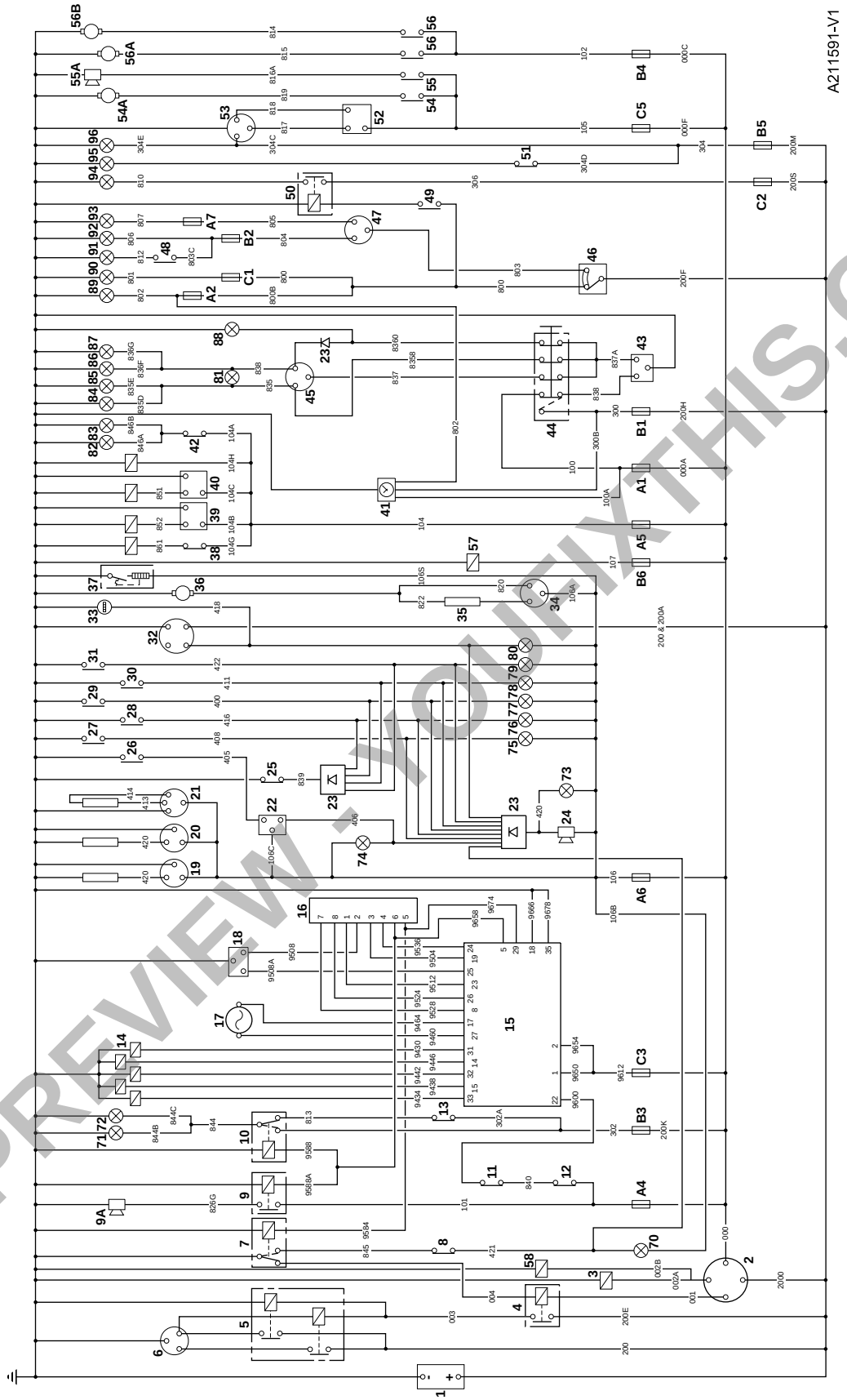


Fig 51.

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Battery

T3-061

⚠ WARNING

Batteries give off an explosive gas. Do not smoke when handling or working on the battery. Keep the battery away from sparks and flames.

Battery electrolyte contains sulphuric acid. It can burn you if it touches your skin or eyes. Wear goggles. Handle the battery carefully to prevent spillage. Keep metallic items (watches, rings, zips etc) away from the battery terminals. Such items could short the terminals and burn you.

