



Section B

Body and Framework

Service Manual - 527-58

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Notes:

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Fork Carriage

Introduction

This topic contains information about a machine DEVICE. Make sure you are referring to the correct device. Refer to the applications table.

Descriptions and procedures relate to the device and not related systems. For information about the systems refer to the relevant topics.

⇒ [Related Topics \(B1-2\)](#)

⇒ [Removal and Replacement \(B1-3\)](#)



Related Topics

Table 1. Related Topics in This Publication

The table lists other topics in the manual that contain information related to this topic. Refer to the applicable topics to complete your procedures. Where applicable the text in this section contains cross references to this page to help you find the correct information. Some machines have different systems and devices. Make sure you refer to the correct topic, refer to Section 1 - Applications .		
Sections	Topic Titles	Sub Titles
1	Applications	ALL
2	ALL (Care and Safety) ⁽¹⁾	ALL

(1) You must obey all of the relevant care and safety procedures.

Removal and Replacement

WARNING

Lifting Equipment

You can be injured if you use faulty lifting equipment. Make sure that lifting equipment is in good condition. Make sure that lifting tackle complies with all local regulations and is suitable for the job. Make sure that lifting equipment is strong enough for the job.

INT-1-3-7

WARNING

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before connecting or removing any hydraulic hose, residual hydraulic pressure trapped in the service hose line must be vented. Make sure the hose service line has been vented before connecting or removing hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11_2

WARNING

Raised Machine

NEVER position yourself or any part of your body under a raised machine which is not properly supported. If the machine moves unexpectedly you could become trapped and suffer serious injury or be killed.

INT-3-3-7_1

Removal

- 1 Position the boom so that the fork carriage **A** can be safely supported when it is disconnected from the boom assembly.
- 2 Park the machine and make it safe. Vent the hydraulic pressure. Obey the care and safety procedures.
[⇒ Related Topics \(B1-2\)](#)
- 3 Support the fork carriage **A**.

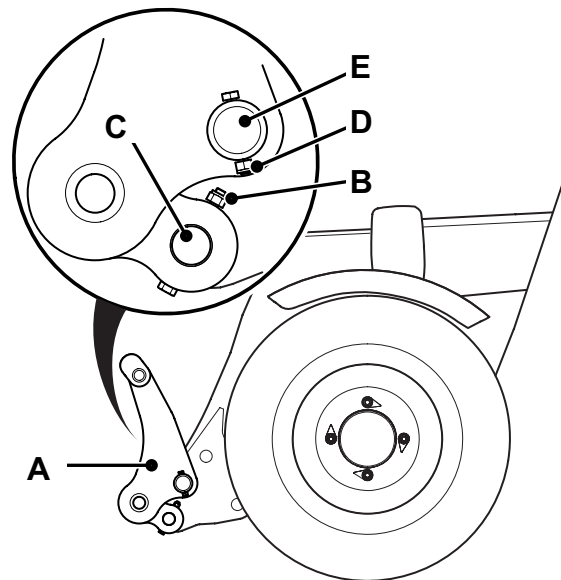


Fig 1.

C093890-C1

- 4 Remove the nut and bolt **B**.
- 5 Using a slide hammer remove the tipping lever pivot pin **C**.
- 6 Remove the nut and bolt **D**.
- 7 Using a slide hammer remove the pivot pin **E**.
- 8 Remove the fork carriage **A**.

Replacement

Replacement is the opposite of the removal procedure.



Section B1 - Body and Framework Fork Carriage

Removal and Replacement

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Cab Heating and Ventilation SYSTEM

Introduction

This topic contains information about a machine SYSTEM. The system has some devices that connect either mechanically, hydraulically or electrically. Make sure you are referring to the correct system. Refer to the applications table. [⇒ *Related Topics* \(!\[\]\(71ceb62b681518c82e95d615e7265d66_img.jpg\) B2-2\)](#).

Descriptions and procedures relate to the system and not the individual devices. For information about the devices refer to the relevant topics. [⇒ *Related Topics* \(!\[\]\(e10773081adcaeab632f9dd4c8931cd5_img.jpg\) B2-2\)](#)

This topic is intended to help you understand what the system does and how it works. Where applicable it also includes procedures such as removal and replacement and dismantle and assemble.

[⇒ *Related Topics* \(!\[\]\(a69696d69cfd88b51cbd02e5288eca32_img.jpg\) B2-2\)](#)

[⇒ *Operation Overview* \(!\[\]\(fc3a57079704ef1b99671c8cafae23be_img.jpg\) B2-3\)](#)

[⇒ *Electrical Operation and Schematics* \(!\[\]\(0ac73c45806a78de248a19d9a2dbe7a6_img.jpg\) B2-4\)](#)

[⇒ *Fault Finding* \(!\[\]\(147b0c7dce349edf02b6b21226344f99_img.jpg\) B2-5\)](#)

Related Topics

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Sections	Topic Titles	Sub Titles
1	Applications	ALL
2	ALL (Care and Safety) ⁽¹⁾	ALL
B	⇒ Cab HV and HVAC Unit (□ B8-1)	ALL
B	⇒ Heater Valve (□ B9-1)	ALL
B	⇒ Cab Air Conditioning SYSTEM (□ B3-1)⁽²⁾	ALL
C	Fuses and Relays	ALL
C	Electrical Harness SYSTEM	ALL

(1) You must obey all of the relevant care and safety procedures.

(2) Machines with air conditioning only

Operation Overview

Fresh air is supplied through the cab air vents **D**. The heater and ventilation unit **A** (HV) uses a blower fan to increase the air speed. The air can also be heated by the heat exchange matrix housed within the HV unit.

On machines with air conditioning the unit also houses the air conditioning evaporator matrix to become a combined heating, ventilation and air conditioning unit (HVAC).
[⇒ Related Topics \(B2-2\)](#)

The machine operator can control the air temperature and speed from within the cab on the heater control panel **E**.

The machine operator must first use the fan On/Off switch **H** to activate the fan.

The operator uses the fan speed switch **G** to select the fan speed - high, medium or low. The temperature control knob **F** is connected to a cable which operates the heater valve **B**.

The heater valve regulates the flow of hot engine coolant through the HV unit. The hot engine coolant flows through the heat exchange matrix and the fan blows air over the fins of the matrix, warming the air.

Item	⇒ Fig 1. (B2-3)
A	Heater and ventilation unit (HV)
B	Heater valve
C	Electrical connector
D	Cab heater vents
E	Heater Control panel
F	Temperature control knob
G	Fan Speed Switch
H	Fan On/Off Switch

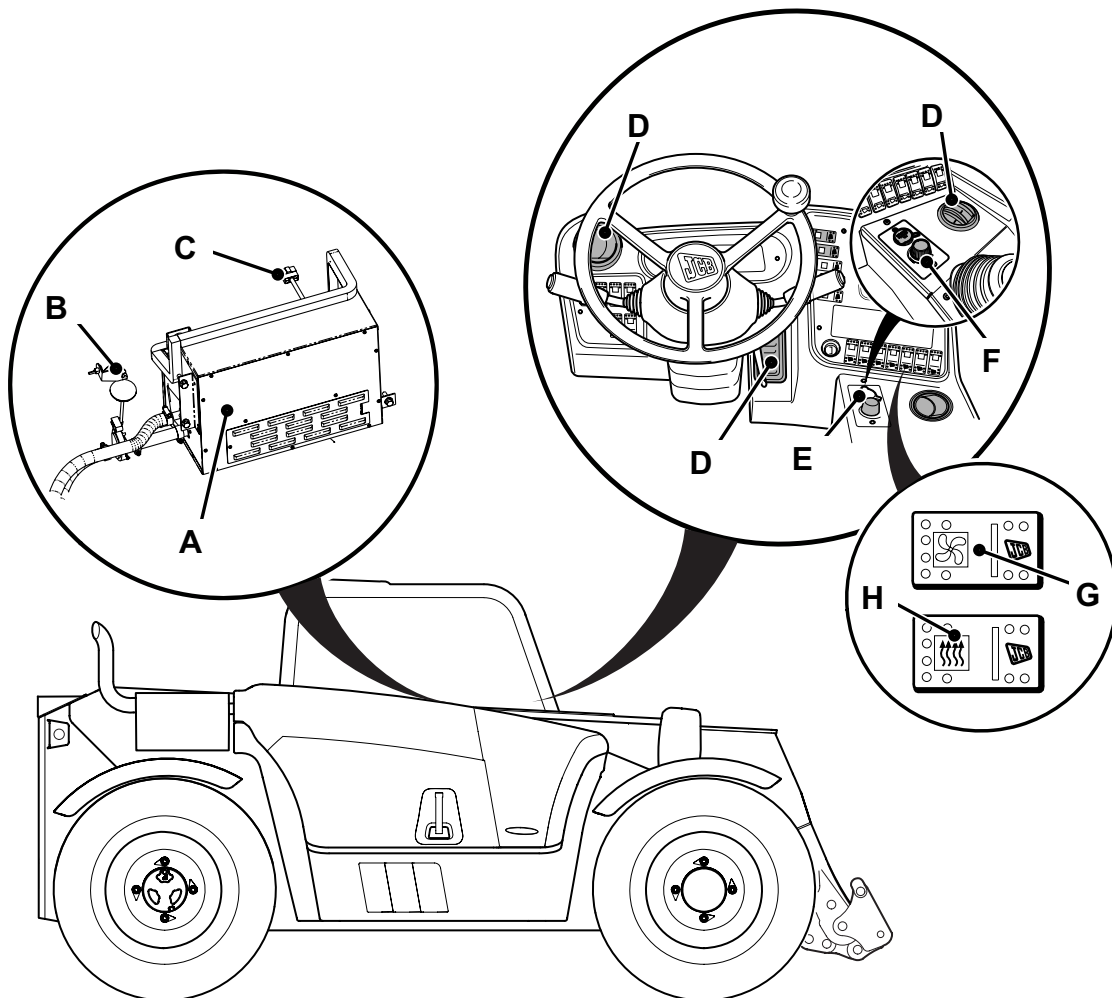


Fig 1.

C093970

Electrical Operation and Schematics

The harness connector pin numbers are shown on the schematic

⇒ Fig 2. (B2-4).

Key	
P33	Heater Connector
P36	Earth Point

Key	
P49	Heater Fan Speed Switch
P60	Heater Fan On/Off Switch
P04	Secondary Fuse Box C

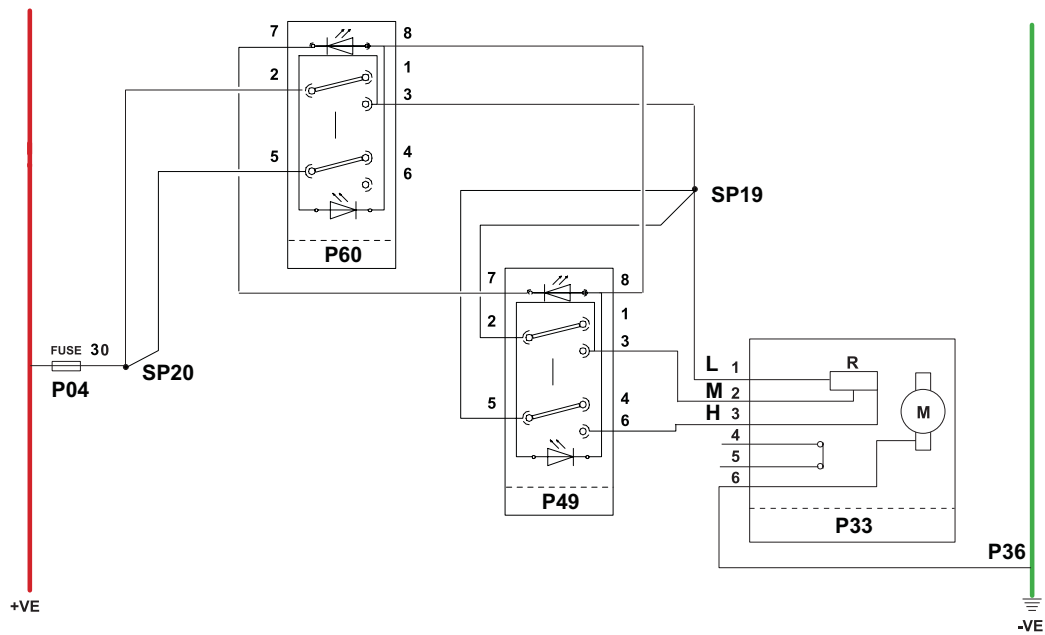


Fig 2.

C067220-C3

Fault Finding

Tables

Fault(s)

⇒ [Table 2. Blower operates on fan speed 3 only \(B2-5\)](#)

⇒ [Table 3. Blower does not operate \(B2-5\)](#)

Table 2. Blower operates on fan speed 3 only

Possible Cause	Action
Blower resistor failed.	Renew resistor.
Blower motor failed.	Renew complete blower motor unit.

Table 3. Blower does not operate

Possible Cause	Action
Fuse blown.	Replace fuse and re-test.



Section B2 - Body and Framework Cab Heating and Ventilation SYSTEM

Fault Finding

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Cab Air Conditioning SYSTEM

Introduction

This topic contains information about a machine SYSTEM. The system has some devices that connect either mechanically, hydraulically or electrically. Make sure you are referring to the correct system. Refer to the applications table. [⇒ Related Topics \(□ B3-2\)](#).

Descriptions and procedures relate to the system and not the individual devices. For information about the devices refer to the relevant topics. [⇒ Related Topics \(□ B3-2\)](#)

This topic is intended to help you understand what the system does and how it works. Where applicable it also includes procedures such as removal and replacement and dismantle and assemble.

[⇒ Related Topics \(□ B3-2\)](#)

[⇒ Specifications \(□ B3-3\)](#)

[⇒ R134a Refrigerant \(□ B3-4\)](#)

[⇒ PAG Type Refrigerant Oil \(□ B3-4\)](#)

[⇒ Operation Overview \(□ B3-5\)](#)

[⇒ Electrical Operation and Schematics \(□ B3-8\)](#)

[⇒ Safety Procedures \(□ B3-10\)](#)

[⇒ Service Checks \(□ B3-11\)](#)

[⇒ Fault Finding \(□ B3-12\)](#)

[⇒ Introduction \(□ B3-12\)](#)

[⇒ Tables \(□ B3-12\)](#)

[⇒ System Diagnosis using Test Gauges \(□ B3-16\)](#)

[⇒ Test Procedures \(□ B3-23\)](#)

[⇒ Leak Testing \(□ B3-23\)](#)

[⇒ Tightening Leaking Hoses \(□ B3-23\)](#)

[⇒ Binary Switch \(□ B3-24\)](#)

[⇒ Refrigerant \(□ B3-25\)](#)

[⇒ Refrigerant Charging and Discharging \(□ B3-25\)](#)

[⇒ Compressor Drive Belt - Adjustment \(□ B3-30\)](#)

Related Topics

Table 1. Related Topics in This Publication

The table lists other topics in the manual that contain information related to this topic. Refer to the applicable topics to complete your procedures. Where applicable the text in this section contains cross references to this page to help you find the correct information. Some machines have different systems and devices. Make sure you refer to the correct topic, refer to **Section 1 - Applications**.

Sections	Topic Titles	Sub Titles
1	Applications	ALL
2	ALL (Care and Safety) ⁽¹⁾	ALL
B	⇒ Cab Heating and Ventilation SYSTEM (B2-1) ⁽²⁾	ALL
B	⇒ Air Conditioning Binary Switch (B7-1)	ALL
B	⇒ Air Conditioning Condenser - Cab Roof Mounted (B6-1)	ALL
B	⇒ Cab HV and HVAC Unit (B8-1)	ALL
C	Fuses and Relays	ALL
C	Electrical Harness SYSTEM	ALL

(1) You must obey all of the relevant care and safety procedures.

(2) Reference for the cab heating and ventilation (HV) part of the HVAC system.



Specifications

Binary Pressure Switch Settings

Low Pressure	2 bar	(2.1 kgf/cm ² , 29.8 lbf/in ²)
High Pressure	26 bar	(26.5 kgf/cm ² , 377 lbf/in ²)

Thermostatic Switch Settings

Cut out	0.2 to 1.4 °C	(32.5 to 34.5 °F)
Cut in	3.4 to 4.8 °C	(38 to 40.6 °F)

Refrigerant

R-134a	1.7 Kg (3.74 lb)
--------	------------------

Oil

Type	PolyAlkylene Glycol (PAG)
Quantities - Recharge the system ⁽¹⁾	1.5 fluid oz. (42.6 ml)

Component Replacement

Condenser	1.0 fluid oz. (28.4 ml)
Evaporator	2.0 fluid oz. (56.8 ml)
Hoses	0.3 fluid oz. (8.5 ml)
Receiver Drier	0.5 fluid oz. (14.2 ml)
Compressor	None - pre charged

(1) The quantity of oil replaced should be the same as that taken out during 'Recovery' procedure.

R134a Refrigerant

TB-006

Refrigerants are the basic ingredient of all air conditioning systems and are used to transfer the heat energy around the system. Refrigerant type R134a is used in the air conditioning system. It's full chemical name is:

1, 1, 1, 2-Tetrafluoroethane (CH₂FCF₂)

R134a is a HFC (HydroFluoroCarbon) and is non-toxic, non-flammable and non-explosive at normal atmospheric temperature and pressure. It can be flammable under certain pressure and air mixtures.

Due to environmental concerns, the use of ozone depleting chlorofluorocarbons (CFCs) in the air conditioning systems is being gradually phased out. The R-12 refrigerant used in some systems contains CFCs. Air conditioning systems using R-134a refrigerant are not compatible with systems using R-12 refrigerant. No attempt should be made to charge R-134a systems with R-12 refrigerant.

Important: Refer to the safety procedures within this section before handling refrigerants.

Good installation practice is required to avoid the release of refrigerant into the atmosphere. Refrigerant R134a contains no chlorine and has an Ozone Depleting Potential (ODP) of zero, and a Global Warming Potential (GWP) of 0.1.

PAG Type Refrigerant Oil

TB-007

The system requires a PAG type refrigerant oil to lubricate the compressor. The oil mixes with the refrigerant and is carried around the system.

It is important that the recommended grade of refrigerant oil is used. Mineral oil is not suitable for R134a refrigerant systems. Do not mix oil types.

The compressor is supplied with an oil charge, but additional oil will be required when the receiver drier is replaced. The oil is added to the compressor through the oil filling plug before the evacuation procedure is started.

Only use fresh, unused oil. Oil that has been exposed to the air will have absorbed water.

Operation Overview

Component Location

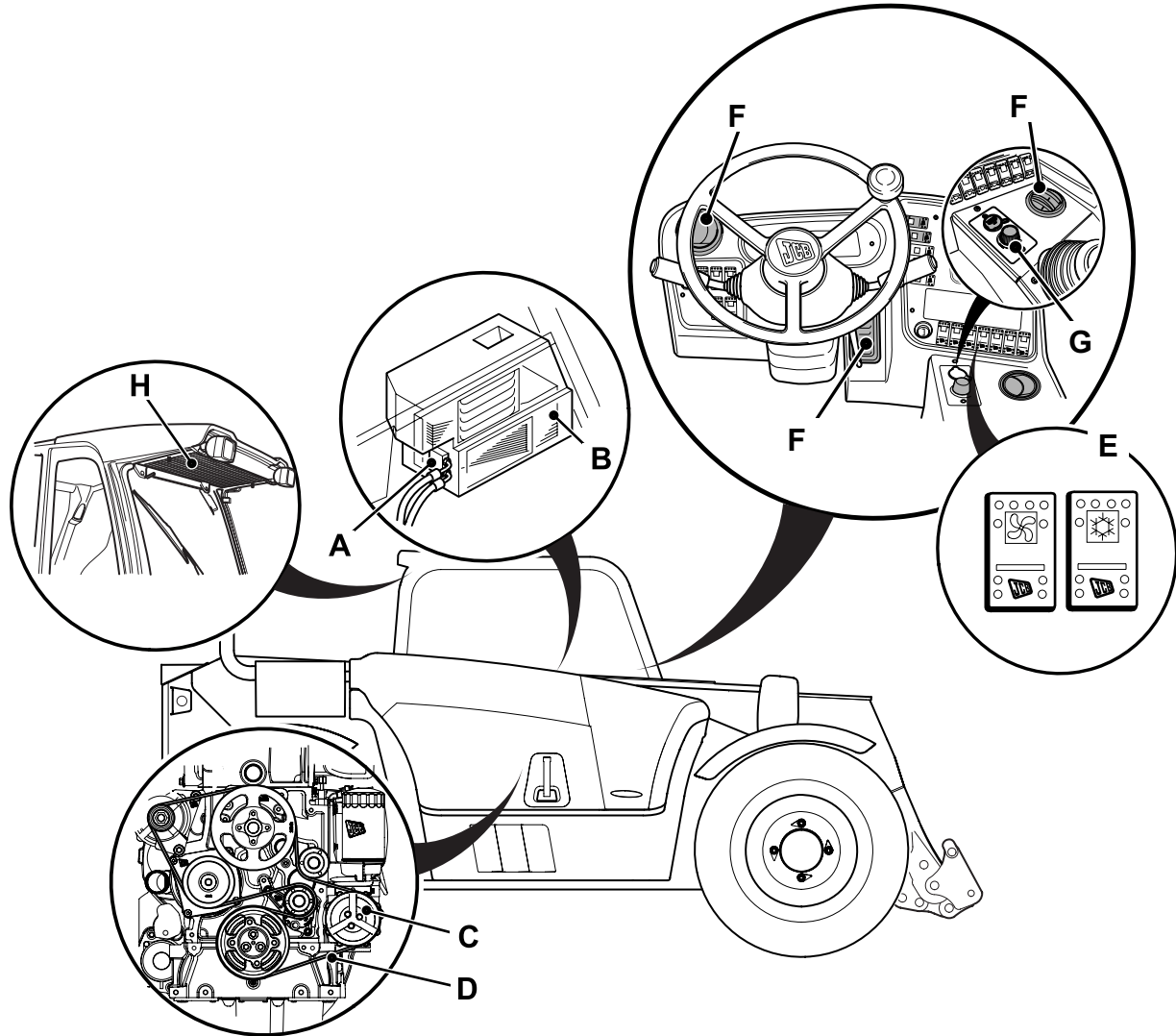


Fig 1.

C093970-C1

Item	
A	Thermostatic Expansion Valve
B	Evaporator Matrix
C	Compressor
D	Front End Accessory Drive Belt (FEAD)
E	Heater/Air Conditioning Switches
F	Heater/Air Conditioning Vents
G	Heater Temperature Control
H	Condenser

System Operation

To maintain optimum operator comfort in warm climates or during seasons of high ambient temperature, the air conditioning system delivers cool, dehumidified air into the cab. Cooling is provided by passing the warm ambient air, together with re circulated air, over an evaporator matrix in the air conditioning unit.

The air conditioning system is a closed circuit through which the refrigerant is circulated, its state changing from gas to liquid and back to gas again, as it is forced through the system.

The major components of the system are the compressor **A**, condenser matrix **B**, receiver drier **C**, binary pressure switch **E**, thermostatic expansion valve **F** and evaporator matrix **G**.

Operate the air conditioning as described in the **Operator Handbook**.

Air conditioning system power is generated from the engine, via an electromagnetic clutch to the compressor. Switches, connected in series, are included in the clutch supply line, all must be closed for the clutch and therefore the air conditioning system to operate.

The compressor **A** draws in low pressure refrigerant gas from the suction line (evaporator to compressor) and increases refrigerant pressure through compression. This process also increases the refrigerant temperature.

High pressure refrigerant is forced from the compressor to the condenser **B**. Ambient air is drawn across the condenser by the condenser fans. In the condenser, the refrigerant changes state to a high pressure, high temperature liquid but with a lower heat content.

The refrigerant passes through the receiver drier **C**, which contains a desiccant to remove moisture from the system. The receiver drier serves as a reservoir for refrigerant and also includes a filter to remove foreign particles from the system.

Note: The receiver drier can only hold a limited amount of moisture, additional moisture can lead to icing and ultimately blockage of the thermostatic expansion valve. If the air conditioning system has been left open or has been leaking for a prolonged period of time, the desiccant will become saturated and the receiver drier will need to be renewed.

The high temperature, high pressure refrigerant is forced by compressor action into the Thermostatic Expansion Valve (TEV) **F**, which meters the amount of refrigerant entering the evaporator. In the Thermostatic Expansion Valve the refrigerant instantaneously expands to become a low pressure, low temperature liquid.

The refrigerant is drawn through the evaporator matrix **G** by the suction of the compressor. The temperature of refrigerant is now considerably below that of the air being drawn across the evaporator matrix by the blowers. Heat is transferred from the ambient and re circulated air to the refrigerant, causing the low pressure liquid to vaporise and become a low pressure gas. Moisture in the air condenses on the evaporator matrix and is drained away via condensate.

Cool de-humidified air is emitted through air vents into the cab.

The low temperature, low pressure, high heat content refrigerant gas, is now drawn by suction back to the compressor, where the cycle is completed.

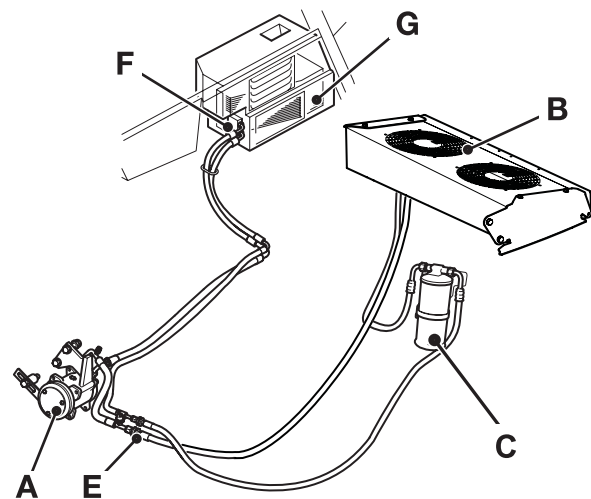


Fig 2.

C067580-C3

System Control

Control of the system is achieved by the cyclic action of the compressor's electromagnetic clutch. When current is fed to the field coil of the compressor's clutch, a magnetic field develops between the field coil and the armature which pulls the field coil, complete with clutch assembly, onto the compressor rotor. Since the clutch assembly is turned constantly by the crankshaft pulley drive belt, the compressor armature turns, starting the refrigeration cycle.

Current is fed to the field coil through a series of switches whose contacts are controlled by the following:

- 1 The manual A/C ON/OFF switch **A** in the control console.
- 2 The freeze protection thermostat switch monitoring the evaporator temperature. The high and low level binary pressure switch.

The ON/OFF Switch **A** will start the refrigeration cycle provided that the ambient temperature in the cab is greater than the thermostat switch cut-out temperature, and the refrigerant pressure remains within the binary pressure switch limits.

The thermostat switch has its sensor inserted in the evaporator matrix. It controls the refrigeration cycle by switching the compressor clutch on and off to prevent freezing of the condensate on the evaporator matrix.

The binary pressure switch assembly is located in the pipework adjacent to the compressor. If the refrigerant pressure exceeds the upper pressure limit or falls below the lower limit, the contacts open and the clutch will disengage, closing down the refrigeration cycle. For binary pressure switch settings, see [➔ Specifications \(B3-3\)](#).

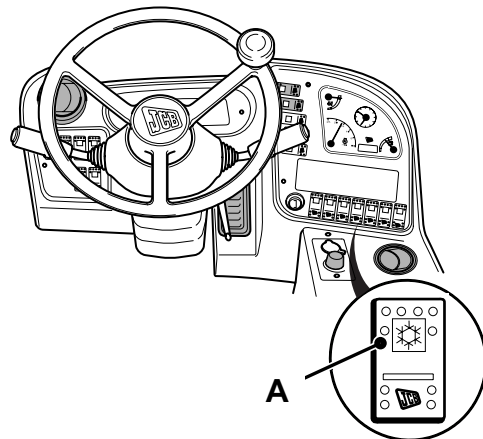


Fig 3.

C093970-C2

Electrical Operation and Schematics

The harness connector pin numbers are shown on the schematic

⇒ [Fig 4.](#) ([B3-9](#)).

Key	
C004/E001	Chassis Harness to Engine Harness Connector
C010	Earth
CRA02	Air Conditioning Fuse Box
CRA03	Battery Connection
E009	Air Conditioning Compressor
E013	Binary Switch
E014	Binary Switch
P04	Secondary Fuse Box C
P24/RC01	Panel Harness to Rear Cab Harness Connector
P33	Heater Connector
P34/RA02	Panel Harness to Panel AC Harness Connector
P36	Earth Point
P44/C044	Panel Harness to Chassis Harness Connector 3
P49	Heater Fan Speed Switch
P60	Heater Fan/Air Conditioning On/Off Switch
RA01	Condenser Fans 1 and 2 Relay
RA03/ CRA01	Chassis AC Harness to Panel AC Harness Connector
RA04	Earth
RC15	Roof Air Conditioning Condenser Fan 1
RC17	Roof Air Conditioning Condenser Fan 2

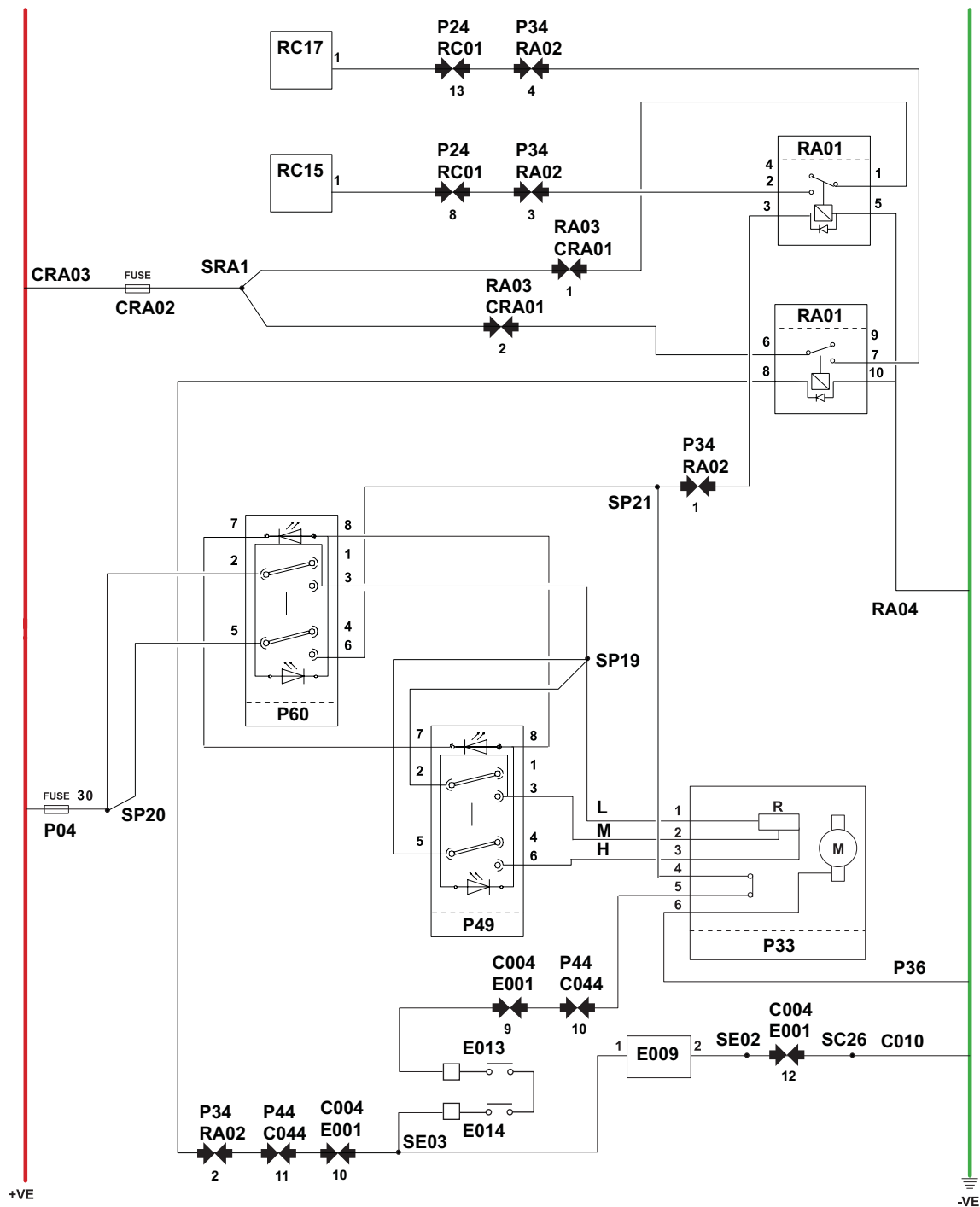


Fig 4.

C067220-C4

Safety Procedures

The air conditioning system includes a pressurised closed circuit containing a non-CFC, environmentally friendly refrigerant, Type R-134a. Any service procedure which breaks into the closed circuit and therefore requires discharging of the system, must only be carried out by service personnel with specialist knowledge of air conditioning systems. The following guidelines should be adhered to by all personnel servicing the air conditioning system.

WARNING

The air conditioning system is a closed loop system and contains pressurised refrigerant. No part of the system should be disconnected until the system has been discharged by a refrigeration engineer or a suitably trained person. You can be severely frostbitten or injured by escaping refrigerant.

4-3-4-1_2

CAUTION

Do not operate the air conditioning system when there is no refrigerant in the system, otherwise the compressor will be damaged.

4-3-4-4

- 1 It is critical that the correct refrigerant (R-134a) is used and that charging is done only by qualified personnel. It is illegal to discharge the refrigerant into the atmosphere but as a precaution in case of accidental leakage, discharging and charging of the vehicle refrigerant system must be conducted in a well ventilated area.
- 2 Containers of refrigerant should be stored in a cool environment away from direct sunlight.

WARNING

Do not carry out welding operations close to the air conditioning refrigerant circuit. A poisonous gas is produced when refrigerant comes into contact with naked flames. Do not smoke or allow naked flames close to the refrigerant circuit.

