0073	900 07 99 0086 900 07 99 0221
Bisherige Produkte bzw. Alternative - LOCTITE	241 / 245	270 / 275	270	241	270 / 275 / 40	–	71

Abdichten von Flächen	STEYR-Ersatzteilenummer		
SILICON	900 07 99 0035	weiß	Produktfarbe
DIRKO	900 07 99 0304	grau	
ATMOSIT COMPACT	900 07 99 0178	schwarz	

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SECURING, MOUNTING, SEALING

with Anaeroben - plastics (AK) *)

*) hardening under exclusion of air usage

Usage	SECURING		TIGHTENING			SEALING	
Class	medium-strength	end-strength	multi purpose	medium-strength	end-strength	pipe thread	surfaces
Code	**SM**	**SF**	**AKM**	**BM**	**BF**	**DR**	**DF**
Manageable strength in minutes	15- 30	15 - 30	15 - 30	15 - 30	5 - 10	15 - 30	sofort
Operating strength in hours	1	1	1	1	0,5	0,5	sofort
Final strength in hours	3	3	3	3	4	12 - 24	24
Temperature range in °C		- 5 bis +150			- 55 bis +200	-55 bis +150	-55 bis +200
Released products Fa. LOCTITE	**242**	**262**	**270**	**641**	**648**	**572**	**510/518**
Product colour	blau	rot	grün	gelb	grün	weiß	rot
STEYR-spare parts number	900 07 99 1633	900 07 99 1658	900 07 99 0088	900 07 99 1675	900 07 99 0184	900 07 99 0073	900 07 99 0086 900 07 99 0221
Previous products or alternative - LOCTITE	241 / 245	270 / 275	270	241	270 / 275 / 40	–	71

Sealing of surfaces'		STEYR-spare parts number		
	SILICON	900 07 99 0035	white	product colour
	DIRKO	900 07 99 0304	grey	
	ATMOSIT COMPACT	900 07 99 0178	black	

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Chapter

2007

WORKSHOP MANUAL

M968	**CS68**	**from DBD0040007**
M975	**CS75**	**from DBD0040007**
M9078	**CS78**	**from DBD0055001**
M9086	**CS86**	**from DBD0055001**
M9094	**CS94**	**from DBD0055001**
9105	**CS110**	**from DBD0075001**
9115	**CS120**	**from DBD0075001**
9125	**CS130**	**from DBD0075001**
9145	**CS150**	**from DBD0075001**

2007

CASE-STEYR Landmaschinentechnik GmbH
Technical Documentation
A - 4300 St. Valentin, Steyrer Straße 32

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May, 2000

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INDEX

INDEX 2
SPECIAL TOOLS 5
FOR THE USER 7
Engine serial number 7
SAFETY REGULATIONS 8
ENGINE DATA 9
Lifting the engine 9
TECHNICAL DATA 10
Cylinder block 10
Cylinder liners 10
Cylinder head 10
Valves, rocker arms and push rods 11
Camshaft 12
Crankshaft 12
Flywheel 13
crankshaft inertia weight (engine type 420) 13
Camshaft drive 13
Con-rods 14
Pistons, piston rings and piston pins 14
Lubrication system 15
Lubrication oil pump (320, 420) 15
Lubrication oil pump (620) 15
Thermostat 15
Coolant temperature switch
Coolant temperature transmitter 15
Cooling water pump (320, 420) 16
Cooling water pump (620) 16
Turbo charger 16
Tightening torques 17
CONSTRUCTION 18
General information 18
Cylinder block 18
Flywheel casing 18
Cylinder head 19
Valve mechanism 19
Crankshaft drive 19
Timing gears 20
Lubrication system 21
Cooling system 22
Intake / exhaust system 23

https://truckmanualshub.com/

JOB INSTRUCTIONS 24
1. CYLINDER BLOCK 24
A. Measuring the cylinder liner wear 24
B. Removing the cylinder liner 24
C. Checking the cylinder block 24
D. Replacing the camshaft bush 24
E. Oversize bushes for the camshaft 25
F. Fitting the plug at the rear camshaft end 27
G. Fitting the plug at the rear camshaft end after inserting an oversize bush 27
H. Installing the oil dipstick tube 27
I. Fitting the cylinder liner 27
2. FLYWHEEL CASING 29
A. Fitting the flywheel casing 29
B. Replacing the rear crankshaft sealing ring 29
3. CYLINDER HEAD 30
A. Removing the cylinder head 30
B. Removing the valves 30
C. Checking the cylinder head 30
D. Replacing the valve guides 31
E. Machining the valve seat 32
F. Replacing the valve seat rings 32
G. Grinding the valves 32
H. Fitting the valves 32
I. Fitting the cylinder head 33
4. VALVE MECHANISM 34
A. Maintenance of the rocker arm system 34
B. Replacing the camshaft / camshaft gear wheel 34
C. Checking and adjusting the valve clearance 35
5. CRANKSHAFT 36
A. Removing the crankshaft 36
B. Checking the crankshaft 36
C. Replacing the crankshaft gear wheels 36
D. Replacement of the crankshaft ring gear (engine type 420 only) 37
E. Fitting the crankshaft 37
F. Crankshaft hub 38
G. Replacing the crankshaft belt pulley and vibration damper 38
H. Checking the rubber element in the vibration damper (620/420) 39
6. CON-RODS AND PISTONS 40
A. Removing the pistons together with the con-rods 40
B. Checking and replacing the con-rod bearings 40
C. Checking the con-rod 40
D. Con-rod weight groups 41
E. Checking and replacing the piston rings 42
F. Checking the pistons 43
G. Fitting the piston pin 43
H. Fitting the pistons and con-rods 43
7. BALANCING UNIT (420) 44
A. Removing and dismantling the balancing unit 44
B. Balancing unit maintenance 44
C. Fitting the balancing unit 44

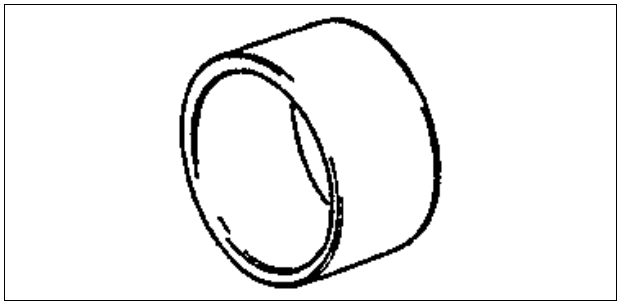
https://truckmanualshub.com/

8. FLYWHEEL 45
A. Replacing the starter ring gear on the flywheel 45
B. Fitting the flywheel 45
9. TIMING MECHANISM 46
A. Removing the timing gear case 46
B. Replacing the intermediate gear wheel bush 46
C. Fitting the timing gear case 47
D. Front power take-off / auxiliary drive 48
10. LUBRICATION SYSTEM 49
A. Checking the oil pressure valve 49
B. Removing and checking the oil pump 49
C. Assembling and fitting the oil pump 50
D. Fitting the sump 50
E. Oil cooler 50
F. Piston cooling nozzles (620) 51
G. Recommended lubrication oils 51
11. COOLING SYSTEM 52
A. Thermostat 52
B. Repairing the coolant pump 52
C. Coolant quality requirements 53
12. INTAKE / EXHAUST SYSTEM 54
A. Checking the air filter 54
B. Checking the intake / exhaust system 54
C. Checking the boost pressure 54
D. Checking the turbo charger 55
E. Fitting the turbo charger 56

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SPECIAL TOOLS

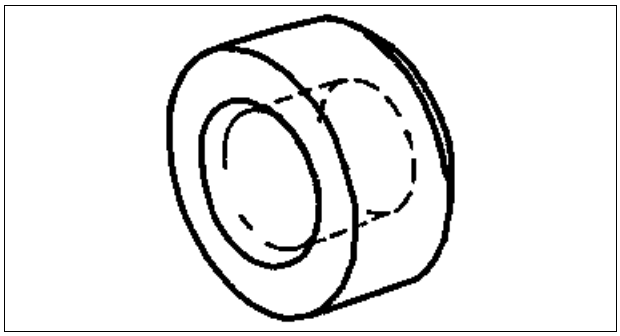
Pressing tool for the front crankshaft dust seal



SS00B064

1 off 1TSW 519

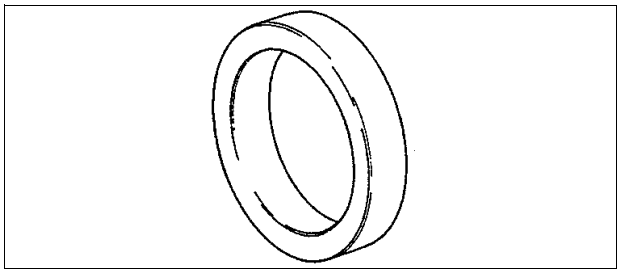
Pressing tool for the front crankshaft shaft sealing ring



SS00B065

1 off 1TSW 520

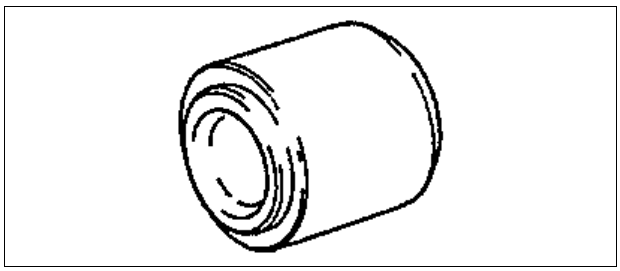
Pressing tool for the rear crankshaft shaft seal



SS00B066

1 off 1TSW 521

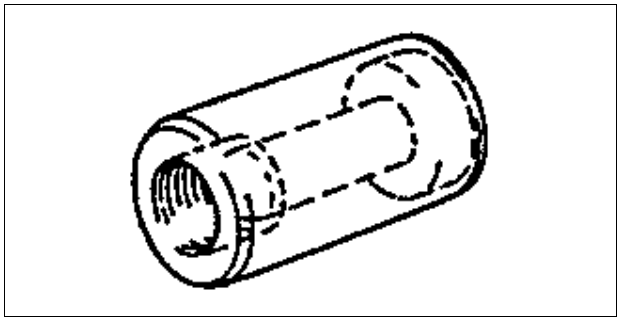
Pressing tool for cam shaft cover



SS00B067

1 off 1TSW 522

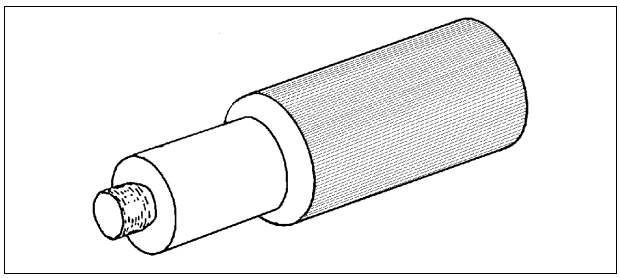
Assembly pin for the water pump seal



SS00B068

1 off 1TSW 523

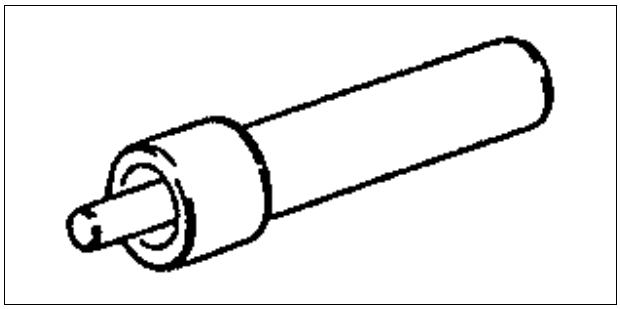
Universal pin



SS00B077

1 off 1TSW 18390

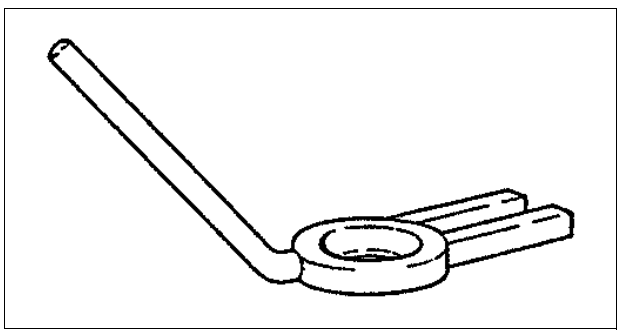
Pressing tool for valve guides



SS00B069

1 off 1TSW 524

Valve spring tensioning lever

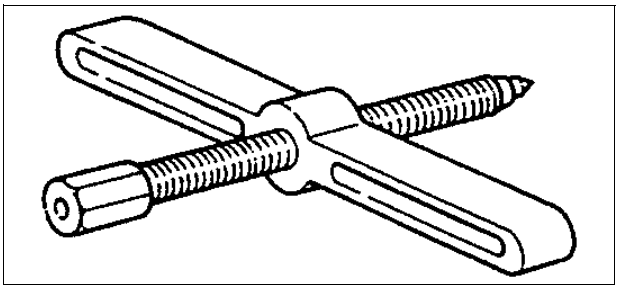


SS00B071

1 off 1TSW 014

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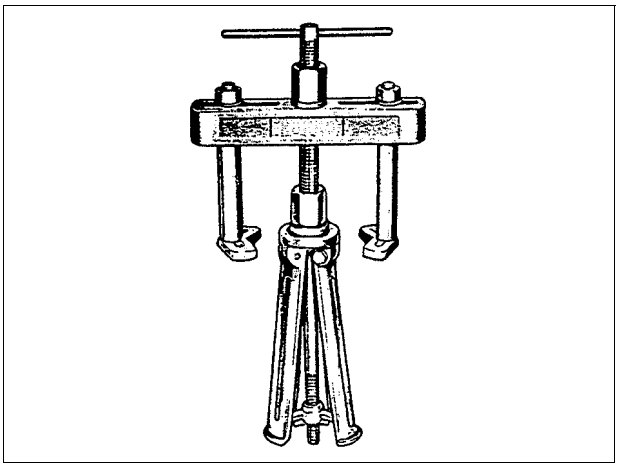
Extractor



SS00B070

1 off 1TSW 662

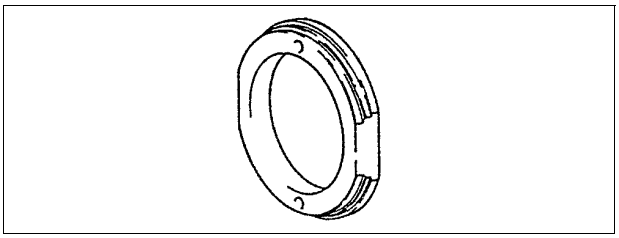
Cylinder liner extractor



SS00B072

1 off 1TSW 510

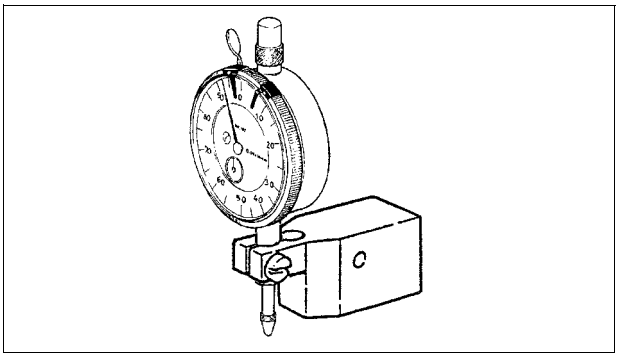
Extraction plate



SS00B073

1 off 1TSW 508

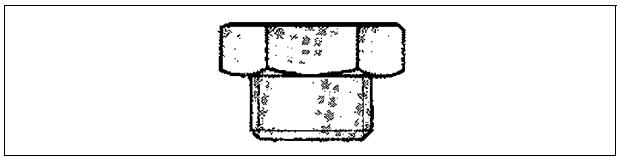
Dial test indicator and holder



SS00B075

1 off 1TSW 5610 Holder
1 off 1TSW 17049-6 Dial test indicator

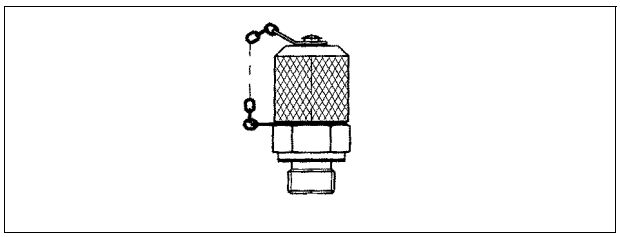
Screw-in fitting



SS00B082

1 off 1TSW 663

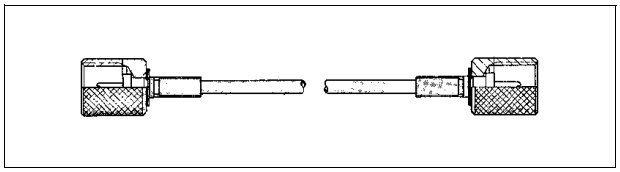
Mini-measuring connection



SS98J031

1 off 1TSW 640 M10x1

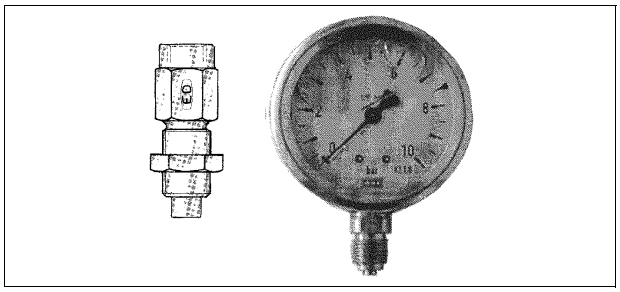
Mini-measuring line



SS98J030

1 off 1TSW 635

Pressure gauge and connection



SS00B076

1 off 1TSW 645 Connection
1 off 1TSW 5002 Pressure gauge

Open-ended spanner for visco-hub

Not illustrated

1 off 1TSW 664

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FOR THE USER

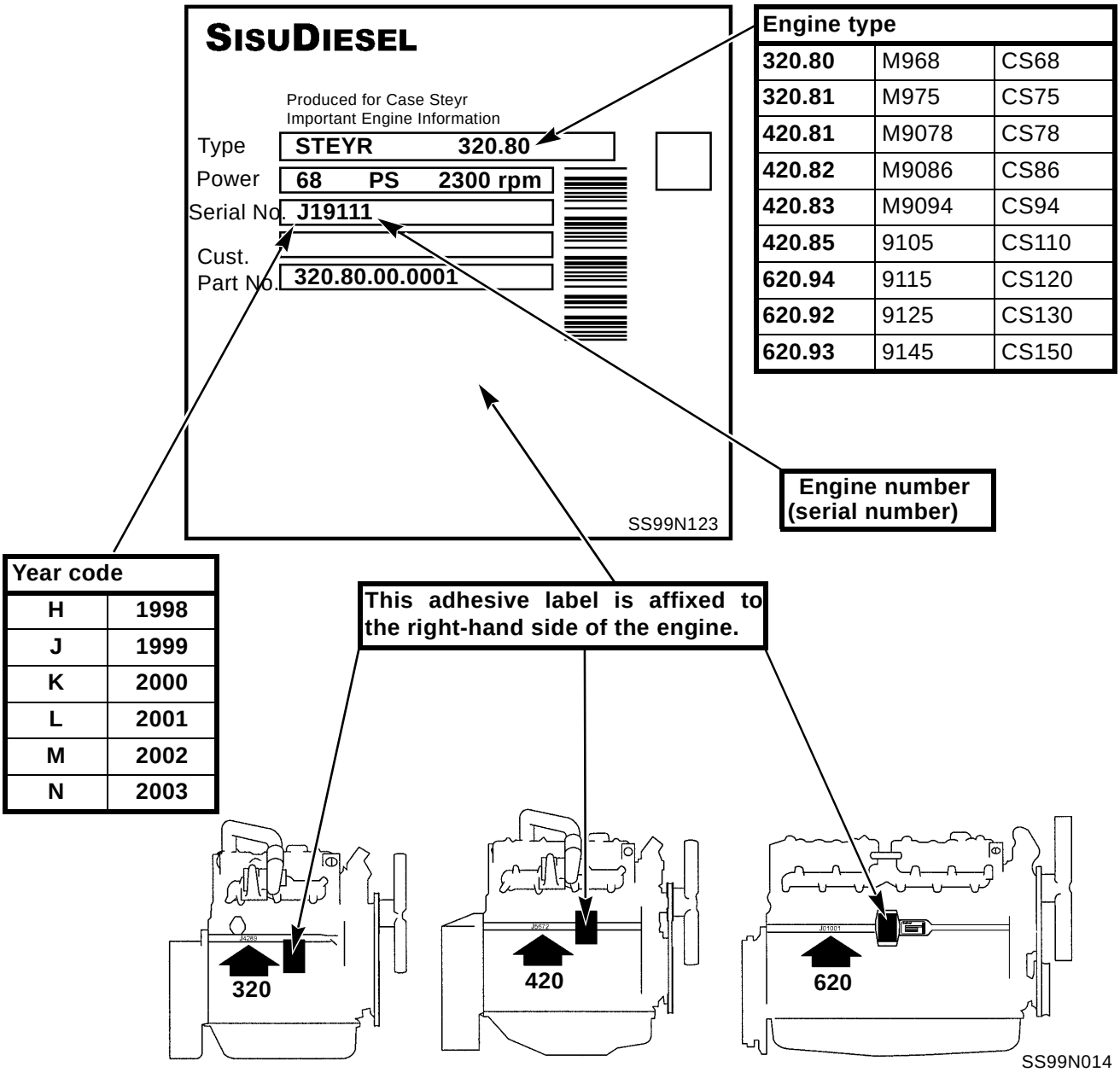
The purpose of this manual is to provide basic information required to service and repair Steyr – Sisu diesel engines.

Engine types 320, 420 and 620 are of the same design, therefore the same repair instructions can be used for the varying engine types. Any differences affecting repair work are listed in the technical data and repair instructions. All dimensions are specified in millimetres and apply to parts at a temperature of +20 °C, if not specified otherwise.

Before starting repair work, make sure all necessary special tools, spare parts and accessories are available. It is not absolutely necessary to have all the special tools mentioned in this manual. However, having them does make it quicker and easier to carry out any repairs necessary. After a repair, the engine must be run in just like a new engine.

If any questions arise, which cannot be clarified with the aid of this manual, please contact Case Steyr Customer Service in St. Valentin or the respective importer.
When making any queries, please specify the following engine data:

Engine serial number



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SAFETY REGULATIONS

The possibility of injury always exists when carrying out maintenance and repair work. Read the following safety regulations and information before starting work.



•) Never start repair work, which you do not fully understand.

•) Make sure that the environment is safe to work in.

•) Make sure the location is clean and in a good state.

•) Never use incorrect or unsuitable tools.

•) Remove all rings, chains and watches before commencing work.

•) Use state of the art safety equipment. For example, wear goggles when using compressed air for cleaning, grinding, hammering or similar work.

•) Use a lifting device for lifting or transporting heavy parts (over 20 kg). Make sure the hooks and chains are in a good condition and sit firmly in place.

•) Never work below an engine hanging from a lifting device or raised by a jack. Always secure with strong support trestles before commencing work.

•) Only use **original Case-Steyr spare parts**.

•) Only start the engine from the cab, using the ignition key.

•) Never start the engine with the protective covers removed.

WARNING: *It is difficult to see the radiator fan when the engine is running! Baggy clothes and long hair can get caught in rotating engine parts!*

•) If the engine is started in a confined space, sufficient ventilation must be provided.

•) Never use auxiliary starting fuels on an aerosol basis whilst the pre-glow starting facility is in operation (explosion hazard).

•) Ear muffs must be worn when testing the engine or working close to the engine.

•) Always switch the engine OFF before carrying out
maintenance or repair work.

•) Avoid touching the exhaust manifold, turbo charger and other hot engine parts.

•) When the engine is hot and the coolant is pressurised, be careful when opening the radiator cap. Coolant and lubrication oil out of the hot engine can cause severe injuries if contact is made with the skin.

•) Naked flames and smoking are not permitted in the vicinity of fuel tanks or batteries. Electric sparks should be avoided. (Particularly when charging the batteries. Explosion hazard!)

•) Disconnect the cable at the negative battery pole before carrying out service or repair work on the electrical system.

•) If the engine gets excessively hot (over 300 °C), for example, if it catches fire, the viton seals (e.g. bottom O-ring on the cylinder liner or the O-ring on the oil pressure valve) release highly caustic HF acid. Never touch viton seals, which have been subjected to unusually high temperatures, with bare hands. Always wear neoprene gloves or thick work gloves and safety goggles when removing these harmful substances. Wash the seals and contaminated surfaces with a 10% hydroxide solution or another alkaline solution. Collect the material in air-tight sealed plastic bags and bring them to an authorised collecting depot.

IMPORTANT: *Viton seals may never be burned!*

•) When checking the injection nozzles, never touch the fuel, which is ejected under high pressure. The jet will penetrate the skin and cause serious poisoning. If contact is made with the skin, consult a doctor without delay!

Fuel, lubrication oil and coolant can cause skin irritations, if contact is made over a longer period.

•) Avoid running the engine in idle unnecessarily.

When carrying out service work, take measures to prevent fuel or other fluids from entering the ground or drains.

•) All seals are asbestos-free.

•) Be careful when washing the engine using a washing facility with a high water pressure. Do not wash, for example, the electrical and fuel systems under high pressure as they can easily be damaged.

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ENGINE DATA

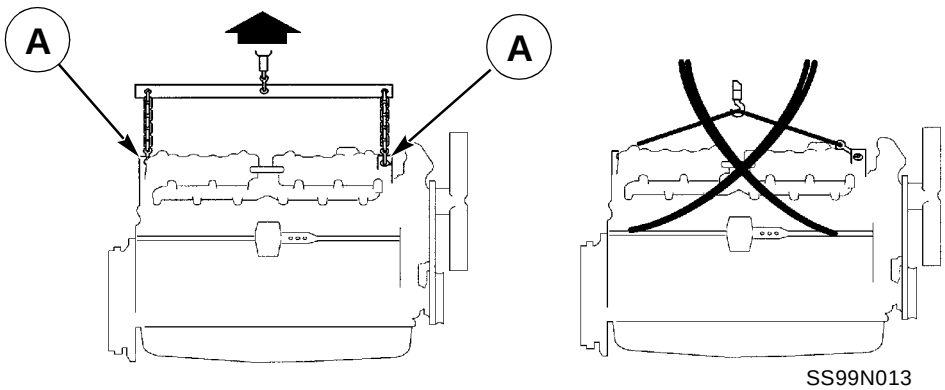
Engine type	320.80	320.82	420.81	420.82	420.83	420.85	620.94	620.92	620.93
Number of cylinders	3		4				6		
Capacity (dm^3)	3,3		4,4				6,6		
Bore (mm)	108								
Stroke (mm)	120								
Delivery start marking of the V-belt pulley (° before UDC)	$15^{\pm1}$					$14^{\pm1}$	$15^{\pm1}$		$13^{\pm1}$
Compression ratio	16,5 : 1		18,5 : 1			16,5:1	18,5 : 1		16,5:1
Method of combustion	direct injection								
Injection sequence	1 - 2 - 3		1 - 2 - 4 - 3				1 - 5 - 3 - 6 - 2 - 4		
Compression pressure[1] (bar)	24								
Charge-air pressure[2] (bar)	1,10	1,20	1,10	1,20	1,30	1,30	0,70	0,78	1,1
Weight[3] (kg)	280		340				510		
Direction of rotation of the crankshaft	Clockwise								

[1]) Minimum value when idling at operating temperature.
Highest permissible difference between the cylinders is 3 bar.
[2]) measured at full load and nominal engine speed
[3]) Without flywheel and electrical equipment.

Lifting the engine

The engine is lifted safely by means of a lifting device, on which the lifting power acts vertically on the lifting eyes.

A = Engine lifting eyes



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TECHNICAL DATA

Cylinder block

Guide pin bore holes ..... 13.250 - 13.320 mm
Diameter of the crankshaft bearing base bore hole ..... 91.000 - 91.025 mm
Diameter of the crankshaft bearing base bore hole (bearing 162000010800) ..... 92.000 - 92.025 mm
Bore hole diameter of the cylinder liner:
- top ..... 124.514 - 124.554 mm
- bottom ..... 123.000 - 123.040 mm
Diameter of the camshaft bearing bush (if fitted) ..... 50.010 - 50.070 mm
Construction height of the cylinder block ..... 428.170 - 428.430 mm

Cylinder liners

Liner height above the cylinder block ..... 0.030 - 0.080 mm
Highest permissible height difference between cylinder liners ..... 0.02 mm
Diameter of the cylinder liner bore holes in the engine block:
- top end of liner ..... 124.475 - 124.500 mm
- bottom end of liner ..... 122.961 - 122.986 mm
Cylinder liner bore hole ..... 108.010 - 108.032 mm
Height, cylinder liner flange ..... 9.03 - 9.05 mm
Height, cylinder liner flange, 1st oversize SP NO 162000040713 ..... 9.08 - 9.10 mm
Height, cylinder liner flange, 2nd oversize SP NO 162000040714 ..... 9.13 - 9.15 mm
Height, cylinder liner flange, 3rd oversize SP NO 162000040715 ..... 9.23 - 9.25 mm
Outer diameter of the cylinder liner flange ..... 131.700 - 131.800 mm

Cylinder head

Construction height of the cylinder head ..... 104.800 - 105.000 mm
Minimum height of the cylinder head after surface grinding ..... 104.000 mm
Inner diameter of the valve guide (when not fitted) ..... 9.000 - 9.015 mm
Outer diameter of the valve guide ..... 16.028 - 16.039 mm
Diameter of the bore hole for the valve guide in the cylinder head ..... 16.000 - 16.018 mm
Projection of the valve guide over the cylinder head face ..... 21 mm
Depth, valve head below cylinder head surface:
- Inlet valve ..... 0.7 ± 0.05 mm (max. 1.70 mm)
- Outlet valve ..... 0.6 ± 0.05 mm (max. 1.60 mm)
Valve seat angle:
- Inlet valve ..... $35^{\circ+20'}$
- Outlet valve ..... $45^{\circ+20'}$
Valve seat width:
- Inlet valve ..... 2.9 - 3.7 mm
- Outlet valve ..... 1.3 - 2.3 mm

Diameter, outlet valve seat insert SP NO 162000040718 ..... 44.070 - 44.132 mm
Bore hole in cylinder head for outlet valve seat insert ..... 44.000 - 44.025 mm

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Valves, rocker arms and push rods

Valve control times at a valve play of 1.0 mm:
- Inlet valve opens ..... 0° ±2° before TDC
- Inlet valve closes ..... 16° ±2° after BDC
- Outlet valve opens ..... 39° ±2° before BDC
- Outlet valve closes ..... 1° ±2° after TDC

Valve play when engine is cold/hot:
- Inlet valve ..... 0.35 mm
- Outlet valve ..... 0.35 mm

Valve head angle:
- Inlet valve ..... $35°^{-20'}$
- Outlet valve ..... $45°^{-20'}$

Valve head diameter:
- Inlet valve ..... 48 mm
- Outlet valve ..... 41 mm

Maximum opening of the valves:
- Inlet valve ..... 10.9 mm
- Outlet valve ..... 12.1 mm

Diameter, inlet valve stem ..... 8.960 - 8.975 mm
Diameter, outlet valve stem ..... 8.925 - 8.940 mm
Clearance, inlet valve stem (guide fitted in cylinder head) ..... 0.025 - 0.055 mm
Wear limit (inlet valve stem) ..... 0.30 mm
Clearance, outlet valve stem (guide fitted in cylinder head) ..... 0.060 - 0.090 mm
Wear limit (outlet valve stem) ..... 0.35 mm
Inner diameter of the valve guide (when not fitted) ..... 9.000 - 9.015 mm
Outer diameter of the valve guide ..... 16.028 - 16.039 mm
Diameter of the bore hole for the valve guide in the cylinder head ..... 16.000 - 16.018 mm
Projection of the valve guide over the cylinder head face ..... 21 mm

Depth, valve head below cylinder head surface:
- Inlet valve ..... 0.7 ± 0.05 mm
- Outlet valve ..... 0.6 ± 0.05 mm

Length of the valve spring, relaxed ..... 69.8 mm

Force of the valve spring compressed to a length of:
- 48.6 mm ..... $327^{\pm 17}$ N
- 37.4 mm ..... $500^{\pm 23}$ N

Diameter, rocker arm shaft ..... 22.970 - 22.990 mm
Diameter of rocker arm bore hole ..... 23.000 - 23.021 mm
Permissible deflection of the push rod (free) ..... 0.4 mm
Length of the rocker arm spring, relaxed ..... 80 mm
Force of the valve spring compressed to a length of 58 mm ..... 80 - 100 N
Outer diameter of the tappet ..... 29.939 - 29.960 mm
Diameter of the tappet bore holes in the cylinder block ..... 30.000 - 30.043 mm

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Camshaft

Diameter, 1st camshaft bearing journal ..... 49.925 - 49.950 mm
Diameter of the other camshaft bearing journals ..... 49.885 - 49.910 mm
Diameter, camshaft bearing journals 2, 3 and 4 (engine type 620) ..... 49.865 - 49.890 mm
Diameter of the 1st camshaft bearing bore hole (bushes fitted) ..... 50.010 - 50.070 mm
Diameter of the other camshaft bearing bore holes ..... 50.000 - 50.025 mm
Play, 1st camshaft bearing ..... 0.060 - 0.145 mm
Play of the other camshaft bearings ..... 0.090 - 0.140 mm
Play of camshaft bearings 2, 3 and 4 (engine type 620) ..... 0.110 - 0.160 mm
Bearing tolerances in the cylinder block ..... 0.025 - 0.080 mm
Diameter of the bearing seat bore holes in the cylinder block ..... 55.620 - 55.650 mm
Axial play of the camshaft with a 0.5 mm seal between the cylinder block and
timing case and between the timing case and timing case cover ..... 0.5 - 1.0 mm
Cam height (dimension between cam base circle and cam lobe):
- Inlet valve ..... 41.180 - 41.430 mm
- Outlet valve ..... 40.080 - 40.330 mm
Cam stroke:
- Inlet valve ..... 7.38 mm
- Outlet valve ..... 8.28 mm
Max. permissible deviation of the camshaft ..... 0.03 mm (max. deflection of the dial test indicator)

Crankshaft

Diameter of the con-rod bearing journals:
- Standard dimension ..... 67,981 - 68000 mm
- 1st repair level 0.25 mm ..... 67.731 - 67.750 mm
- 2nd repair level 0.50 mm ..... 67.481 - 67.500 mm
- 3rd repair level 1.00 mm ..... 66.981 - 67.000 mm
- 4th repair level 1.50 mm ..... 66.481 - 66.500 mm
Width of the con-rod bearing journal ..... 40.000 - 40.160 mm

Diameter of the crankshaft journals:
- Standard dimension ..... 84.985 - 85.020 mm
- 1st repair level 0.25 mm ..... 84.735 - 84.770 mm
- 2nd repair level 0.50 mm ..... 84.485 - 84.520 mm
- 3rd repair level 1.00 mm ..... 83.985 - 84.020 mm
- 4th repair level 1.50 mm ..... 83.485 - 83.520 mm
Diameter, crankshaft bearing casing ..... 91.000 - 91.025 mm

Thickness of the main bearing shells
- Standard dimension ..... 2.955 - 2.965 mm
- 1st repair level 0.25 mm ..... 3.080 - 3.090 mm
- 2nd repair level 0.50 mm ..... 3.205 - 3.215 mm
- 3rd repair level 1.00 mm ..... 3.455 - 3.465 mm
- 4th repair level 1.50 mm ..... 3.705 - 3.715 mm
- Bearing ET NR 162000010800 (see Chapter 5. B) ..... 3.705 - 3.715 mm
Crankshaft bearing play ..... 0.050 - 0.127 mm
Width of the journal at the thrust bearing (crankshaft bearing at flywheel):
- Standard dimension (2 standard thrust washers) ..... 45.000 - 45.080 mm
- 1st repair level (one standard thrust washer and one with an oversize of 0.1 mm) 45.100 - 45.180 mm
- 2nd repair level (one standard thrust washer and one with an oversize of 0.2 mm) 45.200 - 45.280 mm
- 3rd repair level (one 0.1 mm thrust washer and one with an oversize of 0.2 mm) .. 45.300 - 45.380 mm
- 4th repair level (two thrust washers with an oversize of 0.2 mm) ..... 45.400 - 45.480 mm
Other crankshaft bearing journals must not be ground wider.
Axial play of the crankshaft ..... 0.100 - 0.380 mm
Max. permissible out-of-true of the crankshaft or con-rod bearing journals ..... 0.03 mm
Max. permissible imbalance of the crankshaft ..... 1.0 Ncm max.
Diameter of gear wheel collar for the additional
crankshaft inertia weight (engine type 420) ..... 150.220 - 150.260 mm
Inner diameter of ring gear for the additional
crankshaft inertia weight (engine type 420) ..... 150.000 - 150.040 mm

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Flywheel

Overlap of the starter ring gear on the flywheel ..... 0.425 - 0.600 mm
Before pressing the starter ring gear onto the flywheel, the
ring gear must be heated up to a temperature of ..... 150 - 200 °C
Max. permissible imbalance at the flywheel ..... 1.0 Ncm max.
Max. permissible warpage of the clutch surface measured at the inner
edge of the clutch surface 0.06:ø200

crankshaft inertia weight (engine type 420)

tooth flank play for the wheels:
- crankshaft gear wheel and flywheel ..... 0.1 - 0.3 mm
- between the flywheels ..... 0.05 - 0.250 mm
Axial play of the flywheels ..... 0.1 - 0.5 mm
Shaft diameter at the bearing points ..... 36.000 - 36.016 mm
Inner diameter of the flywheel bush (when fitted) ..... 36.050 - 36.075 mm
Drilling diameter, rear wall of casing ..... 36.058 - 36.083 mm
Drilling diameter, front wall of casing ..... 35.958 - 35.983 mm
Thickness of a washer between casing and cylinder block ..... 0.2 mm

Camshaft drive

Tooth flank play:
Intermediate gear wheel – crankshaft ..... 0.05 - 0.25 mm
Intermediate gear wheel – camshaft ..... 0.05 - 0.25 mm
Intermediate gear wheel – injection pump ..... 0.05 - 0.25 mm
Max. permissible lateral runout of the wheels ..... 0.05 mm
Intermediate gear wheel SP NO 162000010708 (with friction bearing):
- Inner diameter, intermediate gear wheel shaft bush (when fitted) ..... 55.000 - 55.030 mm
- Diameter of the intermediate gear wheel shaft ..... 54.951 - 54.970 mm
Inner diameter, camshaft gear wheel ..... 32.000 - 32.025 mm
Diameter, end of camshaft shank ..... 32.043 - 32.059 mm

Timing marks:
The timing marks located on the gear wheels correspond to the TDC of the
piston in the 1st cylinder, between the compression stroke and firing stroke.
On the crankshaft gear wheel ..... 2 dots on the teeth
On the intermediate gear wheel:
- opposite the crankshaft gear wheel ..... "0" mark on the tooth
- opposite the camshaft gear wheel ..... 1 dot on the tooth
- opposite the injection pump gear wheel ..... 1 dot at the recess
On the camshaft gear wheel ..... 1 dot at the recess
On the injection pump gear wheel ..... 1 dot on the tooth

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Con-rods

Inner diameter, small end bearing bush
(bush pressed into the con-rod) ..... 40.025 - 40.040 mm
Outer diameter of the small end bearing bush ..... 44.082 - 44.120 mm
Bearing bush taper in the con-rod ..... 0.057 - 0.120 mm
Bore hole, upper con-rod bearing ..... 44.000 - 44.025 mm
Bore hole, lower con-rod bearing ..... 71.730 - 71.749 mm

Thickness of the con-rod bearing shells:
- Standard ..... 1.835 - 1.842 mm
- 1st repair level 0.25 mm ..... 1.960 - 1.967 mm
- 2nd repair level 0.50 mm ..... 2.085 - 2.092 mm
- 3rd repair level 1.00 mm ..... 2.335 - 2.342 mm
- 4th repair level 1.50 mm ..... 2.585 - 2.592 mm

Con-rod bearing play ..... 0.046 - 0.098 mm
Con-rod bearing axial play ..... 0.200 - 0.410 mm
Perpendicular of the con-rod bore holes to the longitudinal axis of the con-rod 0.15:100
Parallelism of the con-rod bearing bore holes 0.05:100
The weight markings are punched in the bottom end of the con-rod.
Max. permissible weight difference between con-rods in the same engine ..... 20 g

Pistons, piston rings and piston pins

Smallest gap width between the piston and cylinder head measured
through the injection nozzle orifice using lead wire ..... 0.900 - 1.150 mm
Piston diameter:
- 17 mm upwards from the base ..... 107.873 - 107.887 mm

Piston pin bore hole in the piston ..... 40.003 - 40.009 mm
Diameter, piston pin ..... 39.991 - 40.000 mm

Width of the piston ring grooves:
- 1st groove (rectangular compression ring) ..... 2.560 - 2.580 mm
- 2nd groove ..... 2.520 - 2.540 mm
- 3rd groove ..... 4.040 - 4.060 mm

Vertical play of the piston rings in their grooves:
- 1st groove (rectangular compression ring) ..... 0.07 - 0.102 mm
- 2nd groove ..... 0.03 - 0.062 mm
- 3rd groove ..... 0.05 - 0.082 mm
- Wear limit ..... 0.15 mm

Piston ring height (in direction of cylinder):
- 1st groove (rectangular compression ring) ..... 2.478 - 2.490 mm
- 2nd groove ..... 2.478 - 2.490 mm
- 3rd groove ..... 3.975 - 3.990 mm

End play of piston rings (with piston fitted):
- 1st groove (wedge-type compression ring) ..... 0.40 - 0.55 mm
- 1st groove (rectangular compression ring) ..... 0.30 - 0.45 mm
- 2nd groove ..... 0.60 - 0.80 mm
- 3rd groove ..... 0.30 - 0.60 mm
- Wear limit, rings I and III ..... 1.0 mm
- Wear limit, ring II ..... 1.5 mm

Max. permissible weight difference between pistons in the same engine ..... 25 g

NOTE: *When fitting the pistons, make sure the piston recess is on the same side as the injection nozzles.*

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Lubrication system

Oil pressure at normal operating temperature:
- idling ..... at least 1.0 bar
- at operational speed ..... 2.5 - 4 bar
Length of the spring in the oil pressure valve, relaxed ..... 80 mm
Force of the valve spring compressed to a length of ..... 54^{+5} N
Oil pressure valve piston diameter ..... 19.602 - 19.635 mm
Oil pressure valve cylinder diameter ..... 19.700 - 19.752 mm
Lubrication oil filter – overflow valve opens at a differential pressure of ..... 1.5 - 2.5 bar
Oil pressure switch opens when ..... p > 0.5 bar

Lubrication oil pump (320, 420)

Tooth flank play when the crankshaft lies firmly against the under side of the bearing
- between the crankshaft and oil pump drive gear wheels ..... 0.05 - 0.25 mm
- between the oil pump gear wheels ..... 0.16 - 0.26 mm
Diameter of the drive shaft in the housing and cover ..... 17.966 - 17.984 mm
Diameter of the drive shaft bore hole in the housing and cover ..... 18.000 - 18.018 mm
Bore hole diameter of the gear wheel on the drive shaft ..... 18.060 - 18.078 mm
Diameter of drive shaft ..... 18.028 - 18.039 mm
Depth of the drive shaft end below the housing surface ..... 0.5 - 1.0 mm
Thickness of the housing seal ..... 0.06 - 0.08 mm

Outer diameter of the gear wheels ..... 43.486 - 43.525 mm
Housing diameter ..... 43.650 - 43.750 mm
Width of the gear wheels ..... 24.000 - 24.027 mm
Axial play of the gear wheels ..... 0.03 - 0.11 mm
Housing depth ..... 24.000 - 24.043 mm
Number of teeth on the drive gear wheel (engine type 320) 51
Number of teeth on the drive gear wheel (engine type 420) 46

Lubrication oil pump (620)

Tooth flank play when the crankshaft lies firmly against the under side of the bearing
- between the crankshaft and oil pump gear wheels ..... 0.05 - 0.025 mm
- between the oil pump gear wheels ..... 0.16 - 0.26 mm
Diameter of the drive shaft in the housing and cover ..... 17.966 - 17.984 mm
Diameter of the drive shaft bore hole in the housing and cover ..... 18.000 - 18.018 mm
Bore hole diameter of the gear wheel on the drive shaft ..... 18.000 - 18.018 mm
Diameter of the drive shaft at the drive ..... 17.966 - 17.984 mm
Diameter of the drive shaft in the pump housing ..... 20.035 - 20.048 mm
Depth of the drive shaft end below the housing surface ..... 0.5 - 1.0 mm
Thickness of the housing seal ..... 0.06 - 0.08 mm
Outer diameter of the gear wheels ..... 43.486 - 43.525 mm
Housing diameter ..... 43.650 - 43.750 mm
Width of the gear wheels ..... 32.000 - 32.027 mm
Axial play of the gear wheels ..... 0.03 - 0.11 mm
Housing depth ..... 32.000 - 32.043 mm
Number of teeth on the drive gear wheel 46

Thermostat

Type ..... ∅67/79 °C
Starts opening at ..... 79 °C$^{\pm 2}$
Fully open at ..... 94 °C
Maximum opening ..... 8 mm

Coolant temperature switch
Coolant temperature transmitter

Type of contact ..... Normally open
Operating temperature ..... 106 °C$^{\pm 3}$

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Cooling water pump (320, 420)

Bearing outer diameter ..... 52 mm
Bearing housing diameter ..... 51.979 - 52.009 mm
Shaft diameter at bearing ..... 20.002 - 20.015 mm
Shaft diameter at impeller ..... 15.907 - 15.920 mm
Diameter of impeller bore hole ..... 15.881 - 15.899 mm
The impeller must be pressed onto the shaft so that the remaining
clearance to the back of the housing is ..... 1.8 - 2.2 mm
Diameter of fan hub ..... 25.00 - 25.20 mm
Permissible imbalance of the fan ..... 0.3 Ncm max (30 pcm)
Permissible eccentricity of fan ..... ± 0.3 mm
V-belt tension, when pressed on between the two pulleys,
amount of give ..... 15 - 20 mm

Cooling water pump (620)

Bearing outer diameter ..... 52 mm
Bearing housing diameter ..... 51.979 - 52.009 mm
Shaft diameter at bearing ..... 19.980 - 19.993 mm
Shaft diameter at impeller ..... 15.907 - 15.920 mm
Diameter of impeller bore hole ..... 15.876 - 15.894 mm
The impeller must be pressed onto the shaft so that
there is the following clearance to the back of the housing ..... 0.8 - 1.2 mm
Diameter of the fan hub ..... 0.3 Ncm max (30 pcm)
V-belt tension, when pressed on between the two pulleys,
amount of give ..... 15 - 20 mm

Turbo charger

Schwitzer (320)

Axial play of the shaft ..... max. 0.14 mm
Radial play of the shaft[1] ..... max. 0.61 mm
Tightening torque for the turbine housing bolts ..... 22 Nm
Tightening torque for the hexagon nut on the shaft ..... 6.8 Nm

Schwitzer (420)

Axial play of the shaft ..... max. 0.14 mm
Radial play of the shaft[1] ..... max. 0.51 mm
Tightening torque for the turbine housing bolts ..... 22 Nm
Tightening torque for the hexagon nut on the shaft ..... 8.1 Nm

Schwitzer (620)

Axial play of the shaft ..... max. 0.14 mm
Radial play of the shaft[1] ..... max. 0.95 mm
Tightening torque for the turbine housing bolts ..... 17 Nm
Tightening torque for the hexagon nut on the shaft ..... 15.6 Nm

[1]) Measured at the turbine shaft nut.

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Tightening torques

Cylinder head nuts and bolts ..... 80 Nm+90°+90° (+60° after 15 - 20 min. warming up time)
Cylinder head bolts in the cylinder block ..... 30 Nm
Crankshaft bearing bolts ..... 200 Nm
Con-rod nuts ..... 40 Nm + 90°
Nut on the crankshaft (face):
- 320/420 ..... 600 Nm
- 620 ..... 1000 Nm
Counterweight of the crankshaft (320) ..... 160 Nm
Belt pulley bolts ..... 30 Nm
Securing bolts for flywheel ..... 140 Nm
Securing bolts for flywheel casing:
- internal M12 bolts ..... 110 Nm
- external M10 bolts ..... 60 Nm
Retaining screws for intermediate gear wheel (with friction bearing):
- M10 ..... 60 Nm
- M14 ..... 200 Nm
Bolts for balancing unit (420) ..... 60 Nm
Piston cooling nozzles (620.93) ..... 30 Nm
Nut for lubrication oil pump gear wheel ..... 60 Nm
Retaining screws for lubrication oil pump ..... 60 Nm
Connecting pipe for lubrication oil cooler ..... 60 Nm
Nut for belt pulley on coolant pump ..... 120 Nm
Fan bolts ..... 30 Nm
Nuts/bolts for exhaust manifold ..... 50 Nm
Bolts for air intake duct ..... 30 Nm
Nut for injection pump gear wheel ..... 90 Nm
Retaining nuts for injection nozzles (for bolts) ..... 15 Nm
Injection nozzle union nut ..... 60 Nm
Injection line union nut ..... 25 Nm

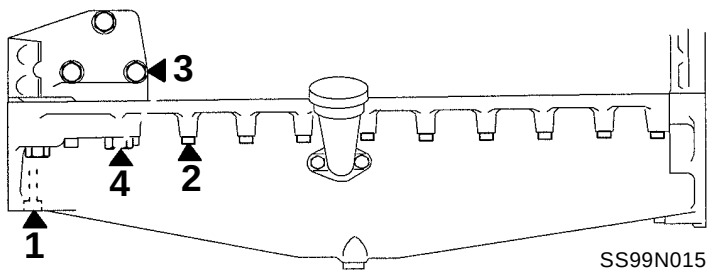
NOTE: *Use washers for aluminium parts.*

If no particular tightening torques are specified,
always use the values specified in the table below.

	M8	M10
Cast iron	$35^{\pm 5}$ Nm	$70^{\pm 5}$ Nm
Aluminium	$25^{\pm 5}$ Nm	$50^{\pm 5}$ Nm

Bolts for the self-supporting oil sump

1	M8	25 Nm
2	M10	90 Nm
3	M14	160 Nm
4	M20	600 Nm

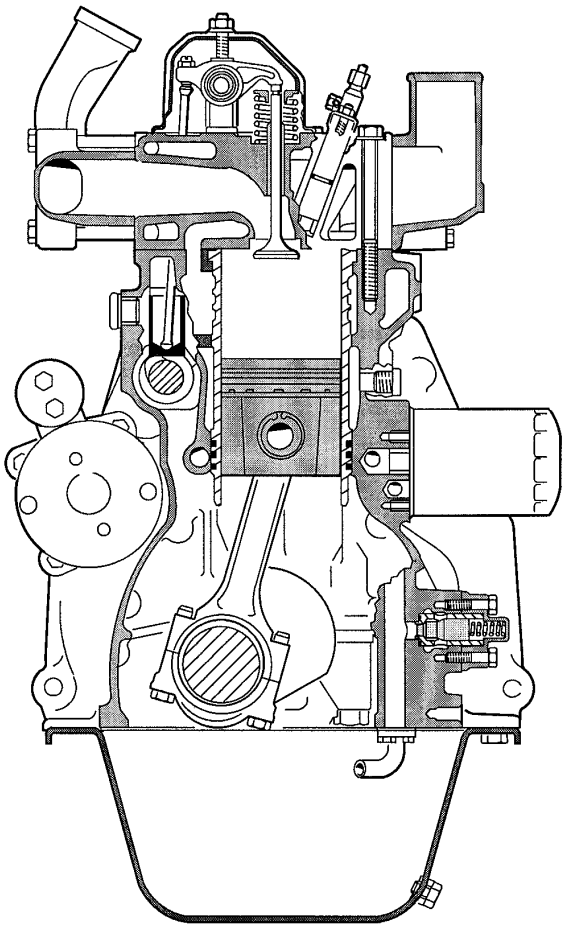


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CONSTRUCTION

General information

The 20 series Steyr-Sisu diesel engines are water-cooled, four stroke, in-line engines (with 3, 4 or 6 cylinders) with direct injection. All models are equipped with an exhaust gas turbocharger.



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Cylinder block

The rib-reinforced cylinder block forms the main engine unit, onto which other engine components are mounted.

The wet, replaceable cylinder liners are supported in the middle, thus reducing vibration and the coolant flow is mainly directed to the upper section of the cylinder liners.

The bottom part of the cylinder liner and the cylinder block are sealed by three O-rings, which are inserted in the grooves in the cylinder liner. The upper part is sealed by the cylinder head gasket.

The camshaft is located in the cylinder block. The front camshaft bearing seat is fitted with a separate bearing bush. The remaining bearing seats are incorporated into the cylinder block. The exception is the engine type 620 which is fitted with separate bearing bushes in all camshaft bearing seats. The bore hole for the rear end of the camshaft is sealed by means of a plug.

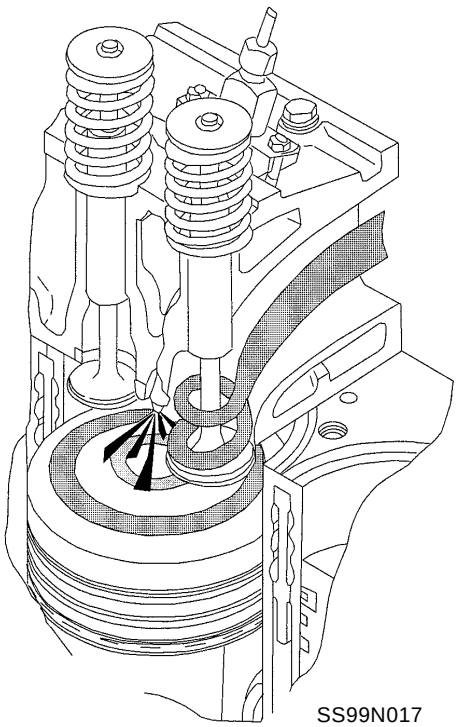
Guide bearings are fitted on both sides of the rear crankshaft bearings (crankshaft – axial bearings).

Flywheel casing

The flywheel casing is fitted at the rear end of the cylinder block. The seal for the rear end of the crankshaft is fitted in a bore hole in the casing. The flange for the starter is located in the flywheel casing.

The underside of the flywheel casing is used as a sealing surface for the oil sump seal. This means that the underside of the cylinder block must be flush with the flywheel casing. When the flywheel casing is fitted, its position is determined by sprung dowel pins.

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SS99N017

Cylinder head

Engine types 320 and 420 are equipped with one cylinder head. Engine type 620 is equipped with two cylinder heads which are interchangeable with each other and also with the type 320 cylinder head. Each cylinder has its own intake and outlet ducts in the cylinder head. To compensate for thermal stress, a cold inlet valve is fitted between the hot outlet valves

The cylinder head bolts are high-tensile pre-tensioned bolts, which are tightened to their elongation limit in accordance with the angular tightening principle. Due to the high degree of elongation, the retaining power is kept constant throughout the entire service life, and the bolts do not therefore have to be check tightened.

The injection nozzle seats are integrated into the cylinder head. The inlet and outlet valve guides are identical and can be interchanged. Furthermore, the outlet valves are fitted with replaceable valve seat inserts.

Valve mechanism

The valve mechanism is operated by the camshaft in the cylinder block. The drive power is transferred via valve tappets and push rods. The camshaft gear wheel is force fitted and is secured by a feather key. Every bearing is lubricated by the pressure lubrication system via the drilled oil channels.

Crankshaft drive

The crankshaft is made from forged chrome alloy special steel and the bearing and sealing surfaces are induction tempered. The bearings can thus be ground four times without further heat treatment being necessary. The gear wheels are located at the front end of the crankshaft. They are force fit and drive the intermediate gear wheel and the oil pump. In addition, the front end of the crankshaft has key-ways for the V-belt pulley hub. An oil scraper ring is used between the hub and gear wheel and a dust seal is fitted on the hub to protect the seal.

The crankshaft is supported in the cylinder block by crankshaft bearings on both sides of each cylinder. Thus, there is one crankshaft bearing more than there are cylinders. The crankshaft axial bearings are located in both sides of the rearmost crankshaft bearing. A flywheel is mounted at the rear end of the crankshaft and carries a strong, force fit crown gear.

The forged con-rod has an I-shaped cross-section. The lower con-rod bearing is split horizontally. The bearing cover is secured by means of two special bolts and nuts. The upper part has a wedge-shaped bearing seat in which the small end bearing bush is force fitted.

The piston is made of an eutectic aluminium alloy. There is a combustion chamber in the piston head. The shape of the combustion chamber optimises the carburetion of air and fuel.

The piston is equipped with three rings. The upper, molybdenum-coated piston ring has a rectangular cross-section. Types 420.85 and 620.93 have an upper piston ring with a trapezoidal cross-section.

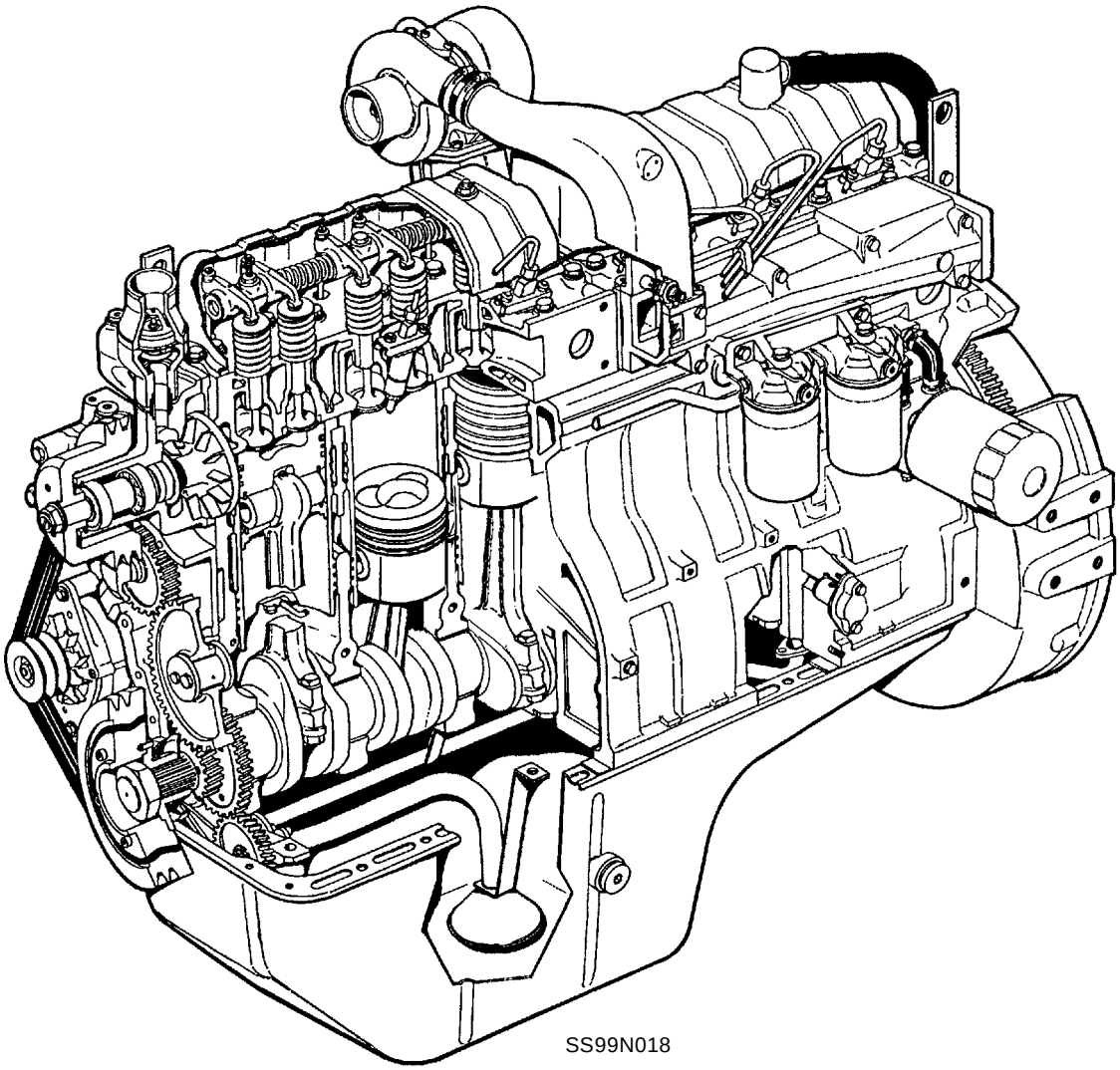
The middle ring is wedge-shaped and is fitted in its groove. The wedge shape takes up the play.

The oil scraper ring is sprung and has a two-stage, chrome-plated scraping edge.

The pistons are ring carrier pistons (the top piston ring has a cast iron ring carrier, which is cast into the piston). In addition, the piston is graphite-coated to ensure trouble-free running in.

Four-cylinder engines (type 420) are equipped with a balancing unit. The eccentric weights, which rotate at double the engine speed, compensate for the up and down mass forces exerted by the pistons and crankshaft drive.

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SS99N018

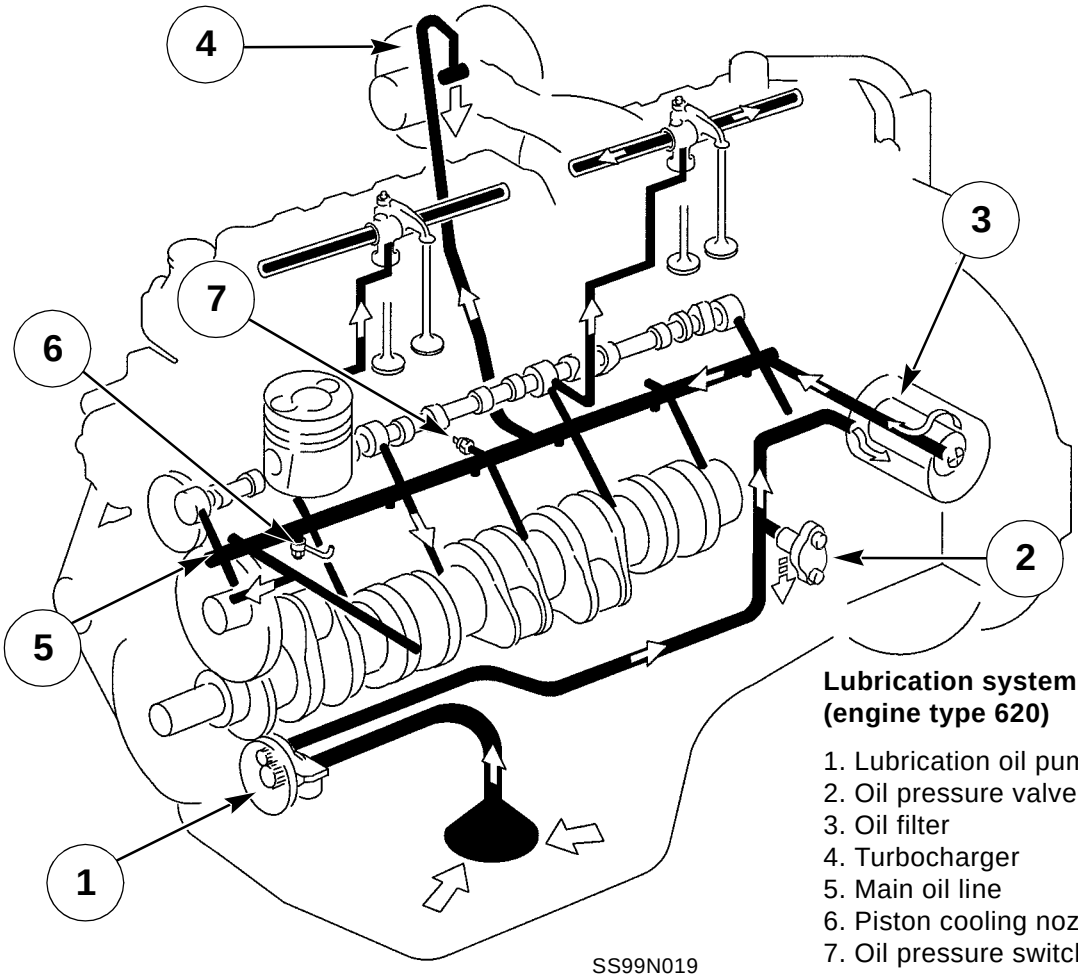
Timing gears

The timing gears are tempered, helical gear wheels.
The gear wheels are located in the timing gear case, which is fitted at the front of the engine.
The timing gears drive the camshaft, the fuel injection pump and the oil pump.

The hydraulic pump is driven by the timing gears or by a separate drive unit on the gearbox.

The intermediate gear wheel is borne on a friction bearing.
The bearing journal is fixed to the front surface of the cylinder block.

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Lubrication system (engine type 620)

1. Lubrication oil pump
2. Oil pressure valve
3. Oil filter
4. Turbocharger
5. Main oil line
6. Piston cooling nozzles
7. Oil pressure switch

Lubrication system

The engine is equipped with a pressure lubrication system, in which the oil pump (gear pump) is fixed to the lower part of the cylinder block. The pump sucks the oil in via an intake basket. After the pump, the oil is fed through an oil line to the oil pressure valve and oil filter. The oil is then fed through the main oil line, from which other oil lines branch off. The oil flows through the oil lines to the crankshaft bearings and through the crankshaft to the con-rod bearings.

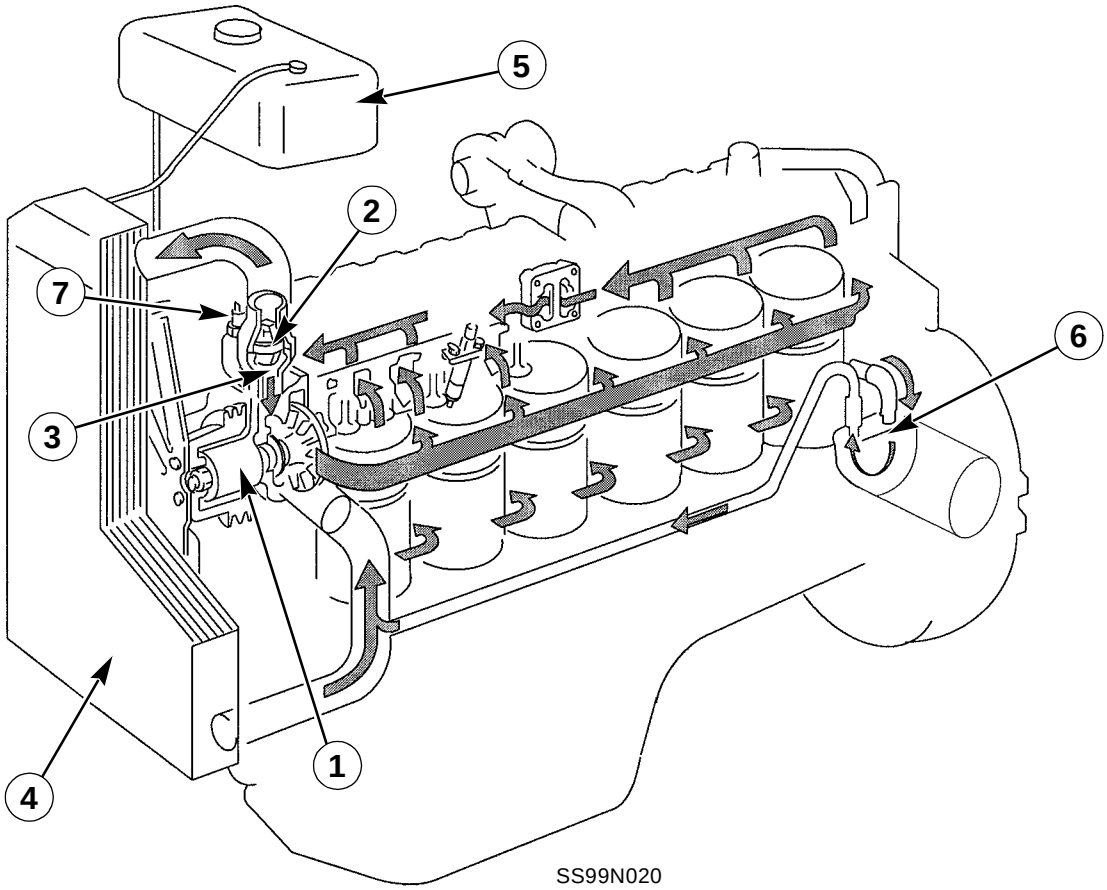
The main oil line then feeds the oil to the turbo charger, to the balancing unit (420) and to a pneumatic compressor, if fitted. In addition, the intermediate gear wheel bush, the camshaft bearing points and the valve mechanism are lubricated via the main oil line.

In the 620,93 engine, the piston heads are sprayed with oil from below and cooled as long as the lubrication oil pressure is higher than 3 bar.

The oil pressure valve is located below the oil filter on the left-hand side of the engine. The valve regulates the lubrication oil pressure so that a constant value is maintained independent of the engine speed. Depending upon the grade of oil, the engine speed and temperature, the oil pressure is **aprox. 2.5 - 4 bar**.
The oil pressure is **at least 1.0 bar** at idling speed.

The oil filter is a one-way main stream filter, which is fitted on the left-hand side of the engine. An overflow valve, on the underside of the filter, ensures reliable cold starting and sufficient lubrication in the event of a filter blockage. In addition, there is a non-return valve which prevents the filter being completely drained of oil.
The oil pressure switch opens at a pressure of 0.5 bar.

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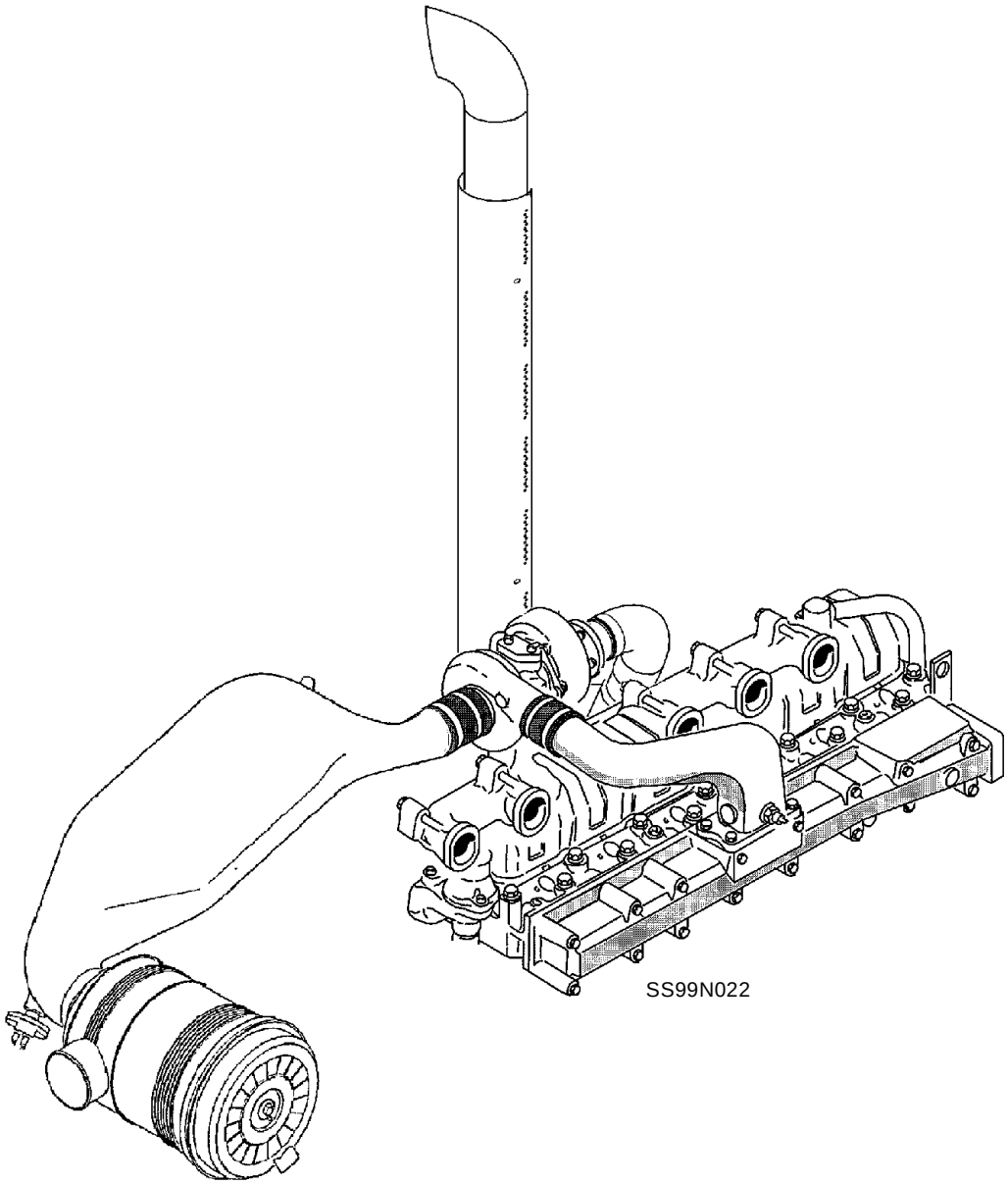
Cooling system

1. Coolant pump
2. Thermostat
3. Bypass channel
4. Radiator
5. Expansion chamber
6. Oil cooler
7. Engine temperature transmitter

Cooling system

The belt-driven rotary coolant pump is located at the front end of the cylinder block.
The thermostat housing is situated above the pump.
The system operates with internal coolant circulation through the bypass channel, the circulation being regulated by means of a two-way thermostat.
This function ensures an even temperature-rise under all conditions.

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Intake / exhaust system

The filter system for the engine intake air comprises a pre-cyclone filter (integrated into the air filter) and a dry air filter with safety cartridge. The intake air is rotated in the pre-cyclone filter. This removes most of the dirt particles, which are then discharged via the pre-cyclone filter's dust discharge valve.

The dirt particles in the air are collected in the main cartridge, which can be cleaned as required. The internal safety cartridge stops dirt particles getting into the engine in the event of the main cartridge breaking or being fitted incorrectly.

An electronic differential pressure transmitter is located in the filter housing. This transmitter causes an indicator lamp to light up on the instrument panel if the air filter is blocked. The intake system also comprises the lines between the air filter and the exhaust turbocharger and between the turbocharger and the inlet manifold.

The exhaust manifold is fixed to the cylinder head by means of anti-fatigue bolts, without a separate seal The manifold bolts do not need to be check tightened.

The turbocharger is small and thus also reacts quickly at low engine speeds. The turbocharger is lubricated and cooled by oil from the engine lubrication system.

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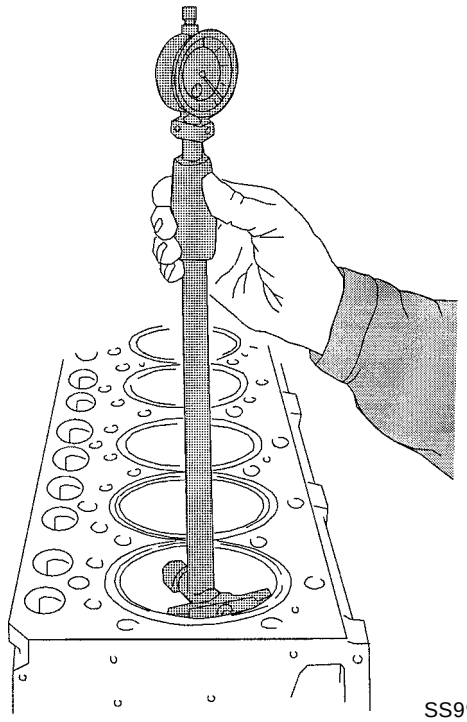
JOB INSTRUCTIONS

1. CYLINDER BLOCK

A. Measuring the cylinder liner wear

1. Set the dial test indicator to zero by means of a micrometer screw or using a new cylinder liner (initial dimension **108.00 mm**).

2. Thoroughly clean the inner surface of the cylinder liner before the measurement.



SS99N036

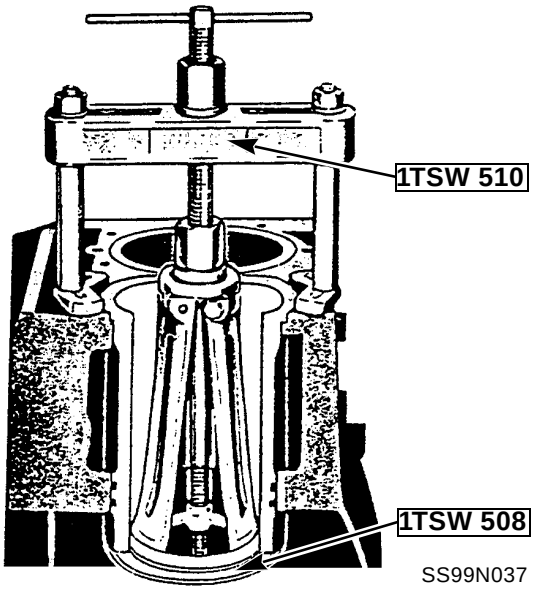
3. Measure cross-wise at the top end, bottom end and in the middle of the cylinder liner.

4. Check the displayed value for max. wear and ovality (compare with nominal values).

B. Removing the cylinder liner

1. If the cylinder liners are to be re-used, they must be marked so they can be re-fitted in the same positions.

2. Remove the cylinder liners using the 1TSW 508 and 1TSW 510 extraction tools.



SS99N037

C. Checking the cylinder block

1. Clean the cylinder block and all oil lines.

2. Check the cooling channels and remove scale and dirt deposits in order to ensure correct engine cooling.

3. Check the tightness of the shell plugs and screw plugs in the cylinder block and make sure the cylinder block and sealing surfaces are in good condition.

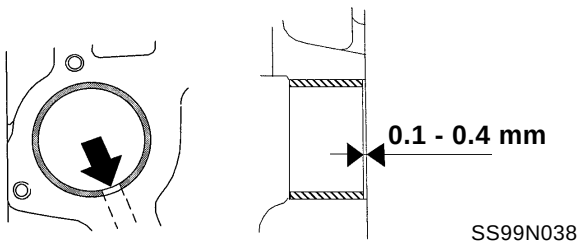
4. Measure the wear on the camshaft bearing points (compare with nominal values).

NOTE: *If the surface of the cylinder block has to be re-ground, the pistons must be shortened by a corresponding amount. Pay attention to the valve head clearances at the top surface of the piston.*

D. Replacing the camshaft bush

1. Pull the bush out using an internal extractor. After removing the rear camshaft end support piece, the bush can be driven out using a long drift.

2. Clean the bush seating.

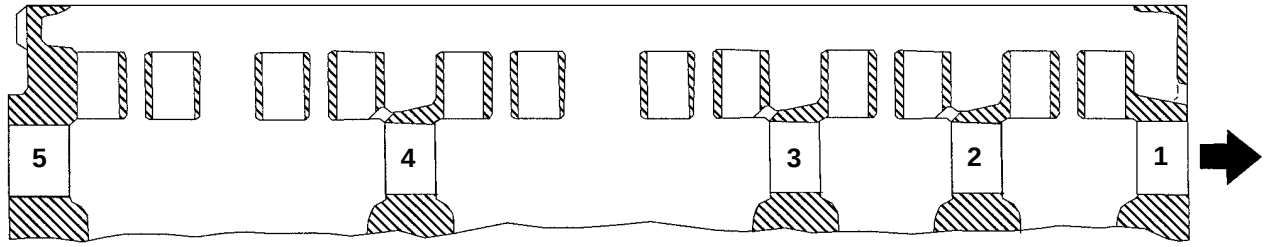


SS99N038

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3. Press fit a new bush. Pay attention to the position of the oil bore hole. The bush does not have to be reamed as it has the correct inner diameter if it is fitted in the correct place.

NOTE: *For the engine type 620 all camshaft bearing points are fitted with a separate bearing bush. Pay attention to the different outer diameters when removing and fitting the bushes.*



SS99N039

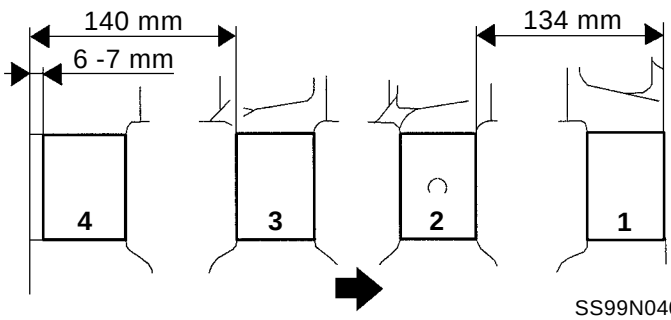
The numbering starts at the front end of the engine.

	Spare part number	Bore hole diameter
1.	162000010716	55.62 - 55.65
2.	162000010718	55.42 - 55.45
3.	162000010719	55.22 - 55.25
4.	162000010718	55.42 - 55.45
5.	162000010720	55.64 - 55.67

E. Oversize bushes for the camshaft

If the seat of the camshaft bush (front bearing) is damaged, a bush with an oversize outer diameter of **0.4 mm** can be fitted. Bushes are also available for the other camshaft bearings which are not normally fitted with bushes. The spare part numbers and machining dimensions for the bush seatings are shown in the figure.

WARNING: *Observe the position of the bush oil bore holes.*
The bushes do not have to be reamed after being fitted.



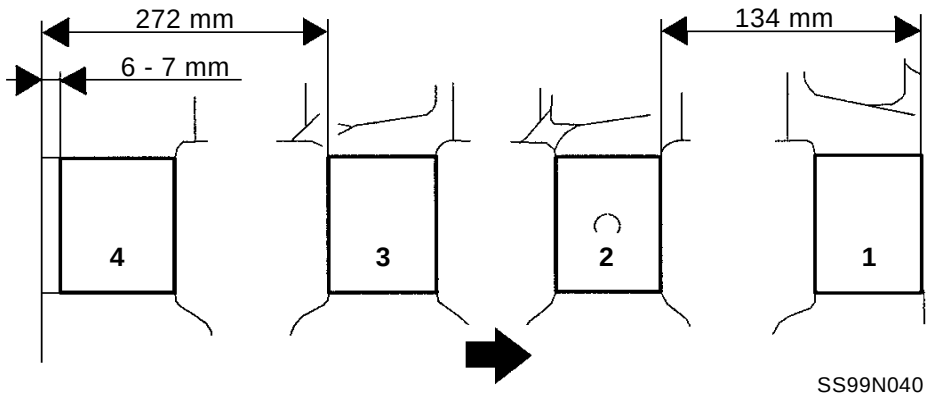
SS99N040

Oversized bearing bushes for engine type 320

	Spare part number	Bore hole diameter
1.	162000010776	56.02 - 56.05
2.	162000010718	55.42 - 55.45
3.	162000010718	55.42 - 55.45
4.	162000010720	55.64 - 55.67

The numbering starts at the front end of the engine.

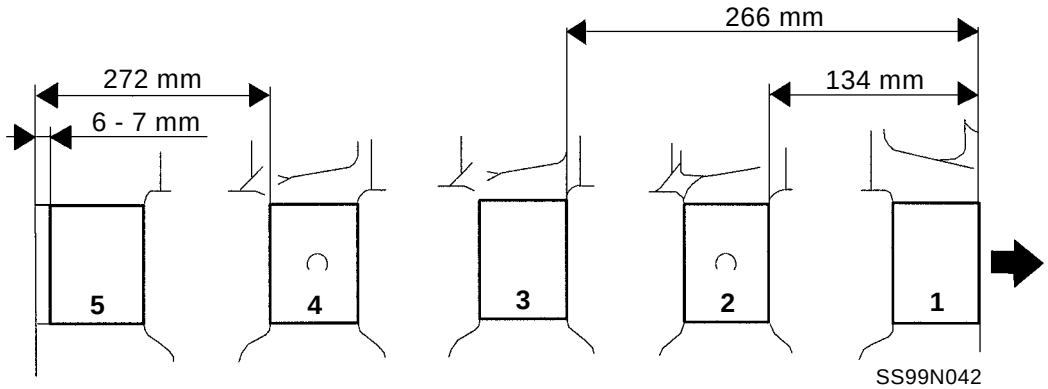
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Oversized camshaft bearing bushes for engine type 420

	Spare part number	Bore hole diameter
1.	162000010776	56.02 - 56.05
2.	162000010718	55.42 - 55.45
3.	162000010718	55.42 - 55.45
4.	162000010720	55.64 - 55.67

The numbering starts at the front end of the engine.



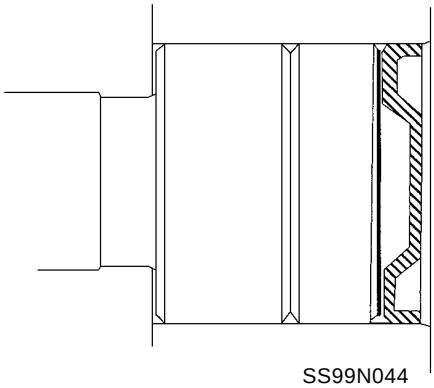
Oversized camshaft bearing bushes for engine type 620

	Spare part number	Bore hole diameter
1.	162000010776	56.02 - 56.05
2.	162000010777	55.62 - 55.65
3.	162000010718	55.42 - 55.45
4.	162000010777	55.62 - 55.65
5.	162000010779	55.84 - 55.87

The numbering starts at the front end of the engine.

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F. Fitting the plug at the rear camshaft end



SS99N044

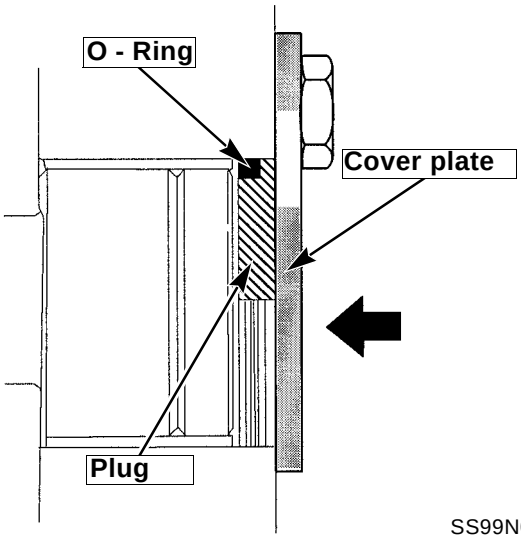
1. Clean the plug seating.

2. Apply sealant (e.g. Loctite 572) to the contact surface of the plug.

3. Force fit the plug using the pressing tool (1TSW 522).

NOTE: *Do not drive the plug in too far, as it could impair the axial play of the camshaft.*

G. Fitting the plug at the rear camshaft end after inserting an oversize bush



SS99N043

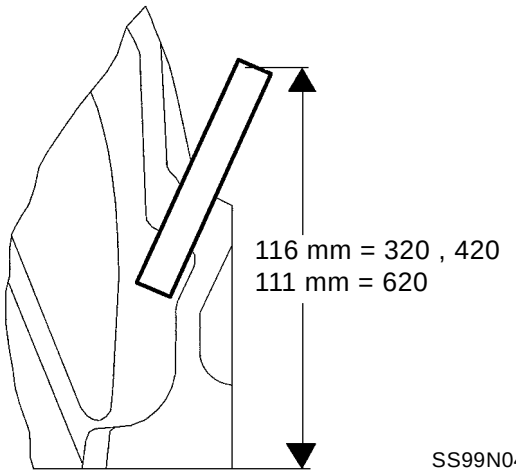
Upon completion, the rear camshaft end plug is replaced by the plug (spare part number 162000010797) and the O-ring (spare part number 162000010798). In engines where the flywheel casing does not cover the stopper plug, the cover plate (spare part number 162000010799) must be fitted.

H. Installing the oil dipstick tube

1. Clean the tube seating.

2. Apply locking fluid (e.g. Loctite 601) to the bottom end of the tube.

3. Drive the guide tube into the cylinder block to the dimension shown in the figure.



SS99N045

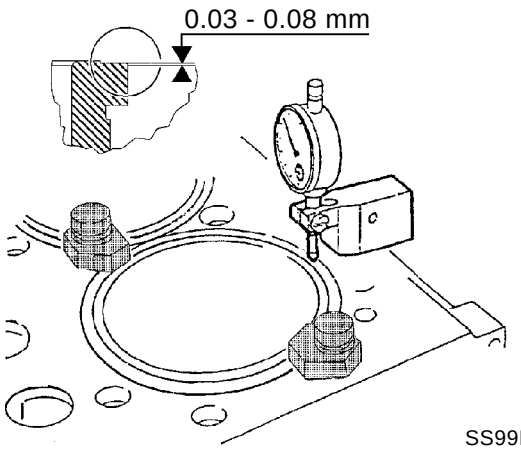
NOTE: *The position of the tube influences the measured engine oil level.*

I. Fitting the cylinder liner

1. Clean the cylinder liner and liner recess in the cylinder block. Without the O-ring, it must be easy to turn the liner to its installation position.

2. Apply a thin coat of marking paint to the underside of the cylinder liner flange. Fit the cylinder liner without O-rings and turn it back and forth. Remove the cylinder liner and check whether there is paint over the entire contact surface.

3. Clean the contact surfaces.



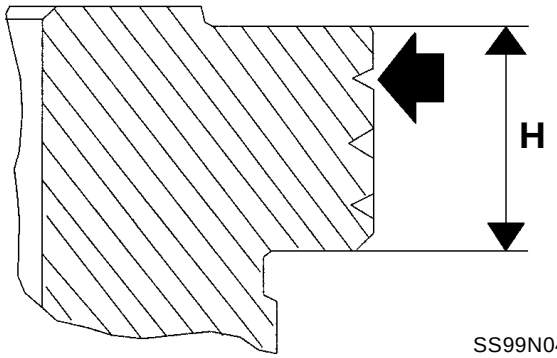
SS99N048

4. Fit the cylinder liners and secure each liner using two clamps. Measure the cylinder liner height using a dial test indicator and the holder (1TSW 5610). Set the dial test indicator to zero on a flat surface, e.g. the cylinder block. Measure each cylinder liner at four points. The cylinder liner should protrude from the top of the cylinder block by **0.03 - 0.08 mm**.

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The difference in height between the cylinder liners within one cylinder head must not exceed **0.02 mm**. In addition, a middle cylinder liner must not be lower than one of the outer ones.

5. If the cylinder liner height is insufficient, a liner with a higher flange must be fitted.



SS99N049

Spare part number	Height (H)	Marking grooves (quantity)
162000040704	$9.03^{+0,02}$	(standard)
162000040713	$9.08^{+0,02}$	1
162000040714	$9.13^{+0,02}$	2
162000040715	$9.23^{+0,02}$	3

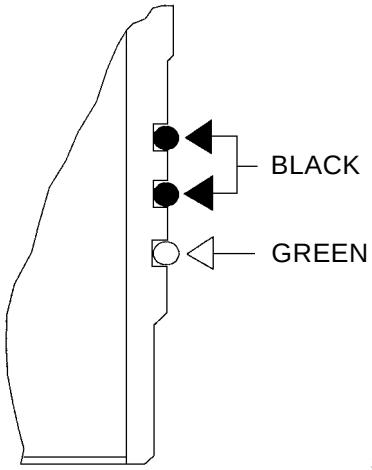
An oversize of the cylinder liner (higher flange) is marked as follows on the outer circumference by means of one or more marking grooves:

1. oversize, 0.05 mm = 1 marking groove

2. oversize, 0.10 mm = 2 marking grooves

3. oversize, 0.20 mm = 3 marking grooves

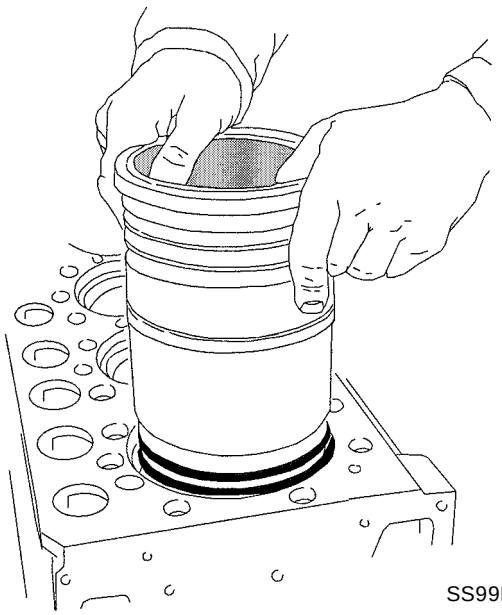
6. If the height of a cylinder liner is not the same over the entire circumference, the cylinder liner flange and recess depth must be checked. Cylinder liners with warped flanges must be replaced. If necessary, ream the liner seating in the cylinder block.



SS99N050

7. Insert the O-rings in the grooves in the lower cylinder section and lubricate them with liquid soap (not with oil).

NOTE: *Stretch the O-rings as little as possible when pulling them onto the cylinder liners. The max. permissible elongation is 6 %.*



SS99N051

8. Press the cylinder liners into the cylinder block. It should be easy to press them into their initial position. Make sure the cylinder liners do not move upwards once they have been fitted.

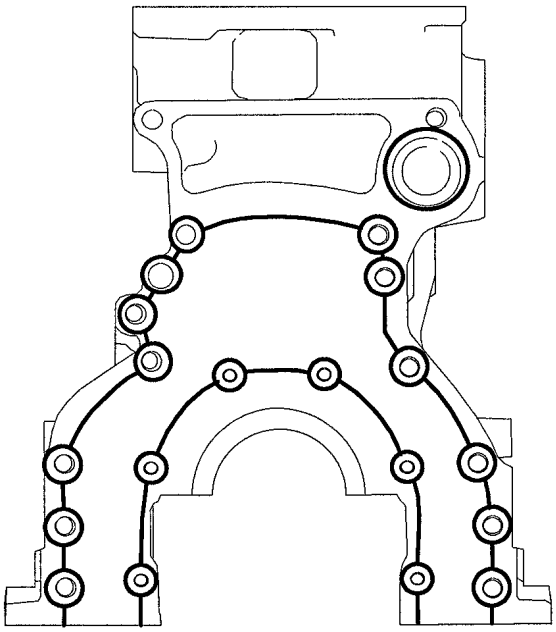
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2. FLYWHEEL CASING

A. Fitting the flywheel casing

The flywheel casing is centred on the cylinder block by means of two sprung dowel pins. The flywheel casings, which are also available as a spare part, are supplied with the bore holes for the pins.

1. Clean the sealing surfaces between the cylinder block and flywheel housing.



SS99N052

2. Apply sealant (e.g. silicone) to the points shown in the figure.

3. Lift the flywheel casing to the correct position and insert all the bolts.

4. Centre the casing and fit the sprung dowel pins using a mandrel.

5. Tighten the inner ring bolts to a torque of **60 Nm** and the outer ring bolts to a torque of **110 Nm**.

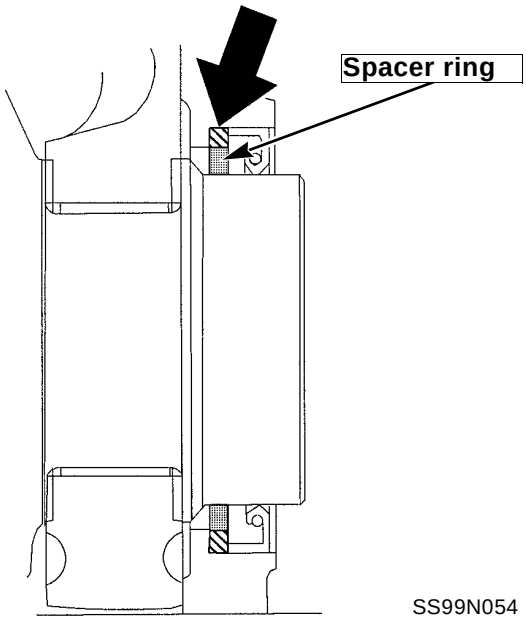
B. Replacing the rear crankshaft sealing ring

1. Separate the tractor between the engine and power unit.

2. Remove the flywheel.

3. Remove the sealing ring without damaging the crankshaft.

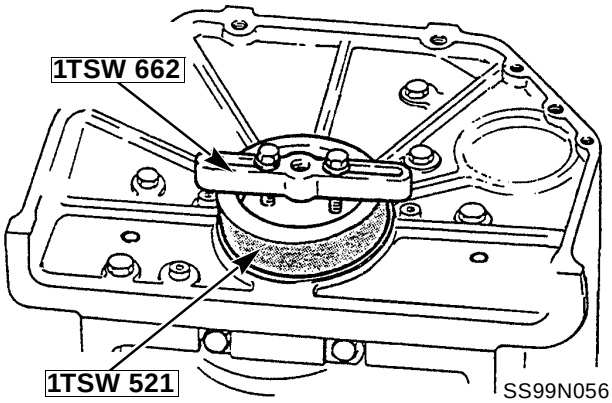
4. Clean the sealing ring seat and grind any burr.



SS99N054

NOTE: *If the crankshaft is worn at the sealing ring seat, a **2 mm** spacer ring (spare part number* 162000020718 *can be fitted behind the crankshaft sealing ring.*

5. Carefully press the sealing ring in down to the bottom of the flywheel casing using the 1TSW 521 and 1TSW 662 fitting tools.



SS99N056

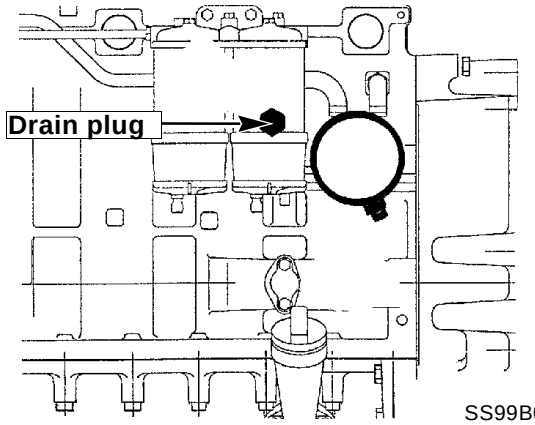
NOTE: *THE ASSEMBLY PROCEDURE MUST BE CARRIED OUT IN A DRY AND OIL-FREE STATE.*

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3. CYLINDER HEAD

A. Removing the cylinder head

1. Clean the outside of the engine.



SS99B056

Drain the coolant at the engine drain plug and the drain cock on the underside of the radiator. Disconnect the coolant hoses from the cylinder head and the thermostat housing.

2. Remove the intake lines between the exhaust turbo charger and the air filter and between the exhaust turbo charger and the intake manifold.

3. Remove the oil lines from the exhaust turbo charger.

4. Remove the fuel hose running to the thermo-start tank.

5. Remove the injection lines and leakage oil lines. Remove the injection nozzles. Fit all open connections with sealing caps.

6. Remove the intake and exhaust manifolds as well as the thermostat housing.

NOTE: *It is also possible to remove the cylinder head even when these parts are still fitted.*

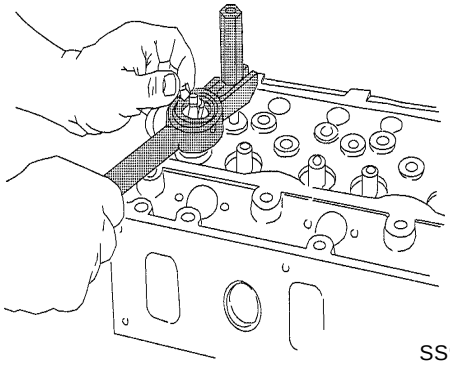
7. Remove the valve cover and bleed hose.

8. Remove the rocker arm mechanism and the push rods.

9. Loosen all cylinder head bolts by a ¼ of a revolution and then unscrew them. Remove the cylinder head.

B. Removing the valves

Make sure that those valves which are to be re-used are marked accordingly, so that they can be re-inserted in their original seating.



SS99N057

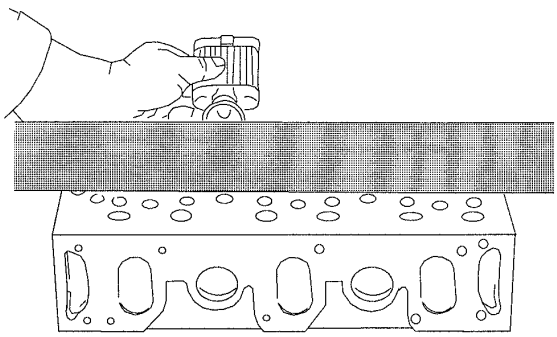
1. Screw a nut on a grub screw for the rocker arm mechanism. For 3 and 6 cylinder engines no grub screw is provided on the valves for the middle cylinders. A screw of an appropriate length should be used instead.

2. Compress the valve springs by means of the 1TSW 014 lever. Remove the valve spring seat retainers, the spring guide and the spring. Remove the valves.

C. Checking the cylinder head

1. Remove carbon deposits from the outlet channels, clean the sealing surfaces and wash the cylinder head.

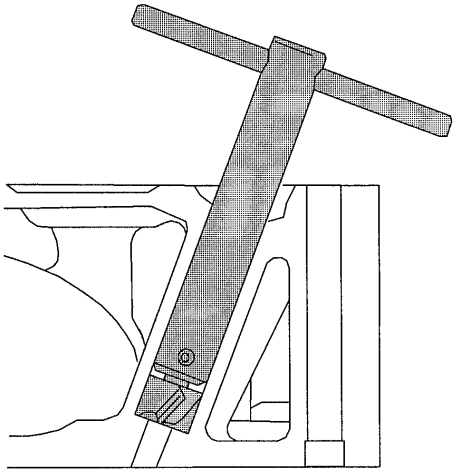
2. Check the cylinder head for cracks and any other damage.



SS99N058

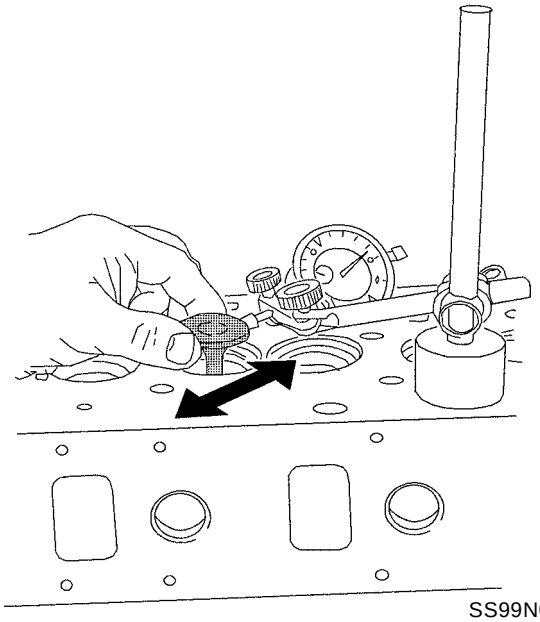
3. Check the evenness of the cylinder head using a straight edge. An uneven or bent surface must undergo surface grinding. After being ground, the height of the cylinder head may not be less than **104.00 mm**. The valve disk depth from the surface of the cylinder head must be **0.60 mm** for outlet valves and **0.70 mm** for inlet valves.

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SS99N059

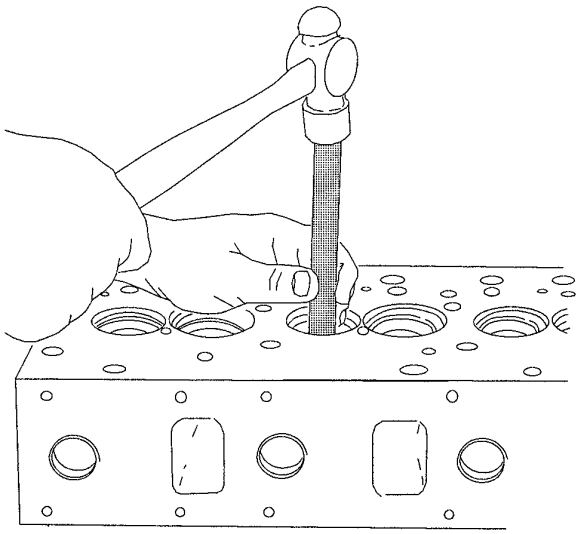
4. If necessary, clean the injection nozzle support in the cylinder head using a reamer.



SS99N060

5. Measure the clearance between the valve stem and guide by means of a dial test indicator. Lift the valve so that the valve disk juts out of the surface of the cylinder head by 15 mm and measure the clearance. In the case of inlet valves, it may not exceed **0.30 mm** and **0.35 mm** for outlet valves. To determine whether the valve guide is worn, a new valve must be used for the measurement.

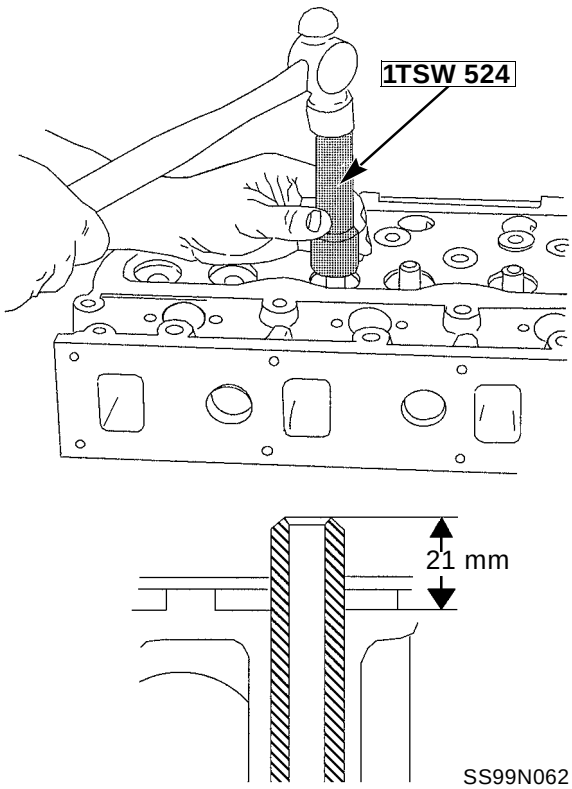
D. Replacing the valve guides



SS99N061

1. Press or drive the old guides out using a mandrel. Clean the valve guide seats.

2. Fit the new guides using the 1TSW 524 pressing-in tool, thus ensuring the correct installation height (21 mm above the end face of the spring).

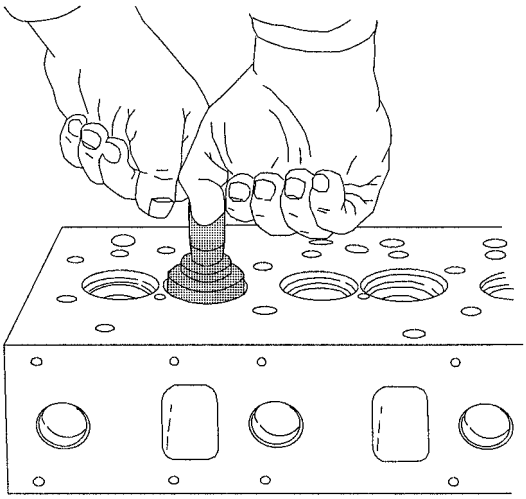


SS99N062

3. The same guides are used for inlet and outlet valves. Make sure the steepest chamfer on the guide points towards the valve spring. Also make sure the valves do not stick in the guides.

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E. Machining the valve seat



SS99N063

A damaged valve seat must be machined using a milling cutter. If the width of the seat exceeds **2.3 mm** in the case of an outlet valve and **3.7 mm** in the case of an inlet valve, then it has to be reduced at the outer edge, in particular.

The valve seat angle is **45°$^{+20'}$** for outlet valves and **35°$^{+20'}$** for inlet valves.

F. Replacing the valve seat rings

The outlet valves are equipped with separate valve seat rings. If the sealing surface is so badly damaged that it cannot be repaired, then the valve seat rings have to be replaced.

1. Grind the valve disk on a disused valve so that it fits snugly in the valve seat. Fit the valve and weld it to the seat correctly. Cool it with water.

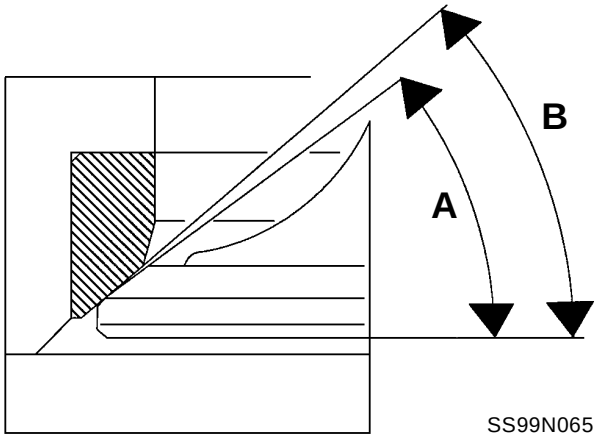
2. Turn the cylinder head round and drive the valve out together with the seat.

3. Clean the valve seat. Cool the new valve seat ring in dry ice or liquid nitrogen.

4. Fit the valve seat ring using a suitable pressing tool. Re-work the seat.

G. Grinding the valves

In order to ensure that a sufficient sealing effect is attained around the valves, there are different sealing surface angles. Thus, there is a particularly narrow sealing surface, which ensures an effective sealing effect even after prolonged operation.



SS99N065

	A	B
INLET VALVE	35°$^{-20'}$	35°$^{+20'}$
OUTLET VALVE	45°$^{-20'}$	45°$^{+20'}$

1. Grind the damaged valve disk using a valve grinding tool. Adjust the angle to **45°$^{-20'}$** for outlet valves and **35°$^{-20'}$** for inlet valves.

2. If the edge of the valve disk is less than **1.5 mm** after grinding or the valve stem is bent, the valve must be replaced.

3. Grind in the valves using grinding paste and check the contact surface with marking dye.

4. Clean the grinding paste off the cylinder head and valves.

H. Fitting the valves

1. Use a spring tester to check the straightness, length and tension of the valve springs. Compare these values with the technical data.

2. Lubricate the valve stems and insert the valves in the cylinder in the correct order.

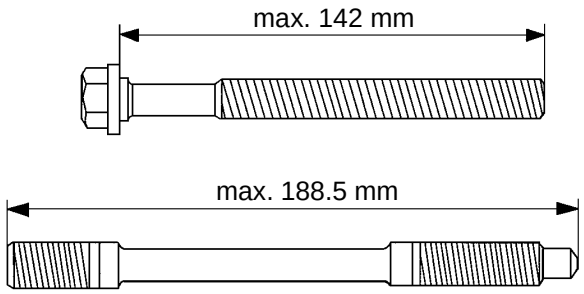
3. Fit the valve springs, valve disks and valve spring seat retainers in the cylinder head with the aid of the 1TSW 014 lever.

4. After inserting the valves, tap the ends of the valve stems, e.g. with a plastic hammer, to make sure the valve spring seat retainers are sitting correctly.

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I. Fitting the cylinder head

1. Measure the length of the cylinder head bolts. The length should lie within the limit values specified in the figure. If this is not the case, the bolt must be replaced.

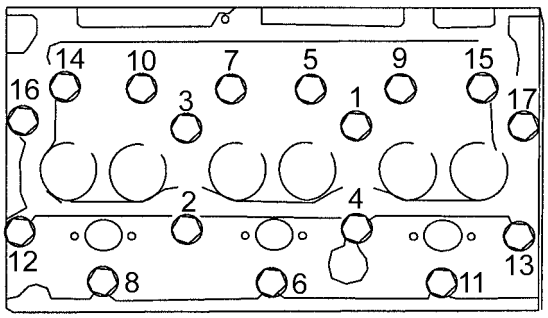


SS99N066

2. Screw the cylinder head grub screws into the cylinder head and a tighten them to a torque of **30 Nm**. Insert the push rods, if they have been removed.

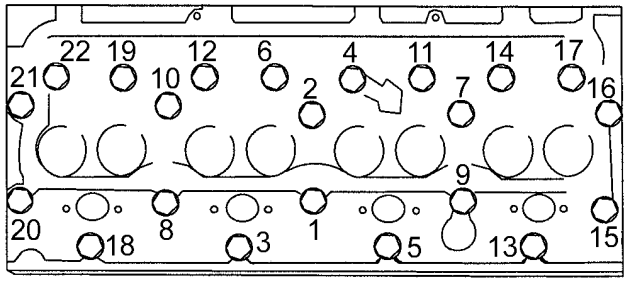
3. Make sure the sealing surfaces are clean and fit the cylinder head gasket. For engine type 620 use a straightedge to make sure the cylinder heads are parallel to each other. Clean, oil and insert the bolts.

320, 620



SS99N067

420



SS99N068

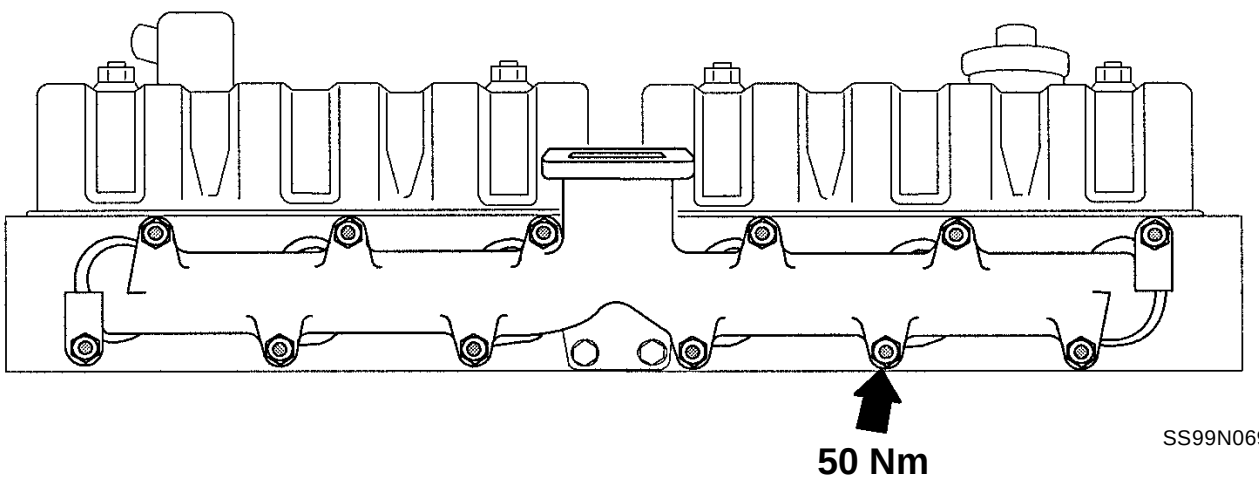
4. The figures show the bolt tightening sequence. The correct sequence is also cast into the cylinder heads.

5. Tighten the bolts in phases as follows:

1. Pre-tension of **80 Nm**
2. Tighten by **90°**
3. Tighten by **90°**
4. Adjust the valve clearance (see page 35).
5. Fit the other engine parts, add coolant and engine oil. Let the engine run at low load for approx. 15 - 20 minutes.
6. Tighten by **60°**.
7. Adjust the valve clearance

NOTE: *The cylinder head does not have to be tightened again after this procedure.*

Tighten the exhaust manifold securing bolts/nuts to a torque of **50 Nm**.



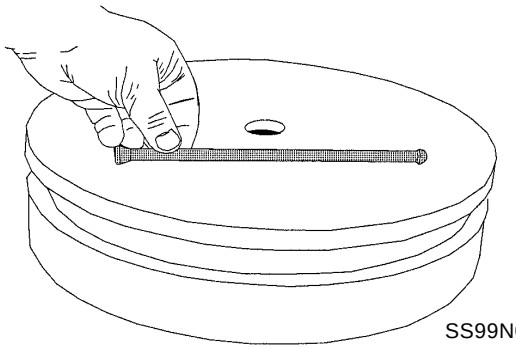
SS99N069

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4. VALVE MECHANISM

A. Maintenance of the rocker arm system

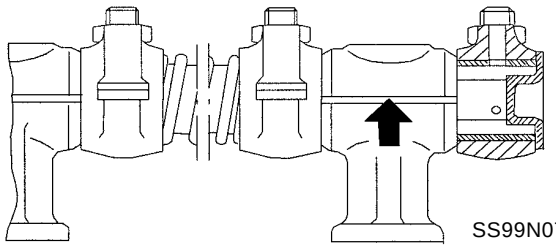
1. Check the valve tappets, particularly the guide surface on the camshaft. Replace worn and bent valve tappets.

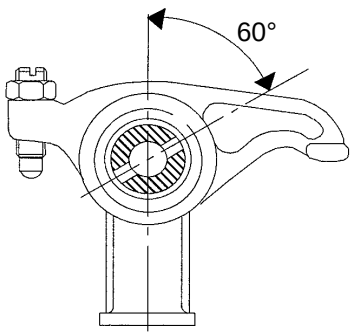

SS99N070

2. Check the straightness of the push rod. Also check the condition of the spherical faces at the ends of the push rod.

3. Dismantle the rocker arm mechanism and clean the components. Check the rocker arm shaft for wear and the condition of the oil lines.

4. If the pressure surface of the rocker arm is worn, grind it until it has the right shape. Do not grind off more than necessary as the pressure surface is hardened.


SS99N072



SS99N073

5. Fix a flange seal on one end of the rocker arm shaft. Lubricate the shaft and assemble the parts in the correct order. Make sure the shaft and the bearing retainers are in the right position. The split side of the retainers and the oil bore holes in the shaft must be on the valve side, as shown in the figure. Fix the other flange seal

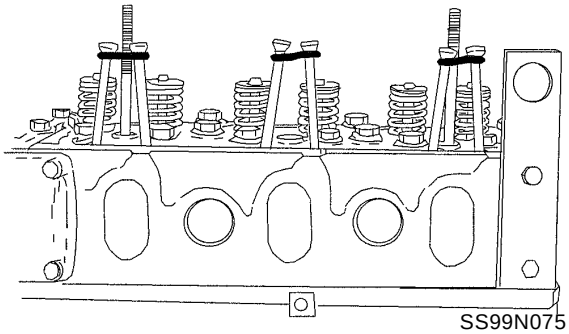
B. Replacing the camshaft / camshaft gear wheel

1. Remove the suction pipe between the turbo charger and the intake manifold. Remove the cover for the valve mechanism and the bleed pipe. Remove the rocker arm mechanism.

2. Remove the radiator, the fan, the alternator and the V-belts.

3. Loosen the crankshaft nut. Remove the V-belt pulley complete with hub (for engine type 620 loosen the belt pulley first).

4. Remove the gearwheel case cover.


SS99N075

5. Lock the valve tappets so that they do not fall down on removing the camshaft and impair the installation of the camshaft. Raise two adjacent valve push rods by tilting them towards each other. Clamp adjacent push rods together to form a pair (e.g. using an O-ring) so they remain in the top position.

WARNING: *Excessive tensioning of the push rods causes deformation.*

6. Turn the crankshaft, so the positioning marks on the camshaft gear wheel and intermediate gear wheel coincide. Pull the camshaft out.

7. Loosen the camshaft gear wheel using a suitable mandrel.

8. If the used camshaft or camshaft gear wheel is going to be re-fitted, clean them before assembly.

9. Push the feather key into the corresponding groove in the camshaft. Heat the camshaft gear wheel up to **200 °C** and fit it in the corresponding position.

10. Grease the bearing surfaces and press the shaft into the cylinder block, paying attention to the position marks on the camshaft gear wheel.

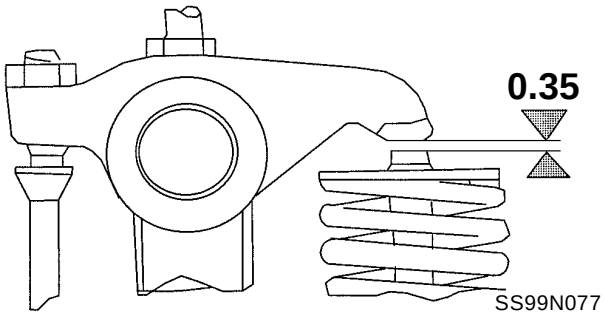
11. Fit the timing gear case cover and the belt pulley complete with hub.

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12. Release the push rods and fit the rocker arm mechanism. Adjust the valves. Then screw the valve cover and air bleed hose onto the cylinder head. Also fit the suction pipe between the turbo charger and intake manifold.

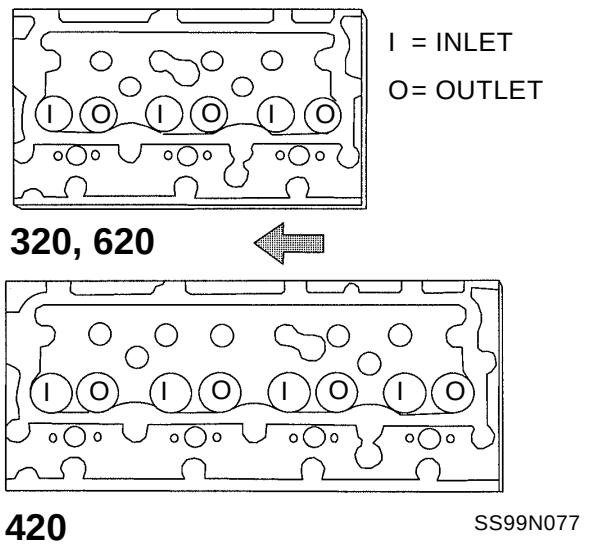
13. Fit the alternator and V-belts. Tension the V-belts accordingly. Fit the radiator.

C. Checking and adjusting the valve clearance



The inlet and outlet valves have a clearance of **0.35 mm**. It can be checked when the engine is hot or cold. Check and adjust the valve clearances of a cylinder whilst the piston is at top dead centre of the compression stroke. Proceed according to the injection sequence of the engine.

If the valve clearance deviates from the specified value, loosen the locking nut and adjust it to the correct value via the adjusting screw. A **0.35 mm feeler gauge** must fit **tightly** between the rocker arm and the end of the valve stem.



Engine type 320

Check the valve play in the injection sequence.

Injection sequence:	**1 2 3**

- check the valves in cylinder 1 when the cylinder 3 outlet valve is fully open (6th valve from the front of the engine).

- check the cylinder 2 valves when the cylinder 1 outlet valve (2nd valve) is fully open.

- check the cylinder 3 valves when the cylinder 2 outlet valve (4th valve) is fully open.

Engine type 420

- turn the crankshaft in the direction of rotation until the valves of cylinder 4 overlap. (Outlet valve closes, inlet valve opens). Check the valves of the first cylinder.

- turn the crankshaft 1/2 of a revolution in the direction of rotation so that the valves of cylinder 3 change over. Check the valves of cylinder 2.

- continue work in the sequence of injection:

Injection sequence:	**1 2 4 3**
Change-over of the valves in the cylinders:	**4 3 1 2**

Engine type 620

- turn the crankshaft in the direction of rotation until the valves of cylinder 6 overlap. (Outlet valve closes, inlet valve opens). Check the valves of the first cylinder.

- turn the crankshaft 1/3 of a revolution in the direction of rotation so that the valves of the 2nd cylinder overlap. Check the valves of the 5th cylinder.

- continue work in the sequence of injection:

Injection sequence:	**1 5 3 6 2 4**
Valve overlap:	**6 2 4 1 5 3**

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5. CRANKSHAFT

A. Removing the crankshaft

1. Unscrew the sump.

2. Separate the balancing unit lubrication oil line from the cylinder block and remove the balancing unit fixing bolts. Remove the balancing unit and the lubrication oil line (only for engine type 420).

3. Unscrew the securing bolts for the lubrication oil pump pressure line in the cylinder block. Remove the oil pump and the intake/pressure lines.

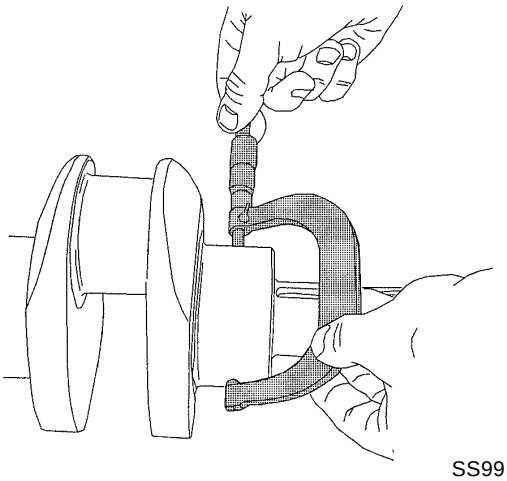
4. Remove the flywheel casing.

5. Remove the belt pulley/hub from the front end of the crankshaft (also refer to the instructions concerning the timing gears page 46).

6. Remove the con-rod bearing covers and push the con-rods up so they are not in the way when removing the crankshaft.

7. Remove the crankshaft bearing covers and lift the crankshaft out.

B. Checking the crankshaft

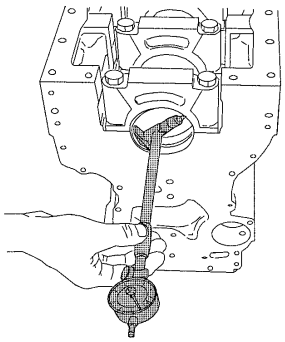


SS99N078

1. Clean the crankshaft. Do not forget to clean the oil bore holes.

2. Measure the wear on the crankshaft bearing journals at different points. Ovality, conicity or other wear must not exceed **0.03 mm**.

3. Insert the bearing caps with new bearing shells and tighten them to the correct torque. Measure the inner diameter with a dial test indicator, which has been reset to zero according to the dimensions measured under item 2. The indicator thus displays the actual bearing play. If the bearing housing which shows signs of wear is not round, take measurements at several points.

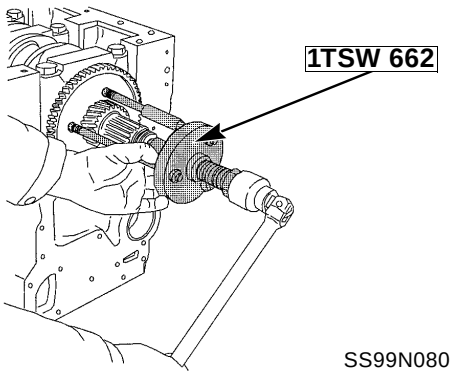


SS99N079

4. If the bearing play exceeds **0.18 mm** for the crankshaft bearings or **0.14 mm** for con-rod bearings with new bearing shells, the bearing journals on the crankshaft must be ground. For the correct undersize and corresponding bearings, refer to the technical data. Make sure the radii do not change during the grinding process.

NOTE: *In the event of the crankshaft bearing base bore holes being damaged or worn as a result of bearing damage, crankshaft bearings are also available as a spare part with an oversize of 1.0 mm (outside dimension) and an undersize of 0.5 mm (inside dimension). The cylinder block must now be machined to a dimension of* ***92.000 - 92.025 mm****. The crankshaft must be machined to a dimension of* ***84.485 - 84.520 mm****. The bearing shell with a groove and a hole is fitted in the cylinder block and the bearing shell without an oil bore hole in the bearing cap.*

C. Replacing the crankshaft gear wheels



SS99N080

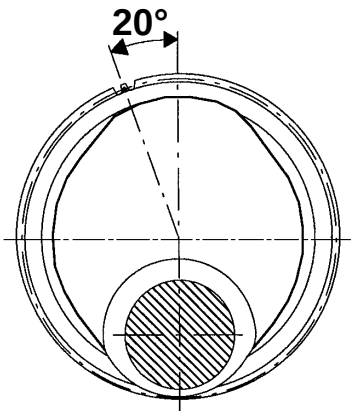
1. Attach an extractor to the crankshaft gear wheels and pull off both gear wheels.

2. Clean the seat on the crankshaft using a wire brush, for example.

3. Heat up the new gear wheels to **200 °C**. Drive the gear wheels onto the shaft using a suitable sleeve or soft mandrel. Pay attention to the position of the feather key and make sure the alignment marks on the front gear wheel are visible. Allow the parts to cool down.

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D. Replacement of the crankshaft ring gear (engine type 420 only)



SS99N081

1. Mark the position of the ring gear on the shaft.

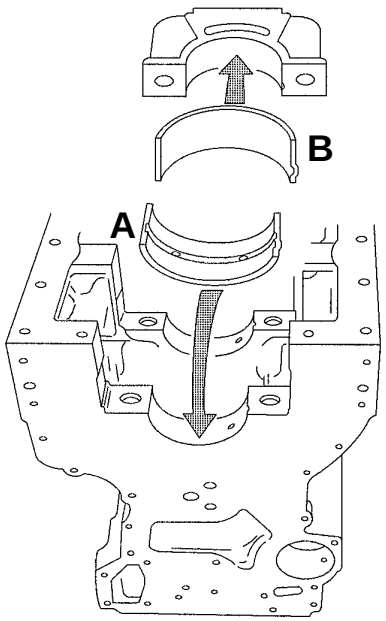
2. Heat the ring gear using a welding torch and loosen it using a suitable mandrel.

3. Heat up the new gear wheels to **250 °C**. Fit the ring gear such that the contact surface faces the crankshaft flange and the gears are aligned with the marking or in accordance with the above figure. Hammer the ring gear downward and allow it to cool down.

NOTE: *The above figure shows the back view of the crankshaft and the con-rod foot bearing for cylinder 2.*

E. Fitting the crankshaft

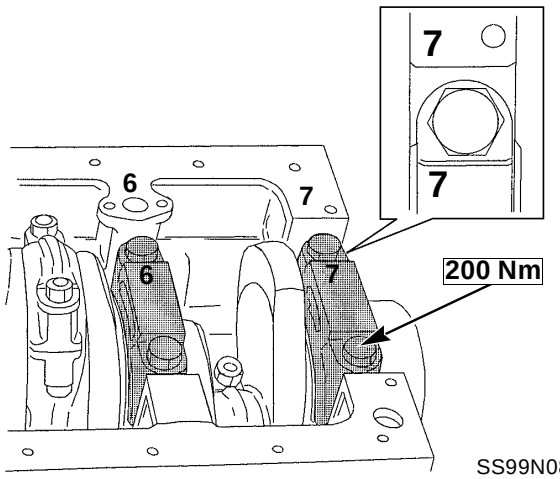
1. Clean the oil lines, bearing shells and seats. Make sure the crankshaft is clean.



SS99N082

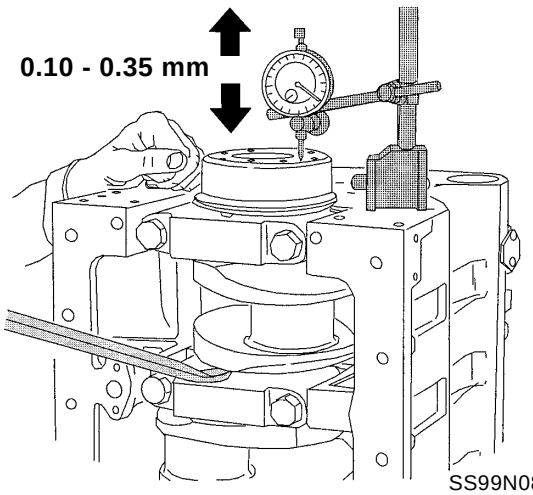
2. Fit a bearing shell (**A**) with an oil bore hole and oil groove in the cylinder block and a bearing shell (**B**) without an oil bore hole in the bearing cover. Make sure the bearing shell noses engage in the corresponding notches and that the shells to be fitted in the cylinder block have an oil bore hole which aligns with the oil bore hole in the cylinder block.

3. Lubricate the bearing surfaces and fit the crankshaft. Insert the axial bearings for the crankshaft so that the lubrication grooves point towards the crankshaft.



SS99N083

4. Insert the crankshaft bearing covers according to their numbering, with axial bearings at the rear, which have got joggles. Lubricate the bolts and tighten them to a torque of **200 Nm**.



SS99N084

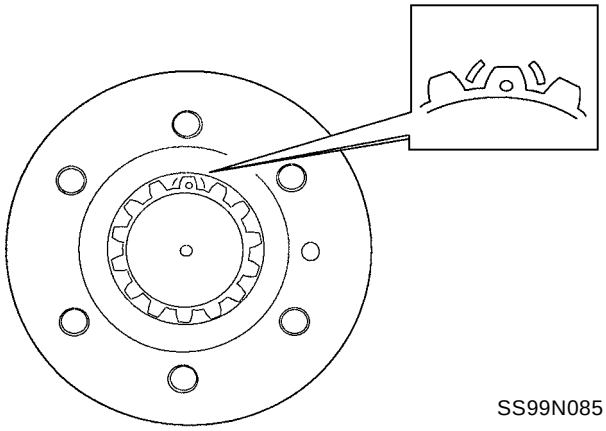
5. Make sure the crankshaft turns freely and without sticking. Check the axial play using a dial test indicator. The correct axial play is approx. **0.10 - 0.35 mm**. If there is excessive axial play, oversized axial bearings must be fitted.

NOTE: *The bearing shells must never be reamed or machined and the sides of the bearing covers must not be filed.*

WARNING: *For engine type 320 the bolt tightening torque for the crankshaft counterweight is **160 Nm**. Apply a locking fluid (e.g. Loctite 271) to the bolt threads.*

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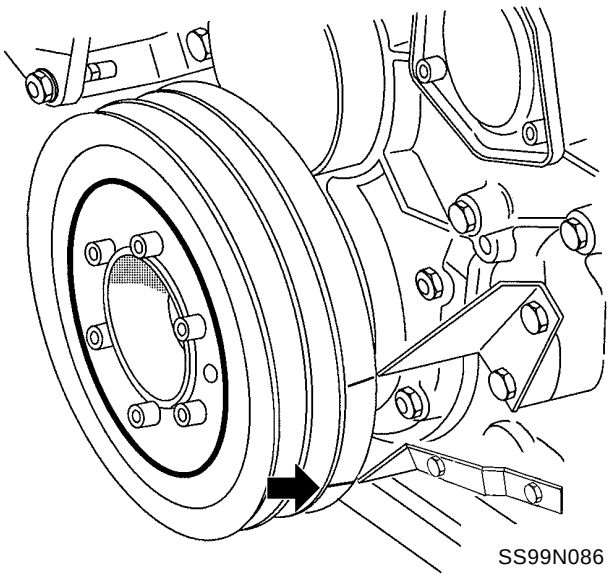
F. Crankshaft hub



SS99N085

When fitting the hub at the front end of the crankshaft, make sure it is in the correct position. (engines with injection marking on the vibration damper.) The hub has an installation marking:
-- both lines on the hub must lie adjacent to the dot marking • on a crankshaft tooth.

G. Replacing the crankshaft belt pulley and vibration damper



SS99N086

NOTE: *In the case of a second hydraulic circuit the markings on the belt pulley and on the casing are located lower down for reasons of space.*

1. Loosen the alternator securing bolts and remove the V-belt.

2. Unscrew the bolts holding the belt pulley and vibration damper and remove the parts. The belt pulley and vibration damper are pinned together with the crankshaft hub (injection mark on the vibration damper).

3. Fix a new vibration damper or belt pulley onto the crankshaft. Drive the dowel pins in and tighten the securing bolts to a torque of **30 Nm**.

NOTE: *Vibration dampers (belt pulleys) supplied as a spare part do not have an injection marking. New vibration dampers must be marked after being fitted.*

4. Turn the crankshaft until the piston of the first cylinder is at top dead centre (TDC). Let the valve fall against the cylinder head. Mount the dial test indicator at the top of the valve stem and set it to zero when the piston is at top dead centre. Then turn the crankshaft against the direction of rotation until the dial test indicator reads approx. 15 mm below TDC. Then slowly turn the crankshaft in the direction of rotation until the dial test indicator shows the value which corresponds to the injection marking (see table below).

NOTE: *Refer to setting data on page 9*

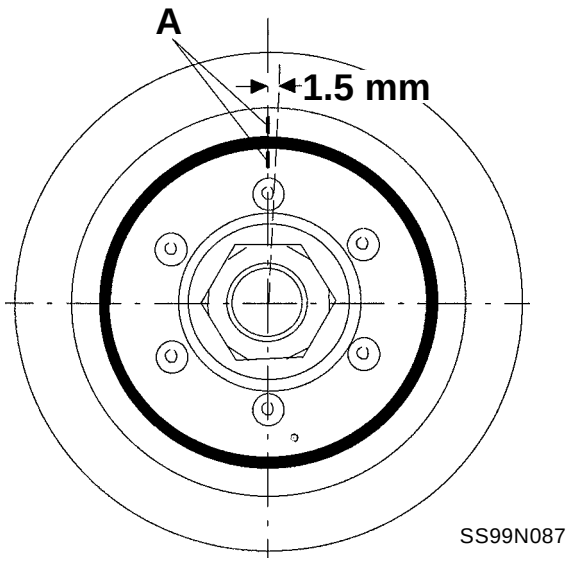
5. Inscribe the injection marking by means of an electric engraving pen **(do not punch it in)**.

Piston stroke to top dead centre in comparison to crankshaft angle

320, 420, 620			
Degrees	mm	Degrees	mm
1°	0.012	16°	2.983
2°	0.047	17°	3.363
3°	0.106	18°	3.765
4°	0.188	19°	4.188
5°	0.294	20°	4.633
6°	0.423	21°	5.100
7°	0.576	22°	5.587
8°	0.752	23°	6.095
9°	0.951	24°	6.624
10°	1.173	25°	7.173
11°	1.418	26°	7.742
12°	1.686	27°	8.331
13°	1.976	28°	8.939
14°	2.289	29°	9.567
15°	2.625	30°	10.213

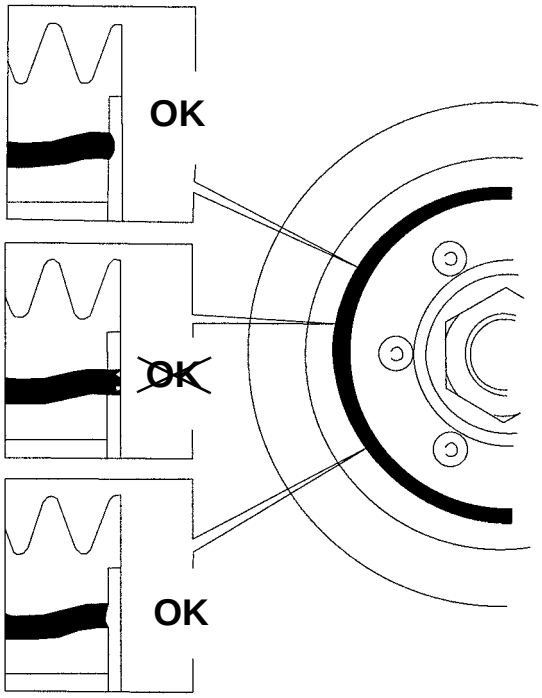
https://truckmanualshub.com/

H. Checking the rubber element in the vibration damper (620/420)



SS99N087

1. If the lines (**A**) are misaligned by more than **1.5 mm**, the vibration damper must be replaced.



SS99N088

2. Also check the condition of the rubber element. If pieces of rubber are missing or the rubber part is more than **3.5 mm** below the surface, or if a forward motion of the inertial component (outer ring) is discernible, the vibration damper must be replaced.

IMPORTANT: *The vibration dampers should be replaced every 4000 operating hours!*

https://truckmanualshub.com/

6. CON-RODS AND PISTONS

A. Removing the pistons together with the con-rods

1. Unscrew the sump and the lubrication oil pressure and suction lines.

2. Unscrew the cylinder head.

3. Scratch the carbon ridge off the cylinder liner. If necessary, scrape off the sharp abrasion edge at the reversal point of the piston ring.

4. Remove the con-rod bearing covers and bearing shells. If the bearing shells are to be re-used, their order must be marked.

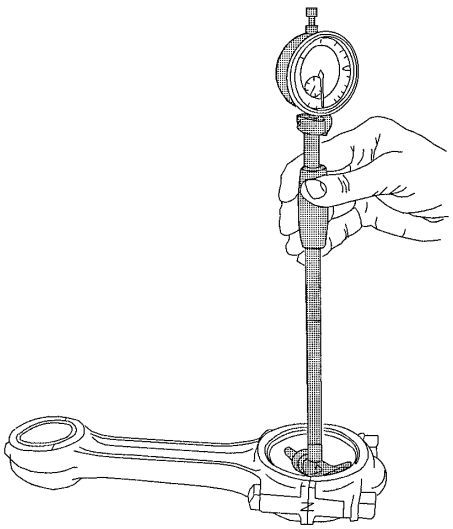
5. Push the piston and con-rod up by using the shaft of a hammer or some similar object.

6. Remove the piston pin circlips. Push the piston pin out.

NOTE: *If the piston pin does not move by applying finger pressure, the piston must be gradually heated up to* ***100 °C****.*

B. Checking and replacing the con-rod bearings

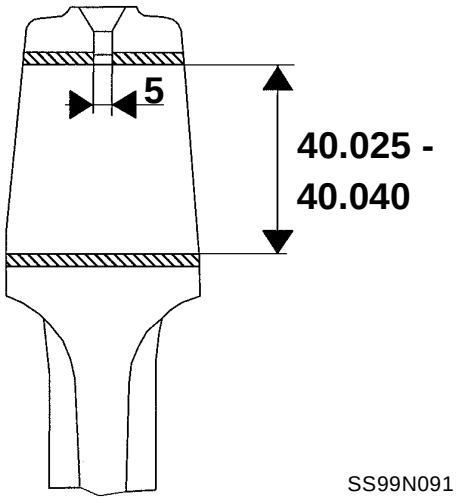
1. Clean the con-rod and bearing shells. Fit the bearing shells and tighten the bolts to a torque of **40 Nm + 90°**.



SS99N090

2. Measure the inner diameter with a plug gauge, which has been zeroed at the diameter of the applicable bearing journal. If new bearing shells have a clearance of more than **0.14 mm**, the con-rod bearing journals must be ground and the next bearing shell undersize fitted (repair kit).

3. If the small end bearing bush is worn, it must be driven out using a suitable mandrel.

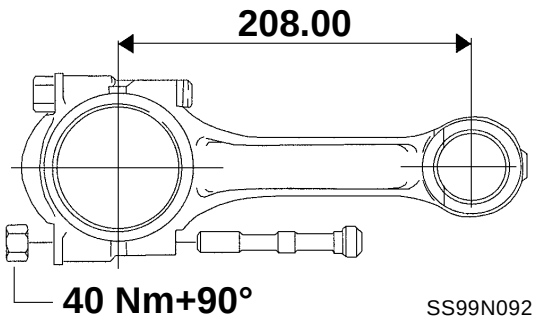


SS99N091

4. Press the new bush in. The oil channel in the bush must coincide with the corresponding channel in the con-rod. After fitting it, drill a hole with a ∅ of **5 mm**. Use a reamer to ream the bush to the correct diameter.

C. Checking the con-rod

Check the con-rod by means of a special device.

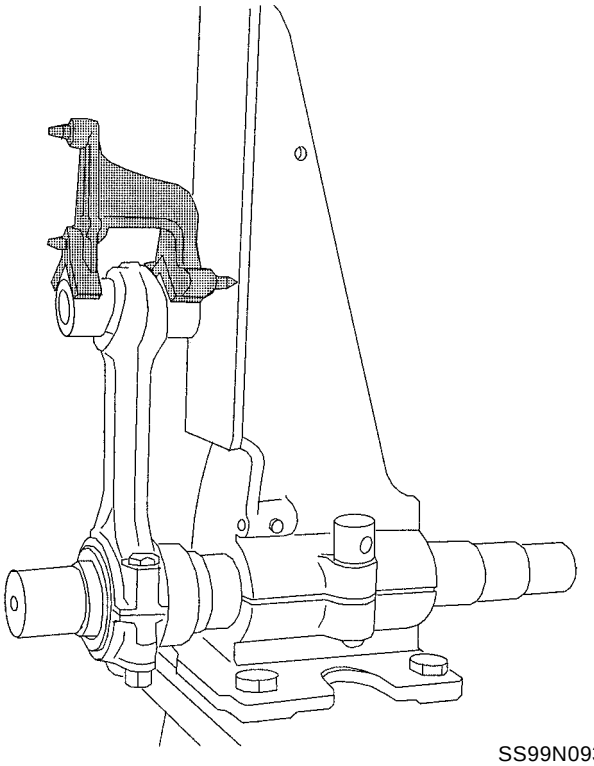


SS99N092

1. Fit the con-rod covers and tighten the nuts to a torque of **40 Nm + 90°**.

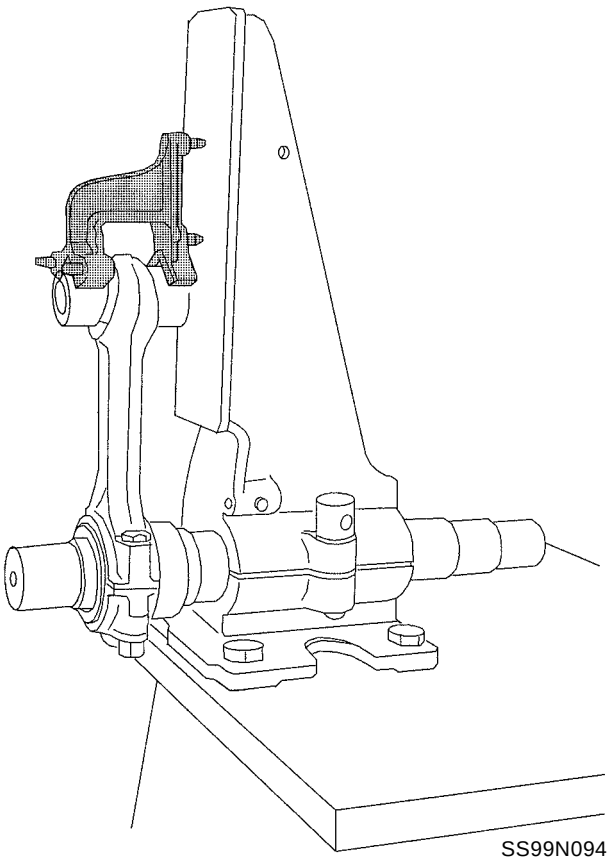
2. Clamp the con-rod in the test device and insert the piston pin into the bush.

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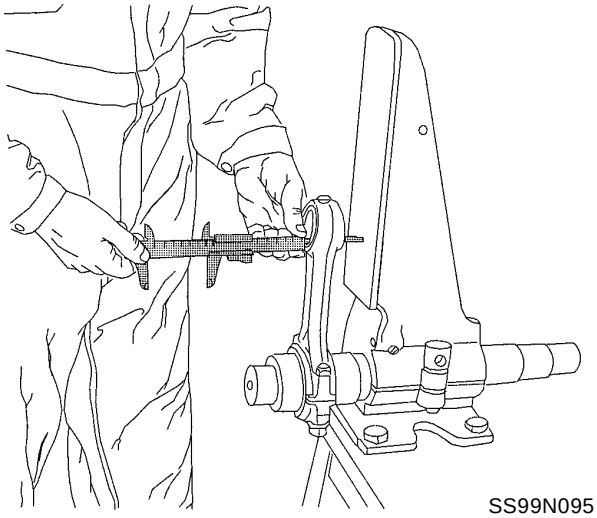
SS99N093

3. Place the aligning gauge at the top of the piston pin. Check the con-rods for distortion with the alignment gauge pins in a horizontal position.



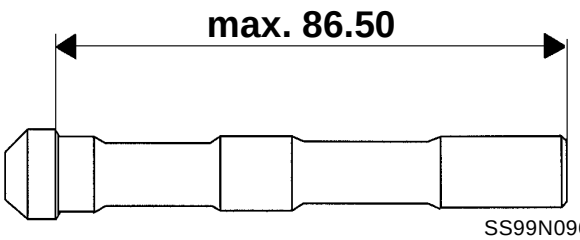
SS99N094

4. Check the con-rods for bending with the test pins in a vertical position.



SS99N095

5. Also check the con-rod for S-shaped bending. For this purpose, use a micrometer to measure the distance between the outer face of the small end bearing bush and the measuring surface of the test device. Then turn the con-rod round and carry out the same measurement. The difference between the measured values must not exceed **0.6 mm**.

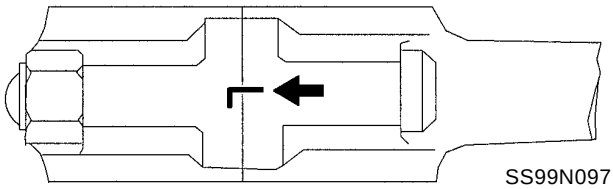


SS99N096

6. Measure the length of the con-rod bolts. This must not exceed **86.50 mm**. If the bolt is longer, it must be replaced by a new one. It is advisable to replace the bolts every time they are loosened.

D. Con-rod weight groups

The con-rods are split into weight groups of **20 g**. A letter designates the weight group. It is marked on the side of the con-rod. All con-rods in an engine must belong to the same weight group, which means the permissible weight difference is **20 g**.



SS99N097

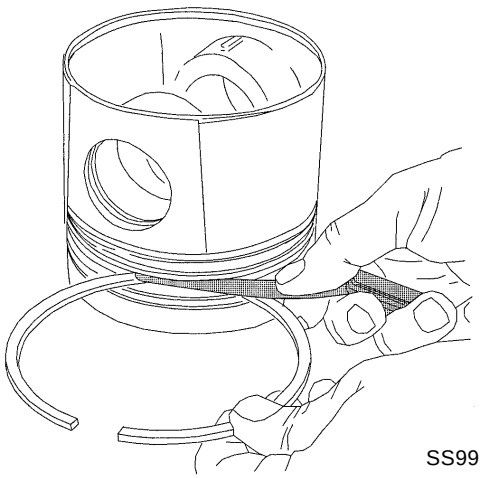
https://truckmanualshub.com/

The letter stands for the following weights:

	Weight:	Spare part number
X	2150 - 2169 g	354139A1
A	2170 - 2189 g	162000030706
B	2190 - 2209 g	162000030707
C	2210 - 2229 g	162000030708
D	2230 - 2249 g	162000030709
I	2250 - 2269 g	162000030710
H	2270 - 2289 g	162000030711
I	2290 - 2309 g	162000030712
J	2310 - 2329 g	162000030713
K	2330 - 2349 g	162000030714
L	2350 - 2369 g	162000030715
M	2370 - 2389 g	162000030716
N	2390 - 2409 g	162000030717
O	2410 - 2429 g	162000030718
P	2430 - 2449 g	162000030719
R	2450 - 2469 g	162000030720
S	2470 - 2489 g	162000030721
T	2490 - 2509 g	132000030703
U	2510 - 2529 g	354140A1

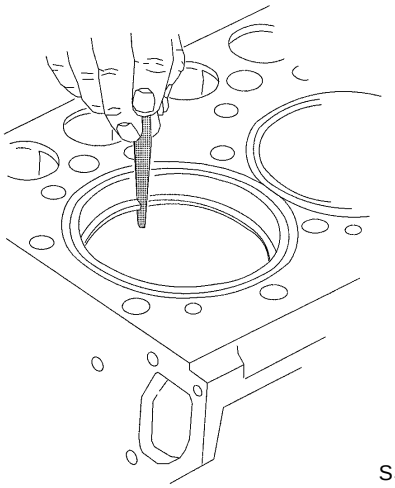
E. Checking and replacing the piston rings

1. Release the piston rings using piston ring pliers. Do not expand the rings more than necessary. If the same rings are to be re-used, then they should be kept in the correct order.



SS99N098

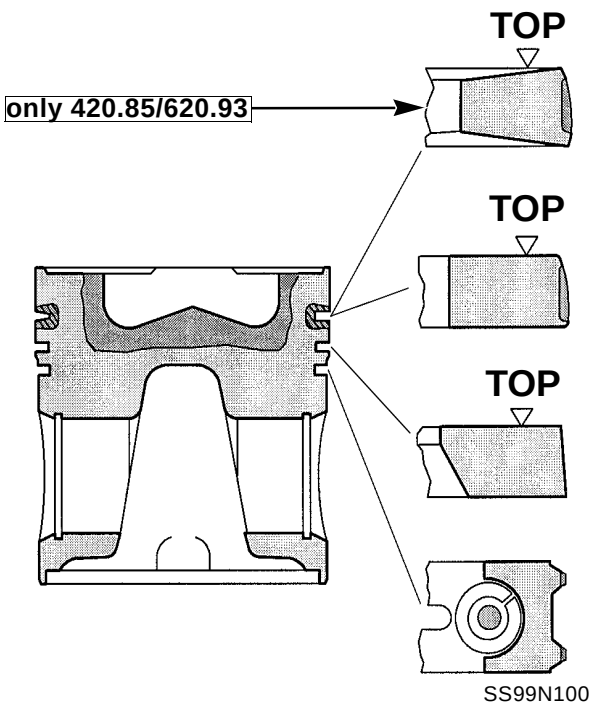
2. Carefully clean the piston ring groove and then measure the piston ring play in the groove. The play must not exceed **0.15 mm**. Check whether the play is due to wear in the ring groove. The rings and/or the pistons must then be replaced accordingly.



SS99N099

3. Insert the piston ring in the cylinder and measure the distance between the ring ends. The distance measured for the 1st and 3rd rings may not exceed **1 mm** and **1.5 mm** for the 2nd ring.

4. Re-insert the piston rings with the aid of the piston ring pliers. Make sure the rings are fitted in the right place and the letters **TOP** or the manufacturer's identification mark on the rings point(s) upwards.

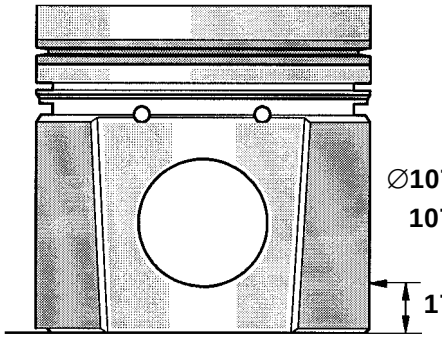


SS99N100

https://truckmanualshub.com/

F. Checking the pistons

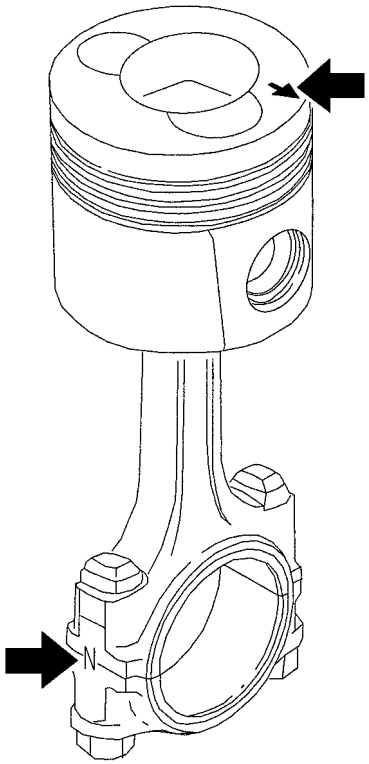
Inspect the pistons and piston pins by performing a visual check. Pay particular attention to possible cracks at the edge of the combustion chamber or at the upper part of the piston pin bore hole. Measure the diameter of the piston at the point indicated in the figure and compare the result with the specified value. Replace the piston, if necessary.



SS99N101

G. Fitting the piston pin

1. Insert the con-rod in the piston and push the piston pin to its position.



SS99N102

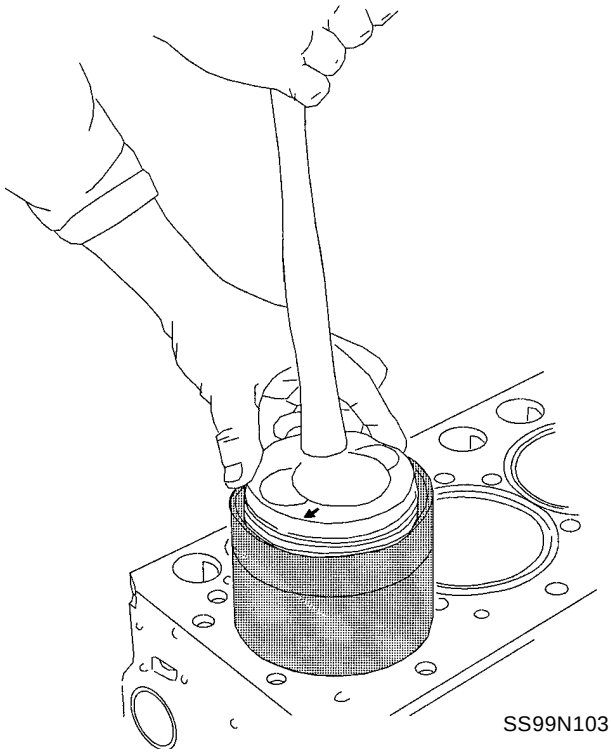
WARNING: *The combustion chamber in the piston and the letter for marking the weight class of the con-rod come on the opposite side.*

2. Then fit the circlips for the piston pin. The ends of the circlips must point upwards.

H. Fitting the pistons and con-rods

1. Insert the bearing shells in the con-rods. Make sure the contact surfaces are clean and the bearing shells sit correctly.

2. Lubricate the piston, piston rings and cylinder with engine oil. Turn the piston ring gaps to different sides of the piston.



SS99N103

3. Use a piston ring clamp or tapered installation tool for fitting. Insert the piston and con-rod so that the weight class mark is on the camshaft side (arrow on the piston points towards the front).

4. Oil the con-rod bearing journals and bearing shells and push the piston down. Mount the bearing cover so that the joggles on the bearing shells are on the same side. Then tighten the nuts to a torque of **40 Nm+90°**.

5. Check whether the lower con-rod bearing has sufficient axial play on the crank journal.

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7. BALANCING UNIT (420)

A. Removing and dismantling the balancing unit

1. Remove the sump.

2. Loosen the lubrication oil line to the balancing unit.

3. Loosen the balancing unit fixing bolts and remove the balancing units including any spacer washers between the balancing unit and the cylinder head.

4. Loosen the balancing shaft clamping bolts. Slide out the shaft in the direction of the clamping bolts. Remove the counterweights and the thrust washers.

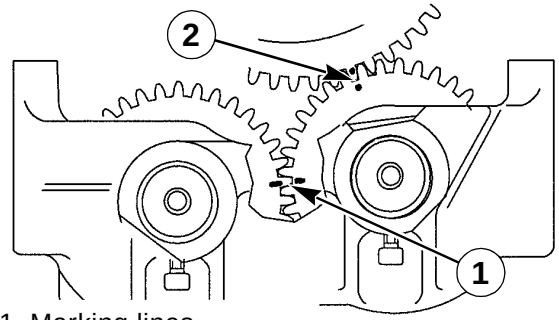
5. Clean all parts thoroughly.

B. Balancing unit maintenance

Check the shaft wear and the condition of the gear wheels and bearings.

1. If the gear wheels are worn out, the counterweights must also be replaced. The gear wheels are not available as a separate spare part.

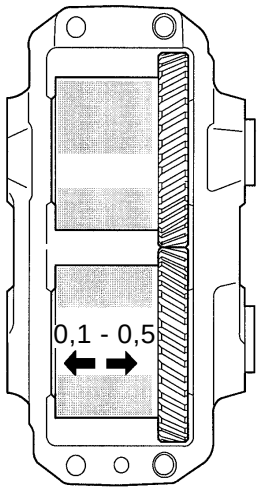
2. If necessary drive the old bearing bushes out of the counterweights using a suitable mandrel. Before removing the bushes mark the position of the oil groove in the bearing bush on the counterweight. Press the new bearing bush into the counterweight, keeping the oil groove aligned with its original position. After fitting, machine the bearing bushes down to their final dimension.



1. Marking lines
2. Marking dots

SS99N104

3. Fit the counterweights into the housing. Take care that the counterweights are in the correct position. The gear wheel marked with a dot should be located uppermost in the housing. The marking lines on the gear wheels should be aligned with each other. Slide the shafts into place from the clamping bolt end. When fitting the shaft between the gear wheel and the housing, also fit the thrust washer.
The end of the shaft is flush with the housing. Apply locking fluid to the clamping bolt threads, (e.g. Loctite 279), and tighten the bolts.

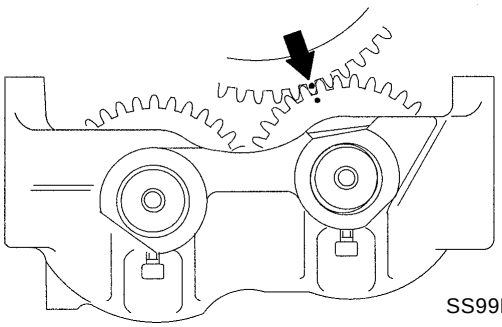


SS99N105

4. Check whether the counterweight tooth play is according to specifications **(0.05 - 0.25 mm)** and that the counterweight axial play is correct **(0.1 - 0.5 mm).**

C. Fitting the balancing unit

1. Fix the sprung dowel pins into place on the cylinder block.



SS99N106

2. Fit the balancing unit into place such that the marking point on the gear wheel matches with the marking point on the crankshaft gear wheel.

3. Tighten the balancing unit bolts to a torque of **60 Nm**. Measure the tooth play between the counterweight and the crankshaft. If the value deviates from that specified **(0.1 - 0.3 mm)** then the tooth play must be adjusted using **0.2 mm** thick spacer washers (spare part number 142080020707) to be fitted between the balancing unit housing and the cylinder block. Insertion or removal of a 0.2 mm ring, alters the tooth play by approx. 0.07 mm.

4. Secure the lubrication oil pipes.

5. Fit the sump.

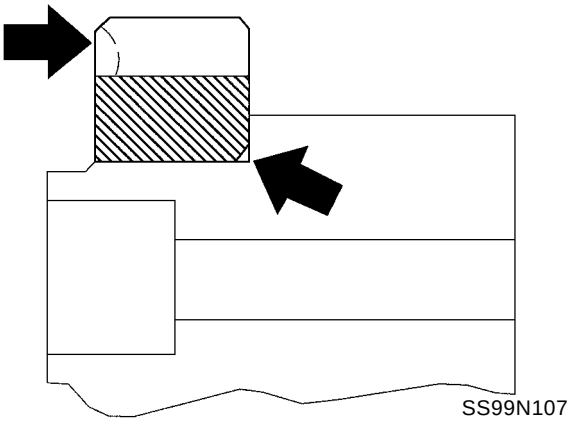
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8. FLYWHEEL

A. Replacing the starter ring gear on the flywheel

The ring gear cannot be re-finished because the teeth on the side of the starter are chamfered and hardened.

1. Free the old ring gear by hitting it with a mandrel. Clean the ring gear seat on the flywheel using a wire brush.



2. Heat up the ring gear to **150 - 200 °C.** Mount the ring gear. The chamfered inner edge must point towards the flywheel and the tooth chamfer towards the starter.

IMPORTANT: *Allow the ring gear to cool down. Do not use coolant.*

B. Fitting the flywheel

1. Clean the contact surfaces on the rear crankshaft flange and on the flywheel.

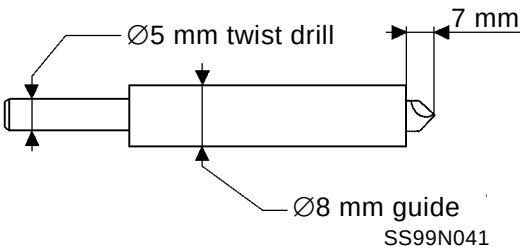
Bolt the flywheel onto the crankshaft. M12 grub screws should be used as guide pins
(2), which fit into the in the securing holes in the flywheel. A **guide sleeve** is used for one flywheel bolt to determine the correct crankshaft position.

3. Tighten the flywheel bolts evenly to a torque of **140 Nm**.

WARNING: *Flywheels for "green (low-emission) engines" supplied as a spare part do not have an injection register marking for the "Time Track" check. The new flywheel should be marked when carrying out the assembly process.*

- Turn the crankshaft until the piston of the first cylinder is at top dead centre (TDC). Let the cylinder 1 valve fall against the cylinder head. Mount the dial test indicator at the top of the valve stem and set it to zero when the piston is at top dead centre**.** Then slowly turn the crankshaft in the direction of rotation until the dial test indicator reads **4.633 mm** after TDC (320 , 420 , 620).

- Drill the hole for the injection register mark in the flywheel using a twist drill (see figure below).



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9. TIMING MECHANISM

A. Removing the timing gear case

The timing gear case acts as a seal to the sump. The casing cannot be removed without first removing the sump.

1. Remove the sump.

2. Remove the fan, the alternator, the V-belt pulleys and the V-belts. If the tractor is equipped with an air-conditioning system or compressed air system, the compressor must also be removed.

3. Loosen the crankshaft nut and remove the belt pulley.

NOTE: *In the case of 620 engines, the belt pulley must be taken off before unscrewing the nut.*

4. For engine types 320 and 420 (with the exception of 420.85), remove the hydraulic pump.

5. Remove the timing gear casecover and remove the metal ring from the crankshaft.

6. Remove the injection pump.

NOTE: *If the timing gear case is not going to be replaced, the injection pump can remain in place. In this case, disconnect all lines and pipes from the pump.*

7. Unscrew the intermediate gear wheel bolts. Remove the flange, gear wheel and bearing journal.

8. Pull out the camshaft.

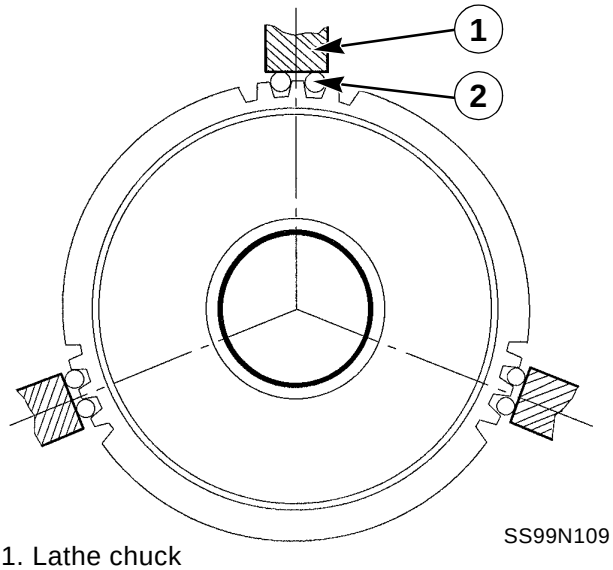
NOTE: *If the cylinder head and valve mechanism are not removed, the valve tappets must be secured against falling down (refer to instructions in page 34).*

9. Unscrew the bolts on the timing gear case and remove the timing gear case. If a wedge has to be driven in between the engine block and timing gear case, make sure the sealing surfaces are not damaged.

10. Take the front crankshaft sealing ring off the timing gear case and clean all parts which have been removed.

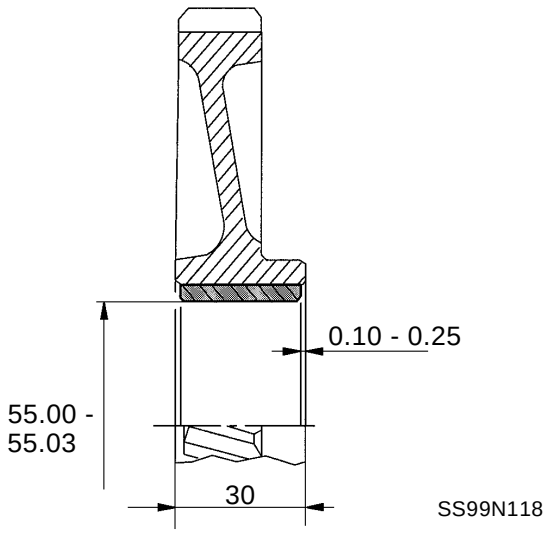
B. Replacing the intermediate gear wheel bush

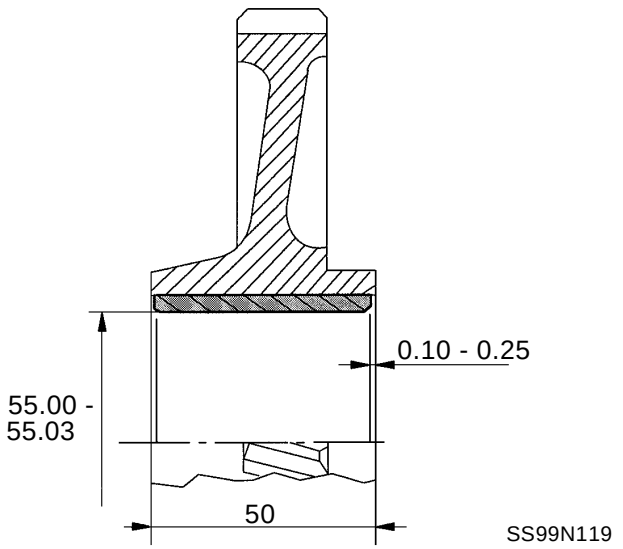
If the intermediate gear wheel bush is to be replaced, press in a new bush so that its rear edge lies within the rear gear wheel edge by **0.1 - 0.25 mm** (see figure).



1. Lathe chuck
2. Roller ø = 5 mm

After fitting, machine the inner diameter of the intermediate gear wheel bush to the correct size. Centre the intermediate gear wheel according to the above figure so the tooth play is kept even.





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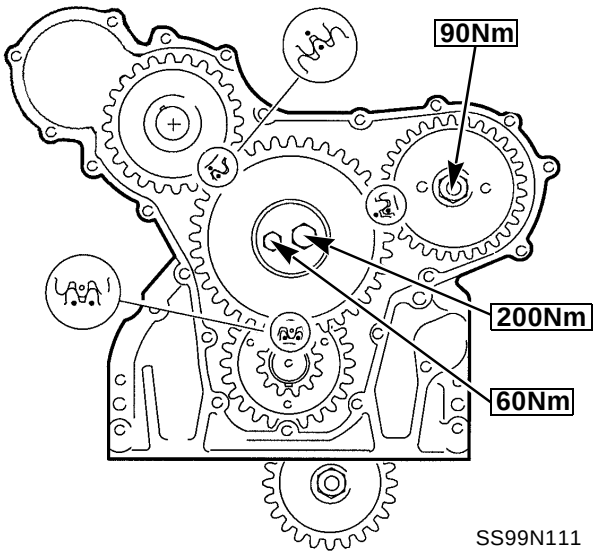
C. Fitting the timing gear case

The position of the timing gear case and the cover is determined by two sprung dowel pins. It therefore does not have to be centred for the assembly process. However, the clearance between various gear wheels must be checked. The timing gear case and cover supplied as spares already have bore holes for the sprung dowel pins.

1. Fit the timing gear case onto the cylinder block using a new seal. Drive the sprung dowel pins in by means of a mandrel. Tighten the nuts and bolts.

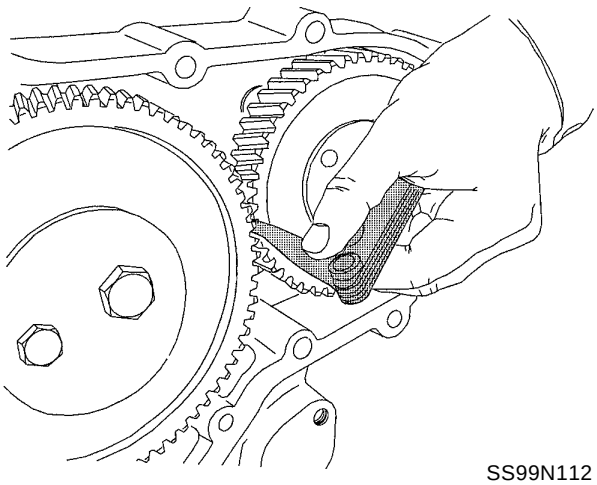
2. Install the injection pump together with the gear wheel (if removed).

3. Oil the camshaft bearings and fit the shaft in the cylinder block. Release the push rods and valve tappets, if they have been suspended.



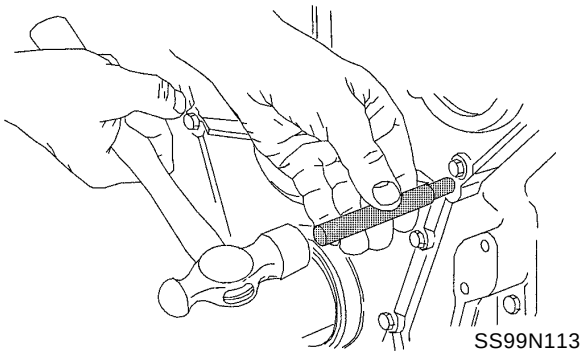
SS99N111

4. Fit the intermediate gear wheel with the shaft grub screw and make sure the marks are aligned correctly. Insert the washer and tighten the bolts to the specified torque.



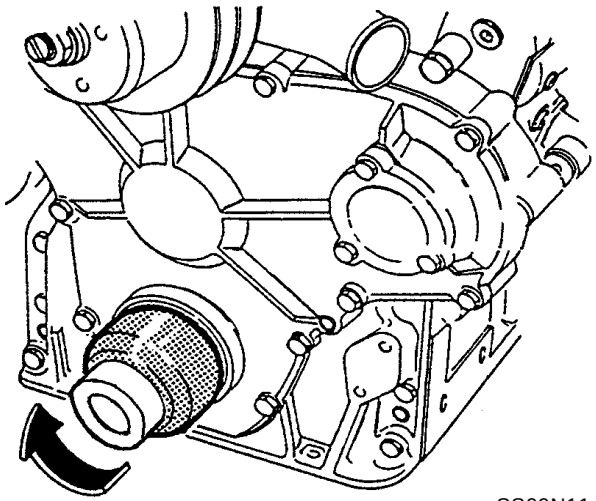
SS99N112

5. Check the tooth play.
It should be between **0.05 - 0.25 mm**.



SS99N113

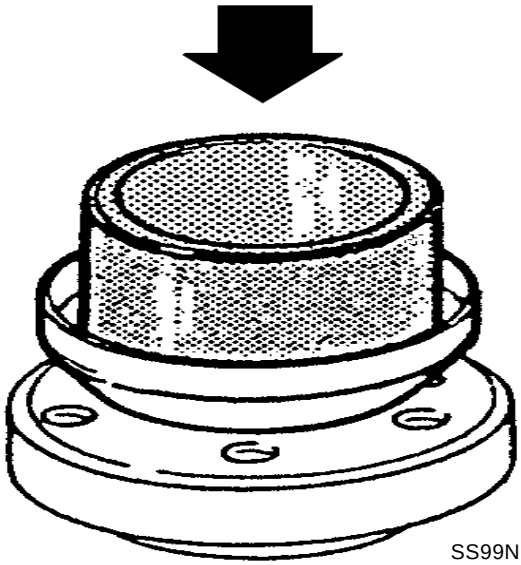
6. Fit the metal ring onto the crankshaft and fit the timing gear case cover, using a new seal. Drive the sprung dowel pins in, by means of a mandrel (mate the hollow pin with the grub screw). Tighten the nuts and bolts.



SS99N114

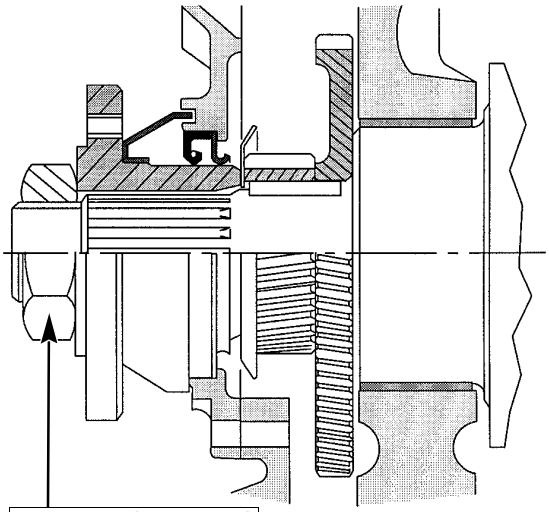
7. Fit the guard plate in the bearing seat and insert the front crankshaft sealing ring by means of the 1TSW 520 special tool.

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SS99N115

8. If it has been removed, re-fit the dust cap on the V-belt pulley hub on the crankshaft. To do so, use the 1TSW 519 pressing tool.



SS99N116

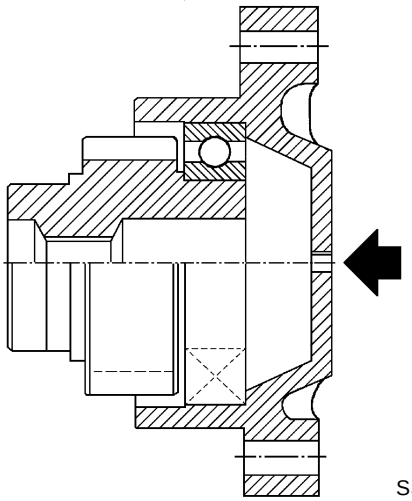
9. Oil both the seal and the sealing surfaces and fit the V-belt pulley together with the hub.

10. Apply a little oil to the thread on crankshaft nut. Tighten the nuts for engine types 320 and 420 to a torque of **600 Nm** and those for engine type 620 to a torque of **1000 Nm**.

11. Re-fit the other parts which have been removed.

D. Front power take-off / auxiliary drive

Engine types 320 and 420 (with the exception of 420.85) are equipped with a timing gearcase with auxiliary drive. The auxiliary drive is driven by the camshaft wheel and drives the hydraulic pump.



SS99N121

Use ball bearing grease (NLGI 2) for the hydraulic pump shaft grooves and coupling sleeve.

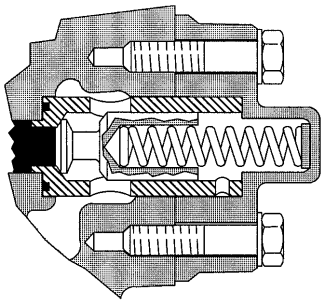
The auxiliary drive is fitted with an external lubrication tube.

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10. LUBRICATION SYSTEM

A. Checking the oil pressure valve

Always check whether the oil pressure valve is functioning if the engine oil pressure does not increase sufficiently or fluctuates noticeably. However, first check whether there is enough oil in the engine.



SS99N122

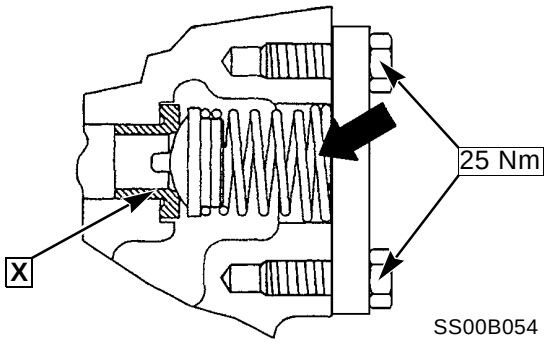
1. Remove the cover on the oil pressure valve and the spring located underneath. Take care to retain the washer between the cover and the spring. Pull the valve insert and cone out of the cylinder block. Take care that the O-Ring is also removed.

2. Clean the parts. Check that the valve cone moves freely in the valve insert. If the valve cone sticks, clean out any particles of dirt. If necessary, grind the parts with fine abrasive wool or use new parts. Clean the sealing surfaces between the cylinder block and the cover.

3. Place a new O-Ring in the groove in the valve insert. Fit the cone and the valve insert in the cylinder head. Fit the washer, cover and spring using a new cover seal.

4. Take note of the asymmetrical shape when fitting the valve cover. The side with the greater distance between the cover centreline and the fixing opening should be underneath.

IMPORTANT: *From engine number **J 7595** onward, a new oil pressure valve should be used.*



SS00B054

The valve seat (X) in this oil pressure valve is glued in using Loctite 638.

Make sure the wider side of the spring is fitted towards the cover.

B. Removing and checking the oil pump

1. Drain the engine oil and remove the sump.

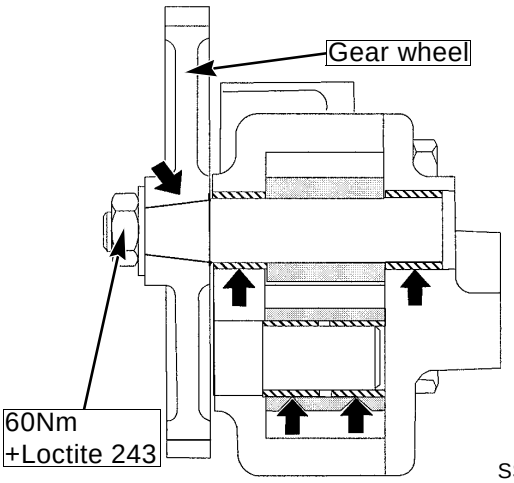
2. Disconnect the intake and pressure lines on the oil pump.

3. Remove the oil pump and any adjusting disks between the pump base and the cylinder block.

4. Release the pump cover and the seal. Remove the gear wheel fitted on the axle.

5. Clamp the pump, at the pump gear wheel, in a vice with protected jaws and unscrew the nut on the drive gear wheel. Use a plastic hammer to drive the pump drive shaft off the gear wheel. Pull the drive shaft gear wheel out of the pump body.

6. Wash the parts and check the wear compared with the dimensions specified under "**Lubrication oil pump**". Replace worn parts and all paper gaskets.



SS99N124

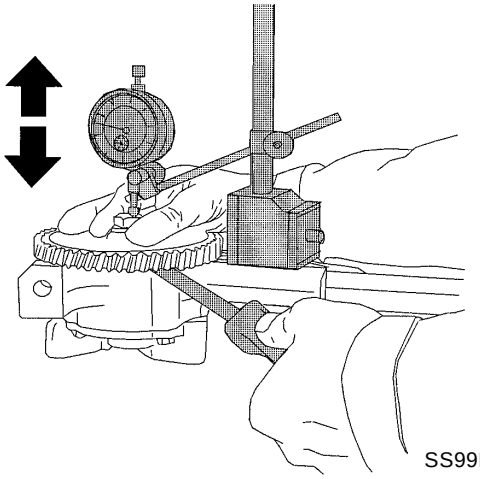
7. The oil pump bearing points for engine type 620 are fitted with separate bearing bushes. On replacing the bearing bushes, machine them to the dimension **18.000 - 18.018 mm** after fitting them.

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C. Assembling and fitting the oil pump

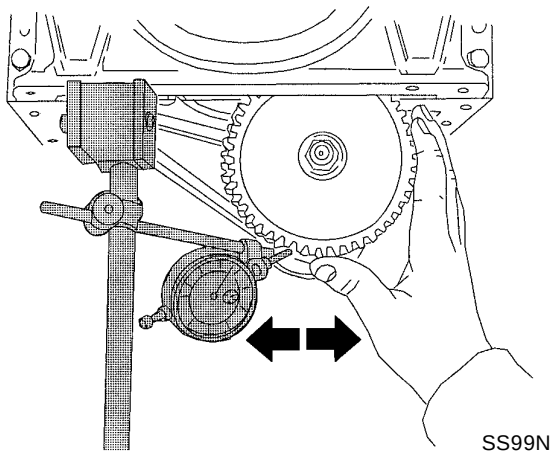
1. Insert the gear wheels into the recess in the pump body. Fit a new seal between the pump body and cover (as required). Tighten the securing bolts a little. Turn the shaft and tap the cover laterally into the position, in which it rotates most easily. Tighten the cover securing bolts and check that the shaft still rotates easily.

2. Fit the drive gear wheel onto the shaft, apply locking fluid to the nut threads (e.g. Loctite 243) and tighten the nut to a torque of **60 Nm**.



SS99N126

3. Clamp the pump at the mounting base in a vice with protected jaws. Check the axial play of the gear wheel **(0.03 - 0.11 mm)** with a dial test indicator. Change the number of seals between the cover and pump body as required.



SS99N127

4. Secure the pump in its position below the cylinder block and use a dial test indicator to check the tooth play between the crankshaft and pump gear wheels. **(0.05 - 0.25mm)**. Change the number of shim rings between the pump base and the cylinder block **(0.2 mm shim ring, order number 162000070716)**. Inserting/removing a 0.2 mm ring changes the tooth play by approx. 0.07 mm.

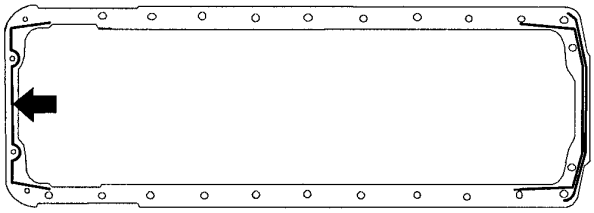
NOTE: *When measuring the tooth play, the engine must be in its operating position (upright) as the bearing play has an effect on the tooth play.*

5. Fix the pump intake and pressure lines, replace the seals on the mounting flange.

6. Fit the sump and fill it with engine oil.

D. Fitting the sump

Fit the sump seal with the silicone strips pointing towards the cylinder block.

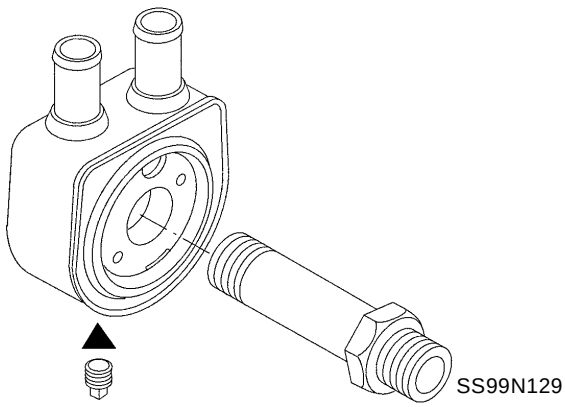


SS99N128

E. Oil cooler

Engine types 620.92 and 620.93 are equipped with an oil cooler, which is located between the engine oil filter and the cylinder block.

1. The coolant must be drained out of the oil cooler before removing it.



SS99N129

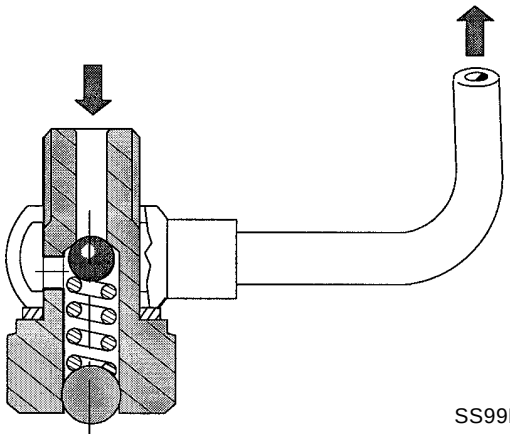
2. Fit new seals. Mount the oil cooler so that the drain connection points downwards. Secure the coolant hoses in a regular manner.

3. Put some screw locking fluid (e.g. Loctite 243) on the thread on the engine end of the mounting pipe and tighten it to a torque of **60 Nm**.

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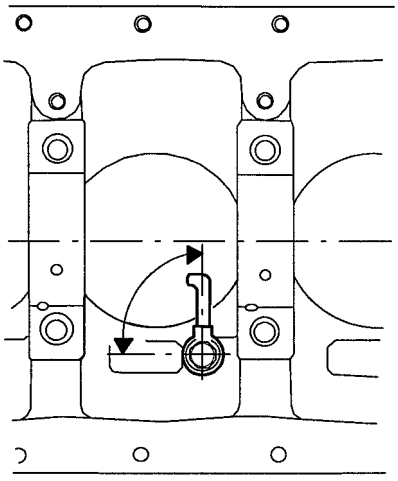
F. Piston cooling nozzles (620)

The piston cooling nozzles for engine type 620.93 can be taken out after removing the sump. The nozzle is equipped with a ball valve. It has an opening pressure of **$3^{\pm 0.25}$ bar**.



SS99N130

1. Change the nozzles as required. Unscrew the nozzles from the engine and remove the nozzle pipe. Insert the new nozzles.



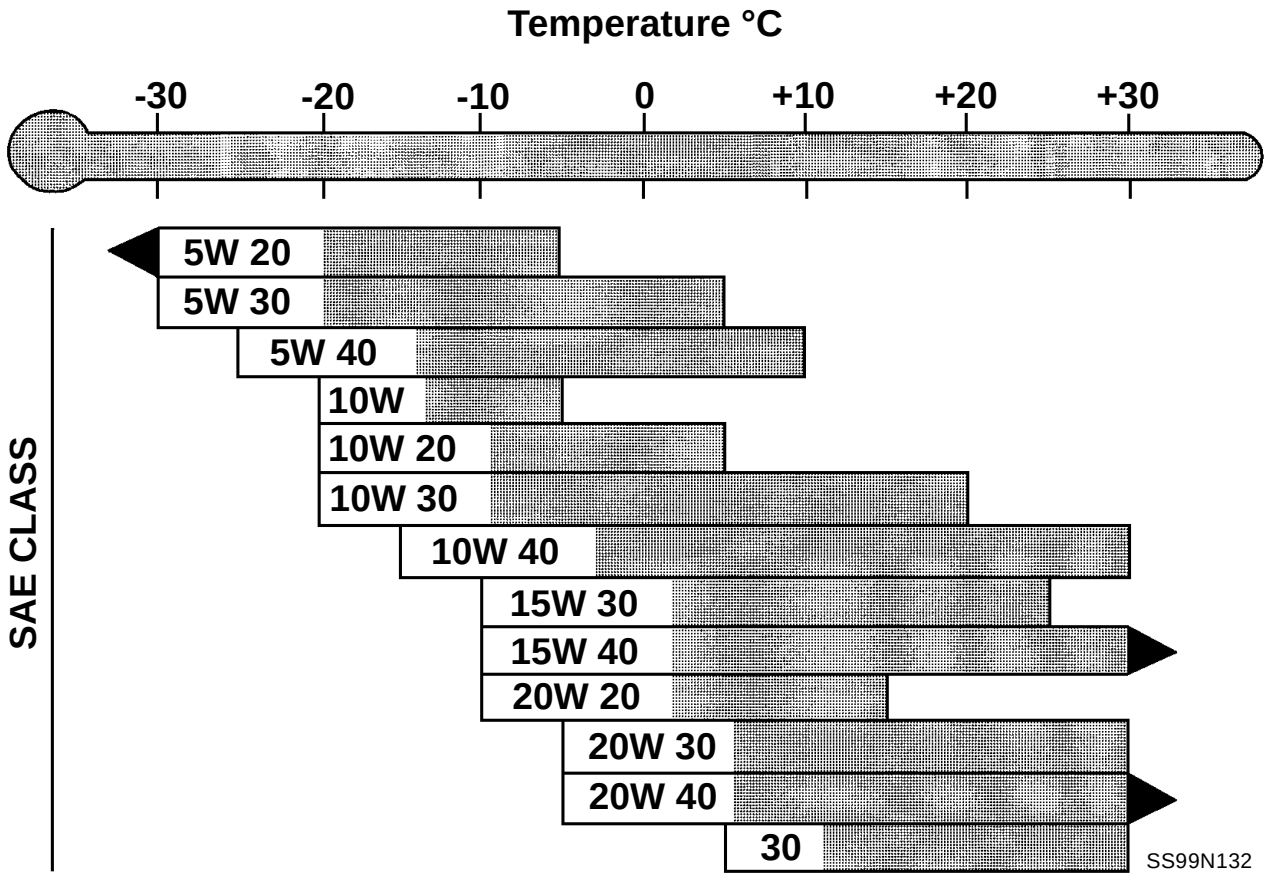
SS99N131

2. On assembling the nozzle, fix the nozzle pipe, as shown in the figure, at an angle of **90**° to the longitudinal axis of the engine. Tighten the nozzle to a torque of **30 Nm**. After assembly, check that the nozzle pipe does not touch the piston or con-rod when the engine is turned over.

G. Recommended lubrication oils

- For engines with a turbo charger

API	**CD/ CE/ CF/ CG-4**
ACEA	**E2-96/E3-96**



SS99N132

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11. COOLING SYSTEM

A. Thermostat

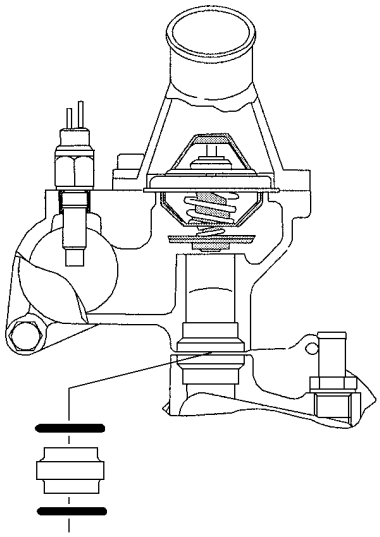
The thermostat is of a two-way design with an opening temperature of 79 °C.

If you have doubts about the functionality of the thermostat, check it as follows:

- place the thermostat in boiling water without it touching the sides of the vessel.

- the thermostat must start to open within 20 seconds.

- the thermostat must be fully open after no longer than 50 seconds. Compare the measured values with those specified in the technical data.



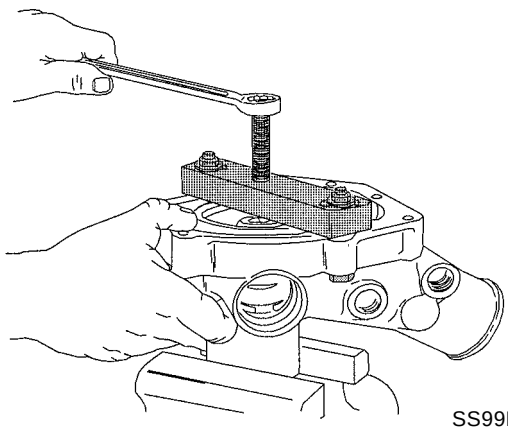
SS99N135

B. Repairing the coolant pump

1. Drain the coolant. Unscrew the thermostat housing, the fan and the V-belt.

2. Remove the coolant pump. Take the back plate off the pump and clean the sealing surfaces.

3. Unscrew the securing nut for the V-belt pulley and remove the belt pulley. Use the 1TSW 662 extractor, if required.



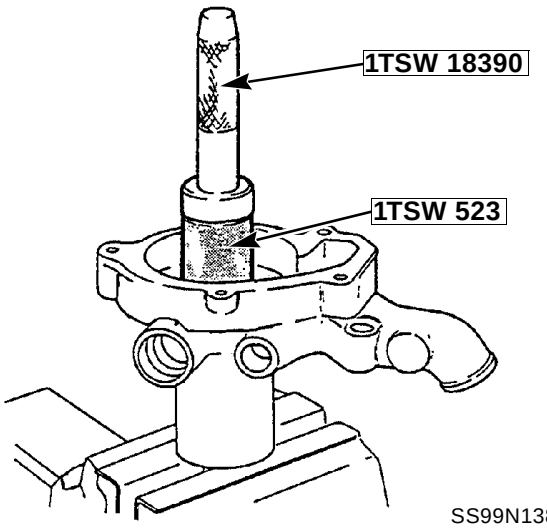
SS99N140

4. Pull the impeller off using the 1TSW 662 extractor.

5. Remove the circlip from the pump body. Use a hydraulic press, for example, to press the shaft with the bearing out of the pump body towards the fan. Clamp the pump body so that the shaft bearing can be taken out.

6. Remove the axial and shaft seals from the pump body by means of a mandrel. Clean the parts and check their condition. Replace worn or faulty parts.

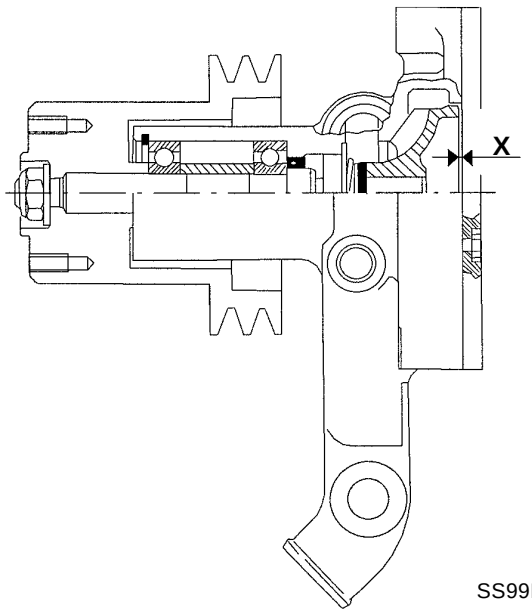
NOTE: *If the pump bearings have to be replaced, it is better to fit the pump repair kit, which also comprises all seals required for the repair (refer to spare parts catalogue).*



SS99N138

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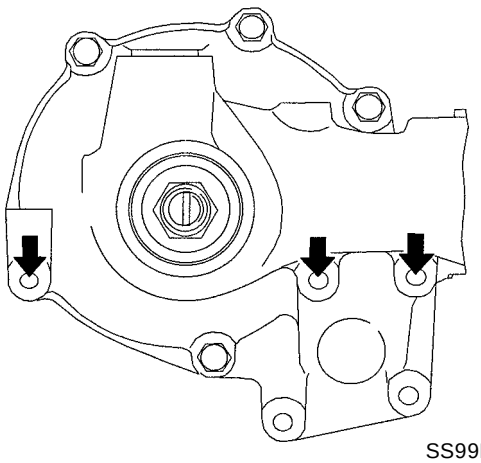
7. Use the 1TSW 523 mandrel to drive the shaft seal into the pump body. Mount the bearings and intermediate sleeves on the shaft. Grease the bearings with plenty of heat-resistant bearing grease. Fit the shaft and bearings in their place so that the forces produced by pressing do not act on the bearing balls. Fit the bearing circlip in its place.



SS99N141

8. Fit the impeller whilst supporting the other end of the coolant pump shaft. The play (X) between the pump casing and impeller for engine types **320/420** is **1.8 - 2.2 mm**, and for type **620** engines **0.8 - 1.2 mm**. Check that the coolant pump shaft rotates freely.

9. Fix the belt pulley on the shaft and tighten the securing nut to a torque of **120 Nm**.



SS99N143

10. Fix the back plate using a new seal. To fit the back plate, use guide pins with a diameter of 8.5 mm for the bore holes shown in the figure (engine type 620).

C. Coolant quality requirements

-if there are no frost resistance requirements, a mixture ratio of 30% is enough to ensure sufficient corrosion protection.

- check the coolant (anti-freeze) mixture ratio at certain intervals. Replace the coolant every two years.

- the water used must be clean and soft, i.e. it must not contain any metals and their salts.

WARNING: *Never use only water as a coolant.*

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12. INTAKE / EXHAUST SYSTEM

An engine equipped with a turbo charger is far more sensitive to faults and contamination in the intake/exhaust system than conventional engines. Particular attention must therefore be paid to the intake/exhaust system.

A. Checking the air filter

The engine performance and service life are largely dependent on the condition of the air filter. A faulty air filter lets dirt particles through, which in the long run will cause damage to the turbo charger and engine. A blocked air filter reduces engine performance and also causes oil leakage through the sealing ring on the turbo charger shaft.

WARNING: *The safety filter located in the main filter does not have to be cleaned, but must be replaced as required (refer to operating instructions).*

B. Checking the intake / exhaust system

IMPORTANT: *Leakages in the intake or exhaust system impair the effect of the turbo charger. Due to the pressure, even small leaks in the manifold or turbine inlet flange quickly get bigger. Leakages must therefore be eliminated without delay.*

1. Check the pipes and sealing surfaces between the air filter and exhaust turbo charger as well as between the exhaust turbo charger and exhaust manifold. If the intake manifold is dusty on the inner side, then there is a leakage in the air filter or in the suction pipes. Eliminate the leakage.

2. Clean the sealing surface of the intake manifold. Use a straightedge to make sure the sealing surface is level. If the sealing surface is not level or is scratched, machine or replace the intake manifold. For engine type 620 make sure the cylinder heads are parallel to each other.

3. Insert a new seal and secure the intake manifold. Tighten the intake manifold securing bolts to a torque of **30 Nm**. Secure the air pipes.

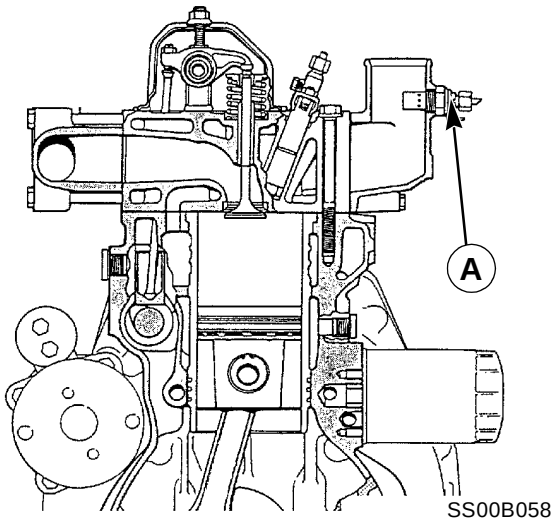
4. Make sure the exhaust manifold is airtight. Tighten the nuts/bolts to a torque of **50 Nm** and check for damage (cracks, deformation, corrosion, etc.). Also check the connection between the turbo charger and exhaust manifold.

5. Remove the manifold, if necessary. Clean the sealing surfaces and remove any carbon deposits. Make sure the sealing surfaces are level. If the mounting flanges are twisted or the sealing surfaces scratched, machine the flange or replace the exhaust manifold.

6. Make sure no loose objects or dirt particles have ingressed into the exhaust pipe or silencer. Such loose objects or dirt particles can increase the back-pressure for the exhaust gases from the turbine wheel.

C. Checking the boost pressure

The boost pressure should be checked before removing the turbo charger.



To check the boost pressure, the screw (1TSW 663) is screwed into the intake manifold instead of the thermo-start unit (A). This applies to all engines. In addition, a mini-measuring connector (1TSW 640), mini-measuring line (ITSW 635) and pressure gauge (1TSW 5002) have to be used.

The boost pressures are specified on page 9.

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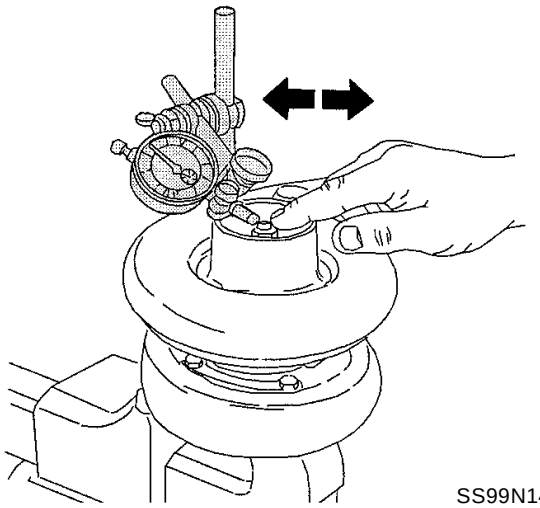
D. Checking the turbo charger

If it is assumed that the turbo charger is faulty, the fault can be determined as follows:

1. Carry out a visual check on the turbine and compressor wheels. The blades must not show any signs of damage, deformation or wear caused by foreign objects.

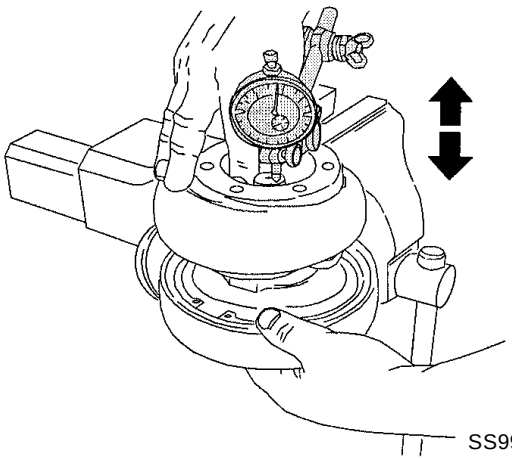
2. Check whether oil leaks through the sealing rings on the shaft in the turbine / compressor housing.

WARNING: *A small amount of oil always comes out on the compressor side at low idling speeds. However, there is no need to worry about this unless a lot of oil is lost.*



SS99N144

3. Check the running play of the turbine shaft. Hold the probe of a dial test indicator against the shaft and move the shaft sideways. Also refer to the play specified under **Technical Data.**



SS99N145

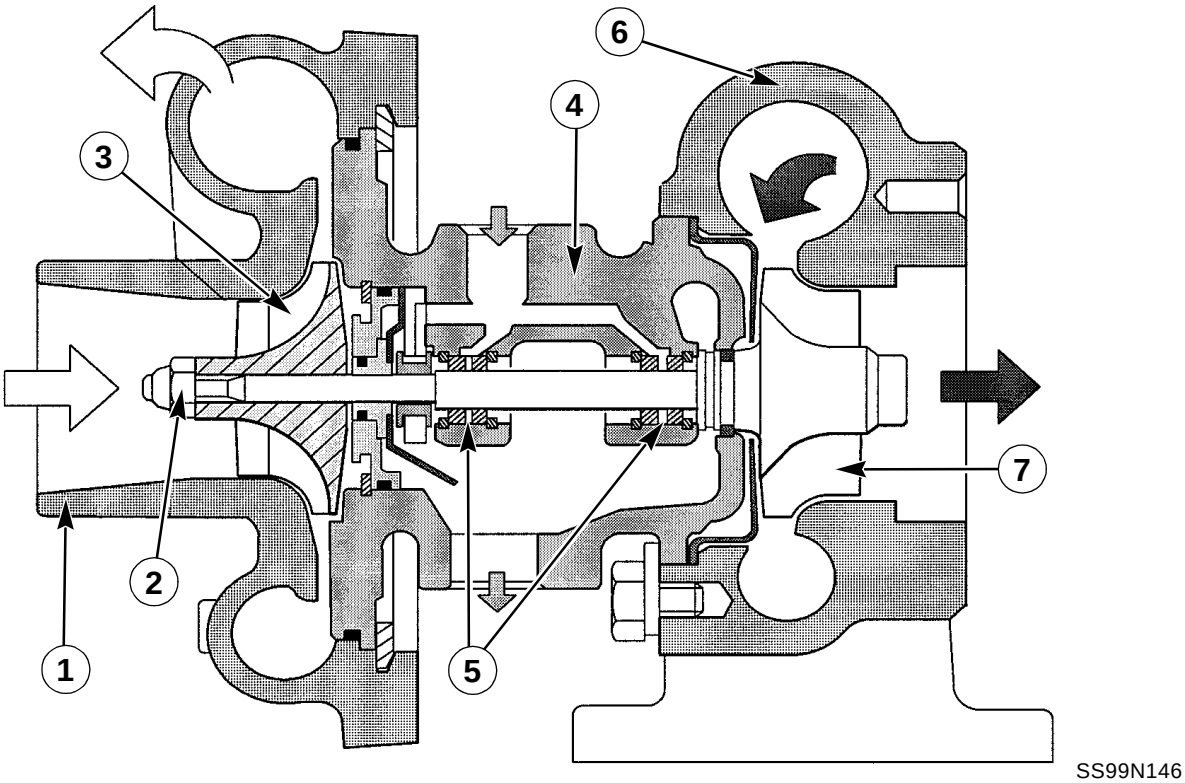
4. Check the axial play of the shaft. Hold the probe of the dial test indicator against the end of the shaft move the shaft axially. Also refer to the play specified under **Technical Data.**

If a fault or wear is confirmed, the turbo charger must be overhauled.

If the engine does not run properly even though the turbo charger is not faulty and does not show excessive wear, the fault could have one of the following causes:

- a blocked air filter
- a leakage in the intake or exhaust system; a leaking flange seal
- A faulty or maladjusted injection pump
- maladjusted throttle linkage
- faulty or maladjusted injection nozzles
- insufficient fuel pressure (e.g. caused by a blocked fuel filter)
- weak compression, incorrect valve clearance

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SS99N146

Schwitzer turbocharger

1. Compressor housing
2. Lock nut
3. Compressor wheel
4. Bearing housing
5. Bearing bushes
6. Turbine housing
7. Shaft and turbine wheel

E. Fitting the turbo charger

First, the cause of possible turbo charger damage must be clarified and eliminated before a new turbo charger is fitted.

For perfect operation of the turbo charger, it is important that the engine lubrication oil is changed in accordance with the relevant instructions and that the correct quality class is used. The maintenance specifications for the oil and air filters must also be adhered to.

The injection pump setting, which must correspond with the manufacturer's specifications, has a major influence on turbo charger operation.

1. Check the fastening and tightness of the exhaust and intake manifolds. Make sure there are no loose carbon particles, rust or other foreign bodies on the exhaust or intake manifolds.

2. Fix the turbo charger onto the exhaust manifold by means of the flange. Always use new seals.

3. Connect the intake / silencer pipe to the turbo charger.

4. Pour clean engine oil into the bearing housing via the oil filler in order to ensure lubrication of the turbo charger bearings after starting the engine.

5. Secure the pressure and oil return pipes. Make sure the turbo charger is held completely by the mounting flange and that the pipes do not put any strain on the turbo charger.

6. Pull out the fuse (for type 320 F15, for types 420 and 620 F29) for the engine cut-out and start the engine several times with the starter. This ensures that there is plenty of oil at all lubrication points before operation. Re-insert the fuse and start the engine. Check the pipe connections for leakage.

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Section

3

HOW IT WORKS
INJECTION SYSTEM

SISU - WD 320 / WD 420

M968 / M975 and CS68 / CS75 (WD 320)

cut in DBD0040007

M9078 - M9094 and CS78 - CS94 (WD 420)

cut in DBD00550001

CASE STEYR Landmaschinentechnik GmbH
Technical Documentation/Training Center
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Sva 7-97340 EN

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Table of contens

FUEL INJECTION SYSTEM (STANADYNE DISTRIBUTOR PUMP) 3
General 3
Fuel system with distributor pump 4
Technical data - Injection pump 5
Stanadyne distributor pump 6
Construction 7
Function 8
Adjusting low idle speed 10
Removing pump 11
Fitting the injection pump and injection timing 12
Bleeding the fuel system 13
Bleeding the Thermostart system 13
Measuring fuel feed pressure 14
Injector 15
Fuel quality requirements 16
Biodiesel fuel 16
Checking injection timing dynamically with TIME TRAC 17

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FUEL INJECTION SYSTEM (STANADYNE DISTRIBUTOR PUMP)

for SISU ENGINE WD 320	**Tractor models**	
	CS68-75 / M968-75	cut-in DBD 0040001
for SISU ENGINE WD 420	**Tractor models**	
	CS78-94 / M9078-94	cut-in DBD 0055001

General

With this fuel system, a diaphragm feed pump on the RH side of the engine, driven by the engine camshaft sucks fuel from the tank via a strainer and feeds it through the fuel filter to the rotary injection pump. During running engine, a small flow of fuel is allowed through the pump and returns to the tank for constant bleeding and cooling the injection pump.

The feed pump has a washable filter. The strainer is combined with a detachable sight glass to drain water and impurities. The lower part of the fuel filter contains a space for possible impurities, it can be drained by a tap.

There is also a tapered metal net filter inside the distributor pump in the inlet line before the pump‘s transfer pump.

No special tools are required for fitting the pump and setting the static timing. After a pump is fitted, the filter and the feed line up to the distibutor pump must be bleeded.

Underneath the top cover of the injection pump, a stop solenoid is fitted. Cutting off the 12 volt DC supply will result in zero delivery, thus the engine stops.

The injection pump is driven by the engines timing gear and is lubricated with diesel fuel only.

NOTE: *There are two important measures to be obeyed after a stanadyne distributor pump is fitted:*

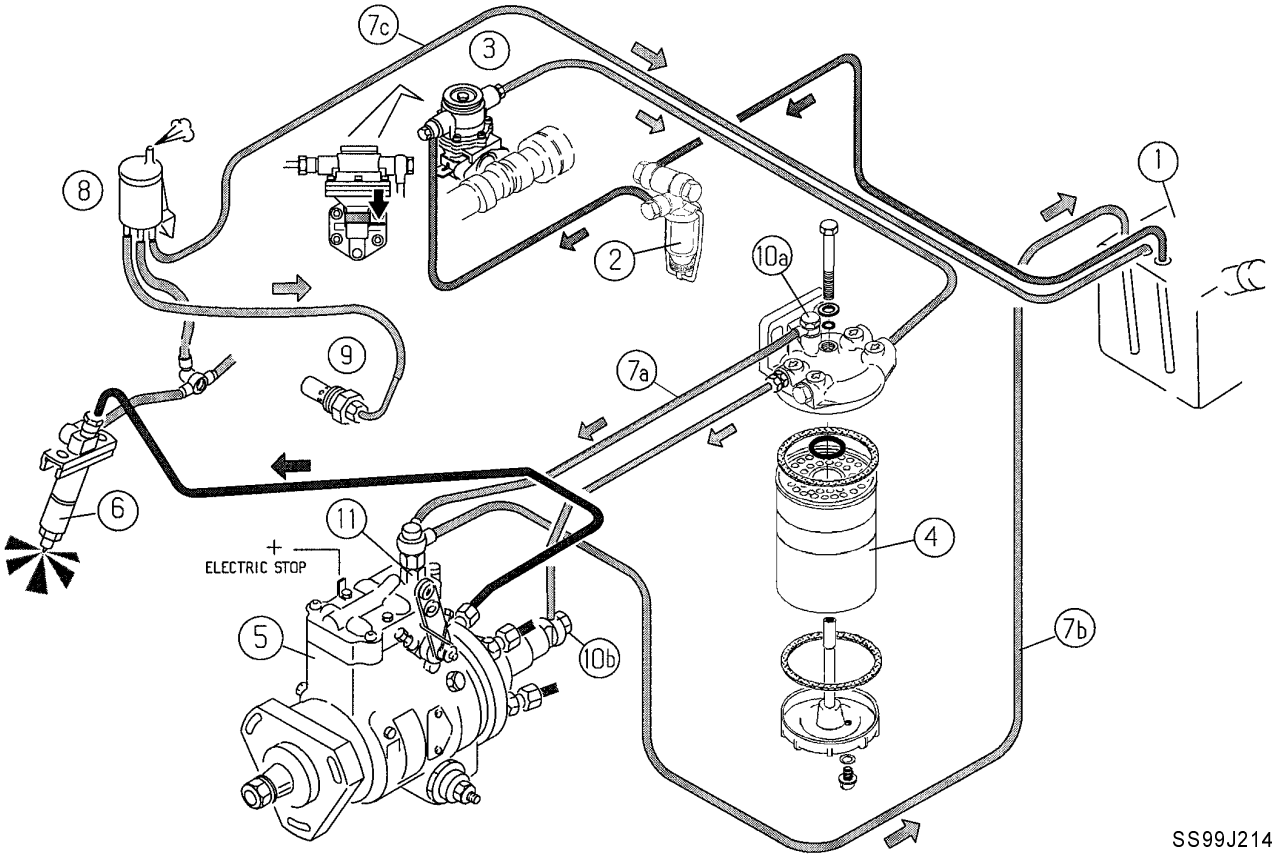
1. Never operate the starter of the engine until the fuel filter and the feed line to the pump is bleeded.
2. Before the first attempt to start, the stop solenoid must not be energized for more than 40 seconds.

For starts in cold seasons, the fuel system is equipped with a thermostart device. A separate reservoir gets filled via a connection from the nozzles leak off line while engine is running. When preheating is required prior to the first start, the reservoir must be filled manually, otherwise the heatercoil of the thermostart could get damaged during preheating. Second, preheating would be inefficient from no fuel gets burnt and no intake air would be warmed up on.

For a good engine performance, low fuel consumption and reduced polution, the injectors are equipped with five hole nozzles and the injection pressure is moderate high. This all are features of a modern engine.

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Fuel system with distributor pump



1. Fuel tank
2. Prefilter
3. Fuel feed pump
4. Fuel filter
5. Distributor pump
6. Injector
7. a - Bleed line
   b - Return fuel to tank
   c - Return fuel to tank
8. Thermostart reservoir
9. Glow plug (Thermostart)
10. a - Bleeding screw
    b - Bleeding screw
11. Overflow valve

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TECHNICAL DATA - Injection pump

Manufacturer:	Stanadyne
Type (general):	DB 4

Tractormodel / Pump type

CS68/M 968	DB4327-5575/A
CS75/M 975	DB4327-5575
CS78/M9078	DB4429-5375/B
CS86/M9086	DB4429-5375/A
CS94/M9094	DB4429-5569

Injection order:

320	1 - 2 - 3
420	1 - 2 - 4 - 3
Direction of rotation	Clockwise

Pump setting (static), given in degree or Piston distance from Top Dead center
engine WD 320/420 - 15° or 2,625 mm

Stop Solenoid

Resistance	3,8 Ohm ± 10 %

Fuel feed pump

Construction	diaphragm pump, separate hand lever
Fuel feed pressure (static)	0,48 bar (48kPa)
Fuel feed pressure min. (used pump)	0,20 bar / max. rpm

Prefilter (water trap)

with sightglas, serviceable to drain water and impurities

Fuelfilter

Lucas, catridge type, with drain tap at the bottom and bleed screw at the top

Injectors

Manufacturer	Stanadyne
Type	five hole nozzle (Typ M)
Opening pressure	270 + 8 bar
Setting pressure (for new or used nozzle)	278 bar

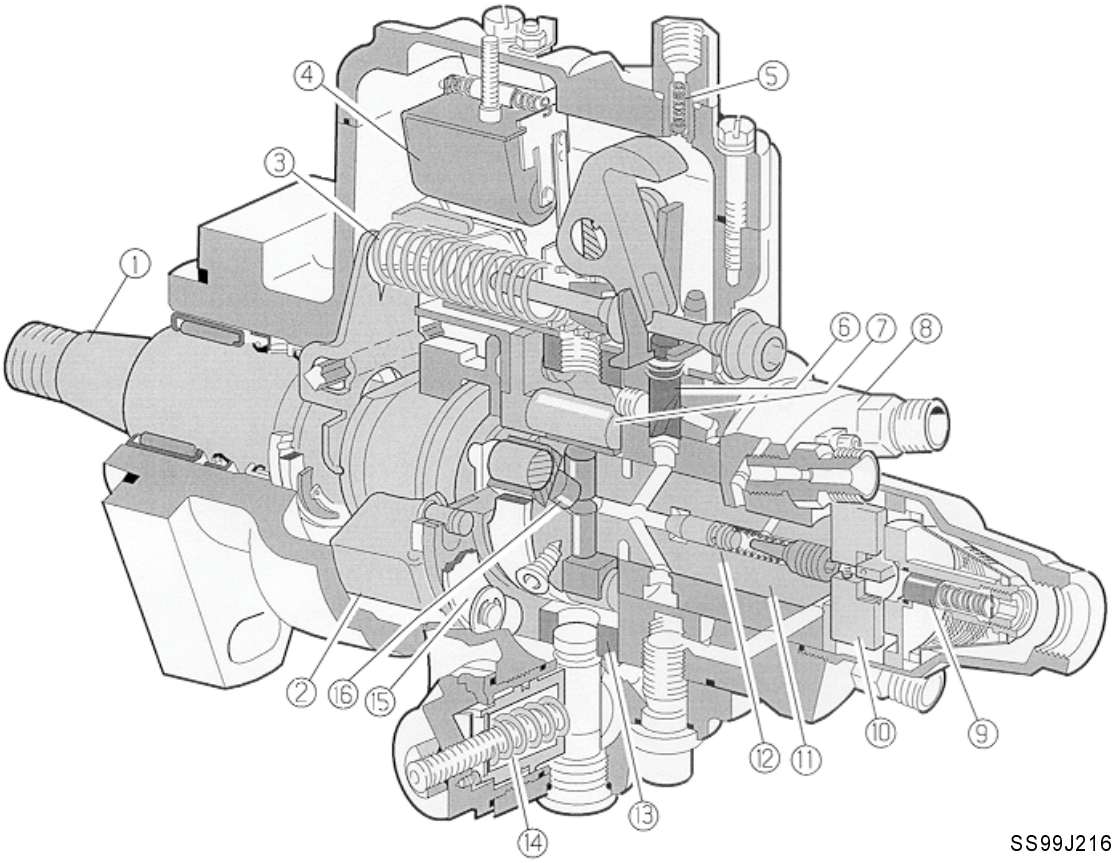
Tractormodel	Nozzle No
CS68/M968 and CS78/M9078	8368 54757
CS75/M975, CS86/M9086 and CS94/M9094	8366 59902

Tightening torques

Pump gear retaining nut	90 Nm
Nozzle retaining nut	60 Nm
Injector retaining nuts (for the studs)	15 Nm

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Stanadyne distributor pump



1. Drive shaft
2. Governor weights
3. Governor spring
4. Stop solenoid
5. Overflow valve
6. Metering valve
7. Cam ring rollers
8. Hydraulic head
9. Pressure regulating valve
10. Transfer pump blades
11. Distributor rotor
12. Pressure valve
13. Cam ring
14. Automatic advance
15. Centrifugal governor
16. Pumping plungers

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Construction

The main rotating components are the drive shaft, the transfer pump blades, the distributor rotor and the governor.

The drive shaft engages in the distributor rotor in the hydraulic head. The drive end of the DB4 rotor incorporates four pumping plungers.

The plungers are actuated towards each other simultaneously by an internal cam ring through rollers and shoes which are carried in slots at the drive end of the rotor. The number of cam lobes normally equals the number of cylinders (not with 3 cylinder engines).

The transfer pump at the rear of the rotor is of the positive displacement vane type and is enclosed in the end cap. The end cap also houses the fuel inlet strainer and transfer pump pressure regulator. The face of the regulator assembly is pressed against the liner and the distributor rotor, and forms an end seal for the transfer pump.

The injection pump is designed in such a way, that the end thrusts against the face of the transfer pump pressure regulator.

The distributor rotor incorporates two charging ports and a single axial port (pressure chamber), in which the pressure valve is placed. Behind the delivery valve, there is one discharge port to serve all head outlets leading to the fuel injection pipes.

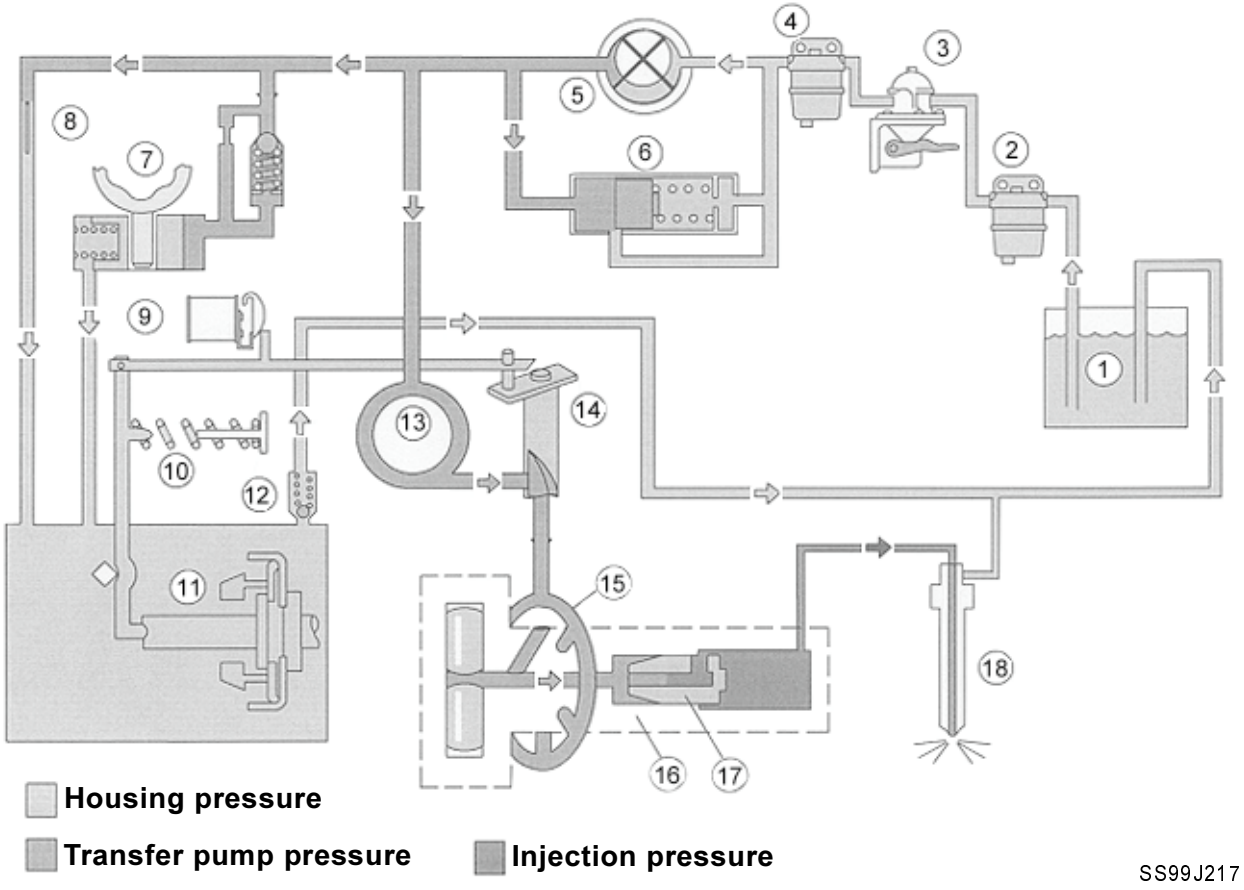
The hydraulic head contains the bore in which the rotor revolves, the metering valve bore, the charging ports and the connections to the fuel injection pipes.

The pump contains a mechanical governor. The centrifugal force of the weights is transfered to the metering valve via a linkage. The metering valve can be closed electrically with the aid of the solenoid situated in the upper part of the pump housing.

The automatic advance is a hydraulic mechanism which turns the cam ring and advances or retards the commencement of the fuel delivery from the pump.

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Function



Main components of the fuel system and Stanadyne distributor pump

1. Fuel tank
2. Water trap
3. Fuel feed pump
4. Fuel filter
5. Transfer pump
6. Pressure regulator valve
7. Automatic advance
8. Air vent passage
9. Stop solenoid
10. Regulator spring
11. Centrifugal weights
12. Overflow valve
13. Hydraulic head connecting passage
14. Metering valve
15. Hydraulic head charging passage
16. Distributor rotor
17. Pressure valve
18. Injector

The fuel feed pump draws fuel from the tank via the water trap and the fuel filter into the fuel injection pump.
In the pump fuel flows through the inlet filter screen into the vane type fuel transfer pump. Some fuel is bypassed through the pressure regulator assembly to the suction side.

Fuel under transfer pump pressure (1,6 bar) flows through the center of the transfer pump into the circular groove on the rotor. It then flows through a connecting passage in the head to the automatic advance and up through a radial passage and then through a con-

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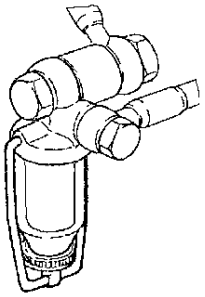
necting passage to the metering valve. The metering valve adjusts the amount of injected fuel and the position of the metering valve which is controlled by the governor (revolution lever) and the stop solenoid. From the metering valve fuel flows to the radial charging passage and further to the head charging ports.

As the rotor revolves, the two rotor inlet passages register with the charging ports in the hydraulic head allow fuel to flow into the pumping chamber. With further rotation, the inlet passages close and the port to the injector opens.
While the discharge post is opened, the rollers contacting the cam lobes are forcing the plungers together. Fuel trapped between the plungers is then pressurised and delivered by the nozzle to the combustion chamber.

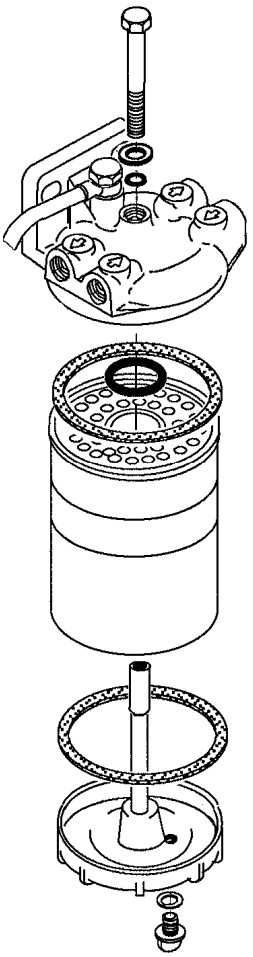
The injection pump is self lubricating with diesel fuel, and thus it has not been connected to the engine lubrication system.

As fuel at transfer pump pressure reaches the charging ports, slots on the rotor shank allow fuel and any entrapped air to flow into the pump housing cavity. In addition, an air vent passage in the hydraulic head connects the outlet side of the transfer pump with the pump housing. This allows air and some fuel to be bled back to the fuel tank via the overflow valve.

The fuel which bypasses fills the housing, lubricates the internal components, cools and carries off any small air bubbles. The pump operates with the housing completely full of fuel; there are no dead air spaces anywhere within the pump.



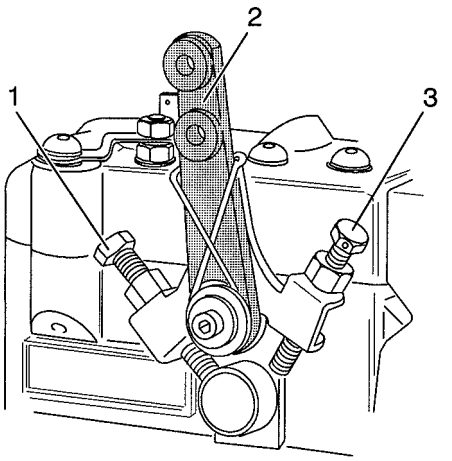
SS99J218



SS98N010

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Adjusting low idle speed



1. Low idle speed
2. Revolution lever
3. Max. revolutions

The low idle speed can be adjusted with a limiting screw in front of the revolution lever. The adjusting screw for max. revs has been sealed. This adjustment has been done in the factory, and adjustment of max. revs afterwards is prohibited. The same regulations are valid for the sealed adjusting screw where the maximum fuel quantity to be injected is adjusted.

NOTE: *The throttle cable is attached to the revolution lever lower hole. To the upper hole a return spring is fastened.*

Other information

The injection pump housing upper cover has been sealed to prevent adjustment of the engine output afterwards. Also the stop solenoid is fitted under this cover. It is recommended, that all pump repairs are made by an authorised Stanadyne workshop.

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Removing pump

1. Clean the pump and the surrounding parts carefully. Remove the delivery pipes, the feed pipe, the throttle cable from the revolution lever and the stop solenoid wires from the pump. Fit protective caps to the pipe unions, to the feed and overflow ports.
2. Remove the cover of the front covering so that the pump gear wheel becomes accessible. Place clean rug underneath the gear to prevent parts like nut and washer from falling down into the timing drive of the engine.
3. Unscrew the gear wheel attaching nut. Detach the gear wheel by using a puller which excerts the pulling force against the pump drive shaft. Don‘t look for a key aligning the gear wheel with the pump drive shaft. There is only a cone to accept the gear wheel. For details see section *„Fitting injection pump and adjusting injection timing“.*

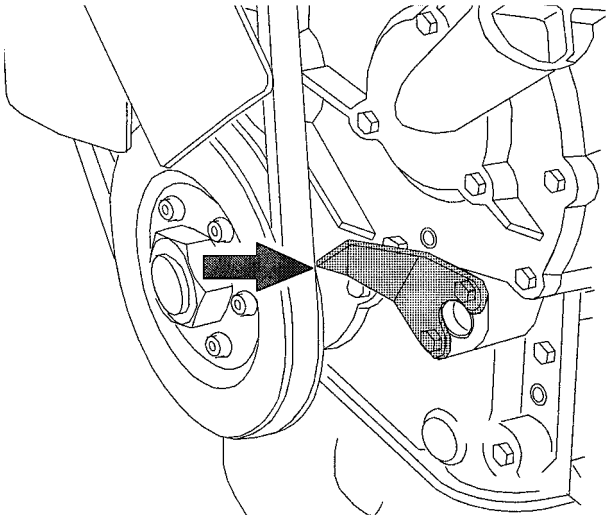
NOTE: *If the timing gear casing has not been removed, the injection pump gear wheel remains in contact with the idler gear and it is unnecessary to mark the positions of the gears.*

ATTENTION: *Before attempting to remove the pump, disconnect the negative battery cable or turn off the battery master switch (if fitted) to avoid cranking by mistake. As the pump is removed, the loose gear wheel could do heavy damage to the timing drive and housing.*

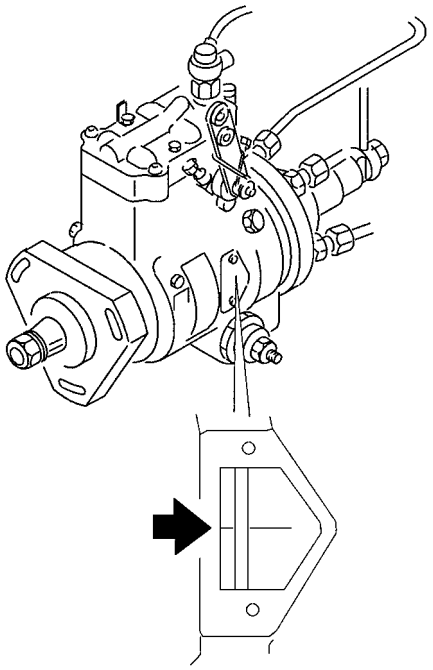
4. Detach the injection pump from the timing gear casing. Clean the sealing surfaces.

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Fitting the injection pump and injection timing



SS99J220



SS99J221

1. Turn the crankshaft to a position where the 1st cylinder piston reaches its compression stroke top dead centre. Then turn the crankshaft backwards until the mark on the pulley passes the timing indicator. After that rotate the crankshaft slowly to running direction until the mark on the pulley is at the point of the timing indicator.
2. Remove the small cover plate on the side of the injection pump. Rotate the pump shaft until the timing marks align (see arrow in picture).
3. Place a new sealing ring on the pump flange. Push the pump into place on the timing gear housing. Note: Key groove in gear is left out from beginning of 1996.
4. Turn the pump in direction of rotation until stop in the slotted holes. See that both the timing marks (on pump and pulley) aligned with their very reference marks. Tighten the pump in position. Fit the gear wheel nut and remove the rug.
5. Tighten the gear wheel nut to a torque of 90 Nm. Loosen pump retaining screws and turn the pump against direction of rotation only for the amount of removing the back lash in the gear drive. Tighten the pump retaining screws and see that the timing marks finally align. Fit the small side cover of the pump. Fasten the pump gear wheel covering.
6. Remove the protective caps from the delivery pipe unions, from the feed and overflow ports. Fit the feed pipe, delivery pipes and the overflow pipe - where needed - with new copper seals. Attach the throttle cable, return spring and connect the electric cables for the stop solenoid.
7. Bleed the fuel system (for details see next page).

NOTE: *Lubrication oil is not needed because fuel in the pump lubricates the internal parts.*

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Bleeding the fuel system

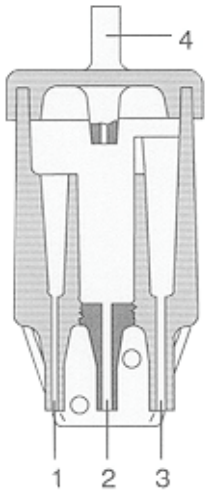
NOTE: *See bleeding screws on page 4.*

NOTE: *This fuel system removes automatically small amount of air bubbles from the filter and the pump when the engine is running. However, bleed the system always when the system has been opened, fuel has been exhausted during driving or a new spare pump has been fitted.*

1. Loosen the bleeding screw 10a on the filter. Pump with the hand pump until no air bubbles flow out of the bleeding screw hole. Tighten the bleeding screw. If the pumping seems to be ineffective, turn the engine a little so that the camshaft cam is not at the feed pump lifter.
2. Pump further with the hand pump and loosen the fuel inlet connection 10b on the injection pump, until the fuel is coming out free from air bubbles. Tighten the connection.
3. Start the engine and make sure that no leaks exist.

NOTE: *When the bleeding is done in this way, fuel flows immediately into the internal transfer pump when the starter motor is rotating and the distributor pump housing is filled quickly with fuel. In the pump housing there is the stop solenoid which must not be switched on for more then 40 seconds when the pump housing upper cavity is empty of fuel.*

Bleeding the Thermostart system



SS99J222

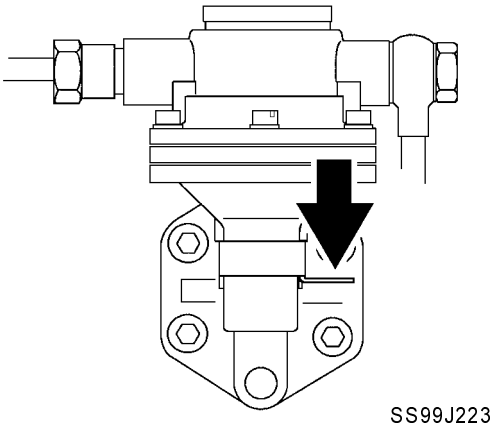
1. Reservoir filling
2. To the glow plug
3. Return to fuel tank
4. Breather

Always remove air from the glow plug fuel pipe when the pipe or the reservoir has been emptied during repair work etc. This prevents from damages to the glow plug caused by lack of fuel while starting.

1. Fill the reservoir with clean fuel, e.g. through the breather.
2. Open the fuel pipe connection to the glow plug and let the fuel come out. Tighten the pipe.

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Measuring fuel feed pressure



If the engine performance is less than it should be, one reason could be that the quantity of fuel injected is not enough. Before the injection pump is suspected, a check should be done whether the fuel feed to the injection pump is suffitient. A reliable value is the feed pressure shown on a pressure gauge under various engine running conditions (e.g. slow idle speed, max. revolutions under load and no load, accelaration under load).

Procedure of pressure test

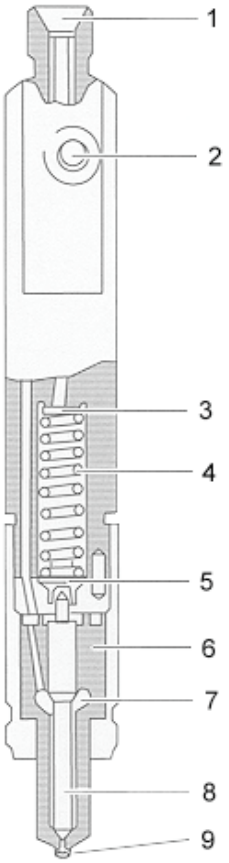
1. Clean the injection pump, filter and fuel pipes.
2. Check if there is sufficient fuel in the fuel tank.
3. Check the function of the fuel tank vent.
4. Check that fuel pipes and especially fuel hoses are nowhere kinked.
5. Connect an appropriate pressure gauge to the inlet port of the injection pump (point **10b** in the previous section *„Bleeding the fuel system“.*
6. Run the engine at slow idle speed. The feed pressure should reach **0,48 bar** (48kPa), minimum pressure must be 0,20 bar.
7. Run the engine at max. speed under no load and under load. The feed pressure **must reach 0,20 bar** with used pump.
8. Check the feed pressure during accelaration, if possible under load. During this test, the feed pressure is allowed to drop for the amount of 0,20 bar.

ATTENTION: *If the fuel would contain contineously air bubbles, check the suction line from the tank to the fuel feed pump. Then repeate the test. See whether the gauge readings have changed.*

NOTE: *If the pressure in at least one of the above recommended tests is lower than demanded, the fuel feed pump has to be changed.*

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Injector



1. Fuel inlet
2. Leak-off fuel
3. Shim
4. Pressure spring
5. Valve stop spacer
6. Nozzle body
7. Pressure chamber
8. Nozzle valve
9. Nozzle hole

The injectors for the 320 and 420 engines have a five hole nozzle. The small quantity of leak off fuel lubricating the needle returns into the fuel tank through the leak off pipe.

When testing an injector, the following performances have to be checked:

1. Injector opening pressure
2. The properties of chattering (creaking) sound
3. Form of spray pattern
4. Sealing of nozzle valve against its seat

Opening pressure

The opening pressure for 320 and 420 engines should be	270 + 8 bar
Setting pressure	278 bar
Adjusting shims available from	1.00 - 1.90 mm
Increment	0.05 mm
Change in opening pressure for one increment step	5.00 bar

Values for nozzle sealing test

After having checked for correct opening pressure, release the pressure to the injector. Pump up again with the hand pump of the test bench to a pressure 20 bar below opening pressure. Immediately tighten the hand valve on the test bench.

Watch the nozzle tip. Within 10 seconds, not a single drop of fuel must occur. It is ok as long the nozzle tip only gets wet.

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Fuel quality requirements

	Requirement	Test method
Density, + 15 °C	0,82....0,86 Kg/dm^3	ASTM D 4052 81, IP 365/84, DIN 51757
Viscosity, + 20 °C	1,5.....8,0 mm/s^2	ASTM D 445 83, IP 71/79
Sulphur content	max. 0,5 P. %	ASTM 129 64, IP 61/65, DIN 51400
Cetene index	min. 45	ASTM D 976 80, IP 218/84
Water content	max. 0,05 P. %	ASTM D 1744 83, IP 74/77, DIN 51777

NOTE: *The fuel must be absolutely clean and contain no water.*

Engine output depending on fuel quality and fuel density

Different fuel qualities like temperature, density and viscosity affect the actual output of the engine. Our output rates use fuel with a density of 0,84 kg/dm^3 and specific heat rate of 42,7 Mj/kg at a fuel temperature of + 15°C.

BIODIESEL FUEL

In Sisu diesel engines, it is accepted to use esterified rape oil as biodiesel fuel or RME (rape oil esterified with methanol) without technical modifications on the engine. The requirement for the acceptance is, that the biodiesel beeing used, is very pure and that it fulfils the Austrian „Ö 1190“ biodiesel standard demands of pureness.

Practically it means that the amount of pure carbon, hydrogen and oxygen content together in the biodiesel is more than 99%.

NOTE: *The warranty forms are the same.*

NOTE: *In the service instructions,* ***two intervals*** *are changed:*
Engineoil change reduced from 250 hours interval to:
125 hours - when engine only little loaded
185 hours - when engine moderate or heavy loaded
Checking and cleaning of nozzles every 1000 hours.

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Checking injection timing dynamically with *TIME TRAC*

General

To meet future emission standards, Case Steyr introduces during the year 2000 the so called E engines („green“ engines) for the tractor models CS 68 to CS150 / M968 to 9145.

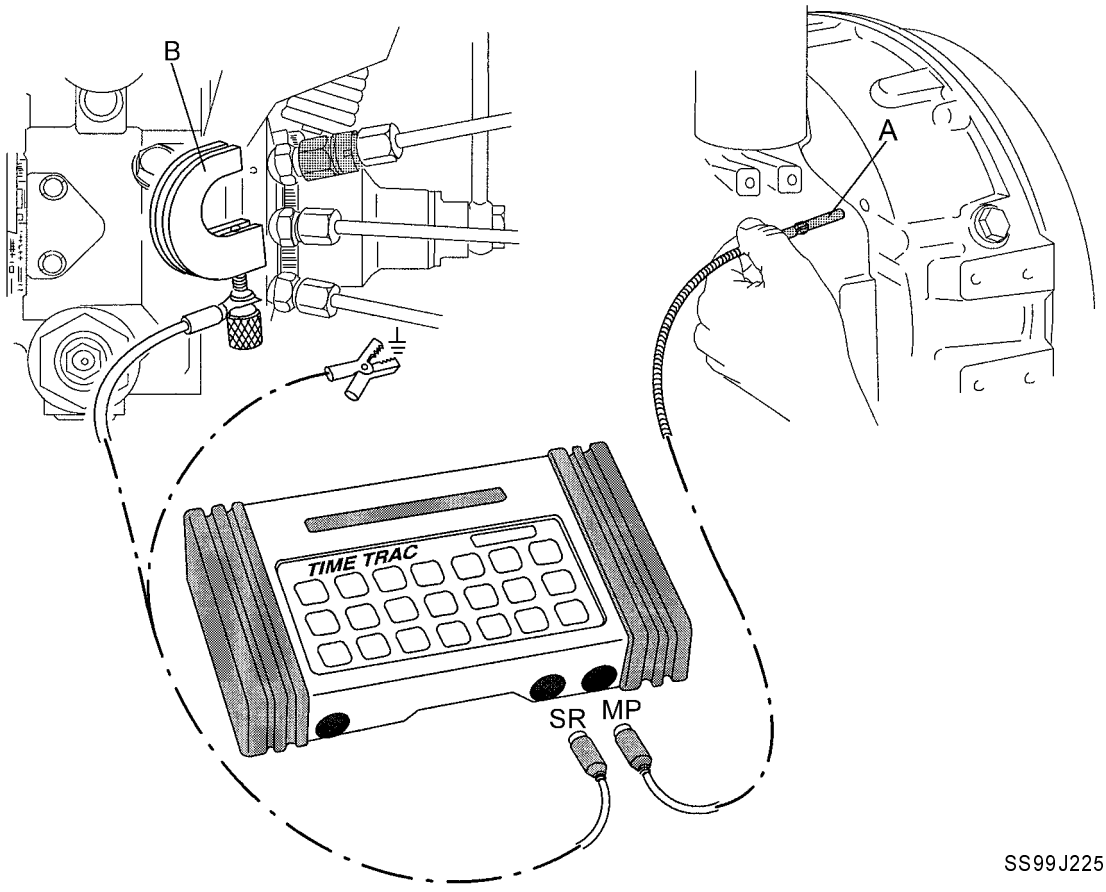
In connection with other measures to improve the combustion process and thus to reduce the emission to the envirement, there is one performance for service people to be done in a new way:

The commencement of delivery has to be checked *dynamically*. That means the check is to be carried out with running engine.

To perform this, an electronic equipment, the so called *TIME TRAC* was introduced by the engine maker. With the TIME TRAC, a detailed instruction is supplied, telling step by step the procedure. In this manual, the most important information should be given.

NOTE: *Prior to the enforcement of the new emission standard, the engines will be equipped with a sensor between delivery port (1st cylinder) and delivery pipe.*

How to connect TIME TRAC



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Description of procedure with *TIME TRAC*

1. After static adjustment of the injection timing and bleeding the system, run the engine to warm up.

NOTE: *All connections, including the magnetic probe insertion and removal, must be done with the engine stopped. Before starting the engine, make sure that all cables are off from any moving parts or hot manifold.*

2. Remove the protective plug from the access hole (8 mm dia) and insert the probe assembly A until it gets stopped by the flywheels front face and then RETRACT IT SLIGHTLY (0,5 ...1,0 mm). This prevents from wear at the end of the probe caused by contacting the running flywheel.
3. Connect the cable of the magnetic probe to socket MP of the Time Trac.
4. Install the adapter B. First place the clamp assembly around the sensor slightly above the brass contact ring and then move it down over the contact ring. Tighten the thumb scew of the clamp ensuring that the end of the screw contacts the contact ring.
5. Connect the cable of the transducer to the socket SR of the Time Trac.
6. Connect the cable with the alligator clip to some clean, unpainted metallic portion of the fuel system or engine.
7. Turn the Time trac on by pressing the ON/CLEAR key. The words „Time Trac“ and then „Model TT 1000“ should appear briefly followed by „R = 0“. The Time Trac can be used as a tachometer at this point without further manipulation.
8. Press MAG PROBE. The display shows „Trig level 30%“. Press ENTER leaving the trigger point at 30%.
9. Display shows „Offset 20.0“. Press ENTER to leave the offset at 20.0.
10. Display shows „Calibrate?“. Start the engine and run it at low idle speed. Press ENTER to continue which will cause the dislay to show „R = ___ Set RPM“.
11. Once the proper RPM is displayed, press ENTER. The display shows „Calibrating...“ for a short periode of time.

NOTE: *If for some reasons the Time Trac loses the engine speed signal or the engine is not running, flash this message 3 times, then return to the tachometer mode. To restart the procedure, press MAG PROBE (point 8).*

12. If for example the engine were running at 850 RPM and timing were 6 ° BTDC, the display should now show „R = 850 MP + 6.0“. Now the Time Trac is ready for use.

NOTE: *If for some reasons the Time Trac loses the magnetic probe signal the display will show „R = 850 no Probe“. Once the magnetic probe signal is restored, the display will show the proper timing value.*

13. *You should measure the pump timing at high idle speed (TT (HI))*. This value is valid for pump timing setting. Adjust if necessary.
14. The cam advance operation of the injection pump you can check at low idle speed (TT (LO)).

NOTE: *Setting values will be available in the workshop manual.*

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Trouble shooting in connection with TIME TRAC

If the timing deviates remarkable from given, check the following:

1. Vibrating delivery pipe, hold the pipe tight with your hand.
2. Distance of magnetic probe from flywheel is not correct. Reset the magnetic probe.
3. „Offset“ or „Trig Level“ value is wrong. Make a reset.
4. Disturbing scratches on the flywheel. Smoothen flywheel face (at stopped engine).
5. Alignment of flywheel is not correct: Distorted crankshaft, contacting surfaces on crankshaft or flywheel is not smooth. Remove flywheel, check the suspected parts and reassemble correct. Test again with Time Trac.

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Chapter

4A

HOW IT WORKS AND TROUBLESHOOTING
Combi Instrument

M9078, M9086, M9094
CS78, CS86, CS94

CASE-STEYR Landmaschinentechnik GmbH
Technical Documentation/Training Center
A – 4300 St. Valentin, Steyrer Straße 32

Sva 7-95391 EN

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March, 2001

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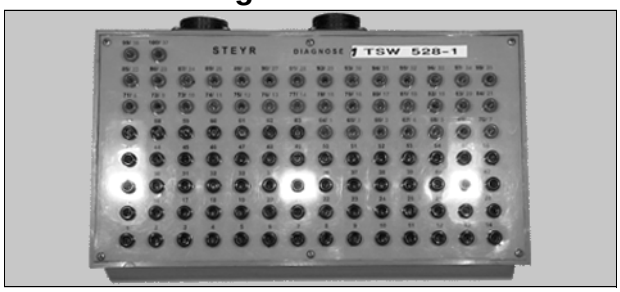
TABLE OF CONTENTS

SPECIAL TOOLS 3
COMBINATION INSTRUMENT 4
PLUG AND PIN ALLOCATION ON THE COMBINATION INSTRUMENT 6
TROUBLESHOOTING USING THE DIAGNOSTIC SYSTEM 7
Plug X9/1 8
Plug X9/2 9
Plug X9/3 10
Plug X9/4 11
Plug X9/5 12
Plug X9/6 15
TEST VALUES 17
1. Frequency to check display of rear PTO shaft speed: 17
2. Frequencies of speed signal of rear PTO shaft: 17
3. Frequency to check front PTO shaft speed signal: 17
4. Frequency to check analogue speed display: 17
5. Fuel gauge: 18
6. Engine temperature gauge: 18
7. Coolant temperature switch S32 18
8. Compressed air indicator: 18
OPERATING AND CODING OF THE DIGITAL INSTRUMENT WITH INTEGRATED OPERATING HOURS COUNTER 19
CALIBRATING THE DRIVING SPEED 20

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SPECIAL TOOLS

Diagnostics Box



SD01B263

1 off 1TSW 528-1
1 off 1TSW 528-35 (edition foil)

Multimeter



SD99M014

1 off 1TSW 516-1

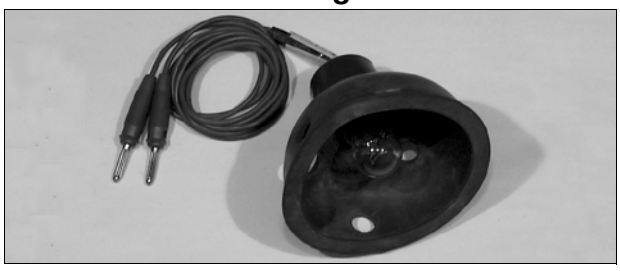
Measuring lines



SD99M013

1 off 1TSW 528-11

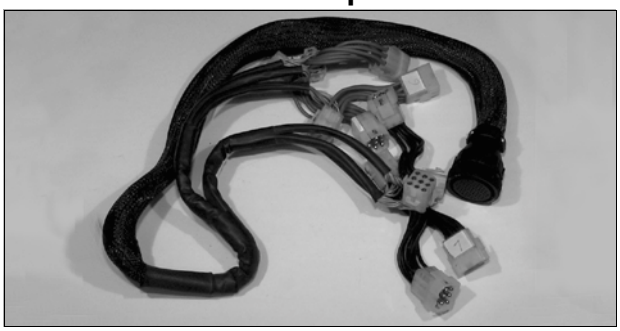
Test light



SD01B018

1 off 1TSW 528-2

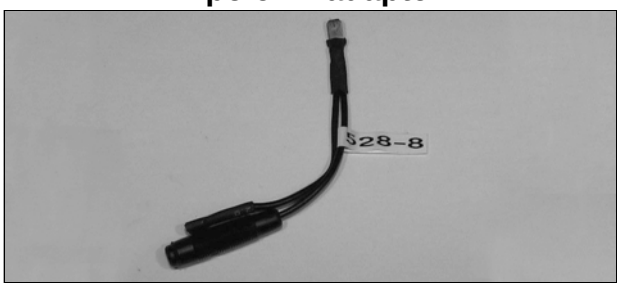
'Y' – Adapter



SD01B019

1 off 1TSW 528-34

1 pole 'Y' adapter



SD01B017

1 off 1TSW 528-8 (black)
1 off 1TSW 528-9 (red)

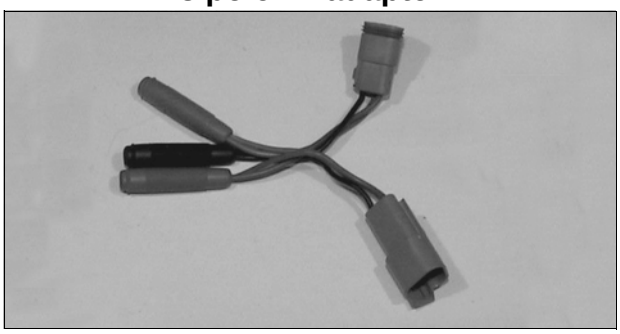
2 pole 'Y' adapter



SD99M012

1 off 1TSW 528-6 (black)

3 pole 'Y' adapter

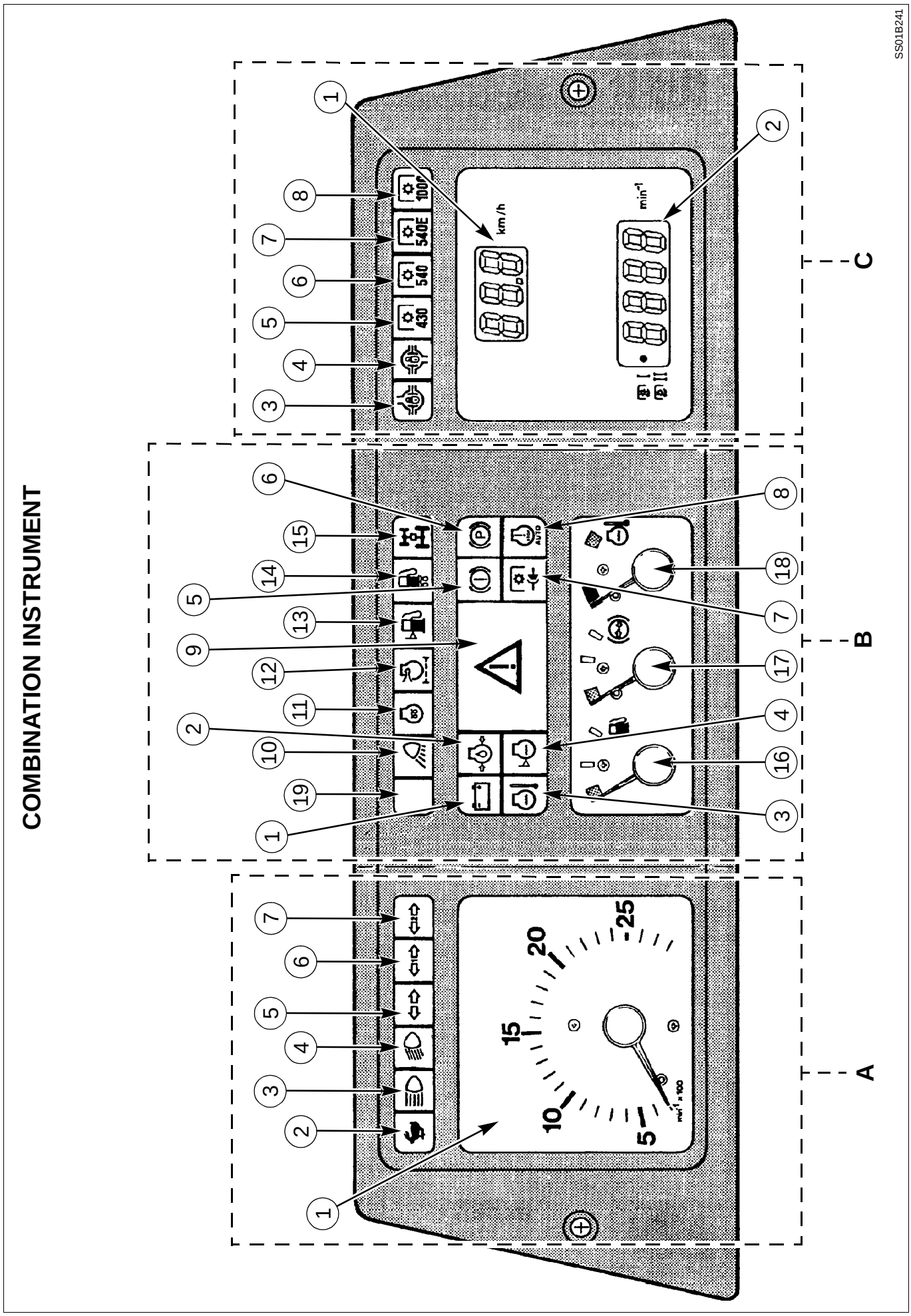


SD01B016

1 off 1TSW 528-44 (black)

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COMBINATION INSTRUMENT



1. The combination instrument is available in two versions:

   a) Digital version: Display of engine speed analogue,
   Display of engine speed, PTO shaft speed and hours of operation digital.

   b) Analogue version: Display of engine speed, drive speed, PTO shaft speed and hours of operation analogue
   (plugs X9/5 and X9/6 not present).

The combination instrument consists of 3 separate display units (prints) connected to each other via plug connectors.

Display Unit A

1. Analogue display for engine speed
   When using the combination instrument the displays for the rear PTO shaft speed and the driving speed are integrated.
2. /L1 Indicator lamp, power-shift
3. /L2 Indicator lamp, main beam
4. /L3 Indicator lamp, lighting
5. /L4 Indicator lamp, trafficator
6. /L5 Indicator lamp, trafficator, 1st trailer
7. /L6 Indicator lamp, trafficator, 2nd trailer

Display Unit B

Central warning system consists of 1 to 9

1. /L20 Indicator lamp, load check
2. /L21 Indicator lamp, engine oil pressure
3. /L25 Indicator lamp, coolant temperature
4. /L26 Indicator lamp, coolant level display
5. /L23 Indicator lamp, compressed air
6. /L24 Indicator lamp, parking brake
7. /L27 Indicator lamp, PTO shaft clutch
8. /L28 Indicator lamp, stationary operation
9. /L29 Indicator lamp, stop
   /L22 Indicator lamp, stop
10. /L8 Indicator lamp, searchlight according to each variant
11. /L9 Indicator lamp, pre-glowing
12. /L10 Indicator lamp, air filter maintenance indicator
13. /L11 Indicator lamp, tank reserve
14. /L12 Indicator lamp, fuel filter heating
15. /L13 Indicator lamp, 4-wheel drive
16. Analogue display tank content
17. Analogue display compressed air
18. Analogue display Coolant temperature
19. /L7 not allocated

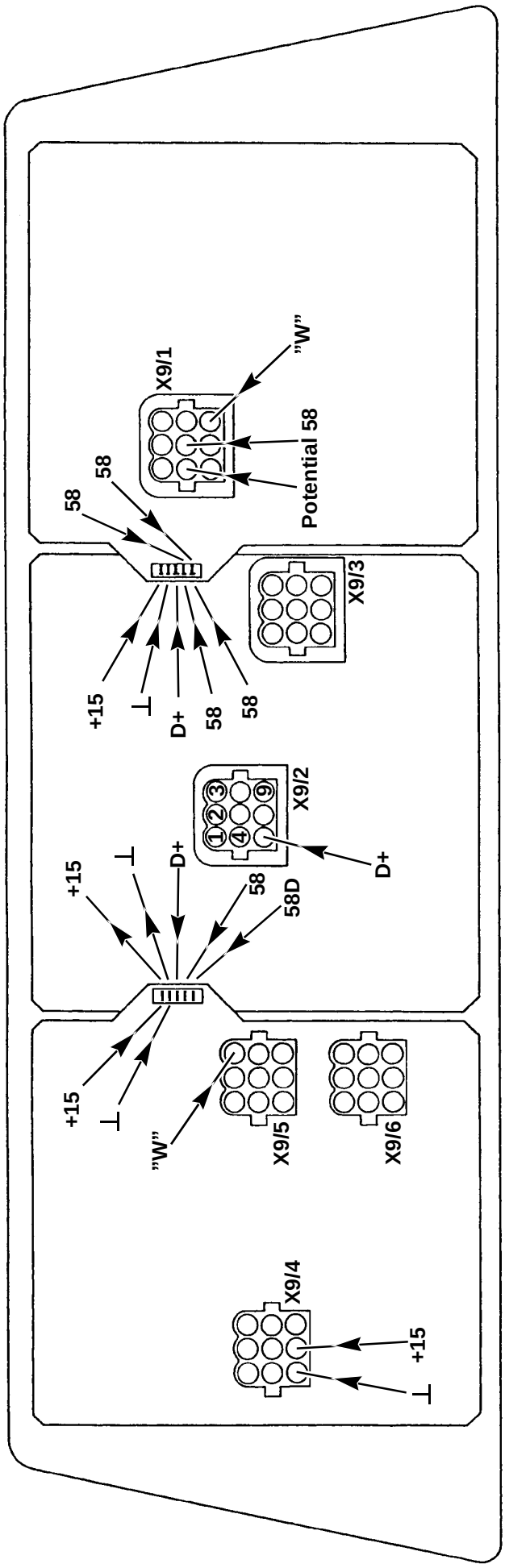
Display Unit C

1. Digital display driving speed
2. Digital display switchable for rear PTO shaft, front PTO shaft and hours of operation
3. /L14 Indicator lamp, rear differential lock
4. /L15 Indicator lamp, front differential lock
5. Indicator lamp, PTO shaft 430
6. Indicator lamp, PTO shaft 540
7. Indicator lamp, PTO shaft 540E
8. Indicator lamp, PTO shaft 1000

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PLUG AND PIN ALLOCATION ON THE COMBINATION INSTRUMENT



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TROUBLESHOOTING USING THE DIAGNOSTIC SYSTEM

To quickly find errors such as e.g.:

display failure or inaccurate displays on the combination instrument

Using the diagnostic system and the table listed you can quickly and safely locate the error.

Test conditions:

	Start button switched off
	Start button switched on (in position 1)
	Engine must be running
X..	Plug
Pin	Pin on specified plug
	Plug is connected
	Plug is not connected
	Connect a bulb of the specified wattage as a load

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Plug X9/1								
Designation	***Pin***	***Cable colour and No.***	***Measure-ment***	***Requirements***	***X9/1***	***Measure from pin to pin***	***X9/4***	***Value***
L1 indicator lamp, green Load-switching stage HIGH via pushbutton	1	C111	U	Load switching stage to HIGH	1	→ ⊥	7	13 - 14 VDC
L1 indicator lamp, green Load-switching stage HIGH via pushbutton	2	S	U	Load switching stage to HIGH	2	→ ⊥	7	0 - 0.3 VDC
L2 indicator lamp, main beam blue	3	E113	U	Main beam ”ON”	3	→ ⊥	7	12 - 14 VDC
Potential 58 for L3, L100, L101, L201, L202, L203	4	E114	U	Light ”ON”	4	→ ⊥	7	12 - 14 VDC
Potential 58 to IC dimmer	5	E115	U	Light ”ON”	5	→ ⊥	7	12 - 14 VDC
L4 indicator lamp, green tractor trafficator	6	C116	U	left and right flashing	6	→ ⊥	7	12 - 14 VDC
L5 indicator lamp, green trafficator – 1st trailer	7	C117	U	1. Trailer hooked up	7	→ ⊥	7	12 - 14 VDC
L6 indicator lamp, green Trafficator – 2nd trailer	8	C118	U	1. and 2nd trailer hooked up	8	→	7	12 - 14 VDC
● Signal engine speed from alternator pin W	9	F119	U	”Extinguish” load check lamp L20	9	→ ⊥	7	approx. 7 VDC  approx. 7.5 VAC
→ MWM – engine	9	F119	f	^{n}engine = 1000 min^{-1}	9	→ ⊥	7	254 Hz
→ SISU – engine	9	F119	f	^{n}engine = 1000 min^{-1}	9	→ ⊥	7	300 Hz

Plug	X9/2							
Designation	***Pin***	***Cable colour and No.***	***Measure-ment***	***Requirements***	***X9/2***	***Measure from pin to pin***	***X9/4***	***Value***
L7 indicator lamp, orange reserve	1					not connected		
L8 indicator lamp, orange Searchlight according to each variant	2	E122	U	Light ”on” and searchlight ”on”	2	→ ⊥	7	12 - 14 VDC
L9 indicator lamp, orange Thermostat	3	C123	U	Pre-glowing pushbutton pressed	3	→ ⊥	7	approx. 12 VDC
L10 indicator lamp, orange air filter (maintenance)	4	B124	U	Air filter ”OK” Air filter ”NOT OK”	4	→ ⊥	7	approx. 12 VDC 0 - 0.3 VDC
L12 indicator lamp, orange Fuel pre-warming	5	B125	U	Fuel temperature > 5°C Fuel temperature < 5°C	5	→ ⊥	7	approx. 7.5 VDC 0.5 - 1 VDC
L13 indicator lamp, orange 4-WD	6	C116	U	4-wheel drive ”OFF” 4-wheel drive "ON"	6	→ ⊥	7	approx. 12 VDC 0 - 0.3 VDC
L20 indicator lamp, red Load check of alternator D+	7	K127	U	Load check lamp lights up Load check lamp does **not** light up	7	→ ⊥	7	approx. 1.5 VDC 13 - 14 VDC
L21 indicator lamp, red Engine oil pressure	8	B128	U	Indicator lamp lights up Indicator lamp does **not** light up	8	→ ⊥	7	0 - 0.3 VDC 12 -14 VDC
L23 indicator lamp, red Compressed Air (supply)	9	B129	U	Pressure < 5.5 bar Pressure > 5.5 bar	9	→ ⊥	7	0 - 0.3 VDC 12 - 14 VDC

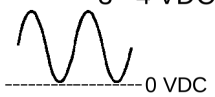
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Plug	X9/3							
Designation	***Pin***	***Cable colour and No.***	***Measure-ment***	***Requirements***	***X9/3***	***Measure from pin to pin***	***X9/4***	***Value***
L24 indicator lamp, red Handbrake	1	B131	U	Handbrake applied Handbrake open	1	→ ⊥	7	0 - 0.3 VDC 12 - 14 VDC
L25 indicator lamp, red Engine temperature >113°ϑ MWM – engine	2	B132	U	< 113 °C > 113 °C	2	→ ⊥	7	12 - 14 VDC 0 - 0.3 VDC
L25 indicator lamp, red Engine temperature >106°ϑ SISU – engine	2	B132	U	< 106 °C > 106 °C	2	→ ⊥	7	12 - 14 VDC 0 - 0.3 VDC
L26 indicator lamp, red Coolant level	3	B133	U	> min. < min.	3	→ ⊥	7	13 - 14 VDC 0 - 0.3 VDC
L27 indicator lamp, red Rear PTO shaft clutch Electro – hydr. applied	4	B134	U	unhooked hooked up	4	→ ⊥	7	approx. 1.5 VDC approx. 12 VDC
L28 indicator lamp, red stationary operation	5	B135	U	enabled **not** enabled	5	→ ⊥	7	0 - 0.3 VDC 12 - 14 VDC
Signal line for Fuel gauge (M100) and L11 indicator lamp Tank reserve	6	F136	R		6	→ ⊥	7	see test values
Signal line for compressed air (M101)	7	F137	R		7	→ ⊥	7	see test values
Signal line for engine temperature (M102)	8	F138	R		8	→ ⊥	7	see test values
not connected	9							

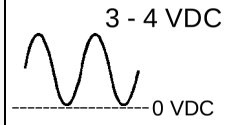
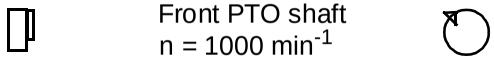
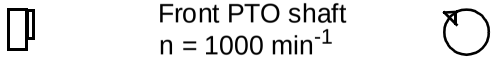
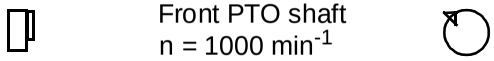
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Plug X9/4								
Designation	***Pin***	***Cable colour and No.***	***Measure-ment***	***Requirements***	***X9/4***	***Measure from pin to pin***	***X9/4***	***Value***
Supply:								
Plus potential 15/1 F14	8	G148	U	⊗ 21W	8	→ ⊥	7	13 - 14 VDC
Ground test under load	7	S	U	⊗ 21W Cl. 8 → Cl. 7	7	→	Batt. -	0 - 0.3 VDC
L14 indicator lamp, orange Differential lock, rear	1	B141	U	Diff. lock "on" Diff. lock "off"	1	→ ⊥	7	0 - 0.6 VDC approx. 8.2 VDC
L15 indicator lamp, orange Front differential lock	2	B142	U	Diff. lock "on" Diff. lock "off"	2	→ ⊥	7	0 - 0.6 VDC approx. 8.2 VDC
L16 indicator lamp, orange, PTO shaft 430	3	B143	U	PTO shaft 430 preselected PTO shaft 430 not preselected	3	→ ⊥	7	0 - 1 VDC approx. 8.2 VDC
L17 indicator lamp, orange, PTO shaft 540	4	B144	U	PTO shaft 540 preselected PTO shaft 540 not preselected	4	→ ⊥	7	0 - 1 VDC approx. 8.2 VDC
L18 indicator lamp, orange, PTO shaft 540E	5	B145	U	PTO shaft 540E preselected PTO shaft 540E not preselected	5	→ ⊥	7	0 - 1 VDC approx. 8.2 VDC
L19 indicator lamp, orange, PTO shaft 1000	6	B146	U	PTO shaft 1000 preselected PTO shaft 1000 not preselected	6	→ ⊥	7	0 - 1 VDC approx. 8.2 VDC

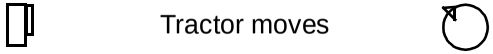
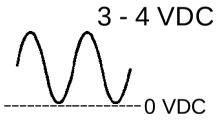
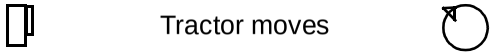
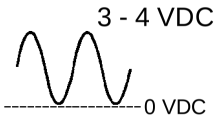
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Plug	X9/5							
Designation	***Pin***	***Cable colour and No.***	***Measure-ment***	***Requirements***	***X9/5***	***Measure from pin to pin***	***X9/4***	***Value***
not connected	1							
Signal for Switching hours of operation display, front and rear PTO shafts, Coding and calibrating	2	B152	U	Pushbutton pressed Pushbutton **not** pressed	2	→ ⊥	7	0 - 0.3 VDC no value set
Signal engine speed from alternator pin W	3	F153	U		3	→ ⊥	7	approx. 7 VDC  approx. 7.5 VAC
Signal engine speed from alternator pin W MWM – engine	3	F153	f	Engine speed n = 1000 min^{-1}	3	→ ⊥	7	254 Hz
Signal engine speed from alternator pin W Sisu – engine	3	F153	f	Engine speed n = 1000 min^{-1}	3	→ ⊥	7	300 Hz
not connected	4							
Signal front PTO shaft speed from sensor B8 (only 9000 series)	5	HB	U		5	→ ⊥	7	3 - 4 VDC  0 VDC VAC according to each PTO shaft speed
Signal front PTO shaft speed from sensor B8 (only 9000 series)	5	HB	f	Front PTO shaft n = 1000 min^{-1}	5	→ ⊥	7	483 Hz

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Plug	X9/5							
Designation	***Pin***	***Cable colour and No.***	***Measure-ment***	***Requirements***	***X9/5***	***Measure from pin to pin***	***X9/4***	***Value***
Signal front PTO shaft speed from sensor B8 (only 9000 series)	6	HB	U		6	→ ⊥	7	 3 - 4 VDC 0 VDC VAC according to each PTO shaft speed
Signal front PTO shaft speed from sensor B8 (only 9000 series)	6	HB	f	 Front PTO shaft n = 1000 min^{-1}	6	→ ⊥	7	483 Hz
Signal front PTO shaft speed from sensor B8 (only 9000 series)	5 and 6	HB HB	R		5	→	(X9/5) 6	1050 Ω ±10 %
from M9000 not connected	5							
Signal front PTO shaft speed from alternator pin W via S29 from M9000	6	F156	U		6	→ ⊥	7	 approx. 7 VDC approx. 7.5 VAC
Signal front PTO shaft speed from alternator pin W from M9000 with MWM – engine	6	F156	f	 Front PTO shaft n = 1000 min^{-1}	6	→ ⊥	7	541 Hz
Signal front PTO shaft speed from alternator pin W from Sisu – engine	6	F156	f	 Front PTO shaft n = 1000 min^{-1}	6	→ ⊥	7	639 Hz

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Plug	**X9/5**							
Designation	***Pin***	***Cable colour and No.***	***Measure-ment***	***Requirements***	***X9/5***	***Measure from pin to pin***	***X9/4***	***Value***
Signal theoretical driving speed sensor B6	7	9000 HA M9000 F157	U	 Tractor moves	7	→ ⊥	7	 3 - 4 VDC 0 VDC VAC according to each driving speed
Signal theoretical driving speed sensor B6	8	9000 HA M9000 F158	U	 Tractor moves	8	→ ⊥	7	 3 - 4 VDC 0 VDC VAC according to each driving speed
Signal theoretical driving speed sensor B6	7 and 8		R		7	→	(X9/5) 8	1050 Ω ± 10 %
not connected	9							

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Plug	X9/6							
Designation	***Pin***	***Cable colour and No.***	***Measure-ment***	***Requirements***	***X9/6***	***Measure from pin to pin***	***X9/4***	***Value***
Signal rear PTO shaft speed from sensor B7 up to DBD0057134	1	F161	U	PTO shaft is turning	1	→ ⊥	7	3 - 4 VDC 0 VDC VAC according to each speed
Signal rear PTO shaft speed from sensor B7 up to DBD0057134	1	F161	f	Speed PTO shaft n = 540 min^{-1}	1	→ ⊥	7	90 Hz
Signal rear PTO shaft speed from sensor B7 up to DBD0057134	2	F162	U	PTO shaft is turning	2	→ ⊥	7	3 - 4 VDC 0 VDC VAC according to each speed
Signal rear PTO shaft speed from sensor B7 up to DBD0057134	2	F162	f	Rear PTO shaft speed n = 540 min^{-1}	2	→ ⊥	7	90 Hz
Signal rear PTO shaft speed from sensor B7 up to DBD0057134	1 and 2	F161 F162	R		1	→	(X9/6) 2	1050 Ω ± 10 %
Signal rear PTO shaft speed from sensor B8 from DBD0057135 onwards	1	F161	U	Rear PTO shaft is turning Rear PTO shaft is **not** turning	1	→ ⊥	7	approx. 4 VDC approx. 6 VDC
Signal rear PTO shaft speed from sensor B8 from DBD0057135 onwards	1	F161	f	Rear PTO shaft speed n = 540 min^{-1}	1	→ ⊥	7	90 Hz
Cabling to X24/3 (reserve) from DBD0057135 onwards	2	F162						

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Plug	X9/6							
Designation	***Pin***	***Cable colour and No.***	***Measure-ment***	***Requirements***	***X9/6***	***Measure from pin to pin***	***X9/4***	***Value***
Signal for additional equipment according to DIN 9684 and ISO 11786	3	F163	U	v < 0.5 km/h v > 0.5 km/h	3	→ ⊥	7	no value set High (13 VDC)
Signal driving speed standardized according to DIN 9684 and ISO 11786 130 impulses / meter 505 Hz (14 km/h)	4	F164	U	Tractor moves	4	→ ⊥	7	approx. 6.5 VDC 0 VDC
Signal driving speed standardized according to DIN 9684 and ISO 11786 130 impulses / meter 505 Hz (14 km/h)	4	F164	f	v = 14 km/h	4	→ ⊥	7	505 Hz
Signal engine speed standardized according to DIN 9684 and ISO 11786	5	F165	U	Engine is turning over	5	→ ⊥	7	approx. 6.5 VDC 0 VDC
Signal engine speed standardized according to DIN 9684 and ISO 11786	5	F165	f	Engine speed n = 1000 min^{-1}	5	→ ⊥	7	260 Hz
Signal rear PTO shaft speed standardized according to DIN 9684 and ISO 11786 40 impulses / revolution	6	F166	U	Rear PTO shaft is turning	6	→ ⊥	7	approx. 6.5 VDC 0 VDC
Signal rear PTO shaft speed standardized according to DIN 9684 and ISO 11786 40 impulses / revolution	6	F166	f	Speed, rear PTO shaft n = 540 min^{-1}	6	→ ⊥	7	360 Hz
not connected	7							
not connected	8							
not connected	9							

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TEST VALUES

1. Frequency to check display of rear PTO shaft speed:

Pick-up cog: 10 teeth

Speed PTO shaft	Frequency
430 min^{-1}	72 Hz
540 min^{-1}	90 Hz
540E min^{-1}	90 Hz
1000 min^{-1}	167 Hz

To carry out a check, the frequency can be calculated:

$$f = \frac{n * z}{60}$$

f .....frequency
n .....speed
z .....no. of teeth

Example: $f = \frac{1000\ min^{-1} * 10}{60} = 167\ Hz$

2. Frequencies of speed signal of rear PTO shaft:

at A12 X12/3 pin 3 to Steyr Veh. No. 04517, Case DBD0010601
at A12 X10/3 pin 8 from DBD 0055001 onwards
at signal plug socket X29 pin 3

Speed PTO shaft	Frequency	Speed PTO shaft	Frequency
430 min^{-1}	288 Hz	540E min^{-1}	360 Hz
540min^{-1}	360 Hz	1000 min^{-1}	667 Hz

3. Frequency to check front PTO shaft speed signal:

Speed Front PTO Shaft	Frequency	
1000 min^{-1}	483 Hz	9000 Series (sensor at front PTO shaft) Pick-up cog with 29 teeth
1000 min^{-1}	541 Hz	M9078 - M9094, up to Veh. No. 04517 CS78 - CS94 up to DBD0010601
1000 min^{-1}	639 Hz	M9078 - M9094 and CS78 - CS94 from DBD0055001 onwards

4. Frequency to check analogue speed display:

Engine speed	permissible deviation	Pointer angle	Frequency from alternator pin ”W”
MWM – engine			
1000 min^{-1}	± 100 min^{-1}	67°	254 Hz
2000 min^{-1}	± 65 min^{-1}	163°	508 Hz
SISU – engine from DBD0055001 onwards			
1000 min^{-1}	± 100 min^{-1}	67°	300 Hz
2000 min^{-1}	± 65 min^{-1}	163°	600 Hz

If the voltage at contact ”W” is to be measured, then half of the control voltage, approx. a 7 V DC voltage, is displayed irrelevant of engine speed.
Engine gearing: dynamo (6 pole pairs)
i = 1 : 2.54 MWM – engine
i = 1 : 3 SISU – engine

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5. Fuel gauge:

	Sensor (B2/1)	Display – Instrument	
Diesel level	Resistance	Pointer angle	Display area
empty	10 Ω	0°	from 0 - 12° red sector
1/8 (1)	31,2 Ω	7,5°	
1/2	95 Ω	30°	from 30 - 35° white sector
1	180 Ω	60°	from 60 - 65° white sector

1) If the diesel level is less than 1/8, then L11 lights up (indicator lamp, tank reserve).

6. Engine temperature gauge:

	Sensor (B1)	Display – Instrument	
Temperature	Resistance	Pointer angle	Display area
45 °C	239 Ω	0°	from 0 - 10° white sector
60 °C	134 Ω	0°	
75 °C	82 Ω	14°	
90 °C	51 Ω	20°	
105 °C	33,4 Ω	42°	from 42 - 52° red sector
113 °C	26,8 Ω	53°	
120 °C	22,4 Ω	60°	

7. Coolant temperature switch S32

Type of contact:	Normally open contact (NOC)	
Switchpoint	113 ± 3 °C (2)	for MWM-engines up to Steyr Veh. No. 04517, Case DBD0010601
Switch point	106 ± 3 °C (2)	for SISU – engines (from DBD0055001 onwards)

2) If the coolant temperature is higher than the value indicated, L25 (indicator lamp, coolant temperature) lights up, L22 and L29 (indicator lamps, stop) flash and the stationary operation cut-off stops the engine.

8. Compressed air indicator:

	Sensor (B3)	Display – Instrument	
Pressure in bar	Resistance	Pointer angle	Display area
0	10 Ω	0°	from 0 - 13° red sector
2	52 Ω	0°	
4	88 Ω	6°	
6 (3)	124 Ω	24°	from 37 - 42° white sector
8	155 Ω	42°	
10	184 Ω	60°	from 59 - 63° white sector

3) If the supply pressure is less than 5.5 bar, L23 (indicator lamp, compressed air) lights up and L22 and L29 (indicator lamps, stop) flash.

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OPERATING AND CODING OF THE DIGITAL INSTRUMENT WITH INTEGRATED OPERATING HOURS COUNTER

General information

All functions are called up using the spring-loaded switch (button), marked by the PTO symbol, on the right-hand side of the instrument panel. To call up the operating functions, you only need to press the button briefly. If the button is pressed for longer than 10 sec., you can check and correct the coding values.

Operating / function

Ignition ON/Starting/Operation	the display shows a small "h" and the cumulative operating hours.
Press the button	the rear PTO shaft speed will be shown on the display.
Press the button again	the front PTO shaft speed will be shown on the display.
Press the button again	the operating hours will again be shown on the display.

Coding

– the engine speed indication (operating hours)
– the rear PTO shaft speed indication
– the front PTO shaft speed indication

General information

Each time the button is briefly pressed, the display will be visibly increased by one impulse. If the button is pressed continually for longer than 1.5 sec's. the impulses will be increased rapidly. When the button is released, "PRO" appears on the display after 8 sec's. The value set is stored by briefly pressing the button once again and the display will return to the starting position (operating hours).

Coding the engine speed indication (operating hours)

Press the button for 20 sec's.

The combination of numbers 1-1 appears in the upper part of the display, the current value or the value to be corrected in the lower part of the display. The code adjustment range is 15 - 255 impulses. For tractors M9078 - M9094 up to **Veh. No. 04517** or CS78 - CS94 up to **DBD0010601 code no. 15** should be stored, from **DBD0055001** onwards **code no. 18** should be stored.

Coding the rear PTO shaft speed indication

Press the button for 22 sec's.

The combination of numbers 2-2 appears in the upper part of the display, the current value or value to be corrected appears in the lower part of the display. The code adjustment range is 1 - 99 impulses. For tractors of the 9000 series, M9078 - M9094 and CS78 - CS94 **code no. 10** should be stored (code no. 10 = 10 teeth on measuring cog).

Coding the front PTO shaft speed indication

Press the button for 24 sec. The combination of numbers 3-3 appears in the upper part of the display, the current value or value to be corrected appears in the lower part of the display. The code adjustment range is 1 - 99 impulses.

For tractors of **the 9000 series code no. 29** should be stored.

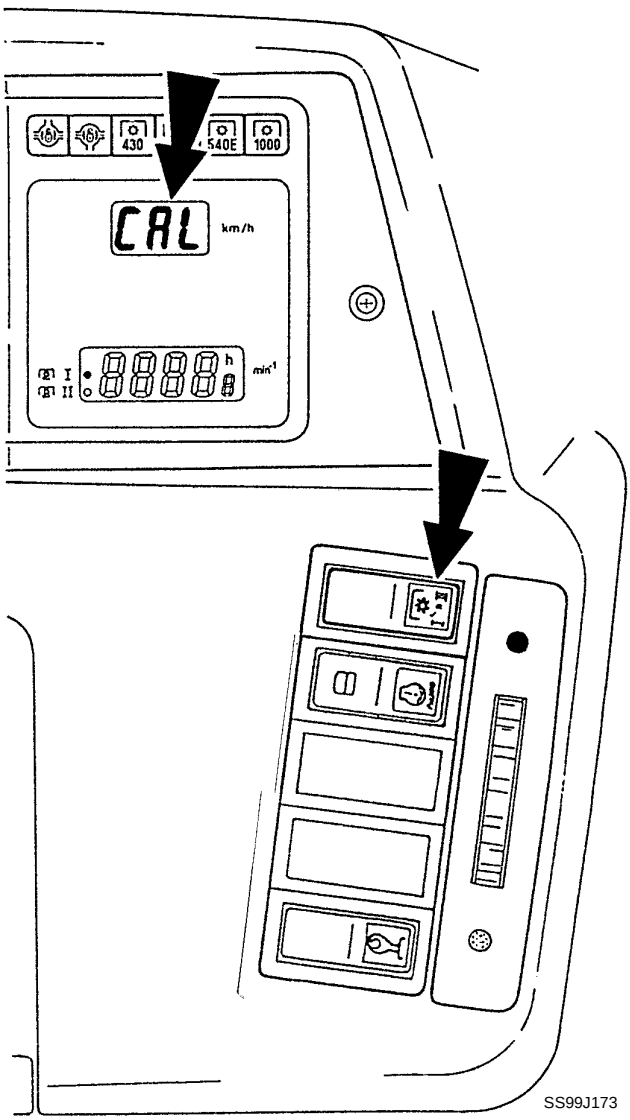
For tractors M9078 - M9094, up to **Veh. No. 04517** or
CS78 - CS94 up to **DBD0010601 code no. 33** should be stored.

For tractors M9078 - M9094 or CS78 - CS94 from **DBD0055001** onwards **code no. 38** should be stored.

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CALIBRATING THE DRIVING SPEED

Re-calibration is required after replacing tyres or when 3 bars appear on the km/h display.



Measure out a distance of exactly 100 m and mark both ends clearly.

– Press the switchover button (front PTO shaft/rear PTO shaft/operating hours) for at least 10 seconds, until CAL appears in the km/h display.
– Drive vehicle froward and when the tractor's front axle passes the 0 mark, press the button briefly.
  The display shows COU.

The impulses will be counted to 9999 on the bottom part of the display, ---- will appear above this, pay no attention to this.

WARNING: *Minimum speed within the 100 m markings = 2 km/h – it is possible to drive faster.*

– When the front axle is in line with the 100 m mark, press the pushbutton briefly once again – the letters **PRO** appear on the display.
– Then press the switchover button once again – the re-calibration values are stored.

If the driving speed is not displayed, the tractor must be stopped and the engine must be stopped and then started again.

If a fault occurs during calibration (delay in pressing the switch etc.), simply switch the ignition OFF before pressing the switch for the last time – the programming sequence will thus not be accepted and the old values remain in effect.

Repeat the procedure.

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Chapter

4B

HOW IT WORKS - ECCU

Electronic Central Control Unit

M9078, M9086, M9094
CS78, CS86, CS94,

from DBD0057135 onwards

CASE-STEYR Landmaschinentechnik GmbH
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TABLE OF CONTENTS

TABLE OF CONTENTS 2
GENERAL INFORMATION 3
ELECTRICAL FITTINGS 4
OPERATING INSTRUCTIONS
SAFETY DEVICES AND PROTECTIVE MEASURES 5
ECCU – POWER SUPPLY 6
POWER SHIFT POWER 2 – FUNCTION 7
EHR CONTROL "TRANSPORT" 8
EHR CONTROL "CONTROL" (LOWER) 9
EHR CONTROL "FAST RETRACT" 10
REAR PTO SHAFT: FUNCTION 11
REAR PTO SHAFT: SWITCHING ON AND OFF 12
REAR PTO SHAFT: MANAGEMENT 13
AUXILIARY CONTROL UNIT – PRESSURE IN CONNECTION "A"
(WITH MULTI-CONTROLLER) 14
AUXILIARY CONTROL UNIT – PRESSURE IN CONNECTION "B"
(WITH MULTI-CONTROLLER) 15
AUXILIARY CONTROL UNIT – "FREEDOM OF MOVEMENT OR FLOATING POSITION"
(WITH MULTI-CONTROLLER) 16
AUXILIARY CONTROL UNIT – PRESSURE IN CONNECTION "A"
(WITH LEVER SWITCH) 17
AUXILIARY CONTROL UNIT – PRESSURE IN CONNECTION "B"
(WITH LEVER SWITCH) 18
AUXILIARY CONTROL UNIT – "FREEDOM OF MOVEMENT OR FLOATING POSITION"
(WITH LEVER SWITCH) 19
4-WHEEL DRIVE (MFD) "ON" (WITHOUT MANAGEMENT AND OPTISTOP) 20
4-WHEEL DRIVE (MFD) "OFF" (WITHOUT MANAGEMENT AND OPTISTOP) 21
4-WHEEL DRIVE (MFD) "ON" (WITH MANAGEMENT AND OPTISTOP) 22
4-WHEEL DRIVE (MFD) "OFF" (WITH MANAGEMENT AND OPTISTOP) 22
DIFFERENTIAL LOCK(S) – MANAGEMENT – EHR IN "CONTROL" FUNCTION 23
DIFFERENTIAL LOCK(S) – MANAGEMENT – EHR IN "TRANSPORT" FUNCTION 23

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GENERAL INFORMATION

Use:

Series M9000 – from DBD0057135 onwards

Types of tractor:

M9078, M9086, M9094 / CS78, CS86, CS94

Location:

In the cab – driver's right-hand side, behind the gearshift levers, under the black interior covering.

Functions:

The ECCU carries out part of the control and regulating functions automatically.
It also carries out the auxiliary functions necessary for control and regulation units, which are fitted with their own electronic box.

Main functions:

1) Power shift – control for Power 2
2) Operation of 2 independent electrical auxiliary control units, e.g. single-action, double-action, floating position
3) Run-up control for the rear PTO shaft (with run-up monitoring)
4) Rear PTO shaft management function

Auxiliary functions:

EHR-B changeover: control voltage for the transport, control and fast retract functions

EHR-B latching circuit for the transport and control functions

Differential locks management: Ground for control (intermediate link between EHR Box and ADM control unit A10)

4-wheel drive indicator lamp activation (MFD)

IMPORTANT for function and troubleshooting:

The ECCU is made up of several electronic circuits.

For this it requires:

A power supply of 12VDC and Ground
(see circuit diagram Page 7, Section C).

Fuse F34 25A to **A12** on the central print. Supply potential +15/2.

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ELECTRICAL FITTINGS

Number of plugs and pin assignment

Plugs:

The ECCU has **6** Molex system plugs (see diagram below)

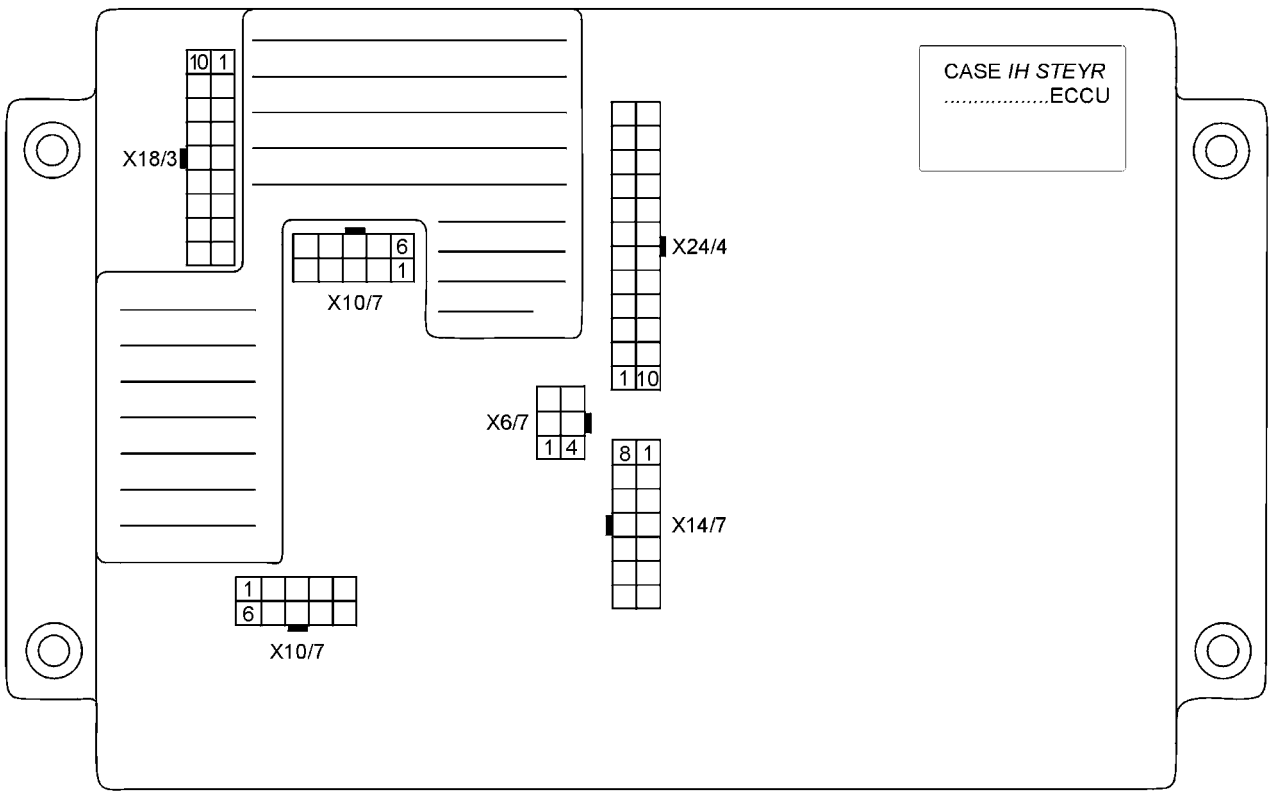
Pin assignment:

If an ECCU plug is viewed in the horizontal position and the securing latch is at the bottom, pin 1 is at the top left-hand side. Count through the rows horizontally.

Abbreviations for Electrical Components

A60	ECCU	**K**	Relay
A25	EHR-Box	**L**	Indicator lamp
A10	ADM (4-wheel drive and differential locks management)	**R**	Resistance
		S	Switch, spring loaded (contacts)
A1	Print	**Y**	Solenoid coil (e.g. from electrically controlled hydraulic valves)
A12	Central print		
F	Fuse	**X..**	Plug-in connection
H	Indicator lamp	⊥	Ground potential

ECCU Box Layout



SS00C068

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OPERATING INSTRUCTIONS
SAFETY DEVICES AND PROTECTIVE MEASURES

Operating voltage:

12 Volt DC nominal (voltage peaks must not exceed 16 Volts)

Take care when using jumper cables for starting:

- Only connect in parallel to another 12 Volt source (battery or vehicle).
- Take care when using starting aid devices: avoid excess voltage.
- Do not reverse connect the poles.
- Never remove jumper cables during the starting procedure and ensure that the cable clips can not inadvertently fall off:
  This will result in voltage peaks – danger to the ECCU.

Arc-welding on the tractor or implements attached:

- Connect the welding equipment ground to the part to be welded.
- Switch the engine OFF and turn the ignition switch S1 to the 0 position.
- Leave the battery connected.

Protection to the inputs to the ECCU Box:

The inputs are of high resistance, hence no risk of overloading through a short circuit.

Protection to the outputs:

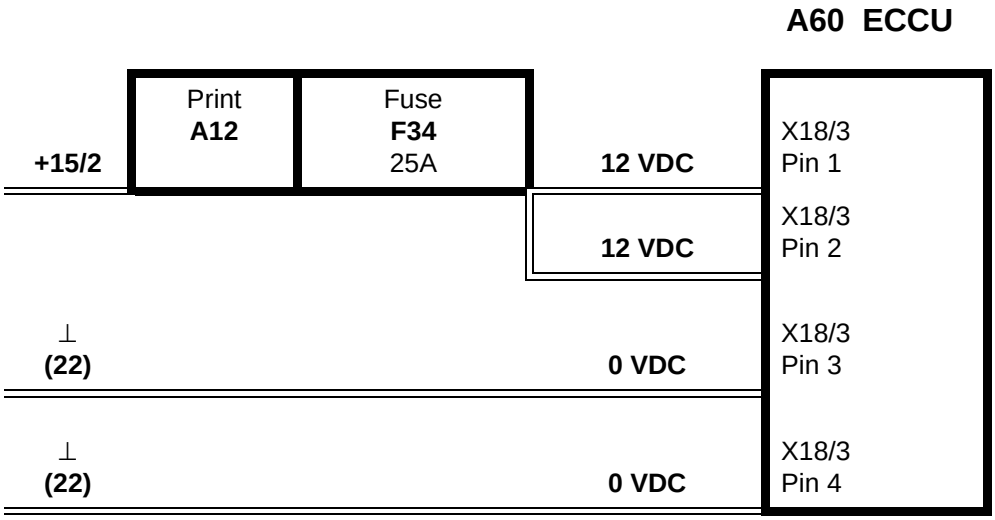
- The outputs to actuators like solenoid valves (PTO, auxiliary control units) are fitted with special output stages with built-in overload protection against e.g. short circuit, short circuit on solenoid coils etc. *They switch OFF if subject to excess current.*
- Outputs to the display – and indicator lamps are on the other hand "Open Collector" outputs.
  They switch these lamps through to ground. During operation in the vehicle, the current is limited by the load resistance (Lamp resistance).
- *When testing, a dummy load (e.g. a lamp of the same but not greater power (Wattage) must be used to limit the test current, otherwise it will result in an electrical short circuit. This will destroy the output stage (transistor) immediately.*

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ECCU – POWER SUPPLY

Conditions: Ignition switch **S1** to position **1**

Inputs



NOTE: *If fuse F34 has blown, this can be immediately recognised by the characteristic, e.g.:*

- The EHR diagnosis LED does not light up, because the supply potential +15 through fuse F33 to the EHR is missing.
  Fuse F34 supplies F33 in series.

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POWER SHIFT POWER 2 – FUNCTION

"HIGH":

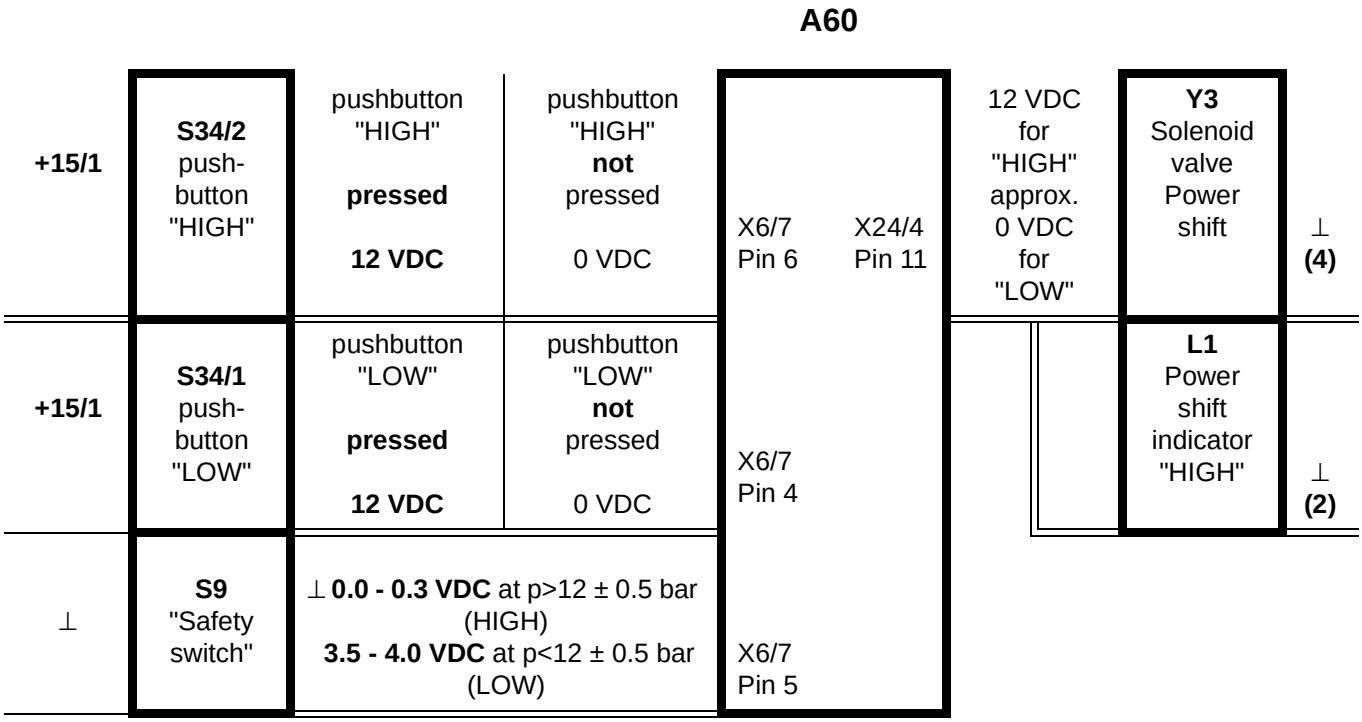
The ECCU (A60) controls the solenoid valve Y3 with 12 VDC.
Solenoid valve Y3 controls the P1 – pressure (18 bar) to the control cylinder.

