

## Body and Framework

Service Manual - Side Engine Loadalls

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# Section B - Body and Framework

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# Technical Data

## Air Conditioning (Option)

### Binary Pressure Switch Settings

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

### 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 Kg (2.2 lb) Maximum charge <sup>(1)</sup>
	1.7 Kg (3.74 lb) Maximum charge <sup>(2)</sup>

(1) Systems with cooling pack mounted condenser.

(2) Systems with roof mounted condenser.

### Oil

Type PolyAlkylene Glycol (PAG)

Quantities - Recharge the system <sup>(1)</sup> 1.5 fluid oz (42.6 ml)

#### Component Replacement

Condenser 1.0 fluid oz (28.4 ml)

Evaporator 2.0 fluid oz (58.6 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.

# Basic Operation

## Boom - Telescopic Operation

### 3 Stage Boom

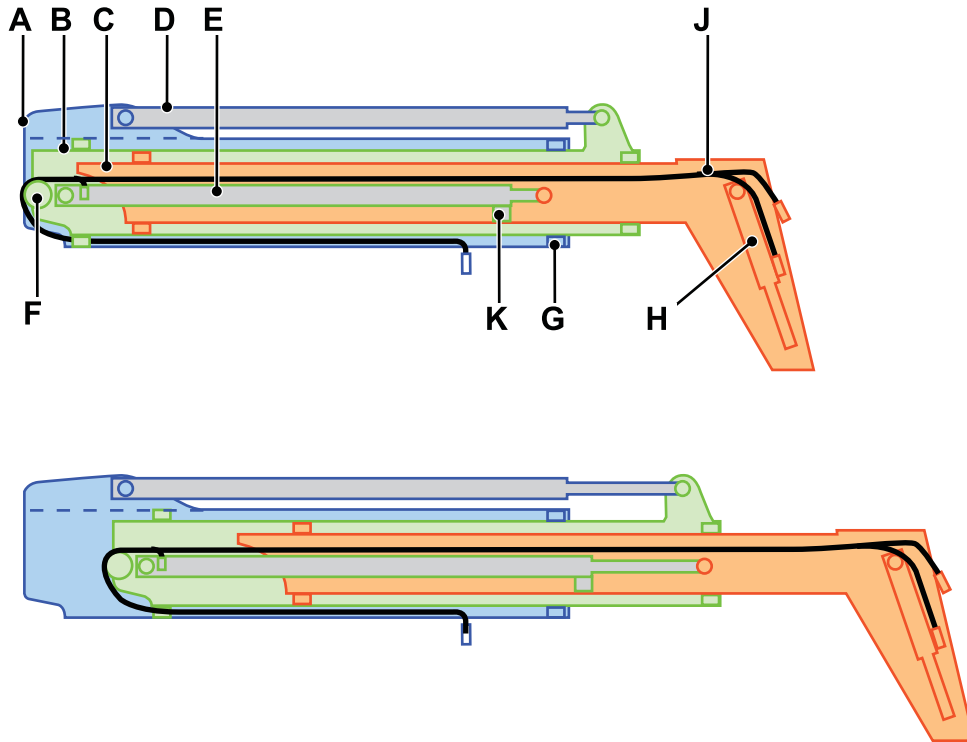


Fig 1.

The telescopic boom consists of three sections, an inner **1C**, intermediate **1B** and outer **1A** section.

When the boom is extended or retracted the inner and outer sections move simultaneously. This is achieved by hydraulically interconnecting the inner and outer extension rams (**1E** and **1D**). See **Section E** for an explanation of the hydraulic operation.

From the diagrams we can see that the hydraulic hoses **1J** connected to the tilt ram, auxiliary service and inner extension ram (telescopic services) are arranged to follow the movement of the inner and intermediate boom sections. As the boom extends the hose runs at the bottom of the inner boom are drawn around the guide roller **1F** and along the top of the inner extension ram **1E**.

If the inner and intermediate booms move out of phase the telescopic service hoses will be damaged. Should a hose of the incorrect length be fitted damage can also occur.

**Important:** To ensure the reliable operation of the telescopic function it is critical that the hoses are routed and fitted correctly.

To ensure the correct clearances and smooth movement between the boom sections special wear pads **1G** together with shims are fitted. Wear pads are fitted at the top, bottom and sides at both ends of the boom sections. The inner extension ram is also fitted with a wear pad **1K** since the inner boom moves in relation to the ram cylinder.

Key → <a href="#">Fig 1. (□ B-2)</a>	
<b>A</b>	Outer boom section (coloured blue)
<b>B</b>	Intermediate boom section (coloured green)
<b>C</b>	Inner boom section (coloured orange)
<b>D</b>	Outer extension ram
<b>E</b>	Inner extension ram
<b>F</b>	Hose guide roller
<b>G</b>	Wear pad
<b>H</b>	Tilt ram
<b>J</b>	Example hose routing - auxiliary service
<b>K</b>	Wear pad - inner extension ram

### Air Conditioning (Option)

#### 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

### 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. Its full chemical name is:

1, 1, 1, 2-Tetraflouroethane (CH<sub>2</sub>FCF<sub>2</sub>)

R134a is a HFC (HydrFlouroCarbon) 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.

### 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**.

**Note:** Some machines are fitted with a cab roof mounted condenser matrix and chassis mounted receiver drier.

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**, which is mounted on the engine cooling pack (note that some machine variants have the condenser mounted on the cab roof). Ambient air is drawn across the condenser by the engine - driven cooling fan. 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 vapourise 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.

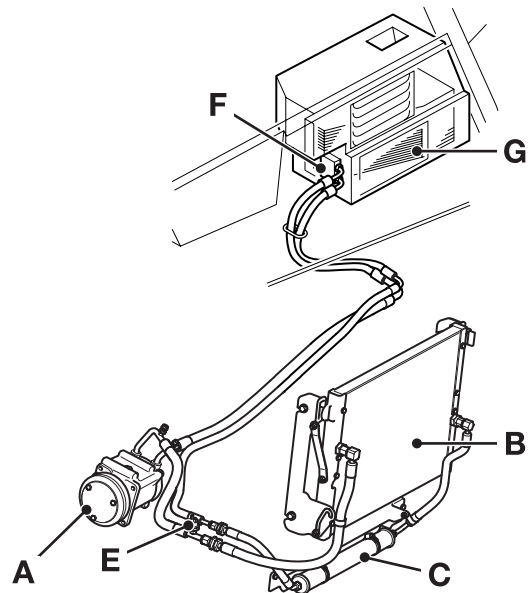


Fig 2.

## System Control

Air conditioning is achieved by refrigeration. The system is a manual control type and is set to ON or OFF by switch **A**. There is no automatic control of the cab air temperature. The heater control **C** and blower control **B** operate as normal. Refrigerated air will be heated by the heater matrix if the heater control is not set to 'cold'.

Control of the system is achieved by activating and deactivating the compressor electromagnetic clutch. When current is fed to the field coil of the compressor 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:

- 1 The manual A/C ON/OFF switch **A** in the control console.
- 2 The freeze protection thermostat switch **D** located inside the HVAC unit. The switch is not adjustable.
- 3 The high and low level binary pressure switch **E** located in the pipework adjacent to the compressor. The switch is not adjustable.

When the A/C switch **A** is set to ON the refrigeration system is active. The system operates within fixed temperature and pressure limits controlled by freeze protection thermostat switch **D** and binary pressure switch **E**. The system does not respond to changes in the cab air temperature.

If the compressor runs continuously condensate on the evaporator matrix will freeze and the system will not be effective. The freeze protection thermostat switch **D** has its sensor probe inserted in the evaporator matrix. When the temperature of the probe is near 0°C the thermostat switch contacts open. The compressor clutch disengages, closing down the refrigeration cycle. As the temperature of the probe increases the thermostat switch contacts close. The compressor clutch engages and refrigeration re-starts.

If the refrigerant pressure exceeds the upper pressure limit or falls below the lower limit, the contacts of binary switch **E** open and the compressor clutch disengages, closing down the refrigeration cycle.

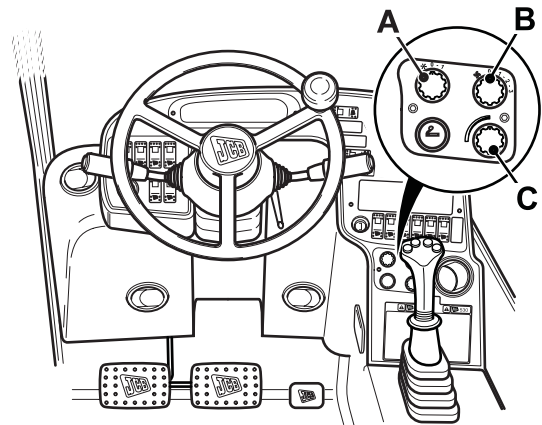


Fig 3.

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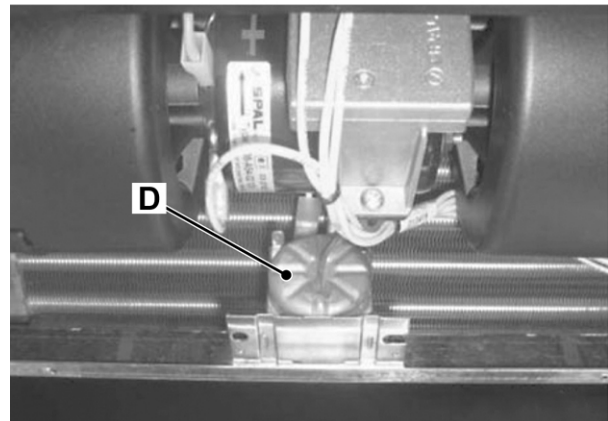
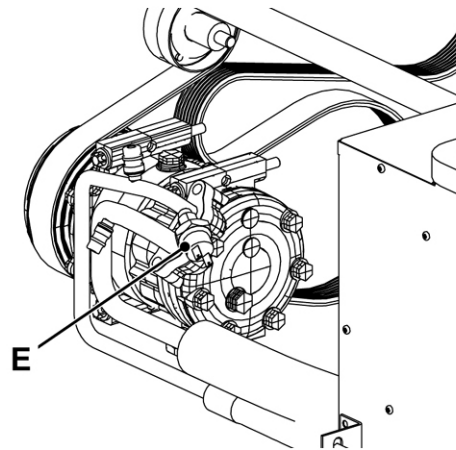


Fig 4.

C094770

## Load Moment Indicator (LMI)

A transducer measures the load exerted on the rear axle and sends a signal to the indicator display box. The display box warns the operator when the machine is nearing its maximum working limit (i.e. when it could tip forward).

**Note:** Machines destined for the North American market are not normally fitted with a Load Moment Indicator.

The display box converts the signal from the transducer mounted on the rear axle into a display of LEDs. Three green LEDs **5-C**, and amber LED **5-D** will illuminate progressively as the load increases.

All LEDs will flash as the load nears the maximum working limit. If the load exceeds the maximum working limit, the red LED **5-E** will illuminate and an audible warning will activate.

Green LED **5-G** remains on whenever power is supplied to the display box.

If a system fault is detected, the audible alarm will sound and various combinations of LEDs will illuminate to indicate a fault code, see **Fault Finding**.

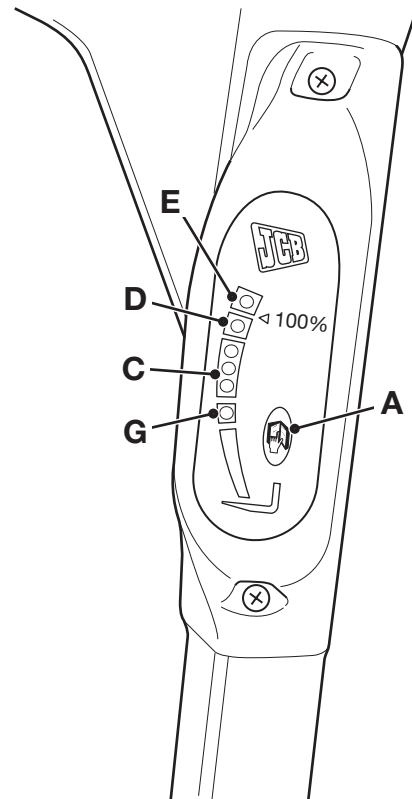


Fig 5. Typical Indicator Display Box

## Type 1: Cooling Pack Mounted Condenser

### SA,SB,SC Machines With Analog Display

⇒ [Fig 6.](#) ([Fig B-10](#)). On the electrical diagram the electrical connectors (example, CA to CP) are shown looking on the mating face of each connector when they are disconnected.

The wire numbers and colours, where appropriate, are shown as an aid to identification whilst fault finding.

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. For details of these connections refer to **Section C, Machine Earth Connections**.

### Component Key:

The following key identifies the component connectors on the electrical diagram. Note that the wires coloured red show the electrical 'live feed'. The wires coloured green show the electrical 'return to earth'. For harness drawings refer to **Section C, Harness Data**.

# Electrical Connections

## Air Conditioning (Option)

- h1** Harness - 721/11867, 721/11869, 721/11880, 721/11883 Panel
- h2** Harness - 721/11881, 721/11882, 721/11879, 721/11966, 721/11866, 721/11868, 721/12106 Chassis
- h3** Harness - 721/11835 Engine

### Connectors (h1)

- CA h1 - h2
- DB Heating, Ventilation and Air Conditioning (HVAC) Unit
- AA Fusebox A
- DC Heater Blower Switch (3-speed)
- CE1 Air Conditioning Switch
- CE2 Air Conditioning Switch
- DE2 Earth Point

### Connectors (h2)

- CP/ h2 - h1
- CV
- CH/ h2 - h3
- CB
- CT Earth Point

### Connectors (h3)

- EA h3 - h2
- EK Air Conditioning Compressor - Clutch Solenoid
- EP Binary Pressure Switch

### Connectors (h3)

- ER Binary Pressure Switch

### Splices (h3)

- SB
- SC

### HVAC Unit:

- M Heater Blower Motor
- R Blower Resistor





## Type 2: Cab Roof Mounted Condenser

### Machines with Analog Display

⇒ [Fig 7. \(□ B-13\)](#). On the electrical diagram the electrical connectors (example, CA to CP) are shown looking on the mating face of each connector when they are disconnected.

The wire numbers and colours, where appropriate, are shown as an aid to identification whilst fault finding.

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. For details of these connections refer to **Section C, Machine Earth Connections**.

### Component Key:

The following key identifies the component connectors on the electrical diagram. Note that the wires coloured red show the electrical 'live feed'. The wires coloured green show the electrical 'return to earth'. For harness drawings refer to **Section C, Harness Data**.

- h1** Harness - 721/11867, 721/11869, 721/11880, 721/11883 Panel
- h2** Harness - 721/11881, 721/11882, 721/11879, 721/11966, 721/11866, 721/11868, 721/12106 Chassis
- h3** Harness - 721/11835 Engine

### h4 Harness - 721/11873 Rear Cab

#### Connectors (h1)

- BK/ Air Conditioning Relay
- BT
- BW Air Conditioning Relay - 721/11869 only
- CA h1 - h2
- DB Heating, Ventilation and Air Conditioning (HVAC) Unit
- AA Fusebox A
- DC Heater Blower Switch (3-speed)
- CE1 Air Conditioning Switch
- CE2 Air Conditioning Switch
- DE1 Earth Point
- DE2 Earth Point
- DX h1 - h4

#### Connectors (h2)

- CP/ h2 - h1
- CV
- CH/ h2 - h3
- CB
- CT Earth Point

#### Connectors (h3)

- EA h3 - h2
- EK Air Conditioning Compressor - Clutch Solenoid
- EP Binary Pressure Switch
- ER Binary Pressure Switch

#### Connectors (h4)

- AA h4 - h1
- AF Earth Point
- AM1 Condenser Fan (+ve)





## Section B - Body and Framework Electrical Connections

Air Conditioning (Option)

### Connectors (h4)

- AM2 Condenser Fan (+ve)
- AM3 Condenser Fan (-ve)
- AM4 Condenser Fan (-ve)

### Splices (h1)

ST/SF/UE

### Splices (h3)

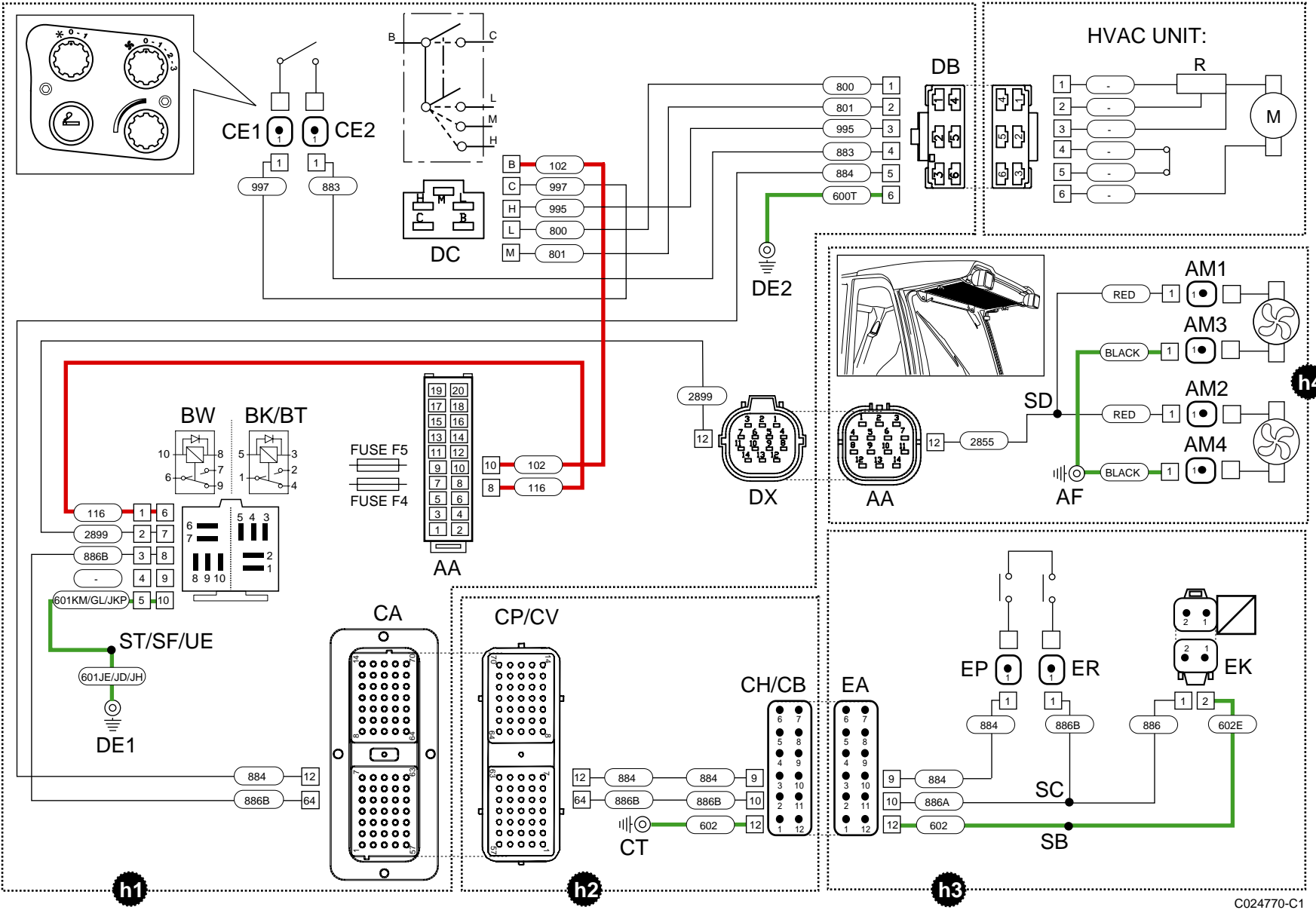
- SB
- SC

### Splices (h4)

SD

### HVAC Unit:

- M Heater Blower Motor
- R Blower Resistor



C024770-C1

Fig 7. Machines with Cab Roof Mounted Condenser and Analog Display

## Machines with Analog Display

⇒ [Fig 8.](#) (□ [B-15](#)). On the electrical diagram the electrical connectors (example, CA to CP) are shown looking on the mating face of each connector when they are disconnected.

The wire numbers and colours, where appropriate, are shown as an aid to identification whilst fault finding.

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. For details of these connections refer to **Section C, Machine Earth Connections**.

### Component Key:

The following key identifies the component connectors on the electrical diagram. Note that the wires coloured red show the electrical 'live feed'. The wires coloured green show the electrical 'return to earth'. For harness drawings refer to **Section C, Harness Data**.

- h1** Harness - 721/11867, 721/11869, 721/11880, 721/11883 Panel
- h2** Harness - 721/11879, 721/11966, 721/11866, 721/11868, 721/12106, 721/11881, 721/11882 Chassis

## Load Moment Indicator (LMI)

### Connectors (h1)

- CA h1 - h2
- DK Indicator Display Box
- AA Fusebox A
- DE1 Earth Point

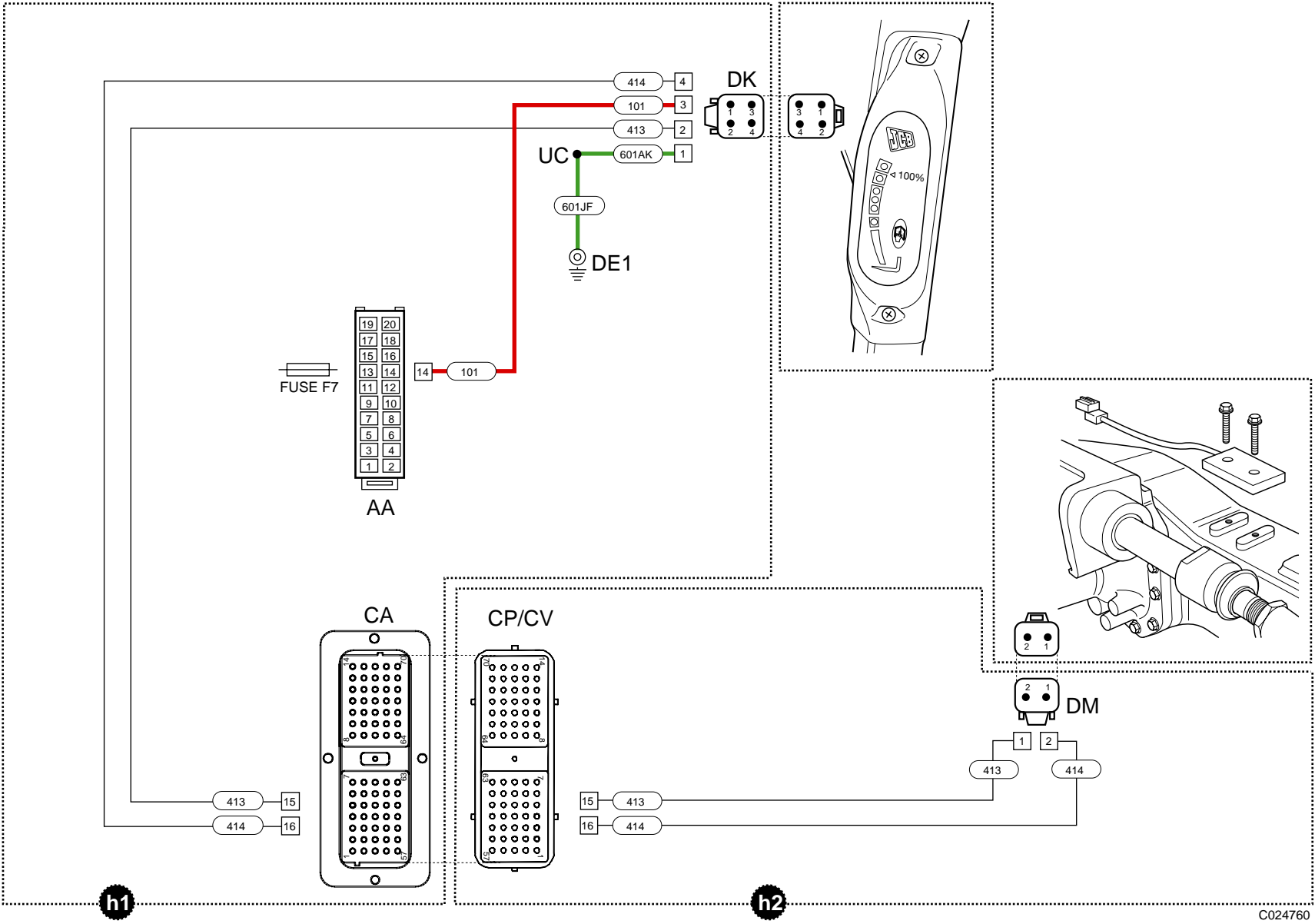
### Connectors (h2)

- CP/ h2 - h1
- CV
- DM Axle Transducer

### Splices (h1)

- UC





C024760

**Fig 8. LMI Wires and Connectors - Machines with Analog Display**

## Machines with Digital Display

**Important:** The connector and wire numbers shown are used on 531/541 4 speed machines. Variations are shown in brackets, it is not possible to show all variations therefore always check with the relevant harness drawing.

⇒ [Fig 8.](#) (□ B-15). On the electrical diagram the electrical connectors are shown looking on the mating face of each connector when they are disconnected.

The wire numbers and colours, where appropriate, are shown as an aid to identification whilst fault finding (these may vary according to machine so always check the correct wiring harness drawing **See Section C- Harness Data.**)

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. For details of these connections refer to **Section C, Machine Earth Connections.**

### Component Key:

The following key identifies the component connectors on the electrical diagram. Note that the wires coloured red show the electrical 'live feed'. The wires coloured green show the electrical 'return to earth'. For harness drawings **See Section C- Harness Data.**

**h1** Harness - 721/12457, 721/12459, 721/12518, 721/12461, 721/12463, 721/12560, 721/12479, 721/12469, 721/12465 Panel

**h2** Harness - 721/ 12458, 721/12517, 721/12460, 721/12462, 721/12559, 721/12478, 721/12468, 721/12464 Chassis

### Connectors (h1)

P093 h1 - h2  
P050 Indicator Display Box  
P001 Fusebox A  
P044 Earth Point

### Connectors (h2)

C035 h2 - h1  
C041 Axle Transducer

### Splices (h1)

SP28  
SP62



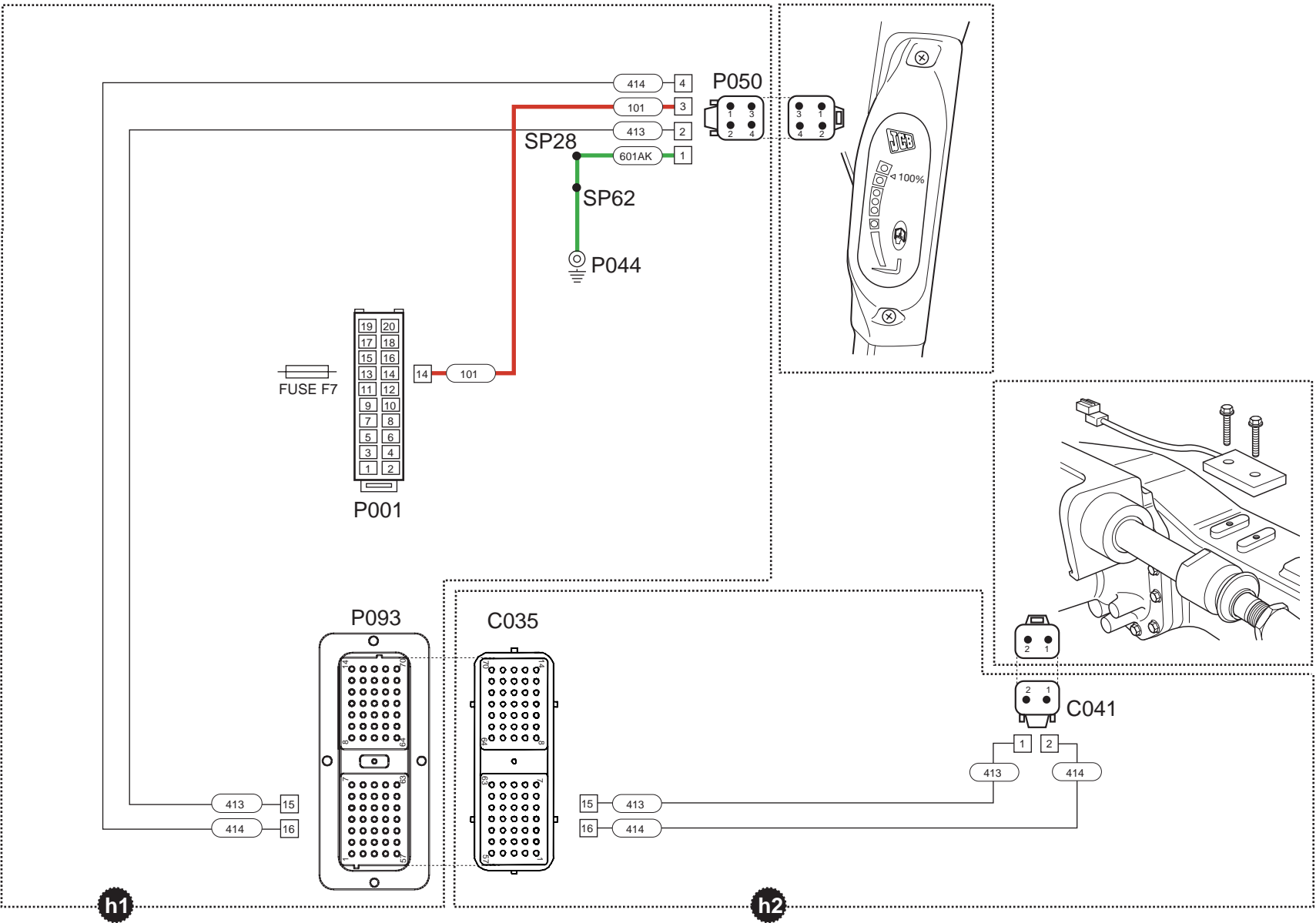


Fig 9. LMI Wires and Connectors - Machines With Digital Display

# Fault Finding

## Air Conditioning (Option)

### General Fault Indications

The system will not function in very low ambient temperatures, therefore 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. The following sections of the manual deal with the major components of the air conditioning systems and give further fault finding and maintenance information.

There are several indications that may help to determine the fault area on a system not working efficiently:

For details of the electrical circuit and connections, see **Electrical Connections**.

#### Fault(s)

⇒ [Table 1. Poor performance \(□ B-18\)](#)

⇒ [Table 2. Warm or slightly cool air emitted from unit \(□ B-18\)](#)

⇒ [Table 3. Blower operates on fan speed 3 only \(□ B-18\)](#)

⇒ [Table 4. Blower does not operate \(□ B-18\)](#)

⇒ [Table 5. Compressor clutch continually cuts out \(□ B-19\)](#)

⇒ [Table 6. No air conditioning \(□ B-19\)](#)

**Table 1. 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 2. Warm or slightly cool air emitted from unit**

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

**Table 3. Blower operates on fan speed 3 only**

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

**Table 4. Blower does not operate**

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



## Section B - Body and Framework Fault Finding

Air Conditioning (Option)

**Table 5. Compressor clutch continually cuts out**

Possible Cause	Action
Condenser matrix blockage.	Remove debris from matrix or renew compressor.
Overcharging of refrigerant system.	Discharge and recharge the system.
Blocked expansion valve or condenser.	Clear blocked component.

**Table 6. No air conditioning**

Check	Yes	No
<b>1</b> 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.
<b>2</b> Is the air conditioning (evaporator) blower working?	Check 3.	Check 4.
<b>3</b> Is the compressor running (visual check of pulley/clutch)?	Check 10.	Check 5.
<b>4</b> Is the air conditioning fuse(s) blown? For details of the electrical circuit and connections, see <b>Electrical Connections</b>	Renew fuse(s) and retest.	Check 9.
<b>5</b> Is there a 12V supply to the binary pressure switch harness?	Check 6.	Check 7.
<b>6</b> Does the compressor clutch engage with binary pressure switch assembly bypassed?	Replace binary pressure switch assembly.	Check 8.
<b>7</b> Does the clutch engage with freeze thermostat switch bypassed?	Renew freeze thermostat switch and retest.	Check all electrical connections.
<b>8</b> Is there a 12V supply at the compressor?	Renew the compressor clutch and re-test.	Renew the compressor relay and re-test.
<b>9</b> Are blower switch and wiring OK?	Renew blower unit complete.	Renew switch or wiring.
<b>10</b> Is the system correctly charged with refrigerant OK?	Check 11.	Charge check required by refrigeration engineer or suitably trained person.
<b>11</b> Is condensor air flow blocked?	Clean condensor and radiator.	Check 12.
<b>12</b> 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 **10-A** to the service ports **10-B**.

<b>10-A</b>	Manifold Gauge Block
<b>10-B</b>	Service Ports
<b>10-C</b>	Low Pressure/Temperature Gas (Blue)
<b>10-D</b>	High Pressure/Temperature Gas (Red)
<b>10-E</b>	High Pressure Liquid
<b>LS</b>	Low Side Gauge
<b>HS</b>	High Side Gauge

This section gives an overview of the following conditions:

- ⇒ [Normally Functioning Air Conditioning System \(□ B-21\)](#)
- ⇒ [Low R-134a Charge \(□ B-22\)](#)
- ⇒ [Poor Refrigerant Circulation \(□ B-22\)](#)
- ⇒ [No Refrigerant Circulation \(□ B-23\)](#)
- ⇒ [Insufficient Cooling of Condenser or Refrigerant Overcharge \(□ B-23\)](#)
- ⇒ [Air in System \(□ B-24\)](#)
- ⇒ [Expansion Valve Improperly Mounted \(□ B-24\)](#)
- ⇒ [Compressor Malfunction \(□ B-25\)](#)
- ⇒ [Some Moisture in the System \(□ B-25\)](#)
- ⇒ [Further Diagnosis \(□ B-26\)](#)

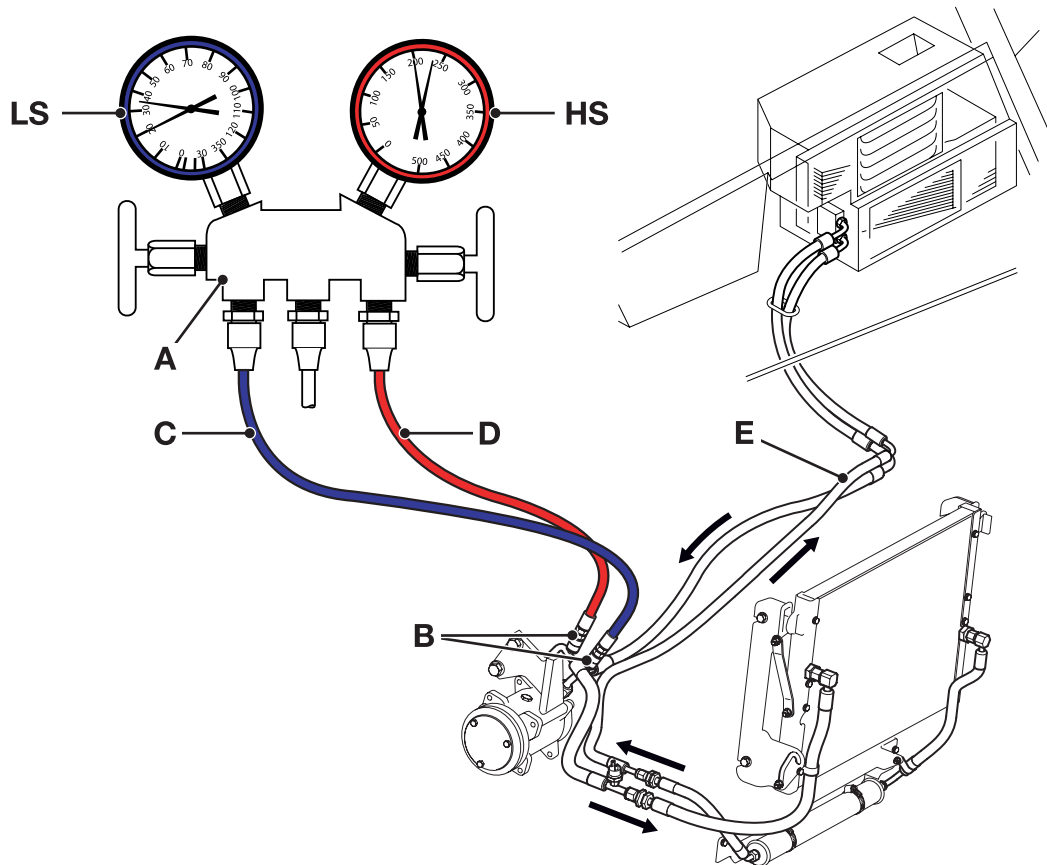


Fig 10. Typical Installation

### Normally Functioning Air Conditioning System

Normal gauge readings will depend on system components and ambient conditions. → [Table 7.](#)

### Normally Functioning Air Conditioning System Gauge Readings (□ B-21).

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

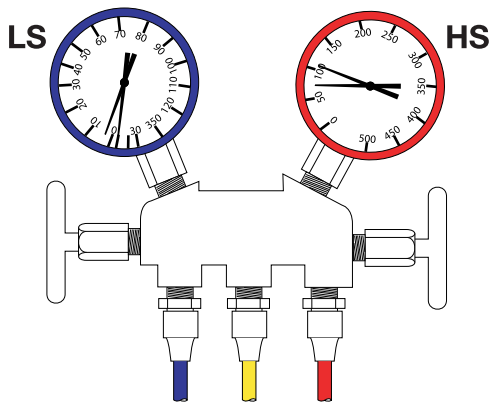
**Table 7. Normally Functioning Air Conditioning System Gauge Readings**

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 <sup>2</sup> )(19 lbf in <sup>2</sup> )	8.76 bar (9 kgf cm <sup>2</sup> )(127 lbf in <sup>2</sup> )	8 (46.4)
25 (77)	55	1.53 bar (1.56 kgf cm <sup>2</sup> )(22 lbf in <sup>2</sup> )	10.8 bar (11 kgf cm <sup>2</sup> )(156.6 lbf in <sup>2</sup> )	8.8 (47.8)
32 (89.6)	55	1.3 bar (1.33 kgf cm <sup>2</sup> )(18.6 lbf in <sup>2</sup> )	13.5 bar (13.77 kgf cm <sup>2</sup> )(195.8 lbf in <sup>2</sup> )	3.6 (38.5)
38 (100.4)	40	1.5 bar (1.53 kgf cm <sup>2</sup> )(21.75 lbf in <sup>2</sup> )	16.3 bar (16.6 kgf cm <sup>2</sup> )(236.4 lbf in <sup>2</sup> )	5.6 (42)
46 (114.8)	28	1.9 bar (1.94 kgf cm <sup>2</sup> )(27.56 lbf in <sup>2</sup> )	19.8 bar (20.19 kgf cm <sup>2</sup> )(287.2 lbf in <sup>2</sup> )	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 8. Gauge Readings**

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



**Fig 11.**

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

## Low R-134a Charge

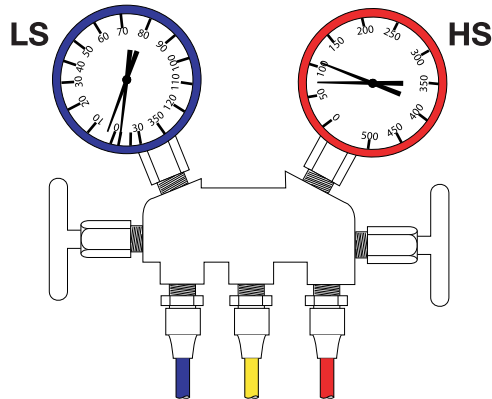


Fig 12.

Table 9. Gauge Readings

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

### 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

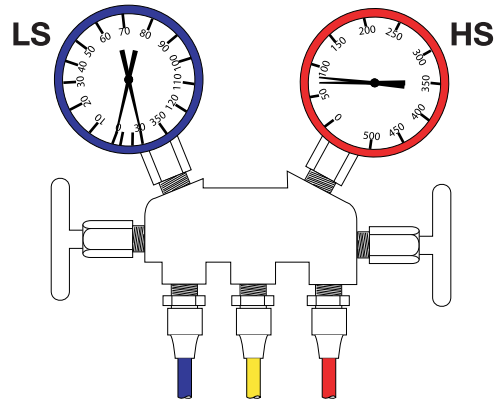


Fig 13.

Table 10. Gauge Readings

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

### 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

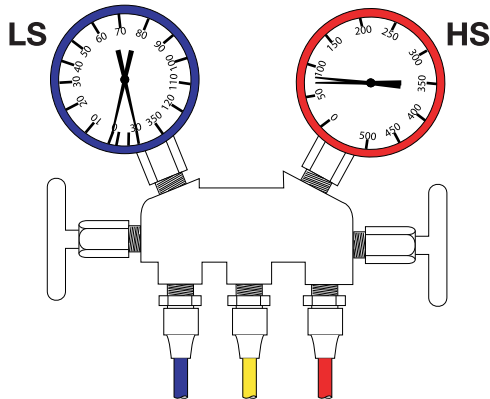


Fig 14.

Table 11. Gauge Readings

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

### 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

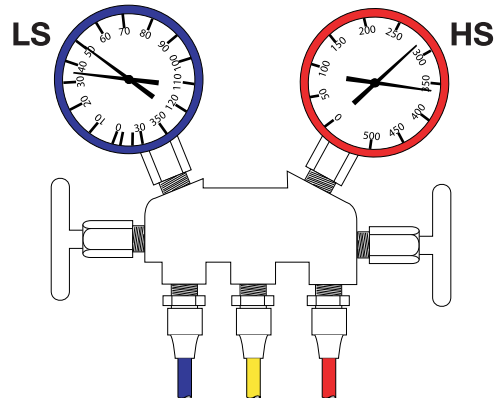


Fig 15.

Table 12. Gauge Readings

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

### 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

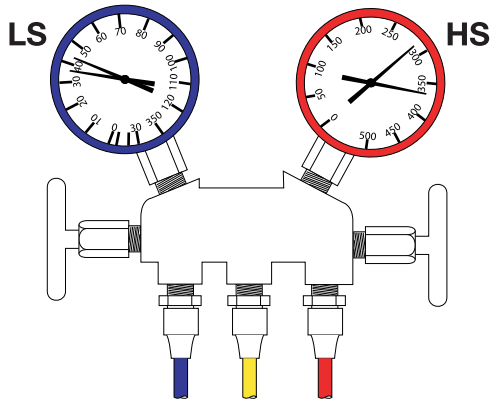


Fig 16.