Set all switches to OFF before disconnecting and connecting the battery. When disconnecting the battery, take off the earth (-) lead first.

Re-charge the battery away from the machine, in a well ventilated area. Switch the charging circuit off before connecting or disconnecting the battery. When you have installed the battery in the machine, wait five minutes before connecting it up.

When reconnecting, fit the positive (+) lead first.

5-3-4-12

⚠ CAUTION

Do not disconnect the battery while the engine is running, otherwise the electrical circuits may be damaged.

INT-3-1-14

⚠ WARNING

Electrical Circuits

Understand the electrical circuit before connecting or disconnecting an electrical component. A wrong connection can cause injury and/or damage.

INT-3-1-4

⚠ DANGER

Electrolyte

Battery electrolyte is toxic and corrosive. Do not breathe the gases given off by the battery. Keep the electrolyte away from your clothes, skin, mouth and eyes. Wear safety glasses.

INT-3-2-1_3

⚠ CAUTION

Damaged or spent batteries and any residue from fires or spillage should be put in a closed acid proof receptacle and must be disposed of in accordance with local environmental waste regulations.

INT-3-1-12

⚠ WARNING

Battery Gases

Batteries give off explosive gases. Keep flames and sparks away from the battery. Do not smoke close to the battery. Make sure there is good ventilation in closed areas where batteries are being used or charged. Do not check the battery charge by shorting the terminals with metal; use a hydrometer or voltmeter.

INT-3-1-8

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Changing the Coolant

⚠ WARNING

The cooling system is pressurised when the coolant is hot. When you remove the cap, hot coolant can spray out and burn you. Make sure that the engine is cool before you work on the cooling system.

9-3-3-1_2

1 Get access to the engine. Refer to ***Access Panels, Engine Cover***.

2 Carefully loosen cap **A** on the coolant reservoir. Let any pressure escape before removing the cap.

3 Place a container of suitable size beneath the radiator.

4 Disconnect the bottom hose from the radiator.

5 Flush the system using clean water. After flushing, reconnect the bottom hose to the radiator.

6 Use the recommended mix of clean, soft water and antifreeze. Fill to the **MIN** level on coolant reservoir.

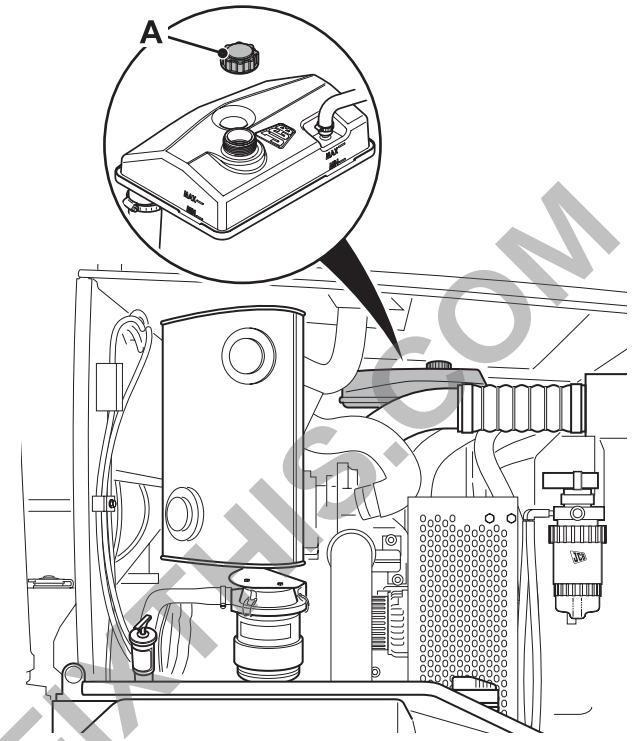
Note: *To prevent air becoming trapped in the cooling system, do not exceed the maximum fill-rate shown. Refer to* ***Fluids, Lubricants and Capacities****.*

7 Refit the filler cap. Make sure it is tight.

8 Run the engine for a while, to raise the coolant to working temperature and pressure.

Note: *Make sure the cab heater control is in the hot position. This will ensure the coolant mixture circulates through the entire cooling system.*

9 Stop the engine. Check for leaks. Check the coolant level and top up if necessary.



T010640-2

Fig 51.