The clutch "HIGH" engages and the clutch "LOW" disengages.

"LOW":

In the "LOW" function, solenoid valve Y3 is de-energised, thus the control cylinder is pressure-free.

The disk springs engage the "LOW" clutch, the release springs disengage the "HIGH" clutch.



Safety circuit:

After pressing the "HIGH" pushbutton, a pressure of >12.5 bar must be present at the safety switch S9 **within 3 sec's.**, otherwise the "LOW" function will automatically be re-selected.

NOTE: *The safety switch S9 must **never** be bridged during operation!*

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EHR CONTROL "TRANSPORT"

NOTE: *To activate the "Transport" function, pushbutton S11/1 on the Multi-controller must be pressed.*

- Once activated by a trigger impulse, this function is maintained *(ECCU latching)* until another function is selected.
- *After the engine has been stopped or whenever it is re-started, the EHR **automatically** goes to the "control" function.*

	Inputs		**A60/4 ECCU**		**Outputs**	**A25**
+15Si	**MC S11/1** pushbutton Transport	Pushbutton "Transport" **pressed** **12 VDC** **not** pressed 0 VDC	X18/3 Pin 9	X18/3 Pin 6	the "transport" function **6,7 VDC**	**EHR** Box Pin 8
9,5 VDC stab.	**R3/4** to print A16	the "transport" function **6,7 VDC**	X18/3 Pin 5	X18/3 Pin 7	0 VDC	S2/72 Con-tacts open

Requirements in the EHR-B box for the "Transport" function:

- Supply +15/2 to the EHR-Box and ECCU must be available.
- S 2/11 (switch +15Si) must be switched to the **"ON"** position.
- Power supply +15Si to Multi-controller contact S11/1 must be available.

NOTE: *After the engine has been started, the pushbutton function "Transport" is also used to activate the EHR!*

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EHR CONTROL "CONTROL" (LOWER)

NOTE: *To activate the "Control" function, 2 buttons on the Multi-controller must always be pressed simultaneously: Button S11/2 and button S11/13 (Safety button)*

- Once activated by a trigger impulse, this function is maintained *(ECCU latching)* until another function is selected.
- *After the engine has been stopped or whenever it is re-started, the EHR* ***automatically*** goes to *the "control" function.*

Inputs			**A60/4 ECCU**		**Outputs**	**A25**
	MC S11/13 and **S11/2** pushbutton **"Control"**	Pushbutton S11/2 "Control" **and** "safety" pushbutton S11/13 **pressed** **12 VDC** 1 or both pushbuttons **not** pressed 0 VDC			"Control" function **5,4 VDC**	**EHR** Box
+15/ Si to **S11/2**			X18/3 Pin 8	X18/3 Pin 6		Pin 8
9,5 VDC stab.	**R3/4** to print A16	"Control" function. 9,5 VDC	X18/3 Pin 5	X18/3 Pin 7	5,4 VDC	S2/72 Con-tacts open

Requirements in the EHR-B box for the "Transport" function:

- Power supply +15/2 to: EHR-Box and ECCU must be available.
- S 2/11 (switch +15Si) must be switched to the **"ON"** position.
- Power supply +15/2 to Multi-controller contact S11/2 must be available.

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EHR CONTROL "FAST RETRACT"

NOTE: *The "Fast Retract" function is only active as long as the pushbutton S2/72 is pressed. The ECCU does not provide latching in this function.*

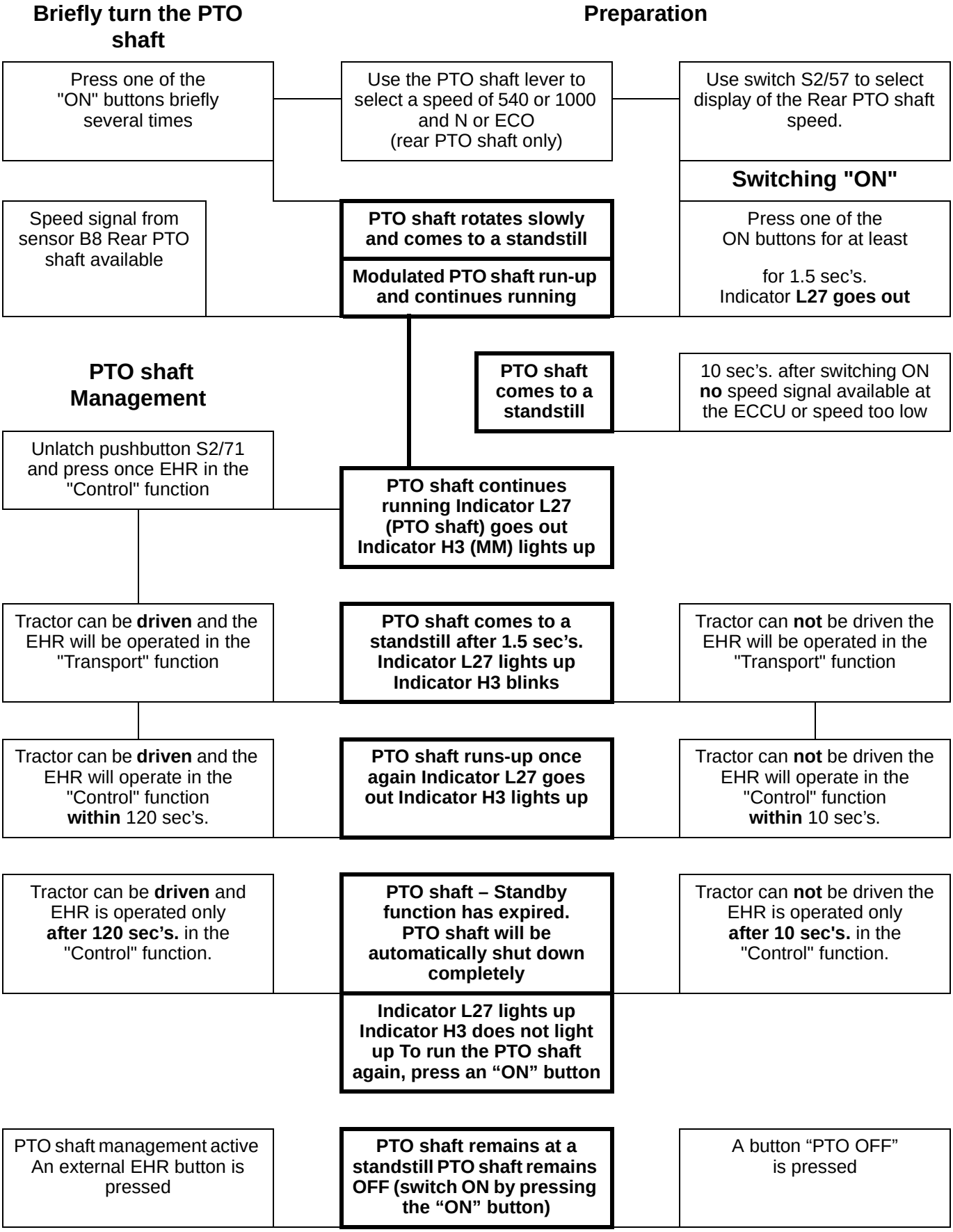
Inputs			**A60/4 ECCU**		**Outputs**	**A25**
in-directly Ground through R3/5	**S2/72** push-button "Fast Retract"	pushbutton "Fast Retract" **pressed** **4,1 VDC** Pushbutton **not** pressed 5.4 VDC	X18/3 Pin 7	X18/3 Pin 6	"Fast Retract" function **4,1 VDC** .	**EHR** Box Pin 8
9,5 VDC stab.	**R3/4** to print A16	"Fast Retract" function 9.5 VDC	X18/3 Pin 5			

Requirements in the EHR-B box for the "Fast Retract" function:

- Supply +15/2 to: The EHR Box and ECCU must be available.
- The connection to ground, via resistor R 3/5 to the "Fast Retract pushbutton" (S2/72) must be made.

REAR PTO SHAFT: FUNCTION

Switching the PTO shaft ON, OFF, Monitoring and Management(only for the rear PTO shaft)



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REAR PTO SHAFT: SWITCHING ON AND OFF

Inputs

Outputs

A60/1 ECCU

D+	**S2/70/2** pushbutton PTO shaft ON, PTO shaft OFF	PTO **ON** Pushbutton **pressed** **12 VDC**	Pushbutton **not** pressed 0 VDC	X24/4 Pin 4	X24/4 Pin 8	**12 VDC**	**Y14** Solenoid valve Rear PTO shaft	⊥ **(4)**
D+	**S17/1** Rear pushbutton PTO **ON**	pushbutton pressed **12 VDC**	Pushbutton **not** pressed 0 VDC	X24/4 Pin 6	X24/4 Pin 10	**12 VDC** 0 VDC	**L27** Indicator lamp PTO shaft	12 VDC +15/1
D+	**S17/2** Rear pushbutton PTO **ON**	pushbutton pressed **12 VDC**	Pushbutton **not** pressed 0 VDC	X24/4 Pin 5				
D+	**S2/70/2** PTO shaft ON, PTO shaft OFF	PTO **OFF** Pushbutton **pressed** **12 VDC**	Pushbutton **not** pressed 0 VDC	X24/4 Pin 22				
D+	**S19/1** Rear pushbutton PTO **OFF**	pushbutton **pressed** **12 VDC**	Pushbutton **not** pressed 0 VDC	X24/4 Pin 24				
D+	**S19/2** Rear pushbutton PTO **OFF**	pushbutton **pressed** **12 VDC**	Pushbutton **not** pressed 0 VDC	X24/4 Pin 23				
⊥ **(20)**	**S14/1** **S14/2** **S15/1** **S15/2** Rear EHRH pushbutton	HER contacts are normally closed **no** pushbutton pressed ⊥ **0 VDC**	**At least 1** rear EHR pushbutton **pressed** approx. 3,8 VDC	X14/7 Pin 4				
Speed PTO shaft roof	**B 8** Rear PTO shaft speed roof	Rear PTO **turns** ⎍⎍⎍ **4 VDC** **90 Hz** **540 rpm**	Ignition **ON** PTO does **not** turn Level “high” 6 VDC “low” 1.5 VDC	X14/7 Pin 14				

Requirements for the rear PTO shaft to run and remain ON after switching ON

- Power supply to the ECCU and to sensor B8 must be available; 12 VDC, Potential +15/1
- Ground potential, through all 4 rear EHR buttons must be available at the ECCU
- Power supply to the PTO “ON” buttons must be available; 12 VDC, Potential D+
- The digital signal must be present, when the PTO shaft turns

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REAR PTO SHAFT: MANAGEMENT

Inputs / Outputs

A60/1 ECCU

	S2/71 pushbutton PTO SHAFT MM "active"	pushbutton PTO MM pressed	pushbutton PTO MM **not** pressed	X24/4 Pin 17	X24/4 Pin 8	EHR Control 12 VDC	**Y14** Solenoid valve	
+15/1		**12 VDC**	0 VDC			Transport 0 VDC	Rear PTO shaft	⊥ **(4)**
PTO shaft runs under Control	**N2/1**	EHR Function **Control** ⊥ **0 VDC**	EHR Function **Transport** 12 VDC	X14/7 Pin 2	X24/4 Pin 19	⊥ **0,7 VDC** 12 VDC	**H3** Indicator lamp PTO SHAFT MM "active"	**+15/1**
Speed	**A1** print	Tractor **can be driven** ⎍⎍⎍ **6.6 VDC**	Tractor can not be driven 0 Hz	X14/7 Pin 12				

Requirements for PTO shaft management:

- *The PTO shaft must already be switched ON, so that Management can be activated!*
- Power supply +15/1 to button S2/71 PTO MM must be available.
- Ground potential from N2/1 must be available at the ECCU in the "Control" function in order to run the PTO shaft in the Management mode.

NOTE: *When the tractor is a t a standstill with the EHR in the "Transport" function and Management active, the PTO shaft switches OFF after 20 sec's.*

- As long as the tractor is in motion, the latching time for the PTO Management is 2 minutes.
- Red indicator lamp H3 blinks during the latching period.

Load relief circuit (automatic):

Inputs / Outputs

A60/1 ECCU

	S40/2 Reed relay	PTO gear lever **540/1000 in "Neutral"**	PTO gear lever in position 540 or 1000	X24/4 Pin 18	X24/4 Pin 8	**12 VDC** after (3 sec's.)	**Y14** Solenoid valve Rear PTO shaft	⊥ **(4)**
D+		**12 VDC**	approx. 0 VDC					
					X24/4 Pin 10	**12 VDC** after (3 sec's.)	**L27** Indicator lamp	**+15/1** 12VDC

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AUXILIARY CONTROL UNIT – PRESSURE IN CONNECTION "A" (WITH MULTI-CONTROLLER)

Version: dual-action, freedom of movement and inhibit block

Operation:

By means of the Multi-controller **(S 11/ green)** or button **(S36)** on the joystick or external pushbutton **(S14/3)** for the front end lifting gear.

NOTE: *If one of the buttons is pressed, all 3 outputs (solenoid valves Y2/1, Y2/3 and Y2/4) will be energised simultaneously.*

- The function “pressure in A” is **only then** active for as long as a button is pressed *(no latching)*
- The power supply to buttons (+15 safety) via fuse **F14** must be available for this reason: switch **S2/11** must be in the **"ON"** position.

Inputs			Outputs				
			A60/6 ECCU				
	S11/ S36 S14/3 pushbutton Pressure in **“A”**	**1** of the 3 buttons **pressed** **12 VDC**			**energised** **12 VDC**	**Y2/1**	
+15Si		**No pushbutton** pressed 0 VDC	X10/7 Pin 5	X10/7 Pin 2	**not** energised 0 VDC		⊥ **(22)**
					energised **12 VDC**	**Y2/3**	
				X10/7 Pin 4	**not** energised 0 VDC		⊥ **(22)**
					energised **12 VDC**	**Y2/4**	
				X10/7 Pin 1	**not** energised 0 VDC		⊥ **(22)**

Requirements for “pressure in connection A”

- Power supply to the ECCU must be available.
- Power supply to the buttons (+15Si) must be available.

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AUXILIARY CONTROL UNIT – PRESSURE IN CONNECTION "B" (WITH MULTI-CONTROLLER)

Version: dual-action, freedom of movement and inhibit block

Operation:

By means of the Multi-controller **(S 11/ green)** or button **(S36)** on the joystick or external pushbutton **(S14/3)** for the front end lifting gear.

NOTE: *If one of the buttons is pressed, both outputs (solenoid valves Y2/1 and Y2/2) will be energised simultaneously.*

- The function “pressure in A” is **only then** active for as long as a button is pressed *(no latching)*
- The power supply to buttons (+15 safety) via fuse **F14** must be available for this reason: switch **S2/11** must be in the **"ON"** position.

	Inputs		A60/6 ECCU		Outputs		
	S11/ S36 S15/3 pushbutton Pressure in **“B”**	**1** of the 3 buttons **pressed** **12 VDC**			**energised** **12 VDC**	**Y2/1**	
+15Si		**No pushbutton** pressed 0 VDC	X10/7 Pin 10	X10/7 Pin 2	**not** energised 0 VDC		⊥ **(22)**
					energised **12 VDC**	**Y2/2**	
				X10/7 Pin 3	**not** energised 0 VDC		⊥ **(22)**

Requirements for “pressure in connection B”

- Power supply to the ECCU must be available.
- Power supply to the buttons (+15Si) must be available.

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AUXILIARY CONTROL UNIT – "FREEDOM OF MOVEMENT OR FLOATING POSITION" (WITH MULTI-CONTROLLER)

Version: dual-action, freedom of movement and inhibit block

Operation:

By means of the Multi-controller **(S 11/11 green)**

NOTE: *If button S11/11 is pressed, both outputs (solenoid valves Y2/3 and Y2/4) will be energised simultaneously.*

- *The "Freedom of movement" function remains active, due to the latching circuit in the ECCU, until another function is selected or the ignition switch is turned to the **"0"** position.*
- The power supply to buttons (+15 safety) via fuse **F14** must be available for this reason: switch **S2/11** must be in the **"ON"** position.

Inputs			A60/6 ECCU		Outputs		
	S11/11 pushbutton Freedom of Movement	Pushbutton S11/11 **pressed** **12 VDC**			**energised** **12 VDC** ***Latching***	**Y2/3**	
+15Si		**No pushbutton** pressed 0 VDC	X10/7 Pin 7	X10/7 Pin 4	**not** energised 0 VDC		⊥ **(22)**
					energised **12 VDC** ***Latching***	**Y2/4**	
				X10/7 Pin 1	**not** energised 0 VDC		⊥ **(22)**

Requirements for "Freedom of movement" (floating position)

- Power supply to the ECCU must be available.
- Power supply to button **S11/11** (+15Si) must be available.

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AUXILIARY CONTROL UNIT – PRESSURE IN CONNECTION "A" (WITH LEVER SWITCH)

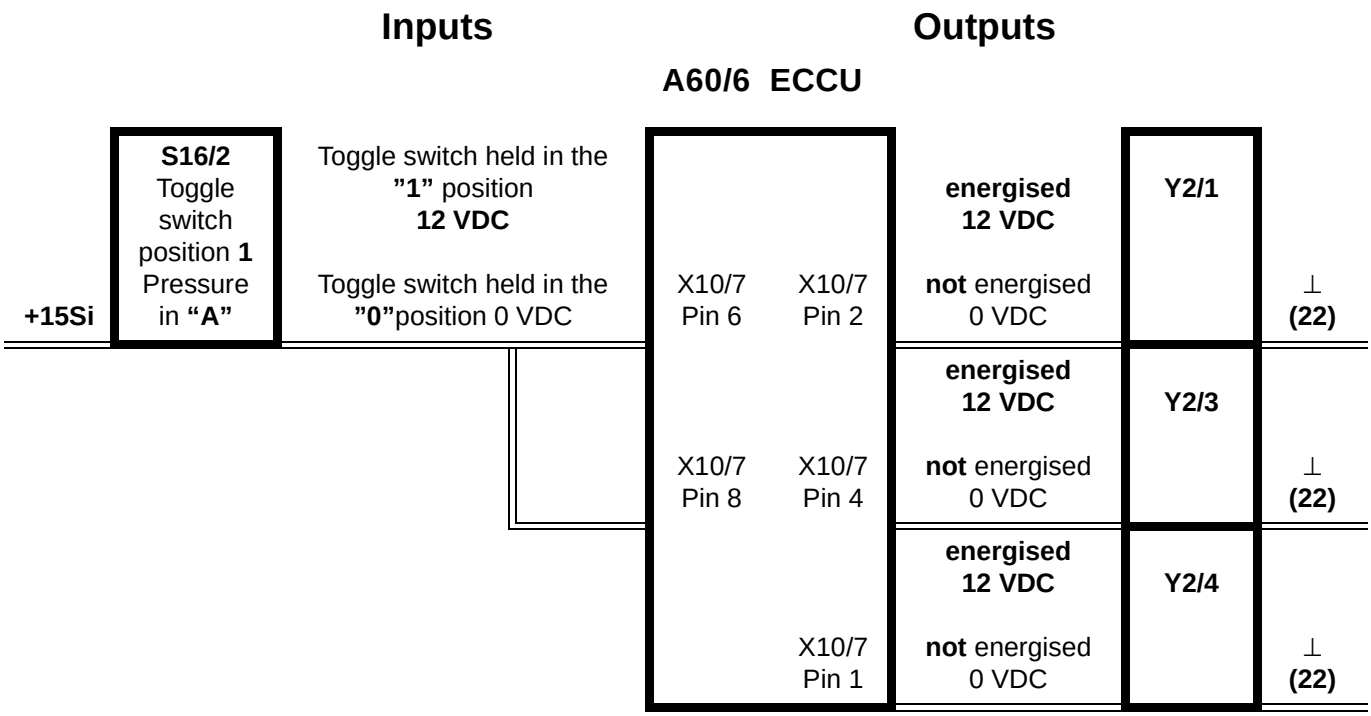
Version: dual-action, freedom of movement and inhibit block

Operation:

with lever switch **S16/2**

NOTE: *If the lever switch S16/2 is moved to position 1, all 3 outputs (solenoid valves Y2/1, Y2/3 and Y2/4) will be energised simultaneously.*

- The switch position **1** is a pushbutton function, for this reason: the "Pressure in A" function is **only then** active as long as the lever switch **S16/2** is held in position **1**. *(no latching)*
- The power supply to the lever switch S16/2 (+15 safety) via fuse **F14** must be available. For this reason: switch **S2/11** must be in the **"ON"** position.



Requirements for "pressure in connection A"

- Power supply to the ECCU must be available.
- Power supply to lever switch **S16** (+15Si) must be available.

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AUXILIARY CONTROL UNIT – PRESSURE IN CONNECTION "B" (WITH LEVER SWITCH)

Function: dual-action, freedom of movement and inhibit block

Operation:

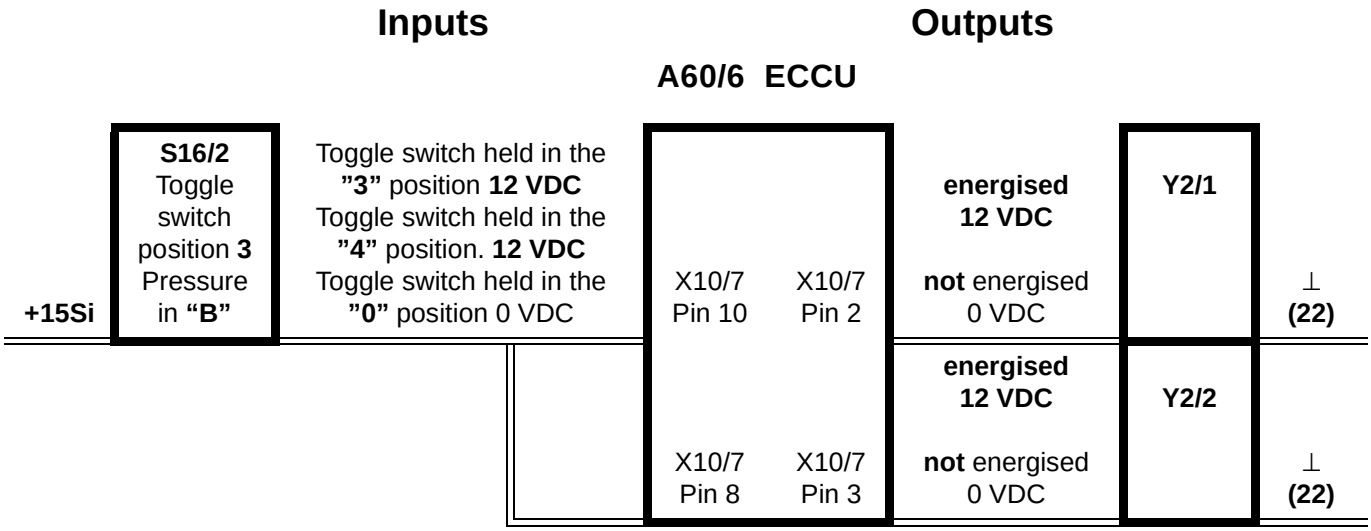
with lever switch **S16/2**

NOTE: *If the lever switch S16/2 is moved to position 3, both outputs (solenoid valves Y2/1, Y2/2) will be energised simultaneously.*

- The switch position **3** is a pushbutton function, for this reason: the "Pressure in B" function is **only then** active as long as the lever switch **S16/2** is held in position **3**. *(no latching)*
- The power supply to buttons (+15 safety) via fuse **F14** must be available: for this reason: switch **S2/11** must be in the **"ON"** position.

Operating a HYDROMOTOR:

- If the lever switch **S16/2** is moved further to position **4**, the output function "pressure in connection B" is maintained:
- ***The lever switch can be latched in position 4 by turning the knob on the lever.***



Requirements for "pressure in connection B"

- Power supply to the ECCU must be available.
- Power supply to the buttons (+15Si) must be available.

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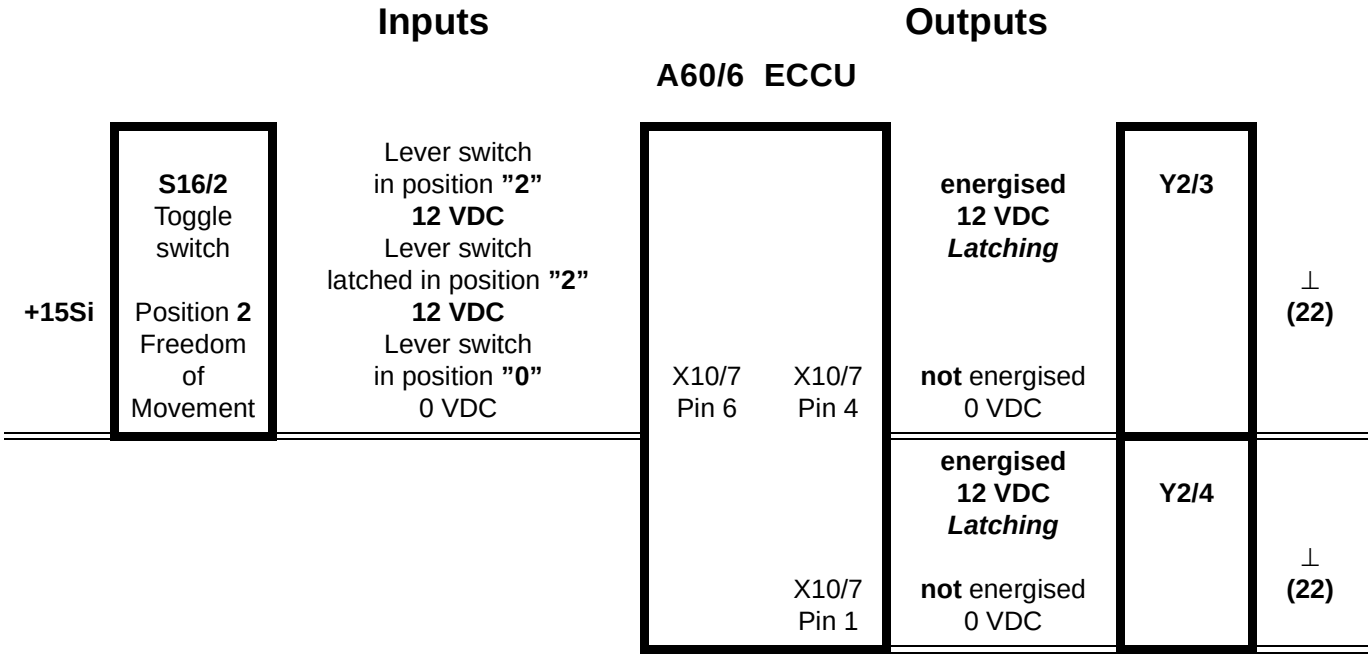
AUXILIARY CONTROL UNIT – "FREEDOM OF MOVEMENT OR FLOATING POSITION" (WITH LEVER SWITCH)

Version: dual-action, freedom of movement and inhibit block

Operation:
with lever switch **S16/2**

NOTE: *If the lever switch S16/4 is moved to position 2, both outputs (solenoid valves Y2/3, Y2/2) will be energised simultaneously.*

- The switch position **2** is a pushbutton function, for this reason: **the "Freedom of movement" function is maintained until the switch is released.**
- *The lever switch can be latched in position 2 by turning the knob on the.*
- The power supply to buttons (+15 safety) via fuse **F14** must be available for this reason: switch **S2/11** must be in the **"ON"** position.



Requirements for "Freedom of movement" (floating position)

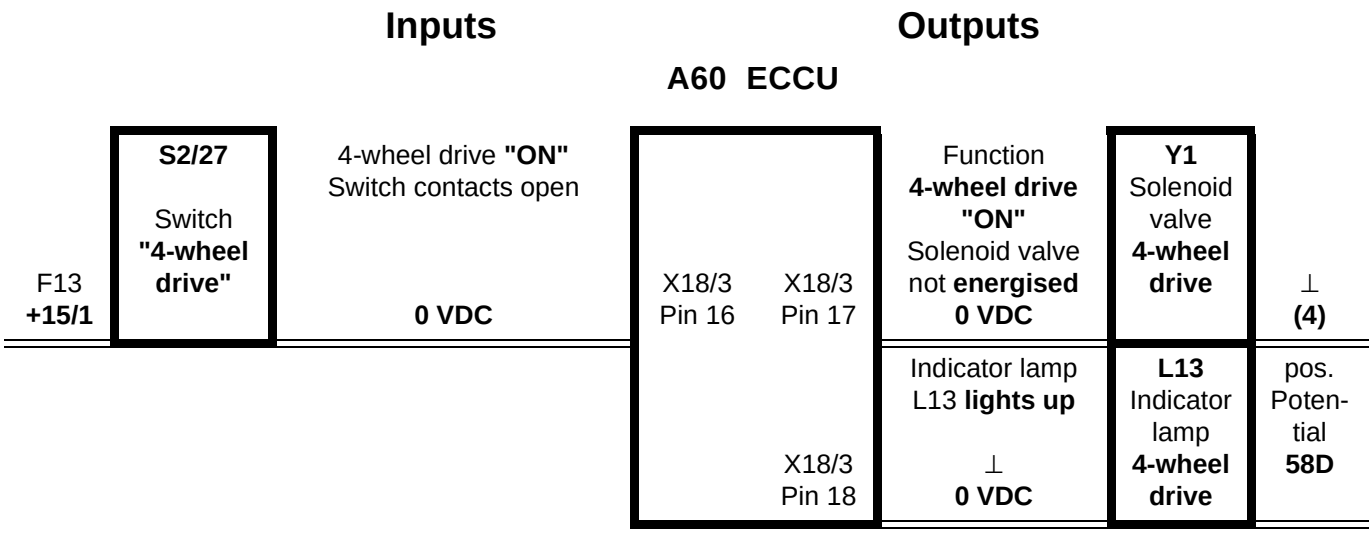
- Power supply to the ECCU must be available.
- Power supply to lever switch **S16/2** (+15Si) must be available.

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4-WHEEL DRIVE (MFD) "ON" (**WITHOUT** MANAGEMENT AND OPTISTOP)

Requirements for 4-wheel drive "ON":

Solenoid valve **Y1 must not** be energized. Due to this, the 4-wheel drive clutch is **not** hydraulically activated (**0 bar** in the 4-wheel drive clutch).
The Belleville springs take effect, engaging the 4-wheel drive clutch.



Potential **58D:**

The letter D stands for “Dimmer”.
The 4-wheel drive indicator lamp L13 is supplied with various voltages in the print A1, independent of whether the tractor’s lights are ON or OFF.

58 D with “Lights OFF”: approx. 8 VDC (indicator lamp bright).
58 D with "Lights OFF": approx. 3.5 VDC (indicator lamp less bright) for night driving).

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4-WHEEL DRIVE (MFD) "OFF" (**WITHOUT** MANAGEMENT AND OPTISTOP)

Requirements for 4-wheel drive "OFF":

Solenoid valve **Y1 is** energised. Due to this, the 4-wheel drive clutch is hydraulically activated (**18 bar** in the 4-wheel drive clutch).
The force of the Belleville springs is counteracted and the <u>4-wheel drive clutch is disengaged.</u>

Inputs			Outputs				
			A60 ECCU				
	S2/27 Switch	4-wheel drive **"OFF"** The switch contacts **are closed**			Function **4-wheel drive "OFF"** Solenoid valve is **energised** **12 VDC**	**Y1** Solenoid valve **4-wheel drive**	⊥ **(4)**
F13 **+15/1**	**"4-wheel drive"**	**12 VDC**	X18/3 Pin 16	X18/3 Pin 17			
					Indicator lamp L13 does not **be driven**	**L13** Indicator lamp **4-wheel drive**	pos. Poten-tial **58D**
				X18/3 Pin 18	Lights OFF: 8 VDC Lights ON: 3.5 VDC		

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4-WHEEL DRIVE (MFD) "ON" (**WITH** MANAGEMENT AND OPTISTOP)

Requirements for 4-wheel drive "ON":

Solenoid valve **Y1 must not** be energized. Due to this, the 4-wheel drive clutch is **not** hydraulically activated (**0 bar** in the 4-wheel drive clutch).
The Belleville springs take effect, engaging the 4-wheel drive clutch.

Inputs				**Outputs**				
				A60 ECCU				
A10 ADM	when **not** braking **12 VDC**	**S2/59** Switch ter **4-WD**	Switch position: 4-WD **"permanently ON"** **0 VDC**	X18/3 Pin 16	X18/3 Pin 17	Function **4-wheel drive "ON"** Solenoid valve not **energised** **0 VDC**	**Y1** Solenoid valve **4-WD**	⊥ **(4)**
A10 ADM	with **MM and** F =< **14 km/h**	**S2/59** Switch **4-WD**	**Management** 4-WD **“ON”** **0 VDC**	X18/3 Pin 17	X18/3 Pin 18	Indicator lamp L13 **lights up** ⊥ **0 VDC**	**L13** Indicator lamp **4-WD**	pos. Poten-tial **58D**

4-WHEEL DRIVE (MFD) "OFF" (**WITH** MANAGEMENT AND OPTISTOP)

Requirements for 4-wheel drive "OFF":

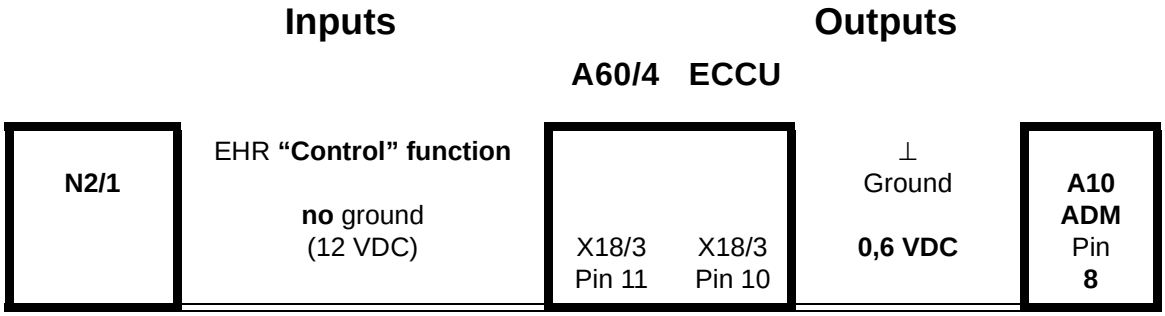
Solenoid valve **Y1 is** energised. Due to this, the 4-wheel drive clutch is hydraulically activated (**18 bar** in the 4-wheel drive clutch).
The force of the Belleville springs is counteracted and the 4-wheel drive clutch is not engaged.

Inputs				**Outputs**				
				A60 ECCU				
A10 ADM	when **not** braking **12 VDC**	**S2/59** Switch ter **4-WD**	Switch position: 4-wheel drive **“OFF”** and **no braking** **12 VDC**	X18/3 Pin 16	X18/3 Pin 17	Function **4-wheel drive “OFF”** Solenoid valve is **energised** **12 VDC**	**Y1** Solenoid valve **4-WD**	⊥ **(4)**
						Indicator lamp L13 does not **light up** Lights OFF: 8 VDC Lights ON: 3.5 VDC	**L13** Indicator lamp **4-WD**	pos. Poten-tial **58D**
					X18/3 Pin 18			

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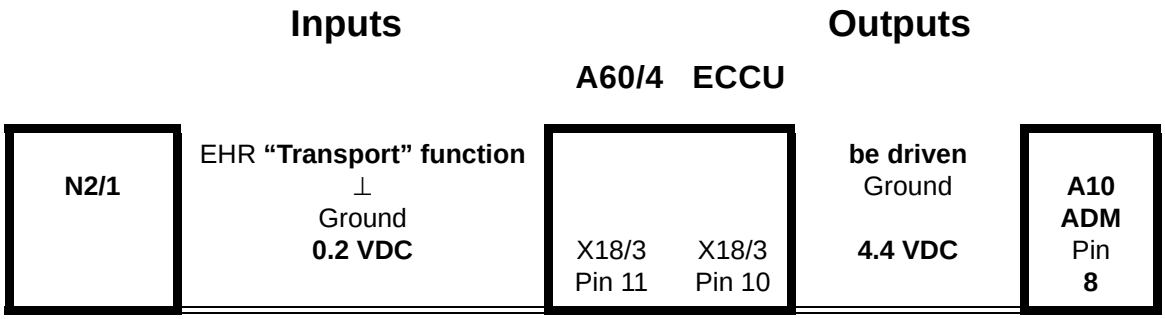
DIFFERENTIAL LOCK(S) – MANAGEMENT – EHR IN "CONTROL" FUNCTION

Version **with** Management and Optistop



DIFFERENTIAL LOCK(S) – MANAGEMENT – EHR IN "TRANSPORT" FUNCTION

Version **with** Management and Optistop



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Chapter

4001

CIRCUIT DIAGRAM

M9078, M9086, M9094, up to Veh. No. 04517
CS78, CS86, CS94 up to DBD0010601

CASE-STEYR Landmaschinentechnik GmbH
Technische Dokumentation/Training Center
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Sva 7-96680 EN

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October, 2000

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TABLE OF CONTENTS

Index for Circuit Diagram 4
Page 1 6
Page 2 8
Page 3 10
Page 4 12
Page 5 14
Page 6 16
Page 7 18
Page 8 20
Page 9 22
Page 10 24
Page 11 26
Page 12 28
Page 13 30
Page 14 32
Page 15 34
Page 16 36
Page 17 38
Page 18 40
Page 19 42
Page 20.1 44
Page 20.2 46
Page 21.1 48
Page 21.2 50
Page 22 52
Page 23 54
Page 24 56
Page 25 58
Page 26 60
Page 27 62
Page 28 64
Page 29 66
Page 30 68
Page 31 70
Page 32 72
Page 33 74
Page 34 76
Page 35 78
Page 36 80

https://truckmanualshub.com/

Page 37 82
Page 38 84
Page 39 86
Page 40 88
Page 41 90
Page 42 92
LIST OF PLUGS, LEFT 94
LIST OF PLUGS, RIGHT 95
LIST OF PLUGS, REAR 96
LIST OF PLUGS, INSTRUMENT PANEL 97
LIST OF PLUGS, RIGHT-HAND SIDE PANEL 98
LIST OF PLUGS, LEFT-HAND SIDE PANEL 99
CENTRAL PRINT A12 100
ROOF PRINT A13 102
COMPONENT CARRIER, LOW-TOP 104
COMPONENT CARRIER, ENGINE ELECTRICS 105
EHR-D PRINT, LEFT, A15 106
EHR CONTROL CONSOLE PRINT A16 106
MHR CONTROL CONSOLE PRINT A16 107
EHR OPERATION A51 107
EHR-D BOX A55 108
POWER SHIFT ’E’ Box A52 108
'E' BOX MULTI – JOYSTICK A11/1 109
E-BOX, REAR PTO SHAFT A50/2 109
PRINT, SINGLE WINCH A33/1
(PRINT, DOUBLE WINCH A33/2) 110
EGE CONTROL UNIT A10 110
AIR CONDITIONING THERMOSTAT SWITCH 111
BLOWER MOTOR CONTROL A21 111
AIR CONDITIONING CONTROL A20 111
RELAYS 112
SWITCHES 114
POTENTIOMETERS 116
SENSORS 117
SOLENOID VALVES 118
INSTRUMENT TEST VALUES 119
LAMPS AND FUSES 120
OPERATING AND CODING OF THE DIGITAL INSTRUMENT WITH INTEGRATED
OPERATING HOURS COUNTER 121
CALIBRATING THE DRIVING SPEED 122

https://truckmanualshub.com/

Index for Circuit Diagram

M9078 - M9094
CS78 - CS94

Title	Page (e.g. Page 1) Section (e.g. A)
1st auxiliary control unit, double-action with floating position/shut-off valve solenoid valve	32A
1st auxiliary control unit, front-end lifting gear, external buttons	32D
1st auxiliary control unit, joystick operated	32B
1st auxiliary control unit, lever switch operated	32E
1st auxiliary control unit, Multi-Controller operated	32C
2nd auxiliary control unit, double-action with floating position/ shut-off valve solenoid valve	31B
2nd auxiliary control unit, lever switch operated	31D
2nd auxiliary control unit, Multi-Controller operated	31C
4-WD	6B#
4-wheel drive management, Opti-Stop	5B#
Air-conditioning system, high-top	20.1A# / 20.2A#
Air-sprung seat	28D
Auxiliary control unit, double action with shut-off valve, lever switch operated	30C
Auxiliary control unit, double action with shut-off valve, with 2nd multi-function lever	29D
Auxiliary control unit, double action, lever switch operated	30B
Auxiliary control unit, double action, rocker switch operated	29B
Auxiliary control unit, single-action, lever switch operated	30A
Auxiliary control unit, single-action, rocker switch operated	29A
Auxiliary control unit, single-action, with 2nd multi-function lever	29C
Auxiliary headlight, high-top	10B#
Auxiliary headlight, low-top	11B#
Blower motor, high-top	21,1A# / 21,2A#
Brake light	5A/6A
Cigarette lighter	28B
Differential lock management, rear	5C#
Differential lock, rear	6C#
Digital clock, high-top	15C#
Dipped/Main beam switchover	10D/11D
EHR auxiliary switch	35G
EHR diagnostics display	35A
EHR enable	36E#
EHR external push button	34D
EHR force measuring bolt	33B
EHR front control	33F
EHR inside operated external buttons	34C
EHR lift/pressure changeover	37E#
EHR lifting/control per Multi-Controller	36B#
EHR lifting/control per rocker switch	37B#
EHR lighting, front panel	35J
EHR lowering speed	35D
EHR mixed control	35E
EHR position sensor	33C
EHR Raise/Lower indicator	35C
EHR Raise+Lower solenoid valve	33D
EHR setpoint	36C/37C
EHR stop button	36D/37D
EHR transport signal	5E#/36A/37A
EHR upper limit	35F
Electronic front implement load relief	42A
Engine cut-out	3D#/4D#
Entrance light, interior lighting, high-top	15E#
External sensor preparation	33E
Floor level heating	14C
Front differential lock	5D#/6D#
Front heated screen, high-top	17D
Front screen washer pump	18D/19D
Front searchlight (2) mounted on trafficator/sidelight, high-top	12D#/13D#
Front searchlight, twin-power, built into roof	12C#/13C#
Front sidelight, high-top	8C#
Front sidelight, low-top	9C#
Front windscreen wiper (sector), high-top	18F#
Front windscreen wiper (sector), low-top	19F#
Fuel filter heating	7A
Fuel pump control	3A/4A

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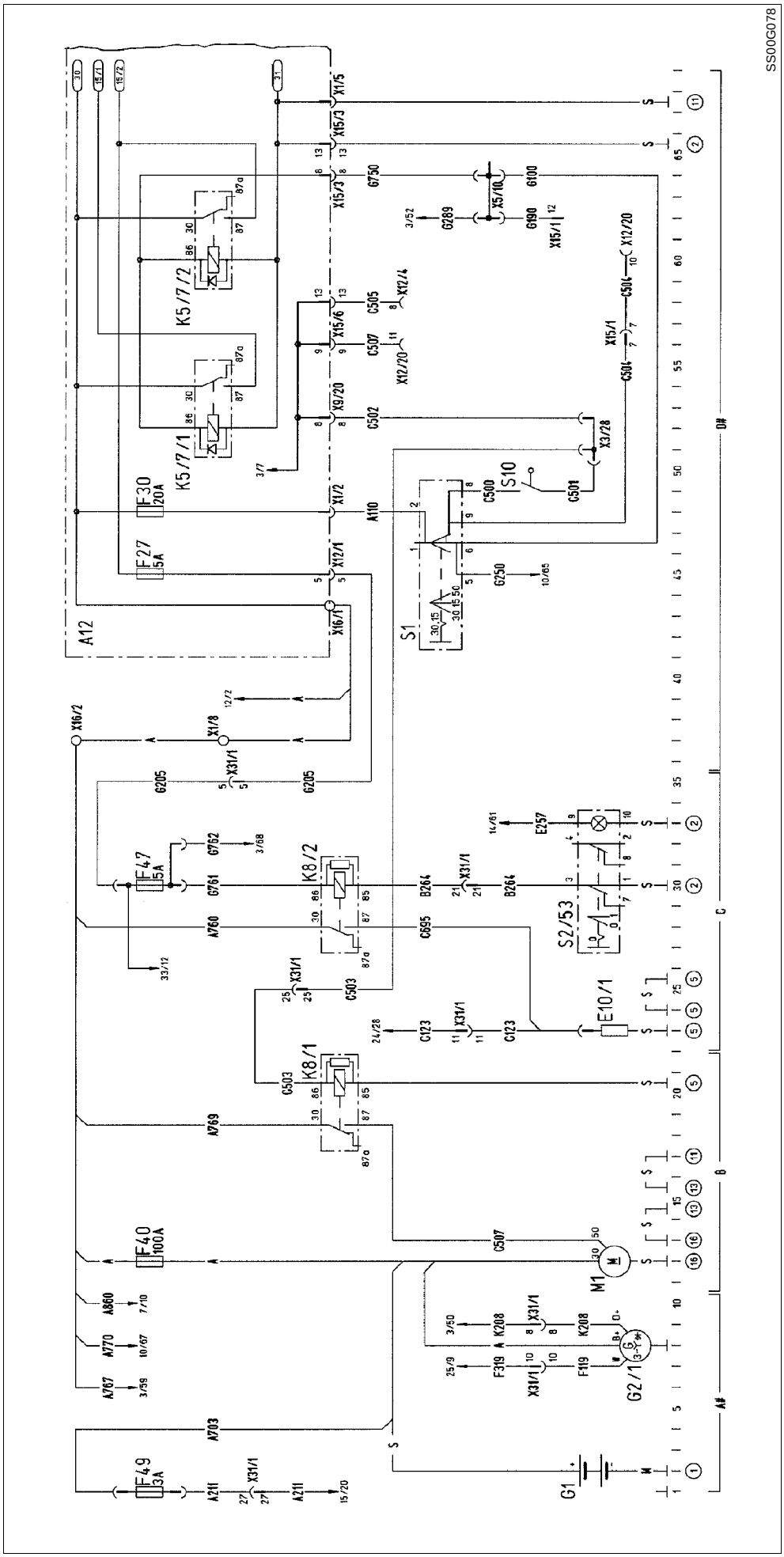
Title	**Page** (e.g. Page 1) **Section** (e.g. A)
Headlights	10C/11C
Heated rear screen, high-top	17E
Horn	18A/19A
Indicator lamps, centre	24B
Indicator lamps, left	24A
Indicator lamps, right	24C
Indicators	8A/9A
Instrument panel, centre, fuel/air/ temperature gauges (analogue)	25D
Instrument panel, centre, warning indicator	25C
Instrument panel, left, rev. counter (analogue)	25B
Instrument panel, right, digital	26A#
Interior light, low-top	16E#
Interior lighting, high-top	15E#
Mechanical operating hours counter	25A
MHR 50%-switch	6E#
Mirror heating, high-top	17A
Mudguard mounted searchlights (left + right)	10A#
Mudguard mounted searchlights, as reversing lights (left + right)	11A#
Number plate lighting, high-top	13B#/17C
On-board computer preparation	22B
Parallel front windscreen wiper	18C/19C
Power shift	7B/7C
Power socket	22C/22D
Power socket	22C/22D
Power supply with main switch	2A#
Power supply without main switch	1A#
Pre-glowing	1C/2C
Radio preparation, high-top	15A#
Radio preparation, low-top	16A#
Rear (inner) searchlight (2+2), high-top	12B#
Rear (outer) searchlight (2), high-top	13A#
Rear (outer) searchlight (2+2), high-top	12A#
Rear PTO shaft	38A
Rear screen washer pump	18E/19E
Rear screen wiper (sector), low-top	19G#
Rear sidelights	8D/9D
Rear windscreen wiper (sector), high-top	18G#
Reserve roof print (high-top)	23C

Title	**Page** (e.g. Page 1) **Section** (e.g. A)
Reserves – central print	7D
Reserves print, EHR operating console	28A
Reserves print, EHR, left	23D
Right instrument panel (without digital)	27A#
Rotating beacon, high-top	15D#
Rotating beacon, low-top	16D#
Safety switch	28C
Screen washer pump, front	18D/19D
Screen washer pump, rear	18E/19E
Searchlight on rear axle	14B
Spotlight, high-top	17B
Standard front wiper, high-top	18F#
Standard front wiper, low-top	19F#
Standard rear wiper, high-top	18G#
Standard rear wiper, low-top	19G#
Standard signal socket for EHR	34B
Standard signal socket for MHR or on-board computer preparation	22B
Standard signal socket, EHR fitted	34B
Standard signal socket, MHR fitted	22B
Starter	1B/2B
Starting with electrical PTO shaft	1D#/3B#
Starting with mechanical PTO shaft	2D#/4B#
Stationary operation cut-out	3C#/4C
Steering column switch	18B/19B
Supply 58, sundry lighting	28E
Supply potential 15, high-top	15B#
Supply potential 15, low-top	16B#
Supply potential 15/1, instrument	23A
Supply potential 58L, instrument	14A
Supply potential 58R, instrument	14D
Supply, ”E” box, ACU, PTO	31A
Supply, EHR operating console	28A
Supply, EHR-D box	33A
Traction control, slip display	34A/35H/35B
Trafficator, high-top	8B#
Trafficator, low-top	9B#
Trailer brake valve, Italy	23B
Trailer socket	22A
Trailer socket	22A
Winch	39A#/40A#/ 41A#
Winch supply	39A/40A/41A
Windscreen wiper (parallel)	18C/19C

EHR = Electronic Lift Control PTO = Power Take Off shaft

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Page 1



Electrical equipment

A12	Central print
E10/1	Glow plug
F27	Fuse, potential 15
F30	Fuse, potential 30
F40	Main fuse
F47	Fuse, pre-glowing, engine cut-out
F49	Fuse, clock, radio
G1	Battery
G2/1	Alternator
K5/7/1	Relay, potential 15/1
K5/7/2	Relay, potential 15/2
K8/1	Relay, starter
K8/2	Relay, pre-glow
M1	Starter
S1	Starter switch
S2/53	Switch, pre-glowing
S10	Clutch switch (start inhibitor)
X1/2	Plug-in connection, instrument cable
X1/5	Plug-in connection, cable, chassis, right
X1/8	Screw, instrument – engine
X3/28	Distributor, instrument, potential 50
X5/10	Distributor, instrument, potential 15
X9/20	Plug-in connection, instrument cable
X12/1	Plug-in connection, instrument cable
X12/4	Plug-in connection, chassis right PTO shaft indicator
X12/20	Plug-in connection, chassis right, transmission
X15/1	Plug-in connection, instrument, chassis, right
X15/3	Plug-in connection, instrument cable
X15/6	Plug-in connection, cable, chassis, right
X16/1	Screw connector, central print, potential 30
X16/2	Screw-on connector, engine 30, fused
X31/1	Plug-in connection, instrument – engine

VERSIONS
to this page
1
on page/pages
2

Grounding points

1	Battery
2	Instrument panel
5	Engine compartment
11	Driver's cab frame
13	Carrier frame
16	Starter

Designation of Sections

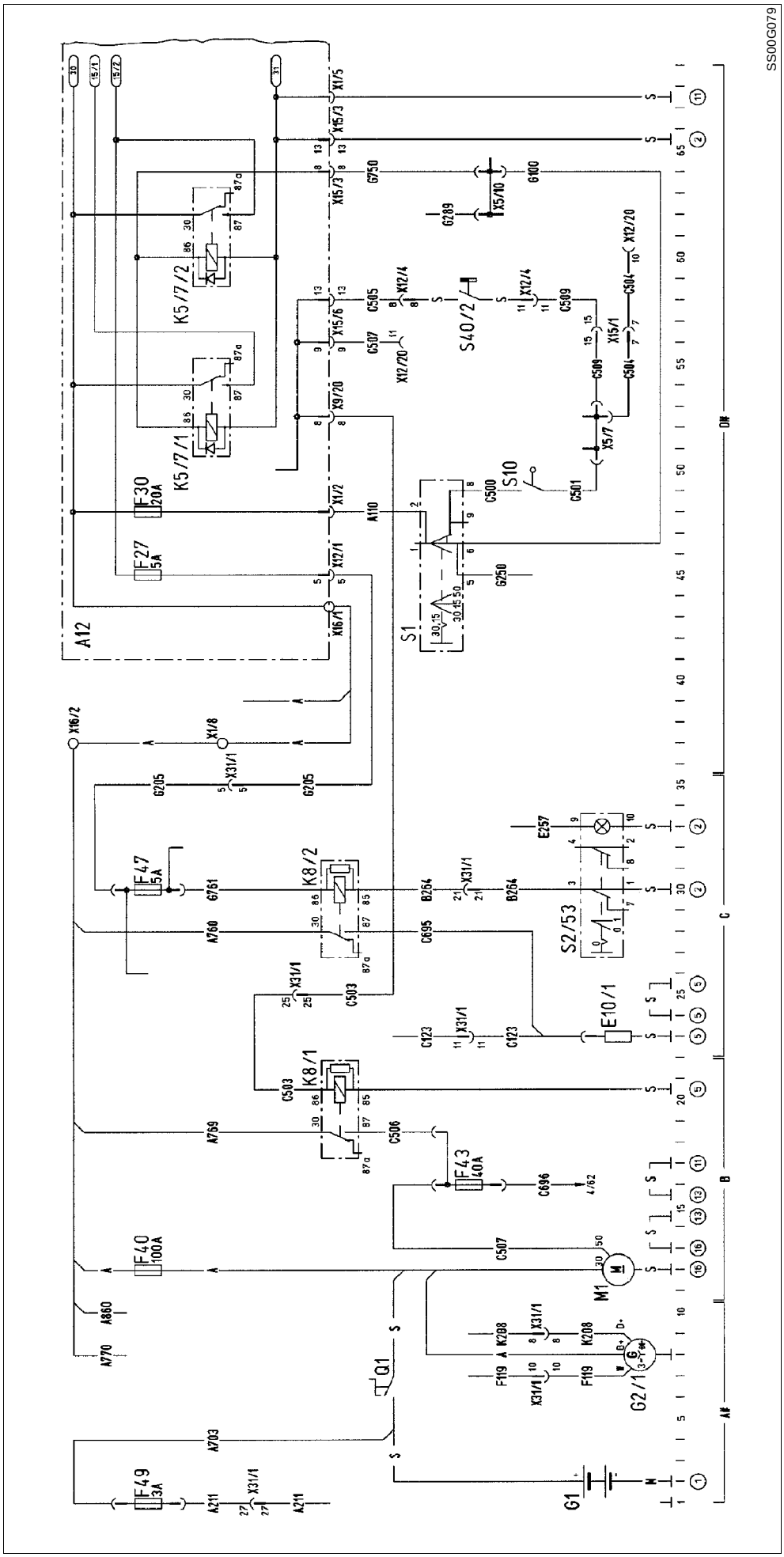
A#	Power supply
B	Starter
C	Pre-glowing
D#	Starting with electrical PTO shaft
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Page 2

Electrical equipment

A12	Central print
E10/1	Glow plug
F27	Fuse, potential 15
F30	Fuse, potential 30
F40	Main fuse
F43	Fuse, engine cut-out, ”Pull”
F47	Fuse, pre-glowing, engine cut-out
F49	Fuse, clock, radio
G1	Battery
G2/1	Alternator
K5/7/1	Relay potential 15/1 supply
K5/7/2	Relay potential 15/2 supply
K8/1	Relay, starter
K8/2	Relay, pre-glow
M1	Starter
S1	Starter switch
S2/53	Switch, pre-glowing
S10	Clutch switch (start inhibitor)
S40/2	Switch, PTO neutral indicator
X1/2	Plug-in connection, instrument cable
X1/5	Plug-in connection, cable, chassis, right
X1/8	Screw, instrument – engine
X5/7	Distributor, instrument, potential 50
X5/10	Distributor, instrument, potential 15
X9/20	Plug-in connection, instrument cable
X12/1	Plug-in connection, instrument cable
X12/4	Plug-in connection, chassis right PTO shaft indicator
X12/20	Plug-in connection, chassis, right, transmission
X15/1	Plug-in connection, instrument, chassis, right
X15/3	Plug-in connection, instrument cable
X15/6	Plug-in connection, cable, chassis, right
X16/1	Screw-on connector, central print, potential 30
X16/2	Screw-on connector, engine 30, fused
X31/1	Plug-in connection, instrument – engine

VERSIONS
to this page
2
on page/pages
1

Grounding points

1	Battery
2	Instrument panel
5	Engine compartment
11	Driver’s cab frame
13	Carrier frame
16	Starter

Designation of Sections

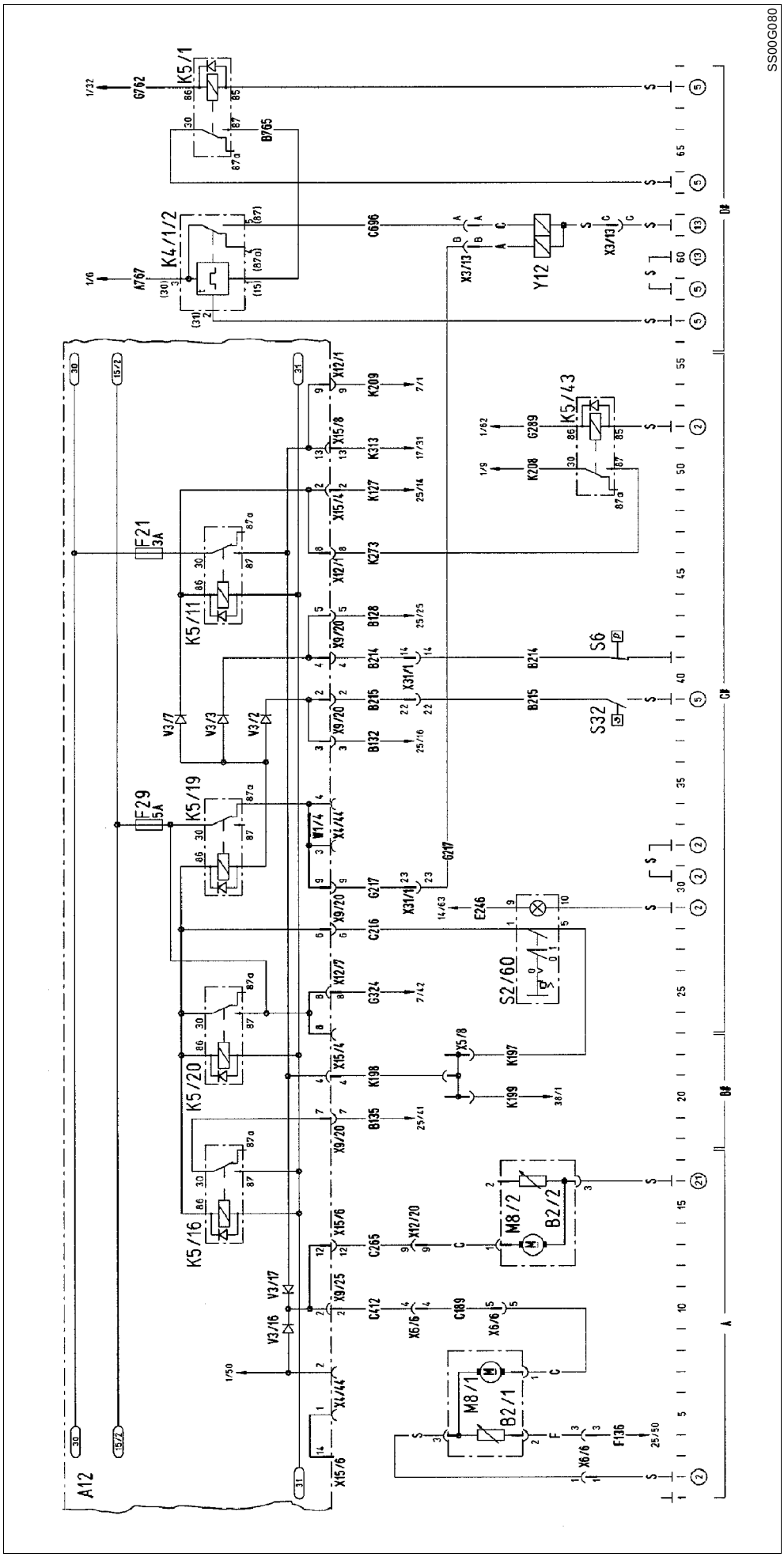
A#	Power supply with battery main switch
B	Starter
C	Pre-glowing
D#	Starting with mechanical PTO shaft
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Page 3

Electrical equipment

A12	Central print
B2/1	Fuel tank content transmitter, left
B2/2	Fuel tank content transmitter, right
F21	Fuse, potential D+
F29	Fuse, potential 15 (cut-out, power shift)
K4/1/2	Relay, engine stop 3 sec.
K5/1	Relay, engine cut-out bridge
K5/11	Relay potential D+ supply
K5/16	Relay, stationary mode cut-out
K5/19	Relay, stationary mode cut-out
K5/20	Relay, stationary mode cut-out
K5/43	Relay, D+ cut-out
M8/1	Left-hand tank pump motor
M8/2	Right-hand tank pump motor
S2/60	Switch, stationary operation
S6	Engine oil pressure switch
S32	Coolant switch
V3/2	Diode 3A interlock
V3/3	Diode 3A interlock
V3/7	Diode 3A interlock
V3/16	Diode 3A interlock
V3/17	Diode 3A interlock
W1/4	Contact bridge, spark start
X3/13	Plug-in connection, engine cut-out
X4/44	Plug-in connection, spark start
X5/8	Distributor, instrument, potential D+
X6/6	Plug-in connection, instrument, chassis, left
X9/20	Plug-in connection, instrument cable
X9/25	Plug-in connection, cable, chassis, left
X12/1	Plug-in connection, instrument cable
X12/7	Plug-in connection, cable, chassis, right
X12/20	Plug-in connection, chassis right, transmission
15/4	Plug-in connection, instrument cable
15/6	Plug-in connection, cable, chassis, right
X15/8	Plug-in connection, cable, roof supply
X31/1	Plug-in connection, instrument – engine
Y12	Engine cut-out solenoid

VERSIONS
to this page
3
on page/pages
4

Grounding points

2	Instrument panel
5	Engine compartment
13	Carrier frame
21	Console Transmission plug

Designation of Sections

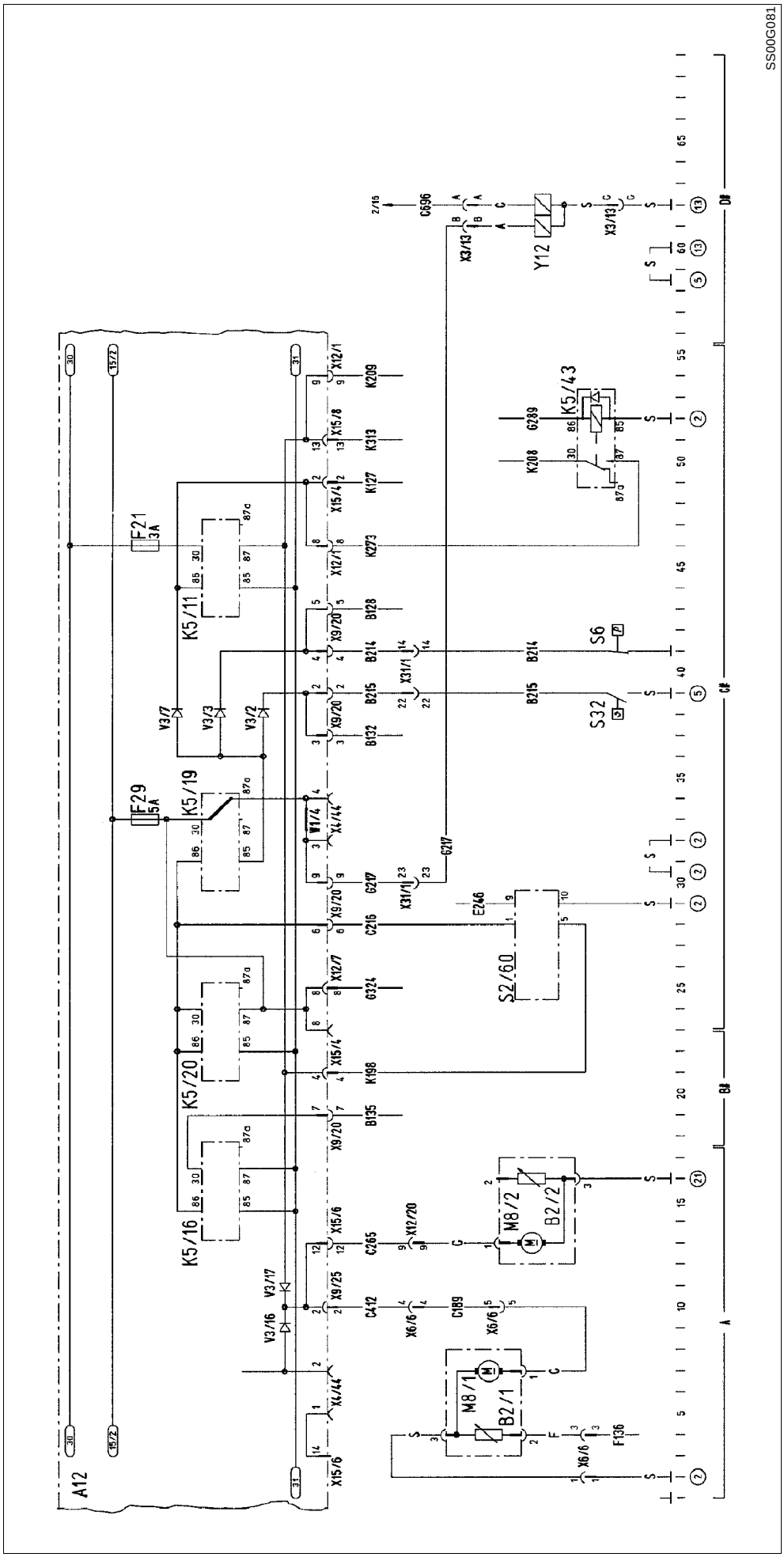
A	Fuel pump control
B#	with electrical PTO shaft
C#	Stationary operation cut-out
B#	Engine cut-out Steyr up to veh. no. 02912 Case up to DBD0007927
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Page 4

Electrical equipment

A12	Central print
B2/1	Fuel tank content transmitter, left
B2/2	Fuel tank content transmitter, right
F21	Fuse, potential D+
F29	Fuse, potential 15 (cut-out, power shift)
K5/11	Relay potential D+ supply
K5/16	Relay, stationary mode cut-out
K5/19	Relay, stationary mode cut-out
K5/20	Relay, stationary mode cut-out
K5/43	Relay, D+ cut-out
M8/1	Left-hand tank pump motor
M8/2	Right-hand tank pump motor
S2/60	Switch, stationary operation
S6	Engine oil pressure switch
S32	Coolant switch
V3/2	Diode
V3/3	Diode
V3/7	Diode
V3/16	Diode
V3/17	Diode
W1/4	Contact bridge, spark start
X3/13	Plug-in connection, engine cut-out
X4/44	Plug-in connection, spark start
X6/6	Plug-in connection, instrument, chassis, left
X9/20	Plug-in connection, instrument cable
X9/25	Plug-in connection, cable, chassis, left
X12/1	Plug-in connection, instrument cable
X12/7	Plug-in connection, cable, chassis, right
X12/20	Plug-in connection, chassis right, transmission
15/4	Plug-in connection, instrument cable
15/6	Plug-in connection, cable, chassis, right
X15/8	Plug-in connection, cable, roof supply
X31/1	Plug-in connection, instrument – engine
Y12	Engine cut-out solenoid

VERSIONS
to this page
4
on page/pages
3

Grounding points

2	Instrument panel
5	Engine compartment
13	Carrier frame
21	Console Transmission plug

Designation of Sections

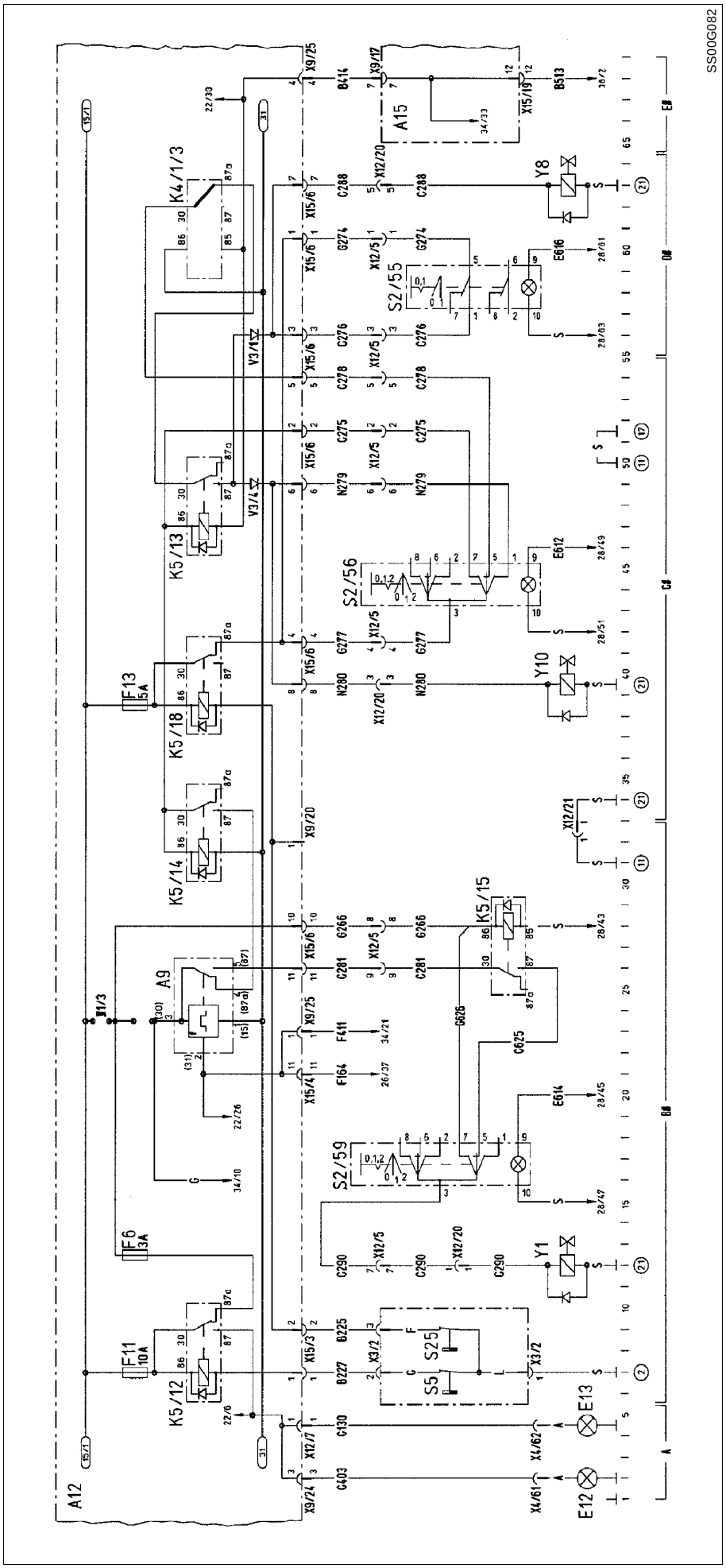
A	Fuel pump control
B#	with mechanical PTO shaft
C#	without stationary operation cut-out
B#	Engine cut-out Steyr from veh. no. 02913 Case from DBD0007928
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Page 5

Electrical equipment

A9	Control unit 14 km/h
A12	Central print
A15	Print, EHR, left
E12	Brake light, left
E13	Brake light, right
F6	Fuse, 4-wheel drive
F11	Fuse, brake lights
F13	Fuse, differential lock
K4/1/3	Relay, differential lock bridge
K5/12	Relay, brake light, Opti-stop
K5/13	Relay, differential lock
K5/14	Relay, management
K5/15	Relay, optistop / management
K5/18	Relay, management
S2/55	Switch, front differential lock
S2/56	Switch, differential lock management
S2/59	Switch, 4-wheel drive management
S5	Switch, brake light
S25	Switch, steering brake
V3/1	Diode
V3/4	Diode
V3/19	Diode
W1/3	Contact bridge, Optistop
X3/2	Plug-in connection, instrument, brake light
X4/61	Plug-in connection, chassis, left, combined tail / brake / trafficator lamp
X4/62	Plug-in connection, chassis, right, combined tail / brake / trafficator lamp
X9/17	Plug-in connection, cable, chassis, left
X9/20	Plug-in connection, instrument cable
X9/24	Plug-in connection, cable, chassis, left
X9/25	Plug-in connection, cable, chassis, left
X12/5	Plug-in connection, chassis right, transmission
X12/7	Plug-in connection, cable, chassis, right
X12/20	Plug-in connection, chassis right, transmission
X12/21	Plug-in connection, chassis right, transmission
X15/3	Plug-in connection, instrument cable
X15/4	Plug-in connection, instrument cable
X15/6	Plug-in connection, cable, chassis, right
X15/19	Plug-in connection, EHR box cable
Y1	4-wheel drive solenoid valve
Y8	Front differential lock solenoid valve
Y10	Differential lock solenoid valve

VERSIONS
to this page
5
on page/pages
6

Grounding points

2	Instrument panel
11	Driver's cab Frame
17	Rear mudguard
21	Console Transmission plug

Designation of Sections

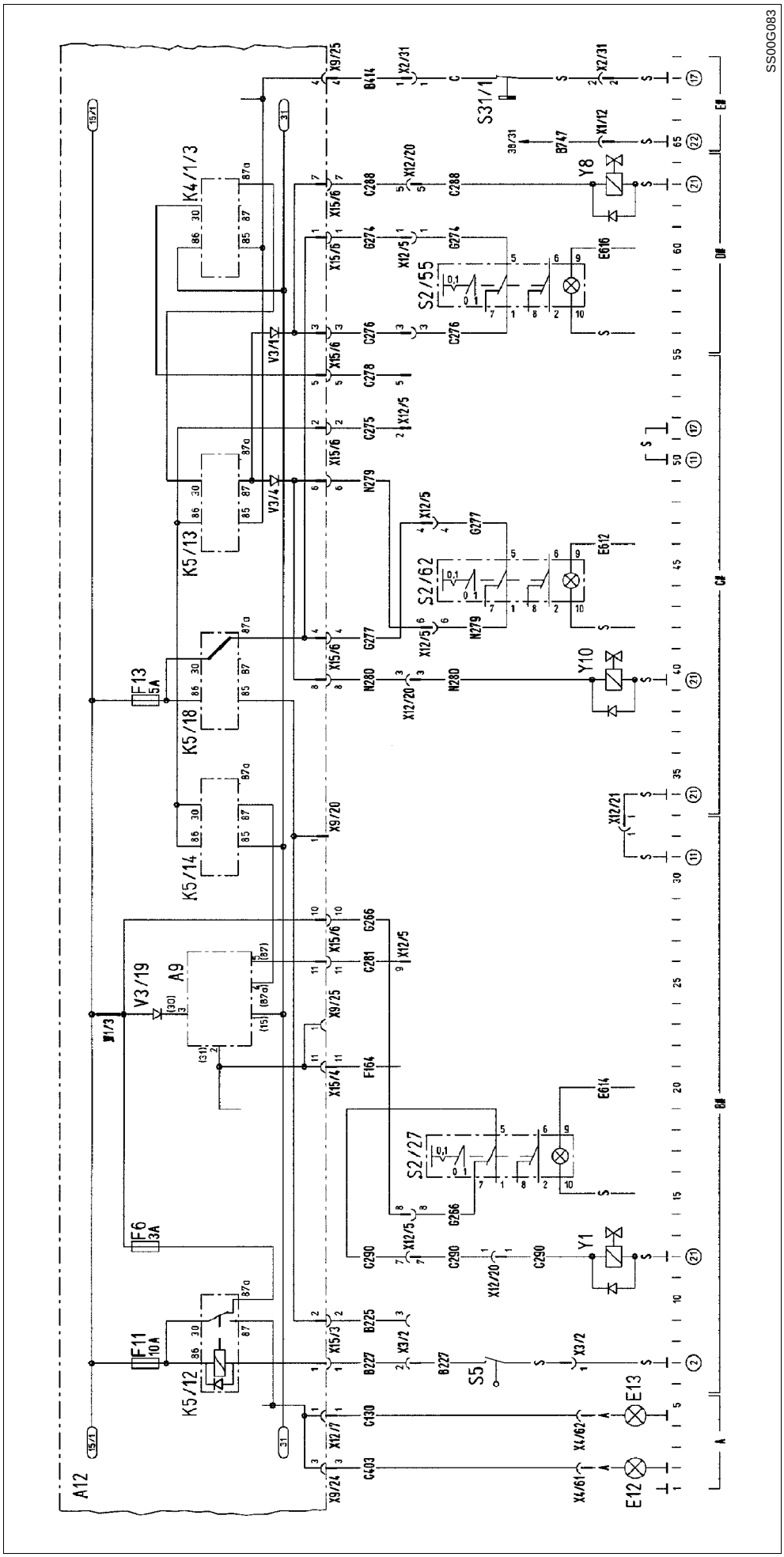
A	Brake light
B#	4-WD, Opti-stop management
C#	Differential lock management
D#	Front differential lock
E#	EHR transport signal
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A9	Control unit 14 km/h
A12	Central print
E12	Brake light, left
E13	Brake light, right
F6	Fuse, 4-wheel drive
F11	Fuse, brake lights
F13	Fuse, differential lock
K4/1/3	Relay, differential lock bridge
K5/12	Relay, brake light, Opti-stop
K5/13	Relay, differential lock
K5/14	Relay, management
K5/18	Relay, management
S2/27	Switch, 4-wheel drive
S2/55	Switch, front differential lock
S2/62	Switch, differential lock
S5	Switch, brake light
S31/1	Switch, lifting gear 50%
V3/1	Diode
V3/4	Diode
W1/3	Contact bridge, Optistop
X1/12	Plug-in connection, cable, chassis, right
X2/31	Plug-in connection, chassis, left, 50 % switch
X3/2	Plug-in connection, instrument, brake light
X4/61	Plug-in connection, chassis, left, combined tail / brake / trafficator lamp
X4/62	Plug-in connection, chassis, right, combined tail / brake / trafficator lamp
X9/20	Plug-in connection, instrument cable
X9/24	Plug-in connection, cable, chassis, left
X9/25	Plug-in connection, cable, chassis, right
X12/5	Plug-in connection, chassis right, transmission
X12/7	Plug-in connection, cable, chassis, right
X12/20	Plug-in connection, chassis right, transmission
X12/21	Plug-in connection, chassis right, transmission
X15/3	Plug-in connection, instrument cable
X15/4	Plug-in connection, instrument cable
X15/6	Plug-in connection, cable, chassis, right
Y1	4-wheel drive solenoid valve
Y8	Front differential lock solenoid valve
Y10	Differential lock solenoid valve

VERSIONS
to this page
6
on page/pages
5

Grounding points

2	Instrument panel
11	Driver's cab Frame
17	Rear mudguard
21	Console Transmission plug
22	E box console

Designation of Sections

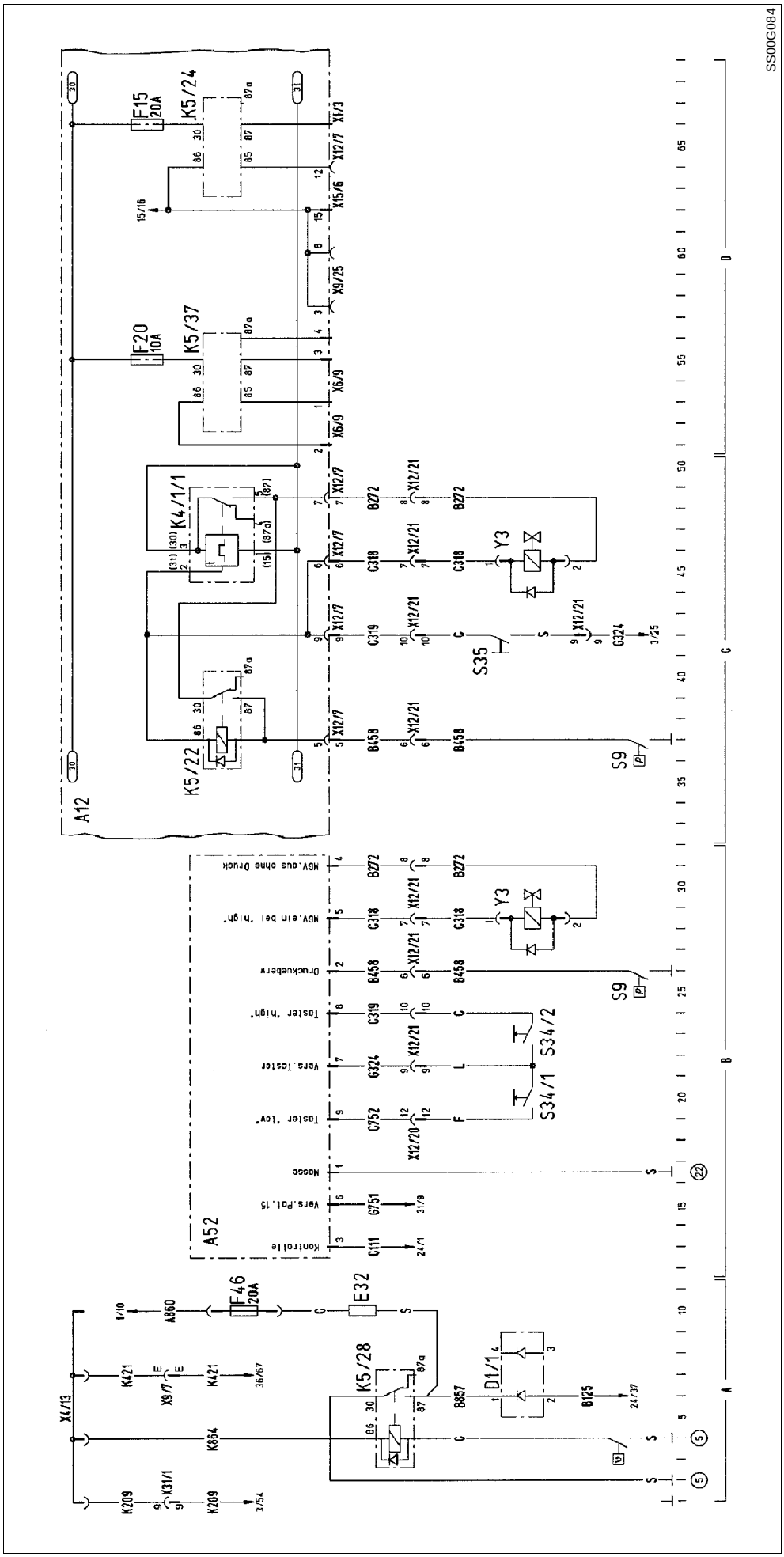
A	Brake light
B#	4-wheel drive
C#	Differential lock
D#	Front differential lock
E#	MHR, 50% switch
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Page 7

Electrical equipment

A12	Central print
A52	'E' box, power shift
D1/1	Diode group, filter heating
E32	Fuel filter heating
F15	Fuse, front loader
F20	Fuse, reserve potential 30
F46	Fuse, EHR, filter heating
K4/1/1	Relay, power shift group 3sec.
K5/22	Relay, power shift group
K5/24	Relay, front loader
K5/28	Relay, fuel filter heating
K5/37	Relay, reserve central print
S9	Control switch, power shift
S34/1	Switch, power shift, "low"
S34/2	Switch, power shift, "high"
S35	Switch, power shift
X1/3	Plug-in connection, front loader
X4/13	Distributor, engine, potential D +
X6/9	Plug-in connection, chassis, right / chassis, left
X9/7	Plug-in connection, engine, chassis, left
X9/25	Plug-in connection, cable, chassis, left
X12/7	Plug-in connection, cable, chassis, right
X12/20	Plug-in connection, chassis, right, transmission
X12/21	Plug-in connection, chassis, right, transmission
X15/6	Plug-in connection, cable, chassis, right
X31/1	Plug-in connection, instrument – engine
Y3	Power shift group solenoid valve

Grounding points

5	Engine compartment
22	E box console

Designation of Sections

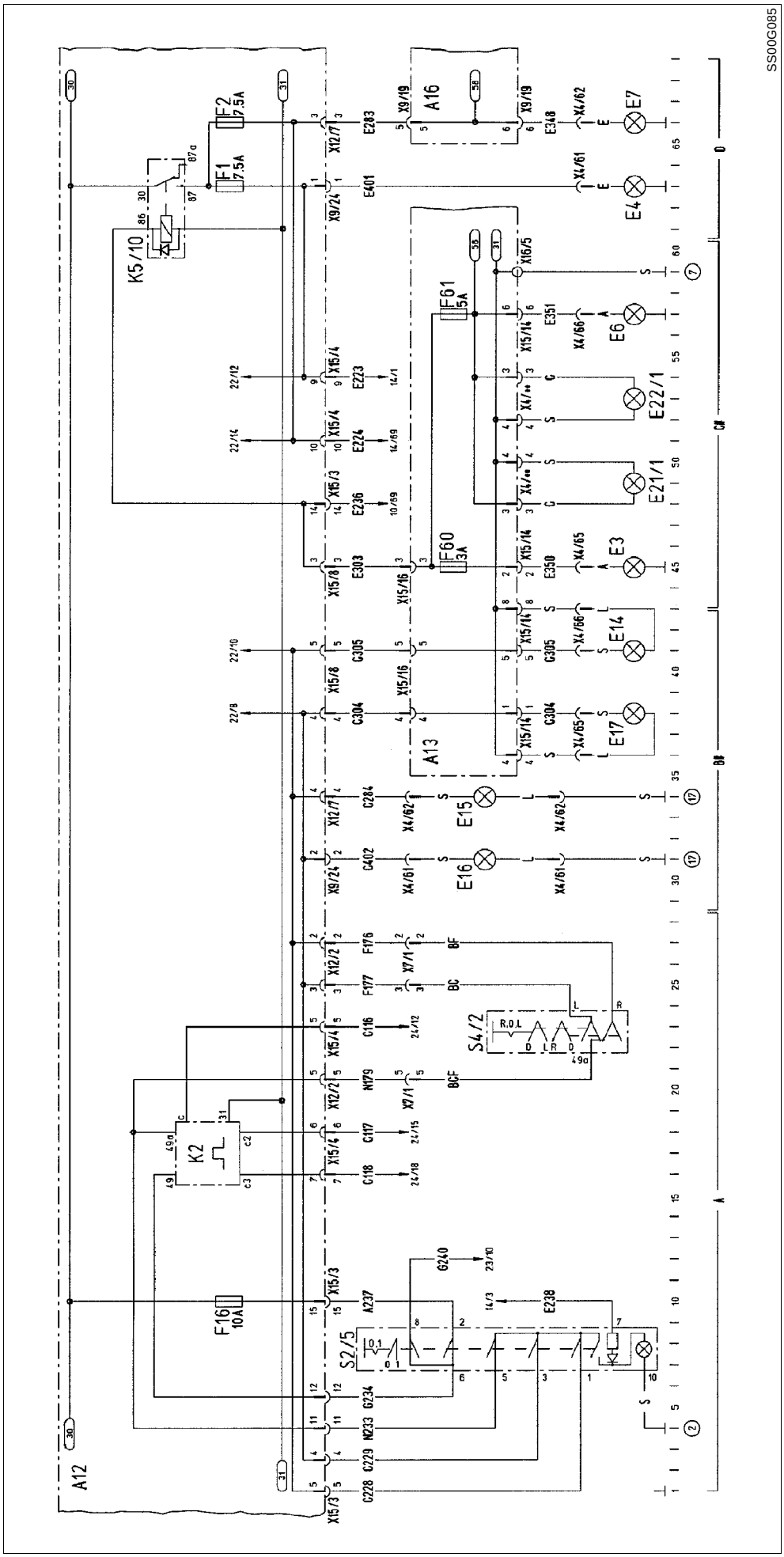
A	fuel filter heating
B	Power shift Steyr from veh. no. 02871 Case from DBD0007888
C	Power shift Steyr up to veh. no. 02870 Case up to DBD0007887
D	Central print, reserves

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
A13	Roof print
A16	EHR print, operating console
E3	Sidelight, front left
E4	Sidelight, rear left
E6	Sidelight, front right
E7	Sidelight, rear right
E14	Trafficator, front right
E15	Trafficator, rear right
E16	Trafficator, rear left
E17	Trafficator, front left
E21/1	Position light in the auxiliary headlight, left
E22/1	Position light in the auxiliary headlight, right
F1	Fuse, light potential 58L
F2	Fuse, light potential 58R
F16	Fuse, hazard warning lights
F60	Fuse, sidelight, front left
F61	Fuse, sidelight, potential 58
K2	Trafficator relay
K5/10	Relay, light, potential 58
S2/5	Switch, hazard warning lights
S4/2	Switch, steering column/trafficator
X4/61	Plug-in connection, combined tail / brake / trafficator lamp
X4/62	Plug-in connection, combined tail / brake / trafficator lamp
X4/65	Plug-in connection, roof frame, Brake/trafficator lamp, left
X4/66	Plug-in connection, roof frame Brake/trafficator lamp, right
X4/..	Plug-in connection, roof switch
X7/1	Plug-in connection, instrument, steering column switch
X9/19	Plug-in connection, cable, chassis, right
X9/24	Plug-in connection, cable, chassis, left
X12/2	Plug-in connection, instrument cable
X12/7	Plug-in connection, cable, chassis, right
X15/3	Plug-in connection, instrument cable
X15/4	Plug-in connection, instrument cable
X15/8	Plug-in connection, cable, roof supply
X15/14	Plug-in connection, roof frame
X15/16	Plug-in connection, cable, roof supply
X16/5	Screw-on connection, ground, roof print

VERSIONS
to this page
8
on page/pages
9

Grounding points

2	Instrument panel
7	Roof panel
17	Rear mudguard

Designation of Sections

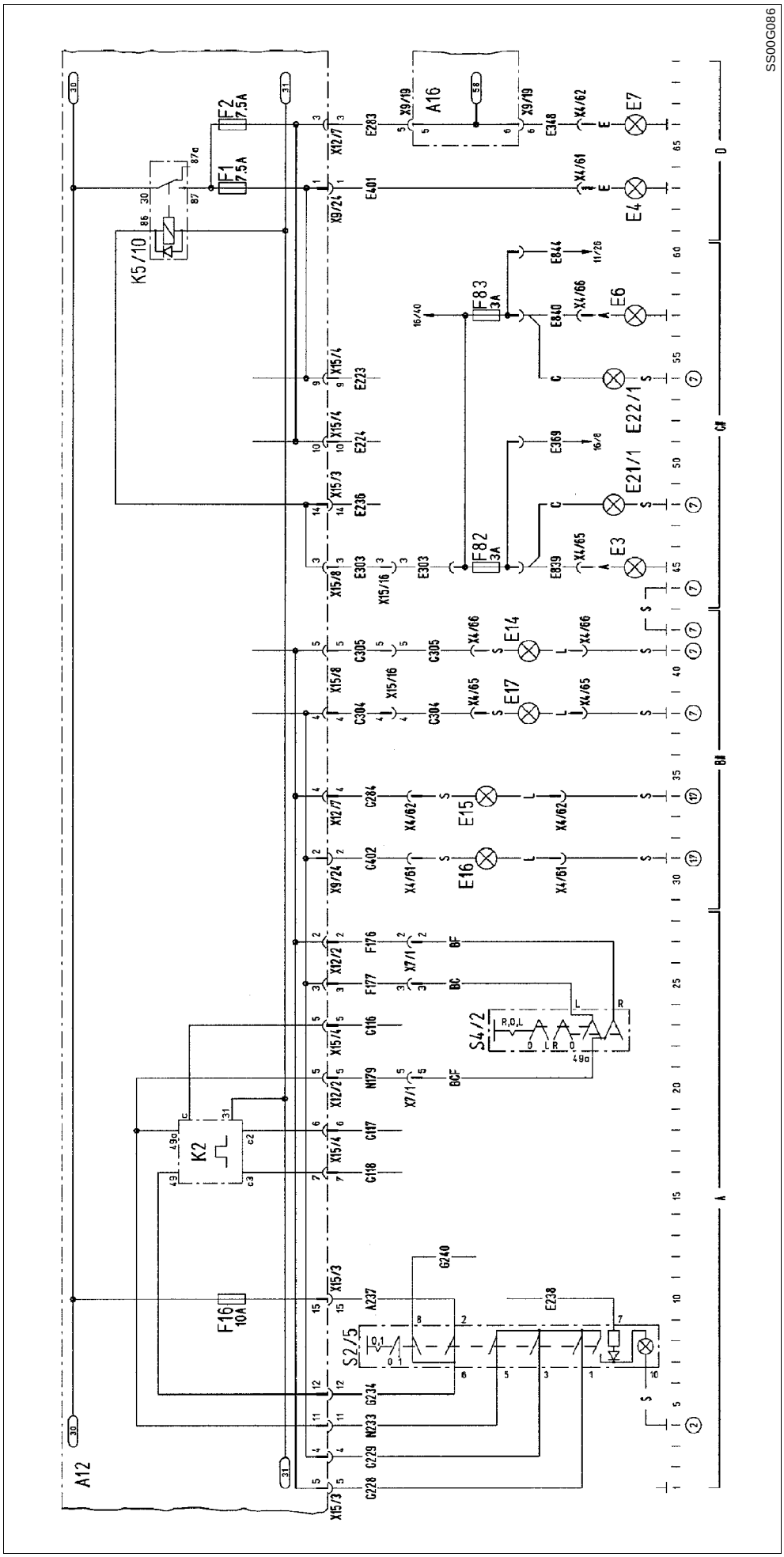
A	Trafficator system
B#	Trafficator, high-top
C#	Sidelight, front, low-top
D	Sidelight, rear
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
A16	EHR print, operating console
E3	Sidelight, front left
E4	Sidelight, rear left
E6	Sidelight, front right
E7	Sidelight, rear right
E14	Trafficator, front right
E15	Trafficator, rear right
E16	Trafficator, rear left
E17	Trafficator, front left
E21/1	Position light in the auxiliary headlight, left
E22/1	Position light in the auxiliary headlight, right
F1	Fuse, light potential 58L
F2	Fuse, light potential 58R
F16	Fuse, hazard warning lights
F82	Fuse, sidelight, front left
F83	Fuse, sidelight, potential 58
K2	Trafficator relay
K5/10	Relay, light, potential 58
S2/5	Switch, hazard warning lights
S4/2	Switch, steering column/trafficator
X4/61	Plug-in connection, combined tail / brake / trafficator lamp
X4/62	Plug-in connection, combined tail / brake / trafficator lamp
X4/65	Plug-in connection, roof frame, Brake/trafficator lamp, left
X4/66	Plug-in connection, roof frame Brake/trafficator lamp, right
X7/1	Instrument, steering column switch
X9/19	Plug-in connection, cable, chassis, right
X9/24	Plug-in connection, cable, chassis, left
X12/2	Plug-in connection, instrument cable
X12/7	Plug-in connection, cable, chassis, right
X15/3	Plug-in connection, instrument cable
X15/4	Plug-in connection, instrument cable
X15/8	Plug-in connection, cable, roof supply
X15/16	Plug-in connection, cable, roof supply

VERSIONS
to this page
9
on page/pages
8

Grounding points

2	Instrument panel
7	Roof panel
17	Rear mudguard

Designation of Sections

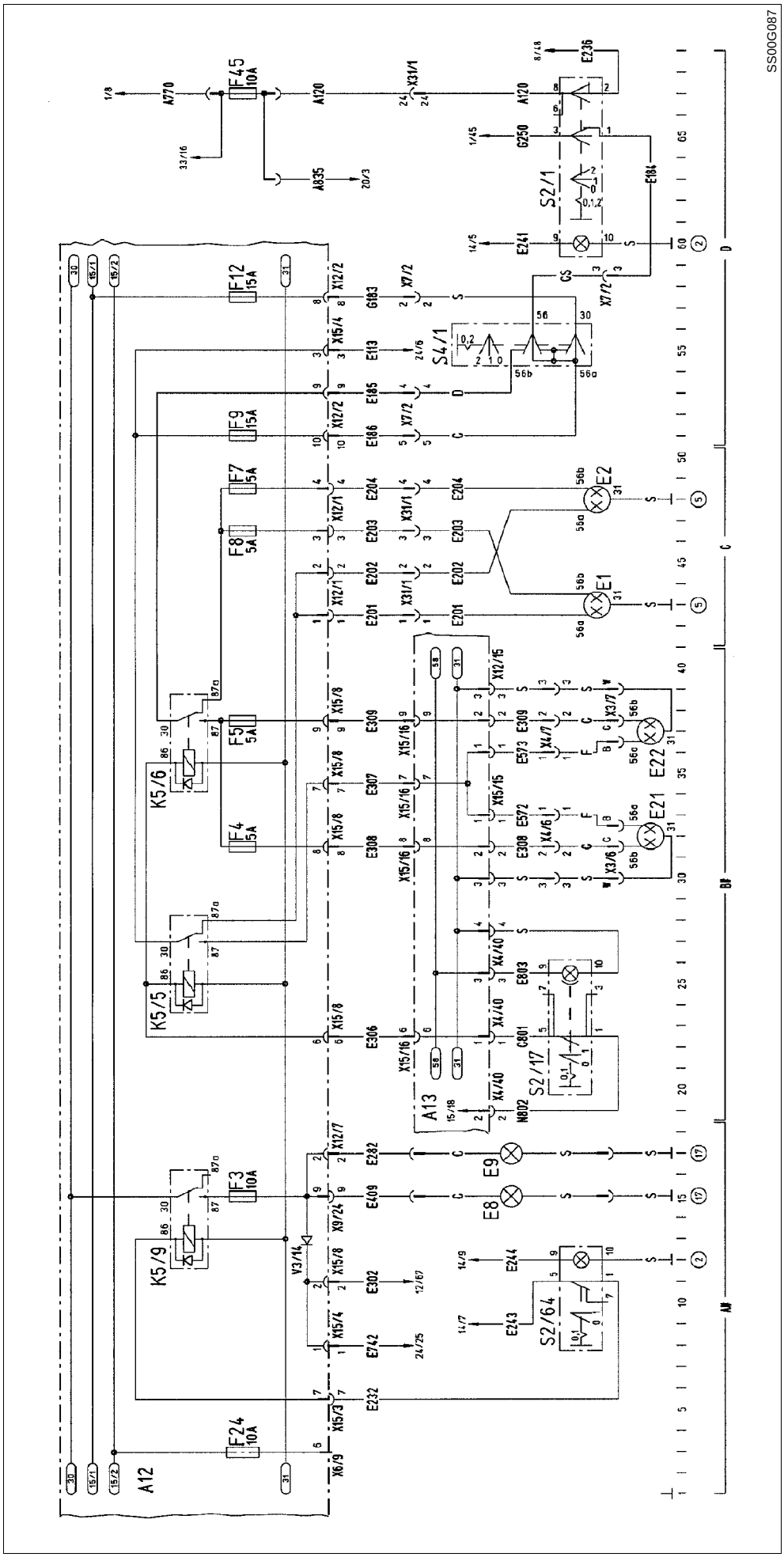
A	Trafficator system
B#	Trafficator, low-top
C#	Sidelight, front, low-top
D	Sidelight, rear
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
A13	Roof print
E1	Headlight, left
E2	Headlight, right
E8	Searchlight, left-hand mudguard
E9	Searchlight, right-hand mudguard
E21	Auxiliary headlight, left
E22	Auxiliary headlight, right
F3	Fuse, searchlight, mudguard
F4	Fuse, dipped beam, auxiliary headlight, left
F5	Fuse, dipped beam, auxiliary headlight, right
F7	Fuse, dipped beam, headlight, right
F8	Fuse, dipped beam, headlight, left
F9	Fuse, main-beam
F12	Fuse, headlight flasher
F24	Fuse, searchlight/ reversing light
F45	Fuse, potential 58, air-cond.
K5/5	Relay, switchover, main beam
K5/6	Relay, switchover, dipped beam
K5/9	Relay, searchlight, mudguard
S2/1	Switch, lighting system
S2/17	Switch, auxiliary headlight
S2/64	Switch, searchlight, mudguard
S4/1	Switch, steering column, dipped beam / main beam
V3/14	Diode
X3/6	Plug-in connection, auxiliary headlight
X3/7	Plug-in connection, auxiliary headlight
X4/6	Plug-in connection, roof canopy, auxiliary headlight
X4/7	Plug-in connection, roof canopy, auxiliary headlight
X4/40	Plug-in connection, roof switch
X6/9	Plug-in connection, chassis, right / chassis, left
X7/2	Plug-in connection, instrument, steering column switch
X9/24	Plug-in connection, cable, chassis, left
X12/1	Plug-in connection, instrument cable
X12/2	Plug-in connection, instrument cable
X12/7	Plug-in connection, chassis right
X12/15	Plug-in connection, roof canopy cable
X15/3	Plug-in connection, instrument cable
X15/4	Plug-in connection, instrument cable
X15/8	Plug-in connection, cable, roof supply
X15/15	Plug-in connection, roof canopy cable
X15/16	Plug-in connection, cable, roof supply
X31/1	Plug-in connection, instrument – engine

VERSIONS
to this page
10
on page/pages
11

Grounding points

2	Instrument panel
7	Roof panel
17	Rear mudguard

Designation of Sections

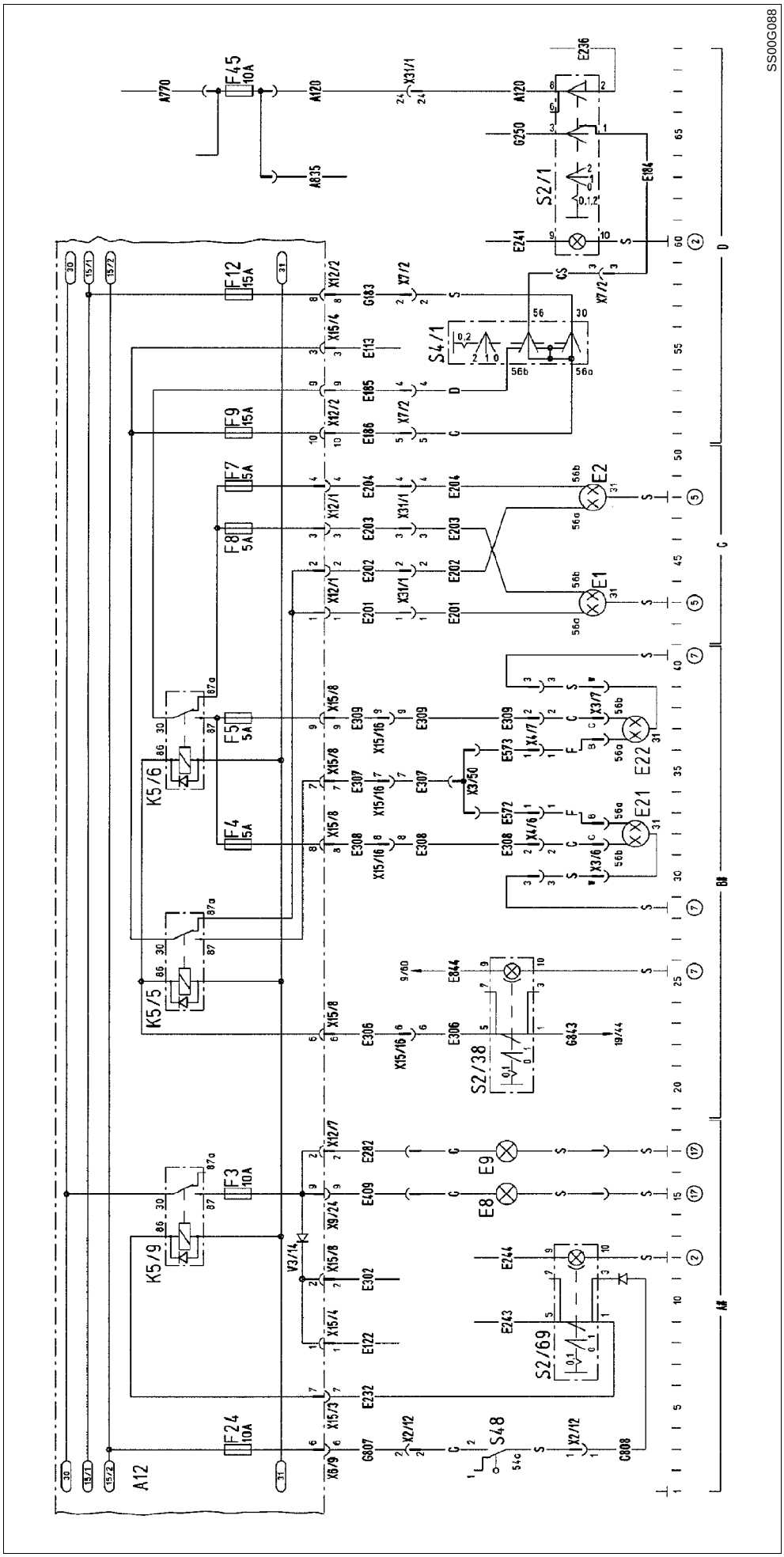
A#	Searchlight, mudguard
B#	Auxiliary headlight, high-top
C	Headlight
D	Dipped/main beam switchover
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Page 11

Electrical equipment

A12	Central print
E1	Headlight, left
E2	Headlight, right
E8	Searchlight, left-hand mudguard
E9	Searchlight, right-hand mudguard
E21	Auxiliary headlight, left
E22	Auxiliary headlight, right
F3	Fuse, searchlight, mudguard
F4	Fuse, dipped beam, auxiliary headlight, left
F5	Fuse, dipped beam, auxiliary headlight, right
F7	Fuse, dipped beam, headlight, right
F8	Fuse, dipped beam, headlight, left
F9	Fuse, main-beam
F12	Fuse, headlight flasher
F24	Fuse, searchlight/ reversing light
F45	Fuse, potential 58, air-cond.
K5/5	Relay, switchover, main beam
K5/6	Relay, switchover, dipped beam
K5/9	Relay, searchlight, mudguard
S2/1	Switch, lighting system
S2/38	Switch, auxiliary headlight
S2/69	Switch, searchlight, mudguard / reversing light
S4/1	Switch, steering column, dipped beam / main beam
S48	Switch, reverse gear
V3/14	Diode

X2/12	Plug-in connection, reversing light/ searchlight
X3/6	Plug-in connection, auxiliary headlight
X3/7	Plug-in connection, auxiliary headlight
X3/50	Distributor, low-top, potential 58
X4/6	Plug-in connection, roof canopy, auxiliary headlight
X4/7	Plug-in connection, roof canopy, auxiliary headlight
X6/9	Plug-in connection, chassis, right / chassis, left
X7/2	Plug-in connection, instrument, steering column switch
X9/24	Plug-in connection, cable, chassis, left
X12/1	Plug-in connection, instrument cable
X12/2	Plug-in connection, instrument cable
X12/7	Plug-in connection, cable, chassis, right
X15/3	Plug-in connection, instrument cable
X15/4	Plug-in connection, instrument cable
X15/8	Plug-in connection, cable, roof supply
X15/16	Plug-in connection, cable, roof supply
X31/1	Plug-in connection, instrument – engine

VERSIONS
to this page
11
on page/pages
10

Grounding points

2	Instrument panel
5	Engine compartment
7	Roof panel
17	Rear mudguard

Designation of Sections

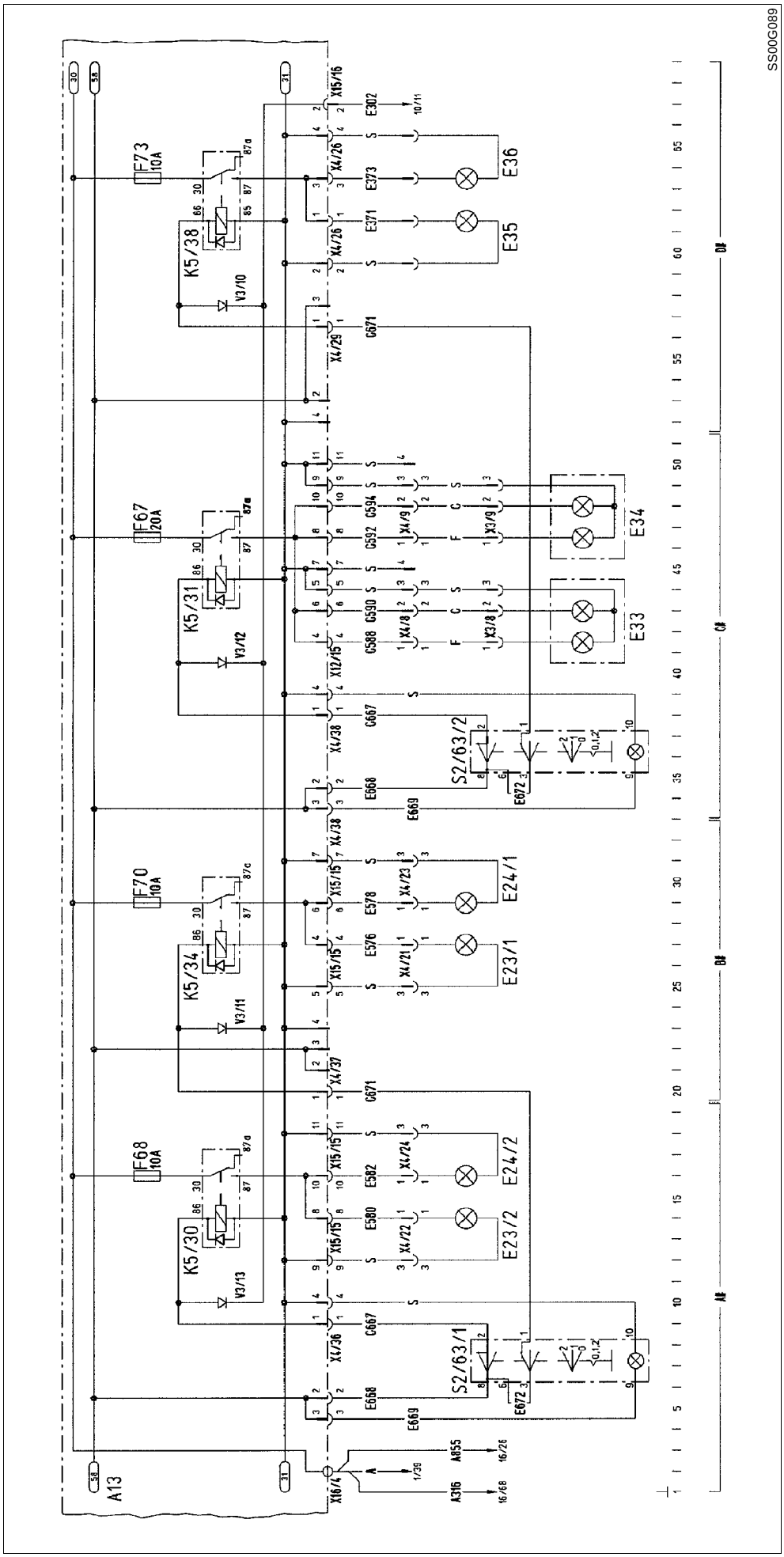
A#	Searchlight mudguard / reversing light
B#	Auxiliary headlight, low-top
C	Headlight
D	Dipped/main beam switchover
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A13	Roof print
E23/1	Roof searchlight, inner, rear, left
E23/2	Roof searchlight, outer, rear, left
E24/1	Roof searchlight, inner, rear, right
E24/2	Roof searchlight, outer, rear right
E33	Roof searchlight, front, twin-power
E34	Roof searchlight, front, twin-power
E35	Searchlight on the trafficator/position light, left
E36	Searchlight on the trafficator/position light, right
F67	Fuse, searchlight, twin power
F68	Fuse, 2 searchlights, rear
F70	Fuse, for 4 searchlights, number plate lighting on roof
F73	Fuse, searchlight on trafficator/position light
K5/30	Relay, 2 roof searchlights, outer, rear, left
K5/31	Relay, searchlight, twin power
K5/34	Relay, 4 searchlights, number plate lighting on roof
K5/38	Relay, searchlight on the trafficator/position light
S2/63/1	Switch, rear searchlight, 2+2
S2/63/2	Switch, front searchlight, 2+2

V3/10	Diode
V3/11	Diode
V3/12	Diode
V3/13	Diode
X3/8	Plug-in connection, searchlight, twin power
X3/9	Plug-in connection, searchlight, twin power
X4/8	Plug-in connection, roof canopy, searchlight
X4/9	Plug-in connection, roof canopy, searchlight
X4/21	Plug-in connection, roof canopy cable
X4/22	Plug-in connection, roof canopy cable
X4/23	Plug-in connection, roof canopy cable
X4/24	Plug-in connection, roof canopy cable
X4/26	Plug-in connection, roof frame
X4/29	Plug-in connection, roof switch
X4/36	Plug-in connection, roof switch
X4/37	Plug-in connection, roof switch
X4/38	Plug-in connection, roof switch
X12/15	Plug-in connection, roof canopy cable
X15/15	Plug-in connection, roof canopy cable
X15/16	Plug-in connection, cable, roof supply
X16/4	Screw-on connector, roof print, potential 30

VERSIONS
to this page
12
on page/pages
13

Grounding points

Designation of Sections

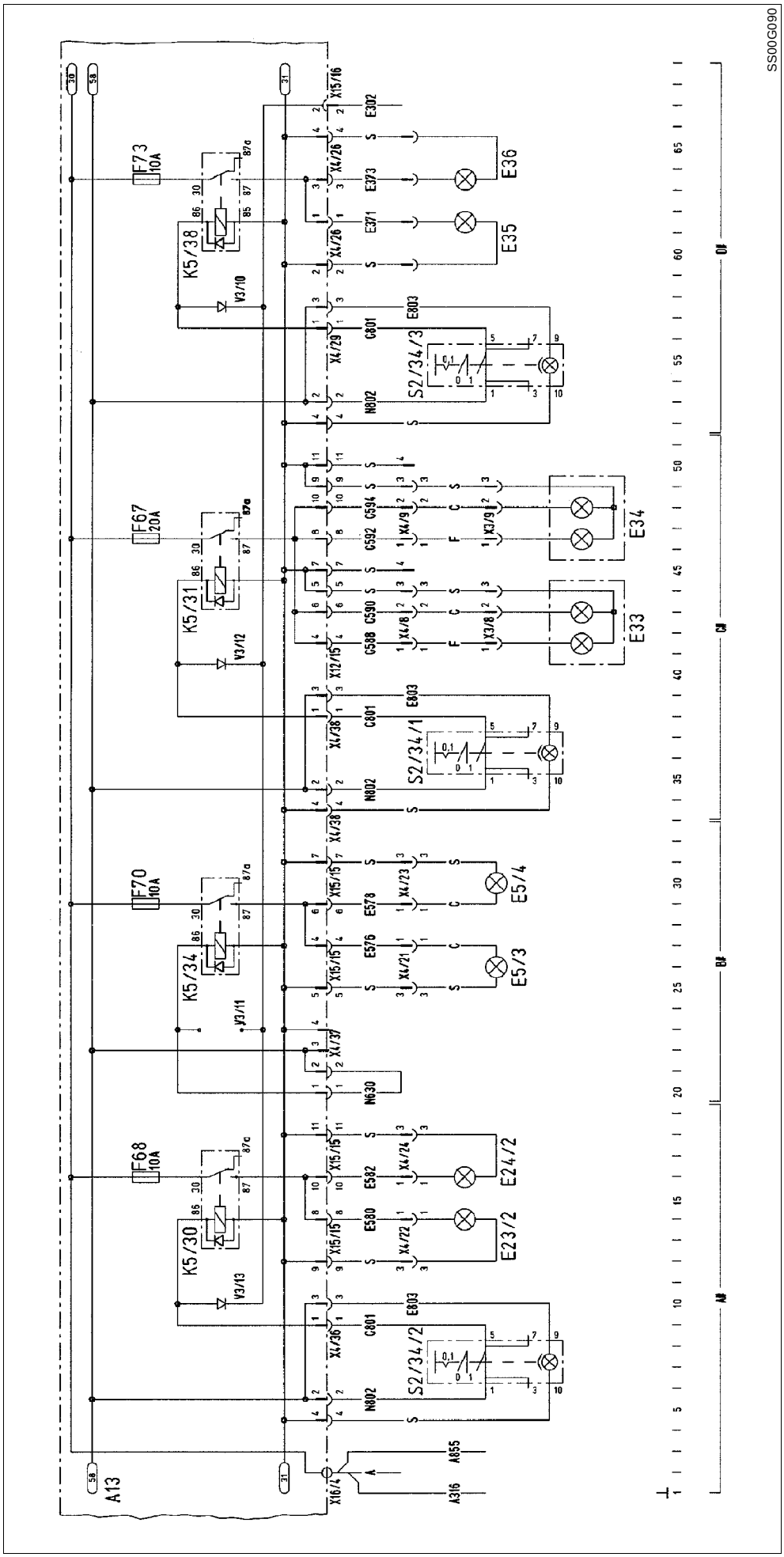
A#	Searchlight high-top, outer, rear
B#	Searchlight high-top, inner, rear
C#	High-top searchlight, front, twin-power
D#	Searchlight on the trafficator/position light
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A13	Roof print
E5/3	Number plate lighting, roof, left
E5/4	Number plate lighting, roof, right
E23/2	Roof searchlight, outer, rear, left
E24/2	Roof searchlight, outer, rear right
E33	Roof searchlight, front, twin-power
E34	Roof searchlight, front, twin-power
E35	Searchlight on the trafficator/position light, left
E36	Searchlight on the trafficator/position light, right
F67	Fuse, searchlight, twin power
F68	Fuse, 2 searchlights, rear
F70	Fuse, for 4 searchlights, number plate lighting on roof
F73	Fuse, searchlight on trafficator/position light
K5/30	Relay, 2 roof searchlights, outer, rear, left
K5/31	Relay, searchlight, twin power
K5/34	Relay, 4 searchlights, number plate lighting on roof
K5/38	Relay, searchlight on the trafficator/position light
S2/34/1	Switch, searchlight, twin power
S2/34/2	Switch, searchlight, roof, rear
S2/34/3	Switch, searchlight, trafficator/position light

V3/10	Diode
V3/11	Diode
V3/12	Diode
V3/13	Diode
X3/8	Plug-in connection, searchlight, twin power
X3/9	Plug-in connection, searchlight, twin power
X4/8	Plug-in connection, roof canopy, searchlight
X4/9	Plug-in connection, roof canopy, searchlight
X4/21	Plug-in connection, roof canopy cable
X4/22	Plug-in connection, roof canopy cable
X4/23	Plug-in connection, roof canopy cable
X4/24	Plug-in connection, roof canopy cable
X4/26	Plug-in connection, roof frame
X4/29	Plug-in connection, roof switch
X4/36	Plug-in connection, roof switch
X4/37	Plug-in connection, roof switch
X4/38	Plug-in connection, roof switch
X12/15	Plug-in connection, roof canopy cable
X15/15	Plug-in connection, roof canopy cable
X15/16	Plug-in connection, cable, roof supply
X16/4	Screw-on connector, roof print, potential 30

VERSIONS
to this page
13
on page/pages
12

Grounding points

Designation of Sections

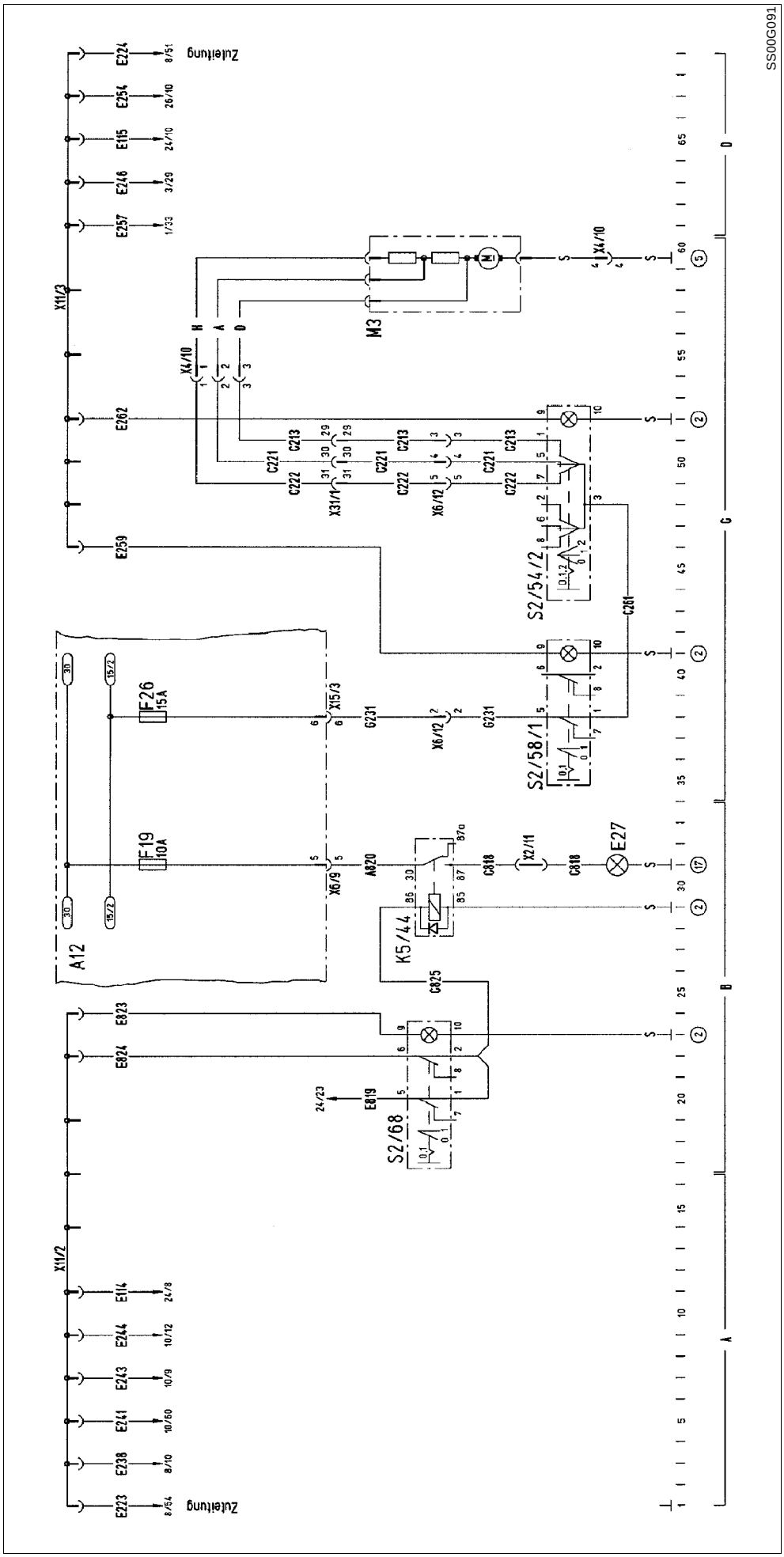
A#	Searchlight high-top, outer, rear
B#	High-top number plate lighting, rear, for 2 searchlights
C#	High-top searchlight, front, twin-power
D#	Searchlight on the trafficator/position light
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

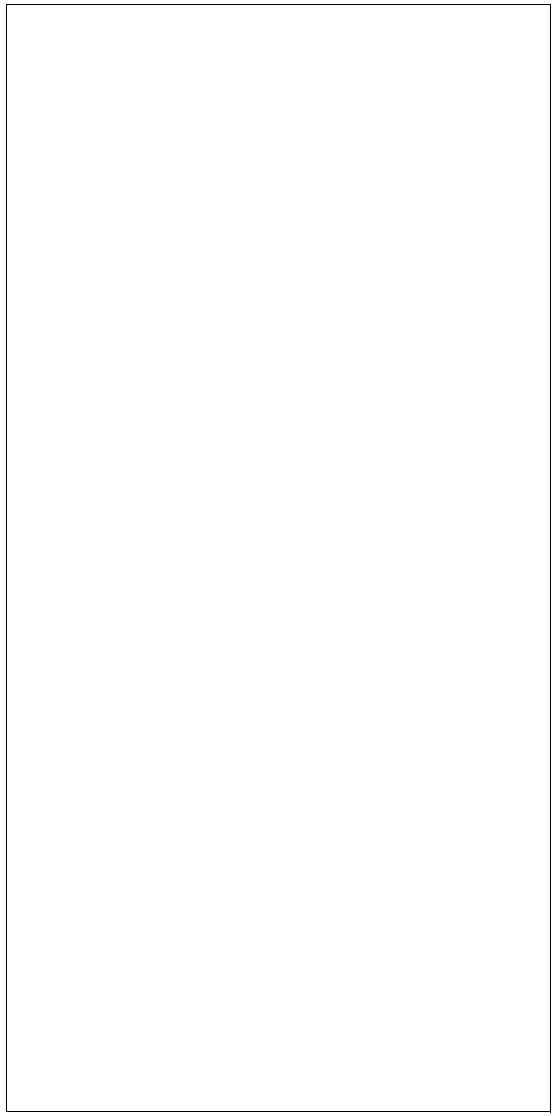
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Electrical equipment

A12	Central print
E27	Searchlight on the rear axle
F19	Fuse, searchlight on the rear axle
F26	Fuse, heating
K5/44	Relay, searchlight, rear axle
M3	Heater blower motor
S2/54/2	Switch, heating level 1-2-3
S2/58/1	Switch, heating ON
S2/68	Switch, searchlight on the rear axle
X2/11	Plug-in connection, searchlight, rear axle
X4/10	Plug-in connection, engine heating
X6/9	Plug-in connection, spare
X6/12	Plug-in connection, heating switch
X11/2	Distributor, instrument, potential 58L
X11/3	Distributor, instrument, potential 58R
X15/3	Plug-in connection, instrument cable
X31/1	Plug-in connection, instrument, engine



Grounding points

2	Instrument panel
5	Engine compartment
17	Rear mudguard

Designation of Sections

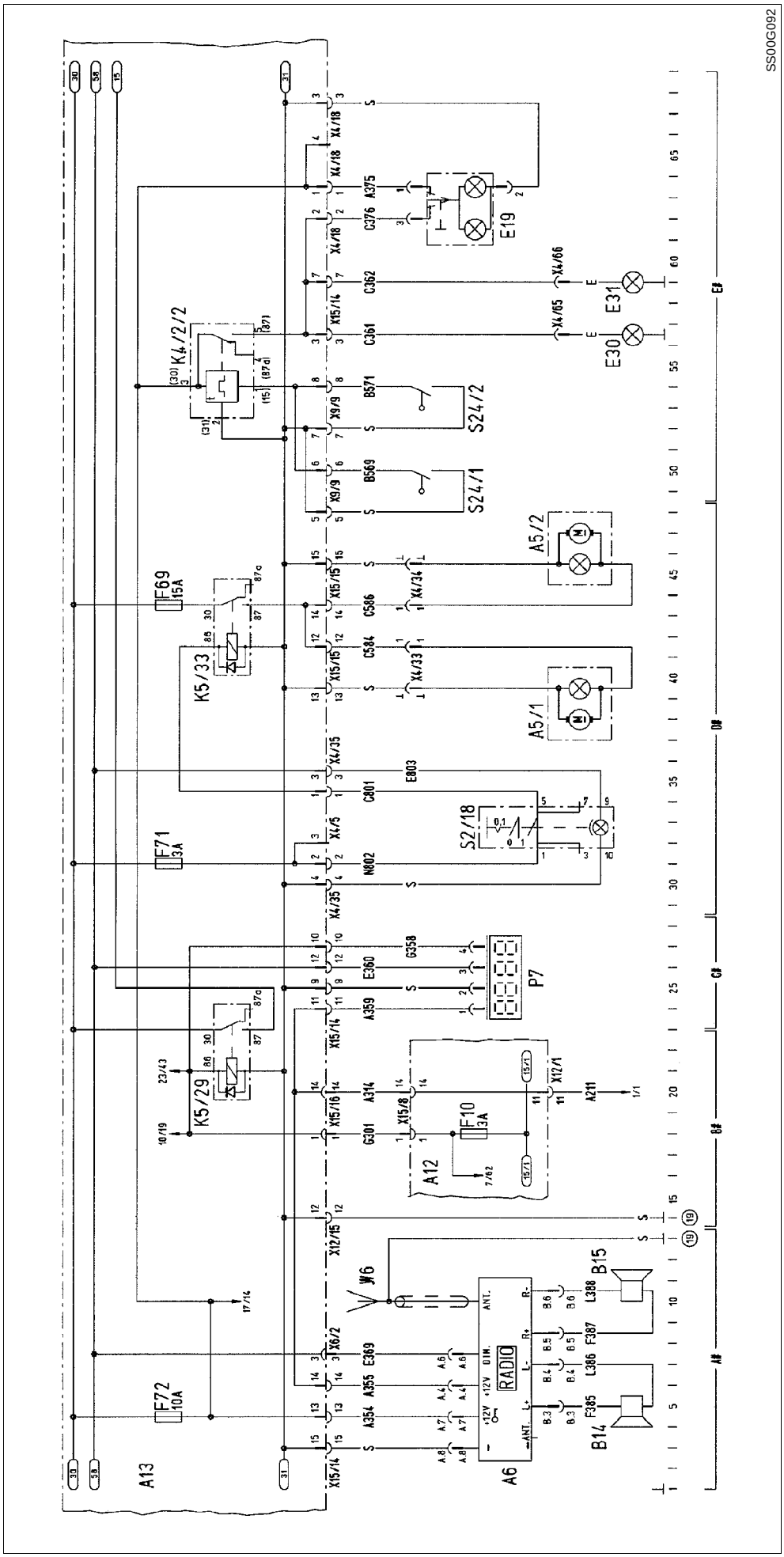
A	Supply, potential 58L, instrument
B	Searchlight on the rear axle
C	Foot-well heating
D	Supply, potential 58R, instrument

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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https://truckmanualshub.com/



Page 15

Electrical equipment

A5/1	Rotating beacon, left
A5/2	Rotating beacon, right
A6	Radio
A12	Central print
A13	Roof print
B14	Right-hand loudspeaker
B15	Left-hand loudspeaker
E19	Interior lighting
E30	Step light, left
E30	Entrance light, right
F10	Fuse, potential 15/1 roof, front loader
F69	Fuse, rotating beacon
F71	Fuse, potential 30
F72	Fuse, spot, interior lighting, mirror heating
K4/2/2	Timed relay, 40 sec's. interior lighting
K5/29	Relay, roof print, potential 15
K5/33	Relay, rotating beacon
P7	Digital clock
S2/18	Switch, rotating beacon
S24/1	Switch, door contact, left
S24/2	Switch, door contact, right
W6	Aerial
X4/5	Plug-in connection, roof frame
X4/18	Plug-in connection, roof frame
X4/33	Plug-in connection, rotating beacon, left
X4/34	Plug-in connection, rotating beacon, right
X4/35	Plug-in connection, switch, rotating beacon
X4/65	Plug-in connection, roof frame, trafficator/position light, left
X4/66	Plug-in connection, roof frame, trafficator/position light, right
X6/2	Plug-in connection, roof frame
X9/9	Plug-in connection, roof canopy cable
X12/1	Plug-in connection, instrument cable
X12/15	Plug-in connection, roof canopy cable
X15/8	Plug-in connection, cable, roof supply
X15/14	Plug-in connection, roof frame
X15/15	Plug-in connection, roof canopy cable
X15/16	Plug-in connection, cable, roof supply

VERSIONS
to this page
15
on page/pages
16

Grounding points

19	Shock absorber, roof

Designation of Sections

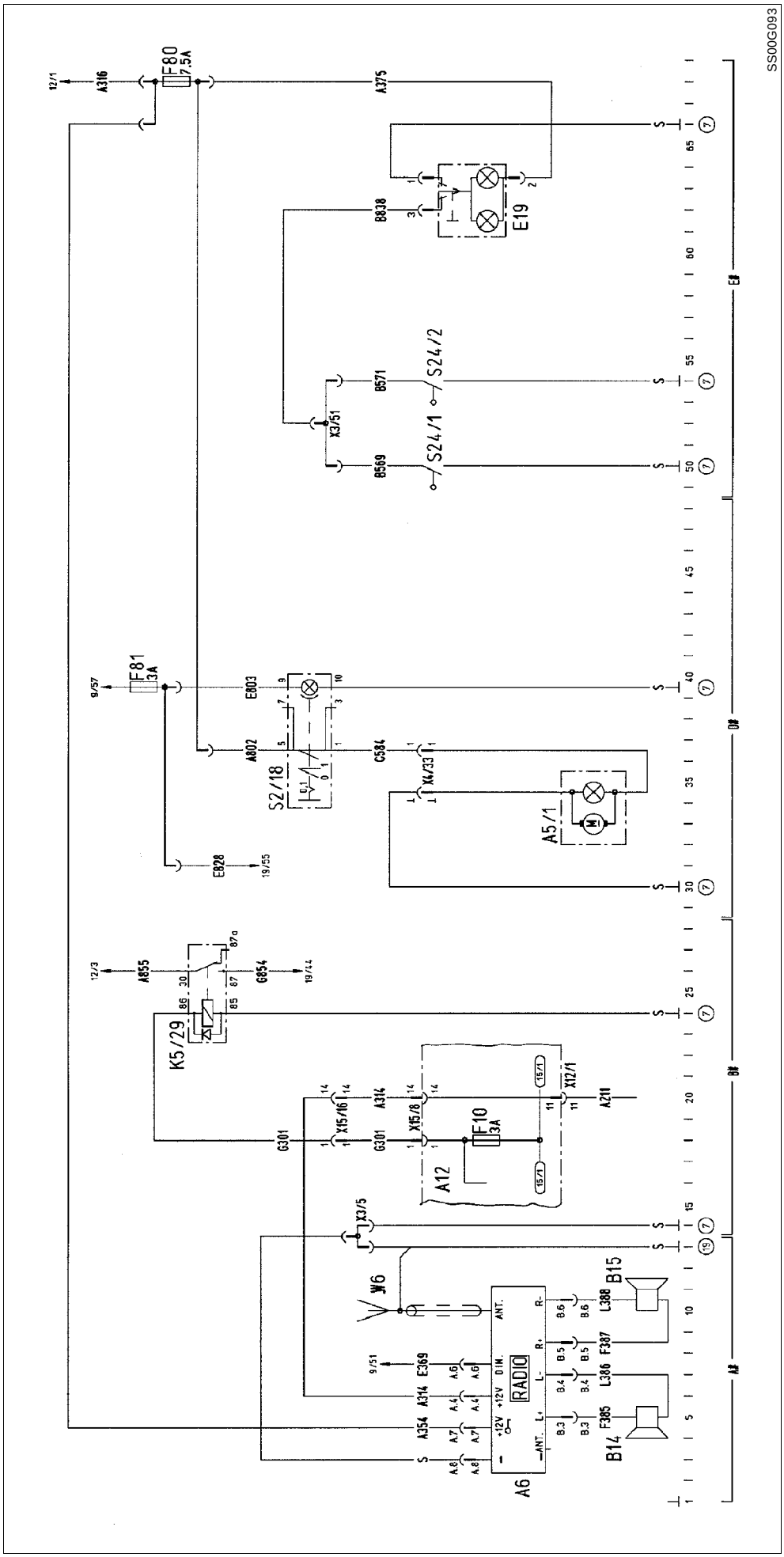
A#	Radio preparation, high-top
B#	Supply potential 15, high-top
C#	Digital clock, high-top
D#	Rotating beacon, high-top
E#	Step / interior lighting, high-top
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A5/1	Rotating beacon, left
A6	Radio
A12	Central print
B14	Right-hand loudspeaker
B15	Left-hand loudspeaker
E19	Interior lighting
F10	Fuse, potential 15/1 roof, front loader
F80	Fuse, interior light, rotating beacon
F81	Fuse, switch illumination
K5/29	Relay, roof print, potential 15
S2/18	Switch, rotating beacon
S2/24/1	Switch, door contact, left
S2/24/2	Switch, door contact, right
W6	Aerial
X3/5	Distributor, aerial ground, low-top
X4/51	Distributor, low-top door contact
X4/33	Socket, rotating beacon, left
X12/1	Plug-in connection, instrument cable
X15/8	Plug-in connection, cable, roof supply
X15/16	Plug-in connection, cable, roof supply

VERSIONS
to this page
16
on page/pages
15

Grounding points

7	Roof panel
19	Shock absorber, roof

Designation of Sections

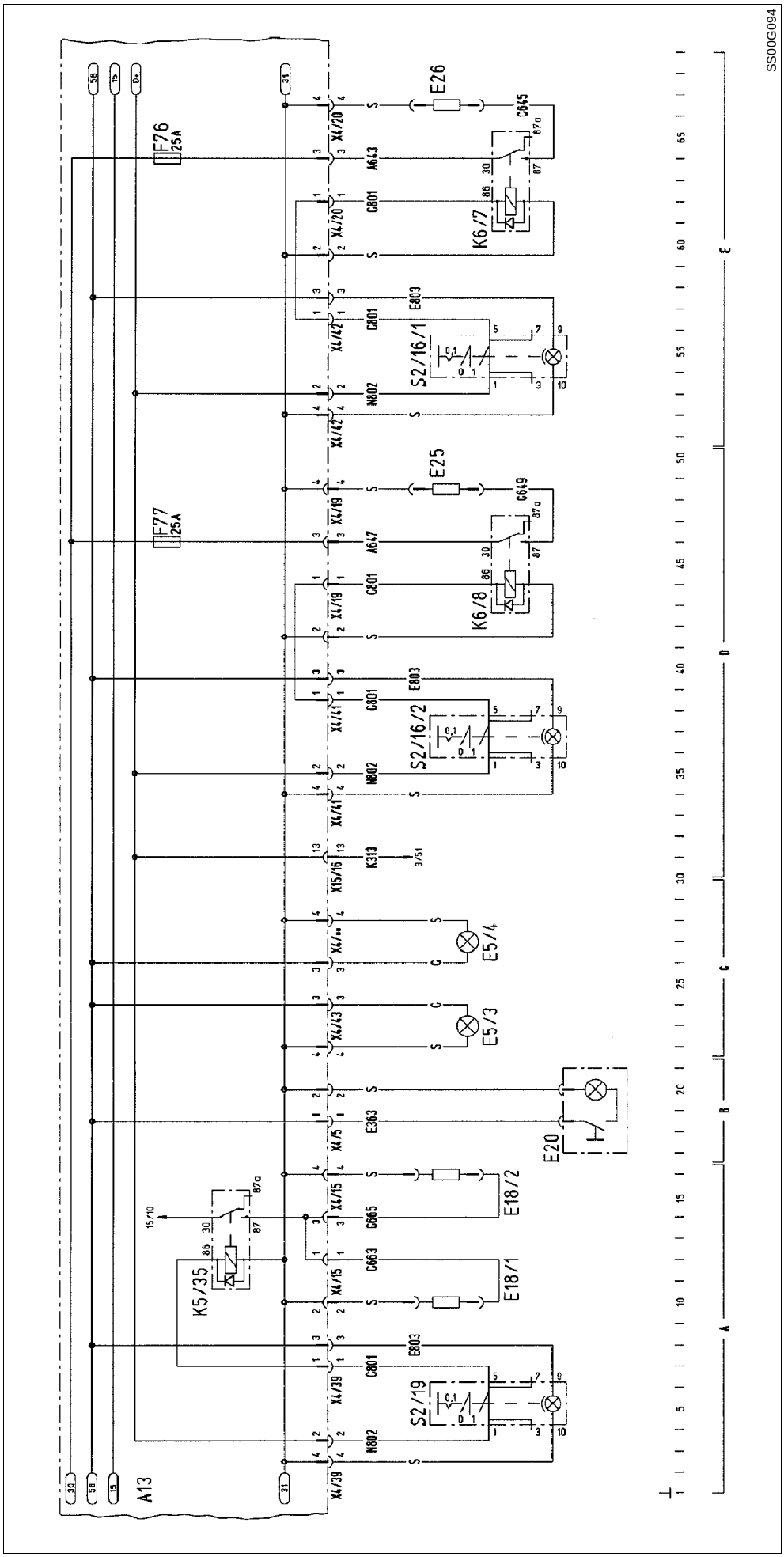
A#	Radio preparation, low-top
B#	Supply potential 15, low-top
D#	Rotating beacon, low-top
E#	Interior lighting, low-top
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

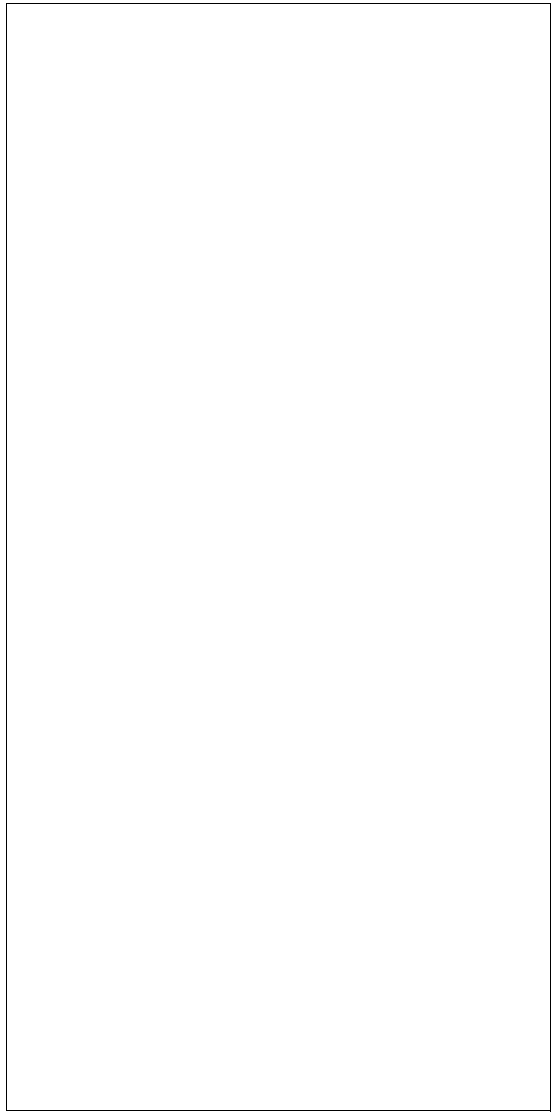
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Electrical equipment

A13	Roof print
E5/3	Number plate lighting, roof, left
E5/4	Number plate lighting, roof, right
E18/1	Heated mirror, left
E18/2	Heated mirror, right
E20	Spot
E25	Heated windscreen, front
E26	Heated screen, rear
E76	Fuse, heated screen, rear
E77	Fuse, heated windscreen, front
K5/35	Relay, heated mirror
K6/7	Relay, heated screen, rear
K6/8	Relay, heated windscreen, front
S2/16/1	Switch, heated screen, rear
S2/16/2	Switch, heated windscreen, front
S2/19	Switch, heated mirror
X4/5	Plug-in connection, roof frame
X4/15	Plug-in connection, mirror heating
X4/19	Plug-in connection, heated windscreen, front
X4/20	Plug-in connection, heated screen, rear
X4/39	Plug-in connection, roof switch
X4/41	Plug-in connection, roof switch
X4/42	Plug-in connection, roof switch
X4/43	Plug-in connection, number plate lighting
X4/..	Plug-in connection, roof switch
X15/16	Plug-in connection, cable, roof supply





Grounding points

Designation of Sections

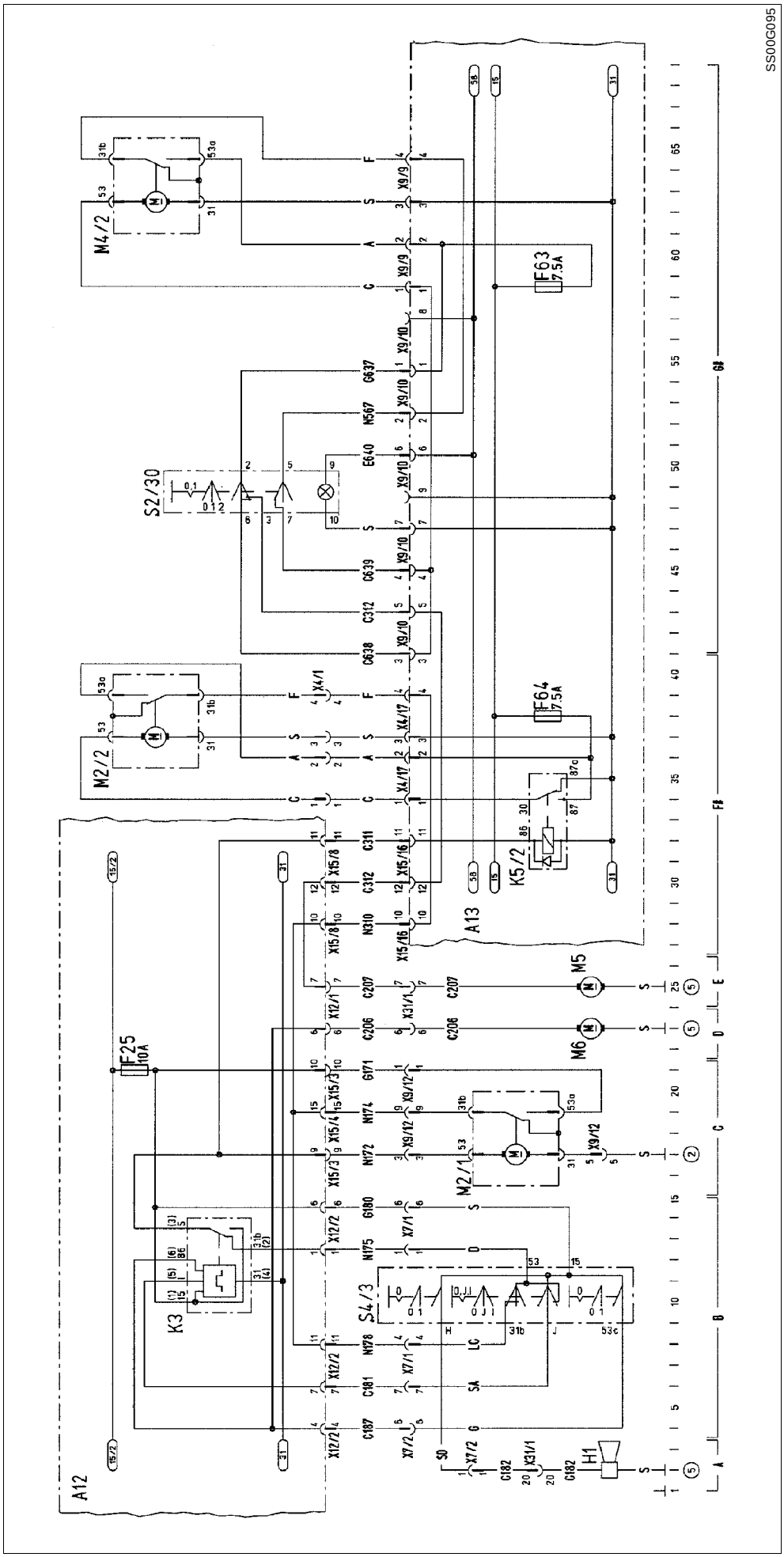
A	Mirror heating, high-top
B	Spot, high-top
C	Roof number plate lighting, high-top
D	Heated windscreen, high-top
E	Heated rear screen, high-top

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
A13	Roof print
F25	Fuse, wiper, horn
F63	Fuse, rear wiper
F64	Fuse, wiper, front, with hinged windscreen
H1	Horn
K3	Interval relay
K5/2	Relay, roof-mounted wiper, front
M2/1	Parallel wiper motor, front
M2/2	Standard wiper motor, front
M4/2	Standard wiper motor, rear
M5	Motor, rear screen washer pump
M6	Motor, front screen washer pump
S2/30	Switch, rear washer/wiper system
S4/3	Steering column switch, wiper/washer system
X4/1	Plug-in connection, roof frame
X4/17	Plug-in connection, roof frame
X7/1	Plug-in connection, instrument, steering column switch
X7/2	Plug-in connection, instrument, steering column switch
X9/9	Plug-in connection, roof canopy cable
X9/10	Plug-in connection, rear wiper
X9/12	Plug-in connection, instrument, wiper
X12/1	Plug-in connection, instrument cable
X12/2	Plug-in connection, instrument cable
X15/3	Plug-in connection, instrument cable
X15/4	Plug-in connection, instrument cable
X15/8	Plug-in connection, cable, roof supply
X15/16	Plug-in connection, cable, roof supply
X31/1	Plug-in connection, instrument – engine

VERSIONS
to this page
18
on page/pages
19

Grounding points

2	Instrument panel
5	Engine compartment

Designation of Sections

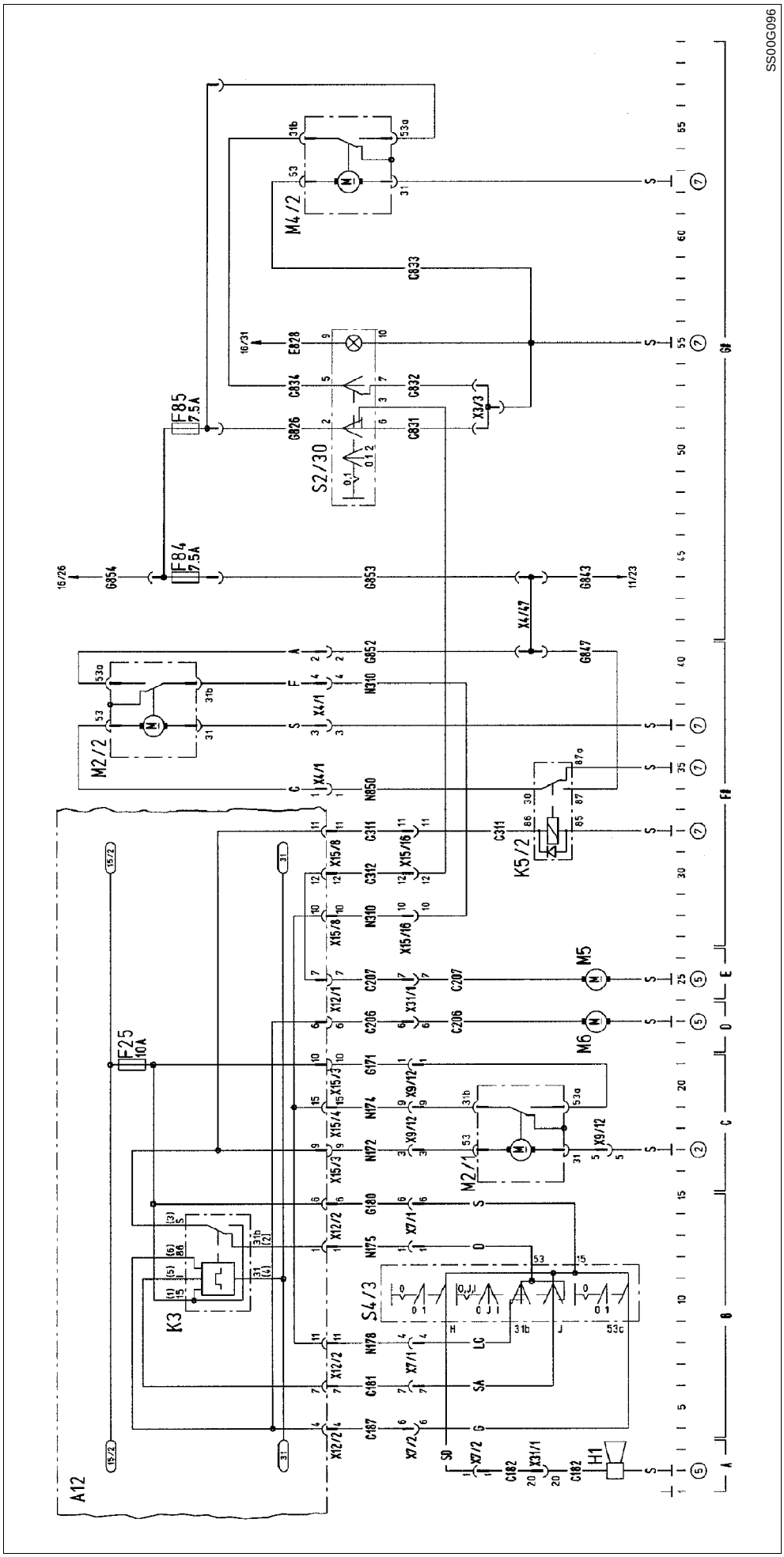
A	Horn
B	Steering column switch
C	Parallel wiper, front
D	Front screen washer pump
E	Rear screen washer pump
F#	Standard wiper, front, high-top
G#	Standard wiper, rear, high-top
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
F25	Fuse, wiper, horn
F84	Fuse, auxiliary headlight, front wiper
F85	Fuse, rear wiper
H1	Horn
K3	Interval relay
K5/2	Relay, roof-mounted wiper, front
M2/1	Parallel wiper motor, front
M2/2	Standard wiper motor, front
M4/2	Standard wiper motor, rear
M5	Motor, rear screen washer pump
M6	Motor, front screen washer pump
S2/30	Switch, rear washer/wiper system
S4/3	Steering column switch, wiper/washer system
X3/3	Distributor, rear washer/wiper, low-top
X4/1	Plug-in connection, roof frame
X3/47	Distributor, low-top, potential 15
X7/1	Plug-in connection, instrument, steering column switch
X7/2	Plug-in connection, instrument, steering column switch
X9/12	Plug-in connection, instrument, wiper
X12/1	Plug-in connection, instrument cable
X12/2	Plug-in connection, instrument cable
X15/3	Plug-in connection, instrument cable
X15/4	Plug-in connection, instrument cable
X15/8	Plug-in connection, cable, roof supply
X15/16	Plug-in connection, cable, roof supply
X31/1	Plug-in connection, instrument – engine

VERSIONS
to this page
19
on page/pages
18

Grounding points

2	Instrument panel
5	Engine compartment
7	Roof panel

Designation of Sections

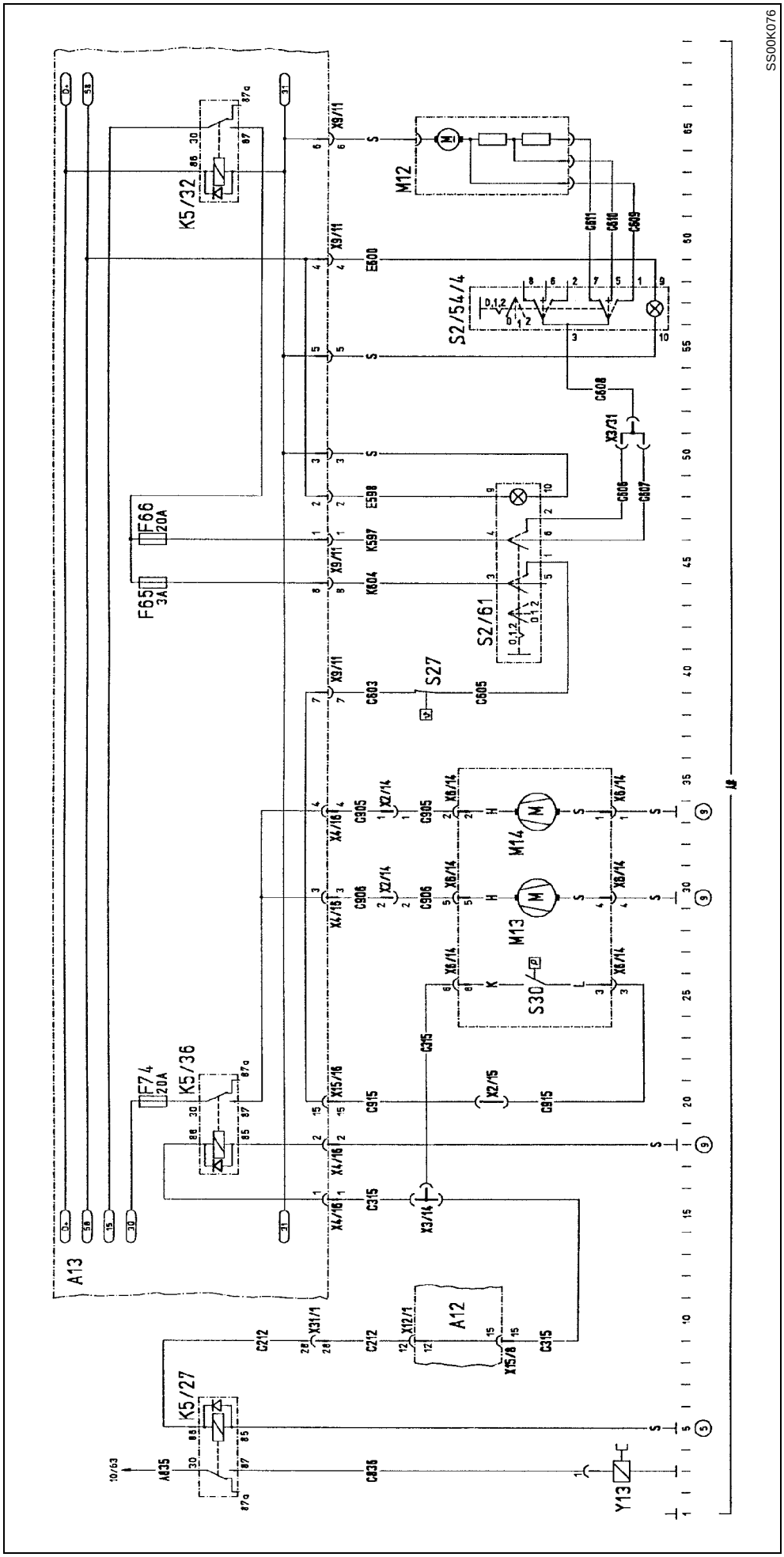
A	Horn
B	Steering column switch
C	Parallel wiper, front
D	Front screen washer pump
E	Rear screen washer pump
F#	Standard wiper, front, low-top
G#	Standard wiper, rear, low-top
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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https://truckmanualshub.com/



Page 20.1

Electrical equipment

A12	Central print
A13	Roof print
F65	Fuse, air conditioning
F66	Fuse, air conditioning, blower motor
F74	Fuse, air-conditioning fan
K5/27	Relay, air conditioning compressor
K5/32	Relay, roof blower motor
K5/36	Relay, air conditioning fan
M12	Air-conditioning blower motor
M13	Condenser, air conditioning
M14	Condenser, air conditioning
S2/54/4	Step switch, blower motor
S2/61	Switch, air conditioning blower motor
S27	Switch, air conditioning thermostat
S30	Pushbutton, air conditioning
X2/14	Plug-in connection, air-conditioning, roof
X2/15	Plug-in connection, air-conditioning, roof
X2/16	Plug-in connection, air-conditioning, roof
X3/14	Distributor, air-conditioning, roof
X3/31	Plug-in connection, cable, air-conditioning, roof
X4/16	Plug-in connection, air-conditioning, roof
X6/14	Plug-in connection, air-conditioning condensor
X9/11	Plug-in connection, air cond., roof
X12/1	Plug-in connection, instrument cable
X15/8	Plug-in connection, cable, roof supply
X15/16	Plug-in connection, cable, roof supply
X31/1	Plug-in connection, instrument – engine
Y13	Magnetic coupling, air conditioning

VERSIONS
to this page
20.1
on page/pages
21.1

Grounding points

5	Engine compartment
9	Screw-on connector, roof print

Designation of Sections

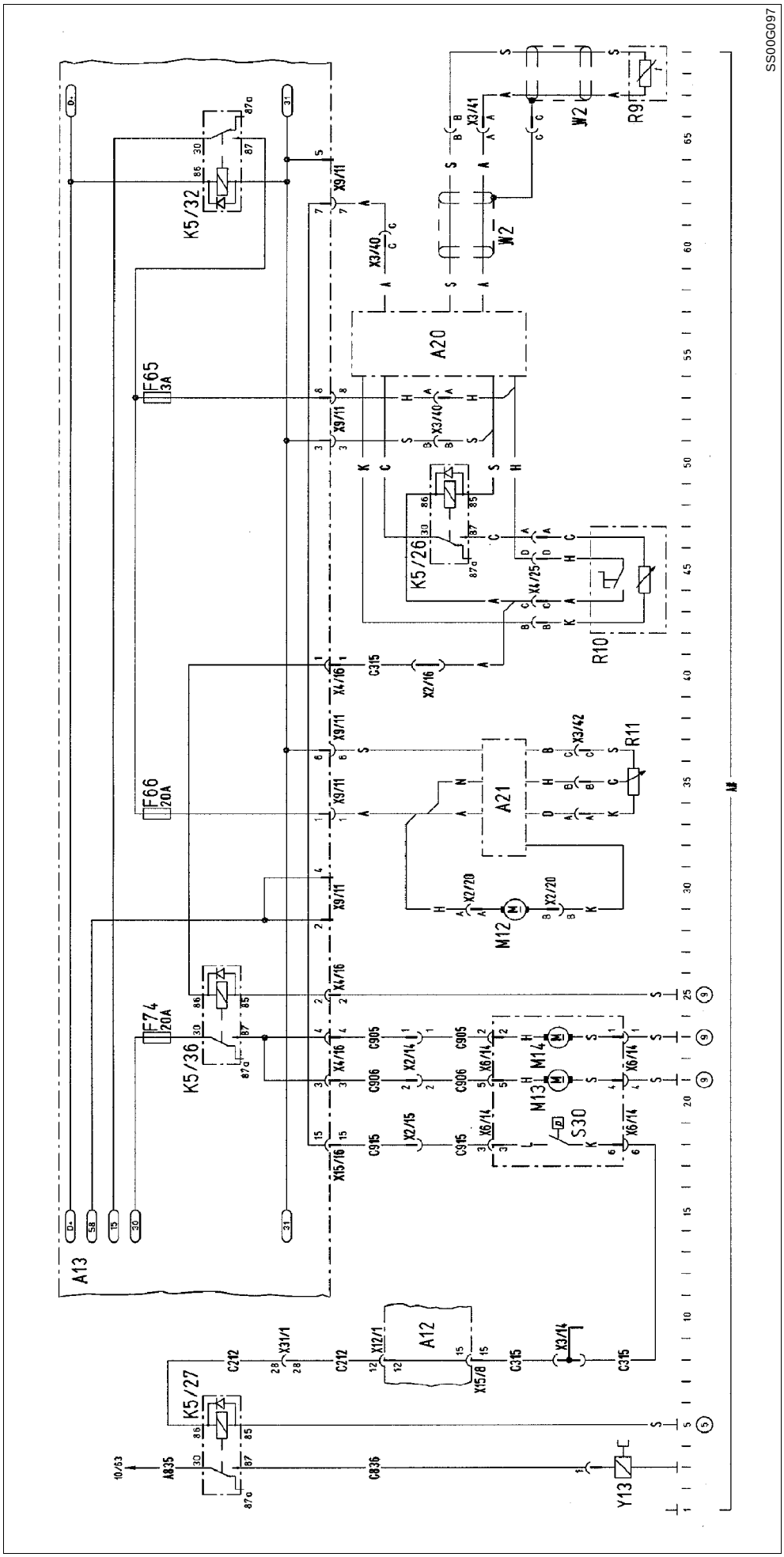
A#	Air-conditioning high-top Steyr up to veh. no. 03447 Case up to DBD0007417
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
A13	Roof print
A20	Air conditioning control
A21	Blower motor control
F65	Fuse, air conditioning
F66	Fuse, air conditioning, blower motor
F74	Fuse, air-conditioning fan
K5/26	Relay, air conditioning
K5/27	Relay, air conditioning compressor
K5/32	Relay, roof blower motor
K5/36	Relay, air conditioning fan
M12	Air-conditioning blower motor
M13	Condenser, air conditioning
M14	Condenser, air conditioning
R9	Temperature sensor
R10	Potentiometer, air conditioning control
R11	Roof blower motor potentiometer
S30	Pushbutton, air conditioning
W2	Air conditioning cable, screened
X2/14	Plug-in connection, air-conditioning, roof
X2/15	Plug-in connection, air-conditioning, roof
X2/16	Plug-in connection, air-conditioning, roof
X2/20	Plug-in connection, roof blower
X3/14	Distributor, air-conditioning, roof
X3/40	Plug-in connection, air cond. control
X3/41	Plug-in connection, temperature sensor
X3/42	Plug-in connection, blower potentiometer
X4/16	Plug-in connection, air-conditioning, roof
X4/25	Plug-in connection, air-conditioning potentiometer
X6/14	Plug-in connection, air-conditioning condensor
X9/11	Plug-in connection, air cond., roof
X12/1	Plug-in connection, instrument cable
X15/8	Plug-in connection, cable, roof supply
X15/16	Plug-in connection, cable, roof supply
X31/1	Plug-in connection, instrument – engine
Y13	Magnetic coupling, air conditioning

VERSIONS
to this page
20.2
on page/pages
21.2

Grounding points

5	Engine compartment
9	Screw-on connector, roof print

Designation of Sections

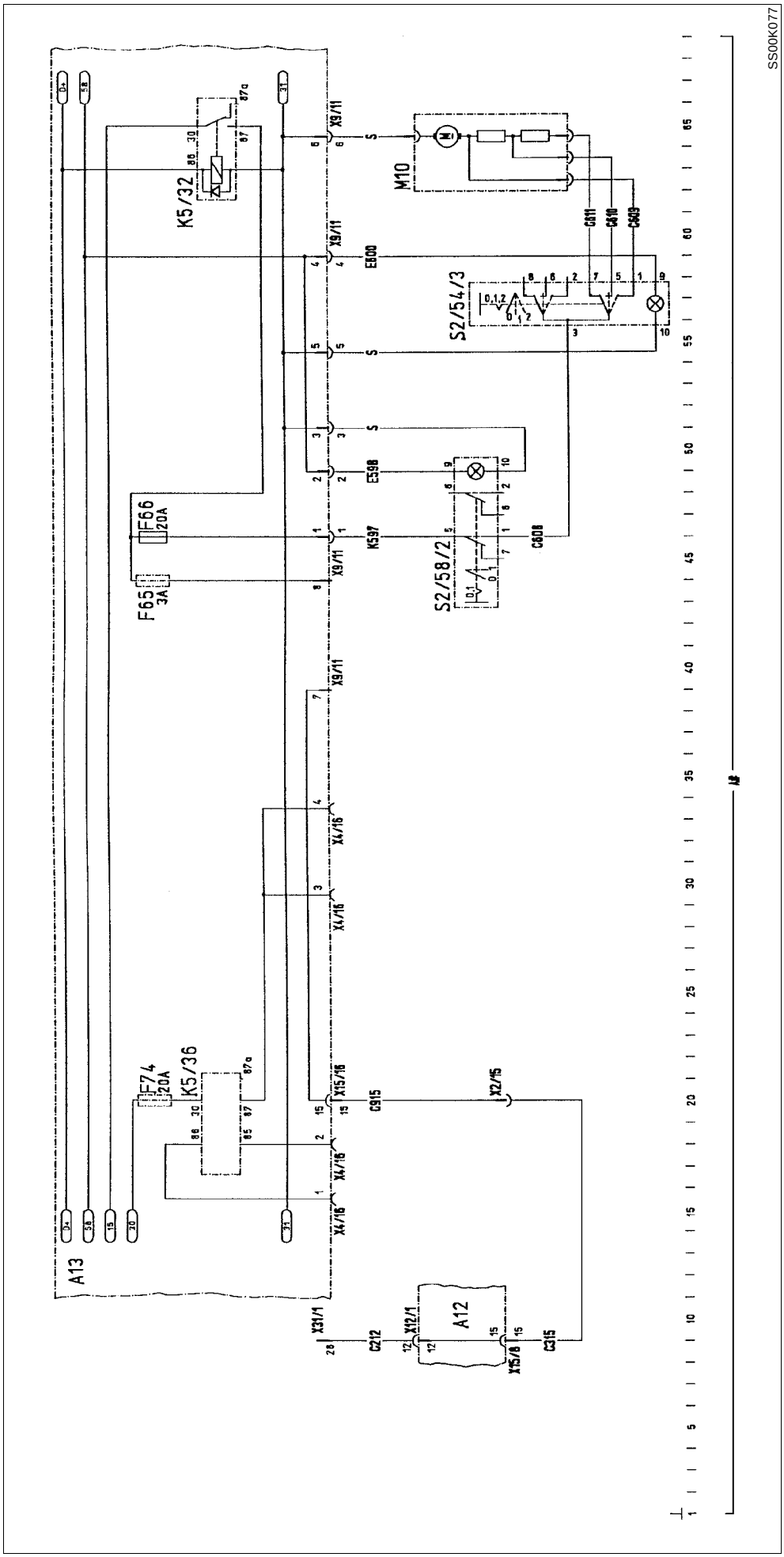
A#	Air-conditioning high-top Steyr from veh. no. 03448 Case from DBD0007418
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Page 21.1

Electrical equipment

A12	Central print
A13	Roof print
F65	Fuse, air conditioning
F66	Fuse, air conditioning, blower motor
F74	Fuse, air-conditioning fan
K5/32	Relay, roof blower motor
K5/36	Relay, air conditioning fan
M10	Air-conditioning blower motor
S2/54/3	Step switch, blower motor
S2/58/2	Switch, blower motor
X2/15	Plug-in connection, air-conditioning, roof
X4/16	Plug-in connection, air-conditioning, roof
X9/11	Plug-in connection, air cond., roof
X12/1	Plug-in connection, instrument cable
X15/8	Plug-in connection, cable, roof supply
X15/16	Plug-in connection, cable, roof supply
X31/1	Plug-in connection, instrument, engine

VERSIONS
to this page
21.1
on page/pages
20.1

Grounding points

Designation of Sections

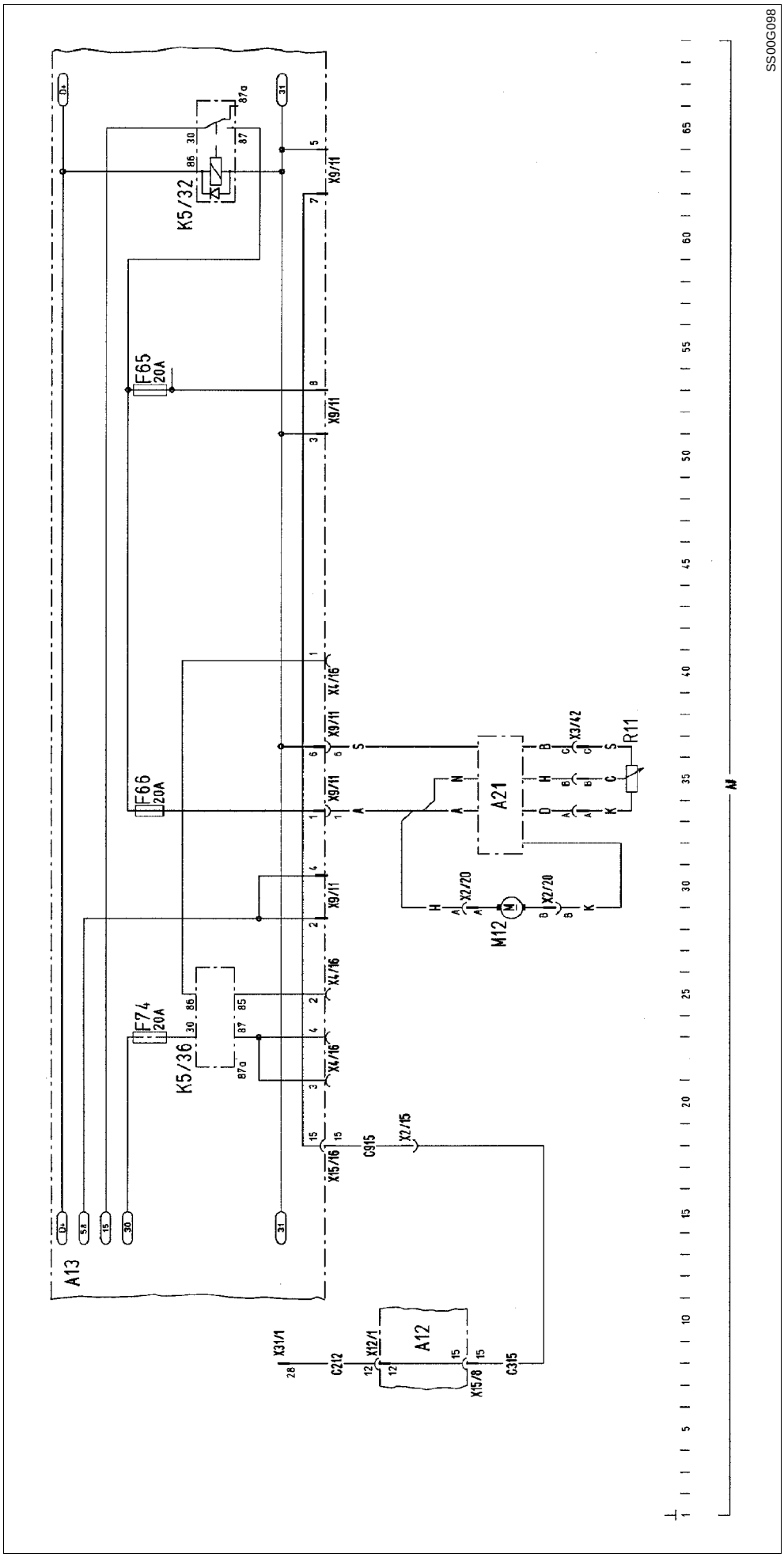
A#	Blower, high-top Steyr up to veh. no. 03447 Case up to DBD0007417
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
A13	Roof print
A21	Blower motor control
F65	Fuse, air conditioning
F66	Fuse, air conditioning, blower motor
F74	Fuse, air-conditioning fan
K5/32	Relay, roof blower motor
K5/36	Relay, air conditioning fan
M12	Air-conditioning blower motor
R11	Roof blower motor potentiometer
X2/15	Plug-in connection, air-conditioning, roof
X2/20	Plug-in connection, roof blower
X3/42	Plug-in connection, blower potentiometer
X4/16	Plug-in connection, air-conditioning, roof
X9/11	Plug-in connection, air cond., roof
X12/1	Plug-in connection, instrument cable
X15/8	Plug-in connection, cable, roof supply
X15/16	Plug-in connection, cable, roof supply
X31/1	Plug-in connection, instrument, engine

VERSIONS
to this page
21.2
on page/pages
20.2

Grounding points

Designation of Sections

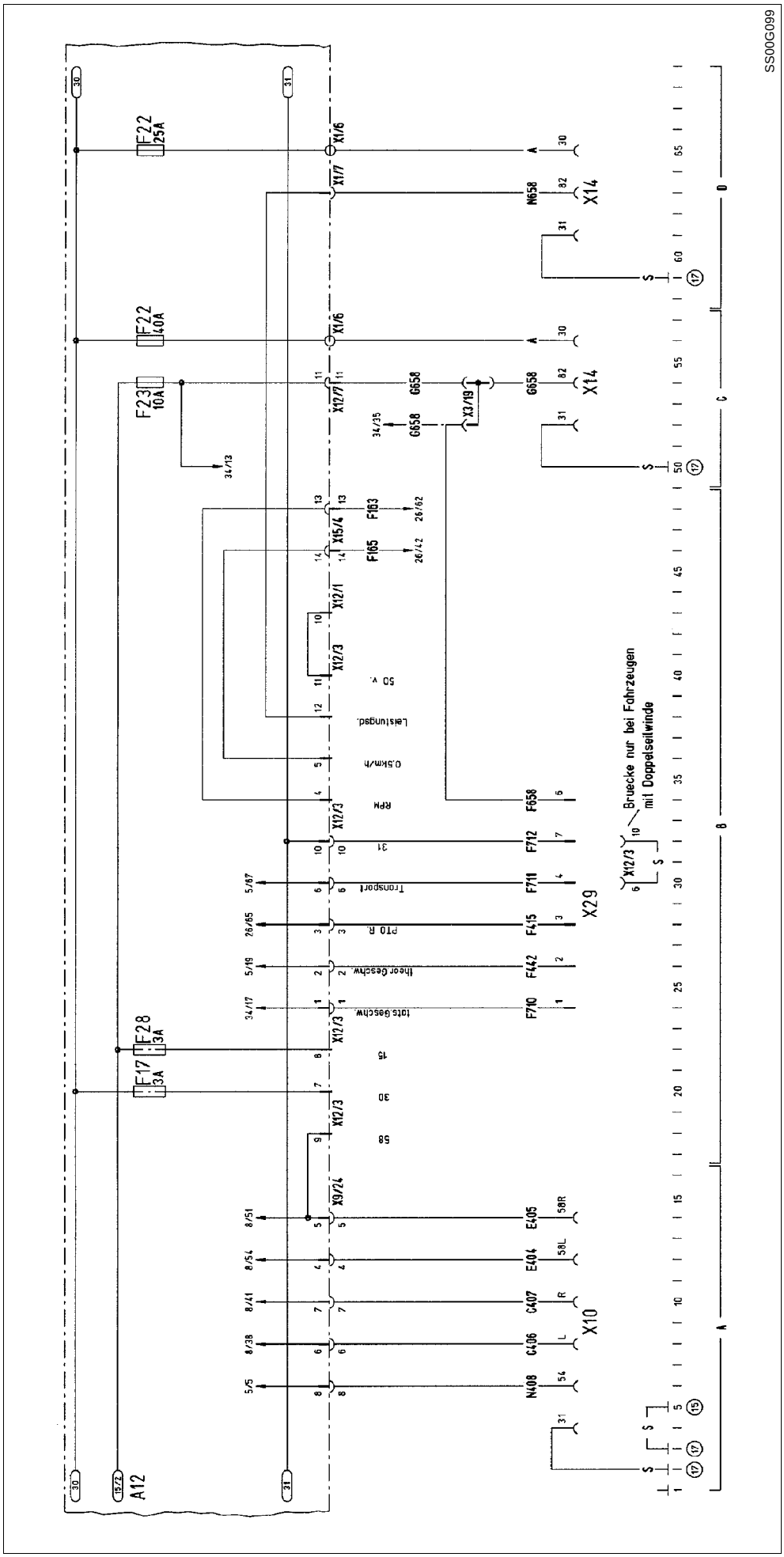
A#	Blower, high-top Steyr from veh. no. 03448 Case from DBD0007418
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
F17	Fuse, potential 30 Spare for on-board computer
F22	Fuse, power socket
F23	Fuse, potential 15, socket
F28	Fuse, potential 30 Spare for on-board computer
X1/6	Screw, power socket
X1/7	Plug-in connection, power socket
X3/19	Distributor, potential 15, socket
X9/24	Plug-in connection, cable, chassis, left
X10	Trailer socket, 7-pole
X12/1	Plug-in connection, instrument cable
X12/3	Spare plug-in connection
X12/7	Plug-in connection, cable, chassis, right
X14	Power socket
X15/4	Plug-in connection, instrument cable
X29	Standard signal socket

Grounding points

15	Socket console
17	Rear mudguard

Designation of Sections

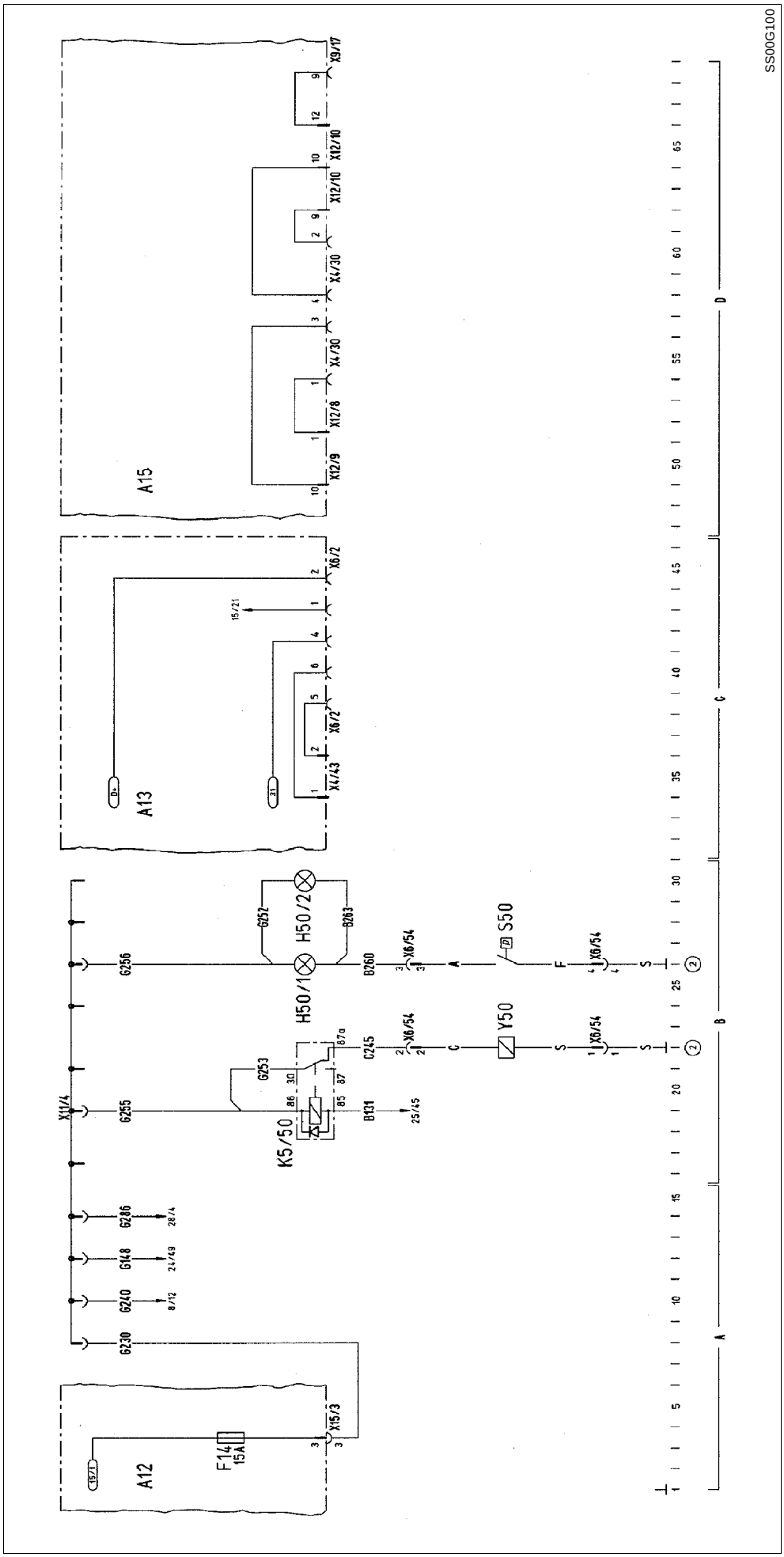
A	Trailer socket
B	Standard signal socket, for MHR or for on-board computer preparation
C	Power socket, 40A Steyr from veh. no. 03266 Case from DBD0008249
D	Power socket, 25A Steyr up to veh. no. 03265 Case up to DBD0008248

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
A13	Roof print
A15	EHR print
F14	Fuse, potential 15/1
H50/1	Trailer brake indicator lamp
H50/2	Trailer brake indicator lamp
K5/50	Relay, trailer brake valve
S50	Switch, trailer brake valve
X4/30	Spare plug-in connection
X4/43	Plug-in connection, number plate lighting
X6/2	Plug-in connection, roof frame
X6/54	Plug-in connection, trailer brake valve
X9/17	Plug-in connection, cable, chassis, left
X11/4	Distributor, instrument, potential 15/1
X12/8	Plug-in connection, EHR box cable
X12/9	Plug-in connection, EHR box cable
X12/10	Plug-in connection, EHR box cable
X15/3	Plug-in connection, instrument cable
Y50	Trailer brake solenoid valve

Grounding points

2	Instrument panel

Designation of Sections

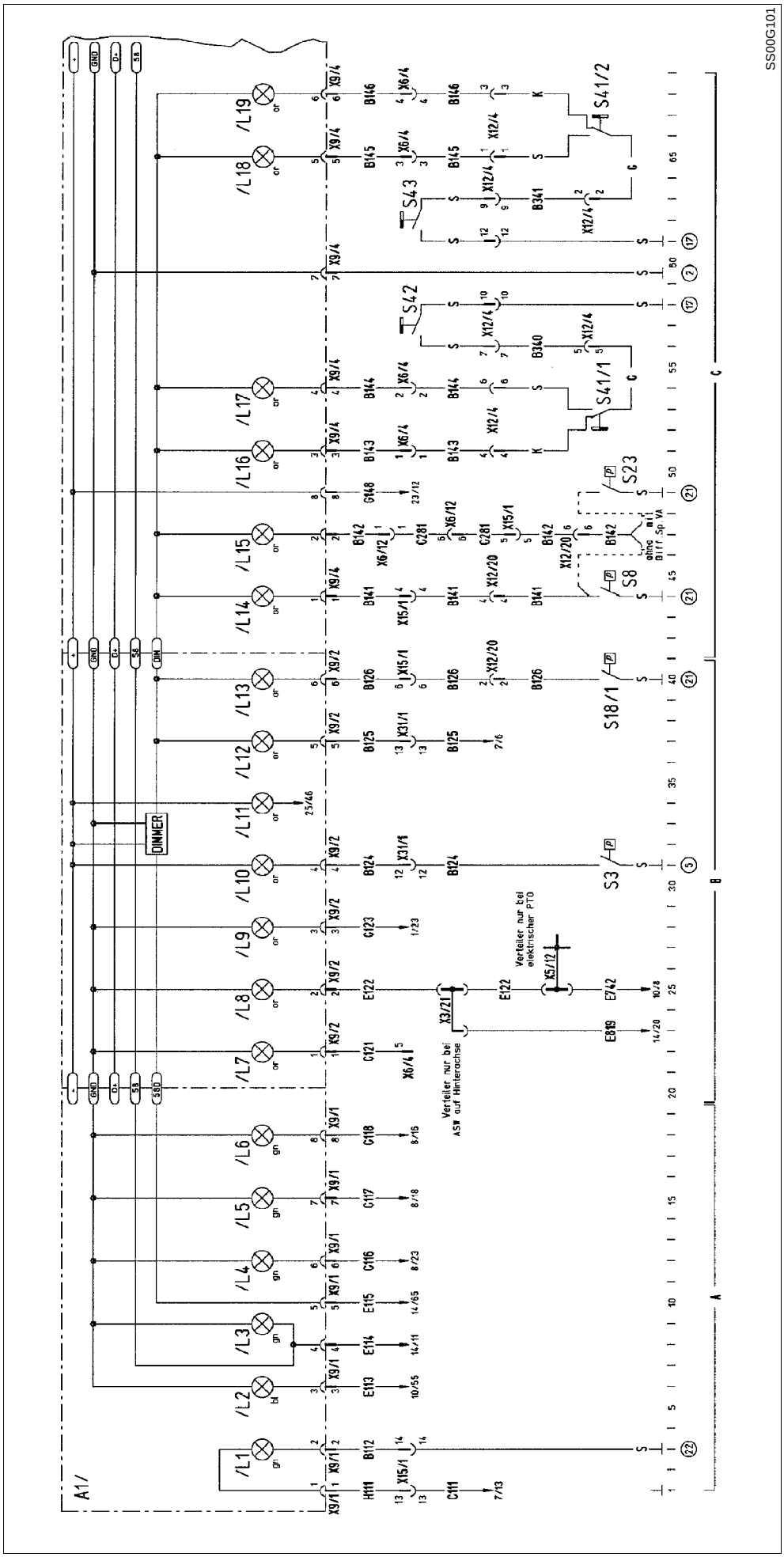
A	Supply, potential 15/1 Instrument panel
B	Trailer brake (Italy)
C	Reserve roof print (high-top)
D	Reserve print, EHR, left

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

/L1	Indicator lamp, power-shift
/L2	Indicator lamp, main beam
/L3	Indicator lamp, lighting
/L4	Indicator lamp, trafficator
/L5	Indicator lamp, trafficator, 1st trailer
/L6	Indicator lamp, trafficator, 2nd trailer
/L7	Indicator lamp, reserve
/L8	Indicator lamp, searchlight
/L9	Indicator lamp, pre-glowing
/L10	Indicator lamp, air filter
/L11	Indicator lamp, tank reserve
/L12	Indicator lamp, fuel filter heating
/L13	Indicator lamp, 4-wheel drive
/L14	Indicator lamp, rear differential lock
/L15	Indicator lamp, front differential lock
/L16	Indicator lamp, PTO shaft 430
/L17	Indicator lamp, PTO shaft 540
/L18	Indicator lamp, PTO shaft 540E
/L19	Indicator lamp, PTO shaft 1000
A1	Combination instrument
S3	Air filter control switch
S8	Control switch, rear differential lock
S18/1	Control switch, 4-wheel drive
S23	Control switch, front differential lock
S41/1	Control switch, PTO shaft 430 / 540
S41/2	Control switch, PTO shaft 540E / 1000
S42	Control switch, PTO shaft 540
S43	Control switch, PTO shaft 1000
X3/21	Distributor, searchlight, rear axle
X5/12	Distributor, instrument cable
X6/4	Plug-in connection, instrument, chassis, right
X6/12	Plug-in connection, heating switch
X9/1	Plug-in connection, instrument cable
X9/2	Plug-in connection, instrument cable
X9/4	Plug-in connection, instrument cable
X12/4	Plug-in connection, chassis right, PTO shaft indicator
X12/20	Plug-in connection, chassis right, transmission
X15/1	Plug-in connection, instrument, chassis, right
X31/1	Plug-in connection, instrument – engine

Grounding points

2	Instrument panel
5	Engine compartment
17	Rear mudguard
21	Console Transmission plug
22	E box console

Designation of Sections

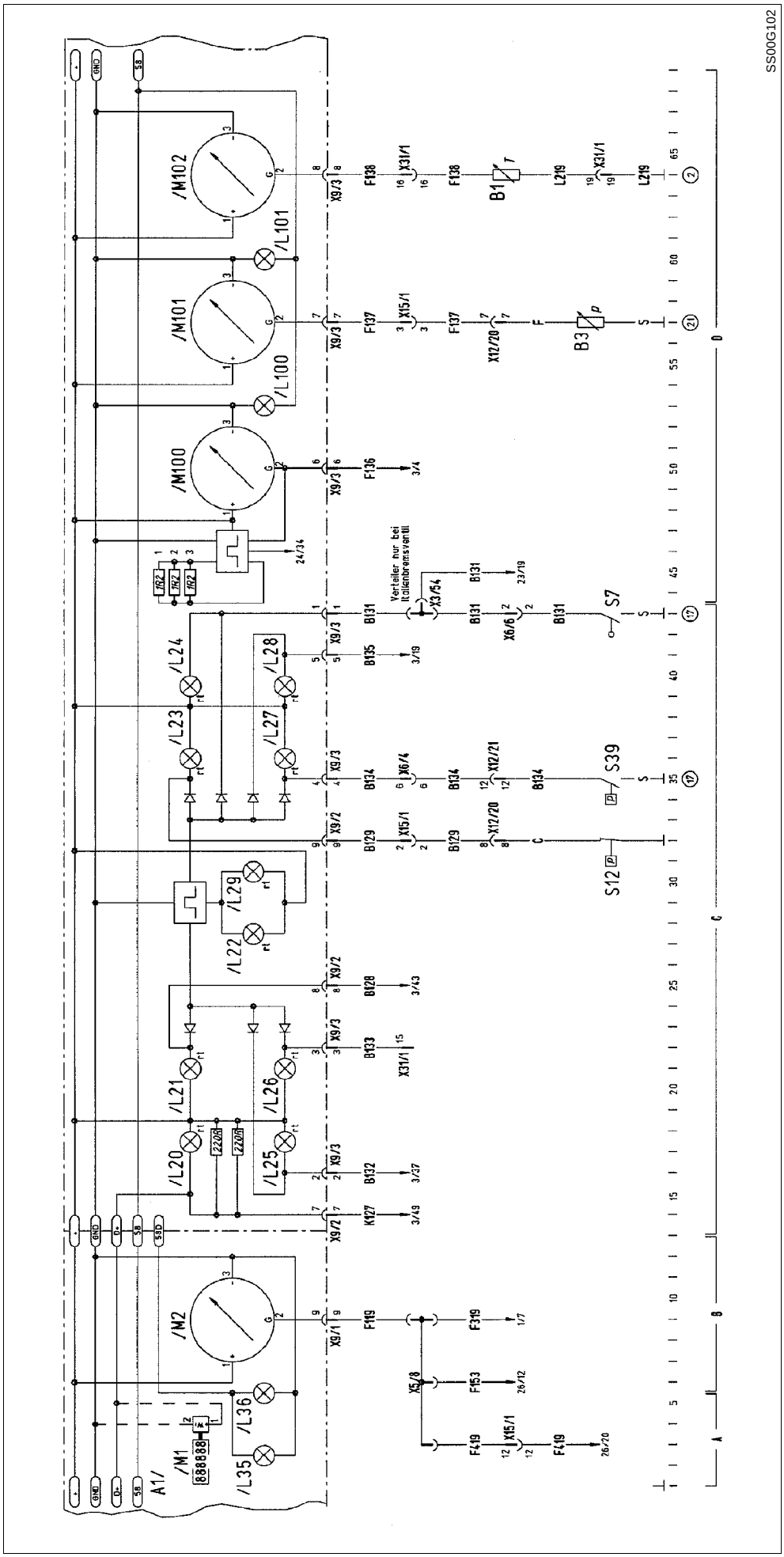
A	Instrument display, left
B	Instrument display, centre
C	Instrument display, right

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

/L20	Indicator lamp, alternator
/L21	Indicator lamp, engine oil pressure
/L22	Indicator lamp, stop
/L23	Indicator lamp, compressed air
/L24	Indicator lamp, parking brake
/L25	Indicator lamp, cooling water temperature
/L26	Indicator lamp, cooling water level display
/L27	Indicator lamp, PTO shaft clutch
/L28	Indicator lamp, stationary operation
/L29	Indicator lamp, stop
/L35	Display lighting
/L36	Display lighting
/L100	Display lighting
/L101	Display lighting
/M1	Operating hours counter
/M2	Rev-counter
/M100	Fuel gauge
/M101	Compressed air gauge
/M102	Water temperature gauge
A1	Combination instrument
B1	Engine temperature transmitter
B3	Compressed air transmitter
S7	Control switch, parking brake
S12	Control switch, compressed air
S39	Control switch, PTO shaft clutch On
X3/54	Distributor, trailer brake valve
X5/8	Distributor, instrument, potential D+
X6/4	Plug-in connection, instrument, chassis, right
X6/6	Plug-in connection, instrument, chassis, left
X9/1	Plug-in connection, instrument cable
X9/2	Plug-in connection, instrument cable
X9/3	Plug-in connection, instrument cable
X12/20	Plug-in connection, chassis right, transmission
X12/21	Plug-in connection, chassis right, transmission
X15/1	Plug-in connection, instrument, chassis, right
X31/1	Plug-in connection, instrument – engine



Grounding points

2	Instrument panel
17	Rear mudguard
21	Console Transmission plug

Designation of Sections

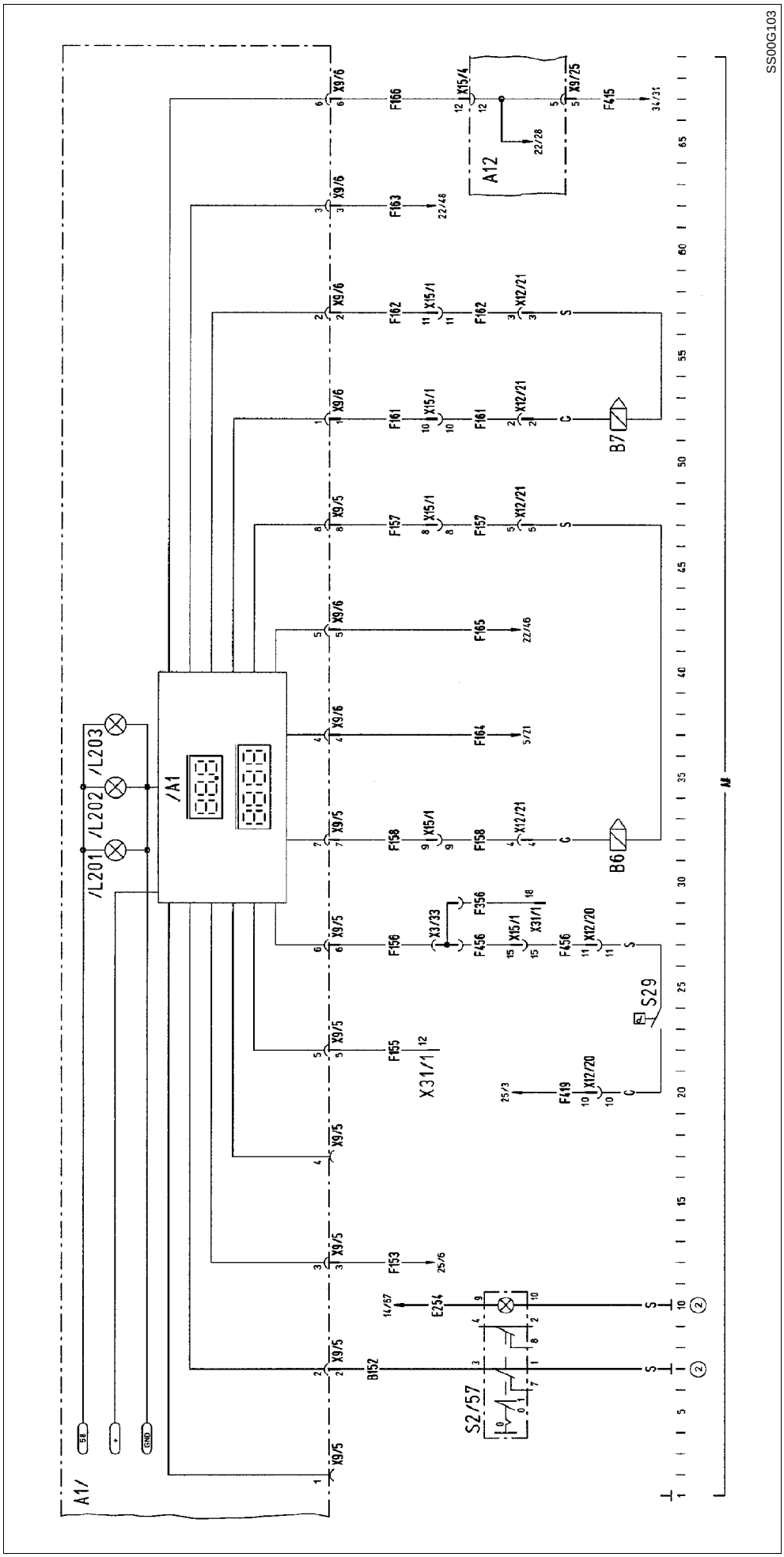
A	Mechanical operating hours counter
B	Instrument left, analogue
C	Instrument, centre, warning display
D	Instrument, centre, analogue

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

/A1	Digital instrument
/L201	Display lighting
/L202	Display lighting
/L203	Display lighting
A1	Combination instrument
A12	Central print
B6	Inductive transmitter, driving speed
B7	Inductive transmitter, PTO shaft speed
S2/57	Switch, digital changeover
S29	Switch, front PTO shaft
X3/33	Distributor, 3-pole, terminal W
X9/5	Plug-in connection, instrument cable
X9/6	Plug-in connection, instrument cable
X9/25	Plug-in connection, chassis, left
X12/20	Plug-in connection, chassis, right, transmission
X12/21	Plug-in connection, chassis, right, transmission
X15/1	Plug-in connection, instrument, chassis, right
X15/4	Plug-in connection, instrument cable
X31/1	Plug-in connection, instrument – engine

VERSIONS
to this page
26
on page/pages
27

Grounding points

2	Instrument panel

Designation of Sections

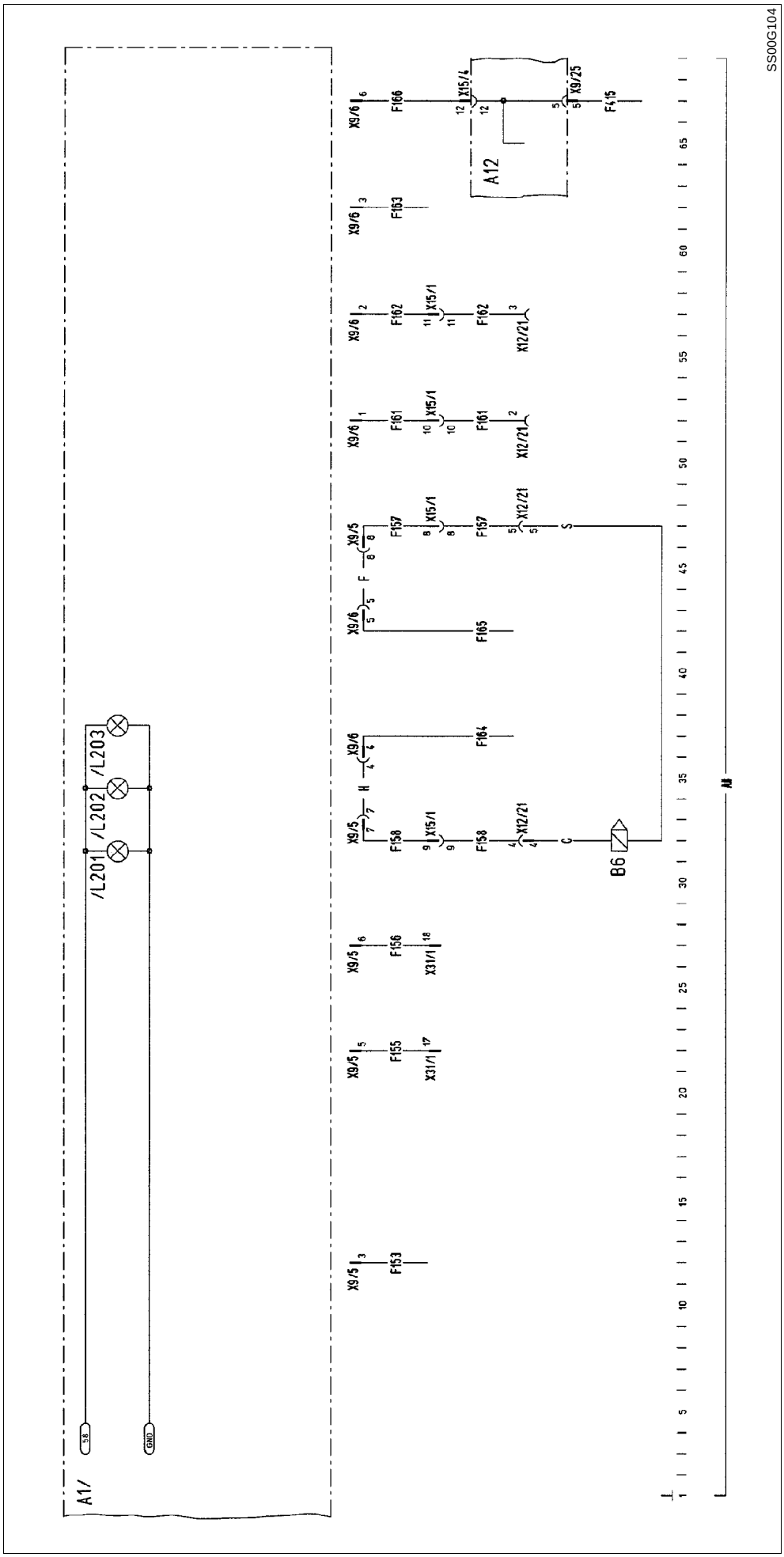
A#	Digital instrument, right
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

/L201	Display lighting
/L202	Display lighting
/L203	Display lighting
A1	Combination instrument
A12	Central print
B6	Inductive transmitter, driving speed
B7	Inductive transmitter, PTO shaft speed
X9/5	Plug-in connection, instrument cable
X9/6	Plug-in connection, instrument cable
X9/25	Plug-in connection, cable, chassis, left
X12/21	Plug-in connection, chassis, right, transmission
X15/1	Plug-in connection, instrument, chassis, right
X15/4	Plug-in connection, instrument cable
X31/1	Plug-in connection, instrument – engine

VERSIONS
to this page
27
on page/pages
26

Grounding points

Designation of Sections

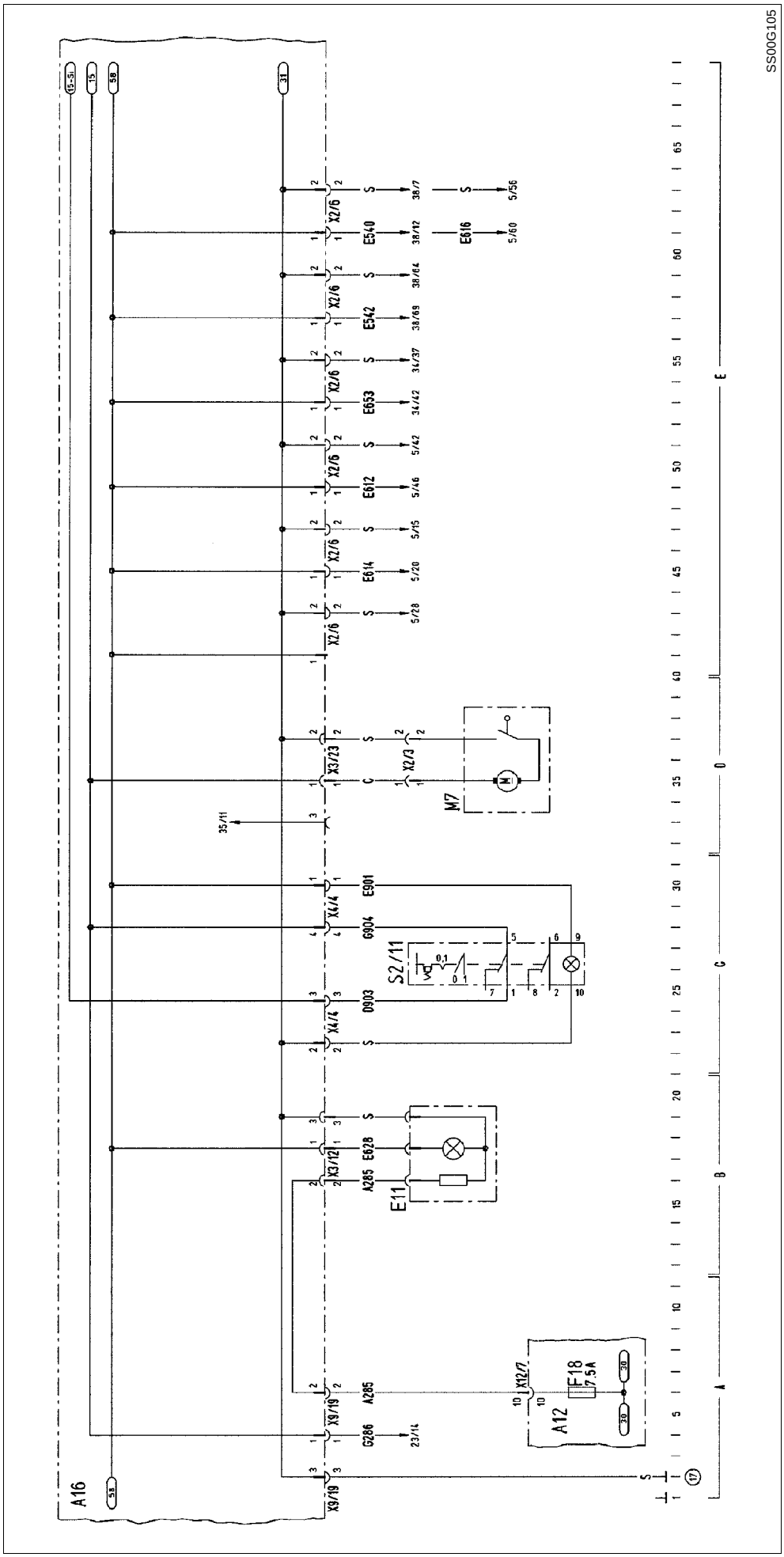
A#	Right instrument panel (without digital)
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
A16	EHR print, operating console
E11	Cigarette lighter
F18	Fuse, cigarette lighter
M7	Compressed air seat motor
S2/11	Safety switch
X2/3	Plug-in connection, air sprung seat
X2/6	Plug-in connection, switch lighting
X3/12	Plug-in connection, cigarette lighter
X3/23	Plug-in connection, air-sprung seat
X4/4	Plug-in connection, safety switch
X9/19	Plug-in connection, cable, chassis, right
X12/7	Plug-in connection, cable, chassis, right

Grounding points

17 Rear mudguard

Designation of Sections

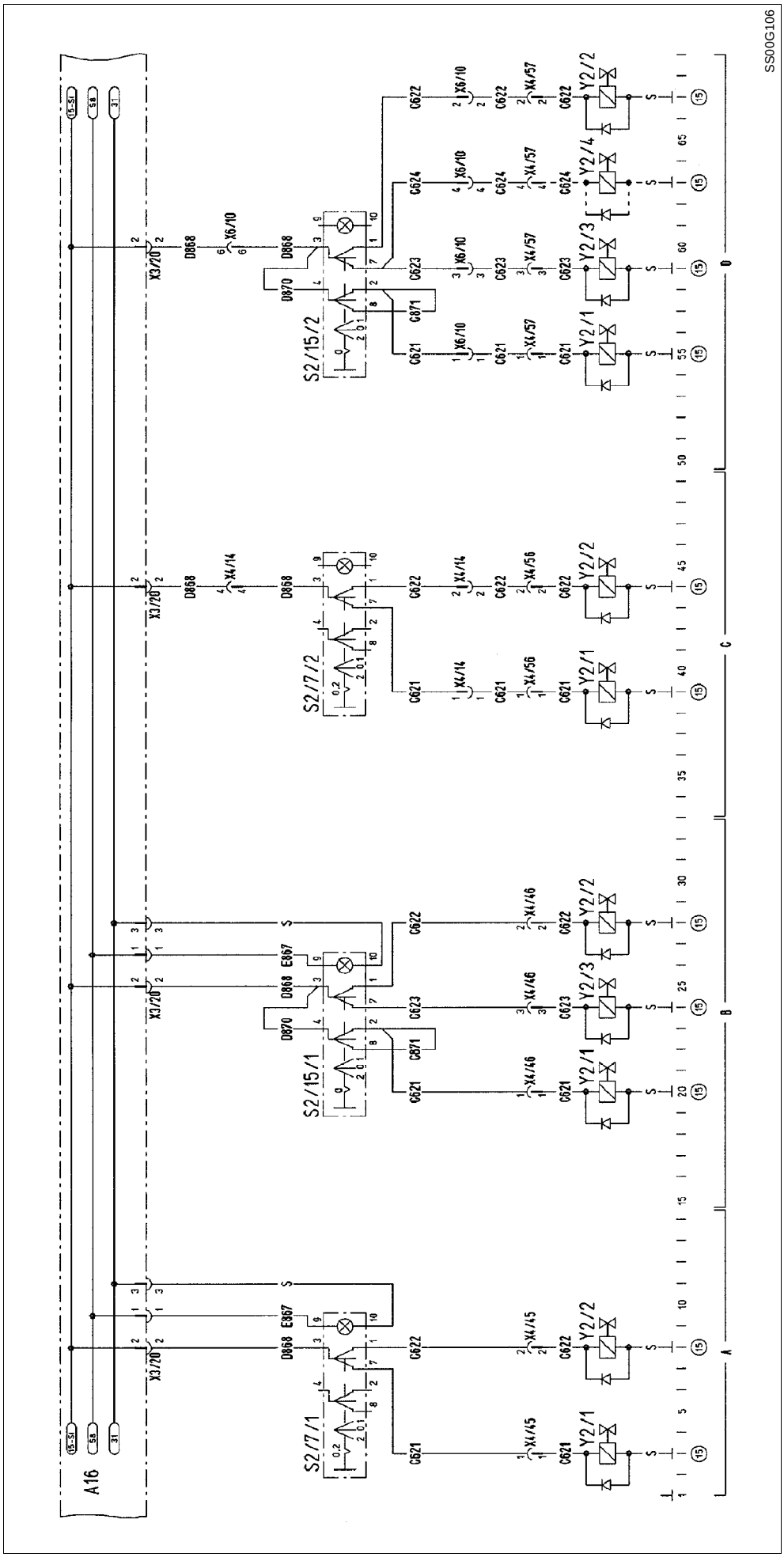
A	Supply, EHR operating console
B	Cigarette lighter
C	Safety switch
D	Air-sprung seat
E	Supply, potential 58 for various switches

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

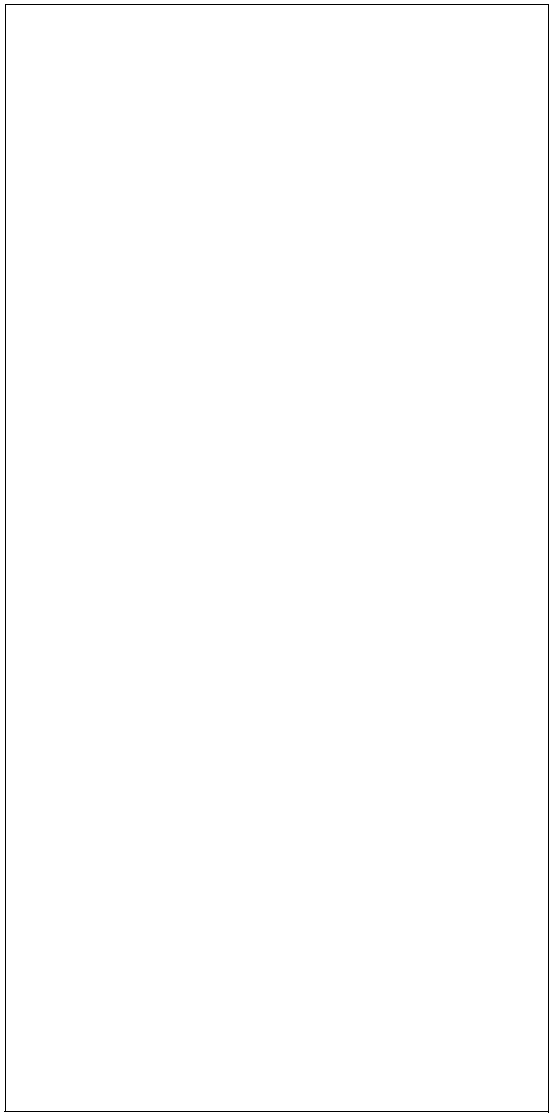
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Electrical equipment

A16	EHR print, operating console
S2/7/1	Rocker switch, auxiliary control unit, single-action
S2/7/2	2nd multi-function lever, single-action
S2/15/1	Rocker switch, auxiliary control unit, double-action
S2/15/2	2nd multi-function lever, double-action
X3/20	Plug-in conection, supply
X4/14	Plug-in connection, 2nd multi-function lever, single-action
X4/45	Plug-in connection, auxiliary control unit, single-action, rocker switch
X4/46	Plug-in connection, auxiliary control unit, double-action, rocker switch
X4/56	Plug-in connection, 2nd multi-function lever, single-action
X4/57	Plug-in connection, 2nd multi-function lever, double-action
X6/10	Plug-in connection, 2nd multi-function lever, double-action
Y2/1	Solenoid valve, control unit
Y2/2	Solenoid valve, control unit
Y2/3	Solenoid valve, control unit
Y2/4	Solenoid valve, interlock block



Grounding points

15	Socket console

Designation of Sections

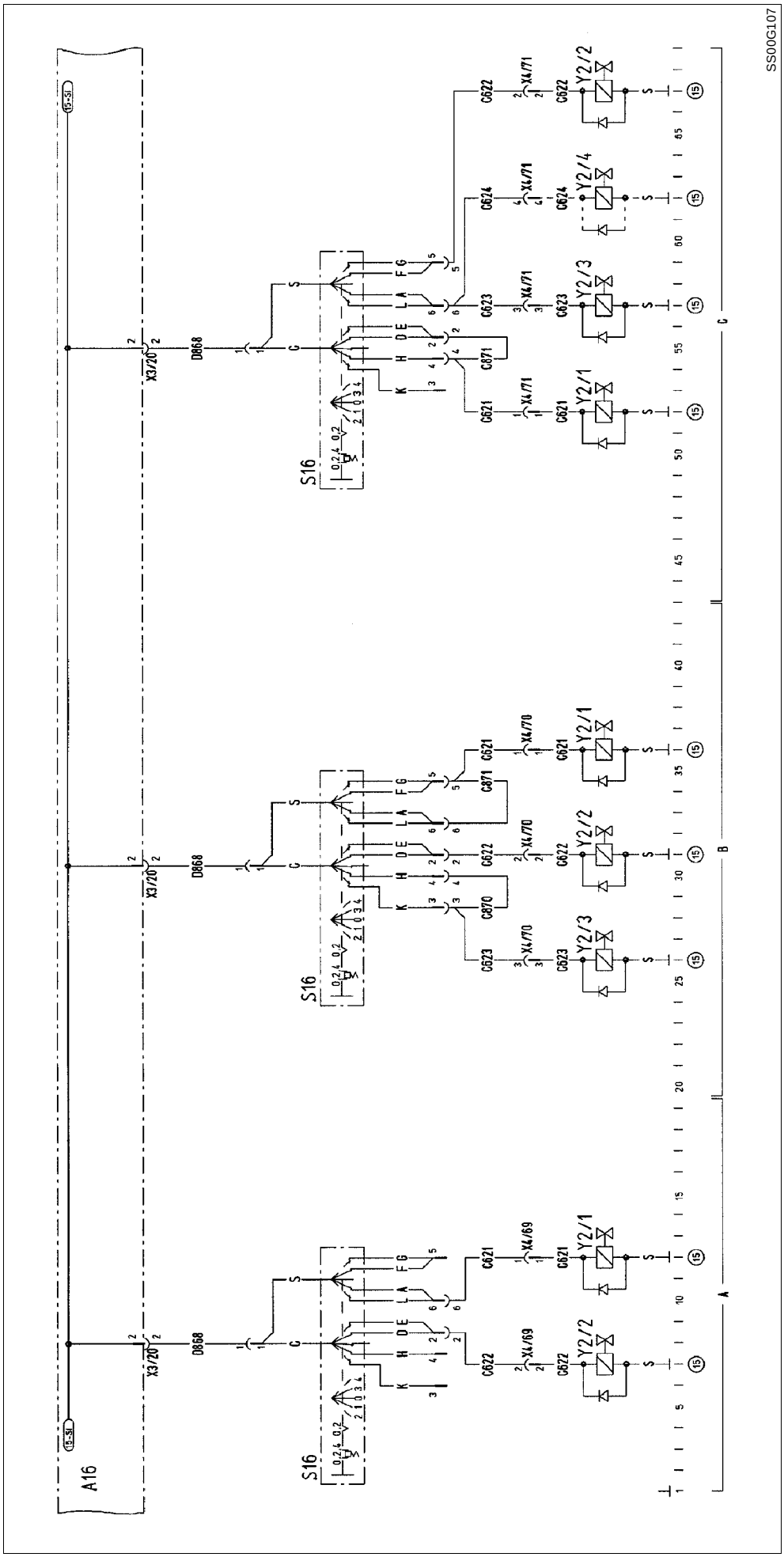
A	Single-action auxiliary control unit with rocker switch
B	Double-action auxiliary control unit with rocker switch
C	Single-action auxiliary control unit with 2nd multi-function lever
D	Double-action auxiliary control unit (with locking block) with 2nd multi-function lever

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A16	EHR print, operating console
S16	Lever switch, auxiliary control unit
X3/20	Plug-in conection, supply
X4/69	Plug-in connection, auxiliary control unit, single-action, lever switch
X4/70	Plug-in connection, auxiliary control unit, double-action, lever switch
X4/71	Plug-in connection, auxiliary control unit, double-action with locking block , lever switch
Y2/1	Solenoid valve, control unit
Y2/2	Solenoid valve, control unit
Y2/3	Solenoid valve, control unit
Y2/4	Solenoid valve, interlock block

Grounding points

15	Socket console

Designation of Sections

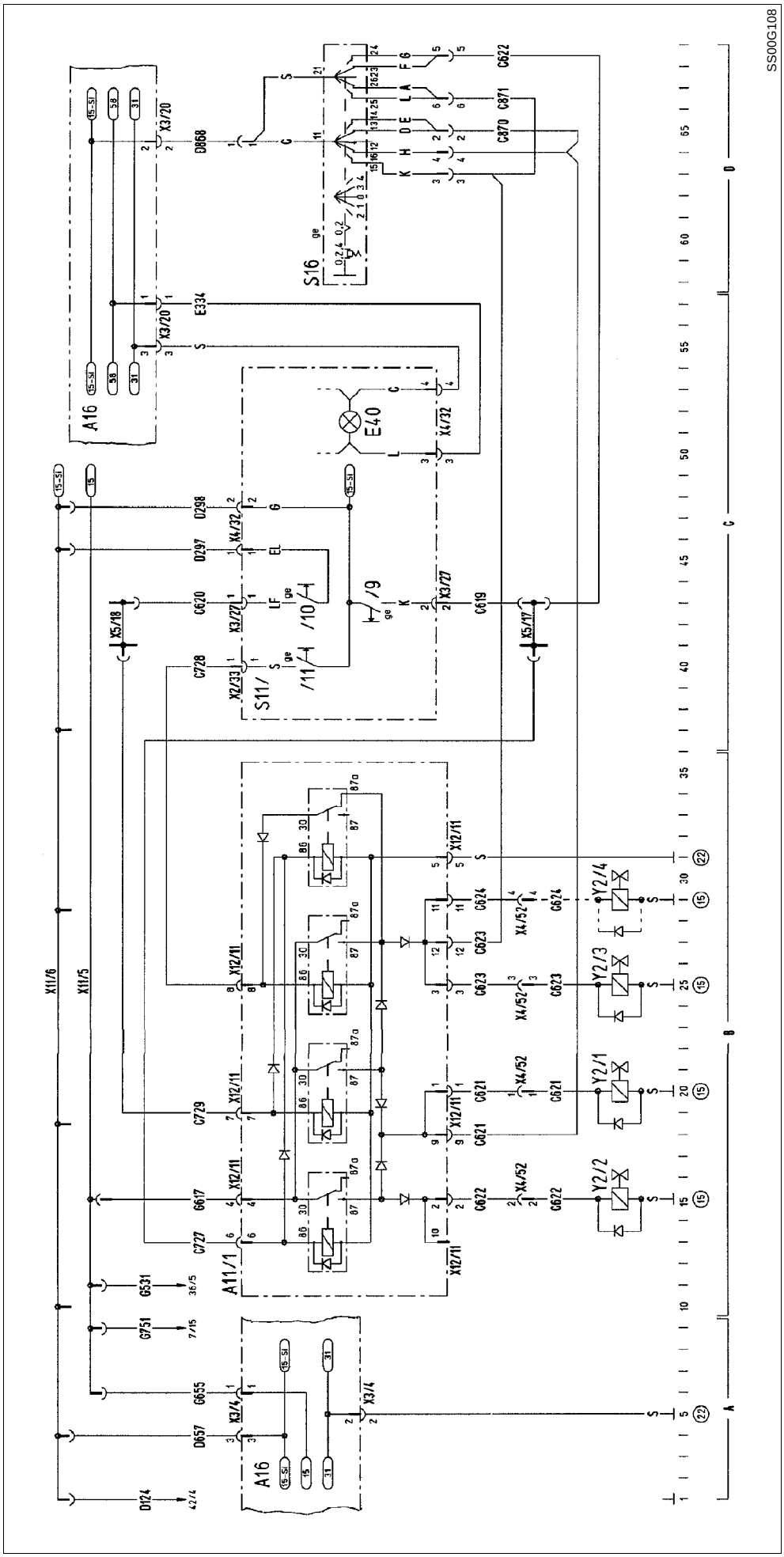
A	Single-action auxiliary control unit with lever switch
B	Double-action auxiliary control unit with lever switch
C	Double-action auxiliary control unit (with locking block) with lever switch

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

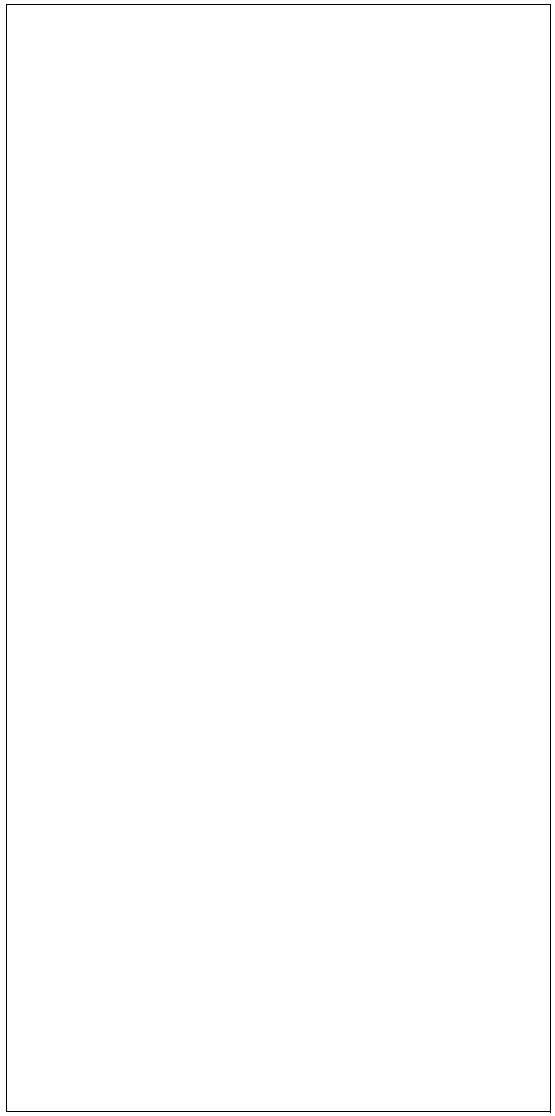
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Electrical equipment

/9	Switch, aux. control unit, yellow, Raise
/10	Switch, aux. control unit, yellow, Lower
/11	Switch, aux. control unit, yellow, floating position
A11/1	'E' box, Multicontroller, joystick
A16	EHR print, operating console
E40	Multi-Controller lighting
S11/	Multi-Controller
S16	Lever switch, auxiliary control unit
X2/33	Plug-in connection, aux. control unit, Multi-Controller
X3/4	Plug-in connection, 'E' box supply
X3/20	Plug-in conection, supply
X3/27	Plug-in connection, 2nd aux. control unit, Multi-Controller
X4/32	Plug-in connection, chassis, right – Multi-Controller
X4/52	Plug-in connection, Multicontroller – solenoid valve, aux. control unit
X5/17	Distributor, control unit, RAISE
X5/18	Distributor, control unit, LOWER
X11/5	Distributor console, potential 15
X11/6	Distributor console, potential 15Si
X4/11	Plug-in connection, Multicontroller – joystick
Y2/1	Solenoid valve, control unit
Y2/2	Solenoid valve, control unit
Y2/3	Solenoid valve, control unit
Y2/4	Solenoid valve, interlock block





Grounding points

15	Socket console
22	E box console

Designation of Sections

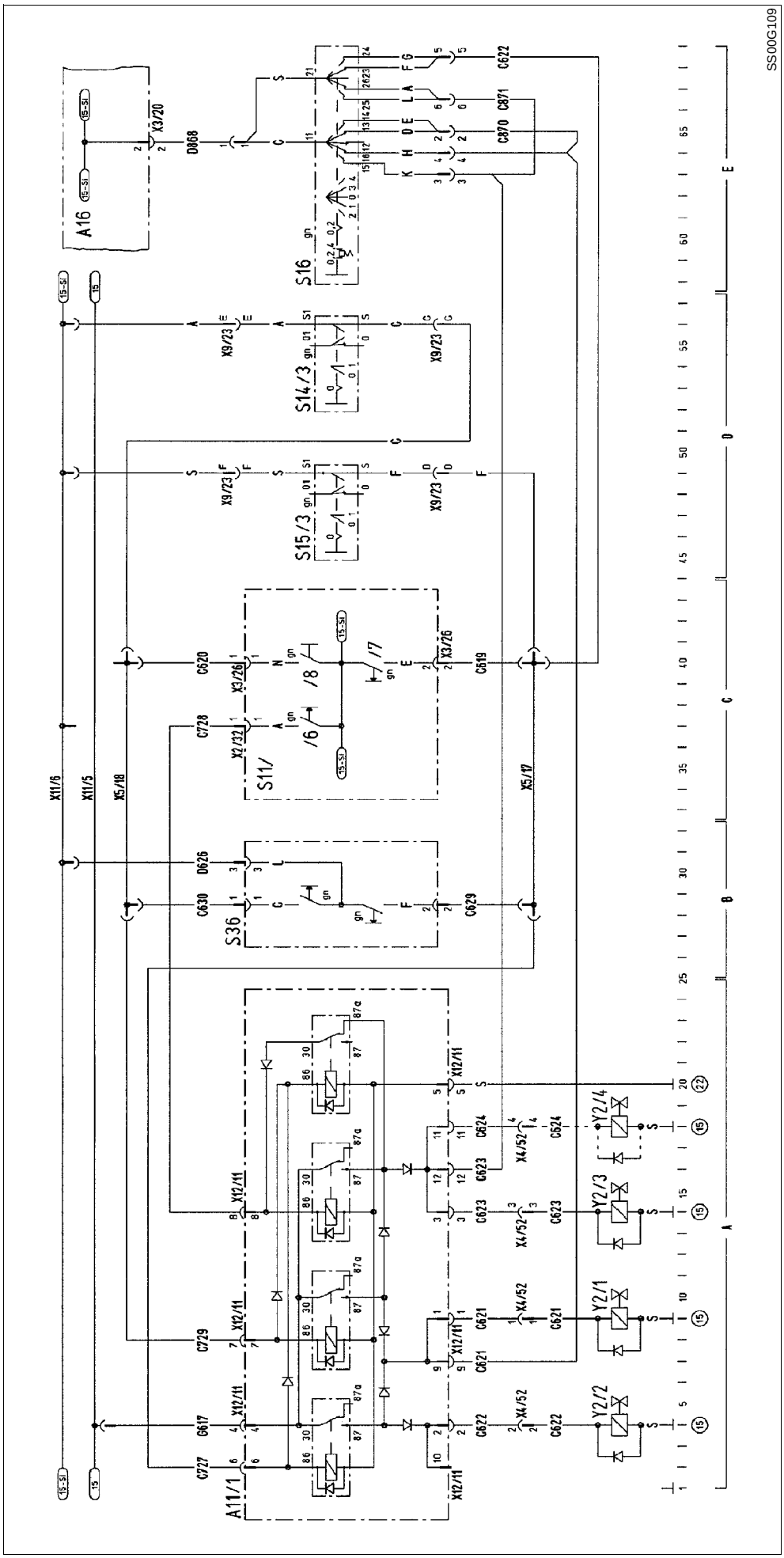
A	Supply, EHR box aux. control unit/PTO shaft
B	2nd double-action auxiliary control unit (with locking block), solenoid valve
C	2nd auxiliary control unit operated by Multi-Controller
C	2nd auxiliary control unit operated by lever switch

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

/6	Switch, 1st auxiliary control unit, green, floating position
/7	Switch, 1st auxiliary control unit, green, Raise
/11	Switch, 1st auxiliary control unit, green, Lower
A11/1	'E' box, Multicontroller, joystick
A16	EHR print, operating console
S11/	Multi-Controller
S14/3	Front lifting gear external pushbutton, Lower
S15/3	Front lifting gear external pushbutton, Raise
S16	Lever switch, auxiliary control unit
S36	Switch, joystick
X2/32	Plug-in connection, aux. control unit, Multi-Controller
X3/20	Plug-in conection, supply
X3/26	Plug-in connection, 1st aux. control unit, Multi-Controller
X4/52	Plug-in connection, Multicontroller – solenoid valve, aux. control unit
X5/17	Distributor, control unit, RAISE
X5/18	Distributor, control unit, LOWER
X9/23	Plug-in connection, external pushbutton, front-end lifting gear
X11/5	Distributor console, potential 15
X11/6	Distributor console, potential 15Si
X4/11	Plug-in connection, Multicontroller – joystick

Y2/1	Solenoid valve, control unit
Y2/2	Solenoid valve, control unit
Y2/3	Solenoid valve, control unit
Y2/4	Solenoid valve, interlock block

Grounding points

15	Socket console
22	E box console

Designation of Sections

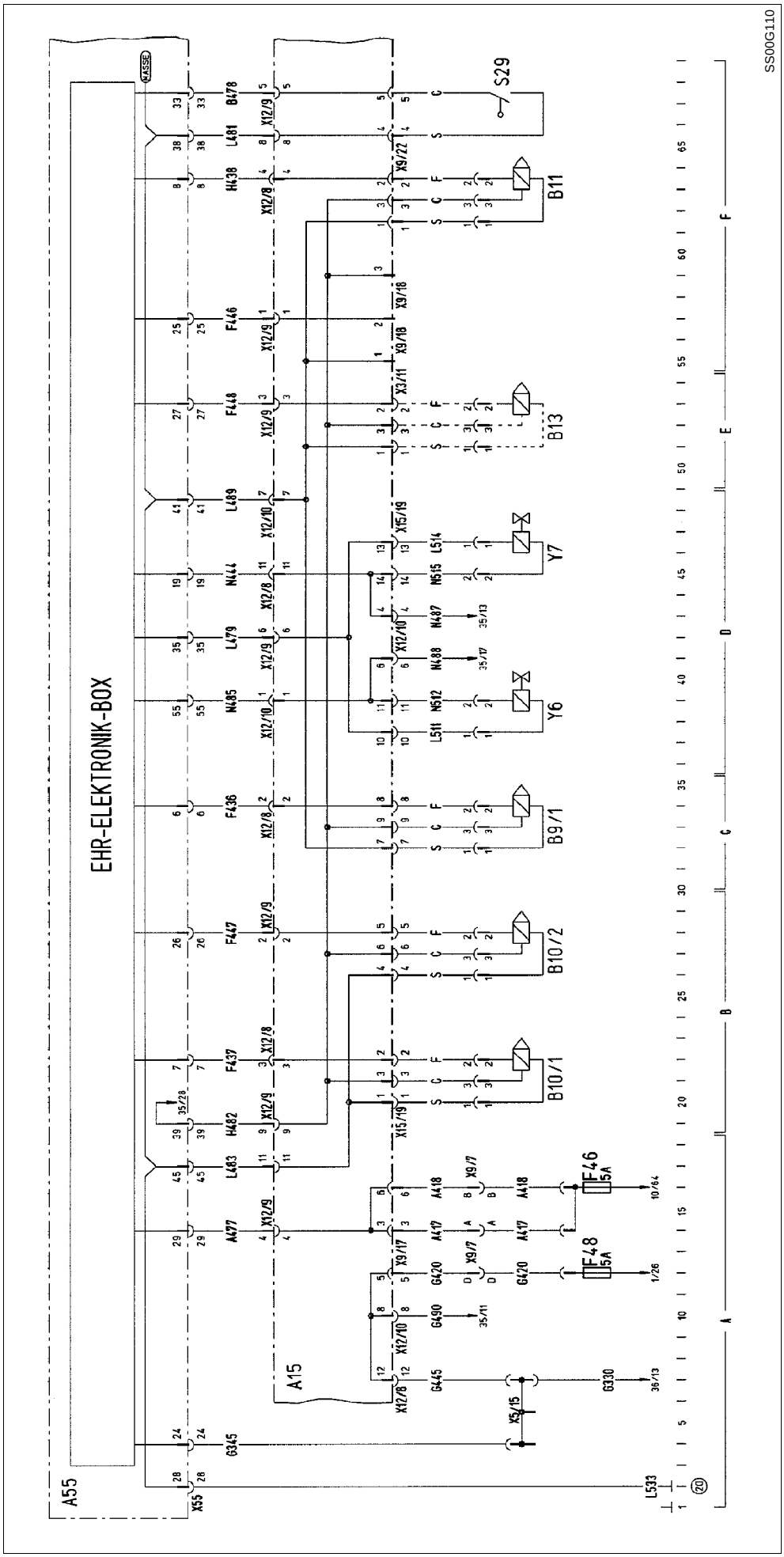
A	Solenoid valve, 1st auxiliary control unit (with locking block)
B	Operation of the 1st auxiliary control unit with joystick
C	Operation of the 1st auxiliary control unit with Multicontroller
D	Operation of the 1st auxiliary control unit Front lifting gear with external pushbutton

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A15	Print, EHR, left
A55	EHR-D control unit
B9/1	EHR position sensor
B10/1	Force measuring bolts, left
B10/2	Force measuring bolts, right
B11	Pressure transmitter, EHR
B13	External transmitter
F46	Fuse, EHR, filter heating
F48	Fuse, potential 15, EHR
S29	Switch, front PTO shaft
X3/11	Plug-in connection, external sensor
X5/15	Distributor, EHR, potential 15
X9/7	Plug-in connection, engine, chassis, left
X9/17	Plug-in connection, chassis, left
X9/18	Plug-in connection, chassis, left
X9/22	Plug-in connection, EHR, lift/pressure
X12/8	Plug-in connection, EHR box cable
X12/9	Plug-in connection, EHR box cable
X12/10	Plug-in connection, EHR box cable
X15/19	Plug-in connection, EHR box cable
X55	Plug-in connection, EHR box cable
Y6	Solenoid valve, EHR, RAISE
Y7	Solenoid valve, EHR, LOWER

Grounding points

20 EHR box

Designation of Sections

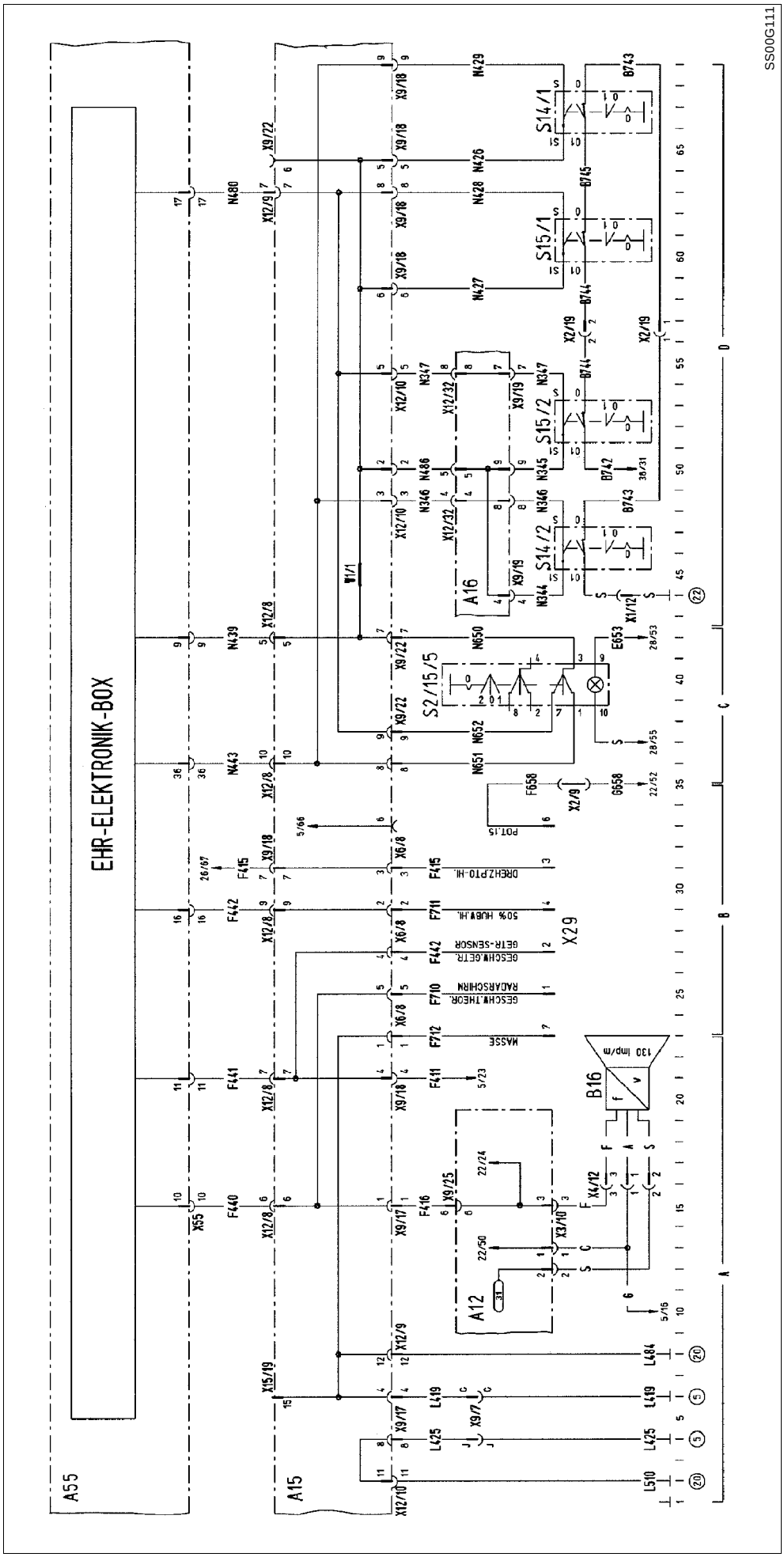
A	Supply, EHR box
B	Force measuring bolt
C	Position sensor
D	EHR RAISE and LOWER solenoid valve
E	External sensor preparation
F	EHR, front control

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
A15	Print, EHR, left
A16	EHR print, operating console
A55	EHR-D control unit
B16	Radar sensor
S2/15/5	Internally operated external pushbutton
S14/1	External pushbutton, Lower, left
S14/2	External pushbutton, Lower, right
S15/1	External pushbutton, Raise, left
S15/2	External pushbutton, Raise, right
W1/1	Contact bridge
X1/12	Plug-in connection, cable, chassis, right
X2/9	Plug-in connection, standard signal socket
X2/19	Plug-in connection, chassis, left, chassis, right
X3/10	Plug-in connection, radar sensor
X4/12	Plug-in connection, radar sensor
X6/8	Plug-in connection, signal socket
X9/7	Plug-in connection, engine, chassis, left
X9/17	Plug-in connection, cable, chassis, left
X9/18	Plug-in connection, cable, chassis, left
X9/19	Plug-in connection, cable, chassis, right
X9/22	Plug-in connection, EHR, lift/pressure
X9/25	Plug-in connection, cable, chassis, left
X12/8	Plug-in connection, EHR box cable
X12/9	Plug-in connection, EHR box cable
X12/10	Plug-in connection, EHR box cable
X12/32	Plug-in connection, EHR box cable
X15/19	Plug-in connection, EHR box cable
X29	Plug-in connection, standard signal socket
X55	Plug-in connection, EHR box cable

Grounding points

5	Engine compartment
20	EHR box
22	E box console

Designation of Sections

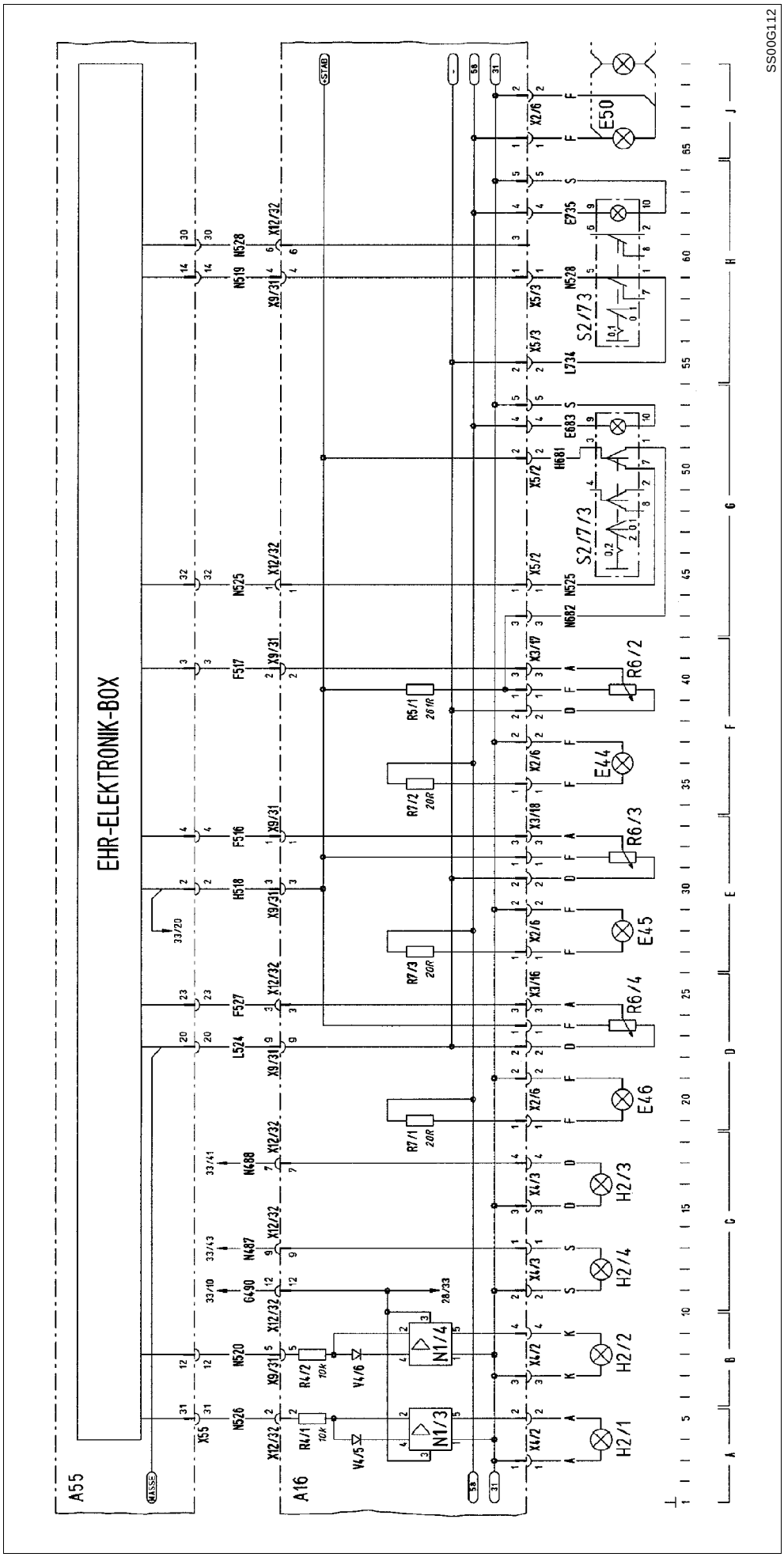
A	Traction control
B	Standard signal socket, for EHR
C	EHR internally actuated external pushbutton
D	EHR external pushbutton

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A16	EHR print, operating console
A55	EHR-D control unit
E46	Lighting, potentiometer, upper limit
E46	Lighting, potentiometer, mixture
E46	Lighting, potentiometer, lowering speed
E50	Lighting, diagnosis front panel
H2/1	Diagnosis display
H2/2	Slip display
H2/3	Raise display
H2/4	Lower display
N1/3	Voltage driver lamp
N1/4	Voltage driver lamp
R4/1	Resistor
R4/2	Resistor
R5/1	Resistor
R6/2	Upper limit potentiometer
R6/3	Mixing potentiometer
R6/4	Lowering speed potentiometer
R7/1	Resistor
R7/2	Resistor
R7/3	Resistor
S2/7/3	Switch, EHR – auxiliary
S2/73	Switch, traction control
V4/5	EHR blocking diode
V4/6	EHR blocking diode
X2/6	Plug-in connection, switch lighting
X3/16	Plug-in connection, potentiometer Upper limit
X3/17	Plug-in connection, potentiometer, mixture
X3/18	Plug-in connection, potentiometer, lowering speed
X4/2	Plug-in connection, diagnosis/slip
X4/3	Plug-in connection RAISE/LOWER
X5/2	Plug-in connection, aux. switch
X5/3	Plug-in connection, ATC switch
X9/31	Plug-in connection, EHR box cable
X12/32	Plug-in connection, EHR box cable
X55	Plug-in connection, EHR box cable

Grounding points

Designation of Sections

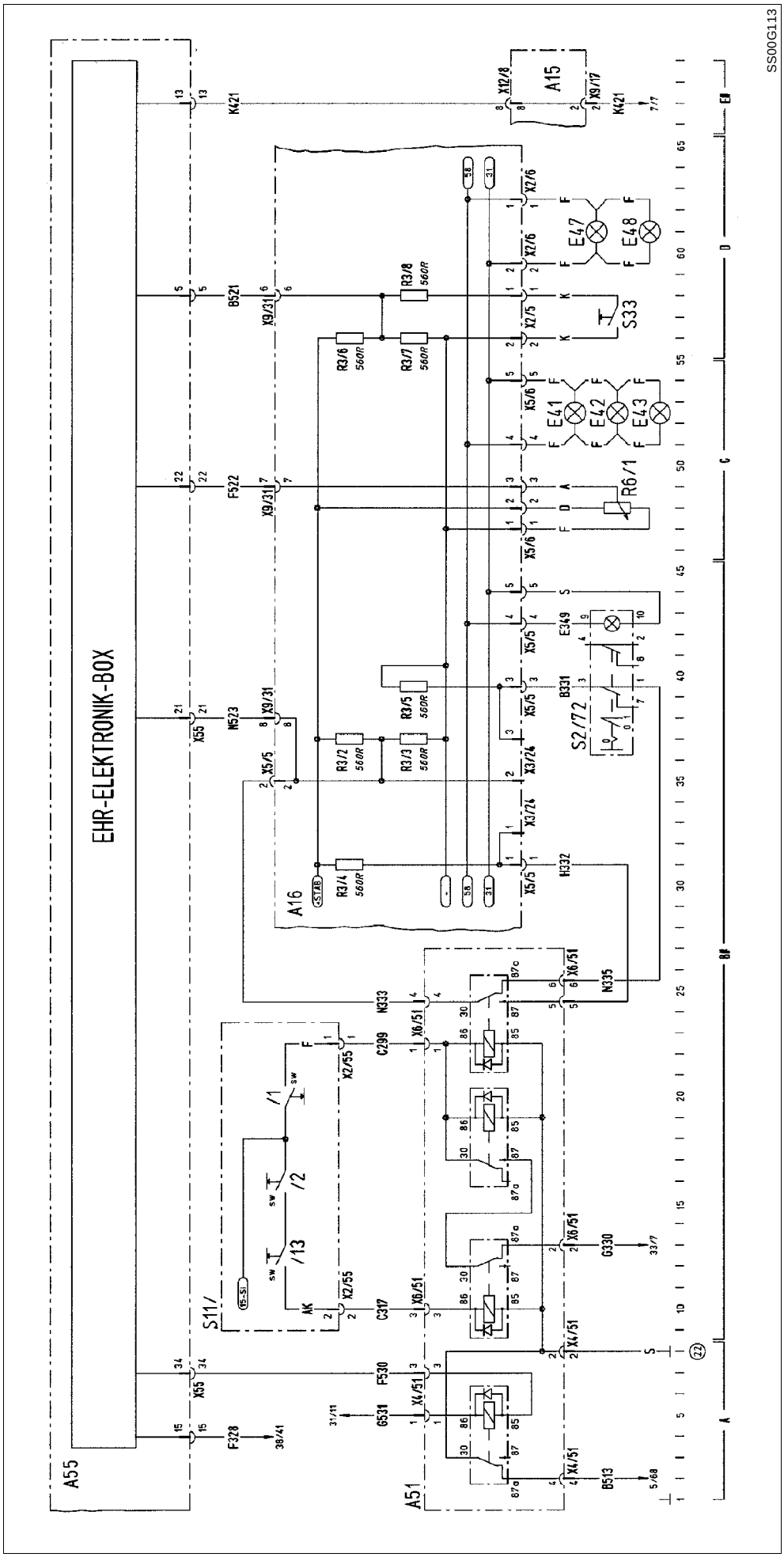
A	EHR diagnostics display
B	EHR – slip display
C	EHR RAISE LOWER display
D	EHR lowering speed
E	EHR mixed control
F	EHR, upper limit
G	EHR auxiliary switch
H	EHR traction control
J	EHR lighting, front panel

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

/1	Switch, EHR lift
/2	Switch, EHR control
/13	Switch, EHR safety
A15	Print, EHR, left
A16	EHR print, operating console
A51	E box, EHR, operation
A55	EHR-D control unit
E41	Setpoint potentiometer lighting
E42	Setpoint potentiometer lighting
E43	Setpoint potentiometer lighting
E47	Stop button lighting
E48	Stop button lighting
R3/2	Resistor
R3/3	Resistor
R3/4	Resistor
R3/5	Resistor
R3/6	Resistor
R3/7	Resistor
R3/8	Resistor
R6/1	Setpoint potentiometer
S2/72	Switch, fast retract
S11/	Multi-Controller
S33	Switch, EHR stop
X2/5	Plug-in connection, EHR stop
X2/6	Plug-in connection, switch lighting
X2/55	Plug-in connection, multi-controller
X3/24	Spare plug-in connection
X4/51	Plug-in connection, EHR box cable
X5/5	Plug-in connection, cable, chassis, right
X5/6	Plug-in connection, EHR setpoint
X6/51	Plug-in connection, multi-controller
X9/17	Plug-in connection, cable, chassis, left
X9/31	Plug-in connection, EHR box cable
X12/8	Plug-in connection, EHR box cable
X55	Plug-in connection, EHR box cable

VERSIONS
to this page
36
on page/pages
37

Grounding points

22	E box console

Designation of Sections

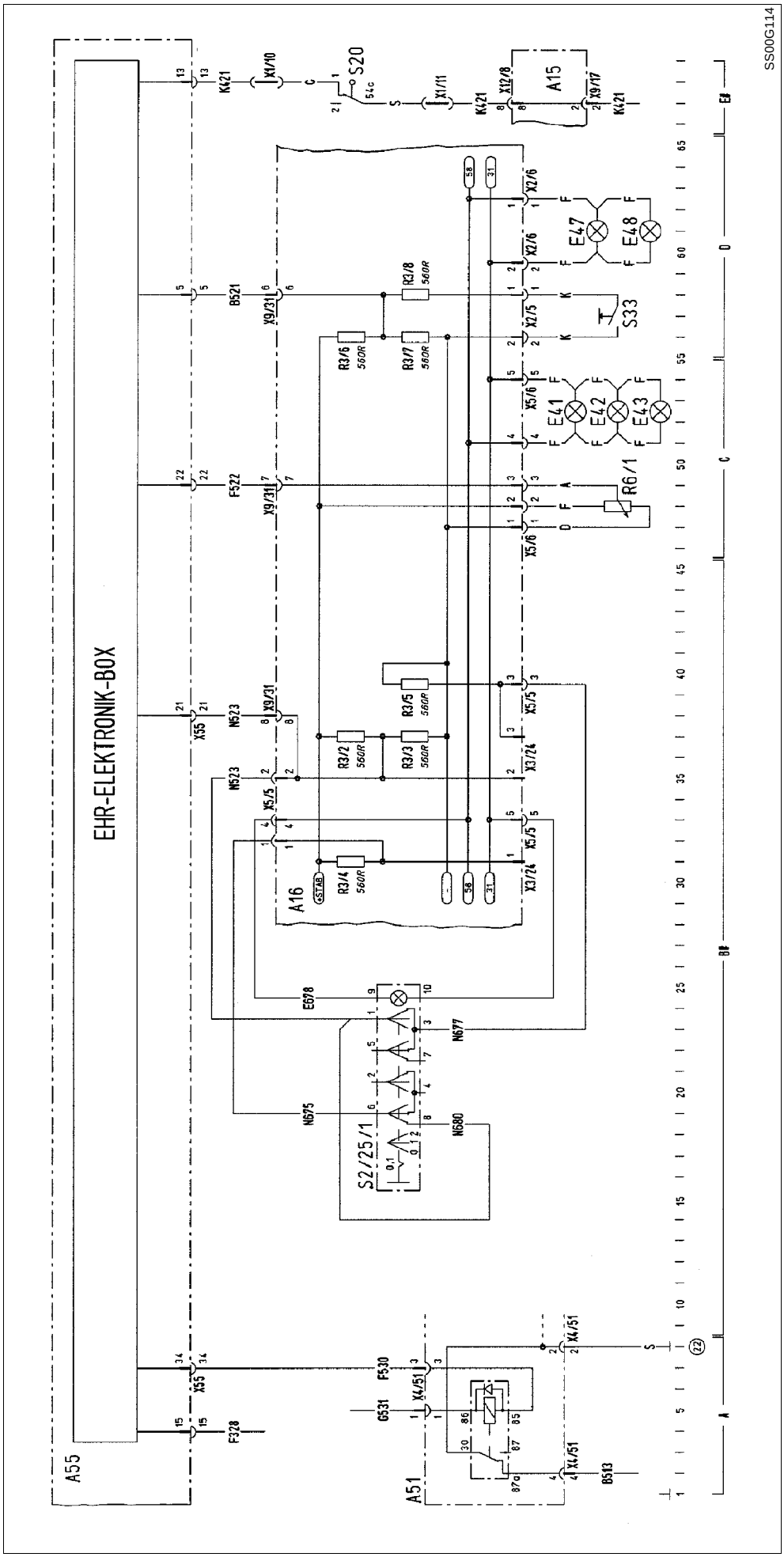
A	EHR transport signal
B#	EHR lift/control on the multi-controller
C	EHR setpoint
D	EHR stop
E#	EHR enable
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A15	Print, EHR, left
A16	EHR print, operating console
A51	E box, EHR, operation
A55	EHR-D control unit
E41	Setpoint potentiometer lighting
E42	Setpoint potentiometer lighting
E43	Setpoint potentiometer lighting
E47	Stop button lighting
E48	Stop button lighting
R3/2	Resistance 560 Ohm
R3/3	Resistance 560 OHM
R3/4	Resistance 560 Ohm
R3/5	Resistance 560 Ohm
R3/6	Resistance 560 Ohm
R3/7	Resistance 560 Ohm
R3/8	Resistance 560 Ohm
R6/1	Setpoint potentiometer
S2/25/1	Switch, EHR lift
S20	Switch, EHR lift/pressure
S33	Switch, EHR stop
X1/10	Plug-in connection, flat, EHR lift/pressure
X1/11	Screw-on connector, central print 30
X2/5	Plug-in connection, EHR stop
X2/6	Plug-in connection, switch lighting
X3/24	Spare plug-in connection
X4/51	Plug-in connection, EHR box cable
X5/5	Plug-in connection, cable, chassis, right
X5/6	Plug-in connection, EHR setpoint
X9/17	Plug-in connection, cable, chassis, left
X9/31	Plug-in connection, EHR box cable
X12/8	Plug-in connection, EHR box cable
X55	Plug-in connection, EHR box cable

VERSIONS
to this page
37
on page/pages
36

Grounding points

22 E box console

Designation of Sections

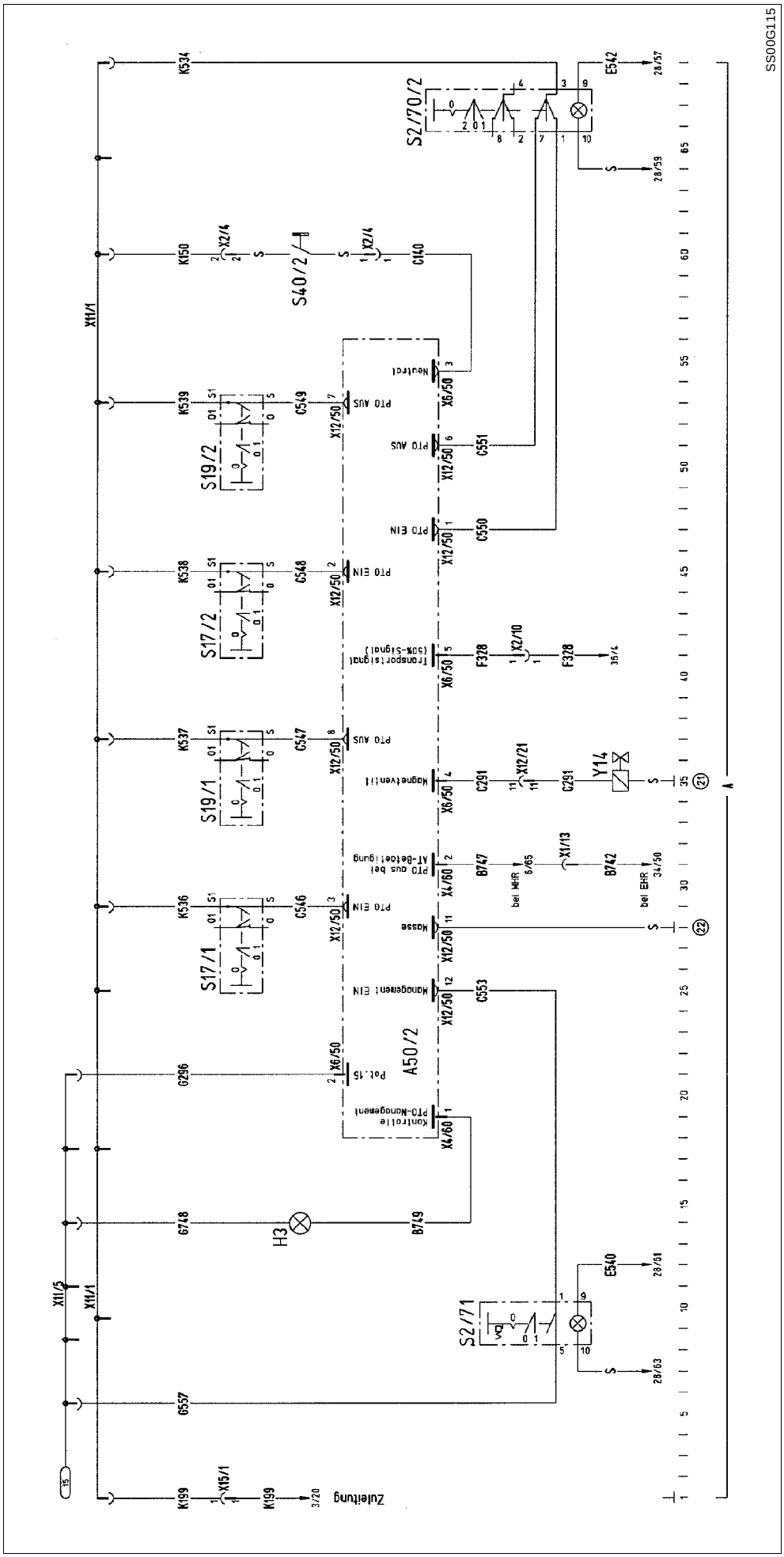
A	EHR transport signal
B#	EHR lift/control on rocker switch
C	EHR setpoint
D	EHR stop
E#	EHR lift/pressure changeover
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A50/2	E box, rear PTO shaft
H3	Indicator, PTO shaft management active
S2/70/2	Switch, rear PTO shaft
S2/71	Switch, PTO shaft management
S17/1	External pushbutton, rear left PTO shaft, ON
S17/2	External pushbutton, rear right PTO shaft, ON
S19/1	External pushbutton, rear left PTO shaft, OFF
S19/2	External pushbutton, rear right PTO shaft, OFF
S40/2	Control switch, rear PTO shaft, neutral
X1/13	Plug-in connection, flat, chassis cable, right
X2/4	Plug-in connection, chassis cable, right, PTO shaft indicator
X2/10	Plug-in connection, chassis, right, EHR box
X4/60	Plug-in connection, cable, chassis, right
X6/50	Plug-in connection, cable, chassis, right
X11/1	Distributor console, potential, Dynamo +
X11/5	Distributor console, potential 15
X12/21	Plug-in connection, chassis, right, transmission
X12/50	Plug-in connection, cable, electrical/ hydraulic PTO shaft
X15/1	Plug-in connection, instrument, chassis, right
Y14	Solenoid valve, rear PTO shaft

Grounding points

1	Console Transmission plug
22	E box console

Designation of Sections

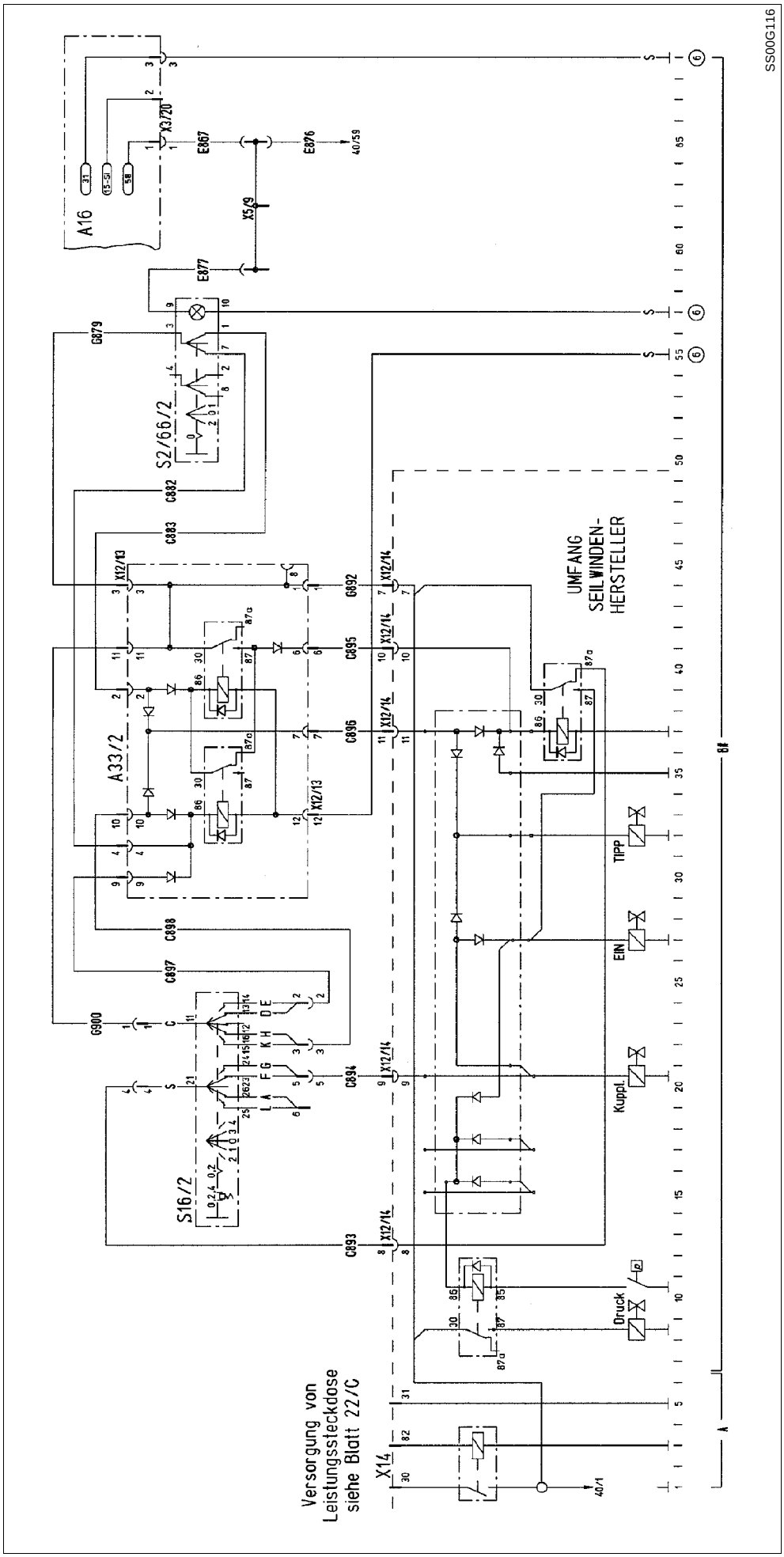
A	Rear PTO shaft

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A16	EHR print, operating console
A33/2	Print, double winch
S2/66/2	Switch, winch brake
S16/2	Switch, winch clutch 2
X3/20	Plug-in conection, supply
X5/9	Distributor, potential 58, winch
X12/13	Plug-in connection, double winch
X12/14	Plug-in connection, double winch
X14	Power socket

VERSIONS
to this page
39
on page/pages
40, 41

Grounding points

6	Distributor for the winch

Designation of Sections

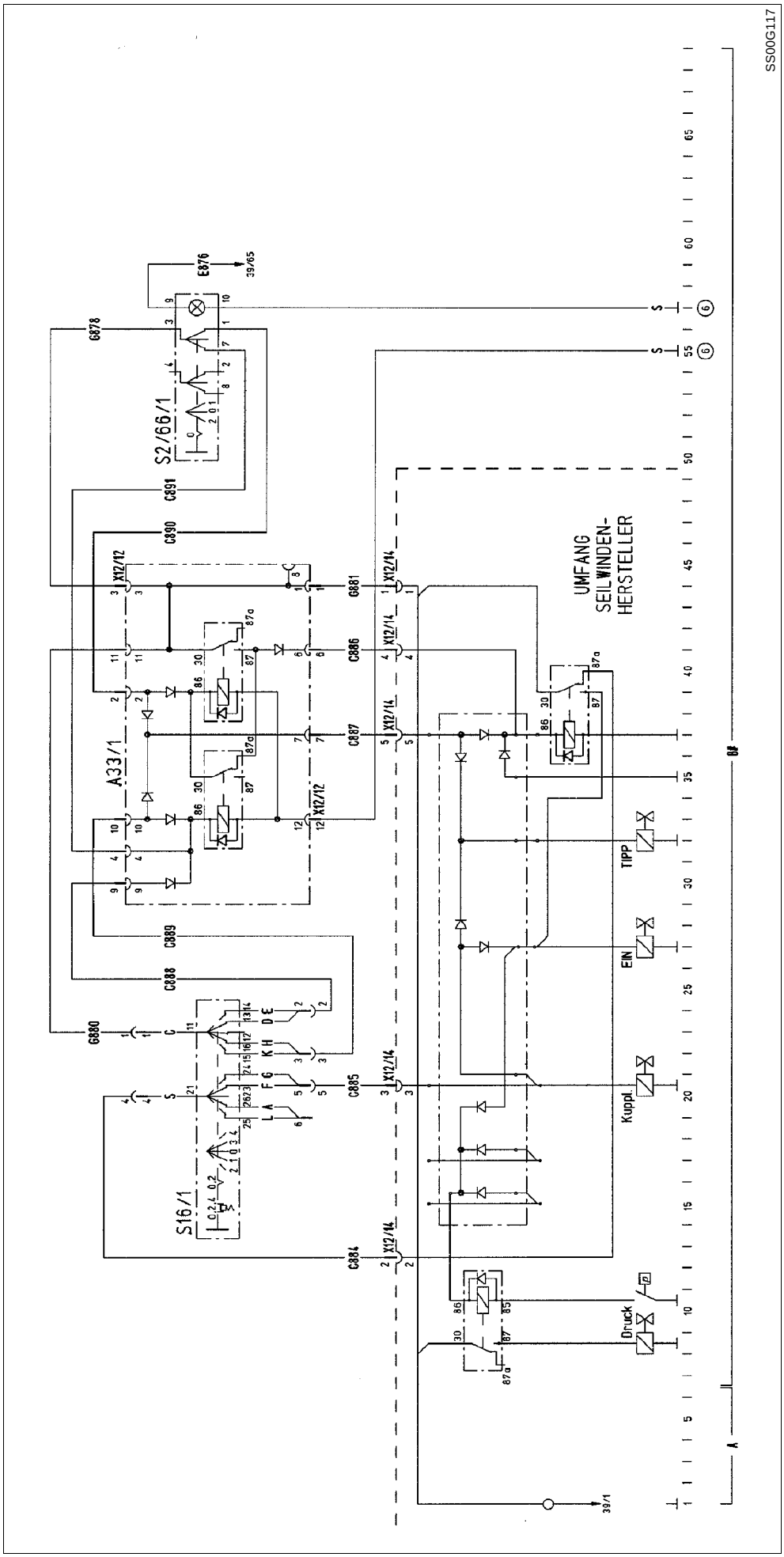
A	Supply, winch
B#	Double winch
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A33/1	Print, single winch
S2/66/1	Switch, winch brake 1
S16/1	Switch, winch clutch 1
X12/12	Plug-in connection, double winch
X12/14	Plug-in connection, double winch

VERSIONS
to this page
40
on page/pages
39, 41

Grounding points

6	Distributor for the winch

Designation of Sections

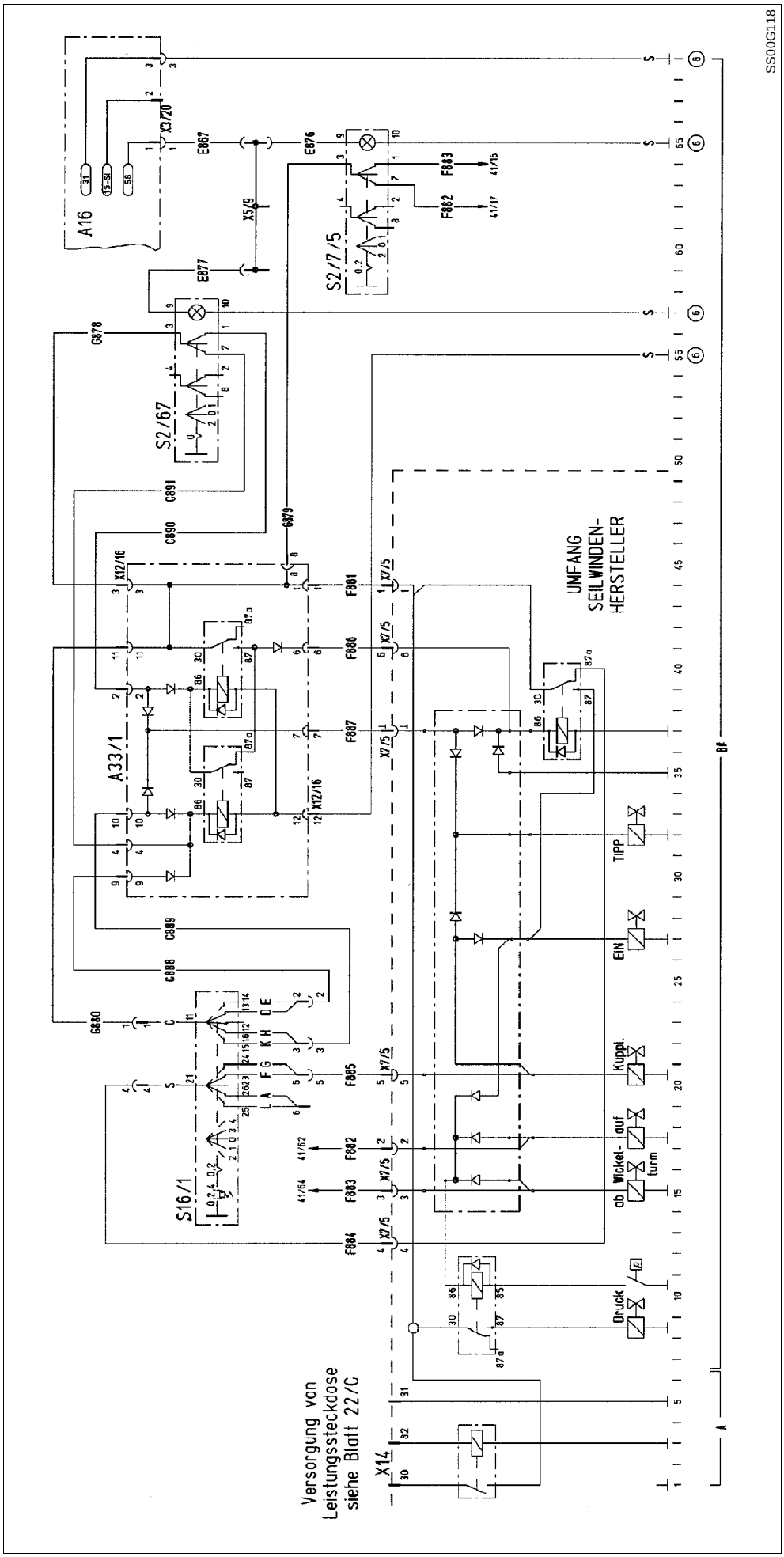
A	Supply, winch
B#	Double winch
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A16	EHR print, operating console
A33/1	Print, single winch
S2/7/5	Switch, winch capstan
S2/67	Switch, winch brake
S16/1	Switch, winch clutch 1
X3/20	Plug-in conection, supply
X5/9	Distributor, potential 58, winch
X7/5	Plug-in connection, single winch
X12/16	Plug-in connection, single winch
X14	Power socket

VERSIONS
to this page
41
on page/pages
39, 40

Grounding points

6	Distributor for the winch

Designation of Sections

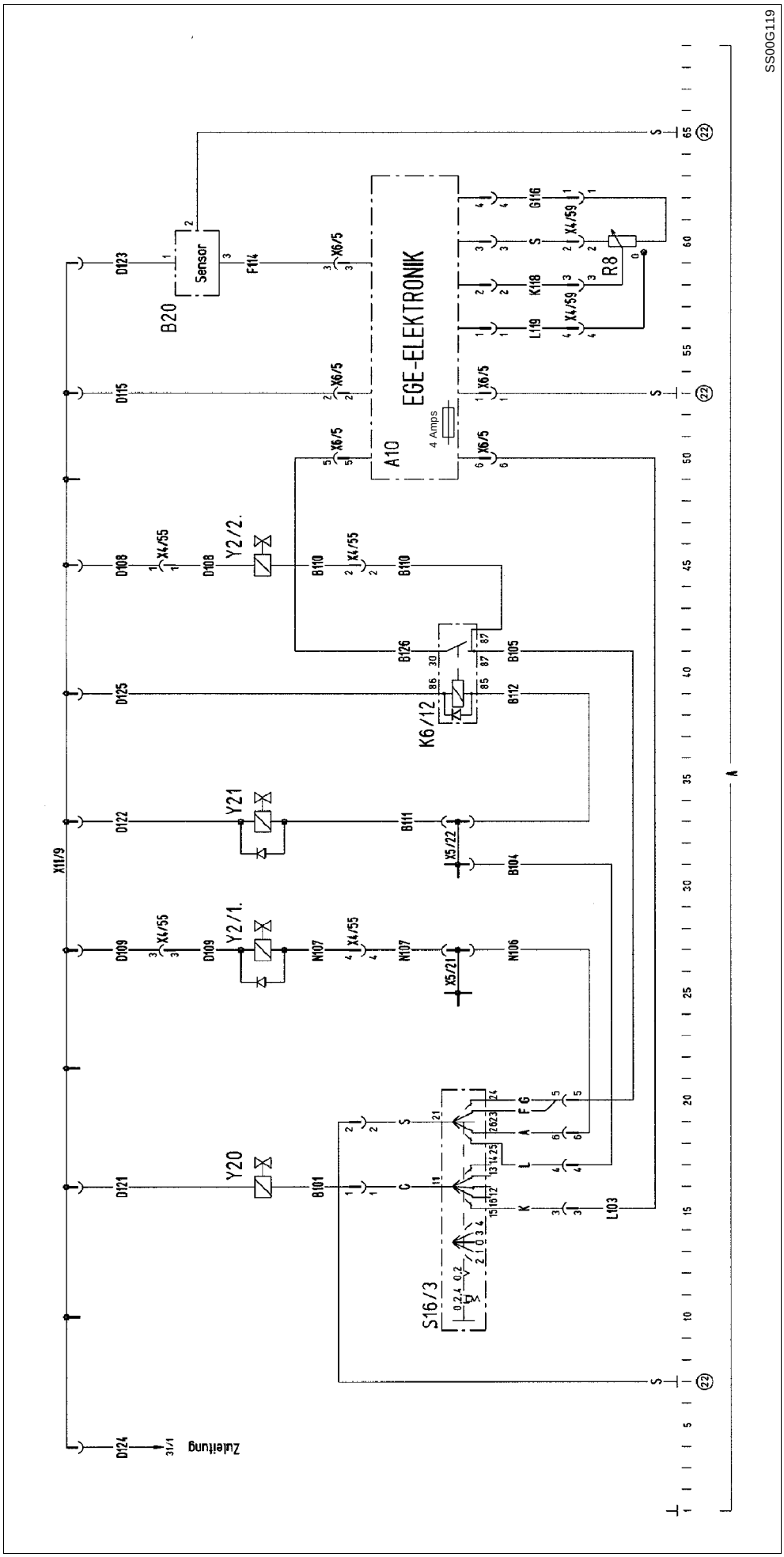
A	Supply, winch
B#	Double winch
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A10	E-Box, EGE
B20	Pressure sensor, EGE
K6/12	Relay, EGE
R8	Potentiometer, EGE
S16/3	Switch, EGE
X4/55	Plug-in connection, EGE solenoid valve
X4/59	Plug-in connection, EGE potentiometer
X5/21	Distributor, EGE console
X5/22	Distributor, EGE console
X6/5	Plug-in connection, electronic implement load relief
X11/9	Distributor, potential 15Si
Y2/1	Solenoid valve, EGE, LOWER
Y2/2	Solenoid valve, EGE, RAISE
Y20	Solenoid valve EGE AB
Y21	Solenoid connector, EGE reservoir

Grounding points

22	E box console

Designation of Sections

A	EGE

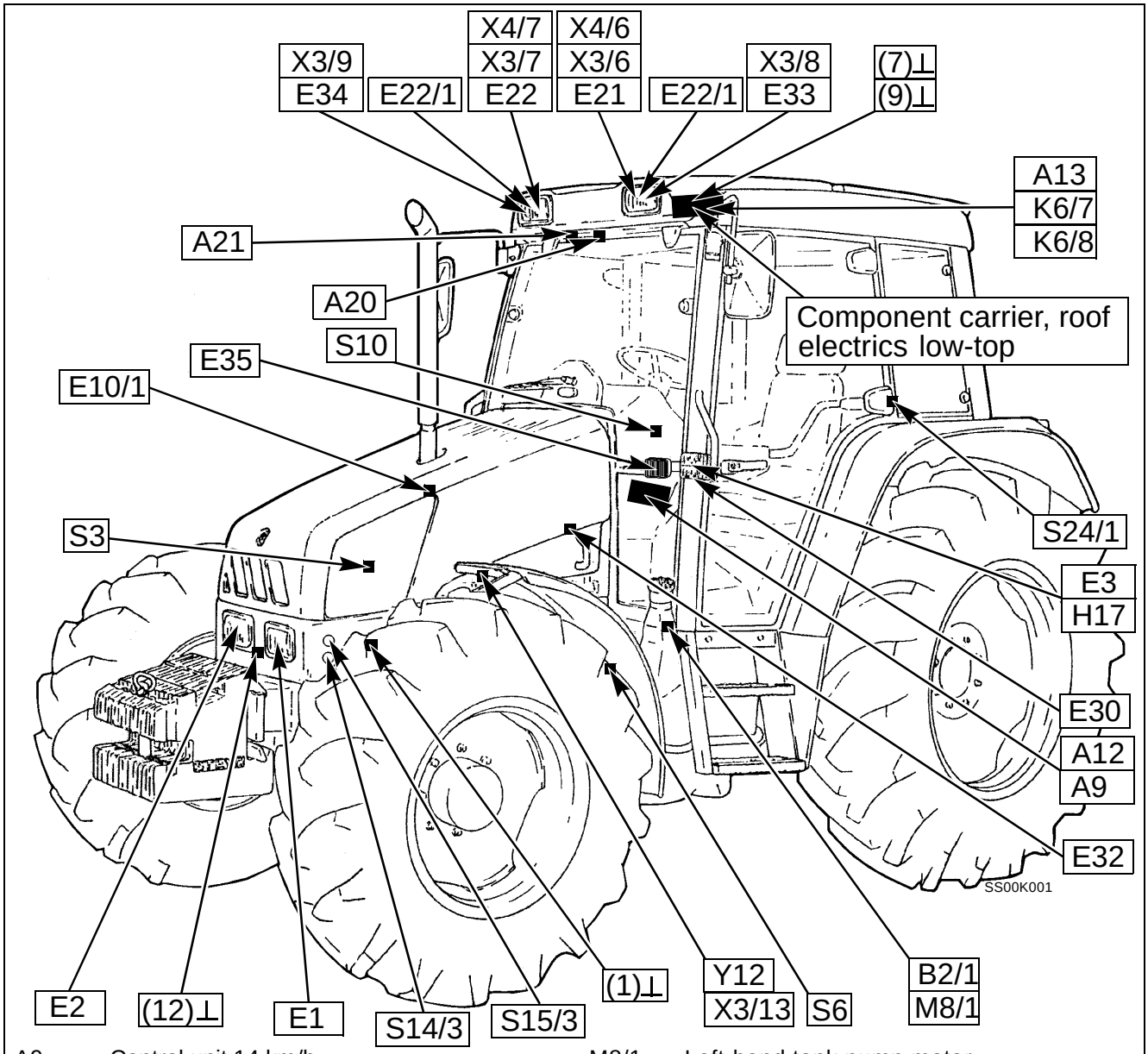
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (potential 15 safety)
E	Grey	potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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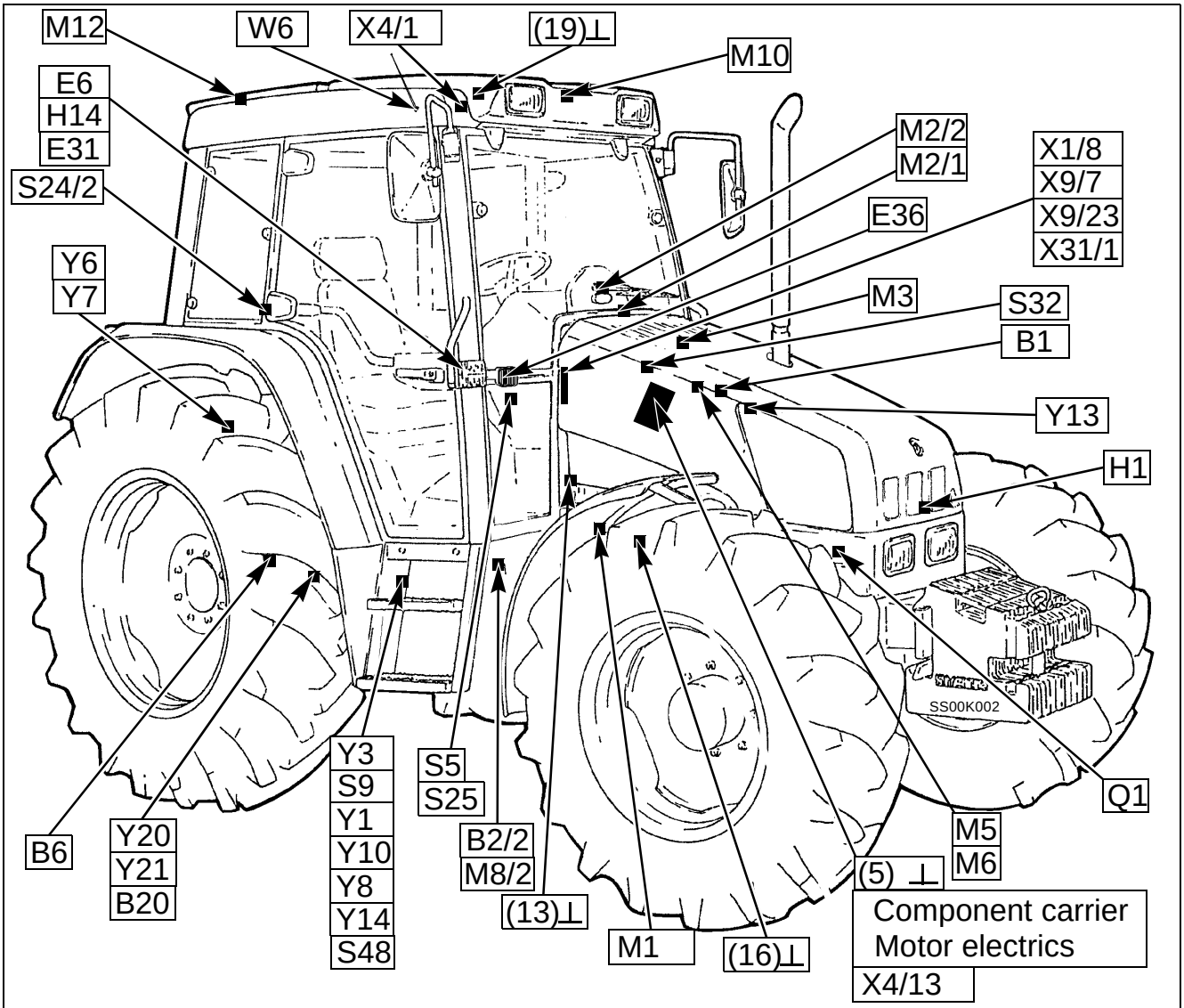
LIST OF PLUGS, LEFT



A9	Control unit 14 km/h
A12	Central print
A13	Foof print
A20	Air conditioning control
A21	Blower motor control
B2/1	Fuel tank content transmitter, left
E1	Headlight, left
E2	Headlight, right
E3	Sidelight, front left
E10/1	Glow plug
E21	Reserve headlight, left
E21/1	Position light, in auxiliary headlamp, left
E2	Reserve headlight, right
E22/1	Position light, in auxiliary headlamp, right
E30	Step light, left
E32	Fuel filter heating
E33	Roof searchlight, front, twin-power
E34	Roof searchlight, front, twin-power
E35	Searchlight on the trafficator/position light
H17	Trafficator, front left
K6/7	Relay, heated screen, rear
K6/8	Relay, heated windscreen, front
M8/1	Left-hand tank pump motor
S 3	Switch, air filter indicator
S 6	Switch, engine oil pressure
S10	Clutch switch (start inhibitor)
S14/3	Front lifting gear external pushbutton "LOWER"
S15/3	Front lifting gear external pushbutton "RAISE"
S24/1	Switch, door contact
X3/6	Plug-in connection, auxiliary headlight
X3/7	Plug-in connection, auxiliary headlight
X3/8	Plug-in connection, searchlight, twin power
X3/9	Plug-in connection, searchlight, twin power
X3/13	Plug-in connection, engine cut-out
Y12	Engine cut-out solenoid
(1)	Ground, battery
(7)	Ground, low-top component carrier
(9)	Ground, screw down point, roof print
(12)	Ground, body, front

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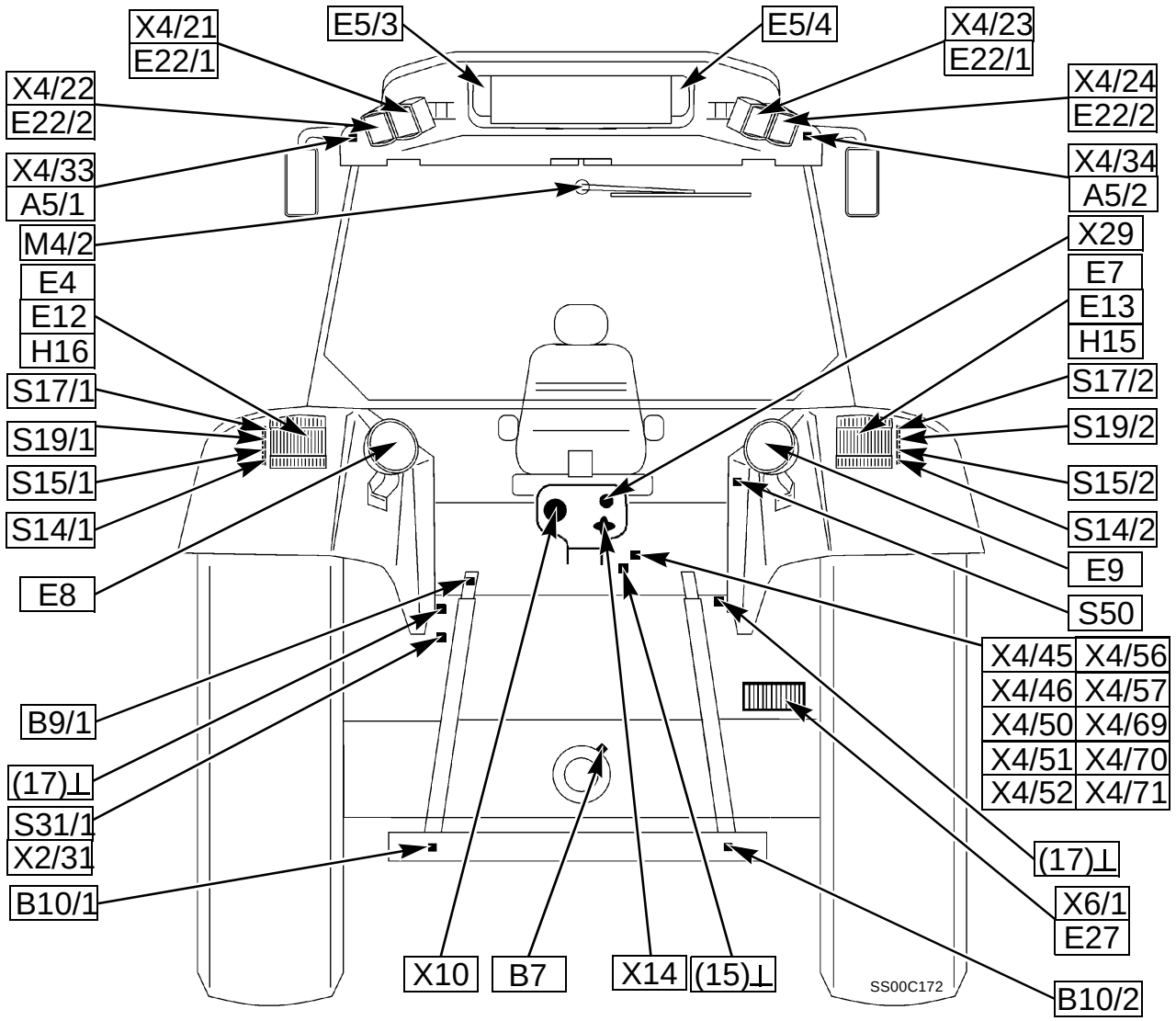
LIST OF PLUGS, RIGHT



B1	Engine temperature transmitter
B2/2	Fuel tank content transmitter, right
B6	Inductive transmitter, driving speed
B20	Pressure sensor, EGE
E6	Sidelight, front right
E30	Courtesy light, right
E36	Searchlight on the trafficator/position light
H1	Horn
H14	Trafficator, front right
M1	Starter
M2/1	Parallel wiper motor, front
M2/2	Standard wiper motor, front
M3	Heater blower motor, bottom
M5	Motor, rear screen washer pump
M6	Motor, front screen washer pump
M8/2	Right-hand tank pump motor
M10	Roof blower motor
M12	Air-conditioning blower motor
Q1	Battery master switch
S5	Switch, brake
S9	Power shift safety switch
S24/2	Switch, door contact
S25	Switch, steering brake
S32	Switch, water temperature indicator
S48	Switch, reversing light
X1/8	Screw, instrument, engine
X4/1	Plug-in connection, roof frame
X9/7	Plug-in connection, engine, chassis, left
X9/23	Plug-in connection, external pushbutton, front-end lifting gear
X4/13	Distributor, engine, potential D +
X31/1	Plug-in connection, instrument – engine
W6	Aerial
Y1	4-wheel drive solenoid valve
Y3	Power shift group solenoid valve
Y6	Solenoid valve, EHR RAISE
Y7	Solenoid valve, EHR, LOWER
Y8	Front differential lock solenoid valve
Y10	Rear differential lock solenoid valve
Y13	Air-conditioning coupling
Y14	Solenoid valve, rear PTO shaft
Y20	Solenoid valve EGE
Y21	Solenoid connector, EGE reservoir
(5)	Ground, engine component carrier
(13)	Ground, bulkhead
(16)	Ground, starter
(19)	Ground, shock absorber, roof

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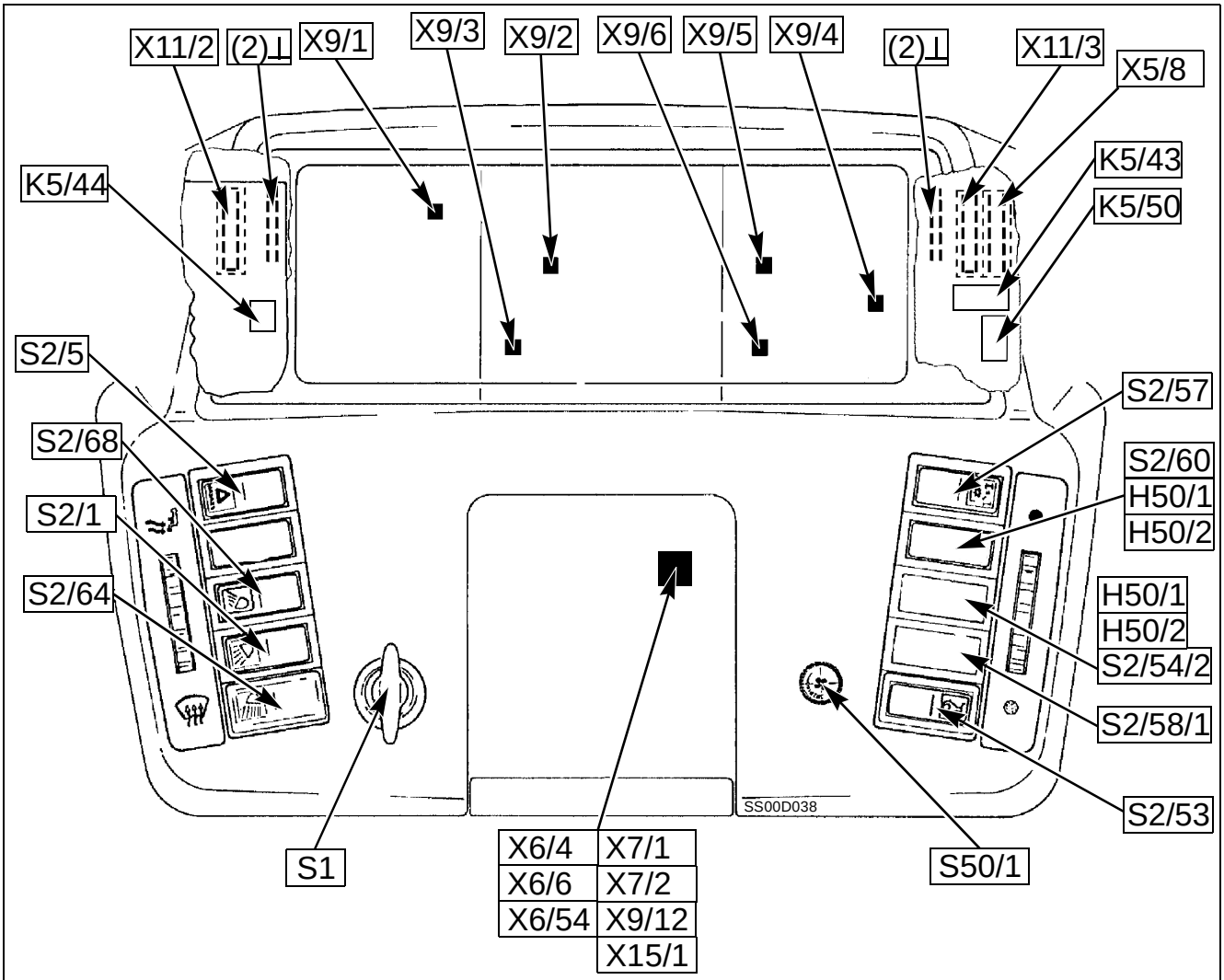
LIST OF PLUGS, REAR