Table 13. Gauge Readings

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

### 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

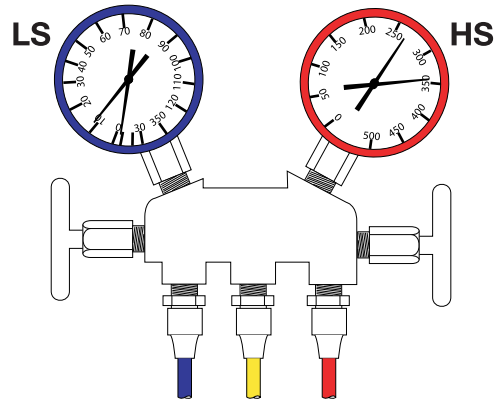


Fig 17.

Table 14. Gauge Readings

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

### 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

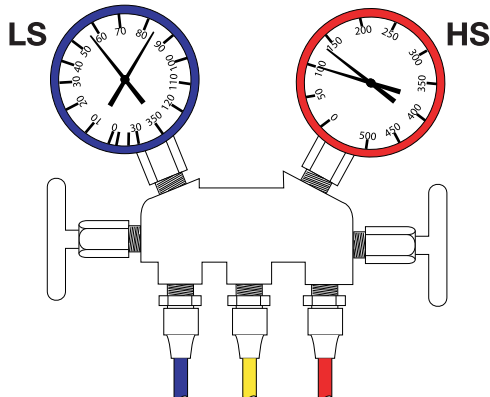


Fig 18.

Table 15. Gauge Readings

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

### 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

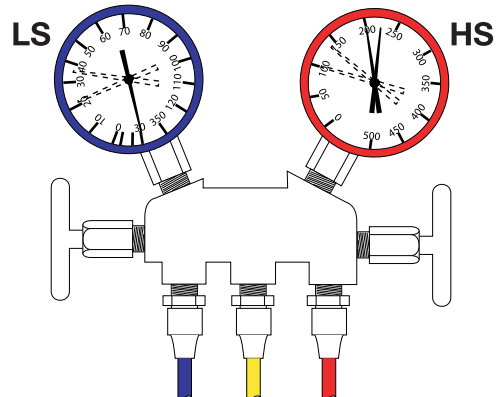


Fig 19.

Table 16. Gauge Readings

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

### 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 B - Body and Framework Fault Finding

Air Conditioning (Option)

### Further Diagnosis

**Table 17.**

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

### Load Moment Indicator (LMI)

#### Fault Codes

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

Note that the audible alarm and fault code cancel after 10 seconds, all the LEDs on the display box will then flash continuously as long as the fault remains. To show the fault code for a further 10 seconds, press and release button 20-A.

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

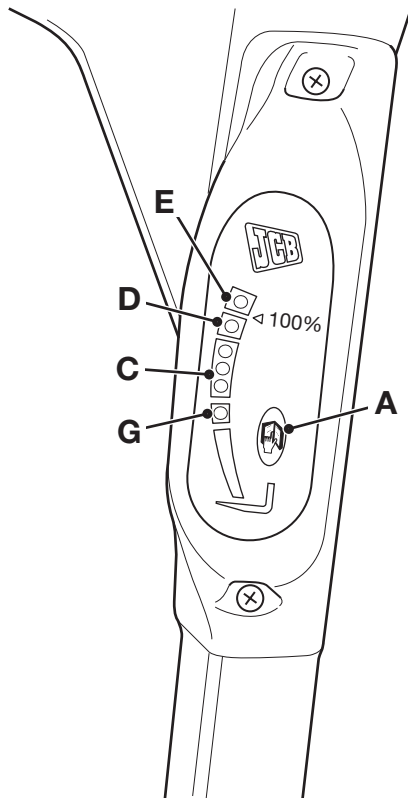


Fig 20. Typical Indicator Display Box

#### WARNING

**If the Load Moment Indicator is faulty, contact your JCB Distributor. Do not try to repair it yourself.**

12-2-1-1

**Important:** A new display box will not be calibrated. Always calibrate the system when fitting a new display box, see **Service Procedures**.

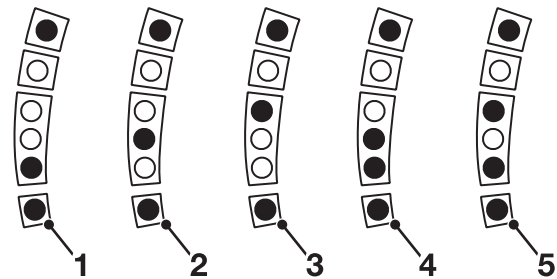


Fig 21. System Fault Codes

Fault Code	Description
1	⇒ <a href="#">Table 18. Transducer signal fault (□ B-28)</a>
2	⇒ <a href="#">Table 19. Calibration out of range (□ B-28)</a>
3	⇒ <a href="#">Table 20. Calibration required (□ B-28)</a>
4	⇒ <a href="#">Table 21. Indicator display box faulty (□ B-28)</a>
5	⇒ <a href="#">Table 22. Low battery voltage (□ B-28)</a>

If any fault codes are displayed, turn the Ignition key switch to OFF and then ON again. If the fault does not clear, ⇒ [Diagnostic Tests \(□ B-31\)](#).



## Section B - Body and Framework Fault Finding

Load Moment Indicator (LMI)

**Table 18. Transducer signal fault**

Possible Cause	Remedy
Transducer not connected.	Check transducer connection.
Faulty harness.	Check for trapped or damaged wires.
Faulty transducer.	Check for water ingress. Replace transducer.

**Table 19. Calibration out of range**

Possible Cause	Remedy
System is incorrectly calibrated.	Re-calibrate the system, see <b>Service Procedures</b> .
Transducer not fixed down correctly.	<ul style="list-style-type: none"><li>– Check mounting surfaces are clean and flat. Check mounting bolts are not bottoming-out.</li><li>– Check tightness of transducer mounting bolts, see <b>Axle Transducer, Removal and Replacement</b>.</li></ul>
Faulty transducer.	Replace transducer and re-calibrate the system.

**Table 20. Calibration required**

Possible Cause	Remedy
System not calibrated.	Calibrate the system, see <b>Service Procedures</b> .

**Table 21. Indicator display box faulty**

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

**Table 22. Low battery voltage**

Possible Cause	Remedy
Battery voltage is below 9 Volts.	Check battery voltage. Do <b>12V Supply and Fuse Test (V1)</b> , <a href="#">⇒ Diagnostic Tests (B-31)</a> .

### General Fault Finding

performing checks and where applicable, specific tests on the system.

The fault finding procedures are given in the form of tables. The tables are designed to identify possible causes by

**Fault:**

⇒ [Table 23. Display box does not work. \(□ B-29\)](#)

⇒ [Table 24. The display box seems to go out of calibration. \(□ B-29\)](#)

⇒ [Table 25. System not functioning correctly \(□ B-30\)](#)

**Table 23. Display box does not work.**

Possible Cause	Action
Blown fuse.	Check fuses.
Display box faulty.	Do <b>Display Box Functional Test</b> , ⇒ <a href="#">Diagnostic Tests (□ B-31)</a>
Display box not receiving 12V supply.	Do <b>12V Supply and Fuse Test (V1)</b> , ⇒ <a href="#">Diagnostic Tests (□ B-31)</a>

**Table 24. The display box seems to go out of calibration.**

Possible Cause	Action
Transducer not fixed down correctly.	Check torque of transducer fixing screws. Check transducer fixing screws are not bottoming out in their holes. Check mounting surfaces are clean and flat, see <b>Axle Transducer, Removal and Replacement</b> .
Faulty transducer.	Replace transducer and re-calibrate the system, see <b>Service Procedures</b> .

**Table 25. System not functioning correctly**

Action	Yes	No
<b>1</b> Do <b>12V Supply and Fuse Test (V1)</b> and record voltage, <a href="#">⇒ Diagnostic Tests (□ B-31)</a> . 12V Supply OK?	Go to 2.	Go to 3
<b>2</b> Is the transducer 12V supply OK?	Go to 4	Go to 5
<b>3</b> Check Ignition ON, fuse condition, battery condition, test box connections. Repair as required. OK now?	Done	Go to 2
<b>4</b> Is the display box OK?	Go to 6	Go to 7
<b>5</b> Do <b>Transducer 12V Supply Test (V2)</b> and record voltage, <a href="#">⇒ Diagnostic Tests (□ B-31)</a> . OK now?	Done	Check Ignition ON, fuse condition, battery condition, test box connections. Repair as required.
<b>6</b> Are the transducer output signals OK?	Go to 8	Go to 9
<b>7</b> Do <b>Display Box Functional Test</b> and re-calibrate, <a href="#">⇒ Diagnostic Tests (□ B-31)</a> . OK now?	Done	Replace display box.
<b>8</b> Can the display box be re-calibrated?	Go to 10	Go to 11
<b>9</b> Do <b>Transducer Output Test (V3)</b> and <b>Transducer Output Test (V4)</b> , <a href="#">⇒ Diagnostic Tests (□ B-31)</a> . OK now?	Done	Go to 12
<b>10</b> Has frequent re-calibration been required?	Possible transducer slipping. Remove the transducer, clean surfaces and re-torque bolts, see <b>Axle Transducer, Removal and Replacement</b> .	
<b>11</b> Do <b>Transducer Output Test (V3)</b> and <b>Transducer Output Test (V4)</b> , <a href="#">⇒ Diagnostic Tests (□ B-31)</a> . OK now?	Replace display box.	Go to 13
<b>12</b> Do <b>Harness Wiring Continuity and Short Circuit Tests</b> and repair as required. <a href="#">⇒ Diagnostic Tests (□ B-31)</a> . OK now?	Done	Check for uneven mounting surfaces or bolt not tightened correctly, see <b>Axle Transducer, Removal and Replacement</b> .
<b>13</b> Check transducer fixed securely. OK now?	Suspect faulty transducer.	Possible transducer slipping. Remove the transducer, clean surfaces and re-torque bolts.

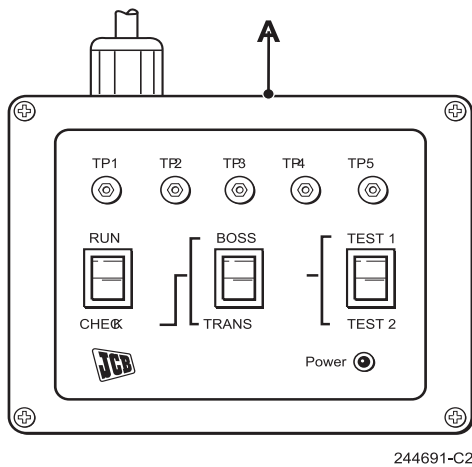
### Diagnostic Tests

If the calibration procedure fails to rectify a problem, there are three main areas where faults can occur:

- Indicator display box
- Axle transducer
- Machine electrical harness

### LMI Test Box

The service engineer can use either the LMI Test Box **22-A** (see **Section 1, Service Tools**) or a suitably calibrated multimeter to diagnose faults in the system down to component level.



**Fig 22.**

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 26. Test Box Test Points**

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

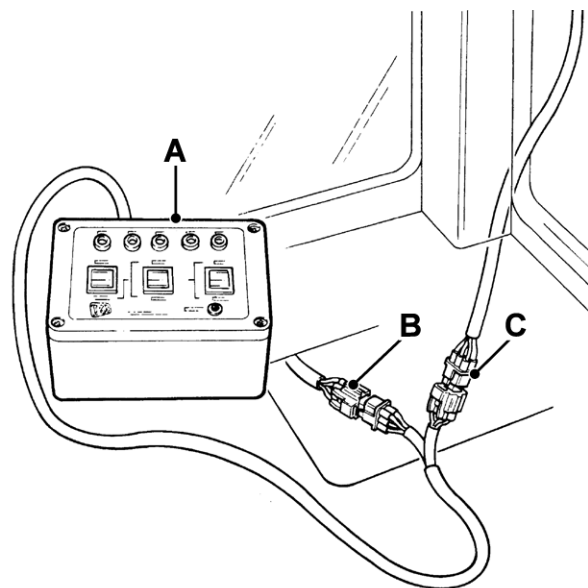
(1) *The black lead of the multimeter should be connected to TP1 (earth) when measuring voltages.*

- (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 **23-A** to harness connectors **23-B** and **23-C** as shown.



**Fig 23.**

- 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.

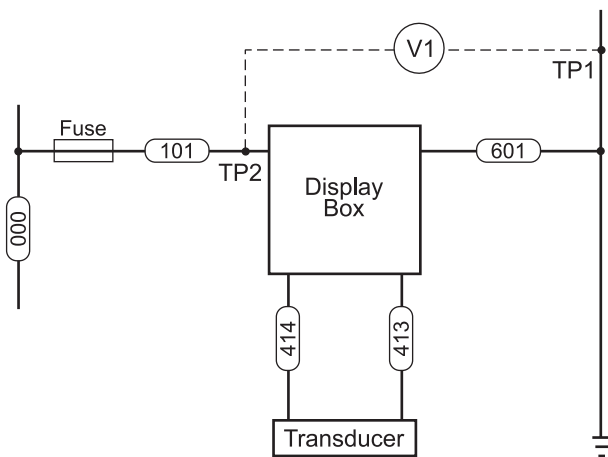
- e The ignition key switch is ON, but the engine is not running.

**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 24. 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).

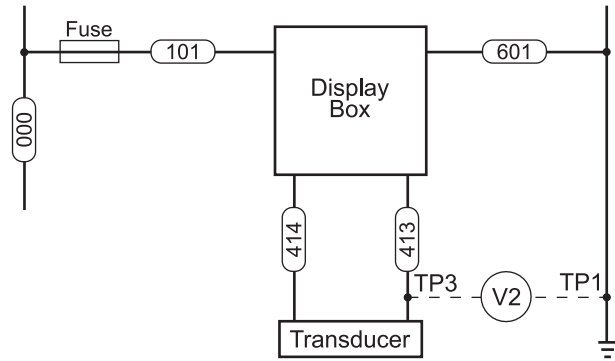
- 2 If the expected reading is not obtained, check that the ignition key switch is ON. Check the condition of the fuse, and the battery. Check the wiring harness connections. Rectify as required.

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 25. 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).

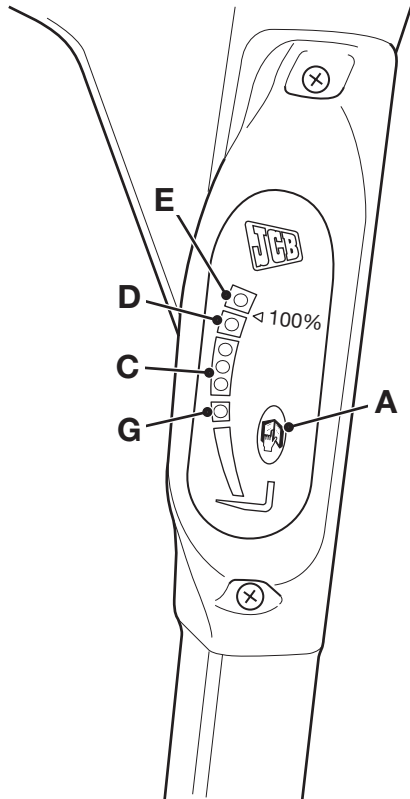
- 2 If the expected reading is not obtained, check that the ignition key switch is ON. Check the condition of the fuse, and the battery. Check the wiring harness connections. Rectify as required.

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

### Display Box Functional Test

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

The green LED **26-G** at the bottom of the display will illuminate to show that the indicator is receiving power.



**Fig 26. Typical Indicator Display Box**

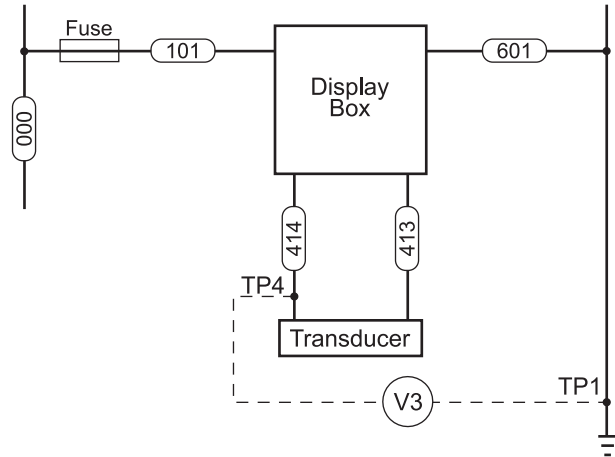
- 2 Press and release button **26-A**. All LEDs on the indicator will flash and the audible alarm will sound if the unit is functioning correctly.

### 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

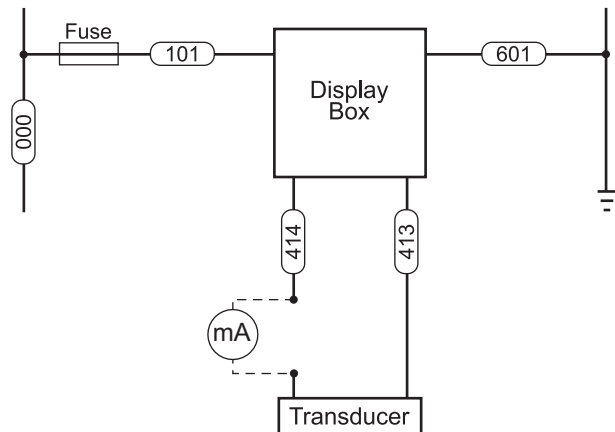
**Important:** This voltage cannot be measured using a voltmeter directly on the wiring. This voltage can only be measured via the test box (see **Section 1, Service Tools**).



**Fig 27. 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 28.**

C093430

- 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 \(B-34\)](#).

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 \(B-36\)](#).

### Harness Wiring Continuity and Short Circuit Test

- 1 Disconnect the display box harness **29-C** from the test box, but leave the test box connected to the machine wiring harness **29-B**.

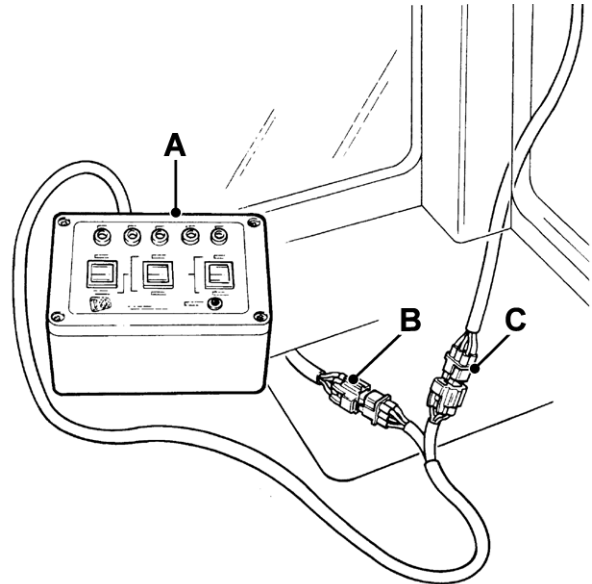


Fig 29.

- 2 Disconnect the transducer harness from the machine wiring harness **30-M**.

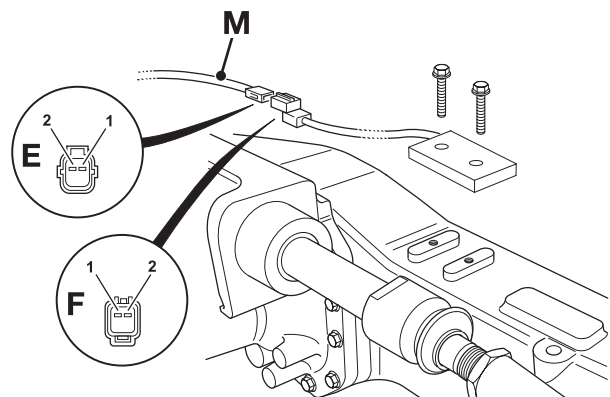


Fig 30.

- 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 **30-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 **30-E**.
- Test point TP5 and pin 1 of connector **30-E**.

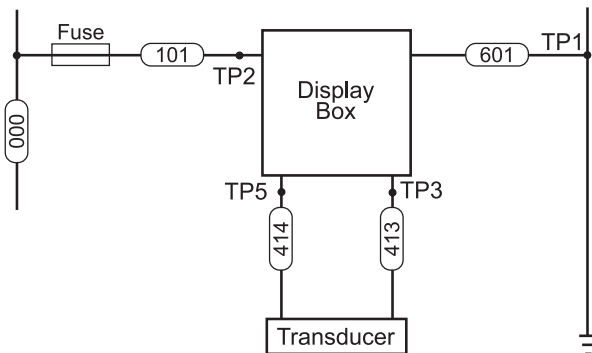
Expected reading: Less than 3 ohms.

**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.

[⇒ Transducer Output Test \(V4\) - with Transducer Removed from the Axle \(□ B-36\)](#)



**Fig 31. 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.

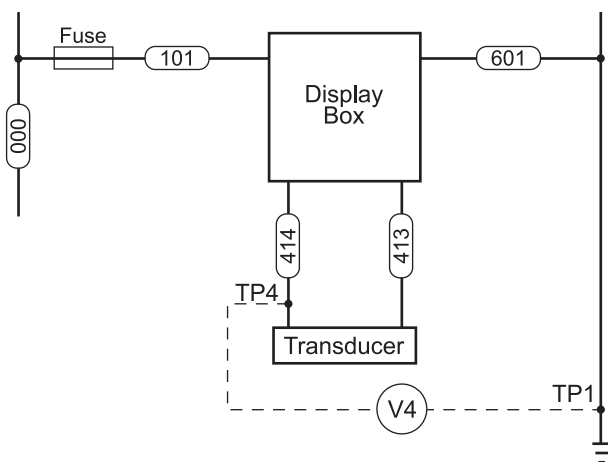
If the expected readings are obtained, but the expected voltage reading from **Transducer Output Test (V3)** is not achieved, test the transducer output with the transducer removed from the axle.

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

- 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

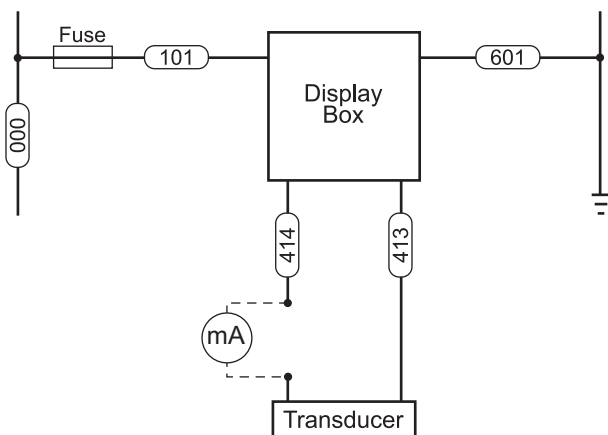
**Important:** This voltage cannot be measured using a voltmeter directly on the wiring. This voltage can only be measured via the test box (see **Section 1, Service Tools**).



**Fig 32. 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.



**Fig 33.**

C093430

- 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, see **Axle Transducer, Removal and Replacement**.



### 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 27. 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. See **Service Procedures**.

# Service Procedures

## Rivet Nuts

TB-001\_2

A 'Rivet Nut' is a one piece fastener installed 'blind' from one side of the machine body/framework. The rivet nut **34-A** is compressed so that a section of its shank forms an 'upset' against the machine body/framework, leaving a durable thread **34-B**.

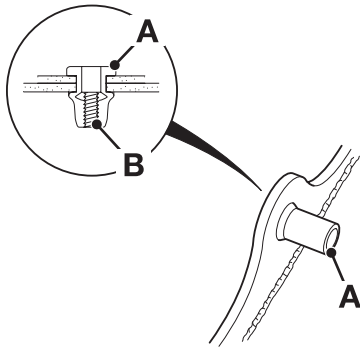


Fig 34.

Rivet nuts are fitted to various parts of the machine body and framework. They are used in a number of applications, for instance, hose clamp and hydraulic valve retention etc.

Various sized rivet nuts are available. → [Table 28. Specifications \(□ B-38\)](#) to determine the size of rivet nut to be used for particular applications.

If for any reason a new rivet nut requires fitting, then the correct installation procedure must be followed. → [Fitting Procedure \(□ B-39\)](#).

**Note:** In an emergency, and if no installation tool is available, it is possible to fit a rivet nut by using a nut and bolt the same thread diameter as the rivet nut being installed. However, this is not the recommended method.

Table 28. Specifications

Rivet Nut Thread Diameter	Rivet Nut Outside Diameter	Material Thickness	Rivet Length (Total)	Drill Hole Dia.
M5	7	0.25 - 3.00	14.00	7.10
		3.00 - 5.50	17.00	
M6	9	0.50 - 3.00	16.00	9.10
		3.00 - 5.50	19.00	
M8	11	0.50 - 3.00	18.00	11.10
		3.00 - 5.50	21.00	
M10	13	1.00 - 3.50	23.00	13.10
		3.50 - 6.00	26.00	

**Note:** All dimensions in mm

### Fitting Procedure

- 1 Drill a hole in the machine body/framework where the rivet nut is to be fitted. De-burr hole edges.
- 2 Screw the rivet nut onto the mandrel of the installation tool. The bottom of the mandrel should be in line with the bottom of the rivet nut **35-A**.

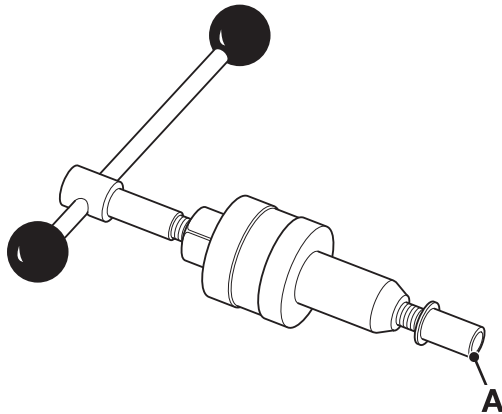


Fig 35.

- 3 Wind the body of the installation tool down the threaded mandrel until it touches the head of the rivet nut **36-B**.

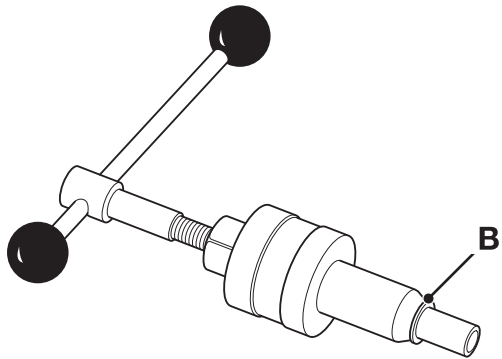


Fig 36.

- 4 Insert the rivet nut (assembled to the tool) into the hole drilled in step 1.
- 5 Hold handle **37-C** and at the same time draw the mandrel into the installation tool by turning nut **37-D**. The rivet nut will contract in length and form an 'upset'

(smooth bulge) seating itself against the body/framework **37-E**.

**Note:** The thread of the rivet nut must not be stripped, take care when 'upsetting' the rivet nut.

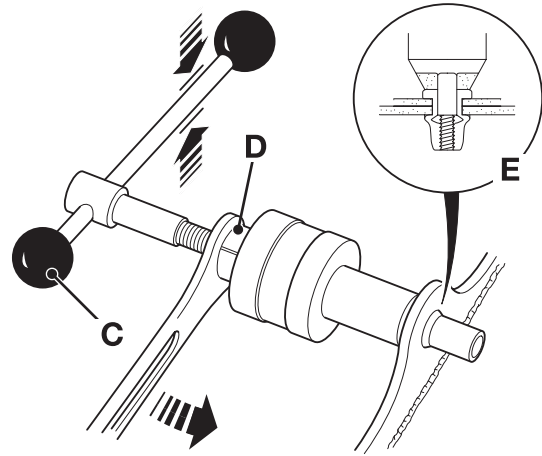
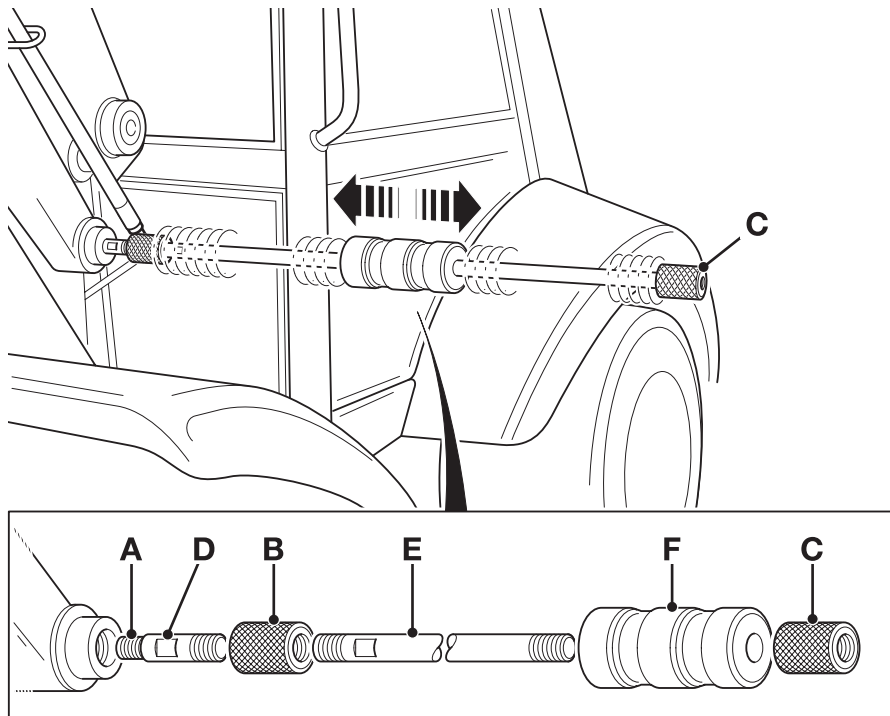


Fig 37.

- 6 Remove the installation tool.

## Slide Hammer Kit

TB-003



**Fig 38. Typical M/c. Installation**

The slide hammer kit is used to remove pivot pins that must be extracted, i.e. cannot be 'knocked through'. The purpose of this description is to explain how the kit and the various components are used to remove the pivot pins.

The adaptors **38-A** that form part of the kit have a screwed thread at each end. One of the threads will always be M20 size, this is to accommodate the end stops, items **38-B** and **38-C**. The other end of the adaptor will have varying thread sizes to suit the different size of threads in the pivot pins.

### Fitting Procedure

- 1 Prepare the pivot pin, for instance, if fitted, remove the pivot pin retaining bolt.
- 2 Determine the thread size of the pivot pin and then fit the appropriate adaptor **38-A** as shown. Use the spanner flats **38-D** to securely fit the adaptor.
- 3 Fit an end stop **38-B** onto the other end of the adaptor (M20 thread size), make sure that the adaptor threads are fully engaged.
- 4 Fit the 'slide bar' **38-E** into the end stop. Again make sure that the threads are fully engaged.
- 5 Fit the 'slide hammer', item **38-F**, onto the slide bar as shown.
- 6 Finally, fit another end stop, item **38-C**, at the end of the slide bar, as shown. The slide hammer kit is now ready to use.
- 7 To extract the pivot pin, slide the hammer along the bar until it contacts end stop **38-C**. Repeat this step until the pivot pin is released.
- 8 To remove the slide hammer kit, reverse steps 2 to 7.

### Air Conditioning (Option)

#### 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.

#### 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.

#### 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



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.

### 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 **39-A** connected to the system low pressure port. Do Not connect the red hose **39-B**. Make sure that both valves are closed.
- 3 Connect the yellow hose **39-C** to the 'Javac' unit filter **39-D**.
- 4 Connect the filter **39-D** to the 'Javac' unit **39-E**.
- 5 Connect the 'Javac' unit **39-E** to an empty receiver bottle **39-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 **39-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 **39-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.

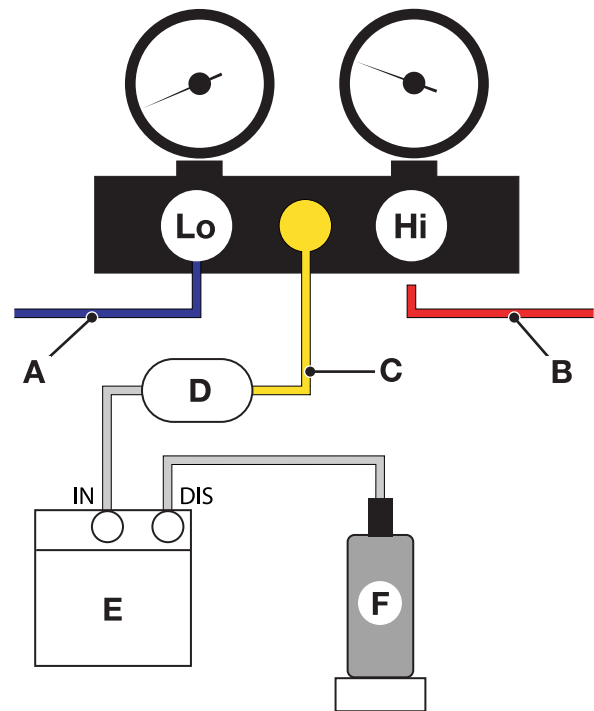


Fig 39. Refrigerant Recovery

### 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 \(□ B-43\)](#).
- 2 Close all valves and connect the manifold as shown. Connect the blue hose **40-A** to the system low pressure port and the red hose **40-B** to the high pressure port.
- 3 Connect the yellow hose **40-C** to the vacuum pump **40-D**.

**Note:** If the Electronic Vacuum Gauge **40-E** is used connected as shown. → [Electronic Vacuum Gauge \(□ B-45\)](#), for further information.

- 4 Open manifold valves.
- 5 Switch on the vacuum pump **40-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.

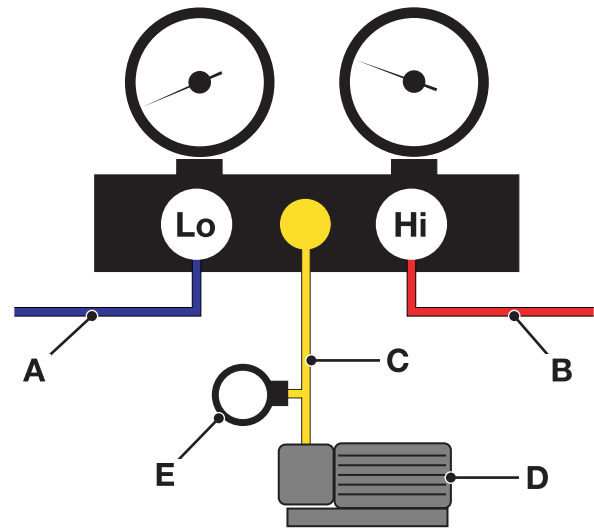


Fig 40. Evacuating

### Electronic Vacuum Gauge

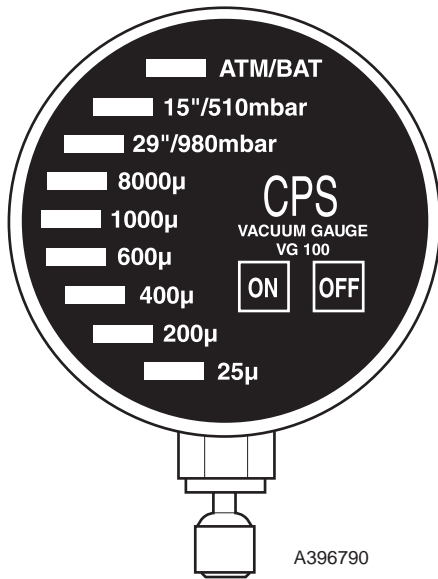


Fig 41.

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).

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

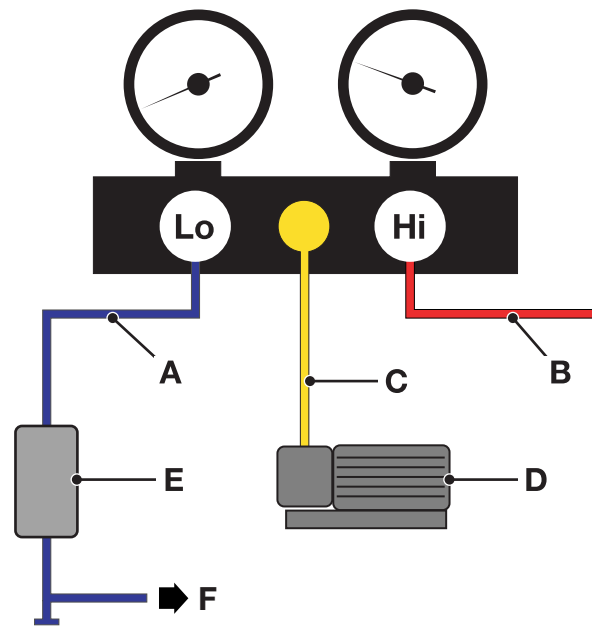
### Relubricating

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 **42-A** connected to the oil injector **42-E** and the red hose **42-B** to the system high pressure port.
- 3 Connect the yellow hose **42-C** to the vacuum pump **42-D**.
- 4 Connect the other end of the oil injector **42-E** to the system low pressure point **42-F**.
- 5 Switch on the vacuum pump **42-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 42. 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 **43-A** to system low pressure and the red hose **43-B** to system high pressure. Connect the yellow hose **43-C** to the refrigerant cylinder **43-D**.
- 2 Invert single valve cylinder on the scales **43-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 **43-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 **43-F** can be used around the replenishing cylinder.

- 4 Close all valves and remove the equipment.

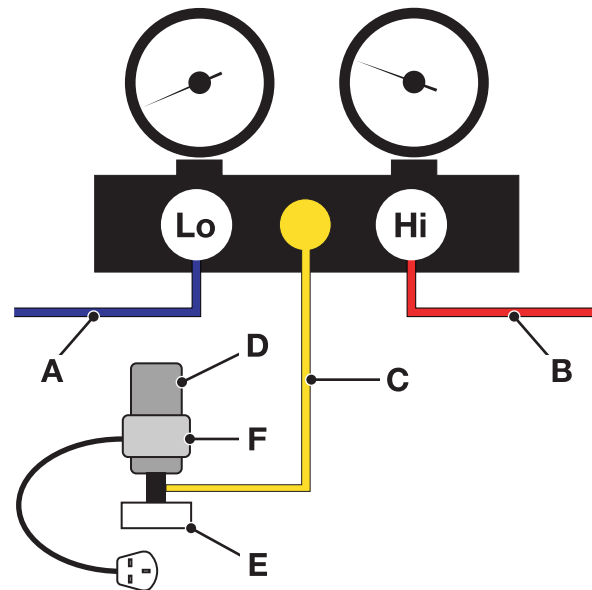
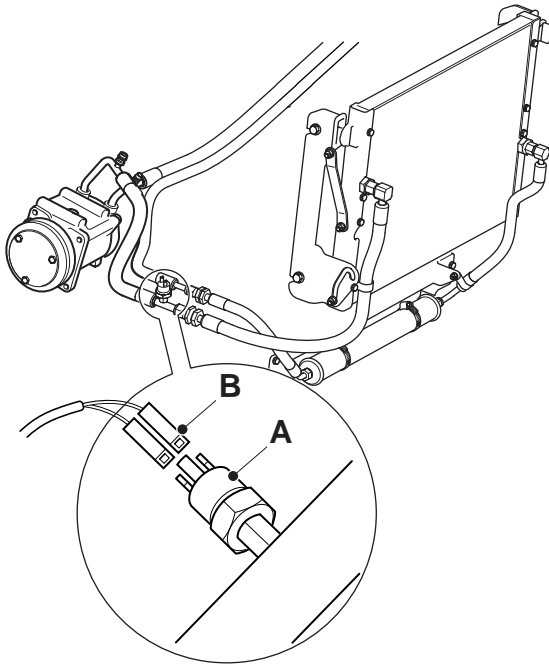


Fig 43. Charging

### Binary Pressure Switch Testing

Before testing the binary pressure switch **44-A** it is important to do a check of the refrigerant charge level. If the refrigerant charge level is satisfactory, test the switch as follows:

- 1 Stop the engine and remove the harness connectors **44-B** from the pressure switch **44-A**.



**Fig 44. Typical Installation**

- 2 Connect a link wire between the two harness connectors (This bypasses the pressure switch).
- 3 Start the engine and air conditioning system. If the system operates, one of the switches inside the binary pressure switch assembly is defective.
- 4 Install a new pressure switch assembly. If the clutch fails to operate, do a check of the harness electrical wiring for damage and open or short circuits. For details of the electrical circuits and connections, see **Electrical Connections**.

### 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 adjustment will not be necessary.

At the recommended service interval, visually inspect the belt for damage, see **Section 3 - Routine Maintenance**.

### Condenser Matrix Cleaning

It is likely that over a period of time, because of the machine's working environment, the airflow around the condenser matrix will become restricted due to a build up of airborne particles.

If the build up of particles is severe, heat dissipation from the refrigerant to the air will be significantly reduced, resulting in poor air conditioning performance.

In extreme cases, over-pressurisation of the system occurs, causing the high pressure cut-out switch to operate and switch off the system.

High pressure cut-out can also be caused by an internal blockage of the condenser matrix.

#### Type 1: Cooling Pack Mounted Condenser

- 1 Park the machine on firm level ground, engage the parking brake and set the transmission to neutral. Lower the attachments to the ground. Stop the engine and remove the starter key.
- 2 Raise the engine cover.
- 3 Clean both sides of radiator **45-A**. Brush off all debris from the tubes and fins using a soft bristle brush **45-Y**. Make sure the loosened material is brushed out of the cooling enclosure.
- 4 Clean both sides of condenser and the front of the cooler (if fitted).
  - a **Machines with no hydraulic cooler:** Release fastener **45-B** and hinge condenser **45-C** away from the radiator. Clean both sides of condenser **45-C**, push it back into position and close the fastener.
  - b **Machines with hydraulic cooler:** Release fastener **45-D** and pull the condenser **45-E** away from the cooler **45-F**. Clean both sides of condenser **45-E** and the front of the cooler **45-F**. Then push back the condenser and pull forward the cooler and condenser together as at **45-G**. Clean the back of the cooler and the front of the radiator **45-H** then push them back into position and close the fasteners **45-D**.
- 5 When clean, close and secure condenser assembly.

- 6 Lower the engine cover.
- 7 Run the air conditioning and check cooling performance.

#### Type 2: Cab Roof Mounted Condenser

- 1 Park the machine on firm level ground, engage the parking brake and set the transmission to neutral. Lower the attachments to the ground. Stop the engine and remove the starter key.
- 2 Support the protective cover **46-L** and remove fasteners **46-M**. Lower the cover to the ground.
- 3 Clean the condenser **46-N**. Brush off all debris from the tubes and fins using a soft bristle brush.
- 4 When clean, refit the cover **46-L** and secure with fasteners **46-M**.
- 5 Run the air conditioning and check cooling performance.

