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B25C Mk II 6 X 6 and 6 X 4

ARTICULATED DUMP TRUCK

OPERATORS MANUAL

Document Part Number 872203

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TO THE OPERATOR

▲ WARNING

Do not operate the machine unless you have read this manual and fully understand how to operate the machine properly.

The safe operation of your **BELL EQUIPMENT** machines very important to prevent any personal injury and/or damage. This manual must be read and fully understood before operating or carrying out any maintenance on your **BELL EQUIPMENT** machine.

SAFETY SYMBOL

The following safety symbol is used for all safety messages. When you see the safety symbol, follow the safety message to avoid personal injury or death.

WARNINGS and **CAUTIONS** must be read, fully understood and followed, before carrying out the action or maintenance procedure concerned.

WARNINGS and **CAUTIONS** are always placed before any action or maintenance procedure where personal injury and/or damage to the machine could occur if that action or maintenance procedure is not carried out correctly.



WARNING AND CAUTION SYMBOL

Throughout this manual the word **WARNING** is used to alert the operator and others of the risk of personal injury during the operation of the equipment. **CAUTION** indicates the possible damage to the machine. **NOTE** highlights information of special interest.

▲ CALIFORNIA PROPOSITION 65 WARNING

Diesel engine exhaust and some of its constituents are known to the state of California to cause Cancer, birth Defects and other Reproductive Harm.



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B25C 6X6 ARTICULATED DUMP TRUCK OPERATORS MANUAL

THIS MANUAL IS APPLICABLE TO

**B25C 6X4 Mk II (409811.01)
B25CE 6X6 Mk II (409812.01)**

Document Part Number 872203

Issue: 0
(September 2001)

Technical Documentation
BELL EQUIPMENT COMPANY
Richards Bay

IMPORTANT

Due to **BELL EQUIPMENT'S** policy of continuous product improvement, the information contained in this manual was correct up to the time of printing (Issue date of manual). Any changes after this date will only be included in the next update of this manual.

The illustrations in this manual are pictorial and not necessarily true representations of components. Photographs and illustrations may show optional equipment.

INTRODUCTION

This manual has been produced to assist you in the correct operation, maintenance and care of your **BELL EQUIPMENT** machine.

This manual is divided into chapters. The information contained in the manual is in logical sequence, with the instructions written in step by step format.

Effective maintenance on your **BELL EQUIPMENT** machine is achieved when personnel fully understand the information contained in this manual.

Every effort has been made to ensure that the information contained in this manual was correct at the time of publication. **BELL EQUIPMENT Co.** has a policy of continuous product development, improvement, and design. **BELL EQUIPMENT Co.** reserves the right to change, amend and update the design of its product at any time without prior notice. With this policy, changes may have occurred that are not included in this manual.

Whilst every endeavour has been made to provide accurate and reliable information, **BELL EQUIPMENT Co.** specifically disclaims any actual or implied warranty and under no circumstances shall be liable for any loss, damage or injury to person or property suffered, whether direct, indirect or consequential, arising from the use of this manual. In particular and without detracting from above, the disclaimer also applies in the event of any specification, warning, or representation contained in this manual being inadequate, inaccurate, or unintentionally misleading.

The user is urged to strictly comply with the instructions and warnings that are given in the interests of general safety. Please do not hesitate to contact your **BELL EQUIPMENT** Product Support Representative whenever you have a query on your **BELL EQUIPMENT** product or this manual.

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Please supply your dealer details here:

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USER'S COMMENT FORM

Should you, as user of this manual, have any suggestion for improving the manual, or you find any errors or omissions, then we would like to know.

Please complete a facsimile of this form and hand it in to your nearest **BELL EQUIPMENT** Product Support Representative or post it directly to your nearest **BELL EQUIPMENT** Branch. Addresses are given at the beginning of this manual.

YOUR COMMENTS,SUGGESTIONS OR QUERIES

MACHINE MODEL:
SERIAL NUMBER:
VIN:
DOCUMENT PART NUMBER AND ISSUE:
PAGE NUMBER:

DOES THE MANUAL MEET YOUR NEEDS?	YES	NO
DID YOU FIND THE INFORMATION ACCURATE?	YES	NO
DID YOU FIND THE INFORMATION EASY TO READ AND UNDERSTAND?	YES	NO
DID YOU FIND THE INFORMATION EASY TO RETRIEVE?	YES	NO
DID YOU FIND THE INFORMATION WELL ILLUSTRATED?	YES	NO

NAME:
COMPANY:
TITLE:
ADDRESS:
TELEPHONE NUMBER:

Thank you for your co-operation.

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ABBREVIATION LIST

The table below lists the abbreviations used in this manual:

Abbreviation	Meaning
°C	degrees Celsius
°F	degrees Fahrenheit
A	ampere
ADT	Articulated Dump Truck
Ah	ampere hours
CB	circuit breaker
d	diagnostic
D	drive
DNS	Do Not Shift
ECU	Electronic Control Unit
FOPS	Falling Objects Protective Structure
ft	foot (feet)
ft lb	foot pound
HP	Horsepower
ISO	International Standards Organisation
kg	kilogram
km	kilometre
km/hr	kilometres per hour
kPa	kilopascal
kW	kilowatt
lb	pound
LCD	Liquid Cristal Display
LED	Light Emitting Diode

Abbreviation	Meaning
m	metre
m ³	cubic metre
N	Neutral
mph	miles per hour
MSDS	Material Safety Data Sheet
Nm	Newton metre
psi	pounds per square inch
PTO	Power Take-Off
R	Reverse
rev/min	revolutions per minute
ROPS	Roll Over Protective Structure
SMR	Service Meter Reading
USGAL	United States Gallon
V	Volt
yd ³	cubic yard

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SAFETY

Material Safety Data Sheets (MSDS)

The Federal Occupational, Safety and Health Administration (OSHA) Standard 29 CFR 1910.1200 and in some cases, State and Local Right-to-Know laws, may require that specific **MSDS** be available to the employees prior to operating this equipment. This may include information on substances contained in this equipment such as antifreeze, engine oil, battery acid, hydraulic fluid and freon (if equipped with an air conditioner).

BELL EQUIPMENT USA Inc. will provide, at no cost, Material Safety Data Sheets which are applicable to its product line. Simply request them from your local **BELL EQUIPMENT** dealer.

To ensure a prompt response, please be sure to include your return address and ZIP (postal) code, along with the model, serial number and/or **VIN** number of your machine.

Unauthorised Modifications of the Roll Over Protective Structure (ROPS) and the Falling Objects Protective Structure (FOPS)

Do not make unauthorised modifications or alterations to the ROPS and FOPS such as: welding on extinguisher brackets, CB aerial brackets, fire suppression systems etc. Unauthorised modifications will affect the structural limits of the ROPS and FOPS and will void the certification.

The Roll Over Protective Structure has been certified to meet specified test requirements according to SAE J1040 and ISO 3471. The Falling Objects Protective Structure has been certified to meet specified test requirements according to SAE J231 and ISO 3449.

Any planned modification or change must be reviewed in advance by the **BELL EQUIPMENT Engineering Department** to determine if the modification or change can be made within the limits of the certifying tests. It is important that each person in your organisation, including management, be made fully aware of these rules involving **ROPS** and **FOPS**. Whenever anyone sees unauthorised modifications or changes to a machine's **ROPS** or **FOPS** both the customer and manufacturer must be notified in writing.

Make sure that all parts are installed correctly if the **ROPS** or **FOPS** is loosened or removed for any reason. Tighten mounting bolts to the correct torque. The protection offered by **ROPS** or **FOPS** will be impaired if they are subjected to structural damage, is involved in an overturn incident, or is altered in any way. A damaged **ROPS** or **FOPS** must be replaced, not reused.

Noise Emission Levels

The sound pressure was tested according to ISO 6394 (SAE J 2103) and the sound power was tested according to ISO 6393 (SAE J 2102).

General Safety

Safety Regulation

Every country (State) has its own safety regulations. It is the obligation of the operator to know and follow these. This also applies to local regulations covering different types of work. Should the recommendations in this manual deviate from those of your country, your local safety regulations should be followed.

Mounting and Dismounting the Machine

Always use the handrails and steps provided to get on and off the machine. Use both hands and face the machine. Never get on or off a moving machine. Never jump off the machine. Use a hand line to pull equipment up onto the platform, do not climb on or off the machine carrying tools or supplies.

Avoid Power Lines

Never move any part of the machine within 3 m (10 ft) plus twice the line insulator length, as serious injury or death may result.

Keep Riders Off the Machine

Do not allow unauthorised personnel on the machine.

Prepare for Emergencies

Keep a first aid kit and fire extinguishers handy and know how to use them. Inspect and have your extinguisher serviced as recommended on its instruction plate. Keep emergency numbers for doctors, ambulance service, hospital and fire department near your telephone.

Handle Flammable Fluids Safety

Handle fuel with care, as it is highly flammable. Do not smoke or go near an open flame or sparks while refueling. Always stop the engine before refueling the machine and fill the fuel tank outdoors.

Keep all fuels and lubricants in properly marked containers and away from all unauthorised persons. Do not smoke in the storage areas.

Store oily rags and other flammable material in a protective container, in a safe place.

Do not weld or flame cut pipes or tubes that have contained flammable fluids. Clean them thoroughly with nonflammable solvent before welding or flame cutting them.

Starting fluid is highly flammable. Keep all sparks and flames away when using it. To prevent accidental discharge when storing the pressurised can, keep the cap on the can and store it in a cool protected place. Do not burn or puncture a starting fluid container.

Clean the Machine Regularly

Wait until the engine has cooled before removing trash from areas such as the engine, radiator, batteries, hydraulic lines, fuel tank and operators cab. Remove any grease, oil or debris build-up. Keep the machine, especially the walkways and steps, free of foreign material, such as debris, oil, tools and other items which are not part of the machine.

Prevent Battery Explosions and Acid Burns

The standard battery supplied with the machine is a sealed type that does not need maintenance. Keep sparks and flames away from the batteries.

If a non-sealed battery is subsequently installed, keep sparks and flames away from the batteries. Use a flashlight to check the battery electrolyte level. Use a voltmeter or hydrometer to check battery charge. Never place a metal object across the posts. Always remove the grounded (Negative -) battery clamp first and replace it last.

Do not smoke in areas where batteries are being charged.

Sulphuric acid in battery electrolyte is poisonous and is strong enough to burn skin, eat holes in clothing and cause blindness if splashed into the eyes.

Avoid the hazard by:

- Filling the batteries in a well ventilated area.
- Wearing eye protection and rubber gloves.
- Avoid breathing fumes when electrolyte is added.
- Avoid spilling or dripping electrolyte.

If you spill acid on yourself:

- Flush your skin with water.
- Apply baking soda or lime to help neutralise the acid.
- Flush your eyes with water for 10 - 15 minutes and get medical attention immediately.

If acid is swallowed:

- Drink large amounts of water or milk.
- Then drink milk of magnesia, beaten eggs, or vegetable oil.
- Get medical attention immediately.

Wear Protective Clothing

Wear a hard hat, protective glasses and other protective equipment as required by the job conditions. Do not wear loose clothing or jewellery that can catch on controls or other parts of the machine.

When you drive connecting pins in or out, guard against injury from flying pieces of debris by wearing goggles or protective glasses. Prolonged exposure to loud noise can cause impairment or loss of hearing. Wear a suitable hearing protective device such as earmuffs or earplugs. Wear gloves when handling wire rope cable.

Use the Seat Belt

Use a seat belt at all times to minimise the chance of injury in an accident.

The seat belt must not be altered or modified in any way. Such changes can render the belt ineffective and unsafe.

The seat belt is designed and intended for the seat's occupant to be of adult build and for one occupant of the seat only.

Avoid High Pressure Fluids

Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve the pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks.

If any fluid is injected into the skin it must be surgically removed within a few hours by a doctor who is familiar with this type of injury or gangrene may result.

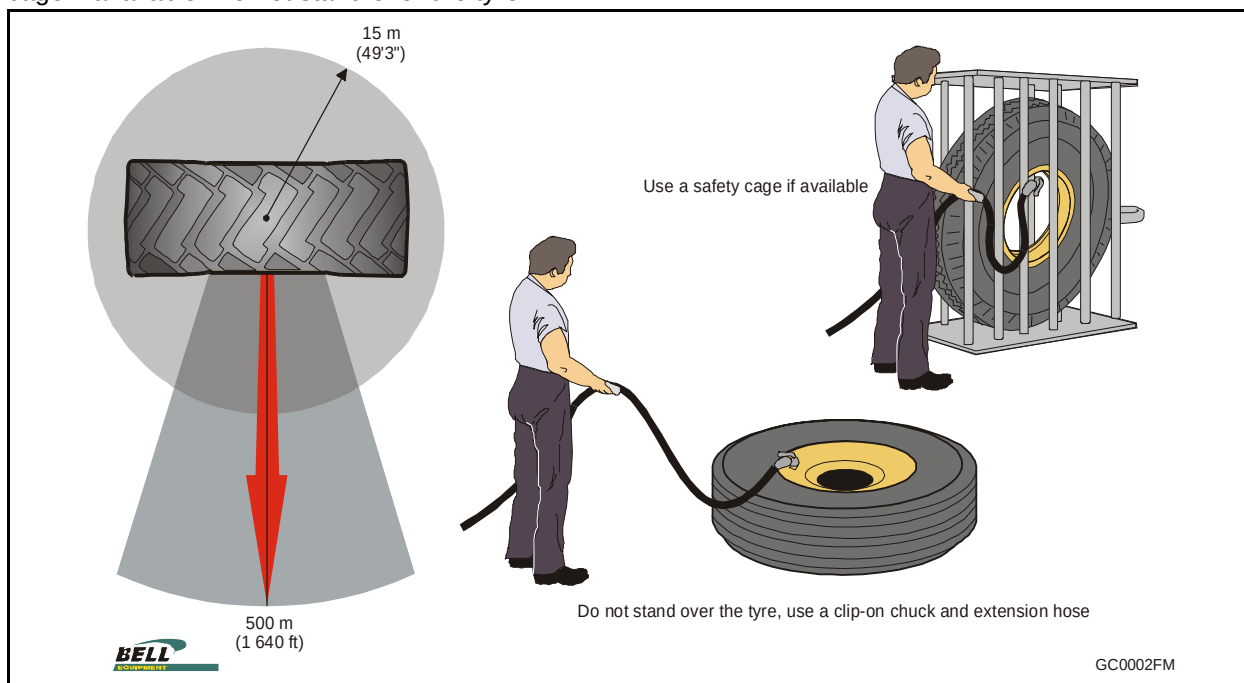
Tyre Information

Welding or heating of the rim components, external fire or excessive use of brakes can cause overheating of the tyres, which could cause a tyre explosion.

This explosion can propel the tyre, rim and final drive components approximately 500 metres (1 640 ft) from the machine, which may cause personal injury or death and/or property damage.

If the tyre is overheating and could explode, do not approach it within the area represented by the shaded area in the drawing, until it has cooled.

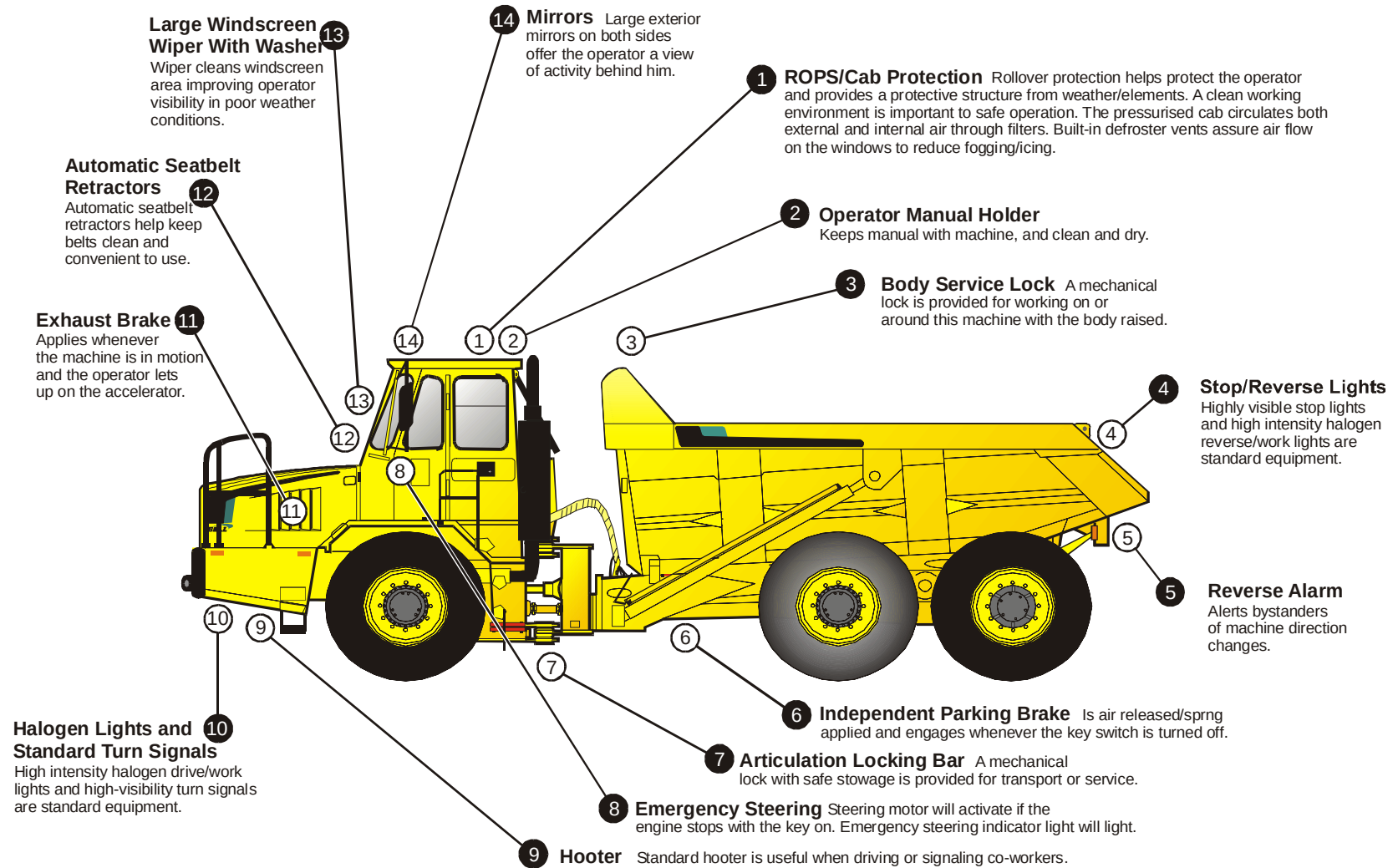
Stand behind the tread and use a self attaching chuck with extension hose to inflate the tyres. Use a safety cage if available. Do not stand over the tyre.



NOTE: It is recommended that only trained personnel service and change tyres and rims.

BELL ARTICULATED DUMP TRUCK SAFETY FEATURES

Please remember, the **operator** is the key to preventing accidents.



GC0003CFM

SAFETY DECALS

There are several safety decals on your **BELL EQUIPMENT** machine. Their exact location and description of the hazard are reviewed in this section. Please take the time to familiarise yourself with these safety decals.

Keep the decals clean by using a soft cloth, water, and soap. Do not use solvent, gasoline, etc. You must replace a decal if it is damaged, missing or cannot be read. If a decal is on a part that is replaced, ensure a new decal is installed on the replacement part. Contact your **BELL EQUIPMENT** Representative for new decals.



Located on the reverse light plate and on the right and left rear of the bin.



Located on the both sides of the machine, near the bin prop.



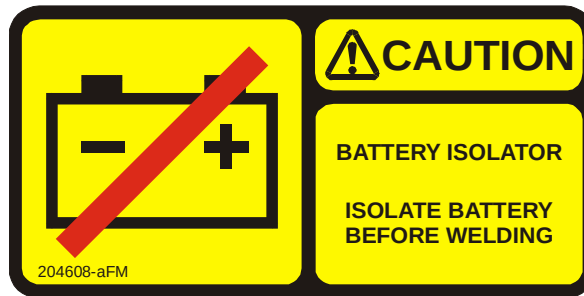
Located on the two air tanks



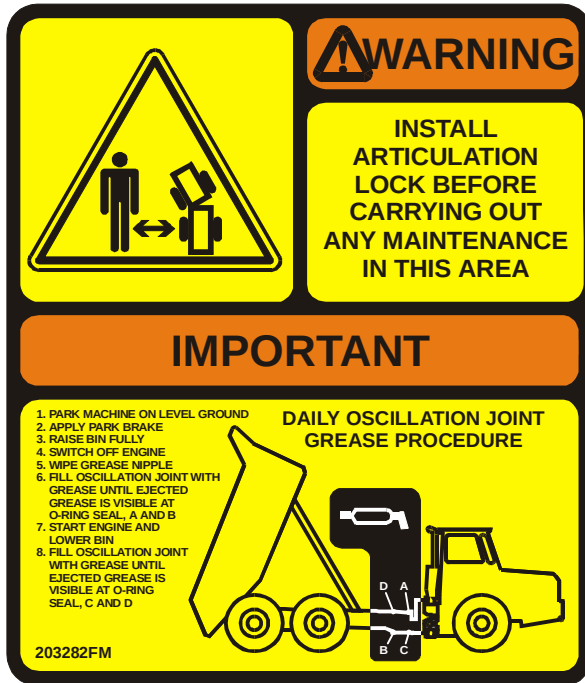
Located inside the cab on the dashboard.



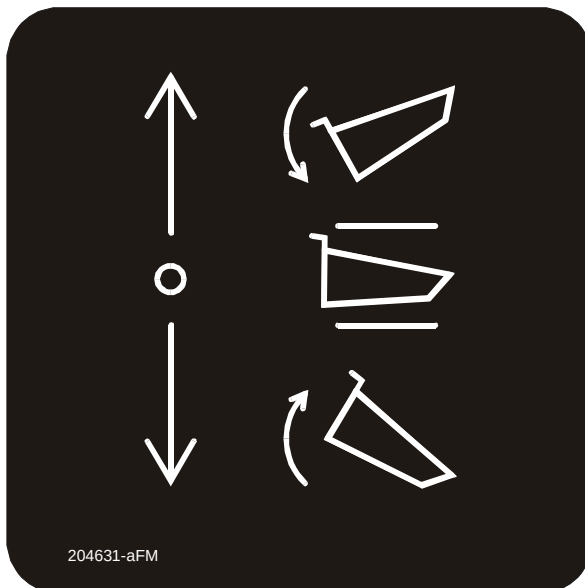
Located on the park brake actuator.



Located in the battery box, near the isolator switch.



Located on both sides of the articulation joint.



Located inside the cab at the bin tip lever.



Located on ten greasing points on the machine.

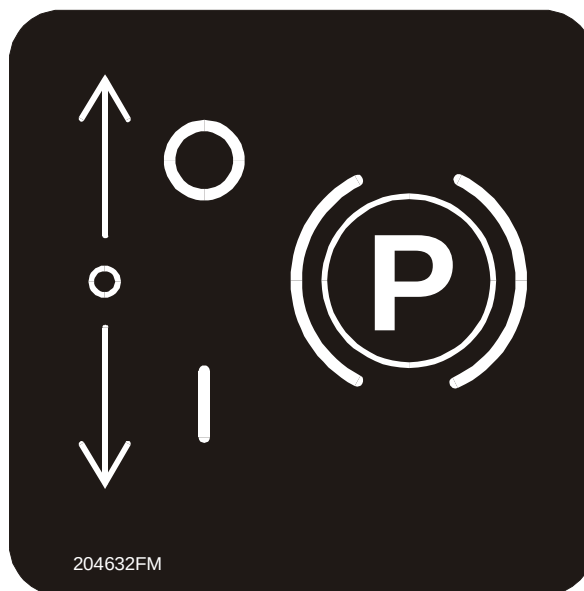


Located at the front and rear lifting points and on the tie down points of the machine.

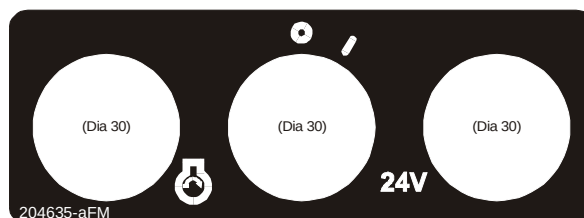


Located inside the PM pack wallet.

Located inside the cab at the ignition switch.



Located inside the cab at the park/emergency brake.



Located inside the cab at the ignition switch.

TYRE PRESSURE B25C 6x6									
MAKE	MODEL	SIZE	FRONT		MIDDLE		REAR		
			kPa	PSI	kPa	PSI	kPa	PSI	
BRIDGESTONE	VKT	20.5R25	425	69	470	69	470	69	
GOODYEAR	RL-2+	20.5R25	425	68	470	68	470	68	
BRIDGESTONE	VKT	23.5R25	310	54	325	47	325	47	
GOODYEAR	RL-2+	23.5R25	310	51	325	51	325	51	
MICHELIN	XADT/XADN	20.5R25**177B	350	51	375	54	375	54	
MICHELIN	XADT	23.5R25**185B	250	36	275	40	275	40	

203292FM

PAYLOAD: 23 000 kg (50 600 lbs)

Located at the articulation joint.

TYRE PRESSURE B25C 6x4									
MAKE	MODEL	SIZE	FRONT		MIDDLE		REAR		
			kPa	PSI	kPa	PSI	kPa	PSI	
BRIDGESTONE	VKT	20.5R25**E2	425	62	470	68	470	68	
GOODYEAR	RL-2+	20.5R25**177B	425	62	470	68	470	68	
MICHELIN	XADT/XADN	20.5R25**177B	350	51	375	54	375	54	

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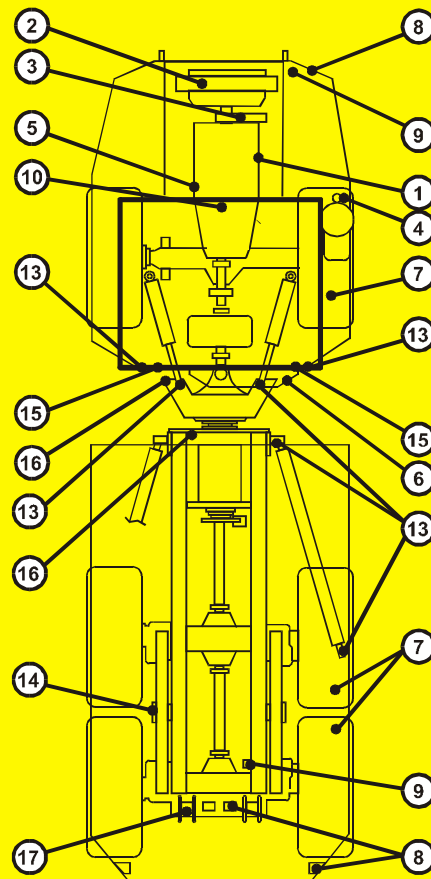
PAYLOAD: 23 000 kg (50 600 lbs)

Located at the articulation joint.

IMPORTANT**⚠ WARNING**

THIS MAINTENANCE SCHEDULE IS SUPPLEMENTARY TO AND DOES NOT REPLACE THE MAINTENANCE SCHEDULE PROVIDED IN THE OPERATORS AND MAINTENANCE MANUAL.

POSITION	DESCRIPTION	ACTION	COMMENTS
DAILY CHECKS			
01	ENGINE OIL LEVEL		NOTE 1
02	ENGINE COOLANT		NOTE 1
03	DRIVE BELTS		VISUAL
04	AIR-FILTER / INDICATOR		NOTE 1
05	TRANSMISSION OIL LEVEL		NOTE 1
06	HYDRAULIC FLUID LEVEL		NOTE 1
07	TYRES		NOTE 3
08	LIGHTS (INTERIOR / EXTERIOR)		VISUAL
09	HOOTER/REVERSE ALARM		SOUND
10	OPERATOR CONTROLS/ INSTRUMENTS		VISUAL
11	OIL, AIR & FUEL LEAKS		NOTE 2
12	LOOSE OR DAMAGED COMPONENTS		VISUAL
DAILY LUBRICATION			
13	TIP & STEERING CYLINDERS		NOTE 1
14	WALKING BEAM PIVOT		NOTE 1
15	FRONT CRADLE PIVOT		NOTE 1
16	OSCILLATION / ARTICULATION JOINT		NOTE 3
17	BIN PIVOT PINS		NOTE 1
NOTE 1: REFER TO SPECIFICATIONS IN THE OPERATORS AND MAINTENANCE MANUAL			
NOTE 2: REFER TO MAINTENANCE IN THE OPERATORS AND MAINTENANCE MANUAL			
NOTE 3: REFER TO MACHINE INSTRUCTION DECAL			
KEY:		 CHECK LEVEL	 CHECK LEVEL
 CHECK	 LUBRICATE	 CHECK LEVEL	



205180-FM

DAILY LUBRICATION AND MAINTENANCE SCHEDULE B17-B30 C#

On the side of the cab, near the entrance.

LEFT BLANK INTENTIONALLY

BULLETINS

Record the relevant information from the Technical Documentation Bulletins, Service Bulletins and Parts Bulletins into this manual as follows:

- Ensure the manual number (87-----) reflected in the bulletin is the same as the 87----- number at the top of the main content pages.
- Carry out the instructions as detailed in the bulletin.
- Record the required information below.
- File the bulletins in numerical order in a suitable 3 or 4 ring binder.

[illegible]

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CHAPTER 1. SPECIFICATIONS

MACHINE SPECIFICATIONS

The specifications for the B25C ADT 6X6 and 6X4 are as follows:

Engine

Model - - - - - OM 366 LA
 Configuration - - - - - Six-cylinder, In-line
 Aspiration - - - - - Turbocharged and intercooled
 Injection type - - - - - Direct
 Nett power - - - - - 185 kW (248 HP) @ 2 500 rev/min
 Idle speed - - - - - 700 ± 20 rev/min
 Engine Stall Speed - - - - - 2710 ± 50 rev/min
 Oil Pressure - - - - - 0,6 Bar @ Idle

Transmission

Model - - - - - Allison MD 3560P

Transfer Case (Drop Box)

Model - - - - - 9100

Axles

Model - - - - - BELL EQUIPMENT

Brakes

Service Brake

Type - - - - - Dual Circuit, hydraulic, dry disc brakes on all wheels
 Caliper type - - - - - Self-adjusting

Emergency/Park Brake

Type - - - Spring applied, air released, self-adjusting, mechanical caliper on drive-line mounted dry disc

Wheels (B25C 6x4)

Tyre size - - - - - 20,5 R 25
 Wheel nut torque - - - - - 650 N·m (480 ft lb)

Wheels (B25C 6x6)

Tyre size - - - - - 23,5 R 25
 Wheel nut torque - - - - - 650 N·m (480 ft lb)

Suspension System

Front

Type - - - - - Air bag, shock absorber with rubber stop

Rear

Type - - - - - Walking beam, sandwich blocks with rubber stops

Hydraulic System

Type - - - - - Load sensing

Pump

Model - - - - - A10 VO 60

Steering System

Type ----- Articulated with two double -acting, hydraulic cylinders
 Number of turns to lock ----- -4,3

Pneumatic System

Reservoir capacity ----- 35 litres (9.25 USGAL)

Electrical System

Voltage ----- 24 V
 Battery Type----- 2 X 12 V, maintenance-free
 Battery capacity ----- 100 Ah
 Starter motor capacity ----- 4 kW
 Alternator voltage rating----- 24 V
 Alternator amperage rating ----- 55 A

Power Ratings (bulbs)

Headlight ----- 24 V 75/70W
 Front park light ----- 24 V 2 W
 Front indicator light ----- 24 V 21 W
 Number plate light----- 24 V 5 W
 Stop/tail light----- 24 V Diode Light Unit
 Rear indicator light ----- 24 V Diode Light Unit
 Reverse light ----- 24 V 21 W
 Interior light ----- 24 V 18 W

Frame and Body**Cab**

Type ----- -FOPS (SAE J231/ISO 3449)/ROPS (SAE J1040/ISO 3471/1)

Bin

Type ----- - Manufactured from high tensile wear and impact resistant alloy steels
 Rated payload ----- 23 000 kg (50706 lb)
 Capacity----- 11.2 m³ (14.6 yd³) struck, 13.9 m³ (18.2 yd³) heaped
 Tip cylinders ----- 2 X Single stage, double acting
 Tipping angle ----- 70°
 Bin raise time ----- 15 seconds
 Bin lower time----- 8 seconds

Mass (B25C 6X4)

Total mass, empty ----- 15 286 kg (33 700 lb)
 Total mass, fully laden ----- 38 286 kg (84 407 lb)

Mass (B25C 6X6)

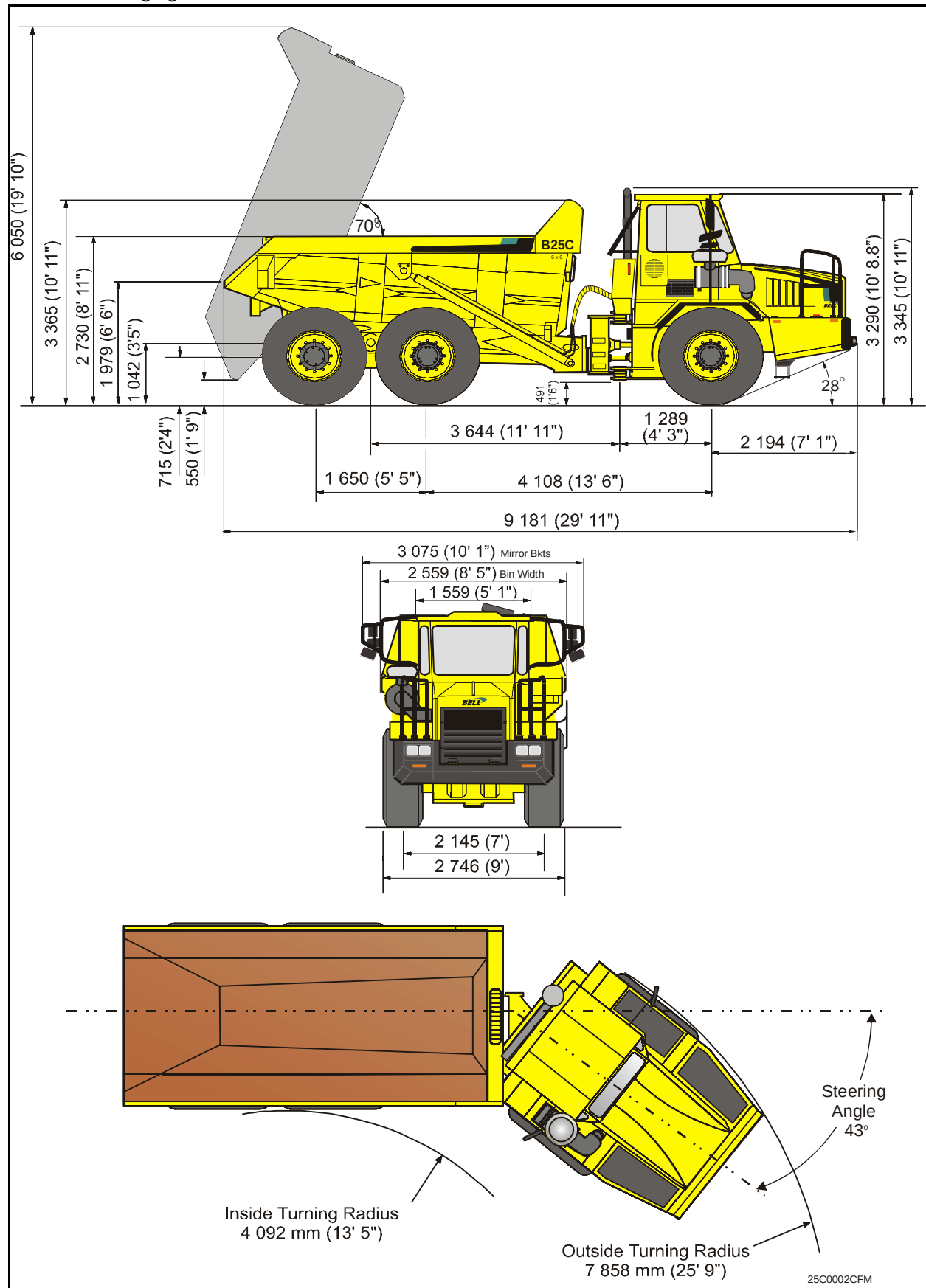
Total mass, empty ----- 16 118 kg (35 534 lb)
 Total mass, fully laden ----- 39 118 kg (86 240 lb)

Service Capacities

Fuel----- 240 litres (63.6 USGAL)
 Engine oil----- 20 litres (5.3 USGAL)
 Engine coolant ----- 60 litres (15.9 USGAL)
 Transmission fluid (initial fill) ----- 25 litres (7.95 USGAL)
 Transmission fluid (refill) ----- 18 litres (4.2 USGAL)
 Hydraulic reservoir ----- 80 litres (21 USGAL)
 Axle oil----- 40 litres (10.5 USGAL)
 Final drive oil ----- 2 litres (0.5 USGAL)

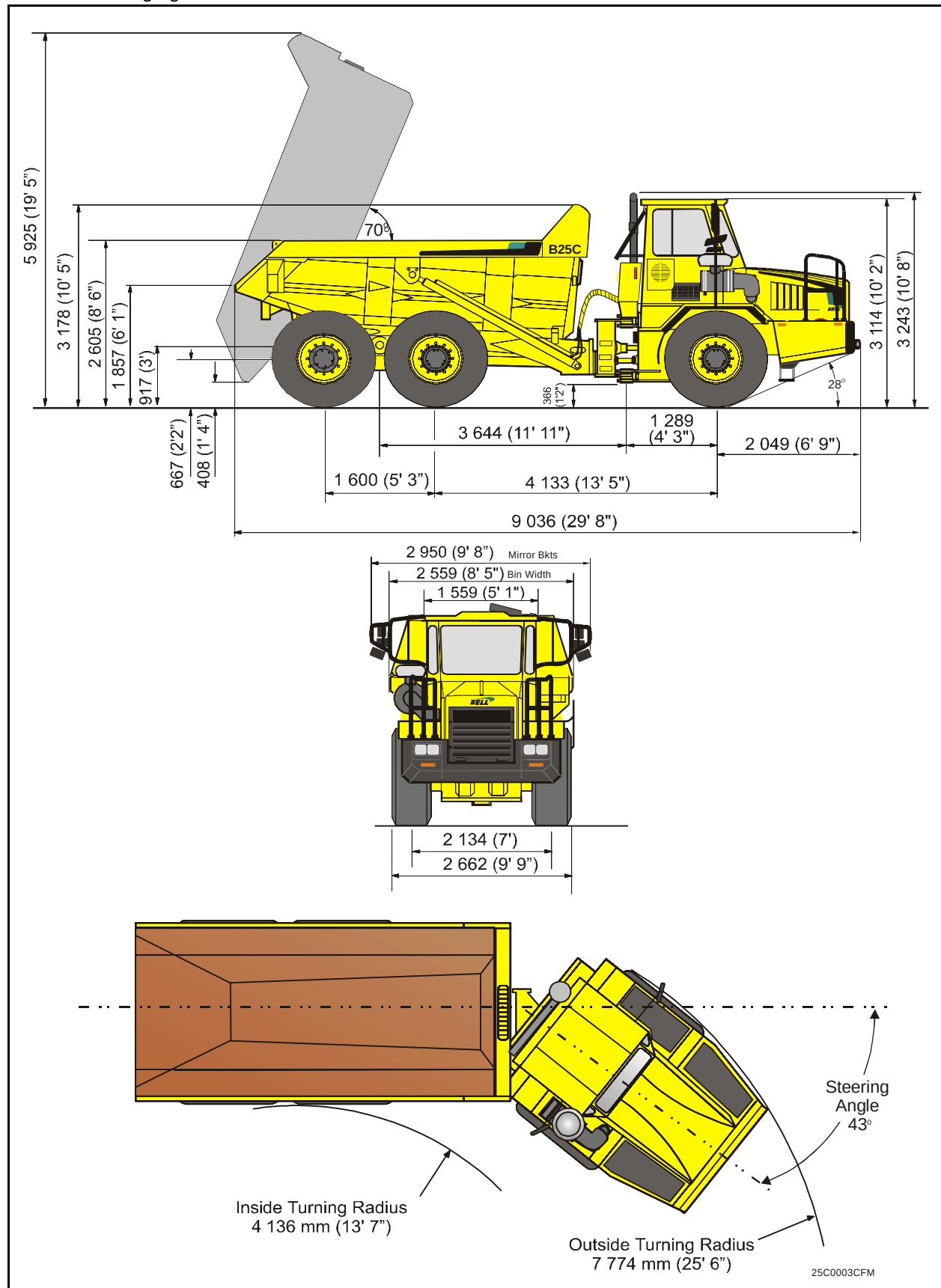
Machine Dimensions

The following figure details the dimensions of the B25C Mk II ADT 6X6:



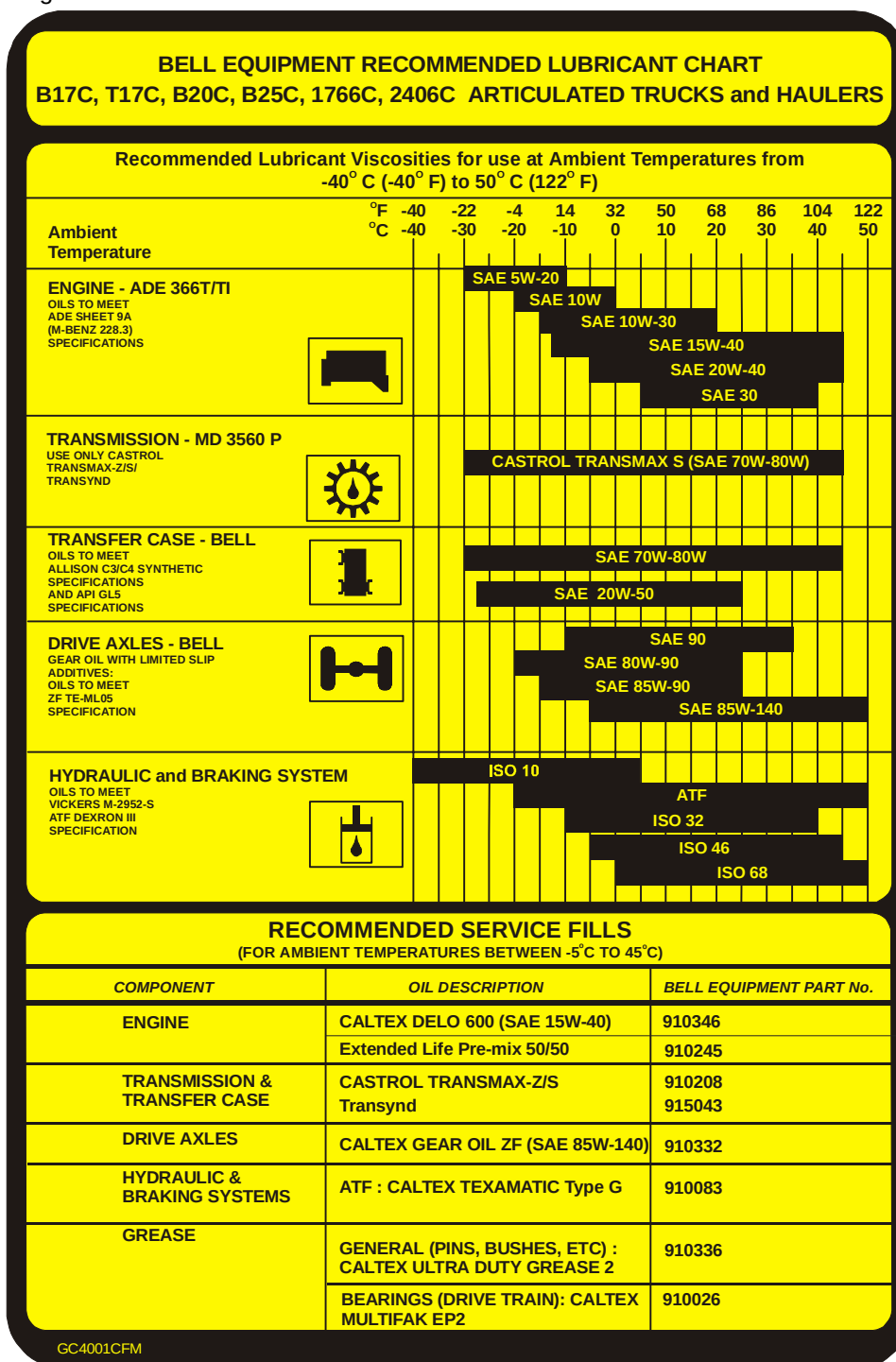
Machine Dimensions

The following figure details the dimensions of the B25C Mk II ADT 6X4:



Recommended Lubricants and Coolant Additives

The following chart details the recommended lubricants and coolant additives:



⚠ CAUTION

1. Caltex Texamatic Type-G is only to be used in the hydraulic system and must NOT be used in the transmission.
2. Failure to use only Castrol Transmax-S or Z in the transmission may render warranty claims invalid.

Recommended Torque Settings

The following tables detail the recommended torque settings:

The torques recommended below are for HAND TIGHTENING unplated fasteners with no lubrication.

When using a bolt or screw in a tapped hole it is assumed that there is sufficient thread engagement to accept the applied torque. Discretion must be used when torqueing into a shallow hole or into soft or brittle materials.

Always adhere to engine / gearbox / **BELL** Equipment etc. manufacturer's
1 lb ft = 1.35582 Nm **1 Nm = 0.737561lb ft**

METRIC SIZES

METRIC BOLT GRADE INTERPRETATION

8.8 8x100=800 Mpa (Ultimate Tensile Stress) 8x8x10=640 Mpa (Yield Stress or Stress at 0.2% permanent set)	10.9 10x100=1000 Mpa (Ultimate Tensile Stress) 10x9x10=900 Mpa (Yield Stress or Stress at 0.2% permanent set)	12.9 12x100=1200 Mpa (Ultimate Tensile Stress) 12x9x10=1080 Mpa (Yield Stress or Stress at 0.2% permanent set)
---	---	--

METRIC NUT GRADE INTERPRETATION

CURRENT STANDARD :
Nuts which are 0.8xD high.