A5/1	Rotating beacon, left
A5/2	Rotating beacon, right
B7	Speed sensor, rear PTO shaft
B9/1	EHR position sensor
B10/1	Force measuring bolts, EHR, left
B10/2	Force measuring bolts, EHR, right
E4	Sidelight, rear left
E5/3	Lighting, number plate, roof
E5/4	Lighting, number plate, roof
E7	Sidelight, rear right
E8	Searchlight, left-hand mudguard
E9	Searchlight, right-hand mudguard
E12	Brake light, left
E13	Brake light, right
E27	Searchlight on the rear axle
E23/1	Searchlight, roof, rear, inner
E23/2	Searchlight, roof, rear, outer
E24/1	Searchlight, roof, rear, inner
E24/2	Searchlight, roof, rear, outer
H15	Trafficator, rear right
H16	Trafficator, rear left
M4/2	Windscreen wiper motor, rear
S14/1	External pushbutton, Lower, left
S14/2	External pushbutton, Lower, right
S15/1	External pushbutton, Raise, left
S15/2	External pushbutton, Raise, right
S17/1	Ext. pushbutton, rear left PTO shaft, ON
S17/2	Ext. pushbutton, rear right PTO shaft, ON
S19/1	Ext. pushbutton, rear left PTO shaft, OFF
S19/2	Ext. pushbutton, rear right PTO shaft, OFF
S31/1	Switch, lifting gear 50 %
S50	Switch, trailer brake valve
X2/31	Plug-in connection, chassis, left, switch 50 %
X4/21	Plug-in connection, roof canopy cable
X4/22	Plug-in connection, roof canopy cable
X4/23	Plug-in connection, roof canopy cable
X4/24	Plug-in connection, roof canopy cable
X4/33	Plug-in connection, rotating beacon, left
X4/34	Plug-in connection, rotating beacon, right
X6/1	Plug-in connection, searchlight
X10	Plug-in connection, 7-pole
X14	Power socket, flat
X29	Standard signal socket
(15)	Ground, console, sockets
(17)	Ground, rear mudguard

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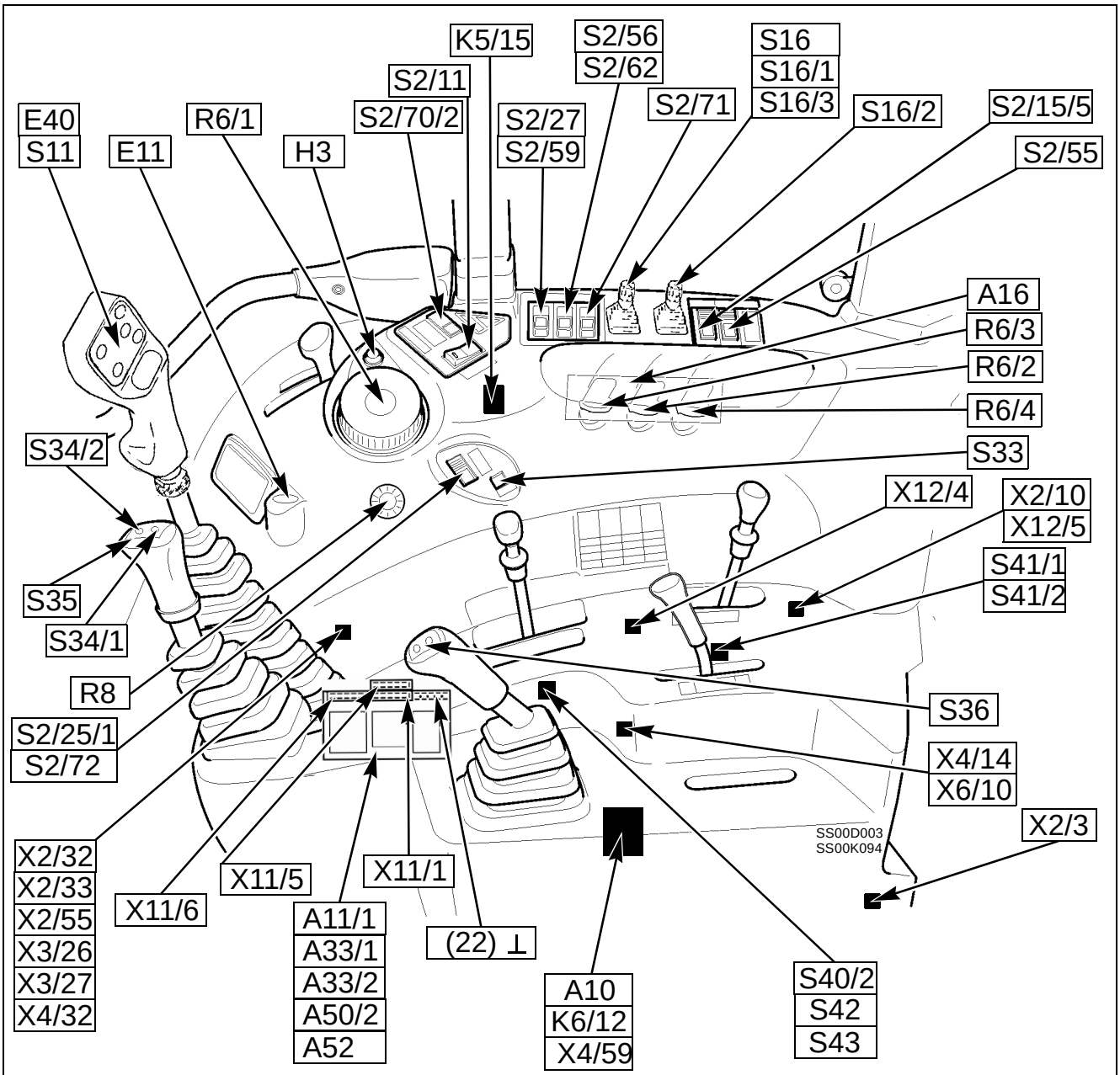
LIST OF PLUGS, INSTRUMENT PANEL



H50/1	Trailer brake indicator
H50/2	Trailer brake indicator
K5/43	Relay, D+ cut-out
K5/44	Relay, searchlight, rear axle
K5/50	Relay, trailer brake valve
S1	Starter switch
S2/1	Switch, lighting system
S2/5	Switch, hazard warning lights
S2/53	Switch, pre-glowing
S2/54/2	Switch, heating level 1-2-3
S2/58/1	Switch, heating ON
S2/57	Switch, digital changeover
S2/60	Switch, stationary operation
S2/64	Switch, searchlight, mudguard
S2/68	Switch, rear axle searchlight
S50/1	Switch, 3-stage blower motor
X5/8	Distributor, instrument potential, D+
X6/4	Plug-in connection, instrument, chassis, right
X6/6	Plug-in connection, instrument, chassis, left
X6/54	Plug-in connection, trailer brake valve
X7/1	Plug-in connection, instrument, steering column switch
X7/2	Plug-in connection, instrument, steering column switch
X9/1	Plug-in connection, instrument cable
X9/2	Plug-in connection, instrument cable
X9/3	Plug-in connection, instrument cable
X9/4	Plug-in connection, instrument cable
X9/5	Plug-in connection, instrument cable
X9/6	Plug-in connection, instrument cable
X9/12	Plug-in connection, instrument – wiper
X10/11	Plug-in connection, instrument, transmission
X11/2	Distributor, instrument potential 58, left
X11/3	Distributor, instrument potential 58, right
X15/1	Plug-in connection, instrument, chassis, right
(2)	Ground, instrument panel

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LIST OF PLUGS, RIGHT-HAND SIDE PANEL

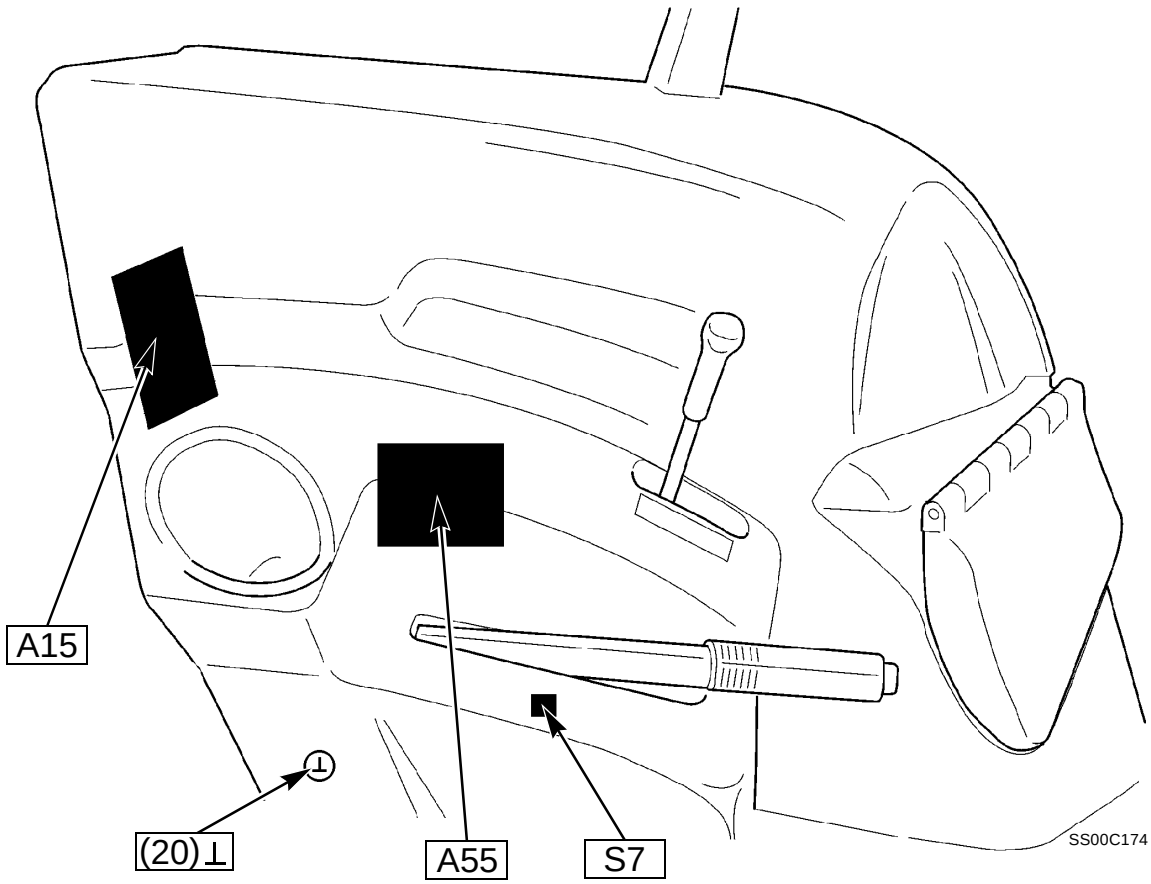


A10	EGE control unit
A11/1	'E' box, Multicontroller, joystick
A16	EHR print, operating console
A16	MHR print, operating console
A33/1	Print, single winch
A33/2	Print, double winch
A50/2	E box, rear PTO shaft
A52	'E' box, power shift
E11	Cigarette lighter
E40	Multi-Controller lighting
H3	Indicator lamp, PTO Management ACTIVE
K5/15	Relay, optistop / management
K6/12	Relay, electronic implement load relief
R6/1	Setpoint potentiometer
R6/2	Upper limit potentiometer
R6/3	Mixing potentiometer
R6/4	Lowering speed potentiometer
R8	Potentiometer, electronic implement load relief
S2/11	Safety switch
S2/15/5	Switch, internally operated external pushbuttons
S2/25/1	Switch, EHR lift (green)
S2/27	Switch, 4-wheel drive
S2/55	Switch, front differential lock
S2/56	Switch, differential lock management
S2/59	Switch, 4-wheel drive management
S2/62	Switch, rear differential lock
S2/70/2	Switch, rear PTO shaft
S2/71	Switch, PTO shaft management
S2/72	Switch, fast retract
S11	Multi-Controller
S16	Lever switch, auxiliary control unit
S16/1	Lever switch, 1st auxiliary control unit
S16/1	Plug-in connection to lever switch 1st auxiliary control unit

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S16/2	Lever switch, 2nd auxiliary control unit	X2/55	Plug-in connection, multi-controller
S16/2	Plug-in connection to lever switch 2nd auxiliary control unit	X3/26	Plug-in connection, 1st aux. control unit, Multi-Controller
S16/3	Switch, electronic implement load relief	X3/27	Plug-in connection, 2nd aux. control unit, Multi-Controller
S33	Switch, EHR stop	X4/14	Plug-in connection, 2nd multi-function lever, single-action
S34/1	Switch, power shift, slow	X4/32	Plug-in connection, chassis, right – Multi-Controller
S34/2	Switch, power shift, fast	X4/59	Plug-in connection, EGE potentiometer
S35	Switch, power shift	X6/10	Plug-in connection, 2nd multi-function lever, double-action
S36	Switch, joystick	X11/1	Distributor console, potential, Dynamo +
S36	Plug-in connection, switch, joystick	X11/5	Distributor console, potential 15
S40/2	Switch, rear PTO shaft (start inhibitor)	X11/6	Distributor console, potential 15Si
S41/1	Switch, PTO shaft 430/540 indicator	X12/4	Plug-in connection, chassis right PTO shaft indicator
S41/2	Switch, PTO shaft 540E/1000 indicator	X12/5	Plug-in connection, chassis, right, transmission
S42	Switch, 540 PTO shaft indicator	(22)	Ground, 'E' box
S43	Switch, 1000 PTO shaft indicator		
X2/3	Plug-in connection, air sprung seat		
X2/10	Plug-on connection, chassis right – EHR box		
X2/32	Plug-in connection, aux. control unit, Multi-Controller		
X2/33	Plug-in connection, aux. control unit, Multi-Controller		

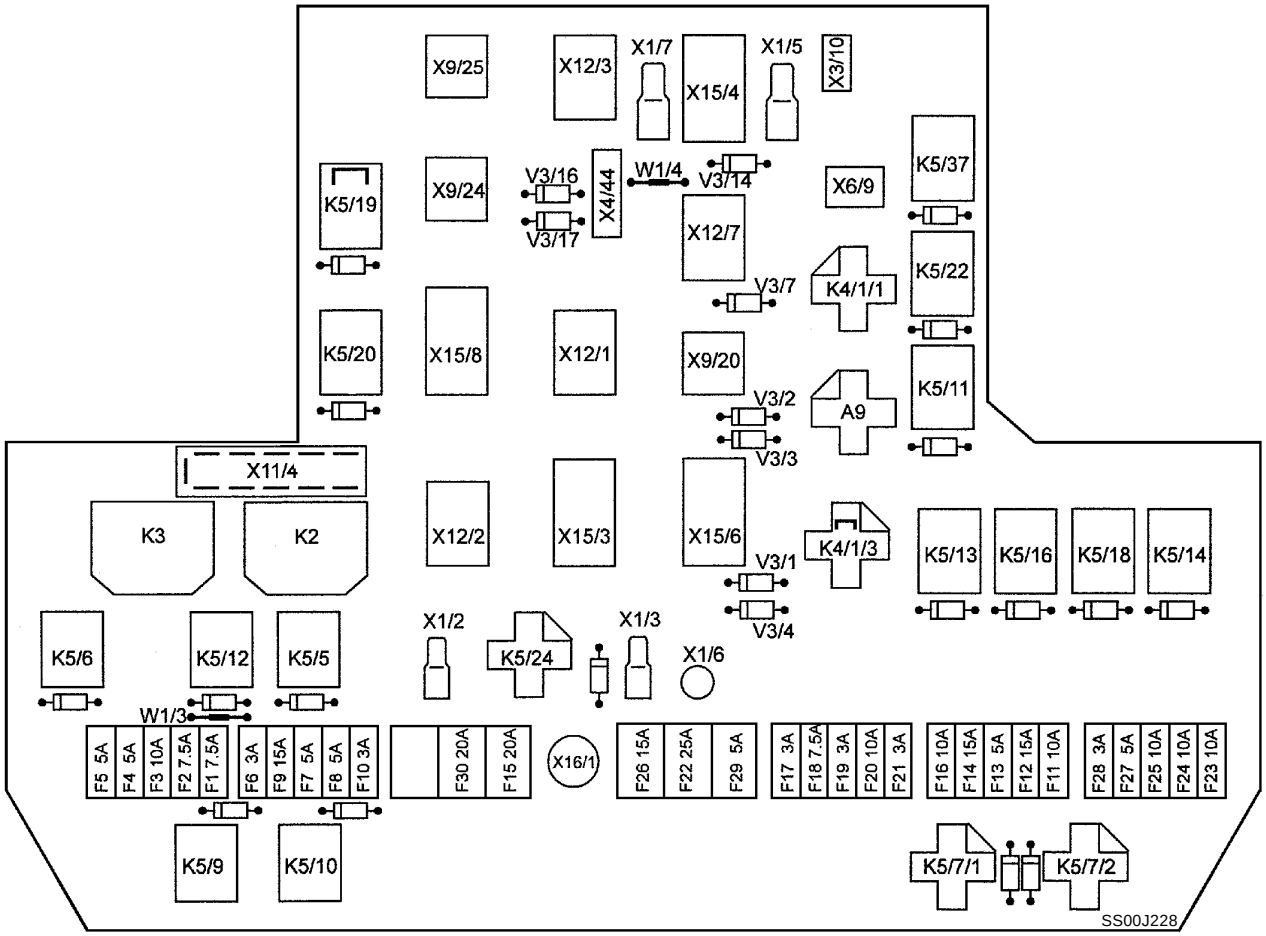
LIST OF PLUGS, LEFT-HAND SIDE PANEL



A15	Distribution print
A55	EHR-D box
S7	Control switch, handbrake
(20)	Ground, EHR box

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CENTRAL PRINT A12



Relays

A9	Control unit 14 km/h
K2	Trafficator relay
K3	Interval relay
K4/1/1	Time relay, 3 secs.
K4/1/3	Bridge
K5/5	Relay, switchover, main beam
K5/6	Relay, switchover, dipped beam
K5/7/1	Relay, potential 15/1
K5/7/2	Relay, potential 15/2
K5/9	Relay, searchlight, mudguard
K5/10	Relay, light, potential 58
K5/11	Relay potential D+ supply
K5/12	Relay, brake light, Opti-stop
K5/13	Relay, differential lock
K5/14	Relay, management
K5/16	Relay, stationary mode cut-out
K5/18	Relay, management
K5/19	Relay, stationary mode cut-out
K5/20	Relay, stationary mode cut-out
K5/22	Relay, power shift group
K5/24	Relay, front loader
K5/37	Relay, reserve central print
K5/43	Relay, D+ cut-out
V3/1	Diode
V3/2	Diode
V3/3	Diode
V3/4	Diode
V3/7	Diode
V3/14	Diode
V3/16	Diode
V3/17	Diode

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List of Plugs

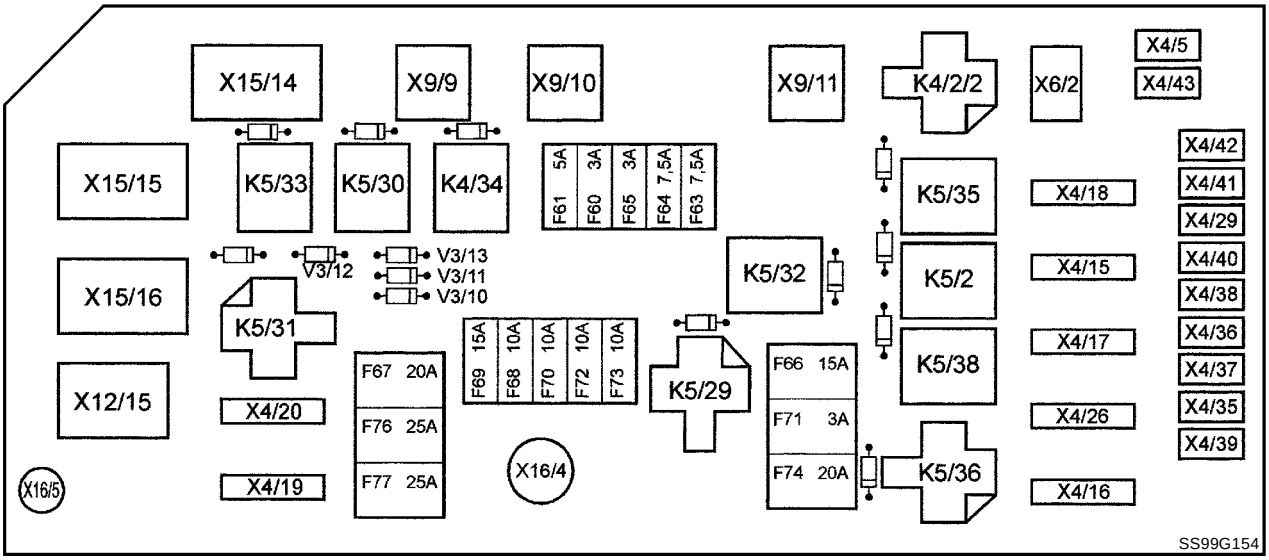
W1/3	Contact bridge, Optistop
W1/4	Contact bridge, spark start
X1/3	Plug-in connection, front loader
X1/5	Plug-in connection, cable, chassis, right
X1/6	Screw, power socket
X1/7	Plug-in connection, power socket
X3/10	Plug-in connection, radar sensor
X4/44	Plug-in connection, spark start
X6/9	Plug-in connection, chassis, right / chassis, left
X9/20	Plug-in connection, instrument cable
X9/24	Plug-in connection, cable, chassis, left
X9/25	Plug-in connection, cable, chassis, left
X11/4	Distributor, instrument, potential 15/1
X12/1	Plug-in connection, instrument cable
X12/2	Plug-in connection, instrument cable
X12/3	Spare plug-in connection
X12/7	Plug-in connection, cable, chassis, right
X15/3	Plug-in connection, instrument cable
X15/4	Plug-in connection, instrument cable
X15/6	Plug-in connection, cable, chassis, right
X15/8	Plug-in connection, cable, roof supply
X16/1	Screw connector, central print, potential 30

Fuses

F1	Parking lamp, potential 58L	7.5 Amps
F2	Parking lamp, potential 58R	7.5 Amps
F3	Searchlight mudguard	10 Amps
F4	Auxiliary headlight, dipped beam, left	5 Amps
F5	Auxiliary headlight, dipped beam, right	5 Amps
F6	4-wheel drive	3 Amps
F7	Headlight, dipped beam, right	5 Amps
F8	Headlight, dipped beam, left	5 Amps
F9	Main beam and indicator	15 Amps
F10	Fuse, potential 15/1, roof, front loader	3 Amps
F11	Brake lamp	10 Amps
F12	Headlight flasher	15 Amps
F13	Differential lock and management	5 Amps
F14	Fuse, potential 15/1	15 Amps
F15	Front loader	20 Amps
F16	Hazard warning flasher	10 Amps
F17	Fuse, potential 30, spare for on-board computer	3 Amps
F18	Cigarette lighter	7.5 Amps
F19	Searchlight on the rear axle	10 Amps
F20	potential 30, spare	10 Amps
F21	potential D+	3 Amps
F22	Power socket	25 Amps
F22	Power socket	40 Amps
F23	potential 15, socket	10 Amps
F24	Searchlight/reversing light	10 Amps
F25	Screen wipers, Horn	10 Amps
F26	Heating	15 Amps
F27	potential 15	5 Amps
F28	potential 30, spare for on-board computer	3 Amps
F29	potential 15 (cut-out, power-shift)	5 Amps
F30	potential 30	20 Amps

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ROOF PRINT A13



Relays

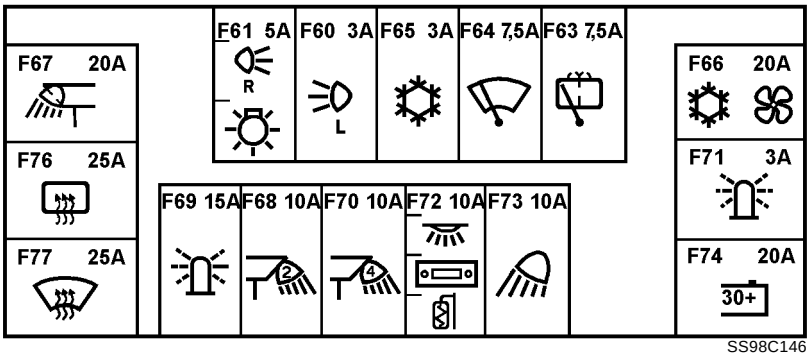
K4/2/2	Time relay 40 sec, interior lamp – delay
K5/2	Front screen wiper (only on hinged windscreen)
K5/29	Terminal 15
K5/30	Searchlight, rear roof, 2 off
K5/31	Searchlight front roof TWIN POWER
K5/32	Blower motor – air conditioning
K5/33	Rotating beacon
K5/34	4 Searchlights, rear, roof, number plate lighting
K5/35	Heated mirror
K5/36	Air-conditioning blower
K5/38	Reserve, searchlight

List of Plugs

V3/10	Diode 3A interlock
V3/11	Diode 3A interlock
V3/12	Diode 3A interlock
V3/13	Diode 3A interlock
X4/5	Plug-in connection, chassis, left,
X4/15	Plug-in connection, mirror heating
X4/16	Spare plug-in connection
X4/17	Plug-in connection, roof frame
X4/18	Plug-in connection, roof frame
X4/19	Plug-in connection, heated windscreen, front
X4/20	Plug-in connection, heated screen, rear
X4/26	Plug-in connection, roof frame
X4/29	Plug-in connection, roof switch
X4/35	Plug-in connection, rotating beacon switch
X4/36	Plug-in connection, roof switch
X4/37	Plug-in connection, roof switch
X4/38	Plug-in connection, roof switch
X4/39	Plug-in connection, roof switch
X4/40	Plug-in connection, roof switch
X4/41	Plug-in connection, roof switch
X4/42	Plug-in connection, roof switch
X4/43	Plug-in connection, number plate lighting
X6/2	Plug-in connection, roof frame
X9/9	Plug-in connection, roof canopy cable
X9/10	Plug-in connection, rear wiper
X9/11	Plug-in connection, roof air cond.
X12/15	Plug-in connection, roof canopy cable
X15/14	Plug-in connection, roof frame
X15/15	Plug-in connection, roof canopy cable
X15/16	Plug-in connection, roof supply cable
X16/4	Distributor, central print 30
X16/5	Screw-on connection, ground, roof print

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Fuses

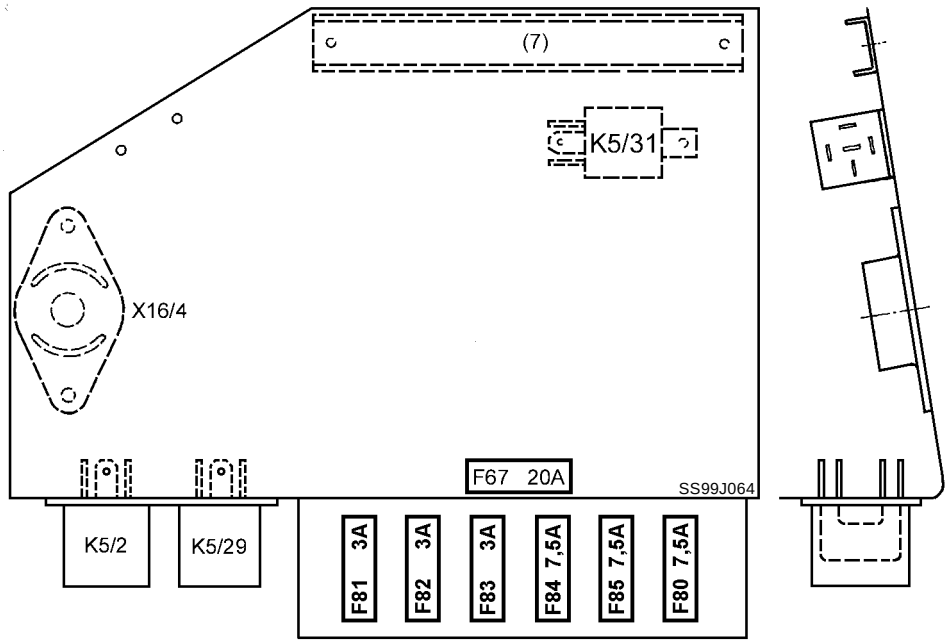


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F60	Parking lamp left front	3 Amps
F61	Parking lamp right front	5 Amps
F63	Rear wiper	7.5 Amps
F64	Wiper front on hinged windscreen	7.5 Amps
F65	Air conditioning	3 Amps
F66	Blower motor/ Air conditioning unit	20 Amps
F67	Searchlight TWIN POWER	20 Amps
F68	Searchlight rear 2	10 Amps
F69	Rotating beacon	15 Amps
F70	4 searchlights, rear, number-plate lighting	10 Amps
F71	Rotating beacon	3 Amps
F72	Spot, radio, interior lighting, heated mirror	10 Amps
F73	Searchlight	10 Amps
F74	Reserve potential 30	20 Amps
F76	Heated rear screen	25 Amps
F77	Heated windscreen	25 Amps

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COMPONENT CARRIER, LOW-TOP



List of Relays and Plugs

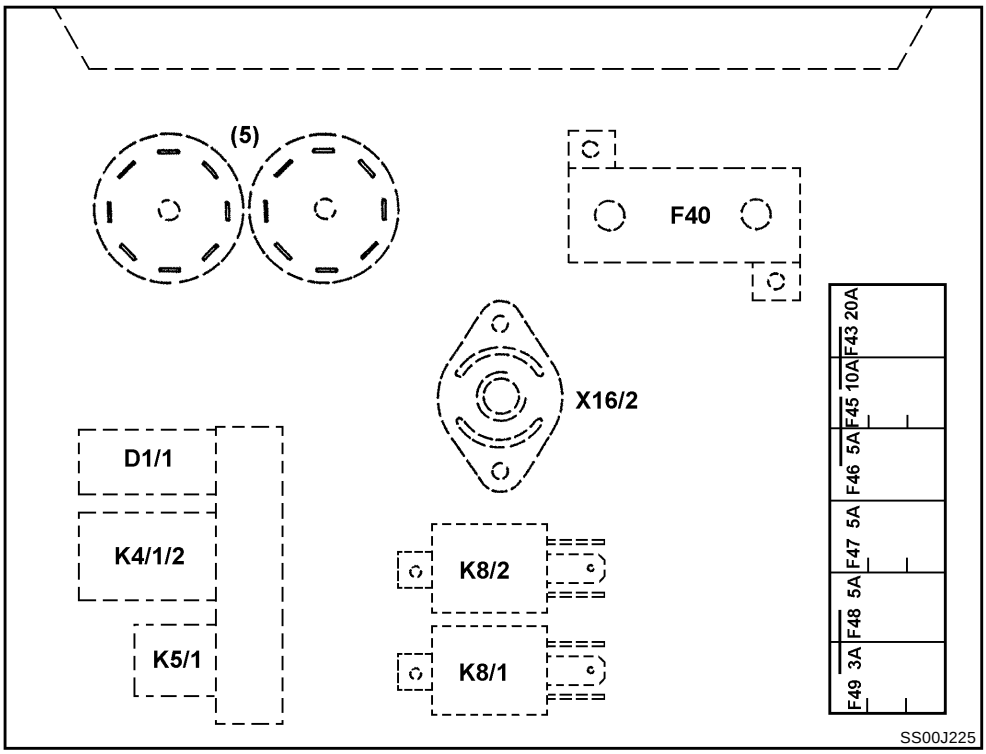
K5/2	Roof-mounted wiper, front	X16/4	Distributor, central print 30
K5/29	Roof print, potential 15	(7)	Ground rail
K5/31	Searchlight front roof TWIN POWER		

Fuses

F67	Searchlight TWIN POWER	20 Amps
F80	Interior light, rotating beacon	7.5 Amps
F81	Switch, lighting, rear washer/wiper	3 Amps
F82	Parking lamp, front	3 Amps
F83	Parking lamp, potential 58	3 Amps
F84	Reserve headlight and front wiper	7.5 Ampere
F85	Rear wiper	7.5 Amps

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COMPONENT CARRIER, ENGINE ELECTRICS



List of Relays and Plugs

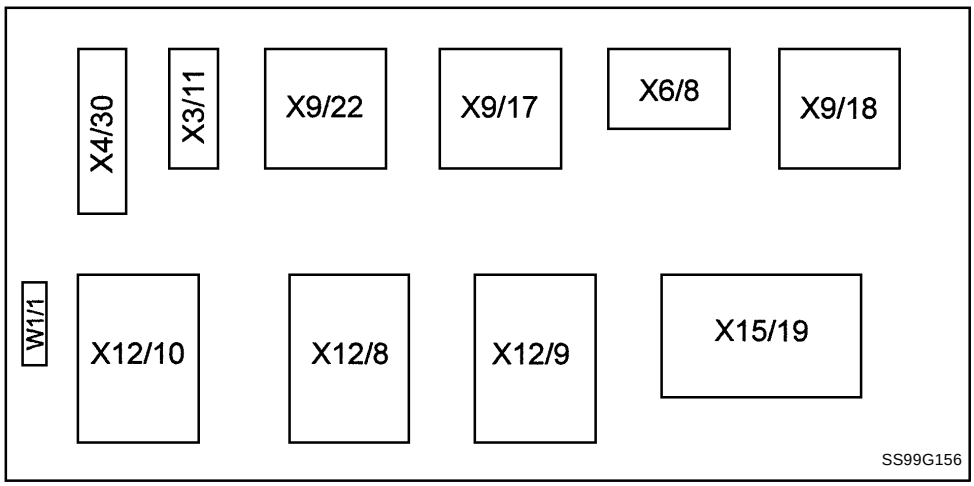
D1/1	Diode group, fuel filter heating	K8/1	Neutral position
K4/1/2	Time relay, cut-out solenoid	K8/2	Pre-glow relay
K5/1	Cut-out solenoid	(5)	Grounding stars

Fuses

F40	Main fuse	100 Amps
F43	Fuel filter heating	20 Amps
F45	potential 30	10 Amps
F46	EHR	5 Amps
F47	potential 15, cut-out solenoid	5 Amps
F48	EHR	5 Amps
F49	potential 30, radio	3 Amps

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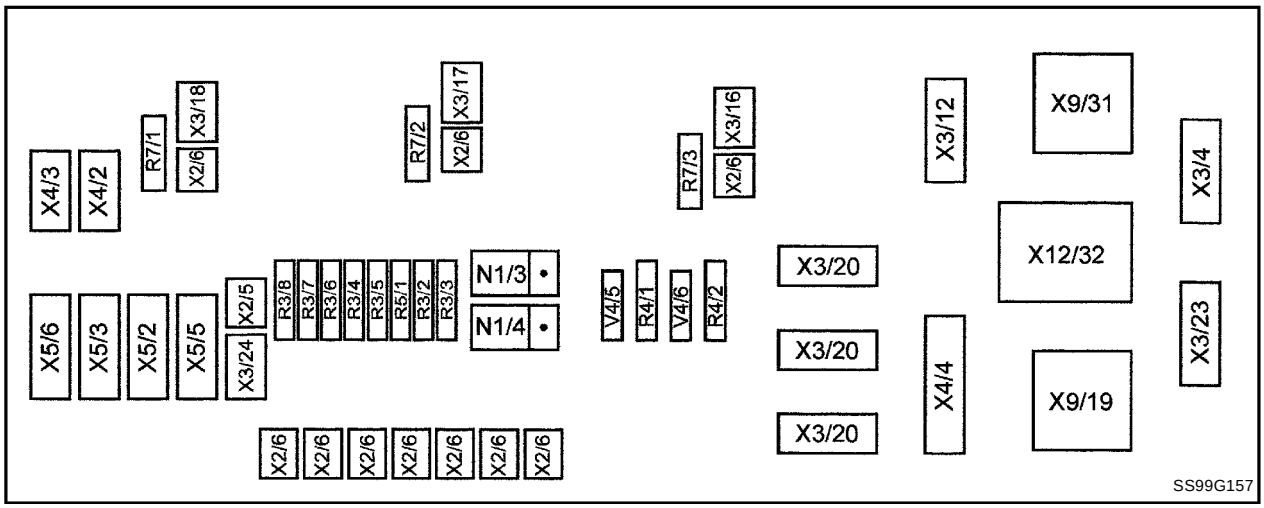
EHR-D PRINT, LEFT, A15



List of Plugs

W1/1	Contact bridge
X3/11	Plug-in connection, external sensor
X4/30	Spare plug-in connection
X6/8	Plug-in connection, signal socket
X9/17	Plug-in connection, cable, chassis, left
X9/18	Plug-in connection, cable, chassis, left
X9/22	Plug-in connection, EHR, lift/pressure
X12/8	Plug-in connection, EHR box cable
X12/9	Plug-in connection, EHR box cable
X12/10	Plug-in connection, EHR box cable
X15/19	Plug-in connection, EHR box cable

EHR CONTROL CONSOLE PRINT A16

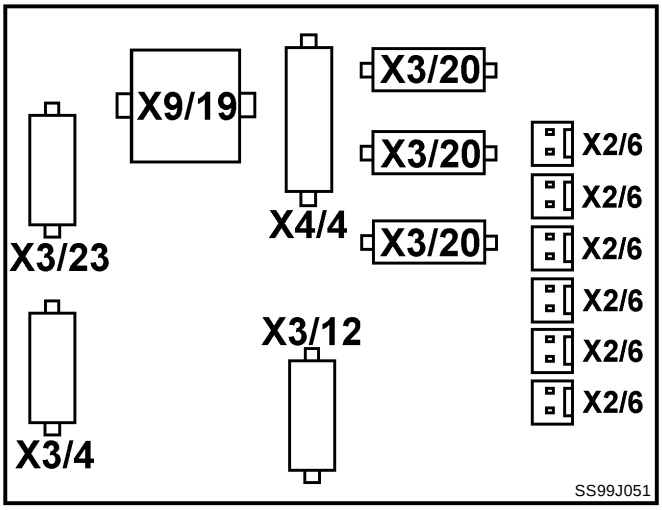


List of Plugs

X2/5	Plug-in connection, EHR stop
X2/6	Plug-in connection, switch lighting
X3/4	Distributor, neutral, front PTO shaft
X3/12	Plug-in connection, cigarette lighter
X3/16	Plug-in connection, lowering speed potentiometer,
X3/17	Plug-in connection, potentiometer, upper limit
X3/18	Plug-in connection, mixing potentiometer
X3/20	Plug-in conection, supply
X3/23	Plug-in connection, air-sprung seat
X3/24	Spare plug-in connection
X4/2	Plug-in connection, diagnosis/slip
X4/3	Plug-in connection RAISE/LOWER
X4/4	Plug-in connection, number plate lighting
X5/2	Plug-in connection, aux. circuit
X5/3	Plug-in connection, ATC switch
X5/5	Plug-in connection, cable, chassis, right
X5/6	Plug-in connection, EHR setpoint
X9/19	Plug-in connection, cable, chassis, right
X9/31	Plug-in connection, EHR box cable
X12/32	Plug-in connection, EHR box cable

https://truckmanualshub.com/

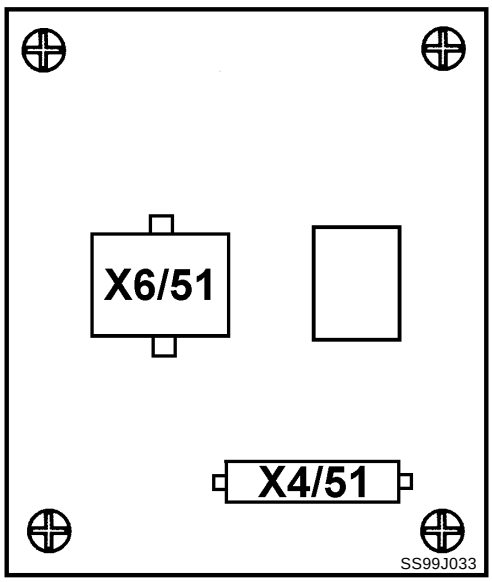
MHR CONTROL CONSOLE PRINT A16



List of Plugs

X2/6	Plug-in connection, switch lighting	X3/23	Plug-in connection, air-sprung seat
X3/4	Plug-in connection, neutral, front PTO shaft	X4/4	Plug-in connection, spark start
X3/12	Plug-in connection, cigarette lighter	X9/19	Plug-in connection, cable, chassis, right
X3/20	Plug-in connection, supply		

EHR OPERATION A51

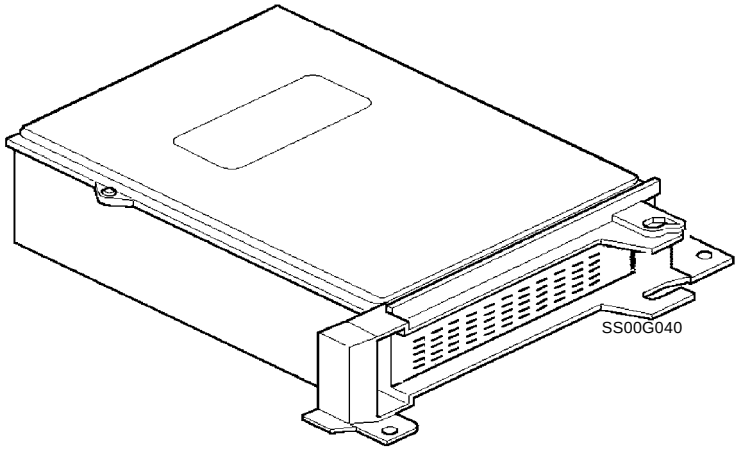


List of Plugs

X4/51	Plug-in connection, EHR box cable	X6/51	Plug-in connection, multi-controller

https://truckmanualshub.com/

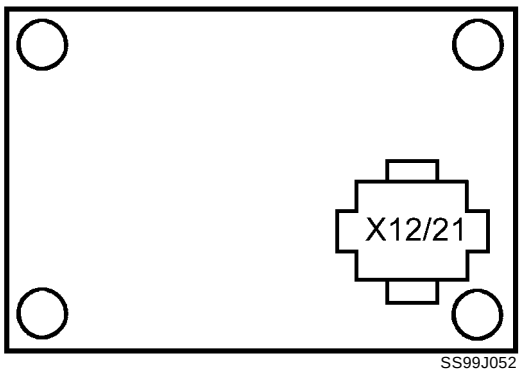
EHR-D BOX A55



List of Plugs

X55 Plug-in connection, EHR box cable

POWER SHIFT ’E’ Box A52

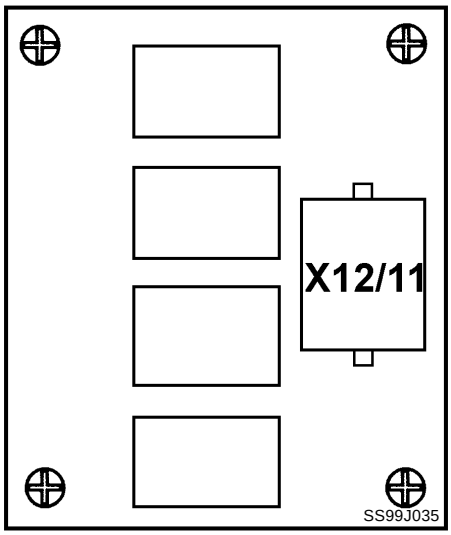


List of Plugs

X12/21 Plug-in connection, chassis, right, transmission

https://truckmanualshub.com/

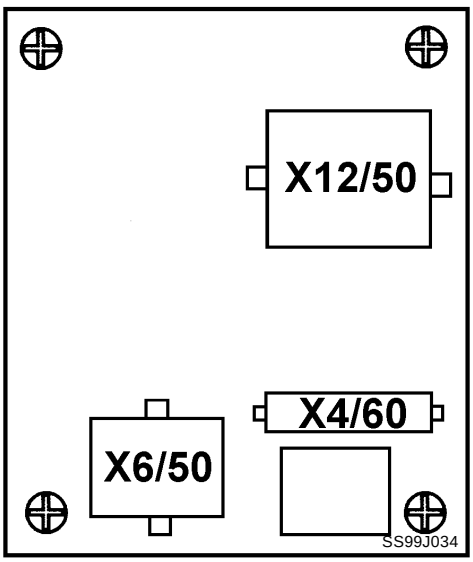
'E' BOX MULTI – JOYSTICK A11/1



List of Plugs

X12/11 Plug-in connection, joystick

E-BOX, REAR PTO SHAFT A50/2

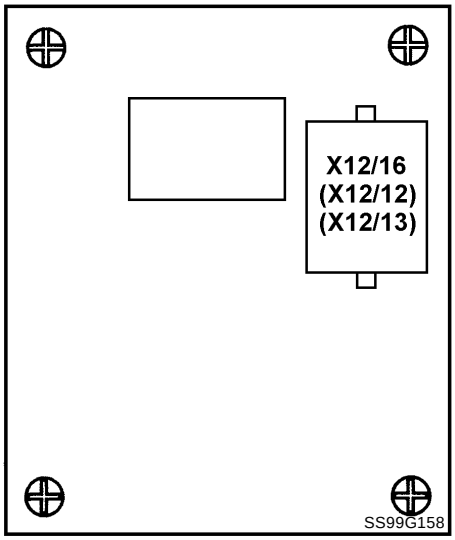


List of Plugs

X4/60 Plug-in connection, cable, chassis, right
X´6/50 Plug-in connection, cable, chassis, right
X12/50 Plug-in connection, cable, electric/hydraulic PTO shaft

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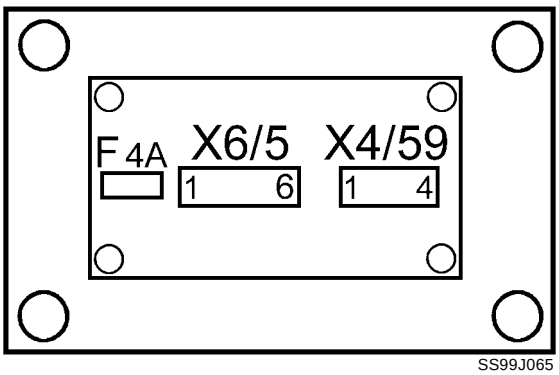
PRINT, SINGLE WINCH A33/1
(PRINT, DOUBLE WINCH A33/2)



List of Plugs

X12/16	Plug-in connection, single winch	X12/13	Plug-in connection, double winch
X12/12	Plug-in connection, double winch		

EGE CONTROL UNIT A10

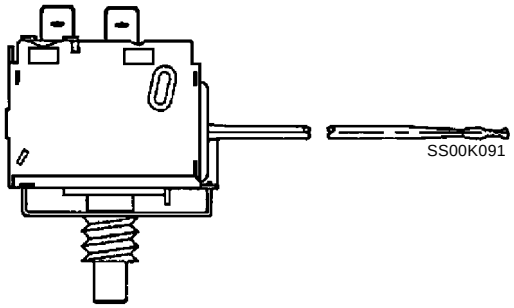


List of Plugs

X4/59	Plug-in connection, EGE potentiometer (R8)	F	Glass tube fuse, 4 Amps
X6/5	Plug-in connection, electronic front implement load relief		(ground potential fuse)

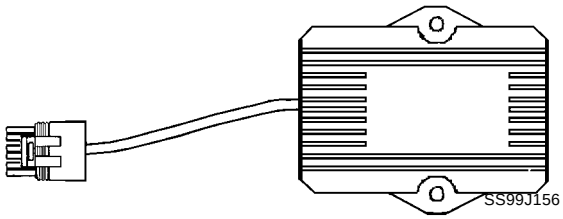
https://truckmanualshub.com/

AIR CONDITIONING THERMOSTAT SWITCH



BLOWER MOTOR CONTROL A21

Steyr from veh. no. 03448
Case from DBD0007418

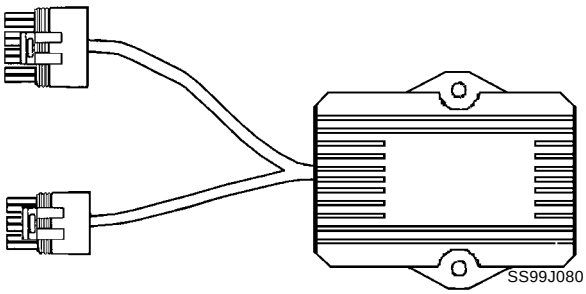


List of Plugs

X3/42 Plug-in connection, blower potentiometer (R11)

AIR CONDITIONING CONTROL A20

Steyr from veh. no. 03448
Case from DBD0007418



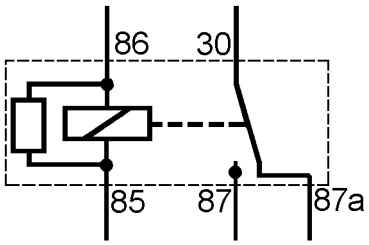
List of Plugs

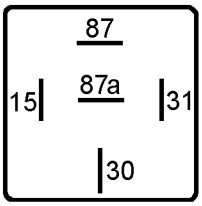
X3/40 Plug-in connection, air cond. control

X4/25 Plug-in connection, air-conditioning potentiometer (R10)

https://truckmanualshub.com/

RELAYS



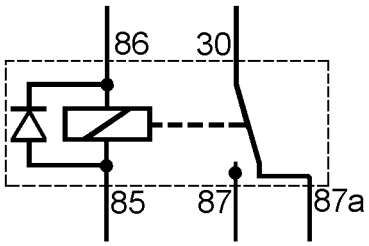


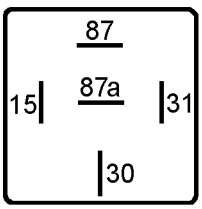
SS99G151

Miniature relay: (Messr's. Wehrle)

Centre zero relay / Normally open
Centre zero relay without diode (K5/17)

Rated voltage:.....12 VDC
Load:.....20/30 A
Suppression..... 390 Ω
Continuous duty.....100 %
Resistance 85 - 86:..... 65 Ω ± 10 %





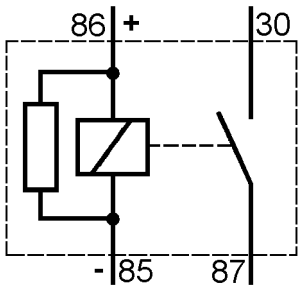
SS00J259

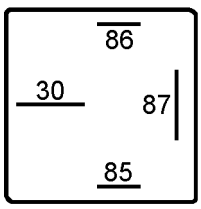
Miniature relay:

Centre zero relay / Normally open

Rated voltage:.....12 VDC
Load:.....20/30 A
Cancellation:..... blocking diode
Continuous duty.....100 %
Resistance 85 - 86:..... 80 Ω ± 10 %

IMPORTANT: *Do not reverse connect coil, or the diode will be destroyed.*

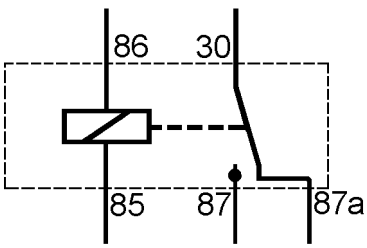


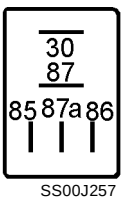


SS99G150

Power relay: (Messr's. Wehrle)

Rated voltage:.....12 VDC
Load:.....70 A
Suppression..... 560 Ω
Continuous duty.....100 %
Resistance 85 - 86:..... 80 Ω





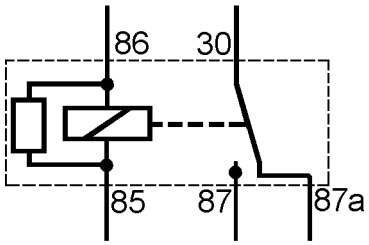
SS00J257

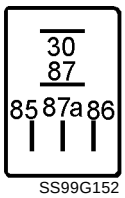
Changeover – micro-relay: (Siemens)

without diode

Rated voltage:.....12 VDC
Load:.....10/20 A
Suppression..... none
Continuous duty.....100 %
Resistance 85 - 86..... 97 Ω ± 10 % at 23 °C

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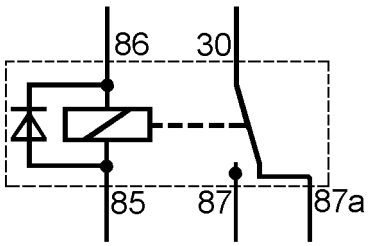


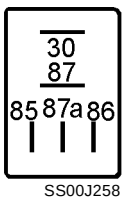


SS99G152

Changeover – micro-relay:
(Messrs Wehrle, Siemens)

Rated voltage: .....12 VDC
Load:.....15/25 A
Suppression.....680 Ω
Continuous duty..... 100 %
Resistance 85 - 86 (Wehrle)..... 90 Ω ± 10 %
Resistance 85 - 86 (Siemens) ..... 97 Ω ± 10 %

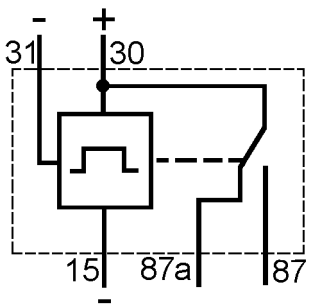


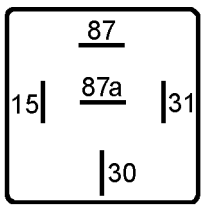


SS00J258

Changeover – micro-relay: (Bosch)
with diode

Rated voltage: .....12 VDC
Load:.....10/20 A
Cancellation:..... blocking diode
Continuous duty..... 100 %
Resistance 85 - 86.....88 Ω ± 10 % at 23 °C

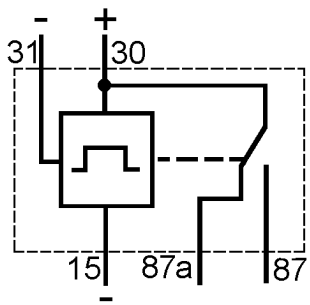


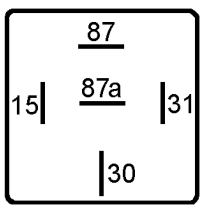


SS99G153

Timed relay 40 sec's. K4/2/2:
(Messr's Wehrle u. Sohn)

Rated voltage: .....12 VDC
Load:.....5 A
Continuous duty..... 100 %

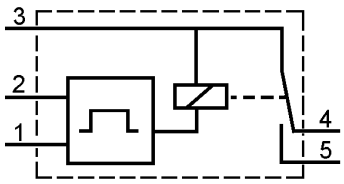


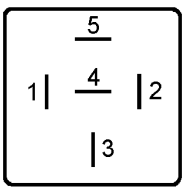


SS99G153

Time relays, 3 sec., K4/1/1, K4/1/2:

Rated voltage: .....12 VDC
Load:.....5 A
Continuous duty..... 100 %





SS00J256

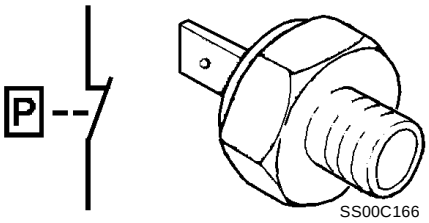
Control unit 14km/h A9:

1 = Ground
2 = Control signal
3 = Supply, plus
4 = Break contact
5 = Make contact

Rated voltage: .....12 VDC
Load:.....10/20 A
Continuous duty..... 100 %
Switching point .....505 Hz
Switching hysteresis.....-10 %

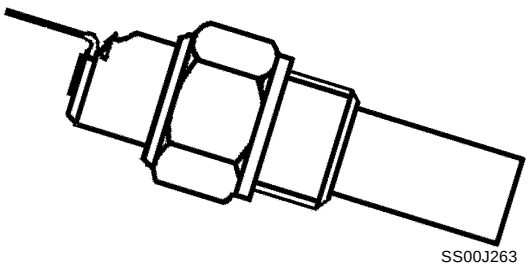
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SWITCHES



Engine oil pressure switch (S6):

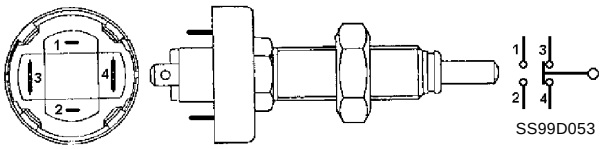
Opens at ..... p > 0.5 bar
Type of contact ..... Normally closed

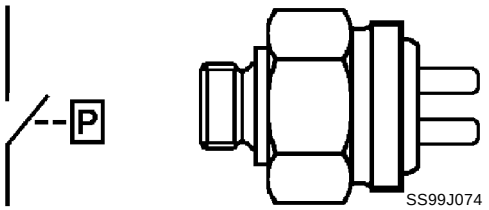


Switch, cooling water temperature (S32):

Switching point ..... ϑ > 110 °C ± 3 °C
Switch-off point ..... 5 °C
Type of contact ..... Normally open
Ground via ..... Chassis and a designated ground connection
Tightening torque ..... max. 20 Nm

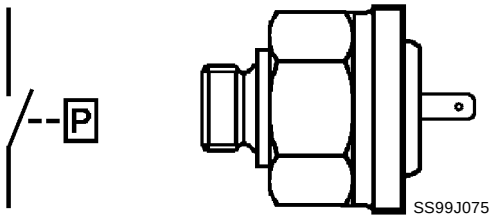
Start safety switch (S10):





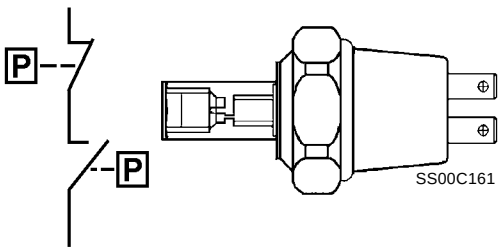
Pressure switches:
Front PTO shaft (S29)

Switching point ..... p > 9 ± 0.5 bar
Type of contact ..... Normally open
Tightening torque ..... max. 30 Nm



Power shift safety switch (S9):

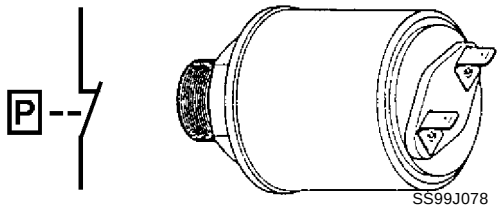
Switching point ..... p > 12 ± 0.5 bar
Type of contact ..... Normally open
Tightening torque ..... max. 30 Nm



Safety switch – Air-cond. system (S30):

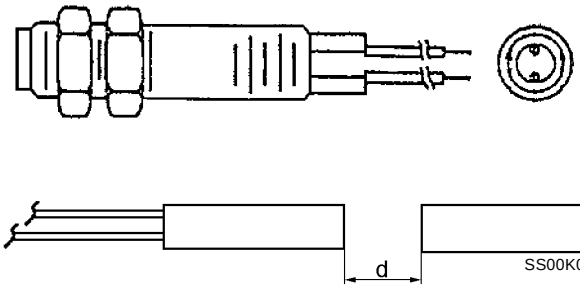
Rated voltage: ..... 12 VDC
High pressure contact, opens at ..... p > 31.5 bar
Low pressure contact, opens at ..... p < 2 bar

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Compressed air switch (S12):

Switching point ..... p > 5.5 bar
Type of contact ..... Normally closed
Ground via ..... Chassis and a designated ground connection

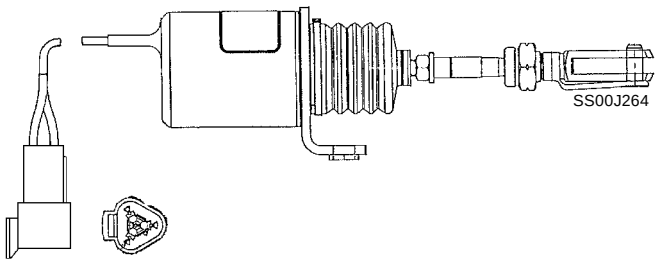


Reed switches (S40/2,S42,S43):

$I_{max.}$ ..... 500 mA
Type of contact ..... Normally open
Operating distance, On (d) ..... 6 mm
Operating distance, Off (d) ..... 14 mm

Reed – changeover relay (S41/1,S41/2):

$I_{max.}$ ..... 500 mA
Type of contact ..... Changeover
Operating distance (d) ..... 6 mm
Operating distance (d) ..... 14 mm



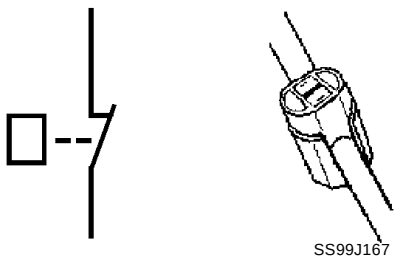
Stop solenoid (Y12):

Rated voltage: ..... 12 VDC
Pull-in coil resistance ..... 0.25 Ω ± 10 % at 20 °C
Holding coil resistance ..... 20 Ω ± 10 % at 20 °C

Not illustrated

Glow plug (E10/1):

Supply voltage: ..... 11 VDC
Heating element res. ..... 0.2 Ω ± 10 %

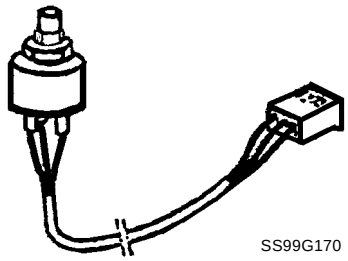


Fuel pre-heating thermostatic switch:

Switching point ..... ϑ > 5 °C
Type of contact ..... Normally closed

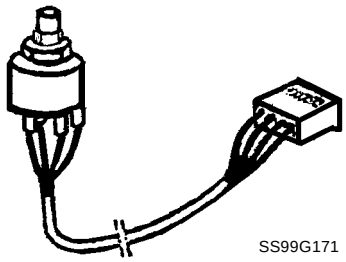
https://truckmanualshub.com/

POTENTIOMETERS


SS99G170

Air-cond. roof blower motor potentiometer (R11):

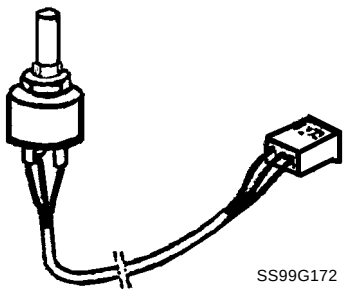
(from infinitely adjustable air conditioning control)
Res. measured A - C .....15 KΩ ± 20 %
Res. measured A - B ..... 0 - 15 KΩ ± 20 %


SS99G171

Air-cond. potentiometer (R10):

(from infinitely adjustable air conditioning control)
Potentiometer with integrated air-cond. –
ON/OFF switch

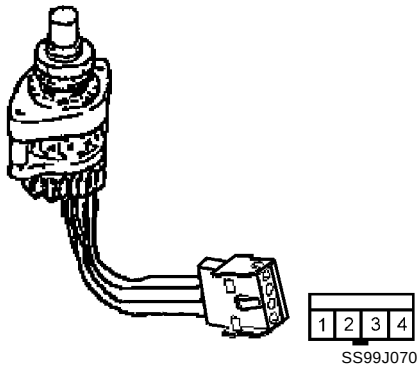
Res. potentiometer .....10 KΩ ± 20 %
Res. measured A - B ..... 0 - 10 KΩ ± 20 %
Switch ON/OFF.....C - D


SS99G172

EHR potentiometer (R6/1,R6/2,R6/3,R6/4):

The 4 EHR potentiometers are identical in value. The differences lie in the wiring and length of the shaft

Res. potentiometer .....4700 Ω ± 20 %
Res. measured A - B .....0 - 4700 Ω ± 20 %



SS99J070

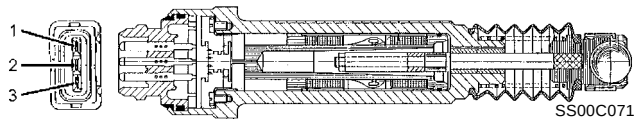
Stepping potentiometer EGE (R8):

Resistance measurement across X4/59

Pin	Latch 0	Latches 1 - 24
3 - 4	3.5 kΩ	3.5 kΩ
2 - 4	•	3.5 kΩ - 0.2 Ω
2 - 3	•	0,2 Ω - 3.5 kΩ
1 - 2	0,2 Ω	•
1 - 2		

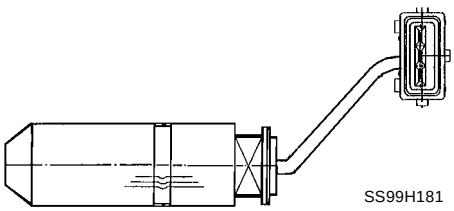
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SENSORS



EHR position sensor (B9/1):

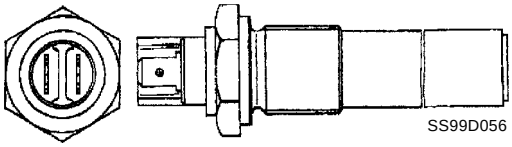
1 = Ground
2 = Signal ..... approx. 2.5 to 7 VDC
3 = Supply ..... 9.5 VDC (EHR box)



EHR force measuring bolts (B10/1,B10/2):

Measurement range: 40 KN (Bosch end number: 545)

1 = Ground
2 = Signal ..... 2.5 to 7.5 VDC (not loaded, approx. 4.7 VDC)
3 = Supply ..... 9.5 VDC (EHR box)



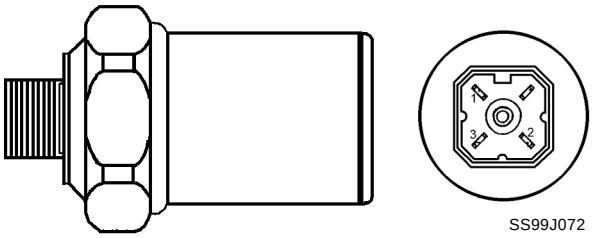
Inductive transmitter, driving speed (B6), Rear PTO shaft speed (B7):

Resistance ..... 1050 Ω ± 10 %
Distance to transmitter wheel ..... 0.5 to 1.0 mm



Air-conditioning temperature sensor (R9):

(from infinitely adjustable air conditioning control)
Type ..... NTC
Resistance A - B ..... ≈ 11 kΩ at 20 °C



Pressure sensor EGE M2 (B20):

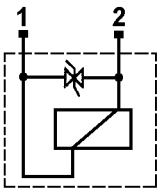
1 = supply voltage: ..... 12 VDC
2 = Ground
3 = signal ..... see table
R_L ..... ≥ 5 kΩ

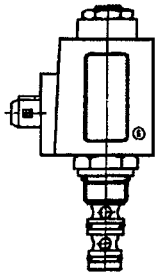
Signal voltage measured at plug X6/5 (pins 1 and 3)

Pressure (bar)	Voltage (V)	Pressure (bar)	Voltage (V)	Pressure (bar)	Voltage (V)
18	0,50	45	1,48	70	2,20
25	0,75	50	1,55	75	2,30
30	0,85	55	1,65	80	2,40
35	1,00	60	1,80	85	2,47
40	1,20	65	1,95	160	5,0

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SOLENOID VALVES



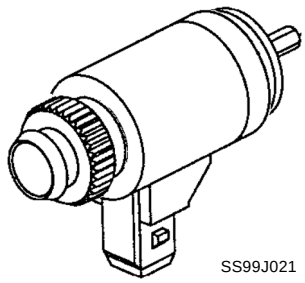


SS99G166

Solenoid valve
4-wheel drive (Y1)
Power shift (Y3)
Rear axle diff. lock (Y10)
Front axle differential lock (Y8)
Rear PTO shaft (Y14):

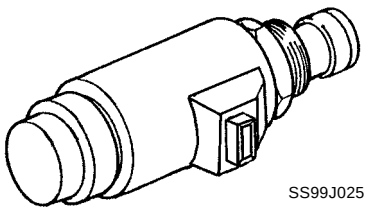
Rated voltage:.....12 VDC
Continuous duty.....100 %
Messrs Hytos
Suppression
Z diodes, anti-parallel
Coil resistance ..... 8 Ω ± 10 % at 20 °C
Bosch
Coil resistance ..... 10 Ω ± 10 % at 20 °C

Solenoid valve EHR control unit (Y6,Y7):



SS99J021

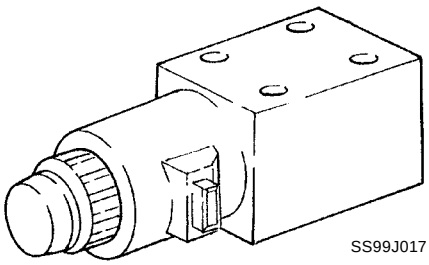
Proportional solenoid: .....12 VDC
$I_{max.}$.....3.5 A
Current control ..... Pulse width modulation
Coil resistance ..... 1.7 Ω



SS99J025

Solenoid valve (shut-off valve)
Auxiliary control unit (Y2/4):

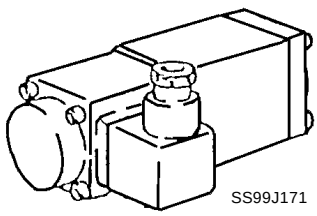
Supply voltage: .....12 VDC
Power.....28.8 W
Coil resistance ..... 5 Ω ± 10 %
Continuous duty.....100 %



SS99J017

Solenoid valve (directional control valve)
Auxiliary control unit (Y2/1,Y2/2,Y2/3):

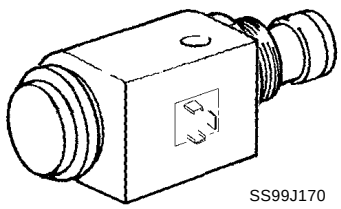
Supply voltage: .....12 VDC
Power.....32,7 W
Coil resistance ..... 4.4 Ω ± 10 %
Continuous duty.....100 %



SS99J171

Solenoid valve EGE (Y2/1, Y2/2):
(Messr's. Wandfluh)

Supply voltage: .....12 VDC
Coil resistance ..... 5.4 Ω ± 10 % at 20 °C
Continuous duty.....100 %



SS99J170

Solenoid valve EGE (Y20, Y21):

Supply voltage: .....12 VDC
Coil resistance ..... 7.5 Ω ± 10 % at 20 °C
Continuous duty.....100 %

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INSTRUMENT TEST VALUES

Fuel tank transmitter B2/1 (left) and B2/2 (right)		Fuel gauge (./M100)	
Diesel level	Resistance Ω	Pointer angle	Display area
0	10	0°	from 0 - 12° red sector
1/8	31,2	7,5°	
1/2	95	30°	from 30 - 35° white sector
1	180	60°	from 60 - 65° white sector

Engine temperature transmitter (B1)		Engine temperature gauge (./M102)	
Temperature °C	Resistance Ω	Pointer angle	Display area
45	239	0°	from 0 - 10° white sector
60	134	0°	
75	82	14°	
90	51	20°	
105	33,4	42°	from 42 - 52° red sector
113	26,8	53°	
120	22,4	60°	

Compressed air transmitter (B3)		Compressed air indicator (./M101)	
Pressure in bar	Resistance Ω	Pointer angle	Display area
0	10	0°	from 0 - 13° red sector
2	52	0°	
4	88	0°	
6	124	24°	from 37 - 42° white sector
8	155	42°	
10	184	60°	from 59 - 63° white sector

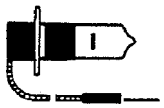
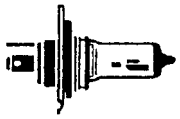
Tractor meter (./M2)			
Engine speed rpm	Permissible deviation	Pointer angle	Frequency at generator terminal "W"
1000	± 100	67°	254 Hz
2000	± 65	163°	508 Hz

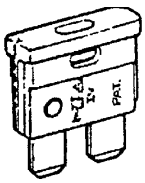
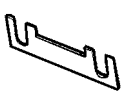
Transmission ratio, engine – generator i = 1: 2,54

Generator has 6 pairs of poles = 6 pulses per revolution

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LAMPS AND FUSES

Rotating beacon	H1 12V - 55W	1-34-772-051	
Searchlight	H3 12 V - 55W	190003452243	
Headlight, roof headlight	H4 12V - 60/55W	190003450013	
Trafficators, front and rear, brake light	P25-1 12 V - 21W	190003452245	
Roof number plate light	L 12 V - 5W	190003452276	
Cab interior light	L 12V - 10W	190003452249	
Front sidelights, tail light	G 12 V - 5W	190003452216	
Cigarette lighter	H 12V 2W	190003452207	
Digital tractor meter	12V/2W	135700580708	
Instrument lighting and indicator lamps	12V/1.2W	190003450031	
Toggle switch, EHR diagnosis LED	W5/1.2-12V-1.2W	190003452250	
Courtesy light, EHR console lighting	T4/4 12 V 4W	190003452212	

3A	violet	1-40-258-203	**20A**	yellow	1-40-258-120	
5A	beige	1-40-258-105	**25A**	white	1-40-258-125	
7,5A	brown	1-40-258-107	**30A**	green	1-40-258-130	
10A	red	1-40-258-110	**40A**	orange	1-40-258-140	
15A	light blue	1-40-258-115				
40A **100A**		1-40-177-040 1-40-277-014				
4 A	(slow-blow)	EGE	ý 5 x 20			

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OPERATING AND CODING OF THE DIGITAL INSTRUMENT WITH INTEGRATED OPERATING HOURS COUNTER

General information

All functions are called up using the spring-loaded switch (button), marked by the PTO symbol, on the right-hand side of the instrument panel. The switch need only be pressed briefly to call up operating functions. If it is held pressed for longer than 10 sec's. coding values can be checked and/or corrected.

Operating / function

Ignition ON/Starting/Operation	the display shows a small "h" and the cumulative operating hours.
Press the button	again the rear PTO shaft speed will be shown on the display.
Press the button again	the front PTO shaft speed will be shown on the display.
Press the button again	the operating hours will again be shown on the display.

Coding

the engine speed (operating hours)
the rear PTO shaft speed indication
the front PTO shaft speed indicator

General information

Each time the button is briefly pressed, the display will be visibly increased by one impulse. If the button is pressed continually for longer than 1.5 sec's. the impulses will be increased rapidly. When the button is released, "PRO" appears on the display after 8 sec's. The value set is stored by briefly pressing the button once again and the display will return to the starting position (operating hours).

Coding the engine speed indication (operating hours)

Press the button for 20 sec's.

The combination of numbers 1 - 1 appears in the upper part of the display, the current value or value to be corrected appears in the lower part of the display. The code adjustment range is 15 - 255 impulses. Tractors M9078 - M9094 or CS78 -94 have the **code number 15**.

Coding the rear PTO shaft speed indication

Press the button for 22 sec's.

The combination of numbers 2 - 2 appears in the upper part of the display, the current value or value to be corrected appears in the lower part of the display. The code adjustment range is 1 - 100 impulses. The **code number 10** must be set and stored for all models (code number 10 = 10 teeth on the measuring wheel).

Coding the rear PTO front speed indication

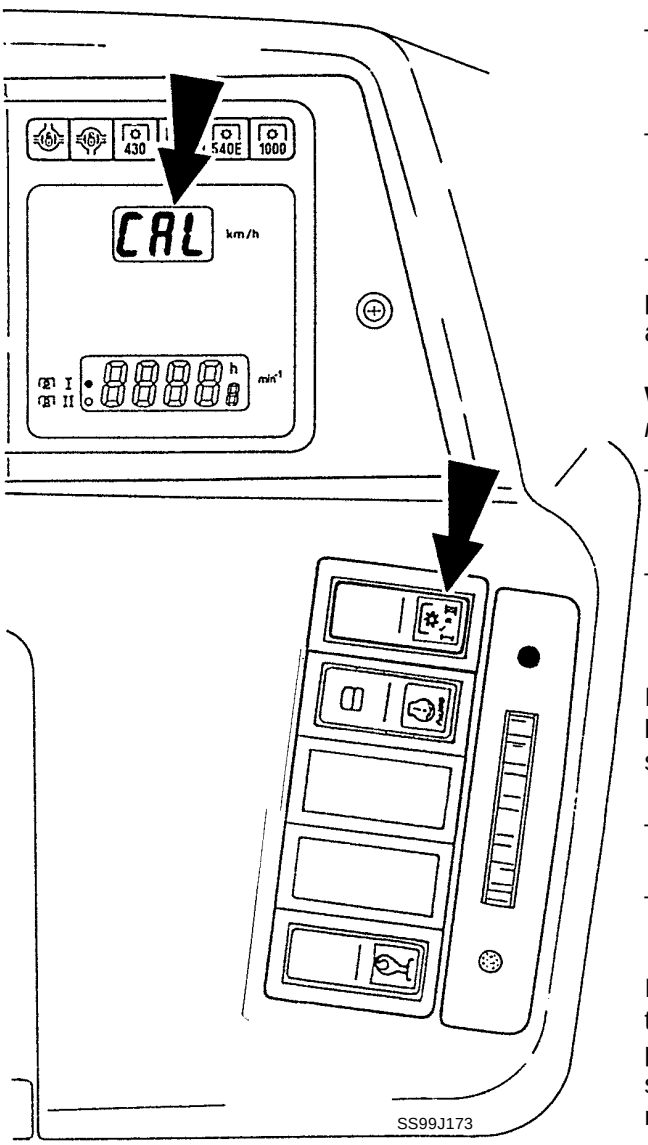
Press the button for 24 sec's.

The combination of numbers 3 - 3 appears in the upper part of the display, the current value or value to be corrected appears in the lower part of the display.
The code adjustment range is 1 - 100 impulses. The **code number 32** must be set and stored for all models.

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CALIBRATING THE DRIVING SPEED

Re-calibration is required after replacing tyres or when 3 bars appear on the km/h display.



Measure out a distance of exactly 100 m and mark both ends clearly.

– Press the pushbutton (Switchover Rear PTO/Front PTO/Operating hours) for at least 10 seconds, until CAL appears on the km/h display.
– Start to drive and when the tractor's front axle is in line with the 0 mark, press the pushbutton briefly – the letters COU will then appear on the display.

The impulses will be counted to 9999 on the bottom part of the display, ---- will appear above this, pay no attention to this.

WARNING: *Minimum speed within the 100 m markings = 2 km/h – it is possible to drive faster.*

– When the front axle is in line with the 100 m mark, press the pushbutton briefly once again – the letters **PRO appear on the display.**
– If the programming sequence was carried out correctly, press again – the digital tractor meter will then store the new, calibrated count.

If the driving speed is not displayed, the tractor must be stopped and the engine must be stopped and then started again.

– When the tractor is at a standstill, 0.0 km/h will be displayed.
– The current speed is displayed when the tractor is in motion.

If a fault occurs during calibration (delay in pressing the switch etc.) – simply switch the ignition OFF before pressing the switch for the last time, the programming sequence will thus not be accepted and the old values remain in effect.

Repeat the procedure.

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Chapter

4002

CIRCUIT DIAGRAM

M9078, M9078a, M9086a, M9094a, CS78, CS78a, CS86a, CS94a

post DBD 0055001

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Technische Dokumentation/Training Center
A - 4300 St. Valentin, Steyrer Straße 32

Sva 7-97390 EN
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October, 1999

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INDEX

CIRCUIT DIAGRAM INDEX 3
SheetSheet 1 5
Sheet 2 7
Sheet 3 9
Sheet 4 11
Sheet 5 13
Sheet 6 15
Sheet 7 17
Sheet 8 19
Sheet 9 21
Sheet 10 23
Sheet 11 25
Sheet 12 27
Sheet 13 29
Sheet 14 31
Sheet 15 33
Sheet 16 35
Sheet 17 37
Sheet 18 39
Sheet 19 41
Sheet 20 43
Sheet 21 45
Sheet 22 47
Sheet 23 49
Sheet 24 51
Sheet 25 53
Sheet 26 55
Sheet 27 57
Sheet 28 59
Sheet 29 61
Sheet 30 63
Sheet 31 65
Sheet 32 67
Sheet 33 69
Sheet 34 71
Sheet 35 73
Sheet 36 75
Sheet 37 77
Sheet 38 79
Sheet 39 81
Sheet 40 83
Sheet 41 85
List of Plugs 87
List of Plugs 88
List of Plugs (at rear) 89
List of Plugs – Instrument Panel 90
List of Plugs – Right-hand Side Panel 91
Central Electrics Print A12 92
Central Electrics Print A12 93
Print – Roof electrics A13 95
Component carrier – Low-Top 97
Component Carrier – Engine Electrics 98
EHR D Print, left, A15 99
EHR-D Print, operating console, A16 100
MHR – Operating Console A16 101
EHR 'E' box – Operating A51 101
EGE control unit A11 102
PTO Shaft Control Unit A50/2 102
4-Wheel Drive Management – Control Unit A10 103

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Power Shift 'E' Box A52 103
Joystick 'E' Box A11/1 104
Print, Single Winch A33 1/2 104
Blower motor – Control A21 105
Air-Conditioning – Control A20 105
Relays 106
Switches 107
Potentiometers 109
Sensors 110
Solenoid Valves 112
Instrument Test Values 114
Lamps and Fuses 115
Operation and Coding the Digital Instrument with Integrated operating Hours Counter 116
Calibrating the speedometer 117

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CIRCUIT DIAGRAM INDEX

M9078 – M9094
CS78 – CS94

Title	**Sheet** (e.g. 1) **Section** (e.g. A)	Title	**Sheet** (e.g. 1) **Section** (e.g. A)
1st auxiliary control unit, front-end lifting gear, external buttons	31D	EHR ext. buttons, internally operated	33C
1st auxiliary control unit, joystick operated	31B	EHR external buttons	33D
1st auxiliary control unit, lever switch operated	31E	EHR front control	32F
1st auxiliary control unit, multi-controller operated	31C	EHR lifting/control per multi-controller	35B#
2nd auxiliary control unit, lever switch operated	30D	EHR lifting/control per rocker switch	36B#
2nd auxiliary control unit, multi-controller operated	30C	EHR lighting, front panel	34J
4-wheel drive	6B#	EHR lowering speed	34D
4-wheel drive, Opti Stop Management	5B#	EHR mixed control	34E
Air-conditioning system, high-top	20A#	EHR Raise + Lower solenoid valve	32D
Air-sprung seat	28D	EHR Raise/Lower indicator	34C
Auxiliary headlight, high-top	10B#	EHR setpoint	35C
Auxiliary headlight, low-top	11B#	EHR stop	35D
Blower motor, high-top	21A#	EHR switchover, lift/pressure	36E#
Brake light	5A	EHR traction control	34H
Centre instrument panel – display	24B	EHR transport signal	35A
Centre instrument panel – warning indicator	25C	EHR transport signal	5E#
Centre instrument panel, analogue	25D	EHR upper limit	34F
Cigarette lighter	28B	EHR – slip display	34B
Diff. lock management	5C#	Electronic front implement load relief	41A
Diff. lock, front	5D#	Engine cut-out with stationary stop	3C
Differential lock	6C#	Engine cut-out without stationary stop	4C
Digital clock, high-top	15C#	External sensor preparation	33E
Dipped/Main beam switchover	10D	Floor level heating	14C
Double winch	38B#	Front heated screen, high-top	17D
Double-action auxiliary control unit (+ shut-off valve) 2nd multi-function lever	29D	Front sidelight, high-top	8C#
Double-action auxiliary control unit (+ shut-off valve) lever switch	29C	Front sidelight, low-top	9C#
Double-action auxiliary control unit rocker switch	29B	Front twinpower searchlight, high-top	12C#
Double-action auxiliary control unit toggle switch	29B	Front washer pump	18D
Double-action auxiliary control unit, floating position + shut-off valve, solenoid valve	31A	Fuel filter heating	7A
Double-action auxiliary control unit, floating position + shut-off valve, solenoid valve	30B	Fuel pump control	3A
EHR auxiliary switch	34G	Headlights	10C
EHR diagnostics display	34A	Heated rear screen, high-top	17E

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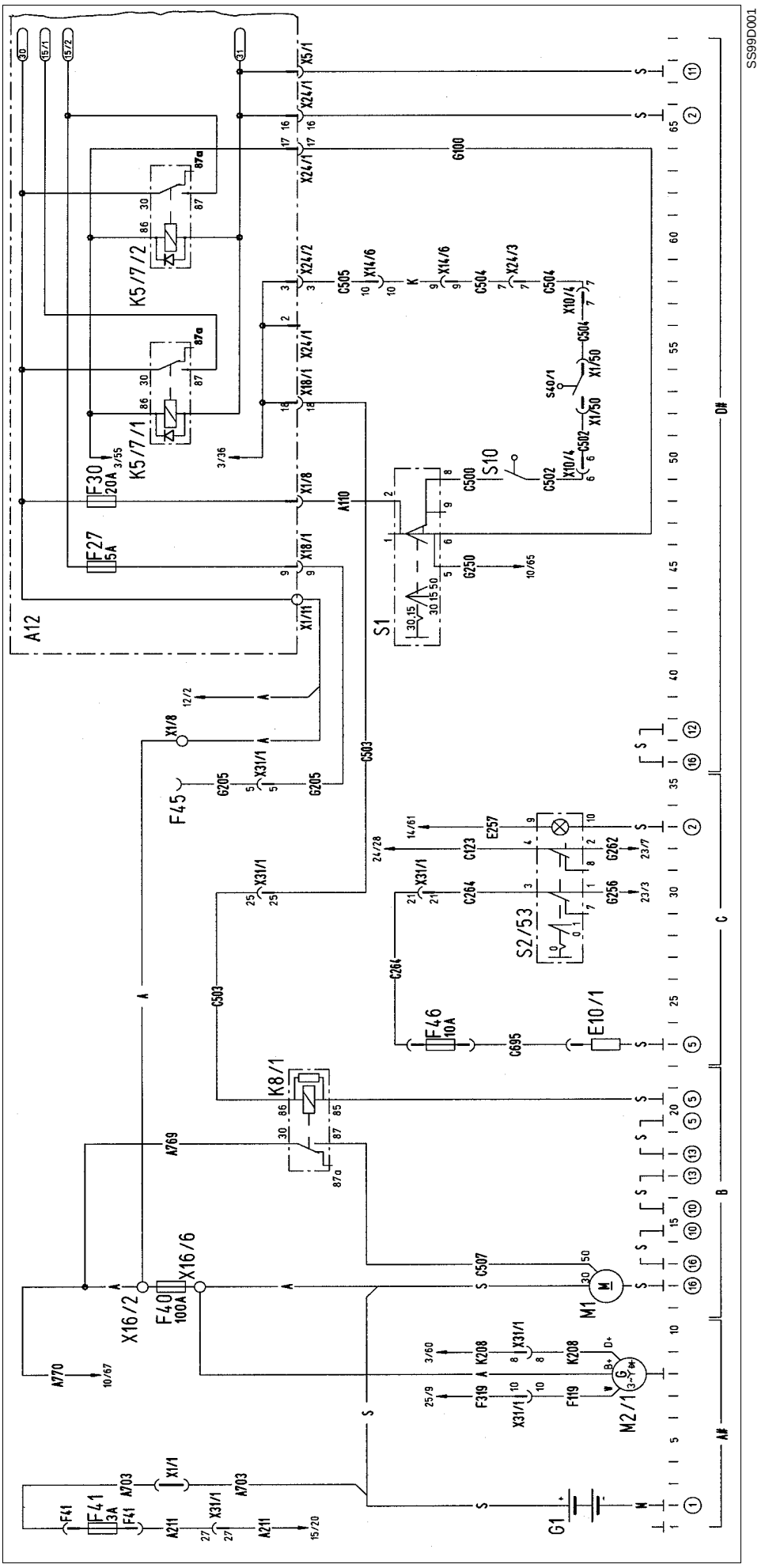
Horn	18A	Searchlight on trafficator/sidelight	12D#
Interior light, low-top	16E#	Searchlight, mudguard	10A#
Italian brake valve	23B	Searchlight, mudguard, as a reversing light	11A#
Left instrument panel – analogue	25B	Sidelight, rear	8D
Left instrument panel – display	24A	Single winch	40B#
Mech. Operating hours counter	25A	Spotlight, high-top	17B
MHR 50%-switch	6E#	Standard front wiper, high-top	18F#
Mirror heating, high-top	17A	Standard front wiper, low-top	19F#
Number plate lighting, high-top	17C	Standard rear wiper, high-top	18G#
Number plate lighting, high-top, with 2 searchlights	13B#	Standard rear wiper, low-top	19G#
Parallel wipers, front	18C	Standard signal socket for EHR	33B
Position sensor	32C	Standard signal socket for MHR or on-board computer preparation	22B
Power sensors	32B	Starter	1B
Power shift	7B	Starting with electrical PTO shaft	1D#
Power socket 40A	22C	Starting with mech. PTO-shaft	2D#
Power supply	1A#	Stationary operation cut-out	3C#
Power supply + battery master switch	2A#	Steering column switch	18B
Pre-glowing	1C	Step/interior lighting, high-top	15E#
Radio preparation, high-top	15A#	Supply potential 15, high-top	15B#
Radio preparation, low-top	16A#	Supply potential 15, low-top	16B#
Rear inner searchlight, high-top	12B#	Supply potential 15/1, instrument	23A
Rear outer searchlight, high-top	12A#	Supply potential 58, various switches	28E
Rear PTO shaft	37A	Supply potential 58L, instrument	14A
Rear washer pump	18E	Supply potential 58R, instrument	14D
Reserve print, EHR, left	23D	Supply, EHR box	32A
Reserve roof print (high-top)	23C	Supply, EHR operating console	28A
Reserves – central print	7D	Supply, ‘E’ box, aux. control unit/ PTO shaft	30A
Right instrument panel – digital	26A#	Traction Control	33A
Right instrument panel – display	24C	Trafficator system	8A
Right instrument panel, without digital	27A#	Trafficator, high-top	8B#
Rotating beacon, high-top	15D#	Trafficator, low-top	9B#
Rotating beacon, low-top	16D#	Trailer socket	22A
Safety switch	28C	Winch supply	38A
Searchlight on rear axle	14B		

EHR = Electronic Lift Control

MHR = Mechanical Lift Control

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Sheet 1



Electrical equipment

A12	Print, central electrics
E10/1	Glow plug
F27	Fuse, potential 15, engine equipment carrier
F30	Fuse, potential 30, ignition
F40	Main fuse 100A
F41	Fuse, clock, radio
F74	Fuse, reserve potential 15
F46	Fuse, pre-glowing
G1	Battery 12V/90AH/480A
K5/7/1	Relay potential 15/1 supply
K5/7/2	Relay potential 15/2 supply
K8/1	Relay, starter motor
M1	Starter motor
M2/1	Parallel wiper motor, front
S1	Switch, pre-glow starter
S2/53	Switch, pre-glowing
S10	Switch, neutral position
S40/1	Neutral switch, front PTO shaft
X1/1	Plug-in connection, flat, potential 30
X1/8	Screw-on connector, instrument – engine
X1/11	Screw-on connector, central print 30
X1/50	Push-on connection, front PTO shaft, neutral
X5/1	Ground distributor, central print
X10/4	Distributor, potential 15, central print
X14	Plug-in connection, chassis right, PTO shaft indicators
X16/2	Screw-on connector, engine 30, fused
X16/6	Screw-on connector, engine 30, not fused
X18/1	Plug-in connection, instrument cable
X24/1	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right
X24/3	Plug-in connection, chassis, right-instrument
X31/1	Plug-in connection, instrument-engine

VERSIONS
to this Sheet
1
on Sheet/Sheets
2

Grounding points

1	Battery
2	Instrument panel
5	Engine compartment
10	Starter mounting
11	Driver's cab frame
12	Carrier frame
13	Bulkhead
16	Starter

Designation of Sections

A#	Power supply
B	Starter
C	Pre-glowing
D#	Starting with electr. PTO shaft
#	several versions available

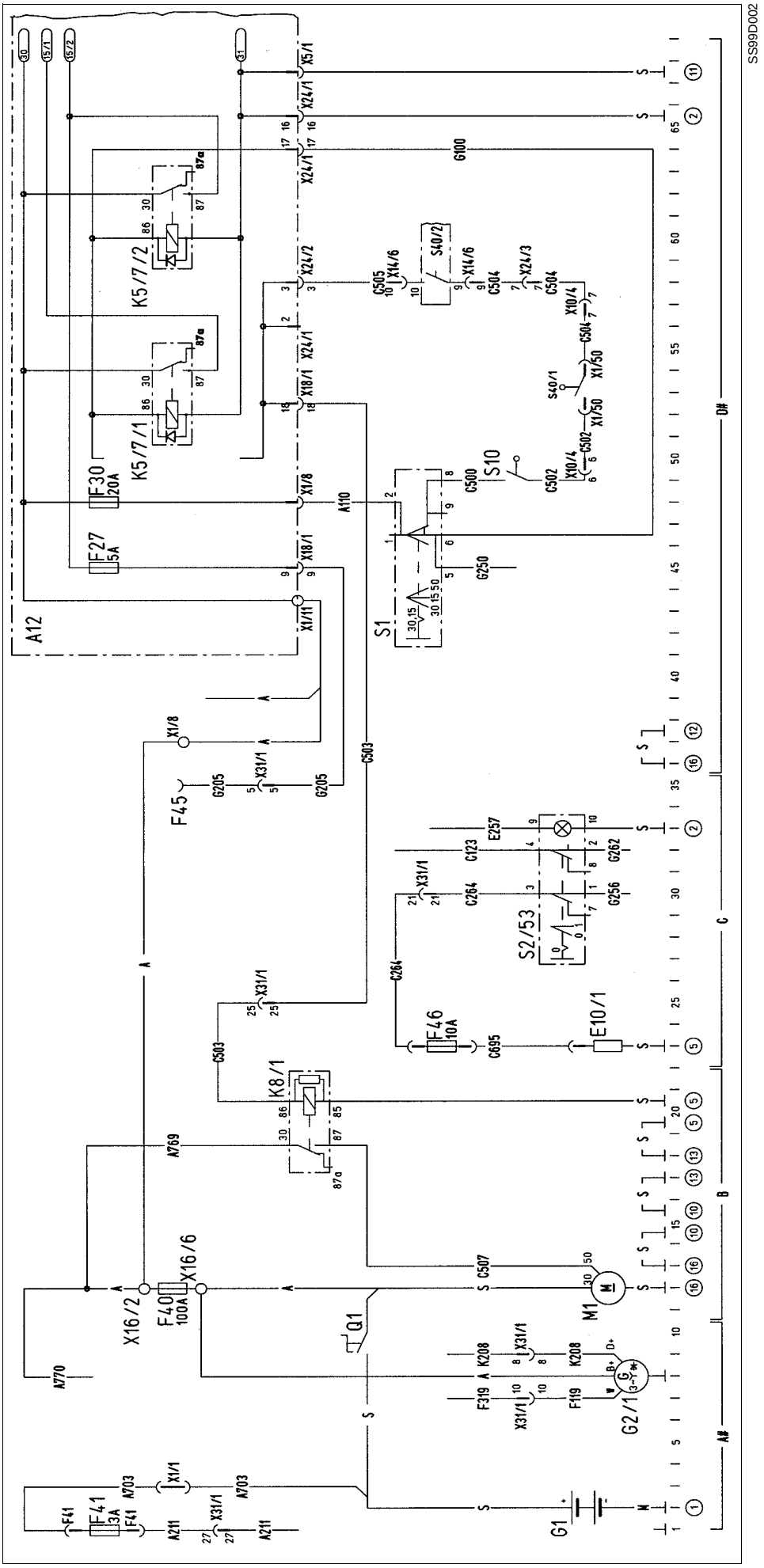
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 2



Electrical equipment

A12	Print, central electrics
E10/1	Glow plug
F27	Fuse, potential 15, engine equipment carrier
F30	Fuse, potential 30, ignition
F40	Main fuse 100A
F41	Fuse, clock, radio
F74	Fuse, reserve potential 15
F46	Fuse, pre-glowing
G1	Battery 12V/90AH/480A
G2/1	Generator 14V/95A
K5/7/1	Relay potential 15/1 supply
K5/7/2	Relay potential 15/2 supply
K8/1	Relay, starter motor
M1	Starter motor
Q1	Battery master switch
S1	Switch, pre-glow starter
S2/53	Switch, pre-glowing
S10	Switch, neutral position
S40/1	Neutral switch, front PTO shaft
S40/2	Neutral switch, rear PTO shaft
X1/1	Plug-in connection, flat, potential 30
X1/8	Screw-on connector, instrument – engine
X1/11	Screw-on connector, central print 30
X1/50	Push-on connection, front PTO shaft, neutral
X5/1	Ground plug-in connection, central print
X10/4	Distributor, potential 15, central print
X14/6	Plug-in connection, chassis right, PTO shaft indicator
X16/2	Screw-on connector, engine 30, fused
X16/6	Screw-on connector, engine 30, not fused
X18/1	Plug-in connection, instrument cable
X24/1	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right
X24/3	Plug-in connection, chassis, right-instrument
X31/1	Plug-in connection, instrument-engine

VERSIONS
to this Sheet
2
on Sheet/Sheets
1

Grounding points

1	Battery
2	Instrument panel
5	Engine compartment
10	Starter mounting
11	Driver's cab frame
13	Bulkhead
16	Starter

Designation of Sections

A#	Power supply
B	Starter
C	Pre-glowing
D#	Starting with electrical PTO shaft
#	several versions available

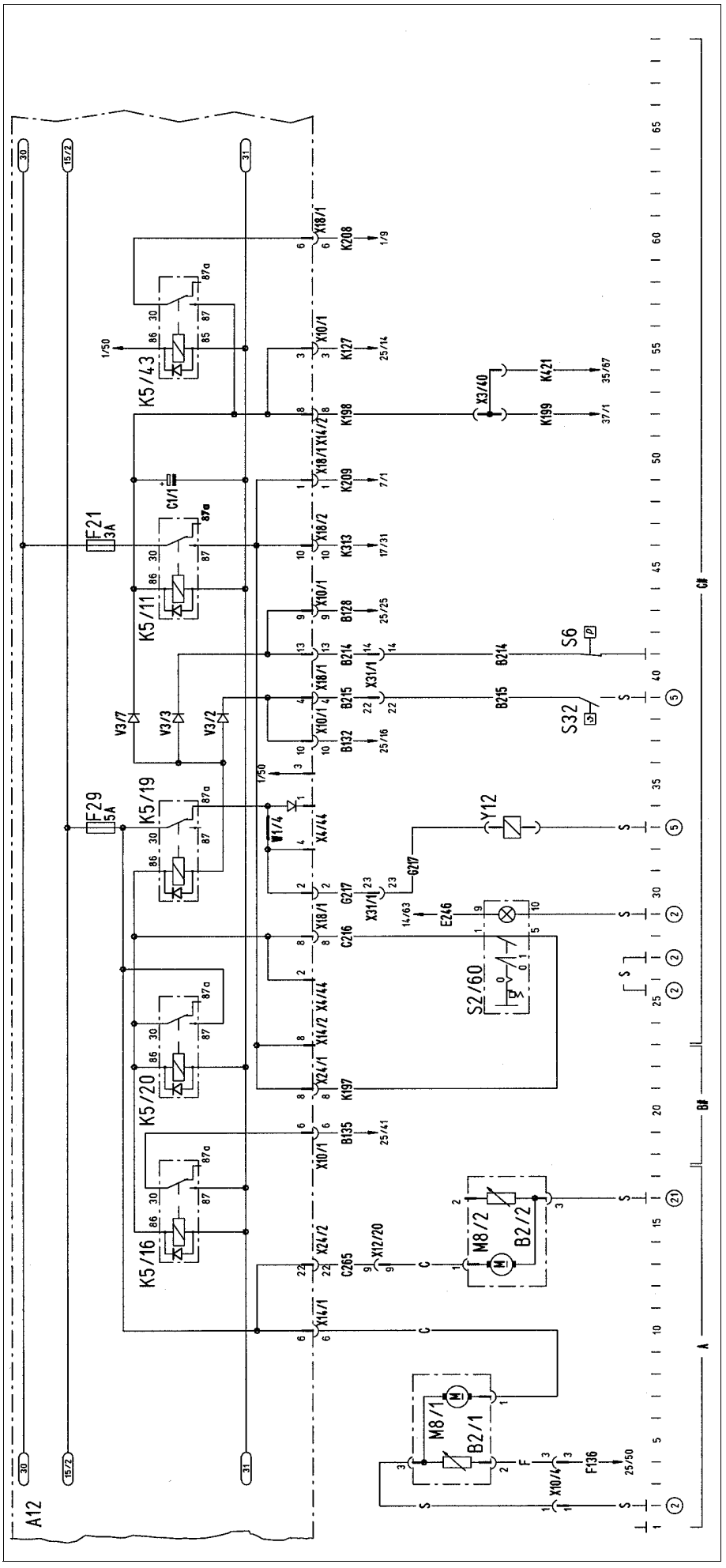
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 3



Electrical equipment

A12	Print, central electrics
B2/1	Fuel tank content transmitter, left
B2/2	Fuel tank content transmitter, right
C1/1	Charging indicator capacitor
F21	Fuse, potential D+
F29	Fuse, potential 15, cut-out, power shift
K5/11	Relay potential D+ supply
K5/16	Relay, stationary operation
K5/19	Relay, stationary operation
K5/20	Relay, stationary operation
K5/43	Relay, D+ cut-out
M8/1	Left-hand tank pump motor
M8/2	Right-hand tank pump motor
S2/60	Switch, stationary operation
S6	Switch, engine oil pressure indicator
S32	Switch, water temperature indicator
V3/2	Diode 0.3A interlock
V3/3	Diode 3A interlock
V3/7	Diode 0.3A interlock
W1/4	Contact bridge, spark start
X3/40	Plug-in connection, air cond. control
X4/44	Plug-in connection, spark start
X10/1	Plug-in connection, instrument cable
X10/4	Distributor, potential 15, central print
X12/20	Plug-in connection, chassis, right, transmission
X14/1	Plug-in connection, cable, chassis, left
X14/2	Plug-in connection, instrument cable
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply
X24/1	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right
X31/1	Plug-in connection, instrument -engine
Y12	Engine cut-out solenoid valve

VERSIONS
to this Sheet
3
on Sheet/Sheets
4

Grounding points

2	Instrument panel
5	Engine compartment
13	Bulkhead
21	Console Transmission plug

Designation of Sections

A	Fuel pump control
B#	with electrical PTO shaft
C#	Stationary operation cut-out
#	several versions available

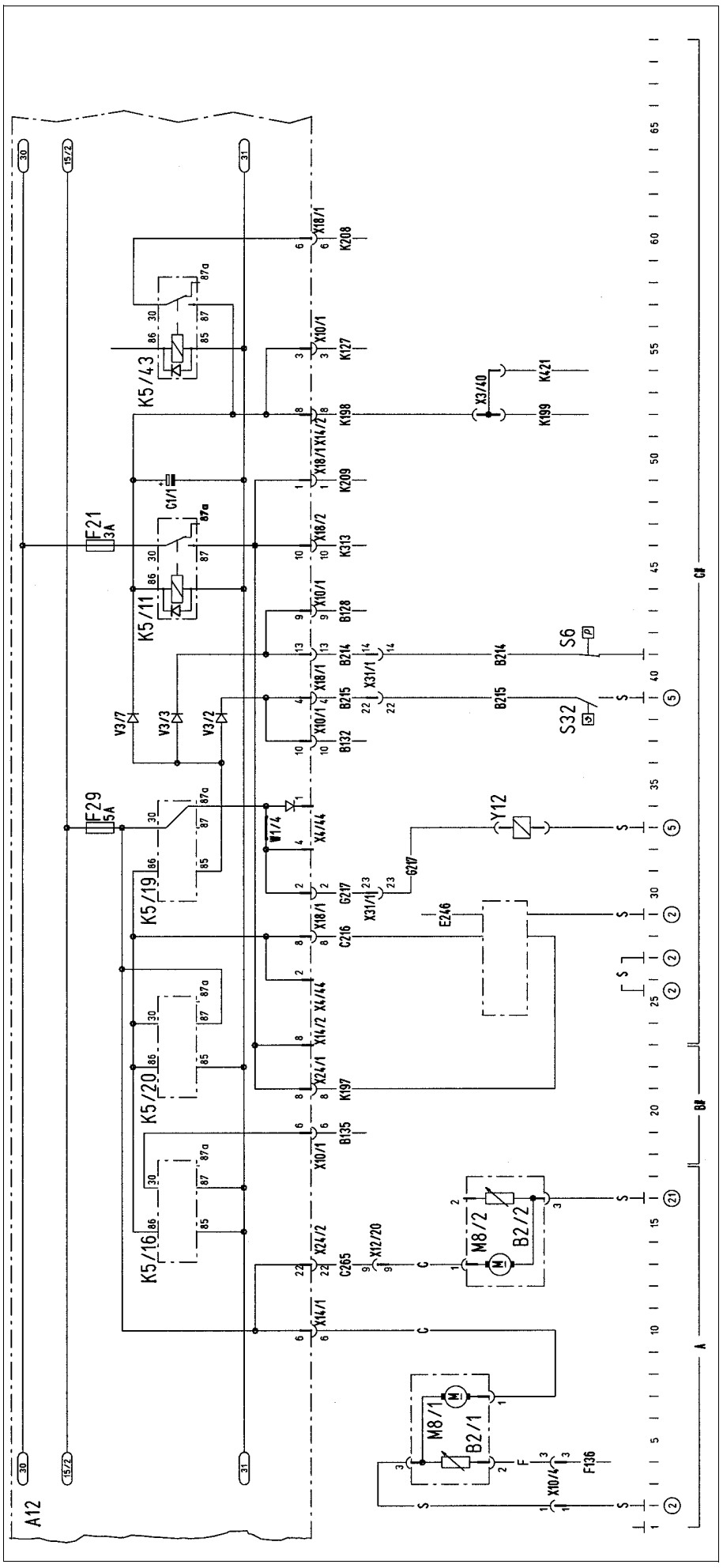
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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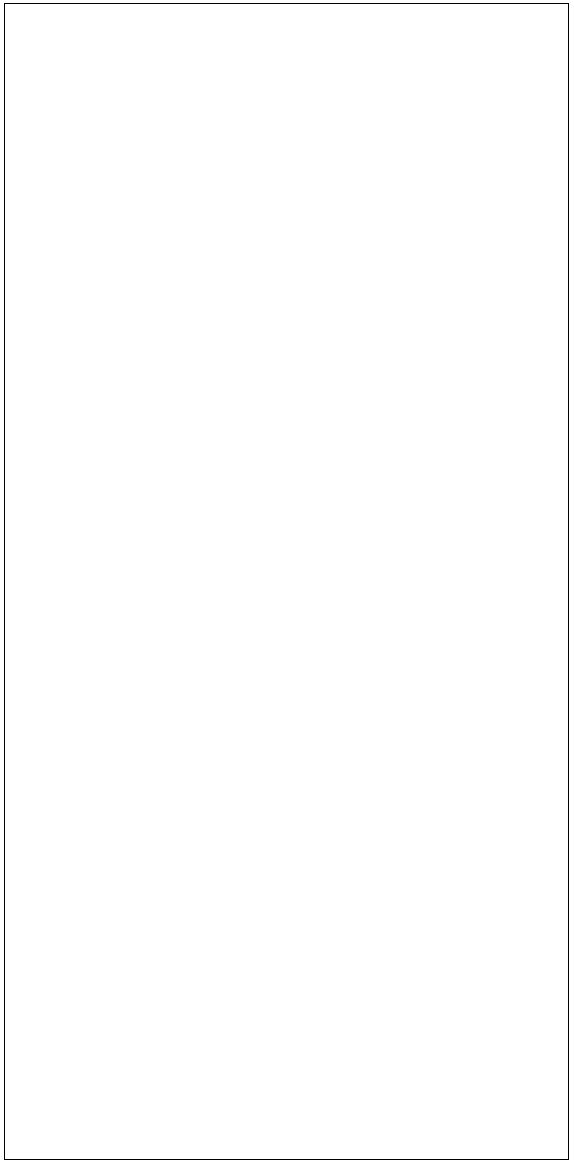
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Sheet 4



Electrical equipment

A12	Print, central electrics
B2/1	Fuel tank content transmitter, left
B2/2	Fuel tank content transmitter, right
C1/1	Charging indicator capacitor
F21	Fuse, potential D+
F29	Fuse, potential 15, cut-out, power shifting
K5/11	Relay potential D+ supply
K5/16	Relay, stationary operation
K5/19	Relay, stationary operation
K5/20	Relay, stationary operation
K5/43	Relay, D+ cut-out
M8/1	Left-hand tank pump motor
M8/2	Right-hand tank pump motor
S6	Switch, engine oil pressure indicator
S32	Switch, water temperature indicator
V3/2	Diode 0.3A interlock
V3/3	Diode 3A interlock
V3/7	Diode 0.3A interlock
W1/4	Contact bridge, spark start
X3/40	Plug-in connection, air cond. control
X4/44	Plug-in connection, spark start
X10/1	Plug-in connection, instrument cable
X10/4	Distributor, potential 15, central print
X12/20	Plug-in connection, chassis, right, transmission
X14/1	Plug-in connection, cable, chassis, left
X14/2	Plug-in connection, instrument cable
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply cable
X24/1	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right
X31/1	Plug-in connection, instrument – engine



VERSIONS
to this Sheet
4
on Sheet/Sheets
3

Grounding points

2	Instrument panel
5	Engine compartment
13	Bulkhead
21	Console Transmission plug

Designation of Sections

A	Fuel pump control
B#	with electrical PTO shaft
C#	Stationary operation cut-out.
#	several versions available

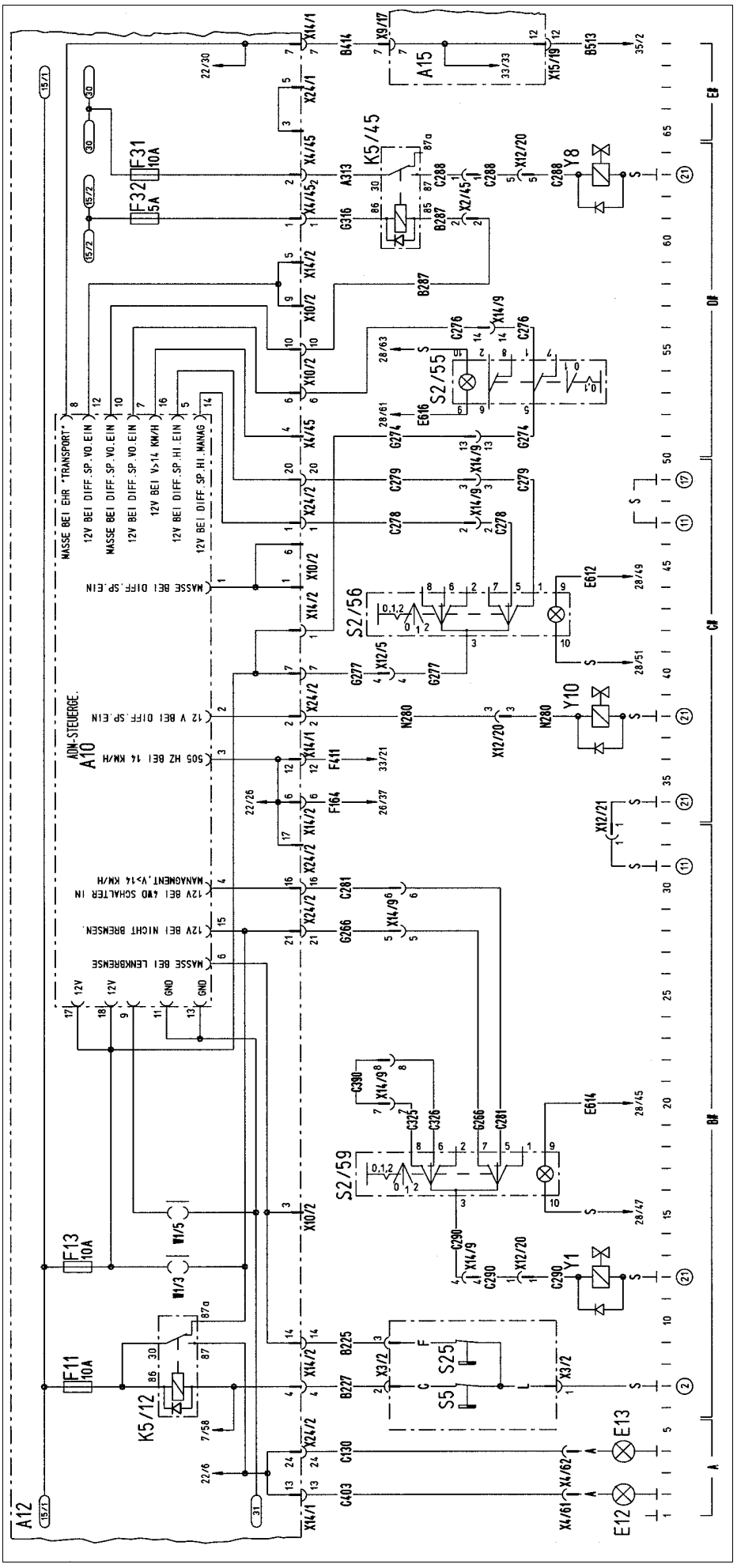
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 5



Electrical equipment

A10	4-wheel drive/Differential Management
A12	Print, central electrics
A15	Print, EHR, left
E12	Brake light, left
E13	Brake light, right
F11	Fuse, brake lights
F13	Fuse, differential lock
F31	Fuse, potential 30, reversing/ searchlight
F32	Fuse, potential 15/2, reversing/ searchlight
K5/12	Relay, brake light, Optistop
K5/45	Relay, front axle differential gearbox
S2/55	Switch, front differential lock
S2/56	Switch, differential lock management
S2/59	Switch, 4-wheel drive management
S5	Switch, brake light
S25	Switch, steering brake
W1/3	Contact bridge, Optistop
W1/5	Contact bridge, low signal
X2/45	Plug-in connection, front axle differential
X3/2	Plug-in connection, instrument, brake light switch
X4/45	Spare plug-in connection
X4/61	Plug-in connection, cable, chassis, left Tail, trafficator, brake lights
X4/62	Plug-in connection, cable, chassis, left Tail, trafficator, brake lights
X9/17	Plug-in connection, cable, chassis, left
X10/2	Plug-in connection, cable, chassis, right
X12/5	Plug-in connection, chassis, right, transmission
X12/20	Plug-in connection, chassis, right, transmission
X12/21	Plug-in connection, chassis, right, transmission
X14	Power socket 40A
X14/2	Plug-in connection, instrument cable
X14/9	Plug-in connection, chassis right, 4-wheel Drive – differential lock, management-switch
X15/19	Plug-in connection, EHR box cable
X24/2	Plug-in connection, chassis, right
Y1	4-wheel drive solenoid valve
Y8	Front differential lock solenoid valve
Y10	Differential lock solenoid valve

VERSIONS
to this Sheet
5
on Sheet/Sheets
6

Grounding points

2	Instrument panel
11	Driver's cab frame
17	Rear mudguard
21	Console Transmission plug

Designation of Sections

A	Brake light
B#	4-wheel drive Opti Stop management
C#	Differential lock management
D#	Front differential lock
E#	EHR transport signal
#	several versions available

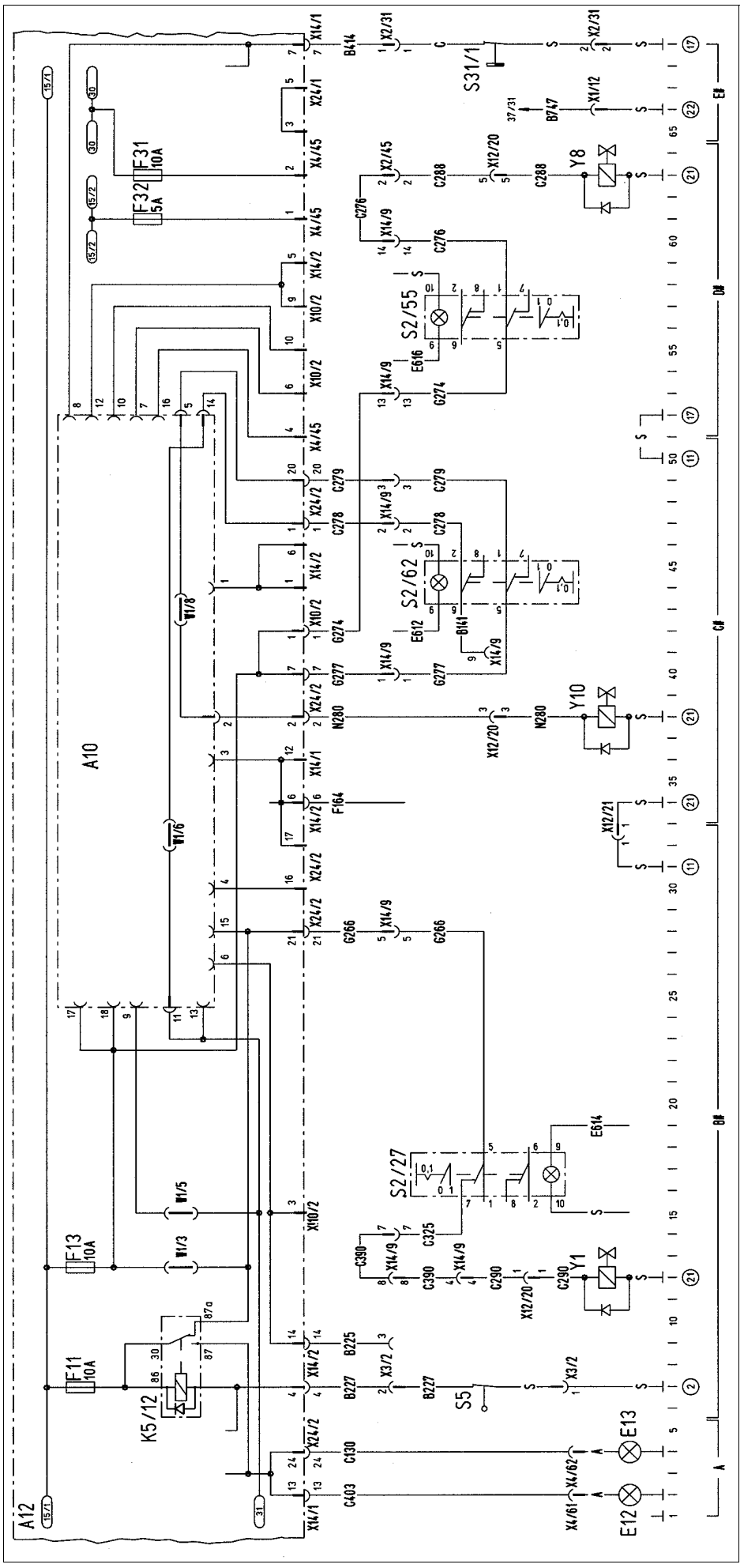
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 6



Electrical equipment

A10	4-wheel drive/Differential locks management control unit
A12	Print, central electrics
E12	Brake light, left
E13	Brake light, right
F11	Fuse, brake lights
F13	Fuse, differential lock
F31	Fuse, potential 30, reversing/ searchlight
F32	Fuse, potential 15/2, reversing/ searchlight
K5/12	Relay, brake light, Optistop
S2/27	Switch, 4-wheel drive
S2/55	Switch, front differential lock
S2/62	Switch, differential lock
S5	Switch, brake light
S31/1	Switch, rear lifting gear 50%
W1/3	Contact bridge, Optistop
W1/5	Contact bridge, low signal
W1/6	Contact bridge, control minus
W1/8	Contact bridge, solenoid valve plus, differential lock
X1/12	Plug-in connection, flat, chassis cable, right
X2/31	Plug-in connection, chassis, left, switch 50%
X2/45	Plug-in connection, front axle differential
X3/2	Plug-in connection, flat, instrument, brake light
X4/45	Spare plug-in connection
X4/61	Plug-in connection, cable, chassis, left Tail, trafficator, brake lights
X4/62	Plug-in connection, cable, chassis, left Tail, trafficator, brake lights
X10/2	Plug-in connection, cable, chassis, right
X12/20	Plug-in connection, chassis, right, transmission
X12/21	Plug-in connection, chassis, right, transmission
X14/1	Plug-in connection, cable, chassis, left
X14/2	Plug-in connection, instrument cable
X14/9	Plug-in connection, chassis right, 4-wheel drive differential lock – management-switch
X24/2	Plug-in connection, chassis, right
Y1	4-wheel drive solenoid valve
Y8	Front differential lock solenoid valve
Y10	Differential lock solenoid valve

VERSIONS
to this Sheet
6
on Sheet/Sheets
5

Grounding points

2	Instrument panel
11	Driver's cab frame
17	Rear mudguard
21	Console, transmission plug
22	'E' Box console

Designation of Sections

A	Brake light
B#	4-wheel drive
C#	Differential lock
D#	Front differential lock
E#	MHR, 50% switch
#	several versions available

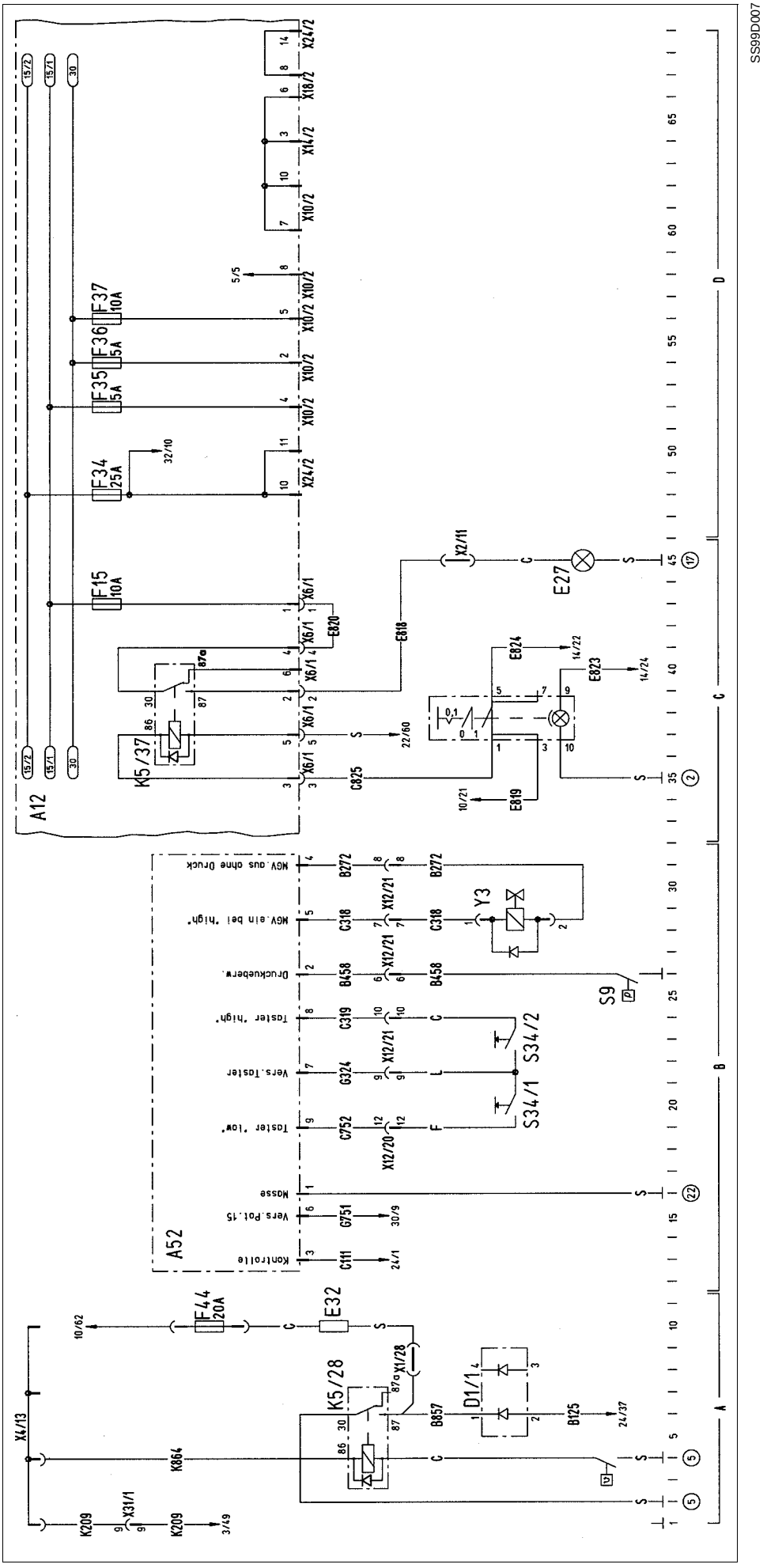
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 7



Electrical equipment

A12	Print, central electrics
A52	'E' box, power shift
D1/1	Diode group, fuel filter heating
E27	Searchlight on the rear axle
E32	Fuel filter heating
F15	Fuse, front loader
F34	Fuse, reserve potential 15
F35	Fuse, reserve potential 15
F36	Fuse, reserve potential 30
F37	Fuse, reserve potential 30
F44	Fuse, filter heating
K5/28	Relay, fuel filter heating
K5/37	Relay, spare, central print
S2/68	Switch, rear axle searchlight
S9	Switch, power shift group indicator
S34/1	Switch, power shift, slow
S34/2	Switch, power shift, fast
X1/28	Plug-in connection, flat, cable, filter heating
X2/11	Plug-in connection, flat, searchlight, rear axle
X4/13	Distributor, engine, dynamo + potential
X6/1	Plug-in connection, spare
X6/1	Plug-in connection, cable, chassis, right
X12/20	Plug-in connection, chassis, right, transmission
X12/21	Plug-in connection, chassis, right, transmission
X14/2	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply cable
X24/2	Plug-in connection, chassis, right
X31/1	Plug-in connection, instrument, engine
Y3	Power shift group solenoid valve

Grounding points

2	Instrument panel
5	Engine compartment
17	Rear mudguard
22	'E' Box console

Designation of Sections

A	Fuel filter heating
B	Power shift
C	Searchlight, mudguard, as a reversing light
D	Central print, reserves

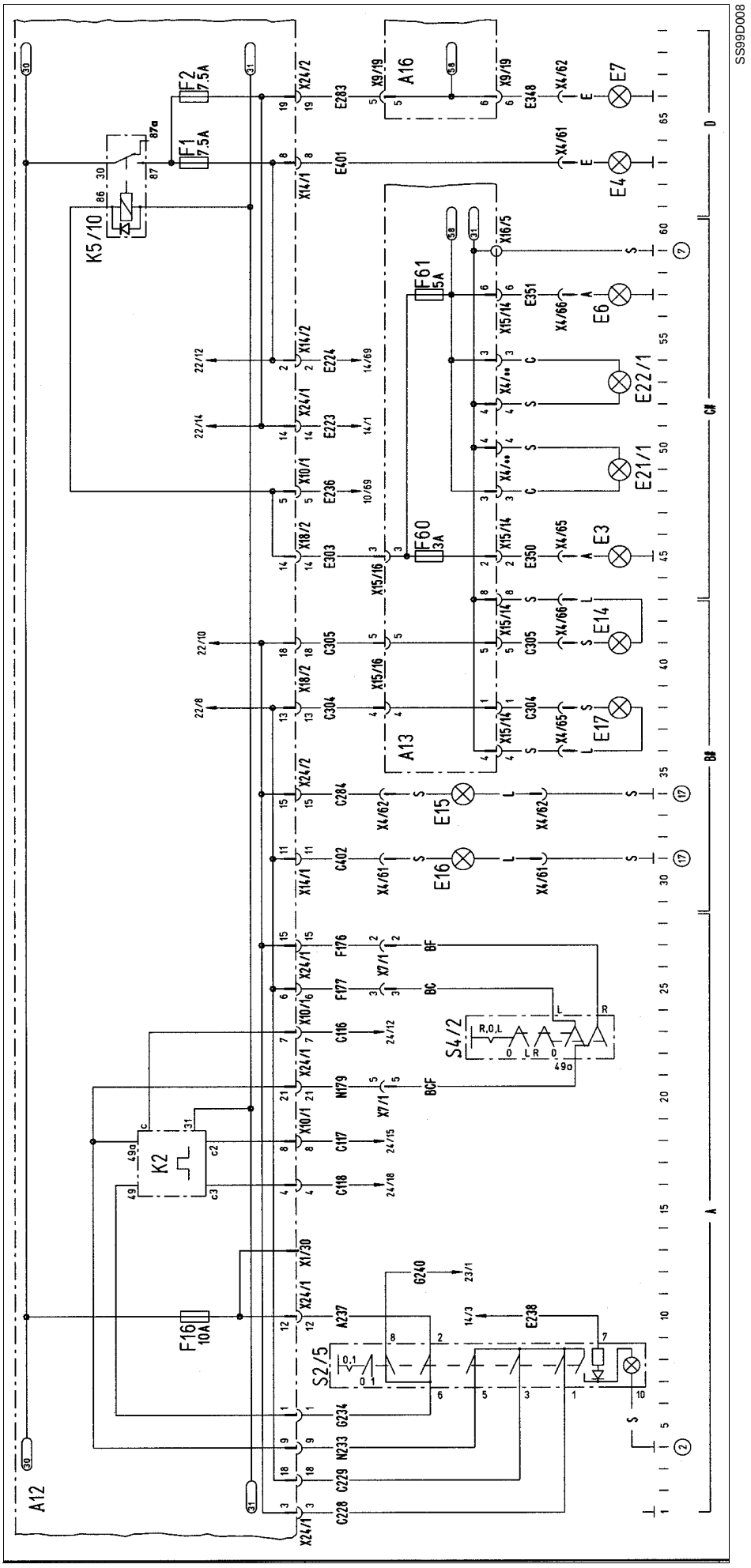
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 8



Electrical equipment

A12	Print, central electrics
A13	Print, roof electrics
A16	Print, EHR operating console
E3	Sidelight, front left
E4	Sidelight, rear left
E6	Sidelight, front right
E7	Sidelight, rear right
E14	Trafficator, front right
E15	Trafficator, rear right
E16	Trafficator, rear left
E17	Trafficator, front left
E21/1	Position light, in auxiliary headlamp, left
E22/1	Position light, in auxiliary headlamp, right
F1	Fuse, light potential 58, left
F2	Fuse, light potential 58, right
F16	Fuse, hazard warning lights
F60	Fuse, sidelight, front left
F61	Fuse, sidelight, potential 58
K2	Blinker relay
K5/10	Relay, light (potential 58)
S2/5	Switch, hazard warning lights
S4/2	Switch, steering column, trafficator
X1/30	Distributor, flat plug-in connector, potential 30,central print
X4/61	Plug-in connection, cable, chassis, left Tail, trafficator, brake lights
X4/62	Plug-in connection, cable, chassis, left Tail, trafficator, brake lights
X4/65	Plug-in connection, roof frame, trafficator/position light, left
X4/66	Plug-in connection, roof frame, trafficator/position light, right
X4/..	Plug-in connection, roof switch
X7/1	Plug-in connection, instrument-steering column
X9/19	Plug-in connection, cable, chassis, right
X10/1	Plug-in connection, instrument cable
X14/1	Plug-in connection, cable, chassis, left
X14/2	Plug-in connection, instrument cable
X15/14	Plug-in connection, roof frame
X15/16	Plug-in connection, supply cable, roof
X16/5	Screw-on connection, ground, roof print
X18/2	Plug-in connection, roof supply cable
X24/1	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right

VERSIONS
to this Sheet
8
on Sheet/Sheets
9

Grounding points

2	Instrument panel
7	Roof panel
17	Rear mudguard

Designation of Sections

A	Trafficator system
B#	Trafficator, high-top
C#	Sidelight, front, high-top
D	Sidelight, rear
#	several versions available

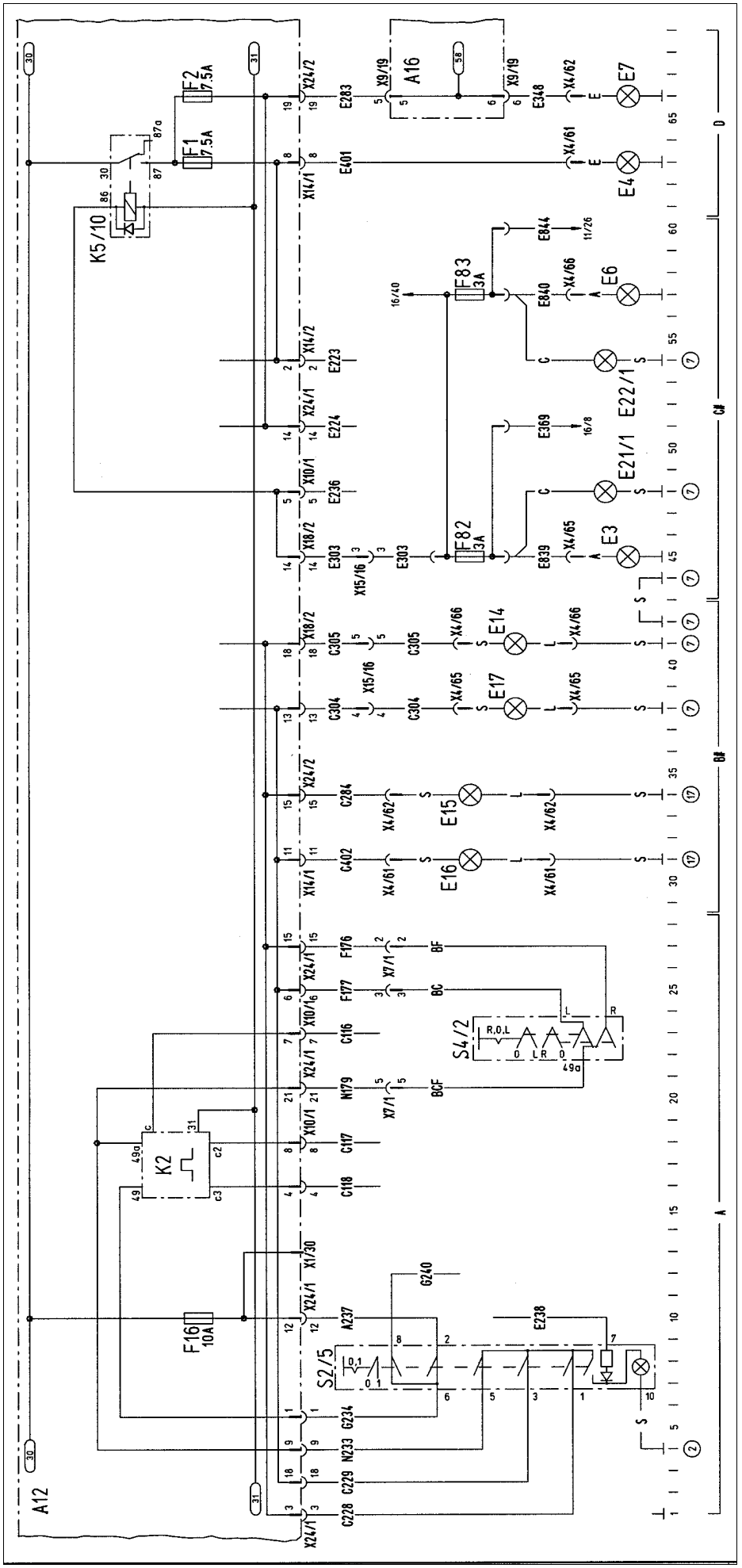
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 9



Electrical equipment

A12	Print, central electrics
A16	Print, EHR operating console
E3	Sidelight, front left
E4	Sidelight, rear left
E6	Sidelight, front right
E7	Sidelight, rear right
E14	Trafficator, front right
E15	Trafficator, rear right
E16	Trafficator, rear left
E17	Trafficator, front left
E21/1	Position light, in auxiliary headlamp, left
E22/1	Position light, in auxiliary headlamp, right
F1	Fuse, light potential 58, left
F2	Fuse, light potential 58, right
F16	Fuse, hazard warning lights
F82	Fuse, sidelight, front left
F83	Fuse, sidelight, potential 58
K2	Blinker relay
K5/10	Relay, light (potential 58)
S2/5	Switch, hazard warning lights
S4/2	Switch, steering column, trafficator
X1/30	Plug-in connection, potential 30, central print
X4/61	Plug-in connection, cable, chassis, left Tail, trafficator, brake lights
X4/62	Plug-in connection, cable, chassis, left Tail, trafficator, brake lights
X4/65	Plug-in connection, roof frame, trafficator/position light, left
X4/66	Plug-in connection, roof frame, trafficator/position light, right
X7/1	Plug-in connection, instrument-steering column
X9/19	Plug-in connection, cable, chassis, right
X10/1	Plug-in connection, instrument cable
X14/1	Plug-in connection, cable, chassis, left
X14/2	Plug-in connection, instrument cable
X15/16	Plug-in connection, supply cable, roof
X18/2	Plug-in connection, roof supply cable
X24/1	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right

VERSIONS
to this Sheet
9
on Sheet/Sheets
8

Grounding points

2	Instrument panel
7	Roof panel
17	Rear mudguard

Designation of Sections

A	Trafficator system
B#	Trafficator, low-top
C#	Sidelight, front, low-top
D	Sidelight, rear
#	several versions available

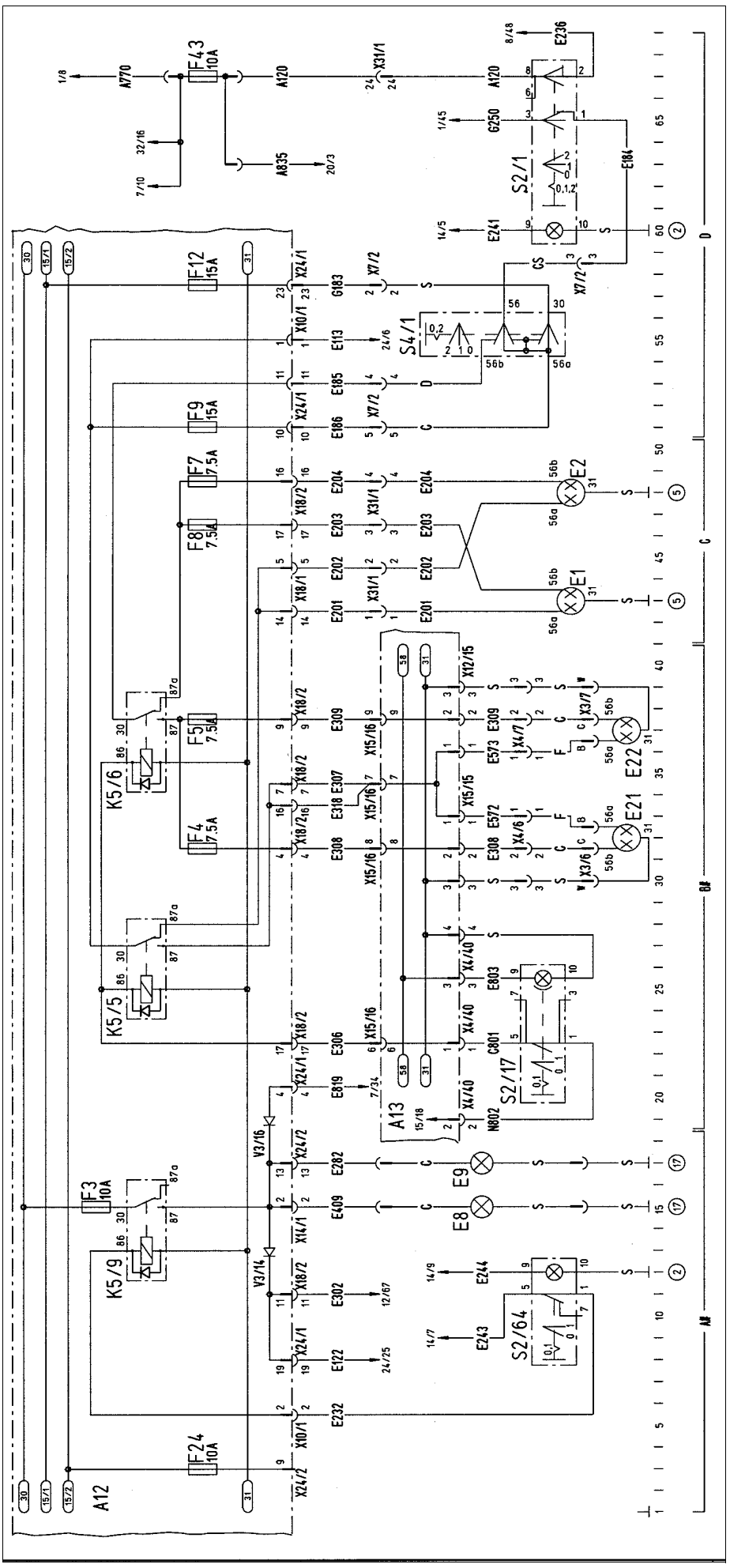
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 10



Electrical equipment

A12	Print, central electrics
A13	Print, roof electrics
E1	Headlight, left
E2	Headlight, right
E8	Searchlight, left-hand mudguard
E9	Searchlight, right-hand mudguard
E21	Auxiliary headlight, left
E22	Auxiliary headlight, right
F3	Fuse, searchlight, mudguard
F4	Fuse, dipped beam, auxiliary roof headlight, left
F5	Fuse, dipped beam, auxiliary roof headlight, right
F7	Fuse, dipped beam, headlight, right
F8	Fuse, dipped beam, headlight, left
F9	Fuse, main-beam
F12	Fuse, headlight flasher
F24	Fuse, searchlight/ reversing light
F43	Fuse, potential 58, air-cond.
K5/5	Relay, switchover, main beam
K5/6	Relay, switchover, dipped beam
K5/9	Relay, searchlight, mudguard
S2/1	Switch, lighting system
S2/17	Switch, auxiliary headlight
S2/64	Switch, searchlight, mudguard
S4/1	Switch, steering column, main/dipped beam
V3/14	Diode 0.1A interlock
V3/16	Diode 0.1A interlock
X3/6	Flat plug-in connection, auxiliary headlight
X3/7	Flat plug-in connection, auxiliary headlight
X4/6	Plug-in connection, roof canopy, auxiliary headlight
X4/7	Plug-in connection, roof canopy, auxiliary headlight
X4/40	Plug-in connection, roof switch
X//2	Plug-in connection, instrument-steering column
X10/1	Plug-in connection, instrument cable
X12/15	Plug-in connection, roof canopy cable
X14/1	Plug-in connection, cable, chassis, left
X15/15	Plug-in connection, roof canopy cable
X15/16	Plug-in connection, supply cable, roof
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply cable
X24/1	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right
X31/1	Plug-in connection, instrument-engine

VERSIONS
to this Sheet
10
on Sheet/Sheets
11

Grounding points

2	Instrument panel
5	Engine compartment
17	Rear mudguard

Designation of Sections

A#	Searchlight, mudguard
B#	Auxiliary headlight, high-top
C	Headlight
D	Dipped beam, main beam switchover
#	several versions available

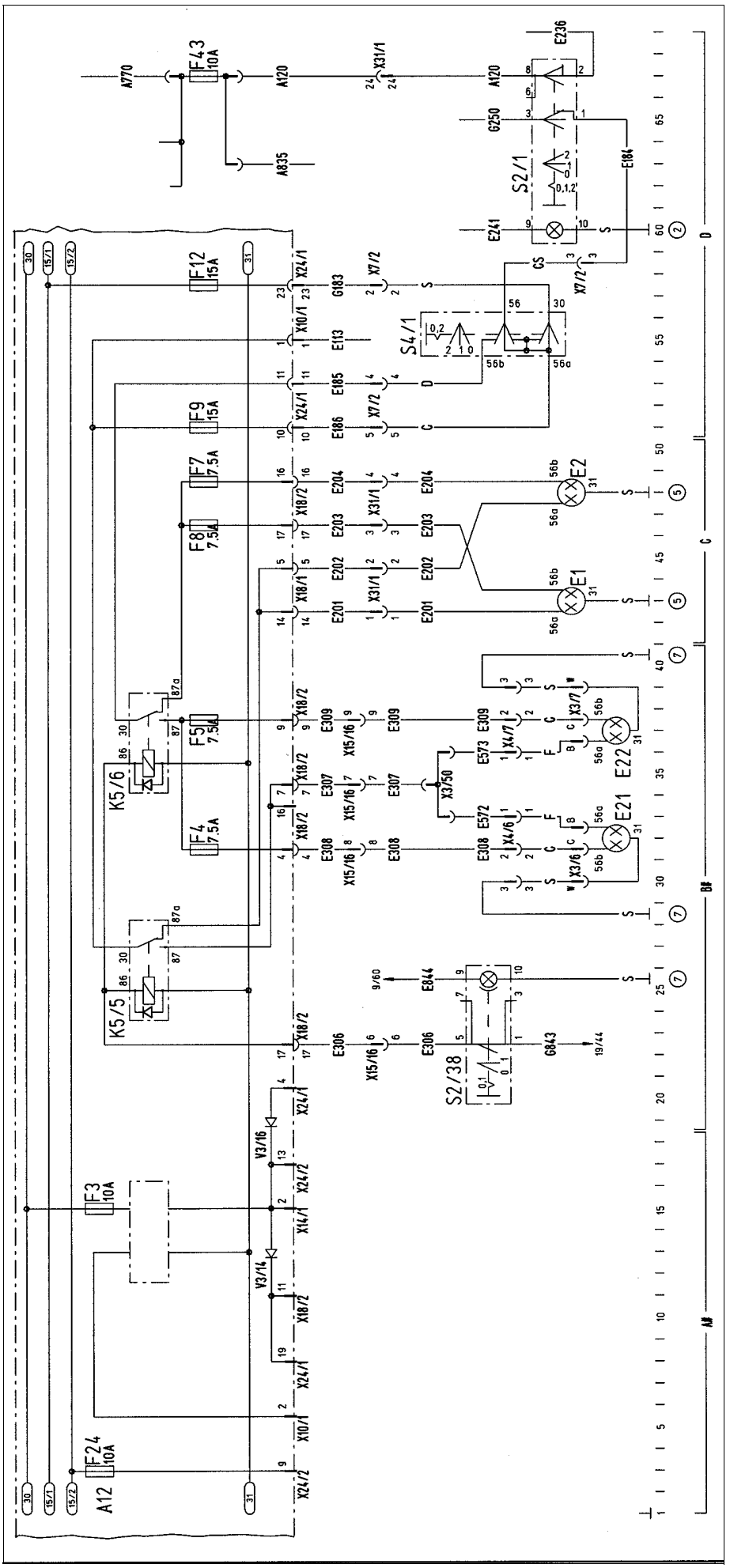
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 11



Electrical equipment

A12	Print, central electrics
E1	Headlight, left
E2	Headlight, right
E21	Auxiliary headlight, left
E22	Auxiliary headlight, right
F3	Fuse, searchlight, mudguard
F4	Fuse, dipped beam, left, auxiliary headlight, left
F5	Fuse, dipped beam, right, auxiliary headlight, right
F7	Fuse, dipped beam, left headlight right
F8	Fuse, dipped beam left, headlight left
F9	Fuse, main-beam
F12	Fuse, headlight flasher
F24	Fuse, searchlight/ searchlight
F43	Fuse, potential 58, air-cond.
K5/5	Relay, switchover, main beam
K5/6	Relay, switchover, dipped beam
S2/1	Switch, lighting system
S2/38	Switch, auxiliary headlight
S4/1	Switch, steering column, main/dipped beam
V3/14	Diode 0.1A interlock
V3/16	Diode 0.1A interlock
X3/6	Flat plug-in connection, auxiliary headlight
X3/7	Flat plug-in connection, auxiliary headlight
X3/50	Distributor, low-top, potential 58
X4/6	Plug-in connection, roof canopy, auxiliary headlight
X4/7	Plug-in connection, roof canopy, auxiliary headlight
X7/2	Plug-in connection, instrument-steering column
X10/1	Plug-in connection, instrument cable
X14/1	Plug-in connection, cable, chassis, left
X15/16	Plug-in connection, supply cable, roof
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply cable
X24/1	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right
X31/1	Plug-in connection, instrument-engine

VERSIONS
to this Sheet
11
on Sheet/Sheets
10

Grounding points

2	Instrument panel
5	Engine compartment
7	Roof panel

Designation of Sections

A#	
B#	Auxiliary headlight, low-top
C	Headlight
D	Dipped/main beam switchover
#	several versions available

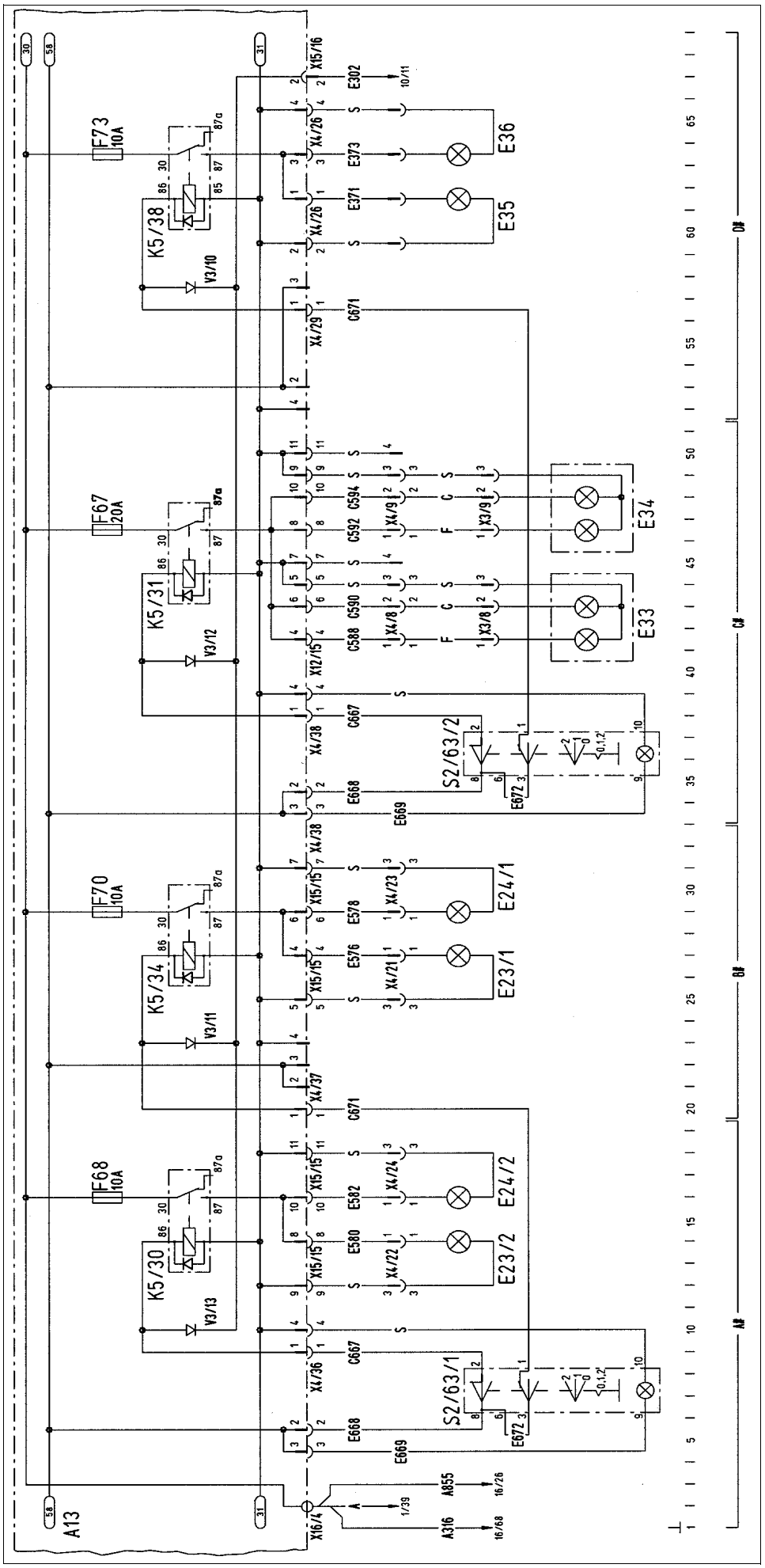
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 12



Electrical equipment

A13	Print, roof electrics
E23/1	Searchlight, roof, rear, inner
E23/2	Searchlight, roof, rear, outer
E24/1	Searchlight, roof, rear, inner
E24/2	Searchlight, roof, rear, outer
E33	Searchlight, roof, front, twinpower
E34	Searchlight, roof, front, twinpower
E35	Searchlight on the trafficator/position light
E36	Searchlight on the trafficator/position light
F67	Fuse, searchlight, twinpower
F68	Fuse 2, searchlight, rear
F70	Fuse, for 4 searchlights, roof number plate lighting
F73	Fuse, searchlight, trafficator/position light
K5/30	Relay, 2 searchlights, rear roof, outer
K5/31	Relay, searchlight, twinpower
K5/34	Relay, for 4 searchlights, roof number plate lighting
K5/38	Relay, searchlight, trafficator/position light
S2/63/1	Switch, rear searchlight, 2+2
S2/63/2	Switch, front searchlight, 2+2
V3/10	Diode 3A interlock
V3/11	Diode 3A interlock
V3/12	Diode 3A interlock
V3/13	Diode 3A interlock
X3/8	Plug-in connection, flat, searchlight, twinpower
X3/9	Plug-in connection, flat, searchlight, twinpower
X4/8	Plug-in connection, roof canopy, searchlight
X4/9	Plug-in connection, roof canopy, searchlight
X4/21	Plug-in connection, roof canopy cable
X4/22	Plug-in connection, roof canopy cable
X4/23	Plug-in connection, roof canopy cable
X4/24	Plug-in connection, roof canopy cable
X4/26	Plug-in connection, roof frame
X4/29	Plug-in connection, roof switch
X4/36	Plug-in connection, roof switch
X4/37	Plug-in connection, roof switch
X4/38	Plug-in connection, roof switch
X12/15	Plug-in connection, roof canopy cable
X15/15	Plug-in connection, roof canopy cable
X15/16	Plug-in connection, supply cable, roof
X16/4	Distributor, central print 30

VERSIONS
to this Sheet
12
on Sheet/Sheets
13

Grounding points

7 Roof panel

Designation of Sections

A#	Searchlight, high-top, rear, outer
B#	Searchlight, high-top, rear, inner
C#	Searchlight, high-top, front, twinpower +
D#	Searchlight on the trafficator/position light
#	several versions available

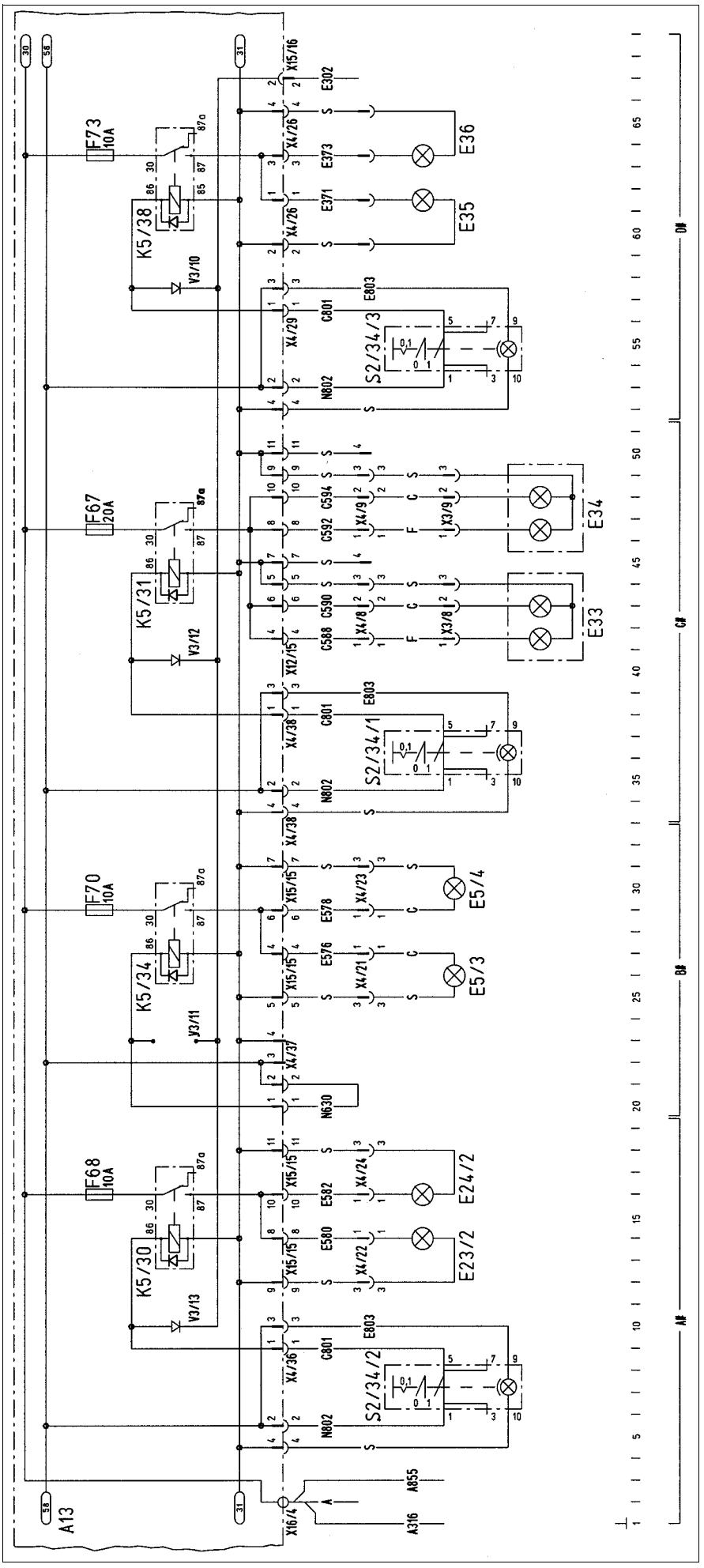
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 13



Electrical equipment

A13	Print, roof electrics
E5/3	Lighting, number plate, roof
E5/3	Lighting, number plate, roof
E23/2	Searchlight, roof, rear, outer
E24/2	Searchlight, roof, rear, outer
E33	Searchlight, roof, front, twinpower
E34	Searchlight, roof, front, twinpower
E35	Searchlight on the trafficator/position light
E36	Searchlight on the trafficator/position light
F67	Fuse, searchlight, twinpower
F68	Fuse 2, searchlight, rear
F70	Fuse, for 4 searchlights, roof number plate
F73	Fuse, searchlight, trafficator/position light
K5/30	Relay, 2 searchlights, rear roof, outer
K5/31	Relay, searchlight, twinpower
K5/34	Fuse, for 4 searchlights, roof number plate
K5/38	Relay, searchlight, trafficator/position light
S2/34/1	Switch, searchlight, twinpower
S2/34/2	Switch, 2 searchlights, roof, rear
S2/34/3	Switch, searchlight trafficator/position light
V3/10	Diode 3A interlock
V3/11	Diode 3A interlock
V3/12	Diode 3A interlock
V3/13	Diode 3A interlock
X3/8	Plug-in connection, flat, searchlight, twinpower
X3/9	Plug-in connection, flat, searchlight, twinpower
X4/8	Plug-in connection, roof canopy, searchlight
X4/9	Plug-in connection, roof canopy, searchlight
X4/21	Plug-in connection, roof canopy cable
X4/22	Plug-in connection, roof canopy cable
X4/23	Plug-in connection, roof canopy cable
X4/24	Plug-in connection, roof canopy cable
X4/26	Plug-in connection, roof frame
X4/29	Plug-in connection, roof switch
X4/36	Plug-in connection, roof switch
X4/37	Plug-in connection, roof switch
X4/38	Plug-in connection, roof switch
X12/15	Plug-in connection, roof canopy cable
X15/15	Plug-in connection, roof canopy cable
X15/16	Plug-in connection, supply cable, roof
X16/4	Distributor, central print 30

VERSIONS
to this Sheet
13
on Sheet/Sheets
12

Grounding points

Designation of Sections

A#	Searchlight, high-top, rear, outer
B#	Number plate lighting, high-top, for 2 searchlight versions up to 5,96
C#	Searchlight, high-top, front, twinpower
D#	Searchlight on the trafficator/position light
#	several versions available

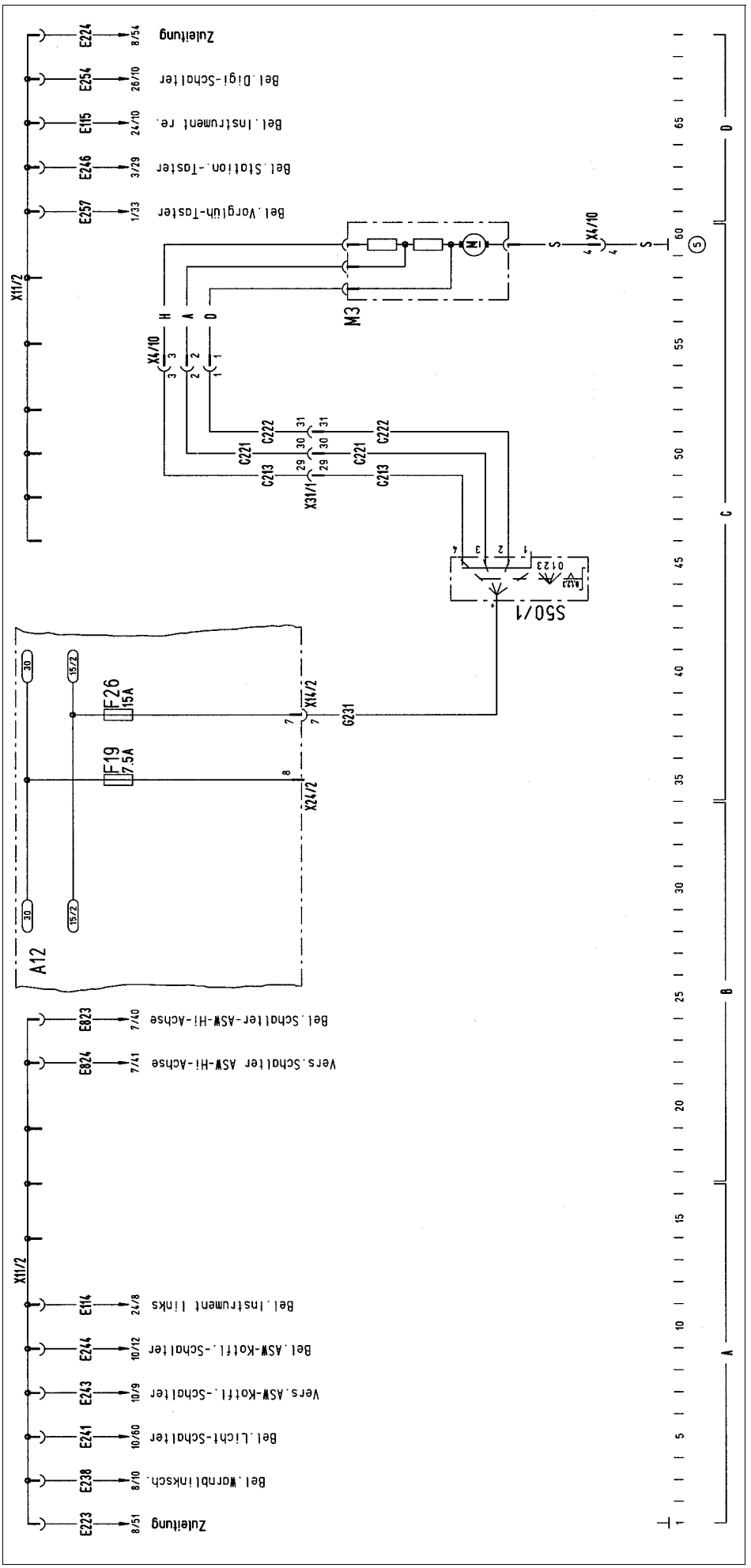
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 14



Electrical equipment

A12	Print, central electrics
F19	Fuse, searchlight, rear axle
F26	Fuse, heating
M3	Heater blower motor
S50/1	Switch, 3-stage blower motor
X4/10	Plug-in connection, flat, engine heating
X11/2	Distributor, instrument potential 58, left
X14/2	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right
X31/1	Plug-in connection, instrument, engine

Grounding points

5	Engine compartment

Designation of Sections

A	Supply potential 58, instrument, left
B	
C	Foot-well heating
D	Supply potential 58, instrument, right

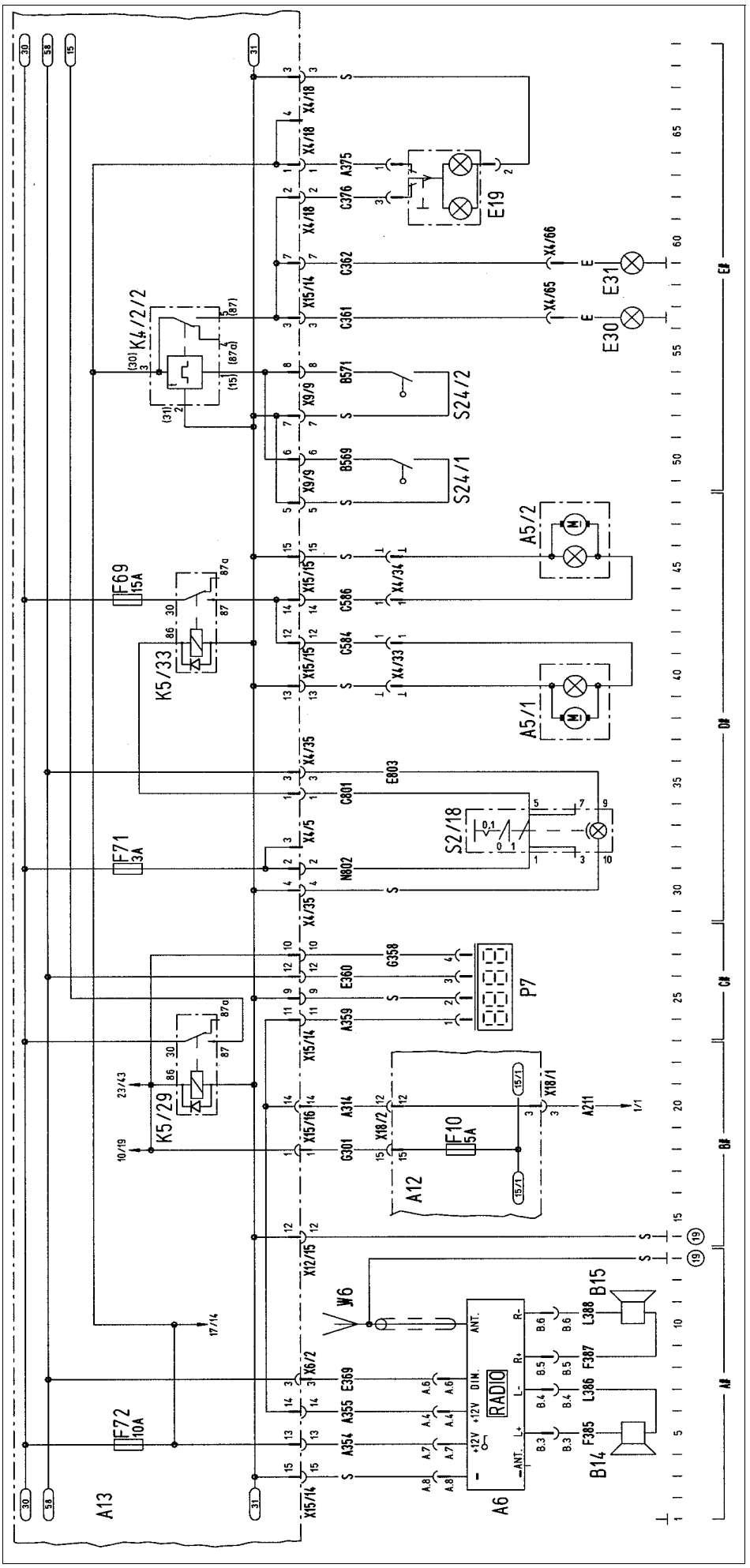
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 15



Electrical equipment

A5/1	Rotating beacon, left
A5/2	Rotating beacon, right
A6	Radio
A12	Print, central electrics
A13	Print, roof electrics
B14	Right-hand loudspeaker
B15	Left-hand loudspeaker
E19	Interior lighting
E30	Step light, left
E30	Courtesy light, right
F10	Fuse 15, roof, front-loader
F69	Fuse, rotating beacon
F71	Fuse, potential 30
F72	Fuse, spot, interior lighting, heated mirror
K4/2/2	Timed relay, 40 sec's. interior lighting
K5/29	Relay, roof print, potential 15
K5/33	Relay, rotating beacon
P7	Digital clock
S2/18	Switch, rotating beacon
S24/1	Switch, door contact
S24/2	Switch, door contact
W6	Aerial
X4/5	Plug-in connection, roof frame
X4/18	Plug-in connection, roof frame
X4/33	Plug-in connection, rotating beacon, left
X4/34	Plug-in connection, rotating beacon, right
X4/35	Plug-in connection, switch, rotating beacon
X4/65	Plug-in connection, roof frame, trafficator/position light, left
X4/66	Plug-in connection, roof frame, trafficator/position light, right
X6/2	Plug-in connection, roof frame
X9/9	Plug-in connection, roof canopy cable
X12/15	Plug-in connection, roof canopy cable
X15/14	Plug-in connection, roof frame
X15/15	Plug-in connection, roof canopy cable
X15/16	Plug-in connection, supply cable, roof
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply cable

VERSIONS
to this Sheet
15
on Sheet/Sheets
16

Grounding points

19	Shock absorber, roof

Designation of Sections

A#	Radio preparation, high-top
B#	Supply potential 15, high-top
C#	Digital clock, high-top
D#	Rotating beacon, high-top
E#	Step, interior lighting, high-top
#	several versions available

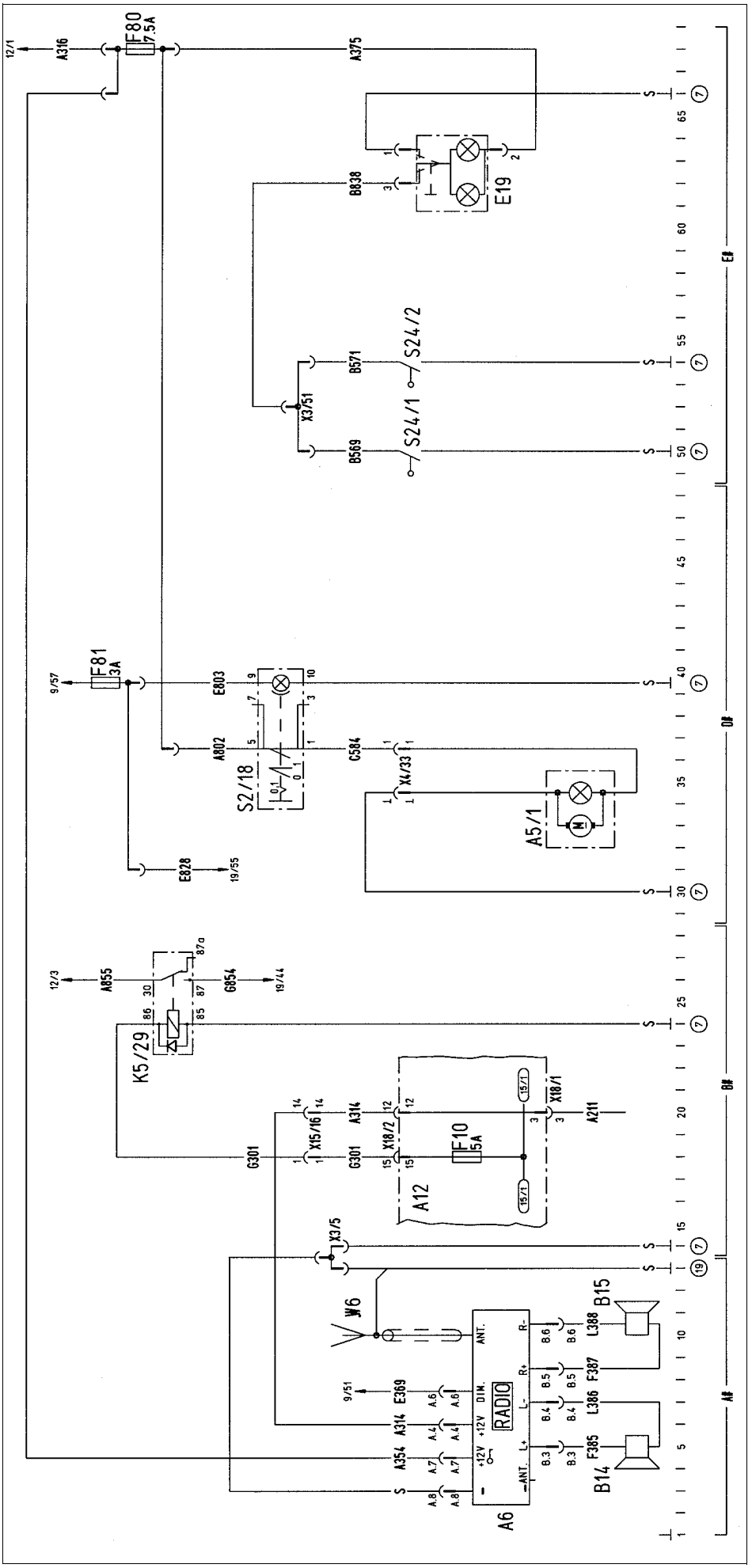
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 16



Electrical equipment

A5/1	Rotating beacon, left
A6	Radio
A12	Print, central electrics
B14	Right-hand loudspeaker
B15	Left-hand loudspeaker
E19	Interior lighting
F10	Fuse 15, roof, front-loader
F80	Fuse, interior light, rotating beacon
F81	Fuse, rear lighting switch, washer/wiper
K5/29	Relay, roof print, potential 15
S2/18	Switch, rotating beacon
S24/1	Switch, door contact
S24/2	Switch, door contact
W6	Aerial
X3/5	Distributor, aerial ground, low-top
X3/51	Distributor, low-top door contact
X4/33	Socket, rotating beacon, left
X15/16	Plug-in connection, supply cable, roof
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply cable

VERSIONS
to this Sheet
16
on Sheet/Sheets
15

Grounding points

7	Roof panel
19	Shock absorber, roof

Designation of Sections

A#	Radio preparation, low-top
B#	Supply potential 15, low-top
C#	
D#	Rotating beacon, low-top
C#	Interior lighting, low-top
#	several versions available

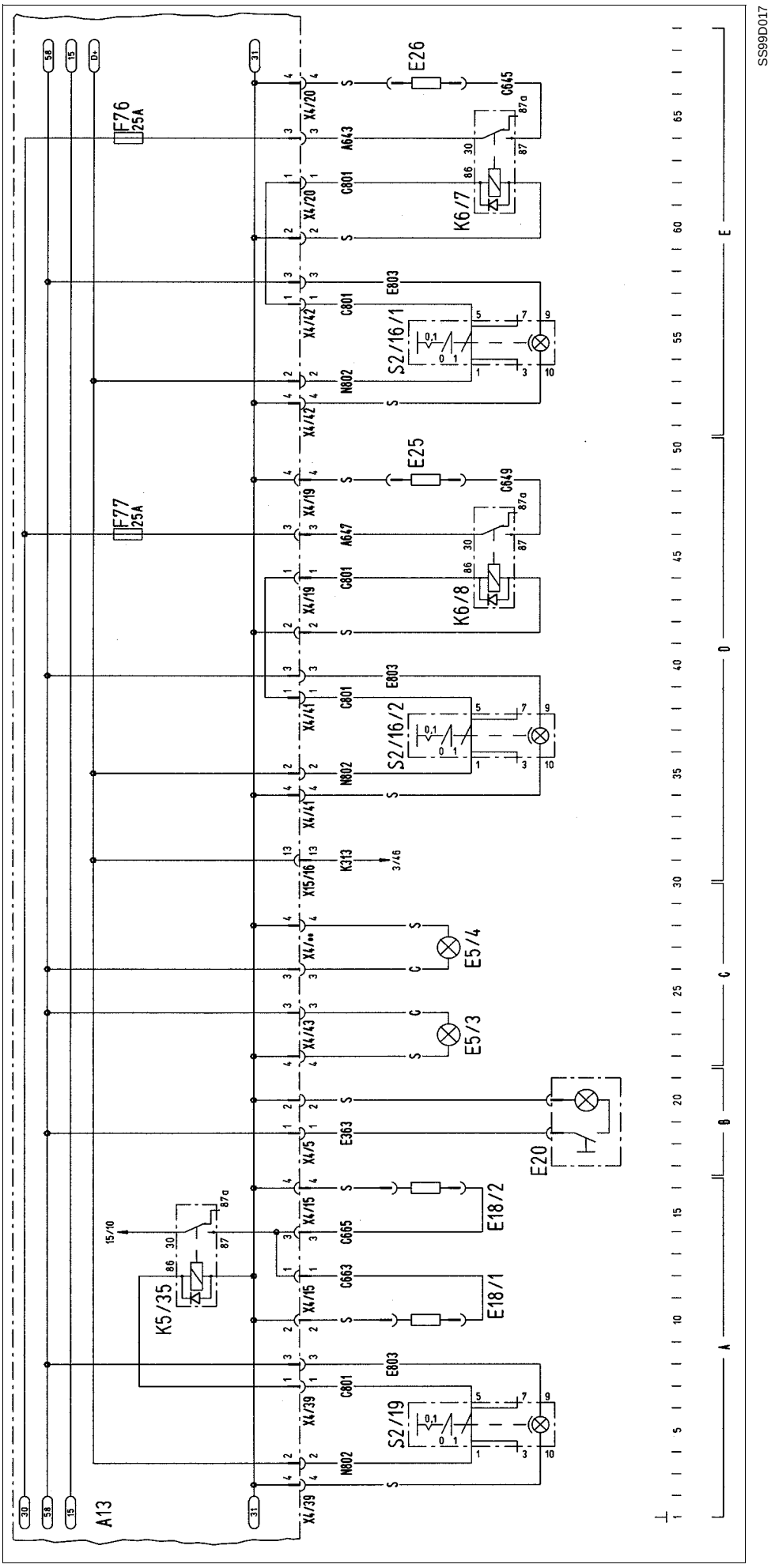
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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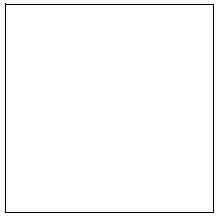
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Sheet 17



Electrical equipment

A13	Print, roof electrics
E5/3	Lighting, number plate, roof
E5/4	Lighting, number plate, roof
E18/1	Heated mirror, left
E18/2	Heated mirror, right
E20	Spot
E25	Heated windscreen, front
E26	Heated screen, rear
E76	Fuse, heated screen, rear
E77	Fuse, heated windscreen, front
K5/35	Relay, heated mirror
K6/7	Relay, heated screen, rear
K6/8	Relay, heated windscreen, front
S2/16/1	Switch, heated screen, rear
S2/16/2	Switch, heated windscreen, front
S2/19	Switch, heated screen
X4/5	Plug-in connection, roof frame
X4/15	Plug-in connection, mirror heating
X4/19	Plug-in connection, heated windscreen, front
X4/20	Plug-in connection, heated screen, rear
X4/39	Plug-in connection, roof switch
X4/41	Plug-in connection, roof switch
X4/42	Plug-in connection, roof switch
X4/43	Plug-in connection, number plate lighting
X4/..	Plug-in connection, roof switch
X15/16	Plug-in connection, supply cable, roof



Grounding points

Designation of Sections

A	Mirror heating, high-top
B	Spot, high-top
C	Roof number plate lighting, high-top
D	Heated windscreen, high-top
E	Heated rear screen, high-top

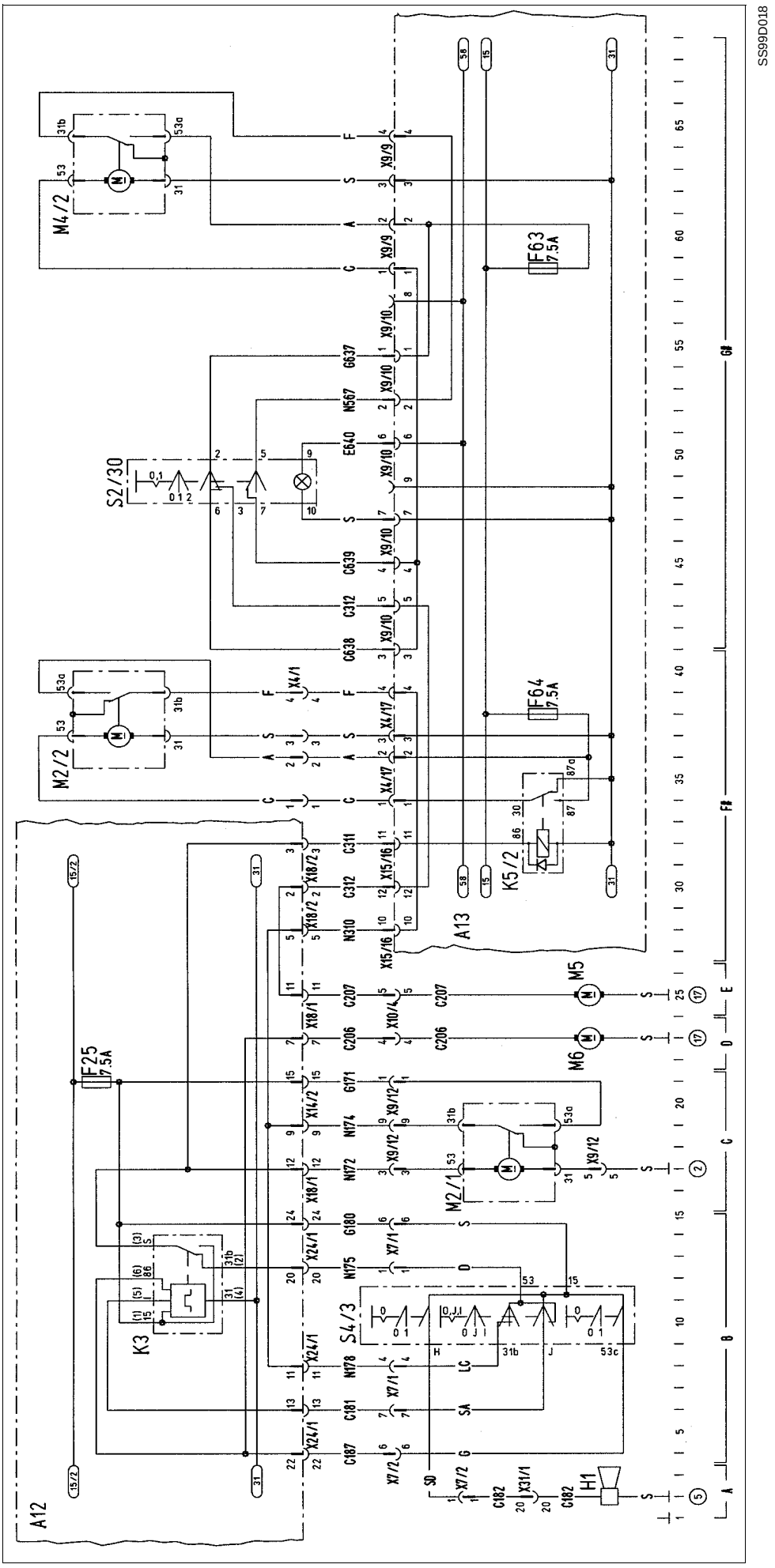
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 18



Electrical equipment

A12	Print, central electrics
A13	Print, roof electrics
F25	Fuse, wiper, horn
F64	Fuse, rear wiper
H1	Horn
K3	Interval relay
K5/2	Relay, roof-mounted wiper, front
M2/1	Parallel wiper motor, front
M2/2	Parallel wiper motor, front
M4/2	Parallel wiper motor, rear
M5	Washer pump motor, rear
M6	Washer pump motor, front-
S2/30	Switch, rear washer/wiper
S4/3	Switch, steering column, washer/wiper
X4/1	Plug-in connection, roof frame
X4/17	Plug-in connection, roof frame
X7/1	Plug-in connection, instrument-steering column
X7/2	Plug-in connection, instrument-steering column
X9/9	Plug-in connection, roof canopy cable
X9/10	Plug-in connection, rear wiper
X9/12	Plug-in connection, instrument – wiper
X10/4	Distributor, potential 15, central print
X14/2	Plug-in connection, instrument cable
X15/16	Plug-in connection, supply cable, roof
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply cable
X24/1	Plug-in connection, instrument cable
X31/1	Plug-in connection, instrument, engine

VERSIONS
to this Sheet
18
on Sheet/Sheets
19

Grounding points

2	Instrument panel
5	Engine compartment
17	Rear mudguard

Designation of Sections

A	Horn
B	steering column switch
C	Parallel wiper, front
D	Washer pump, front
E	Washer pump, rear
F#	Standard wiper, front, high-top
G#	Standard wiper, rear, high-top
#	several versions available

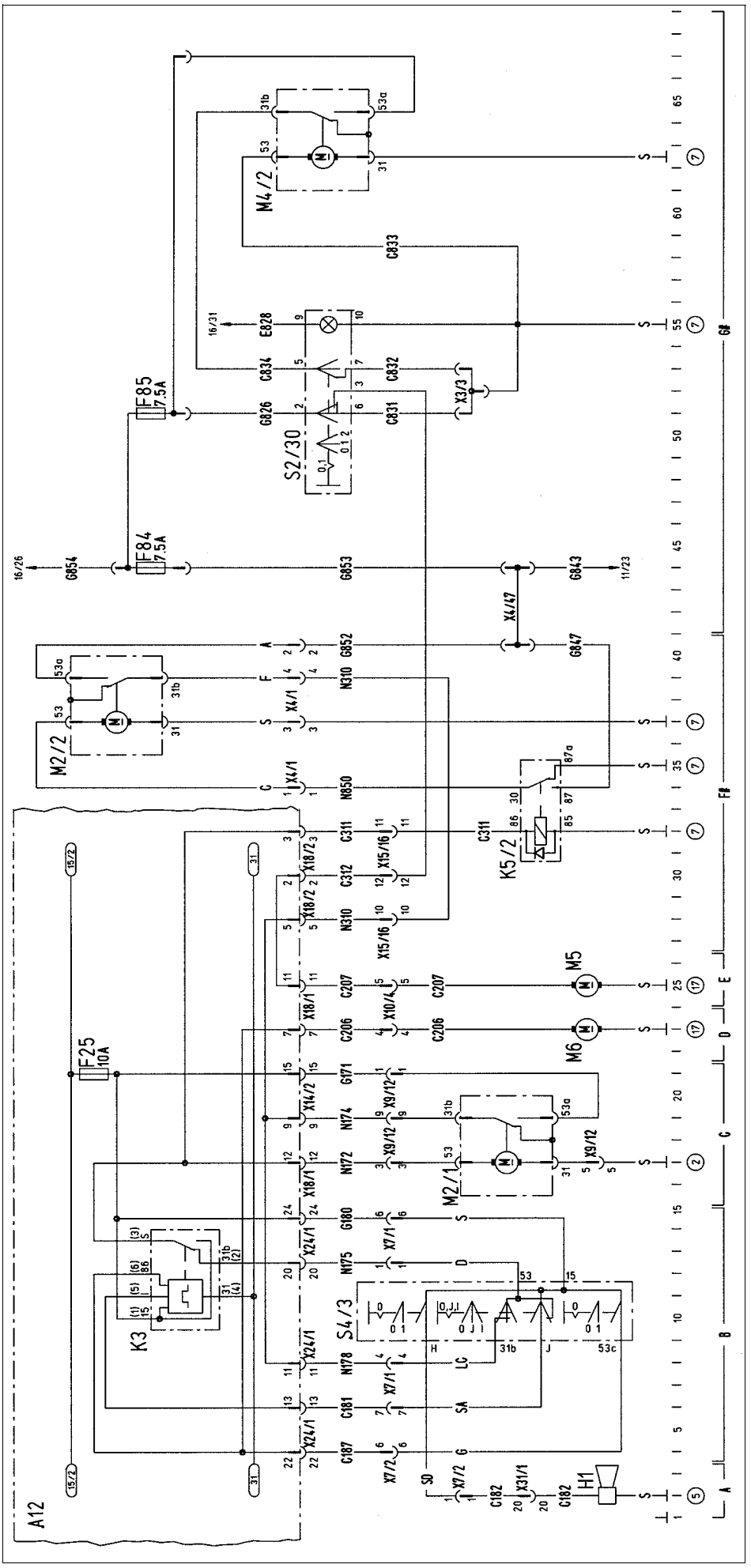
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 19



Electrical equipment

A12	Print, central electrics
F25	Fuse, wiper, horn
F84	Fuse, auxiliary headlight and front wiper
F85	Fuse, rear wiper
H1	Horn
K3	Interval relay
K5/2	Relay, roof-mounted wiper, front
M2/1	Parallel wiper motor, front
M2/2	Parallel wiper motor, front
M4/2	Parallel wiper motor, rear
M5	Washer pump motor, rear
M6	Washer pump motor, front-
S2/30	Switch, rear washer/wiper
S4/3	Switch, steering column, washer/wiper
X3/3	Distributor rear washer/wiper, low-top
X4/1	Plug-in connection, roof frame
X3/47	Distributor, low-top, potential 15
X7/1	Plug-in connection, instrument-steering column
X7/2	Plug-in connection, instrument-steering column
X9/12	Plug-in connection, instrument-wiper
X10/4	Distributor, potential 15, central print
X14/2	Plug-in connection, instrument cable
X15/16	Plug-in connection, supply cable, roof
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply cable
X24/1	Plug-in connection, instrument cable
X31/1	Plug-in connection, instrument, engine

VERSIONS
to this Sheet
19
on Sheet/Sheets
18

Grounding points

2	Instrument panel
5	Engine compartment
7	Roof panel
17	Rear mudguard

Designation of Sections

A	Horn
B	steering column switch
C	Parallel wiper, front
D	Washer pump, front
E	Washer pump, rear
F#	Standard wiper, front, low-top
G#	Standard wiper, rear, low-top
#	several versions available

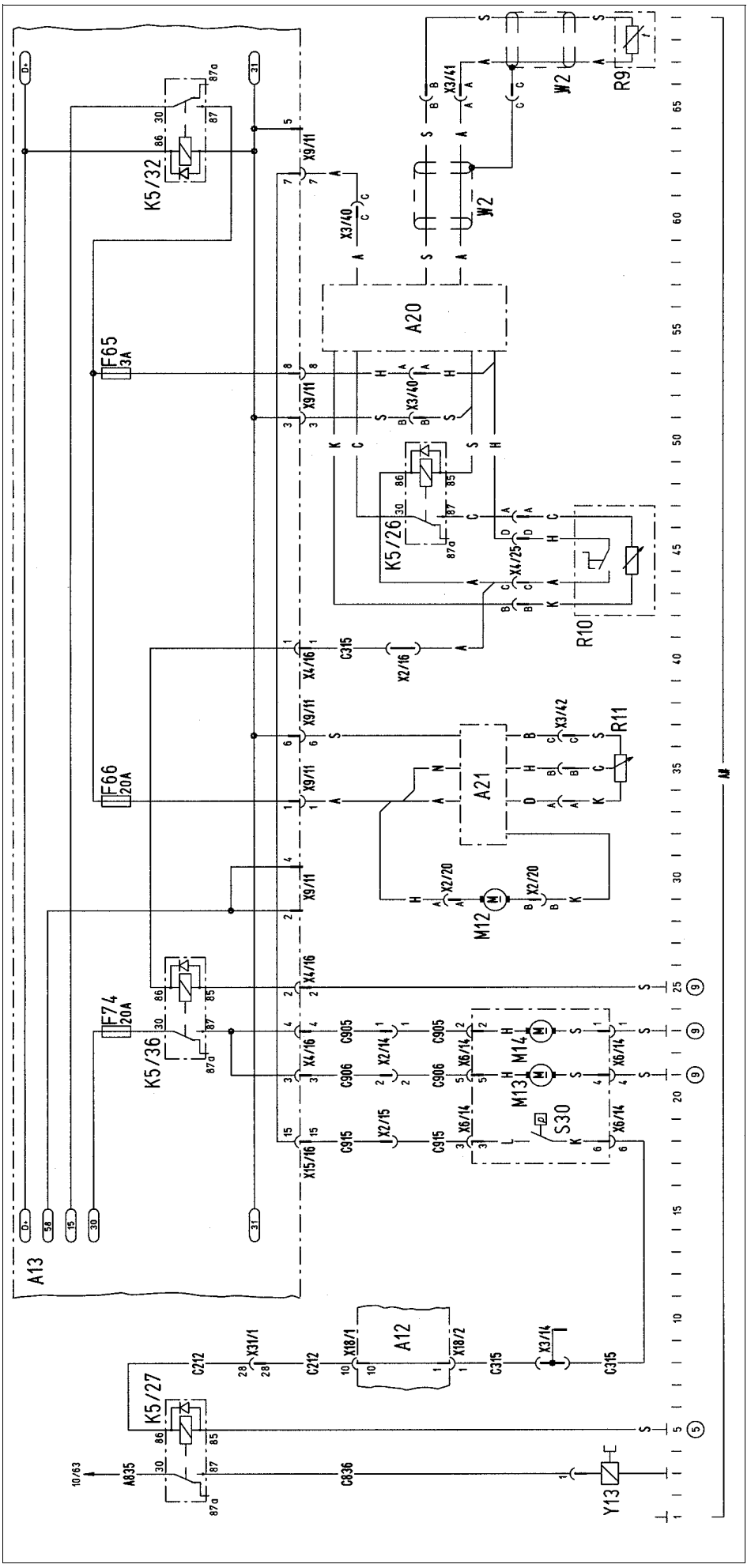
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 20



Electrical equipment

A12	Print, central electrics
A13	Print, roof electrics
A20	Air conditioning control
A21	Blower driver
F65	Fuse, air conditioning
F66	Fuse, air conditioning blower motor
F74	Fuse, air-conditioning blower
K5/26	Relay, air conditioning 5V/12V
K5/27	Relay, air-conditioning compressor
K5/32	Relay, roof blower motor
K5/36	Relay, air-conditioning blower
M12	Roof blower motor
M13	Condenser, air conditioning
M14	Condenser, air conditioning
R9	Temperature sensor
R10	Air conditioning control potentiometer
R11	Roof blower motor potentiometer
S30	Switch, air conditioning pressure
W2	Screened cable, air conditioning
X2/14	Plug-in connection, air-conditioning, roof
X2/15	Flat plug-in connection, air-conditioning, roof
X2/16	Flat plug-in connection, air-conditioning, roof
S2/20	Plug-in connection, roof blower
X3/14	Distributor, air-conditioning, roof
X3/40	Plug-in connection, air cond. control
X3/41	Plug-in connection, temperature sensor
X3/42	Plug-in connection, blower potentiometer
X4/16	Plug-in connection, air-conditioning, roof
X4/25	Plug-in connection, air-conditioning potentiometer
X6/14	Plug-in connection, air-conditioning condensor
X9/11	Plug-in connection, air-conditioning, roof
X15/16	Plug-in connection, supply cable, roof
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply cable
X31/1	Plug-in connection, instrument, engine
Y13	Magnetic coupling, air conditioning

VERSIONS
to this Sheet
20
on Sheet/Sheets
21

Grounding points

5	Engine compartment
9	Screw down point, roof print

Designation of Sections

A#	Air-conditioning high-top
#	several versions available

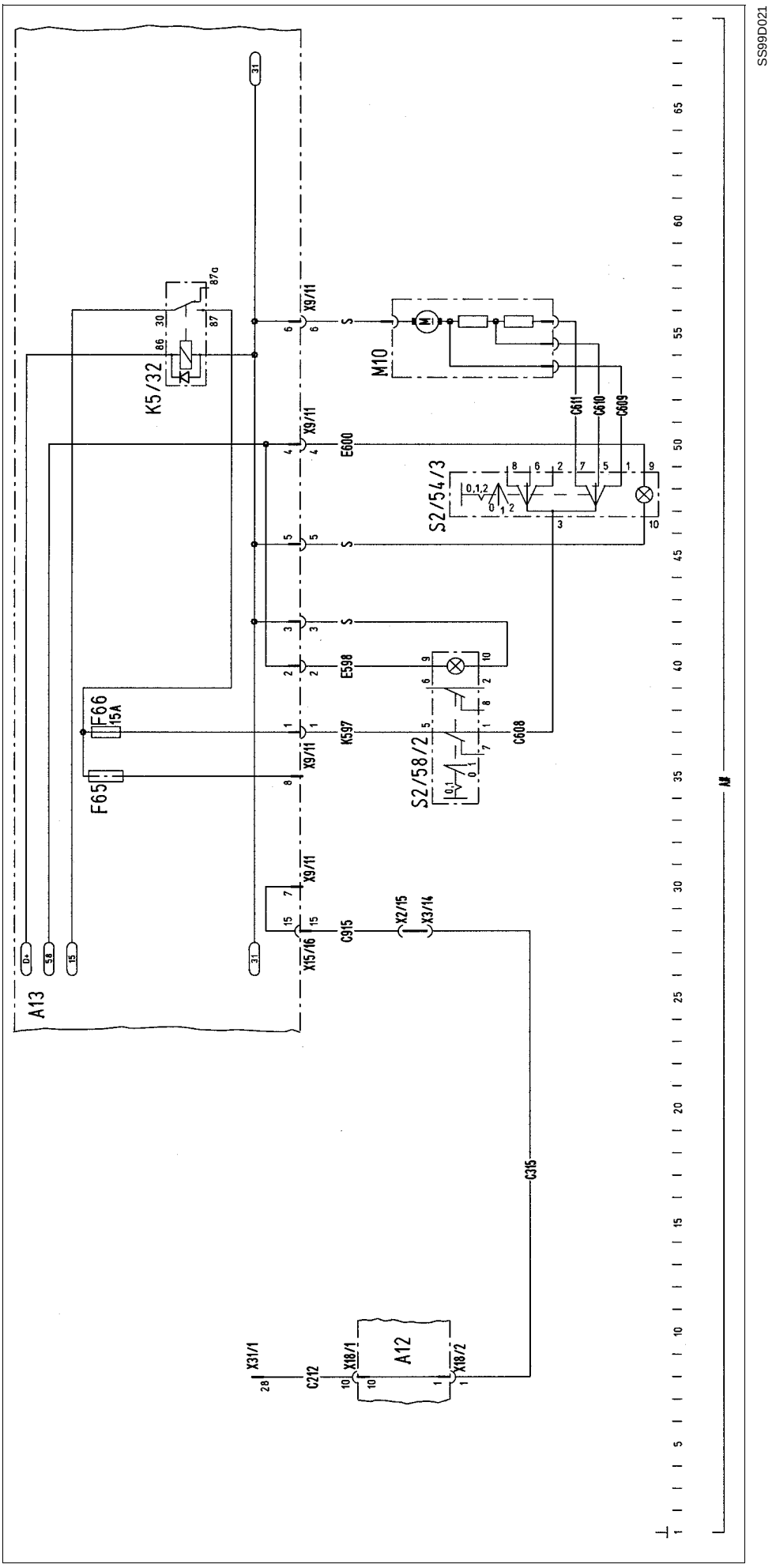
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 21



Electrical equipment

A12	Print, central electrics
A13	Print, roof electrics
F65	Fuse, air conditioning
F66	Fuse, air conditioning blower motor
K5/32	Relay, roof blower motor
M10	Roof blower motor
S2/54/3	Switch, blower motor, positions 1-2-3
S2/58/2	Switch, blower motor ON
X2/15	Flat plug-in connection, air-conditioning, roof
X3/14	Distributor, air-conditioning, roof
X9/11	Flat plug-in connection, air-conditioning, roof
X12/1	Plug-in connection, instrument cable
X15/8	Plug-in connection, supply cable, roof
X15/16	Plug-in connection, supply cable, roof
X31/1	Plug-in connection, instrument, engine

VERSIONS
to this Sheet
21
on Sheet/Sheets
20

Grounding points

Designation of Sections

A#	Blower, high-top
#	several versions available

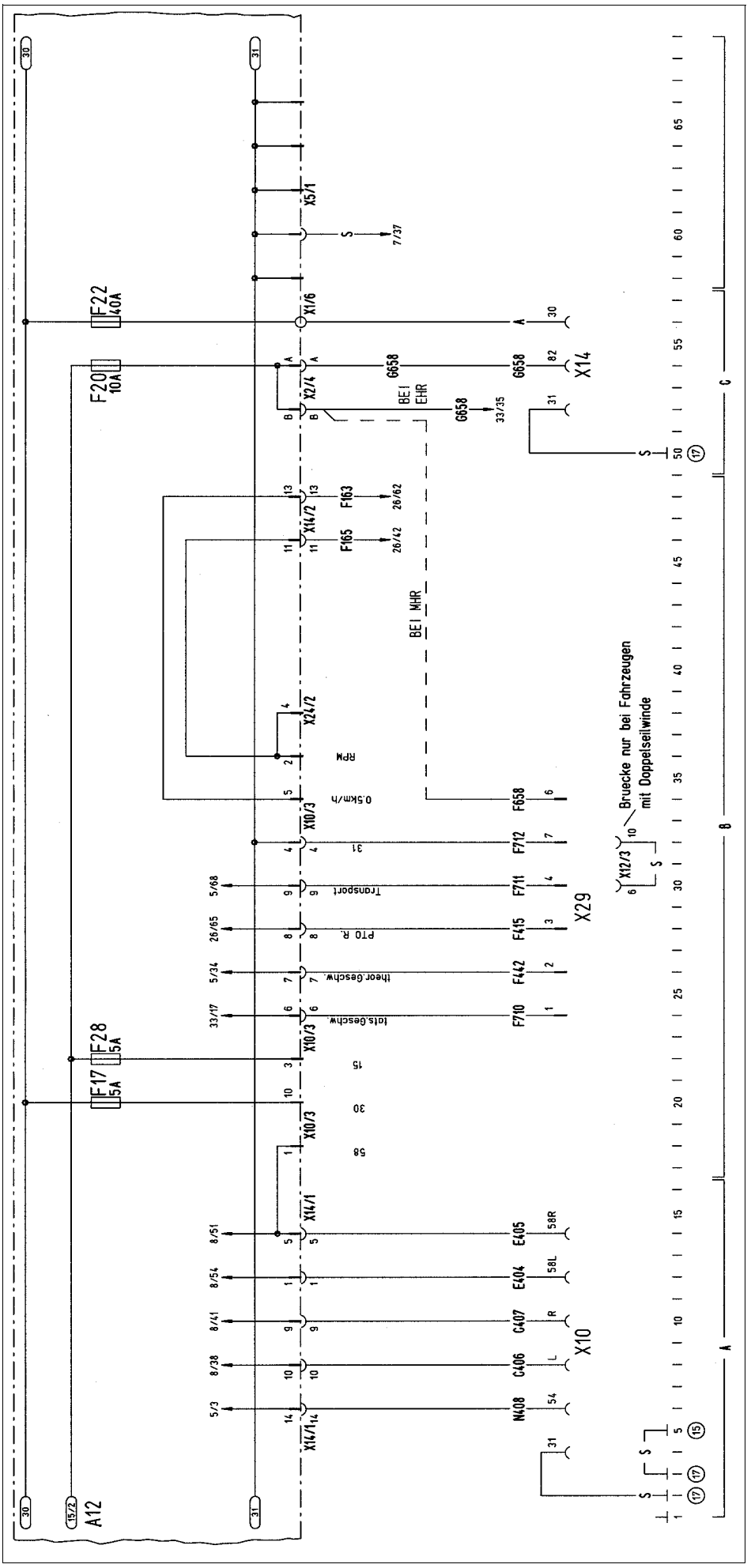
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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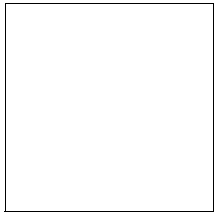
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Sheet 22



Electrical equipment

A12	Print, central electrics
F17	Fuse, reserve potential 30
F20	Fuse, reserve potential 30
F22	Fuse, power socket
F28	Fuse, reserve potential 15
X1/6	Screw-on connection, power socket
X2/4	Plug-in connection, chassis, right, indicator, PTO-shaft
X5/1	Ground plug-in connection, central print
X10	Plug-in connection, 7-pole, trailer
X10/3	Plug-in connection, on-board computer preparation
X12/3	Spare plug-in connection
X14	Flat power socket
X14/1	Plug-in connection, cable, chassis, left
X15/4	Plug-in connection, instrument cable
X29	Standard signal socket



Grounding points

15	Instrument panel sockets
17	Rear mudguard

Designation of Sections

A	Trailer socket
B	Standard signal socket, for MHR or on-board computer preparation
C	Power socket 40A

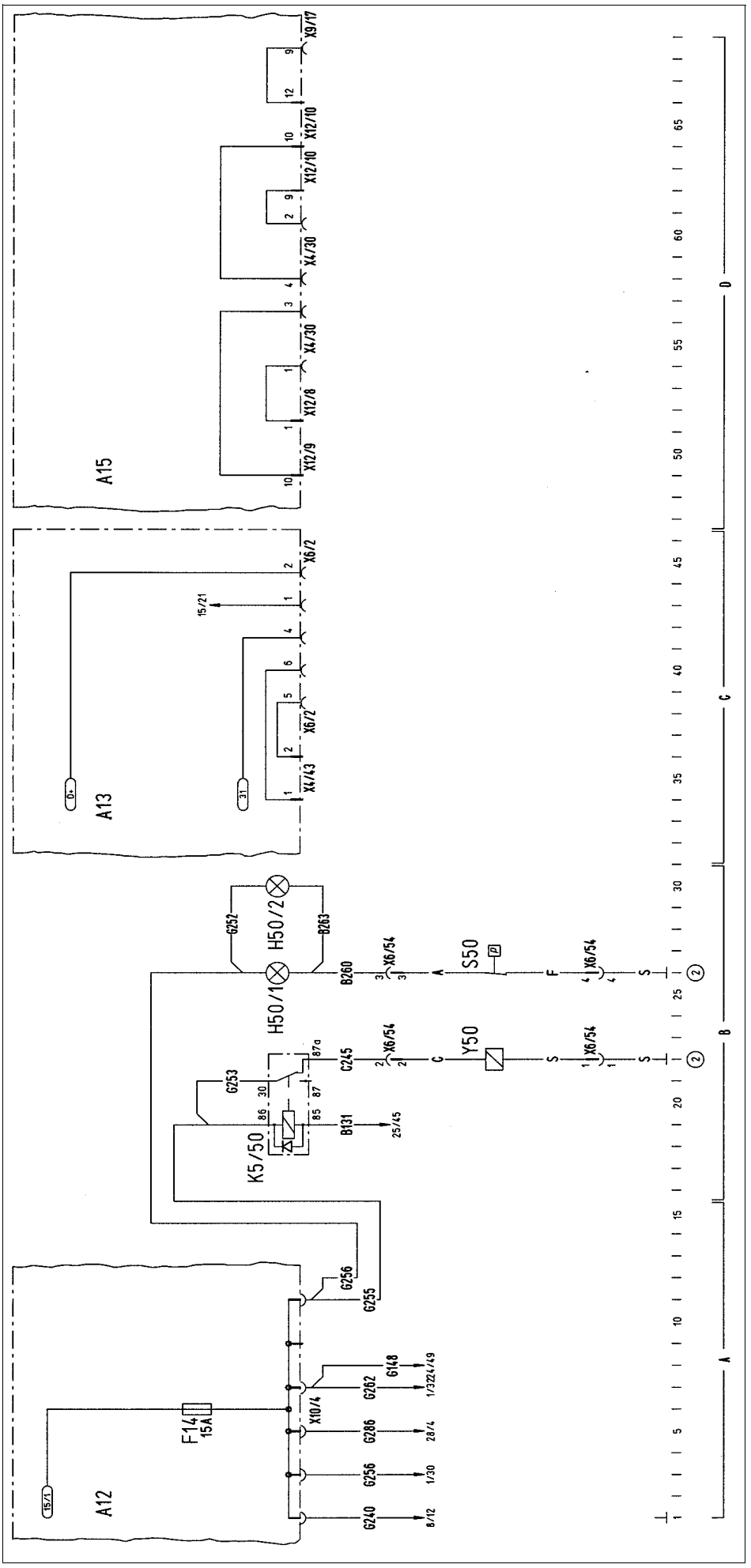
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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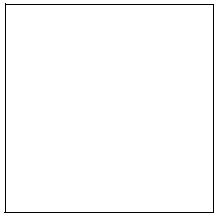
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Sheet 23



Electrical equipment

A12	Print, central electrics
A13	Print, roof electrics
A15	Print, EHR, left
F14	Fuse, potential 15/1
H50/1	Trailer brake indicator
H50/2	Trailer brake indicator
K5/50	Relay, trailer brake valve
S50	Switch, trailer brake valve
X4/30	Spare plug-in connection
X4/43	Plug-in connection, number plate lighting
X6/2	Plug-in connection, roof frame
X6/54	Plug-in connection, trailer brake valve
X9/17	Plug-in connection, cable, chassis, left
X10/4	Distributor, potential 15, central print
X12/8	Plug-in connection, EHR box cable
X12/9	Plug-in connection, EHR box cable
X12/10	Plug-in connection, EHR box cable
Y50	Trailer brake valve, solenoid valve



Grounding points

2	Instrument panel

Designation of Sections

A	Supply potential 15/1, instrument
B	Brake valve, Italy
C	Reserve roof print (high-top)
D	Reserve print, EHR, left

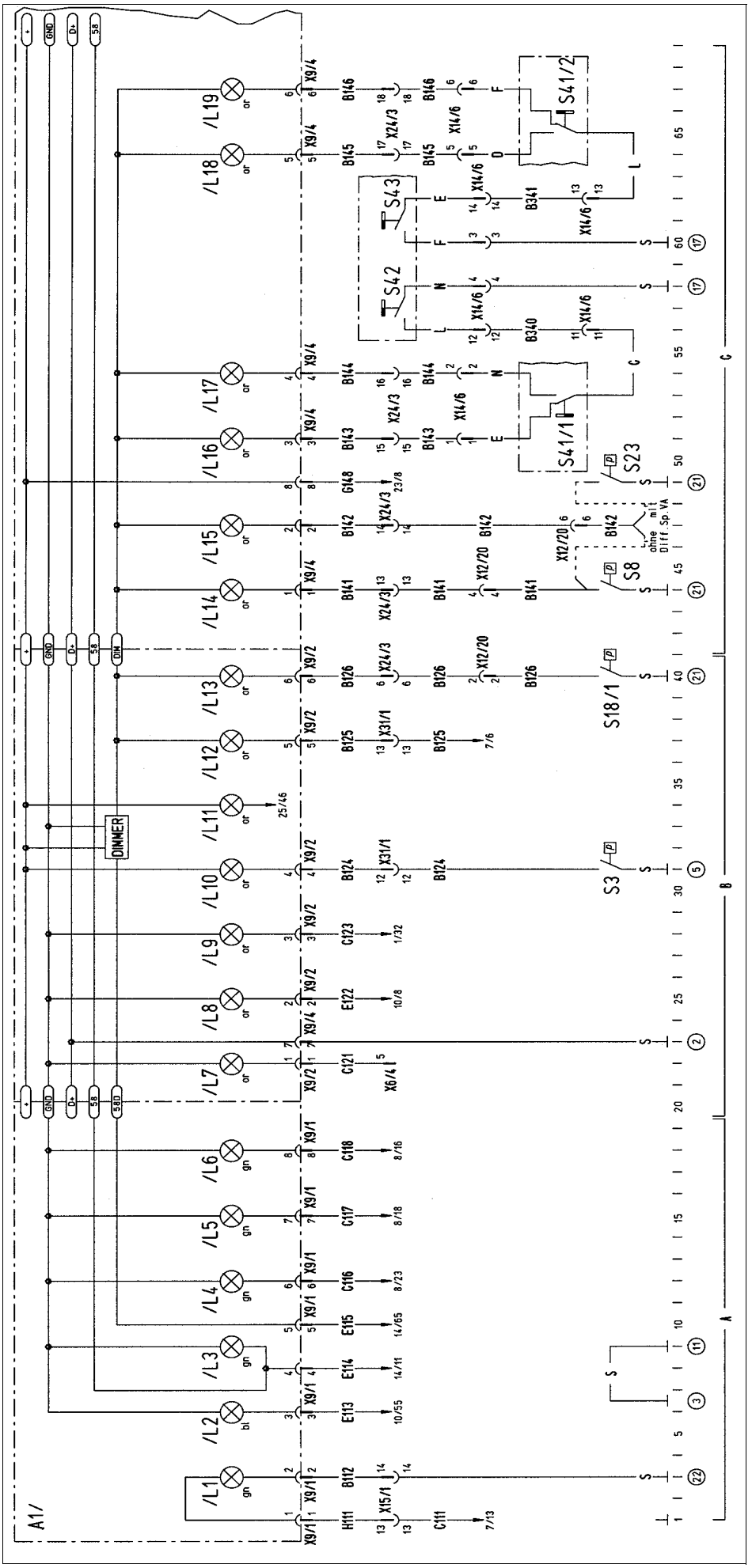
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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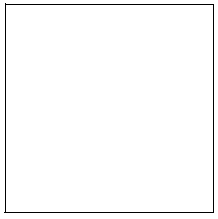
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Sheet 24



Electrical equipment

/L1	Indicator, power shift-fast
/L2	Main beam indicator
/L3	Lighting indicator
/L4	Tractor trafficator indicator
/L5	1st trailer trafficator repeater
/L6	2nd trailer trafficator repeater
/L7	Spare indicator (OR)
/L8	Searchlight indicator
/L9	Pre-glowing indicator
/L10	Air filter indicator
/L11	Tank reserve indicator
/L12	Fuel heater indicator
/L13	4-wheel drive indicator
/L14	Rear differential lock indicator
/L15	Front differential lock indicator
/L16	430 PTO shaft indicator
/L17	540 PTO shaft indicator
/L18	540E PTO shaft indicator
/L19	1000 PTO shaft indicator
A1/	Combination instrument
S3	Switch, air filter indicator
S8	Switch, differential lock indicator
S18/1	Switch, 4-wheel drive indicator, hydraulic
S23	Switch, differential lock indicator, front axle
S41/1	Switch, PTO shaft N/E indicator
S41/2	Switch, PTO shaft N/E indicator
S42	Switch, 540 PTO shaft indicator
S43	Switch, 1000 PTO shaft indicator
X6/4	Plug-in connection, instrument, chassis, right
X9/1	Plug-in connection, instrument cable
X9/2	Plug-in connection, instrument cable
X9/4	Plug-in connection, instrument cable
X12/20	Plug-in connection, chassis, right, transmission
X14/6	Plug-in connection, chassis right, PTO shaft indicator
X15/1	Plug-in connection, instrument-chassis, right
X24/3	Plug-in connection, chassis, right, instrument
X31/1	Plug-in connection, instrument-engine



Grounding points

2	Instrument panel
3	Implement carrier
5	Engine compartment
11	Driver's cab frame
17	Rear mudguard
21	Console Transmission plug
22	E box console

Designation of Sections

A	Instrument left, display
B	Instrument centre, display
C	Instrument right, display

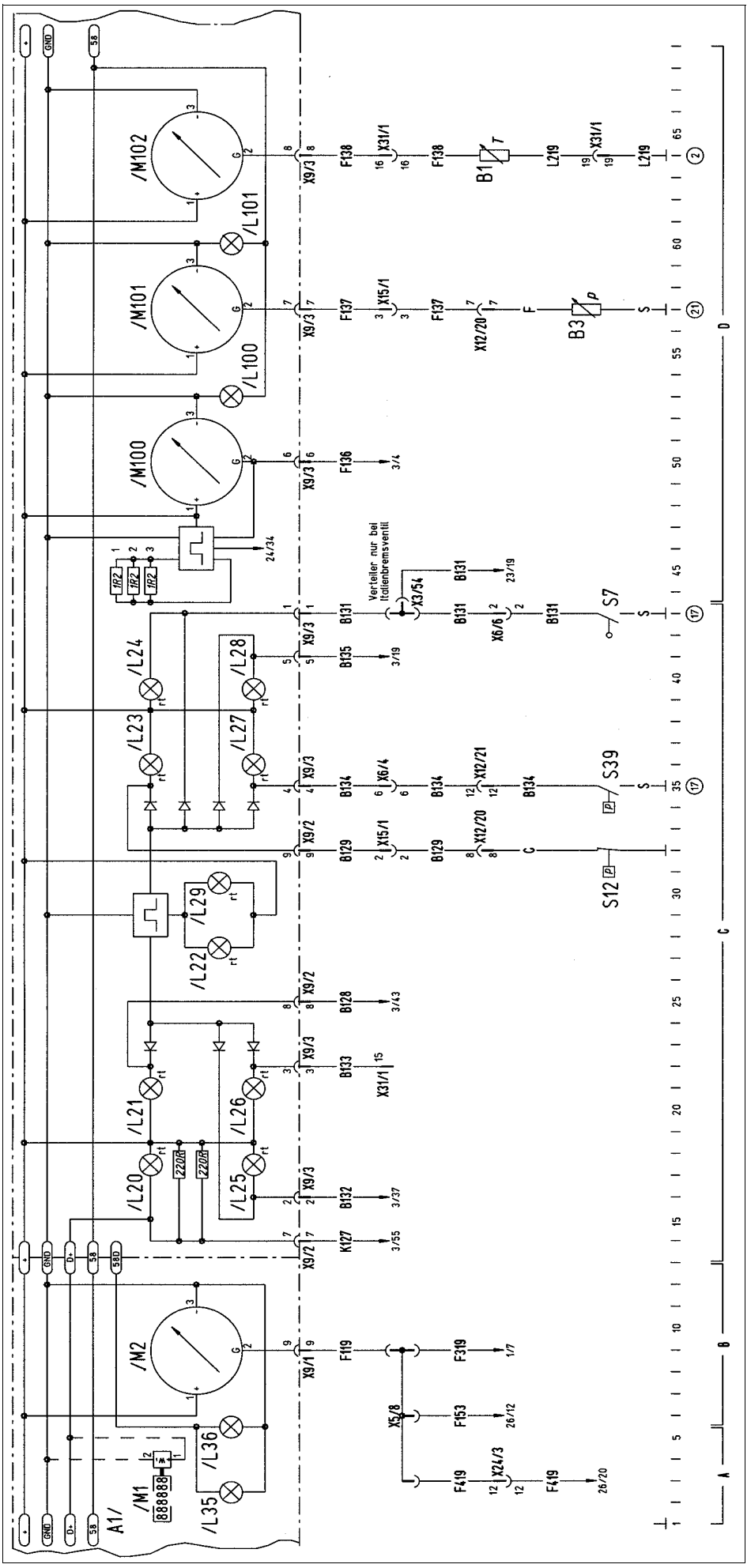
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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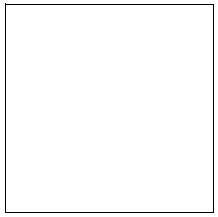
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Sheet 25



Electrical equipment

/L20	Generator charging indicator
/L21	Engine oil pressure indicator
/L22	Stop indicator
/L23	Compressed air indicator
/L24	Handbrake indicator
/L25	Cooling water temperature indicator
/L26	Cooling water level indicator
/L27	PTO shaft clutch indicator
/L28	Stationary operation indicator
/L29	Stop indicator
/L35	Display lighting
/L36	Display lighting
/L100	Display lighting
/L101	Display lighting
/M1	Operating hours counter
/M2	Rev-counter
/M100	Fuel gauge
/M101	Compressed air gauge
/M102	Water temperature gauge
A1/	Combination instrument
B1	Engine temperature transmitter
B3	Compressed air transmitter
S7	Switch, handbrake indicator
S12	Switch, compressed air indicator
S39	Switch, PTO shaft clutch ON
X3/54	Distributor, trailer brake vakve
X5/8	Distributor, instrument potential, dynamo+
X6/4	Plug-in connection, instrument, chassis, right
X6/6	Plug-in connection, instrument, chassis, left
X9/1	Plug-in connection, instrument cable
X9/2	Plug-in connection, instrument cable
X9/3	Plug-in connection, instrument cable
X12/20	Plug-in connection, chassis, right, transmission
X12/21	Plug-in connection, chassis, right, transmission
X15/1	Plug-in connection, instrument-chassis right
X24/3	Plug-in connection, chassis, right, instrument
X31/1	Plug-in connection, instrument-engine



Grounding points

2	Instrument panel
17	Rear mudguard
21	Console Transmission plug

Designation of Sections

A	Mechanically driven op. hours counter
B	Instrument left, analogue
C	Instrument centre, warning display
D	Instrument centre, analogue

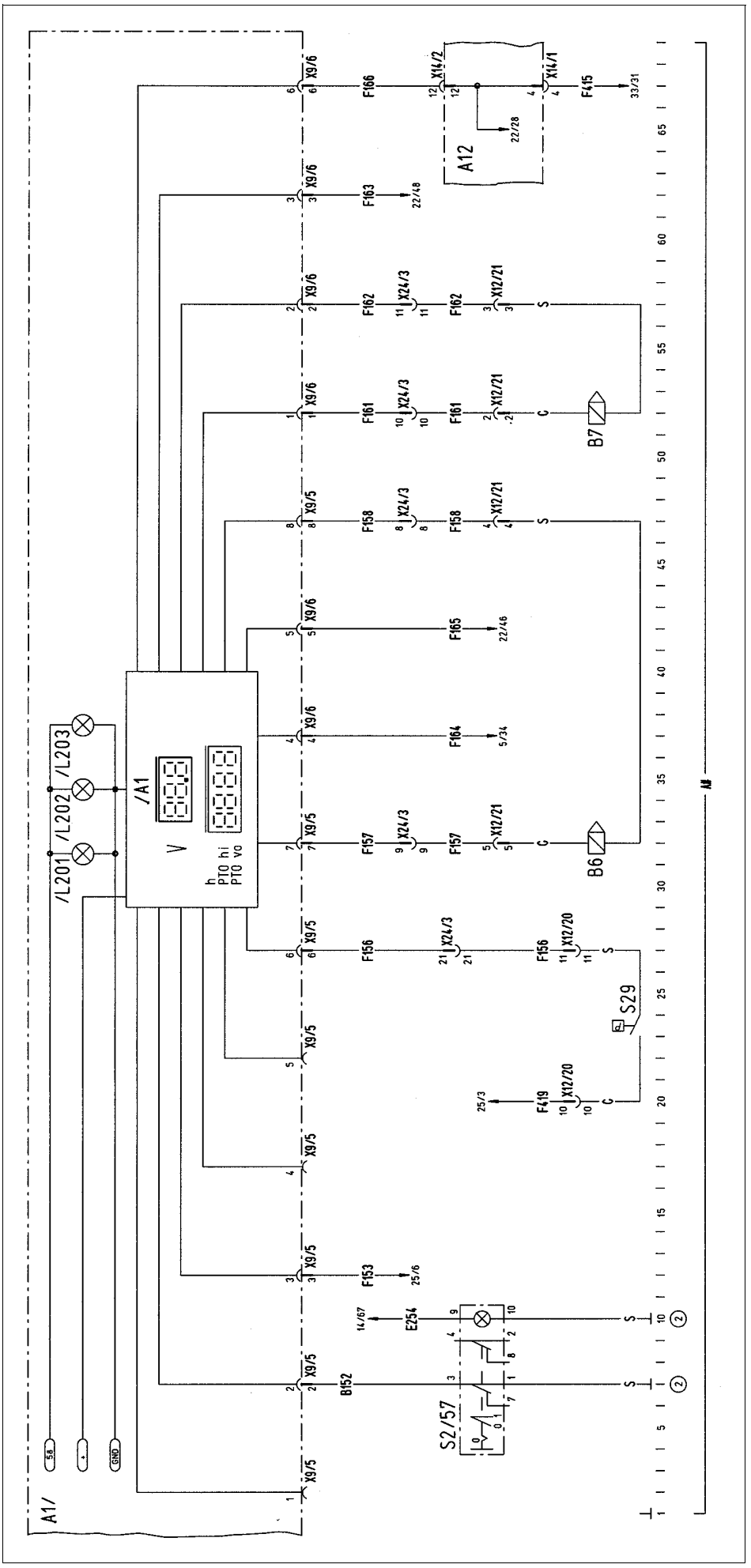
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 26



Electrical equipment

/A1	Digital instrument
/L201	Display lighting
/L203	Display lighting
A1/	Display lighting
A12	Combination instrument
B6	Print, central electrics
B7	Speed, induction transmitter
S2/57	Rear PTO shaft, induction transmitter
S29	Switch, front PTO shaft
X9/5	Plug-in connection, instrument cable
X9/6	Plug-in connection, instrument cable
X12/20	Plug-in connection, chassis, right, transmission
X12/21	Plug-in connection, chassis, right, transmission
X14/1	Plug-in connection, cable, chassis, left
X14/2	Plug-in connection, instrument cable
X24/3	Plug-in connection, chassis, right, instrument

VERSIONS
to this Sheet
26
on Sheet/Sheets
27

Grounding points

2	Instrument panel

Designation of Sections

A#	Instrument right, digital
#	several versions available

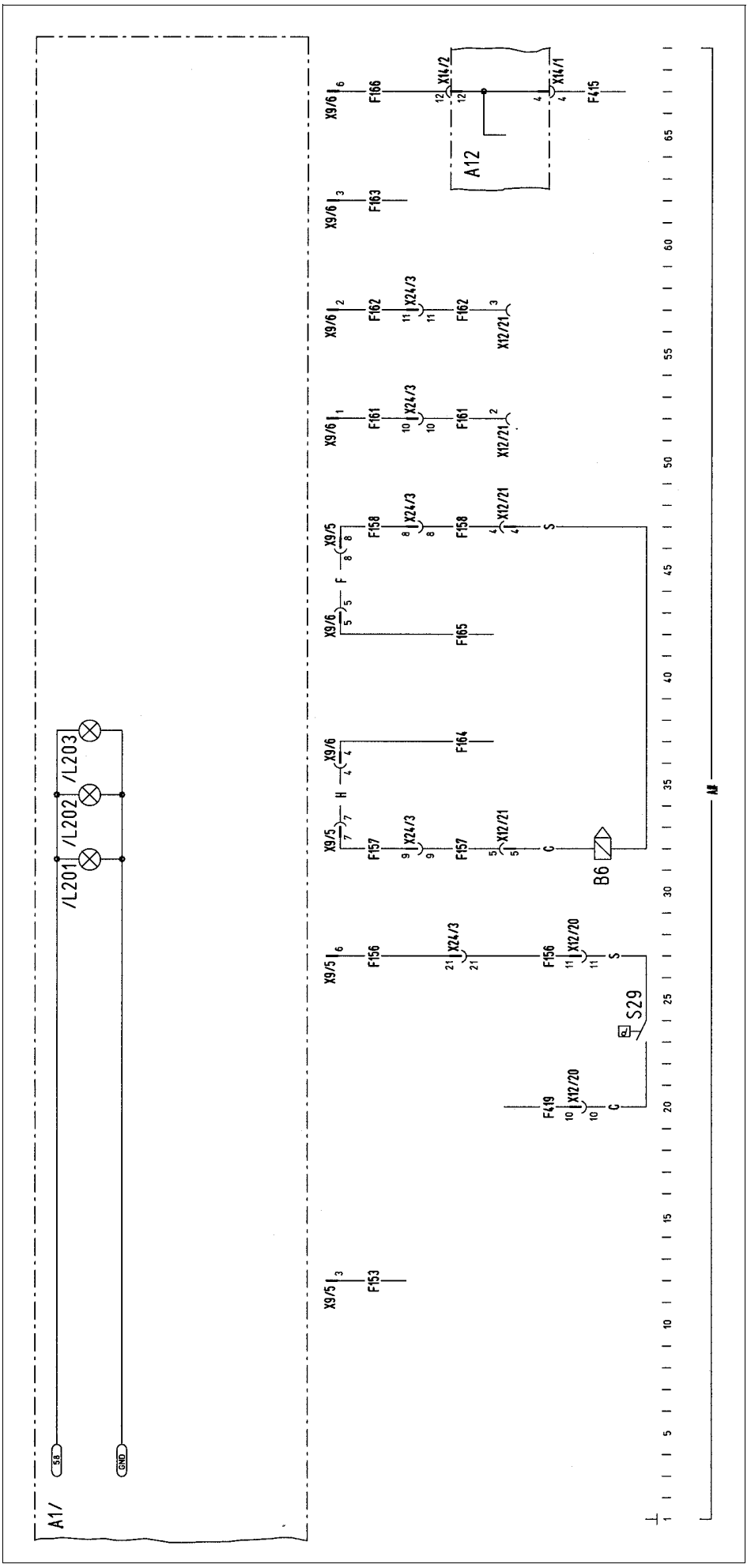
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 27



Electrical equipment

/L201	Display lighting
/L202	Display lighting
/L203	Display lighting
A1/	Combination instrument
A12	Print, central electrics
B6	Speed, induction transmitter
S29	Switch, front PTO shaft
X9/5	Plug-in connection, instrument cable
X9/6	Plug-in connection, instrument cable
X12/20	Plug-in connection, chassis, right, transmission
X12/21	Plug-in connection, chassis, right, transmission
X14/1	Plug-in connection, cable, chassis, left
X14/2	Plug-in connection, instrument cable
X24/3	Plug-in connection, chassis, right, instrument

VERSIONS
to this Sheet
27
on Sheet/Sheets
26

Grounding points

Designation of Sections

A#	Instrument right, without digital
#	several versions available

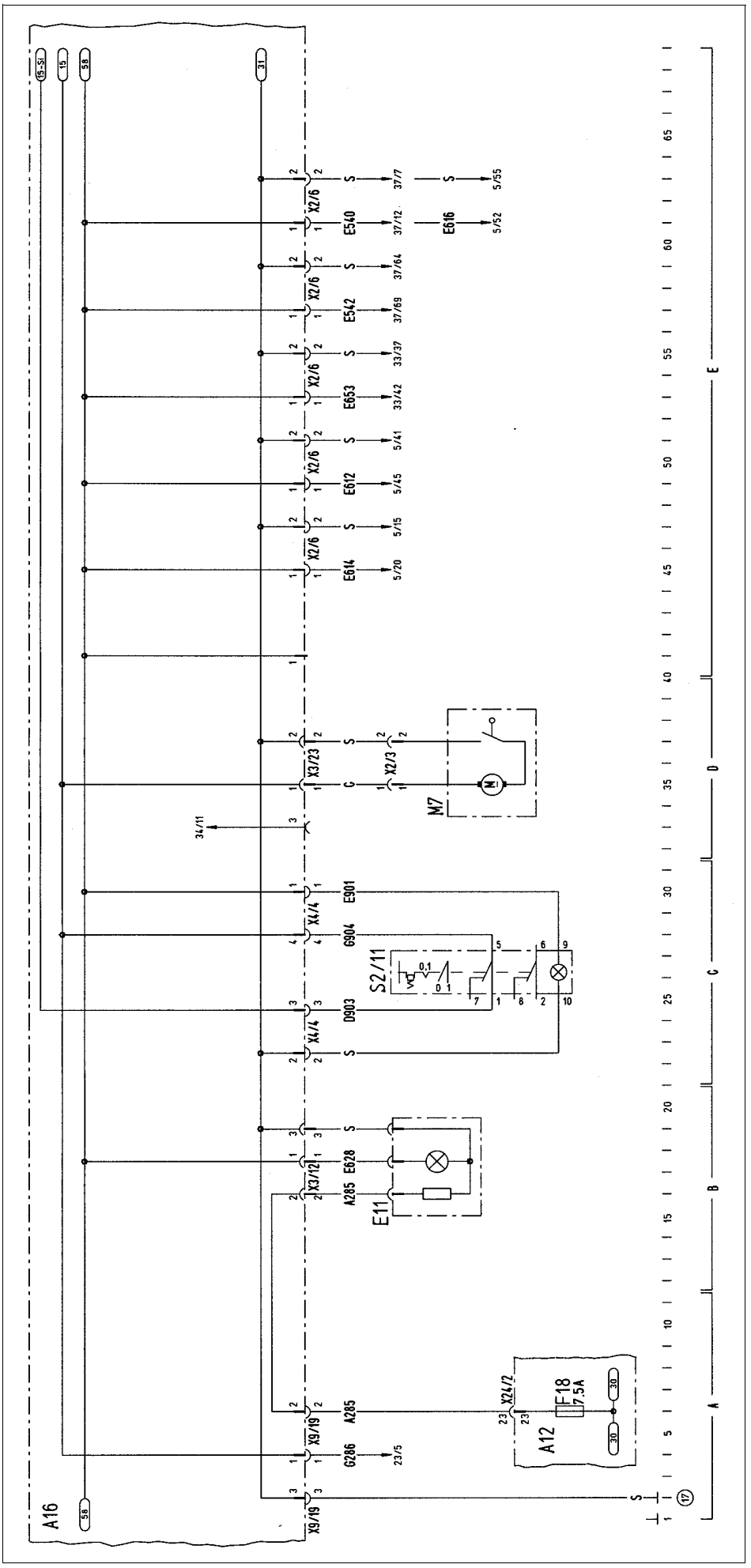
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
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E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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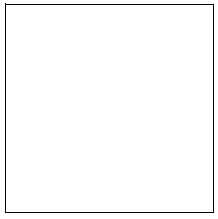
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Sheet 28



Electrical equipment

A12	Print, central electrics
A16	Print, EHR operating console
E11	Cigarette lighter
F18	Fuse, cigarette lighter
M7	Compressed air seat motor
S2/11	Switch, safety
X2/3	Plug-in connection, flat, air sprung seat
X2/6	Plug-in connection, switch lighting
X3/12	Plug-in connection, cigarette lighter
X3/23	Plug-in connection, air-sprung seat
X4/4	Plug-in connection, fuse switch
X9/19	Plug-in connection, cable, chassis, right
X24/2	Plug-in connection, chassis, right



Grounding points

17 Rear mudguard

Designation of Sections

A	Supply, EHR operating console
B	Cigarette lighter
C	Safety switch
D	Air-sprung seat
E	Supply potential 58 for various switches

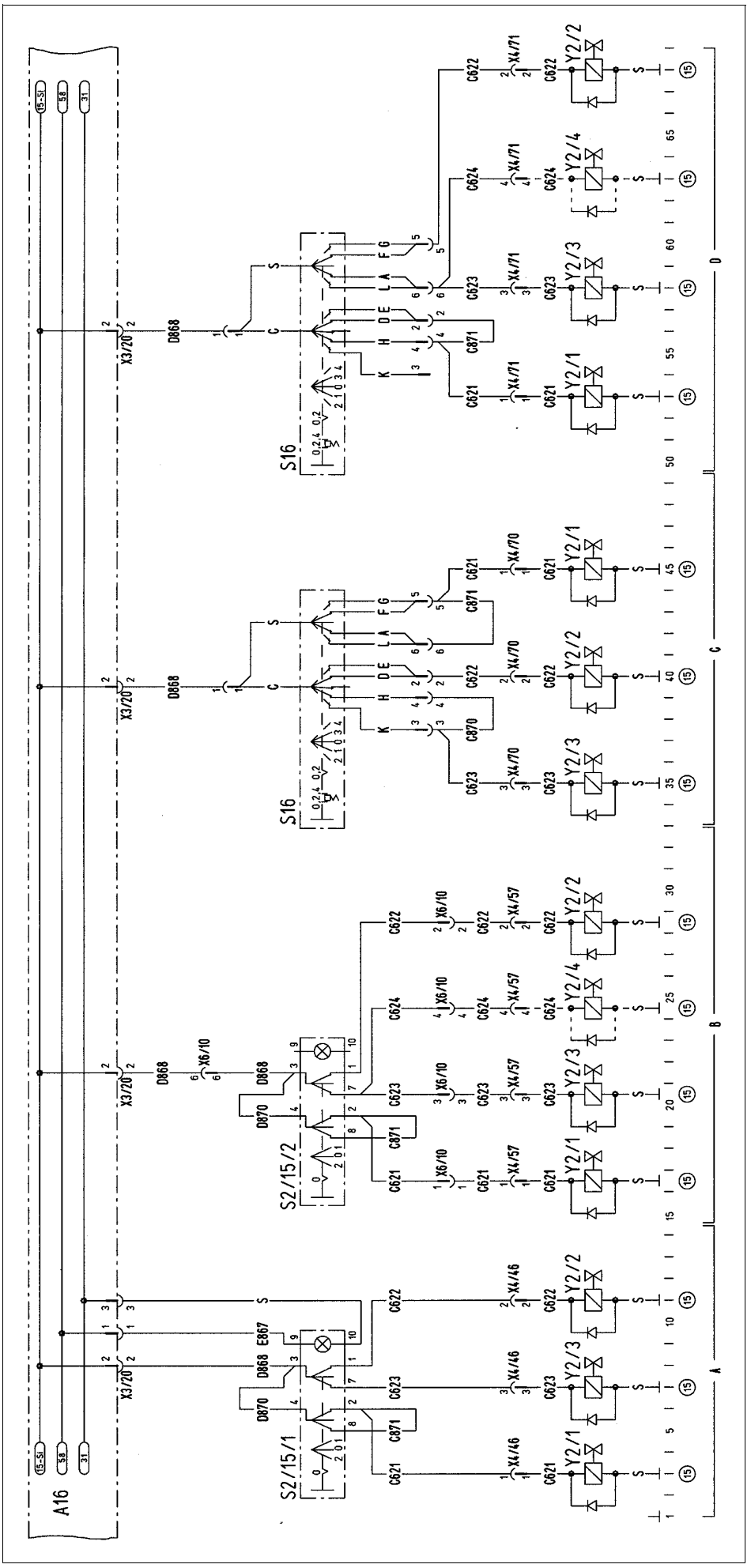
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
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C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 29



Electrical equipment

A16	Print, EHR operating console
S2/15/1	Double-action auxiliary control unit rocker switch
S2/15/1	Rocker switch for double-action auxiliary control unit with shut-off valve
S16	Lever switch, auxiliary control unit
X3/20	Plug-in connection, supply
X4/46	Plug-in connection, double-action auxiliary control unit rocker switch
X4/57	Plug-in connection, solenoid valve, aux. control unit multi-function lever
X4/70	Plug-in connection, solenoid valve, aux. control unit lever switch
X4/71	Plug-in connection, solenoid valve, aux. control unit shut-off valve lever switch
X6/10	Plug-in connection, multi-function lever
Y2/1	Solenoid valve, control unit
Y2/1	Solenoid valve, control unit
Y2/1	Solenoid valve, control unit
Y2/4	Solenoid valve, interlock block

Grounding points

15 Console sockets

Designation of Sections

A Double-action auxiliary control unit rocker switch

B Double-action auxiliary control unit (+ shut-off valve) rocker switch

C Double-action auxiliary control unit lever switch

D Double-action uxiliary control unit (+ shut-off valve) lever switch

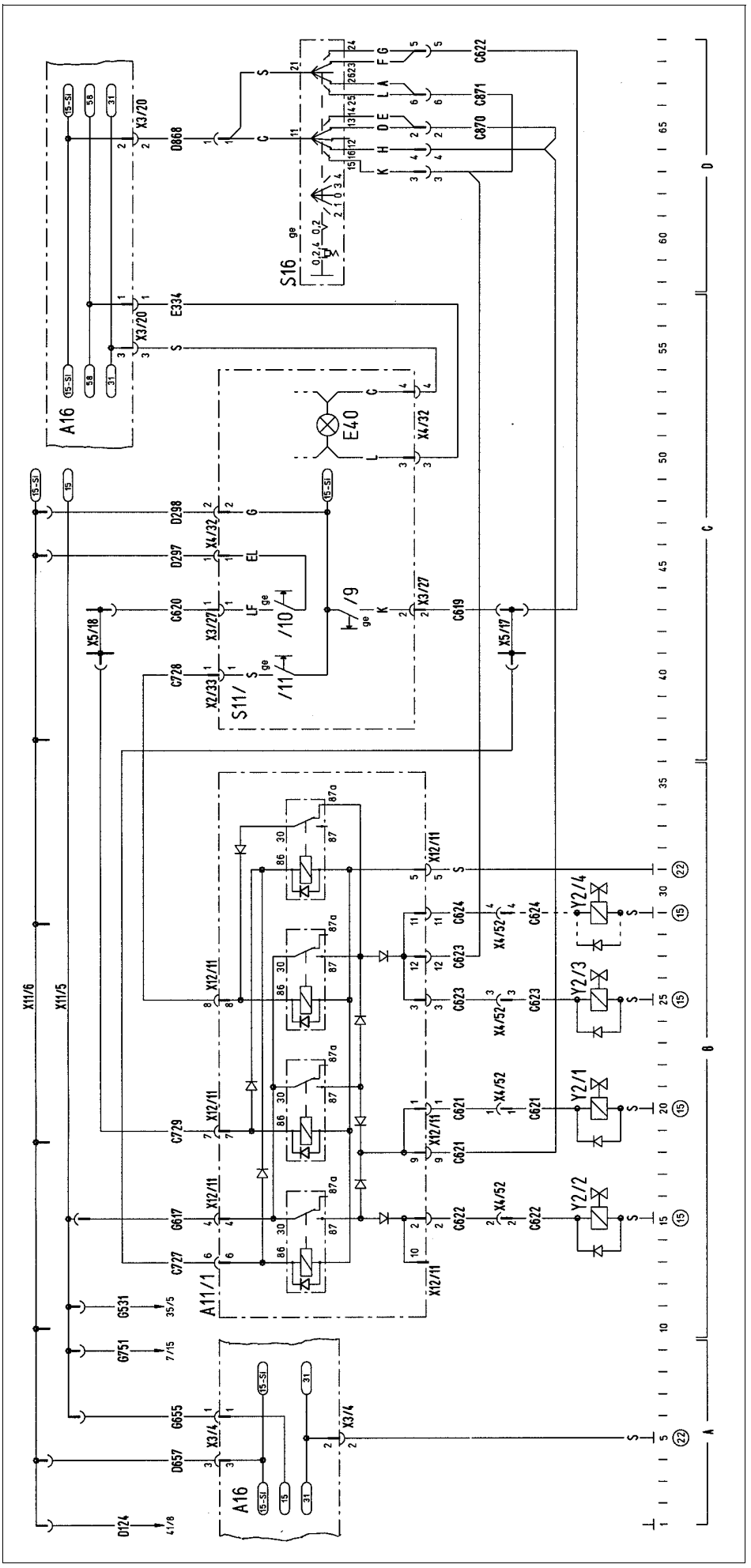
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 30



Electrical equipment

/9	Switch, 2nd aux. control unit, yellow, raise
/10	Switch, 2nd aux. control unit, yellow, lower
/11	Switch, 2nd aux. control unit, yellow, floating position
A11/1	'E' box, joystick
A16	Print, EHR operating console
E40	Multi-controller lighting
S11/	Multi-controller
S16	Lever switch, auxiliary control unit
X2/33	Plug-in connection, aux. control unit, multi-controller
X3/4	Plug-in connection, 'E' box supply
X3/20	Plug-in connection, supply
X3/27	Plug-in connection, 2nd aux. control unit, multi-controller
X4/32	Plug-in connection, chassis, right – multi-controller
X4/52	Plug-in connection, solenoid valve, aux. control unit multi-controller
X5/17	Distributor, aux. control unit – raise
X5/18	Distributor, aux. control unit – lower
X11/5	Distributor console, potential 15
X11/6	Distributor console, potential 15, safety
X12/11	Plug-in connection, joystick
Y2/1	Solenoid valve, control unit
Y2/1	Solenoid valve, control unit
Y2/1	Solenoid valve, control unit
Y2/4	Solenoid valve, interlock block

Grounding points

15	Console sockets
22	'E' box console

Designation of Sections

A	Supply, 'E' box control unit/ PTO-shaft
B	2nd double-action auxiliary control unit with floating position and shut-off valve
C	2nd auxiliary control unit, multi-controller operated
D	2nd auxiliary control unit, lever switch operated

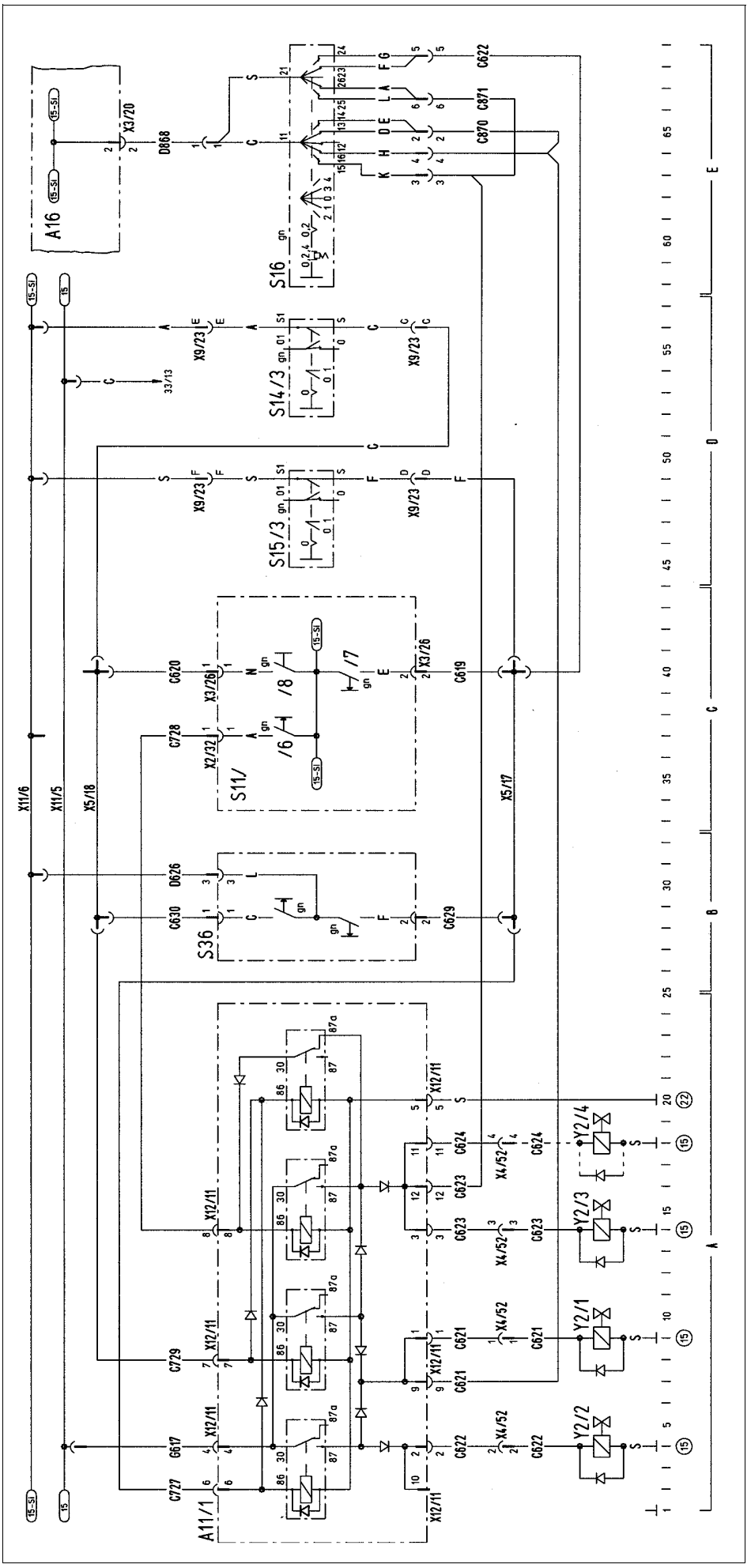
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 31



Electrical equipment

/6	Switch, 1st aux. control unit, green, floating position
/7	Switch, 1st aux. control unit, green, raise
/8	Switch, 1st aux. control unit, green, lower
A11/1	'E' box, joystick
A16	Print, EHR operating console
S11/	Multi-controller
S14/3	Front lifting gear external pushbutton, lower
S15/3	Front lifting gear external pushbutton, raise
S16	Lever switch, auxiliary control unit
S36	Switch, joystick
X2/32	Plug-in connection, aux. control unit, multi-controller
X3/20	Plug-in connection, supply
X3/26	Plug-in connection, 1st aux. control unit, multi-controller
X4/52	Plug-in connection, solenoid valve, aux. control unit multi-controller
X5/17	Distributor, aux. control unit, raise
X5/18	Distributor, aux. control unit, lower
X9/23	Plug-in connection, external pushbutton, front-end lifting gear
X11/5	Distributor console, potential 15
X11/6	Distributor console, potential 15, safety
X12/11	Plug-in connection, joystick
Y2/1	Solenoid valve, control unit
Y2/1	Solenoid valve, control unit
Y2/1	Solenoid valve, control unit
Y2/4	Solenoid valve, interlock block

Grounding points

15	Console sockets
22	'E' box console

Designation of Sections

A	1st double-action auxiliary control unit with floating pos. and shut-off valve
B	1st auxiliary control unit, joystick operated
C	1st auxiliary control unit, multi-controller operated
D	1st auxiliary control unit, front-end lifting gear, external pushbuttons
E	1st auxiliary control unit, lever switch operated

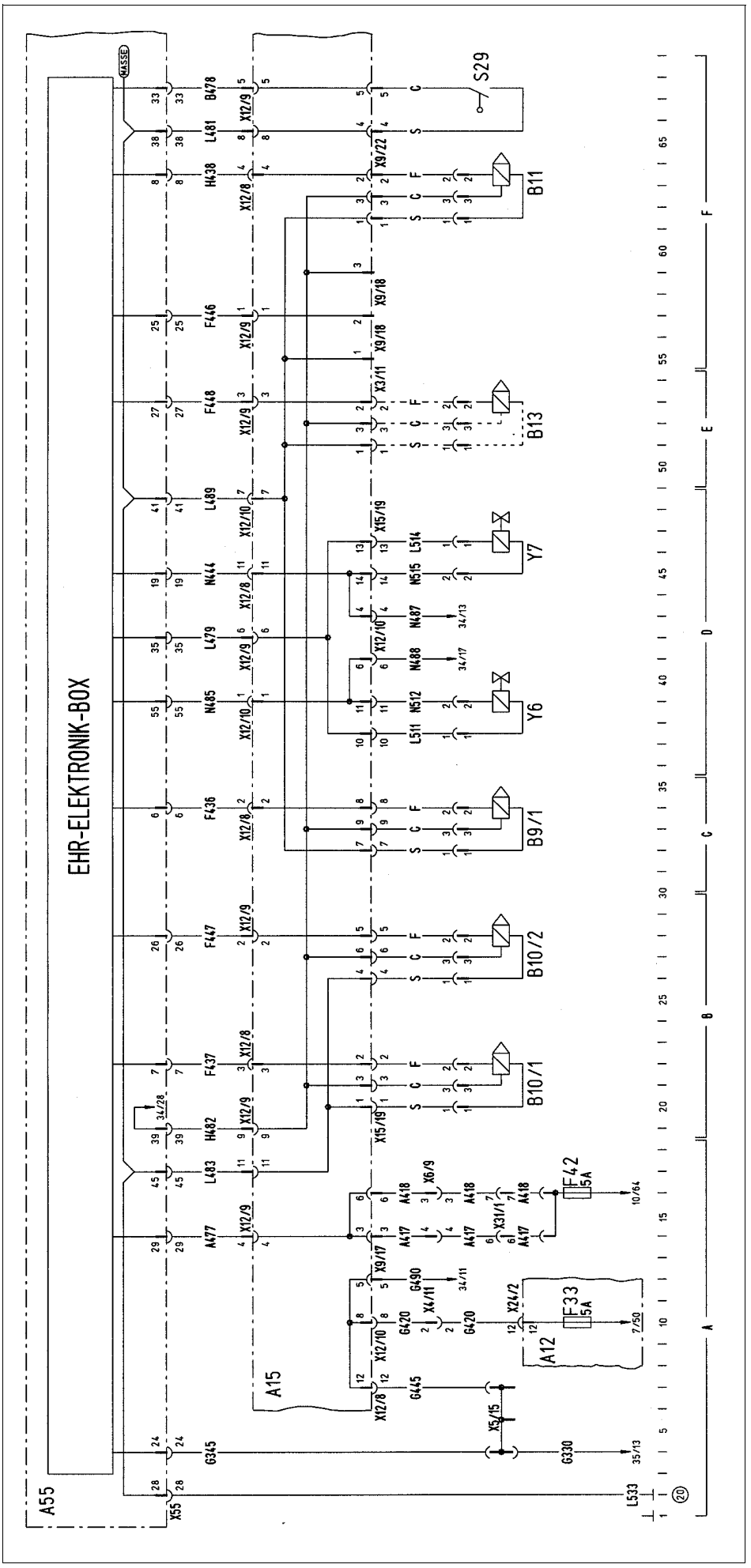
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 32



Electrical equipment

A12	Print, central electrics
A15	Print, EHR, left
A55	Control unit, EHR D
B9/1	Position transmitter, rear lifting gear
B10/1	Power sensor transmitter, left
B10/2	Power sensor transmitter, right
B11	EHR pressure transmitter
B13	External transmitter
F33	Fuse, potential 15, EHR
F42	Fuse, EHR
S29	Switch, front PTO shaft
X3/11	Plug-in connection, external sensor
X4/11	Plug-in connection, EHR B print
X5/15	Distributor, EHR, potential 15
X6/9	Plug-in connection, chassis right/chassis left
X9/17	Plug-in connection, cable, chassis, left
X9/18	Plug-in connection, cable, chassis, left
X9/22	Plug-in connection, EHR lifting gear/ pressure
X12/8	Plug-in connection, EHR box cable
X12/9	Plug-in connection, EHR box cable
X12/10	Plug-in connection, EHR box cable
X15/19	Plug-in connection, EHR box cable
X24/2	Plug-in connection, chassis, right
X31/1	Plug-in connection, instrument, engine
X55	Plug-in connection, flat, EHR box cable
Y6	Solenoid valve, EHR, raise
Y7	Solenoid valve, EHR, lower

Grounding points

20	EHR box

Designation of Sections

A	Supply, EHR box
B	Power sensors
C	Position sensors
D	EHR raise+lower – Solenoid valve
E	Provision for external sensor
F	EHR, front control

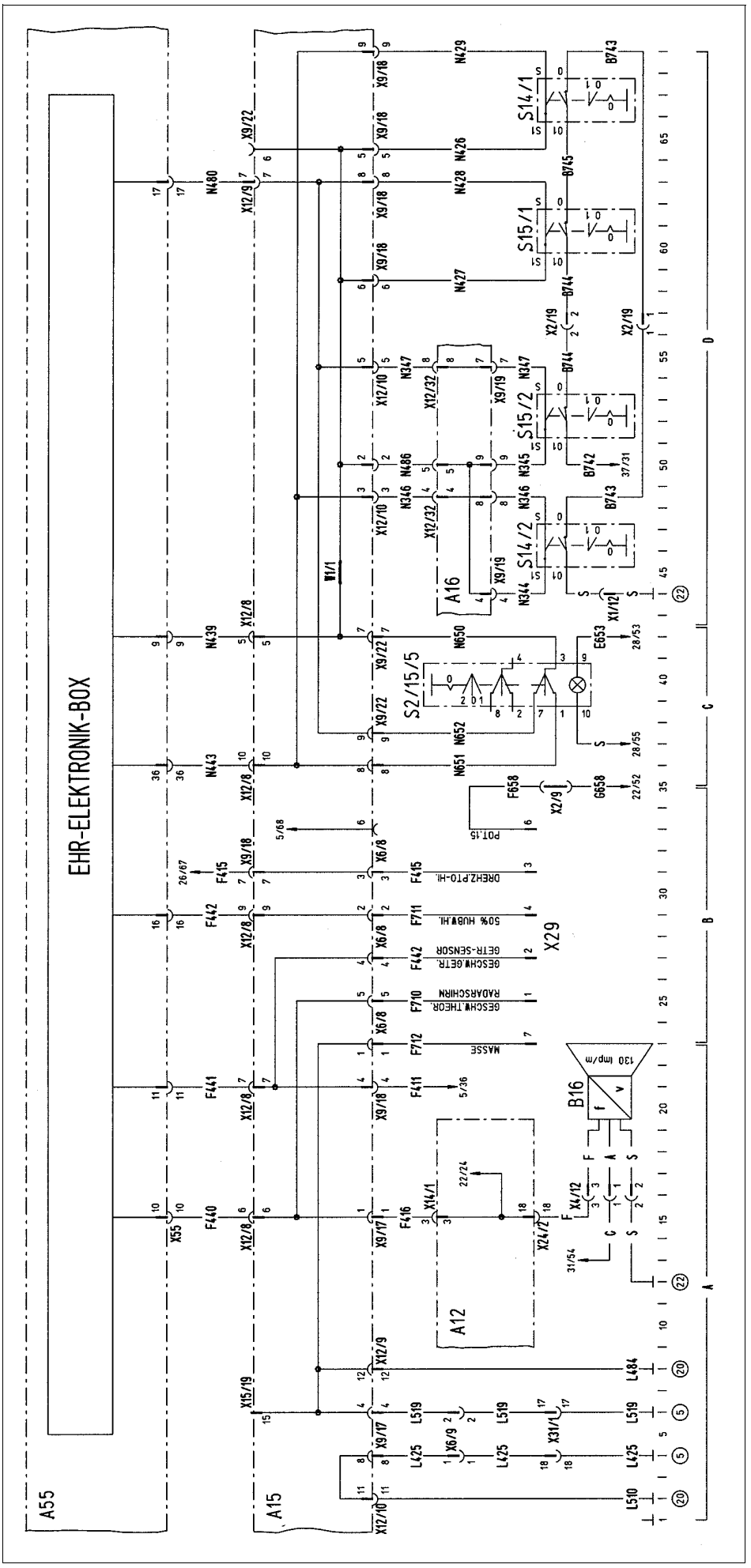
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the ’E’ Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 33



Electrical equipment

A12	Print, central electrics
A15	Print, EHR, left
A16	Print, EHR operating console
A55	Control unit, EHR D
B16	Radar sensor
S2/15/5	Screw-on connection, interior lighting, ext. pushbutton
S14/1	External pushbutton lower, left
S14/2	External pushbutton lower, right
S15/1	External pushbutton raise, left
S15/2	External pushbutton raise, right
W1/1	Contact bridge
X1/12	Plug-in connection, flat, chassis cable, right
X2/9	Plug-in connection, standard signal socket
X2/19	Plug-in connection, chassi left/chassis right
X4/12	Plug-in connection, radar sensor
X6/8	Plug-in connection, signal socket
X6/9	Plug-in connection, chassis right/chassis left
X9/17	Plug-in connection, cable, chassis, left
X9/18	Plug-in connection, cable, chassis, left
X9/19	Plug-in connection, cable, chassis, right
X9/22	Plug-in connection, EHR lifting gear/ pressure
X12/8	Plug-in connection, EHR box cable
X12/9	Plug-in connection, EHR box cable
X12/10	Plug-in connection, EHR box cable
X12/32	Plug-in connection, EHR box cable
X14/1	Plug-in connection, cable, chassis, left
X15/19	Plug-in connection, EHR box cable
X24/2	Plug-in connection, chassis, right
X29	Standard signal socket
X31/1	Plug-in connection, instrument, engine
X55	Plug-in connection, flat, EHR box cable

Grounding points

5	Engine compartment
20	EHR box
22	E box console

Designation of Sections

A	Traction control
B	Standard signal socket, for EHR
C	EHR internally actuated / external pushbutton
D	EHR external pushbutton

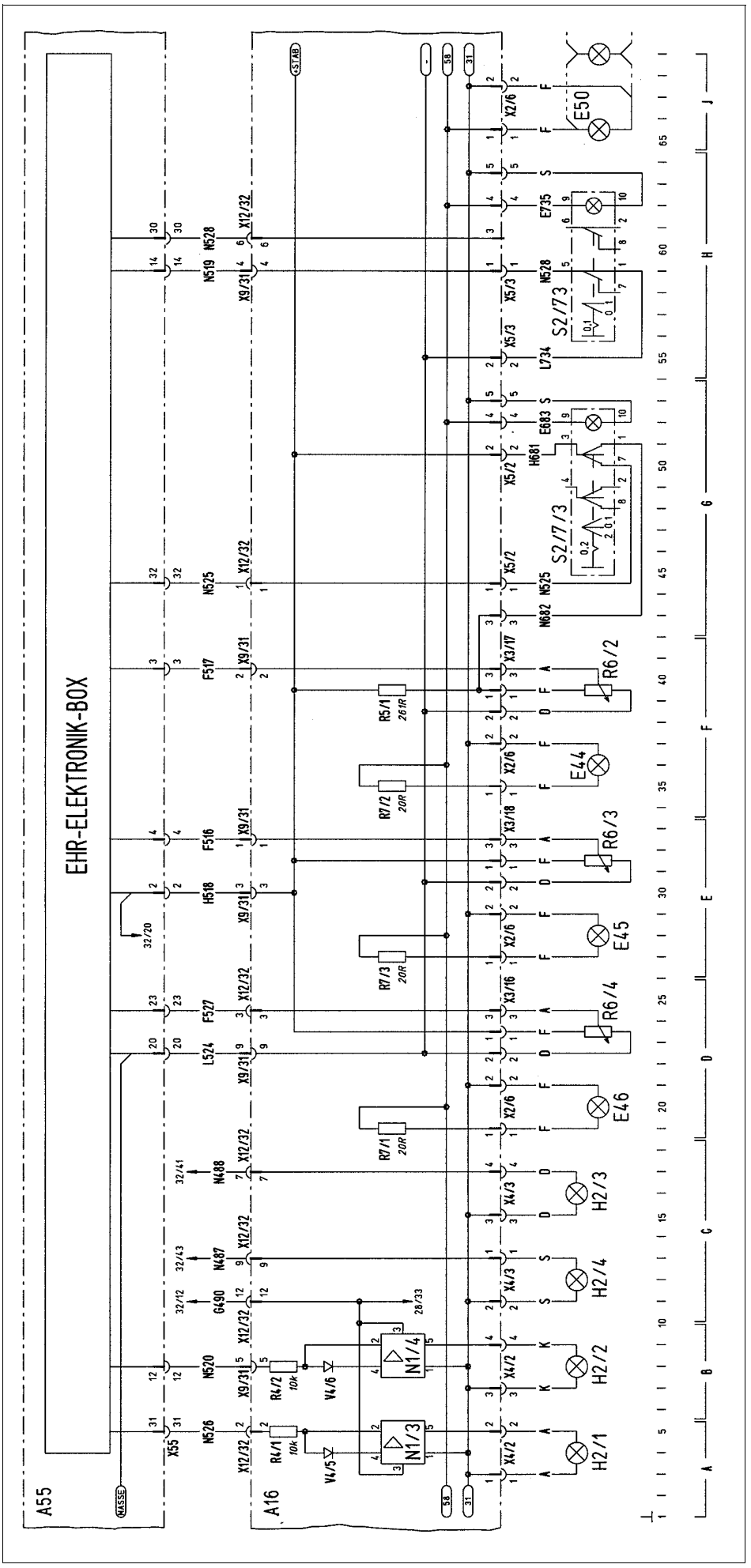
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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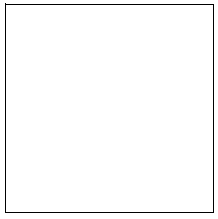
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Sheet 34



Electrical equipment

A16	Print, EHR operating console
A55	Control unit, EHR D
E44	Lighting, upper limit potentiometer
E45	Lighting, mixing potentiometer
E46	Lighting, potentiometer, lowering Speed
E50	Lighting, diagnosis front panel
H2/1	Diagnosis display
H2/2	Slip display
H2/3	Raise display
H2/4	Lower display
N1/3	Driver, diagnosis display
N1/4	Driver, traction control display
R4/1	Resistance 10 kOhm
R4/2	Resistance 10 kOhm
R5/1	Resistance 261 Ohm
R6/2	Upper limit potentiometer
R6/3	Mixing potentiometer
R6/4	Lowering speed potentiometer
R7/1	Resistance 20 Ohm
R7/2	Resistance 20 Ohm
R7/3	Resistance 20 Ohm
S2/7/3	Switch, EHR – auxiliary
S2/73	Switch, traction control
V4/5	EHR blocking diode
V4/6	EHR blocking diode
X2/6	Plug-in connection, switch lighting
X3/16	Plug-in connection, potentiometer, lowering Speed
X3/17	Plug-in connection, end position potentiometer
X3/18	Plug-in connection, mixing potentiometer
X4/2	Plug-in connection, diagnosis/ traction control
X4/3	Plug-in connection raise/lower
X5/2	Plug-in connection, aux. switch
X5/3	Plug-in connection, traction control
X9/31	Plug-in connection, EHR box cable
X12/32	Plug-in connection, EHR box cable
X55	Plug-in connection, flat, EHR box cable



Grounding points

Designation of Sections

A	EHR diagnostics display
B	EHR – slip display
C	EHR raise/lower display
D	EHR lowering speed
E	EHR mixed control
F	EHR upper limit
G	EHR auxiliary switch
H	EHR traction control
J	EHR lighting, front panel

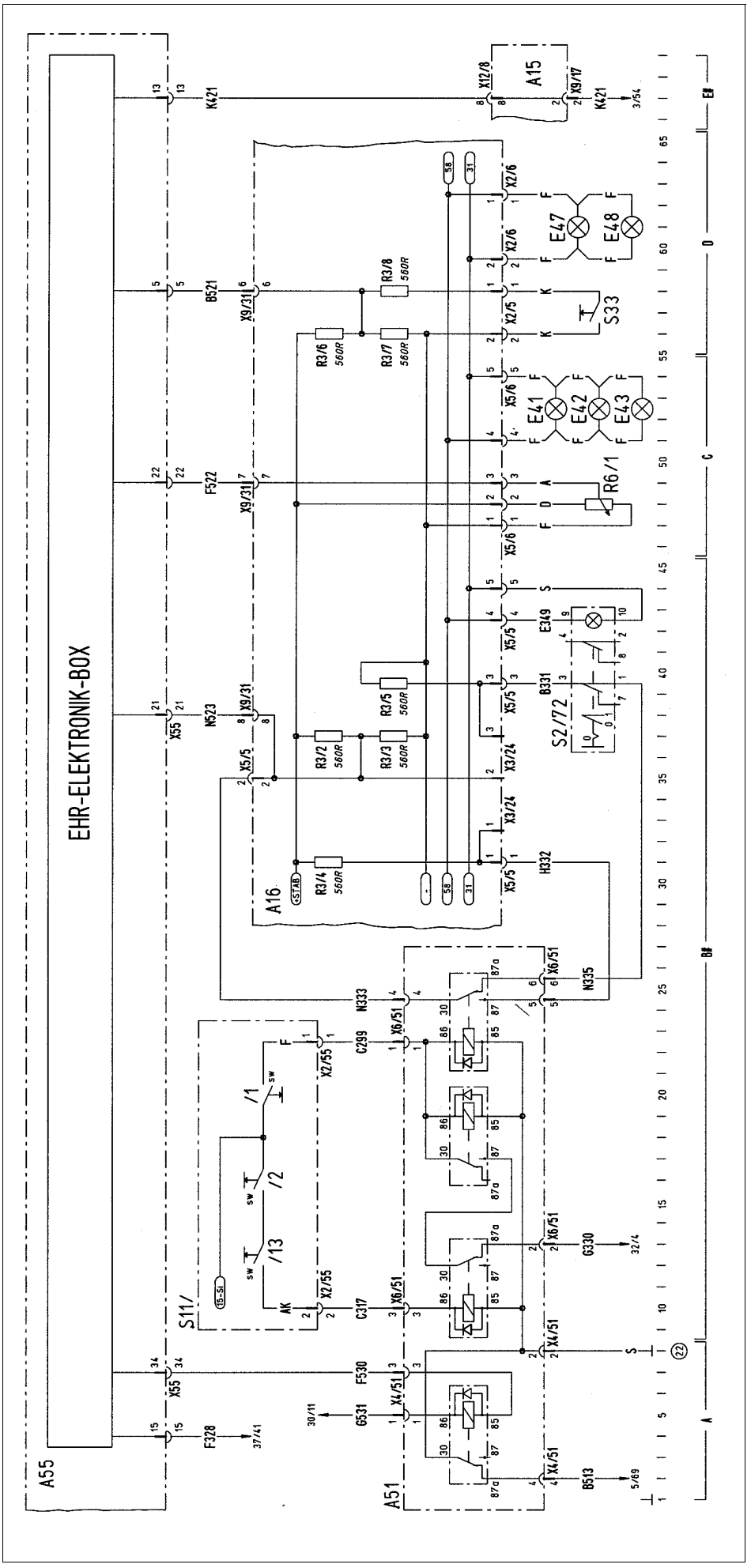
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 35



Electrical equipment

/1	Switch, EHR lift
/2	Switch, EHR control
/13	Switch, EHR safety
A15	Print, EHR, left
A16	Print, EHR operating console
A51	'E' Box, EHR operating
A55	Control unit, EHR D
E41	Setpoint potentiometer lighting
E42	Setpoint potentiometer lighting
E43	Setpoint potentiometer lighting
E47	Stop button lighting
E48	Stop button lighting
R3/2	Resistance 560 Ohm
R3/3	Resistance 560 Ohm
R3/4	Resistance 560 Ohm
R3/5	Resistance 560 Ohm
R3/6	Resistance 560 Ohm
R3/7	Resistance 560 Ohm
R3/8	Resistance 560 Ohm
R6/1	Setpoint potentiometer
S2/72	Switch, fast retract
S11/	Multi-controller
S33	Switch, EHR stop
X2/5	Plug-in connection, EHR stop
X2/6	Plug-in connection, switch lighting
X2/55	Plug-in connection, multi-controller
X3/24	Spare plug-in connection
X4/51	Plug-in connection, EHR box cable
X5/5	Plug-in connection, cable, chassis, right
X5/6	Plug-in connection, EHR setpoint
X6/51	Plug-in connection, multi-controller
X9/17	Plug-in connection, cable, chassis, left
X9/31	Plug-in connection, EHR box cable
X12/8	Plug-in connection, EHR box cable
X55	Plug-in connection, EHR box cable

VERSIONS
to this Sheet
35
on Sheet/Sheets
36

Grounding points

22 E box console

Designation of Sections

A	EHR transport signal
B#	EHR lift/control on the multi-controller
C	EHR setpoint
D	EHR stop
E#	
#	several versions available

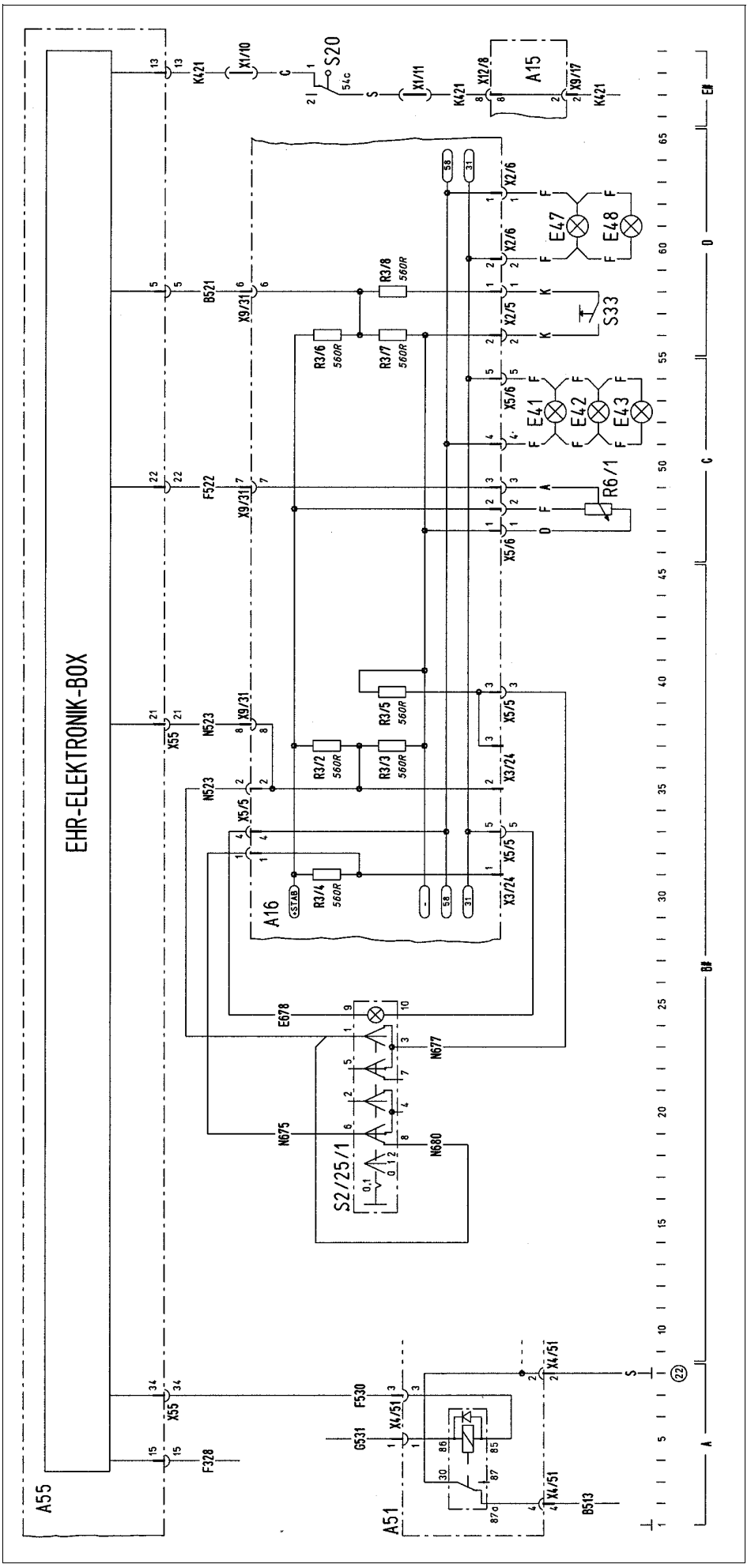
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 36



Electrical equipment

A15	Print, EHR, left
A16	Print, EHR operating console
A51	'E' Box, EHR operating
A55	Control unit, EHR D
E41	Setpoint potentiometer lighting
E42	Setpoint potentiometer lighting
E43	Setpoint potentiometer lighting
E47	Stop button lighting
E48	Stop button lighting
R3/2	Resistance 560 Ohm
R3/3	Resistance 560 Ohm
R3/4	Resistance 560 Ohm
R3/5	Resistance 560 Ohm
R3/6	Resistance 560 Ohm
R3/7	Resistance 560 Ohm
R3/8	Resistance 560 Ohm
R6/1	Setpoint potentiometer
S2/25/1	Switch, EHR lift
S20	Switch, EHR lift/pressure
S33	Switch, EHR stop
X1/10	Plug-in connection, flat, EHR lift/pressure
X1/11	Screw-on connector, central print 30
X2/5	Plug-in connection, EHR stop
X2/6	Plug-in connection, switch lighting
X3/24	Spare plug-in connection
X4/51	Plug-in connection, EHR box cable
X5/5	Plug-in connection, cable, chassis, right
X5/6	Plug-in connection, EHR setpoint
X9/17	Plug-in connection, cable, chassis, left
X9/31	Plug-in connection, EHR box cable
X12/8	Plug-in connection, EHR box cable
X55	Plug-in connection, EHR box cable

VERSIONS
to this Sheet
36
on Sheet/Sheets
35

Grounding points

22 'E' Box console

Designation of Sections

A	EHR transport signal
B#	EHR lift/control on rocker switch
C	EHR setpoint
D	EHR stop
E#	EHR switchover lift/pressure
#	several versions available

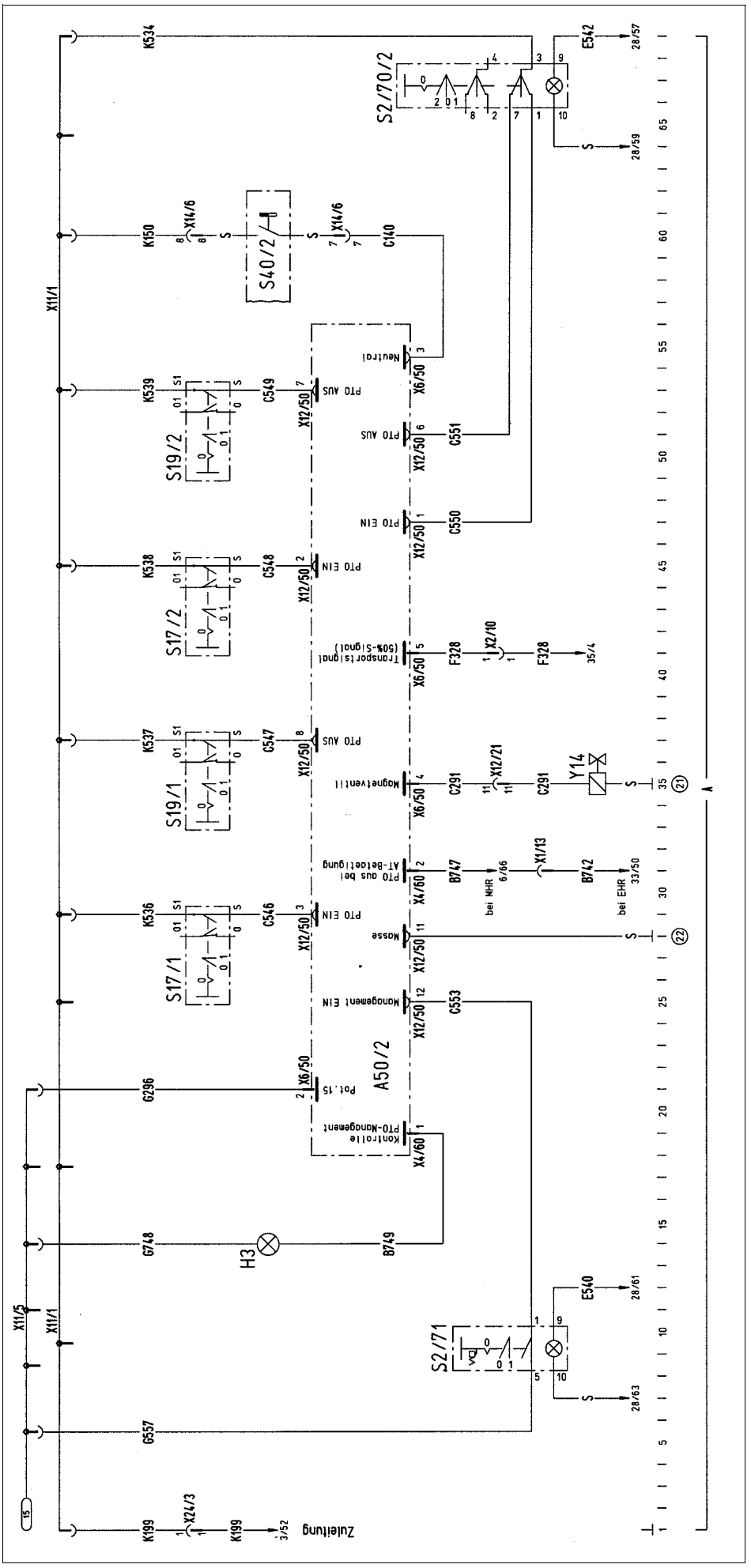
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 37



Electrical equipment

A50/2	E box, rear PTO shaft
H3	Indicator, PTO shaft management active
S2/70/2	Switch, rear PTO shaft
S2/71	Switch, PTO shaft management
S17/1	External pushbutton, rear PTO shaft, ON
S17/2	External pushbutton, rear PTO shaft, ON
S19/1	External pushbutton, rear PTO shaft, OFF
S19/2	External pushbutton, rear PTO shaft, OFF
S40/2	Switch, indicator, rear PTO shaft new
X1/30	Plug-in connection, flat, chassis cable, right
X2/10	Plug-on connection, chassis right – EHR box
X4/60	Plug-in connection, cable, chassis, right
X´6/50	Plug-in connection, cable, chassis, right
X11/5	Distributor console, potential 15
X11/5	Distributor console, potential 15
X12/21	Plug-in connection, chassis, right, transmission
X12/50	Plug-in connection, cable, electrical/ hydraulic PTO shaft
X14/6	Plug-in connection, chassis right – PTO shaft indicator
X24/3	Plug-in connection, chassis, right, instrument
Y14	Solenoid valve, rear PTO shaft

Grounding points

21	Console transmission plug
22	E box console

Designation of Sections

A	Rear PTO shaft

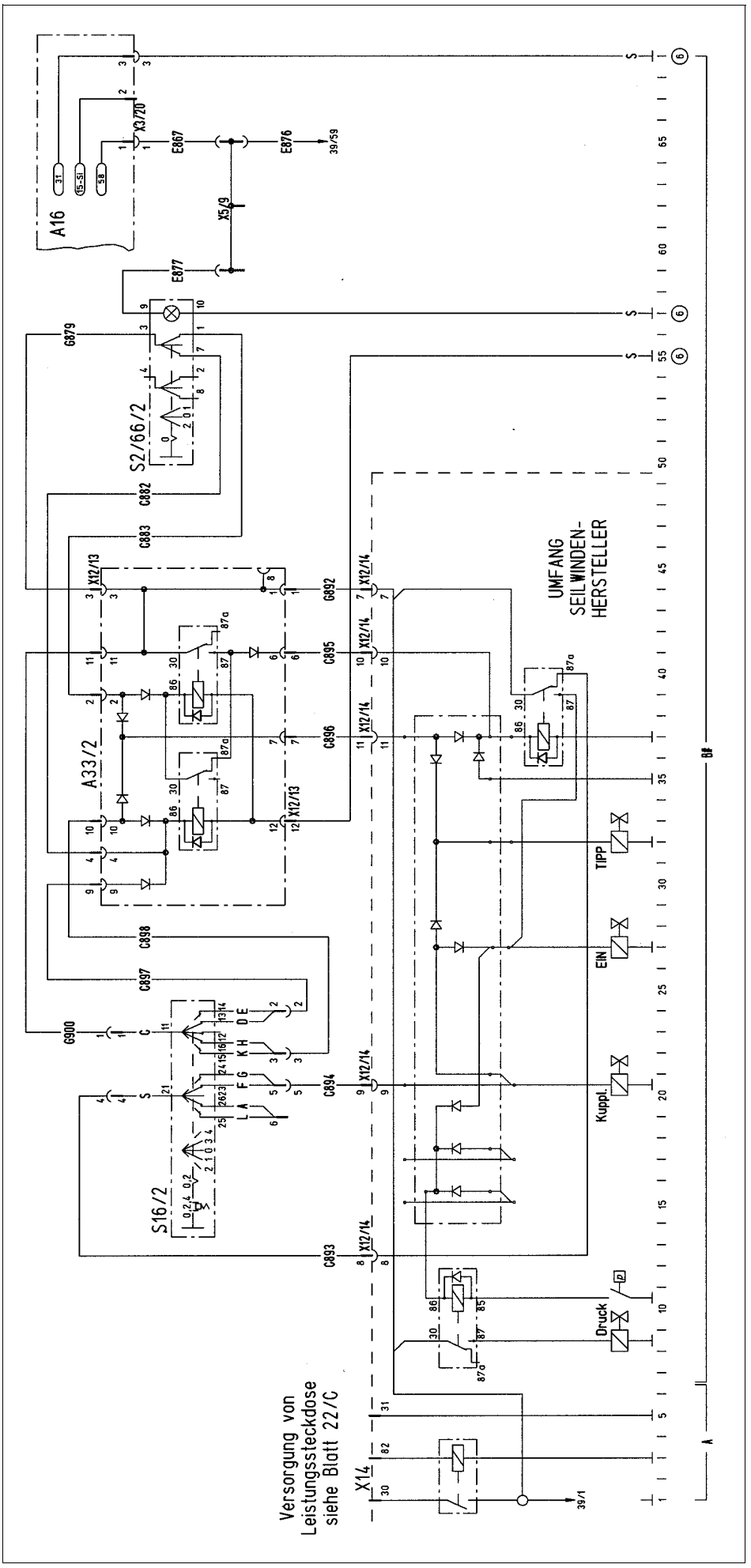
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 38



Electrical equipment

A16	Print, EHR operating console
A33/2	'E' Box, forestry
S2/66/2	Switch, winch, brake 2
S16/2	Switch, winch, clutch 2
X3/20	Plug-in connection, supply
X5/9	Distributor potential 58, winch
X12/13	Plug-in connection, double winch
X12/14	Plug-in connection, double winch
X14	Flat power socket

VERSIONS
to this Sheet
38
on Sheet/Sheets
39, 40

Grounding points

6	Distributor, for the winch

Designation of Sections

A	Supply, winch
B#	Double winch
#	several versions available

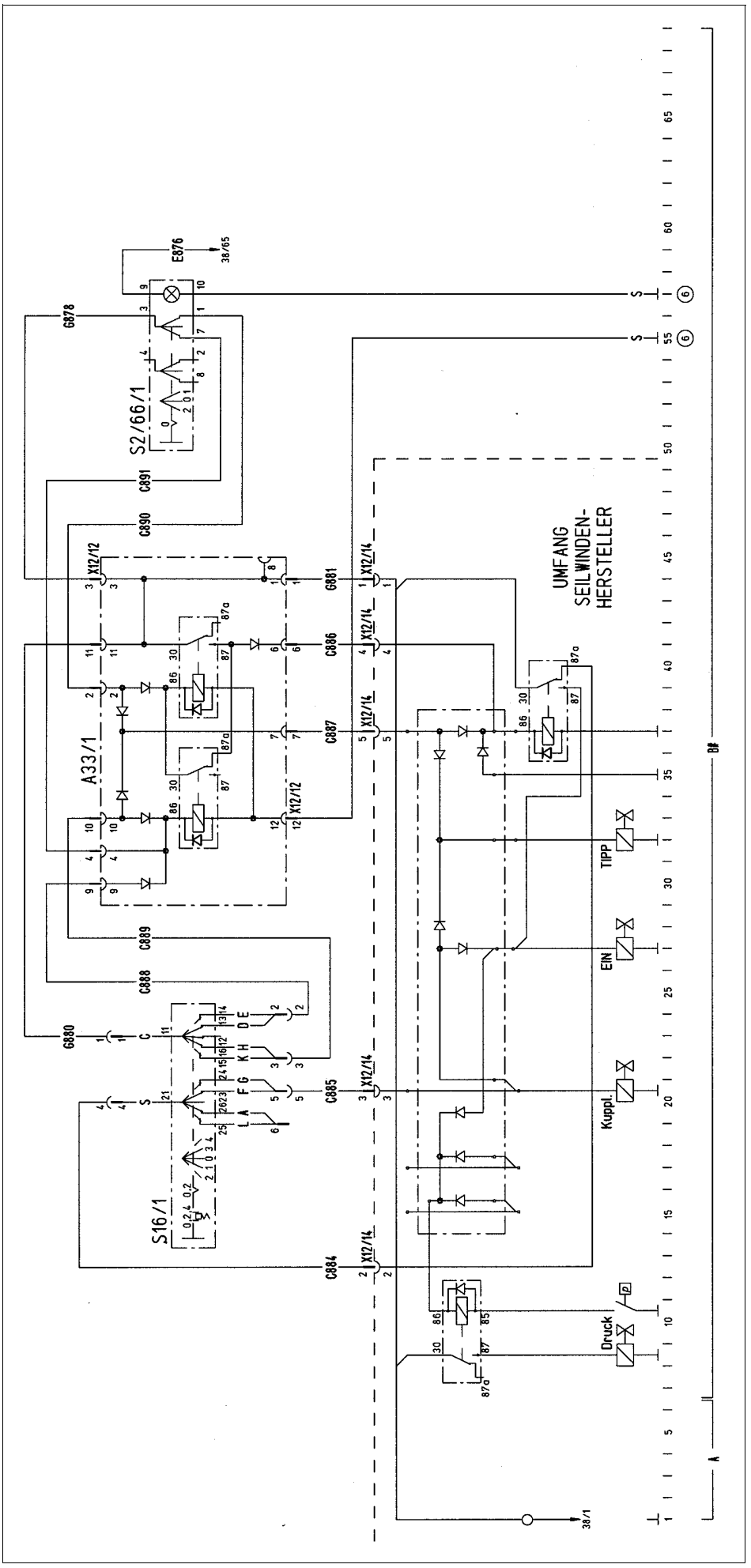
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
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C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 39



Electrical equipment

A33/1	'E' Box, forestry
S2/66/1	Switch, winch, brake 1
S16/2	Switch, winch, clutch 1
X12/12	Plug-in connection, double winch
X12/14	Plug-in connection, double winch

Grounding points

6	Distributor, for the winch

Designation of Sections

A	Supply, winch
B#	Double winch
#	several versions available

Cable colour or coding in accordance with standard 05449

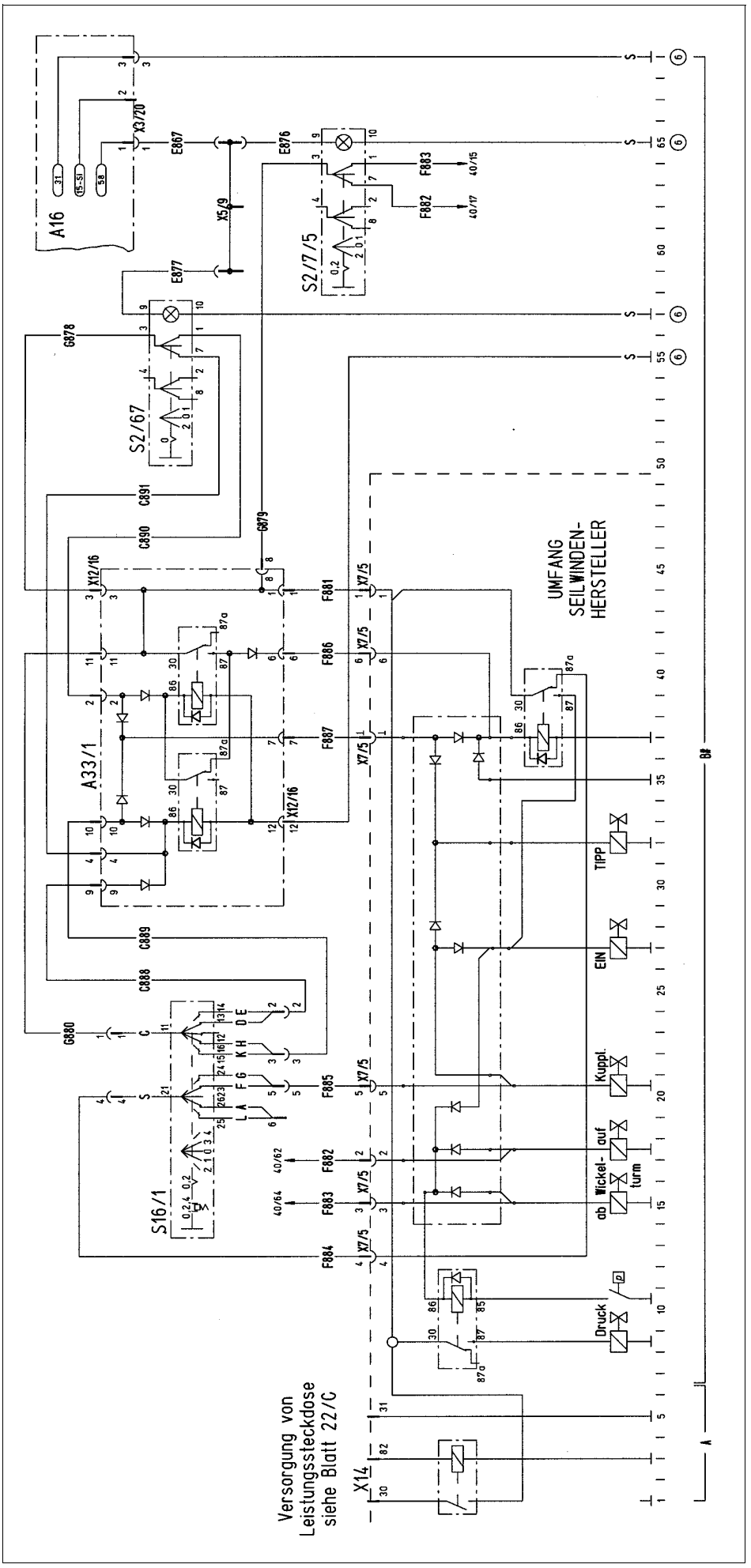
Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

VERSIONS
to this Sheet
39
on Sheet/Sheets
38, 40

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Sheet 40



Electrical equipment

A16	Print, EHR operating console
A33/1	'E' Box, forestry
S2/7/5	Switch, winch capstan
S2/67	Switch, winch brake
S16/2	Switch, winch, clutch 1
X3/20	Plug-in connection, supply
X5/9	Distributor potential 58, winch
X7/5	Plug-in connection, single winch
X12/16	Plug-in connection, single winch
X14	Flat power socket

VERSIONS
to this Sheet
40
on Sheet/Sheets
38, 39

Grounding points

6	Distributor, for the winch

Designation of Sections

A	Supply, winch
B#	Single winch
#	several versions available

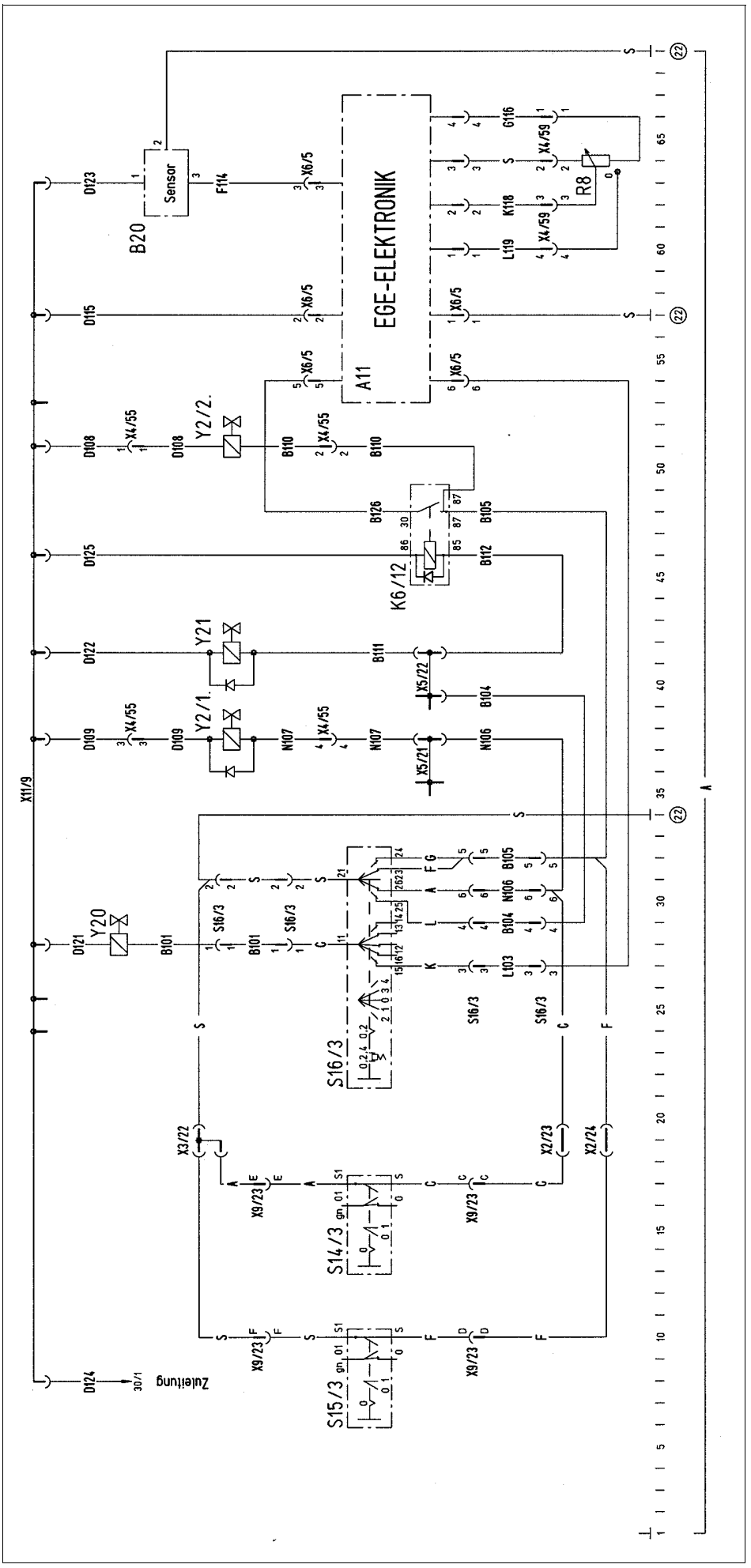
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Sheet 41



Electrical equipment

A11	EGE control unit
B20	EGE pressure sensor
K6/12	Relay, electronic implement load relief
R8	Electronic implement load relief potentiometer
S14/3	Front lifting gear external pushbutton, lower
S15/3	Front lifting gear external pushbutton, raise
S16/3	Lever switch, electronic implement load relief
X2/23	Plug-in connection, flat, electronic implement load relief, parallel ext. pushbutton
X2/24	Plug-in connection, flat, electronic implement load relief, parallel ext. pushbutton
X3/22	Plug-in connection, flat, electronic implement load relief, parallel ext. pushbutton
X4/55	Plug-in connection, EGE Solenoid valve
X4/59	Plug-in connection, EGE potentiometer
X5/21	Distributor, EGE console
X5/22	Distributor, EGE console
X6/5	Plug-in connection, electronic front implement load relief
X9/23	Plug-in connection, external pushbutton, front-end lifting gear
X11/9	Distributor, EGE console, potential 15 Safety
Y2/1	Solenoid valve control unit XXX
Y2/1	Solenoid valve control unit XXX
Y20	Solenoid valve, EGE lower
Y21	Solenoid valve, EGE pressure reservoir