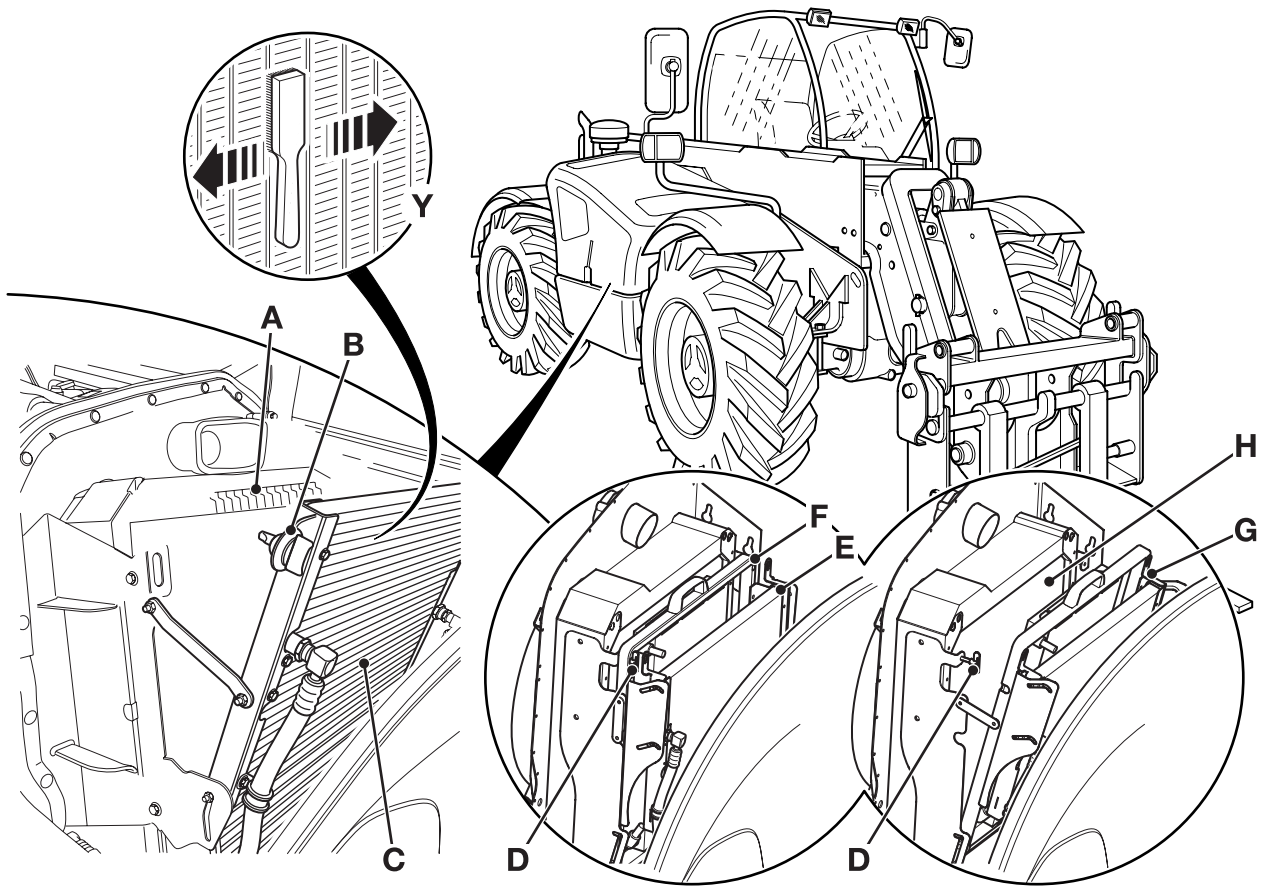


Fig 45. Type 1: Cooling Pack Mounted Condenser

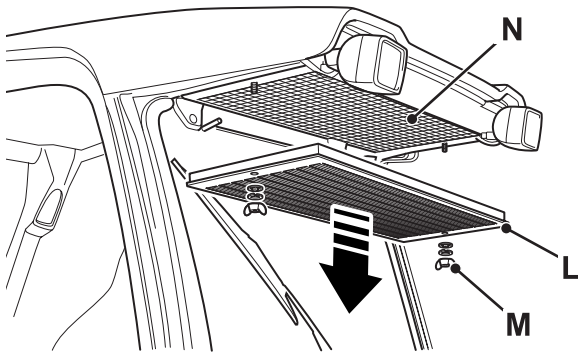


Fig 46. Type 2: Cab Roof Mounted Condenser

## Cab

### ROPS, FOPS Structure - Checks

For the correct procedure, see **Section 3 - Routine Maintenance**.

### Direct Glazing

TB-002\_4

The following procedures explain how to correctly remove and install panes of glass that are directly bonded to the cab frame apertures. When carrying out the procedures, relevant safety precautions must be taken.

- 1 Always wear safety glasses during both removal and replacement.
- 2 Use protective gloves - heavy duty leather gauntlet type gloves when cutting out the broken glass; 'non-slip' type gloves when handling/moving panes of glass; surgical type gloves when using the polyurethane adhesives.
- 3 Wear protective overalls.
- 4 Do not smoke - the activators and primers used in the procedures are highly flammable.
- 5 Do not attempt to handle or move panes of glass unless you are using glass lifters.

Several special tools are required to successfully complete the removal and replacement procedures. Reference is made to the tools in the text. The majority of these tools can be obtained locally and the remainder from JCB Service (see **Service Tools**).

The work must only be carried out in a dry, frost free environment. A protective canopy may be required or the machine/frame must be moved to a sheltered area. In damp or wet conditions, hinged doors and window frames can be removed from the machine and taken to a more suitable (dry) environment.

Glass should not be replaced at temperatures below 5°C (41°F).

### WARNING

Laminated glass must be handled with extra care to prevent breakage. Wherever possible, store and handle it in a vertical attitude. When placing or lifting the glass in a horizontal attitude it must be supported over its whole area, not just at the edges.

BF-1-8\_1

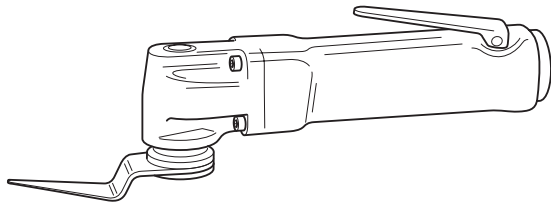
### Removing the Broken Glass and Old Sealant

### WARNING

Always wear safety glasses when removing or installing screen glass. Never use a power operated knife when removing the sealant around a toughened glass screen. The action of the knife could cause particles of glass to be thrown with sufficient force to cause serious injury, even when safety glasses are being worn. Use only hand operated tools when working with toughened glass.

BF-2-3\_1

- 1 Position the machine on level ground and apply the parking brake. Stop the engine. Put protective covers over the cab seat and control pedestals.
- 2 If a laminated pane breaks it will stay in one piece even though the glass is cracked. A toughened pane will shatter and fall apart. The method of removal of the glass depends upon which type it is.
  - a Laminated glass - leave installed until the old sealant has been cut away, after which it will be possible to lift the broken screen away from its frame housing in one piece.
  - b Toughened glass - remove as much of the shattered glass as possible prior to cutting out the old sealant.
- 3 Cut out the old sealant, leaving approximately 1 to 2 mm on the cab frame. There are several tools and techniques for doing this:
  - a Pneumatic Knife. [⇒ Fig 47. \(□ B-52\)](#). This provides one of the easiest methods of removing the sealant around laminated glass. The tool, powered by compressed air, should be sourced locally.



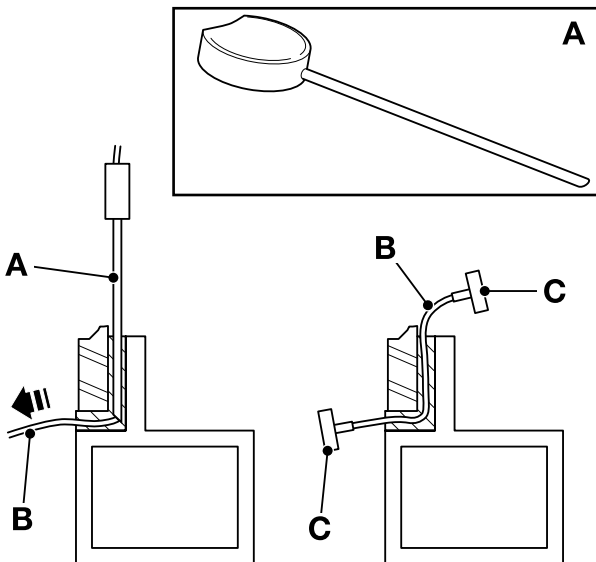
**Fig 47. Pneumatic Knife**

- i Press the handle to start the knife blade oscillating.

**Important:** This tool must not be used on toughened glass.

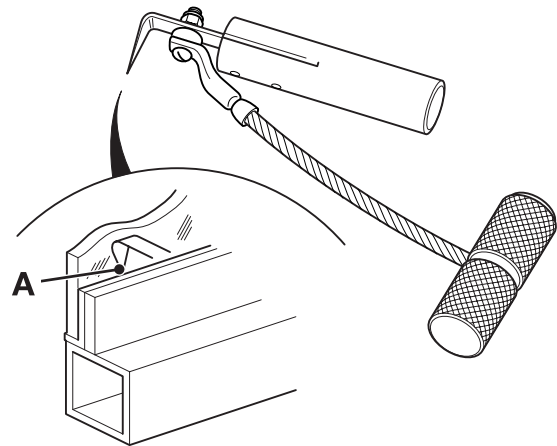
- ii Insert the knife blade into the sealant.
  - iii Slowly move the knife along the sealant with the blade positioned as close to the glass as possible. Do not allow the knife blade to overheat or the sealant will melt.
- b Braided Cutting Wire and Handles. → Fig 48. (□ B-52). This method uses a 3-core wire, a wire starter tube and two handles.

- i Insert the steel tube 48-A into the old sealant on the inside of the glass.



**Fig 48. Braided Cutting Wire and Handles**

- ii Insert the braided cutting wire 48-B down the centre of the steel tube. If necessary, from the outside, cut out local sealant at the point of the tube to gain access to the wire.
  - iii Using suitable pliers, pull the cutting wire through the sealant to the outer side of the glass.
  - iv Secure each end of the braided cutting wire in the special handles 48-C.
  - v Move the cutting wire backwards and forwards in a sawing motion and at the same time gently push or pull the wire to cut through the old sealant.
- c Cut-out Knife. → Fig 49. (□ B-52). The cut-out knife can be used as a left handed or right handed tool.



**Fig 49. Cut-out Knife**

- i Insert the knife blade into the sealant.
  - ii Make sure that the blade of the knife is against the glass 49-A.
  - iii Use the 'pull-handle' to pull the knife along and cut out the old sealant.
- d Craft Knife. → Fig 50. (□ B-53). The blades 50-A are replaceable.
- i Insert the knife blade into the sealant.
  - ii Pull the knife along and cut out the old sealant.

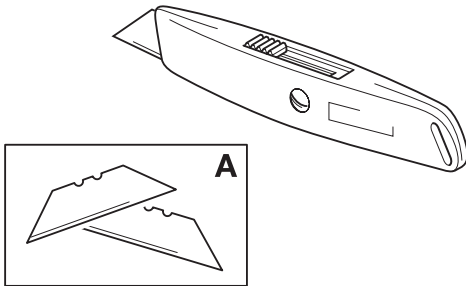


Fig 50. Craft Knife

- 4 Laminated glass - lift out the broken pane using glass lifters.  
  
Toughened glass - remove the cut off sealant and all remaining particles of shattered glass.
- 5 If necessary, trim off the remaining old sealant to leave approximately 1 to 2 mm on the upright face of the cab frame aperture. → [Fig 51.](#) ([B-53](#))

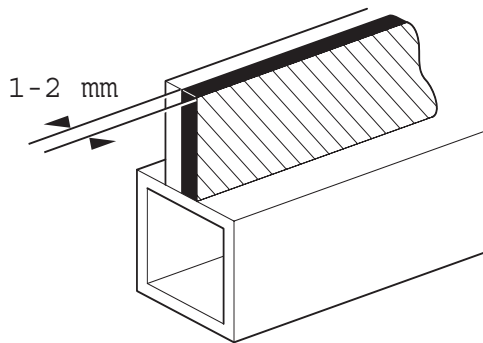


Fig 51.

- 6 Apply a coat of 'Black Primer 206J' to the paintwork if:
  - a Paintwork was damaged or scratched during the glass/sealant removal procedures.
  - b The old sealant was inadvertently cut back to the cab frame during the glass/sealant removal procedures.

### Preparing the Cab Frame Aperture

- 1 If damp or wet, dry the aperture area using a hot air gun (sourced locally).

- 2 Use 'Active Wipe 205' to thoroughly clean and 'prime' the trimmed sealant. Use a lint free cloth to apply the 'Active Wipe 205', allow 5 minutes flash off (drying) time.

**Note:** Do not use any other type of cleaning fluids, otherwise they may be absorbed into the old sealant and ultimately prevent the new glass from bonding.

### Preparing the New Glass

#### WARNING

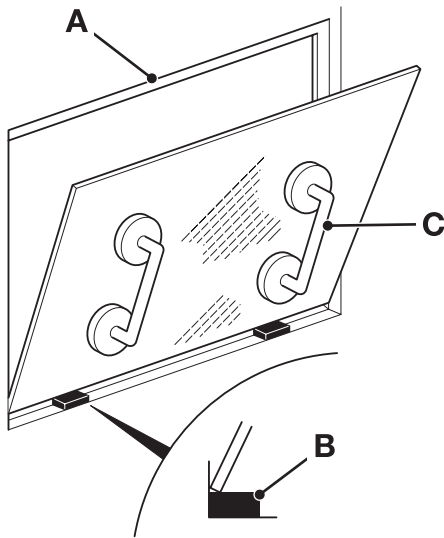
**Laminated glass must be handled with extra care to prevent breakage. Wherever possible, store and handle it in a vertical attitude. When placing or lifting the glass in a horizontal attitude it must be supported over its whole area, not just at the edges.**

BF-1-8\_1

- 1 Make sure that the new glass correctly fits the frame aperture **52-A**.
  - a Put two spacer blocks **52-B** onto the bottom part of the frame aperture.
  - b Install the new glass on the spacer blocks - Always use glass lifters **52-C**. Check that there is an equal sized gap all round the edge of the glass.

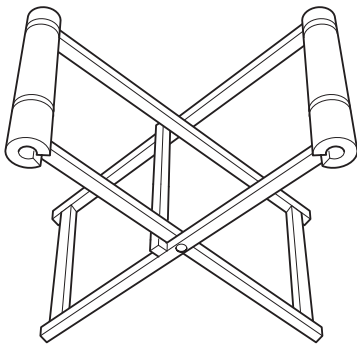
**Note:** The spacer blocks are rectangular in section to give two common gap widths. If necessary they can be trimmed to a smaller size to give an equal sized gap around the glass.

**Important:** The glass edges must not touch the frame, otherwise movement of the frame will chip and eventually break the newly installed glass.



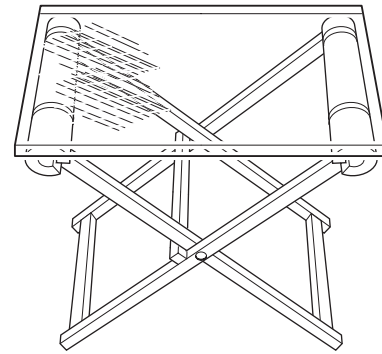
**Fig 52.**

- 2 After checking for size, remove the new glass and place it on a purpose made glass stand. [⇒ Fig 53.](#) (□ B-54).



**Fig 53. Glass Stand**

Small panes of glass will need locating on a 600 x 700 mm x 15 to 19 mm thick plywood board **54-A**, sourced locally to fit the glass stand. It is recommended that an access hole is cut in the board to accommodate the glass lifter, making it easier and safer to handle small panes of glass. The board should be covered with felt or carpet to give an anti-scratch surface. Resting the glass on four spacer blocks will ensure clearance of the cartridge nozzle tip during application of the polyurethane sealant.



**Fig 54.**

- 3 Make sure the glass is positioned on the stand the correct way up (i.e. with the black ceramic ink band upwards) ready for application of primer etc.
- 4 Clean the glass
  - a Use 'Active Wipe 205' to thoroughly clean and 'prime' the black ceramic ink band printed on the glass (see **Note**). Use a lint free cloth to apply the 'Active Wipe 205', allow 5 minutes flash off (drying) time.

**Note:** Do not touch the glass after cleaning with the 'Active Wipe 205'.

- b If the glass does not have a black ceramic ink band, paint a band on the glass using 'Black Primer 206J'. The band should be approximately 25mm (1in) wide, and the edge should be a neat straight line. [⇒ Fig 55.](#) (□ B-54).



**Fig 55.**

- 5 Install the Ultra Fast Adhesive cartridge (see **Sealing and Retaining Compounds**, Section 1 and **Note**) into a suitable applicator gun:

- a Remove the aluminium disc cover from the base of the cartridge and discard the 'desiccant capsule'.
- b Make sure that the rolled edge of the cartridge is not damaged - if necessary, the edges should be pressed flat, otherwise it will be difficult to remove the cartridge from the applicator gun.
- c Pierce the front 'nozzle' end of the cartridge to its maximum diameter.
- d Fit the pre-cut nozzle. [⇒ Fig 56. \(□ B-55\)](#).
- e Install the cartridge in the applicator gun.

**Note:** Cold material will be very difficult to extrude. The cartridges must be pre-heated in a special oven for 1 hour to a temperature of 80°C (176°F). Pre-heating the cartridges makes the adhesive more workable and also brings the 'curing' time down to 30 minutes.

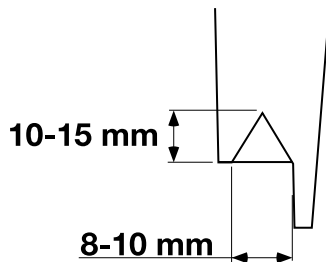


Fig 56.

- 6 Apply the pre-heated adhesive to the glass (do not start in a corner). Keep the nozzle guide **57-A** against the edge of the glass and make sure that the adhesive forms a continuous 'pyramid' shape. [⇒ Fig 57. \(□ B-55\)](#)

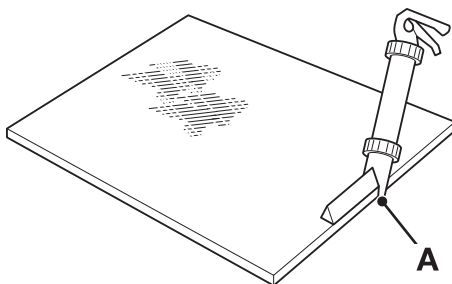


Fig 57.

**Note:** Once the pre-heated adhesive has been applied to the glass, install the glass in the aperture as soon as possible. After approximately 10 minutes the sealant will form a 'skin', this will prevent the glass from bonding.

- 7 After applying the adhesive, leave a small amount of sealant protruding from the nozzle. This will prevent any adhesive left in the cartridge from 'curing'.

### Installing the New Glass

- 1 If the internal trim strip is damaged, renew it (cut to length as required) before fitting the new glass. Make sure the two spacer blocks are in position. [⇒ Preparing the New Glass \(□ B-53\)](#) - step 1.
- 2 Install the glass in the frame aperture:
  - a Always use the special lifting tools when moving the glass. Use a lifting strap to hold large panes of glass in position. [⇒ Fig 58. \(□ B-55\)](#)

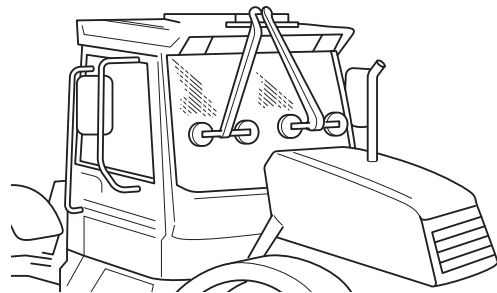
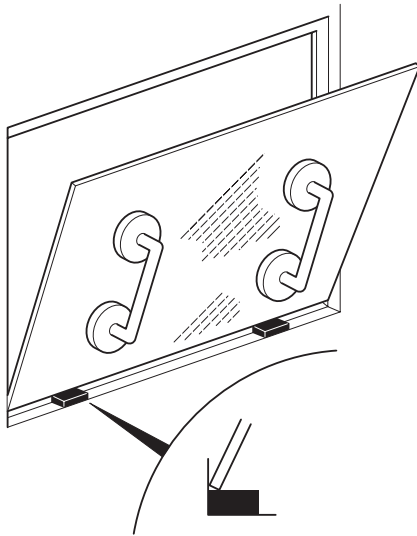


Fig 58. Typical M/c. Installation

- b Sit the bottom edge of the glass on the spacer blocks. [⇒ Fig 59. \(□ B-56\)](#)



**Fig 59.**

**c** Make sure that the glass is correctly positioned, then gently press around the edges of the glass and ensure full adhesive contact is achieved. Do not press too hard or too much adhesive will squeeze out.

**3** Make the inside seal smooth:

- a** Wearing surgical gloves, dip your finger in a soapy water solution.
- b** Use your finger to make the inside seal smooth.

**4** All exposed edges must be sealed using Black Polyurethane Sealant (see **Sealing and Retaining Compounds**, Section 1).

**Important:** Use extreme caution when wiping the inside of the new glass - pushing too hard on the inside of the glass will affect the integrity of the bonded seal.

**5** Clean the glass after installation:

- a** Small amounts of sealant can be cleaned from the glass using the 'Active Wipe 205'.
- b** Large amounts of excess sealant should be left to 'cure' and then cut off with a sharp knife.

**Note:** On completion of the glass replacement procedures, the sealant 'curing' time is 30 minutes. This means that the machine can be driven and used after 30

minutes, but it must not be used during the curing period of 30 minutes.

- c** Clean the glass using a purpose made glass cleaner

**6** On completion of the glass installation procedures tidy the work area:

- a** Remove all broken glass from the cab area.
- b** Remove the protective covers from the cab seat and control pedestals.
- c** Renew all 'warning' and 'information' decals so that the new installation conforms with the original cab installation.

## Load Moment Indicator (LMI)

### Calibration Procedure

The display unit must be calibrated by setting the '100%' point using a known load and boom extension.

#### 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.
- 2 Set the display unit to 'Calibration Mode'.
  - a Turn the starter key to the OFF position. Press and hold button **60-A**
  - b Start the engine with button **60-A** held down. Continue holding the button for approximately 30 seconds after the engine has started (All display LEDs will illuminate during this time).

**Note:** If the button is release during this time, the process must be repeated.

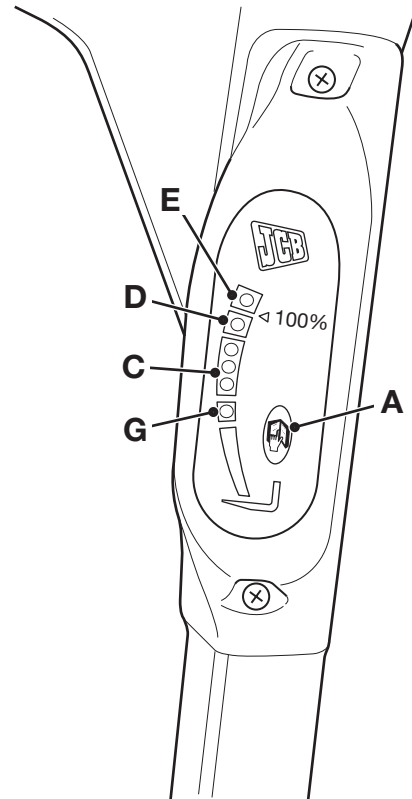
After approximately 30 seconds, the display will show the red LED **60-E** only and the alarm will emit short intermittent bleeps.

- c Release button **60-A**.
- 3 With the boom fully retracted, pick up a known load between 1800 and 2000 kg (3,970 lb - 4,400 lb). Use either pallet forks loaded with a test weight or a bucket filled with a high density material.
- 4 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.

**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 the axle transducer signal is out of range, the display unit will indicate the appropriate error

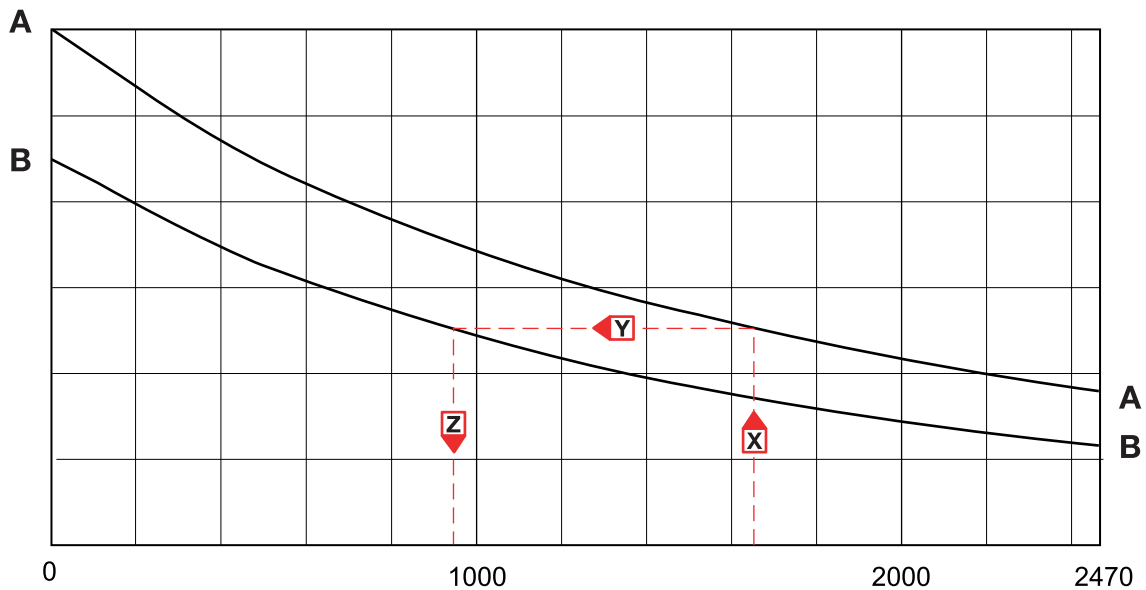
code. Note that the calibration procedure cannot continue until the fault is rectified.

- 5 Press and release button **60-A**. The display will then change to show the red LED **60-E** and amber LED **60-D** only.



**Fig 60. Typical Indicator Display Unit**

- 6 Lower the load to the ground and measure the distance the boom is extended. (This will be the extension figure).



**Fig 61. Example Calibration Chart**

7 Using the calibration chart, mark the distance the boom is extended (i.e. the extension figure measured at step 6) on the horizontal scale.

- a Read vertically from the extension figure (example line **X**) to the 'Tipping Line' **AA**.

**Note:** For this example refer to the example calibration chart. When calibrating a machine, first identify the correct calibration chart for the machine concerned.

⇒ [Calibration Charts](#) (□ B-59).

- b Read horizontally (example line **Y**) to the 'Maximum Working Limit Line' **BB**.
- c Read down to the horizontal scale (example line **Z**) to obtain the dimension for the boom extension 'Maximum Working Limit'.

8 Draw a mark on the boom at the dimension obtained from the calibration chart. Raise and retract the boom to the mark drawn on the boom.

9 Press and release the button **60-A**. The display unit will revert to normal operation. The setting of the 100% point is now complete.



### Calibration Charts

Use the following cross references to view the relevant Calibration Chart for the machine concerned:

⇒ [526-56 Machines \(B-60\)](#)

⇒ [531-70 Machines \(B-61\)](#)

⇒ [532-120, 535-125 Machines \(B-62\)](#)

⇒ [533-105 Machines \(Stabilisers Down\) \(B-63\)](#)

⇒ [533-105 Machines \(Stabilisers Up\) \(B-64\)](#)

⇒ [536-60 Machines \(B-65\)](#)

⇒ [535-95 Machines \(B-66\)](#)

⇒ [535-140 Machines \(B-67\)](#)

⇒ [537-135, 540-140 Machines \(B-68\)](#)

⇒ [541-70 Machines \(B-69\)](#)



Section B - Body and Framework  
Service Procedures

Load Moment Indicator (LMI)

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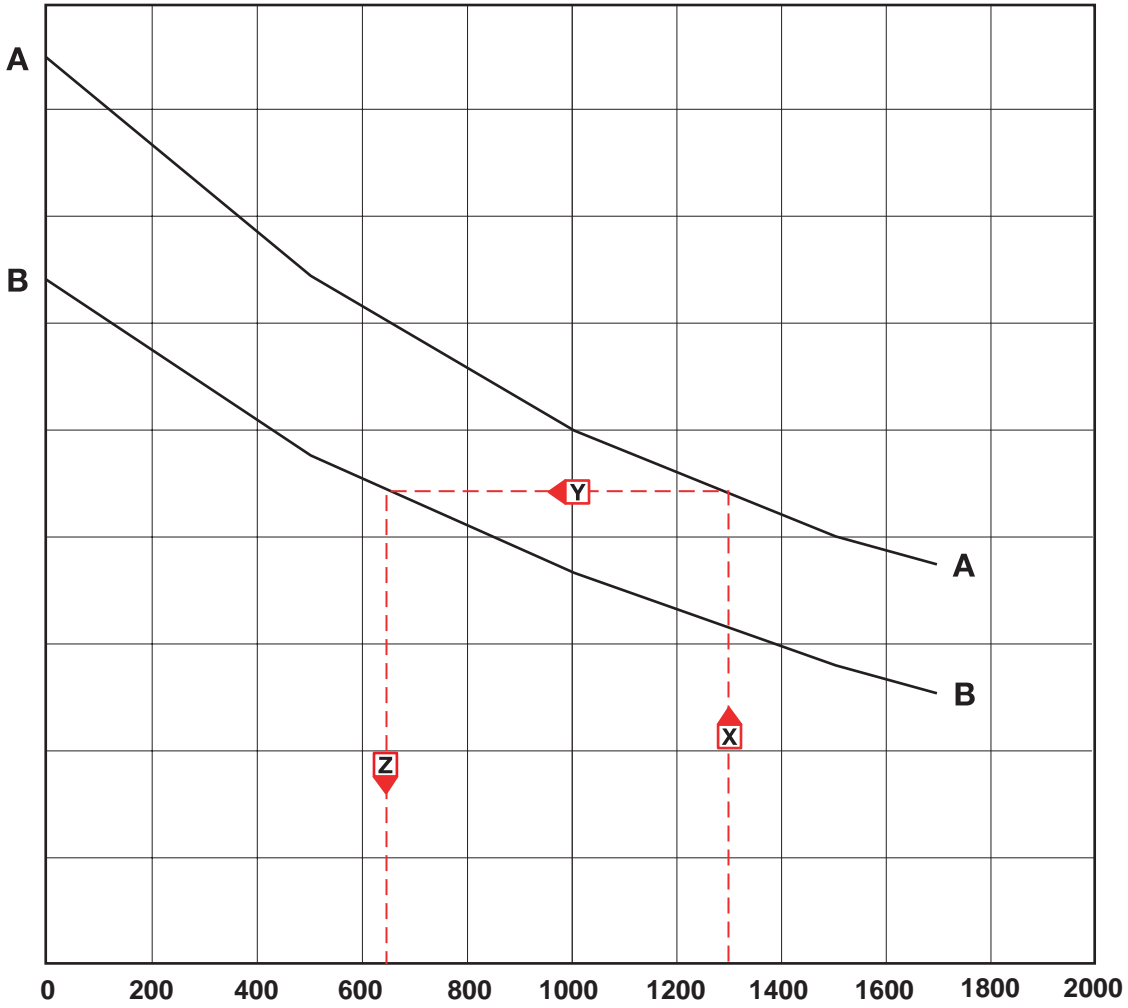


Fig 62. 526-56 Machines



# Section B - Body and Framework Service Procedures

Load Moment Indicator (LMI)

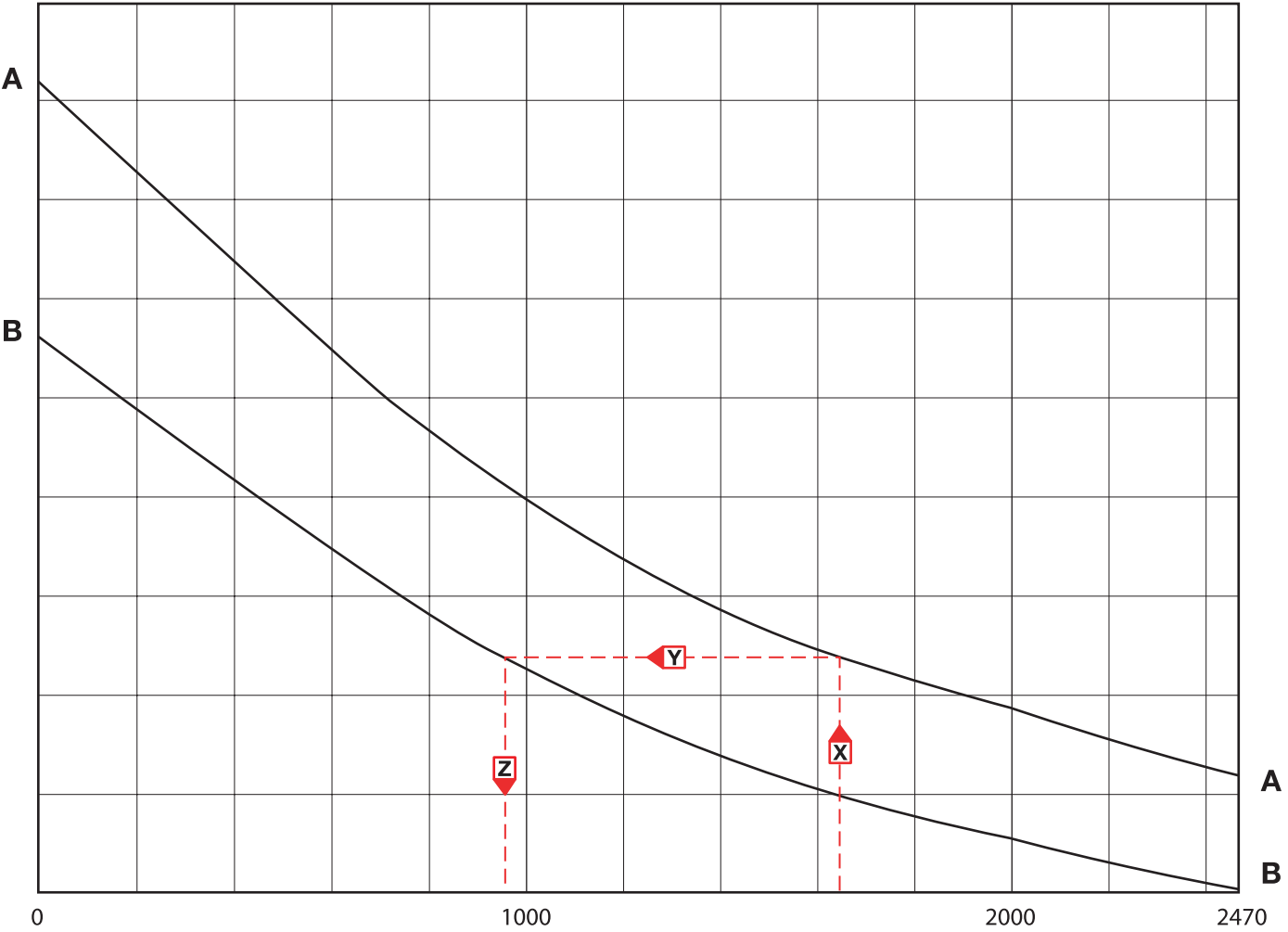


Fig 63. 531-70 Machines



Section B - Body and Framework  
Service Procedures

Load Moment Indicator (LMI)

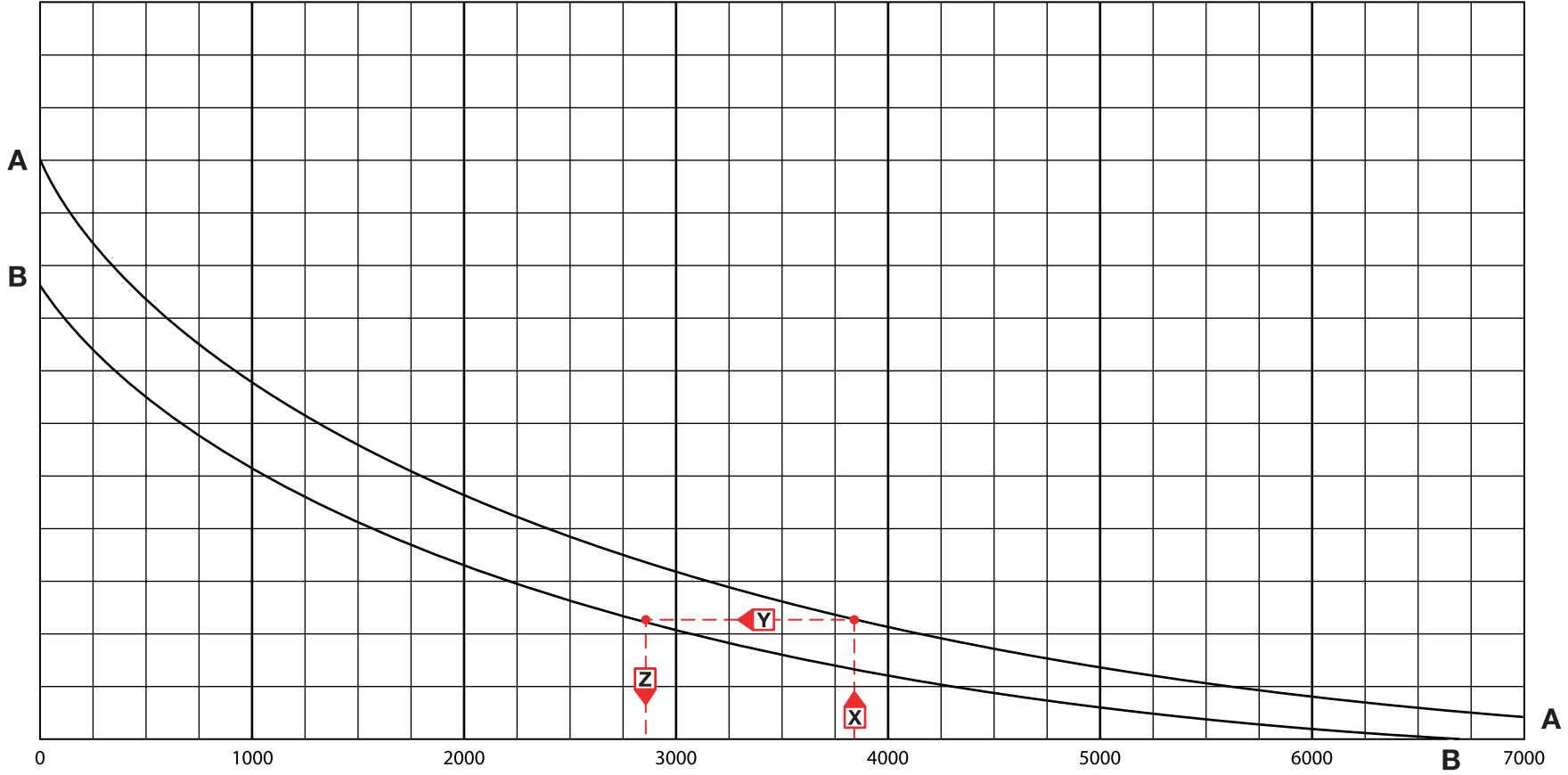


Fig 64. 532-120, 535-125 Machines



# Section B - Body and Framework Service Procedures

Load Moment Indicator (LMI)

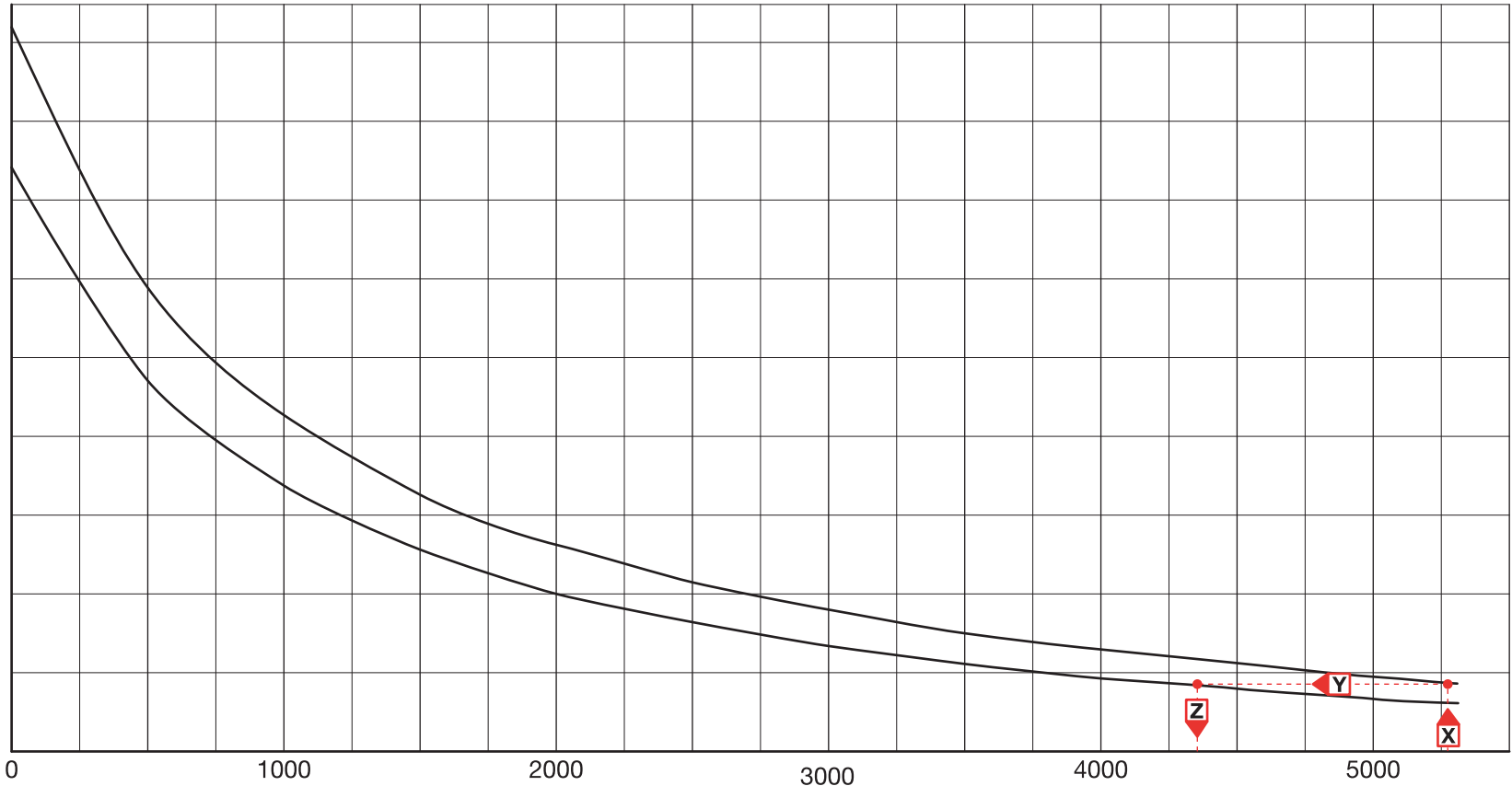


Fig 65. 533-105 Machines (Stabilisers Down)