BF-1-9

- 3 Do not perform welding operations close to refrigerant hoses (maintain a distance of at least 0.5m from hoses).
- 4 Do not steam clean refrigerant system components.
- 5 When charging or discharging the refrigerant system, no smoking or naked flames should be allowed in the immediate vicinity. The refrigerant does not give off a poisonous odour, however, when it comes into

contact with a naked flame, a poisonous gas is produced.

- 6 When handling refrigerant, rubber gloves and goggles should be worn. Operators should ensure no refrigerant comes into contact with the skin. Particular care should be taken when connecting or disconnecting charging hoses or pressure switches. When these components are connected to the system, a short release of refrigerant occurs. This results in a high velocity, very cold gas being emitted from the connection point.
- 7 When checking the state of the refrigerant, it is necessary to run the engine. Extreme care must be taken to avoid moving engine parts such as fans, pulleys and belts.
- 8 Use caution when working near exposed evaporator fins. Painful cuts can be inflicted by the edges of the fins. Also, damage to the fins will reduce the efficiency of the system.
- 9 Make sure pressure cylinders are not over filled, particularly when recovering refrigerant.
- 10 Disconnect battery before doing any work.

WARNING

PAG type oil is an irritant. It can cause skin irritation. Breathing PAG vapour can cause irritation of the eyes, nose and lungs. Prolonged inhalation can cause drowsiness.

BF-1-11

WARNING

PAG oil vapour is extremely flammable. Do not smoke or eat near PAG contaminated material. Exercise caution when working around hot and moving engine parts.

BF-1-12

Service Checks

The air conditioning system needs to be checked regularly to ensure efficient and safe operation.

Before commencing any service operations, carry out a basic service check as described below:

- 1 Start the engine and operate at fast idle speed (1000 RPM).
- 2 Switch on the air conditioning and set to maximum cooling.

Note: The cab temperature needs to be above 20°C. At low ambient temperatures it may be necessary to operate the heating system to prevent the air conditioning system switching off.

- 3 Operate the engine at operating temperature for five to ten minutes.
- 4 Close the cab door and windows and allow the internal temperature to stabilize.
- 5 Measure the temperature at the evaporator outlets. The temperature should change as the compressor clutch cycles in and out. The outlet temperature with the clutch engaged should be significantly below ambient (4°C to 10°C) rising by 6°C to 8°C when the clutch disengages.
- 6 Stop the engine when the tests are complete.

Off-Season Operation

During the off-season, the air conditioning system should be operated for at least five minutes every month to circulate the oil in the system to lubricate the fittings and seals.

When operating the system, ensure that:

- 1 Engine idle speed is greater than 1000 RPM.
- 2 Ambient temperature is greater than 0°C.
- 3 Cab temperature is greater than 20°C.
- 4 The engine is at normal operating temperature.

Fault Finding

Introduction

The system will not function in very low ambient temperatures, therefore fault finding tests should be carried out in a warm environment.

It is recommended that, to locate faults on the system accurately and quickly, an electronic leak detector and a refrigerant pressure gauge should be used. However, leaks can be detected on the system by using soapy water applied to the suspected leak area.

Tables

Fault(s)

⇒ [Table 2. Poor performance \(B3-12\)](#)

⇒ [Table 3. Warm or slightly cool air emitted from unit \(B3-12\)](#)

⇒ [Table 4. Compressor clutch continually cuts out \(B3-12\)](#)

⇒ [Table 5. Poor Performance - Compressor Function Tests \(B3-13\)](#)

⇒ [Table 6. Compressor Not Achieving 24 bar Pressure \(B3-14\)](#)

⇒ [Table 7. No air conditioning \(B3-15\)](#)

Table 2. Poor performance

Possible Cause	Action
Low system pressure.	Discharge and recharge the system.
Condenser matrix air flow restricted.	Remove debris from matrix using compressed air.
Air filter blocked.	Clean with detergent and water.
Compressor drive belt too slack.	Check condition of front end accessory drive belt (FEAD) and auto tensioner mechanism.

Table 3. Warm or slightly cool air emitted from unit

Possible Cause	Action
Expansion valve stuck open or closed.	Renew expansion valve.

Table 4. Compressor clutch continually cuts out

Possible Cause	Action
Condenser matrix blockage.	Remove debris from matrix or
Overcharging of refrigerant system.	Discharge and recharge the system.
Blocked expansion valve or condenser.	Clear blocked component.
Compressor fault.	Do compressor function tests. ⇒ Table 5. Poor Performance - Compressor Function Tests (B3-13)

Table 5. Poor Performance - Compressor Function Tests

Check	Yes	No
1 Is the compressor rotation smooth? With the engine having been turned off for 5 minutes, turn the compressor shaft by turning the armature plate by hand. Check for smooth rotation. Grinding or hanging during shaft rotation is caused by a broken component within the compressor.	Check 2.	Renew compressor.
2 Is the field coil receiving greater than 7.5 V? This test should be conducted with the electrical system on and clutch engaged. Unplug the electrical connector and measure on the machine side. Note: Reversing polarity will short diode resulting in blown fuses.	Check 3.	Rectify electrical problem.
3 Is the field coil resistance between 3 and 4 ohms? Coil resistance out of this range will not engage or will cause fused circuits to open. Unplug the electrical connector, measure on compressor side.	Check 4.	Renew compressor.
4 Is compressor capable of producing 24 bar or more? To check this do the pressure tests. ⇒ System Diagnosis using Test Gauges (□ B3-16) Excessive high pressure can be artificially produced by preventing air flow across the condensor. Preventing air flow through the condensor minimises heat removal from the system resulting in high pressure.	Compressor is functioning correctly.	Follow the pressure fault finding chart. ⇒ Table 6. Compressor Not Achieving 24 bar Pressure (□ B3-14)

Table 6. Compressor Not Achieving 24 bar Pressure

Reason	Test	Action
Low refrigerant charge - possible leakage, suction and discharge pressure are low.	Discharge and recharge the system.	Repair leak. Check system pressures. ⁽¹⁾
System high pressure side blockage - flow to the compressor is stopped or limited.	Check suction pressure is 0.35 bar or less.	Compressor is functioning correctly. Remove system blockage.
Compressor failure - internal compressor damage.	Suction pressure high, Discharge pressure low, do compressor function tests. ⇒ Table 5. Poor Performance - Compressor Function Tests (□ B3-13)	Renew compressor.
Test performed below 10 °C - Low ambient temperature limits pressure.	Move machine to area where temperature is higher.	Check system pressures. ⇒ System Diagnosis using Test Gauges (□ B3-16)

(1) Compressors with dirt/oil build up at hose connections are most likely to have damaged 'O' rings. Check for leaks and replace 'O' rings.

Table 7. No air conditioning

Check	Yes	No
1 Are the controls set correctly, i.e. air conditioning selected, heater control set to coldest position and blower switched on?	Check 2.	Reset controls and retest.
2 Is the air conditioning (evaporator) blower working?	Check 3.	Check 4.
3 Is the compressor running (visual check of pulley/clutch)?	Check 10.	Check 5.
4 Is the air conditioning fuse(s) blown? For details of the electrical circuit and connections, see → Electrical Operation and Schematics (B3-8) .	Renew fuse(s) and retest.	Check 9.
5 Is there a 12V supply to the binary pressure switch harness?	Check 6.	Check 7.
6 Does the compressor clutch engage with binary pressure switch assembly bypassed?	Replace binary pressure switch assembly.	Check 8.
7 Does the clutch engage with freeze thermostat switch bypassed?	Renew freeze thermostat switch and retest.	Check all electrical connections.
8 Is there a 12V supply at the compressor?	Renew the compressor clutch and re-test.	Renew the compressor relay and re-test.
9 Are blower switch and wiring OK?	Renew blower unit complete.	Renew switch or wiring.
10 Is the system correctly charged with refrigerant OK?	Check 11.	Charge check required by refrigeration engineer or suitably trained person.
11 Is condensor air flow blocked?	Clean condensor and radiator.	Check 12.
12 Is evaporator air flow blocked?	Clean filter and, if necessary the evaporator.	Call in refrigeration engineer or suitably trained person.

System Diagnosis using Test Gauges

The condition of the air conditioning system can be checked by attaching a manifold gauge block **5-A** to the service ports **5-B**.

5-A	Manifold Gauge Block
5-B	Service Ports
5-C	Low Pressure/Temperature Gas (Blue)
5-D	High Pressure/Temperature Gas (Red)
5-E	High Pressure Liquid
LS	Low Side Gauge
HS	High Side Gauge

This section gives an overview of the following conditions:

- ⇒ Normally Functioning Air Conditioning System (□ B3-17)
- ⇒ Low R-134a Charge (□ B3-18)
- ⇒ Poor Refrigerant Circulation (□ B3-18)
- ⇒ No Refrigerant Circulation (□ B3-19)
- ⇒ Insufficient Cooling of Condenser or Refrigerant Overcharge (□ B3-19)
- ⇒ Air in System (□ B3-20)
- ⇒ Expansion Valve Improperly Mounted (□ B3-20)
- ⇒ Compressor Malfunction (□ B3-21)
- ⇒ Some Moisture in the System (□ B3-21)
- ⇒ Further Diagnosis (□ B3-22)

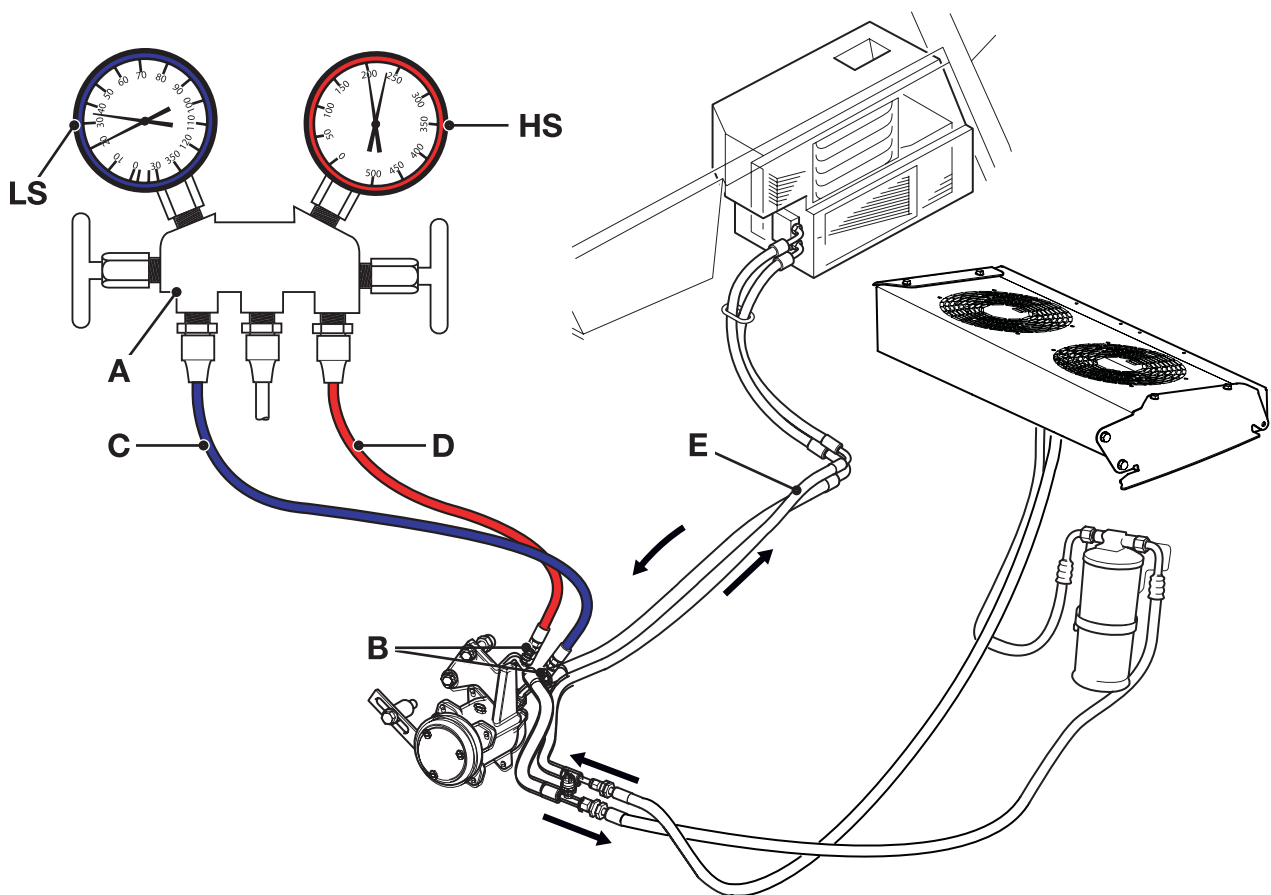


Fig 5.

714360-C3

Normally Functioning Air Conditioning System

Normal gauge readings will depend on system components and ambient conditions. → [Table 8.](#)

Normally Functioning Air Conditioning System Gauge Readings (□ B3-17).

Make sure that the valves are closed and the readings are stable and that the system has a full charge.

Table 8. Normally Functioning Air Conditioning System Gauge Readings

Ambient Temp °C (°F)	Relative Humidity %	Suction Pressure (Low Side)	Discharge Pressure (High Side)	Vent Temp °C (°F)
18 (64.4)	55	1.32 bar (1.34 kgf cm ²)(19 lbf in ²)	8.76 bar (9 kgf cm ²)(127 lbf in ²)	8 (46.4)
25 (77)	55	1.53 bar (1.56 kgf cm ²)(22 lbf in ²)	10.8 bar (11 kgf cm ²)(156.6 lbf in ²)	8.8 (47.8)
32 (89.6)	55	1.3 bar (1.33 kgf cm ²)(18.6 lbf in ²)	13.5 bar (13.77 kgf cm ²)(195.8 lbf in ²)	3.6 (38.5)
38 (100.4)	40	1.5 bar (1.53 kgf cm ²)(21.75 lbf in ²)	16.3 bar (16.6 kgf cm ²)(236.4 lbf in ²)	5.6 (42)
46 (114.8)	28	1.9 bar (1.94 kgf cm ²)(27.56 lbf in ²)	19.8 bar (20.19 kgf cm ²)(287.2 lbf in ²)	11.9 (53.4)

Example - The pressures on the manifold at 25 °C and 55% relative humidity with the engine at 1500 rpm, the blower on maximum, the heater turned off with the door closed and 10 minutes allowed for stabilisation, should be approximately:

Table 9. Gauge Readings

Gauge	Pressure
Low Side LS	Normal: 1.53 bar (1.56 kgf/cm ²) (22.2 lbf/in ²)
High Side HS	Normal: 10.8 bar (11 kgf/cm ²) (156.6 lbf/in ²)

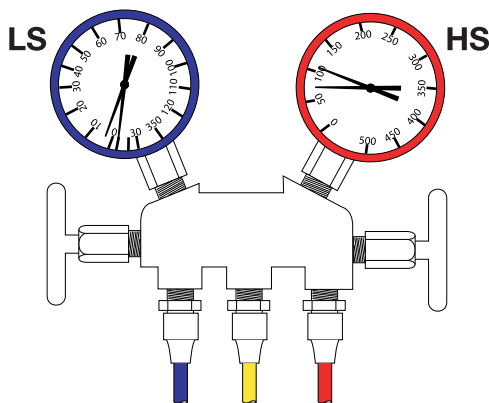


Fig 6.

715220-1

Typically, the high pressure is 6 - 8 times the low pressure.

Low R-134a Charge

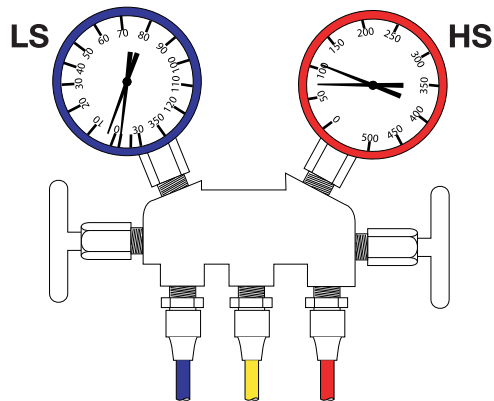


Fig 7.

715220-1

Table 10. Gauge Readings

Gauge	Pressure
Low Side LS	Low: 0.5 bar (0.5 kgf cm ²)(7.25 lbf in ²)
High Side HS	Low: 9.8 bar (10 kgf cm ²)(142 lbf in ²)

Diagnosis

System slightly low on R-134a, due to leak or incorrect charge.

Correction

- 1 Leak test system.
- 2 Evacuate air con. system
- 3 Repair system leaks.
- 4 Charge system with R-134a.
- 5 Operate system and check performance.

Poor Refrigerant Circulation

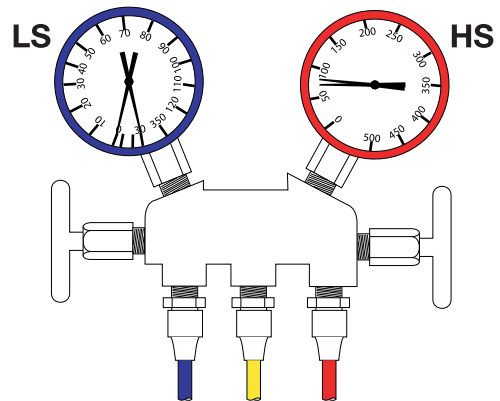


Fig 8.

A268040-1

Table 11. Gauge Readings

Gauge	Pressure
Low Side LS	Zero to negative: -1.0 bar (-1.1 kgf cm ²)(-15 lbf in ²)
High Side HS	Low: 5.4 bar (5.5 kgf cm ²)(78 lbf in ²)

Other Symptoms

Receiver Drier - Frost on tubes from receiver-drier to evaporator unit.

Diagnosis

Refrigerant flow obstructed by dirt, receiver-drier clogged.

Correction

- 1 Evacuate air con. system.
- 2 Replace receiver-drier.
- 3 Charge system with R-134a.
- 4 Operate system and check performance.

No Refrigerant Circulation

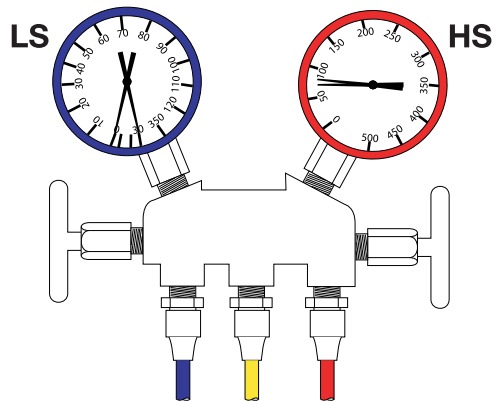


Fig 9.

A268040-1

Table 12. Gauge Readings

Gauge	Pressure
Low Side LS	Zero to negative: -1.0 bar (-1.1 kgf cm ²)(-15 lbf in ²)
High Side HS	Low: 5.4 bar (5.5 kgf cm ²)(78 lbf in ²)

Other Symptoms

Receiver Drier - Frost or moisture on tubes before and after receiver-drier.

Diagnosis

Refrigerant flow obstructed by dirt, moisture or gas leakage from expansion valve heat sensing tube.

Correction

- 1 Evacuate air Con. system.
- 2 Check heat sensing tube at expansion valve. Replace expansion valve if necessary.
- 3 Remove expansion valve and attempt removal of dirt. If dirt cannot be removed, replace expansion valve.
- 4 Replace receiver drier.
- 5 Charge system with R-134a.
- 6 Operate system and check performance.

Insufficient Cooling of Condenser or Refrigerant Overcharge

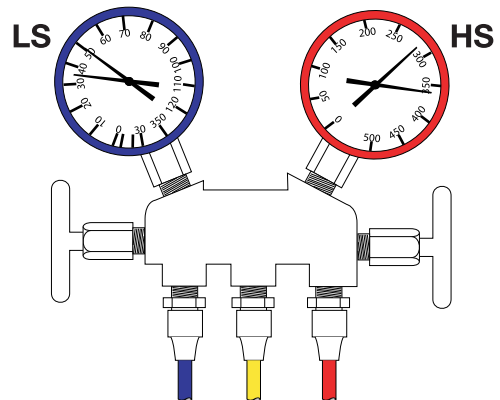


Fig 10.

A268060-1

Table 13. Gauge Readings

Gauge	Pressure
Low Side LS	High: 13.0 bar (3.0kgf cm ²)(43 lbf in ²)
High Side HS	High: 22.1 bar (22.5 kgf cm ²)(320 lbf in ²)

Diagnosis

Refrigerant overcharge, condenser cooling fins clogged with dirt or cooling fans malfunctioning.

Correction

- 1 Clean condenser cooling fins.
- 2 Check cooling fan operation.
- 3 Evacuate air con. system
- 4 Charge system with R-134a.
- 5 Operate system and check performance.

Air in System

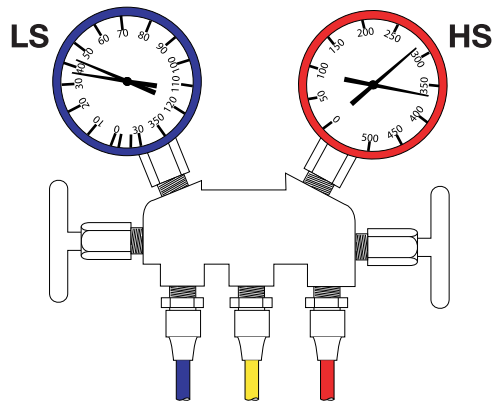


Fig 11.

A268070-1

Table 14. Gauge Readings

Gauge	Pressure
Low Side LS	High: 2.8 bar (2.8kgf cm ²)(40 lbf in ²)
High Side HS	High: 22.1 bar (22.5 kgf cm ²)(320 lbf in ²)

Other Symptoms

Pipes - Low pressure pipes are hot to the touch.

Diagnosis

Air is present in the system, possible from inadequate evacuation procedure.

Correction

- 1 Evacuate air con. system.
- 2 Check compressor oil for contamination. Check compressor for proper oil amount. Correct if necessary.
- 3 Charge system with R-134a.
- 4 Operate system and check performance.

Expansion Valve Improperly Mounted

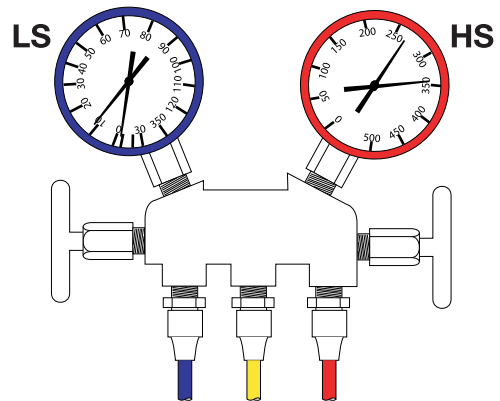


Fig 12.

715230-1

Table 15. Gauge Readings

Gauge	Pressure
Low Side LS	High: 3.5 bar (3.5kgf cm ²)(50 lbf in ²)
High Side HS	High: 22.1 bar (22.5 kgf cm ²)(320 lbf in ²)

Other Symptoms

Pipes - Large amount of frost on low side pipes.

Diagnosis

Excessive refrigerant in low side pipes possible from expansion valve being opened too wide.

Correction

- 1 Leak test system.
- 2 Evacuate air con. system.
- 3 Repair system leaks.
- 4 Charge system with R-134a.
- 5 Operate system and check performance.

Compressor Malfunction

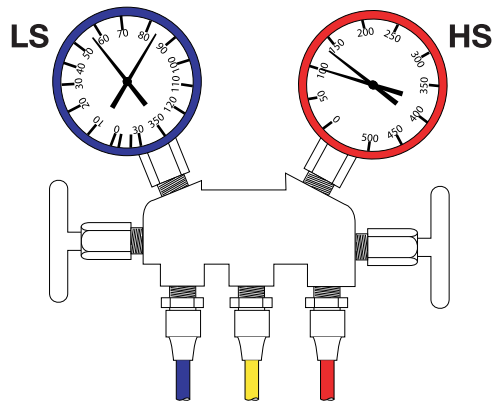


Fig 13.

A268090-1

Table 16. Gauge Readings

Gauge	Pressure
Low Side LS	High: 4.9 bar (35.0kgf cm ²)(71 lbf in ²)
High Side HS	Low: 8.3 bar (8.5 kgf cm ²)(121 lbf in ²)

Diagnosis

Internal compressor leak or compressor mechanically broken.

Correction

- 1 Evacuate air con. system.
- 2 Repair or replace compressor.
- 3 Charge system with R-134a.
- 4 Operate system and check performance.

Some Moisture in the System

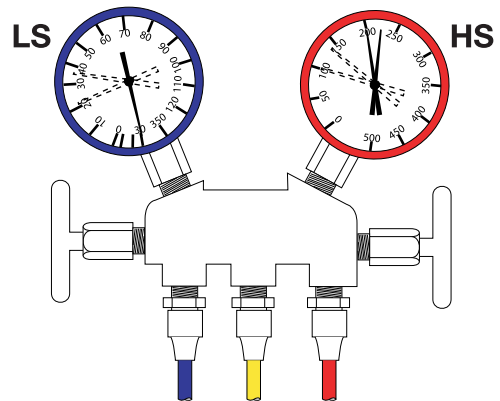


Fig 14.

A268020-1

Table 17. Gauge Readings

Gauge	Pressure
Low Side LS	Normal, then sometimes drops to below zero: -2.1 bar (-2.1kgf cm ²)(-30 lbf in ²)
High Side HS	Normal, then sometimes goes high: 14.8 bar (15.0 kgf cm ²)(214 lbf in ²)

Diagnosis

Moisture in system freezes, temporarily stopping cycle, normal system operation returns when ice melts.

Correction

- 1 Evacuate air con. system.
- 2 Replace receiver-drier.
- 3 Remove moisture by repeatedly evacuating system.
- 4 Charge system with R-134a.
- 5 Operate system and check performance.



Section B3 - Body and Framework Cab Air Conditioning SYSTEM

Fault Finding

Further Diagnosis

Table 18.

High Pressure	Low Pressure	Cycle	Engage	Disengage	Possible Cause
Too High	Too Low	Compressor running continuously			Condenser Dirty
Too High	Normal to Too High	Compressor running continuously			Engine overheating
Normal to Too High	Normal	Compressor running continuously			Air or foreign matter in system or excess refrigerant.
Too High	Too High	Too Fast	Too Short	Normal	Excess refrigerant
Normal to Too Low	Normal to	Too Slow or Too Low	Too long or continuously	Normal or Non-existent	Dirt or excess refrigerant oil in circuit
Normal to Too Low	Too High	Too Fast	Too Short	Normal	Faulty thermostat
Normal to Too Low	Too High	Compressor running continuously			Compressor faulty
Normal to Too Low	Normal to Too High	Compressor running continuously			Low pressure line blocked
Normal to Too Low	Normal	Too Fast	Too Short	Normal	Evaporator blocked
Normal to Too Low	Normal	Too Fast	Too short	Too short	Insufficient refrigerant
Normal to Too Low	Normal	Too Fast	Too Short	Too Long	Evaporator feed line blocked

Test Procedures

Leak Testing

TB-004

WARNING

Leak testing in Air Conditioning systems should be carried out only in a well ventilated area.

BF-1-2

***Note:** The refrigerant is heavier than air and will leak downwards from the defective component. Check in still conditions but in a well ventilated area.*

Hose or pipe connections are likely leakage points of any refrigerant circuit.

It is essential that an electronic leak detector is used to locate leaks accurately. However, if a leak detector is not available, an approximate source can be found by applying soap solution to the suspect area.

To test for leaks in the high pressure side of the system i.e. from the compressor output to the expansion valve, run the air conditioning for a few minutes then switch off the engine and test for leakage using an electronic leak detector or soapy water.

To test for leakage in the low pressure side of the system, switch off the air conditioning and leave for a few minutes before testing.

valve (the evaporator coil is connected to the expansion valve within the air conditioning unit using rigid pipes).

If leakage is detected from a hose connector, either by means of an electronic leak detector or soapy water, tighten the connector up and repeat the leakage test. If leakage is still evident, it will be necessary to discharge the system and renew the connector 'O' ring seal.

Tightening Leaking Hoses

WARNING

The air conditioning system is a closed loop system and contains pressurised refrigerant. No part of the system should be disconnected until the system has been discharged by a refrigeration engineer or a suitably trained person. You can be severely frostbitten or injured by escaping refrigerant.

4-3-4-1_2

The refrigerant hoses have crimped ferrule end fittings. The hose connectors have an 'O' ring seal which compresses when the connection is tight, creating an air tight seal.

Hoses are used to connect the inlets and outlets of the compressor, condenser, receiver drier and expansion

Binary Switch

Before testing the binary pressure switch **A** it is important to check the refrigerant charge level. If the refrigerant charge level is satisfactory, test the switch as described below:

- 1 Switch OFF the engine and remove the harness connectors **B** from the pressure switch **A**.

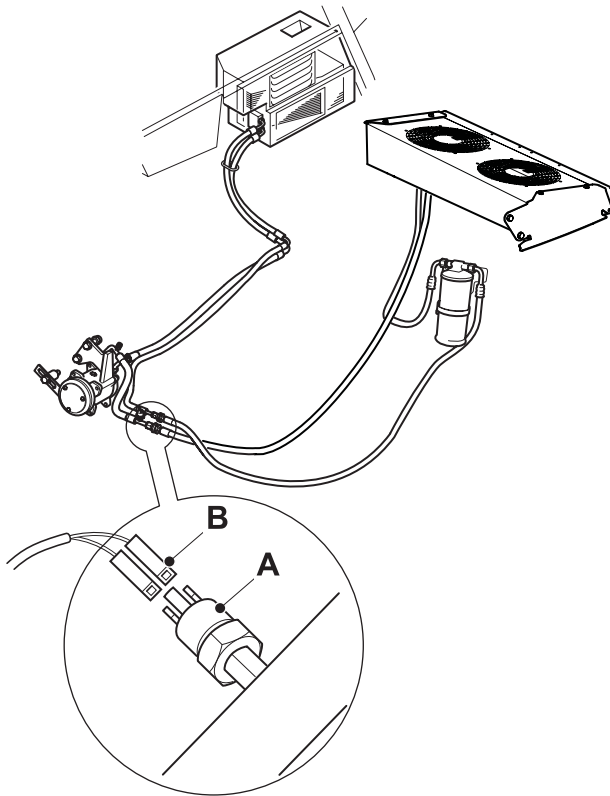


Fig 15.

C067580-C4

- 2 Connect a link wire between the two harness connectors (effectively bypassing the pressure switch).
- 3 Switch on the engine and air conditioning system. If the system operates, one of the switches inside the binary pressure switch assembly is faulty.
- 4 Renew the pressure switch assembly. If the clutch still fails to operate, check the harness electrical wiring for damage and open or short circuits. For details of the

Refrigerant

Refrigerant Charging and Discharging

TB-005

Note: The procedures for refrigerant charging and discharging must only be carried out by qualified service personnel who have received specialist training on the air conditioning system.

WARNING

The air conditioning system is a closed loop system and contains pressurised refrigerant. No part of the system should be disconnected until the system has been discharged by a refrigeration engineer or a suitably trained person. You can be severely frostbitten or injured by escaping refrigerant.

4-3-4-1_2

Refrigerant Recovery

The recovery process clears the system refrigerant prior to servicing or for refrigerant renewal.

Note: Do not re-use refrigerant unless you are aware of its purity.

Note: The JCB recommended 'Javac' unit only recovers refrigerant as a gas. Other units can recover refrigerant as a liquid and/or gas. Always check manufacturers instructions before using.

- 1 Ensure that the engine is OFF and the starter key removed.
- 2 Connect the manifold to the system as shown, with the blue hose **16-A** connected to the system low pressure port. Do Not connect the red hose **16-B**. Make sure that both valves are closed.
- 3 Connect the yellow hose **16-C** to the 'Javac' unit filter **16-D**.
- 4 Connect the filter **16-D** to the 'Javac' unit **16-E**.
- 5 Connect the 'Javac' unit **16-E** to an empty receiver bottle **16-F**. Weigh the bottle before and after filling to assess system capacity.

Note: Do not fill the receiver bottle to more than 80% by weight.

- 6 Switch on 'Javac' unit **16-E** and open the low pressure manifold valve.

Note: If the high pressure warning light on the 'Javac' unit comes on, throttle back the manifold low pressure valve to provide a restriction.

- 7 The 'Javac' unit **16-E** will automatically switch off when a pressure balance exists between the system and the receiver bottle. Switch off 'Javac' at main switch, but leave the system connected. Switch on after 10 minutes, the 'Javac' will restart if residual pressure remains.
- 8 Close valves and remove equipment.

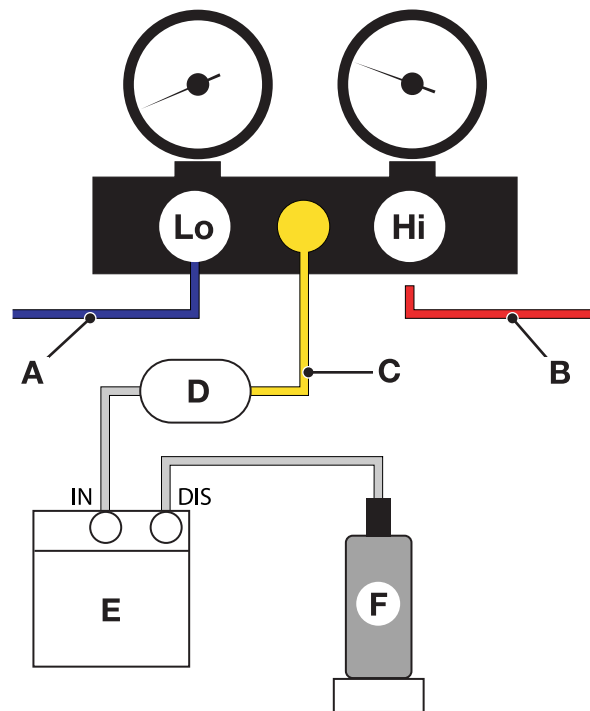


Fig 16. Refrigerant Recovery

Evacuating (Vacuuming)

This procedure follows on from the 'Recovery' process and is necessary to ensure proper refilling of the system with refrigerant.