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Zinc Plated Fasteners and Dacromet Fasteners

Table 2. Torque Settings - UNF Grade 'S' Fasteners

Bolt Size		Hexagon (A/F)	Condition 1			Condition 2		
in.	mm	in.	Nm	kgf m	lbf ft	Nm	kgf m	lbf ft
1/4	6.3	7/16	11.2	1.1	8.3	10.0	1.0	7.4
5/16	7.9	1/2	22.3	2.3	16.4	20.0	2.0	14.7
3/8	9.5	9/16	40.0	4.1	29.5	36.0	3.7	26.5
7/16	11.1	5/8	64.0	6.5	47.2	57.0	5.8	42.0
1/2	12.7	3/4	98.00	10.0	72.3	88.0	9.0	64.9
9/16	14.3	13/16	140.0	14.3	103.2	126.0	12.8	92.9
5/8	15.9	15/16	196.0	20.0	144.6	177.0	18.0	130.5
3/4	19.0	1 1/8	343.0	35.0	253.0	309.0	31.5	227.9
7/8	22.2	1 15/16	547.0	55.8	403.4	492.0	50.2	362.9
1	25.4	1 1/2	814.0	83.0	600.4	732.0	74.6	539.9
1 1/8	31.7	1 7/8	1181.0	120.4	871.1	1063.0	108.4	784.0
1 1/4	38.1	2 1/4	1646.0	167.8	1214.0	1481.0	151.0	1092.3

Table 3. Torque Settings - Metric Grade 8.8 Fasteners

Bolt Size		Hexagon (A/F)	Condition 1			Condition 2		
ISO Metric Thread	mm	mm	Nm	kgf m	lbf ft	Nm	kgf m	lbf ft
M5	5	8	5.8	0.6	4.3	5.2	0.5	3.8
M6	6	10	9.9	1.0	7.3	9.0	0.9	6.6
M8	8	13	24.0	2.4	17.7	22.0	2.2	16.2
M10	10	17	47.0	4.8	34.7	43.0	4.4	31.7
M12	12	19	83.0	8.5	61.2	74.0	7.5	54.6
M16	16	24	205.0	20.9	151.2	184.0	18.8	135.7
M20	20	30	400.0	40.8	295.0	360.0	36.7	265.5
M24	24	36	690.0	70.4	508.9	621.0	63.3	458.0
M30	30	46	1372.0	139.9	1011.9	1235.0	125.9	910.9
M36	36	55	2399.0	244.6	1769.4	2159.0	220.0	1592.4

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Heater and Air Conditioning: 411 before 1241500, 416 before 1243000

Cleaning the Recirculation Filter

⚠ CAUTION

The filter may be filled with dust. Wear goggles and a face mask when removing the filter.

2-3-3-6

1 Park the machine on level ground. Engage the parking brake. Put the transmission in neutral. Lower the attachments to the ground. Stop the engine. Remove the starter key.

2 To gain access to the cab recirculation air filter **F**, turn fastener **G** one quarter turn anti-clockwise and remove cover **H**.

3 Remove the filter **F**, shake out the loose dust and clean using low pressure compressed air. Renew the filter if damaged.

4 Wash filter **F** in warm water with mild detergent. Rinse all trace of detergent from filter. Make sure filter is dry before refitting.

5 Refit filter **F** and cover **H**, make sure bottom lug on cover is located. Push in and turn fastener **G** one quarter turn clockwise. Make sure that the cover is secure.