# Section B - Body and Framework Service Procedures

Load Moment Indicator (LMI)

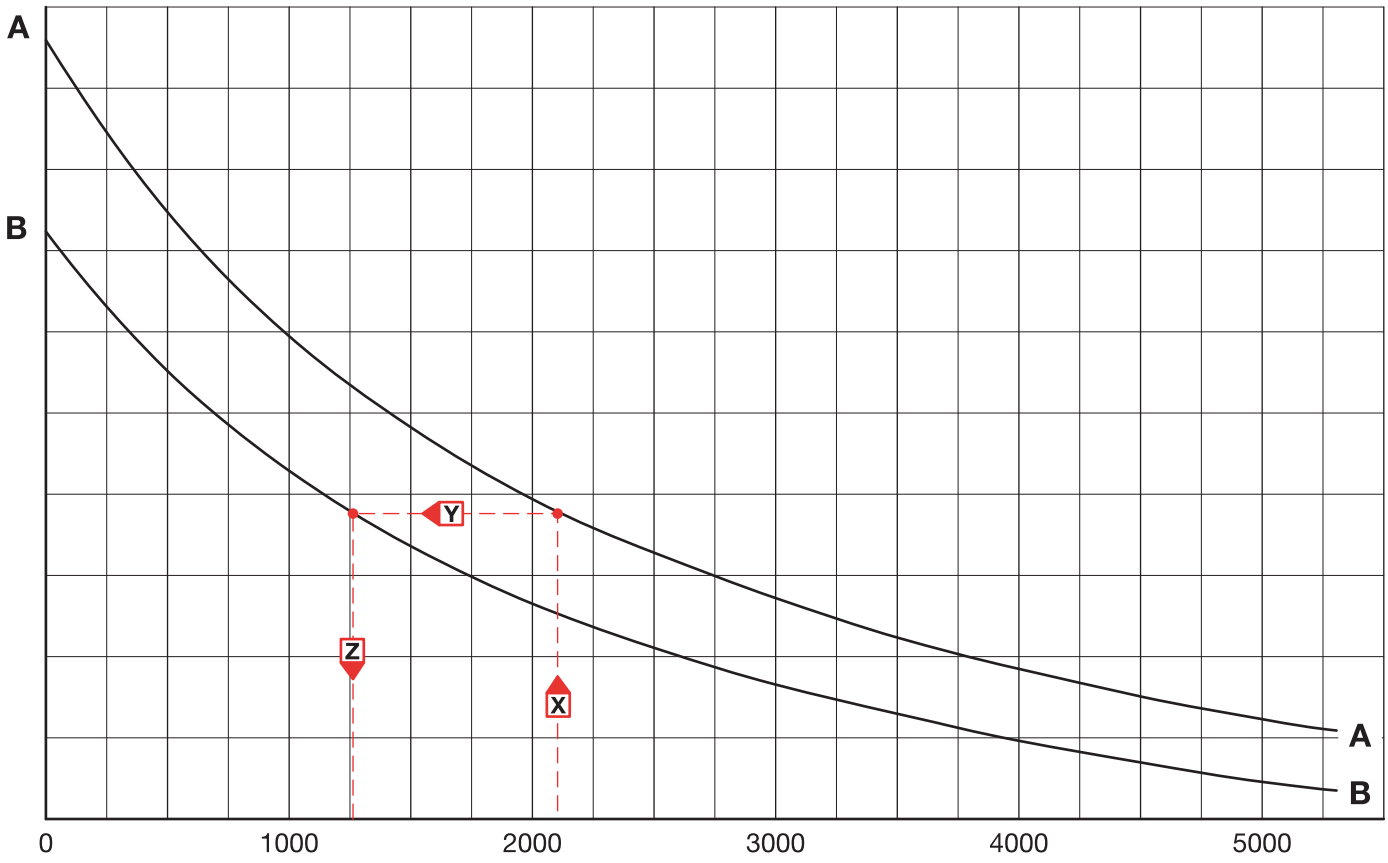


Fig 66. 533-105 Machines (Stabilisers Up)



Section B - Body and Framework  
Service Procedures

Load Moment Indicator (LMI)

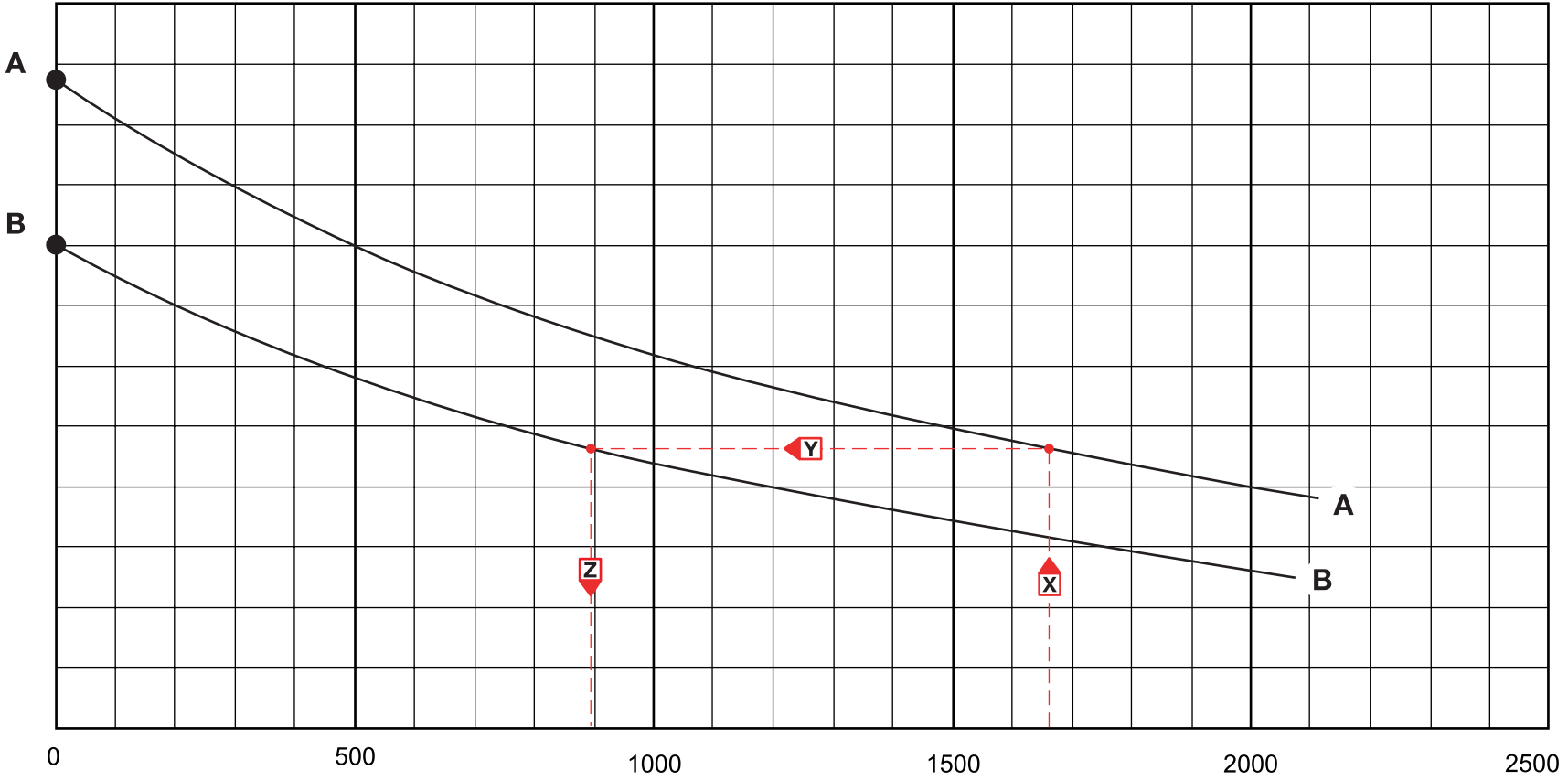


Fig 67. 536-60 Machines



Section B - Body and Framework  
Service Procedures

Load Moment Indicator (LMI)

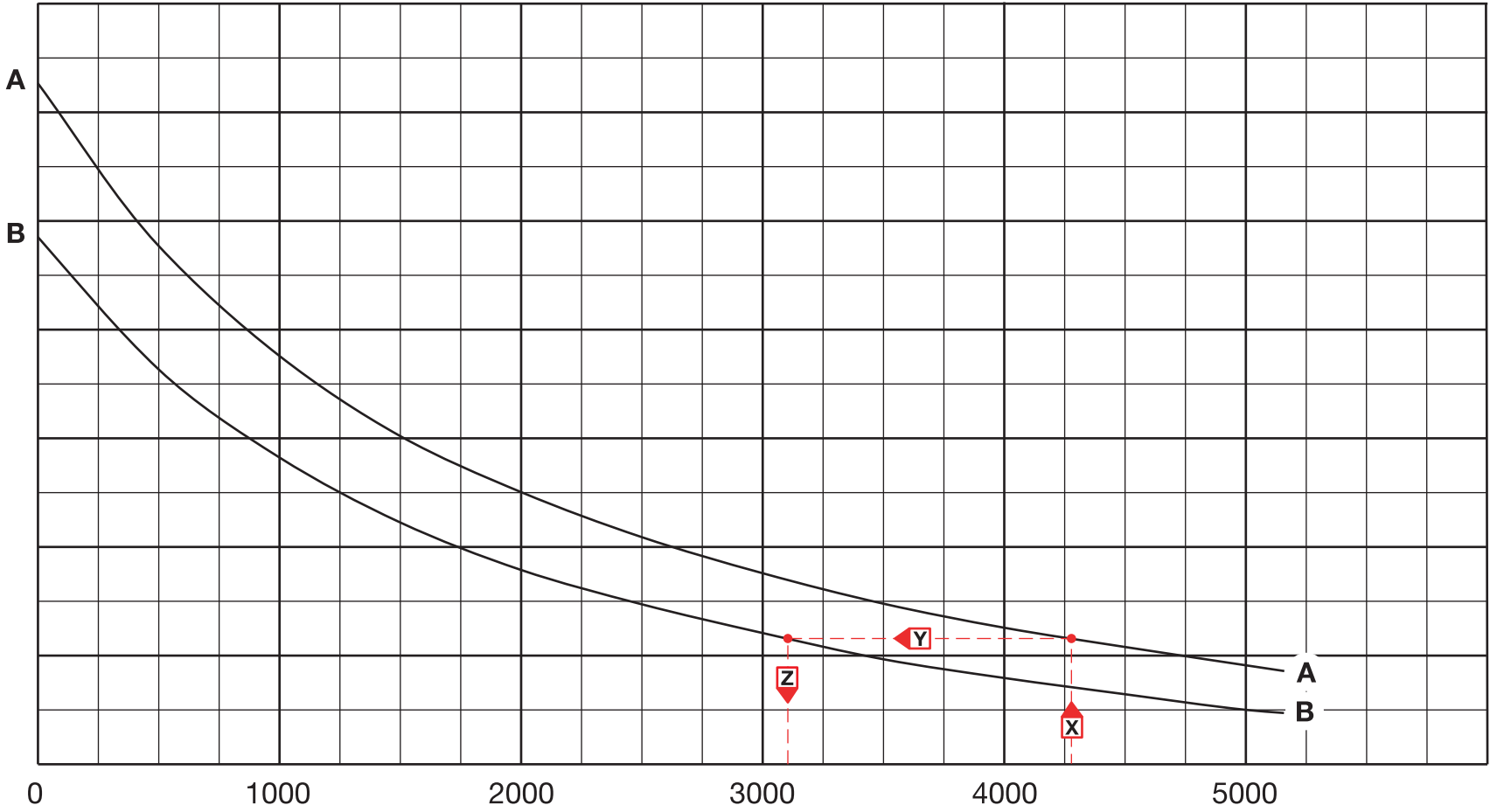


Fig 68. 535-95 Machines



# Section B - Body and Framework Service Procedures

Load Moment Indicator (LMI)

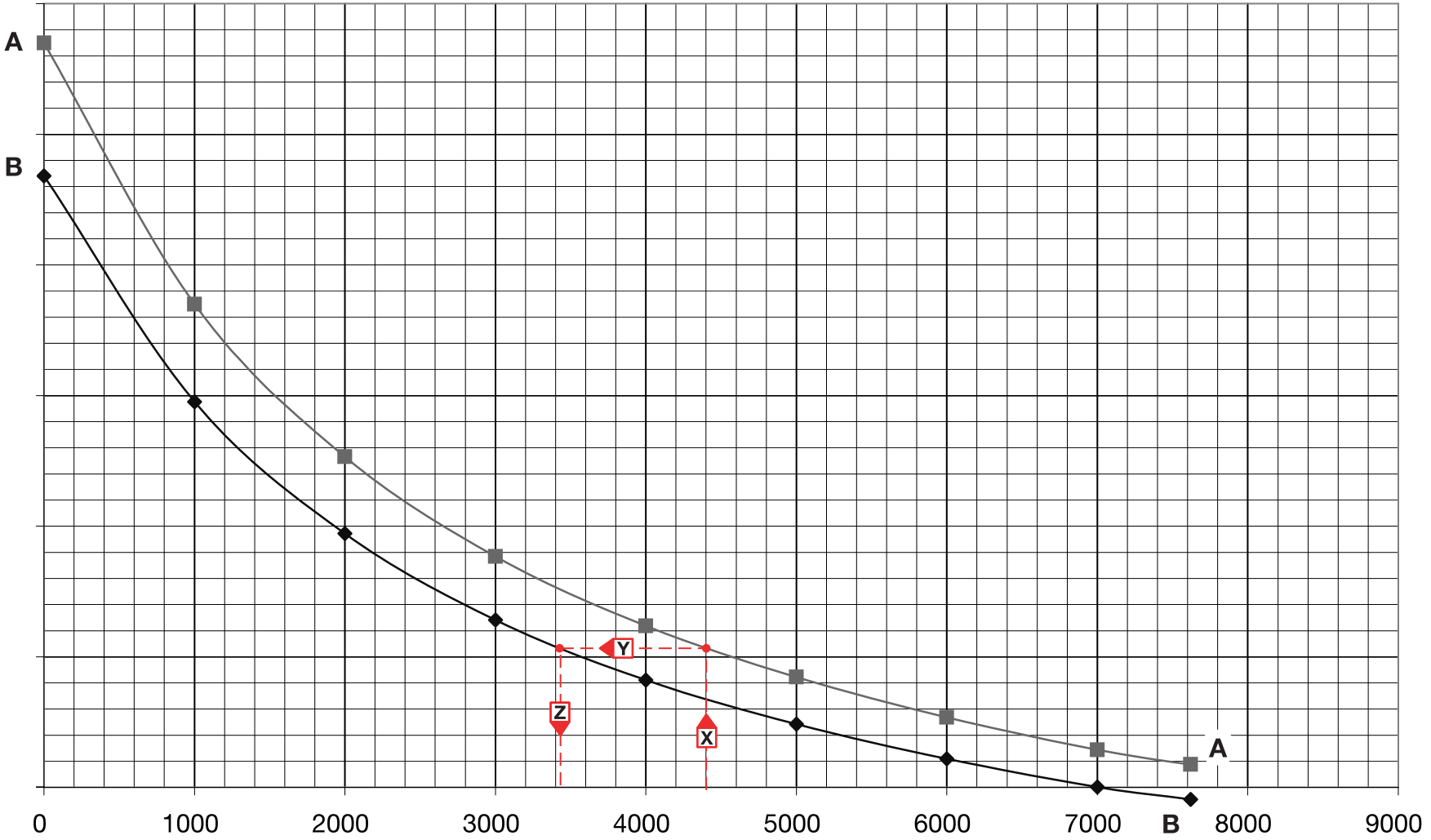


Fig 69. 535-140 Machines



# Section B - Body and Framework Service Procedures

Load Moment Indicator (LMI)

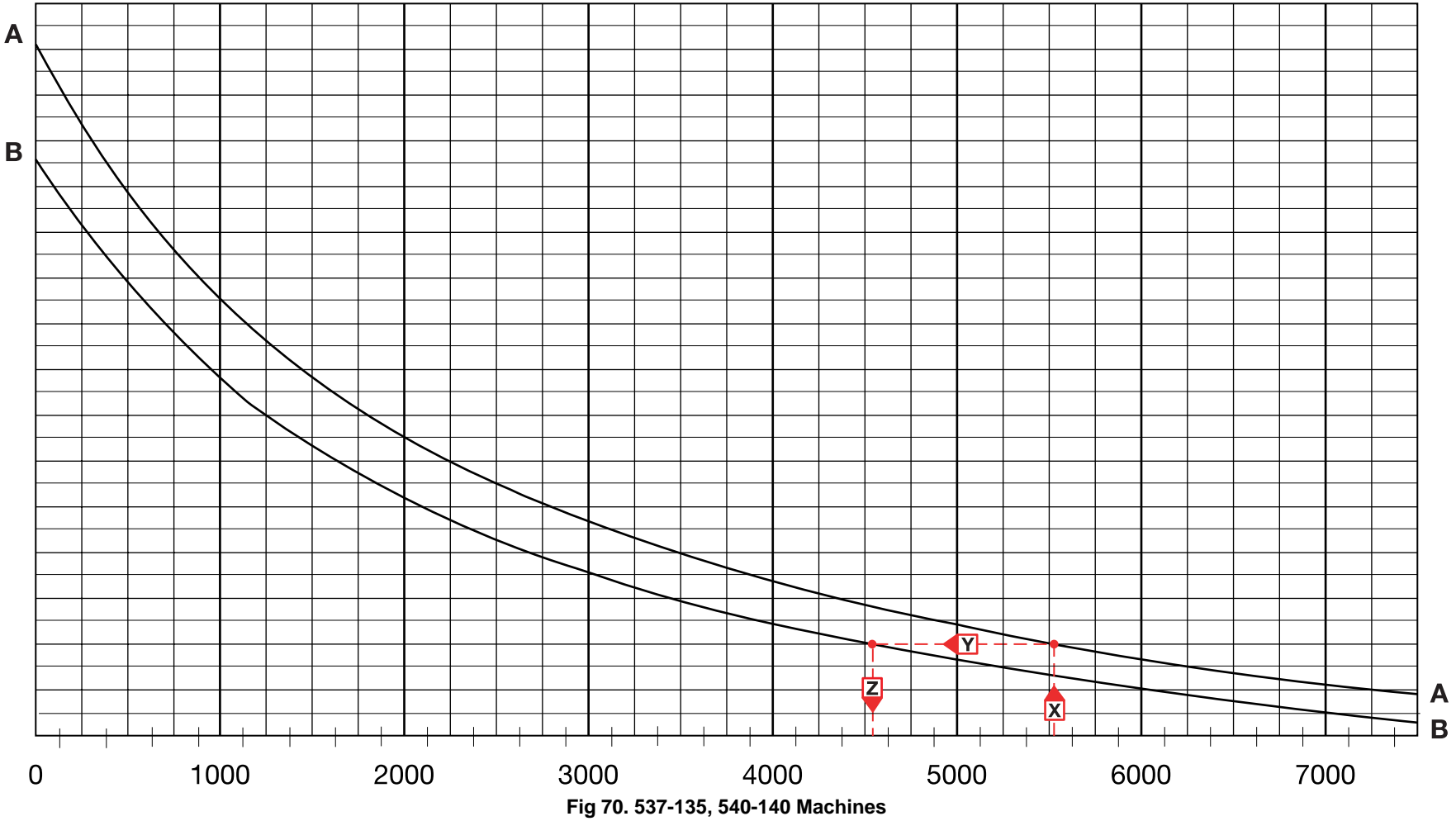
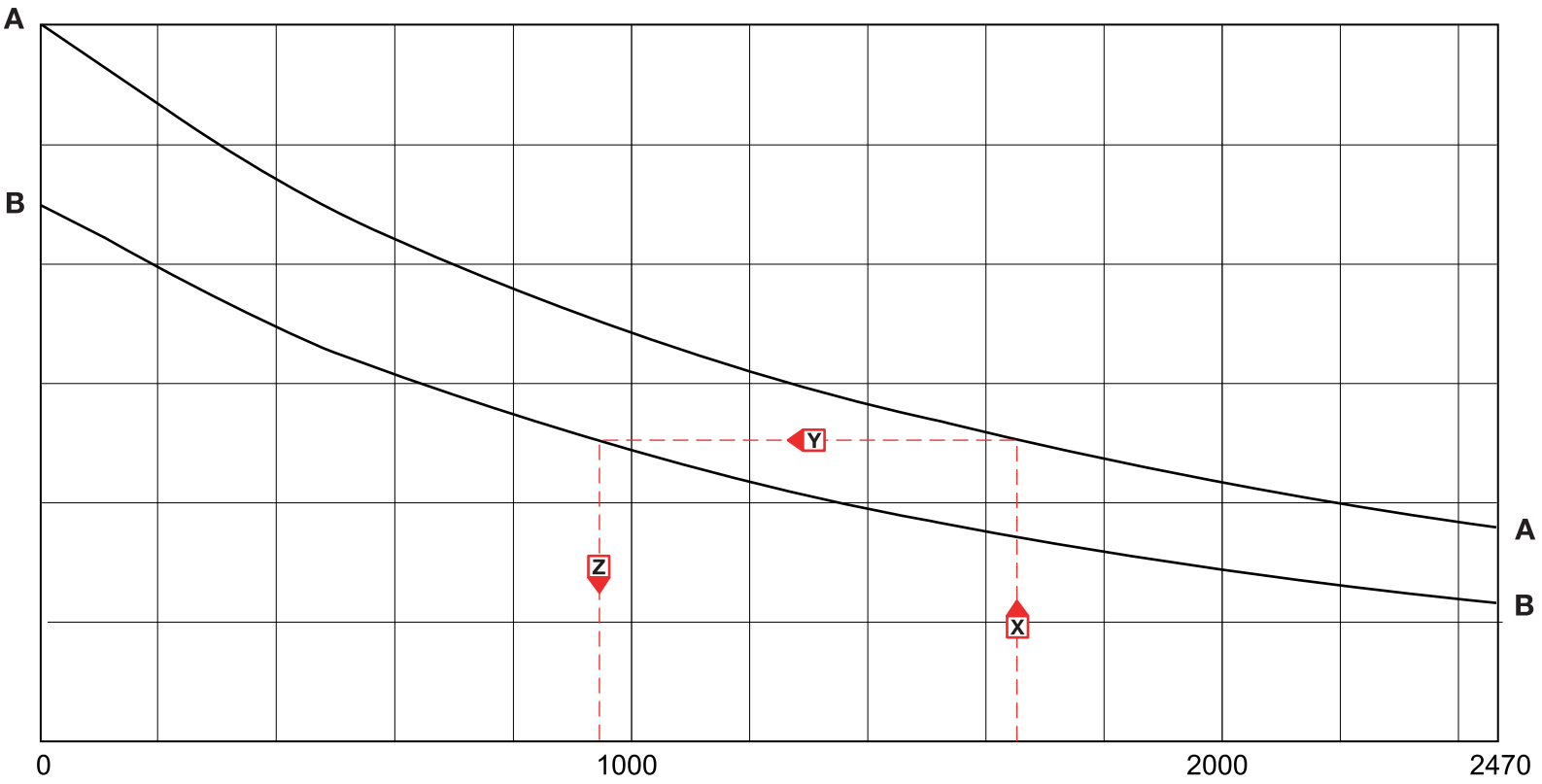


Fig 70. 537-135, 540-140 Machines



**Section B - Body and Framework  
Service Procedures**

Load Moment Indicator (LMI)



**Fig 71. 541-70 Machines**



## **Boom**

### **Wear Pad Renewal**

The procedure for renewing the wear pads is included as part of the boom dismantling and assembly procedures. See ***Boom, Boom Shimming described later in this section.***

## Load Moment Indicator (LMI)

### Removal and Replacement

#### Axle Transducer

##### Removal

Carry out General Safety procedures. See **Section 2 - General Procedures**.

#### 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

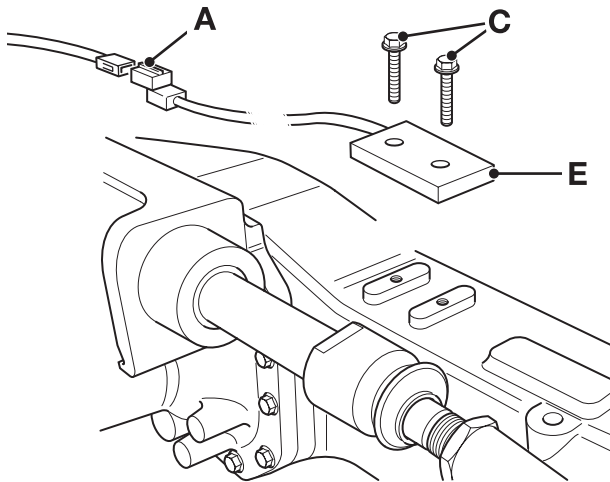


Fig 72.

- 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 **72-A**.
- 4 On HiViz machines remove the transducer cover bracket screws **73-D** and remove the bracket **73-B**.
- 5 Remove bolts **72-C** and remove the transducer **72/73-E**.

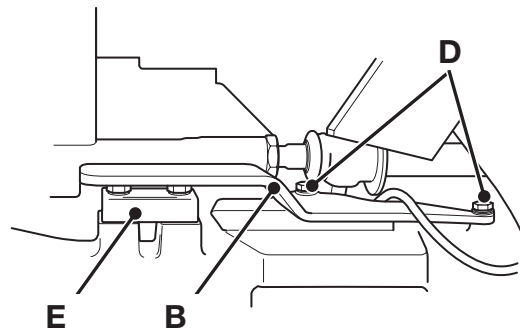


Fig 73. HiViz Machines

##### 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) (see **Section 1 - Service Aids**) to the mounting faces.
- 4 Position the transducer **72-E** as shown. Check the bolt holes align and the mating faces are flush.
- 5 Secure the transducer with bolts **72-C**. Coat the bolts with JCB Threadlocker and Sealer (see **Section 1 - Service Aids**) and torque tighten evenly.
- 6 Connect the electrical harness **72-A**. Ensure the cable to the transducer is secured clear of the axle



## Section B - Body and Framework Load Moment Indicator (LMI)

Removal and Replacement

oscillation stops, and cannot be damaged by movement of the trackrod.

- 7 On HiViz machines replace the transducer cover bracket **73-B** and screws **73-D**.
- 8 Calibrate the LMI system, see **Section 3 - Service Procedures**.

**Table 29. Torque Settings**

Item		Nm	kgf m	lbf ft
72-C <sup>(1)</sup>	M10	67	6.83	49.4
	M12	122	12.44	90

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

## Air Conditioning (Option)

### Removal and Replacement

#### Air Conditioning Unit (HVAC)

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](#) (□ B-43)

Get access to the thermostatic expansion valve by lowering the unit without disconnecting the hoses. In this instance it is not necessary to evacuate the refrigerant.

- 1 Park the machine and make it safe. See **Section 2 - General Procedures**.
- 2 Lift the boom and fit the safety strut. See **Section 2 - General Procedures**.
- 3 Drain the cooling system.
- 4 Remove cover (if fitted) to get access to the air conditioning (HVAC) unit.
- 5 Disconnect the heater hoses at the heater tap **74-E**, and heater hose at the heater matrix **74-F**.
- 6 Disconnect the air conditioning hoses at the expansion valve **74-G**.
- 7 Undo clip **74-K** and disconnect cable **74-L** from the heater shut off valve.

- 8 Remove bolts **74-H** and **74-J** securing the air conditioning (HVAC) unit to the machine. Carefully remove the unit sufficiently to access the electrical harness connector at the rear. Disconnect the electrical connector.

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

- 9 Remove the unit from the machine.

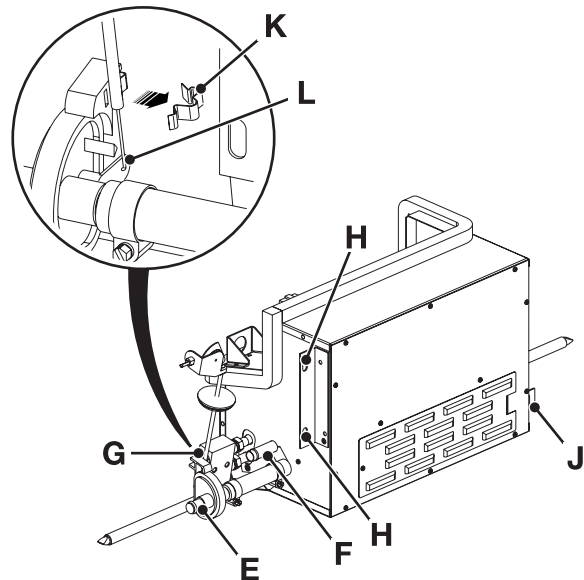


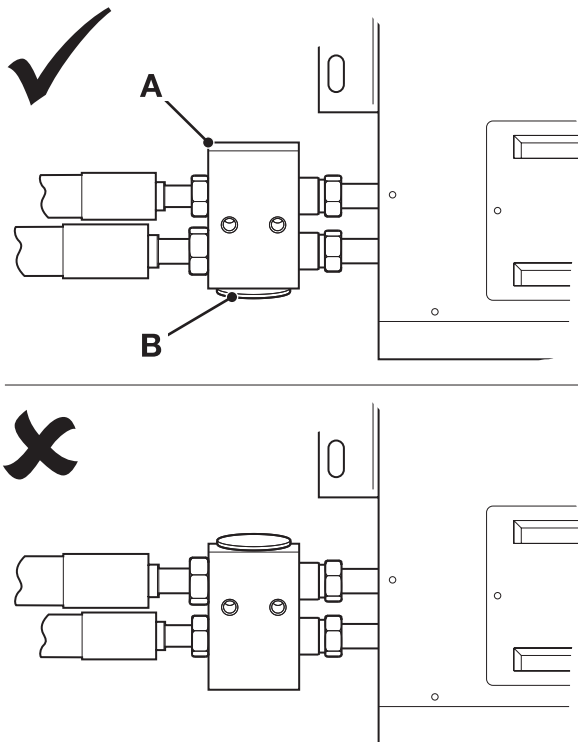
Fig 74. Typical Installation

### Replacement

Replacement is the opposite of the removal procedure.

During the replacement procedure do this work also:

Make sure that the expansion valve **75-A** is fitted correctly with the diaphragm **75-B** located below the valve.



**Fig 75.**

Recharge the air conditioning system and check for leaks.

Refill the cooling system and check for leaks.

#### Freeze Thermostat

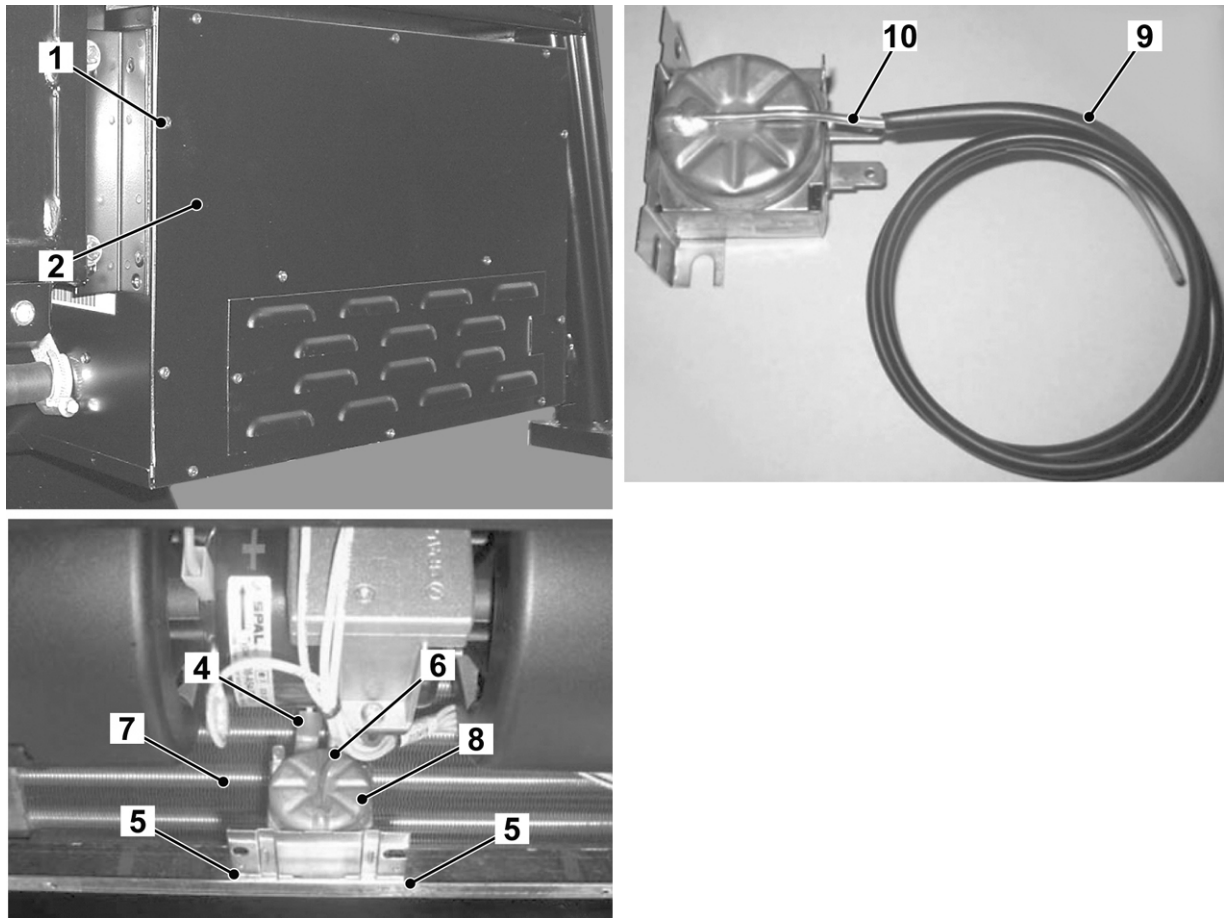


Fig 76.

C094750

#### Removal

- 1 Park the machine and make it safe. Install the boom safety strut. Obey the care and safety procedures. **Section 2 - General Procedures**
- 2 Undo twelve screws 1 and lift off the HVAC unit cover 2.
- 3 Undo two fixing bolts 5 then remove the two electrical connectors 4.
- 4 Carefully remove the thermostat 8 and its sensor probe 6. Note the routing of the sensor. Do not make sharp bends in the sensor probe.

#### Replacement

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

- If a new thermostat is to be installed carefully remove the protective sleeve 9 from the sensor probe 10. Do not make sharp bends in the sensor probe.
- Make sure the HVAC cover sealing gasket locates correctly.

### Binary Pressure Switch

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. Disconnect the battery. See **Section 2 - General Procedures**.
- 2 Remove the harness connectors **77-B**.
- 3 Remove the pressure switch assembly **77-A**.

#### Replacement

- 1 Screw the pressure switch **77-A** into the threaded port and tighten sufficiently to make a gas-tight seal.
- 2 Reconnect the harness connectors **77-B**.
- 3 Charge the air conditioning system.
- 4 Operate the air conditioning system and check around the pressure switch for leaks. If leaks are found, tighten the pressure switch until the leaking stops.

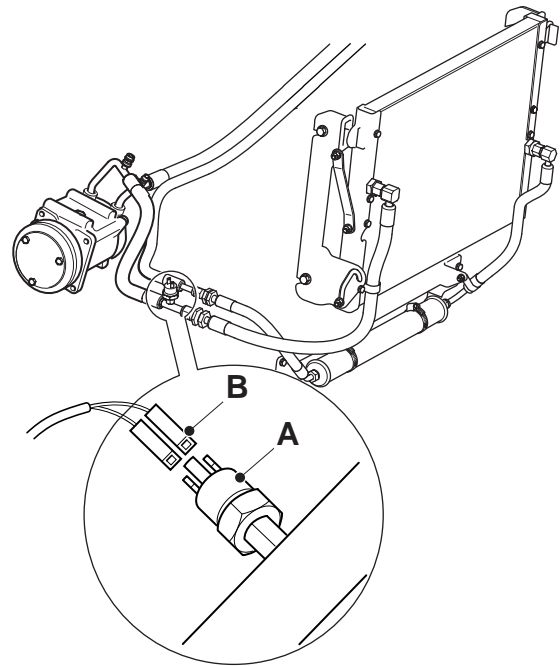


Fig 77. Typical Installation

### Roof Mounted Condenser Unit

#### 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 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

**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**.

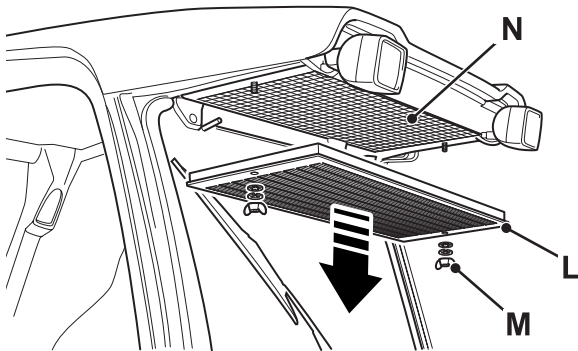


Fig 78.

- 2 Discharge the air conditioning system **see Section B - Service Procedures**.
- 3 Support the protective cover **78-L** and remove fasteners **78-M**. Lower the cover to the ground.
- 4 Clean the condenser **78-N**. Brush off all debris from the tubes and fins using a soft bristle brush.
- 5 Cut the cable ties **79-A** to release the worklight harness **79-B**.

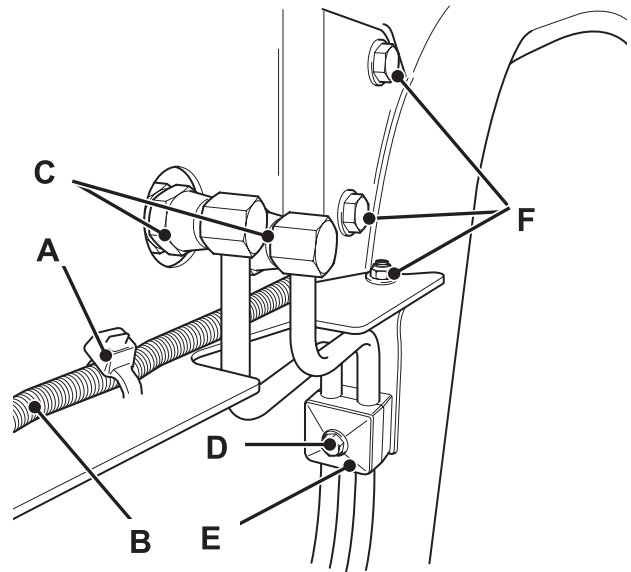


Fig 79.

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

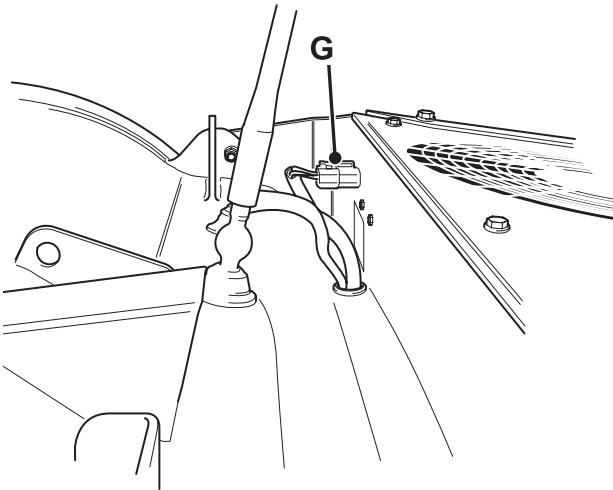
**Note:** To prevent damage to the worklights or harness when lifting or fitting the condensor unit, make sure that the lights and harness are out of the way.

- 7 Remove the bolt **79-D** securing the pipe clamp **79-E**.
- 8 Disconnect the harness connector **80-G**.
- 9 Disconnect both pipes **79-C** from the condenser.
- 10 Using lifting equipment support the weight of the condensor unit.

### Replacement

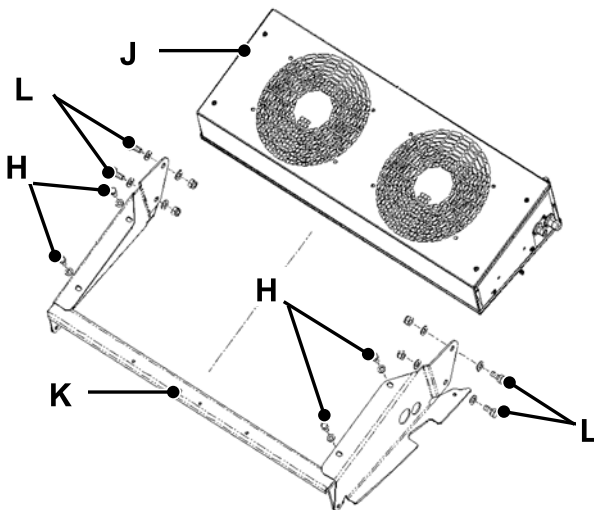
Replacement is the opposite of the removal sequence.

Recharge the air conditioning system and check for leaks  
see **Section B - Service Procedures**.



**Fig 80.**

- 11 Unscrew the condenser support nuts and bolts **79-F** / **81-L**.
- 12 Lift the condenser unit **81-J** and support bracket **81-K** clear of the machine.
- 13 Remove the screws **81-H** and lift the support bracket **81-K** from the condenser unit **81-J**.



**Fig 81.**

### Cooling Pack Mounted Condenser Unit

**Note:** Before removing the condenser matrix, discharge the air conditioning system. Refer to **Service Procedures, Air Conditioning - Refrigerant Charging and Discharging**.

The condenser matrix **82-A** is mounted onto the cooling pack in the engine compartment.

If the condenser is being removed only to get access to the cooling pack, this can be done without disconnecting the air conditioning hoses i.e. with the system fully charged. Remove the screws **82-C** and the condenser can be carefully laid to one side leaving the hoses still connected. Make sure that hoses do not kink. Do not allow the condenser to hang on the hoses unsupported.

The assistance of a refrigeration engineer or suitably trained person will be necessary when removing the condenser matrix as the refrigerant needs to be discharged from the system.

#### Removal

- 1 Park the machine and make it safe. See **Section 2 - General Procedures**.

#### WARNING

##### Raised Equipment

**Never walk or work under raised equipment unless it is supported by a mechanical device. Equipment which is supported only by a hydraulic device can drop and injure you if the hydraulic system fails or if the control is operated (even with the engine stopped).**

13-2-3-7\_2

- 2 Lift the engine cover.
- 3 Disconnect and remove the battery.