Grounding points

22 'E' Box console

Designation of Sections

A Electronic front implement load relief

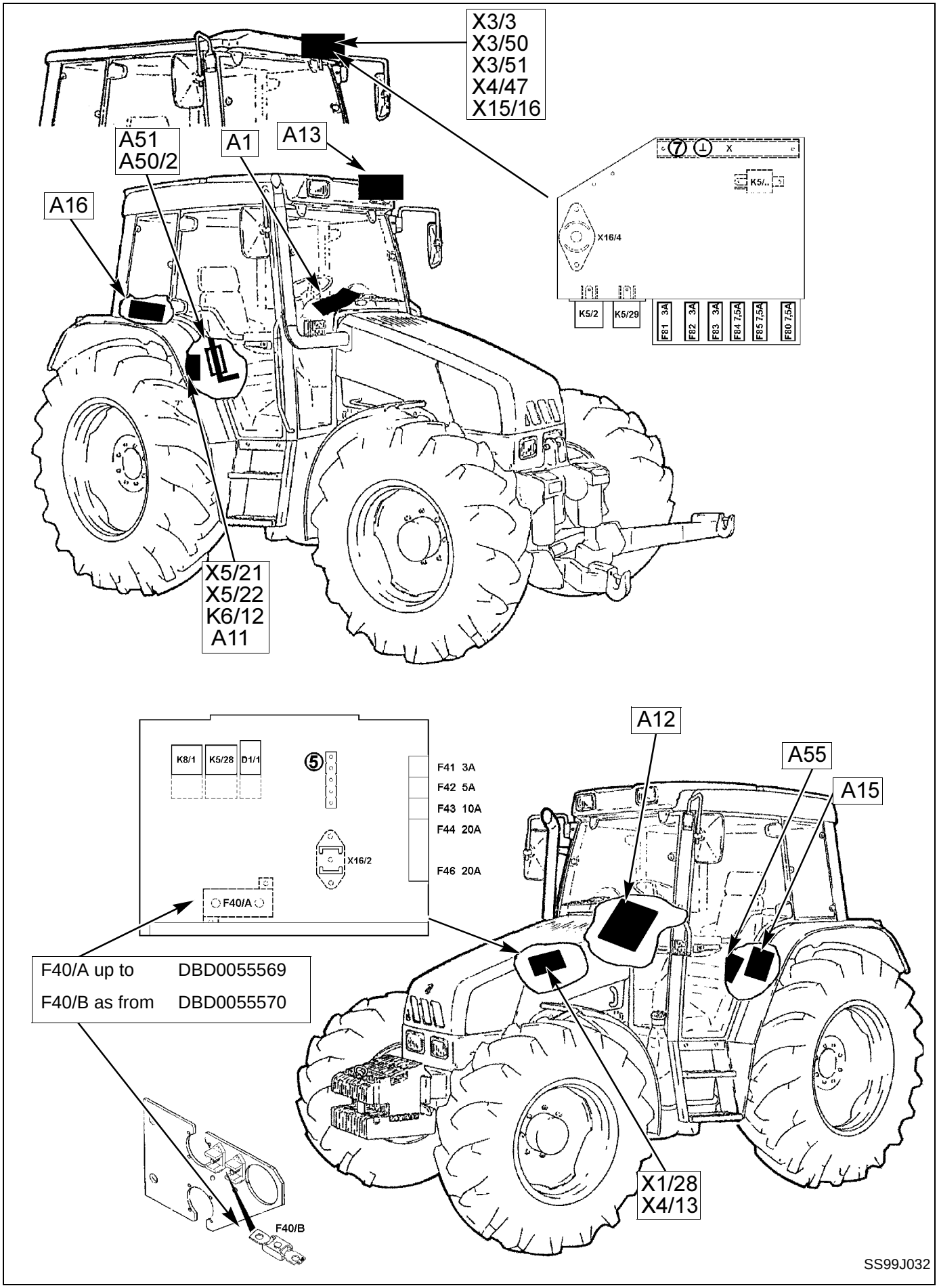
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+ 30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) switched current after the pre-glow switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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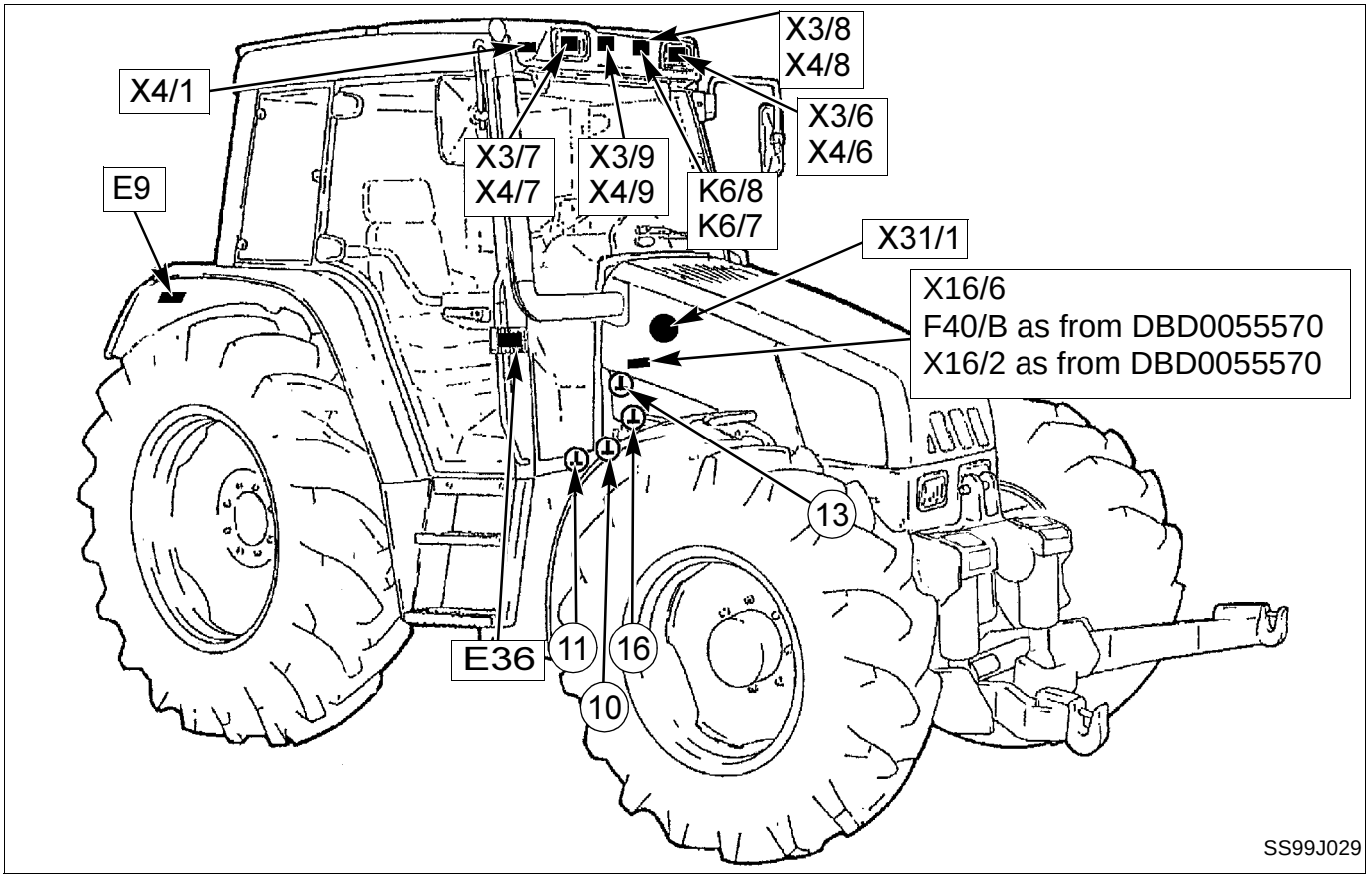
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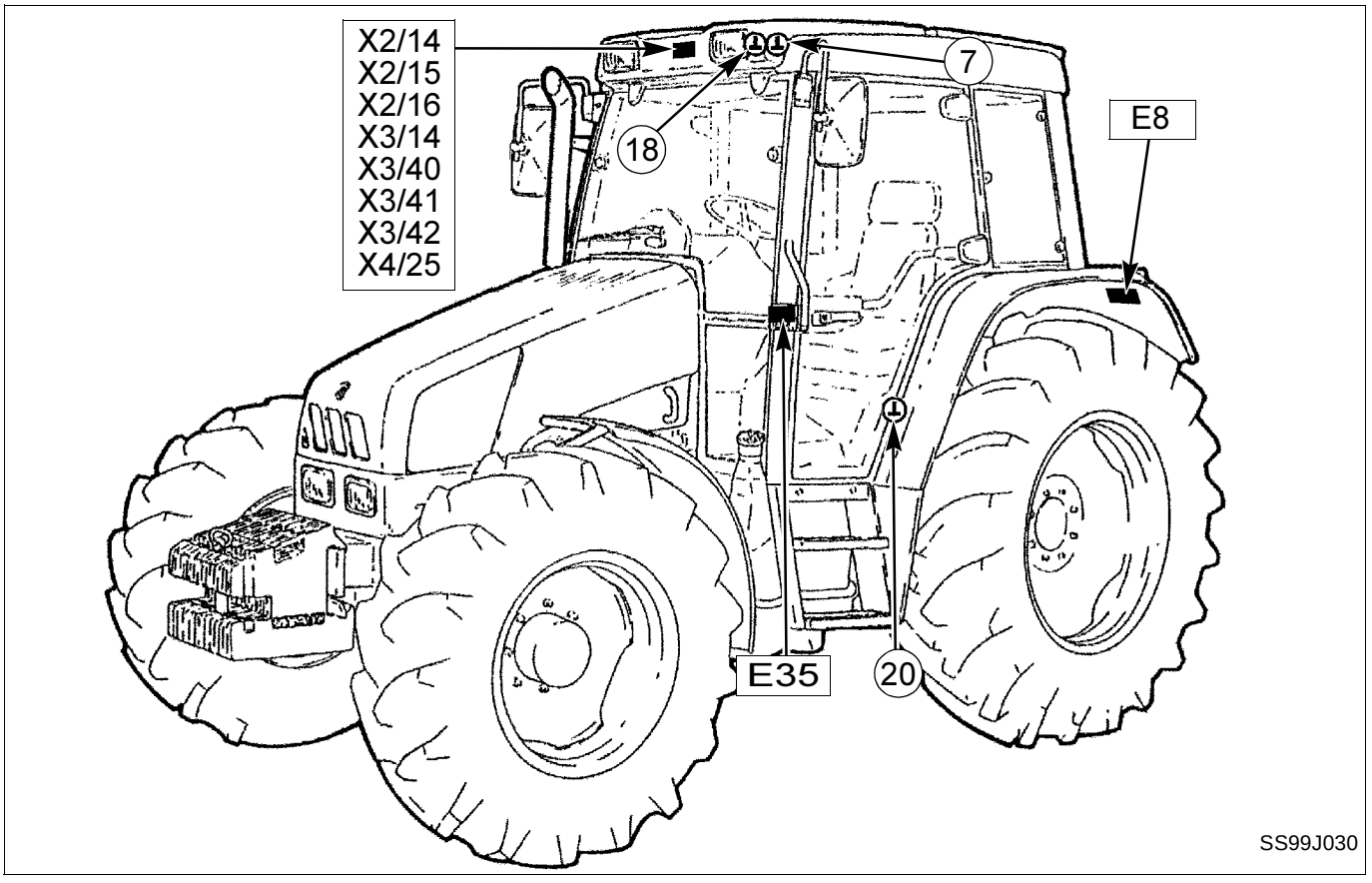
List of Plugs



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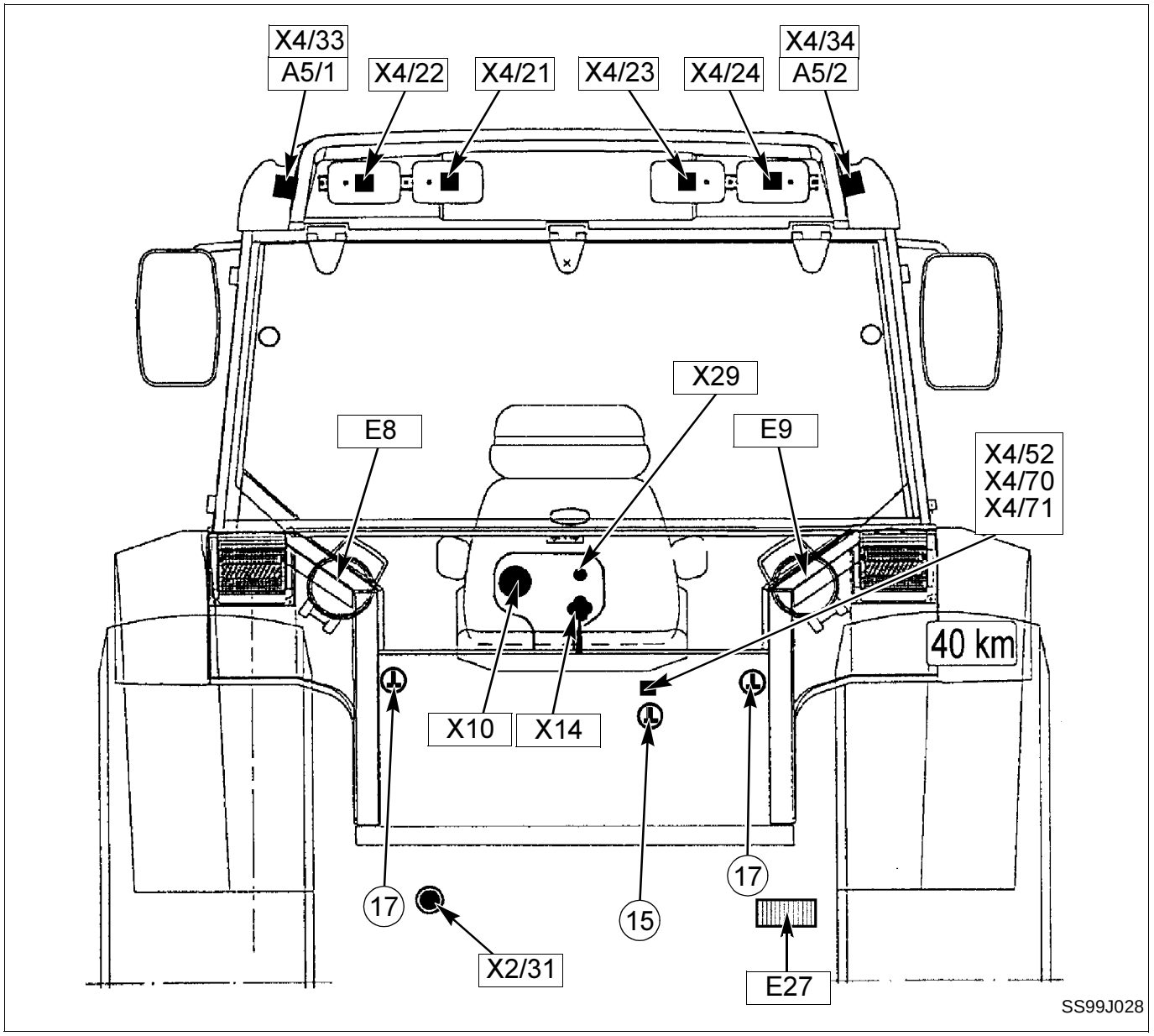
List of Plugs





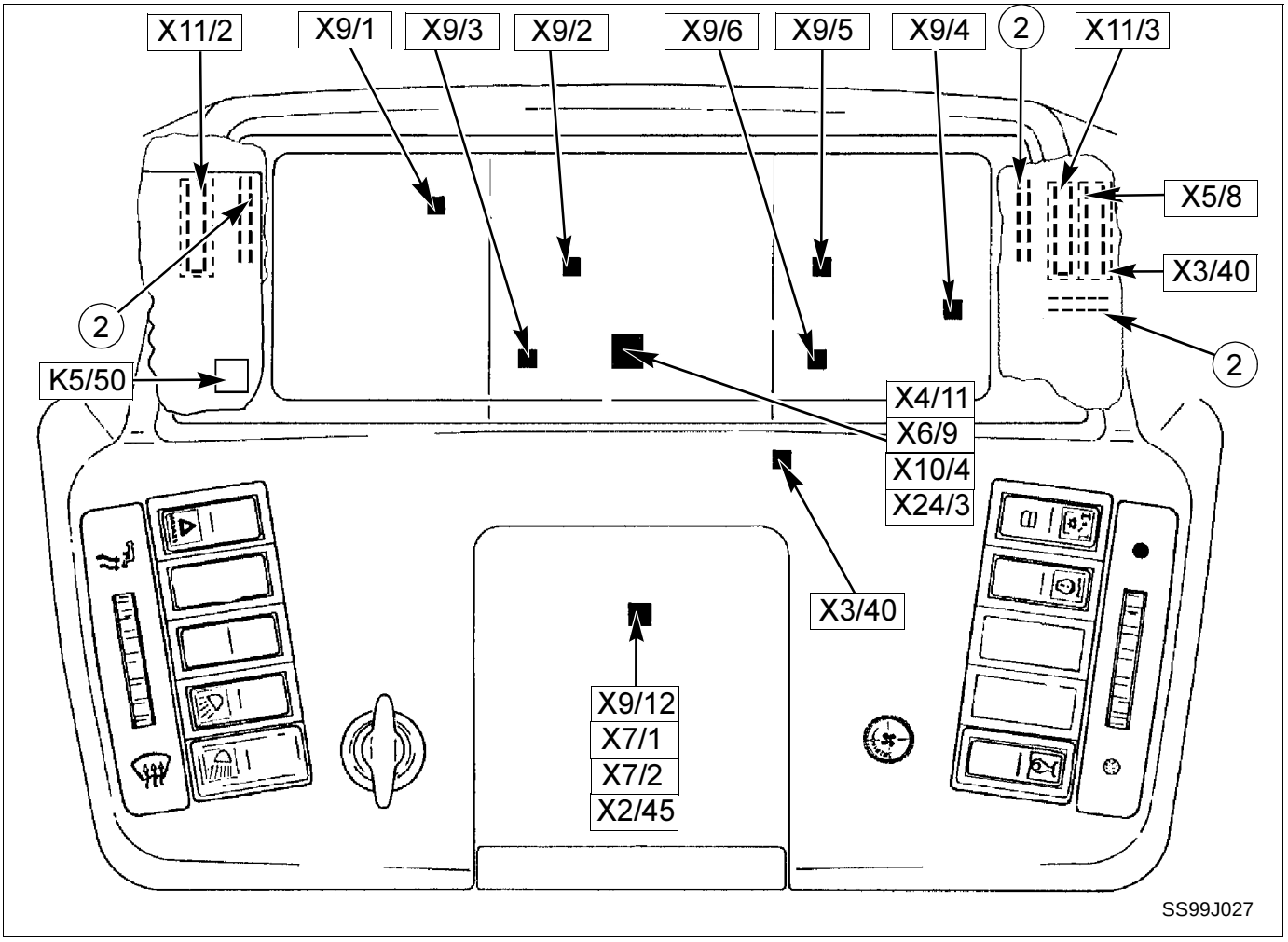
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List of Plugs (at rear)



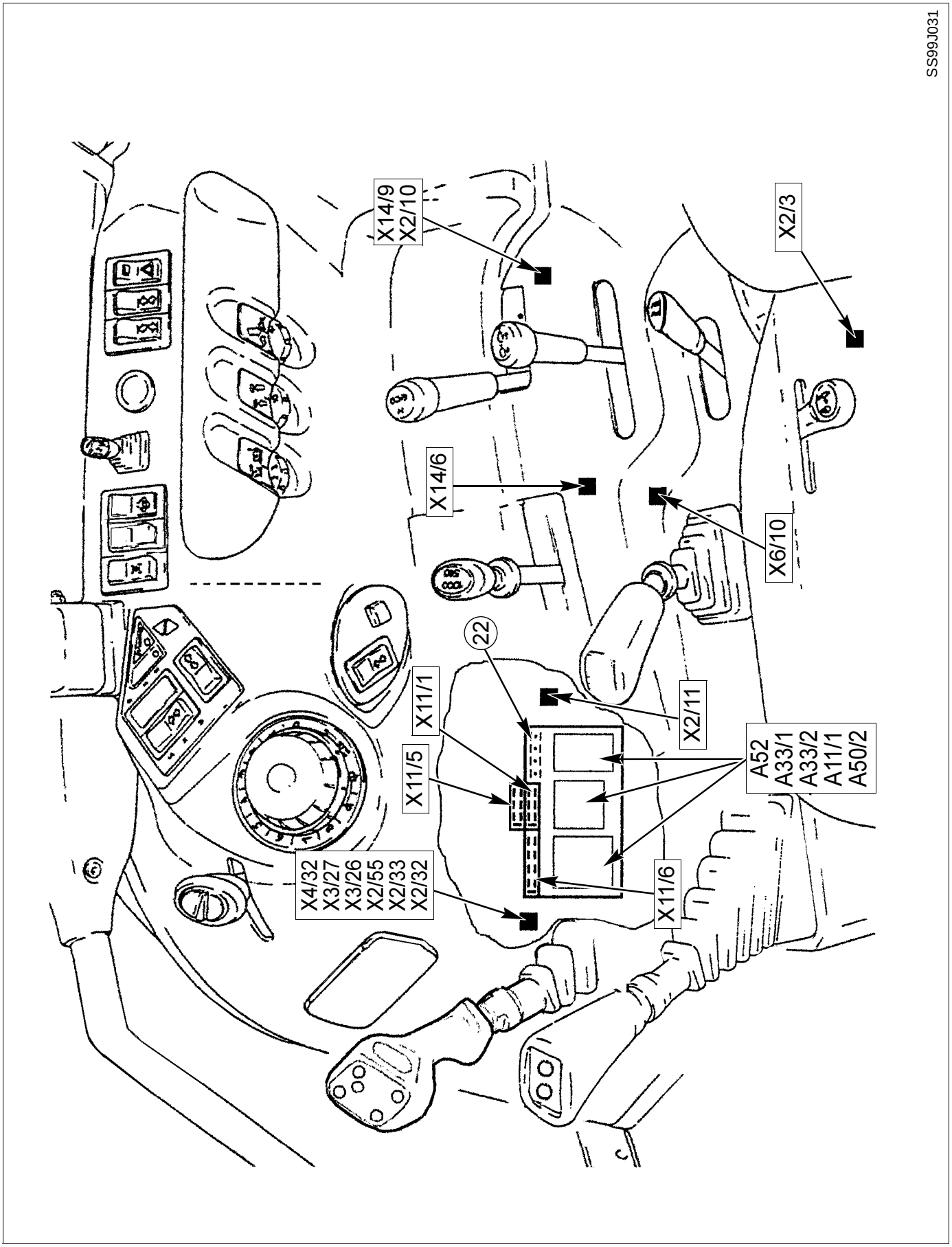
https://truckmanualshub.com/

List of Plugs – Instrument Panel



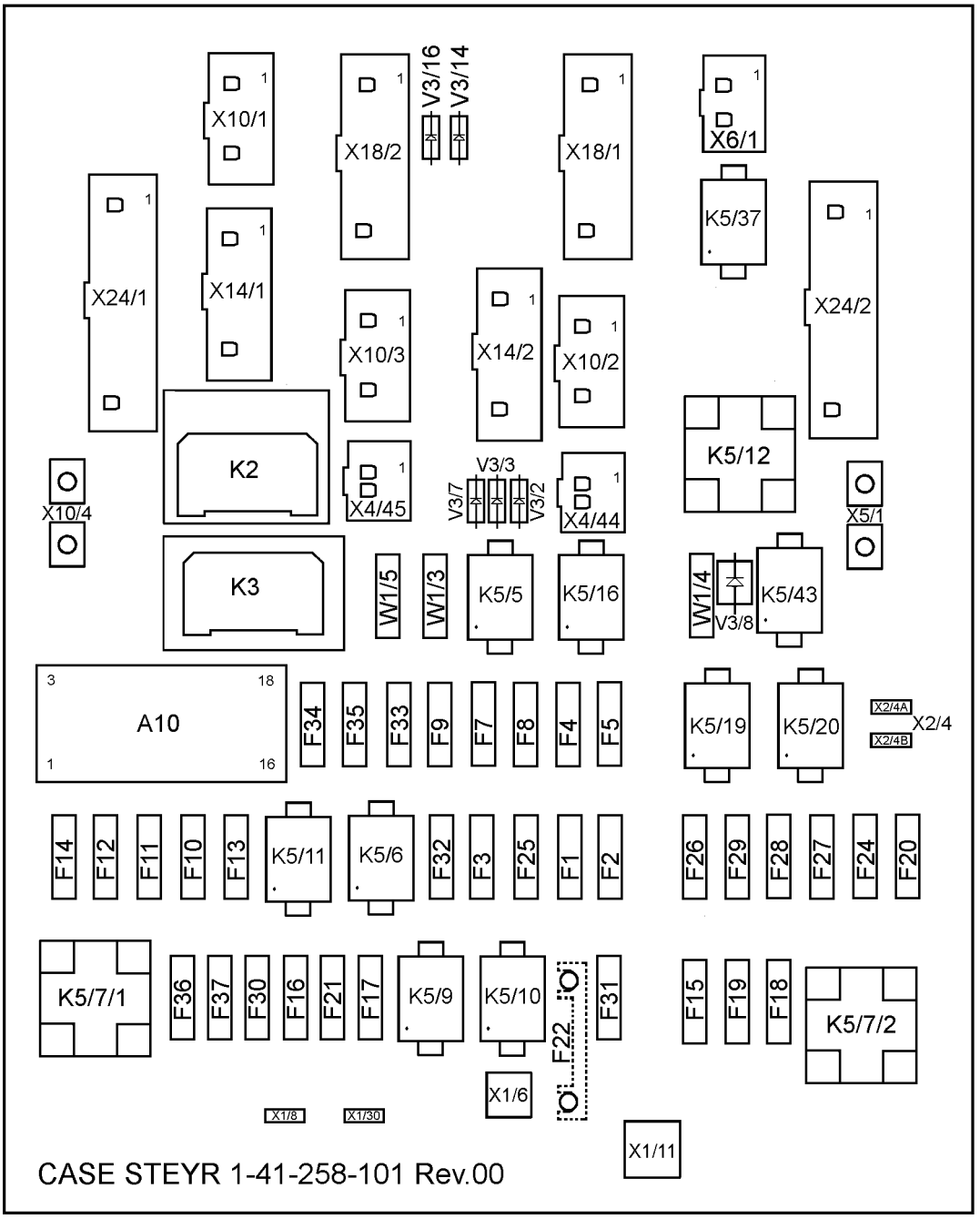
https://truckmanualshub.com/

List of Plugs – Right-hand Side Panel



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Central Electrics Print A12



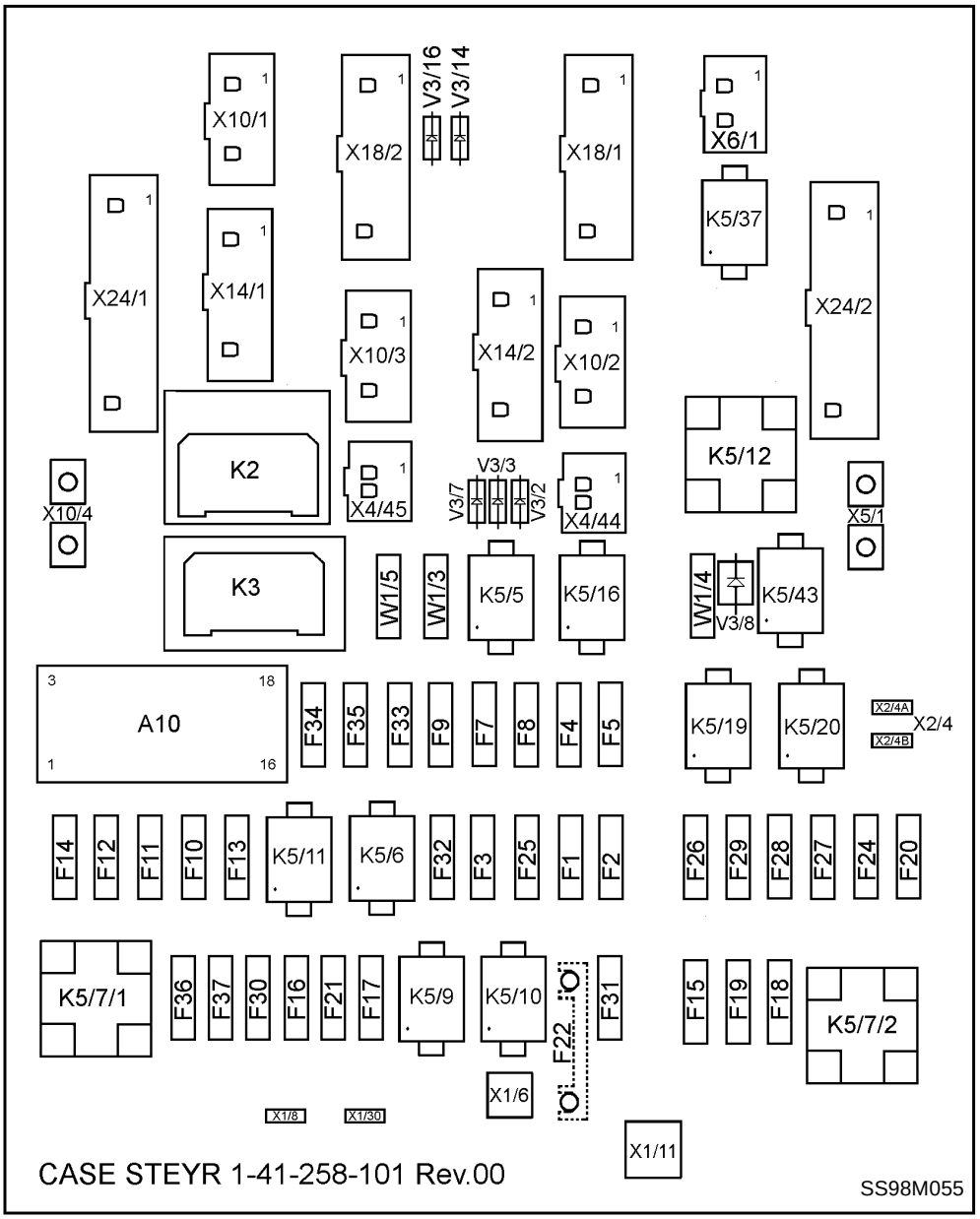
SS98M055

Relays – Central Electrics

A10	4-wheel drive/Differential Management
K2	Flasher unit
K3	Wiper/Washer (Interval)
K5/5	Switchover relay for high beam
K5/6	Switchover relay for dipped beam
K5/7/1	Potential 15/1
K5/7/2	Potential 15/2
K5/9	Searchlight mudguard
K5/10	Light (Potential 58)
K5/11	D+ supply
K5/12	Brake light/Optistop
K5/16	Stationary stop
K5/19	Stationary operation stop
K5/20	Stationary operation stop
K5/37	Reserve
K5/43	D+ switch OFF

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Central Electrics Print A12

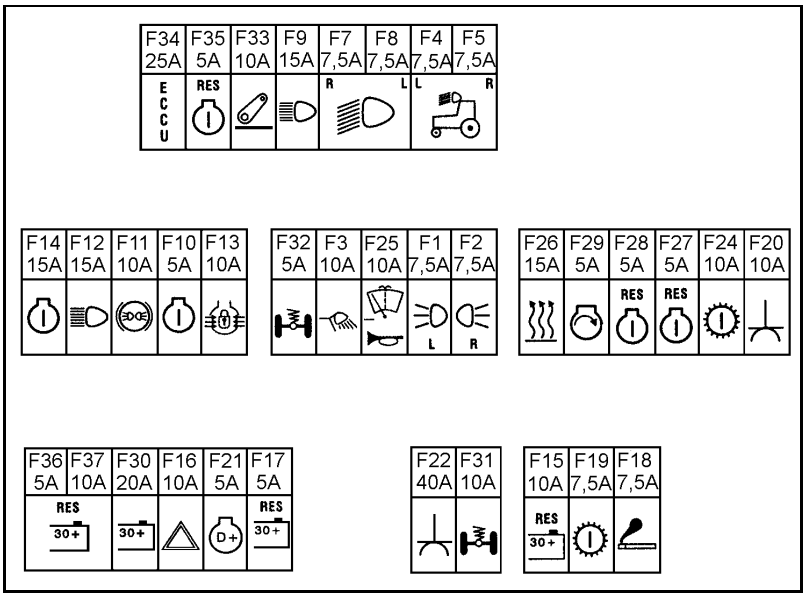


List of Plugs – Central Electrics

V3/2	Diode 0.3A interlock
V3/3	Diode 0.3A interlock
V3/7	Diode 0.3A interlock
V3/8	Diode 2A interlock
V3/14	Diode 0.1A interlock
V3/16	Diode 0.1A interlock
W1/3	Contact bridge, Optistop
W1/4	Contact bridge, spark start
W1/5	Contact bridge, low signal
X1/6	Plug-in connection, flat, instrument cable
X1/8	Screw-on connector, instrument-engine
X1/11	Screw-on connector, central print 30
X1/30	Plug-in connection, potential 30, central print
X2/4	Plug-in connection, potential 15 socket
X4/44	Plug-in connection, spark start
X4/45	Plug-in connection, sprung front axle
X5/1	Ground distributor, central print
X6/1	Plug-in connection, spare
X10/1	Plug-in connection, instrument cable
X10/2	Plug-in connection, cable, chassis, right
X10/3	Plug-in connection, on-board computer provision
X10/4	Plug-in connection, chassis right, instrument
X14/1	Plug-in connection, cable chassis, left
X14/2	Plug-in connection, instrument cable
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply cable
X24/1	Plug-in connection, instrument cable
X24/2	Plug-in connection, cable, chassis, right

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Fuses – Central electrics print

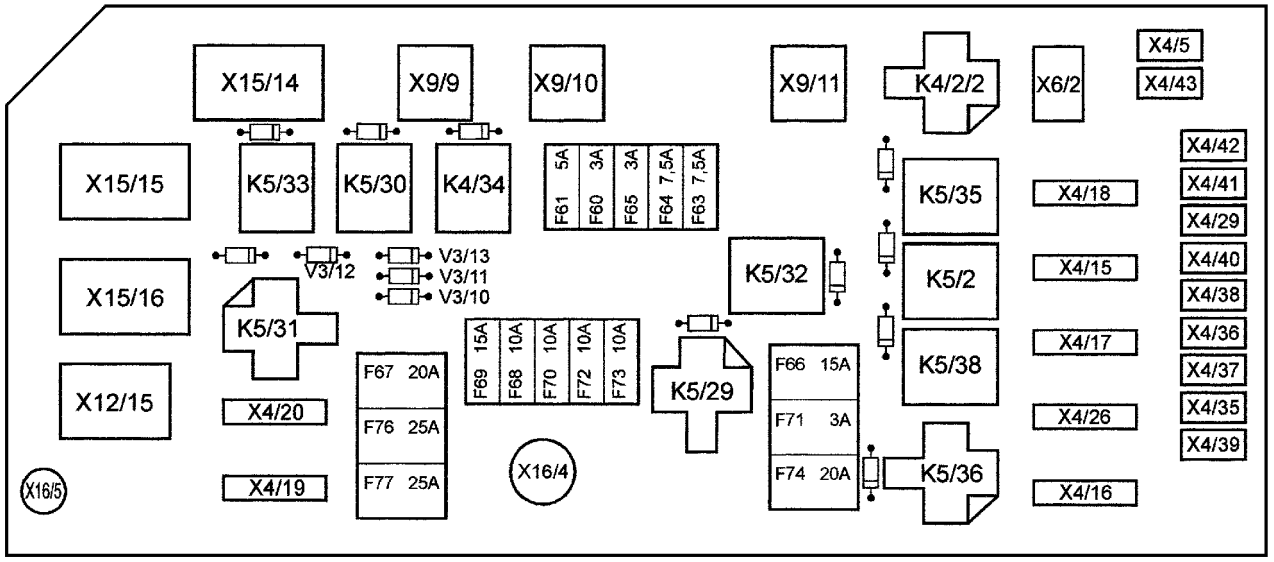


SS99K028

F1	58 L Parking lamp, left	7.5 Amps
F2	58 R Parking lamp, right	7.5 Amps
F3	Searchlight mudguard	10 Amps
F4	Dipped beam left roof spare head lamp	7.5 Amps
F5	Dipped beam right roof spare head lamp	7.5 Amps
F7	Dipped beam right head lamp	7.5 Amps
F8	Dipped beam left head lamp	7.5 Amps
F9	Main beam	15 Amps
F10	Roof potential 15, Front loader	5 Amps
F11	Brake light	10 Amps
F12	Head lamp flasher	15 Amps
F13	Differential front and rear	10 Amps
F14	Flasher, E-control unit, Pneumatic seat suspension	15 Amps
F15	Front loader	10 Amps
F16	Hazard warning flasher	10 Amps
F17	Reserve potential 30	5 Amps
F18	Cigarette lighter	7.5 Amps
F19	Searchlight, rear axle	7.5 Amps
F20	Potential 30, socket	10 Amps
F21	D+, Fuel pump	5 Amps
F22	Power outlet socket	40 Amps
F24	Searchlight/reversing light	10 Amps
F25	Screen wipers, Horn	10 Amps
F26	Heating	15 Amps
F27	Reserve potential 15	5 Amps
F28	Reserve potential 15	5 Amps
F29	Engine stop	5 Amps
F30	Ignition switch supply	20 Amps
F31	Reserve potential 30, searchlight/reversing light	10 Amps
F32	Reserve potential 15, searchlight/reversing light	5 Amps
F33	Potential 15, EHR	10 Amps
F34	Reserve potential 15	25 Amps
F35	Reserve potential 15	5 Amps
F36	Reserve potential 30	5 Amps
F37	Reserve potential 30	10 Amps

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Print – Roof electrics A13



SS99G154

Relays – Roof electrics

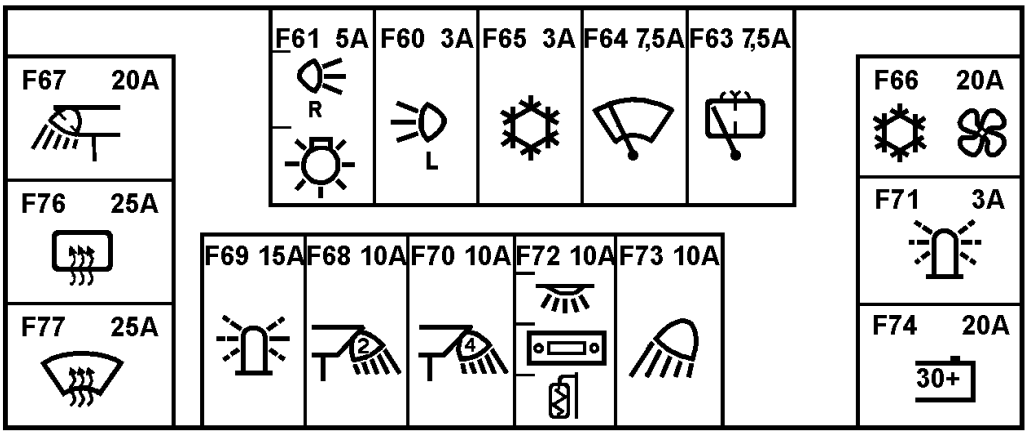
K4/2/2	Time relay 40 sec, Interior lamp – delay
K5/2	Front screen wiper (only on hinged windscreen)
K5/29	Terminal 15
K5/30	Searchlight, rear roof, 2 off
K5/31	Searchlight front roof TWIN POWER
K5/32	Blower motor – Air conditioning
K5/33	Rotating beacon
K5/34	4 Searchlight rear roof, Number plate lighting
K5/35	Heated mirror
K5/36	Air-conditioning blower
K5/38	Reserve, searchlight

List of Plugs – Roof electrics

V3/10	Diode 3A interlock
V3/11	Diode 3A interlock
V3/12	Diode 3A interlock
V3/13	Diode 3A interlock
X4/5	Plug-in connection, chassis, left
X4/15	Plug-in connection, mirror heating
X4/16	Plug-in connection, reserve
X4/17	Plug-in connection, roof frame
X4/18	Plug-in connection, roof frame
X4/19	Plug-in connection, heated windscreen, front
X4/20	Plug-in connection, heated screen, rear
X4/26	Plug-in connection, roof frame
X4/29	Plug-in connection, roof switch
X4/35	Plug-in connection, rotating beacon switch
X4/36	Plug-in connection, roof switch
X4/37	Plug-in connection, roof switch
X4/38	Plug-in connection, roof switch
X4/39	Plug-in connection, roof switch
X4/40	Plug-in connection, roof switch
X4/41	Plug-in connection, roof switch
X4/42	Plug-in connection, roof switch
X4/43	Plug-in connection, number plate lighting
X6/2	Plug-in connection, roof frame
X9/9	Plug-in connection, roof canopy cable
X9/10	Plug-in connection, rear wiper
X9/11	Plug-in connection, roof air cond.
X12/15	Plug-in connection, roof canopy cable
X15/14	Plug-in connection, roof frame
X15/15	Plug-in connection, roof canopy cable
X15/16	Plug-in connection, roof supply cable
X16/4	Distributor, central print 30

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Fuses – Roof electrics

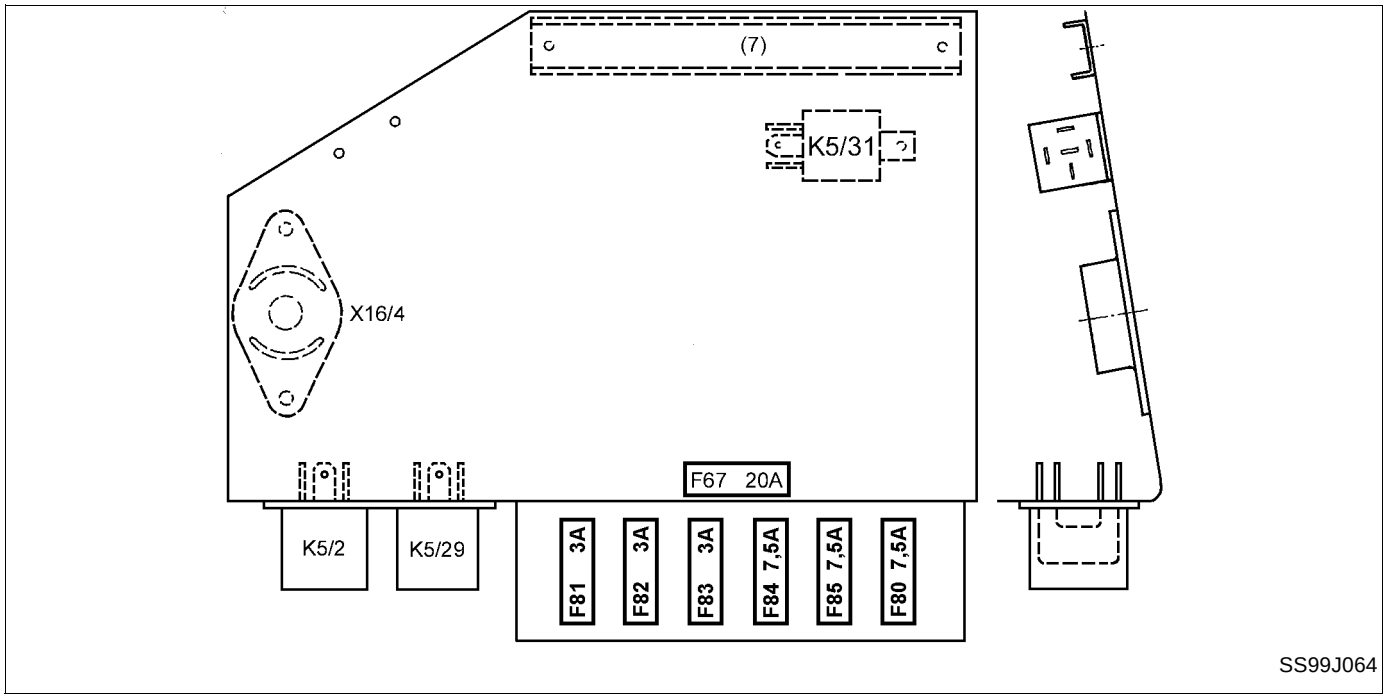


SS98C146

F60	Parking lamp, front left	3 Amps
F61	Parking lamp, front right	5 Amps
F63	Rear wiper	7.5 Amps
F64	Wiper front on hinged windscreen	7.5 Amps
F65	Air conditioning	5 Amps
F66	Blower motor/ Air conditioning	20 Amps
F67	Searchlights, TWIN POWER	20 Amps
F68	Searchlight rear 2	10 Amps
F69	Rotating warning lamp	15 Amps
F70	4 Searchlights, rear, number-plate lighting	10 Amps
F71	Rotating warning lamp	3 Amps
F72	Spot, radio, interior lighting, heated mirror	10 Amps
F73	Searchlight	10 Amps
F74	Reserve potential 30	20 Amps
F76	Heated rear screen	25 Amps
F77	Heated front windscreen	25 Amps

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Component carrier – Low-Top



List of Relays and Plugs – Component carrier – Low-Top

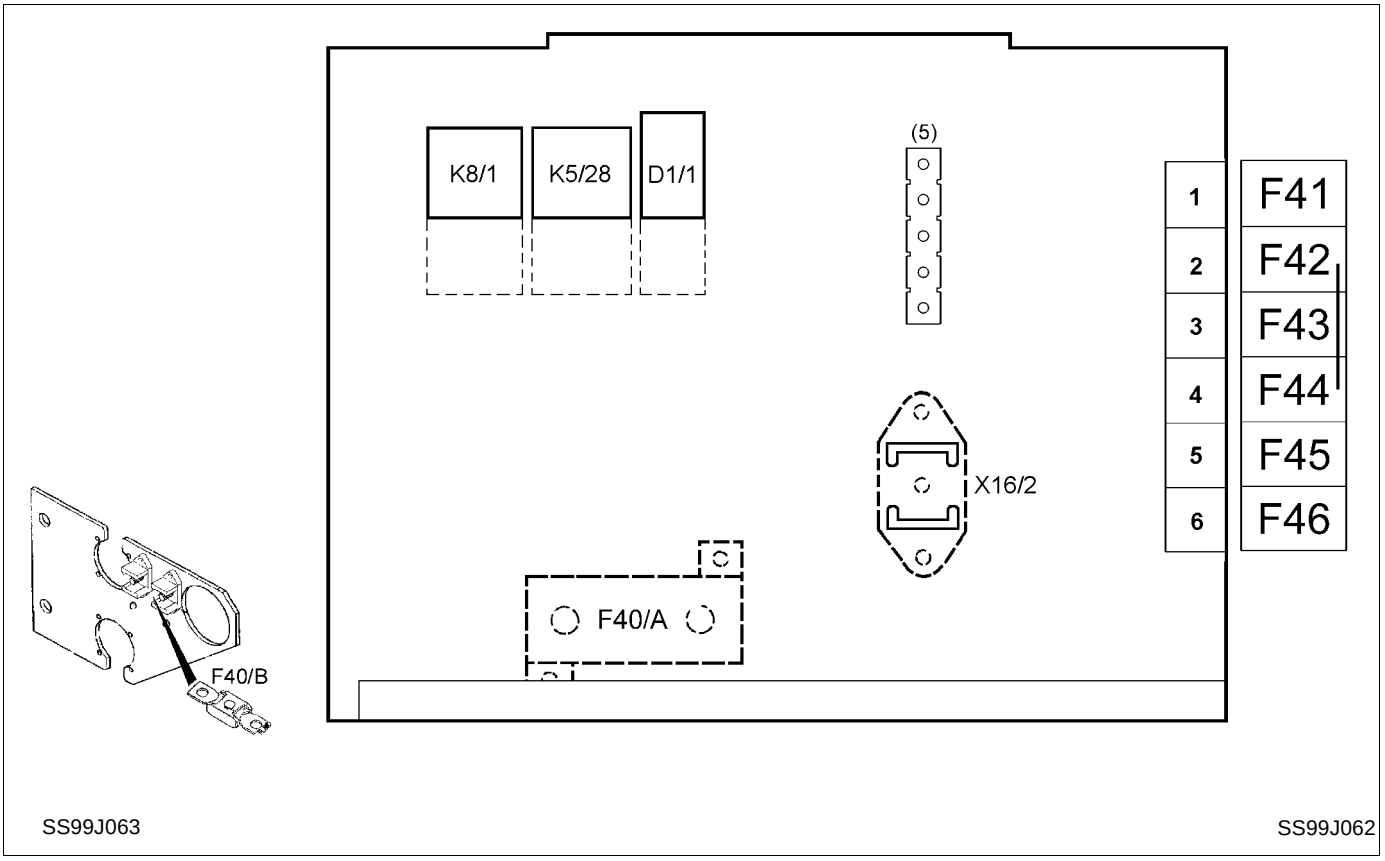
K5/2	Roof-mounted wiper, front
K5/29	Roof print, potential 15
K5/31	Searchlight front roof TWIN POWER
X16/4	Distributor, central print 30
(7)	Ground rail

Fuses – Component carrier – Low-Top

F67	Searchlight TWIN POWER	20 Amps
F80	Interior light, rotating beacon	7.5 Amps
F81	Switch, lighting, rear washer/wiper	3 Amps
F82	Parking lamp, front	3 Amps
F83	Parking lamp, potential 58	3 Amps
F84	reserve headlight and front wiper	7.5 Amps
F85	Rear wiper	7.5 Amps

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Component Carrier – Engine Electrics



List of Relays and Plugs – Component carrier – Engine Electrics

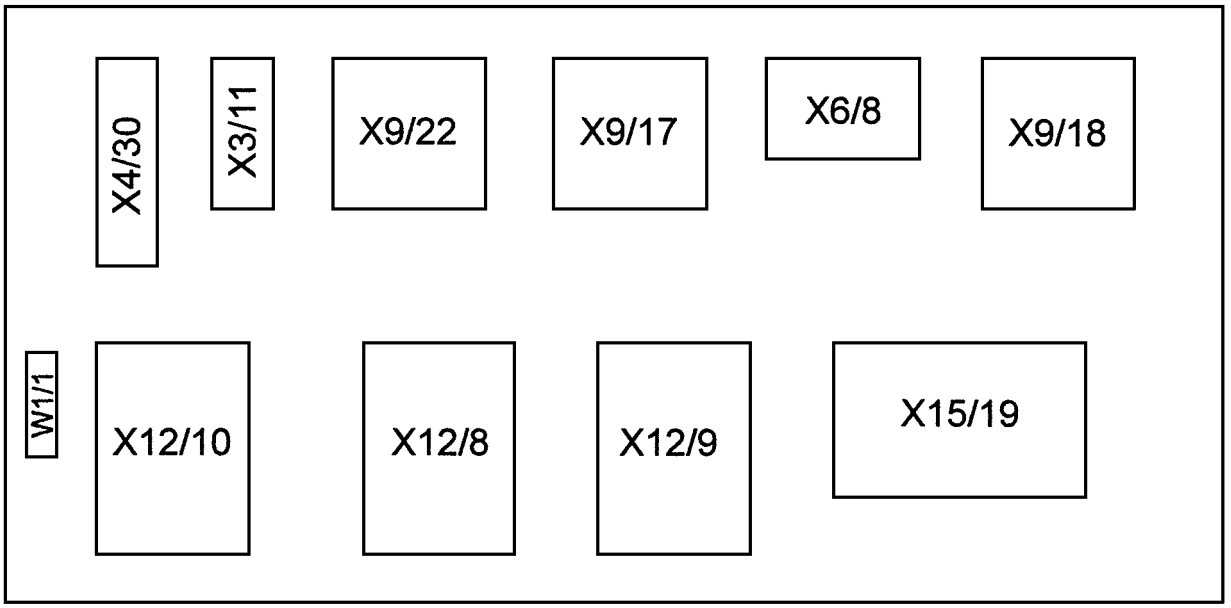
D1/1	Diode group, fuel filter heating
K8/1	Starter motor
K5/28	Fuel filter heating
X16/2	Screw-on connector, engine 30, fused (up to DBD0055569)
(5)	Ground rail

Fuses – Engine Electrics Component Carrier

F40/A	Main fuse (up to DBD0055569)	100 Amps
F40/B	Main fuse (as from DBD0055569)	100 Amps
F41	Clock	3 Amps
F42	EHR	5 Amps
F43	Potential 58, air-cond.	10 Amps
F44	Filter heating	20 Amps
F45	Reserve potential 15	
F46	Pre-glowing	10 Amps

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EHR D Print, left, A15



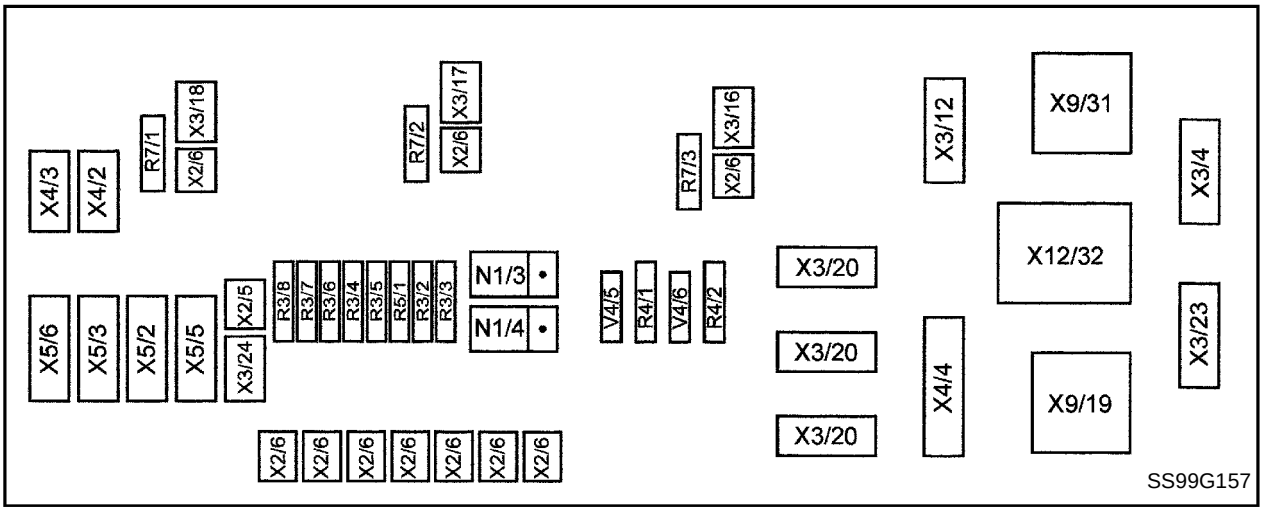
SS99G156

List of Plugs – EHR-D Print (left)

W1/1	Contact bridge
X3/11	Plug-in connection, external sensor
X4/30	Spare plug-in connection
X6/8	Plug-in connection, signal socket
X9/17	Plug-in connection, cable, chassis, left
X9/18	Plug-in connection, cable, chassis, left
X9/22	Plug-in connection, EHR lifting gear/pressure
X12/8	Plug-in connection, EHR box cable
X12/9	Plug-in connection, EHR box cable
X12/10	Plug-in connection, EHR box cable
X15/19	Plug-in connection, EHR box cable

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EHR-D Print, operating console, A16

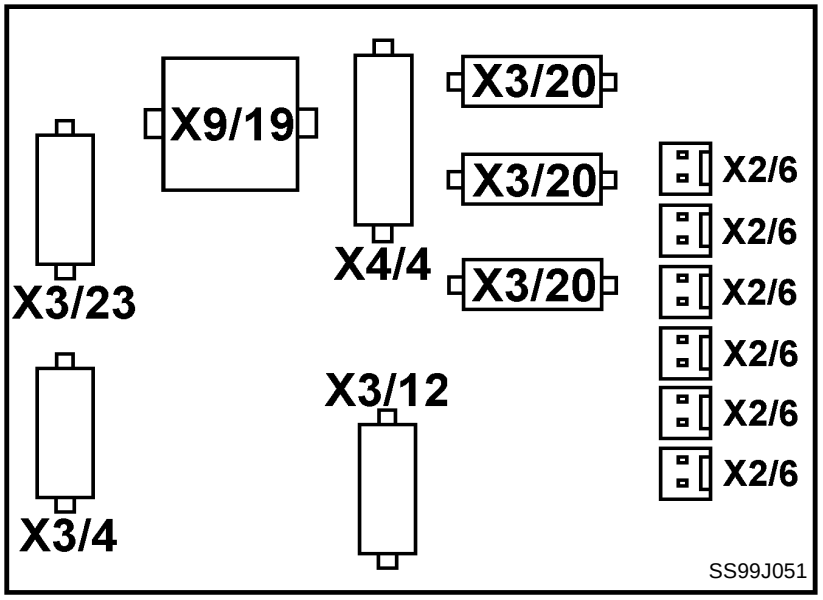


List of Plugs – EHR-D Print (operating console)

N1/3	Diagnosis lamp
N1/4	Diagnosis lamp
R3/2	Resistance 560 Ohm
R3/3	Resistance 560 Ohm
R3/4	Resistance 560 Ohm
R3/5	Resistance 560 Ohm
R3/6	Resistance 560 Ohm
R3/7	Resistance 560 Ohm
R3/8	Resistance 560 Ohm
R4/1	Resistance 10 kOhm
R4/2	Resistance 10 kOhm
R5/1	Resistance 261 Ohm
R7/1	Resistance 20 Ohm
R7/2	Resistance 20 Ohm
R7/3	Resistance 20 Ohm
V4/5	EHR blocking diode
V4/5	EHR blocking diode
X2/5	Plug-in connection, EHR stop
X2/6	Plug-in connection, switch lighting
X3/4	Distributor, neutral, front PTO shaft
X3/12	Plug-in connection, cigarette lighter
X3/16	Plug-in connection, lowering speed potentiometer
X3/17	Plug-in connection, end position potentiometer
X3/18	Plug-in connection, mixing potentiometer
X3/20	Plug-in conection, supply
X3/23	Plug-in connection, air-sprung seat
X3/24	Spare plug-in connection
X4/2	Plug-in connection, diagnosis/slip
X4/3	Plug-in connection RAISE/LOWER
X4/4	Plug-in connection, number plate lighting
X5/2	Plug-in connection, aux. circuit
X5/3	Plug-in connection, ATC switch
X5/5	Plug-in connection, cable, chassis, right
X5/6	Plug-in connection, EHR setpoint
X9/19	Plug-in connection, cable, chassis, right
X9/31	Plug-in connection, EHR box cable
X12/32	Plug-in connection, EHR box cable

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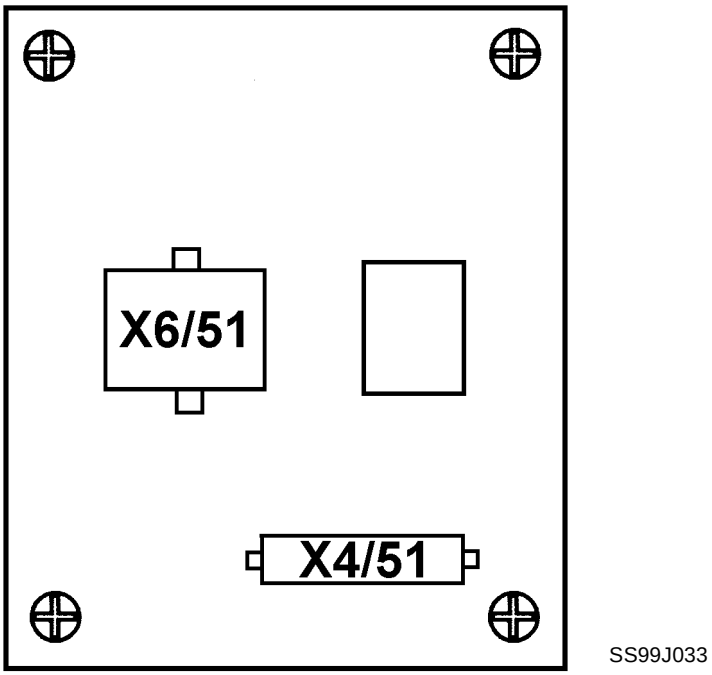
MHR – Operating Console A16



List of Plugs – MHR Operating Console

X2/6	Plug-in connection, switch lighting	X3/23	Plug-in connection, air-sprung seat
X3/4	Distributor, neutral, front PTO shaft	X4/4	Plug-in connection, spark start
X3/12	Plug-in connection, cigarette lighter	X9/19	Plug-in connection, cable, chassis, right
X3/20	Plug-in conection, supply		

EHR 'E' box – Operating A51

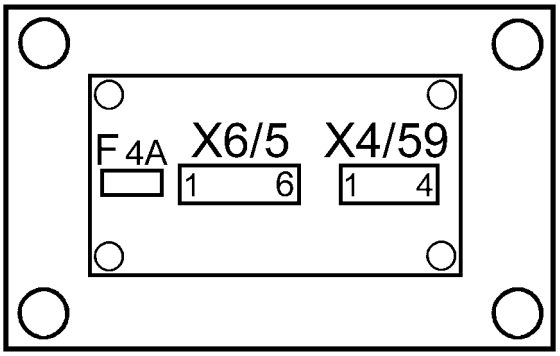


List of Plugs – EHR Operating

X4/51	Plug-in connection, EHR box cable	X6/51	Plug-in connection, multi-controller

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EGE control unit A11

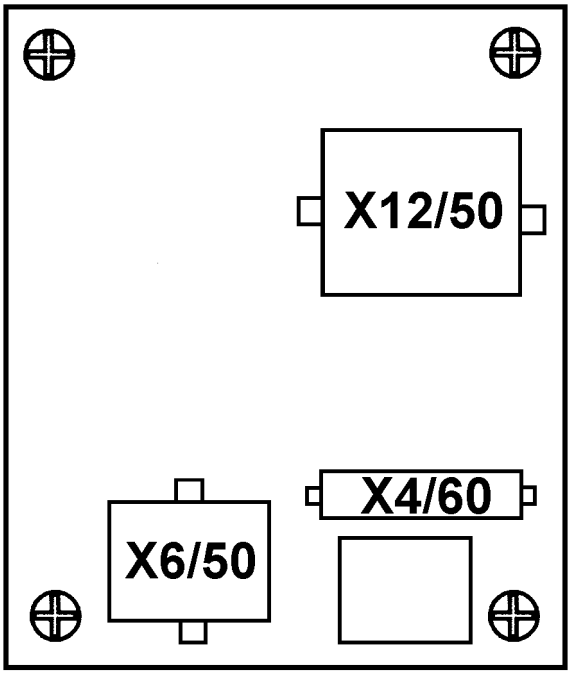


SS99J065

List of plugs, EGE control unit

X4/59	Plug-in connection, EGE potentiometer (R8)
X6/5	Plug-in connection, electronic front implement load relief

PTO Shaft Control Unit A50/2



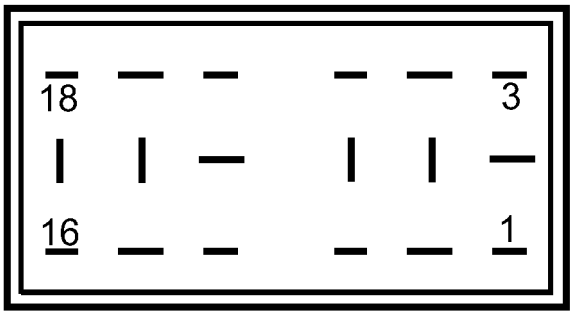
SS99J034

List of Plugs, PTO Shaft Control Unit

X4/60	Plug-in connection, cable, chassis, right
X6/50	Plug-in connection, cable, chassis, right
X12/50	Plug-in connection, cable, electrical/hydraulic PTO shaft

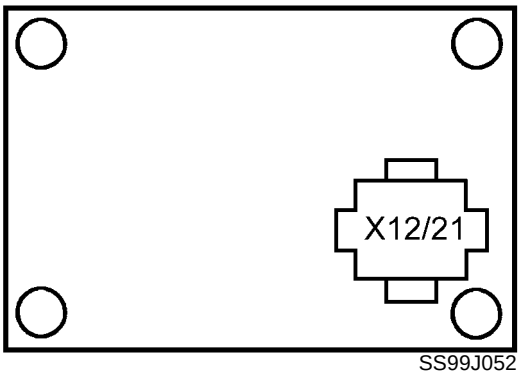
https://truckmanualshub.com/

4-Wheel Drive Management – Control Unit A10



SS99J071

Power Shift 'E' Box A52



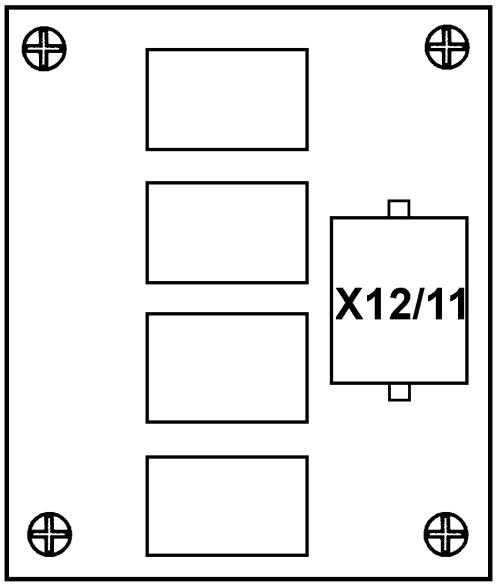
SS99J052

List of Plugs – Power Shift

X12/21 Plug-in connection, chassis, right, transmission

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Joystick ’E’ Box A11/1

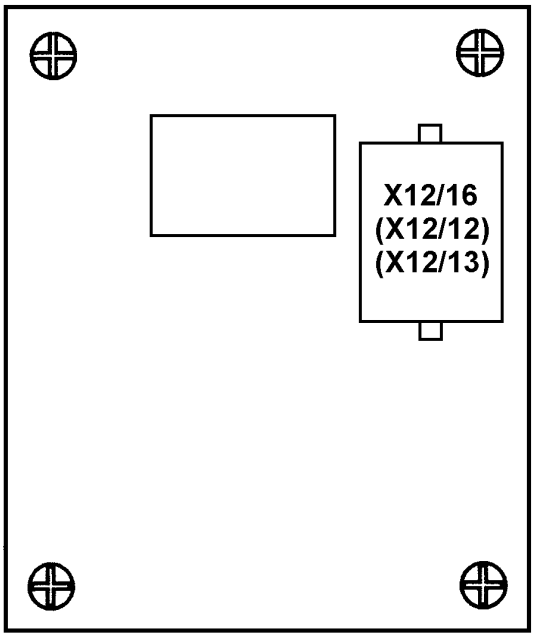


SS99J035

List of Plugs – Joystick 'E' Box A11/1

X12/11 Plug-in connection, joystick

Print, Single Winch A33 1/2



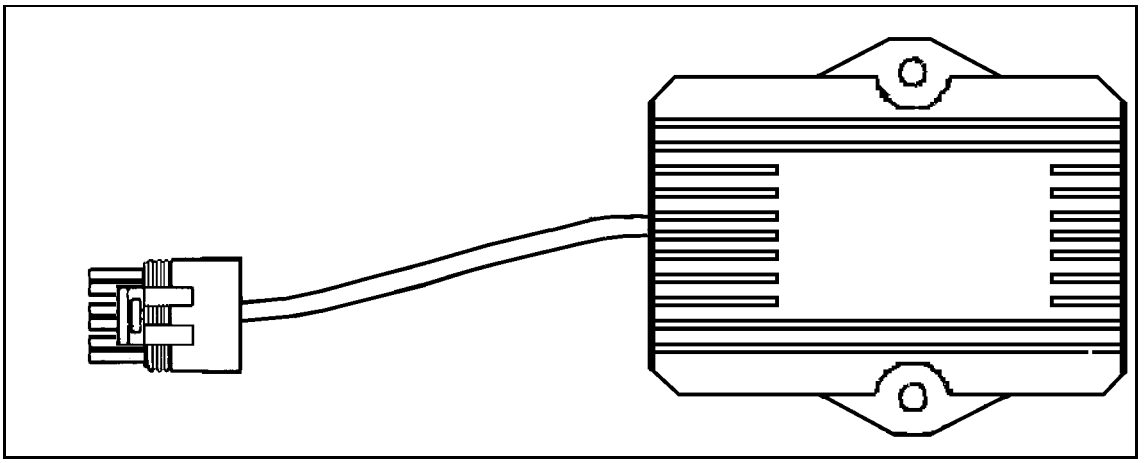
SS99G158

List of Plugs – Winch

X12/16 Plug-in connection, single winch
X12/12 Plug-in connection, double winch
X12/13 Plug-in connection, double winch

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Blower motor – Control A21

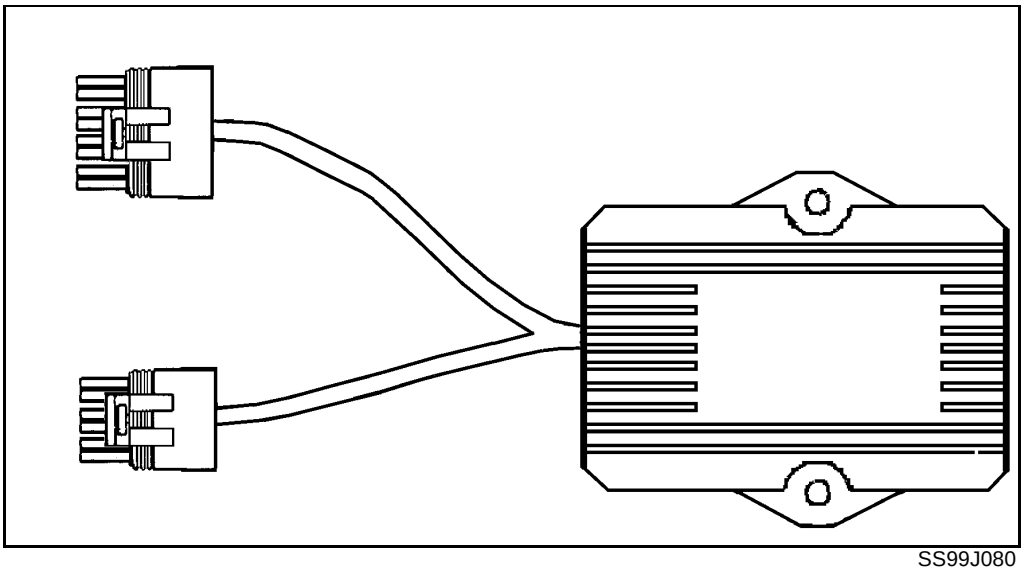


SS99J156

List of plugs, blower motor – control

X3/42 Plug-in connection, blower potentiometer (R11)

Air-Conditioning – Control A20



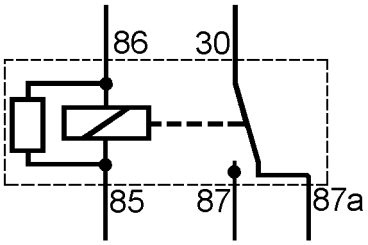
SS99J080

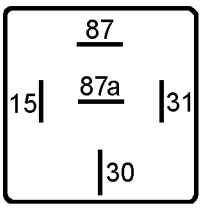
List of Plugs, Air-Conditioning – Control

X3/40 Plug-in connection, air cond. control
X4/25 Plug-in connection, air-conditioning potentiometer (R10)

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Relays



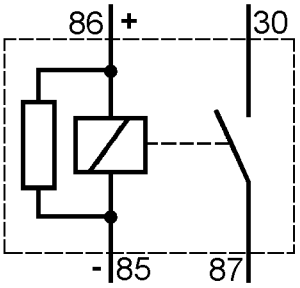


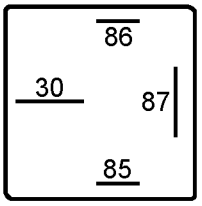
SS99G151

Miniature relay: (Messr's. Wehrle)

Centre zero relay / Normally open
Centre zero relay without diode (K5/17)

Rated voltage	12 VDC
Load	20/30 A
Suppression	390 Ω
Continuous duty	100%
Resistance 85 – 86	65 Ω ± 10%

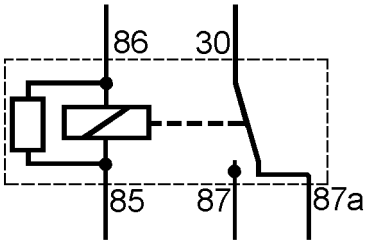


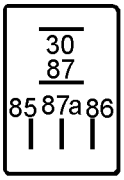


SS99G150

Power relay: (Messr's. Wehrle)

Rated voltage	12 VDC
Load	70 A
Suppression	560 Ω
Continuous duty	100%
Resistance 85 – 86	80 Ω

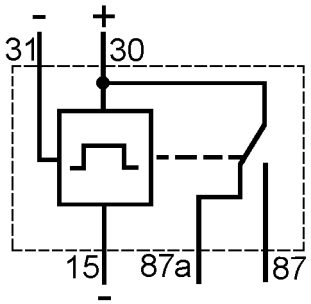


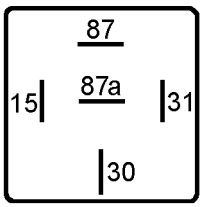


SS99G152

Centre zero – micro-relay: (Messr's. Wehrle)

Rated voltage	12 VDC
Load	15/25 A
Suppression	680 Ω
Continuous duty	100%
Resistance 85 – 86	90 Ω ± 10% at 23 °C





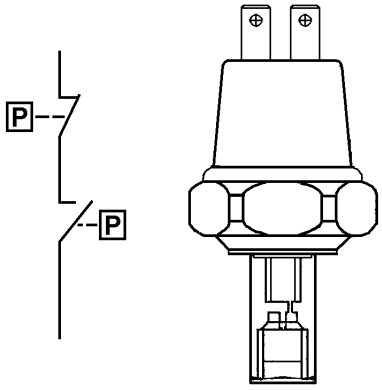
SS99G153

Timed relay 40 sec's. K4/2/2:
(Messr's Wehrle u. Sohn)

Rated voltage	12 VDC
Load	5 A
Continuous duty	100%

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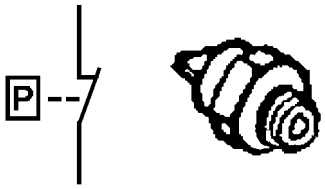
Switches



SS99G174

Safety switch – Air-cond. system (S30):

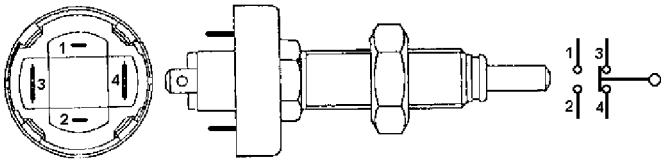
Rated voltage ..... 12 VDC
High pressure contact, opens at .....p > 31.5 bar
Low pressure contact, opens at .....p < 2 bar



SS99H186

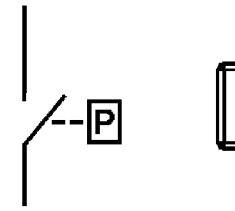
Engine oil pressure switch (S6):

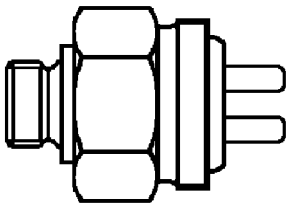
opens at .....p > 0.5 bar
Type of contact..... Normally closed



SS99D053

Start safety switch (S10):

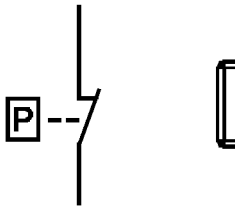


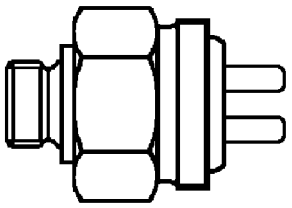


SS99J074

Pressure switches:
Rear axle diff. lock (S8)
Front axle diff. lock (S23)
Front PTO shaft (S29)

Switching point..... p > 9 ± 0.5 bar
Tightening torque .....max. 30 Nm
Type of contact..... Normally open

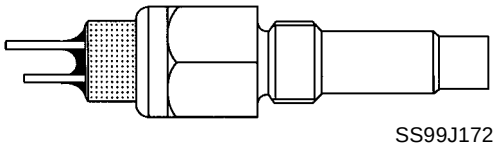




SS99J158

Pressure switch, 4-wheel drive (S18/1)
Rear PTO shaft (S39):

Switching point..... p > 9 ± 0.5 bar
Tightening torque .....max. 30 Nm
Type of contact..... Normally closed



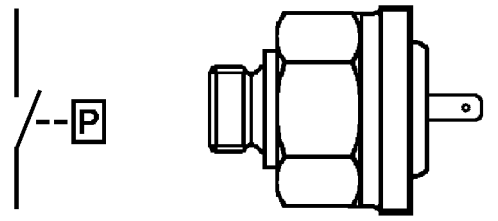
SS99J172

Switch, cooling water temperature (S32)
Engine temperature transmitter (B1):

(one component)

Switching temperature .....106 °C ± 3 °C
Type of contact..... Normally open

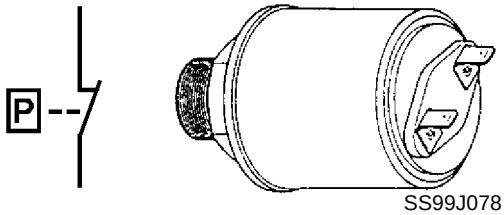
https://truckmanualshub.com/



SS99J075

Power shift safety switch (S9):

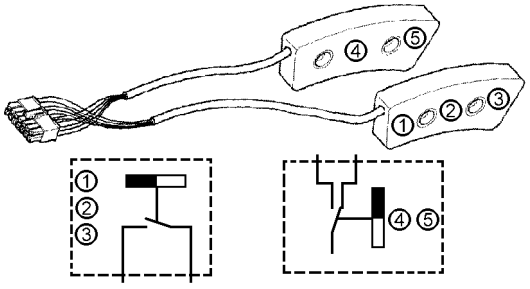
Switching point.....p > 12 ± 0.5 bar
Tightening torque.....max. 30 Nm
Type of contact..... Normally open



SS99J078

Compressed air switch (S12):

Switching point.....p > 5.5 bar
Type of contact..... Normally closed



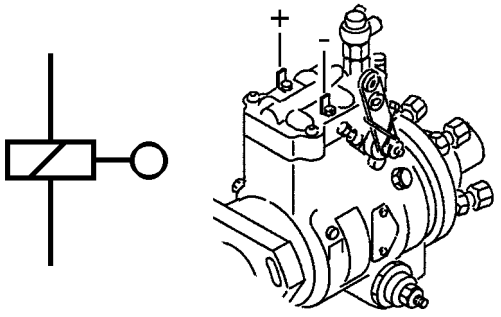
SS99J079

Reed relay (S42,S43,S40/2):

$I_{max.}$ .....500 mA
Type of contact..... Normally open

Reed – changeover relay (S41/1,S41/2):

$I_{max.}$ .....500 mA
Type of contact.....Changeover



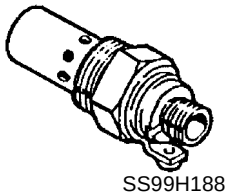
SS99J069

Stop solenoid (Y12):

Rated voltage.....12 VDC
Coil resistance ..... 3.8 Ω ± 10% at 20 °C

The solenoid must not be activated for longer than 40 seconds in a dry state. As the cooling effect of the fuel on the coil is missing.

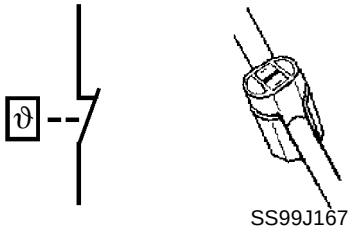
IMPORTANT: *Starter switch S1 must only be switched to position 1 immediately prior to starting.*



SS99H188

Thermo-start unit (E10/1):

Supply voltage .....12 VDC
Heating element res..... 1 Ω ± 10%



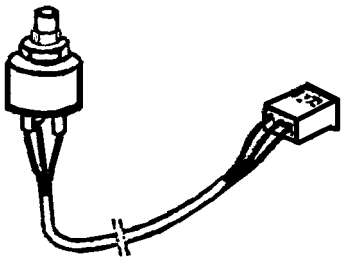
SS99J167

Fuel pre-heating thermostatic switch:

Switching point .....ϑ > 5 °C
Type of contact..... Normally closed

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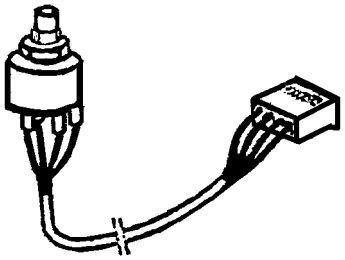
Potentiometers



SS99G170

Air-cond. roof blower motor potentiometer (R11):

Res. measured A – C..... 15 KΩ ± 20%
Res. measured A – B..... 0 – 15 KΩ ± 20%

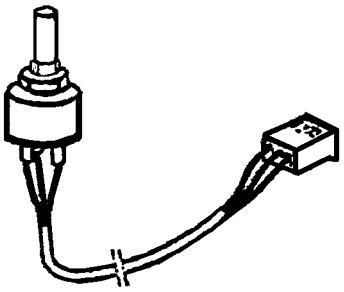


SS99G171

Air-cond. potentiometer (R10):

Potentiometer with integrated air-cond. – ON/OFF Switches

Res. potentiometer..... 10 KΩ ± 20%
Res. measured A – B..... 0 – 10 KΩ ± 20%
Switch ON/OFF.....C – D

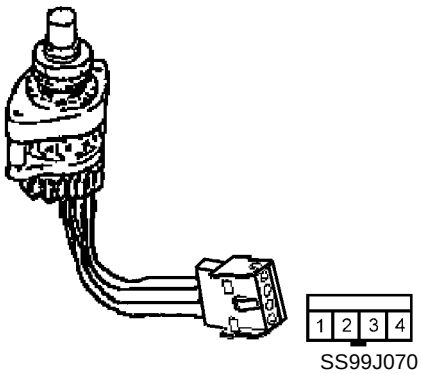


SS99G172

EHR potentiometer (R6/1,R6/2,R6/3,R6/4):

The 4 EHR potentiometers are identical in value. The differences lie in the wiring and length of the shaft.

Res. potentiometer.....4700 Ω ± 20%
Res. measured A – B.....0 – 4700 Ω ± 20%



SS99J070

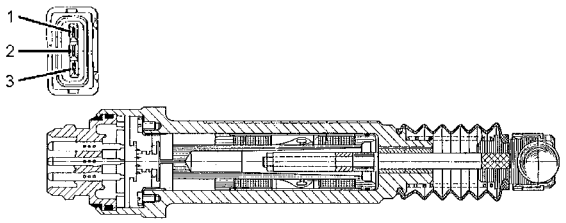
Stepping potentiometer EGE (R8):

Resistance measurement across X4/59

Pin	Latch 0	Latches 1 – 24
3 – 4	3.5 kΩ	3.5 kΩ
2 – 4	∞	3.5 kΩ – 0.2 Ω
2 – 3	∞	0.2 Ω – 3.5 kΩ
1 – 2	0,2 Ω	∞
1 – 2	—••	—•—

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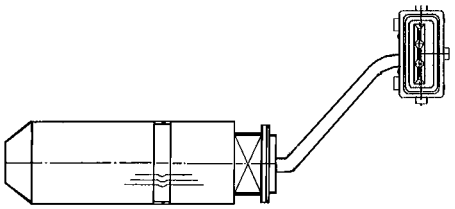
Sensors



SS99J068

EHR position sensor (B9/1):

1 = ground
2 = signal .....approx. 2.5 to 7 VDC
3 = supply .....9.5 VDC (EHR box)

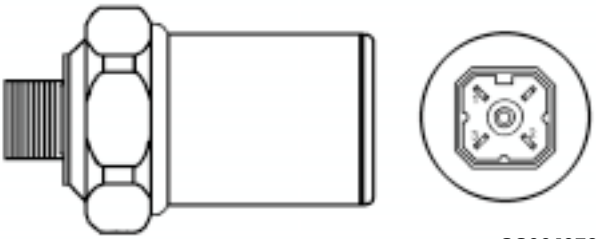


SS99H181

EHR force measuring bolts (B10/1,B10/2):

Measurement range: 40KN (Bosch end number: 545)

1 = ground
2 = signal .....2.5 to 7.5 VDC
(not loaded, approx. 4.7 VDC)
3 = supply .....9.5 VDC (EHR box)



SS99J072

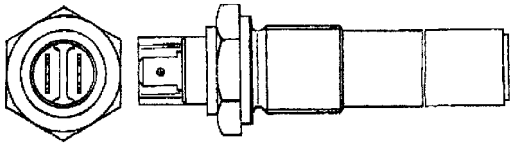
Pressure sensor EGE M2 (B20):

1 = supply voltage:.....12 VDC
2 = ground
3 = signal .....see table
R_L ..... ≥ 5 kΩ

Signal voltage measured at plug X6/5 (pins 1 and 3)

Pressure (bar)	Voltage (V)	Pressure (bar)	Voltage (V)	Pressure (bar)	Voltage (V)
18	0.50	45	1.48	70	2.20
25	0.75	50	1.55	75	2.30
30	0.85	55	1.65	80	2.40
35	1.00	60	1.80	85	2.47
40	1.20	65	1.95	160	5.0

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SS99D056

Inductive transmitter, driving speed (B6)
Rear PTO shaft speed (B7):

Resistance .....1050 Ω ± 10%



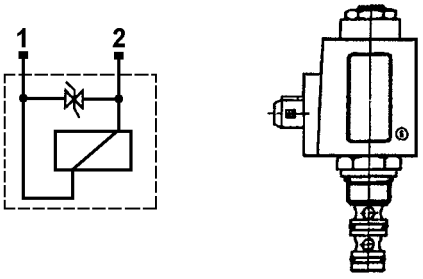
SS99J157

Air-conditioning temperature sensor (R9):

Type..... NTC
Resistance A – B..... ≈ 11 kΩ at 20 °C

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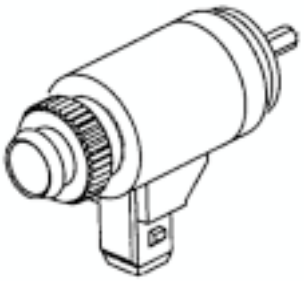
Solenoid Valves



SS99G166

Solenoid Valves
4-wheel drive (Y1)
Power shift (Y3)
Rear axle diff. lock (Y10)
Front axle diff. lock (Y8)
Rear PTO shaft (Y14), Messr's Hytos:

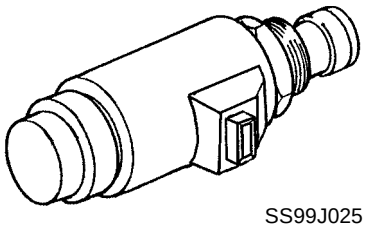
Rated voltage.....12 VDC
Suppression.....double Z diode
Continuous duty..... 100%
Resistance..... 8 Ω ± 10% at 20 °C



SS99J021

Solenoid valve EHR control unit (Y6,Y7):

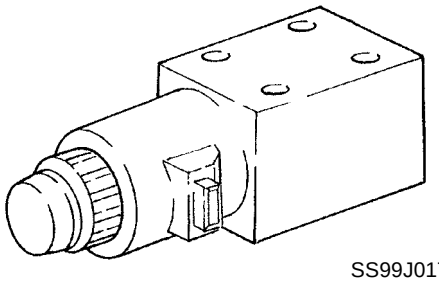
Proportional solenoid.....12 VDC
$I_{max.}$ .....3.5 A
Current control..... Pulse width modulation
Coil res.....1.7 Ω



SS99J025

Solenoid valve, shut-off valve
Auxiliary control unit (Y2/4):

Supply voltage .....12 VDC
Resistance..... 5 Ω ± 10%
Power.....28.8 W
Continuous duty..... 100%

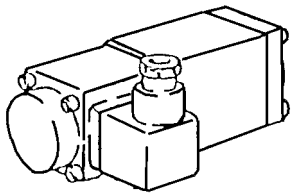


SS99J017

Solenoid valve (directional control valve)
Auxiliary control unit (Y2/1,Y2/2,Y2/3):

Supply voltage .....12 VDC
Resistance..... 4.4 Ω ± 10%
Power.....32,7 W
Continuous duty..... 100%

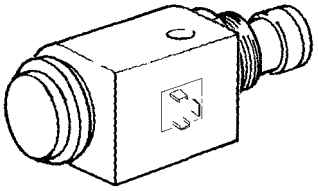
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SS99J171

Solenoid valve EGE (Y2/1, Y2/2): (Messr's. Wandfluh)

Supply voltage..... 12 VDC
Resistance .....5.4 Ω ± 10% at 20 °C
Continuous duty 100%



SS99J170

Solenoid valve EGE (Y20, Y21):

Supply voltage..... 12 VDC
Resistance .....7.5 Ω ± 10% at 20 °C
Continuous duty 100%

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Instrument Test Values

Fuel tank transmitter B2/1 (left) and B2/2 (right)		Fuel gauge	
Diesel level	Resistance Ω	Pointer angle	Display range
0	10	0°	from 0 – 12° red sector
1/8	31.2	7.5°	
1/2	95	30°	from 30 – 35° white sector
1	180	60°	from 60 – 65° white sector

Engine temperature transmitter (B1)		Engine temperature gauge	
Temperature°C	Resistance Ω	Pointer angle	Display range
45	239	0°	from 0 – 10° white sector
60	134	0°	
75	82	14°	
90	51	20°	
105	33,4	42°	from 42 – 52° red sector
113	26,8	53°	
120	22,4	60°	

Compressed air transmitter (B3)		Compressed air indicator	
Pressure in bar	Resistance Ω	Pointer angle	Display range
0	10	0°	from 0 – 13° red sector
2	52	0°	
4	88	0°	
6	124	24°	from 37 – 42° white sector
8	155	42°	
10	184	60°	from 59 – 63° white sector

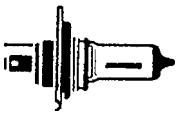
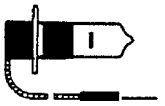
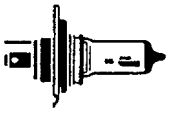
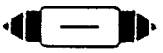
Tractormeter			
Engine speed ^{1}/min	Permissible deviation	Pointer angle	Frequency at generator terminal "W"
1000	± 100	67°	300 Hz
2000	± 65	163°	600 Hz

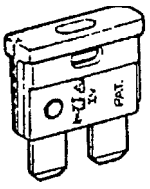
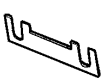
Transmission ratio, engine – generator i = 1: 3

Generator has 6 pairs of poles = 6 pulses per revolution

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Lamps and Fuses

Rotating beacon	H1 12V – 55W	1-34-772-051	
Searchlight	H3 12 V – 55W	90003452243	
Headlight, roof headlight	H4 12V – 60/55W	90003450013	
Trafficators, front and rear, brake light	P25-1 12V – 21W	90003452245	
Roof number plate light	L 12 V – 5W	90003452276	
Cab interior light	L 12V – 10W	90003452249	
Front sidelights, tail light	G 12 V – 5W	90003452216	
Cigarette lighter	H 12V 2W	90003452207	
Digital tractor meter	12V/2W	35700580708	
Instrument lighting and indicator lamps	12V/1.2W	90003450031	
Toggle switch, EHR diagnosis LED	W5/1.2-12V-1.2W	90003452250	
Courtesy light, EHR console lighting	T4/4 12 V 4W	90003452212	

3A	violet	1-40-258-203	**20A**	yellow	1-40-258-120	
5A	beige	1-40-258-105	**25A**	white	1-40-258-125	
7.5A	brown	1-40-258-107	**30A**	green	1-40-258-130	
10A	red	1-40-258-110	**40A**	orange	1-40-258-140	
15A	light blue	1-40-258-115				
40A **100A**		1-40-177-040 1-40-277-014				
100A		1-40-277-100				
4 A	(slow-blow)	EGE	∅ 5 x 20			

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Operation and Coding the Digital Instrument with Integrated operating Hours Counter

General information

All functions are called up using the spring-loaded switch (button), marked by the PTO symbol, on the right-hand side of the instrument panel. The switch need only be pressed briefly to call up operating functions. If it is held pressed for longer than 10 sec's. coding values can be checked and/or corrected.

Operating / function

Ignition On/Starting/Operation	the display shows a small "h" and the cumulative operating hours.
Press the button	again the rear PTO shaft speed will be shown on the display.
Press the button again	the front PTO shaft speed will be shown on the display.
Press the button again	the operating hours will again be shown on the display.

Coding

the engine speed (operating hours)
of the rear PTO shaft speed indicator
of the front PTO shaft speed indicator

General information

Each time the button is briefly pressed, the display will be visibly increased by one impulse. If the button is pressed continually for longer than 1.5 sec's. the impulses will be increased rapidly. When the button is released, "PRO" appears on the display after 8 sec's. The value set is stored by briefly pressing the button once again and the display will return to the starting position (operating hours).

Coding the engine speed indication (operating hours)

Press the button for 20 sec's.

The combination of numbers 1 – 1 appears in the upper part of the display, the current value or value to be corrected appears in the lower part of the display. The code adjustment range is 15 – 255 impulses. Tractors M9078 – M9094 or CS78 – 94 have the **code number 18**.

Coding the rear PTO shaft speed indication

Press the button for 22 sec's.

The combination of numbers 2 – 2 appears in the upper part of the display, the current value or value to be corrected appears in the lower part of the display. The code adjustment range is 1 – 100 impulses. The **code number 10** must be set and stored for all models (code number 10 = 10 teeth on the measuring wheel).

Coding the rear PTO front speed indication

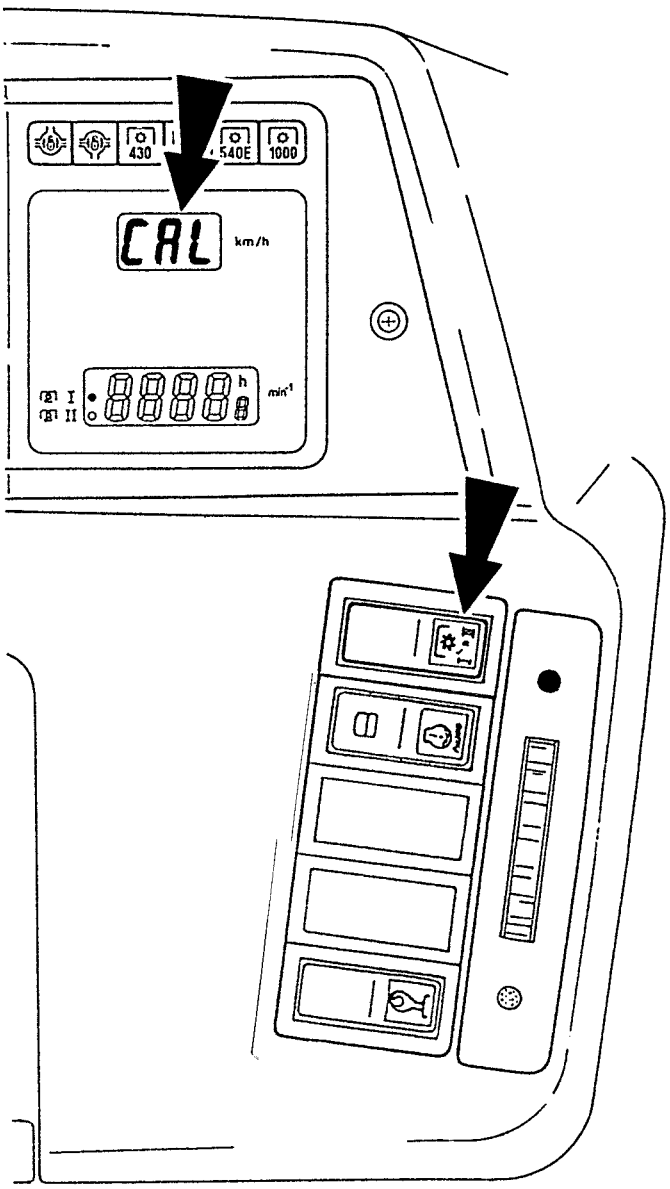
Press the button for 24 sec's.

The combination of numbers 3 – 3 appears in the upper part of the display, the current value or value to be corrected appears in the lower part of the display.
The code adjustment range is 1 – 100 impulses. The **code number 38** must be set and stored for all models.

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Calibrating the speedometer

Re-calibration is required after replacing tyres or when 3 bars appear on the km/h display.



SS99J173

Measure out a distance of exactly 100 m and mark both ends clearly.

– Press the pushbutton (Switchover Rear PTO/ Front PTO/Operating hours) for at least 10 seconds, until **CAL** appears on the km/h display.

– Start to drive and when the tractor's front axle is in line with the 0 mark, press the pushbutton briefly – the letters **COU** will then appear on the display.

The impulses will be counted to 9999 on the bottom part of the display, ---- will appear above this, pay no attention to this.

WARNING: *Minimum speed within the 100 m markings = 2 km/h – it is possible to drive faster.*

– When the front axle is in line with the 100 m mark, press the pushbutton briefly once again – the letters **PRO** appear on the display.

– Bring the tractor to a halt and if the programming sequence was carried out correctly, press the pushbutton briefly once again – the tractor will then store the new, calibrated count.

If a fault occurs during calibration (delay in pressing the switch etc.) – simply switch the ignition OFF before pressing the switch for the last time, the programming sequence will thus not be accepted and the old values remain in effect.

Repeat the procedure.

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Chapter

4003

CIRCUIT DIAGRAM

M9078, M9086, M9094,
CS78, CS86, CS94

post DBD 0057135

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Technische Dokumentation/Training Center
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Sva 7-98691 EN
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December, 2000

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TABLE OF CONTENTS

Index for Circuit Diagram 4
Page 1 6
Page 2 8
Page 3 10
Page 4 12
Page 5 14
Page 6 16
Page 7 18
Page 8 20
Page 9 22
Page 10 24
Page 11 26
Page 12 28
Page 13 30
Page 14 32
Page 15 34
Page 16 36
Page 17 38
Page 18 40
Page 19 42
Page 20 44
Page 21 46
Page 22 48
Page 23 50
Page 24 52
Page 25 54
Page 26 56
Page 27 58
Page 28 60
Page 29 62
Page 30 64
Page 31 66
Page 32 68
Page 33 70
Page 34 72
Page 35 74
Page 36 76
Page 37 78
Page 38 80

https://truckmanualshub.com/

List of Plugs, Left 82
List of Plugs, Right 83
List of Plugs (at rear) 84
List of Plugs – Instrument Panel 85
List of plugs, roof lining, high-top 86
List of plugs, roof lining, low-top 86
List of plugs, EHR, right-hand side panel 87
List of plugs, EHR, right-hand side panel, with EGE and EFH 88
List of plugs, MHR, right-hand side panel, with EGE and EFH 89
List of Plugs – Left-hand Side Panel 90
Central Print A12 91
ECCU A60
(Electronic Central Control Unit) 93
Print – Roof electrics A13 94
Component carrier – Low-Top 96
Component Carrier – Engine Electrics 97
Print – EHR Left, A15 (Distribution Print) 98
Print, EHR-B Operating Console A16 98
MHR – Operating Console A16 99
EHR Control Unit A25 99
EGE Control Unit A11 100
EFH print A17 100
EFH control unit A55/2 101
4-Wheel Drive Management – Control Unit A10 101
Blower motor – Control A21 102
Air-Conditioning – Control A20 102
Relays 103
Switch 104
Potentiometer for 106
Sensors 107
Solenoid Valves 109
Heating elements 111
Instrument Test Values 112
Lamps and Fuses 113
Operation and Coding the Digital Instrument with Integrated operating Hours Counter 114
Calibrating the speedometer 115

https://truckmanualshub.com/

Index for Circuit Diagram

M9078 - M9094
CS78 - CS94

Title	Page (e.g. Page 1) Section (e.g. A)
1st auxiliary control unit, double-action with freedom of movement/ shut-off valve ECCU	28A
1st auxiliary control unit, front-end lifting gear, external buttons	28D
1st auxiliary control unit, joystick operated	28B
1st auxiliary control unit, lever switch operated	28E
1st auxiliary control unit, multi-controller operated	28C
2nd auxiliary control unit, double-action with freedom of movement/shut-off valve ECCU	29A
2nd auxiliary control unit, lever switch operated	29C
2nd auxiliary control unit, multi-controller operated	29B
4-WD	6B#
4-wheel drive management, Opti-Stop	5B#
Air-conditioning system, high-top	20A#
Air-sprung seat	27D
Auxiliary headlight, high-top	10B#
Auxiliary headlight, low-top	11B#
Blower motor, high-top	21A#
Brake light	6A#
Brake light, with management	5A#
Central print ground	22D
Cigarette lighter	27B
Differential lock management, rear	5C#
Differential lock, rear	6C#
Digital clock, high-top	15C#
Dipped/Main beam switchover	10D/11D
ECCU supply	7C
EHR diagnostics display	32A
EHR external push button	31D
EHR internally operated external pushbuttons	31C
EHR lift / pressure changeover	34C#
EHR lift limiting	32F
EHR lifting/control on the multi-controller	33A#
EHR lifting/control per rocker switch	34A#
EHR lighting, front panel	32J
EHR lowering speed	32D
EHR mixed control	32E
EHR over-lift (hitch)	31C

Title	Page (e.g. Page 1) Section (e.g. A)
EHR position sensor	30C
EHR power sensor	30B
EHR Raise+Lower solenoid valve	30D
EHR Raise/Lower indicator	32C
EHR setpoint	32G
EHR slip indicator	32B
EHR stop button	32H
EHR transport signal	5E#
EHR-B box ground	31A
EHR-B signal conversion	33B/34B
Electronic front implement load relief, up to DBD 0057986	36A
Electronic front-end lifting gear control, from DBD 0057987 onwards	37 / 38
Engine cut-out	4B#
Floor-level heating	14B
Front differential lock	5D#/6D#
Front screen washer pump	18D/19D
Front searchlight (2) mounted on trafficator/sidelight, high-top	12D#/13D#
Front searchlight, twin-power, built into roof	12C#/13C#
Front sidelight, high-top	8C#
Front sidelight, low-top	9C#
Fuel filter heating	7A
Fuel pump control	3A/4A
Headlights	10C/11C
Heated rear window, high-top	17E
Heated windscreen, high-top	17D
Horn	18A/19A
Indicator lamps, centre	24B
Indicator lamps, left	24A
Indicator lamps, right	24C
Indicators	8A/9A
Instrument panel, centre, fuel/air/ temperature gauges (analogue)	25C
Instrument panel, centre, warning indicator	25B
Instrument panel, left, rev. counter (analogue)	25A
Instrument panel, right (digital)	26A
Interior light, high-top	15E#
Interior light, low-top	16E#
MHR – 50%-switch (transport signal)	6E#
Mirror heating, high-top	17A

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Title	**Page** (e.g. Page 1) **Section** (e.g. A)
Mudguard mounted searchlights (left + right)	10A#
Mudguard mounted searchlights, as reversing lights (left + right)	11A#
Number plate lighting, high-top	17C
Parallel front windscreen wiper	18C
Power shift	7B
Power socket	22C
Power socket 40A	22C
Power supply with main switch	2A#
Power supply without main switch	1A#
Pre-glowing	1C/2C
Radio preparation, high-top	15A#
Radio preparation, low-top	16A#
Rear (inner) searchlight (2+2), high-top	12B#
Rear (outer) searchlight (2), high-top	13A#
Rear (outer) searchlight (2+2), high-top	12A#
Rear PTO shaft	35A
Rear screen washer pump	18E/19E
Rear screen wiper (sector), low-top	19G#
Rear sidelights	8D/9D
Reserve roof print (high-top)	23C
Reserves print, EHR operating console	23C
Reserves print, EHR, left	30E
Reserves – central print	7E
Reversing facility	23B
Rotating beacon, high-top	15D#
Rotating beacon, low-top	16D#
Safety switch	27C
Screen washer pump, front	18D/19D
Screen washer pump, rear	18E/19E
Searchlight on rear axle	7D
Spotlight, high-top	17B
Standard front wiper, high-top	18F#
Standard front wiper, low-top	19F#
Standard rear screen wiper, high-top	18G#
Standard rear wiper, high-top	18G#
Standard rear wiper, low-top	19G#

Title	**Page** (e.g. Page 1) **Section** (e.g. A)
Standard signal socket for EHR	31B
Standard signal socket for MHR or on-board computer preparation	22B
Standard signal socket, EHR fitted	31B
Standard signal socket, MHR fitted	22B
Standard windscreen wiper, high-top	18F#
Standard windscreen wiper, low-top	19F#
Starter	1B/2B
Starting with electrical PTO shaft	1D#
Starting with mechanical PTO shaft	2D#
Starting, with front PTO shaft	2D#
Stationary operation cut-out	3B#
Steering column switch	18B/19B
Step/interior lighting, high-top	15E#
Supply 58, sundry lighting	27E
Supply potential 15, high-top	15B#
Supply potential 15, low-top	16B#
Supply potential 58L, instrument	14A
Supply potential 58R, instrument	14C
Supply, EHR operating console	27A
Supply, EHR-B box	30A
Supply, on-board computer	22B
Supply, potential 31, central print	22D
Supply, potential 31, EHR-B box	31A
Trafficator, high-top	8B#
Trafficator, low-top	9B#
Trailer brake valve, Italy	23A
Trailer socket	22A
Trailer socket	22A
Windscreen wiper (parallel)	18C#

EHR = Electronic Lift Control

MHR = Mechanical Lift Control

ECCU = Electronic Central Control Unit

PTO = Power Take Off shaft

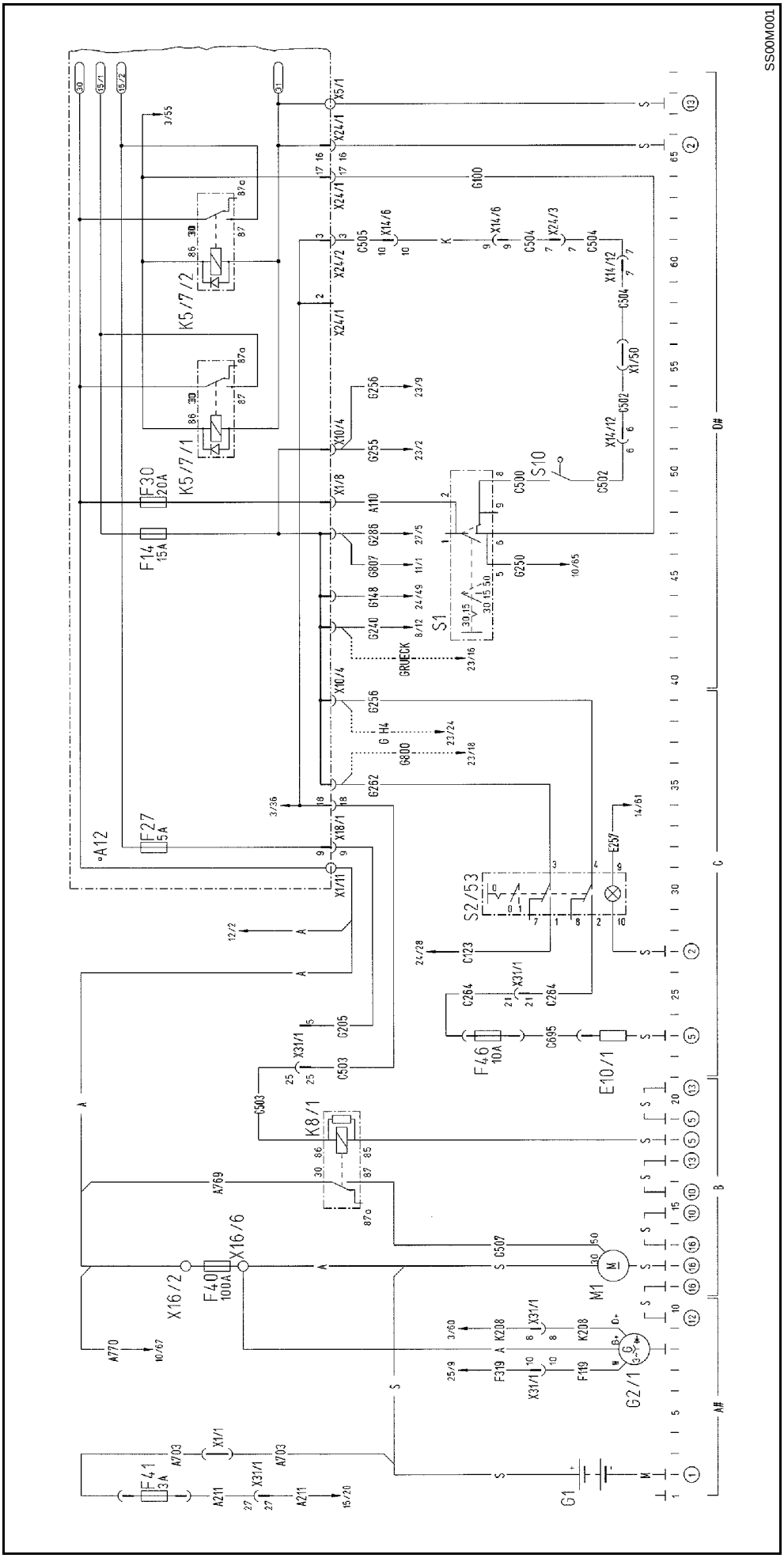
EGE = Electronic front implement load relief

EFH = Electronic front-end lifting gear control

..... = only applies for the reversing facility

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Page 1



Electrical equipment

A12	Central print
E10/1	Thermo-start
F14	Fuse, potential 15/1
F27	Fuse, potential 15 Motor component carrier
F30	Fuse, potential 30, ignition switch
F40	Main fuse 100A
F41	Fuse; clock, radio
F46	Fuse Thermo-start
G1	Battery
G2/1	Alternator
K5/7/1	Relay potential 15/1 supply
K5/7/2	Relay potential 15/2 supply
K8/1	Relay, starter
M1	Starter
S1	Starter switch
S2/53	Switch, pre-glowing
S10	Clutch pedal switch (start inhibitor)
X1/1	Plug-in connection, flat, potential 30
X12/8	Plug-in connection, central print
X1/11	Screw-on connection, central print 30
X1/50	Plug-in connector, front PTO shaft, neutral
X5/1	Ground plug-in connection, central print
X10/4	Distributor, potential 15, central print
X14/6	Plug-in connection, chassis right, PTO shaft indicator
X24/12	Plug-in connection, instrument cable, chassis, left
X16/2	Screw-on connector, engine 30, fused
X16/6	Screw-on connector, engine 30, not fused
X18/1	Plug-in connection, instrument cable
X24/1	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right
X24/3	Plug-in connection, chassis, right, instrument cable
X31/1	Plug-in connection, instrument – engine

VERSIONS
to this page
1
on page/pages
2

Grounding points

1	Battery
2	Instrument panel
5	Engine compartment
10	Starter mounting
12	Body, front
13	Bulkhead
16	Starter

Designation of Sections

A#	Power supply without main switch
B	Starter
C	Pre-glowing
D#	Starting with electrical PTO shaft
#	several versions available

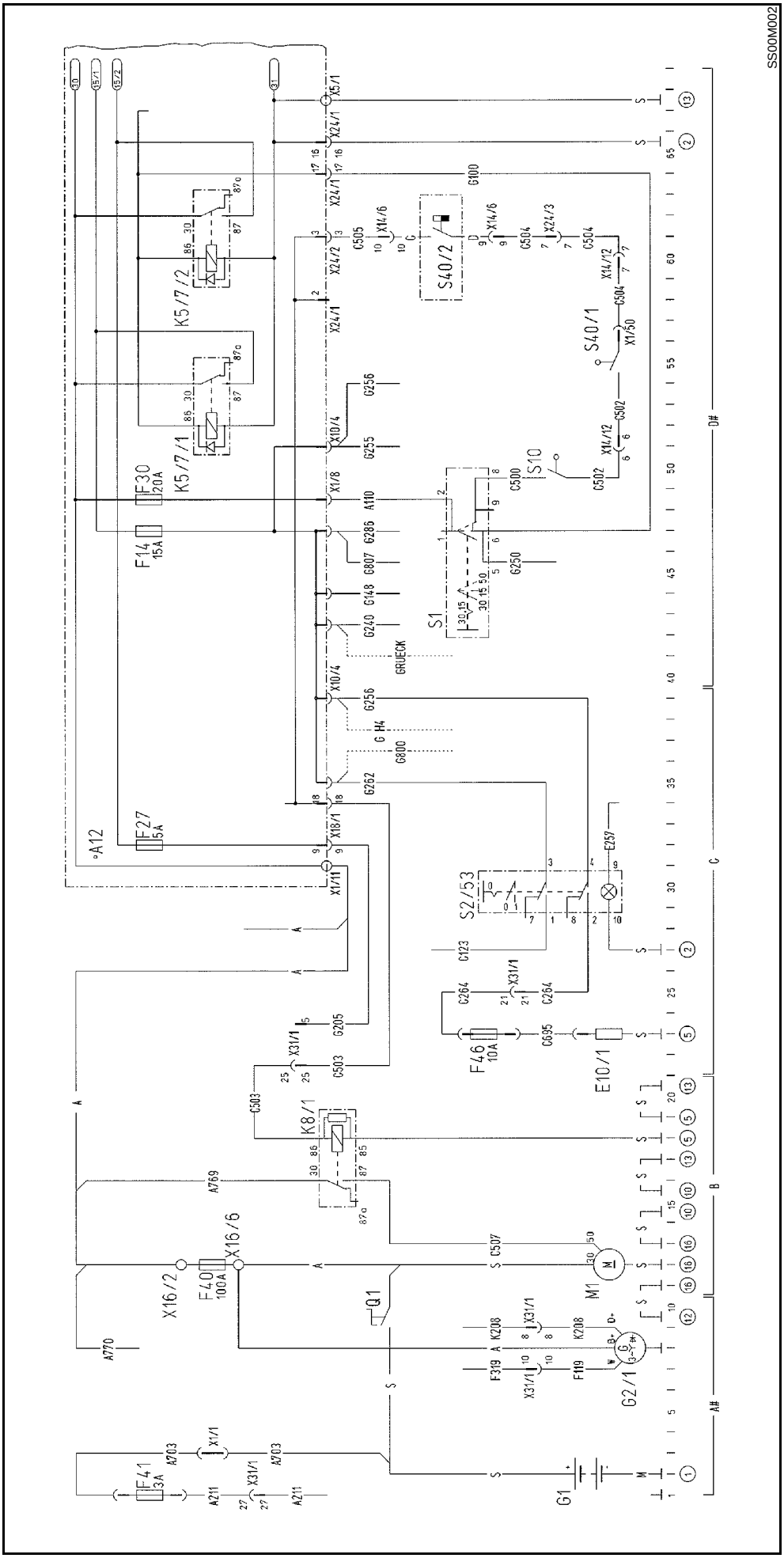
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Page 2



Electrical equipment

A12	Central print
E10/1	Thermo-start
F14	Fuse, potential 15/1
F27	Fuse, potential 15 Engine component carrier
F30	Fuse, potential 30, starter switch
F40	Main fuse 100A
F41	Fuse, clock, radio
F46	Fuse Thermo-start
G1	Battery
G2/1	Alternator
K5/7/1	Relay potential 15/1 supply
K5/7/2	Relay potential 15/2 supply
K8/1	Relay, Starter
16	Starter
Q1	Main switch, battery
S1	Starter switch
S2/53	Switch, pre-glowing
S10	Clutch pedal switch (start inhibitor)
S40/1	Switch, front PTO shaft (start inhibitor)
S40/2	Switch, rear PTO shaft (start inhibitor)
X1/1	Plug-in connection, flat, potential 30
X1/8	Plug-in connection, central print
X1/11	Screw-on connector, central print 30
X1/50	Plug-in connector, front PTO shaft, neutral
X5/1	Plug-in connection, ground, central print
X10/4	Distributor, potential 15, central print
X14/6	Plug-in connection, chassis, right, PTO shaft indicator
X14/12	Plug-in connection, instrument cable, chassis, left
X16/2	Screw-on connector, engine 30, fused
X16/6	Screw-on connector, engine 30, not fused
X18/1	Plug-in connection, instrument cable
X24/1	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right
X24/3	Plug-in connection, chassis, right, instrument cable
X31/1	Plug-in connection, instrument – engine

VERSIONS
to this page
2
on page/pages
1

Grounding points

1	Battery
2	Instrument panel
5	Engine compartment
10	Starter mounting
12	Body, front
13	Bulkhead
16	Starter

Designation of Sections

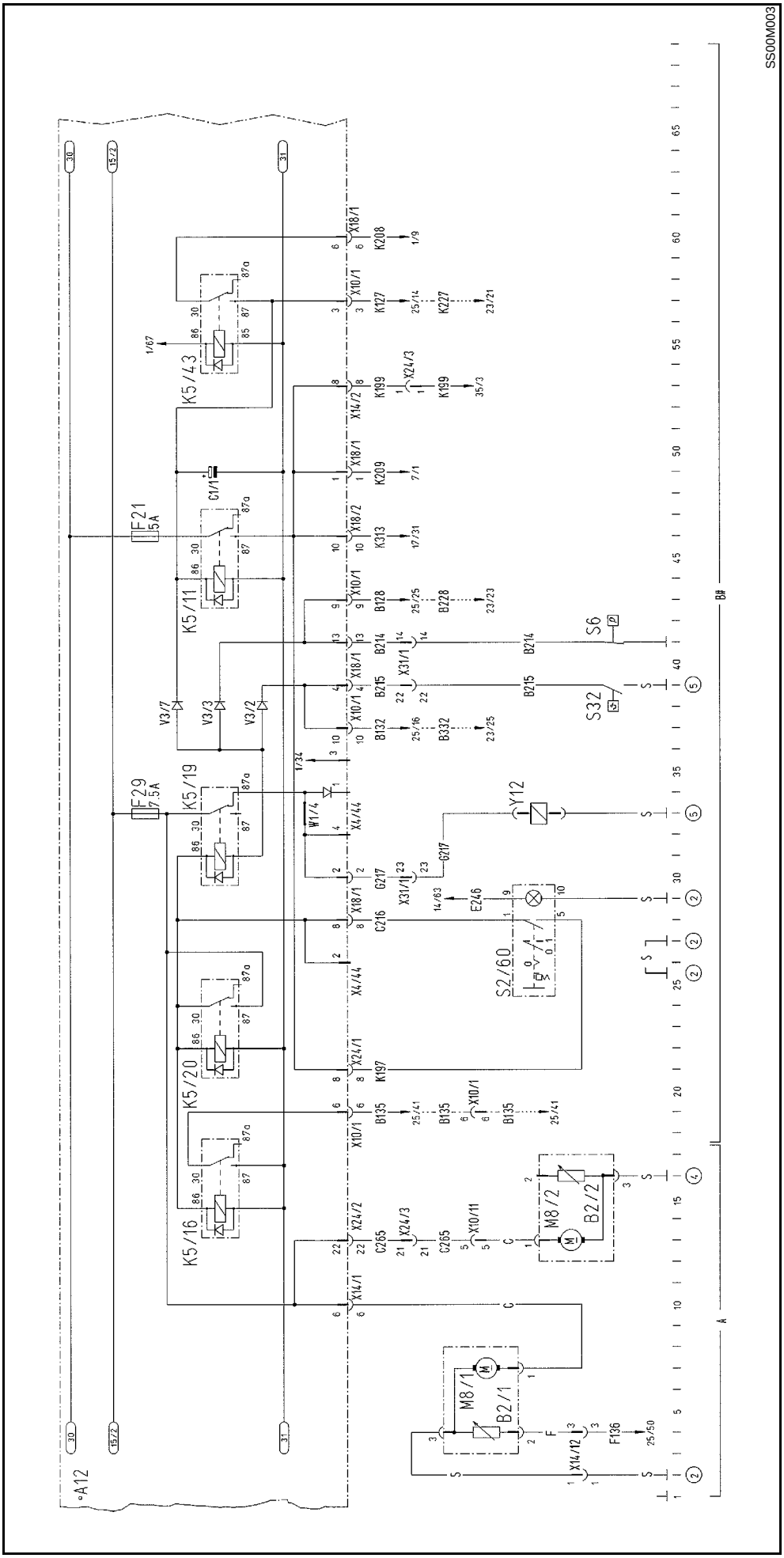
A#	Power supply with main switch
B	Starter
C	Pre-glowing
D#	Starting with mechanical PTO shaft and front PTO shaft
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Page 3

Electrical equipment

A12	Central print
B2/1	Fuel tank content transmitter, left
B2/2	Fuel tank content transmitter, right
C1/1	Charging indicator capacitor
F21	Fuse, potential D+
F29	Fuse, potential 15, stationary operation cut-out,
K5/11	Relay potential D+ supply
K5/16	Relay, stationary operation
K5/19	Relay, stationary operation
K5/20	Relay, stationary operation
K5/43	Relay, D+ cut-out
M8/1	Left-hand tank pump motor
M8/2	Right-hand tank pump motor
S2/60	Switch, stationary operation
S6	Switch, engine oil pressure indicator
S32	Switch, water temperature indicator
V3/2	Diode 0.3A, interlock
V3/3	Diode 3A, interlock
V3/7	Diode 0.3A, interlock
W1/4	Contact bridge, spark start
X4/44	Plug-in connection, spark start
X10/1	Plug-in connection, instrument cable
X10/11	Plug-in connection, instrument – transmission
X14/1	Plug-in connection, cable, chassis, left
X14/2	Plug-in connection, instrument cable
X14/12	Plug-in connection, instrument cable chassis, left
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply
X24/1	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right
X24/3	Plug-in connection, chassis, right, instrument cable
X31/1	Plug-in connection, instrument – engine
Y12	Engine cut-out solenoid

VERSIONS
to this page
3
on page/pages
4

Grounding points

2	Instrument panel
4	Console Instrument plug
5	Engine compartment

Designation of Sections

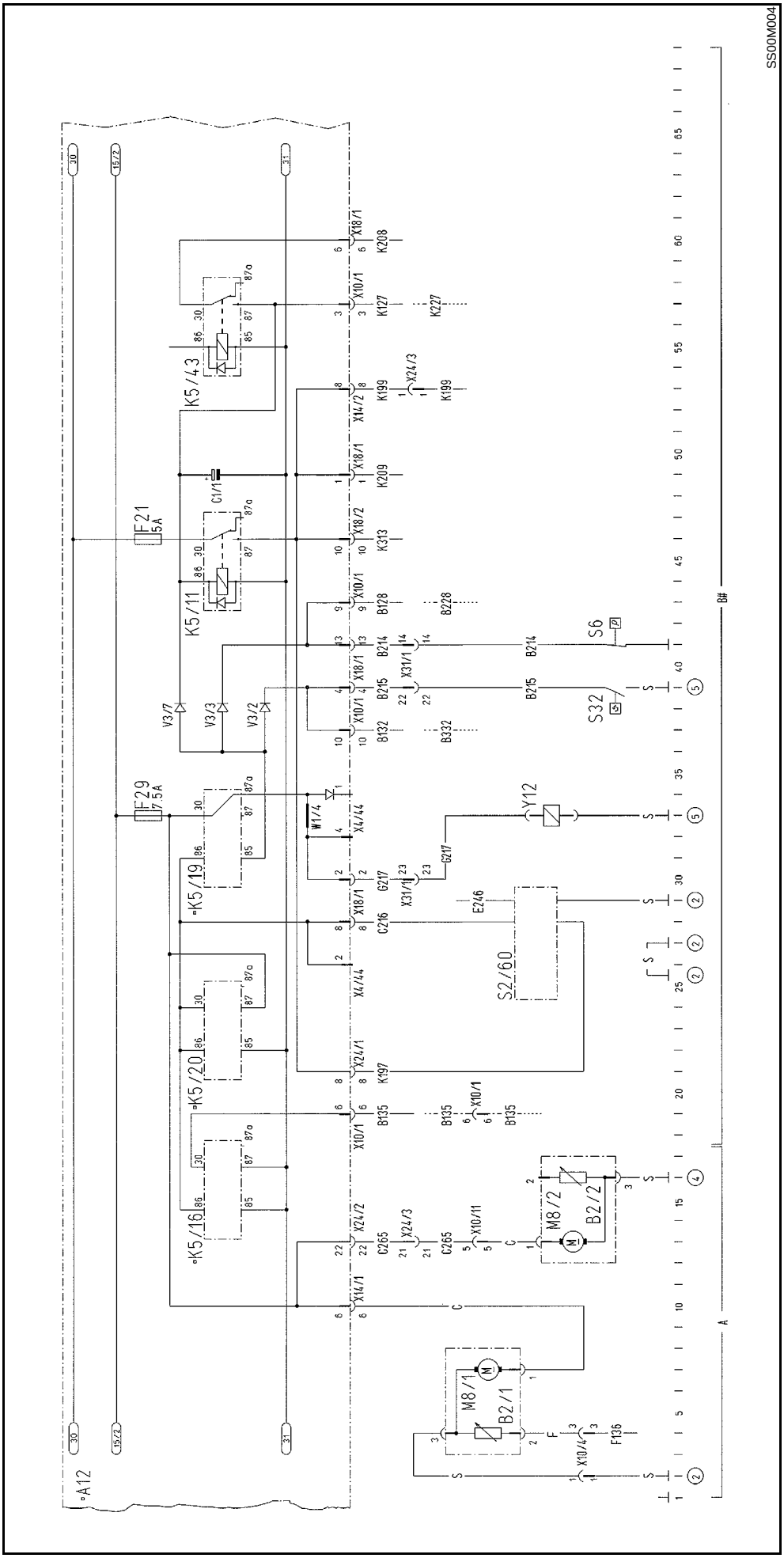
A	Fuel pump control
B#	Stationary operation cut-out
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
B2/1	Fuel tank content transmitter, left
B2/2	Fuel tank content transmitter, right
C1/1	Charging indicator capacitor
F21	Fuse, potential D+
F29	Fuse, potential 15, stationary operation cut-out,
K5/11	Relay potential D+ supply
K5/16	Relay, stationary operation
K5/19	Relay, stationary operation
K5/20	Relay, stationary operation
K5/43	Relay, D+ cut-out
M8/1	Left-hand tank pump motor
M8/2	Right-hand tank pump motor
S2/60	Switch, stationary operation
S6	Switch, engine oil pressure indicator
S32	Switch, water temperature indicator
V3/2	Diode 0.3A, interlock
V3/3	Diode 3A, interlock
V3/7	Diode 0.3A, interlock
W1/4	Contact bridge, spark start
X4/44	Plug-in connection, spark start
X10/1	Plug-in connection, instrument cable
X10/4	Distributor, potential 15, central print
X10/11	Plug-in connection, instrument – transmission
X14/1	Plug-in connection, cable, chassis, left
X14/2	Plug-in connection, instrument,
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply
X24/1	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right
X24/3	Plug-in connection, chassis, right, instrument cable
X31/1	Plug-in connection, instrument – engine
Y12	Engine cut-out solenoid

VERSIONS
to this page
4
on page/pages
3

Grounding points

2	Instrument panel
4	Console Instrument plug
5	Engine compartment

Designation of Sections

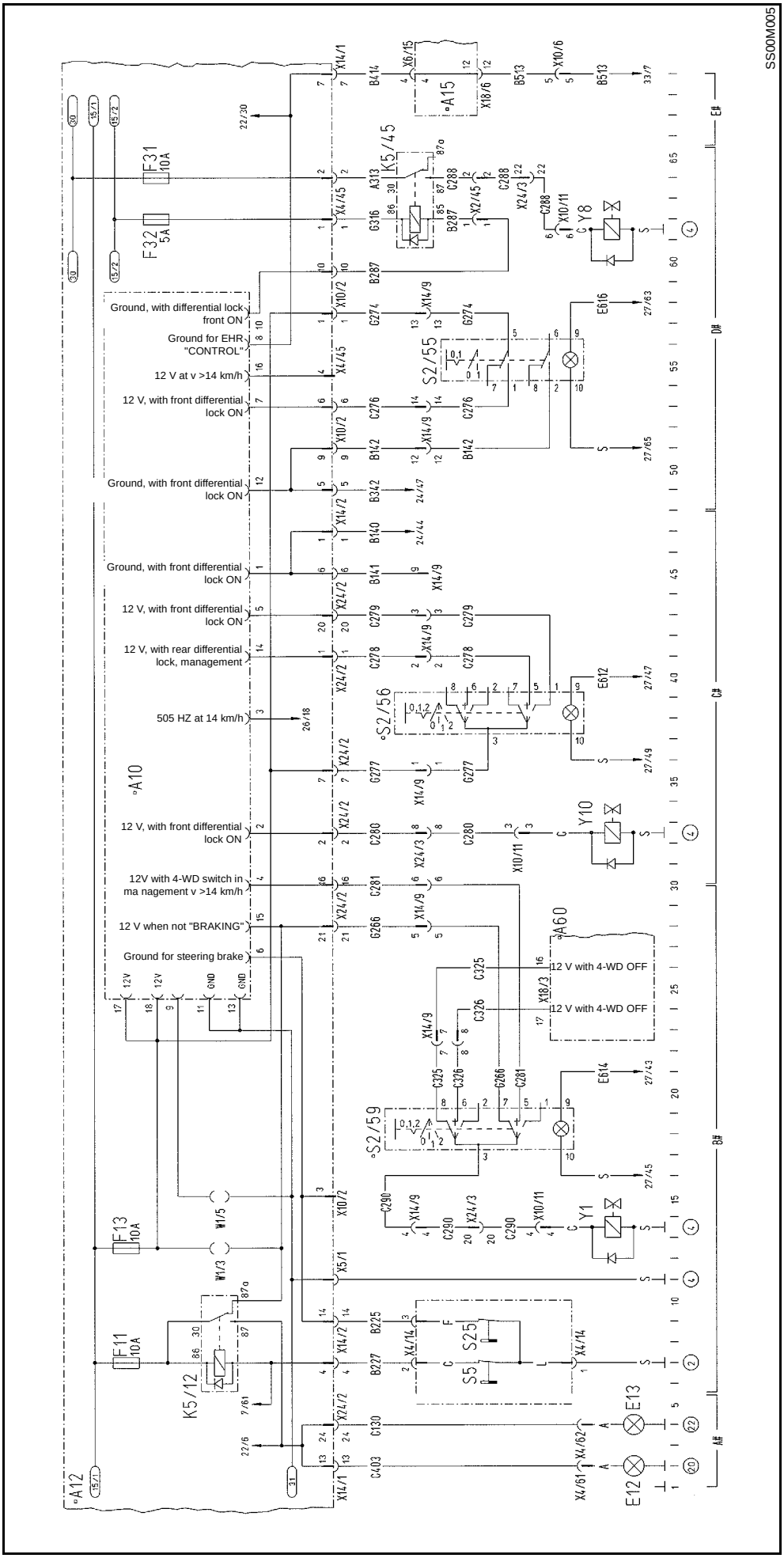
A	Fuel pump control
B#	Engine cut-out
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A10	4-wheel drive/Differential locks management control unit
A12	Central print
A15	Print, EHR, left
A60	ECCU (Electrical Central Control Unit)
E12	Brake light, left
E13	Brake light, right
F11	Fuse, brake lights
F13	Fuse, differential lock
F31	Fuse, front differential lock
F32	Fuse, front differential lock
K5/12	Relay, brake light, Opti-Stop
K5/45	Relay, front axle differential gearbox
S2/55	Switch, front differential lock
S2/56	Switch, rear differential lock management
S2/59	Switch, 4-wheel drive management
S5	Switch, brake light
S25	Switch, steering brake
W1/3	Contact bridge, Opti-Stop
W1/5	Contact bridge, 'low' signal
X2/45	Plug-in connection, differential lock, front axle
X4/14	Plug-in connection, brake light, Opti-Stop
X4/45	Spare plug-in connection
X4/61	Plug-in connection, cable, chassis, left Tail, trafficator, brake lights
X4/62	Plug-in connection, cable, chassis, right Tail, trafficator, brake lights
X5/1	Plug-in connection, central print, ground
X6/15	Plug-in connection, chassis cable, left - EHR print, left
X10/2	Plug-in connection, cable, chassis, right
X10/6	Plug-in connection, instrument, chassis, left
X10/11	Plug-in connection, instrument – transmission
X14/1	Plug-in connection, cable, chassis, left
X14/2	Plug-in connection, instrument
X14/9	Plug-in connection, chassis, right, 4-wheel drive – differential lock – management – switch
X24/3	Plug-in connection, chassis, right, ECCU
X18/6	Plug-in connection EHR – distribution print
X24/2	Plug-in connection, chassis, right
X24/3	Plug-in connection, chassis, right, instrument cable
Y1	4-wheel drive solenoid valve
Y8	Front differential lock solenoid valve
Y10	Rear differential lock solenoid valve

VERSIONS
to this page
5
on page/pages
6

Grounding points

2	Instrument panel
4	Console Instrument plug
20	EHR box console
22	Console for 'E' box

Designation of Sections

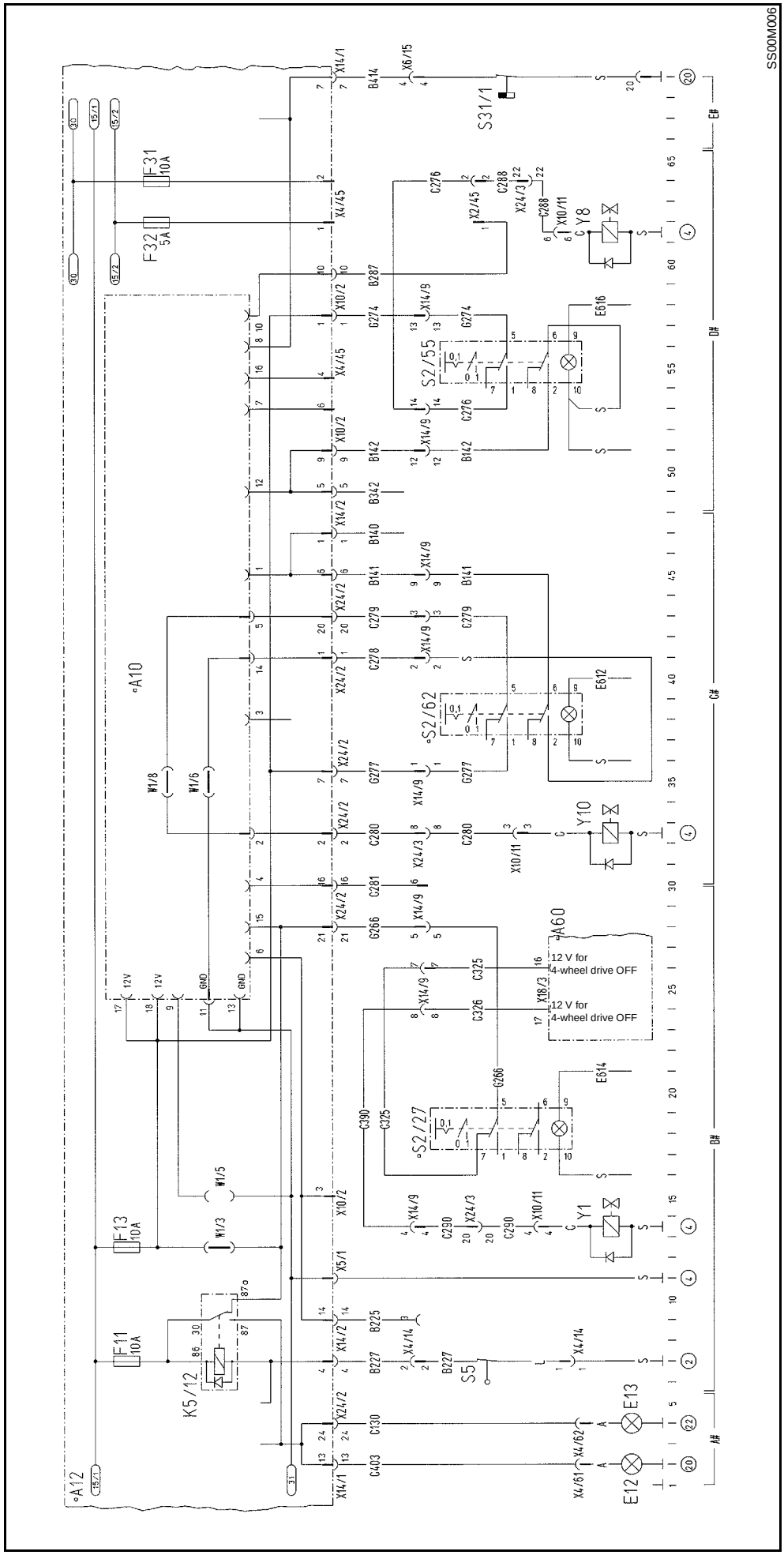
A#	Brake light, with management
B#	4-WD Opti-Stop management
C#	Differential lock management
D#	Front differential lock
E#	EHR transport signal
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A10	4-wheel drive/Differential locks management control unit
A12	Central print
A60	ECCU (Electrical Central Control Unit)
E12	Brake light, left
E13	Brake light, right
F11	Fuse, brake lights
F13	Fuse, differential lock
F31	Fuse, front differential lock
F32	Fuse, front differential lock
K5/12	Relay, brake light/Opti-Stop
S2/27	Switch, 4-wheel drive
S2/55	Switch, front differential lock
S2/62	Switch, rear differential lock
S5	Switch, brake light
S31/1	Switch, rear lifting gear 50%
W1/3	Contact bridge, Opti-Stop
W1/5	Contact bridge, 'low' signal
W1/6	Contact bridge, control minus
W1/8	Contact bridge, solenoid valve plus, differential lock
X2/45	Plug-in connection, differential lock, front axle
X4/14	Plug-in connection, brake light, Opti-Stop
X4/45	Spare plug-in connection
X4/61	Plug-in connection, cable, chassis, left Tail, trafficator, brake lights
X4/62	Plug-in connection, cable, chassis, right Tail, trafficator, brake lights
X5/1	Ground plug-in connection, central print
X6/15	Plug-in connection, chassis cable, left - EHR print, left
X10/2	Plug-in connection, cable, chassis, right
X10/11	Plug-in connection, instrument – transmission
X14/1	Plug-in connection, cable, chassis, left
X14/2	Plug-in connection, instrument cable
X14/9	Plug-in connection, chassis, right, 4-wheel drive – differential lock – management – switch
X24/3	Plug-in connection, chassis, right, ECCU
X24/2	Plug-in connection, chassis, right
X24/3	Plug-in connection, chassis, right, instrument cable
Y1	4-wheel drive solenoid valve
Y8	Front differential lock solenoid valve
Y10	Rear differential lock solenoid valve

VERSIONS
to this page
6
on page/pages
5

Grounding points

2	Instrument panel
4	Console Instrument plug
20	EHR box console
22	E box console

Designation of Sections

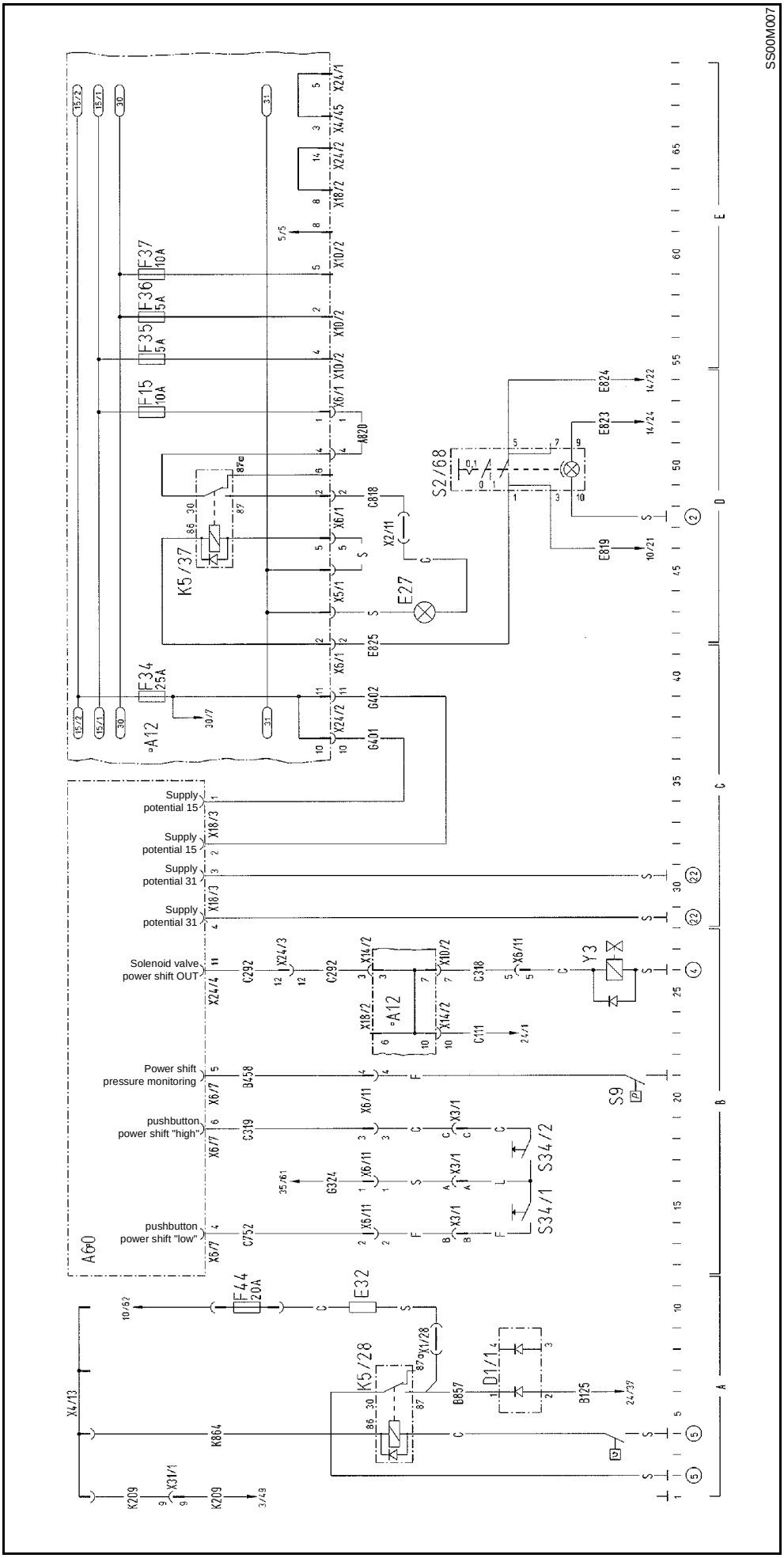
A#	Brake light
B#	4-wheel drive
C#	Rear differential lock
D#	Front differential lock
E#	MHR, 50% switch
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
A60	ECCU (Electrical Central Control Unit)
D1/1	Diode group, fuel filter heating
E27	Searchlight on the rear axle
E32	Fuel filter heating
F15	Fuse, searchlight, rear axle
F34	Fuse, reserve potential 15
F35	Fuse, reserve potential 15
F36	Fuse, reserve potential 30
F37	Fuse, reserve potential 30
F44	Fuse, fuel filter heating
K5/28	Relay, fuel filter heating
K5/37	Relay, searchlight, rear axle
S2/68	Switch, rear axle searchlight
S9	Power shift group safety switch
S34/1	Switch, power shift, "LOW"
S34/2	Switch, power shift, "HIGH"
X1/28	Plug-in connection, flat, filter heating
X2/11	Plug-in connection, searchlight, rear axle
X3/1	Plug-in connection, power shift
X4/13	Distributor, engine, potential D +
X4/45	Central print, spare plug-in connection
X5/1	Plug-in connection, central print, ground
X6/1	Plug-in connection, spare
X6/7	Plug-in connection, spare
X6/11	Plug-in connection, chassis, right, power shift
X10/2	Plug-in connection, cable, chassis, right
X14/2	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply
X24/3	Plug-in connection, chassis, right, ECCU
X24/1	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right
X24/3	Plug-in connection, chassis, right, instrument cable
X24/4	Plug-in connection, chassis, right, ECCU
X31/1	Plug-in connection, instrument – engine
Y3	Power shift group solenoid valve

Grounding points

2	Instrument panel
4	Console Instrument plug
5	Engine compartment
22	E box console

Designation of Sections

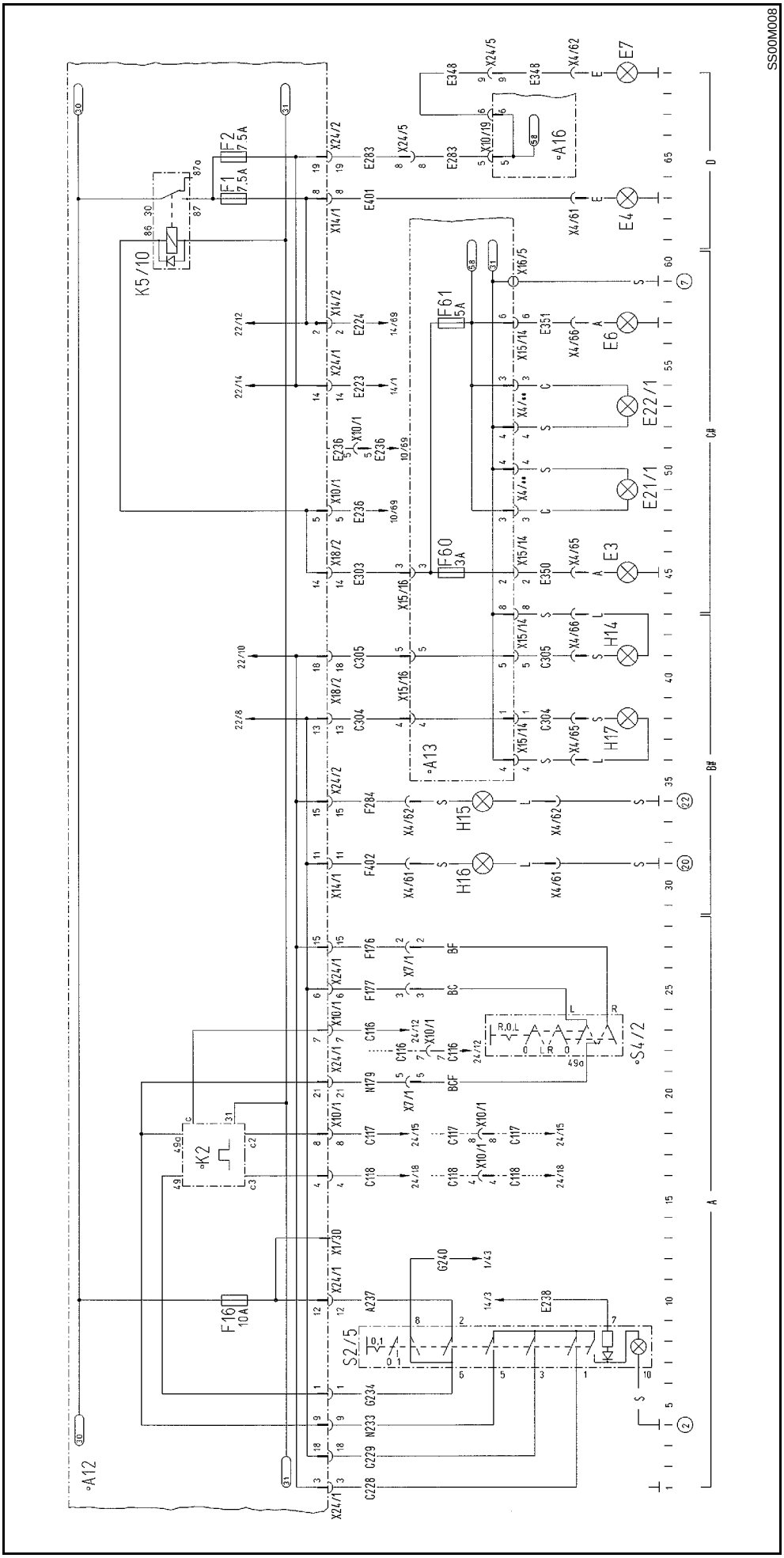
A	Fuel filter heating
B	Power shift
C	Power supply, ECCU
D	Searchlight on the rear axle
E	Reserves – central print

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
A13	Print, roof electrics
A16	Print, EHR operating console
E3	Sidelight, front left
E4	Sidelight, rear left
E6	Sidelight, front right
E7	Sidelight, rear right
E21/1	Position light, in auxiliary headlamp, left
E22/1	Position light, in auxiliary headlamp, right
F1	Fuse, light potential 58, left
F2	Fuse, light potential 58, right
F16	Fuse, hazard warning lights
F60	Fuse, sidelight, front left
F61	Fuse, sidelight, potential 58
H14	Trafficator, front right
H15	Trafficator, rear right
H16	Trafficator, rear left
H17	Trafficator, front left
K2	Trafficator relay
K5/10	Relay, light (potential 58)
S2/5	Switch, hazard warning lights
S4/2	Switch, steering column, trafficator
X1/30	Plug-in connection, central print potential 30, central print
X4/61	Plug-in connection, cable, chassis, left Tail, trafficator, brake lights
X4/62	Plug-in connection, cable, chassis, right Tail, trafficator, brake lights
X4/65	Plug-in connection, roof frame, trafficator/position light, left
X4/66	Plug-in connection, roof frame, trafficator/position light, right
X4/..	Plug-in connection, roof switch
X7/1	Plug-in connection, instrument – steering column
X10/1	Plug-in connection, instrument cable
X10/19	Plug-in connection, operating console – print
X14/1	Plug-in connection, cable, chassis, left
X14/2	Plug-in connection, instrument cable
X15/14	Plug-in connection, roof frame
X15/16	Plug-in connection, roof supply
X16/5	Screw-on connection, ground, roof print
X18/2	Plug-in connection, roof supply
X24/1	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right
X24/5	Plug-in connection, chassis, right, operating console

VERSIONS
to this page
8
on page/pages
9

Grounding points

2	Instrument panel
7	Roof panel
20	EHR box console
22	E box console

Designation of Sections

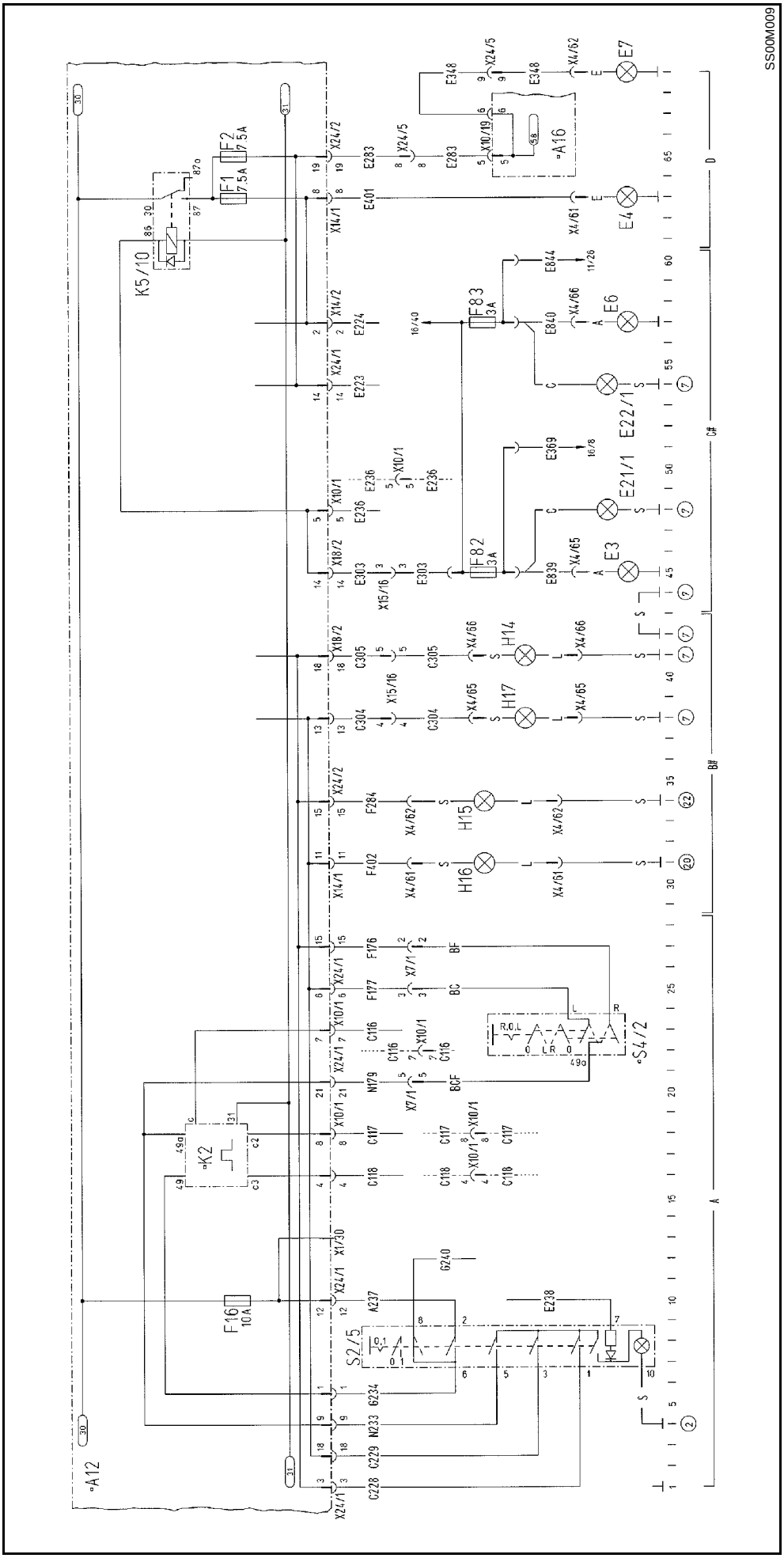
A	Trafficator system
B#	Trafficator, high-top
C#	Sidelight, front, low-top
D	Sidelight, rear
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
A16	Print, EHR operating console
E3	Sidelight, front left
E4	Sidelight, rear left
E6	Sidelight, front right
E7	Sidelight, rear right
E21/1	Position light in the auxiliary headlight, left
E22/1	Position light in the auxiliary headlight, right
F1	Fuse, light potential 58, left
F2	Fuse, light potential 58, right
F16	Fuse, hazard warning lights
F82	Fuse, sidelight, front left
F83	Fuse, sidelight, potential 58
H14	Trafficator, front right
H15	Trafficator, rear right
H16	Trafficator, rear left
H17	Trafficator, front left
K2	Trafficator relay
K5/10	Relay, light (potential 58)
S2/5	Switch, hazard warning lights
S4/2	Switch, steering column, trafficator
X1/30	Plug-in connection, central print potential 30, central print
X4/61	Plug-in connection, cable, chassis, left Tail, trafficator, brake lights
X4/62	Plug-in connection, cable, chassis, right Tail, trafficator, brake lights
X4/65	Plug-in connection, roof frame, trafficator/position light, left
X4/66	Plug-in connection, roof frame, trafficator/position light, right
X7/1	Plug-in connection, instrument – steering column
X10/1	Plug-in connection, instrument cable
X10/19	Plug-in connection, operating console – print
X14/1	Plug-in connection, cable, chassis, left
X14/2	Plug-in connection, instrument cable
X15/16	Plug-in connection, roof supply
X18/2	Plug-in connection, roof supply
X24/1	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right
X24/5	Plug-in connection, chassis, right, operating console

VERSIONS
to this page
9
on page/pages
8

Grounding points

2	Instrument panel
7	Roof panel
20	EHR box console
22	E box console

Designation of Sections

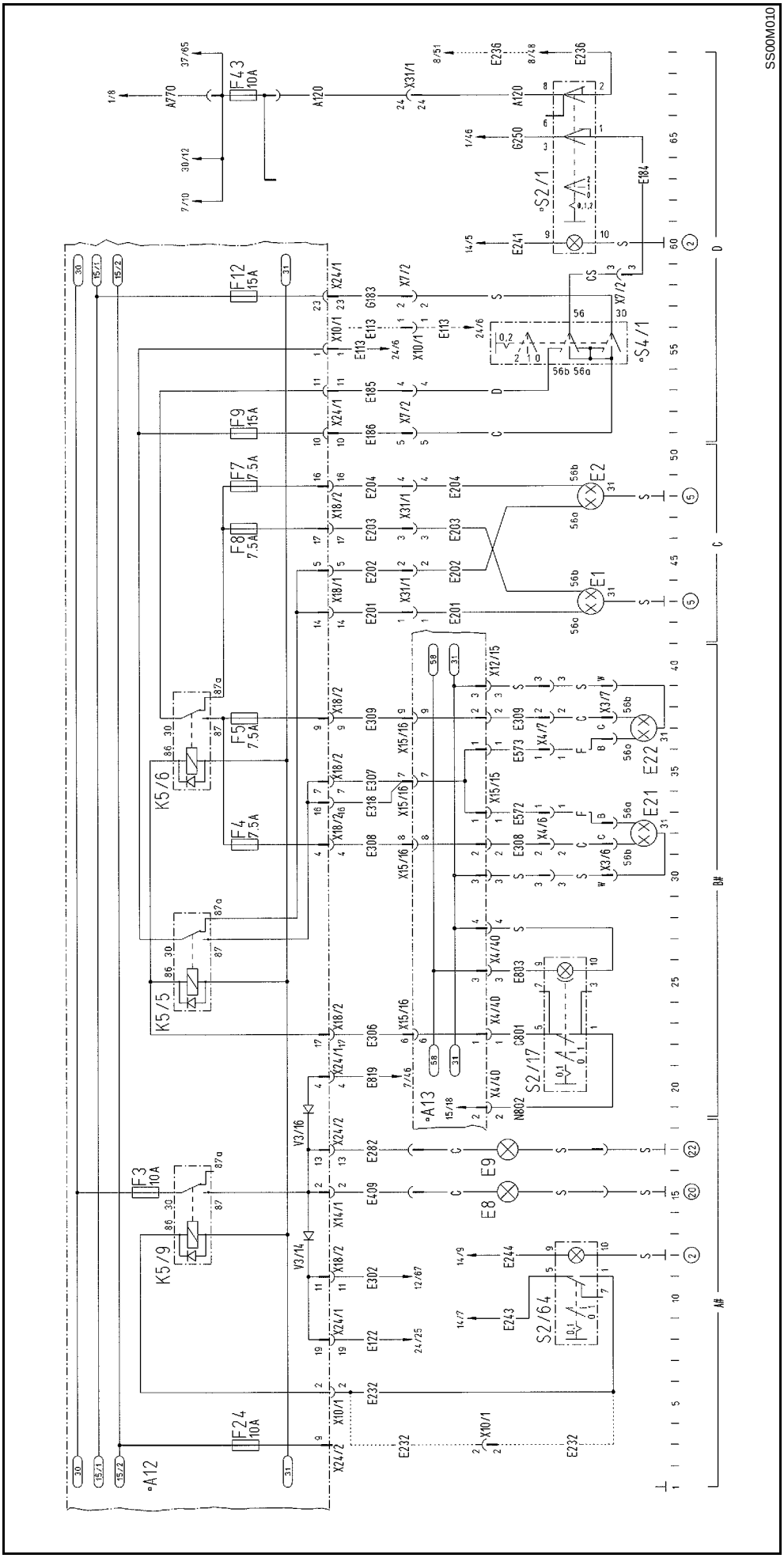
A	Trafficator system
B#	Trafficator, low-top
C#	Sidelight, front, low-top
D	Sidelight, rear
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
A13	Print, roof electrics
E1	Headlight, left
E2	Headlight, right
E8	Searchlight, left-hand mudguard
E9	Searchlight, right-hand mudguard
E21	Auxiliary headlight, left
E22	Auxiliary headlight, right
F3	Fuse, searchlight, mudguard
F4	Fuse, dipped beam, auxiliary roof headlight, left
F5	Fuse, dipped beam, auxiliary roof headlight, right
F7	Fuse, dipped beam, headlight, right
F8	Fuse, dipped beam, headlight, left
F9	Fuse, main-beam
F12	Fuse, headlight flasher
F24	Fuse, searchlight/ reversing light
F43	Fuse, supply, potential 58
K5/5	Relay, switchover, main beam
K5/6	Relay, switchover, dipped beam
K5/9	Relay, searchlight, mudguard
S2/1	Switch, lighting system
S2/17	Switch, auxiliary headlight
S2/64	Switch, searchlight, mudguard
S4/1	Switch, steering column, main/dipped beam
V3/14	Diode 0.1A interlock
V3/16	Diode 0.1A interlock
X3/6	Flat plug-in connection, auxiliary headlight
X3/7	Flat plug-in connection, auxiliary headlight
X4/6	Plug-in connection, roof canopy – auxiliary headlight
X4/7	Plug-in connection, roof canopy – auxiliary headlight
X4/40	Plug-in connection, roof switch
X7/2	Plug-in connection, instrument – steering column
X10/1	Plug-in connection, instrument cable
X12/15	Plug-in connection, roof canopy cable
X14/1	Plug-in connection, cable, chassis, left
X15/15	Plug-in connection, roof canopy cable
X15/16	Plug-in connection, roof supply
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply
X24/1	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right
X31/1	Plug-in connection, instrument – engine

VERSIONS
to this page
10
on page/pages
11

Grounding points

2	Instrument panel
5	Engine compartment
20	EHR box console
22	E box console

Designation of Sections

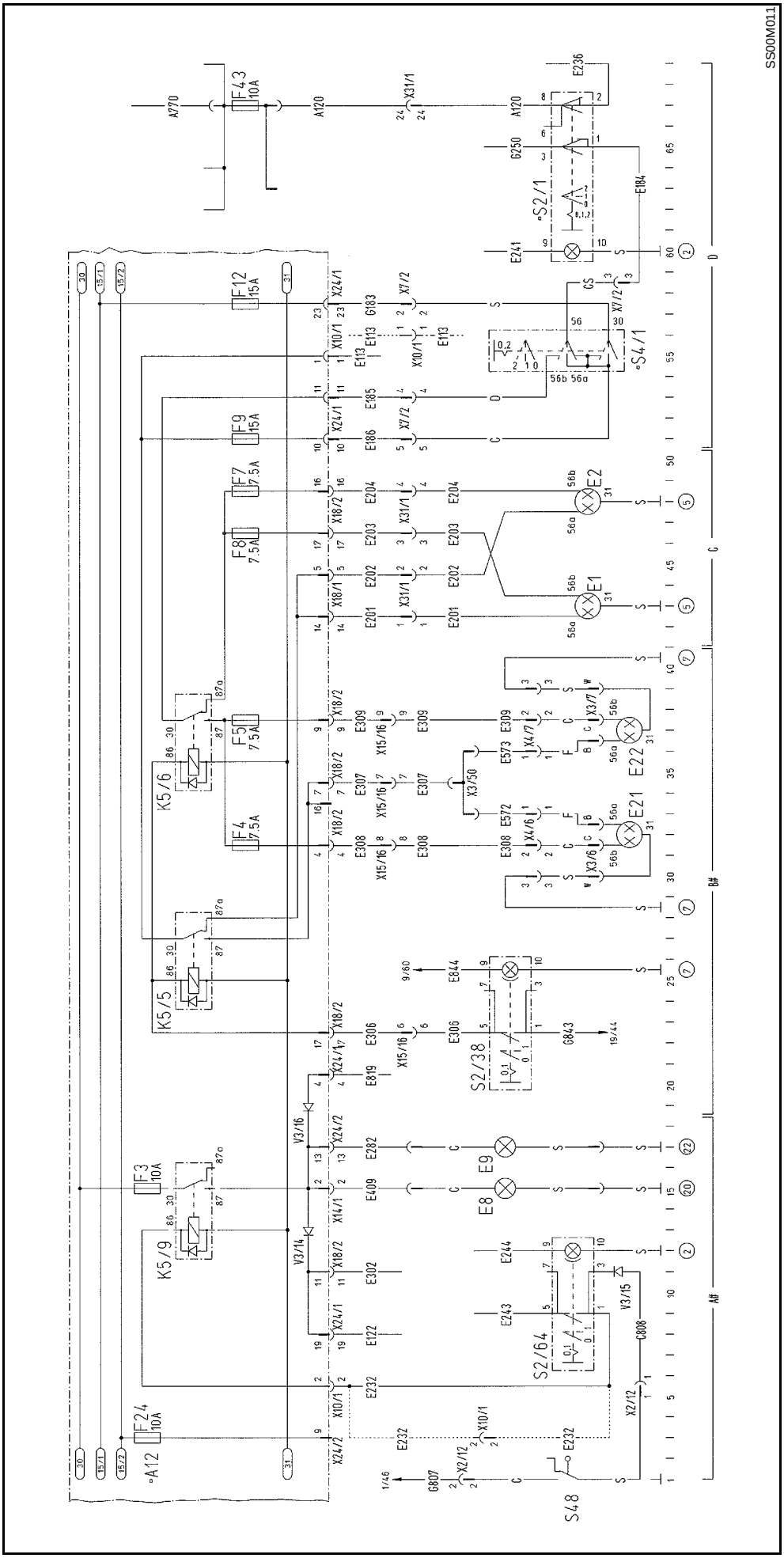
A#	Searchlight, mudguard
B#	Auxiliary headlight, high-top
C	Headlight
D	Dipped/main beam switchover
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
E1	Headlight, left
E2	Headlight, right
E8	Searchlight, left-hand mudguard
E9	Searchlight, right-hand mudguard
E21	Auxiliary headlight, left
E22	Auxiliary headlight, right
F3	Fuse, searchlight, mudguard
F4	Fuse, dipped beam, right, auxiliary headlight, left
F5	Fuse, dipped beam, right, auxiliary headlight, right
F7	Fuse, dipped beam, headlight, right
F8	Fuse, dipped beam, headlight, left
F9	Fuse, main-beam
F12	Fuse, headlight flasher
F24	Fuse, searchlight/ reversing light
F43	Fuse, supply, potential 58
K5/5	Relay, switchover, main beam
K5/6	Relay, switchover, dipped beam
K5/9	Relay, searchlight, mudguard
S2/1	Switch, lighting system
S2/38	Switch, auxiliary headlight
S2/64	Switch, searchlight, mudguard
S4/1	Switch, steering column, main/dipped beam
S48	Switch, reverse gear
V3/14	Diode 0.1A interlock
V3/15	Diode 0.1A interlock
V3/16	Diode 0.1A interlock
X2/12	Switch, searchlight, reversing light
X3/6	Flat plug-in connection, auxiliary headlight
X3/7	Flat plug-in connection, auxiliary headlight
X3/50	Distributor, low-top, potential 58
X4/6	Plug-in connection, roof canopy - auxiliary headlight
X4/7	Plug-in connection, roof canopy - auxiliary headlight
X7/2	Plug-in connection, instrument – steering column
X10/1	Plug-in connection, instrument cable
X14/1	Plug-in connection, cable, chassis, left
X15/16	Plug-in connection, roof supply
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply
X24/1	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right
X31/1	Plug-in connection, instrument – engine

VERSIONS
to this page
11
on page/pages
10

Grounding points

2	Instrument panel
5	Engine compartment
7	Roof panel
20	EHR box console
22	E box console

Designation of Sections

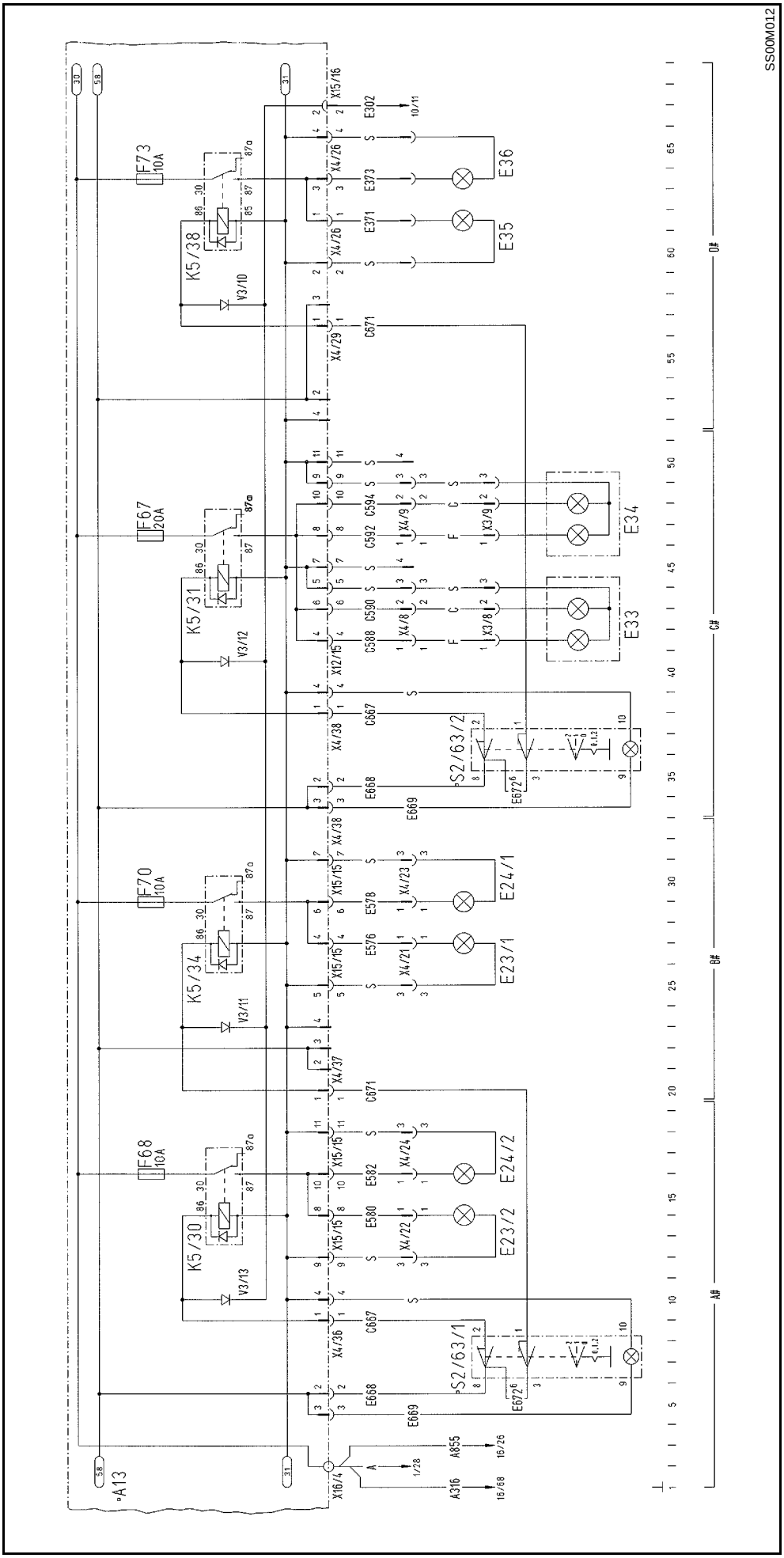
A#	Searchlight, mudguard reversing light
B#	Auxiliary headlight, low-top
C	Headlight
D	Dipped/main beam switchover
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A13	Print, roof electrics
E23/1	Searchlight, roof, rear, inner
E23/2	Searchlight, roof, rear, outer
E24/1	Searchlight, roof, rear, inner
E24/2	Searchlight, roof, rear, outer
E33	Searchlight, roof, front, twin power
E34	Searchlight, roof, front, twin power
E35	Searchlight on the trafficator/position light
E36	Searchlight on the fixing bracket
F67	Fuse, searchlight, twin power
F68	Fuse, 2 searchlights, rear
F70	Fuse, for 4 searchlights, roof number plate lighting
F73	Fuse, searchlight trafficator/position light
K5/30	Relay, 2 searchlights, roof, rear outer
K5/31	Relay, searchlight, twin power
K5/34	Relay, for 4 searchlights, roof number plate lighting
K5/38	Relay, searchlight, trafficator/position light
S2/63/1	Switch, rear searchlight, 2+2
S2/63/2	Switch, front searchlight, 2+2
V3/10	Diode 3A interlock
V3/11	Diode 3A interlock
V3/12	Diode 3A interlock
V3/13	Diode 3A interlock

X3/8	Flat plug-in connection, twin power searchlight
X3/9	Flat plug-in connection, twin power searchlight
X4/8	Plug-in connection, roof canopy, Searchlight
X4/9	Plug-in connection, roof canopy, Searchlight
X4/21	Plug-in connection, roof canopy cable
X4/22	Plug-in connection, roof canopy cable
X4/23	Plug-in connection, roof canopy cable
X4/24	Plug-in connection, roof canopy cable
X4/26	Plug-in connection, roof frame
X4/29	Plug-in connection, roof switch
X4/36	Plug-in connection, roof switch
X4/37	Plug-in connection, roof switch
X4/38	Plug-in connection, roof switch
X12/15	Plug-in connection, roof canopy cable
X15/15	Plug-in connection, roof canopy cable
X15/16	Plug-in connection, roof supply
X16/4	Screw-on connector, roof print 30

VERSIONS
to this page
12
on page/pages
13

Grounding points

Designation of Sections

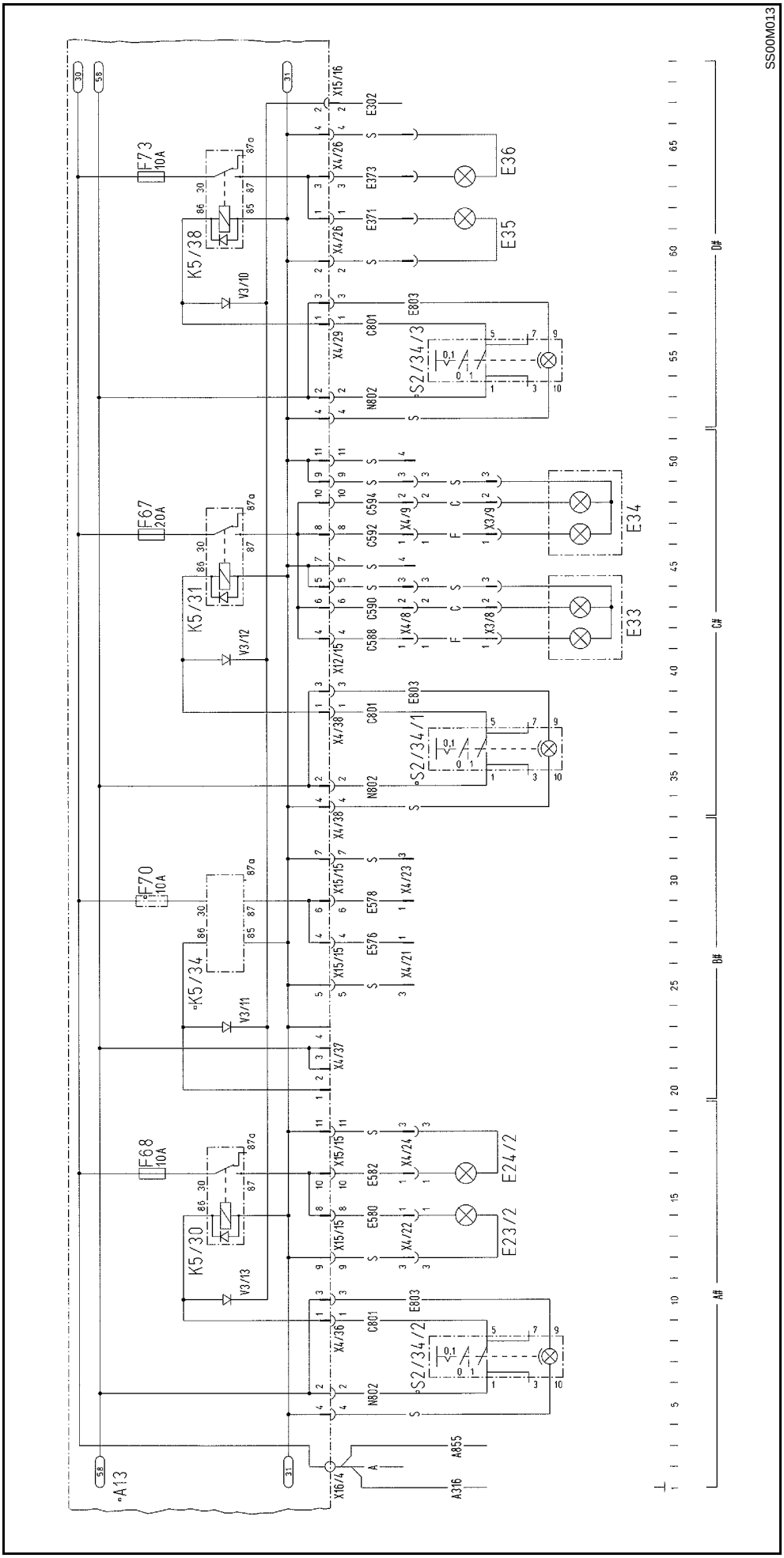
A#	Searchlight, high-top, rear, outer
B#	Searchlight, high-top, rear, inner
C#	Searchlight, high-top, front, twin power
D#	Searchlight on the trafficator/position light
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A13	Print, roof electrics
E23/2	Searchlight, roof, rear, outer
E24/2	Searchlight, roof, rear, outer
E33	Searchlight, roof, front, twin power
E34	Searchlight, roof, front, twin power
E35	Searchlight on the trafficator/position light
E36	Searchlight on the fixing bracket
F67	Fuse, searchlight, twin power
F68	Fuse, 2 searchlights, rear
F70	Fuse, for 4 searchlights, roof number plate
F73	Fuse, searchlight trafficator/position light
K5/30	Relay, 2 searchlights, roof, rear outer
K5/31	Relay, searchlight, twin power
K5/34	Fuse, for 4 searchlights, roof number plate
K5/38	Relay, searchlight, trafficator/position light
S2/34/1	Switch, searchlight, twin power
S2/34/2	Switch, 2 searchlights, roof, rear
S2/34/3	Switch, searchlight trafficator/position light
V3/10	Diode 3A interlock
V3/11	Diode 3A interlock
V3/12	Diode 3A interlock
V3/13	Diode 3A interlock
X3/8	Flat plug-in connection, twin power searchlight
X3/9	Flat plug-in connection, twin power searchlight
X4/8	Plug-in connection, roof canopy, Searchlight
X4/9	Plug-in connection, roof canopy, Searchlight
X4/21	Plug-in connection, roof canopy cable
X4/22	Plug-in connection, roof canopy cable
X4/23	Plug-in connection, roof canopy cable
X4/24	Plug-in connection, roof canopy cable
X4/26	Plug-in connection, roof frame
X4/29	Plug-in connection, roof switch
X4/36	Plug-in connection, roof switch
X4/37	Plug-in connection, roof switch
X4/38	Plug-in connection, roof switch
X12/15	Plug-in connection, roof canopy cable
X15/15	Plug-in connection, roof canopy cable
X15/16	Plug-in connection, roof supply
X16/4	Screw-on connector, roof print 30

VERSIONS
to this page
13
on page/pages
12

Grounding points

Designation of Sections

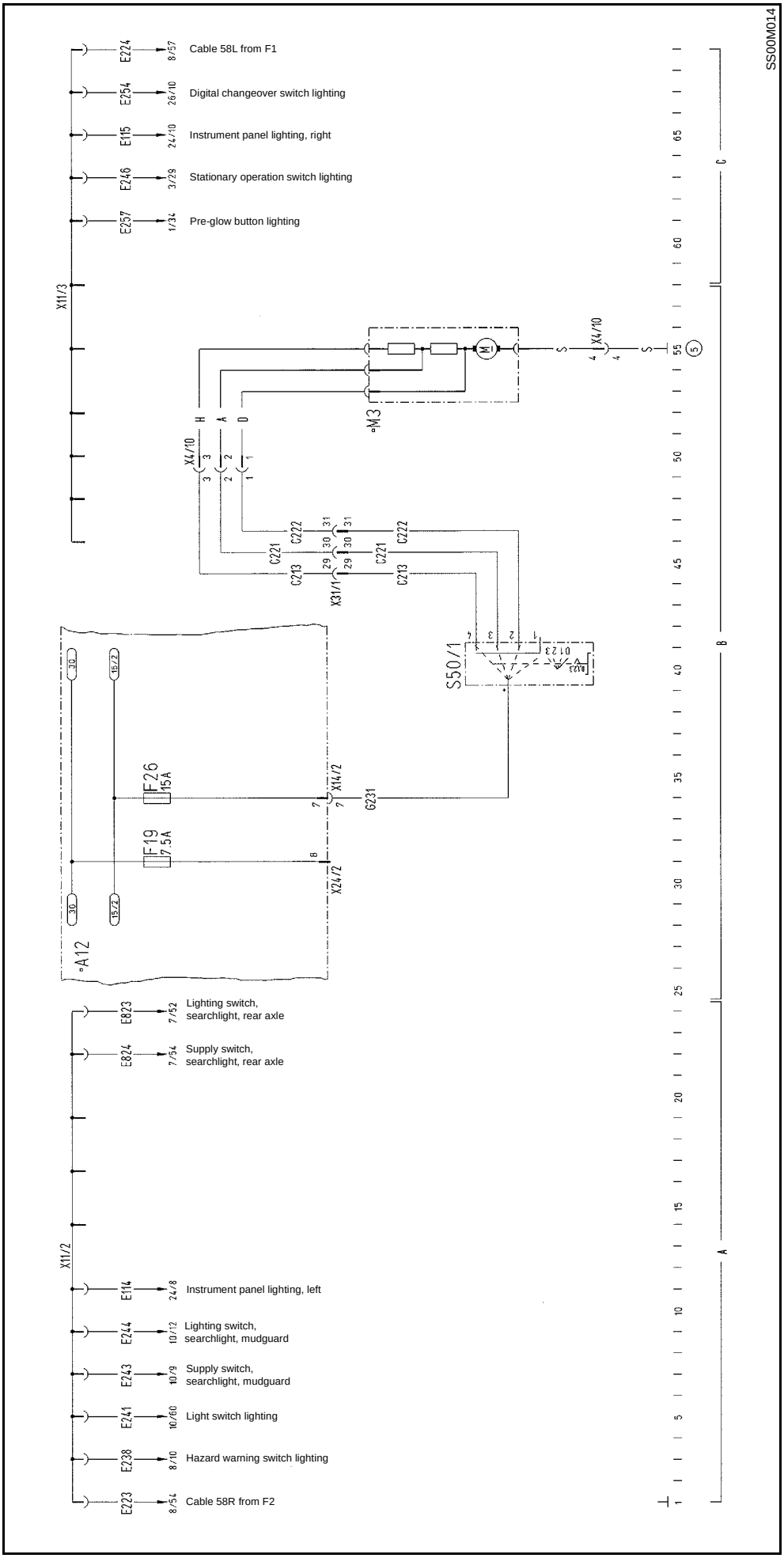
A#	2 Searchlights, high-top, rear, outer
B#	Number plate lighting, roof searchlight
C#	Searchlight, high-top, front, twin power
D#	Searchlight on the trafficator/position light
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
F19	Fuse, searchlight rear axle
F26	Fuse, heating
M3	Heater blower motor
S50/1	Switch, 3-stage blower motor
X4/10	Plug-in connection, flat, engine heating
X11/2	Distributor, instrument potential 58, left
X11/3	Distributor, instrument potential 58, right
X14/2	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right
X31/1	Plug-in connection, instrument – engine

Grounding points

5 Engine compartment

Designation of Sections

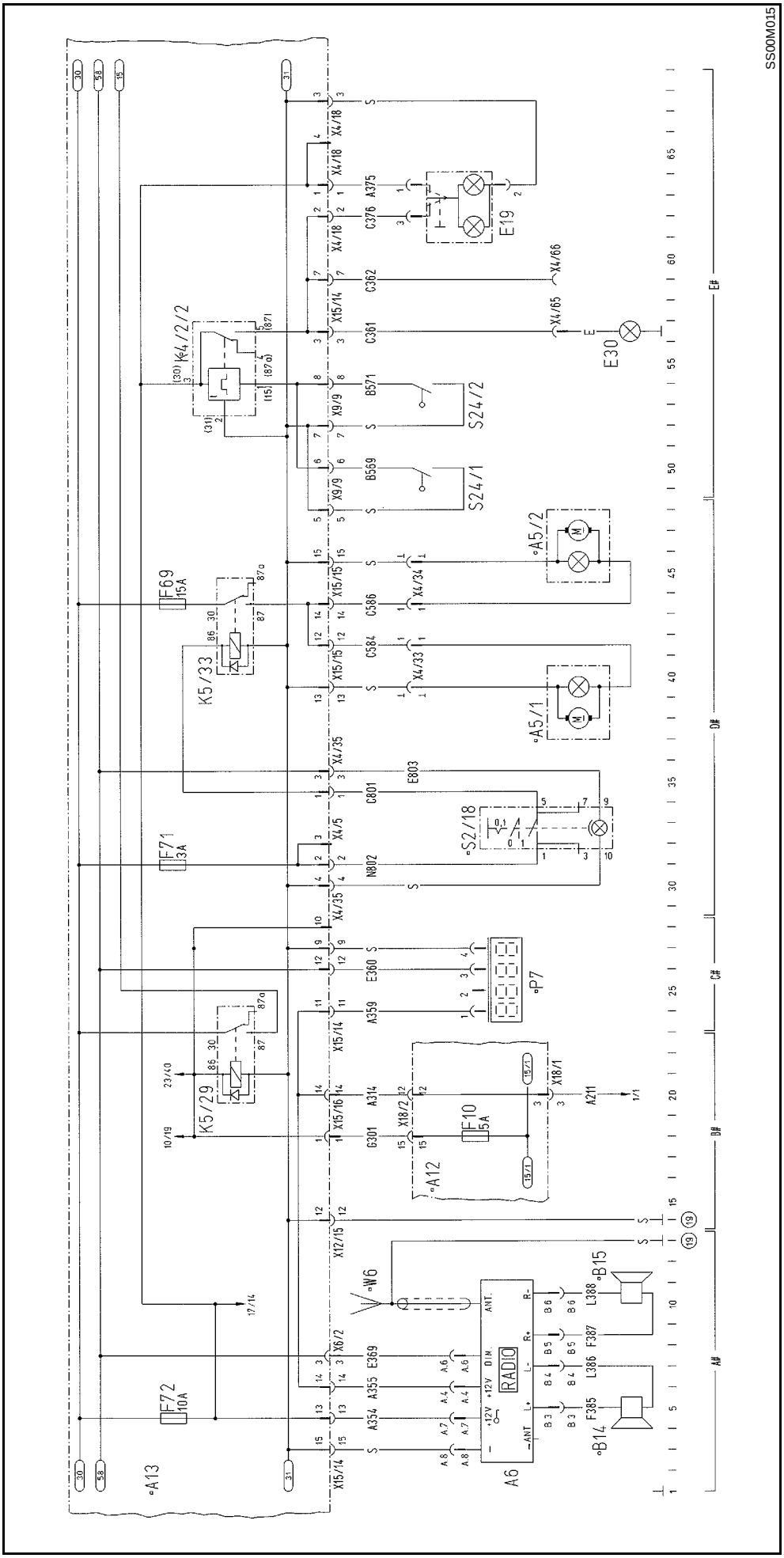
A	Supply potential 58, instrument, left
C	Foot-well heating
C	Supply potential 58, instrument, right

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A5/1	Rotating beacon, left
A5/2	Rotating beacon, right
A6	Radio
A12	Central print
A13	Print, roof electrics
B14	Right-hand loudspeaker
B15	Left-hand loudspeaker
E19	Interior lighting
E30	Step light, left
F10	Fuse, roof, potential 15
F69	Fuse, rotating beacon
F71	Fuse, potential 30
F72	Fuse, spot, interior lighting, heated mirror
K4/2/2	Timed relay, 40 sec's. interior lighting
K5/29	Relay, roof print, potential 15
K5/33	Relay, rotating beacon
P7	Digital clock
S2/18	Switch, rotating beacon
S24/1	Switch, door contact
S24/2	Switch, door contact
W6	Aerial
X4/5	Plug-in connection, roof frame
X4/18	Plug-in connection, roof frame
X4/33	Plug-in connection, rotating beacon, left
X4/34	Plug-in connection, rotating beacon, right
X4/35	Plug-in connection, switch, rotating beacon
X4/65	Plug-in connection, roof frame, trafficator/position light, left
X4/66	Plug-in connection, roof frame, trafficator/position light, right
X6/2	Plug-in connection, roof frame
X9/9	Plug-in connection, roof canopy cable
X12/15	Plug-in connection, roof canopy cable
X15/14	Plug-in connection, roof frame
X15/15	Plug-in connection, roof canopy cable
X15/16	Plug-in connection, roof supply
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply

VERSIONS
to this page
15
on page/pages
16

Grounding points

19	Shock absorber, roof

Designation of Sections

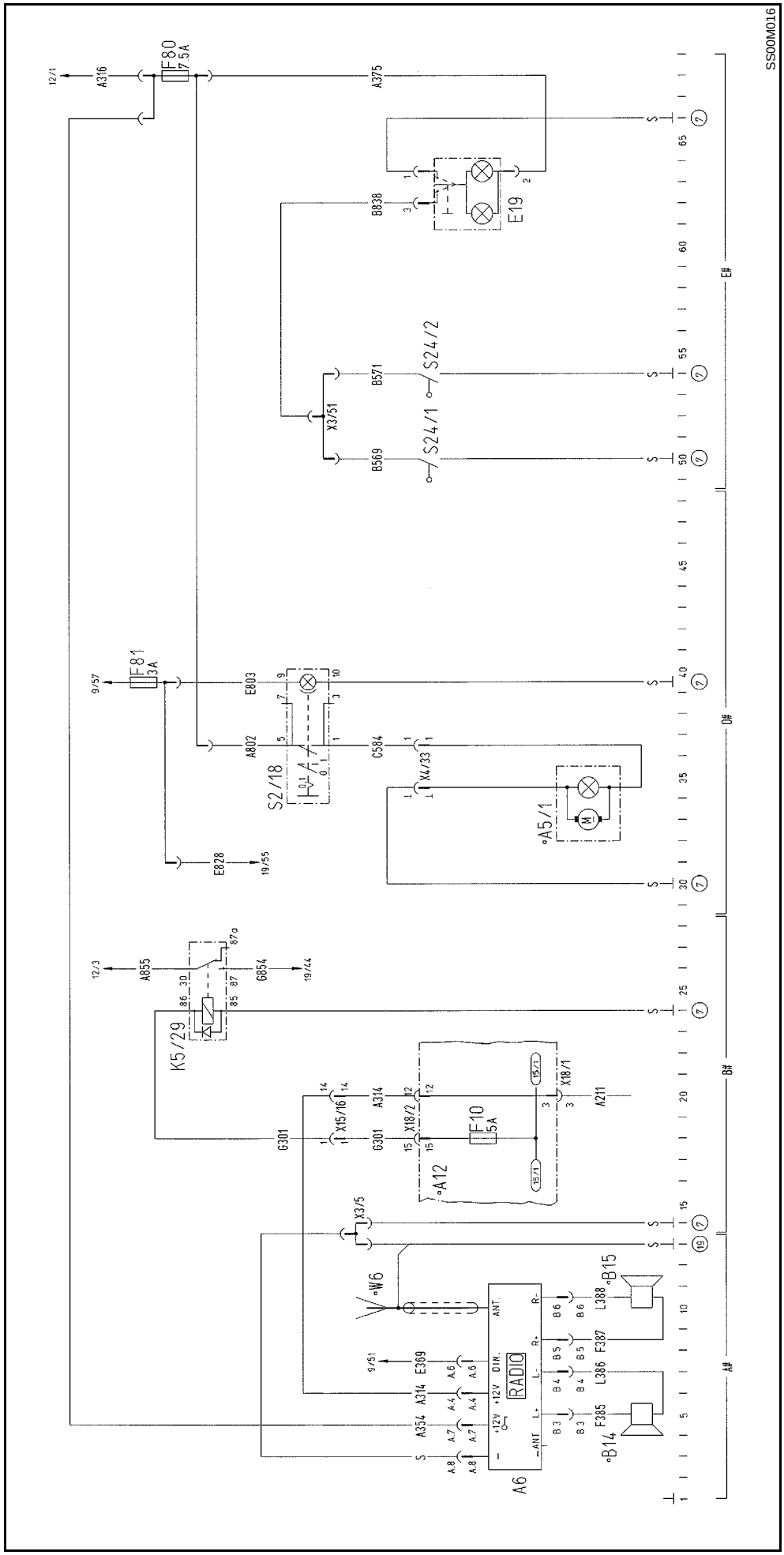
A#	Radio preparation, high-top
B#	Supply potential 15, high-top
C#	Digital clock, high-top
D#	Rotating beacon, high-top
E#	Step, interior lighting, high-top
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A5/1	Rotating beacon, left
A6	Radio
A12	Central print
B14	Right-hand loudspeaker
B15	Left-hand loudspeaker
E19	Interior lighting
F10	Fuse, roof, potential 15
F80	Fuse, interior light, rotating beacon
F81	Fuse, rear lighting switch, rear washer/wiper
K5/29	Relay, roof print, potential 15
S2/18	Switch, rotating beacon
S24/1	Switch, door contact
S24/2	Switch, door contact
W6	Aerial
X3/5	Distributor, aerial ground, low-top
X3/51	Distributor, low-top door contact
X4/33	Socket, rotating beacon, left
X15/16	Plug-in connection, roof supply
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply

VERSIONS
to this page
16
on page/pages
15

Grounding points

7	Roof panel
19	Shock absorber, roof

Designation of Sections

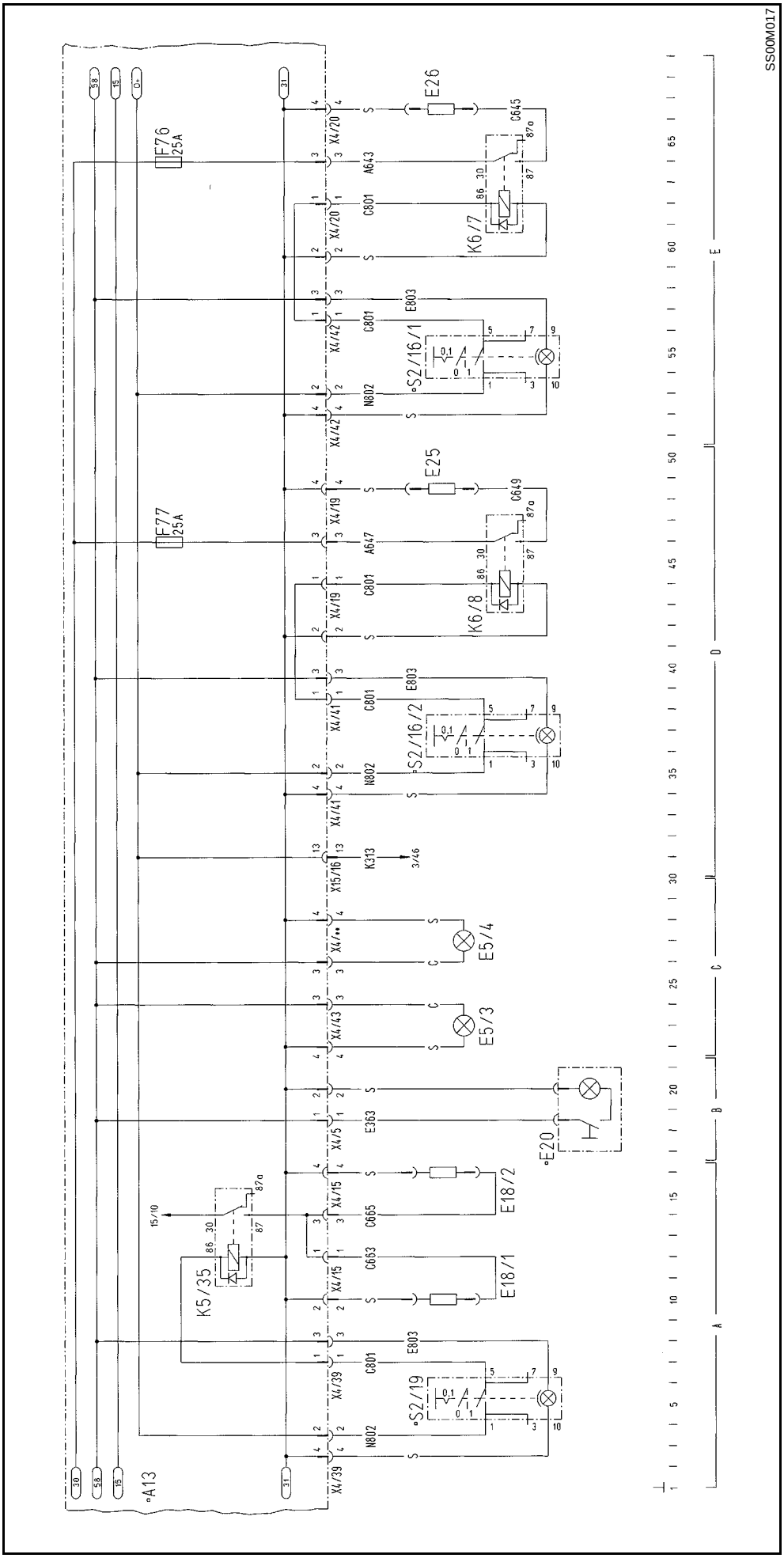
A#	Radio preparation, low-top
B#	Supply potential 15, low-top
D#	Rotating beacon, low-top
C#	Interior lighting, low-top
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

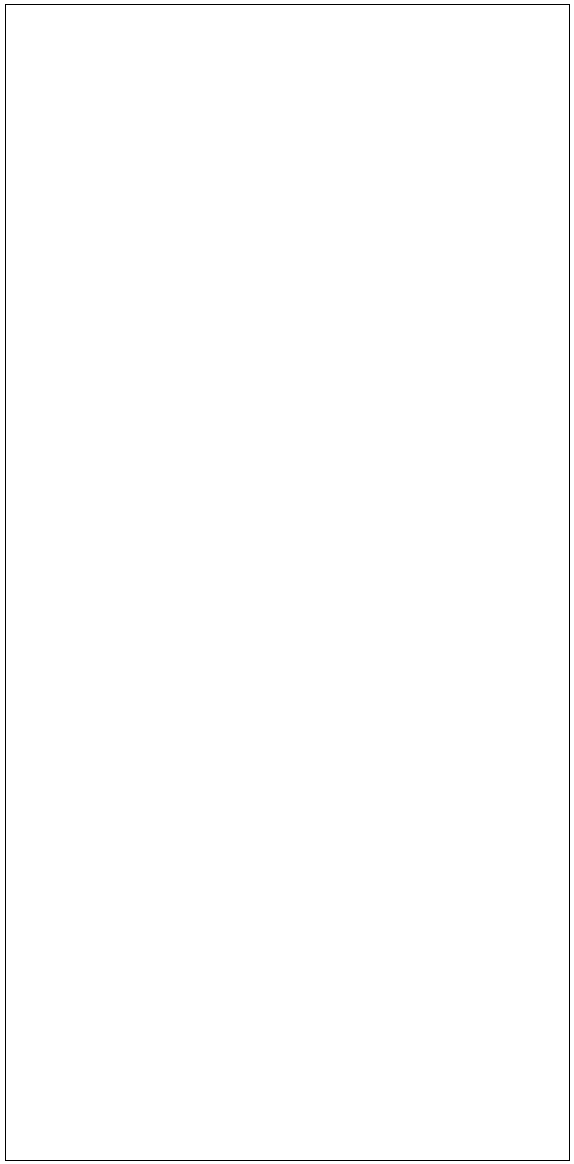
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Electrical equipment

A13	Print, roof electrics
E5/3	Lighting, number plate, roof
E5/4	Lighting, number plate, roof
E18/1	Heated mirror, left
E18/2	Heated mirror, right
E20	Spot
E25	Heated windscreen
E26	Heated rear window
E76	Fuse, heated rear window
E77	Fuse, heated windscreen
K5/35	Relay, heated mirror
K6/7	Relay, heated rear window
K6/8	Relay, heated windscreen
S2/16/1	Switch, heated rear window
S2/16/2	Switch, heated windscreen
S2/19	Switch, heated screen
X4/5	Plug-in connection, roof frame
X4/15	Plug-in connection, mirror heating
X4/19	Plug-in connection, heated windscreen
X4/20	Plug-in connection, heated rear window
X4/39	Plug-in connection, roof switch
X4/41	Plug-in connection, roof switch
X4/42	Plug-in connection, roof switch
X4/43	Plug-in connection, number plate lighting
X4/..	Plug-in connection, roof switch
X15/16	Plug-in connection, roof supply



Grounding points

Designation of Sections

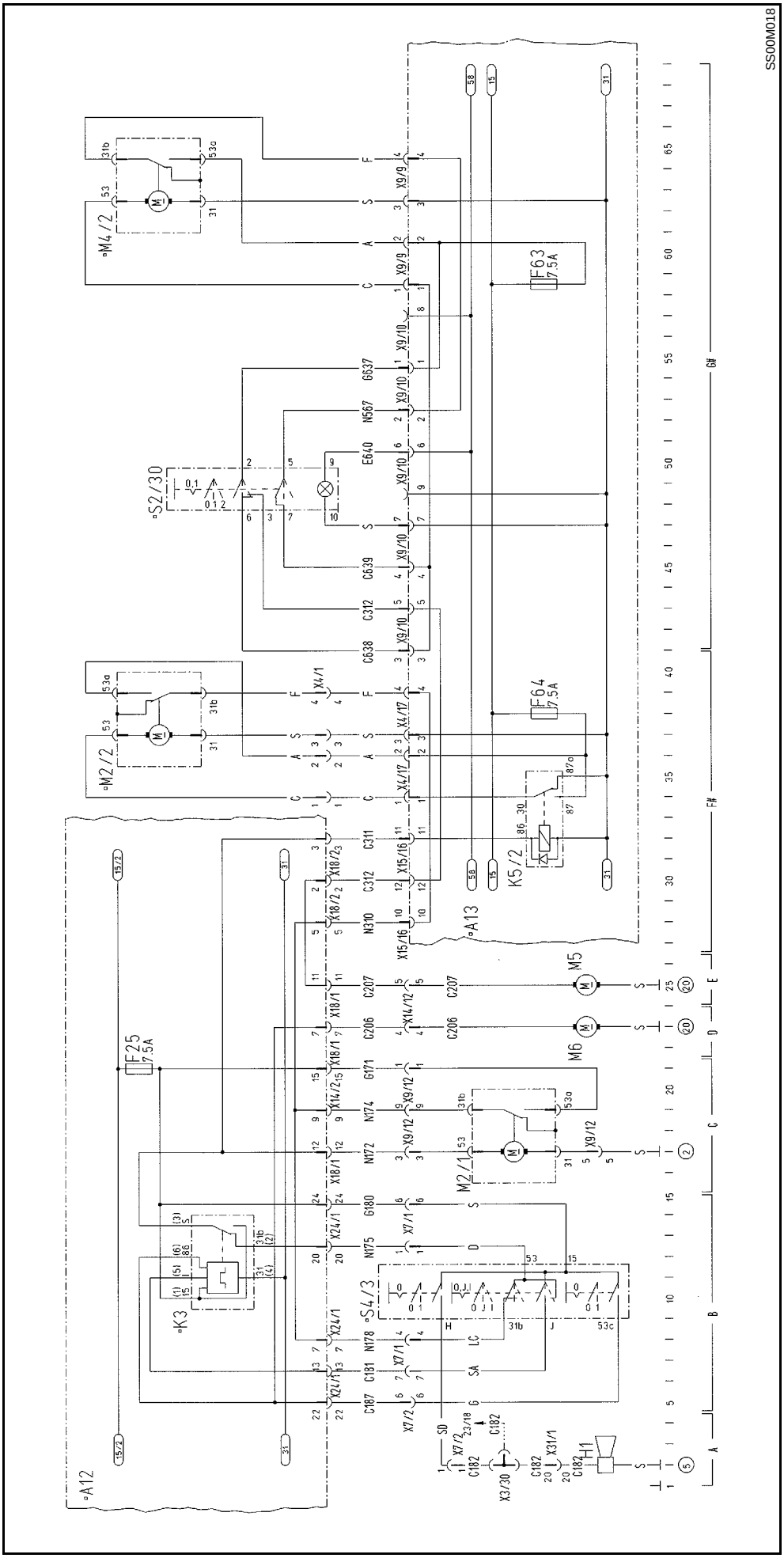
A	Mirror heating, high-top
B	Spot, high-top
C	Roof number plate lighting, high-top
D	Heated windscreen, high-top
E	Heated rear window, high-top

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
A13	Print, roof electrics
F25	Fuse, wiper, horn
F63	Fuse, rear wiper
F64	Fuse, wiper, hinged windscreen
H1	Horn
K3	Interval relay
K5/2	Relay, roof-mounted wiper, front
M2/1	Parallel wiper motor, front
M2/2	Standard wiper motor, front
M4/2	Standard wiper motor, rear
M5	Washer pump motor, rear
M6	Washer pump motor, front
S2/30	Switch, rear washer/wiper
S4/3	Switch, steering column, washer/wiper
X3/30	Plug-in connection, horn, reversing facility
X4/1	Plug-in connection, roof frame
X4/17	Plug-in connection, roof frame
X7/1	Plug-in connection, instrument – steering column
X7/2	Plug-in connection, instrument – steering column
X9/9	Plug-in connection, roof canopy cable
X9/10	Plug-in connection, rear wiper
X9/12	Plug-in connection, instrument – wiper
X14/2	Plug-in connection, instrument cable
X14/12	Plug-in connection, instrument cable chassis, left
X15/16	Plug-in connection, roof supply
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply
X24/1	Plug-in connection, instrument cable
X31/1	Plug-in connection, instrument – engine

VERSIONS
to this page
18
on page/pages
19

Grounding points

2	Instrument panel
5	Engine compartment
20	EHR box console

Designation of Sections

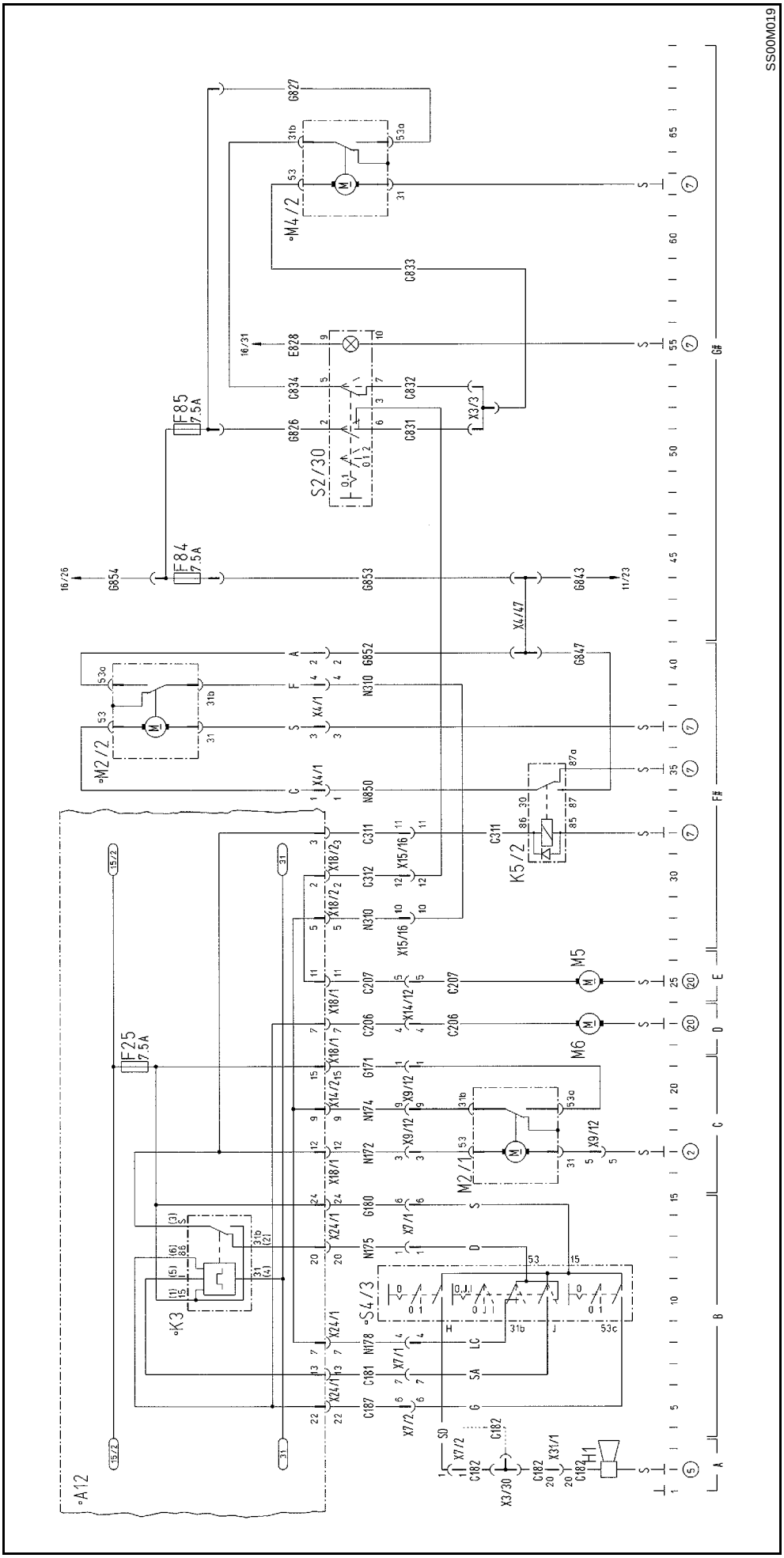
A	Horn
B	Steering column switch
C	Parallel wiper, front
D	Washer pump, front
E	Washer pump, rear
F#	Standard wiper, front, high-top
G#	Standard wiper, rear, high-top
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
F25	Fuse, wiper, horn
F84	Fuse, auxiliary headlight and front wiper
F85	Fuse, rear wiper
H1	Horn
K3	Interval relay
K5/2	Relay, roof-mounted wiper, front
M2/1	Parallel wiper motor, front
M2/2	Standard wiper motor, front
M4/2	Standard wiper motor, rear
M5	Washer pump motor, rear
M6	Washer pump motor, front
S2/30	Switch, rear washer/wiper
S4/3	Switch, steering column, washer/wiper
X3/3	Distributor rear washer/wiper, low-top
X4/1	Plug-in connection, roof frame
X3/47	Distributor, low-top, potential 15
X7/1	Plug-in connection, instrument – steering column
X7/2	Plug-in connection, instrument-steering column
X9/12	Plug-in connection, instrument – wiper
X14/2	Plug-in connection, instrument cable
X14/12	Plug-in connection, instrument cable chassis, left
X15/16	Plug-in connection, roof supply
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply
X24/1	Plug-in connection, instrument cable
X31/1	Plug-in connection, instrument – engine

VERSIONS
to this page
19
on page/pages
18

Grounding points

2	Instrument panel
5	Engine compartment
7	Roof panel
20	EHR box console

Designation of Sections

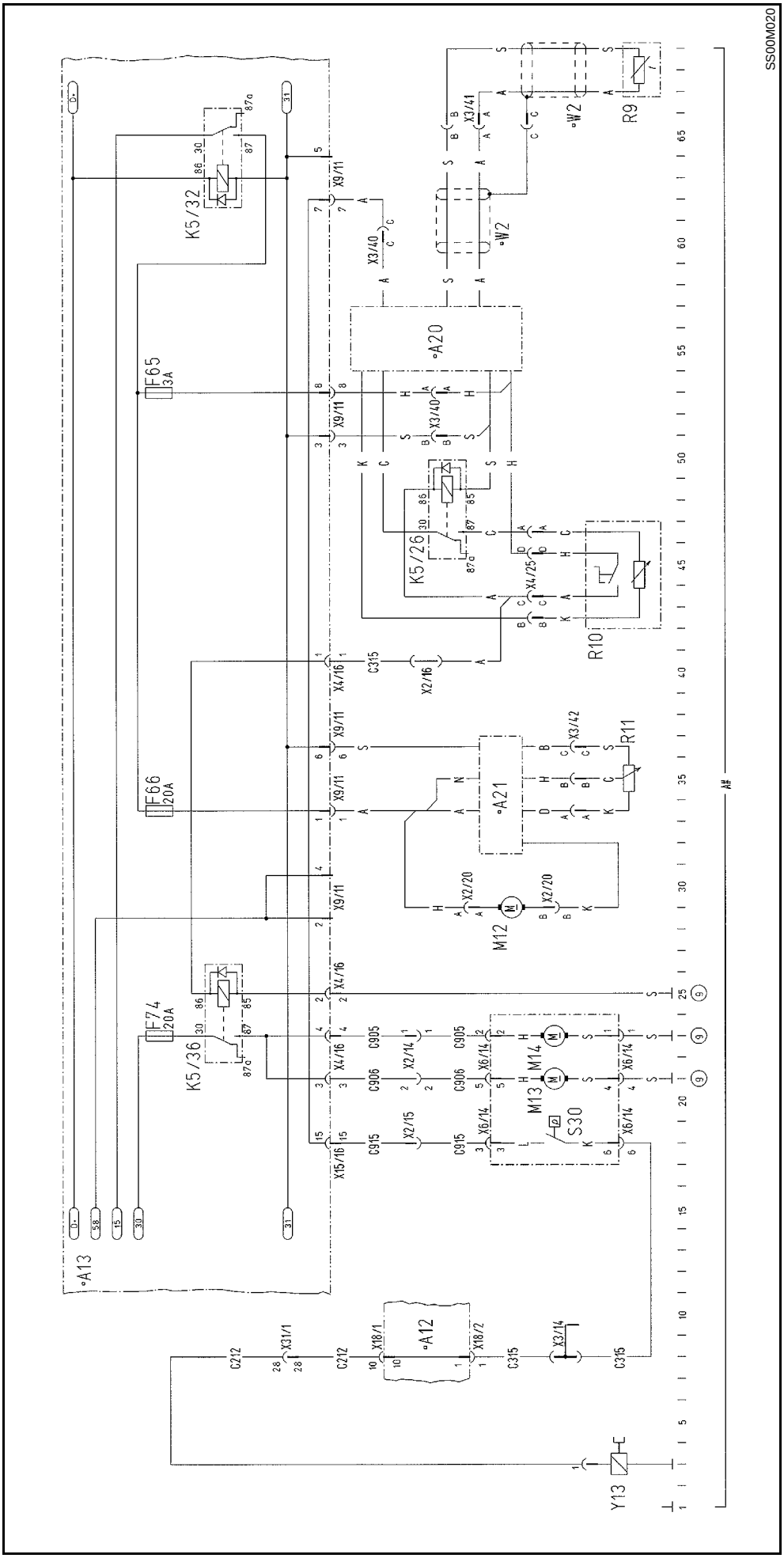
A	Horn
B	Steering column switch
C	Parallel wiper, front
D	Washer pump, front
E	Washer pump, rear
F#	Standard wiper, front, low-top
G#	Standard wiper, rear, low-top
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
A13	Print, roof electrics
A20	Air conditioning control
A21	Blower motor control
F65	Fuse, air conditioning
F66	Fuse, air conditioning, blower motor
F74	Fuse, air-conditioning blower
K5/26	Relay, air conditioning 5V/12V
K5/32	Relay, roof blower motor
K5/36	Relay, air-conditioning blower
M12	Air-conditioning blower motor
M13	Condenser, air conditioning
M14	Condenser, air conditioning
R9	Temperature sensor
R10	Air conditioning control potentiometer
R11	Roof blower motor potentiometer
S30	Switch, air conditioning pressure
W2	Screened cable, air conditioning
X2/14	Plug-in connection, air-conditioning, roof
X2/15	Flat plug-in connection, air-conditioning, roof
X2/16	Flat plug-in connection, air-conditioning, roof
X2/20	Plug-in connection, roof blower
X3/14	Distributor, air-conditioning, roof
X3/40	Plug-in connection, air cond. control
X3/41	Plug-in connection, temperature sensor
X3/42	Plug-in connection, blower potentiometer
X4/16	Plug-in connection, air-conditioning, roof
X4/25	Plug-in connection, air-conditioning potentiometer
X6/14	Plug-in connection, air-conditioning condenser
X9/11	Plug-in connection, roof air cond.
X15/16	Plug-in connection, roof supply
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply
X31/1	Plug-in connection, instrument – engine
Y13	Magnetic coupling, air conditioning

VERSIONS
to this page
20
on page/pages
21

Grounding points

9	Screw down point, roof print

Designation of Sections

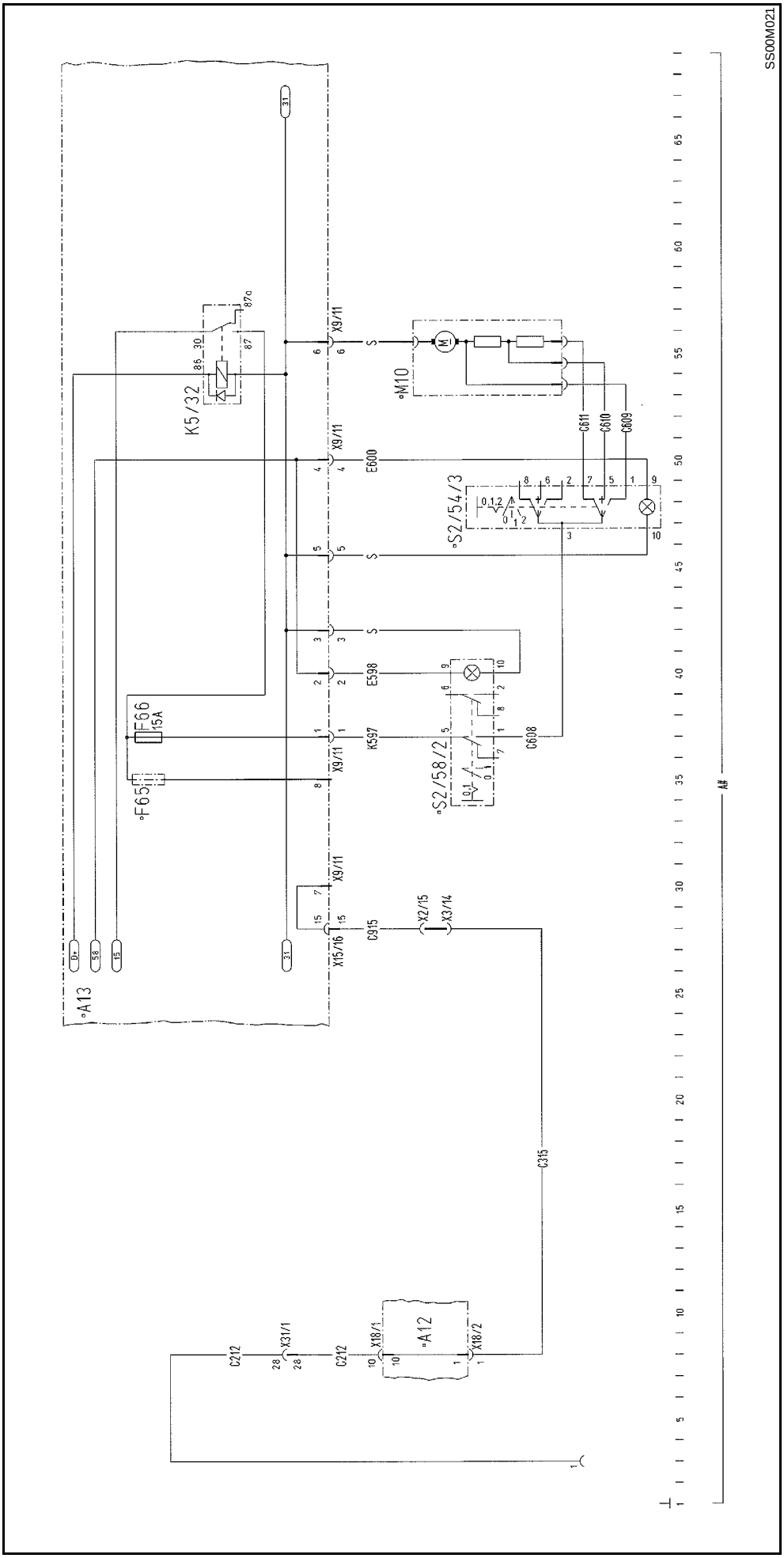
A#	Air-conditioning high-top
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
A13	Print, roof electrics
F65	Fuse, air conditioning
F66	Fuse, air conditioning blower motor
K5/32	Relay, roof blower motor
M10	Roof blower motor
S2/54/3	Switch, blower motor, positions 1-2-3
S2/58/2	Switch, blower motor ON
X2/15	Flat plug-in connection, air-conditioning, roof
X3/14	Distributor, air-conditioning, roof
X9/11	Flat plug-in connection, air-conditioning, roof
X15/16	Plug-in connection, roof supply
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply
X31/1	Plug-in connection, instrument – engine

VERSIONS
to this page
21
on page/pages
20

Grounding points

Designation of Sections

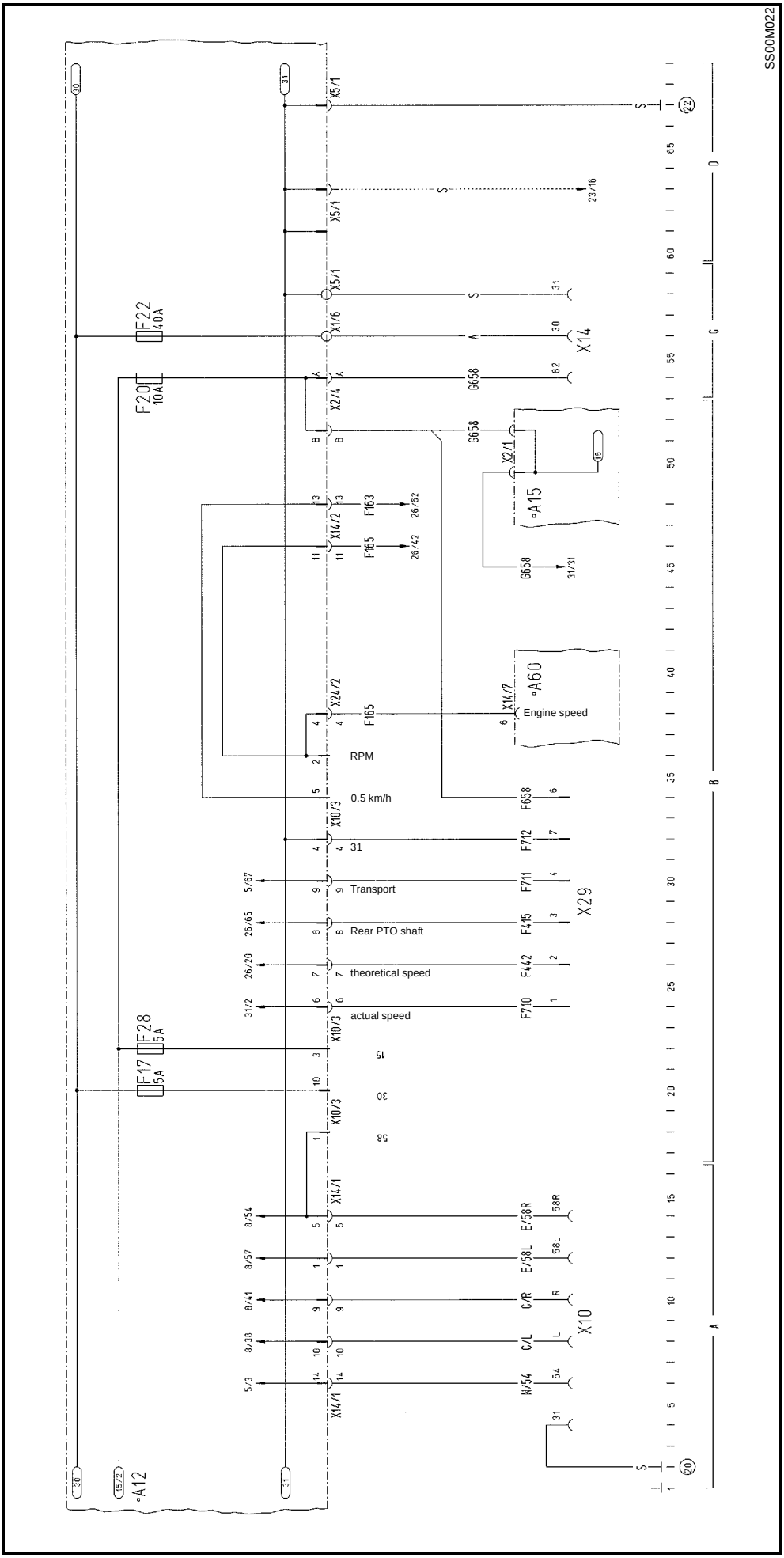
A#	Blower, high-top
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

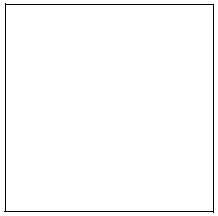
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Electrical equipment

A12	Central print
A15	Print, EHR, left
A60	ECCU (Electrical Central Control Unit)
F17	Fuse, reserve potential 30, (for on-board computer)
F20	Fuse, reserve potential 30
F22	Fuse, power socket
F28	Fuse, reserve potential 15 (for on-board computer)
X1/6	Screw-on connection, power socket
X2/1	Plug-in connection, potential 15, socket
X2/4	Plug-in connection, chassis, right, indicator, PTO-shaft
X5/1	Ground plug-in connection, central print
X10	Plug-in connection, 7-pole, trailer
X10/3	Plug-in connection, preparation for on-board computer
X14	Power socket 40A
X14/1	Plug-in connection, cable, chassis, left
X14/2	Plug-in connection, instrument cable
X14/7	Plug-in connection, chassis right, ECCU
X24/2	Plug-in connection, chassis, right
X29	Standard signal socket



Grounding points

20	EHR box console
22	E box console

Designation of Sections

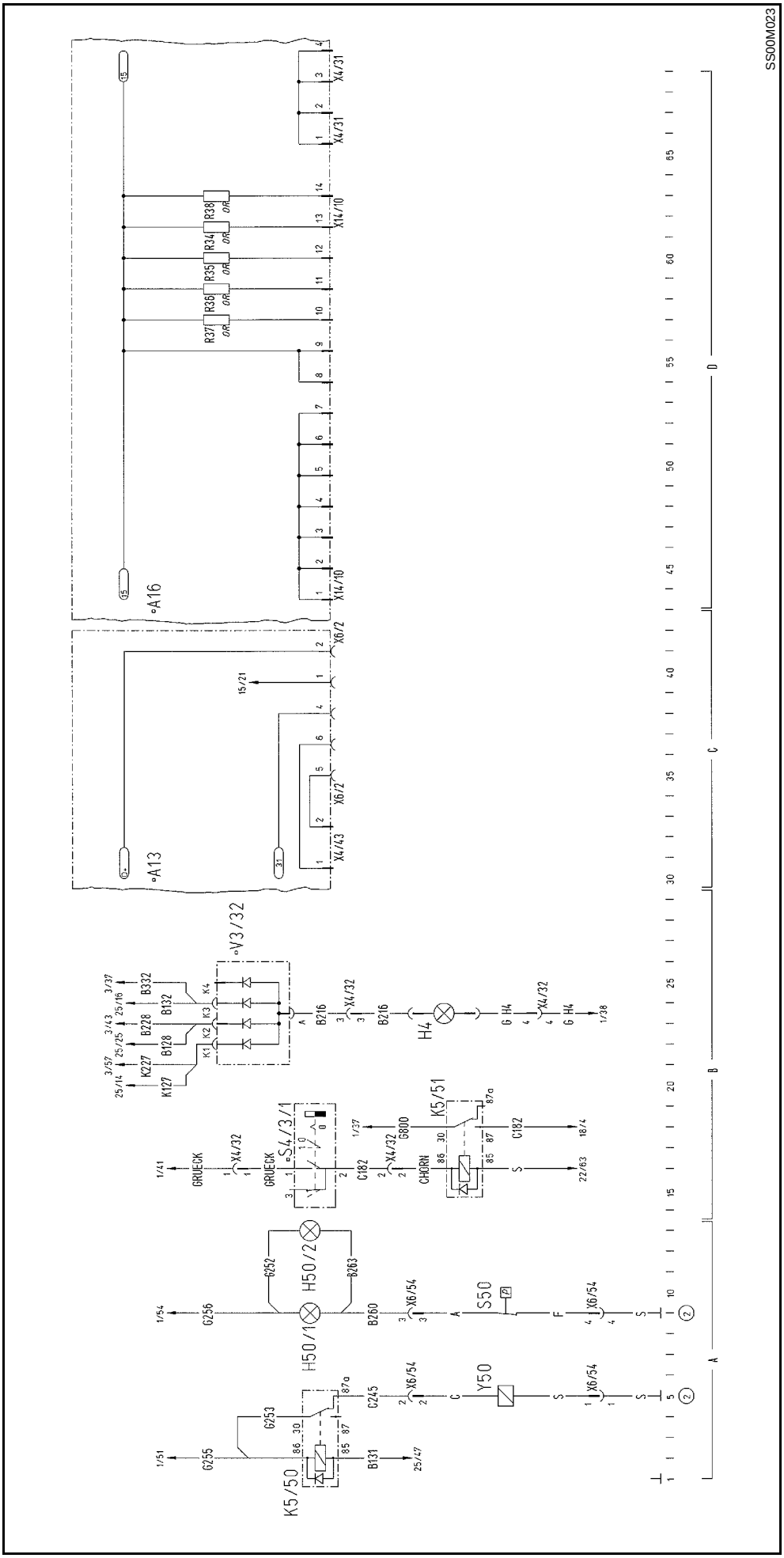
A	Trailer socket
B	Standard signal socket, for MHR or on-board computer preparation
C	Power socket 40A
D	Central print, ground

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

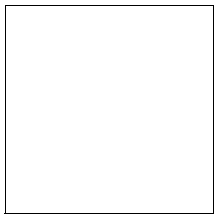
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Electrical equipment

A13	Print, roof electrics
A16	Print, EHR operating console
H4	Indicator lamp/warning lamp, reversing facility
H50/1	Trailer brake indicator
H50/2	Trailer brake indicator
K5/50	Relay, trailer brake valve
K5/51	Horn relay, reversing facility
R34	Resistance, spare, 0 Ohm
R35	Resistance, spare, 0 Ohm
R36	Resistance, spare, 0 Ohm
R37	Resistance, spare, 0 Ohm
R38	Resistance, spare, 0 Ohm
S4/3/1	Horn button, reversing facility
S50	Switch, trailer brake valve
V3/32	Diode group, reversing facility
X4/31	Spare plug-in connection, op. console
X4/32	Plug-in connection, reversing facility
X4/43	Plug-in connection, number plate lighting
X6/2	Plug-in connection, roof frame
X6/54	Plug-in connection, trailer brake valve
X4/10	Plug-in connection, EHR B print, spare
Y50	Trailer brake valve, solenoid valve



Grounding points

2 Instrument panel

Designation of Sections

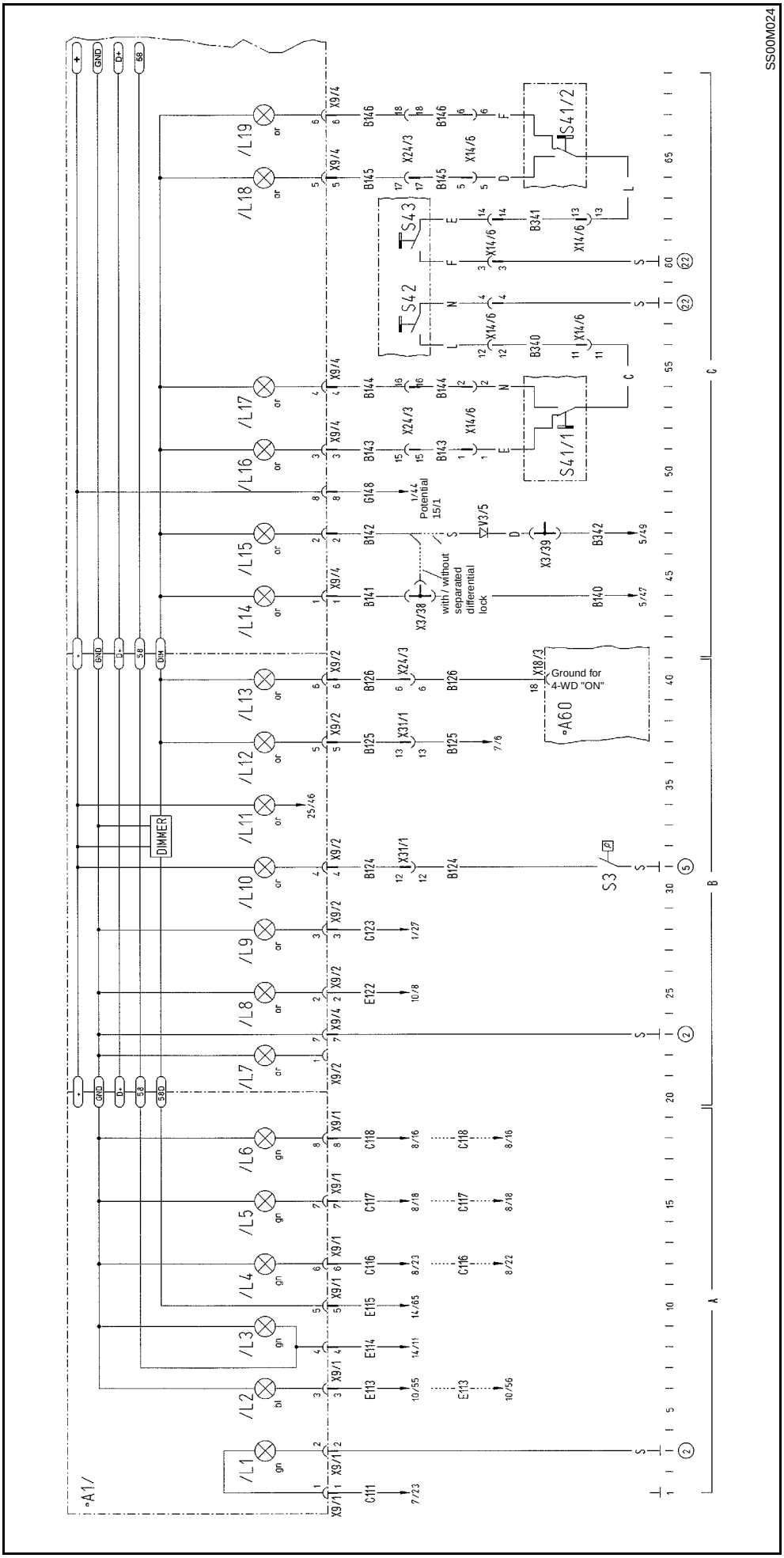
A	Trailer brake valve, Italy
B	Reversing facility
C	Reserve roof print (high-top)
D	Reserve EHR operating console

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

/L1	Indicator, power shift (fast)
/L2	Main beam indicator
/L3	Lighting indicator
/L4	Tractor trafficator indicator
/L5	1st trailer trafficator repeater
/L6	2nd trailer trafficator repeater
/L7	Spare indicator (OR)
/L8	Searchlight indicator
/L9	Thermo-start indicator
/L10	Air filter indicator
/L11	Tank reserve indicator
/L12	Fuel filter heating indicator
/L13	4-wheel drive indicator
/L14	Rear differential lock indicator
/L15	Front differential lock indicator
/L16	430 PTO shaft indicator
/L17	540 PTO shaft indicator
/L18	540E PTO shaft indicator
/L19	1000 PTO shaft indicator
A1	Combination instrument
A60	ECCU (Electrical Central Control Unit)
S3	Switch, air filter indicator
S41/1	Switch, PTO shaft N/E indicator
S41/2	Switch, PTO shaft E/N indicator
S42	Switch, 540 PTO shaft indicator
S43	Switch, 1000 PTO shaft indicator
V3/5	Diode 3A interlock
X3/38	Distributor, differential lock indicator
X3/39	Distributor, indicator, front differential lock
X9/1	Plug-in connection, instrument cable
X9/2	Plug-in connection, instrument cable
X9/4	Plug-in connection, instrument cable
X14/6	Plug-in connection, chassis, right, shaft indicator
X24/3	Plug-in connection, chassis, right, ECCU
X24/3	Plug-in connection, chassis, right, instrument cable
X31/1	Plug-in connection, instrument – engine

Grounding points

2	Instrument panel
5	Engine compartment
22	E box console

Designation of Sections

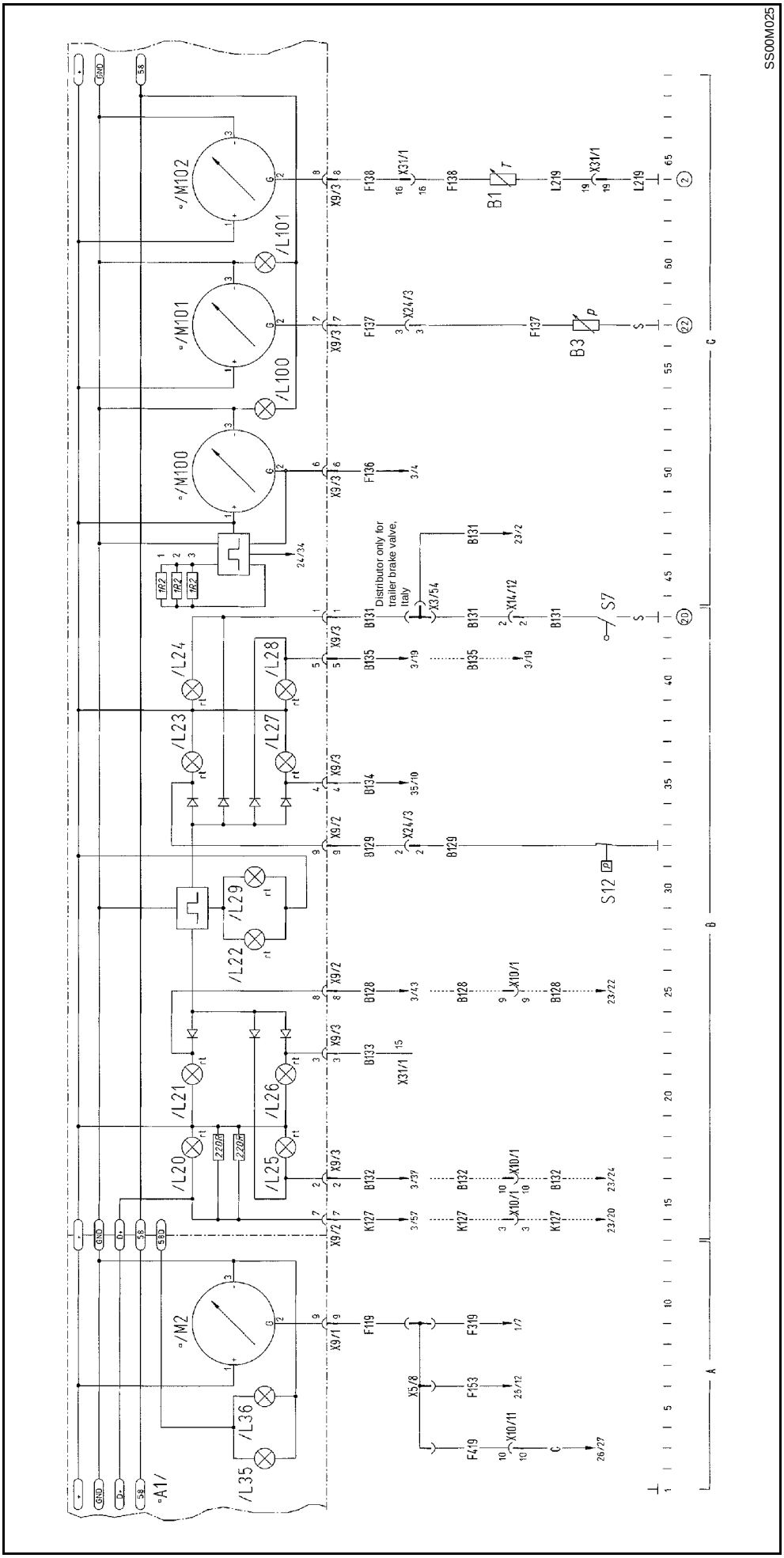
A	Instrument display, left
B	Instrument display, centre
C	Instrument display, right

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

/L20	Alternator charging indicator
/L21	Engine oil pressure indicator
/L22	Stop indicator
/L23	Compressed air indicator
/L24	Handbrake indicator
/L25	Cooling water temperature indicator
/L26	Cooling water level indicator
/L27	PTO shaft clutch indicator
/L28	Stationary operation indicator
/L29	Stop indicator
/L35	Display lighting
/L36	Display lighting
/L100	Display lighting
/L101	Display lighting
/M2	Rev-counter
/M100	Fuel gauge
/M101	Compressed air gauge
/M102	Water temperature gauge
A1	Combination instrument
B1	Engine temperature transmitter
B3	Compressed air transmitter
S7	Switch, handbrake indicator
S12	Switch, compressed air indicator
X3/54	Distributor, trailer brake valve
X5/8	Distributor, instrument potential, dynamo +
X9/1	Plug-in connection, instrument cable
X9/2	Plug-in connection, instrument cable
X9/3	Plug-in connection, instrument cable
X10/1	Plug-in connection, instrument cable
X10/11	Plug-in connection, instrument – transmission
X14/12	Plug-in connection, instrument – chassis left
X24/3	Plug-in connection, chassis, right, instrument cable
X31/1	Plug-in connection, instrument – engine

Grounding points

2	Instrument panel
20	EHR box console
22	E box console

Designation of Sections

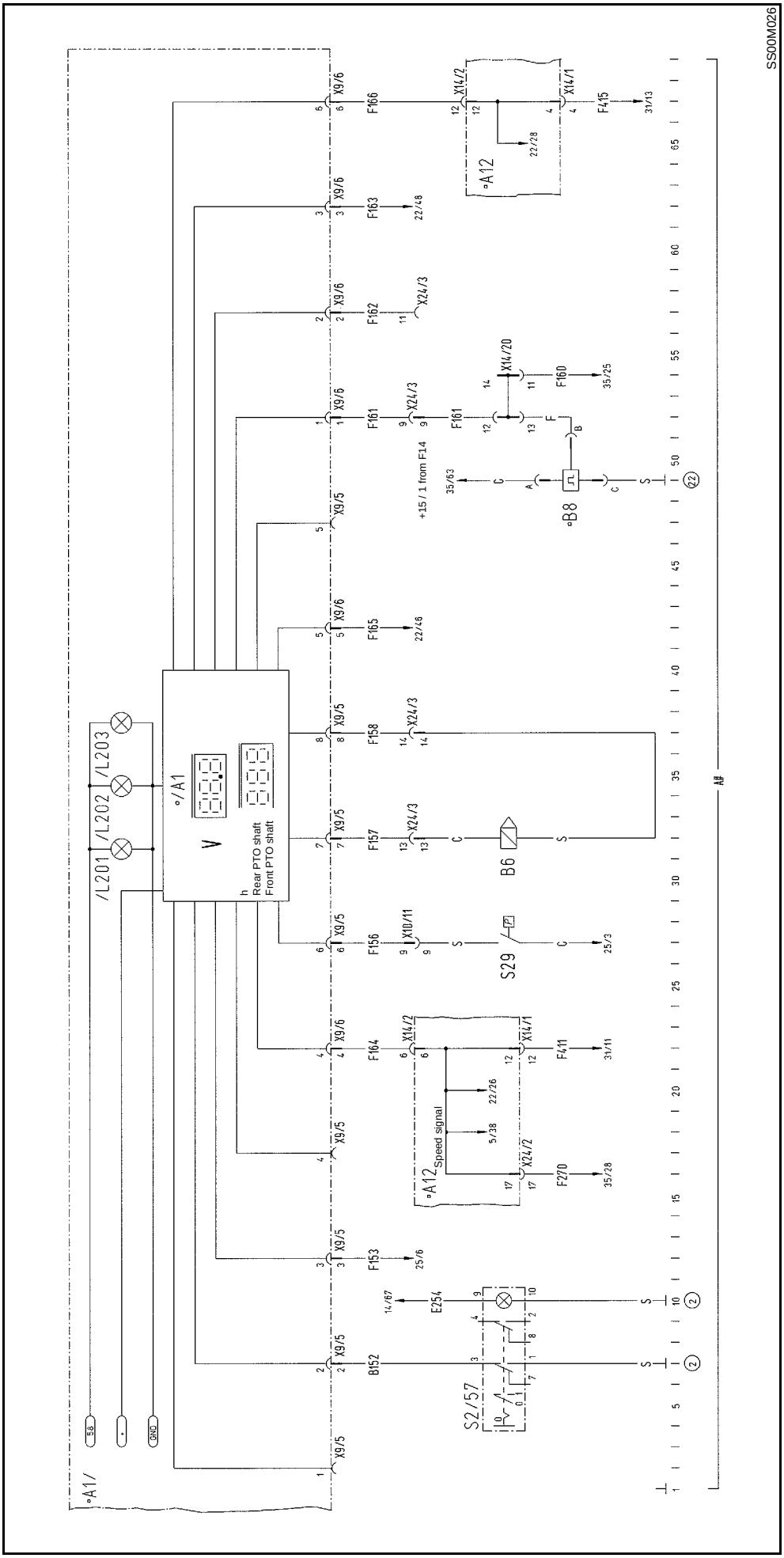
A	Instrument left, analogue
B	Instrument centre, warning indicator
D	Instrument centre, analogue

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

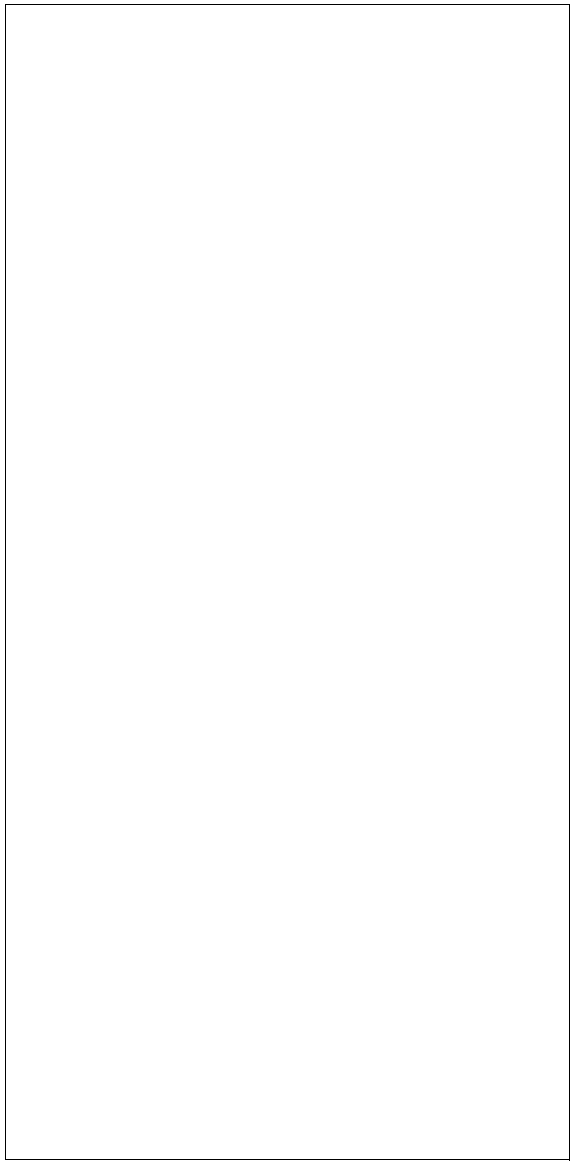
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Electrical equipment

/A1	Digital instrument
/L201	Display lighting
/L202	Display lighting
/L203	Display lighting
A1/	Display lighting
A12	Central print
B6	Inductive transmitter, driving speed
B8	Hall generator, rear PTO shaft
S2/57	Switch, digital changeover
S29	Switch, front PTO shaft
X9/5	Plug-in connection, instrument cable
X9/6	Plug-in connection, instrument cable
X10/11	Plug-in connection, instrument – transmission
X14/1	Plug-in connection, cable, chassis, left
X14/2	Plug-in connection, instrument cable
X14/20	Distributor console, potential 15
X24/2	Plug-in connection, chassis, right
X24/3	Plug-in connection, chassis, right, instrument cable



Grounding points

2	Instrument panel
22	E box console

Designation of Sections

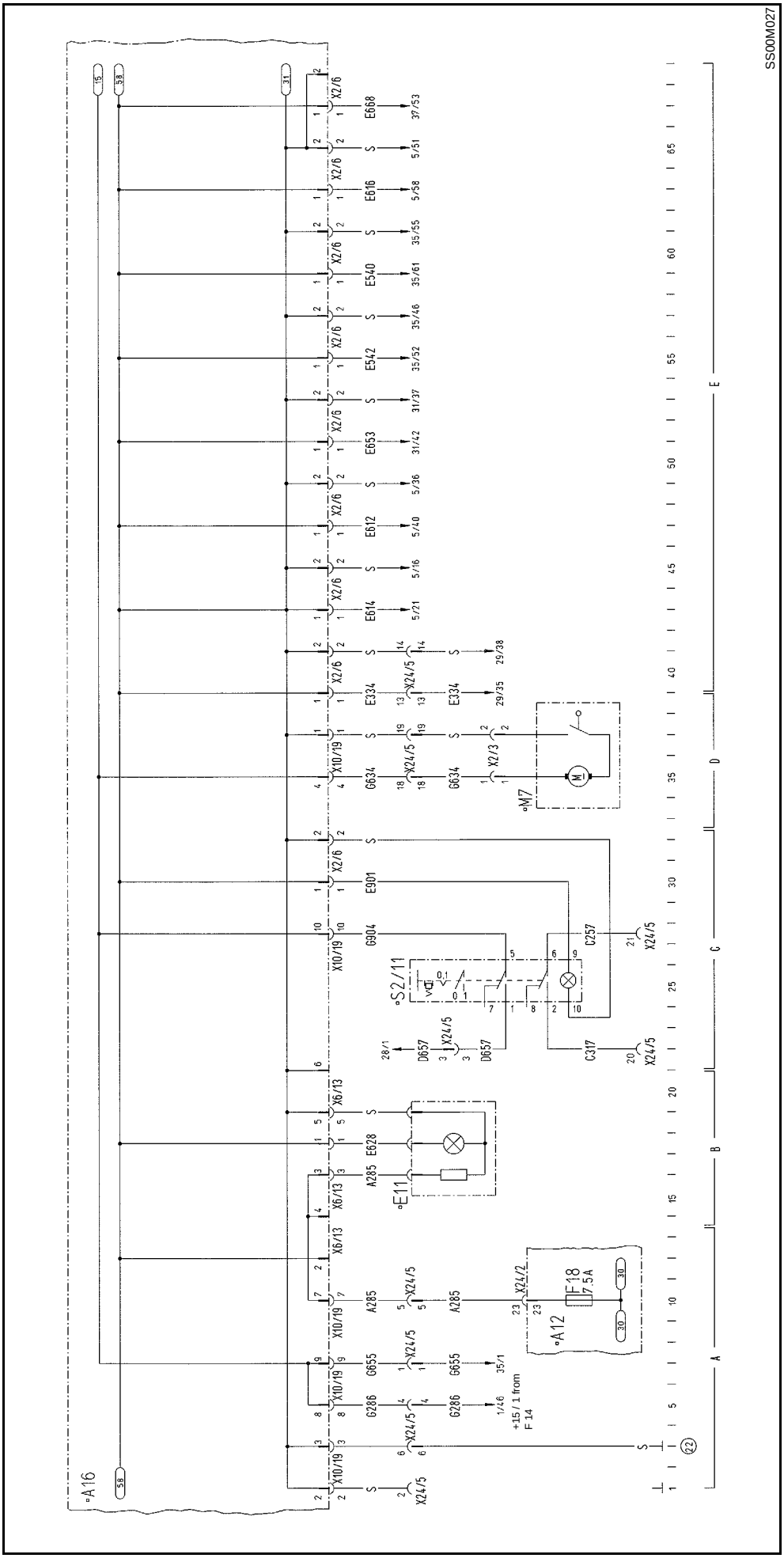
A	Instrument right, digital

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

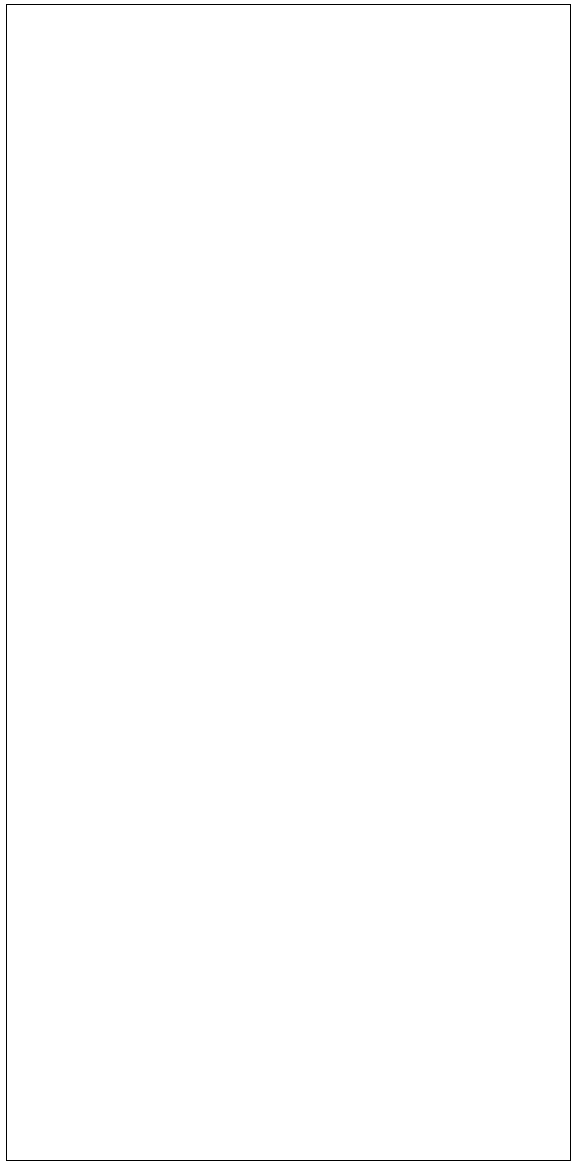
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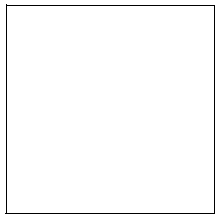
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Electrical equipment

A12	Central print
A16	Print, EHR operating console
E11	Cigarette lighter
F18	Fuse, cigarette lighter
M7	Compressed air seat motor
S2/11	Safety switch
X2/3	Plug-in connection, air sprung seat
X2/6	Plug-in connection, switch lighting
X6/13	Plug-in connection, operating console – cigarette lighter
X10/19	Plug-in connection, operating console – print
X24/2	Plug-in connection, chassis, right
X24/5	Plug-in connection, chassis, right, operating console





Grounding points

22	E box console

Designation of Sections

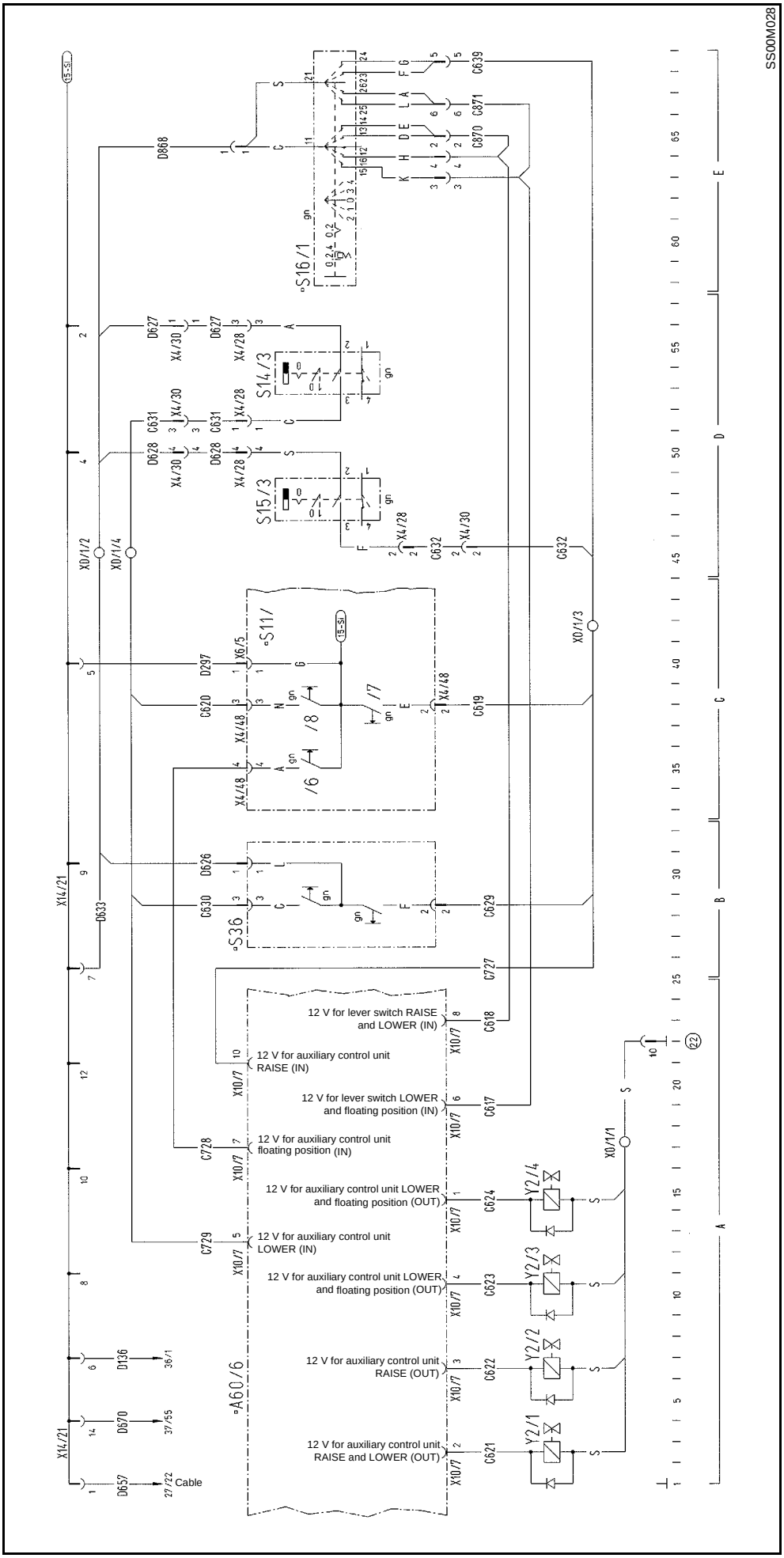
A	Supply, EHR operating console
B	Cigarette lighter
C	Safety switch
D	Air-sprung seat
E	Supply 58, sundry lighting

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

/6	Switch, 1st aux. control unit, green, floating position
/7	Switch, 1st aux. control unit, green, raise
/8	Switch, 1st aux. control unit, green, lower
A60/6	ECCU 1st auxiliary control unit
S11/	Multi-controller
S14/3	Front lifting gear external pushbutton, Lower
S15/3	Front-end lifting gear external pushbutton, Raise
S16/1	Lever switch, 1st auxiliary control unit
S36	Switch, multi-controller joystick
X0/1/1	Weld point, auxiliary control unit, potential 31
X0/1/2	Weld point, auxiliary control unit, potential 15-Si
X0/1/3	Weld point, auxiliary control unit, RAISE
X0/1/4	Weld point, auxiliary control unit, LOWER
X4/28	Plug-in connection, external pushbutton, front-end lifting gear
X4/30	Plug-in connection, external pushbutton, front-end lifting gear
X4/48	Plug-in connection, Multi-Controller, 1st auxiliary control unit
X6/5	Plug-in connection, front implement load relief
X10/7	Plug-in connection, auxiliary control unit ECCU
X14/21	Distributor console, potential 15 safety
Y2/1	Solenoid valve, control unit
Y2/2	Solenoid valve, control unit
Y2/3	Solenoid valve, control unit
Y2/4	Solenoid valve, interlock block

Grounding points

22 E box console

Designation of Sections

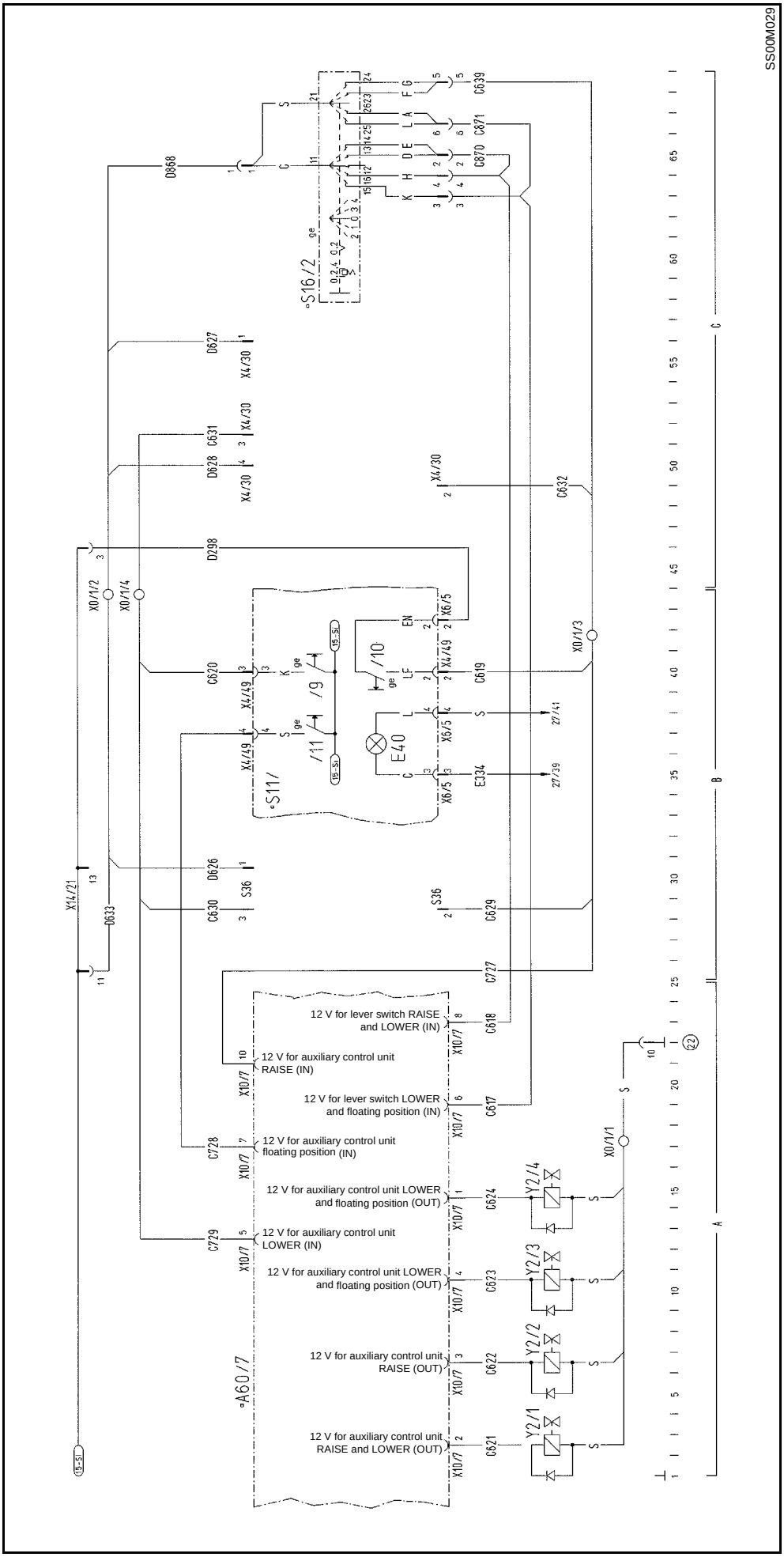
A	ECCU 1st auxiliary control unit double-action with interlock block
B	Operation of the 1st auxiliary control unit joystick
C	Operation of the 1st auxiliary control unit multi-controller
D	Operation of the 1st auxiliary control unit, front-end lifting gear
E	1st auxiliary control unit, lever toggle switch

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

/9	Switch, 2nd aux. control unit, yellow, raise
/10	Switch, 2nd aux. control unit, yellow, lower
/11	Switch, 2nd aux. control unit, yellow, floating position
A60/7	ECCU 2nd auxiliary control unit
E40	Multi-controller lighting
S11/	Multi-controller
S16/2	Lever switch, 2nd auxiliary control unit
S36	Switch, multi-controller joystick
X0/1/1	Weld point, auxiliary control unit, potential 31
X0/1/2	Weld point, auxiliary control unit, potential 15-Si
X0/1/3	Weld point, auxiliary control unit, RAISE
X0/1/4	Weld point, auxiliary control unit, LOWER
X4/30	Plug-in connection, external pushbutton, front-end lifting gear
X4/49	Plug-in connection, 2nd aux. control unit, Multi-Controller
X6/5	Plug-in connection, front implement load relief
X10/7	Plug-in connection, ECCU auxiliary control unit
X14/21	Distributor console, potential 15 safety
Y2/1	Solenoid valve, control unit
Y2/2	Solenoid valve, control unit
Y2/3	Solenoid valve, control unit
Y2/4	Solenoid valve, interlock block

Grounding points

22 E box console

Designation of Sections

A ECCU 2nd auxiliary control unit double-action with interlock block

B 1st auxiliary control unit operated, multi-controller

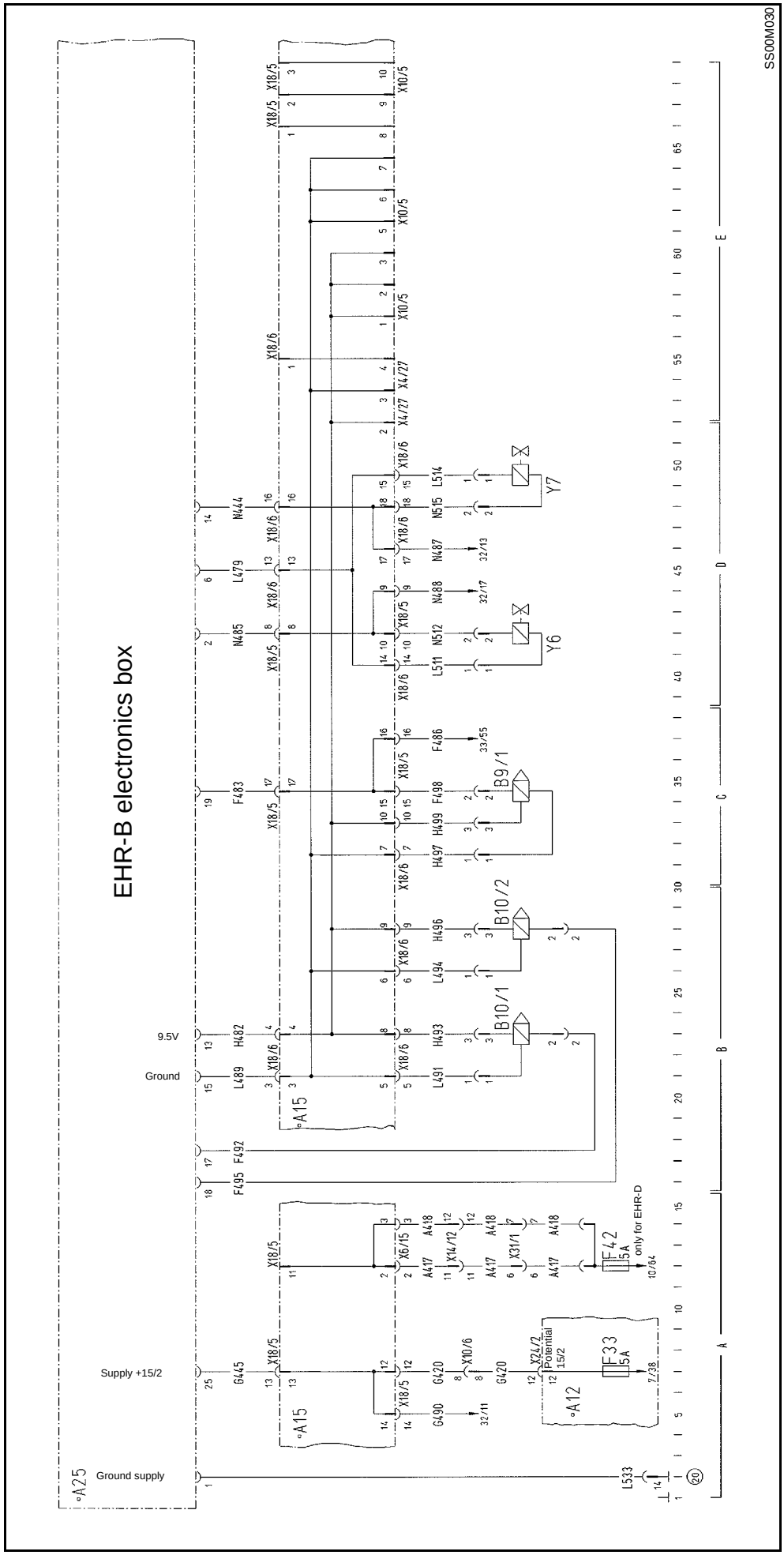
C 2nd auxiliary control unit operated by toggle switch

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
A15	Print, EHR, left
A25	Control unit EHR-B
B9/1	Position transmitter, rear lifting gear
B10/1	Power sensor, left
B10/2	Power sensor, right
F33	Fuse, potential 15, EHR
F42	Fuse, potential 30 (EHR-D)
X4/27	Plug-in connection, external sensor
X6/15	Plug-in connection, chassis, left, print left
X10/5	Plug-in connection, front control
X10/6	Plug-in connection, instrument cable chassis, left
X14/12	Plug-in connection, instrument cable chassis, left
X18/5	Plug-in connection, EHR distribution print
X18/6	Plug-in connection, EHR distribution print
X24/2	Plug-in connection, chassis, right
X31/1	Plug-in connection, instrument – engine
Y6	Solenoid valve, EHR, raise
Y7	Solenoid valve, EHR, lower

Grounding points

20	EHR box console

Designation of Sections

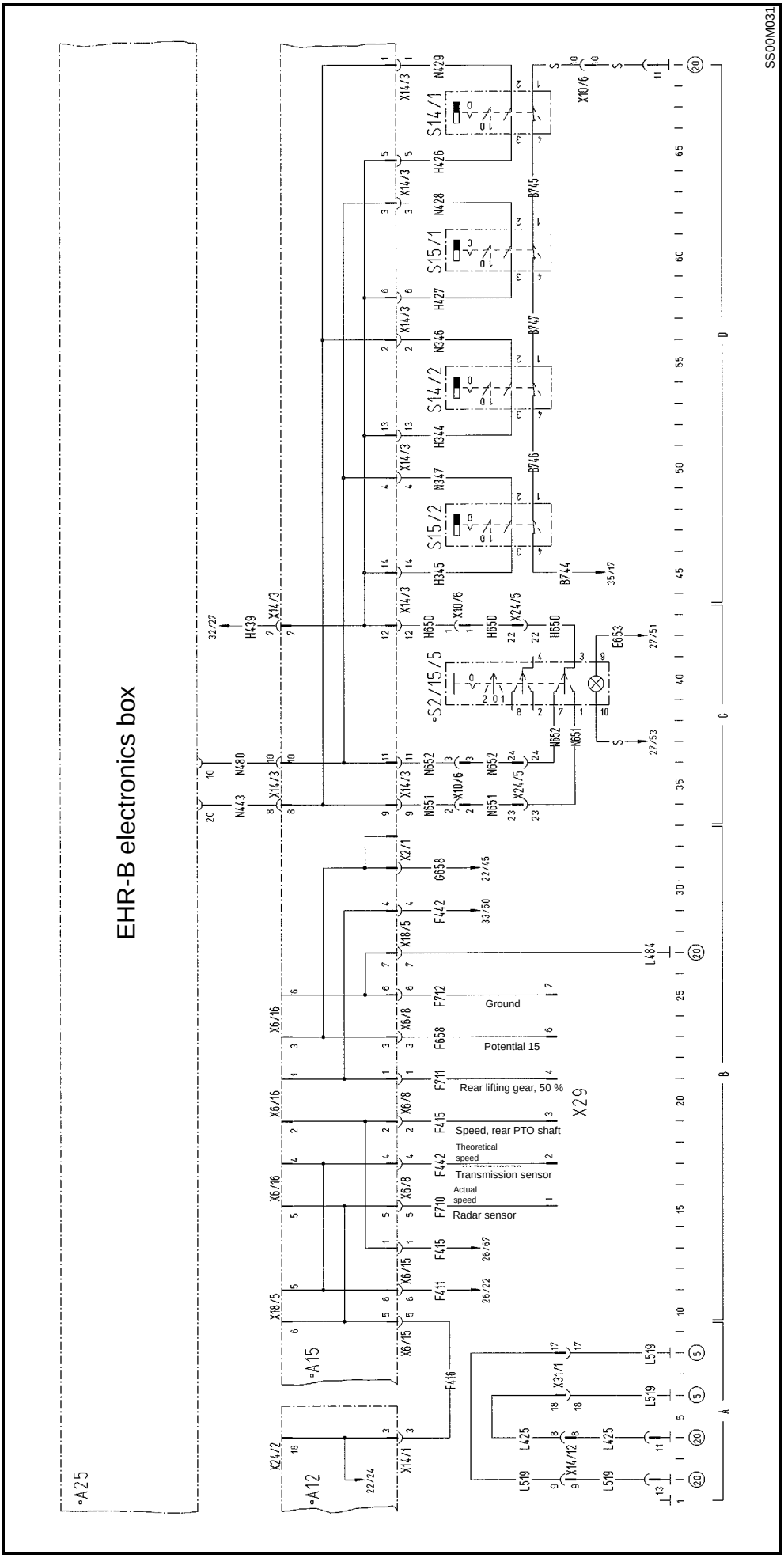
A	Supply, EHR box
B	Power sensors
C	Position sensor
D	EHR RAISE/LOWER – solenoid valve
E	Reserve print, EHR, left

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A12	Central print
A15	Print, EHR, left
A25	Control unit EHR-B
S2/15/5	Switch, internally operated external pushbuttons
S14/1	External pushbutton, Lower, left
S14/2	External pushbutton, Lower, right
S15/1	External pushbutton, Raise, left
S15/2	External pushbutton, Raise, right
X2/1	Plug-in connection, potential 15 socket
X6/8	Plug-in connection, signal socket
X6/15	Plug-in connection, cable, chassis, left, print left
X6/16	Plug-in connection, front pressure control
X10/6	Plug-in connection, instrument cable chassis, left
X14/1	Plug-in connection, cable, chassis, left
X14/3	Plug-in connection, EHR – distribution print
X14/12	Plug-in connection, instrument cable, chassis, left
X18/5	Plug-in connection, EHR – distribution print
X24/2	Plug-in connection, chassis, right
X24/5	Plug-in connection, chassis, right, operating console
X29	Standard signal socket
X31/1	Plug-in connection, instrument – engine

Grounding points

5	Engine compartment
20	EHR box console

Designation of Sections

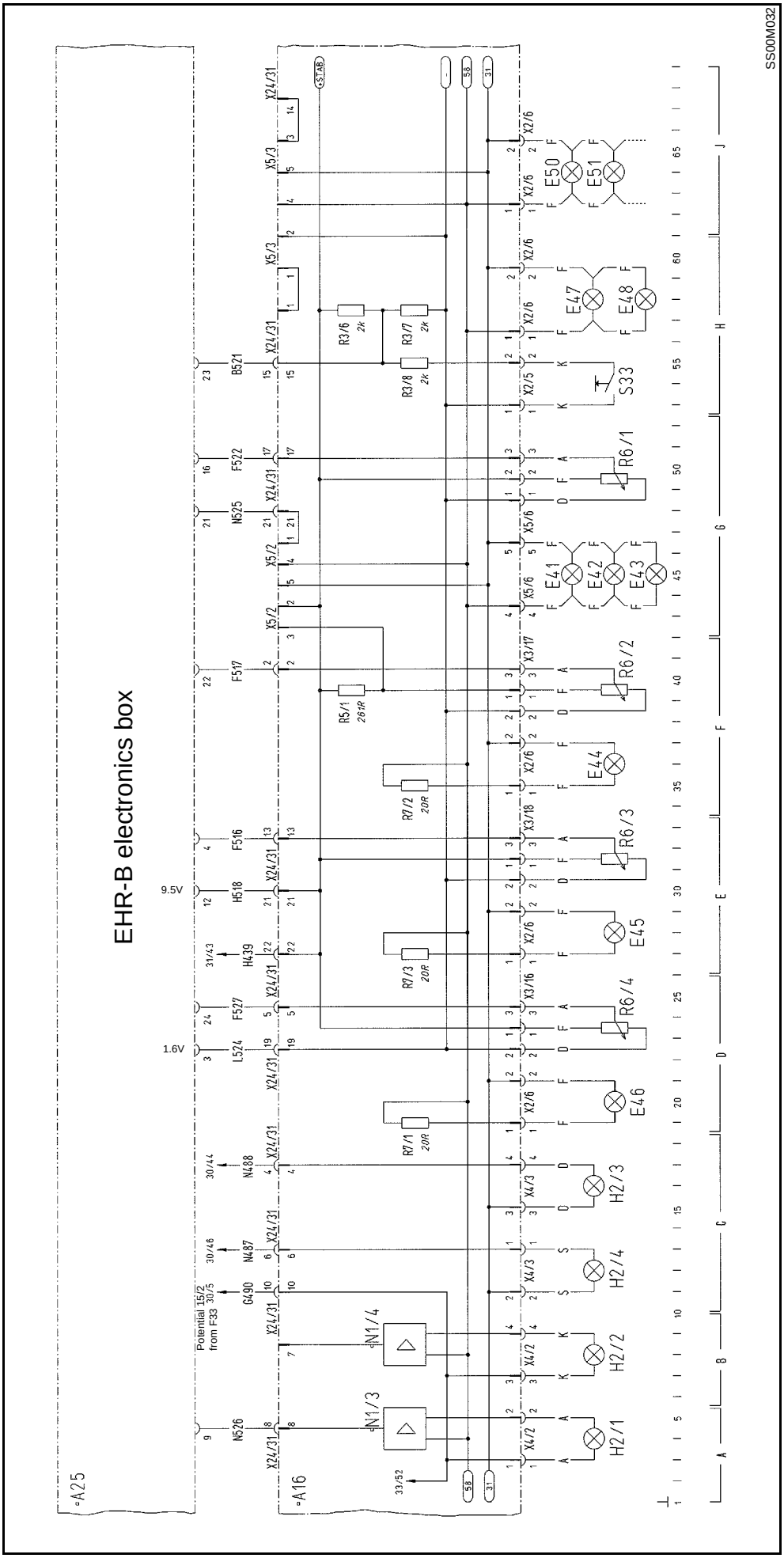
A	Supply, EHR box, ground
B	Standard signal socket, for EHR
C	EHR internal actuation external pushbutton or over-lift
D	EHR external pushbutton

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A16	Print, EHR operating console
A25	Control unit EHR-B
E41	Setpoint potentiometer lighting
E42	Setpoint potentiometer lighting
E43	Setpoint potentiometer lighting
E44	Lighting, potentiometer, lift limitation
E45	Lighting, mixing potentiometer
E46	Lighting, potentiometer, owering Speed
E47	Stop button lighting
E48	Stop button lighting
E50	Lighting, diagnosis front panel
E51	Lighting, diagnosis front panel
H2/1	Diagnosis display
H2/2	Slip display
H2/3	Raise display
H2/4	Lower display
N1/3	Driver, diagnosis display
N1/4	Driver, traction control display
R3/6	Resistance 560 OHM
R3/7	Resistance 560 OHM
R3/8	Resistance 560 OHM
R5/1	Resistance 261 Ohm
R6/1	Setpoint potentiometer
R6/2	Lift limitation potentiometer
R6/3	Mixing potentiometer
R6/4	Lowering speed potentiometer
R7/1	Resistance 20 Ohm
R7/2	Resistance 20 Ohm
R7/3	Resistance 20 Ohm

S33	Switch, EHR stop
X2/5	Plug-in connection, EHR stop button
X2/6	Plug-in connection, switch lighting
X3/16	Plug-in connection, potentiometer, lowering speed
X3/17	Plug-in connection, potentiometer, end limit
X3/18	Plug-in connection, potentiometer, mixing
X4/2	Plug-in connection, diagnosis/ traction control
X4/3	Plug-in connection raise/lower
X5/2	Plug-in connection, aux. switch
X5/3	Plug-in connection, traction control
X5/6	Plug-in connection, EHR setpoint
X2/31	Plug-in connection, print, EHR operating console

Grounding points

Designation of Sections

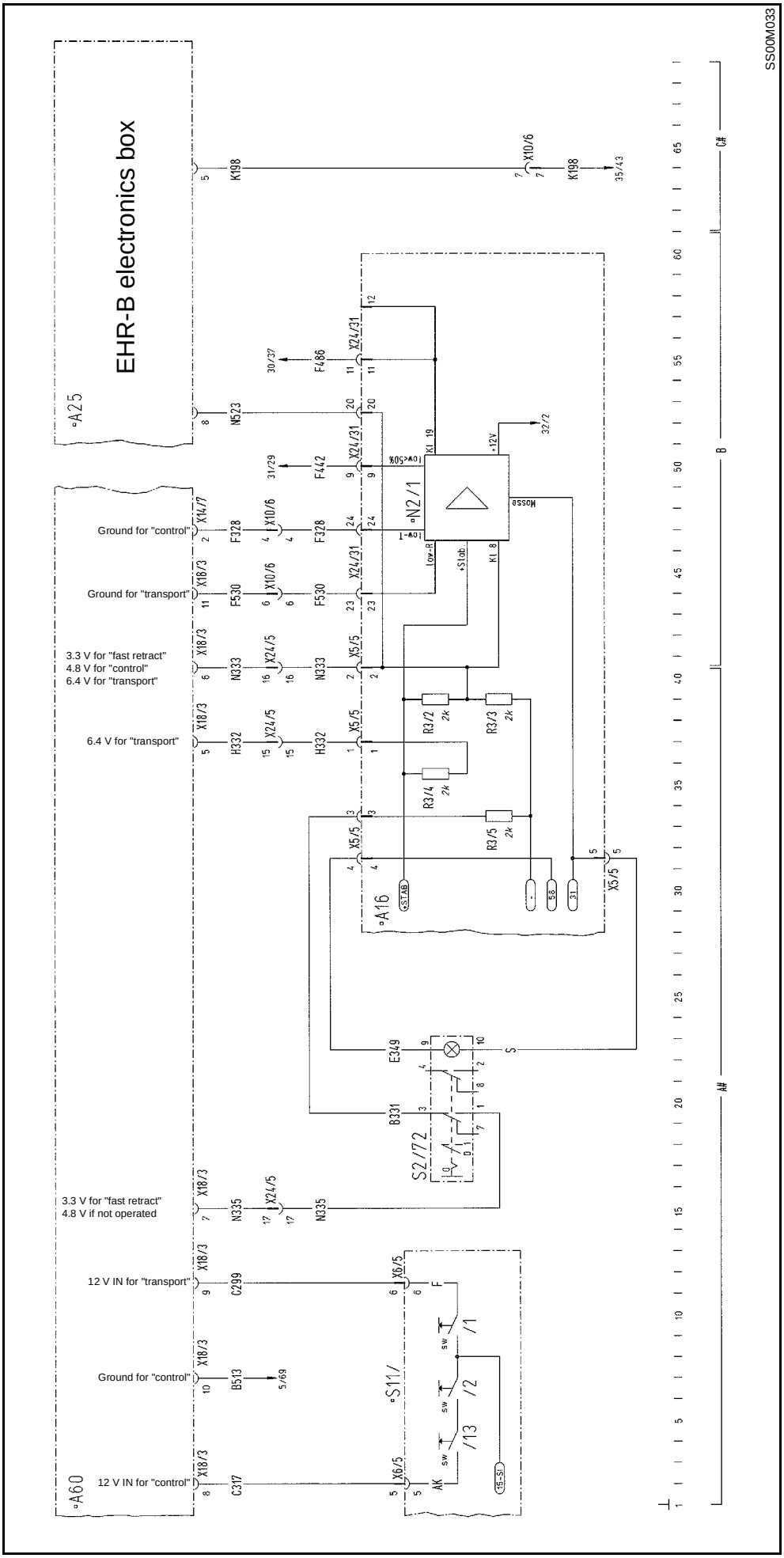
A	EHR diagnostics display
B	EHR – slip indicator
C	EHR raise/lower display
D	EHR lowering speed
E	EHR mixed control
F	EHR, lift limitation
G	EHR setpoint
H	EHR stop
J	EHR lighting, front panel

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

/1	Switch, EHR lift
/2	Switch, EHR control
/13	Switch, EHR safety
A16	Print, EHR operating console
A25	Control unit EHR-B
A60	ECCU (Electrical Central Control Unit)
N2/1	EHR-B signal conversion
R3/2	Resistance 560 OHM
R3/3	Resistance 560 OHM
R3/4	Resistance 560 OHM
R3/5	Resistance 560 OHM
S2/72	Switch, fast retract
S11/	Multi-controller
X5/5	Plug-in connection, cable, chassis, right
X6/5	Plug-in connection, front implement load relief
X10/6	Plug-in connection, instruments, cable, chassis, left
X14/7	Plug-in connection, chassis right, ECCU
X18/3	Plug-in connection, chassis, right, ECCU
X24/5	Plug-in connection, chassis, right, operating console
X24/31	Plug-in connection, print, EHR – operating console

VERSIONS
to this page
33
on page/pages
34

Grounding points

Designation of Sections

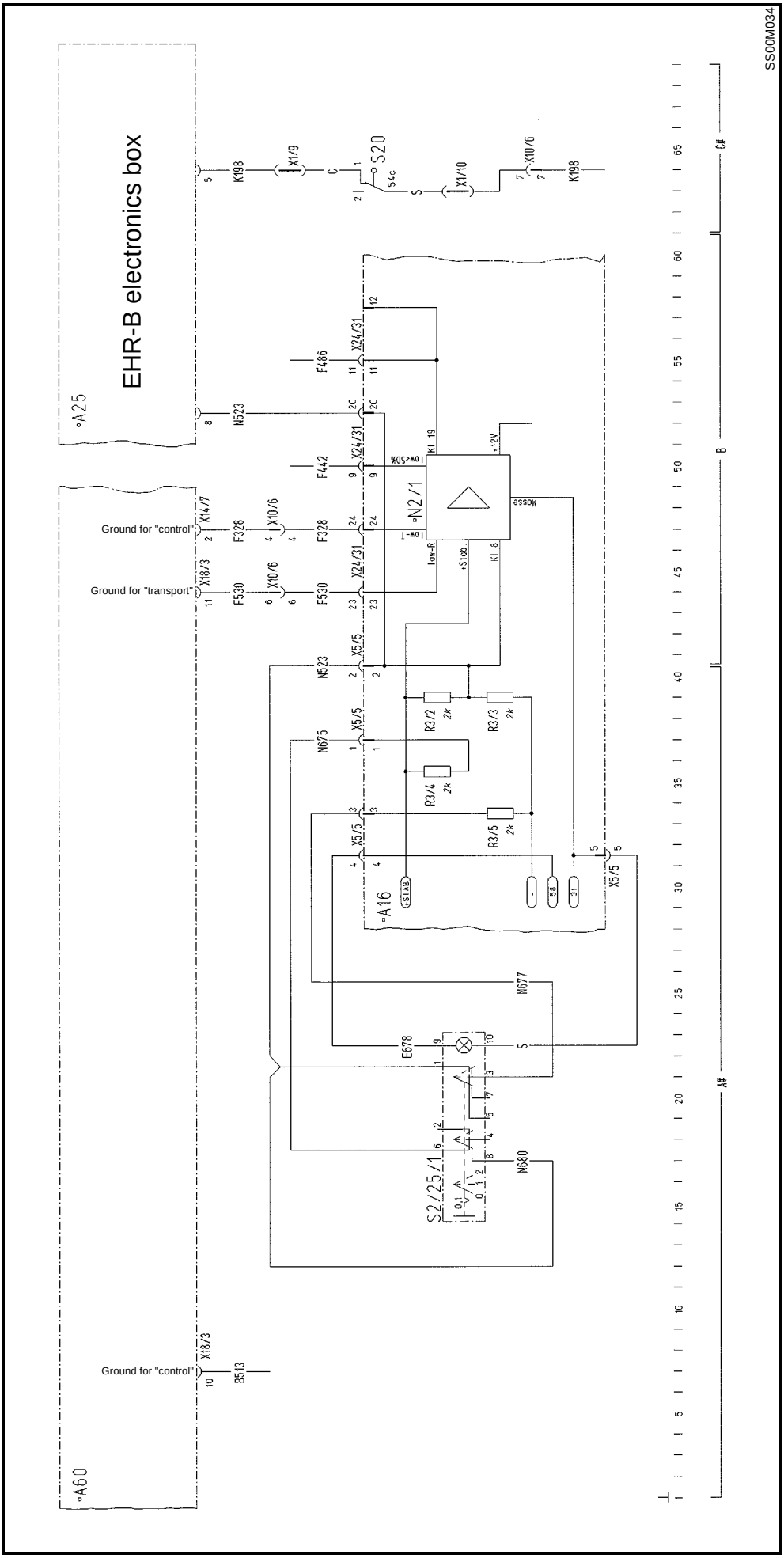
A#	EHR lift with Multi-Controller
B	EHR-B signal switchover
C#	Rear PTO shaft
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A16	Print, EHR operating console
A25	Control unit EHR-B
A60	ECCU (Electrical Central Control Unit)
N2/1	EHR-B signal conversion
R3/2	Resistance 560 OHM
R3/3	Resistance 560 OHM
R3/4	Resistance 560 OHM
R3/5	Resistance 560 OHM
S2/25/1	Switch, EHR lift
S20	Switch, EHR lift/pressure
X1/9	Plug-in connection, lift/pressure switch
X1/10	Plug-in connection, lift/pressure switch
X5/5	Plug-in connection, cable, chassis, right
X10/6	Plug-in connection, instruments, cable, chassis, left
X14/7	Plug-in connection, chassis right, ECCU
X18/3	Plug-in connection, instruments, cable, chassis, left
X24/31	Plug-in connection, print, EHR – operating console

VERSIONS
to this page
34
on page/pages
33

Grounding points

Designation of Sections

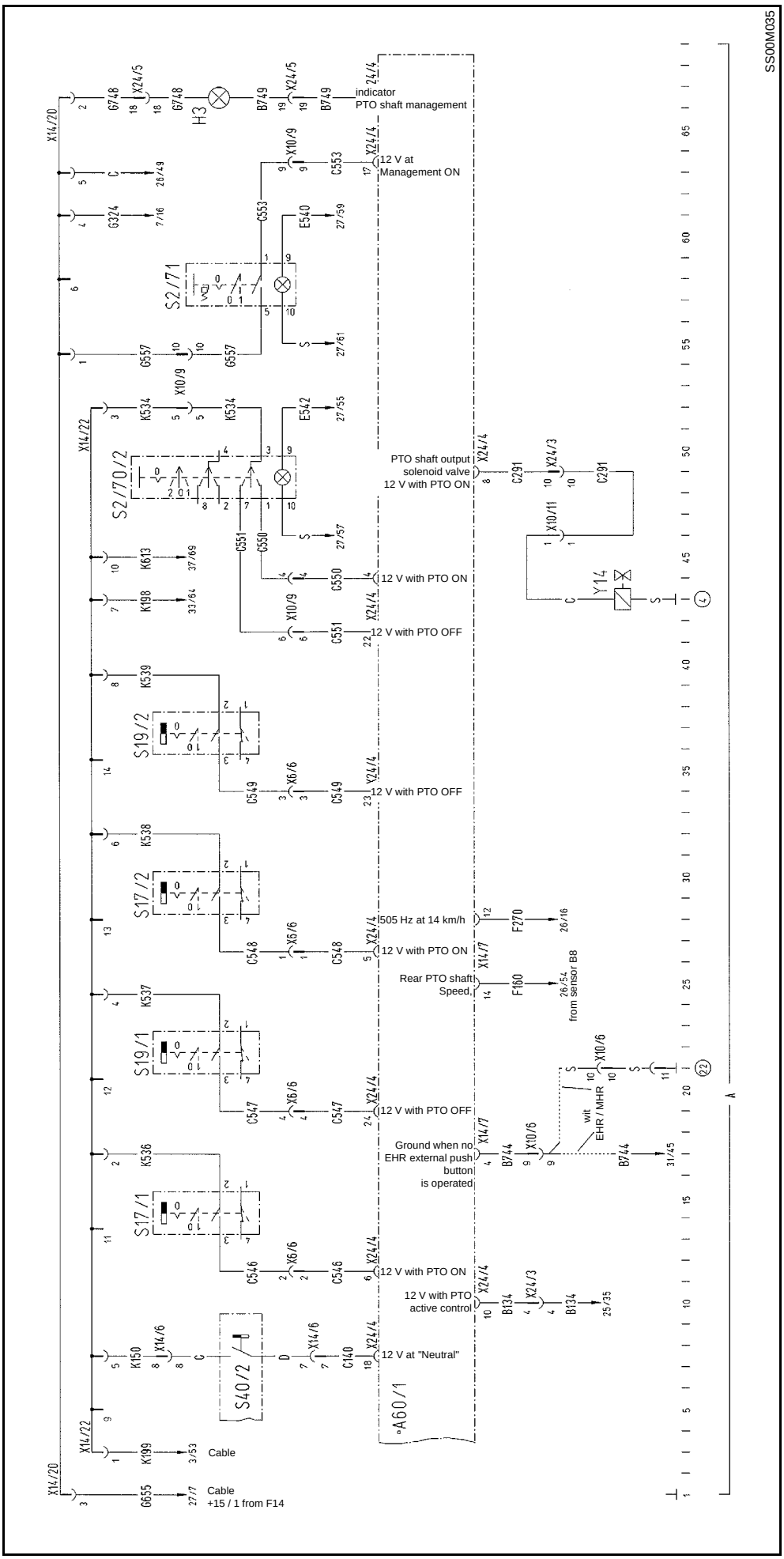
A#	EHR lifting switch
B	EHR-B signal switchover
C#	EHR lift/pressure changeover
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A60/1	ECCU – rear PTO shaft
H3	Indicator lamp, PTO Management ACTIVE
S2/70/2	Switch, rear PTO shaft
S2/71	Switch, PTO shaft management
S17/1	External pushbutton, rear PTO shaft, ON
S17/2	External pushbutton, rear PTO shaft, ON
S19/1	External pushbutton, rear PTO shaft, OFF
S19/2	External pushbutton, rear PTO shaft, OFF
S40/2	Switch, rear PTO shaft (start inhibitor)
X6/6	Plug-in connection, chassis, right, External pushbutton, PTO shaft
X10/6	Plug-in connection, instrument, chassis, left
X10/9	Plug-in connection, instrument – chassis right – switch
X10/11	Plug-in connection, instrument – transmission
X14/6	Plug-in connection, chassis right, PTO shaft indicator
X14/7	Plug-in connection, chassis right, ECCU
X14/20	Distributor console, potential 15/1
X14/22	Distributor console, potential D+
X24/3	Plug-in connection, chassis, right, instrument cable
X24/4	Plug-in connection, chassis, right, ECCU
X24/5	Plug-in connection, chassis, right, operating console
Y14	Solenoid valve, rear PTO shaft

Grounding points

4	Console Instrument plug
22	E box console

Designation of Sections

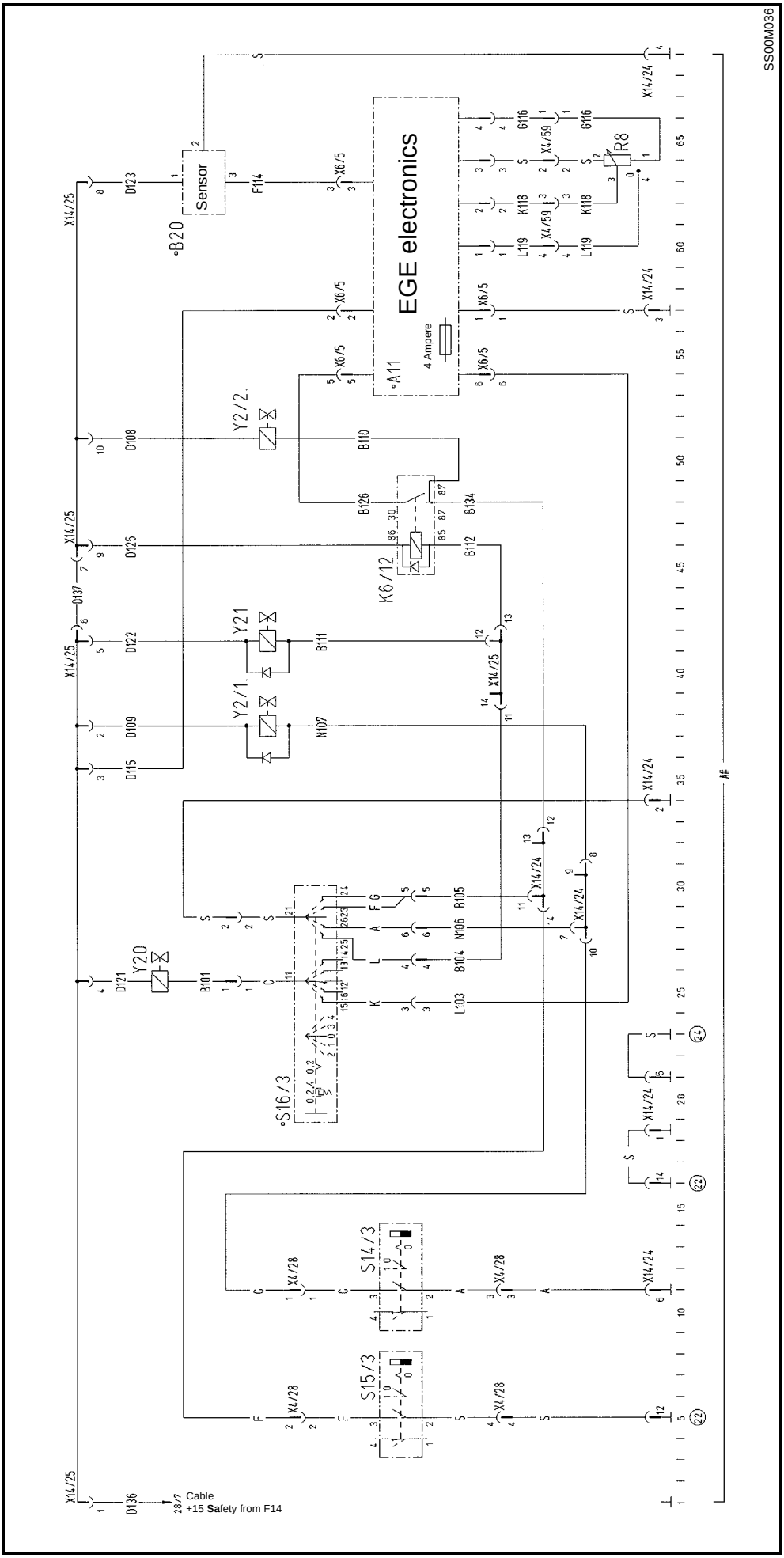
A	Rear PTO shaft

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A11	EGE control unit
B20	Pressure sensor, EGE
K6/12	Relay, EGE
R8	Potentiometer, EGE
S14/3	Front lifting gear LOWER external pushbutton
S15/3	Front lifting gear RAISE external pushbutton
S16/3	Switch, EGE
X4/28	Plug-in connection, external pushbutton, front-end lifting gear
X4/59	Plug-in connection, EGE potentiometer
X6/5	EGE plug-in connection
X14/24	EGE distributor
X14/25	EGE distributor
Y2/1	Solenoid valve, control unit 1
Y2/2	Solenoid valve, control unit 2
Y20	Solenoid valve, EGE down
Y21	Solenoid valve, EGE reservoir

VERSIONS
to this page
36
on page/pages
37, 38

Grounding points

22	E box console
24	Plate, EGE electrics

Designation of Sections

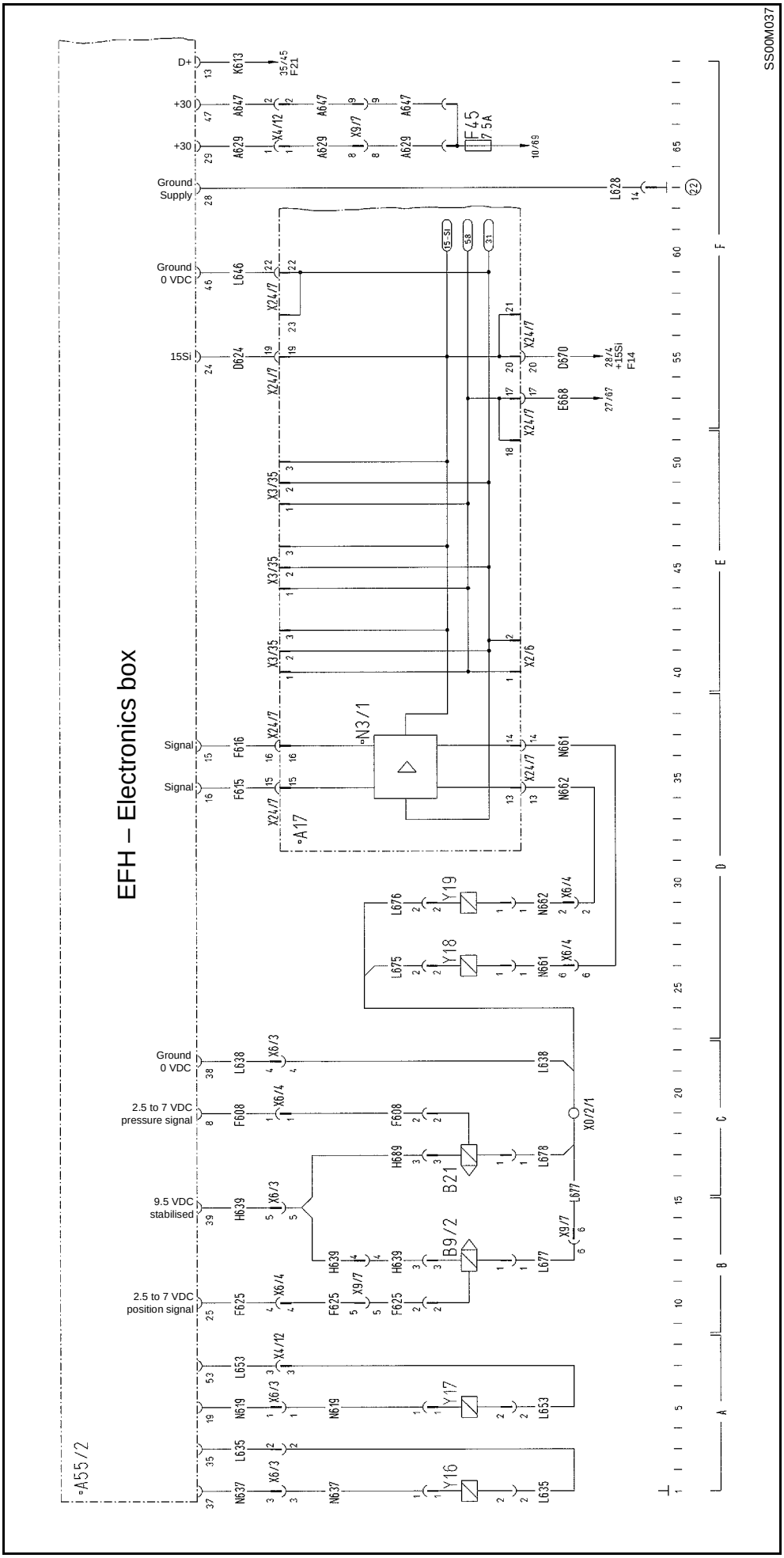
A#	EGE up to DBD0057986
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