To avoid leakage in the vacuum system itself, Do not use extensions to the yellow hose (use standard 2 metre length).

- 1 Recover all refrigerant from the system.
→ [Refrigerant Recovery](#) (□ B3-25).
- 2 Close all valves and connect the manifold as shown. Connect the blue hose 17-A to the system low pressure port and the red hose 17-B to the high pressure port.
- 3 Connect the yellow hose 17-C to the vacuum pump 17-D.

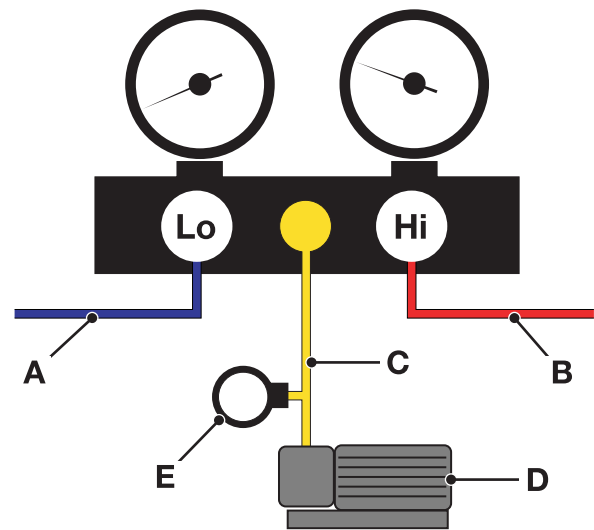


Fig 17. Evacuating

Note: If the Electronic Vacuum Gauge 17-E is used connected as shown. → [Electronic Vacuum Gauge](#) (□ B3-27), for further information.

- 4 Open manifold valves.
- 5 Switch on the vacuum pump 17-D until 740mm (29 in) mercury vacuum reads on both gauges.

Note: Achievable vacuum will vary with altitude. Maximum gauge reading will be 25mm (1 in) less for every 305 metres (1000 feet) above sea level.

- 6 Maintain suction for approximately 30 minutes.

Note: If the vacuum falls rapidly the system is leaking. Check all connections and reseal. If the point of leakage is not obvious, recharge the system and test again.

- 7 Close valves and remove equipment.

Electronic Vacuum Gauge

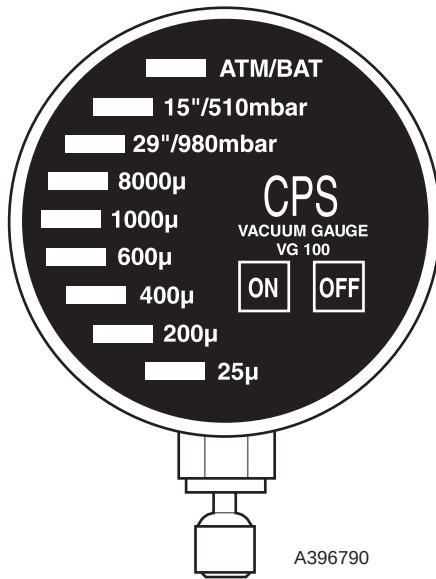


Fig 18.

The CPS VG100 vacuum gauge is an electronic type using LED's to indicate various states of vacuum. It is used in place of or to supplement the gauge on the vacuum pump.

Before connecting into the system switch on to check that the first LED lights to show that the battery is in good condition.

Note: The indicator lights show pressure in inches of mercury (Hg) and vacuum in microns (0.001mm Hg).

ATM/BAT	Normal atmospheric pressure reading. Battery condition.
15"/510mbar	381mm (15 in)Hg. Partial vacuum - Vacuum system is operating.
29"/980mbar	736mm (29 in)Hg. No vacuum drawn - Possible system leakage.
8000	8.0mm (0.31 in)Hg. Partial vacuum - If the reading does not progress the system may have a slow leak.
1000	1.0mm (0.039 in)Hg. Deeper vacuum.
600	0.6mm (0.023 in)Hg. Deep vacuum.
400	0.4mm (0.015 in)Hg. Deep vacuum.
200	0.2mm (0.0078 in)Hg. Deep vacuum.
25	0.025mm (0.00098 in)Hg. Pump Test. Maximum sustainable vacuum.

Relubricating

Pre-lubrication is essential after recovering system refrigerant, vacuuming and component flushing.

The system should be evacuated to a vacuum of 740mm (29 in) of mercury before re-lubricating.

- 1 Ensure that the engine is OFF and the starter key is removed.
- 2 Close all valves and connect the manifold as shown, with the blue hose **19-A** connected to the oil injector **19-E** and the red hose **19-B** to the system high pressure port.
- 3 Connect the yellow hose **19-C** to the vacuum pump **19-D**.
- 4 Connect the other end of the oil injector **19-E** to the system low pressure point **19-F**.
- 5 Switch on the vacuum pump **19-D** and open the high pressure side valve.
- 6 Unscrew the oil injector cap and add the specified quantity of refrigerant oil.
- 7 When 740mm (29 in) mercury shows on the vacuum gauge, open the oil injector valve to allow the oil into the system.
- 8 If more oil is needed repeat the above procedure. The quantity of oil should be the same as that taken out during the 'Recovery' procedure.

Note: Use only PAG oil in R-134a systems.

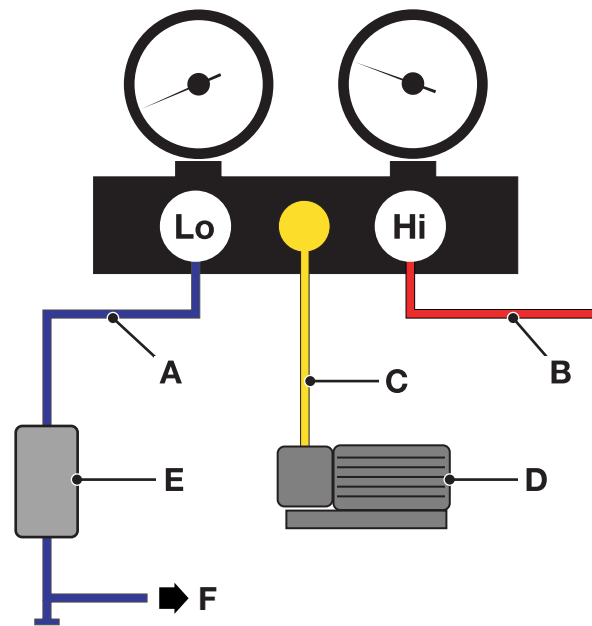


Fig 19. Relubricating

Charging

This procedure is industry recommended practice for refilling air conditioning systems with refrigerant.

Evacuate the system beforehand to 740mm (29 in) of mercury.

- 1 Close all valves and connect the manifold as shown. Connect the blue hose **20-A** to system low pressure and the red hose **20-B** to system high pressure. Connect the yellow hose **20-C** to the refrigerant cylinder **20-D**.
- 2 Invert single valve cylinder on the scales **20-E** and zero the scale reading

Note: Some refrigerant cylinders have separate valves for gas and liquid. Be sure to connect to the liquid port when following the above procedure.

Note: Refrigerant can be used either in gas or liquid form. If recharging with gas follow the manufacturers instructions and recharge only via the low pressure port. Do not use liquid refrigerant at the low pressure port.

- 3 Slowly open the high pressure valve and allow the vacuum to draw-in refrigerant to the specified weight for the system. Refer to **Technical Data**.

Add refrigerant until the scales **20-E** indicate the specified weight for the system or the weight obtained when the system refrigerant was previously recovered.

Note: To speed up the process a thermostatically controlled thermal blanket **20-F** can be used around the replenishing cylinder.

- 4 Close all valves and remove the equipment.

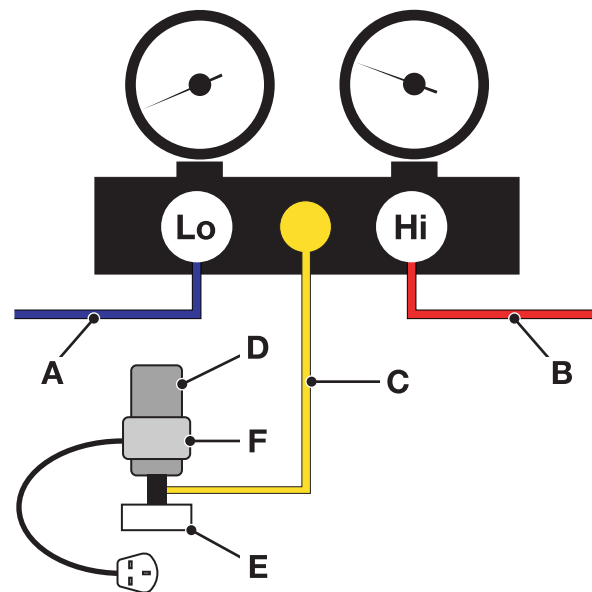


Fig 20. Charging

Compressor Drive Belt - Adjustment

The air conditioning compressor is driven by the front end accessory drive belt (FEAD).

The belt is automatically kept in tension so will not need to be adjusted.

At the recommended service interval, visually inspect the belt for damage, see **Section 3 - Routine Maintenance**. → [Related Topics \(B3-2\)](#).

Longitudinal Load Moment SYSTEM

Introduction

This topic contains information about a machine SYSTEM. The system has some devices that connect either mechanically, hydraulically or electrically. Make sure you are referring to the correct system. Refer to the applications table. [⇒ Related Topics \(□ B4-2\)](#).

Descriptions and procedures relate to the system and not the individual devices. For information about the devices refer to the relevant topics. [⇒ Related Topics \(□ B4-2\)](#)

This topic is intended to help you understand what the system does and how it works. Where applicable it also includes procedures such as removal and replacement and dismantle and assemble.

[⇒ Related Topics \(□ B4-2\)](#)

[⇒ Operation Overview \(□ B4-3\)](#)

[⇒ Longitudinal Load Moment Indicator \(LLMI\) \(□ B4-4\)](#)

[⇒ Longitudinal Load Moment Control System \(LLMC\) \(□ B4-7\)](#)

[⇒ Electrical Operation and Schematics \(□ B4-10\)](#)

[⇒ LLMI System \(□ B4-11\)](#)

[⇒ LLMC System \(□ B4-12\)](#)

[⇒ LLMI - Calibration \(□ B4-14\)](#)

[⇒ Fault Finding \(□ B4-16\)](#)

[⇒ LLMI Fault Codes \(□ B4-16\)](#)

[⇒ LLMI Fault Finding \(□ B4-18\)](#)

[⇒ LLMC Fault Codes \(□ B4-20\)](#)

[⇒ LLMC Fault Finding Tables \(□ B4-21\)](#)

[⇒ LLMI Tests \(□ B4-22\)](#)

[⇒ LLMC Tests \(□ B4-30\)](#)

Related Topics

Table 1. Related Topics in This Publication

The table lists other topics in the manual that contain information related to this topic. Refer to the applicable topics to complete your procedures. Where applicable the text in this section contains cross references to this page to help you find the correct information. Some machines have different systems and devices. Make sure you refer to the correct topic, refer to Section 1 - Applications .		
Sections	Topic Titles	Sub Titles
1	Applications	ALL
1	Service Tools	ALL
2	ALL (Care and Safety) ⁽¹⁾	ALL
B	⇒ LMI Axle Transducer (□ B13-1)	ALL
B	LLMI Inclinometers and Sensors	ALL
C	Fuses and Relays	ALL
C	Electrical Harness SYSTEM	ALL
M	Fault Code SYSTEM	ALL
M	ServiceMASTER SYSTEM	ALL
M	ServiceMASTER Tools	ALL

(1) You must obey all of the relevant care and safety procedures.

Operation Overview

Longitudinal Load Moment

The longitudinal load moment (LLM) is a product of the load on the boom and the distance the load is moved forward from the centre of gravity of the machine. As the load is moved forward so the load moment increases to a value where the machine will tip forwards.

The Longitudinal Load Moment Indicator (LLMI) warns the operator when the machine is near its maximum forward longitudinal load moment. → [Longitudinal Load Moment Indicator \(LLMI\) \(□ B4-4\)](#)

The Longitudinal Load Moment Control (LLMC) (if fitted) isolates the controls to prevent the operator exceeding the maximum forward longitudinal load moment. → [Longitudinal Load Moment Control System \(LLMC\) \(□ B4-7\)](#)

Note: Machines fitted with LLMC are also fitted with LLMI.

Important: The LLMI and LLMC systems do not warn the operator when the machine is at risk of tipping or overturning **SIDEWAYS** or **REARWARDS**. The LLMI and LLMC systems are not intended to warn the operator of tipping or overturning when the machine is travelling, operating on unsuitable ground or subjected to sudden overloading.

The longitudinal load moment indicator and control systems (LLMI and LLMC) are only an enhancement to the devices that JCB currently fit as standard, i.e. loadcharts and boom extension markers. LLMI and LLMC systems must not to be relied upon as the primary source of protection for the machine. Duty of care is still with the operator/site agent to:

- know the mass and load centre of loads being handled.
- know boom angle and extension that will be required to place the load (this can be checked by doing a dry run first without the load).
- while moving the load, obey lift charts, boom extension markers and LLMI indications.

The systems are designed to help you to work more safely
- They are not a substitute for skill and common sense!

Longitudinal Load Moment Indicator (LLMI)

LLMI Operator Interface

The LLMI unit warns the operator when the machine is nearing its maximum forward longitudinal load moment (when the load moment could cause the machine to tip forward).

The system is permanently ON when the ignition is ON. Green LED **D** is lit to confirm the unit is ON.

A sensor measures the load exerted on the rear axle and sends a signal to the indicator unit. The indicator unit converts the signal into a display in the form of three green LEDs **A**, one amber LED **B** and one red LED **C**. The LEDs will illuminate progressively as the load increases.

The amber LED **B** will flash as the load nears the maximum working limit.

If the load exceeds the maximum working limit, the red LED **C** will illuminate and an audible warning will activate.

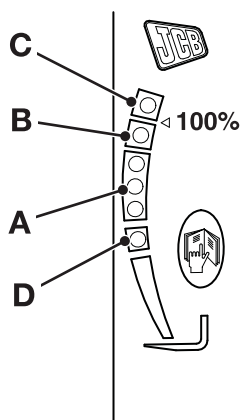


Fig 1.

C093820-C7

The display brightness and audible warning levels can be adjusted. [⇒ Setting the Volume and Brightness \(B4-5\)](#)

If the system detects a fault, the audible alarm will sound and a combination of LEDs illuminate to indicate a fault code. [⇒ LLMI Fault Codes \(B4-16\)](#)

Setting the Volume and Brightness

The volume of the audible alarm, and the brightness of the display LEDs can be set by the operator using display button **E**. This allows the volume and brightness to be reduced for night time use. The possible options are:

- Full volume and full brightness (default setting)
- Reduced volume and full brightness
- Full volume and reduced brightness
- Reduced volume and reduced brightness

1 Park the machine (unloaded) on level ground with the engine running. Apply the park brake and place the forward/reverse lever in the neutral position.

2 The green light **D** at the bottom of the display will illuminate to show that the indicator is receiving power.

3 Press and hold the display button **E**.

The display will cycle through the volume and brightness options, pausing for approximately three seconds to demonstrate each option.

4 Release the button during the required demonstration to select the option.

Note: The system will reset to the default setting when the starter key is switched to the off position.

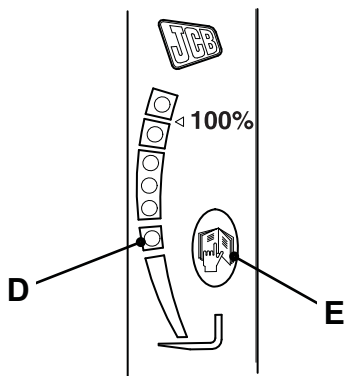


Fig 2.

C093810-C1

LLMI System Operation

A transducer **1** measures the load exerted on the rear axle and sends a signal to the LLMI unit. The unit converts the

signal into the longitudinal load moment value and drives the display LED's as required.

The LLMI unit is CAN enabled. The calculated longitudinal load moment is transmitted on the CANbus.

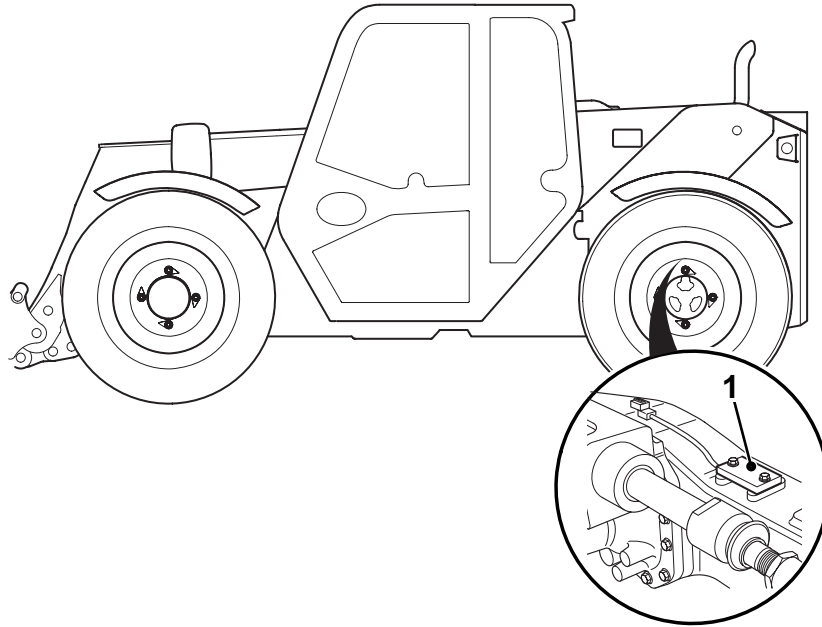


Fig 3. Component Location

C094180-C1

Longitudinal Load Moment Control System (LLMC)

LLMC Operator interface

The LLMC system slows operation of the boom lower, boom extend, dump and crowd functions as the machine gets closer to its maximum working limit (ie, when the load moment could cause the machine to tip forward). Automatic isolation of the hydraulic services prevents the operator from exceeding the maximum longitudinal load moment.

The system is permanently ON when the ignition is ON. The system automatically switches between active (green symbol **F** illuminated) and not active (amber symbol **H** illuminated) depending on the machine status. The LLMI system functions as normal. [⇒ LLMI Operator Interface \(□ B4-4\)](#)

As the machine gets closer to its stability limit the boom hydraulic services slow down and then stop. Only boom raise and retract services will operate.

If there is a system fault the boom hydraulic services are automatically isolated and the light **A** on the LMS will be illuminated.

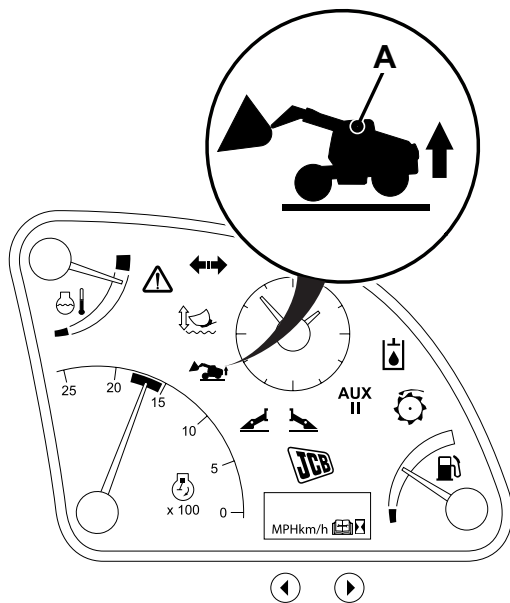


Fig 4.

432711-9-C2

System Override

The system can be temporarily overridden.

Important: Make sure it is safe to recover the load before overriding the LLMC system. Refer to the load charts.

- 1 Press and hold the mode button **G**. When all the LEDs flash the override function is enabled for a maximum of 60 seconds. An audible alarm will sound.
- 2 Operate the controls to recover the load and then release button **G**. The override function can not be selected again until 5 seconds have elapsed.

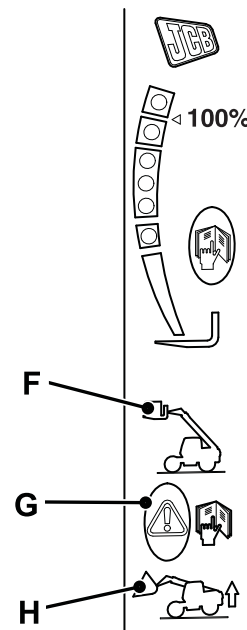


Fig 5.

C093820-C6

System Operation

The LLMC system is controlled by the machine hydraulic control ECU 2. The ECU gets inputs from the axle transducer 1, chassis and boom mounted electric inclinometers 3, 4 boom retracted proximity switch 5 and transmission speed sensor 7.

The ECU compares the machine status to pre-set values stored in its memory. Outputs from the ECU control the proportional solenoids on the main control valve.

The boom angle sensors inform the ECU when the boom has been raised above a specified angle. This angle varies according to the country of use.

The LLMC system is able to isolate the hydraulic system when the machine has a fault. The isolation solenoid 6 is located within the control valve block.

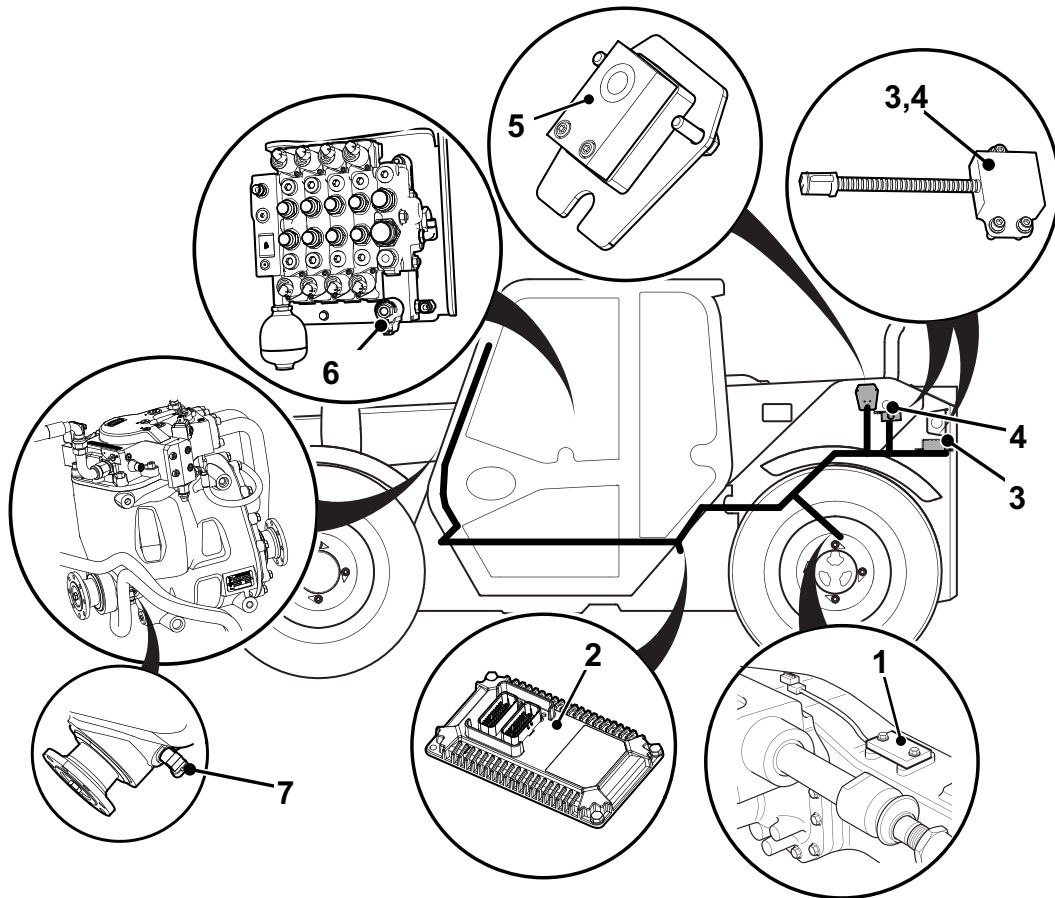


Fig 6.

C094180

Hydraulic Operation and Schematics

LLMI System

The LLMI system does not interface with the hydraulic system.

LLMC System

When the LLMC system slows or stops the hydraulic services the hydraulic ECU automatically controls the proportional solenoids on the main control valve. The main hydraulic system works in the normal way.

LLMC Isolation

The LLMC (Longitudinal Load Moment Control) system uses the dump solenoid **B** to isolate the hydraulic controls. The power for the solenoid is provided by the hydraulic control ECU depending on data from the LLMC system. If a fault should develop in the system the solenoid defaults to the not de-energised position and the hydraulic controls are isolated.

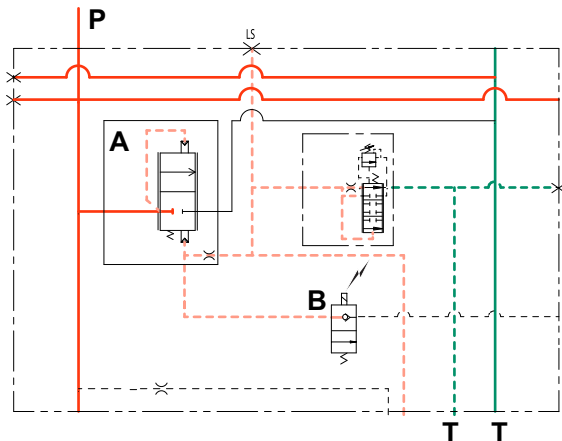


Fig 7. Hydraulic Controls Active

C094050-C2

When the dump solenoid **B** is energised the hydraulic controls are active. The solenoid allows the load sense line to build up pressure. The load sense pressure acts on the by-pass valve **A** and closes it off from the tank return line. The pump flow from port **P** supplies the hydraulic service spools.

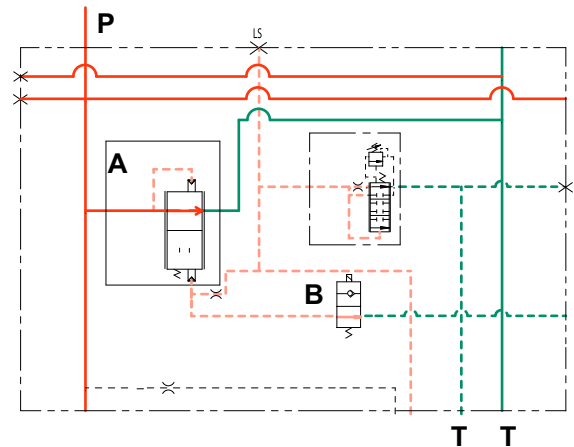


Fig 8. Hydraulic Controls Isolated

C094050-C3

When the dump solenoid **B** is not energised all of the load sense pressure is dumped to tank via the **T** port. The by-pass valve **A** opens as there is no load sense pressure on the valve to hold it closed. This dumps the pump pressure back to tank so that there is no pressure available to operate the services.

Electrical Operation and Schematics

Important: *Diagrams are for illustration only. It is not possible to show all variations therefore always check with the relevant harness drawing.*

Before fault finding make sure that you understand how the electrical circuits work.

Earth Points

Faults may be caused by poor earth connections. Although earth connections are shown, it must be remembered that the cab assembly is earthed via further earth strap and cable connections. [⇒ Related Topics \(□ B4-2\)](#)

LLMI System

⇒ [Electrical Schematic - LLMI System \(B4-11\)](#)

Key	
C025	Transducer - rear axle mounted
P01/C001	Chassis to panel harness interconnect
P02	Fuse Box A
P27	LLMI unit - CAN enabled
P28	LLMI unit - CAN bus connection

The LLMI unit P27 is self contained. It is connected to the machine battery via the ignition switch and a fuse. Power

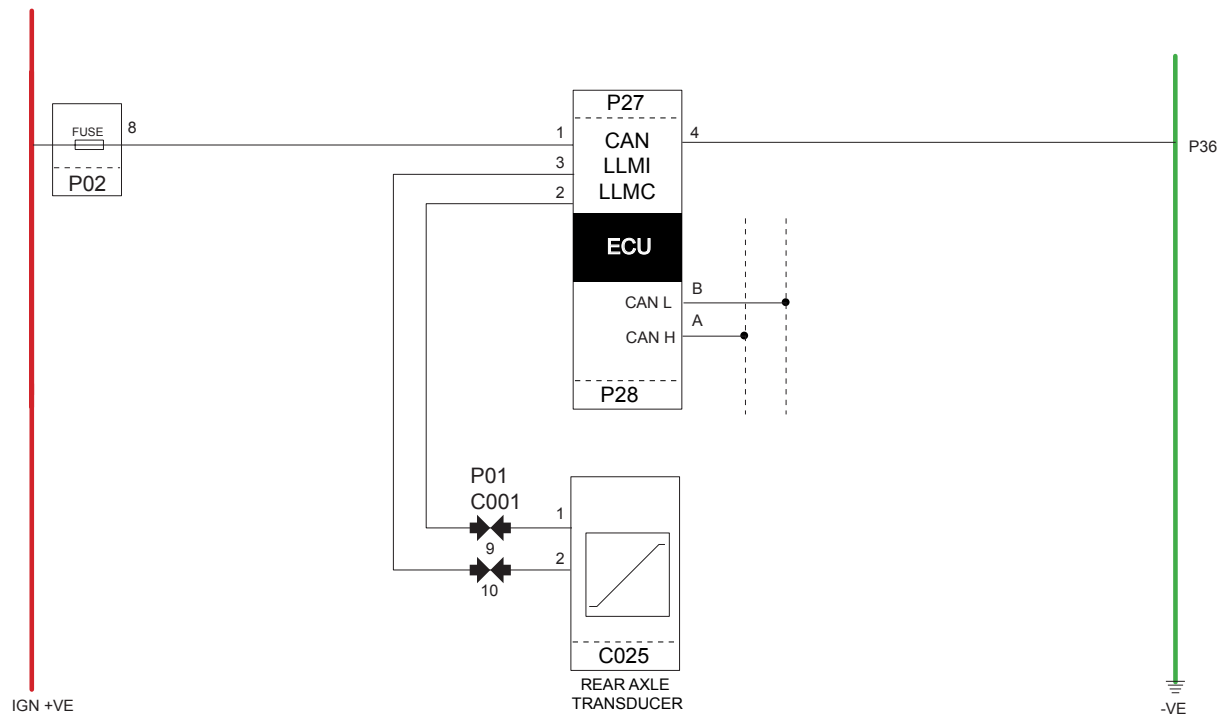
is connected to the unit when the ignition is set to ON (P27, pin 1).

The LLMI unit must be calibrated for correct operation of the LLMI system.

Transducer C025 is powered from the LLMI unit (C025, pin 1).

Output from the transducer (C025, pin 2) is processed by the LLMI unit. The unit drives its warning LEDs and audible warning depending on the value of the calculated longitudinal load moment.

The LLMI unit is CAN enabled. The calculated longitudinal load moment is transmitted on the CANbus via connector P28.



C093910-C1

Fig 9. Electrical Schematic - LLMI System

LLMC System

The LLMC system operates when the boom is moved from the fully retracted position, or when the boom is raised above a specific angle. The angle varies according to the designated country of the machine.

- Australia/New Zealand - the LLMC is operative at boom angles greater than 10°.
- Rest of the World - the LLMC is operative at boom angles greater than 45°.

Important: If installing a new Hydraulic control ECU or LMS ECU make sure to check that the machine is set-up correctly for the country of use in the Servicemaster LMS setup tool.

⇒ Electrical Schematic - LLMC System (□ B4-13)	
Key	
C023	Inclinometer - boom mounted
C037	Earth
C045	Boom extend/retract proximity switch
C046	Transmission ECU - connector J1
C047	Transmission ECU - connector J2
C048	Hydraulic control ECU - connector J1
C049	Hydraulic control ECU - connector J2
C052	Inclinometer - chassis mounted
P28	LLMI unit - CAN enabled
T001/C006	Chassis Harness to Transmission Harness Connector
T006	Transmission speed sensor
V001/C003	Chassis Harness to Valve Block Harness Connector
V010	Hydraulic Isolation Dump Solenoid

Inputs

Longitudinal Load Moment The LLMI unit P28 operates in the normal way. The LLMI unit is CAN enabled. The calculated longitudinal load moment is transmitted on the CANbus. ⇒ [LLMI System \(□ B4-11\)](#)

Since the hydraulic control ECU is also CAN enabled it is able to process the longitudinal load moment value.

Boom Retracted/Extended Proximity switch C045 changes state when the boom is fully retracted. Hydraulic control ECU detects the switch state.

Machine Stationary/Travelling The signal from transmission speed sensor T006 is used by the hydraulic control ECU to determine when the machine is travelling and when the machine is stationary.

Boom Angle The outputs from chassis and boom angle electric inclinometers C052 and C023 change as the boom and chassis angles change in the longitudinal plane. The output signals are used by the hydraulic control ECU to calculate the boom elevation angle in relation to the chassis.

Outputs

The hydraulic control ECU responds to the motion control input devices. Outputs from the ECU control the proportional solenoids on the main control valve. As the machine gets closer to its stability limit the hydraulic services operate at proportionally reduced speed and ultimately stop.

Hydraulic Shut Off The hydraulic control ECU monitors the machine status. If the status is not as expected (e.g. the boom angle rate of change is not as expected for the load moment or control inputs), it is assumed that there is a hydraulic system fault. The ECU isolates the main hydraulic system by energising the dump solenoid valve V010.

Boom Retract Damping

When the boom is being retracted the Hydraulic Control ECU reduces the flow to the retract proportional solenoid just before the boom reaches the fully retracted position. This dampens the shock of the boom being fully retracted.

Important: If installing a new Hydraulic control ECU or LMS ECU make sure to check that this option is selected when fitted.