#### 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

- 4 Make sure that the air conditioning system is fully discharged, refer to **Service Procedures, Air Conditioning - Refrigerant Charging and Discharging**.
- 5 Put a label on the hoses before disconnecting to help identification when replacing.
- 6 Disconnect the air conditioning hoses at the pipe stubs **82-B** on the side of the condenser. Plug the hose ends to prevent ingress of dirt and loss of fluid.

**Note:** To prevent damaging to the condenser when removing or installing the hoses, it is necessary that the hexagon flats on the pipe stubs **82-B** must be held with a spanner whilst loosening or tightening the hose nuts.

When removing components or hoses, retain any lubricant within the component/hose and fill the system with the same amount of clean lubricant (PAG Oil).

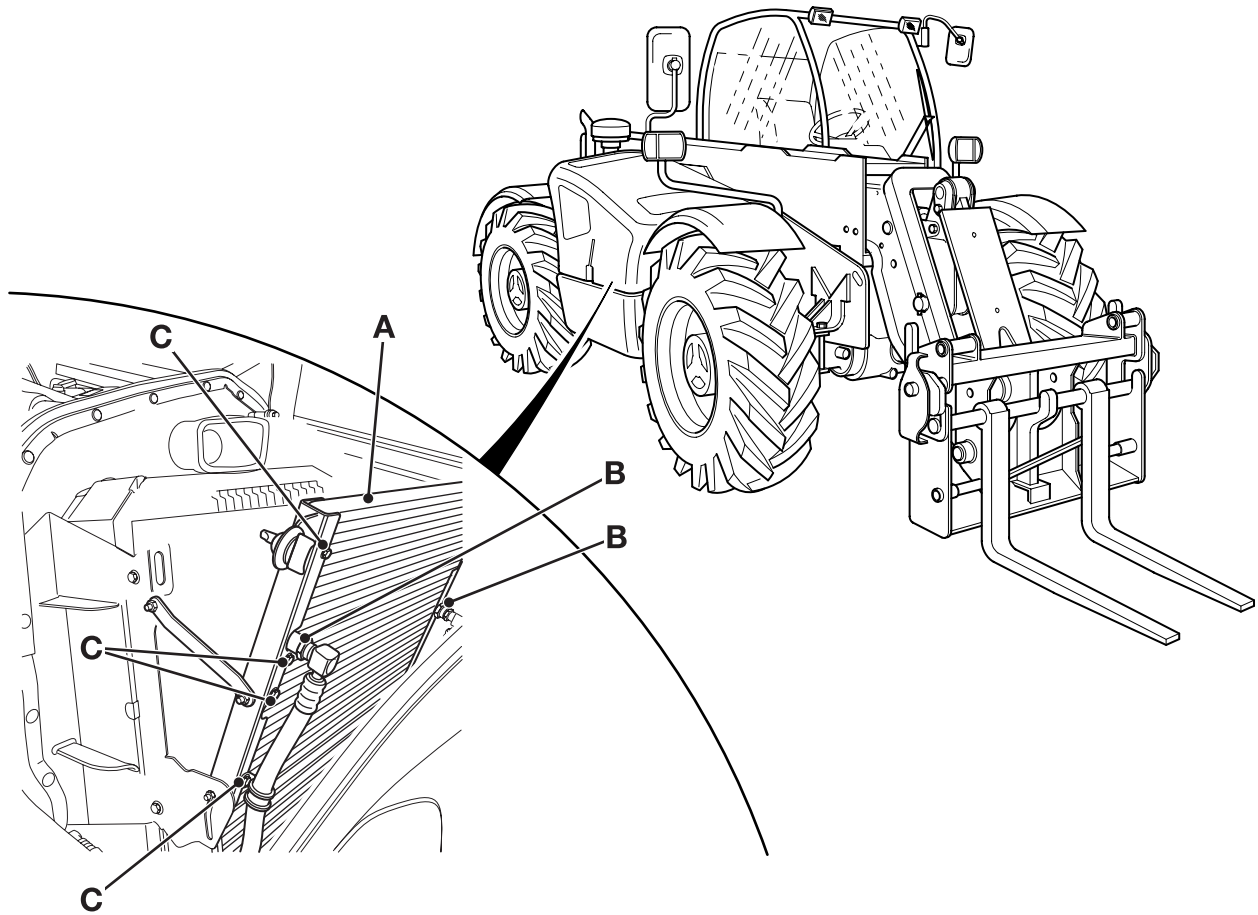
- 7 Remove screws **82-C** and carefully lift the condenser matrix from the machine.

#### Replacement

Replacement is the opposite of the removal procedure.

During the replacement procedure do this work also:

- After replacement recharge the system. Refer to **Service Procedures, Air Conditioning - Refrigerant Charging and Discharging**.
- Operate the air conditioning and check the hose connections for leaks. In the cab, set the air conditioning to maximum cooling and check that cooled air comes from the vents.



**Fig 82. Typical Installation**

## Boom

### Fork Carriage 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

#### 2 Stage Booms

##### Removal

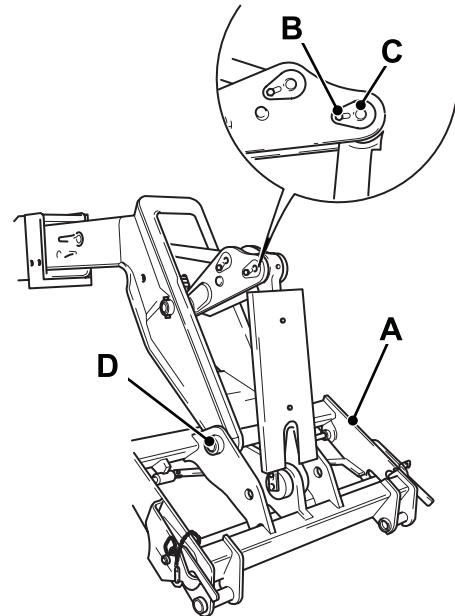


Fig 83.

- 1 Position the boom so that the fork carriage **83-A** can be safely supported when it is disconnected from the boom assembly.
- 2 Stop the engine, apply the park brake and remove the starter key. Operate the loader controls to vent any trapped hydraulic pressure.
- 3 Support the fork carriage **83-A**.
- 4 Undo the bolt **83-B** and drift out the tipping lever pivot **83-C**.
- 5 Remove the lock nut and bolt from the pivot pin trunnion. Drift out pivot pin **83-D** from its location.
- 6 Remove the fork carriage **83-A**.

### Replacement

Replacement is the reversal of removal.

### 3 and 4 Stage Booms

#### Removal

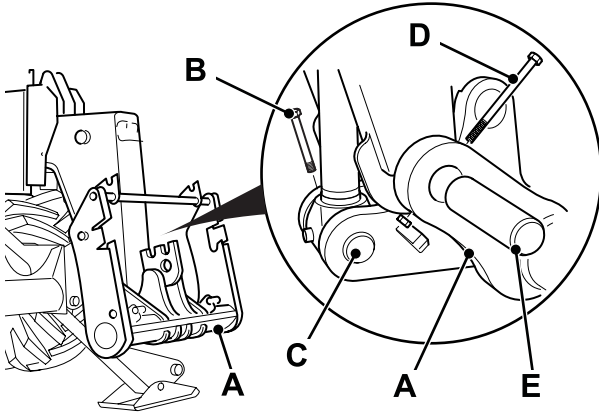


Fig 84.

- 1 Position the boom so that the fork carriage **84-A** can be safely supported when it is disconnected from the boom assembly.
- 2 Stop the engine, apply the park brake and remove the starter key. Operate the loader controls to vent any trapped hydraulic pressure.
- 3 Support the fork carriage **84-A**.
- 4 Remove the tilt ram pivot lock nut and bolt **84-B** and then drift out pivot pin **84-C**. Be sure not to damage the tilt ram piston rod.
- 5 Remove the lock nut and bolt **84-D** from the pivot pin trunnion. Drift out pivot pin **84-E** from its location.
- 6 Remove the fork carriage **84-A**.

### Replacement

Replacement is the reversal of removal.

## Inclinometer Indicator

### Removal and Replacement

#### Removal

⇒ [Fig 85.](#) ([B-83](#))

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

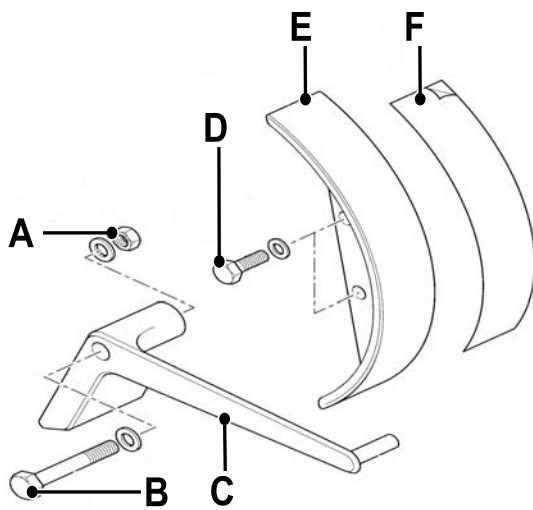


Fig 85.

#### 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**.

### Boom Rear Cover (HiViz Machines)

#### Removal and Replacement

##### Removal

- 1 Lower the boom.
- 2 Unscrew the three securing screws **86-A**.
- 3 Remove the cover **86-B**.

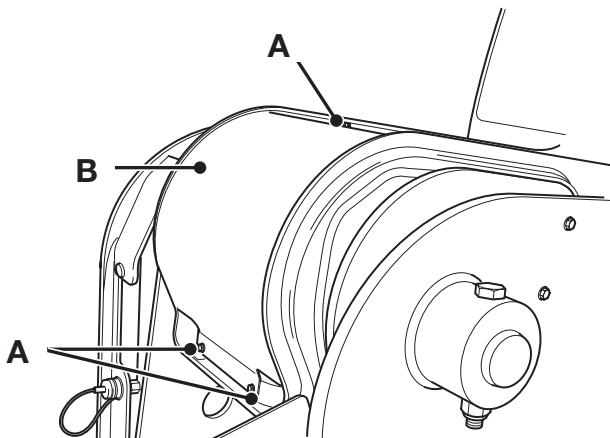


Fig 86.

##### Replacement

Replacement is the opposite of the removal procedure.

## Removal and Replacement

### 2 Stage Boom (531, 541 Machines)

#### 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

**Note:** The complete boom assembly has a mass of approximately 3,000kg (6,613lb). The lift ram has a mass of approximately 250kg (550lb). Support the ram at all times to prevent personal injury and damage to the machine and equipment.

- 1 Position the machine on firm level ground and apply the handbrake. Remove any boom attachments, including forks and fork bar.
- 2 Fully lower the boom. Open the rear access cover and disconnect the displacement ram by removing bolts **87-A** and withdrawing pivot pin **87-B**. Operate

the carriage crowd control to retract the displacement ram.

- 3 Lower the boom onto a suitable support in the semi-raised position to gain access to the lift ram rod end and the displacement rams head end. Support the boom from above ready for removal. Use lifting shackles of suitable capacity fitted to the forward and rear lifting points.
- 4 Support the lift ram and disconnect the lift ram rod end by removing bolt **87-C** and withdraw pivot pin **87-D**. Use the slide hammer kit, see **Service Tools**, Section 1. Lower the ram onto suitable packing material to protect the piston rod.
- 5 Switch off the engine and operate the controls to vent residual pressure.
- 6 Loosen the filler cap to vent the hydraulic tank. Label the connections and disconnect hydraulic hoses at **87-E**.
- 7 Label the connections and disconnect extension ram hoses **87-F** and **87-G**.

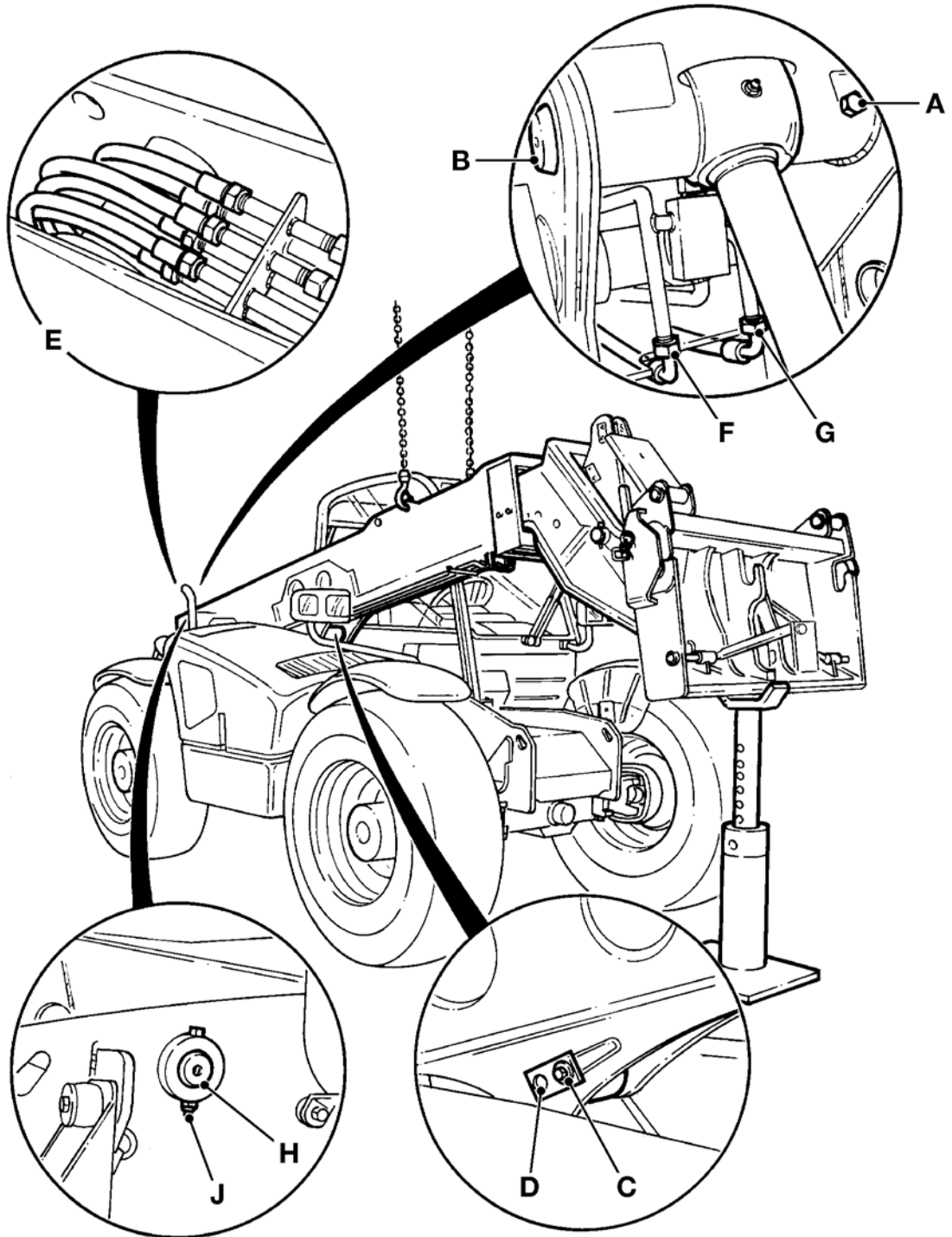


Fig 87. 531, 541 Machines upto 10.5m Lift Height

- 8 Ensure the boom is fully supported. Note that there will be one of three types of main pivot pin for the boom.
- Type 1 - Remove bolt **87-H** and withdraw the pivot pin.
  - Types 2 and 3 - Remove items **88-1** - **88-6**, noting the quantity and arrangement of the spacers.

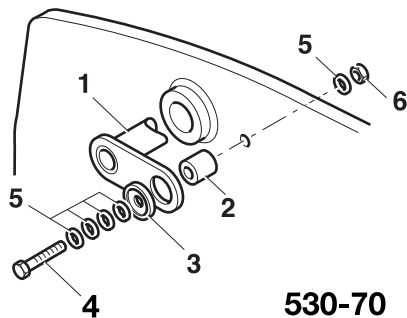
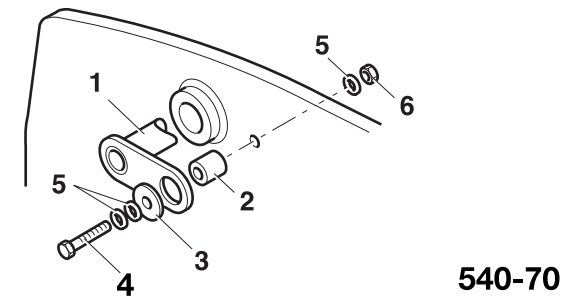


Fig 88. Types 2 and 3

- 9 Carefully lift the boom clear of the machine, checking for any remaining connections. Lower the boom onto suitable packing material.

### Replacement

Replacement is the reversal of Removal.

Check the hydraulic oil level and refill if necessary.

Grease all pivot pins, see **Section 3 - Service Schedules**.

For main pivot pins types 2 & 3, do the following: identify the position and quantity of all washers and spacers for the Loadall model, as shown below. Align the locking plate and fit spacer **88-2**, large washer **88-3**, washers **88-5** and bolt **88-4**. Secure in place with washer **88-5** and nut **88-6**. Tighten the bolt to 476 Nm (352 lbf ft).

### 2 Stage Boom (526, 536 Machines)

#### 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

**Note:** The complete boom assembly has a mass of approximately 3,000kg (6,613lb). The lift ram has a mass of approximately 250kg (550lb). Support the ram at all times to prevent personal injury and damage to the machine and equipment.

- 1 Park the machine and make it safe. Obey the general safety procedures, see **Section 2 - General Procedures**.
- 2 Remove boom attachments, including forks and fork bar.
- 3 Lower the boom onto a suitable support in the semi-raised position to gain access to the lift ram rod end and the displacement rams head end. Support the

boom from above ready for removal. Use lifting shackles of suitable capacity attached to the forward and rear lifting points.

- 4 Support the lift ram and disconnect the lift ram rod end by removing bolt **89-A** and remove the pivot pin **89-B**. Use the slide hammer kit, see **Section 1 - Service Tools**. Lower the ram onto packing material to prevent damage to the piston rod.
- 5 Support the displacement rams and disconnect the head end of the rams by removing bolt **89-C** and remove the pivot pin **89-D**. Use the slide hammer kit, see **Section 1 - Service Tools**. Lower the ram onto packing material to prevent damage to the piston rod
- 6 Vent the hydraulic pressure, see **Section 2 - General procedures**.
- 7 Loosen the filler cap to vent the hydraulic tank.
- 8 Put a label on the connections and disconnect hydraulic hoses. Hydraulic hose connections for 536 machines shown at **89-E**. Hydraulic hose connections for 526 machines shown at **89-M**.
- 9 Put a label on the connections and disconnect extension ram hoses at **89-F** and **89-G**.
- 10 Make sure that the boom is fully supported. Remove bolt **89-H** and remove the pivot pin **89-J**.
- 11 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:

Check the hydraulic oil level and fill if necessary.

Grease all pivot pins, see **Section 3 - Service Schedules**, Section 3.

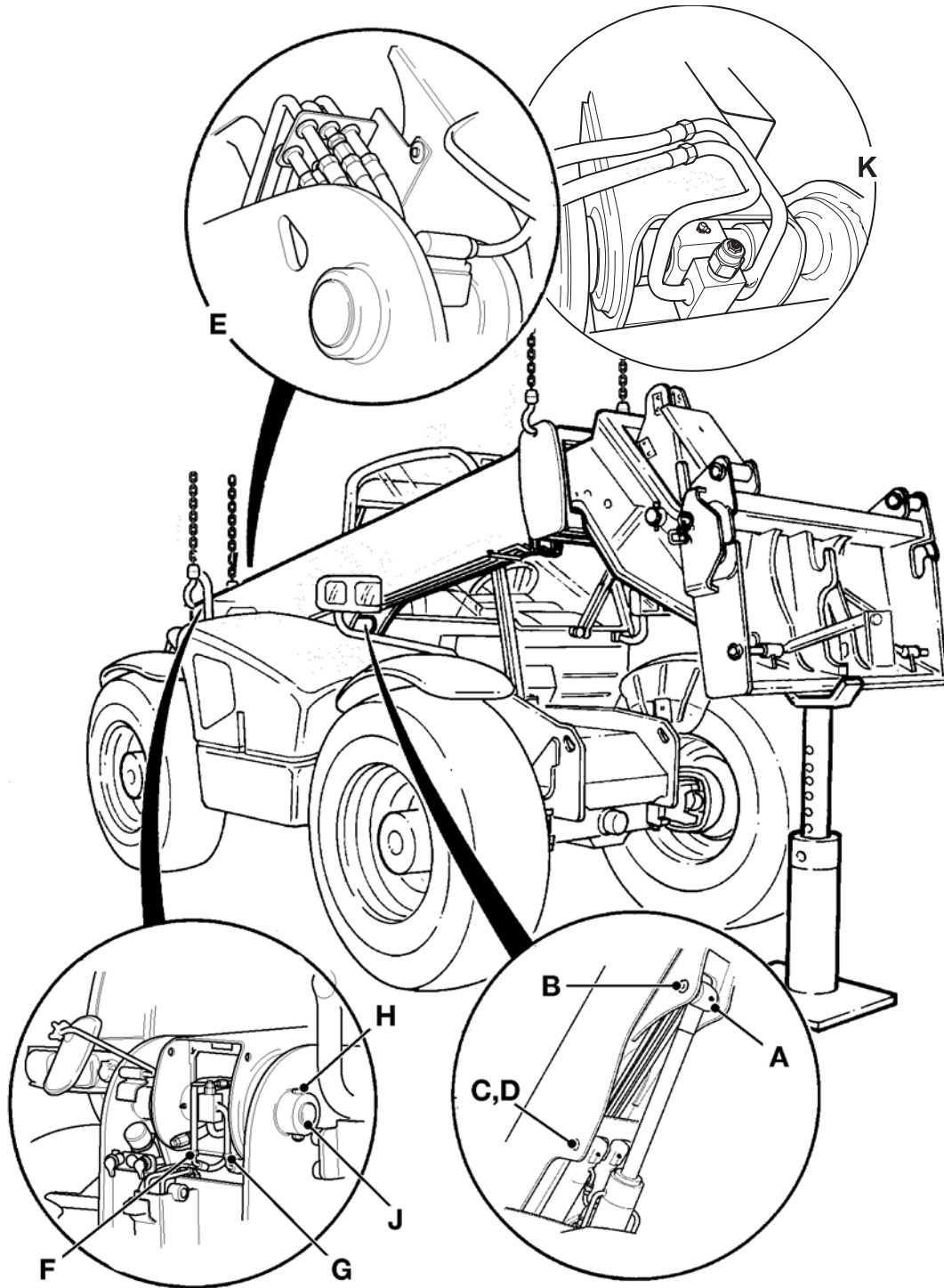


Fig 89. 536 Machines upto 10.5m Lift Height

### 3 and 4 Stage Booms

#### 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

**Note:** The complete boom assembly has a mass of approximately 3250kg (7166 lb). The lift ram has a mass of approximately 280kg (617 lb) and the displacement ram 31kg (69 lb). Support the ram at all times to prevent personal injury and damage to the machine and equipment.

- 1 Position the machine on firm level ground and apply the handbrake. Remove any boom attachments.
- 2 Lower the boom onto a suitable support in the semi-raised position to gain access to the lift ram rod end. Support the boom from above ready for removal. Use lifting shackles of suitable capacity fitted to the forward lifting points if the carriage is fitted, or the rear lifting points if the carriage is not attached.

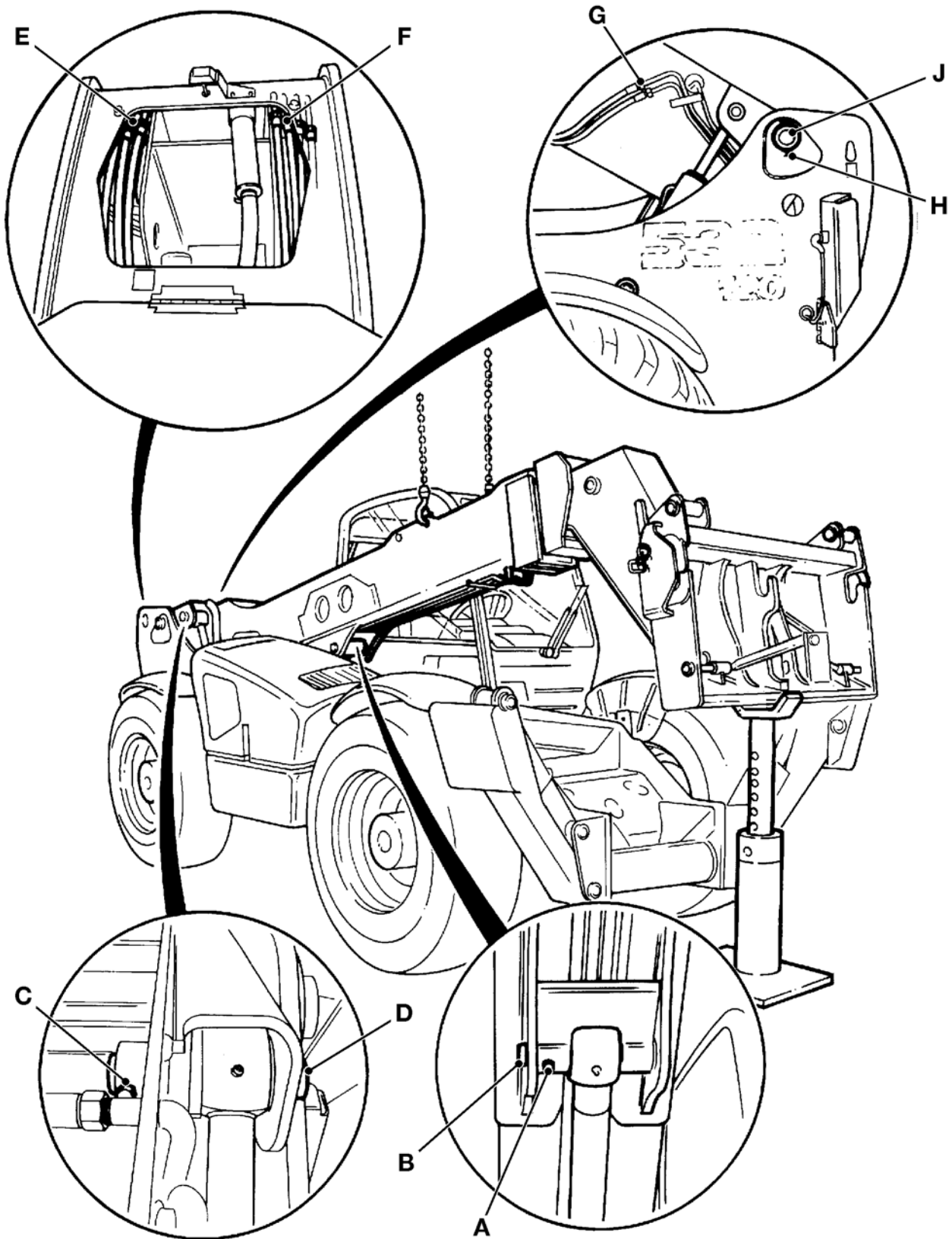
- 3 Remove the boom rear cover (HiViz Machines) see the procedure for this → [Boom Rear Cover \(HiViz Machines\) \(□ B-84\)](#).
- 4 Support the lift ram and disconnect the lift ram rod end by removing bolt **90-A** and withdraw pivot pin **90-B**. Operate the boom lower control to fully retract the ram. Lower the ram onto suitable packing material to protect the piston rod.
- 5 Switch off the engine and operate the controls to vent residual pressure.
- 6 Support the displacement ram. Loosen the filler cap to vent the hydraulic tank. Label the connections and disconnect the displacement ram hoses at **90-F** and **90-G**.
- 7 Remove bolt **90-C** and withdraw pivot pin **90-D**. Lower the displacement ram onto suitable packing material to protect the piston rod.
- 8 Label the connections and disconnect hydraulic hoses at **90-E**.
- 9 Ensure the boom is fully supported. Remove bolt **90-H** and withdraw pivot pin **90-J**. Carefully lift the boom clear of the machine, checking for any remaining connections. Lower the boom onto suitable packing material.

### Replacement

Replacement is the reverse of the removal procedure.

Check the hydraulic oil level and refill if necessary.

Grease all pivot pins, see **Section 3 - Service Schedules**.



**Fig 90. 3 Stage Boom (Typical)**

Three stage boom machine shown, four stage machine similar.

## Dismantling and Assembly

### 2 Stage Boom

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, auxiliary and extension rams services. → [5 \(□ B-97\)](#)
- Tilt ram removal and replacement. See **Section E - Hydraulics**.
- Extension ram removal and replacement. See **Section E - Hydraulics**.
- Wear pads and shims. → [Boom Shimming \(□ B-117\)](#)
- Displacement ram removal and replacement. See **Section E - Hydraulics**.

### 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. ⇒ [Fork Carriage Removal and Replacement \(□ B-81\)](#).
- 2 Remove the tilt ram 91-A. See **Section E - Hydraulics**.
- 3 Remove the extension ram 91-B. See **Section E - Hydraulics**.
- 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 91-C.
  - b Remove the tilt ram hoses 91-D. Label and disconnect the hoses at the steel pipes on the underside of the boom. Pull out the hoses through guide channels 91F from the rear in the direction of arrow 91-X. Then pull out the hoses through the apertures under the boom in the direction of arrow 91-Y. Cap all open hoses and ports.
  - c Remove the auxiliary service hoses 91-E. Label and disconnect the hoses at the steel pipes on the underside of the boom and at the front of the boom. Pull out the hoses in the same way as the tilt ram hoses. Cap all open hoses and ports.
- 5 Remove the inner boom 91-H
  - a Remove the front wear pads 91-G from the outer boom 91-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 91-H and draw it out from the outer section 91-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 intermediate boom section is withdrawn forces may cause the whole assembly to move.*

### Assembly

Assembly is the reverse of dismantling but note the following:

- 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 91-C at the inside of the inner boom.
- 5 Check that the boom wear pad shimming is correct. ⇒ [Boom Shimming \(□ B-117\)](#).

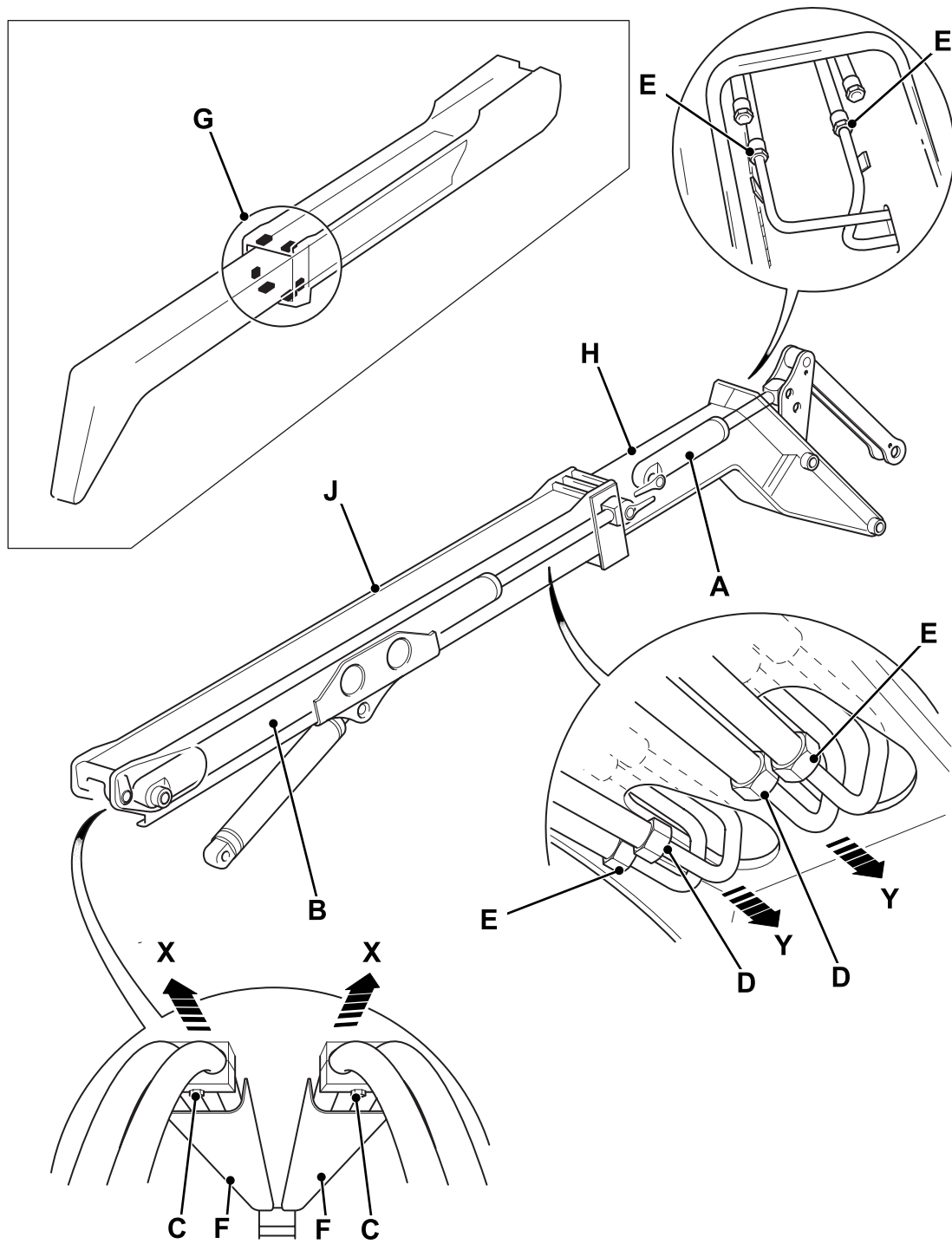


Fig 91. 2 Stage Boom

### 3 Stage Boom

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, auxiliary and extension rams services. → [5 \(□ B-97\)](#)
- Tilt ram removal and replacement. See **Section E - Hydraulics**.
- Outer extension ram removal and replacement. See **Section E - Hydraulics**.
- Inner extension ram removal and replacement.
- Wear pads and shims. → [Boom Shimming \(□ B-117\)](#)
- Displacement ram removal and replacement. See **Section E - Hydraulics**.

### 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

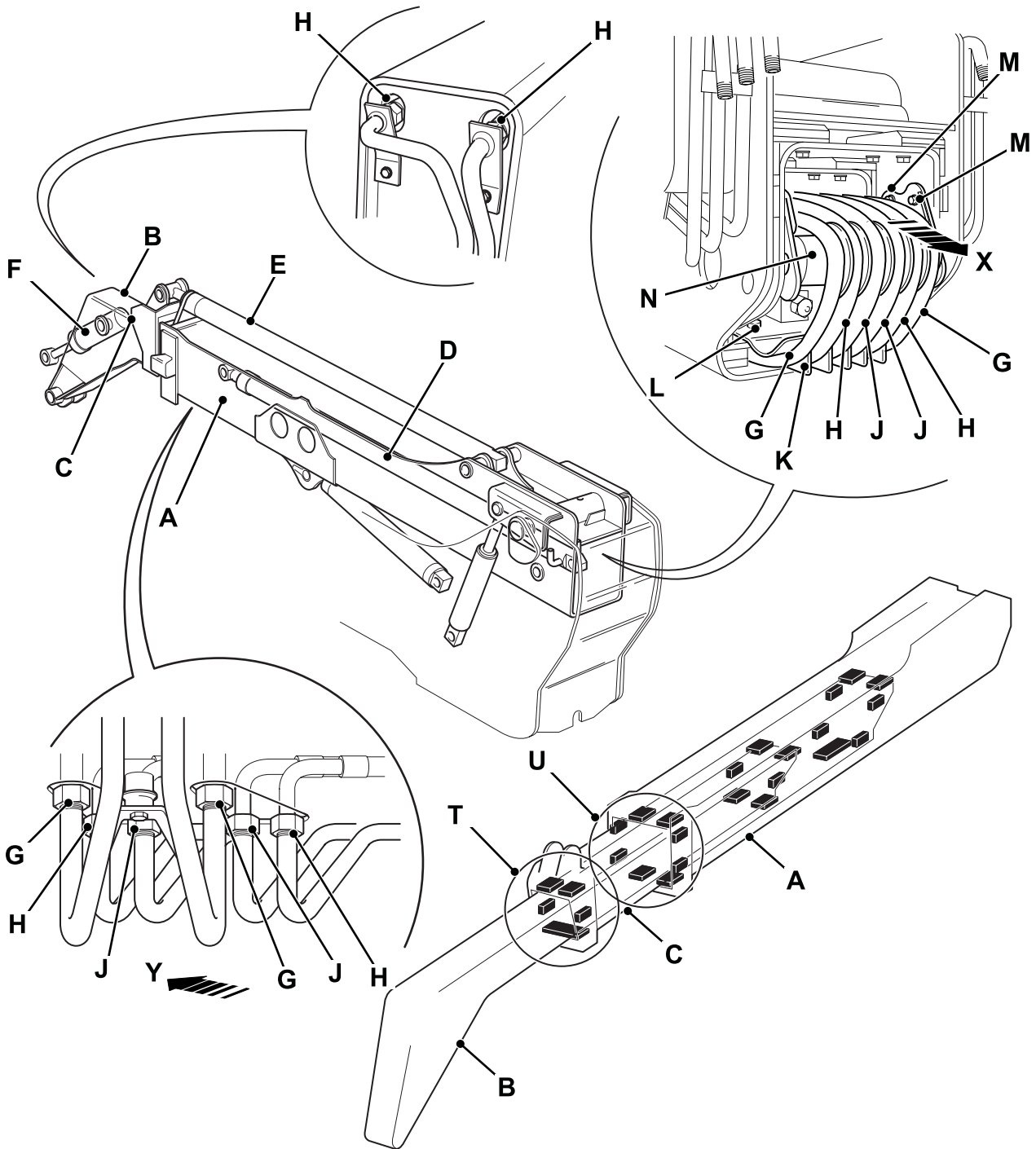


Fig 92. 3 Stage Boom

### Dismantling

- 1 Remove the fork carriage. ⇒ [Fork Carriage Removal and Replacement \(□ B-81\)](#).
- 2 Remove the tilt ram 92-F. See **Section E - Hydraulics**.
- 3 Remove the inner extension ram 92-D. See **Section - Hydraulics**.
- 4 Remove the outer extension ram 92-E. See **Section E - Hydraulics**.
- 5 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 bolts 92-M and remove the boom hose guide roller assembly 92-N.
  - b Undo bolts 92-L and remove hose guide 92-K.
  - c Remove the tilt ram hoses 92-J. Label and disconnect the hoses at the steel pipes on the underside of the boom. Pull out the hoses from the rear in the direction of arrow 92-X. Then pull out the hoses through the apertures under the boom in the direction of arrow 92-Y. Cap all open hoses and ports.
  - d Remove the auxiliary service hoses 92-H. Label and disconnect the hoses at the steel pipes on the underside of the boom and at the front of the boom. Pull out the hoses in the same way as the tilt ram hoses. Cap all open hoses and ports.
  - e Remove the inner extension ram hoses 92-G. Label and disconnect the hoses at the steel pipes on the underside of the boom. Pull out the hoses through the apertures under the boom in the direction of arrow 92-Y. Cap all open hoses and ports.
- 6 Remove the inner boom 92-B.
  - a Remove the front wear pads 92-T from the intermediate boom 92-C. 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 92-B and draw it out from the intermediate section 92-C. Make sure that the intermediate section remains stationary. 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 intermediate section.

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

- 7 Remove the intermediate boom 92-C
  - a Remove the front wear pads 92-U from the outer boom 92-A. 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 intermediate 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 intermediate boom 92-C and draw it out from the outer section 92-A. Before the intermediate 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 intermediate boom section is withdrawn forces may cause the whole assembly to move.*

### Assembly

Assembly is the reverse of dismantling but note the following:

- 1 Check the length of the hose pairs. The hose lengths must be equal to within +/- 1mm for each service pair (tilt ram pair, inner extension 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 six telescopic service hoses if any of the hoses are damaged.

- 3 Assemble the boom sections so that the boom is fully retracted. Fit the outer extension ram followed by the inner ram. See **Section E**.

**Note:** To enable alignment of the rod end pivot of the inner ram, the hydraulic hoses must be fitted so that the boom can be extended. The length of the inner and intermediate boom sections protruding from the outer section must be kept equal to avoid damage to the telescopic service hoses.

- 4 Make sure that the hose routing is correct. DO NOT cross over any hoses. The tilt ram and auxiliary service hoses are routed through the hose guide and along the tray fitted to the top of the inner extension ram **92-D**.
- 5 Check that the boom wear pad shimming is correct. → [Boom Shimming \(□ B-117\)](#).
- 6 Pivot the hose guide roller assembly **92-N** so as to take up the hose slack. DO NOT use excessive force when setting the roller assembly.

### 4 Stage Boom

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, auxiliary and extension rams services. See **Section E - Hydraulics**.
- Tilt ram removal and replacement. See **Section E - Hydraulics**.
- Outer extension ram removal and replacement. See **Section E - Hydraulics**.
- Inner extension ram removal and replacement.
- Wear pads and shims. → [Boom Shimming \(□ B-117\)](#)

### 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

### Remove the Primary External Components

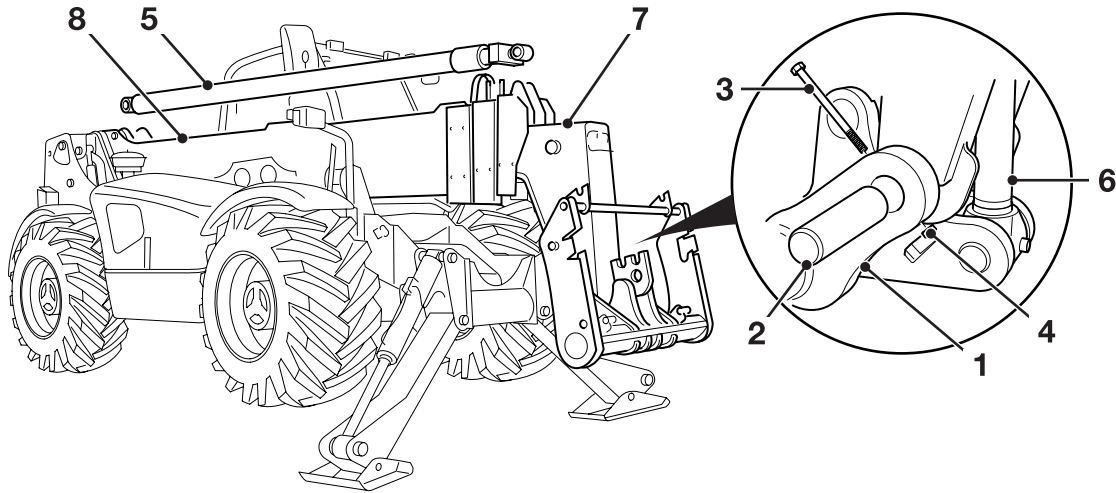


Fig 93. 4 Stage Boom

- 1 Remove the fork carriage → [Fork Carriage Removal and Replacement \(□ B-81\)](#).
- 2 Remove tilt ram 93-6. See [Tilt Ram - Removal](#), Section E.
- 3 Remove the outer extension ram 93-5 from the boom assembly 93-8. See [Outer Extension Ram - Removal](#), Section E.