A17	EFH print
A55/2	EFH control unit
B9/2	Position sensor, front lifting gear
B21	Pressure sensor, EFH
F45	Fuse, EFH, potential 30
N3/1	EFH power circuit
X0/2/1	Weld point, EFH, potential 31
X2/6	Plug-in connection, switch lighting
X3/35	Plug-in connection, EFH print, reserve
X4/12	Plug-in connection, EFH, chassis, right
X6/3	Plug-in connection, EFH, chassis, right,
X6/4	Plug-in connection, EFH, chassis, right
X9/7	Plug-in connection, EFH, chassis, right Engine
X24/7	Plug-in connection, EFH print
Y16	Solenoid valve EFH RAISE
Y17	Solenoid valve EFH LOWER
Y18	Solenoid valve, 14 bar reservoir
Y18	Solenoid valve, 40 bar reservoir

VERSIONS
to this page
37
on page/pages
36

Grounding points

22	E box console

Designation of Sections

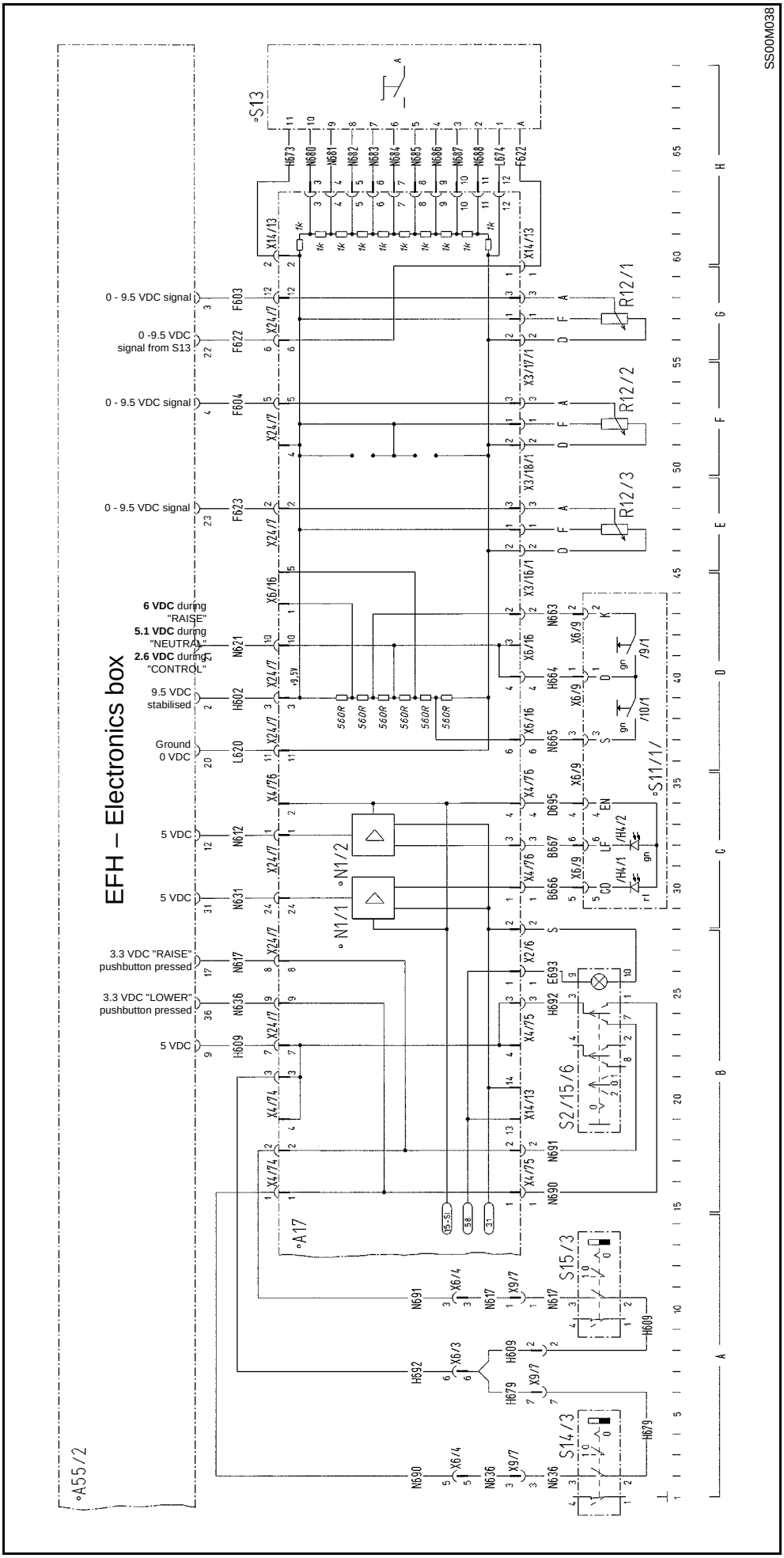
#	EFH from DBD0057987 onwards
A	EFH RAISE / LOWER
B	EFH position sensor
C	EFH pressure sensor
D	EFH reservoir
E	EFH – reserves print
F	EFH supply
#	several versions available

Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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Electrical equipment

/9/1	Pushbutton, green, EFH RAISE
/10/1	Pushbutton, green, EFH LOWER
/H4/1	EFH diagnosis display
/H4/2	display, EFH indicator
A17	EFH print
A55/2	EFH control unit
N1/1	Voltage amplifier
N1/2	Voltage amplifier
R12/1	EFH lift limitation potentiometer
R12/2	EFH mixing potentiometer
R12/3	EFH lowering speed potentiometer
S2/15/6	Internally operated external pushbutton, EFH
S11/1/	Multi-controller
S13	Rotary switch EFH (10 position)
S14/3	Front lifting gear LOWER external pushbutton
S15/3	Front lifting gear RAISE external pushbutton
X2/6	Plug-in connection, switch lighting
X3/16/1	Plug-in connection, potentiometer, lowering speed
X3/17/1	Plug-in connection, potentiometer, lift limitation
X3/18/1	Plug-in connection, potentiometer, mixing
X4/74	Plug-in connection, EFH cable, external pushbutton
X4/75	Plug-in connection, EFH cable, internally operated external pushbuttons
X4/76	Plug-in connection, EFH indicators
X6/3	Plug-in connection, EFH, chassis, right,
X6/4	Plug-in connection, EFH, chassis, right
X6/9	Plug-in connection, EFH, chassis, right
X6/16	Plug-in connection EFH grip
X9/7	Plug-in connection, EFH, chassis, right Engine
X14/13	Plug-in connection, EFH rotary switch
X24/7	Plug-in connection, EFH print

VERSIONS
to this page
38
on page/pages
36

Grounding points

Designation of Sections

#	EFH from DBD0057987 onwards
A	EFH – external pushbutton
B	EFH – internal pushbutton
C	EFH – indicators
D	EFH – multi-controller operation
E	EFH – lowering speed
F	EFH – mixing
G	EFH – lift limitation
H	EFH – setpoint
#	several versions available

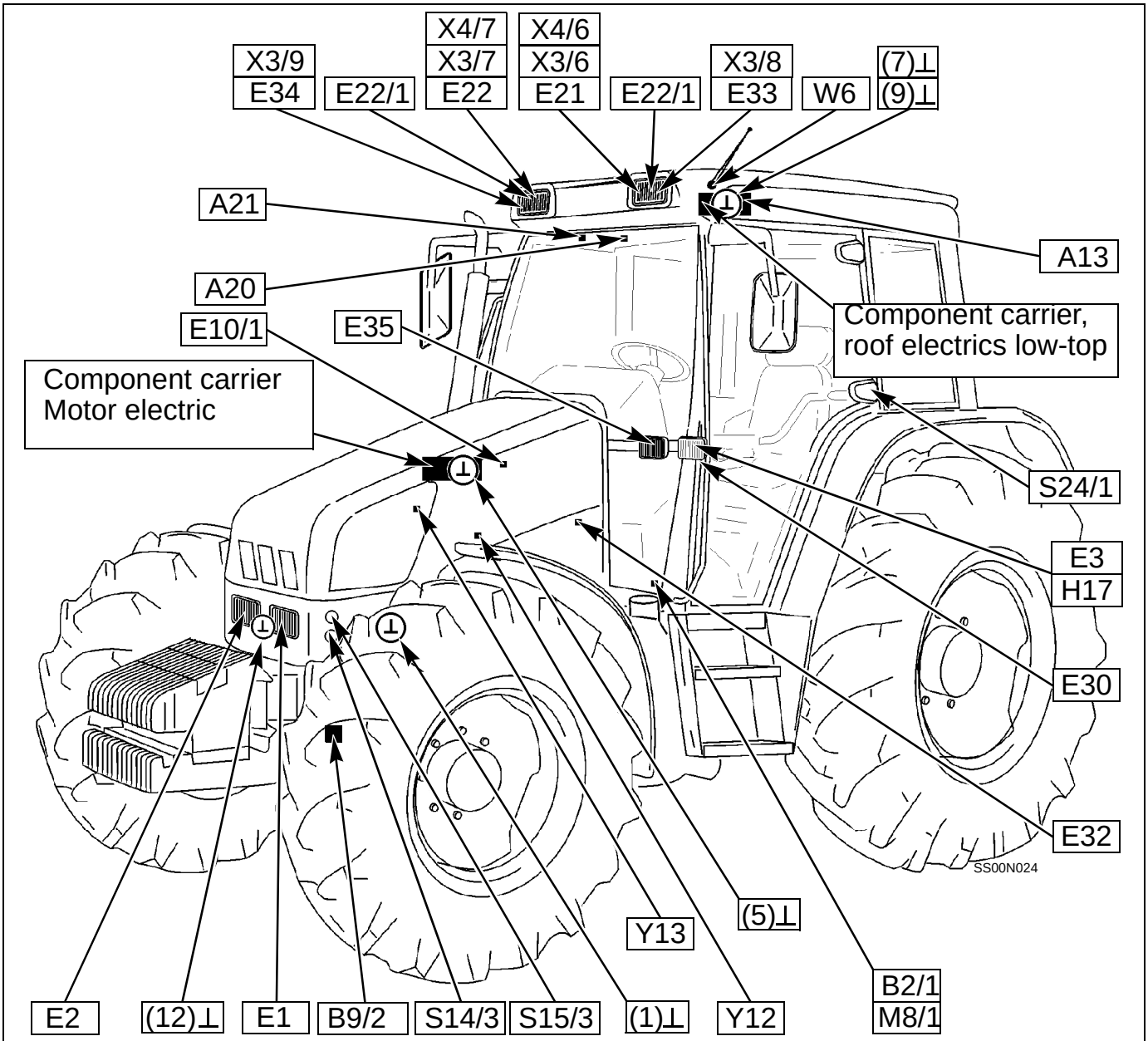
Cable colour or coding in accordance with standard 05449

Ident. letter	Colour	Type of use
A	Red	+30 (potential 30) = Cont. current
B	Beige	-- Control line (ground)
C	White	+ Control line (positive)
D	Yellow	+ 15 Si (Potential 15 safety)
E	Grey	Potential 58 Lighting cable
F	Green	Signal cable
G	Violet	+ 15 (potential 15.1 or 15.2) Switched current after the starter switch
H	Orange	VDC, stabilised by the 'E' Box
K	Light blue	D+
L	Brown	Ground via a box
M		Grounding strip
N	Pink	Spare
P	Colourless	Spare
S	Black	Ground, directly to a grounding point

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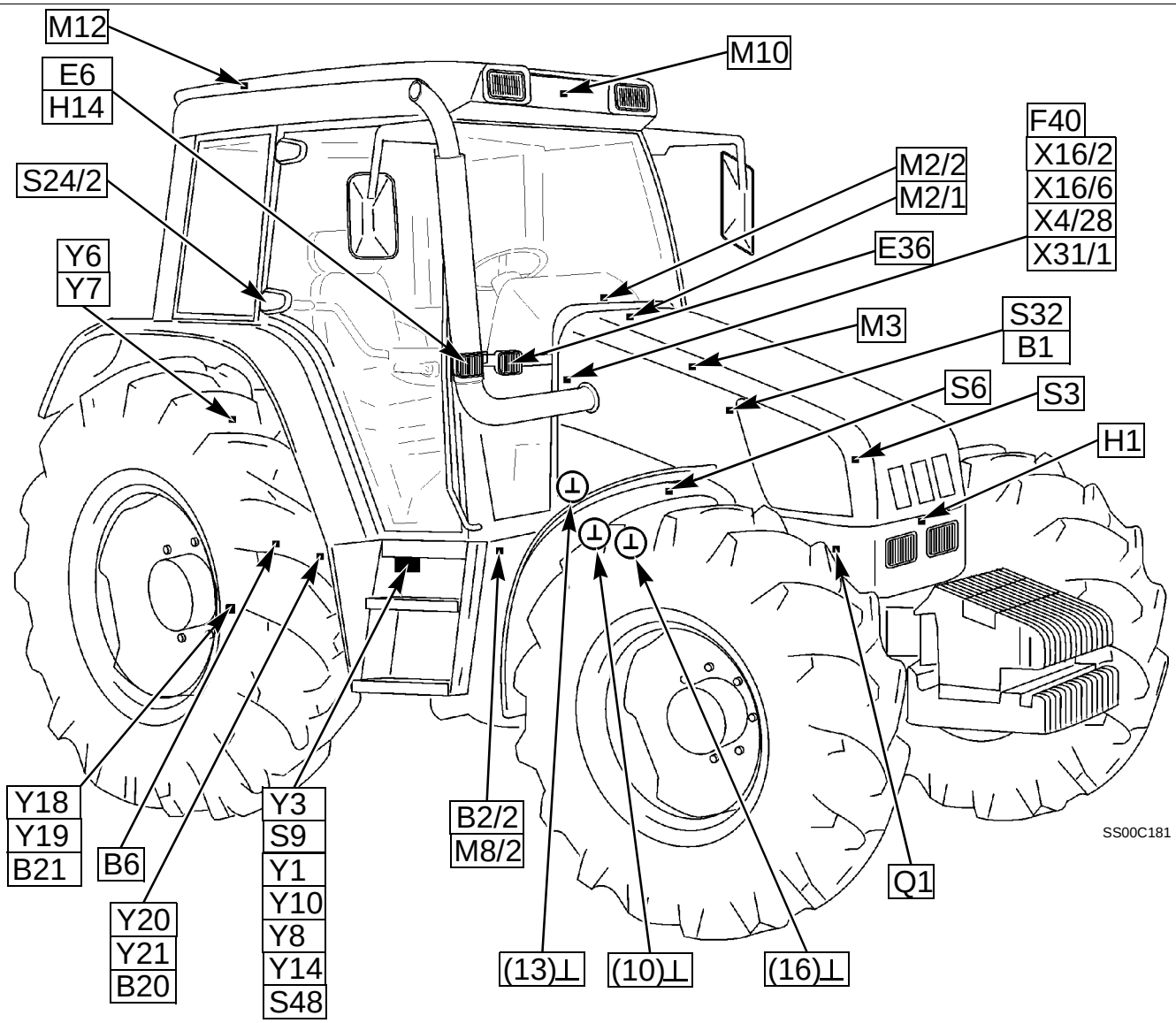
List of Plugs, Left



A13	Print, roof electrics
A20	Air conditioning control
A21	Blower motor control
B2/1	Fuel tank content transmitter, left
B9/2	Position sensor, front lifting gear
E1	Headlight, left
E2	Headlight, right
E3	Sidelight, front left
E10/1	Thermo-start
E21	Reserve headlight, left
E21/1	Position light, in auxiliary headlamp, left
E2	Reserve headlight, right
E22/1	Position light, in auxiliary headlamp, right
E30	Step light, left
E32	Fuel filter heating
E33	Searchlight, roof, front, twinpower
E34	Searchlight, roof, front, twinpower
E35	Searchlight on the trafficator/position light
H17	Trafficator, front left
M8/1	Left-hand tank pump motor
S14/3	Front lifting gear external pushbutton "LOWER"
S15/3	Front lifting gear external pushbutton "RAISE"
S24/1	Switch, door contact
W6	Aerial
X3/6	Flat plug-in connection, auxiliary headlight
X3/7	Flat plug-in connection, auxiliary headlight
X3/8	Flat plug-in connection, twin power searchlight
X3/9	Flat plug-in connection, twin power searchlight
Y12	Engine cut-out solenoid
Y13	Air-conditioning coupling
(1)	Ground, battery
(5)	Ground, engine electrics component carrier
(7)	Ground, low-top component carrier
(9)	Ground, screw down point, roof print
(12)	Ground, body, front

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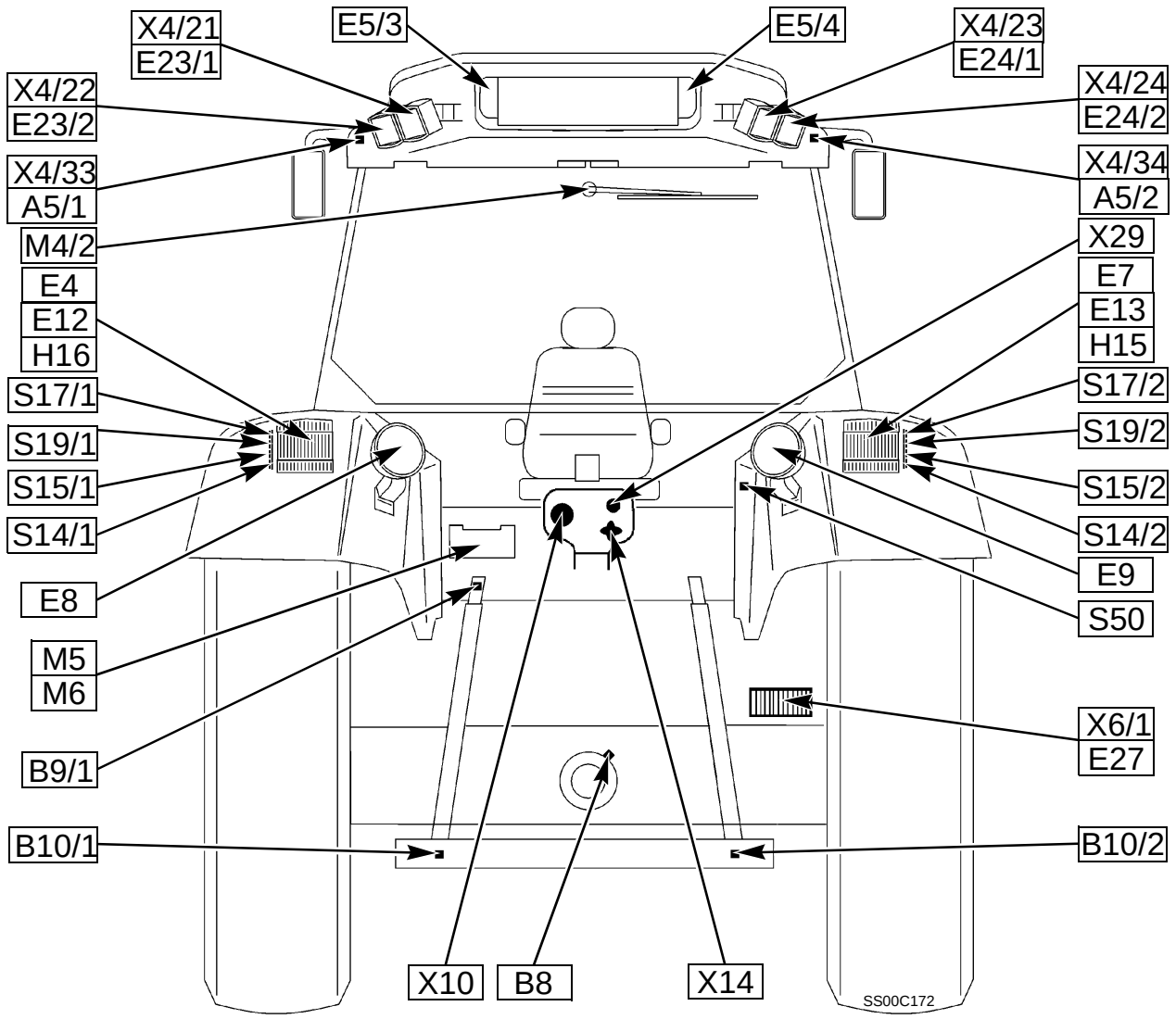
List of Plugs, Right



B1	Engine temperature transmitter
B2/2	Fuel tank content transmitter, right
B6	Inductive transmitter, driving speed
B20	Pressure sensor, EGE
B21	Pressure sensor, EFH
E6	Sidelight, front right
E36	Searchlight on the fixing bracket
F40	Main fuse 100A
H1	Horn
H14	Trafficator, front right
M2/1	Parallel wiper motor, front
M2/2	Standard wiper motor, front
M3	Heater blower motor, bottom
M8/2	Right-hand tank pump motor
M10	Roof blower motor
M12	Air-conditioning blower motor
Q1	Battery master switch
S3	Switch, air filter indicator
S6	Oil pressure switch
S9	Power shift safety switch
S24/2	Switch, door contact
S32	Switch, water temperature indicator
S48	Switch, reversing light
X16/2	Screw-on connector, engine 30, fused
X16/6	Screw-on connector, engine 30, not fused
X4/28	Plug-in connection, external pushbutton, Front-end lifting gear
X31/1	Plug-in connection, instrument – engine
Y1	4-wheel drive solenoid valve
Y3	Power shift group solenoid valve
Y6	Solenoid valve, EHR RAISE
Y7	Solenoid valve, EHR, LOWER
Y8	Front differential lock solenoid valve
Y10	Rear differential lock solenoid valve
Y14	Solenoid valve, rear PTO shaft
Y18	Solenoid valve, 14 bar reservoir (EFH)
Y19	Solenoid valve, 40 bar reservoir (EFH)
Y20	Solenoid valve EGE
Y21	Solenoid connector, EGE reservoir
(10)	Ground, starter mounting
(13)	Ground, bulkhead
(16)	Ground, starter

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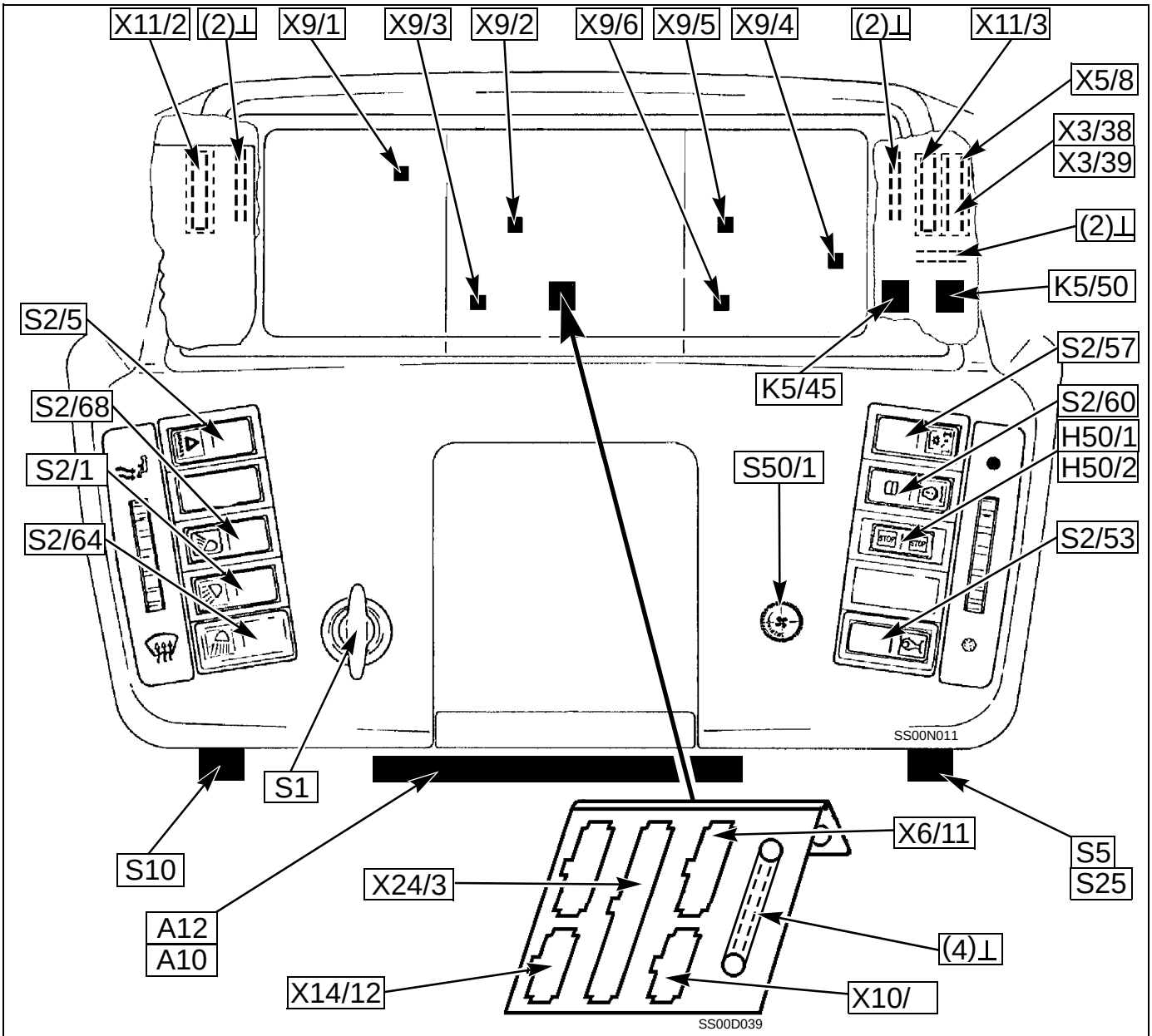
List of Plugs (at rear)



A5/1	Rotating beacon, left
A5/2	Rotating beacon, right
B8	Speed sensor, rear PTO shaft
B9/1	EHR position sensor
B10/1	EHR power sensor, left
B10/2	EHR power sensor, right
E4	Sidelight, rear left
E5/3	Lighting, number plate, roof
E5/4	Lighting, number plate, roof
E7	Sidelight, rear right
E8	Searchlight, left-hand mudguard
E9	Searchlight, right-hand mudguard
E12	Brake light, left
E13	Brake light, right
E27	Searchlight on the rear axle
E23/1	Searchlight, roof, rear, inner
E23/2	Searchlight, roof, rear, outer
E24/1	Searchlight, roof, rear, inner
E24/2	Searchlight, roof, rear, outer
H15	Trafficator, rear right
H16	Trafficator, rear left
M4/2	Windscreen wiper motor, rear
M5	Rear screen washer pump
M6	Front screen washer pump
S14/1	External pushbutton, Lower, left
S14/2	External pushbutton, Lower, right
S15/1	External pushbutton, Raise, left
S15/2	External pushbutton, Raise, right
S17/1	External pushbutton, rear left PTO shaft, ON
S17/2	External pushbutton, rear right PTO shaft, ON
S19/1	External pushbutton, rear left PTO shaft, OFF
S19/2	External pushbutton, rear right PTO shaft, OFF
S50	Switch, trailer brake valve
X4/21	Plug-in connection, roof canopy cable
X4/22	Plug-in connection, roof canopy cable
X4/23	Plug-in connection, roof canopy cable
X4/24	Plug-in connection, roof canopy cable
X4/33	Plug-in connection, rotating beacon, left
X4/34	Plug-in connection, rotating beacon, right
X6/1	Plug-in connection, searchlight
X10	Plug-in connection, 7-pole
X14	Power socket, flat
X29	Standard signal socket

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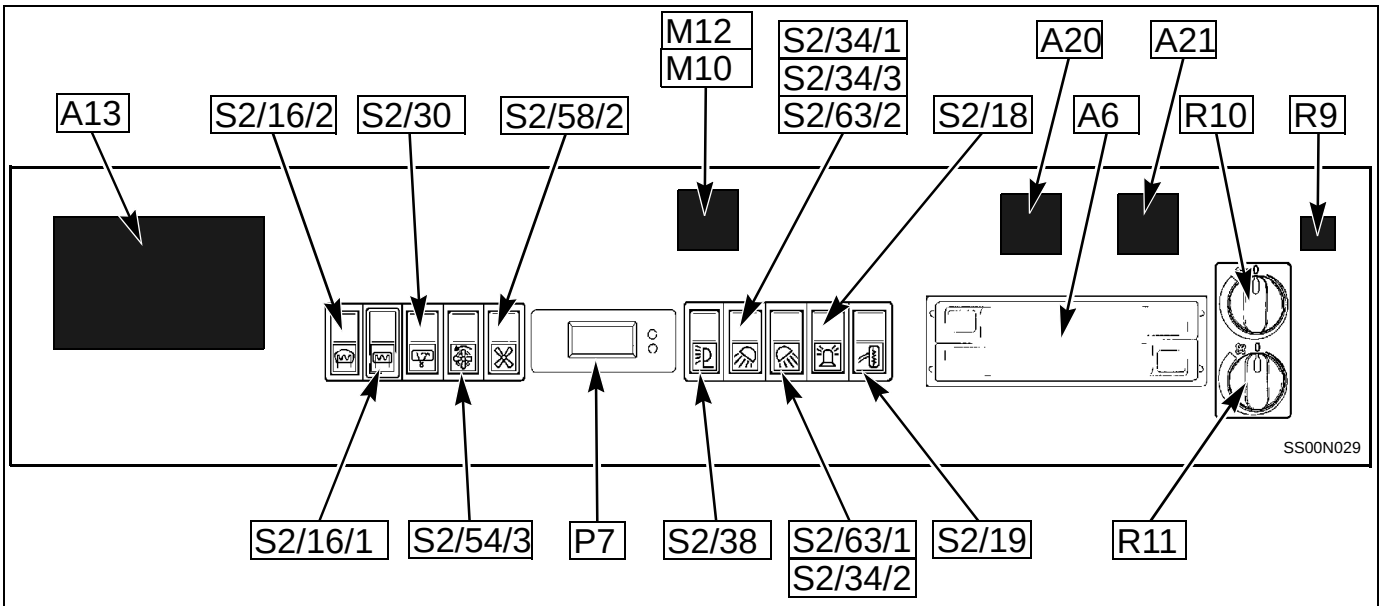
List of Plugs – Instrument Panel



A10	4-wheel drive/Differential Management – control unit
A12	Central print
H50/1	Trailer brake indicator
H50/2	Trailer brake indicator
K5/45	Relay, front axle differential gearbox
K5/50	Relay, trailer brakes
S1	Starter switch
S10	Clutch switch (start inhibitor)
S2/1	Switch, lighting system
S2/5	Switch, hazard warning lights
S2/53	Switch, pre-glowing
S2/57	Switch, digital changeover
S2/60	Switch, stationary operation
S2/64	Switch, searchlight, mudguard
S2/68	Switch, rear axle searchlight
S5	Brake light switch
S25	Switch, steering brake
S50/1	Switch, 3-stage blower motor
X3/38	Distributor, differential lock indicator
X3/39	Distributor, differential lock indicator, front
X5/8	Distributor, instrument potential, D+
X6/11	Plug-in connection, chassis, right, power shift
X9/1	Plug-in connection, instrument cable
X9/2	Plug-in connection, instrument cable
X9/3	Plug-in connection, instrument cable
X9/4	Plug-in connection, instrument cable
X9/5	Plug-in connection, instrument cable
X9/6	Plug-in connection, instrument cable
X10/11	Plug-in connection, instrument, transmission
X11/2	Distributor, instrument potential 58, left
X11/3	Distributor, instrument potential 58, right
X14/12	Plug-in connection, instrument cable chassis, left
X24/3	SPlug-in connection, chassis, right, instrument cable
(2)	Ground, instrument panel
(4)	Ground, console, instrument plug

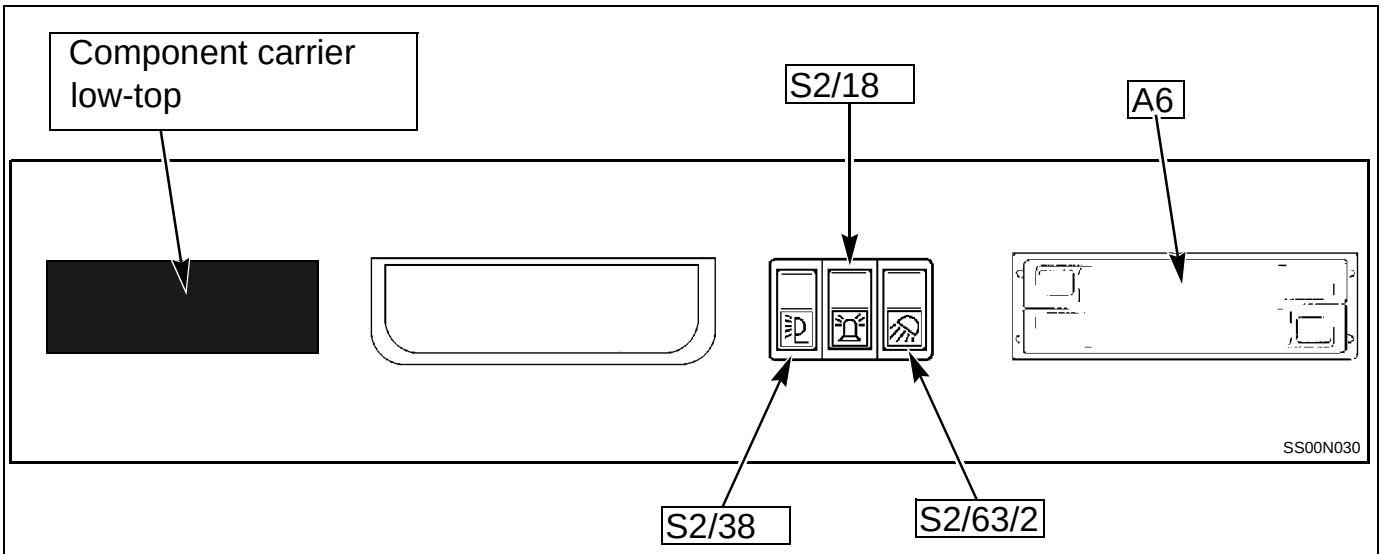
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List of plugs, roof lining, high-top



A6	Radio
A13	Print, roof print
A20	Air conditioning control
A21	Blower motor control
M10	Roof blower motor
M12	Roof blower motor
S2/16/1	Switch, heated rear window
S2/16/2	Switch, heated windscreen
S2/18	Switch, rotating beacon
S2/19	Switch, mirror heating
S2/30	Switch, rear washer/wiper system
S2/34/1	Switch, searchlight, twin power
S2/34/2	Switch, 2 searchlights, roof, rear
S2/34/3	Switch, searchlight trafficator/position light
S2/38	Switch, auxiliary headlight
S2/54/3	Switch, blower motor, positions 1-2-3
S2/58/2	Switch, blower motor ON / OFF
S2/63/1	Switch, rear searchlight, 2+2
S2/63/2	Switch, front searchlight, 2+2
P7	Digital clock
R9	Temperature sensor
R10	Air conditioning control potentiometer
R11	Roof blower motor potentiometer

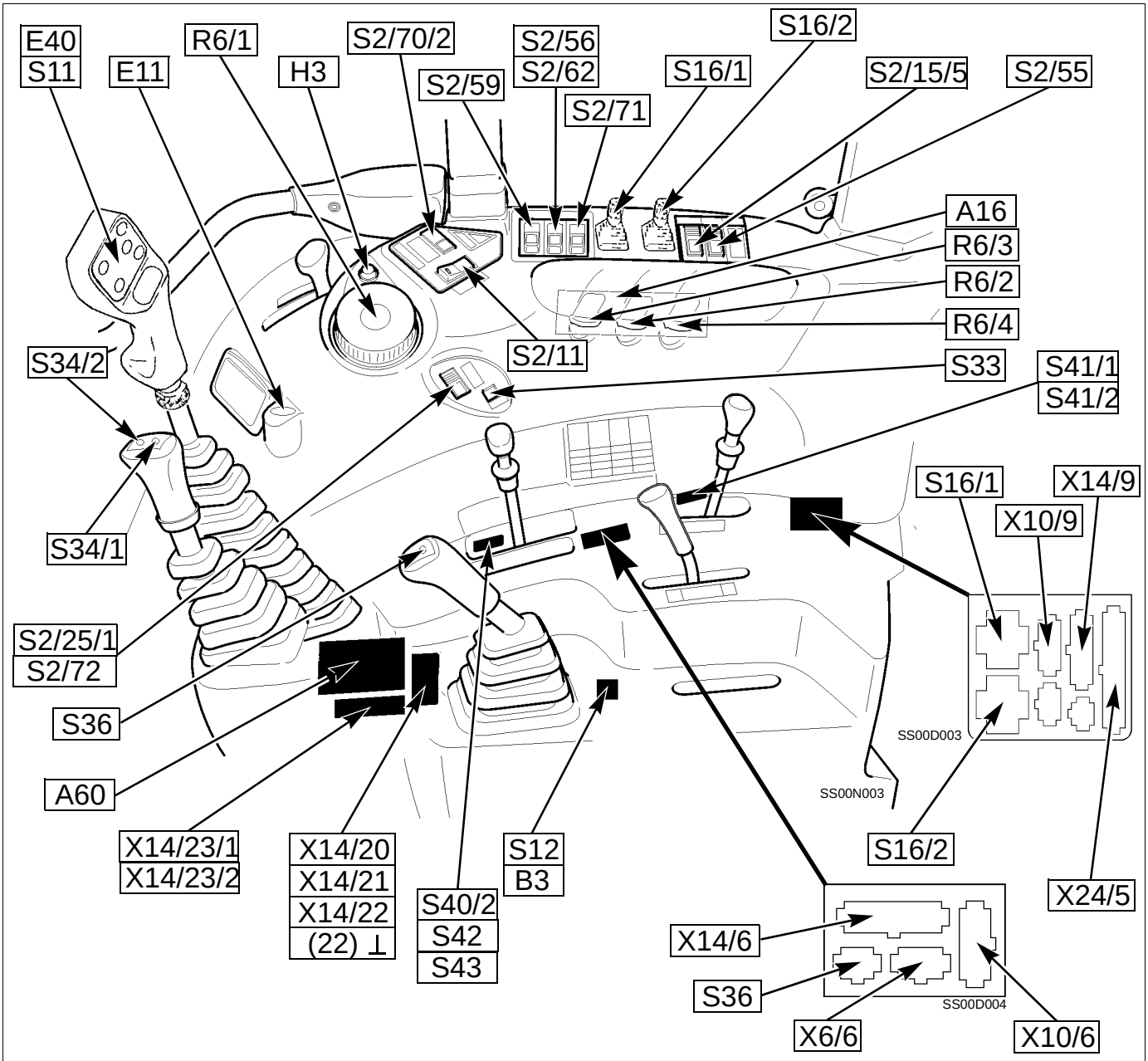
List of plugs, roof lining, low-top



A6	Radio
S2/18	Switch, rotating beacon
S2/38	Switch, auxiliary headlight
S2/63/2	Switch, front searchlight, 2+2

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List of plugs, EHR, right-hand side panel

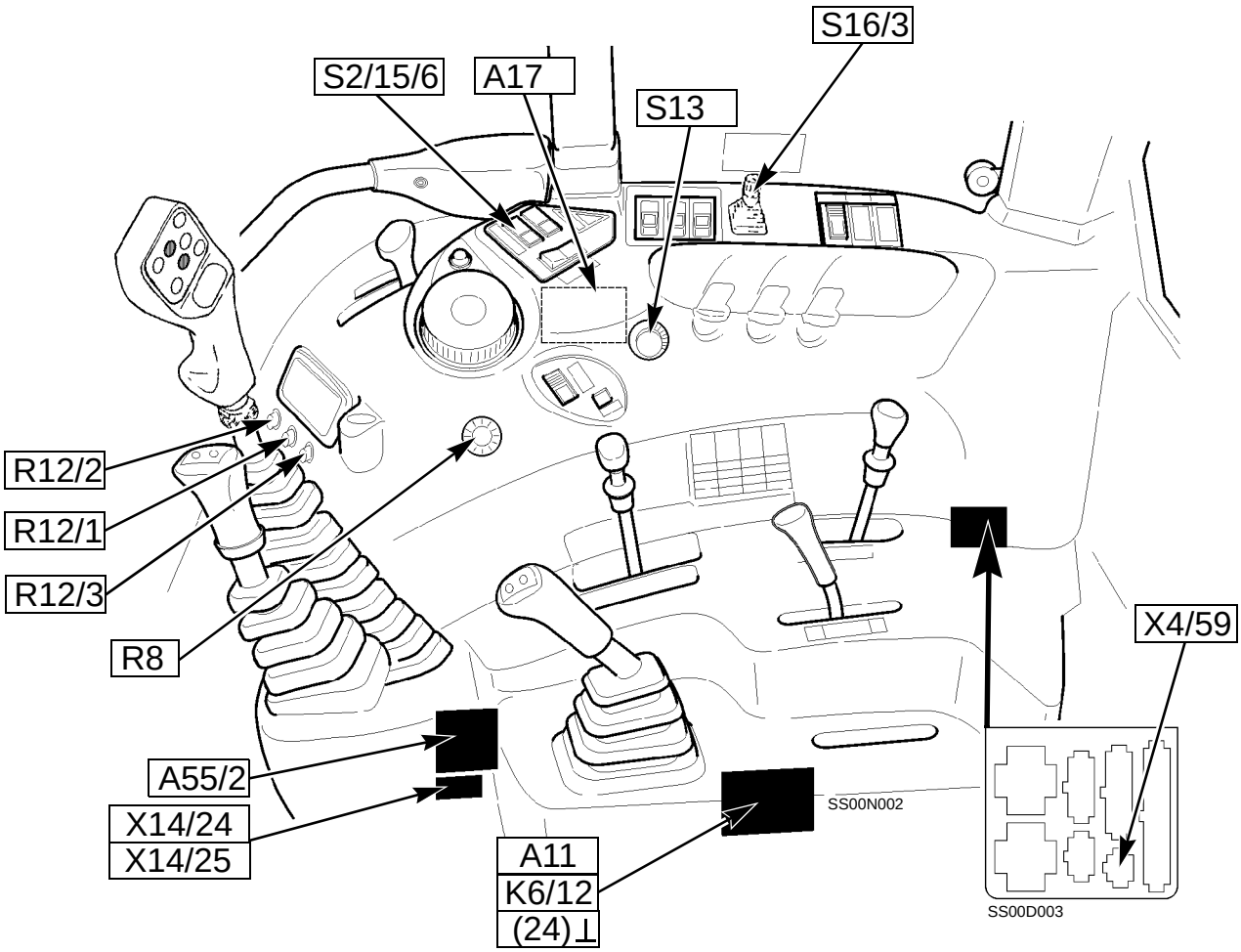


A16	Print, EHR-B operating console
A16	Print, MHR operating console
A60	ECCU (Electrical Central Control Unit)
B3	Compressed air transmitter
E11	Cigarette lighter
E40	Multi-controller lighting
H3	Indicator lamp, PTO Management ACTIVE
R6/1	Setpoint potentiometer
R6/2	Lift limitation potentiometer
R6/3	Mixing potentiometer
R6/4	Lowering speed potentiometer
S2/11	Safety switch
S2/15/5	Switch, internally operated external pushbuttons
S2/25/1	Switch, EHR lift (green)
S2/55	Switch, front differential lock
S2/56	Switch, differential lock management
S2/59	Switch, 4-wheel drive management
S2/62	Switch, rear differential lock
S2/70/2	Switch, rear PTO shaft
S2/71	Switch, PTO shaft management
S2/72	Switch, fast retract
S11	Multi-controller
S12	Switch, compressed air indicator
S16/1	Lever switch, 1st auxiliary control unit
S16/1	Plug-in connection to lever switch 1st auxiliary control unit
S16/2	Lever switch, 2nd auxiliary control unit
S16/2	Plug-in connection to lever switch 2nd auxiliary control unit
S33	Switch, EHR stop

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S34/1	Switch, power shift, slow
S34/2	Switch, power shift, fast
S36	Switch, joystick
S36	Plug-in connection, switch, joystick
S40/2	Switch, rear PTO shaft (start inhibitor)
S41/1	Switch, PTO shaft N/E indicator
S41/2	Switch, PTO shaft N/E indicator
S42	Switch, 540 PTO shaft indicator
S43	Switch, 1000 PTO shaft indicator
X10/9	Plug-in connection, instrument – chassis right – switch
X14/6	Plug-in connection, chassis right, PTO shaft indicator
X14/9	Plug-in connection, chassis right, 4-wheel drive differential lock management switch
X14/20	Distributor console, potential 15/1
X14/21	Distributor console, potential 15 safety
X14/22	Distributor console, potential D+
X14/23/1	Distributor, Multi-Controller joystick, 1st auxiliary control unit
X14/23/2	Distributor, Multi-Controller joystick, 2nd auxiliary control unit
X24/5	Plug-in connection, chassis, right, operating console
(22)	Ground, 'E' box

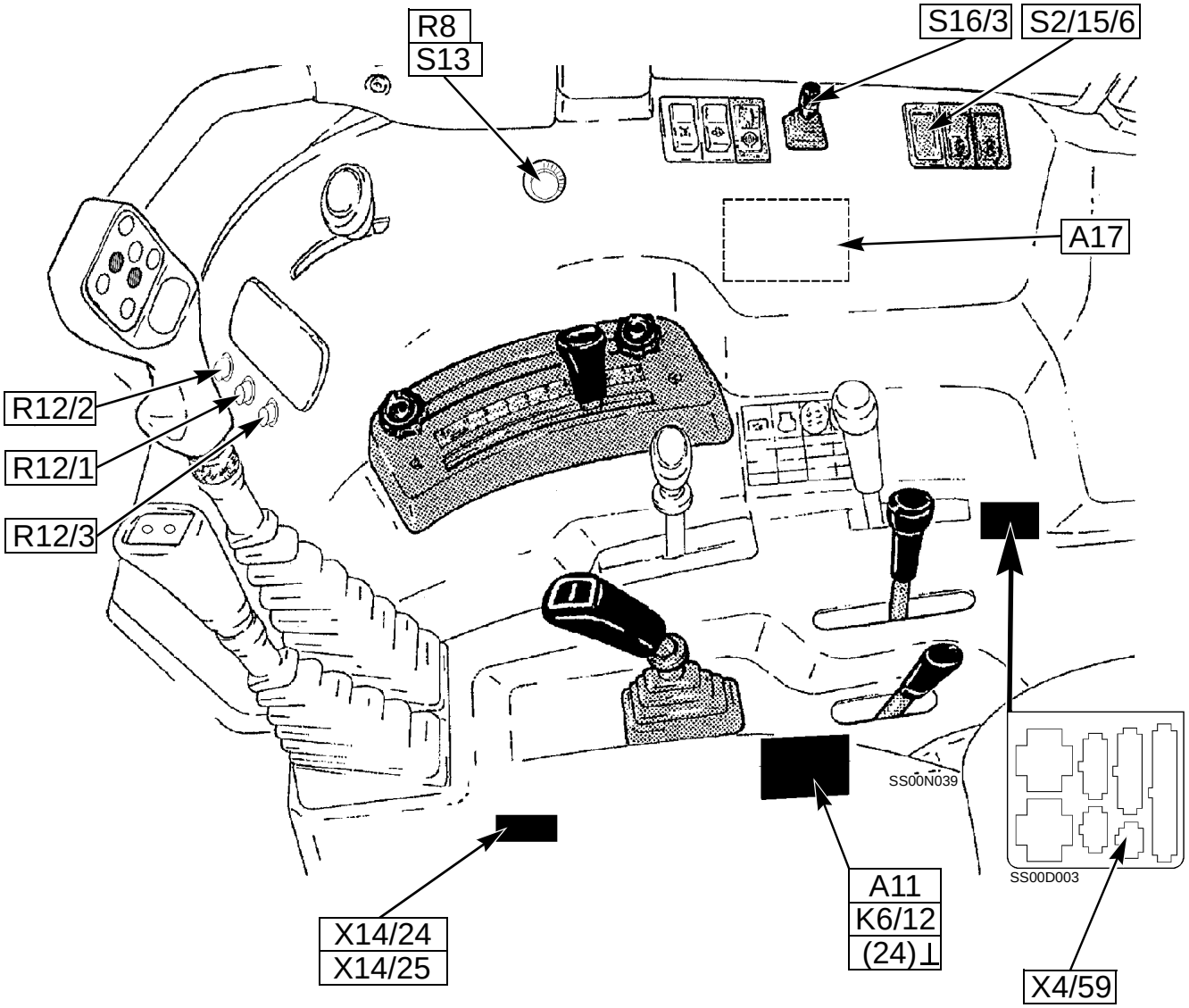
List of plugs, EHR, right-hand side panel, with EGE and EFH



A11	EGE control unit
A17	EFH print, with EHR
A17*	EFH print, with MHR
A55/2	EFH control unit, with EHR (with MHR in place of A25)
K6/12	Relay, electronic implement load relief
R8	Electronic implement load relief potentiometer
R12/1	EFH lift limitation potentiometer
R12/2	EFH mixing potentiometer
R12/3	EFH lowering speed potentiometer
S2/15/6	Internally operated external pushbutton, EFH
S13	Rotary switch EFH, 10 position
S16/3	Switch, electronic implement load relief
X4/59	Plug-in connection, EGE potentiometer
X14/24	Distributor, electronic implement load relief
X14/25	Distributor, electronic implement load relief
(24)	Ground, EGE electrics

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List of plugs, MHR, right-hand side panel, with EGE and EFH

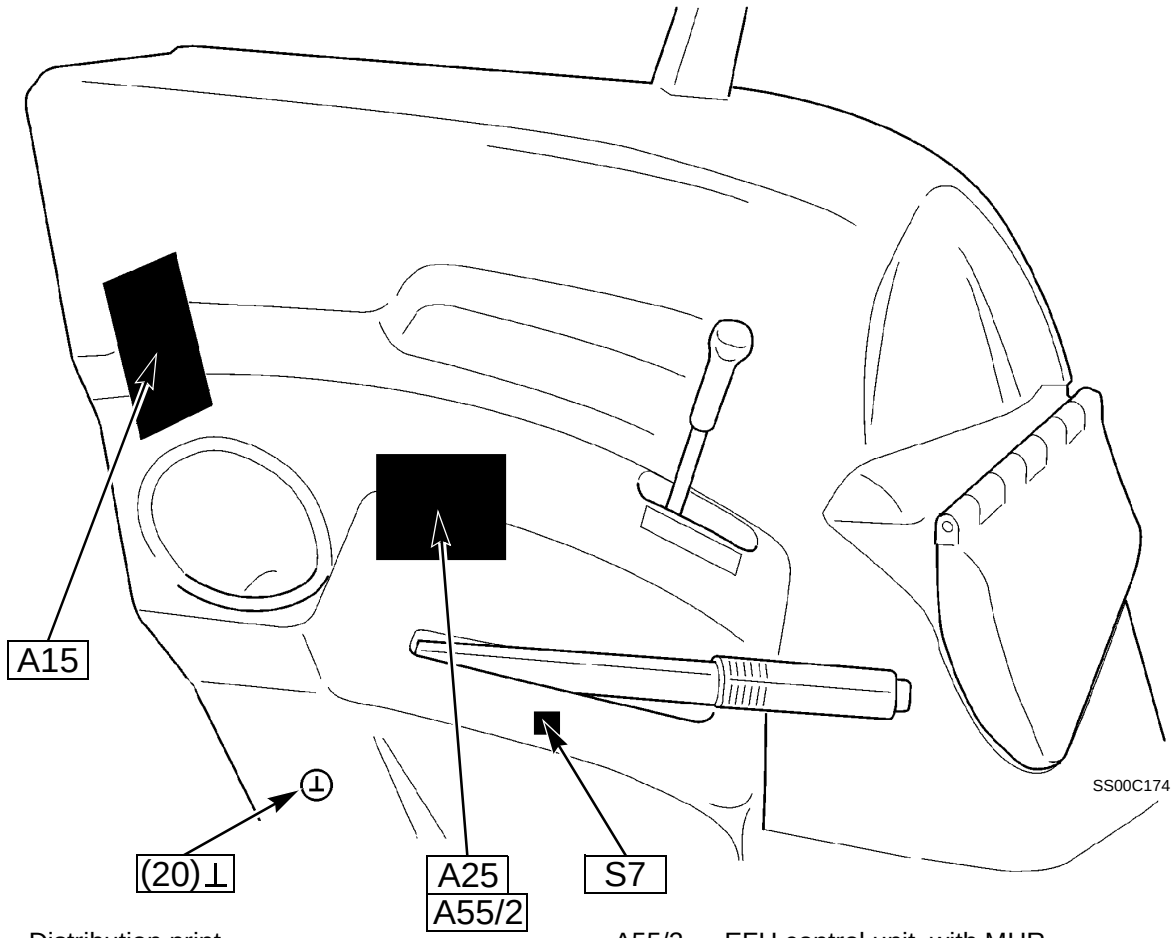


A11	EGE control unit
A17	EFH print
K6/12	Relay, EGE
R8	Electronic implement load relief potentiometer
R12/1	EFH lift limitation potentiometer
R12/2	EFH mixing potentiometer
R12/3	EFH lowering speed potentiometer
S2/15/6	Internally operated external pushbutton, EFH
S13	Rotary switch EFH, 10 position
S16/3	Switch, electronic implement load relief
X4/59	Plug-in connection, EGE potentiometer
X14/24	Distributor, electronic implement load relief
X14/25	Distributor, electronic implement load relief
(24)	Ground, EGE electrics

NOTE: *The position of the EFH control unit A55/2 is for MHR in place of the EHR-B control unit A25.*

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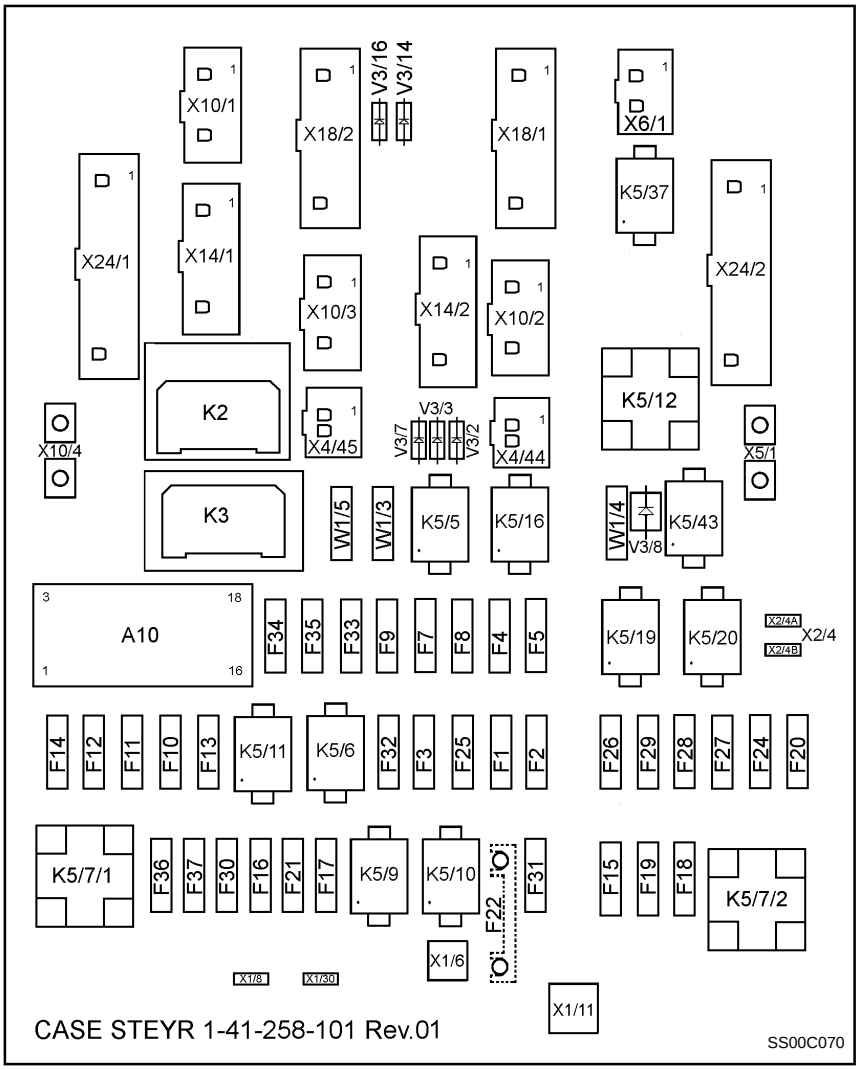
List of Plugs – Left-hand Side Panel



A15	Distribution print (with reversing facility, under the right-hand side panel)	A55/2	EFH control unit, with MHR
A25	EHR-B control unit (with reversing facility, under the right-hand side panel)	S7	Control switch, handbrake
		(20)	Ground, EHR box

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Central Print A12



Relays

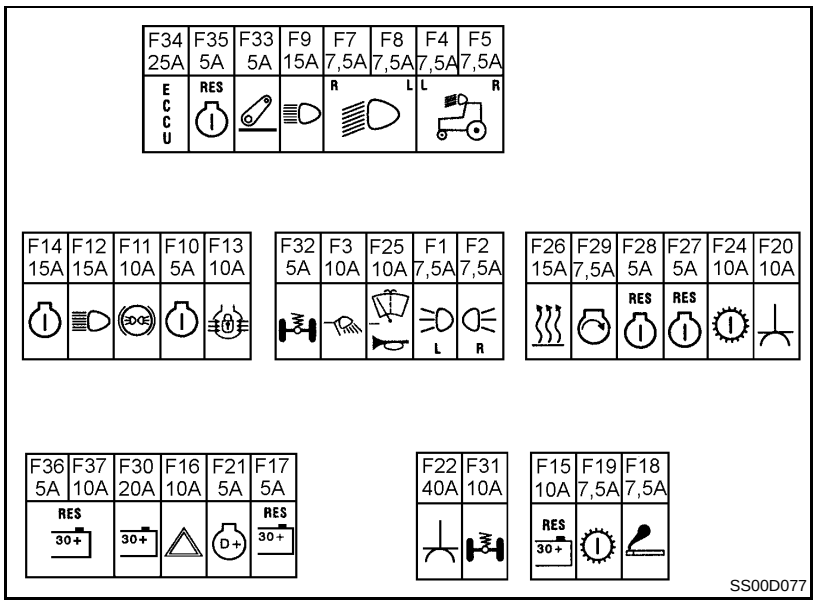
A10	4-wheel drive/Differential Management
K2	Flasher unit
K3	Interval relay
K5/5	Switchover relay for high beam
K5/6	Switchover relay for dipped beam
K5/7/1	Potential 15/1
K5/7/2	Potential 15/2
K5/9	Searchlight mudguard
K5/10	Light (Potential 58)
K5/11	Potential D+ supply
K5/12	Brake light/Opti-Stop
K5/16	Stationary stop
K5/19	Stationary operation stop
K5/20	Stationary operation stop
K5/37	Reserve (searchlight, rear axle)
K5/43	D+ switch OFF

List of Plugs

W1/3	Contact bridge, Opti-Stop
W1/4	Contact bridge, spark start
W1/5	Contact bridge, low signal
X1/6	Plug-in connection, power socket
X1/8	Plug-in connection, central print
X1/11	Screw-on connection, central print 30
X1/30	Plug-in connection, central print Potential 30, central print
X2/4	Plug-in connection, potential 15 socket
X4/44	Plug-in connection, spark start
X4/45	Spare plug-in connection
X5/1	Ground distributor, central print
X6/1	Plug-in connection, searchlight Rear axle
X10/1	Plug-in connection, instrument cable
X10/2	Plug-in connection, cable, chassis, right
X10/3	Plug-in connection, on-board computer provision
X10/4	Distributor, potential 15, central print
X14/1	Plug-in connection, cable chassis, left
X14/2	Plug-in connection, instrument cable
X18/1	Plug-in connection, instrument cable
X18/2	Plug-in connection, roof supply
X24/1	Plug-in connection, instrument cable
X24/2	Plug-in connection, chassis, right

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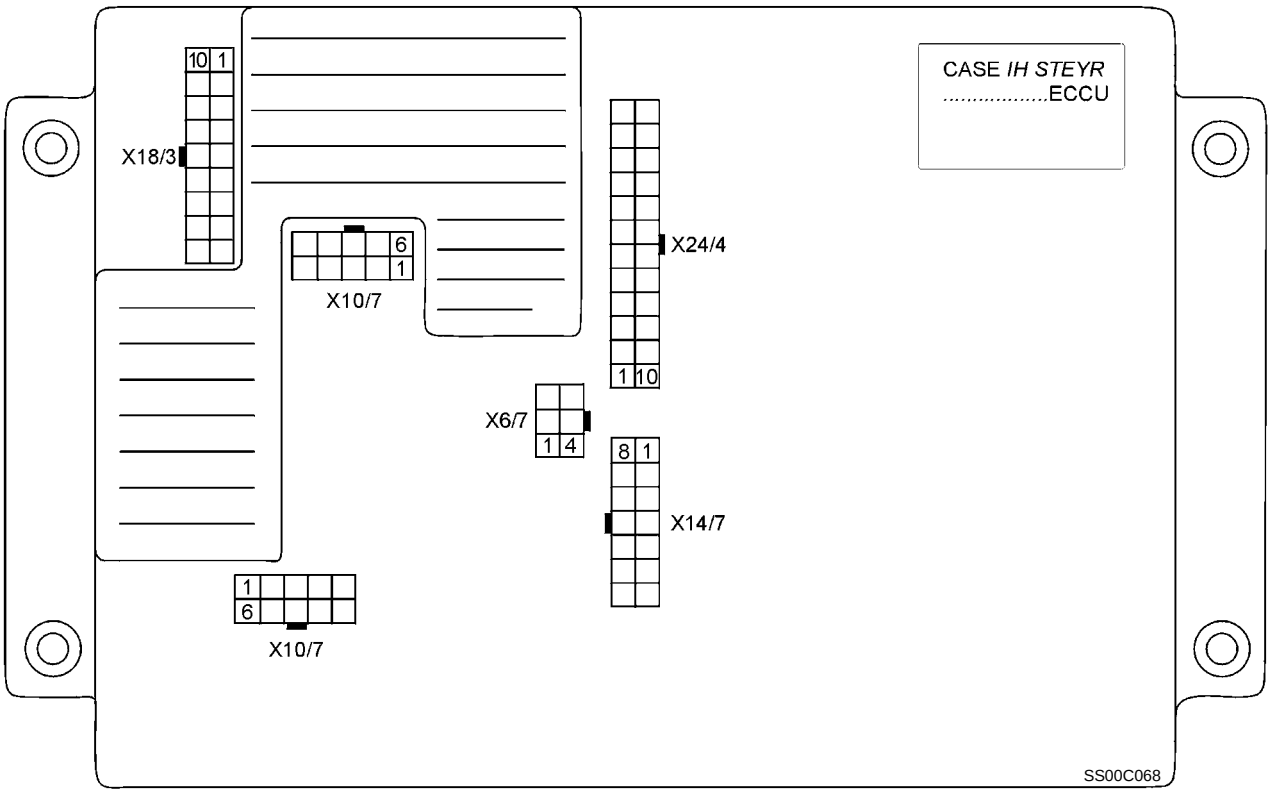
Fuses



F1	58 L Parking lamp, left	7.5 Amps
F2	58 R Parking lamp, right	7.5 Amps
F3	Searchlight mudguard	10 Amps
F4	Dipped beam left roof spare headlight	7.5 Amps
7.5	Dipped beam right roof spare headlight	5 Amps
F7	Dipped beam right headlight	7.5 Amps
F8	Dipped beam left headlight	7.5 Amps
F9	Main beam	15 Amps
F10	Roof potential 15/1	5 Amps
F11	Brake lamp	10 Amps
F12	Headlight flasher	15 Amps
F13	Differential front and rear	10 Amps
F14	Potential 15/1	15 Amps
F15	Searchlight, rear axle	10 Amps
F16	Hazard warning flasher	10 Amps
F17	Reserve potential 30	5 Amps
F18	Cigarette lighter	7.5 Amps
F19	Searchlight, rear axle	7.5 Amps
F20	Potential 10/2, standard signal socket	10 Amps
F21	Potential D+	5 Amps
F22	Power outlet socket	40 Amps
F24	Searchlight/reversing light	10 Amps
F25	Screen wipers, horn	10 Amps
F26	Foot-well heating	15 Amps
F27	Reserve potential 15/2	5 Amps
F28	Reserve potential 1572 (for on-board computer)	5 Amps
F29	Potential 15/2 (stationary stop)	7.5 Amps
F30	Ignition switch supply	20 Amps
F31	Potential 30 (front differential lock)	10 Amps
F32	Potential 15/2 (front differential lock)	5 Amps
F33	Potential 15/2, EHR	5 Amps
F34	Potential 15/2, ECCU	25 Amps
F35	Reserve potential 15/1	5 Amps
F36	Reserve potential 30	5 Amps
F37	Reserve potential 30	10 Amps

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ECCU A60
(Electronic Central Control Unit)



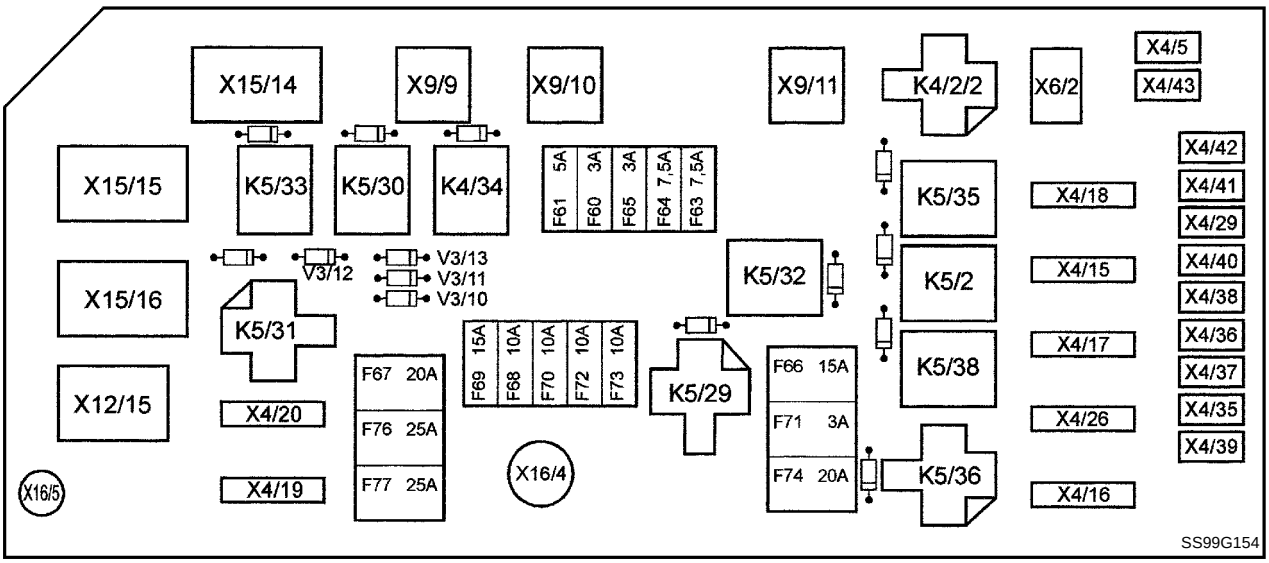
List of Plugs – ECCU

X6/7	Plug-in connection, spare
X10/7	Plug-in connection, ECCU auxiliary control unit
X14/7	Plug-in connection, chassis right, ECCU
X18/3	Plug-in connection, chassis, right, ECCU
X24/4	Plug-in connection, chassis, right, ECCU

NOTE: *The ECCU of the tractor series 9100 (9105 - 9145 / CS110 - 150) and M9000 (9078 - 9094 / CS78 - 94) are **not** identical!*

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Print – Roof electrics A13



Relays

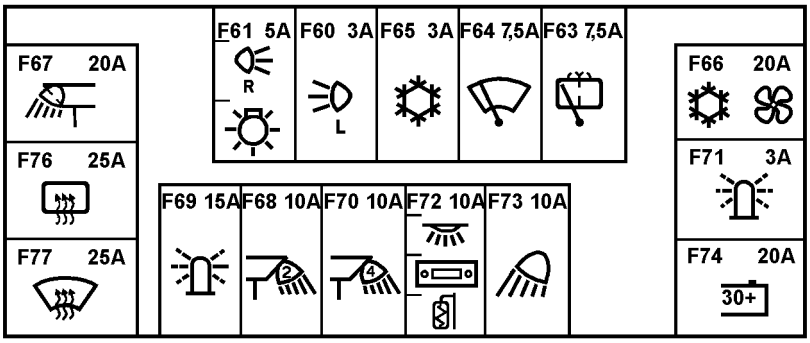
K4/2/2	Time relay 40 sec, interior lamp – delay
K5/2	Windscreen wiper front
K5/29	Potential 15
K5/30	2 Searchlights, rear, roof
K5/31	Searchlight, front, roof TWIN POWER
K5/32	Blower motor – air conditioning
K5/33	Rotating beacon
K5/34	4 Searchlights, rear, roof, number plate lighting
K5/35	Mirror heating
K5/36	Air conditioning, fan
K5/38	Searchlight (flasher/sidelight)

List of Plugs

X4/5	Plug-in connection, roof frame
X4/15	Plug-in connection, mirror heating
X4/16	Plug-in connection, air-conditioning, roof
X4/17	Plug-in connection, roof frame
X4/18	Plug-in connection, roof frame
X4/19	Plug-in connection, heated windscreen
X4/20	Plug-in connection, heated rear window
X4/26	Plug-in connection, roof frame
X4/29	Plug-in connection, roof switch
X4/35	Plug-in connection, rotating beacon switch
X4/36	Plug-in connection, roof switch
X4/37	Plug-in connection, roof switch
X4/38	Plug-in connection, roof switch
X4/39	Plug-in connection, roof switch
X4/40	Plug-in connection, roof switch
X4/41	Plug-in connection, roof switch
X4/42	Plug-in connection, roof switch
X4/43	Plug-in connection, number plate lighting
X6/2	Plug-in connection, roof frame
X9/9	Plug-in connection, roof canopy cable
X9/10	Plug-in connection, rear wiper
X9/11	Plug-in connection, roof air cond.
X12/15	Plug-in connection, roof canopy cable
X15/14	Plug-in connection, roof frame
X15/15	Plug-in connection, roof canopy cable
X15/16	Plug-in connection, roof supply
X16/4	Screw connector, potential 30
X16/5	Screw connector, ground 9

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Fuses

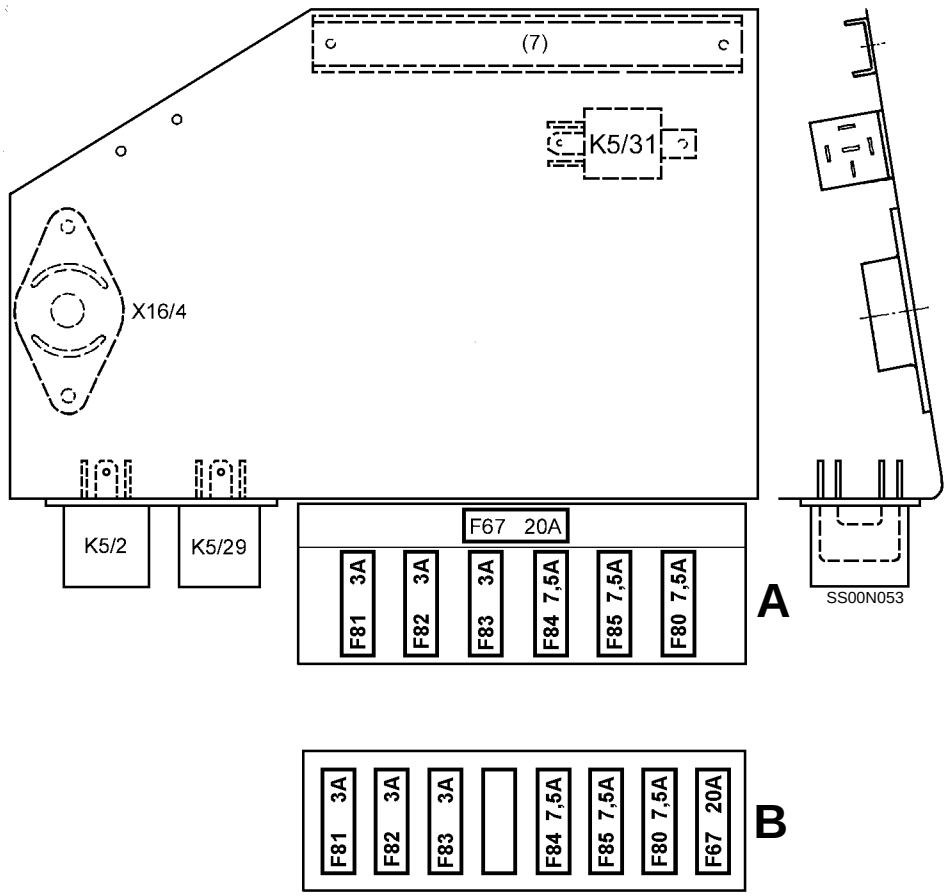


SS98C146

F60	Parking lamp, front left	3 Amps
F61	Parking lamp right front, potential 58	5 Amps
F63	Rear wiper	7.5 Amps
F64	Front windscreen wiper	7.5 Amps
F65	Air conditioning	5 Amps
F66	Blower motor/ Air conditioning	20 Amps
F67	Searchlight TWIN POWER	20 Amps
F68	2 searchlights, rear	10 Amps
F69	Rotating beacon	15 Amps
F70	4 searchlights, rear, number-plate lighting	10 Amps
F71	Rotating beacon	3 Amps
F72	Spot, radio, interior lighting, mirror heating	10 Amps
F3	Searchlight (flasher/sidelight)	10 Amps
F74	Air conditioning fan	20 Amps
F76	Heated rear window	25 Amps
F77	Heated windscreen	25 Amps

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Component carrier – Low-Top



List of Relays and Plugs

K5/2	Windscreen wiper, front	X16/4	Screw connector, potential 30
K5/29	Potential 15	(7)	Ground rail
K5/31	Searchlight front roof TWIN POWER		

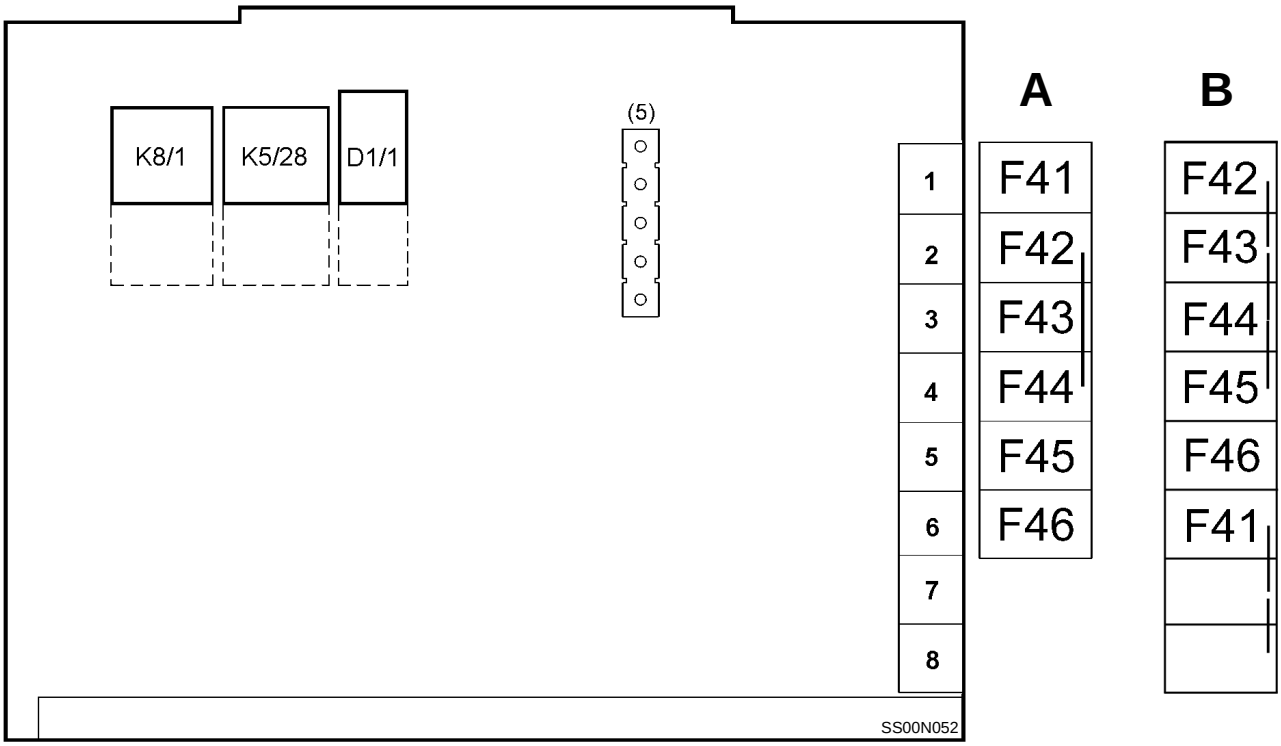
Fuses

A Fuse box, up to DBD0058541
B Fuse box, from DBD0058542 onwards

F67	Searchlight TWIN POWER	20 Amps
F80	Interior light, rotating beacon	7.5 Amps
F81	Switch, lighting, rear washer/wiper	3 Amps
F82	Parking lamp, front	3 Amps
F83	Parking lamp, right front (potential 58)	3 Amps
F84	Reserve headlight and front wiper	7.5 Amps
F85	Rear wiper	7.5 Amps

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Component Carrier – Engine Electrics



List of Relays and Plugs

D1/1	Diode group, fuel filter heating
K5/28	Fuel filter heating
K8/1	Starter
(5)	Ground rail

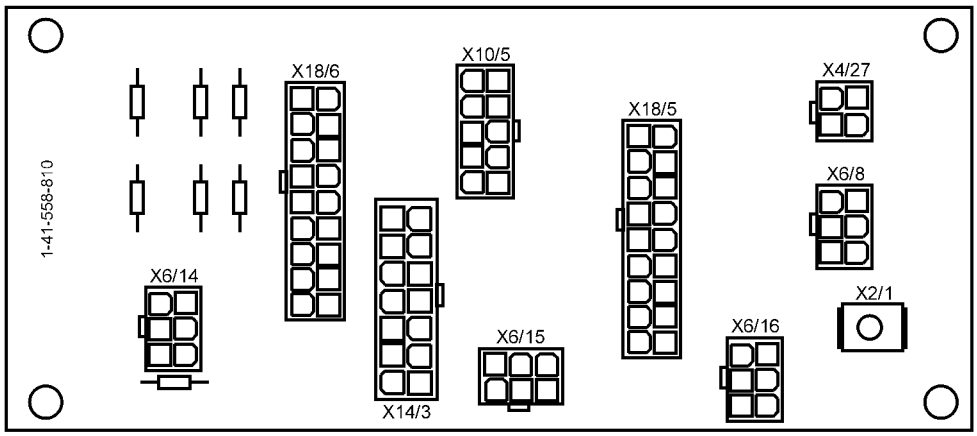
Fuses

A	Fuse box, up to DBD0058541
B	Fuse box, from DBD0058542 onwards

F41	Clock	3 Amps
F42	Spare, potential 30(EHR-D)	5 Amps
F43	Supply potential 58	10 Amps
F44	Fuel filter heating	20 Amps
F45	Potential 30 / EFH	5 Amps
F46	Pre-glowing	10 Amps

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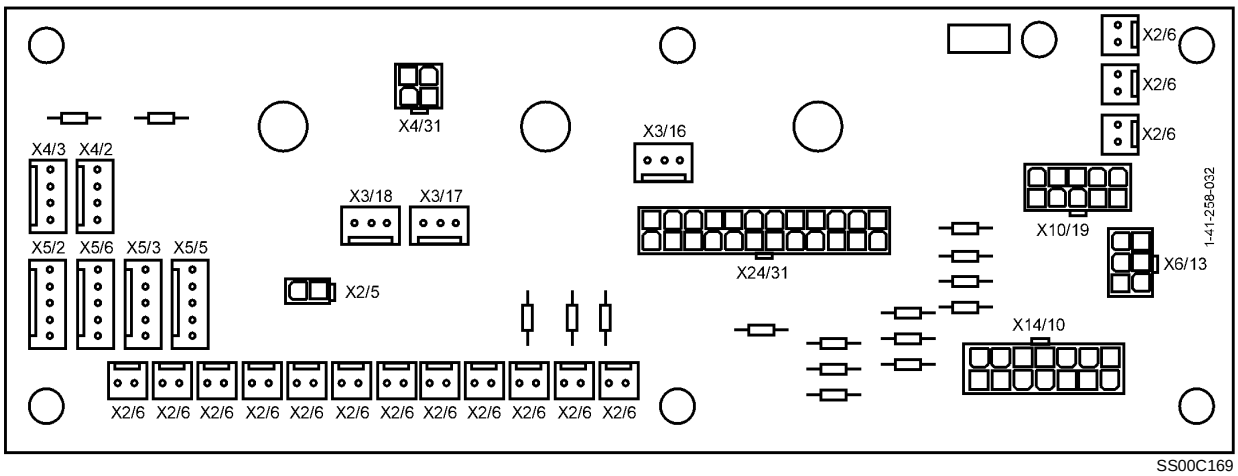
Print – EHR Left, A15 (Distribution Print)



List of Plugs

X2/1	Plug-in connection, potential 15 socket
X4/27	Plug-in connection, external sensor
X6/8	Plug-in connection, signal socket
X6/14	Plug-in connection, air-conditioning condenser
X6/15	Plug-in connection, chassis cable, left – EHR print, left
X6/16	Plug-in connection, front pressure control
X10/5	Plug-in connection, front control
X14/3	Plug-in connection, EHR distribution print
X18/5	Plug-in connection, EHR distribution print
X18/6	Plug-in connection, EHR distribution print

Print, EHR-B Operating Console A16

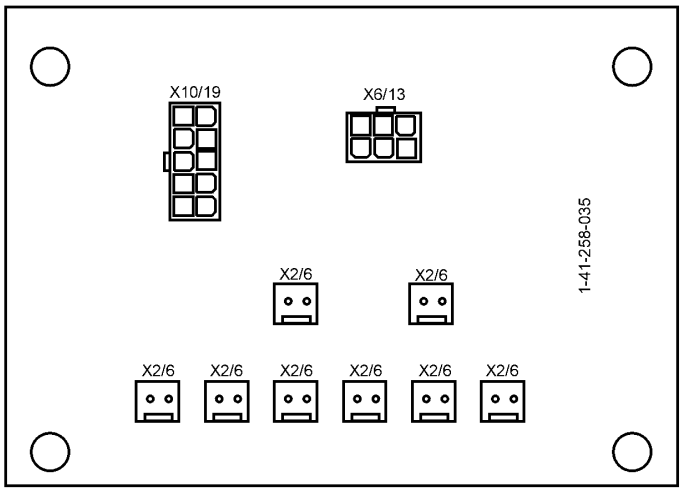


List of Plugs

X2/5	Plug-in connection, EHR stop
X2/6	Plug-in connection, switch lighting
X3/16	Plug-in connection, potentiometer, lowering speed
X3/17	Plug-in connection, potentiometer, lift limitation
X3/18	Plug-in connection, mixing potentiometer
X4/2	Plug-in connection, diagnosis/slip
X4/3	Plug-in connection RAISE/LOWER
X4/31	Spare plug-in connection, op. console
X5/2	Plug-in connection, aux. circuit
X5/3	Plug-in connection, ATC switch
X5/5	Plug-in connection, cable, chassis, right
X5/6	Plug-in connection, EHR setpoint
X6/13	Plug-in connection, operating console, cigarette lighter
X10/19	Plug-in connection, operating console, print
X4/10	Plug-in connection, EHR print, spare
X24/31	Plug-in connection, EHR print, operating console

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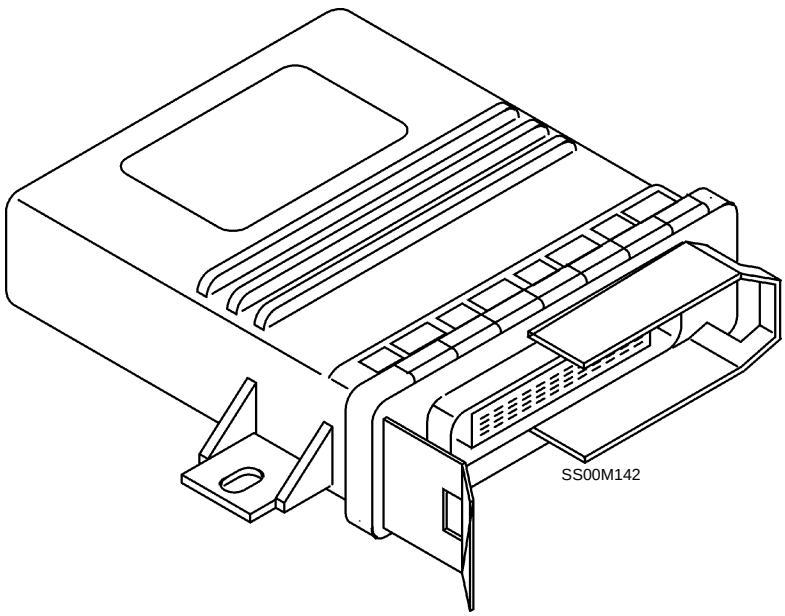
MHR – Operating Console A16



List of Plugs

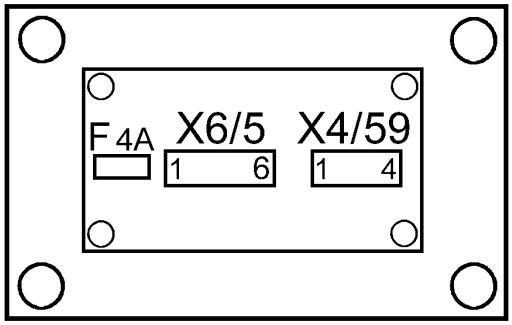
X2/6	Plug-in connection, switch lighting
X6/13	Plug-in connection, operating console, cigarette lighter
X10/19	Plug-in connection, operating console, print

EHR Control Unit A25



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EGE Control Unit A11

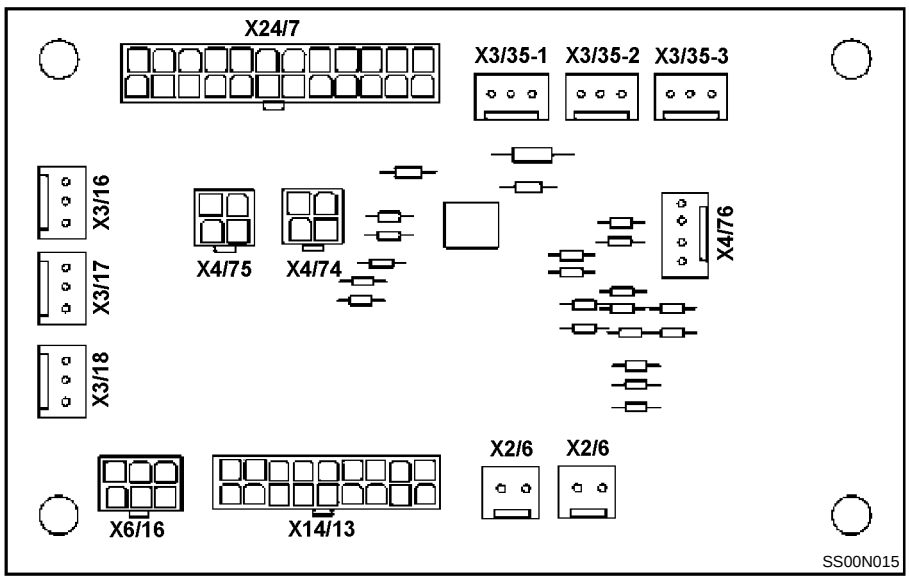


SS99J065

List of Plugs

X4/59	Plug-in connection, EGE potentiometer (R8)
X6/5	Plug-in connection, electronic front implement load relief
F	Glass tube fuse, 4 Amps (ground potential fuse)

EFH print A17



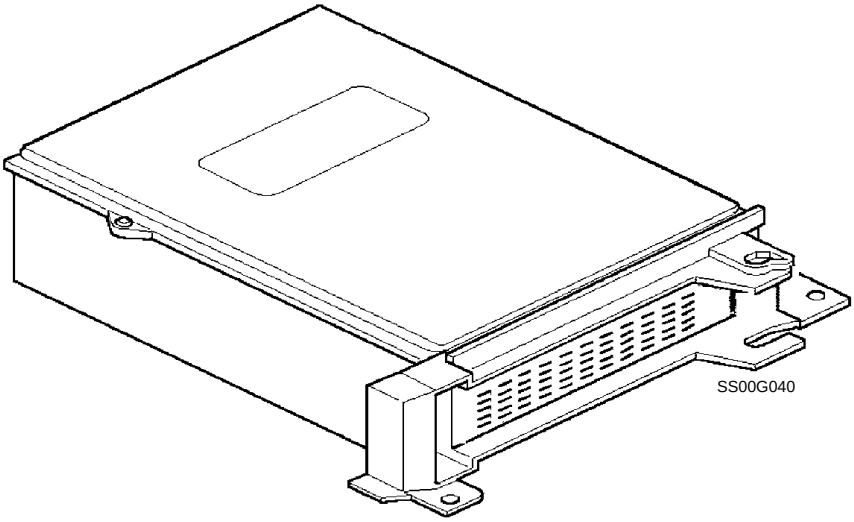
SS00N015

List of Plugs

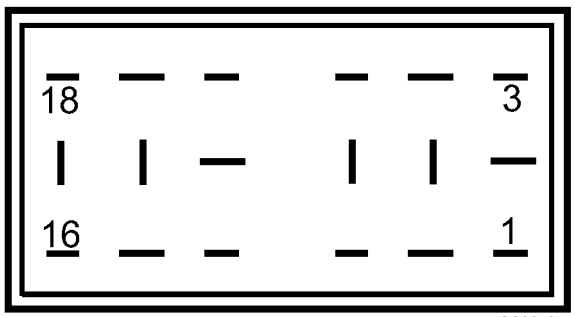
X2/6	Plug-in connection, switch lighting
X6/16	Plug-in connection, EFH grip
X14/13	Plug-in connection, EFH rotary switch
X4/76	Plug-in connection, EFH indicators
X4/75	Plug-in connection, EFH print, cable, internally operated external pushbutton
X4/74	Plug-in connection, EFH print, cable, external pushbutton
X3/17	Plug-in connection, potentiometer, lift limitation
X3/18	Plug-in connection, mixing potentiometer
X24/7	Plug-in connection, EFH print
X3/35	Plug-in connection, EFH print, reserve
X3/16	Plug-in connection, potentiometer lowering speed

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EFH control unit A55/2

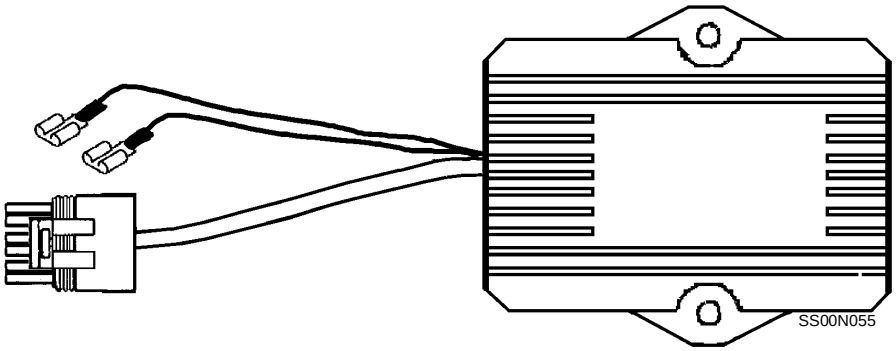


4-Wheel Drive Management – Control Unit A10



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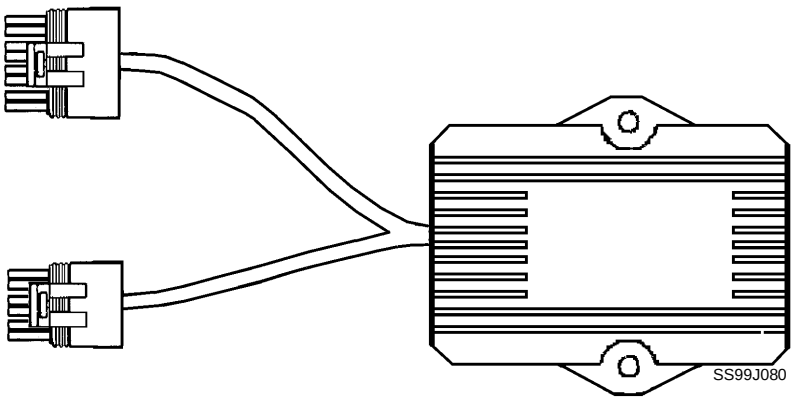
Blower motor – Control A21



List of Plugs

S2/20 Plug-in connection, roof blower
X3/42 Plug-in connection, blower potentiometer (R11)

Air-Conditioning – Control A20

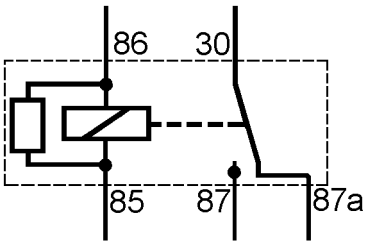


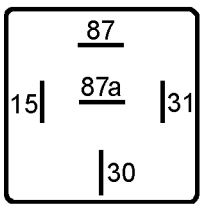
List of Plugs

X3/40 Plug-in connection, air cond. control
X4/25 Plug-in connection, air-conditioning potentiometer (R10)

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Relays



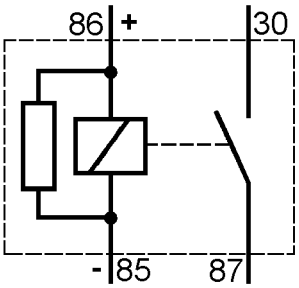


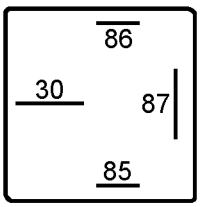
SS99G151

Miniature relay: (Messrs Wehrle)

Centre zero relay / Normally open
Centre zero relay without diode (K5/17)

Rated voltage ..... 12 VDC
Load ..... 20/30 A
Suppression ..... 390 Ω
Continuous duty 100%
Resistance 85 - 86 ..... 65 Ω ± 10%

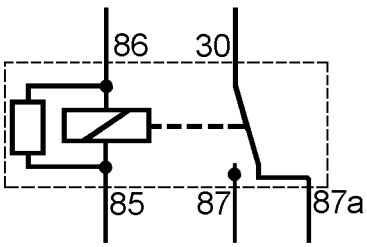


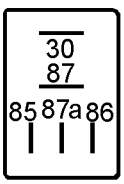


SS99G150

Power relay: (Messrs Wehrle)

Rated voltage ..... 12 VDC
Load ..... 70 A
Suppression ..... 560 Ω
Continuous duty ..... 100 %
Resistance 85 - 86 ..... 80 Ω

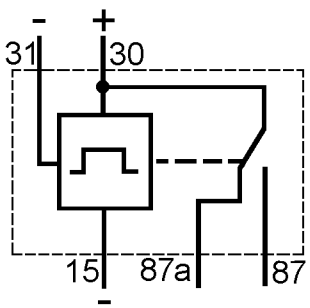


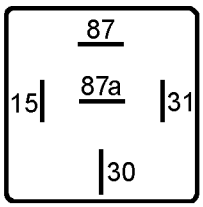


SS99G152

Centre zero relay – micro-relay: (Messrs Wehrle)

Rated voltage ..... 12 VDC
Load ..... 15/25 A
Suppression ..... 680 Ω
Continuous duty ..... 100 %
Resistance 85 - 86 ..... 90 Ω ±10% at 23°C





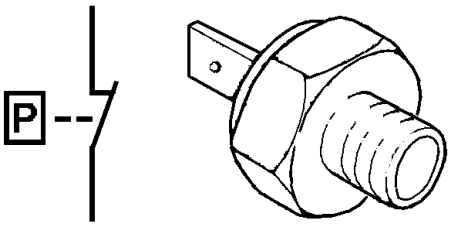
SS99G153

Timed relay 40 sec's. K4/2/2:(Messrs Wehrle u. Sohn)

Rated voltage ..... 12 VDC
Load ..... 5 A
Continuous duty 100%

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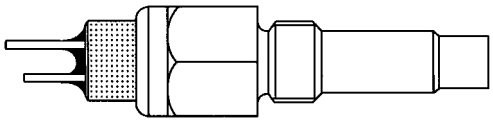
Switch



SS00C166

Engine oil pressure switch (S6):

Opens at ..... p > 0.5 bar
Type of contact ..... Normally closed



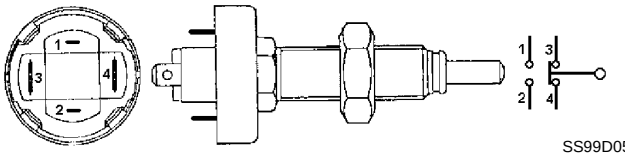
SS99J172

Switch, cooling water temperature (S32)
Engine temperature transmitter (B1):

(one component)

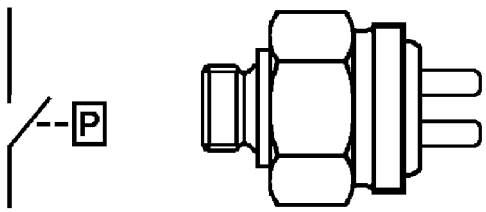
Switching point ..... ϑ > 106°C ± 3°C
Type of contact ..... Normally open
Ground via .... housing and own ground connection
Tightening torque ..... max. 20 Nm

Start safety switch (S10):



SS99D053

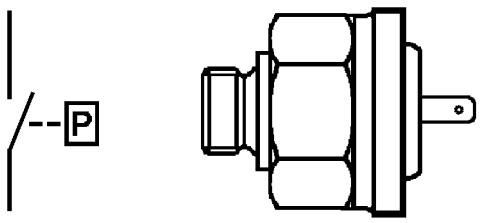
Pressure switches:
Front PTO shaft (S29)



SS99J074

Switching point ..... p > 9 ± 0.5 bar
Type of contact ..... Normally open
Tightening torque ..... max. 30 Nm

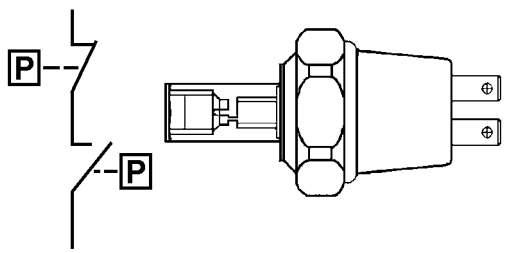
Power shift safety switch (S9):



SS99J075

Switching point ..... p > 12 ± 0.5 bar
Type of contact ..... Normally open
Tightening torque ..... max. 30 Nm

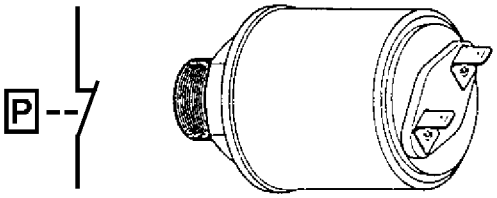
Safety switch – Air-cond. system (S30):



SS99G174

Rated voltage ..... 12 VDC
High pressure contact, opens at ..... p > 31.5 bar
Low pressure contact, opens at ..... p < 2 bar

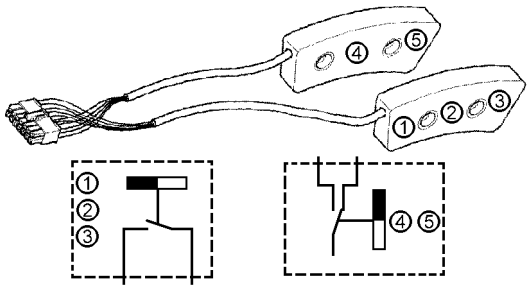
https://truckmanualshub.com/



SS99J078

Compressed air switch (S12):

Switching point ..... p > 5.5 bar
Type of contact ..... Normally closed
Ground via ... housing and own ground connection



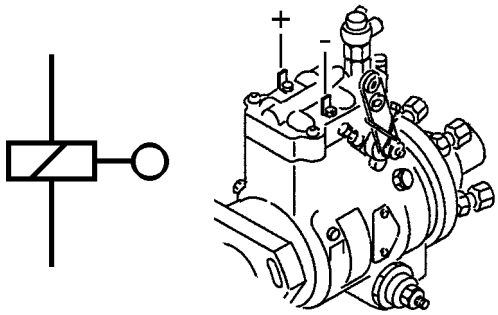
SS99J079

Reed relays (S40/2, S42, S43):

$I_{max.}$ ..... 500 mA
Type of contact ..... Normally open

Reed – changeover relay (S41/1,S41/2):

$I_{max.}$ ..... 500 mA
Type of contact ..... Changeover



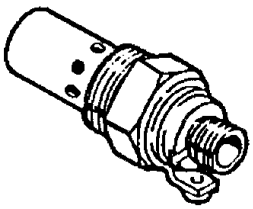
SS99J069

Cut-out solenoid (Y12):

Rated voltage ..... 12 VDC
Coil resistance ..... 3.8 Ω ± 10% at 20°C

The cut-out solenoid must not be activated for longer than 40 seconds in a dry state. As the cooling effect of the fuel on the coil is missing.

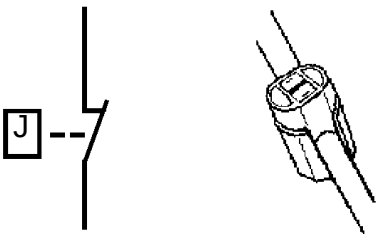
IMPORTANT: *Starter switch S1 must only be switched to position 1 immediately prior to starting.*



SS99H188

Thermo-start unit (E10/1):

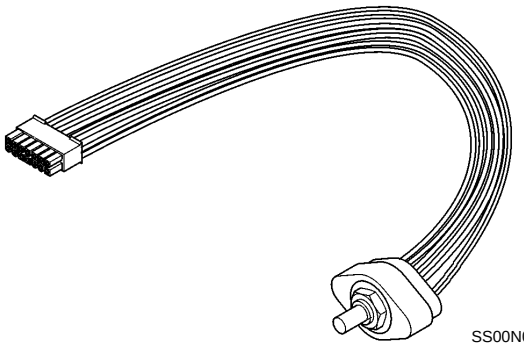
Supply voltage ..... 12 VDC
Heating element res. ..... 1 Ω ± 10%



SS99J167

Fuel pre-heating thermostatic switch:

Switching point ..... ϑ > 5°C
Type of contact ..... Normally closed



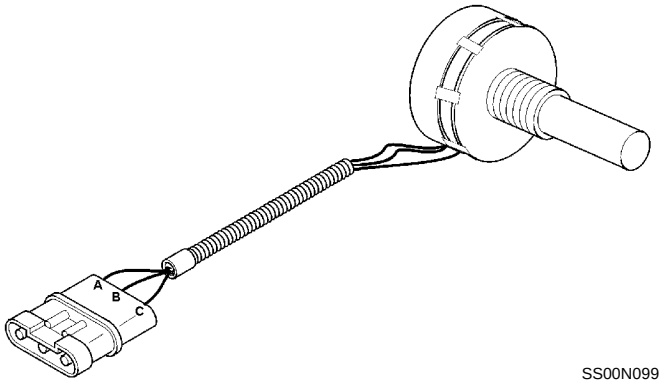
SS00N016

EFH 10 position switch (S13):

Switch position	Pin at X14/13	Voltage measured against pin 1	Switch position	Pin at X14/13	Voltage measured against pin 1
0	12	Ground			
1	11	1.55 VDC	6	6	6.46 VDC
2	10	2.82 VDC	7	5	7.21 VDC
3	9	3.89 VDC	8	4	7.96 VDC
4	8	4.84 VDC	9	3	8.75 VDC
5	7	5.68 VDC	10	2	9.6 VDC

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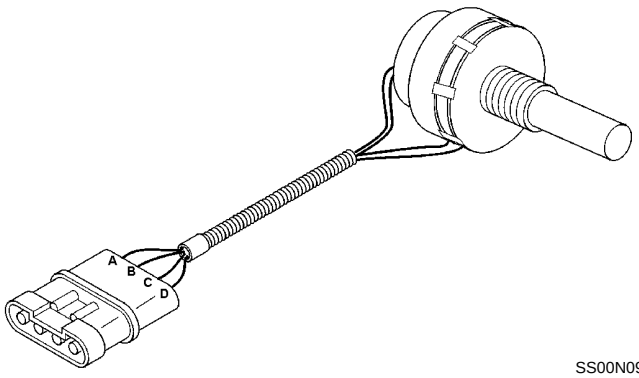
Potentiometer for



SS00N099

Air-cond. roof blower motor potentiometer (R11):

Res. measured A - C ..... 15 KΩ ± 20%
Res. measured A - B ..... 0 - 15 KΩ ± 20%

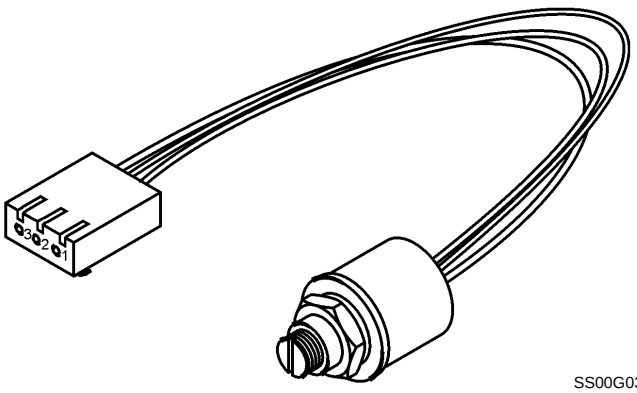


SS00N098

Air-cond. potentiometer (R10):

Potentiometer with integrated air-cond. – ON/OFF switch

Res. potentiometer ..... 10 KΩ ± 20%
Res. measured A - B ..... 0 - 10 KΩ ± 20%
Switch ON/OFF ..... C - D

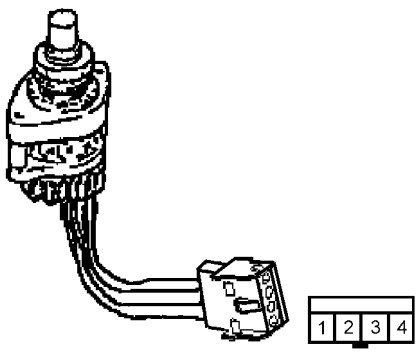


SS00G039

EHR potentiometers (R6/1,R6/2,R6/3,R6/4) EFH potentiometers (R12/1,R12/2,R12/3):

The potentiometers are identical in value. The differences lie in the wiring and length of the shaft

Res. potentiometer ..... 4700 Ω ± 20%
Res. measured 1 - 2 ..... 0 - 4700 Ω ± 20%



SS99J070

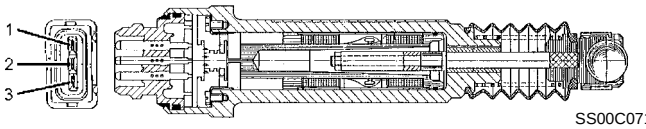
Stepping potentiometer EGE (R8):

Resistance measurement across X4/59

Pin	Latch 0	Latches 1 - 24
3 - 4	3.5 kΩ	3.5 kΩ
2 - 4	•	3.5 kΩ - 0.2 Ω
2 - 3	•	0.2 Ω - 3.5 kΩ
1 - 2	0.2 Ω	•
1 - 2	—•—	—/•—

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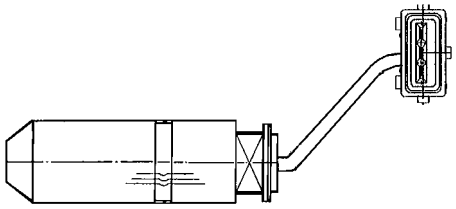
Sensors



SS00C071

EHR position sensor (B9/1):

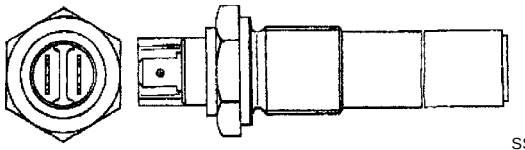
1 = Ground
2 = Signal ..... approx. 2.5 to 7 VDC
3 = Supply ..... 9.5 VDC (EHR box)


SS99H181

EHR force sensors (B10/1,B10/2):

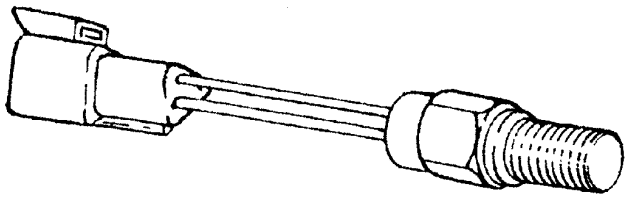
Measurement range:40KN (Bosch end number: 545)

1 = Ground
2 = Signal ..... 2.5 to 7.5 VDC
(not loaded, approx. 4.7 VDC)
3 = Supply ..... 9.5 VDC (EHR box)


SS99D056

Inductive transmitter, driving speed (B6):

Resistance ..... 1050 Ω ± 10%
Distance to transmitter wheel ..... 0.5 to 1.0mm


SS00N020

Hall sensor, rear PTO shaft speed (B8):

Supply voltage ..... 12 VDC
Current consumption ..... 15 mA
Operating range ..... 1Hz to 25 kHz
Distance to transmitter wheel ..... 1.0 to 3.0 mm

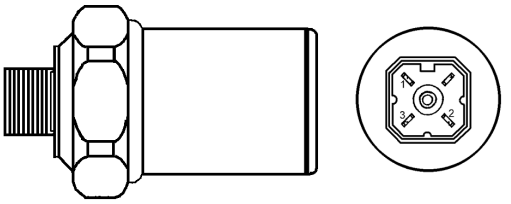
A = Supply
B = Signal
C = ground


SS99J157

Air-conditioning temperature sensor (R9):

Type ..... NTC
Resistance A - B ..... ≈ 11 kΩ at 20°C

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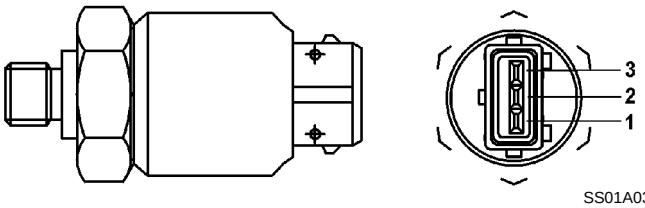
SS99J072

Pressure sensor EGE M2 (B20):

1 = Supply voltage ..... 12 VDC
2 = Ground
3 = Signal ..... see table
R_L ..... ≥ 5 kΩ

Signal voltage measured at plug X6/5 (pins 1 and 3)

Pressure (bar)	Voltage (V)	Pressure (bar)	Voltage (V)	Pressure (bar)	Voltage (V)
18	0.50	45	1.48	70	2.20
25	0.75	50	1.55	75	2.30
30	0.85	55	1.65	80	2.40
35	1.00	60	1.80	85	2.47
40	1.20	65	1.95	160	5.0

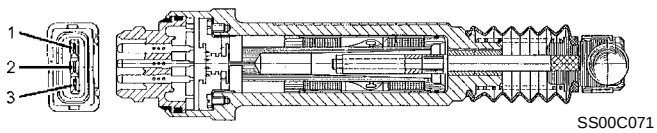


SS01A038

Pressure sensor, EFH (B21):

1 = Ground
2 = Signal
0 bar ..... 25% of the supply voltage
200 bar ..... 75% of the supply voltage
3 = Supply ..... 9.5 VDC (EFH box)
Pressure range ..... 0 to 200 bar
Tightening torque ..... 20 Nm

Position sensor EFH (B9/2):

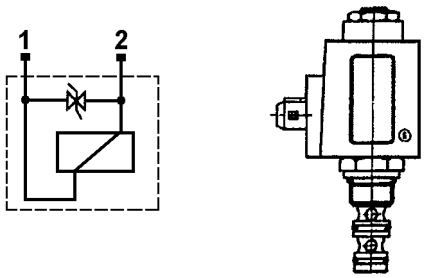


SS00C071

1 = Ground
2 = Signal ..... approx. 2.5 to 7 VDC
3 = Supply ..... 9.5 VDC (EHR box)

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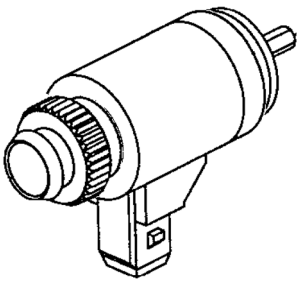
Solenoid Valves



SS99G166

Solenoid valve
4-wheel drive (Y1), power shift (Y3)
Rear axle diff. lock (Y10)
Front axle differential lock (Y8)
Rear PTO shaft (Y14), Messrs Hytos:

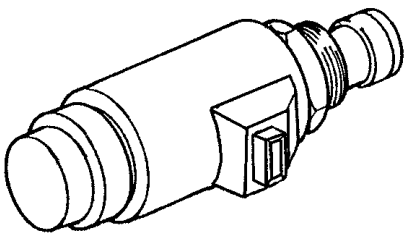
Rated voltage ..... 12 VDC
Suppression ..... Z diodes, anti-parallel
Coil resistance ..... 8 Ω ± 10% at 20°C
Continuous duty 100%



SS99J021

Solenoid valve EHR control unit (Y6,Y7):

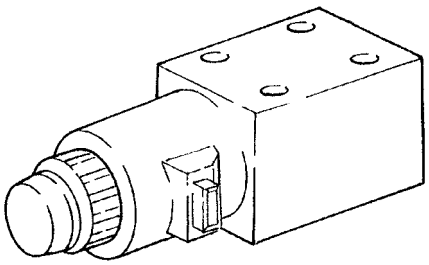
Proportional solenoid ..... 12 VDC
$I_{max.}$ ..... 3.5 A
Current control ..... Pulse width modulation
Coil resistance ..... 1.7 Ω



SS99J025

Solenoid valve (shut-off valve)
Auxiliary control unit (Y2/4):

Supply voltage ..... 12 VDC
Power ..... 28.8 W
Coil resistance ..... 5 Ω ± 10%
Continuous duty 100%

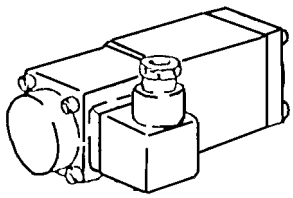


SS99J017

Solenoid valve (directional control valve)
Auxiliary control unit (Y2/1,Y2/2,Y2/3):

Supply voltage ..... 12 VDC
Power ..... 32.7 W
Coil resistance ..... 4.4 Ω ± 10%
Continuous duty 100%

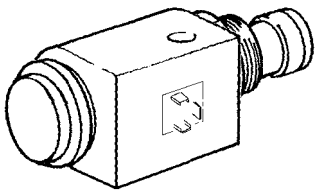
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SS99J171

Solenoid valve EGE (Y2/1, Y2/2): (Messrs Wandfluh)

Supply voltage ..... 12 VDC
Coil resistance ..... 5.4 Ω ± 10% at 20°C
Continuous duty 100%



SS99J170

Solenoid valve EGE (Y20, Y21):

Supply voltage ..... 12 VDC
Coil resistance ..... 7.5 Ω ± 10% at 20°C
Continuous duty 100%

NOT ILLUSTRATED

Solenoid valve, EFH control unit (Y16, Y17):

Supply voltage ..... 12 VDC
Coil resistance ..... 1.7 Ω + 5 Ω at 20°C

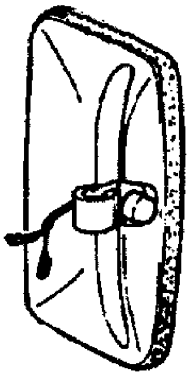
NOT ILLUSTRATED

EFH solenoid valve (Y18, Y19):

Supply voltage ..... 12 VDC
Coil resistance ..... 8.8 Ω ± 10% at 20°C

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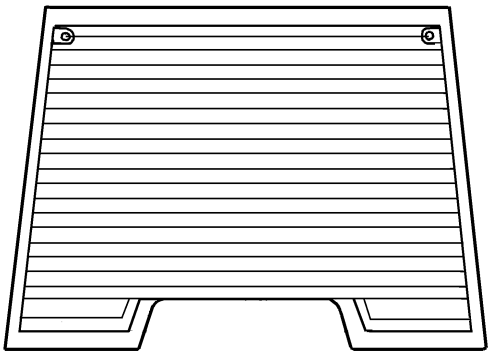
Heating elements



SS00J092

Mirror heating E18/1 and E18/2:

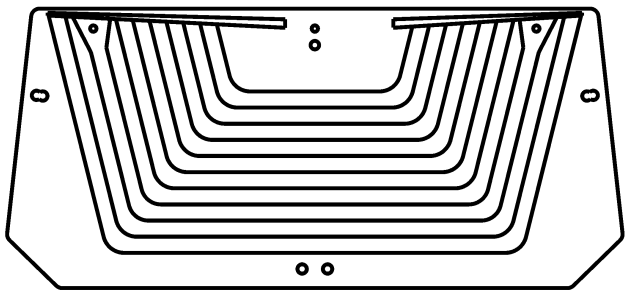
Power ..... 20 W
Current at 12 V ..... approx. 1.7 A
Resistance ..... 7.2 Ω ± 20%
Rated voltage ..... 12 VDC



SS00J093

Heated windscreen; E25:

Power ..... 280 W
Current consumption at 12V ..... 23 A
Rated voltage ..... 12 VDC



SS00J039

Heated screen, rear, E26:

Power ..... 220 W
Current consumption at 12 V ..... 18 A
Rated voltage ..... 12 VDC

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Instrument Test Values

Fuel tank transmitter B2/1 (left) and B2/2 (right)		Fuel gauge (./M100)	
Diesel level	Resistance Ω	Pointer angle	Display area
0	10	0°	from 0 - 12° red sector
1/8	31.2	7.5°	
1/2	95	30°	from 30 - 35° white sector
1	180	60°	from 60 - 65° white sector

Engine temperature transmitter (B1)		Engine temperature gauge (./M102)	
Temperature °C	Resistance Ω	Pointer angle	Display area
45	239	0°	from 0 - 10° white sector
60	134	0°	
75	82	14°	
90	51	20°	
105	33.4	42°	from 42 - 52° red sector
113	26.8	53°	
120	22.4	60°	

Compressed air transmitter (B3)		Compressed air indicator (./M101)	
Pressure in bar	Resistance Ω	Pointer angle	Display area
0	10	0°	from 0 - 13° red sector
2	52	0°	
4	88	0°	
6	124	24°	from 37 - 42° white sector
8	155	42°	
10	184	60°	from 59 - 63° white sector

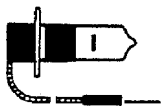
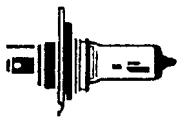
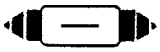
Tractor meter (./M2)			
Engine speed rpm	Permissible deviation	Pointer angle	Frequency at alternator terminal "W"
1000	± 100	67°	300 Hz
2000	± 65	163°	600 Hz

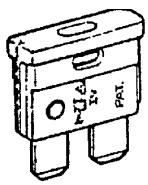
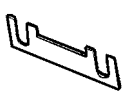
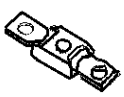
Transmission ratio, engine – generator i = 1: 3

Generator has 6 pairs of poles = 6 impulses per revolution

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Lamps and Fuses

Rotating beacon	H1 12V - 55W	1-34-772-051	
Searchlight	H3 12 V - 55W	190003452243	
Headlight, roof headlight	H4 12V - 60/55W	190003450013	
Trafficators, front and rear, brake light	P25-1 12 V - 21W	190003452245	
Roof number plate light	L 12 V - 5W	190003452276	
Cab interior light	L 12V - 10W	190003452249	
Front sidelights, tail light	G 12 V - 5W	190003452216	
Cigarette lighter	H 12V 2W	190003452207	
Digital tractor meter	12V/2W	135700580708	
Instrument lighting and indicator lamps	12V/1.2W	190003450031	
Toggle switch, EHR diagnosis LED	W5/1.2-12V-1.2W	190003452250	
Courtesy light, EHR console lighting	T4/4 12 V 4W	190003452212	

3A	violet	1-40-258-203	**20A**	yellow	1-40-258-120	
5A	beige	1-40-258-105	**25A**	white	1-40-258-125	
7.5A	brown	1-40-258-107	**30A**	green	1-40-258-130	
10A	red	1-40-258-110	**40A**	orange	1-40-258-140	
15A	light blue	1-40-258-115				
40A		1-40-177-040				
100A		1-40-277-100				
4 A	(slow-blow)	EGE	ý 5 x 20			

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Operation and Coding the Digital Instrument with Integrated operating Hours Counter

General information

All functions are called up using the spring-loaded switch (button), marked by the PTO symbol, on the right-hand side of the instrument panel. The switch need only be pressed briefly to call up operating functions. If it is held pressed for longer than 10 sec’s. coding values can be checked and/or corrected.

Operating / function

Ignition ON/Starting/Operation	the display shows a small "h" and the cumulative operating hours.
Press the button	again the rear PTO shaft speed will be shown on the display.
Press the button again	the front PTO shaft speed will be shown on the display.
Press the button again	the operating hours will again be shown on the display.

Coding

the engine speed (operating hours)
the rear PTO shaft speed indication
the front PTO shaft speed indicator

General information

Each time the button is briefly pressed, the display will be visibly increased by one impulse. If the button is pressed continually for longer than 1.5 sec’s. the impulses will be increased rapidly. When the button is released, "PRO" appears on the display after 8 sec’s. The value set is stored by briefly pressing the button once again and the display will return to the starting position (operating hours).

Coding the engine speed indication (operating hours)

Press the button for 20 sec’s.

The combination of numbers 1 - 1 appears in the upper part of the display, the current value or value to be corrected appears in the lower part of the display. The code adjustment range is 15 - 255 impulses. Tractors M9078 - M9094 or CS78 -94 have the **code number 18** (from DBD0055001).

Coding the rear PTO shaft speed indication

Press the button for 22 sec’s.

The combination of numbers 2 - 2 appears in the upper part of the display, the current value or value to be corrected appears in the lower part of the display. The code adjustment range is 1 - 100 impulses. The **code number 10** must be set and stored for all models (code number 10 = 10 teeth on the measuring wheel).

Coding the rear PTO front speed indication

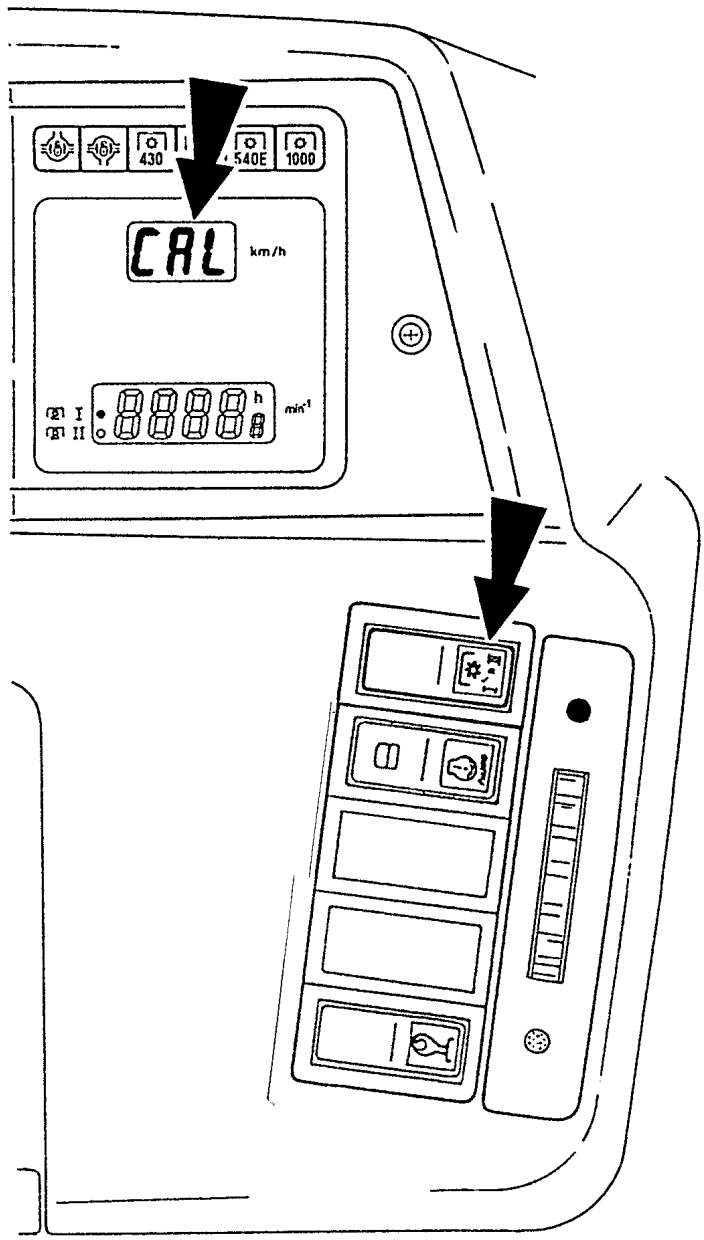
Press the button for 24 sec’s.

The combination of numbers 3 - 3 appears in the upper part of the display, the current value or value to be corrected appears in the lower part of the display.
The code adjustment range is 1 - 100 impulses. The **code number 38** must be set and stored for all models (from DBD0055001).

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Calibrating the speedometer

Re-calibration is required after replacing tyres or when 3 bars appear on the km/h display.



SS99J173

Measure out a distance of exactly 100 m and mark both ends clearly.

– Press the pushbutton (Switchover Rear PTO/Front PTO/Operating hours) for at least 10 seconds, until CAL appears on the km/h display.
– Start to drive and when the tractor's front axle is in line with the 0 mark, press the pushbutton briefly – the letters COU will then appear on the display.

The impulses will be counted to 9999 on the bottom part of the display, ---- will appear above this, pay no attention to this.

WARNING: *Minimum speed within the 100 m markings = 2 km/h – it is possible to drive faster.*

– When the front axle is in line with the 100 m mark, press the pushbutton briefly once again – the letters **PRO appear on the display.**
– If the programming sequence was carried out correctly, press the pushbutton again – the digital tractor meter will then store the new, calibrated count.

If the driving speed is not displayed, the tractor must be stopped and the engine must be stopped and then started again.

– When the tractor is at a standstill, 0.0 km/h will be displayed.
– The current speed is displayed when the tractor is in motion.

If a fault occurs during calibration (delay in pressing the switch etc.) – simply switch the ignition OFF before pressing the switch for the last time, the programming sequence will thus not be accepted and the old values remain in effect.

Repeat the procedure.

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Kapitel 5001

WERKSTATTHANDBUCH VORDERACHSE
WORKSHOP-MANUAL FRONT AXLE

TYP 20.16

CASE STEYR Landmaschinentechnik GmbH
Technische Dokumentation
A - 4300 St. Valentin, Steyrer Straße 32

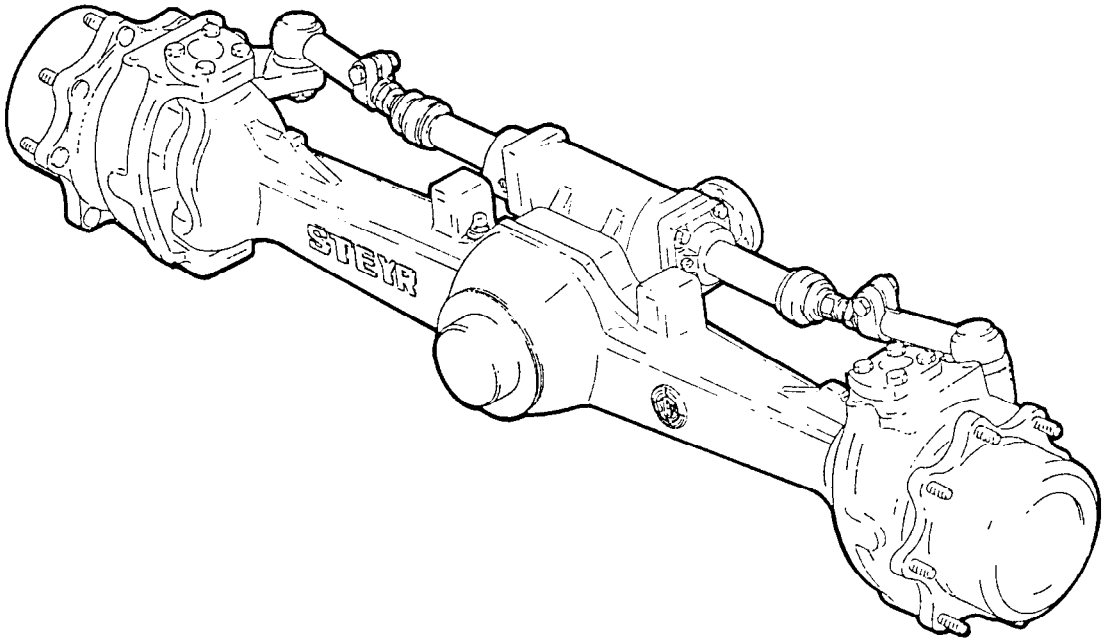
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WERKSTATTHANDBUCH
WORKSHOP MANUAL

VORDERACHSE - FRONT AXLE
TYP 20.16



STEYR 9000

9078 , 9083 , 9086 , 9094

TS 222/95
DA 27419 - 1,3 - 04.95

d - e

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Ausführungen		*Possibilitys*	
B 342.27*)	**1 -33 -341 -054**	**129 945**	**LTA B 316 LS**
B 342.28	**1 -33 -341 -055**	**129 947**	**LTA B 316 KH**
B 343.30	**1 -33 -341 -086**	**129 949**	**LTA C 316 KHB**

*)	Standardausführung	*)	*Basic edition*
LS	= Lamellenselbstsperrdifferential	*LS*	= *Limited slip differential*
KH	= Hydraulisch betätigte Klauensperre (100% Sperre)	*KH*	= *Hydraulic operated locking device*
B	= Innenliegende nasse Vollscheiben-bremse	*B*	= *Oil immersed disc brake system*
LTA	= Lenktriebachse	*LTA*	= *Steering drive axle*
APL	= Allrad Planetenlenkachse	*APL*	= *Steering drive axle with epicyclic final drives*

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Inhalt der Bereiche
Index of sections

Bereich *Section*	Beschreibung *Description*
A	Spezifikation *Specifications and features*
B	Bereichsansichten *Section view*
C	Anzugsdrehmomente *Torque settings*
D	Schmierung *Lubrication*
E	Spezialwerkzeuge *Special tools*
F	Demontage, Montage und Einstellungen *Disassembling, reassembling and setting operations*

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BESCHREIBUNG

Allrad Planetenlenkachse - Achsbrücke gegossen, Zentralantrieb, Achseinsatz mit Achsbrücke verschraubt.
Wahlweise Lamellen-Selbstsperrdifferential oder mechanische 100% Sperre elektrohydraulisch betätigt.
Endantriebe, Planetengetriebe mit oder ohne nasser Scheibenbremse.

SPEZIFIKATION

DIFFERENTIAL

Übersetzung		z=	12/32
Zahnflankenspiel		mm	0,16 - 0,21
Einstellscheiben für Triebling (in 0,1 Abstufung)		mm	2,5 - 3,4
Rollmoment der Trieblingslager auf Ø = 30,50 mm		N	P = 105 - 157
Rollmoment des gesamten Differentials		N	(P + 39) - (P + 60)
Anlaufscheibenstärke für Achskegelräder		mm	1,45 - 1,55
Anlaufscheibenstärke für Ausgleichskegelräder		mm	1,47 - 1,55
Stärke der Außenlamellen	Lamellen-	mm	0,97 - 1,03
Stärke der Innenlamellen	selbstsperr-	mm	1,57 - 1,63
Stärke der Einstellscheiben	differential	mm	2,77 - 2,83

LENKUNG

Kolbenstange Ø	mm	36
ZylinderbohrungsØ	mm	63
Hub nach beiden Seiten	mm	130
Max. Arbeitsdruck	bar	120
Vorspur	mm	0 bis -2
Einschlagwinkel	°	55°

ENDANTRIEBE

Übersetzung	i=	1 : 6
Anlaufscheibenstärke für Planetenräder	mm	1,45 - 1,55
Radlagereinstellung	keine (Teile müssen maßhaltig sein)	
Bremsscheibenstärke	mm	4,75 - 4,9
Mindeststärke der Bremsscheibe (Verschleißgrenze)	mm	4

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DESCRIPTION

Steering drive axle - monobloc housing in nodular cast iron - centre differential with limited slip differential or mechanical locking device hydraulic operated.
Planetary reduction final drives with or without oil immersed brake discs.
Steering cylinder integrated in the differential support.

SPECIFICATION & FEATURES

BEVEL DRIVE - DIFFERENTIAL

Ratio	T	12/32
Backlash	mm	0,16 to 0,21
Shims thickness for bevel pinion position	mm	2,5 to 3,4 (0,1 by 0,1)
Bevel pinion bearing pre-load measured on diameter D = 30.50 mm	N	P = 105 to 157
Bevel gear set (total) bearing pre-load (measured on the pinion queue)	N	T= (P + 60) to (P + 39)
Thickness - sun gear thrust washer	mm	1,45 to 1,55
Thickness - planet gear thrust washer	mm	1,47 to 1,55
Thickness - selflocking differential fixed plates	mm	0,97 to 1,03
Thickness - selflocking differential rotating plates	mm	1,57 to 1,63
Thickness - selflocking differential spacer	mm	2,77 to 2,83

STEERING

Piston rod diameter	mm	36
Cylinder bore diameter	mm	63
Stroke for each side	mm	130
Max. pressure travel	bar	120
Toe - in	mm	0 to -2
Steering angle	°	55°

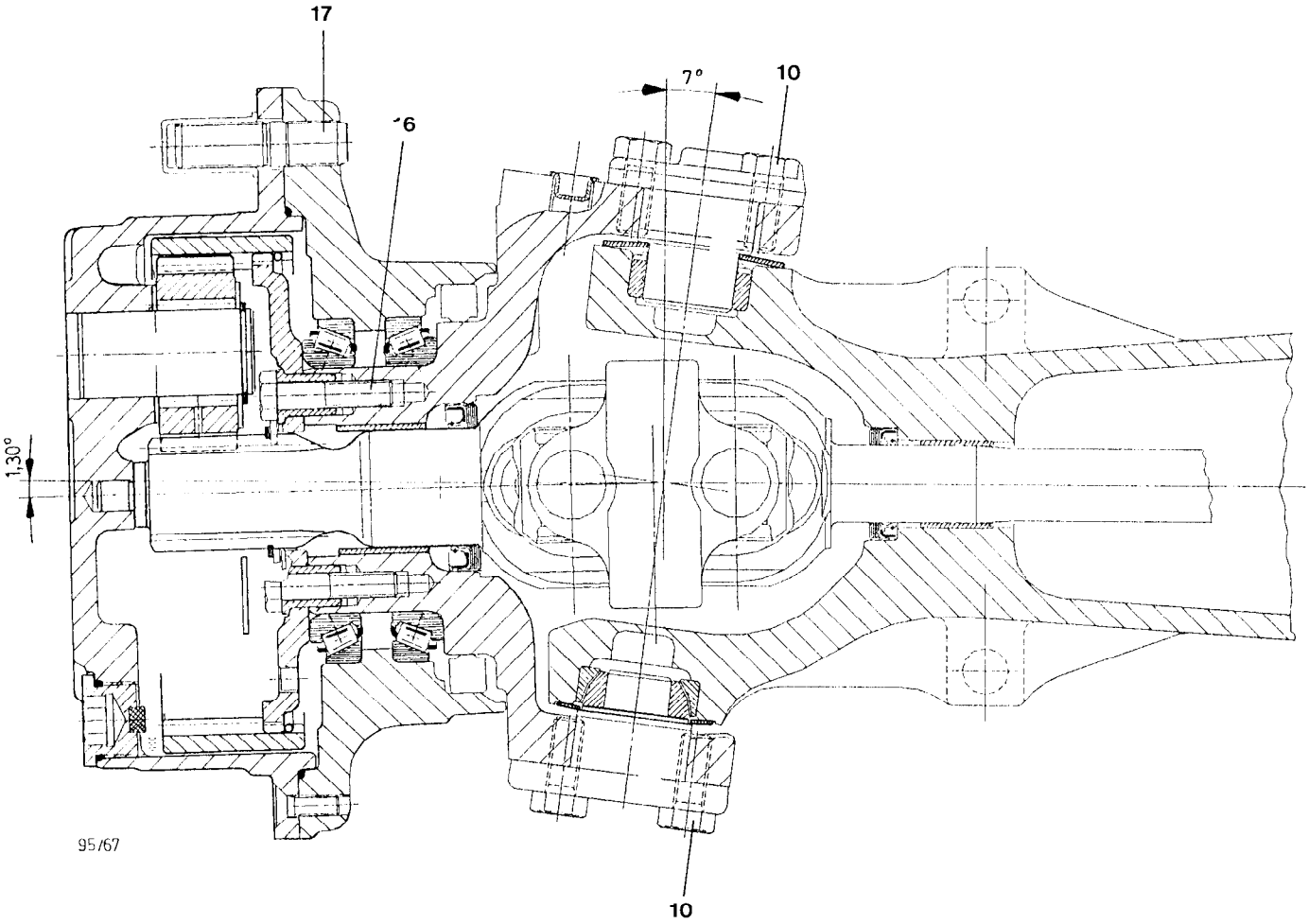
FINAL DRIVES

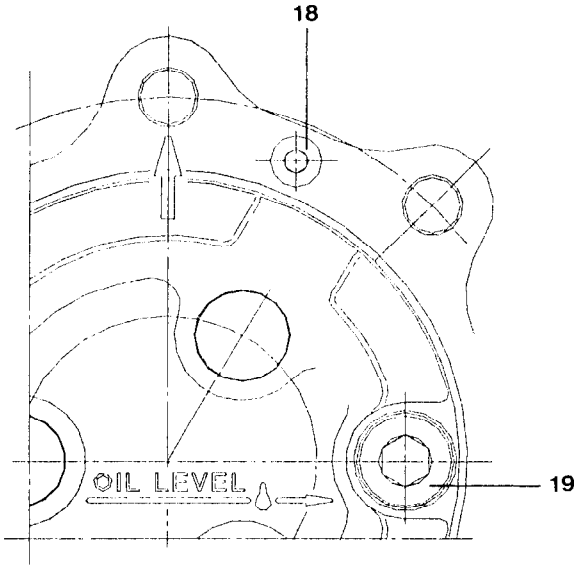
Epicyclic reduction ratio	T	1 : 6
Thrust washer thickness - planetary gear	mm	1,45 to 1,55
Wheel bearing setting		'Set right' System
Brake disc thickness	mm	4,75 to 4,90
Brake disc max. wear - Thickness	mm	4

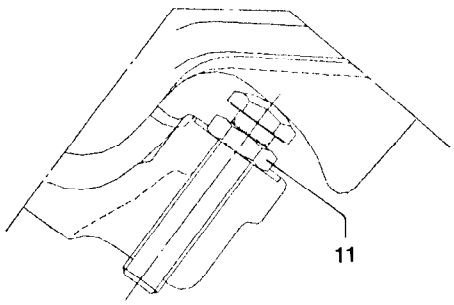
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ENDANTRIEB OHNE BREMSE

FINAL DRIVE WITHOUT BRAKE



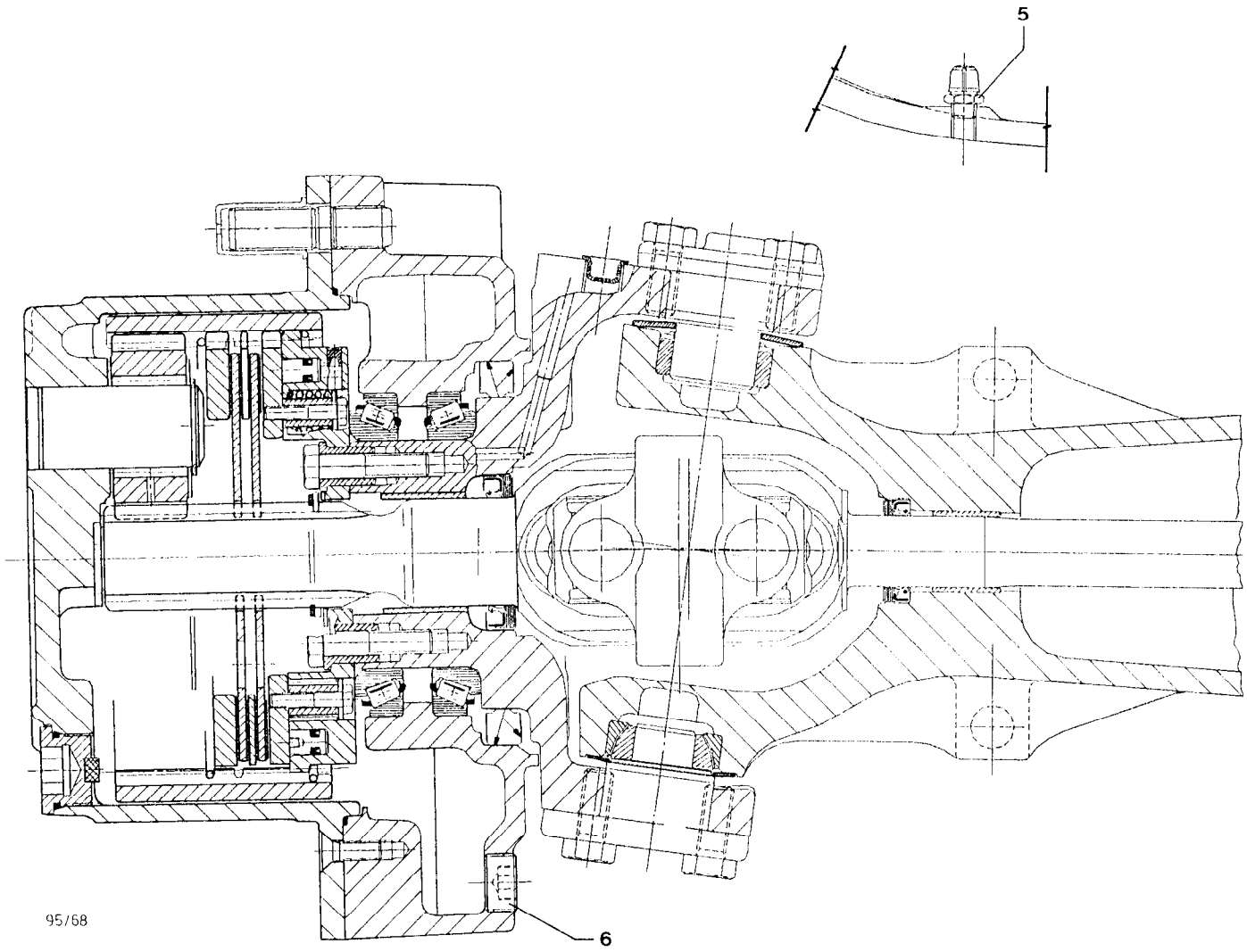


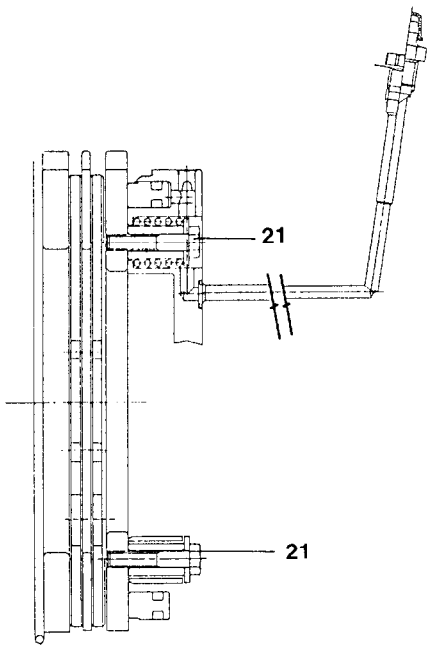


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ENDANTRIEB MIT BREMSE

FINAL DRIVE WITH BRAKE

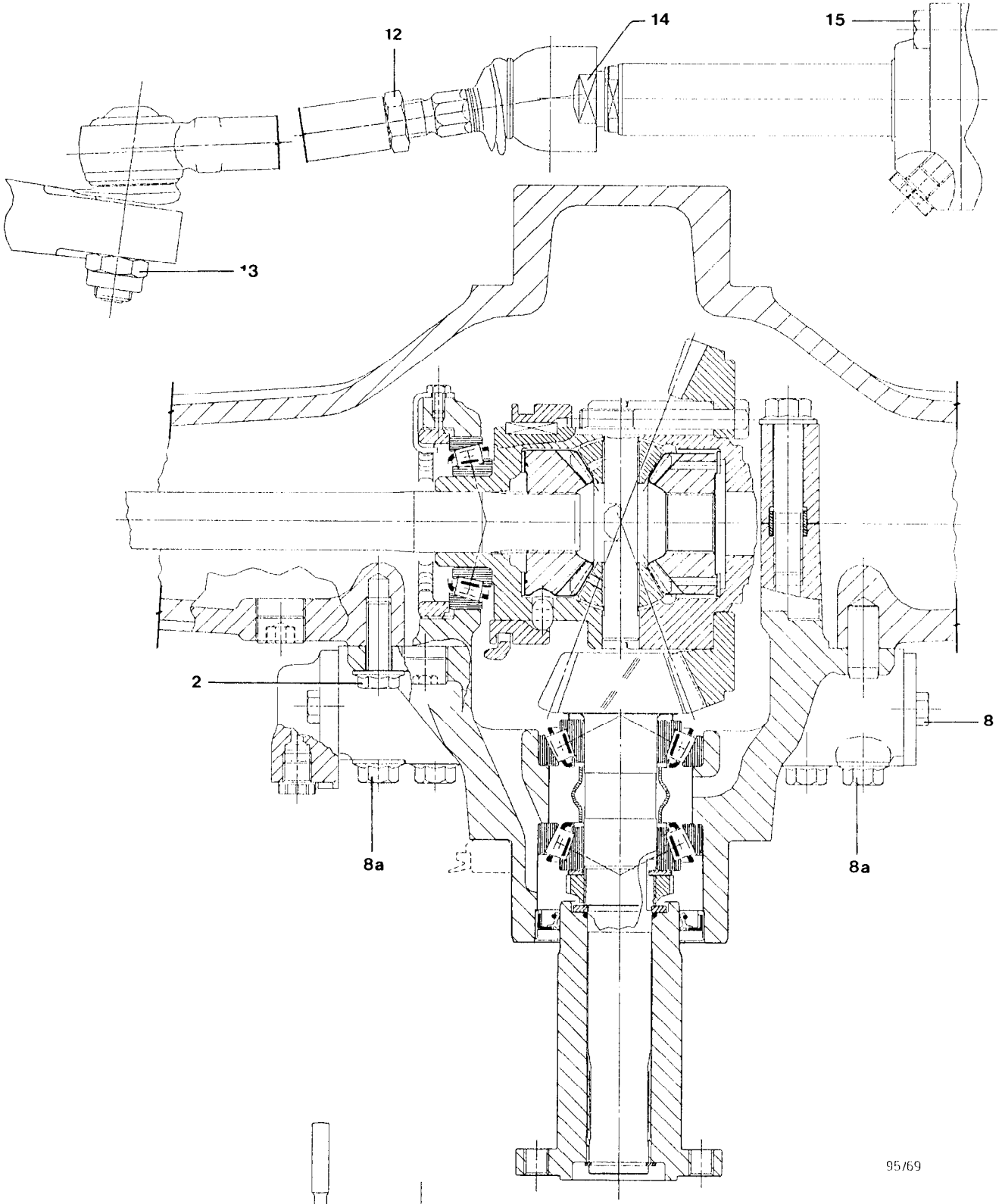


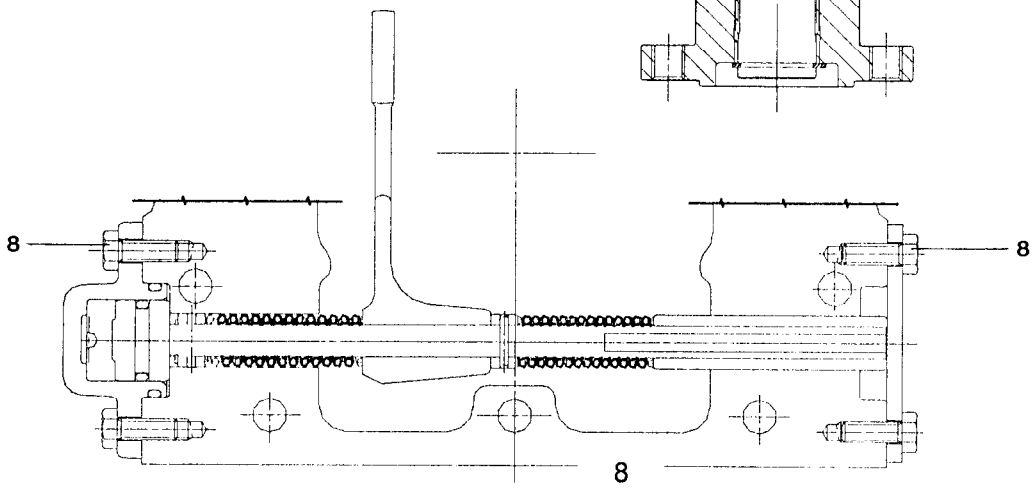


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DIFFERENTIAL MIT SPERRE 100%

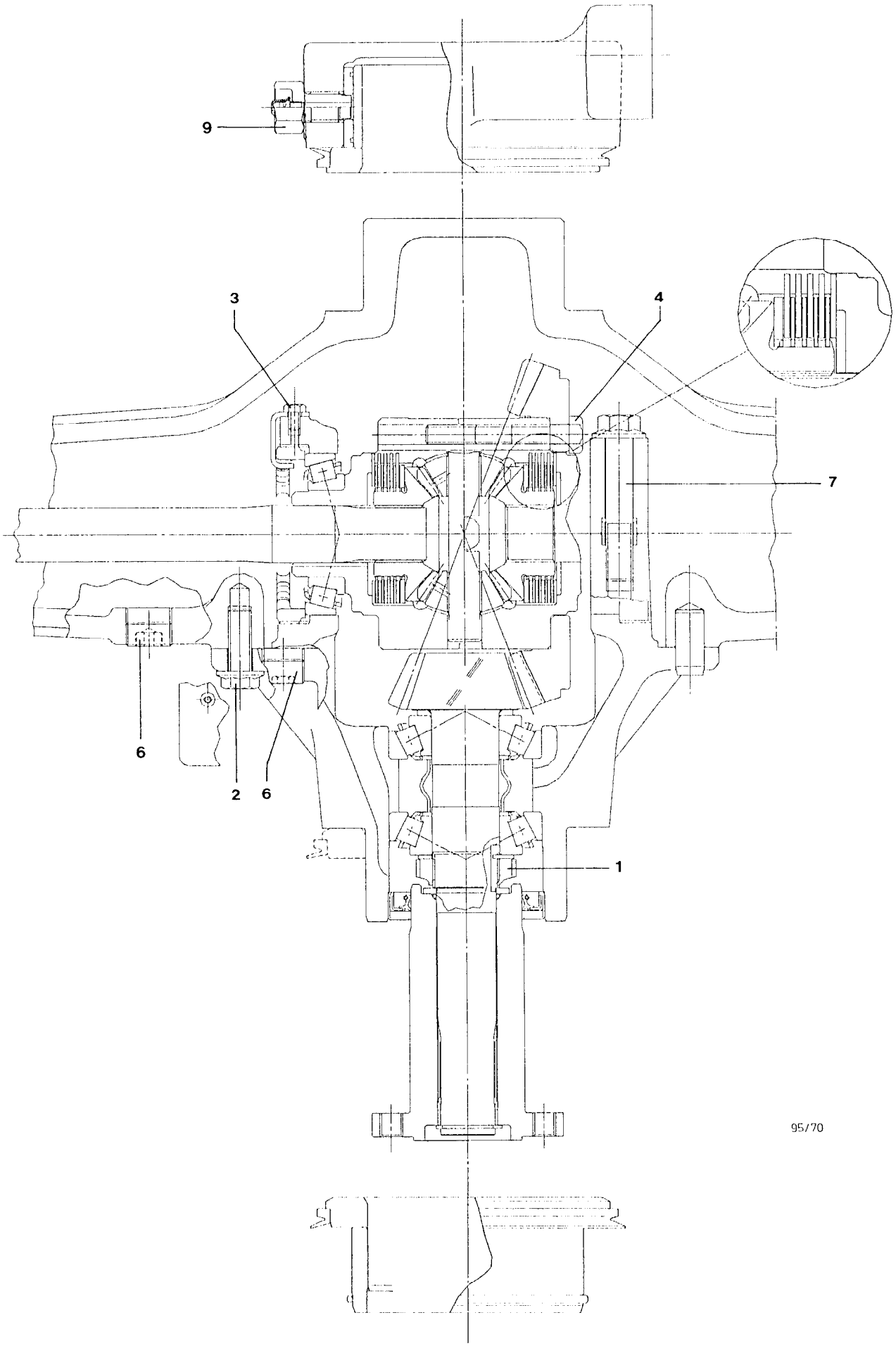
DIFFERENTIAL WITH 100% DIFF LOCK





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LAMELLENSELBSTSPERRDIFFERTENTIAL *LIMITED SLIP DIFFERENTIAL*

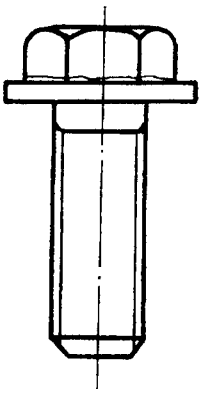


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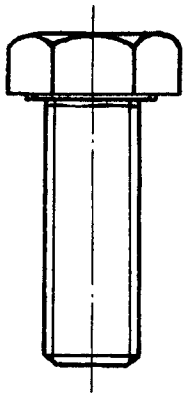
ANZUGSDREHMOMENTE (nach Positionsnummern von Seite B, B1, B2 und B3)

BESCHREIBUNG		Gewinde	Nm
DIFFERENTIAL - ACHSGEHÄUSE			
1 Nutmutter am Triebling		M 35 x 1,5	bis auf richtige Lagervorspannung
2 Achseinsatzbefestigung (Schrauben wahlweise)	*)	M 12 x 33	169
	*)	M 12 x 35	135 + Loctite 270
3 Sicherung bei Einstellmutter für Tellerradlager		M 6 x 12	13
4 Tellerradbefestigung (Loctite 270 verbauen)		M 10 x 75	78
5 Gehäuseentlüftung		M 10 x 1	10
6 Ölfüll- und Niveauschraube		M 24 x 1,5	70
7 Bügel für Tellerradlager am Achseinsatz		M 14 x 75	266
8 Deckel für Differentialsperreschaltung		M 8 x 20	27,6
8a Befestigungsschrauben für Differentialsperre		M 12 x 75	169
9 Fixierschraube für Buchse zur Pendellagerung		M 16	200
ACHSSCHENKELBOLZEN			
10 Befestigung der Achschenkelbolzen		M 12	120
11 Einstellschraube für Lenkeinschlag		M 16	150
12 Kontermutter auf Spurstange		M 18 x 1,5	120
13 Spurstangengelenk		M 18 x 1,5	165
14 Verschraubung Kugelgelenk-Kolbenstange		-	300
15 Befestigungsschrauben für Lenkzylinder		M 12	120
ENDANTRIEBE			
16 Hohlrad - Befestigungsschrauben		M 10	78
17 Radbolzen		M 18	70
18 Befestigungsschrauben für Planetenträger		M 8	25
19 Verschlußschraube		M 30	80
20 Radmuttern (nach 50 Betriebsstunden nachziehen)			300
21 Bremskolbenbefestigung		M 6	10

*) Pos. 2



M 12 x 33 12.9
169 Nm



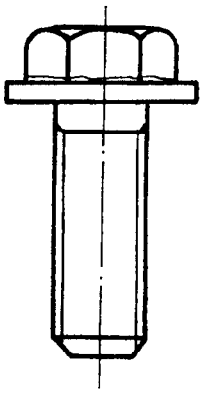
M 12 x 35 10.9
135 Nm + Loctite 270

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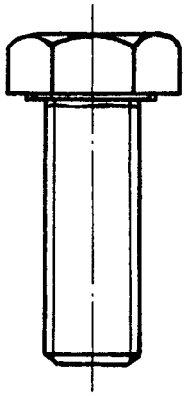
TIGHTENING TORQUE (refer to page B, B1, B2 and B3 for identification)

DESCRIPTION		*Thread*	*Nm*
BEVEL GEAR - DIFFERENTIAL - AXLE HOUSING			
1 Input shaft ring nut		*M 35 x 1,5*	*as per pre-load*
2 Bolt - differential support to axle housing (optional)	*)	*M 12 x 33*	*169*
	*)	*M 12 x 35*	*135 +Loctite 270*
3 Bolt - differential side ring nut lock plate		*M 6 x 12*	*13*
4 Bolt - crown wheel to differential carrier (use loctite 270)		*M 10 x 75*	*78*
5 Axle housing breather		*M 10 x 1*	*10*
6 Plug - oil fill and level		*M 24 x 1,5*	*70*
7 Bolts - half collar to differential support		*M 14 x 75*	*266*
8 Bolts - differential locking device covers		*M 8 x 20*	*27,6*
8a Bolts - differential lock		*M 12 x 75*	*169*
9 Bolt - pivot bushing stop		*M 16*	*200*
KING PIN - STEERING RODS			
10 Bolts - king pin to swivel housing		*M 12*	*120*
11 Bolt - steering stop lock nut		*M 16*	*150*
12 Nuts - tie rod to ball joint		*M 18 x 1,5*	*120*
13 Nuts - ball joint to swivel housing		*M 18 x 1,5*	*165*
14 Ball joint to steering piston rod		*-*	*300*
15 Bolts - steering cylinder to differential carrier		*M 12*	*120*
FINAL DRIVES			
16 Bolts - Wheel hub bearings		*M 10*	*78*
17 Stud - Planetary gear carrier		*M 18*	*70*
18 Screw - Planetary carrier to wheel hub		*M 8*	*25*
19 Whell hub drain plug		*M 30*	*80*
20 Nuts - Wheel rim to final drive	*(Re-tighten after 50 hours)*		*300*
21 Bolts - brakes self-adjust device		*M 6*	*10*

*) Pos. 2



M 12 x 33 12.9
169 Nm



M 12 x 35 10.9
135 Nm + Loctite 270

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SCHMIERUNG
LUBRICATION

Ölspezifikation MIL-L-2105 C und API GL 5 für Differential und Endantriebe.
Use oil with specifications MIL-L-2105 C and API GL 5 on differential and on final drives.

FÜLLMENGEN *QUANTITY*	Liter *Lts.*		
Differential *Differential*	5,0		
Endantriebe je Seite *Final reduction oil q.ty. for each side*	0,7	(1,75)	(mit Bremse) *(with brakes)*

ÖLKONTROLLE und WECHSEL
CHECK and CHANGE OF OIL

Laut Serviceplan (Betriebsanleitung / Kundendienstheft)
According the maintenance schedule (Operating instructions / Service manual)

SCHMIERVORSCHRIFT
GREASING

siehe Betriebsanleitung oder Kundendienstheft
According the maintenance schedule of the operators manual)

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SPEZIALWERKZEUGE

SPECIAL TOOLS

https://truckmanualshub.com/

I SPEZIALWERKZEUGE
Diese Spezialwerkzeuge sind für eine Reparatur unbedingt erforderlich.

1. **TSW 529** Montagehülse für Lenkzylinder
2. **TSW 530** Kalibrier- u. Montagehülse für Lenkzylinder
3. **TSW 531** Nutmutternschlüssel für Trieblingsmutter
4. **TSW 532** Schlüssel für Ringmutter - Differential
5. **TSW 533*** Setzer für Kassettendichtring der Radnabe

II SPEZIALWERKZEUGE
Spezialwerkzeuge mit Maßskizzen zur Selbstanfertigung oder im ZED auf Bestellung erhältlich.

6. **TSW 534** Setzer für Wellendichtring - Triebling
7. **TSW 535*** Setzer für Lagerbüchse im Achsgehäuse
8. **TSW 536*** Setzer für Wellendichtring im Achsgehäuse
9. **TSW 537*** Setzer für Büchse im Achsschenkel
10. **TSW 538*** Setzer für Dichtring im Achsschenkel
11. **TSW 539** Werkzeug zur Lagerdistanz-Ermittlung

* in Verbindung mit Universalgriff TSW 18390

I *SPECIAL TOOLS*
The following special purpose tools are absolutely necessary for repair.

1. ***TSW 529*** *Mounting sleeve for steering cylinder*
2. ***TSW 530*** *Calibrating and mounting sleeve for steering cylinder*
3. ***TSW 531*** *Wrench for bevel pinion ring nut*
4. ***TSW 532*** *Wrench for differential side ring nut*
5. ***TSW 533**** *Driver for cassette oil seal*

II *SPECIAL TOOLS*
Special-purpose tools with sketches for self manufacturing or available from the central spare parts service upon request.

6. ***TSW 534*** *Driver for bevel pinion oil seal*
7. ***TSW 535**** *Driver for axle housing bush*
8. ***TSW 536**** *Driver for axle housing oil seal*
9. ***TSW 537**** *Driver for swivel housing bush*
10. ***TSW 538**** *Driver for swivel housing oil seal*
11. ***TSW 539*** *Kit for bevel distance measurement*

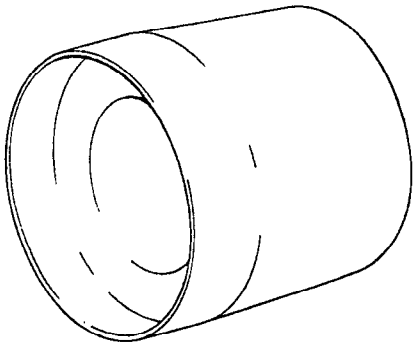
* *Universal handles TSW 18390*

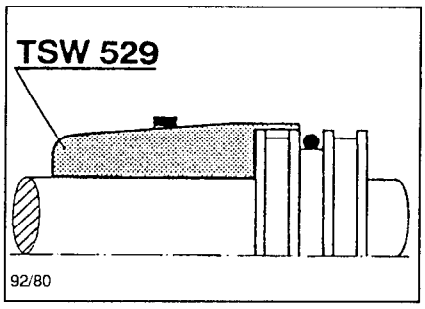
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Spezialwerkzeug für Lenkzylinder
Kategorie I

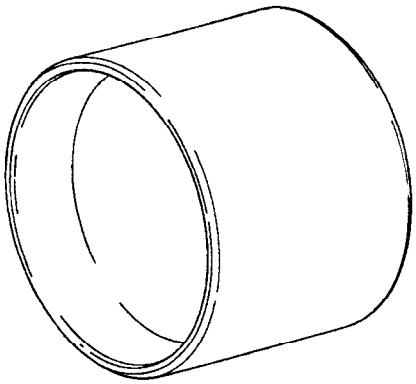
Special tools for steering cylinder
Category I

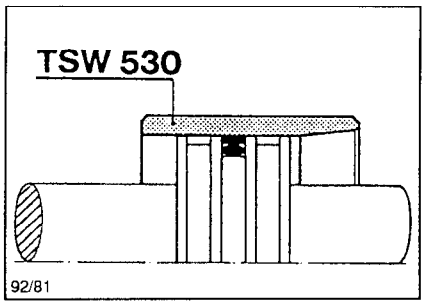
1
TSW 529





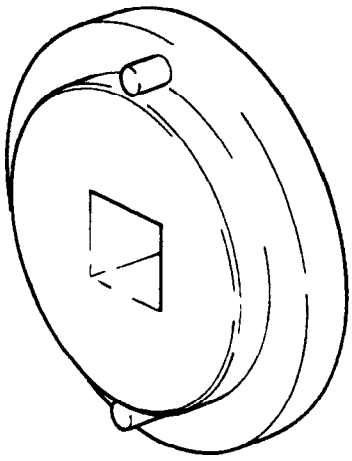
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TSW 530



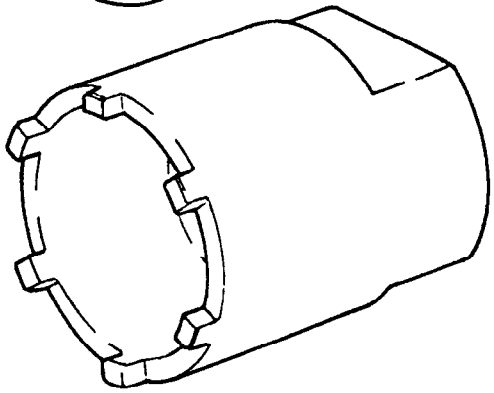


Spezialwerkzeug Kategorie I

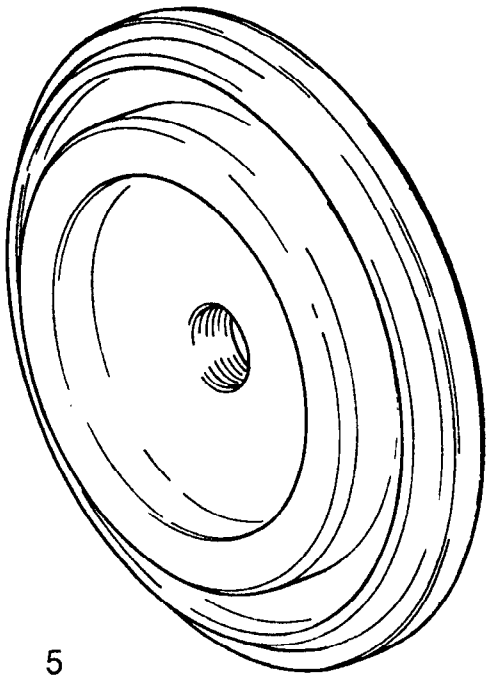
Special tools Category I



4
TSW 532



3
TSW 531



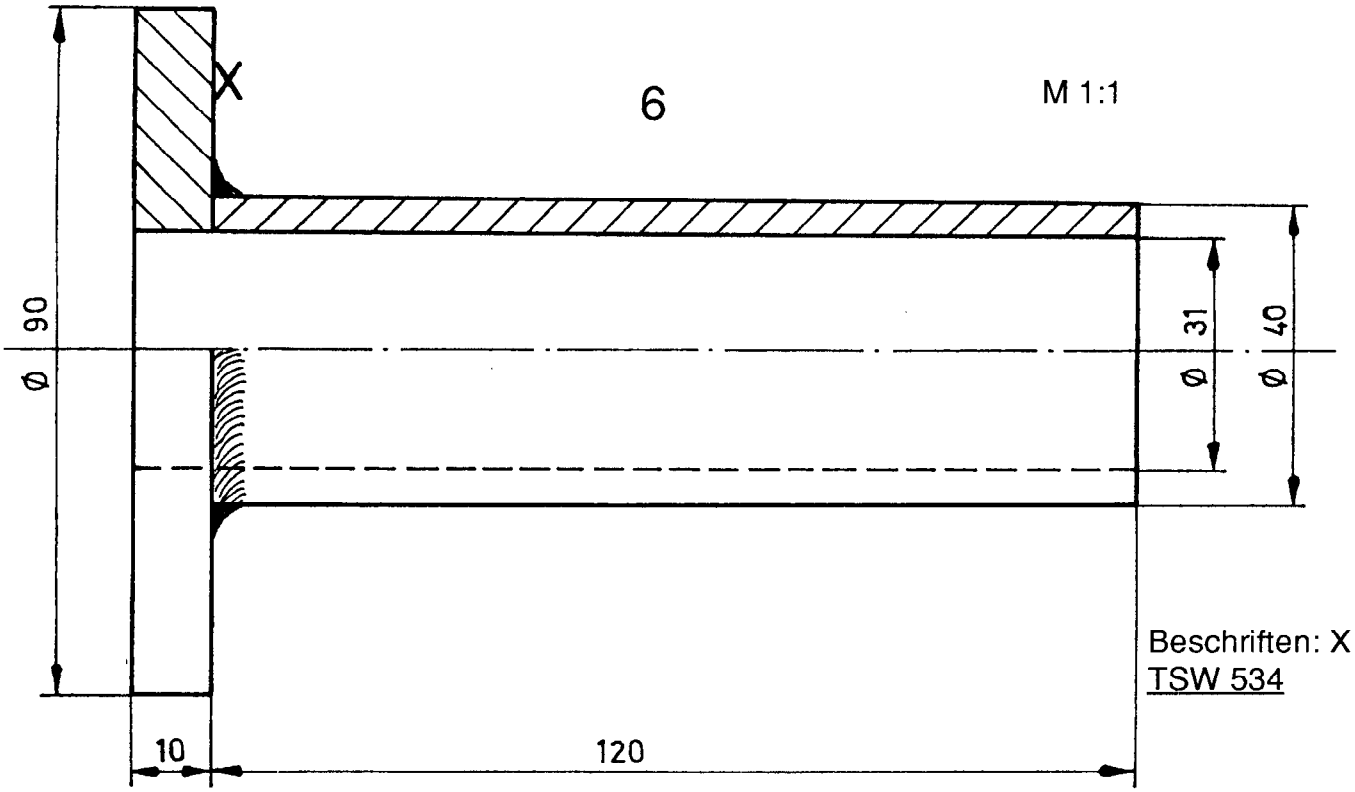
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TSW 533

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Spezialwerkzeug Kategorie II *Special tools Category II*

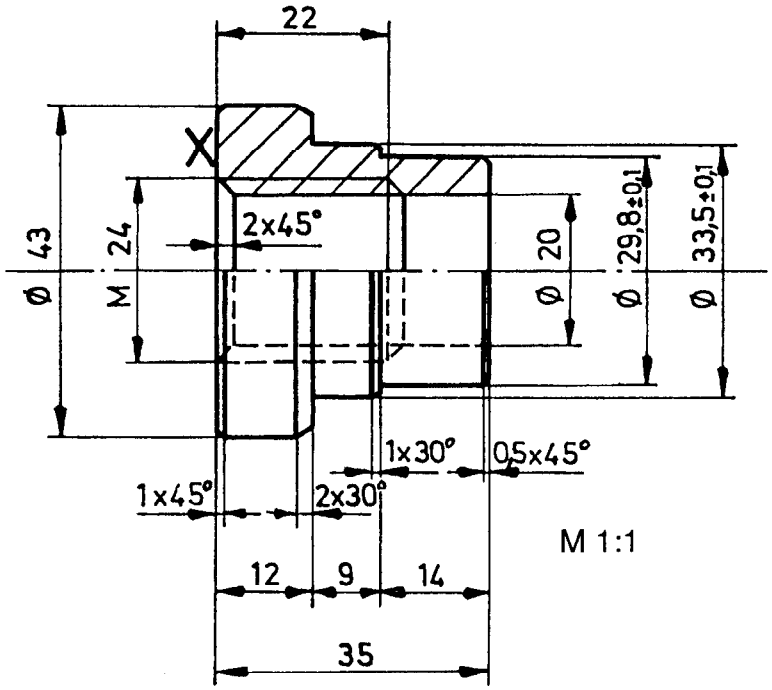
6

M 1:1



Beschriften: X
TSW 534

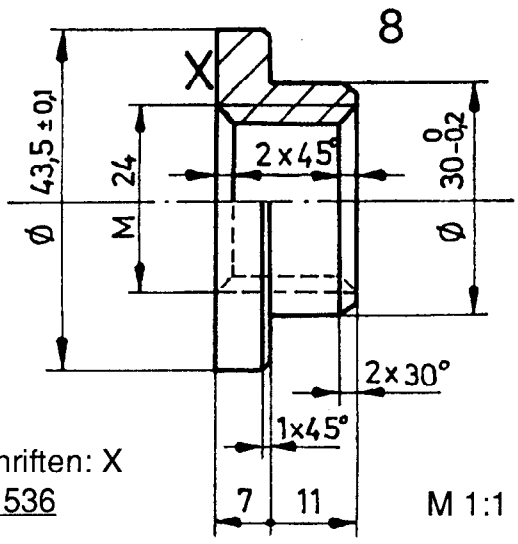
7



M 1:1

Beschriften: X
TSW 535

8



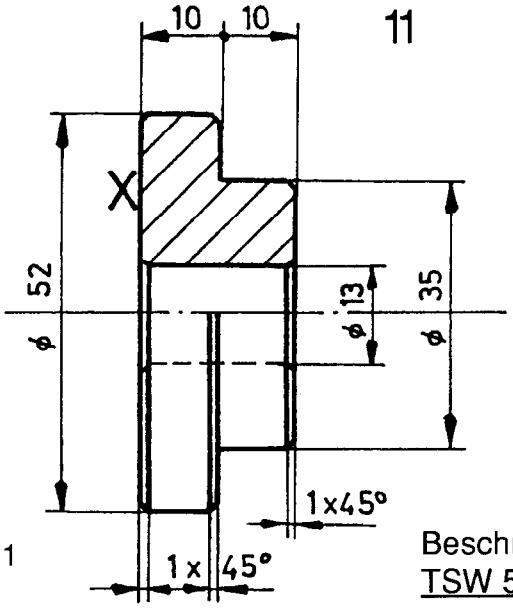
Beschriften: X
TSW 536

M 1:1

Beschriften: =
Marking:

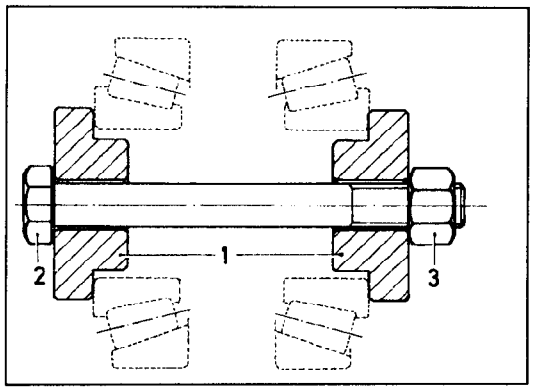
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11



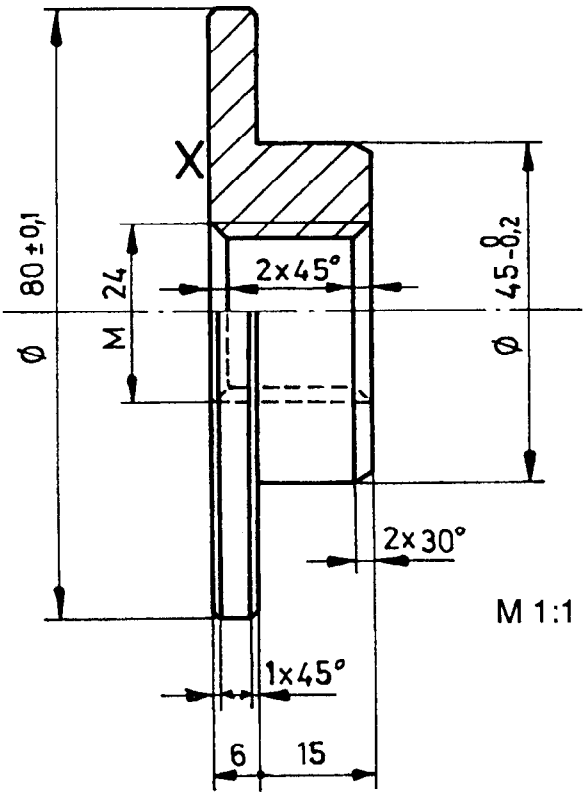
M 1:1

Beschriften: X
TSW 539



1 = Pos. 11 2x
2 = SK Schraube M12 x 110 - 8,8 - A3C DIN 931
3 = SK Mutter M12 - 8 - A3C DIN 934

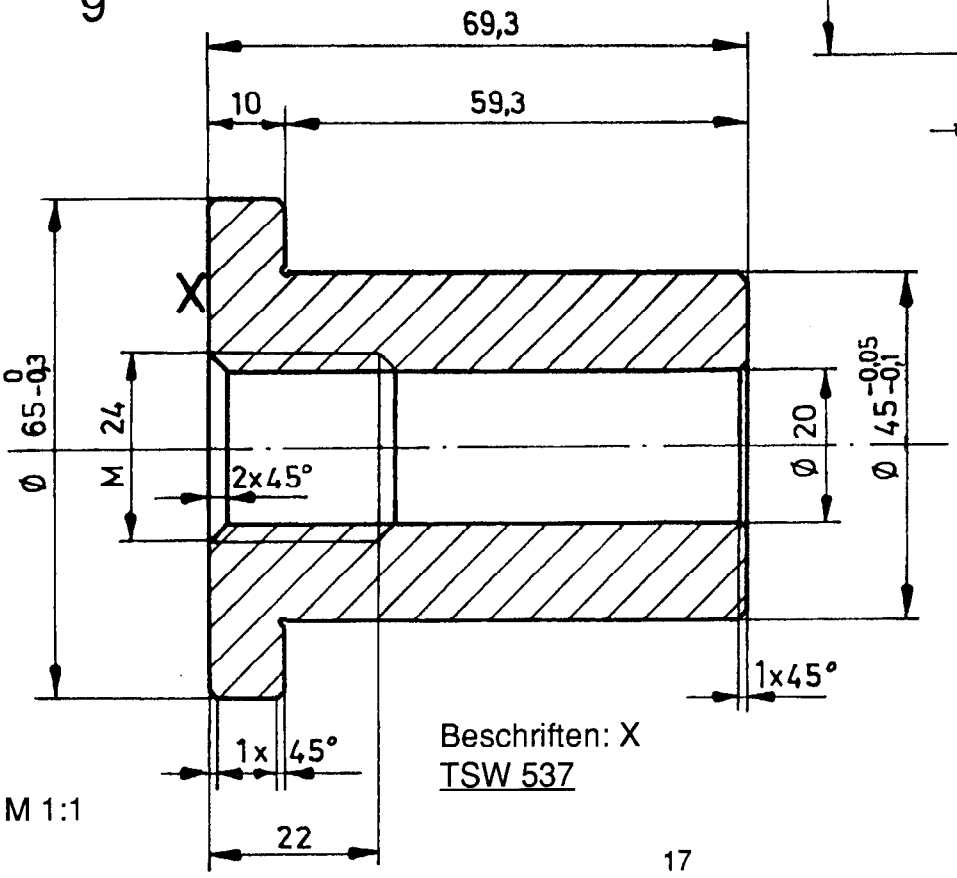
10



Beschriften: X
TSW 538

M 1:1

9



M 1:1

Beschriften: X
TSW 537

Beschriften: =
Marking:

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NOTIZEN - *NOTES*

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DEMONTAGE - EINSTELLUNGEN UND MONTAGE

DISASSEMBLING - SETTING OPERATIONS AND REASSEMBLING

Inhalt	Seite	*Index of pages*	*Page*
Vorwort	F 1-2	*Foreword*	*F 1-2*
Planeten-Endantriebe	F 3	*Epicyclic reduction*	*F 3*
Radnabe	F 4	*Wheel hub*	*F 4*
Achsschenkelträger	F 5	*Swivel housing*	*F 5*
Antriebswelle	F 6	*Drive shaft*	*F 6*
Lenkzylinder und Vorspur	F 7	*Steering cylinder and toe-in*	*F 7*
Differentialeinsatz	F 8.0	*Differential support and bevel gear pinion set*	*F 8.0*
Einstellung für Tragbild	F 8.1	*Setting the bevel distance*	*F 8.1*
Einstellung der Trieblingslager	F 8.2	*Pinion bearing pre-load*	*F 8.2*
Zahnflankenspiel	F 8.3	*Crown wheel pinion backlash*	*F 8.3*
Einstellung des Tellerradlagers	F 8.4	*Differential bearing pre-load*	*F 8.4*
Differential	F 9.0	*Differential*	*F 9.0*
Achsbrücke	F 10	*Axle housing*	*F 10*

VORWORT

FOREWORD

DEMONTAGE - MONTAGE

DISASSEMBLY - REASSEMBLY

Bei Reparaturen an Endantrieb, Radlagerung, Achsschenkelbolzen und Bremsen, kann die Achse im Fahrzeug eingebaut bleiben.
Wenn die Achse aus dem Fahrzeug ausgebaut werden muß, ist auf die Sicherheit für die Person zu achten.

The overhauling of final drives, wheel hubs and king pins can be completed without remove the axle from the vehicle.
Should it be necessary to remove the axle assembly, adequate supporting of the vehicle must be ensured to work with safety.

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WELLENDICHTRINGE

Vor der Montage von Wellendichtringen ist auf folgendes zu achten:

- Wellendichtring vor der Montage eine 1/2 Stunde in jenes Öl legen, welches er abzudichten hat.
- Lauffläche für Wellendichtring reinigen und auf Beschädigung prüfen.
- Lippen müßen zur Ölseite eingebaut werden.
- Bei mehrlippigen Ringen, Fett zwischen die Lippen geben.

- Einbau nur mit Setzer vornehmen. Keinesfalls direkt auf den Dichtring schlagen.
- Dichtlippen bei der Montage auf die Lauffläche vor Beschädigung schützen.

"O" RING

- Vor dem Einbau immer ölen, Wellen beim Durchschieben drehen.

EINSTELLSCHEIBEN

- Für jede Einstellung die Scheiben entsprechend bestimmen.
- Scheiben vor der Verwendung immer messen.

LAGER

- Für eine korrekte Montage auf 80° - 90° C anwärmen und mit Setzer montieren.

SPANNSTIFT

- Spannstift immer so montieren, daß die Öffnung in die Belastungsrichtung zeigt.
- Spannstifte in Spiralform haben keine besondere Einbaurichtung.

DICHTUNGSMATERIAL

- Flächen mit Silikon oder Loctite 510 abdichten.
- Die Flächen müssen rein und fettfrei sein.

OIL SEAL FOR ROTATING SHAFT

For an installation of oil seal adhere to the following recommendation:

- *Before installation soak the seal for half hour in the same oil that will be used in the housing to be sealed.*
- *Clean the shaft and ensure the seal area of the same is not damage, fitting or grooved.*
- *Place the sealing lips towards the oil side.*

- *Lubricate the seal lip (oil is better than grease) and fill with grease the space between oil lip and dust lip of dual lip seals.*
- *Instal the oil seal using a suitable seal driver. Avoid hammering directly on the seal.*
- *To ,avoid damages to the seal lip caused by the shaft: adequately protect the same during shaft assembly procedure.*

"O" RING

- *Ensure adequate lubrification of these seal before inserting them in their seats to avoid twisting during shaft assembly.*

SHIMS

- *For each adjustment select the correct shim's by individual measurement.*
- *Do not thrust pack measurement or the thickness indicated on the shim.*

BEARINGS

- *For a correct assembly it is suggested: Warming from 80° C to 90° C before installation in their respective seats.*

ROLL PIN

- *When installing split cut roll pin ensure the cut is oriented towards the direction of the force acting on the roll pin.*
- *Spiral type roll pin do not require any precaution.*

SEALING COMPOUND

- *On area to be sealed use Silastik or Loctite 510, ensuring both side to be sealed are clean, dry and totally free from grase and oil.*

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PLANETENENDANTRIEB *EPICYCLIC REDUCTION GEARS*

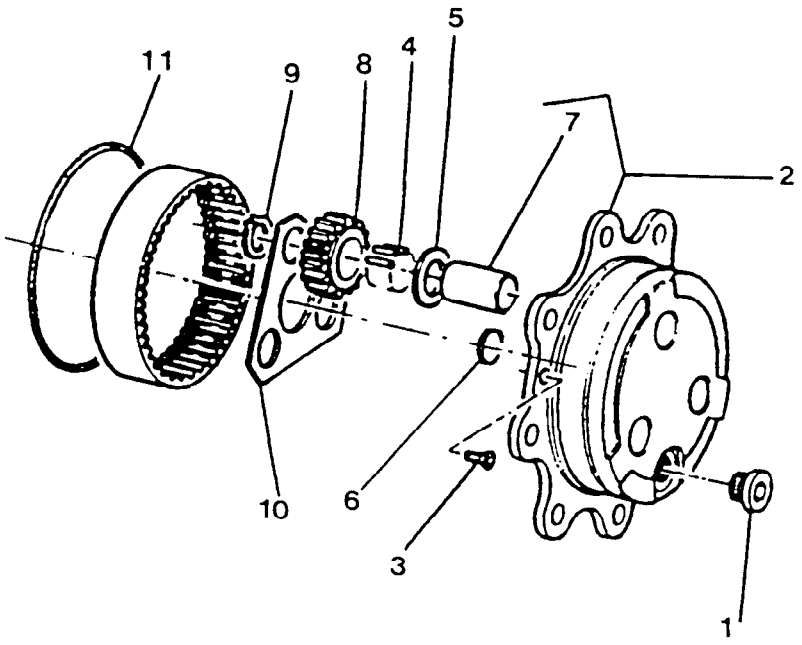


Fig. 1

- Verschlußstopfen (1) nach unten drehen und Öl ablassen.
- Beide Befestigungsschrauben (3) entfernen und Planetenträger von der Radnabe abziehen.
- Nadellager (4) und Anlaufscheiben (5) auf Verschleiß prüfen und wenn nötig austauschen.
- Die Bolzen (7) der Planetenräder sind in den Planetenträger eingepreßt und als Einzelstücke nicht austauschbar. Bei Beschädigung ganzen Träger tauschen.
- O-Ring (11) nach jeder Demontage kontrollieren bzw. erneuern.
- Montage: Teile der Nadellager mit Fett positionieren.
- Öl füllen, auf die richtige Spezifikation und Menge achten.

- Ölstand kontrollieren. Verschlußstopfen dazu waagrecht stellen.

- *Turn the hub so that the filler plug (1) is at the lowest position and drain the hub oil.*
- *Unscrew the two screws (3) and remove the planetary carrier assembly from the hub.*

- *Inspect the needle bearings (4) and the thrust washer (5) for wear and replace if necessary.*
- *The planetary gear shafts (7) are fitted to the carrier with interference. In case of wear or demage replace the carrier assembly.*

- *Inspect the "O" ring (11) and replace if necessary.*
- *Reassembling: if necessary hold the needle bearing in position with grease.*
- *Refill the hub with correct oil, see specification. The drain level plug bore position, must be at the top.*
- *Check the oil level with the plug at the horizontal line.*

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RADNABE

WHEEL HUB

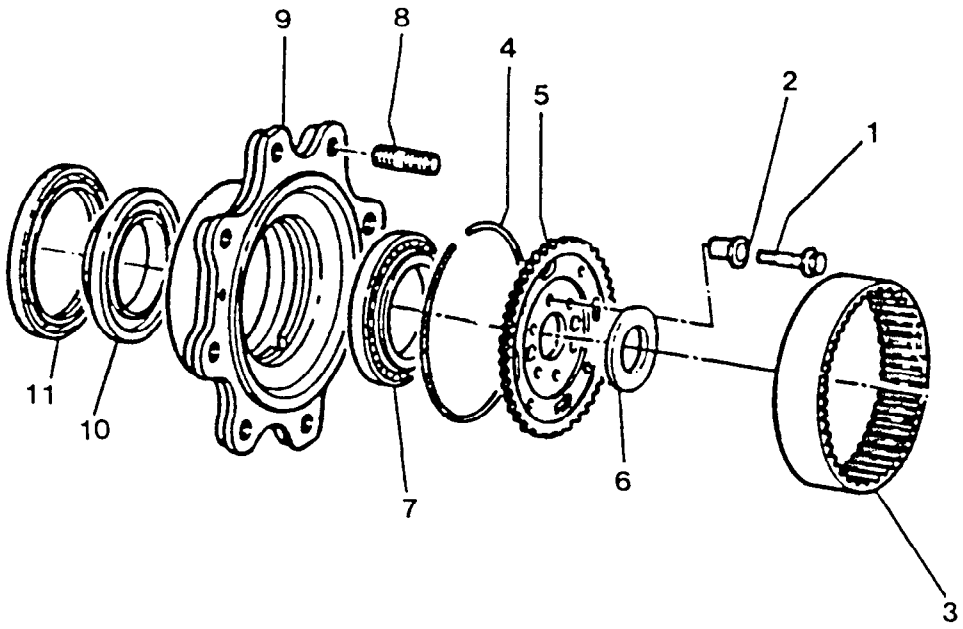


Fig.2

- Schrauben (1) entfernen.
- Hohlrad mit 2 Schrauben M 10 abdrücken und Radnabe abnehmen.

- Zum Abmontieren des Hohlradträgers vom Hohlrad Sicherungsring (4) entfernen.
- Kassettendichtring (11) austauschen.
- Die Radlagereinstellung basiert auf den sehr engen Toleranzen und braucht daher nicht eingestellt werden.

- Vor der Montage auf Maßhaltigkeit der Teile achten.
- Teile mit Abweichung austauschen.

- *Unscrew the bolts (1).*
- *Use 2 bolts M 10 as puller, on the threaded holes of the wheel carrier to remove the assy crown gear / wheel carrier.*
- *Remove the lock ring (4) to separate the crown gear.*
- *Replace the cassette seal (11).*
- *The special arrangement "Set Right" of the bearings does not require specific setting of pre-load or clearance because the interested surfaces are machined to fine tolerances.*
- *In any case befor reassembling of new parts it is better to check the following dimensions.*
- *Replace the incorrect items.*

A = 11,975 - 12,025 mm

B = 52,229 - 52,279 mm

C = 14 mm

D = 20,00 - 20,10 mm

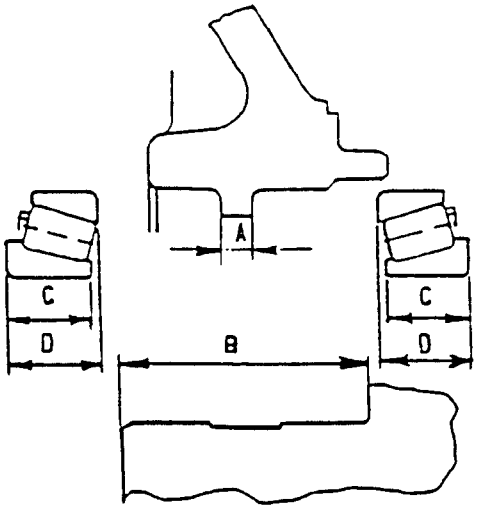


Fig. 3

Spezialwerkzeug:
Setzer f. Kassettendichtring (11) TSW 533

Special tools:
Driver for cassette oil seal (11) TSW 533

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RADNABE MIT BREMSE

WHEEL HUB WITH BRAKES

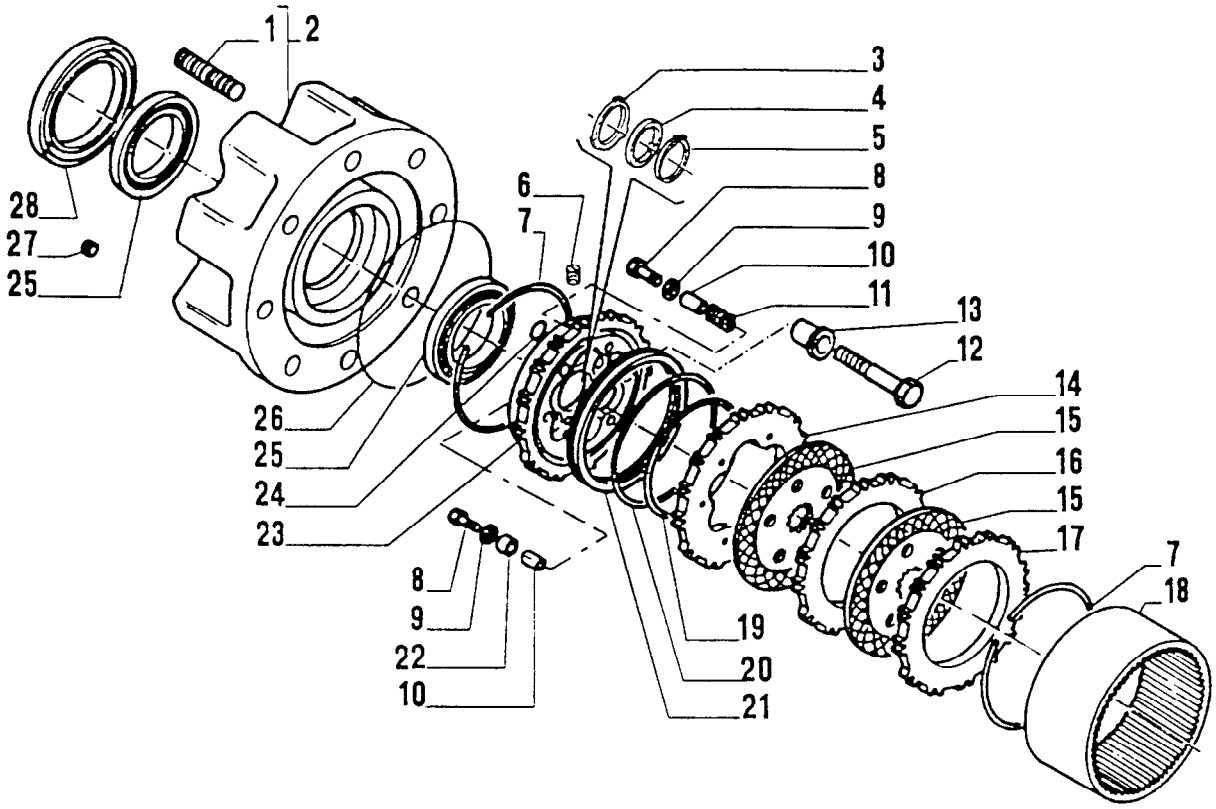


Fig. 2.1

- Schrauben (12) entfernen.
- Hohlrad mit 2 Schrauben M 10 abdrücken; Bremse und Radnabe abnehmen.

- Zum Ausbau der Bremsteile aus dem Hohlrad Sicherungsring (7) entfernen.

- Vor dem Herausnehmen des Bremskolben Schrauben (8) entfernen.
- Bremsmanschetten prüfen bzw. austauschen.
- Bremsenteile kontrollieren und wenn nötig austauschen.
- O-Ring (24) und Kassettendichtring (28) erneuern.

- *Unscrew the bolts (12).*
- *Use 2 bolts M 10 as puller, on the threaded holes of the wheel carrier to remove the assy crown gear / wheel carrier and brakes.*
- *Remove the locking rings (7) to separate the crown gear, the reaction plates and the brake discs.*
- *Unscrew the bolts (8) to split the brake piston.*
- *Check the piston seals for damages or wear. Replace if required.*
- *Inspect all different parts for wear or damages in particular the brake disc.*
- *Replace the "O" ring (24)*

Spezialwerkzeug:
Setzer f. Kassettendichtring (28) TSW 533

Special tools:
Driver for cassette oil seal (28) TSW 533

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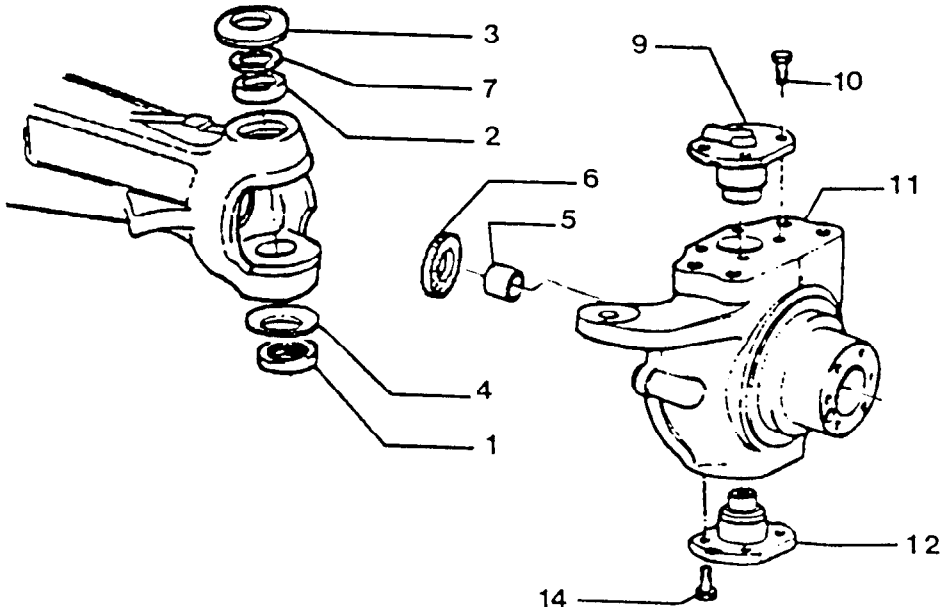
ACHSSCHENKELTRÄGER UND ACHSSCHENKELBOLZEN

- Das untere Achsschenkellager (1) ist auf den Achsschenkelbolzen aufgepreßt. Der Lagerring wird zum Einbau in die Achsbrücke abgekühlt.
- Die Lagerbüchse (2) muß zum Einbau in die Achsbrücke abgekühlt werden.

SWIVEL HOUSINGS KING PINS

- *The pivot bearing (1) (at the bottom) has to be assembled under the press for the race placed on the king pin and in cold conditions (as in azote bath) for the race placed on the axle.*
- *The top bearing (2) is an angular bushing and must be cooled (as in azote bath) before mounting in the axle seat.*

Fig. 4



ACHSSCHENKELLAGER

Für die Achsschenkellager ist keine Einstellung nötig. Die Tellerfedern (3,4) sind zwischen den Bolzen (9 bzw. 12) und der Achsbrücke eingebaut, wodurch sowohl die Lagervorspannung als auch die Abdichtung bewerkstelligt wird.

SWIVEL PIN BEARING

No particular setting operation is required for the king pin bearing being the king pins assembled with belleville springs (3,4) placed between then and the axle housing seats. The belleville springs have the purpose of preloading and sealing the system.

Spezialwerkzeuge:
Setzer für Büchse (5) TSW 537
Setzer für Dichtring (6) TSW 538

Special tools:
Driver for bushing (5) TSW 537
Driver for oil seal (6) TSW 538

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ANTRIEBSWELLE *DRIVE SHAFT*

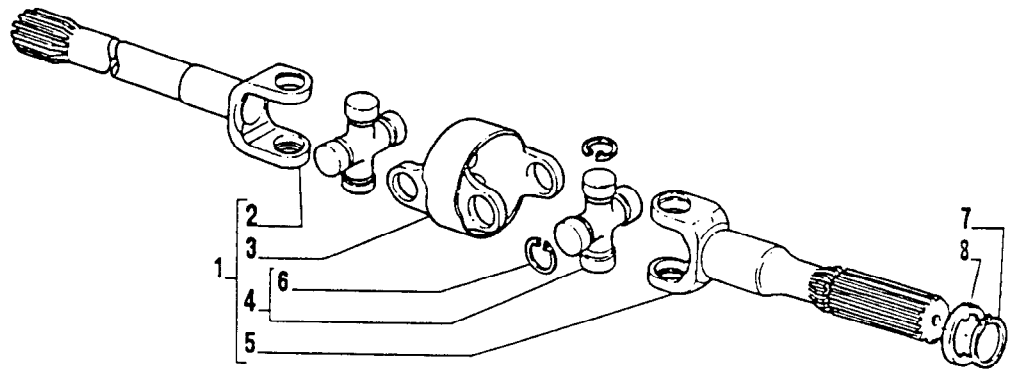


Fig. 5

Keilwellenprofile kontrollieren.
Bei Verschleiß der Gelenke diese austauschen.

Inspect the shaft splines for wear or demage. Replace the spiders if wear occured to inner needles or to the other components.

Anmerkung: Die Reparatur der Universalgelenke ist gleich jener, konventioneller Gelenkwellen.

***Note**: overhaul of the two universals joints follows conventional workshop practice.*

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LENKZYLINDER

STEERING CYLINDER

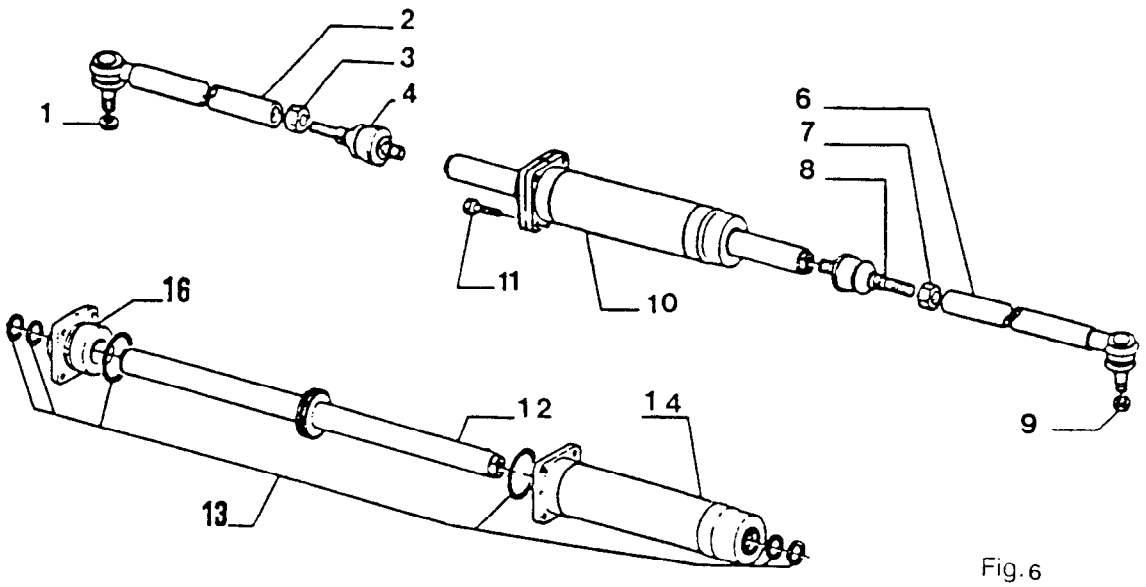


Fig. 6

- Kolbenstange (12) auf Verschleiß bzw. Beschädigung prüfen.
- Bei Undichtheiten immer beide Seiten abdichten (Dichtsatz 13)
- Spurstangengelenke auf Verschleiß prüfen und wenn nötig erneuern.

- *Inspect the steering piston rod (12) for wear or damages.*
- *If any leakage is evident, replace th seal kit (13).*
- *Inspect the track rod ends and track rod to piston rod ball joint.*

VORSPUR

TOE-IN

Die Vorspur ist auf 0 bis 2 mm einzustellen.

The Toe-in value is P = A from 0 to 2 mm

Nach einer Reparatur wie folgt vorgehen:

After a complete overhauling of the steering rods line follow the procedure here below indicate to set the toe-in:

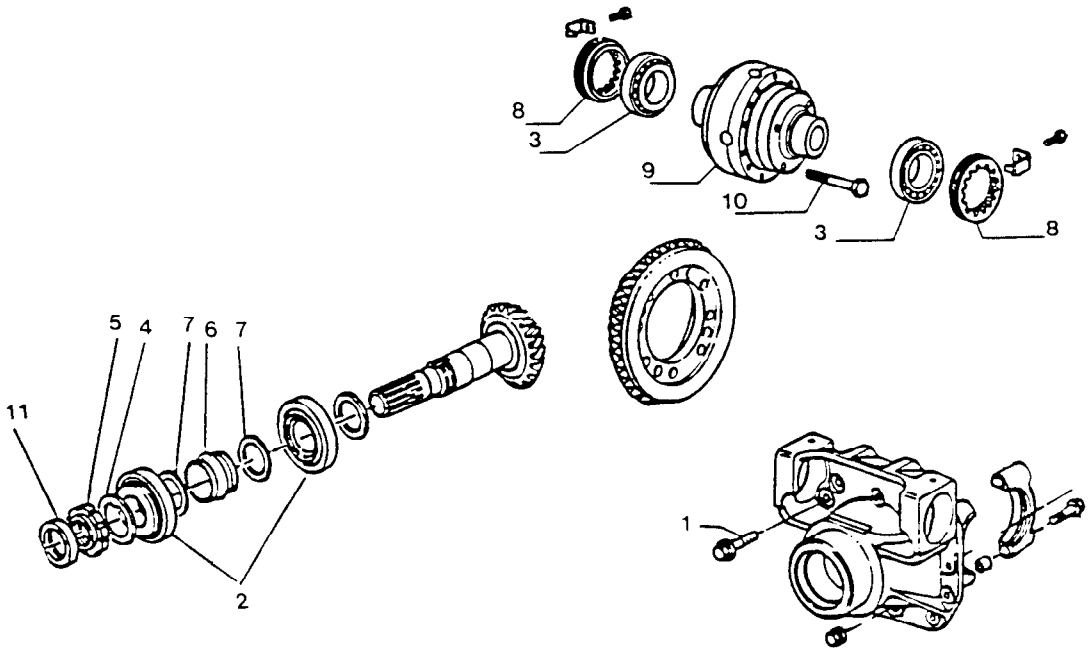
- Die beiden Gelenke (4 und 8) montieren und auf richtiges Moment anziehen.
- Die beiden Gelenke (4 und 8) soweit in die Spurstangen (2 und 6) einschrauben bis die Vorspur annähernd erreicht ist.
- Spurstangen (2 und 6) am Gehäuse montieren. Lenkzylinderweg nach beiden Seiten kontrollieren und wenn nötig angleichen.
- Mutter (1 und 9) auf richtiges Drehmoment festziehen.
- Vorspur durch drehen der Kugelgelenke (4 und 8) richtig stellen.
- Kontermuttern (3 und 7) auf das richtige Drehmoment festziehen.

- *Install the 2 ball joints (4 and 8) on the steering piston rod and tighten them to the correct torque.*
- *Screw each end (2 and 6) to the ball joint (4 and 8) of the same quantity until a total length near to the toe-in setting value is reached.*
- *Install the ball joint ends (2 and 6) into the swivel housing and check for the rod steering cylinder is central.*
- *Tighten the nuts (1 and 9) to the correct torque.*
- *Complete the setting operation rotating each ball joint end (4 and 8) until the adjustement is correct.*
- *Tighten the lock nuts (3 and 7) to the correct torque.*

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DIFFERENTIAL, EINSATZ UND TRIEBLING/ TELLERRAD

DIFFERENTIAL SUPPORT AND CROWN WHEEL / PINION SET



Zur Demontage des Achseinsatzes Antriebswellen und Schrauben (1) entfernen.
Trieblingslager (2) und Differentiallager (3) kontrollieren bzw. erneuern.
Die Nutmutter (5), die Distanzbüchse (6) und die Scheibe (7) sowie der Wellendichtring sind nach jeder Demontage zu erneuern.

To remove the differential assembly, unscrew the bolts (1) for on bench overhauling.
Inspect the pinion bearings (2) and the differential side bearings (3) for wear or damage.
In case of bevel gears replacement, ring nut (5), collapsible spacer (6) and washers (7) must be replaced.

Replace the oil seal to avoid oil leak.

Die Einstellung ist wie folgt vorzunehmen:

The setting operation to do for this group are as follows:

Tragbild einstellen
Trieblingslager einstellen (Rollmoment)
Zahnflankenspiel einstellen
Differentiallager einstellen (Rollmoment)

Setting the bevel distance (contactreflection)
Setting the pre-load of pinion bearings
Setting the pinion / crown wheel back-lash
Setting the differential bearing preload

Spezialwerkzeuge:
Schlüssel für Nutmutter (5) TSW 531
Setzer für Dichtring (11) TSW 534
Schlüssel für Ringmutter (8) TSW 532

Special tools:
Wrench for pinion ring nut (5) TSW 531
Driver for oil seal (11) TSW 534
Wrench for differential ring nut (8) TSW 532

ACHTUNG: Tellerrad immer auf die richtige Seite einbauen.

***Please note** that crown wheel can be fitted bot rh and lh of the pinion always ensure correct position.*

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TRAGBILDEINSTELLUNG

- Lageraußenringe (1und 2) in das Gehäuse einsetzen
- Lager (3 und 4) mit der Vorrichtung (11) auf leichtes Rollmoment vorspannen.
- Bohrungsdurchmesser (D) messen und Radius errechnen.
- Mit einem Tiefenmaß und einer Welle Distanz Y messen.
- Maß A errechnen A = Radius + Y

Einstellscheibe wie folgt errechnen:

X = A - B (Trieblingsmaß)

- Triebling einbauen "errechnete Einstellscheiben nicht vergessen"

Wichtig: Lager müssen gut sitzen

SETTING THE BEVEL DISTANCE

- *Install the pinion bearings in the differential support casing and ligthtly clamp the bearings using tool (11) so that the bearing cones can just be turned by hand.Do not overtighten.*
- *Using an internal micrometer, measure the side bearing bore (D) and determine the radius.*
- *Locate a circular bar (6) across bearing bores in the support casing, and using a dept gauge, measure the dimensions (Y).*
- *Calculate the distance A = radius + Y.*

Determinate the required thickness of shim using the following calculation:

X = A - B

- *Select the calculated shim thickness from the range available, and install on the pinion shaft.*
- *Press the inner bearing into the pinion shaft, ensuring that it is fully seated.*

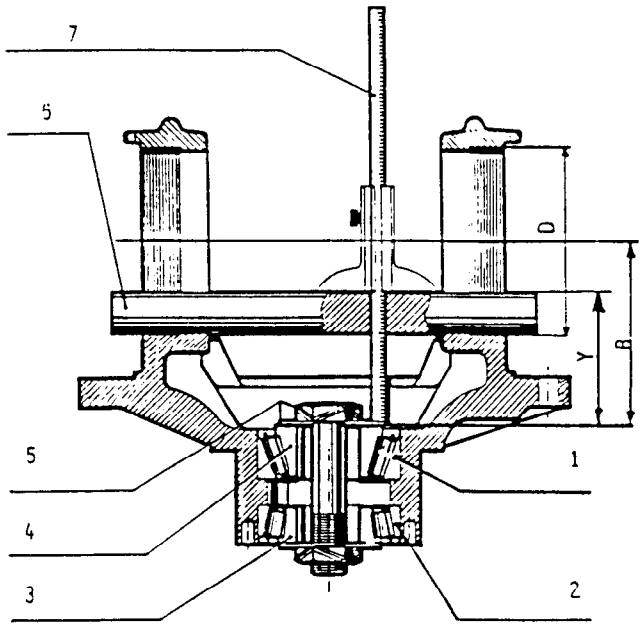


Fig. 12

Position des Trieblingsmaßes B
Position of gear protrusion dimension

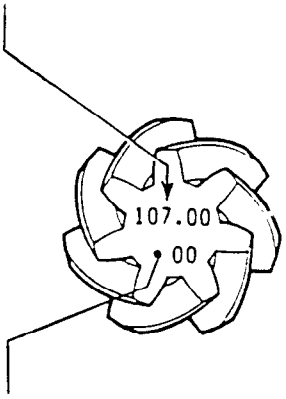


Fig. 11

Paarungsnummer
Position of spiral gear - pinion mating number

Spezialwerkzeuge:
Tiefenmaß und Vorrichtung TSW 539

Special tools:
Kit for bevel distance measurement TSW 539

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VORSPANNUNG DES TRIEBLINGSLAGER

- Vorspannung des Trieblingslagers ohne Wellendichtring durch Abrollen messen.
- Die Einstellung wird durch festziehen der Nutmutter erreicht.
- Rollmoment mit einem Rollmomentprüfer oder einer Federwaage prüfen.
- Nutmutter zum Triebling durch einschlagen sichern.

PRE-LOAD OF PINION BEARINGS

- *The specified pinion bearing pre-load has to be measured on the diameter of the pinion queue without flange and seal.*
- *Fix the ring nut in order to have the above pre- load value.*
- *To check the pre-load setting use a spring balance with a cord wrapped around the pinion queue.*
- *Secure the ring nut on pinion shaft spline (avoid use of sharp punches or chisels).*

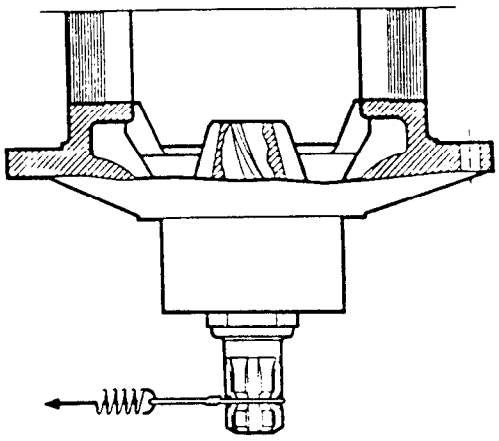


Fig. 13

Spezialwerkzeug:
Nutmutternschlüssel TSW 531

Special tools:
Wrench for pinion ring nut TSW 531

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ZAHNFLANKENSPIEL FÜR TRIEBLING UND TELLERRAD

CROWN WHEEL / PINION BACKLASH

Die Einstellung wird durch gegenläufiges verdrehen der Nutmuttern an den Differentiallagern erreicht.
Wenn sich die Nutmuttern zuschwer drehen lassen, müßen die Schrauben zum Lagerbefestigungsbügel leicht gelöst werden.

See specifications for the correct amount of back-lash. The adjustment is made by turning the side ring nuts.
The ring nuts push against the bearings and move the crown wheel toward or away from the bevel pinion.
When you make this adjustment the ring nuts can be difficult to move. It will then be necessary to loosen the bearing cap nuts a small amount.

Die Schrauben nur so weit lösen als unbedingt nötig.

Do not loose the nuts more than necessary.

Einstellvorgang wie folgt vornehmen:

Do the procedure as follows:

- Tellerradseitige Ringmutter im Uhrzeigersinn drehen bis nur mehr ein leichtes Zahnflankenspiel spürbar ist.
- Zweite Ringmutter anziehen bis Widerstand spürbar wird und Lager dabei mit Plastikhammer immer etwas entspannen.
- Meßuhr im rechten Winkel zur Tellerradverzahnung ansetzen.
- Zahnflankenspiel an mindestens 3-4 Positionen messen.
- Bei unterschiedlichen Spiel ist das kleinste gemessene Spiel ausschlaggebend.
- Gegebenenfalls die Position des Tellerrades soweit verändern bis das richtige Zahnflankenspiel erreicht ist.

- *Turn the right nut on the crown wheel side of the differential in a clockwise direction. At the same time hit the bearing caps lightly with a soft faced hammer to aligne the bearings.*
- *Turn the other ring nut in a clockwise direction. At the same time hit the bearings caps lightly with a soft faced hammer to align the bearings.*
- *Put the dial gauge in position so that the probe is in contact with and at 90° to a tooth on the crown wheel.*
- *Check the amount of backlash between the crown wheel and the pinion.*
- *Make a note of the clearance, if the amount of clearence is different, put the probe of the dial gauge on the tooth that has the smallest clearance.*
- *Move the crown wheel toward or away from the pinion by moving each ring nut an aqual amount. Do this until the dial gauge shows the prescribed clearance.*

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LAGERVORSPANNUNG DER DIFFERENZIALLAGER

Die Vorgangsweise ist wie folgt:

- Nach der Einstellung des richtigen Zahnspieles über den Triebling das gesamte Differential drehen, gleich der Messung der Trieblingslagervorspannung.

- Beide Ringmuttern immer gleichmäßig anziehen bis das richtige Rollmoment erreicht ist (siehe nachstehende Angabe).

- Schrauben zur Lagerbrücke auf richtiges Drehmoment festschrauben.

- Zahnflankenspiel nochmals kontrollieren.

- Das gesamte Rollmoment von (Differential +Trieblingslager) wird immer auf den Schaftdurchmesser des Trieblings (30,50 mm) bezogen.

T = Rollmoment des gesamten Differential

P = Rollmoment des Trieblings
T = (P + 39 N) - (P + 60 N)

DIFFERENTIAL BEARING PRE - LOAD

Adjust the differential side bearing pre - load using the following method:

- *With the crown wheel in mesh with the pinion and the backlash correctly set, rotate the pinion with a cord wrapped around the pinion queue and using a spring balance, record the effort required to rotate the pinion and the differential components.*

- *Tighten each differential side bearing adjuster ringnut by equal amounts, to preserve the backlash adjustment. Install the adjuster ringnut lock tabs.*

- *Thigt the half collar bolts to the torque specification.*

- *Recheck to make sure that the backlash is correct.*

- *The total amount of the pre - load to find (differential + pinion bearings) on the diameter 30.50 mm of the pinion queue must be.*

T = Total amount of pre load on differential bearings

P = Pre load of pinion bearings
T = (P + 39 N) to (P + 60 N)

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SELBSTSPERRDIFFERENTIAL *SELF - LOCKING DIFFERENTIAL*

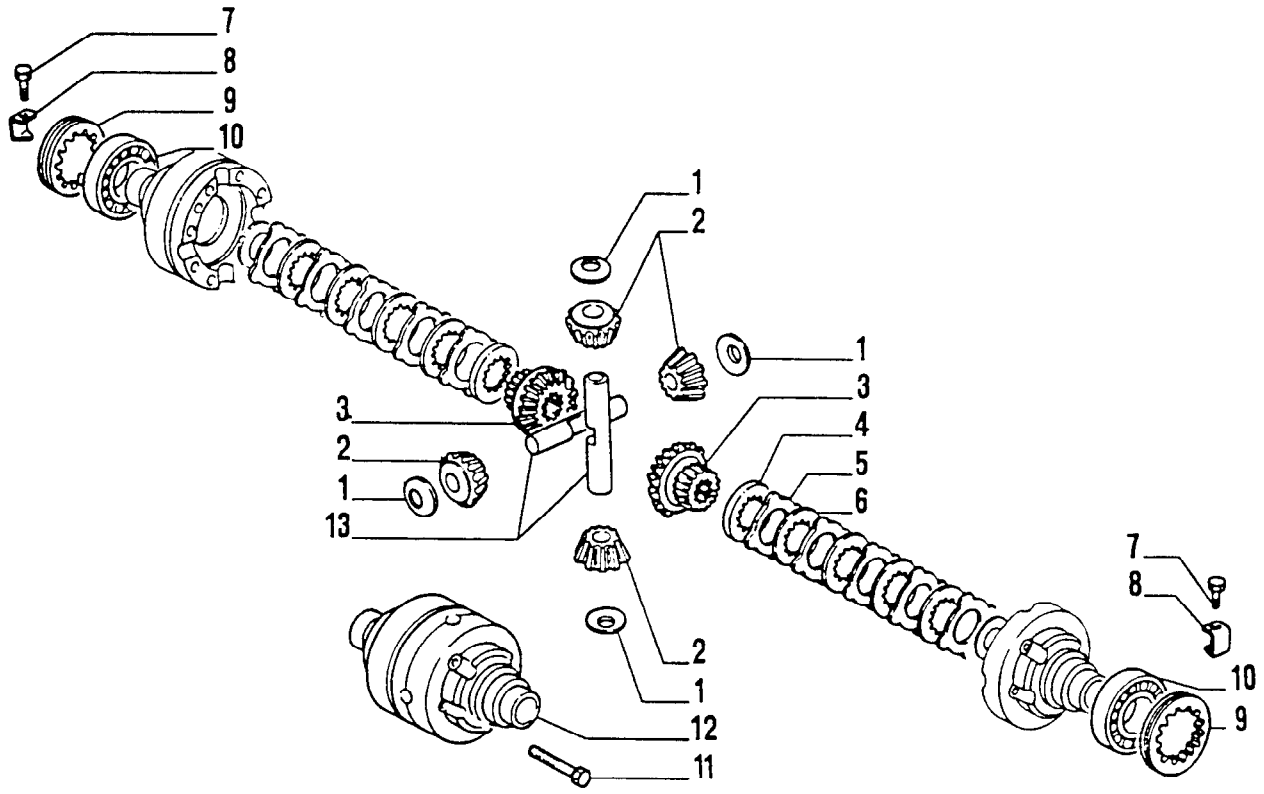


Fig. 14

- Sinterlamellen (4) kontrollieren und wenn nötig austauschen.
- *Inspect the sintered discs (4) for wear and replace if necessary.*
- Maximaler Verschleiß pro Lamelle = 0,10 mm von 2,67 - 2,73 mm.
- *Maximum wear for each disc: 0,10 mm. Disc worn out from mm. 2,67 to 2,73*
- Sinterlamellen (6) auf Verschleiß prüfen, bzw. austauschen.
- *Inspect the sintered discs (6) for wear and replace if necessary.*
- Maximaler Verschleiß pro Lamelle 0,15 mm von 1,42 - 1,48 mm.
- *Maximum wear for each disc: 0,15 mm. Disc worn out from mm. 1,42 to 1,48*
- Grundscheibe (1) kontrollieren bzw. erneuern.
- *Inspect the thrust washers (1) for wear and replace if necessary.*
- Die restlichen Teile des Sperrdifferentials (13).
- *Inspect the other differential components and the shafts (13) in particular.*
- Tellerradschrauben (11) mit Loctite 270 sichern.
- *Use Loctite 270 fixing the bolts (11) which fasten the crown wheel to differential housing.*

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MECHANISCHE DIFFERENTIALSPERRE *MECHANICAL LOCKING DIFFERENTIAL*

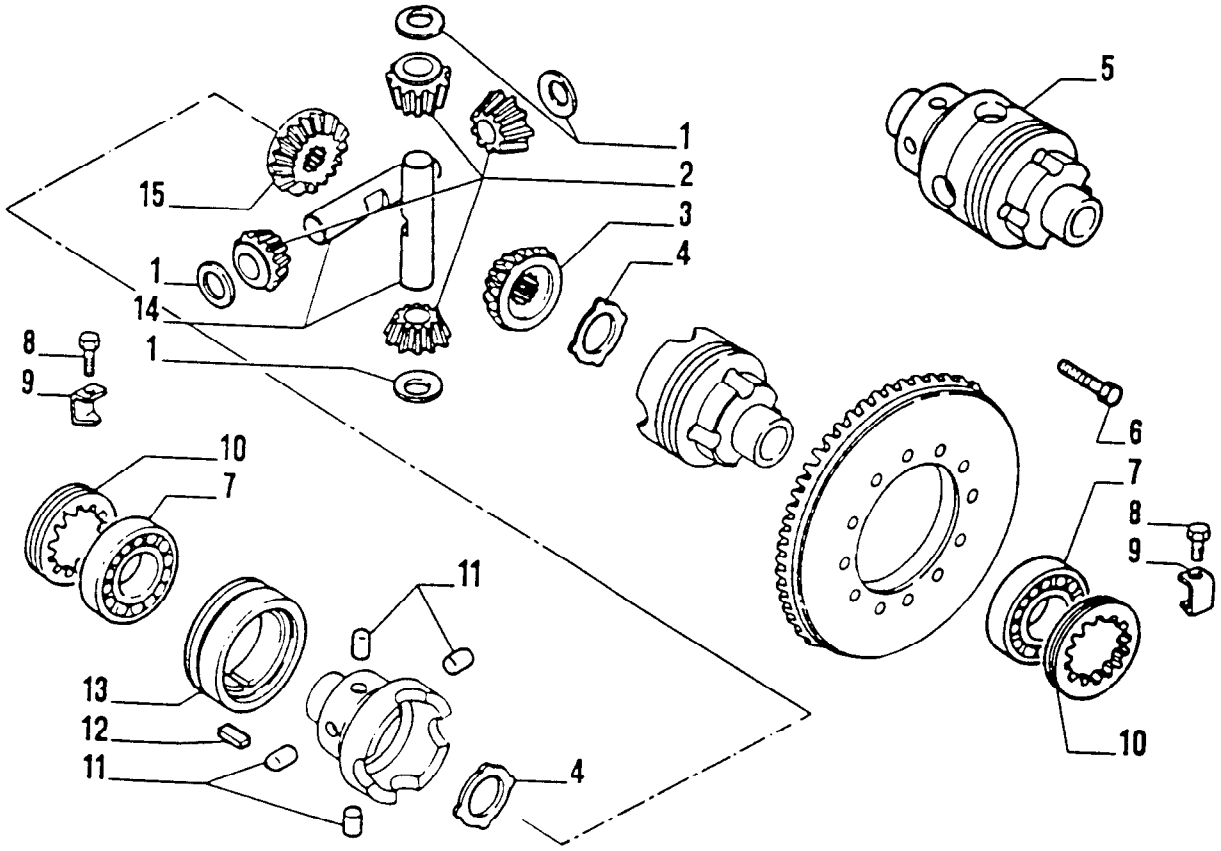


Fig. 14.1

- Schaltring (13) und die Sperrstifte (11) ausbauen und kontrollieren.
- Anlaufscheiben (1,4) auf Verschleiß prüfen.
- Die restlichen Teile im besonderen die Bolzen (14) überprüfen bzw. alle schadhaften Teile austauschen.
- Die Schrauben (6) mit Loctite 270 sichern.

- *Remove the sleeve (13) and recover the 4 pins (11). Inspect the parts for wear or damage.*
- *Inspect the thrust washer (1,4) for wear.*
- *Inspect the other items of the differential and in particular the shafts (14).*
- *Use Loctite 270 fixing the bolts which fasten the crown wheel to differential housing.*

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SCHALTUNG DER DIFFERENTIALSPERRE *DIFFERENTIAL LOCKING DEVICE*

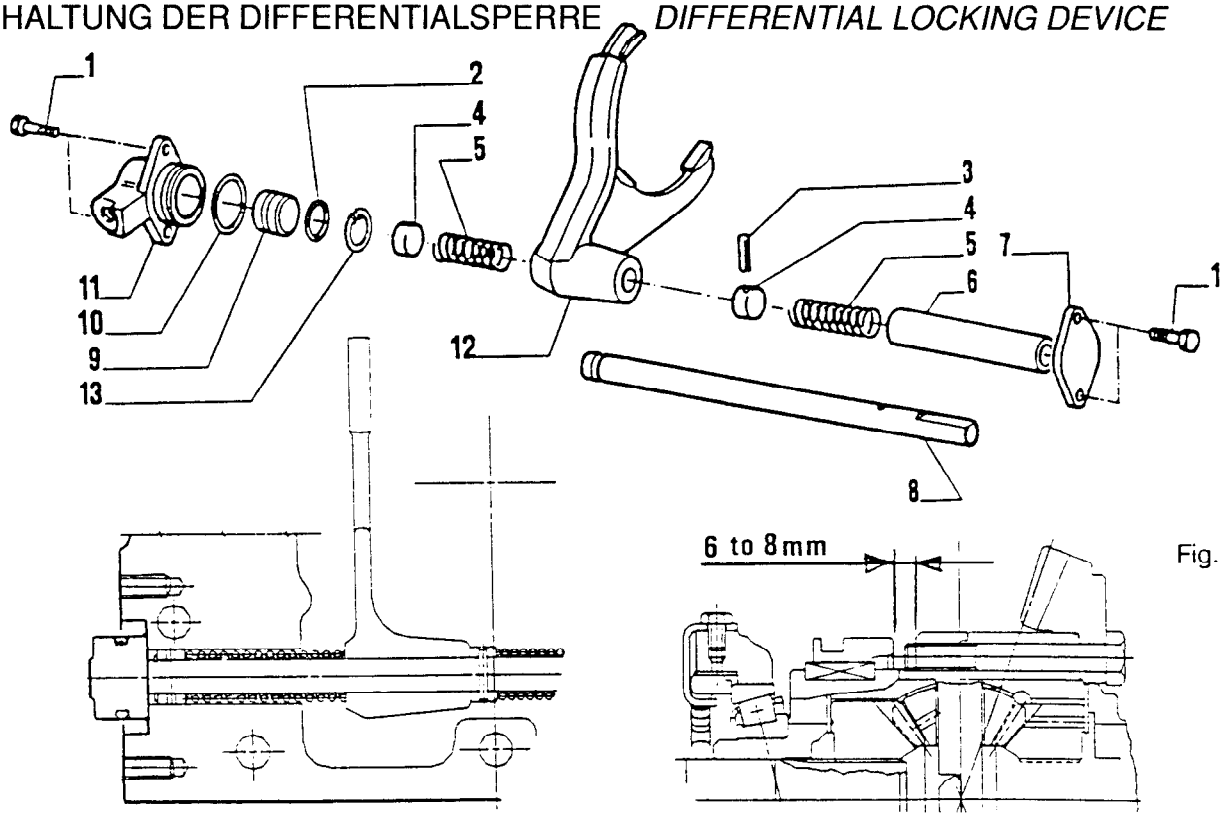


Fig. 14.2

- Schrauben (1) Deckel (11) und Deckel (7) abnehmen.
- O-Ringe (2) und (10) austauschen.
- Alle Teile der Sperrschaltung im Besonderen die Schaltgabel kontrollieren bzw. erneuern.
- Deckel (7) und (11) mit Loctite 510 abdichten.

Während der Montage ist folgendes zu beachten:

- Schaltweg des Schaltringes bestimmen.
- Dazu Kolben (9) mit der flachen Seite zur Schaltstange (7) ohne Deckel (11) einschieben. Kolben bis auf Anlage am Gehäuse hineindrücken damit die Distanz zwischen Ausgleichsgehäuse und Schaltring gemessen werden kann. Das Maß soll nicht größer als 6 - 8 mm sein.
- Ist das Maß größer, muß der Kolben mit der erhabenen Seite zur Schaltstange eingebaut werden.
- Alle weiteren Montagearbeiten in umgekehrter Reihenfolge der Demontage durchführen.

- *Unscrew the bolts (1) to remove the piston housing (11) and the cover (7).*
- *Inspect the 'O' rings (2) and (10). Replace if required.*
- *Inspect the fork and the other items of the locking device for wear or damage.*
- *Use Loctite 510 between housing and cover (7).*

During reassembling:

- *Check for the correct operating of the locking engagement sleeve.*
- *To do this install the piston (9) with the flate surface towards the rod and without its cover (11). Then push the piston completely towards the housing in order to operate the locking device and measure the distance between sleeve and differential housing. This distance should be of 6 to 8 mm maximum.*
- *If this value is greater reverse the position of the piston. (The relief has to be towards the rod).*

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ACHSBRÜCKE

AXLE HOUSING

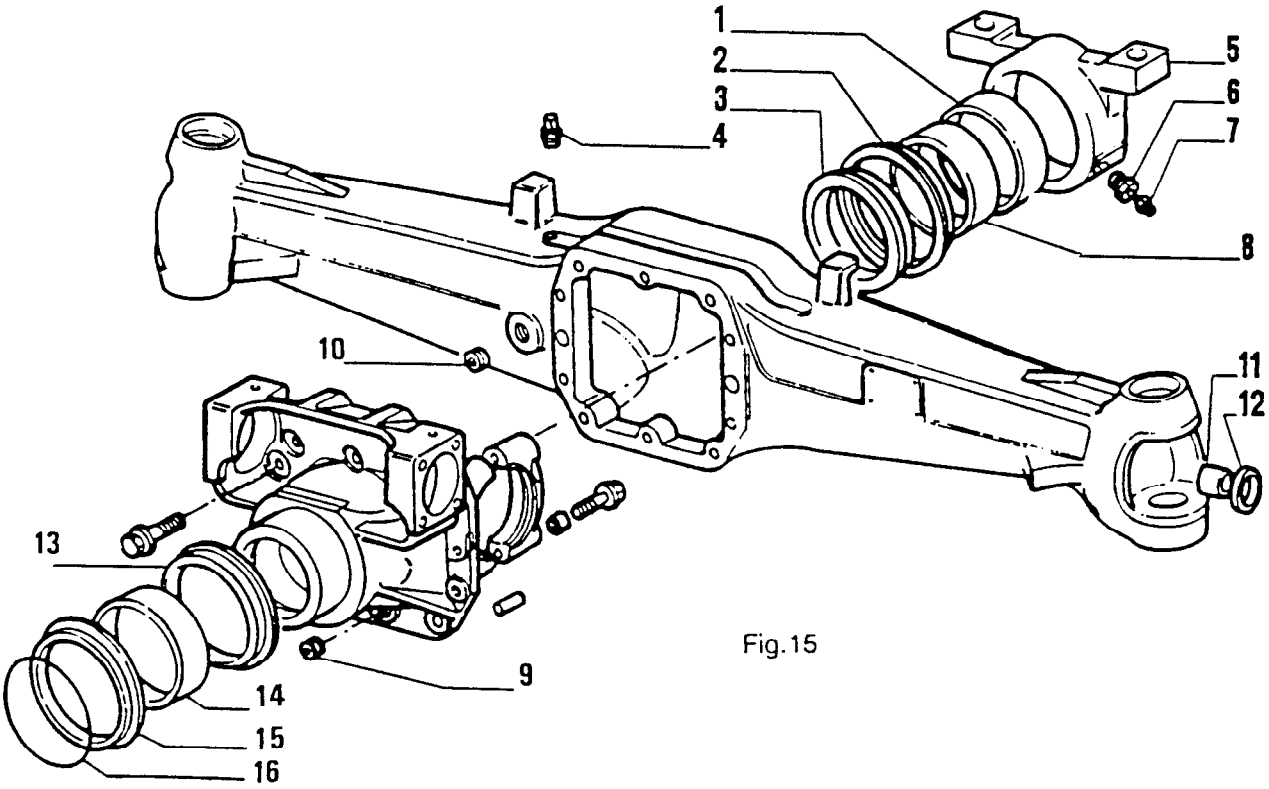


Fig.15

- Lagerbüchsen (1,8,14) kontrollieren.
- Anlaufscheiben (3, 13) kontrollieren. Dichtringe (2,15,16) austauschen.
- Entlüftung (4) auf Funktion prüfen.
- Öl ablassen bei Verschlußstopfen (9).
- Büchse (11) und Dichtring (12) kontrollieren und wenn nötig austauschen.
- Öleinfüllschraube (10) ist zugleich Niveauschraube.
- Zum Abdichten der Flanschfläche zwischen Einsatz und Achsbrücke Loctite 510 verwenden.

- *Inspect the pivot bushings (1,8,14).*
- *Inspect the thrust rings (3, 13). Replace the seals (2,15,16) if necessary.*
- *Inspect the breather pipe (4) for a correct valve working.*
- *Drain the oil from the plug (9) on the differential support.*
- *Inspect the axle housing bush (11) and the oil seal (12) for wear and replace if necessary.*
- *Refill and check the oil level from the plug (10) placed on the axel housing.*
- *Use Loctite 510 between differential support and axle housing.*

Spezialwerkzeuge:
- Setzer für Büchse (11) TSW 535
- Setzer für Dichtring (12) TSW 536

Special tools:
- *Driver for axle housing push (11) TSW 535*
- *Driver for axle housing seal (12) TSW 536*

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Chapter

6003

TROUBLESHOOTING

4-Wheel Drive – Differential lock – Management
(as of DBD 0055001)

M9078, M9078a, M9086a, M9094a, CS78, CS78a, CS86a, CS94a

CASE-STEYR Landmaschinentechnik GmbH
Training Center
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Troubleshooting using the Diagnostic System for ADM

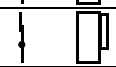
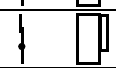
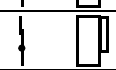
The function and operation of **4**-wheel drive and **D**ifferential lock **M**anagement is almost identical to that of previous models, which was known as DIFALMA. The main difference is that one control unit, designated **A 10**, is used instead of several relays. The control unit A10 is also located on central print A12. ADM was introduced at the same time as the Valmet 420 motor (from Pin no. DB 0055001 on) and a new central print A12. Both the diagnostic system and the following table of test values is required in order to be able to locate the fault quickly and accurately.

Test conditions:

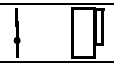
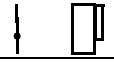
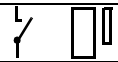
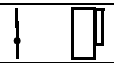
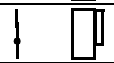
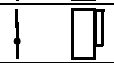
	Ignition switched OFF
	Ignition switched ON
	Engine must be running
X..	Plug
Pin	Pin on the given plug
	"E" Box connected
	"E" Box not connected
	Connect a bulb of the wattage stated as a load

Parts of the diagnostic system required:

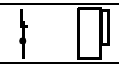
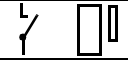
Order no.	Purpose
TSW 528-85 "Y" adapter	Adapter for ADM A10 control unit
TSW 528-6 "Y" adapter 2 pole Jet	Solenoid valve Y1 4-wheel drive, Inhibit solenoid valve Y10
TSW 528-11 Measuring cables 1.5 m, red, blue	From Multimeter to "Y" adapter
TSW 528-2 test lamp 5 - 35 Watt	To place a load on the supply cables
TSW 516-1 Multimeter	General

Designation	A10 Pin	Meas. unit	Conditions	Measure from pin to pin	Value
Supply to control unit A10					
Ground	11	V	 45W	17 + → 11	12 - 14 VDC
Ground	13	V	 45W	18 + → 13	12 - 14 VDC
Supply +ve F13 10 A 15/1	17				
Supply +ve F13 10 A 15/1	18				
Signals (inputs)					
Driving speed signal from A1 digital instrument	3	V	 Tractor is at a standstill	11 – → 3	approx. 0.9 VDC
	3	V	 Tractor is in motion	11 – → 3	approx. 6.1 VDC
	3	f	 Tractor is moving at 14 km/h	11 – → 3	505 Hz
"Transport" EHR signal from A55 EHR Box (ground signal)	8	V	 HER "Transport" position	17 + → 8	approx. 7.8 VDC
	8	V	 EHR "Control" position	17 + → 8	approx. 12 VDC
"Transport" MHR signal from S31/1 (ground signal)	8	V	 MHR position > 50 %	17 + → 8	approx. 7.8 VDC
	8	V	 MHR position < 50 %	17 + → 8	approx. 12 VDC
Steering brake S25 signal (ground signal)	6	V	 Left or right-hand strng. brake appl.	17 + → 6	12 - 14 VDC
	6	V	 Steering brake not applied	17 + → 6	approx. 0.8 VDC
Steering brake signal for 4-wheel drive	9	V	 Bridge W1/5 fitted to A12 4-wh. drv switches OFF w/ strng. brake in use	17 + → 9	12 - 14 VDC
	9	V	 Without bridge W1/5 4-wheel drive does not switch "OFF"	17 + → 9	approx. 8 VDC

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Designation	A10 Pin	Meas. unit	Conditions	Measure from pin to pin	Value
Signal (output)					
Signal 14 km/h (not used for Series 90)	16	V	 Tractor moving at > 14 km/h	11 – → 16	12 - 14 VDC
	16	V	 Tractor stat. or moving at < 14 km/h	11 – → 16	0 VDC
Outputs for 4-wheel drive					
S2/59 4-wheel drive "OFF" F11 10 A (with OPTI-STOP)	15	V	 Brake not applied (without W1/3)	11 – → 15	12 - 14 VDC
	15	V	 Brake applied (without W1/3)	11 – → 15	0 VDC
Resistance measurement Y1	15	R	 S2/59 4-wheel drive "OFF" position	11 – → 15	11 Ω ± 10 %
S2/59 4-wheel drive "AUTO"	4	V	 Brake not applied < 14 km/h	11 – → 4	0 VDC
	4	V	 Brake not applied > 14 km/h	11 – → 4	12 - 14 VDC
	4	V	 Brake applied > 14 km/h	11 – → 4	0 VDC
S2/59 4-wheel drive "ON"		V	 Measured at S2/59 pin 3	– → 3	0 VDC
Inhibit inputs					
Inhibit "AUTO" signal	14	V	 S2/56 inhibit "AUTO" position	11 – → 14	12 - 14 VDC
	14	V	 S2/56 positions "OFF" and "ON"	11 – → 14	0 VDC
Inhibit "ON" signal	5	V	 S2/56 "ON" position	11 – → 5	12 - 14 VDC
	5	V	 S2/56 positions "AUTO" and "OFF"	11 – → 5	0 VDC
Inhibit FA "ON" signal (optional equipment)	7	V	 S2/55 inhibit FA "ON" position	11 – → 7	12 - 14 VDC
	7	V	 S2/55 inhibit FA "OFF" position	11 – → 7	0 VDC

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Designation	A10 Pin	Meas. unit	Conditions	Measure from pin to pin	Value
Inhibit outputs					
Inhibit "OFF"	2	V	 S2/56 inhibit "OFF" position	11 – → 2	0 VDC
Inhibit "AUTO" (Front and rear axle are shifted at the same time)	2	V	 S2/56 "AUTO" / < 14 km/h / EHR "CONTROL" (MHR < 50 %) / no steering brake applied	11 – → 2	12 - 14 VDC
	2	V	 S2/56 "AUTO" / > 14 km/h / or EHR "TRANSPORT" (MHR > 50 %) or steering brake applied	11 – → 2	0 VDC
Inhibit "ON"	2	V	 S2/56 "ON" position / EHR "TRANSPORT" (MHR > 50 %) > 14 km/h / no steering brake applied	11 – → 2	12 - 14 VDC
	2	V	 S2/56 inhibit "ON" position / steering brake applied	11 – → 2	0 VDC
Resistance measurement Y10	2	R		11 – → 2	9 Ω ± 10 %
Relay K5/45 for solenoid valve Y8 inhibit front axle	12	V	 S2/56 "AUTO" / < 14 km/h / EHR "CONTROL" (MHR < 50 %) / no steering brake applied	17 + → 12	12 - 14 VDC
	12	V	 S2/55 "ON" position	17 + → 12	12 - 14 VDC
	12	V	 S2/56 "ON" position / EHR "TRANSPORT" (MHR > 50 %) or > 14 km/h / or steering brake applied and S2/55 "OFF"	17 + → 12	0 VDC

NOTE:

– All values measured with the Digital Multimeter.

– The indicator lights from the rear and front axle locks are switched ON by pressure switches S8 and S23.

– FA is the abbreviation for Front Axle.

– OPTI - STOP means that 4-wheel drive is automatically switched ON when braking with both pedals.

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Chapter

6005

WORKSHOP MANUAL

Power unit TW 557

6005

CASE STEYR Landmaschinentechnik GmbH
Technische Dokumentation
A - 4300 St. Valentin, Steyrer Straße 32

Sva 7-99240 EN

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INTRODUCTION

The workshop manual in hand gives the trained expert instructions in the repairing of

T557 power units for STEYR tractors 9078/a, 9086/a, 9094a and M9083a

It is assumed that standard equipment such as tools and devices is available.

Special tools are kept to a minimum; they have been given a tool number and can be ordered from STEYR.

These repair instructions only deal with the disassembly and reassembly of one version. Differing work procedures of other possible versions can be easily discerned by qualified personnel. Also refer to the corresponding section and perspective illustrations.

However, the repair of your aggregate can necessitate differing work procedures and also differing adjustment and test data due to further technical development of the product.

We therefore recommend you to place your STEYR product in the hands of continually trained personnel.

Damage due to inexpert execution of repair works through untrained personnel and possible follow-up costs resulting thereof are excluded from contractual liability.

This also applies to the renunciation of original STEYR spare parts.

Steyr-Landmaschinentechnik GesmbH

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GENERAL WORK INFORMATION

Personnel repairing STEYR aggregates are generally responsible for work safety.

The observance of all valid safety regulations and legal provisions is precondition in order to prevent injury to persons and damage to products during maintenance and repair works.

Trained personnel are a precondition for the proper repairing of these STEYR products. The repairer is obliged to carry out training accordingly.

Cleanliness and competent working must be observed during the execution of all repair works. Transmissions removed from the vehicle must therefore be cleaned before opening.

It is assumed that the tools stipulated by STEYR are utilized.

All parts are to be cleaned upon disassembly. This is particularly applicable to corners, pockets and angles of housings and covers.

Old sealing compound is to be carefully removed.

Lubricating oil bores, grooves and pipes are to be checked for free passage. They must be free from deposits, foreign bodies or preservative agents. The latter applies in particularly to new parts.

Parts which are damaged during disassembly are generally to be replaced by new parts, e.g. radial sealing rings, O-rings, slotted rings, cap seals, protective caps etc. Parts such as rolling bearings, thrust washers, synchronizers, etc., which are subject to normal wear during operation, must be checked by an expert. He assesses if they are to be used again.

Parts which have been shrunk on warm must be redriven upon cooling, in order to guarantee proper installation. Shafts, bearings etc. must be lubricated before being pressed in.

All stipulated setting values, test data and tightening torques must be observed when reassembling.

The STEYR aggregates are filled up with oil upon completion of repair work.Procedure and permissible oil types can be taken from the operation instructions/operating media stipulations. The oil inspection plug and oil drain plug are to be tightened with the stipulated torque after filling up with oil.

Use only original STEYR spare parts!

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Table of contents

		Page
	Technical data	1
	Installation drawing	2
	Important assembly instructions	3
	Tightening torques (standard)	4
	Transmission diagrams	5-6
	Transmission sections and perspective diagrams	7-32
1.1	**Intermediate housing and clutch operator - disassembly**	33
1.2	**Intermediate housing and clutch operator - reassembly**	35
2.1.	**4-fold power take-off shaft - disassembly**	38
	Gear shift mechanism 4-fold power take-off shaft - disassembly	39
2.2	**4-fold power take-off shaft - reassembly**	41
	Gear shift mechanism 4-fold power take-off shaft - reassembly	44
3.1	**Power shift transmission - disassembly**	45
3.2	**Power shift transmission - reassembly**	51
4.1	**Transmission - disassembly**	59
	Gear shift mechanism 3rd-4th gear - dismantle	60
	Countershaft - dismantle	60
	Reverse idler gear - dismantle	61
	Gear shift mechanism 1st-2nd gear - dismantle	62
	Lubricating lines - dismantle	62
	Main shaft - dismantle	62
	Double spur gear/side cover -dismantle	63
	Power take-off shaft shift mechanism - dismantle	65
	Intermediate shaft - dismantle	66
	Power take-off shaft gear shift mechanism - dismantle	67
4.2	**Transmission - reassembly**	68
	Intermediate shaft - reassembly	68
	Power take-off shaft gear shift mechanism - installation	69
	Intermediate shaft - installation	71
	Power take-off shaft - installation	72
	Main shaft - preassembly	75
	Main shaft - installation	77
	Gear shift mechanism 1st-2nd gear - installation	79
	Reverse idler gear - installation	79
	Drive shaft and inlet spur gears - installation	80
	Contershaft - preassembly	81
	Countershaft - installation	84
	Gear shift mechanism 3rd-4th gear - installation	86
	Gear shift mechanism 1st-2nd gear and 3rd-4th gear - adjust	87
	Double spur gear/side cover -reassembly	88
5.1	**Side gear shift mechanism - disassembly**	89
	Side gear shift mechanism „gear“ - disassembly	89
	Side gear shift mechanism „group“ - disassembly	90

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		Page
5.2	**Side gear shift mechanism - reassembly**	91
	Side gear shift mechanism „group“ - reassembly	93
	Side gear shift mechanism „gear“ - reassembly	94
	Gear shift mechanism F-R/FS - adjust	95
6.1	**Rear axle - disassembly**	97
	Brake - disassembly	97
	Differential - disassembly	99
	Bevel pinion - dismantle	100
	Gear shift mechanism field/road - dismantle	101
	Power take-off shaft - dismantle	101
	Axle hub - disassembly	103
6.2	**Rear axle - reassembly**	105
	Hollow shaft - installation	105
	Power take-off shaft - installation	106
	Gear shift mechanism field/road - installation	108
	Contact reflection adjustment bevel pinion/crown wheel	109
	Adjustment of the bevel pinion bearing	110
	Bevel pinion - installation	111
	Differential - reassembly	113
	Contact reflection - inspection	117
	Brake - reassembly	118
	Axle hub - reassembly	121
7.1	**Front axle drive - disassembly**	125
7.2	**Front axle drive - reassembly**	129
	Adjustment of the all-wheel drive	130
	Axial play of the bearing - adjust	133
	Adjusting disk for tooth profile backlash - determine	135
8.1	**Hydraulic lifting gear - disassembly**	137
8.2	**Hydraulic lifting gear - reassembly**	138
	Special tools	139

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Max. input power	70,5 KW (94 PS)
Max. input speed	2300 rpm.
Max.input torque	350 Nm
Max. all-wheel output moment	1450 Nm
Max. vehicle total weight	7000 kg
Max. rear axle load capacity	5600 kg
Max. rear axle tires/index radius	16,9 - 38 / 795 mm
Oil capacity	approx. 30 l
Permissible operating temperature	100° C
Oil quality	STOU/UTTO API GL4
Deadweight	820 kg
Max. working capacity/lifting gear	36950 Nm

Propulsion unit description (basic version)

4-gear variable speed transmission with reverse range unit, preselection unit and field-road unit (dog)
Shift operation on the right-hand side 1st - 4th gear, unit F/R and preselection unit synchronized
Rear axle with bevel gear drive, differential with 4 bevel gear wheels and electrohydraulic differential lock (dog)
Final drive via planetary gear
Operating brake wet multi-disk brake, hydraulically operated
Parking brake mechanically operated
Power take-off drive shifting via power take-off shaft clutch independent of drive mechanism (540/1000 rpm)
All-wheel drive laid out centralized, load switching via electrohydraulic-operated multi-disk clutch
Lifting gear as split construction, separate oil system, without regulating unit, suitable for Bosch EHR operation

Optional versions

Preselection unit*.....40km/h
Crawling gear*
2-stage power shift transmission**
Power take-off shaft with 4 speeds
Travel PTO shaft (clockwise/anti-clockwise rotation)
Lateral PTO shaft drive
Sensor for digital indicator for vehicle speed and PTO shaft speed

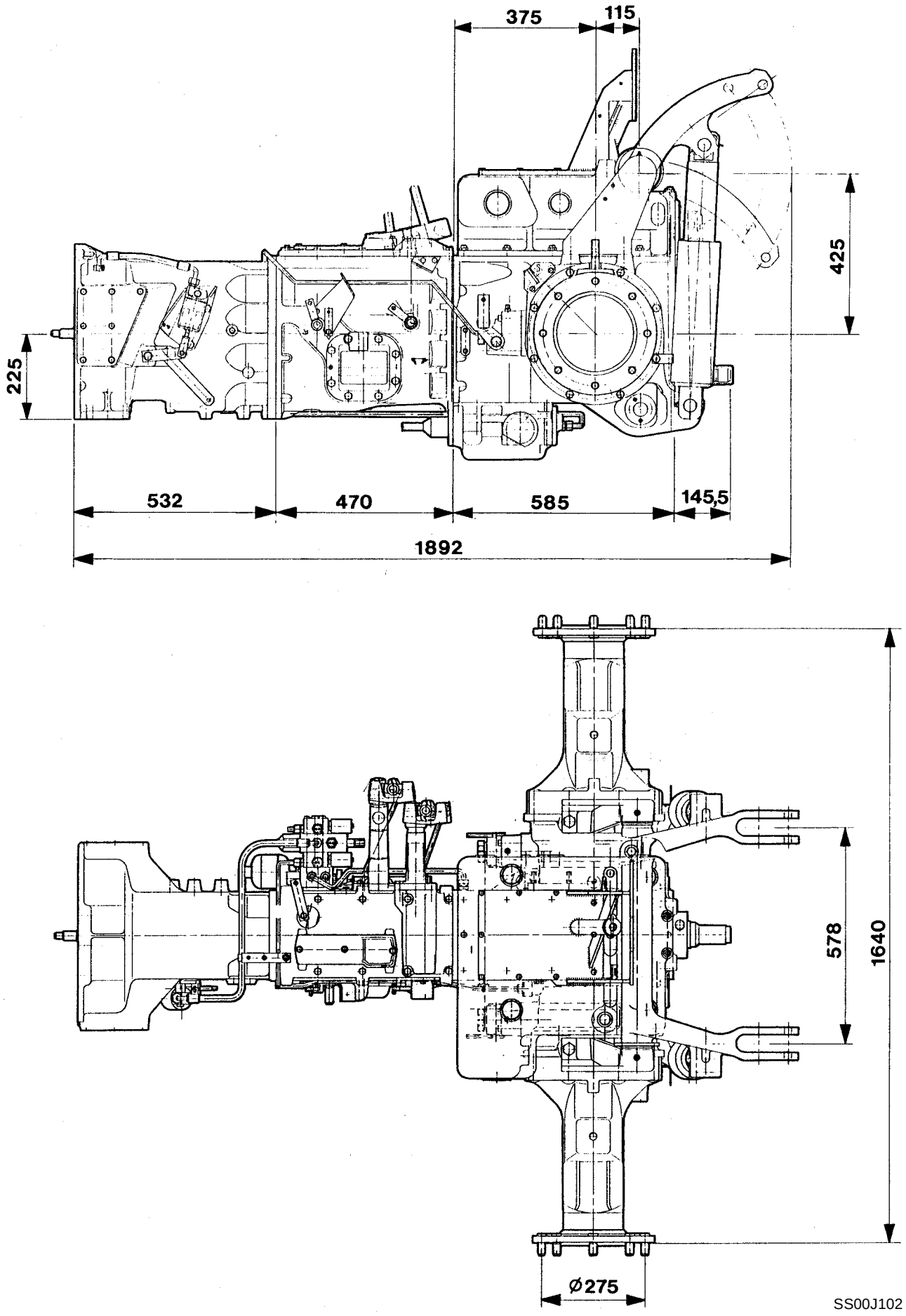
* (not possible with power shift transmission)
** (not possible with crawling gear/preselection unit)

Number of gears

	Fw.	Rev.
Basic version	16	8
Crawling gear	32	16
With power shift transmission	16	16

SPECIFICATIONS SUBJECT TO CHANGE !

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- Use only original STEYR spare parts
- Oil bores must be free (blow-through)
- Rectangular rings must fit easily into groove
- Lubricate needle bearings and cylinder liners before assembling
- Slightly grease radial sealing ring
- Always replace castellated nuts and nuts which are secured by hammering in
- Keep sealing surfaces clean
- Use sealing compound sparingly
- Rub down cylinder liners with Molykote paste G
- Slot of the tensioning sleeve in force direction

Sealing and lubricants recommendation

Sealing of surfaces	-	Loctite 518
Securing of screws	-	Loctite 243/Loctite 638
Lubricants	-	Stabutherm GH 461 - Kluber
		Loctite metal grease Antiseize
		Optimol Olista Longtime 2
		Molykote paste G

Important tightening torques and adjusting values

Main shaft - nut		150 Nm
Countershaft - nut		200 Nm
Bevel pinion - nut		450 Nm
Mount/elevating shaft - screws		380 Nm
Power shift transmission - tighten nuts in vice and turn back by 312°		
Drive hollow shaft	Axial clearance	0,4 - 0,6 mm
Spur gears/4-fold PTO shaft	Axial clearance	0,1 - 0,3 mm
PTO shaft	Axial clearance	0,1 - 0,3 mm
Crown wheel/bevel binion	Backlash of teeth	0,15 - 0,30 mm
Rear axle shaft bearing	Axial clearance	0 - 0,015 mm

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Tightening torques (in Nm) of headed screws, nuts and studs
Couples de serrage (en Nm) des vis, écrous et goujons filetés

SCREWS AND NUTS
VIS ET ECROUS

		galvanized galvanisé 0.125 µ				polished brillant 0.14 µ			
Property class	old	6G	8G	10K	12K	6G	8G	10K	12K
Classe de résistance	new	6,9	8,9	10,9	12,9	6,9	8,9	10,9	12,9
	Dimensions Dimensions	METRIC REGULAR THREAD FILETAGE METRIQUE A PAS GROS							
	M 4		2,7	3,8	4,6		2,9	4,1	4,9
	M 5		5,5	8,0	9,5		6,0	8,5	10
	M 6		9,5	13	16		10	14	17
	M 8		23	32	39		25	35	41
	M10		46	64	77		49	69	83
	M12		80	110	135		86	120	145
	M14		125	180	215		135	190	230
	M16		195	275	330		210	295	355
	M18		270	390	455		290	405	485
	M20		385	540	650		410	580	690
	M22		510	720	870		550	780	930
	M24		660	930	1100		710	1000	1200
	M27		980	1400	1650		1050	1500	1800
	M30		1350	1850	2250		1450	2000	2400
		METRIC FINE PITCH THREAD FILETAGE METRIQUE A PAS FINS							
	M 8x1		25	35	42		27	38	45
	M10x1,25		49	68	82		52	73	88
	M12x1,25		88	125	150		95	135	160
	M12x1,5		83	115	140		90	125	150
	M14x1,5		140	195	235		150	210	250
	M16x1,5		210	295	350		225	315	380
	M18x1,5		305	425	510		325	460	550
	M20x1,5		425	600	720		460	640	770
	M22x1,5		570	800	960		610	860	1050
	M24x2		720	1000	1200		780	1100	1300
	M27x2		1050	1500	1800		1150	1600	1950
	M30x2		1450	2050	2500		1600	2250	2700

1) µ tot. is the total pitch of threads, screw head/nut mating surfaces.

1) µ tot. est le coefficient de friction total pour les filetages, les surfaces d'appui des têtes de vis ou des écrous.

ATTENTION! Cadmium-plated/copper-plated screws and nuts are to be tightened with a torque 25 % below the galvanized values.

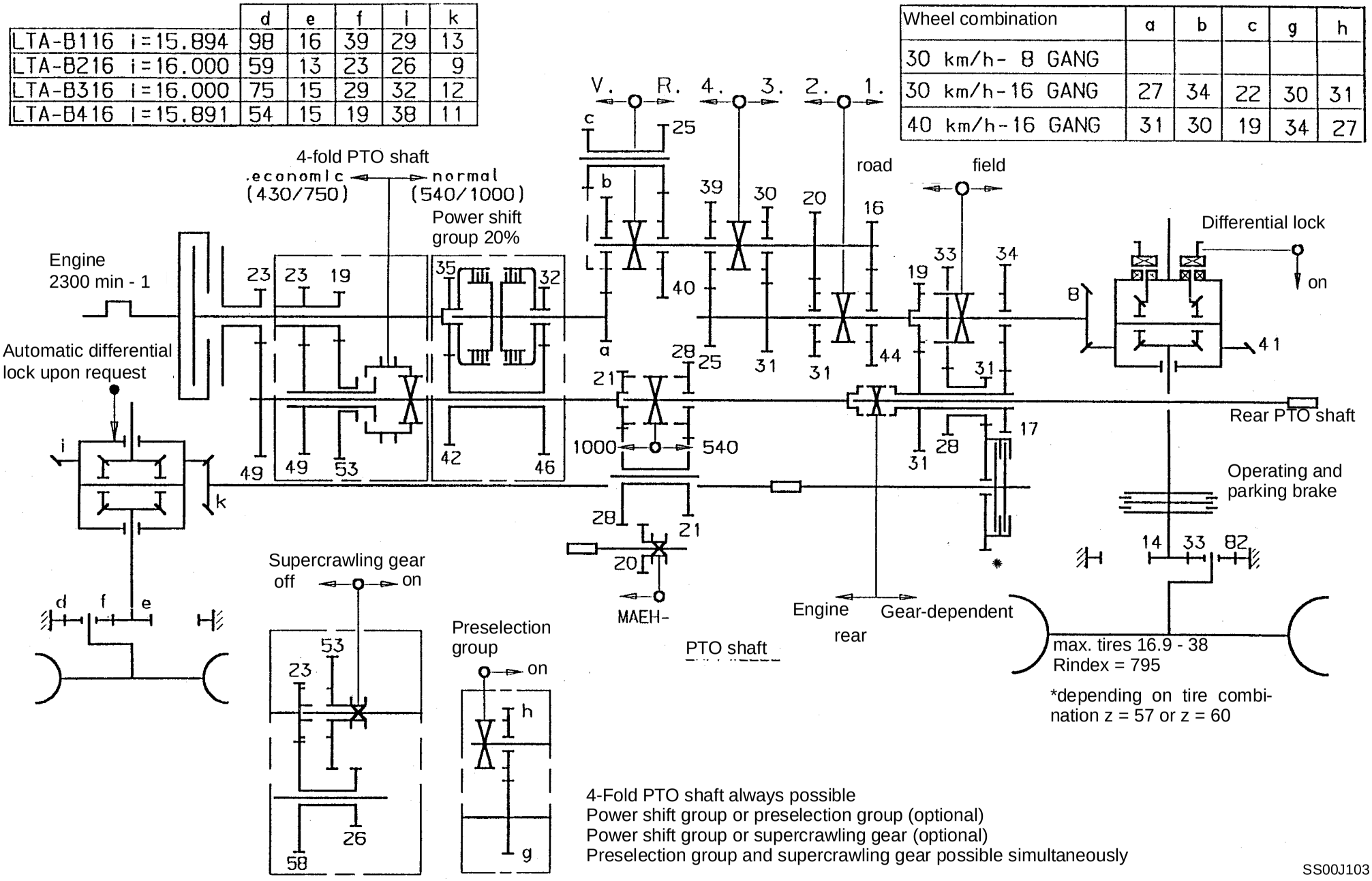
ATTENTION! Les vis et écrous cadmiés ou cuivrés doivent être serrés avec des couples 25 % moins élevés que les valeurs galvanisées.

Studs are screwed into the work piece with half the torque.