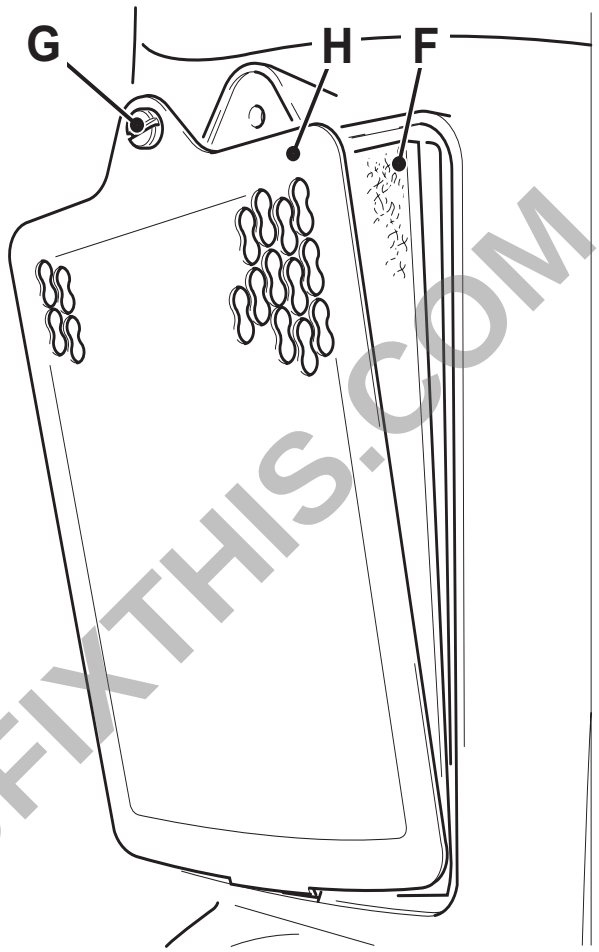


Fig 24.

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Safety Mechanism

Install the Maintenance Strut

1 If necessary, empty the shovel.

2 Make sure that the machine is parked correctly in the straight-ahead position on hard, level ground. Refer to ***Stopping and Parking the Machine (Operation Section)***.

3 Lift the loader arms sufficiently to install the maintenance strut **A**.

4 If applicable, run the engine at idle for 2 - 3 minutes to let the turbo-charger cool.

5 Stop the engine and remove the starter key.

6 Put chocks on both sides of all the wheels.

7 Install the articulation lock. Refer to ***Articulation Lock*** (Operation Section).

8 Remove the maintenance strut **A** from its stowage position.

9 Put the maintenance strut in position around the ram.

10 Lock the maintenance strut in position with the strap **B**.

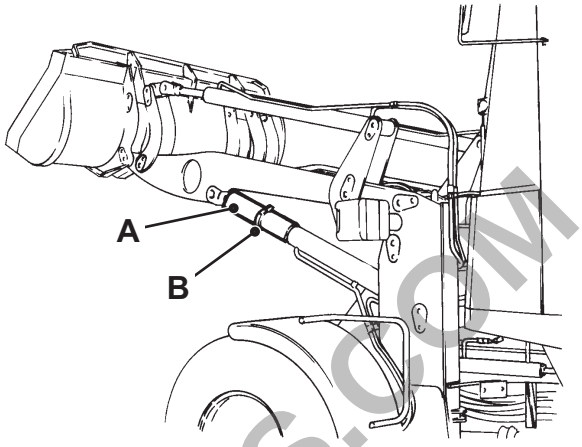
11 Start the engine.

12 Slowly lower the loader arm onto the maintenance strut. Stop the movement immediately the maintenance strut supports the weight of the loader arm.

13 Stop the engine and remove the starter key.

14 Remove the battery isolation key. Refer to ***Battery Isolation Switch***.

Note: *Be careful when you lower the loader arm onto the maintenance strut. 'Feather' the control lever to lower the loader arm slowly.*



S203720-V1

Fig 2.

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411 before 1241500, 416 before 1243000

Checking the Fluid Level

WARNING

Fluid Under Pressure

Fine jets of fluid at high pressure can penetrate the skin. Keep face and hands well clear of fluid under pressure and wear protective glasses and gloves. Hold a piece of cardboard close to suspected leaks and then inspect the cardboard for signs of fluid. If fluid penetrates your skin, get medical help immediately.

INT-3-1-10_3

1 Apply the parking brake, put the transmission in neutral, lower the shovel/attachment to the ground. Make sure it is flat on the ground. Stop the engine.

2 Look at the fluid level in the sight glass **A**. The level should be visible in the sight glass.

3 If necessary, top up with hydraulic fluid.

4 Open the right side engine cover. Open filler cap **B**.

5 Top up the system with hydraulic fluid. ⇨ *Fluids, Lubricants and Capacities (3-18)*.

6 Refit filler cap **B**. Make sure it is secure. Close and lock the engine cover.

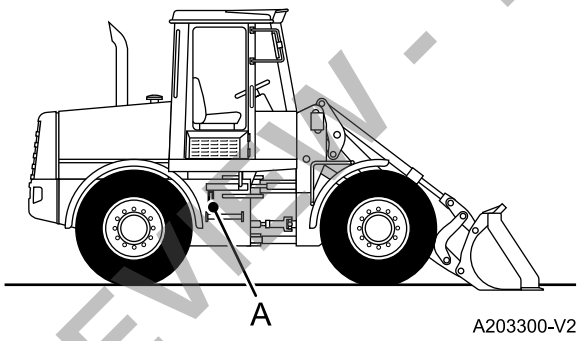


Fig 76.