892/00056 and blanking caps 816/00189, as appropriate, to prevent ingress of dirt or moisture.

### 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

#### 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

### Dismantle the Main Boom Assembly

The following paragraphs describe the procedures required to fully dismantle the boom assembly. Only dismantle the boom as far as is required to complete the task in hand.

**Important:** Clearly mark all hoses and pipework that are disconnected to facilitate reassembly. Use blanking plugs

### 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

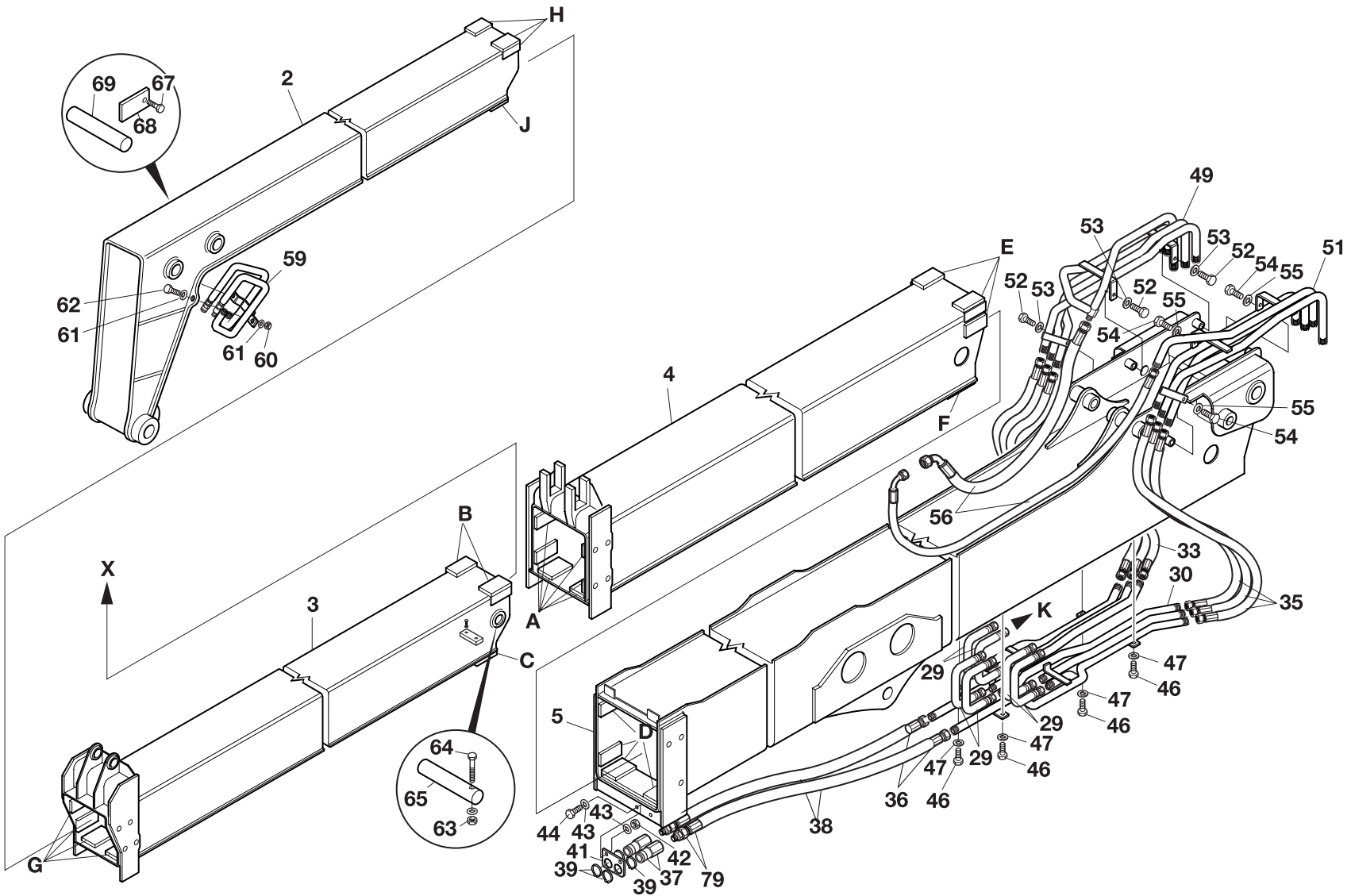


Fig 94. 4 Stage Boom (Sheet 1 of 2)

For Sheet 2 of 2 (items K and X). → Fig 95. (□ B-102).

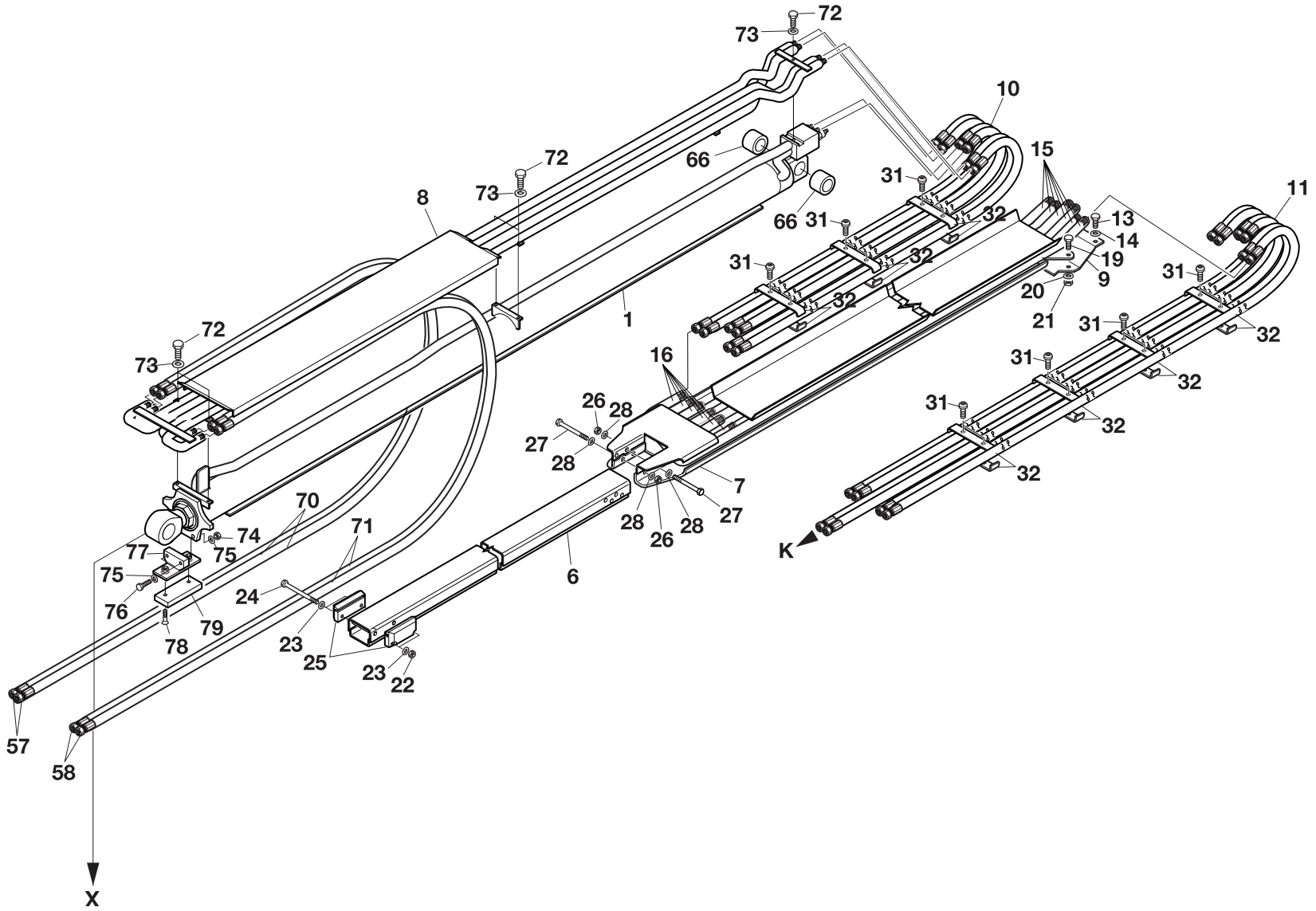


Fig 95. 4 Stage Boom (Sheet 2 of 2)

For Sheet 1 of 2 (items K and X), ⇒ [Fig 94.](#) (□ [B-101](#)).

- 1 Remove the bolts **95-13** and washers **95-14** to release the main pipe assembly support plate **95-9** from its location points on the first intermediate boom **94-4**. Identify and disconnect the six hoses at the rear connection points **95-15**.
- 2 At the rear of the inner ram, identify and disconnect the four hose connections at the inner boom pipe assembly **95-8** and the two hose connections at the inner ram **95-1**.
- 3 Pull the main pipe assembly **95-7**, together with support arm **95-6**, rearwards until you can get access to the front connection block **95-16**. Identify and disconnect the six hose connections at the front connection block **95-16**.
- 4 Remove two screws, two washers and two locknuts **96-1** retaining hose and tracking assembly **96-2**. Move hose and tracking assembly **96-2** away from the work area. If required, remove and replace any damaged hoses.

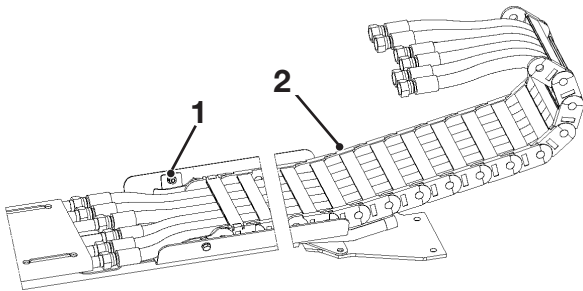


Fig 96.

- 5 Remove the two bolts **95-19**, two washers **95-20** and two nuts **95-21**, then remove the main pipe assembly support plate **95-9** from the main pipe assembly **95-7**.
- 6 Remove the main pipe assembly **95-7** from the inner ram **95-1**.
- 7 On the support arm **95-6**: If required, remove the two nuts **95-22**, four washers **95-23** and two bolts **95-24** and remove the two wear blocks **95-25**.

**Note:** Remove the support arm only if absolutely necessary. Correct functioning of the assembled boom depends on careful and accurate assembly of its

*components. Misalignment of pipework and/or hoses will result in malfunction of the boom and damage to the hoses and/or boom structure.*

- 8 If required, remove the four nuts **95-26**, four bolts **95-27** and the eight washers **95-28** and remove the support arm **95-6** from the main pipe assembly **95-7**.
- 9 Remove the front wear pads **94-A** from the first intermediate boom **94-4**, remove the side and top wear pads **94-B** from the rear of the second intermediate boom **94-3**. The bottom pads **94-C** should be left in situ. Remove the inner boom **94-2** and second intermediate boom **94-3** sub-assembly from the first intermediate boom **94-4**. Remove bottom pads **94-C** if required.
- 10 Remove the front wear pads **94-D** from the outer boom **94-5**, remove the top and side wear pads **94-E** from rear of the first intermediate boom **94-4**. The bottom pads **94-F** should be left in situ. Remove the first intermediate boom **94-4** from the outer boom **94-5**. Remove bottom pads **94-F** if required.
- 11 At the forward underside position on the outer boom **94-4**: Identify and disconnect the six connections **95-K** where the main hose assembly **95-11** joins the six 'U' pipes **94-29**.
- 12 If required, disconnect the six 'U' pipes **94-29** from the external pipe assembly **94-30**.
- 13 Remove the main hose assembly **95-11** through the rear of the outer boom **94-5**. If required, remove the eight bolts **95-31** and remove the four sets of pipe clips **94-32** from the hose assembly.
- 14 At the rear underside position on the outer boom **94-5**, disconnect the right hand external hoses **94-33** from the external pipe assembly **94-30**. Disconnect the left hand external hoses **94-35** from the external pipe assembly **94-30**.
- 15 Disconnect the connections **94-36** and **94-37** and remove the auxiliary hoses **94-38**. If required, remove two of the four circlips **94-39** and remove the auxiliary couplings **94-40** from the bracket **94-41**.
- 16 If required, remove the two nuts **94-42**, four washers **94-43** and two bolts **94-44** and remove the bracket **94-41** from the outer boom.

- 17 At the underside of the outer boom **94-5**: Support the external pipe assembly **94-30** and remove the six bolts **94-46** and six washers **94-47**. Remove the external pipe assembly **94-30** from the work area. Disassemble the two sections of the assembly only if one part is defective.
- 18 Identify and disconnect the three right external hoses **94-33** from the right external pipes assembly **94-49**. Remove the three hoses **94-33** from the work area.
- 19 Identify and disconnect the three left external hoses **94-35** from the left external pipes assembly **94-51**. Remove the three hoses **94-35** from the work area.
- 20 Support the right external pipes assembly **94-49** and remove the three bolts **94-52** and three washers **94-53**. Remove the pipes assembly **94-49** from the work area.
- 21 Support the left external pipes assembly **94-51** and remove the three bolts **94-54** and three washers **94-55**. Remove the pipes assembly **94-51** from the work area.
- 22 If required, disconnect the two tilt ram hoses **94-56** from each of the external pipe assemblies **94-49** and **94-51**.
- 23 On the second intermediate boom and inner boom sub-assembly (items **94-2** and **94-3**): Make sure that the two tilt ram connectors **95-57** are free to move in the head of the inner boom **94-2**. Identify and disconnect the two auxiliary hoses **95-58** from the auxiliary pipe assembly **94-59**.
- 24 Remove the two nuts **94-57**, four washers **94-61** and two bolts **94-62** and remove the auxiliary pipe assembly **94-59** from the inner boom **94-2**.
- 25 At the rear inner ram location: Remove the nut **94-63** and bolt **94-64** and remove the rear location pin **94-65** and the two spacers **94-66**. Use a block of wood or similar soft material to support the rear of the inner ram **95-1**.
- 26 Remove the front wear pads **94-G** from the second intermediate boom **94-3**. Remove the top and side pads **94-H** from the rear of the inner boom **94-2**. The bottom pads **94-2** should be left in situ. Remove the inner boom from the second intermediate boom **94-3**. Remove bottom pads **94-J** if required.
- 27 At the front inner ram location: Remove the bolt **94-67** and plate **94-68** and remove the front inner ram location pin **94-69**. Move the inner ram assembly rearwards until you can get access to the tilt ram hoses **95-70** and auxiliary hoses **95-71**.
- 28 Identify and disconnect twin hose assemblies **95-70** and **95-71** from the front end of the inner boom pipe assembly **95-8**. Carefully remove hose assemblies **95-70** and **95-71** from the inner boom **94-2**.
- 29 Remove the inner ram assembly from the inner boom **94-2**.
- 30 Remove the five bolts **95-72** and five washers **95-73** and remove the inner boom pipe assembly **95-8** from the inner ram **95-1**.
- 31 Remove the two nuts **95-74**, four washers **95-75** and the two bolts **95-76** and remove the front wear pad bracket **95-77** from the inner ram **95-1**.
- 32 Remove the two countersunk screws **95-78** and remove the front wear pad **95-79** from its bracket **95-77**.

#### Assembly

#### 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:** These procedures refer to left and right, front and rear positions. This assumes the operator is positioned at the base of the boom assembly looking towards the boom nose.

**Note:** Correct functioning of the assembled boom depends on careful and accurate assembly of its components. Misalignment of pipework and/or hoses will result in malfunction of the boom and damage to the hoses and/or boom structure.

#### 1 Check Twin Hose Assemblies:

- a Before proceeding with the assembly, ensure that in all twin hose assemblies, the hoses are of equal length. → Fig 97. (□ B-105). Any hose pairs which are misaligned by more than 1mm must not be used.

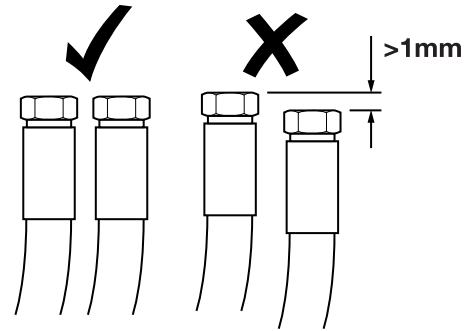


Fig 97.

#### 2 Outer Boom Hose Assembly:

- a At the front end of the external pipe assembly 94-30: Measure and record the horizontal distance X. → Fig 98. (□ B-105). This measurement should be approximately 220 mm (8.7 in.).

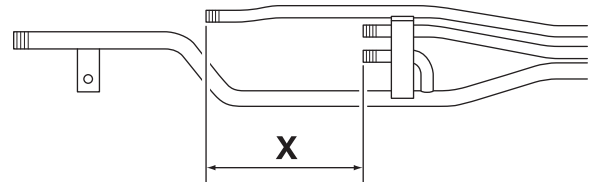
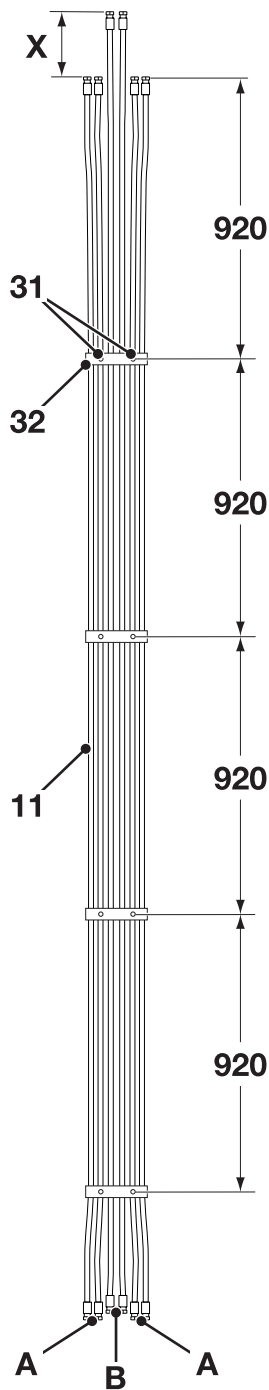


Fig 98.

- b In a suitably clean area, arrange the three hoses of the outer boom hose assembly 94-11 adjacent to each other as shown. Identify which end of the hose assembly will be the front end with regard to boom position. Arrange the two front connectors of the central hose relative to the two shorter side hoses to reflect the dimension X recorded in step a. The hose connectors will now interface correctly with the six 'U' pipes 94-29 on the external pipe assembly.



**Fig 99. Outer Boom Hose Assembly**

- c Make sure the hoses are not twisted. Using a front connector of the shorter length hoses as a datum,

measure 920 mm (36.2 in.). Apply JCB Threadlocker and Sealer to the threads of two bolts **99-31** and install a hose clip **99-32** and two bolts at this point to locate the three hoses in position.

- d Using the hose clip **99-32** installed in the previous step as a datum, install the remaining three hose clips **99-32** and six bolts **99-31** at 920 mm (36.2 in.) intervals along the hose assembly, applying JCB Threadlocker and Sealer to the threads of bolts **99-31**.

- 3 Check Hose Lengths. → [Table 30. Hose Lengths](#) ([□ B-106](#)).

**Table 30. Hose Lengths**

Hose	Length
<b>99-A</b>	4100mm (161.4 in) +/- 20mm (0.8 in)
<b>99-B</b>	4300mm (169 in) +/- 20mm (0.8 in)

**Important:** The following assembly must be carried out on a flat, level surface.

- 4 Assembly of Main Pipe Assembly and Support Arm:
- a Assemble the support arm **95-6** and the main pipe assembly **95-7** together using the nuts **95-6**, bolts **95-27** and washers **95-28**. Apply JCB Threadlocker and Sealer and hand tighten.

- i If a suitable length of flat level surface is available - Place the assembly on the level surface. Torque tighten the nuts to 28Nm (21 lbf ft).

**Note:** Ensure that the lower joint **100-A** between the pipe assembly and the support arm is absolutely flat and level, otherwise damage will be caused to the hoses when the boom is operated. Check both before and after torque tightening the nuts.

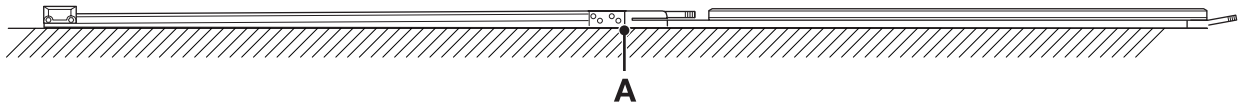


Fig 100.

- ii If a suitable length of flat level surface is not available - Invert the assembly and place it on best available flat surface. Place a straight edge **101-A**, e.g. a spirit level, across the joint. Support the ends of the assembly at **101-B** and **101-C**, ensuring that the straight edge is in contact with both parts of the pipe assembly along its whole length, i.e. the line D A F must

be completely straight. Torque tighten the nuts to 28Nm (21 lbf ft).

**Note:** Ensure that the joint **101-D** between the base of the pipe assembly and the support arm is absolutely flat and level, otherwise damage will be caused to the hoses when the boom is operated. Check both before and after torque tightening the nuts.

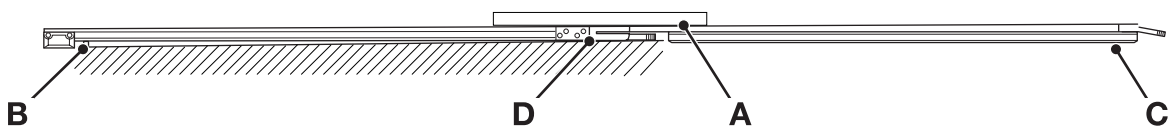


Fig 101.

- b Fit the main pipe assembly support plate **102-9** to the rear of the main pipe assembly **102-7** with the two bolts **102-19**, washers **102-20** and nuts **102-21**. Torque the bolts **102-19** to 28 Nm (20.6 lbf ft).

- d Install the two wear blocks **103-25** to the front of the support arm **103-6** with the two bolts **103-24**, four washers **103-23** and two nuts **103-22**. Torque tighten the two nuts **103-22** to 28 Nm (20.6 lbf ft).

**Note:** Ensure that the support plate **102-9** is fitted correctly otherwise damage to the assembly will occur.

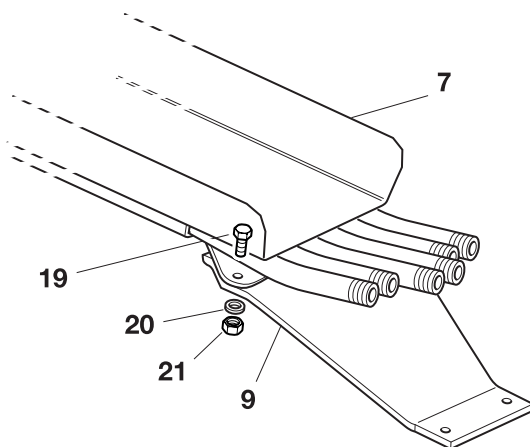


Fig 102.

- c Apply JCB Threadlocker and Sealer to the threads of the two bolts **103-24**.

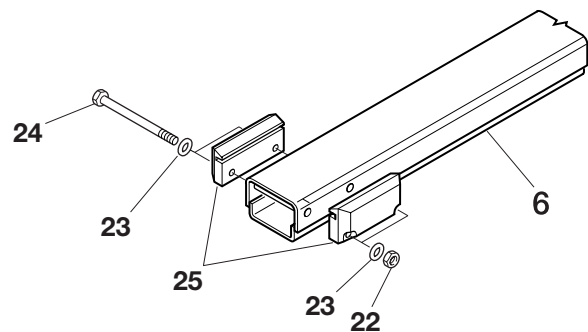
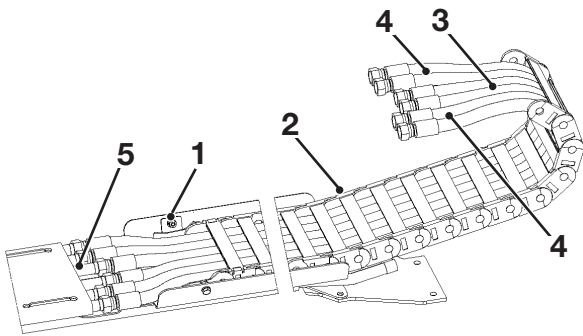


Fig 103.

- 5 Inner Boom Hose Assembly:

- a In a suitably clean area, clip mounting bracket **104-1** in place onto hose chain tracking **104-2**.
- b Slide the two hoses **104-3** (2360mm long) through the tracking. Slide two hoses **104-4** (2400mm long) on each side of hoses **104-3**.

- c Place hoses and tracking on to the pipe assembly **104-5**. Connect the hoses to the steels on the pipe assembly. Torque to 33Nm (25 lbf ft).
- d Using two screws, plain washers and locknuts removed at step 4 of **Dismantle the Main Boom Assembly** fix the bracket **104-1** to the pipe assembly.



**Fig 104. Inner Boom Hoses**

- 6 Inner Boom Assembly:
  - a Install the front wear pad **105-79** to the front wear pad bracket **105-77** with the two countersunk screws **105-78**. Torque tighten the two screws **105-78** to 28 Nm (20.6 lbf ft).
  - b Install the front wear pad bracket **105-77** to the front of the inner ram **105-1** with the two bolts **105-76**, four washers **105-75** and two nuts **105-74**. Torque tighten the two nuts **105-74** to 28 Nm (20.6 lbf ft).
  - c Put the inner boom pipe assembly **105-8** in position on the top of the inner ram **105-1**. Install the five bolts **105-72** with five washers **105-73** to locate it in position. Torque tighten the bolts **105-72** to 28 Nm (20.6 lbf ft).
  - d Connect twin hose assembly **106-70** at **106-A**, and twin hose assembly **106-71** at **105-B**, working from the inner connection points outwards. Torque tighten the connections to 33 Nm (24.3 lbf ft).

**Note:** Make sure the twin hoses are not twisted after tightening.

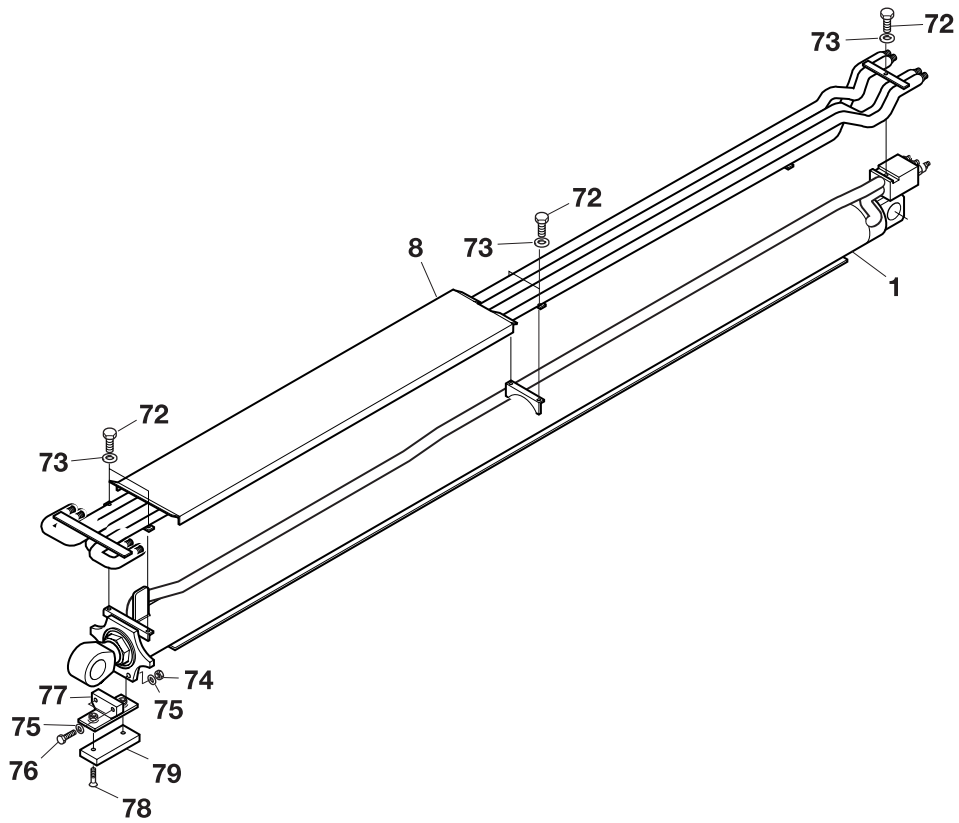
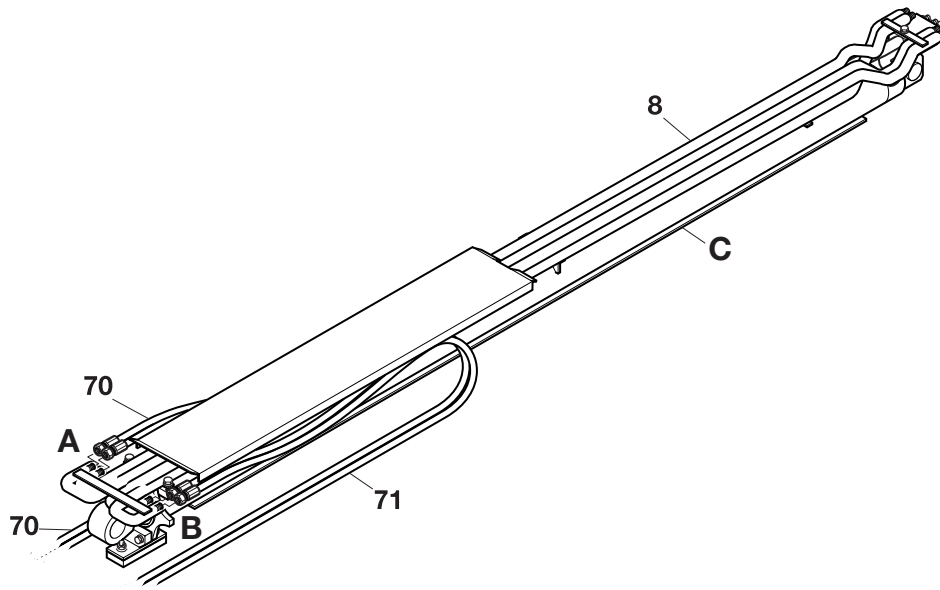
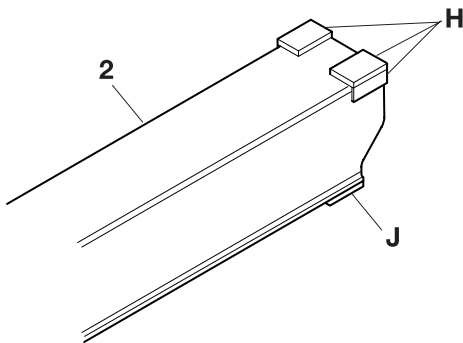


Fig 105. Inner Ram Assembly



**Fig 106. Inner Ram Assembly**

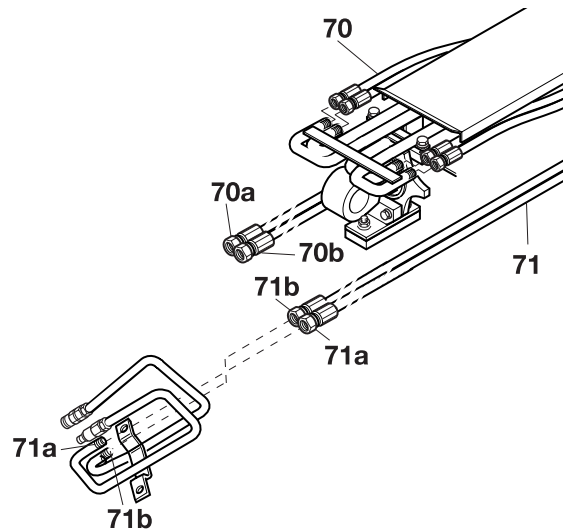
- e Install the top and side wear pads **107-H** and the bottom pads **107-J** (if removed) to the inner boom **107-2**.



**Fig 107.**

- f Apply grease to twin hose assemblies **107-70** and **107-70** and to the slide plate **106-C** of the inner ram.
- g Offer the inner ram assembly **108-A** to the rear of the inner boom **107-2**. Carefully feed the two twin hose assemblies **108-70** and **108-71** into the inner boom **107-2**, making sure each pair locates in the guide channels approximately half way along the bottom surface of the inner boom. Continue to

feed the two twin hose assemblies **108-70** and **108-71** until they appear in the openings in the front end of the inner boom.



**Fig 108.**

- h Pull twin hoses **108-70** and **108-71** a little way out of the boom. Connect twin hoses to the auxiliary pipe assembly **109-59**. Hose end **108-71a** (the outer hose) attaches to the upper pipe of the

auxiliary pipe assembly; hose end **108-71b** attaches to the lower pipe of the assembly. Torque tighten these two hose connectors to 33 Nm (24.3 lbf ft).

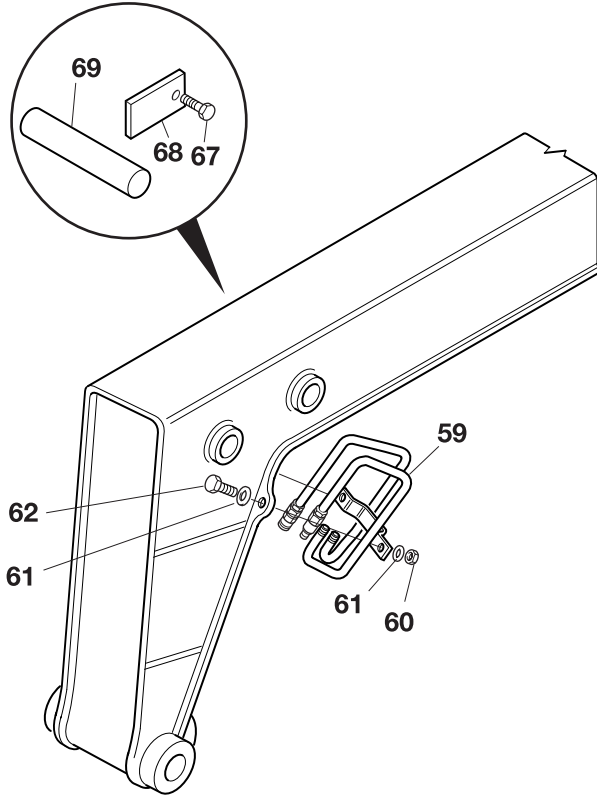


Fig 109.

- i Install the auxiliary pipe assembly **109-59** to the left side of the inner boom **107-2** with the two nuts, four washers and two bolts **109-60**, **-61** and **-62**, carefully pushing any spare hose back into the boom. Torque tighten the two nuts **109-60** to 28 Nm (20.6 lbf ft).

**Note:** Twin hose **108-70** connects to the tilt ram, when fitted. The outermost hose **108-70a** attaches to the head end of the tilt ram and hose **108-70b** attaches to the rod end. See **Tilt Ram - Removal and Replacement** in Section E.

- j Carefully install the inner ram assembly into the inner boom **107-2**. Apply grease to the front inner ram location pin **109-69**, then align the front end of the inner ram and install the front inner ram

location pin **109-69** with the plate **109-68** and bolt **109-67**.

#### 7 Second Intermediate Boom Assembly:

- a Fit wear block **110-78** (if removed during disassembly) into the second intermediate boom **110-3**.

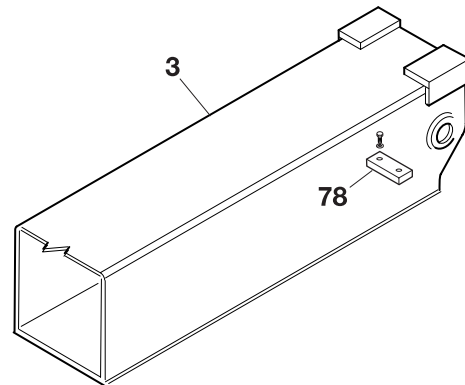


Fig 110.

- b Insert the assembled inner boom **107-2** into the second intermediate boom **110-3**.
- c Shim the top and side rear wear pads **107-H** of the inner boom **107-2**. [⇒ Boom Shimming \(□ B-117\)](#).

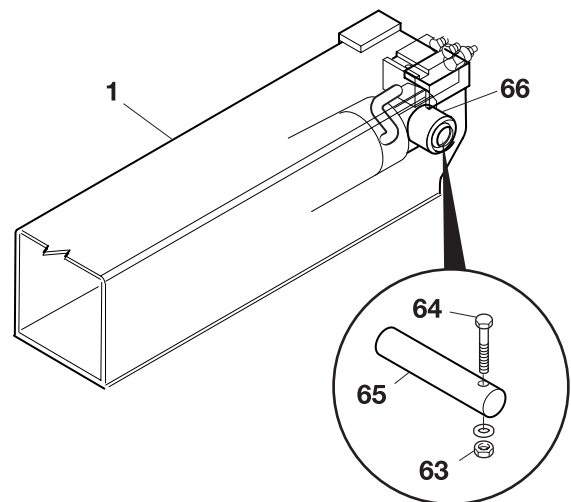
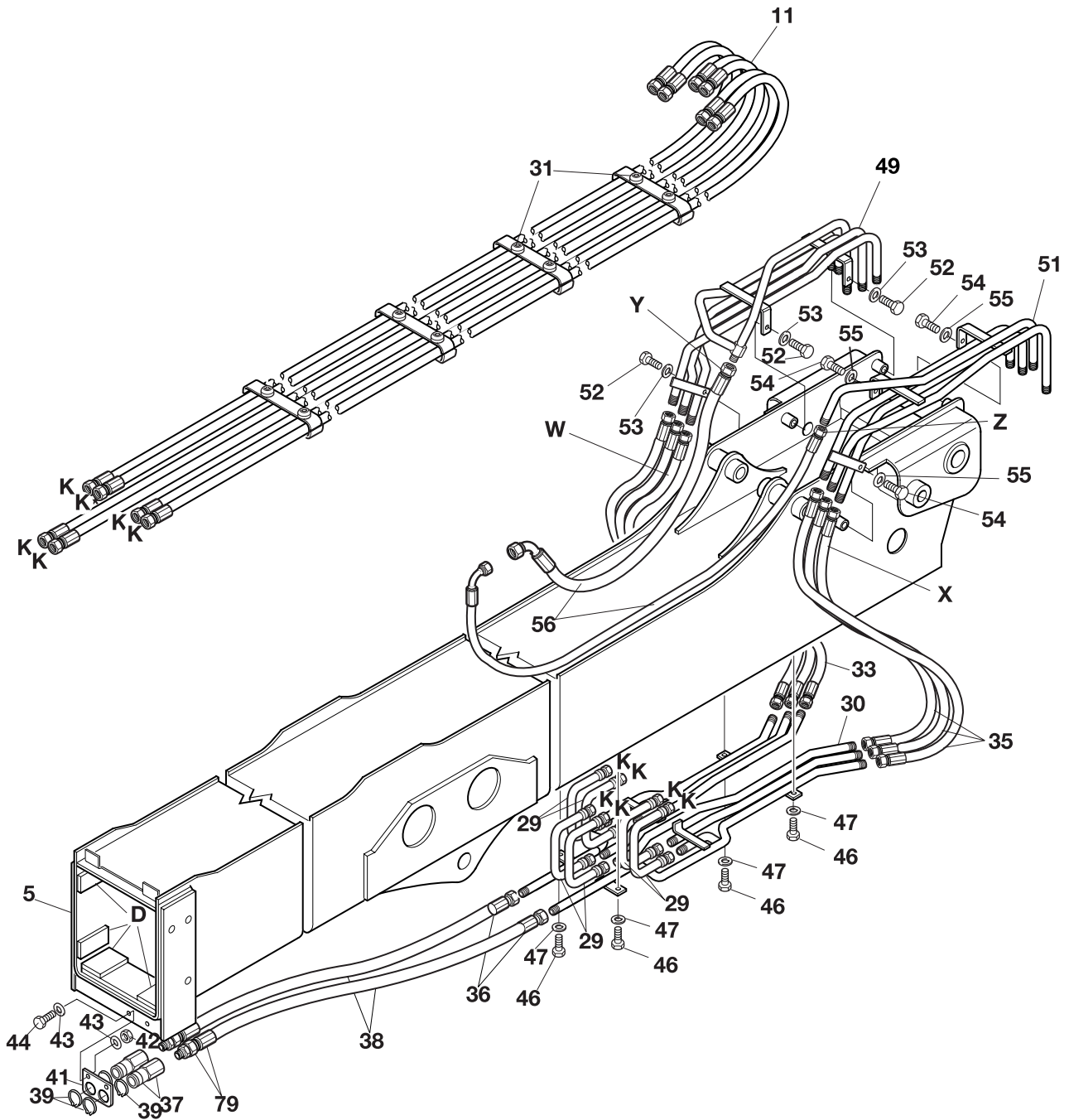


Fig 111.

- d Apply grease to the rear inner ram location pin **111-65**. Align the rear end of the inner ram **111-1** and install the rear inner ram location pin **111-65** with the two spacers **111-66**, the bolt **111-64** and the nut and washer **111-63**. Torque tighten the nut **111-63** to 98 Nm (72 lbf ft).
  
- e Shim the front wear pads of the second intermediate boom **110-3**. [⇒ Boom Shimming \(□ B-117\)](#).



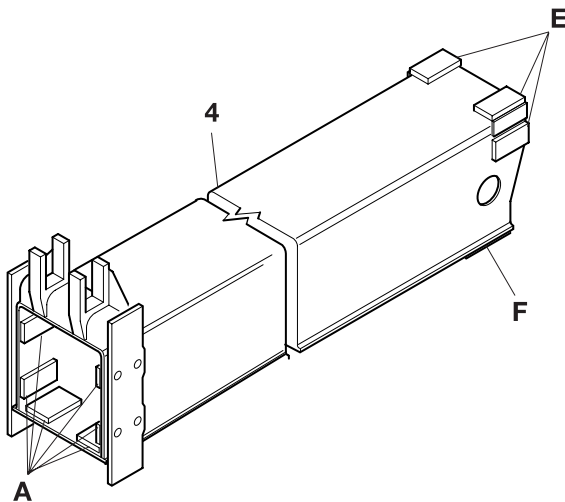
**Fig 112. Outer Boom Assembly**

**8** Outer Boom Assembly:

- a Install the external pipe assembly **112-30** to the underside of the outer boom **112-5** with the six

bolts **112-46** and six washers **112-47**. Torque tighten the bolts **112-46** to 28 Nm (20.6 lbf ft).