8x100=800 Mpa Proof Stress

FUTURE STANDARD :
(Subject to international agreement)
Nuts which are 1.0xD high.



8x100=800 Mpa Proof Stress

ISO Grade 4.6 400 MPa (25.90 tsi)	4.6 Manufacturer's Mark Grade (Optional)
ISO Grade 6.9 600 MPa (38.85 tsi)	6.9 Manufacturer's Mark Grade (Optional)

ISO Grade 8.8 800 MPa (51.80 tsi)	8.8 Manufacturer's Mark Grade
ISO Grade 10.9 1000 MPa (64.75 tsi)	10.9 Manufacturer's Mark Grade
ISO Grade 12.9 1200 MPa (77.70 tsi)	12.9 Manufacturer's Mark Grade

ISO Metric Coarse -Torques [Nm]

Size	M5	M6	M8	M10	M12	M14	M16	M18	M20	M22	M24	M27	M30	M36
Pitch (mm)	0.8	1	1.25	1.5	1.75	2	2	2.5	2.5	2.5	3	3	3.5	4
T/Stress area (mm ²)	14.2	20.1	36.6	58	84.3	115	157	193	245	303	353	459	561	817
ISO Gr. 4.6	2	4	10	19	34	58	85	115	165	220	285	420	560	980
ISO Gr. 6.9	5	8.5	21	41	72	115	180	245	345	465	600	890	1200	2118
ISO Gr. 8.8	6	10	25	49	86	135	210	290	410	550	710	1050	1450	2520
ISO Gr. 10.9	8	14	35	69	120	190	295	400	580	780	1000	1500	2000	3430
ISO Gr. 12.9	10	17	41	83	145	230	355	485	690	930	1200	1800	2400	4100

ISO Metric Fine -Torques [Nm]

Size	M8	M10	M12	M12	M14	M16	M18	M20	M22	M24	M27	M30
Pitch (mm)	1	1.25	1.25	1.5	1.5	1.5	1.5	1.5	1.5	2	2	2
T/Stress area (mm ²)	39.2	61.2	92.1	88.1	125	167	216	272	333	384	496	621
ISO Gr. 6.9	23	44	80	76	125	190	275	385	520	650	970	1350
ISO Gr. 8.8	27	52	95	90	150	225	325	460	610	780	1150	1600
ISO Gr. 10.9	38	73	135	125	210	315	460	640	860	1100	1600	2250
ISO Gr. 12.9	45	88	160	150	250	380	550	770	1050	1300	1950	2700

RESEARCH AND DEVELOPMENT Drawing Number 700999/1 rev A

24/6/96

GD0001CFM



Imperial Sizes - BS Grades

IMPERIAL SIZES - BS GRADES

BS Grade A 28 tsi (432 Mpa)	Coarse or Fine		Manufacturer's Mark Grade
BS Grade S 50 tsi (772 Mpa)	Coarse or Fine		Manufacturer's Mark Grade

BS Grade T 55 tsi (849 Mpa)	Coarse or Fine		Manufacturer's Mark Grade
BS Grade V 65 tsi (1004 Mpa)	Coarse or Fine		Manufacturer's Mark Grade

Unified Coarse (UNC) - Torques in Nm.

Size	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"	7/8"	1"	1 1/8"	1 1/4"	1 3/8"	1 1/2"
Threads/inch	20	18	16	14	13	12	11	10	9	8	7	7	6	6
T/Stress area (mm ²)	20.5	33.8	50	68.6	91.5	117.4	146	215	298	391	492	625	745	906
BS Grade A	4	9	16	25	38	56	78	138	221	335	467	670	861	1148
BS Grade S	12	24	43	66	108	150	209	371	586	885	1256	1735	2333	3051
BS Grade T	12	26	45	72	114	162	221	383	646	957	1376	1914	2512	3290
BS Grade V	16	31	55	90	138	191	263	479	766	1148	1615	2273	2991	4008

Unified Fine (UNF) up to 1", and UN-8 TPI for dia 1 1/8" and above. Torques in Nm.

Size	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"	7/8"	1"	1 1/8"	1 1/4"	1 3/8"	1 1/2"
Threads/inch	28	24	24	20	20	18	18	16	14	12	8	8	8	8
T/Stress area (mm ²)	23.5	37.4	56.6	76.6	103	131	165	241	328	428	510	645	795	963
BS Grade A	5	10	18	29	43	60	90	150	239	359	490	670	933	1196
BS Grade S	13	26	48	78	114	167	233	407	646	957	1316	1794	2452	3230
BS Grade T	14	29	51	84	126	179	239	431	694	1029	1376	1974	2632	3529
BS Grade V	17	35	60	96	150	215	299	526	837	1256	1675	2393	3230	4247

IMPERIAL SIZES - SAE GRADES

SAE Grade 1 26.8 tsi (414 Mpa)	Manufacturer's Mark	
SAE Grade 5 (1 1/8" - 1 1/2") 46.9 tsi (724 Mpa)	Manufacturer's Mark	

SAE Grade 5 (1/4" - 1") 53.6 tsi (828 Mpa)	Manufacturer's Mark	
SAE Grade 8 67 tsi (1035 Mpa)	Manufacturer's Mark	

Unified Coarse (UNC) - Torques in Nm.

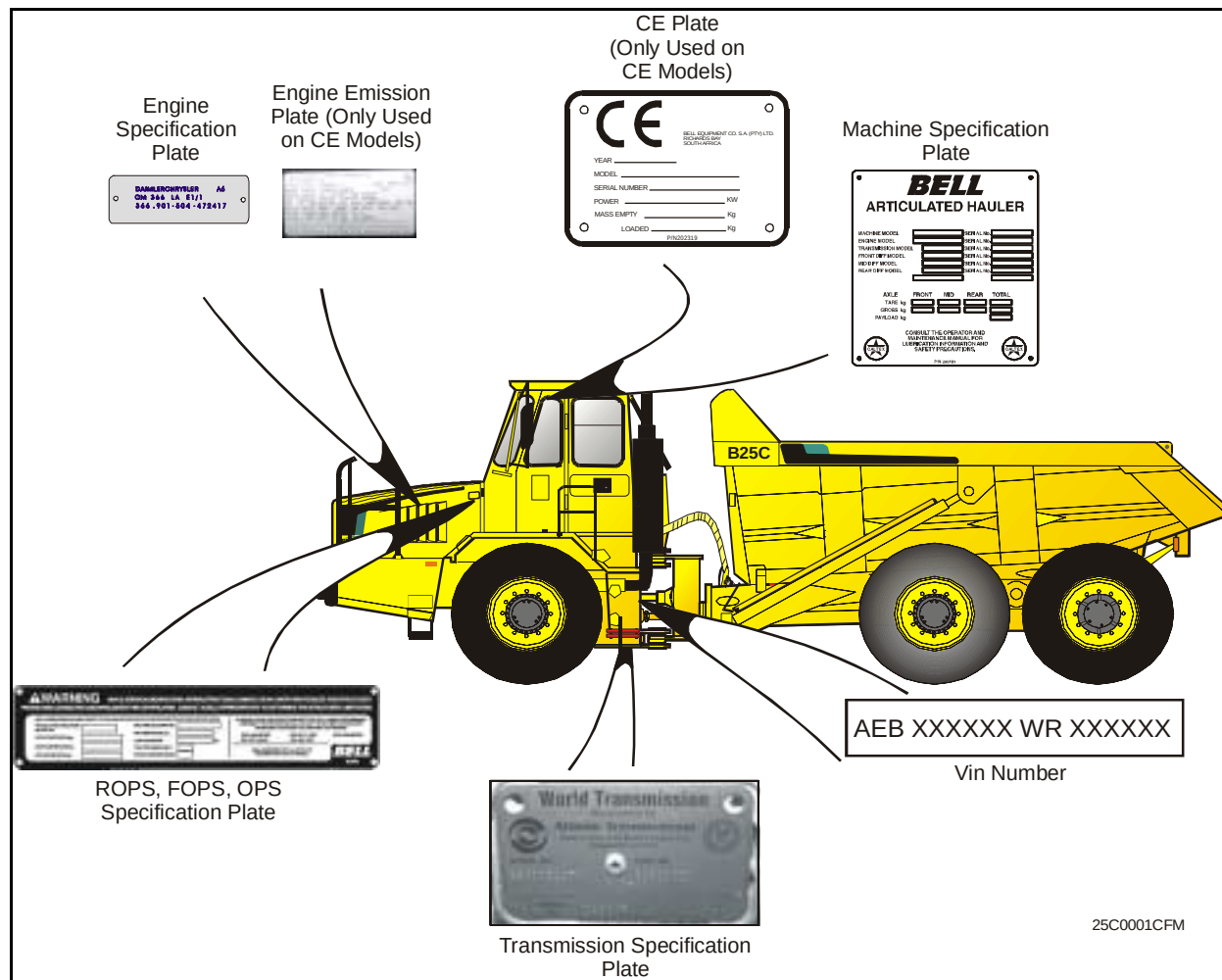
Size	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"	7/8"	1"	1 1/8"	1 1/4"	1 3/8"	1 1/2"
Threads/inch	20	18	16	14	13	12	11	10	9	8	7	7	6	6
T/Stress area (mm ²)	20.5	33.8	50	68.6	91.5	117.4	146	215	298	391	492	625	745	906
SAE Grade 1	4	9	16	25	38	56	78	138	221	335	467	670	861	1148
SAE Grade 5	11	22	40	62	101	140	196	348	550	830	1347	1860	2501	3270
SAE Grade 8	16	32	57	92	142	197	271	493	789	1184	1665	2343	3083	4131

Unified Fine (UNF) up to 1", and UN-8 TPI for dia 1 1/8" and above. Torques in Nm.

Size	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"	7/8"	1"	1 1/8"	1 1/4"	1 3/8"	1 1/2"
Threads/inch	28	24	24	20	20	18	18	16	14	12	8	8	8	8
T/Stress area (mm ²)	23.5	37.4	56.6	76.6	103	131	165	241	328	428	510	645	795	963
SAE Grade 1	5	10	18	29	43	60	90	150	239	359	490	670	933	1196
SAE Grade 5	12	25	45	73	107	157	219	382	606	898	1411	1924	2629	3463
SAE Grade 8	17	36	62	99	154	222	308	543	863	1295	1726	2466	3329	4378

Serial Number Plates

The following figure identifies and locates the main serial number plates for the machine, engine and transmission of the B25C Mk II 6X6 and 6X4.



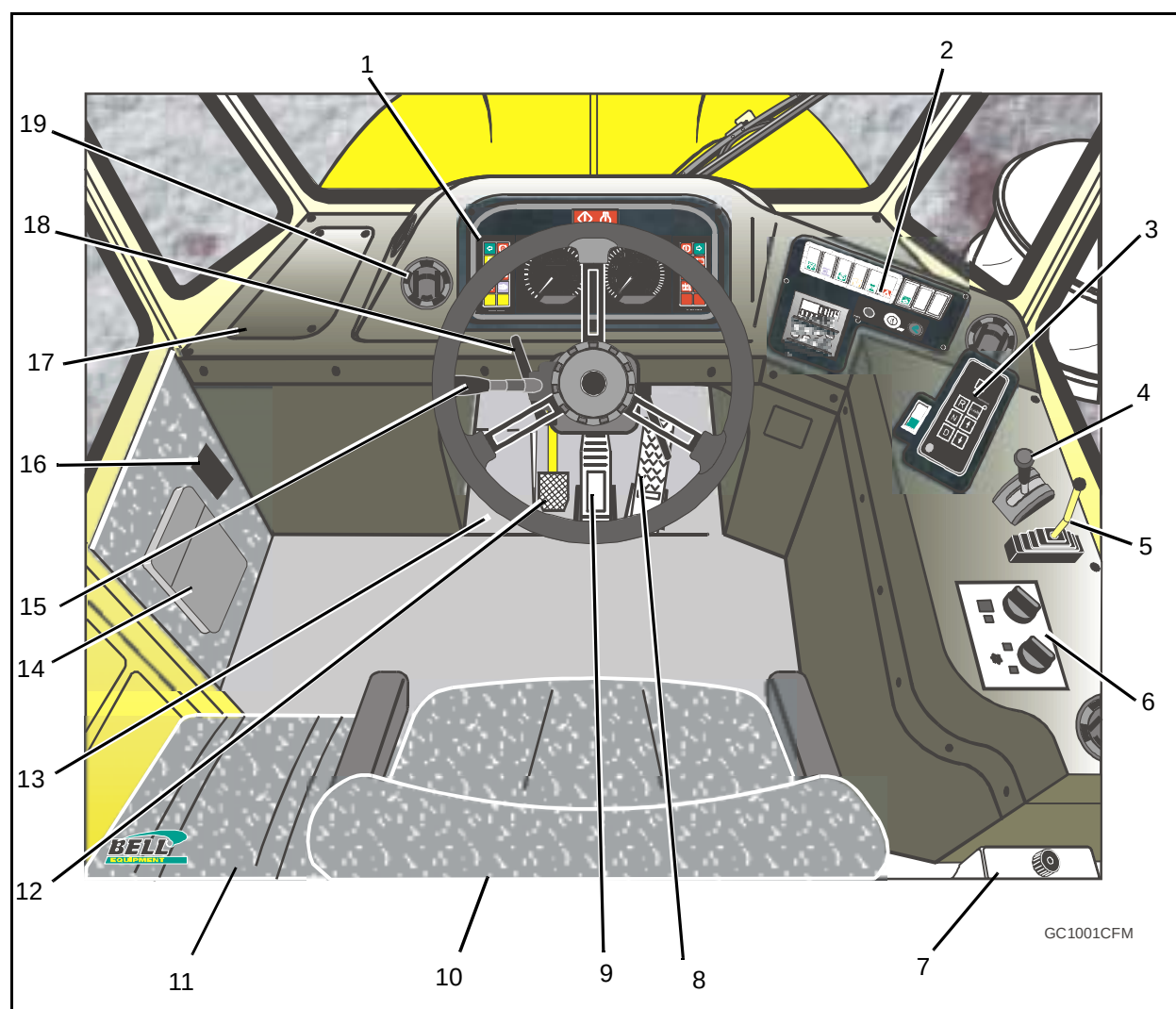
CHAPTER 2. OPERATOR CONTROL AND INSTRUMENTS

INTRODUCTION

This chapter details the layout and operation of the controls and instruments in the B25C Articulated Dump Truck.

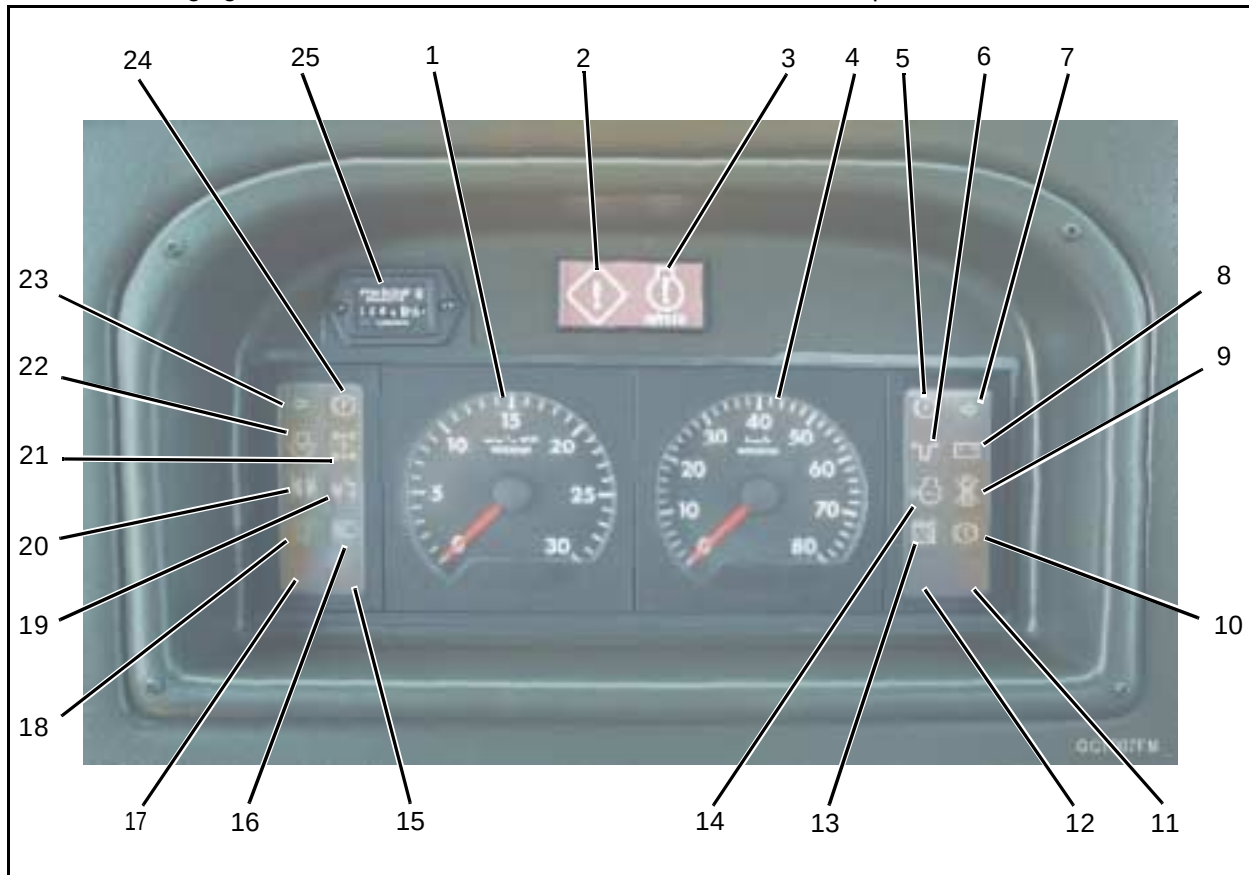
The main operator controls and instruments for the B25C are located in the cab.

The following figure details the layout of the controls and instruments in the cab for the B25C:



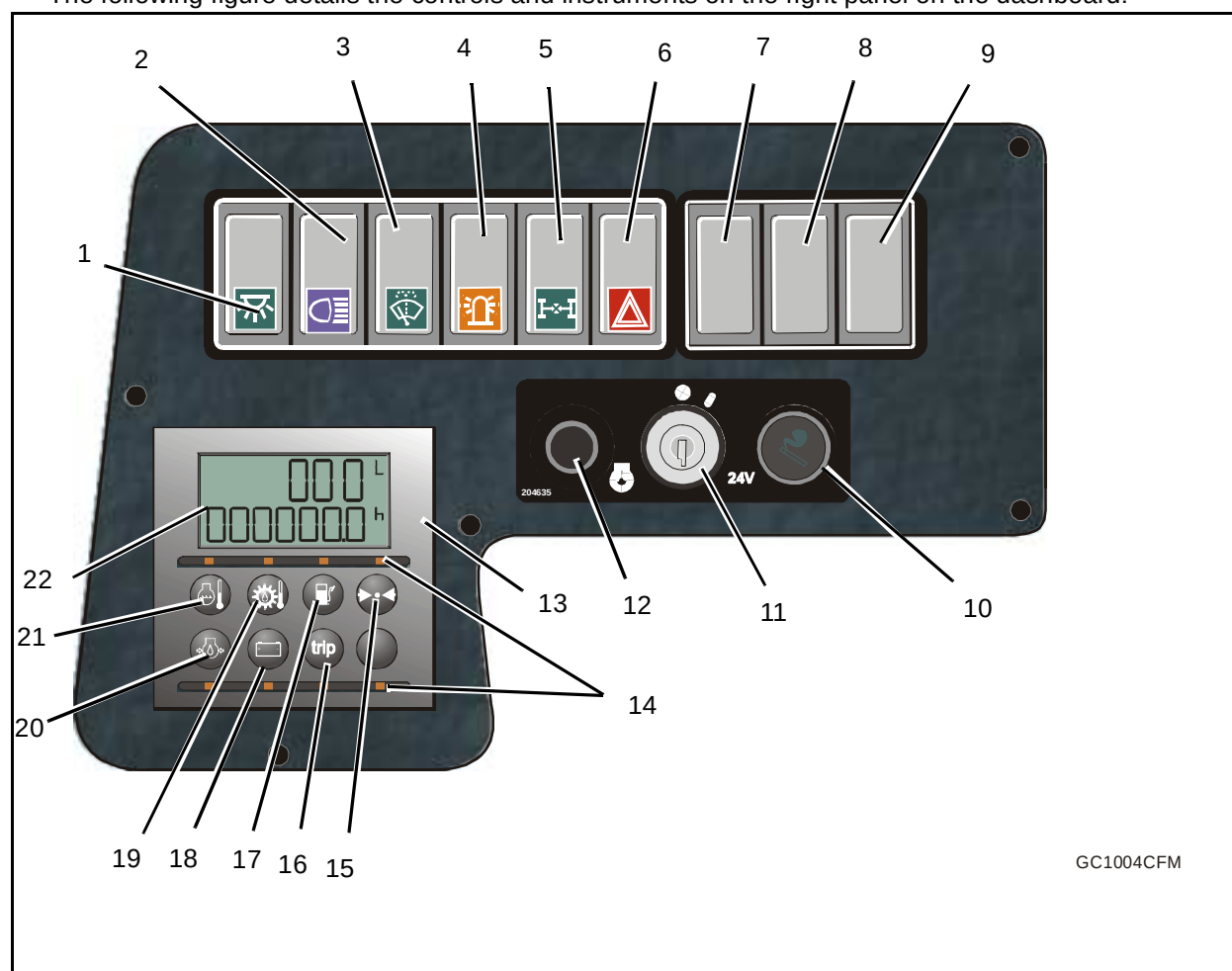
- | | |
|---------------------------------------|---|
| 1. Centre panel (instruments) | 11. Trainer seat |
| 2. Right panel (controls) | 12. Retarder pedal |
| 3. Gear shift control unit | 13. Footrest |
| 4. Park/emergency brake control lever | 14. Document holder |
| 5. Bin tip control lever | 15. Steering column switch |
| 6. Climate control panel | 16. Drinks holder |
| 7. Windscreen washer bottle | 17. Electrical distribution box cover plate |
| 8. Accelerator pedal | 18. Steering wheel adjustment lever (x2) |
| 9. Service brake pedal | 19. Climate control vent (x7) |
| 10. Operator's seat | |

The following figure details the controls and instruments on the centre panel on the dashboard:



- | | |
|--|--|
| 1. Tachometer | 13. High hydraulic fluid temp warning indicator |
| 2. Main warning indicator | 14. Low engine coolant level warning indicator |
| 3. Overspeed warning indicator | 15. Blank insert |
| 4. Speedometer | 16. High beam indicator light |
| 5. Brake system low pressure warning indicator | 17. Blank insert |
| 6. Emergency steering warning indicator | 18. Rotating beacon warning indicator (optional) |
| 7. Direction indicator (right) | 19. Bin raised warning indicator |
| 8. Alternator (charge) warning indicator | 20. Exhaust brake/retarder warning indicator |
| 9. "Do Not Shift" warning indicator | 21. Inter-axle differential lock warning indicator |
| 10. Low pneumatic pressure warning indicator | 22. Cold start warning indicator (optional) |
| 11. Blank insert | 23. Direction indicator (left) |
| 12. Blank insert | 24. Park brake/emergency warning indicator |

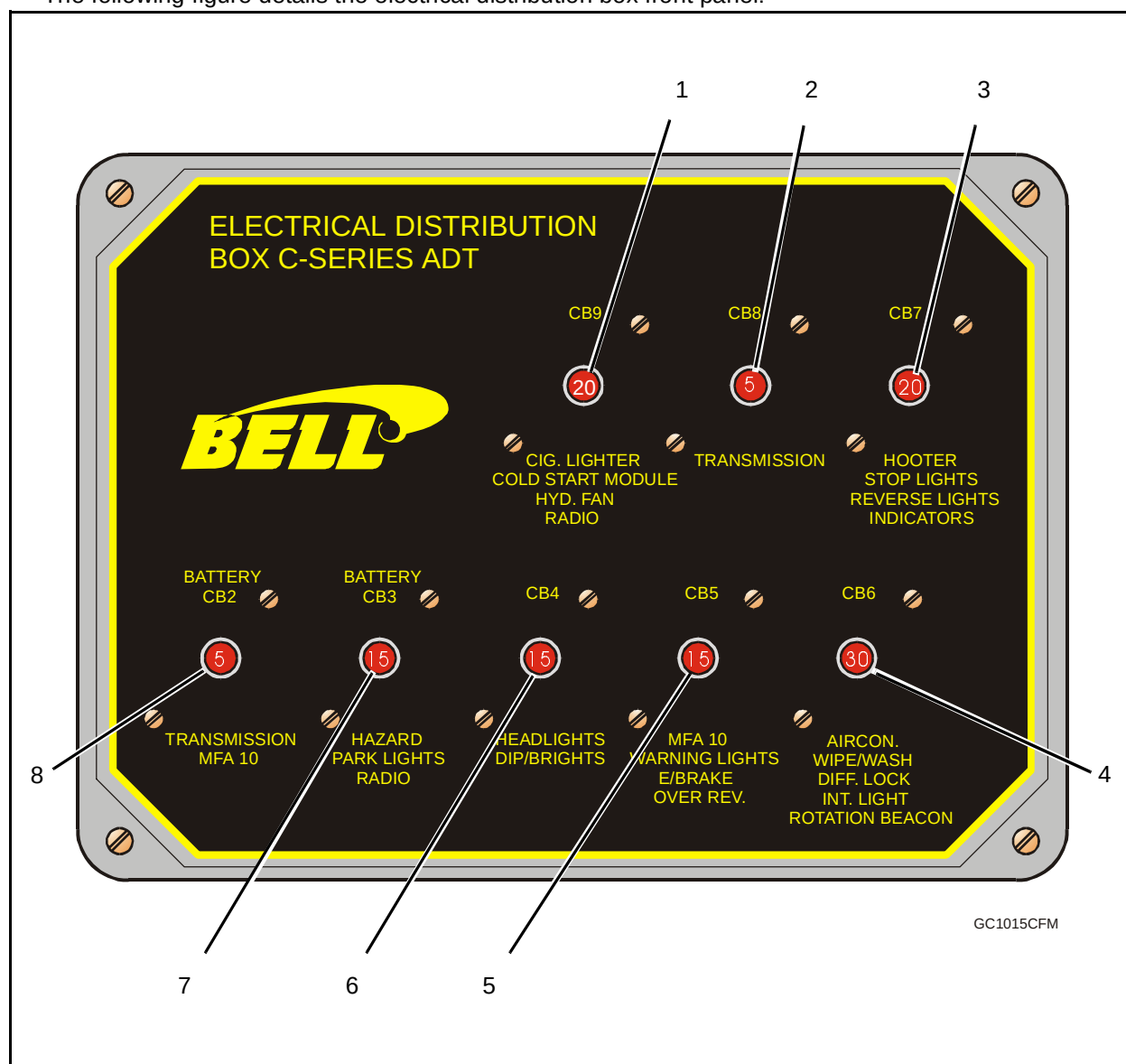
The following figure details the controls and instruments on the right panel on the dashboard:



- | | |
|--|---|
| 1. Interior light switch | 12. Starter button |
| 2. Headlight switch | 13. Master display unit |
| 3. Windscreen wiper/washer switch | 14. LEDs (8 off) |
| 4. Rotating beacon switch (*if fitted) | 15. System air pressure button |
| 5. Inter-axle differential lock switch | 16. Trip button |
| 6. Hazard switch | 17. Fuel button |
| 7. Blank insert | 18. System voltage button |
| 8. Blank insert | 19. Transmission fluid temperature button |
| 9. Blank insert | 20. Engine oil pressure button |
| 10. Cigarette lighter/24V accessory socket | 21. Engine coolant temperature button |
| 11. Ignition switch | 22. Digital display screen |

*The rotating beacon switch is part of the kit fitted with the rotating beacon which is optional equipment

The following figure details the electrical distribution box front panel:



- | | |
|------------------------------|------------------------------|
| 1. 20A circuit breaker (CB9) | 5. 15A circuit breaker (CB5) |
| 2. 5A circuit breaker (CB8) | 6. 15A circuit breaker (CB4) |
| 3. 20A circuit breaker (CB7) | 7. 15A circuit breaker (CB3) |
| 4. 30A circuit breaker (CB6) | 8. 5A circuit breaker (CB2) |

CONTROLS AND INSTRUMENTS

GAUGES

Hour Meter (SMR Meter)



The hour meter (SMR meter) is located on the centre panel of the dashboard.

The gauge displays the service meter readings (SMR) for the machine service life.

The gauge is used to determine the service intervals for the machine.

Speedometer



The speedometer is located on the centre panel of the dashboard.

The speedometer monitors the machine speed in kilometres per hour (km/h).

Tachometer



The tachometer is located on the centre of the dashboard.

The tachometer monitors the engine speed in revolutions per minute (rev/min).

▲ CAUTION

A maximum engine speed of 2850 rev/min must not be exceeded or serious damage will be caused to the engine.

Incorporated on the face of the tachometer is a Led caution sign (▲). This sign is not visible until an overspeed situation is caused. Refer to Engine Overspeed warning indicator in this Chapter.

Warning Indicators

Main Warning Indicator

▲ CAUTION

Continued operation of the machine with the main warning indicator illuminated will cause serious damage to the engine, transmission or the bin.



The main warning indicator (1) is located on the centre panel of the dashboard.

- The main warning indicator flashes to warn the operator of one of the following conditions or problems with the machine system:
- Low coolant level
- High hydraulic fluid temperature
- Low pneumatic system pressure
- Brake system failure
- Emergency steering system in operation
- Park/emergency brake **ON** (no buzzer).

If the main warning indicator flashes, stop the machine immediately and investigate the cause.

If one or more of the above faults occur, the respective warning indicator on the dashboard will also flash when the main warning indicator flashes.

A warning buzzer also sounds when the main warning indicator flashes if the engine is running, (except for the park/emergency brake **ON** condition).

Engine Overspeed Warning Indicator



The engine overspeed warning indicator (1) is located on the centre panel of the dashboard.

▲ CAUTION

If the engine overspeed warning indicator illuminates, the engine speed must be reduced immediately, using the service brake.

The engine overspeed warning indicator flashes and a warning buzzer sounds when the engine speed exceeds 2 850 rev/min.

If the operator continues to overspeed and the engine speed exceeds 2 950 rev/min the following occurs:

- The engine overspeed warning indicator ceases flashing but stays illuminated.
- The exhaust brake is automatically applied.
- A caution symbol Δ flashes on the tachometer.
- A louder buzzer sounds.
- The error is logged into the master display unit computer.

Brake System Low Pressure Warning Indicator

▲ WARNING

If the brake system low pressure warning indicator flashes, the machine must be stopped immediately. Machine damage and/or personal injury, perhaps fatal, may result if this warning is ignored.



The brake system failure indicator (1) is located on the centre panel of the dashboard.

The indicator flashes if the brake systems hydraulic pressure drops below 11 000 kPa (1 600 psi).

NOTE:The main warning indicator and the warning buzzer are also activated with the brake system low pressure warning indicator.

Emergency Steering Warning Indicator

▲ CAUTION

If the emergency steering warning indicator flashes, the machine must be steered to safety as soon as possible and then stopped.



The emergency steering warning indicator (1) is located on the centre panel of the dashboard.

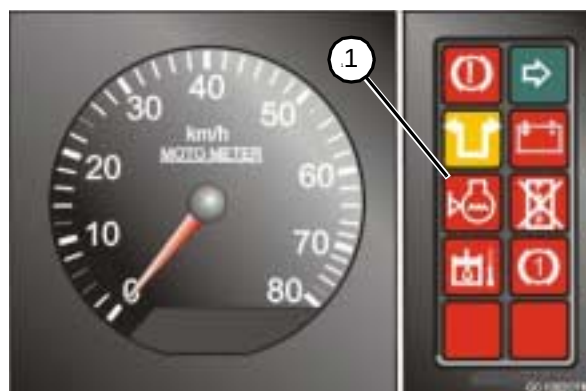
The emergency steering warning indicator flashes if there is an engine or main hydraulic pump failure and the emergency steering is activated.

NOTE:The main warning indicator and the warning buzzer are also activated with the emergency steering warning indicator.

Low Engine Coolant Level Warning Indicator

▲ CAUTION

If the low engine coolant level warning indicator flashes, the machine must be stopped and the engine shut down immediately. Engine damage may result if this caution is ignored.



The low engine coolant level warning indicator (1) is located on the centre panel of the dashboard.

The warning indicator flashes when the engine coolant requires replenishing immediately.

NOTE:1. The main warning indicator and the warning buzzer are also activated with the low engine coolant level warning indicator.

2. The low engine coolant level warning indicator may flash briefly on start-up when the ignition key is turned to the ON position.

High Hydraulic Fluid Temperature Warning Indicator

▲ CAUTION

If the high hydraulic fluid temperature warning indicator flashes, the machine must be stopped immediately.



The high hydraulic fluid temperature warning indicator (1) is located on the centre panel of the dashboard and flashes when the hydraulic fluid temperature exceeds 120°C (248°F).

The high hydraulic fluid temperature warning indicator If overheating occurs stop the machine, engage neutral and allow the engine to run at 1500 rev/min until the hydraulic temperature returns to normal temperature and the warning indicator extinguishes.

NOTE:The main warning indicator and the warning buzzer are also activated with the high hydraulic fluid temperature warning indicator.

Alternator (Charge) Warning Indicator

▲ CAUTION

If the alternator warning indicator illuminates, the fault must be rectified or the batteries will be discharged.



The alternator warning indicator (1) is located on the centre panel of the dashboard.

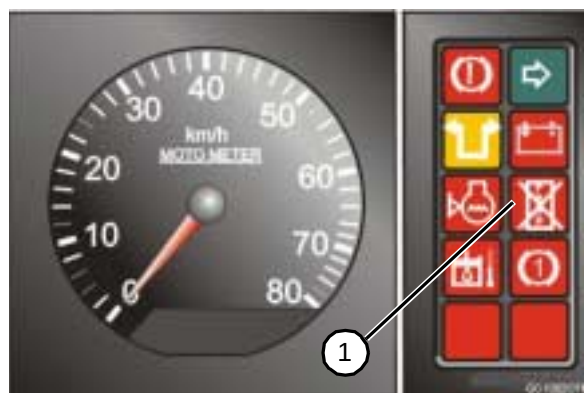
The warning indicator illuminates if the alternator is not charging the batteries or if the engine is not running and the ignition switch is **ON**.

The normal operating voltage is 24V.

“Do Not Shift” Warning Indicator

▲ CAUTION

If the “Do Not Shift” warning indicator illuminates, the machine must be stopped immediately using only the service brake and **NOT** the gear shift control.



The “Do Not Shift” warning indicator (1) is located on the centre panel of the dashboard.

The electronic control system is programmed to inform the operator of a problem with the transmission system and automatically take action to protect the operator, machine and transmission.

When the Electronic Control Unit (ECU) detects a “Do Not Shift” (DNS) condition, the ECU restricts shifting, turns on the DNS warning indicator and registers a diagnostic code.

▲ CAUTION

For some problems, diagnostic codes may be registered without the ECU activating the DNS warning indicator. **BELL EQUIPMENT** Product Support should be consulted whenever there is a transmission related concern.

Each time that the engine is started, the DNS warning indicator will illuminate, then extinguish after a few seconds. The momentary illumination of the DNS indicates that the status light circuits are working correctly.

If the DNS warning indicator does not illuminate during ignition, or if the indicator remains on after ignition, the system should be checked immediately.

Continued illumination of the DNS during machine operation (other than start-up) indicates that the ECU has signalled a diagnostic code.

Illumination of the DNS is accompanied by a flashing display from the gear shift control digital display screen. The display will show the actual gear attained and the transmission will not respond to shift selector requests.

The indications from the gear shift control digital display screen are provided to inform the operator that the transmission is not performing as designed and is operating with reduced capabilities.

Before turning off the ignition, the transmission may be operated for a short time in the selected gear in order to "limp home" for service assistance.

Service should be performed immediately in order to minimise the potential for damage to the transmission.

When the DNS warning indicator illuminates and the ignition switch is off, the transmission will remain in **N** (Neutral) until the condition causing the DNS warning indicator to illuminate is corrected.

Generally, while the DNS warning indicator is illuminated, upshifts and downshifts will be restricted and direction changes will not occur. Shift selection will not respond to any operator shift requests while the DNS warning indicator is illuminated.

The lockup clutch is disengaged when transmission shifting is restricted or during any critical transmission malfunction.

If a transmission problem occurs while driving, the transmission will default to 3rd gear until the machine is stopped and then Neutral only can be selected until the fault is rectified.

Refer to the error code table in Chapter 9 and Chapter 17 and to Gear Shifting in Chapter 4 for further information.

NOTE:The "Do Not Shift" warning indicator is also referred to as the Check Trans (check transmission) warning indicator.

Low Pneumatic Pressure Warning Indicator



The low pneumatic pressure warning indicator (1) is located on the centre panel of the dashboard.

NOTE:The symbol {1} for the low pneumatic pressure warning indicator appears on some models. The function of the indicator remains the same

The low pneumatic pressure warning indicator flashes when the air pressure in the pneumatic tank is below 500 kPa (72.5 psi).

NOTE:The park/emergency brake cannot be released until the air pressure in the tank is allowed to build up to approximately 550 kPa (79.8 psi) and the low pneumatic pressure indicator extinguishes.

Cold Start Warning Indicator

▲ CAUTION

Do not start the engine until the cold start warning indicator extinguishes. Damage to the engine could occur if this caution is ignored.



The cold start warning indicator (1) is located on the centre panel of the dashboard.

The cold start function is automatic. When the ignition is switched on and the engine coolant temperature is below 15°C (59°F), the warning indicator illuminates.

NOTE:The cold start warning indicator illuminates briefly on start-up, when the ignition key is turned to the ON position.

When it is safe to start the engine, the cold start warning indicator extinguishes.

Exhaust Brake/Retarder Warning Indicator



The exhaust brake/retarder warning indicator (1) is located on the centre panel of the dashboard.

NOTE:The exhaust brake is automatically applied when the accelerator pedal is fully released (and transmission lockup is engaged). The exhaust brake is deactivated when the accelerator pedal is re-applied (or the machine is out of lockup mode). The exhaust brake/retarder warning indicator then extinguishes.

Rotating Beacon Warning Indicator

NOTE:The rotating beacon is optional equipment.



The rotating beacon warning indicator (1) is located on the centre panel of the dashboard.

The rotating beacon warning indicator illuminates when the warning beacon on top of the cab is switched on at the rotating beacon switch.

Park Emergency Brake Warning Indicator



The park emergency warning indicator (1) is located on the centre panel of the dashboard.

The park emergency brake warning indicator illuminates when the park emergency brake is applied and extinguishes when it is released.

Bin Raised Warning Indicator**▲ WARNING**

As a safety precaution it is recommended that the operator should not drive the machine when the bin up indicator is illuminated as this may cause serious damage to the machine and/or injury to personnel. Refer to Tip Control Lever in this Chapter for special instructions regarding driving the machine while the bin is raised.



The bin raised warning indicator (1) is located on the centre panel of the dashboard.

The bin raised warning indicator will illuminate when the bin is raised.

Information Indicators**Inter-axle Differential Lock Indicator****▲ CAUTION**

Do not operate the machine on hard surfaces with the inter-axle differential lock engaged. Damage to the drive train may result if this caution is not observed.



The inter-axle differential lock indicator (1) is located on the centre panel of the dashboard.

The inter-axle differential lock indicator illuminates when the longitudinal differential lock is engaged.

If the lock is selected while the machine is moving, the indicator will not illuminate until the conditions are correct for the lock to be engaged (normally a reduction in speed).

Above paragraph is true except for machines after S.B. 2000/043 as this function is now pneumatic and not mechanical.

Direction Indicators

The direction indicators (1) are located on the centre panel of the dashboard.

NOTE: The left and right direction indicators function in the same way, only the left turn indicator is shown.

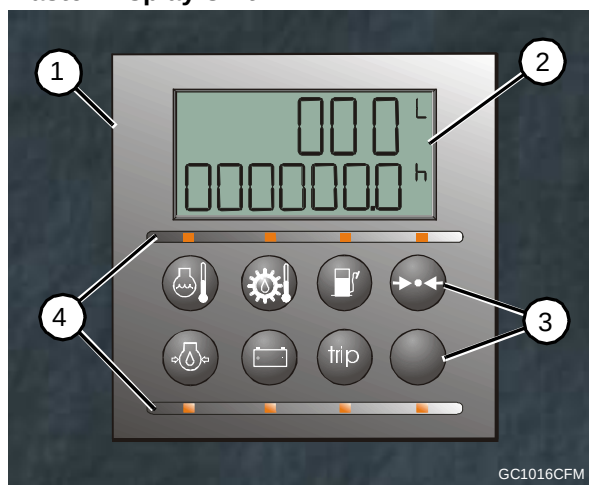
A direction indicator will flash when the steering column switch is moved to indicate a right or left turn.

If the hazard switch is ON, both direction indicators flash.

High Beam Indicator

The high beam indicator (1) is located on the centre panel of the dashboard.

The indicator illuminates when the high beam mode on the headlights is selected on the steering column switch.

Master Display Unit

The master display unit (1) is located on the right side panel on the dashboard.

The master display unit comprises the digital display screen (2), two rows of buttons (3) and two rows of light emitting diodes (LED) (4).

The buttons are manually operated to display the condition of machine systems and the results of the selected function are displayed on the digital display screen.

All systems are constantly monitored.

The digital display screen displays two values, one value on the top line of the screen and the other on the bottom line of the screen, in accordance with the top and bottom rows of buttons.

The LEDs are red warning indicators or indicators for the relevant system being monitored.

When the ignition is switched on the unit performs a brief self-test. If there is a problem with one of the systems tested the relevant LED flashes and the relevant value is displayed on the digital display screen.

NOTE: Every error which is encountered by the master display unit is logged and stored in the units computer. The computer can store 250 errors per function (system).

BELL EQUIPMENT Product Support can retrieve the error reports from the unit for analysis purposes.

If there is no problem in the systems tested then the unit settles to the default display.

Default Display

When the ignition switch is turned on and the self-test is completed, the digital display screen displays two values as follows:



- The amount of fuel in the fuel tank is displayed on the top of the screen (1). The amount of fuel is displayed in litres. Refer to Fuel Button later in this section.

NOTE: The fuel tank capacity is 240 litres (63.4 USGAL).

- The number of hours that the engine has been in operation is displayed on the bottom line of the screen (2).

NOTE: The engine operation hours are also referred to as the SMR (Service Meter Reading) and it is this reading which is used to determine the service intervals as detailed in the service guide. Refer to Maintenance Schedule, Chapter 8.

- The display for the engine operating hours will change to the odometer reading (kilometres clocked by the machine) as soon as the engine is started.

When one of the buttons on the top row is pressed, the value for that particular system is displayed on the top line of the screen.

When one of the buttons on the bottom row is pressed, the value for that particular system is displayed on the bottom line of the screen.

The relevant LED illuminates to indicate which system button has been pressed and thus which system is being displayed.

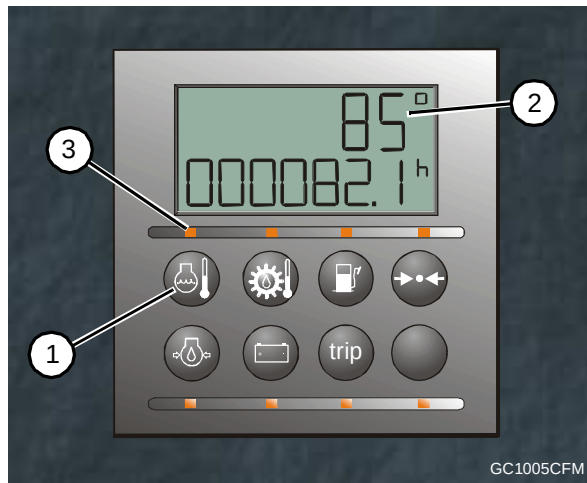
Pressing a button again will cause the display to revert to the default display.

NOTE:The last button on each row is not connected to any system and remain as options for future use.

When a critical value of any of the monitored functions is reached, its value on the LCD screen overrides any other function displayed at that time. In conjunction with the displayed value, the critical function's LED is activated together with a warning buzzer to alert the operator to the problem.

The buttons and their functions are as follows:

Engine Coolant Temperature Button



When the engine coolant button (1) is pressed the engine coolant temperature (2) is displayed in degrees Celsius ($^{\circ}\text{C}$) on the top line of the digital display screen and the LED (3) illuminates.

The normal operating temperature range is 85°C to 95°C (185°F to 203°F).

When the engine coolant temperature button is pressed again the display for the engine coolant temperature is cancelled and default (fuel reading) is displayed.

▲ WARNING

At the first warning of a high coolant temperature, the operator must stop the machine and allow the engine to idle (cool down). When the high engine coolant temperature warning extinguish, the engine must shut-down and the cause for the warning investigated.

The operator is warned of high engine coolant temperature as follows:

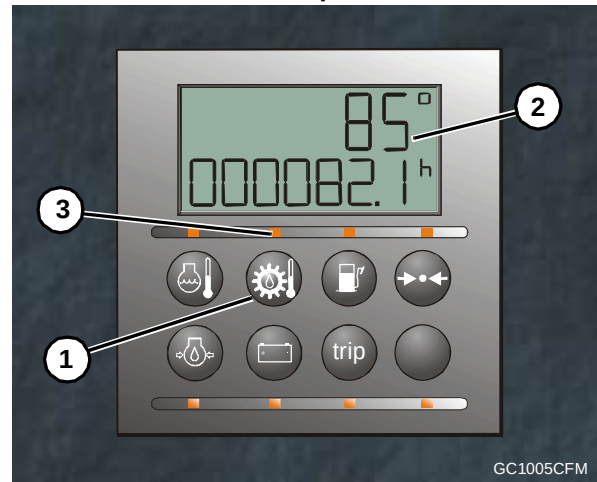
If the engine coolant temperature reaches 98°C (208°F):

- The temperature displayed on the screen flashes.
- The LED flashes.
- A warning buzzer sounds intermittently.