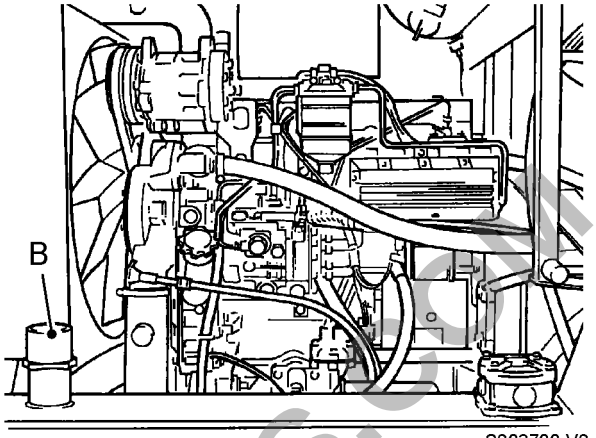


Fig 77.

CAUTION

If the fluid is cloudy, then water or air has contaminated the system. This could damage the hydraulic pump. Contact your JCB Distributor immediately.

12-5-1-4

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Routine Maintenance

Service Requirements

Introduction

T3-095

Your machine has been designed and built to give maximum performance, economy and ease of use under a wide variety of operating conditions. Prior to delivery, your machine was inspected both at the Factory and by your Distributor to ensure that it reaches you in optimum condition. To maintain this condition and ensure trouble free operation it is important that the routine services, as specified in this Manual, are carried out by an approved JCB Distributor at the recommended intervals.

This section of the Manual gives full details of the service requirements necessary to maintain your JCB machine at peak efficiency.

A Service Manual for your machine is available from your JCB Distributor. The Service Manual contains information on how to repair, dismantle and assemble your machine correctly.

It can be seen from the Service Schedules on the following pages that many essential service checks should only be carried out by a JCB trained specialist. Only JCB Distributor Service Engineers have been trained by JCB to carry out such specialist tasks, and only JCB Distributor Service Engineers are equipped with the necessary special tools and test equipment to perform such tasks, thoroughly, safely, accurately and efficiently.

JCB regularly updates its Distributors advising them of any product developments, changes in specifications and procedures. Therefore only a JCB Distributor is fully able to maintain and service your machine.

A Service Record Sheet or Book is provided which will enable you to plan your service requirements and keep a service history record. It should be dated, signed and stamped by your Distributor each time your machine is serviced.

Remember, if your machine has been correctly maintained, not only will it give you improved reliability but its resale value will be greatly enhanced.

Owner/Operator Support

JCB together with your Distributor wants you to be completely satisfied with your new JCB machine. If you do encounter a problem however, you should contact your Distributor's Service Department who are there to help you!

You will have been given the names of the relevant service contacts at your Distributor when the machine was installed.

To get the most from your Distributor please help them to satisfy you by:

1 Giving your name, address and telephone number.

2 Quoting your machine model and serial number.

3 Date of purchase and hours of work.

4 Nature of the problem.

Remember, only your JCB Distributor has access to the vast resources available at JCB to help support you. In addition, your Distributor is able to offer a variety of programmes covering Warranty, Fixed Price Servicing, Safety Inspections, including weight tests, covering both legal and insurance requirements.

Service/Maintenance Agreements

To help plan and spread the costs of maintaining your machine, we strongly recommend you take advantage of the many Service and Maintenance Agreements your Distributor can offer. These can be tailor made to meet your operating conditions, work schedule etc.

Please consult your JCB Distributor for details.

Initial Service and Inspection

T3-005_2

To further protect your machine's performance it is essential your JCB Distributor carries out an initial service and inspection when the machine is one month old or when it has completed 100 hours of operation (whichever

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occurs first). You should notify your Distributor in advance to allow the necessary arrangements to be made.

Fit for Purpose Tests for Lifting Equipment

T3-097

All lifting equipment (for example forks, lifting hooks and shackles) need regular inspection and testing by a competent person to ensure they are fit for purpose.