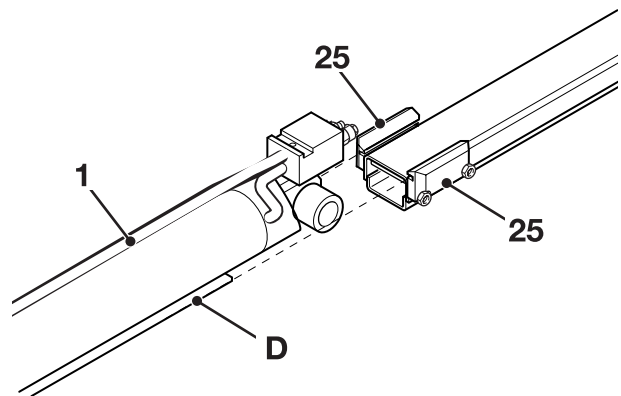
- b** Install the bracket **112-41** to the outer boom with the two bolts **112-44**, four washers **112-43** and two nuts **112-42**. Torque tighten the two nuts **112-42** to 56 Nm (41 lbf ft).
- c** If applicable: Install the two couplings **112-37** to the bracket **112-41** with the circlips **112-39**.
- d** Install the auxiliary hoses to the couplings **112-37** and the external pipe assembly **112-30**. Torque tighten the connections **112-36** and **112-79** to 58 Nm (43 lbf ft).
- e** Apply grease to the main hose assembly **112-11**.
- f** From the rear of the outer boom **112-5**: With the heads of the pipe clip bolts **112-31** upwards, feed the front end of the main hose assembly **112-11** into the outer boom **112-5**. Do this until the hose connectors appear through the exit holes in the front underside of the outer boom **112-5**. Make sure the main hose assembly **112-11** is positioned flat on the lower inside surface of the outer boom **112-5**.
- g** At the front underside position on the outer boom **112-5**: Install the six 'U' pipes **112-29** to the six hoses of the main hose assembly **112-11**. Connect the unions at the same time, rotating each union a small amount at a time to prevent the hoses from twisting.
- h** Push the main hose assembly **112-11** back into the outer boom **112-5** slightly and connect the 'U' pipes **112-29** to the external pipe assembly **112-30**. Connect the unions at the same time, rotating each union a small amount at a time to prevent the hoses from twisting.
- i** Make sure the six 'U' pipes **112-29** are vertical before torque tightening the connections at both ends of the 'U' pipes to 33 Nm (24.3 lbf ft).
- j** At the top right rear position on the outer boom **112-5**: Install the right external pipes assembly **112-49** to the outer boom **112-5** with the three bolts **112-52** and three washers **112-53**. Torque tighten the three bolts **112-52** to 28 Nm (20.6 lbf ft).
- k** On the right rear side of the outer boom **112-5**: Connect the three right external hoses **112-33** to their three related connectors at the external pipe assembly **112-30** and right external pipes assembly **112-49**. Torque tighten each end of the bottom hose **112-Y** to 44 Nm (32.5 lbf ft). Torque tighten the four remaining connections to 33 Nm (24.3 lbf ft).
- l** At the top left rear position on the outer boom **112-5**: Install the left external pipes assembly **112-51** to the outer boom **112-5** with the three bolts **112-54** and three washers **112-55**. Torque tighten the three bolts **112-54** to 28 Nm (20.6 lbf ft).
- m** On the left rear side of the outer boom **112-5**: Connect the three left external hoses **112-35** to their three related connectors at the external pipe assembly **112-30** and left external pipes assembly **112-51**. Torque tighten each end of the bottom hose **112-X** to 44 Nm (32.5 lbf ft). Torque tighten the four remaining connections to 33 Nm (24.3 lbf ft).
- n** Connect the two hoses **112-56** to their connections on the right and left external pipe assemblies **112-49** and **112-51**. Torque the connection **112-Y** to pipe assembly **112-49** to 115 Nm (85 lbf ft), and the connection **112-Z** to pipe assembly **112-51** to 58 Nm (43 lbf ft).
- o** Install the front wear pads **113-A** and rear wear pads **113-E** to the first intermediate boom **113-4**. Tighten the bottom wear pads **113-F**. ⇒ [Boom Shimming \(□ B-117\)](#).
- p** Insert the first intermediate boom assembly **113-4** into the outer boom assembly **112-5**.
- q** Shim the applicable wear pads. ⇒ [Boom Shimming \(□ B-117\)](#).



**Fig 113. Outer Boom Assembly**

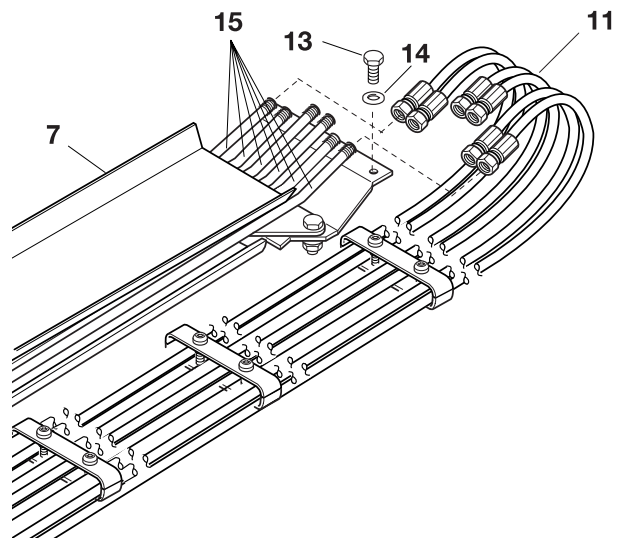
**9 Main Boom - Final Assembly:**

- a** Insert the second intermediate boom /inner boom assembly into the first intermediate boom/outer boom assembly.
- b** Shim the remaining wear pads. → [Boom Shimming \(B-117\)](#).
- c** Place hoses and tracking on to the pipe assembly. Connect the hoses to the steels on the pipe assembly. Torque to 33Nm (25 lbf ft).
- d** Pull the loose hose ends of the inner boom hose assembly **95-10** out of the back of the inner boom **94-2** (where they were stowed for safety during Inner Boom Assembly) and position them up and over the top of the outer boom **94-5**.
- e** Carefully insert the main pipe assembly **95-7** and support arm **95-6** sub assembly (see step 4) into the inner boom, making sure that the slots on the insides of the support arm wear blocks **114-25** engage with the slide plate **114-D** on the bottom of the inner ram **114-1**. Continue to push the assembly in, until it is approximately half way in to the inner boom **114-1**. Make sure the pipe and support arm sub-assembly is adequately supported.



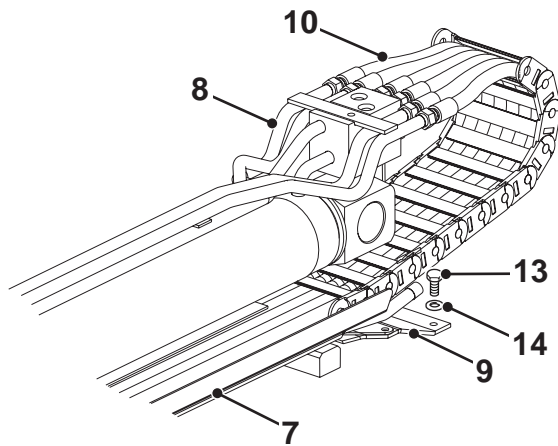
**Fig 114.**

- f** Connect the six connectors of the main hose assembly **115-11**, working from the inside outwards, to their related connectors at the rear of pipes **115-15** on the main pipe assembly **115-7**. Make sure the hoses do not twist during this step.



**Fig 115.**

- g** Connect the six hoses of the inner boom hose assembly **116-10** to the two hose connection points on the inner ram and the four hose connection points on the inner boom pipe assembly **116-8**, working from the inner connection points outwards. Torque tighten the six connections to 33 Nm (24.3 lbf ft).



**Fig 116.**

- h Push the main pipe assembly **116-7** fully in until the bolt holes in the main pipe assembly support plate **116-9** align with their location holes in the first intermediate boom.
- i Apply JCB Threadlocker And Sealer to the threads of the bolts **116-13**.

**Note:** Early machines have two fixing bolts. Later machines have a different support plate with four fixing bolts.

- j Install the bolts **116-13** together with washers **116-14** to locate the main pipe assembly **116-7** in position. Torque the bolts **116-13** to 28 Nm (20.6 lbf ft).
- k Torque the six hose connections at the rear connection points **115-15** (connected at step 10f) to 33 Nm (24.3 lbf ft).
- l Install the primary external components. The installation of the primary components is the reverse of the removal procedure. → [Remove the Primary External Components \(□ B-100\)](#).

Grease all pivot pins, see **Section 3 - Service Schedules**.

**Table 31. Torque Settings**

Item	Nm	lbf ft
13	28	21
19	28	21
22	28	21
26	28	21
31	11	8.3
36	58	43
42	56	41
46	28	21
52	28	21
54	28	21
60	28	21
63	98	72
72	28	21
74	28	21
78	28	21
79	58	43

**Table 32. Hose Connections**

Item	Nm	lbf ft
W	44	32
X	44	32
Y	115	85
Z	58	43

**Note:** Unless specified, torque hose connections to 33Nm (24lbf ft).

## Boom Shimming

### Typical Method

This procedure details a typical method for shimming a boom. ⇒ [Measurements \(B-121\)](#), for specific information.

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 **117-A**.

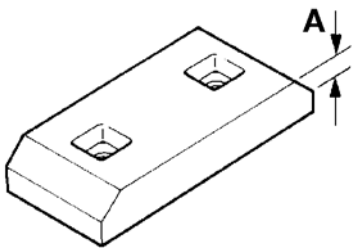


Fig 117.

On 2 stage machines shim inner boom **118-A** to outer boom **118-B**.

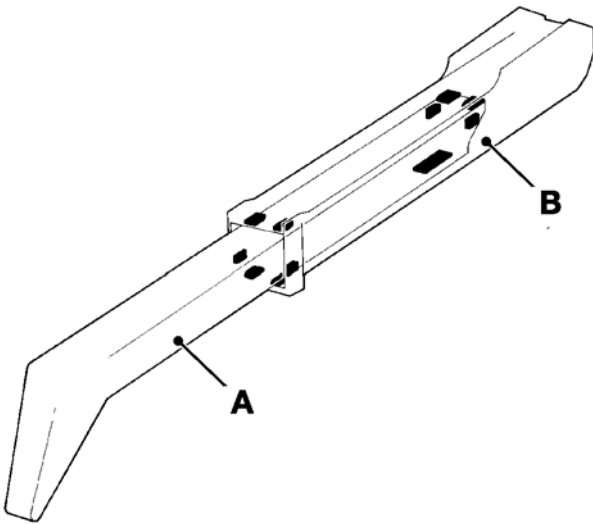


Fig 118. 2 Stage Boom

On 3 stage machines shim intermediate boom **119-A** to outer boom **119-B** then repeat the procedure for inner **119-C** to intermediate boom **119-A**.

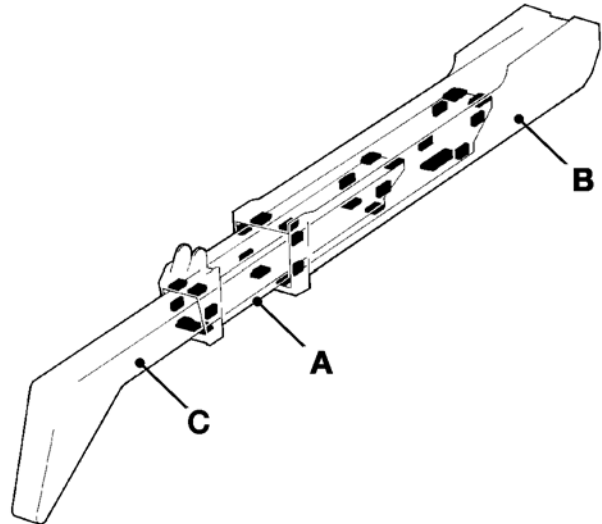


Fig 119. 3 Stage Boom

On 4 stage boom machines shim the rear wear pads of the second intermediate boom first. Then do the general shimming procedure for the outer, first intermediate, second intermediate and inner booms.

### Lower Wear Pads

(2) Pads fitted with M10 bolts

#### 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. [⇒ Measurements \(□ B-121\)](#). If this dimension is below limits shims must be installed below the lower wear pads to get the correct dimension.
- 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 **120-A** and add shims **120-B** as necessary to get the correct boom clearance dimensions. [⇒ Measurements \(□ B-121\)](#).

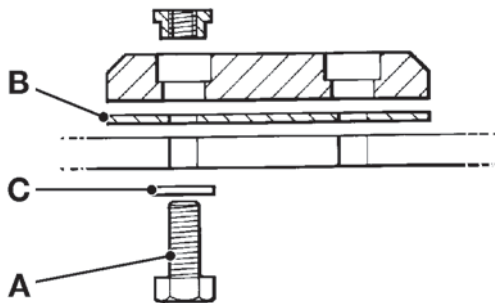


Fig 120.

- 5 Measure the total thickness of shims below each pad.
- 6 Add or remove plain washers **120-C** below the heads of wear pad bolts **120-A** to make sure that there is sufficient thread engagement. Use the correct number of washers. [⇒ Measurements \(□ B-121\)](#)
- 7 Install shims and torque tighten bolts **120-A**. [⇒ Table 33. Torque Settings \(□ B-118\)](#).

Table 33. Torque Settings

Item	Nm	lbf ft	kgf m
120-A <sup>(1)</sup>	98	72	10
120-A <sup>(2)</sup>	58	42.7	5.9

(1) Pads fitted with M12 bolts

#### 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. [⇒ Measurements \(□ B-121\)](#). If this dimension is below limits shims must be installed below the lower wear pads to get the correct dimension.
- 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 **120-A** and add shims **120-B** as necessary to get the correct boom clearance dimensions. [⇒ Measurements \(□ B-121\)](#).
- 6 Measure the total thickness of shims below each pad.
- 7 Add or remove plain washers **120-C** below the heads of wear pad bolts **120-A** to make sure that there is sufficient thread engagement. Use the correct number of washers. [⇒ Measurements \(□ B-121\)](#)
- 8 Remove wedges, install shims and torque tighten bolts. [⇒ Table 34. Torque Settings \(□ B-119\)](#).

#### Top Wear Pads

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

- 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. [⇒ Measurements \(□ B-121\)](#).
- 3 Install or remove shims **121-B** to get the correct vertical clearance. Measure the total thickness of shims below each pad.

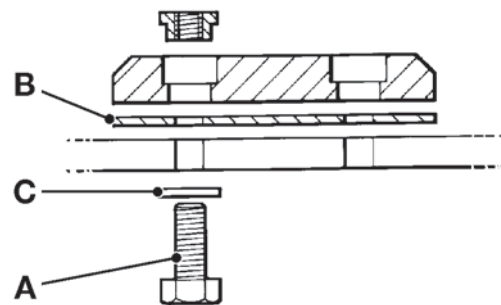


Fig 121.

- 4 Add or remove plain washers **121-C** below the heads of wear pad bolts **121-A** to make sure that there is sufficient thread engagement. Use the correct number of washers. [⇒ Measurements \(□ B-121\)](#)
- 5 Install shims and torque tighten bolts **121-A**. [⇒ Table 34. Torque Settings \(□ B-119\)](#).

Table 34. Torque Settings

Item	Nm	lbf ft	kgf m
<b>121-A<sup>(1)</sup></b>	98	72	10
<b>121-A<sup>(2)</sup></b>	58	42.7	5.9

(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.  
⇒ [Measurements \(□ B-121\)](#)
- 2 Loosen the side wear pad bolts **122-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.

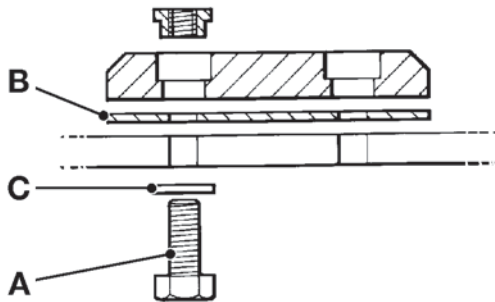


Fig 122.

- 3 Measure the total thickness of shims below each pad.
- 4 Add or remove plain washers **122-C** below the heads of wear pad bolts **122-A** to make sure that there is sufficient thread engagement. Use the correct number of washers. ⇒ [Measurements \(□ B-121\)](#)
- 5 Install shims and torque tighten bolts **122-A**.  
⇒ [Table 35. Torque Settings \(□ B-120\)](#).

Table 35. Torque Settings

Item	Nm	lbf ft	kgf m
122-A <sup>(1)</sup>	98	72	10
122-A <sup>(2)</sup>	58	42.7	5.9

(1) Pads fitted with M12 bolts

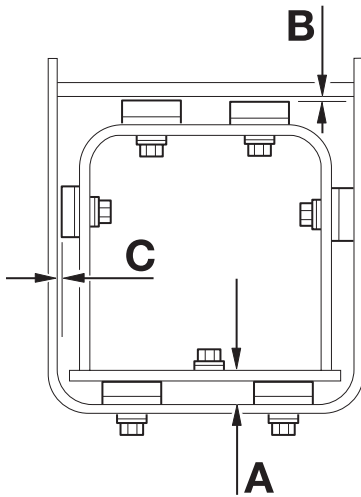
(2) Pads fitted with M10 bolts

### Measurements

#### 2 Stage Boom

Make sure that the wear pads are installed correctly to prevent fouling. → [Fig 124.](#) ([□ B-122](#))

→ [Typical Method](#) ([□ B-117](#)), for the shimming method.



**Fig 123. 2 Stage Boom**

Detail	Shim thickness	Number of washers
124-C	0 to 3 mm	2
	3.2 to 6 mm	1
	6.2 to 8 mm	0
124-D	0 mm	4
	1.6 to 3 mm	3
	3.2 to 6 mm	2
	6.2 to 8 mm	1
124-E	0 mm to 3 mm	2
	3.2 to 6 mm	1
	6.2 to 8 mm	0

**Table 36. Maximum Gap**

Dimension	Location	Maximum Gap
123-A		37 - 41mm (1.45 - 1.60in)
123-B	Boom Front	3mm (0.12in)
	Boom Rear	1.5mm (0.06in)
123-C	Boom Front	3mm (0.12in)
	Boom Rear	1.5mm (0.06in)

**Table 37. Number of plain washers to be fitted under bolt**

Detail	Shim thickness	Number of washers
124-A	0 to 3 mm	3
	3.2 to 6 mm	2
	6.2 to 8 mm	1
124-B	0 mm	4
	1.6 to 3 mm	3
	3.2 to 8 mm	2

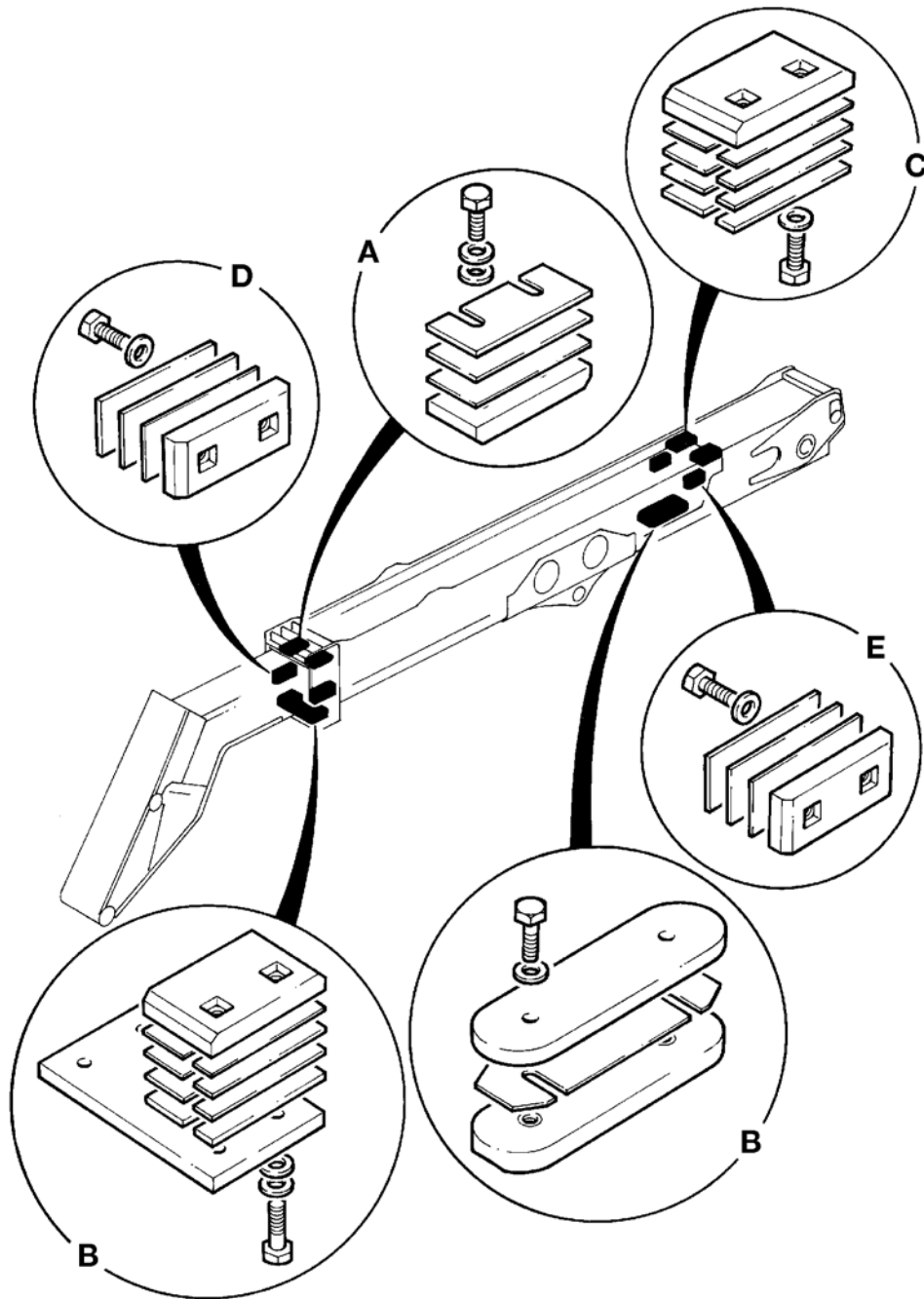


Fig 124. 2 Stage Boom

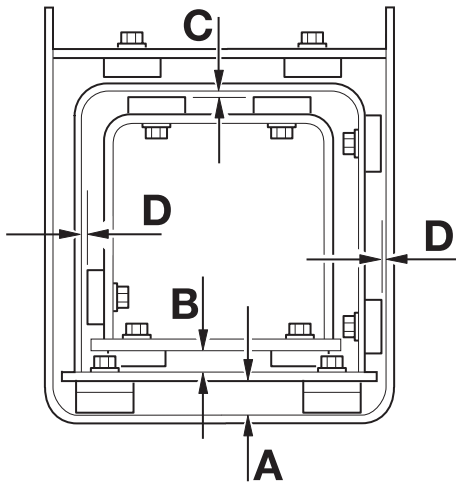
### 3 Stage Boom (Excluding HiViz Machines)

Make sure wear pads are fitted the correct way round to prevent fouling. ⇒ [Fig 126.](#) (□ [B-124](#))

**Note:** Use dome headed Tuf-lok bolts at **126-B** and **126-C**.

**Note:** The intermediate to outer boom, bottom right hand wear pad (shown at **126-A**) may vary, check the parts catalogue.

⇒ [Typical Method](#) (□ [B-117](#)), or the shimming method.



**Fig 125. 3 Stage Boom**

**Table 38. Maximum Gap**

Dimension	Maximum Gap
125-A	37 - 41mm (1.45 - 1.60in)
125-B	21 - 25mm (0.83 to 0.98in)
125-C	3mm (0.12in)
125-D	1.5mm (0.06in)

**Table 39. Number of plain washers to be fitted under bolt**

Detail	Shim thickness	Number of washers
126-A <sup>(1)</sup>	0 mm	3
	1.6 to 4.6mm	1
	over 4.6 mm	0

Detail	Shim thickness	Number of washers
126-B <sup>(1)</sup> , 126-F <sup>(2)</sup>	0 mm	4
	2 to 3 mm	3
	4 to 6 mm	2
	7 to 8 mm	1
126-C <sup>(1)</sup> , 126-H <sup>(2)</sup>	0 to 1.6 mm	6
	3 to 5 mm	5
	6 mm	4
126-D <sup>(1)</sup>	0 mm	4
	1.6 to 3.2 mm	3
	6 mm	2
126-E <sup>(1)</sup>	0 mm	4
	1.6 to 3.2 mm	3
	3.6 to 6.0 mm	2
126-G <sup>(2)</sup>	0 to 8 mm	0
126-J <sup>(2)</sup>	0 mm	4
	1.6 to 3.2 mm	3
	6 mm	2
126-K <sup>(2)</sup>	0 mm	4
	1.6 to 3.2 mm	3
	3.6 to 6.0 mm	2

(1) Intermediate to outer boom.

(2) Inner to intermediate boom.

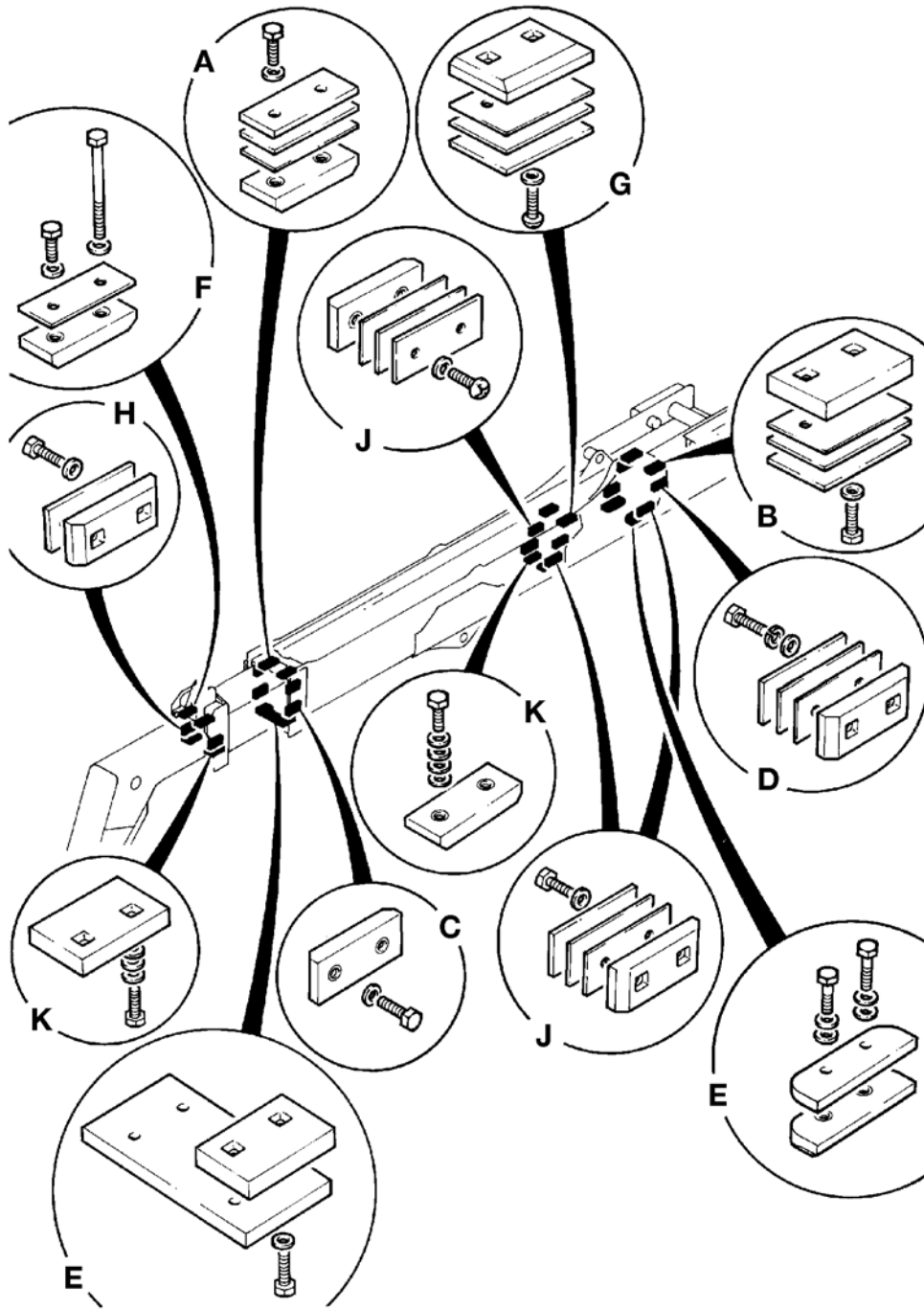


Fig 126. 3 Stage Boom (Excluding HiViz Machines)

### 3 Stage Boom (HiViz Machines)

⇒ **Typical Method** (□ B-117), or the shimming method.

**Note:** Use TUF-LOK bolts at 128-6, 128-13 and TUF-LOK screws at 128-3, 128-4 & 128-5.

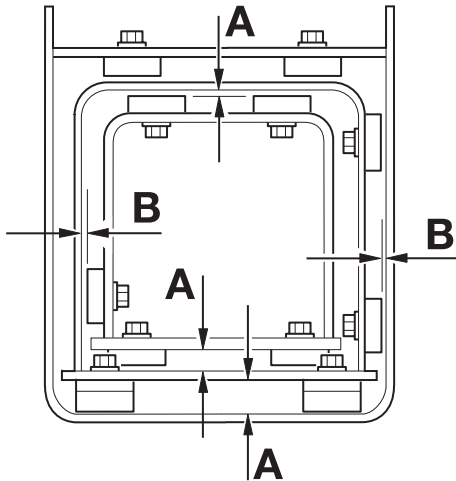


Fig 127.

Table 40. Measurements

Dimension A	
Front	Vertical clearance Max 3.0 mm (0.11 in)
Rear	Vertical clearance Max 1.5mm (0.05 in)
Dimension B	
Front	Side clearance Max 3.0 mm (0.11 in)
Rear	Side clearance Max 1.5mm (0.05 in)

### Carriage Adjustment (Non Sway Machines)

After assembly (with equal tyre pressures on both side of the machine) check the height of the left hand and right hand sides of the carriage. The height variation must not exceed 6mm. If this measurement is greater the carriage can be adjusted as follows.

- The shims under the bottom front wear pads can be adjusted to a maximum shim difference of 3.2 mm.
- Further adjustment can be made by fitting a maximum of 2 shims between the axle and the chassis. Make sure the screws are torque tightened.

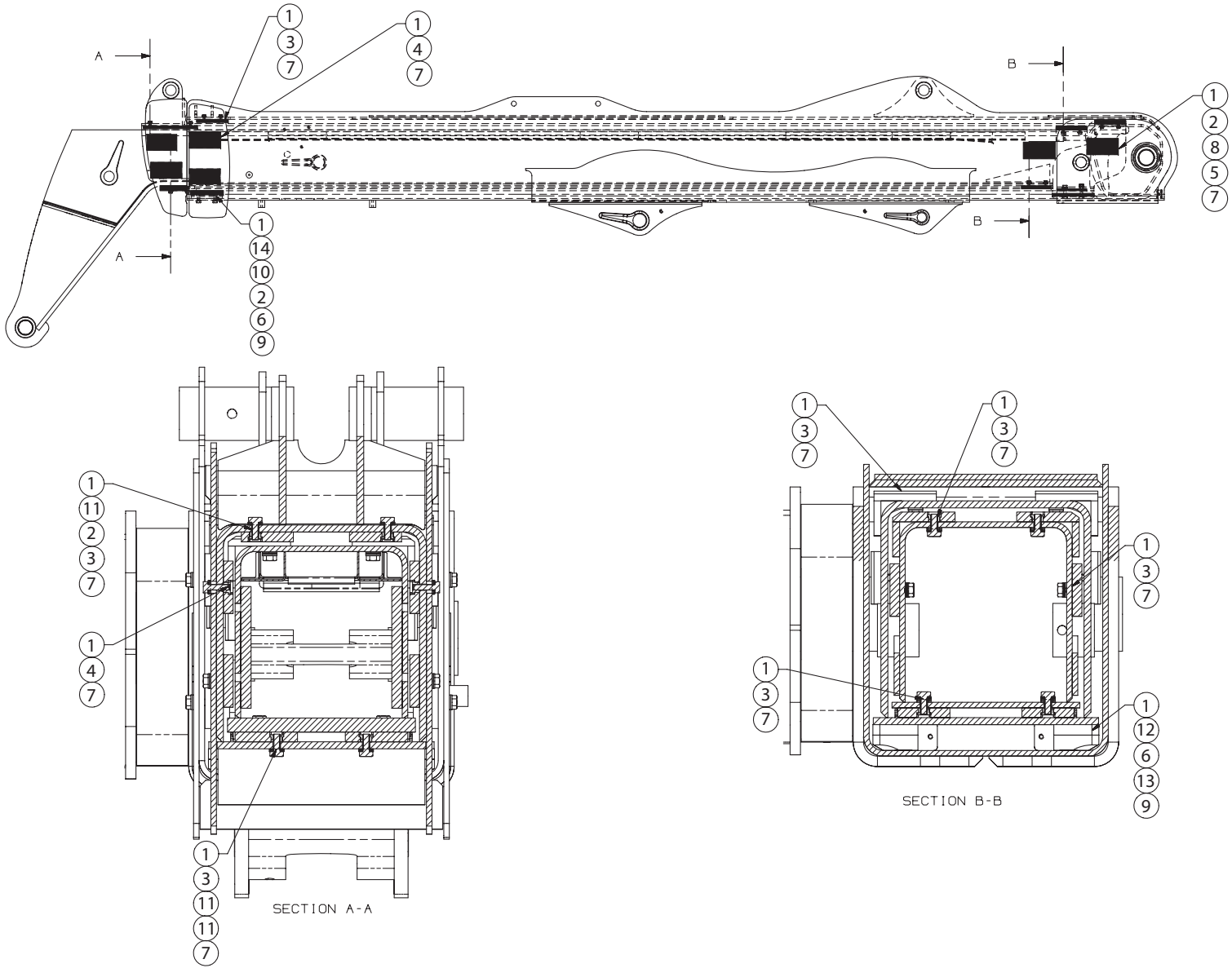
Table 41.

⇒ Fig 128. (□ B-126)

ITEM NO.	QUANTITY USED	DESCRIPTION
1	28	WEAR PAD
2	12	SHIM PLATE 1.6 mm
3	28	SET SCREW M10 X 25
4	16	SET SCREW M10 X 30
5	4	SET SCREW M10 X 35
6	6	BOLT M12 X 45
7	108	M10 PLAIN WASHER
8	8	SHIM PLATE 0.5 mm
9	16	M12 PLAIN WASHER
10	2	SHIM PLATE 0.7mm
11	14	SHIM PLATE
12	2	SPACER
13	2	BOLT M12 X 50
14	1	WEAR PAD SUPPORT PLATE

Table 42. Torque Settings

Item	Nm	lbf ft	kgf m
128-6,16	98	72	10
128-3,4,5	58	42.7	5.9

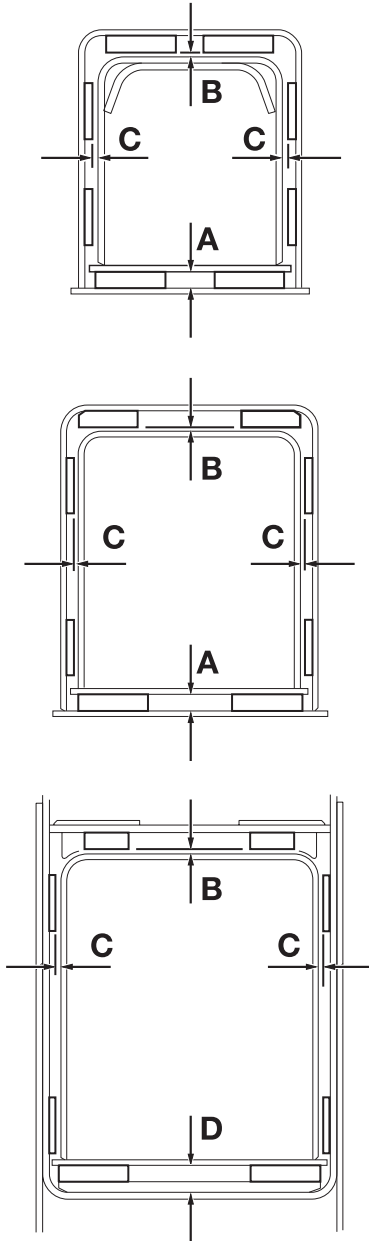


**Fig 128. HiViz Boom Shimming**

### 4 Stage Boom

Make sure wear pads are fitted the correct way round to prevent fouling. ⇒ [Fig 130.](#) ([B-128](#)).

⇒ [Typical Method](#) ([B-117](#)), for the shimming method.



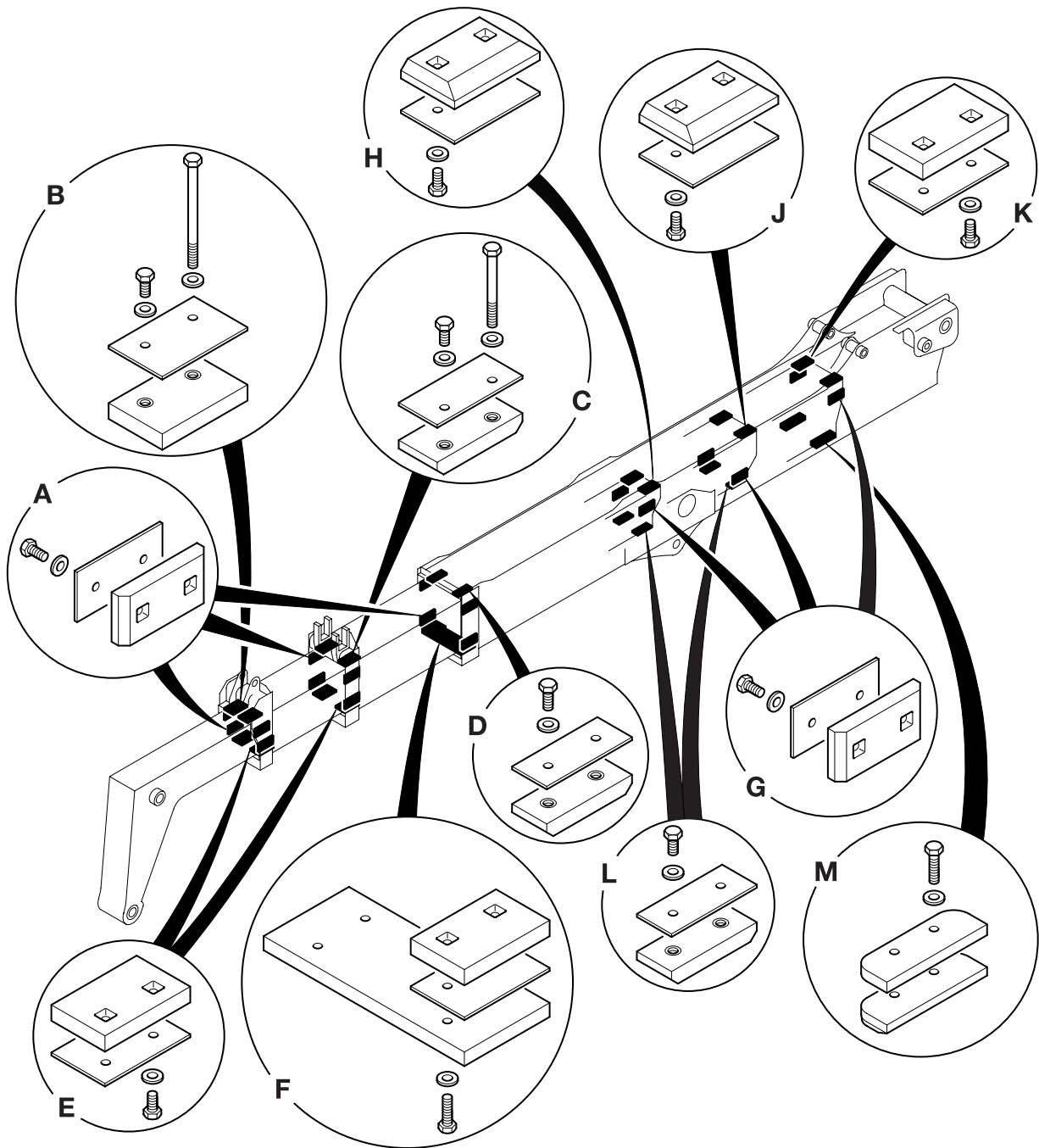
**Fig 129. 4 Stage Boom**

**Table 43. Maximum Gap**

Dimension	Maximum Gap
129-A	22mm (0.87in)
129-B	3mm (0.12in)
129-C	1.5mm (0.06in)
129-D	37mm (1.45in)

**Table 44. Number of plain washers to be fitted under bolt**

Detail	Total Shim Thickness mm (in)	Washers Required
130-D	0	3
	1.6 - 4.6 (0.062 - 0.181)	1
	over 4.6 (0.181)	0
130-B,130-C, 130-J,130-K	0	4
	2 - 3 (0.079 - 0.118)	3
	4 - 6 (0.157 - 0.236)	2
	7 - 8 (0.275 - 0.315)	1
130-H	0	3
	2 - 5 (0.079 - 0.197)	1
	6 - 8 (0.157 - 0.315)	0
130-A,130-G	0	4
	1.6 - 3 (0.062 - 0.118)	3
130-E,130-F, 130-L,130-M	0	4
	1.6 - 3.2 (0.062 - 0.126)	3
	3.6 - 8 (0.142 - 0.315)	2



**Fig 130. 4 Stage Boom**

**Note:** Washer and shim configurations are variable due to individual sizing.

### Pivot Shims

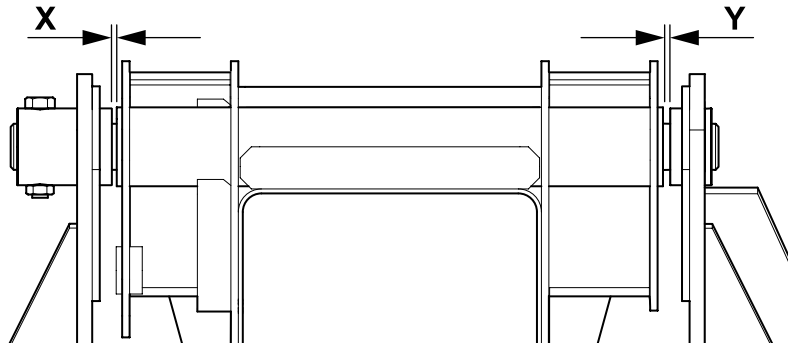


Fig 131.

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

- 1 Measure 131-X and 131-Y.
- 2 Use the following illustration to calculate the total gap Z:

$$\text{Total Gap } Z = 131X + 131Y$$

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.