Les goujons filetés sont vissés avec un demi-couple dans la pièce.

	d	e	f	i	k
LTA-B116 i=15.894	98	16	39	29	13
LTA-B216 i=16.000	59	13	23	26	9
LTA-B316 i=16.000	75	15	29	32	12
LTA-B416 i=15.891	54	15	19	38	11

Wheel combination	a	b	c	g	h
30 km/h- 8 GANG					
30 km/h-16 GANG	27	34	22	30	31
40 km/h-16 GANG	31	30	19	34	27



4-Fold PTO shaft always possible
Power shift group or preselection group (optional)
Power shift group or supercrawling gear (optional)
Preselection group and supercrawling gear possible simultaneously

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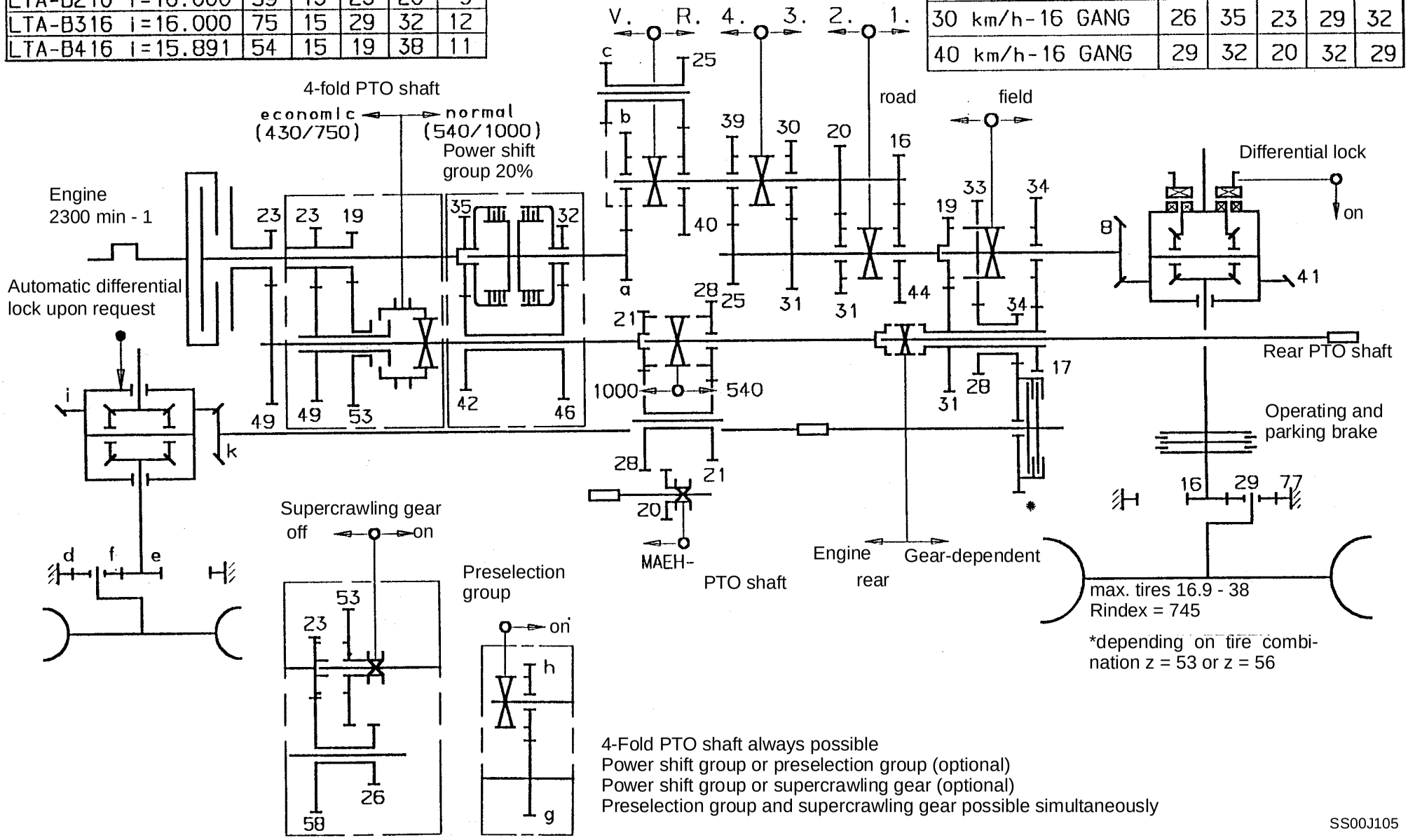
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Transmission diagram i = 6.8

Transmission diagram i = 5.8

	d	e	f	i	k
LTA-B116 i=15.894	98	16	39	29	13
LTA-B216 i=16.000	59	13	23	26	9
LTA-B316 i=16.000	75	15	29	32	12
LTA-B416 i=15.891	54	15	19	38	11

Wheel combination	a	b	c	g	h
30 km/h- 8 GANG					
30 km/h-16 GANG	26	35	23	29	32
40 km/h-16 GANG	29	32	20	32	29



4-Fold PTO shaft always possible
Power shift group or preselection group (optional)
Power shift group or supercrawling gear (optional)
Preselection group and supercrawling gear possible simultaneously

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Page

Intermediate housing - clutch operator - 540/1000 PTO shaft 8

Intermediate housing - clutch operator 9

4-fold power take-off shaft 10-11

Power shift transmission 12-13

Propulsion unit with preselection group 14

Propulsion unit with preselection group and 540/1000 PTO shaft 15

Travel power take-off shaft 16-17

Supercrawling gear 18-19

Side gearshift mechanism „group“ 20-21

Side gearshift mechanism „gear“ 22-23

Rear axle with brake and planetary drive 0 = 6.8 24

Planetary drive i = 5.8 25

Rear axle 26

Planetary drive i = 6.8 27

Planetary drive i = 5.8 28

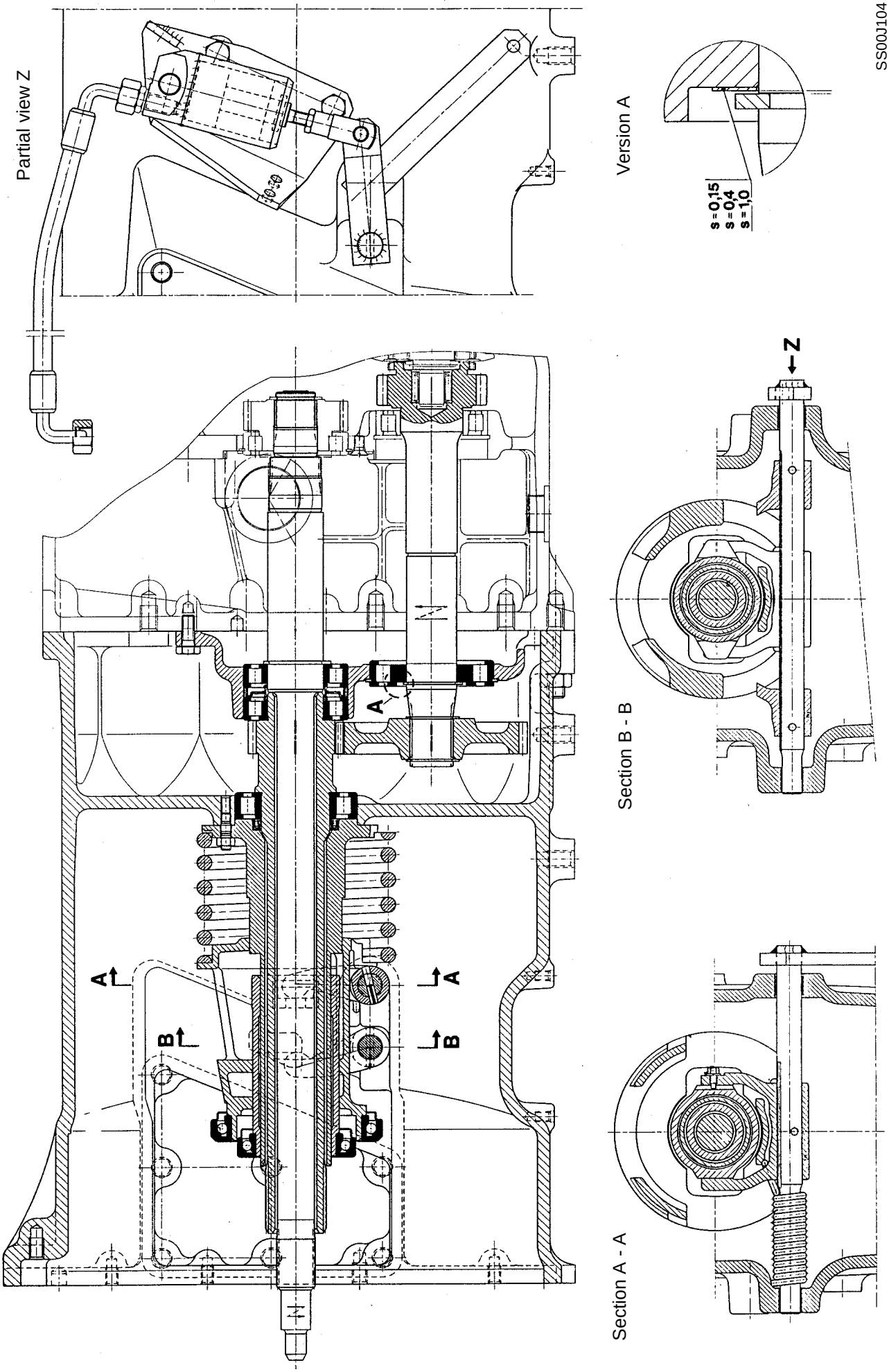
Brake 29

Front axle drive 30-31

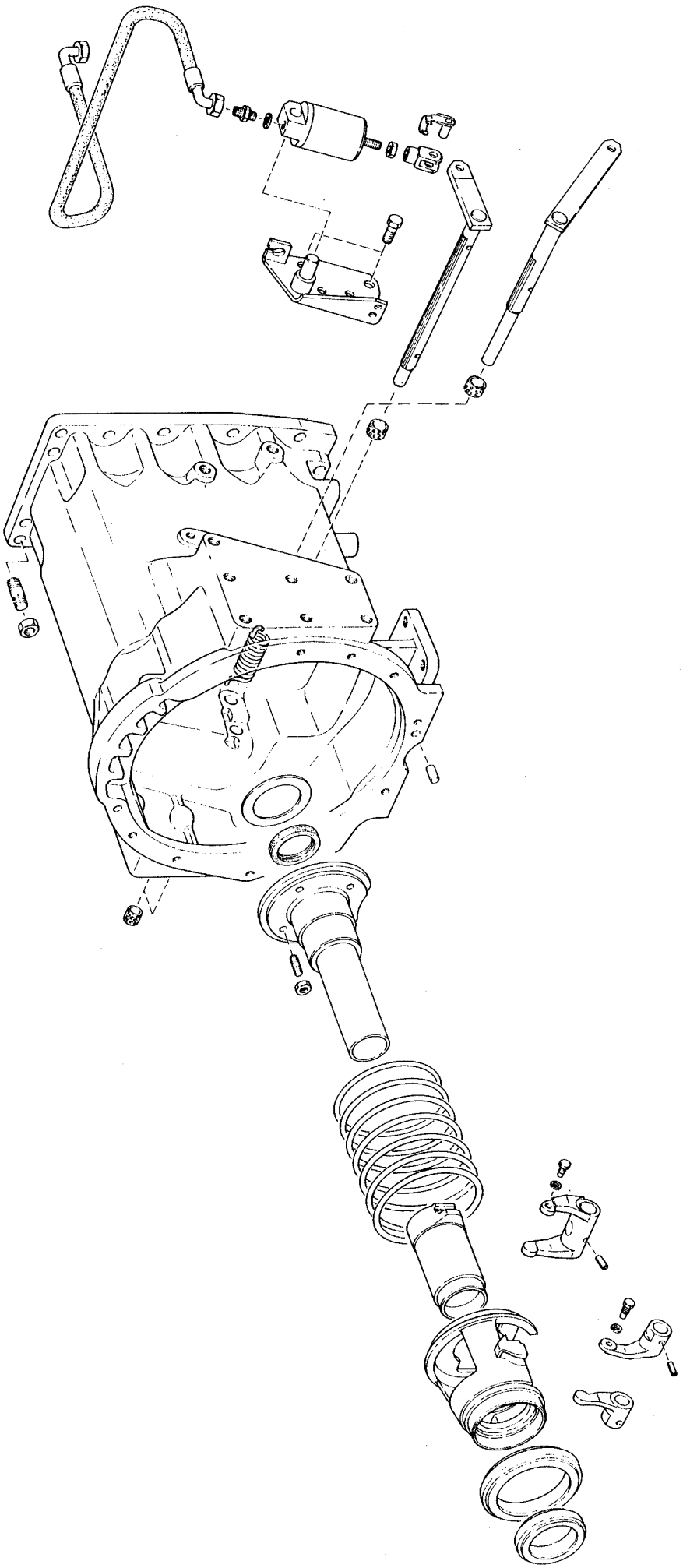
Hydraulic lifting gear 32

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Intermediate housing - clutch operator - 540/1000 PTO shaft

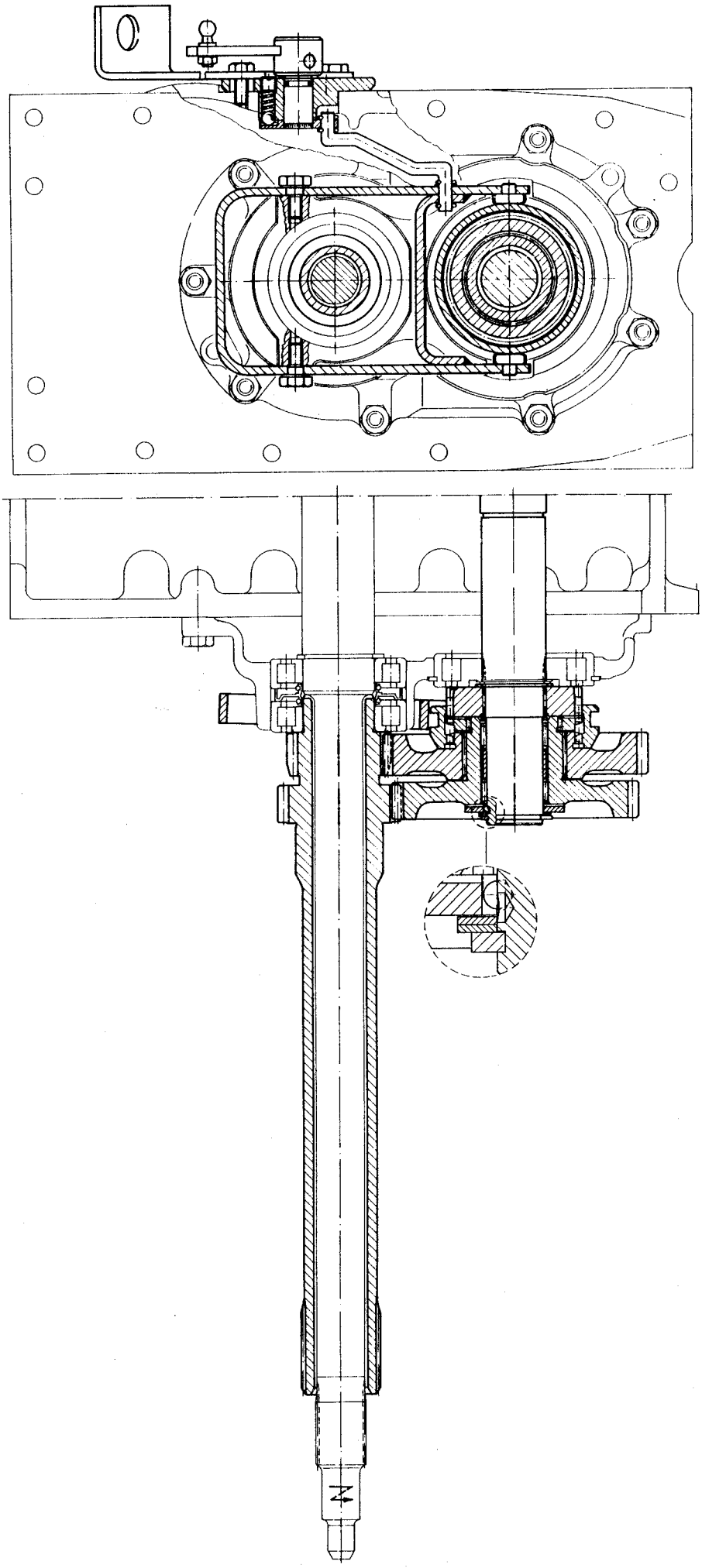


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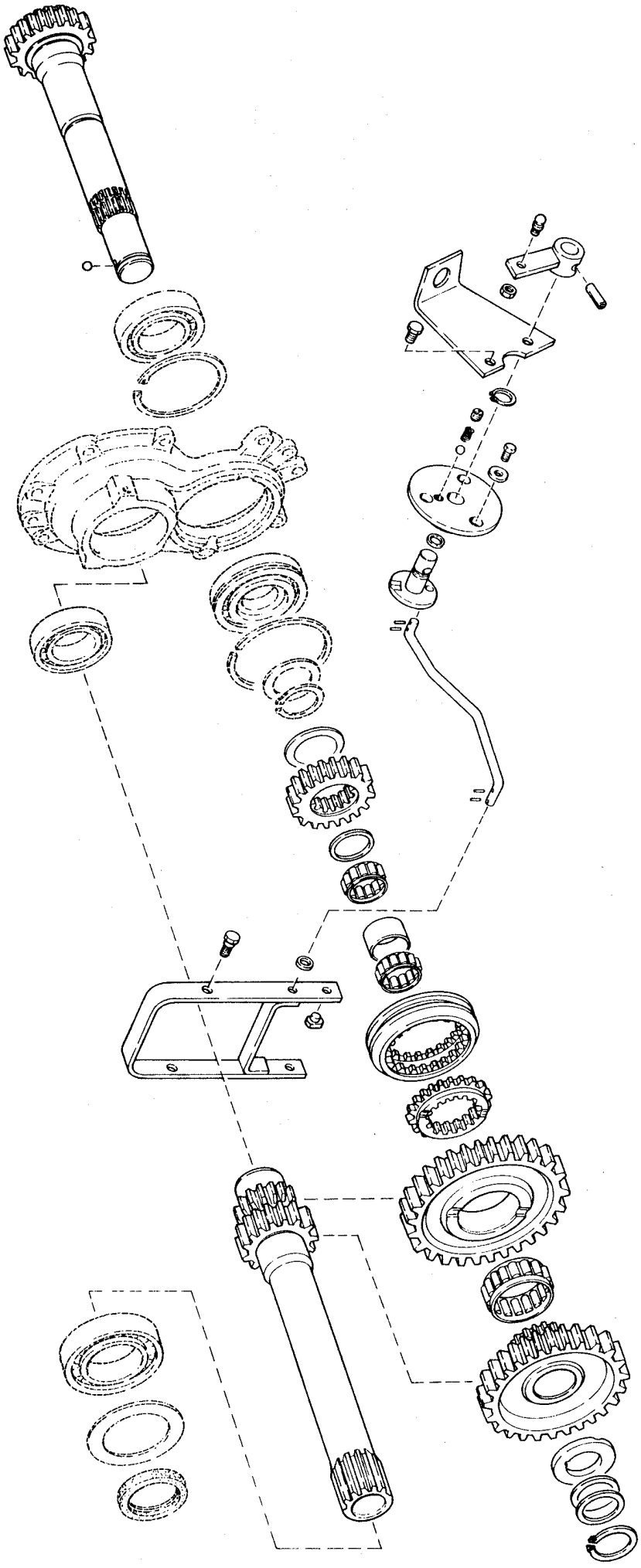
Intermediate housing - clutch operator

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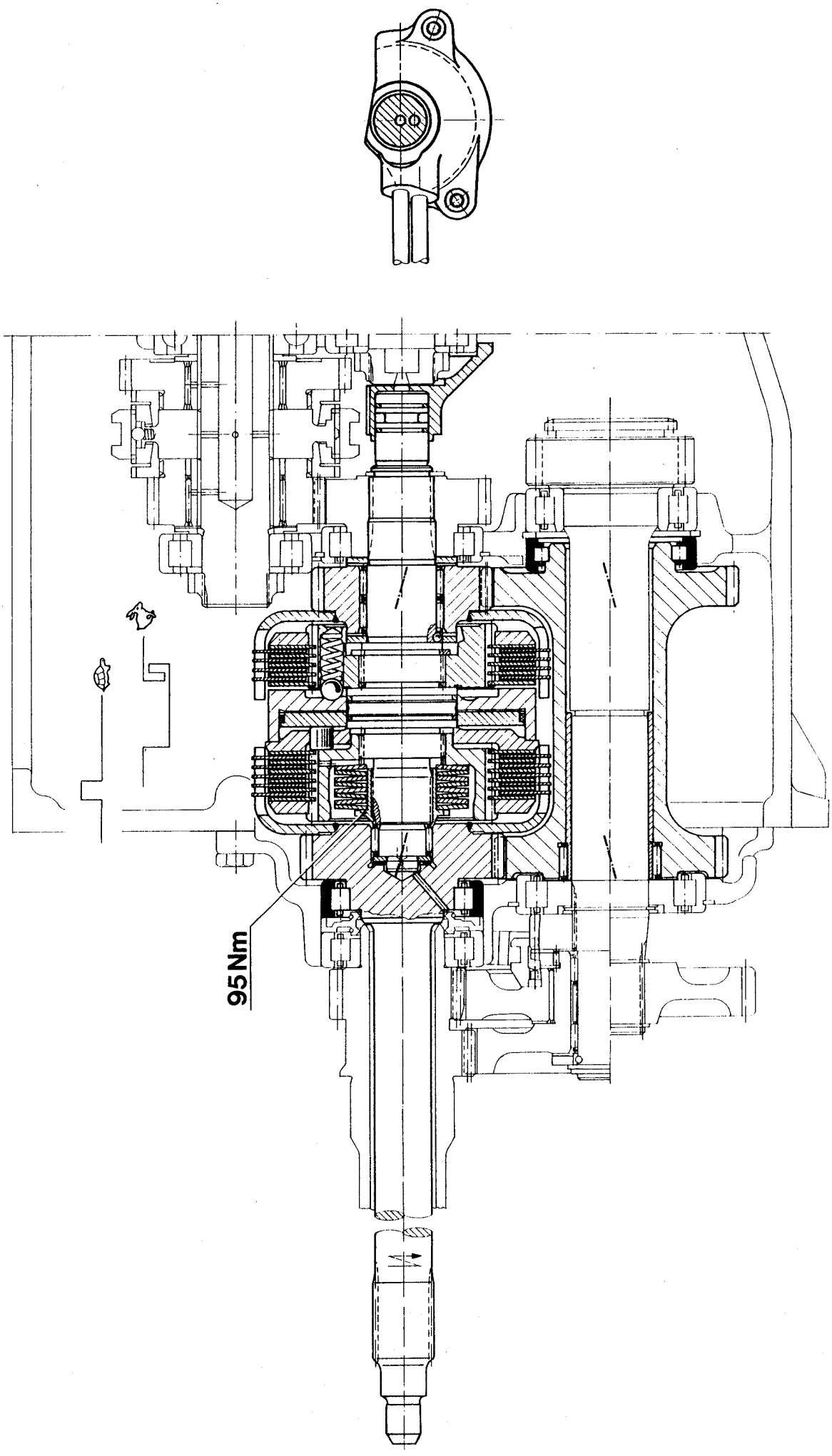
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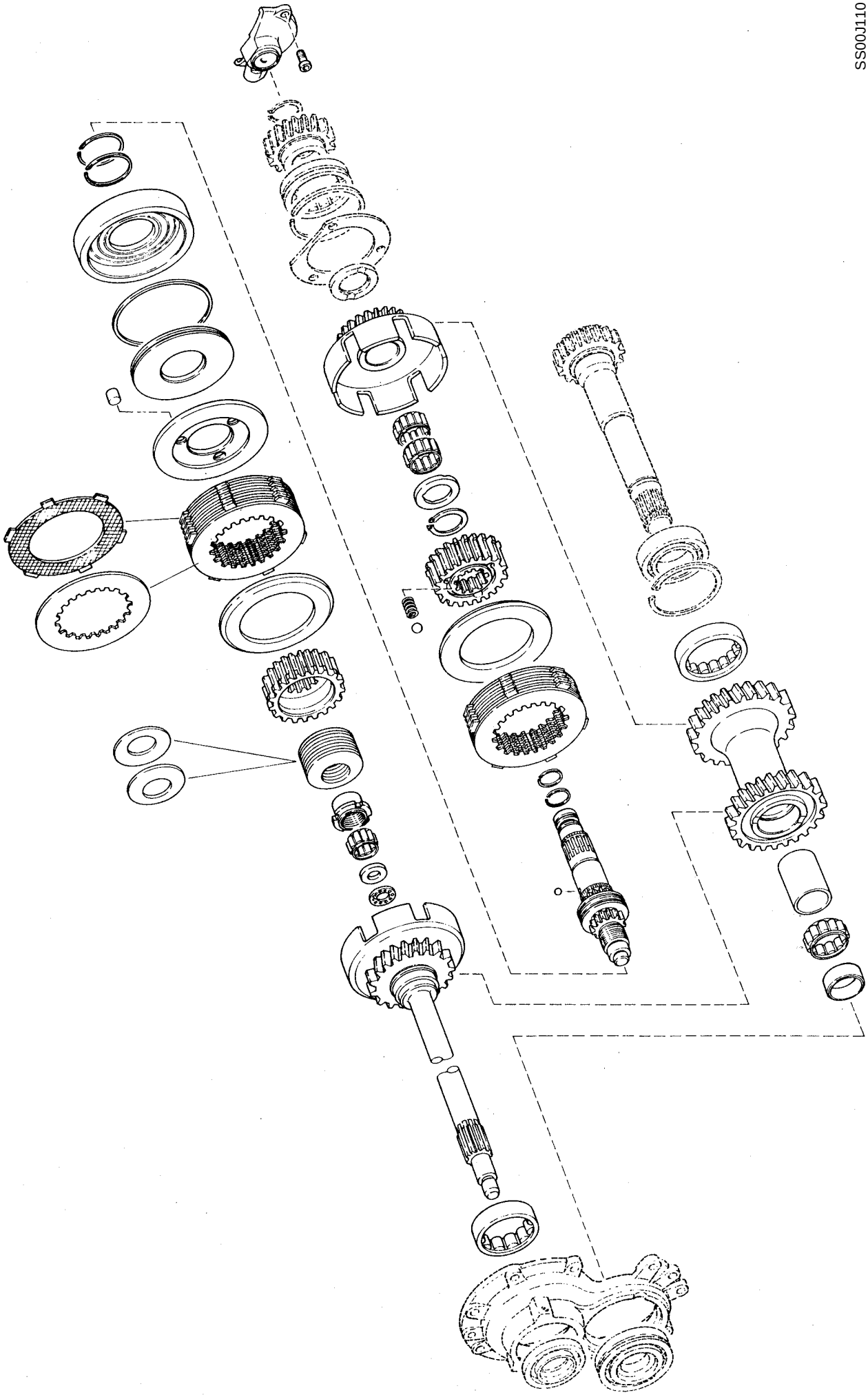
4-fold power take-off shaft

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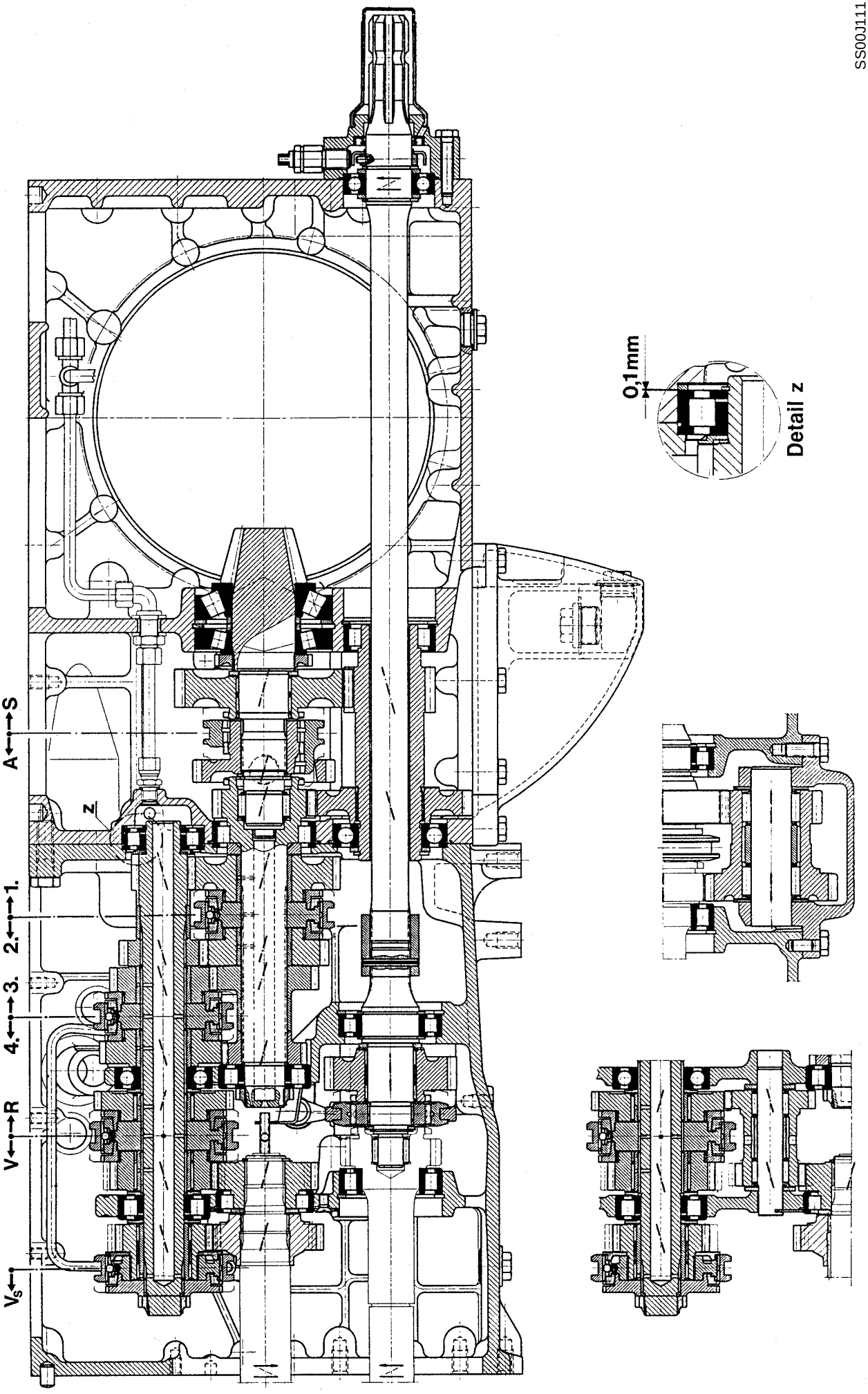


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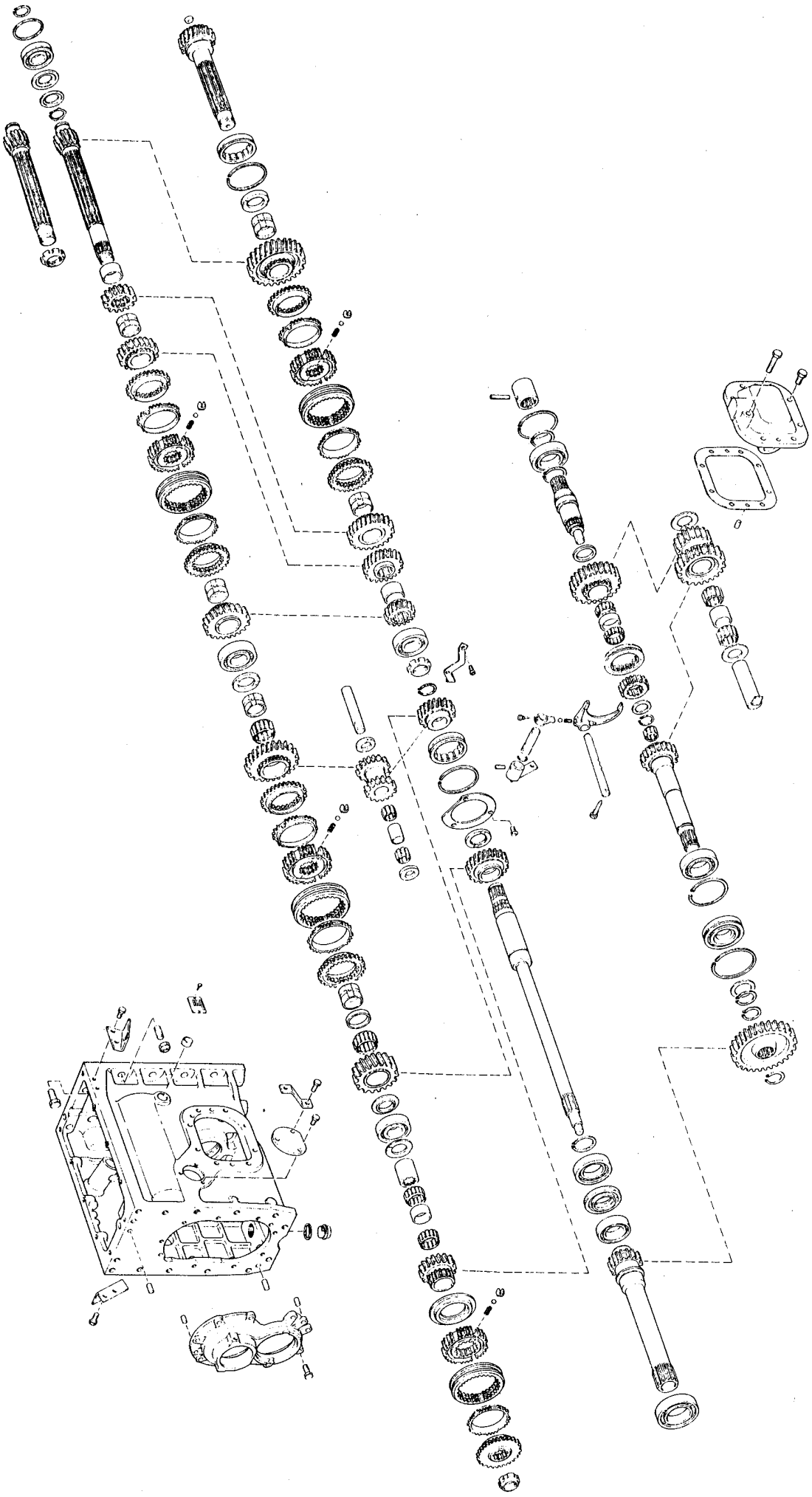
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Propulsion unit with preselection group



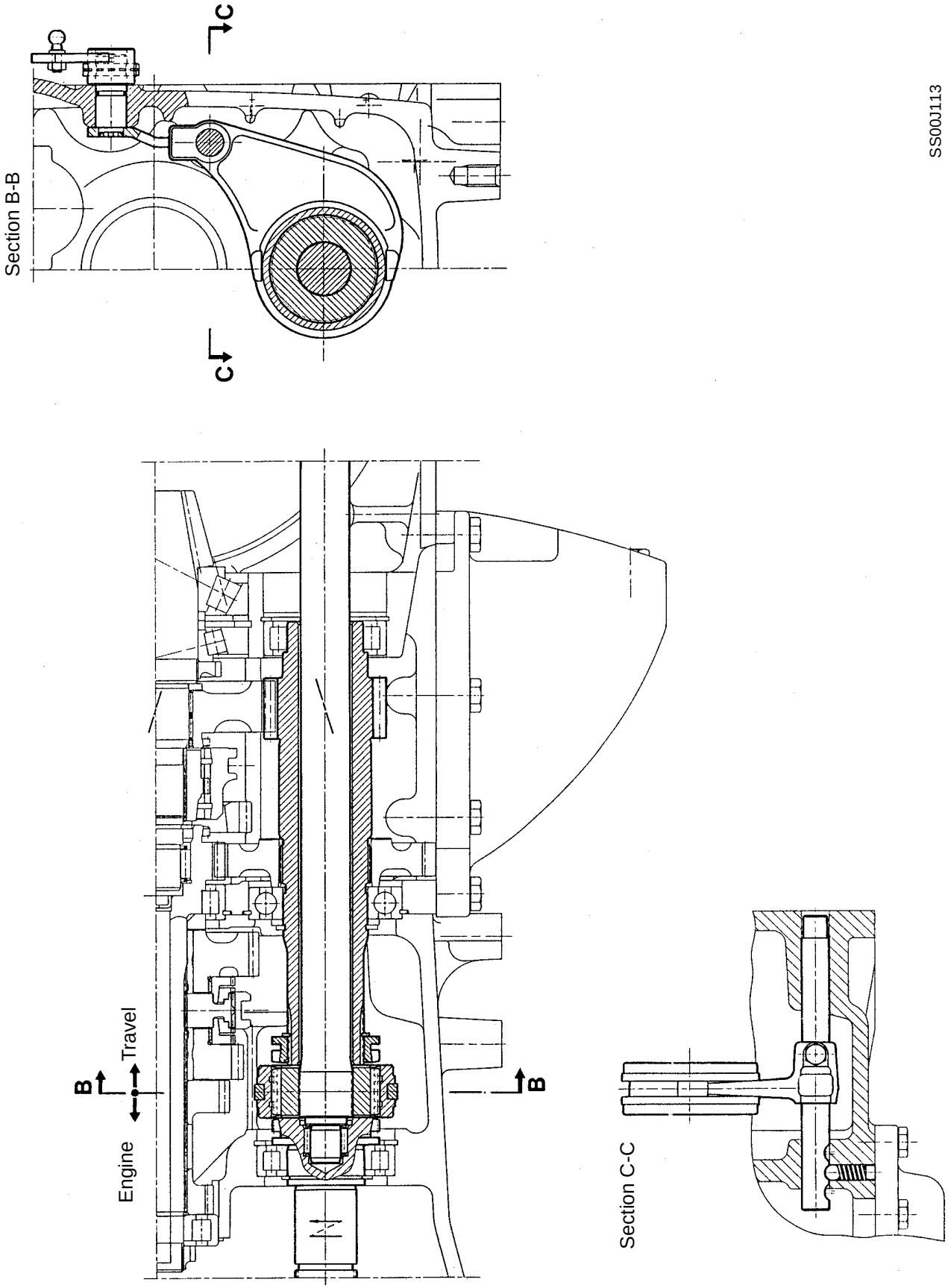
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Propulsion unit with preselection group and 540/1000 PTO shaft



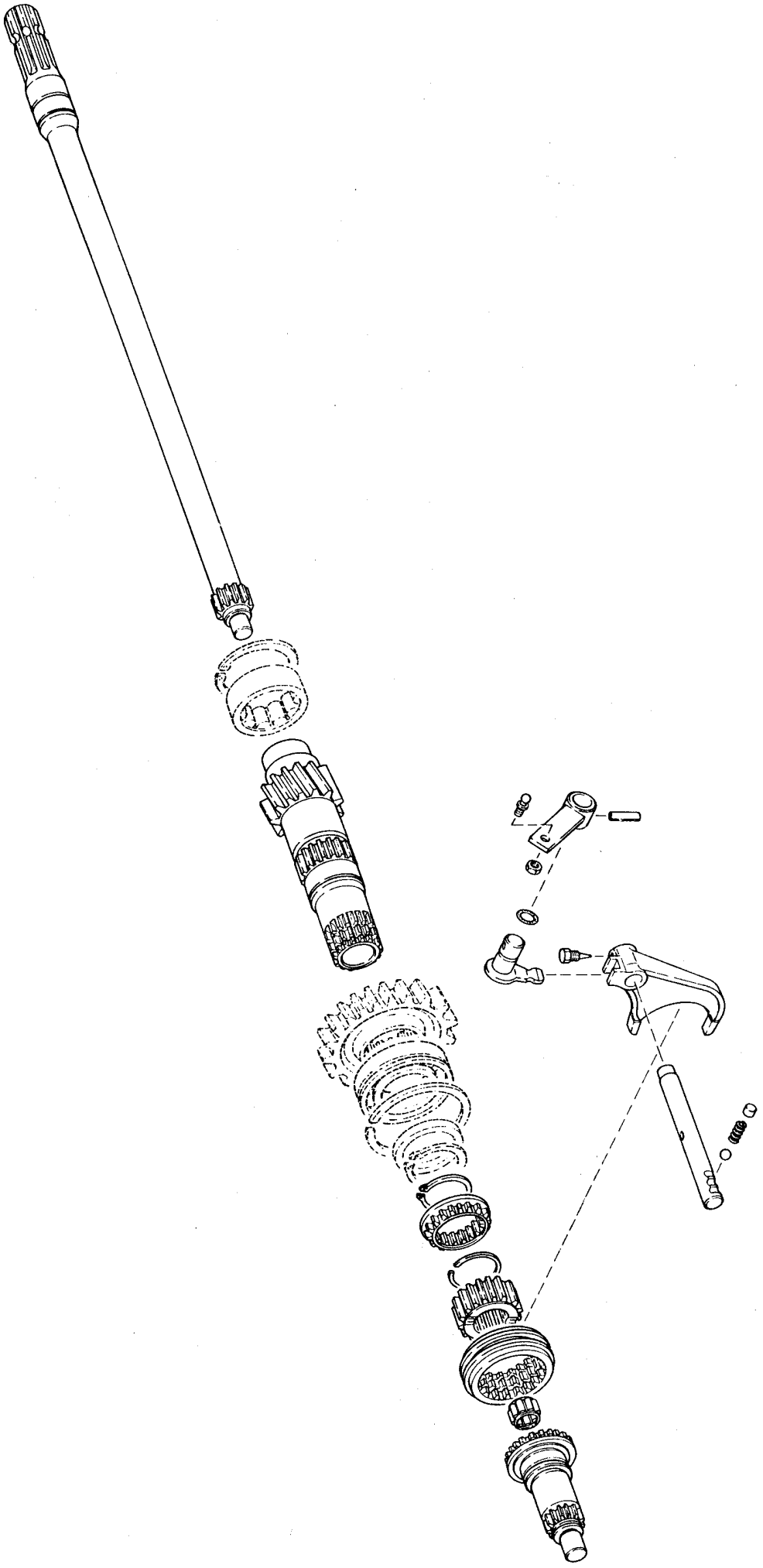
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Travel power take-off shaft

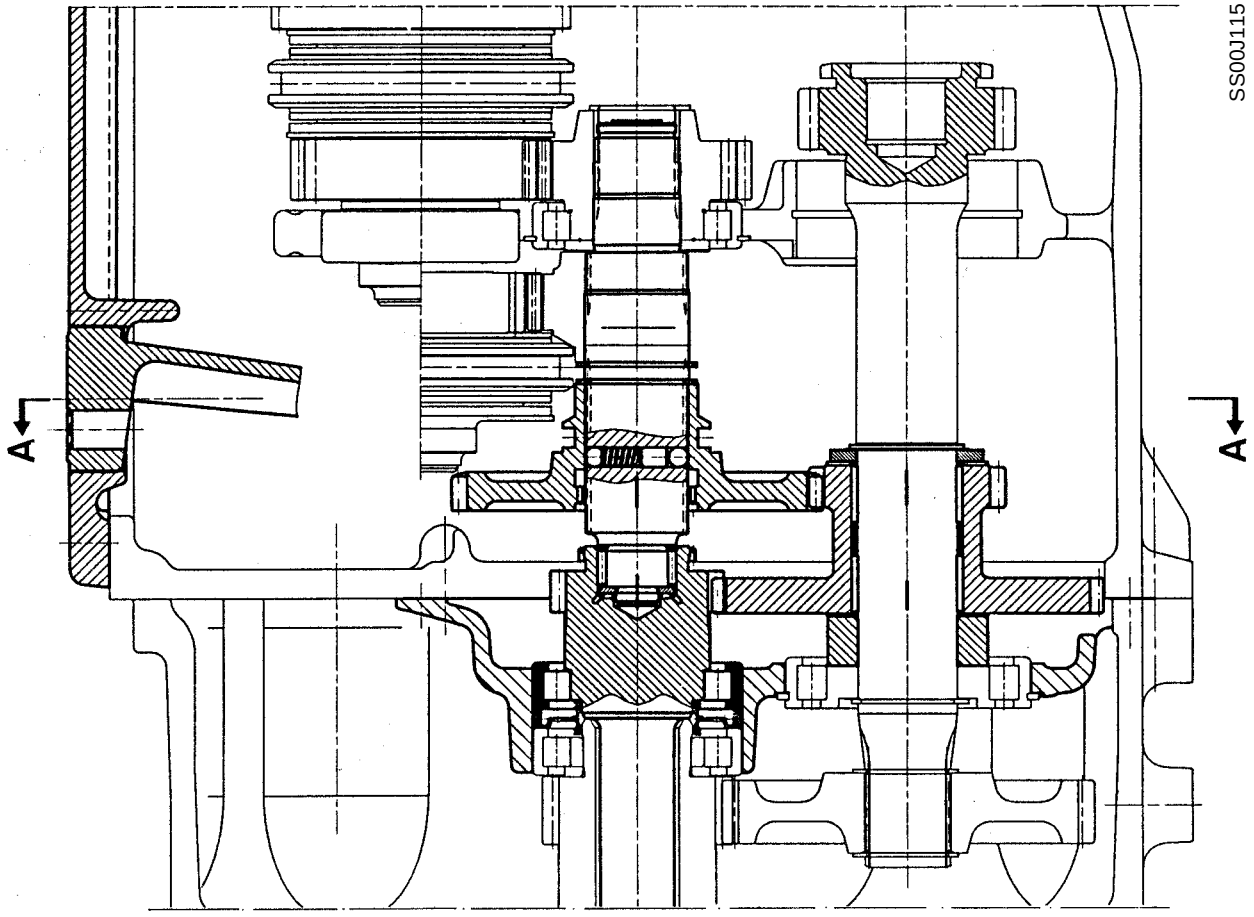


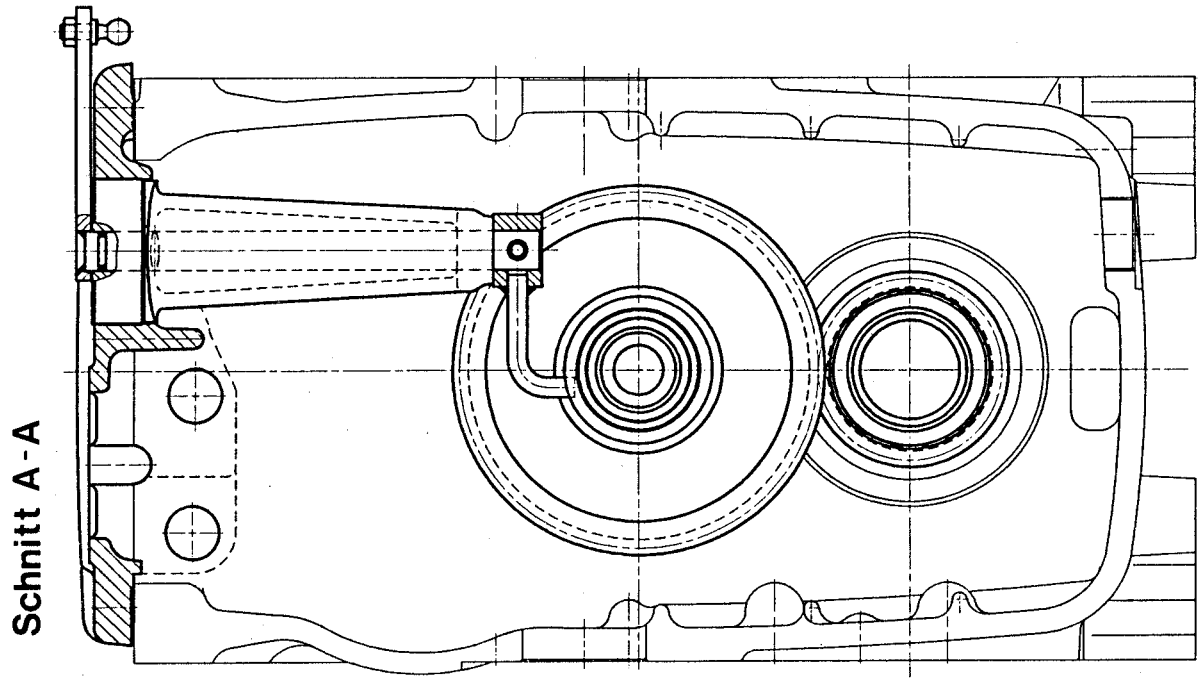
https://truckmanualshub.com/

Travel power take-off shaft

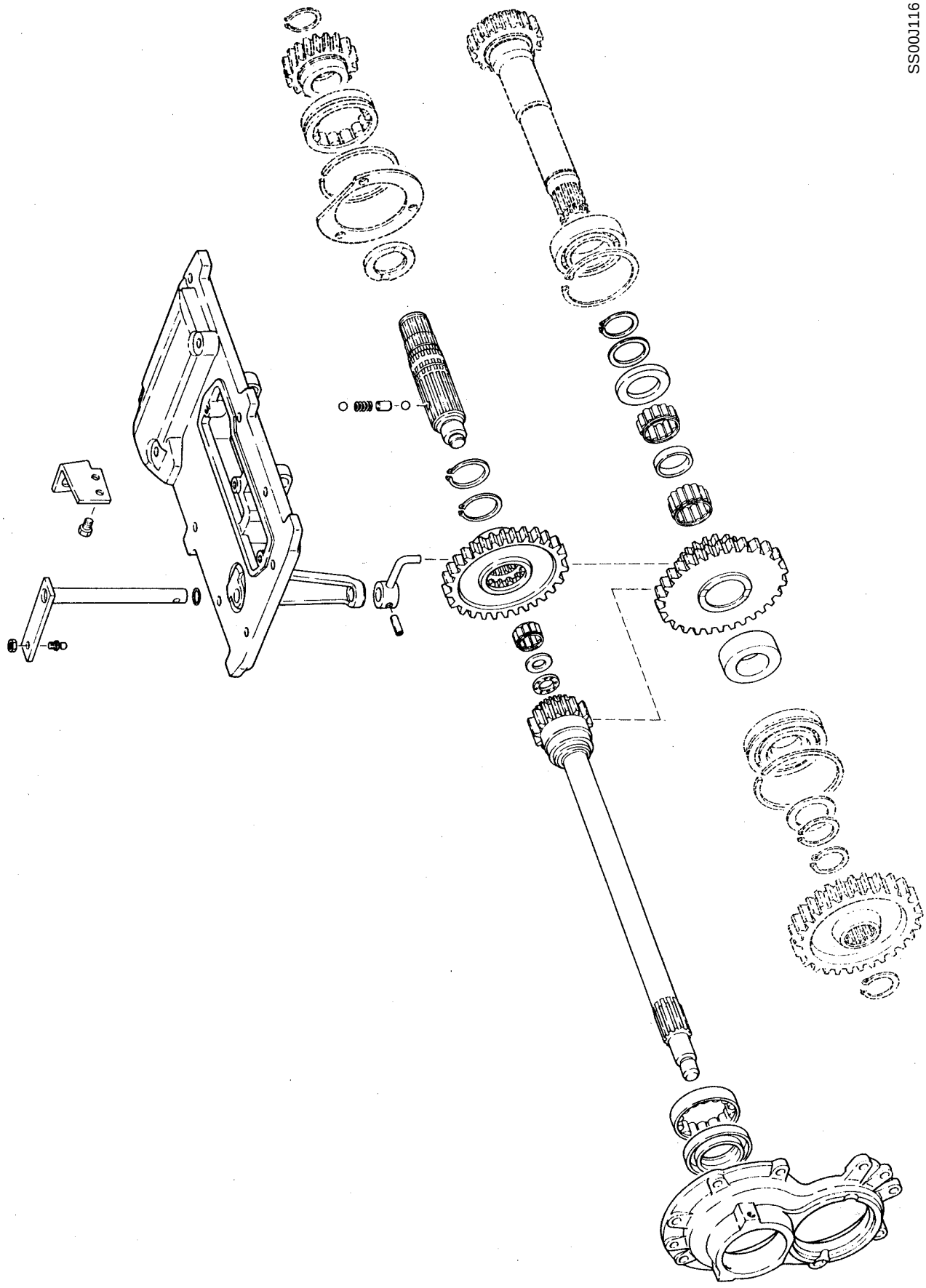


https://truckmanualshub.com/



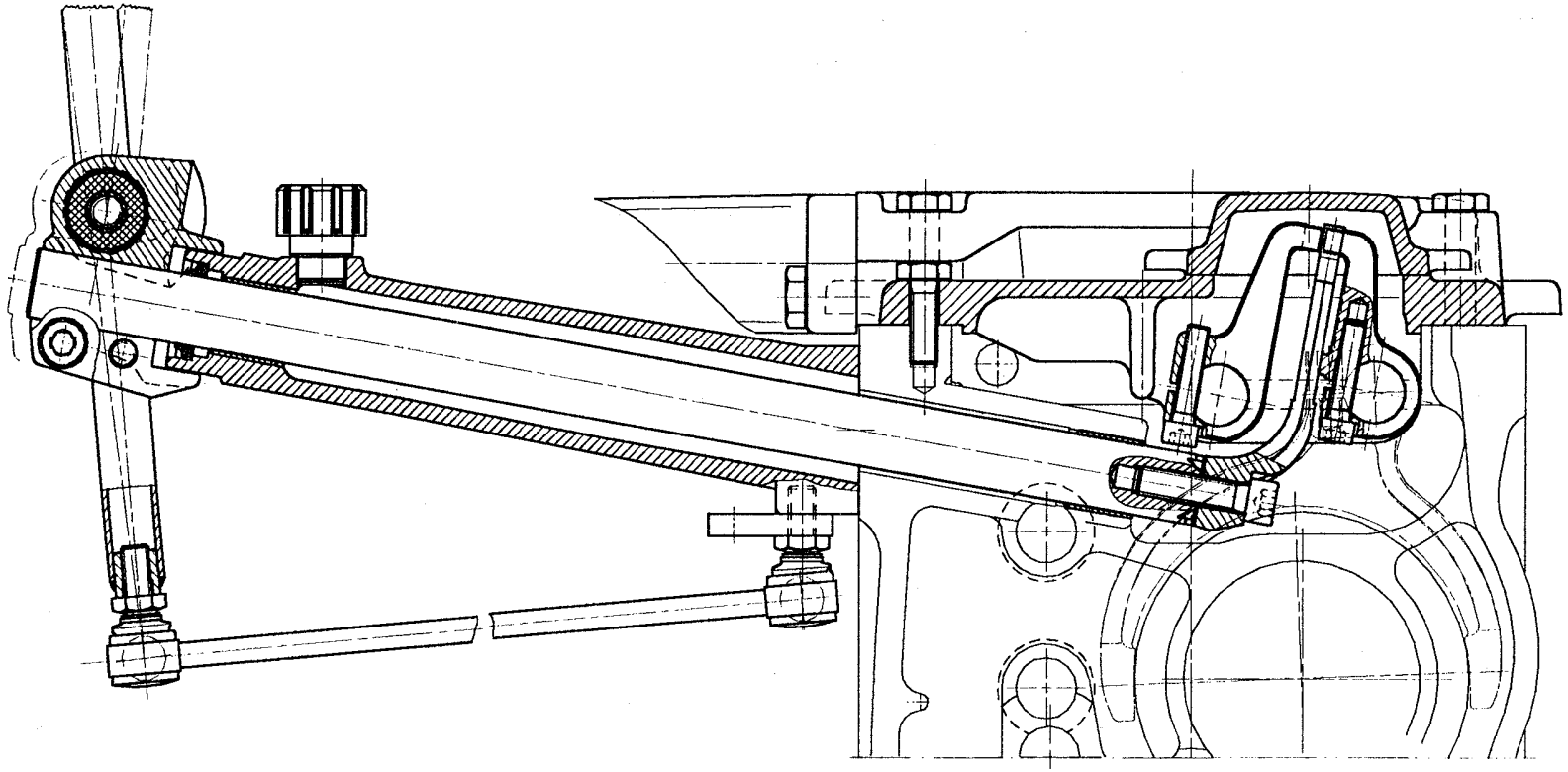


https://truckmanualshub.com/

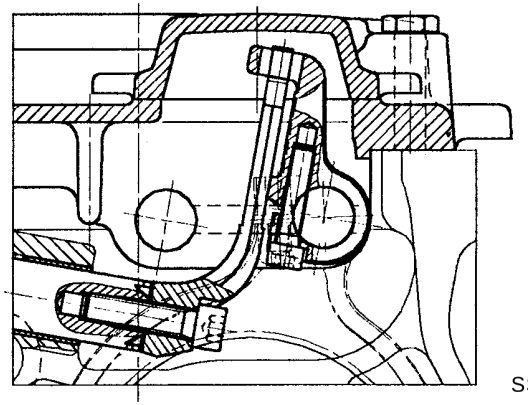


Supercrawling gear

Side gearshift mechanism „group“



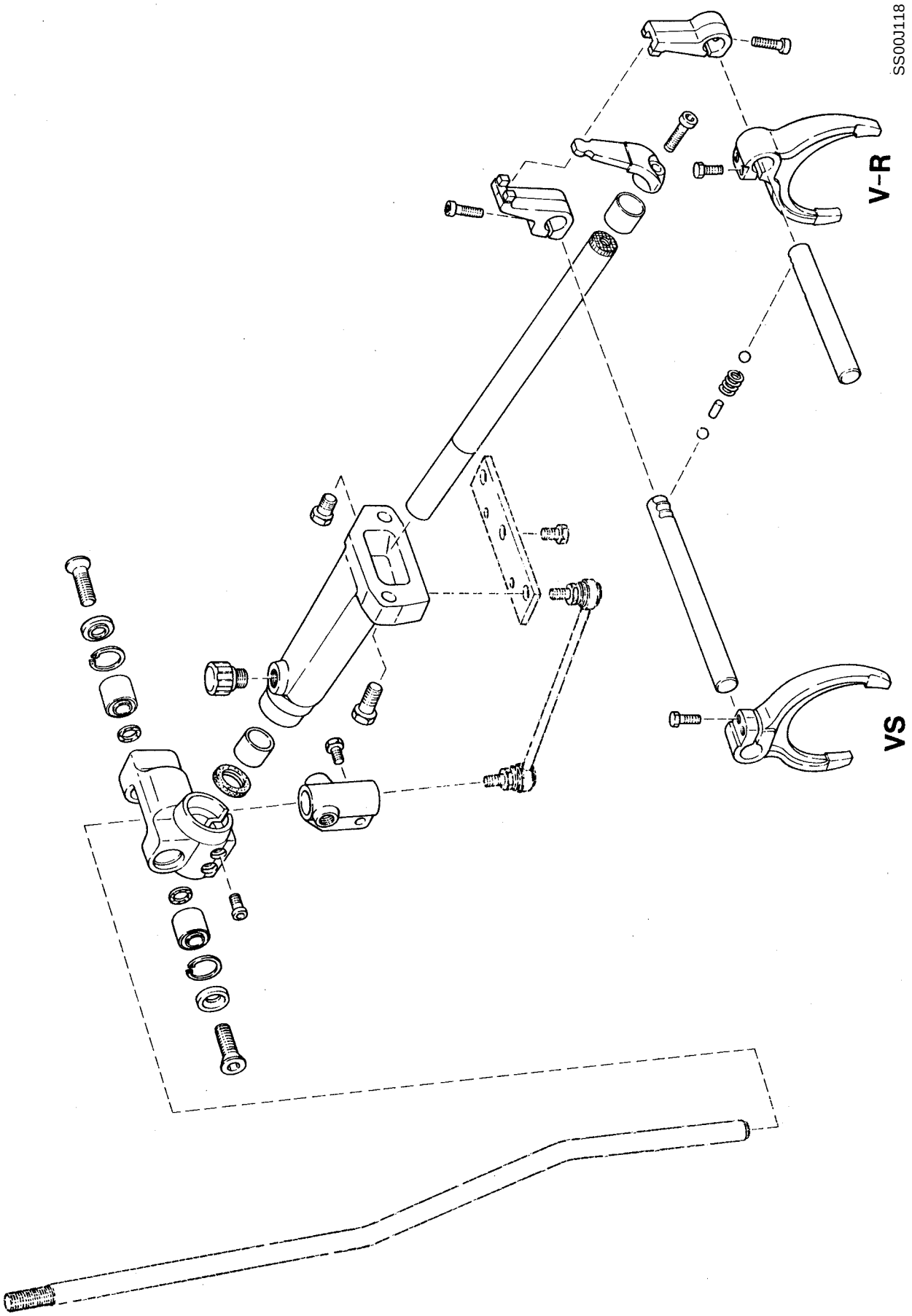
power shift
transmission



SS00J117

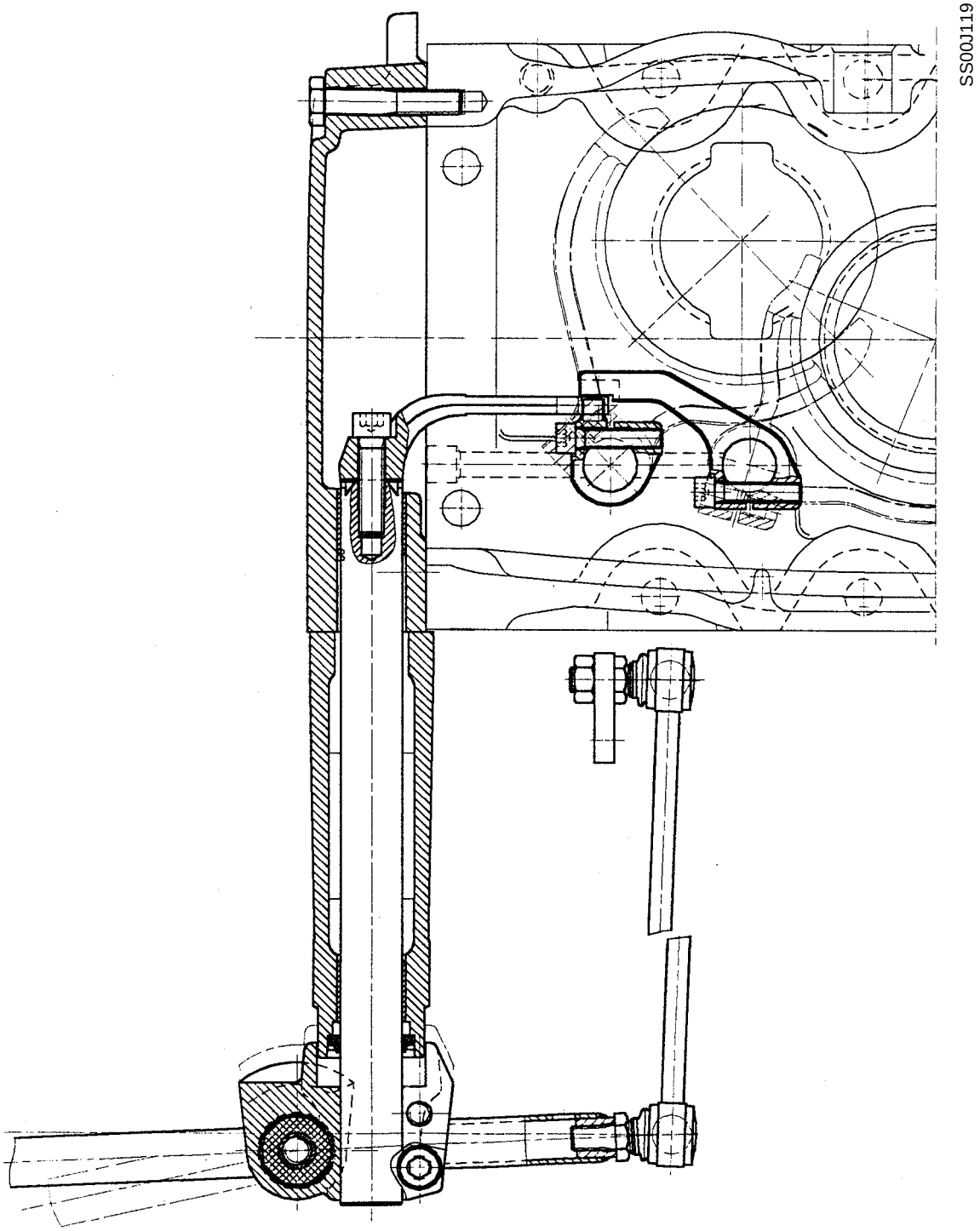
https://truckmanualshub.com/

https://truckmanualshub.com/



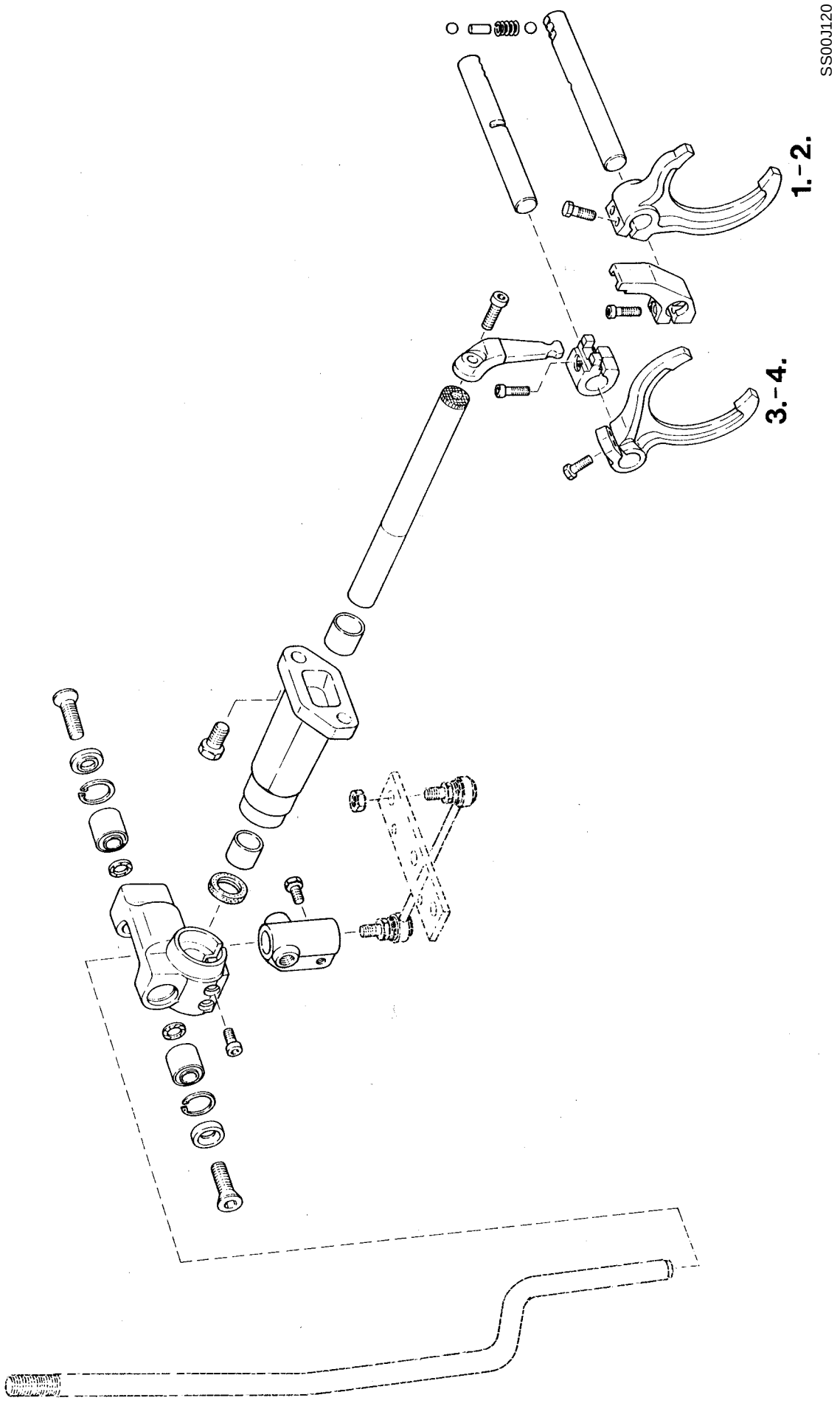
Side gearshift mechanism „group“

https://truckmanualshub.com/



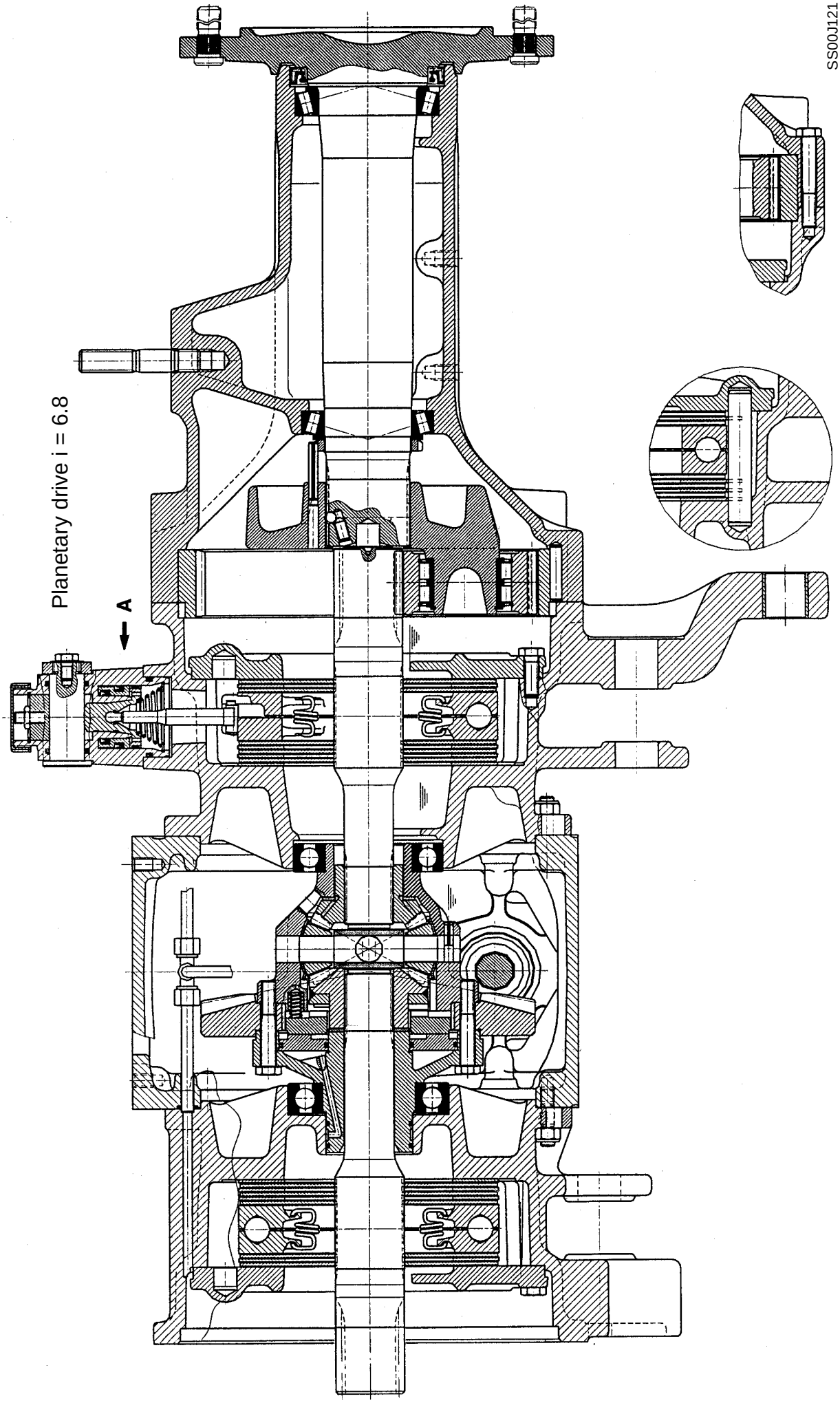
SS00J119

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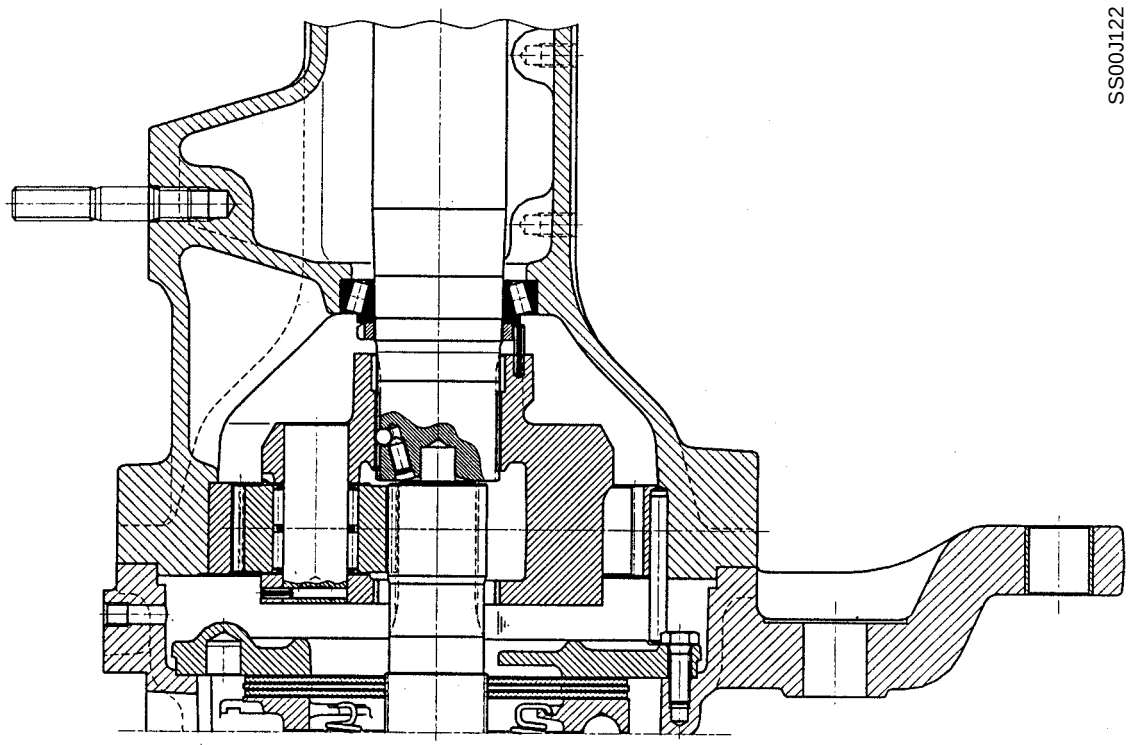


Side gearshift mechanism „gear“

https://truckmanualshub.com/

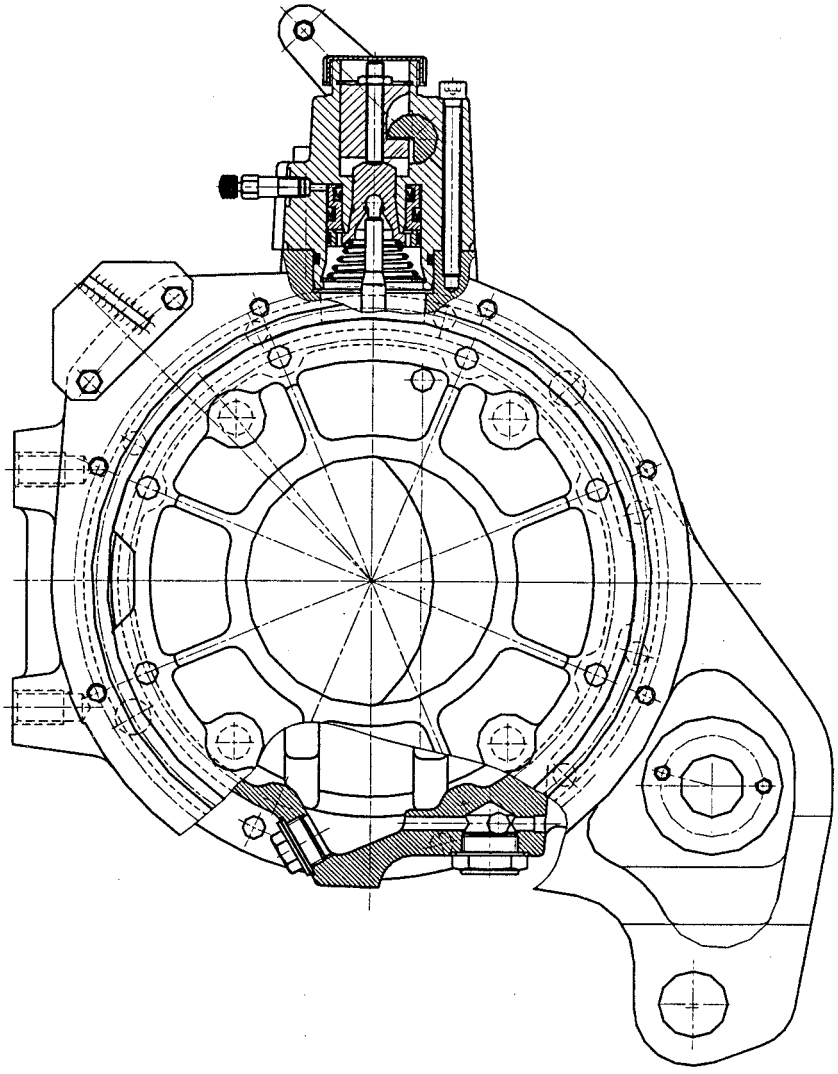


https://truckmanualshub.com/



SS003122

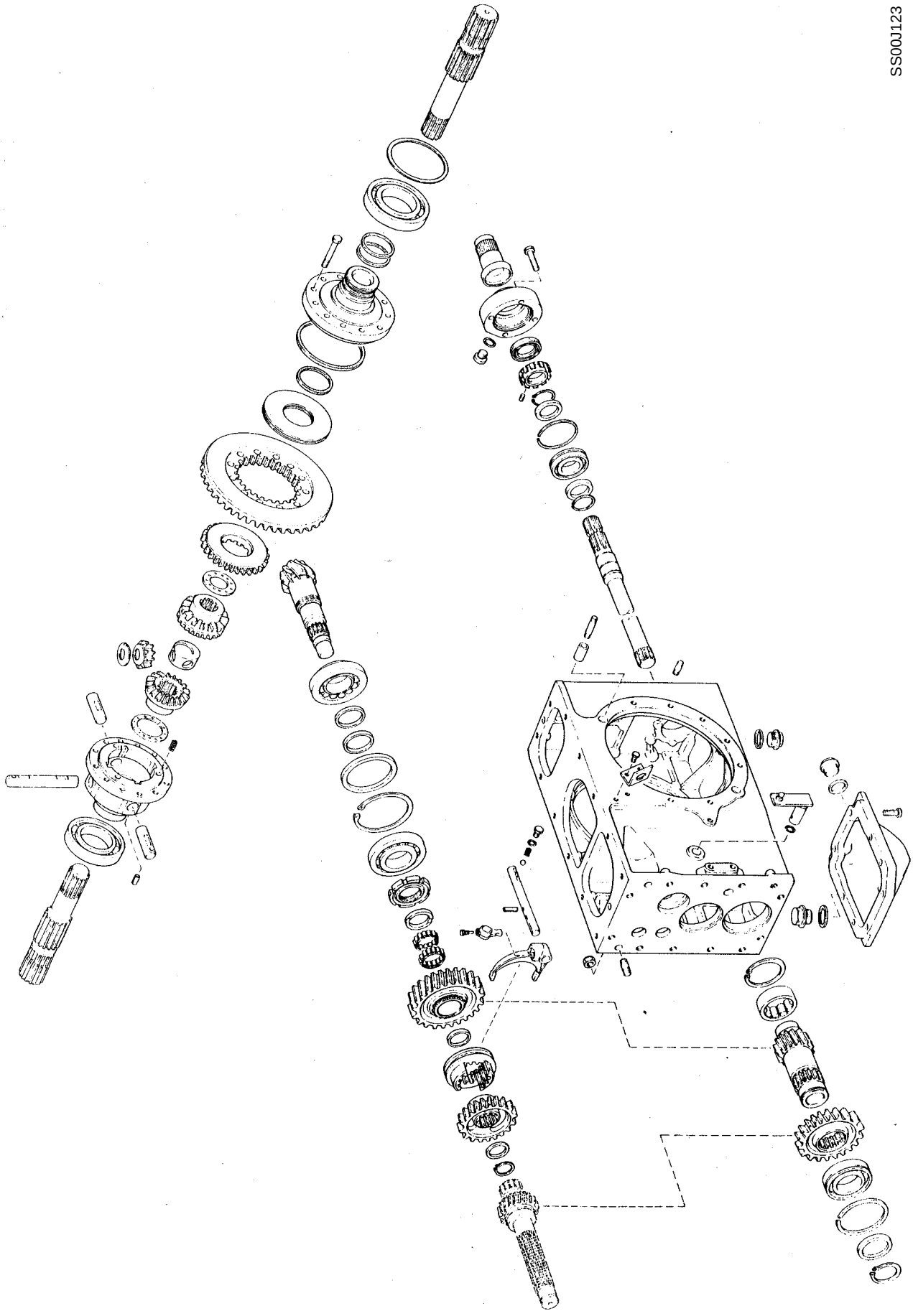
Planetary drive i = 5.8



View A

Planetary drive i = 5.8

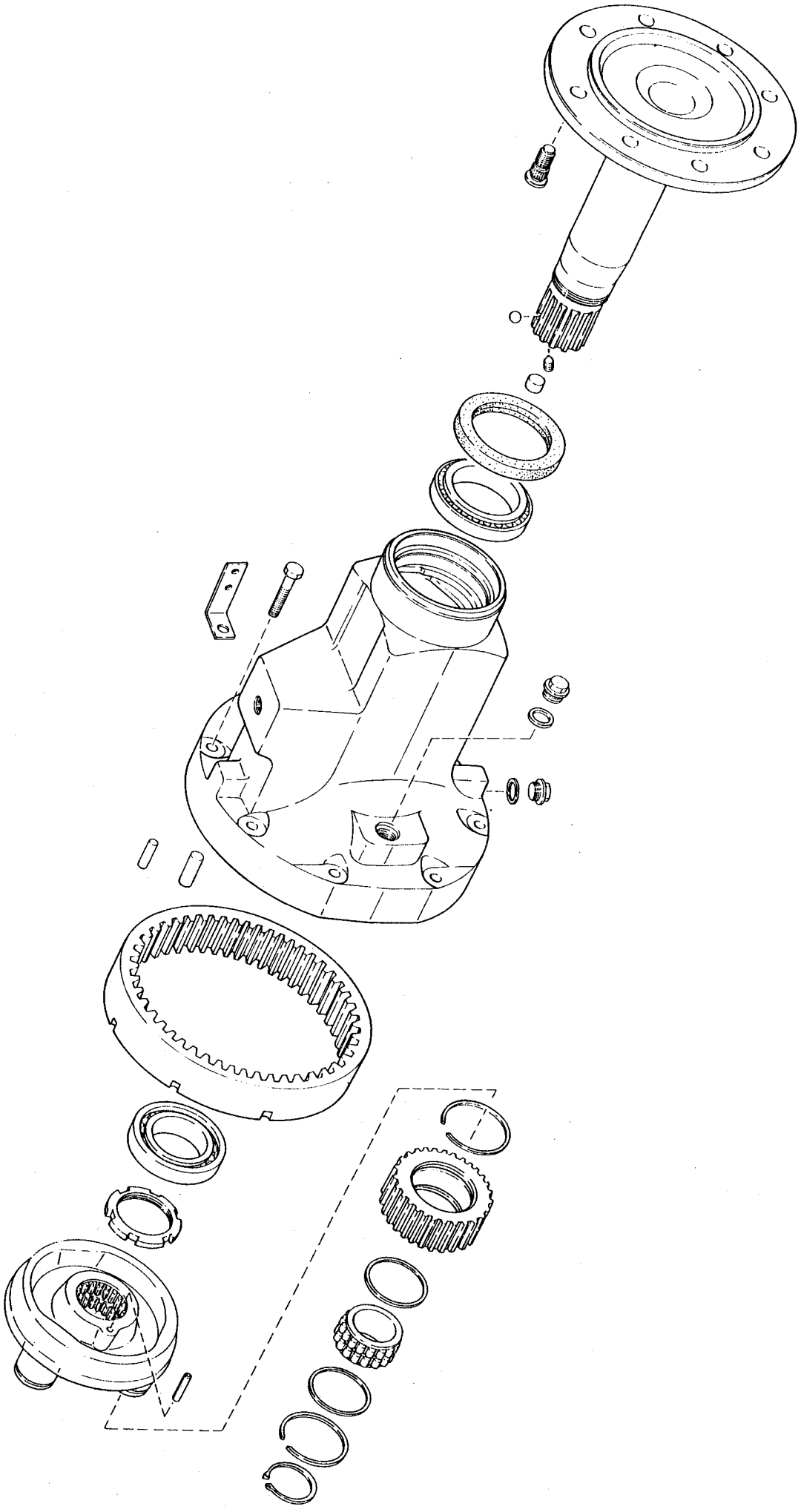
https://truckmanualshub.com/



SS00J123

https://truckmanualshub.com/

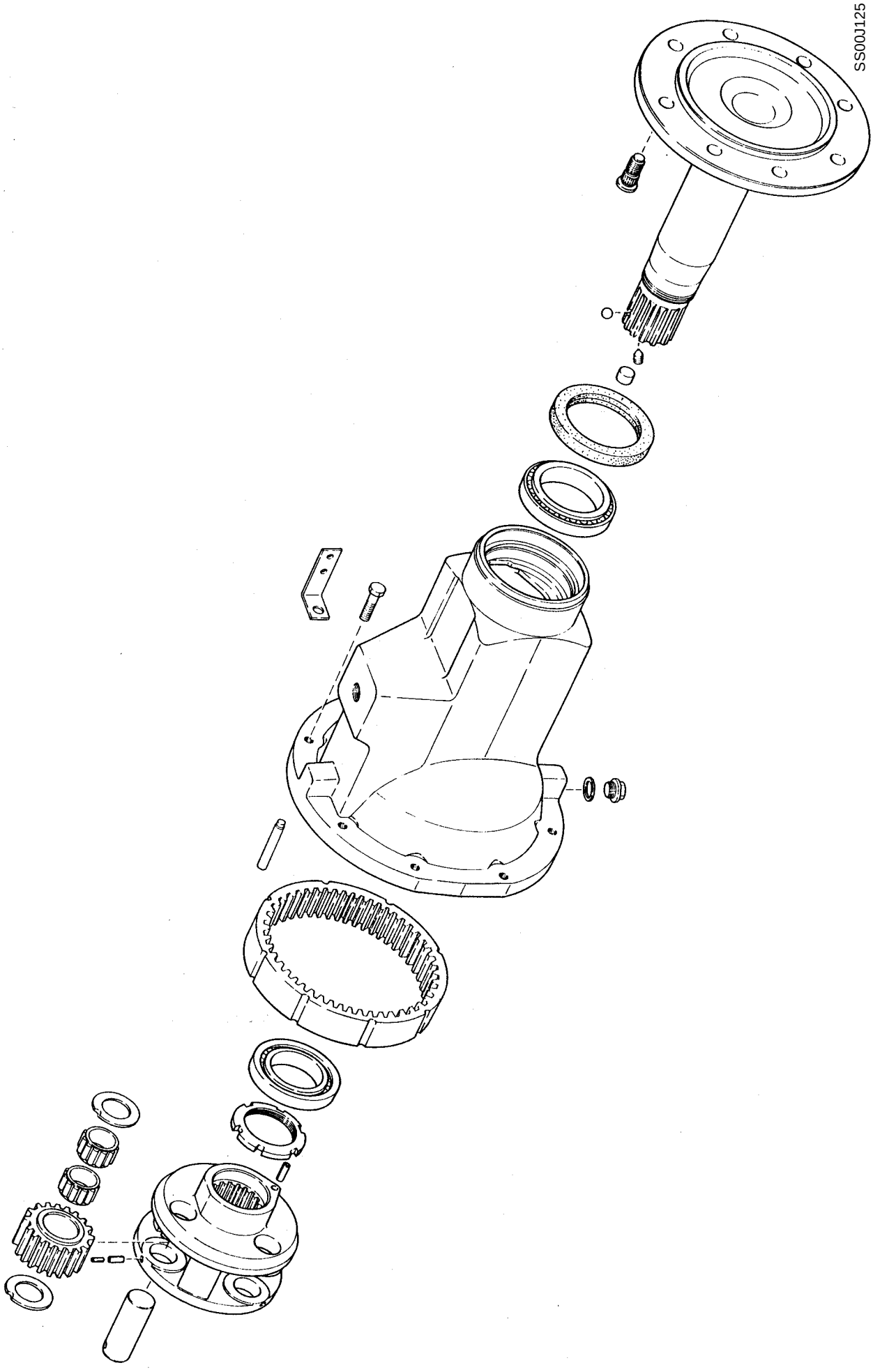
SS00J124



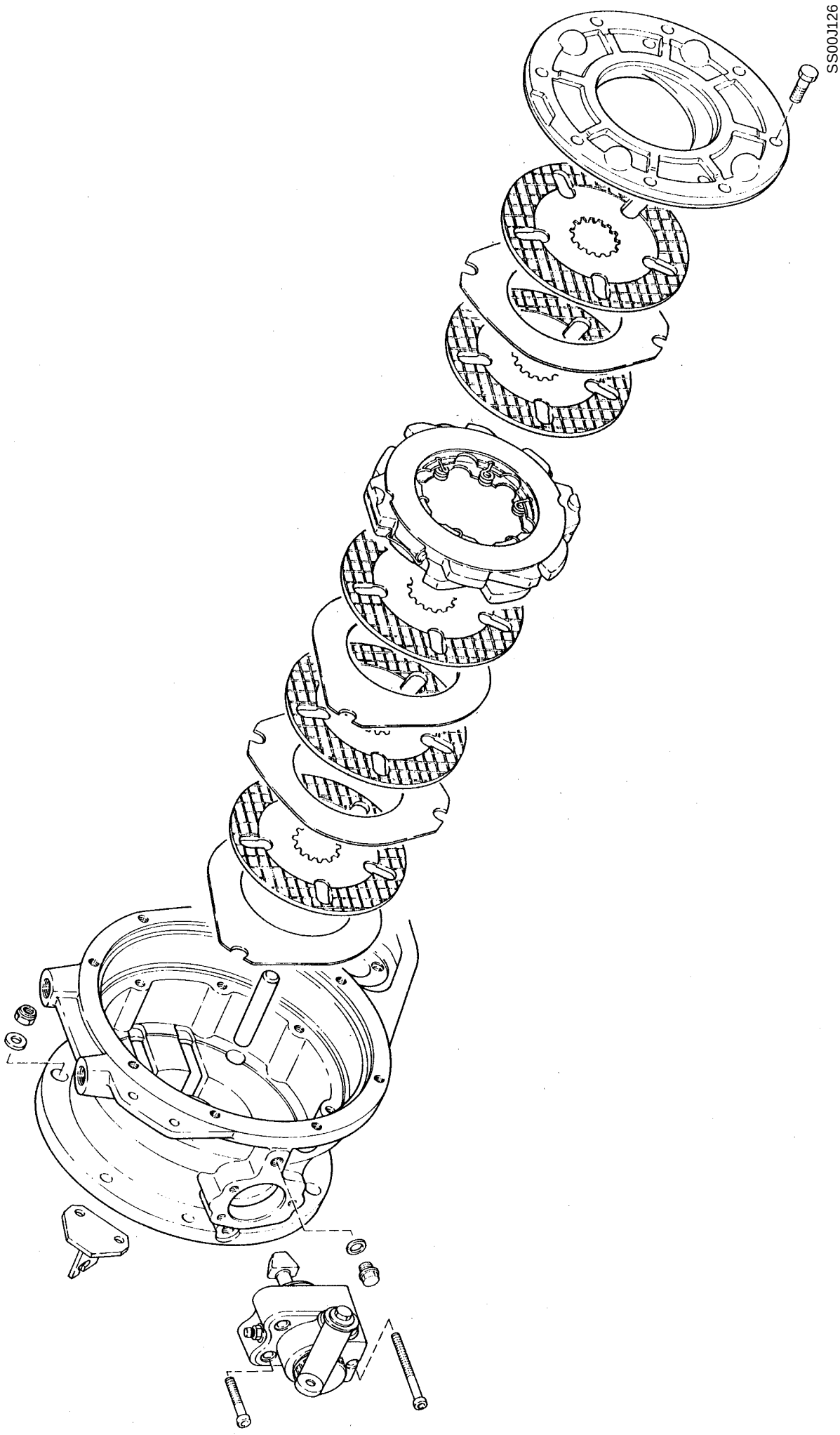
Planetary drive i = 6.8

https://truckmanualshub.com/

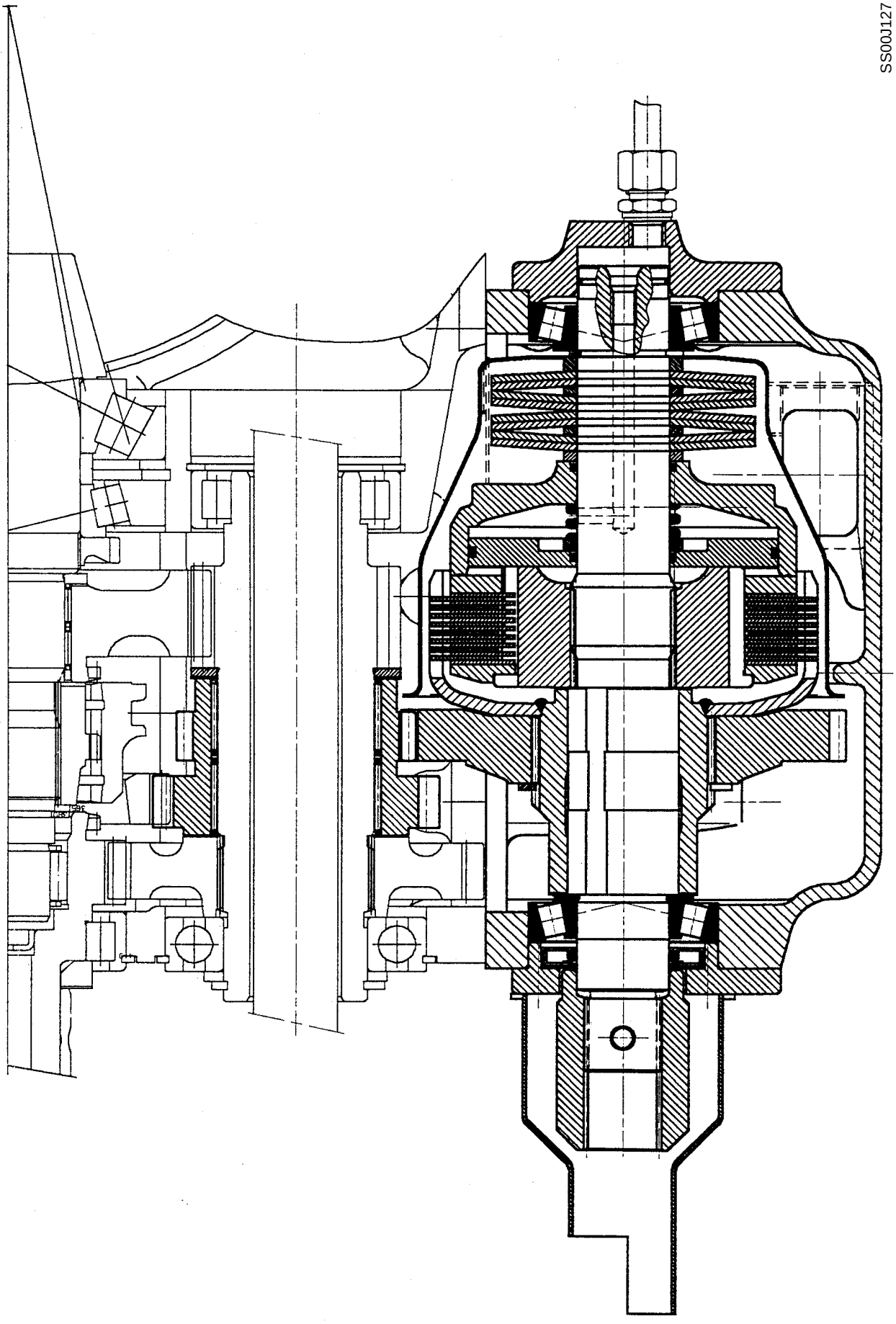
Planetary drive i = 5.8



https://truckmanualshub.com/

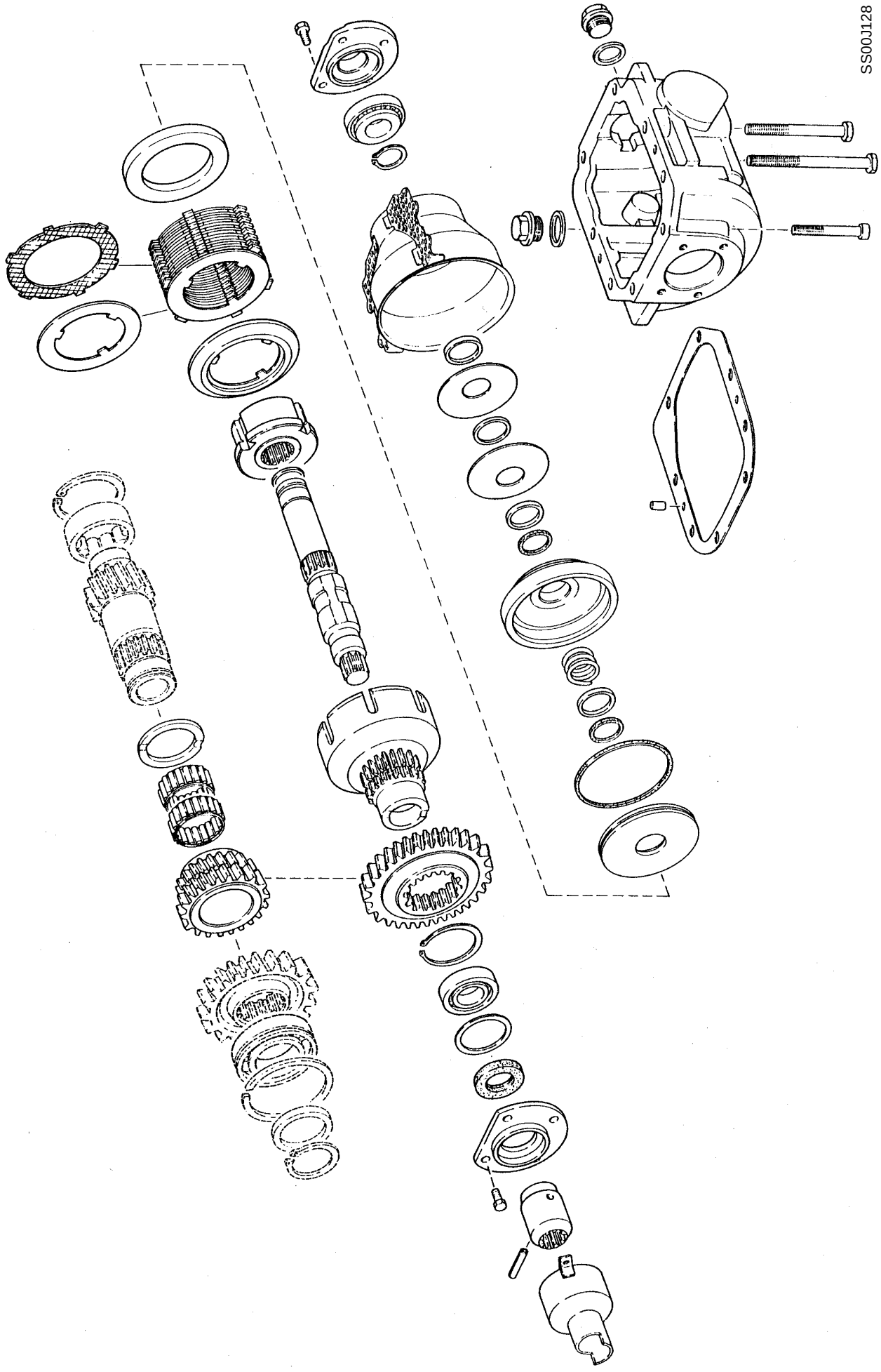


https://truckmanualshub.com/

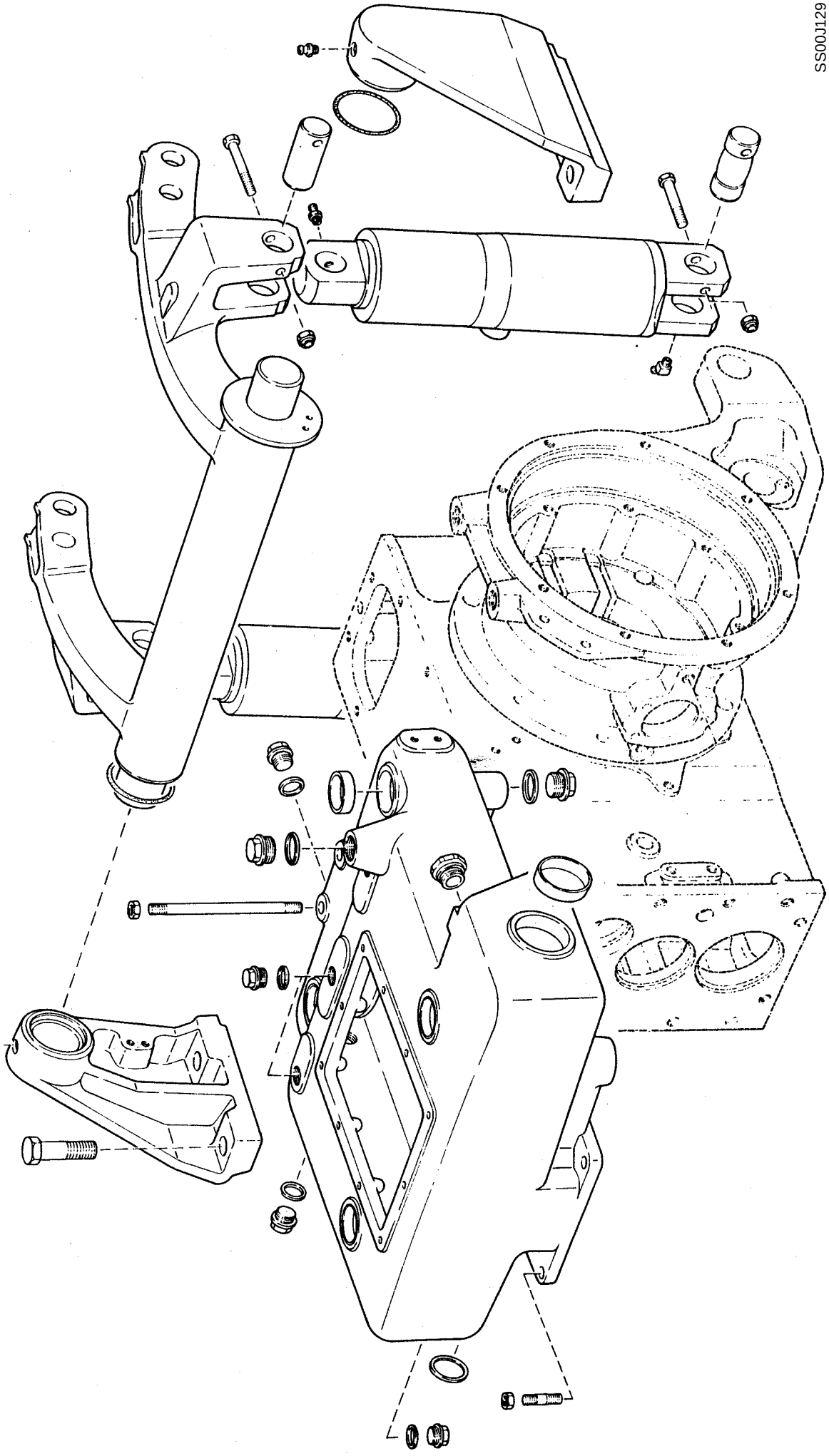


SS00J127

https://truckmanualshub.com/



https://truckmanualshub.com/

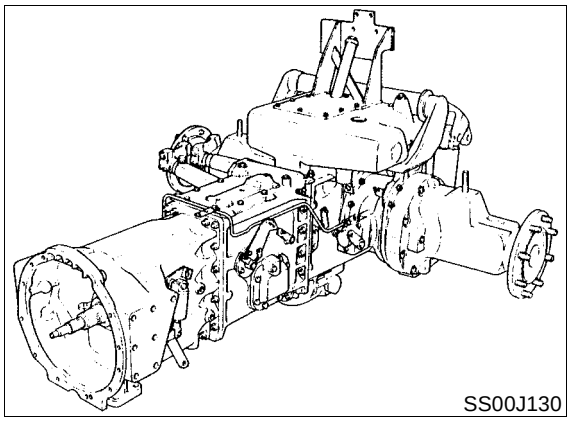


SS00J129

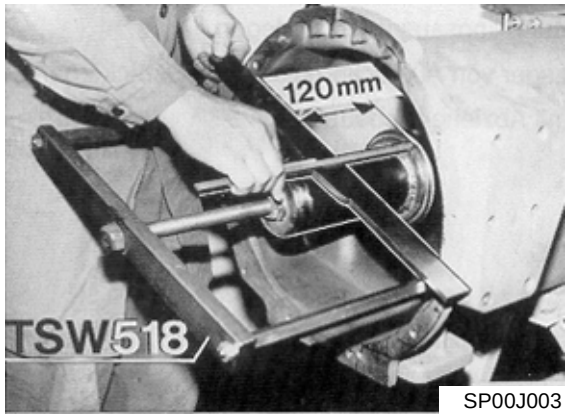
https://truckmanualshub.com/

Intermediate housing and clutch operator - disassembly

The propulsion unit has been completely disassembled.
Drain oil and hydraulic oil from propulsion unit.

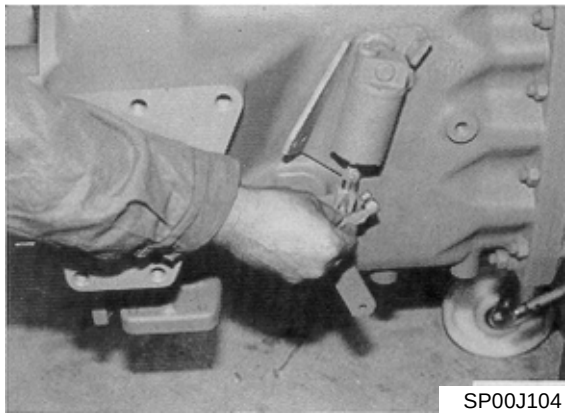

SS00J130

Flange on TSW 518 clamp device and preset power take-off shaft release bearing to 120 mm.

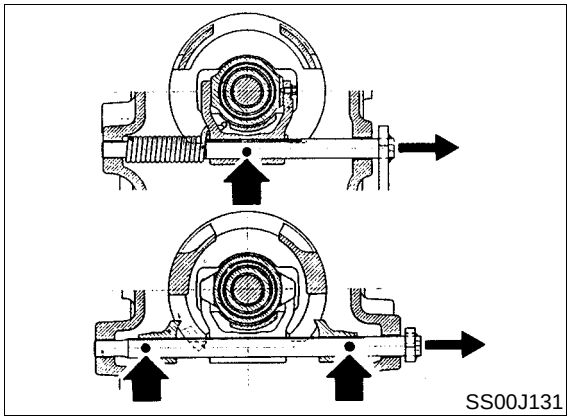


SP00J003

Dismount and remove pressure cylinder.

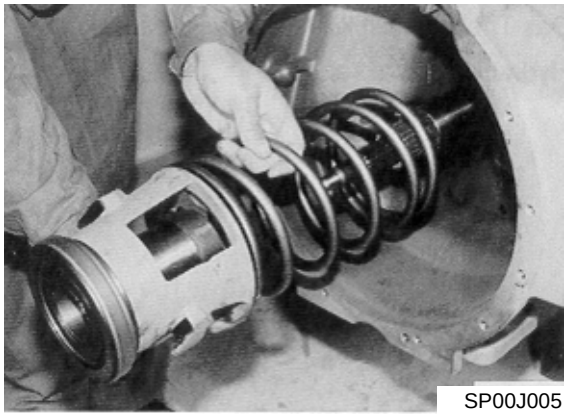

SP00J104

Force out the clamping sleeves of the release levers.
Remove release shafts and release forks.

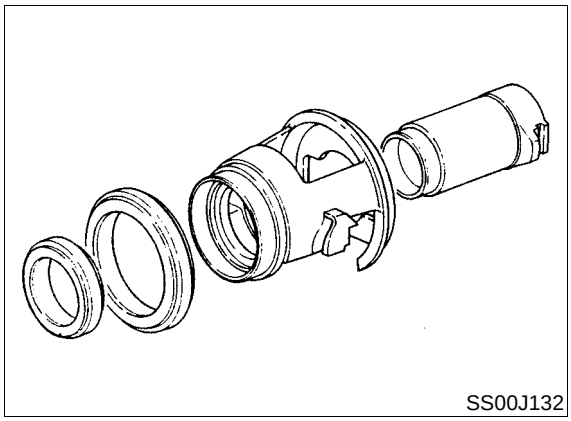

SS00J131

https://truckmanualshub.com/

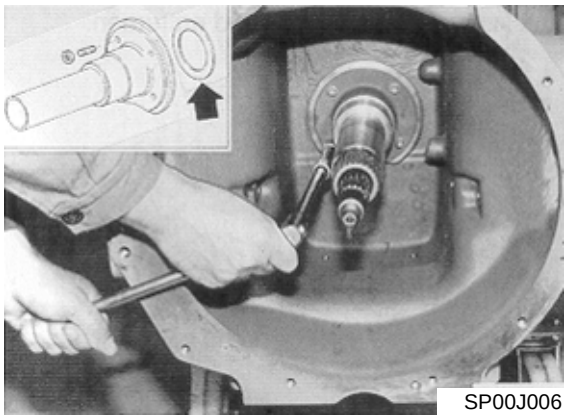
Relieve spring and remove clamping device.
Remove clutch operator and pressure spring.


SP00J005

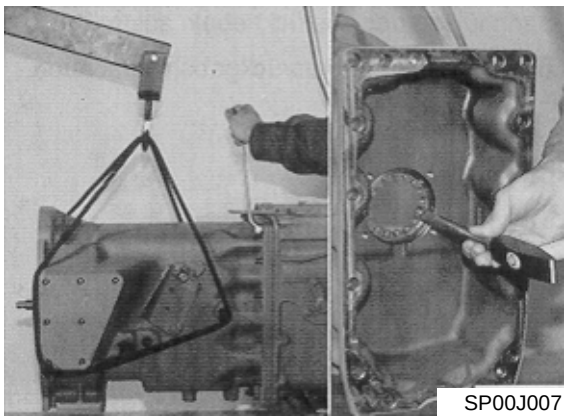
Disassemble clutch operator.
Remove bearing from sleeve and housing with extractor.


SS00J132

Remove bearing tube.
Pay attention to adjusting disk.


SP00J006

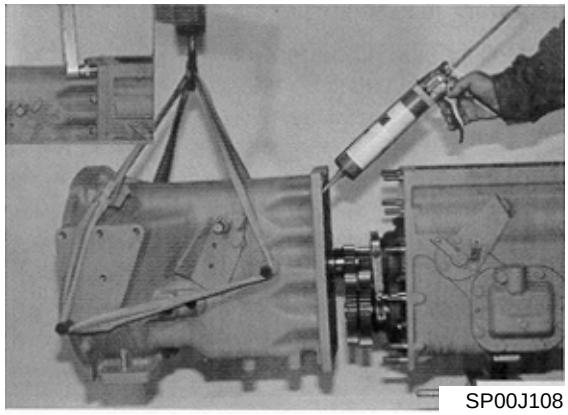
Dismount intermediate housing.
Dismantle hollow shaft bearing.


SP00J007

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Intermediate housing and clutch operator - reassembly

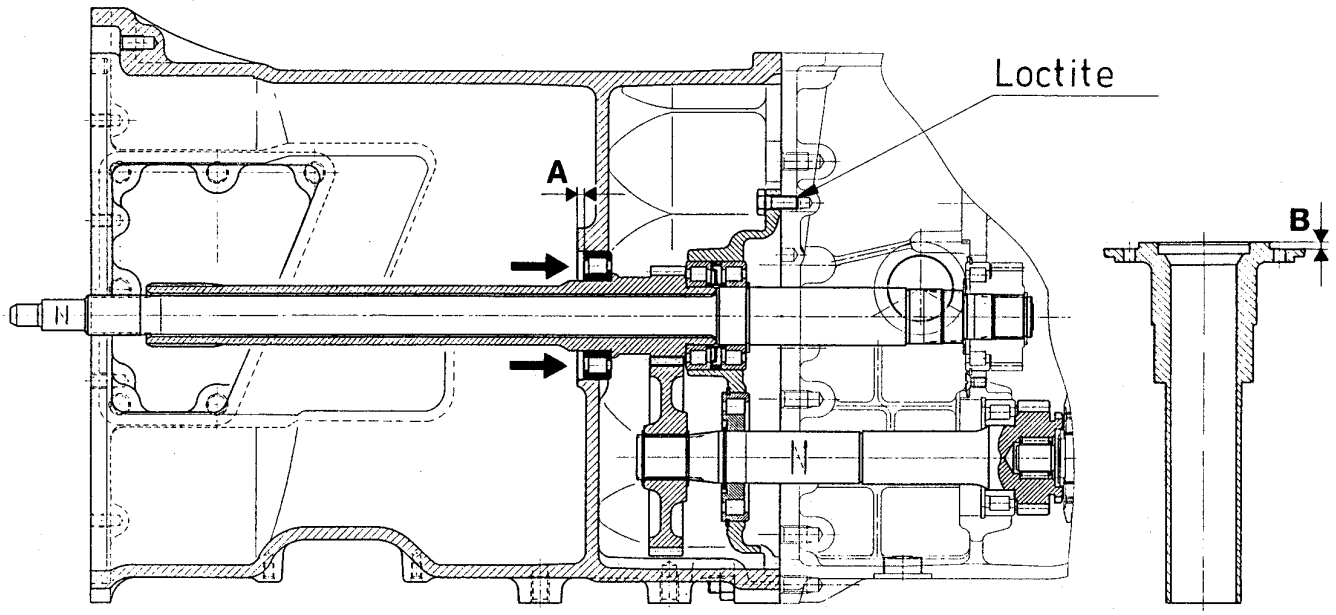
Fit intermediate housing. Seal with Loctite.
Tighten nuts with torque.



SP00J108

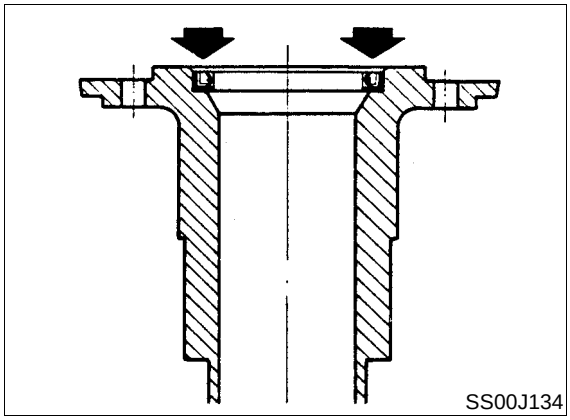
Adjust the axial clearance of the drive hollow shaft:

- Fit hollow shaft bearing in intermediate housing and set to limit
- Determine dimension A in intermediate housing
- Determine dimension B on bearing tube
- Dimension A minus dimension B, minus 0.4 mm (axial clearance) gives the thickness of the adjusting disk



SS00J133

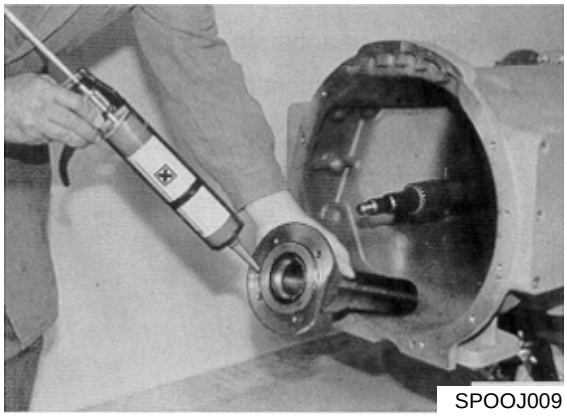
Renew radial sealing ring.



SS00J134

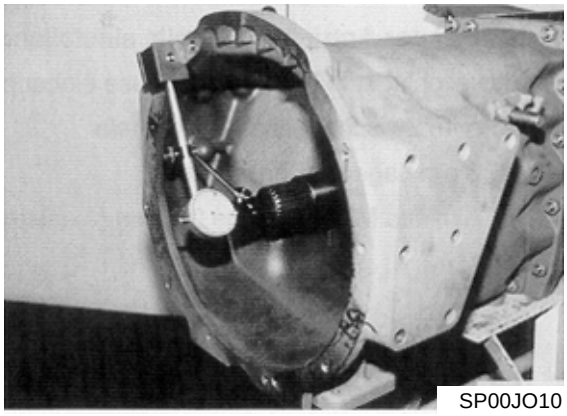
https://truckmanualshub.com/

Seal bearing tube with sealing compound and install with determind adjusting disk.



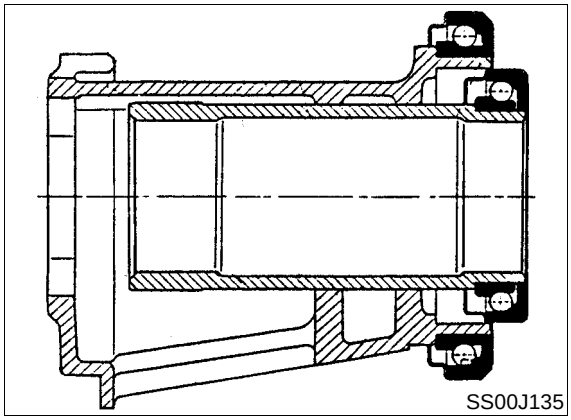
SPOOJ009

Check the hollow shaft axial clearance (0.4 - 0.6 mm).



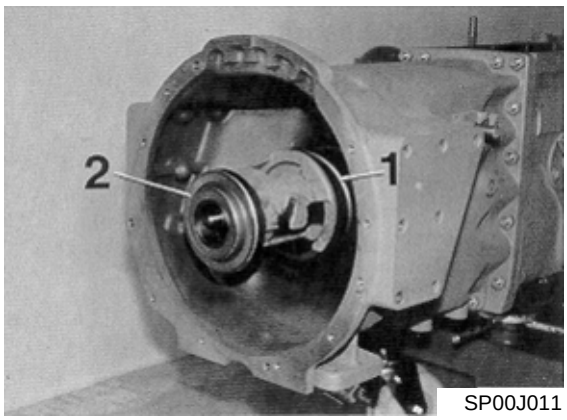
SP00JO10

Reassemble clutch operator.
Press bearing onto sleeve and housing.
Coat sliding surfaces with Molykote paste BR2-plus



SS00J135

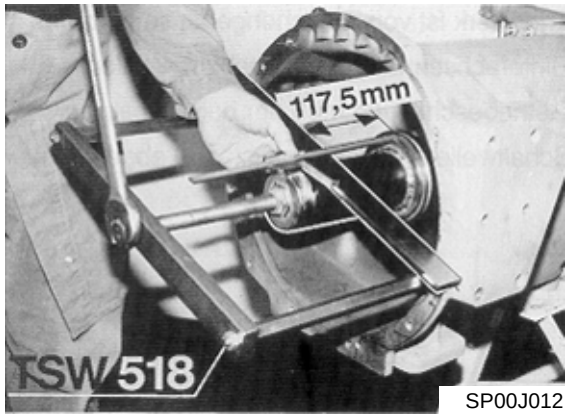
Bring pressure spring (1) and clutch operator (2) into installation position.



SP00J011

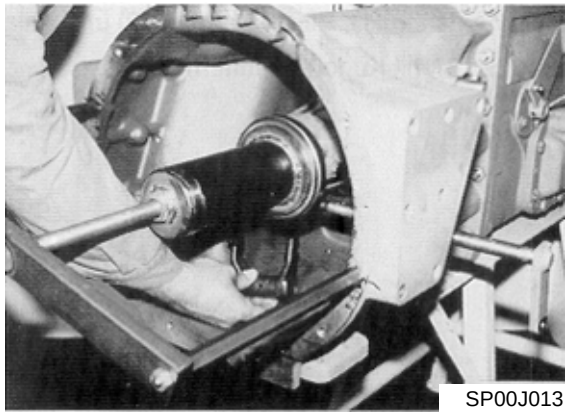
https://truckmanualshub.com/

Bring the power take-off shaft release bearing to a distance of 117.5 mm (gauge) with the TSW 518 clamping device.



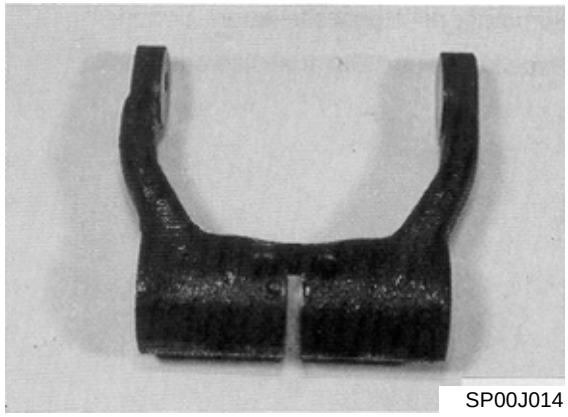
SP00J012

Fit release levers and forks. Force in clamping sleeves.



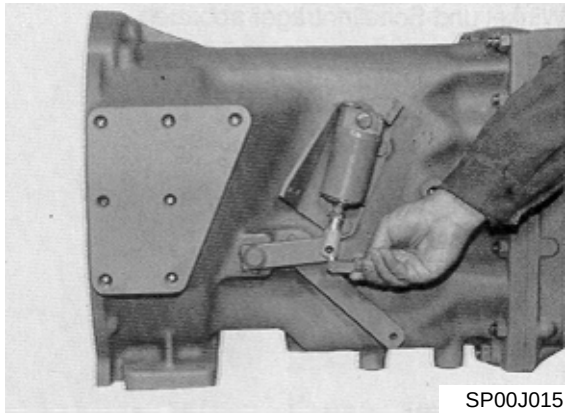
SP00J013

Divide the new release fork for the power take-off shaft clutch by breaking it.



SP00J014

Mount pressure cylinder.
Remove clamping device and recheck adjusting value.

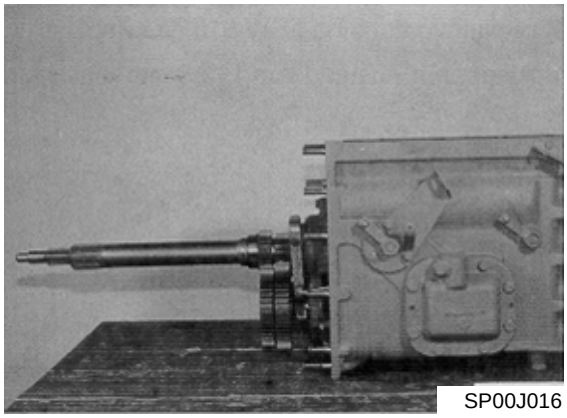


SP00J015

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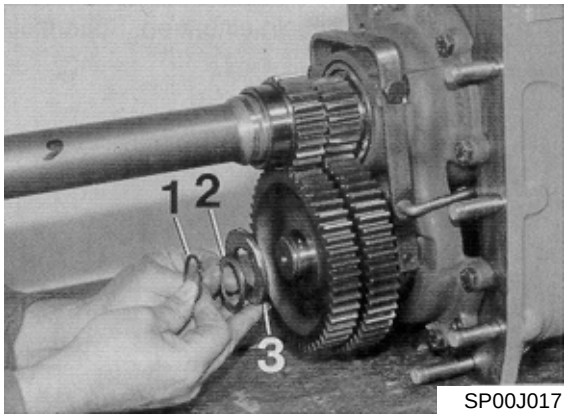
4-fold power take-off shaft - disassembly

Propulsion unit has been separated from intern ediate housing.
Rear axle does not have to be removed.
Transmission gearshift mechanism must only be removed if the gearshift shaft and rod are to be removed.



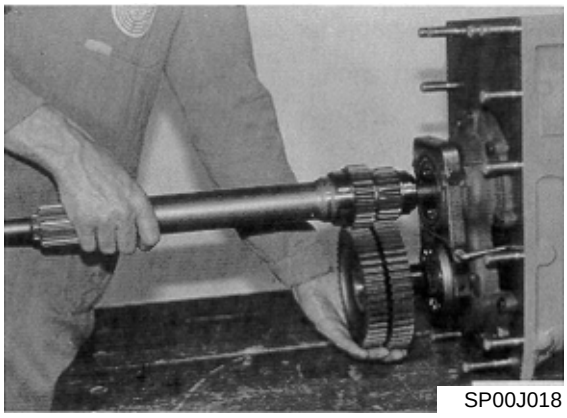
SP00J016

Remove lovk ring (1), adjusting disk (2) and thrust disk (3) with ball (4).



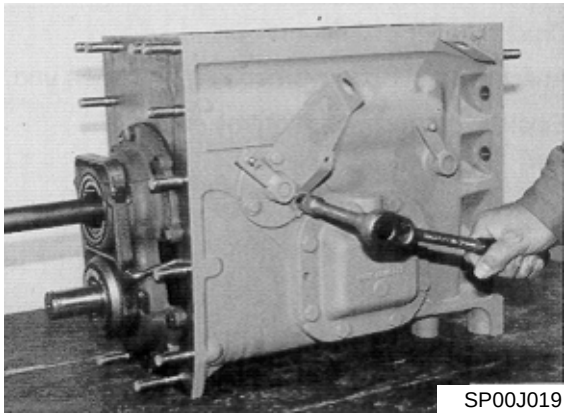
SP00J017

Pull out spur gears with hollow shaft.
Remove needle cage and spacer sleeve.



SP00J018

Remove angle piece and clamp carrier.

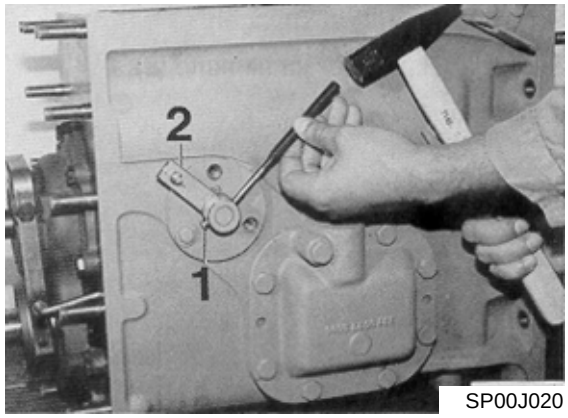


SP00J019

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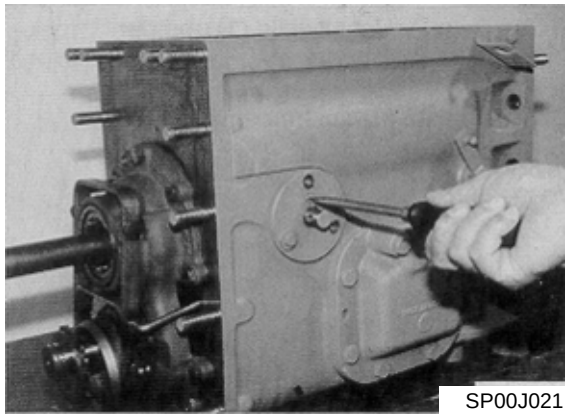
GEARSHIFT MECHANISM 4-fold POWER TAKE-OFF SHAFT - disassembly

Remove clamping sleeve (1) and operating lever (2).

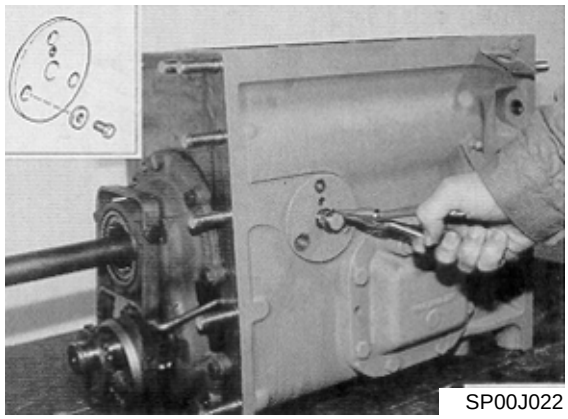


SP00J020

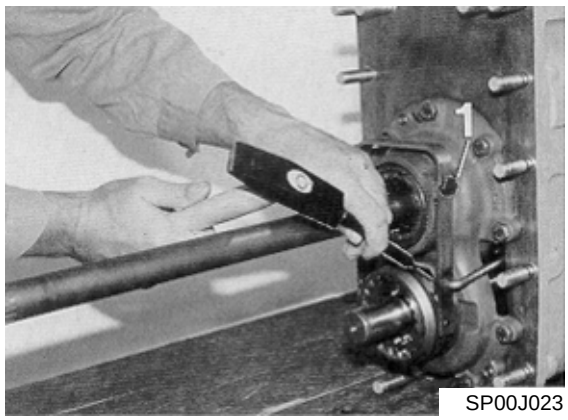
Unscrew stud.
Remove spring and ball (8.0 mm Ø).


SP00J021

Remove lock ring.
Dismount flange bearing.


SP00J022

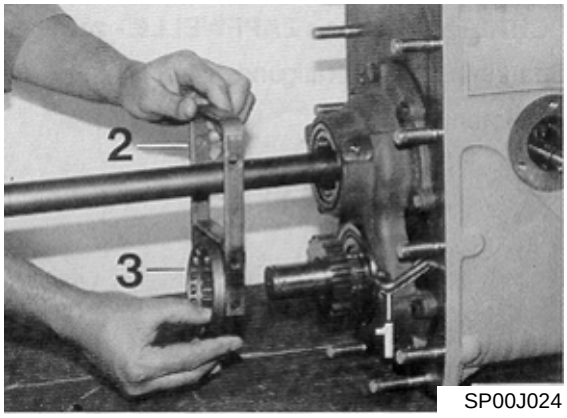
Force out tensioning stud of the gearshift rod.
Remove screws (1) of the shift fork.



SP00J023

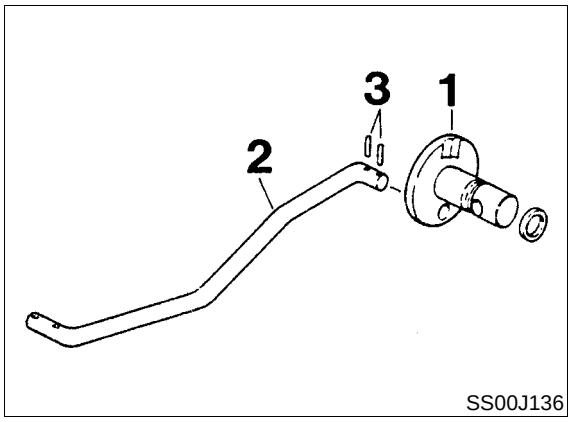
https://truckmanualshub.com/

Hang out gearshift rod (1).
Remove shift fork (2) and sliding sleeve (3).



SP00J024

Dismantle the gearshift shaft (1)
and the gearshift rod (2).
Force out tensioning pins (3).

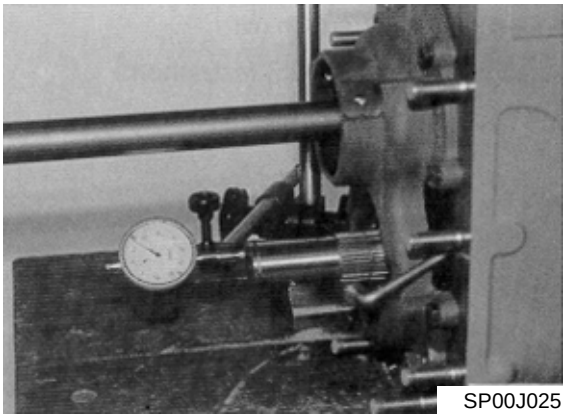


SS00J136

https://truckmanualshub.com/

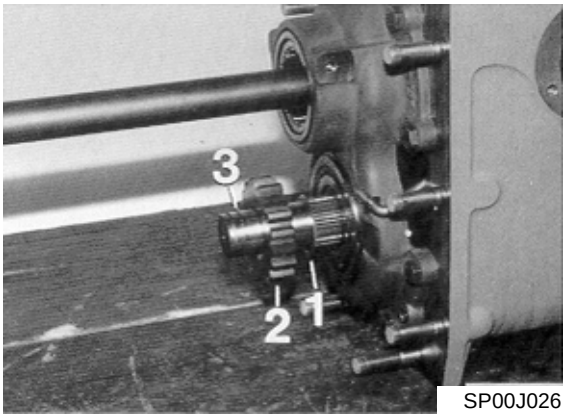
4-fold power take-off shaft - reassembly

Check axial clearance (0.1 - 0.3 mm) of the power take-off shaft.



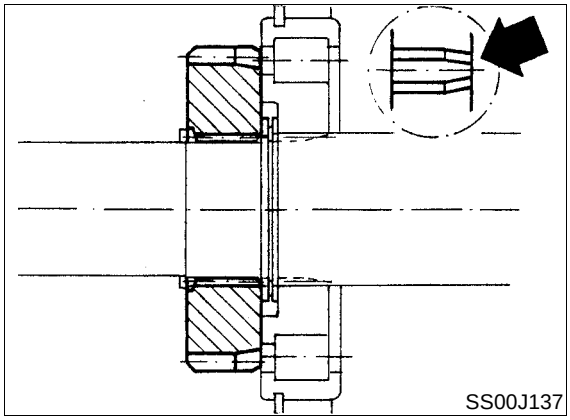
SP00J025

Push adjusting disk (1), sleeve carrier (2) and thrust disk (3) onto power take-off shaft.



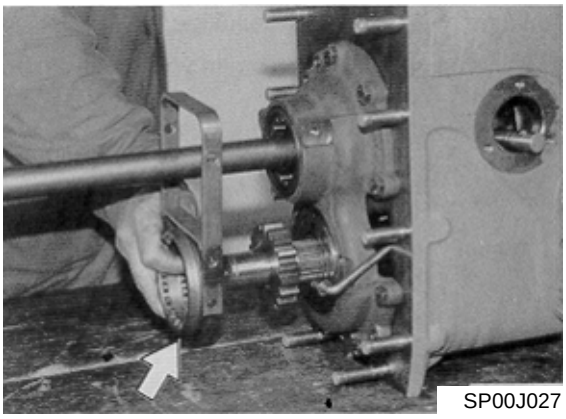
SP00J026

Sleeve carrier relief grind to the rear.



SS00J137

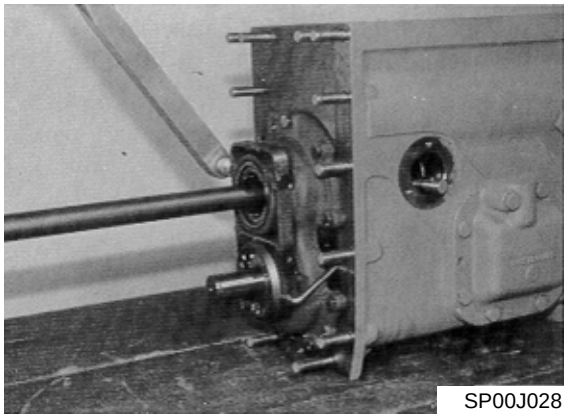
Mount shift fork together with sliding sleeve. Bevelling to the front.



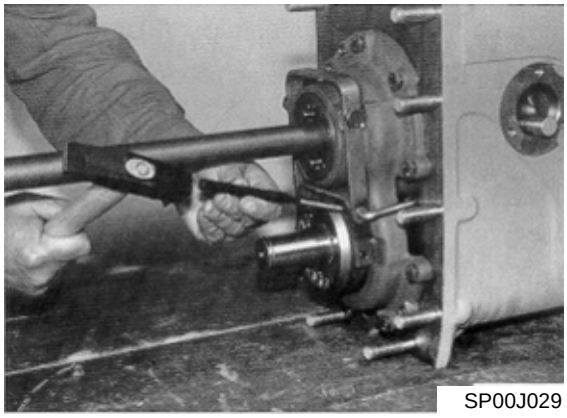
SP00J027

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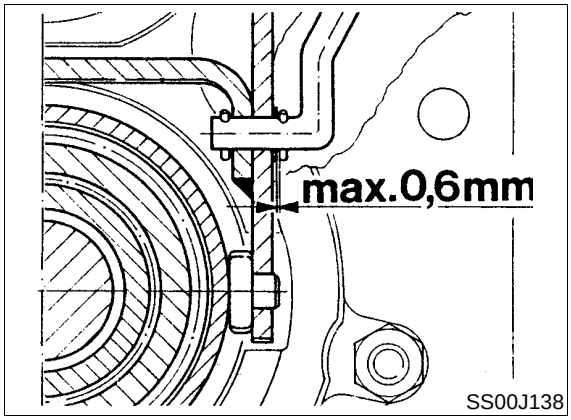
Tighten retaining screws with a torque of 25 Nm.
Secure wit Loctite.


SP00J028

Mount gearshift rod.
Secure with clamping sleeve.

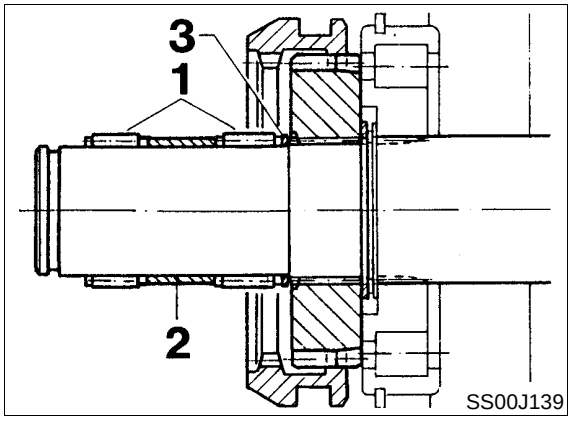

SP00J029

Check axial clearance!



SS00J138

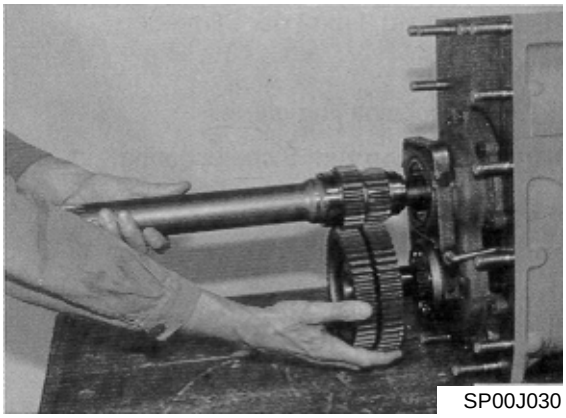
Preassemble thrust ring (3), both needle cages (1) with spacer sleeve (2) onto power take-off shaft.



SS00J139

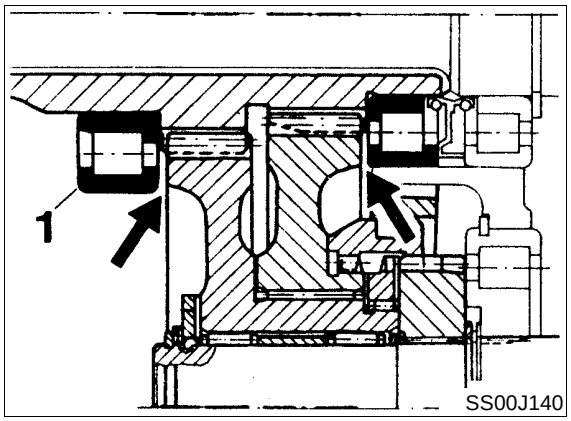
https://truckmanualshub.com/

Mount hollow shaft together with spur gears with needle bearing and driver.



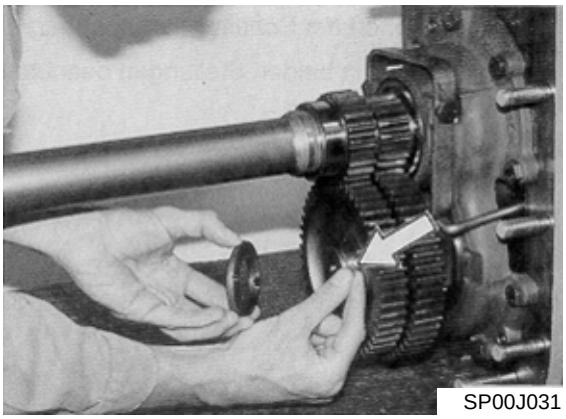
SP00J030

Push front bearing (1) onto hollow shaft.
There should be the same clearance on both sides between the bearing and spur gears.



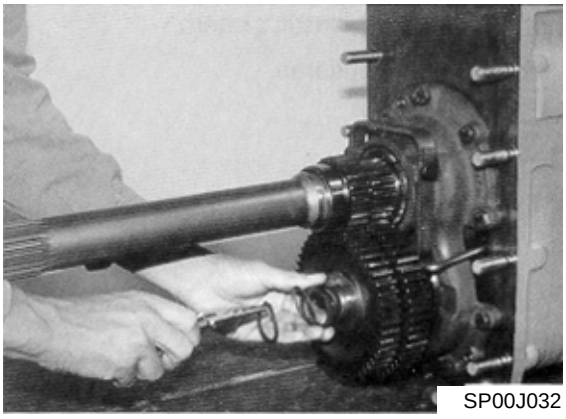
SS00J140

3.5 mm Ø ball to prevent torsional movement in the bore of the power take-off shaft.
Mount thrust disk with the oil groove towards the bearing.



SP00J031

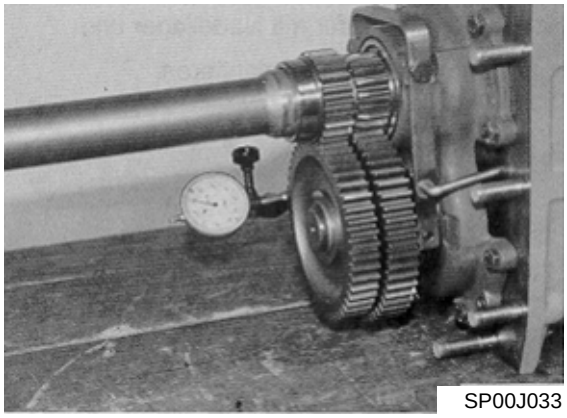
Mount adjusting disks and lock ring.



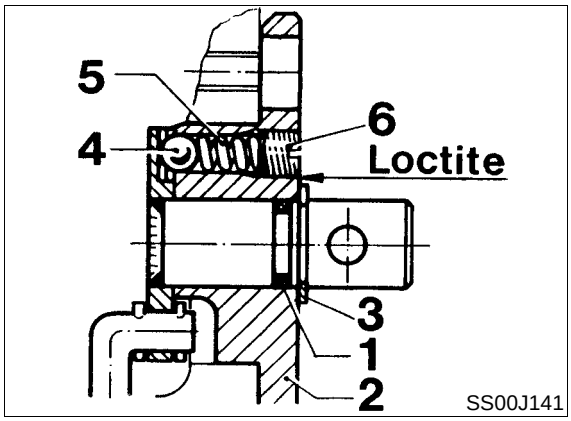
SP00J032

https://truckmanualshub.com/

Check axial clearance (0.1 - 0.3 mm) of the gearwheels.
Correct with the adjusting disk.
Thicker disks towards the lock ring.

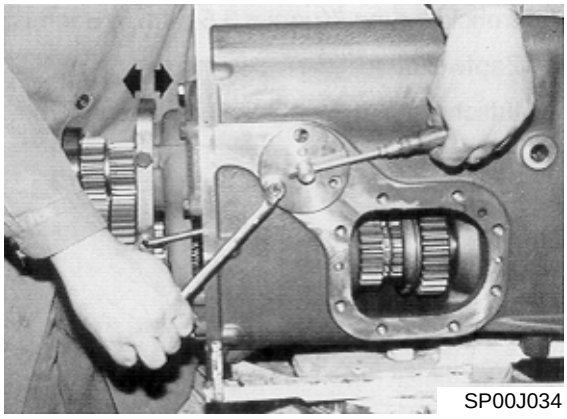

SP00J033

GEARSHIFT mechanism
4-fold power take-off shaft - reassembly
Replace sealing ring (1).
Seal flange bearing (2) and mount.
Snap on lock ring. (3).
Mount ball (4) and spring (5).
Secure stud (6) with Loctite.
Screw in screws by hand
seal with Loctite.

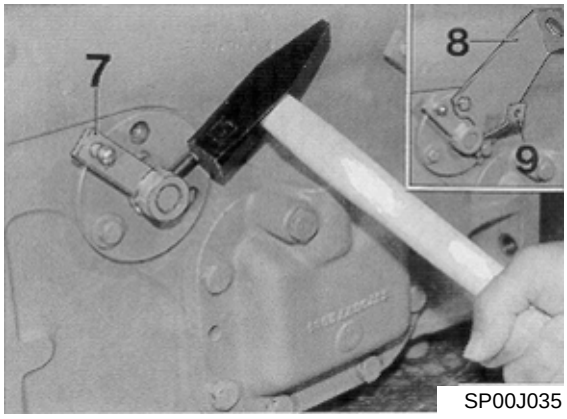


SS00J141

Adjust gearshift travel by turning the gearshift shaft.
Observe the play of the fork in both positions.


SP00J034

Secure lever (7) with tensioning pin.
Mount angle pieces (8+9).



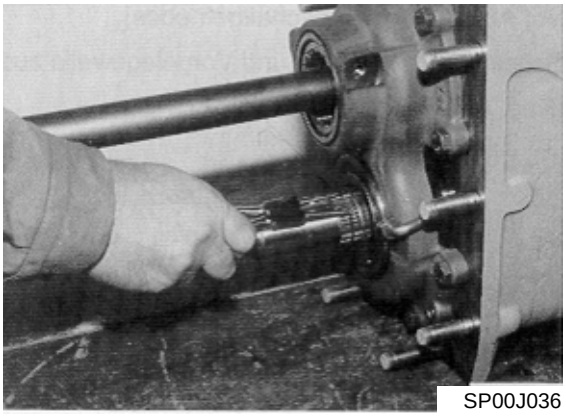
SP00J035

https://truckmanualshub.com/

Power shift transmission - disassembly

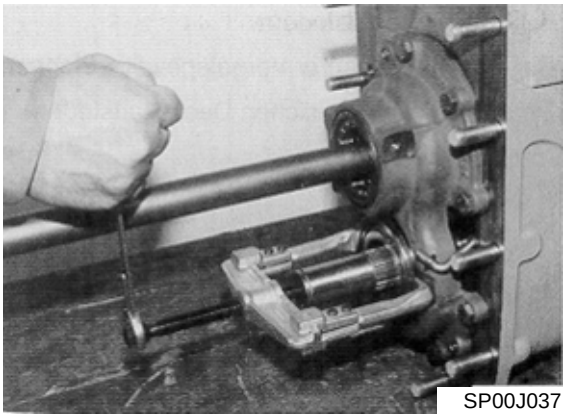
Dismount gearshift cover and side gearshift mechanism.
Separate propulsion unit from rear axle and
dismantle countershaft (chapter 4.1, page 60)
(When only dismantling the power shift transmission, this can be carried out without separating the rear axle and propulsion unit and without dismantling the countershaft by releasing the lock ring on the side cover.)

Remove lock ring and adjusting disks.



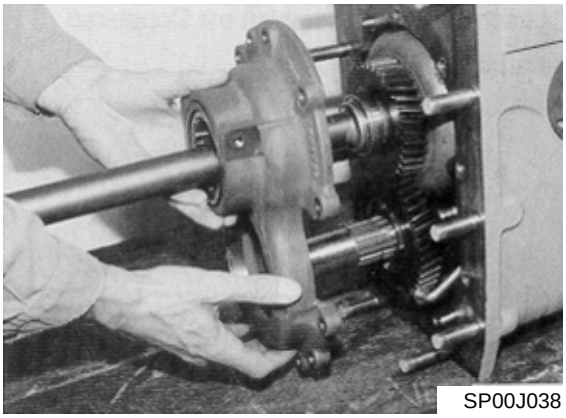
SP00J036

Dismantle bearing with extractor.



SP00J037

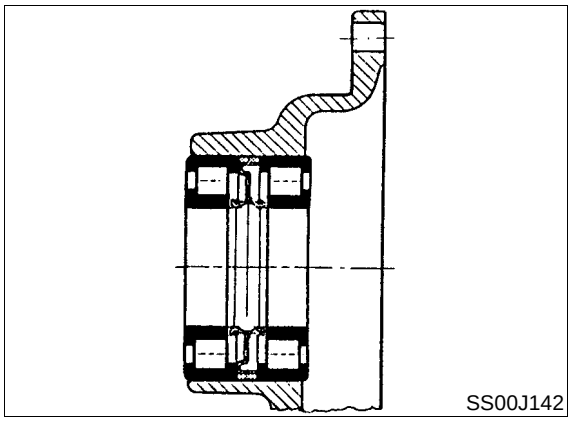
Loosen screws.
Dismantle bearing cover.



SP00J038

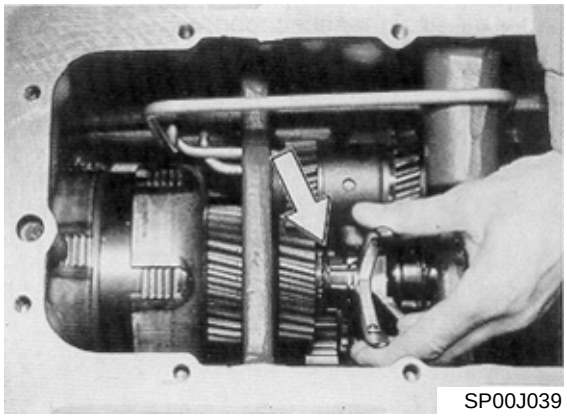
https://truckmanualshub.com/

Dismantle both bearings and radial sealing ring.

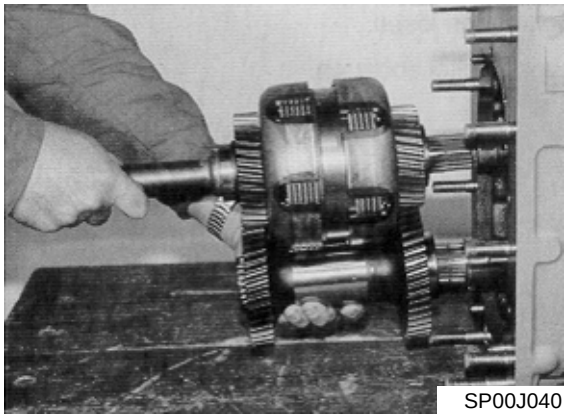

SS00J142

Dismantle gearshift mechanism 3rd - 4th gear and countershaft before dismantling the power shift transmission.
(Chapter 4.1, page 60)

Release lock ring.
(If the contershaft has not been dismantled, release lock ring through left-hand side cover. Countershaft assembly 540/1000.)

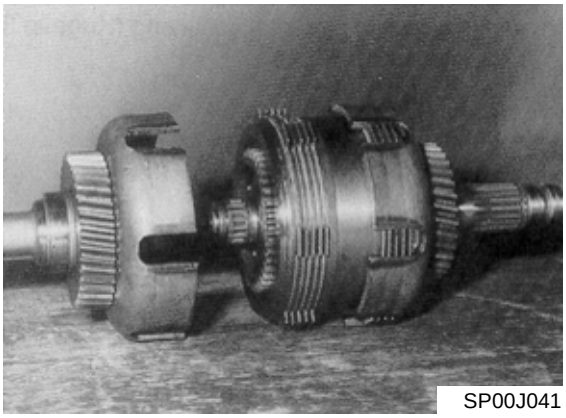

SP00J039

Pull out power shift transmission complete with dual wheel.


SP00J040

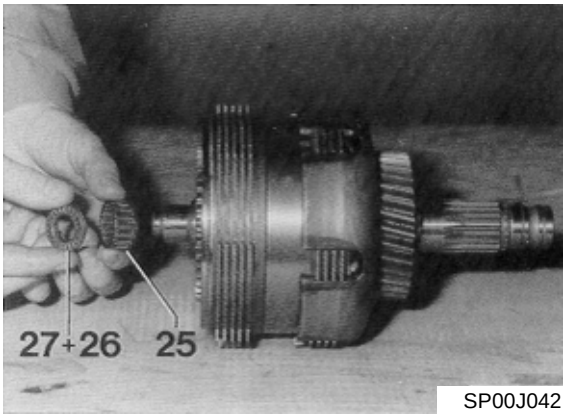
https://truckmanualshub.com/

Remove drive shaft.



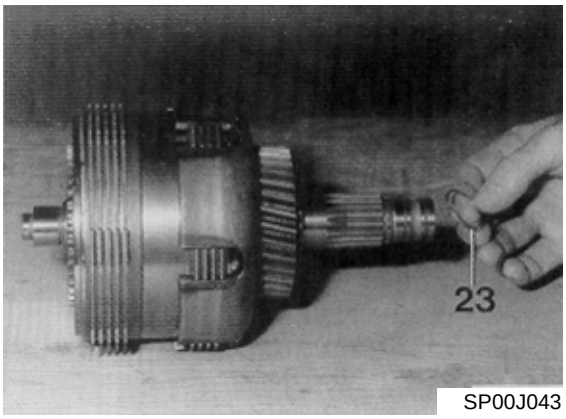
SP00J041

Remove needle collar (27), bearing disk (26) and needle cage (25).



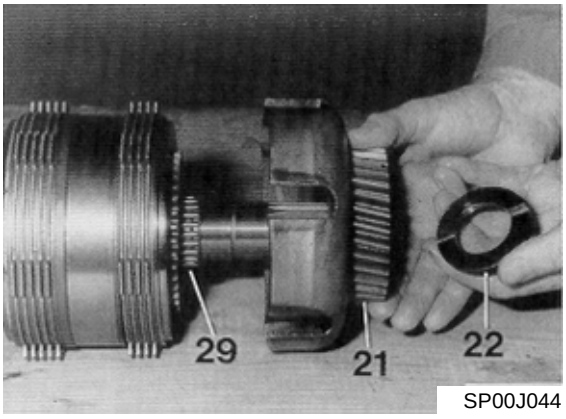
SP00J042

Remove both rectangular rings (23).



SP00J043

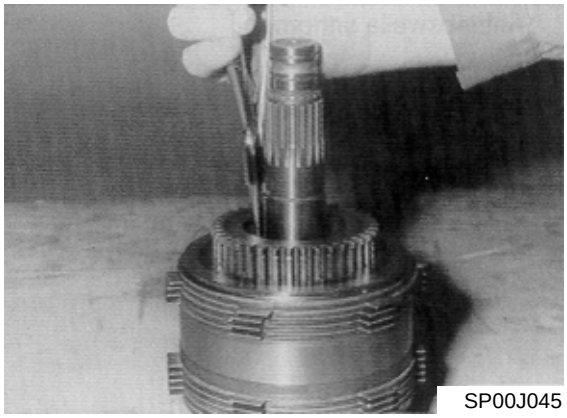
Remove thrust disk (22), spur gear (21) and needle cages (29).



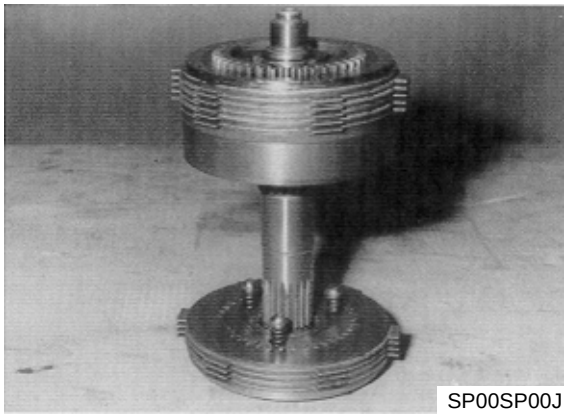
SP00J044

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Remove thrust disk and 3.5 mm Ø ball for preventing torsional movement.
Release lock ring.


SP00J045

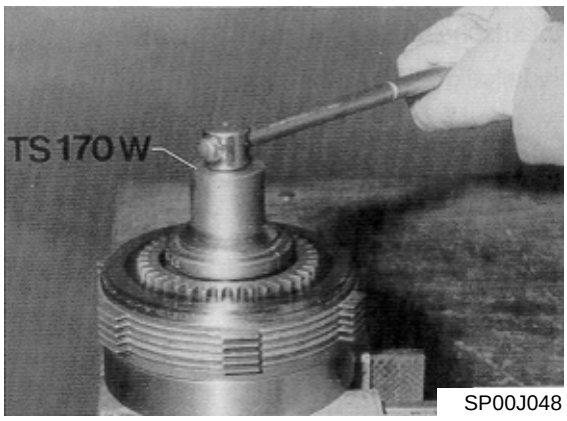
Remove multi-disk set of the group „high“.


SP00SP00J

Remove lock on castellated nut.


SP00J047

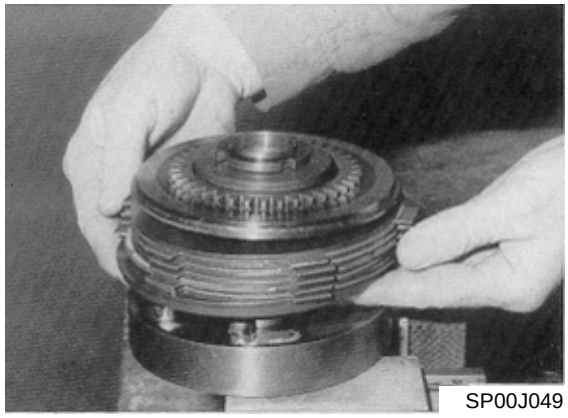
Loosen castellated nut with special tool TS 170W.



SP00J048

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Remove multi-disk set of the group „low“.



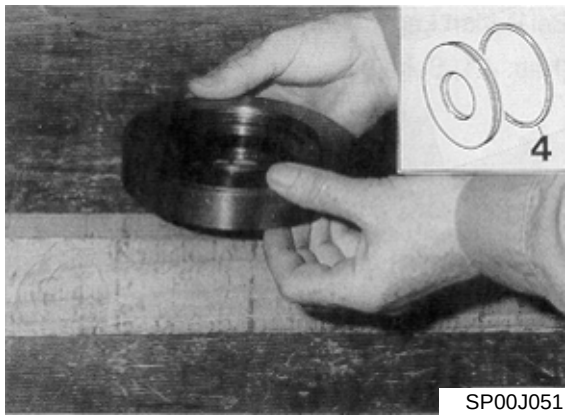
SP00J049

Remove pressure cylinder and piston from shaft.



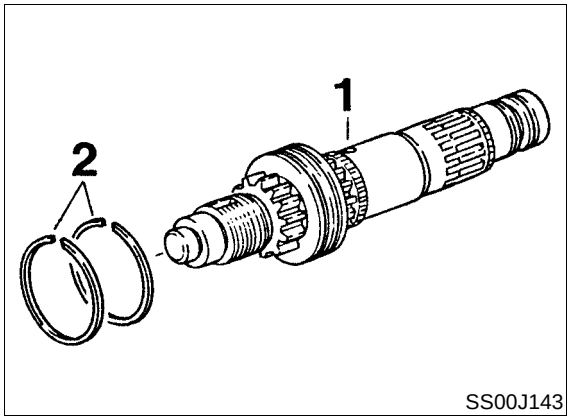
SP00J050

Dismantle piston from pressure cylinder.
Remove quad ring (4) from piston.



SP00J051

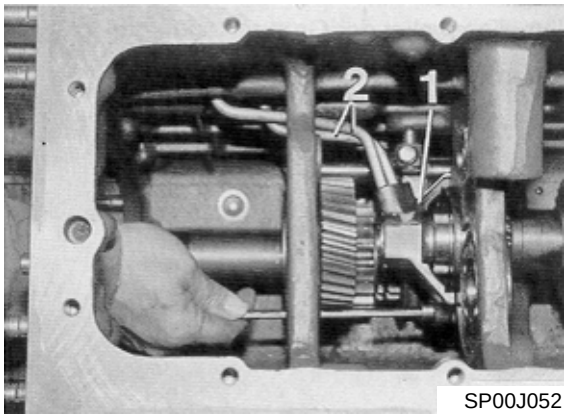
Remove rectangular rings (2) from clutch shaft.



SS00J143

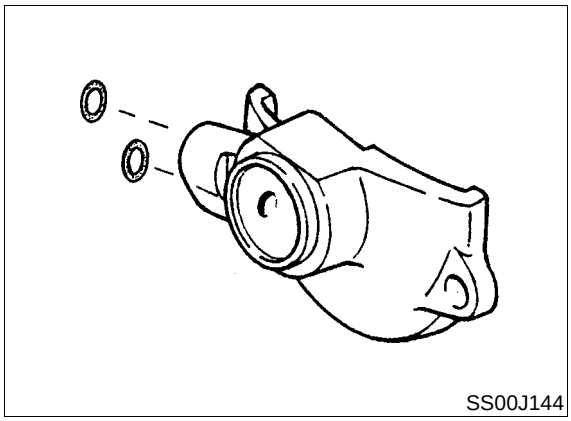
https://truckmanualshub.com/

Remove control unit.
Remove oil feed cover (1)
and separate from oil lines (2).

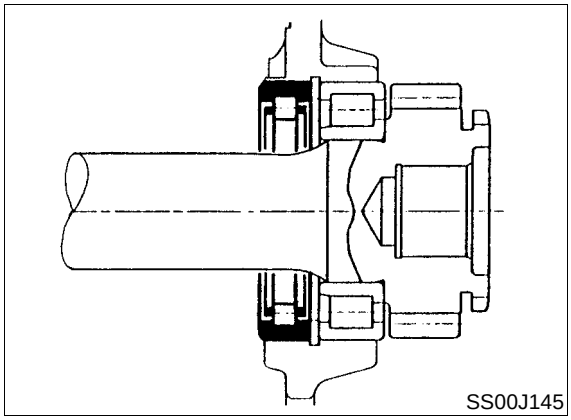


SP00J052

Remove O-rings.


SS00J144

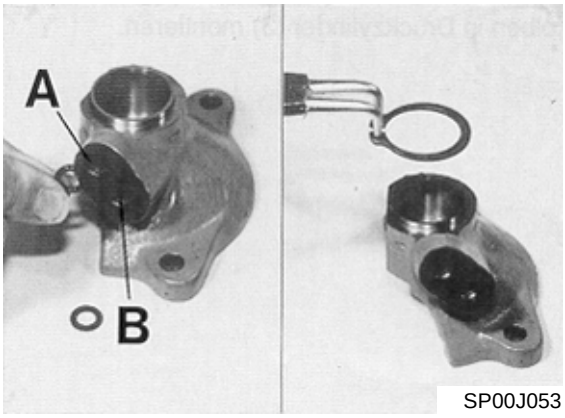
Dismantle bearings if necessary.
(Chapter 4.1, page 64)


SS00J145

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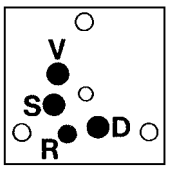
Power shift transmission - reassembly

Replace both O-rings in the oil line bores.
Preassemble lock ring!
A - Pressure bore
B - Lubrication bore

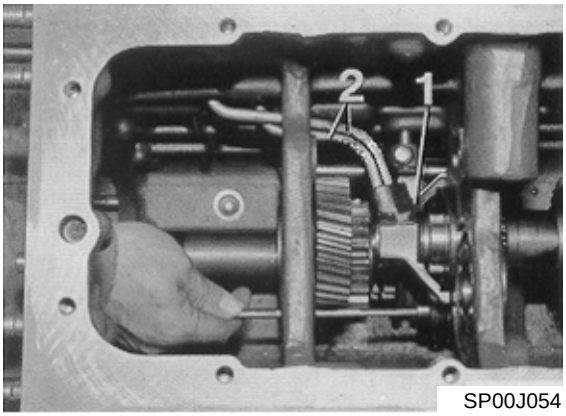


SP00J053

Oil feed cover (1) in installation position.
Insert oil lines (2) into bore.
Short pressure line into bore A.
Long lubrication line into bore B.
Mount oil feed cover (1) and press upwards (align).
Secure screws with Loctite and fasten.

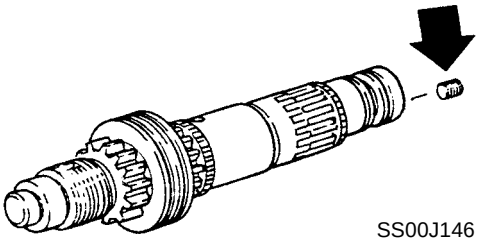


V = Lubrication line countershaft
S = Lubrication line LSG
D = Pressure line
R = Return flow bore

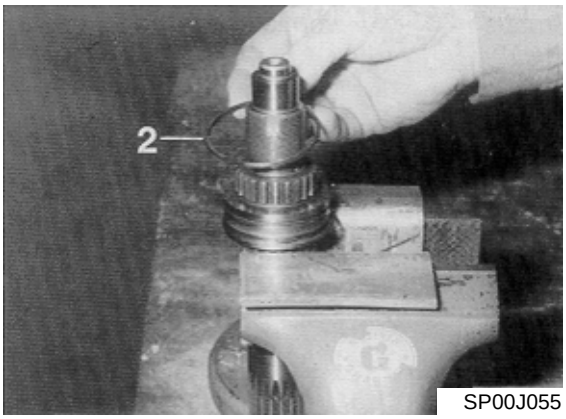


SP00J054

Mount rectangular rings (2) on clutch shaft.

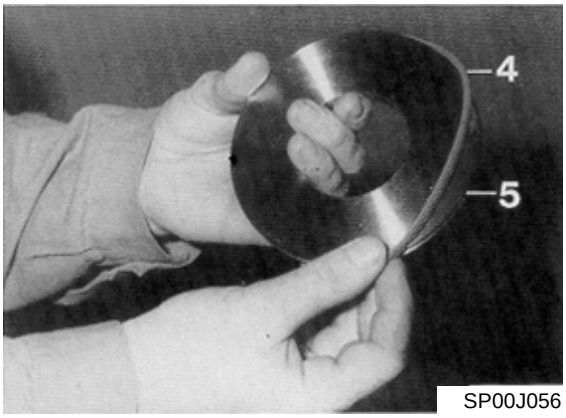

SS00J146

Screw in stud slightly.
Secure with Loctite.



SP00J055

Replace quad rings (4) on piston (5).



SP00J056

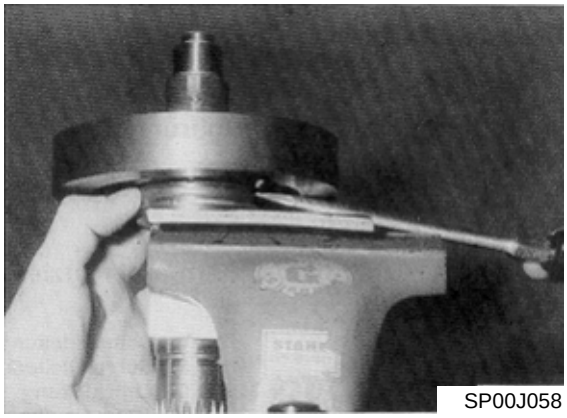
https://truckmanualshub.com/

Mount piston in pressure cylinder (3).

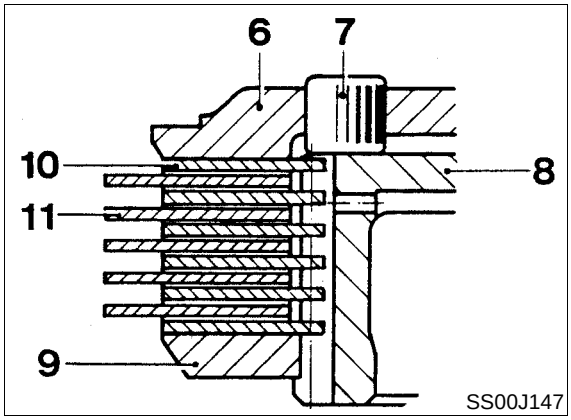


SP00J057

Mount pressure cylinder on clutch shaft.

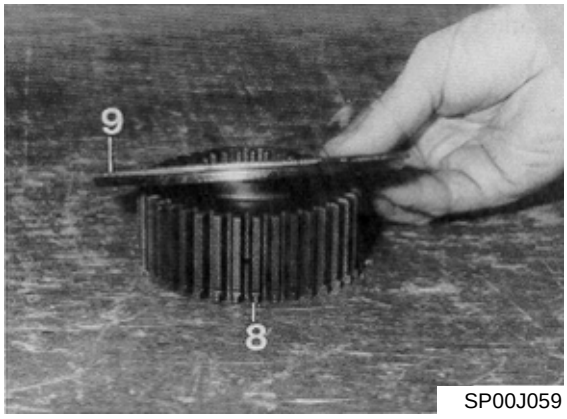

SP00J058

Preassemble set „low“.



SS00J147

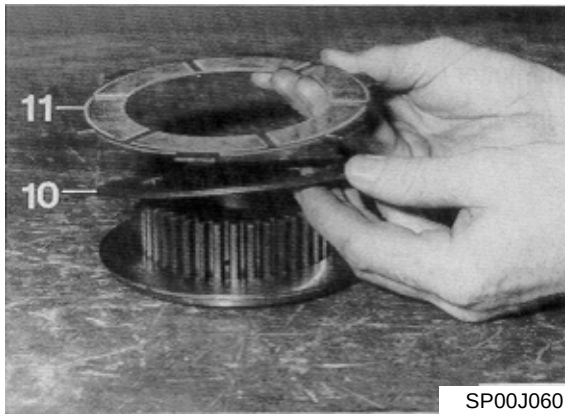
Mount pressure plate (9) on disk carrier (8).



SP00J059

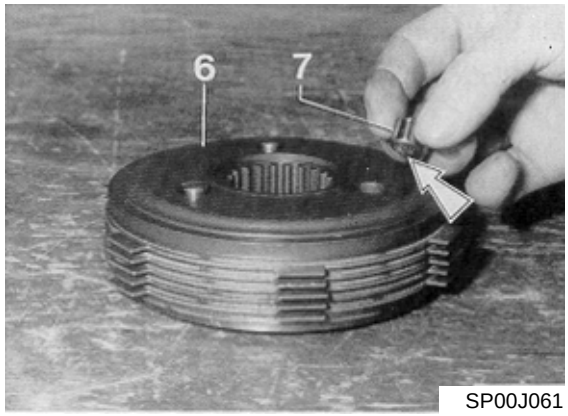
https://truckmanualshub.com/

Preassemble inner (10) and outer disks (11).



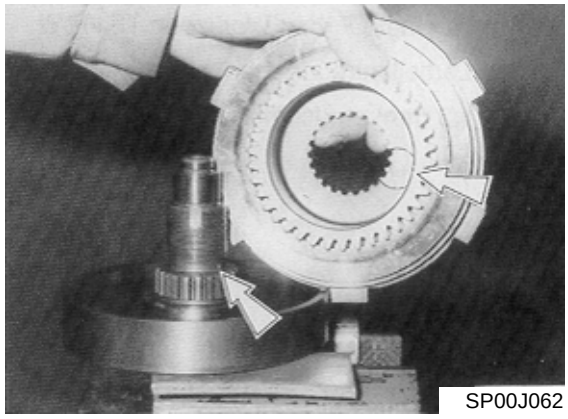
SP00J060

Place pressure disk (6) on set.
Fix cylinder rollers (7) with grease.

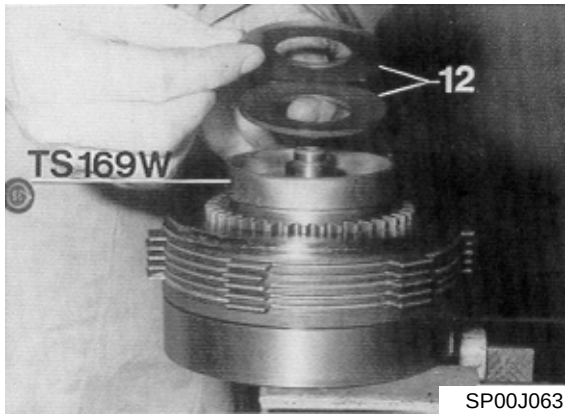


SP00J061

Mount preassembled multi-disk set on clutch shaft.
Attention: Recess for oil bore of shaft.


SP00J062

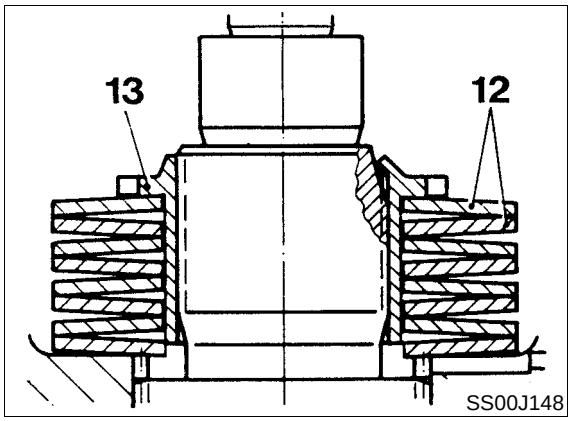
Center outside disks with drive shaft.
Center disk springs (12) with special tool (TS 169W).



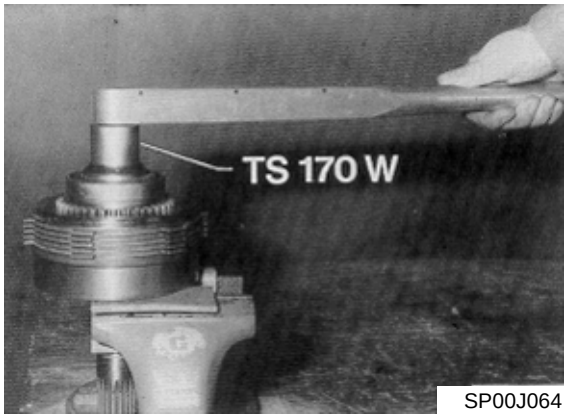
SP00J063

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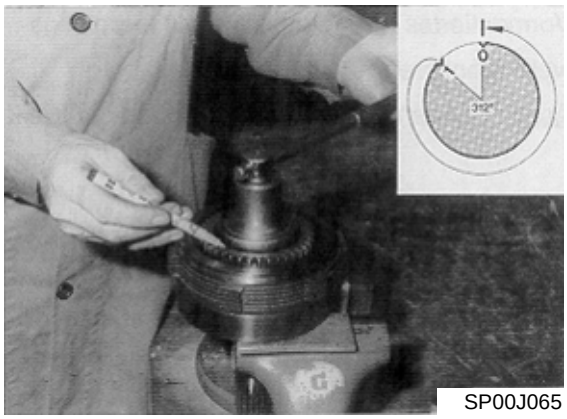
Postition of disk springs (12).
Screw castellated nut (13) onto clutch shaft.



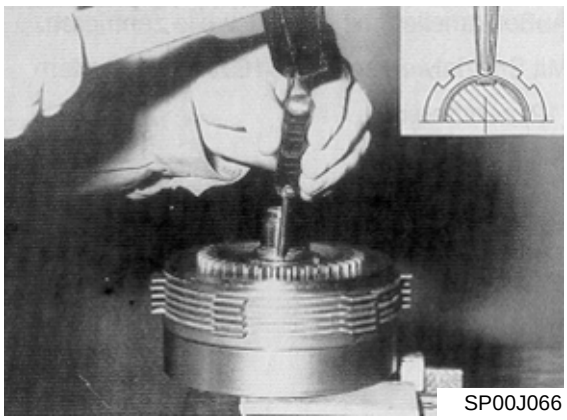
Tighten castellated nut in vice with special tool (TS170W).



Transfer the mark (O) from tool TS170W onto the multi-disk carrier.
Turn back 312° (= 1.3 mm).

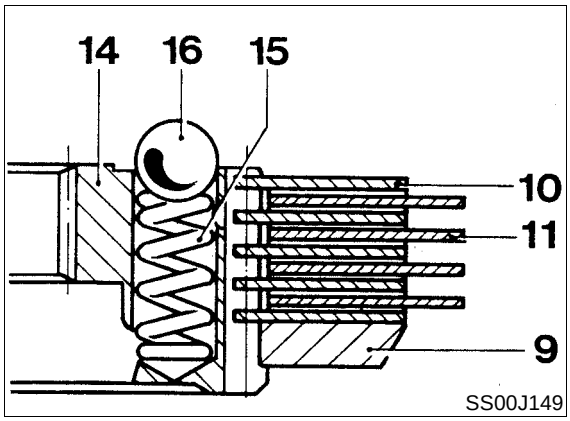


Secure castellated nut.

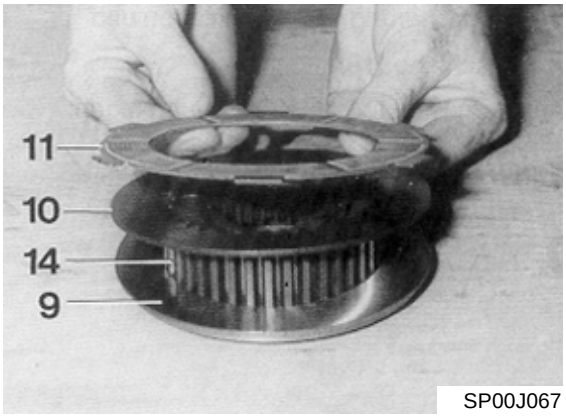


https://truckmanualshub.com/

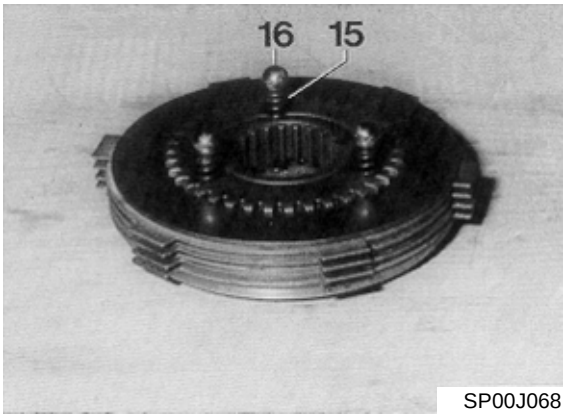
Preassemble set „high“.



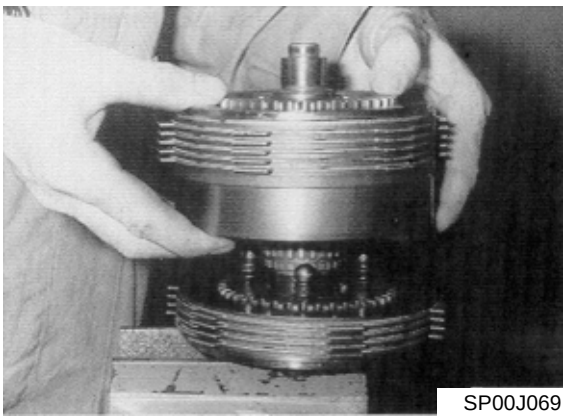
Place pressure plate (9) on multi-disk carrier (14).
Preassemble inner (10) and outer disks (11).



Mount springs (15) and balls (16) in bores of the multi-disk carrier.

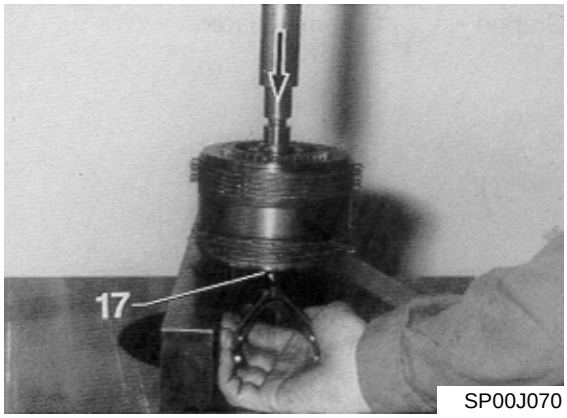


Hold the set firmly together and mount.
Pressure cylinder must not slip.



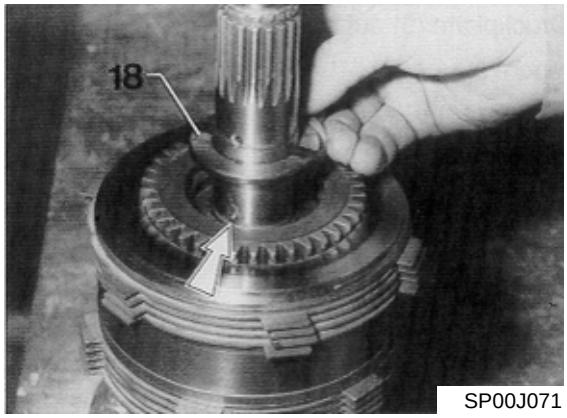
https://truckmanualshub.com/

Press both sets together and mount lock ring (17).



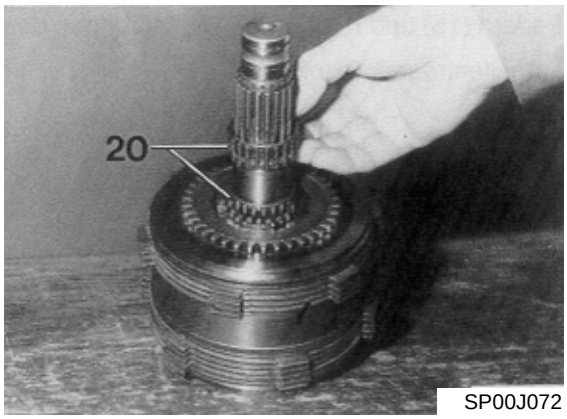
SP00J070

Insert torsional lock (ball) and mount thrust disk (18).
Attention: Do not place ball in oil bore.



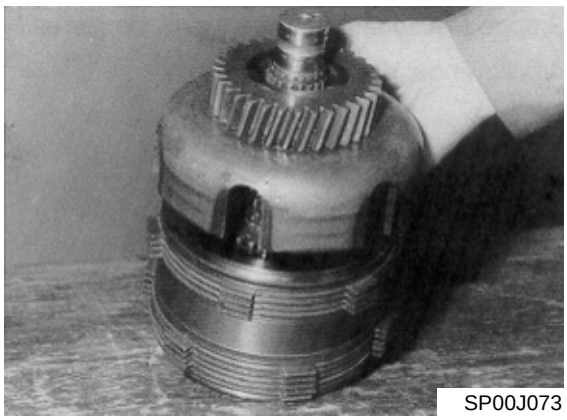
SP00J071

Mount needle cages (20).



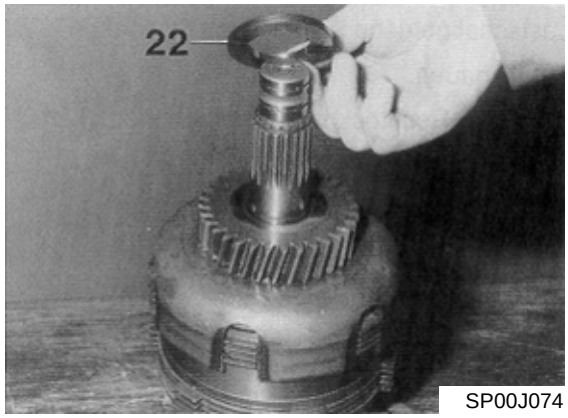
SP00J072

Mount spur gear with clutch bell.


SP00J073

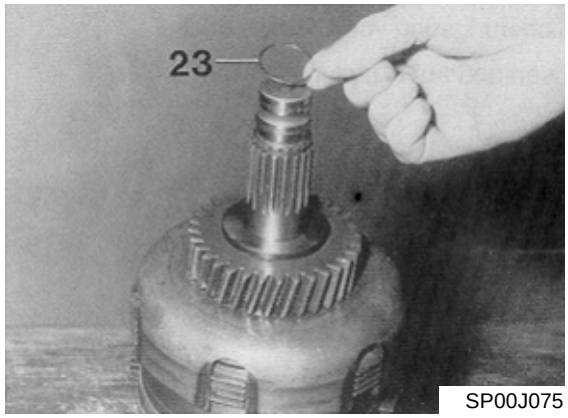
https://truckmanualshub.com/

Check the axial clearance of the preselection group.
Adjust axial clearance with thrust disk (22) (0.1 mm).



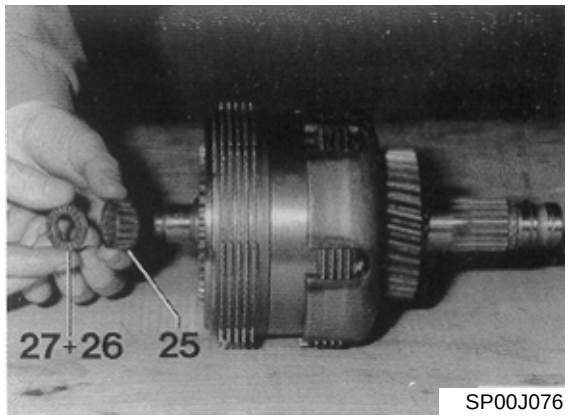
SP00J074

Mount rectangular rings (23) centered.
In order to make assemblying easier, grease the groove of the clutch shaft.



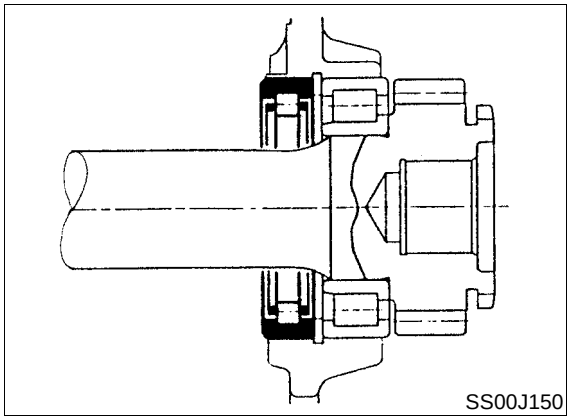
SP00J075

Mount needle cages (25), bearing disk (26) and needle collar (27).



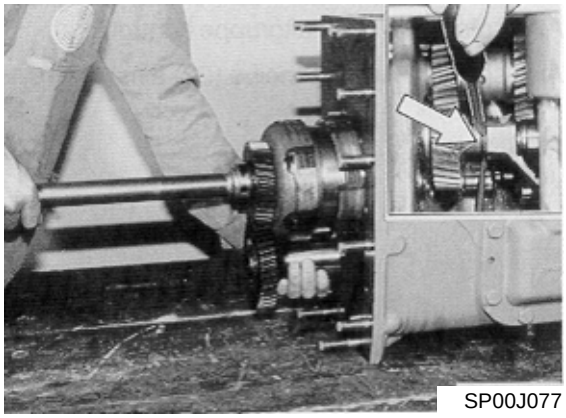
SP00J076

Install bearing if necessary.
(Chapter 4.2 page 73)

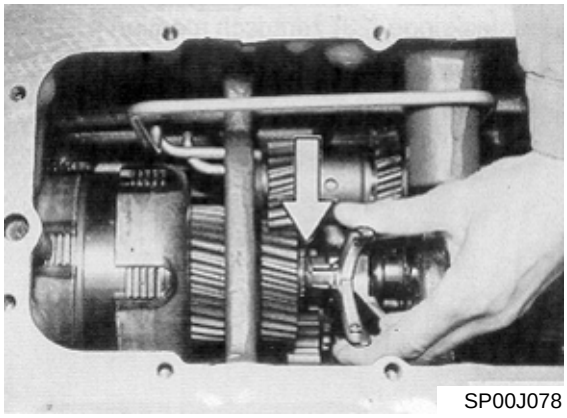

SS00J150

https://truckmanualshub.com/

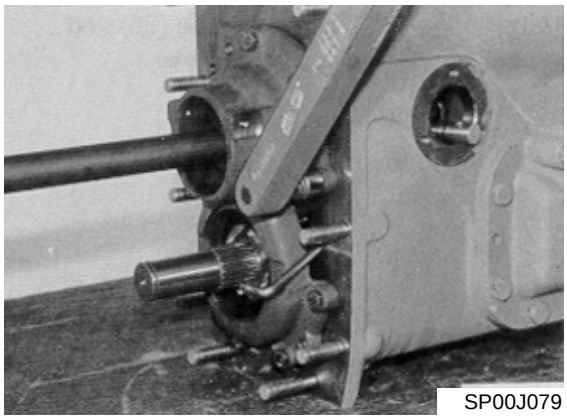
Install power shift transmission complete with dual wheel.
Attention: Press rectangular rings together.


SP00J077

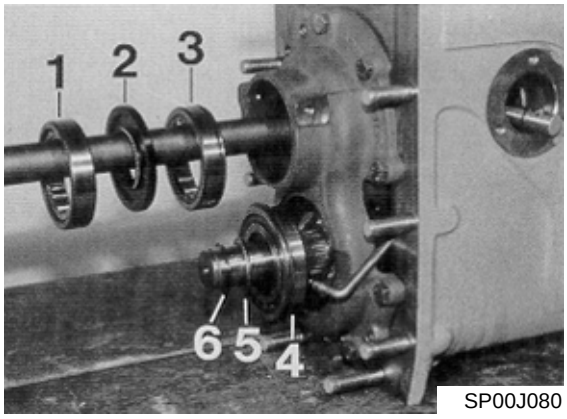
Remove lock ring from oil feed cover
and mount on clutch shaft.


SP00J078

Mount bearing cover.
Secure screws with Loctite and tighten with torque.


SP00J079

Mount bearing (1),
radial sealing ring (2) (pay attention to rotating direction!)
and bearing (3) at the top, bearing (4),
adjusting disks (5) and lock ring (6) at the bottom.
Check axial clearance of the
power take-off shaft (0.1 - 0.3 mm)
(Chapter 2.2, page 41)

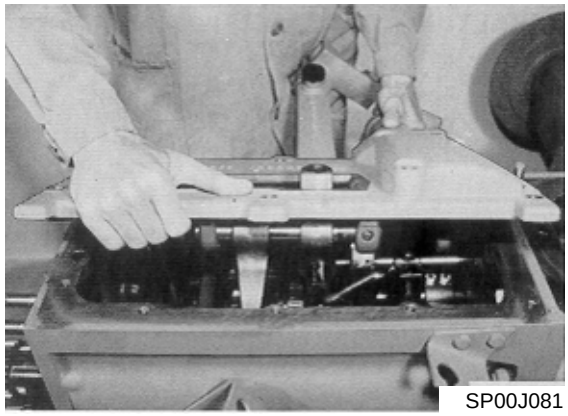


SP00J080

https://truckmanualshub.com/

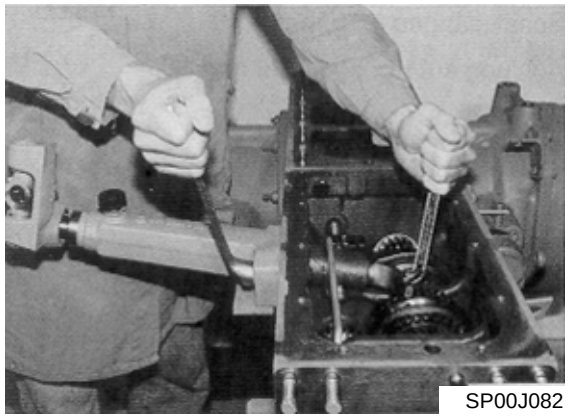
Transmission - disassembly

Dismount gear shift mechanism cover.



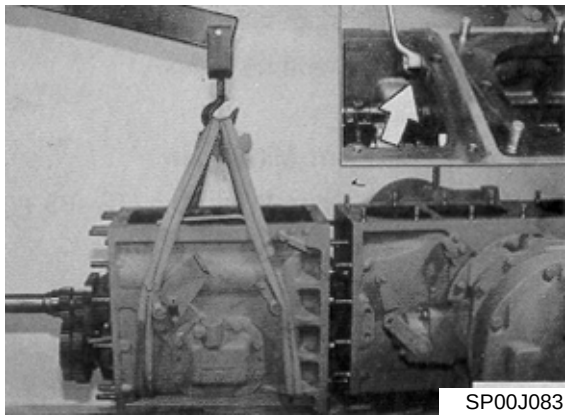
SP00J081

Remove side gear shift mechanism „gear“.



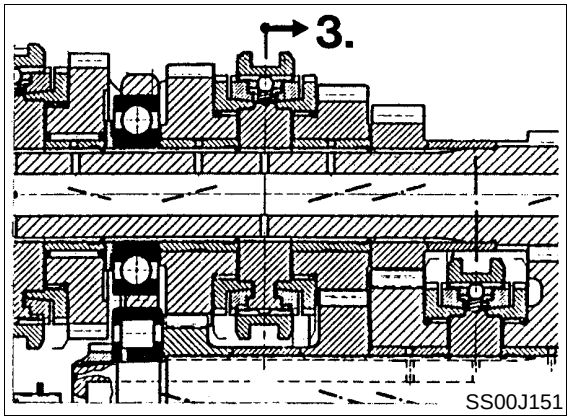
SP00J082

Separate transmission from rear axle.



SP00J083

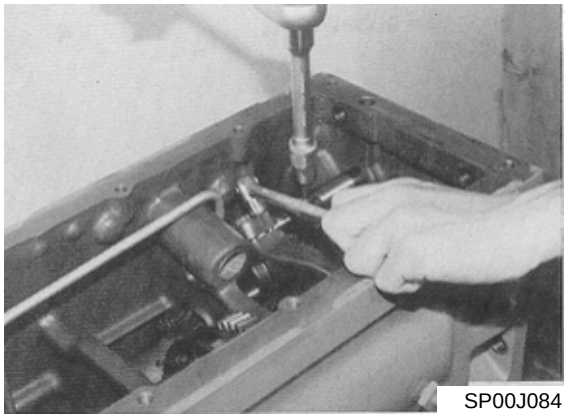
Engage 3rd gear.



SS00J151

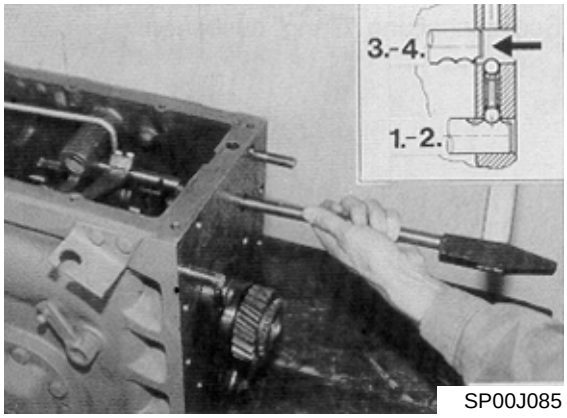
https://truckmanualshub.com/

GEAR SHIFT MECHANISM 3rd-4th GEAR - dismantle.



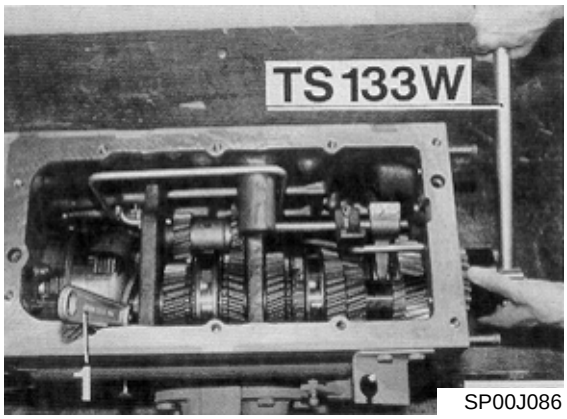
SP00J084

Remove gear shift rods.
Pay attention to ball, spring and pin.



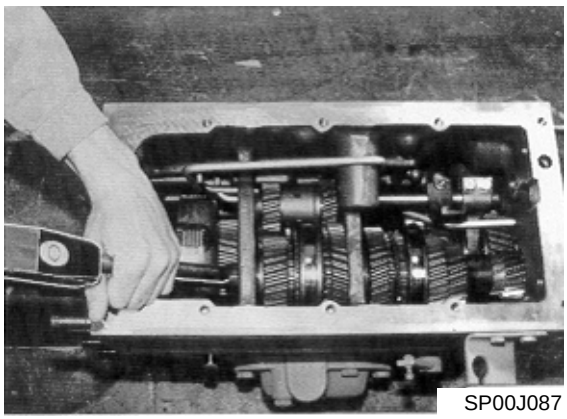
SP00J085

COUNTERSHAFT - dismantle.
Power shift transmission does not have to be dismantled.
Unlock castellated nut.
Loosen the castellated nut via the main shaft with a hook spanner (1) and special tool TS 133W.



SP00J086

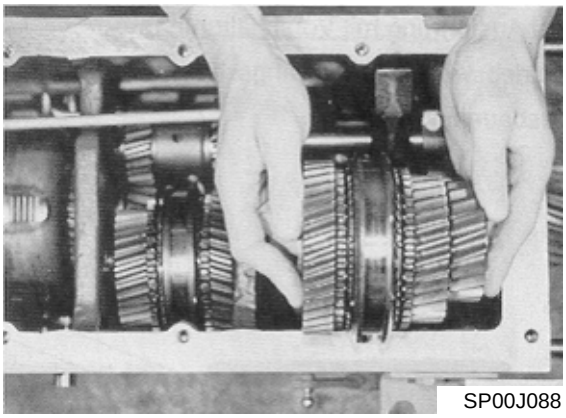
Dismantle countershaft to the rear.



SP00J087

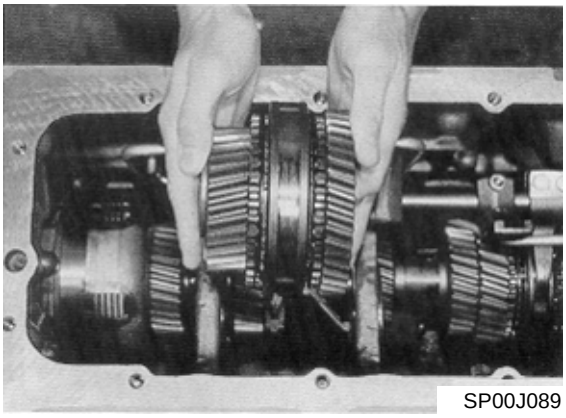
https://truckmanualshub.com/

Remove spur gears, synchronizer units and thrust disks of 3rd and 4th gear.



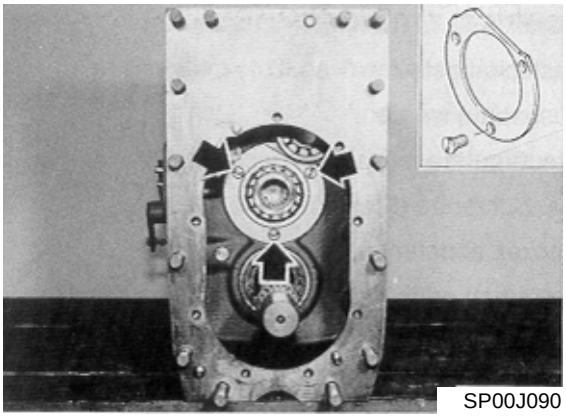
SP00J088

Remove spur gears, synchronizer unit and thrust disks of F-R set.



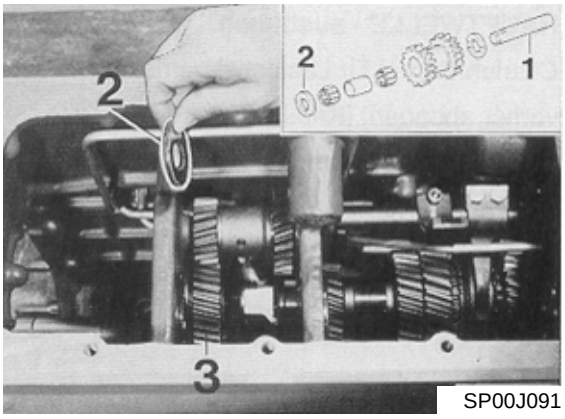
SP00J089

REVERSE IDLER GEAR - dismantle.
Power shift transmission must be dismantled beforehand. (chapter 3.1)
Remove retainer.



SP00J090

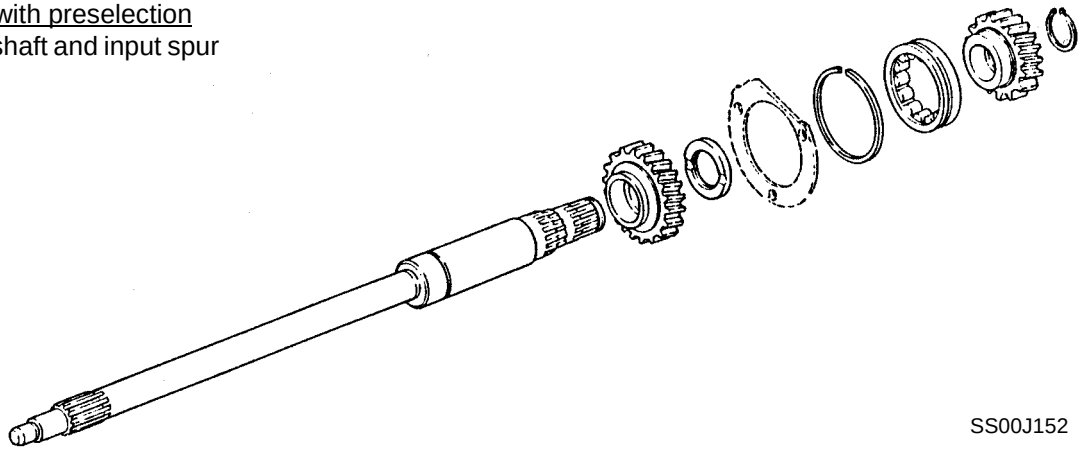
Push shaft (1) backwards and remove thrust disk (2).
Dismantle shaft (1) from the front.
Then remove spur gear (3).



SP00J091

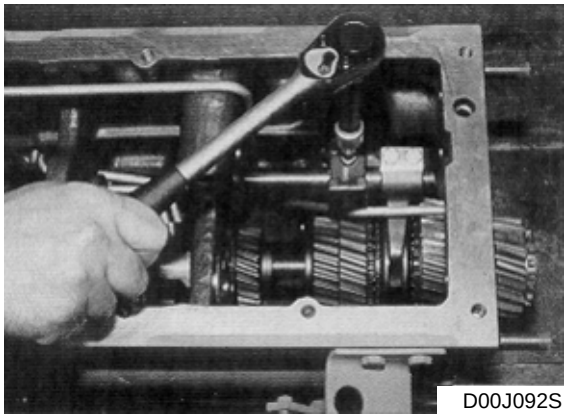
https://truckmanualshub.com/

In the case of version with preselection group dismantle drive shaft and input spur gears.



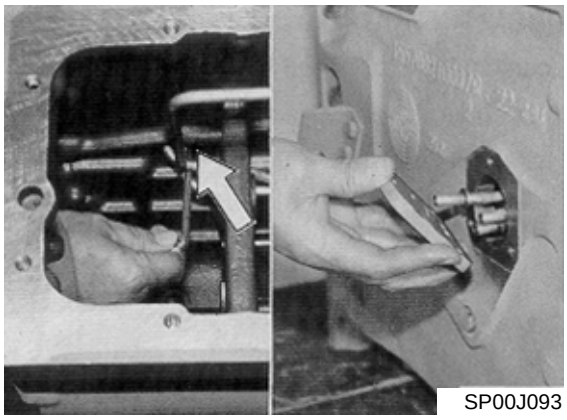
SS00J152

GEAR SHIFT MECHANISM 1st-2nd GEAR - dismantle.
(see 3rd-4th gear page 60)



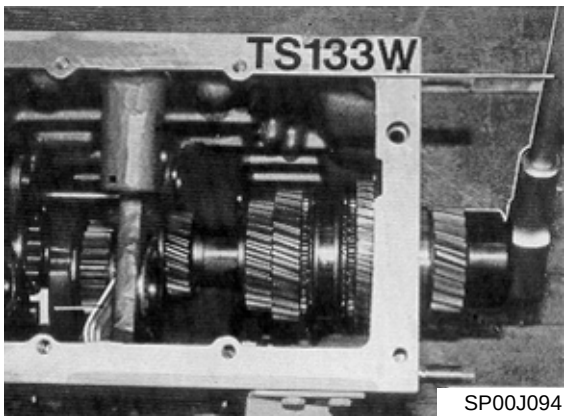
D00J092S

LUBRICATING LINES - dismantle.
Power shift transmission (chapter 3.1) must be dismantled beforehand.
Control units must be dismantled.
Loosen fillister head screw (arrow).
Remove cover.
Remove lines.



SP00J093

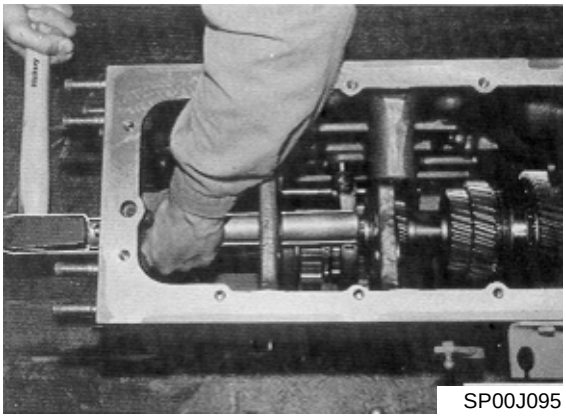
MAIN SHAFT - dismantle.
Dismount oil feed cover for power shift transmission beforehand. (chapter 3.1, page 50)
Unlock castellated nut, loosen with hook spanner (1) and special tool (TS 133W).



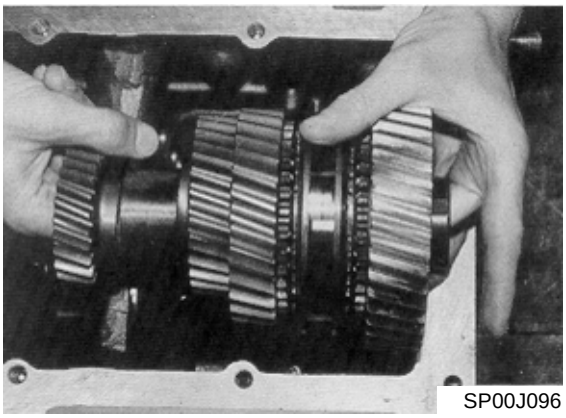
SP00J094

https://truckmanualshub.com/

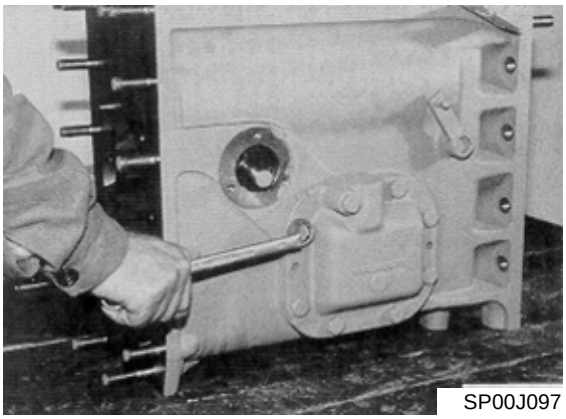
Force shaft out to the rear.


SP00J095

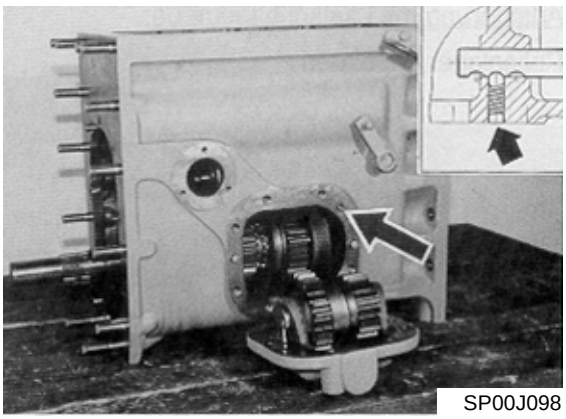
Remove spur gears and synchronizer unit of 1st - 4th gears.


SP00J096

DOUBLE SPUR GEAR/SIDE COVER - dismantle.
Remove side cover.
Pay attention to adjusting screws.

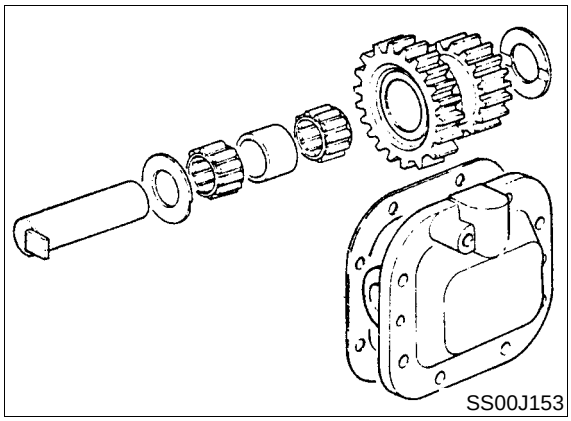

SP00J097

In the case of travel power take-off shaft, pay attention to gear shift lock.

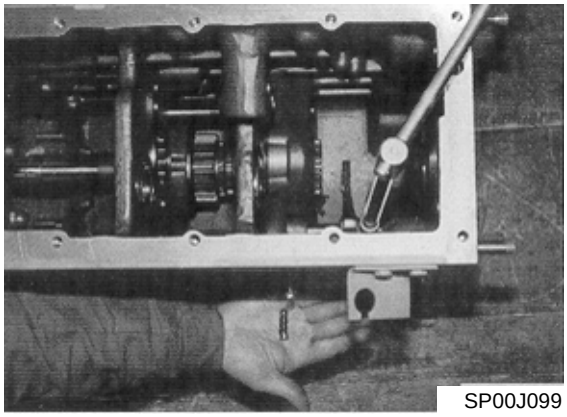

SP00J098

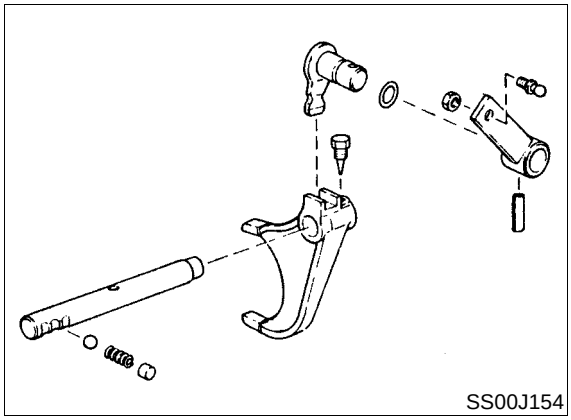
https://truckmanualshub.com/

Disassemble the countershaft of the power take-off shaft.

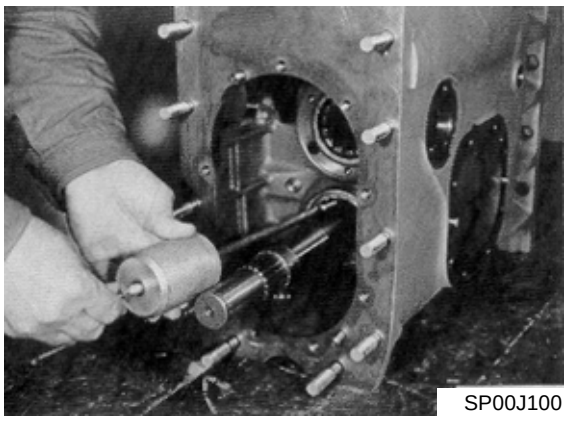

SS00J153

Version with travel power take-off shaft.
Dismantle gear shift mechanism.


SP00J099


SS00J154

Version with power shift transmission:
Dismantle roller bearings.


SP00J100

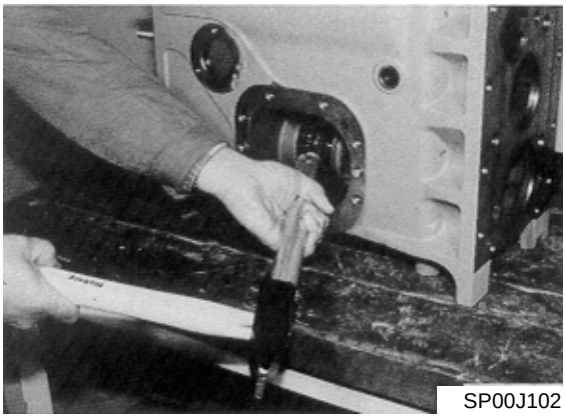
https://truckmanualshub.com/

POWER TAKE-OFF SHAFT - dismantle.



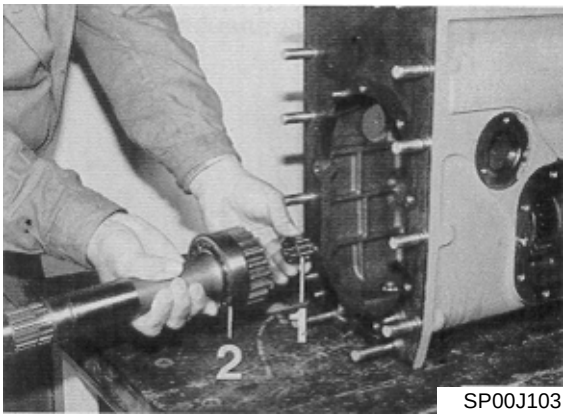
SP00J101

Force out power take-off shaft.



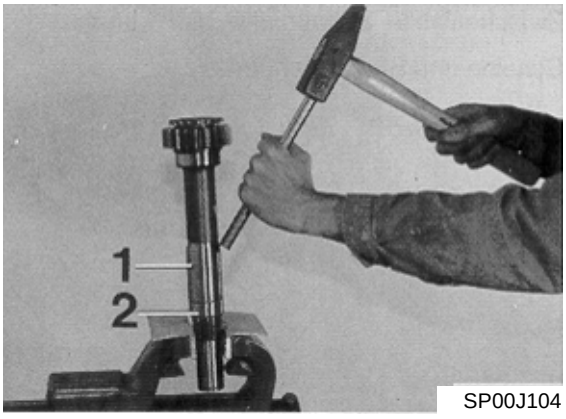
SP00J102

Remove needle cage (1).
Pull off bearing (2).



SP00J103

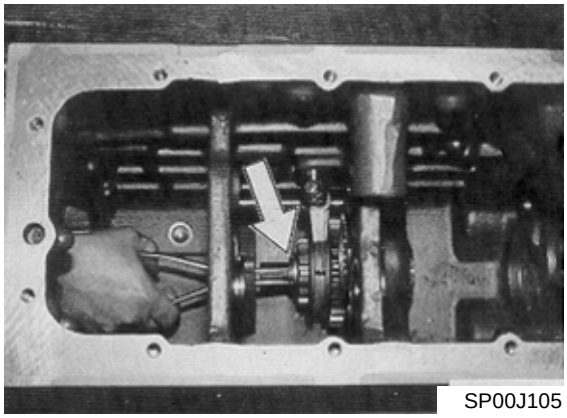
<u>Version with power shift transmission:</u>
Remove spacer sleeve (1) and inner ring (2).



SP00J104

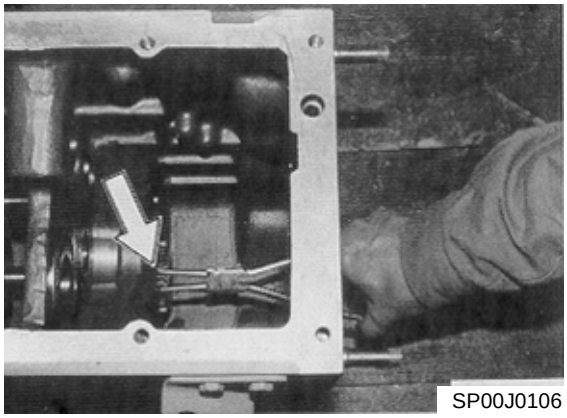
https://truckmanualshub.com/

Dismantle lock ring in the front.



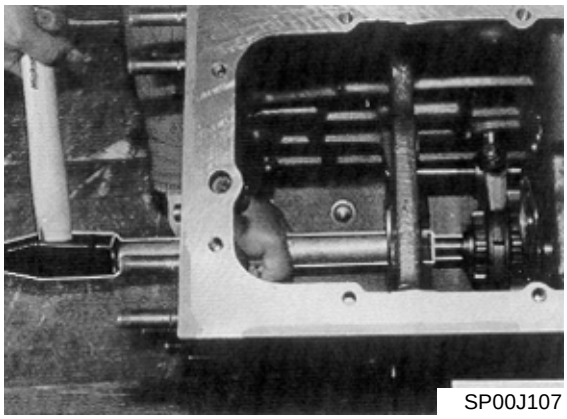
SP00J105

Dismantle lock ring at the rear.



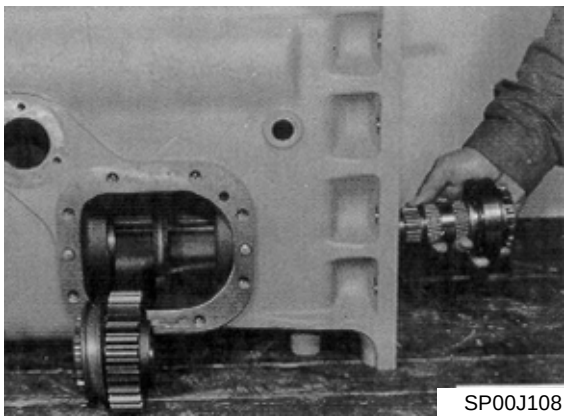
SP00J0106

INTERMEDIATE SHAFT - dismantle.



SP00J107

Remove intermediate shaft, sliding sleeve, sliding sleeve carrier, disk and spur gear.

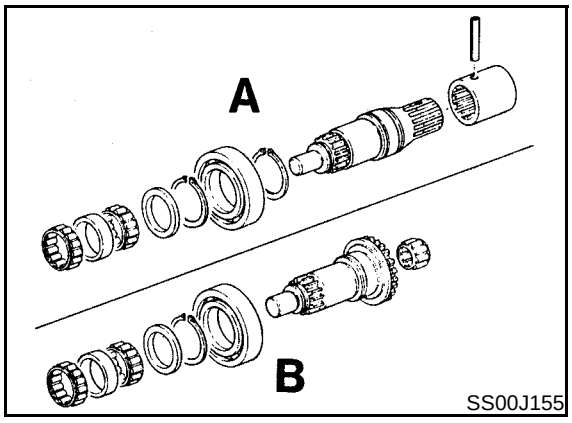


SP00J108

https://truckmanualshub.com/

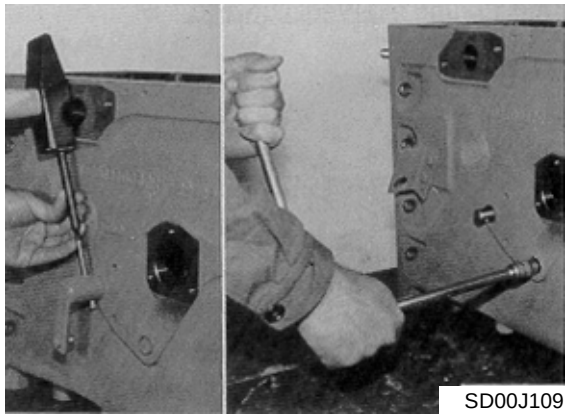
Disassemble intermediate shaft.

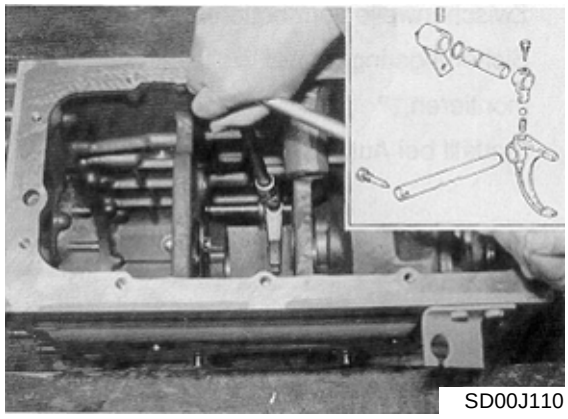
A-engine power take-off shaft
B-with travel power take-off shaft



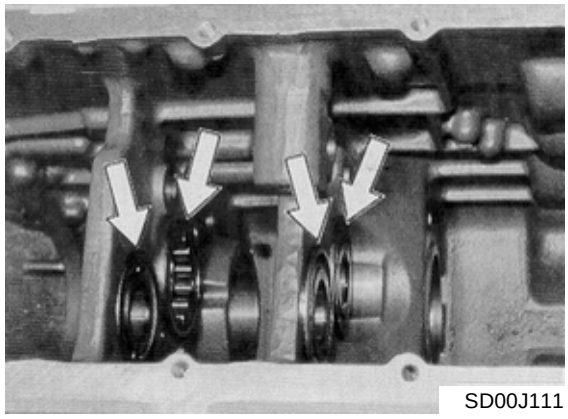
SS00J155

POWER TAKE-OfF SHAFT GEAR SHIFT MECHANISM-dismantle.


SD00J109


SD00J110

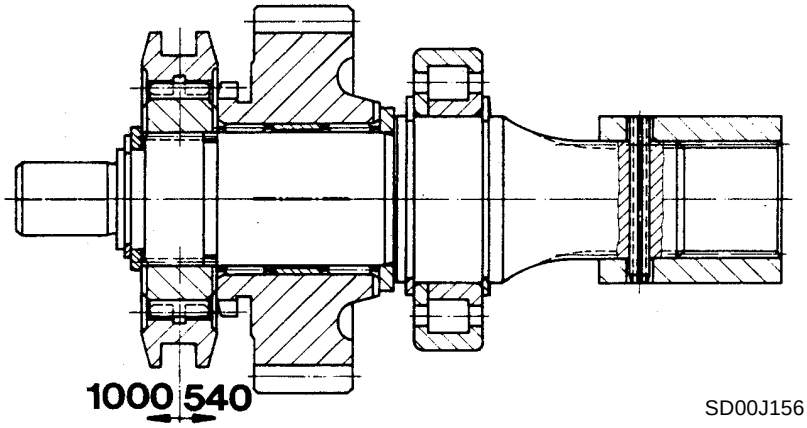
Dismantle bearing from transmission housing.


SD00J111

https://truckmanualshub.com/

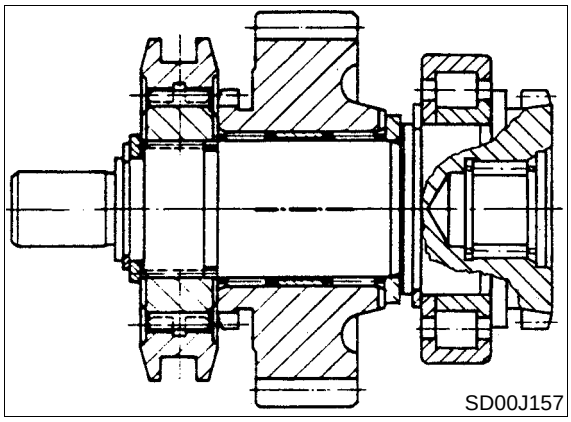
Transmission - reassembly

INTERMEDIATE SHAFT
reassembly

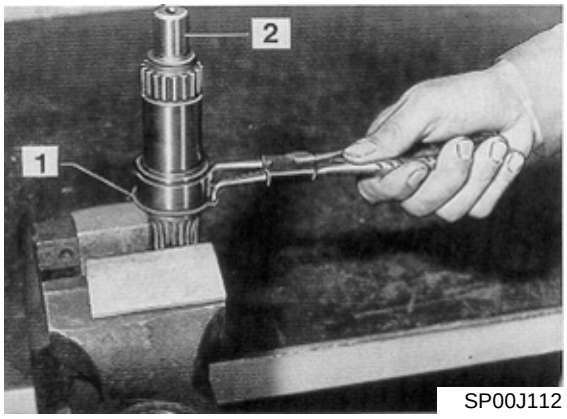


SD00J156

Version with travel power take-off shaft.

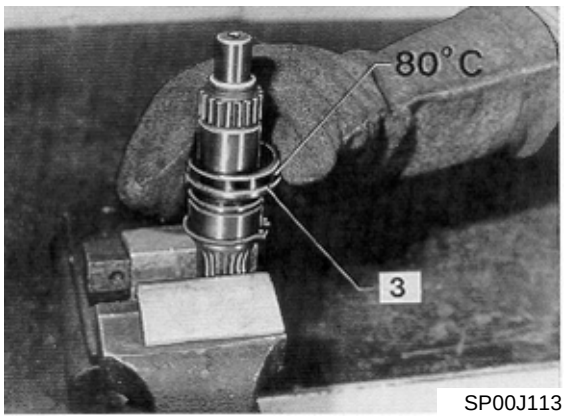

SD00J157

Preassemble intermediate shaft, mount lock ring (1) on shaft (2). (not applicable for version with travel power take-off shaft)



SP00J112

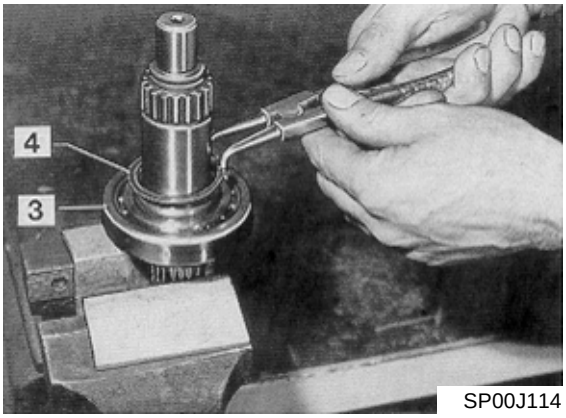
Mount bearing inner ring (3) warm.



SP00J113

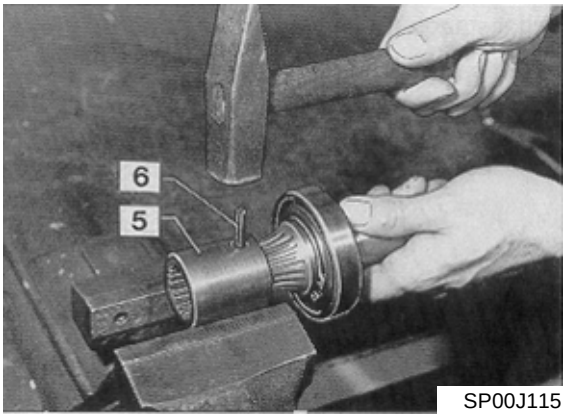
https://truckmanualshub.com/

Mount bearing with disk (3) and lock ring (4).



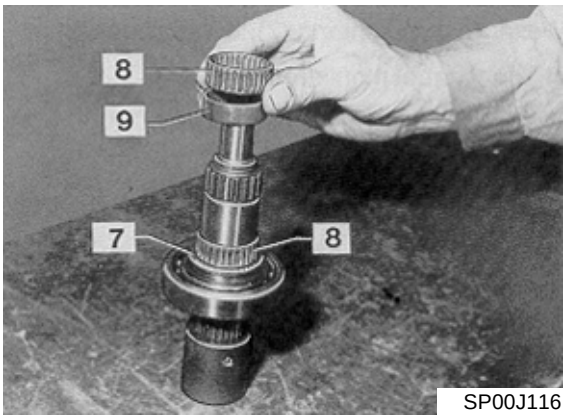
SP00J114

Secure sleeve (5) with clamping sleeve (6).
(not applicable for version with
travel power-take-off shaft)



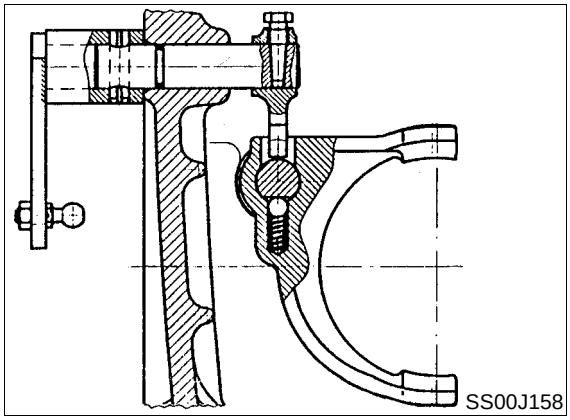
SP00J115

Mount disk (7), both bearings (8) and spacer ring (9).



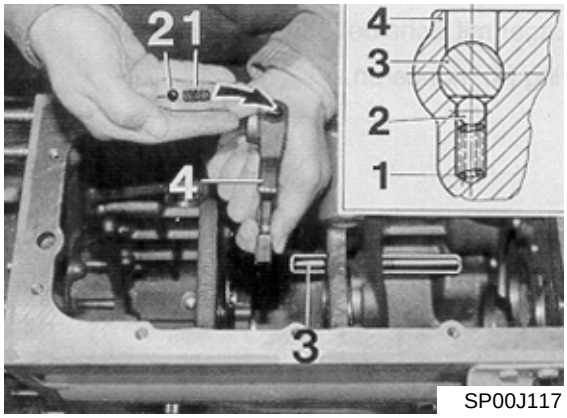
SP00J116

POWER TAKE-OFF SHAFT GEAR SHIFT MECHANISM-installation.


SS00J158

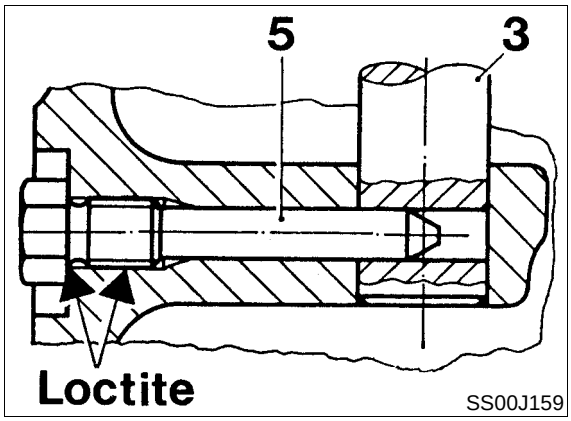
https://truckmanualshub.com/

Insert spring (1) and ball (2) into shift fork.
Mount shift rod (3) and shift fork (4).



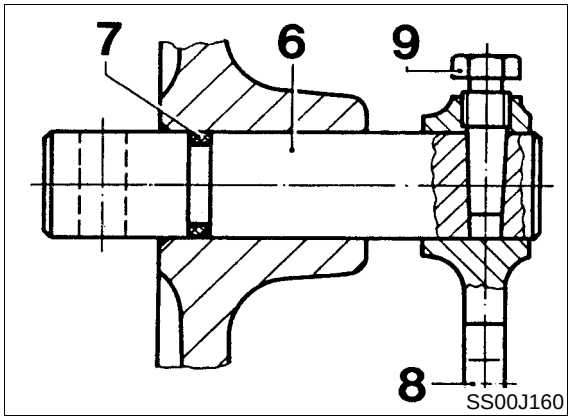
SP00J117

Fix shift rod (3) with locking screw (5).
Secure screw with Loctite.



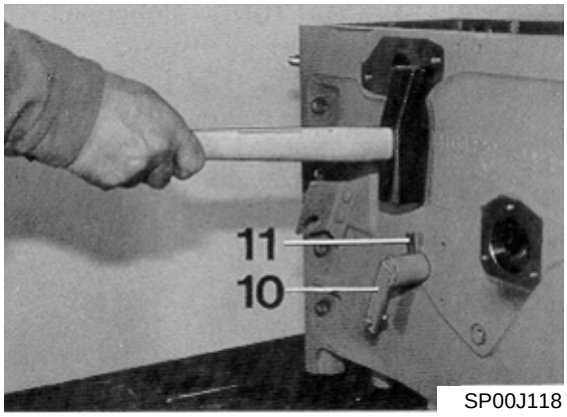
SS00J159

Mount shaft (6) with sealing ring (7),
shift finger (8) in shift fork (lubricate).
Fix with cone bolt (9).



SS00J160

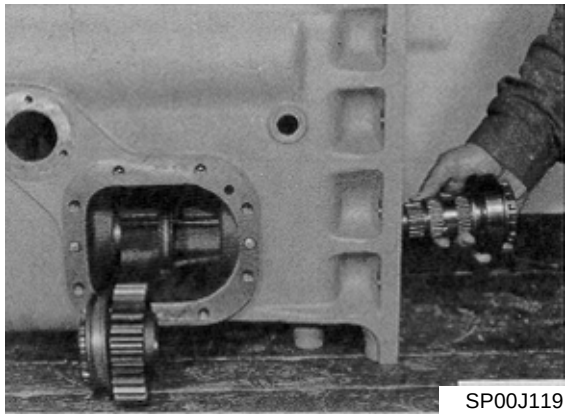
Secure lever (10) with tensioning pin (11).



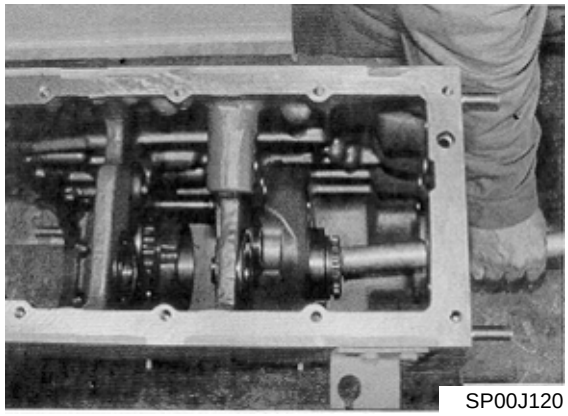
SP00J118

https://truckmanualshub.com/

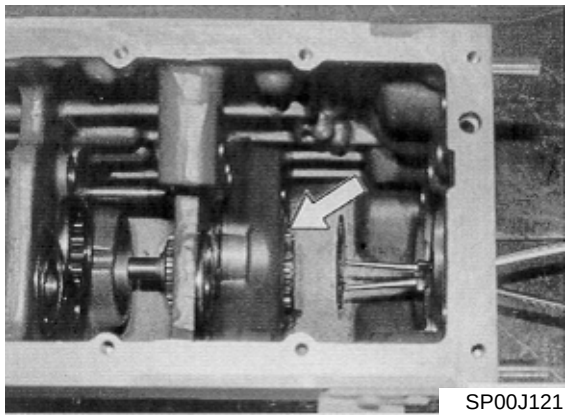
INTERMEDIATE SHAFT - installation.
Install preassembled intermediate shaft, spur gear, sliding sleeve carrier and sliding sleeve.


SP00J119

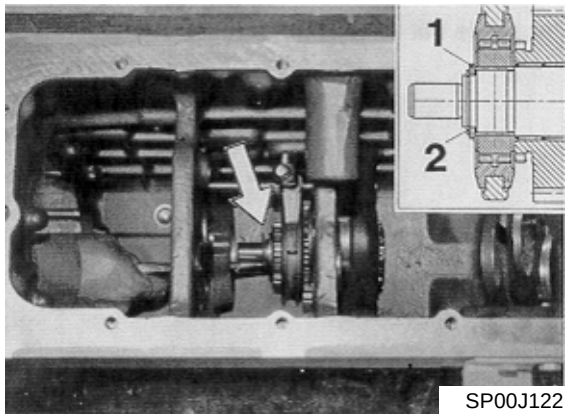
Force in intermediate shaft.


SP00J120

Mount lock ring.


SP00J121

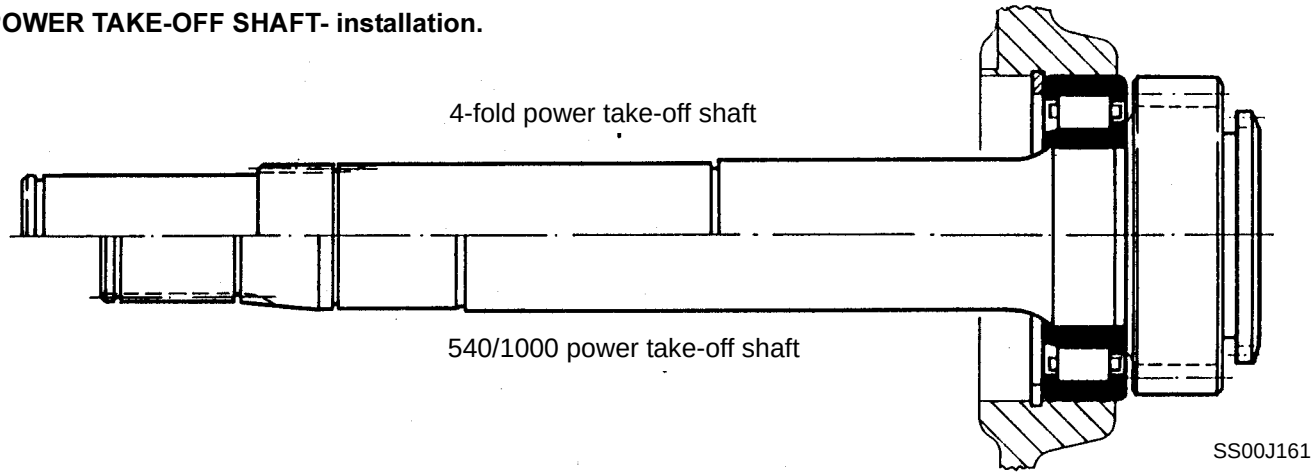
Mount disk (1) and lock ring (2).



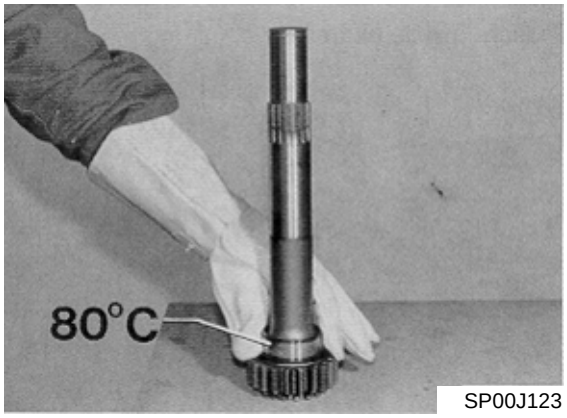
SP00J122

https://truckmanualshub.com/

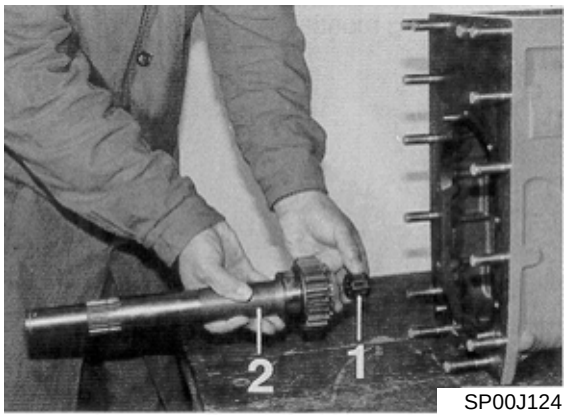
POWER TAKE-OFF SHAFT- installation.



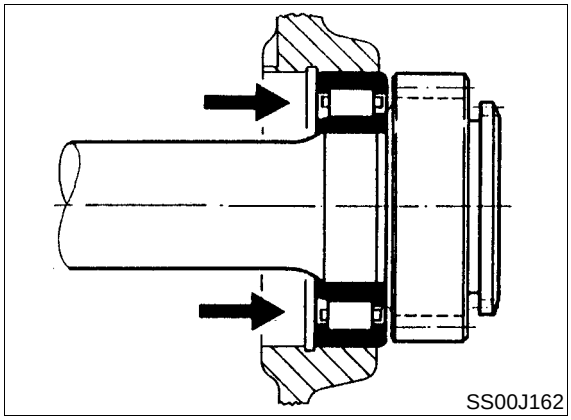
Mount bearing warm.



Needle cage (1) in power take-off shaft (2).

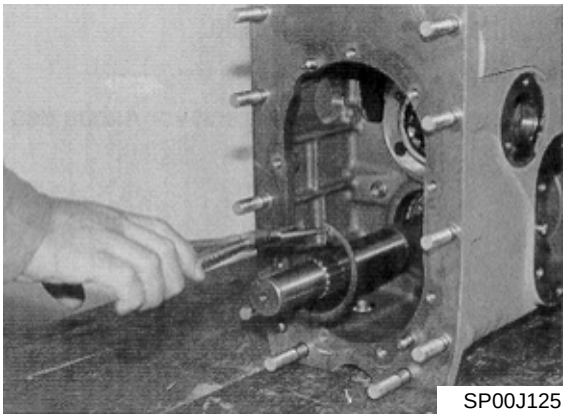


Mount power take-off shaft with bearing.

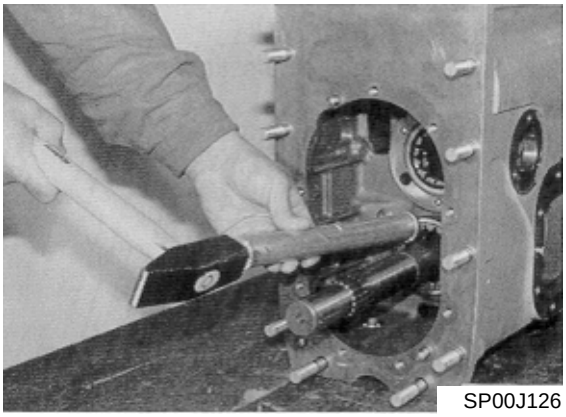


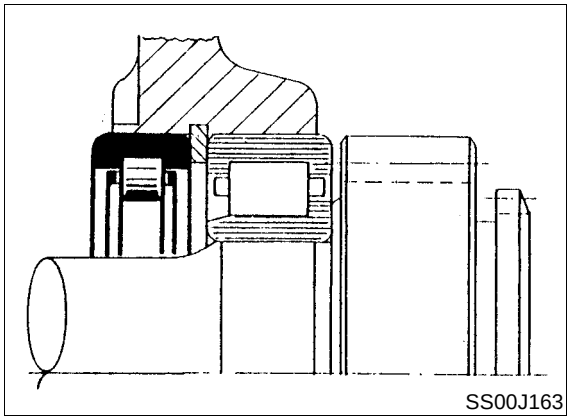
https://truckmanualshub.com/

Mount lock ring.

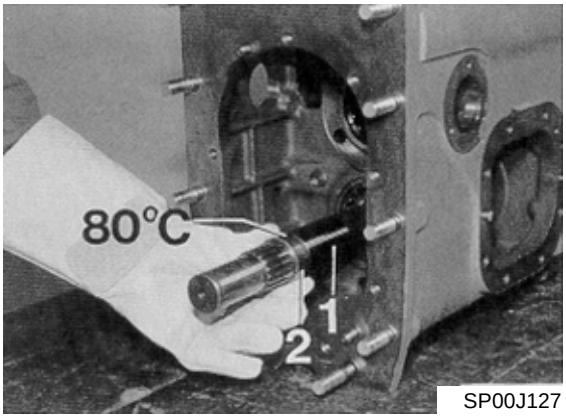

SP00J125

Version with power shift transmission:
Mount bearing.


SP00J126


SS00J163

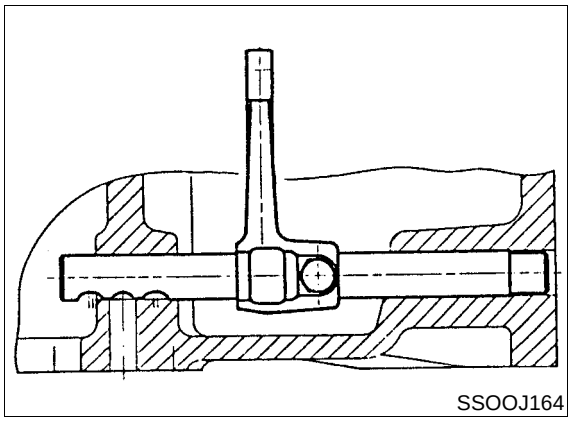
Slide on spacer sleeve (1).
Mount inner ring (2) warm.



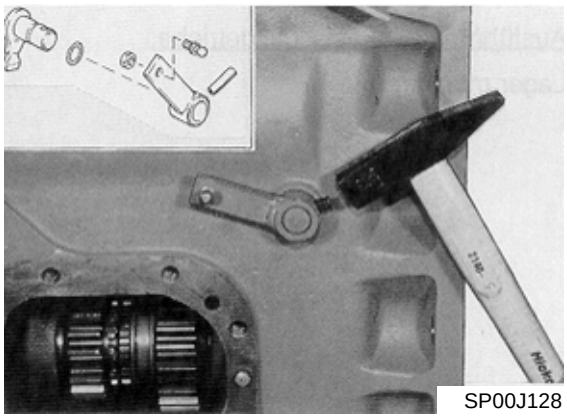
SP00J127

https://truckmanualshub.com/

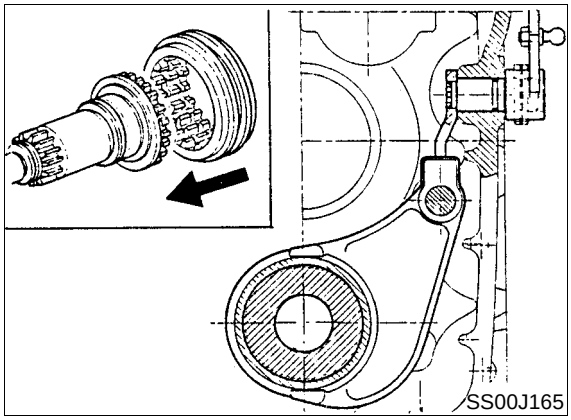
Version with travel power take-off shaft.
Install gear shift mechanism.
Attention: Only mount shift lock before fitting the side cover.


SSOOJ164

Mount shift finger.
Fix lever with clamping sleeve.

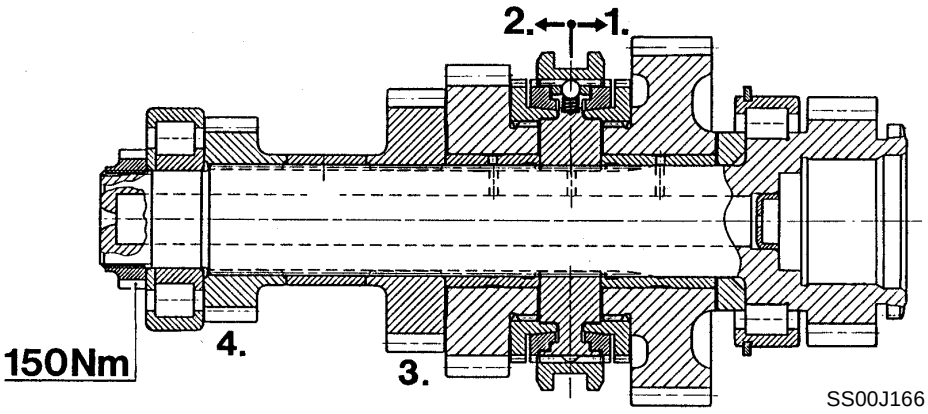

SP00J128

Mount sliding sleeve in shift fork on engine power take-off shaft.


SS00J165

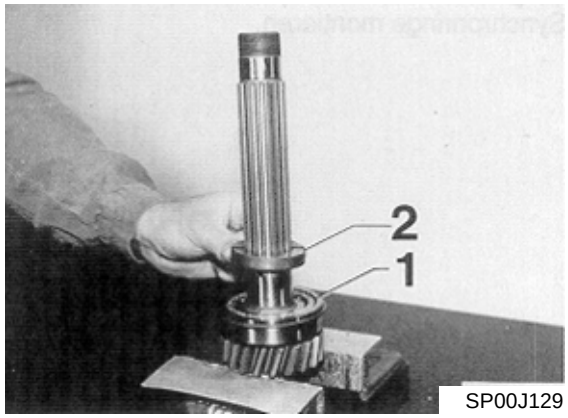
https://truckmanualshub.com/

MAIN SHAFT - preassembly.



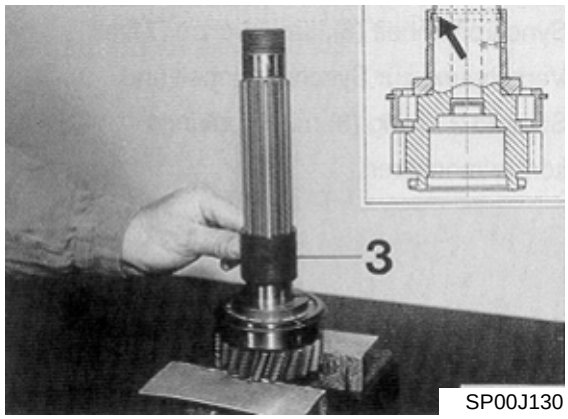
SS00J166

Mount bearing with retaining ring (1) and thrust disk (2).



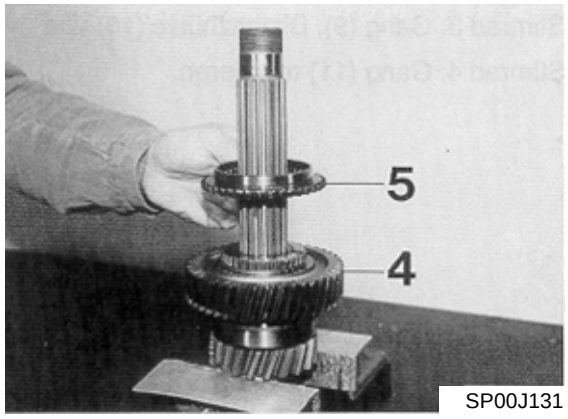
SP00J129

Mount bush (3) with serration (to secure against torsional movement) towards synchronizer unit.



SP00J130

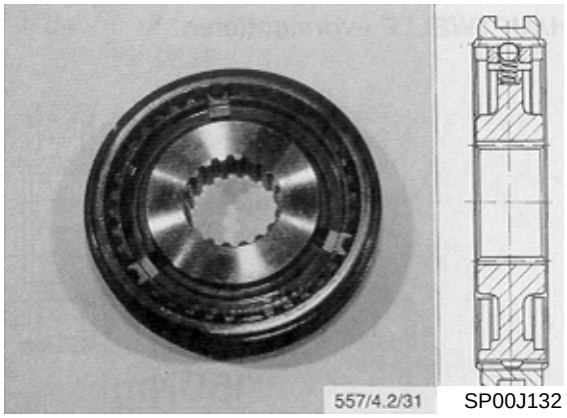
Mount spur gear wheel 1st gear (4) an clutch body (5).



SP00J131

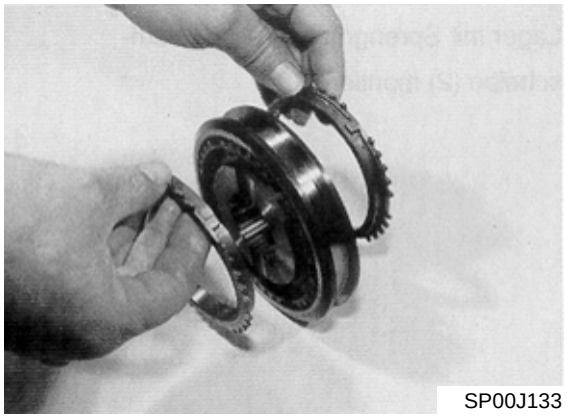
https://truckmanualshub.com/

Reassemble synchronizer unit 1st-2nd gear.

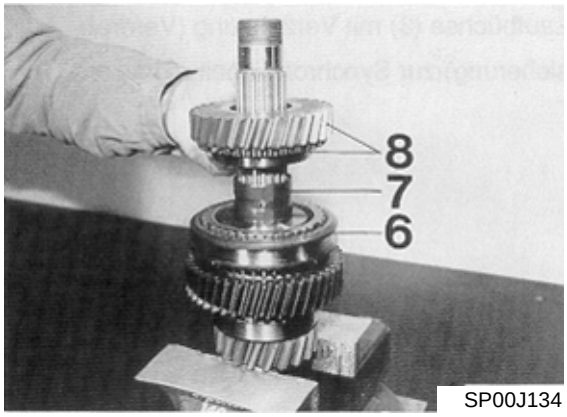


SP00J132

Mount synchronizer rings.

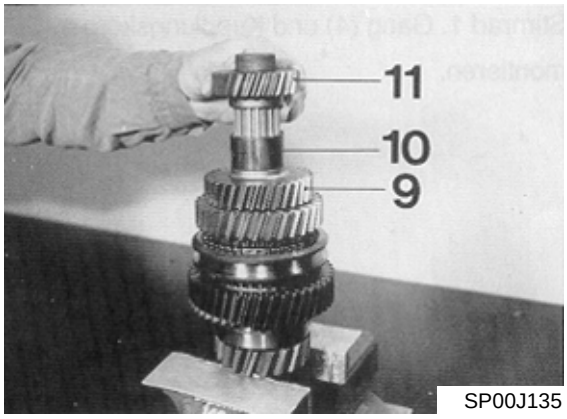

SP00J133

Mount synchronizer unit (6),
bush (7) with serration towards the synchronizer unit
and spur gear wheel 2nd gear (8) with clutch body.



SP00J134

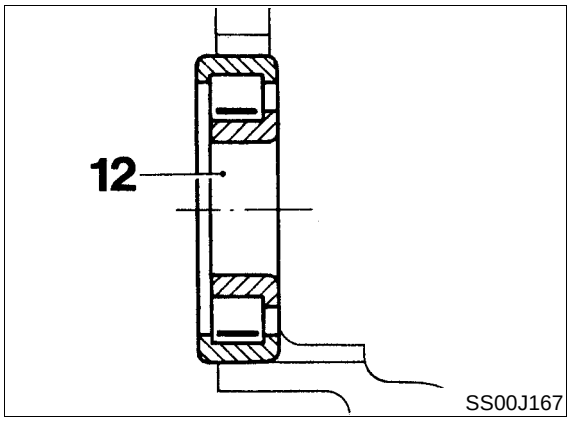
Mount spur gear wheel 3rd gear (9),
spacer sleeve (10)
and spur gear wheel 4th gear (11).



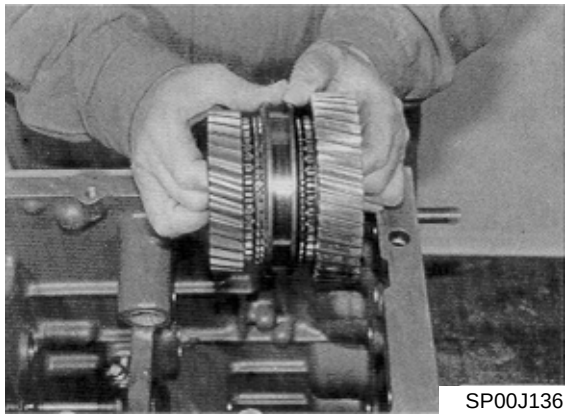
SP00J135

https://truckmanualshub.com/

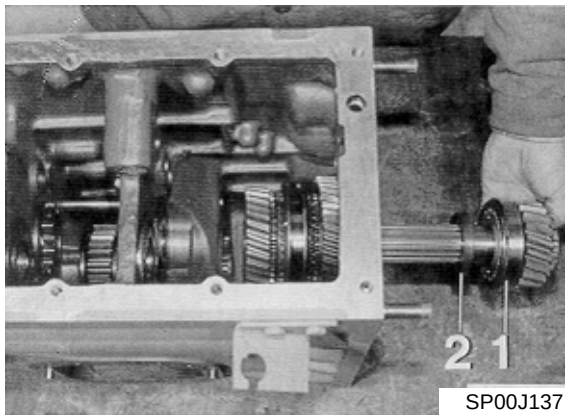
MAIN SHAFT - installation.
Install bearing (12) without in housing.



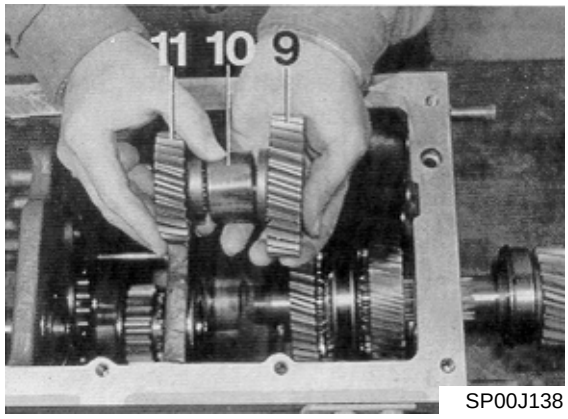
Insert spur gear and synchronizer unit 1st-2nd gear.



Install main shaft with bearing (1) and thrust disk (2).

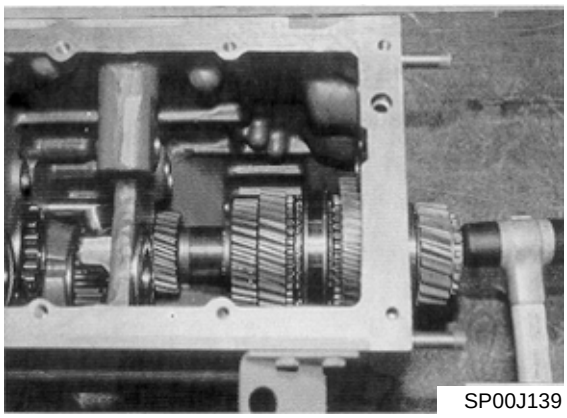


Mount spur gear wheel 3rd-4th gear (9+11)
and spacer sleeve (10).

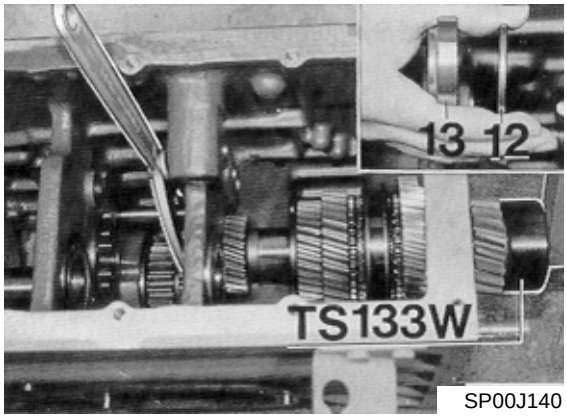


https://truckmanualshub.com/

Install complete main shaft.

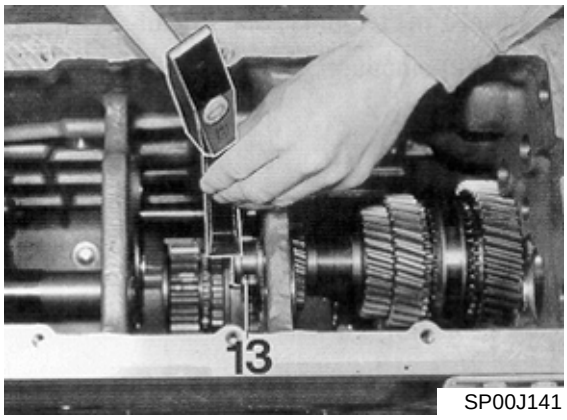

SP00J139

Mount bearing disk (12) and castellated nut (13).
Tighten castellated nut with hook spanner
and special tool (TS 133W) with 150 Nm.



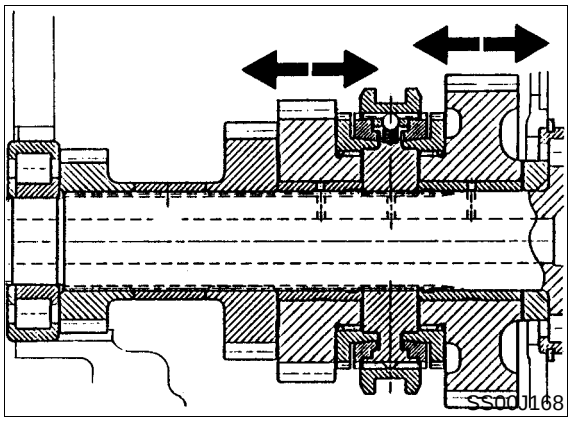
SP00J140

Secure castellated nut (13).



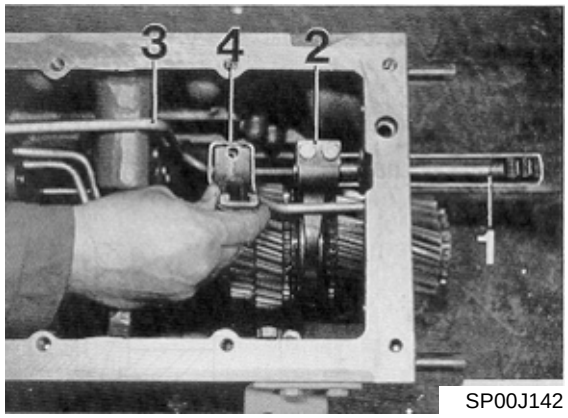
SP00J141

Check axial clearance (0.2-0.3 mm) of the spur gear wheels 1st-2nd gear.
Mount oil feed cover for power shift transmission centered (push upwards).
(Chapter 3.2, page 51)


SS00J168

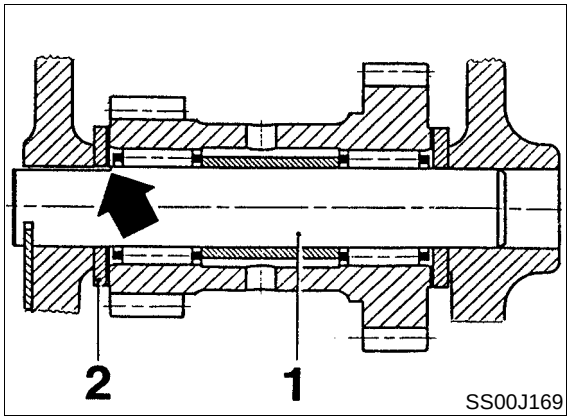
https://truckmanualshub.com/

GEAR SHIFT MECHANISM 1st-2nd GEAR- installation.
Install shift rod (1) and shift fork (2).
Mount oil line (3) over shift fork
and driver (4) over oil line.
Fix shift rod in installation position.
Turn driver to the left. Secure screw with Loctite and fasten.
Adjustment of the gear shift only after mounting the gear shift mechanism 3rd-4th gear.

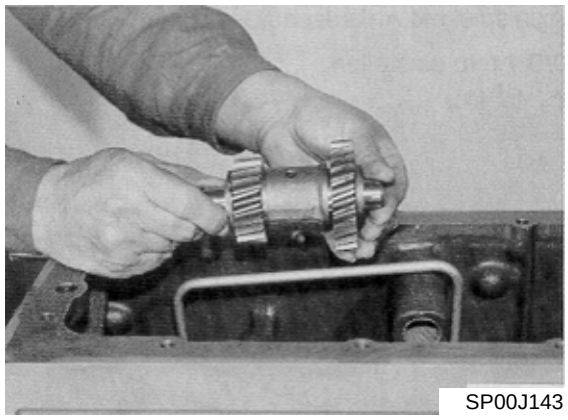


SP00J142

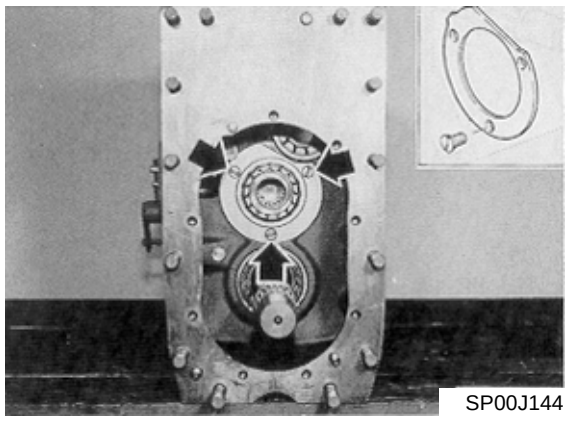
REVERSE IDLER GEAR - installation.
Pay attention to correct installation of shaft (1) and thrust disk (2).



SS00J169


SP00J143

Mount retainer.
Secure screws with Loctite and tighten.

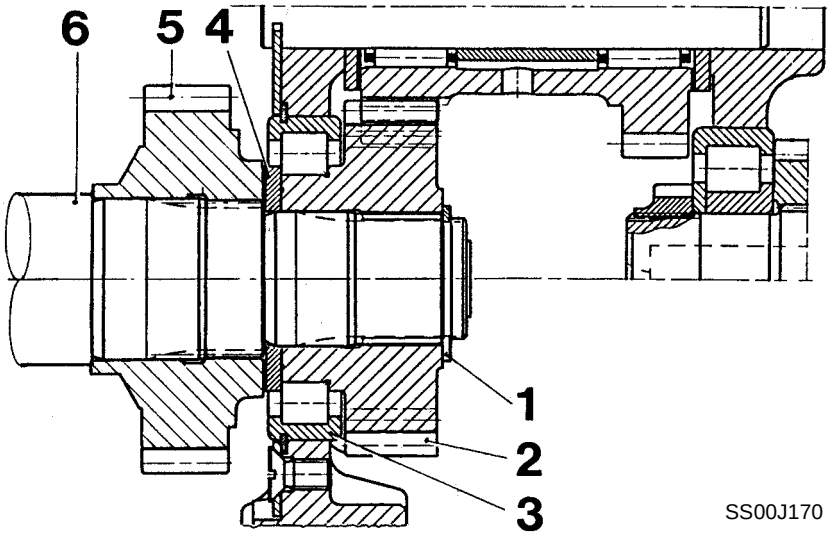

SP00J144

https://truckmanualshub.com/

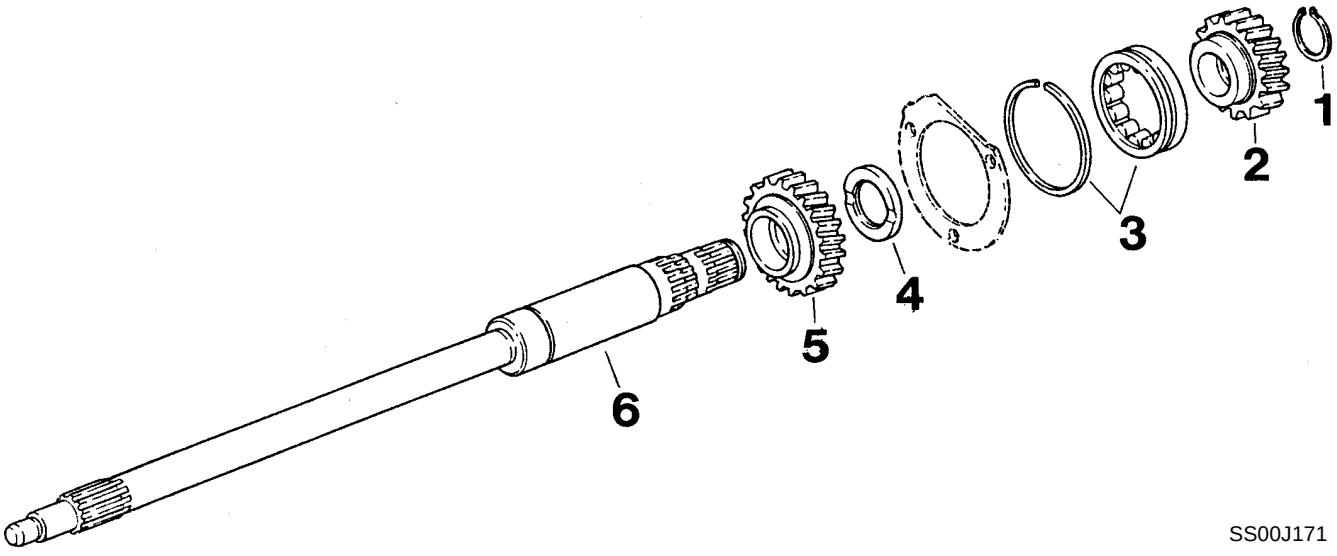
Version with preselection group:

DRIVE SHAFT AND INLET SPUR GEARS - installation.

(Version power shift transmission chapter 3.2)

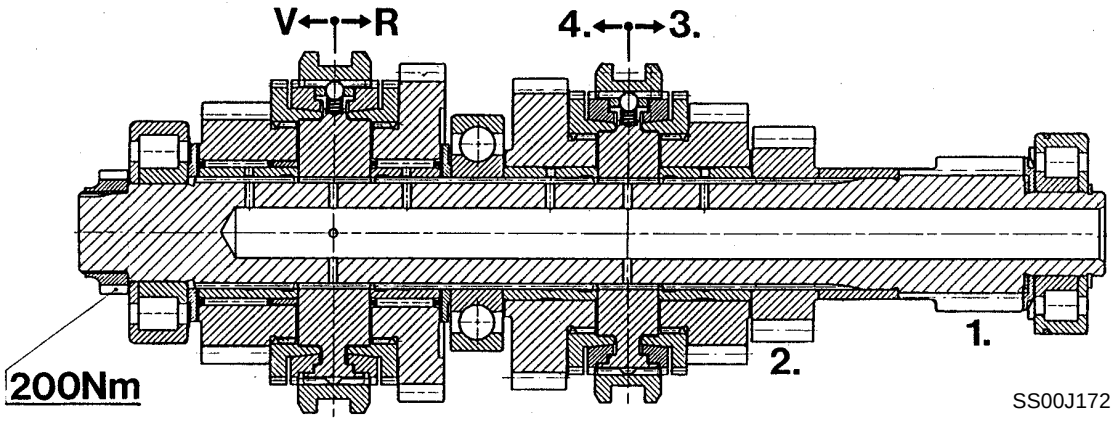


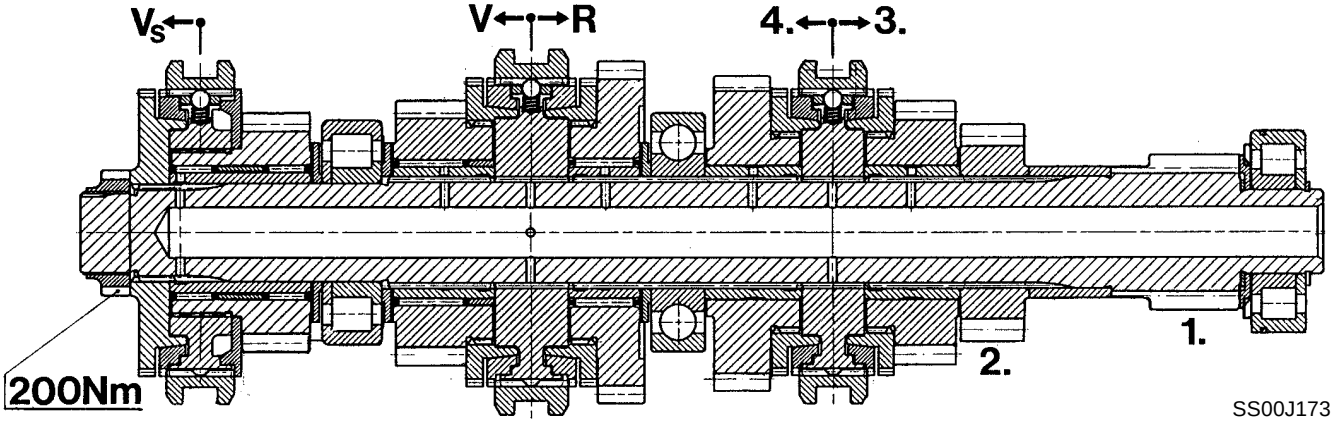
Adjust axial clearance with thrust disk (4) to 0-0,1 mm.



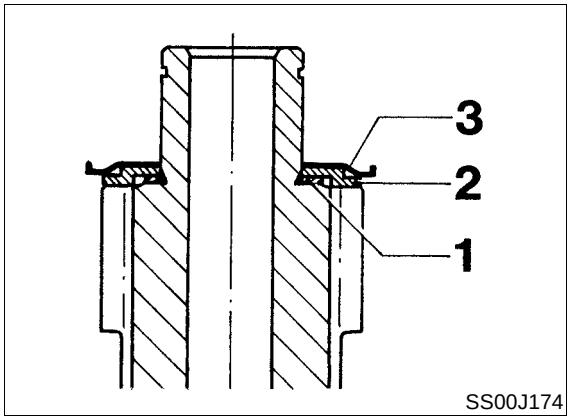
https://truckmanualshub.com/

COUNTERSHAFT - preassembly

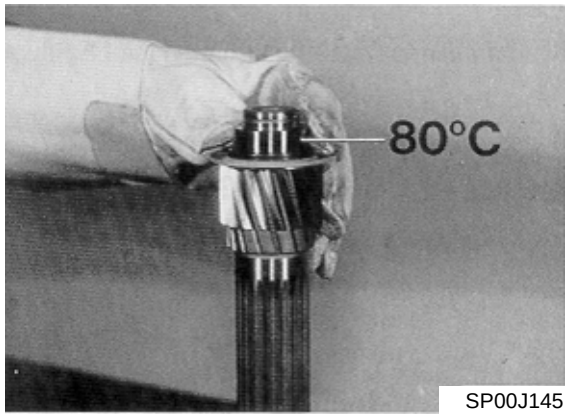




Mount bearing ring (1), disk (2) and Nilox ring (3).
Pay attention that the bearing ring is fitted correctly (correct side).

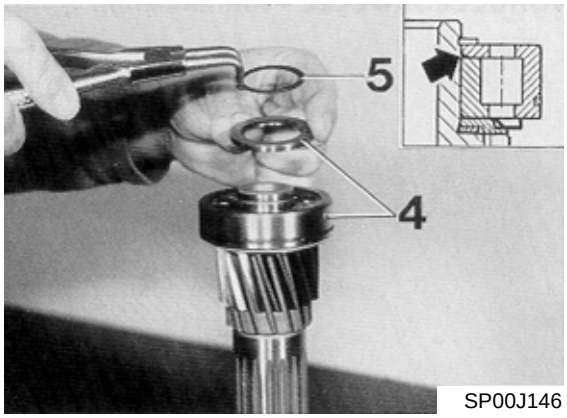


Mount bearing inner ring warm.



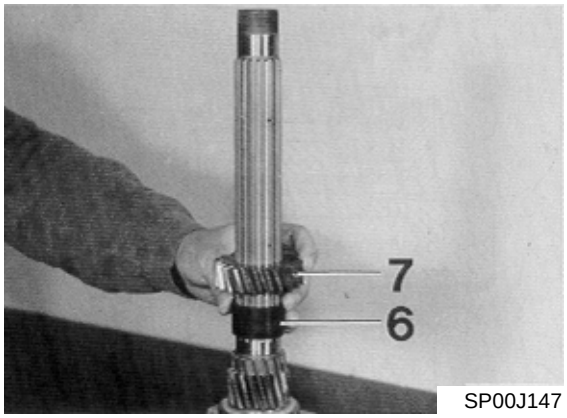
https://truckmanualshub.com/

Mount bearing with retaining ring
and bearing disk (4), as well as lock ring (5).
Pay attention to the correct assembling of
the bearing disk.



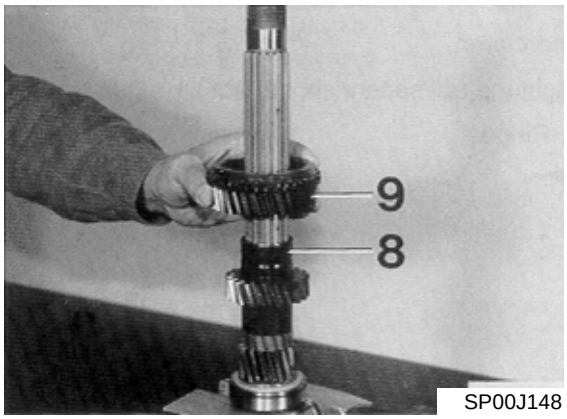
SP00J146

Mount spacer sleeve (6)
and spur gear wheel 2nd gear (7).



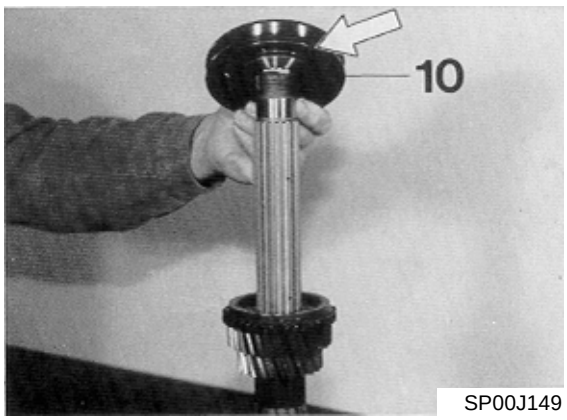
SP00J147

Mount bush (8) with serration (to secure against
torsional movement) towards spur gear wheel 2nd
gear and spur gear wheel 3rd gear (9) with clutch
body.



SP00J148

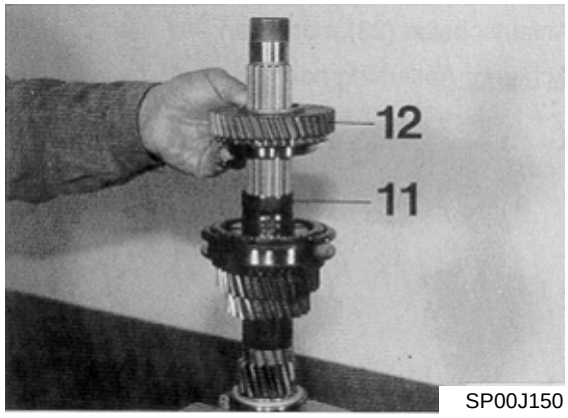
Assemble synchronizer unit (see main shaft page 76).
Mount complete synchronizer unit (10).
Attention: Stepping to 3rd gear.



SP00J149

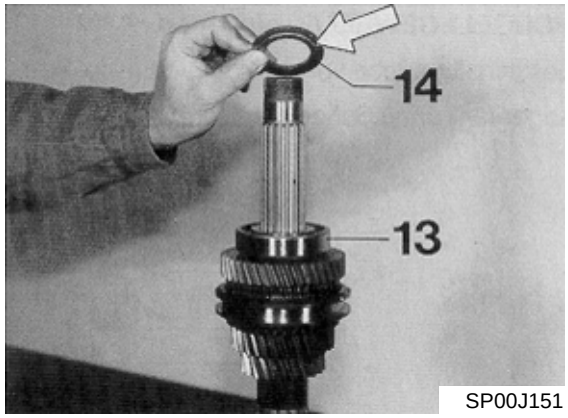
https://truckmanualshub.com/

Mount bush (11) with serration towards synchronizer unit and spur gear 4th gear wheel (12) with clutch body.



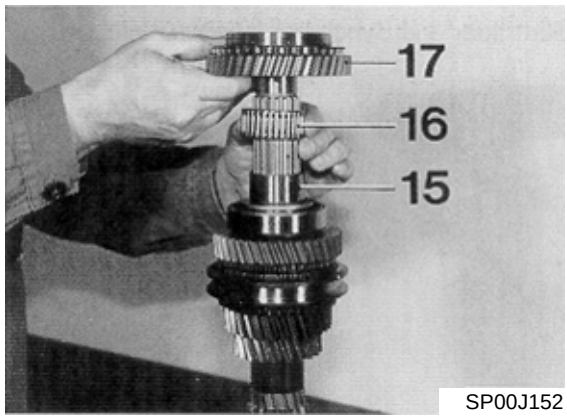
SP00J150

Mount bearing (13)
and thrust disk (14) with collar towards bearing.



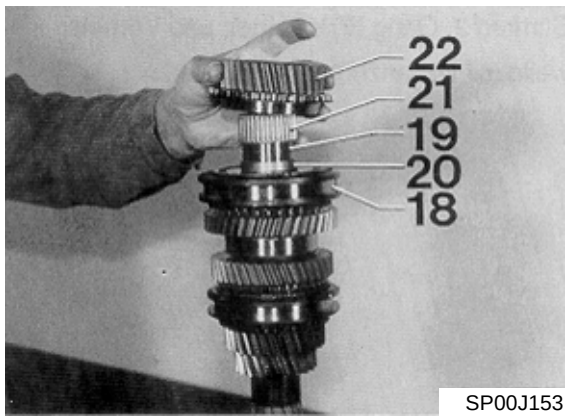
SP00J151

Mount bush (15) with serration towards thrust disk, needle bearing (16), spur gear-R (17) with clutch body.



SP00J152

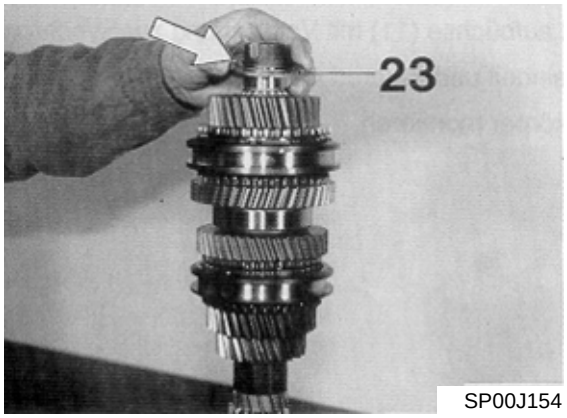
Reassemble synchronizer unit
(see main shaft page 76).
Mount complete synchronizer unit (18).
Mount bush (19) with serration towards synchronizer unit, spacer ring (20), needle bearing (21) and spur gear-F (22) with clutch body.



SP00J153

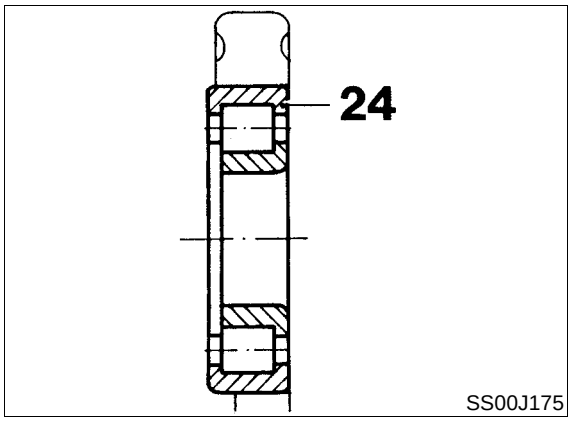
https://truckmanualshub.com/

Mount thrust disk (23).
Attention: Stepping upwards.



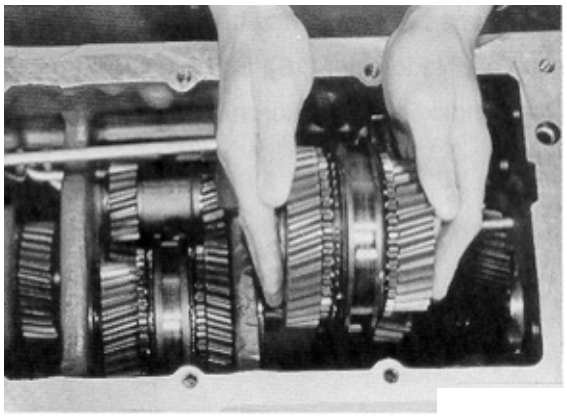
SP00J154

COUNTERSHAFT - installation.
Install power shift transmission beforehand (chapter 3.2).
Install bearing (24) without disk in housing.

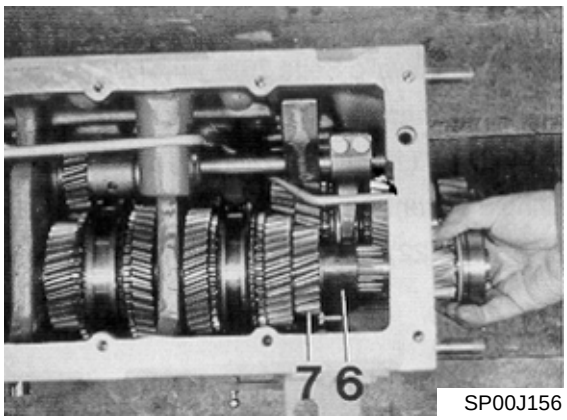


SS00J175

Insert spur gears and synchronizer units.



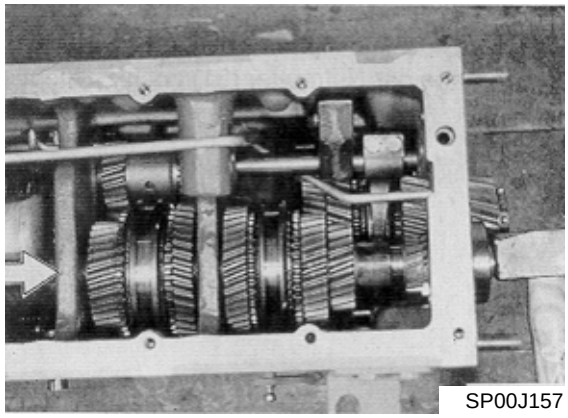
Insert spur gear wheel 2nd gear (7)
and mount countershaft with spacer sleeve (6).



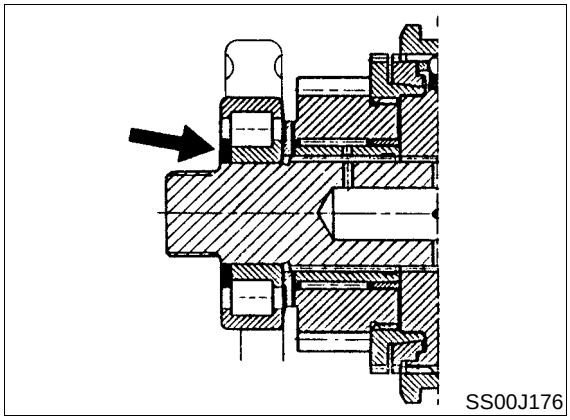
SP00J156

https://truckmanualshub.com/

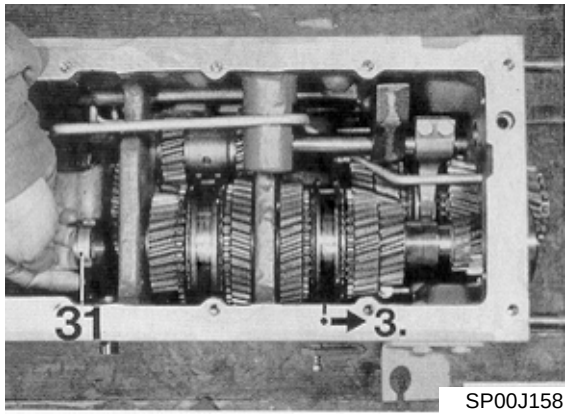
Install complete countershaft.
Attention: Hold bearing (arrow) against it.


SP00J157

Mount bearing disk.

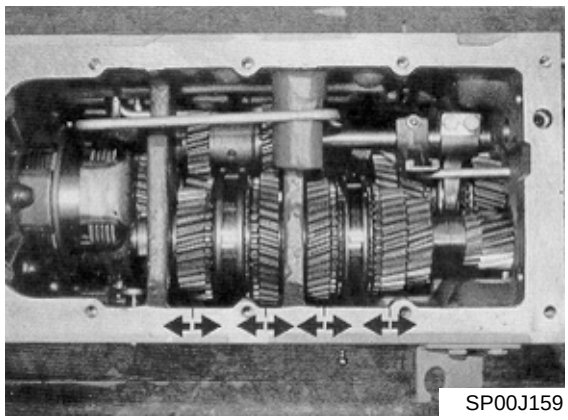

SS00J176

Engage 3rd gear.
Tighten castellated nut (31) with hook spanner and special tool (TS 133W) over the main shaft with 200 Nm.
Secure castellated nut.
(as main shaft page 78)



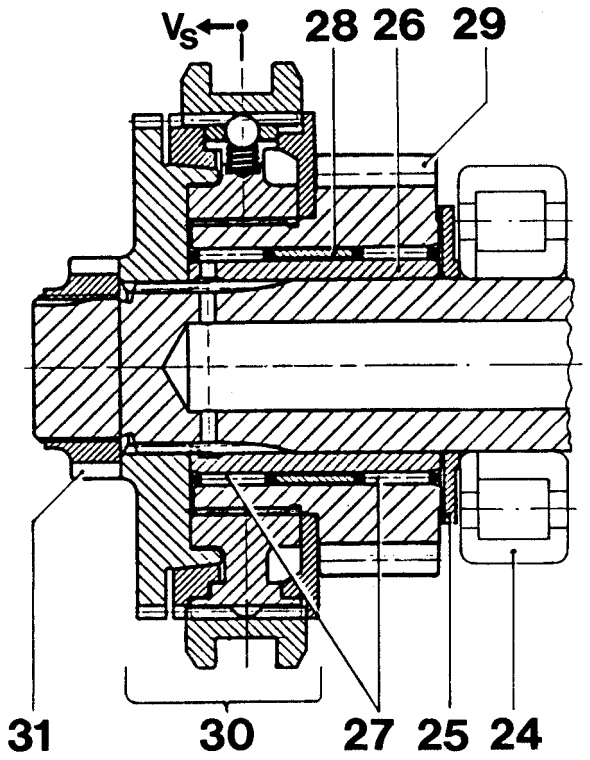
SP00J158

Check axial clearance (0.3 mm) of the spur gears.
Adjust axial clearance of the countershaft to 0.0-0.1 mm.
Reassemble transmission and rear axle.

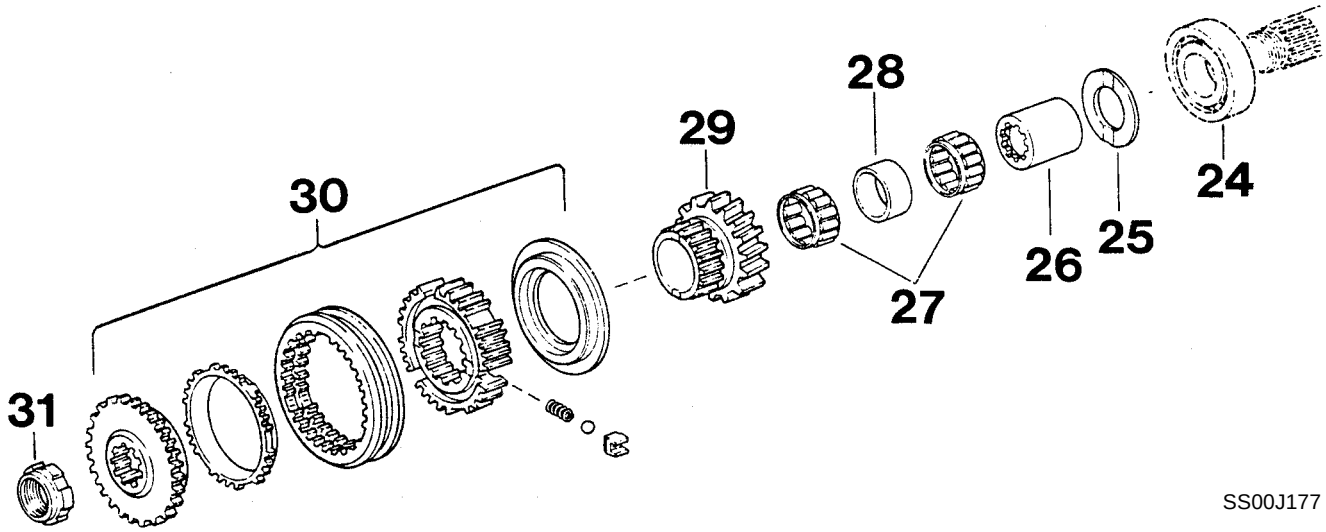

SP00J159

https://truckmanualshub.com/

Version with preselection group:
To be assembled before mounting the castellated nut (31)!

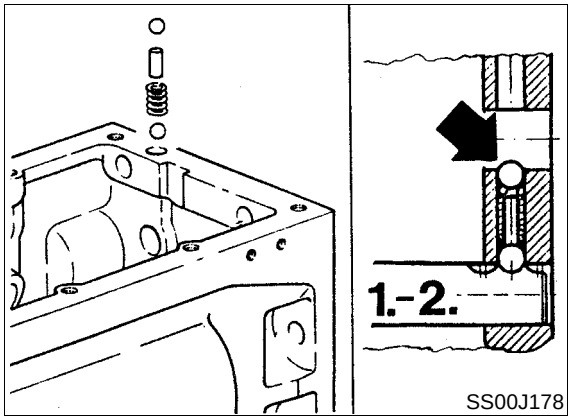


SS00K017



SS00J177

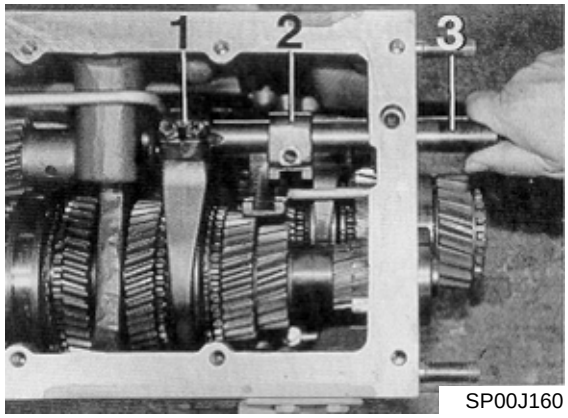
GEAR SHIFT MECHANISM 3rd-4th GEAR - installation.
Mount gear shift lock (balls, springs and barring bolt.)



SS00J178

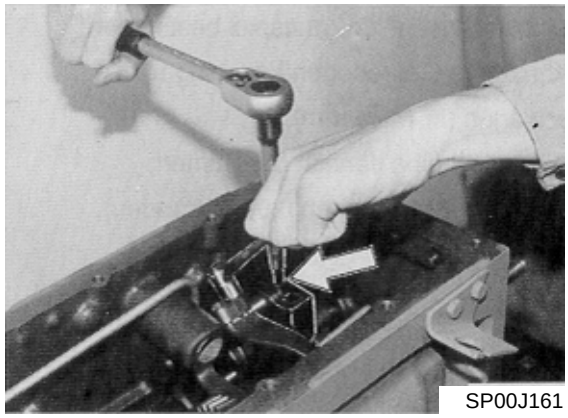
https://truckmanualshub.com/

Mount shift fork (1), driver (2) and shift rod (3).

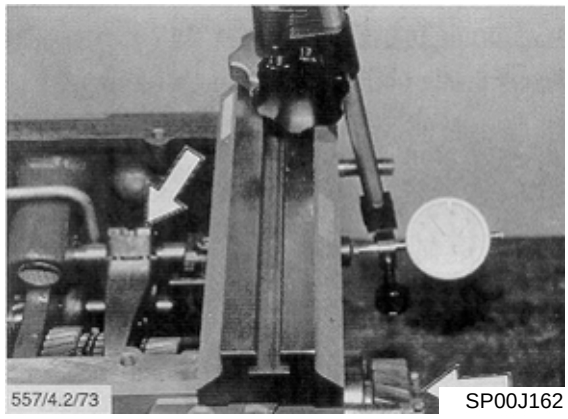


SP00J160

GEAR SHIFT MECHANISM 3rd-4th GEAR - adjustment.
Block countershaft.
(Not necessary if the rear axle is installed).
Fix driver 3rd-4th gear.
(Secure screws with Loctite).

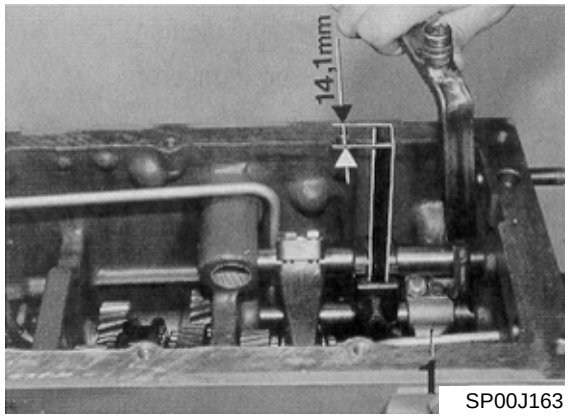

SP00J161

Adjustment of shift travel.
Then fix shift fork.
(Secure screws with Loctite).



SP00J162

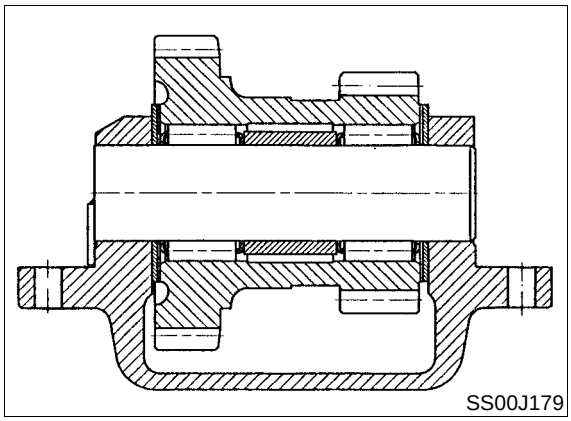
GEAR SHIFT MECHANISM 1st-2nd GEAR - adjustment.
Block main shaft.
(Not necessary if rear axle is still installed).
With gauge at 14.1 mm both drivers in neutral position.
Tighten shift fork (1).
Adjust shift travel as with 3rd-4th gear.



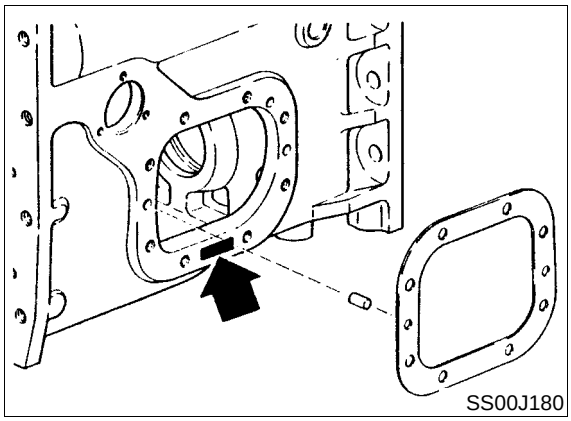
SP00J163

https://truckmanualshub.com/

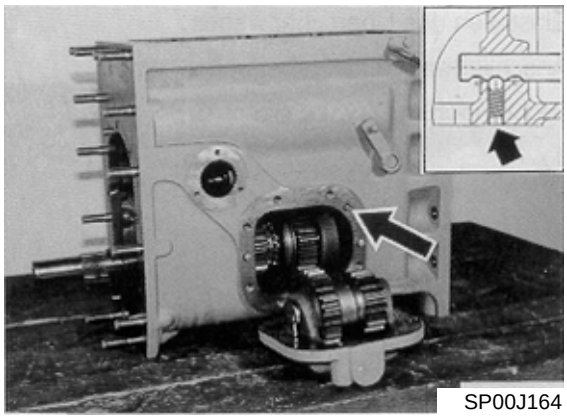
DOUBLE SPUR GEAR/SIDE COVER - reassembly.


SS00J179

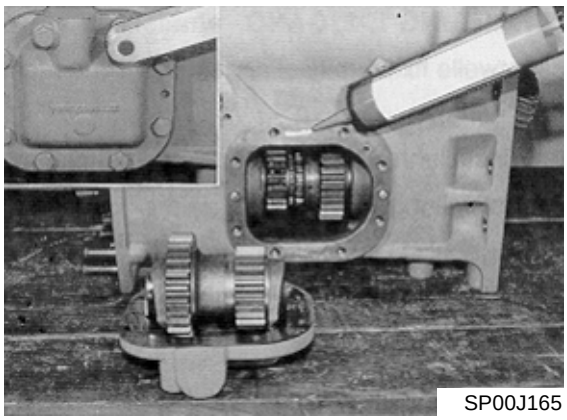
Determine adjusting disk for tooth backlash.
Deviation hammered into transmission housing
(in 1/100 mm).
Determine adjusting disk accordingly
(round off up to 0.02, from 0.03 round off upwards).


SS00J180

<u>Version with power take-off shaft</u>
Mount shift lock.


SP00J164

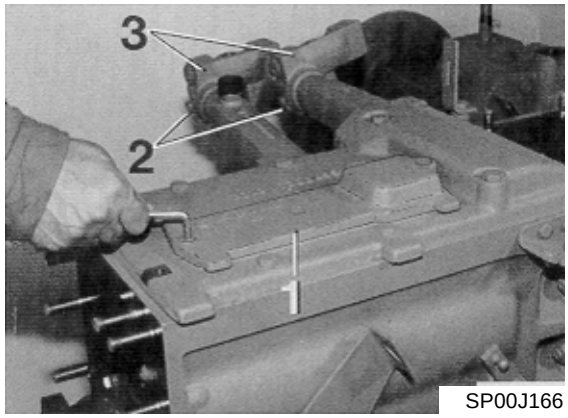
Seal flange surfaces with Loctite.
Mount cover with adjusting disk.
Tighten screws with torque.


SP00J165

https://truckmanualshub.com/

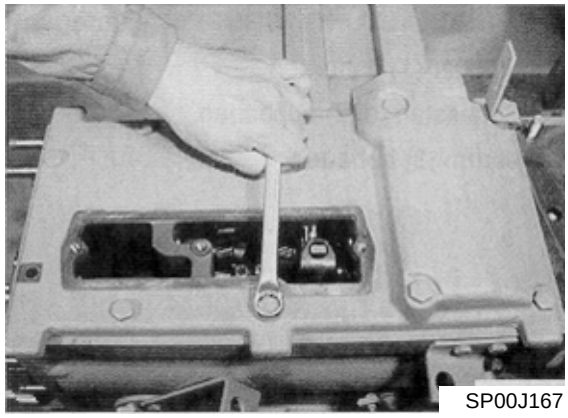
Side gear shift mechanism - disassembly

Dismount cover (1).
Loosen screws (2) and
remove shift stub axles (3).

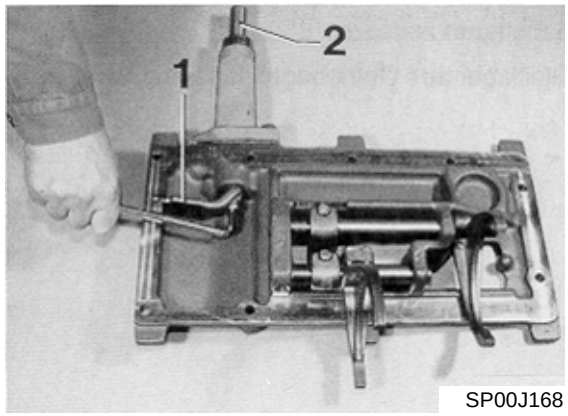


SP00J166

Dismount transmission housing cover.

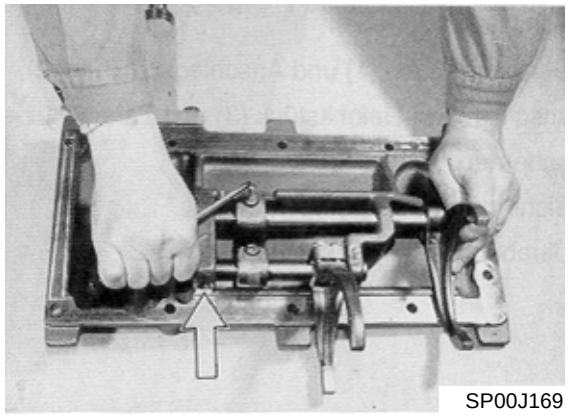

SP00J167

SIDE GEAR SHIFT MECHANISM „GEAR“ - disassembly.
Remove shift finger (1).
Dismantle shift shaft (2).



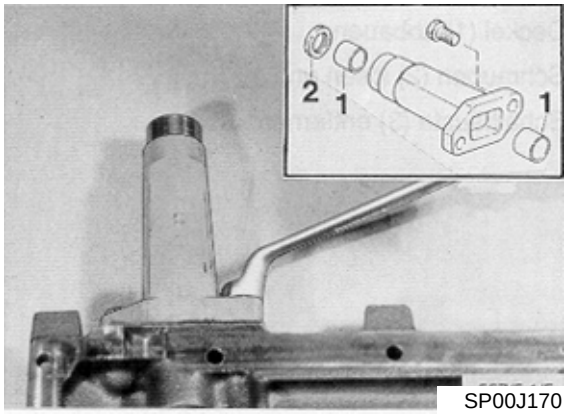
SP00J168

Dismantle driver, shift rods and shift forks.
Pay attention to shift lock!


SP00J169

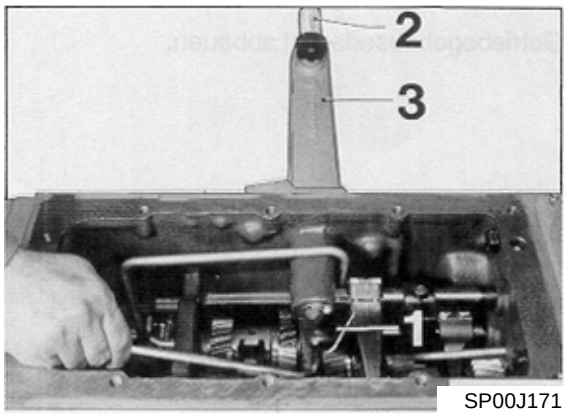
https://truckmanualshub.com/

Dismount shift tower.
Dismantle sliding bearing (1) and scraper ring (2).



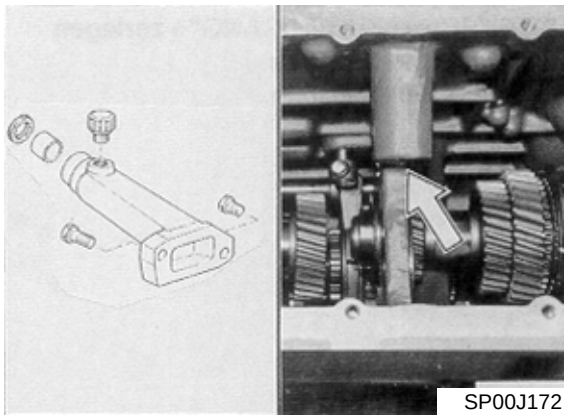
SP00J170

SIDE GEAR SHIFT MECHANISM „GROUP“ - disassembly.
Remove shift finger (1)
and dismantle shift rod (2).
Dismount shift tower (3).

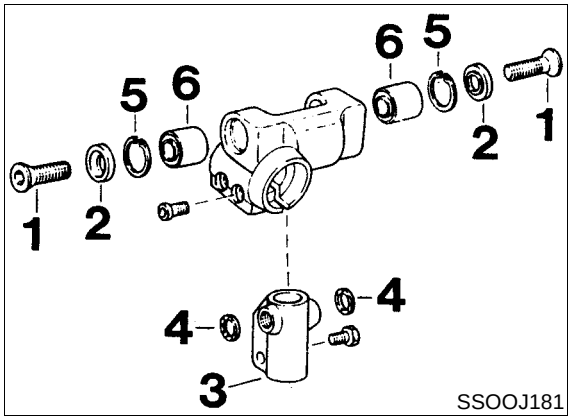


SP00J171

Disassemble shift tower.
Dismantle sliding bearing from transmission housing.


SP00J172

Disassemble shift stub axle.
Remove countersunk screws (1) and limit disks (2),
then remove joint piece (3) and serrated disks (4).
Release lock rings (5).
Force out ultrabushes (6).

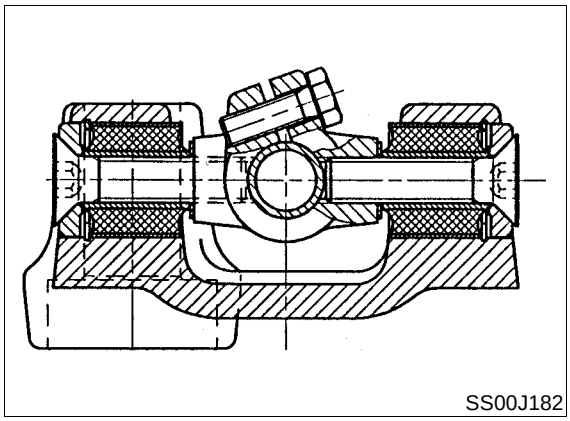


SSOOJ181

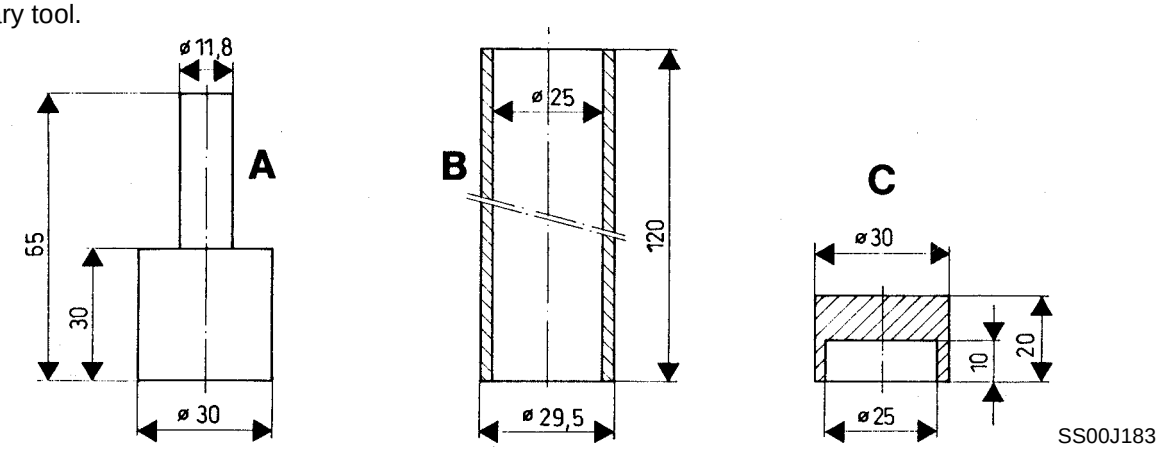
https://truckmanualshub.com/

Side gear shift mechanism - reassembly

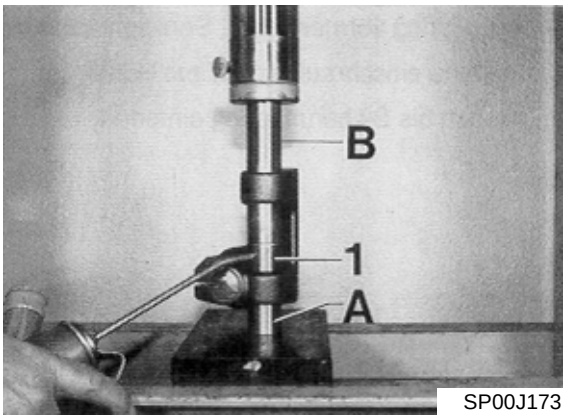
Reassemble shift stub axle.



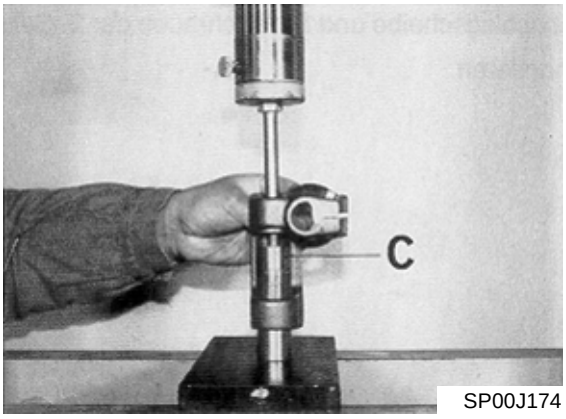
Make up auxiliary tool.



Tension on lock ring.
Lubricate ultrabush (1),
center with auxiliary mandrel (A)
and press in with sleeve (B).
Attention: Bevel of ultrabush towards joint piece.



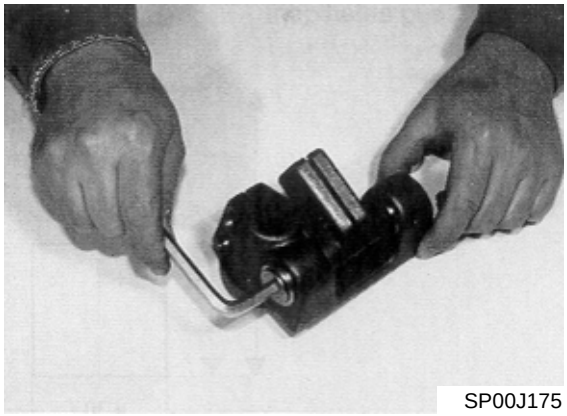
Tension second lock ring.
Press in second ultrabush with auxiliary tool (C)
and with the help of a long screw. (M 10).



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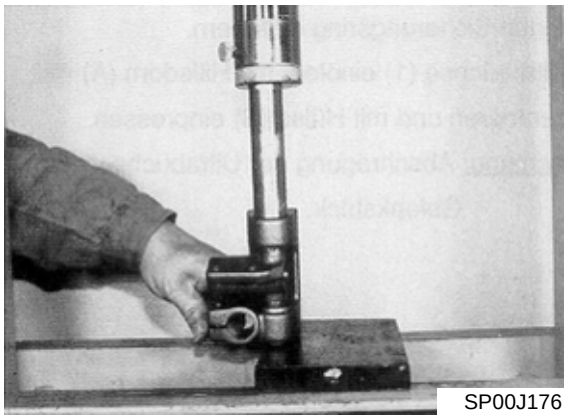
Relieve lock ring.
Press ultrabush down approx. 4 mm.
(For easier assembling of serrated disks and joint piece)

Preassemble joint piece with both serrated disks.
Mount stop disk and countersunk screw on one side.



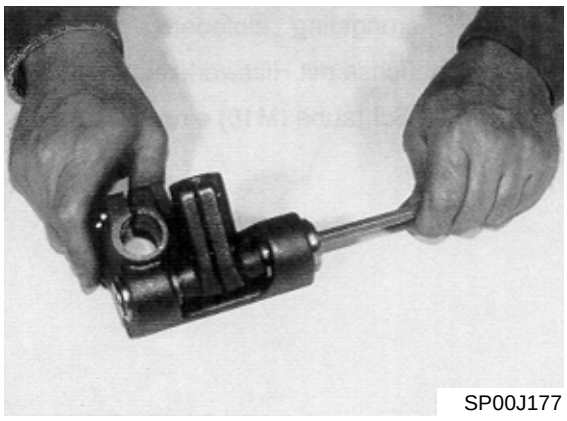
SP00J175

Preassemble lock ring. Screw in countersunk screw for centering and press in with sleeve until the lock ring snaps in.



SP00J176

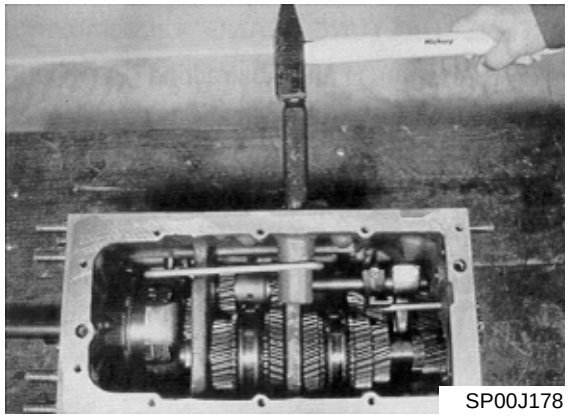
Mount stop disk and countersunk screw of the 2nd side.



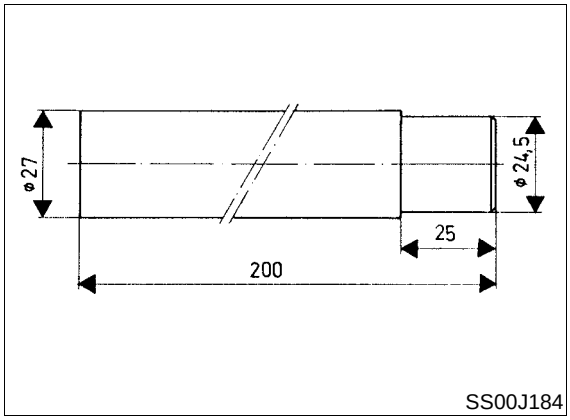
SP00J177

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SIDE GEAR SHIFT MECHANISM „GROUP“-reassembly.
Install sliding bearing in transmission housing with auxiliary tool.

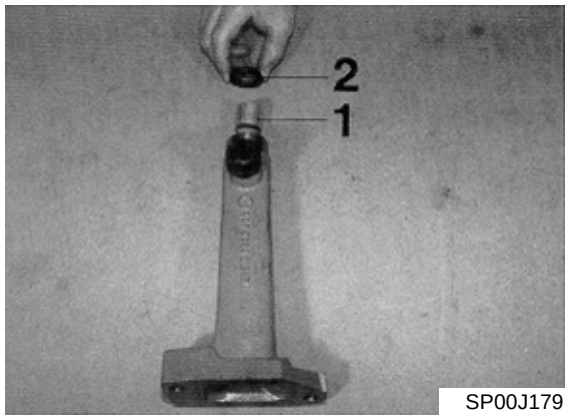

SP00J178

Make auxiliary tool.



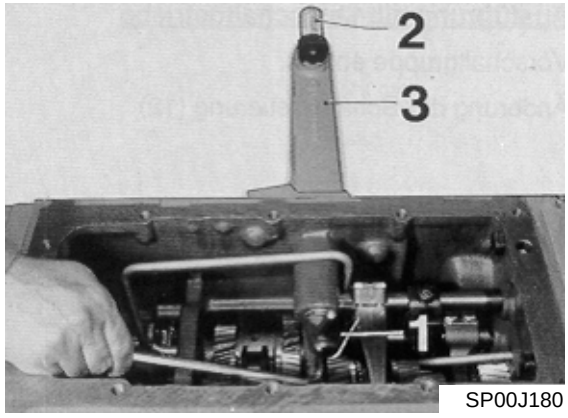
SS00J184

Reassemble shift tower.
Mount sliding bearing (1) and scraper ring (2).



SP00J179

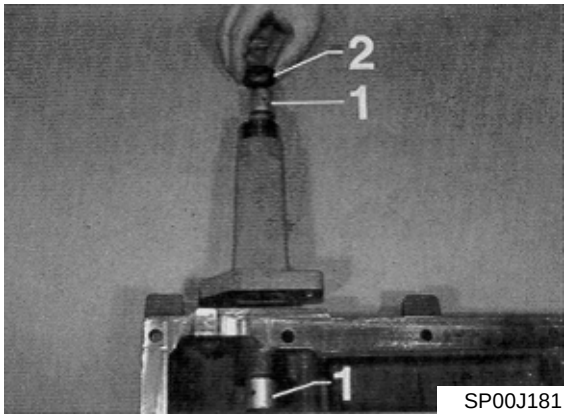
Seal shift tower (3) and install shift shaft (2).
Fix shift finger (1).
Secure screw with Loctite.



SP00J180

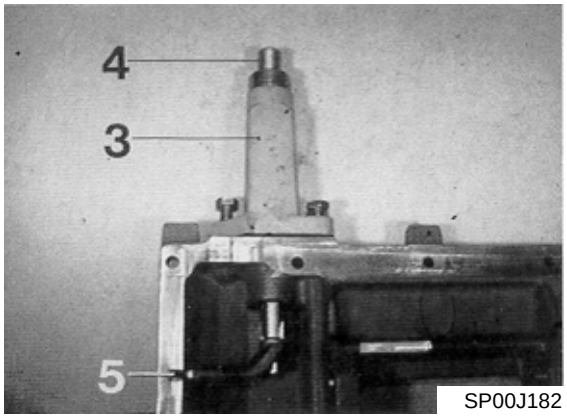
https://truckmanualshub.com/

SIDE GEAR SHIFT MECHANISM -“GEAR“ - reassembly



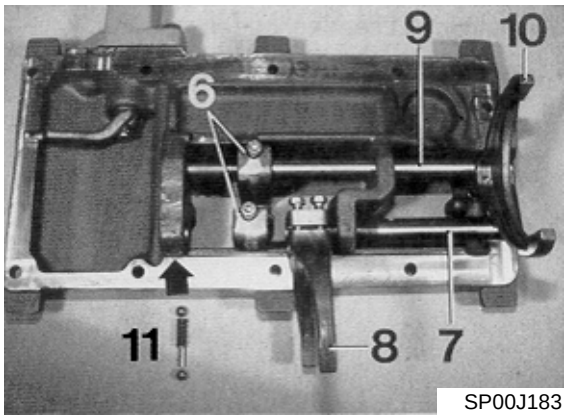
SP00J181

Seal shift tower (3) and mount,
install shift shaft (4) and fix shift finger (5).
Secure screw with Loctite.



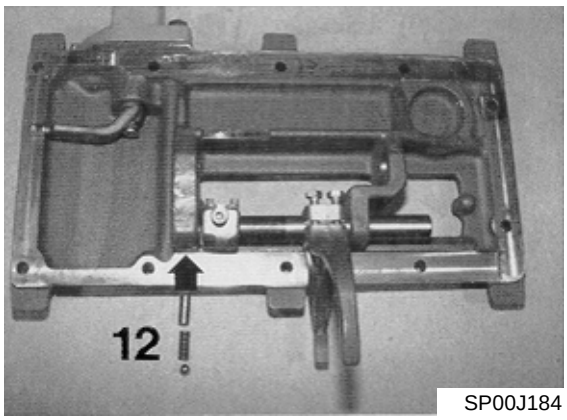
SP00J182

Version with preselection group:
Mount both drivers (6), shift shaft-FR (7),
shift fork (8), shift shaft-FS (9) and shift fork (10).
Attention: Installation of the shift lock (11)



SP00J183

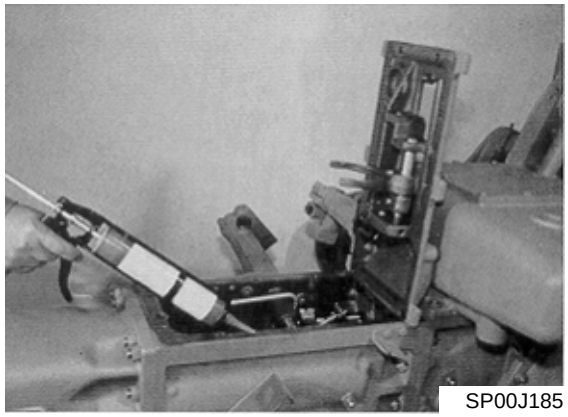
Version with power shift transmission
Preselection group not applicable.
Alteration of the shift lock (12).



SP00J184

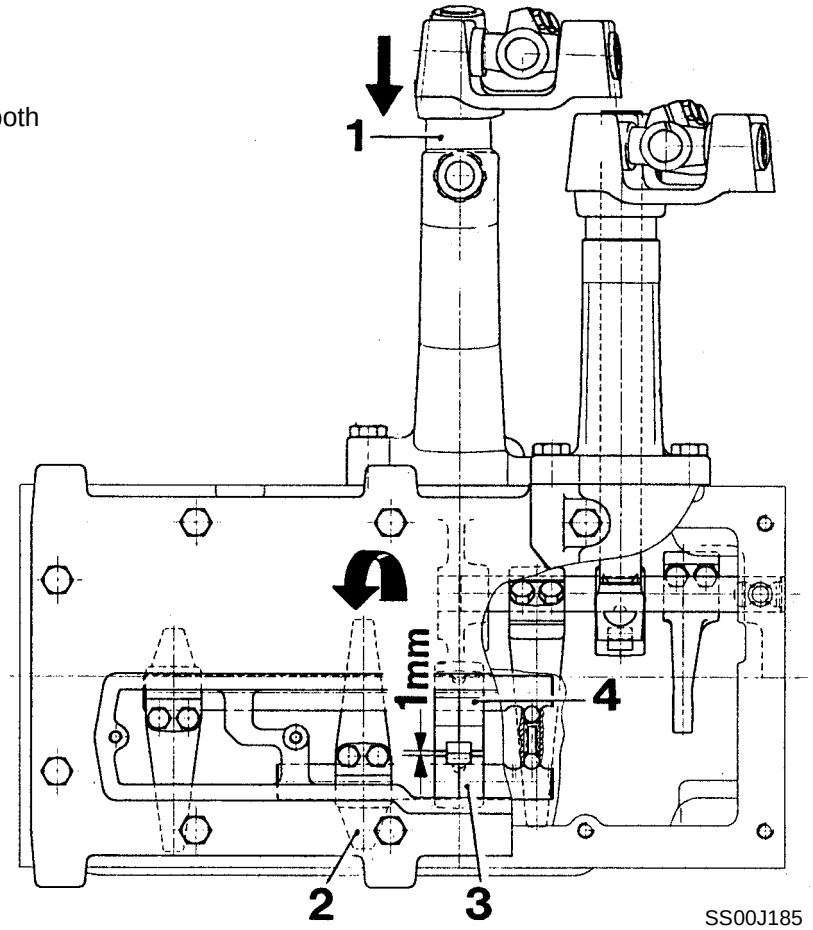
https://truckmanualshub.com/

Seal and mount preassembled shift cover.
Fix shift stub axles.



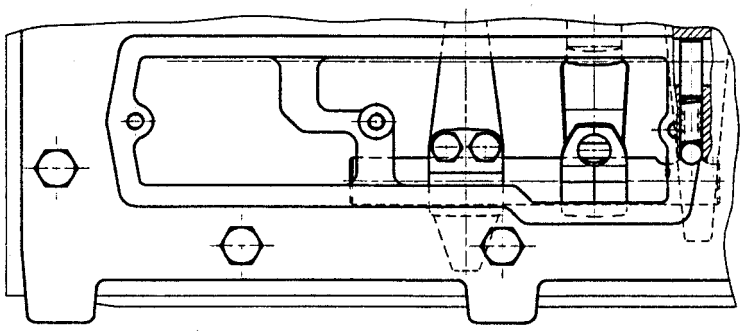
SP00J185

GEAR SHIFT MECHANISM F-R/FS -adjust.
Press shift shaft FR (1) to center up to limit.
Press shift fork (2) upwards and clamp.
Check driver FR (3) shift travel (0.1 mm) on both sides.
Align driver FS (4) on driver FR (3)
and check shift travel (0.5 mm).
Check E dimension (1 mm) of both drivers.
Secure all screws with Loctite.



SS00J185

<u>Version with power shift transmission</u>
Adjustment of preselection group not applicable.



SS00J186

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5.2

Mount cover.

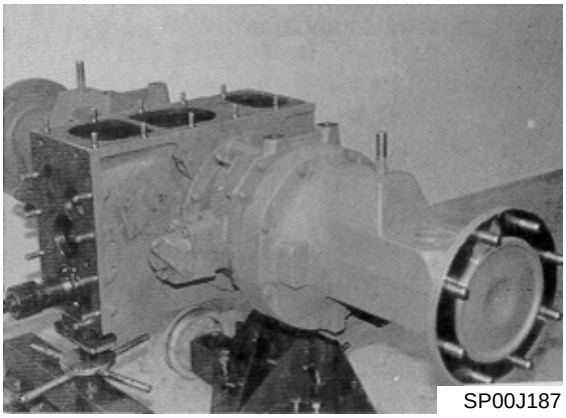


SP00J186

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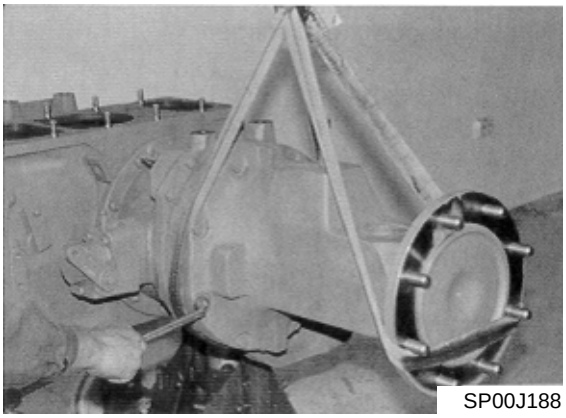
Rear axle - disassembly

Dismount propulsion unit (chapter 4.1)
and lifting gear (chapter 8.1).



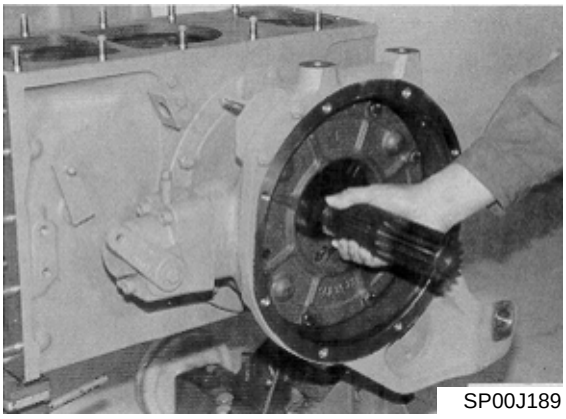
SP00J187

Dismount axle hub.
Right-hand axle half does not have to be dismounted.



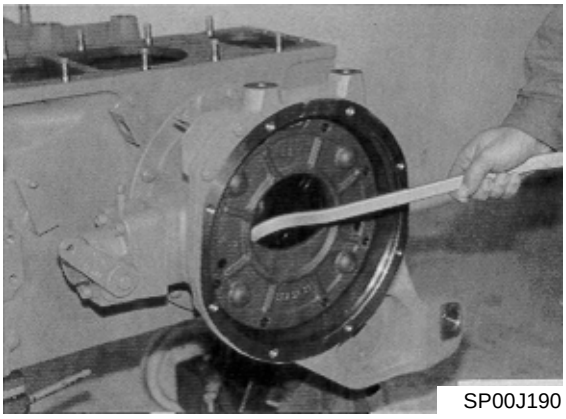
SP00J188

Pull out pinion shaft.



SP00J189

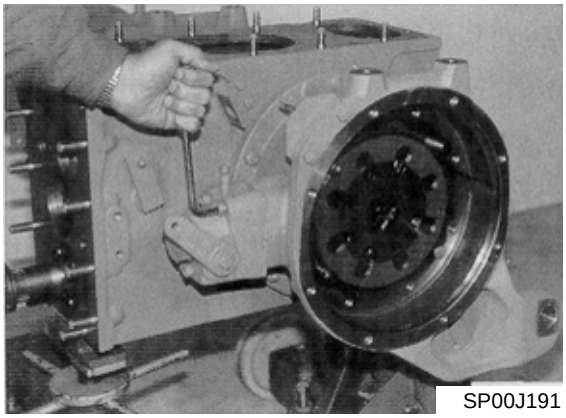
Brake - disassembly.
Dismount brake plate.



SP00J190

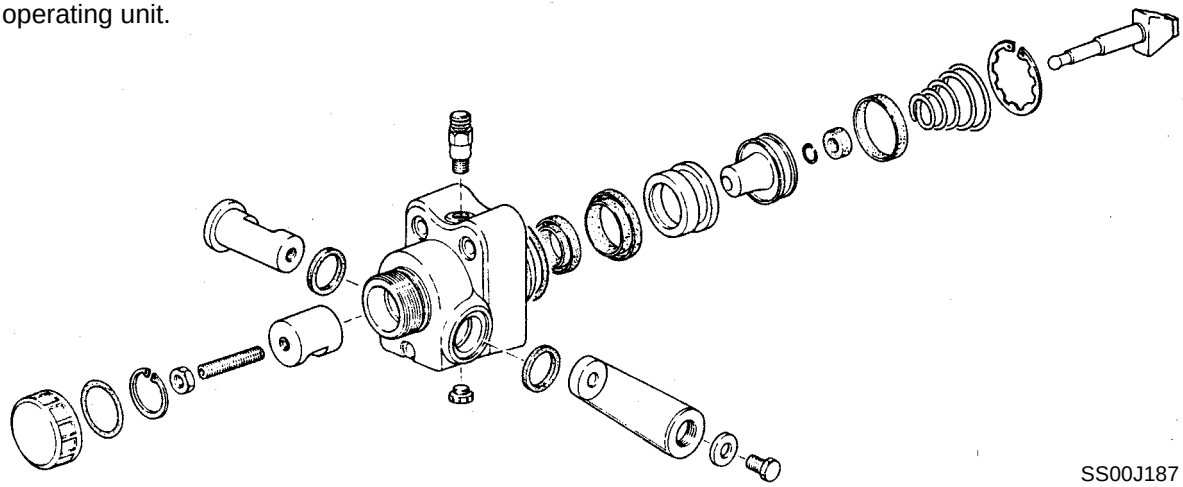
https://truckmanualshub.com/

Dismount operating unit.



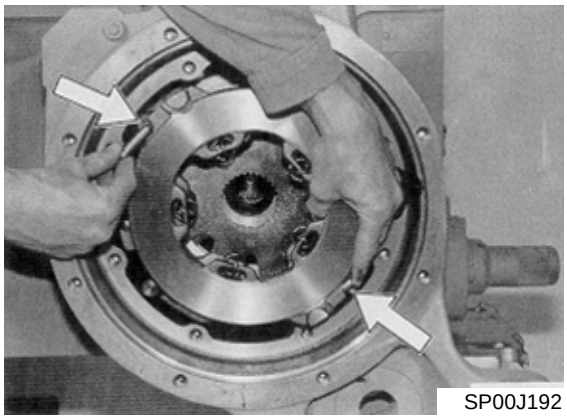
SP00J191

Disassemble operating unit.



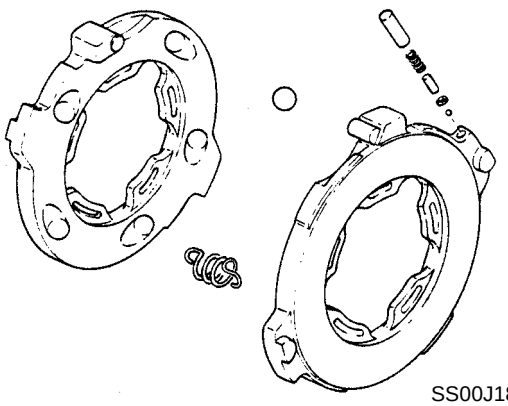
SS00J187

Dismantle complete brake unit.
Attention: Secure ball, disk, pin, spring and piston.



SP00J192

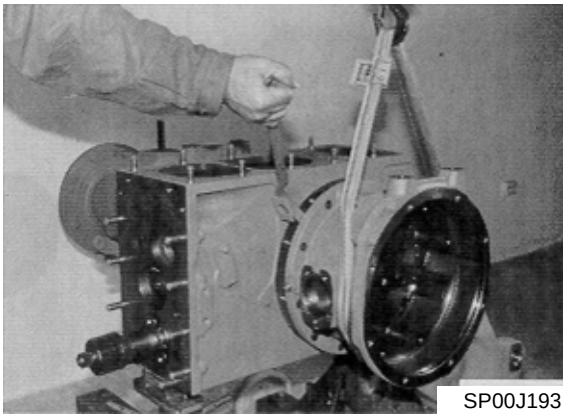
Disassemble operating disk.



SS00J188

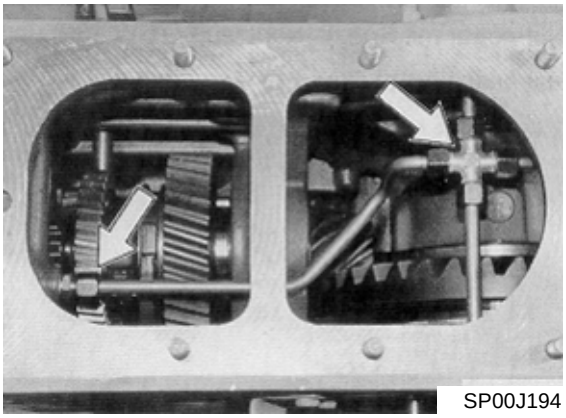
https://truckmanualshub.com/

Dismount brake housing.
Attention: Adjusting disks



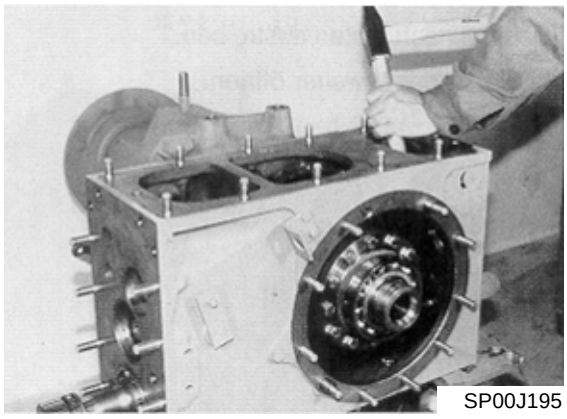
SP00J193

Dismantle oil lines.

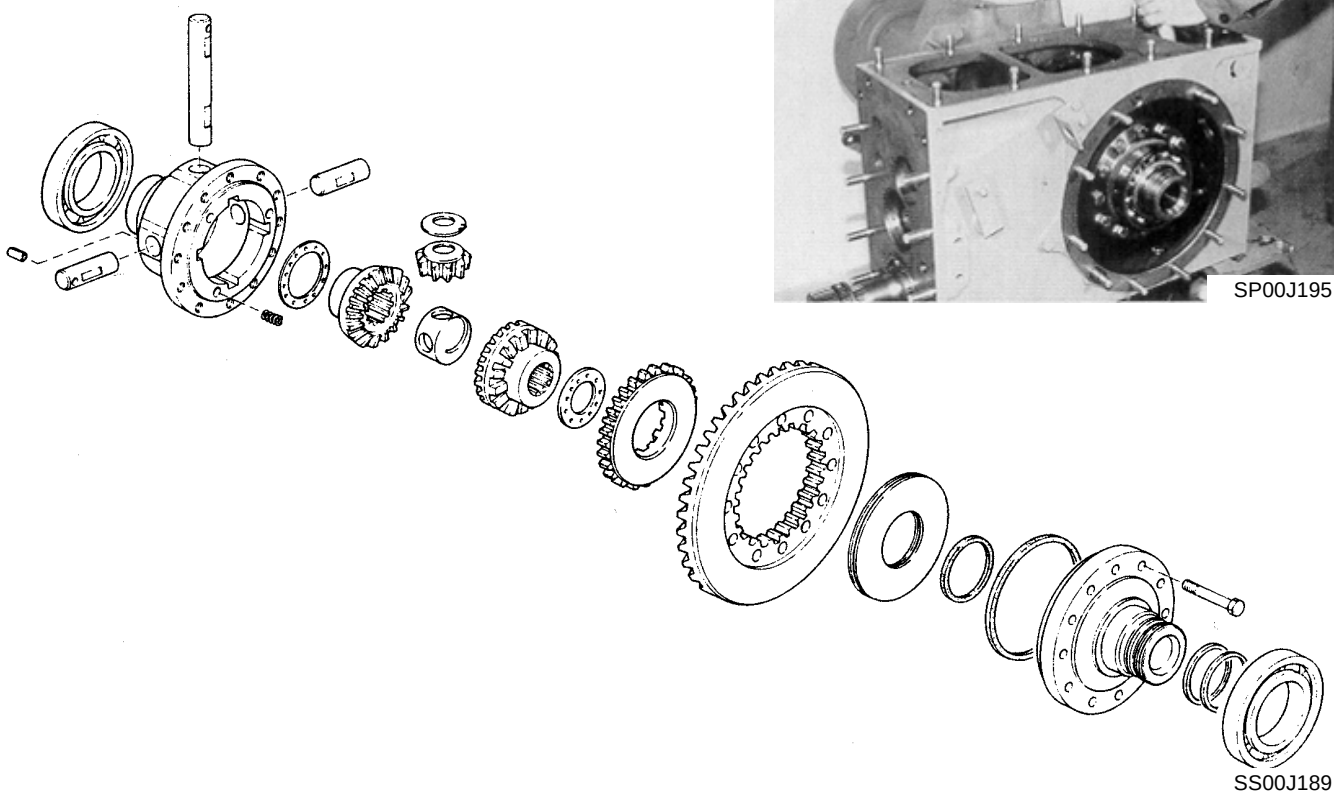


SP00J194

DIFFERENTIAL - disassembly



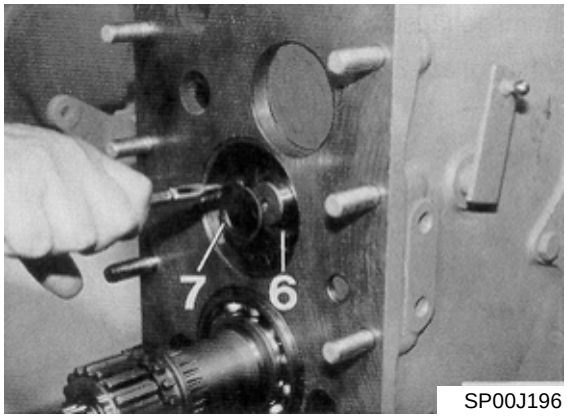
SP00J195



SS00J189

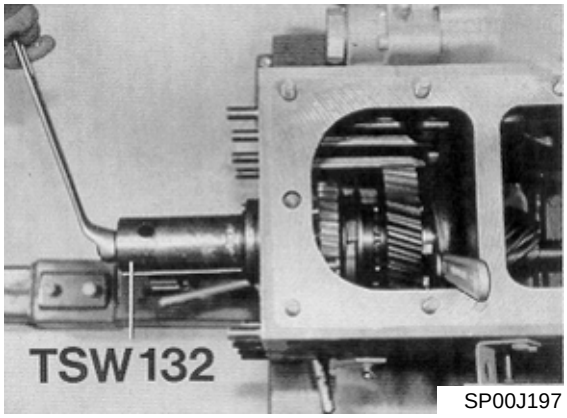
https://truckmanualshub.com/

BEVEL PINION - dismantle.
Remove lock ring (7) and support disk (6).