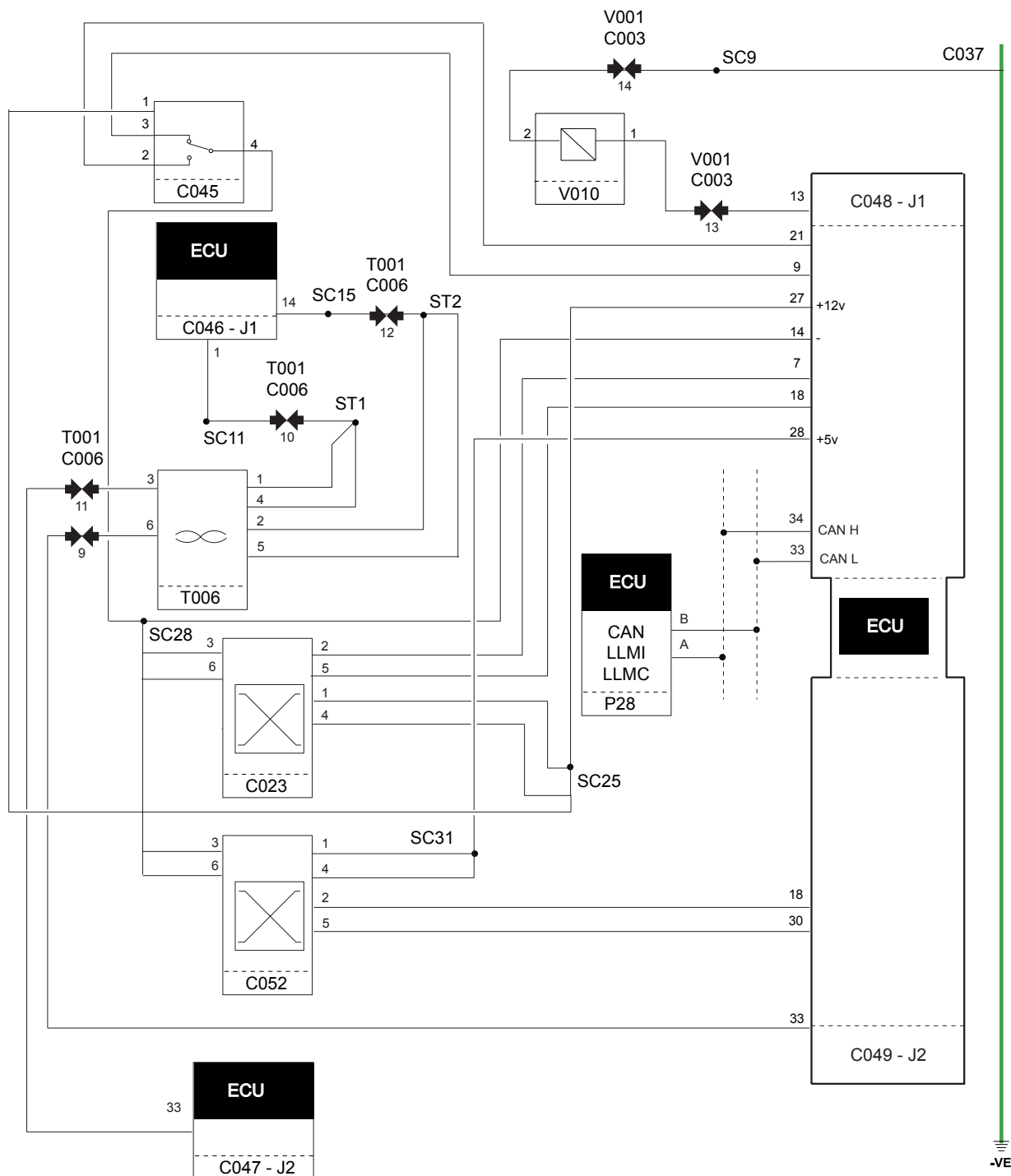


Fig 10. Electrical Schematic - LLMC System

C093920-C1

LLMI - Calibration

The display unit must be calibrated by setting the tip point and machine calibration point.

The tip point is the point at which the machine starts to tip forward due to the load moment.

The machine calibration point is a function of the machine chassis and boom type.

Storing the tip and calibration values in the LLM unit memory enables the unit to drive the LLMI LED warning display using the correct load moment data.

Important: *A new LLMI unit is not calibrated. After installation of a new unit do the calibration procedure.*

Note: *The LLMI system must be correctly calibrated for the LLMC system (if fitted) to function correctly.*

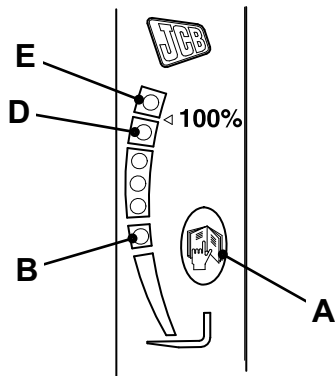


Fig 11.

C093810-C4

WARNING

During the following procedure, do not raise the load more than 600 mm above ground level otherwise the machine may be able to tip forward at a dangerous angle. Keep all personnel clear of the front and rear of the machine.

ELEC-4-1

- 1 Park the machine on firm level ground with the wheels in the straight ahead position.

Note: If the following actions are not completed within a five minute period, the display unit will automatically leave the 'Calibration Mode' and the memory will revert to the previous settings. If there is a system fault the unit will indicate the appropriate fault code. The calibration procedure cannot continue until the fault is rectified.

- 2 Set the display unit to 'Calibration Mode'.
 - a Turn the starter key to the OFF position. Press and hold button **A**
 - b Start the engine with button **A** held down. All the display LEDs will illuminate. Keep the button held down for approximately 30 seconds. After approximately 15 seconds a 'Stop Now' warning will display on the instrument panel, this does not indicate a fault. Continue holding the button until the display shows the red LED **E** only. The alarm will emit short intermittent bleeps.

Note: If the button is released too soon, the process must be repeated.

- c Release button **A**.

- 3 With the boom fully retracted, pick up a load weighing 2700 kg. Use either pallet forks loaded with a test weight or a bucket filled with a high density material.
- 4 Tilt the forks or bucket back to retain the load.
- 5 Make sure that the machine is standing level with the wheels in the straight ahead position.
- 6 Slowly extend the boom, keeping the load close to the ground, until the machine is balanced about the front axle with the rear wheels off the ground.
- 7 Press and release button **A**. The display will then change to show the red LED **E** and amber LED **D**. The setting of the tip point value is now complete.
- 8 Remove the load. Remove the forks or attachment as applicable. Leave the Q-fit attached.
- 9 Retract the boom and position it so that the top of the boom structure is horizontal.

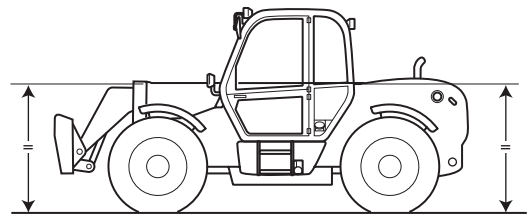


Fig 12.

C093850

- 10 Press and release the button **A**. The display unit will revert to normal operation. The setting of calibration point is now complete and the LLMI unit is calibrated.

Note: The calibration procedure causes the system to log a fault code (L071). This does not indicate a system fault. If necessary use JCB Servicemaster to clear the code from the fault code log.

Fault Finding

LLMI Fault Codes

When the system detects a fault, the audible alarm will sound and various combinations of LEDs on the display unit will illuminate to indicate a fault code for approximately 10 seconds.

The audible alarm and fault code cancel after 10 seconds, all the LEDs on the display unit will then flash continuously as long as the fault remains. To show the fault code for a further 10 seconds, press and release button **E**.

When the fault clears, the display will return to normal.

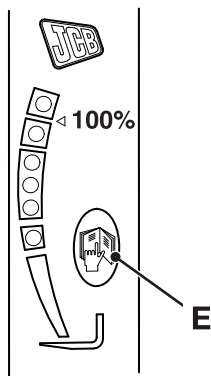
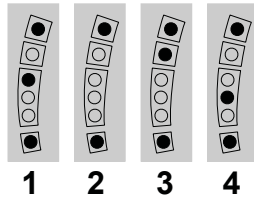


Fig 13.

C093810-C2

If fault codes are displayed, turn the Ignition key switch to OFF and then ON again. If the fault does not clear refer to the fault finding tables. → [LLMI Fault Finding \(B4-18\)](#)

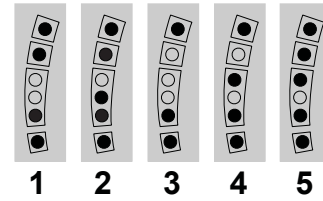
Fault Codes - Calibration Faults



C093940-C1

1	No calibration
2	Tip point invalid
3	Calibration point invalid
4	Calibration error
	Fault finding table. ⇒ Table 2. Calibration faults (B4-18)

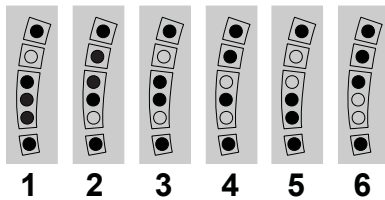
Fault Codes - LLM External Faults



C093940-C3

1	CAN Bus error
2	Mode data error (LLMC only)
3	Axle transducer out of range
4	Battery voltage at unit low
5	Battery voltage at unit high
	Fault finding table. ⇒ Table 4. External faults (B4-18)

Fault Codes - LLM Unit Faults



C093940-C2

1-6	LLM unit internal faults
	Fault finding table. ⇒ Table 3. Indicator display unit faults (B4-18)

LLMI Fault Finding

The fault finding procedures are given in the form of tables. The tables are designed to identify possible causes by performing checks and where applicable, specific tests on the system.

⇒ [Table 2. Calibration faults \(□ B4-18\)](#)

⇒ [Table 3. Indicator display unit faults \(□ B4-18\)](#)

⇒ [Table 4. External faults \(□ B4-18\)](#)

⇒ [Table 5. Sequential fault finding \(□ B4-19\)](#)

Table 2. Calibration faults

Possible Cause	Remedy
System not calibrated or not calibrated correctly.	Calibrate the system. ⇒ LLMI - Calibration (□ B4-14)
Transducer not connected.	Check transducer wires connection.
Transducer not fixed down correctly.	– Check mounting surfaces are clean and flat. Check mounting bolts are not bottoming-out. – Check tightness of transducer mounting bolts. ⇒ LMI Axle Transducer (□ B17-1)
Faulty harness.	Check for trapped or damaged wires.
Faulty transducer.	Check for water ingress. Replace transducer and re-calibrate the system.

Table 3. Indicator display unit faults

Possible Cause	Remedy
The display unit has detected an internal error.	Turn the Ignition key switch OFF and then ON again. Replace the display unit if the fault does not clear. Calibrate the system.

Table 4. External faults

Possible Cause	Remedy
Blown fuse.	Check fuses.
Display unit not receiving 12V supply.	Do 12V Supply and Fuse Test (V1) , ⇒ LLMI Tests (□ B4-22)
Battery voltage too low.	Check battery voltage. Do 12V Supply and Fuse Test (V1) , ⇒ LLMI Tests (□ B4-22)
Battery voltage too high.	Check battery voltage. Do 12V Supply and Fuse Test (V1) , ⇒ LLMI Tests (□ B4-22)
Axle transducer signal out of range.	– Check mounting surfaces are clean and flat. Check mounting bolts are not bottoming-out. – Check tightness of transducer mounting bolts. ⇒ LMI Axle Transducer (□ B17-1) – Check transducer wires connection. – Do Transducer Output test (V3). ⇒ LLMI Tests (□ B4-22)
CAN Bus fault.	Use Service Master to check fault code log for applicable CAN fault codes.

Table 5. Sequential fault finding

Action	Yes	No
1 Do 12V Supply and Fuse Test (V1) and record voltage, ⇒ LLMI Tests (□ B4-22) . 12V Supply OK?	Go to 2	Go to 3
2 Is the transducer 12V supply OK?	Go to 4	Go to 5
3 Check Ignition ON, fuse condition, battery condition, test box connections. Repair as required. OK now?	Done	Go to 2
4 Is the display unit OK?	Go to 6	Go to 7
5 Do Transducer 12V Supply Test (V2) and record voltage, ⇒ LLMI Tests (□ B4-22) . OK now?	Done	Check Ignition ON, fuse condition, battery condition, test box connections. Repair as required.
6 Are the transducer output signals OK?	Go to 8	Go to 9
7 Do Display Unit Functional Test and re-calibrate, ⇒ LLMI Tests (□ B4-22) . OK now?	Done	Replace display box.
8 Can the display unit be re-calibrated?	Go to 10	Go to 11
9 Do Transducer Output Test (V3) and Transducer Output Test (V4) , ⇒ LLMI Tests (□ B4-22) . OK now?	Done	Go to 12
10 Has frequent re-calibration been required?	Possible transducer slipping. Remove the transducer, clean surfaces and re-torque bolts. ⇒ LMI Axle Transducer (□ B17-1)	
11 Do Transducer Output Test (V3) and Transducer Output Test (V4) , ⇒ LLMI Tests (□ B4-22) . OK now?	Replace display unit.	Go to 13
12 Do Harness Wiring Continuity and Short Circuit Tests and repair as required. ⇒ LLMI Tests (□ B4-22) . OK now?	Done	Check for uneven mounting surfaces or bolt not tightened correctly. ⇒ LMI Axle Transducer (□ B17-1)
13 Check transducer fixed securely. OK now?	Suspect faulty transducer.	Possible transducer slipping. Remove the transducer, clean surfaces and re-torque bolts.

LLMC Fault Codes

The machine will log some system faults as an error code. These error codes can be accessed with the correct diagnostics software tool, using a laptop computer connected to the machine CAN system.

For the fault code descriptions refer to **Section M - Fault Code SYSTEM**. ➔ [Related Topics \(B4-2\)](#)

To access the fault codes and diagnostic software use the Servicemaster program. Refer to **Section M - Servicemaster System** and **Section M - Servicemaster tools**. ➔ [Related Topics \(B4-2\)](#)

LLMC Fault Finding Tables

Note: Before fault finding the LLMC system check for LLMI faults → [LLMI Fault Finding \(B4-18\)](#)

This system has a diagnostics page in **JCB Servicemaster**. Use of Servicemaster is the preferred

method for fault finding electrical or electronic faults.
→ [Related Topics \(B4-2\)](#)

The fault finding procedures are given in the form of tables. The tables are designed to identify possible causes by performing checks and where applicable, specific tests on the system.

Table 6. Boom back sensor signal fault

Possible Cause	Remedy
Transducer not mounted correctly	Rectify loose or missing fixings
Transducer not connected.	Check transducer connection.
Faulty harness.	Check for trapped or damaged wires.
Faulty transducer.	Check for water ingress. Replace transducer.

Table 7. Chassis inclinometer signal fault

Possible Cause	Remedy
Transducer not mounted correctly	Rectify loose or missing fixings
Transducer not connected.	Check transducer connection.
Faulty harness.	Check for trapped or damaged wires.
Faulty transducer.	Check for water ingress. Replace transducer.

Table 8. Boom inclinometer signal fault

Possible Cause	Remedy
Transducer not mounted correctly	Rectify loose or missing fixings
Transducer not connected.	Check transducer connection.
Faulty harness.	Check for trapped or damaged wires.
Faulty transducer.	Check for water ingress. Replace transducer.

Table 9. Transmission Speed sensor signal fault

Possible Cause	Remedy
Transducer not mounted correctly	Rectify loose or missing fixings
Transducer not connected.	Check transducer connection.
Faulty harness.	Check for trapped or damaged wires.
Faulty transducer.	Check for water ingress. Replace transducer.

LLMI Tests

LLMI Self Test Function

The LLMI unit has a self test function. Perform the test as follows:

- 1 Park the machine (unloaded) on level ground with the engine running. Apply the park brake and place the forward/reverse lever in the neutral position.
- 2 The green LED **D** at the bottom of the display illuminates to show that the indicator is receiving power.
- 3 Press the display button **E** and release.
- 4 All LEDs on the indicator flash and the audible alarm sounds if the unit is functioning correctly.

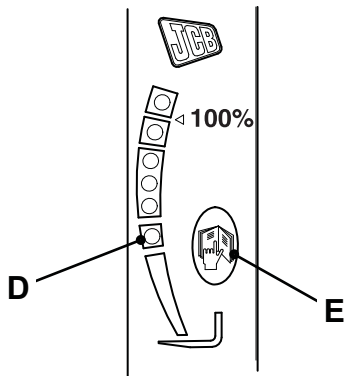


Fig 14.

C093810-C1

If the unit is faulty replace it with a new one.

LLMI Diagnostic Tests

Before doing the diagnostic tests do the LLMI unit self test and calibration procedures.

⇒ [LLMI Self Test Function \(B4-22\)](#)

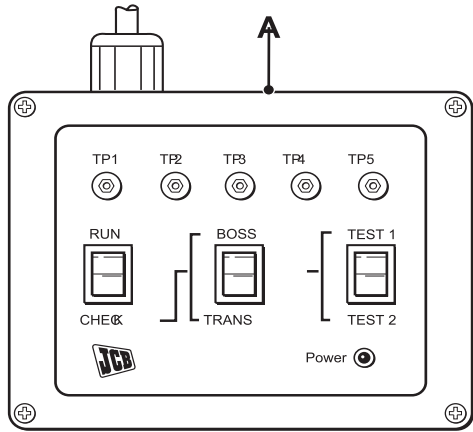
⇒ [LLMI - Calibration \(B4-14\)](#)

If the calibration and self test procedures fail to rectify a fault, there are two main areas where faults can occur:

- Axle transducer
- Machine electrical harness

LMI Test Box

The service engineer can use either the LMI Test Box **A** or a suitably calibrated multimeter to diagnose faults in the system down to component level. → [Related Topics](#) ([B4-2](#))



244691-C2

244691-C2

Fig 15.

The test box has five test points, TP1 to TP5 which allow current signals (mA) in the circuit to be read as voltages by connecting a digital multimeter. The test points also allow continuity and open/short circuit tests to be made.

Table 10. Test Box Test Points

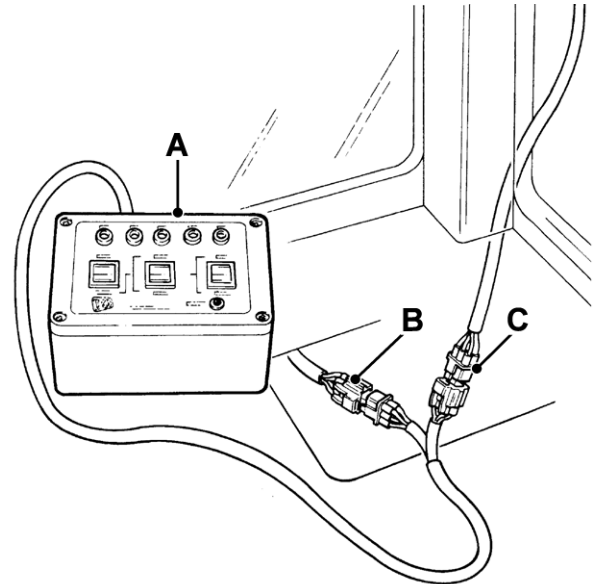
Test Point	Function
TP1 ⁽¹⁾	Earth
TP2	Display box 12V supply
TP3	Transducer 12V supply
TP4 ⁽²⁾	Transducer output (Signal)
TP5 ⁽³⁾	Transducer output (voltage)

- (1) The black lead of the multimeter should be connected to TP1 (earth) when measuring voltages.
- (2) Measures the current signal in the transducer return wire and converts this to a voltage which can be read by the multimeter.
- (3) Is a direct connection to the transducer return wire.

The test box also has three switches, TEST 1/TEST 2, TRANS/BOSS, RUN/CHECK to change settings for the various tests.

The test box is connected between the four-pin plug and socket, which connect the display box to the machine wiring harness behind the instrument panel in the cab.

- 1 Remove the instrument panel and connect test box **A** to harness connectors **B** and **C** as shown.



764180-C2

Fig 16.

- 2 Before carrying out the tests make sure that:
 - a The machine is on level ground with the boom horizontal.
 - b The forks are fitted, with no load.
 - c The boom is fully retracted.
 - d Two-wheel drive is engaged (if fitted) and the machine has been driven backwards and forwards several times with the wheels in the straight ahead position.
 - e The ignition key switch is ON, but the engine is not running.

Important: The testing procedures described in this section should be carried out on level ground with the road wheels in the straight ahead position. The indicator display box will be affected by extreme steer lock and axle angles.

12V Supply and Fuse Test (V1)

- 1 Set the test box switches to RUN / TRANS / TEST 1, then measure the voltage between test points TP1 and TP2.

Expected reading: Battery voltage 11.0V to 15.0V

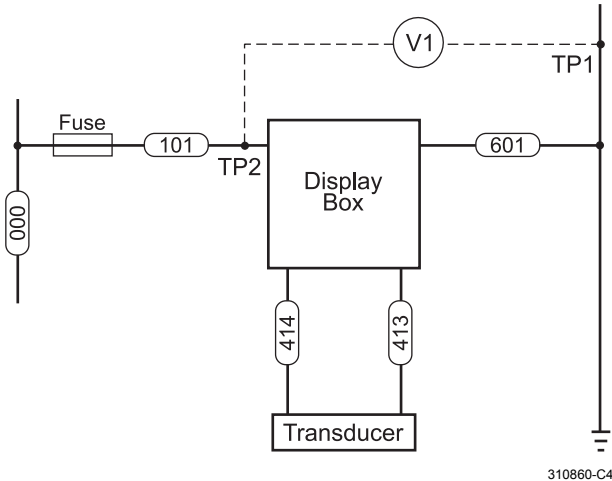


Fig 17. Display Box Supply Test (V1)

If the test box is not available, measure the voltage between the feed wire to the display box (TP2) and earth (TP1).

- 2 If the expected reading is not obtained, check that the ignition key switch is ON. Check the condition of the fuse, and the battery. Check the wiring harness connections. Rectify as required.

For details of the wiring harness and connections, see **Electrical Connections**.

Transducer 12V Supply Test (V2)

- 1 Set the test box switches to RUN / TRANS / TEST 1, then measure the voltage between test points TP1 and TP3.

Expected reading: Battery voltage 11.0V to 15.0V

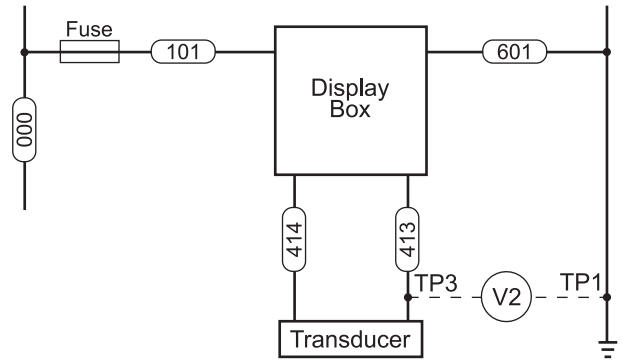


Fig 18. Transducer Supply Test (V2)

If the test box is not available, measure the voltage between the feed wire to the transducer (TP3) and earth (TP1).

- 2 If the expected reading is not obtained, check that the ignition key switch is ON. Check the condition of the fuse, and the battery. Check the wiring harness connections. Rectify as required.

If the expected reading is still not obtained after completing the above checks, the display box should be renewed.

Transducer Output Test (V3) - with Transducer Fitted to the Axle

- 1 Set the test box switches to RUN / TRANS / TEST 1, then measure the voltage between TP1 and TP4.

Expected reading: 4.3V to 4.7V

Important: This voltage cannot be measured using a voltmeter directly on the wiring. This voltage can only be measured via the test box.

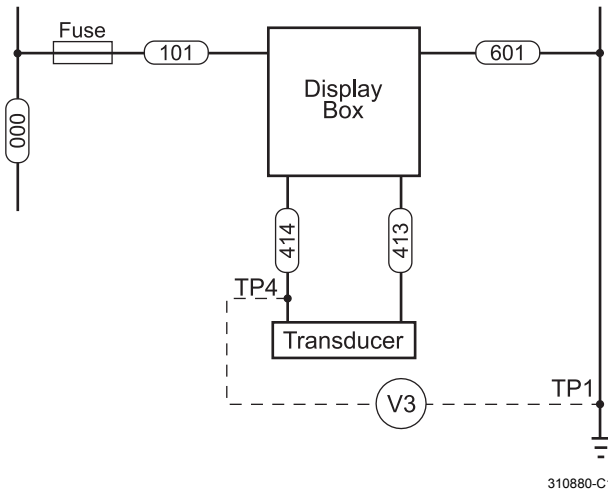


Fig 19. Transducer Output Test (V3)

If the test box is not available, use a good quality multimeter capable of reading milliamps (mA) to measure the current in wire no. 414 as shown below.

The expected reading should be 45 to 55 mA.

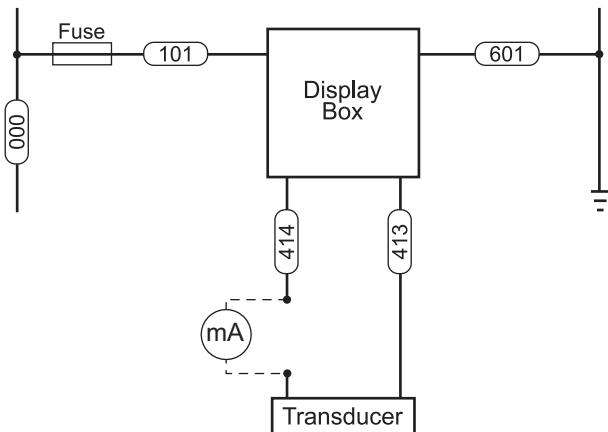


Fig 20.

- 2 If the expected reading is not obtained, one of the following faults is most likely:

a Poor earth connection.

b Poor feed connection.

c Poor installation of transducer.

If the wiring is suspected, check for possible harness faults, [⇒ Harness Wiring Continuity and Short Circuit Test \(B4-27\)](#).

If a transducer fault or incorrect transducer mounting is suspected, test the transducer output with the transducer removed from the axle. [⇒ Transducer Output Test \(V4\) - with Transducer Removed from the Axle \(B4-28\)](#).

Harness Wiring Continuity and Short Circuit Test

- 1 Disconnect the display box harness **C** from the test box, but leave the test box connected to the machine wiring harness **B**.

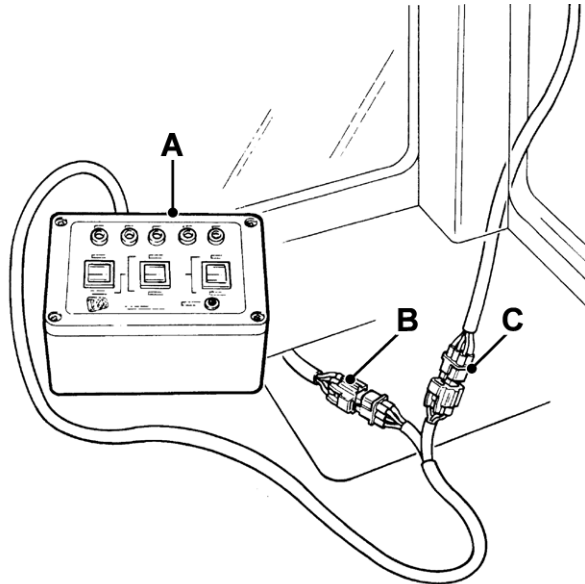


Fig 21.

764180-C2

- 2 Disconnect the transducer harness from the machine wiring harness **M**.

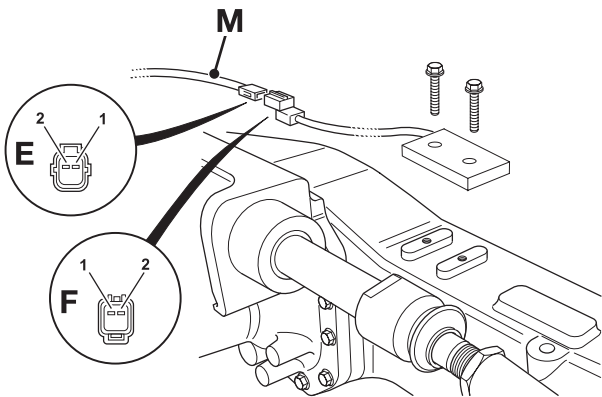


Fig 22.

C023470

- 3 Set the test box switches to CHECK / TRANS / TEST 1. Turn OFF the ignition switch and check for continuity between the following points on the test box

and the two pin connector **E** that was connected to the transducer.

Continuity Test: Switch the multimeter to the Ohms scale and measure the electrical resistance between:

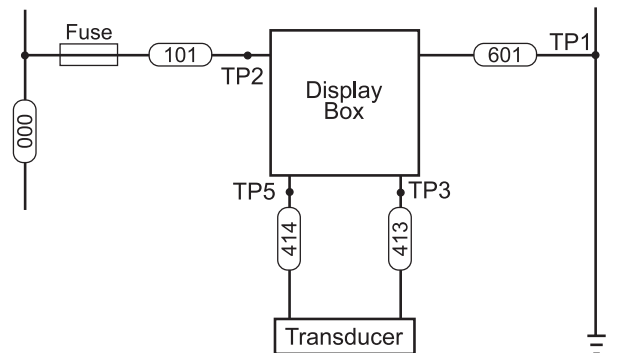
- Test point TP3 and pin 2 of connector **E**.
- Test point TP5 and pin 1 of connector **E**.

Expected reading: Less than 3 ohms.

Short Circuit Test: Measure the electrical resistance between:

- Test points TP1 and TP5
- Test points TP3 and TP5
- Test points TP1 and TP3

Expected reading: Open Circuit.



310860-C3

Fig 23. Harness Continuity and Short Circuit Tests

If the test box is not available, disconnect the display box harness from the machine wiring harness, turn OFF the ignition switch and using a multimeter check for continuity or short circuits in the harness wiring between the display box and transducer electrical connectors.

- 4 If the expected readings are not obtained, check for damaged wiring and faulty connections.

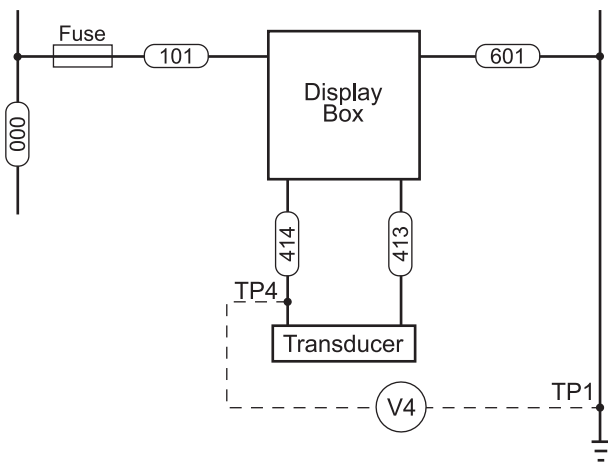
If the expected readings are obtained, but the expected voltage reading from **Transducer Output Test (V3)** is not achieved, test the transducer output with the transducer removed from the axle.
[⇒ Transducer Output Test \(V4\) - with Transducer Removed from the Axle \(B4-28\)](#)

Transducer Output Test (V4) - with Transducer Removed from the Axle

- 1 Remove the transducer from the axle, reconnect to the machine wiring harness and support the transducer under the machine.
- 2 Set the test box switches to RUN / TRANS / TEST 1, then measure the voltage between TP1 and TP4.

Expected reading: 4.48V to 4.52V

Important: This voltage cannot be measured using a voltmeter directly on the wiring. This voltage can only be measured via the test box. → [Related Topics \(B4-2\)](#)

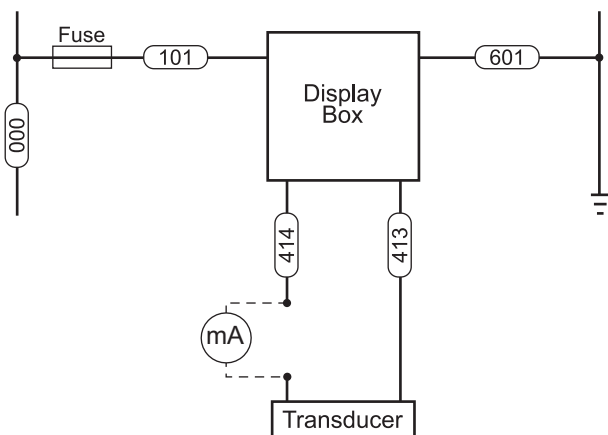


310890-C1

Fig 24. Transducer Output Test (V4)

If the test box is not available, use a good quality multimeter capable of reading milliamps (mA) to measure the current in wire no. 414 as shown below.

The expected reading should be 47 to 53 mA.



C093430

Fig 25.

- 3 If the transducer is not distorted, then the voltage V4 should be between 4.48V and 4.52V. If it is outside this range, but within 4.40V to 4.60V, the transducer may still be serviceable, providing the result of **Transducer Output Test (V3)** is satisfactory.

If the transducer passes this test, having failed **Transducer Output Test (V3)**, the apparent failure may be due to uneven transducer mounting.

- a Check mounting surfaces are clean, flat and free from paint and rust etc.
- b Refit the transducer to the axle and torque tighten the fixing screws. → [LMI Axle Transducer \(B17-1\)](#)



Test Results

The following table may be used to record the values and must be submitted in the event of a warranty claim. If applicable, any warranty parts must also be returned with any additional information such as: which lights are not illuminating, or if the display box function test is not successful.

Table 11. Test Results

Test	Expected:	Actual:
Supply and Fuse Test (V1)	11.0 to 15.0V	
Transducer Supply Test (V2)	11.0 to 15.0V	
Transducer Output Test (V3)	4.3 to 4.7V	
	45 to 55 mA	
Transducer Output Test (V4)	4.48V to 4.52V	
	47 to 53 mA	

Note: When returning equipment under warranty, the results of the above tests **MUST** be stated.