This may be needed every six months or at least annually in some countries to meet and comply with legislation and for insurance purposes.

Check with your local JCB distributor for further advice.

Obtaining Replacement Parts

T3-096

If you use non-genuine JCB parts or consumables, then you can compromise the health and safety of the operator and cause machine failure

A Parts Book for your machine is available from your JCB Distributor. The Parts Book will help you identify parts and order them from your JCB distributor.

Your dealer will need to know the exact model, build and serial number of your machine. See ***Identifying Your Machine (Introduction section)***.

The data plate also shows the serial numbers of the engine, transmission and axle(s), where applicable. But remember if any of these units have been changed, the serial number on the data plate may be wrong. Check on the unit itself.

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Adjusting the Air Conditioning Compressor Drive Belt

⚠ WARNING

Make sure the engine cannot be started. Disconnect the battery before doing this job.

2-3-3-5

1 Park the machine on level ground.

2 Apply the parking brake, put the transmission in neutral and stop the engine.

3 Open the right side engine panel.

4 Loosen pivot bolt **A** (not shown). Loosen bolts **B** and **C**.

5 Adjust the belt by positioning the compressor to give 5 mm (3/16 in) slack at the mid point of the longest run.

6 Tighten bolts **B** and **C**. Tighten pivot bolt **A**.

7 Close and lock the engine panel.

⚠ 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

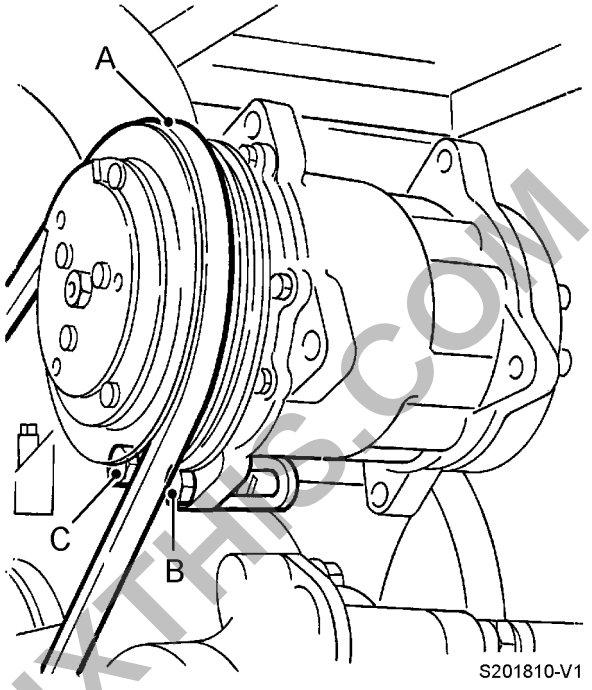


Fig 46.

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Park Brake (Smoothshift Transmission)

Note: *Smoothshift machine serial numbers as follows: 411 from Serial No. 527850,* 416 from Serial No. 530100

Testing the Park Brake

⚠ WARNING

Before testing the park brake make sure the area around the machine is clear of people.

2-2-4-5

Test the brake on a level, dry surface. Make sure your seat belt is securely fastened.

1 The attachment should be in the travelling position.

2 Make sure the park brake is fully engaged

3 Switch off transmission disconnect switch. (On facia panel.)

4 Switch off Auto/Manual switch.

5 On the EMS press the two arrow keys and the SETUP key at the same time, to select the AEB setup menu

- **a** Use the UP or DOWN arrows to select the park brake test menu.
- **b** Press SETUP key to select **park brake test on**.

6 Select third gear/range (**3**).

- **a** Push down hard on the brake pedal and select forward drive.

Note: *An audible alarm will sound and a warning light will show when the park brake is engaged with the machine in forward (**F**) drive. The alarm will stop when neutral (**N**) drive is selected.*

⚠ WARNING

If the machine starts to move during the following test, immediately apply the foot brake and reduce the engine speed.

2-2-5-1

7 Release the brake pedal.

- **a** If the machine has not moved, use the accelerator pedal to gradually increase the engine speed to 1500rpm. The machine should not move.
- **b** Reduce the engine speed to idle and set the forward/reverse lever (or switch) to neutral.

  Do not do this test for longer than 20 seconds.