If the engine coolant temperature reaches 105°C (221°F):

- The display and LED cease flashing but remain illuminated.
- The warning buzzer sounds continuously.
- The error is logged in the unit's computer and stored in its memory.

Transmission Fluid Temperature button



When the transmission fluid temperature button (1) is pressed the transmission fluid temperature (2) is displayed in degrees Celsius ($^{\circ}\text{C}$) on the top line of the digital display screen and the LED (3) illuminates.

NOTE:The transmission fluid converter out temperature is monitored with this function.

When the transmission fluid temperature button is pressed again the display for the transmission fluid temperature is cancelled and default is displayed.

▲ WARNING

At the first warning of a high transmission fluid temperature, the operator must stop the machine, shutdown the engine and the cause for the warning investigated.

The operator is warned of a high transmission fluid temperature as follows:

- If the transmission fluid temperature 135°C (275°F):
- The temperature displayed on the screen flashes.
- The LED flashes.
- A warning buzzer sounds intermittently.

If the transmission fluid temperature reaches 145°C (293°F):

- The display and the LED cease flashing but remain illuminated.
- The warning buzzer sounds continuously.
- The error is locked in the unit's computer and stored in its memory.

Fuel Button



When the fuel button (1) is pressed the amount of fuel (2) in the fuel tank is displayed in litres on the top line of the digital display screen and the LED (3) illuminates.

The fuel tank capacity is 240 litres (63.4 USGAL.)

NOTE: On initial fill (from empty) the fuel tank will take slightly more than 240 litres.

▲ WARNING

At the first warning of low fuel the operator should refill as soon as possible. If the fuel tank is allowed to completely empty, the fuel system must be bled.

The operator is warned of low fuel as follows:

If the fuel in the tank reaches a level of 20 litres (5.3 USGAL):

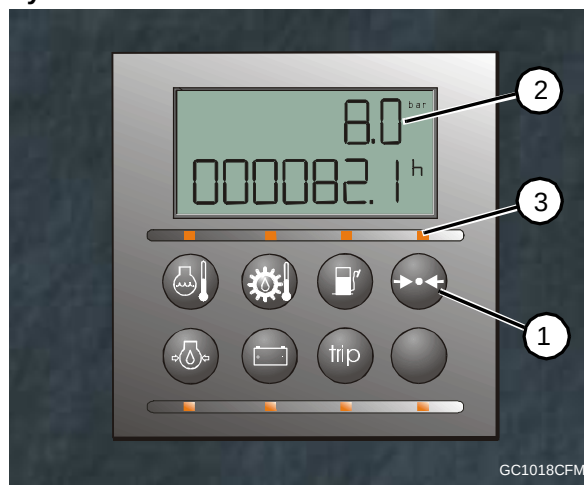
- The fuel level displayed on the screen flashes.
- The LED flashes.

- A warning buzzer sounds intermittently.

If the fuel in the tank reaches a level of 10 litres (2.6 USGAL):

- The display and the LED cease flashing but remain illuminated.
- The warning buzzer sounds continuously.
- The error is locked in the unit's computer and stored in its memory.

System Pressure button



When the system air pressure button (1) is pressed the air pressure (2) is displayed in bars on the top line of the digital display screen and the LED (3) illuminates.

The normal operating pressure is 8 bar (800 kPa or 116 psi).

When the system air pressure button is pressed again the display for the air pressure is cancelled and default is displayed.

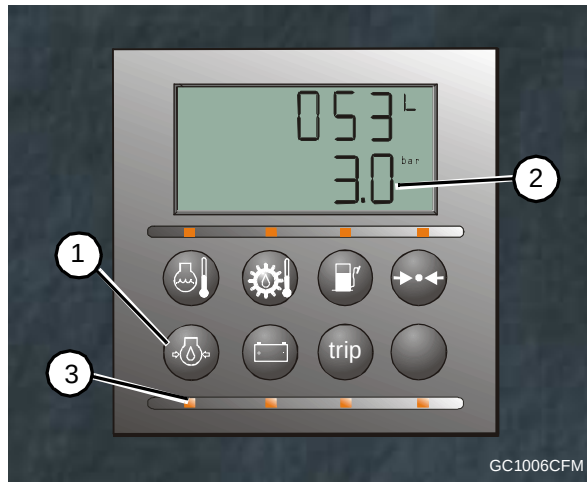
The operator is warned of a low system air pressure as follows:

If the air pressure reaches 5 bar (500 kPa or 72.5 psi):

- The pressure displayed on the screen flashes.
- The LED flashes.
- A warning buzzer sounds intermittently.

If the air pressure reaches 4.5 bar (450 kPa or 65 psi):

- The display and the LED cease flashing but remain illuminated.
- The warning buzzer sounds continuously.
- The error is logged in the unit's computer and stored in its memory.

Engine Oil Pressure Button

When the engine oil pressure button (1) is pressed the engine oil pressure (2) is displayed in bars on the bottom line of the digital display screen and the LED (3) illuminates.

The operating pressures are 0,6 bar (60 kPa or 8.7 psi) @ idle (700 ± 20 rev/min) rising to between 2.5 and 6 bar (250 to 600 kPa or 36.3 to 87 psi) @ rated engine speed (2710 ± 50 rev/min, high idle).

When the engine oil pressure button is pressed again the display for the engine oil pressure is cancelled and default is displayed.

▲ CAUTION

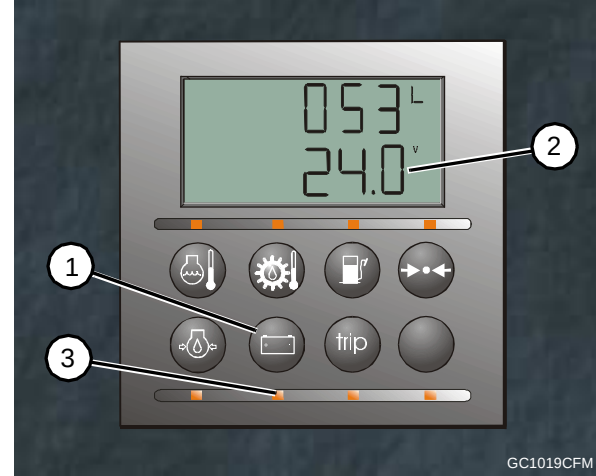
At the first warning of a low engine oil pressure, the operator must stop the machine, shut-down the engine and the cause for the warning investigated.

The operator is warned of a low engine oil pressure as follows:

- If the engine oil pressure reaches 70 kPa (0,7 Bar or 10.15 psi):
- The pressure displayed on the screen flashes.
- The LED flashes.
- A warning buzzer sounds intermittently.

If the engine oil pressure reaches 50 kPa (0,5 Bar or 7.25 psi):

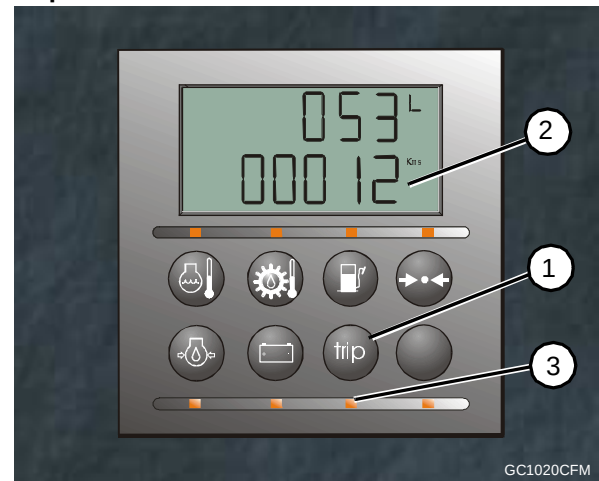
- The display and the LED cease flashing but remain illuminated.
- The warning buzzer sounds continuously.
- The error is logged in the unit's computer and stored in its memory.

System Voltage Button

When the system voltage button (1) is pressed the electrical system voltage (2) is displayed on the bottom line of the digital display screen and the LED (3) illuminates.

The system's operating voltage is 24V.

If the charge is low, check the battery charge indicator, the alternator and the alternator drive belts.

Trip Button

When the trip button (1) is pressed for longer than 5 seconds the display (2) at the bottom of the digital display screen is zeroed for the tripmeter mode and the LED (3) illuminates.

The number of kilometres travelled (since zeroing) is counted up as the machine is travelling.

When the trip button is pressed again the tripmeter mode is cancelled and the total kilometres travelled is displayed.

Switches



A row of switches is located on the right side panel on the dashboard.

There are nine positions for switches on the panel. Each switch is manually operated to select a required function.

NOTE: There are blanking plates in the switch positions not used. The rotating beacon switch is part of the optional equipment kit.

The switches and their functions are as follows:

Interior Light Switch



The interior light switch (1) is used to operate the interior light on the roof of the cab.

The switch has two positions:

- OFF; switch in the normal position.
- ON; switch in the down position.

- Windscreen washer ON; switch held in the

Lights Switch



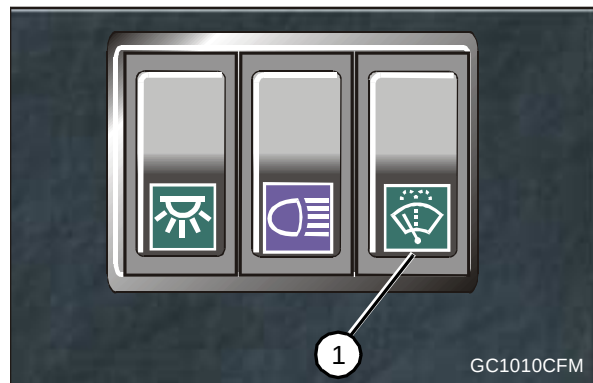
The light switch (1) is used to operate the headlights, park lights, tail lights and number plate light.

The lights switch has three positions:

- OFF; switch in the normal position.
- Park lights, tail lights, number plate light and instrument panel lighting ON; switch in the central position.
- Headlights ON; switch in the down position.

NOTE: The park, tail, number plate and instrument panel lights will illuminate when the lights switch is in the central position, even if the ignition switch is OFF. However the ignition switch must be ON for the headlights to operate from the ignition switch in the down position.

Windscreen Wiper/Washer Switch



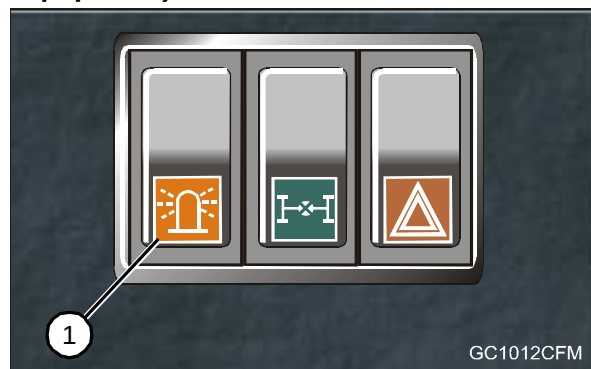
The windscreen wiper/washer switch (1) is used to operate the windscreen wiper motor and the windscreen washer pump on the water bottle.

The switch has three positions:

- OFF; switch in the normal position.
- Windscreen wiper ON; switch in the centre position.
- Windscreen washer ON; switch held in the down position.

NOTE:The switch is spring-loaded from the washer position to the central position.

Rotating Beacon Switch (Optional Equipment)



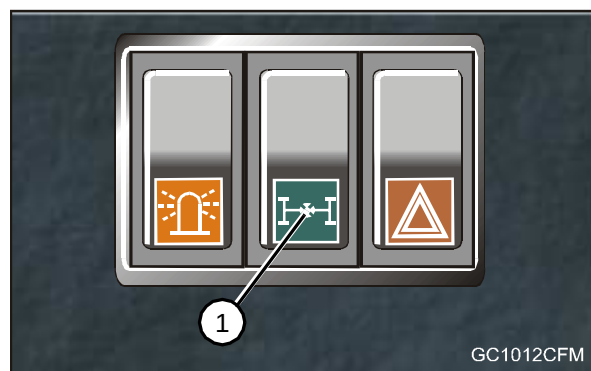
The rotating beacon switch (1) is used to operate the warning beacon on the roof of the cab.

The switch has two positions:

- OFF; switch in the normal position.
- ON; switch in the down position.

NOTE:The rotating beacon is optional equipment

Inter-axle Differential Lock Switch



The inter-axle differential lock switch (1) is used to apply the longitudinal lock in the transfer case.

The switch has two positions:

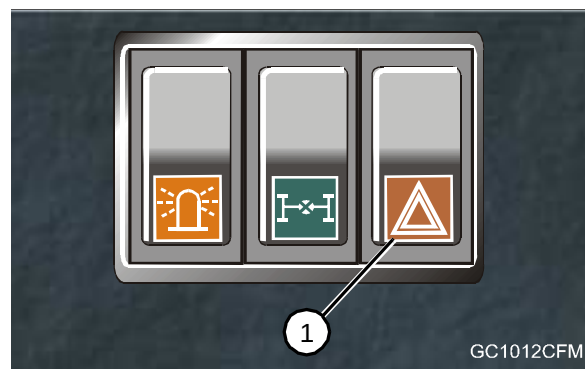
- OFF; switch in the normal position.
- ON; switch in the down position.

⚠ CAUTION

1. The inter-axle differential lock must not be engaged when the machine is moving.
2. The inter-axle differential lock must only be used when the ground conditions are very poor and must not be used on graded or tar surfaces.

NOTE:When the inter-axle differential lock is engaged the inter-axle differential lock indicator on the instrument panel illuminates.

Hazard Indicators Switch



The hazard indicators switch (1) is used to operate the direction indicators.

The switch has two positions:

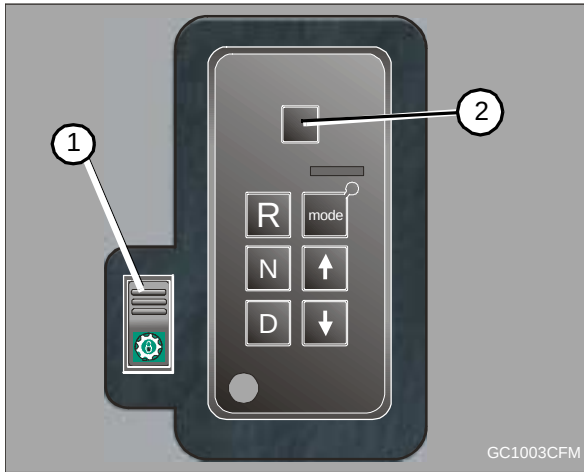
- OFF; switch in the normal position.
- ON; switch in the down position.

When the switch is ON, both of the rear direction indicators and both of the front direction indicators will flash.

The two direction indicators on the instrument panel will also flash when the hazard indicator switch is ON.

NOTE:The hazard indicators switch will operate the direction indicators and the direction indicators when the ignition switch is ON or OFF.

Range Hold Switch



The range hold switch (1) is located on the right of the cab next to the gear shift control.

The range hold switch has two positions:

- **OFF**; switch in the normal position:
- **ON**; switch in the down position.

When the switch is **OFF**, the transmission is in the normal automatic operating mode.

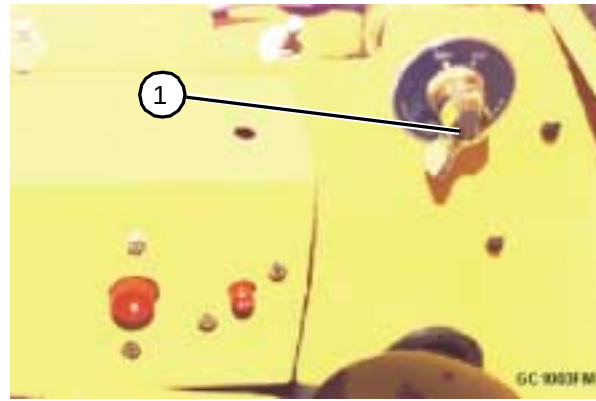
NOTE: Shift cycling or “gear hunting” on certain uphill applications can be eliminated by correct use of the range hold switch.

When the switch is **ON**, the transmission will hold the gear that it is in at the time of the switch being activated. Normal *downshifting* will occur, but the transmission will not *upshift* to a higher gear until the switch is switched off (except in overspeed conditions).

When the switch is activated, the gear shift display (2) will indicate the gear that the transmission will be held in.

When the range hold switch is switched OFF, normal gear selection will continue and the display will show the original value.

Battery Disconnect Switch



The battery disconnect switch (1) is located inside the battery box.

The battery disconnect switch is used to isolate the electrical power from the batteries to the machine.

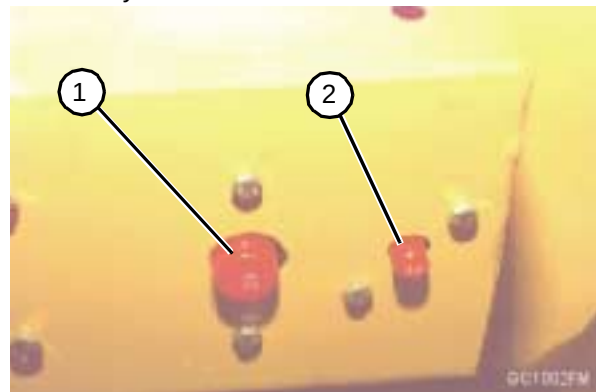
▲ CAUTION

1. Always switch **OFF** the battery disconnect switch when the engine is shut down and the machine is left unattended. If the switch is left **ON** for long periods while the engine is shut down, the batteries may become discharged.
2. Always switch **OFF** the battery disconnect switch before any maintenance or repair is performed on the machine's electrical system or any welding work is performed.

The battery disconnect switch has two positions, OFF and ON, the switch position is clearly marked on the switch's face plate. **B30C Mk II 6X6**

Battery Circuit Breaker Box

The battery circuit breaker box is located inside the battery box.

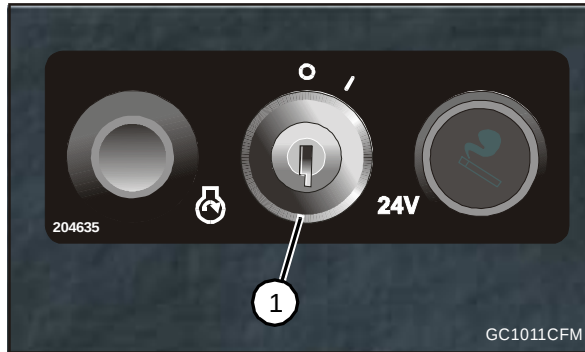


There are two circuit breakers rated at 60A (1) and 20A (2).

The 60 A circuit breaker protects the machine's electrical circuits from a possible overload condition or fault from the batteries.

The 20A circuit breaker protects the cold start system.

Ignition Switch



The ignition switch (1) is located on the right panel on the dashboard.

The ignition switch is key operated and has two positions, OFF and ON.

NOTE:The ignition switch will only operate if the battery disconnect switch is ON. Refer to previous description.

When the ignition switch is switched ON, the following indicators illuminate or flash:

- Main warning indicator.
- Park/emergency brake indicator.
- Emergency steering warning indicator.
- Alternator warning indicator

- "Do not shift" warning indicator.
- Low pneumatic pressure warning indicator.
- Low engine coolant warning indicator (flashes briefly).
- Cold start indicator (optional).

NOTE:1. Transmission digital display unit, will display neutral (N).

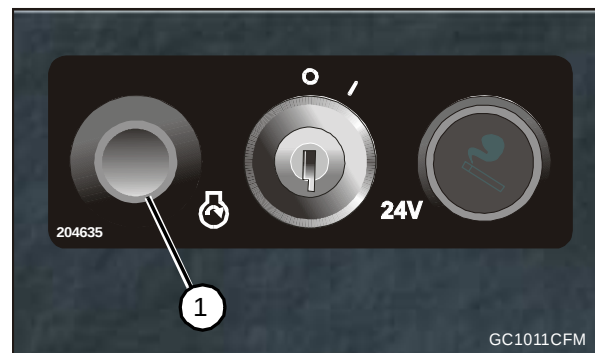
2. The park/emergency brake warning indicator will extinguish when the park/emergency brake is released. The other warning indicators will extinguish when the engine is started.

When the ignition switch is switched OFF, the "kill" lever on the injection pump is activated causing the engine to stop. All electrical functions will be terminated.

⚠ CAUTION

Do not stop the engine immediately after bringing the machine to a halt. Allow the engine to idle for two minutes before switching off the ignition. This allows for proper lubrication and for all temperatures to stabilise.

Start Button



The start button (1) is located on the right panel on the dashboard.

The start button is used to activate the starter motor when starting the engine. Whenever the start button is kept depressed the starter motor will be activated. Releasing the start button will deactivate the starter motor.

▲ CAUTION

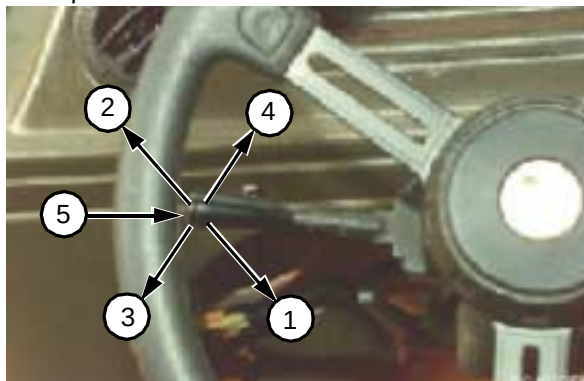
Do not hold in the start button (operate the starter motor) for more than seventeen seconds. If the engine does start during this period, wait one minute before attempting again to start the engine. If the engine does not start after two attempts, investigate the cause.

Note: The start button will only operate if the batteries disconnect switch and the ignition switch are ON. Refer to previous description.

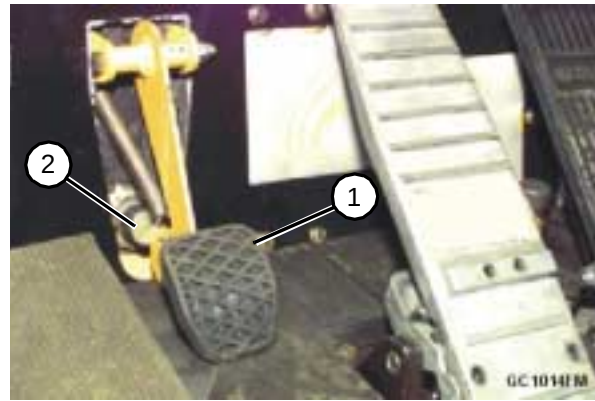
Steering Column Switch

The steering column switch is a stalk switch (1) located on the steering column.

The operation of the switch is as follows:



- To indicate a left turn move the switch towards (1) the operator.
- To indicate a right turn move the switch away (2) from the operator.
- For high beam headlights move the switch downwards (3).
- To dip the headlights move the switch upwards (4).
- To operate the horn push the end (5) of the switch.

Retarder Switch/Pedal

The retarder pedal (1) is located next to the brake pedal and when depressed it switches the retarder switch (2) **ON** and **OFF** when pedal is released.

The retarder switch operates the hydraulic retarder to assist the braking system.

The retarder only operates in conjunction with the exhaust brake.

NOTE: The retarder can only function when the exhaust brake is functioning.

Controls**Steering Wheel**

NOTE: There is no self-centring action on the steering. The machine must be returned to the straight ahead position by turning the steering wheel.

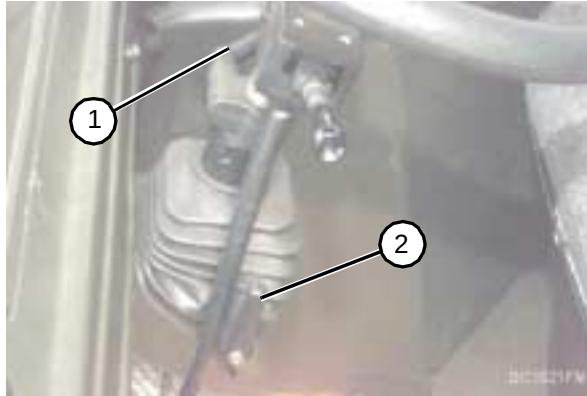
▲ CAUTION

If there is an engine or main pump failure, the ground driven emergency steering system will enable the operator to steer the machine to a safe stop. In this event the machine must be stopped as quickly as possible.

The steering wheel can be adjusted to ensure maximum operator comfort.

Adjust the Steering Wheel

Telescopic Adjustment

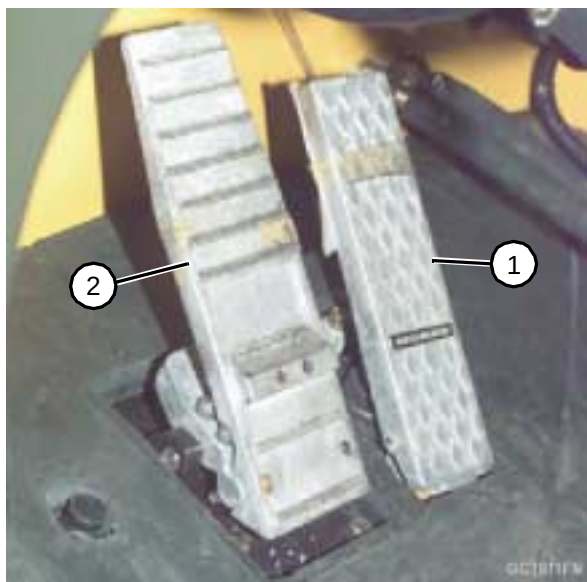


- Unlock the steering wheel by moving the lock (1) upwards.
- Adjust the steering wheel up/down for operator comfort.
- Lock the steering wheel into place by moving the lock downwards until it is secure.

Tilting Adjustment

- Unlock the steering wheel by moving the lock (2) upwards.
- Adjust the steering wheel forwards/backwards for operator comfort.
- Lock the steering wheel into place by moving the lock downwards until it is secure.

Accelerator and Brake Pedals

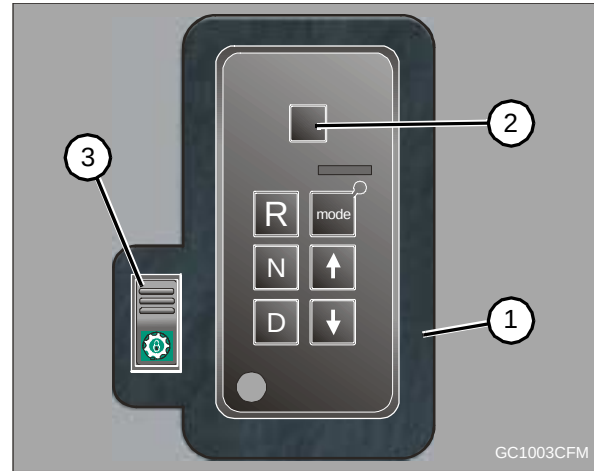


The accelerator pedal (1) and the brake pedal (2) are located on the cab floor.

Both pedals are progressive and spring loaded to an up, neutral position.

The accelerator pedal operates the throttle linkage on the engine and the brake pedal operates the hydraulic service brakes.

Gear Shift Control



The gear shift control(1) is located on the right side of the cab.

The gear shift control comprises of a digital display screen (2) and the selector buttons marked as follows:

- **D** (Drive), is used to select a forward gear range.
- **N** (Neutral), is used to select neutral gear.
- **R** (Reverse), is used to select reverse gear.
- **Mode**, To select Economy mode. Mode default automatically to Performance Mode when machine is started.

NOTE: The Performance mode is the typical mode for normal operating and Economy mode would be selected for on-road driving.

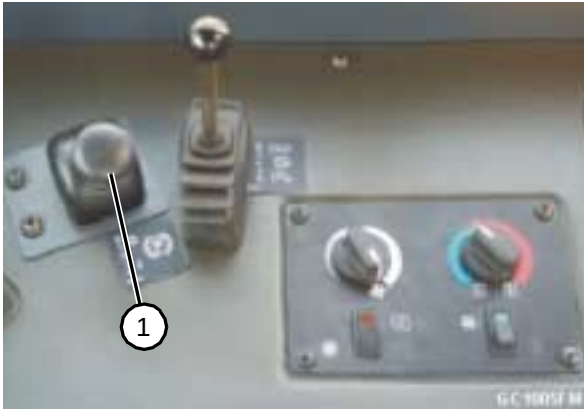
In the economy mode, shifts occur at lower engine speeds (rev/min) thus saving fuel on long flat hauls.

- ↑ (Up) and ↓ (Down), are used to select a specific range of gears in Drive.

Switch (3). Refer to Range Hold Switch in this Chapter.

For details of the gear shift control functions: Refer to **Operating Instructions, Chapter 4** and **Operating Techniques, Chapter 5**.

Park/Emergency Brake Control Valve



The park/emergency brake control valve lever (1) is located on the right side of the cab.

The park/emergency brake control lever is used to mechanically apply the park/emergency brake and to pneumatically release it.

▲ WARNING

Under normal circumstances the operator must not leave the machine unattended with the engine running. If the circumstances are such that the operator must leave the engine running, the operator must not leave the machine until he has:

- Put the transmission in N.
- Applied the park/emergency brake and ensured that it is properly engaged.
- Chocked the wheels and taken all other steps necessary to prevent the machine from moving.

- To release the park/emergency brake pull the lever up and move it away from the operator to the **RELEASE** position.
- To apply the park/emergency brake move the lever backwards to the **APPLY** position.

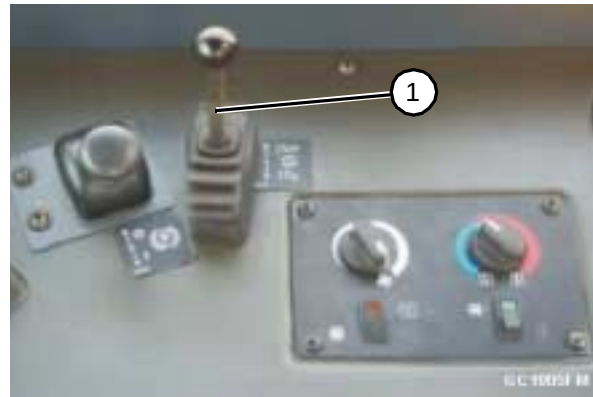
NOTE:When the park/emergency brake valve lever is in the **APPLY** position, the park/emergency brake warning indicator on the instrument panel illuminates.

When the ignition is turned off the park brake will automatically be applied.

▲ WARNING

After releasing the park/emergency brake the operator must wait until the park/emergency warning indicator on the instrument panel extinguishes before driving off. This prevents the machine from being driven with the park/emergency brake applied because of low air pressure.

Tip Control Lever



The tip control lever (1) is located on right side of the cab.

The tip control lever is used to raise and lower the bin.

The following procedure must be used to operate the tip control:

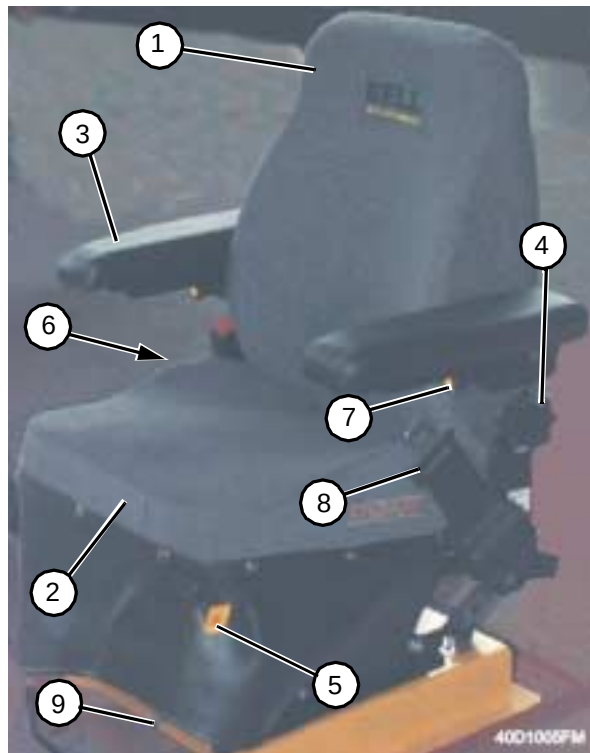
- To tip the bin the tip control lever must be moved towards the operator.
- To lower the bin the tip control lever must be moved away from the operator.

NOTE:The tip control lever is spring-loaded to the central (holding) position.

The bin raised warning indicator on the instrument panel illuminates as soon as the bin is raised off the chassis and only extinguishes when the bin is fully lowered onto the chassis.

Operator's Seat

The operator's seat is fully adjustable to suit the operator's height, weight and reach.



The main components of the operator's seat are as follows:

- Back rest (1).
- Seat squab (2).
- Arm rest (3). (Optional)
- Backrest angle adjustment knob (4).
- Seat squab height adjustment lever (5).
- Weight adjustment lever (6)
- Arm rest angle adjustment knob (7).
- Seat Belt (8).
- Backwards/forwards adjustment lever (9).

The seat is adjusted as follows:

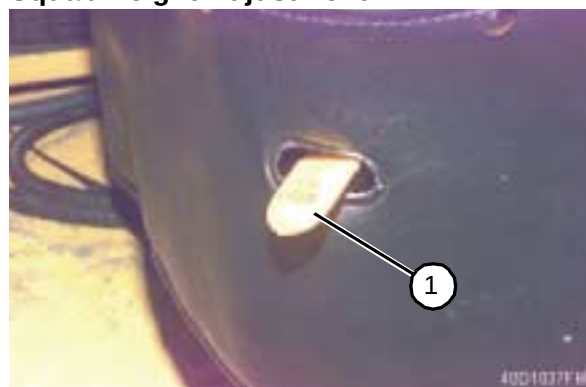
Back Rest Angle Adjustment



The back rest adjustment knob (1) is located on the left of the seat.

Turn the knob to obtain the required angle of the backrest.

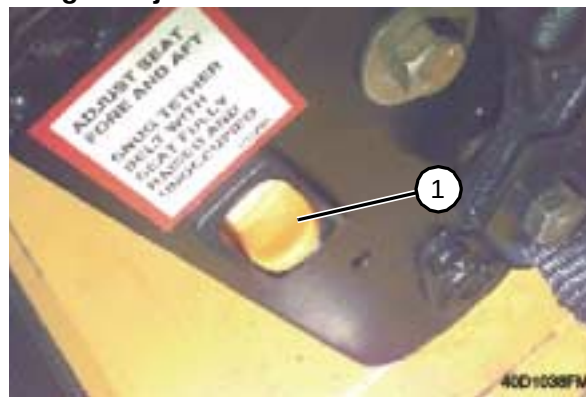
Squab Height Adjustment



The seat squab height adjustment lever (1) is located on the front right of the seat.

Pull and hold the adjustment lever up to obtain the most comfortable driving position.

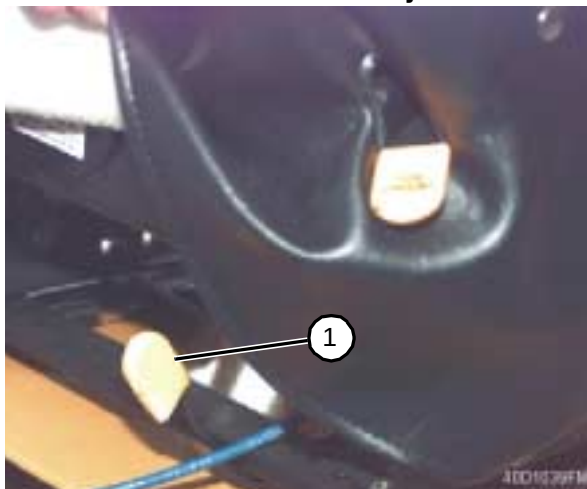
Weight Adjustment



The weight adjustment pneumatic valve (1) is located on the right side of the seat.

Use the adjustment valve to obtain the most comfortable seat suspension.

Backwards and Forwards Adjustment



The backwards and forwards adjustment lever (1) is located underneath the seat at the front.

The lever adjusts the seat along its slide and allows the seat to be moved closer to or further away from the steering wheel.

The following procedure must be used to move the seat:

- Pull and hold the lever up.
- Move the seat towards or away from the steering wheel until the required position is reached.
- Release the lever

Arm Rests (Optional)



The arm rests may be lifted to allow easier access to the seat and then lowered for driver comfort.

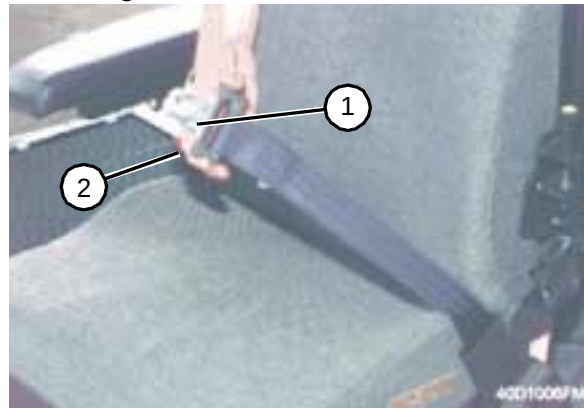
To adjust the angle of the arm rests, turn the knob (1), under the arm rest, until the most comfortable position is reached.

Seat Belt

A self-adjustable, lap seat belt is an integral part of the seat.

The seat belt is designed to fit firmly across the front of the pelvis.

Fastening



- Pull the seat belt out and push the buckle (1) into the fixed clasp (2) until it clicks into position.
- Ensure that the connection is secure and that the belt fits tightly across the pelvis.
- Ensure that the strap of the belt is not twisted.

Releasing

Press down the red push button on the fixed clasp.

The seat belt is spring-loaded to return to its stowage position.

▲ WARNING

1. Always wear a seat belt when operating the machine. In an accident it may save your life.
2. Check the condition of the seat belt and mounting hardware before operating the machine. Replace the seat belt at least every three years, regardless of the condition.

NOTE: Clean the seat belt regularly with a soap and water solution.

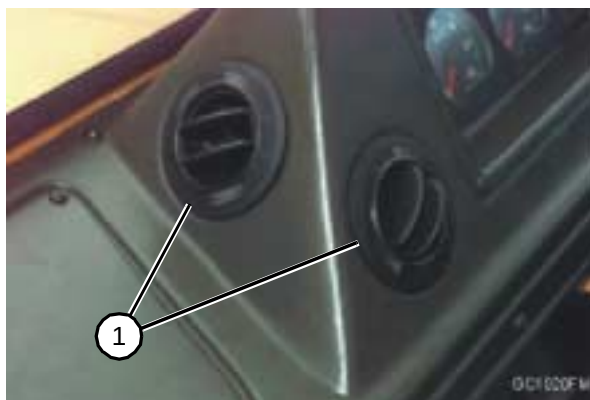
Document Pocket



A document pocket is located at the back of the operator's seat.

Climate Control

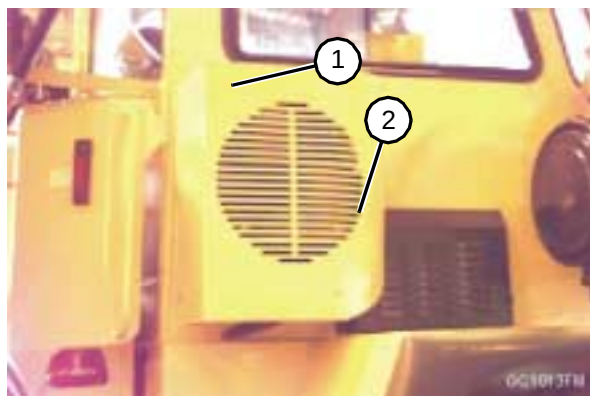
Vents



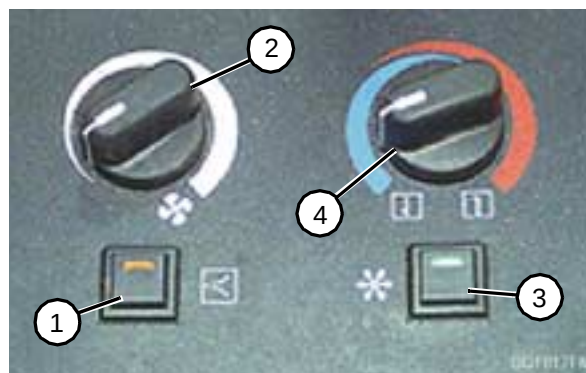
There are seven climate control vents (1) installed in the cab.

The vents are opened and closed manually and allow the operator to control the fresh air flow or the air conditioned air flow inside the cab.

Air Conditioner (Optional Equipment)



The air conditioner (1) and the filter housing (2) are located on the right side of the cab.



The air conditioner's control panel is located on the right of the cab and enables the following functions:

Switch (1) controls the fresh air vent. When the switch is pressed the air vent is opened to allow fresh air into the cab.

When the fan speed knob (2) is turned in a clockwise direction, the fan speed is increased. A counter clockwise turn of the fan speed knob decreases the fan speed.

Air conditioner switch (3) switches the air conditioner **on** or **off**.

NOTE: The air conditioner switch is optional. If an air conditioner is not installed, the face plate does not have this switch.

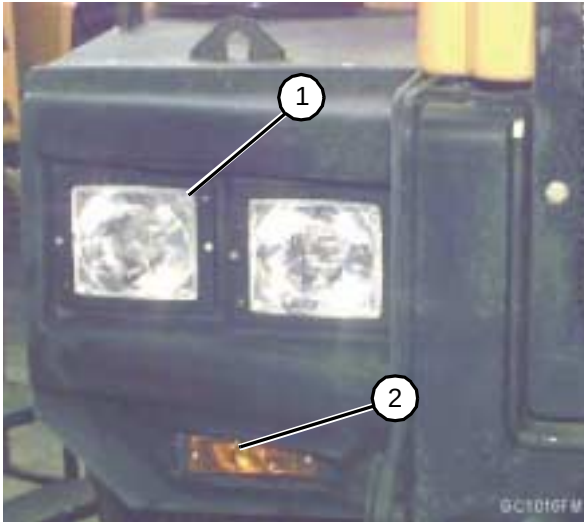
When the air conditioner switch is **ON**, and the fan switch is also **ON**, conditioned air is circulated through the air vents.

When the temperature control knob (4) is turned in a clockwise direction, the air circulated through the air vents is progressively warmed.

When the temperature control knob is turned in a counter clockwise direction, the air circulated through the air vents is progressively cooled.

Lights

Front Lights

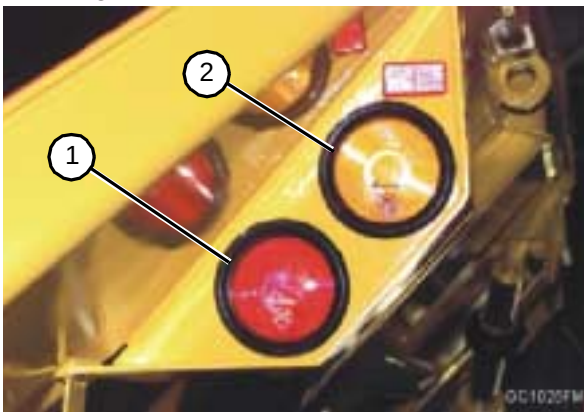


The front of the machine is equipped with four headlights (1), two on each side, and two indicators (2).

The headlights are operated from the lights switch on the dashboard and the stalk switch on the steering column.

When the lights switch is switched to the central position, the park light bulb inside the unit illuminates and the main headlight bulb illuminates when the lights switch is in the bottom position.

Rear Lights



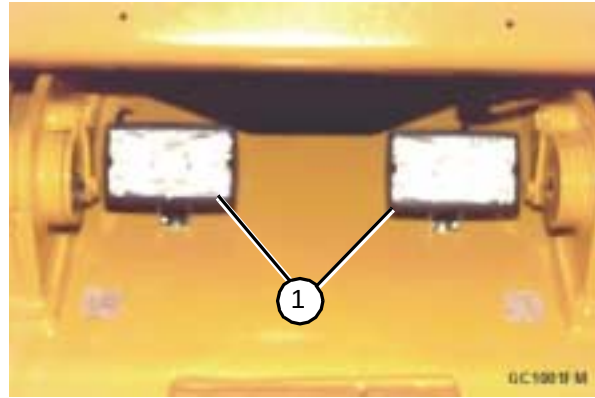
The rear of the machine is equipped with stop/tail lights (1) and indicator lights (2).

The stop light bulb illuminates when the brake pedal is depressed.

The tail light bulb operates from the lights switch on the dashboard.

The indicator bulb operates from the stalk switch on the steering column.

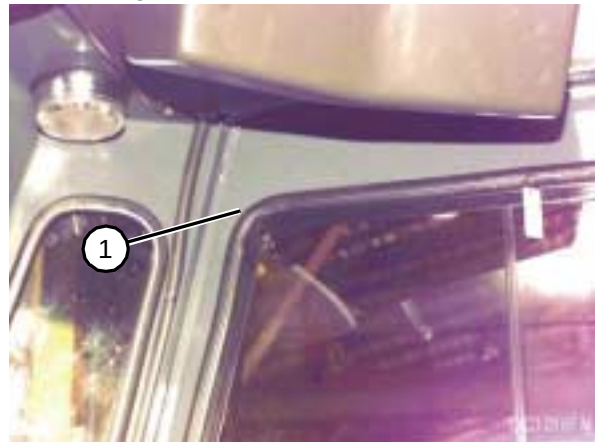
Reverse Lights



The machine is equipped with two white, reverse, halogen lights (1).

The reverse lights illuminate and a warning buzzer sounds when the reverse gear is selected.

Interior Light



An interior light (1) is fitted on the roof of the cab and is operated from a switch on the dashboard.

Electrical Distribution Box



The electrical distribution box is located below the cover on the top, left side of the dashboard.

To gain access to the electrical distribution box, remove the cover on the top, left of the dashboard.

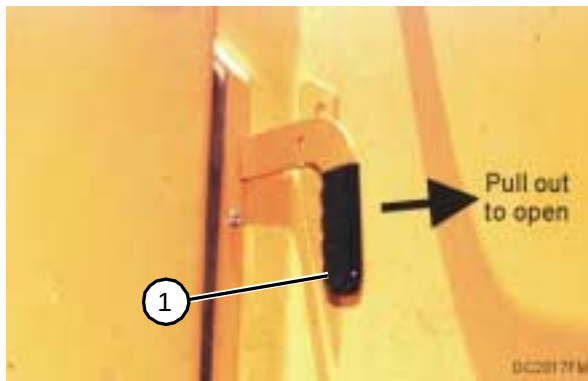


The electrical distribution box comprises eight circuit breakers which provide electrical overload protection for the particular circuits identified on the face plate.