Important: The system must always be re-calibrated after performing the above tests, and before operating the machine. ➔ [LLMI - Calibration \(B4-14\)](#)

LLMC Tests

LLMC Functional Check

Do the LLMI unit self test procedure. → [LLMI Self Test Function](#) ([B4-22](#))

Park the machine (unloaded) on level ground with the engine running. Fully retract and lower the boom. The symbol **H** should illuminate. Do the test procedures in the table in the sequence shown.

Test	Operation	Result
1 ⁽¹⁾	Raise the boom above 10°.	Symbol H = OFF Symbol F = ON
2	Partly raise and extend the boom.	Symbol H = OFF Symbol F = ON
3	Drive the machine forwards.	Symbol F = OFF Symbol H = ON
4	Stop the machine.	Symbol F = ON Symbol H = OFF
5	Press and release button E . When the LLMI LEDs flash, operate boom lower.	The boom should not lower.
6	Press and release button E . When the LLMI LEDs flash, operate boom extend.	The boom should not extend.
7	Press and release button E . When the LLMI LEDs flash, operate boom raise.	The boom should raise.
8	Press and release button E . When the LLMI LEDs flash, operate boom retract.	The boom should retract.

(1) *Australia and New Zealand only.*

If the machine does not operate correctly use Servicemaster to read the fault code log. Investigate related fault codes.

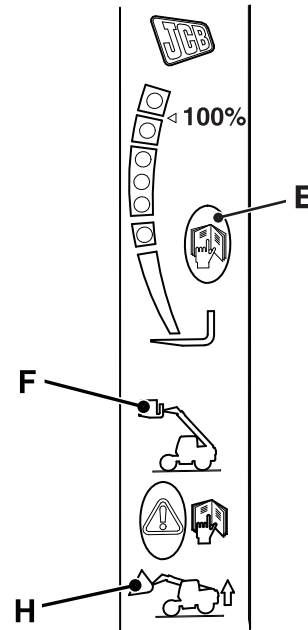


Fig 26.

C093820-C8

Cab

Introduction

This topic contains information about a machine DEVICE. Make sure you are referring to the correct device. Refer to the applications table.

Descriptions and procedures relate to the device and not related systems. For information about the systems refer to the relevant topics.

[⇒ Related Topics \(B5-2\)](#)

[⇒ Removal and Replacement \(B5-4\)](#)

[⇒ Roller Blind \(B5-4\)](#)

[⇒ Roof Liner \(B5-5\)](#)

[⇒ Instrument Panels \(B5-7\)](#)

[⇒ Door Handle \(B5-9\)](#)

[⇒ Door \(B5-10\)](#)

[⇒ Screen Guard \(B5-11\)](#)

[⇒ Roof Guard \(B5-12\)](#)

[⇒ Wiper Motor Front \(B5-13\)](#)

[⇒ Wiper Motor Rear \(B5-14\)](#)

[⇒ Wiper Motor Roof \(B5-15\)](#)

[⇒ Cab \(B5-16\)](#)

Related Topics

Table 1. Related Topics in This Publication

The table lists other topics in the manual that contain information related to this topic. Refer to the applicable topics to complete your procedures. Where applicable the text in this section contains cross references to this page to help you find the correct information. Some machines have different systems and devices. Make sure you refer to the correct topic, refer to **Section 1 - Applications**.

Sections	Topic Titles	Sub Titles
1	Applications	ALL
1	Service Tools	ALL
2	ALL (Care and Safety) ⁽¹⁾	ALL
3	ROPS/FOPS (and OECD) Structure	Checking the ROPS/FOPS (and OECD) Structure
3	Engine	Checking the Coolant Level
3	Access Panels	ALL
B	⇒ Cab Air Conditioning SYSTEM (B3-1)	⇒ Refrigerant Charging and Discharging (B3-25)
E	Section E - Control Lever - Electro Servo	Removal and Replacement
G	Single Axle Service Brakes SYSTEM	Bleeding
G	External Parkbrake Brake SYSTEM	Adjustment
H	Steer Mode Valve	Removal and Replacement
K	Throttle Cable	Removal and Replacement
K	Hand Throttle	Adjustment

(1) You must obey all of the relevant care and safety procedures.

Table 2. Service Tools

The table lists the service tools you will need to do some of the procedures in this topic. Make sure you have the correct service tools BEFORE you start the procedures

Tool Part Number	Description
892/00843 ⁽¹⁾	Glass Stand
892/00842 ⁽¹⁾	Glass Lifters
892/00845 ⁽¹⁾	Cartridge Gun
892/00847 ⁽¹⁾	Nylon Spatula
992/12300 ⁽¹⁾	Mobile Oven 12V
992/12400 ⁽¹⁾	Static Oven 240V
992/12600 ⁽¹⁾	Static Oven 240V
4104/1310 ⁽¹⁾	Hand Cleaner
926/15500 ⁽¹⁾	Rubber Spacer Blocks
992/12800 ⁽¹⁾	Cut-Out Knife
992/12801 ⁽¹⁾	`L' Blades
892/00846 ⁽¹⁾	Glass Extractor (Handles)



Section B5 - Body and Framework Cab

Related Topics

The table lists the service tools you will need to do some of the procedures in this topic. Make sure you have the correct service tools BEFORE you start the procedures

Tool Part Number	Description
892/00848 ⁽¹⁾	Wire Starter
892/00849 ⁽¹⁾	Braided Cutting Wire

(1) Tool available from JCB Service, refer to Section 1 - Service Tools

Removal and Replacement

Roller Blind

Removal and Replacement

Removal

- 1 Ensure both blinds are fully retracted.
- 2 Remove all four trim panel screws **A** and detach the trim panel **B** to gain access to the blind assembly **C**.

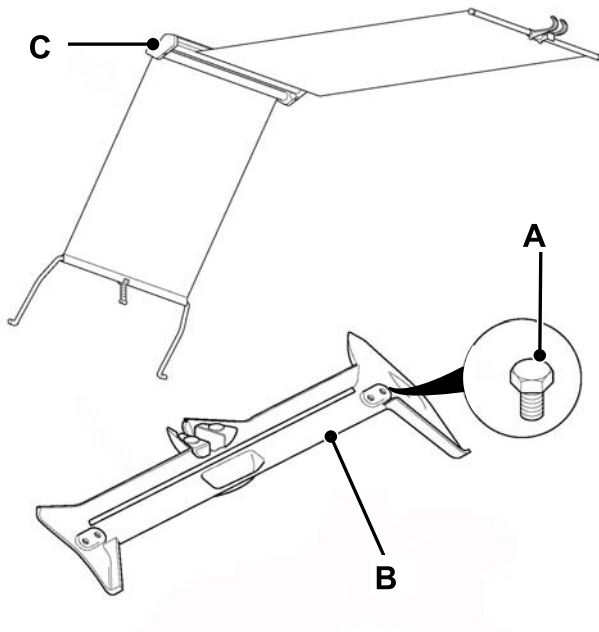


Fig 1.

C046870-C2

Replacement

Replacement is the opposite of the removal procedure.

Roof Liner

Removal and Replacement

Note: Take care during the removal and replacement procedure. Make sure your hands and clothes are clean. The roof liner is easily damaged.

Removal

- 1 With the aid of one more person hold the roof liner **B** and remove the screws **A**.
- 2 Lower the liner to get access to the electrical connectors at the interior lights **C** and audio speakers **D**.

Note: Not all machines have audio speakers.

- 3 Disconnect the electrical connectors at the interior lights and audio speakers.
- 4 Remove the roof liner.

Note: Put the roof liner into a clean plastic bag and keep it in a safe place. The roof liner is easily damaged.

Replacement

Replacement is the opposite of the removal procedure.

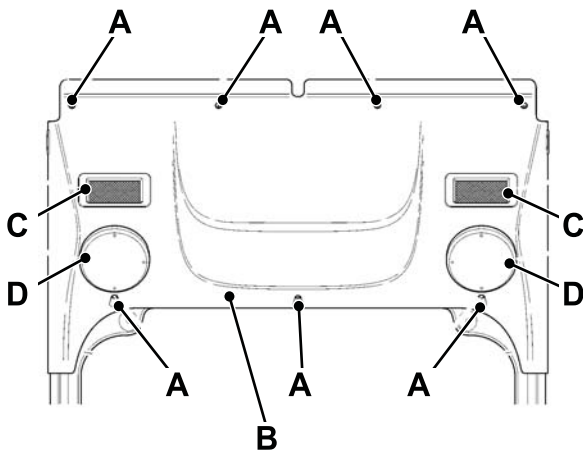


Fig 2.

C048100

Floor Mat

Removal and Replacement

Removal

- 1 Remove the nuts **B** and remove the pedal pads **A** from the machine.
- 2 Remove the bolts **E** and retaining plate **F**.
- 3 Remove the screws **D** and kick strips **C**.
- 4 Remove the trim retainers **G** from the front section of the mat.
- 5 Remove the mat from the machine.

Replacement

Replacement is the opposite of the removal procedure.

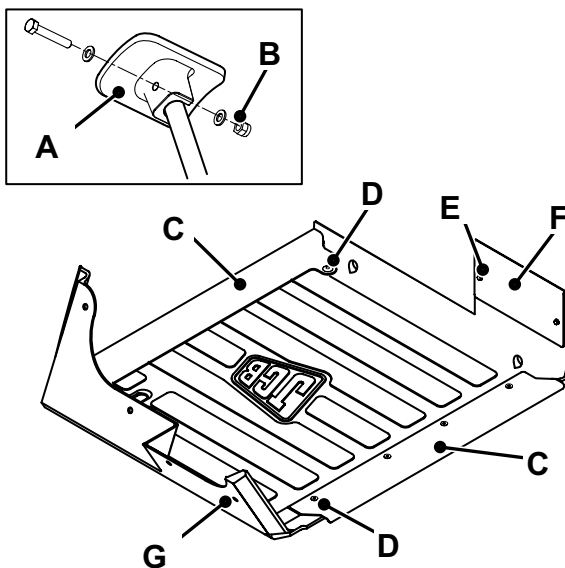


Fig 3.

C097170-C1

Instrument Panels

Removal

- 1 Remove the steering wheel. → [Fig 4.](#) ([B5-7](#)).

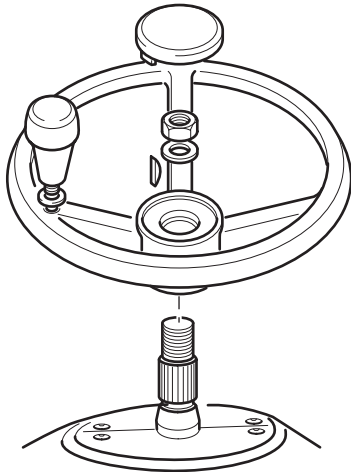


Fig 4.

770320

- 2 Remove the two button head screws **A**, remove the steering column lower surround.

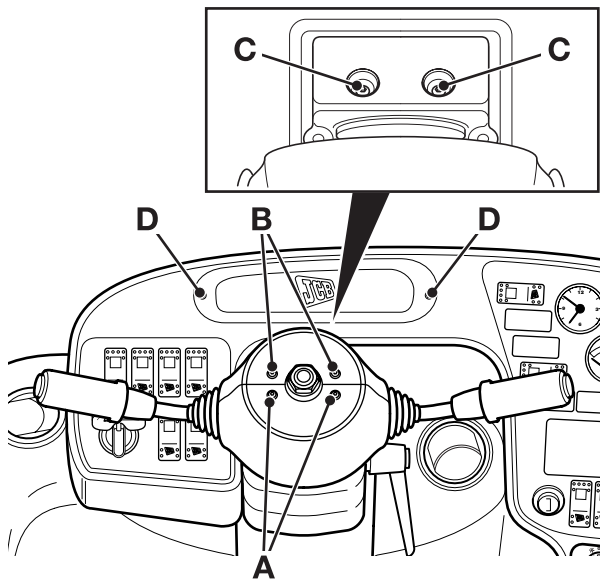


Fig 5.

445611-1

- 3 Remove the two button head screws **B** and two screws **C**, remove the steering column upper surround.

- 4 Remove the two Allen key head screws **D** that hold the warning display unit, unplug and remove the unit.

Note: Do not touch the electrical connector pins on electronic type LCD displays. Put protective caps on the harness connector and the connector on the display.

- 5 Remove the two screws **E** that hold the steer Mode Select (SMS) switch panel in place, disconnect all connections and remove the panel.

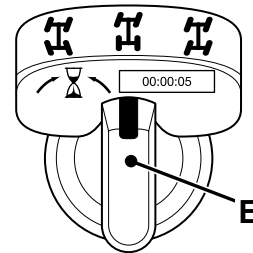


Fig 6.

432710-C2

- 6 Remove the two screws **F** that hold the heater control panel in place, disconnect all connection and remove the panel.

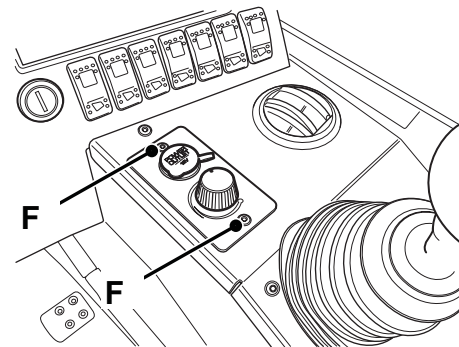


Fig 7.

T016820-1-C2

- 7 Remove the radio **J** (if fitted).

- 8 Remove the three screws **G** that hold the main switch and instrument panel in place, disconnect all connections and remove the panel.

Note: Do not touch the electrical connector pins on electronic type instruments **H**. Put protective caps on the harness connectors and the connectors on the instruments.

- 9 Remove screws **M**, **P**, **R**, **S** and remove the upper right hand panel **R**, carefully feeding the harness through the aperture.

Note: Screw item **R** is removed from the front of the panel, i.e. the opposite side to that shown.

- 10 Remove screws **K**, **L**, **T**. Remove the lower left hand panel **U**.

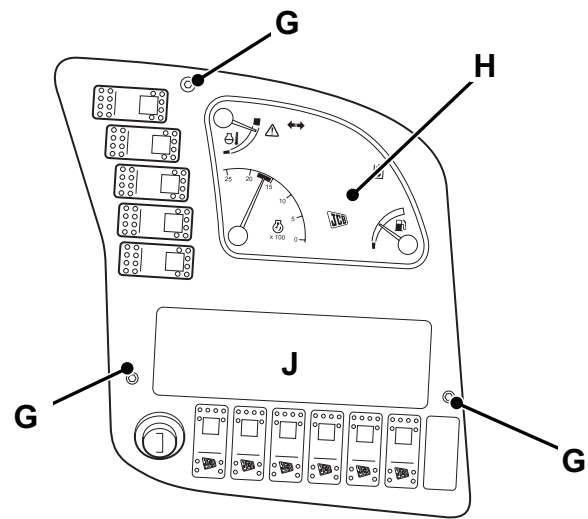


Fig 8.

432710-C4

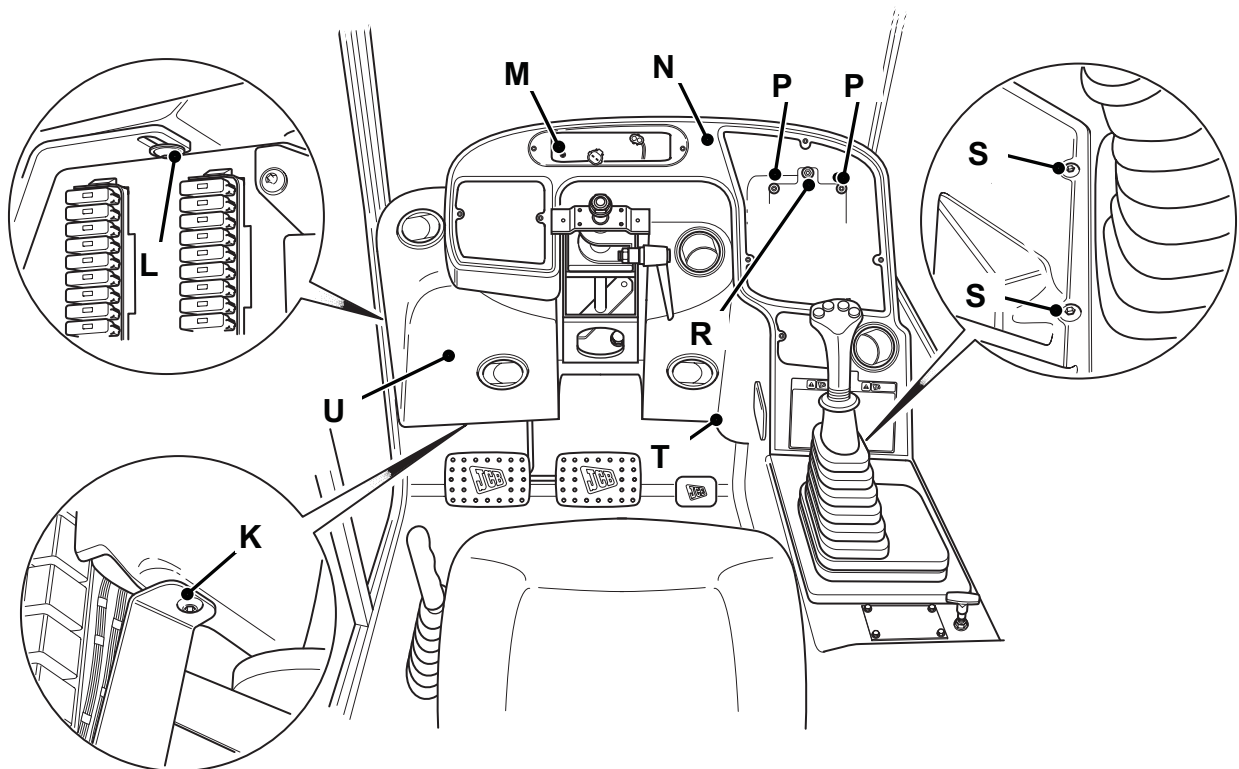


Fig 9.

C011960-C1

Door Handle

Removal

- 1 Support the outer handle unit **D**.
- 2 Remove screws **E** from the inside of the door and lift away the cover plate **F**.
- 3 Disconnect the latch assembly from the handle lever **C**.
- 4 Slightly tilt the handle unit **D** to unhook the unit from the door assembly. Retain gasket **A** and trim plate **B**.

Replacement

Replacement is the opposite of the removal procedure.

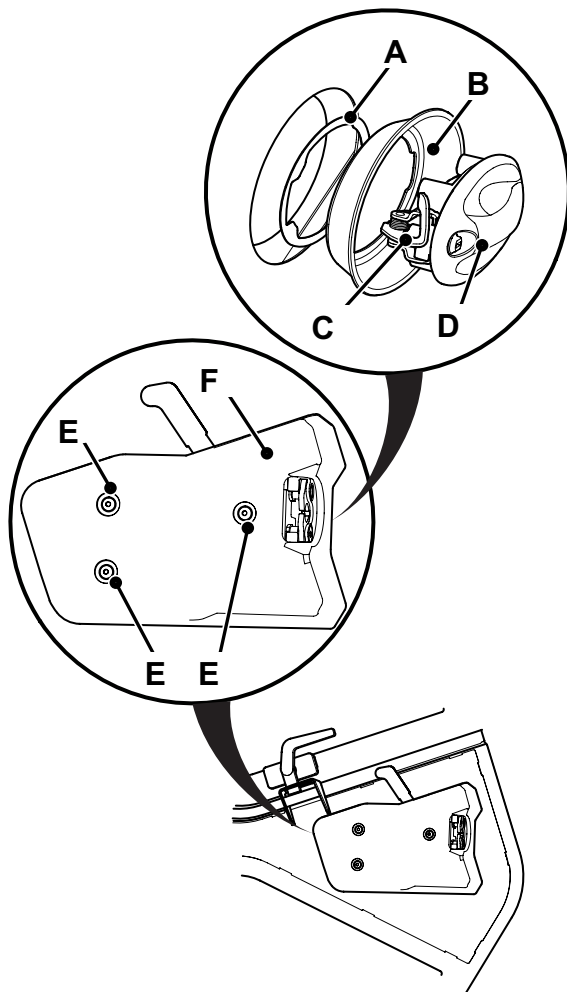


Fig 10.

C093950-C1

Door

Removal

- 1 Divide the doors by releasing the locking handle **A**.
- 2 Make sure that the upper door **D** is supported.

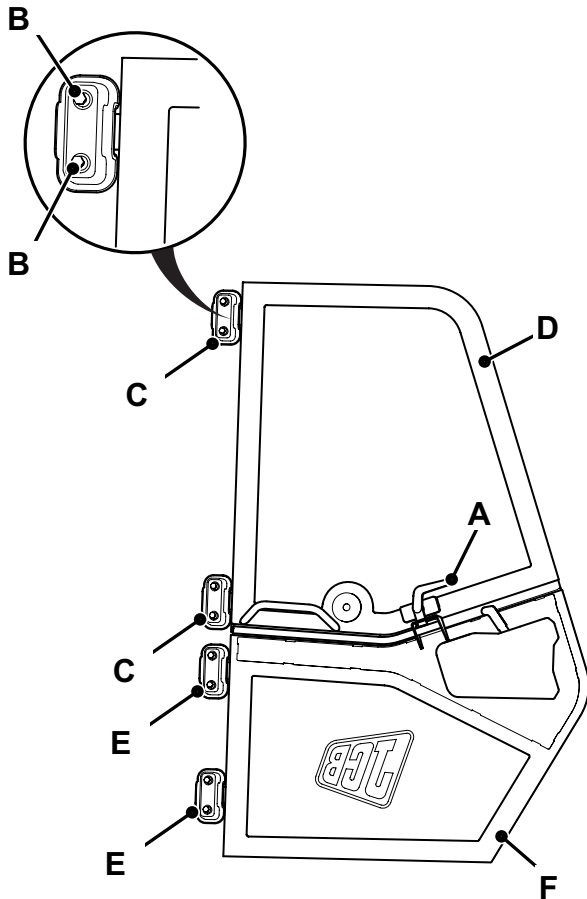


Fig 11.

C093950

- 7 Remove the lower door **F** complete with hinges **E** from the machine.

Replacement

Replacement is the opposite of the removal procedure.

- 3 Working inside the cab remove the bolts **B** from the upper door hinges **C**.
- 4 Remove the upper door **D** complete with hinges **C** from the machine.
- 5 Make sure that the lower door **F** is supported.
- 6 Working inside the cab remove the bolts **B** from the lower door hinges **E**.

Screen Guard

Removal and Replacement

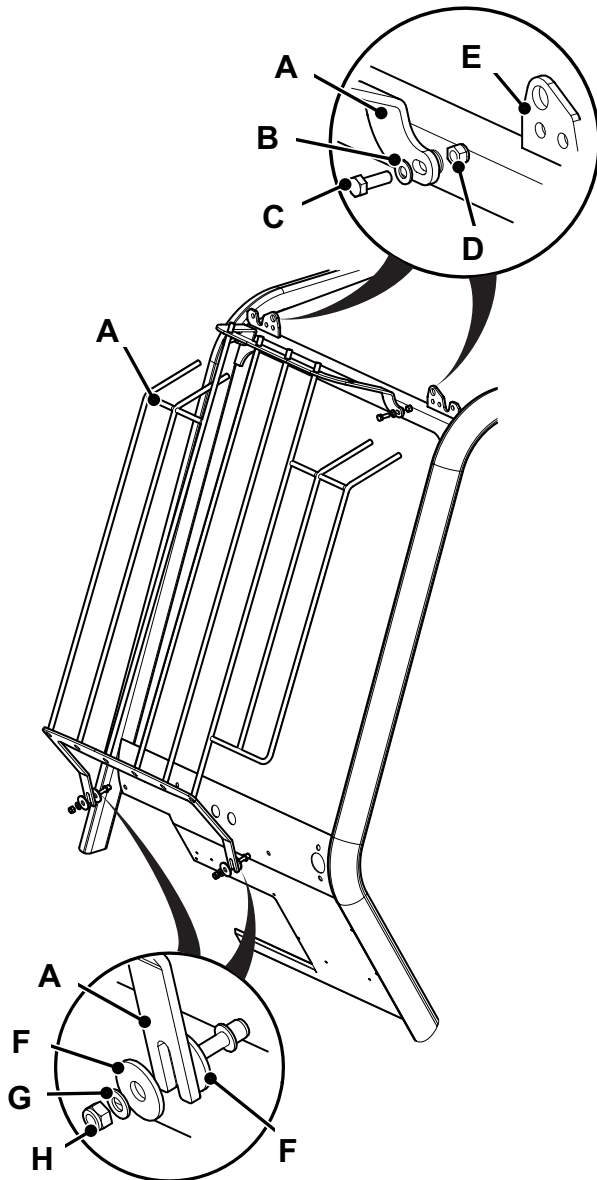


Fig 12.

C095710

- 2 Support the guard **A**.
- 3 Remove the upper nuts **D**, bolts **C** and washers **B**.
- 4 Remove the lower nuts **H** and washers **G** and **F**.
- 5 Remove the guard **A** from the machine.

Replacement

Replacement is the opposite of the removal procedure.

Removal

- 1 Make the machine safe with the boom lowered. Refer to **Section 3 - Routine Maintenance**.

Roof Guard

Removal and Replacement

Removal

- 1 Remove the rear mounting bolt **A** and unscrew the front guard mounting bolts **B** from the windscreen guard.

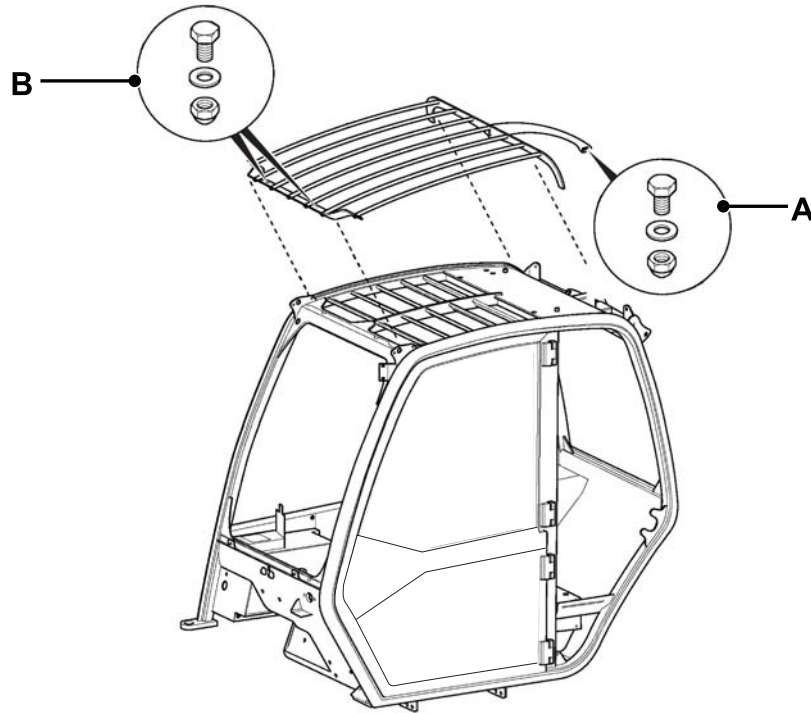


Fig 13.

C046890-C3

Replacement

Replacement is the opposite of the removal procedure.

Wiper Motor Front

Removal and Replacement

Removal

- 1 Remove the instrument panels. Refer to **Instrument Panels**.
- 2 Disconnect the wiper motor electrical connector **A**.
- 3 Remove the tube **B** at the cab bulkhead adapter.
- 4 Remove the nuts **C** and pull the wiper arm assembly **D** off the motor shafts.
- 5 With the aid of one more person hold the wiper motor **E** and at the same time remove the nuts **F**.
- 6 Remove the wiper motor **E**.

Replacement

Note: If the wiper motor is defective it must be replaced. It is not possible to repair a defective wiper motor.

Replacement is the opposite of the removal procedure.

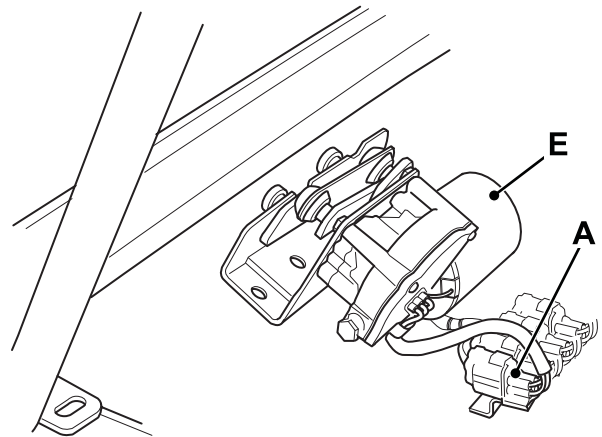
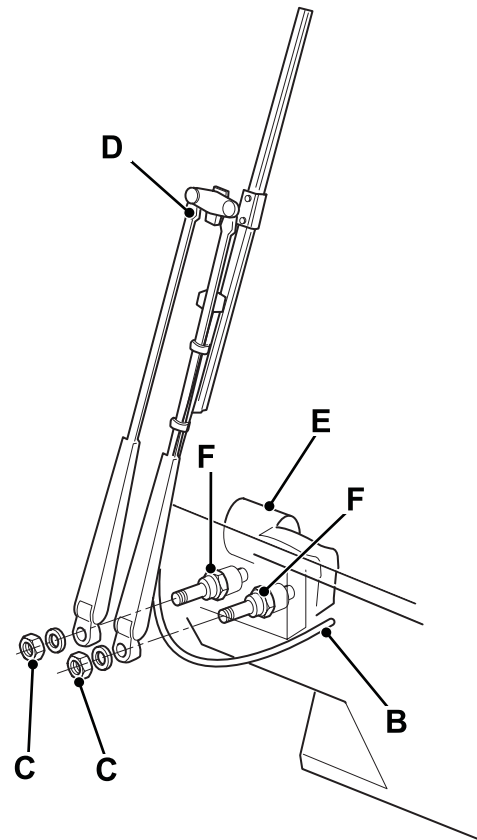


Fig 14.

C045680

Wiper Motor Rear

Removal and Replacement

Removal

- 1 Remove the wiper motor cover **A**.
- 2 Disconnect the wiper motor electrical connector **B**.
- 3 Flip up cover **C**.
- 4 Remove both locknuts and grommet assembly **D** and pull the wiper arm assembly off from the motor shaft
- 5 With the aid of one more person hold the wiper motor **F** from inside the cab and remove locknut **E**.
- 6 Remove the wiper motor **F**.

Note: If the wiper motor is defective it must be replaced. It is not possible to repair a defective wiper motor.

Replacement

Replacement is the opposite of the removal procedure.

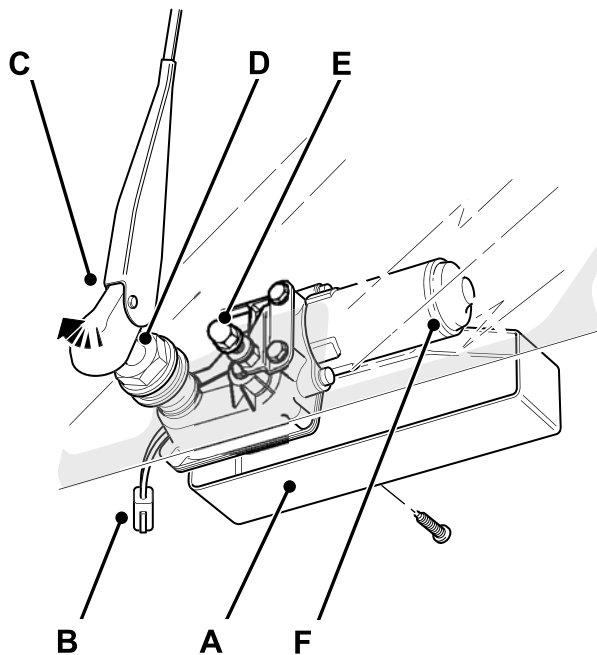


Fig 15.

C047640

Wiper Motor Roof

Removal and Replacement

Removal

- 1 Remove the cab roof liner. → [Roof Liner \(B5-5\)](#)
- 2 Remove the wiper motor cover **A**.
- 3 Disconnect the wiper motor electrical connector **B**
- 4 Flip up cover **C**.
- 5 Remove both locknuts and grommet assembly **D** and pull the wiper arm assembly off from the motor shaft.
- 6 With the aid of one more person hold the wiper motor **F** from inside the cab and at the same time remove locknut **E**.
- 7 Remove the wiper motor **F**.

Replacement

Note: If the wiper motor is defective it must be replaced. It is not possible to repair a defective wiper motor.

Replacement is the opposite of the removal procedure.

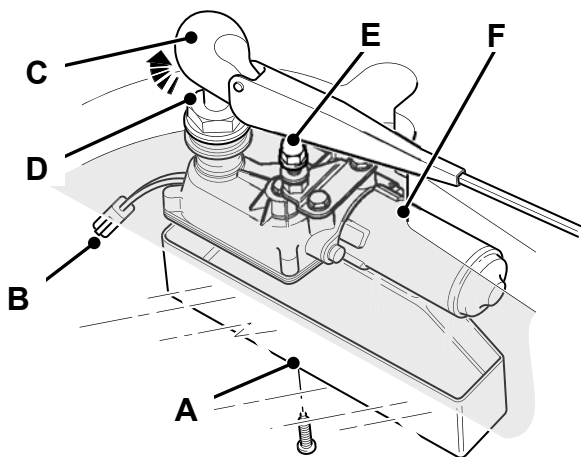


Fig 16.

C047670

Cab

Removal

WARNING

Make the machine safe before working underneath it. Park the machine on level ground, lower the attachments to the ground. Apply the park brake, put the transmission in neutral and stop the engine. Block both sides of all four wheels.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.