8 Press SETUP key again to select **park brake test off**.

9 Lower attachment and stop the engine.

Note: *If the machine moved during the test,* ***⇨ Adjusting the Park Brake (G-18)****. Do not use the machine with faulty brakes.*

⚠ WARNING

Do not use a machine with a faulty park brake.

3-2-3-10_2

⚠ WARNING

Non approved modifications to drive ratios, machine weight or wheel and tyre sizes may adversely affect the performance of the park brake.

3-2-3-11

Park Brake Transmission Disconnect

When fully engaged, the park brake electrically disconnects the transmission drive; this prevents the machine from being driven with the park brake on.

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411HT JCB 444 T3 Gear Pump

Serial No:.....	**Destination:**.....	**Inspector:**.....
Build No:.....	**Fuel Colour:**.....	**Date:**.....

Pressures are in bars	Requirements	Initial	Final
Pumps	**411HT**	**Reading**	**Reading**
Standby - P1			
Standby - P2			
Control pilot	35-41		
Steer control pressure (P1, idle, LS connected, after standby)	30 typical, record the value		
System pressure - P1			
System pressure - P2			
Main relief valve - P1	220-225		
Main relief valve - P2	220-225		
Unloader	170-175		
Steer and Auxiliary Relief Valves			
Steer relief valve	200-205		
Lift headside ARV @ minimum engine speed at P1	345-350(1)		
Bucket rodside ARV @ minimum engine speed at P1	240-245(1)		
Bucket headside ARV @ minimum engine speed at P1	150-155		
Brakes			
Brake charge cut-in	80-85		
Brake charge cut-out	113-117		
Brake line pressure	43-47		
Brake, dead engine:-			
...Line pressure on 1st pedal press	43-47		
...Line pressure on 5th full pedal press	Must equal 1st press		
A -Brake line after brakes rested for at least 1 minute	Record		
B - Instrument reading vented (nominally zero)	0.00		
Residual brake pressure **A** - **B** =	0.2 maximum		
Engine Stall Speed (RPM)			
Idle	875-900		
Flight	2300-2350		
Transmission stall in 3rd gear	2180-2220		
Hydraulic RV stall (arms fully lowered)	+0/-30 of flight		
Combined transmission and hydraulic	+0/-280 of transmission stall		
Steer RV stall	+0/-30 of flight		
Combined transmission and steer RV	+0/-320 of transmission stall		
Lift Time (Seconds)			
Full lift cycle, maximum revolutions	4.4-5.0		

(1) Can not be set by production, make sure the reading = P1 record. If less than P1 contact Engineering.

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411 before 1241500, 416 before 1243000

○ Initial 100 Hour Check Only

Table 1. Key

☐ Regular Maintenance Check

Pre-start Cold Checks, Service Points and Fluid Levels	Operation	10 Hr(1)	100 Hr(2)	250 Hr	As and When	500 Hr	1000 Hr	2000 Hr
ENGINE								
Oil Level	- Check	☐	☐	☐		☐	☐	☐
Oil and Filter	- Change		○	☐		☐	☐	☐
Oil and Filter (Tier 2 Engines)(3)	- Change					☐	☐	☐
Air Cleaner Outer Element	- Change				☐			
Air Cleaner Inner Element (Every 3rd Outer Element)	- Change				☐			
Fuel Filter	- Drain				☐			
Fuel Filter	- Change		○			☐	☐	☐
Coolant Level	- Check	☐	☐	☐		☐	☐	☐
Antifreeze Strength	- Check		○		☐			
Coolant	- Change							☐
Fuel Sedimenter	- Drain				☐			
Fan Belt Tension/Condition	- Check		○	☐		☐	☐	☐
Valve Clearances	- Check and Adjust							☐
Valve Clearances (New 1000 Series) (AK & AM Build)	- Check and Adjust						☐	☐
Engine Mount Security	- Check		○			☐	☐	☐
Air Compressor Belt Tension/Condition (if fitted)	- Check		○	☐		☐	☐	☐
TRANSMISSION AND AXLES								
Transmission Oil Level	- Check		☐	☐		☐	☐	☐
Transmission Oil	- Change		○				☐	☐
Transmission Strainer/Filter	- Change		○				☐	☐
Axle(s) Oil Level	- Check		☐	☐		☐	☐	☐
Axle(s) Oil	- Change					☐	☐	☐
Hub Oil Levels	- Check		☐	☐		☐	☐	☐
Hub Oil	- Change					☐	☐	☐

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Fire Extinguisher (if fitted)

T3-022

Checking the Fire Extinguisher

Check the fire extinguisher for damage, security and signs of leaking.