Push in a circuit breaker to reset a circuit that has tripped.

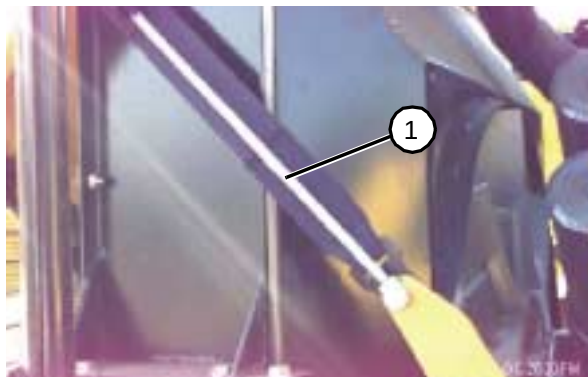
Miscellaneous Equipment

Bonnet Catch Release Lever



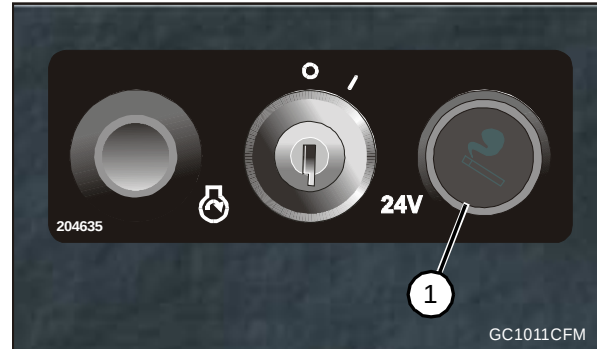
The bonnet catch release lever (1) is located on the left side of the cab/bonnet.

When the lever is pulled the bonnet catch is released and the bonnet can be raised.



When the bonnet is raised ensure that it is fully open, the lifting strut (1) will be fully extended.

Cigarette Lighter/ 24 V Accessories Socket



The cigarette lighter (1) is located in the 24 V accessories socket on the right panel of the dashboard.

The following procedure must be used to operate the cigarette lighter:

- Ensure that the ignition switch is **ON**.
- Press the lighter push button in and release.
- Wait until a click is heard.
- Remove the lighter from the housing.

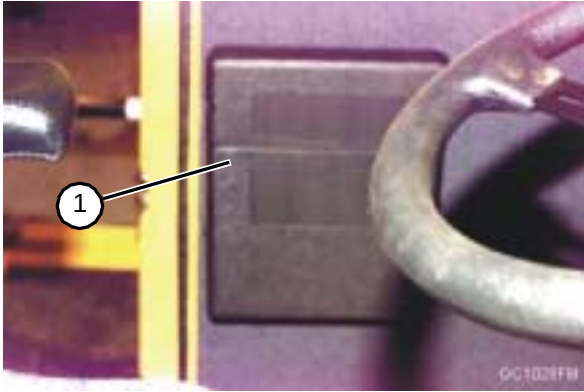
▲ WARNING

Do not touch the front of the lighter when removing it from the housing. This will cause a serious burn.

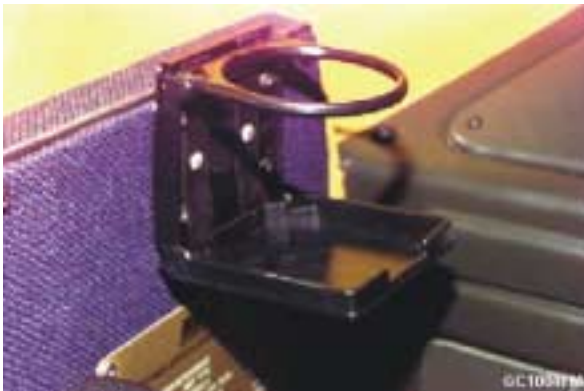
The cigarette lighter socket can be used as a 24 V power supply point.

The following procedure must be used to utilise the socket as a power point:

- Remove the cigarette lighter from the socket and store in a safe place.
- Place the 24 V accessory plug into the socket. The accessory will have electrical power when the ignition switch is **ON**.
- When the accessory is no longer required replace the cigarette lighter into the socket.

Document Holder

- The document holder is located on the left side of the cab, next to the door.
- The document holder contains the Operator Manual.

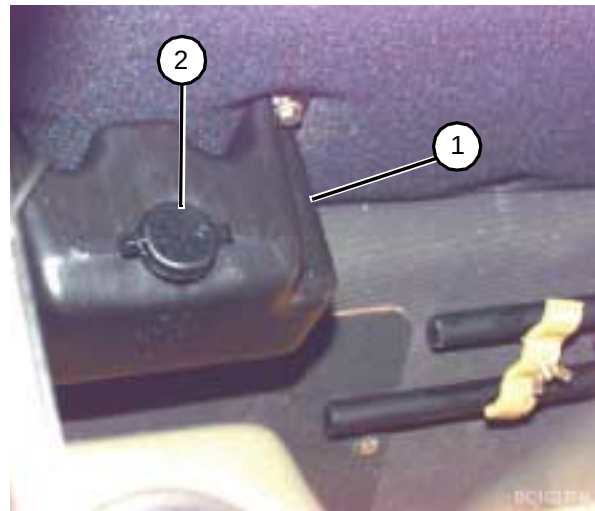
Drinks Holder

A drinks holder is located on the left of the cab.

The holder can be folded flat when not in use.

Wheel Spanner and Brace

A wheel spanner and brace are located at the rear of the cab, behind the operator's seat and are secured in position by two plates.

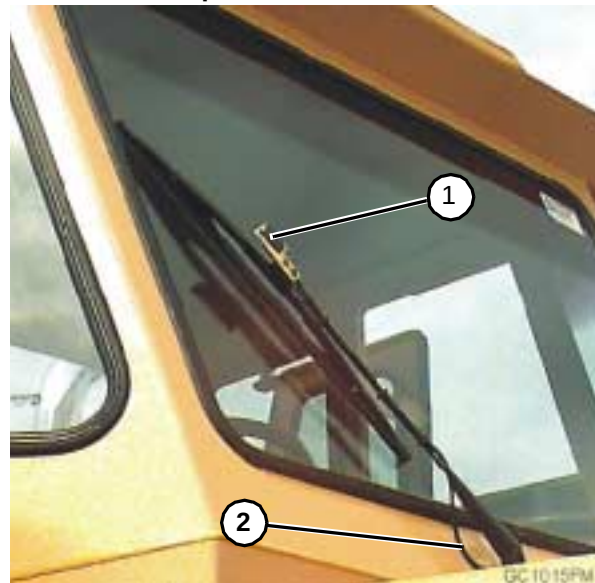
Windscreen Washer Water Bottle

The windscreen washer water bottle (1) is located at the right rear of the cab.

The bottle is a reservoir for the water delivered through the nozzle fitted to the windscreen wiper arm.

The following procedure must be used to refill the water bottle:

- Remove the filler cap/pump assembly (2) and fill the bottle with a window cleaning solution.
- Ensure that the cap is replaced securely and that the electrical connection and water delivery pipe are also secure.

Windscreen Wiper and Washer Nozzle

The machine is fitted with a single windscreen wiper which is equipped with a washer nozzle (1).

When the wiper/washer switch is in the centre position, the windscreen wiper motor is switched on and the wiper arm is activated.

When the wiper/washer switch is held down in the bottom position, the water pump on the washer bottle is switched on. Water is then delivered through the pipe (2) and via the nozzle to the windscreen.

Trainer Seat



The trainer seat is located on the left side of the operator's seat.

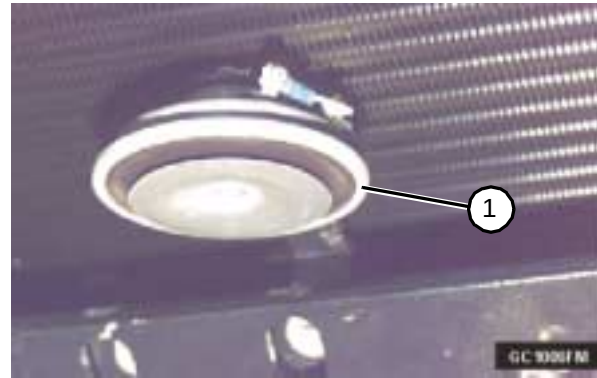
The seat is not adjustable and is equipped with a seat belt.

The seat belt for the trainer is fastened, released and adjusted in the same way as the operator's seat belt.

▲ WARNING

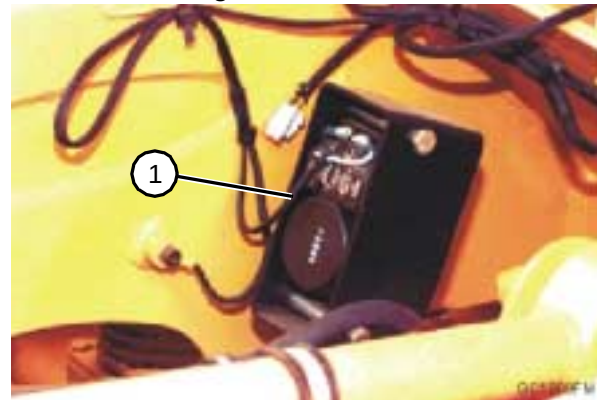
1. Always wear a seat belt when travelling as a trainer or trainee in the machine. In an accident it may save your life.
2. Check the condition of the seat belt and mounting hardware before travelling in the trainer seat. Replace the seat belt at least every three years, regardless of the condition.

Horn



The horn is located on the front, right of the machine, behind the engine grill and is operated from the steering column stalk switch.

Reverse Warning Buzzer



When reverse gear is selected, the reverse lights illuminate and a warning buzzer (1) sounds at the rear of the machine.

LEFT BLANK INTENTIONALLY

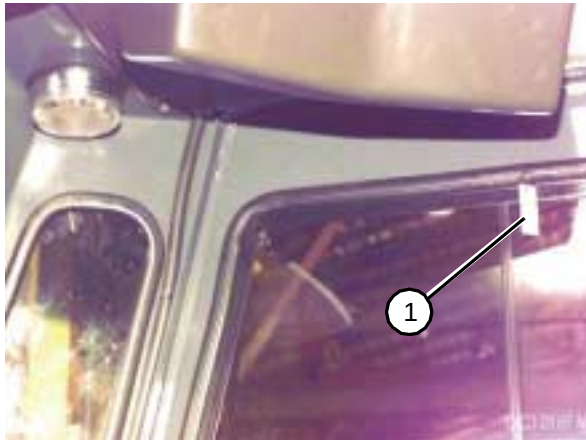
CHAPTER 3. PROCEDURES BEFORE STARTING

Safety Instructions

Before operating the machine the following safety instructions must be observed:

- Read and fully understand this manual, before you start operating the machine.
- Never operate the machine while under the influence of alcohol, medication or any other drugs.
- Wear the required protective clothing for safe machine operation.
- When mounting or dismounting the machine always face the machine and use the hand rails and steps provided. Always use both hands and one foot or one hand and both feet. Never jump off the machine.

The cab has 2 exit points, which are as follows:



- The cab access door (for normal access and exiting of the cab).
- Emergency exit (right side window). The window is removed by pulling the emergency exit tag (1) to remove the rubber molding and then pushing the windows out of the frame.

Running-in Instructions

The machine's run-in period is the First 100 SMR of operation. The machine **MUST** be serviced at 100 SMR to ensure maximum machine service life.

The 100 SMR service **MUST ONLY** be done by **BELL EQUIPMENT** Service Personnel.

Procedures Before Starting

Safety Rules

Operator Duties

The operator must know the rules and safety aspects of the site. The operator must study the following rules and become aware of how to avoid serious injury and/or machine damage.

- It is the operator's duty to report all damage and wear which may endanger the operator or cause damage to the machine.
- Only trained personnel may operate the machine.
- Check that a "**DO NOT OPERATE**" tag is not attached to the steering wheel. If the tag is attached, do not operate the machine.
- Complete the Walk Round Check (refer to next instruction). If any defects are found, do not operate the machine. Attach the "**DO NOT OPERATE**" tag to the steering wheel and remove the machine key.
- Report all defects and problems encountered during the Walk Round Check to the service personnel.

Daily Walk Round Check

The Daily Walk Round Check must always be carried out before operating the machine at the beginning of a work shift or after a change of operator during a shift.

The operator starts his check at the left of the machine and walks around the machine in a clockwise direction.

NOTE: The machine must be parked in the straight ahead position on firm, level ground with the bin down and the park/emergency brake applied.

It is recommended that the machine is thoroughly washed before starting the Walk Round Check.

The following is a list of the tasks required in the Daily Walk Round Check. For a more detailed description of the tasks refer to the **Daily or 10 Hourly Service Checks in Chapter 9**.

The service decal located on the side of the cab lists the scheduled service needs (maintenance schedule) and is useful for locating the items.

1. Raise the bonnet and check the condition of the lifting strut, pivots and restraining straps.
2. Check the transmission oil level.
3. Check the condition and tension of the alternator belts.
4. Check for loose, frayed or corroded connections in the wiring harness.
5. Check the engine mountings and cab mountings are secure and the rubber elements are not damaged.
6. Ensure that all the hose connections are tight and inspect for leaks, cracks or chafing damage.
7. Check that the exhaust connections, exhaust brake valve and actuator are secure.
8. Check that the batteries are secure and the connections are tight.
9. Check that the electric fan and cooler fins of the hydraulic oil cooler are not damaged.
10. Check that the hydraulic oil cooler fins are not restricted and the wiring harness for the fan is secure.
11. Check the compressed air drier assembly and unloader valve for security and damage.
12. Check the cooling pack for cleanliness and ensure there are no restrictions to the cooling function.
13. Check the security of the cooling pack assembly and inspect for leaks.
14. Inspect the air cleaner assembly for damage and security.
15. Clean the pre-cleaner bowl if required.
16. Check the service indicator and service the filter elements if required.
17. Reset the service indicator. Check that the vacuator valve is not restricted and is undamaged.
18. Inspect the connections from the air cleaner to the turbocharger.
19. Check the engine oil level.
20. Check the engine coolant level.
21. Check the condition and the tension of the air conditioner compressor drive belts (if fitted).
22. Check the throttle linkage and the throttle position sensor cable connections are secure.
23. Drain the fuel/water separator filter.
24. Drain the air reservoir and change the air drier element if required.
25. Inspect the suspension air bags, shock absorbers and verify that the axle restraint cable is in place.
26. Check that the steering cylinders are secure.
27. Check the transfer case oil level.
28. Ensure that the transfer case mountings are secure and undamaged.
29. Check the hydraulic fluid level.
30. Check the disc brake pads (if mud covers are not fitted).
31. Lubricate as required.
32. Inspect the park/emergency brake disc pad lining.
33. Check the axles and components (trailing arms, stabiliser links and sandwich blocks) for leaks, damage and security.
34. Ensure that the drive shaft assemblies are secure.
35. Check the wheels, wheel nuts and components for damage and security.
36. Check the tyres for cuts and damage.
37. Check the tyre pressures (refer to the decal for pressures).
38. Check the fuel level.
39. Ensure that the windshield, side and rear windows and the rear view mirrors are clean.
40. Ensure that there are no obstructions around the machine before moving off.
41. Ensure that there are no obstructions in the cab, especially under and around the pedals and controls before moving off.
42. Ensure that the seat belt is in proper working order and fasten the seat belt before start-up.

CHAPTER 4. OPERATING INSTRUCTIONS

▲ CAUTION

Read and understand all of the operator related chapters in this manual before performing any of the following procedures and obey all Warnings and Cautions contained in the sections. Refer to the detailed procedures in the relevant chapter.

Safety Rules

Trainers are only allowed on machines provided with a trainer seat and with approval by site management.

Always wear the seat belt when operating the machine.

Check that the mirrors are correctly positioned for the best visibility.

Check that no personnel are near the machine.

Adapt the machine speed to road conditions, load and visibility.

Starting the Engine

Before Starting the Engine

Ensure that the Procedures Before Starting have been performed.

Ensure that the Daily or 10 Hourly Service Checks have been completed.

Adjust the operator's seat for the best operator comfort and easy access to the machine controls.

Fasten the seat belt and adjust the seat belt to fit firmly across the front of the pelvis.

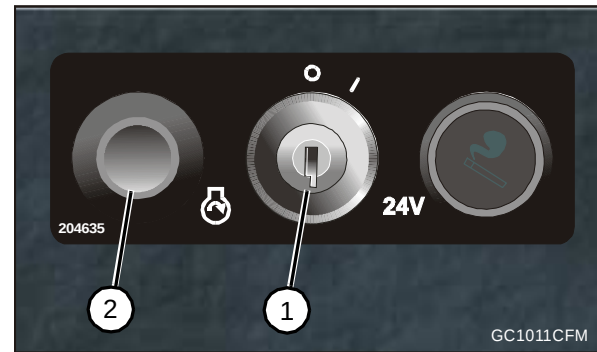
Starting the Engine in Warm Weather

Starting the engine in warm weather does not require any special procedures.

The following procedure must be used to start the engine in warm weather:

- Ensure the battery disconnect switch is turned **ON**.
- Ensure the park/emergency brake is applied.
- Ensure the gear shift is in the neutral position.

NOTE: The engine cannot be started when any gear is selected.



- Insert the ignition key into the ignition switch (1).
- Turn the ignition switch clockwise to the **ON** position and check that the following indicators illuminate or flash:
 - i . Main warning indicator.
 - ii . Park/emergency brake indicator.
 - iii . Alternator warning indicator.
 - iv . Emergency steering warning indicator.
 - v . "Do not shift" warning indicator.
 - vi . Low pneumatic pressure warning indicator

▲ CAUTION

If any of the indicators do not illuminate then either the bulb is blown or there is an electrical fault. The fault must be rectified immediately.

Press the accelerator pedal approx. 1 quarter of its travel.

▲ CAUTION

Allow the engine to idle for at least half a minute. Thereafter operate the machine at less than full throttle until operating temperatures have been reached and no warning indicators are illuminated. Do not run the engine at high speed (rev/min) or heavy loading until the engine oil, transmission fluid and hydraulic fluid have reached normal operating temperatures.

Press the start button (2) until the engine starts.

▲ CAUTION

Do not hold the start button in the start position for more than seventeen seconds. If the engine does not start, wait one minute before attempting to restart the engine to allow the battery to stabilise. If the engine does not start after two attempts investigate the cause.

Starting the Engine in Cold Weather**▲ CAUTION**

Allow the engine to idle for at least half a minute. Thereafter run the machine at less than full throttle until operating temperatures have reached normal range and no warning indicators are illuminated. In extremely cold weather the transmission must be allowed to warm up before operation.

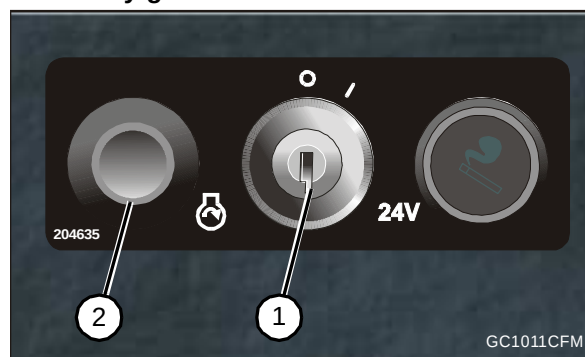
The transmission is programmed to restrict full operation until specific temperatures are reached. Refer to the following chart for temperature restrictions:

Sump Oil Temperature	Do Not Shift Warning Indicator	Operation
-7°C (19.3°F)	Off	Neutral, Reverse and 2nd gear attainable.
Above -7°C (19.4°F)	Off	Full operation of all gears.

The following procedure must be used to start the engine in cold weather:

- Ensure the batteries disconnect switch is turned ON.
- Ensure the park/emergency brake is applied.
- Ensure the gear shift is in the neutral position.

NOTE:The engine cannot be started when any gear is selected.



- Insert the ignition key into the ignition switch (1).
- Turn the ignition switch clockwise to the **ON** position and check that the following indicators illuminate:
 - vii . Main warning indicator.
 - viii . Park/emergency brake indicator.
 - ix . Alternator warning indicator.
 - x . Emergency steering warning indicator.
 - xi . "Do not shift" warning indicator.
 - xii . Low pneumatic pressure warning indicator
 - xiii . Cold start indicator will also illuminate.

NOTE:The cold start function of the machine is automatic. The cold start function will only operate when the outside temperature drops below 15°C (59°F).

- Wait until the cold start indicator light extinguishes (approx. 20 seconds).
- Press the accelerator pedal approx. 1 quarter of its travel.

▲ CAUTION

Do not run the engine at high speed (rev/min) or heavy loading until the engine oil, transmission fluid and hydraulic fluid have warmed up to normal operating temperatures.

- Press the start button (2) until the engine starts.

▲ CAUTION

Do not hold the start button in the start position for more than seventeen seconds. If the engine does not start, wait one minute before attempting to restart the engine to allow the battery to stabilise. If the engine does not start after two attempts investigate the cause.

Shutting Down the Engine

- The following procedure must be used to shut down the engine:
 - i . Stop the machine in the straight ahead position.
 - ii . Apply the park/emergency brake.
 - iii . Select neutral (N).

NOTE: Never stop the engine from high idle. This will cause damage to the turbochargers and the engine.

- iv . Allow the engine to idle for 2 minutes to allow the engine temperature to stabilise.
- v . Turn the ignition switch counter-clockwise to the **OFF** position.
- vi . If the machine is stopped overnight ensure the battery disconnect switch is turned to the **OFF** position and that the park/emergency brake is **ON**.

Driving**Safety Rules****▲ CAUTION**

- 1. Never maintain a stall condition for more than 30 seconds at any one time because of the rapid rise in fluid temperature. Do not allow the converter-out fluid temperature (transmission fluid temperature as displayed on the driver's instrument panel) to exceed 120°C (248°F).**
- 2. Never permit a stall condition to arise if the converter-out fluid temperature (as displayed on the driver's instrument panel) is below 45°C (113°F) or if the sump fluid temperature (as displayed on the Pro-Link® 9000 diagnostic tool) is below 30°C (86°F).**
- 3. Serious transmission damage will be caused if the CAUTIONS above are ignored.**

Check that all the gauges and indicators are operational. Ensure the readings are correct. Refer to **Chapter 2, Operator's, Controls and Instruments** for the correct readings.

Check the steering and brake functions and confirm that the reverse alarm sounds when reverse is selected.

Ensure that the rear view mirrors are adjusted for maximum vision to the rear of the machine.

Check that there are no personnel on or around the machine before driving the machine.

Sound the horn before moving off.

Gear Shifting**▲ CAUTION**

Do not allow the machine to free wheel (coast in neutral) as this will cause damage to the transmission.

The transmission has 6 forward gears and 3 reverse gear with automatic lockup in all gears (except 1st gear). The transmission can be operated as a fully automatic transmission. All automatic gear shifting will be controlled by the machine's electronic control unit.

Gear Shifting Safety Functions

During normal operation when the **D** (Drive) button is pressed, the digital display shows the highest forward gear attainable for the shift schedule in use.

Abnormal operation is also indicated on the digital display screen.

When all segments of the digital display are illuminated for more than 12 seconds, the ECU did not complete initialisation.

When the digital display is blank, there is no power to the selector.

When the display shows the symbol: + (cateye), a selector-related fault code has been logged.

Conditions which illuminate the "Do Not Shift" (DNS) warning indicator will disable the shift selector and the digital display will show the gear actually attained. Refer to **"Do Not Shift" Warning Indicator in Chapter 2.**

The transmission will not shift into gear if a DNS code is active.

When the display shows either a **R** (Reverse) or **D** (Drive) has been requested and the display is flashing, the requested gear has not been achieved due to an inhibit function. Allow the engine to idle, reselect neutral then reselect the gear.

Check for active codes when D is not attained. Once **D** is attained, the transmission will shift into the lowest gear programmed for the **D** position (usually 1 st).

To access diagnostic codes, press the UP and DOWN arrow buttons in unison, twice.

Gear Shifting

Gear shifting is dependent upon engine speed (rev/min) and operating conditions (on site conditions).

The following procedure must be used in gear shifting:

- Start the engine.
- Ensure that the park/emergency brake is applied.
- Apply the service brake.

Forward Selection.

▲ CAUTION

Stop the machine before shifting from reverse gear to a forward gear. Refer to Downshift or Reverse Inhibitor in this Section.

- Select **D** (Drive) on the gear selector.
- Release the park/emergency brake.
- Release the service brake and increase the engine speed (rev/min).

As the machine speed increases, the transmission will select (sequentially) the next gear.

With **D** (Drive) selected, the attainable gears will be displayed.

Reverse Selection.

▲ CAUTION

Stop the machine before shifting from a forward gear to reverse gear. Refer to Downshift or Reverse Inhibitor in this Section.

- Select **R** (Reverse) on the gear selector.
- Release the park/emergency brake.
- Release the service brake and increase the engine speed (rev/min).
- **R** (Reverse) will be displayed as the selected gear.

Manual Gear Shifting

Manual selection of gears within the D selection is achieved by pressing ↑ (Up) and ↓ (Down) arrow buttons until the desired gear is shown in the digital display screen.

Accelerator Control

▲ WARNING

To help in avoiding injury or property damage caused by sudden movement of the machine, do not make shifts from N to D or R when the throttle is open

If the operator shifts while the throttle is open too much, the transmission will engage only if the throttle is closed in the next three seconds. That can cause a sudden movement of the machine. Leaving the throttle open longer than three seconds causes the transmission to remain in **N** (neutral). Avoid this condition by making shifts from **N** to **D** or **R** only when the throttle is closed.

The position of the accelerator pedal influences the timing at which automatic shifting occurs. When the pedal is fully depressed, upshifts will occur automatically at high engine speeds.

An electronic throttle position signal tells the ECU how much the operator has depressed the pedal.

Excessive throttle position affects directional change shifts (shifts from **N** to **R** or **D**).

Downshift or Reverse Inhibitor**▲ CAUTION**

The shift from N to D or R is inhibited when engine speed is above idle. N must be reselected and the speed reduced before the shift will occur. When shifts to D or R are inhibited, the digit on the selector display screen will flash.

Although there is no speed limitation on upshifting, there is on downshifting and shifts from **N** into **D** or **R**. If a downshift or **N**-to-gear shift is selected when the engine speed is too high, the ECU will prevent the shift from occurring until **N** is reselected and/or the shift is made at a lower speed.

Diagnostic Codes

Diagnostic codes are numerical indications, (displayed on the gear shift digital display screen), relating to a malfunction in transmission operation.

Each code consists of a two-digit main code and a two digit sub-code.

These codes are logged in a list in the ECU memory with the most recent code listed first. The codes in the list have information recorded as shown in the table below (codes are examples):

Code List Position	Main Code	Sub-Code	Active Indicator
d1	21	12	YES
d2	41	12	YES
d3	23	12	NO
d4	34	12	NO
d5	56	11	NO
Displayed on the shift selector and diagnostic tool, d = "diagnostic"			Yes = DNS warning indicator illuminated

There are two more codes, Ignition Cycle Counter and Event Counter. Access to these codes is through a diagnostic tool only. For further details of the Pro-Link® diagnostic tool and the Electronic Controls Troubleshooting Manual, Refer to **BELL EQUIPMENT** Product Support.

A maximum of five codes (numbered d1-d5) may be listed in the memory at one time.

As codes are added, the oldest non-active code is dropped from the list.

If all codes are active, the code with the lowest priority that is not included on the severity list is dropped from the list.

The ECU separately stores the active and historical (non-active) codes:

- An active code is any code that is current in the ECU decision-making process.
- Historical codes are codes that are retained in the ECU's memory and will not necessarily affect the ECU decision-making process.

Historical codes are useful in determining if a problem is isolated, is intermittent or results from a previous malfunction.

When the diagnostic mode is entered, the first code (position d1) is displayed as follows (each display item lasts for approximately one second):

- d, one main code (two-digits displayed one-at-a-time), sub-code (two-digit displayed one-at-a-time).
- Sequence repeats.
- Press the MODE button momentarily to display codes for position d2-d5 in the same manner.

After a fixed number of ignition cycles, a code may be deleted from the memory if it has not recurred.

The shift selector diagnostic mode will end automatically after two minutes without operator input.

Diagnostic Code Display Procedure**▲ WARNING**

Bring the machine to a stop at a safe location and apply the park/emergency brake before displaying and reading diagnostic codes.

Diagnostic codes can be read and cleared by two methods:

- With the Pro-Link® diagnostic tool, Refer to **BELL EQUIPMENT** Product Support.
- With the gear shift control buttons.

To Display Stored Codes

- Simultaneously press the ↑ (Up) and ↓ (Down) arrow buttons twice to access the diagnostic display mode (if pressed just once the hydraulic fluid level will be checked, Refer to **CHAPTER 9. DAILY OR 10 HOURLY SERVICE CHECKS**)
- Observe the digital display for codes (codes will appear one digit at a time).
- Press the **MODE** button to see the next code.
- Repeat for subsequent codes.

To Clear Active Indicators and Resume Machine Operation



- Press and hold the **MODE** button for approximately five seconds until the mode indicator **LED (1)** flashes.
- Release the **MODE** button.
- Active indicators and the DNS warning indicator will not be illuminated.

Some codes are self-clearing and others require ignition cycles to clear.

For a list of diagnostic codes, Refer to **Troubleshooting** in the last **Chapter** of this manual.

Braking

The general rule for braking is that the retarder should be used before the service brakes in order to reduce the brake pad wear.

Exhaust Brake

The exhaust brake system is fully automatic and will be activated when the accelerator pedal is released.

When the exhaust brake is applied, the transmission automatically starts to downshift to a lower gear. The digital display will indicate "2" while this happens.

When second gear is attained and the machine has slowed, the exhaust brake will be disengaged and the digital display will return to the previous value shown.

Retarder

The retarder switch is applied to avoid using the service brake over extended periods thus reducing the risk of overheating of the brake assembly.

The application of the retarder increases the hydraulic braking pressure and can be used to brake a laden machine on steep inclines.

The retarder braking effect is dependent on the gear selection. The lower the gear, the greater the braking effect.

Service Brakes and Park/Emergency Brake

During normal operation the machine must be stopped using the service brakes.

Service Brakes

▲ WARNING

Avoid using the service brake over extended periods. Excessive use of the service brakes will result in the brake assembly overheating which in extreme circumstances could result in a brake assembly failure.

Stopping the machine with the service brakes is done as follows:

- Release the accelerator.

NOTE:When the accelerator is released the exhaust brake is activated.

- While driving the machine normally the brake pedal must be pressed.
- When extra brake force is required, use the retarder switch to activate the retarder.

To resume driving, release the brake pedal and retarder.

NOTE:The transmission will automatically select the lowest pull-off gear.

Park/Emergency Brake

NOTE:The park/emergency brake must only be applied when the machine is completely stationary.

When the machine is to be stopped for more than a few seconds the following must be done:

- Stop the machine using the service brake.
- Apply the park/emergency brake.
- Release the service brake.
- Select Neutral (N)

High Transmission Fluid Temperature

The transmission is considered to be overheated when any of the following temperatures are exceeded:

Sump Fluid	121°C (250°F)
Fluid to Cooler	149°C (300°F)

If the sump fluid temperature reaches 128°C (262°F) the ECU will inhibit operation in the higher gears.

If the transmission overheats during normal operation, check the fluid level in the transmission. Refer to **Check the Transmission Fluid Level in Chapter 9**.

If the engine overheats, the transmission also probably overheated.

Stop the machine and check the cooling system.

If the cooling system appears to be functioning correctly, run the engine at 1 500 rev/min with the transmission in **N**.

This should reduce the transmission and the engine temperatures to normal operating levels in 2 to 3 minutes.

If temperatures do not decrease, reduce the engine speed.

⚠ CAUTION

The engine should never be operated for more than 30 seconds at full throttle with the transmission in gear and the output stalled. Prolonged operation of this type will cause the transmission fluid temperature to become excessively high and result in damage to the transmission.

If the engine overheats, an engine problem is indicated.

If high temperature in either the engine or the transmission persists, stop the engine and investigate the cause.

Operating with Inter-axle Differential Lock

NOTE: It is recommended that the inter-axle differential lock is only engaged when the machine is operating on very poor ground conditions. The differential lock must not be engaged when the machine is operating on tar or graded surfaces.

The inter-axle differential lock switch operates the differential lock in the transfer case.

⚠ CAUTION

The differential lock must not be engaged when the machine is moving. This will cause damage to the differential.

Inter-axle Differential Lock Control

Engaging the Inter-axle Differential Lock

The following procedure must be used to engage the inter-axle differential lock:

- Stop the machine before entering poor ground conditions.
- Apply the park/emergency brake.
- Select Neutral (**N**).
- Switch the differential lock switch **ON**.
- The inter-axle differential lock indicator will illuminate.
- Select Drive (**D**).
- Release the park/emergency brake.
- Drive off slowly.

Disengaging the Inter-axle Differential Lock

When the ground conditions improve the inter-axle differential lock must be disengaged.

The following procedure must be used to disengage the inter-axle differential lock:

- Stop the machine when on the improved ground surface.
- Apply the park/emergency brake.
- Select Neutral (**N**).
- Switch the inter-axle differential lock switch **OFF**.
- The inter-axle differential lock indicator will extinguish.
- Release the park/emergency brake.
- Drive off normally.

Loading the Machine

The following procedure must be used to load the machine:

- Position the machine in a straight ahead position.
- Apply the park/emergency brake.
- Select Neutral (**N**).

When the loading operator signals that the bin is fully loaded the following must be done:

Select Drive (**D**).

Release the park/emergency brake and drive off slowly.

Raising the Bin

- Position the machine in a straight ahead position.
- Apply the park/emergency brake.
- Select Neutral (**N**).
- Increase the engine speed to approximately 1 500 rev/min
- Move the tip control lever towards the operator and hold in position until the bin is almost to maximum travel.
- Reduce engine speed as the bin reaches maximum travel.
- Release the tip control lever.

NOTE:The tip control lever is spring-loaded to the central position (holding position).

Lowering the Bin

- Move the tip control lever away from the operator and hold in position until the bin is fully lowered
- Release the tip control lever.
- Ensure that the bin raised warning indicator is extinguished.

NOTE:If the bin is not fully lowered (the bin raised warning indicator is illuminated), the transmission will only select 1st gear, neutral and reverse. As soon as the bin raised warning indicator is extinguished, normal transmission gear selection will resume.

- Select Drive (**D**).
- Release the park/emergency brake and drive off slowly.

NOTE:The tip control lever is spring-loaded to the central position (holding position).

▲ WARNING

Do not operate the bin tip lever unless the transmission is in Neutral (or dumping in first or reverse gear). This practice can override the safety functions and could cause damage to the machine and/or personal injury.

Steering

Normal Steering

The machine's normal steering system is operational when the engine is operating.

▲ WARNING

There is no self-centering function on the machine steering. After turning the steering, the machine must be straightened by turning the steering wheel to the straight ahead position.

Emergency Steering

▲ WARNING

If there is an engine or main pump failure, the ground driven emergency steering system will enable the operator to steer the machine to a safe stop. In this event the machine must be stopped as quickly as possible.

When the engine or main pump fails the emergency steering indicator will flash.

The machine's emergency steering system is ground driven.

Overnight Parking

When the machine is to be parked overnight the following must be done:

- Ensure the machine is unloaded.
- Park the machine on firm level ground.
- Move all the switches to the **OFF** position.
- Ensure the transmission is in Neutral (**N**).
- Ensure the park/emergency brake is applied.
- Switch the ignition **OFF** and remove the key.
- Lock the cab door.

- Open the battery box lid and move the battery disconnect switch to the **OFF** position .
- Ensure the battery box lid is closed properly. Secure with padlocks if required.
- Ensure that the fuel cap and the bonnet release levers are locked.

Operating Indoors

Machines may only be operated in buildings approved by site management.

When operating the machine indoors ensure that there is sufficient ventilation for the exhaust fumes to escape.

Do not exceed the maximum floor load.

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CHAPTER 5. OPERATING TECHNIQUES

The following information details suggested techniques to obtain the safest and most efficient use of your machine.

Safety Rules

Ensure there is sufficient space for the machine before entering confined areas.

Accidents and injuries must be reported immediately. Site management must also be informed of any "narrow escapes" and areas and situations which could present an accident risk.

If possible, after an accident, the machine must be left in its position.

Do not do anything to the machine that may hamper an investigation into the accident.

Follow the instructions given by the site management.

Hydraulic Retarder

Observe the following cautions when using the retarder:

The retarder will only operate when the engine is at closed throttle.

Observe transmission and engine temperature limits at all times. Select the lowest possible transmission range to increase the cooling system capacity and total retardation available.

In the event of overheating, decrease the use of the retarder and use the service brakes.

Observe the high hydraulic fluid temperature warning indicator and stop the machine immediately if it illuminates. Allow the engine to run at 1 500 rev/min until the hydraulic temperature returns to normal and the warning indicator extinguishes

Gear Selection

The transmission makes it unnecessary to select the right moment to upshift or downshift during changing travelling conditions. However knowledge of the ranges and when to select them will make machine control and operator's job easier.

The following table is a brief summary of the range selection covered in this manual.

R	Completely stop the machine before shifting from a forward gear to R or from R to a forward gear
▲ WARNING Do not allow the machine to coast in N, there is no engine braking and the operator may lose control. Coasting in neutral will also cause transmission damage.	
N	Use N to start the machine and for periods of engine idle operation. N is selected by the ECU at start-up. Always select N before turning off the engine.
The shift from N to D or R is inhibited when engine speed is above idle. N must be re-selected and the idle speed reduced before the shift will occur. When shifts to D or R are inhibited, the digit on the shift selector will flash.	
D	The transmission will initially attain first gear when D is selected. As machine speed increases, the transmission will upshift automatically through each gear. As the machine slows, the transmission will downshift automatically. The shift selector will display the highest range available. Even though D is selected, it may not be attained due to active inhibit functions such as high throttle or engine idle speeds. Check for active diagnostic codes if D is not attained.
▲ WARNING If the operator just downshifts or just uses the service brakes while going downhill, he may lose full control of the machine.	

To help in keeping full control on downhills, use a combination of downshifting, braking and the retarder. Downshifting to a lower gear increases engine braking and helps the operator maintain full control. The transmission has a feature which prevents automatic upshifting above the lower gear selected. However during downhill operation, if engine governed speed is exceeded in the lower gear, the transmission may upshift to the next higher gear. This will reduce braking and may cause loss of control. Apply the service brakes and/or retarder to prevent exceeding engine governed speed in the lower gear selected.	
6 5 4 3 2 1	Occasionally road conditions, load or traffic conditions will make it desirable to restrict automatic shifting to a lower gear. Lower gears provide greater engine braking for going down grades (the lower the gear; the greater the braking effect). The shift control utilises ↑ (Up) and ↓ (Down) arrow buttons to select individual forward gears. The shift control will display the operator's choice. Even though a lower gear was selected, the transmission may not downshift until machine speed is reduced.
1	Use this gear when pulling through mud and deep snow, when manoeuvring in tight spaces or while driving up/down grades. 1st gear provides the machine with maximum driving torque and maximum engine braking effect. Push the ↓ (Down) arrow button on the shift selector until first gear appears on the display screen. When selecting D from N and the bin is raised (bin raised warning indicator is illuminated), the transmission will limit gear selection to 1st gear. The display on the shift selector will show "1". As soon as the bin is fully lowered (bin raised warning indicator is extinguished), the transmission will automatically revert to normal gear selection and the gear shift screen will revert to the original display.
R	Reverse operation of the machine is not affected by the bin raised condition (as described above).
2	When retarding, (i.e. the operator takes his foot off the accelerator) the transmission will start downshifting from the current gear, down to the 2nd gear to maximise engine braking. The gear shift display will show "2" as long as the retardation is in progress and will revert back to the original displayed value when: - 2nd gear is attained and the machine has slowed down to almost a stop. - or when the operator applies the accelerator to cancel retardation. The engine exhaust brake is automatically applied and the exhaust brake warning indicator is illuminated during the above retardation period.
GEAR (RANGE) HOLD	The range hold switch (next to the shift selector) allows the operator to hold the transmission in a gear of his choice to improve cycle time in abnormal operating conditions. When the switch is actuated, the gear that the transmission is in at the time, will be "held". No upshifting will happen beyond this gear (except in overspeed conditions) but downshifting is allowed. The "held" gear is displayed on the shift selector. When the range hold switch is switched OFF, normal gear selection (upshifting) will continue and the display will show the original value.
MODE	• MODE, is used in diagnosis code reading. Refer to Trouble-shooting at the end of this manual.

Gear Pre-selection

Gear pre-selection means selecting a lower gear to match driving conditions which the operator encounters or expects to encounter.

Learning to take advantage of pre-selected shifts will give the operator better control on slick or icy roads and on downgrades.

Downshifting to a lower gear increases engine braking.

The selection of a lower gear often prevents cycling between that gear and the next higher gear on a series of up-and-down gradients.

Transport Operation

When operating the machine in ideal conditions (e.g. level graded surfaces) normal driving and gear selection must be used.

The machine may be operated at maximum speed in accordance with the site and road regulations.

Always adapt the machine speed to the road and traffic conditions.

When driving through a bend do not drive too fast. The machine's centre of gravity is changed which may cause the machine to tip or roll if the road is slippery or cambered the wrong way.

The machine load must not be allowed to fall off the machine at any time.

Do not use the inter-axle differential lock when operating on smooth graded surfaces.

Due to the mass of the machine allow for long braking distances, especially on slippery roads.

Uphill Operation

If the machine is operating in full automatic mode, transmission will select the correct gear for travelling uphill.

When operating on slippery roads the inter-axle differential lock must be applied to allow for even traction on all the driving wheels.

The engine speed must be kept constant at all times when driving uphill.

Note: Shift cycling or "gear hunting" on certain uphill applications can be eliminated by driving in manual gearshift mode.

"Gear Hunting"

Under certain conditions, the transmission may start shift cycling or "gear hunting" i.e. The transmission changes up and down between two gears at short intervals. This is because the power is insufficient for operating in the higher gear but is sufficient for upshifting from the lower gear.

When the range hold switch is **ON** the transmission will hold the gear that it is in at the time of the switch being activated. Normal downshifting will occur, but the transmission will not upshift to a higher gear until the switch is switched **OFF**.

When level ground is reached the machine must be operated normally.

Downhill Operation

When driving downhill the exhaust brake and retarder must be utilised to assist the service brakes and to reduce brake pad wear.

If necessary, slow down before the downhill slope begins so that the transmission automatically selects a low gear.

During icy or other slippery conditions, utilise the inter-differential lock to improve traction and braking effect.

Using the Engine to Slow the Machine

▲ WARNING

If the operator just downshifts or just uses the service brakes while going downhill, he may lose full control of the machine.

To help in keeping full control on downhills, use a combination of downshifting, braking and the retarder.

Downshifting to a lower gear increases engine braking and helps the operator maintain full control.

The transmission has a feature which prevents automatic upshifting above the lower gear selected. However during downhill operation, if engine governed speed is exceeded in the lower gear, the transmission may upshift to the next higher gear. This will reduce braking and may cause a loss of control.

Apply the service brakes and/or retarder to prevent exceeding engine governed speed in the lower gear selected.

To use the engine as a braking force, the operator must:

- Take his foot off the accelerator.
- The transmission will start to downshift and the exhaust brake will be applied.

If the machine is exceeding the maximum speed for this gear, use the service brakes and/or retarder to slow the machine.

When a lower speed is reached, the ECU will automatically downshift the transmission.

Engine braking provides good speed control for travelling downhill. When the machine is fully loaded, or the gradient is steep, it may be desirable to pre-select a lower gear before reaching the gradient.

Use the hydraulic retarder on severe gradients.

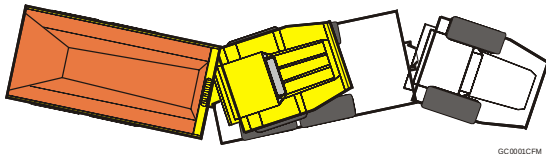
If engine-governed speed is exceeded, the transmission will upshift automatically to the next gear.

Off-road Operation

Do not operate too close to quarry edges, ramp edges, quay edges and soft edges that may collapse under the machine weight.

Always use the inter-axle differential lock and six-wheel drive during off-road operation when there is a risk of wheels slipping.

Always engage the inter-axle differential lock before any of the wheels begin to slip.



To cover difficult areas (e.g. soft mud) use the articulation steering combined with the inter-axle differential lock to move through the area in the so called "duck waddle".

Where the ground is particularly soft and there is no space restriction, choose a new track for each approach to avoid making deep tracks.

Public Road Operation

The operator must abide with all traffic regulations.

The operator must understand that the machine is wider, slower and heavier than other vehicles and may be an obstruction to other traffic.

Always have the headlights and a roof warning beacon on when operating on public roads.

Ensure the machine is evenly loaded and that none of the load can fall off the machine.

It is recommended that the load is covered when operating on public roads.

Due to the excellent off-road properties of the machine it is possible that public roads can be avoided, but always obtain permission from the management before taking off-road short-cuts.

Loading

Ensure there is sufficient space for the machine before entering confined areas.

Ensure that no personnel are near the machine or loading area.

Do not operate too close to quarry edges, ramp edges, quay edges and soft edges that may collapse under the machine's weight.

Be aware of other machines and personnel when entering or leaving the loading area.

If a spotter is present follow only his instructions.

Reverse up to a loading machine in a single, straight manoeuvre so that you can maintain eye contact at all times with the operator of the loader.

Steer the machine so that it is straight. The operator must have clear and unobstructed vision through his rear view mirrors. If the machine is articulated and not in the straight ahead position the operator may find it difficult to observe the spotter and the loading machines.

Stop the machine on a firm level surface.

Ensure that the bin is fully lowered so that the load is not dumped into a bin which is supported on the tip cylinders.

Do not overload by exceeding the rated capacity of the machine. The operator of the dump truck is responsible for the size and mass of the load.

Ensure the machine is loaded evenly. An uneven load will cause tyre and axle damage.

Before moving off with a load ensure that it is safely contained in the bin and no part of it can fall off. Ensure that no parts of the load are protruding from the bin.