GEN-4-1_1

- 1 Park the machine and make it safe. Release the hydraulic pressure. Obey the general safety procedures, see **Section 2 - General Procedures**. [⇒ Related Topics \(□ B5-2\)](#)
- 2 Remove the battery covers and disconnect the battery. Refer to **Section 3 - Routine Maintenance**. [⇒ Related Topics \(□ B5-2\)](#)
- 3 Remove the cab undershield. Refer to **Section 3 - Routine Maintenance**. [⇒ Related Topics \(□ B5-2\)](#)
- 4 Remove the deckplate. Refer to **Section 3 - Routine Maintenance**. [⇒ Related Topics \(□ B5-2\)](#)
- 5 Remove the bolts and remove the cab front cover **A**.
- 6 Remove the floor mat. [⇒ Floor Mat \(□ B5-6\)](#)
- 7 Disconnect the bulkhead electrical connectors **V**.
- 8 Disconnect the inching pedal electrical connectors **U** (if fitted).
- 9 Disconnect all hydraulic hoses from steering unit **N**. Cap all open ports to prevent loss of fluid and contamination
- 10 Undo the hose clips and disconnect heater hoses **S**.

Important: If the machine is fitted with air conditioning, DO NOT attempt to disconnect any air conditioning hoses until the refrigerant has been discharged. Charging and discharging the system requires special equipment and training. If necessary, use the services of a specialist refrigeration engineer.

WARNING

The air conditioning system is a closed loop system and contains pressurised refrigerant. No part of the system should be disconnected until the system has been discharged by a refrigeration engineer or a suitably trained person. You can be severely frostbitten or injured by escaping refrigerant.

4-3-4-1_2

- 11 If applicable, once the system has been discharged, disconnect the air conditioning hoses at the thermostatic expansion valve (TEV) **R**.
- 12 Disconnect the condenser pipes **B** at the condenser.
- 13 Remove the hose claps **C**.
- 14 Disconnect engine throttle cable. Refer to **Section K - Throttle Cable**. [⇒ Related Topics \(□ B5-2\)](#)
- 15 Ensure all wheels are chocked and release parking brake.
- 16 Working at the park brake caliper, disconnect clevis **K**, note which of the three holes on the actuating lever **L** is used.
- 17 Remove clip or loosen locknut **H** as applicable. Disconnect the cable **J** from the bracket. Note the cable routing to the underside of the cab.
- 18 Disconnect the brake flexi pipe **P** from the chassis connector. Cap the pipe and adaptor to prevent loss of fluid and contamination.
- 19 Disconnect the cab earth strap **M**.
- 20 Disconnect hitch cable **T** (if fitted).
- 21 Disconnect the washer hoses.
- 22 Remove the plate on the front left and rear mount.
- 23 Remove the control lever. Refer to **Section E - Control Lever - Electro Servo**. [⇒ Related Topics \(□ B5-2\)](#)
- 24 Remove the screws **D** and Varispeed/Hand throttle control panel **F**. Disconnect the electrical connector **E** from the chassis harness.

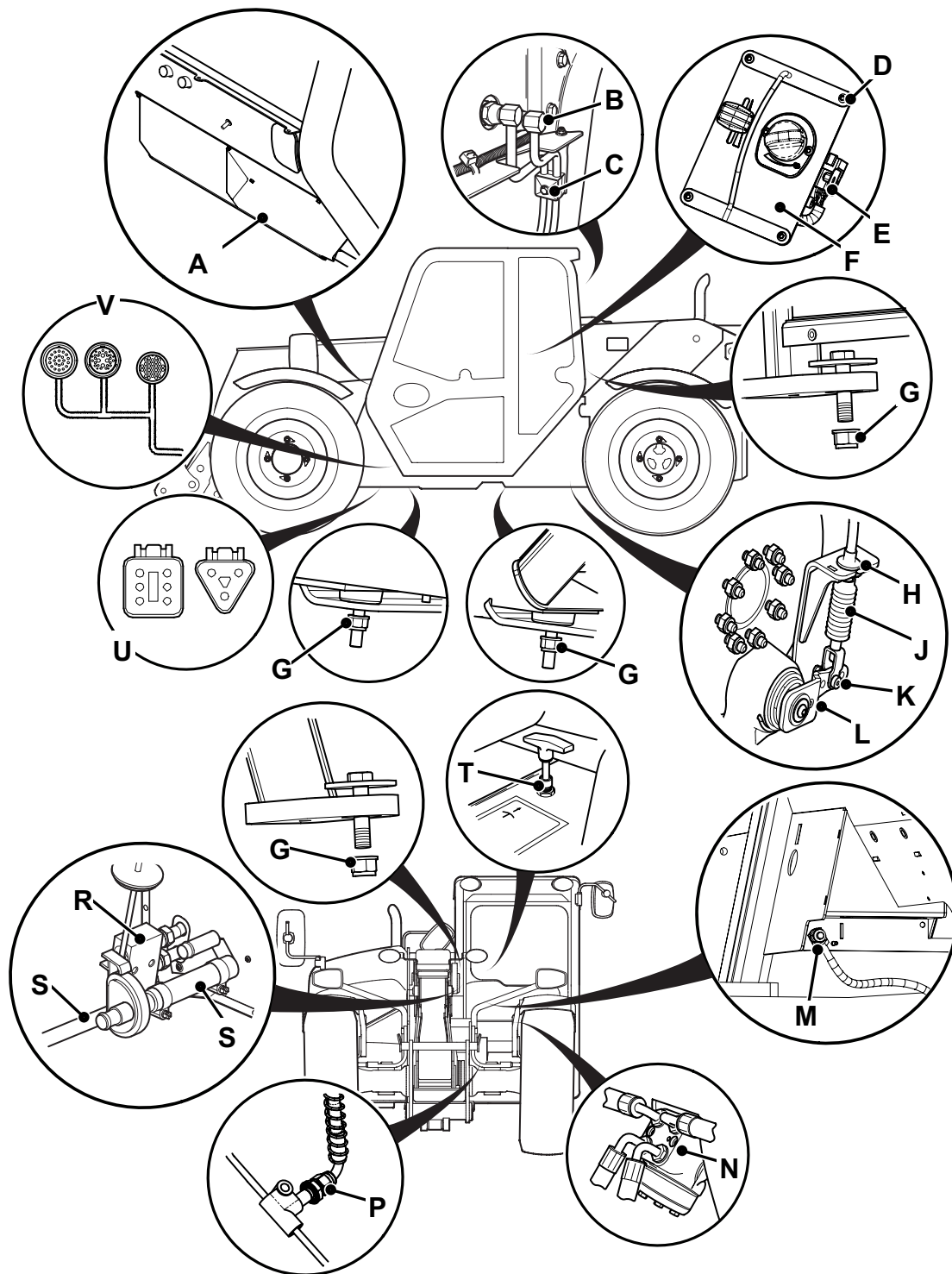


Fig 17.

C097170

- 25 Disconnect the manual steer mode cable (if fitted). Refer to **Section H - Manual Steer Mode Valve.** [⇒ Related Topics \(□ B5-2\)](#)
- 26 Unscrew and remove cab mounting bolts and nuts **G**.
- 27 Attach appropriate lifting equipment to the ROPS and FOPS cage.
- 28 Carefully lift the cab from the machine, ensuring that all connections have been released and are clear of any obstruction.

Replacement

Replacement is the opposite of the removal procedure.

During the replacement procedure do this work also:

- Torque tighten the cab mounting bolts, see **Section 3 - Routine Maintenance.** [⇒ Related Topics \(□ B5-2\)](#)

Note: On low cab machines the right rear cab mounting bolt is orientated as at 1. To aid installation it is acceptable to install the bolt as shown at 2. [⇒ Fig 18. \(□ B5-18\)](#)

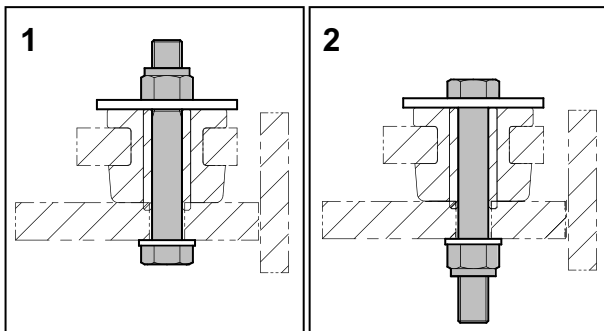


Fig 18.

C107110

- Do a check of the cab mounting rubbers. If damaged or worn replace.
- Use the cab filter protection plate **X** between the filter gasket **X** and cab whilst the cab is lowered onto the chassis. The lower part of the plate locates in the slot in the chassis **Y**. For tool details refer to **Section 1 - Service Tools.** [⇒ Related Topics \(□ B5-2\)](#)

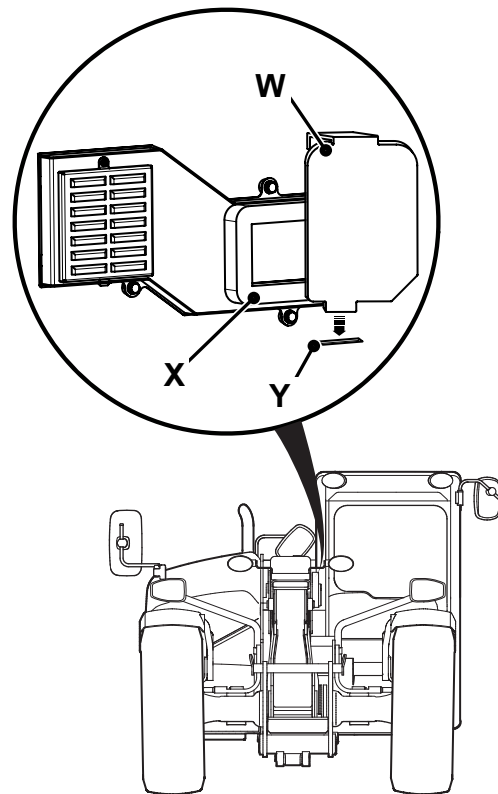


Fig 19.

C097170-C3

- Make sure that all cables are connected and correctly adjusted. Make sure that they are routed and secured correctly.
- Make sure that all electrical and hydraulic services operate correctly.
- Bleed the brakes, see **Section G - Brakes.** [⇒ Related Topics \(□ B5-2\)](#)
- If applicable, recharge the air conditioning system, see **Section B - Air Conditioning SYSTEM.** [⇒ Related Topics \(□ B5-2\)](#)
- Check the throttle cable adjustment. Refer to **Section K - Throttle Pedal and Cable.** [⇒ Related Topics \(□ B5-2\)](#)
- Check hand throttle operation and adjust if necessary. Refer to **Section K - Hand Throttle.** [⇒ Related Topics \(□ B5-2\)](#)
- Check the parkbrake adjustment and adjust if necessary. Refer to **Section 3 - Routine Maintenance.** [⇒ Related Topics \(□ B5-2\)](#)

Air Conditioning Condenser - Cab Roof Mounted

Introduction

This topic contains information about a machine DEVICE. Make sure you are referring to the correct device. Refer to the applications table.

Descriptions and procedures relate to the device and not related systems. For information about the systems refer to the relevant topics.

[⇒ *Related Topics* \(!\[\]\(3627fc0ff4ec9910032cebadf7b66aa1_img.jpg\) B6-2\)](#)

[⇒ *Removal and Replacement* \(!\[\]\(7fd65f65fc0b6791cf7fbd42ae8069a8_img.jpg\) B6-3\)](#)

[⇒ *Removal* \(!\[\]\(0f6aa2a0983c59439ece9809b385c976_img.jpg\) B6-3\)](#)

[⇒ *Replacement* \(!\[\]\(8cb427162659ecbca69b5be29d5ff78b_img.jpg\) B6-5\)](#)

Related Topics

Table 1. Related Topics in This Publication

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Sections	Topic Titles	Sub Titles
1	Applications	ALL
2	ALL (Care and Safety) ⁽¹⁾	ALL
B	⇒ Cab Air Conditioning SYSTEM (□ B3-1)	⇒ Operation Overview (□ B3-5)
B	⇒ Cab Air Conditioning SYSTEM (□ B3-1)	⇒ Refrigerant Charging and Discharging (□ B3-25)

(1) You must obey all of the relevant care and safety procedures.

Removal and Replacement

Removal

WARNING

The air conditioning system is a closed loop system and contains pressurised refrigerant. No part of the system should be disconnected until the system has been discharged by a refrigeration engineer or a suitably trained person. You can be severely frostbitten or injured by escaping refrigerant.

4-3-4-1_2

WARNING

Lifting Equipment

You can be injured if you use incorrect or faulty lifting equipment. You must identify the weight of the item to be lifted then choose lifting equipment that is strong enough and suitable for the job. Make sure that lifting equipment is in good condition and complies with all local regulations.

INT-1-3-7_2

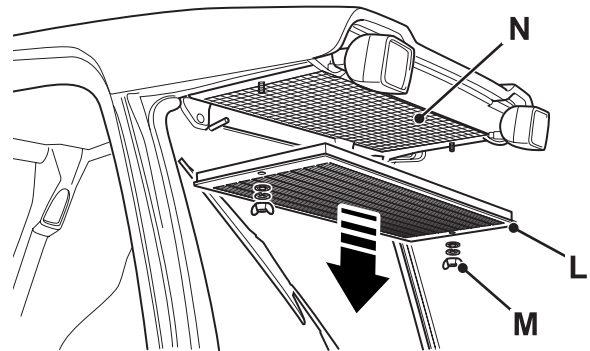
WARNING

This component is heavy. It must only be removed or handled using a suitable lifting method and device.

BF-4-1_1

Complete removal of the unit will require the refrigerant to be evacuated from the system.

- 1 Park the machine and make it safe. See **Section 2 - General Procedures**. [➔ Related Topics \(B6-2\)](#)



803680-1

Fig 1.

- 2 Discharge the air conditioning system. [➔ Related Topics \(B6-2\)](#)
- 3 Support the protective cover **L** and remove fasteners **M**. Lower the cover to the ground.
- 4 Clean the condenser **N**. Brush off all debris from the tubes and fins using a soft bristle brush.
- 5 Cut the cable ties **A** to release the worklight harness **B**.

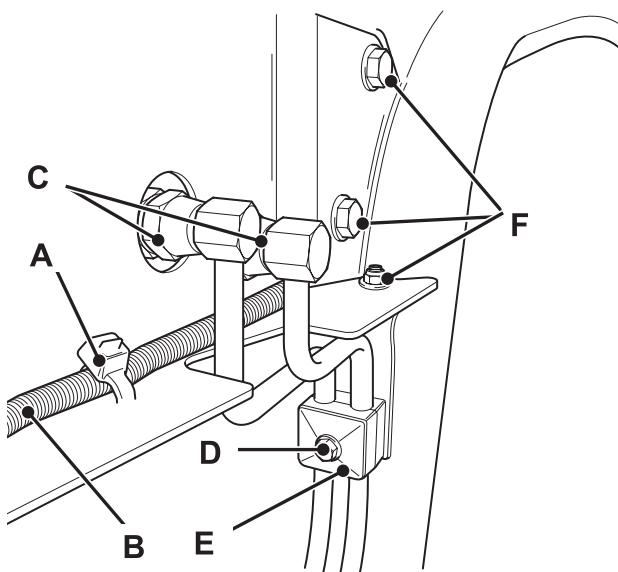


Fig 2.

C054920

- 6 Remove the worklight securing screws and lift the lights and brackets clear of the machine.

Note: To prevent damage to the worklights or harness when lifting or fitting the condenser unit, make sure that the lights and harness are out of the way.

- 7 Remove the bolt **D** securing the pipe clamp **E**.
- 8 Disconnect the harness connector **G**.
- 9 Disconnect both pipes **C** from the condenser.
- 10 Using lifting equipment support the weight of the condenser unit.

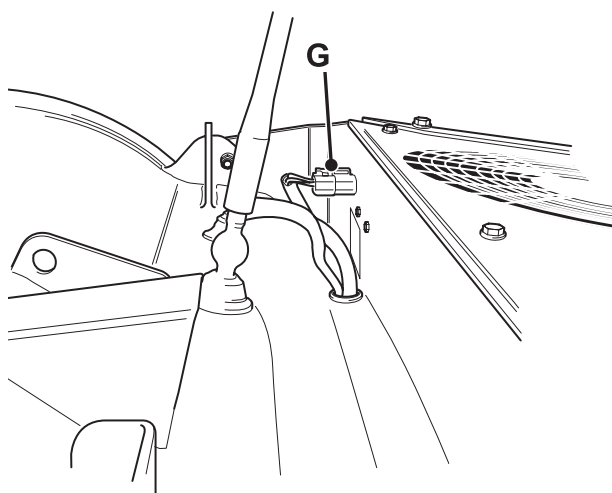


Fig 3.

C054930

- 11 Unscrew the condenser support nuts and bolts **F / L**.
- 12 Lift the condenser unit **J** and support bracket **K** clear of the machine.
- 13 Remove the screws **H** and lift the support bracket **K** from the condenser unit **J**.

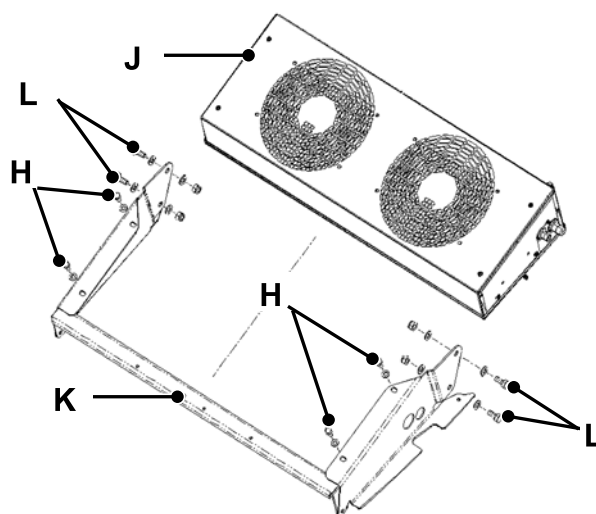


Fig 4.

C054820



Section B6 - Body and Framework

Air Conditioning Condenser - Cab Roof Mounted

Removal and Replacement

Replacement

Replacement is the opposite of the removal procedure.

Recharge the air conditioning system and check for leaks.

⇒ [Related Topics](#) ([□ B6-2](#))



Section B6 - Body and Framework

Air Conditioning Condenser - Cab Roof Mounted

Removal and Replacement

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Air Conditioning Binary Switch

Introduction

This topic contains information about a machine DEVICE. Make sure you are referring to the correct device. Refer to the applications table.

Descriptions and procedures relate to the device and not related systems. For information about the systems refer to the relevant topics.

[⇒ *Related Topics* \(!\[\]\(c633ca686f968ee3284507001e9d20ea_img.jpg\) B7-2\)](#)

[⇒ *Removal and Replacement* \(!\[\]\(cd9d0704c249be5c9161bfdf10f39607_img.jpg\) B7-3\)](#)

[⇒ *Removal* \(!\[\]\(1ac07df3f1292d2ef4f76373df7eeb4c_img.jpg\) B7-3\)](#)

[⇒ *Replacement* \(!\[\]\(34dc7389c65dd2e95174695130acc51b_img.jpg\) B7-3\)](#)

Related Topics

Table 1. Related Topics in This Publication

The table lists other topics in the manual that contain information related to this topic. Refer to the applicable topics to complete your procedures. Where applicable the text in this section contains cross references to this page to help you find the correct information. Some machines have different systems and devices. Make sure you refer to the correct topic, refer to Section 1 - Applications .		
Sections	Topic Titles	Sub Titles
1	Applications	ALL
2	ALL (Care and Safety) ⁽¹⁾	ALL
B	⇒ Cab Air Conditioning SYSTEM (B3-1)	⇒ Operation Overview (B3-5)
B	⇒ Cab Air Conditioning SYSTEM (B3-1)	⇒ Refrigerant (B3-25)
B	⇒ Cab Air Conditioning SYSTEM (B3-1)	⇒ Test Procedures (B3-23), ⇒ Binary Switch (B3-24)

(1) You must obey all of the relevant care and safety procedures.

Removal and Replacement

The binary pressure switch assembly is located in the engine compartment, adjacent to the air conditioning compressor.

Removal

WARNING

Goggles and rubber gloves must be worn when pressure switches are removed or fitted. A small amount of refrigerant is released which can be harmful to the skin or eyes.

BF-1-10

- 1 Park the machine and make it safe. Obey the care and safety procedures. → [Related Topics \(□ B7-2\)](#)
- 2 Remove the harness connectors **B**, then unscrew the pressure switch assembly **A**.

Replacement

- 1 Screw the pressure switch **A** into the threaded port and tighten sufficiently to form a gas-tight seal.
- 2 Reconnect the harness connectors **B**.
- 3 Charge the air conditioning system. → [Refrigerant Charging and Discharging \(□ B3-25\)](#)
- 4 Operate the air conditioning system and check around the pressure switch for leaks. If leaks are found, tighten the pressure switch further until the leaking stops.

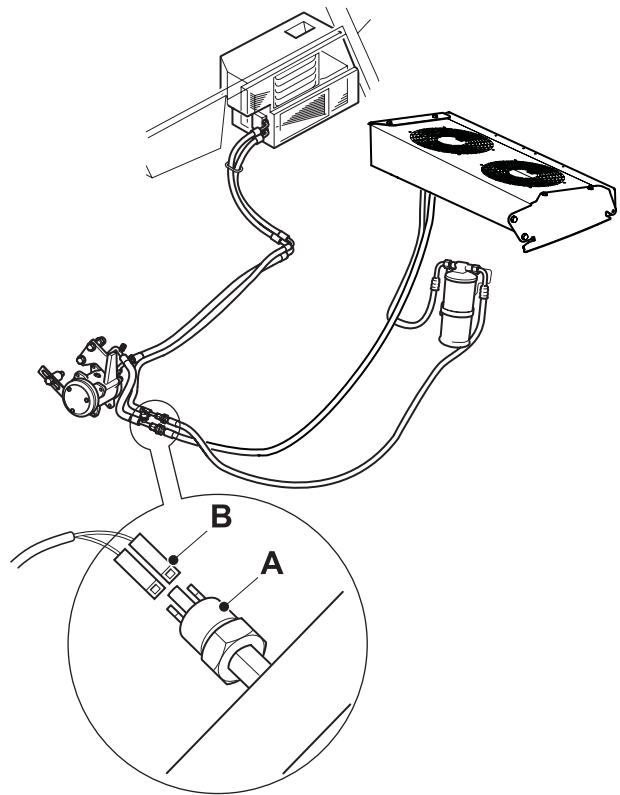


Fig 1.

C067580-C5



Section B7 - Body and Framework Air Conditioning Binary Switch

Removal and Replacement

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Cab HV and HVAC Unit

Introduction

This topic contains information about a machine DEVICE. Make sure you are referring to the correct device. Refer to the applications table.

Descriptions and procedures relate to the device and not related systems. For information about the systems refer to the relevant topics.

This topic is intended to help you understand what the device does and how it works. Where applicable it also includes procedures such as removal and replacement and dismantle and assemble.

[⇒ *Related Topics* \(!\[\]\(e921c990b9f5f06c856e9d5d7f06f32c_img.jpg\) B8-2\)](#)

[⇒ *Removal and Replacement* \(!\[\]\(4b09627c6aee76709902ed296c8ddffd_img.jpg\) B8-3\)](#)

[⇒ *Removal* \(!\[\]\(a925161443d23ea756164ad8b2fbef7d_img.jpg\) B8-3\)](#)

[⇒ *Replacement* \(!\[\]\(a0553b6a21912fa4dfa0bf08fea80f88_img.jpg\) B8-4\)](#)

Related Topics

Table 1. Related Topics in This Publication

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Sections	Topic Titles	Sub Titles
1	Applications	
2	ALL (Care and Safety) ⁽¹⁾	ALL
3	Engine	Changing the Coolant
B	⇒ Cab Heating and Ventilation SYSTEM (□ B2-1)	⇒ Operation Overview (□ B2-3)
B	⇒ Cab Air Conditioning SYSTEM (□ B3-1)⁽²⁾	⇒ Operation Overview (□ B3-5)
B	⇒ Cab Air Conditioning SYSTEM (□ B3-1)⁽²⁾	⇒ Refrigerant Charging and Discharging (□ B3-25)
B	⇒ Heater Valve (□ B9-1)	⇒ Removal and Replacement (□ B9-3)
B	⇒ Cab (□ B5-1)	⇒ Removal and Replacement (□ B5-4)

(1) You must obey all of the relevant care and safety procedures.

(2) HVAC unit only

Removal and Replacement

The heating, ventilation and air conditioning unit (HVAC) contains a blower unit, evaporator matrix and thermostat. It is located below the right front side of the cab.

Removal

WARNING

The air conditioning system is a closed loop system and contains pressurised refrigerant. No part of the system should be disconnected until the system has been discharged by a refrigeration engineer or a suitably trained person. You can be severely frostbitten or injured by escaping refrigerant.

4-3-4-1_2

To remove the unit it is necessary to evacuate (discharge) the refrigerant from the system. [⇒ Refrigerant Charging and Discharging \(□ B3-25\)](#)

- 1 Park the machine and make it safe. See **Section 2 - General Procedures**. [⇒ Related Topics \(□ B8-2\)](#)
- 2 Lift the boom and fit the safety strut. See **Section 2 - General Procedures**. [⇒ Related Topics \(□ B8-2\)](#)
- 3 Drain the cooling system.
- 4 Remove the cab. [⇒ Cab \(□ B5-1\)](#)
- 5 Remove the chassis side cover. [⇒ Chassis Side Cover \(□ B11-8\)](#)
- 6 Remove bolts **H** and **J** securing the air conditioning (HVAC) unit to the cab. Carefully remove the unit sufficiently to access the electrical harness connector at the rear. Disconnect the electrical connector. [⇒ Fig 1. \(□ B8-3\)](#)

Note: The electrical harness connector is located behind the unit and cannot be disconnected until the unit is pulled away from the cab.

- 7 Remove the unit from the cab.

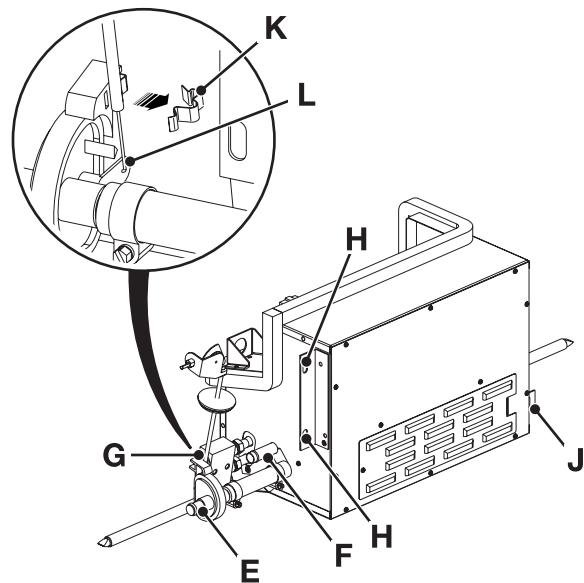


Fig 1.

715680-1

Replacement

Replacement is the opposite of the removal procedure.

During the replacement procedure do this work also:

⇒ [Fig 2.](#) ([B8-4](#))

- Make sure that the expansion valve **A** is fitted correctly with the diaphragm **B** located below the valve.
- Recharge the air conditioning system and check for leaks.
- Refill the cooling system and check for leaks.

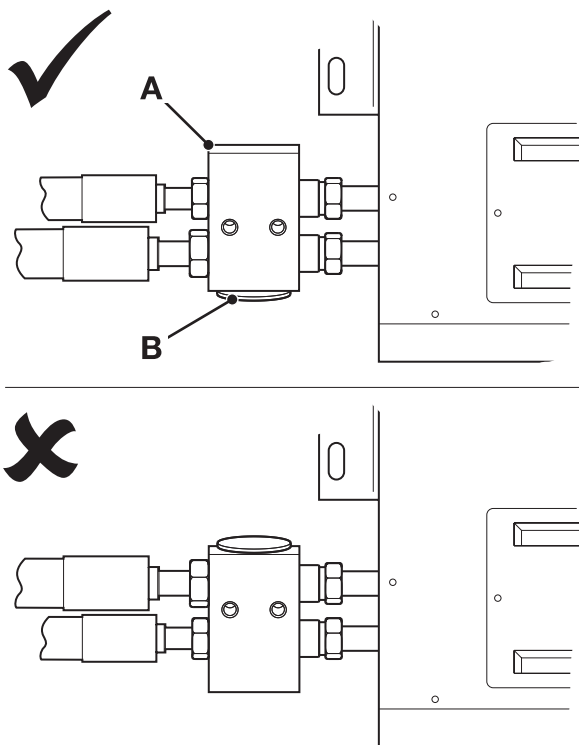


Fig 2.

718090-1

Heater Valve

Introduction

This topic contains information about a machine DEVICE. Make sure you are referring to the correct device. Refer to the applications table.

Descriptions and procedures relate to the device and not related systems. For information about the systems refer to the relevant topics.

[⇒ Related Topics \(!\[\]\(262b02db68c96837beb2778d0ab7fc35_img.jpg\) B9-2\)](#)

[⇒ Removal and Replacement \(!\[\]\(48ff7e3248e7674e47eb50ded892ebc4_img.jpg\) B9-3\)](#)

[⇒ Removal \(!\[\]\(897200d8fd784bd09f3b24426f4017c9_img.jpg\) B9-3\)](#)

[⇒ Replacement \(!\[\]\(031ab9ba41ee47bcc526ece531bda3c4_img.jpg\) B9-3\)](#)

Related Topics

Table 1. Related Topics in This Publication

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Sections	Topic Titles	Sub Titles
1	Applications	ALL
2	ALL (Care and Safety) ⁽¹⁾	ALL
3	Engine	Checking the Coolant Level
B	⇒ Cab Heating and Ventilation SYSTEM (B2-1)	

(1) You must obey all of the relevant care and safety procedures.

Removal and Replacement

The cab heater valve **A** is part of the heater assembly installed on the external part of the cab.

Removal

- 1 Park the machine and make it safe. Lift the boom and fit the safety strut. Obey the care and safety procedures. → [Related Topics \(□ B9-2\)](#)
- 2 Make sure that the engine cannot be started.
- 3 If the engine is hot let it cool for one hour.
- 4 Seal the heater hoses **B** with clamps.
- 5 Put aligned marks on the control cable outer **C** and valve body **D**.
- 6 Remove the clip **E**.

Note: There will be some leakage of engine coolant when the hoses **B** are removed. Be prepared.

- 7 Loosen the clips **F** and remove the hoses **B** at the valve.
- 8 Disconnect the control cable **G** at the valve lever **H**.

Replacement

Replacement is the opposite of the removal procedure. During the replacement procedure do this work also:

- Align the marks on the control cable outer **C** and valve body **D** and then replace clip **E**.

When the replacement procedure is complete do this work also:

- Start the engine and operate the cab heater at the maximum temperature. Operate the engine for 5 minutes.
- Stop the engine and see if there are coolant leaks.
- Do an engine coolant level check. → [Related Topics \(□ B9-2\)](#)

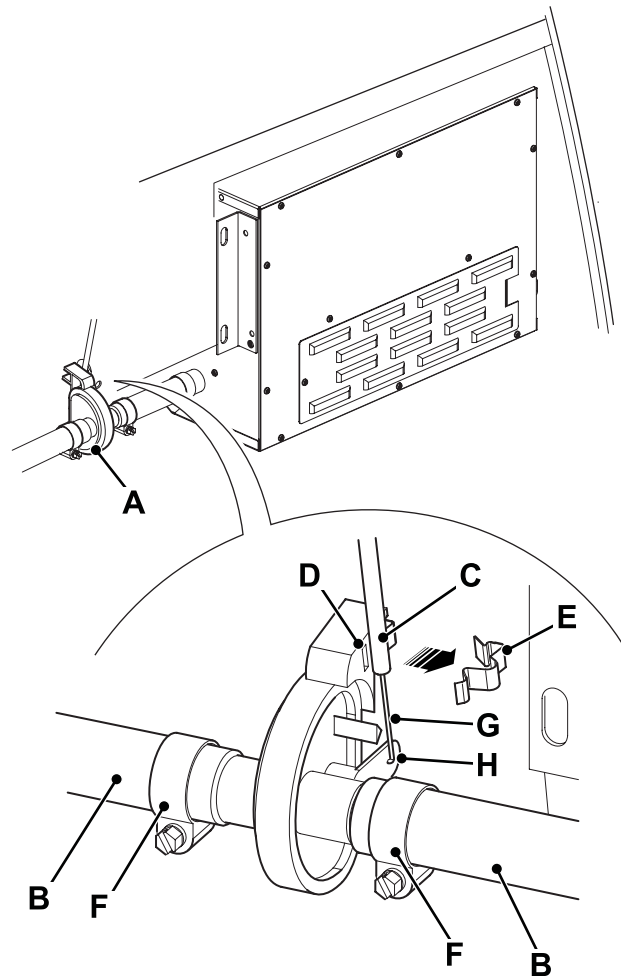


Fig 1.

C045530



Section B9 - Body and Framework

Heater Valve

Removal and Replacement

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Fuel Tank

Introduction

This topic contains information about a machine DEVICE. Make sure you are referring to the correct device. Refer to the applications table.

Descriptions and procedures relate to the device and not related systems. For information about the systems refer to the relevant topics.

[⇒ Related Topics \(!\[\]\(3470656b30b6b9ec4b12aca9c89b8502_img.jpg\) B10-2\)](#)

[⇒ Specifications \(!\[\]\(5f14d13c8732cabf33c0851f477e9f44_img.jpg\) B10-3\)](#)

[⇒ Removal and Replacement \(!\[\]\(80d9c316f2af47b5a300de83baeb8a17_img.jpg\) B10-4\)](#)

[⇒ Fuel Level Sender \(!\[\]\(365041449e985f10ed845c60a1e4b82f_img.jpg\) B10-5\)](#)



Related Topics

Table 1. Related Topics in This Publication

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Sections	Topic Titles	Sub Titles
1	Applications	ALL
2	ALL (Care and Safety) ⁽¹⁾	ALL
3	Routine Maintenance	Fluids, Lubricants and Capacities
3	Routine Maintenance	Access Panels

(1) You must obey all of the relevant care and safety procedures.