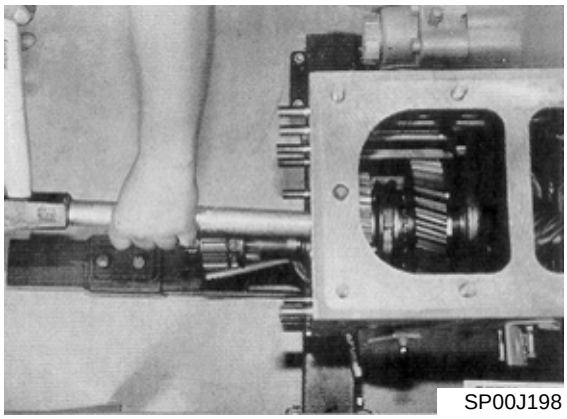
SP00J196

Open castellated nut with special tool (TSW 132) and hook spanner.

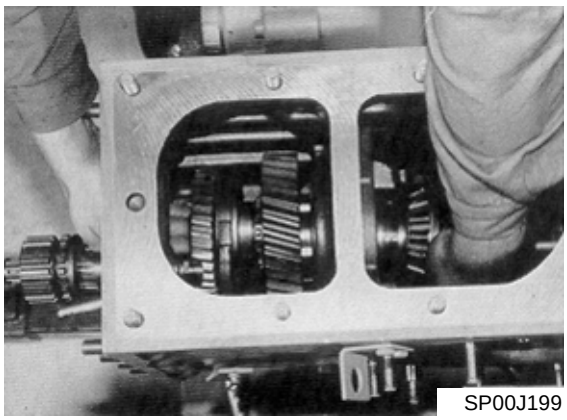


SP00J197

Force pinion out to the rear.
Open castellated nut further thereby.

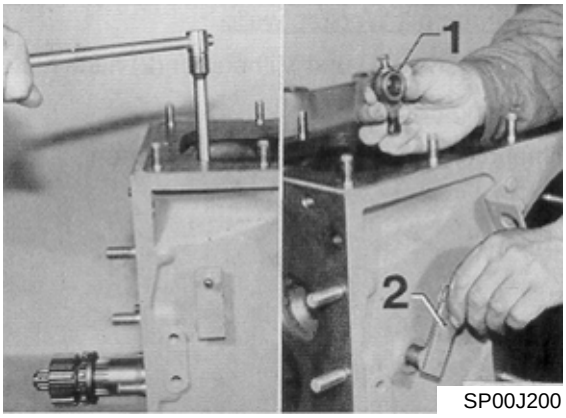

SP00J198

Dismantle pinion with adjusting disks, bearing, spur gears and castellated nut.


SP00J199

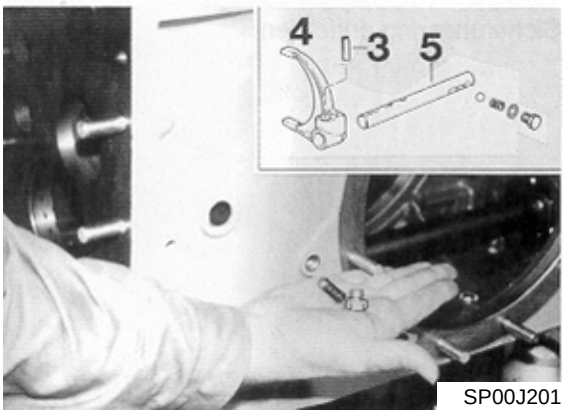
https://truckmanualshub.com/

GEAR SHIFT MECHANISM FIELD/ROAD - dismantle.
Dismantle shift finger (1) and shift shaft (2).



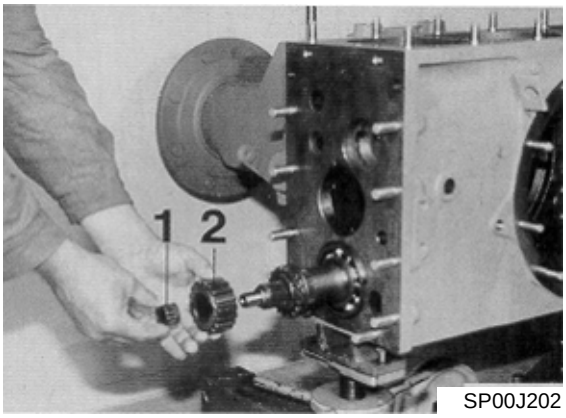
SP00J200

Remove shift lock.
Force out tension pin (3).
Remove shift fork (4) and shift shaft (5).



SP00J201

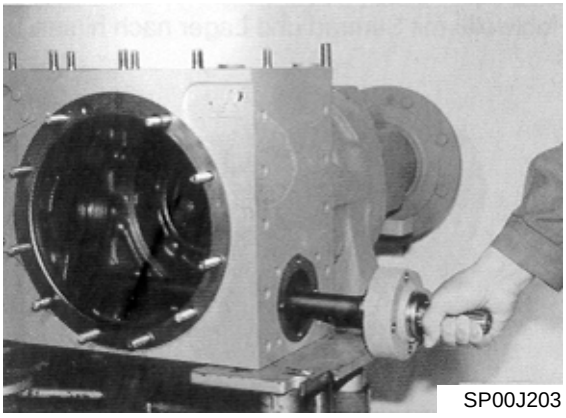
POWER TAKE-OFF SHAFT - dismantle.
Version with travel power take-off shaft
Dismount needle bearing (1)
and sliding sleeve carrier (2).



SP00J202

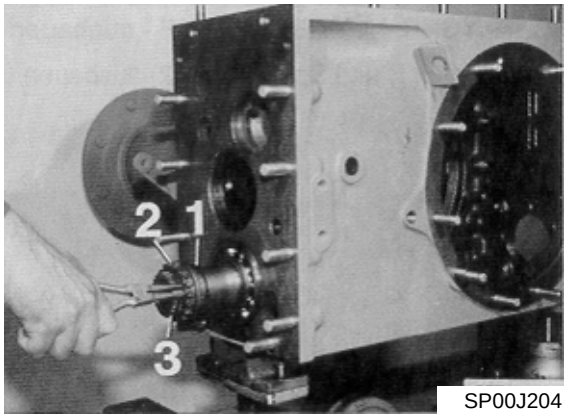
Dismantle power take-off shaft.

Attention: Engage travel power take-off shaft if the power take-off shaft is to be dismantled whilst assembled.


SP00J203

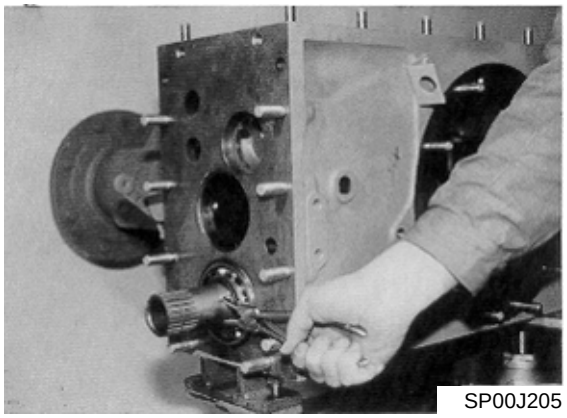
https://truckmanualshub.com/

Version with travel power take-off shaft
Lock ring (1) and driver (2) at the rear.
Remove radial sealing ring (3).
Remove driver and lock ring.

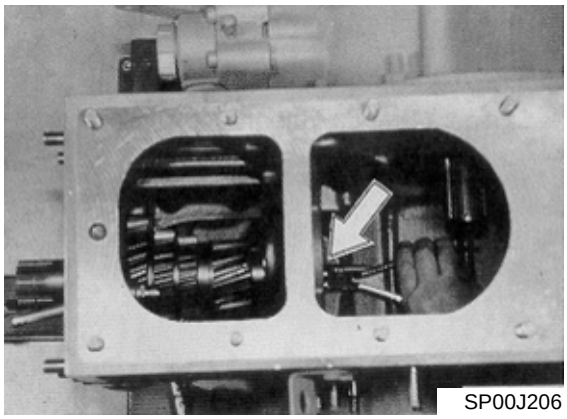


SP00J204

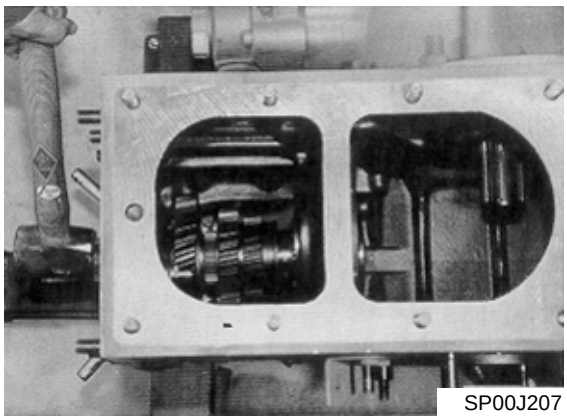
Remove lock ring.


SP00J205

Remove lock ring.

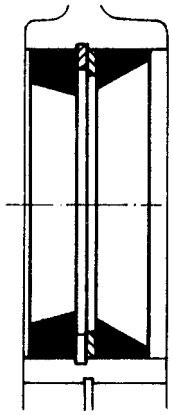

SP00J206

Dismantle hollow shaft with spur gear and bearing to the rear.


SP00J207

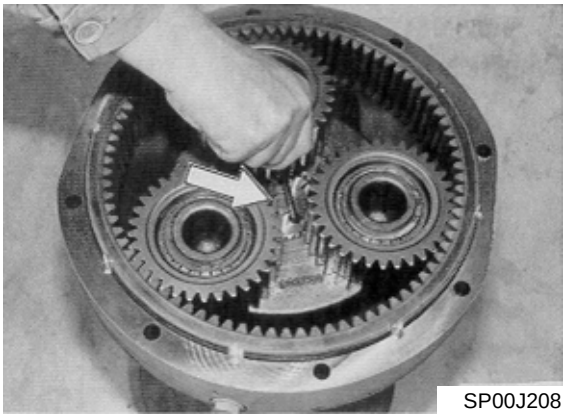
https://truckmanualshub.com/

Dismantle pinion bearing outer rings, adjusting disks for contact reflection and lock ring from rear axle housing.



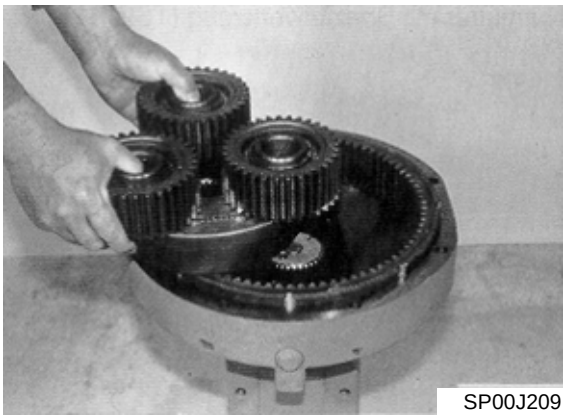
SS00J190

AXLE HUB - disassembly.
Unlock planetary gear carrier.
Remove stud and ball.
Remove cylinder roller.



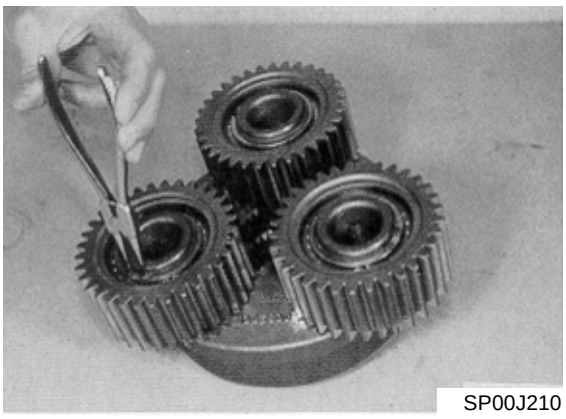
SP00J208

Remove planetary gear carrier.



SP00J209

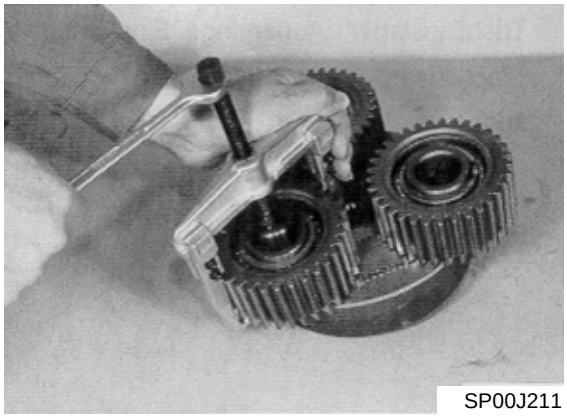
Remove lock rings.



SP00J210

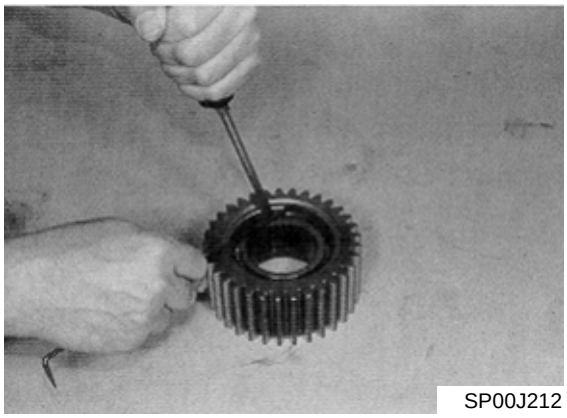
https://truckmanualshub.com/

Dismount planetary gears with extractor.



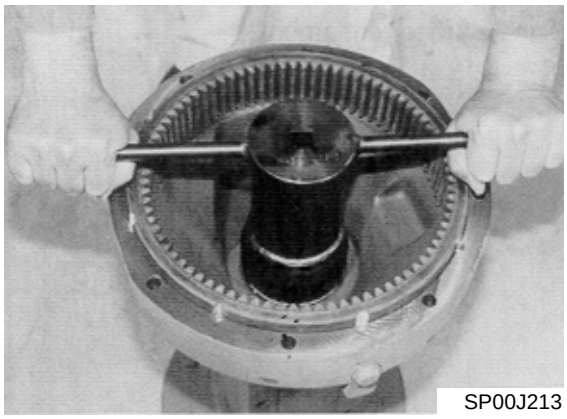
SP00J211

Remove snap rings on both sides.
Dismantle bearing.



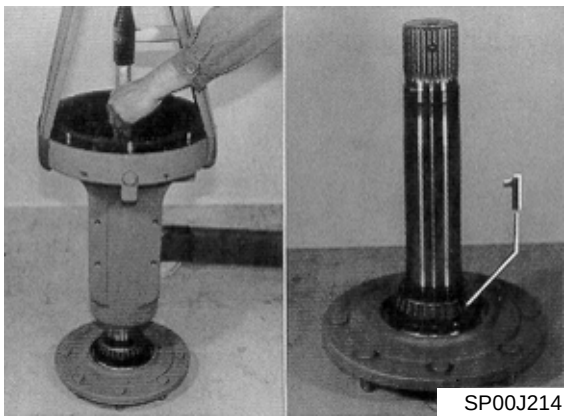
SP00J212

Loosen castellated nut with special tool (TSW 129).



SP00J213

Dismantle axle shaft and pull-off bearing (1).

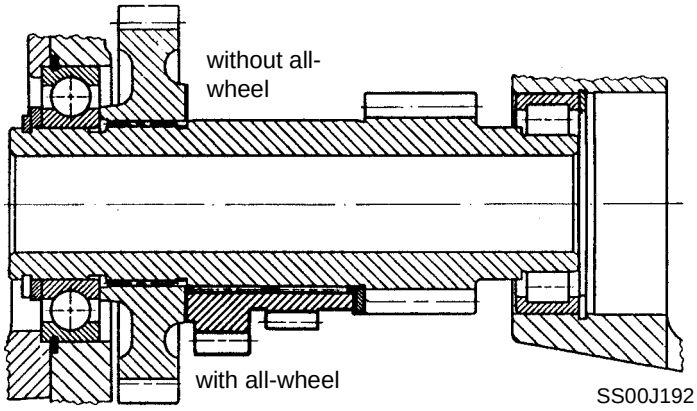


SP00J214

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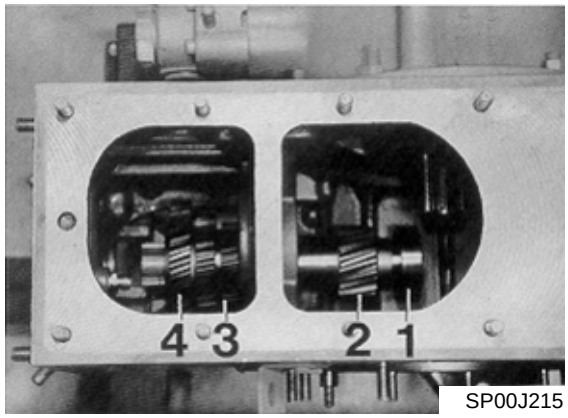
Rear axle - reassembly

HOLLOW SHAFT - installation



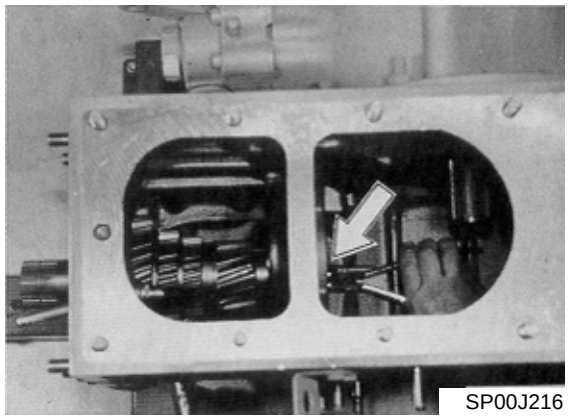
SS00J192

Roller bearing (1) on hollow shaft (2).
Install double spur gear for all-wheel (3) with disk and bearing as well as spur gear.

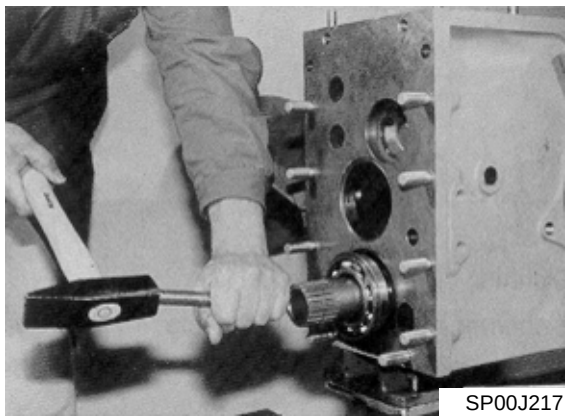


SP00J215

Snap on rear lock ring.

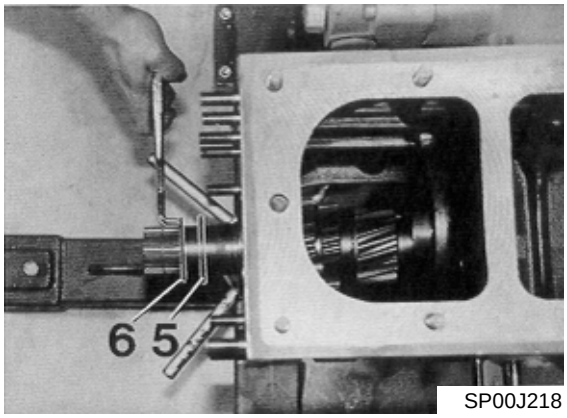

SP00J216

Install bearing with snap ring.


SP00J217

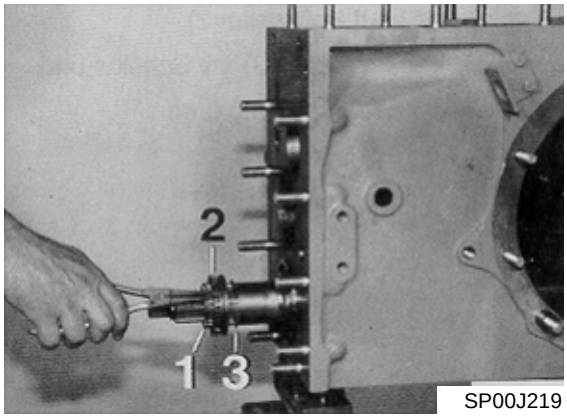
https://truckmanualshub.com/

Install spacer disk (5) and lock ring (6).



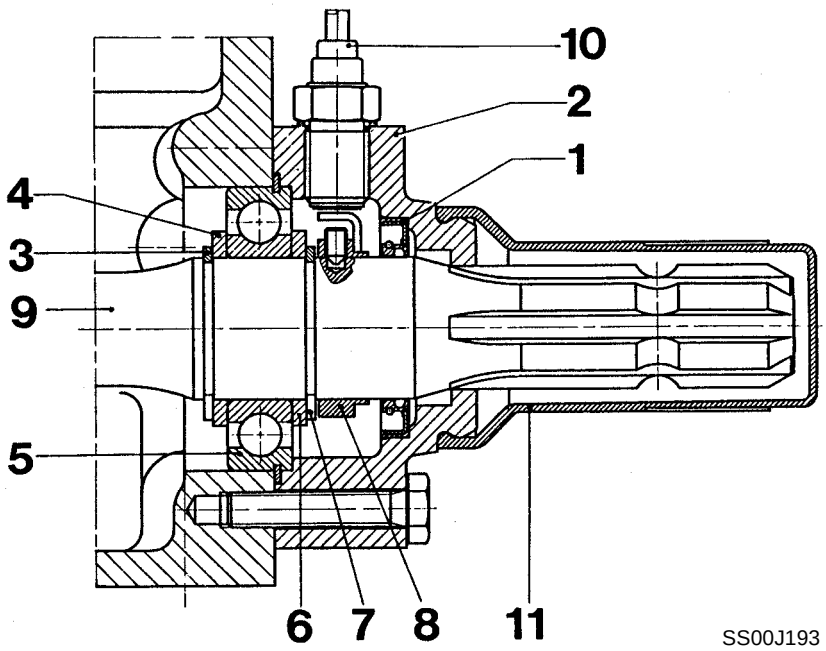
SP00J218

Version with travel power take-off shaft
Mount lock ring (1), driver (2) and shaft ring (3).



SP00J219

POWER TAKE-OFF SHAFT - installation

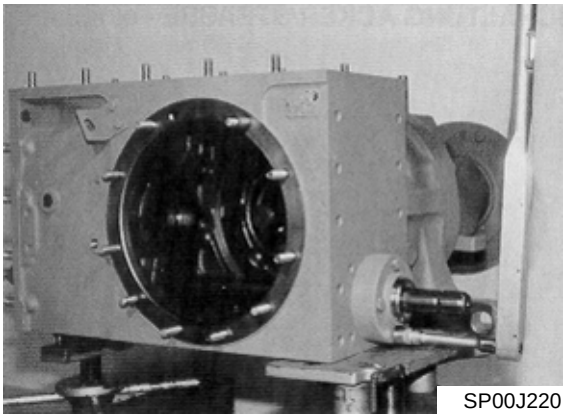


SS00J193

Sealing ring (1) in bearing cover (2).
Lock ring (3), thrust disk (4), grooved ball bearing (5),
thrust disk (6), lock ring (7),
and transmitter wheel (8) on power take-off shaft (9).

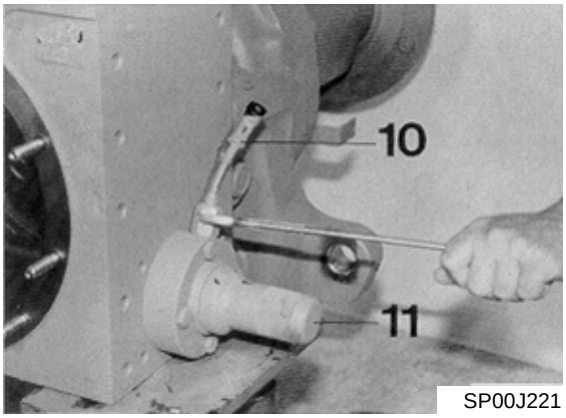
https://truckmanualshub.com/

Mount power take-off shaft with bearing cover.



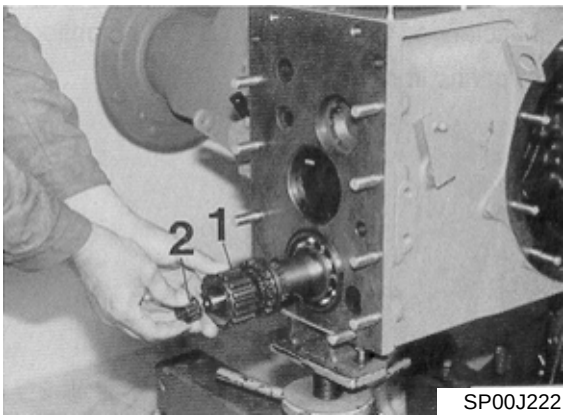
SP00J220

Mount inductive pickup (10) (50 Nm)
and power take-off shaft protection (11).



SP00J221

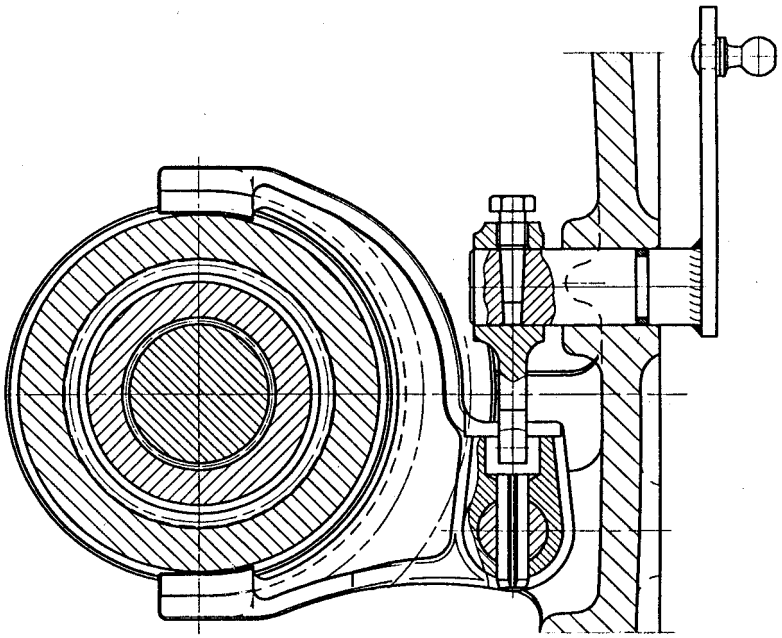
Mount sleeve carrier (1) and needle bearing (2).



SP00J222

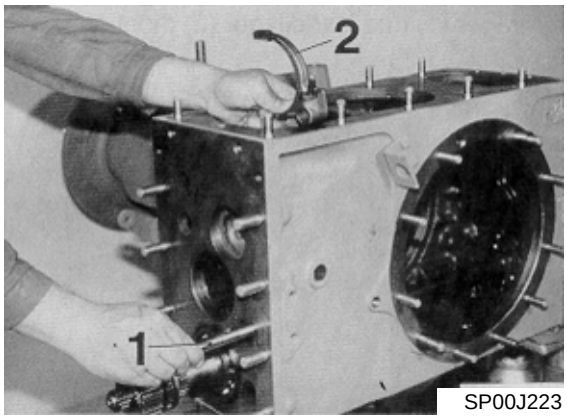
https://truckmanualshub.com/

GEAR SHIFT MECHANISM FIELD/ROAD - installation



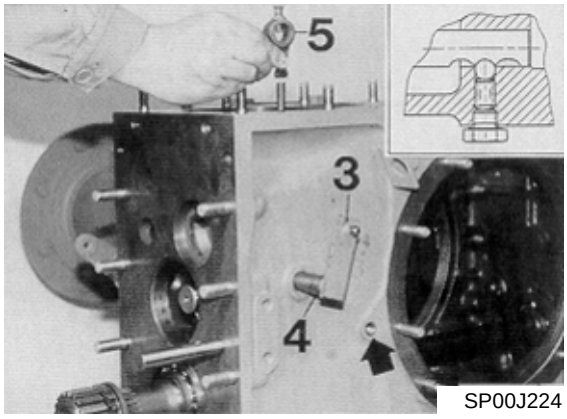
SS00J194

Mount gear shift rod (1) and shift fork (2).
Secure with tensioning pin.



SP00J223

Mount gear shift shaft (3) with O-ring (4)
and shift finger (5).
Install shift lock (arrow).



SP00J224

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CONTACT REFLECTION ADJUSTMENT bevel pinion - crown gear (Gleason type gear teeth)

This is a dimensional adjustment based on a standard adjusting disk (s = 4.00 mm) whereby the dimension of the housing (0), pinion (0) and rear (drive direction) pinion bearing (31,5 mm) is standard. Every deviation (correction) of a standard dimension must therefore be compensated by changing the thickness of the adjusting disks. In order to simplify the adjusting procedure, the deviation (correction) from the specified value in a hundredth millimeter is given on the housing and pinion, not the measured dimension.

The actual dimension of the rear pinion bearing is to be measured at all costs and is to be compared to the standard dimension (T = 31.5 mm) in order to determine the correction.

A = Housing correction, to be read on the upper surface of the rear axle housing in right drive direction
A1 = Housing dimension, to be measured from center of crown gear to lock ring groove between the pinion bearings.
B = Pinion correction, to be read from the face surface of the pinion.
B1 = Pinion dimension, to be measured from the center of the crown gear to the mating surface of the pinion on the rear angular roller bearing.
C = Standard adjusting disk (s = 4.00 mm)
D = Correction of the rear pinion bearing, calculated from the difference between measured dimension and standard dimension (T = 31.5 mm)
X = Adjusting disk thickness, calculated from the standard disk (s = 4.00 mm) by means of the corrections

Note: 0.04 mm is rounded off downwards --- 0.05 mm is rounded off upwards

CONTACT REFLECTION ADJUSTMENT (example**)**

A (Housing correction) = -7

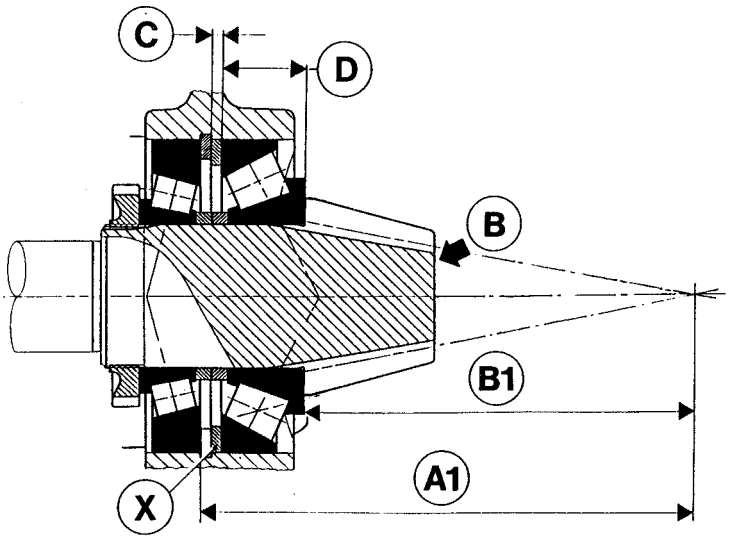
B (Pinion correction) = + 25
Bearing standard dimension
= 31.5 mm
Bearing measured = 31.62 mm
D (Bearing correction) = + 00.12 mm

Attention

Check contact reflection after reassembly
Tragbildkontrolle

Correction A is added to the disk thickness (s) or substracted from the disk thickness (s) as applicable
= Housing = - disk +housing = +disk
In the case of correction B and D the sign must be changed from + to - and from - to +.
The value of the disk is thus subtracted or addes.

C (Standard disk)	=	4,00 mm	
A = **-** 7	=	**-** 0,07 mm	
	=	3,93 mm	
B = **+** 25	=	**-** 0,25 mm	
	=	3,68 mm	
D = **+** 12	=	**-** 0,12 mm	
X =		3,56 mm	**3,60 mm**



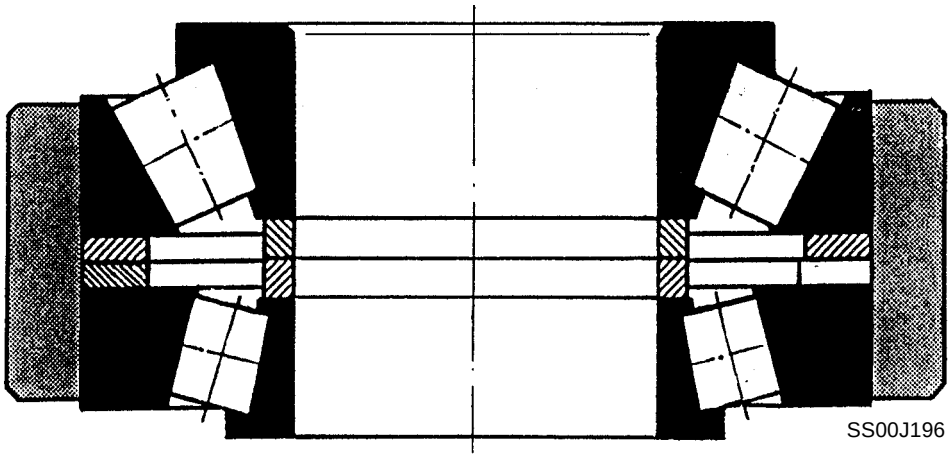
SS00J195

https://truckmanualshub.com/

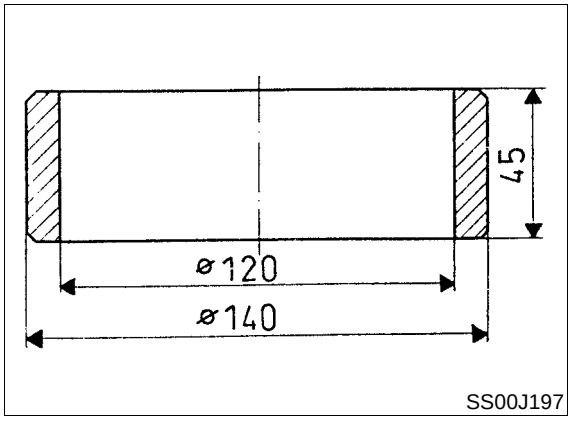
ADJUSTMENT OF THE BEVEL PINION BEARING (bearing pretension)
The bearing pretension of the pinion bearing must be reset before fitting the pinion.

This adjustment is best carried out as follows with the bearings removed:
1. Lay front bearing on the shoulder of the inner ring.
2. Lay determined adjusting disk for contact reflection and the lock ring on the bearing outer ring.
3.)Lay the adjusting disks of the bearing pretension of the old bearing centered on the bearing inner ring.
4. Lay the rear bearing on top with the shoulder of the inner ring upwards.
5. Center the bearings to each other via the outer rings with the help of a centering aid.
6. Carefully press the bearings together via the inner rings. Turn continually.
   Pressing power up to 4.000 kg.
7. Check the rolling moment or set to approx. 4-5 Nm by changing the adjusting disks.
8. Increase the adjusting disk thickness by 0.05 mm. Now the bearings should turn easily
   at a pressing force of 4.000 kg.
9. Check the pinion bearing pretension after installation in the rear axle house.
   M =specified moment 0.1-1.5 Nm (0,01-0,15kg)
   F =value for the spring balance in kg
   R =radius of the bearing in m

$$F = \frac{M}{R}$$


SS00J196

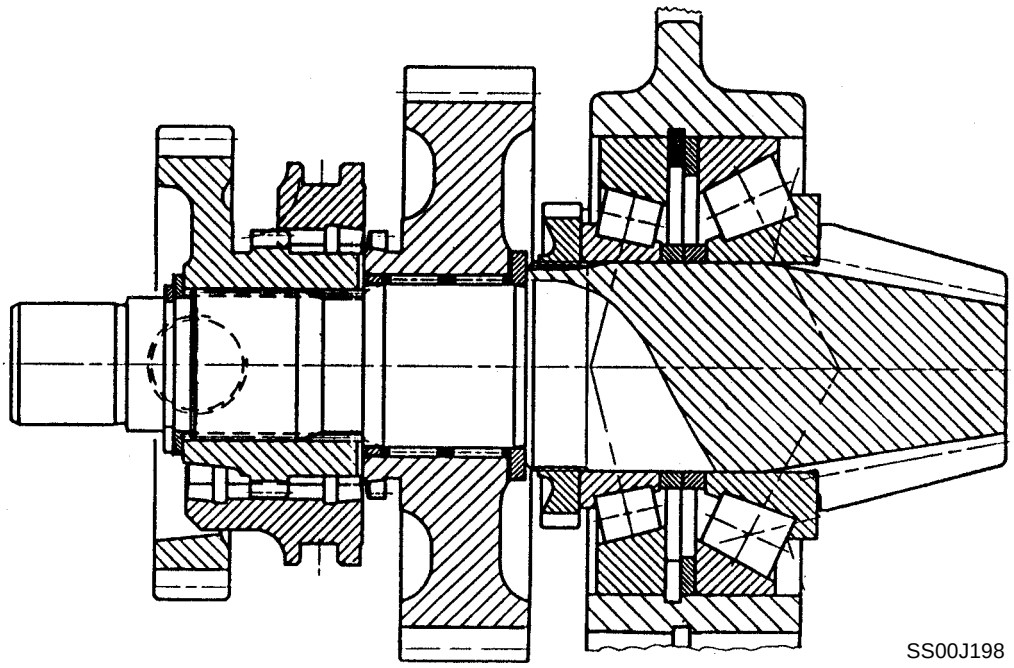
Make centering aid.



SS00J197

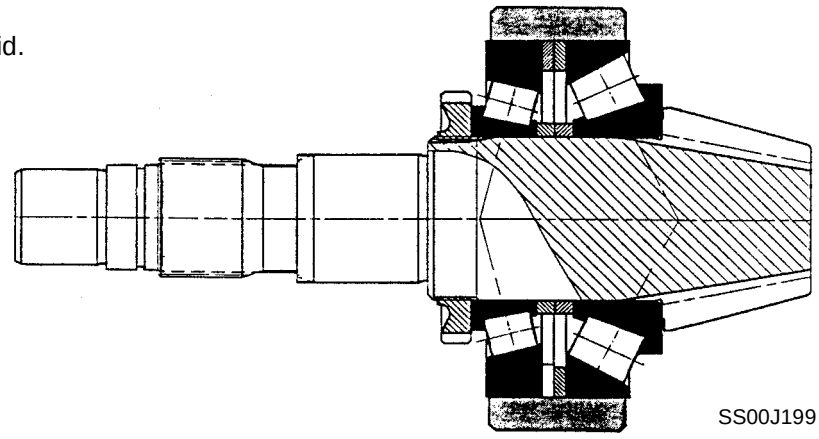
https://truckmanualshub.com/

BEVEL PINION - installation



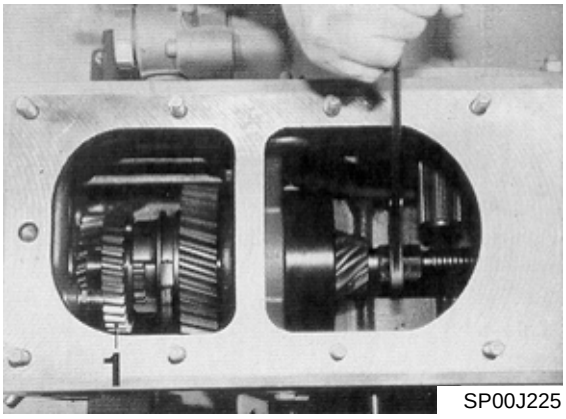
SS00J198

Preassemble pinion, bearing, adjusting disk, lock ring and castellated nut with centering aid.



SS00J199

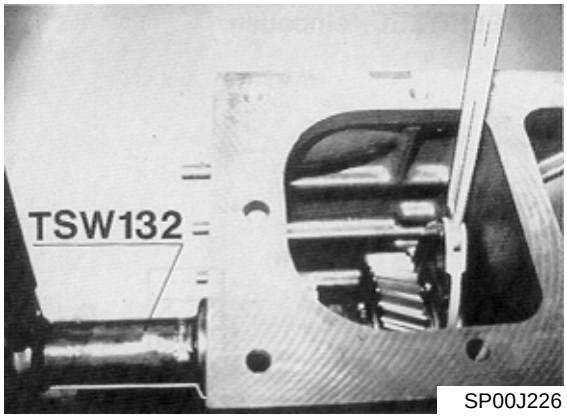
Insert complete field group with all-wheel drive wheel (1) in housing and center on pinion.
Press in pinion together with bearing and centering aid until the lock ring snaps in.



SP00J225

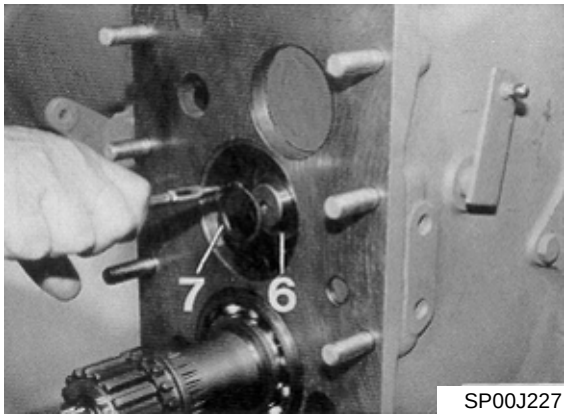
https://truckmanualshub.com/

Tighten castellated nut with special tool (TWS 132) to 450 Nm. Check bearing pretension (0.1-1.5 Nm). Secure castellated nut.



SP00J226

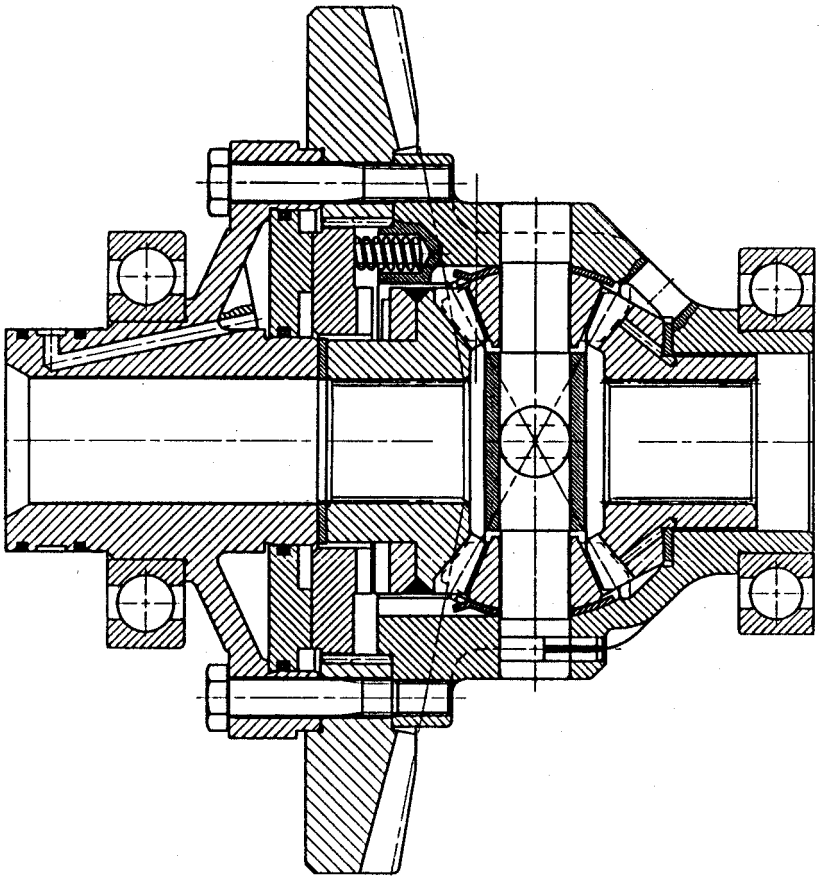
Mount supporting disk (6) and lock ring (7).



SP00J227

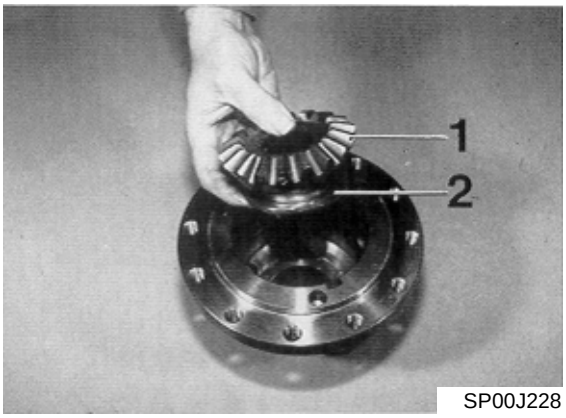
https://truckmanualshub.com/

DIFFERENTIAL - reassembly



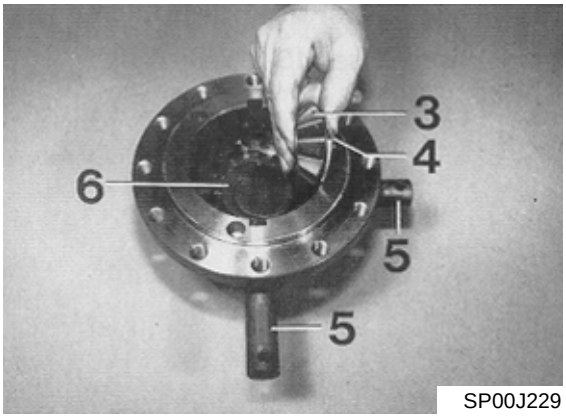
SS00J200

Install axial bevel gear (1) with thrust disk (2).



SP00J228

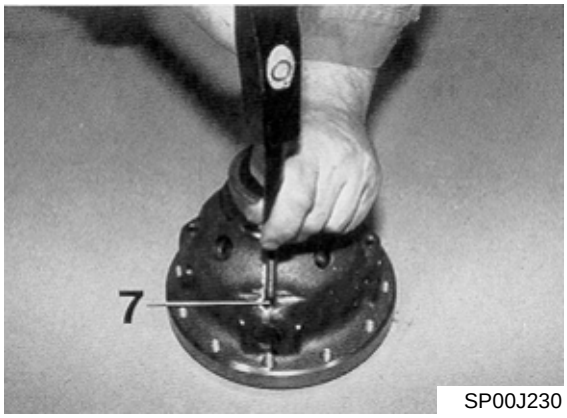
Install differential bevel gears (3) with thrust disks (4), differential wheel axles (5) and differential hub (6).
Attention: Oil groove of the differential hub upwards



SP00J229

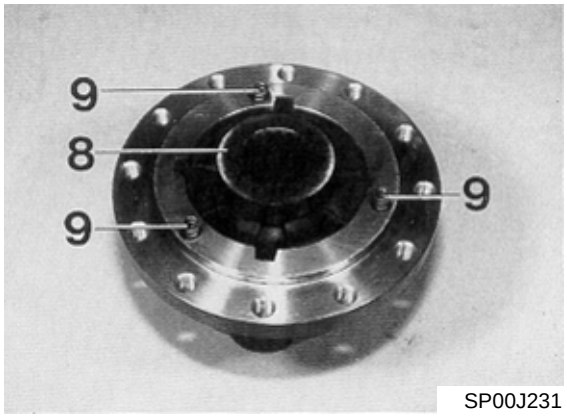
https://truckmanualshub.com/

Secure the differential wheel axles with tensioning pins (7).



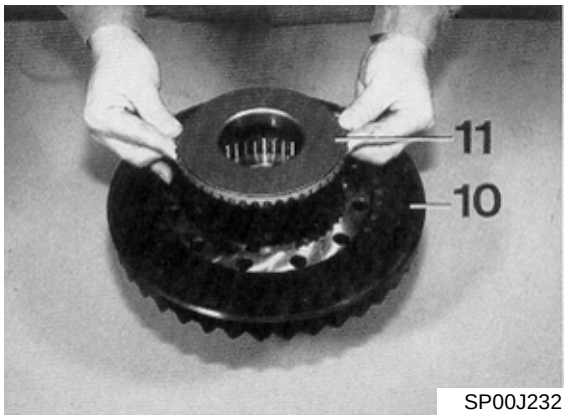
SP00J230

Mount axle bevel gear (8) and pressure springs (9).



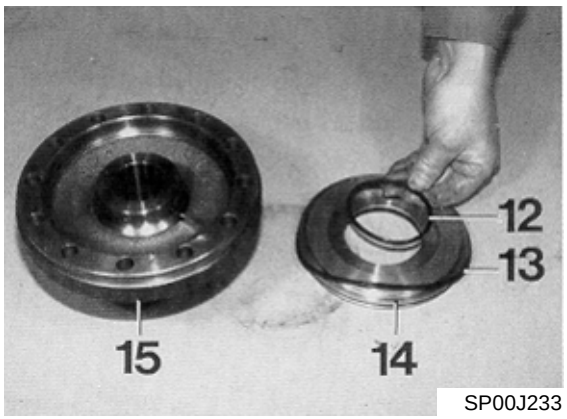
SP00J231

Mount crown gear (10) and lock disk (11).



SP00J232

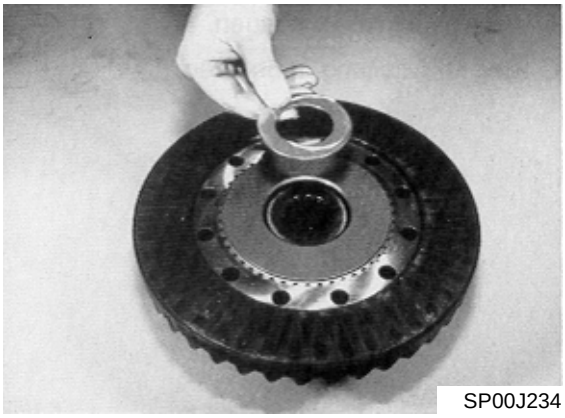
Mount quad rings (12+13) on piston (14) and install in differential housing (15).



SP00J233

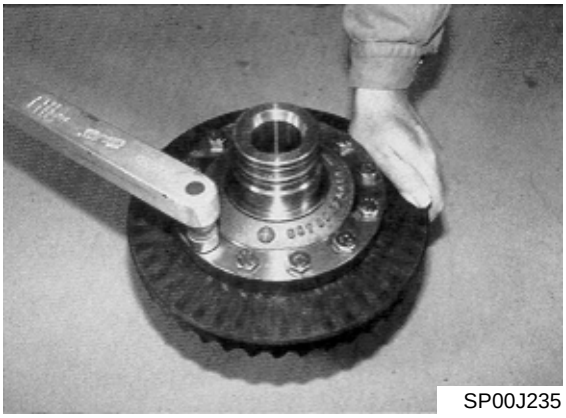
https://truckmanualshub.com/

Mount thrust disk.



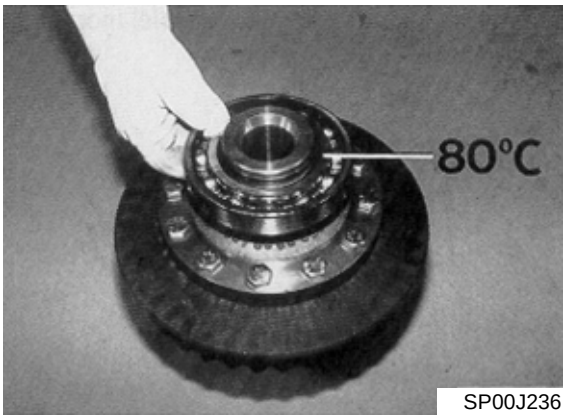
SP00J234

Mount differential housing.
Secure screws with Loctite
and tighten with a torque of 110 Nm.



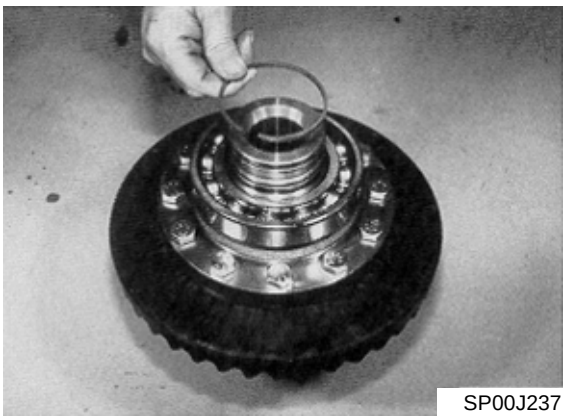
SP00J235

Mount both bearings warm.



SP00J236

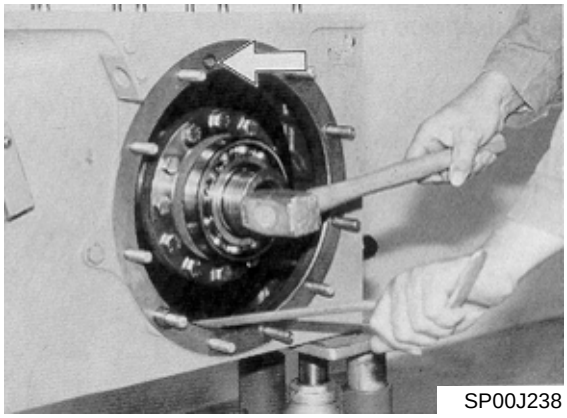
Mount rectangular rings.



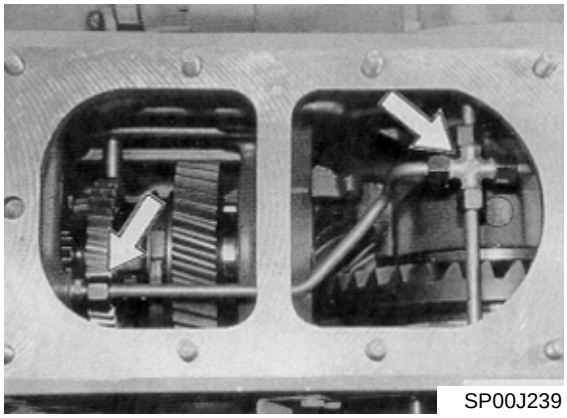
SP00J237

https://truckmanualshub.com/

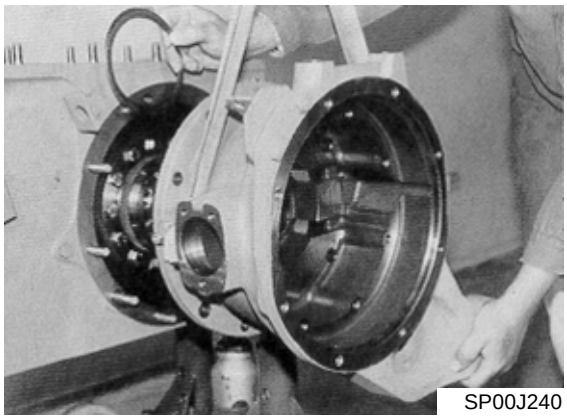
Install differential gear.
Mount O-rings for oil line.


SP00J238

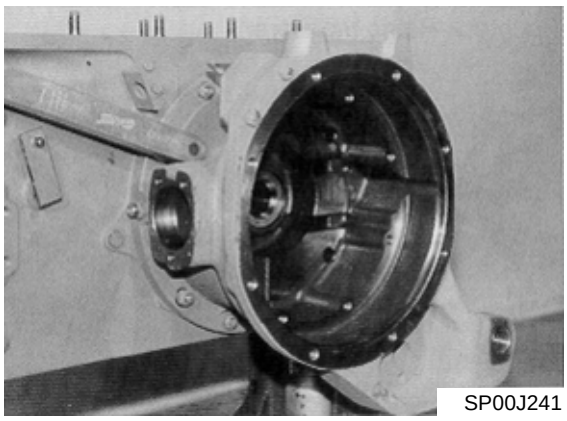
Install oil lines.


SP00J239

Mount adjusting disks for tooth profile backlash.


SP00J240

Seal left-hand brake housing and mount.
Quality of studs 10.9

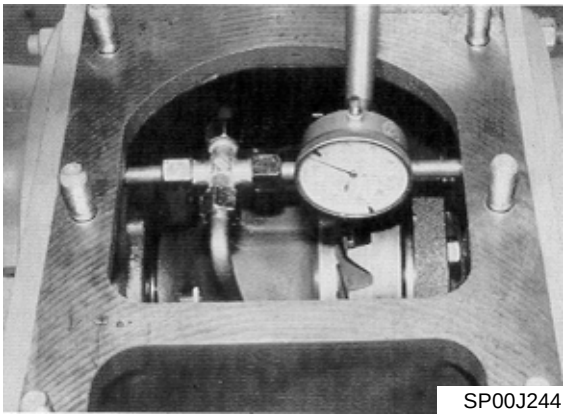

SP00J241

https://truckmanualshub.com/

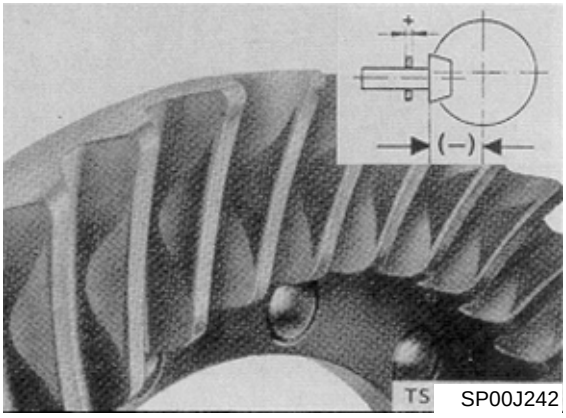
Position differential gear.


SP00JS243

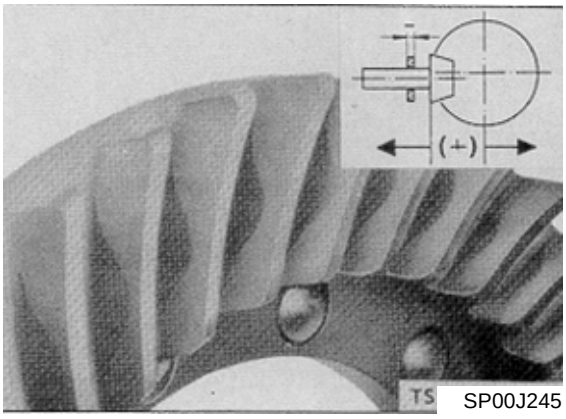
Check tooth profile backlash (0.15 - 0.30 mm).


SP00J244

CONTACT REFLECTION - check

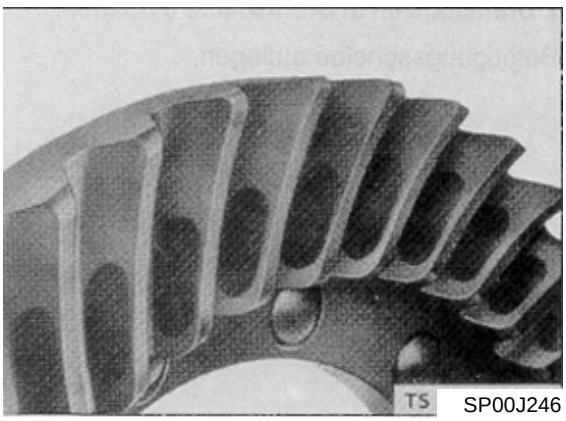


SP00J242



SP00J245

Ideal contact reflection.
Thickness of adjusting disk is correct.

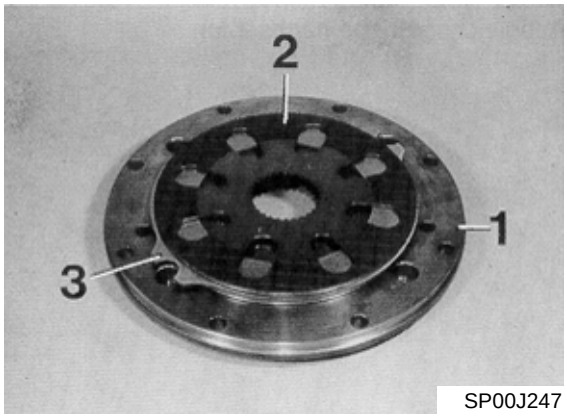


SP00J246

https://truckmanualshub.com/

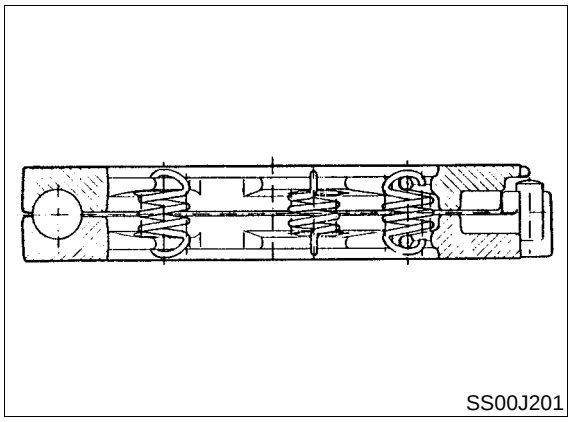
BRAKE - reassembly

Preassemble brake plate (1), two lining disks (2) and one intermediate disk (3).

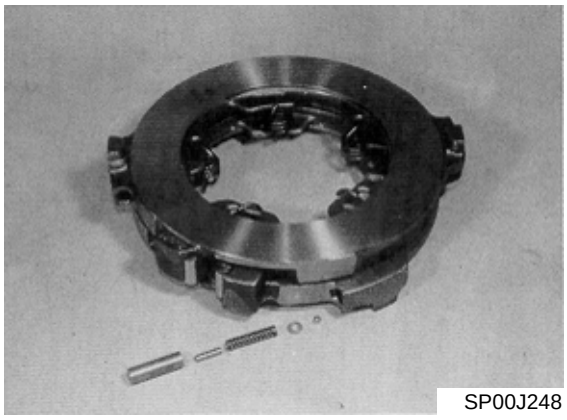


SP00J247

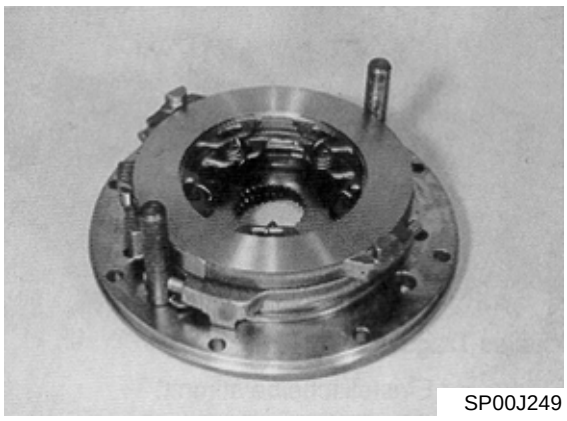
Reassemble operating disk.


SS00J201

Preassemble damping mechanism.

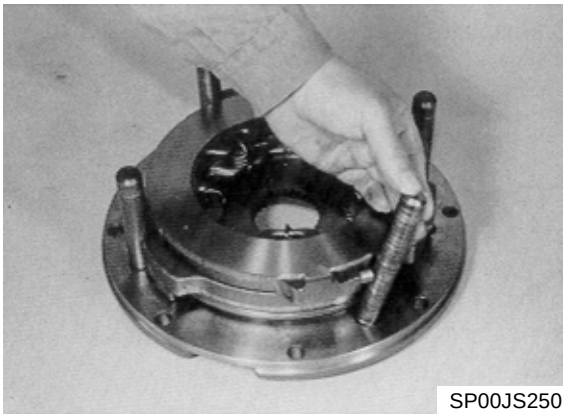

SP00J248

Fit 2 brake bolts into brake plate.
Mount operating disk.


SP00J249

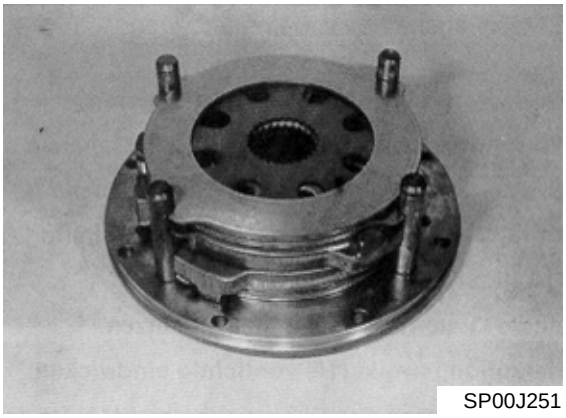
https://truckmanualshub.com/

Fit the other two brake bolts.



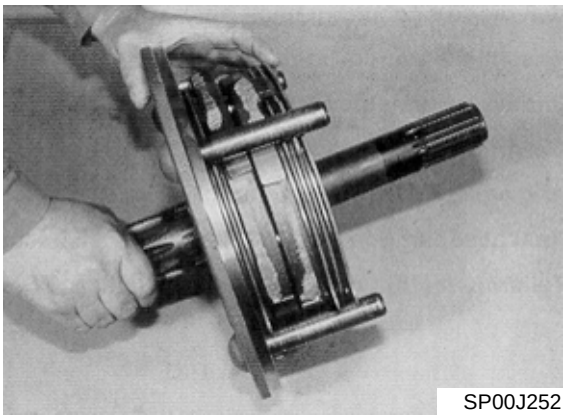
SP00JS250

Preassemble three lining disks and three intermediate disks.



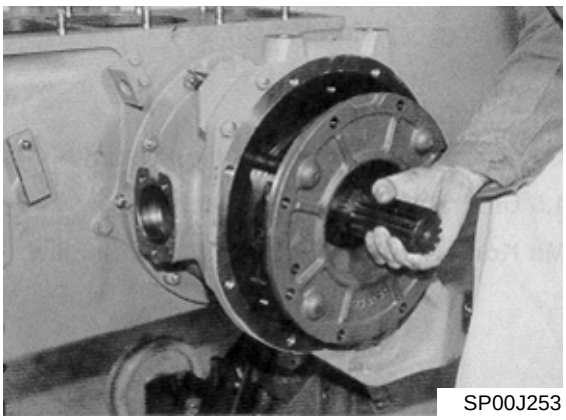
SP00J251

Push pinion shaft into preassembled brake.



SP00J252

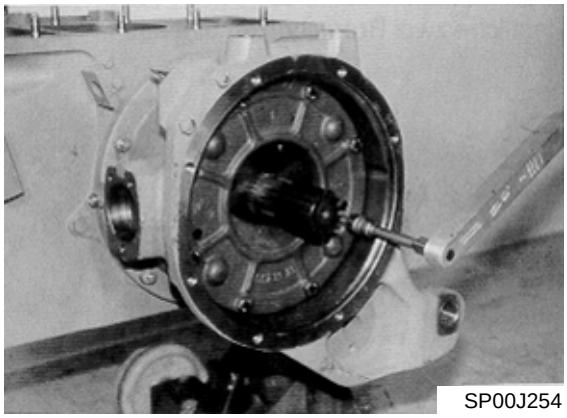
Install brake unit in brake housing.



SP00J253

https://truckmanualshub.com/

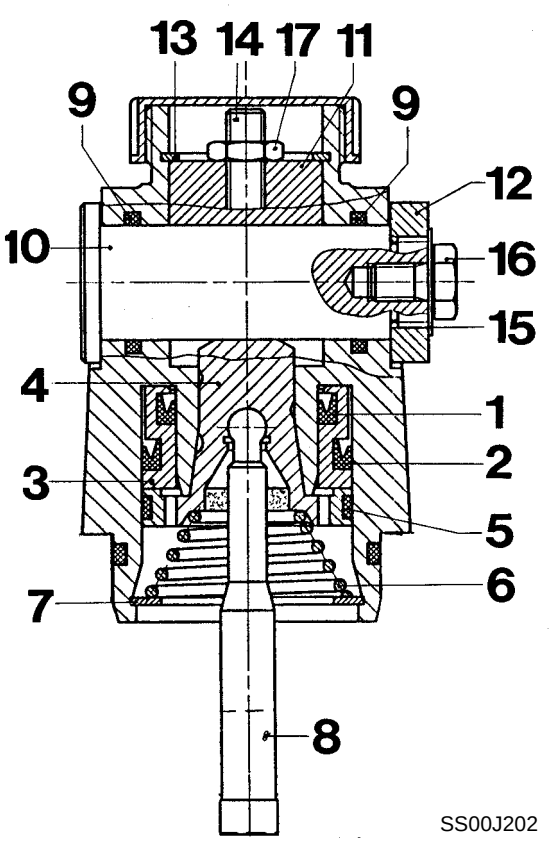
Tighten brake plate.



SP00J254

Reassemble operating unit

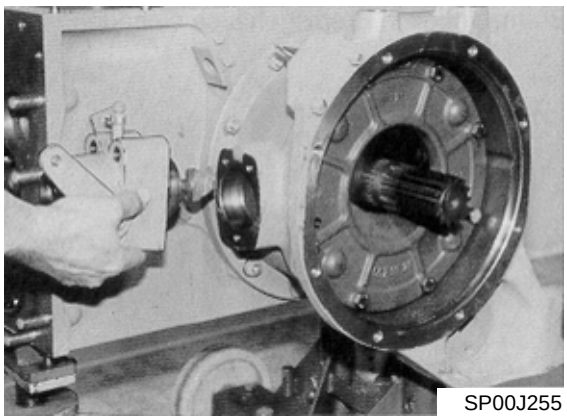
Mount grooved ring (1+2) on piston (3).
Carefully push preassembled piston into housing.
Mount pressure tappet (4) with new guide band (5).
Insert pressure spring (6) and mount lock ring (7).
Mount operating wedge (8).
Insert both quad rings (9) in the groove.
Carefully push in operating shaft (10).
In order to insert the guide piston (11),
provisionally push on the brake lever (12)
and turn so that the recess faces upwards.
Then push in the guide piston (11) to the limit
and turn until the lock ring (13) can be mounted.
Adjust stud (14) until the guide piston lies on the
lock ring (basic position).
Then push the lever (12) onto the shaft and secure
with spring plate (15) and screw (16) (46 - 50 Nm).



SS00J202

Install operating unit.

Adjusting the brake:
Tighten stud (14) with 12 Nm.
Turn back 1.5 rotations.
Secure with counternut (17) and Loctite.

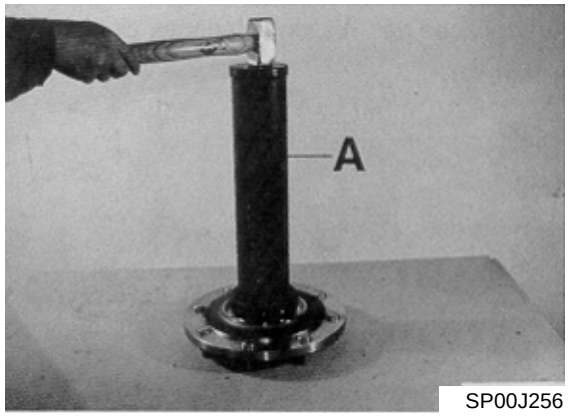


SP00J255

https://truckmanualshub.com/

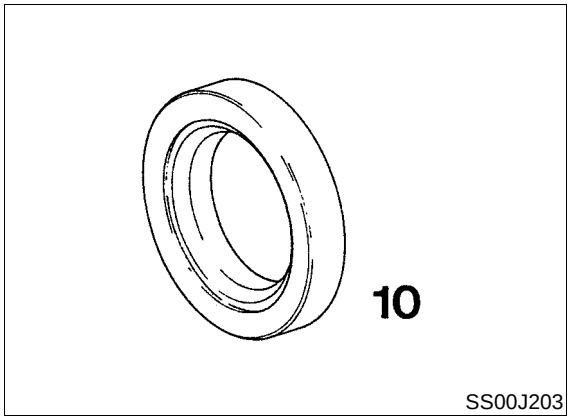
AXLE HUB - reassembly

Coat inner surface of the radial sealing ring with Loctite and mount with auxiliary tool (A).



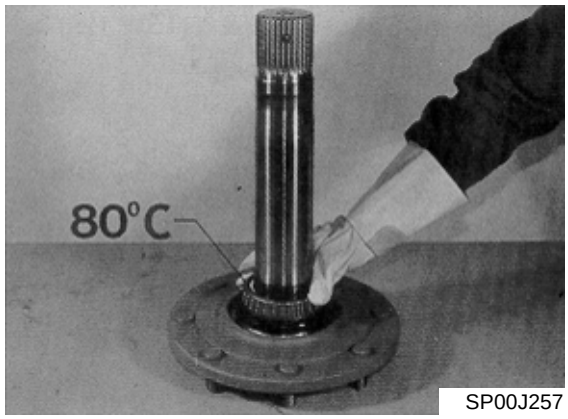
SP00J256

Make auxiliary tool
(see special tools page 139)



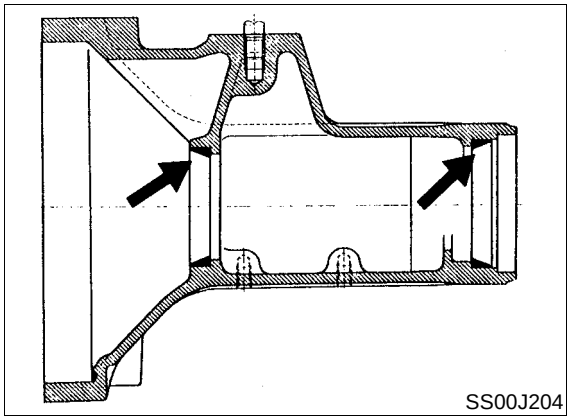
SS00J203

Mount tapered roller bearing warm.



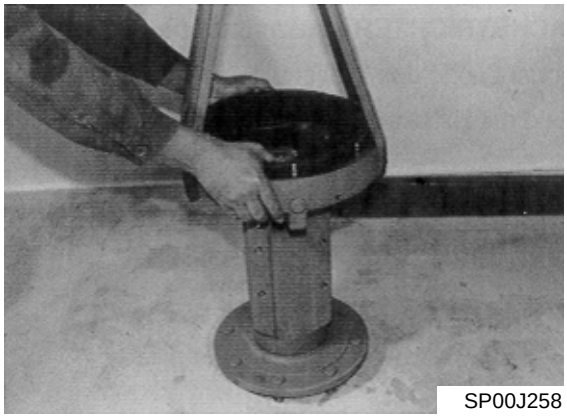
SP00J257

Press bearing outer rings into axle hub.

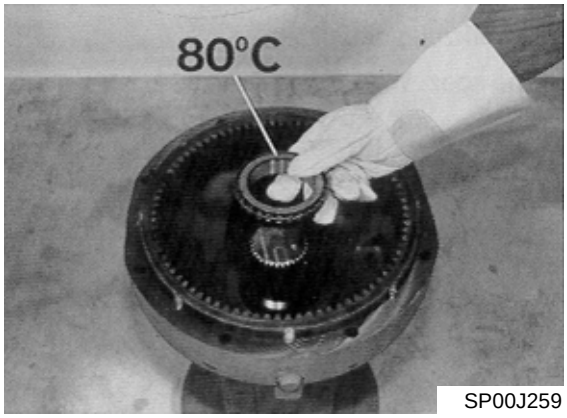

SS00J204

https://truckmanualshub.com/

Lubricate the outer surfaces of the radial sealing ring and mount axle hub.

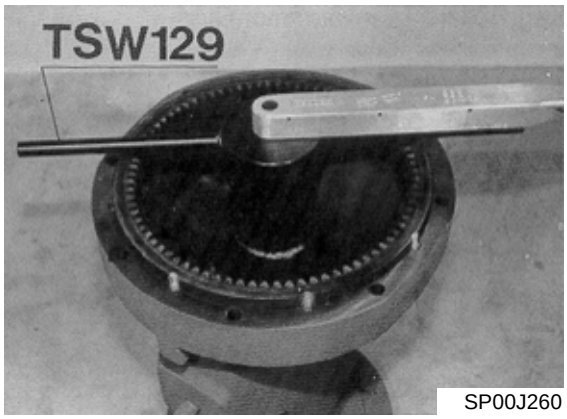

SP00J258

Mount tapered roller bearing warm.



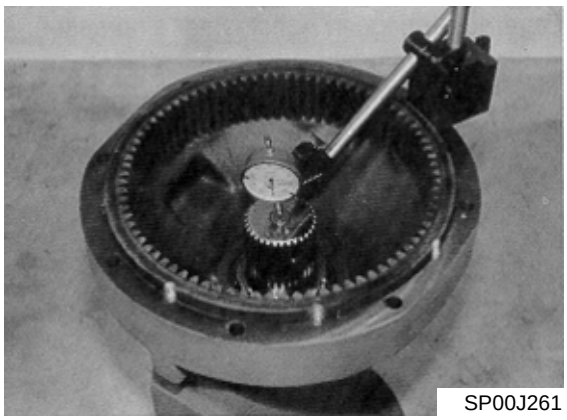
SP00J259

Tighten castellated nut with special tool (TSW 129) to 250 Nm. Turn by 90°.
Knock axle shaft free.



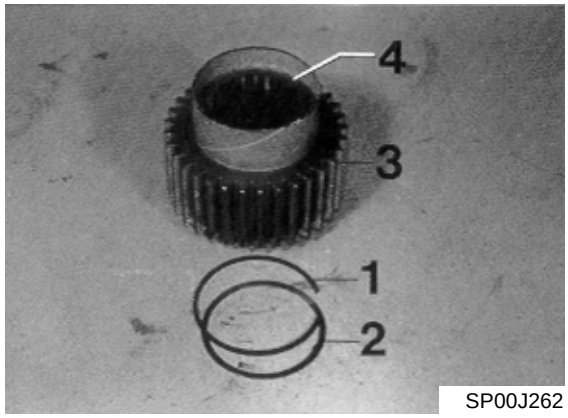
SP00J260

Check the axial clearance of the rear axle shaft bearing. Adjust the axial clearance (0-0.015 mm) by turning the castellated nut.


SP00J261

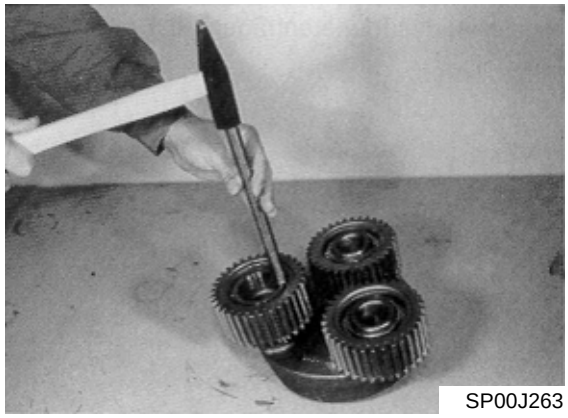
https://truckmanualshub.com/

Snap ring (1) and thrust disk (2) in planetary gear (3).
Press tapered roller bearing (4) in.
Attention: Bearing number upwards
Use roller protection
Mount thrust disk (2)
and snap ring (1) of the second side.

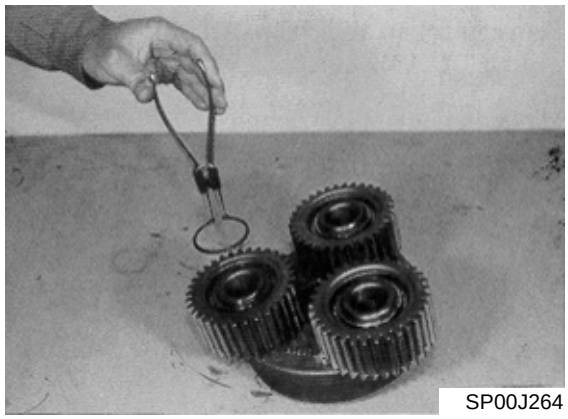


SP00J262

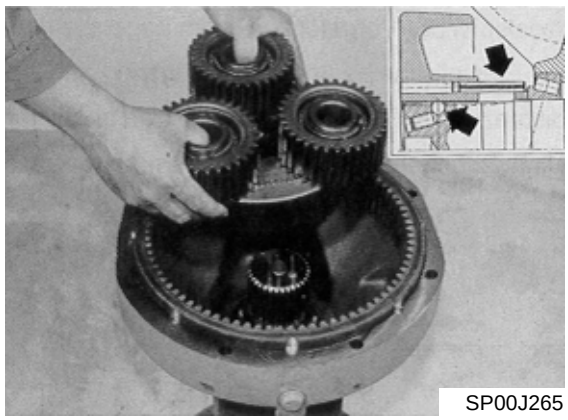
Mount preassembled planetary gears on planetary gear carrier.


SP00J263

Snap on lock rings.

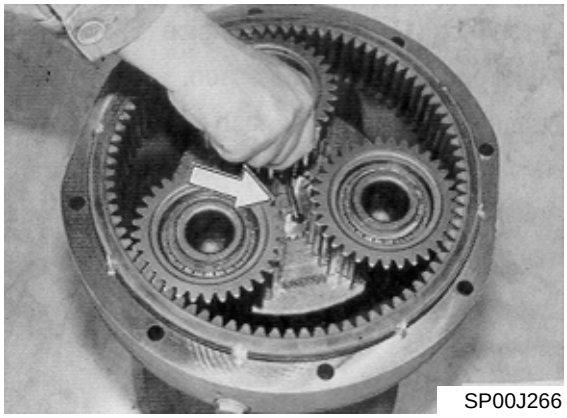

SP00J264

Insert greased ball in bore of the shaft.
Mount planetary gear carrier on axle shaft.
Clamping sleeve in planetary gear carrier secures castellated nut.


SP00J265

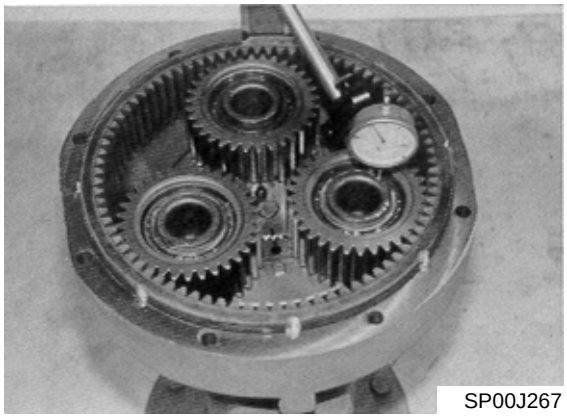
https://truckmanualshub.com/

Insert cylinder roller.
Mount stud with Loctite.
Tighten and open by 20°.



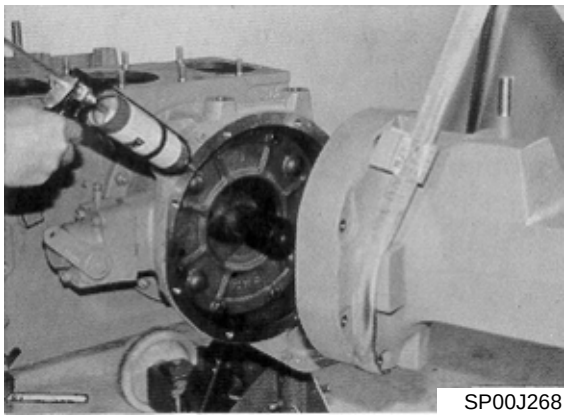
SP00J266

Check axial clearance of the planetary gear carrier (0.1 mm)



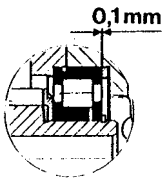
SP00J267

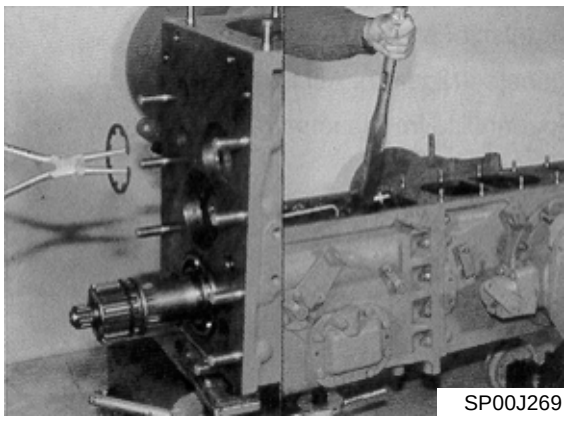
Seal flange surfaces. Flange on axle hub and tighten with torque.
Tighten with torque.
(Stud quality 10.9)



SP00J268

Space out axial clearance of the countershaft in the bearing seat of the rear axle to 0.1 mm with adjusting disk and lock ring. Seal the housing flange surfaces. Reassemble rear axle housing and transmission housing.



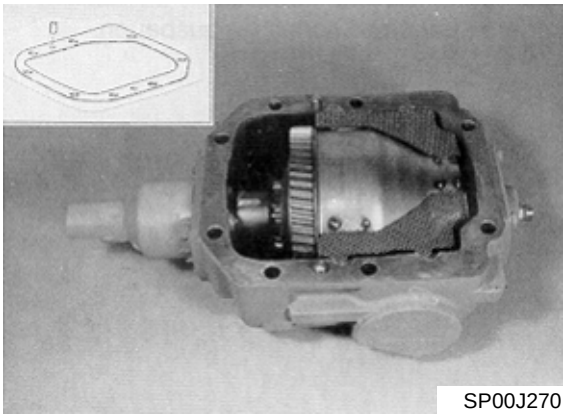


SP00J269

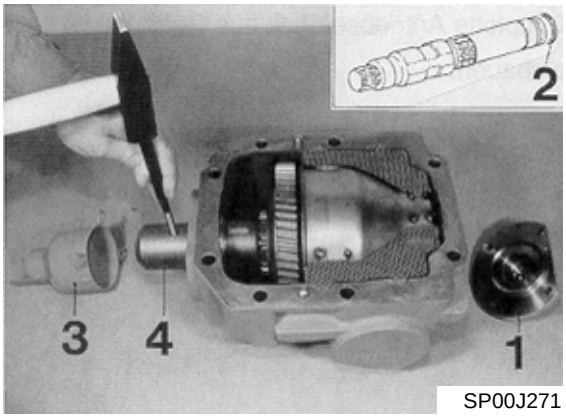
https://truckmanualshub.com/

Front axle drive - disassembly

Dismount front axle drive from rear axle housing.
Pay attention to adjusting disks.

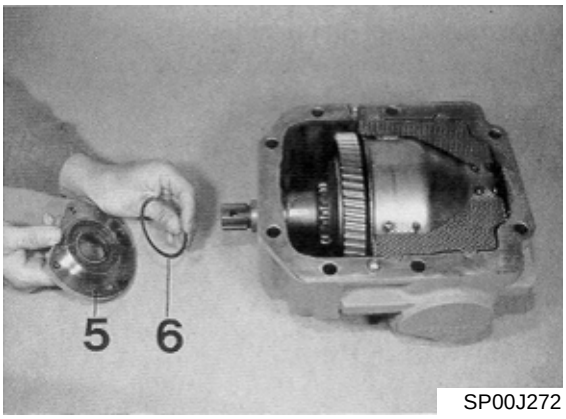

SP00J270

Dismount rear cover (1), piston ring (2) from shaft, protective cap (3) and sleeve (4).



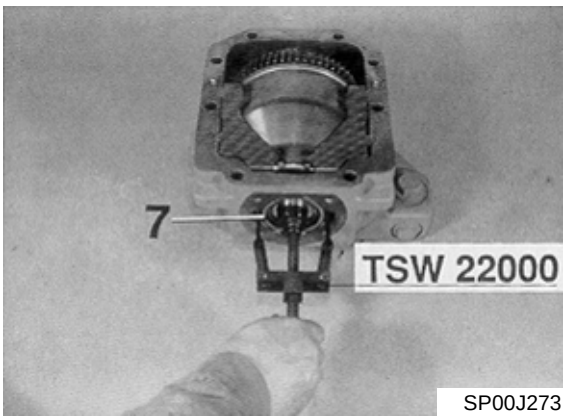
SP00J271

Remove front cover (5) and adjusting disk (6).



SP00J272

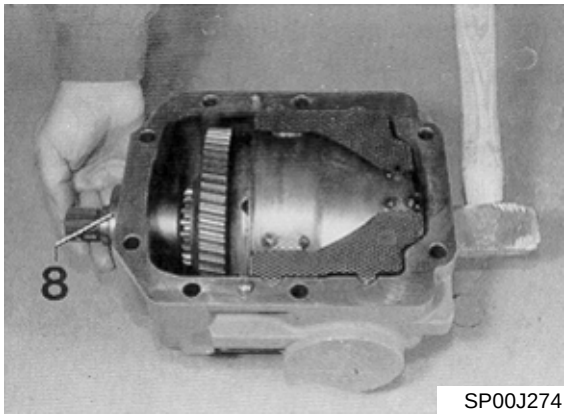
Pull off bearing outer ring (7) of the rear bearing with special tool (TSW 22000).



SP00J273

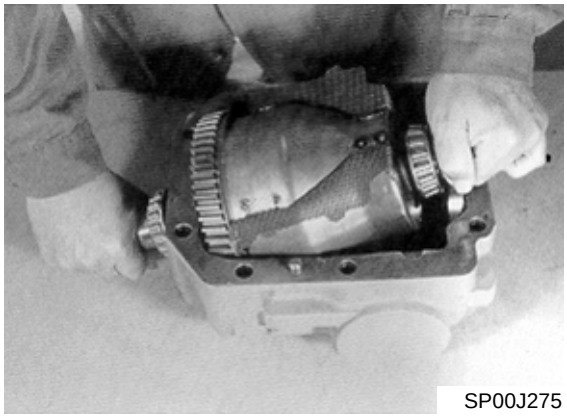
https://truckmanualshub.com/

Dismantle front bearing outer ring (8).

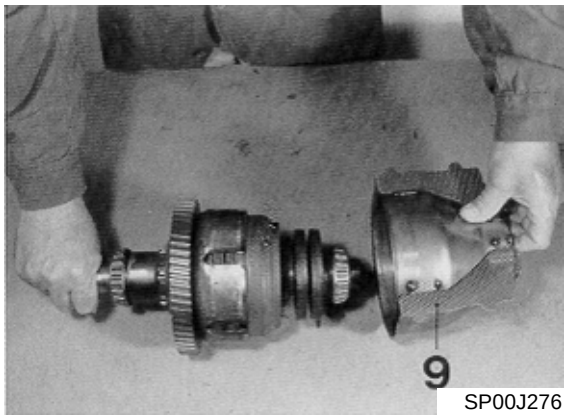


SP00J274

Dismantle complete drive unit from housing.

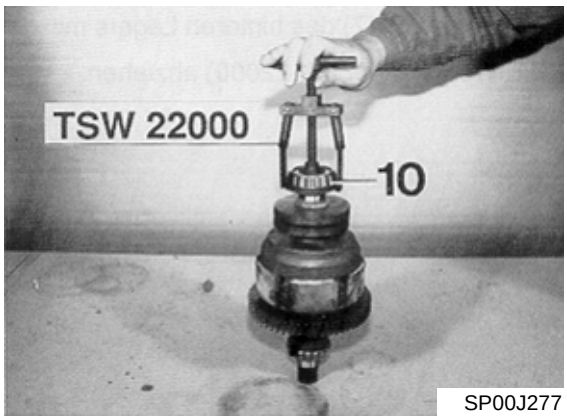

SP00J275

Remove clutch capsule (9).



SP00J276

Pull off rear roller bearing (10)
with special tool (TSW 22000).



SP00J277

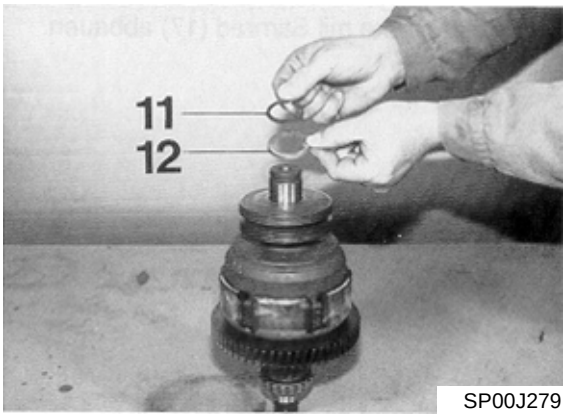
https://truckmanualshub.com/

Pretension spring pack with special tool (TSW 127) and unlock lock ring.



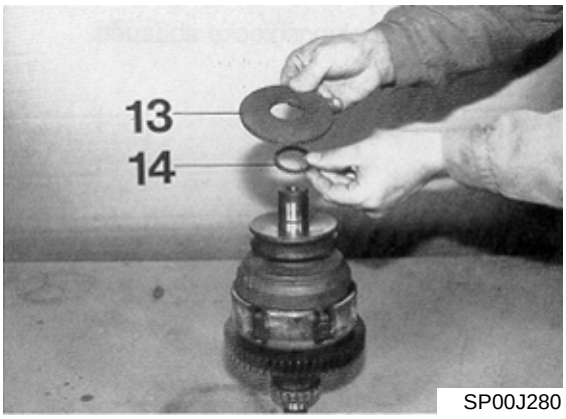
SP00J278

Remove lock ring (11) and disk (12).



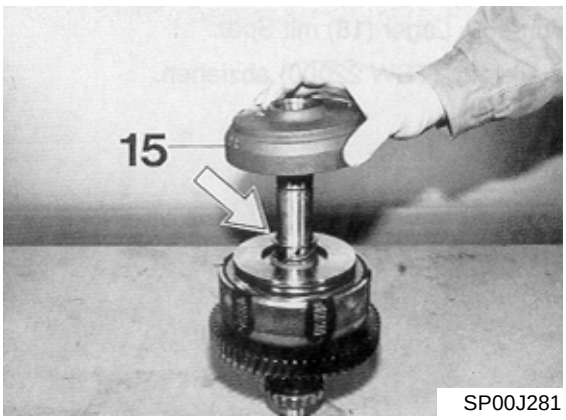
SP00J279

Remove spring plates (13) with disks (14).



SP00J280

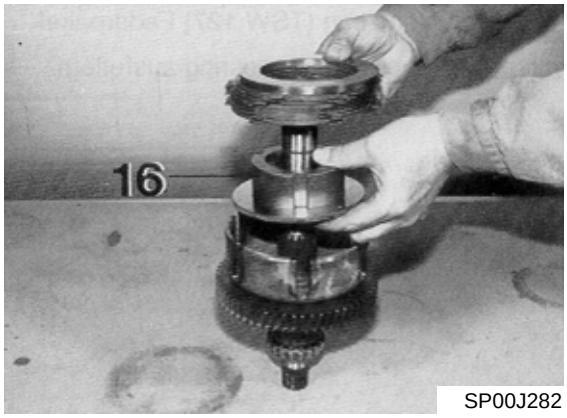
Dismount pressure cylinder (15) with spring, disks, piston and O-rings.



SP00J281

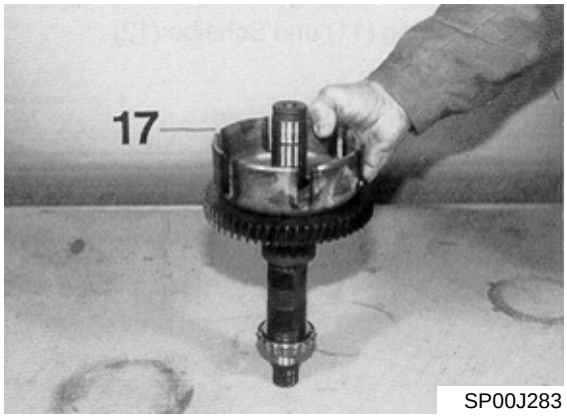
https://truckmanualshub.com/

Dismount multi-disk carrier (16) with pressure disk, pressure ring and multi-disk pack.



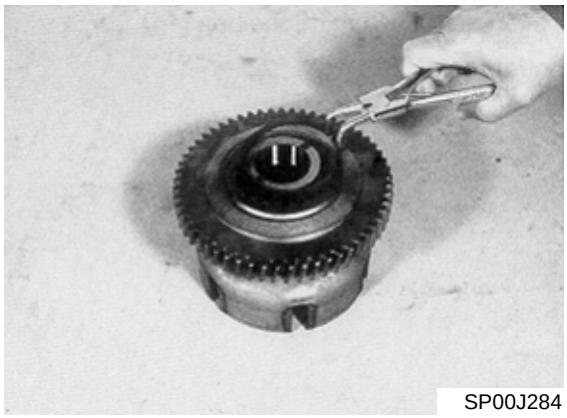
SP00J282

Dismount clutch case with spur gear (17).

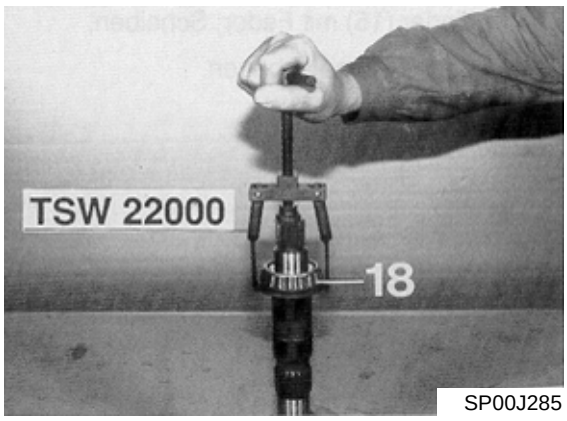


SP00J283

Dismount spur gear from clutch case.


SP00J284

Pull of front bearing (18) with special tool (TSW 22000).

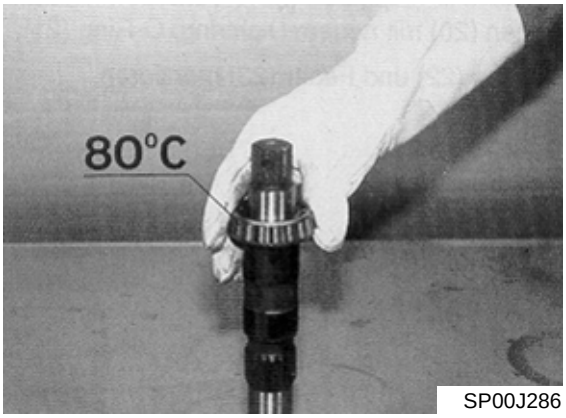


SP00J285

https://truckmanualshub.com/

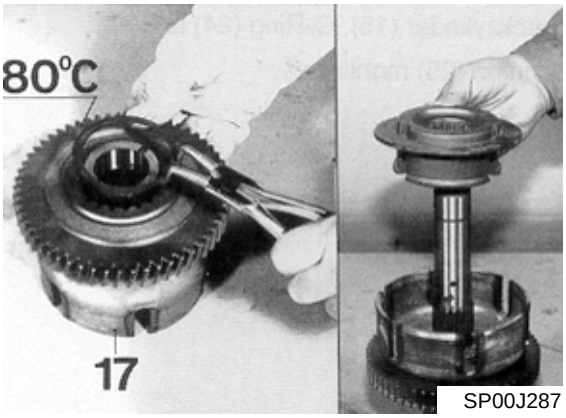
Front axle drive - reassembly

Mount front bearing warm.



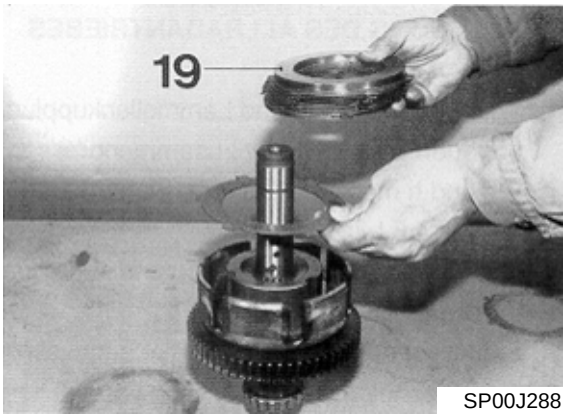
SP00J286

Mount spur gear on clutch case (17) warm and snap on lock ring.
Mount clutch case with spur gear and multi-disk carrier with pressure ring on drive shaft (grease).



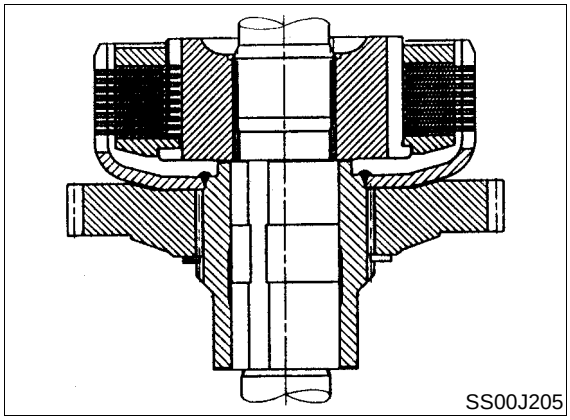
SP00J287

Mount multi-disk pack and pressure disk (19).



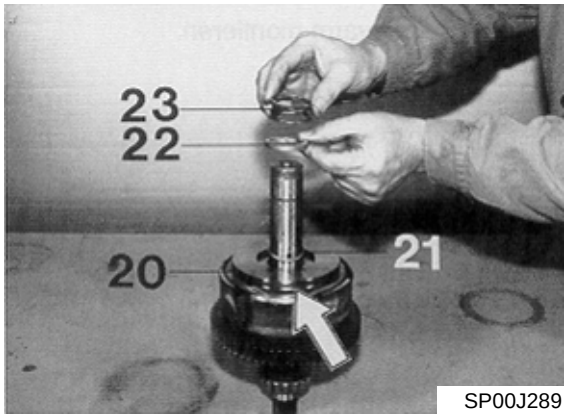
SP00J288

Layout of multi-disk clutch.


SS00J205

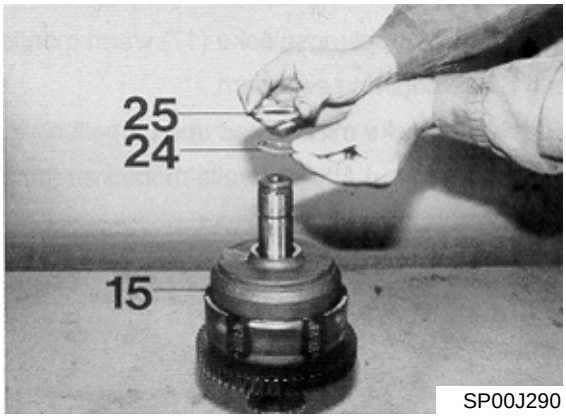
https://truckmanualshub.com/

Mount piston (20) with new sealing ring, O-ring (21), disk (22) and spring (23).



SP00J289

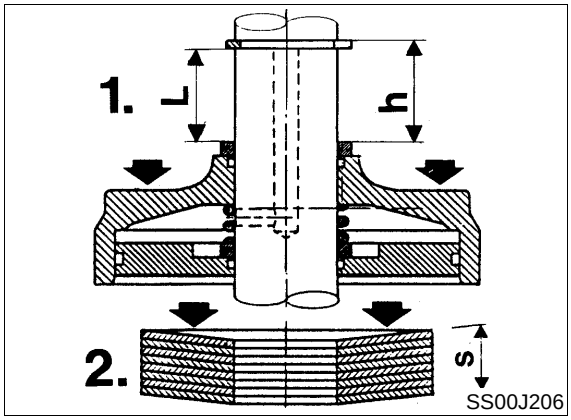
Mount pressure cylinder (15), O-ring (24) and disk (25).



SP00J290

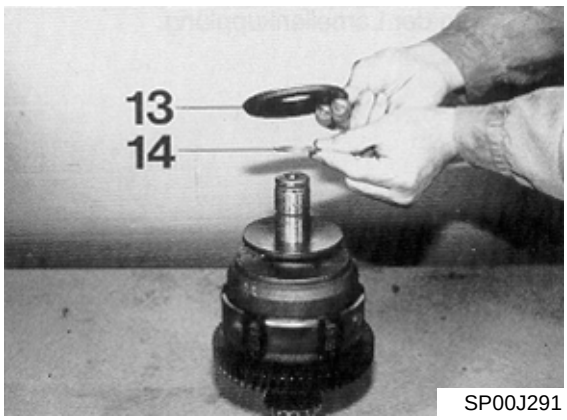
ADJUSTMENT OF THE ALL-WHEEL DRIVE

1. Press the preassembled shaft and multi-disk clutch together above the pressure cylinder. Measure distance h - 2.5 mm (lock ring) = shaft dimension L
2. Lay spring plates together and press together. Measure thickness (s) of the spring plate pack + 8.36 mm = L1
3. Calculate adjusting disk L-L1



SS00J206

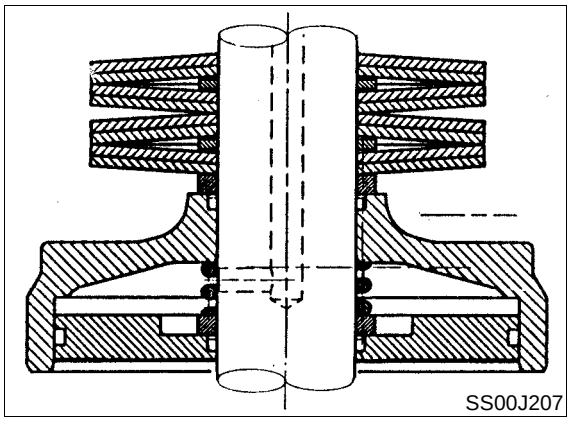
Mount spring plates (13) and disks (14).



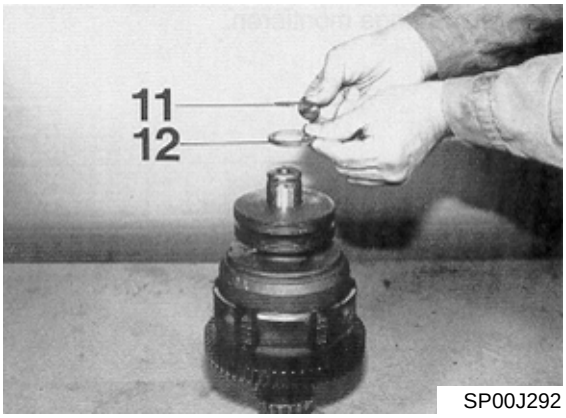
SP00J291

https://truckmanualshub.com/

Layout of spring plates.

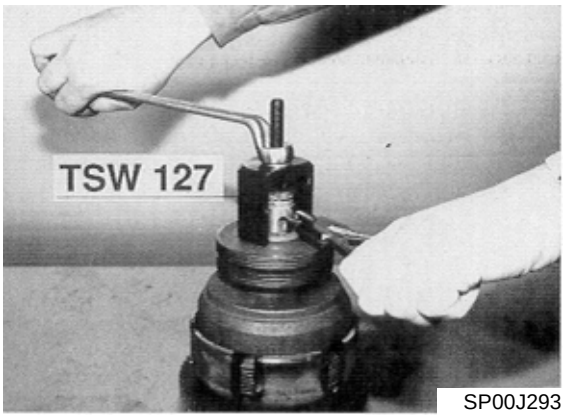

SS00J207

Mount disk (12) and lock ring (11).



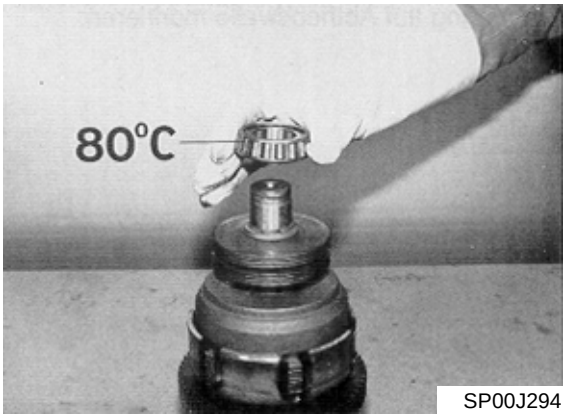
SP00J292

Pretension spring pack with special tool (TSW 127) and snap on lock ring.



SP00J293

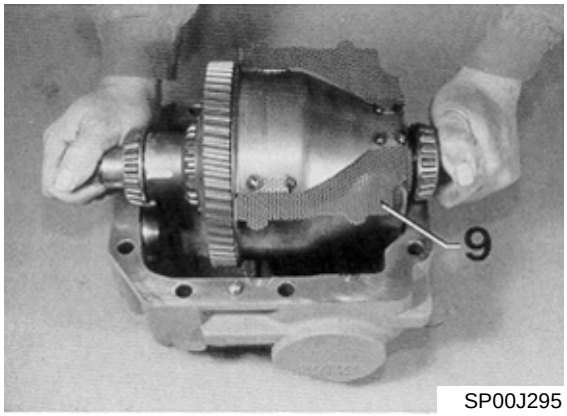
Mount rear roller bearing warm.



SP00J294

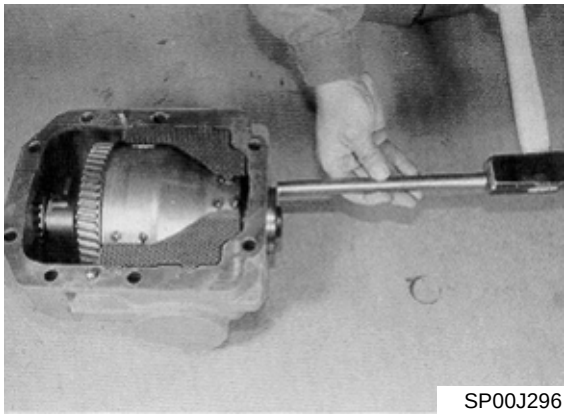
https://truckmanualshub.com/

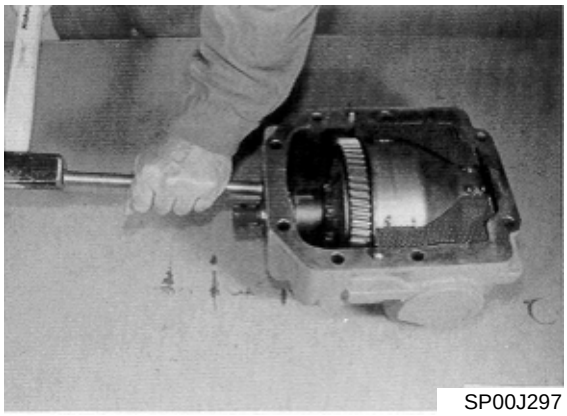
Mount clutch case (9).
Install complete drive unit in housing.



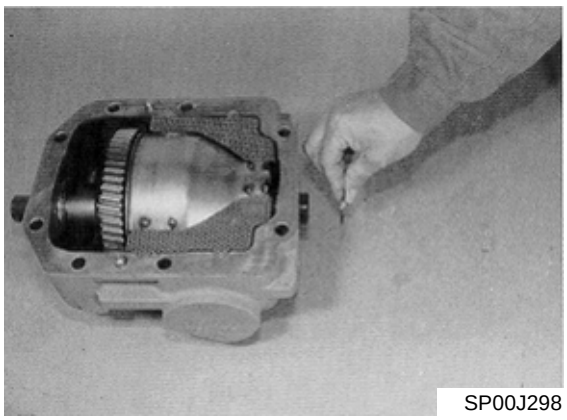
SP00J295

Mount bearing outer rings.


SP00J296

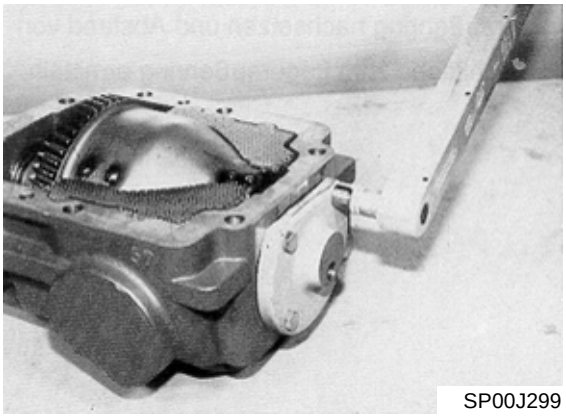

SP00J297

Mount piston ring on drive shaft.


SP00J298

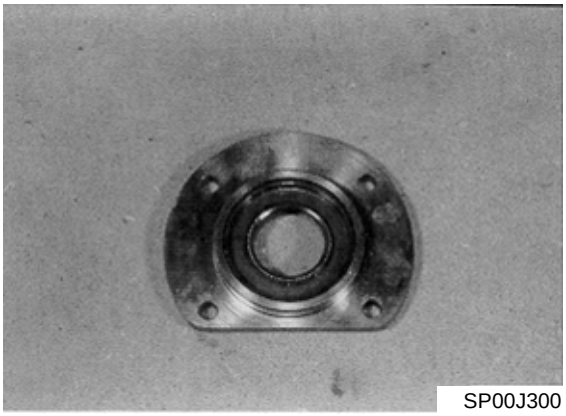
https://truckmanualshub.com/

Seal rear cover and mount.



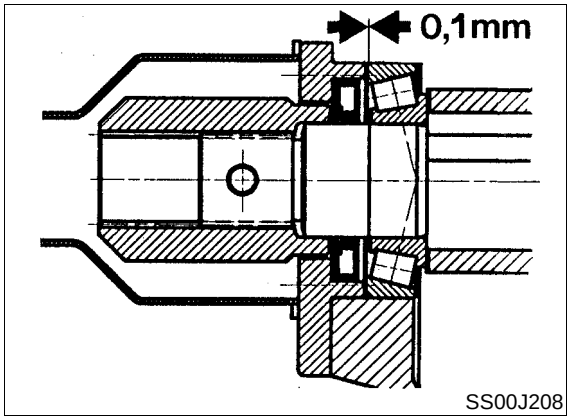
SP00J299

Press new radial sealing ring into front cover.



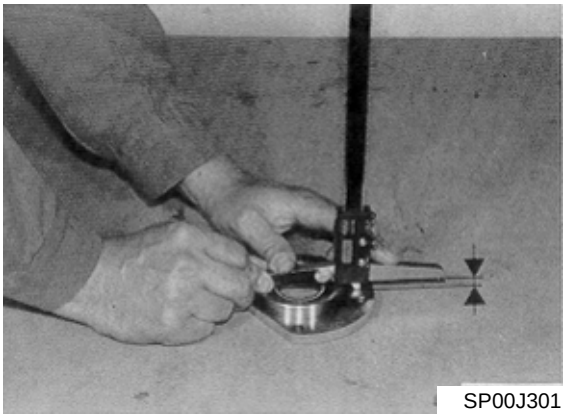
SP00J300

AXIAL-CLEARANCE OF THE BEARING (0.02 - 0.15 mm) - adjust



SS00J208

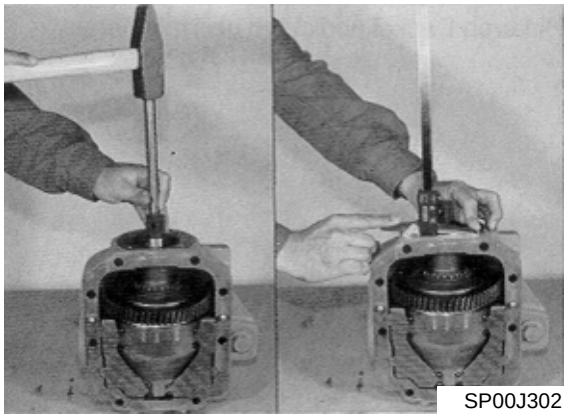
Measure front cover.



SP00J301

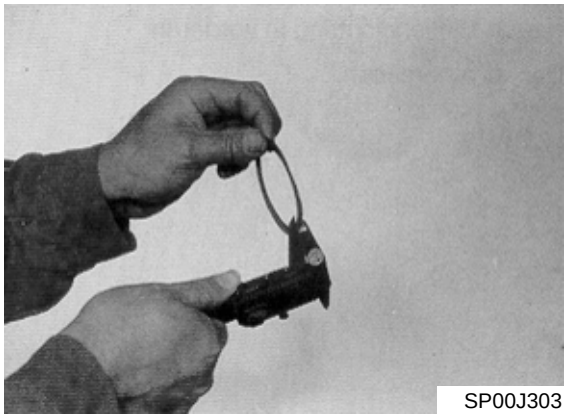
https://truckmanualshub.com/

Position bearing outer ring and determine distance from flange surface to bearing outer ring.



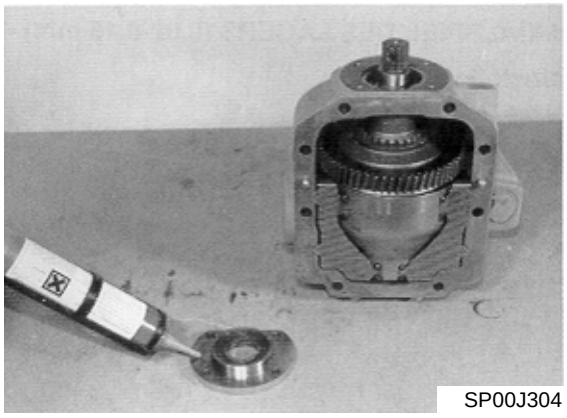
SP00J302

The difference between the two dimensions minus 0.1 mm (medium value) gives the thickness of the adjusting disk.



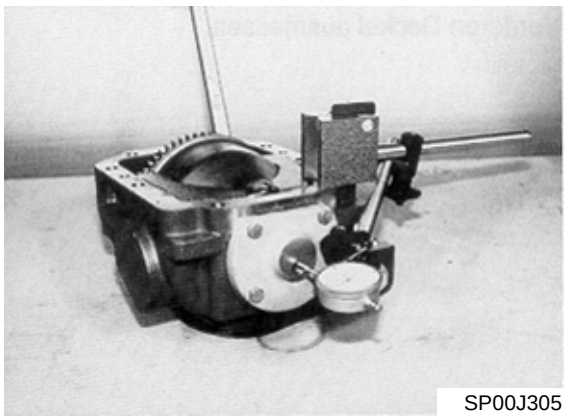
SP00J303

Seal front cover and mount with determined adjusting disk.



SP00J304

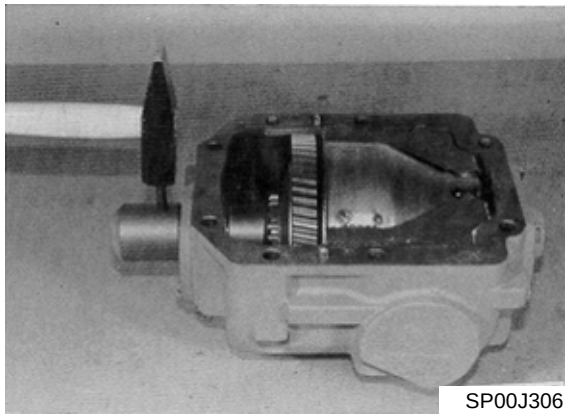
Check axial clearance of the shaft bearing (0.02 - 0.15)



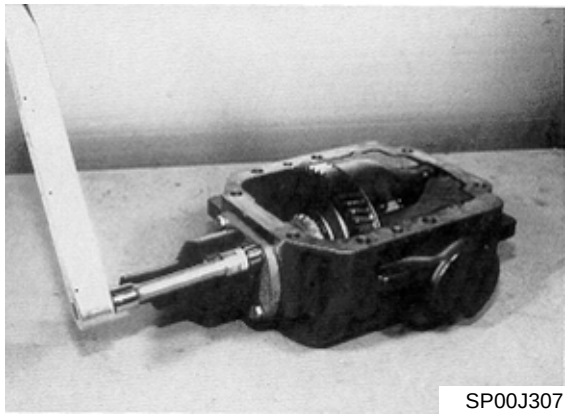
SP00J305

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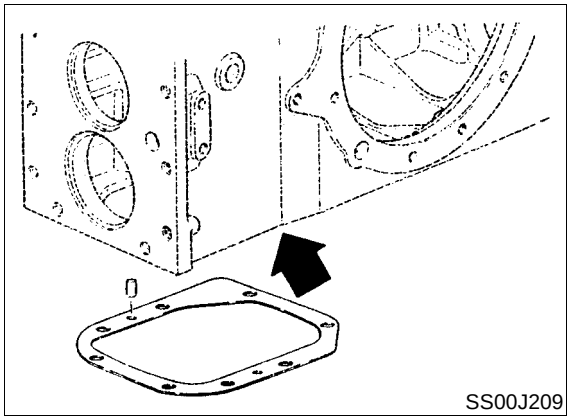
Secure sleeve with tensioning pin.


SP00J306

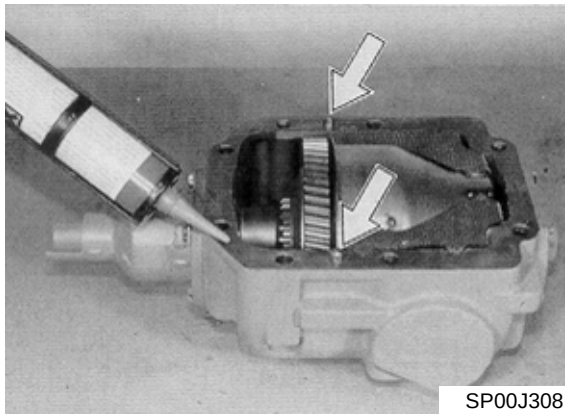
Mount protective cap.


SP00J307

ADJUSTING DISK FOR TOOTH PROFILE BACKLASH-determine
Read correction value on rear axle.
Hammered-in in 1/100 mm.
0.02 mm - round off
0.03 mm - round off (upwards)

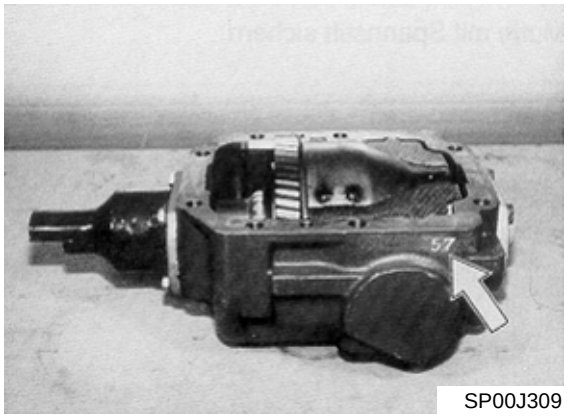

SS00J209

Mount cylinder studs.
Seal flange surfaces and mount all-wheel drive with adjusting disk.
Tighten with torque.


SP00J308

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The number of teeth of the spur gear is hammered into the drive housing.
(All-wheel gear ratio)



SP00J309

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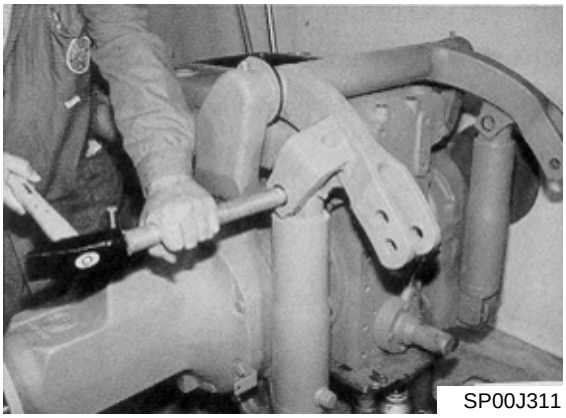
Hydraulic lifting gear - disassembly

Remove console.



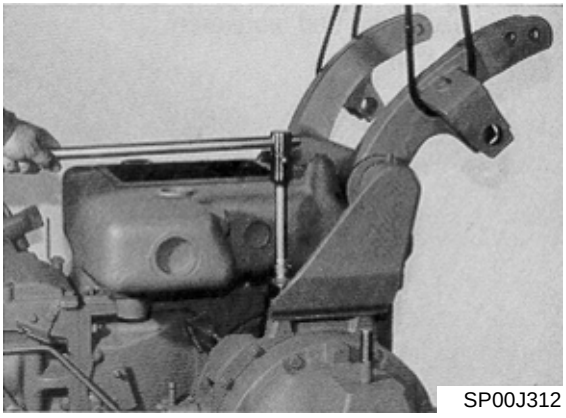
SP00J310

Dismount both lifting cylinders.



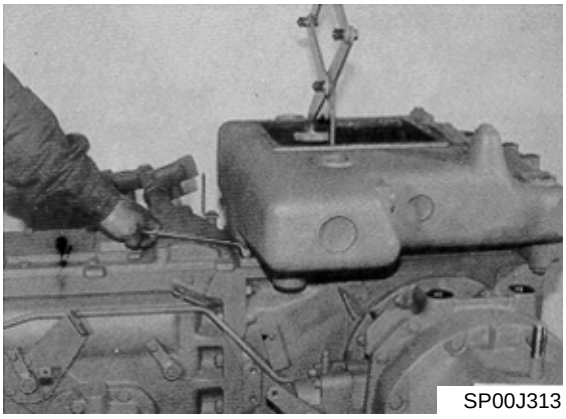
SP00J311

Dismount bearing pedestals and remove lifting shaft.



SP00J312

Dismount oil tank.

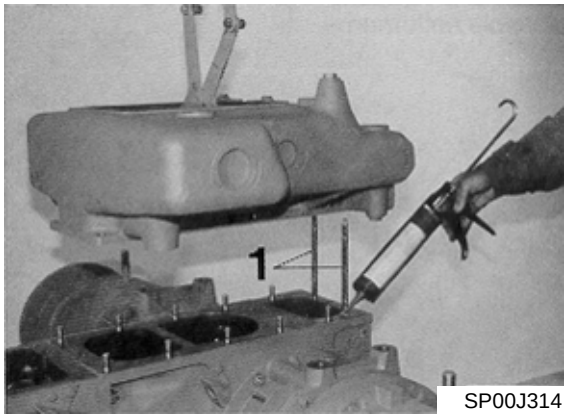


SP00J313

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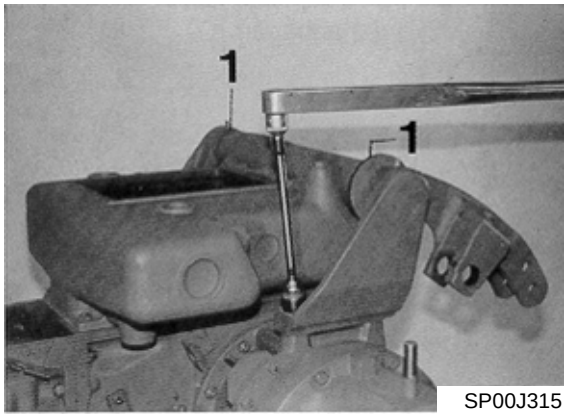
Hydraulic lifting gear - reassembly

Seal flange surface.
Mount oil tank.
Attention: Both rear studs (1) are of 10.9 quality,
observe tightening torque.



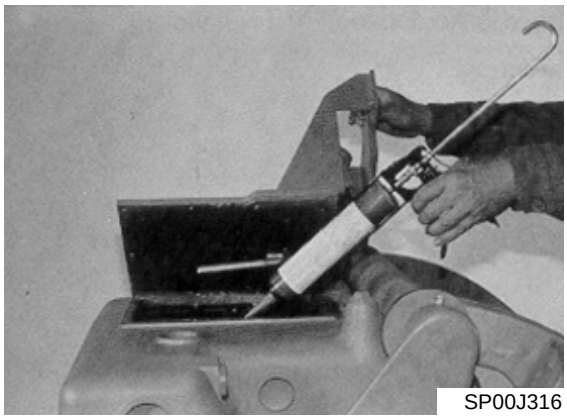
SP00J314

Mount lifting shaft and both bearing pedestals.
Pay attention to sealing rings (1)
Tightening torque of the SK screws 380 Nm.

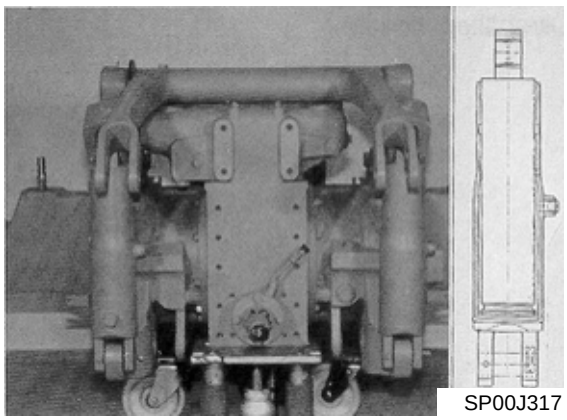


SP00J315

Seal console and mount.


SP00J316

Mount lifting cylinder.


SP00J317

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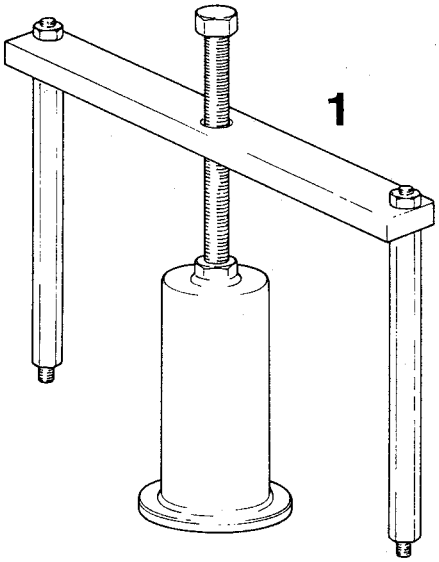
I. These special tools are necessary for carrying out repairs.

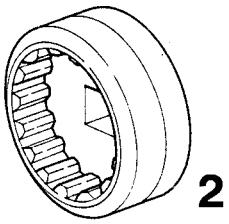
1	**TSW 518**	Clamping device for spring release bearing PTO shaft clutch
2	**TSW 133**	Socket spanner for main shaft
3	**TSW 132**	Socket spanner for bevel pinion shaft
4	**TSW 170**	Spanner for castellated nuts with degrees scale for power shift group
5	**TSW 169**	Centering sleeve for spring plates of power shift group
6	**TSW 22000**	Extractor for bearing outer and inner rings for front axle drive
7	**TSW 127**	Clamping device for spring plates of front axle drive
8	**TSW 506**	Clamping device for adjusting pinion bearing
	TSW 506-2.1	Sleeve for T557 to complement the existing clamping device TSW 506
9	**TSW 129**	Spanner for castellated nuts for rear axle shaft
	TSW 129-2	Disk with square socket to be welded on to existing spanner for castellated nuts TSW 129
10	**TSW 525**	Press-in tool for WDR rear axle shaft

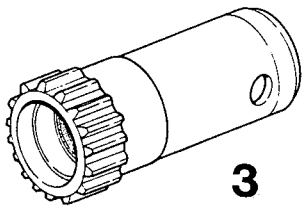
III. Available from dealers

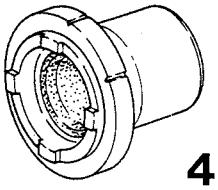
11	**BELZER DUOGRIP 19 No. 4113**	Adjustable hook spanner
12	**KUKKO No. 15-3 od. 17-3**	Separating device for tapered roller bearings

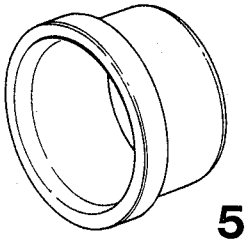
https://truckmanualshub.com/

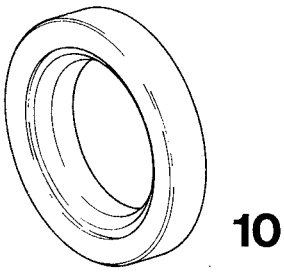


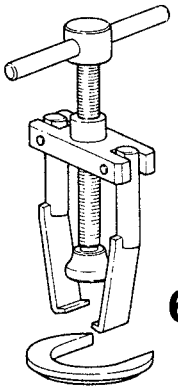


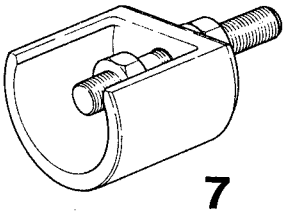


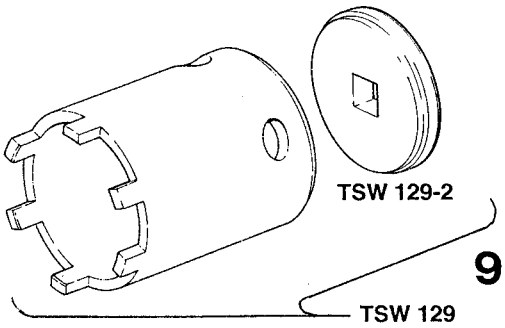


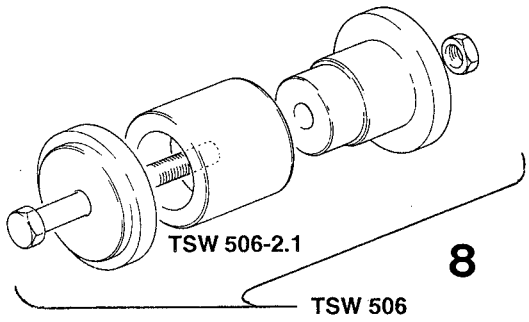


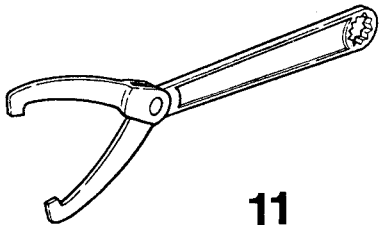


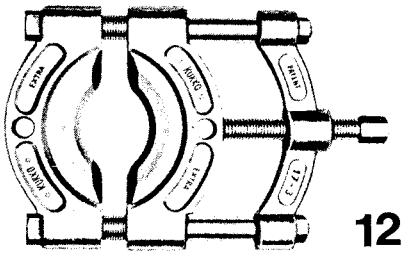












SS00J210

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Section

8B

HOW IT WORKS AND TROUBLESHOOTING

Electronic Hitch Control (EHR-D)

CASE STEYR Landmaschinentechnik GmbH
Training Center
A - 4300 St. Valentin, Steyrer Straße 32

Sva 7-95350 EN
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November 2000

https://truckmanualshub.com/

EHR D M9078-M9094 / CS78-CS94
1st edition

St.Valentin, November 1997
L-LAS / So / Schw

Table of contents

1	-	2	Mechanical hitch control
3	-	4	Components of the EHR D
5	-	36	Function
37	-	38	Position sensor - construction and signal processing
39	-	40	Position sensor - technical data and characteristic
41	-	42	Adjusting the position sensor
43	-	44	Draught sensor - construction and correct assembly
45	-	46	Draught sensor - technical data and signal processing
47	-	48	EHR - proportional control valve
49	-	54	EHR - proportional control valve - position NEUTRAL - position RAISE - Position DROP
55	-	56	Print Multi-Controller
57	-	58	High pressure hydraulic circuit
59	-	60	Ride control
61	-	62	Slip control
63	-	64	EHR electronic box (controller) A55
		65	Pin assignment of A55
		66	Operation EHR D
		67	Diagnose system
68	-	72	Code list for errors
73	-	79	Fault tracing and testing with CSLT diagnostic system 528
80	-	90	Control valve EHR 5-OC

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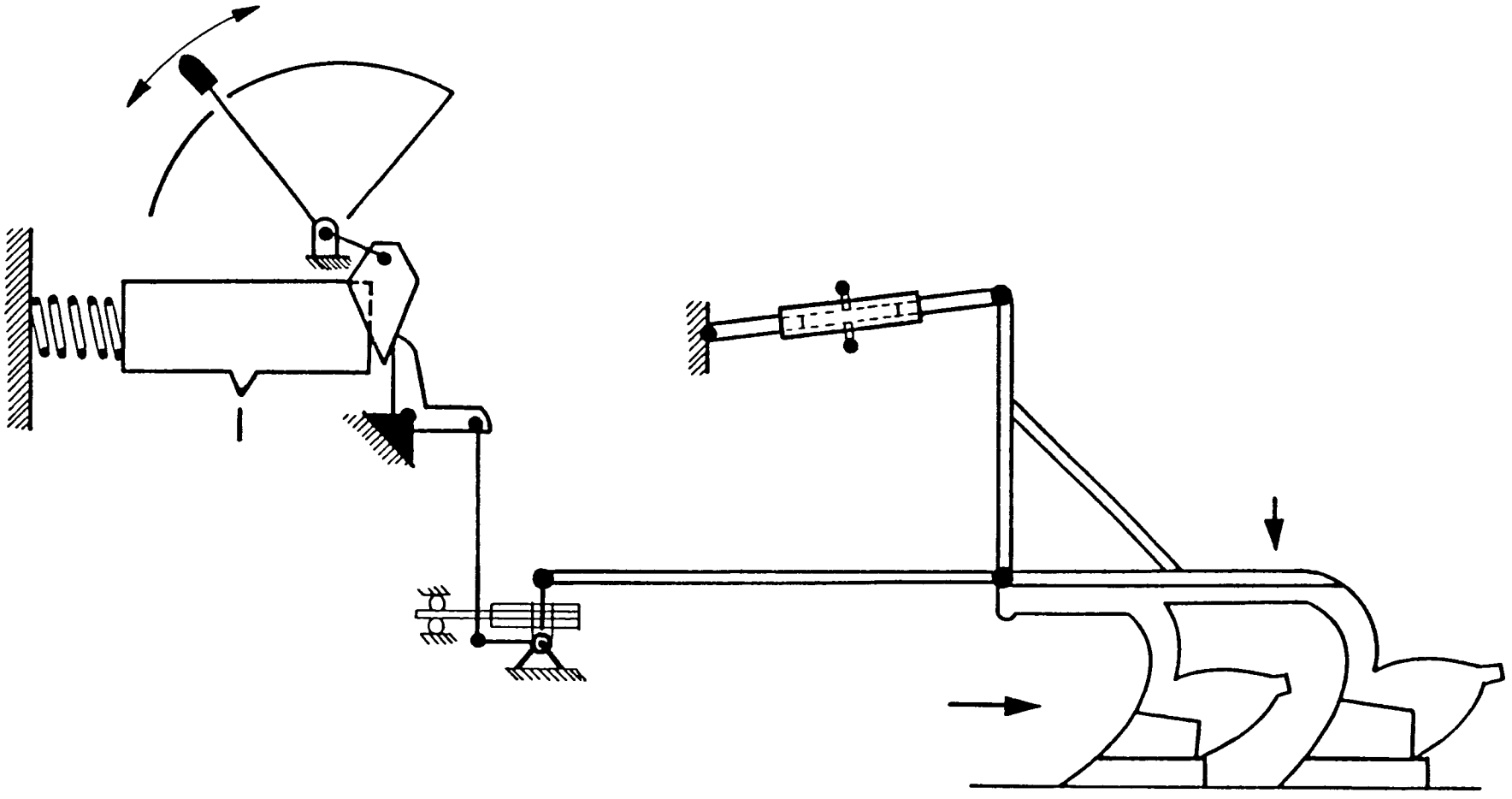
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MECHANICALLY CONTROLLED HYDRAULICS

A mechanically controlled hydraulic system is a hydraulic system in which levers/rods are used to transmit the impulses.

The impulses are those motional processes which act on the hydraulics through the changing load resistance, limited and controlled by the control spring.

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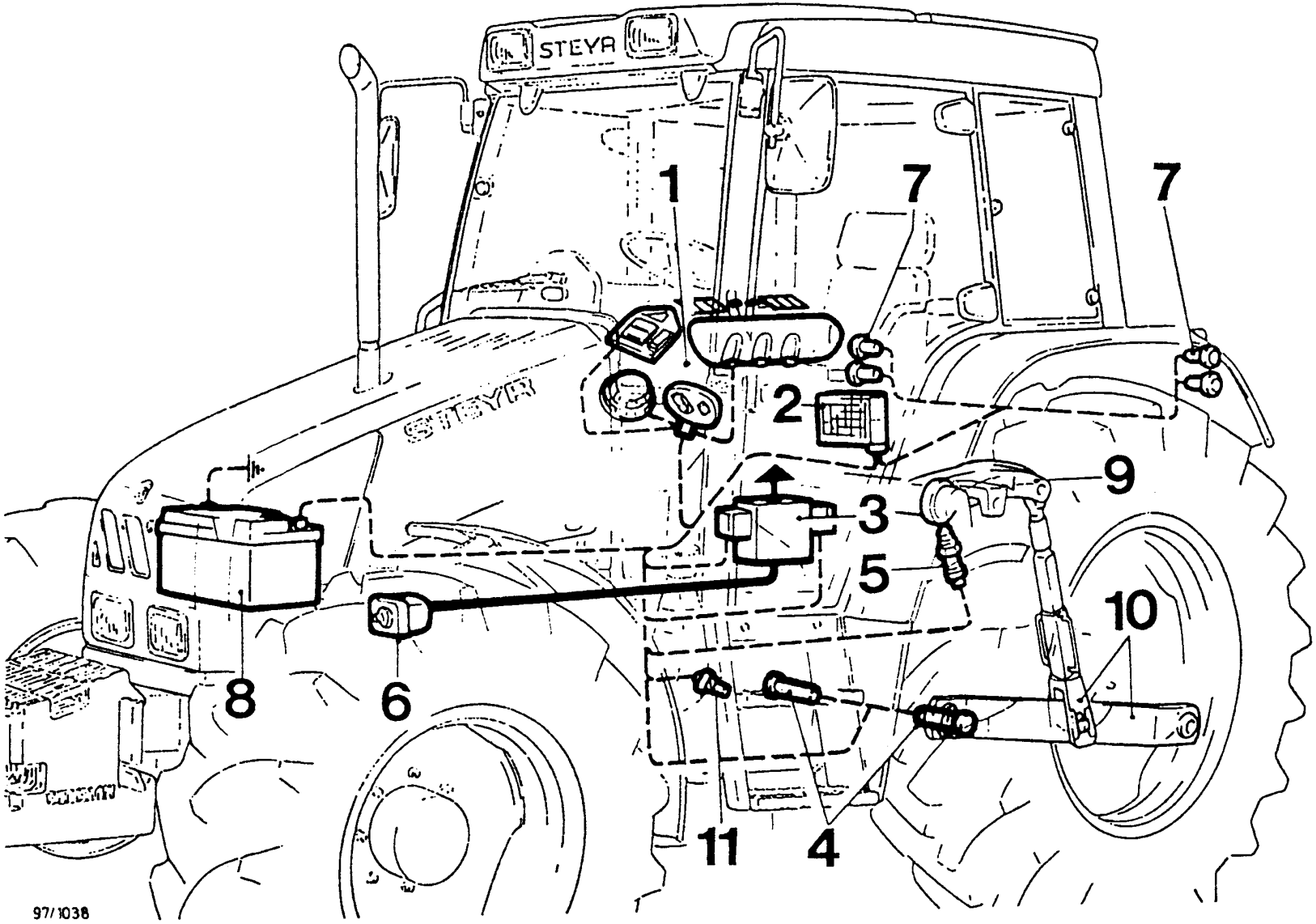
SS00K151

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"EHR D" - COMPONENTS OF THE DIGITAL ELECTRONIC LIFTING GEAR CONTROL

1 Control panel
2 Electronic box
3 EHR 23 OC automatic electrical control
4 Sensor pin for tractive force (force sensor - 2 pieces)
5 Position sensor
6 Hydraulic pump
7 Tail operation left and right
8 Battery
9 Lifting arm
10 Lifting gear
11 Ground speed sensor

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SS00K152

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FUNCTIONAL DESCRIPTION

1 Lift switch - comprices
(3 positions and 5 functions)
RAISE - WORK (also enable *)
FAST RETRACTION (floating)

2 Set point adjuster
(main potentiometer)
max. lift - max. lowering

3 Intermix (potentiometer)
Position-intermix-pure draught control

4 Lift limit (potentiometer)
to limit lift position

5 Drop speed (potentiometer)
lowering throttle

6 EHR D-auxiliary switch
Normal-excessive lift-ride controll OFF

7 LED's to indicate
raise - lower

8 EMERGENCY OFF - stop button

9 Security switch
(to cut off function of hydraulic auxiliary valves during ride on road)

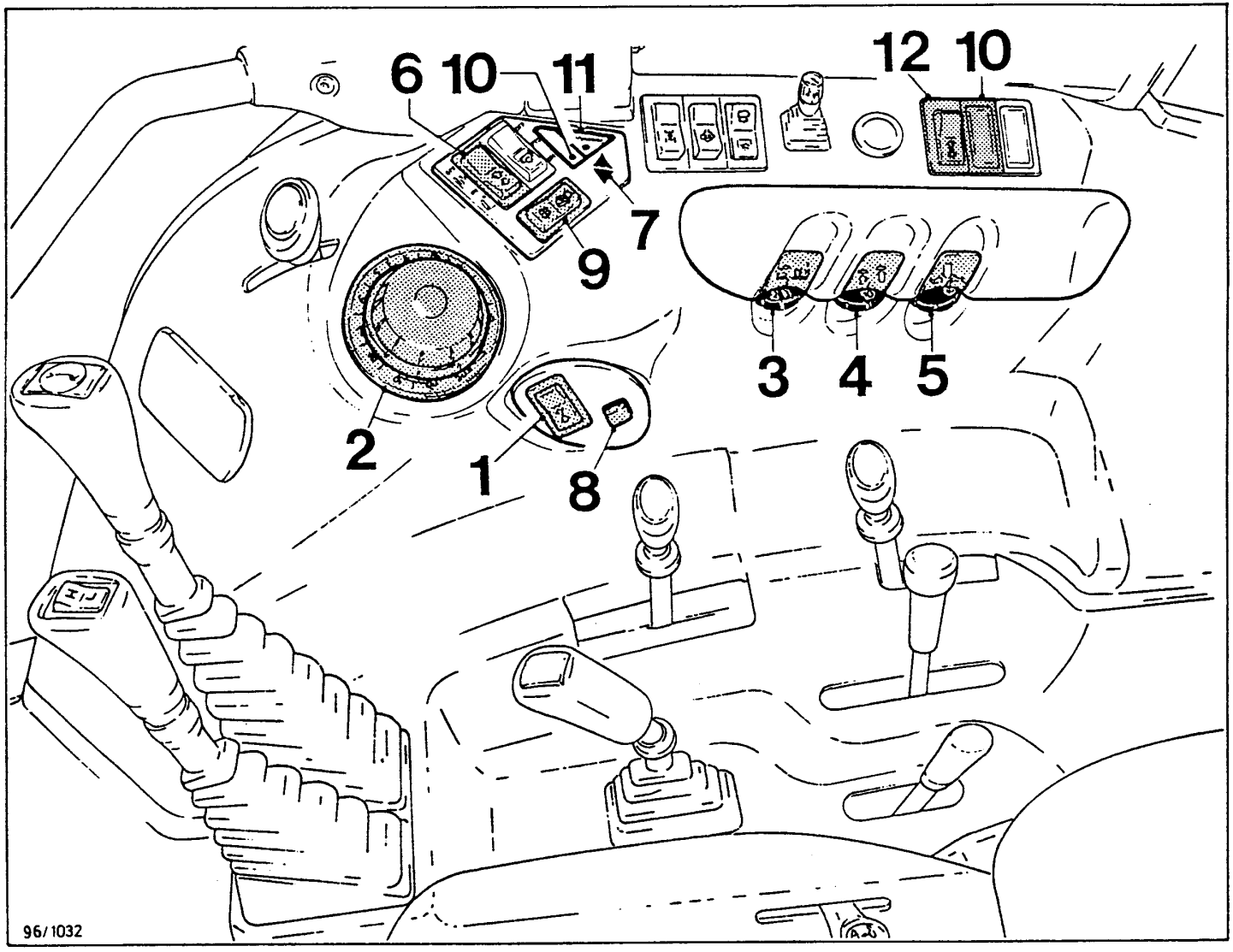
10 Operating mode switch
Draught control -slip control or pressure control
Check light lit when slip control is active

11 Diagnostic display

12 Supplementary switch for RAISE and DROP
(Parallel function to tail buttons - option)

*) Note: after start of engine - after tail operation or EMERGENCY shut off, the EHR system must be enabled. For this, RAISE/LOWER for a short moment. Without ENABLE, also lowering is NOT possible.

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SS00K153

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1) Lift switch: (standard version without Multi-Controller)

Position 1 = **Raise (up to the set lift limit)**

= also transport position

also to "enable"

Position 2 = **Work**

(middle position) (the lifting gear proceeds to the set point adjustment. Also "enable")

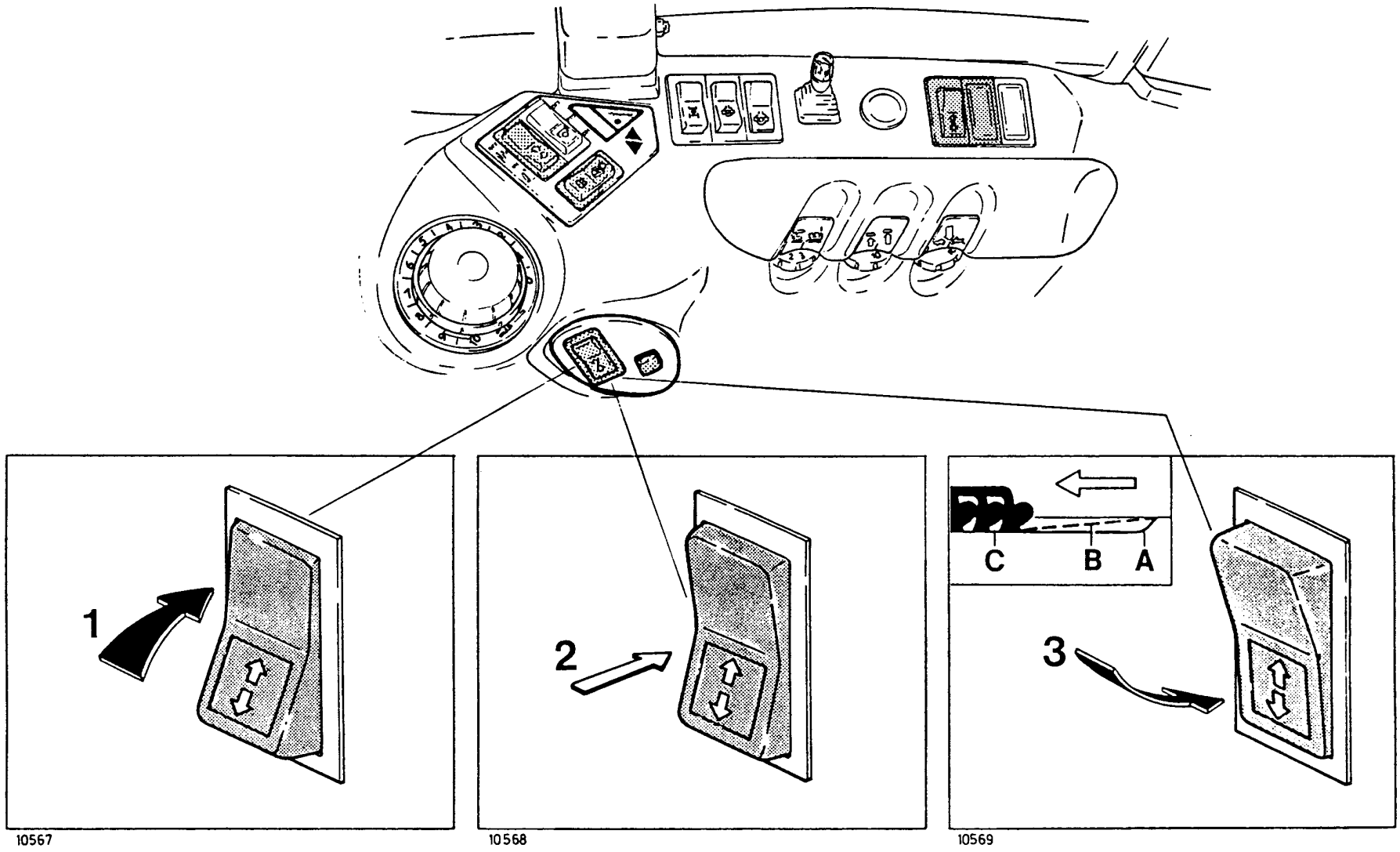
Position 3 = **Fast retraction -** (the set point adjustment will be neglected, as long as the switch is pressed down: release switch as soon as the working depth has been attained.

A = fast retraction

B = normal (switch not pressed)

C = set point adjustment

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SS00K154

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FUNCTIONAL DESCRIPTION with **Multi-Controller** (optional)

1. Buttons for RAISE and WORK
upper button: raise-transport-enable *
lower button, together pressed with safety button (rear):
work and enable *

1.1 Momentary switch - for fast retraction

2 Set point adjuster
(main potentiometer)
max. lift - max. lowering

3 Intermix (potentiometer)
Position-intermix-pure draught control

4 Lift limit (potentiometer)
to limit lift position

5 Drop speed (potentiometer)
lowering throttle

6 EHR D-auxiliary switch
Normal-excessive lift-ride controll OFF

7 LED's to indicate
raise - lower

8. EMERGENCY OFF - stop button

9 Security switch
(to cut off function of hydraulic auxiliary valves during ride on road)

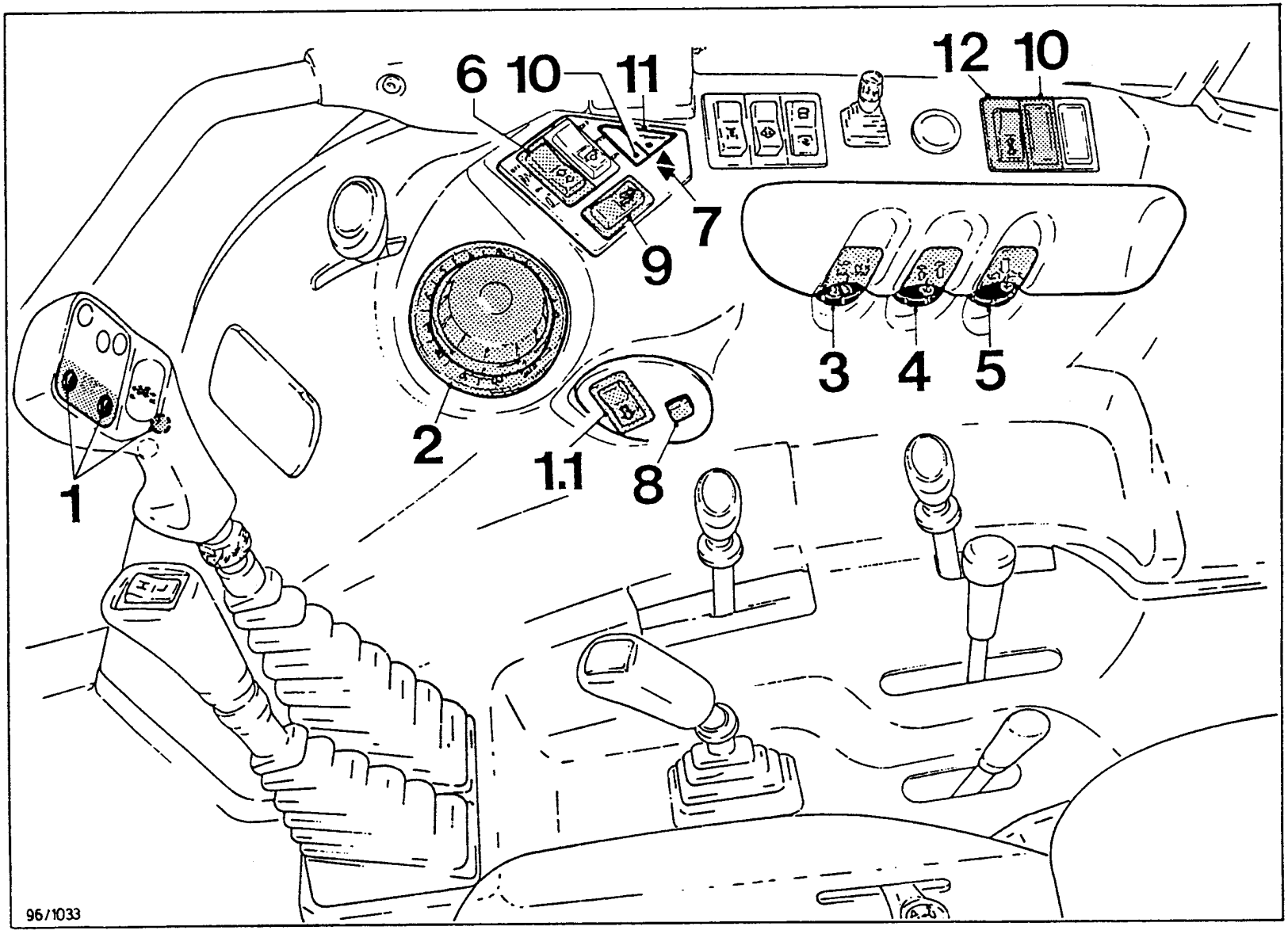
10 Operating mode switch
Draught control -slip control or pressure control
Check light lit when slip control is active

11 Diagnostic display

12 Supplementary switch for RAISE and DROP
(Parallel function to tail buttons - option)

*) Note: after start of engine - after tail operation or EMERGENCY shut off, the EHR system must be enabled. For this, RAISE/LOWER for a short moment. Without ENABLE also losering is NOT possible.

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2) Setpoint adjuster:

For setting the desired working depth or position of the mounted implement. (The working depth in the case of tractive force control, the height position of the implement in the case of position control)

0 = max. lifting height (lifting gear at the top) up to the set lifting limit

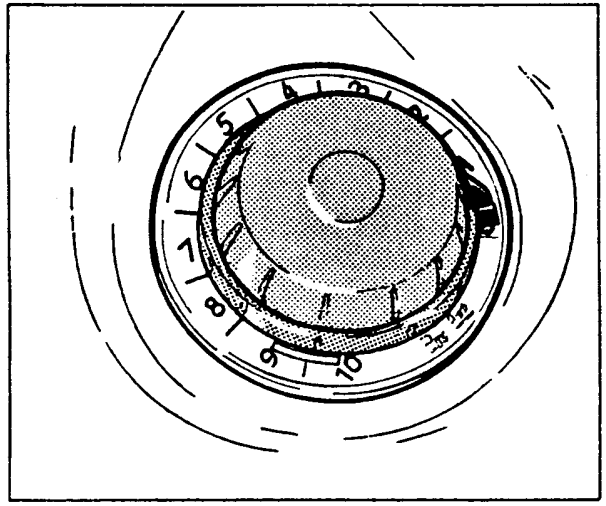
9 = max. lowering (lifting gear at the bottom)

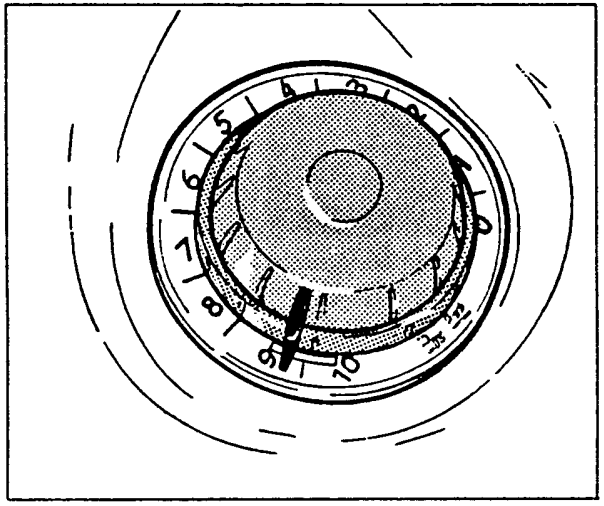
9 - 10 = floating position (lower LED lights up)

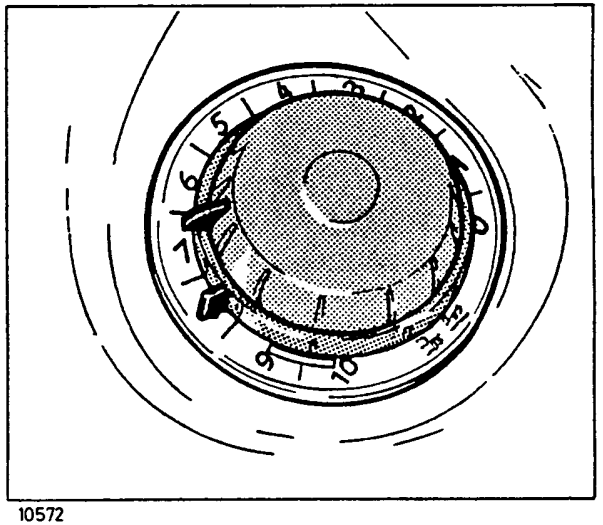
Set the adjusting ring to the initial position!

This is easily found (lock) with the adjuster and is always retained.

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3) Tractive force control:

Position / tractive force or stepless mixed control of both controlled variables.

0 = 100 % tractive force control

The current value of the tractive force is supplied by the two force sensors.

1 - 9 = Mixed control

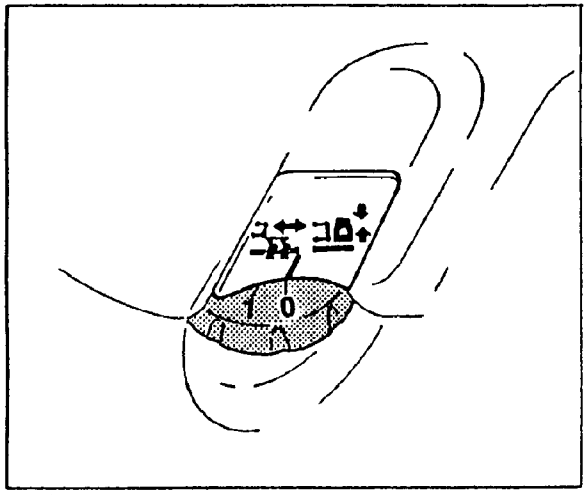
(Example: 5 = 50 % traction - 50 % position)

The actual values of the position and tractive force are mixed and processed in an adjustable ratio on the control panel.

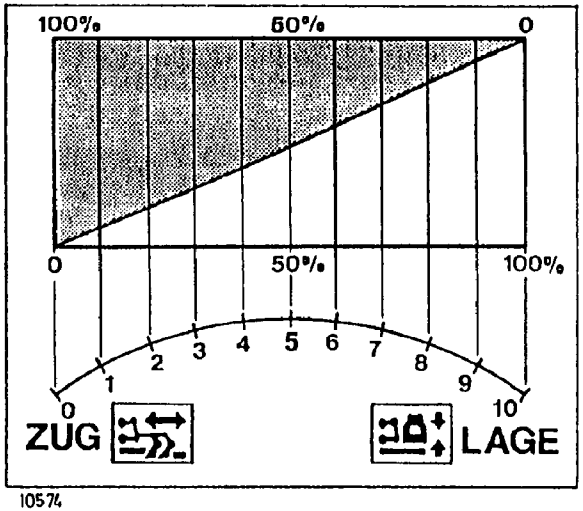
10 = 100 % position control

The actual value of the position is supplied by the position sensor via the rotational movement of the lifting shaft.

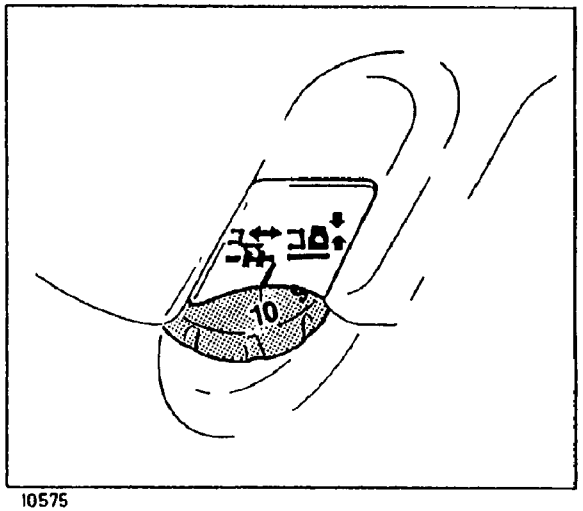
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4) Lifting limitation:

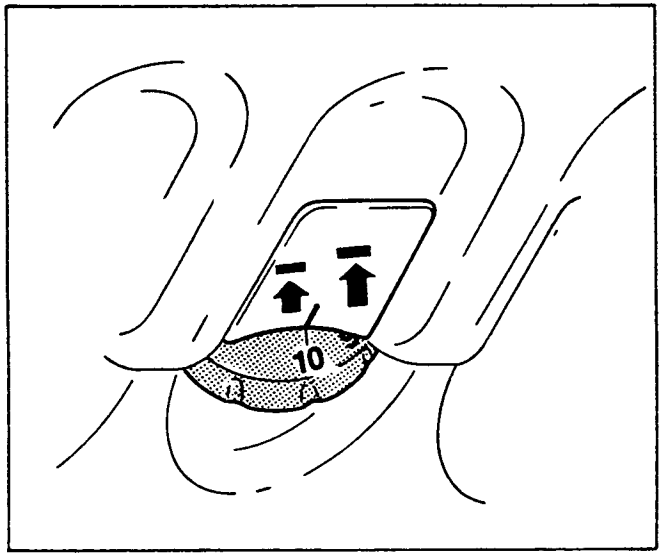
For stepless limitation of the lifting height.

10 = upper lifting limitation = max. lifting height

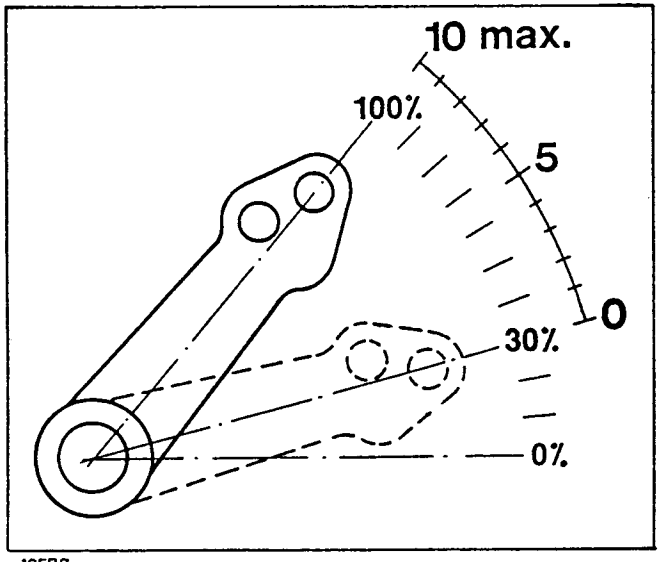
0 = lower lifting limitation = approx. 30 % of the max. lifting height

0 - 10 = adjustable lifting height range

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5) Lowering speed:

For stepless adjustment of the lowering speed down to zero.

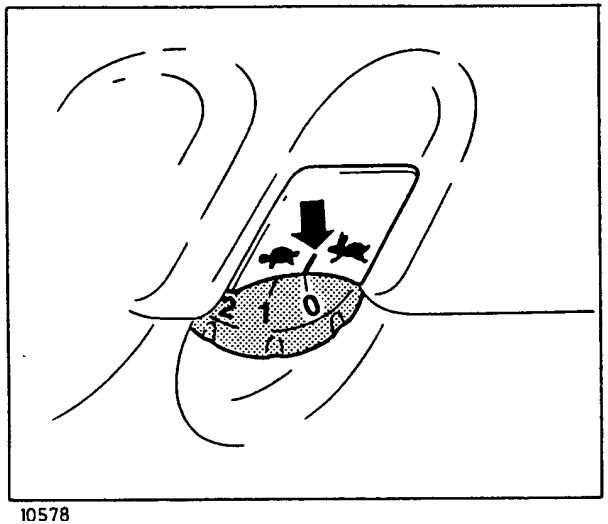
0 = closed, lowering not possible

1 =  = slow lowering

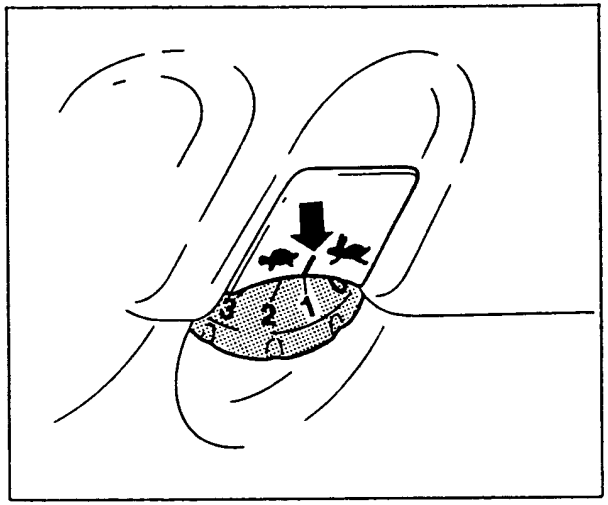
10 =  = fast lowering, max. lowering speed

ATTENTION! The lowering speed during tractive force regulation, e.g. when plowing, should only be limited to such an extent which is absolutely necessary as otherwise the control function will be impaired thus increasing slippage. (When lowering a heavy implement, set the lowering throttle to ).

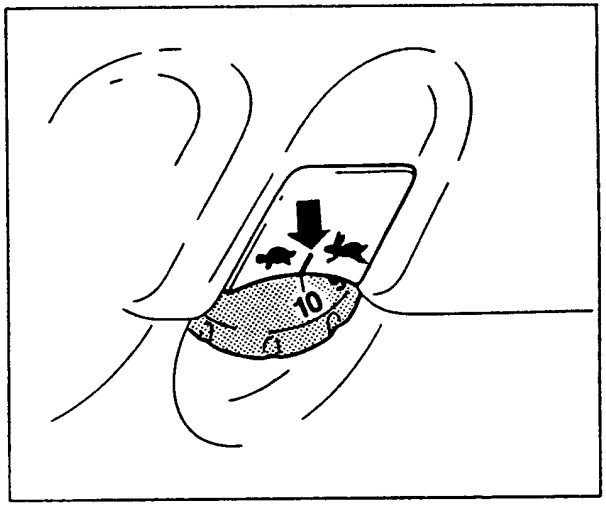
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BASIC FUNCTION OF THE "EHR" DURING POSITION CONTROL

1. Set the mix potentiometer to 10 (position control).

2. The position and lifting height are set on the control panel by the setpoint and lifting limitation potentiometers.

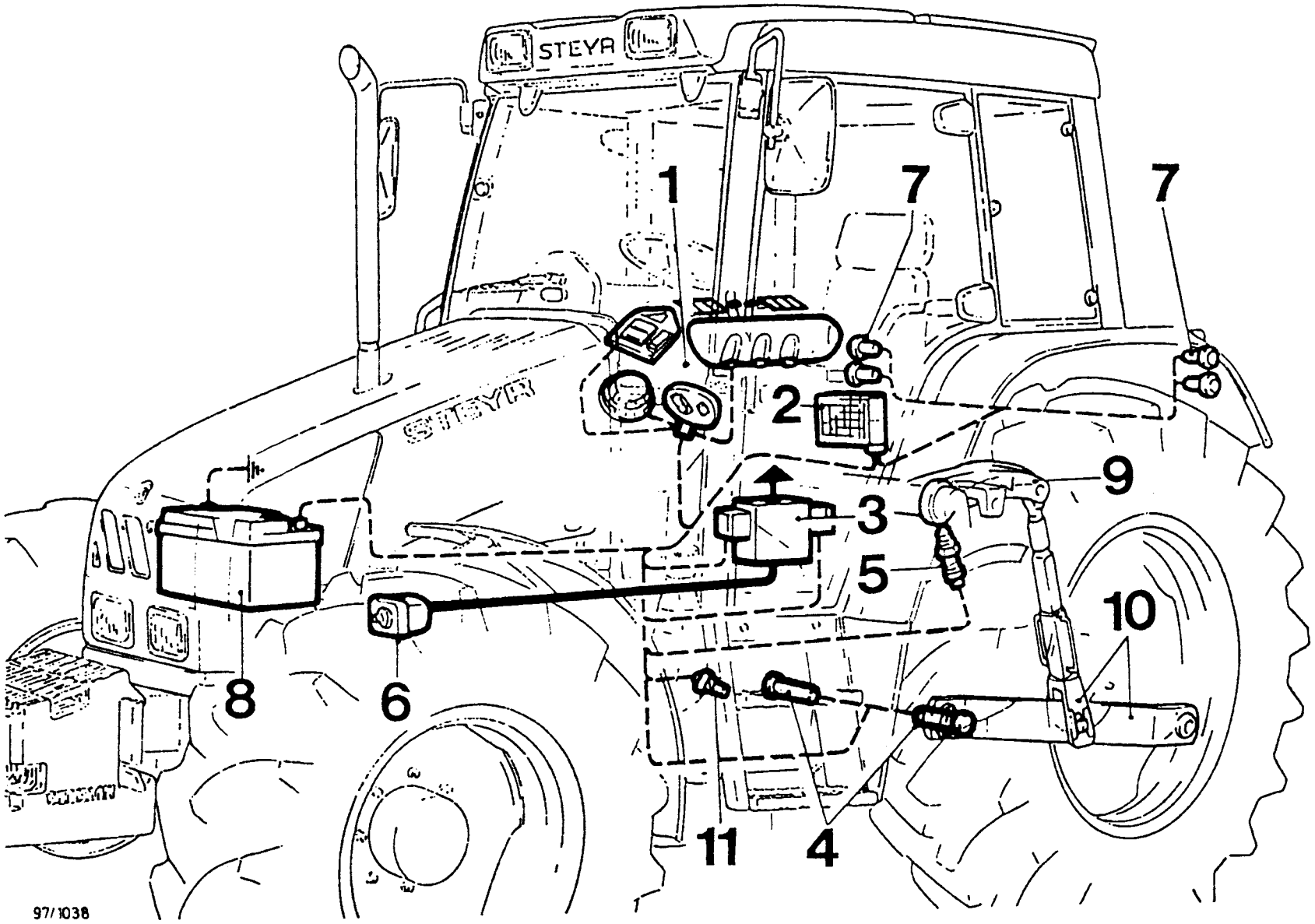
3. The electronics box carries out a variance comparison.

4. The control valve is activated and carries out the raising and lowering procedure.

5. The lifting arms change their position (hydraulics).

6. The position sensor signals the actual state to the electronics box whereby the function is completed.
   The two force sensors are not incorporated in the control when during 100% position control. An exact change of position of the lifting arms is thus only possible during 100% position control!

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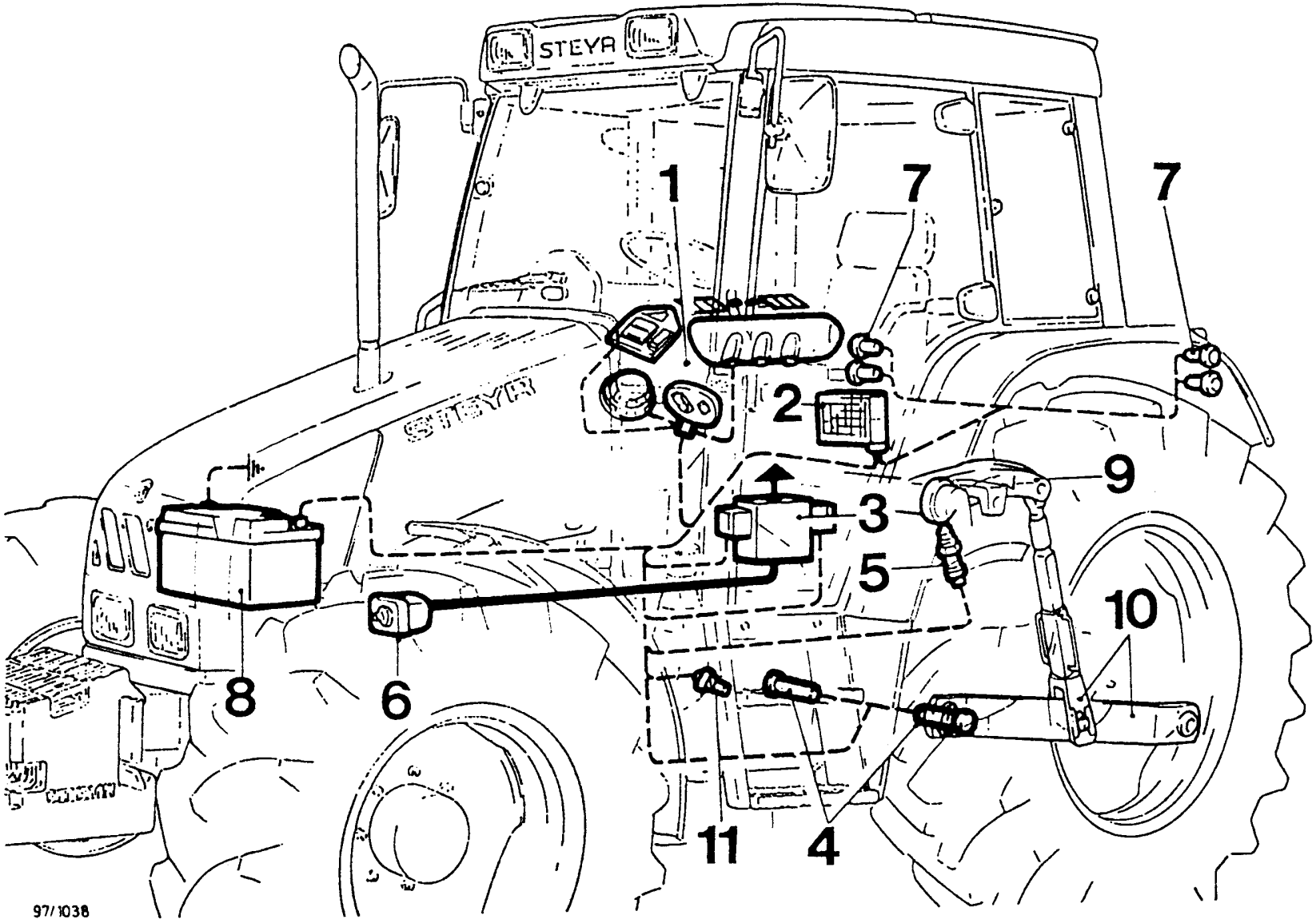
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BASIC FUNCTION OF THE "EHR" DURING TRACTIVE FORCE CONTROL

Sequence of a control function:

1. Set mix potentiometer to 100% tractive force (0).
2. The driver sets the desired values (setpoints) at the control panel.
3. The setpoints are immediately transmitted to the electronics box.
4. The momentary actual values are simultaneously recorded by the sensors and transmitted to the electronics box.
5. The electronic box continuously compares the setpoint values with the actual values.
6. If the actual values do not correspond exactly with the setpoint values, then the electronic box immediately activates one of the two solenoids on the "EHR" control unit until the actual values correspond with the setpoints values. This is why the desired working depth can only be set under tractive force load (e.g. plowing). An exact setting of the position of the lifting arms s not possible during tractive force control!
7. As the "EHR" system used by STEYR carries out a continuous acknowledgment of the actual values, such a system is called a CLOSED - LOOP CONTROL CIRCUIT.

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6) "EHR D" auxiliary switch:

OFF = Oscillation damper switched off

ON = Middle position - normal operation with oscillation damper

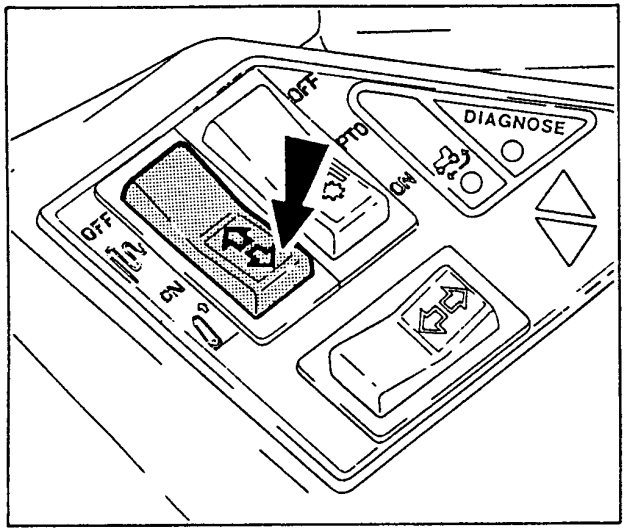
 = Excessive lift - for locking and unlocking the hitch trailor hook

"EHR D" oscillation damper (switch in the middle position):

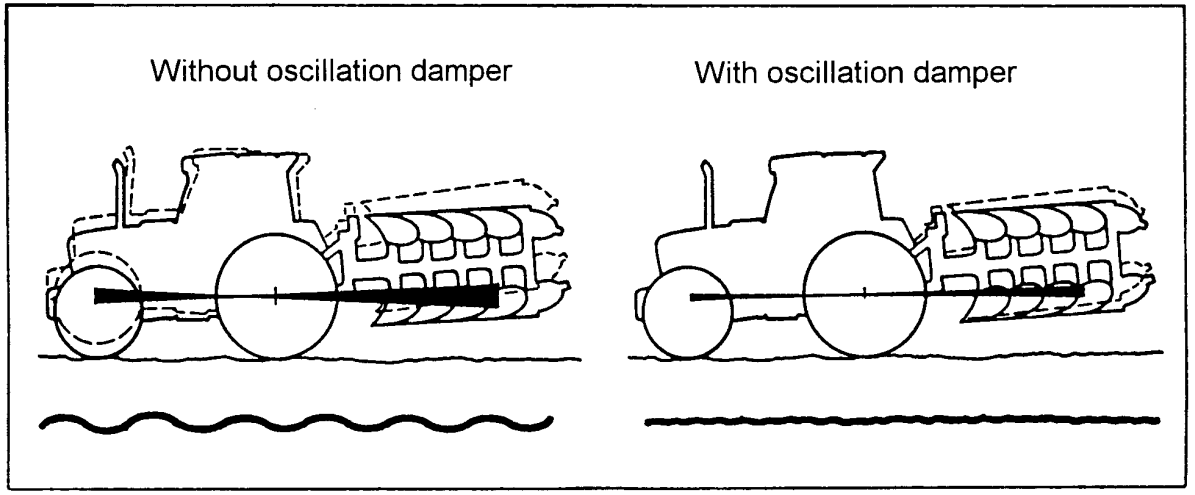
The "EHR" must be enabled, the lifting switch must be in the transport position and the driving speed must be more than 8 km/h. Oscillations and jolts which occur during the transportation of heavy mounted implements are reduced by the **"EHR D"** (see figure).

Advantages: Less mechanical strain on the hydraulic linkage and the implement. Increased driving safety thanks to the constant wheel grip of the front wheels which permits a higher driving speed.

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Switching off the oscillation damper:

(Switch depressed at the top)

ATTENTION: The driving characteristics change as a result of the rigid suspension of the mounted implement (see figure on the previous page!)

7) LEDs:

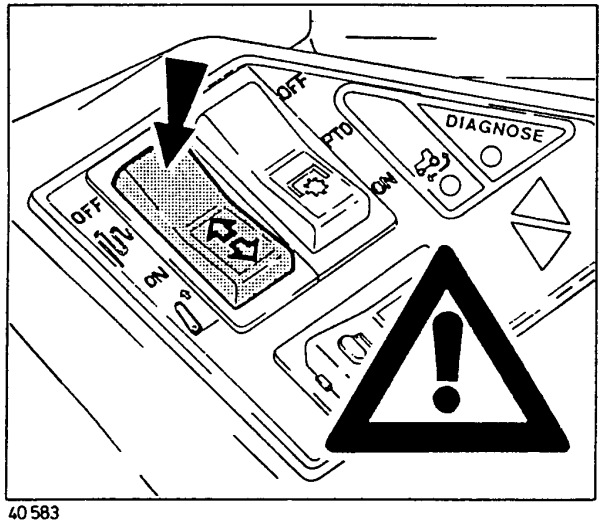
The desired function of the control can be checked via the LEDs.

- ↑ Lights up when the lifting gear is raised
- ↓ Lights up when the lifting gear is lowered

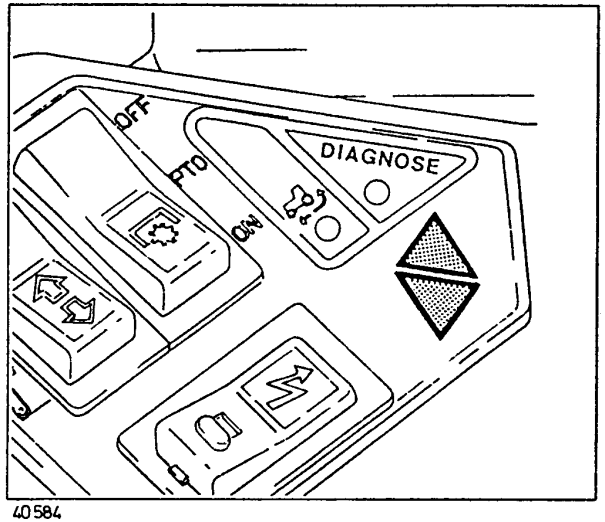
8) Stop button (red **"EMERGENCY OFF"** button):

All functions of the "EHR" are interrupted when the stop button is pressed. The diagnostic LED lights up (indicates locking). The system has to be reactivated (unlocked).

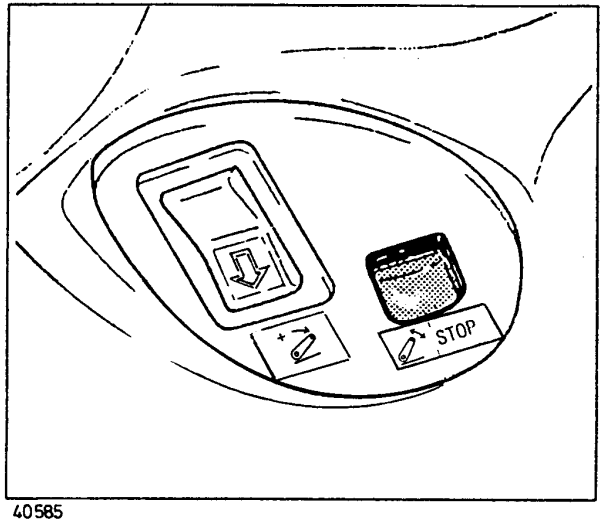
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9) Safety switch:

10) Operating mode switch (option):

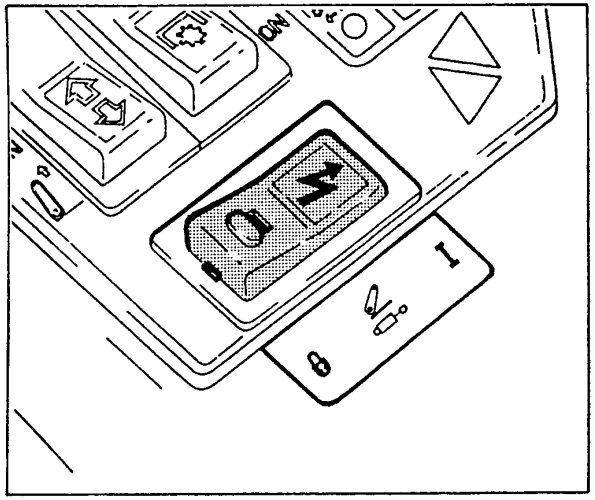
(Pressure, traction, slippage control)

Wheel slippage is also incorporated as a controlled variable in the "EHR D" when equipped with a radar sensor. A control lamp (LED) signals that the slippage control is switched on.

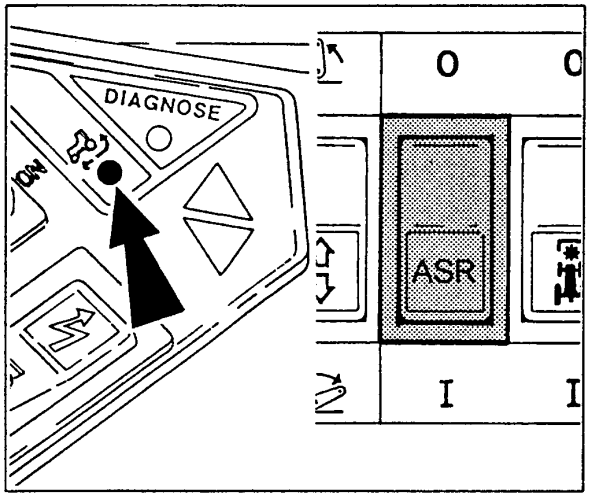
ATTENTION! Switch off the slippage control when working near the radar unit! (DANGER FOR EYES)

If the vehicle stands still for longer then 30 seconds, then the slippage control has to be switched on again!

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11) Diagnostic display:

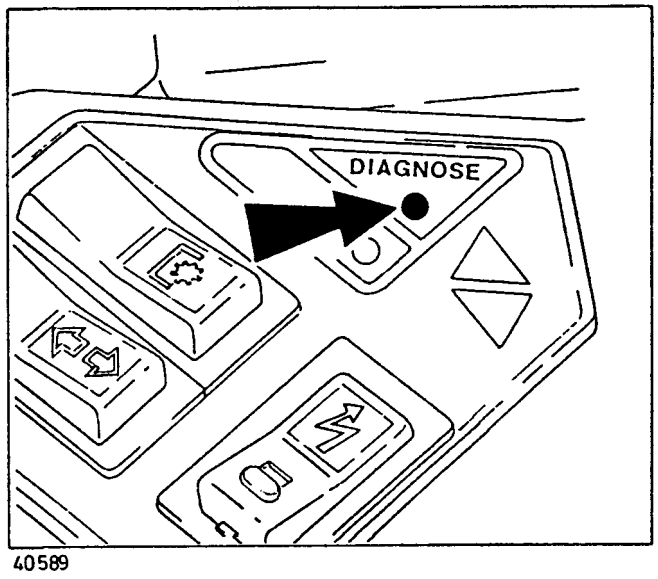
After switching on the ignition, the diagnostic LED lights up as long as the "EHR D" system remains locked.

If the system is OK, then the diagnostic LED goes out after releasing (activating) the "EHR D" system.

Diagnostic display in the event of a malfunction:

If the integrated diagnostic system discerns a fault in the "EHR D" system, then the LED signals the respective fault by flashing rhythmically.

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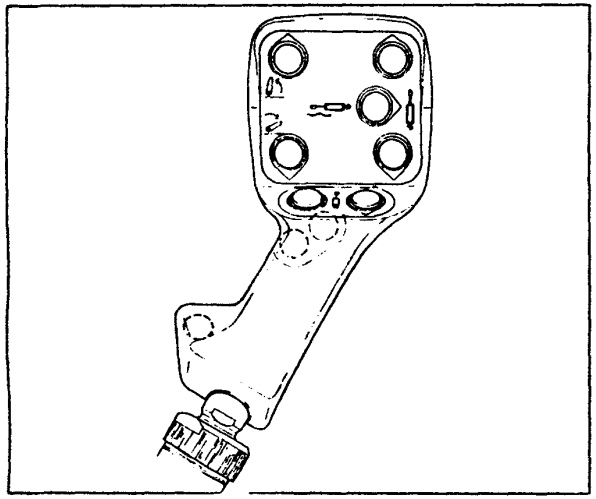
Tail operation:

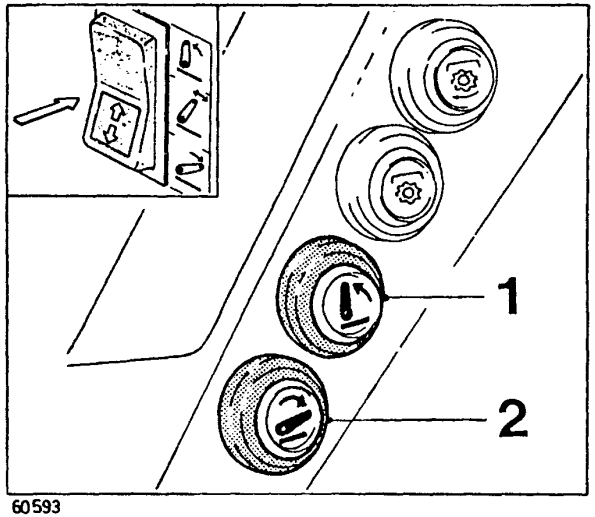
↑ = Button - lifting gear is raised (1)

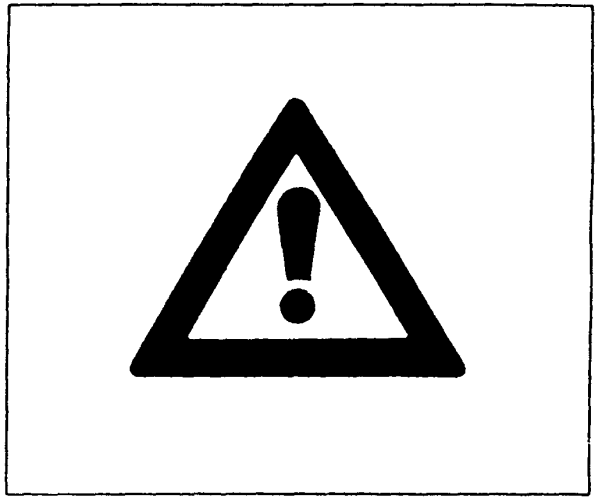
↓ = Button - lifting gear is lowered (2)

ATTENTION! All other operating possibilities of the "EHR D" system are blocked during tail operation. This lock is released again by pressing the RAISE or LOWER buttons (releasing of the "EHR D" system).
Only low lifting speeds are possible during tail operation (for safety reasons).

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General information:

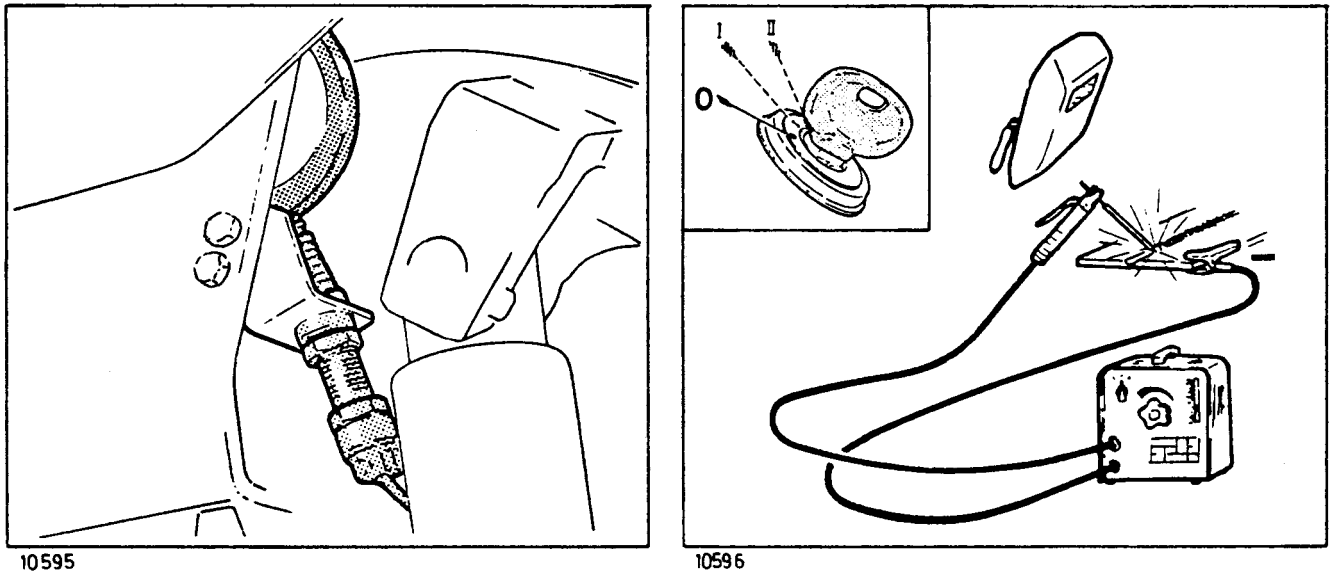
The electronic box **does not** have to be disconnected when welding work is carried out on the tractor. However, it is absolutely necessary that the **ignition switch** is in the **"0" position**! (The ground terminal of the welding unit must be near to the area which is being welded!). Do not disconnect the battery.

Engine boost start (voltage > 18 volts) will destroy the EHR-electronic box!

When using high pressure cleaners, keep the water jet away from sensitive components such as control units, sensor etc..

Note: Keep clean the excenter with operates the position sensor and do NOT grease it!

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EMERGENCY OPERATION

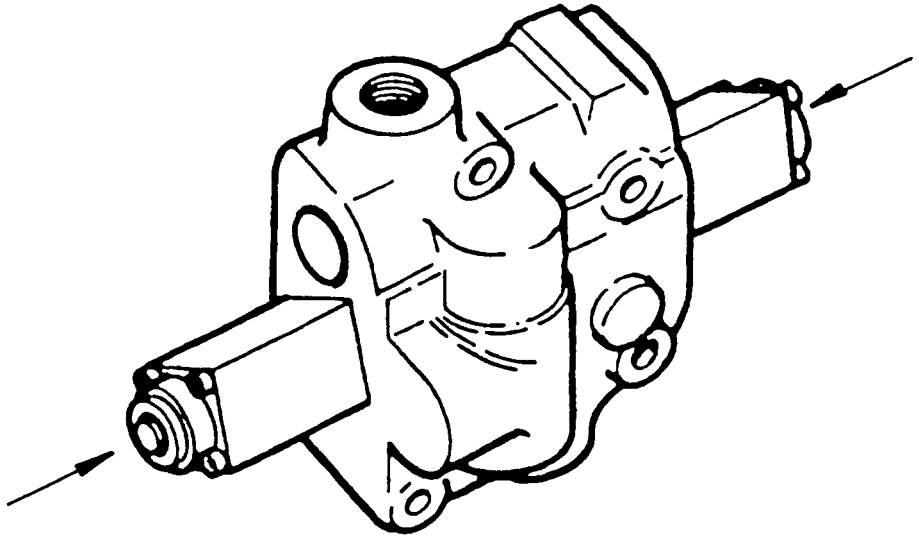
In the event of a total failure of the electrics/electronics system, a raising / lowering procedure can be carried out through manual operation of the magnets.

1. Remove both plugs from the solenoid valves.
2. RAISE emergency operation (press button at front solenoid)
3. LOWERING emergency operation (press button at rear solenoid)

Hydraulic pressure is necessary for LOWERING by emergency operation (running engine/pump).

If engine can not run, the pipe connection at port A on the EHR-control valve has to be loosened to lower the implement.

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INDUCTIVE POSITION SENSOR WITH AC/DC CONVERTER

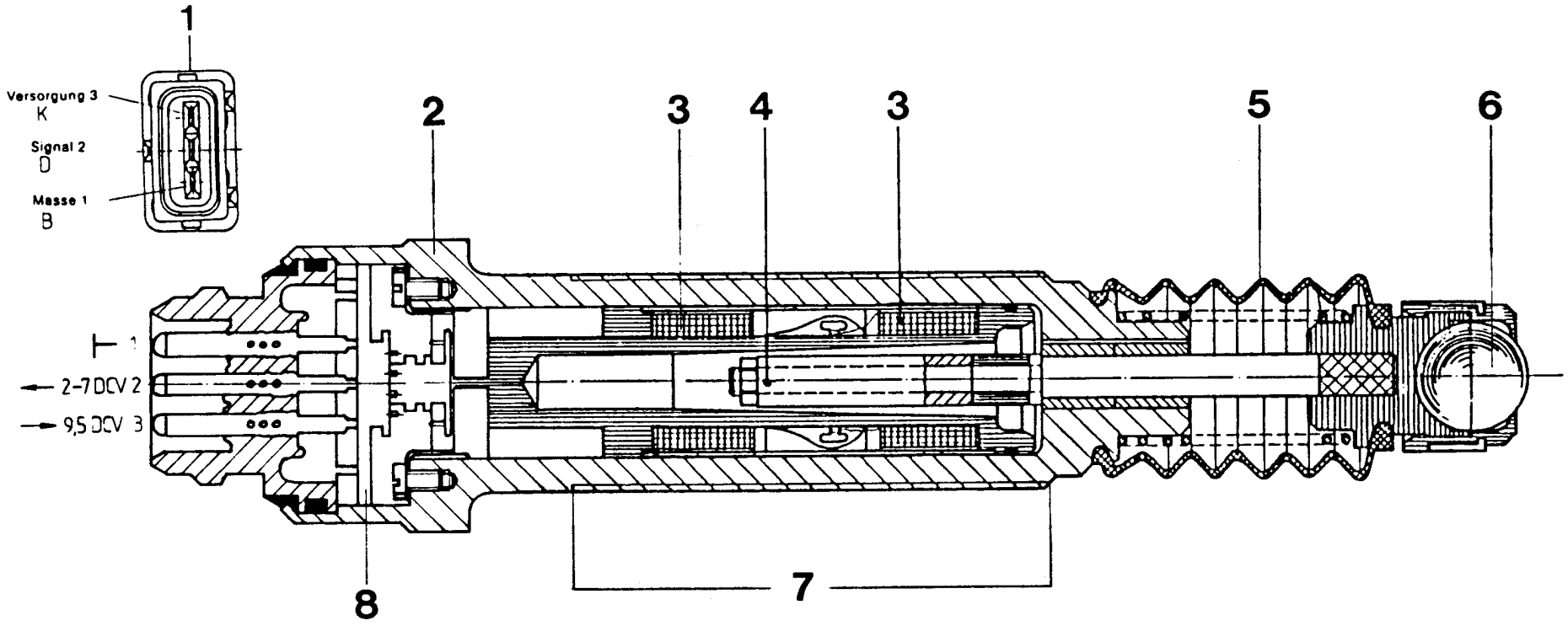
Setup and function:

The position sensor converts the linear movement (cam lift) into an electric signal. The sensor works contactless and thus free from wear through the inductive displacement pickup according to the differential throttling principle. The integrated electronics system incorporates an AC/DC converter and a temperature compensator. The output signal is proportional to the cam lift, thus proportional to the position of the drawbar or implement.

Brief description:

1. 3 pin connector
   - 1 = ground
   - 2 = output voltage (signal)
   - 3 = supply voltage
2. housing with hexagon
3. differential coil
4. ferrit core
5. rubber boot
6. contacting ball
7. thread for fitting and adjusting
8. oscillator and AC / DC converter

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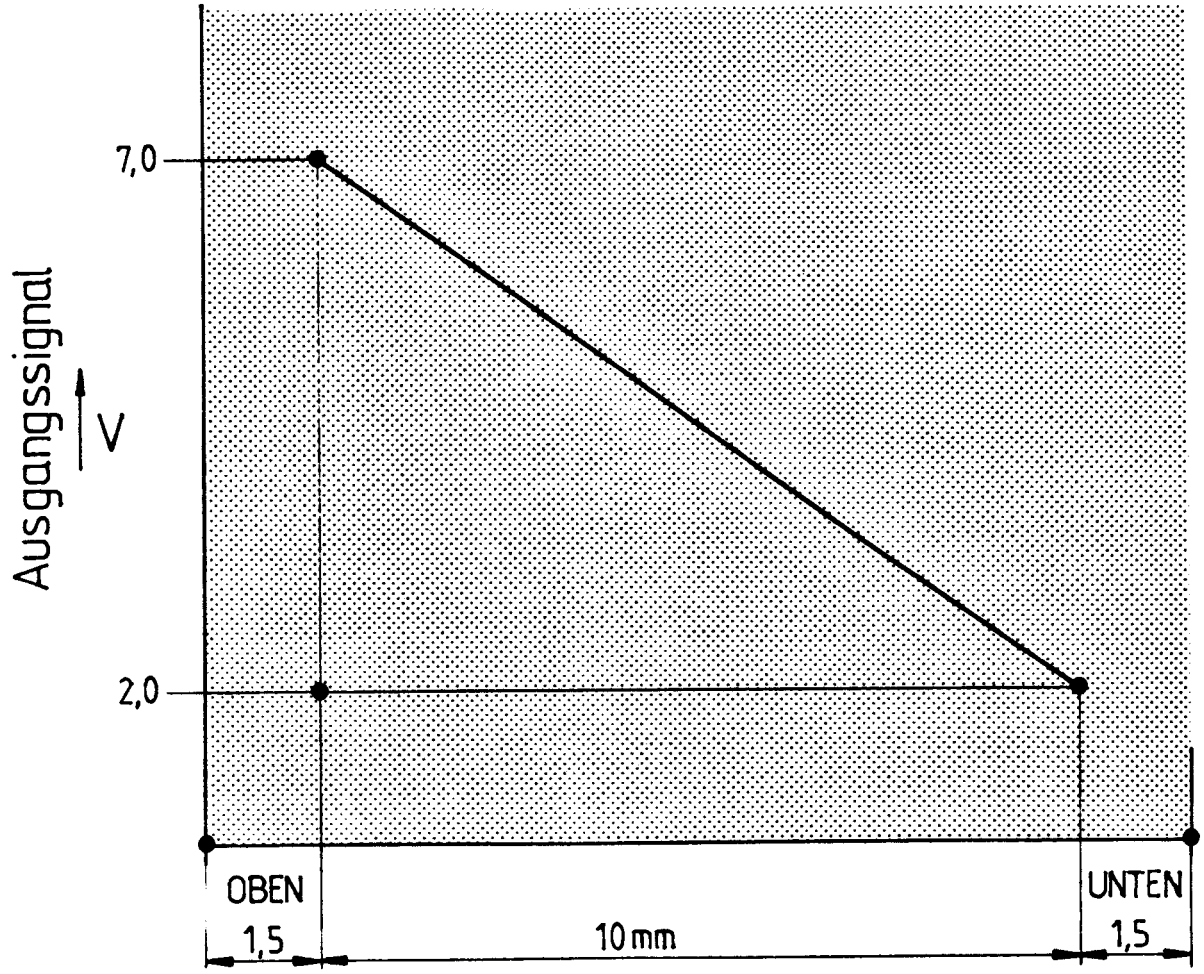
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POSITION SENSOR - technical data and characteristics

Maximum mechanical stroke	13 mm
Maximum sensing stroke	10 mm
Supply voltage	9,5 V DC stabilized
	(to be measured from pin 3 to pin 1)
Output signal	from 2 to 7 Volts, according to the momentary position of ferrit core or lifting gear (to be measured from pin 2 to pin 1).
Resistance values	pin 3 to 1 appr. 4,8 kΩ
(Ohm's resistance only, with	pin 2 to 1 appr. 6,2 kΩ
sensor disconnected)	pin 3 to 2 appr. 1,36 kΩ
Linearity	< ± 3% of 10 mm stroke
Fitting	Thread M 24 x 1,5
Protection class against	proof against splashing water
enviremental stress	

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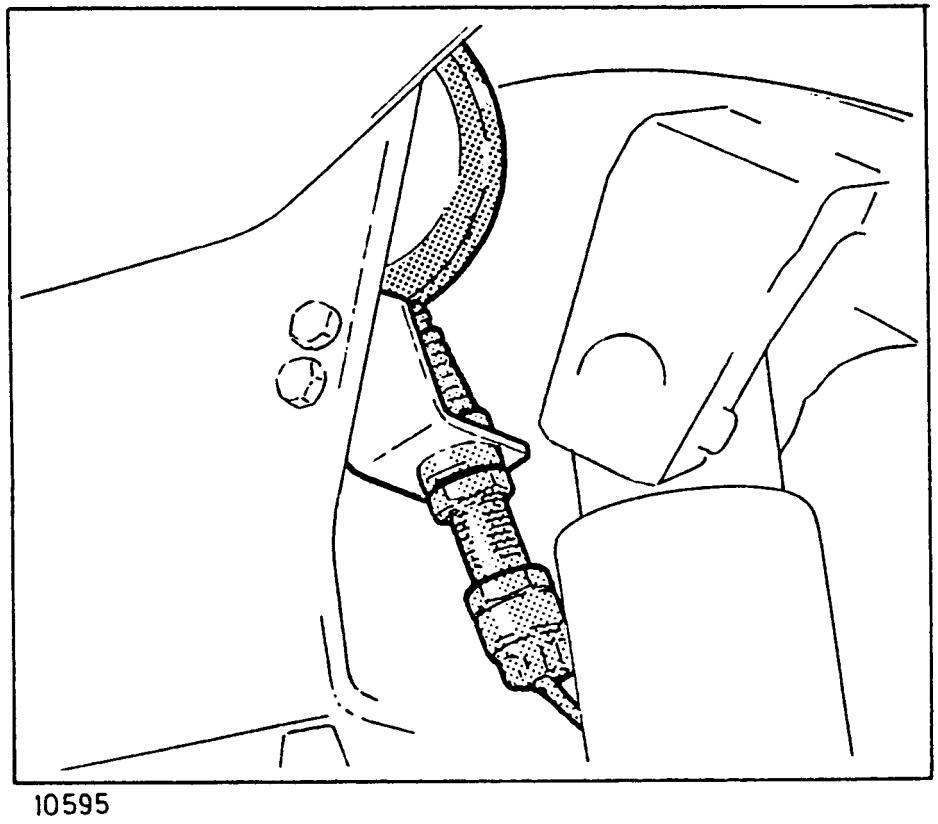


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ADJUSTMENT OF THE POSITION SENSOR

- Start the engine. By pressing the tail button "lower", bring the lifting gear to ist lowest possible position.
- Screw in the sensor together with its checknut until the ball contacts the excenter.
- Turn the sensor 1 turn clockwise.
- Connect the harness to the sensor.
- Raise lifting gear to the upper most position by pressing the tail button "raise".
  Check now the free-travel of the lift cylinder (desired value is 5 mm at the plunger).
- For correction,
  turn sensor clockwise to enlarge the amount of free travel
  turn sensor anticlockwise to reduse the amount of free travel
- Note: After any alteration of the adjustment of the sensor, lower the lifting gear a small amount with the help of the tail button and raise again. Finally, a free travel of 5 mm at the plunger must be achived.
- Do not lubricate excenter and ball.

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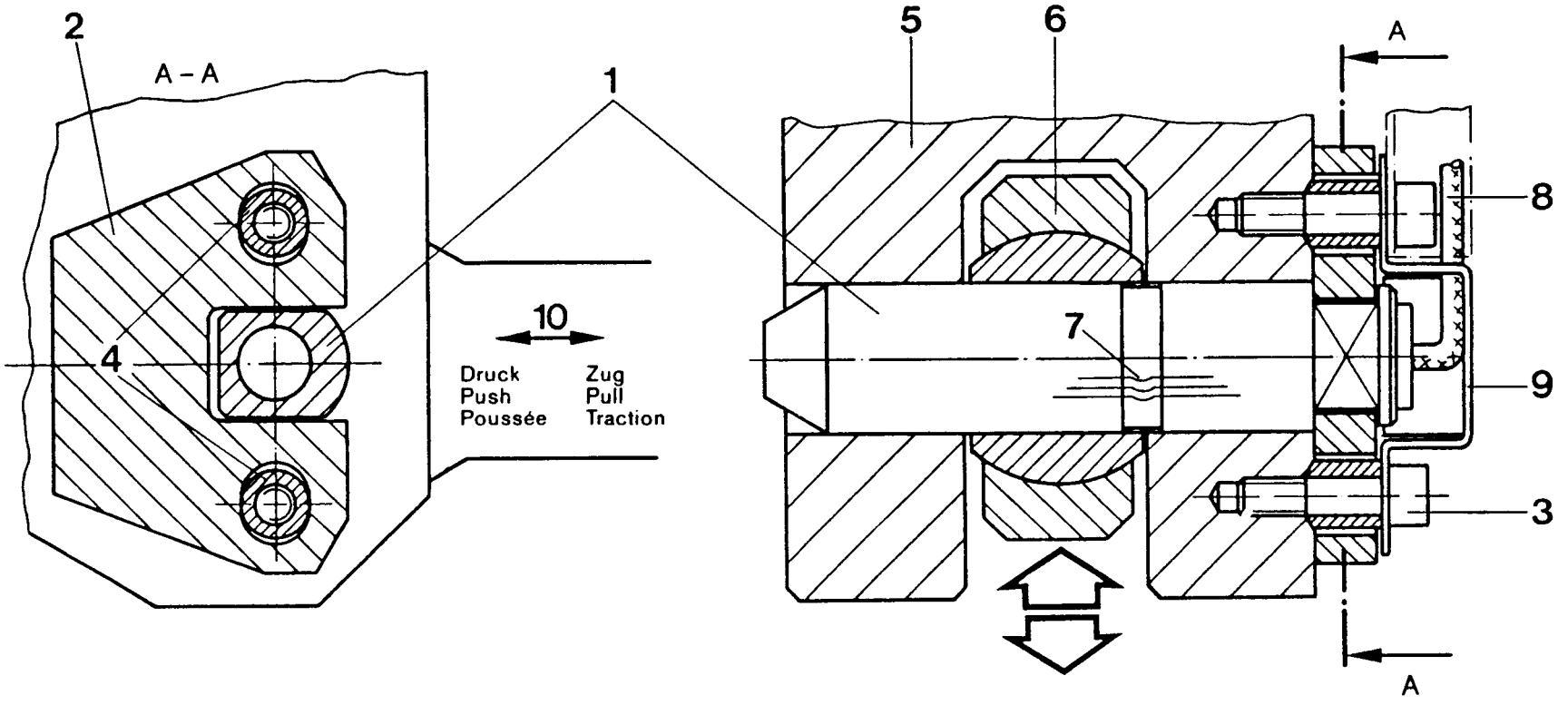
FORCE SENSOR - SETUP AND CORRECT ASSEMBLY

1. Force measuring pin (must be fitted tension free)
2. Fastening bow
3. Fastening screws
4. Distance sleeves
5. Final drive housing
6. Lower link
7. Measuring electronic
8. 3 pole connecting cable
9. Cable cover
10. Measuring directions

Function:

- The EHR D" force sensors operate according to the **magneto-elastic** principle.
- The interior of the hollow force sensor is fitted with a primary and secondary coil.
- An oscillator generates an alternating voltage in the kHz range from the supply (9.5 V direct voltage) for the primary coil.
- There is no magnetic flow through the secondary coil when the force sensor is not under load.
- The more the force sensor is loaded, the higher the flow through the secondary coil in which a voltage is induced.
- The signal voltage is rectified, smoothed and amplified in an electronic circuit which is also integrated in the force sensor.
- The signal voltage is approx. 50% of the supply voltage (4.7 V = see diagram) in an unloaded condition.
- **The signal voltage drops when there is tractive action** and increases when there is pushing action (**observe the installation position**).
- The signal voltage supplied by the force sensor can move in a range of 25% to 75% of the supply voltage.
- In the transport position (above 8 km/h), the force sensor is used as a signal transmitter for the oscillation damper.

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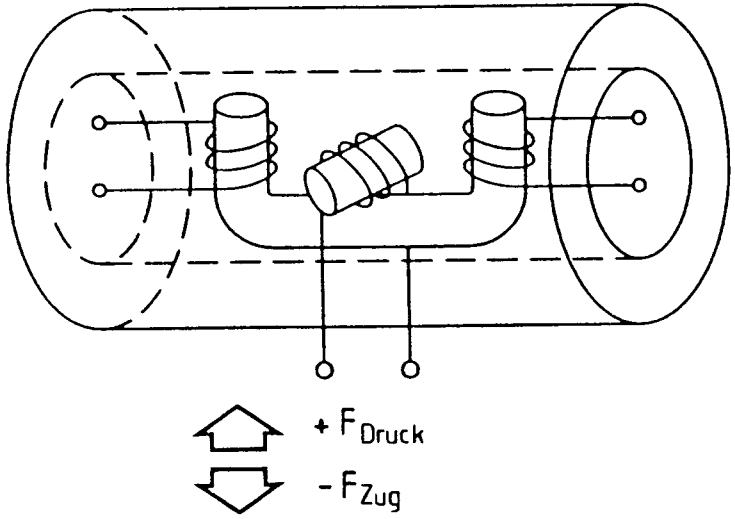
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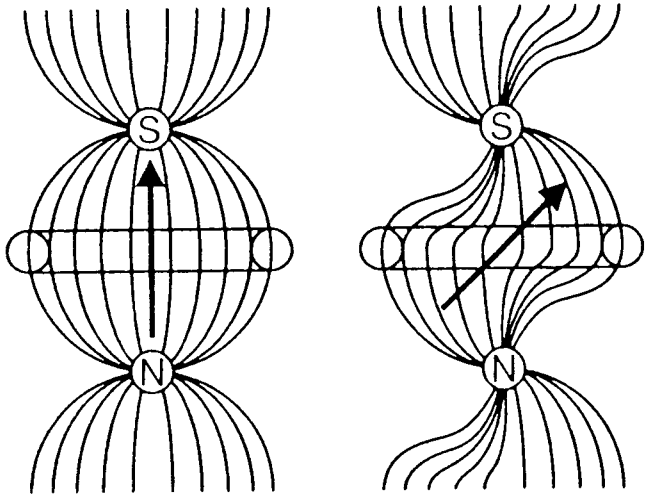
FORCE SENSOR - TECHNICAL DATA AND SIGNAL CONDITIONING

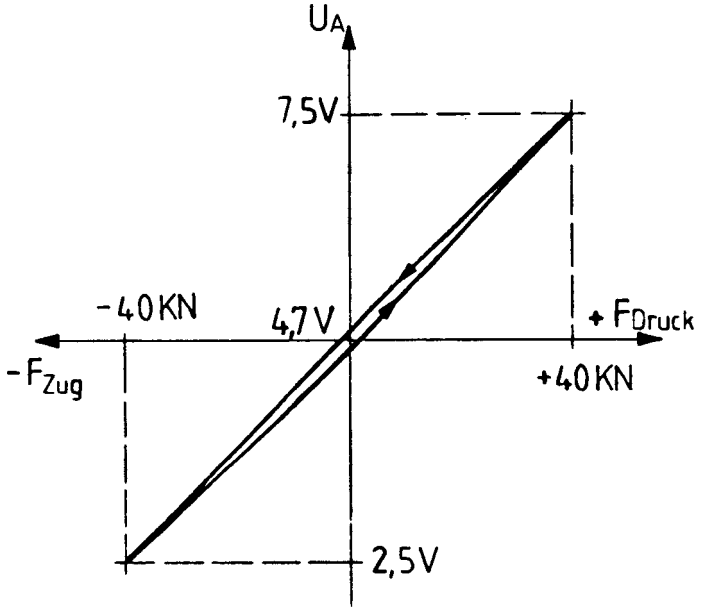
Force measuring pin			for a tractive force of up to 40 kN (pin Bosch end no.: 545)
Supply voltage			9.5 V stabilized direct voltage at terminal 3,
			Ground at terminal 1; stabilizing stage in electronics box
Current draw			< 100 mA
Voltage values	terminal 1 and 3	=	9.5 V =
	terminal 1 and 2	=	2.5 to 7.5 V = depending on load
Load resistance across terminals 1 and 2			> 10 kΩ
Type of protection			water proof when in a submerged state

The "EHR D" (9000 series) force sensors correspond to the EMC guidelines (**E**lectro **M**agnetic **C**ompatibility).

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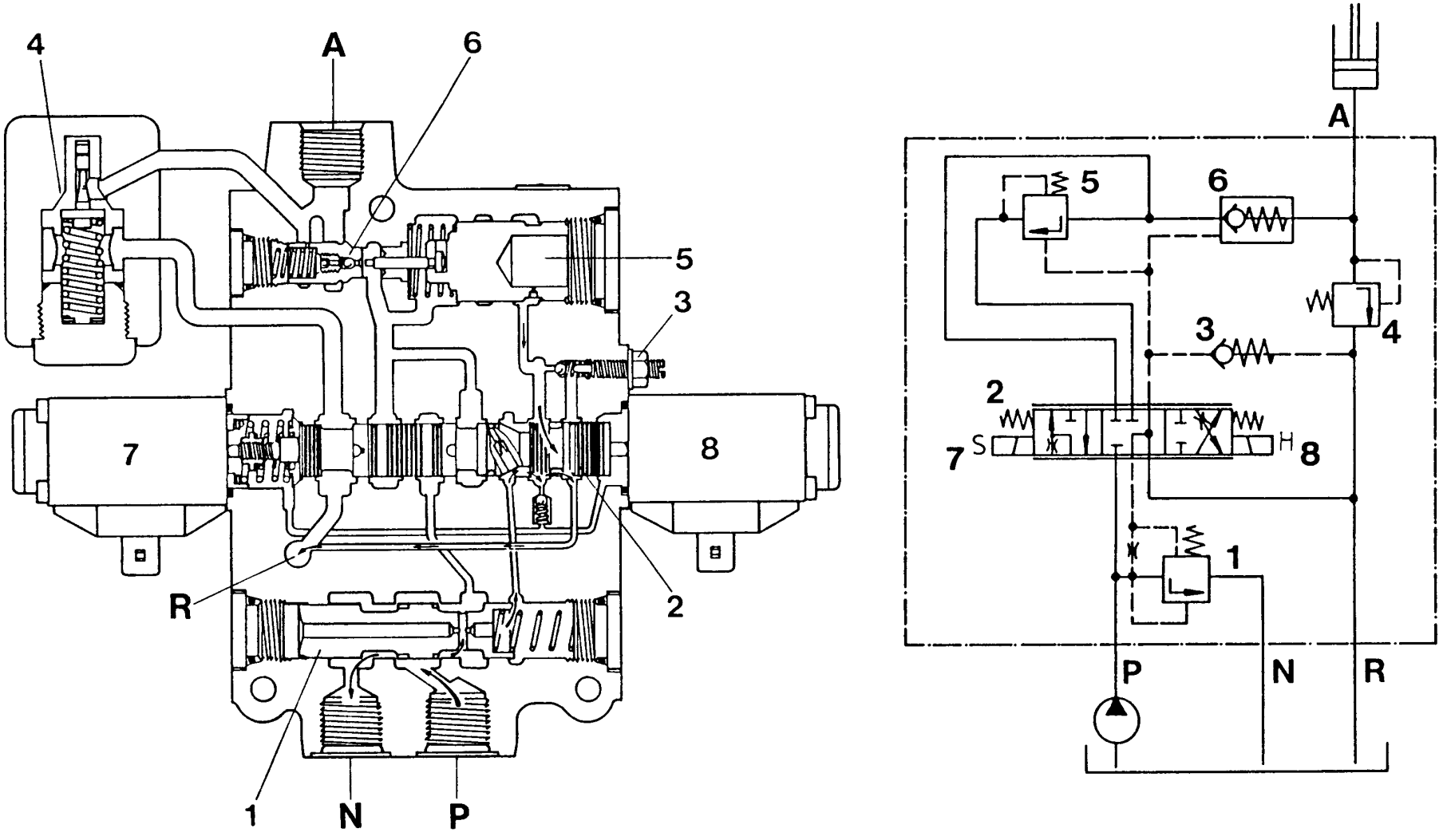
EHR-PROPORTIONAL HITCH CONTROL VALVE

1	3 way flow regulator for RAISE	7	Solenoid for DROP (Y7) black plug
2	main control spool	8	Solenoid for RAISE (Y6) white plug
3	pressure control valve	A	port consumer (lift cylinders)
4	shock valve	P	port pressure (from pump)
5	2 way flow regulator for DROP	N	port neutral
6	lowering valve with pilot (leak proof)	R	port return (tank)

Technical data:

Ambient temperature	- 25 ..... + 60 ° C
Medium	Hydraulic oils on mineral basis, standardized in DIN and ISO, others on request
Viscosity	10 ..... 400 mm²/s
Working temperature for medium	- 25 ..... + 80 ° C
Max. permissable Working pressure	P: 250 bar, R: 5 bar, N: 30 bar
Max. flow rate	80 l/min
Max. permissable leak rate	max. 2 cm³ per min. at 125 bar, viscosity 35 mm²/s
System of control	direct actuation by means of proportional solenoids 12 V system coil resistance: R = 1,7 + 0,5 Ω/ Imax. = 3,5 A
Electr. connection	plug 2 pin
Standard of electr. connection	IP 64 A
Shock valve	250 bar max. pressure

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EHR-CONTROL VALVE - NEUTRAL POSITION

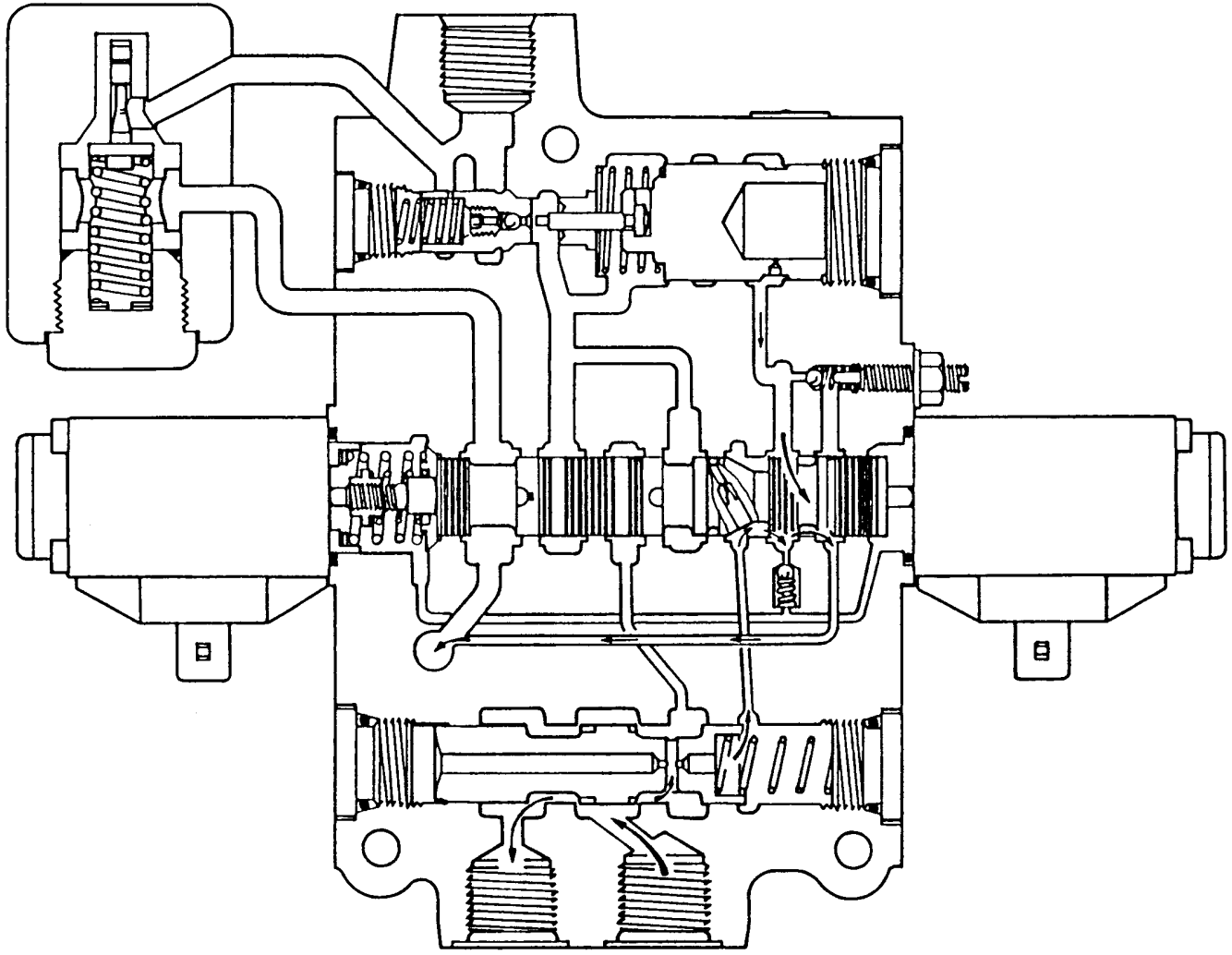
Non of the solenoids are energized.

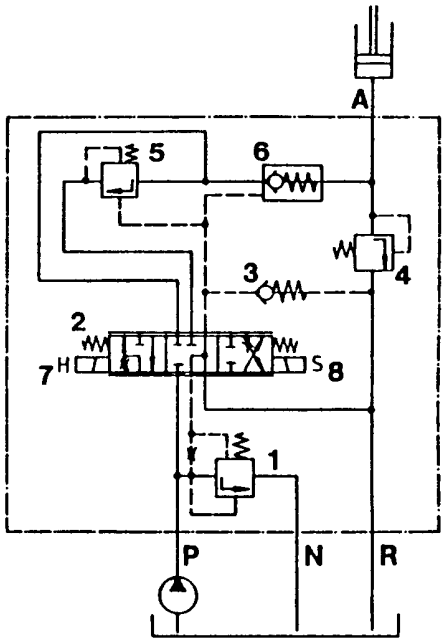
The pump oil flows from port P to port N, passing through the 3 way flow regulator. From there the oil flows back to the sump.

The load pressure rests on the closed lowering valve 6 and on the closed shock valve 4 in parallel.

Picks of pressure, originating from mass acceleration of an implement, cause the shock valve to open, thus preventing the hydraulical - and mechanical system of the hitch from excessive stress.

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EHR-CONTROL VALVE - RAISE POSITION

The control valve is a component of a closed look control circuit.

In the event of a control deviation, the RAISE control command is passed to the solenoid Y8 (RAISE) from the electronic control unit A55.

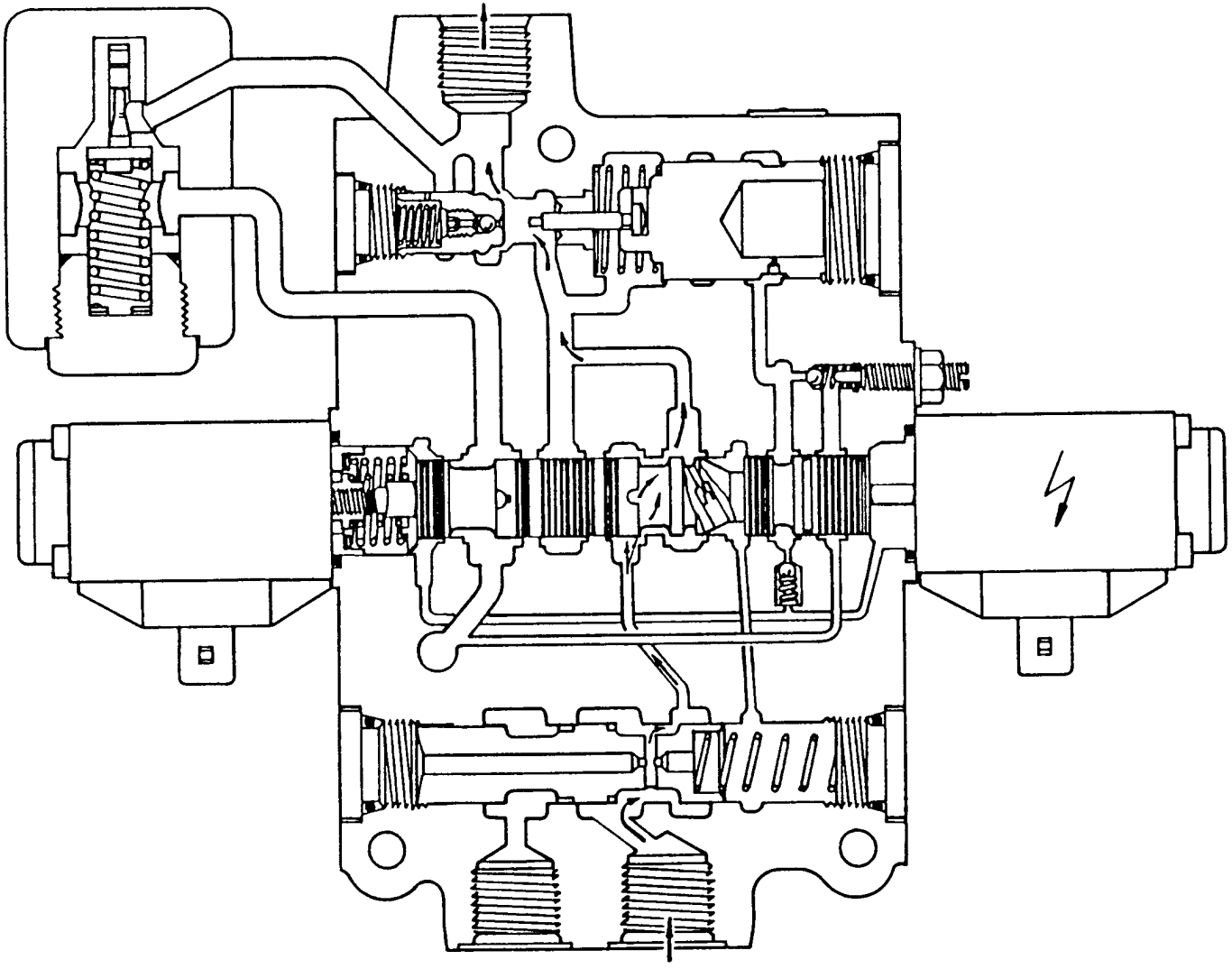
The control spool opens the metering edge according to the control deviation.

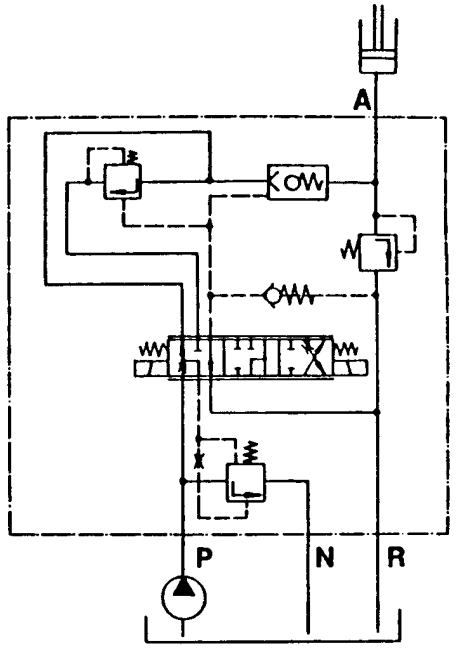
When RAISING, the pump oil flows via spool 2, check valve 5, port A to the lift cylinders.

The flow control spool 1 and the main spool 2 comprise a 3 way flow regulator (pressure balance).

The function of the flow regulator ensures an almost constant lifting speed even if the load and thus the load pressure varies in a wide range.

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EHR-CONTROL VALVE - DROP POSITION

The control valve is a component of a closed loop control circuit.

In the event of a control deviation, the DROP control command is passed to the solenoid Y8 (DROP) from the electronic control unit A55.

The control spool opens the metering edge according to the control deviation.

When DROPING, a pressure of 5 to 6 bar is acting on the control piston at 6, thus opening the pilot of the lowering valve. Finally, the lowering valve opens.

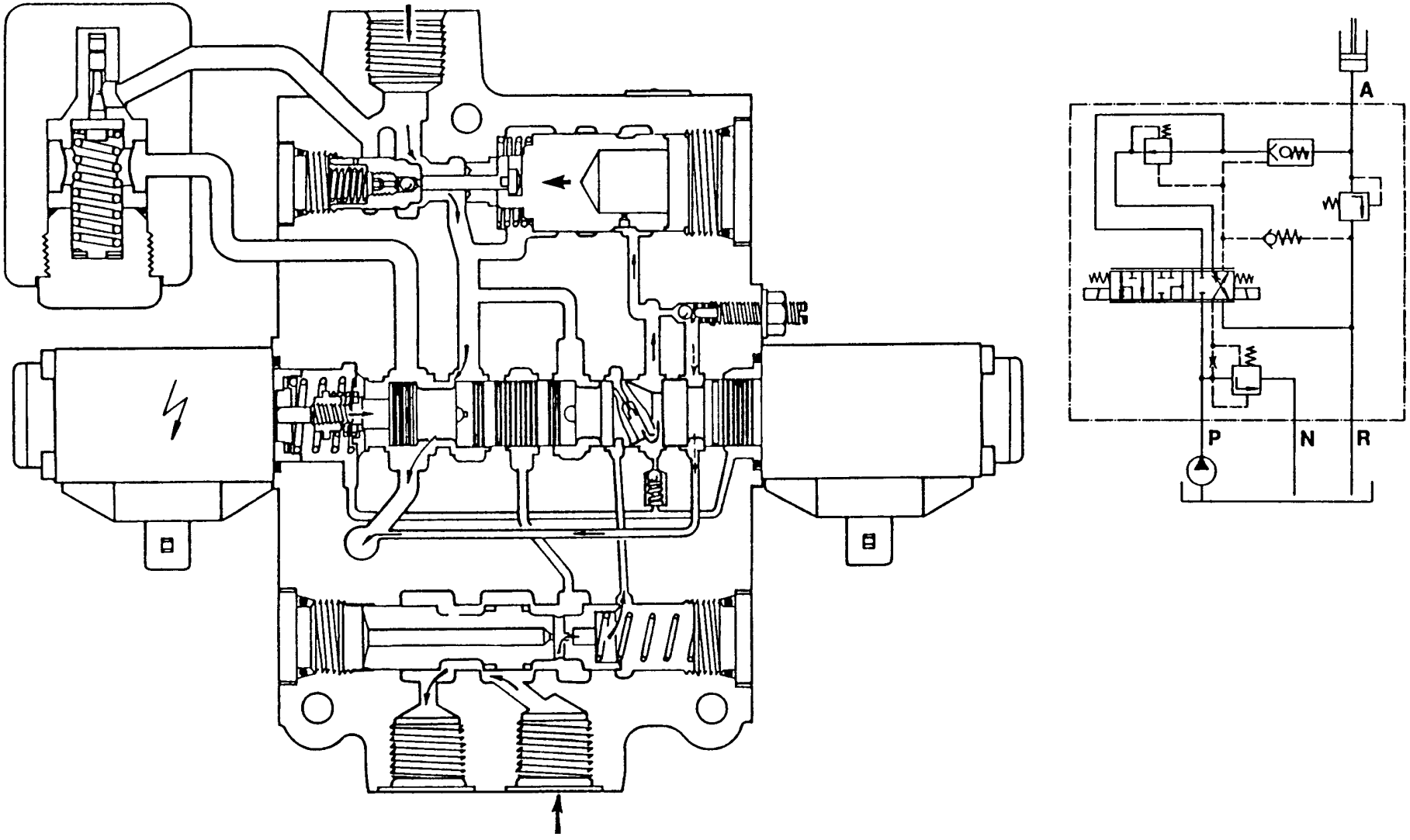
The lowering valve opens proportionally according to the control deviation.

The lowering oil flow is passing the lowering valve 6 and the metering edge of the main control spool 2.

5 and 6 act as a 2 way flow regulator.

The function of the flow regulator ensures an almost constant drop speed, even if the load and thus the load pressure varies in a wide range.

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ADDITIONAL PRINT with the option Multi-Controller

With this issue, there are momentary operated buttons fitted into the Multi-Controller for the functions RAISE and WORK.

The electronic of the print comprises a memory function. After releasing the button the actuated function remains activ until another signal is put in.

From the print a DC signal is sent to pin 21 of the EHR-box A55 via the print A16.

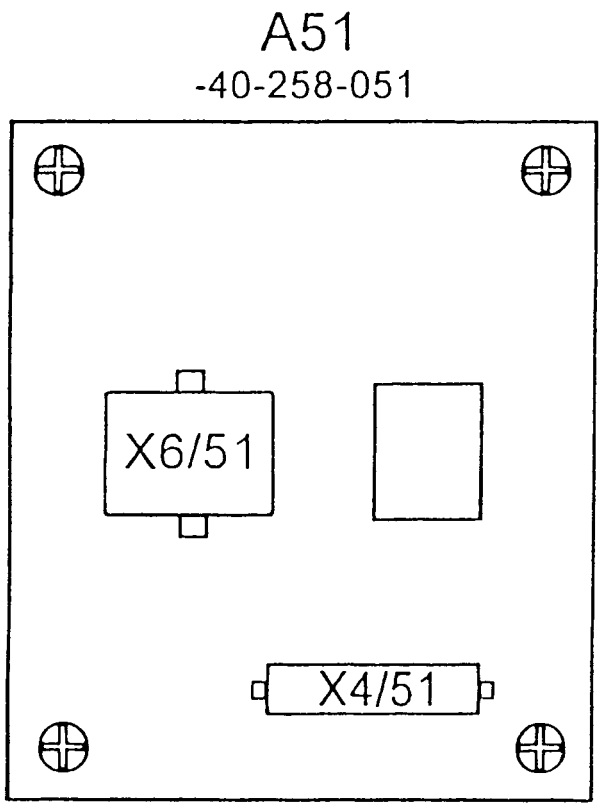
The signal voltage coresponds to the function choosen:

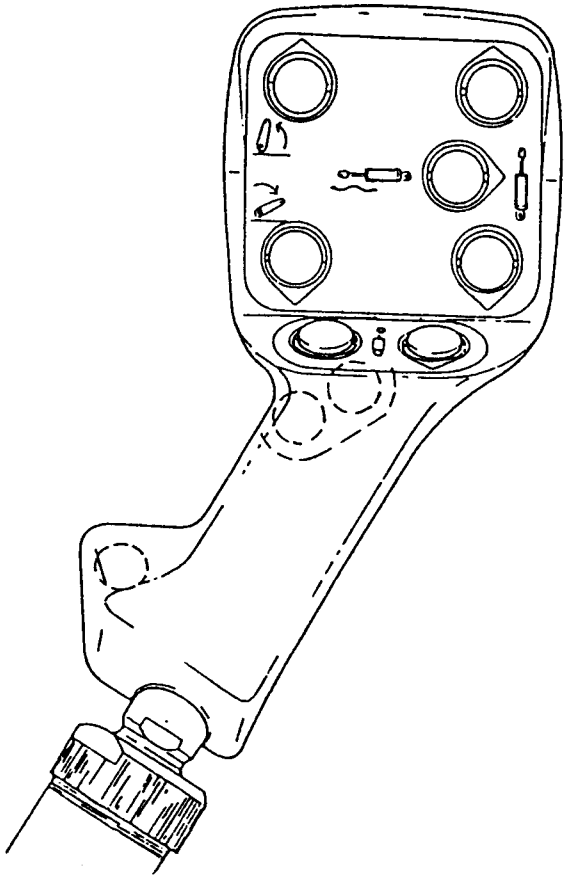
RAISE = 2/3 of 9,5 Volts

WORK = ½ of 9,5 Volts

FAST RETRACTION = 1/3 of 9,5 Volts

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HYDRAULIC HIGH PRESSURE CIRCUIT - list of components

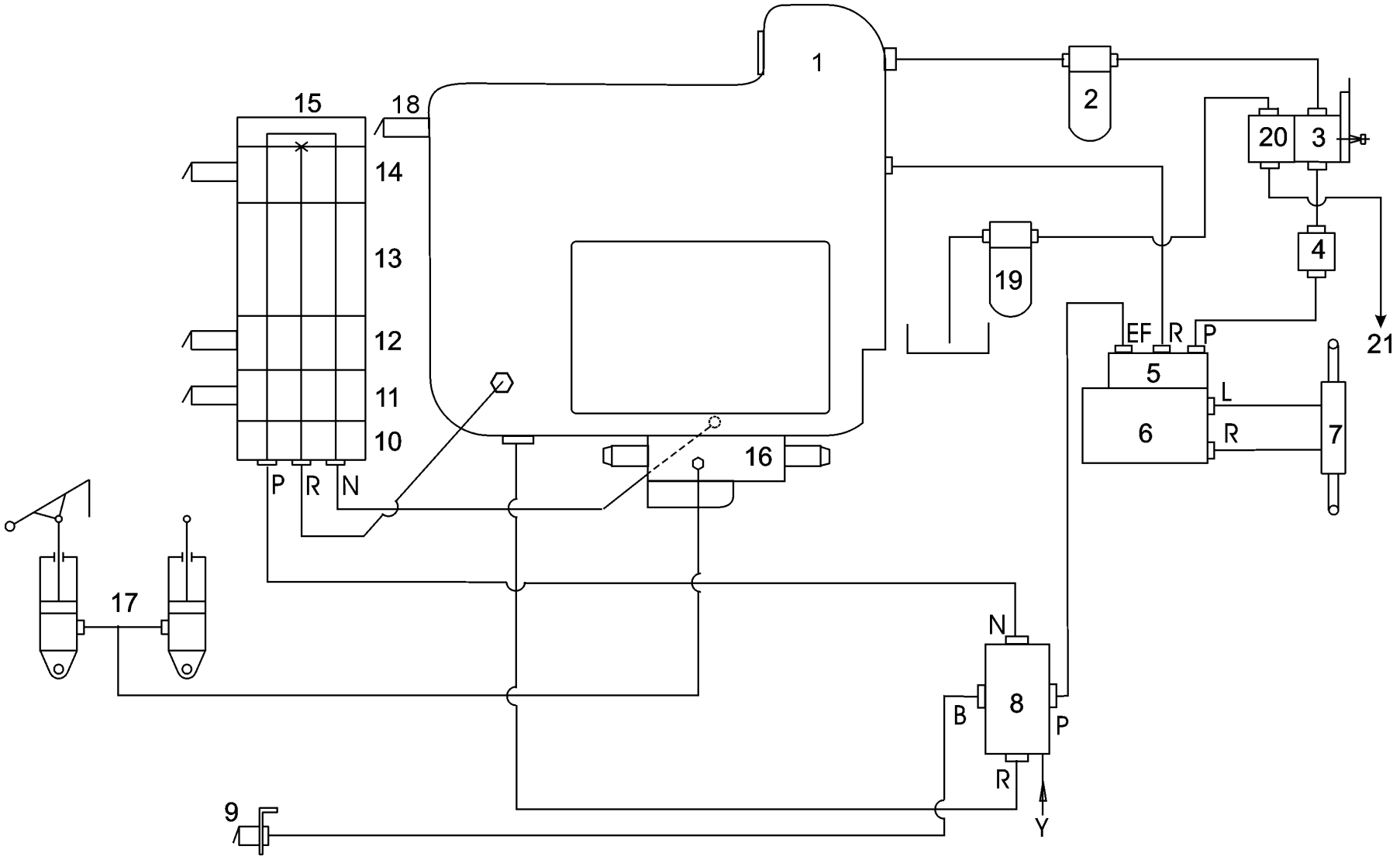
1. Oil tank
2. Oil filter (suction-type)
3. Hydropump V = 16 cm³ Q = 50 l/min at 2300 engine rpm
4. Silencer
5. Priority valve
6. Steering orbitrol
7. Steering cylinder
8. Hydraulic trailer brake valve (option)
9. Coupler for trailer brake valve
10. Connection plate for aux. valves (with integrated pressure reliev valve, set to 175 bar)
11. Aux. control valve, mechanical controlled, single- or double acting
12. Aux. control valve, mechanical controlled, single- or double acting
13. Intermediate block
14. Auxiliary control valve, electrical controlled, single- or double acting
15. End plate
16. EHR proportional control valve with incorporated shock valve, set to 250 bar
17. Plunger type - lift cylinders
18. Coupler for free return of oil
19. Gearoil filter
20. Hydropump V = 11 cm³ Q=29l/min at 2300 engine rpm
21. Pipe to transmission control system, constant working pressure 18 bar

P = Pressure supply (from pump)
R = Return (tank)
N = Neutral circulation

Y = Control line from service brake
L = left
R = right

B = Brake EF = Excess flow

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OSCILLATION DAMPING

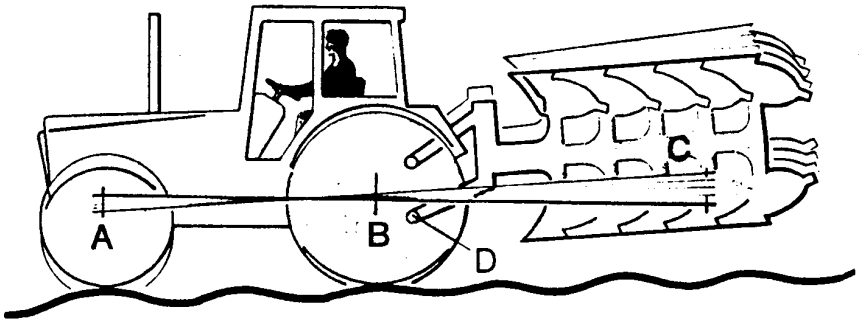
Heavy implements are often fitted to the three-point linkage during transport runs with the tractor causing typical nodding movements. Active oscillation damping is carried out by means of the digital electronic lifting gear control ("EHR D") when in a raised position. Oscillating movements cause dynamic strains on the force measuring pins in the lower rods. The force signals from the force measuring pins are recorded. A suitable control circuit evaluates them and attains a quicker oscillation damping through less control movements.

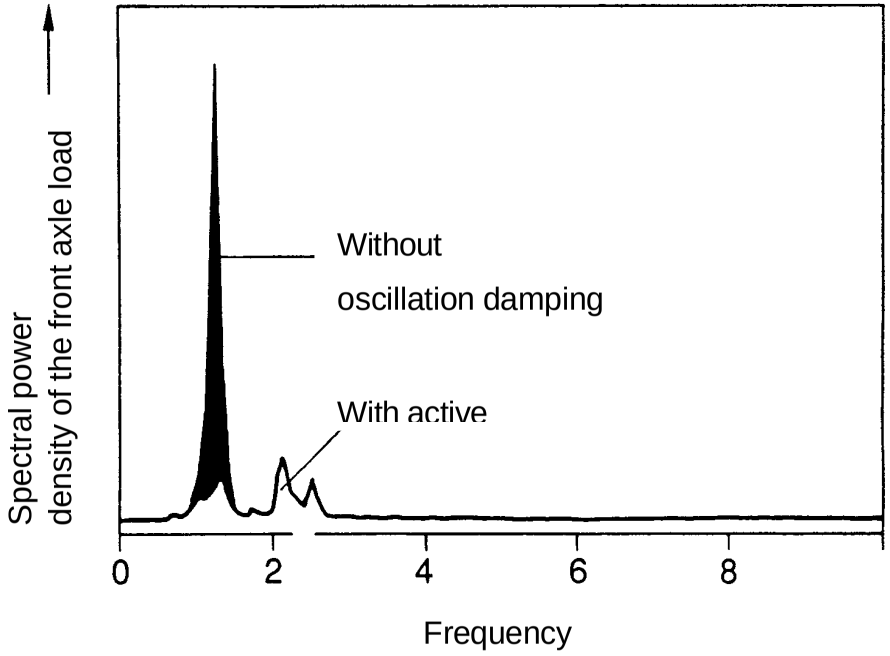
ADVANTAGES: Nodding movements are reduced - steering safety increases - the driving speed can be increased - driving comfort is improved - dynamic strains are reduced - stabilization of the total lifting height above ground.
The lowering throttle function is out of service during the oscillation damping operating mode. The possible lowering speed is thus at a maximum.

"Switching on"- criteria The "EHR" must be released - the lifting switch must be in the transport position - the driving speed must be higher than 8 km/h or the gearbox frequency must be higher than 290 Hz.

If these criteria have been met, then the lifting gear is lowered from the "final position" by approx. 3% to its "medium axis of oscillation". The oscillation damper is switched on as soon as the lowering procedure commences. Initially, however, the effect of the oscillation damper is weak but then becomes fully active after two seconds. The maximum deflection of the lifting gear around its "medium axis of oscillation" is restricted upwards by the "final position". Downwards, the lifting gear can move away from the axis of oscillation by approx. 4%. This gives a calculated maximum distance of approx. 7% from the "upper final position". All percentage specifications are based on 100% overall lift of the lifting gear.
The oscillation damper switches off automatically at a driving speed of under 2 km/h or a gearbox frequency of under 72 Hz. The oscillation damper can be permanently switched off by switching the operating mode switch to the "off" position.

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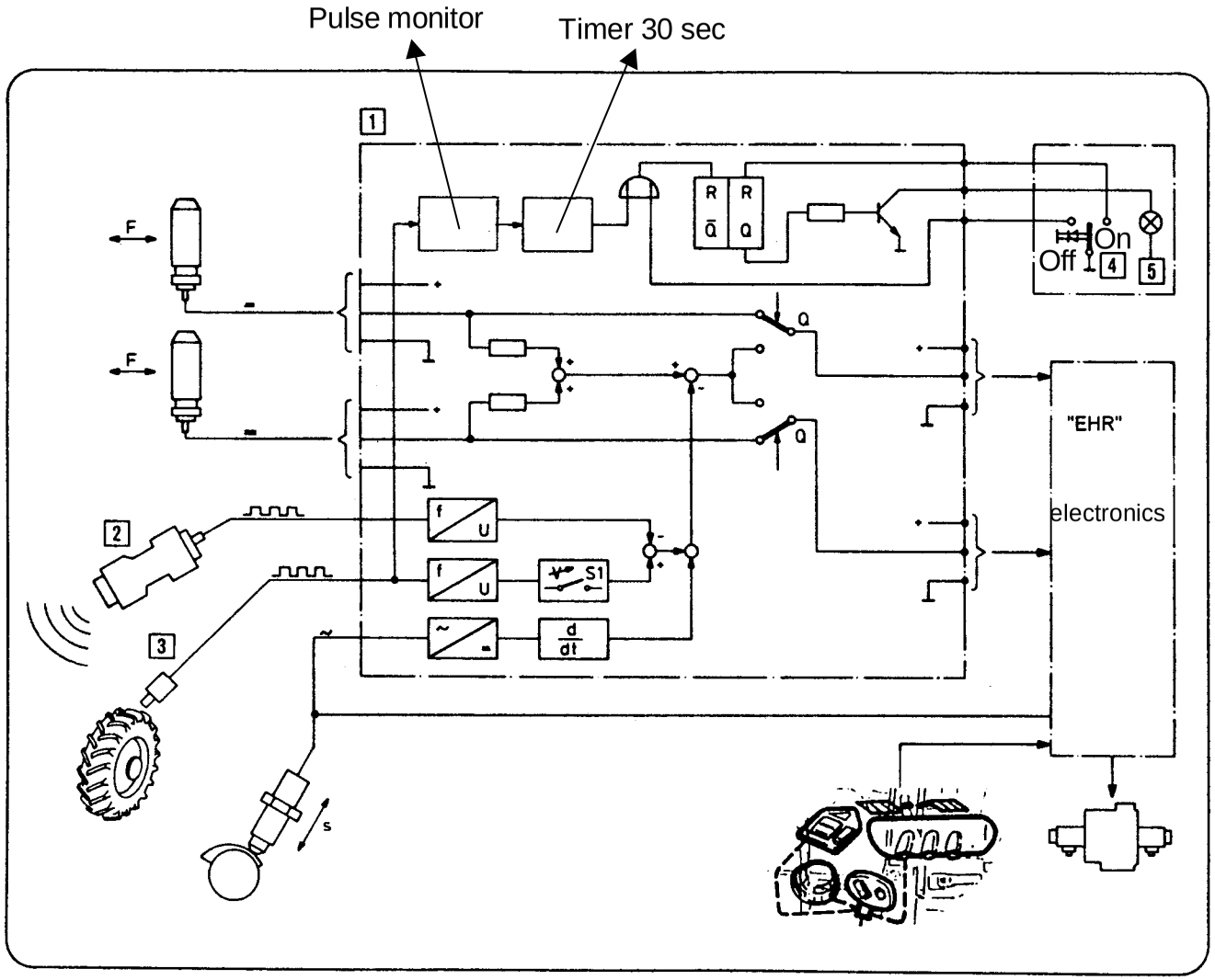
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SLIPPAGE CONTROL

The control strategy in the case of slippage control is to use the sum of the tractive force and slippage as the controlled variable according to which the depth is set. The measurement of the actual speed on the field is carried out by a radar sensor (2). The theoretical speed is determined by an inductive sensor in the gearbox. If the differential speed is lower than the limit value which has been determined (approx. 25% slippage), then the system operates with tractive force control. The tractive force is automatically changed when slippage exceeds approx. 25% so that the working depth and the slippage are reduced. The slippage control is activated by a switch on the control panel. This status is retained as long as the wheel speed sensor supplies impulses (the tractor is running). A radar signal which supplies approx. 36 Hz per km/h or 130 impulses per driven meter is used as a reference value for the standardization of the gearbox signal. The signal frequency from the gearbox sensor is identical with that of the radar. The slippage limit value is given as a fixed value and cannot be adjusted.

If there is no gearbox impulse for more then 30 seconds (the tractor is standing), then the slippage control automatically switches off.

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ELECTRONIC CONTROL UNIT (with management function -40-258-116)

Voltage supply and its monitoring

a) The control unit has to be directly supplied with the battery voltage as this direct connection of ground and positive pole on the battery is relatively free from voltage peaks and dips.
This voltage is switched on via a relay fitted in the control unit when the ignition is switched on. In addition, the D+ voltage is also required to attain the release of the electronics.

b) The circuit allocated to the relay switches the control off in the event of the following errors:
- Wrong polarity of the battery
- Voltage > 18 volts, e.g. using a 24 V battery instead of a 12 V battery.
- Short-circuit at the supply of all sensors
- Short-circuit at the supply of all operating devices, e.g. potentiometers, etc.

c) A stabilized voltage of 9.5 V is generated from the battery voltage to supply the electronic circuit in the control unit as well as the operating device and the sensors. This voltage is short-circuit proof.

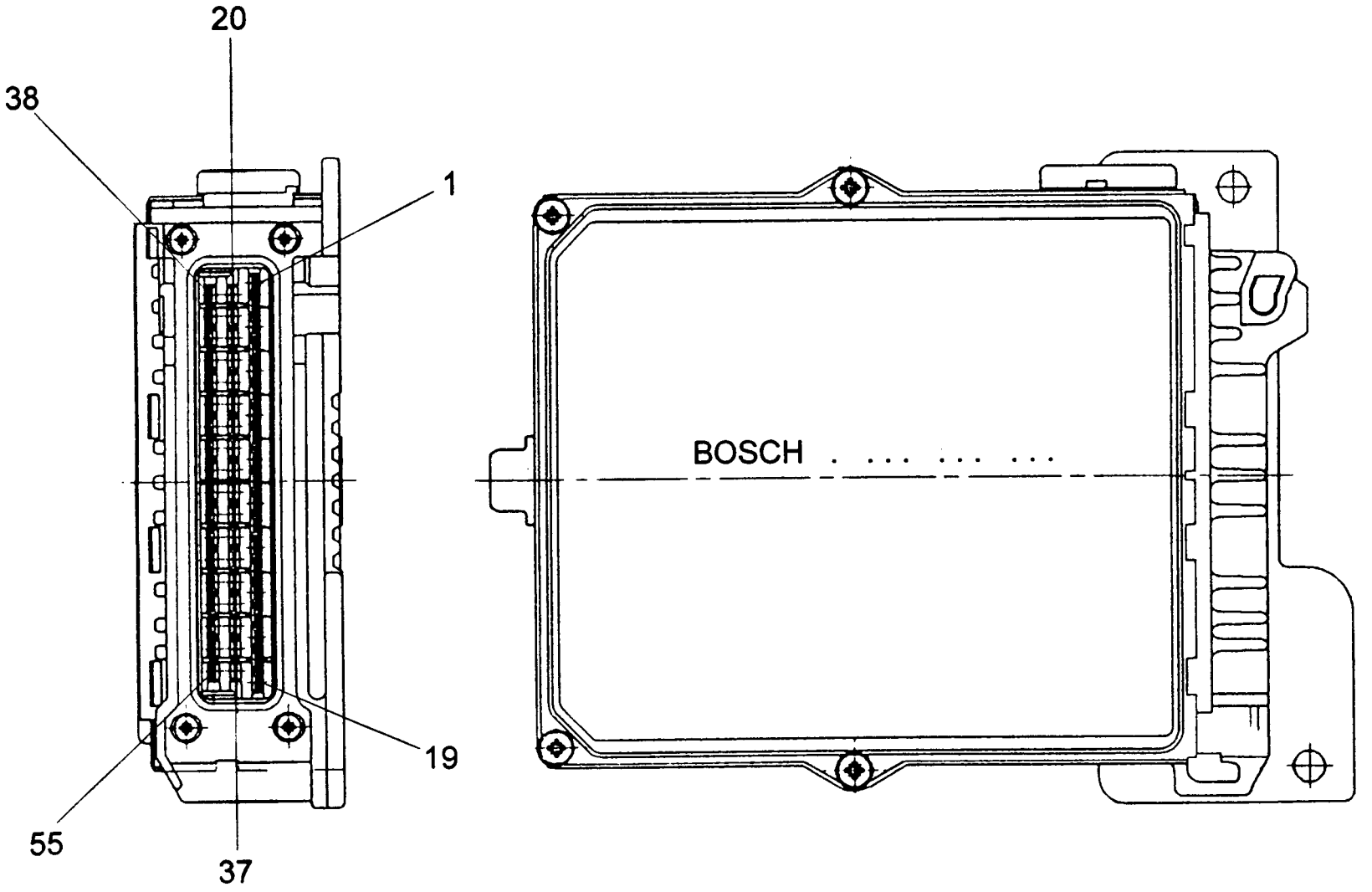
d) The control unit is protected against positive and negative voltage peaks by means of a break down diode. Voltage peaks with a duration of > 0.01 seconds lead to the relay switching off.

e) There is a maximum current draw of 3.5 A when activating the solenoids, up to 0.6 A without control operation.

The E box is located to the left of the driver underneath the lower cover.

CSLT spare part No. - 40 - 258 - 016	Bosch Nr. 538 201 036 53 RT0295	= without management function for diff.lock and PTO rear
CSLT spare part No. - 40 - 258 - 116	Bosch Nr. 538 201 036 53 RT0341	= with management function

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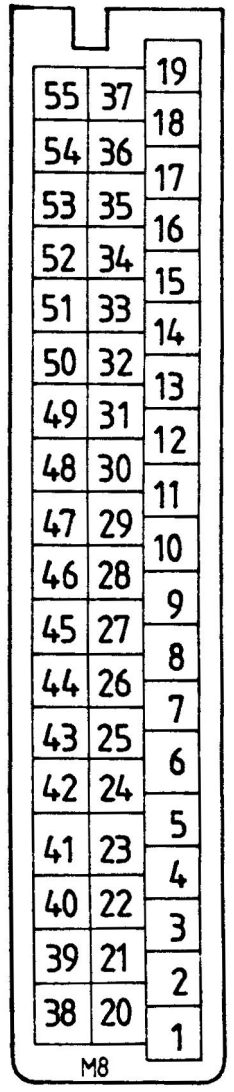


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Pin assignment of the 55 pole plug on the "EHR D" control unit

2) Printed board supply, stabilized 9.5 V
3) Final position loop
4) Mixed control loop (position - tractive force)
5) STOP button
6) Position sensor signal, tail
7) Force sensor, left, signal
8) Pressure sensor signal
9) Tail button right and left, supply
10) Radar signal
11) Digital signal (driving speed)
12) Slippage signal lamp
13) D+ enable
14) Operating mode switch - slippage control
15) Transport signal f. PTO management *
16) Lifting status (norm signal socket)
17) Tail button, right and left, raise
19) Solenoid valve, lower +
20) Potentiometer ground and A16 printed board
21) Lifting switch
22) Loop setpoint potentiometer
23) Loop lowering speed potentiometer
24) Terminal 15 +
25) Position sensor front signal
26) Force sensor right signal
27) External sensor position signal
28) Ground
29) Battery plus
30) Pressure control operating mode switch
31) Diagnostic display
32) Oscillation damper "Off"
33) 33 and 38 connected front operation,
33 and 38 open rear operation,
(pressure control)
34) Transport signal for lock management
(ground for "TRANSPORT" to V/R-Box)
35) Solenoid valve lower and raise ground
36) Tail button lower right and left
38) Ground for pressure control switch
front / rear
39) Supply for position sensors and force sensors,
9,5 V stabilized
41) Ground pressure sensor and position sensors
45) Ground force sensors
55) Solenoid valve raise +



* Signals at pin 15 and 34 are available with control unit CSLT part No. -40-258-116 only.

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OPERATION OF THE DIGITAL ELECTRONIC LIFTING GEAR CONTROL ("EHR D")

The "EHR D" is a lifting gear control on a digital basis. It is the follow up model of the "EHR-4" which was based on analogue technology. Operation of the "EHR D" is similar to that of the "EHR-4". It is assumed that the operating concept of the "EHR-4" is known. The most important operating elements and their functions have been retained.

The operating concept of the "EHR D" which has been developed by STEYR functions as follows:

When switching on the ignition lock, the diagnostic LED and the slippage LED on the "EHR D" light up for a short moment. This is a self-test. The "EHR D" is ready for operation and can be released once the LEDs go out.
A permanent lighting up of the diagnostic LED indicates the locking state of the "EHR D".
The "EHR D" is released by simply pressing the lifting/lowering button (terminal 21 on the "EHR D" control box). After being released, the "EHR D" initially restricts the current for the solenoid valves for safety reasons. The speed of the lifting gear is thus limited. This current restriction is cancelled after reaching the controller dead zone for the first time or by repeatedly pressing the lifting/lowering button. The maximum speed of the lifting gear can then be attained.
The "EHR D" locks when the STOP button is pressed. All controllers then become inactive. The locking state is also indicated by a permanent lighting up of the diagnostic LED.
The "EHR D" also locks when the tail button is operated. The tail button function and the STOP function can be activated in all operating states.
Lifting by means of the tail button is terminated when the position sensor attains a signal of >= 74.5% of its supply voltage. The setting of the lowering speed does not have an effect during operation of the oscillation damper. The lowering throttle operates in all other operating modes.

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DIAGNOSTIC "EHR D"

The "EHR D" permanently monitors the system for errors. Errors which occur are split into three classes. The "EHR D" reacts differently depending on the error class.

Grave errors:
- The control is stopped and locked
- The relay is switched off (protection of the output stage)
- Driver notification: Diagnostic LED gives an error code.
  Termination of the error output when the control takes up again.
- Control takes up again: ---> Eliminate error and operate ignition lock.

"Medium" errors:
- The control is stopped and locked
- Driver notification: Diagnostic LED gives error code.
  Termination of the error output when the control takes up again..
- Control takes up again: ---> Eliminate error and release the "EHR".

Slight errors:
- Control is continued
- Driver notification: Diagnostic LED gives an error code.
  The diagnostic LED goes out after pressing the lifting button if the error has been eliminated. However, a code number output which has been started is finished.
  Exception: If a speed signal (= radar or gearbox signal) does not arrive, then this error is only output in the "SLIPPAGE" switch position.
  Errors can be localized and determined with the aid of the error code list.

In the event of the signal line to the mixed potentiometer being interrupted, e.g. error code 36 is displayed by the following flashing frequency (refer to error code list):

- Long pause - three flashes - short pause - six flashes -

The diagnostic LED goes out when all errors have been eliminated.
A continuos lighting up of the diagnostic LED indicates the locking state of the "EHR D". If the "EHR D" discerns an error in the system, then the output of the corresponding flashing code has the highest priority.

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ERROR CODE LIST

Error Code	Short description	Pin No.	Description of error
**********			**GRAVE ERRORS** **********
11	RAISE final stage	55	Final stage for the lifting magnet is defective or the magnet line after terminal 35 is interrupted. F46 defective.
12	LOWER final stage	19 is	Final stage for the lowering magnet is defective or the magnet line after terminal 35 is interrupted. F46 defective.
13	Short-circuit	35	The current measured at terminal 35 is too high. ---☭ Short-circuit between terminal 19 and terminal 35 or between terminal 55 and 35 (short-circuit of magnet possible, short-circuit against vehicle ground is not recognized.)
14	Cable breakage	35	No current is measured at terminal 35 event though the magnets are activated. -> Cable breakage in the feedlines to the magnets (terminals 19, 55 or 35 possible). -> Possibly defective magnet. -> Perhaps no battery voltage at terminal 29 (defective fuse, F46).
15	Tail button	9	Tail button signal OK or the tail button function is faulty.
16	Supply	2	Supply fpr operating element not OK.
		20	9.5 V supply or ground not OK

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Error code	Short description	Pin no.	Description of error
********** **GRAVE ERRORS** **********			
17	Battery	29	Battery voltage is above 18 volts.
18	Transport circuit	21	Signal from the transport circuit (transport/control/retract) not OK. Cable breakage or signal not available.

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Error Code	Short description	Pin No.	Description of error
**********	**********	**********	**"MEDIUM" ERRORS** **********
21	Stop button	5	Stop button signal not OK. Cable breakage or button not connected.
22	Position sensor tail	6	Position signal not OK during tail operation - Cable breakage or sensor not connected. - Short-circuit or ground contact possible. - Faulty adjustment of the position sensor.
23	Setpoint pot.	22	Signal of the setpoint pot.not OK. Cable breakage or pot.not connected.
24	Upper final position (lifting limit)	3	Position signal not OK during front operation. Cable breakage or pot.not connected.
25	Position sensor front	25	Position signal not OK during front operation. - Cable breakage or sensor not connected. - Short-circuit or ground contact possible. - Faulty adjustment of the position sensor.
26	Position sensor	27	External position sensor signal is connected to ground.

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Error code	Short description	Pin No.	Description of error
**********			**SLIGHT ERRORS** **********
31	Force measuring pin, right	26	Signal of the force measuring pin, (right) not OK. - Cable breakage or sensor not connected. - Short-circuit or ground contact possible. - Possible overloading of the force measuring pin.
32	Force measuring pin, left	7	Signal of the force measuring pin, (left) not OK. - Cable breakage or sensor not connected. - Short-circuit or ground contact possible. - Possible overloading of the force measuring pin.
33	Battery	29	Battery voltage too low (smaller than 12V).
34	Lowering pot.	23	Signal from the lowering speed pot not OK. Cable breakage or pot. not connected
36	Mixed pot.	4	Signal from the mixed pot. not OK. Cable breakage or pot not connected.
37	Defective valve		The lifting gear does not raise even though there is an active RAISE current at terminal 55 of the "EHR D" box. Is the engine on? If so, then no oil pressure available, the valve sticks or the lifting gear is overloaded.
38	Pressure sensor	8	Faulty pressure sensor signal (only responds when pressure control is preselected at the switch)

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Error code	Short description	Pin No.	Description of error
**********			**PULSE GENERATOR** **********
41	Radar sensor	10	Radar signal missing even though there is a gearbox signal. This error can only be displayed in the "Slippage control" switch position.
42	Gearbox signal	11	Gearbox signal missing even though there is a radar signal. This error can only be displayed in the "Slippage control".
			If both speed signals are missing then an error is not recognized as this state is normal when the vehicle is standing still.

Remark concerning the diagnosis of the external position sensor:

The "EHR D" switches over to external signal when there is a proper external sensor signal. If the sensor is missing, then the external control is switched off. A missing external position sensor is a normal operating instance. As an external control switch position is missing, the "EHR D" does not know when it can diagnose/display that the external sensor is missing. A complete external sensor diagnosis is thus not possible. Only a ground contact on the signal line is recognized and displayed.

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TROUBLE SHOOTING WITH THE DIAGNOSTIC SYSTEM

The lifting gear is fitted with a self-diagnosis system but cannot identify all 100% of th faults. The faults which are identified are displayed globally. If a fault is identified by the self-diagnosis system, it is displayed via flashing signals and can be followed up in the error code list.

e.g. Error 22	Trail position sensor	Position sensor not OK during tail operation Cable breakage or sensor not connected Short-circuit or ground contact possible Faulty adjustment of the position sensor

Any fault can be localized easily and quickly by means of the diagnosis system and the table.

Test requirements:		Ignition switched off
		Ignition switched on
		Engine must run
	X..	Plug
	Terminal	Terminal on specified plug
		E-Box connected
		E-Box disconnected
		Connect lamp with the specified wattage as load

Parts required for the diagnosis system

Order number:		Use:
TSW 528-1	100-pole diagnosis box	general
TSW 528-36	55-pole Y-Adapter	„EHR D“ electonics box
TSW 528-33	3-pole Y-Adapter	force measuring pin, position sensor
TSW 528-6	2-pole Y-Adapter angular	„EHR“ control unit Y6 and Y7
TSW 528-11	1.5 m test lines, red, blue	general
TSW 528-2	5 – 35 watt test lamp	for loading supply lines

Multimeter, if available, otherwise a multimeter set can be ordered from the central spare part service under the number TSW 516.

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Designation	X55 Terminal	Number of Cable color	Mea-sure-ment	Requirements	Measure from terminal to terminal	Value
E-Box supply						
Ground	28	L533	U	21 W	29 + → 28	12 - 14 VDC
Permanent plus F46	29	A477	U	21 W	28 ⊥ → 29	12 - 14 VDC
Potential plus 15/2 F48	24	G345	U	21 W	28 ⊥ → 24	12 - 14 VDC
D+ from K5/11 F21	13	K421	U	21W	28 ⊥ → 13	12 - 14 VDC
If the EHR diagnosis lamp does not indicate any errors → continue.						
Stabilised 9.5 VDC supply for operating elements.						
Ground	20	L524	U		2 + → 20	9,5 VDC
Plus 9,5 VDC stabilised	2	H518	U		20 ⊥ → 2	9,5 VDC
Plus 9,5 VDC stabilised	2	H518	R		20 / ⊥ → 2	>330 ohms /∞
Stabilised 9.5 VDC supply for force sensors.						
Ground	45	L483	U		39 + → 45	9,5 VDC
Plus 9,5 VDC stabilised	39	H482	U		45 ⊥ → 39	9,5 VDC
Plus 9,5 VDC stabilised	39	H482	R		45 → 39	>330 ohms

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Stabilised 9.5 VDC supply for pressure sensor, rare-, front- and external position sensors.								
Ground	41	L489	U		39	⏚ →	41	9,5 VDC
Plus 9,5 VDC stabilised	39	H482	U		41	⊥ →	39	9,5 VDC
Plus 9,5 VDC stabilised	39	H482	R		41 /	⊥ →	39	>330 ohms / ∞
Raise/lower/activation/fast retraction buttons.								
Activate transport signal	21	N523	U	Safety switch „ON“ Press RAISE button 1x	28	⊥ →	21	approx. 6,4 VDC
Control signal	21	N523	U	Press LOWER button 1x	28	⊥ →	21	approx. 4,8 VDC
Fast retraction signal S7/72	21	N523	U	Keep fast retraction button depressed	28	⊥ →	21	approx. 3,3 VDC
Multi-Controller S11/ ((safety switch „on“)								
	X6/51			X4/51				
Signal transport / raise enable S11/1	1	C299	U	S11/1 engaged S11/1 not engaged	2	⊥ →	1	12 VDC 0 VDC
Signal drop / work S11/3 + S11/13	3	C317	U	S11/3 +S11/13 engaged S11/3 + S11/13 not engaged	2	⊥ →	3	12 VDC 0 VDC
	X55				X55			
Signal transport/raise/enable	21	N523	U	S11/1 once engaged	28	⊥ →	21	appr. 6,4 VDC
Signal work /drop S11/3 + S11/13	21	N523	U	S11/3 + S11/13 once engaged	28	⊥ →	21	appr. 4,8 VDC
Signal fast retraction S2/72	21	N523	U	S2/72 engaged S2/72 not engaged	28	⊥ →	21	appr. 3,3 VDC appr. 4,8 VDC

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Activation of the RAISE Y6 and LOWER Y7 solenoid valves						
Ground for Y6 and Y7	35	L479	U	Lifting gear whilst raising and lowering	28 ⊥ → 35	max. 0,35 VDC = 3,5 A
Plus for Y6 ⎍⎍	55	N485	U	Lifting gear whilst raising	35 ⊥ → 55	1,8 - 6 VDC
Plus for Y6	55	N485	R		35 / ⊥ → 55	1,7-2,2 ohms / ∞
Plus for Y7 ⎍⎍	19	N444	U	Lifting gear whilst lowering (lowering throttle max.)	35 ⊥ → 19	1,8 - 6 VDC
Plus for Y7	19	N444	R		35 / ⊥ → 19	1,7-2,2 ohms / ∞
External button for raising/lowering (cabin)						
Supply from E-Box	9	N439	U		28 ⊥ → 9	5 VDC
Supply from E-Box	9	N439	U	RAISE button depressed LOWER button depressed	28 ⊥ → 9	3,3 VDC
Signal from RAISE ext. button S2/15/5, S15/1, S15/2	17	N480	U	RAISE button released RAISE button depressed	28 ⊥ → 17	0 VDC 3,3 VDC
Signal from LOWER ext. button S2/15/5, 14/1, S14/2	36	N443	U	LOWER button released LOWER button depressed	28 ⊥ → 36	0 VDC 3,3 VDC
STOP button						
Signal from STOP button S33	5	B521	U	Button released Button depressed	28 ⊥ → 5	4,8 VDC 0 VDC *
Tail position sensor B9/1						
Ground from E-Box	41	L489	U		39 + → 41	9,5 VDC
Plus supply 9.5 stabilised	39	H482	U		41 ⊥ → 39	9,5 VDC
Signal from position sensor	6	F436	U	Lifting gear at the top Lifting gear at the bottom	41 ⊥ → 6	approx. 7 VDC approx. 2 VDC

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Setpoint potentiometer R6/1									
Signal from potentiometer	22	F522	U		Pot. position 0 Pot. position 10	20	⊥	→	22	9,5 VDC 0 VDC
* A16 from Messrs. Enzmann = 0 VDC, A16 from Messrs. Berifors approx. 3,3 VDC									
Lifting limitation potentiometer (uper final position) R6/2									
Signal from potentiometer	3	F517	U		Pot. position 0 Pot. position10	20	⊥	→	3	0 VDC 9,1 VDC
Lowering speed potentiometer R6/4									
Signal from potentiometer	23	F527	U		Pot. position 0 Pot. position 10	20	⊥	→	23	0 VDC 9,5 VDC
Mixed potentiometer R6/3									
Signal from potentiometer	4	F516	U		Pot. position 0 Pot. position 10	20	⊥	→	4	0 VDC 9,5 VDC
Position sensor, front B9/2, external B13									
Signal from front sensor Changeover switch S29 closed	25	F446	U		Lifting gear at the top Lifting gear at the bottem	41	⊥	→	25	approx. 7 VDC approx. 2 VDC
Signal from external sensor Active by plugging on	27	F448	U		Signal depends on position of sensor	41	⊥	→	27	2 - 7 VDC

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Change over switch for front/rear control (for front control only) S29									
Ground to S29	38	L481	U		39	┼	→	38	9,5 VDC
Signal from S29	33	B478	U	S29 open S29 closed	38	⊥	→	33	5 VDC 0 VDC
Force measuring pin left B10/1 right B10/2									
Signal from force measuring pin left	7	F437	U	Lifting gear unloaded Lifting gear, traction Lifting gear, pushing	45	⊥	→	7	approx. 4,7 VDC < 4,7 VDC > 4,7 VDC
Signal from force measuring pin right	26	F447	U	Lifting gear unloaded Lifting gear, traction Liftiging gear, pushing	45	⊥	→	26	approx. 4,7 VDC < 4,7 VDC > 4,7 VDC
Auxiliary switch S2/7/3									
Signal – Excessive lift	3	F517	U	Pot. Lift limit. R6/2 Position 10 Switch S2/7/3 Excessive lift	20	⊥	→	3	appr. 9,1 VDC 9,5 VDC
Signal for oscillation damping OFF	32	N525	U	S2/7/3 ON position S2/7/3 OFF position	20	⊥	→	32	0 VDC 9,5 VDC
Switch for slippage or pressure control S2/65									
Signal for slippage control	14	N519	U	S2/65 position 0	20	⊥	→	14	0 VDC
Signal for pressure control	30	N528	U	S2/65 position 2	20	⊥	→	30	0VDC
Signal for draught – and position control			U	S2/65 position 1	20 20	⊥	→	14 30	5 VDC 12 VDC
Ground speed signal									
Signal from instrument X9/6 Terminal 4 ⊓⊔⊓⊔	11	F441	U	Tractor is standing still	20	⊥	→	11	appr. 1 VDC appr. 6,8 VDC
Signal from instrument X9/6 Terminal 4 ⊓⊔⊓⊔	11	F441	f	Tractor is running at 14 km/h	20	⊥	→	11	505 Hz

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Radar signal from B16									
Signal from radar	10	F440	U	Tractor is standing still Tractor is driving	20	⊥	→	10	
Signal from radar	10	F440	f	Tractor is running at 14 km/h	20	⊥	→	10	505 Hz
Control lamps									
Signal for diagnostic lamp H2/1	31	N526	U	Lifting gear locked Lifting gear released	20	⊥	→	31	5 VDC 0 VDC
Signal for slippage control lamp H2/2	12	N520	U	Slippage control OFF Slippage control ON	20	⊥	→	12	0 VDC 5 VDC
	A15 X12/10								
RAISE lamp H2/3	6	N488	U	Lifting gear raised Lifting gear lowering or standing still		⊥	→	6	1,8 - 6 VDC 0 VDC
LOWER lamp H2/4	4	N487	U	Lifting gear lowering/ Lifting gear raised or standing still		⊥	→	4	1,8 - 6 VDC 0 VDC
	X55 Terminal								
Signal for signal socket, PTO shaft and lock management.									
Signal (ground) for PTO shaft-management	15	F328	U	Lifting gear – TRANSPORT Lifting gear - CONTROL	29	+	→	15	0 VDC 12 - 14 VDC
Signal (ground) for lock-management	34	F530	U	Lifting gear - TRANSPORT Lifting gear - CONTROL	29	+	→	34	12 - 14 VDC 0 VDC
Signal (plus) 50% for signal socket X29	16	F442	U	Lifting gear over 50 % Lifting gear under 50 %	28	⊥	→	16	12 - 14 VDC 0 VDC
Pressure control (not used by STEYR)									
Signal from pressure sensor B11	8	H438	U	Lifting gear unloaded Lifting gear depending on load (P)	20	⊥	→	8	2 - 7 VDC
Terminals 1, 18, 37, 40, 42, 44 and 46 to 54 are not assigned.									

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CONTROL VALVE EHR 5-OC

GENERAL:

With tractor models CS78-CS94/M9078-M9094, the Hitch control valve EHR 4-OC has been succeeded by the control valve EHR 5-OC. Never the less, the common designation EHR-D (D stands for digital) for the Hitch control is still the same.

How the technician recognizes the change:

a) The control valve EHR 5-OC (which is flanged to the oiltank at the RH side) is remarkable smaller in size, for the shock valve is cancelled.
b) The solenoids for the functions RAISE and DROP are arranged in parallel and face to the rear. The lower solenoid will be for RAISE, the upper one for DROP.
c) The three position momentary switch for the functions RIDE CONTROL OFF and EXTRA LIFT at the RH side in the cabine is cancelled.
d) With the option HITCH TRAILER COUPLING, a two position momentary switch is fitted for the function EXTRA LIFT.

How the operator recognizes the change:

c) The three position momentary switch for the functions RIDE CONTROL OFF and EXTRA LIFT at the RH side in the cabine is cancelled.
d) With the option HITCH TRAILER COUPLING, a two position momentary switch is fitted for the function EXTRA LIFT.

NOTE:

With the control valve EHR 5-OC, the function DROP is identical to the control valve EHR 23 OC (tractor series 9100), but different to the control valve EHR 4-OC. For the mentioned reason, also the electronic hitch control box had to be changed.

Cut-in: (Control valve EHR 5-OC and EHR-D electronic box Bosch No. 0538 201 043)

CS78-CS94	PIN	No.	10113
M9078 - M9094	PIN	No.	04230

With PIN No. DBD 0055001 (cut-in of SISU engine), the control box is the same as of CS110-CS150/9105-9145 (BOSCH No. 0538 201 052). *With this control box, it is again possible to realise the option „pressure control“.*

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Changes in operating the tractor:

When driving with an attached implement, e.g. driving on the field or on the road with lifted plough, the operator has to obey the following rules:

a) The EHR must be enabled (diagnose LED off)
b) The command RAISE must have been given
Now, automatically RIDE CONTROL will get activ as soon as the ground speed is > 8 km/h. This automatic function substitutes the purpose of the shock valve in the former control valve.

Changes of EHR functions (important for the field technician when trouble shooting):

a) After a RAISE function was finished, load pressure also exists at the check valve. If by chance the lifting gear would move down grandually due to an internal leak in the system, also have checked whether the check valve in the control valve EHR 5-OC is leaking or not (see sections „valve construction“ and „functions“).

b) During a DROP function, the EHR components *Drop modul, Position sensor and Electronic control box* act as a *closed sloop control circuit.* Thus, a two way flow divider is not required in the EHR 5-OC control valve. Instead, the E-box compares the voltage drop per second of the position sensor signal (drop rate) with the set value of the DROP SPEED potentiometer. If a correction is necessary, the E-box will alter the current to the DROP solenoid, resulting in an altered cross section at the partially open drop valve.
With the EHR 5-OC control valve, different load pressures are compensated electronically.

With the former EHR 4-OC control valve, a two way hydraulic flow divider was employed to compensate different load pressures.

c) If the lifting gear would move down gradually (internal leakage in the system):
It is not necessary to check a shock valve, since it does not exist in the control valve EHR 5-OC.

NOTE:

Since the solenoids of both the versions of control valves are the same, electrical values for trouble shooting also remain valid (see page with technical data).

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CONTROL VALVE EHR 5-OC

Construction - see graph's 2, 5 and 6

The control valve is designed for flange mounting. At the flange, the ports P, R1 and P2 are visible. R1 is a separate port for the drop oil flow. Port A is designed as screwed connection. The control valve is compiled of two moduls: a RAISE modul and a DROP modul. In the raise modul, there is a control spool for the function RAISE. The drop modul equals those of the control valve EHR 23-OC (of the series 9100). The valve seat is part of the housing. Each modul is driven by a proportional solenoid. The orify Dr acts as a damper for the spool of the flow divider. The check valve has a switch function for the oil flow to and from the lift cylinder.

Technical data

• Construction			Flange mounting
• Ports	P	=	Pressure(from pump via aux. valves)
	R2	=	Neutral flow (to tank)
	R1	=	Return flow to tank (drop oil flow)
	A	=	to load (single acting lift cylinder)
• Max. pressure during lift			210 bar
• Max. oil flow (at port P)			60 l/min
• Ohm`s resistance of the solenoids			$1{,}7\ ^{+\,0{,}5}$ Ohm
• Function RAISE			direct control with proportional solenoid Y6, 3 way flow divider
• Function DROP			control via pilot valve with proportional solenoid Y7
• Control of current to solenoid			Puls Width Modulation
• Puls frequency			appr. 1 kHz, constant
• Max. allowed current			3,5 amps (per solenoid)
• Load compensation at DROP			electronically
Emergency actuation of the control valve			provision for manual actuation at the outer end of each solenoid.

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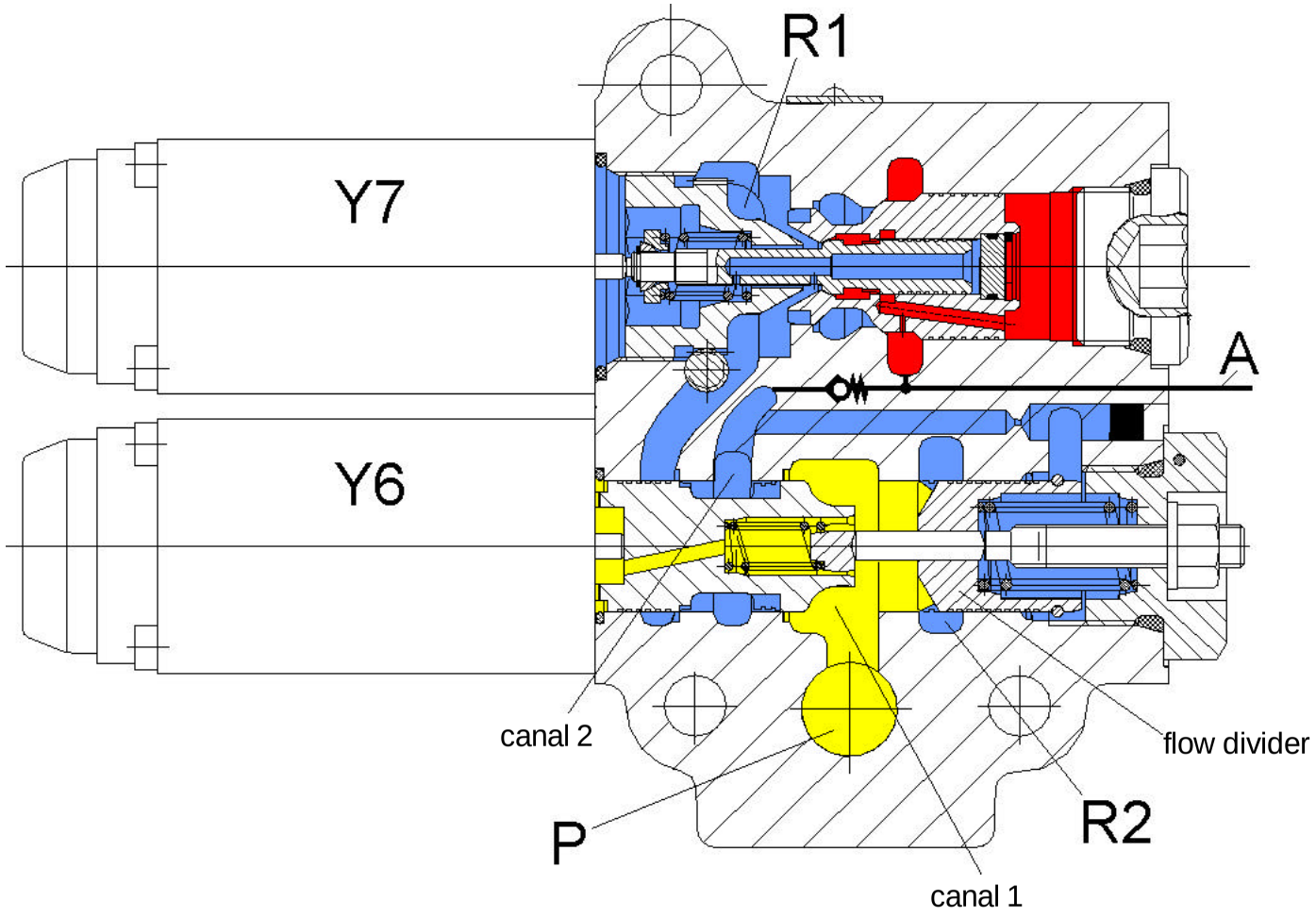
Function NEUTRAL - see graph 2

As shown in the picture, in neutral position of the valve, the oil flow from the pump flows from port P via the flow divider to port R2 and then returns to the tank. This side of the flow divider where the return spring of the spool is placed, is interconnected with port R1. To the other side, the pressure of the neutral circulating oil is exerted. The forces acting on either side of the spool of the flow divider determine its position in the housing.

The sum of the forces acting on each side of the spool of the flow divider will be always equal. Therefore, the pressure at the spring side of the spool is lower for the amount of *spring force/area* compared to the other side. In the following descriptions, this pressure difference (Δp) will be called *control pressure drop.* This control pressure drop acts always in channel 1 and channel 2 and is equal in all situations. In channel 1 there will be always the higher pressure. Channel 2 is interconnected with port R1. To produce the control pressure drop, the spool of the flow divider moves in this very position, where the oil flow from P to R2 will adjust itself to this pressure drop.
Both the moduls RAISE and DROP are in closed position during neutral circulation of the oil flow.

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„Neutral“



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Function RAISE - see graph 3

The proportional solenoid Y6 for RAISE is energized. Thus, control spool 3 will be moved to the right. In this position there is no interconnection to port R1. In this position, the metering grooves of control spool 3 provide a connection from channel 1 to channel 2. As a result, the spring of the flow divider moves the spool to the left, creating a partial restriction to the oil flow from P to R2. The pressure raises until check valve 4 opens. Load pressure is acting at the spring side of the flow divider control spool. The pressure in channel 1 is higher for the amount of the control pressure drop (Δp). This pressure (load pressure plus Δp) is created by the metering grooves of the flow divider control spool between P and R2. Due to the control pressure drop the oil flows through the metering grooves of the control spool to port A and finally moves the piston in the lift cylinder.

NOTE: *The position (stroke) of the control spool 3, and as a result of this - the cross section at the metering grooves open to allow a determined flow rate is purely controlled by the solenoid RAISE. It exerts a determined push against spring 5. The solenoids are designed to be able to work proportional.*

The load pressure acts on the flow divider. This makes the flow rate independent from the load (load pressure). This is called *load compensation.*

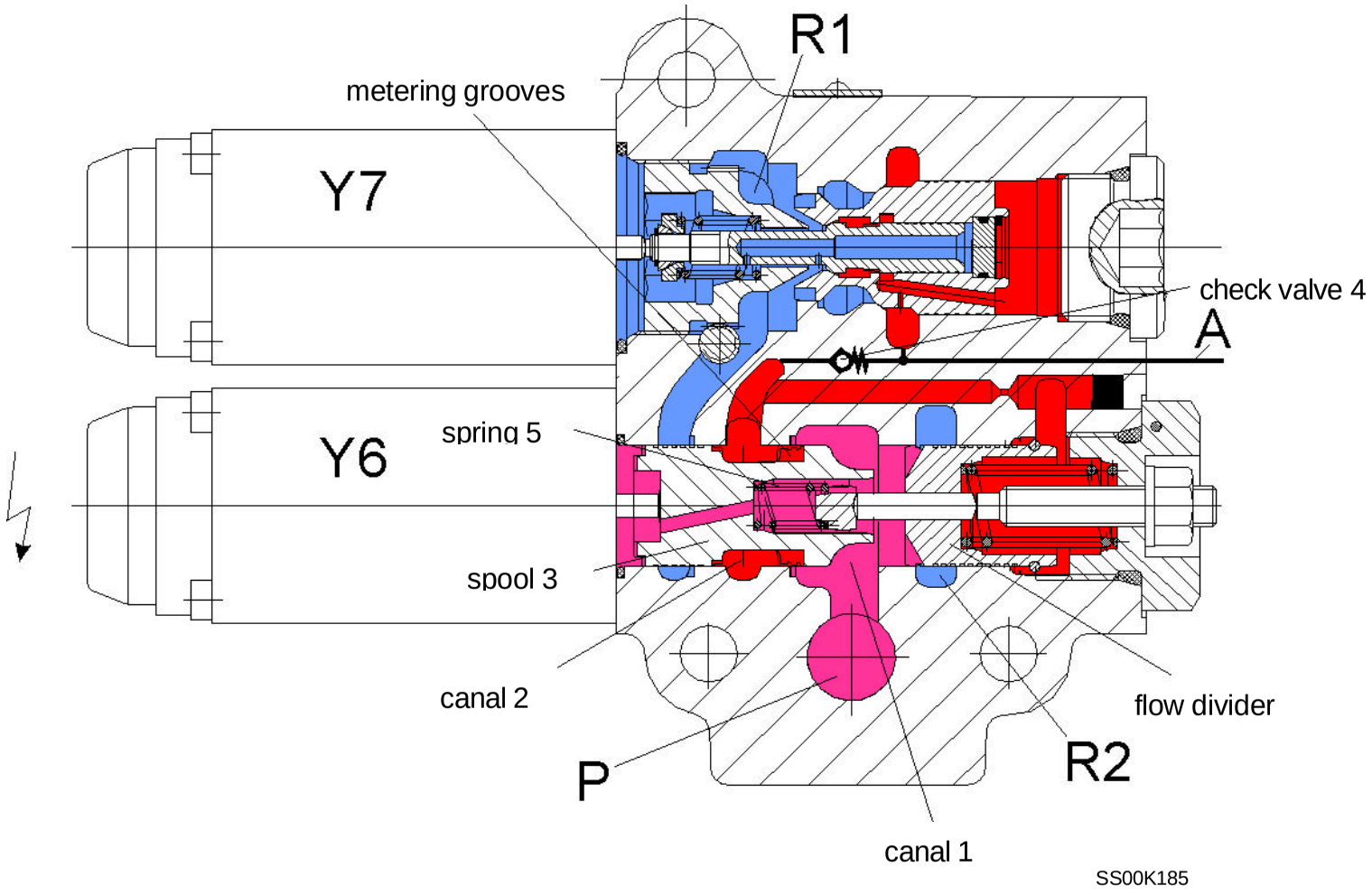
According to the requirements, the electronic control box provides a pulsed DC current in the range of 1,3 to 3,5 amps. A flow rate proportional to the electrical current is the result.

During RAISE, the flow rate to the lift cylinders is a function of the electrical current.

Also during RAISE, the solenoid DROP (Y7) is not energized. The DROP modul is not activ, it is closed.

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„Raise“



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Function DROP - see graph 4

If the function DROP is required, only the DROP modul will be open. The flow divider acts equal as in function NEUTRAL. The RAISE modul is closed. The essential components of the DROP modul are the *pilot control spool* and the *main control spool.* Both units are a combination of spool - and seat element. The spool controls the flow rate during DROP while the valve seat element makes the modul leak proove during NEUTRAL and RAISE. The pilot control spool is placed concentric in the main control spool. Spring 6 pulls the pilot control spool to the left against the pilot valve seat. Again the pilot valve seat is integrated in the main control spool. As a result, also the main control spool gets pulled to the left against its valve seat. The pilot control spool is pressure compensated by means of bore 7. Its not the same with the main control spool. In any condition and position, load pressure is exerted to the circular ring area AR on ist left side. As soon as the main valve seat is closed, load pressure also acts on the area AS at the right side of the main control spool. Since area AS is bigger than area AR, the main valve seat gets mainly held closed by the load pressure.
NOTE: *The force created to keep the valve closed increases with the load pressure. This construction assures a save sealing of the valve, even at high load pressure. When the main valve has to open, due to the function of the pilot the big closing force gets eliminated.*

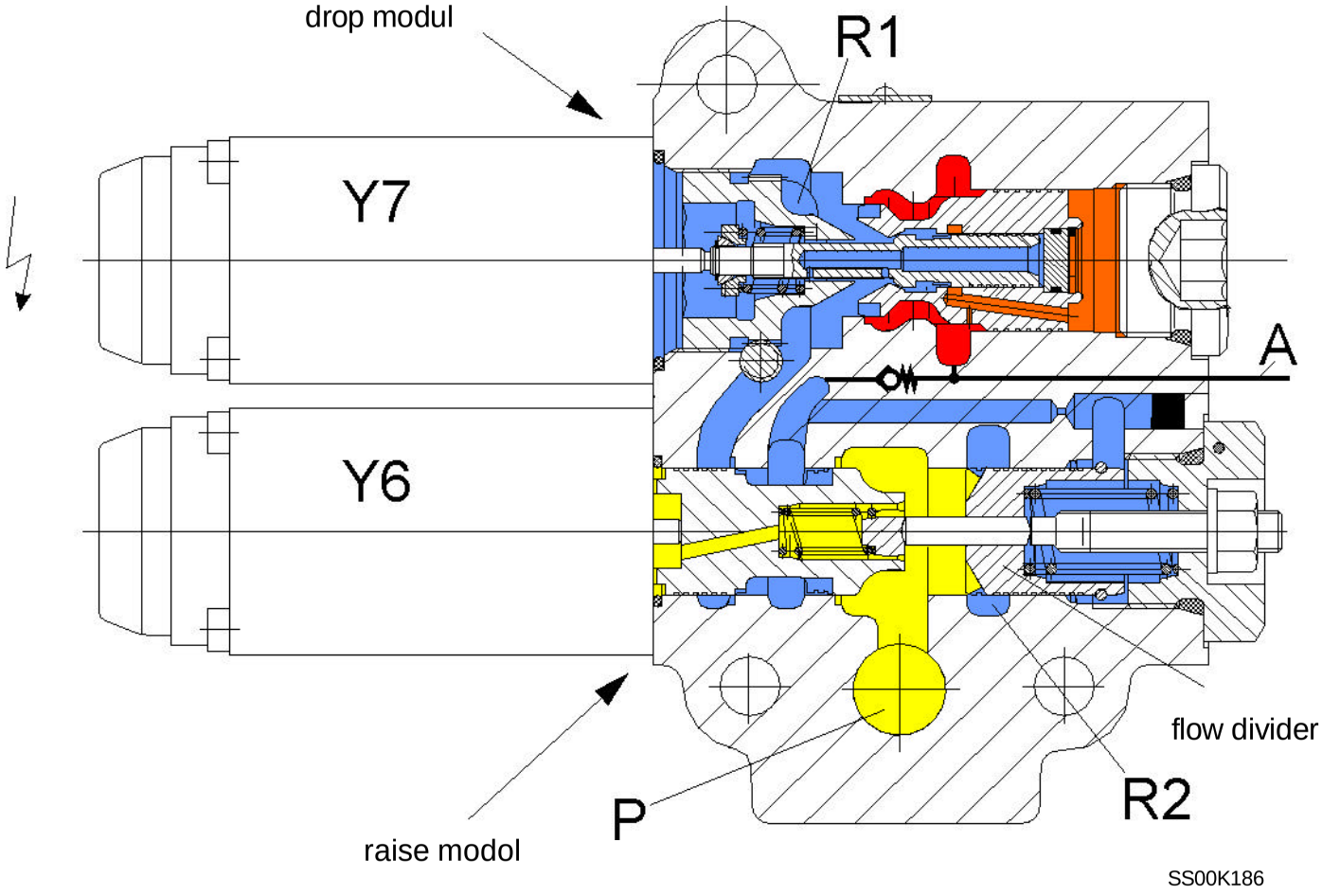
During DROP, the solenoid DROP Y7 gets energized. According to the requirements, the electronic control box provides a pulsed DC current in the range of 1,3 to 3,5 amps. As a result, the pilot control spool gets moved to the right. First the pilot valve seat gets opened, second the metering grooves allow oil flow from chamber 8 to port R1. The pressure in chamber 8 drops below load pressure. Immediately, oil under load pressure passes the orify 9 and enters chamber 8. The intermediate pressure in chamber 8 is determined by the open area of the pilot metering grooves.