Unloading

Ensure there is sufficient space for the machine before entering confined areas.

Do not operate or stop too close to quarry edges, ramp edges, quay edges and soft edges that may collapse under the machine mass. The use of stopping chocks or other safety devices is recommended.

Reverse up to the unloading site in a single, straight manoeuvre so that you can maintain eye contact at all times with the spotter and have all-round vision from the machine.

If a spotter is present follow only his instructions.

Steer the machine so that it is straight and on level ground. The operator must have clear and unobstructed vision through his rear view mirrors. If the machine is articulated and not in the straight ahead position the operator may find it difficult to observe the spotter and the dumping action.

When raising the bin ensure that when the bin is fully raised it is no less than 4 metres (13') away from any power lines.

Ensure that no personnel are near the machine or dumping area.

Be aware of other machines and personnel when entering or leaving the dumping area.

▲ WARNING

Do not operate the bin tip lever unless the transmission is in Neutral (or dumping in 1st or Reverse). This practice can over-ride the safety functions and could cause damage to the machine and/or personal injury.

Stuck Machine

NOTE: If the ground is soft with deep wheel tracks constant attention must be given to the rear chassis angle.

If the rear chassis starts to lean sideways excessively, stop the machine immediately and try another route.

If the machine becomes stuck the following must be done:

- Select Neutral (**N**).
- Engage the inter-axle differential lock.
- Select Drive (**D**).
- Check that the inter-axle differential lock indicator illuminates.
- Drive off slowly keeping the engine speed (rev/min) constant and not too high.
- To assist with traction, turn the steering wheel one way and then the other alternately causing the machine to adopt a "duck waddle".
- Continue with this movement until the machine is free and can be operated normally.

NOTE: If the machine does not move, get a towing vehicle to move the machine from the soft soil.

Rocking Out

▲ WARNING

To help in avoiding injury or property damage caused by sudden movement of the machine, do not make shifts from N to D or R when the throttle is open.

If the operator shifts while the throttle is open too much, the transmission will engage only if the throttle is closed in the next three seconds. That can cause a sudden movement of the machine. Leaving the throttle open longer than three seconds causes the transmission to remain in **N**.

Avoid this condition by making shifts from **N** to **D** or **R** only when the throttle is closed.

▲ CAUTION

Do not make N to D or directional shift changes when the engine speed is above idle. Also if the wheels are stuck and not turning, do not apply full power for more than 30 seconds in either D or R.

Full power for more than 30 seconds under the above conditions will cause the transmission to overheat.

If the transmission overheats, shift to **N** and operate the engine at 1 500 rev/min until it cools (2-3 minutes).

If the machine is stuck in deep sand, snow or mud, it may be possible to rock it out as follows:

- Shift to **D** and apply steady, light throttle (never full throttle).
- When the vehicle has rocked forward as far as it will go, apply the service brakes.
- Allow the engine to return to idle.
- Select **R**.
- Release the service brakes and apply a steady, light throttle and allow the machine to rock in **R** as far as it will go.
- Again apply and hold the service brake and allow the engine to return to idle.
- This procedure may be repeated in **D** and **R** if each directional shift continues to move the machine progressively further.

CHAPTER 6. RECOVERY AND TRANSPORTATION

Towing

Safety Rules

Always consult your **BELL EQUIPMENT** Product Support Representative before towing a disabled machine.

Always chock the machine before releasing the brakes and/or disconnecting the driveshafts.

Only use a rigid tow bar preferably an A-frame.

Ensure that the tow bar is strong enough to tow a machine at least 1.5 times the gross mass of the towing machine when towing from mud or on a grade.

Never exceed 2 km/h (1 to 2 m.p.h.) when towing a disabled machine for short distances.

Load a disabled machine onto a suitable breakdown vehicle or remove the driveshafts between the transmission and transfer case when moving it long distances.

Shielding must be provided on the towing machine and the disabled machine if the operator can possibly be injured due to the tow bar breaking.

Do not allow any unauthorised personnel on the disabled machine.

Gradual smooth movement is necessary for safe towing. Quick movements will overload the tow bar and cause it to break.

The towing machine must be the same size or larger than the disabled machine. Ensure the towing machine has sufficient brake capacity, mass and power to control both machines. Take account of the ground conditions and gradient when towing a disabled machine.

A larger machine and a solid tow bar is required when towing a disabled machine downhill. An additional machine connected to the rear may also be required to prevent the disabled machine from rolling away.

If the disabled machine is to be articulated (manoeuvred) a towing machine with a solid tow bar must be attached to the front of the machine for manoeuvring and a machine attached to the rear for controlling.

Minimum towing capacity is required for towing on smooth level surfaces and maximum towing capacity is required for towing on gradients and poor ground conditions.

▲ CAUTION

Failure to lift the wheels off the road or disconnect the driveline can cause damage to the transmission.

The engine cannot be started by pushing or towing.

Towing a Machine with Inoperable Engine

▲ WARNING

- 1. Before releasing the brakes, always chock the wheels to prevent the machine from rolling.**
- 2. Ensure the brake system of the towing machine is sufficient to hold the combined mass of the towing machine and the disabled machine.**
- 3. Removing the driveshafts on either side of the park/emergency brake renders the park/emergency brake inoperative.**

With the engine stopped the machine hydraulic and pneumatic systems are not operative. This means there is no powered steering or braking system.

NOTE: The park/emergency brake may be released mechanically but the steering system will remain inoperative. Articulation can only be obtained by disconnecting the steering cylinders hydraulic supply hoses.

Road speed must not exceed 2 km/hr. (1 to 2 m.p.h.).

Before towing disconnect the driveshaft between the transmission and the transfer case.

With the brakes released and the driveshafts disconnected, the towing machine must be capable of steering and stopping the complete mass of the disabled machine.

NOTE: Given the danger in towing a vehicle without an effective braking system it is recommended that the machine is transported on a suitable breakdown vehicle.

Towing a Machine with Operable Engine

If the steering system has no fault and the engine can be run, an operator must steer the machine.

If the failure is in the transmission do not run the engine, as the engine is directly coupled to the transmission. Refer to **Towing A Machine With Inoperable Engine** (previous instruction).

If the failure is in the transfer case, engage neutral and disconnect the driveshaft connecting the transfer case to the front differential and the driveshaft connecting the transfer case to the through drive.

If the fault does not affect the braking system the brakes can be released using the park/emergency brake hand control **AFTER** the wheels have been chocked.

Towing a Machine with Inoperable Steering System

Use these procedure in conjunction with relevant Engine Operative or Engine Inoperative Towing Procedures detailed previously.

If the machine must articulate while being towed and the steering system is inoperable disconnect as follows:

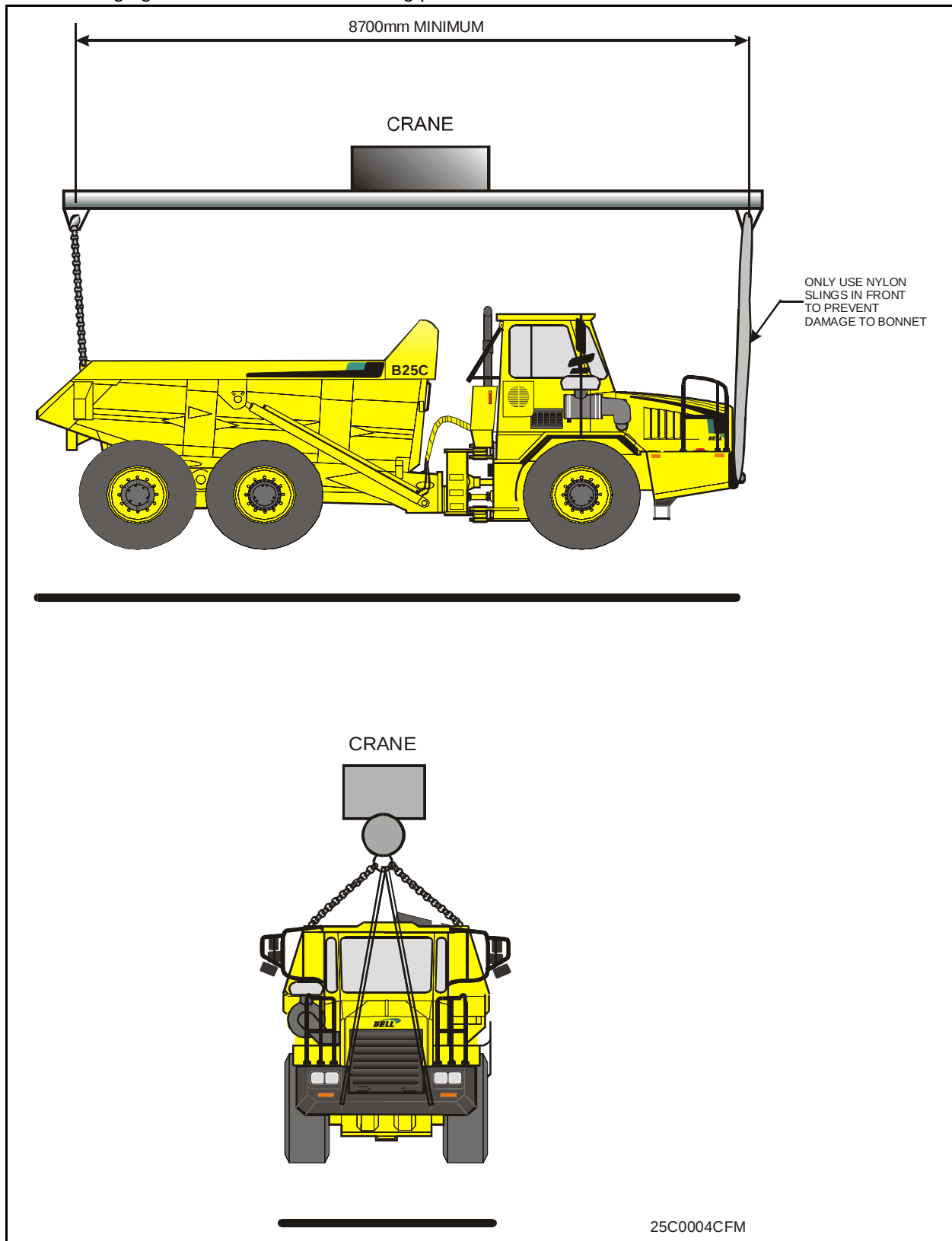
- Remove the supply hoses from the T-pieces on the left hand steering cylinder.
- Block off the two supply hoses using suitable plugs.

NOTE: Some oil spillage will be unavoidable. Clean up any oil spillage as soon as possible.

- Loop the two steering cylinder T-pieces together using a suitable hose.

Machine Lifting Points

The following figure details the machine lifting points:



NOTE: Ensure that the articulation bar is installed.

Lifting the Machine

NOTE:The machine lifting points are indicated in red on the machine.

When lifting the machine the following must be done:

- Park the transporting vehicle next to the machine being lifted.
- Install the articulation safety bar.
- Attach the chains to the machine lifting points and the lifting beam.

NOTE:The lifting beam must be longer than the machine length to avoid damaging the machine and must be able to carry the total machine weight.

- Attach the lifting beam to the crane.

NOTE:The crane must be able to carry total machine weight.

- Use proper rated cables and slings for lifting.

- Position spreader beam correctly for level machine lifting.
- Lift the lifting beam until all the play in the chain is removed.
- Lift the machine until it is clear of the transporting vehicle's trailer.

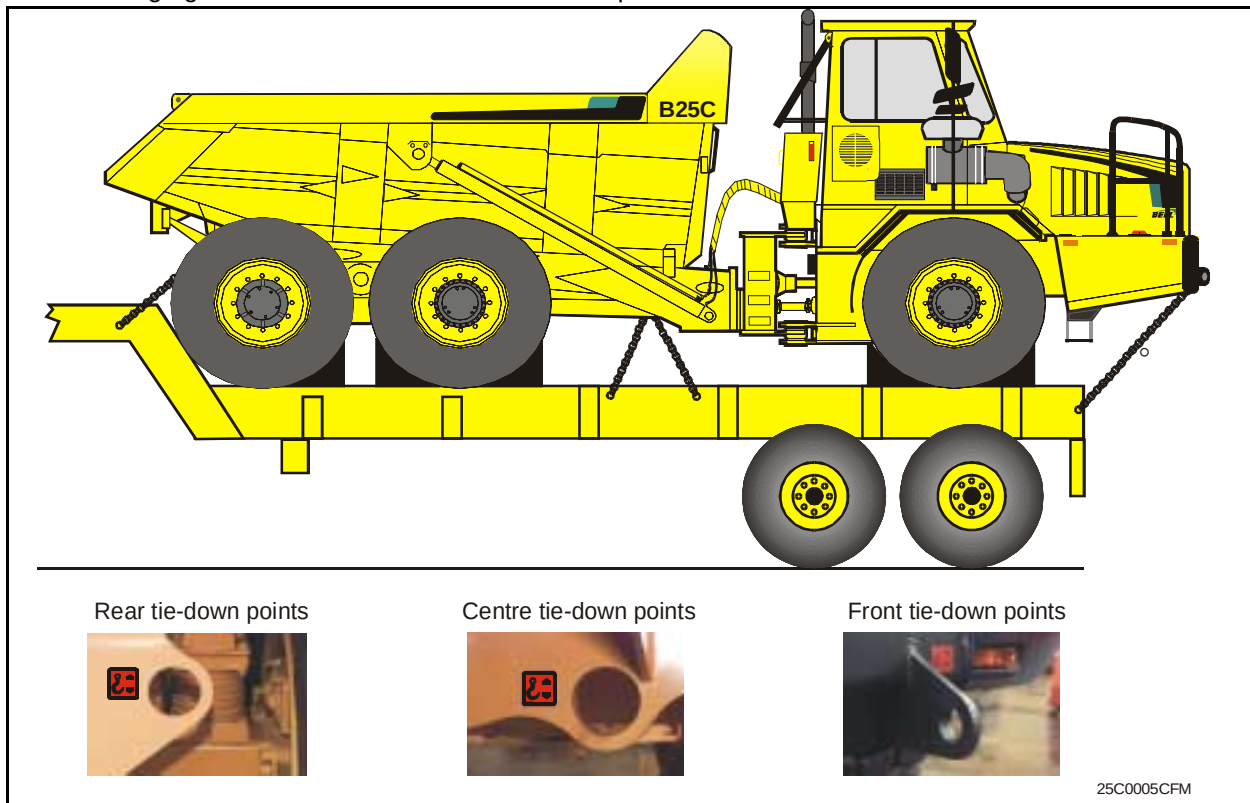
NOTE:The crane must be moved slowly to prevent excessive swinging of the lifted machine.

- Move the machine over the transporting vehicle's trailer slowly.
- When the machine is directly over the transporting vehicle's trailer lower the machine onto the trailer slowly, following the instructions of the spotters.
- Lower the lifting beam until the chain can be removed from the machine.
- Lift the lifting beam and move it away from the machine.
- Chock all the machine's wheels.
- Secure the machine to the transporting vehicle's trailer with chains.

NOTE:Improper lifting or tie downs can allow the load to shift and cause injury and damage.

Machine Tie-down Points

The following figure indicates the machine tie-down points:



NOTE: Ensure that the articulation bar is installed.

Transporting

Transporting the Machine on Other Vehicles

The machine can be loaded onto the transporting vehicle by two methods:

- Lifting the machine (refer to Lifting the Machine and Machine Lifting Points; previous procedure).
- Driving the machine.

Safety Rules

Always use the aid of spotters when loading the machine onto the transporting vehicle.

Ensure the transporting vehicle is capable of safely carrying the machine.

When driving the machine onto other transportation vehicles do not install the articulation safety bar until the machine is secured.

When the machine is lifted onto the transportation vehicle the articulation safety bar must be installed.

Always chock the machine when securing it to the transportation vehicle.

Driving the Machine onto a Transporting Vehicle

To drive the machine onto the transporting vehicle the following must be done:

- Position the transporting vehicle's trailer against the loading ramp.
- Drive the machine onto the trailer very slowly following the instruction of the spotter.
- Install the articulation safety bar.
- Chock all the machine wheels.
- Secure the machine to the transporting vehicle's trailer with chains.

NOTE: Improper tie downs can allow the load to shift and cause injury and damage.

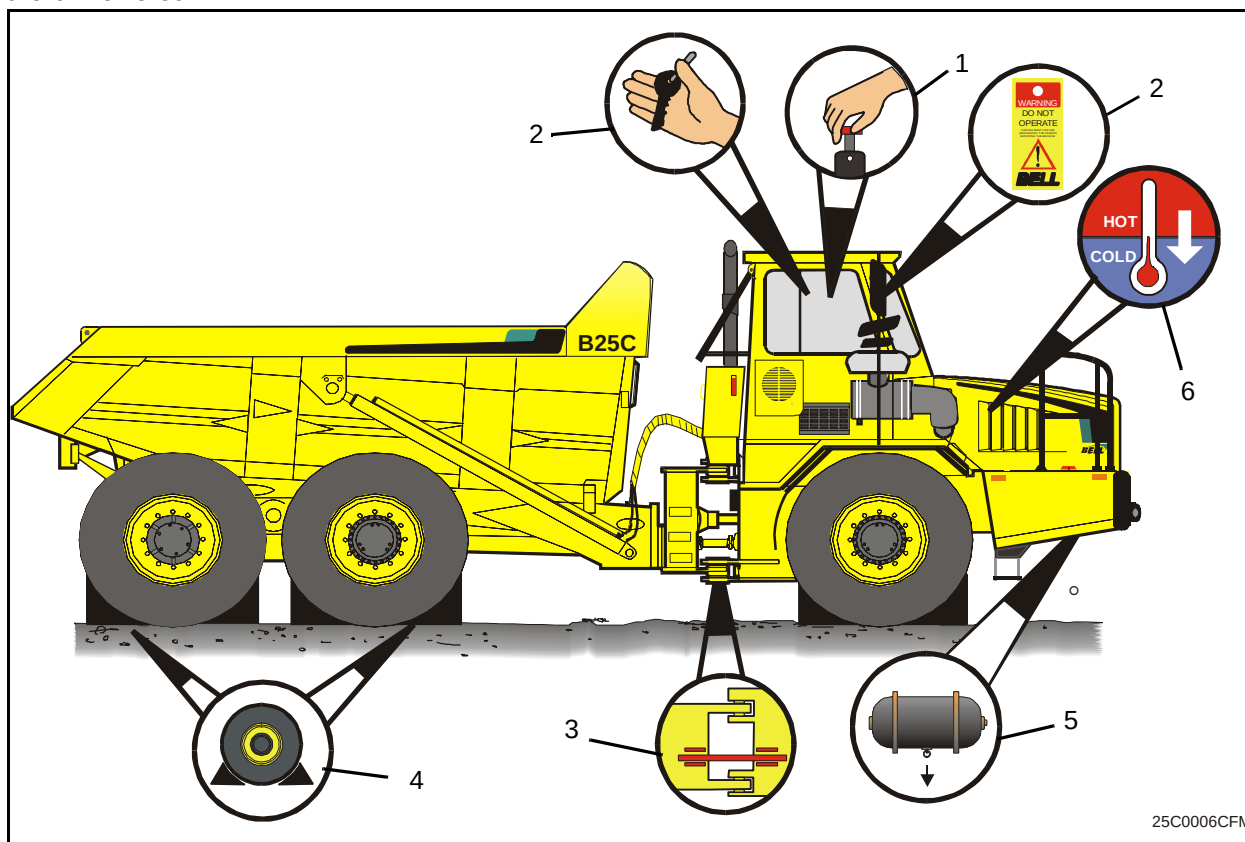
- Drive the transporting machine away slowly.

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CHAPTER 7. PRE-SERVICE INSTRUCTIONS

Service Position

Before starting to work on the machine, unload it, wash it thoroughly and park it on firm level ground with the bin lowered.



25C0006CFM

Park the machine in the straight ahead position and prepare for servicing as detailed below:

▲ WARNING

If the following steps are not observed it could result in injury or death.

- Shut down the engine and apply the park/emergency brake.
- Remove the keys from the ignition switch and attach the "DO NOT OPERATE" warning sign to the steering wheel.
- Install the articulation safety bar.

▲ WARNING

When servicing the machine and one of the axles of the machine is raised off the ground using jacks, the wheels on at least one of the other axles must be chocked. This is because there is a risk that the machine may roll off the jacks, even if the park/emergency brake is applied.

- Install wheel chocks to ensure that the machine cannot move backwards or forwards during the service.

▲ WARNING

Beware of hot fluids and components. Do not work on a hot machine.

- Allow the machine to cool down.
- Relieve all pressure in the relevant system before any lines, fittings or related items are disconnected or removed, as follows:
 - i . The air pressure is relieved by holding open the drain valve on the air reservoir.
 - ii . The cooling system pressure can only be safely relieved by allowing the engine coolant to cool down until it is safe to remove the filler cap.
 - iii . The hydraulic, fuel and air conditioner system pressures should only be relieved by qualified personnel.

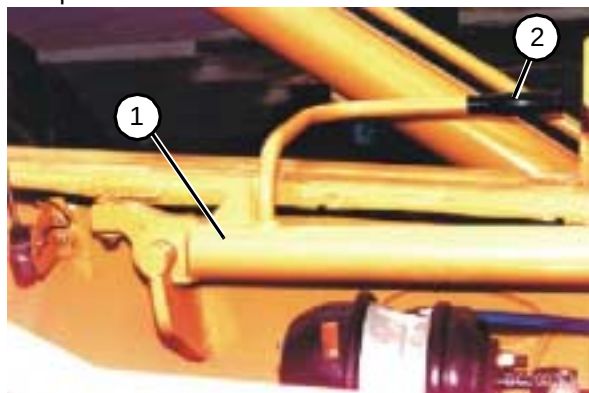
Install the Bin Prop

▲ WARNING

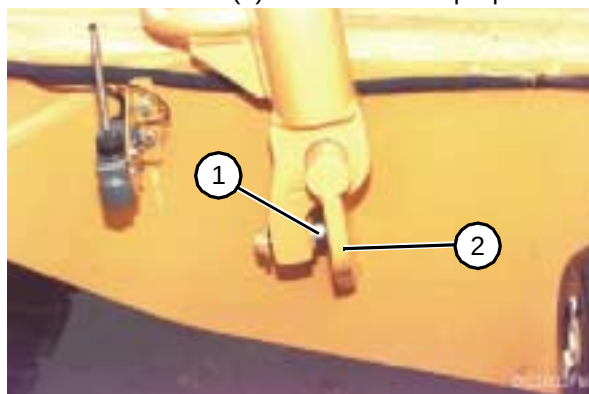
When the bin is raised to perform maintenance tasks, the bin prop must be installed.

The following procedures must be used to install the bin prop:

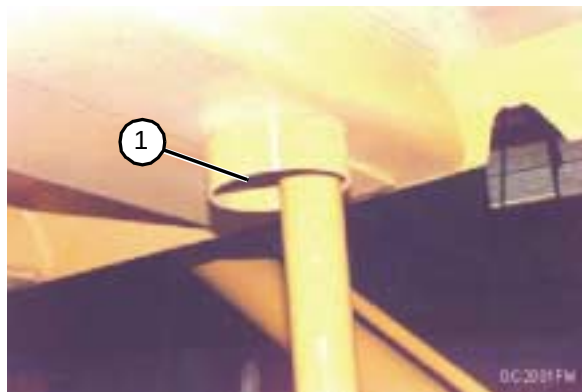
- The operator, in the cab, must control the bin operation.



- Raise the bin high enough to allow the bin prop (1) to be hinged up to the vertical position.
- Use the handle (2) to raise the bin prop.



- Ensure that the bin prop stop bolt (1) is located firmly against the stop (2).



- Lower the bin until the bin prop is located safely inside the holder (1)

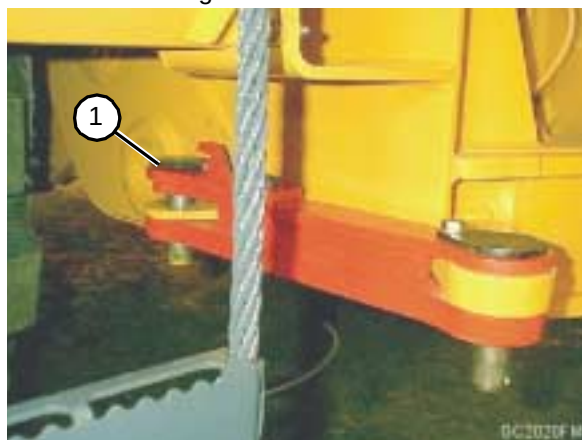
▲ WARNING

Check to ensure that the bin prop is located safely inside the holder.

Install the Articulation Safety Bar

The following procedures must be used to install the articulation safety bar:

- Park the machine in the straight ahead position.
- Shut down the engine and apply the park/emergency brake
- Remove the keys from the ignition switch and attach the "DO NOT OPERATE" warning sign to the steering wheel.



- Remove the pin (1) from the articulation safety bar mounting.



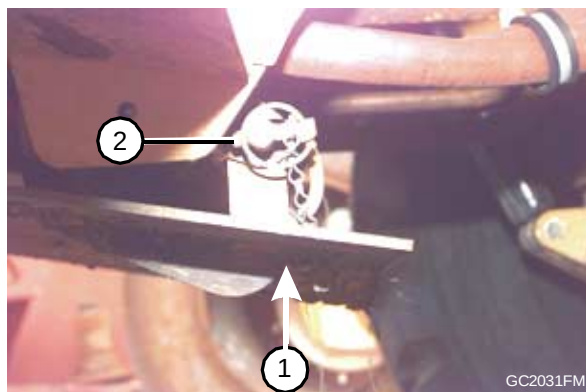
- Swing the articulation safety bar out and locate it on the lug (1).
- Fit the pin through the holes to secure in position. The steering wheel must be turned so that the articulation allows the holes to align.
- Secure the articulation safety bar back in the travelling position after the service.

Lower and Raise the Belly Plate

To perform some maintenance tasks it is necessary to lower the belly plate for access.

Lower the Belly Plate

The following procedures must be used to lower the belly plate:



- Position a trolley jack under the belly plate in position (1).
- Raise the trolley jack until it touches against the belly plate.

▲ WARNING

Be careful when lowering the belly plate as it can cause injury or even death if it slips off the trolley jack.

- Release the clips (2) on each side of the belly plate.
- Slowly lower the trolley jack.

- Remove the trolley jack slowly, allowing the belly plate to rest safely on the ground.

Raise the Belly Plate

The following procedures must be used to raise the belly plate:

▲ WARNING

Be careful when raising the belly plate as it can cause injury or even death if it slips off the trolley jack.

- Manoeuvre a trolley jack under the belly plate so that the belly plate can be safely raised.
- Secure the clips and remove the trolley jack.

Rules when Servicing

General

Do not carry out any work on the machine unless you are trained and have the knowledge to carry out the work.

Service which is not carried out in the correct way may be dangerous. Make sure that you have sufficient knowledge, the correct information, the correct tools and the right equipment in order to carry out the service in the correct way.

Repair or change broken tools and faulty equipment. Read all plates and decals on the machine and in the manual before you start servicing the machine. Each of the instructions contains important information about handling and servicing.

Do not wear loose fitting clothing or jewellery when working on the machine.

Always wear a hard hat, safety glasses, gloves, shoes and other protective articles as the job requires.

When carrying out service work in the articulation area, ensure that the articulation safety bar has been installed.

Always stop the engine to service the machine, unless otherwise instructed in this manual.

When changing oil in the engine, fluid in the hydraulic system or transmission, remember that the oil and fluid may be hot and can cause burns.

When lifting or supporting components, use equipment with a lifting capacity which is at least as great as the components.

All lifting devices, for example slings and ratchet blocks, must comply with national regulations for lifting devices. **BELL EQUIPMENT COMPANY** will not accept any responsibility if any lifting devices, tools or working methods are used other than those described in this manual.

- Stop the engine before removing engine covers or similar.
- Make sure that no tools or other objects which can cause damage are left in or on the machine.
- Switch **OFF** the batteries disconnect switch or disconnect the battery before performing maintenance on the machine.
- Relieve the pressure in the relevant system gradually before starting to work on a system component or assembly.
- All pressurised vessels must be opened very carefully.
- When checking for leaks, use a piece of paper or wood, do not use your hands.
- Never set a pressure limiting valve to a higher pressure than that recommended by the manufacturer. Only qualified personnel must adjust any valve settings.
- Before starting the engine indoors, make sure that the ventilation is sufficient to cope with the exhaust gases.
- Do not stand behind the machine while the engine is running.

Contaminated Oils and Fluids

Whenever the engine oil or transmission or hydraulic fluid is changed always inspect the old oil and fluid for any signs of contamination (water and foreign matter etc.) The presence of contamination could indicate a fault in the system.

The old oil and hydraulic fluid filters must also be checked for the presence of foreign matter.

Always use new, clean oil, fluids and filters when replenishing the systems.

Measures to Prevent Fires

There is always a risk of fire.

Find out which type of fire extinguisher to use, where it is kept and how to use it.

Any fire fighting equipment stored on the machine must be maintained in working order.

At the slightest sign of fire, and if the situation allows, take the following steps:

- Move the machine away from the danger area.
- Stop the engine and turn the ignition to the OFF position.
- Leave the cab.
- Start putting out the fire and notify the fire brigade if required.

Do not smoke or have a naked flame near a machine when filling with fuel or when the fuel system has been opened.

Diesel fuel oil is flammable and should not be used for cleaning, use an approved solvent.

Remember that certain solvents can cause skin rashes and are usually flammable. Do not inhale solvent vapour.

Store flammable starting aids in a cool, well ventilated location. Remember that such aids (starting gas) must not be used in connection with preheating of the induction manifold.

Keep the work place clean. Oil and/or water on the floor makes it slippery.

Oil and/or water in close proximity to electrical equipment or electrically powered tools are dangerous and any spills should be cleaned up immediately.

Oily clothes are a serious fire hazard.

Check daily that the machine and equipment are free from dirt and oil. In this way the risk of fire is reduced and it is easier to detect faulty or loose components.

▲ WARNING

Do not point the high pressure jet at personnel.

▲ CAUTION

If a high pressure jet is used for cleaning, take great care as the insulation of electrical leads can become damaged even at a moderately high pressure and temperature.

Check if the electric leads have been damaged by chafing which could lead to a short circuit and fire.

Check that there is no damage to hydraulic and brake hoses caused by chafing.

▲ CAUTION

Switch OFF the battery disconnect switch or disconnect the batteries, when welding on the machine.

Welding and grinding may only be done on the machine when it is placed in a clean area where there are no fuel tanks, hydraulic pipes or similar lying around. Take extra care when welding and grinding near flammable objects. A fire extinguisher should be kept handy.

Refrigerant R134a

The air conditioning system contains refrigerant R134a. Servicing, refilling or emptying of the refrigerant R134a must only be done by trained and qualified service personnel.

▲ WARNING

- 1. Refrigerant R134a can cause frostbite, if it comes into contact with bare skin.**
- 2. The air conditioning system is pressurised. Never loosen the filling plug on the compressor or any hose and pipe unions, as an unintentional leak could result. If a leak is suspected, do not try to refill the system. Contact your *BELL EQUIPMENT* Representative.**

Avoid breathing in the air conditioner refrigerant and lubricant vapour or mist. Exposure may irritate the eyes, nose and throat.

The refrigerant is under high pressure and the system must be serviced by qualified personnel only. Improper service methods may cause injury.

If accidental system discharge occurs, ventilate the work area before resuming work.

Additional health and safety information may be obtained from your refrigerant and lubricant manufacturers.

Working on Painted Surfaces

When welding and cutting, the paint must first be removed up to a distance of 100 mm (4") from the welding or cutting point. Paint which is heated gives off unhealthy gases.

Ideally paint should be removed using sand blasting. If the paint cannot be removed using sand blasting, it must be removed in some other way for example using paint stripper or a high speed grinder.

Note: When using paint stripper or a high speed grinder, you must use a portable air extractor, safety glasses and protective gloves.

Working with Polymer Material

Polymer materials, such as rubber and certain kinds of plastics, can give off gases when heated. These gases can be dangerous to your health and to the environment.

The following protective measures should be taken:

- Protect the polymer material from heat before welding or cutting near the material.
- Do not burn polymer materials when disposing of them.

CHAPTER 8. MAINTENANCE SCHEDULES

Preventative maintenance is very important. It includes lubrication, checks and adjustments which the operator can perform. Procedures which require **BELL EQUIPMENT** Product Support to perform are noted in the instructions.

Most of these service measures are simple to carry out and do not need any detailed explanation. The instructions which require specific procedures are detailed in this Chapter.

NOTE: The 100 hour service is done by **BELL EQUIPMENT** Product Support.

Maintenance Schedule in Running Hours								
Details	Daily	1st 100	Every 250	Every 500	Every 1000	Every 2000	Every 3000	As Required
ENGINE								
NOTE: For further maintenance and service procedures, refer to the Mercedes-Benz OM 366 LA Manual.								
Adjust the valve clearance		x		x				
Change the primary fuel filter		x			x			
Change the secondary fuel filter					x			
Change the oil and oil filters		x	x					
Change the crankcase breather							x	
Change the air cleaner secondary filter						x		
Change the coolant						x		
Check the oil level	x							
Check the coolant level	x							
Check the coolant specification								*x
Check the tension of the drive belts			x					
Check the engine compartment components								x
Check the air cleaner primary filter								x
Clean pre-cleaner assembly								x
Drain the primary fuel filter								x
Flush and renew the coolant						x		
Service injectors on #300 / #400 engines							**x	

Maintenance Schedule in Running Hours								
Details	Daily	1st 100	Every 250	Every 500	Every 1000	Every 2000	Every 3000	As Required
TRANSMISSION-ALLISON HD/MD								
Change the filters					***X			
Change the oil					****X			
Check the oil level	X							
TRANSMISSION - ZF 210								
Change the filters		X			X			
Change the oil		X			X			
Check the oil level	X							
Transfer Case								
Change the oil		X			****X			
Check the oil level			X					
HYDRAULICS								
Change the oil						****X		
Change the filters		X					X	
Change the breather filter					X			
Check the oil level	X							
AXELS AND CHASSIS								
Change the oil in the differentials and final drives		X				X		
Change the brake fluid * if applicable						X		
Check the oil level in the differentials and final drives			X					
Check the service brake pads				X				
Check the park brake pads				X				
Check the wheel nuts		X						
Check the brake fluid level * if applicable	X							

Maintenance Schedule in Running Hours								
Details	Daily	1st 100	Every 250	Every 500	Every 1000	Every 2000	Every 3000	As Required
CAB, PNEUMATICS AND ELECTRICAL								
Change the air drier filter					X			
Check the operator controls and instruments	X							
Check the working lights, reverse buzzer and horn	X							
Check the electrical connections			X					
LUBRICATION								
Grease the hinges					X			
Grease the propshafts						*****X		
Grease the through drive bearing				***** X				
Grease the PTO propshaft				X				
Grease all other lubrication points	X							
GENERAL WALK ROUND								
Check for oil, air and fuel leaks	X							
Check for loose or damaged components	X							
Clean coolers								X

NOTES:

- * Refer to bulletin 93/695 regarding water & coolant specification
- ** If sulfur content is above 0.5%, service between 1200 and 1800 hours.
- *** Allison Transmission filters to be changed 1st 1000 hrs service, thereafter every 2000 hrs (as per SB99_115)
- **** Change intervals can be extended by oil sampling.
- ***** As per bulletin - 99/120
- ***** Every 250 hours if operated in excessively wet conditions.

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CHAPTER 9. DAILY OR 10 HOURLY SERVICE CHECKS

Introduction

The daily or 10 hourly service checks must be performed by qualified service personnel.

It is recommended that the daily or 10 hourly service checks are performed in conjunction with the Walk Round Checks so that the operator can assist in the service checks which require two people.

Service Instructions

Ensure that the machine is in the service position. Refer to **Pre-service Instructions, Chapter 7.**

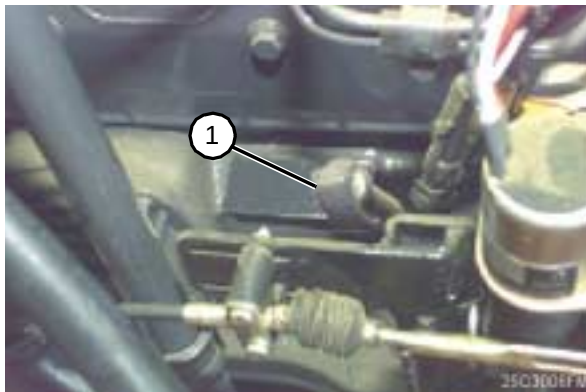
Engine

NOTE:For further engine information or details not shown in this manual, refer to the Mercedes-Benz Manual OM 366 LA.

Open the bonnet.

Check the bonnet catch for damage and ensure that the bolts are secure.

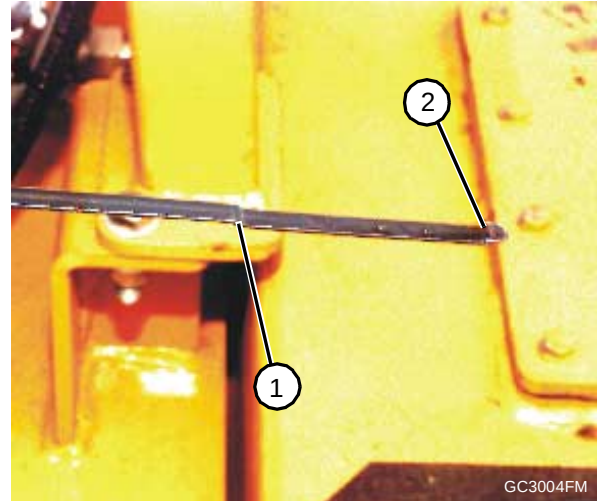
Check the Oil Level



Release the clip (1) and remove the dipstick.

Wipe the dipstick clean with a lint free cloth.

Re-insert the dipstick, ensuring that it is properly seated.



Remove the dipstick and check that the oil level reaches the upper mark (1) on the dipstick.

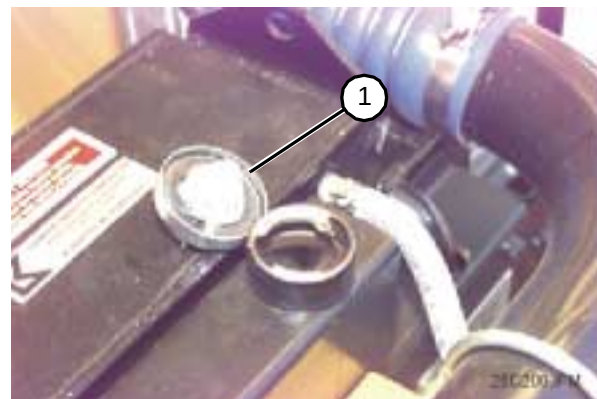
Re-insert the dipstick, ensuring that it is properly seated and fasten the dipstick clip.

If necessary, replenish the engine oil. Refer to **Fill the Engine with Oil in Chapter 10.**

Check the Coolant Level

▲ WARNING

Check the coolant level when the engine is cold. Whenever the cap on the expansion tank needs to be removed, remember that the system may be under pressure which could cause hot coolant to be ejected.



Remove the filler cap (1) on the radiator expansion tank.

There must be approximately 6 mm (1/4") of coolant in the bottom of the tank when the engine is cold.

If the water level is not correct, top up with coolant to approximately 6 mm (1/4") in the bottom of the tank. Refer to **Specifications, Chapter 1 - Recommended Lubricants and Coolant Additives**.

NOTE: If there is too much coolant in the tank, when cold, the tank will purge itself and overflow with excess coolant.

▲ CAUTION

If coolant is ever drained from the cooling system, it must be replaced with the recommended coolant specified by the manufacturer.

Transmission

Check the Transmission Fluid Level

Always check the fluid level at least twice. If the readings are not consistent, check and clean the transmission breather.

There are two methods for checking the transmission fluid level, they are as follows:

- The dipstick check when the transmission fluid is cold.
- The dipstick check when the transmission fluid is hot.

Dipstick Check - Transmission Fluid COLD (Cold Check)

The Cold Check determines if the transmission has sufficient fluid to be operated safely until a Hot Check can be made.

▲ CAUTION

DO NOT start the engine until the presence of transmission fluid has been confirmed.

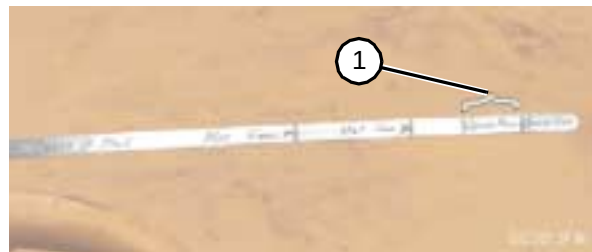
A cold check may be performed before after initial start-up and the presence of sufficient transmission fluid has been confirmed. The sump fluid temperature is then typically 16°C to 49°C (60°F to 120°F)

- Ensure that the machine is parked on a level surface and the park/emergency brake is applied.
- Ensure that the transmission is in Neutral (N).

- Shift to **D** (Drive) and then to **R** (Reverse) to expel all air from the transmission circuits and fill the system with fluid.
- Shift to **N** (neutral) and leave the engine at idle.



- With the engine running unscrew and remove the dipstick (1) from the tube and wipe clean.
- Clean the end of the tube before inserting the dipstick.
- Insert the dipstick into the tube and remove to check the fluid level.
- Repeat the check procedure to verify the reading.



- If the fluid level is within the "Cold Full and Cold Add" band (1) the transmission may be operated until the fluid is hot enough to perform a "Hot Check".
- If the fluid level is not within the "Cold Full and Cold Add" band, add or drain transmission fluid as necessary to bring it within the band.

▲ CAUTION

1. The fluid level rises as the fluid temperature increases. DO NOT fill above the "Hot" mark if the transmission fluid is below normal operating temperatures. Normal operating temperature is 71°C to 93°C (160°F to 200°F). The oil level at 80°C (176°F) is valid and must not be exceeded.
2. The transmission must not be operated for extended periods until a "Hot Check" has verified proper fluid level.

Dipstick Check - Transmission Fluid HOT (Hot Check)

The Hot Check verifies proper fluid level.

Ensure that the transmission fluid has reached normal operating temperature; 71°C to 93°C (160°F to 200°F)

NOTE: Check the transmission fluid temperature on the master display unit.

- Ensure that the machine is parked on a level surface and the park/emergency brake is applied.
- Allow the engine to run at idle in **N** (Neutral).



- Unscrew and remove the dipstick (1) from the tube and wipe clean.
- Clean the end of the tube before inserting the dipstick.
- Insert the dipstick into the tube and remove to check the fluid level.
- Repeat the check procedure to verify the reading.



- The safe operating fluid level is at the "Hot Full and Hot Add" band (1).
- If the fluid level is not at the "Hot Full and Hot Add" band, add or drain transmission fluid as necessary to bring it to the mark.

Push-button Check - (Electronic Transmission Fluid Level Check)

The electronic method of checking the transmission fluid level incorporates a fluid level sensor to display the fluid level on the shift selector.

The electronic method compensates for transmission fluid temperature between 65°C to 104°C (149°F to 220°F). Any temperature below 65°C (149°F) or above 104°C (220°F) will result in an **Invalid for Display** condition.

The normal operating temperature of the transmission fluid is 71°C to 93°C (160°F to 200°F), *measured at the transmission sump*.

The reading obtained on the digital analogue will show the temperature *measured at the transmission convertor out*. Note that this temperature is normally *higher* than the sump temperature.

The following procedure must be used to check the transmission fluid level using the push-button shift selector:

- Ensure that the machine is parked on a level surface and the park/emergency brake is applied.
- Allow the engine to run at idle in **N** (Neutral).



- press the ↑ (Up) and ↓ (Down) arrow buttons (1) simultaneously.

NOTE: The fluid level checked may be delayed until the following conditions are met:

- The fluid temperature is above 65°C (149°F) and below 104°C (220°F).
- The transmission is in neutral.
- The machine has been stationary for approximately two minutes to allow the fluid to settle.
- The engine is at idle.
- The transmission output shaft is stopped.

NOTE: The indication of a delayed fluid level check is a flashing display and a digital countdown from 8 to 1.

- Check the characters displayed.
- The fluid level information is sequentially displayed on the digital analogue as in the following examples:

Correct Fluid Level

"O" then "L" are displayed ("OL" represents 'Fluid (Oil) Level Check Mode'), followed by "O" the "K". The "OK" display indicates the fluid is within the "OK" zone. The sensor display and the transmission dipstick may not agree because the oil level sensor compensates for fluid temperature.

Low Fluid Level

"O" then "L" are displayed ("OL" represents Low Oil Level) and the number of quarts that the transmission fluid is low e.g. "O" then "2" indicates 2 additional quarts/litres of fluid will bring the level within the middle of the "OK" zone.

NOTE:1 quart is approximately equal to 1 litre.

High Fluid Level

"O" then "L" are displayed (OL" represents 'Fluid (Oil) Level Check Mode'), followed by "H" the "I" ("HI" represents High Oil Level) and the number that the transmission is overfilled e.g. "O" then "1" indicates 1 quart/litre of fluid above the full transmission level.

Replenish or drain the transmission fluid as required. Refer to **First 100 Hour Service, Chapter 10 - Change the Transmission Fluid and Filter.**

NOTE:The maximum Low Oil Level and High Oil Level values are "04". If the transmission fluid level is lower or higher than 4 quarts/litres, the fluid level have to be checked twice to obtain the correct reading.

If a condition occurs which prevents the display of fluid level information, the Invalid for display will show the reason as follows:

Invalid for Display

"O" the "L" is displayed ("OL" represents 'Fluid (Oil) Level Check Mode'), followed by a numerical display. The numerical display is a fault code and indicates conditions are not correct to receive the fluid level information, or that there's a system malfunction. The numbers are fault codes.

The fault codes are as follows:

O X	Settling time to short
5 0	Engine speed (rev/min) too low
5 9	Engine speed (rev/min) too high
6 5	Neutral not selected
7 0	Sump oil temperature too low
7 9	Sump oil temperature too high
8 9	Output shaft is rotating
9 5	Sensor failure

Correct the problem as indicated as above.

When all the conditions have been met, the countdown resumes where it is stopped.