Specifications

Refer to **Section 3 - Fluids, Lubricants and Capacities** for the fuel tank capacities for each machine variant.

⇒ [Related Topics](#) ([B10-2](#))

Removal and Replacement

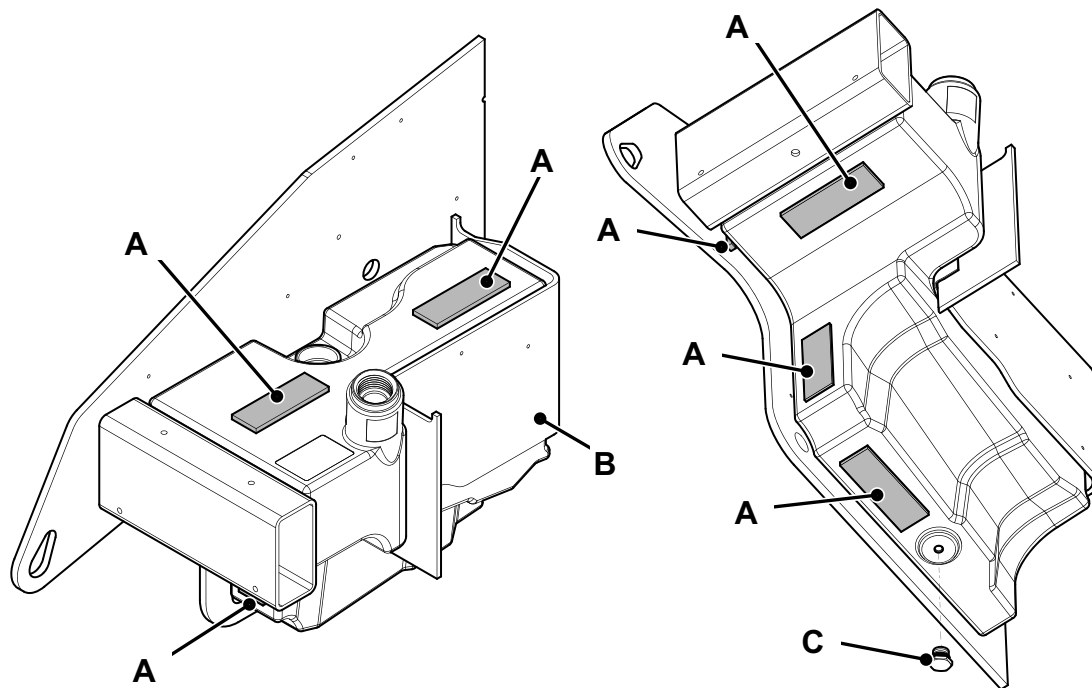


Fig 1. Fuel Tank

C095800

Removal

Park the machine and make it safe. Vent the hydraulic pressure. Obey the General Safety procedures, see **Section 2 - General Procedures**. [⇒ Related Topics \(B10-2\)](#)

- 1 Remove the front deckplate. See **Section 3 - Access Panels**. [⇒ Related Topics \(B10-2\)](#)
- 2 Remove the drain plug **C** and drain fuel tank contents into a suitable clean container.
- 3 Disconnect the fuel sender unit. [⇒ Fuel Level Sender \(B10-5\)](#)
- 4 Lift the fuel tank **B** from the machine.

Replacement

Replacement is the opposite of the removal procedure.

During the replacement procedure do this work also:

- Make sure that the tank support pads **A** are installed and secure.
- Use a new seal when installing the drain plug **C**.
- Fill the tank with clean fuel. Make sure all connections are tight and check for leaks.

Fuel Level Sender

Removal

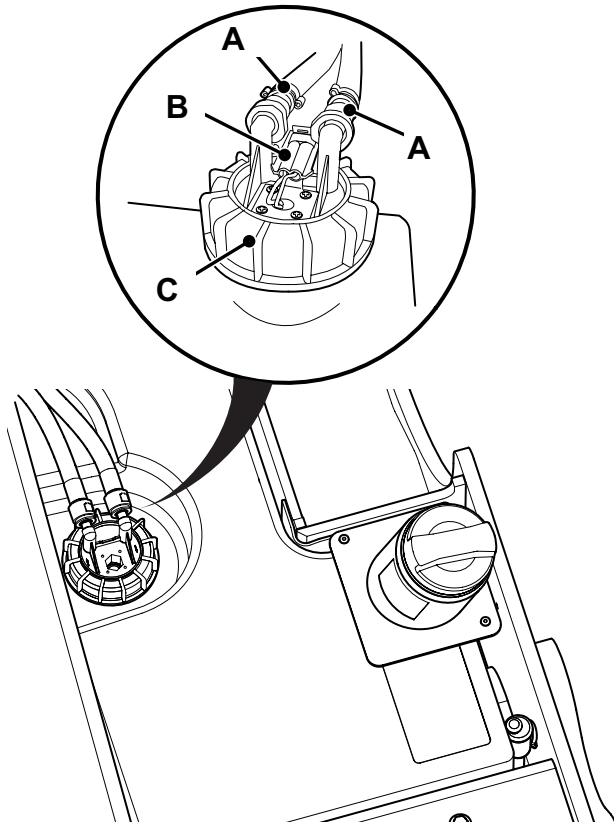


Fig 2.

C095780

Replacement

Replacement is the opposite of the removal procedure.

During the replacement procedure do this work also:

- Before replacing the fuel level sender unit the float must be reset. Move the float to the top of its travel and then let it to fall down to the lowest point of travel.
- Make sure to install the fuel level sender unit with the pipe connections pointing to the rear of the machine as shown.
- Examine the gasket to make sure it is clean and in good condition. If not install a new gasket.

- 1 Carry out General Safety procedures, see **Section 2 - General Procedures.** [⇒ Related Topics \(B10-2\)](#)
- 2 Remove the front deckplate. See **Section 3 - Access Panels.** [⇒ Related Topics \(B10-2\)](#)
- 3 Put a label on the fuel feed and return hoses **A** before disconnecting to help identification when replacing.
- 4 Disconnect the fuel feed and return hoses **A**.
- 5 Disconnect the fuel sender electrical connector **B**.
- 6 Unscrew the sender unit **C** from the fuel tank.



Section B10 - Body and Framework

Fuel Tank

Removal and Replacement

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Chassis Panels

Introduction

This topic contains information about a machine DEVICE. Make sure you are referring to the correct device. Refer to the applications table.

Descriptions and procedures relate to the device and not related systems. For information about the systems refer to the relevant topics.

[⇒ Related Topics \(□ B11-2\)](#)

[⇒ Removal and Replacement \(□ B11-3\)](#)

[⇒ Engine Cover \(□ B11-3\)](#)

[⇒ Mudguard Assembly \(□ B11-5\)](#)

[⇒ Battery Cover \(□ B11-7\)](#)

[⇒ Rear Cover \(□ B11-6\)](#)

[⇒ Chassis Undershields \(□ B11-7\)](#)

[⇒ Engine Undershield \(□ B11-7\)](#)

[⇒ Chaff Guard \(□ B11-7\)](#)

[⇒ Deck Plate \(□ B11-7\)](#)

[⇒ Chassis Side Cover \(□ B11-8\)](#)



Related Topics

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Sections	Topic Titles	Sub Titles
1	<i>Applications</i>	ALL
2	ALL (Care and Safety) ⁽¹⁾	ALL

(1) You must obey all of the relevant care and safety procedures.

Removal and Replacement

Engine Cover

Removal

- 1 Park the machine and make it safe. Obey the general safety procedures, see **Section 2 - General Procedures**. → [Related Topics \(B11-2\)](#)
- 2 Disconnect the battery.
- 3 Open the engine cover **A** fully. Support the cover using suitable overhead lifting equipment.

WARNING

Beware of the hot exhaust system even with the engine stopped.

ENG-4-3

- 4 Unscrew gas strut **C** from the radiator cowl.
- 5 Remove the bolts from hinges **B**.
- 6 Using the lifting equipment manoeuvre the engine cover clear of the machine.
- 7 Remove the air filter. Loosen clips **D** on the pipes to the engine and pre-cleaner (if fitted). Undo fixing bolts **E** and remove the filter assembly. Cap the air intake manifold inlet with tape or similar to prevent ingress of dirt etc.
- 8 Remove engine pod and lower the pod complete with guards to the ground.

Replacement

Replacement is the opposite of the removal procedure.

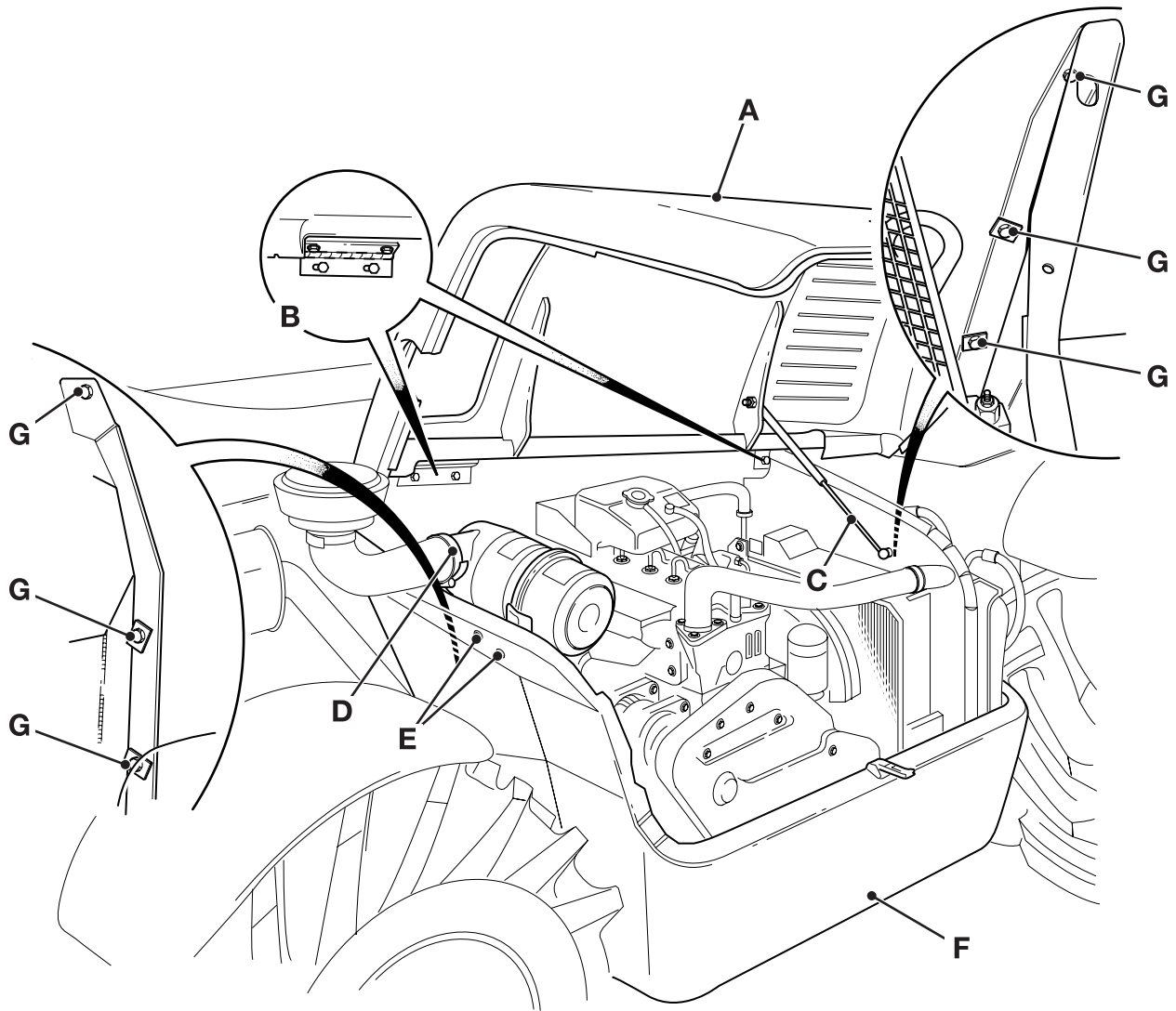


Fig 1. Typical Machine

C025730

Mudguard Assembly

The procedure shown is for one mudguard assembly, this is identical for all the mudguards on the vehicle.

Removal of the Top Guard Assembly

- 1 Remove the bolts, nuts and washers **A** releasing the lower saddle clamps **D**.
- 2 Lift off the clamping plates **B** and the mudguard cover.
- 3 Remove the support strips **C**.

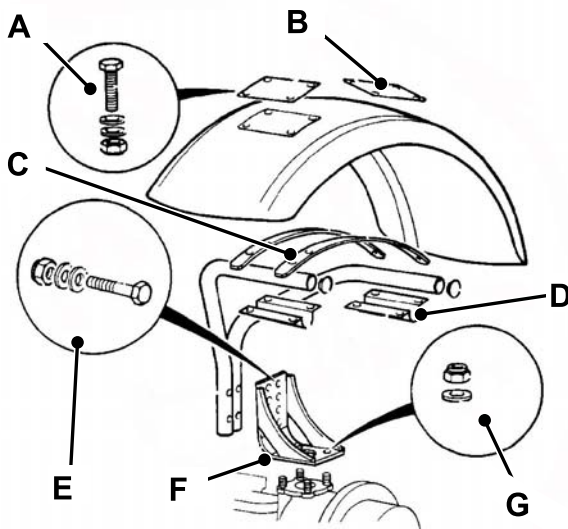


Fig 2.

C046840-C1

Removal of the Complete Mudguard Assembly

- 1 Remove the roadwheel if greater access required see **Section F - Wheel Removal and Replacement.**
[⇒ Related Topics \(□ B11-2\)](#)
- 2 Remove the top guard assembly [⇒ Removal of the Top Guard Assembly \(□ B11-5\)](#)
- 3 Remove the mounting arm bolts **E** and lift the arm assembly clear.
- 4 The support bracket nuts **G** can now be removed and the bracket **F** can now be lifted clear.

Replacement

Replacement is the opposite of the removal procedure.

Replacement

Replacement is the opposite of the removal procedure.

Rear Cover

Removal and Replacement

Removal

WARNING

The exhaust pipe becomes extremely hot when the engine is running and will remain so for some time after the engine is stopped. If you touch the hot pipe you could be severely burned.

13-2-4-11

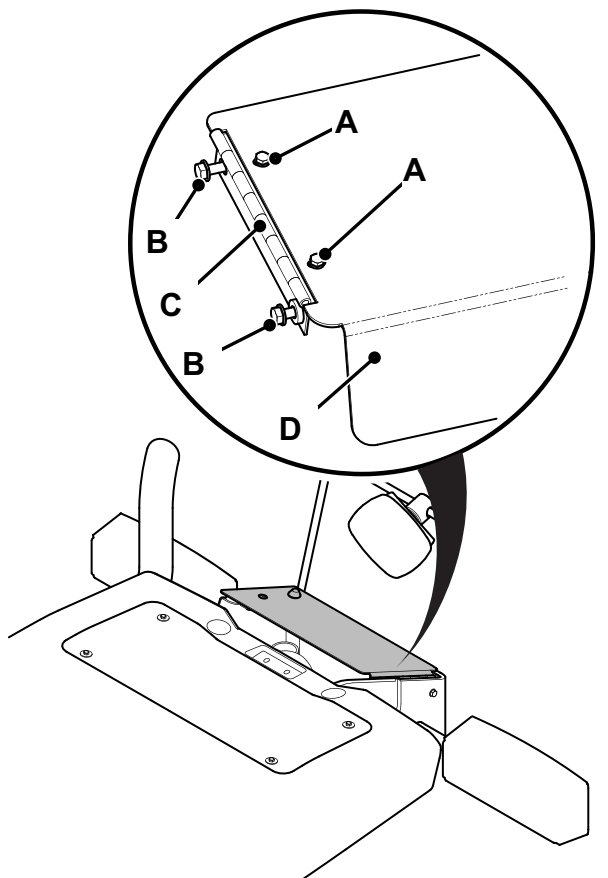


Fig 3.

C095790

- 1 Park the machine and make it safe. Obey the general safety procedures, see **Section 2 - General Procedures**. [➔ Related Topics \(B11-2\)](#)

- 2 To remove the cover:
 - a Support the cover **D**.
 - b Remove the bolts **A**.
 - c Remove the cover **D** from the machine.
- 3 To remove the hinge:
 - a Remove the bolts **B**.
 - b Remove the hinge **C** from the machine.

Replacement

Replacement is the opposite of the removal procedure.



Battery Cover

Removal and Replacement

For this procedure, refer to **Section 3 - Routine Maintenance**.

Chassis Undershields

Removal and Replacement

For this procedure, refer to **Section 3 - Routine Maintenance**.

Engine Undershield

Removal and Replacement

For this procedure, refer to **Section 3 - Routine Maintenance**.

Chaff Guard

Removal and Replacement

For this procedure, refer to **Section 3 - Routine Maintenance**.

Deck Plate

Removal and Replacement

For this procedure, refer to **Section 3 - Routine Maintenance**.

Chassis Side Cover

Removal

- 1 Park the machine and make it safe with the boom raised. Obey the general safety procedures, see [Section 2 - General Procedures](#). [⇒ Related Topics \(□ B11-2\)](#)
- 2 Remove the cab assembly. [⇒ Cab \(□ B5-1\)](#)
- 3 Remove the bolts and washers **D**.
- 4 Support the clamping plate **F** and remove the bolts and washers **E**.
- 5 Remove the clamping plate **F**.
- 6 Remove the bolts and washers **B**.
- 7 Remove the clamping plate **A**.
- 8 Remove the side cover **C** from the machine.

Replacement

Replacement is the opposite of the removal procedure.

During the replacement procedure do this work also:

- Torque tighten the bolts **B**, **D** and **E** to 12 Nm (8.85 lbf ft)

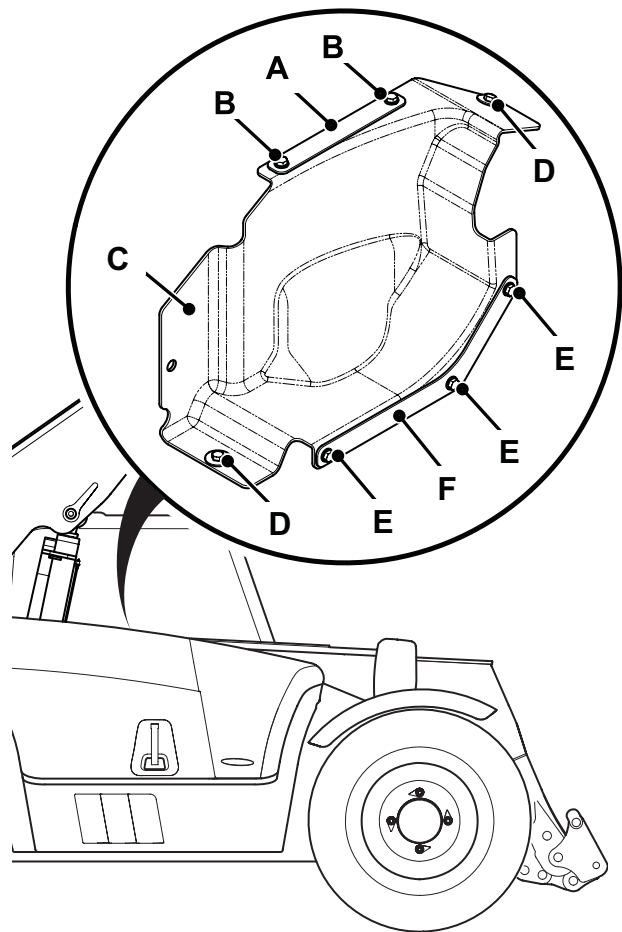


Fig 4.

C094940

Boom

Introduction

This topic contains information about a machine DEVICE. Make sure you are referring to the correct device. Refer to the applications table.

Descriptions and procedures relate to the device and not related systems. For information about the systems refer to the relevant topics.

This topic is intended to help you understand what the device does and how it works. Where applicable it also includes procedures such as removal and replacement and dismantle and assemble.

[⇒ Related Topics \(B12-2\)](#)

[⇒ Wear Pads and Shims \(B12-3\)](#)

[⇒ Wear Pad Clearance \(B12-3\)](#)

[⇒ Typical Shimming Procedure \(B12-5\)](#)

[⇒ Angle Indicator Removal and Replacement \(B12-9\)](#)

[⇒ Pivot Shims \(B12-10\)](#)

[⇒ Removal and Replacement \(B12-11\)](#)

[⇒ Dismantling and Assembly \(B12-14\)](#)

[⇒ Boom Hoses and Pipework \(B12-17\)](#)

Related Topics

Table 1. Related Topics in This Publication

The table lists other topics in the manual that contain information related to this topic. Refer to the applicable topics to complete your procedures. Where applicable the text in this section contains cross references to this page to help you find the correct information. Some machines have different systems and devices. Make sure you refer to the correct topic, refer to Section 1 - Applications .		
Sections	Topic Titles	Sub Titles
1	Applications	ALL
2	ALL (Care and Safety) ⁽¹⁾	ALL
3	Greasing	Every 50Hours
3	Hydraulic System	Checking the Hydraulic Fluid Level
3	Access Panels	Rear Boom Cover
E	LSP Electro Servo Flowshare Hydraulic System	ALL
E	Extension Ram	Removal and Replacement
E	Lift Rams	Removal and Replacement
E	Displacement Ram	Removal and Replacement
E	Tilt Ram	Removal and Replacement

(1) You must obey all of the relevant care and safety procedures.

Wear Pads and Shims

Wear Pad Clearance

Make sure that the wear pads are installed correctly to prevent fouling. ⇒ [Fig 2. \(□ B12-4\)](#)

⇒ [Typical Shimming Procedure \(□ B12-5\)](#), for the shimming method.

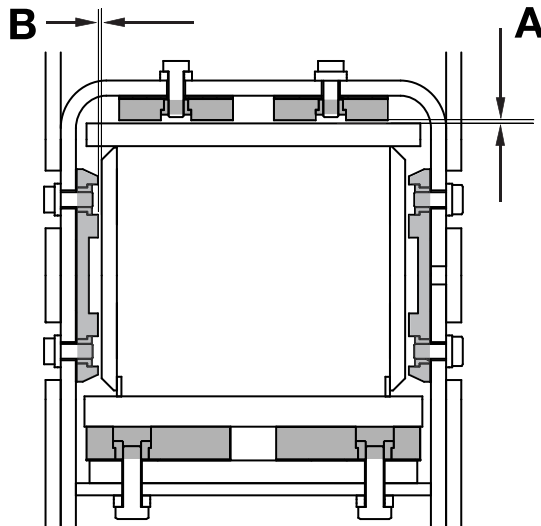


Fig 1.

C094520-C1

Location	Shim thickness	Number of washers	
Side Pads	0.5 to 2.5 mm	2	
	3.0 to 4.5 mm	1	
	5.0 to 6.5 mm	0	
	7.0 to 8.0 mm	0	
	1.6 to 4.2 mm		2
	4.7 to 6.4 mm		1
Lower Front Pads	0 mm	4	N/A
	1.3 to 3 mm	3	
	3.2 to 8 mm	2	
Lower Rear Pad	NA		2

Table 2. Maximum Gap

Dimension ⇒ Fig 1. (□ B12-3)	Maximum Gap
A	1.5 mm
B	1.5 mm

Table 3. Number of plain washers to be fitted under bolt

Location	Shim thickness	Number of washers	
		Front	Rear
Upper Pads	1.6 to 4.2 mm	3	2
	4.7 to 6.4 mm	2	1
	6.9 to 8.0 mm	1	

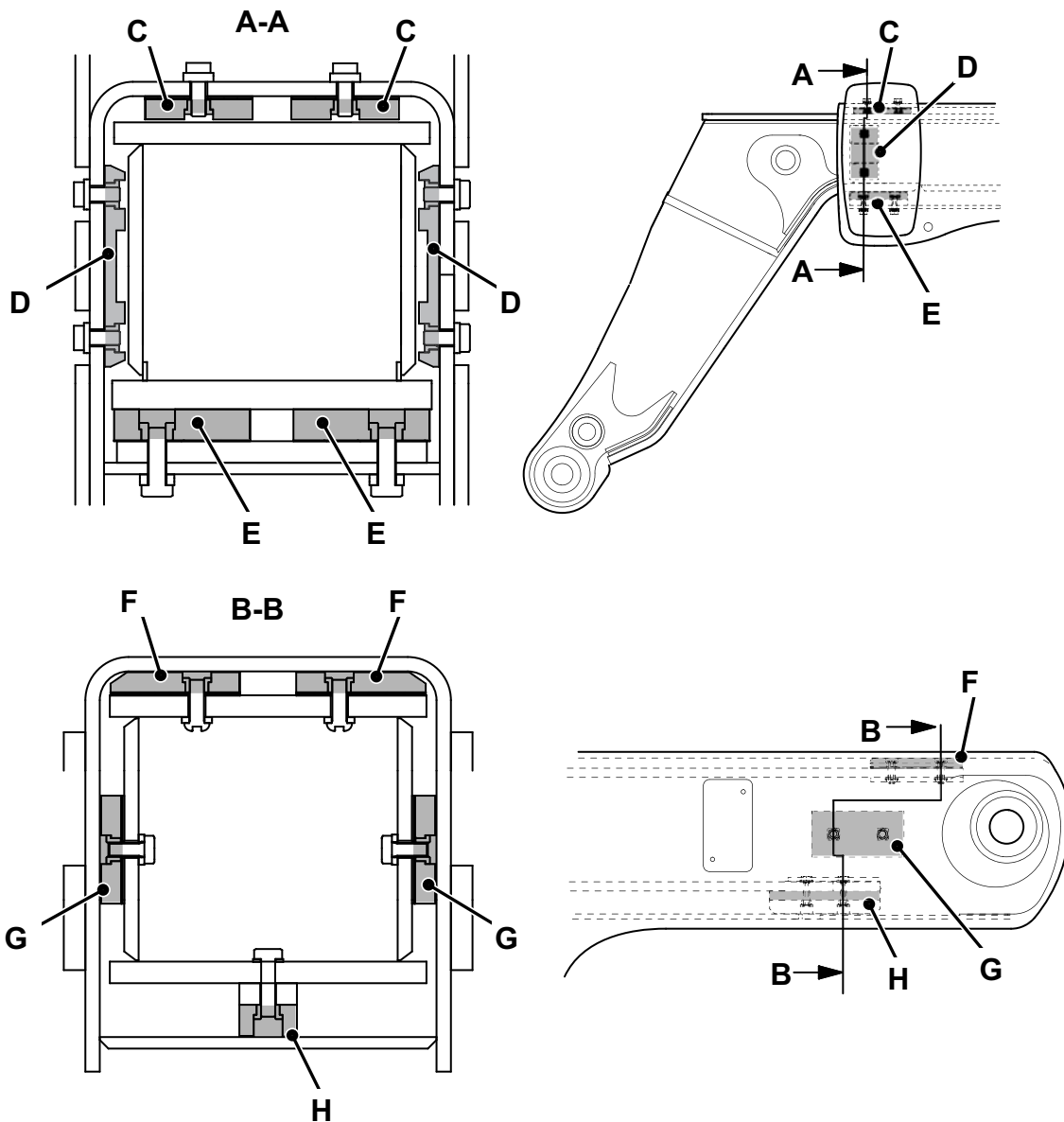


Fig 2. Wear pad layout

C094520

Typical Shimming Procedure

Shims are fitted under the pads for adjustment of boom clearance. Partly worn pads may be shimmed to restore correct boom clearance.

Renew the wear pads when, or before they are worn down to depth of chamfer as shown at **A**.

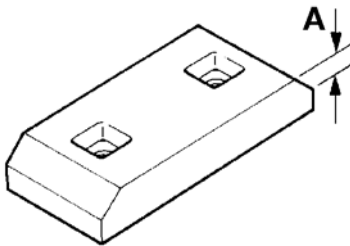


Fig 3.

259401-1

Shim inner boom **C** to outer boom **B**.

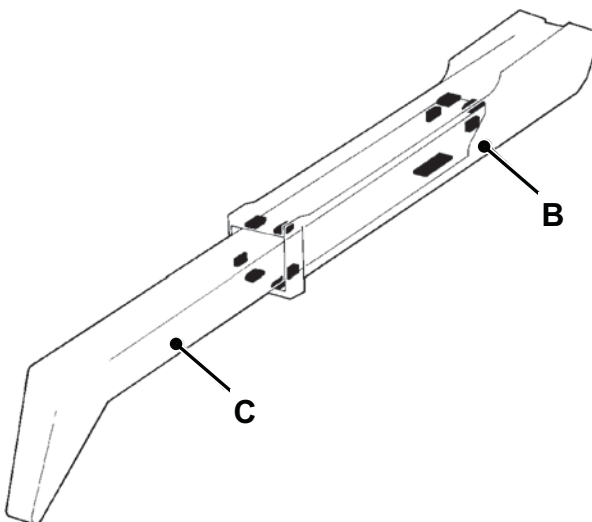


Fig 4.

259402-1-C1

Lower Wear Pads

Front Lower Wear Pads

- 1 Lift the boom a small amount so that the forks are off the ground.
- 2 Measure the distances between the lower boom faces which must be as specified. If this dimension is below limits shims must be installed below the lower wear pads to get the correct dimension. [⇒ Wear Pad Clearance \(□ B12-3\)](#)
- 3 Put the forks on the ground so that there is no weight on the lower wear pads.
- 4 Remove the lower wear pad bolts **A** and add shims **B** as necessary to get the correct boom clearance dimensions.

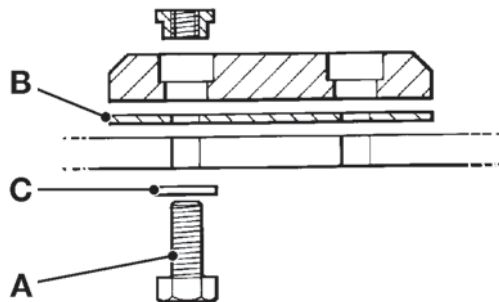


Fig 5.

S343451-1

- 5 Measure the total thickness of shims below each pad.
- 6 Add or remove plain washers **C** below the heads of wear pad bolts **A** to make sure that there is sufficient thread engagement. Use the correct number of washers. [⇒ Table 3. Number of plain washers to be fitted under bolt \(□ B12-3\)](#)
- 7 Install shims and torque tighten bolts **A**. [⇒ Table 4. Torque Settings \(□ B12-6\)](#)

Rear Lower Wear Pads

- 1 Put forks on the ground.
- 2 Remove the boom rear cover.
- 3 Measure the distances between the lower boom faces which must be as specified. If this dimension is below limits shims must be installed below the lower wear pads to get the correct dimension. [⇒ Wear Pad Clearance \(□ B12-3\)](#)
- 4 Lift the boom a small amount so that the forks are off the ground and place wedges below the inner boom
- 5 Remove the lower wear pad bolts **A** and add shims **B** as necessary to get the correct boom clearance dimensions.
- 6 Measure the total thickness of shims below each pad.
- 7 Add or remove plain washers **C** below the heads of wear pad bolts **A** to make sure that there is sufficient thread engagement. Use the correct number of washers. [⇒ Table 3. Number of plain washers to be fitted under bolt \(□ B12-3\)](#)
- 8 Remove wedges, install shims and torque tighten bolts. [⇒ Table 4. Torque Settings \(□ B12-6\)](#).

Table 4. Torque Settings

Item	Nm	lbf ft	kgf m
A ⁽¹⁾	98	72	10
A ⁽²⁾	56	41	5.7

- (1) Pads fitted with M12 bolts
 (2) Pads fitted with M10 bolts

Upper Wear Pads

Note: The following procedure applies to both front and rear upper wear pads.

Note: Rear upper wear pads are secured with dome head screws and washers.

- 1 Lift the boom until the inner boom is resting on the lower wear pads.
- 2 Measure the total vertical clearance which must be as specified. [⇒ Wear Pad Clearance \(□ B12-3\)](#)
- 3 Install or remove shims **B** to get the correct vertical clearance. Measure the total thickness of shims below each pad.

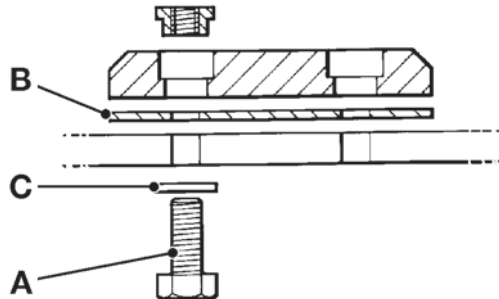


Fig 6.

S343451-1

- 4 Add or remove plain washers **C** below the heads of wear pad bolts **A** to make sure that there is sufficient thread engagement. Use the correct number of washers. [⇒ Table 3. Number of plain washers to be fitted under bolt \(□ B12-3\)](#)
- 5 Install shims and torque tighten bolts **A**. [⇒ Table 5. Torque Settings \(□ B12-7\)](#).

Table 5. Torque Settings

Item	Nm	lbf ft	kgf m
A ⁽¹⁾	98	72	10
A ⁽²⁾	56	41	5.7

- (1) Pads fitted with M12 bolts
(2) Pads fitted with M10 bolts

Side Wear Pads

Note: The following procedure applies to both front and rear side wear pads.

- 1 Pull the boom to one side and measure the total side clearance of the boom which should be as specified. [⇒ Wear Pad Clearance \(□ B12-3\)](#)
- 2 Loosen the side wear pad bolts **A** and shim as necessary. Divide the number of shims equally each side to make sure that the inner boom is central within the outer boom.

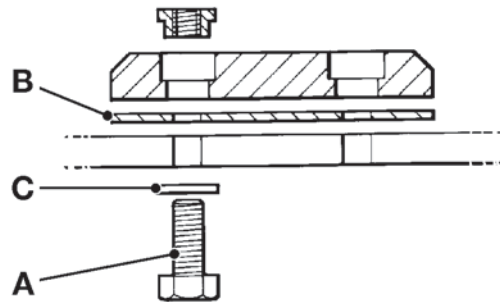


Fig 7.