Finally, the force exerted to area AS, (determined by the intermediate pressure in chamber 8) will be equal to the force exerted to area AR. At this moment, the main control spool will follow the movement of the pilot control spool. Due to this special construction, great control forces can be created.
NOTE:

For the function DROP, there is no load compensation as with the function RAISE.
During DROP, load is compensated by the „closed loop control circuit“ electronically.

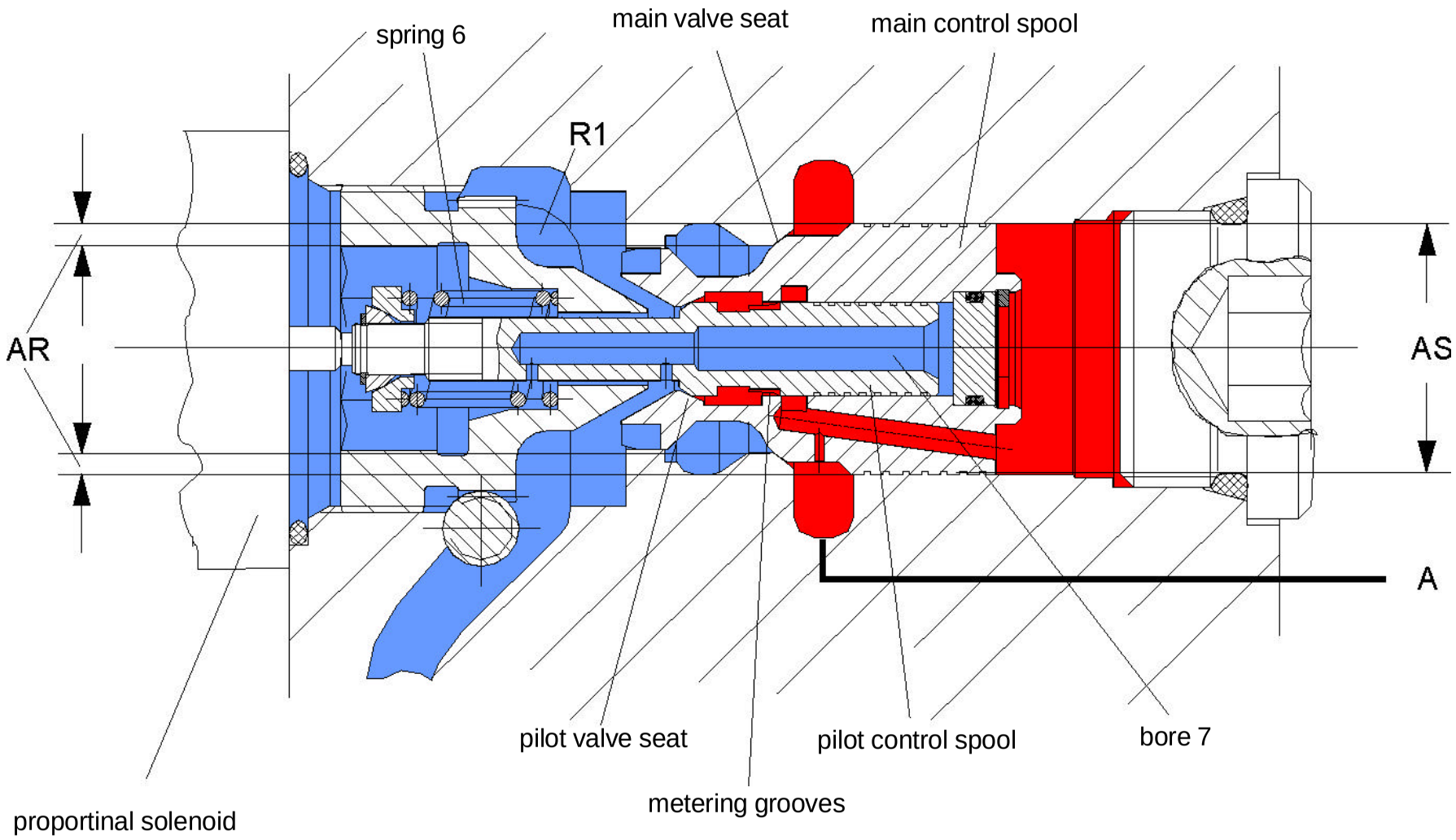
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„Drop“



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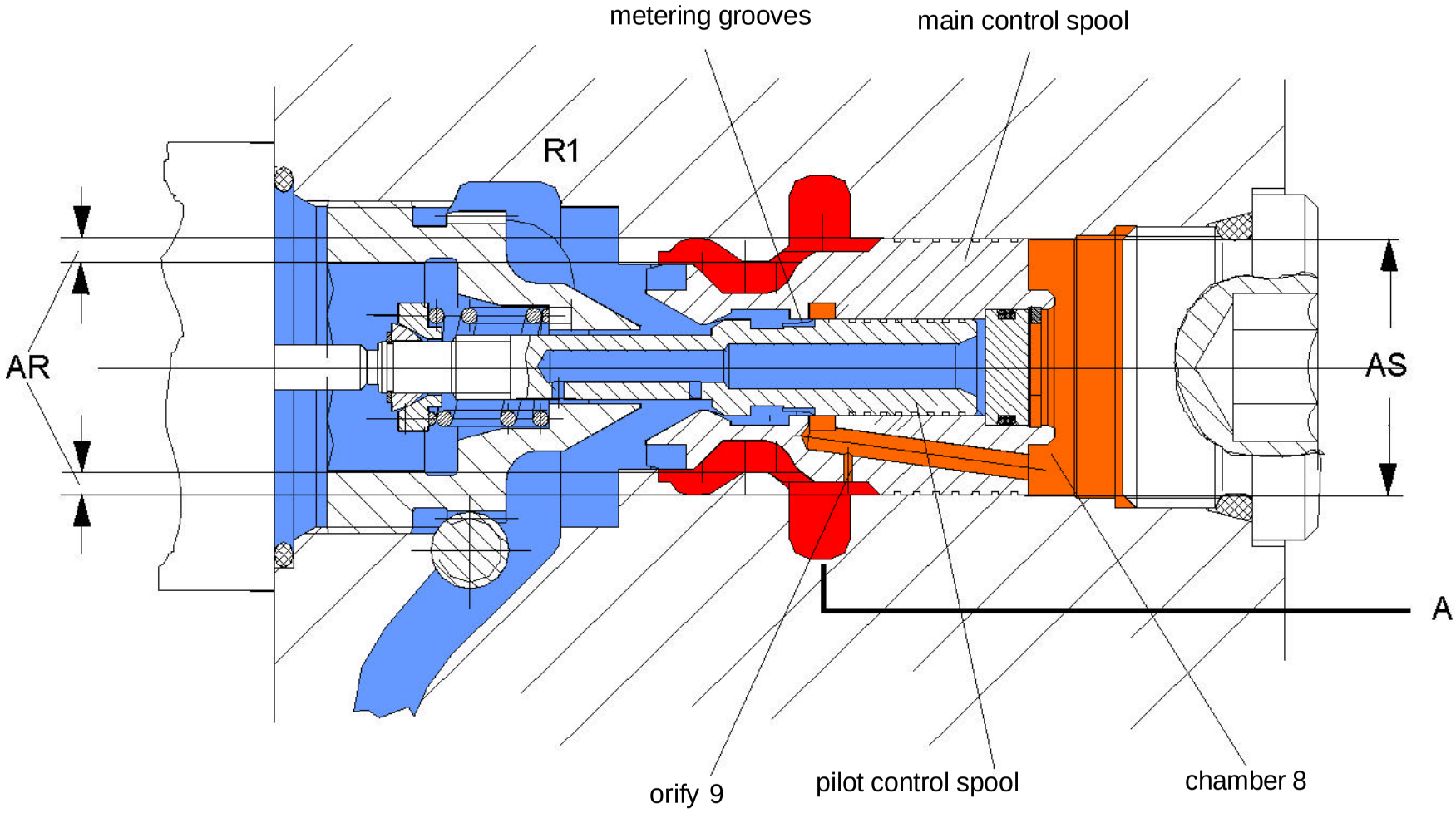
Drop valve closed



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Drop valve open



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Chapter

8C

FUNCTIONAL DESCRIPTION AND TROUBLESHOOTING

Electronic lifting gear control system (EHR-B)

from DBD0057135 onwards

8C

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TABLE OF CONTENTS

EHR-B ELECTRONIC LIFTING GEAR CONTROL SYSTEM 5
Functions of the EHR-B 5
General Remarks 5
EHR-B COMPONENTS 6
EHR-B OPERATION 7
FUNCTIONAL DESCRIPTION (WITHOUT MULTI-CONTROLLER) 8
1. Raise switch (without multi-controller): 9
FUNCTIONAL DESCRIPTION (WITH MULTI-CONTROLLER) 10
1. Buttons for Transport and Control on the Multi-Controller: 11
2. Setpoint adjusting wheel: 12
3. Pulling power control: 13
4. Lift Limiting: 14
5. Lowering speed: 15
BASIC FUNCTIONS OF THE EHR FOR POSITION CONTROL 16
BASIC FUNCTIONS OF THE EHR FOR PULLING POWER CONTROL 17
OSCILLATION DAMPING 18
Deactivating oscillation damping 20
6. Light emitting diodes: 20
7. Stop button: 20
8. Safety switch: 20
9. Traction control indicator lamp: 21
10. Diagnosis display: 21
11. Rear operating position: 21
EMERGENCY OPERATION 22
DIGITAL, INDUCTIVE POSITION SENSOR 23
Position sensor – Technical Data and Characteristics 24
Adjusting the Position Sensor 25
POWER SENSORS – DESIGN AND INSTALLATION 26
Power Sensor – Technical Data and Signal Shaping 27
ELECTRONIC CONTROL UNIT (with management functions) 28
HIGH PRESSURE HYDRAULIC CIRCUIT 30
CONTROL VALVE EHR 5-OC 32
NEUTRAL FUNCTION – GRAPHIC 2 34
RAISE FUNCTION – GRAPHIC 3 36
LOWER VALVE CLOSED 37
LOWER FUNCTION – GRAPHIC 5 AND GRAPHIC 6 38
LOWER VALVE OPENED 39
EHR-B DIAGNOSIS 40
FAULT CODE LIST 41
SERIOUS FAULTS 41
MEDIUM FAULTS 41
SLIGHT FAULTS 42
PIN ASSIGNMENT OF EHR-B BOX A25 43
TROUBLESHOOTING USING THE DIAGNOSTIC SYSTEM 44

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EHR-B ELECTRONIC LIFTING GEAR CONTROL SYSTEM

The EHR-B electronic lifting gear control system is specially designed for small to medium tractors.

This version is for use on Case / Steyr CS 78 - 94 / M9078 - 94 tractors from DBD0057135 onwards (beginning of production February 2000). In connection with the rear lifting gear, it replaces the EHR-D.

It represents an alternative to hydro-mechanical lifting gear control systems. The above mentioned types of tractor are offered with a choice of both versions.

Functions of the EHR-B

– Position control
– Pulling power control (and mixed operation)
– Rear operating position
– Oscillation damping (automatic)
– System diagnosis (with fault code display)

NOTE: *The basic function of the EHR-B corresponds to the state of the art of the EHR-D:*

– Setpoints (from potentiometers) and Actual Values (from sensors) are fed to the Electronic Box as analogue signals (DC voltages).
– After A/D conversion (analogue / digital), these are available in the E-Box for digital processing in a closed control circuit.

General Remarks

Operating voltage:

12 Volt DC nominal, voltage peaks must not exceed 16 Volts

Jumper lead starting:

– It must only be connected in parallel to another 12 Volt source battery or vehicle).
– Do not reverse connect the poles.
– Take care when using starting aid devices – avoid overvoltages!
– Never remove jumper cables during the starting procedure and ensure that the cable clips can not inadvertently fall off.

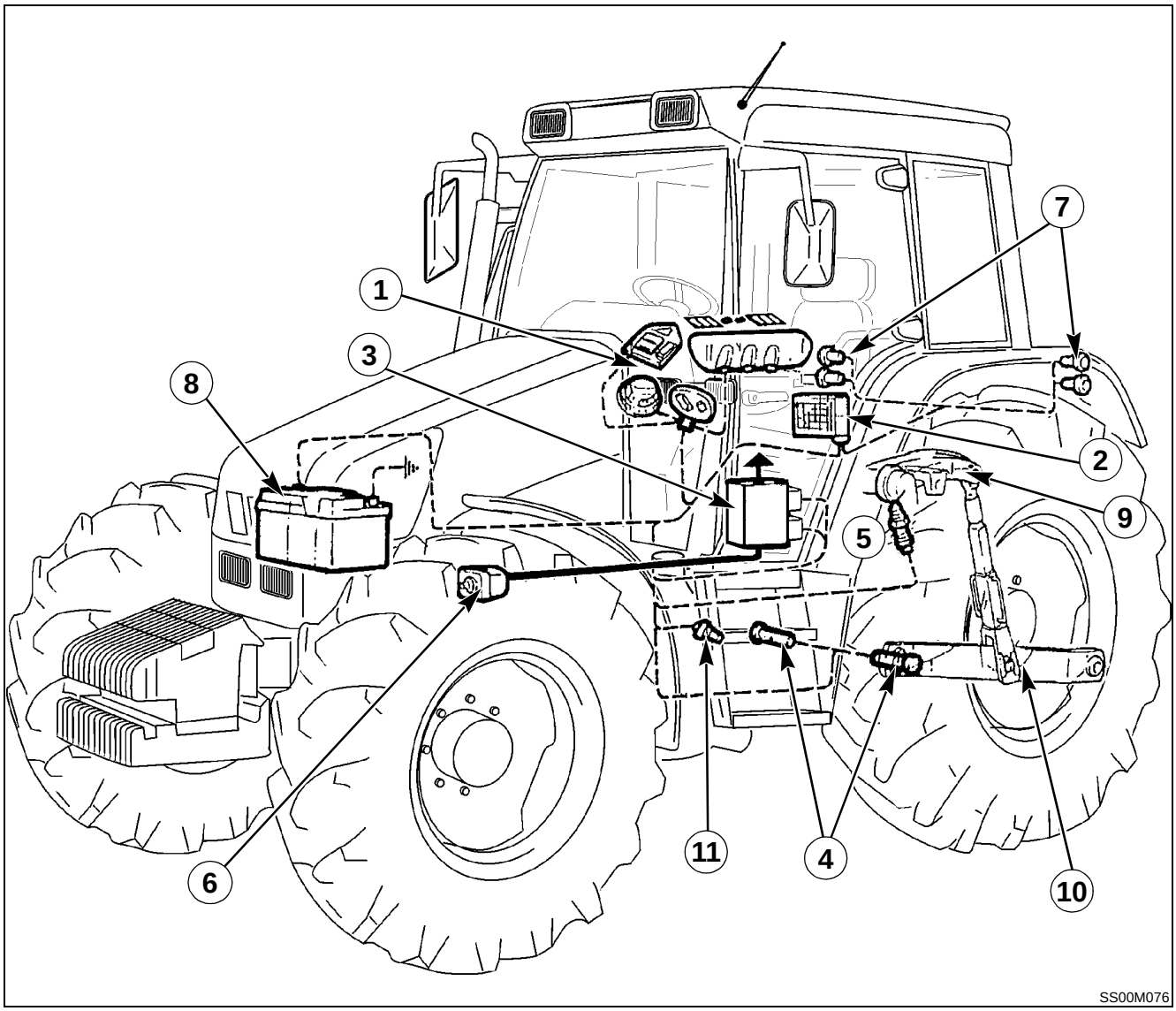
  This will result in voltage peaks – endangering the electronic components.

Welding work on the tractor:

– Always switch the engine OFF and turn the ignition switch S1 to the 0 position.
– Do not disconnect the electronics box.
– Do not disconnect the battery.
– **Connect the welding equipment ground to the part to be welded.**

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EHR-B COMPONENTS



1. Operating console
2. EHR – electronics box A25
3. Control unit Y6, Y7
4. Power sensors B10/1, B10/2
5. Position sensor B9/1
6. Hydraulic pump
7. Rear operating positions, left and right
8. Battery G1
9. Lifting arm with eccentric for position sensor
10. Lifting Gear Linkage
11. Driving speed sensor B6

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EHR-B OPERATION



The EHR-B is a digital lifting gear control system. The EHR-B operating concept was developed by Steyr.

Brief description of operating functions:

When the starter switch S1 is switched to ON, the diagnosis LED's on the EHR-B light up briefly.

This is a self-test. When the LED's go out, the EHR-B is operational and can be enabled.

The disabled status of the EHR-B is indicated by the diagnosis LED lighting continuously.

The EHR-B is enabled by simply operating the raise switch (without multi-controller) or by operating the TRANSPORT button on the multi-controller.

Once enabled, the EHR-B initially limits current to the solenoid valves for safety. The raising speed is thus limited.

This current limiting ceases, when the upper limit position has been reached for the first time or if the raise switch or button is repeatedly operated. Thereafter, the maximum lifting speed can be achieved.

If the STOP button is operated, the EHR-B is disabled. This deactivates all controls.

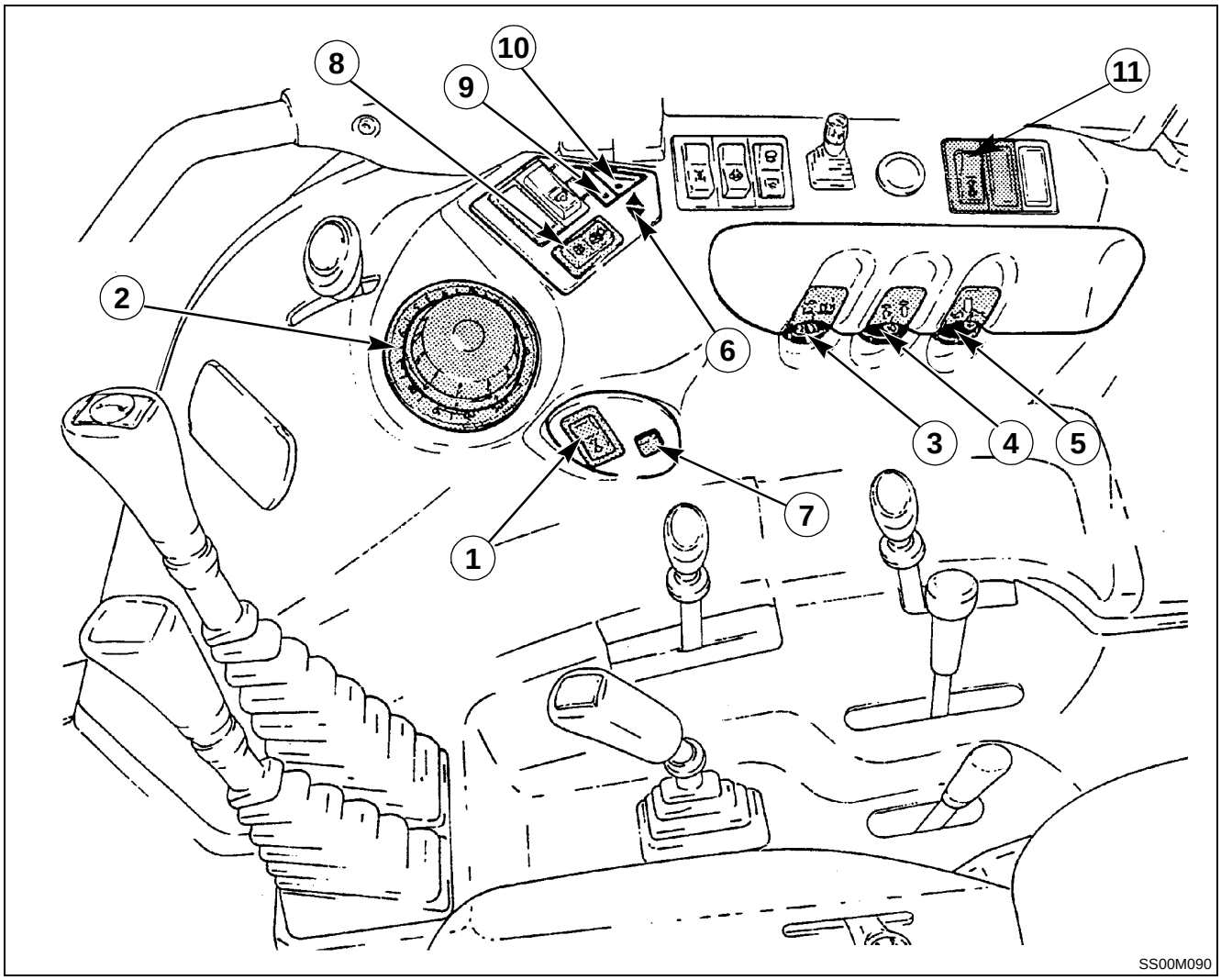
The disabled state is also indicated by the diagnosis LED lighting continuously.

The EHR-B also disables if the rear operating position buttons are operated. The rear operating position button function and the STOP button can be operated in all operating modes.

The lifting process, using the rear operating position button, is terminated when the signal from the position sensor reaches a value of > 74.5% of its supply voltage.

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FUNCTIONAL DESCRIPTION (WITHOUT MULTI-CONTROLLER)



1. **Raise switch (without multi-controller)**

   (3 switch positions with 5 functions)
   TRANSPORT – CONTOL – FAST RETRACTION
   Transport safety device, enabling the EHR system*)

2. **Setpoint adjusting wheel (main potentiometer)**

   max. raise – max. lower

3. **Mixed control potentiometer**

   Position-pulling power-mixed-control

4. **Lift limiting potentiometer**

   Limits the lifting height

5. **Lowering speed potentiometer**

   Lowering throttle

6. **Lower / Raise LED's**

7. **EMERGENCY STOP button**

8. **Safety switch**

   Disables all electro-magnetic auxiliary control units and the TRANSPORT and CONTROL button on versions with multi controller.
   With the exception of the external buttons and internally operated external pushbuttons

9. **Indicator lamp**

   Traction control

10. **Diagnosis display**

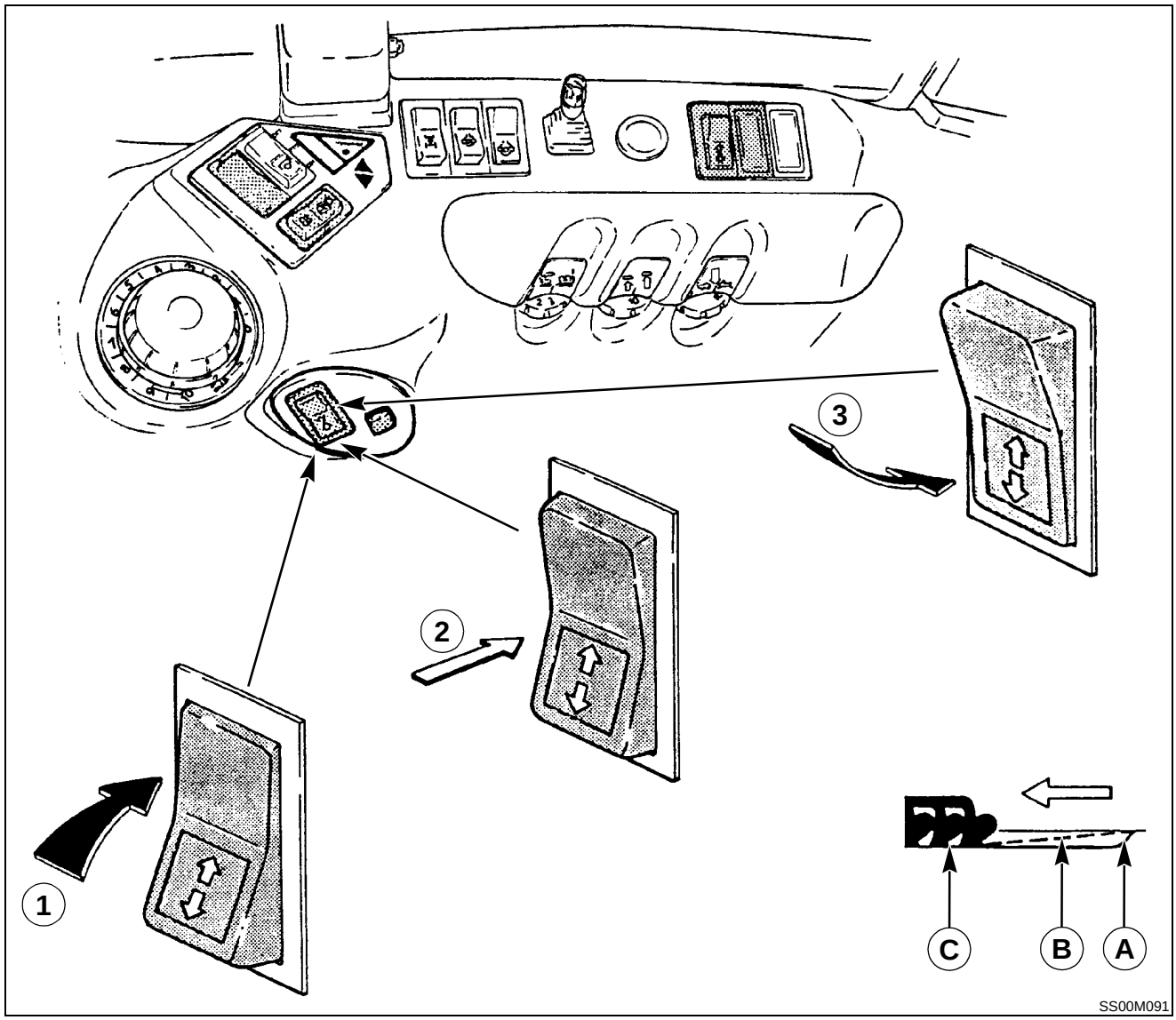
11. **EHR lifting gear operation**

    RAISE/LOWER
    (parallel circuit to the external buttons)

*) Enabling (activating) the EHR system: After the ignition switch has been switched ON, after operating from the rear operating position or if the EMERGENCY STOP has been operated, the EHR system must be enabled = switching from TRANSPORT to CONTROL or vice-versa, it is not possible to lower the lifting gear without enabling.

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1. Raise switch (without multi-controller):



3 switch positions with 5 functions

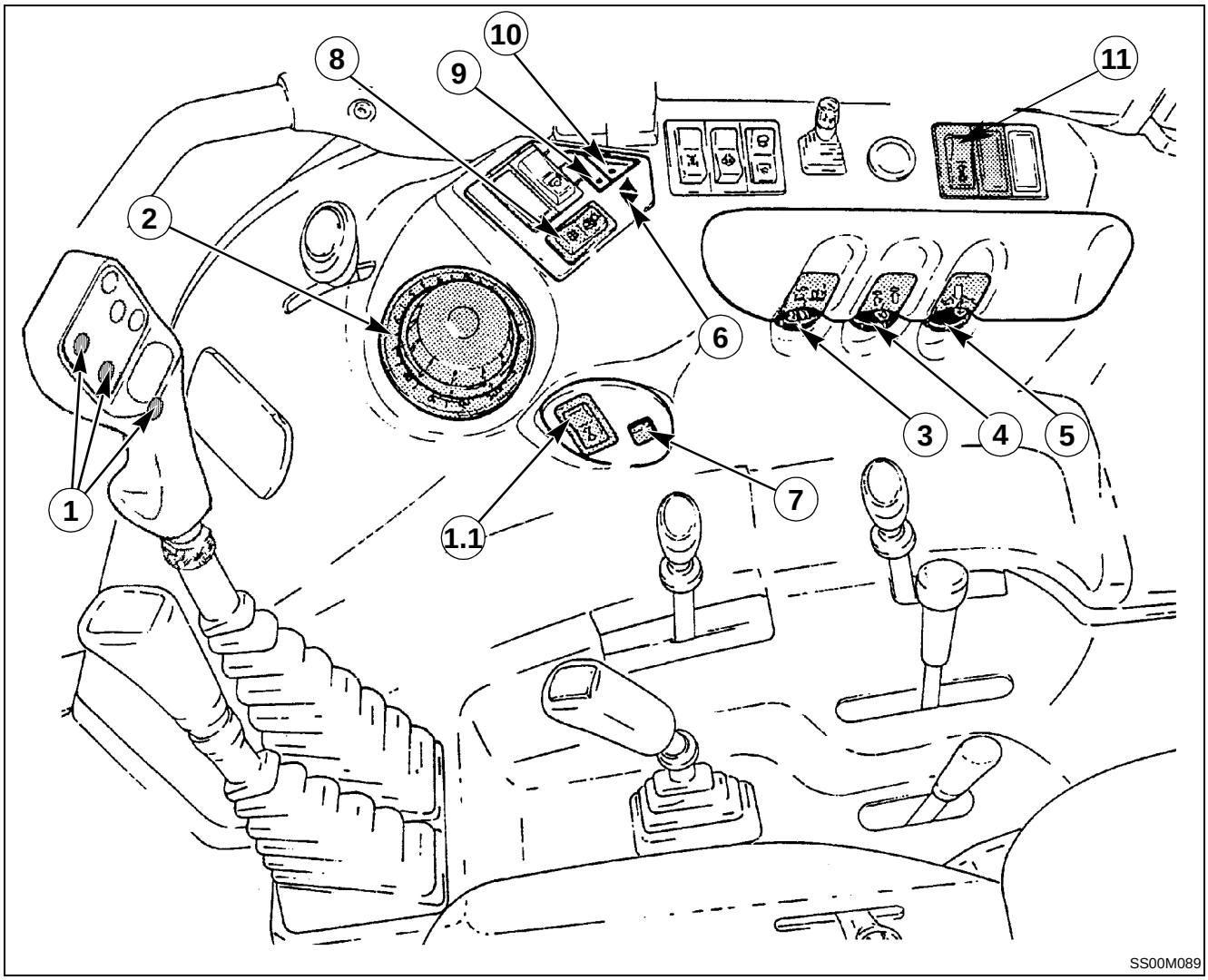
Position 1
- TRANSPORT function – at the same time RAISE function (lifting height only up to the lift limit level set!)
- EHR system ACTIVATION function by switching from CONTROL to TRANSPORT

Mid-position 2
- CONTROL function – working implement automatically lowers to the pre-selected position according to the setpoint. (Enabling)

Position 3
- FAST RETRACTION function – fast retraction of the implement connected to the working depth required. The setpoint selected will be overridden as long as the pushbutton is held pressed.
  (release the button when the working depth has been achieved!)
  A = FAST RETRACTION
  B = normal (button not pressed)
  C = setpoint value selected

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FUNCTIONAL DESCRIPTION (WITH MULTI-CONTROLLER)



1. Button for TRANSPORT and CONTROL

Top left-hand button: 2 functions activating TRANSPORT (raising)
Bottom left-hand button + button at rear: CONTROL (lowering)

1.1 Fast retraction button

2. Setpoint adjusting wheel (main potentiometer)

max. raise – max. lower

3. Mixed control potentiometer

Position-pulling power-mixed-control

4. Lift limiting potentiometer

Limits the lifting height

5. Lowering speed potentiometer

Lowering throttle

6. Light emitting diodes

7. EMERGENCY STOP button

8. Safety switch

Disables all electro-magnetic auxiliary control units + function TRANSPORT – CONTOL

9. Indicator lamp

Traction control

10. Diagnosis display

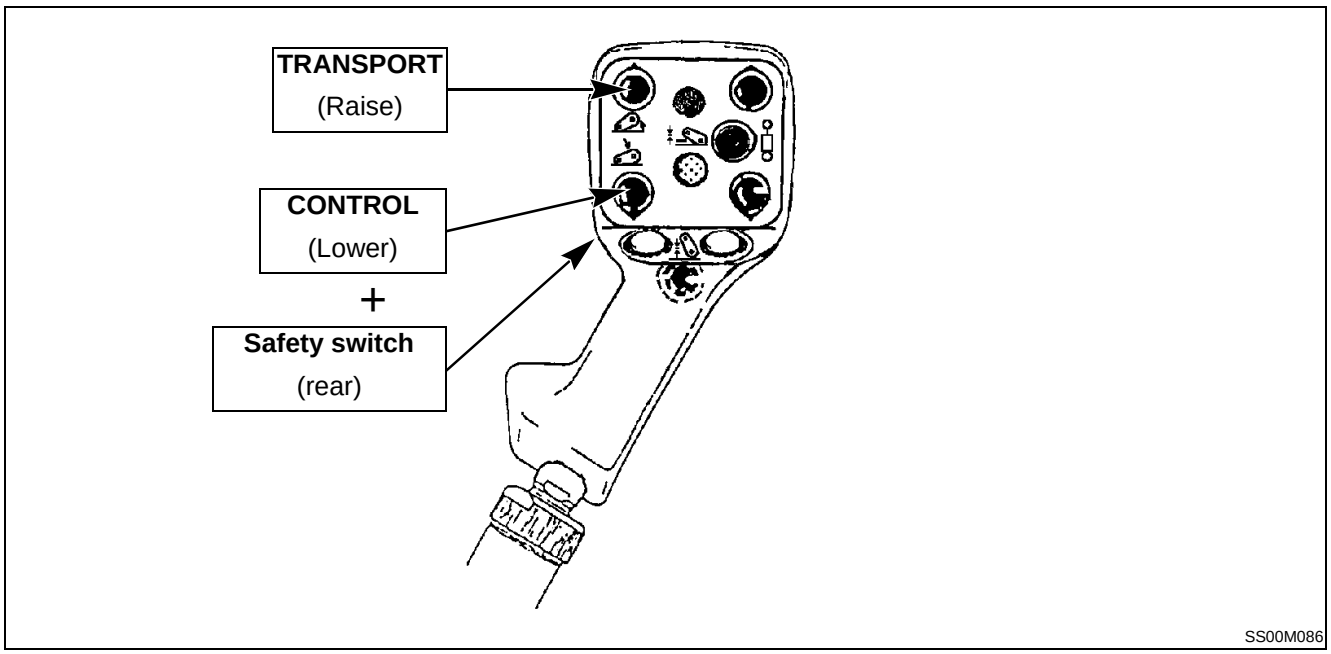
11. EHR lifting gear operation RAISE – LOWER

(parallel circuit to the external buttons)

*) Enabling (activating) the EHR system: After the ignition switch has been switched ON, after operating from the rear operating position or if the "EMERGENCY STOP" has been operated, the EHR system must be enabled = switching from TRANSPORT to CONTROL or vice-versa, it is not possible to lower the lifting gear without enabling.

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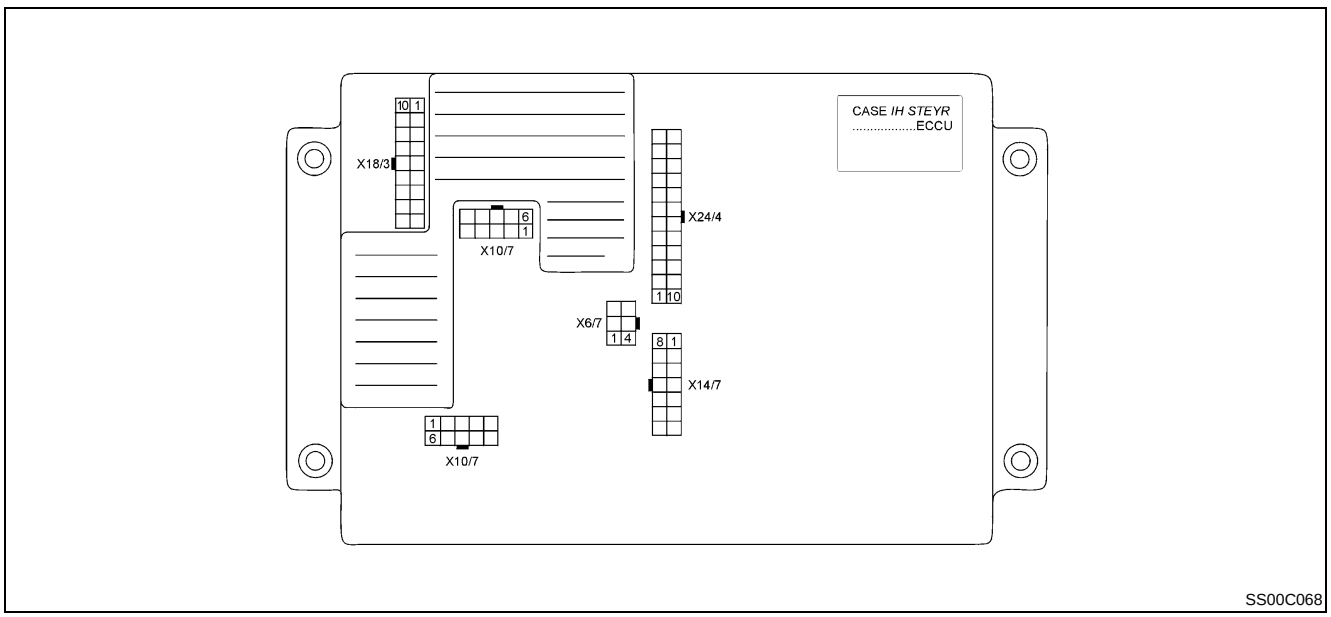
1. Buttons for Transport and Control on the Multi-Controller:



The TRANSPORT and CONTROL functions are operated by the two buttons on the top and bottom left-hand side of the multi-controller.

After operating either the TRANSPORT or CONTROL button, the self-hold function is activated in the ECCU box (A 60).

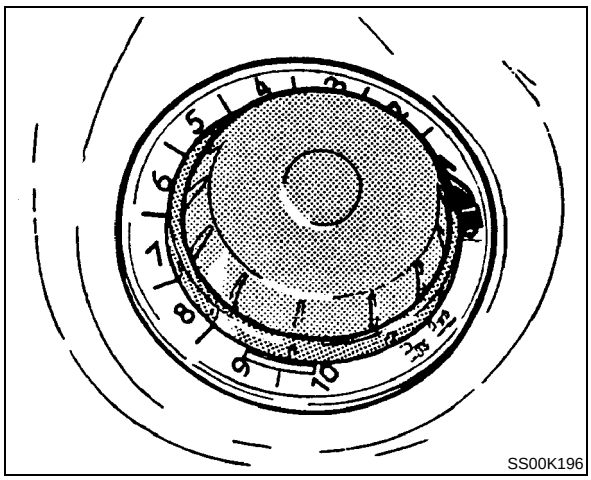
For details of this function, refer to the Service Manual, Chapter 4 B, ECCU – Functional Description and Circuit Diagram 4003.



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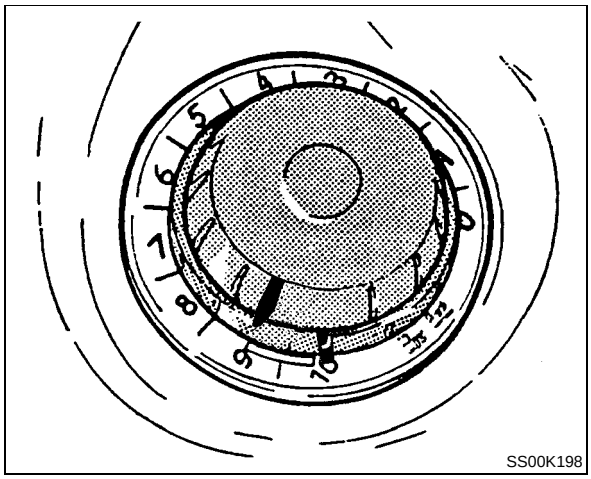
2. Setpoint adjusting wheel:

To set the desired working depth or position of the implement connected. (for pulling power control the working depth, for position control the height position of the implement.)



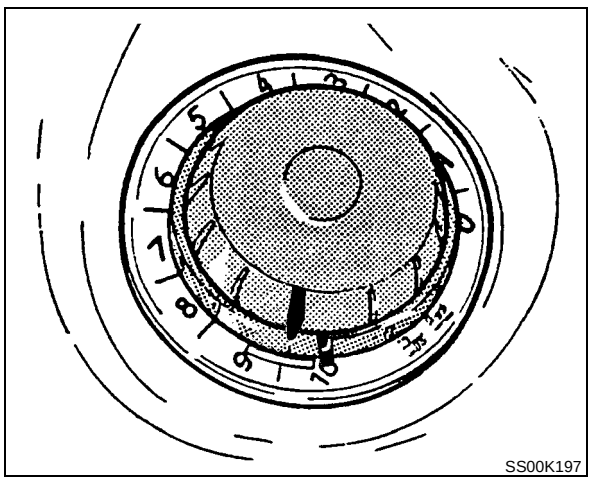
0 = max. raise

(lifting gear raised) up to the set lift limitation



9 = max. lower

(lifting gear lowered)



9 - 10 = (floating position)

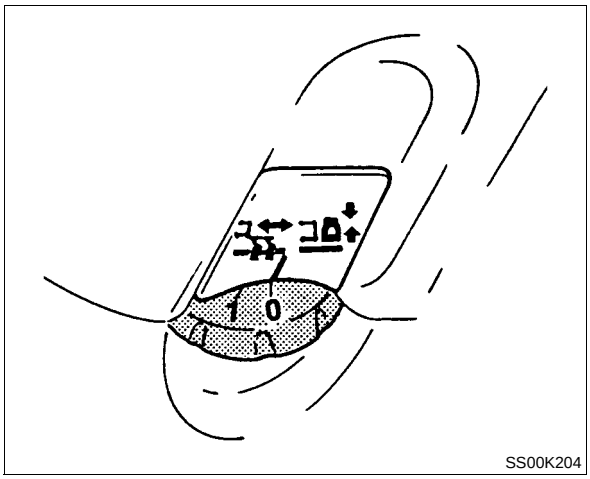
Set the adjuster ring to the basic position!

This can be found easily with the handwheel (latch) and remains in effect.

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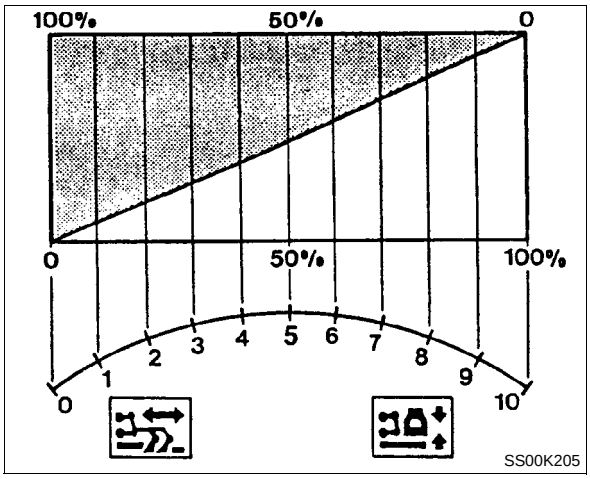
3. Pulling power control:

Position or pulling power control or a mixture of both control variables.



0 = 100% pulling power control

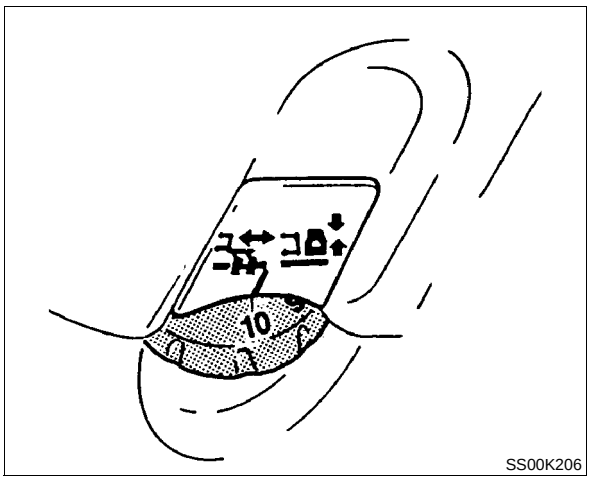
The actual pulling power value is provided by the two power sensors.



1 - 9 = mixed control

(Example: 5 = 50% pulling power – 50% position)

The actual values for position and pulling power are mixed and processed at an adjustable ratio on the switch console.



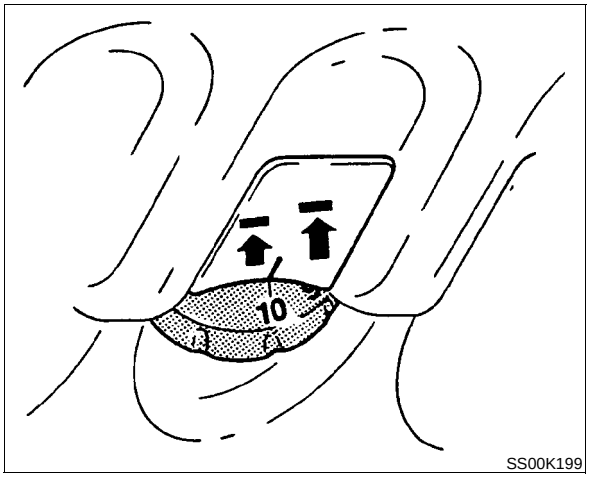
10 = 100% position control

The actual value of the position is supplied by the position sensor, which is controlled by a cam disc.

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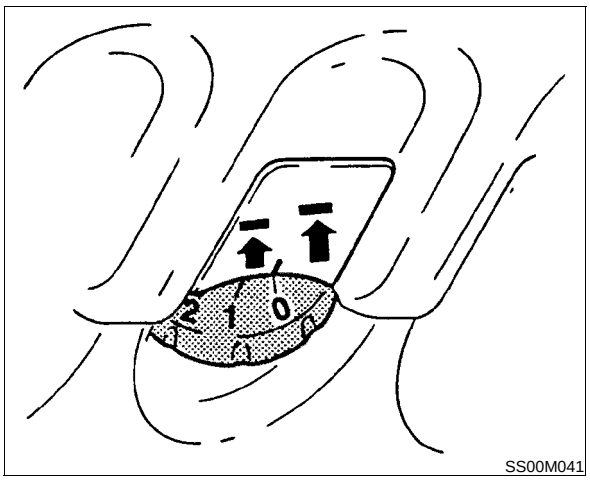
4. Lift Limiting:

for infinite limiting of the lifting height



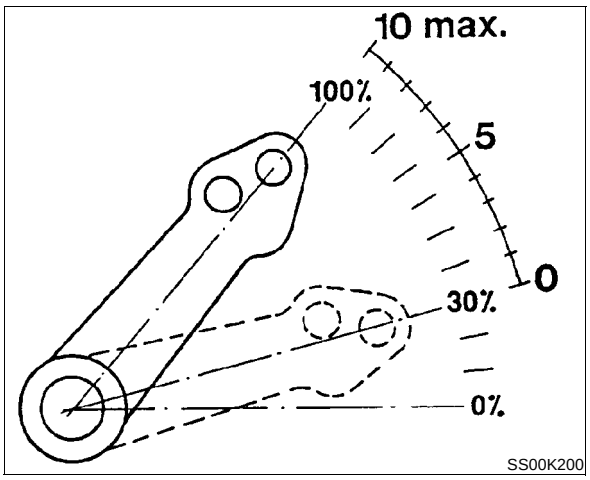
10 = upper lift limit =

max. lifting height



0 = lower lift limit =

approx. 30% of the max. lifting height



0 - 10 = adjustable lifting height

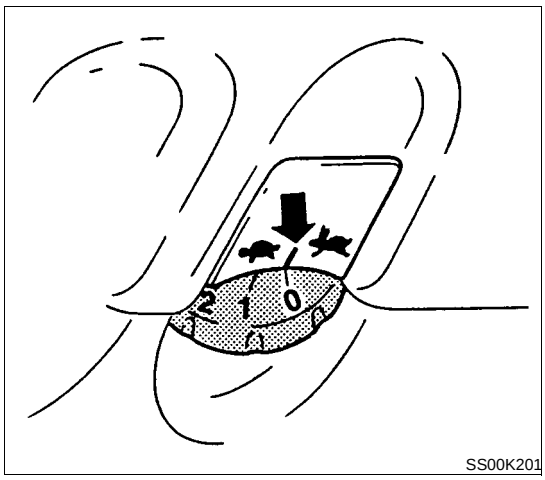
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5. Lowering speed:

To infinitely adjust the lowering speed to zero.

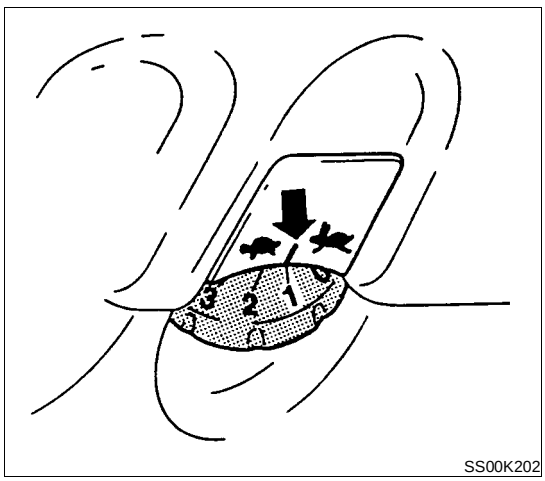
WARNING: *The lowering speed should be matched to the requirements of the implement fitted!*

(when lowering a heavy implement, set to  *!)*



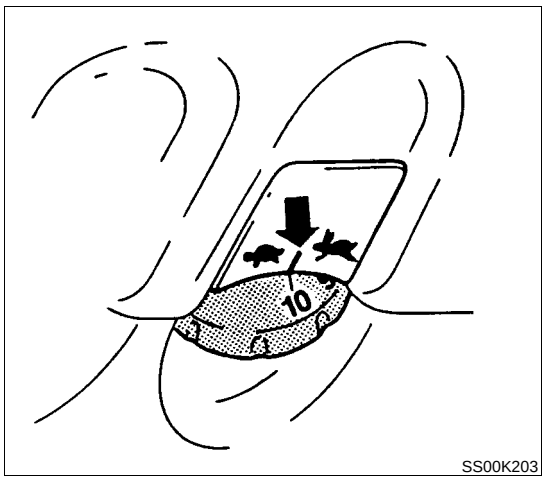
SS00K201

0 = closed, lowering not possible



SS00K202

1 =  = lowering slowly



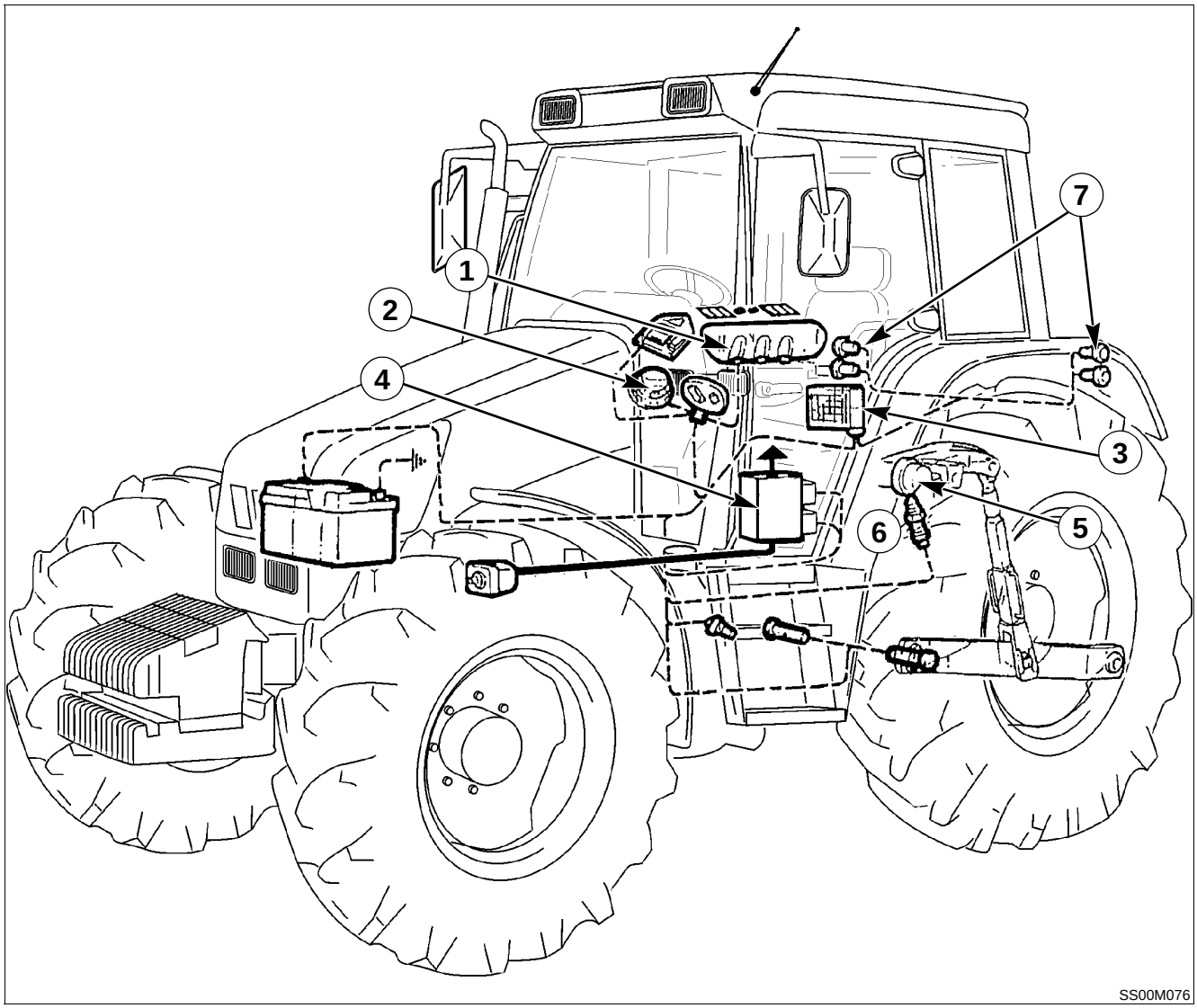
SS00K203

10 =  = lowering quickly,

max. lowering speed

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BASIC FUNCTIONS OF THE EHR FOR POSITION CONTROL

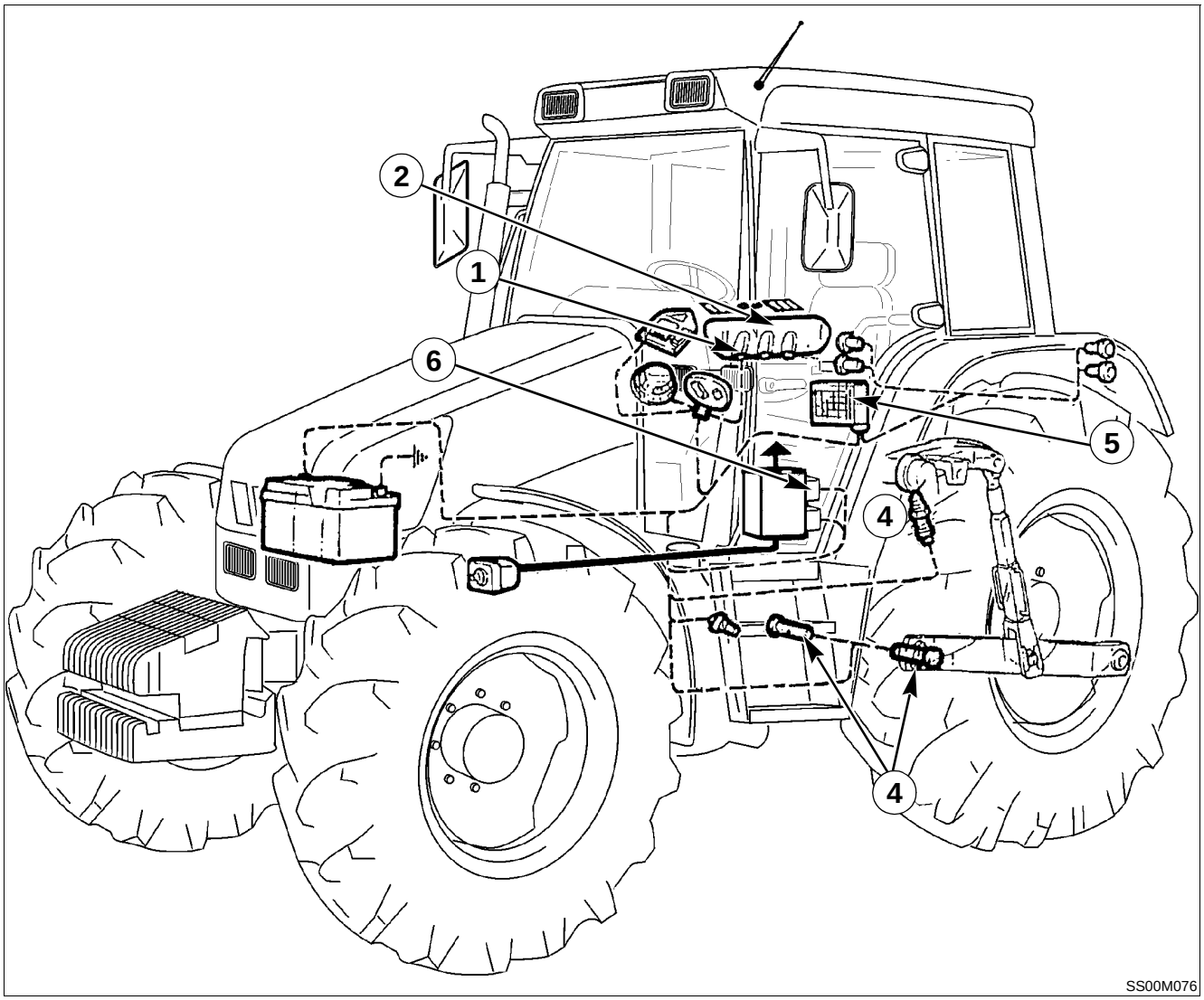


1. Set the mixer potentiometer to 10 (position control).
2. Position and lifting height are set on the operating console using the setpoint and lift limiting potentiometers.
3. The electronic box makes a NOMINAL-ACTUAL comparison.
4. The control valve is operated and carries out raise and lower processes.
5. The control cam alters its position (hydraulics).
6. Position sensor reports ACTUAL state to the electronic box, whereby the function is completed.

   Neither of the two power sensors are in operation in 100% position control, precise position changes of the lifting arms is therefore only possible in 100% position control!

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BASIC FUNCTIONS OF THE EHR FOR PULLING POWER CONTROL

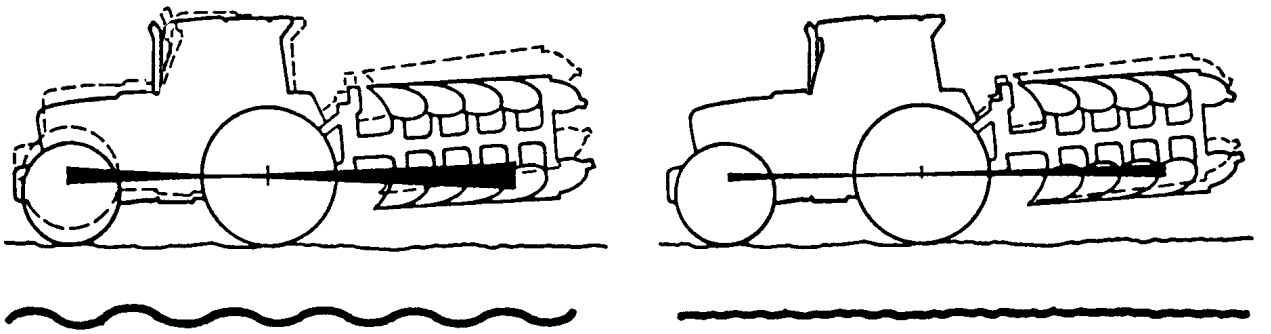


Example of a control function sequence:

1. Set the mixer potentiometer to 0 (100% pulling power).
2. The driver sets the desired setpoint values on the operating console.
3. The setpoint values set are fed to the electronics box.
4. The momentary actual values are simultaneously acquired by the sensors and passed on to the electronics box.
5. The electronics box continually compares the setpoint values to the actual values.
6. If the actual values do not correspond exactly with the setpoint values, one of the two solenoids on the solenoid control valve will be operated until such time as the actual values correspond with the setpoint values. For this reason, the desired working depth can only be set under pulling power control (e.g. ploughing). Precise positioning of the lifting arms is not possible in pulling power control!
7. Due to the fact that there is constant feedback of the actual value with the EHR system, such systems are as CLOSED CONTROL CIRCUITS or LOOPS.

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OSCILLATION DAMPING



SS00M084

EHR-B oscillation damping is activated by:

– activating the system

– switching the raise switch to position 1 = TRANSPORT (without multi-controller)

– operating the TRANSPORT button (with multi-controller)

Oscillations and shocks, which occur when transporting heavy implements, are reduced by the oscillation damping (see diagram).

ADVANTAGES: Less mechanical loading of the hydraulic linkages and the implement, increased driving safety through constant front wheel ground contact, whereby a higher driving speed is permitted.

NOTE: *With the TRANSPORT (RAISE) function, only 93% of the max. lifting height is achieved. The remaining 7% are required as play for oscillation damping.*

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Heavy implements are often fitted to the tractor's three-point linkage for transportation. This leads to pitching movements during transportation.

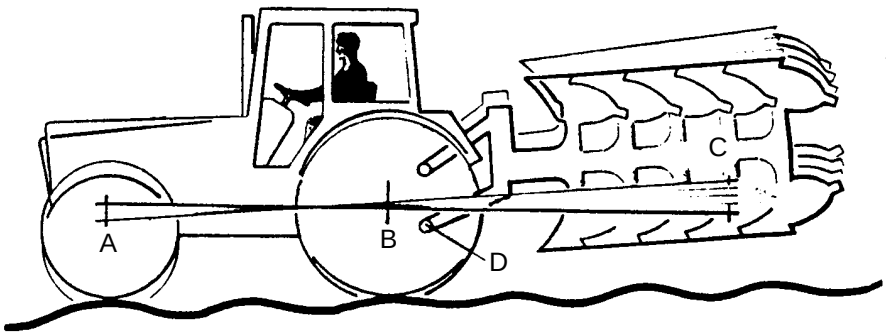
With the aid of EHR-B, active oscillation damping is in operation in the raised position. Oscillations lead to dynamic loading of the power sensors in the lower linkages. The signals are acquired from the sensors. A suitable control circuit evaluates these and achieves quick oscillation damping by making slight adjustments to the lifting gear.

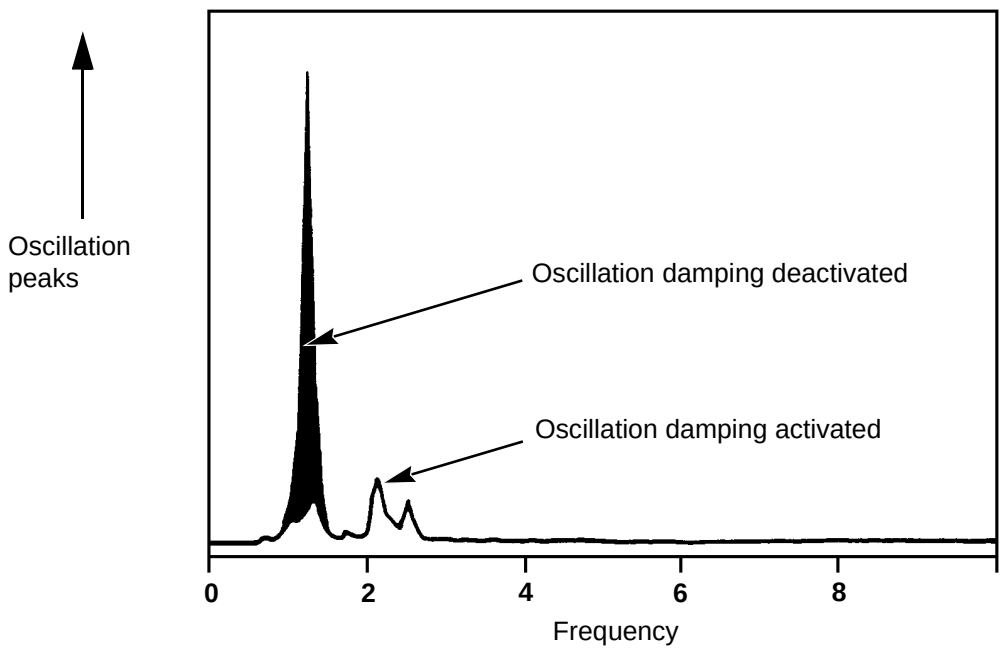
The lowering throttle function is deactivated in the oscillation damping mode. The possible lowering speed is therefore maximum speed.

Switching ON criteria: EHR must be activated – the raise switch must be in the TRANSPORT position with multi-controller versions, the TRANSPORT button must be operated.

When these criteria are fulfilled, the lifting gear sinks from the "upper limit" position by approx. 3% to its "mid axis of oscillation". The oscillation damping is already active at the beginning of the lowering procedure. The effects of oscillation damping are however initially weak but it is fully active after 2 seconds. The maximum movement of the lifting gear about its "mid axis of oscillation" is limited, in an upward direction, by the "upper limit" position. The lifting arms can deviate downwards by approx. 4% from the axis of oscillation. This results in a maximum total distance from the "upper limit" of approx. 7%. All percentages given are in relation to 100% of the total range of the lifting gear.

Oscillation damping is switched OFF automatically by switching the raise switch to the CONTROL position or by pressing the CONTROL button on versions with multi-controller.





SS00M143

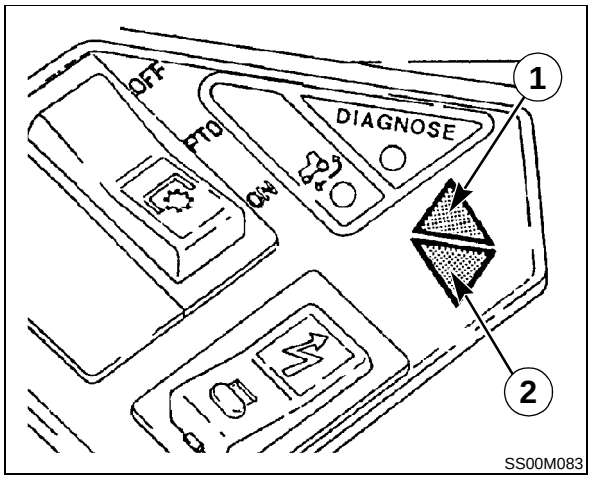
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Deactivating oscillation damping

Switching the raise switch to position 2 = CONTROL (without multi-controller)

Operating the CONTROL button + safety switch (with multi-controller)

WARNING: *Driving characteristics will alter after deactivating oscillation damping, due to the rigid implement connection (see drawing on previous page!)*

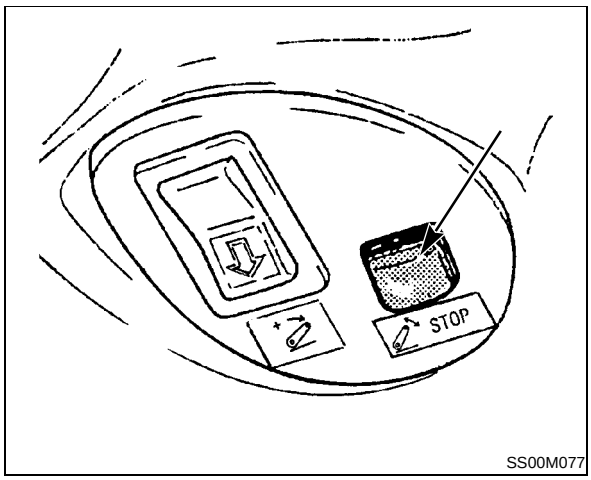


6. Light emitting diodes:

The desired control function is indicated by light emitting diodes.

1 = lights up, when the lifting gear rises

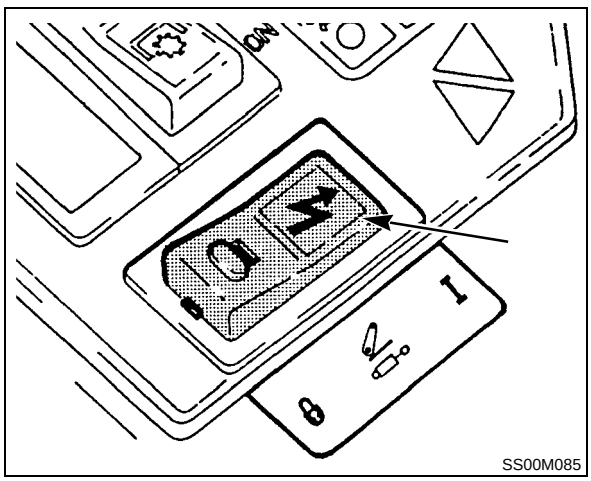
2 = lights up, when the lifting gear lowers



7. Stop button:

(EMERGENCY STOP – red button)

When the stop button is operated, all EHR functions are interrupted. Diagnosis LED lights up (indicates latching). System must be re-activated (unlatched).

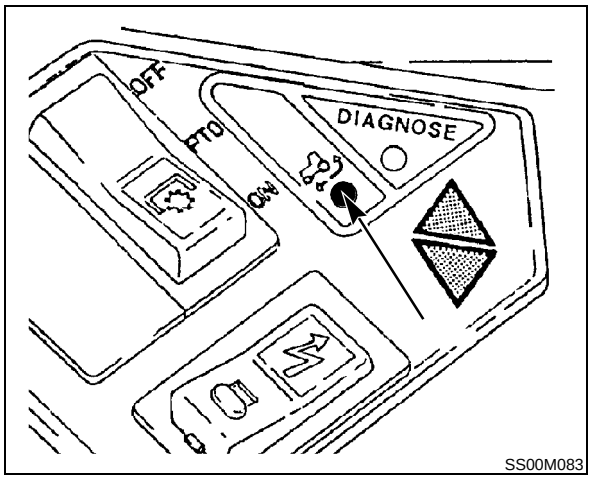


8. Safety switch:

The power supply to the Raising/Lowering pushbutton and all electrical auxiliary control units can be switched ON or OFF using the latchable safety switch.

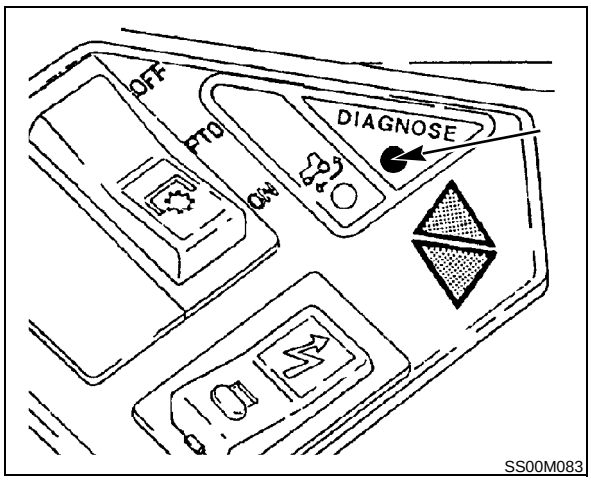
WARNING: *When driving on public highways, the system must be secured against inadvertent operation from the mutli-controller, by switching OFF the power supply with the safety switch.*

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9. Traction control indicator lamp:

The traction control option is only available for series 9100 tractors (identical components).



10. Diagnosis display:

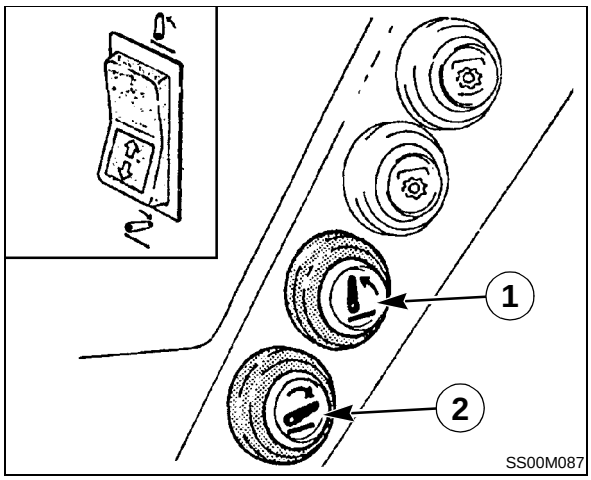
After switching ON the ignition, the diagnosis LED lights up, for as long as the EHR-B system remains latched.

If the system is OK, the diagnosis LED goes out after the EHR-B system is unlatched (activated).

Diagnosis display in the case of a fault:

If the integrated diagnosis system detects a fault in the EHR-B system, this fault is indicated by flashing signals.

The fault can be defined using the fault code list.



11. Rear operating position:

1.) Button – raises lifting gear

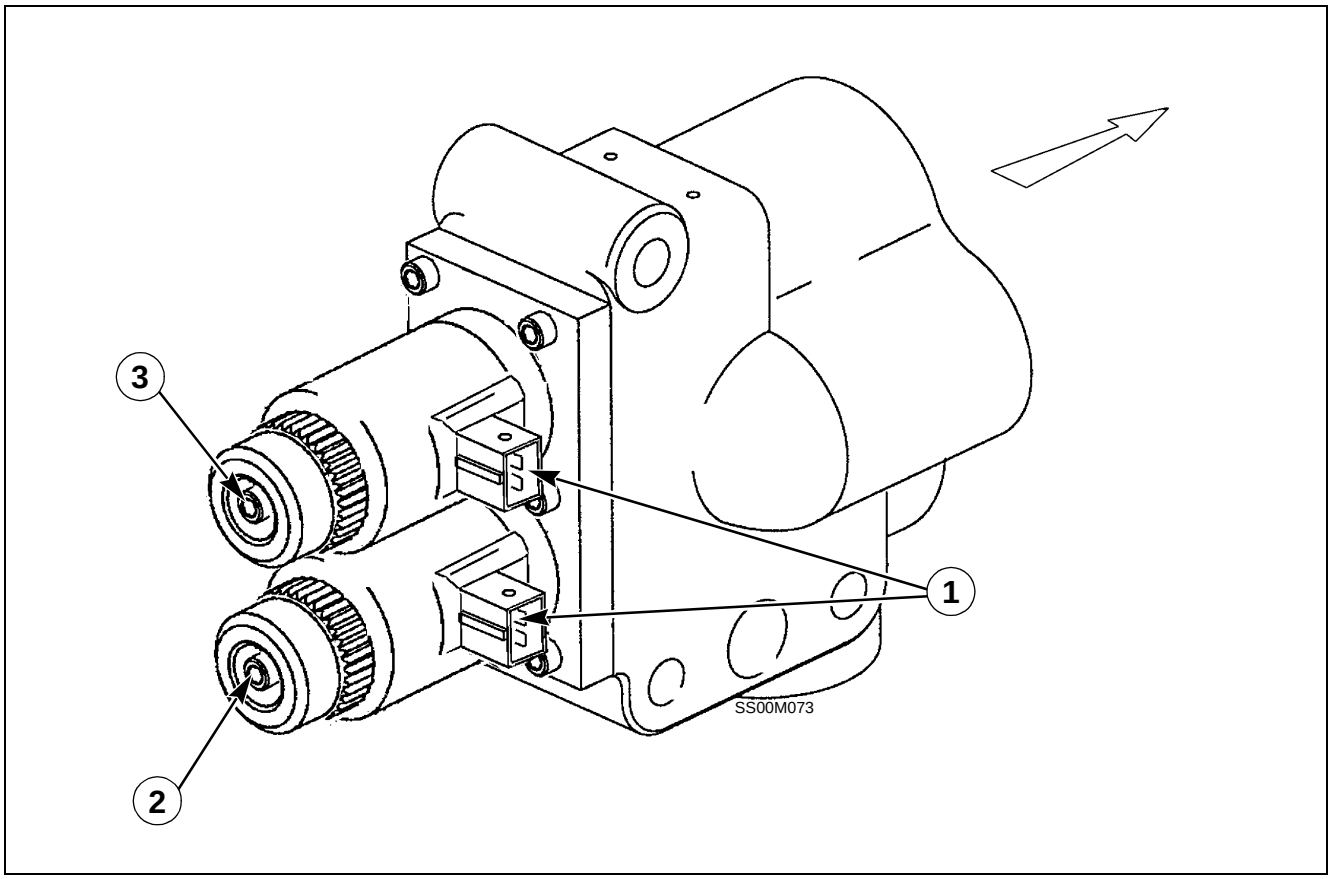
2.) Button – lowers lifting gear

WARNING: *During operation from the rear position, all other EHR control options are inhibited. The latch is cancelled again by operating the switch or the TRANSPORT or CONTROL button (unlatching the EHR system).*

For safety reasons, the rear operating position raises/lowers the lifting gear at a reduced speed.

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EMERGENCY OPERATION



If the tractor's electrical or electronics system suffers a complete failure, raising or lowering can be done by manually operating the solenoids.

1. Disconnect both plugs from the solenoid valves.

2. Emergency operation **RAISE** rear, bottom solenoid forward (driving direction)

3. Emergency operation **LOWER** rear, upper solenoid forward (driving direction)

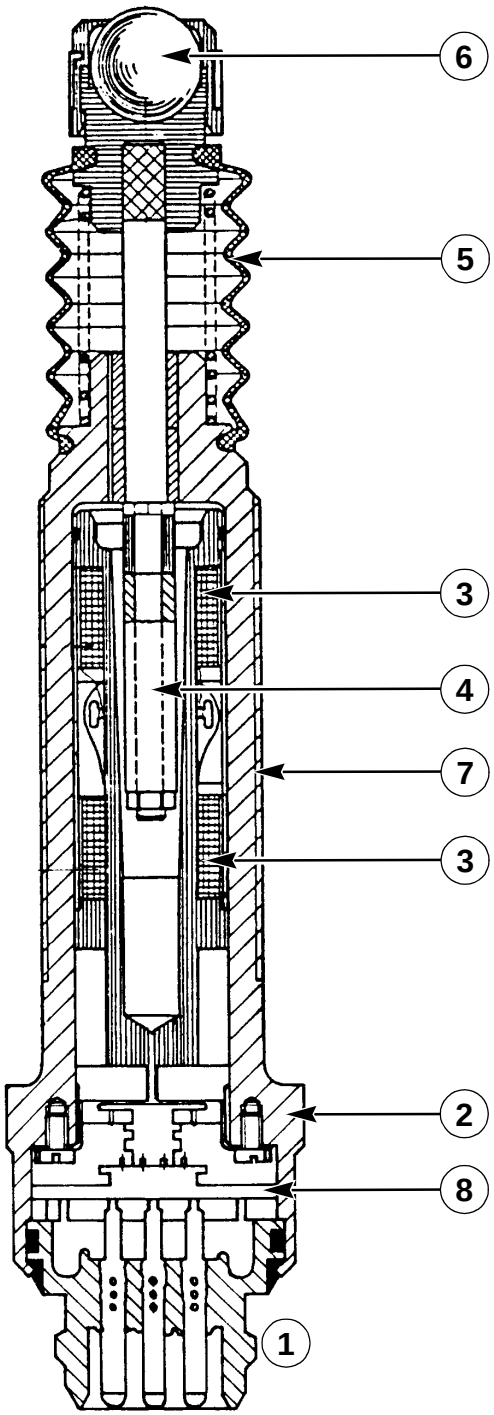
NOTE: *LOWERING using the emergency operation can also be carried out with the engine at a standstill.*

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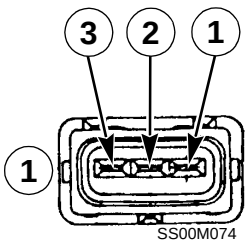
DIGITAL, INDUCTIVE POSITION SENSOR

Construction and function

The position sensor is an inductive travel sensor, with a stroke (measuring range) of 10 mm. It operates without contacts, on the basis of an inductive voltage divider and has thus a low rate of wear. The internal components comprise a differential coil, in which a ferrite core is moved. The inductive resistance of the coil is altered by the movement of the coil within it, thus continuously altering an alternating voltage present at a centre tap-off.

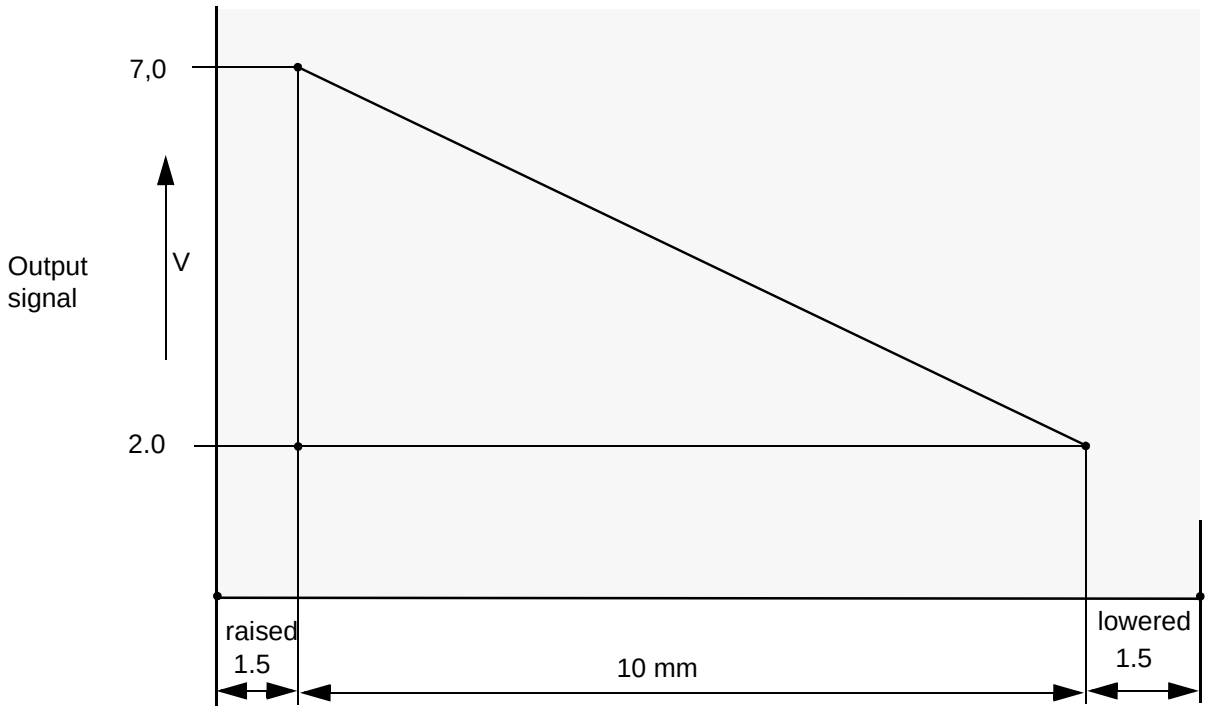


1. 3-pole connector
   1 = Ground
   2 = output voltage (signal)
   3 = supply voltage
2. Housing with hexagon
3. Differential coil
4. Ferrite core
5. Rubber cover
6. Ball sensor
7. Adjustable thread for installation
8. AC / DC converter



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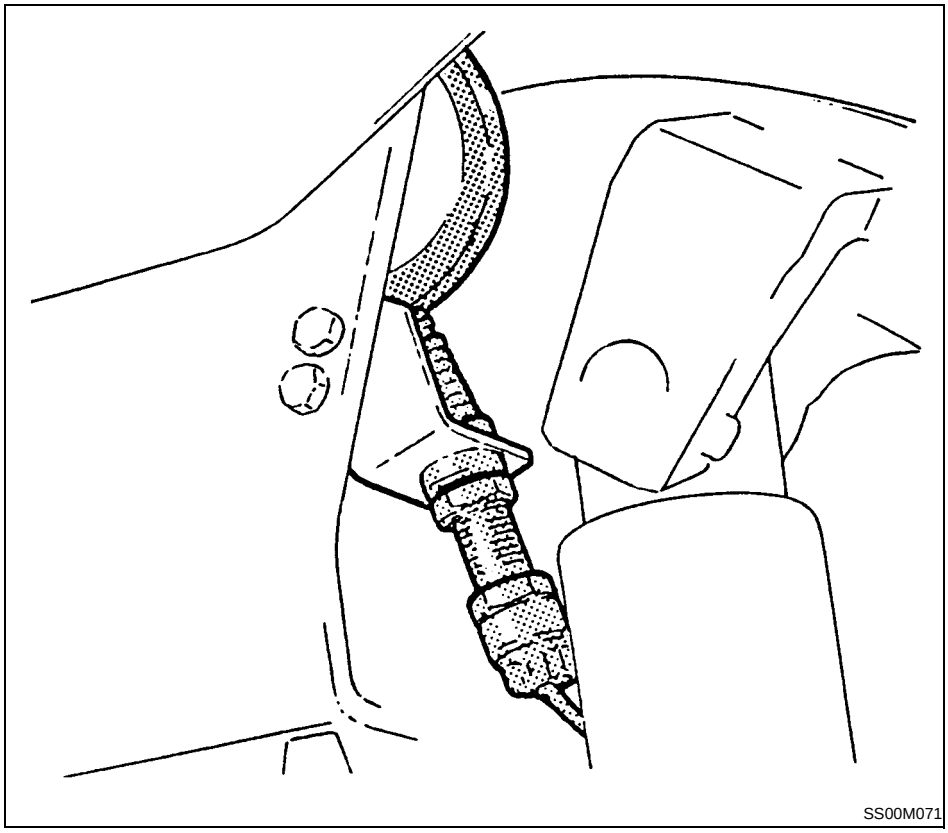
Position sensor – Technical Data and Characteristics



Total range	13 mm
Measuring range	10 mm
Supply voltage	9.5 V stab. direct current
	(measured at terminals 1 and 3 on the sensor)
Output signal	dependent upon the actual position of the ferrite core, between 2.0 and 7.0 V = (measured at terminal 2 on terminal 1 of the sensor)
Deviation	±3% over 10 mm measuring range
Securing thread	M 24 x 1.5
Degree of protection	splash-proof

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Adjusting the Position Sensor



– Start the engine, lower the lifting gear to its lower limit by operating the external "lower" pushbutton.

– Screw the position sensor in by the locking nut, until the ball makes contact with the cam disc and then one turn more.

– Connect the position sensor.

– Raise the lifting gear to its upper limit by operating the external "raise" pushbutton.

– Raise the lower linkage by hand and check the freedom of movement of the cylinder (freedom of movement at the cylinder 5 mm).

  Turning the position sensor to the left reduces freedom of movement.

– Turning the position sensor to the right increases freedom of movement.

– After each adjustment to the position sensor, lower the lifting gear slightly by operating the external "lower" pushbutton, then raise it to its upper limit again by pressing the external "raise" pushbutton and check the freedom of movement.

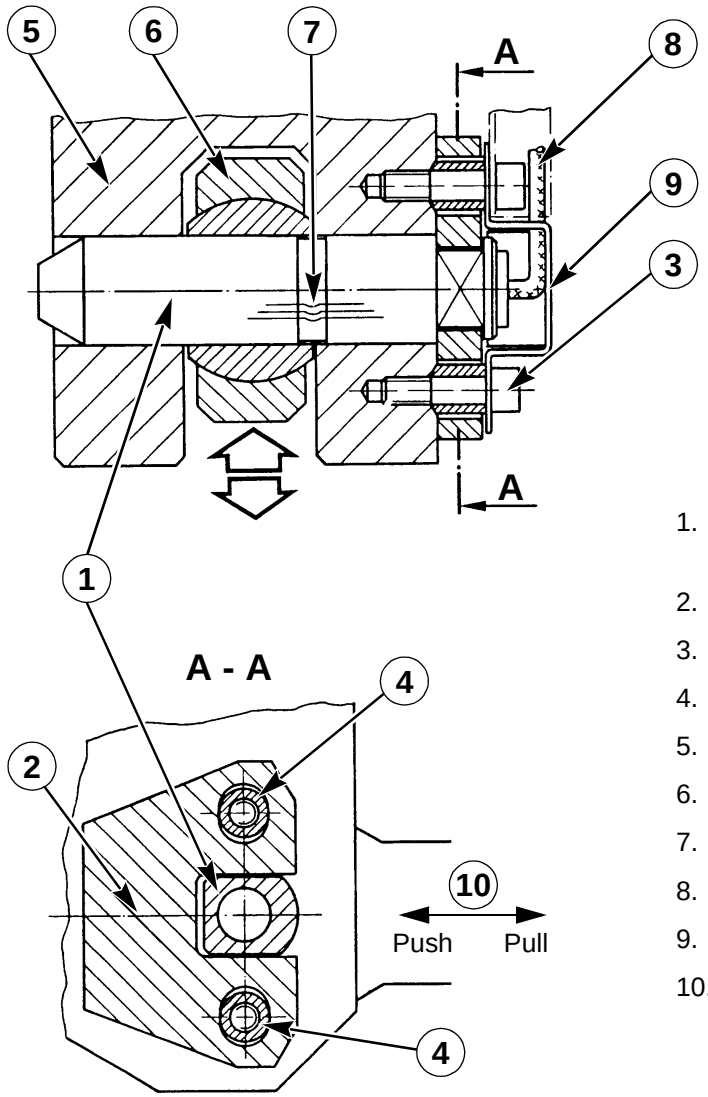
– Repeat the procedure, until a freedom of movement of 5 mm has been achieved, measured at the lifting cylinder's piston rod.

NOTE: *Keep the cam disc for the position sensor clean, do not grease! (dirt adhering to the grease can cause malfunction!).*

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POWER SENSORS – DESIGN AND INSTALLATION

In the switch position CONTROL, the power sensor is used as a signal transmitter for pulling power control and in the TRANSPORT position, it is used as a signal transmitter for oscillation damping.



1. Power sensor (must be fitted free of strain)
2. Fastening bracket
3. Securing screw
4. Spacer sleeves
5. Axle stub
6. Lower linkage
7. Measuring electronics
8. 3-pole connection cable
9. Cable cover
10. Directions of measurement

SS00M072

Function:

– The EHR-B power sensors work on the magneto-elastic principle.

– One primary and one secondary coil are fitted inside the hollow power sensor.

– From the power supply voltage (9.5 V direct current), an oscillator generates a voltage, in the kHz range, for the primary coil.

– When the power sensor is not subject to load, there is no magnetic flux in the secondary coil.

– The more the power sensor is subject to load, the more the secondary coil is energised and a voltage is induced into it.

– The signal voltage is rectified, smoothed and amplified in the electronic circuits, which are also integrated into the power sensor.

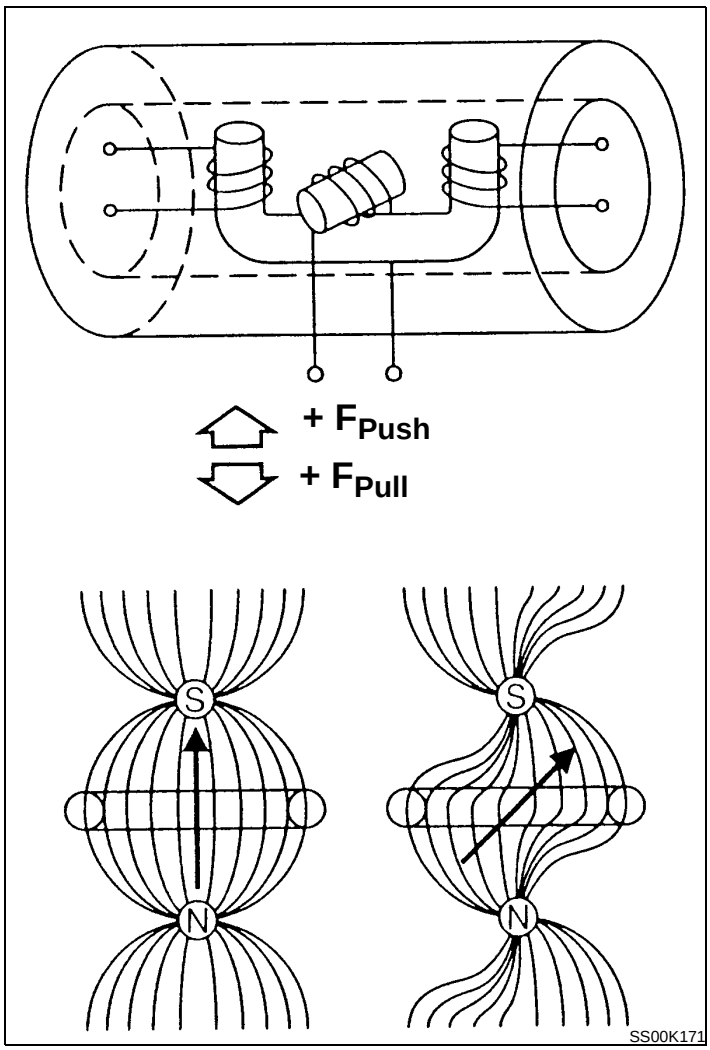
– The signal voltage, in an unloaded state is approx. 50% of the supply voltage (4.7 V = see diagram).

– When a pulling force is applied, the signal voltage decrease, when a pushing force is applied it increases (observe correct installation).

– The signal voltage produced by the power sensor can be within a range of between 25% to 75% of the supply voltage.

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Power Sensor – Technical Data and Signal Shaping

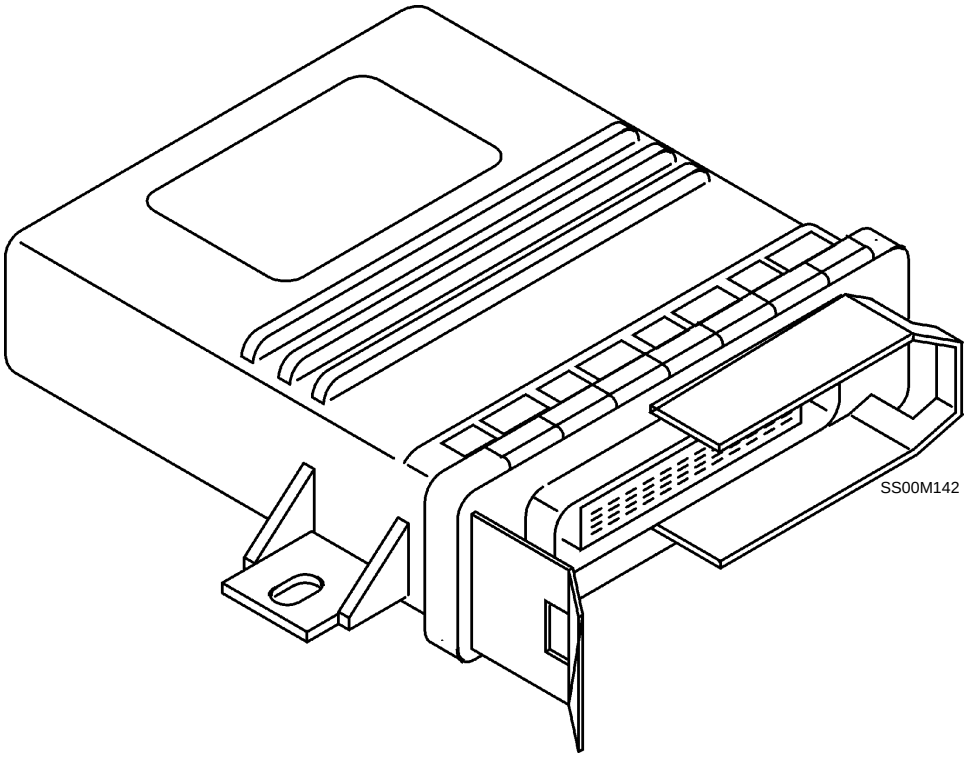


Power sensor	40 kN pulling power (Bolt Bosch-End. No.: 545)
Power supply voltage	9.5 V stabilised direct current at terminal 3,
	Ground at terminal 1; stabilising stage in the electronics box
Current consumption	< 100 mA
Voltage value terminals 1 and 3	= 9.5 V
Terminals 1 and 2	= 2.5 to 7.5 V (dependent upon loading)
Degree of protection	waterproof

NOTE: *The power sensors comply with EMC directives (Electro-Magnetic Compatibility).*

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ELECTRONIC CONTROL UNIT (with management functions)



Power supply voltages and monitoring

a) The control unit must be connected direct to the battery voltage, as direct connection to the positive and negative poles of the battery is relatively free of voltage peaks and drops.

   This voltage is switched by a relay built into the control unit , when the lifting gear control is switched ON. The D+ voltage produced by the alternator is used for this purpose.

b) The circuit assigned to the relay shuts the system down if the following faults occur:

   – Battery reverse polarity

   – Overvoltage > 18 Volt, e.g. using a 24 V battery instead of 12 V

   – Cable breakage or short circuit on the position sensor

   – Short circuit in the stabilised supply voltage exceeding 0.1 sec.

c) To supply the electronic circuit in the control unit, the operating panel and sensors, a stabilised voltage of 9.5 V and a reference voltage of 1.65 V are generated from the battery voltage. These voltages are short-circuit-proof.

d) The control unit is protected against positive and negative voltage peaks by a power zener diode at the battery connection. Voltage peaks with a duration of > 0.1 sec. Will lead to the relay being de-energised.

e) The current consumption is 0.2 A when the lifting gear is at a standstill and max. 4.0 A when the lifting gear is in motion.

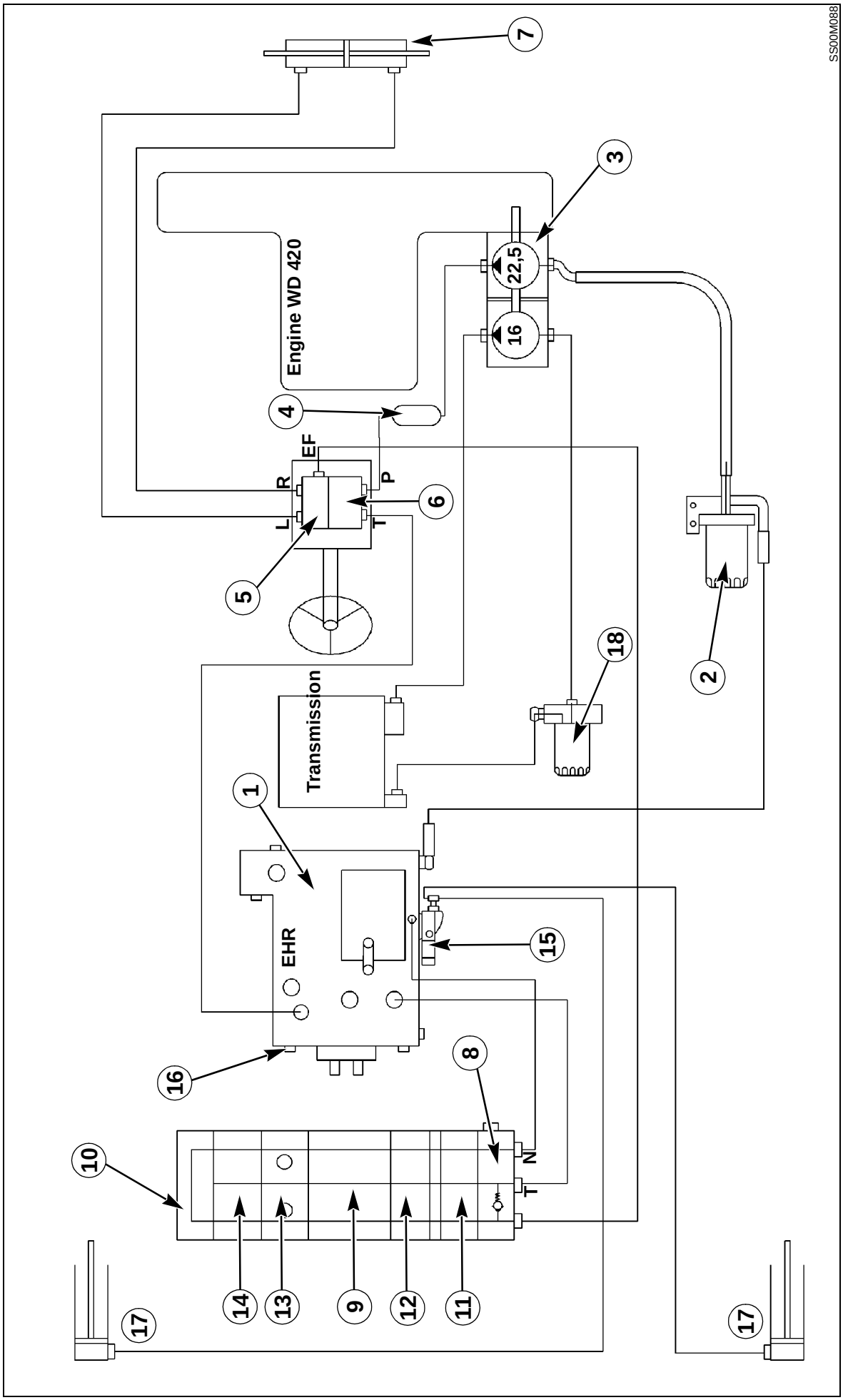
   The electronics box is located to the left of the driver, under a black cover.

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HIGH PRESSURE HYDRAULIC CIRCUIT



List of components

1. Hydraulic fluid reservoir
2. Hydraulic suction filter
3. Tandem hydraulic pump
   22.5 cm³ 50 l/min at 2300 rpm engine speed
   16 cm³ 35 l/min at 2300 rpm engine speed (P1 circuit)
4. Splash baffle
5. Priority valve on the steering servostat
6. Steering servostat
7. Steering cylinder
8. Connection plate, hydr. Auxiliary control unit with integrated pressure limiting valve 175 bar
9. Intermediate piece
10. End plate
11. Mechanical or electrical auxiliary control unit, single or double-action
12. Mechanical or electrical auxiliary control unit, single or double-action
13. Mechanical or electrical auxiliary control unit, single or double-action
14. Electrical auxiliary control unit, single or double-action
15. EHR control unit
16. Plug-in connection, return flow
17. Hydraulic cylinders, left and right
18. Transmission oil filter

P = Pressure

T = Return

N = Neutral circulation

L = left

R = right

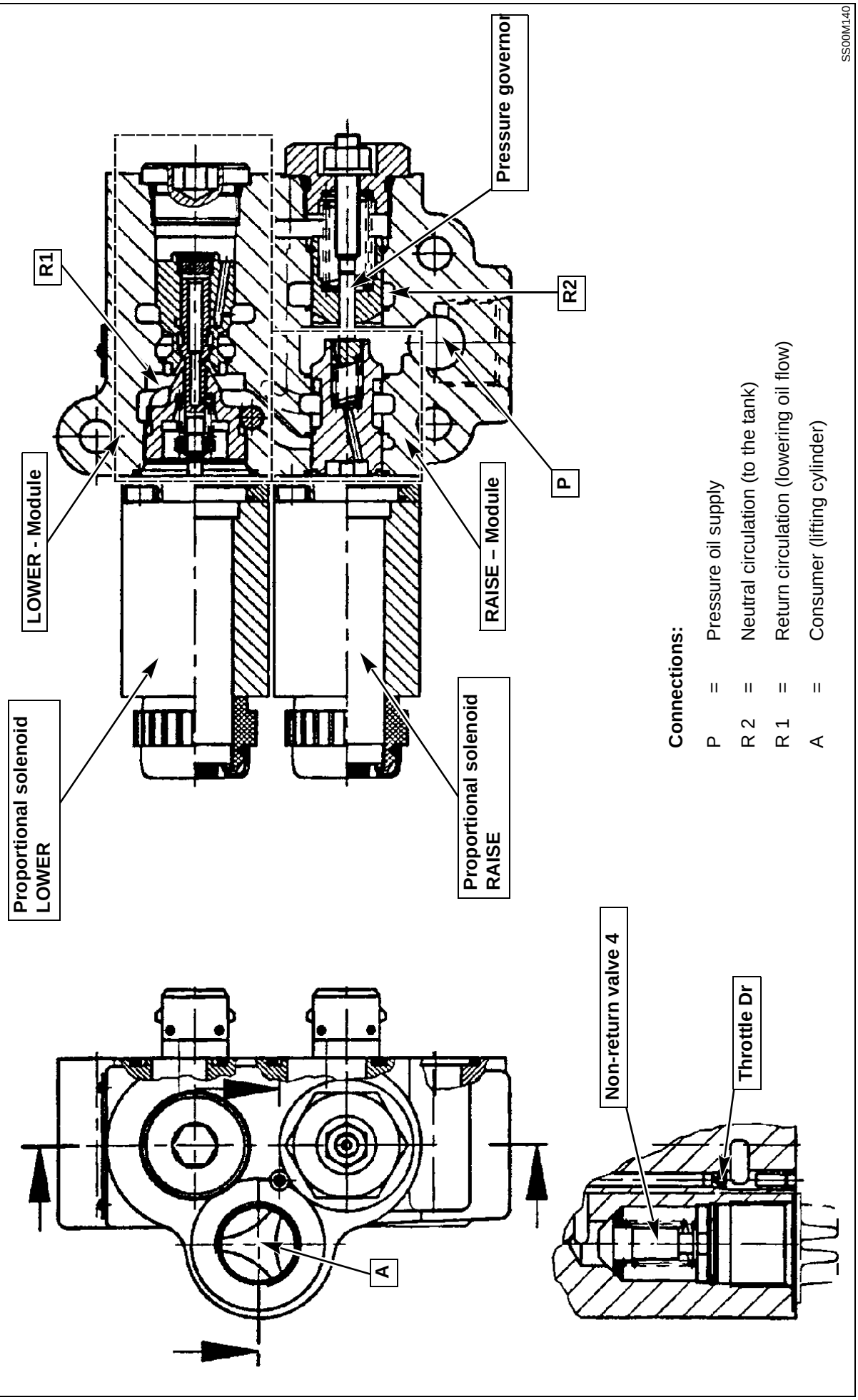
EF = Excess flow (connection for other consumers)

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Graphic

CONTROL VALVE EHR 5-OC



Connections:

P = Pressure oil supply

R 2 = Neutral circulation (to the tank)

R 1 = Return circulation (lowering oil flow)

A = Consumer (lifting cylinder)

General information:

The control valve EHR 5-OC distinguishes itself through electrical - proportional control, high dynamics and low leakage rate.

This hydraulic valve can only be used in last position of a hydraulic circuit. Lifting gear movements are thus not affected by pressure changes of other consumers. However, when other consumers are operated, the EHR 5-OC control valve has lower priority

Construction:

The control valve is of a flanged construction and includes connections P, R1 and R2 on the flange. The consumer connection A is located at the front, as a screw-on connection. The control valve is made up of a Raise and Lower module. Each module is operated by a proportional solenoid. The pressure governor is damped by throttle Dr.

Both solenoids are fitted at the rear and have an emergency operating facility.

Technical Data

Max. pressure during RAISE	210 bar
Max. pump oil flow	60 l/min
Resistance of the solenoid coils	1.7 + 0.5 Ohm
RAISE function	directly controlled by proportional solenoid Y6, 3-way oil flow regulator with pressure governor
LOWER function	pilot controlled by proportional solenoid Y7
Regulation of solenoid current	pulse width modulation PWM
Pulse frequency	approx. 2 kHz, constant
Max. solenoid current	4.0 Ampere
Load compensation	
For LOWER	by signal from the position sensor and electronics box
Emergency operation	by manual operation on the front of the solenoids

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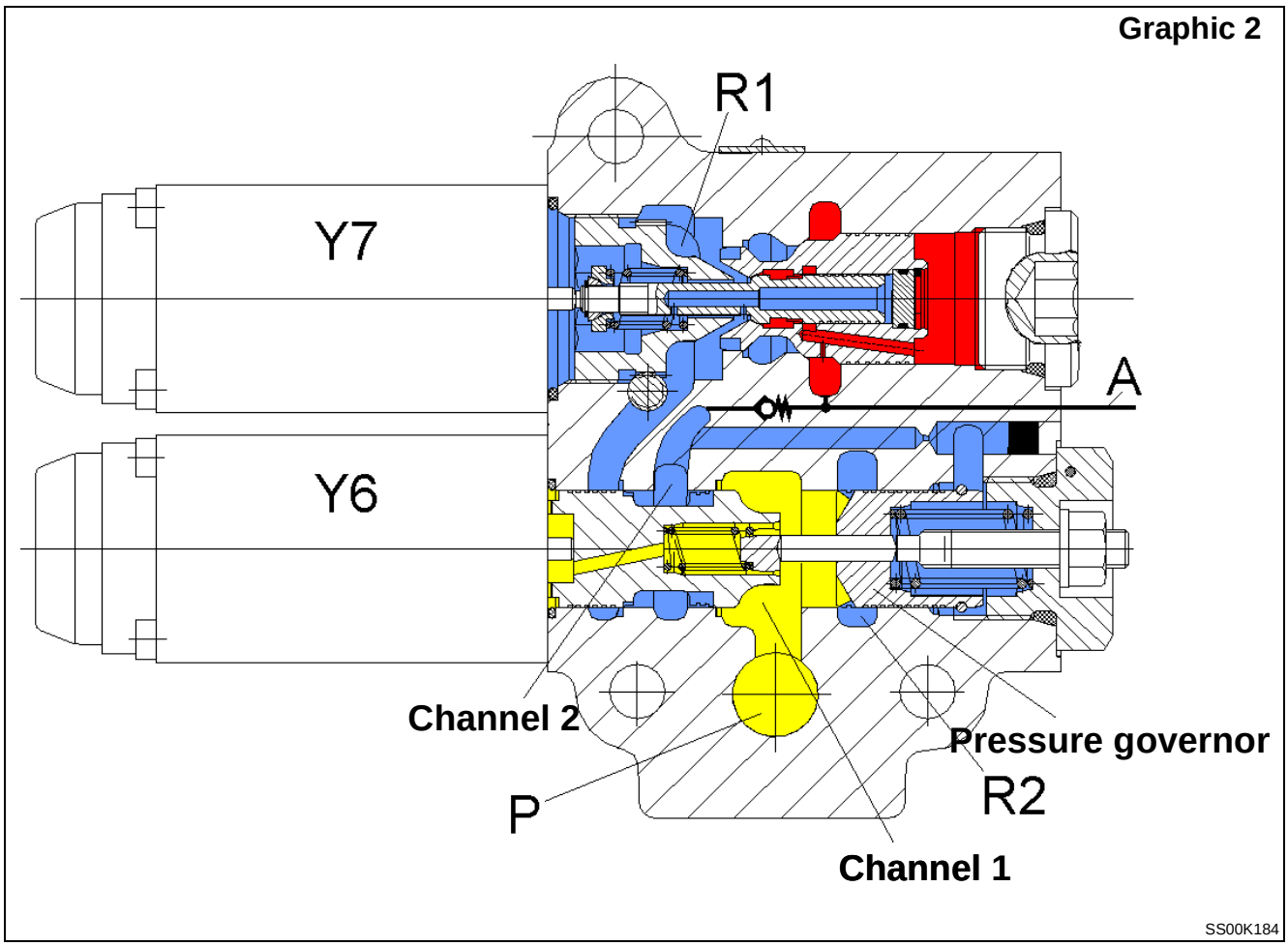
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NEUTRAL FUNCTION – GRAPHIC 2

In the valve position shown, oil flows from connection P, through the pressure governor to connection R2 and then to the tank. The spring side of the pressure governor is connected to the return feed R1, the other side is under circulation oil pressure. The forces on the faces of the pressure governor determine their position within the housing.

The sum of the forces on both faces are always equal. Thus the pressure on the spring side of the pressure regulator is always lower than that on the opposite side by the sum of spring pressure/face area. In the following, this pressure difference is referred to as the control pressure drop. This control pressure drop is always present in channels 1 and 2 and is the same under all conditions. Channel 1 is always under a higher pressure. Channel 2 has a connection to R1. In order to produce the control pressure drop, the pressure governor assumes the position, in which the oil flow from P to R2 is throttled to this pressure.

Raise and Lower modules are closed in the neutral position shown here.



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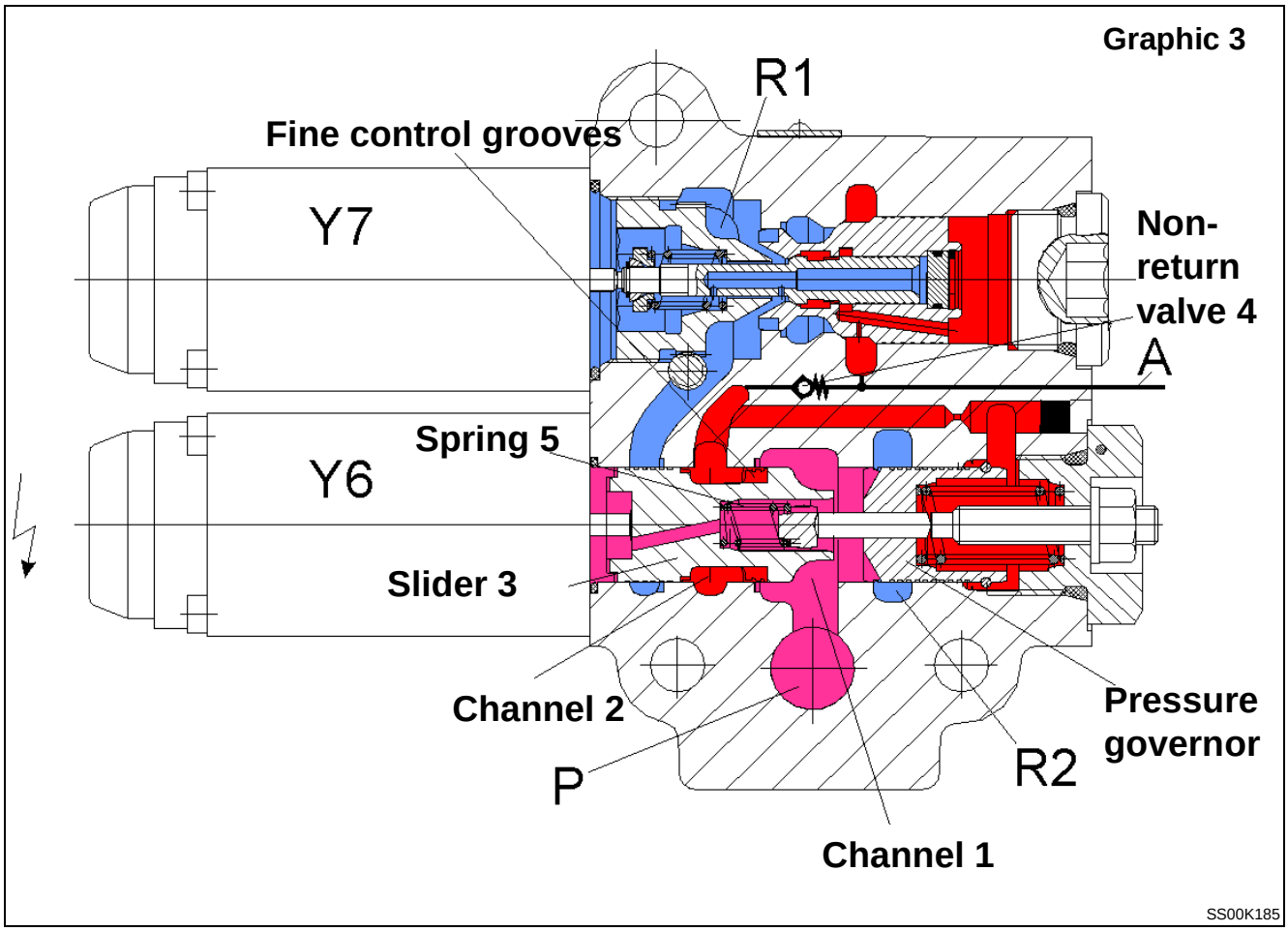
RAISE FUNCTION – GRAPHIC 3

The lifting module proportional solenoid Y6 is energised. This causes the slider to move to the right. In this position, channel 2 is cut off from the separate return R1. In this position, the fine control grooves on slider 3 connect channels 1 and 2. This causes the pressure governor spring to push the pressure governor to the left and throttle the oil flow from P to R2. The pressure then increases, until non-return valve 4 opens. The spring side of the pressure regulator is now connected to the load pressure. The pressure in channel 1 is higher by the amount of the control pressure drop. The load pressure plus the control pressure drop is penned up between P and R2 by the controlling edge of the pressure governor. The control pressure drop drives the oil through the fine control grooves to the consumer (A). Whereby the cross sectional area of the fine control grooves determines the oil flow rate. With this construction, the stroke of slider 3 is only governed by the solenoid's force, which acts against the force of the spring 5.

The electronics box controls the solenoid current between 1.3 to 3.5 amperes, according to the control deviation (nominal value/actual value difference) The oil flow is thus proportional to the electrical solenoid current (proportional valve).

As the load pressure acts on the pressure governor, oil flow is also independent of the load (load compensation).

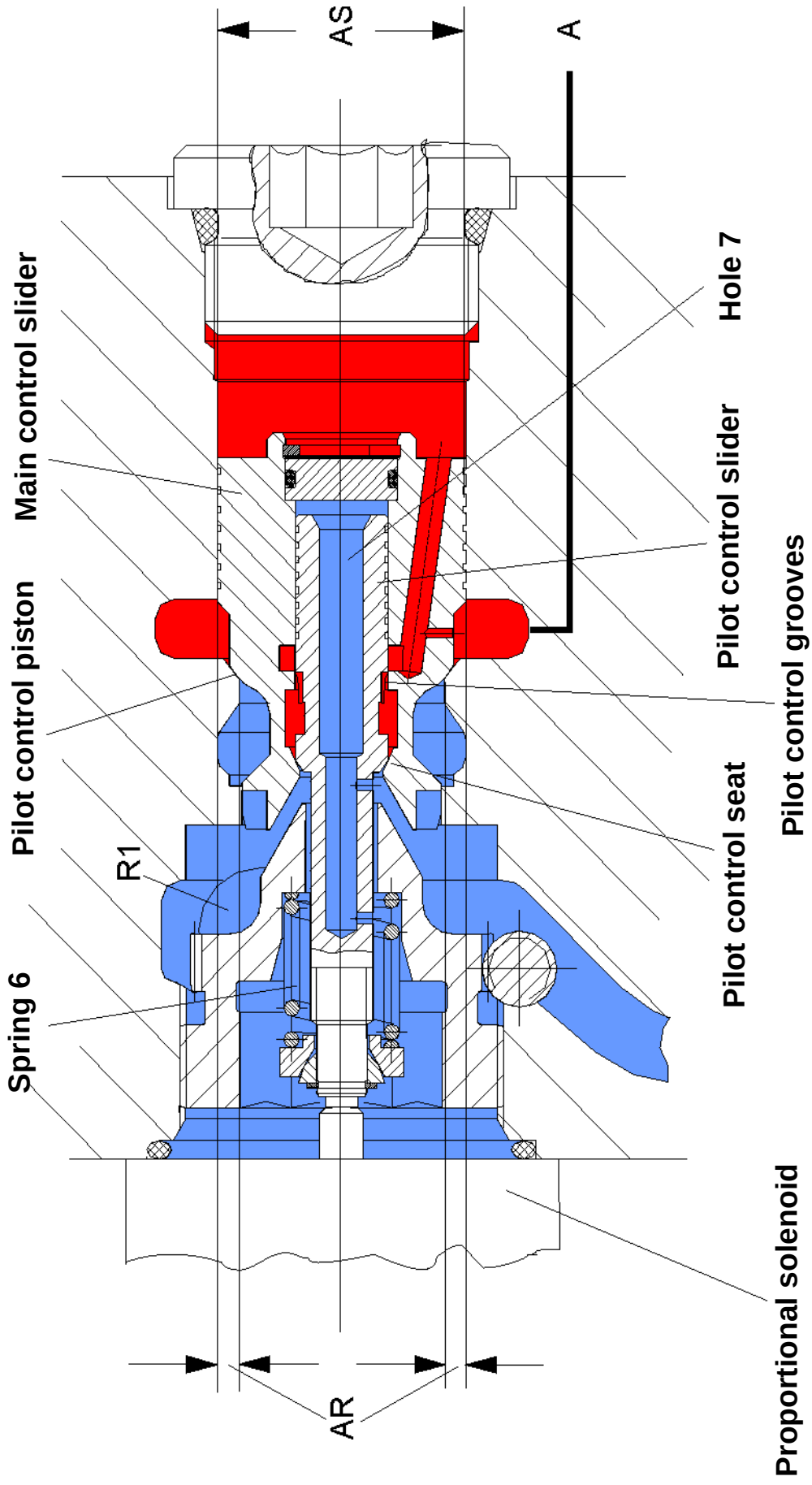
The Lower module is not activated in this function, i.e. it is closed.



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Graphic

LOWER VALVE CLOSED



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LOWER FUNCTION – GRAPHIC 5 AND GRAPHIC 6

Only the Lower module is open during the LOWER function. The pressure governor acts in the same way as described for the neutral position. The Raise module is closed. The fundamental parts of the Lower module are the pilot control slider and the main control slider. Both parts are a combination of slider and seating element. The slider is responsible for fine control of the oil flow and the seating element for sealing. The pilot control slider is located in the centre of the main control slider. Spring 6 pulls the pilot control slider to the left, against the pilot control seat. Due to the fact that the pilot control seat is integrated into the main control slide, this is also pulled to the left, against the main control seat. The pilot control slider is pressure equalised through hole 7. This is not the case with the main control slider. Here, the load pressure always acts on the left-hand side, on the ring surface AR and also on the right-hand side, on the face AS, in a closed state. Due to the fact that surface AS is larger than AR, the main control slider is held in this position by the pressure.

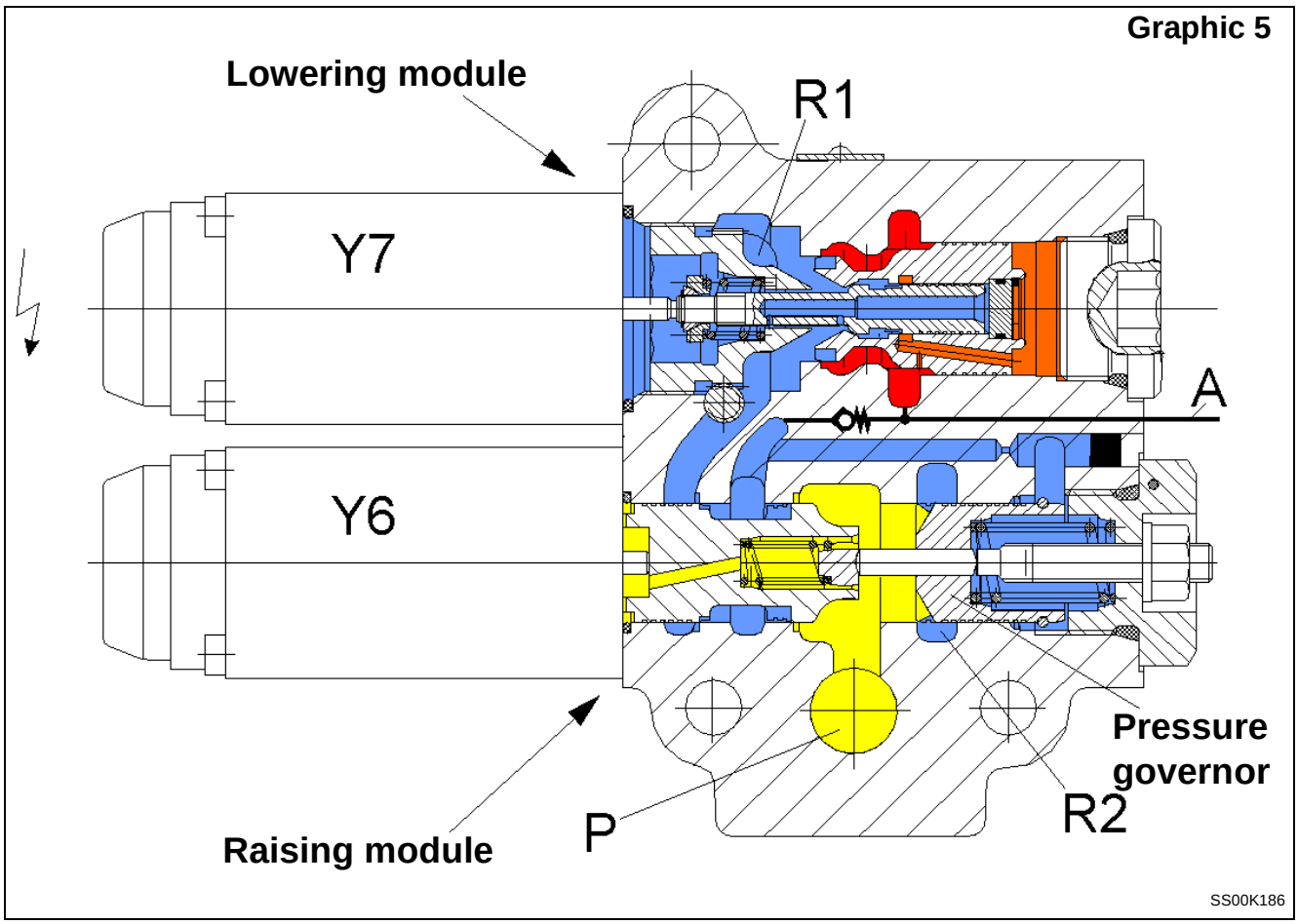
If the proportional solenoid LOWER Y7 is energised by the electronics box, the pilot control slider will be moved to the right. This initially opens the pilot control seat, resulting in the pilot control grooves being opened. Oil flows from chamber 8 to the return. Thus the pressure in this chamber falls below the load pressure. Further oil flows through throttle 9 into this chamber. The intermediate pressure in chamber 8 is dependent upon the cross sectional area of the pilot control grooves.

If the force, caused by the pressure in chamber 8 on surface AS, the same as the force caused by the load pressure on the ring surface, the main control slider follows the pilot control slider from this position (follow-up control). Greater actuating power is achieved by this construction.

NOTE: *Hydraulic load compensation, as in the Raise function, does not take place.*

In individual cases, the load for the Lower function is electronically compensated by the position control circuit.

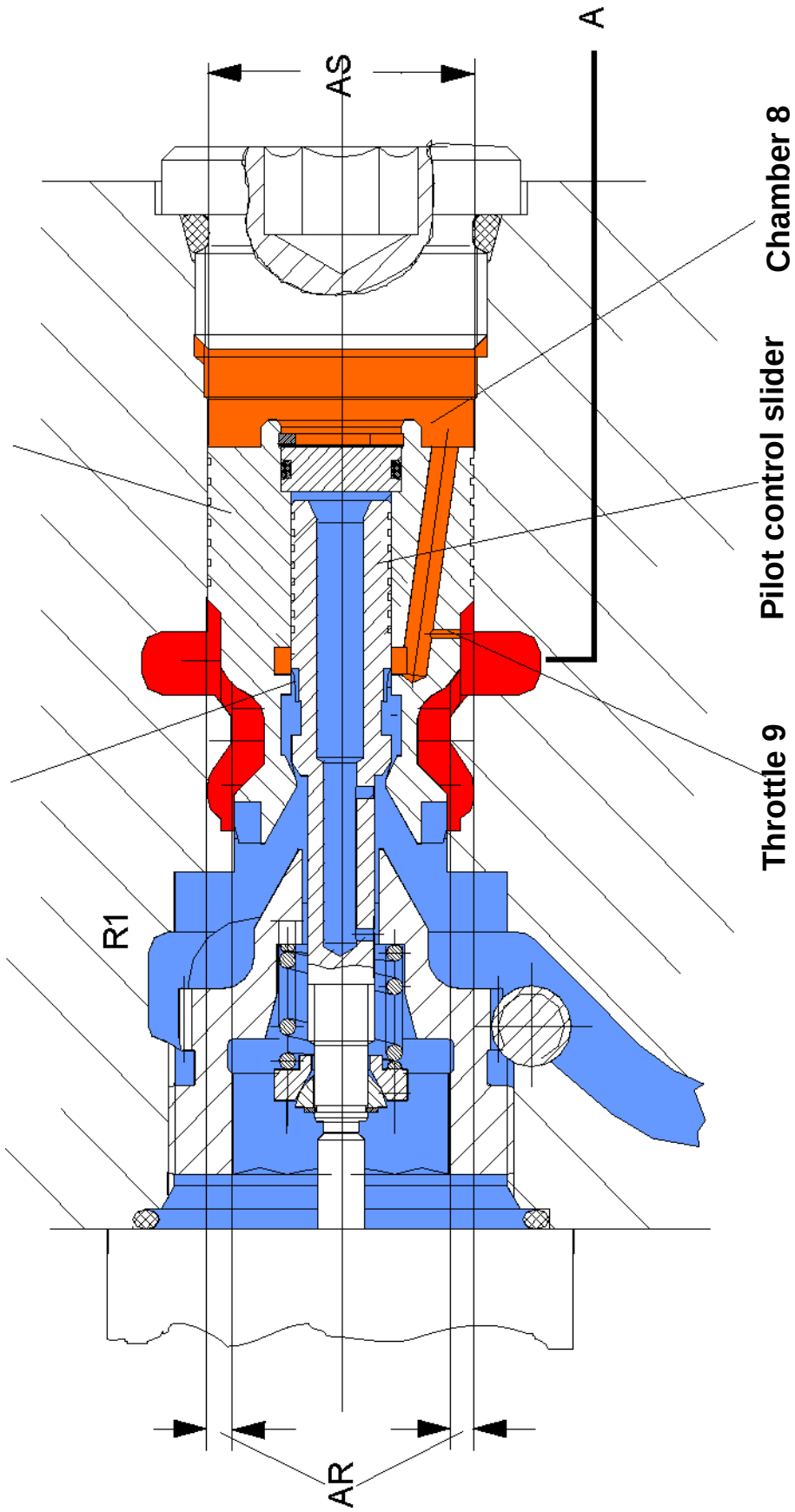
Graphic 5



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Graphic 6

LOWER VALVE OPENED



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EHR-B DIAGNOSIS

The EHR-B continuously monitors the system for faults. Faults occurring are divided into three categories. The EHR-B reacts differently, according to the fault category.

Serious Faults
- The control system is stopped and latched (disabled)
- The relay is de-energised (output stage protection)
- Indication for the driver: Diagnosis LED issues a fault code.

  The fault code is goes out when control is resumed.
- Resumption of control: ---> Remedy the cause of the fault and operate the ignition switch.

Medium Faults
- The control system is stopped and latched (disabled)

  Indication for the driver: Diagnosis LED issues a fault code.

  The fault code is goes out when control is resumed.
- Resumption of control: ---> Remedy the cause of the fault and unlatch the EHR at the transport switch or button.

Slight Fault
- Control is continued
- Indication for the driver: Diagnosis LED issues a fault code.

  After operating the raise switch, the diagnosis LED goes out, if the fault has been remedied.

  However, a code number output, which has been started, is completed.

The fault code list can be used to localize and determine faults.

If the signal line to the mixer potentiometer is interrupted, for example, fault code 36 is signalled by the following flashing frequency.

Refer to fault code list.

- Long pause – flashes three times – short pause – flashes six times -

When all faults have been remedied, the diagnosis LED goes out.

The disabled status of the EHR-B is indicated by the diagnosis LED lighting continuously. If the EHR-B detects a fault in the system, output of the corresponding blink code has top priority.

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FAULT CODE LIST

SERIOUS FAULTS			
Fault Code	Brief description	Pin No.	Fault description
11	RAISE output stage	2	RAISE magnet output stage is defective or line to Pin 6 is interrupted.
12	LOWER output stage	14	LOWER magnet output stage is defective or line to Pin 6 is interrupted.
13	Short-circuit	6	The current measured at Pin 6 is too high. There may be a short-circuit between Pin 14 and Pin 6 or between Pin 2 and Pin 6. There may be an interturn fault in a solenoid coil.
14	RAISE rear pushbutton	10	Faulty signal from rear pushbutton or a RAISE rear pushbutton is malfunctioning.
15	LOWER rear pushbutton	20	Faulty signal from rear pushbutton or a LOWER rear pushbutton is malfunctioning.
16	9.5 VDC supply 9.5 VDC supply (instead of ground)	12 3	Parts of the control unit are not ok (resistance too low). 9.5 VDC supply or (and) 1.6 VDC (reference voltage) not ok.
18	Changeover TRANSPORT, or CONTROL (LOWER) or FAST RETRACTION	8	Faulty signal (see values for control voltage in circuit diagram 4003, page 33, Pin 8 on A25 Box EHR-B) faulty cabling, on Print A16 or in A25. EHR LIFT switch S2/25/1 defective (on versions without multi-controller). ECCU Box A60 defective (on versions with multi-controller).

NOTE: *If the supply to EHR-B Box A25 fails, a fault code is not output.*

Reason

a) In the event of a failure of +15/2 (12VDC), e.g. fuse F33 or F34 defective, the diagnosis LED cannot light up and thus a fault code cannot be output.

b) There is no +30 (12VDC) supply to the EHR-B permanent plus.

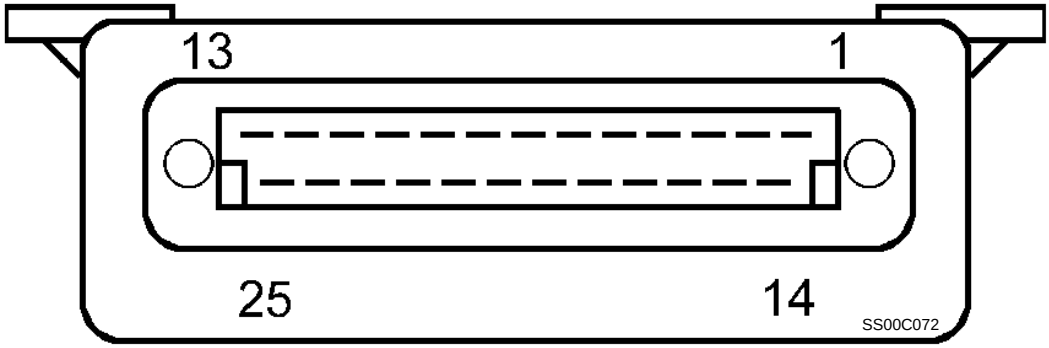
MEDIUM FAULTS			
Fault Code	Brief description	Pin No.	Fault description
21	Stop button	23	Faulty signal from the STOP button, interruption or button defective.
22	Position sensor (rear)	19	Faulty signal from POSITION sensor – Interruption or sensor not connected. – There may be a short-circuit or short to earth. – Sensor set incorrectly (signal voltage outside setpoint range) – Sensor defective.
23	Setpoint potentiometer	16	Faulty signal from SETPOINT potentiometer: – Interruption or potentiometer not connected. – Potentiometer defective.
24	Potentiometer for upper limit (lift limitation)	22	Faulty signal from UPPER LIMIT potentiometer: – Interruption or potentiometer not connected. – Potentiometer defective.

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SLIGHT FAULTS			
Fault Code	Brief description	Pin No.	Fault description
31	Power sensor – right	18	Faulty signal from the power sensor, right: – Interruption or sensor not connected. – There may be a short circuit or short to ground. – The power sensor may be overloaded. – Power sensor defective
32	Power sensor – left	17	Faulty signal from the power sensor, left: – Interruption or sensor not connected. – There may be a short circuit or short to ground. – The power sensor may be overloaded. – Power sensor defective
34	Potentiometer for Lowering Speed	24	Faulty signal from Lowering Seed potentiometer. – Interruption or potentiometer not connected. – Potentiometer defective.
36	Mixing potentiometer	4	Faulty signal from Mixing potentiometer. – Interruption or potentiometer not connected. – Potentiometer defective.

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PIN ASSIGNMENT OF EHR-B BOX A25



Pin	*Cable*	*Function*
1	L533	Permanent ground to box
2	N485	+Pulse width modulation to Y6 RAISE
3	L524	Ground from box to potentiometer, resistor network and external IC for management systems
4	F516	Signal from mixed control potentiometer
5	K198	D+ supply
6	L479	Ground to Y6 and Y7 via box
7	-------	No pin assignment
8	N523	TRANSPORT – CONTROL – FAST RETRACTION signal
9	N526	Signal to driver for H2/1 diagnosis
10	N480	Signal from RAISE external pushbutton
11	-------	No pin assignment
12	H518	+9.5 VDC stab. to potentiometer, resistor network and external IC for management systems, supply to external pushbuttons
13	H482	+9.5 VDC stab. to sensors
14	N444	+Pulse width modulation to Y7 LOWER
15	L489	Ground from box to sensors
16	F522	Signal from Setpoint potentiometer
17	F492	Signal from Power sensor, left B10/1
18	F495	Signal from Power sensor, right B10/2
19	F483	Signal from Position sensor B9/1
20	N443	Signal from LOWER external pushbutton
21	N525	Not used
22	F517	Signal from Upper Limit potentiometer
23	B521	EMERGENCY STOP signal
24	F527	Signal from Lowering Speed potentiometer
25	G445	+15 Supply

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TROUBLESHOOTING USING THE DIAGNOSTIC SYSTEM

The lifting gear is equipped with a self-diagnosis system, but it cannot detect 100% of the faults; detected faults are indicated globally. If the self-diagnosis system detects a fault, it is indicated by flashing signals, which are explained in the fault code list.

p.ex. Fault 22 rear position sensor	Rear position sensor defective
	Cable breakage or sensor not connected
	There may be a short circuit or short to ground
	Faulty position sensor setting

Faults can be localized swiftly and reliably by means of the diagnostic system and the aforementioned table.

Test conditions:

	Ignition switched OFF
	Ignition switched ON
	Engine must be running
X	Plug
Pin	Pin on specified plug
	"E" Box connected
	"E" Box not connected
	Connect a bulb of the specified wattage as a load

Parts of the diagnostic system required:		**Use**
1TSW 528-1	Diagnostic box, 100-pole	General
1TSW 528-10	25-pole Y adapter	EHR-B electronics box
1TSW 528-33	3-pole Y adapter	Power sensors, position sensor
1TSW 528-6	2-pole Y adapter, angular	EHR control unit Y6 and Y7
1TSW 528-11	Measuring cables 1.5 m, red, blue	General
1TSW 528-2	Test lamp 5 - 35 W	for loading supply lines
1TSW 516	Multimeter set	

Designation	*X25 pin*	*Cable colour and No.*	*Meas-urement*	*Requirements*	*Measure from pin to pin*	*Value*
Supply, E box	**A25** X25				**A25** X25 → **A25** X25	
Plus potential 15/2 F33	25	G445	U	45W	25 + → ⊥ 1	13 -14 VDC
Ground test under load	1	L533	U	45W	1 ⊥ → ⊥ Batt.	0 –0.3 VDC
D+ from K5/11 F21	5	K198	U	21W	5 + → ⊥ 1	13 -14 VDC
If no faults are indicated by the EHR diagnosis lamp, → continue						
9.5 VDC stabilized for operating controls and resistor circuits on print A16						
Plus 9.5 VDC stabilized	12	H518	U		12 + → ⊥ 1	9.5 VDC
Reference voltage	3	L524	U		3 + → ⊥ 1	1,6 VDC
Plus 9.5 VDC stabilized	12	H518	R		12 → 3	> 330 ohms
9.5 VDC supply, stabilized, for power sensors and position sensor						
Plus 9.5 VDC stabilized	13	H482	U		13 + → ⊥ 15	9.5 VDC
Ground	15	L489	U		15 + → ⊥ 1	approx. 0 VDC
Plus 9.5 VDC stabilized	13	H482	R		13 → 15	> 330 ohms

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Designation	*X25 pin*	*Cable colour and No.*	*Measure-ment*	*Requirements*	*Measure from pin to pin*	*Value*
Multi-Controller S11/ (safety switch ON)						
	A60 X18/3		Input signals from multi-controller to ECCU / A60		**A60** X18/3 → **A60** X18/3	
Transport / Raise signal Activating S11/1	9	C299	U	S11/1 operated S11/1 not operated	9 → 3	12 VDC 0 VDC
Lower / Control signal S11/2 + S11/13	8	C317	U	S11/2 + S11/13 operated S11/2 + S11/13 not operated	8 → 3	12 VDC 0 VDC
	A16 X24/31		Output signal from print A16		**A16** X24/31 → **A16** X24/31	
Transport / Raise / Activating	20		U	S11/1 operated	20 → ⊥ 1	approx. 6,7 VDC
Control / Lower signal S11/2 + S11/13	20		U	S11/2 + S11/13 operated	20 → ⊥ 1	approx. 5.4 VDC
Fast retraction signal S2/72	20		U	S2/72 operated S2/72 not operated	20 → ⊥ 1	approx. 4.1 VDC approx. 5.4 VDC
	A25 X25		Input signal from print A16 to EHR-B/Box A25		**A25** X25 → **A25** X25	
Transport / Raise / Activating signal	8	N523	U	S11/1 operated	8 → ⊥ 1	approx. 6.7 VDC
Control / Lower / signal S11/2 + S11/13	8	N523	U	S11/2 + S11/13 operated	8 → ⊥ 1	approx. 5.4 VDC
Fast retraction signal S2/72	8	N523	U	S2/72 operated S2/72 not operated	8 → ⊥ 1	apprx. 4.1 VDC approx. 5.4 VDC

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Designation	X25 pin	Cable colour and No.	Meas-urement	Requirements	Measure from pin to pin	Value
Lifting switch: Raise / Transport / Control / Fast retraction S2/25/1						
Transport / Activating (Raise) signal	8	N523	U	Lifting switch in position: RAISE	8 → ⊥ 1	approx. 6.7 VDC
Control signal	8	N523	U	Lifting switch in position: CONTROL	8 → ⊥ 1	approx. 5.4 VDC
Fast retraction signal	8	N523	U	Lifting switch in position: FAST RETRACTION	8 → ⊥ 1	approx. 4.1 VDC
Activation of the Raise Y6 and Lower solenoid valves						
Ground for Y6 and Y7	6	L479	U	Lifting gear during Raise and Lower processes	6 + → ⊥ 1	max.0.22 VDC = 4.0 A
Plus for Y6	2	N485	U	Lifting gear during Raise process	2 → ⊥ 1	2.5 - 6 VDC
Plus for Y6	2	N485	R		2 → 1	1.7 - 2.2 ohms
Plus for Y7	14	N444	U	Lifting gear during Lower process	14 → 1	2.5 - 6 VDC
Plus for Y7	14	N444	R		14 → 1	1.7 - 2.2 ohms
External pushbuttons for Raise / Lower and internally operated external pushbuttons (cab)						
Supply, E box	12	H518	U		12 → 1	9.5 VDC
Signal from Raise external pushbutton S15/1, S15/2	10	N480	U	Raise pushbutton not pressed Raise pushbutton pressed	10 → 1	1.6 VDC 9.5 VDC
Signal from Lower external pushbutton S14/1, S14/2	20	N443	U	Lower pushbutton not pressed Lower pushbutton pressed	20 → 1	1.6 VDC 9.5 VDC
Stop pushbutton S33						
Signal from Stop pushbutton	23	B521	U	Pushbutton not pressed Pushbutton pressed	23 → 1	5.4 VDC 4.2 VDC

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Designation	X25 pin	Cable colour and No.	Meas-urement	Requirements	Measure from pin to pin	Value
Supply to rear position sensor B9/1, power sensors B10/1 and B10/2						
Supply, E box	15	L489	U		15 → ⊥ 15	approx. 0 VDC
Plus supply, 9.5 stabilised	13	H482	U		13 → ⊥ 15	9.5 VDC
Signal from position sensor	19	F483	U	Lifting gear up / down	19 → ⊥ 15	approx. 7 VDC approx. 2.3 VDC
Power sensors, left, B10/1, right, B10/2						
Signal from power sensor, left	17	F492	U	Sensors not under load Lifting gear pull Lifting gear thrust	17 → ⊥ 1	approx. 4.7 VDC <4.7 VDC >4.7 VDC
Signal from power sensor, right	18	F495	U	Sensors not under load Lifting gear pull / thrust	18 → ⊥ 1	approx. 4.7 VDC <4.7 VDC >4.7 VDC
R6/1 Setpoint potentiometer						
Signal from potentiometer	16	F522	U	Potentiometer in position 0 Potentiometer in position 10	16 → ⊥ 1	9.5 VDC 1.6 VDC
Lift limiting potentiometer (upper limit) R6/2						
Signal from potentiometer	22	F517	U	Potentiometer in position 0 Potentiometer in position 10	22 → ⊥ 1	1.6 VDC 9.0 VDC
Lowering speed potentiometer R6/4						
Signal from potentiometer	24	F527	U	Potentiometer in position 0 Potentiometer in position 10	24 → ⊥ 1	1.6 VDC 9.5 VDC
Mixing potentiometer R6/3						
Signal from potentiometer	4	F516	U	Potentiometer in position 0 Potentiometer in position 10	4 → ⊥ 1	1.6 VDC 9,.5 VDC

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Designation	*X25 pin*	*Cable colour and No.*	*Meas-urement*	*Requirements*	*Measure from pin to pin*	Value
Indicator lamps	**A25** X25				**A25** X25	
Signal for diagnosis lamp H2/1	9	N526	U	Lifting gear locked Lifting gear released	9 → ⊥ 1	5 VDC 0 VDC
	A15 X18/5				**A15** X18/5	
RAISE lamp H2/3	9	N488	U	Lifting gear raises / lowers or stationary	9 → ⊥ 1	2.5 - 6 VDC 0 VDC
	A15 X18/6				**A15** X18/6	
LOWER lamp H2/4	17	N487	U	Lifting gear lowers / SW position Lifting gear raises / stationary	17 → ⊥ 1	2.5 - 6 VDC 0 VDC

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Chapter

8E

FUNCTIONAL DESCRIPTION AND TROUBLESHOOTING

Electronic front hitch control (EFH)

M9078, M9086, M9094
CS78, CS86, CS94

from DBD0057987 onwards

CNH Österreich GmbH
Technical Documentation / Training Center
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Sva 6-50640 EN

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May, 2002

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TABLE OF CONTENTS

ELECTRONIC FRONT HITCH CONTROL (EFH) 3
Functions 3
Type of control 3
General Remarks 3
COMPONENTS 4
GENERAL DESCRIPTION 5
OPERATING CONTROLS 6
1. Multi-Controller 7
2. Indicator lamp IMPLEMENT LOAD RELIEF (green) 7
3. Indicator lamp DIAGNOSIS (red) 7
4. RAISE / TRANSPORT button 8
5. LOWER / CONTROL button 8
6. Setpoint stepping switch 9
7. Potentiometer for mixed control 10
8. Potentiometer for lift limitation 11
9. Potentiometer for lowering speed 12
10. RAISE / LOWER button (in the cab) 13
11. Front operation 13
12. Changeover switch (latchable) for RAISE/AUTO (Automatic) operating mode ...13
13. Safety switch (latchable) 14
POSITION CONTROL FUNCTION 15
PRESSURE CONTROL FUNCTION 16
CALIBRATION 17
OSCILLATION DAMPING 18
EMERGENCY OPERATION 19
POSITION SENSOR 20
Construction and function 20
Characteristic curve 21
Technical Data 21
PRESSURE SENSOR 23
Function: 23
Technical Data 24
RESERVOIR BLOCK (complete) 25
EFH LINE PLAN – EHR version 26
EFH components – EHR version 27
EFH LINE PLAN – MHR version 28
EFH components – MHR version 29
EFH CONTROL VALVE SB 23-OC 30
NEUTRAL function 31
RAISE function 32
LOWER function 33
EFH CONTROL VALVE SB 23-LS 34
NEUTRAL function 34
RAISE function 35
LOWER function 36
DIAGNOSIS 37
Fault codes 38
Pin assignment, plug X55 (EFH box A55/2) 41
TROUBLESHOOTING USING THE DIAGNOSTIC SYSTEM 43

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ELECTRONIC FRONT HITCH CONTROL (EFH)

The EFH front hitch control system was specially designed for small and medium-sized tractors. The EFH replaces the front hitch with electronic implement load relief (EGE) version.

Serial use began with DBD 57987.

Functions

Position control
Pressure control
Mixed control
Front operation
Oscillation damping (40 bar pressure reservoir)
System diagnosis with fault code display

NOTE: *The basic function of the EFH corresponds to the state of the art of the EHR-D. Setpoints (from potentiometers) and actual values (from sensors) are fed to the electronics box as analog signals (direct current). After A/D conversion (analog / digital), they are digitally processed in the EFH box.*

Type of control

Closed-loop control circuit

General Remarks

Operating voltage:

– 12 Volt DC nominal, voltage peaks must not exceed 16 Volts

Jumper lead starting:

– Only connect in parallel to another 12 Volt supply (battery or vehicle).

– Do not reverse connect the poles.

– Take care when using starting aid devices – avoid overvoltages!

– Never remove jumper cables during the starting procedure and ensure that the cable clamps cannot inadvertently fall off. This will result in voltage peaks – endangering the electronic components.

Welding work on the tractor:

– Switch the engine off and turn the ignition switch S1 to the 0 position.

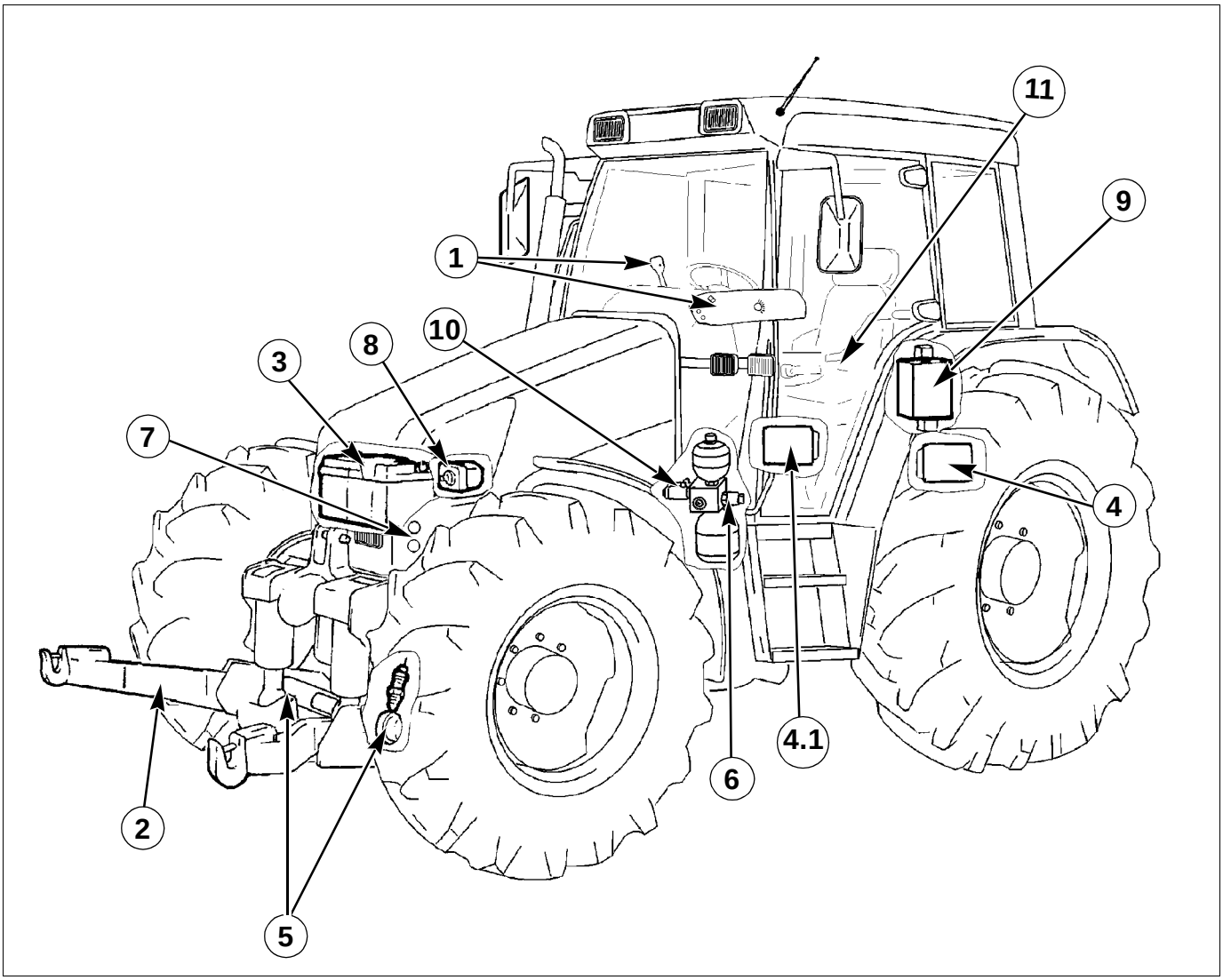
– Do not disconnect the electronics box.

– Do not disconnect the battery.

– **Connect the welding equipment ground to the part to be welded.**

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COMPONENTS



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1 . Operating controls

2 . Lower link

3 . Battery

4 . EFH electronics box A55/2, rear left (item for MHR version)

4 .1. EFH electronics box A55/2, right, in front of ECCU (item for EHR version)

5 . Position sensor with eccentric B9/2
- for chassis-borne front hitch-front left
- for axle-borne front hitch-front right

6 . Pressure sensor B21

7 . Front RAISE/LOWER button

8 . Hydraulic pump

9 . Control valve with actuators Y16, Y17

10 . Reservoir block with solenoid valves Y18, Y19

11 . EFH print A17
- for MHR version – right, centre, behind side panel
- for EHR version – below setpoint potentiometer for EHR

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GENERAL DESCRIPTION



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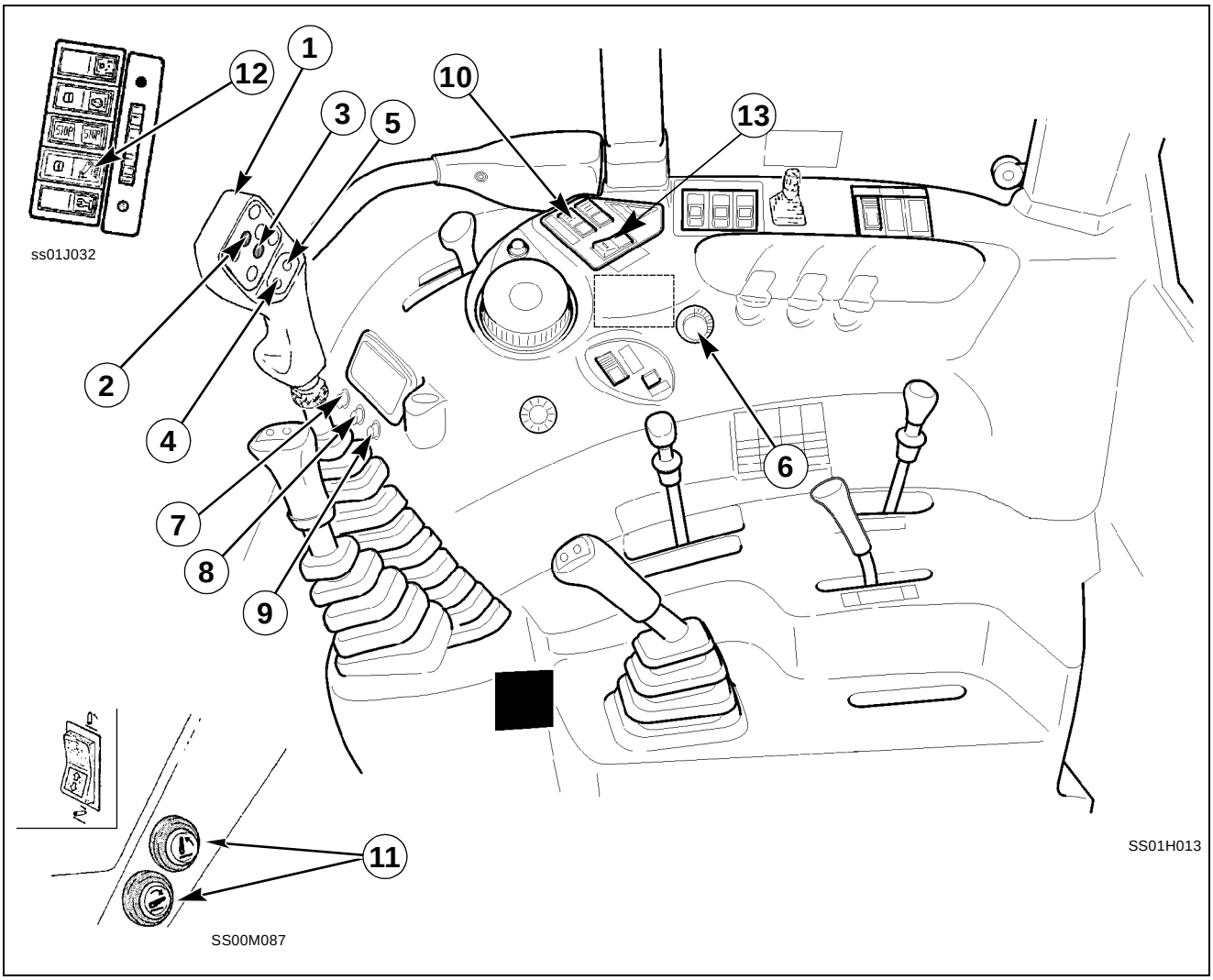
The EFH is an electronic 3-point hitch control system on a digital basis and can be operated in the position, pressure or mixed control operating mode.

The main difference between the electronic front hitch control (EFH) and the electronic control for the rear-end 3-point hitch (EHR) lies in the control system. The former is equipped with a pressure control system instead of a draft control system. Pressure sensor B21 supplies an analog signal (VDC), which is proportional to the current operating pressure in the lifting cylinders, to electronics box A55/2.

This hydraulic system enables the reduction of the downward pressure of the implement to be adjusted in steps. This is advantageous for working with the front mowing machine. This control system constantly regulates the set downward pressure of the mowing machine. This ensures a constant downward pressure even on uneven ground and also protects the turf.

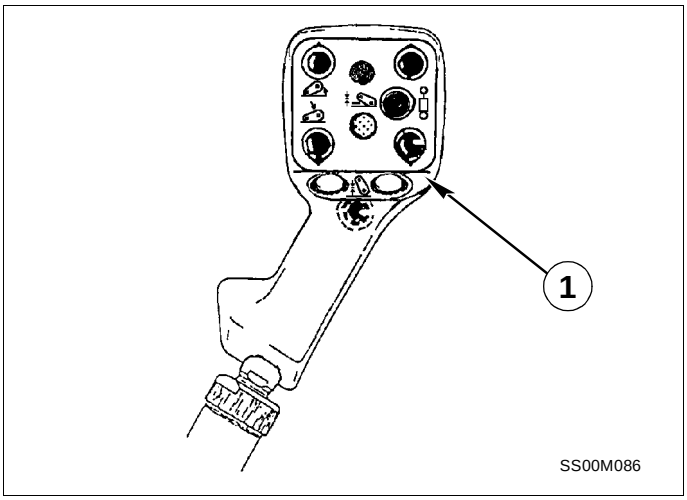
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OPERATING CONTROLS



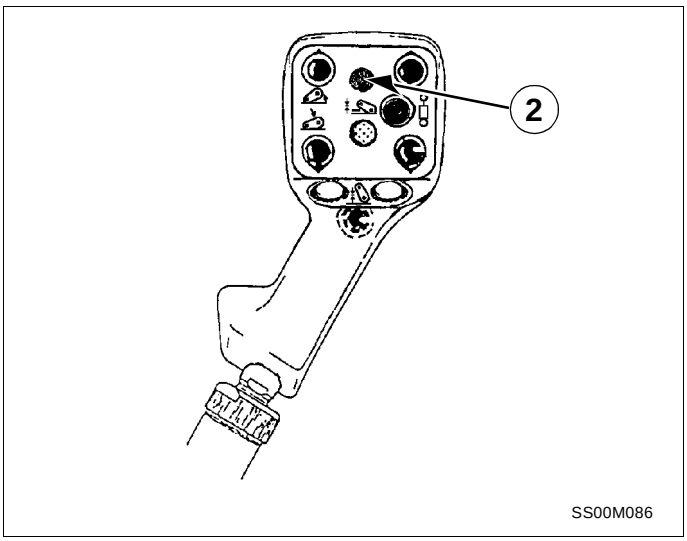
1. **Multi-Controller**
2. **Indicator lamp, green**
   – Indicates implement load relief
3. **Indicator lamp, red (diagnosis)**
   – Self test, fault code indication
4. **RAISE / TRANSPORT button**
5. **LOWER / CONTROL button**
6. **Setpoint rotary switch** (10 levels)
   – max. raise – max. lower implement load relief
7. **Mixed control potentiometer**
   – Position-draft-mixed control
8. **Lift limitation potentiometer**
   – Limits the lifting height
9. **Lowering speed potentiometer**
   – Lowering throttle
10. **RAISE / LOWER button (in cab)**
    – Parallel circuit to front button
11. **RAISE / LOWER button (front operation)**
12. **Changeover switch for RAISE / AUTO operating mode**
13. **Safety switch (latchable)**
    – Disables the RAISE / LOWER pushbutton function at the Multi-Controller as well as all electro-magnetic auxiliary valves.

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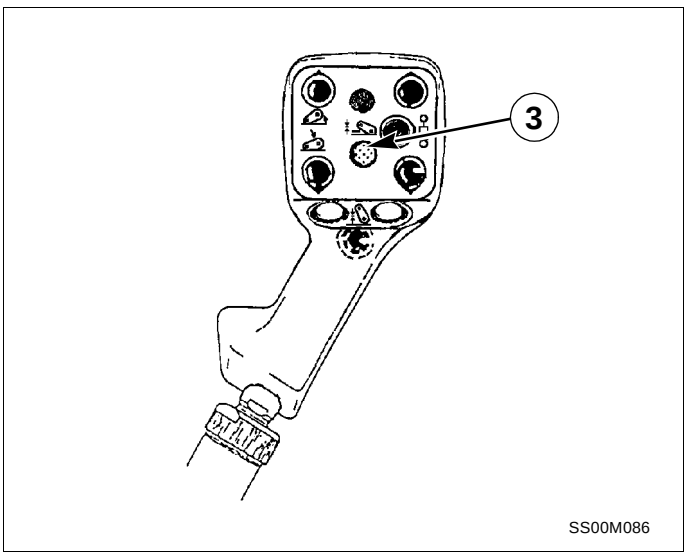
1. Multi-Controller

The pushbutton functions are only available when the safety switch (item 13) is switched on.



2. Indicator lamp IMPLEMENT LOAD RELIEF (green)

This lamp lights up when the setpoint rotary switch (item 6) is in switch positions 1 - 10, provided that a calibration value has been stored in the system.



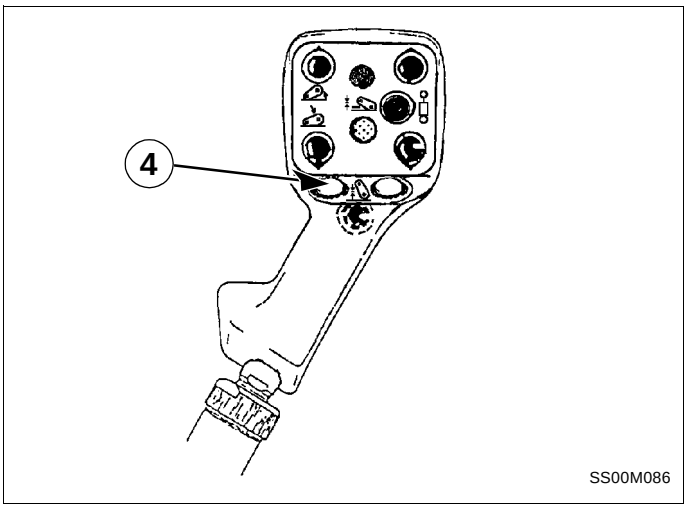
3. Indicator lamp DIAGNOSIS (red)

On turning the ignition switch to position ‘1‘, the DIAGNOSIS indicator lamp lights up for a short moment. This is a functional test of the EFH and the display.

Diagnosis display:
If the integrated diagnosis system detects a fault in the system, this fault is indicated by flashing signals. The flashing signals indicate fault codes
(see example page 37).

The faults can be defined using the fault code list (see page 38).

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4. RAISE / TRANSPORT button

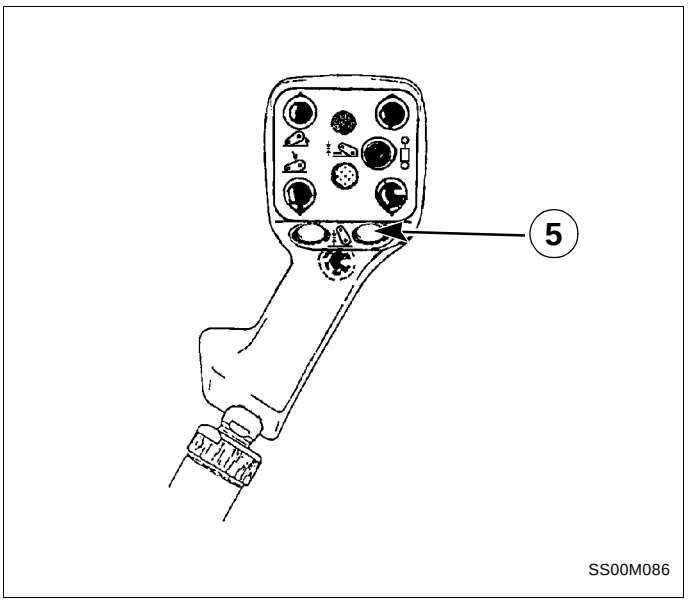
Changeover switch (item 12) in RAISE operating mode:

Hydraulics lift whilst the RAISE button (item 4) is pressed.

Changeover switch (item 12) in AUTO operating mode:

Hydraulics lift to upper limit (transport position) on pressing the RAISE button (item 4) for a short moment.

Oscillation damping is only activated in the pressure control operating mode.



5. LOWER / CONTROL button

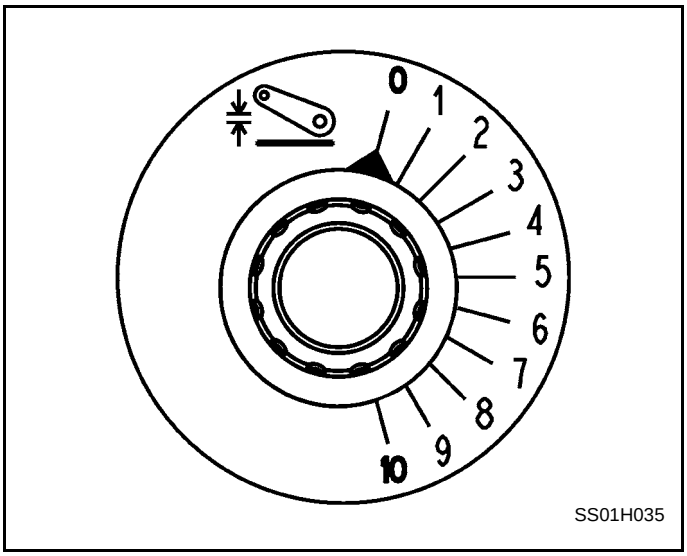
On pressing the LOWER button (item 5) on the Multi-Controller for a short moment, the front hitch is lowered to the limit or to the setpoint value.

WARNING: If a calibration value has not been stored in the system or the operating pressure in the lifting cylinder is < 14 bar, the LOWER button (item 5) cannot be used for lowering in the pressure control operating mode. Lowering is then only possible by means of the parallel switch to the front button (item 10) or the front button (item 11).

Lowering is possible by means of the LOWER button (item 5), independent of the operating pressure, in the position control operating mode.

The LOWER button (item 5) is also used to connect the control function (CONTROL) in the pressure control operating mode.

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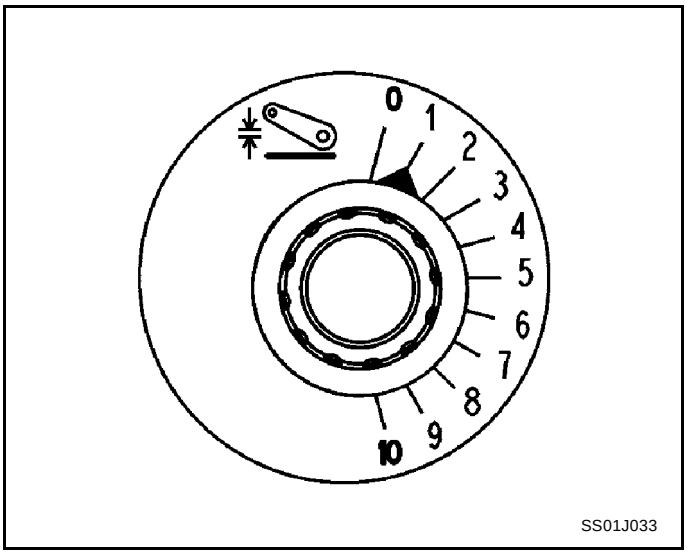


6. Setpoint stepping switch

It is used to set the required load relief for pressure control (the downward pressure of the implement on the ground) or the position (height) of the implement fitted.

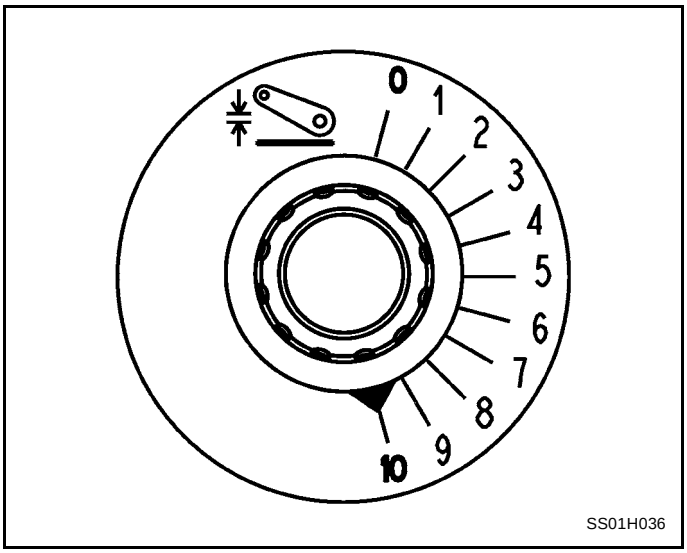
0 = max. lowering and (simultaneously) floating position

3-point hitch lowered



1 = Minimum load relief

(In pressure control operating mode)

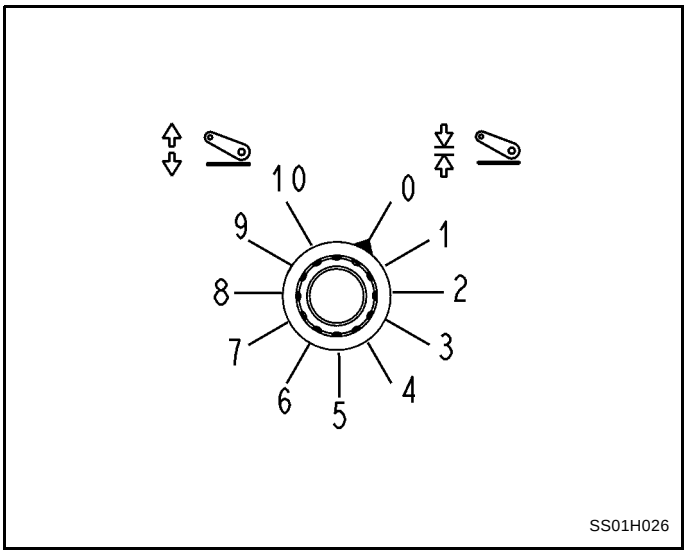


10 = max. lift

3-point hitch raised
(up to the lift limit set)

Maximum load relief in pressure control operating mode

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7. Potentiometer for mixed control

Position, pressure or mixed control of both control variables.

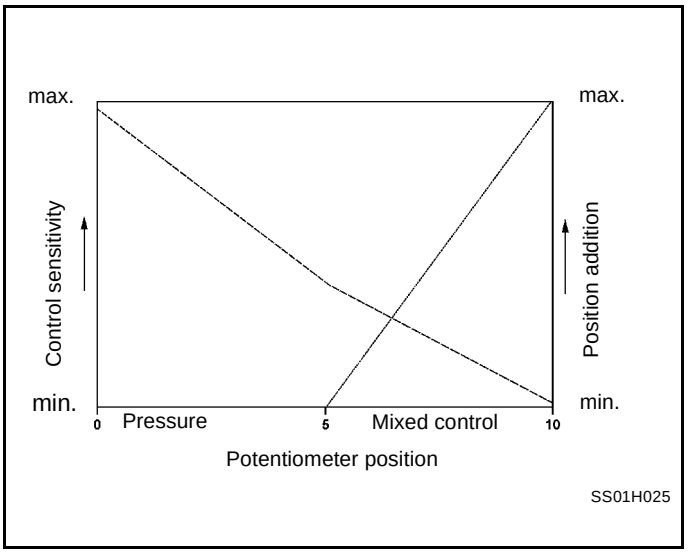
0 = 100 % pressure control and simultaneously max. control sensitivity

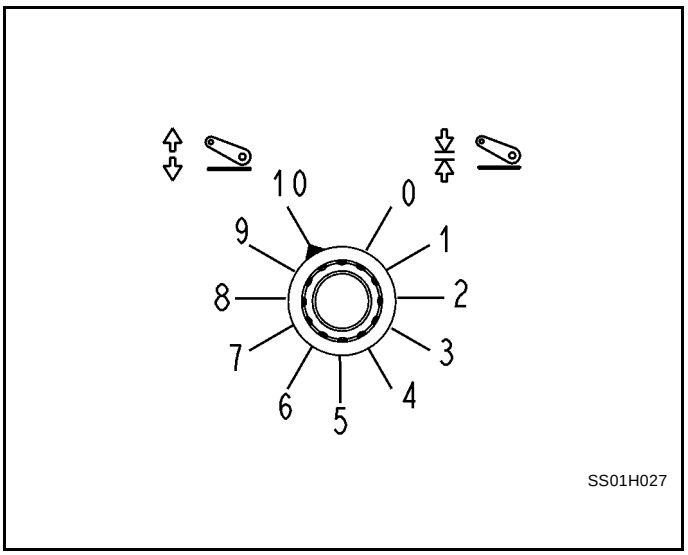
The actual value of the momentary load pressure in the lifting cylinders is supplied by the pressure sensor.

1 - 5 = Control sensitivity variation

5 - 9 = Mixed control

The actual values for position and load pressure are mixed and processed at an adjustable ratio in the EFH box.

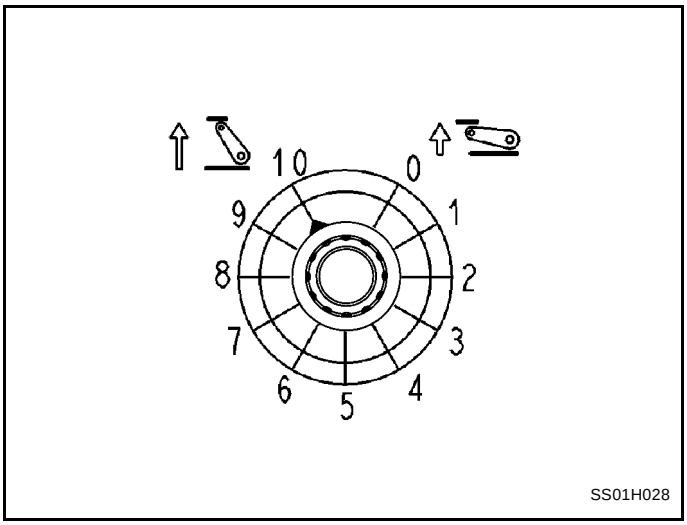




10 = 100 % position control

The actual position value is supplied by the position sensor.

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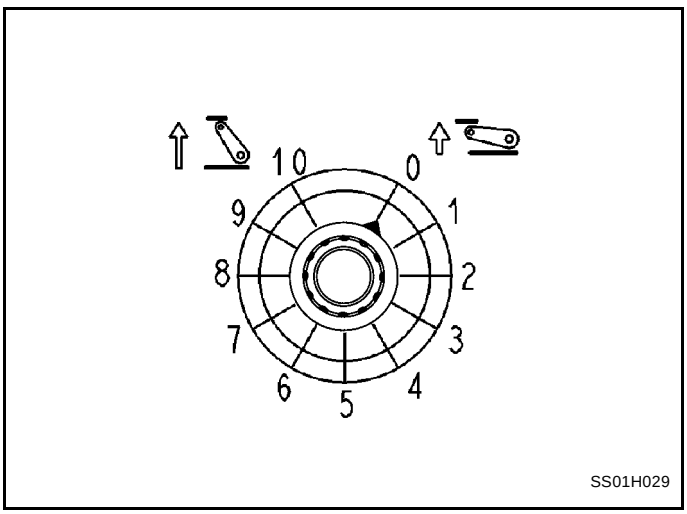


8. Potentiometer for lift limitation

For infinite limiting of the lifting height

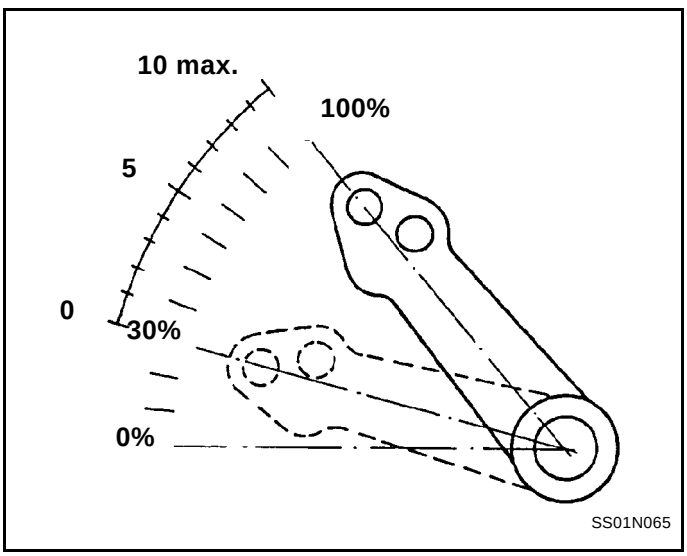
10 = upper lift limit =

max. lifting height



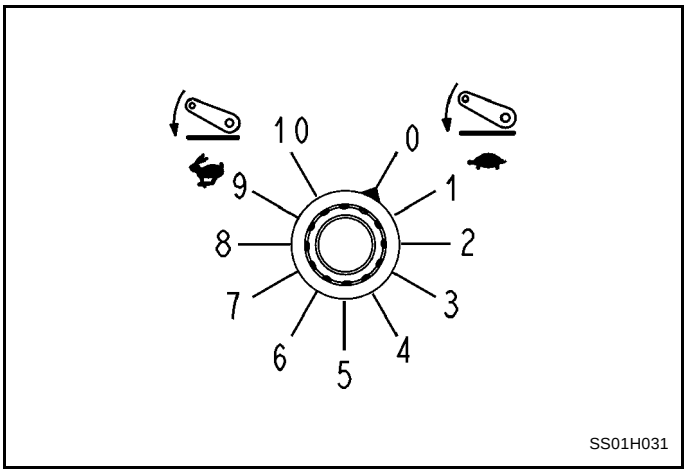
0 = lower lift limit =

approx. 30 % of the max. lifting height



0 - 10 = adjustable lifting height

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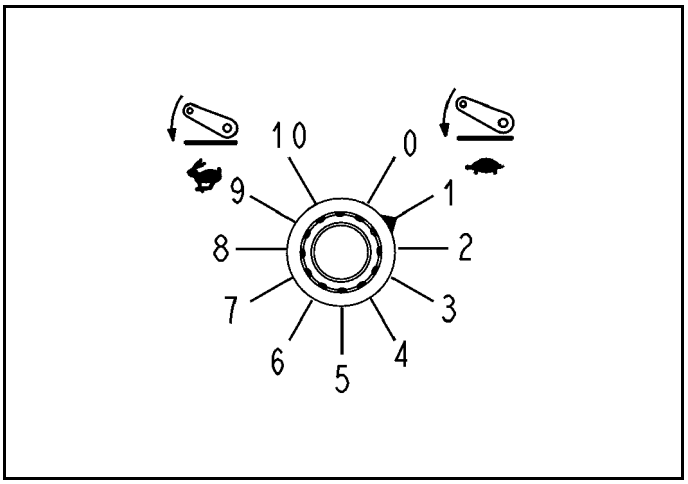
SS01H031

9. Potentiometer for lowering speed

For infinite adjustment of the lowering speed.

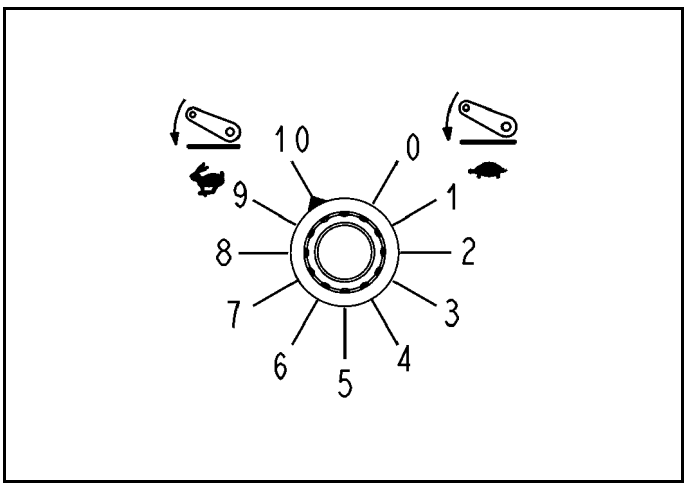
WARNING: *The lowering speed should be matched to the requirements of the implement fitted!*
When lowering a heavy implement, set to  *!*

0 = lowering not possible



SS01H032

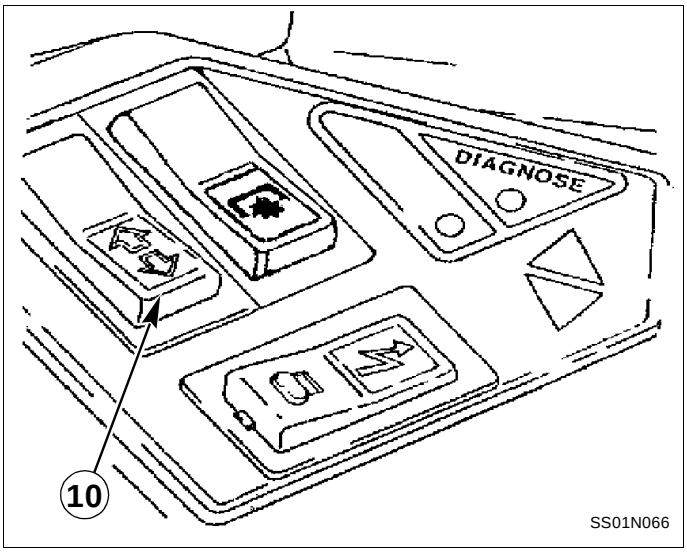
1 =  **= minimum lowering speed**



SS01H030

10 =  **= maximum lowering speed**

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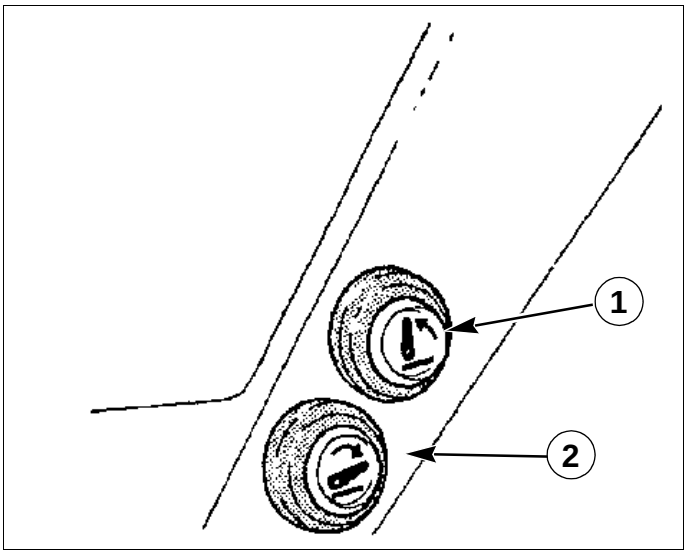


10. RAISE / LOWER button (in the cab)

Parallel circuit to front button

For safety reasons, the lifting and lowering speeds are reduced when operating this button.

Used for mounting implements.

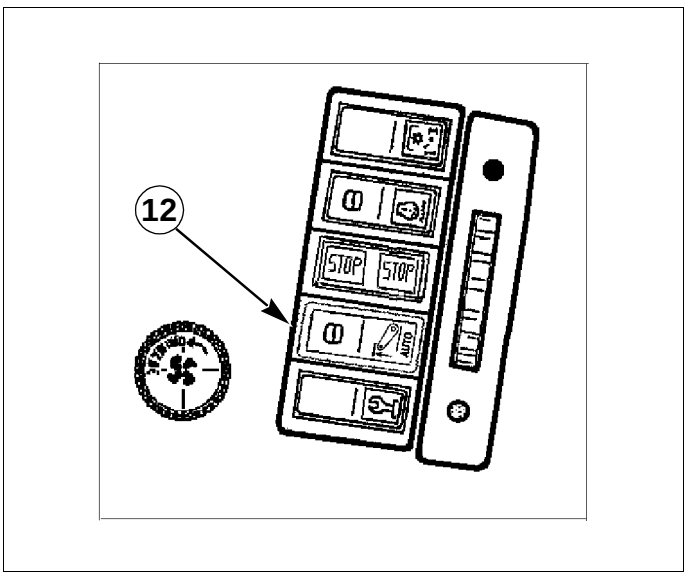


11. Front operation

1.) RAISE button

2.) LOWER button

For safety reasons, the lifting and lowering speeds are reduced during front operation and on operating the RAISE/LOWER button in the cab.
(Used for mounting implements)



12. Changeover switch (latchable) for RAISE/AUTO (Automatic) operating mode

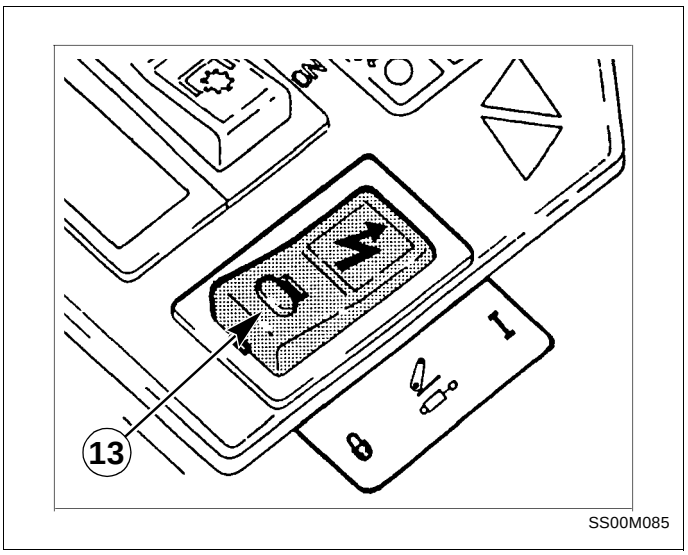
RAISE switch position:

Hydraulics lift whilst the RAISE button on the Multi-Controller is pressed.

AUTO switch position:

On pressing the RAISE button on the Multi-Controller for a short moment, the front hitch is automatically raised to the upper limit, dependent on the setting of the potentiometer for lift limitation (transport position).

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13. Safety switch (latchable)

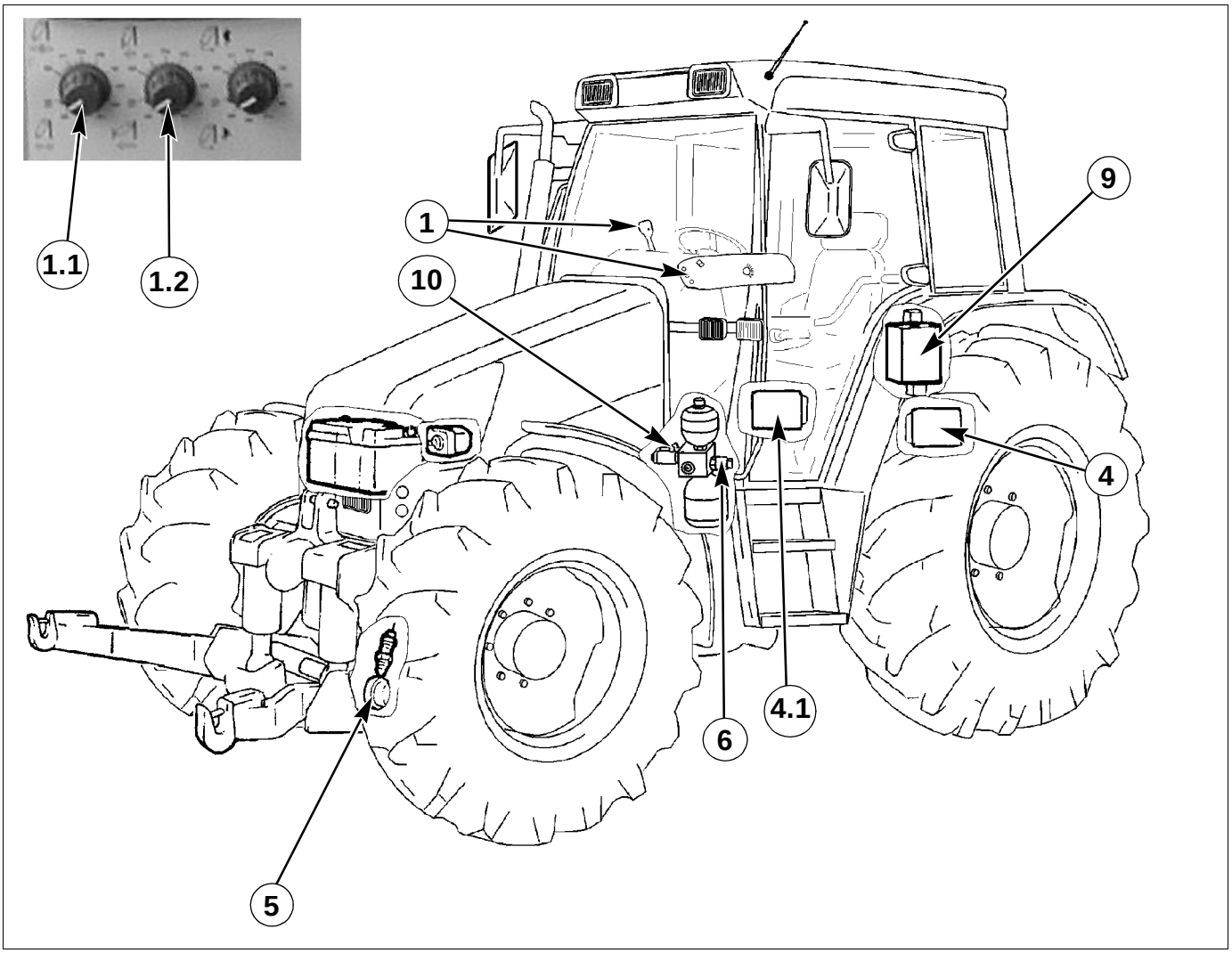
The power supply to the RAISE/LOWER buttons and all electrical auxiliary valves can be switched on/off using the safety switch.

Power supply to the safety switch via F14 (15A).

WARNING: *When travelling on roads, the system must be secured against inadvertent operation at the Multi-Controller by switching off the power supply (+15 / safety).*

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POSITION CONTROL FUNCTION

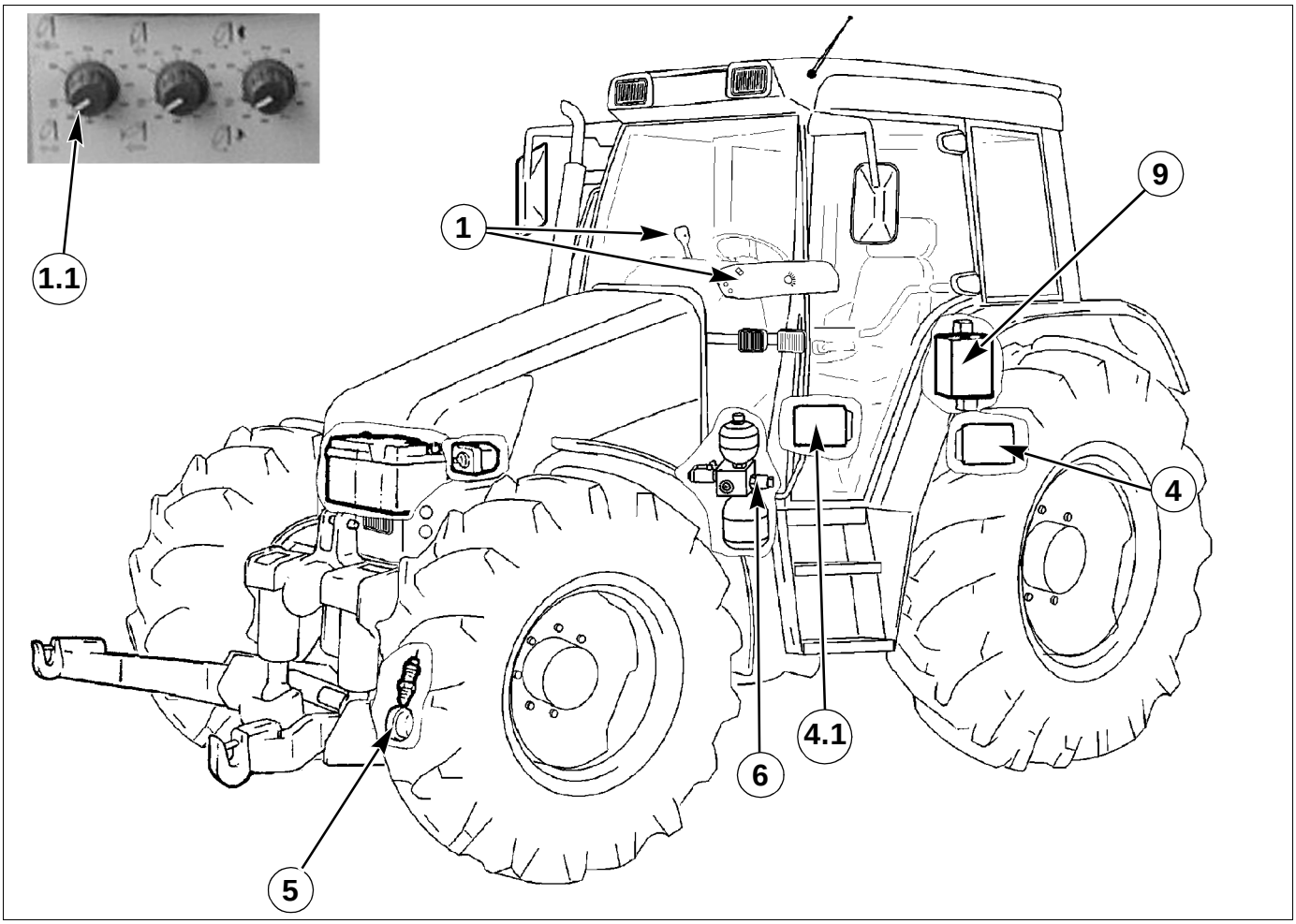


SS01N064

– Turn the mixed control potentiometer (item 1.1) to position 10 (position control).
– The position / lifting height is set by means of the setpoint rotary switch (item 1) and the potentiometer for lift limitation (item 1.2) or the RAISE/LOWER button (item 1).
– The electronics box (item 4/4.1) makes a SETPOINT-ACTUAL value comparison.
– The control valve (item 9) is triggered and carries out the lifting / lowering procedure.
– The control cam (item 5) alters its position by turning.
– The position sensor (item 5) signals the ACTUAL value to the electronics box (item 4.1), whereby the control function is completed.

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PRESSURE CONTROL FUNCTION



SS01N064

Example of a control function sequence:

– Turn the mixed control potentiometer (item 1.1) to basic setting, position 0 = 100 % pressure control (also corresponds to max. control sensitivity). If required, the control sensitivity can be varied between switch positions 0 to 5. If this setting is not sufficient, e.g. very bumpy ground, position control can be added in setting range 5 - 9 until the control operates in a steady state.

– Use the setpoint rotary switch (item 1), switch position 1 - 10, to adjust the pressure relief (downward pressure), dependent on the implement fitted, the desired driving speed and the composition of the soil.

– The setpoint values are forwarded to the electronics box (item 4/4.1).

– The actual values are simultaneously acquired by the sensors (item 5/6) and passed on to the electronics box.

– The electronics box (item 4/4.1) continually compares the setpoint values to the actual values.

– If necessary, the electronics box (item 4/4.1) operates one of the two control valve (item 9) magnets until the actual values correspond with the setpoint values (closed-loop control circuit). This ensures a constant ground contact pressure of the implement.

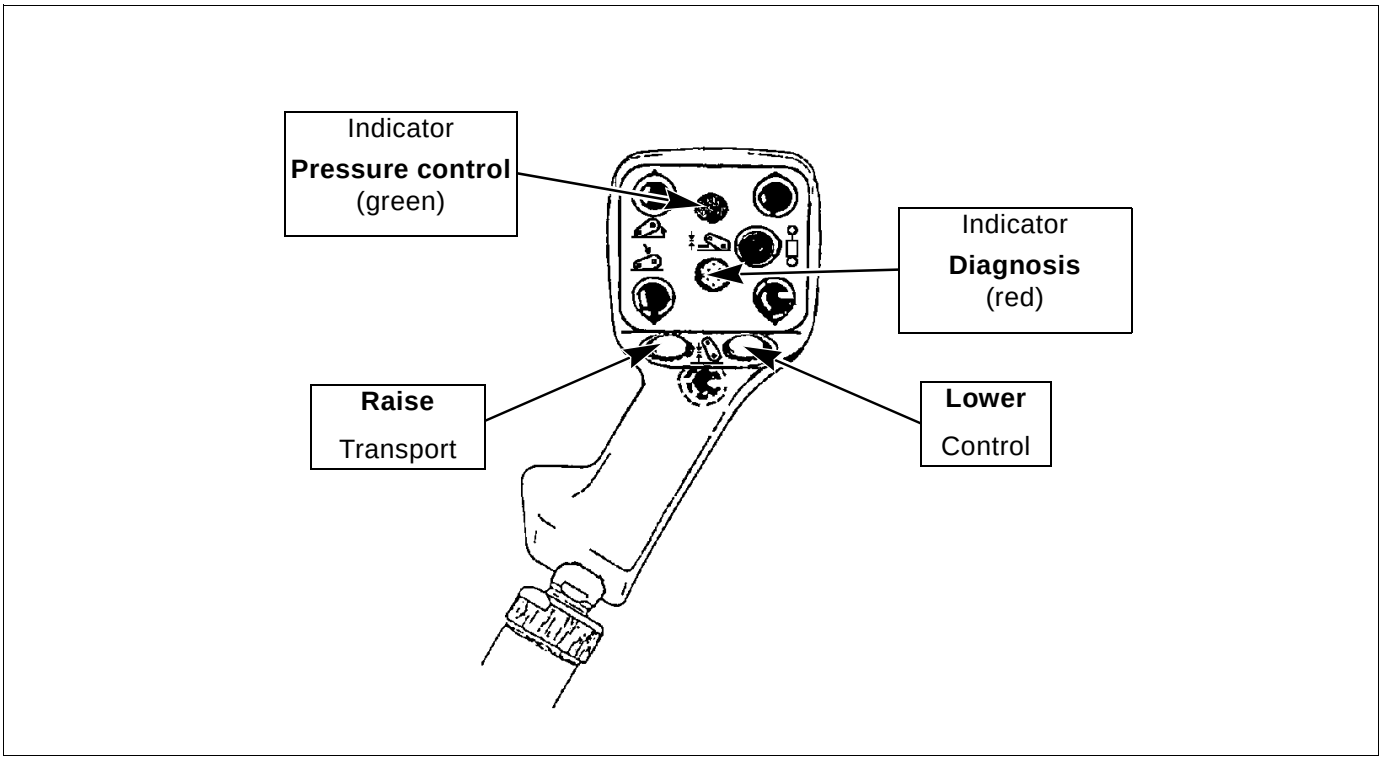
NOTE: *Both hydro-reservoirs are connected in the pressure control operating mode*

IMPORTANT: *In order to get a perfect control function, the front hydraulics must be recalibrated every time the implement is changed, with the implement at working height (but raised above the ground).*

The current cylinder pressure (load pressure of the implement) is stored in the system during this procedure.

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CALIBRATION



SS00M086

Procedure:

To calibrate, park the tractor with mounted front implement on a horizontal surface.

Apply the parking brake and start the engine.

Set the upper limit to the approx. working height of the implement fitted by means of the LIFT LIMITATION potentiometer.

NOTE: *The implement, however, must not touch the ground during the calibration process.*

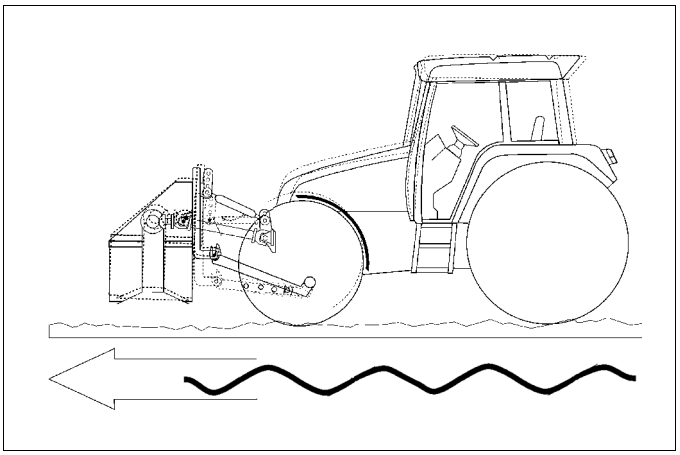
Press the RAISE button and keep it depressed until the DIAGNOSIS indicator starts flashing. When the flashing signals stop (approx. 5 sec.), the calibration value (= load pressure) is automatically stored. If a calibration value has been stored, the indicator lamp (green) lights up upon operating the setpoint rotary switch in position 1 - 10.

After this calibration process, pressures of between 15 bar and the stored load pressure can be set by means of the setpoint rotary switch.

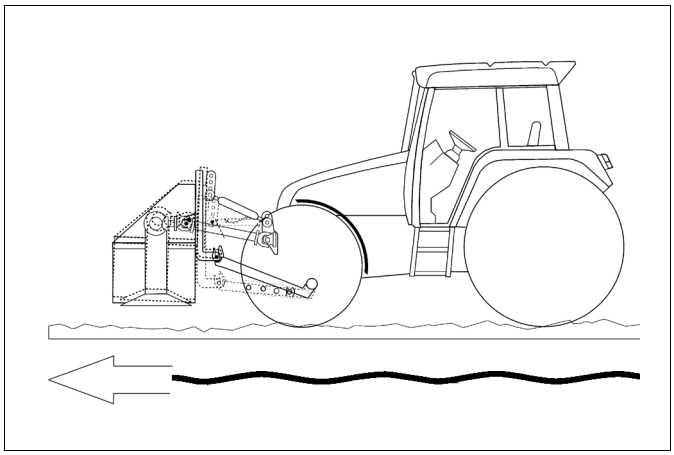
IMPORTANT: *If the current cylinder pressure is < 14 bar, then the calibration value is not stored.*
The LOWER button can only be used for lowering in the position control operating mode (mixed control potentiometer in position 10). Only the switch (parallel switch to front button) can be used for lowering in the pressure control operating mode.

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OSCILLATION DAMPING



SS01N067



SS01N068

The EFH is equipped with passive oscillation damping.

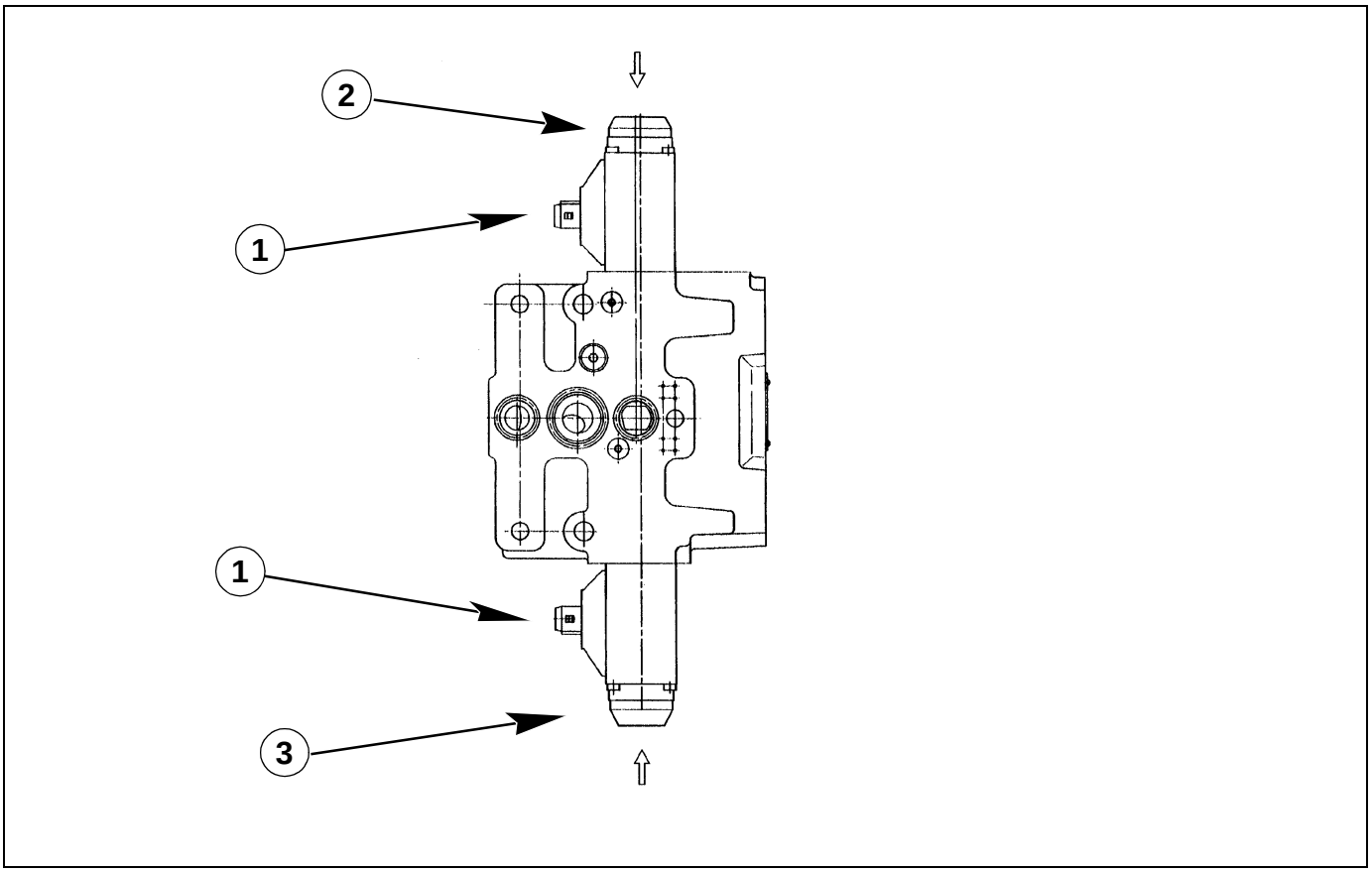
On pressing the RAISE/TRANSPORT button on the Multi-Controller, the hydro-reservoir (40 bar) is automatically connected approx. 2 sec. after reaching the upper limit (lift limitation setting). Passive oscillation damping is then active.

NOTE: *When the MIXED CONTROL potentiometer is in position 10 (100 % position control), the 40 bar reservoir is not connected and passive oscillation damping is thus not active.*

Oscillation damping is also switched off automatically on changing over to the position control operating mode or on leaving the upper limit by means of the front button or the RAISE/LOWER button.

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EMERGENCY OPERATION



SS01J028

If the tractor's electrical or electronics system suffers a complete failure, raising or lowering can be done by manually operating the control valve.

1. Disconnect both plugs from the solenoid valves.
2. **RAISE** emergency operation.
3. **LOWER** emergency operation.

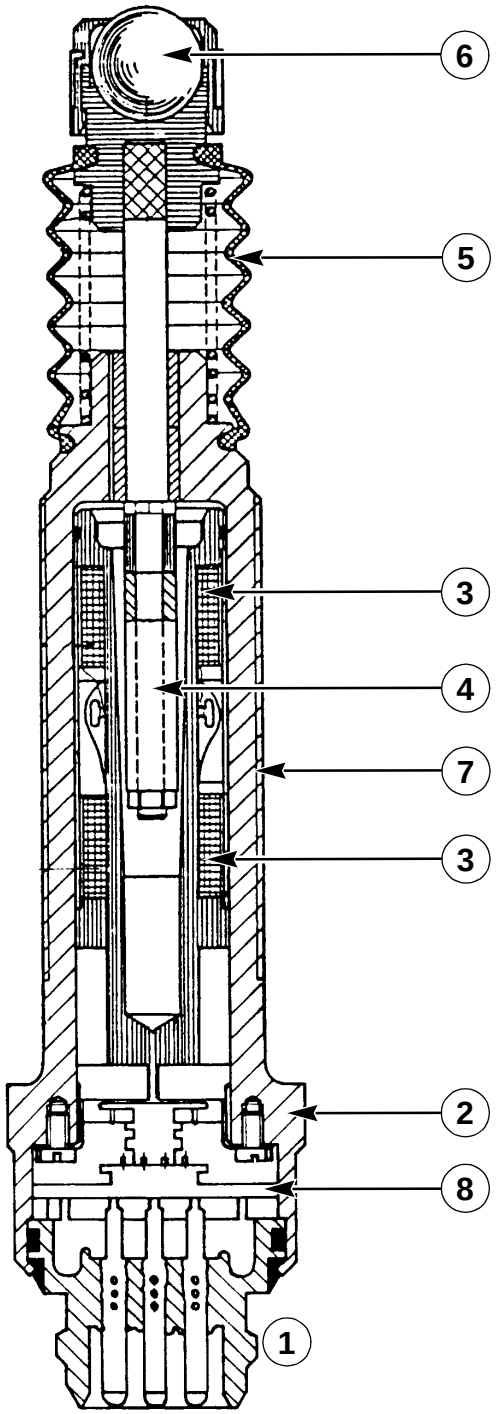
NOTE: *The LOWER emergency operation function can also be used when the engine is at a standstill.*

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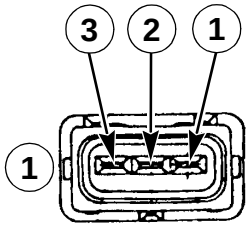
POSITION SENSOR

Construction and function

The position sensor is an inductive travel sensor, with a stroke (measuring range) of 10 mm. It operates without contacts, on the basis of an inductive voltage divider and has thus a low rate of wear. The position of the ferrite core in the differential coil is relative to the position (position of lifting arms). The inductive resistance of the coil is altered by the movement of the coil within it, thus continuously altering an alternating voltage present at a centre tap-off.



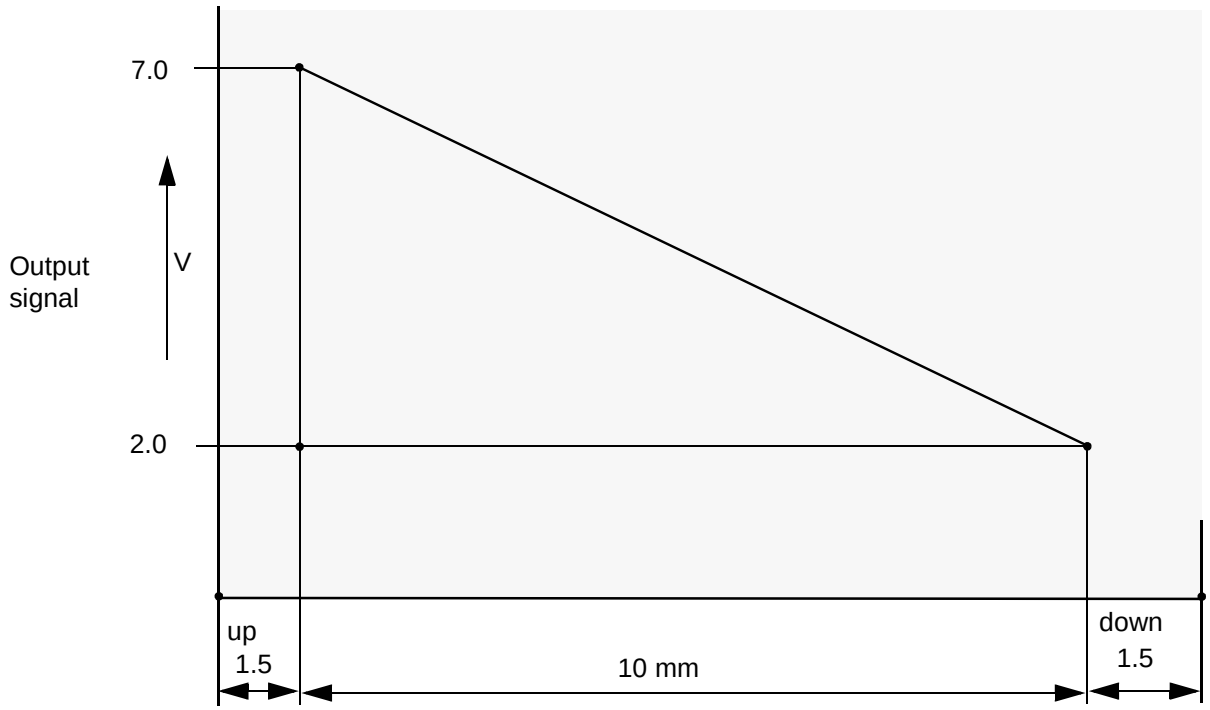
1. 3-pole connector
2. Housing with hexagon
3. Differential coil
4. Ferrite core
5. Rubber cover
6. Ball feeler
7. Adjustable thread for installation
8. AC / DC converter



SS00M074

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Characteristic curve

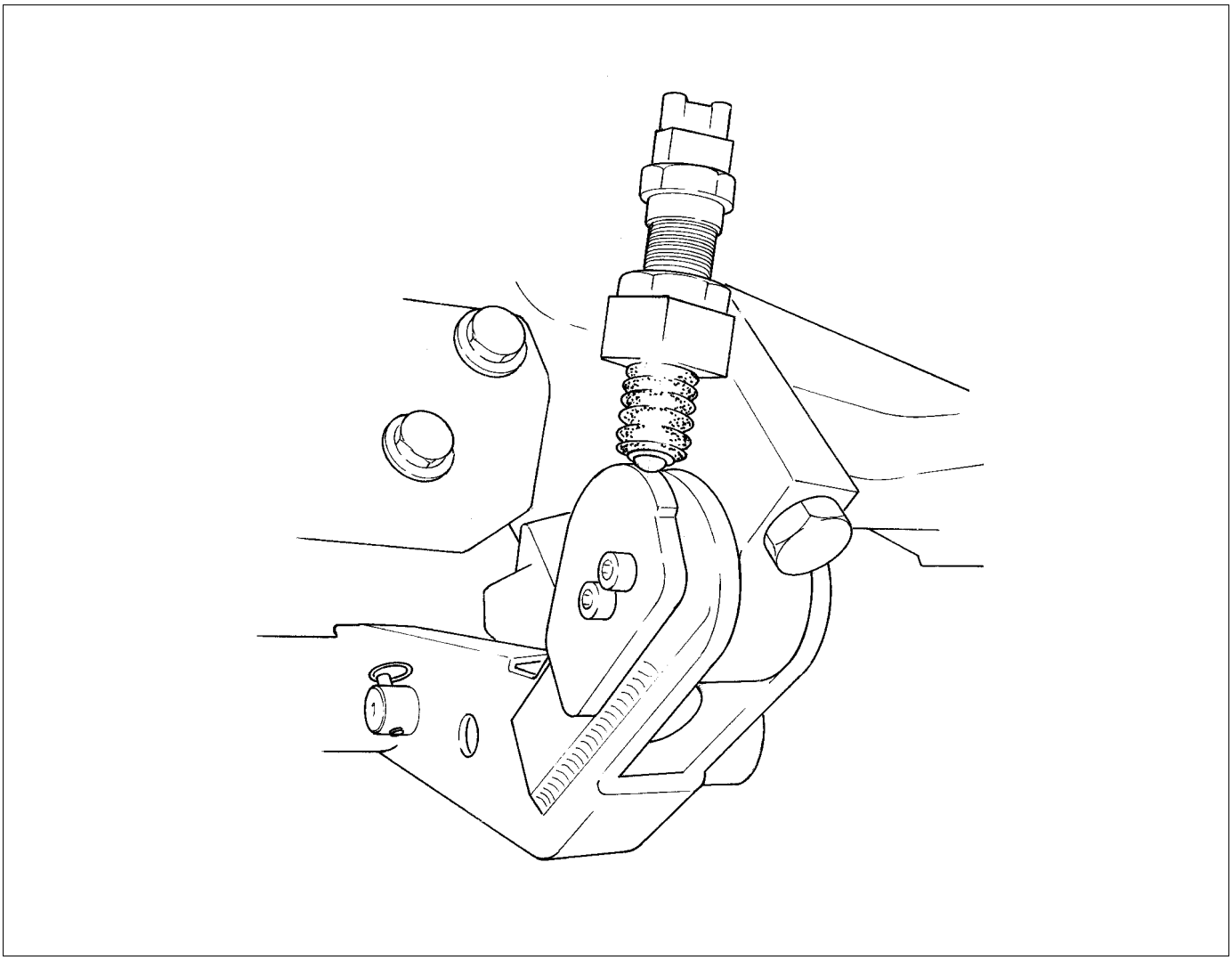


Technical Data

Total range	13 mm
Measuring range	10 mm
Supply, + 9.5 VDC (stabilised)	Pin 3
Supply, ground	Pin 1
Current consumption	≤15 mA
Signal VDC (25 to 75 % of supply voltage)	Pin 2
Deviation	± 3 % over 10 mm measuring range
Load resistance	> 3 kΩ
Fastening thread	M 24 x 1.5
Degree of protection	splash-proof

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Adjusting the Position Sensor



SS01N070

1. Adjusting the sensor

- Loosen the locking nut and turn the sensor away from the control cam until the front hitch can be raised to the mechanical limit (lifting cylinder in limit position) by means of the front pushbutton or the parallel pushbutton (in the cab).
- Fit test adapter 1TSW 528-33 between the position sensor and the connecting cable.
- Turn (screw in) the position sensor clockwise until there is a signal voltage of 7.15 - 7.20 VDC between pins 1 and 2.
- Then secure the position sensor using the locking nut.
- Make sure there is still a freedom of movement at the ball feeler of the sensor in the ”lifting cylinder in limit position” position.
- Turn the ignition switch to position ”0”. Then start the engine again.

2. Checking the limit stop

- Lower the lifting arms.
- Raise right through to the limit stop by means of the front pushbutton.
- Once the EFH box has switched off the control valve, there must be a free lift of approx. 3 mm at the lifting cylinder piston rods.
- Correct the sensor setting, if necessary.

NOTE: *Keep the cam disc for the position sensor clean, do not grease! (dirt adhering to the grease can cause malfunctions).*

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PRESSURE SENSOR

The pressure sensor is **permanently** subjected to a load pressure by the lifting cylinders and is used as a signal transmitter for pressure control in the CONTROL operating mode.

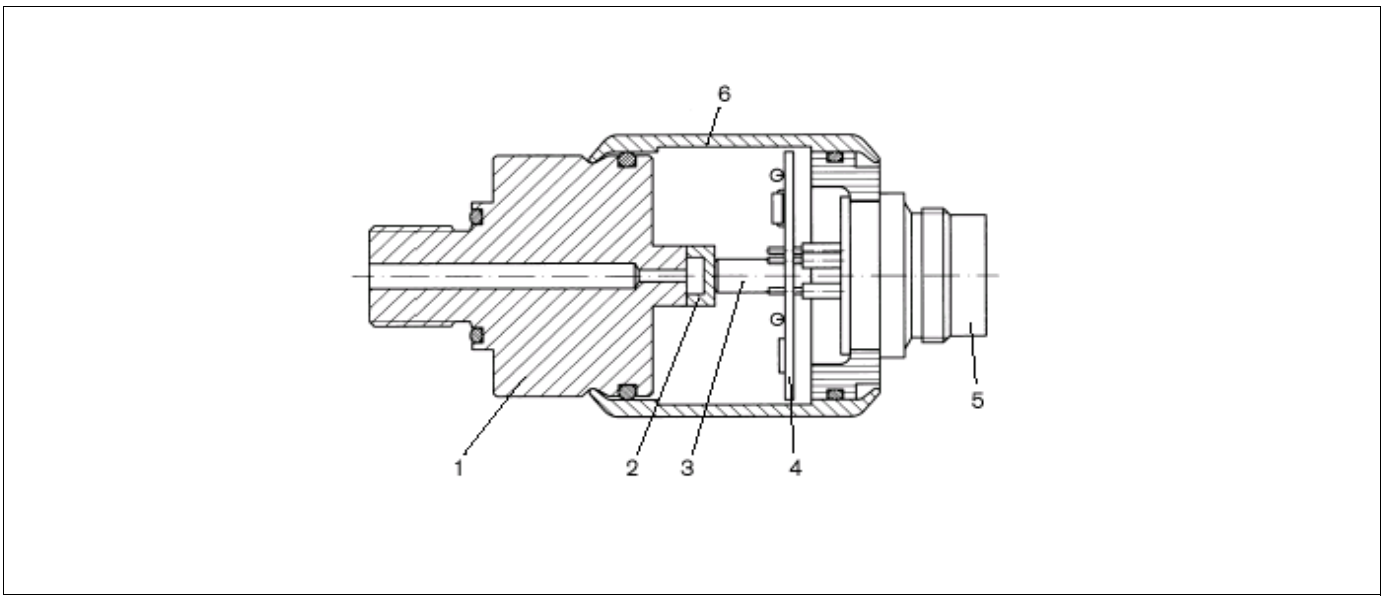


SS01N071

Function:

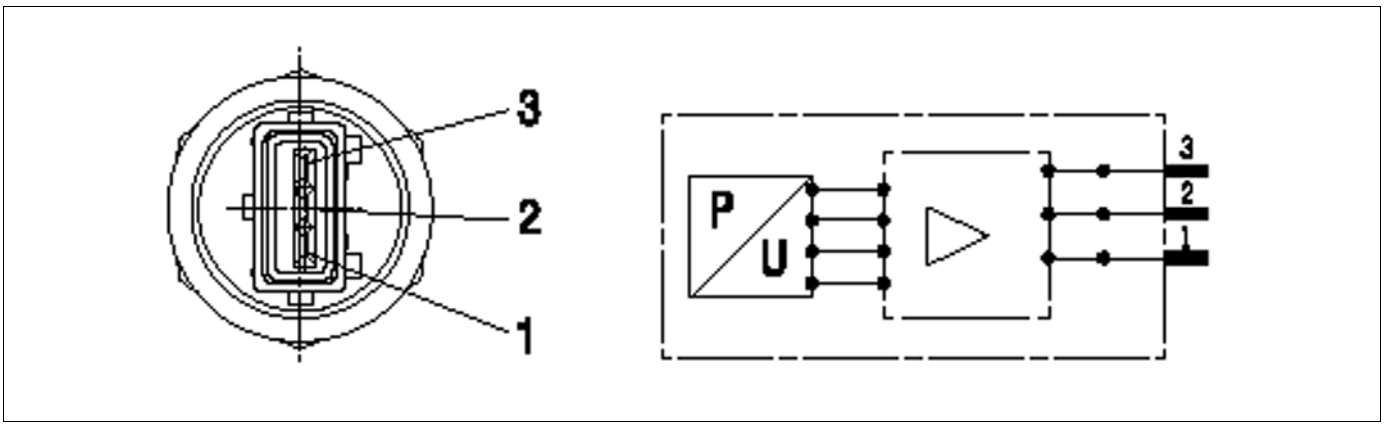
- The pressure sensor is fitted directly on the reservoir block.
- The pressure sensor is designed for a load pressure range of 0 to 200 bar.
- The pressure sensor element consists of a high-quality steel diaphragm (spring material), coated with thin-layer strain gauge, fully bridge-connected, and integrated electronics with temperature compensation.
- The pressure sensor is supplied with a stabilised direct voltage of 9.5 V from the electronics box.
- The output signal changes proportionally to the operating pressure applied.
- At a pressure of 0 bar, the signal voltage is 25 % of the supply voltage (approx. 2.4 VDC).
- The signal voltage increases with the operating pressure.
- The signal voltage output by the pressure sensor can be within a range of 25 to 75 % of the supply voltage.

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SS02A086

1 Connecting piece
2 Diaphragm
3 FLEX circuit
4 Evaluation circuit
5 Connector
6 Housing



SS02A087

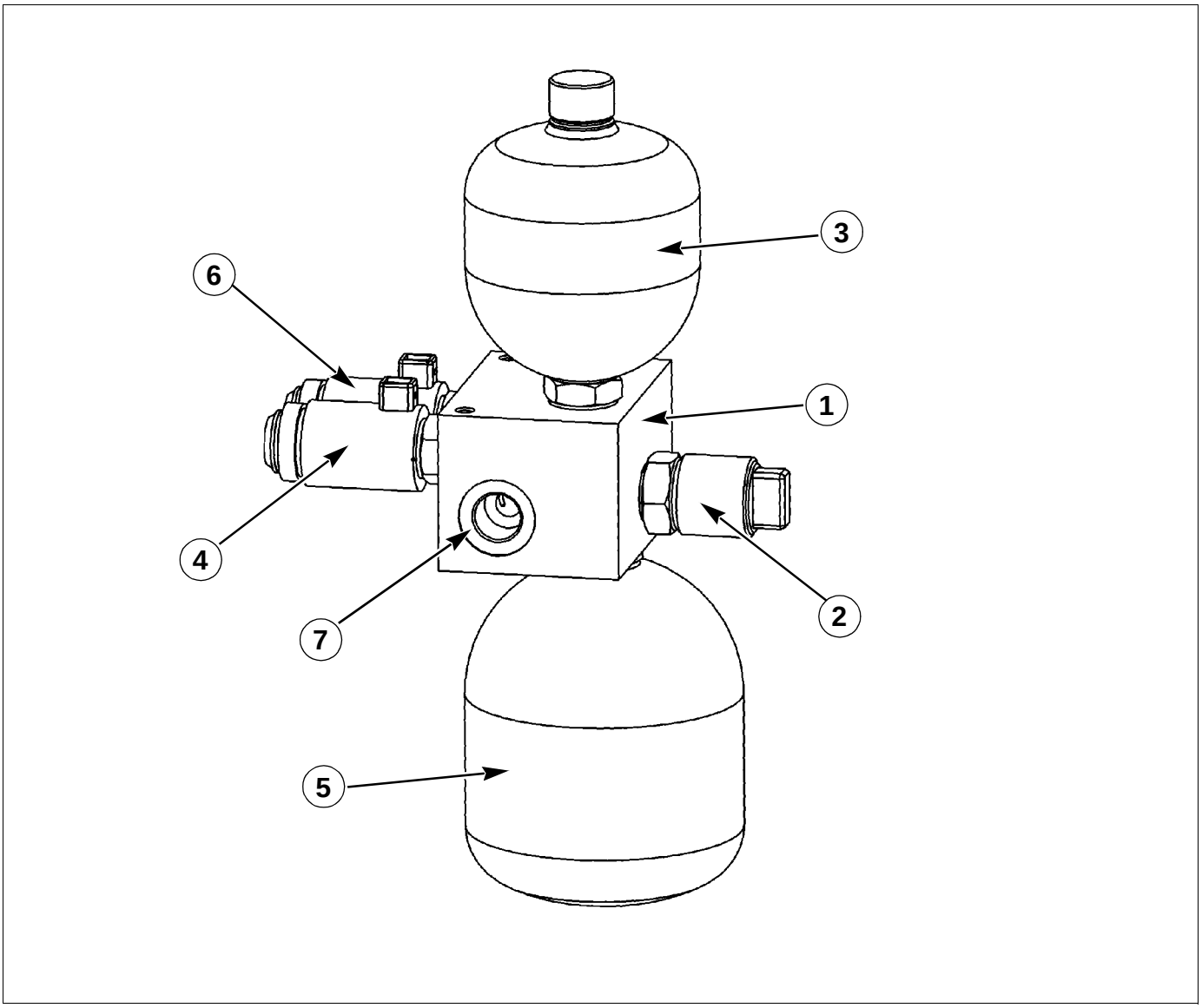
Technical Data

Pressure sensor ..... Bosch End No.: 550
Pressure measuring range ..... 0 - 200 bar
Supply, +9.5 V stabilised direct voltage ..... Pin 3
Supply, ground ..... Pin 1
Current consumption ..... ≤15 mA
Signal direct voltage (VDC) ..... Pin 2
Signal voltage at 0 bar ..... 25 % of supply voltage
Signal voltage at 200 bar ..... 75 % of supply voltage
Load resistance of signal ..... > 10 kΩ
Degree of protection ..... dust-proof, splash-proof

NOTE: *The pressure sensor complies with EMC directives (Electro-Magnetic Compatibility).*

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RESERVOIR BLOCK (complete)



SS01H033

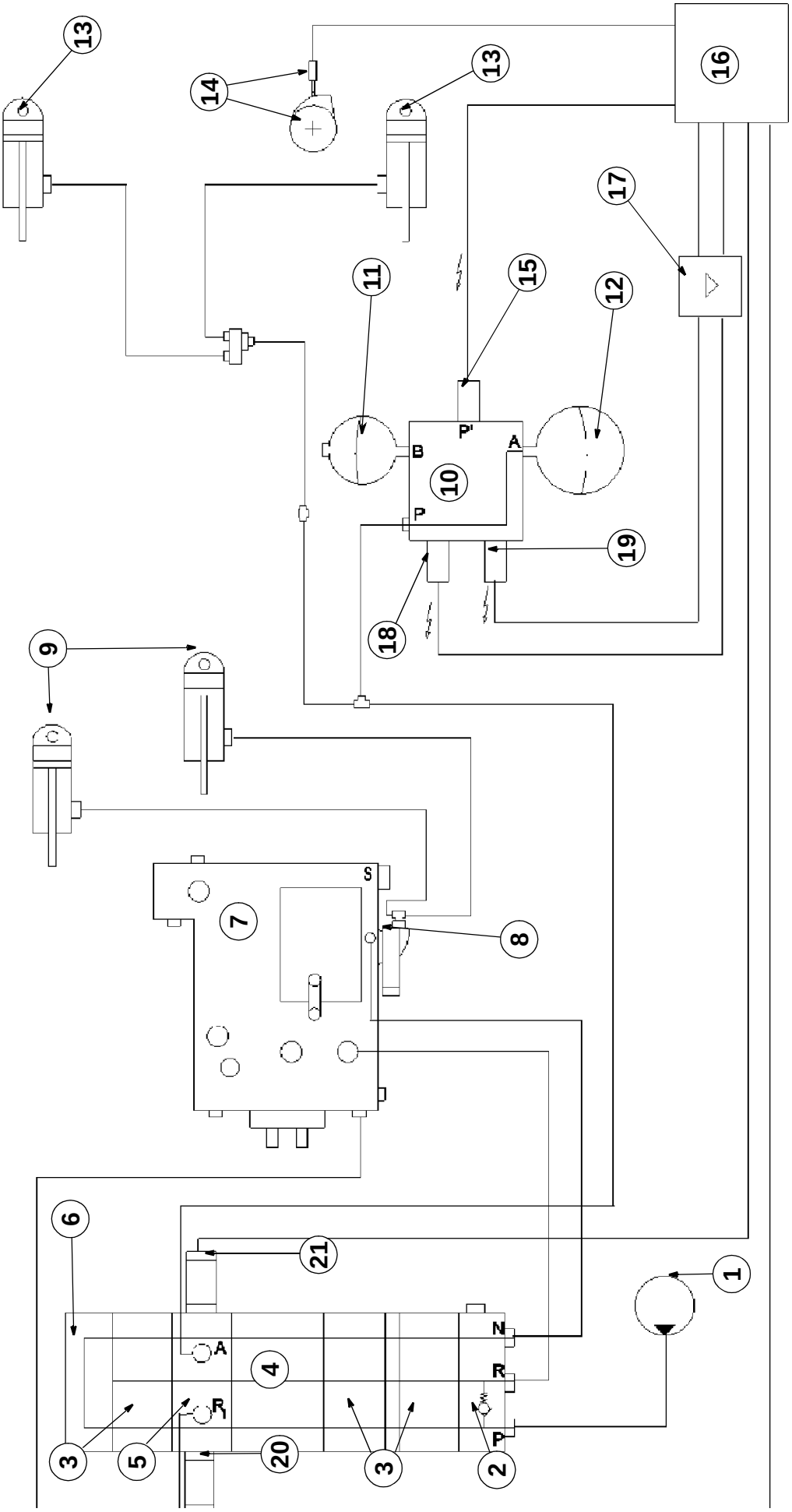
1. Control block
2. Pressure sensor
3. Hydro-reservoir, 14 bar
4. Solenoid valve Y18 (14 bar)
3. Hydro-reservoir, 40 bar
6. Solenoid valve Y19 (40 bar)
7. Pressure connection

The reservoir block is fitted on the right-hand axle stub of the rear axle in the forward driving direction. It comprises the connecting block, the 14 bar hydro-reservoir, the 40 bar hydro-reservoir, 2 solenoid valves and the pressure sensor. The hydro-reservoirs are connected or disconnected via the outputs pin 15 (14 bar hydro-reservoir) and pin 16 (40 bar hydro-reservoir) of electronics box A55/2 (depending on the operating mode).

There is a voltage of 12 DCV at pins 15 and 16 in the pressure control operating mode. Both hydro-reservoirs are connected via solenoid valves Y18 and Y19. On operating the RAISE/TRANSPORT button in the pressure control operating mode, both hydro-reservoirs are disconnected before the 40 bar hydro-reservoir is connected approx. 2 sec. after reaching the upper limit. Passive oscillation damping is thus automatically active for transport operations. Both hydro-reservoirs remain disconnected in the 100 % position control operating mode. Oscillation damping is thus not ensured. If a problem occurs on triggering solenoid valves Y18 and Y19, refer to Troubleshooting, page 43.

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EFH LINE PLAN – EHR version



EFH components – EHR version

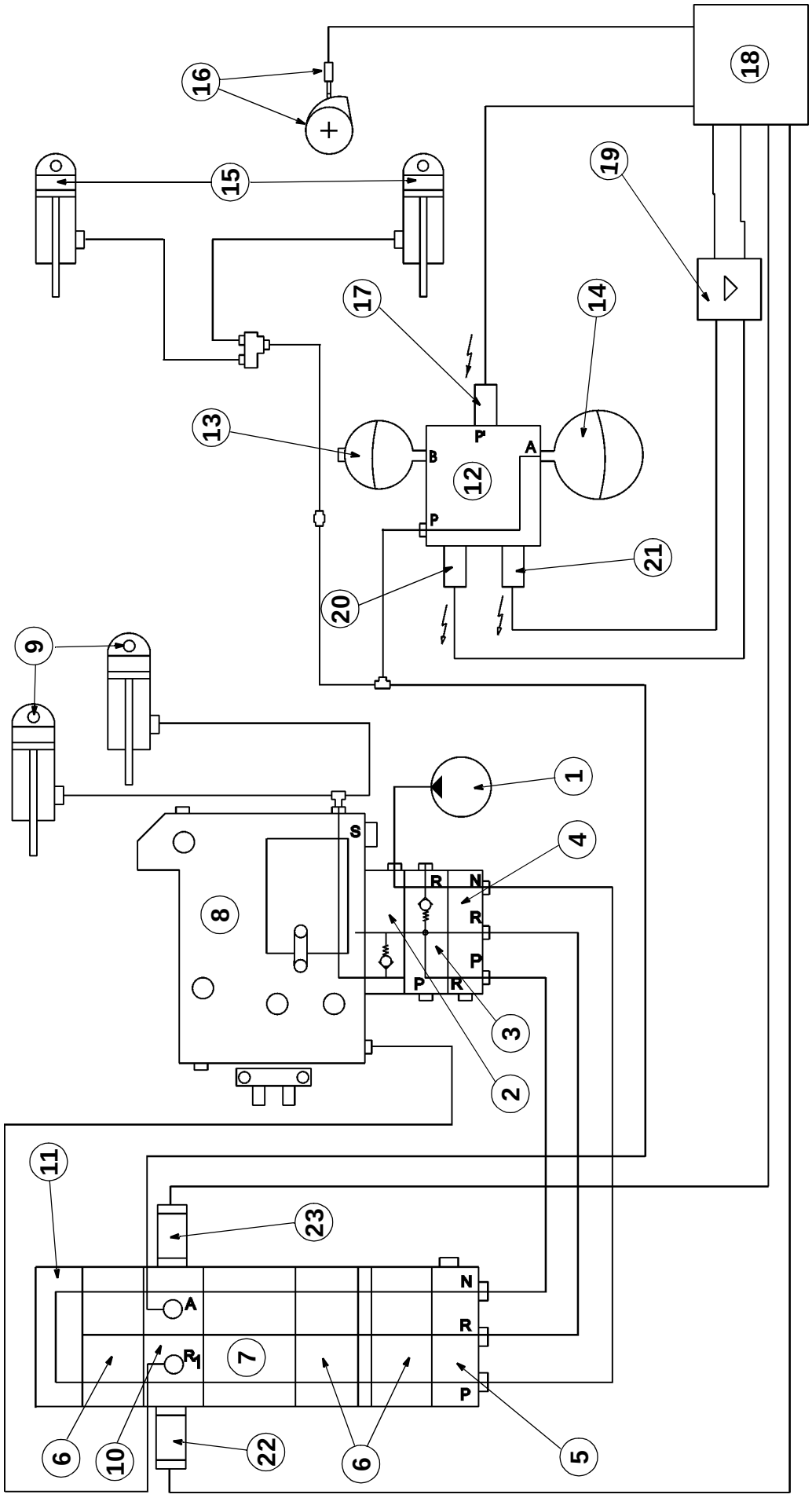
1. Hydraulic pump
2. Connection plate
3. Auxiliary valves
4. Intermediate block
5. Control unit, EFH (SB 23 OC)
6. End plate
7. Hydraulic fluid reservoir
8. Control unit (EHR 5-OC)
9. Lifting cylinder, rear hydraulics
10. Reservoir block
11. Reservoir, 14 bar (capacity of 0.5 l)
12. Reservoir, 40 bar (capacity of 0.75 l)
13. Lifting cylinder, EFH
14. Control cam with position sensor
15. Pressure sensor
16. Electronics box, EFH (A55/2)
17. EFH power circuit (print A17)
18. Solenoid valve for 14 bar hydro-reservoir
19. Solenoid valve for 40 bar hydro-reservoir
20. RAISE solenoid valve
21. LOWER solenoid valve

P = Pressure
R = Return
R1 = Return
N = Neutral circulation
A = Feed, 40 bar hydro-reservoir
B = Feed, 14 bar hydro-reservoir

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EFH LINE PLAN – MHR version



EFH components – MHR version

1. Hydraulic pump
2. Side cover
3. Control unit (SR 60)
4. End plate
5. Connection plate
6. Auxiliary valves
7. Oil tank
8. Intermediate block
9. Lifting cylinder, rear hydraulics
10. Control unit, EFH (SB 23 OC)
11. End plate
12. Reservoir block
13. Reservoir, 14 bar (capacity of 0.5 l)
14. Reservoir, 40 bar (capacity of 0.75 l)
15. Lifting cylinder, EFH
16. Control cam with position sensor
17. Pressure sensor
18. Electronics box, EFH (A55/2)
19. EFH power circuit (print A17)
20. Solenoid valve for 14 bar hydro-reservoir
21. Solenoid valve for 40 bar hydro-reservoir
22. RAISE solenoid valve
23. LOWER solenoid valve

P = Pressure

R = Return

R1 = Return

N = Neutral circulation

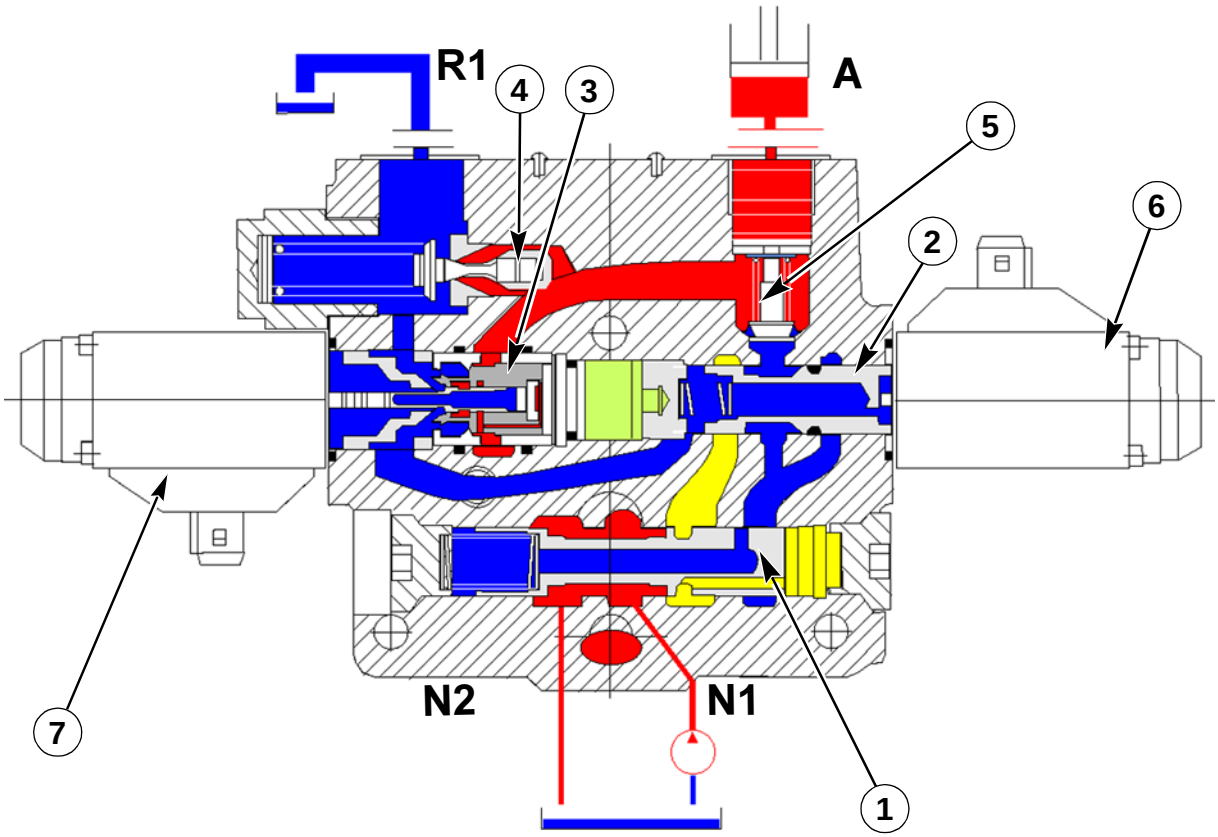
A = Feed, 40 bar hydro-reservoir

B = Feed, 14 bar hydro-reservoir

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EFH CONTROL VALVE SB 23-OC



SS01N057

This control valve is only used for the EFH in the serial version (hydraulic system, OC version)

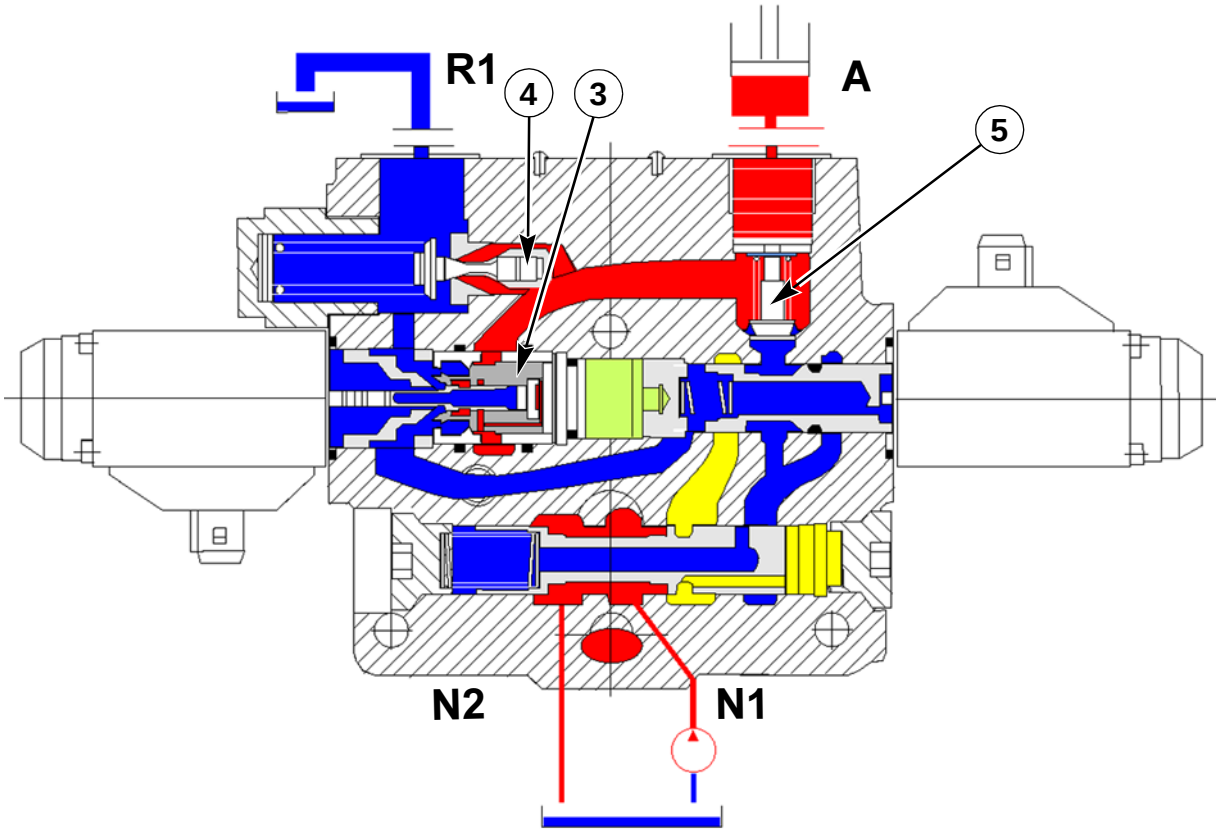
1	Oil flow regulator for RAISE	A	Lifting cylinder connection, front hitch
2	Control slide	P	Pump connection
3	Lowering valve	N1	Neutral circulation connection (control valve input)
4	Load safety valve	N2	Neutral circulation connection (run-on connection)
5	Non-return valve	R	Return connection
6	RAISE solenoid (Y16), white plug	R1	External return
7	LOWER solenoid (Y17), black plug		

Technical data:

Ambient temperature	- 25 ..... +60 °C
Pressure agent	Hydraulic oils on a mineral basis in accord. with DIN/ISO; others upon request
Viscosity	10 ..... 400 mm²/s
Pressure agent temperature	- 25 ..... +80 °C
Permissible max. pressure	P: 250 bar, R1: 5 bar, N: 30 bar, R: 20 bar
Nominal flow rate	80 l/min
Load drop at connection A	max. 4 cm³ per min. at 125 bar, viscosity 35 mm²/s
Type of operation	Direct slider operation through 12 V proportional solenoids
Solenoid coil:	$R = 1.7\ \Omega^{\pm 10\ \%}$ / $I_{max.} = 3.5$ A
Electr. connections	2-pole plug connection
Degree of protection	IP 64 A
Load safety valve	220 + 20 bar

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NEUTRAL function



SS01N057

The solenoids are deenergised.

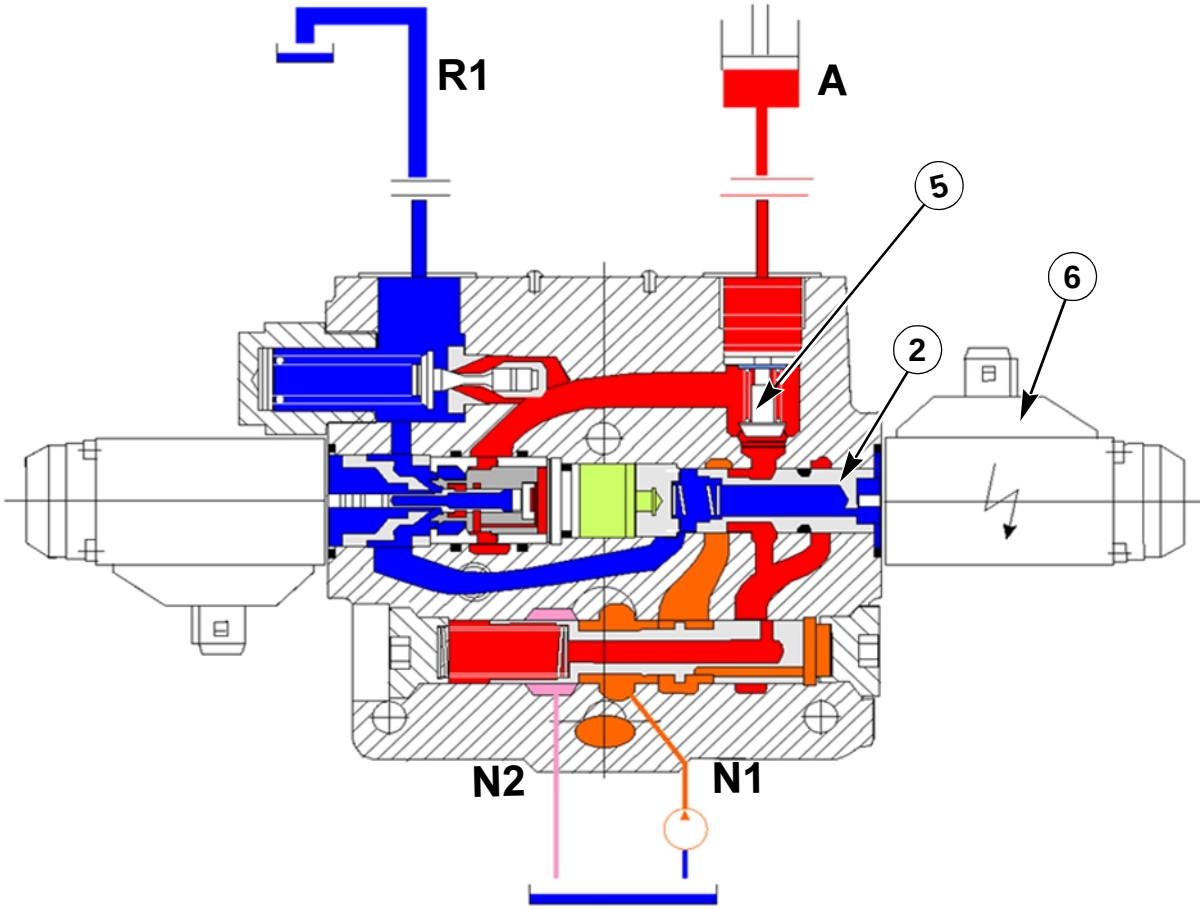
The pump oil flow flows from N1 via the rate regulator to neutral circulation connection N2 and then to the oil sump.

The load at connection A is maintained by non-return valve 5 and lowering valve 3.

Pressure peaks, caused by the mass acceleration of the implements fitted, are kept in check by load safety valve 4.

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RAISE function



SS01N058

The control valve is the actuator in the closed-loop control circuit.

In the event of a control deviation, the electronics box sends the RAISE control command to solenoid valve Y16 (RAISE).

Control slider 2 opens proportionally to the control deviation.

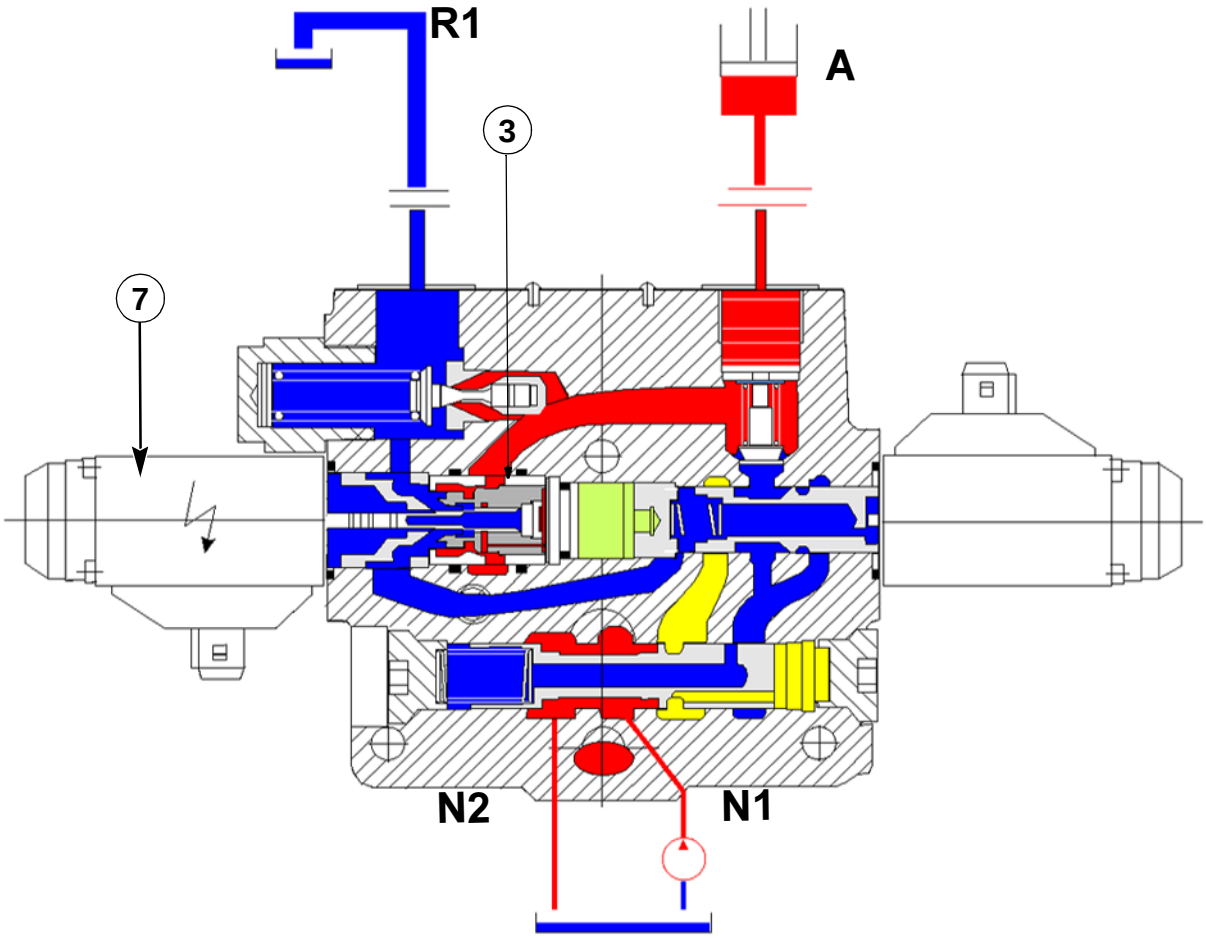
During the RAISE process, the pump oil flow flows via control slider 2 and non-return valve 5 to cylinder connection A.

The control slider and pressure controller operate as a 3-way oil flow regulator (pressure governor).

The function of the oil flow regulator ensures a more or less constant lifting speed even when the 3-point hitch linkage is subjected to high load variations.

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LOWER function



SS01N059

The control valve is the actuator in the closed-loop control circuit.

In the event of a control deviation, EFH box A55/2 sends the LOWER control command to solenoid valve Y17 (LOWER).

Lowering valve 3 opens proportionally to the control deviation.

During the LOWER process, the position sensor records the lowering speed and sends it to the EHR box. The EHR box can now control a more or less constant lowering speed at various loads. This is attained by triggering proportional solenoid Y17 (LOWER) with a varying current. The lowering valve is then opened more or less.

The lowering oil flow now flows via lowering valve 3 to return R1 and back into the tank.

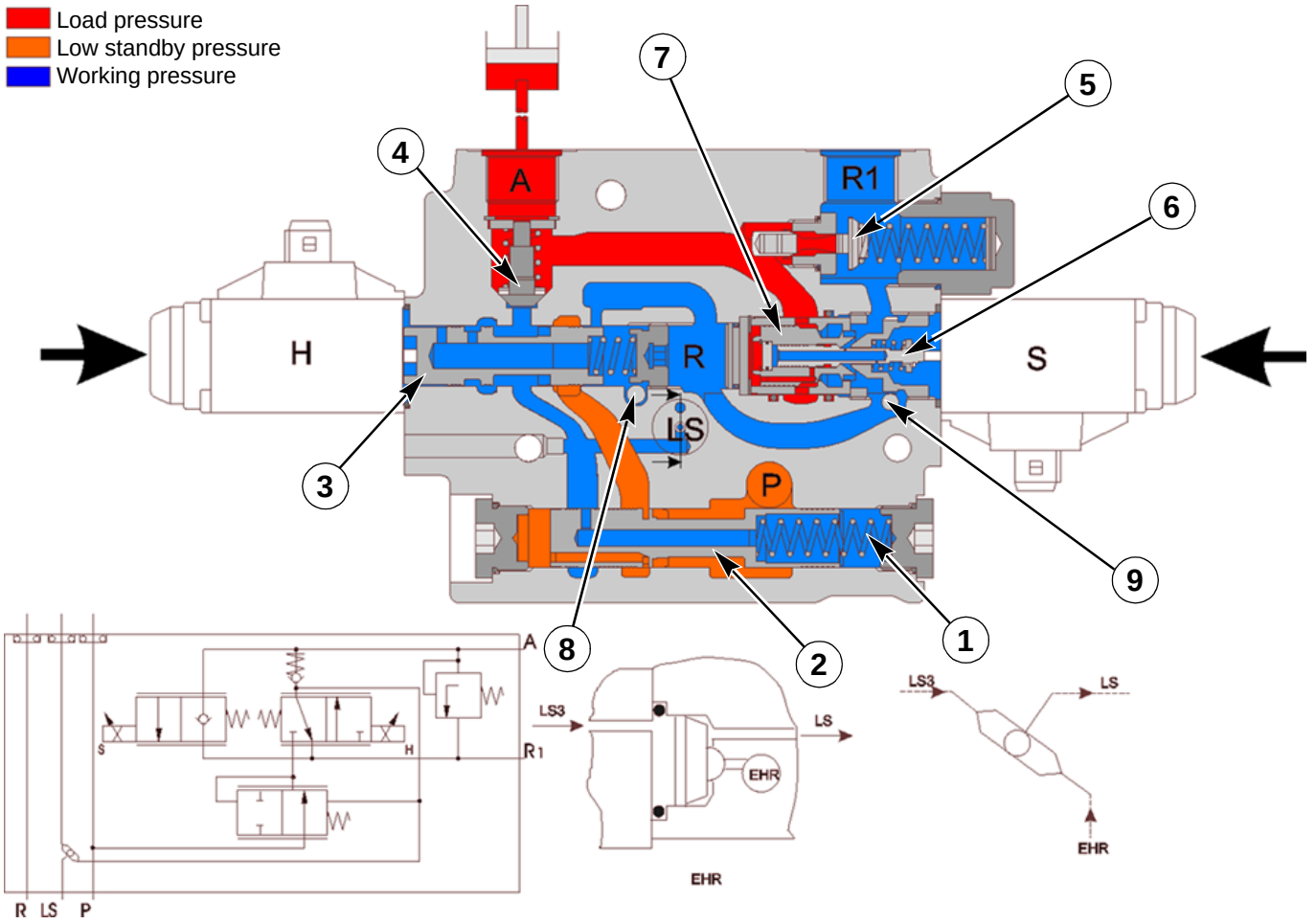
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EFH CONTROL VALVE SB 23-LS

General information:

Control valve SB 23-LS is only used for the EFH in conjunction with the load sensing optional equipment (OC-LS).

This control valve is located in the third position as seen from the connection plate. It is an electro-magnetic, proportional control valve of plate construction with an integrated 2-way oil flow regulator, which lies parallel to the P channel. The solenoids are controlled by pulse-width modulation from EFH Box A55/2.



SS01M209

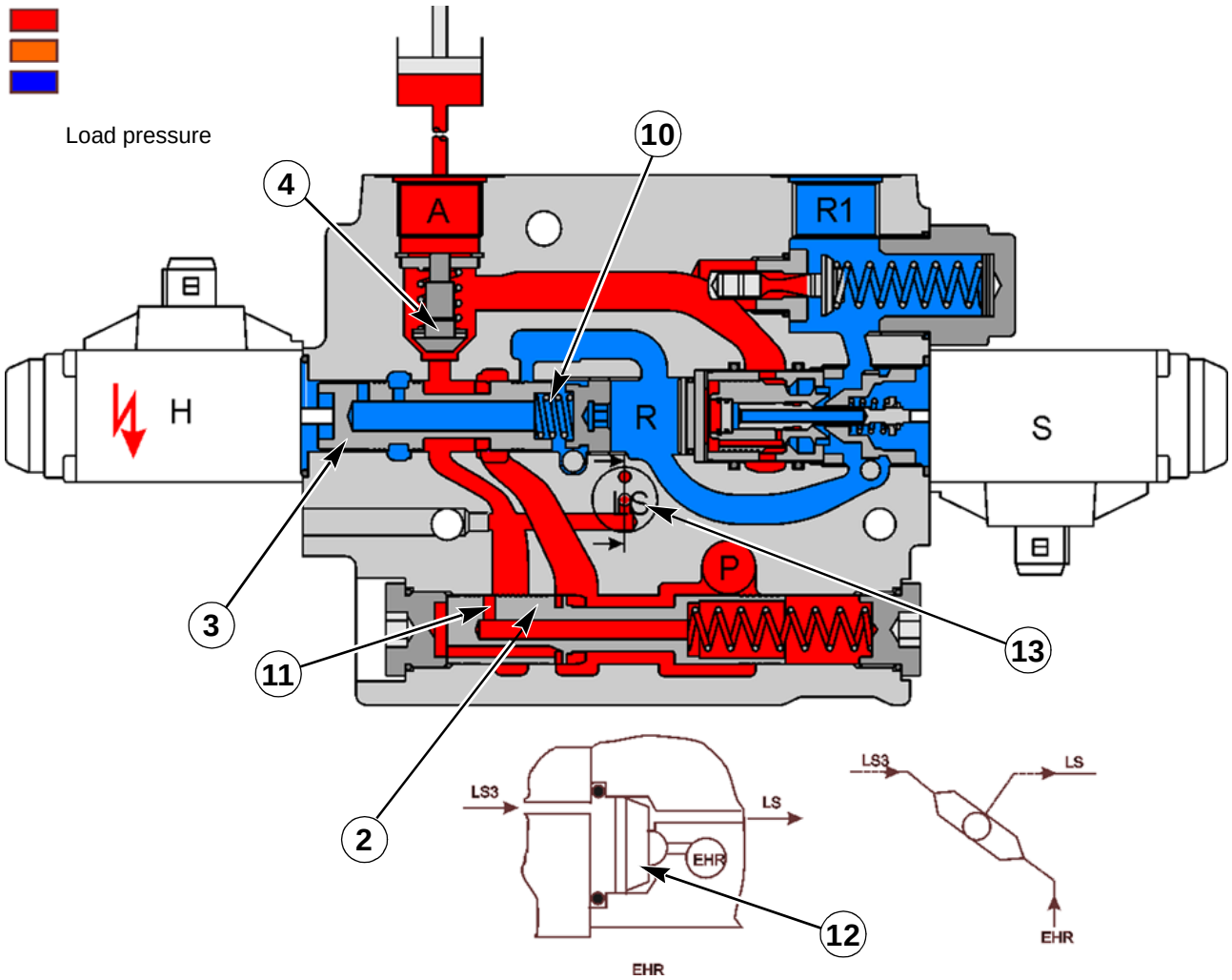
NEUTRAL function

Solenoids (H) and (S) are deenergised. Spring (1) has brought the slider (2) of the 2-way flow regulator, against the low standby pressure, into a balanced position. The pressure can flow from channel (P) up to the closed slider (3). The (LS) channel is also connected via slider (3) for lifting to channel (R). The load pressure from output (A) acts on the conical slide valve (4), load safety valve (5), pilot cone (6) and main conical slide valve (7) for lowering .

NOTE: *If the control valve is disassembled for cleaning or repair work, attention must be paid to the fact that the fixing screws (8) and (9) must not be moved, otherwise the control unit setting will be altered. If the control valve has been misaligned, it must be replaced (replacement valve).*

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RAISE function



SS01M208

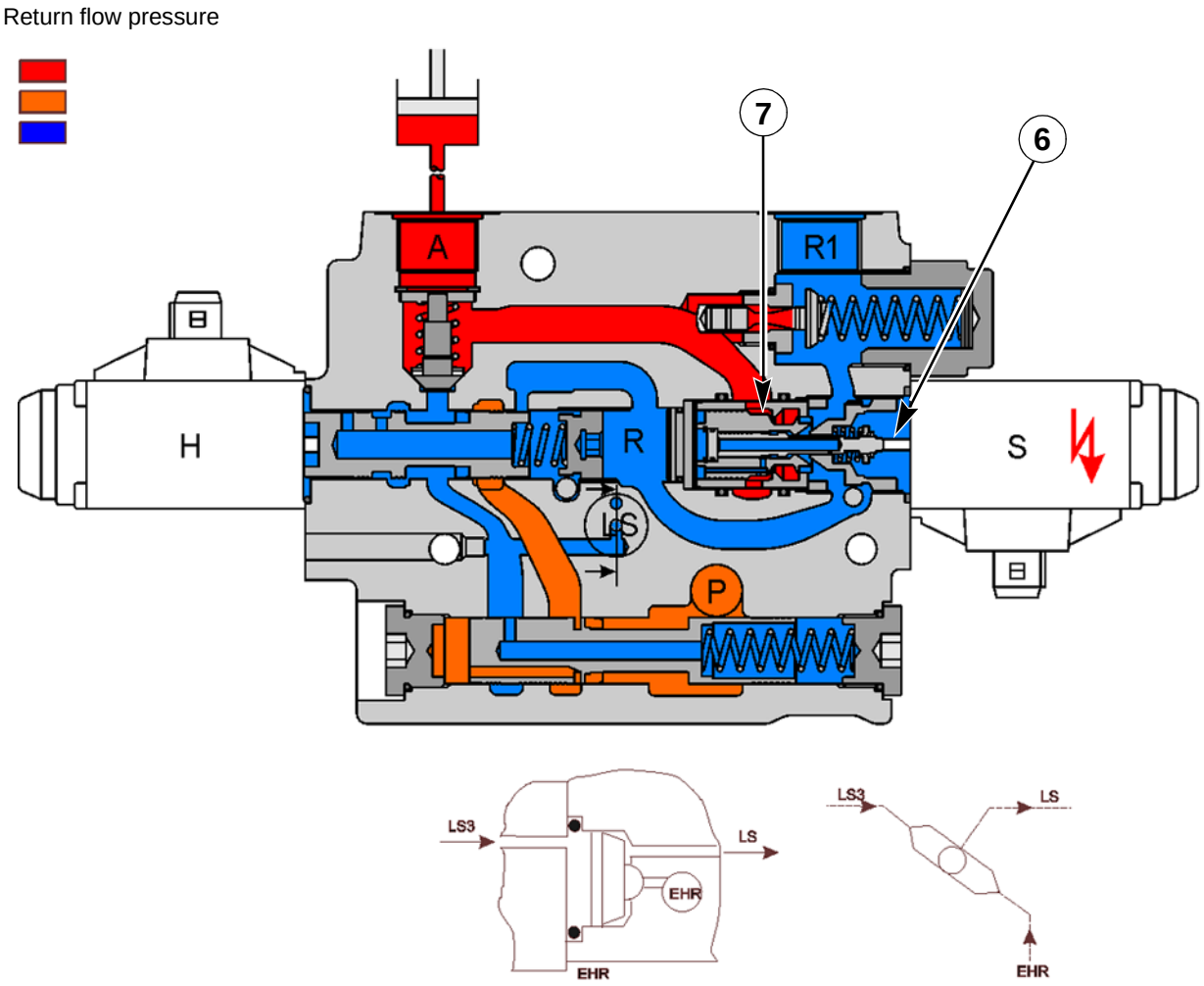
The solenoid (H) is energised by E-box A55/2. The current corresponds to the control deviation. The control slider (3) is pushed against the force of the spring (10) by the solenoid (H). The pressurised oil from channel (P) can, on the one hand, now flow via the open control edge of the slider (3) through the hole (11) and act on the spring side of the 2-way oil flow regulator (2), and on the other hand, flow via the shuttle valve (12) into the LS channel (13) and act on the spring side of the control slider (3-way oil flow regulator) of the connection plate. At the same time, the conical valve (4) is opened by the flow of oil to output (A). The working pressure now builds up, according to the implement load and the speed at which it is being raised. The lifting speed is dependent upon the electrical current, which flows through solenoid (H) and opens the control cross-section of the control slider (3). The slider (3) acts as an adjustable throttle for the 2-way oil flow regulator (2).

This results in the following options:

1. A lifting speed which does not depend on the load or the pump flow
2. Parallel operation of several auxiliary valves, the steering and EHR, which work with different oil flow rates and pressures until the momentary pump flow is achieved.

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LOWER function



SS01M207

In accordance with the setting of the lowering speed (potentiometer), a certain current is fed to the solenoid (S) from the EFH box. The position sensor reports the actual lowering speed value to the EFH box, where a continuous Nominal/Actual comparison is carried out and the current to the solenoid coil (S) is varied accordingly. This results in a lowering speed independent of the load.

By supplying the solenoid (S) with current, the pilot cone (6) opens. The load pressure on the rear side of the main cone (7) is thus passed into the return. The load pressure acting on the front now opens the main cone (7). Thus the travel of the main valve (7) is determined by the travel of the solenoid (S) and the pilot valve (6). When the main cone (7) opens, this causes the pilot cone (6) to shut off. When the pilot cone (6) shuts off, the load pressure acts on the back of the main cone again. The return oil flow returns to the tank via an external line (R1).

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DIAGNOSIS

General

The EFH is equipped with a self-diagnosis system. The EFH box continuously monitors the system for faults. Faults which occur are indicated in the form of fault codes, which are divided into three categories: Minor faults, fairly serious faults, serious faults.

Fault code display

In every fault category, faults which occur are output as two-digit codes by the DIAGNOSIS indicator.
The fault codes are displayed in a continuous operation, i.e. a corresponding fault code is continuously displayed until the fault has been remedied.
Example of a fault: If the signal line to the MIXED CONTROL potentiometer (position / pressure control) is interrupted, fault code 36 is indicated in the following flashing sequence:
Long pause – three flashing signals – short pause – six flashing signals – long pause – three flashing signals – short pause – six flashing signals –

. . . . . _ _ _ . . . . . _ _ _ _ _ _ . . . . . _ _ _ . . . . . _ _ _ _ _ _ . . . . . .

If several faults occur simultaneously, then they are displayed one after the other in a continuous operation, whereby the most serious fault has priority. The remaining faults are still displayed after a fault has been remedied.

Fault code assignment

The first digit in the fault code characterises the seriousness of the fault which has occurred.
The second digit allocates the type of fault.
3 = Minor faults
2 = Fairly serious faults
1 = Serious faults

Minor faults

- Control is continued
- Indication for the driver: DIAGNOSIS indicator outputs fault code(s).
- The DIAGNOSIS indicator goes out as soon as the fault has been remedied. However, a fault code output which has been started, is completed. When all faults have been remedied, the DIAGNOSIS indicator goes out.

Fairly serious faults

- The control system is stopped.
- Indication for the driver: The DIAGNOSIS indicator outputs fault code(s).
- Fault code output is terminated when control is resumed.
- Resumption of control: Rectify fault, restart engine and operate EFH.

Serious faults

- The control system is stopped.
- The relay in the EFH box is switched off (output stage protection).
- Indication for the driver: The DIAGNOSIS indicator outputs fault code(s).
- Fault code output is terminated when control is resumed.
- Resumption of control: Rectify fault, start engine and operate EFH.

If the EFH detects a fault in the system, output of the corresponding flashing code has top priority.
The fault code list (see page 38) can be used to localise and determine faults.

Remedying of faults

Detected faults are only indicated globally by the flashing code. Not all possible faults are displayed.
Certain faults can only be localised through measurements, the results of which are compared with the specified values (see page 43). The routing of electrical cables is shown in Chapter 4003 (circuit diagram).

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Fault codes

MINOR FAULTS			
Code	**Brief description**	**Pin**	**Fault description (cause)**
33	Battery or cabling between battery and EFH box	29, 47 and 28	Voltage between pins 29, 47 and 28 too low (< 12 VDC) • V-belt tension insufficient (slip, generator drive) • Battery, generator, generator controller faulty • Transfer resistors in cabling too big
34	Signal, potentiometer LOWERING SPEED R12/3	23	Signal voltage not in permissible range (< 0 VDC or > 9.5 VDC) • Supply to potentiometer faulty • Cable breakage or potentiometer not connected • Interruption or short-circuit in the signal line • Potentiometer defective: Setpoint resistance 4k7$^{\pm 20\%}$
36	Signal, potentiometer POSITION/PRESSURE CONTROL (mixing) R12/2	4	Signal voltage not in permissible range (< 0 VDC or > 9.5 VDC) • Supply to potentiometer faulty • Cable breakage or potentiometer not connected • Interruption or short-circuit in the signal line • Potentiometer defective: Setpoint resistance 4k7$^{\pm 20\%}$
37	EFH control valve RAISE function Oil flow Oil pressure		Correct current between pin 37 and pin 35 (RAISE solenoid), but lifting cylinders do not lift: • EHR does not have an electrical, hydraulic or mechanical fault: Excessive load • Position sensor has wrong setting • Top link not coupled correctly • Top link not adjusted correctly • Lower link bearing stiff • Mechanical fault in EFH control valve: Slider or valve parts stuck or valve seats leaking • Insufficient pressure to EFH control valve
38	Pressure sensor	8	Signal voltage is < 0.25 or > 0.75 x supply voltage: • Supply to sensor faulty or sensor defective • Interruption or short-circuit in the signal line • Input resistance too small (< 10k ohms): EFH box defective • Pressure at sensor > 200 bar: Excessive load on front hitch

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FAIRLY SERIOUS FAULTS			
Code	**Brief description**	**Pin**	**Fault description (cause)**
23	Signal, stepping switch S13 Setting the LOAD RELIEF	22	Signal voltage not adjustable in perm. range (0 to 9.5 VDC): • Supply (9.5 VDC and ground) from EFH box to resistor chain on print A17 defective (test values: see page 43) • Resistor chain on print A17 defective (test values: see page 43) • Plug-in connection to stepping switch defective • Stepping switch is not connected (plug X14/13) • Stepping switch defective (test values: see page 43) • Interruption or short-circuit in the signal line
24	Signal, potentiometer LIFT LIMITATION (upper limit) R12/1	3	Signal voltage not in permissible range (< 0 VDC or > 9.5 VDC) • Supply to potentiometer faulty • Cable breakage or potentiometer not connected • Interruption or short-circuit in the signal line • Potentiometer defective: Setpoint resistance 4k7$^{\pm 20\%}$
25	Signal, position sensor front hitch	25	Signal voltage not in permissible range: (< 2 VDC or > 7.4 VDC) • Faulty position sensor setting • Supply to sensor faulty or sensor defective • Interruption or short-circuit in the signal line • Input resistance too small (< 3k ohms): EFH box defective
28	Signals: TRANSPORT/RAISE, NEUTRAL and LOWER/CONTROL	21	Signal voltage not in permissible range: (test values: see page 43) • Supply (9.5 VDC and ground) from EFH box to resistor chain on print A17 defective (test values: see page 43) • Resistor chain on print A17 defective (resistance values: see 4003 Circuit Diagram) • Interruption or short-circuit in the signal line

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SERIOUS FAULTS			
Code	**Brief description**	**Pin**	**Fault description (cause)**
11	RAISE output stage	37	No current flow via solenoid Y16 RAISE: • Fuse F45 (7.5 A) defective • RAISE output stage defective (EFH box defective) • Interruption in lines from pin 37 to 35 or solenoid
12	LOWER output stage	19	No current flow via solenoid Y17 LOWER: • Fuse F45 (7.5 A) defective • LOWER output stage defective (EFH box defective) • Interruption in lines from pin 19 to 53 or solenoid
13	Electrical circuit, solenoid Y16 RAISE	35	Current consumption too high (max 4 Amps) • Short-circuit between pin 37 and 35 (electrical cable) • Short-circuit in solenoid coil Y16
13	Electrical circuit, solenoid Y17 LOWER	53	Current consumption too high (max 4 Amps) • Short-circuit between pin 19 and 53 (electrical cable) • Short-circuit in solenoid coil Y17
14	Lines from pin 37 and 35 to solenoid Y16 RAISE	35	No current is measured at pin 35 even though solenoid Y16 RAISE is triggered: • Interruption or very high resistance (contact fault or oxidation) in the line between pin 37 and pin 35 • Short-circuit in solenoid coil Y16
14	Lines from pin 19 and 53 to solenoid coil Y17 LOWER	53	No current is measured at pin 53 even though solenoid coil Y17 LOWER is triggered: • Interruption or very high resistance (contact fault or oxidation) in the line between pin 19 and pin 53 • Short-circuit in solenoid coil Y17
15	RAISE external button LOWER external button (Front button) RAISE/LOWER button (in cab)	9	Signal level not in permissible range: (test values: see page 43): • Contacts of front buttons faulty • Contacts of RAISE/LOWER button (cab) faulty • Resistance too high (contact fault or oxidation) or short-circuit to other parts along the line between pin 9 and pin 17 or between pin 9 and pin 36
17 (34) (36)	9.5 VDC supply for potentiometer and two resistor chains on print A17	2	+ 9.5 VDC supply (pin 2) faulty or ground supply (pin 20) faulty: • Resistance of the line network between pin 2 and pin 20 < 330 ohms or > 0 ohms • EHR box defective
17 (34) (36)	9.5 VDC supply for the EFH sensors	39	+ 9.5 VDC supply (pin 39) faulty or ground supply (pin 38) faulty: • Resistance of the line network between pin 39 and pin 38 < 330 ohms or > 0 ohms • EHR box defective
17	Permanent + supply (Battery +)	29 and 47	Supply voltage > 18 V: • Wrong starting aid (24 V or wrong starting aid device) • Generator controller faulty

NOTE: *In the event of a short-circuit between pins 2 and 20 or between pins 2 and 28 or between pin 2 and the ground connection or between pins 39 and 38 or between pins 39 and 28 or between pin 39 and the ground connection, the EFH does not function* ***and*** *a fault code cannot be output.*

NOTE: *If there is a supply failure (+15/Si) at pin 24 (fuse F14, 15 A), the DIAGNOSIS indicator cannot light up and thus cannot output a fault code.*

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Pin assignment, plug X55 (EFH box A55/2)

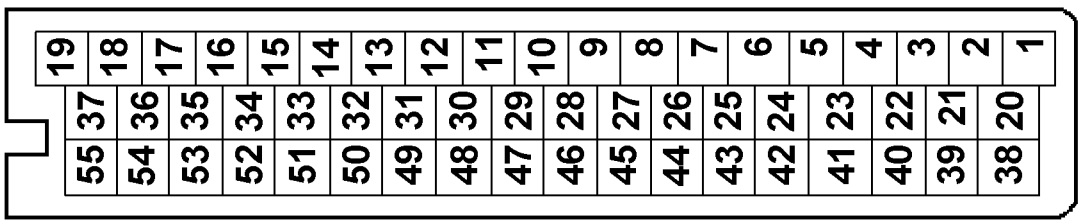
Pin	Cable marking	Function
2	H602	Supply, 9.5 VDC stabilised: for operating controls R12/1 to R12/3 (potentiometers), for LOAD RELIEF stepping switch S13 and its resistor network (A17), for resistor network (A17) – signals (Multi-Controller) TRANSPORT/RAISE NEUTRAL LOWER/CONTROL
3	F603	Input signal (analog), LIFT LIMITATION, from potentiometer R12/1
4	F604	Input signal (analog), MIXED CONTROL, from potentiometer R12/2
8	F608	Input signal (analog), actual value from pressure sensor B21
9	H609	Supply, + 5 VDC for: RAISE external button S15/3 and LOWER external button S14/3 as well as RAISE/LOWER button S2/15/6 in cab
12	N612	Output signal (digital) for LOAD RELIEF indicator H4/2 (via N1/2 driver)
13	K613	Input signal, ENABLE (+ 12 VDC) Dynamo plus (D+) from F21 (5A) via relay K5/11 on print A12
15	F615	Output signal (digital) to driver N3/1 (Y18, 14 bar hydro-reservoir)
16	F616	Output signal (digital) to driver N3/1 (Y19, 40 bar hydro-reservoir)
17	N617	Input signal (digital) from RAISE external button S15/3 and RAISE button S2/15/6 in cab
19	N619	+ activation (pulse-width modulation) for valve solenoid Y17, LOWER function
20	L620	Ground supply: for operating controls R12/1 to R12/3 (potentiometers), for LOAD RELIEF stepping switch S13 and its resistor network (A17), for resistor network (A17) – signals (Multi-Controller) TRANSPORT/RAISE NEUTRAL LOWER/CONTROL
21	N621	Input signals (digital) for: TRANSPORT/RAISE, NEUTRAL and LOWER/CONTROL
22	F622	Input signal LOAD RELIEF setting, from stepping switch S13 (10 steps = 10 signal levels)

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Pin	Cable marking	Function
23	F623	Input signal (analog), LOWERING SPEED, from potentiometer R12/3
24	D624	Supply, + 15/Si (safety) for EFH box A55/2, from F14 (15 A)
25	F625	Input signal (analog), actual value, from position sensor B9/2 (front hitch)
28	L628	Supply, ground for EFH box A55/2, from ground connection 22
29	A629	Supply, + permanent for EFH box A55/2, from F45 (7.5 A)
31	N631	Output signal (digital) to N1/1 (DIAGNOSIS indicator H4/1 red)
35	L635	Ground to valve solenoid Y16, RAISE function
36	N636	Input signal (digital) from LOWER external button S14/3 and LOWER button S2/15/6 in cab
37	N637	+ activation (pulse-width modulation) for valve solenoid Y16, RAISE function
38	L638	Supply, ground from EFH box to: B21 (pressure sensor) and B9/2 (position sensor) as well as to valve solenoids Y18 (14 bar hydro-reservoir) and Y19 (40 bar hydro-reservoir)
39	H639	Supply, 9.5 VDC stabilised, for B21 (pressure sensor) and B9/2 (position sensor)
46	L646	Supply, ground from EFH box to print A17 for: N3/1(driver for Y18 and Y19) N1/1 (driver for H4/1 red DIAGNOSIS indicator) N1/2 (driver for H4/2 green LOAD RELIEF indicator)
47	A647	Supply, + permanent for EFH box, from F45 (7.5 A)
53	L653	Ground to valve solenoid Y17, LOWER function

The following pins are not used: 1, 5, 6, 7, 10, 11, 14, 18, 26, 27, 30, 32, 33, 34, 40 to 45, 48 to 52, 54 and 55.

Plug X55



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TROUBLESHOOTING USING THE DIAGNOSTIC SYSTEM

General

If, in the event of an EFH failure, fault codes are indicated by the DIAGNOSIS indicator, the ”troubleshooting by measuring” area can already be restricted to certain sections (see Circuit Diagram, Chapter 4003). However, if in doubt, the supply to the EFH box (test values: see page 43) should always be checked first.

NOTE: *Correct measurement results are only ensured when the test conditions are met.*

Test conditions

Symbol	Meaning of symbol
	Ignition switch S1 in position ”0”
	Ignition switch S1 in position ”1”
	Engine is running and charging indicator lamp has gone out
X..	Plug designation
Pin	Pin on specified plug
	E-box connected to cable harness
	E-box disconnected from cable harness
	Test lamp with prescribed wattage (connect as a load)

Measuring procedure (example)

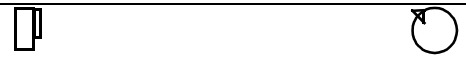
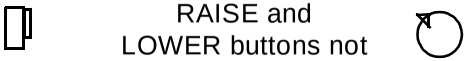
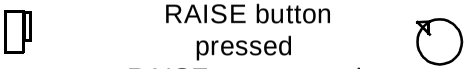
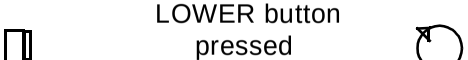
Insert 'Y' adapter 1TSW 528-36 (55-pole) between EFH box A55/2 and its mating connector (cable harness). Connect the 'Y' adapter to diagnostic box 1TSW 528-1. Plug the measuring cables (1TSW528-11) into the multimeter sockets according to the measured variable, e.g. voltage (U). Select the measured variable and measuring range on the multimeter. Insert the other end of the measuring cables into two suitable pin jacks (see measuring step). Observe the measurement requirements, read off and note the measured value and compare it with the specified value.

Parts of the diagnostic system required

Tool No.	Designation	Use
1TSW 528-1	Diagnostic box, 100-pole	General
1TSW 528-36	55 pole 'Y' adapter	EFH electronics box
1TSW 528-33	3 pole 'Y' adapter	Pressure sensor, position sensor
1TSW 528-6	2 pole 'Y' adapter, square	Solenoid of EFH control valve, as well as solenoid valves Y18 and Y19
1TSW 528-84	'Y' adapter for Molex plug incl. foil for diagnostic box	Print A17
1TSW 528-11	2 measuring cables, 1.5 m	General
1TSW 528-2	Test lamp 5 to 35 W	For loading supply lines
1TSW 516	Multimeter set	General

Designation	**A55/2 X55** pin	Cable colour and No.	Meas. variable	Requirements	**A55/2 X55**	Measurement from pin to pin	**A55/2 X55**	Measured value
Supply, EFH box A55/2				apply load using test lamp				
+ permanent, from A14 fuse F45 (7.5 A)	29	A629	U	45W	29	+ → ⊥	28	12 - 14 VDC
+ permanent, from A14 fuse F45 (7.5 A)	47	A647	U	45W	47	+ → ⊥	28	12 - 14 VDC
+ potential 15/Si from A12 fuse F14 (15 A)	24	D624	U	45W	24	+ → ⊥	28	12 - 14 VDC
Ground from neg. pole of the battery via ground connection 22 (right of ECCU box)	28	L628		45W	29	+ → ⊥	28	
			U		28	⊥ → ⊥	Batt.	0 - 0.5 VDC
D+ from A12, F21 (K5/11)	13	K613	U	21W	13	+ → ⊥	28	12 - 14 VDC
Supply: + 9.5 VDC, stabilised, and ground, from EFH box A55/2 for the following control elements: Potentiometer R12/1 to R12/3, stepping switch S13 and two resistor chains on print A17								
Ground from EFH box	20	L620	U		20	⊥ → ⊥	28	0 - 0.3 VDC
Plus 9.5 VDC stabilised	2	H602	U		2	+ → ⊥	20	9.5 VDC
Plus 9.5 VDC stabilised	2	H602	R		2	→	20	> 330 Ω
Plus 9.5 VDC stabilised	2	H602	R		2	→ ⊥	28	•
Ground supply, from EFH box A55/2 for: Pressure sensor B21, position sensor B9/2 and for valve solenoids Y18 and Y19								
Ground from E-box	38	L638	U		38	⊥ → ⊥	28	0 - 0.3 VDC
Ground supply, from EFH box A55/2 to print A17 for: N3/1(driver for Y18 and Y19) N1/1 (driver for H4/1 red DIAGNOSIS indicator) and N1/2 (driver for H4/2 green LOAD RELIEF indicator)								
Ground from E-box	46	L646	U		46	⊥ → ⊥	28	0 - 0.3 VDC

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Designation	A55/2 X55 pin	Cable colour and No.	Meas. variable	Requirements	A55/2 X55	Measure from pin to pin	A55/2 X55	Measured value
9.5 VDC supply, stabilised, from EFH box A55/2 for: Pressure sensor B21 and position sensor B9/2								
Plus 9.5 VDC stabilised	39	H639	U		39	+ → ⊥	38	9.5 VDC
Plus 9.5 VDC stabilised	39	H639	R		39	→	38	> 330 Ω
Plus 9.5 VDC stabilised	39	H639	R		39	→ ⊥	28	8 - 9 kΩ
Input signals (digital) at EFH Box A55/2 (from print A17), for the following functions: TRANSPORT/RAISE, NEUTRAL and LOWER/CONTROL								
Transport / Raise signal	21	N621	U		21	→ ⊥	28	approx. 6 VDC
Neutral signal	21	N621	U		21	→ ⊥	28	approx. 5.1 VDC
Control / Lower signal	21	N621	U		21	→ ⊥	28	approx. 2.7 VDC
Input signals (digital): from RAISE external button S15/3, from LOWER external button S14/3, and from RAISE/LOWER button S2/15/6 in the cab								
Supply* from E-box to buttons	9	H609	U	 RAISE and LOWER buttons not pressed	9	+ → ⊥	28	5 VDC
Signal, RAISE button S15/3 and S2/15/6	17	N617	U	 RAISE button pressed RAISE not pressed	17	+ → ⊥	28	approx. 3.3 VDC 0 VDC
Signal, LOWER button S14/3 and S2/15/6	36	N636	U	 LOWER button pressed LOWER not pressed	36	+ → ⊥	28	approx. 3.3 VDC 0 VDC
Input signal from stepping switch S13 (10 switching steps = 10 voltage levels VDC)								
Signal from stepping switch adjusting LOAD RELIEF	22	F622	U		22	+ → ⊥	28	Measurement values see next page

* On pressing a RAISE or LOWER button, the voltage of the supply (pin 9) has the same value as the signal voltage (approx. 3.3 VDC)

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LOAD RELIEF signal

Voltage level, stepping switch S13 (measured at print A17)

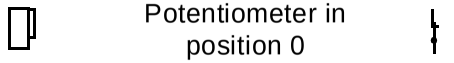
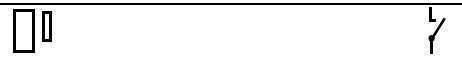
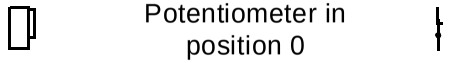
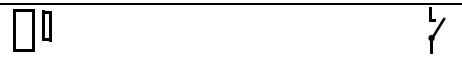
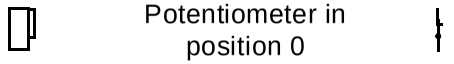
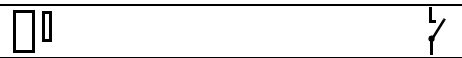
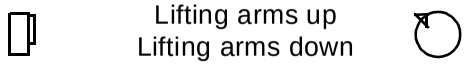
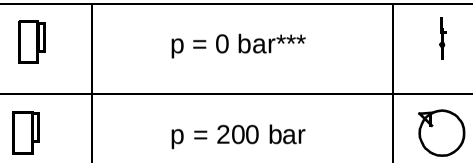
S13 Switch position	**S13** pin	Cable colour and No.	Meas. variable	Requirements	**A17 X24/7** pin	Measure from pin to pin	**A17 X24/7** pin	Measured value
0	1 (A)	L674	U	Switch S13 on print A17 connected (plug X14/13)	6	→ ⊥	11	0 VDC
1	2 (A)	N688	U		6	→ ⊥	11	approx. 1.5 VDC
2	3 (A)	N687	U		6	→ ⊥	11	approx. 2.8 VDC
3	4 (A)	N686	U		6	→ ⊥	11	approx. 3.9 VDC
4	5 (A)	N685	U		6	→ ⊥	11	approx. 4.8 VDC
5	6 (A)	N684	U		6	→ ⊥	11	approx. 5.7 VDC
6	7 (A)	N683	U		6	→ ⊥	11	approx. 6.5 VDC
7	8 (A)	N682	U		6	→ ⊥	11	approx. 7.2 VDC
8	9 (A)	N681	U		6	→ ⊥	11	approx. 8.0 VDC
9	10 (A)	N680	U		6	→ ⊥	11	approx. 8.7 VDC
10	11 (A)	H673	U		6	→ ⊥	11	approx. 9.6 VDC

General

- The voltage levels of the signal must have the same value at the EFH box, pin 22, as on print A17, plug X24/7, pin 6 or at stepping switch S13, pin A. If the value is not the same, proceed as follows:
- Disconnect all plugs on print A17.
- Measure the resistance between pins 11 and 3 on plug X24/7 on print A17. If both resistor chains, located parallel, are ok, then there is an equivalent resistance of approx. 2.5 kΩ.
- Connect plug X24/7 to print A17. Turn ignition switch S1 to position "1" so that print A17 is supplied with a stabilised voltage of 9.5 VDC by the EFH box. Print A17 can also be supplied by an external voltage source during a test.
  Plug X24/7 pin 3: 9.5 VDC stabilised, pin 11: Ground.
- Check the voltage level in accordance with the above table and circuit diagram 4003. Also check the voltage level at plug X14/13.

NOTE: *The voltage level of the signal is generated by a resistor chain on print A17 (see 4003, Circuit Diagram). Stepping switch S13 only provides the pick-off for the voltage level (X14/13) and forwards it to the EFH box, pin 22.*

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Designation	A55/2 X55 pin	Cable colour and No.	Meas. variable	Requirements	A55/2 X55	Measure from pin to pin	A55/2 X55	Measured value
Input signals (analog setpoints) from operating controls (potentiometers R12/1 to R12/3)								
Lift limitation potentiometer (upper limit) R12/1								
Signal from potentiometer R12/1	3	F603	U	 Potentiometer in position 0 Position 10	3	→ ⊥	28	0 VDC 9.5 VDC
Resistance of potentiometer (nominal)			R			→		4k7± 20%
Mixed control potentiometer R12/2								
Signal from potentiometer R12/2	4	F604	U	 Potentiometer in position 0 Position 10	4	→ ⊥	28	0 VDC 9.5 VDC
Resistance of potentiometer (nominal)			R			→		4k7± 20%
Lowering speed potentiometer R12/3								
Signal from potentiometer R12/3	23	F623	U	 Potentiometer in position 0 Position 10	23	→ ⊥	28	0 VDC 9.5 VDC
Resistance of potentiometer (nominal)			R			→		4k7± 20%
Input signals* (analog actual values) from position sensor (front hitch) B9/2 and from pressure sensor B21								
Signal from position sensor B9/2	25	F625	U	 Lifting arms up Lifting arms down	25	→ ⊥	28	approx. 7.1 VDC approx. 2.4 VDC
Signal** from pressure sensor B21	8	F608	U	 p = 0 bar***	8	→ ⊥	28	approx. 2.4 VDC
				p = 200 bar				approx. 7.1 VDC

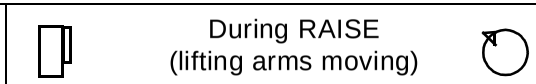
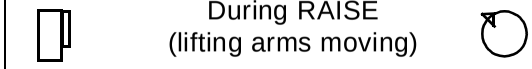
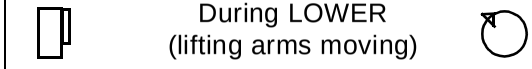
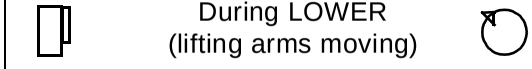
NOTE: *Check the potentiometer for interruption over the entire adjusting range.*

* The residual ripple of the signals may only lie in the milli-volt alternating voltage (mVAC) range. E.g.: Position sensor residual ripple <10mVss

** Prerequisite: Supply voltage of sensor 9.5 VDC (see pressure sensor page 23)

*** Front hitch unloaded: Lower lifting arms completely, switch engine off and then turn ignition switch to position 1.

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Designation	**A55/2 X55** pin	Cable colour and No.	Meas. variable	Requirements	**A55/2 X55**	Measure from pin to pin	**A55/2 X55**	Measured value
Activation of RAISE valve solenoid Y16 (digital output) pulse-width modulation								
Plus for Y16	37	N637	U	 During RAISE (lifting arms moving)	37	→ ⊥	35	0 - 3.2 VDC
Ground * for Y16	35	L635	U	 During RAISE (lifting arms moving)	35	→ ⊥	28	max.0.3 VDC
Ends of solenoid coil Y16	35 and 37	N635 and L637	R		37	→	35	1.8 Ω± 10%
Ends of solenoid coil Y16	35 or 37	N635 or L637	R		35 or 37	→	28	•
Activation of LOWER valve solenoid Y17 (digital output) pulse-width modulation								
Plus for Y17	19	N619	U	 During LOWER (lifting arms moving)	19	→ ⊥	53	0 - 2.8 VDC
Ground** for Y17	53	L653	U	 During LOWER (lifting arms moving)	53	→ ⊥	28	max.0.22 VDC
Ends of solenoid coilY 17	19 and 53	N619 and L653	R		19	→	53	1.8 Ω± 10%
Ends of solenoid coil Y17	19 or 53	N619 or L653	R		19 or 53	→	28	•

* Pin 35 is ground **in front of** the precision resistor in the EFR box, between pins 35 and 28.

** Pin 53 is ground **in front of** the precision resistor in the EFR box, between pins 53 and 28.

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Designation	A55/2 X55 pin	Cable colour and No.	Meas. variable	Requirements	A55/2 X55	Measure from pin to pin	A55/2 X55	Measured value
Output signal (digital) to N1/1 driver, DIAGNOSIS indicator H4/1 (red)								
Signal, indicator lamp DIAGNOSIS H4/1	31	N631	U	Indicator lights up Indicator does not light up	31	→ ⊥	28	approx. 5 VDC approx. 0 VDC
Output signal (digital) to N1/2 driver, LOAD RELIEF indicator H4/2 (green)								
Signal, indicator lamp LOAD RELIEF H4/2	12	N612	U	Indicator lights up Indicator does not light up	12	→ ⊥	28	approx. 5 VDC approx. 0 VDC
Output signal (digital) to driver N3/1 for triggering valve solenoid Y18 (14 bar hydro-reservoir)								
Signal to driver	15	F615	U	N3/1 triggered N3/1 not triggered	15	→ ⊥	28	11 - 12 VDC approx. 0 VDC
Output signal (digital) to driver N3/1 for triggering valve solenoid Y19 (40 bar hydro-reservoir)								
Signal to driver	16	F616	U	N3/1 triggered N3/1 not triggered	16	→ ⊥	28	11 - 12 VDC approx. 0 VDC
Output signal (digital) for triggering valve solenoid Y18 (14 bar hydro-reservoir) for driver N3/1								
	A17 X24/7				**A17 X24/7**		**A55/2 X55**	Measured value
Control Y18	14	N661	U	Y18 energised Y18 not energised	14	→ ⊥	38	12 - 13 VDC approx. 0 VDC
Ends of solenoid coil Y18	14	N661	R		14	→	38	8.5 Ω ± 10%
Output signal (digital) for triggering valve solenoid Y19 (40 bar hydro-reservoir) for driver N3/1								
Control Y19	13	N662	U	Y19 energised Y19 not energised	13	→ ⊥	38	12 - 13 VDC approx. 0 VDC
Ends of solenoid coil Y19	13	N662	R		13	→	38	8,5 Ω ± 10%

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