NOTE:Report sensor failure or any problem you are having difficulty correcting to your nearest BELL EQUIPMENT representative.

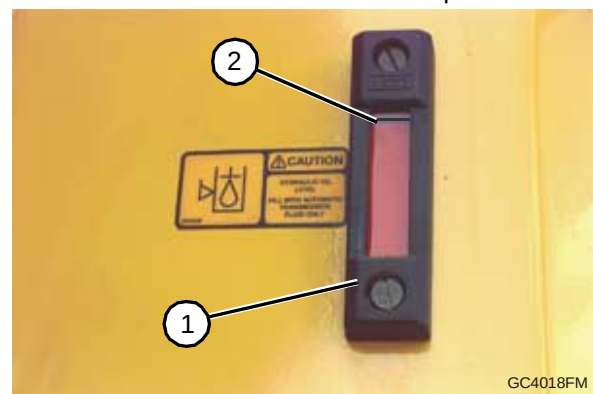
To exit the fluid level display mode, press any range button on the push-button shift selector.

Perform a general, visual check on the transmission and components as follows:

Hydraulics

Check the Hydraulic Fluid Level

Ensure that the bin is in the lowered position.



Check the hydraulic fluid level in the sight glass (1).

The fluid level must be on the mark (2).

If necessary replenish the fluid in the hydraulic tank. Refer to **Specifications, Chapter 1 - Recommended Lubricants and Coolants.**

Cab and Electrical

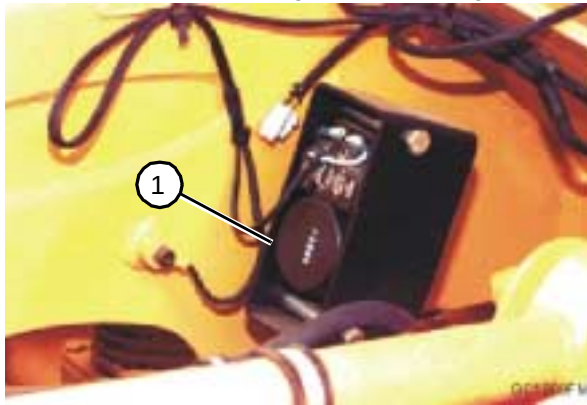
Check the Operator's Controls and Instruments

Carry out a functional check on all controls and instruments daily. Refer to **Specifications, Chapter 1 - Recommended Lubricants And Coolants**.

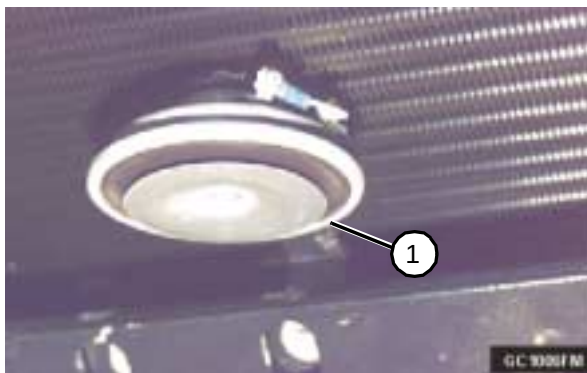
Check all Working Lights, Reverse Buzzer and Horn

Two people are needed to perform this check. One person inside the cab to control the switches and the other outside to ensure all the lights are working. Refer to **Operator Controls and Instruments, Chapter 2**.

- Switch all the lights on in turn, including headlight (dipped and high beam), indicators, hazard and brake lights.
- Make sure the path is clear behind the machine, and then reverse to ensure the buzzer and reverse lights are working.



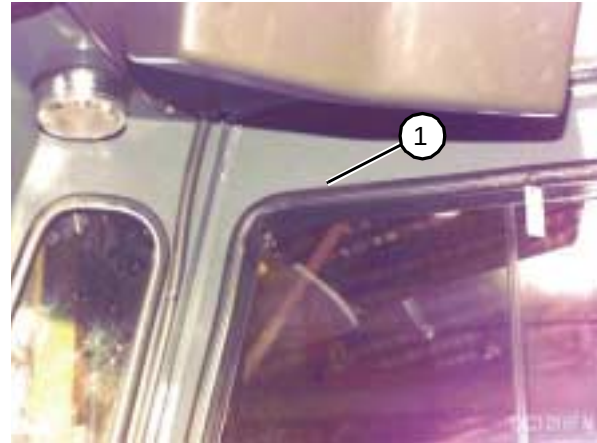
Ensure that the reverse buzzer (1) is securely mounted.



Functionally test the horn (1) and ensure that it is securely mounted.

Check the Interior Light

Carry out a functional check on the interior light daily. Refer to **Chapter 2 - Operator Controls and Instruments**.



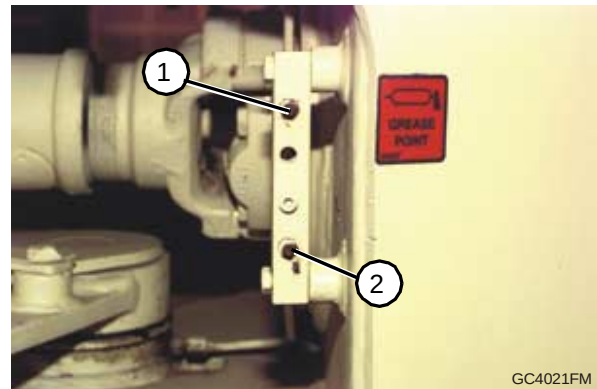
Check that the interior light (1) is securely mounted and not damaged.

Lubrication

Grease Lubrication Points

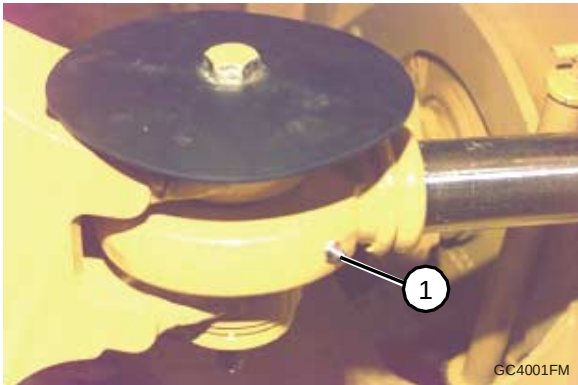
Use EP2 lithium based grease in a grease gun to lubricate the following:

NOTE: The oscillation joint must be greased daily in accordance with the procedure described on the decal at the articulation joint. One shot of grease daily at the other grease points should be sufficient for normal operating requirements.

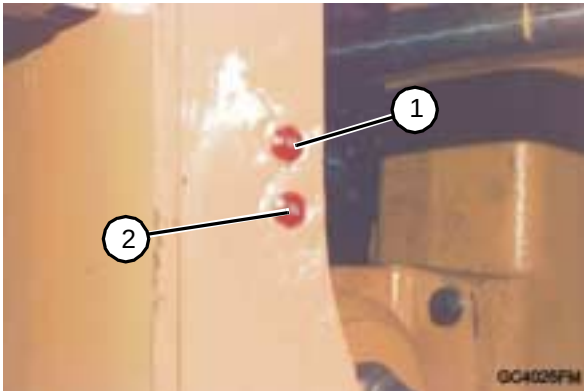


The upper articulation joint at grease nipple (1).

The lower articulation joint at grease nipple (2).

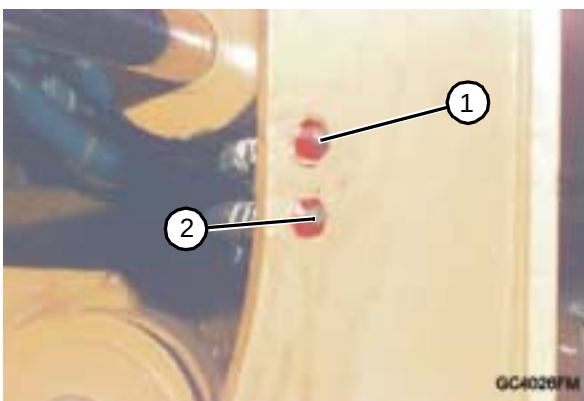


The left side steering cylinder's piston pivot pin at grease nipple (1) left and right side.



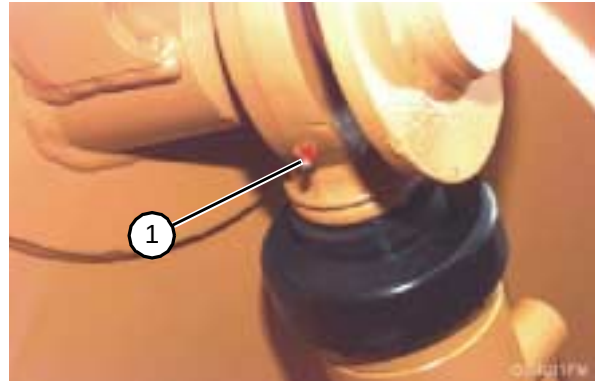
The left side steering cylinder pivot pin at grease nipple (1)

The left, front axle suspension pivot pin at grease nipple (2).

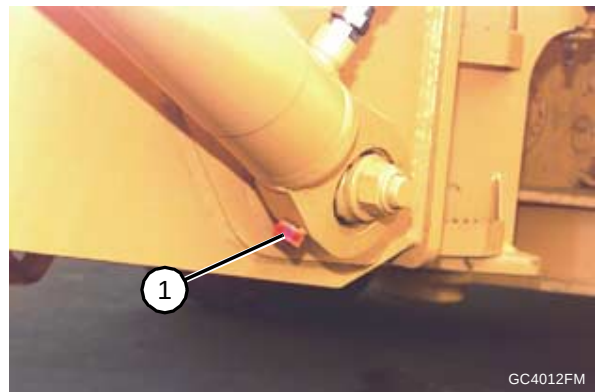


The right side steering cylinder pivot pin at grease nipple (1).

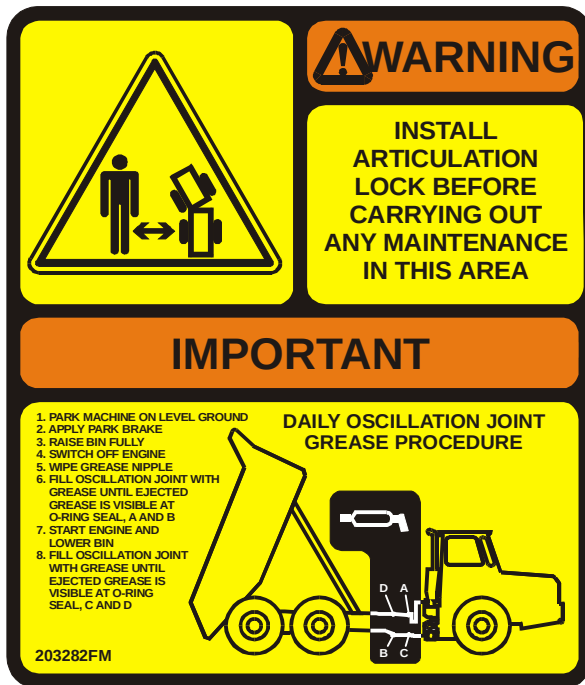
The right, front axle suspension pivot pin at grease nipples (2).



The upper tip cylinder pivot pins at grease nipples (1), on both right and left tip cylinders.



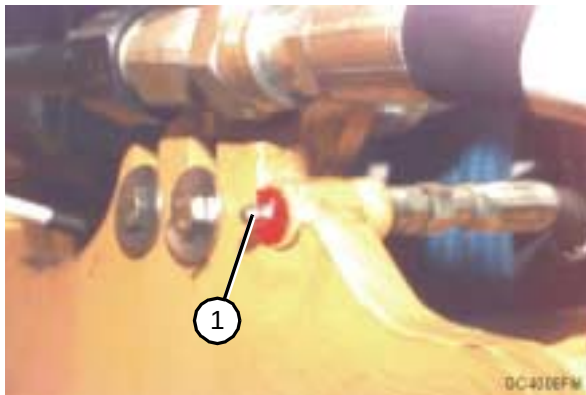
The lower tip cylinder pivot pins at grease nipples (2), on both right and left tip cylinders.



NOTE: Observe the Warning and the grease procedure printed on the decals located on both sides of the articulation joint. See above.

⚠ WARNING

When the bin is raised to the full up position, always raise the bin prop and never enter the area between the bin and the chassis unless the bin is safely lowered on to the bin prop.

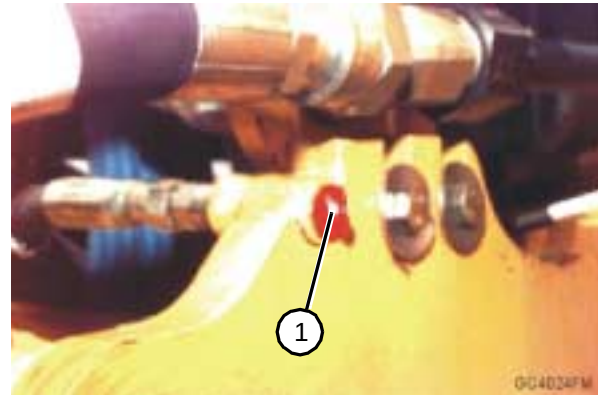


The through drive bearing, top at grease nipple (1).

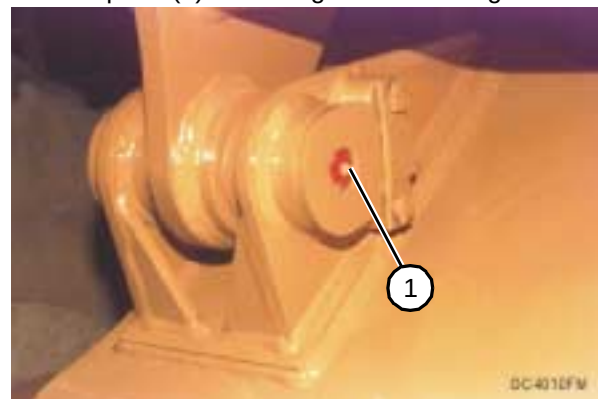
Procedure For Greasing the Through Drive Bearing

- Loosen the pipes at the through drive bearing, front, rear and top.
- Grease each grease point until grease is seen at the pipe end.

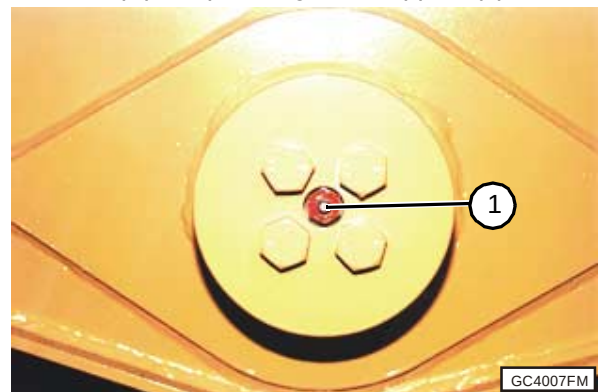
- Replace the pipe and grease that grease point again, allowing only 3 pumps on the grease gun. Repeat this step for the other two grease points as well.



Grease point (1) for through drive bearing rear.



The bin tip pivot pins at grease nipples (1).



The walking beam pivot pins, on both sides of the machine, at grease nipples (1).

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CHAPTER 10. FIRST 100 HOURS SERVICE

Introduction

The 100 hours service must be performed by **BELL EQUIPMENT** Product Support service personnel.

Service Instructions

Ensure that the machine is in the service position. Refer to **Pre-service Instructions, Chapter 7**.

Perform all the Daily or 10 Hourly Service Checks.

Perform the following additional tasks:

Engine

NOTE:For further engine information or details not shown in this manual, refer to the Mercedes-Benz Manual OM 366 LA.

Change the Oil and Oil Filters

▲ CAUTION

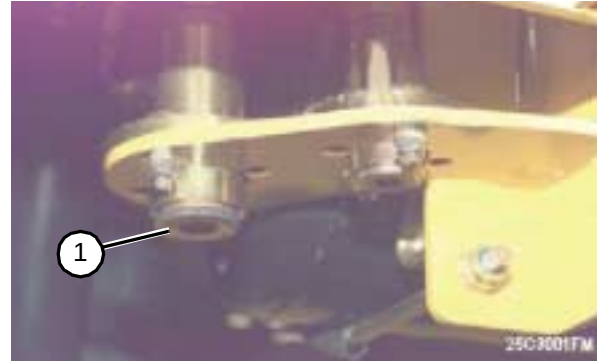
When changing oil and oil filters always inspect the old oil and old filters for foreign matter or contamination. If in doubt contact a BELL EQUIPMENT representative for advice.

Drain the Oil

NOTE:The engine oil will drain easier when the engine is warm.

▲ WARNING

Be careful when draining oil, hot oil can cause burns to unprotected skin.



Place a 20 litre (5.3 USGAL) container under the sump drain plug (1).

NOTE:A drain chute under the drain plug will direct the oil flow.

Remove the drain plug and the sealing washer from the sump.

NOTE:The sealing washer may stick to the sump, ensure that it is removed.

Allow the oil to drain into the container.

Clean the drain plug and check for damage to the thread. If the drain plug is damaged, replace it with a new one.

Re-install the drain plug with a new sealing washer into the sump.

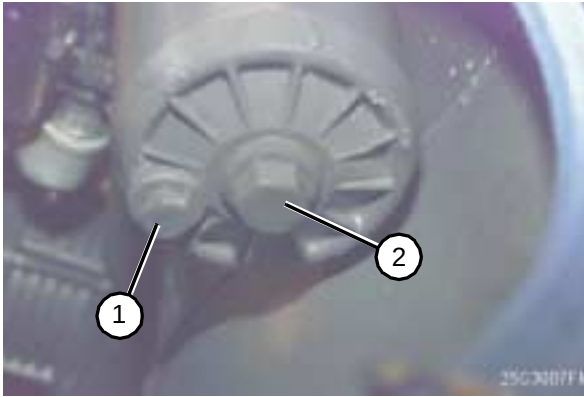
Change the Oil Filters

The oil filters must be changed at every oil change.

▲ CAUTION

The oil filters must be changed and cannot be cleaned.

Place a 1 litre (0.3 USGAL) container under the oil filter.

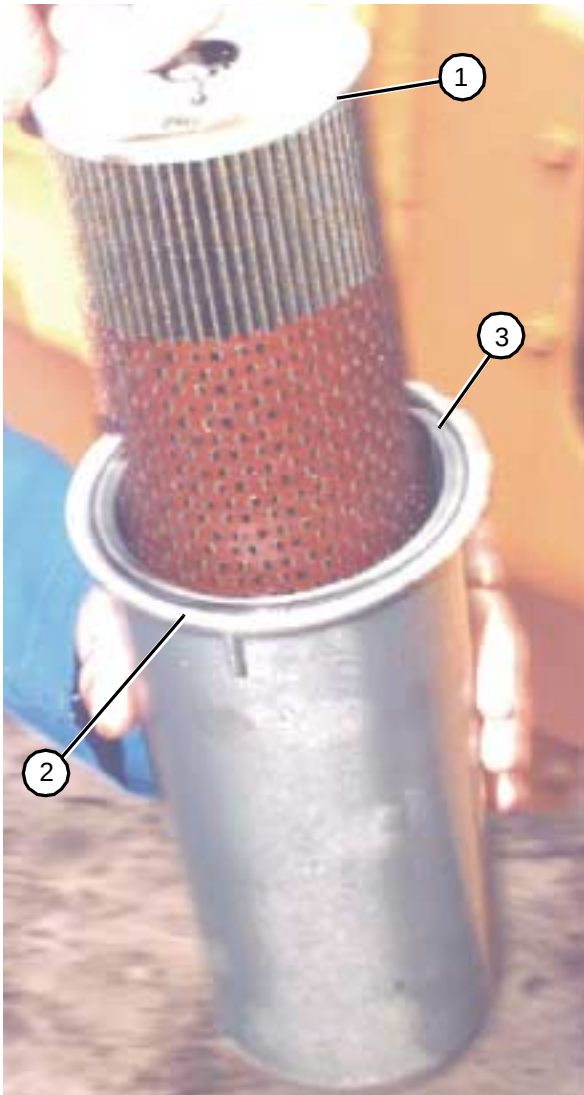


Place a 1 litre (0.3 USGAL) container under the oil filters.

Allow the oil to drain into the container.

Unscrew and remove the oil filter retaining bolt (2) and discard the sealing ring.

Remove the oil filter bowl and filter element.

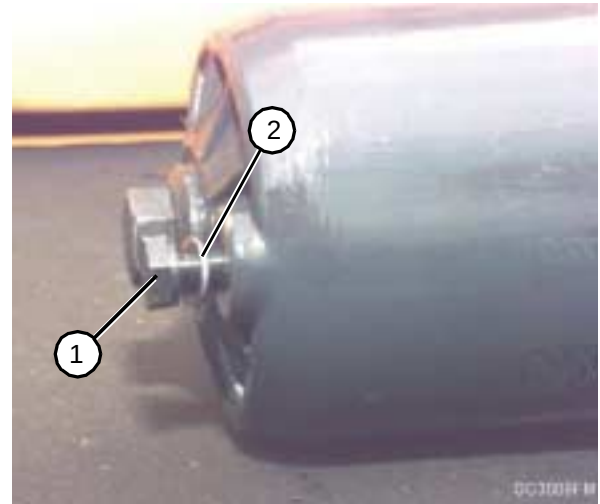


Remove and discard the filter element (1).

Clean the filter bowl with diesel fuel and dry with compressed air.

Discard the sealing ring (3).

Smear a film of oil onto the new sealing ring (3) and fit to filter bowl.



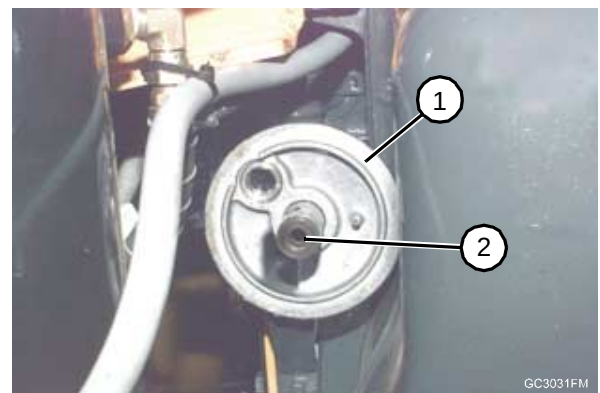
Re-fit the new oil filter drain plug (1) with a new sealing washer (2) (tightening torque is 20Nm (14.75 ft lb)).

Insert a new filter element into the filter bowl. (Spring against the bottom of the bowl).

Fill the oil filter bowl with oil. **Refer to Chapter 1 - Recommended, Lubricants and Coolants - Specifications.**

▲ CAUTION

It is important to fill the filter bowl with oil before fitting. This ensures lubrication directly after starting the engine.

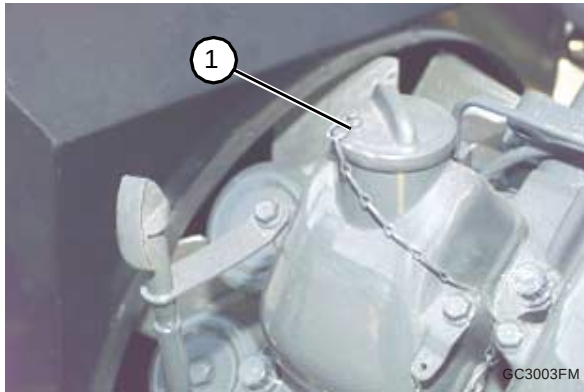


Clean the face of the filter head (1).

Position the filter bowl to the centre of the filter head and locate the retaining bolt in the boss (2).

Tighten the retaining bolt and ensure that the filter bowl is secure. Torque to 45 Nm (33.1 ft. lb.).

Fill the Engine with Oil



Clean the oil filler cap (1) and the area around it.

Remove the oil filler cap.

Fill with oil until the oil level is on the upper mark on the dipstick. Refer to **Chapter 1 Recommended Lubricants and Coolant - Specifications**.

▲ CAUTION

Refit the oil filler cap securely.

Allow the machine to run at low idle for at least one minute and check for oil leaks at the filter. Retighten the retaining bolt if necessary.

▲ CAUTION

Do not overfill the engine with oil.

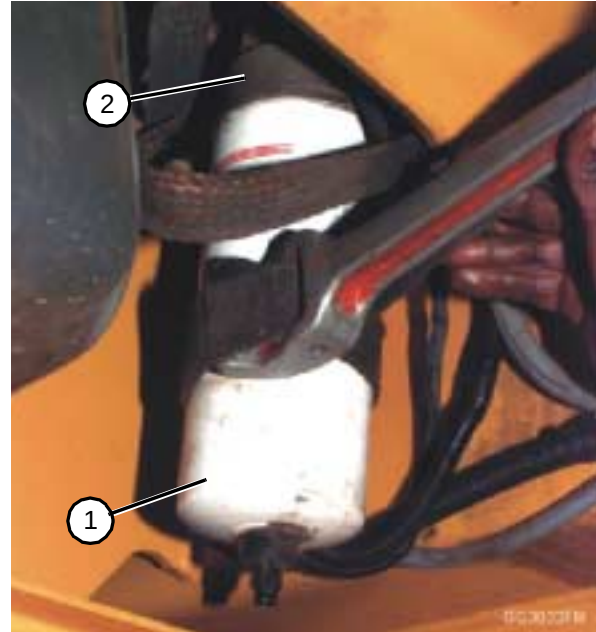
Check continuously during the filling procedure to ensure that the engine oil level reaches the upper mark on the dipstick.

▲ CAUTION

If no oil pressure reading is shown after approximately 10 seconds, stop the engine and determine the cause.

Change the Primary Fuel Filter

Fit a hose clamp on the fuel hose between the fuel tank and the primary fuel filter to stop fuel flow.



Unscrew and remove the primary fuel filter (1) from the filter head (2).

Discard the fuel filter, do not re-use.

Clean the filter head with a lint-free cloth.



Fill a new primary fuel filter with fuel, smear a little oil on the seal (1) and secure in place.

Remove the hose clamp from the fuel hose.

Bleed the fuel system.

Start the engine and check for leaks at the fuel filter head.

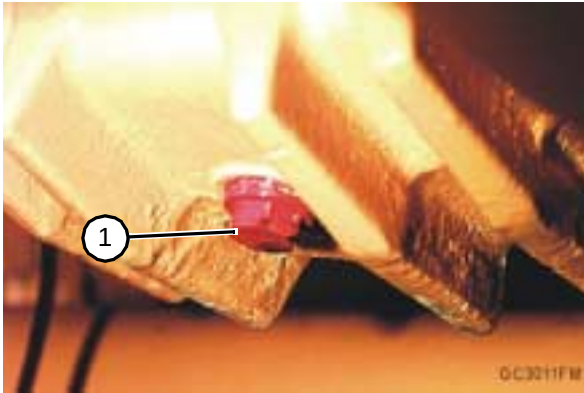
Adjust the Engine Valve Clearance

Refer to the Mercedes-Benz Manual OM 366 LA for the procedures.

Transfer Case (Drop Box)

Change the Transfer Case Oil

NOTE:The oil in the transfer case must be warm to make draining the oil easier.



Place a 10 litre container under the transfer case drain plug (1).

Remove the drain plug and sealing ring.

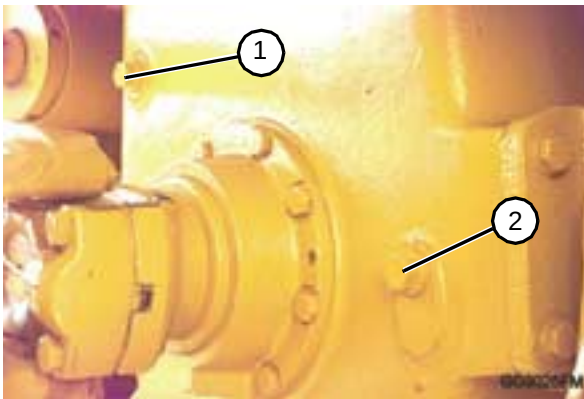
Allow the oil to drain and discard.

Clean the drain plug and the sealing surface on the housing.

Install the drain plug with a new sealing ring.

Tighten the drain plug to 25 to 32 Nm (18 to 23.6 lb. ft.).

Inspect the drained transfer case oil for evidence of dirt, foreign matter or excessive water. (A small amount of condensation is normal to during operation). Report oil contamination to **BELL EQUIPMENT** Product Support.



Remove the oil filler plug (1) and replenish the transfer case oil with 4.5 litres of oil through the oil filler plug hole.

NOTE:The oil can also be replenished through the breather hole.

Fill the transfer case with the correct grade of oil. Refer to Chapter 1 - Recommended Fuels, Lubricants and Coolant Additives.

⚠ CAUTION

Failure to fill the transfer case with the correct amount of oil will lead to serious internal damage.

NOTE:Filling the lower section of the transfer case with oil must be done slowly because the air must be expelled. Fill with small quantities at a time.

The oil level must be level with the oil level plug hole (2). (To check, remove plug (2)).

When oil begins to flow from the oil level plug hole, replace the plug.

Check for signs of oil leaks at the drain plug.

⚠ CAUTION

It is important to re-check the oil level after the machine has operated for a short time in order to allow the new oil to properly circulate in the inter-axle differential.

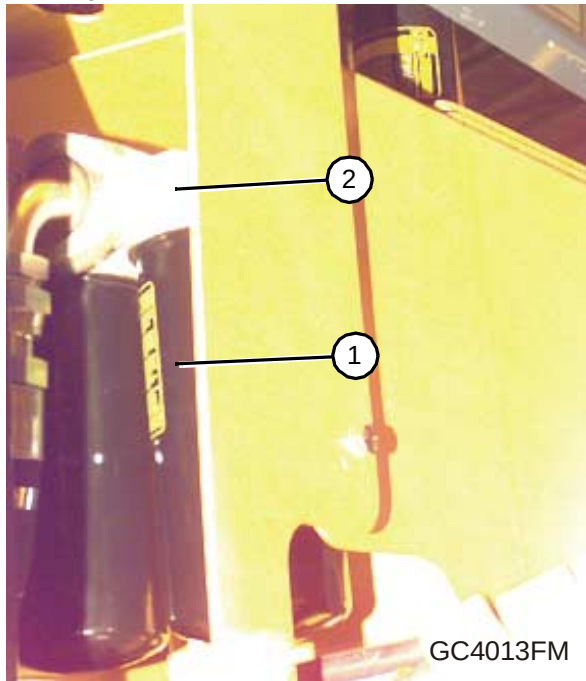
Drive the machine slowly to allow the oil to circulate into the differential.

Check the transfer case oil level again.

Hydraulics

Change the Return Filters

Clean the area around the filters and the filter housing.



Unscrew and remove the return filters (1) and seals from the return filter housing (2).

Install new filters and seals onto the return filter housing.

Lubricate the seals with a film of clean oil before assembly.

Hand tighten the filters and then tighten a further 90°.

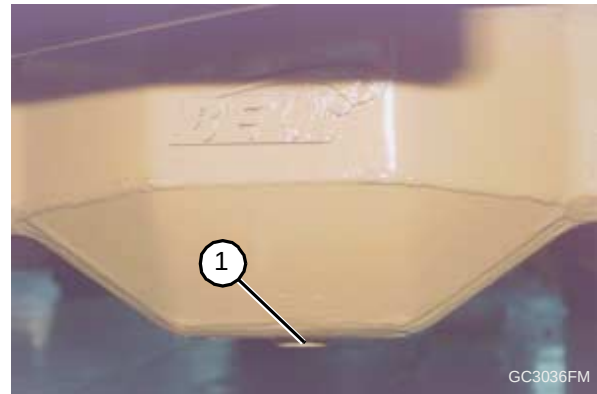
▲ CAUTION

Only **BELL EQUIPMENT** filters are to be used. **BELL EQUIPMENT** filters have the correct micron filtration rating for the hydraulic system.

Axles, Differentials and Final Drives

Change the Oil in the Differentials

NOTE: The procedure is the same for all the axil differentials. The rear axle of the B25C 6X4 is a trailing axle and requires no oil change.



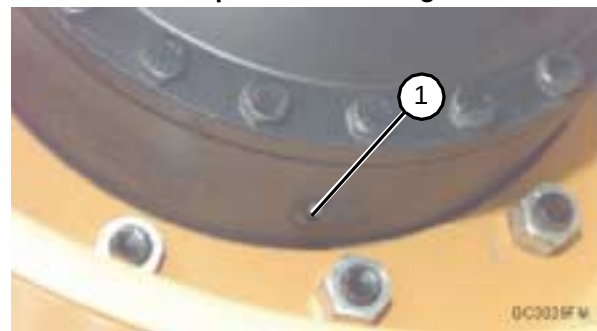
Remove the drain plug (1) from the axle housing and allow the oil to drain into a 45 litre (11,9 USGAL) container.

Clean the drain plug and reinstall in the axle housing.

Replenish the oil in the axle housing.

Change the Oil in the Final Drives

NOTE: The procedure is the same for all the final drives. The rear axle of the B25C 6X4 is a trailing axle and its final drives require no oil change.

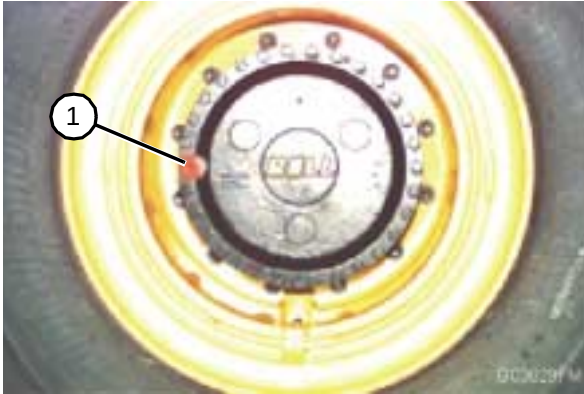


Rotate each wheel so that the drain plug (1) is at the lowest point.

Unscrew and remove the drain plug from the final drive and allow the oil drain into a 20 litre (5.3 USGAL) container.

Clean the drain plug and install into the final drive.

Rotate the wheels so that the word **BELL** is in the horizontal position.



Remove the fill plug (1) and fill the final drives with oil through the fill hole until the oil flows from the drain hole. Refer to **Specifications, Chapter 1 - Recommended Lubricants and Coolant Additives**.

Clean the fill plug and install into the final drive.

Check the Wheel Nuts

Ensure that the wheel nuts are secure. Torque to 650 N·m (480 ft. lb.) if required.

CHAPTER 11. 250 HOURS SERVICE

Introduction

The 250 hours service must be performed by **BELL EQUIPMENT** Product Support service personnel.

The 250 hours service must be performed when the machine has operated for 250 hours and the service must be repeated every 250 hours thereafter.

Service Instructions

Ensure that the machine is in the service position. Refer to **Pre-service Instructions, Chapter 7**.

Perform all the Daily or 10 Hourly Service Checks.

Perform the following additional tasks:

Engine

NOTE:For further engine information or details not shown in this manual, refer to the Mercedes-Benz Manual OM 366 LA.

Change the Oil and Oil Filters

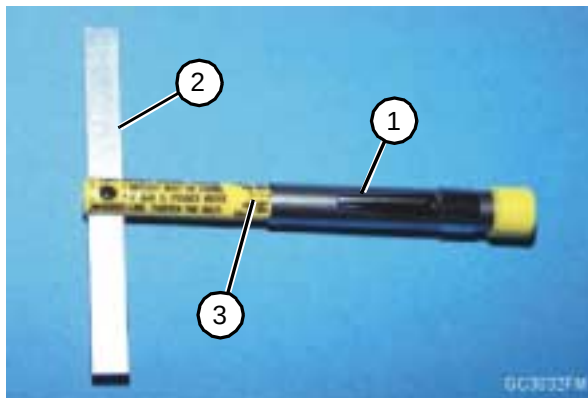
Procedure described in **Chapter 10, First 100 Hours Service**.

Check the Tension of the Drive Belts

NOTE:The following procedure is applicable to the alternator drive belts and the air conditioner compressor drive belts.

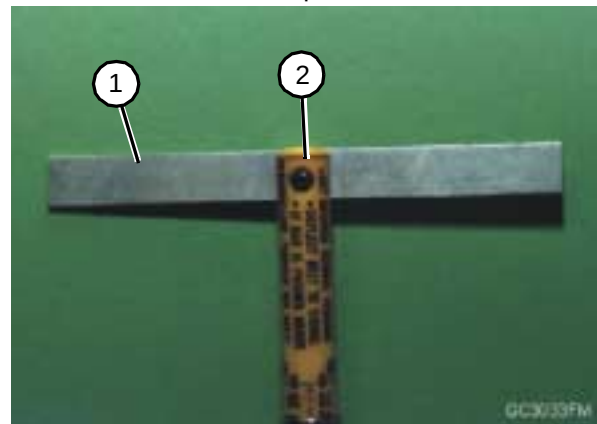
The drive belt's tension should be: new belts 40 to 45 kg (88 to 99 lb.); old belts 30 to 40 kg (66 to 88 lb.).

Use an automotive tension tester to measure the drive belts tension.



- Unscrew the sleeve (1) and release the feeler bar (2).
- Place the feeler bar in the perpendicular position.
- Pull the feeler bar down.
- Set the tension for measuring new belts by turning the sleeve to the 40 to 45 kg (88 to 99 lb.) mark on the scale (3)
- Position the tension tester on the middle of the drive belt.
- Press down the tension tester until the touch signal is felt at the top of the cap.
- Carefully remove the tension tester from the drive belt and read the scale.

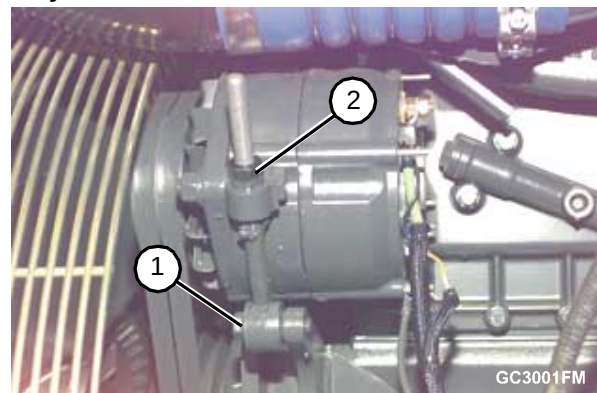
The feeler bar has three positions:



- If the bottom of the feeler bar (1) is on the gauge line (2), the belt tension is correct.
- If the bottom of the feeler bar is below the gauge line, the belt tension is too tight.
- If the bottom of the feeler bar is above the gauge line, the belt tension is too loose.

If the correct readings are not obtained, adjust the drive belts.

Adjust the Alternator Drive Belts



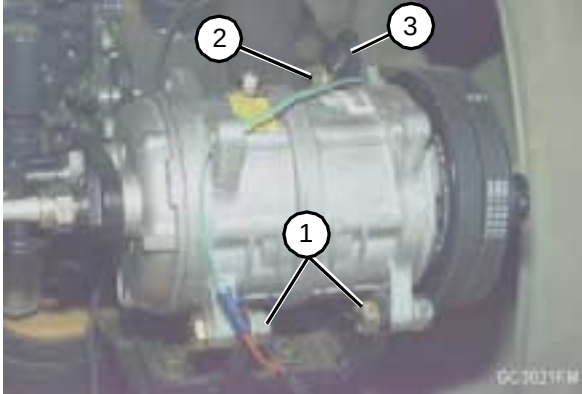
Slacken the securing bolt (1) on the alternator.

Tighten the adjusting nut (2) to increase the tension of the drive belts.

Use the tension tester to measure the tension. Refer to Check the Tension of the Drive Belts (previous instruction).

Repeat the procedure until the correct tension is achieved then tighten the securing bolt.

Adjust the Air Conditioner Compressor Drive Belts (Optional Equipment)



Loosen the adjusting bolts (1) and manually move the air conditioner compressor forward on the bracket to apply tension to the drive belts.

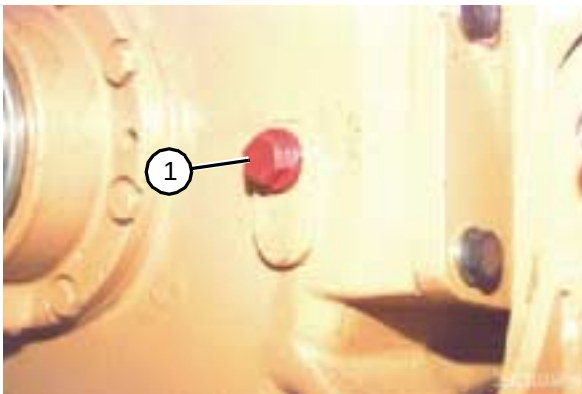
Secure the adjusting bolts.

Measure the drive belt tension. Refer to Check the Tension of the Drive Belts in this Chapter.

On obtaining the correct tension ensure that the adjusting bolts are secure.

Transfer Case

Check the Oil Level



Remove the oil level plug (1). The oil level must be level with the oil level plug hole.

If the oil needs replenishing, fill through the filler hole until oil begins to flow from the hole.

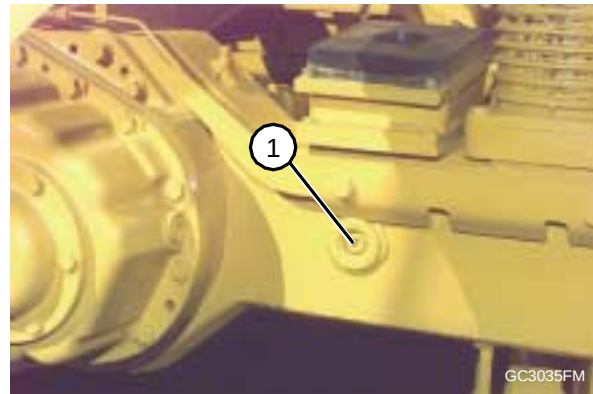
Replace the level plug and check for oil leaks at the plug when the transmission has been operating for approximately five minutes.

Use the correct grade of oil. Refer to **Chapter 1- Recommended Fuels, Lubricants and Coolant Additives**.

Axles and Chassis

Check the Oil Level in the Differentials

NOTE: The procedure is the same for all the axle differentials. The rear axle of the B25C 6X4 is a trailing axle and requires no oil check.



Clean the axle housing around the level/filler plug (1).

Remove the level/filler plug from the axle housing.

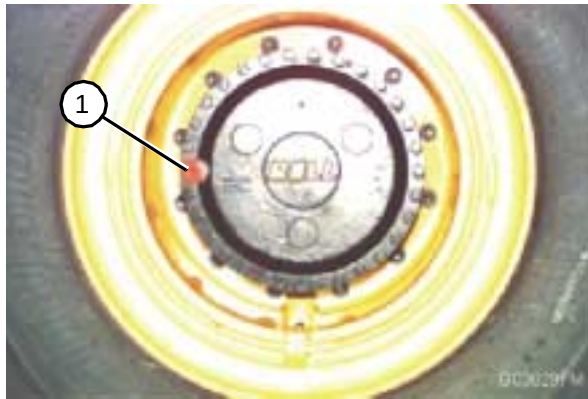
The oil must be level with the bottom of the level/filler plug hole.

Replenish with new oil if necessary, via the level/filler hole. Refer to **Specifications, Chapter 1 - Recommended Lubricants and Coolant Additives**.

Reinstall the level/filler plug.

Check the Oil Level in the Final Drives

NOTE: The procedure is the same for all the final drives. The rear axle of the B25C 6X4 is a trailing axle and requires no oil check.



Rotate the wheels so that the level/filler plug (1) is in a horizontal position.

Remove the level plug from the level/filler hole and check the oil level in each of the final drives.

The oil level must be at the bottom of the level/filler hole.

If necessary top up the oil until the oil flows from the level/filler hole. Refer to **Specifications - Recommended Lubricants and Coolant Additives**.

Reinstall the level plug securely.

Electrical

Check the Electrical Connections

Check the wiring for security and to ensure that no fraying has taken place.

Ensure that the electrical connections are secure and that the alternator, starter motor, air conditioner compressor motor, buzzer and horn earth cables are secure.

Visually inspect all the sender units and switches in the engine compartment for damage.

Ensure that the electrical cables and wires are routed correctly and that all securing straps are functional and undamaged.

Check that the cables and wires are fastened in the correct position and no chafing can occur when the machine is in use.

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CHAPTER 12. 500 HOURS SERVICE

Introduction

The 500 hours service must be performed when the machine has operated for 500 hours and the service must be repeated every 500 hours thereafter.

Every 500 hours service must be performed by qualified service personnel.

Service Instructions

Ensure that the machine is in the service position. Refer to **Preservice Instructions, Chapter 7**.

Perform all the Daily or 10 Hourly Service Checks.

Perform the following additional tasks.

Engine

NOTE:For further engine information or details not shown in this manual, refer to the Mercedes-Benz Manual OM 366 LA.

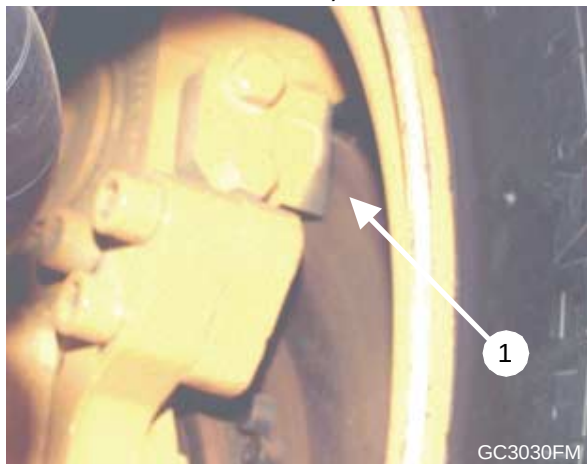
Adjust the Engine Valve Clearance

Refer to the Mercedes-Benz Manual OM 366 LA for the procedures.