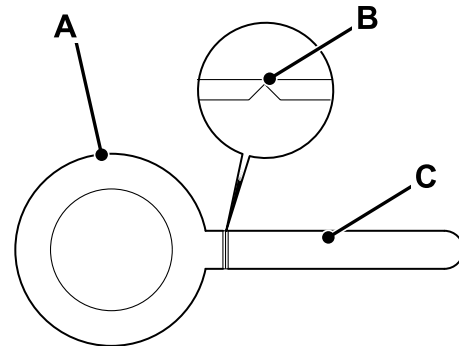


Fig 132.

**Note:** If new shims are necessary, install "handled" shims 132-A . When these have been installed and the gap Z is correct snap the handle 132-C from the shim 132-A at the crease 132-B.

## Cab

### Internal Components

#### Roller Blind

##### Removal and Replacement

###### Removal

- 1 Ensure both blinds are fully retracted.
- 2 Remove all four trim panel screws **133-A** and detach the trim panel **133-B** to gain access to the blind assembly **133-C**.

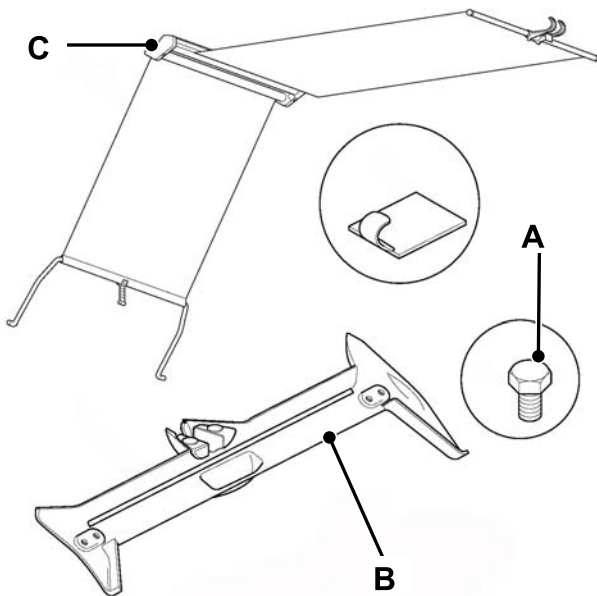


Fig 133.

###### Replacement

Replacement is the reverse 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 **134-B** and remove the screws **134-A**.
- 2 Lower the liner to get access to the electrical connectors at the interior lights **134-C** and audio speakers **134-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.

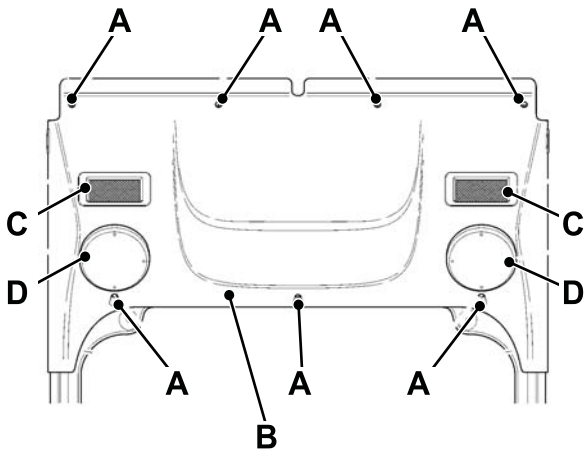


Fig 134.

## Instrument Panels

### Removal

- 1 Remove the steering wheel. → [Fig 135.](#) (□ [B-132](#)).

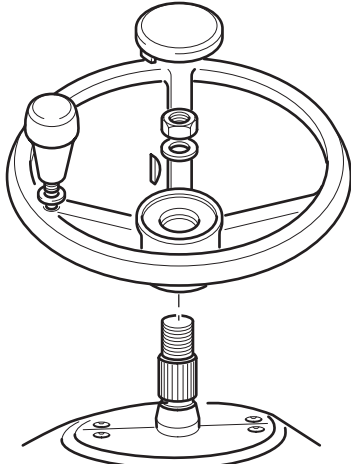


Fig 135.

- 2 Remove the two button head screws **136-A**, remove the steering column lower surround.

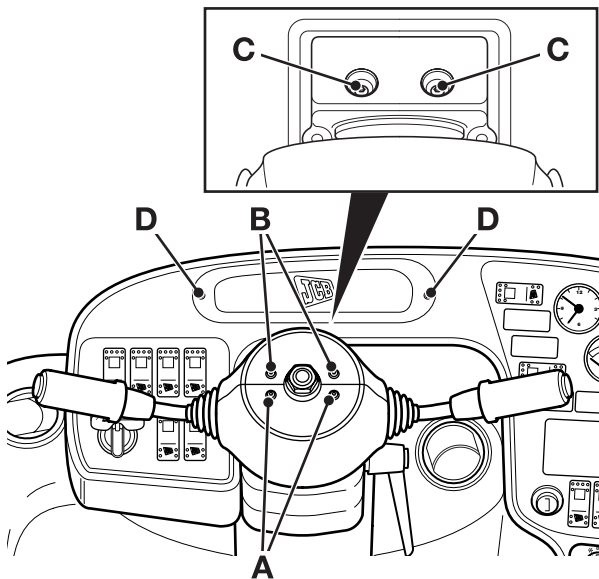


Fig 136.

- 3 Remove the two button head screws **136-B** and two screws **136-C**, remove the steering column upper surround.
- 4 Remove the two Allen key head screws **136-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 **137-A** that hold the steer Mode Select (SMS) switch panel in place, disconnect all connections and remove the panel.

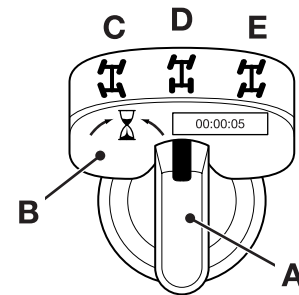


Fig 137.

- 6 Remove the two screws **138-A** that hold the heater control panel in place, disconnect all connection and remove the panel.

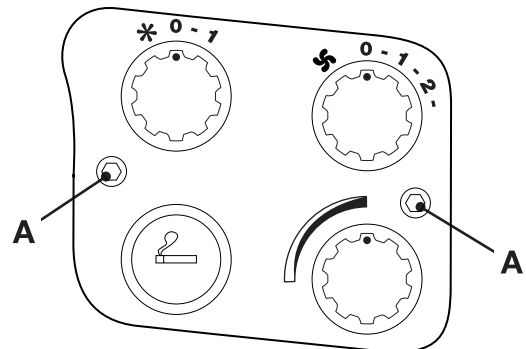


Fig 138.

- 7 Remove the radio **139-A** (if fitted).

- 8 Remove the three screws **139-B** that hold the main switch and instrument panel in place, disconnect all connections and remove the panel.
- 9 Remove screws **140-A**, **140-B**, **140-C**, **140-D** and remove the upper right hand panel **140-E**, carefully feeding the harness through the aperture.

**Note:** Screw item **140-B** is removed from the front of the panel, i.e. the opposite side to that shown.

- 10 Remove screws **140-F**, **140-G**, **140-H**. Remove the lower left hand panel **140-J**.

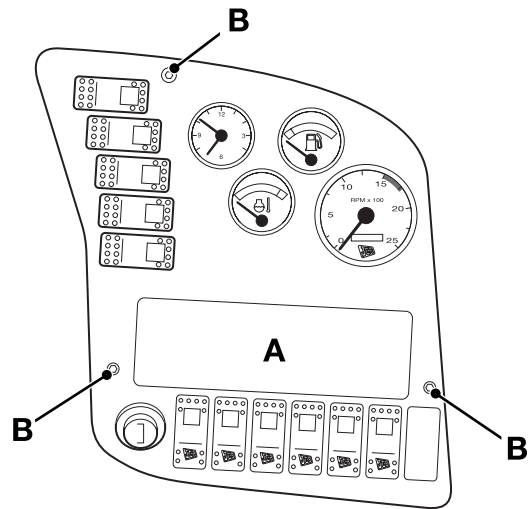


Fig 139.

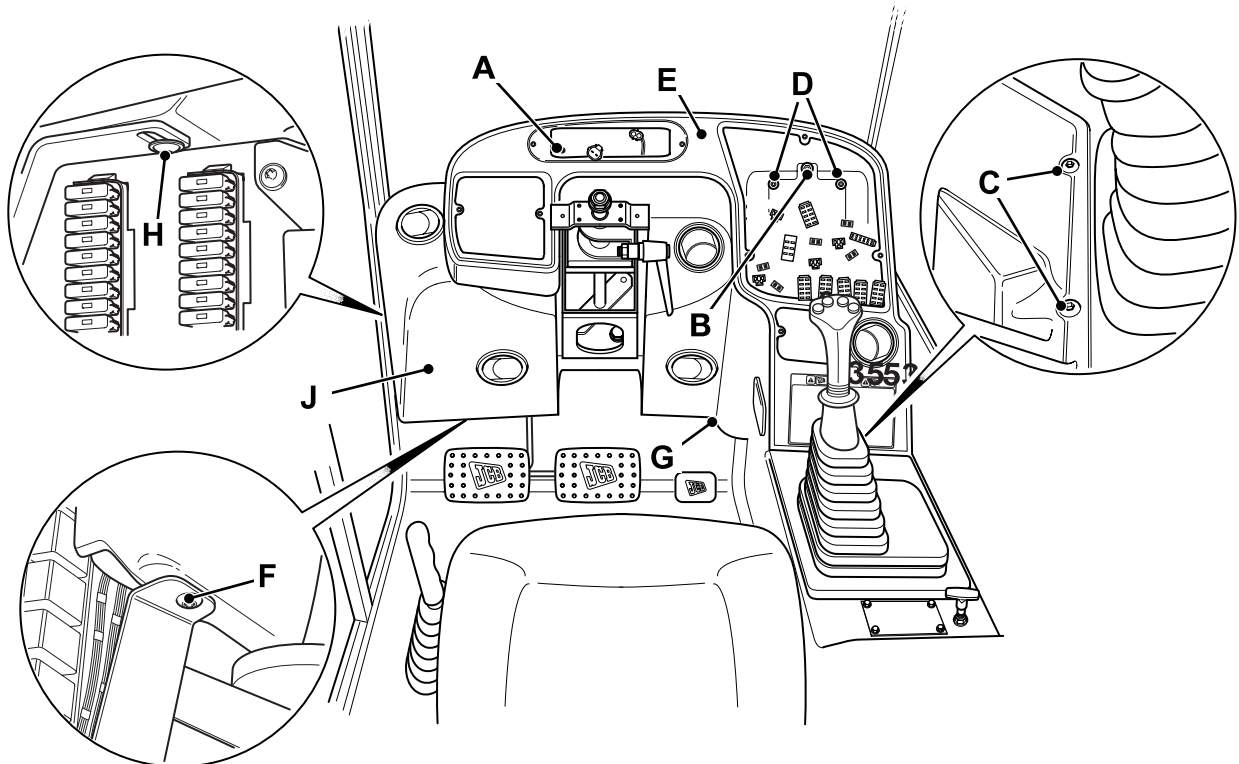


Fig 140.

## External Components

### Door Handle Removal and Replacement

#### Removal

- 1 Remove screws **141-A** from the inside of the door and lift away the cover plate **141-B**.
- 2 Remove screws **141-C** and disconnect the latch assembly **141-E** from the handle unit **141-G**.
- 3 Remove screws **141-D** whilst supporting the outer handle unit.
- 4 Slightly tilt the handle unit **141-G** to unhook the unit from the door assembly. Retain gasket **141-F**.

#### Removal

- 1 Divide the doors by releasing the locking handle **142-A**. (Two piece door assembly only)
- 2 Make sure that the door **D** is supported.
- 3 Use a thin punch and a hammer to tap securing pin **G** from the hinge assemblies **B**.
- 4 Use a punch and a hammer to tap hinge pin **C** from the hinge assemblies **B**.
- 5 Do procedures **3** and **4** for all other hinges on door **D**.

Fig 141.

#### Replacement

Replacement is the reverse of the removal sequence.

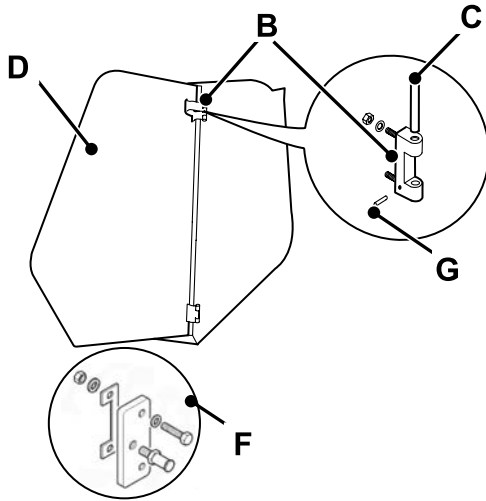
### Door Removal and Replacement

⇒ [Fig 142. \(□ B-134\)](#) and ⇒ [Fig 143. \(□ B-135\)](#)

Fig 142. Two Piece Door Assembly

- 6 Carefully remove the door **D** from the hinge assembly **B**.
- 7 If necessary remove the hinge assembly **B** by removing the nuts from inside the cab.
- 8 Do procedures **2** to **6** for the lower part of door **142-E**. (Two piece door assembly only)

- 9 If necessary the door catch assembly **F** can be removed by removing the nuts, bolts and locking plate.



**Fig 143. Single Piece Door Assembly**

### Replacement

Replacement is the opposite of the removal procedure.

### Roof Guard

#### Removal and Replacement

##### Removal

- 1 Remove the rear mounting bolt **144-A** and unscrew the front guard mounting bolts **144-B** from the windscreen guard.

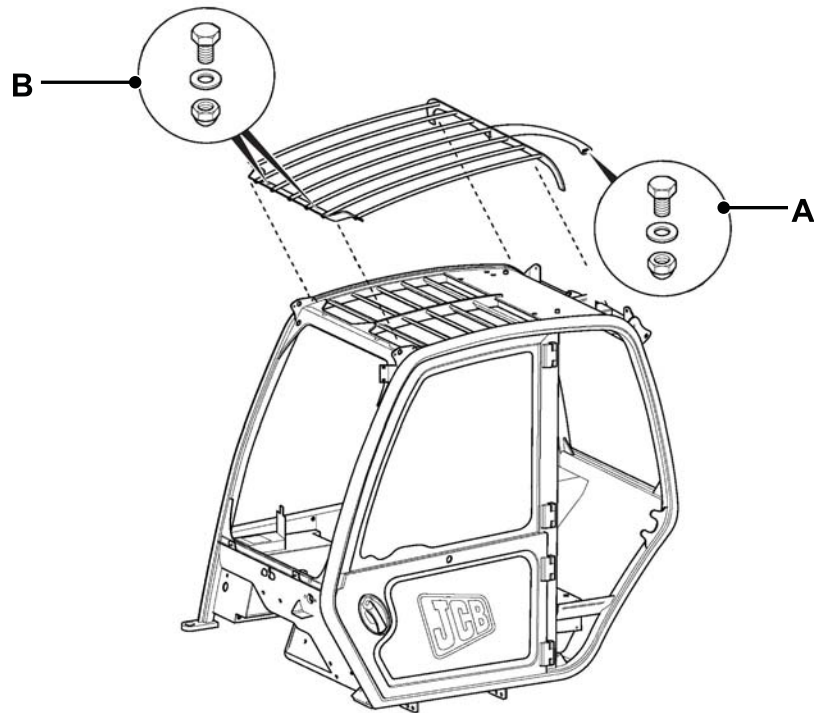


Fig 144.

### Replacement

Replacement is the reverse of the above procedure.

### Wiper Motor Front

#### Removal and Replacement

##### Removal

- 1 Remove the instrument panels. Refer to **Instrument Panels**.
- 2 Disconnect the wiper motor electrical connector **134-A**.
- 3 Remove the tube **134-B** at the cab bulkhead adapter.

- 4 Remove the nuts **134-C** and pull the wiper arm assembly **134-D** off the motor shafts.
- 5 With the aid of one more person hold the wiper motor **134-E** and at the same time remove the nuts **134-F**.
- 6 Remove the wiper motor **134-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.

## Wiper Motor Rear

### Removal and Replacement

#### Removal

- 1 Remove the wiper motor cover **146-A**.
- 2 Disconnect the wiper motor electrical connector **146-B**.
- 3 Flip up cover **146-C**.
- 4 Remove both locknuts and grommet assembly **146-D** and pull the wiper arm assembly off from the motor shaft
- 5 With the aid of one more person hold the wiper motor **146-F** from inside the cab and remove locknut **146-E**.
- 6 Remove the wiper motor **146-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.

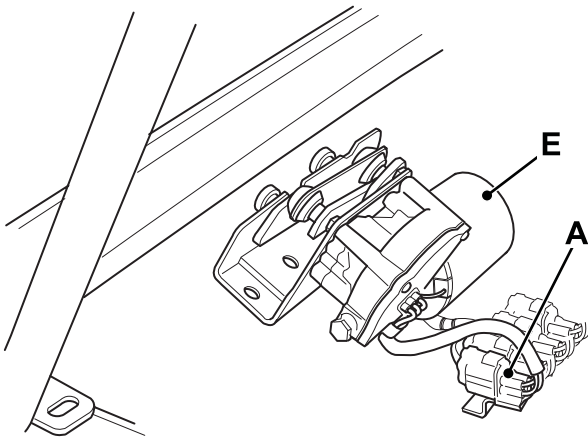
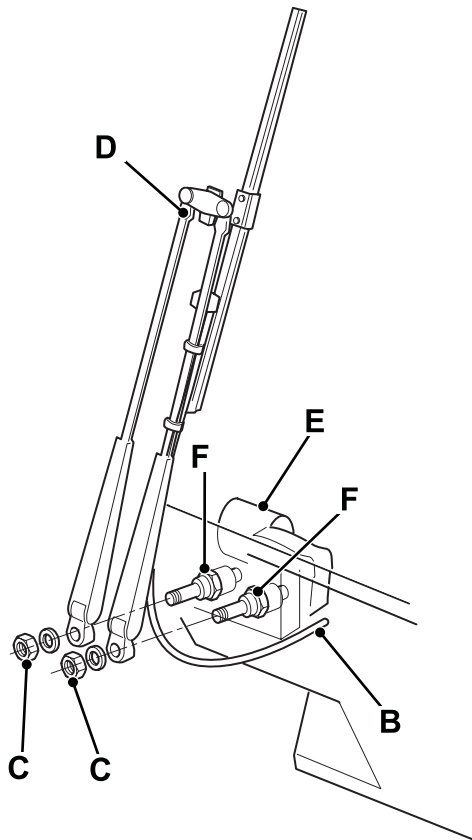


Fig 145.

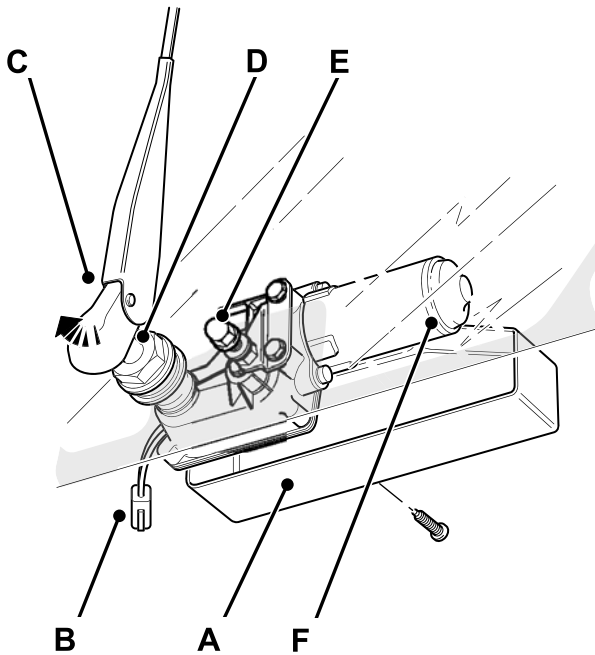


Fig 146.

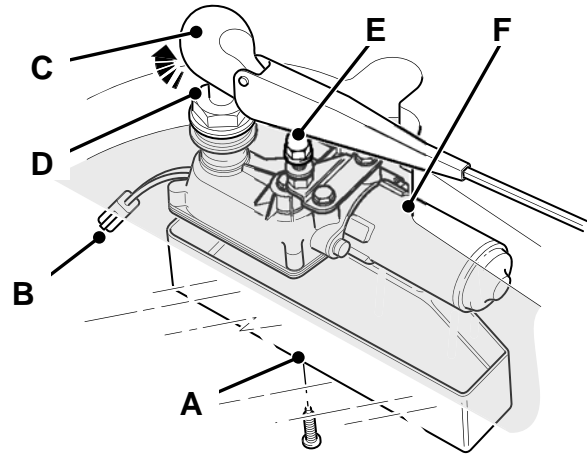


Fig 147.

### 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.

## Wiper Motor Roof

### Removal and Replacement

#### Removal

- 1 Remove the cab roof liner. Refer to **Cab Roof Liner**
- 2 Remove the wiper motor cover **147-A**.
- 3 Disconnect the wiper motor electrical connector **147-B**
- 4 Flip up cover **147-C**.
- 5 Remove both locknuts and grommet assembly **147-D** and pull the wiper arm assembly off from the motor shaft.
- 6 With the aid of one more person hold the wiper motor **147-F** from inside the cab and at the same time remove locknut **147-E**.
- 7 Remove the wiper motor **147-F**.

## Removal and Replacement

### 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 Raise the boom and fit the safety strut, see **Section 2 - Boom Safety Strut**.
- 2 Vent all residual hydraulic pressure.
- 3 Remove the battery cover and disconnect the battery.
- 4 Disconnect all hydraulic hoses from steering unit **148-A**. Cap all open ports to prevent loss of fluid and ingress of dirt.
- 5 Remove heater cover **148-T** (if fitted). Undo the hose clips and disconnect heater hoses **148-B**.

**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

- 6 If applicable, once the system has been discharged, disconnect the air conditioning hoses at the thermostatic expansion valve (TEV) **148-K**.

**Note:** Some machines are fitted with a cab roof mounted air conditioning condenser. Disconnect the condenser hoses at the rear of the cab.

- 7 Disconnect engine throttle cable (if fitted). Refer to **Section D - Controls**.
- 8 Disconnect the throttle pedal electrical connectors (if fitted). Refer to **Section D - Controls**.
- 9 Ensure all wheels are chocked and release parking brake. Disconnect parking brake cable **148-D**.

**Note:** Machines with 6 speed gearboxes are fitted with an integral park brake assembly. For park brake cable disconnecting procedures see **Section G**.

- 10 On machines with a cab mounted control lever, remove the control lever gaiter plate and push gaiters outside cab.
- 11 Disconnect the chassis electrical harness **148-E**. Disconnect the cab earth strap **148-U**.
- 12 Undo the fuel filler hose clip **148-F**. Loosen the fuel tank filter hose on fuel tank filler neck **148-S** so that the two separate at step 17.
- 13 On machines with cab mounted brake servo, disconnect the brake pipe **148-R** and servo hose **148-H** (shown at **148-X**). Cap all open hoses and pipes to prevent fluid loss and ingress of dirt.
- 14 Disconnect hitch cable **148-J** (if fitted).
- 15 Unscrew and remove cab mounting bolts **148-L**, **148-M**, **148-N** and **148-P**.
- 16 Attach appropriate lifting equipment to the ROPS and FOPS cage.
- 17 Carefully lift the cab from the machine, ensuring that all connections have been released and are clear of any obstruction. Cap off fuel tank filler neck **148-S** to prevent contamination.

### Replacement

Replacement is the reverse of the removal sequence.



Torque tighten the cab mounting bolts, see **Section 3 - Routine Maintenance**.

Bleed the brakes, see **Section G - Brakes**.

If applicable, recharge the air conditioning system, see **Section B - Service Procedures**.

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.

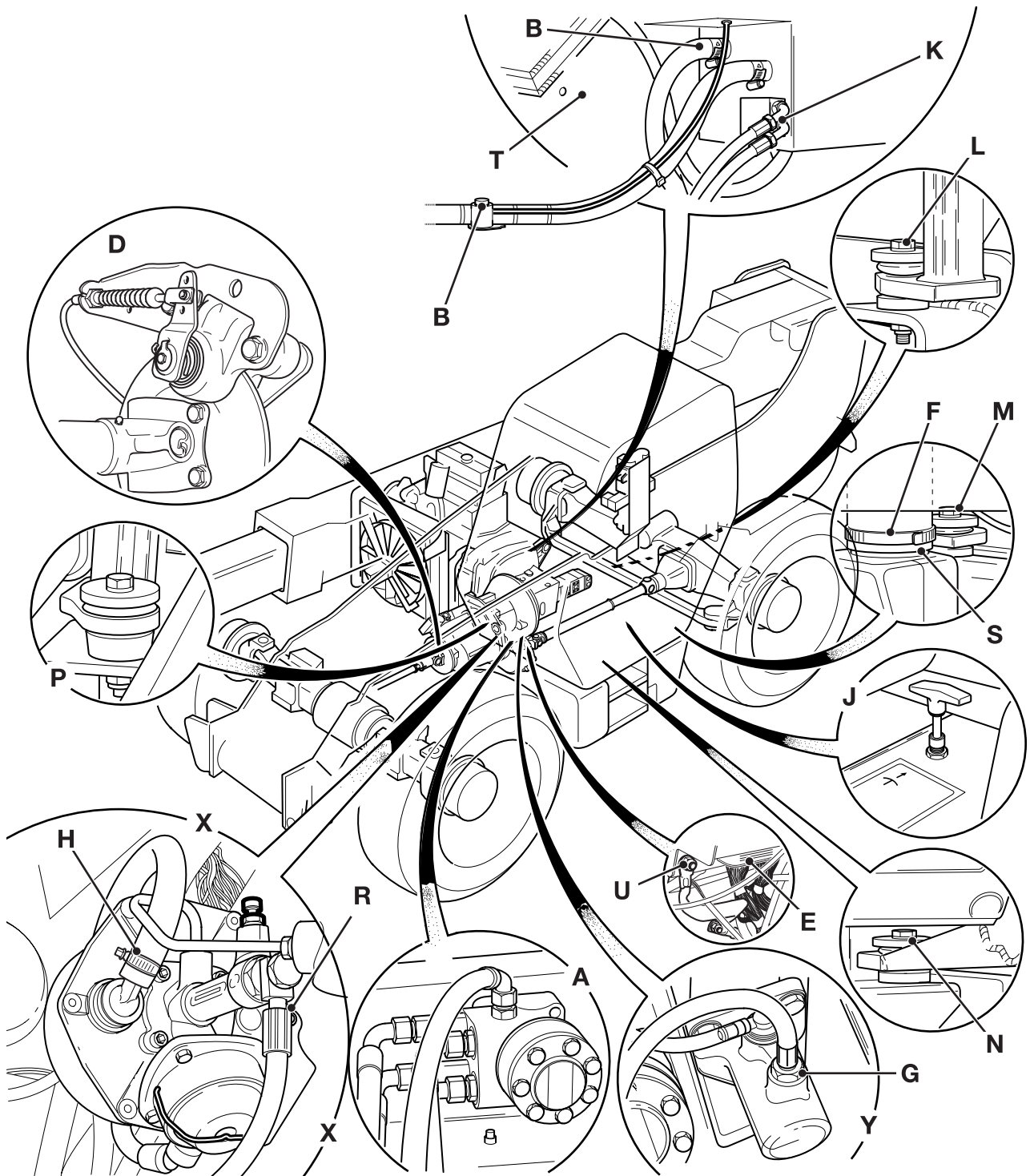


Fig 148. Typical Machine

# Cab Heater Valve

## Removal and Replacement

The cab heater valve **149-A** is part of the heater assembly installed on the external part of the cab.

### Removal

- 1 Lift the boom and fit the safety strut.
- 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 **149-B** with clamps.
- 5 Put aligned marks on the control cable outer **149-C** and valve body **149-D**.
- 6 Remove the clip **149-E**.

**Note:** There will be some leakage of engine coolant when the hoses **149-B** are removed. Be prepared.

- 7 Loosen the clips **149-F** and remove the hoses **149-B** at the valve.
- 8 Disconnect the control cable **149-G** at the valve lever **149-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 **149-C** and valve body **149-D** and then replace clip **149-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. Refer to **Section 3**.

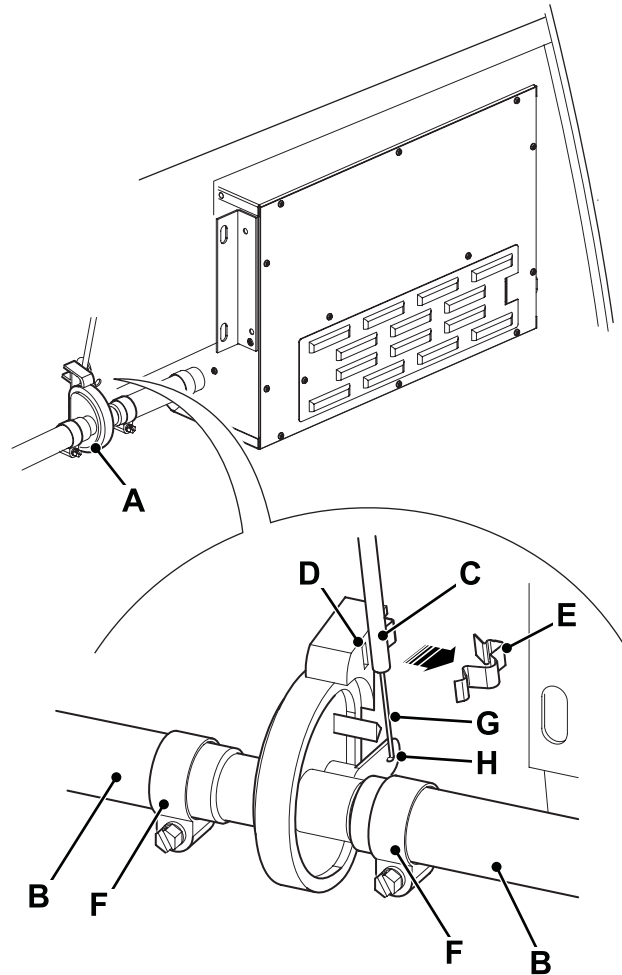


Fig 149.

# Fuel Tank

## Removal and Replacement

### Removal

Park the machine and make it safe. Obey the General Safety procedures, see **Section 2 - General Procedures**.

#### **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 Remove the steps **150-A** and battery cover **150-B**.
- 2 Disconnect and remove the battery.
- 3 Remove the drain plug and drain fuel tank contents into a suitable clean container.
- 4 Put a label on the fuel feed and return hoses before disconnecting to help identification when replacing.
- 5 Disconnect the fuel feed and return hoses **150-C**.
- 6 Disconnect the fuel sender **150-D**.
- 7 Undo the clip **150-E** that attaches the filler pipe to the tank.
- 8 Support the tank, remove nuts **150-F** and bolts **150-G** to remove the holding straps **150-H**.
- 9 Remove the fuel tank from machine.

### Replacement

Replacement is the opposite of the removal procedure.

During the replacement procedure do this work also:

Make sure hoses **150-C** are fitted to the correct tank connectors.

If the tank sender unit has been removed, it should be installed with the float arm pointing to the front of the machine.

Use a new seal when installing the drain plug.

Fill the tank with clean fuel. Make sure all connections are tight and check for leaks.

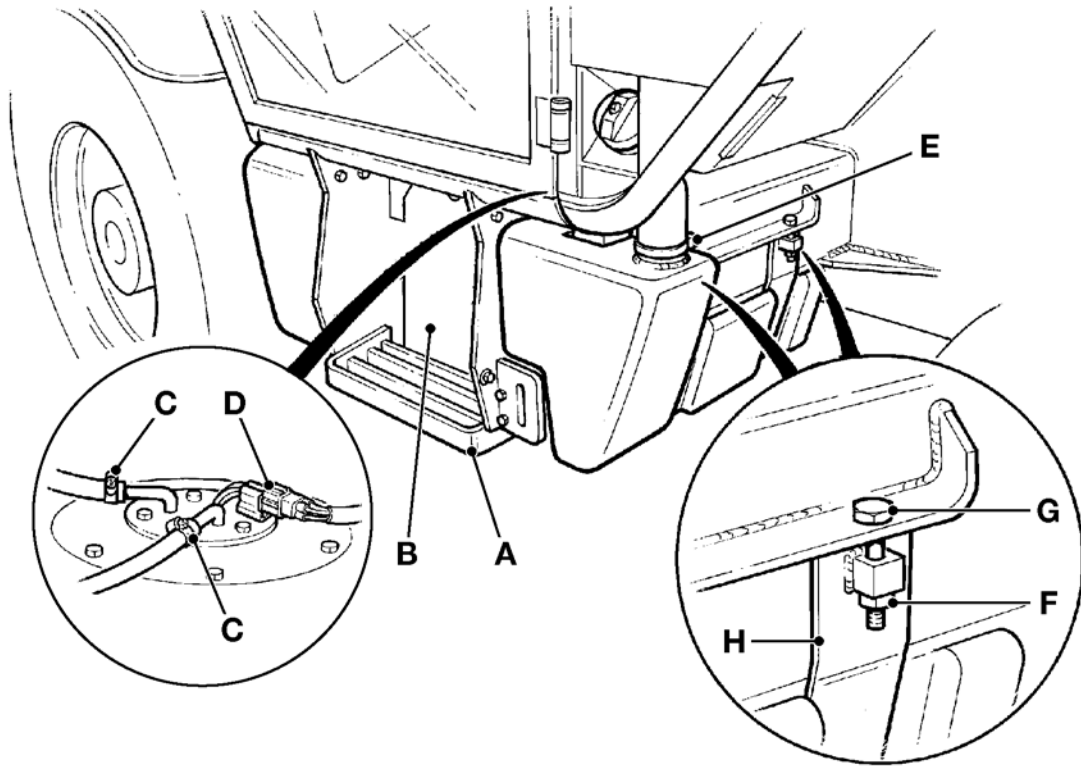


Fig 150. Fuel Tank

## Fuel Level Sender

### Removal

- 1 Park the machine and make it safe. Obey the general safety procedures, see **Section 2 - General Procedures**.
- 2 Lower the fuel tank from the machine, see [➔ Removal \(□ B-143\)](#).
- 3 Remove bolts **K** and carefully lift the fuel level sender out of the tank.

### Replacement

Replacement is the opposite of the removal procedure.

During the replacement procedure do this work also:

Examine the gasket **L** to make sure it is clean and in good condition. If not install a new gasket.

When installing the fuel level sender unit, make sure the float arm **M** is pointing to the front of the machine.

Apply JCB Threadlocker and Sealer to the threads of bolts **K**. Torque tighten the bolts.

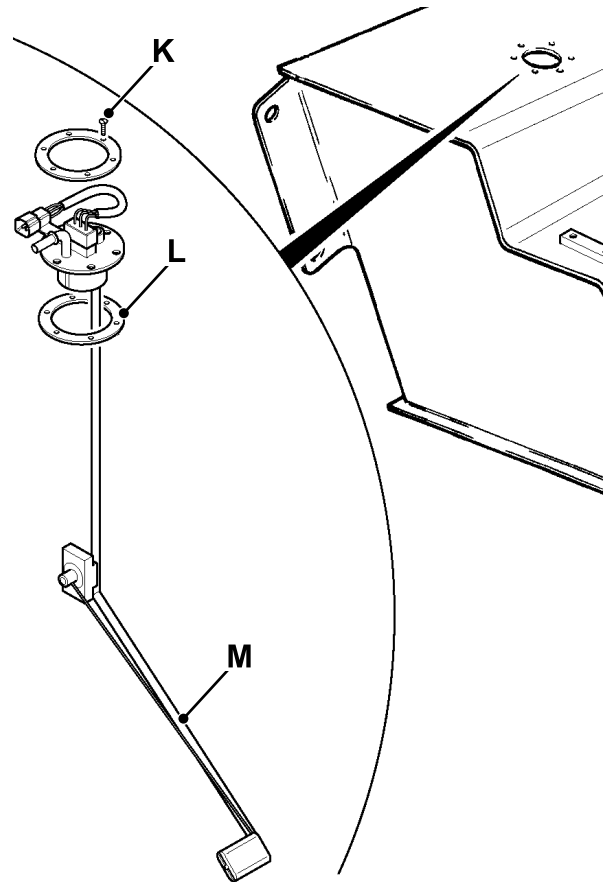


Fig 151.

Table 45. Torque Settings

Item	Nm	lbf ft	kgf m
K	7	5	0.7



## Section B - Body and Framework Fuel Tank

Removal and Replacement

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# Engine Cover

## Removal and Replacement

### Removal

- 1 Park the machine on firm level ground, engage the parking brake and set the transmission to neutral. Stop the engine and remove the starter key.
- 2 Disconnect the battery.
- 3 Open the engine cover **152-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 **152-C** from the radiator cowl.
- 5 Remove the bolts from hinges **152-B**.
- 6 Using the lifting equipment manoeuvre the engine cover clear of the machine.
- 7 Remove the air filter. Loosen clips **152-D** on the pipes to the engine and pre-cleaner (if fitted). Undo fixing bolts **152-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 base **152-F**. Support the pod. Remove six bolts **152-G** and lower the pod complete with guards to the ground.

### Replacement

Replacement is the reverse of the removal sequence.

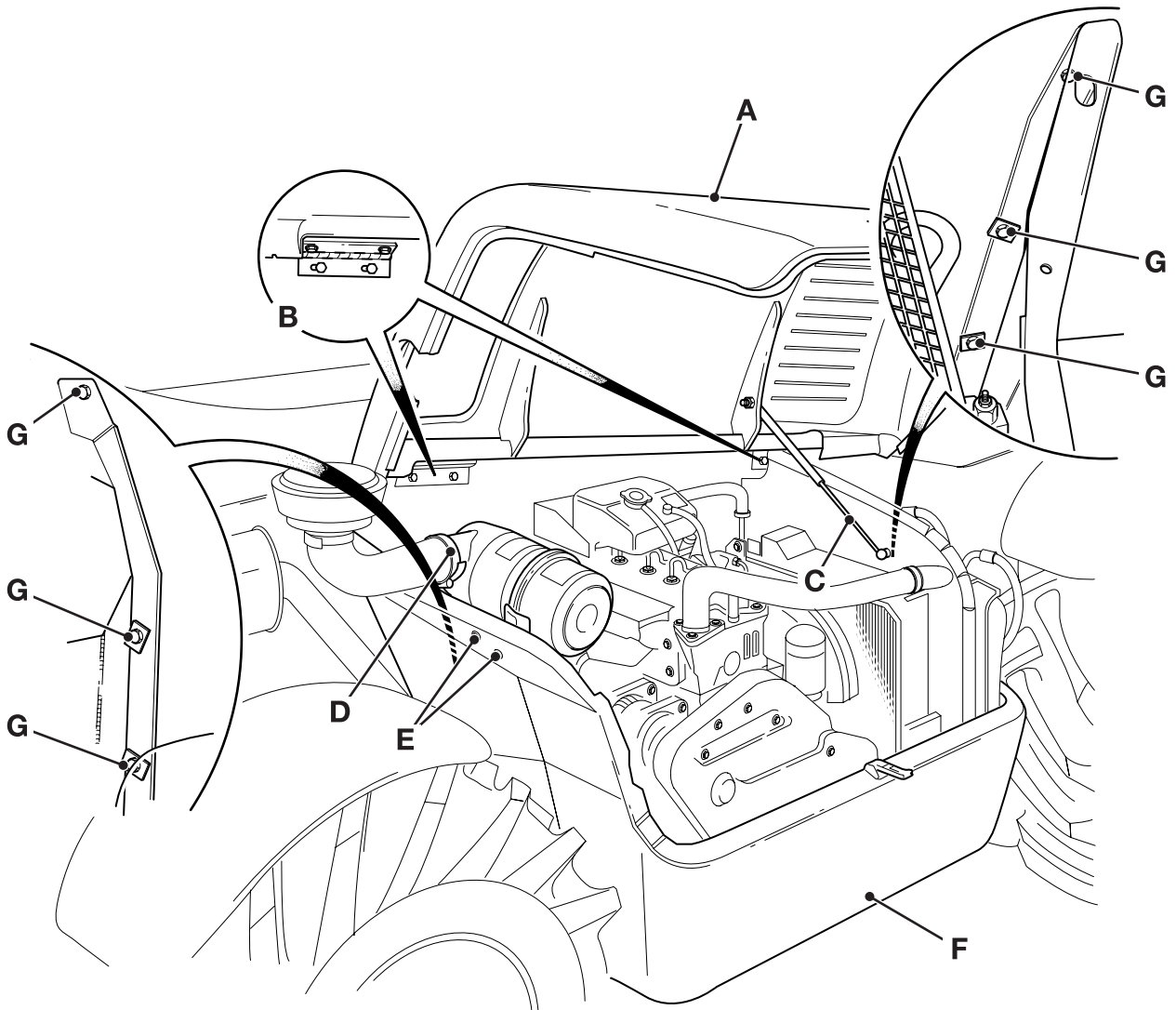


Fig 152. Typical Machine

## Mudguards

### Removal and Replacement

#### 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 **153-A** releasing the lower saddle clamps **153-D**.
- 2 Lift off the clamping plates **153-B** and the mudguard cover.
- 3 Remove the support strips **153-C**.

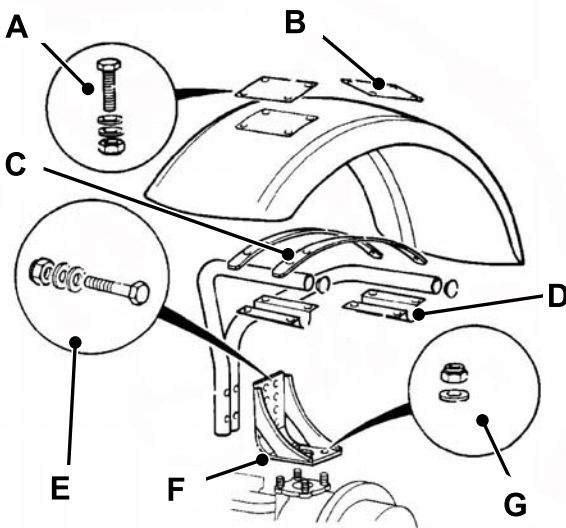


Fig 153.

#### Replacement

Replacement is the reverse of the removal sequence.

#### Replacement

Replacement is the reverse of the removal sequence.

#### Removal of the Complete Mudguard Assembly

- 1 Remove the roadwheel if greater access required *see section F - Wheel Removal and Replacement*.
- 2 Remove the top guard assembly ⇒ [Removal of the Top Guard Assembly \(□ B-149\)](#)
- 3 Remove the mounting arm bolts **153-E** and lift the arm assembly clear.
- 4 The support bracket nuts **153-G** can now be removed and the bracket **153-F** can now be lifted clear.



## Section B - Body and Framework Mudguards

Removal and Replacement

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