S343451-1

- 3 Measure the total thickness of shims below each pad.
- 4 Add or remove plain washers **C** below the heads of wear pad bolts **A** to make sure that there is sufficient thread engagement. Use the correct number of washers. [⇒ Table 3. Number of plain washers to be fitted under bolt \(□ B12-3\)](#)
- 5 Install shims and torque tighten bolts **A**. [⇒ Table 6. Torque Settings \(□ B12-7\)](#).

Table 6. Torque Settings

Item	Nm	lbf ft	kgf m
A ⁽¹⁾	98	72	10
A ⁽²⁾	56	41	5.7

- (1) Pads fitted with M12 bolts
(2) Pads fitted with M10 bolts

Checking the Boom Carriage Alignment

When the boom is assembled do a check of the height of the left and right sides of the carriage. Make sure that the tyre pressures are correct to give an accurate measurement. If the measurements are different adjust the front lower wear pad shims. The maximum difference between the shims must be 3.2 mm. [⇒ Lower Wear Pads \(B12-6\)](#)

Angle Indicator Removal and Replacement

Removal

- 1 Slacken the locknut **A**.
- 2 Remove bolt **B** and the pointer arm **C**.
- 3 To detach dial **E** remove bolts **D**.

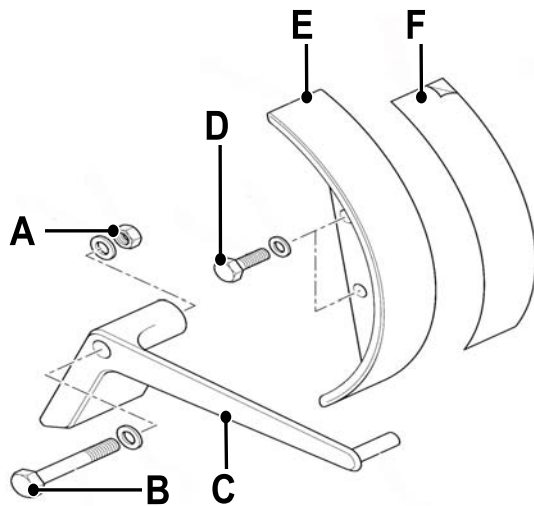


Fig 8.

C046900

Replacement

Replacement is the opposite of the removal procedure.

Note: If dial scale is worn this can be replaced by removing decal **F** and replacing with new decal.

Note: Grease pivot bolt **B** to ensure smooth operation of pointer arm **C**.

Pivot Shims

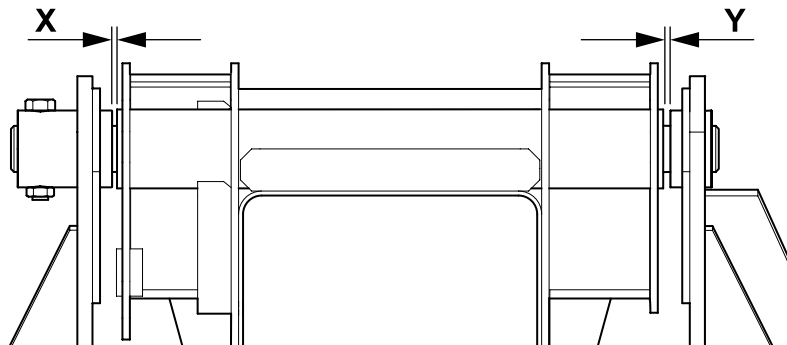


Fig 9.

249790-1

Note: The illustration shows the boom viewed from the rear of the machine.

- 1 Measure **X** and **Y**.
- 2 Use the following illustration to calculate the total gap **Z**:

$$\text{Total Gap } Z = X + Y$$

The total gap **Z** must not be more than 3mm.

- 3 If necessary add the correct quantity of shims to get the correct measurement. Add the shims equally at the two sides to make sure the boom is central on the pivot.

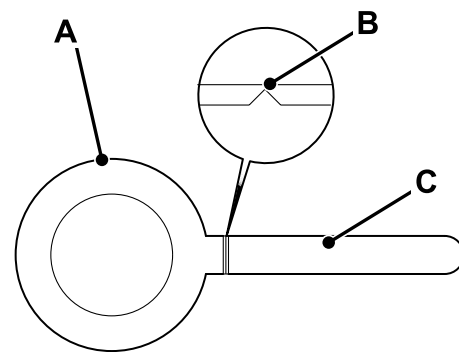


Fig 10.

C079130

Note: If new shims are necessary, install "handled" shims **A**. When these have been installed and the gap **Z** is correct snap the handle **C** from the shim **A** at the crease **B**.

Removal and Replacement

WARNING

Lifting Equipment

You can be injured if you use faulty lifting equipment. Make sure that lifting equipment is in good condition. Make sure that lifting tackle complies with all local regulations and is suitable for the job. Make sure that lifting equipment is strong enough for the job.

INT-1-3-7

WARNING

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before connecting or removing any hydraulic hose, residual hydraulic pressure trapped in the service hose line must be vented. Make sure the hose service line has been vented before connecting or removing hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11_2

WARNING

Raised Machine

NEVER position yourself or any part of your body under a raised machine which is not properly supported. If the machine moves unexpectedly you could become trapped and suffer serious injury or be killed.

INT-3-3-7_1

Note: The boom does not need to be removed to replace the auxiliary and tilt hoses. ➔ [Auxiliary and Tilt Hoses \(!\[\]\(beb6890ce3c927ccc575109de78f9b29_img.jpg\) B12-18\)](#)

Removal

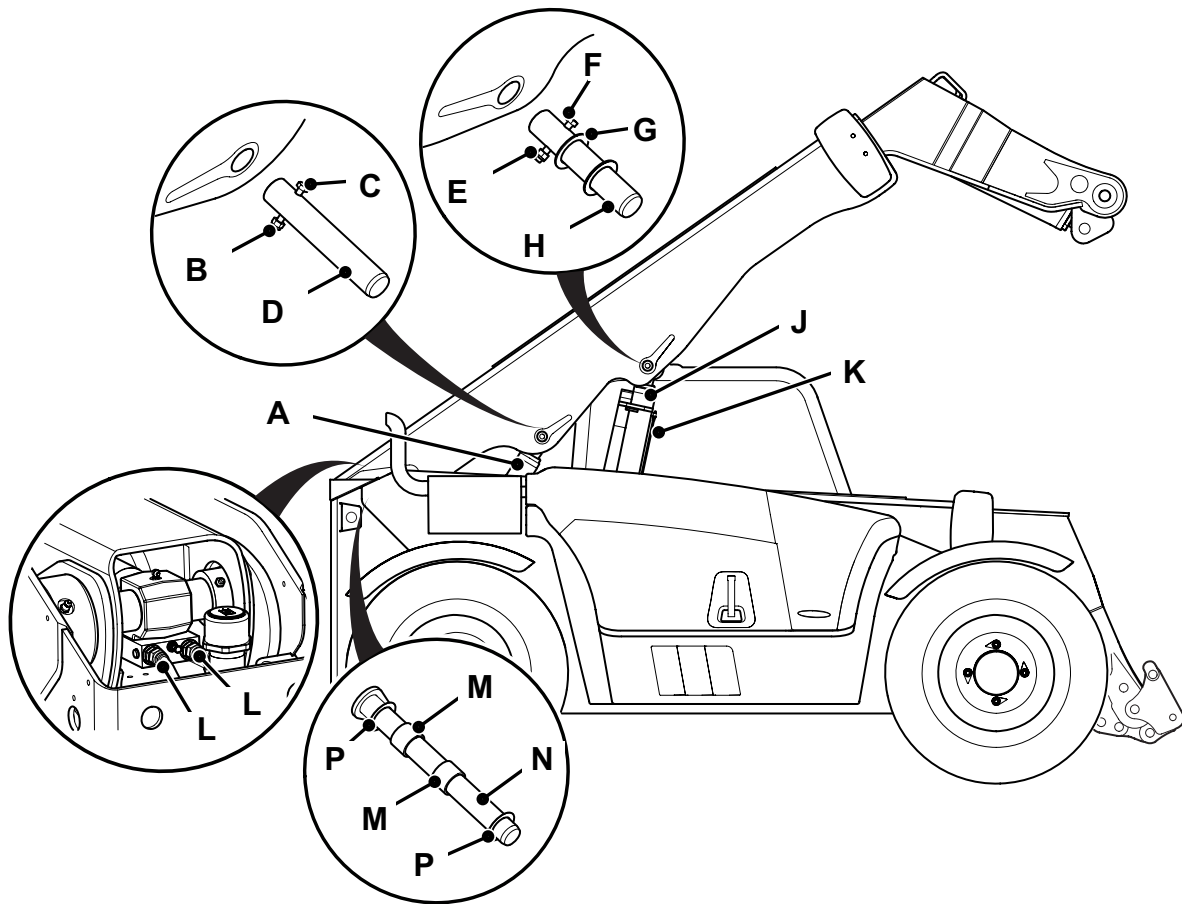


Fig 11.

C094540

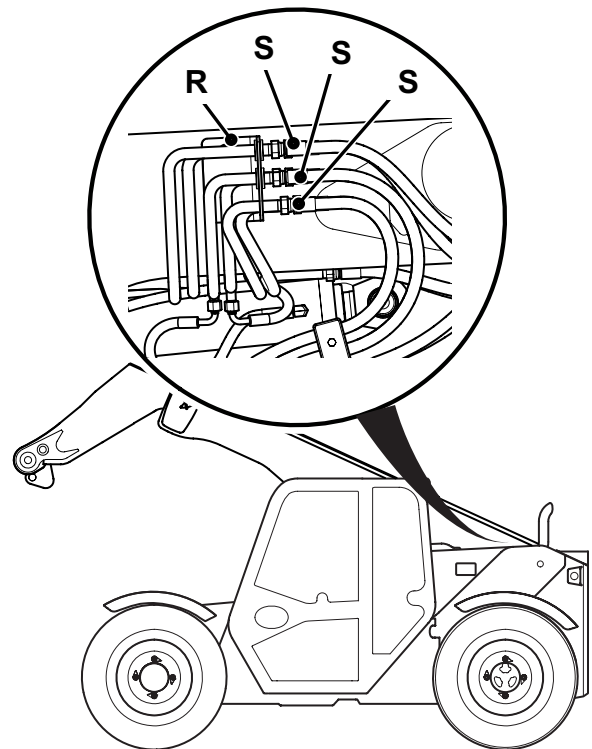
- 1 Park the machine and make it safe. Release the hydraulic pressure. Obey the general safety procedures, see **Section 2 - General Procedures**. [⇒ Related Topics \(□ B12-2\)](#)
- 2 Remove boom attachments, including forks and fork bar.
- 3 Remove the boom rear cover. Refer to **Section 3 - Access Panels**. [⇒ Related Topics \(□ B12-2\)](#)
- 4 Remove the deck plate. Refer to **Section 3 - Access Panels**. [⇒ Related Topics \(□ B12-2\)](#)
- 5 Lower the boom onto a suitable support in the semi-raised position to gain access to the lift ram rod end and the displacement ram head end. Support the boom from above ready for removal. Use lifting shackles of suitable capacity attached to the forward and rear lifting points.
- 6 Support the lift ram J and disconnect the lift ram rod end by removing nut E and bolt F.
- 7 Disconnect the electrical connectors.
- 8 Using the slide hammer kit, remove the pivot pin H, see **Section 1 - Service Tools**.

Note: Make sure to retrieve washers G.

- 9 Lower the ram **J** onto packing material to prevent damage to the piston rod.

Note: Make sure not to damage the remote grease point and pipe **K**.

- 10 Support the displacement ram **A** and disconnect the head end of the ram by removing nut **B** and bolt **C**.
- 11 Using the slide hammer kit, remove the pivot pin **D**, see **Section 1 - Service Tools**.
- 12 Lower the ram **A** onto packing material to prevent damage to the piston rod
- 13 Vent the hydraulic pressure, see **Section 2 - General procedures**. → [Related Topics \(□ B12-2\)](#)
- 14 Loosen the filler cap to vent the hydraulic tank.
- 15 Put a label on the connections and disconnect the hydraulic hoses **L** at the rear of the boom.
- 16 Put a label on the connections and disconnect the hoses **S** from the pipes at the pipe support bracket **R**.



C094540-C3

Fig 12.

- 17 Make sure that the boom is fully supported. Remove bolt and remove the pivot pin **N**.

Note: Make sure to retrieve the spacer shims **P**.

- 18 Carefully lift the boom clear of the machine, checking for any remaining connections.

Replacement

Replacement is the opposite of the removal procedure.

During the replacement procedure do this work also:

- Do a check of the boom pivot bushes **M**. Replace if necessary.
- Check the hydraulic oil level and fill if necessary.
- Grease all pivot pins, see **Section 3 - Greasing**. → [Related Topics \(□ B12-2\)](#)
- Do a check of the pivot shim clearance. → [Pivot Shims \(□ B12-10\)](#)

Dismantling and Assembly

Unless the boom fabrications are damaged there is normally no requirement to separate the boom sections. The boom sections can be separated with the boom assembly removed or fitted to the machine as required.

Note: *The following procedures can be carried out without the need to separate the boom sections or remove the boom from the machine:*

- Hose removal and replacement for the tilt ram and auxiliary services. [⇒ Auxiliary and Tilt Hoses \(□ B12-18\)](#)
- Tilt ram removal and replacement. See **Section E - Hydraulics**. [⇒ Related Topics \(□ B12-2\)](#)
- Extension ram removal and replacement. See **Section E - Hydraulics**. [⇒ Related Topics \(□ B12-2\)](#)
- Wear pads and shims. [⇒ Wear Pads and Shims \(□ B12-3\)](#)
- Displacement ram removal and replacement. See **Section E - Hydraulics**. [⇒ Related Topics \(□ B12-2\)](#)
- Lift ram removal and replacement. See **Section E - Hydraulics**. [⇒ Related Topics \(□ B12-2\)](#)

WARNING

Lifting Equipment

You can be injured if you use faulty lifting equipment. Make sure that lifting equipment is in good condition. Make sure that lifting tackle complies with all local regulations and is suitable for the job. Make sure that lifting equipment is strong enough for the job.

INT-1-3-7

WARNING

Hydraulic Pressure

Hydraulic fluid at system pressure can injure you. Before connecting or removing any hydraulic hose, residual hydraulic pressure trapped in the service hose line must be vented. Make sure the hose service line has been vented before connecting or removing hoses. Make sure the engine cannot be started while the hoses are open.

INT-3-1-11_2

WARNING

Raised Machine

NEVER position yourself or any part of your body under a raised machine which is not properly supported. If the machine moves unexpectedly you could become trapped and suffer serious injury or be killed.

INT-3-3-7_1

Dismantling

- 1 Remove the fork carriage. [⇒ Related Topics \(□ B12-2\)](#)
- 2 Remove the tilt ram A. See **Section E - Hydraulics**. [⇒ Related Topics \(□ B12-2\)](#)
- 3 Remove the extension ram B. See **Section E - Hydraulics**. [⇒ Related Topics \(□ B12-2\)](#)
- 4 Remove the telescopic hydraulic service hoses. To ensure that the hoses do not become damaged or tangled they must be removed before attempting to separate the boom sections. Remove hoses as follows:
 - a Undo the hose clamps C.
 - b Remove the tilt ram and auxiliary hoses D. Label and disconnect the hoses at the steel pipes on the underside of the boom. Pull out the hoses through guide channels F from the rear in the direction of arrow X. Then pull out the hoses through the apertures under the boom in the direction of arrow Y. Cap all open hoses and ports.
- 5 Remove the inner boom H.
 - a Remove the front wear pads G from the outer boom J. Make sure that the boom assembly is fully supported by the outer boom and then remove the upper and side wear pads. Lift the front of the inner boom clear of the lower wear pads and then remove them. Label all the wear pads and keep them together with their shims.
 - b Support the front end of the inner boom H and draw it out from the outer section J. Before the inner section is all the way out attach suitable lifting equipment. Make sure the section is fully supported by the lifting equipment and then draw it free from the outer section.

Important: If the boom assembly has been removed from the machine make sure that it is securely supported. When the inner boom section is withdrawn forces may cause the whole assembly to move.

Assembly

Assembly is the opposite of the dismantling procedure.

During the assembly procedure do this work also:

- 1 Check the length of the hose pairs. The hose lengths must be equal to within +/- 1mm for each service pair (tilt ram pair, and auxiliary service pair).
 - 2 DO NOT renew individual hoses. The hoses can stretch over time. New hoses may not be the same length. Renew all four telescopic service hoses if any of the hoses are damaged.
 - 3 Assemble the boom sections so that the boom is fully retracted.
- Note:** To enable alignment of the rod end pivot of the extension ram, the hydraulic hoses must be fitted so that the boom can be extended.
- 4 Make sure that the hose routing is correct. DO NOT cross over any hoses. the tilt ram and auxiliary service hoses pass through the guide channels in the top of the inner boom. When all the hoses are correctly connected fit the clamps C at the inside of the inner boom.
 - 5 Check that the boom wear pad shimming is correct. [⇒ Wear Pads and Shims \(□ B12-3\)](#).
 - 6 Check that the boom pivot shimming is correct. [⇒ Pivot Shims \(□ B12-10\)](#)

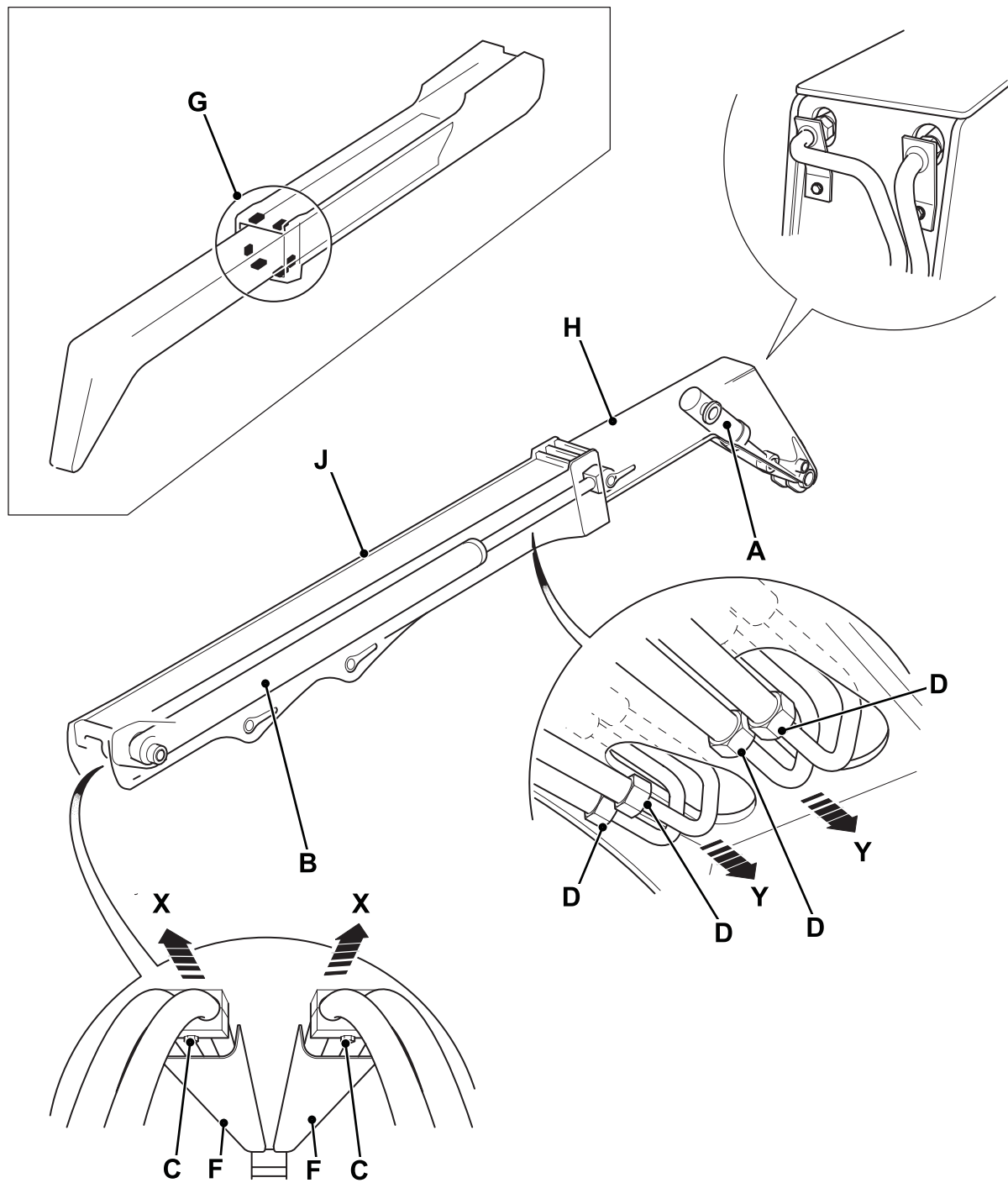


Fig 13.

C096430

Boom Hoses and Pipework

Item	Description
A	Extension Ram
B	Tilt Ram

Item	Description
C	Displacement Ram
D	Auxiliary Hoses

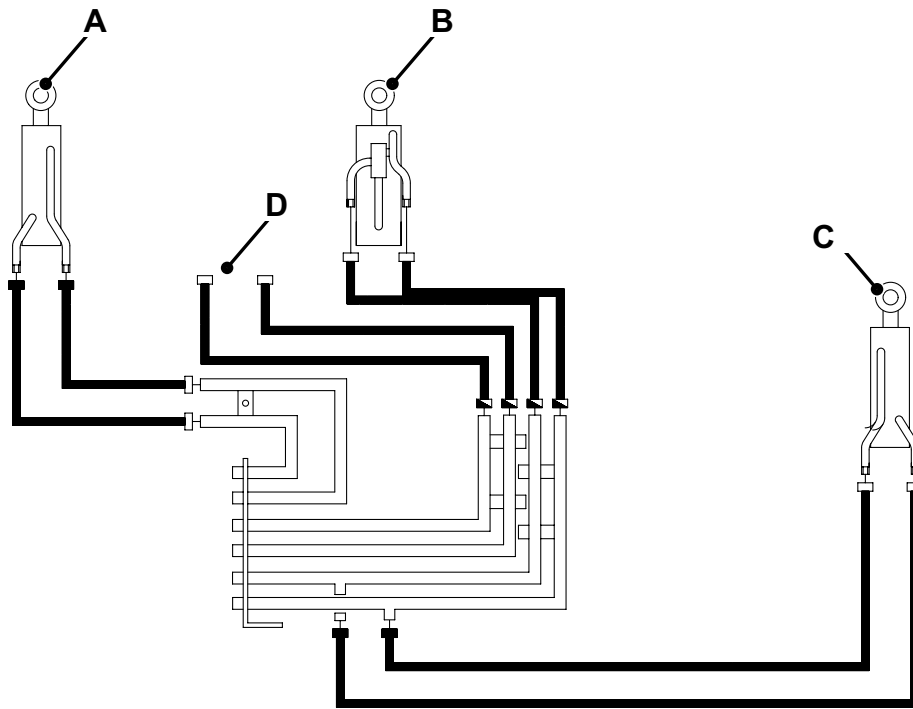


Fig 14.

C094530

Auxiliary and Tilt Hoses

Removal

- 1 Park the machine and make it safe. Obey the general safety procedures, see **Section 2 - General Procedures**. [⇒ Related Topics \(□ B12-2\)](#)
- 2 Extend the boom by approximately 1 metre (3ft 4 inches).
- 3 Remove boom attachments, including forks and fork bar.
- 4 Release the hydraulic pressure, see **Section 2 - General Procedures**. [⇒ Related Topics \(□ B12-2\)](#)
- 5 Remove the boom rear cover. Refer to **Section 3 - Access Panels**. [⇒ Related Topics \(□ B12-2\)](#)
- 6 Remove the extension ram **E**. Refer to **Section E - Hydraulics**. [⇒ Related Topics \(□ B12-2\)](#)
- 7 Install a pivot pin into the boom rear pivot.
- 8 Remove the tilt ram **D**. Refer to **Section E - Hydraulics**. [⇒ Related Topics \(□ B12-2\)](#)
- 9 Put a label on the hydraulic hoses to aid replacement.
- 10 Remove the auxiliary pipe bracket retaining bolts **B**.
- 11 Disconnect the hoses **A** from the auxiliary pipes **C**.
- 12 Disconnect the auxiliary and tilt hoses **L** from the boom pipes **K**.
- 13 Remove the hose clamp securing bolts **G** and hose clamps **F**.
- 14 Remove the tilt ram and auxiliary hoses **H**. Pull out the hoses through guide channels **J** from the rear in the direction of arrow **X**. Then pull out the hoses through the apertures under the boom **M** in the direction of arrow **Y**. Cap all open hoses and ports.

Replacement

- 1 Install the hoses **L** through the apertures under the boom **M**.
- 2 Connect the hoses **L** to the boom pipes **K**.
- 3 Pull the hoses **L** through to the rear of the boom.
- 4 Using a long rod with a hook end feed the hoses into the channels **J**. The hoses will need to be lifted slightly to enter the channel.

- 5 Make sure to pull the tilt ram hoses into position and install the tilt ram **D**, refer to **Section E - Hydraulics**. [⇒ Related Topics \(□ B12-2\)](#)
- 6 Connect the auxiliary hoses **A** to the auxiliary pipes **C**.
- 7 Install the auxiliary pipe bracket retaining bolts **B**.
- 8 Install the hose clamps **F** and securing bolts **G**.
- 9 Install the extension ram **E**, refer to **Section E - Hydraulics**. [⇒ Related Topics \(□ B12-2\)](#)
- 10 Replace the boom rear cover. Refer to **Section 3 - Access Panels**. [⇒ Related Topics \(□ B12-2\)](#)
- 11 Check the hydraulic oil level and fill if necessary.
- 12 Check operation of the boom services and make sure that there are no leaks.
- 13 Grease all pivot pins, see **Section 3 - Greasing**. [⇒ Related Topics \(□ B12-2\)](#)
- 14 Check the pivot shim clearance. [⇒ Pivot Shims \(□ B12-10\)](#)

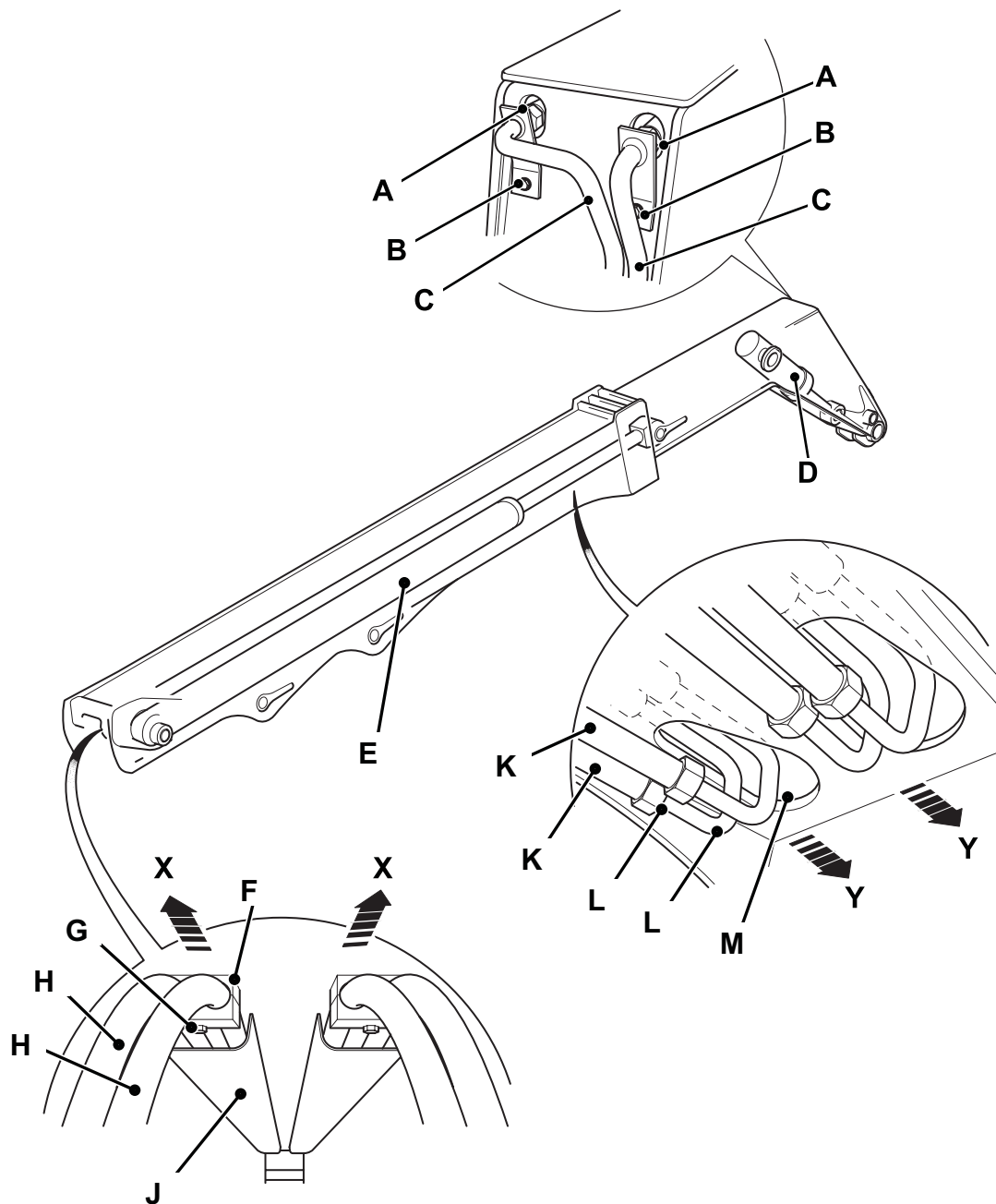


Fig 15.

C096430-C1



Section B12 - Body and Framework

Boom

Boom Hoses and Pipework

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LMI Axle Transducer

Introduction

This topic contains information about a machine DEVICE. Make sure you are referring to the correct device. Refer to the applications table.

Descriptions and procedures relate to the device and not related systems. For information about the systems refer to the relevant topics.

[⇒ *Related Topics* \(!\[\]\(f1562d89d26a2af7eb64be7129fc8ec0_img.jpg\) B13-2\)](#)

[⇒ *Removal and Replacement* \(!\[\]\(0c786ebcc476adc8e87a8b72037b1322_img.jpg\) B13-3\)](#)

[⇒ *Removal* \(!\[\]\(6b3ce3474af78b569e49511398405d3c_img.jpg\) B13-3\)](#)

[⇒ *Replacement* \(!\[\]\(cd62541f90988e413d20714dcc85997b_img.jpg\) B13-3\)](#)

Related Topics

Table 1. Related Topics in This Publication

The table lists other topics in the manual that contain information related to this topic. Refer to the applicable topics to complete your procedures. Where applicable the text in this section contains cross references to this page to help you find the correct information. Some machines have different systems and devices. Make sure you refer to the correct topic, refer to Section 1 - Applications .		
Sections	Topic Titles	Sub Titles
1	Applications	ALL
2	ALL (Care and Safety) ⁽¹⁾	ALL
B	⇒ Longitudinal Load Moment SYSTEM (B4-1)	ALL

(1) You must obey all of the relevant care and safety procedures.

Removal and Replacement

Removal

Carry out General Safety procedures. See **Section 2 - General Procedures**. [⇒ Related Topics \(B13-2\)](#)

WARNING

A raised and badly supported machine can fall on you. Position the machine on a firm, level surface before raising one end. Ensure the other end is securely chocked. Do not rely solely on the machine hydraulics or jacks to support the machine when working under it.

Disconnect the battery, to prevent the engine being started while you are beneath the machine.

GEN-1-1

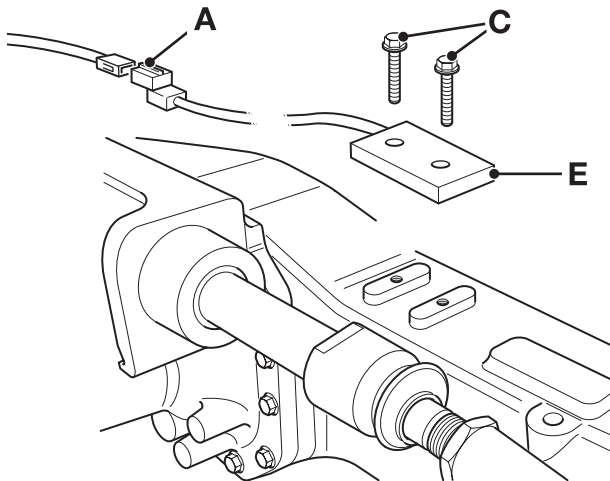


Fig 1.

A709280-1

- 1 Raise the rear end of the machine, under the chassis, until the rear wheels are clear of the ground.

Important: Do not lift the machine from under the axle.

- 2 Remove a road wheel, angle and support the axle to gain access to the transducer.
- 3 Disconnect the electrical harness **A**.
- 4 Remove bolts **C** and remove the transducer **E**.

Replacement

- 1 Remove any old sealant, rust, dirt or paint from the mounting faces on the axle.
- 2 Make sure the mounting faces are flat, level and free of burrs.
- 3 Apply JCB Retainer (High Strength) to the mounting faces.
- 4 Position the transducer **E** as shown. Check the bolt holes align and the mating faces are flush.
- 5 Secure the transducer with bolts **C**. Coat the bolts with JCB Threadlocker and Sealer and torque tighten evenly.
- 6 Connect the electrical harness **A**. Ensure the cable to the transducer is secured clear of the axle oscillation stops, and cannot be damaged by movement of the trackrod.
- 7 Calibrate the LMI system. [⇒ LLMI - Calibration \(B4-14\)](#)

Table 2. Torque Settings

Item		Nm	kgf m	lbf ft
C ⁽¹⁾	M12	122	12.44	90

(1) Dry bolt (i.e. not lubricated).



Section B13 - Body and Framework

LMI Axle Transducer

Removal and Replacement

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