Axles and Chassis

Check the Service Brake Pads

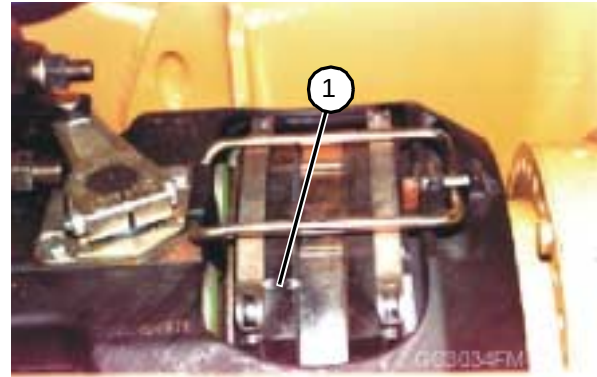
NOTE:If mud covers are fitted they will have to be removed first, for access.



Inspect between the brake disk and the calliper (1), if there is less than 2 mm (0.08 in) between the two, change the pads.

Check the Park/Emergency Brake Pads

Raise the bin and install the bin prop.



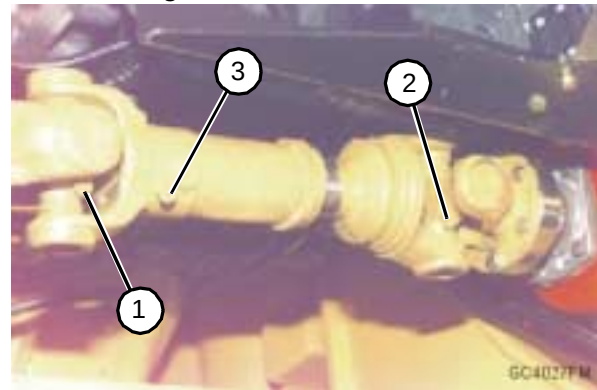
Measure the thickness of the brake pads (1).

If either one of the brake pads have worn to thickness of 5.1 mm (0.2 in) then both brake pads must be replaced.

Lubrication

Grease the PTO Propshaft

NOTE:Photograph is of a typical propshaft arrangement.



Remove the plugs (1 and 2) and fit grease nipples.

▲ CAUTION

Use only grease which conforms to DIN 51825-Kp 2P-30. Caltex Ultra Duty Grease 2 conforms to this specification. Refer to BELL Product Support if in doubt.

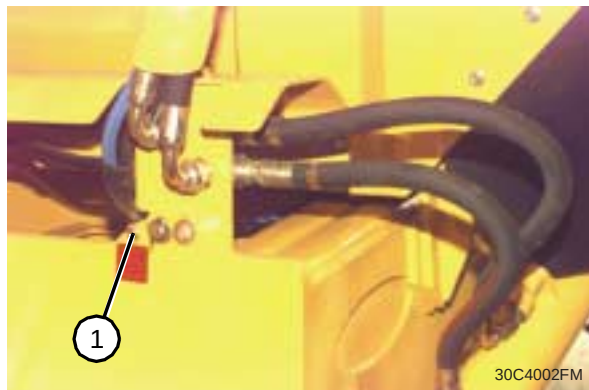
Lubricate the cross and roller on both universal joints.

Remove the plug (3) and fit a grease nipple.

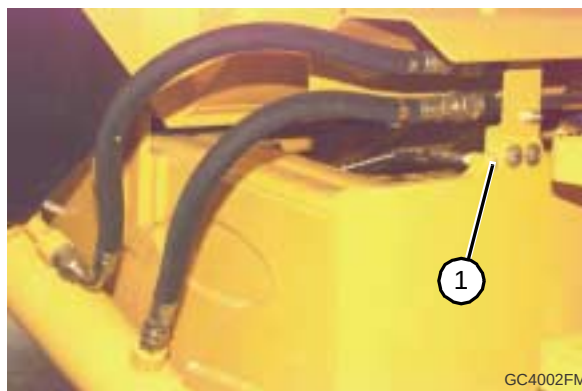
Lubricate the slip joint.

Replace all plugs using a drop of Loctite.

Grease the through drive bearing.



The through drive bearing, top at grease nipple (1).



Grease the through drive bearing rear at position (1).

Procedure For Greasing the Through Drive Bearing

- Loosen the pipes at the through drive bearing, front, rear and top.
- Grease each grease point until grease is seen at the pipe end.
- Replace the pipe and grease that grease point again, allowing only 3 pumps on the grease gun. Repeat this step for the other two grease points as well.

CHAPTER 13. 1 000 HOURS SERVICE

Introduction

The 1 000 hours service must be performed when the machine has operated for 1 000 hours and the service must be repeated every 1 000 hours thereafter.

Every 1 000 hours service must be performed by qualified service personnel.

Service Instructions

Ensure that the machine is in the service position. Refer to **Pre-service Instructions, Chapter 7**.

Perform all the Daily or 10 Hourly Service Checks.

Perform the following additional tasks:

Engine

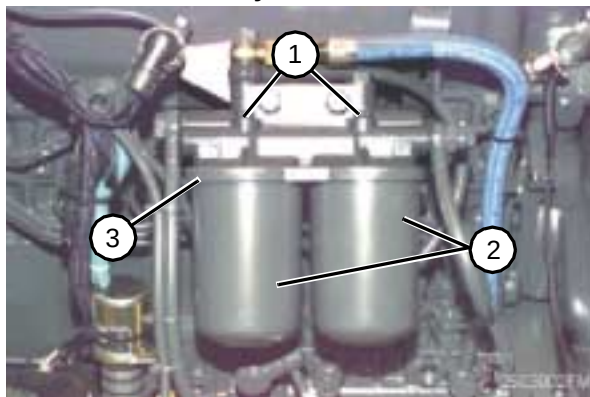
NOTE:For further engine information or details not shown in this manual, refer to the Mercedes-Benz Manual OM 366 LA.

Change the Primary Fuel Filter

Procedure described in **Chapter 10, First 100 Hours Service**.

Change the Secondary Fuel Filters

NOTE:The procedure for changing each of the secondary fuel filters is the same.



Unscrew and remove both filter's retaining bolts (1) and remove the secondary fuel filters (2) from the filter head (3).



Remove the fuel filter's housings with the filter elements from the filter head.



Remove the filter elements from the filter housings.

Discard the filter elements, do not re-use.

Clean and check the filter housings for damage.



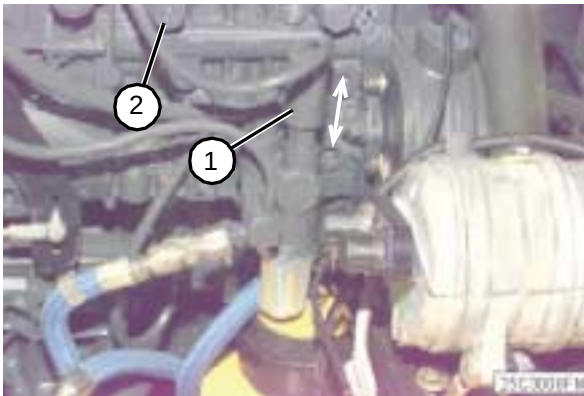
Clean the filter head with a lint free cloth and renew the sealing rings (1) of the filter head.

Fit a new filter elements into the filter housings.

Smear a little fuel on the new sealing rings of the filter head.

Fill the filter housings with fuel and re-fit in the filter head.

Secure the filter housings with the securing bolts.



Operate the pump (1) until the flow relief valve (2) on the injection pump is heard to open (chattering sound).

Start the engine and check for leaks at the secondary fuel filter head.

Transmission

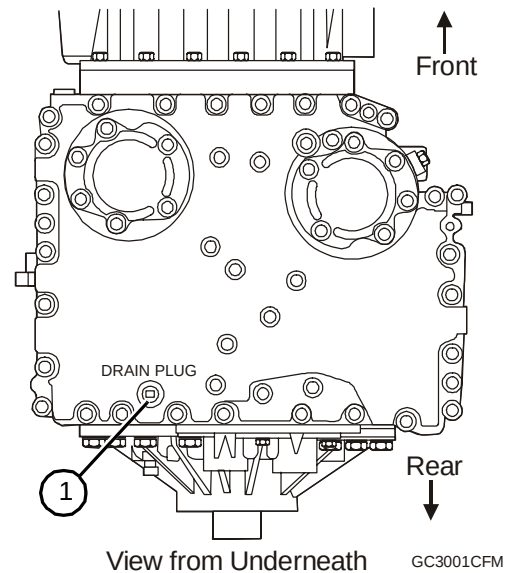
Change the Transmission Fluid and Filters

The change intervals can be extended by oil sampling. The filters must be changed at the first 1000 hrs. and thereafter every 2000 hrs.

Drain the Transmission Fluid

Ensure that the transmission fluid has reached normal operating temperature; 65°C to 93°C (116°F to 200°F).

NOTE: Check the transmission fluid temperature on the master display unit.



Place a 20 litre (5.28 USGAL) container under the transmission drain plug (1).

Be careful when draining the transmission fluid, hot fluid can cause burns to unprotected skin.

Remove the drain plug with its sealing ring and allow the fluid to drain into the container.

Disconnect the pipes from the transmission fluid cooler, allowing the cooler fluid to drain into the container.

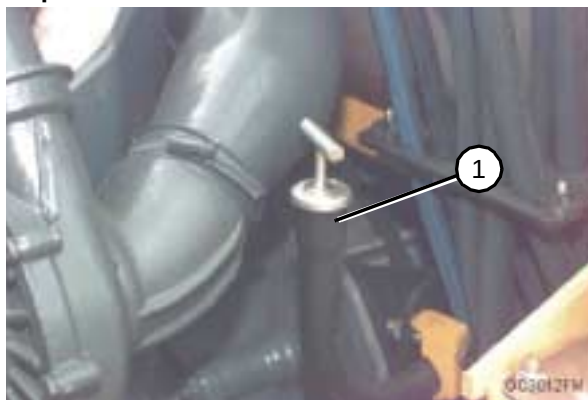
reconnect the pipes to the transmission fluid cooler.

Clean the drain plug and the sealing surface on the housing.

Install the drain plug with a new sealing ring.

Tighten the drain plug to 25 to 32 Nm (18.4 to 23.6 lb. ft.).

Inspect the drained transmission fluid for evidence of dirt, foreign matter or excessive water. (A small amount of condensation is normal during operation). Report transmission fluid contamination to **BELL EQUIPMENT** Product Support.

Replenish the Transmission Fluid

Use a funnel in the dipstick tube (1) to replenish the transmission fluid.

Fill the transmission with the correct grade of fluid. Refer to **Chapter 1 - Recommended fuels, Lubricants and Coolant Additives**.

Check the fluid with the dipstick at regular intervals during the filling procedure. Use the Cold Check method initially, followed by one of the other two methods as detailed in **Checking the Transmission Fluid Level - Daily or 10 Hourly Service Checks**, Chapter 9.

Check for signs of fluid leaks at the drain plug.

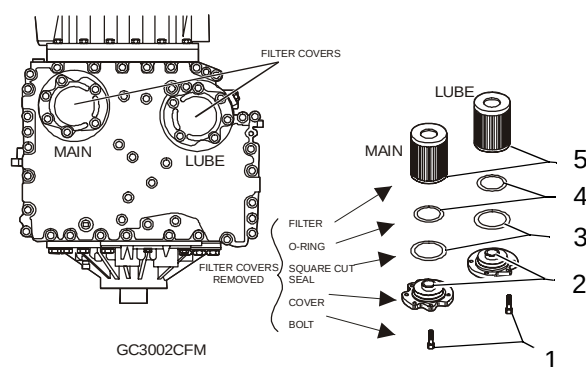
Change the Transmission Fluid Filters

Pump up the front axle with the levelling valve to allow sufficient space to replace the filters and support the assembly on blocks.

Place a container underneath the filters to avoid fluid spillage.

NOTE: Only two litres of oil is wasted during replacement.

Always replace both filters and do not re-use them.



Remove the 12 bolts (1) securing the two filter covers (2) to the housing.

Remove the "O"-rings (3) and seals (4) from the filter covers.

Discard the filters (5), Do not re-use.

Smear a small amount of oil on the "O"-rings inside the new filters.

Install the seals onto the filter covers.

Install the filters and secure with the filter covers.

Torque the securing bolts to 51 to 61 Nm (38 to 45 lb. ft.).

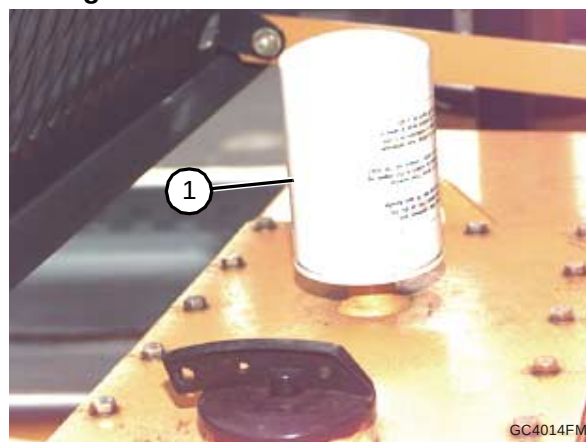
Replenish the transmission fluid.

Check for fluid leaks at the filter covers.

Change The Transfer Case Oil

Procedures are detailed in **Chapter 10, First 100 Hours Service**.

The change intervals can be extended by oil sampling.

Hydraulics**Change the Breather Filter**

Unscrew and remove the breather filter (1) from the filter housing.

Discard the breather filter and seal.

Lubricate the seal of the new breather filter and install.

Tighten the filter hand tight, then a further 90°.

Pneumatics

Change the Air Drier Filter (Unloader Valve)

Drain the air reservoir to release the air pressure in the system

Open the external compartment lid to gain access to the air drier filter.



Unscrew and remove the filter cartridge. Discard the filter and O-ring, do not re-use.

Fit a new filter cartridge to the filter head with a new O-ring. Smear a little oil on the new O-ring before fitting

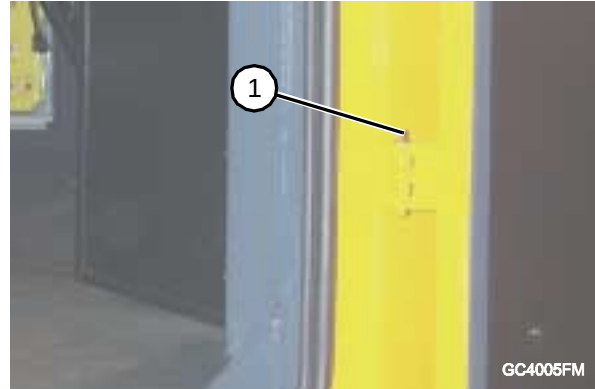
Tighten the air drier filter cartridge by hand and then one half turn further.

Start the engine and when the air pressure has reached normal operating pressure, check for air leaks at the filter head.

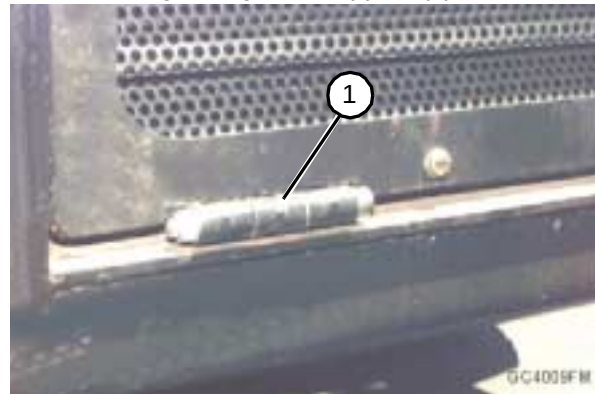
Lubrication

Grease the Hinges

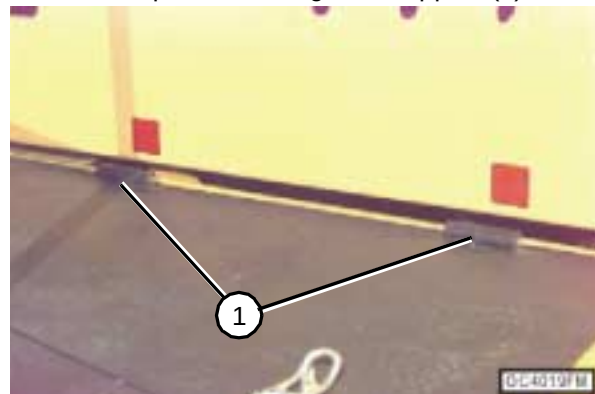
The following lubrication points are greased at least every 1 00 hours. (dependent upon the operating condition).



The door hinges at grease nipples (1).



The bonnet pivot bolts at grease nipples (1).

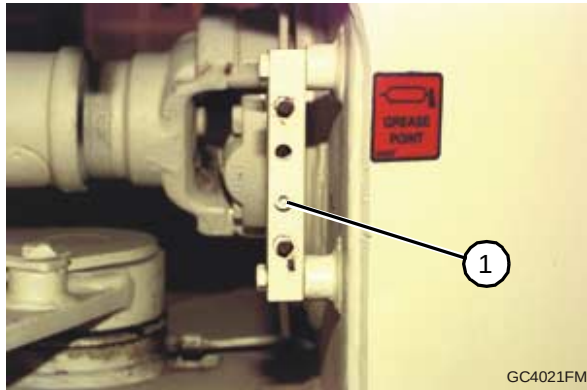


The battery box hinges at grease nipples (1).

Grease the Through Drive Bearing

NOTE:The Through Drive Bearing should be lubricated every 250 hours if the machine is operated in excessively wet conditions.

Greasing Procedure



Grease the through drive bearing front at point (1).



The through drive bearing, top at grease nipple (1).



Remove the blanking plug (1), fit a grease nipple and grease the through drive bearing; rear.

- Loosen the pipes at the through drive bearing, front, rear and top.
- Grease each grease point until grease is seen at the pipe end.
- Replace the pipe and grease that grease point again, allowing only 3 pumps on the grease gun. Repeat this step for the other two grease points as well. Remove the plug (1) and replace with a grease nipple.

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CHAPTER 14. 2 000 HOURS SERVICE

Introduction

The 2 000 hours service must be performed when the machine has operated for 2 000 hours and the service must be repeated every 2 000 hours thereafter.

Every 2 000 hours service must be performed by qualified service personnel.

Service Instructions

Ensure that the machine is in the service position. Refer to **Pre-service Instructions, Chapter 7**.

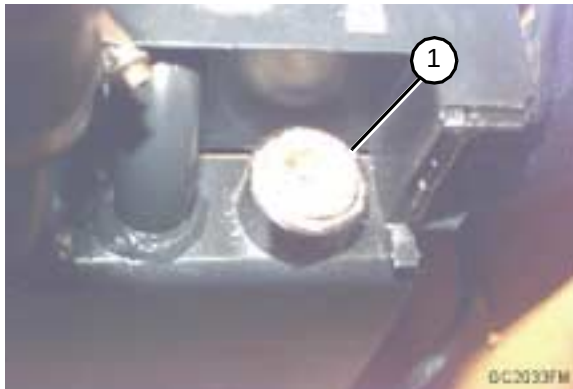
Perform all the Daily or 10 Hourly Service Checks.

Perform the following additional tasks.

Engine

NOTE: For further engine information or details not shown in this manual, refer to the Mercedes-Benz Manual OM 366 LA.

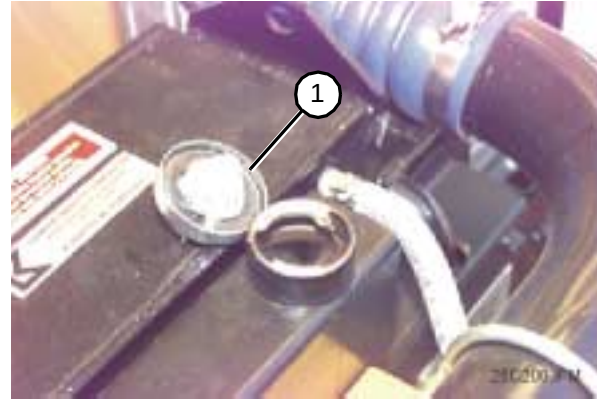
Flush and Renew the Coolant



Place a 48 litre (12.7 USGAL) container under the drain plug (1) at the bottom, right of the radiator.

Unscrew and remove the drain plug.

Allow the coolant to drain into the container.



Remove the filler cap (1) on the radiator expansion tank.

Fill the radiator expansion tank to the top with clean water.

Unscrew and remove the drain plug and allow the water to drain.

Flush the cooling system by repeating the procedure until clean water runs from the radiator.

Replace the drain plug.

⚠ CAUTION

If coolant is ever drained from the cooling system, it must be replaced with the recommended coolant mixture. Do not use water alone.

Fill the radiator with the correct coolant. Refer to **Chapter 1 - Recommended Fuels, Lubricants and Coolant Additives**. Fill the radiator expansion tank until the level is at the top.

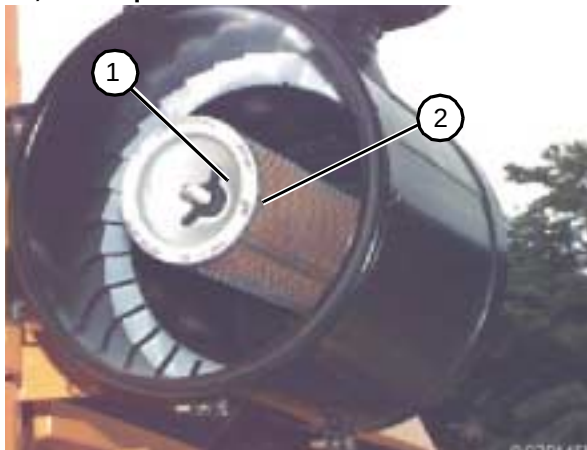
Leave the filler cap off the expansion tank and start the engine.

Purge all the air out of the tank by keeping the tank full to the top. The level will eventually stabilise at the top of the tank.

Replace the filler cap.

Change the Air Cleaner Secondary Filter

Remove the primary filter element from the air cleaner housing. Procedure described in **Chapter 16, As Required Service**.



Remove the wing nut (1) from the secondary filter element (2).



Remove the secondary filter element (1) from the air cleaner housing and discard.

Clean the inside of the air cleaner housing.

Install the new safety filter element into the air cleaner housing and secure with the wing nut. Do not over-tighten the wing nut.

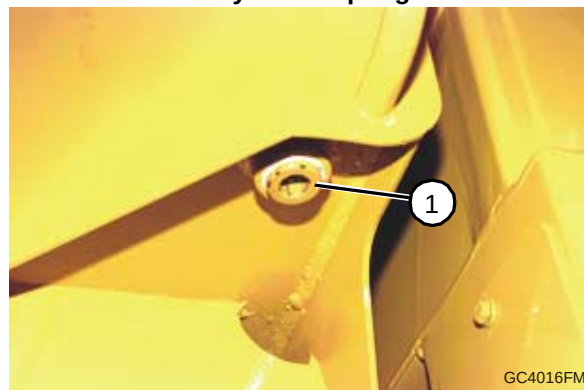
Install the primary filter element and the end cover onto the air cleaner housing, securing it with the clips.

Press the top of the air cleaner service indicator, to reset it, after installation is complete.

Hydraulics

Change the Hydraulic Fluid

NOTE: The change intervals can be extended by oil sampling.



Place a 140 litre (37 USGAL) container under the drain plug (1) on the hydraulic tank.

Remove the drain plug and allow the fluid to drain into the container.

Remove the seal from the drain plug and discard.

Clean the drain plug and fit a new seal.

Install the drain plug into the hydraulic tank.

Replenish the hydraulic tank with clean hydraulic fluid. Refer to **Specifications - Recommended Lubricants and Coolant Additives**.

Axles and Chassis

Change the Oil in the Differentials

Procedure described in **Chapter 10, First 100 Hours Service**.

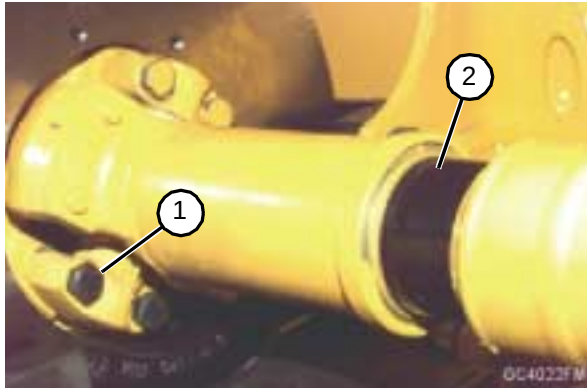
Change the Oil in the Final Drives

Procedure described in **Chapter 10, First 100 Hours Service**.

Lubrication

Grease the Propshafts

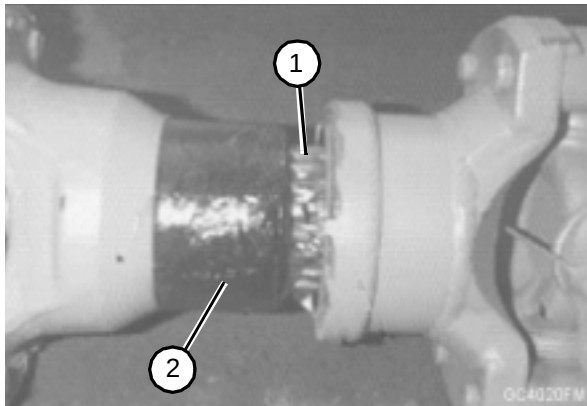
NOTE: Photographs are of typical propshaft arrangements.



Unscrew and remove the propshaft securing bolts (1) in order to extend the propshaft at slip joint (2).

▲ CAUTION

Do not extend the propshaft too far. The male and female splines must not disengage. Correct phasing of the propshaft is important to the balance of the propshaft.



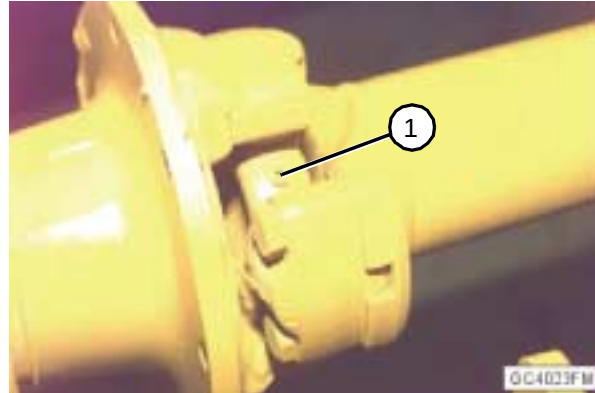
Extend the propshaft to expose the metal spline (1).

▲ CAUTION

Use only grease which conforms to DIN 51825-Kp 2P-30. Caltex Ultra Duty Grease 2 conforms to this specification. Refer to BELL Product Support if in doubt.

Apply grease to the exposed metal spline and to the Teflon coating (2) on the female end of the slip joint.

Install the propshaft.



Remove the plugs (1) on each universal and install a grease nipple.

Lubricate the cross and roller on each universal joint.

Replace the plugs using a drop of Loctite.

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CHAPTER 15. 3 000 HOURS SERVICE

Introduction

The 3 000 hours service must be performed when the machine has operated for 3 000 hours and the service must be repeated every 3 000 hours thereafter.

Every 3 000 hours service must be performed by qualified service personnel.

Service Instructions

Ensure that the machine is in the service position. Refer to **Pre-service Instructions, Chapter 7**.

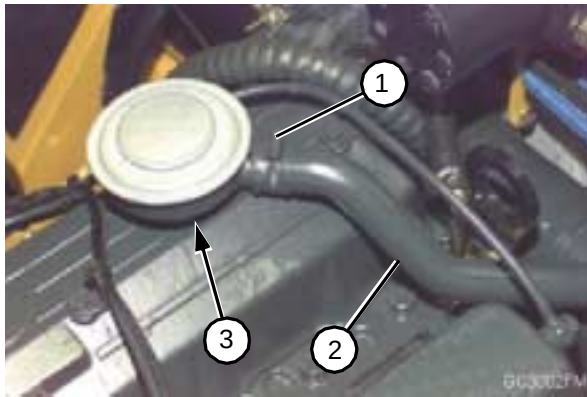
Perform all the Daily or 10 Hourly Service Checks.

Perform the following additional tasks.

Engine

NOTE:For further engine information or details not shown in this manual, refer to the Mercedes-Benz Manual OM 366 LA.

Change the Crankcase Breather (Oil Separator)



Loosen the hose clamp (1) and pull the rubber pipe (2) from the outlet port.

Unscrew the securing nut, remove the crankcase breather and discard it.

Fit a new crankcase breather and secure the rubber pipe with the hose clamp.

Service the Injectors

Refer to the Mercedes-Benz Manual OM 366 LA for the procedures.

NOTE:If the sulphur content is above 0.5%, service between 1 200 and 1 800 hours.

Hydraulics

Change the Return Filters

Procedure described in **Chapter 10, First 100 Hours Service**.

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CHAPTER 16. AS REQUIRED SERVICE

Introduction

This chapter details services which are described in the maintenance schedule as tasks which are performed as required.

This chapter details unscheduled maintenance tasks.

Service Instructions

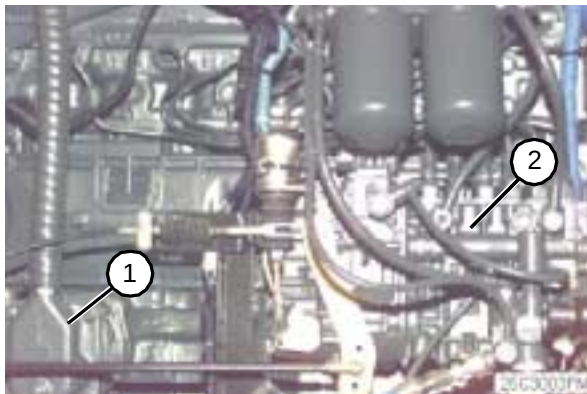
Ensure that the machine is in the service position. Refer to **Pre-service Instructions, Chapter 7.**

Engine

NOTE:For further engine information or details not shown in this manual, refer to the Mercedes-Benz Manual OM 366 LA.

Check the Engine Compartment Components

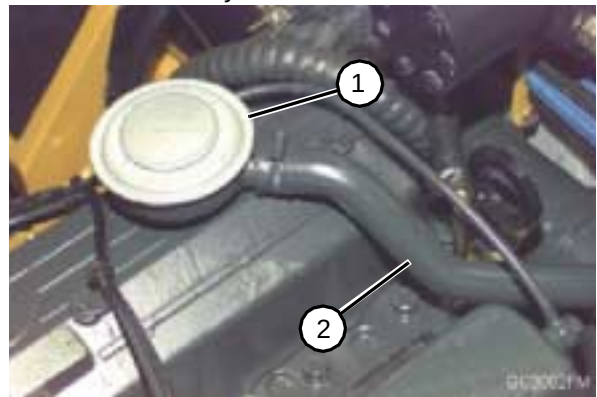
Perform a general, visual check on the engine and components in the engine compartment as follows:



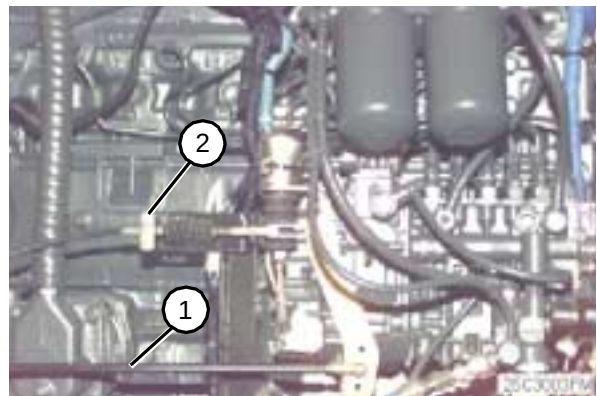
Check the compressor (1) and injection pump (2) for cracks and security.



Check the airconditioning compressor pump for cracks and security.

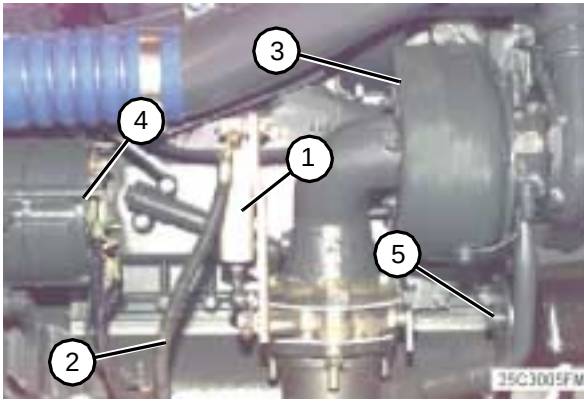


Check the engine breather (1) for cleanliness and security. Ensure that the engine breather pipe (2) is secure and not blocked.



Check that the throttle linkage (1) and the throttle position sensor linkage (2) are secure and not damaged.

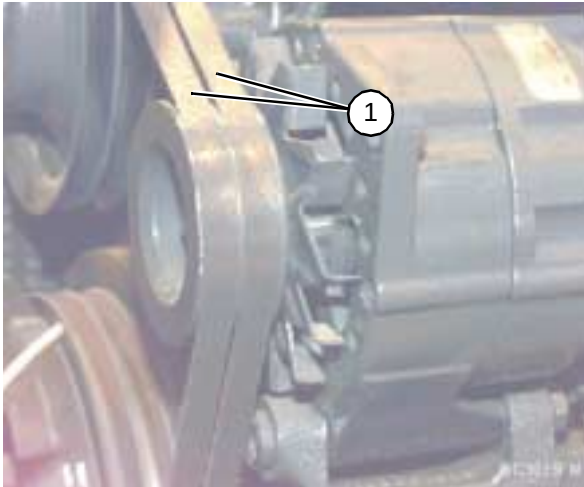
Check the manifolds for cracks and security.



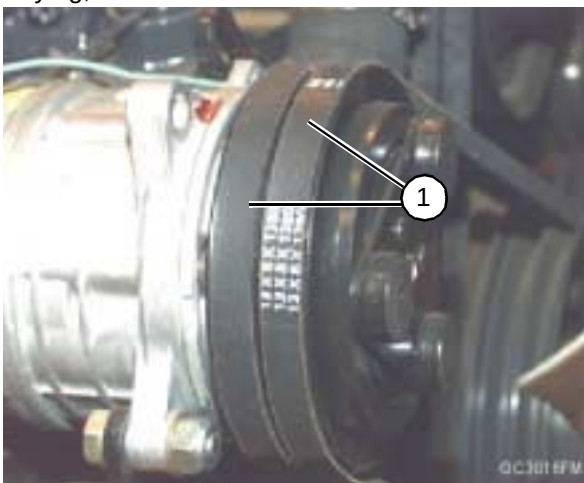
Check the exhaust brake valve (1) and linkage for damage and security.

Check the air hose (2) on the exhaust brake valve for security and leaks.

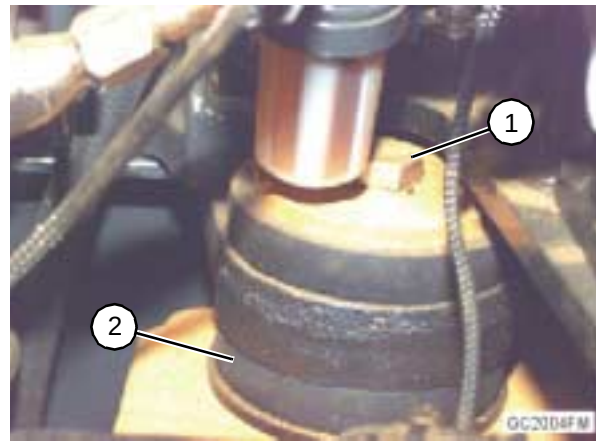
Check the turbocharger (3), alternator (4) and starter motor (5) for damage and security.



Inspect the alternator drive belts (1) for cracks, fraying, wear and tension.



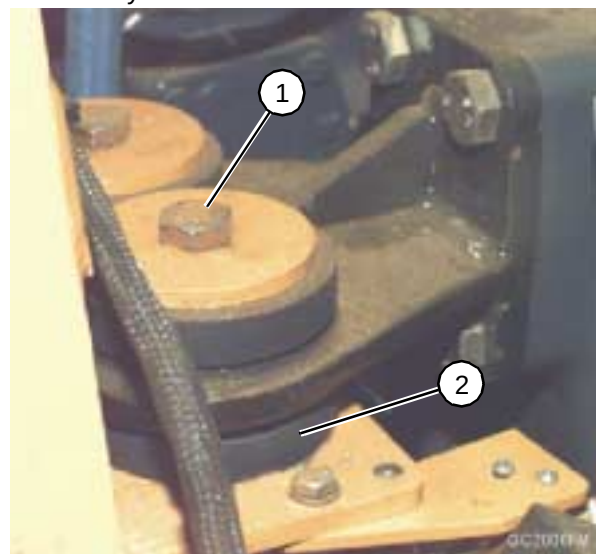
Inspect the air-conditioner compressor drive belts (1) for cracks, fraying, wear and tension.



Inspect the engine mounting bolts (1) for security.

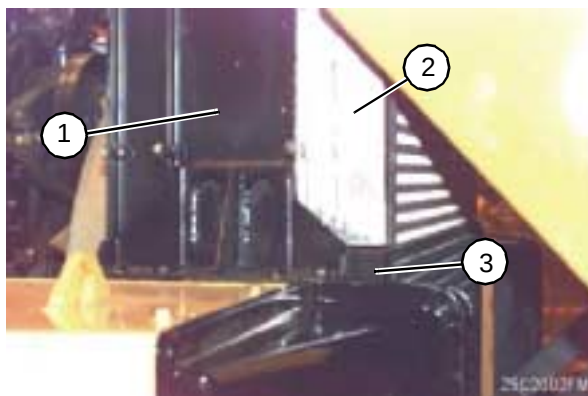
Check that the rubber mountings (2) are secure and not damaged.

Check the air hose (2) on the exhaust brake valve for security and leaks.



Inspect the transmission mounting bolts (1) for security.

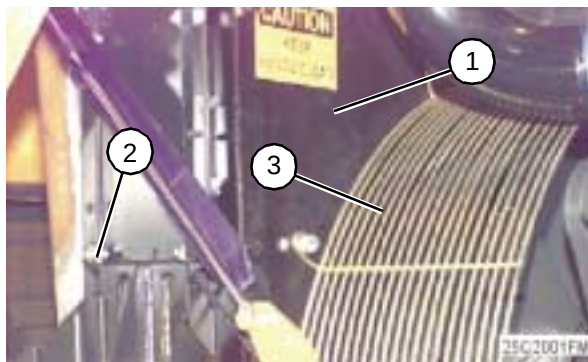
Check that the rubber mountings (2) are secure and not damaged.



Check the radiator (1), intercooler (2) and transmission cooler (3) for damage and security.

Check the hoses and clamps for damage and security.

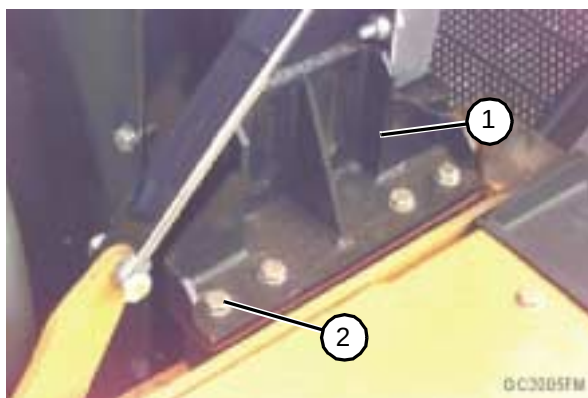
Check the fins for damage and cleanliness. Ensure that there is no restriction to the air flow.



Check the fan cowling (1) for damage and cracks.

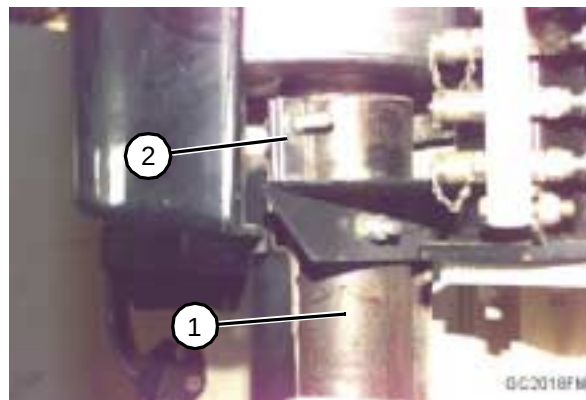
Ensure that the mounting bolts (2) are secure.

Check that the fan guard (3) is undamaged and secure.



Check that the cooling pack mountings (1) are not damaged and that the bolts (2) are secure.

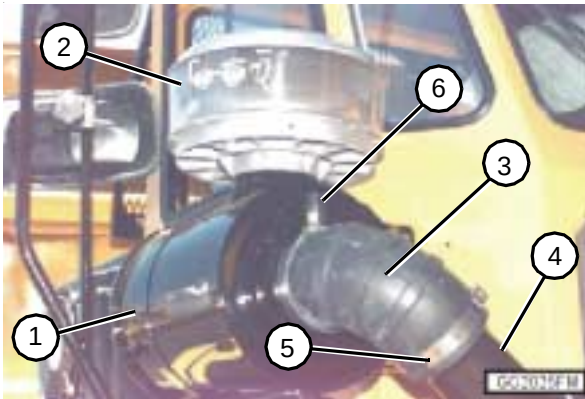
Check the radiator fins for damage and cleanliness. Ensure that there is no restriction to the air flow.



Check the exhaust pipes (1), mounting bolts and clamps (2) for security and damage.



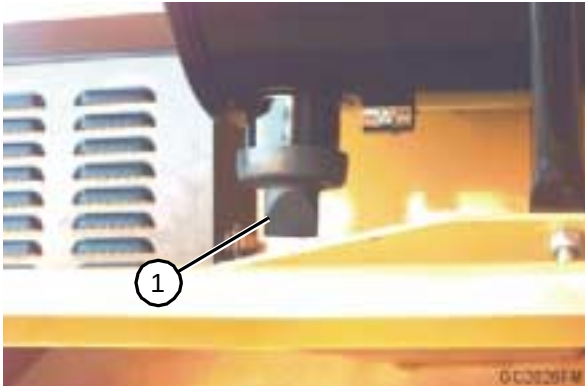
Check the exhaust stack, mounting bolts and clamps for security and damage.



Check the air cleaner assembly for damage to the air cleaner (1) and pre-cleaner (2).

Check the rubber elbow (3), connecting pipes (4), clamps (5) and mounting bolts for security and damage.

Check that the service indicator (6) is not showing a red flag, re-set if necessary.

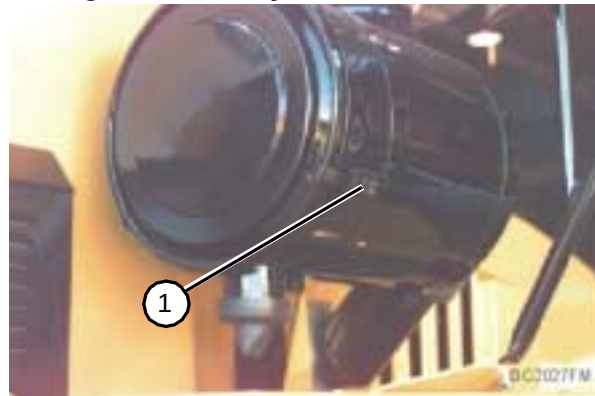


Check that the vacuator valve (1) is undamaged and free from obstruction.



Check the level of the dirt in the bowl, if it reaches the level (1) marked on the bowl, the bowl must be cleaned.

Change the Primary Filter Element



Remove the end cover from the air cleaner housing by releasing the clips (1).



Unscrew the wing nut (1) and remove the internal cover (2) from the end cover (3).

Clean the internal cover and the end cover with a damp cloth.

Replace the internal cover and secure with the wing nut.



Unscrew and remove the wing nut (1) securing the primary filter.



Remove the primary filter element (1) from the air cleaner housing.

Discard the primary filter element, do not re-use.

Clean the air cleaner housing and inspect for damage.

Install the new primary filter element into the air cleaner housing and secure with the wing nut. Do not over-tighten the wing nut.

Install the end cover and secure with the clips onto the air cleaner housing.

Check the end cover to ensure that it is fitted correctly with the arrows pointing up.

Clean the Air Cleaner Pre-cleaner Bowl



Remove the wing nut (1) securing the lid (2) to the bowl (3).

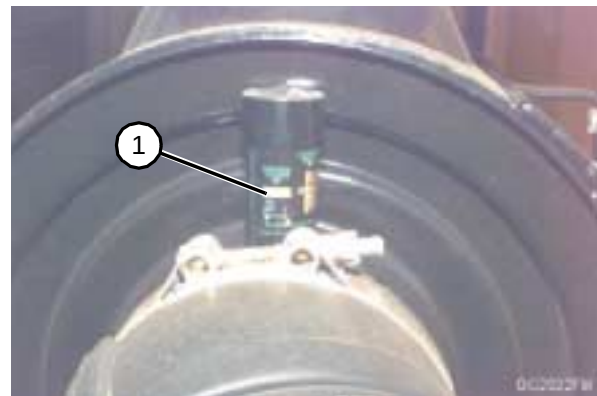


Remove the lid (1) and bowl (2) from the pre-cleaner body (3).

Remove the dirt from the bowl and clean the bowl with a lint-free cloth.

Install first the bowl then the lid onto the pre-cleaner body and secure them with the wing nut.

Check the Air Cleaner Service Indicator



Check the indication window (1) on the air cleaner service indicator.

If the window shows a red flag, the air cleaner filter element must be changed.

Check for Oil and Fuel Leaks

Perform a visual inspection for oil and fuel leaks on and around the engine and components inside the engine compartment.

Check all Hoses and Clamps

Visually inspect all the hoses in the engine compartment for leaks, cracks, deterioration and chafing damage.

Ensure that the hoses are routed correctly, all securing straps are functional and undamaged.

Check that the hoses are fastened in the correct position and no chafing can occur when the machine is in use.

Check all the clamps in the engine compartment to ensure that they are secure.

Check all Electrical Components, Cables and Connections

Visually inspect all the sender units and switches in the engine compartment for damage.

Ensure that the electrical cables and wires are routed correctly and that all securing straps are functional and undamaged.

Check that the cables and wires are fastened in the correct position and no chafing can occur when the machine is in use.

Check all the electrical connections in the engine compartment to ensure that they are secure.

Check the Wiring

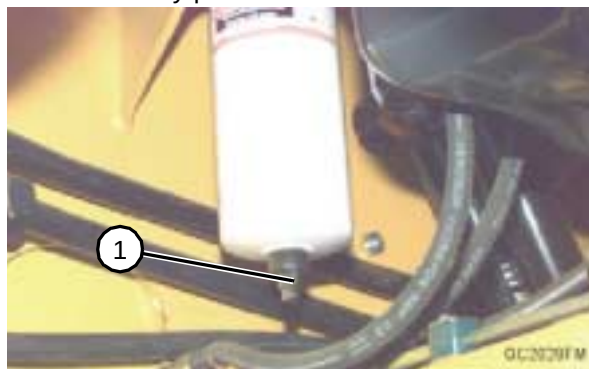
Check the wiring daily for security and to ensure that no fraying has taken place.

Ensure that the connections are secure and that the alternator, starter motor, air conditioner compressor motor, buzzer and horn earth cables are secure.

Visually inspect all the sender units and switches for damage.

Drain the Primary Fuel Filter

Lower the belly plate.



Loosen the wing nut (1) on the primary fuel filter.

Drain the accumulated water into a container.

Tighten the wing nut when fuel flows out water free.

Raise the belly plate.

Clean the Cooling Pack

Raise the bonnet and switch off the battery disconnect switch.

Wash the cooling pack from the rear using a pressure washer and a mild detergent that is not caustic to aluminium.

Keep the fins free from obstructions which may restrict the air flow.

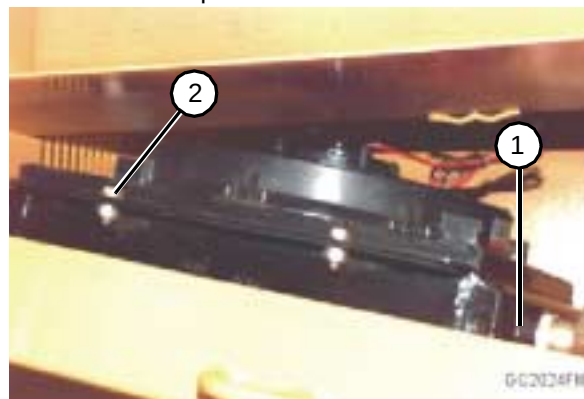
NOTE: If there has been transmission failure the fluid cooler must be sent in for ultrasonic cleaning. Contact **BELL EQUIPMENT** Product Support.

Hydraulics

Check and Clean the Retarder Cooler

Open the battery box lid.

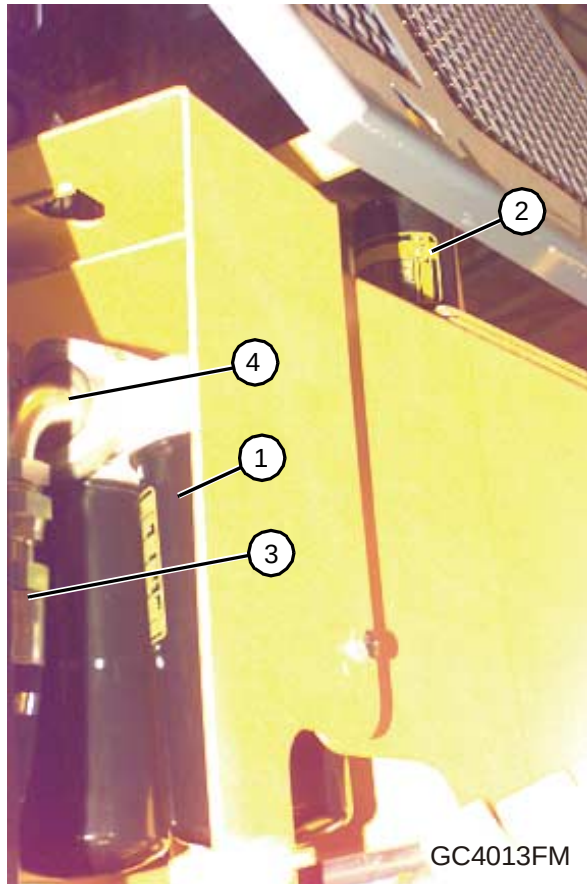
Check the cooler, if it is dusty and mud-packed, clean with a soap and water solution.



Check hoses and fasteners (1) for security and leaks, and ensure that the four mounting bolts (2) are secure to prevent vibration.

NOTE: If there has been a failure in the retarder cooling system, the cooler must be removed and tested. Contact **BELL EQUIPMENT** Product Support.

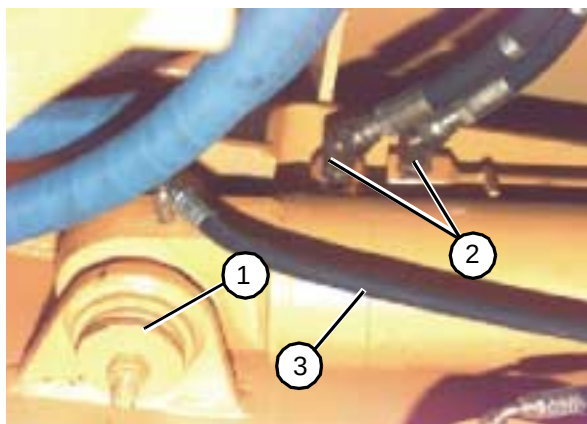
Check the Return Filters, Breather, Hoses and Connections



Check the return filters (1) and breather (2) for damage, security and leaks.

Check that the hoses (3) and connectors (4) are secure and not damaged.

Check the Steering Cylinders, Hoses and Connections

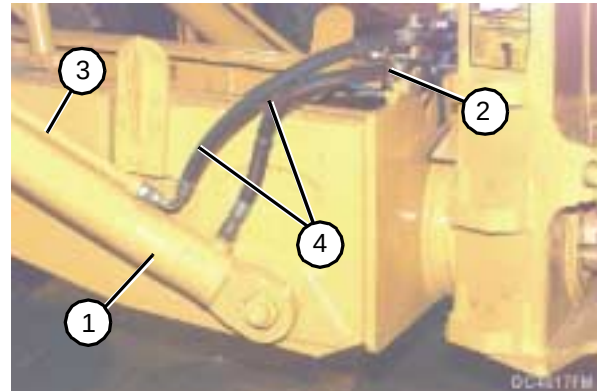


Check both of the steering cylinders for damage and leaks and ensure that the mountings (1) are secure.

Ensure that the hydraulic hoses and connections (2) are secure and undamaged.

Check that the lubrication hoses (3) are secure and not damaged.

Check the Tip Cylinders, Hoses, Pipes and Connections

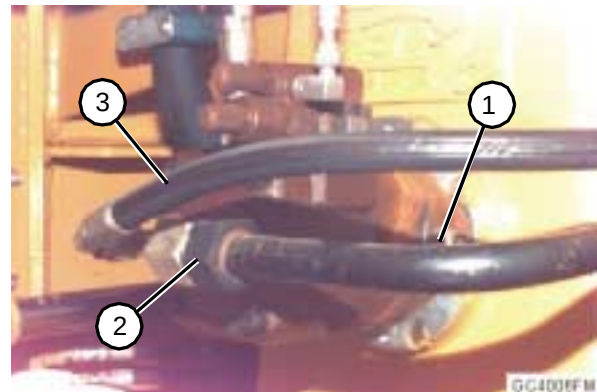


NOTE:Hydraulic protection sheet removed for clarity

Check the tip cylinders (1) for damage and leaks.

Ensure that the connections (2), pipes (3) and hoses (4) are secure and undamaged.

Check the Hydraulic Pump, Hoses and Clamps



Check the main hydraulic pump mounting bolts (1), connections (2) and hoses (3) for security.

Check the hoses and connections for damage and leaks.

Axles and Chassis

Inspect all pipes, hoses, clamps and connections on the axles and differentials for security.

Ensure that the hoses cannot chafe against moving parts.

Check all the axles for damage and security.

Check all the differentials for signs of leaks, damage and security.

Check all the driveshafts for damage and security.

Check that the sandwich blocks are not damaged and that the securing bolts are secure.

Ensure that the walking beam and joints are not damaged and that the securing bolts are secure.

Ensure that the suspension air bags, shock absorbers and the restraint cable are secure and undamaged.

CHAPTER 17. TROUBLE SHOOTING

Introduction

It is important to properly operate and maintain the machine and its components and to immediately rectify any faults which may occur.

Further information regarding the measures listed under "Remedy" can be obtained from the Service Manual or your **BELL EQUIPMENT** Product Support Representative.

NOTE: These lists are not exhaustive. If in doubt contact your **BELL EQUIPMENT** Product Support Representative.

Engine		
Symptom	Possible Cause	Remedy
Starter pinion does not turn or turns too slowly.	Battery insufficiently charged.	Charge battery.
	Connecting cable to starter loose.	Tighten cable at terminal; if necessary, solder on a new terminal.
	Carbon brushes shorting to earth, jamming in guides, or poor contact.	Clean carbon brushes with a clean cloth moistened in diesel (do not use emery paper); have the brushes renewed if necessary. Refer to BELL EQUIPMENT Product Support.
	Solenoid switch of starter faulty.	Refer to BELL EQUIPMENT Product Support.
	Freewheel clutch of starter slipping.	Refer to BELL EQUIPMENT Product Support.
Engine does not start, or stops immediately.	Fuel tank almost or completely empty.	Refuel and bleed system.
	Fuel filter clogged.	Clean filter; renew element, if necessary.
	Fuel line, pre-cleaner or strainer clogged.	Clean and bleed system.
	Leak in fuel system or in filter seals.	Seals, bleed.
	Fuel with insufficient fluidity.	Wash off wax deposits on strainer and filters, or renew filter element and use winter-grade fuel matched to outside temperature.
	Outside temperature too low.	Observe measures for winter operation.

Engine		
Symptom	Possible Cause	Remedy
Engine runs irregularly, cuts out or has poor performance.	Fuel tank almost or completely empty. Fuel filter clogged. Fuel line, pre-cleaner or strainer clogged. Leak in fuel system or in filter seals. Fuel with insufficient fluidity. Outside temperature too low. Bypass valves in fuel filter or in injection pump do not maintain pressure. Vent in fuel tank filler cap clogged. Start of delivery of injection pump incorrectly set. Injection nozzles jam or do not atomise. Insufficient air at higher speeds (because air filter fouled). Throttle linkage or control lever not at full stop. Exhaust valve for exhaust brake, one or both cylinder banks, or valve at end of exhaust line is closed or jammed.	Refuel and bleed system. Clean filter; renew element, if necessary. Clean and bleed system. Seal, bleed. Wash off wax deposits on strainer and filters, or renew filter element and use winter-grade fuel matched to outside temperature. Observe measures for winter operation. Check, renew if necessary. Clean cap. Check and adjust start of delivery. Renew nozzles. Clean air filter. Check, set correctly if necessary. Check position of exhaust valves; clear jamming valves.
Black exhaust.	Injection nozzles are damaged or fouled by carbon deposits. Start of delivery of injection pump incorrectly set. Excessive fuel delivery. Air filter fouled. Exhaust valve for exhaust brake, one or both cylinder banks, or valve at end of exhaust line is closed or jammed.	Renew nozzles. Set correctly. Check injection pump. Clean. Check position of exhaust valves; clear jamming valves.

Engine		
Symptom	Possible Cause	Remedy
Blue exhaust.	Oil level in engine or in oil bath air filter too high. Engine oil in combustion chamber (because piston rings jamming, cylinder liners are scored or excessive play in valve guides, or valve stem seals leaking).	Correct oil level. Refer to BELL EQUIPMENT Product Support.
White exhaust.	Cylinder head or cylinder head gasket leaking, coolant in combustion chamber.	Measure compression pressure to determine defective cylinder and rectify damage or refer to BELL EQUIPMENT Product Support.
Engine pinking.	Leak in nozzle holder or nozzles not properly atomising. Start of delivery of injection pump incorrectly set.	Renew nozzles. Tighten nut of nozzle holder. Check and adjust start of delivery.
Engine knocking.	Bearing damage to crankshaft or damage to piston.	Switch off engine immediately and refer to BELL EQUIPMENT Product Support.
Coolant temperature too high.	Insufficient coolant or cooling system not properly vented. Belt for driving coolant pump or fan insufficiently tensioned or broken. Radiator fouled or clogged with deposits on inside; radiator fouled on outside. Automatic fan coupling of viscous fan faulty. Thermostats faulty.	Replenish, vent. Tension or renew. Clean or flush out deposits. Block fan temporarily and refer to BELL EQUIPMENT Product Support. Renew.
Engine oil pressure drops. CAUTION: If pressure drops rapidly, switch off engine immediately	Oil level in sump too low. Engine oil too thin. Pressure relief valve blocked or leaking when open, oil pump faulty, oil pressure gauge faulty, wear causing excessive bearing play, damage to bearings.	Replenish oil to correct level. Refill with correct grade of oil. Refer to Chapter 1, Specifications - Recommended Lubricants and Coolant Additives Chart ; Check for presence of water or fuel in oil. Refer to BELL EQUIPMENT Product Support.

Engine		
Symptom	Possible Cause	Remedy
Alternator indicator warning light does not illuminate when engine is not running.	Bulb faulty or electric lead interrupted.	Replace bulb or rectify interruption.
Alternator indicator warning light illuminates when engine is running.	Drive belt not tensioned correctly.	Check, correct belt tension.
	Drive belt broken.	Replace drive belt.
	Alternator, rectifier or regulator faulty.	Check, renew faulty parts, refer to BELL EQUIPMENT Product Support.

Transmission		
Symptom	Possible Cause	Remedy
Low clutch pressure.	Low oil level.	Refill transmission. Refer to Chapter 1, Specifications - Recommended Lubricants and Coolant Additives Chart .
Low converter charging pump output.	Low oil level.	Refill transmission. Refer to Chapter 1, Specifications - Recommended Lubricants and Coolant Additives Chart .
	Suction screen blocked.	Clean the suction screen.
Overheating.	Low oil level.	Refill transmission. Refer to Chapter 1, Specifications - Recommended Lubricants and Coolant Additives Chart .

Axles		
Symptom	Possible Cause	Remedy
Final drive leaking oil.	Loose or damaged oil plugs.	Tighten or replace the oil plugs.
	Oil level too high.	Drain oil to the correct level.
	Final drive bolts loose.	Tighten the final drive bolts to the correct torque.
	Axle breather blocked.	Clean the axle breather.

Axles		
Symptom	Possible Cause	Remedy
Noisy final drive.	Low oil level in the final drive.	Refill the final drive. Refer to Chapter 1, Specifications - Recommended Lubricants and Coolant Additives Chart .
Final drive overheating.	Oil level too high. Oil level too low.	Drain oil to the correct level. Refill the final drive. Refer to Chapter 1, Specifications - Recommended Lubricants and Coolant Additives Chart.
Differential assembly leaking oil.	Bolts loose on main housing.	Tighten bolts to the correct torque.
Differential assembly noisy.	Oil level too low.	Refill the differential. Refer to Chapter 1, Specifications - Recommended Lubricants and Coolant Additives Chart .
Differential assembly overheating.	Oil level too high. Oil level too low. Axle breather blocked.	Drain the oil to the correct level. Refill the differential. Refer to Chapter 1, Specifications - Recommended Lubricants and Coolant Additives Chart . Clean the axle breather.

Wheels		
Symptom	Possible Cause	Remedy
Wheel misalignment.	Wheel bent or damaged.	Change the wheel.
Wheel cracked.	Impact damage.	Change the wheel.

Tyres		
Symptom	Possible Cause	Remedy
Tyres wearing in tread centre	Tyres over inflated	Reduce the tyre pressure to the correct level
Tyres wearing on both sides of the tread	Tyres under inflated	Increase the tyre pressure to the correct level
Tyres loosing pressure	Tyre punctured	Repair the puncture or change the tyre

Tyres		
Symptom	Possible Cause	Remedy
Cracks, splits or bulges in the tyre sidewall	Impact damage.	Change the tyre.
	Defective tyre.	Change the tyre.
	Tyre over inflated.	Change the tyre.
	Tyre under inflated.	Change the tyre.
Rapid tyre wear	Excessive speed.	Instruct the operator on proper driving. Change the tyre.
	Poor road surface conditions	Recommend road surface maintenance. Change the tyre.
Tyre component heat separation	Excessive speed	Instruct the operator on proper driving. Change the tyre
Cracks in the tyre tread grooves	Incorrect tyre pressure	Change the tyre if separation occurs.

Brakes		
Symptom	Possible Cause	Remedy
Increased stopping distances.	Worn brake pads.	Change the brake pads.
	Oil or grease on the brake pads.	Change the brake pads.
Squealing noise from the brakes when applied.	Brake pads glazed.	Change the brake pads.
	Brake discs warped or scored.	Inspect the brake discs for damage.
Brakes do not fully release.	Brake calliper pistons sticking.	Change the brake calliper.

Hydraulics		
Symptom	Possible Cause	Remedy
Pump not delivering hydraulic fluid.	Hydraulic fluid in hydraulic tank is too low.	Refill the hydraulic tank. Refer to Chapter 1, Specifications - Recommended Lubricants and Coolant Additives Chart .
	Outlet pipe from the tank to the pump is blocked.	Check the suction strainer for blockages. Clean if necessary.
	Hydraulic fluid viscosity and type is incorrect.	Drain and refill the hydraulic system. Refer to Chapter 1, Specifications - Recommended Lubricants and Coolant Additives Chart .
Pump making noise.	Pump intake is partially blocked.	Clean the hydraulic tank strainer. Check the hydraulic fluid condition, if necessary drain and flush the system and refill. Refer to Chapter 1, Specifications - Recommended Lubricants and Coolant Additives Chart .
	Breather is blocked.	Replace the breather filter.

Electrics		
Symptom	Possible Cause	Remedy
Gauge not working properly.	Circuit breaker tripped.	Reset circuit breaker.
	Loose or broken connections.	Tighten or repair the connections.
	Gauge defective.	Change the gauge.
Switch not working properly.	Circuit breaker tripped.	Reset circuit breaker.
	Loose or broken connections	Tighten or repair the connections.
	Switch defective	Change the switch.
Warning indicator not working.	Warning indicator bulb defective.	Change the bulb.
	Circuit breaker tripped	Reset circuit breaker.
	Loose or broken connections	Tighten or repair the connections
Alternator charge warning indicator not illuminated when master switch is in the ON position.	Warning indicator bulb defective.	Change the bulb.

Electrics		
Symptom	Possible Cause	Remedy
Alternator charge warning indicator illuminated when engine is on.	Alternator drive belt is loose or broken. Poor battery connections.	Adjust drive belt tension or fit new drive belt. Clean and check the battery connections.
Batteries do not hold a charge.	Battery cells dry. Short running time with lights on.	Check the battery electrolyte and top up. Remove the batteries and charge or fit new batteries.
Starter motor does not turn or turns very slowly.	Batteries are flat. Batteries defective or damaged. Battery terminals loose or damaged. Start button defective or damaged.	Charge the batteries. Change the batteries. Tighten or clean the battery terminals. Change the start button.
Starter motor does not disengage after the engine has started.	Start button defective or damaged.	Change the start button.
Headlights do not work	Circuit breaker tripped. Headlight bulb defective. Light switch defective. Loose or broken connections.	Reset circuit breaker. Change the bulb. Change the switch. Tighten or repair the connections.
Only high beam or low beam comes on.	Headlight bulb defective. Loose or broken connection.	Change the bulb. Tighten or repair the connections.
One headlight does not come on (high or low beam).	Headlight bulb defective. Loose or broken connection.	Change the bulb. Tighten or repair the connections.
High beam indicator light does not illuminate when high beam is selected.	Indicator bulb defective. Loose or broken connection	Change the bulb Tighten or repair the connections
Tail lights do not come on.	Tail light bulb defective. Light switch defective. Loose or broken connection.	Change the bulb. Change the light switch. Tighten or repair the connections.

Electrics		
Symptom	Possible Cause	Remedy
Stop lights do not come on.	Stop light bulb defective.	Change the bulb
	Loose or broken connection.	Tighten or repair the connections.
Turn indicator and horn does not work.	Circuit breaker tripped.	Reset the circuit breaker.
Right turn indicator does not work.	Bulb defective.	Change the bulb.
	Loose or broken connection.	Tighten or repair the connections.
Left turn indicator does not work.	Bulb defective	Change the bulb
	Loose or broken connection	Tighten or repair the connections
Windscreen wiper does not work.	Circuit breaker tripped.	Reset the circuit breaker.
	Wiper switch defective.	Change the switch.
	Loose or broken connections.	Tighten or repair the connections.

Rear Frame and Cab Trouble Shooting		
Symptom	Possible Cause	Remedy
Excessive cab movement while machine is operating.	Loose or missing mounting bolt(s) or rubbers.	Tighten or replace the mounting bolts and/or rubbers.
A smear remains on the windscreen when the windscreen wiper is in operation.	Wiper blade damaged.	Replace the wiper blade.
	Oil or grease on the windscreen.	Clean the windscreen.
Seat is difficult to adjust.	Obstruction in the seat runner.	Remove the obstruction.
	Lack of lubricant.	Lubricate the seat runners.
Excessive movement of the wing mirrors while machine is operating.	Loose or missing retaining bolts.	Tighten or replace the retaining bolts.
Wing mirror difficult to view.	Damaged wing mirror arm.	Replace wing mirror arm.
	Incorrect adjustment.	Adjust as necessary.
	Wing mirror damaged.	Replace the wing mirror.

Transmission Diagnostic Codes

NOTE:The Electronic Trouble Shooting Manual contains a full trouble shooting guide, Refer to BELL EQUIPMENT Product Support.

Diagnostic Code Response

The following ECU (Electronic Control Unit) responses to a fault provide for safe transmission operation:

DNS (Do Not Shift) Response

- Release lockup clutch and inhibit lockup operation.
- Inhibit all shifts.
- Turn on the DNS warning indicator (Check Trans Light).
- Display the range permitted.
- Ignore any gear selection inputs from the push-button shift selector.

DNA (Do Not Adapt) Response

- The ECU stops adaptive shift control while the code is active.

SOL OFF (Solenoid Off) Response

- All solenoids are commanded off (turning solenoids "A" and "B" off electrically causes them to be on hydraulically).

RPR (Return to Previous Range) Response

- When the speed sensor ratio or C3 pressure switch tests associated with a shift are not successful, the ECU commands the same gear as commanded before the shift.

NNC (Neutral No Clutches) Response

- When certain speed sensor ratio or C3 pressure switch tests are not successful, the ECU commands a neutral condition with no clutches applied.

Diagnostic Code List And Description

Main Code	Sub-Code	Description	DNS Warning Indicator	Inhibited Operation Description	Recommended Procedures
13	12	ECU input voltage: low	Yes	DNS, DNA, SOL OFF (hydraulic default)	Check: Battery direct ground and power connections are tight and clean. Vehicle batteries are charged. Vehicle charging system is not over or under charging. VIM connections are tight, clean and undamaged. Wiring is correctly installed. ECU connectors are tight, clean and undamaged.
	13	ECU input voltage: medium low	No	DNA	
	23	ECU input voltage: high	Yes	DNS, SOL OFF (hydraulic default)	
14	12	Oil level sensor: failed low	No	None	Check: Engine speed sensor, output speed sensor, temperature sensor and oil level sensor are working correctly. Wiring harness for open circuits and short circuits to ground or to battery.
	23	Oil level sensor: failed high			
21	12	Throttle position sensor: failed low	No	Use throttle default values: DNA	Check: TPS connector is properly connected. End of TPS cable is pulled out properly. Engine fuel lever is in idle position and provides correct amount of stroke on TPS cable. Wiring harness to TPS for open circuits and short circuits to ground or between wires.
	23	Throttle position sensor: failed high			

Main Code	Sub-Code	Description	DNS Warning Indicator	Inhibited Operation Description	Recommended Procedures
22	14	Engine speed sensor reasonableness test	No	Use default engine speed: DNA	Check: Speed sensor connectors are tight, clean and undamaged. Speed sensor mounting bolts are correctly torqued to 24-29 Nm (18-21 lb. ft.). Wiring harness to sensors for open circuits and short circuits to ground or between wires.
	15	Turbine speed sensor reasonableness test	Yes	DNS, locked in current range: DNA	
	16	Output speed sensor reasonableness test	Yes ¹		
23	12	Primary shift selector or RSI link fault	Yes	Hold in last valid direction. May cause "cateye" display	Check: ECU connectors are tight, clean and undamaged. Remote shift selector is tight and jumper wire is cut. Wiring harness on remote for open circuits to ground or between wires. Shift selector display line for faults.
	14	Secondary shift selector or RSI link fault	Yes	Hold in last valid direction.	
	16	Shift selector display line fault	No	None. May cause "cateye" display.	

Main Code	Sub-Code	Description	DNS Warning Indicator	Inhibited Operation Description	Recommended Procedures
24	12	Sump fluid temperature: cold	Yes	DNS: lock in neutral	Check: Air temperature is below-32°C (-25°F) If Yes: This is a correct response for temperature. If No: Check that main transmission connector is tight, clean and undamaged. ECU connectors are tight, clean and undamaged.
	23	Sump fluid temperature: hot	No	No upshifts above a calibration range.	Park machine on level ground, allow engine to idle with park/emergency brake applied and wheels chocked. Check: Correct dipstick is installed. If Incorrect: Correct fluid level. If Correct: Check for engine system overheating, causing transmission to overheat. ECU and transmission connectors are tight, clean and undamaged.

Main Code	Sub-Code	Description	DNS Warning Indicator	Inhibited Operation Description	Recommended Procedures
25	00	Output speed sensor: detected at 0 output rpm: Low	Yes ¹	DNS, lock in current range (Low): DNA.	Check: Speed sensor connector is tight, clean and undamaged. ECU connector are tight, clean and undamaged. Fluid level is correct. Sensor mounting bolts are correctly torqued to 24-29 Nm (18-21 lb.ft.). Wiring harness to sensor for open circuits and short circuits to ground or between wires.
	11	Output speed sensor: detected at 0 output rpm: 1st	Yes ¹	DNS, lock in current range (1st): DNA.	
	22	Output speed sensor: detected at 0 output rpm: 2nd	Yes ¹	DNS, lock in current range (2nd): DNA.	
	33	Output speed sensor: detected at 0 output rpm: 3rd.	Yes ¹	DNS, lock in current range (3rd): DNA.	
	44	Output speed sensor: detected at 0 output rpm: 4th	Yes ¹	DNS, lock in current range (4th): DNA.	
	55	Output speed sensor: detected at 0 output rpm: 5th	Yes ¹	DNS, lock in current range (5th): DNA.	
	66	Output speed sensor: detected at 0 output rpm: 6th	Yes ¹	DNS, lock in current range (Low): DNA.	
	77	Output speed sensor: detected at 0 output rpm: Reverse Range	Yes ¹	DNS, lock in current range (Low): DNA.	
26	00	Throttle source not detected	No	Use throttle default values: DNA	Check: Throttle source not detected. Engine coolant source not detected. Park machine on level ground, allow engine to idle with park/emergency brake applied and wheels chocked. Check: Correct dipstick is installed. Fluid level is correct.
	11	Engine coolant source not detected	No	Use default value of OF	

Main Code	Sub-Code	Description	DNS Warning Indicator	Inhibited Operation Description	Recommended Procedures
32	00	C3 pressure switch open: low range	Yes	DNS: lock in current range (low), DNA	Check: Main transmission connector and ECU connectors are tight, clean and undamaged. Wiring harness for open circuits and short circuits to ground or between wires.
	33	C3 pressure switch open: 3rd range	Yes	DNS: lock in current range (3rd), DNA	
	55	C3 pressure switch open: 5th range	Yes	DNS: lock in current range (5th), DNA	
	77	C3 pressure switch open: reverse range	Yes	DNS: lock in current range (R), DNA	
33	12	Sump oil temperature sensor: failed low	No	Use default value of 93°C (200°F)	Check: Main transmission connector and ECU connectors are tight, clean and undamaged. Wiring harness for open circuits and short circuits to ground or between wires.
	23	Sump oil temperature sensor: failed high			
34	12	Factory calibration compatibility number wrong.	Yes	DNS, SOL OFF (hydraulic default), DNA	Re-calibrate or replace ECU Customer modifiable constants checksum.
	13	Factory calibration block checksum.			
	14	Power off block checksum	No	Use previous location, or factory calibration and reset adaptive, DNA	
	15	Diagnostic queue block checksum.	No	Use previous location, or clear diagnostic queue, DNA.	
	16	Real time block checksum.	Yes	DNS, SOL OFF (hydraulic default), DNA	
	17	Customer modifiable constants checksum.	Yes		

Main Code	Sub-Code	Description	DNS Warning Indicator	Inhibited Operation Description	Recommended Procedures
35	00	Power interruption (code set after power restored)	No	None (hydraulic default during interruption)	Check: ECU and VIM connectors are tight, clean and undamaged. Wiring has correct power and ground connections. Power connections are battery direct. Ground connections are battery direct. Ignition switch connections are correct.
	16	Real time write interruption	Yes	DNS, SOL OFF (hydraulic default), DNA	
36	00	Hardware/software not compatible	Yes ²	DNS, SOL OFF (hydraulic default), DNA	Re-program or replace ECU
42	12	Short-to-battery, A solenoid circuit	Yes	DNS, SOL OFF, DNA	Check: Main transmission connector and ECU connectors are tight, clean and undamaged. Wiring harness is not pulled too tight and there is no damage, chafing or screws through harness. Wiring harness for open circuits and short circuits to ground or between wires. Unauthorised repairs have not been made. Change harness.
	13	Short-to-battery, B solenoid circuit			
	14	Short-to-battery, C solenoid circuit			
	15	Short-to-battery, D solenoid circuit			
	16	Short-to-battery, E solenoid circuit			
	21	Short-to-battery, F solenoid circuit	No	Lockup inhibited, DNA	
	22	Short-to-battery, G solenoid circuit	Yes	DNS, SOL OFF, DNA	
	23	Short-to-battery, H solenoid circuit	No	Differential lock inhibited (30 70 only) retarder operation inhibited.	
	24	Short-to-battery, J solenoid circuit	No	Low and 1st inhibited	
	26	Short-to-battery, N solenoid circuit	No	Low and 1st inhibited, retarder allowed	

Main Code	Sub-Code	Description	DNS Warning Indicator	Inhibited Operation Description	Recommended Procedures
44	12	Short-to-ground, A solenoid circuit	Yes	DNS, SOL OFF (hydraulic default), DNA	Check: ECU connectors and transmission connectors are tight, clean and undamaged. Wiring harness for open circuits and short circuits to ground or between wires.
	13	Short-to-ground, B solenoid circuit			
	14	Short-to-ground, C solenoid circuit			
	15	Short-to-ground, D solenoid circuit			
	16	Short-to-ground, E solenoid circuit			
	21	Short-to-ground, F solenoid circuit	No	Lockup inhibited, DNA	
	22	Short-to-ground, G solenoid circuit	Yes	DNS, SOL OFF (hydraulic default), DNA	
	23	Short-to-ground, H solenoid circuit	No	Differential lock inhibited (30 70 only) retarder operation inhibited.	
	24	Short-to-ground, J solenoid circuit	No	Low and 1st inhibited	
	26	Short-to-ground, N solenoid circuit	No	Low and 1st inhibited, retarder allowed	

Main Code	Sub-Code	Description	DNS Warning Indicator	Inhibited Operation Description	Recommended Procedures
45	12	Open circuit, A solenoid circuit	Yes	DNS, SOL OFF (hydraulic default), DNA	Check: ECU connectors and transmission connectors are tight, clean and undamaged.
	13	Open circuit, B solenoid circuit			
	14	Open circuit, C solenoid circuit			
	15	Open circuit, D solenoid circuit			
	16	Open circuit, E solenoid circuit			
	21	Open circuit, F solenoid circuit	No	Lockup inhibited, DNA	
	22	Open circuit, G solenoid circuit	Yes	DNS, SOL OFF (hydraulic default), DNA	
	23	Open circuit, H solenoid circuit	No	Differential lock inhibited (30 70 only) retarder operation inhibited.	
	24	Open circuit, J solenoid circuit	No	Low and 1st inhibited	
	26	Open circuit, N solenoid circuit	No	Low and 1st inhibited, retarder allowed	
46	21	Over-current, F solenoid circuit	No	Lockup inhibited, DNA	Overcurrent (F Solenoid). Overcurrent (N and H Solenoid) Overcurrent (A, B, C, D, E and G Solenoids)
	26	Over-current, N and H solenoid circuit	No	Low and 1st inhibited or retarder inhibited, DNA	
	27	Over-current, A-Hi solenoid circuit	No	DNS, SOL OFF (hydraulic default), DNA	

Main Code	Sub-Code	Description	DNS Warning Indicator	Inhibited Operation Description	Recommended Procedures
51	01	Off-going ratio test (during shift), low to 1	Yes	DNS, RPR, DNA	Check: Output and turbine speed sensor connectors are tight, clean and undamaged. Speed sensor wiring harness for open circuits and short circuits to ground or between wires. Park machine on level ground, allow engine to idle with park/emergency brake applied and wheels chocked. Check: correct dipstick is installed. Fluid level is correct.
	10	Off-going ratio test (during shift), 1 to low			
	12	Off-going ratio test (during shift), 1 to 2			
	21	Off-going ratio test (during shift), 2 to 1			
	23	Off-going ratio test (during shift), 2 to 3			
	24	Off-going ratio test (during shift), 2 to 4			
	35	Off-going ratio test (during shift), 3 to 5			
	42	Off-going ratio test (during shift), 4 to 2			
	43	Off-going ratio test (during shift), 4 to 3	Yes ¹		
	45	Off-going ratio test (during shift), 4 to 5			
	46	Off-going ratio test (during shift), 4 to 6	Yes		
	53	Off-going ratio test (during shift), 5 to 3			
	64	Off-going ratio test (during shift), 6 to 4			
	65	Off-going ratio test (during shift), 6 to 5			
	XY	Off-going ratio test (during shift), X to Y ³			

Main Code	Sub-Code	Description	DNS Warning Indicator	Inhibited Operation Description	Recommended Procedures
52	01	Off-going C3PS test (during shift), low to 1	Yes	DNS, RPR, DNA	Check: Output and turbine speed sensor connectors are tight, clean and undamaged. Speed sensor wiring harness for open circuits and short circuits to ground or between wires. Park machine on level ground, allow engine to idle with park/emergency brake applied and wheels chocked. Check: correct dipstick is installed. Fluid level is correct.
	08	Off-going C3PS test (during shift), low to N1		DNS, NNC, DNA	
	32	Off-going C3PS test (during shift), 3 to 2		DNS, RPR, DNA	
	34	Off-going C3PS test (during shift), 3 to 4			
	54	Off-going C3PS test (during shift), 5 to 4			
	56	Off-going C3PS test (during shift), 5 to 6			
	71	Off-going C3PS test (during shift), R to 1		DNS, NNC, DNA	
	72	Off-going C3PS test (during shift), R to 2			
	78	Off-going C3PS test (during shift), R to N1			
	99	Off-going C3PS test (during shift), N3 to N2		DNS, RPR, DNA	
XY	Off-going C3PS test (during shift), X to Y ³	-----			

Main Code	Sub-Code	Description	DNS Warning Indicator	Inhibited Operation Description	Recommended Procedures
53	08	Off-going speed test (during shift), L to N1	Yes ¹	DNS, NNC, DNA	Check: Output and turbine speed sensor connectors are tight, clean and undamaged. Speed sensor wiring harness for open circuits and short circuits to ground or between wires. Park machine on level ground, allow engine to idle with park/emergency brake applied and wheels chocked. Check: correct dipstick is installed. Fluid level is correct. EEPROM calibration is correct for the transmission
	18	Off-going speed test (during shift), 1 to N1			
	28	Off-going speed test (during shift), 2 to N1			
	29	Off-going speed test (during shift), 2 to N2	Yes ¹	DNS, RPR, DNA	
	38	Off-going speed test (during shift), 3 to N1	Yes ¹	DNS, NNC, DNA	
	39	Off-going speed test (during shift), 3 to N3	Yes ¹	DNS, RPR, DNA	
	48	Off-going speed test (during shift), 4 to N1	Yes ¹	DNS, NNC, DNA	
	49	Off-going speed test (during shift), 4 to N3	Yes ¹	DNS, RPR, DNA	
	58	Off-going speed test (during shift), 5 to N1	Yes ¹	DNS, NNC, DNA	
	59	Off-going speed test (during shift), 5 to N3	Yes ¹	DNS, RPR, DNA	
	68	Off-going speed test (during shift), 6 to N1	Yes ¹	DNS, NNC, DNA	
	69	Off-going speed test (during shift), 6 to N4	Yes ¹	DNS, RPR, DNA	
	78	Off-going speed test (during shift), R to N1	Yes	DNS, NNC, DNA	
	99	Off-going speed test (during shift), N2 to N3 or N3 to N2	Yes	DNS, RPR, DNA	
	XY	Off-going speed test (during shift), X to Y ³	Yes	-----	

Main Code	Sub-Code	Description	DNS Warning Indicator	Inhibited Operation Description	Recommended Procedures
54	01	Oncoming ratio test (after shift), L to 1	Yes	DNS, RPR, DNA	Check: Output and turbine speed sensor connectors are tight, clean and undamaged. Speed sensor wiring harness for open circuits and short circuits to ground or between wires. Park machine on level ground, allow engine to idle with park/emergency brake applied and wheels chocked. Check: correct dipstick is installed. Fluid level is correct. EEPROM calibration is correct for the transmission
	07	Oncoming ratio test (after shift), L to R		DNS, NNC, DNA	
	10	Oncoming ratio test (after shift), 1 to L		DNS, RPR, DNA	
	12	Oncoming ratio test (after shift), 1 to 2			
	17	Oncoming ratio test (after shift), 1 to R		DNS, NNC, DNA	
	21	Oncoming ratio test (after shift), 2 to 1		DNS, RPR, DNA	
	23	Oncoming ratio test (after shift), 2 to 3			
	24	Oncoming ratio test (during shift), 2 to 4			
	27	Oncoming ratio test (after shift), 2 to R			
	32	Oncoming ratio test (after shift), 3 to 2			
	34	Oncoming ratio test (after shift), 3 to 4			
	35	Oncoming ratio test (after shift), 3 to 5			
	42	Oncoming ratio test (after shift), 4 to 2			
	43	Oncoming ratio test (after shift), 4 to 3			
	45	Oncoming ratio test (after shift), 4 to 5		DNS, RPR, or SOL OFF (hydraulic default) DNA	
	46	Oncoming ratio test (during shift), 4 to 6		DNS, RPR, DNA	
	53	Oncoming ratio test (during shift), 5 to 3			
	54	Oncoming ratio test (after shift), 5 to 4			
	56	Oncoming ratio test (after shift), 5 to 6			

Main Code	Sub-Code	Description	DNS Warning Indicator	Inhibited Operation Description	Recommended Procedures
54 (cont.)	64	Oncoming ratio test (after shift), 6 to 4	Yes	DNS, RPR, DNA	Check (cont.)
	65	Oncoming ratio test (after shift), 6 to 5			
	70	Oncoming ratio test (after shift), R to L		DNS, NNC, DNA	
	71	Oncoming ratio test (after shift), R to 1			
	72	Oncoming ratio test (after shift), R to 2			
	80	Oncoming ratio test (after shift), N1 to L		DNS, RPR, DNA	
	81	Oncoming ratio test (after shift), N1 to 1			
	82	Oncoming ratio test (after shift), N1 to 2			
	83	Oncoming ratio test (after shift), N1 to 3			
	85	Oncoming ratio test (after shift), N1 to 5			
	86	Oncoming ratio test (after shift), N1 to 6			
	92	Oncoming ratio test (after shift), N2 to 2			
	93	Oncoming ratio test (after shift), N3 to 3			
	95	Oncoming ratio test (after shift), N3 to 5			
	96	Oncoming ratio test (after shift), N4 to 6			
	XY	Oncoming ratio test (after shift), X to Y ³			

Main Code	Sub-Code	Description	DNS Warning Indicator	Inhibited Operation Description	Recommended Procedures
55	07	Oncoming C3PS test (after shift), N4 to 6	Yes ¹	DNS, NNC, DNA	Park machine on level ground, allow engine to idle with park/emergency brake applied and wheels chocked. Check: Correct dipstick is installed. Fluid level is correct. Check also: Output and turbine speed sensor connectors are tight, clean and undamaged. Speed sensor wiring harness for open circuits and short circuits to ground or between wires. ECU connectors and transmission connectors are tight, clean and undamaged. C3 pressure switch wiring for open circuits and short circuits to ground or between wires.
	17	Oncoming C3PS test (after shift), 1 to R			
	27	Oncoming C3PS test (after shift), 2 to R			
	87	Oncoming C3PS test (after shift), N1 to R	Yes		
	97	Oncoming C3PS test (after shift), NVL to R	Yes ¹		
	XY	Oncoming C3PS test (after shift), X to Y ³	-----	-----	
56	00	Range verification test, L	Yes ¹	DNS, 1st, Low, or SOL OFF (Low), DNA	Output and turbine speed sensor connectors are tight, clean and undamaged. Speed sensor wiring harness for open circuits and short circuits to ground or between wires. ECU connectors and transmission connectors are tight, clean and undamaged. Park machine on level ground, allow engine to idle with park/emergency brake applied and wheels chocked. Check: Correct dipstick is installed. Fluid level is correct.
	11	Range verification ratio test, 1st	Yes	DNS, 6th, DNA	
	22	Range verification ratio test, 2nd	Yes ¹	DNS, 6th or 5th, DNA	
	33	Range verification ratio test, 3rd	Yes ¹	DNS, 5th or SOL OFF (4th), DNA	
	44	Range verification ratio test, 4th	Yes	DNS, 6th, DNA	
	55	Range verification ratio test, 5th	Yes ¹	DNS, 3rd or 5th, DNA	
	66	Range verification ratio test, 6th	Yes	DNS, 5th, 3rd or SOL OFF (3rd), DNA	
	77	Range verification ratio test, R	Yes	DNS, N2 or N3, DNA	

Main Code	Sub-Code	Description	DNS Warning Indicator	Inhibited Operation Description	Recommended Procedures
57	11	Range verification C3PS test, 1st	Yes	DNS, SOL OFF (3rd), DNA	Park machine on level ground, allow engine to idle with park/emergency brake applied and wheels chocked. Check: Correct dipstick is installed. Fluid level is correct Check also: Output and turbine speed sensor connectors are tight, clean and undamaged. Speed sensor wiring harness for open circuits and short circuits to ground or between wires. ECU connectors and transmission connectors are tight, clean and undamaged. C3 pressure switch wiring for open circuits and short circuits to ground or between wires.
	22	Range verification C3PS test, 2nd		DNS, 3rd, DNA	
	44	Range verification C3PS test, 4th		DNS, 5th or SOL OFF (3rd), DNA	
	66	Range verification C3PS test, 6th		DNS, SOL OFF (5th), DNA	
	88	Range verification C3PS test, N1		DNS, N3, DNA	
	99	Range verification C3PS test, N2 or N4			
61	00	Retarder oil temperature, hot	No	None	Check: Fluid level is correct Retarder apply system is not allowing retarder and throttle to be applied at the same time. Fluid cooler is adequately sized for load.
62	12	Retarder temperature sensor failed, low	No	None	Check: Retarder temperature measured with Ddr is inconsistent with code, or determine if code is active using shift selector. Ambient temperature is above 178°C (352°F) or below -45°C (-49°F)
	23	Retarder temperature sensor failed, high			
	32	Engine coolant sensor failed, low		Use default value of 0°F	
	33	Engine coolant sensor failed, high			

Main Code	Sub-Code	Description	DNS Warning Indicator	Inhibited Operation Description	Recommended Procedures
63	00	Input function fault	Yes	Depends on input function, DNA	Check: Input wiring, switches and connectors to determine why input states are sent.
	26	Kick-down input failed on	No	Kick-down operation inhibited	
	40	Service brake status input failed on	No	No auto Neutral to Drive shifts for refuse packer. (I/O package #41). No retarder if a TPS code is also active.	
64	12	Retarder modulation request sensor failed, low	No	Retarder operation inhibited	Use DDR to read retarder counts and identify problem wires. Check wiring for short to battery, ground wire open or short to ground.
	23	Retarder modulation request sensor failed, high			
66	00	Serial communications interface fault	No	Use default throttle values, DNA	Check: Serial connection to engine computer is tight, clean and undamaged. SCI wiring harness for open and short circuits and short circuits to ground. If DDR is not available, also ensure that transmission ECU connections are clean and undamaged. SCI engine coolant source fault.
	11	SCI engine coolant source fault		Use default value of 0°F	

Main Code	Sub-Code	Description	DNS Warning Indicator	Inhibited Operation Description	Recommended Procedures
69	27	ECU, inoperative A-Hi switch	Yes	DNS, NNC, DNA	Clear diagnostic code and retry machine start. If code recurs, re-program ECU. Replace ECU. SPI (Serial Peripheral Interface). Output or input failure.
	28	ECU, inoperative F-Hi switch	Yes	Lockup inhibited, DNA	
	29	ECU, inoperative N and H-Hi switch	No	Low and 1st inhibited, retarder inhibited, DNA	
	33	ECU, COP (Computer Operating Properly) time-out	No	Reset ECU, shutdown ECU on 2nd occurrence (power loss; hydraulic defaults). May cause "cateye" display, DNA ^a	
	34	ECU, write time-out	Yes	DNS, SOL OFF (hydraulic default), DNA	
	35	ECU, checksum test	No	Induce COP time-out (reset ECU), DNA ^a	
	36	ECU, RAM self test		Induce COP time-out (reset ECU), DNA ^a	
	39	Communication chip addressing error		Use defaults for J1939 data, DNA	
	41	ECU, I/O ASIC addressing test	No	Induce COP time-out (reset ECU), DNA ^a	
	42	SPI output failure	Yes	GPO 1-8 and reverse warning inoperable	
	43	SPI input failure		DNS, lock in range, DNA	

NOTES

- ¹ This code is logged to real time to protect the transmission in case a loss of power to the ECU (Power Interruption, code 3500) occurs.
- ² The ECU hardware or software must be changed so that they are compatible.
- ³ Additional codes could be logged for other shifts where X indicates range shifted from and Y indicates range shifted to.
- ^a the COP reset will clear the active inhibit.

If the points in the recommended Procedure check out, Refer to **BELL EQUIPMENT** Product Support.

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