Check that the gauge **A** indicates that the extinguisher is charged i.e. the needle is in the GREEN segment.

Note: *If the needle is in or very near the RED segment at either end of the gauge, the extinguisher must be serviced or replaced.*

Make sure the safety pin **B** is fitted and secure.

The extinguisher should be serviced every 12 months by a suitably qualified person.

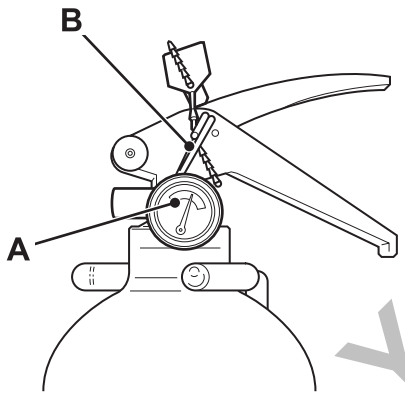


Fig 100.

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Earthing - Cab and Cab Roof ..... C - 146
Options ..... C - 147

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Front and Rear Worklights and Beacon

Table 13.

Main Components: See ⇨ *Fig 70. (C-85)*

1 LH Front Worklight (RF)
2 Fuse A1
3 Front Worklight Switch (Off-On-On) (RC)
4 Fuse A2
5 RH Front Worklight (RG)
6 LH Front Aux Worklight (RH)
7 RH Front Aux Worklight (RJ)
8 Fuse A3
9 Rear Worklight Switch (On-Off) (RD)
10 Fuse A4
11 LH Rear Worklight (RK)
12 RH Rear Worklight (RL)
13 LH Aux Worklight (Roof) (RM)
14 RH Aux Worklight (Roof) (RN)
15 LH Aux Worklight (Bonnet)
16 RH Aux Worklight (Bonnet)
17 Fuse B7
18 Beacon Switch (On-Off) (RE)
19 Beacon
20 Interior Light RH (TE)

Fuses: See ⇨ *411 From 1241500, 416 From 1243000 to 1317499 (C-11)*

Table 14.

Connections: See ⇨ *Fig 70. (C-85)*	
A	⇨ *Fig 76. (C-99)*
B	⇨ *Fig 67. (C-79)*
C	⇨ *Fig 71. (C-88)*
D	⇨ *Fig 76. (C-99)*
E	⇨ *Fig 66. (C-77)*
F	⇨ *Fig 76. (C-99)*
G	⇨ *Fig 66. (C-77)*
H	⇨ *Fig 76. (C-99)*
I	⇨ *Fig 76. (C-99)*
J	⇨ *Fig 76. (C-99)*
K	⇨ *Fig 76. (C-99)*
L	⇨ *Fig 66. (C-77)*
M	⇨ *Fig 76. (C-99)*
N	⇨ *Fig 76. (C-99)*
O	⇨ *Fig 76. (C-99)*
P	⇨ *Fig 76. (C-99)*
Q	⇨ *Fig 76. (C-99)*
R	⇨ *Fig 71. (C-88)*
S	⇨ *Fig 73. (C-92)*
T	⇨ *Fig 73. (C-92)*
U	⇨ *Fig 69. (C-83)*
V	⇨ *Fig 68. (C-81)*
W	⇨ *Fig 68. (C-81)*
X	⇨ *Fig 69. (C-83)*
Y	⇨ *Fig 71. (C-88)*
Z	⇨ *Fig 72. (C-90)*
AA	⇨ *Fig 76. (C-99)*
AB	⇨ *Fig 76. (C-99)*
AC	⇨ *Fig 76. (C-99)*
AD	⇨ *Fig 76. (C-99)*
AE	⇨ *Fig 76. (C-99)*
AF	⇨ *Fig 76. (C-99)*
AG	⇨ *Fig 76. (C-99)*

For **next** schematic	⇨ *Fig 71. (C-88)*
For component key	⇨ *Table 15. (C-86)*
For connecting schematics key	⇨ *Table 16. (C-86)*

For **previous** schematic	⇨ *Fig 69. (C-83)*
For component key	⇨ *Table 11. (C-82)*
For connecting schematics key	⇨ *Table 12. (C-82)*

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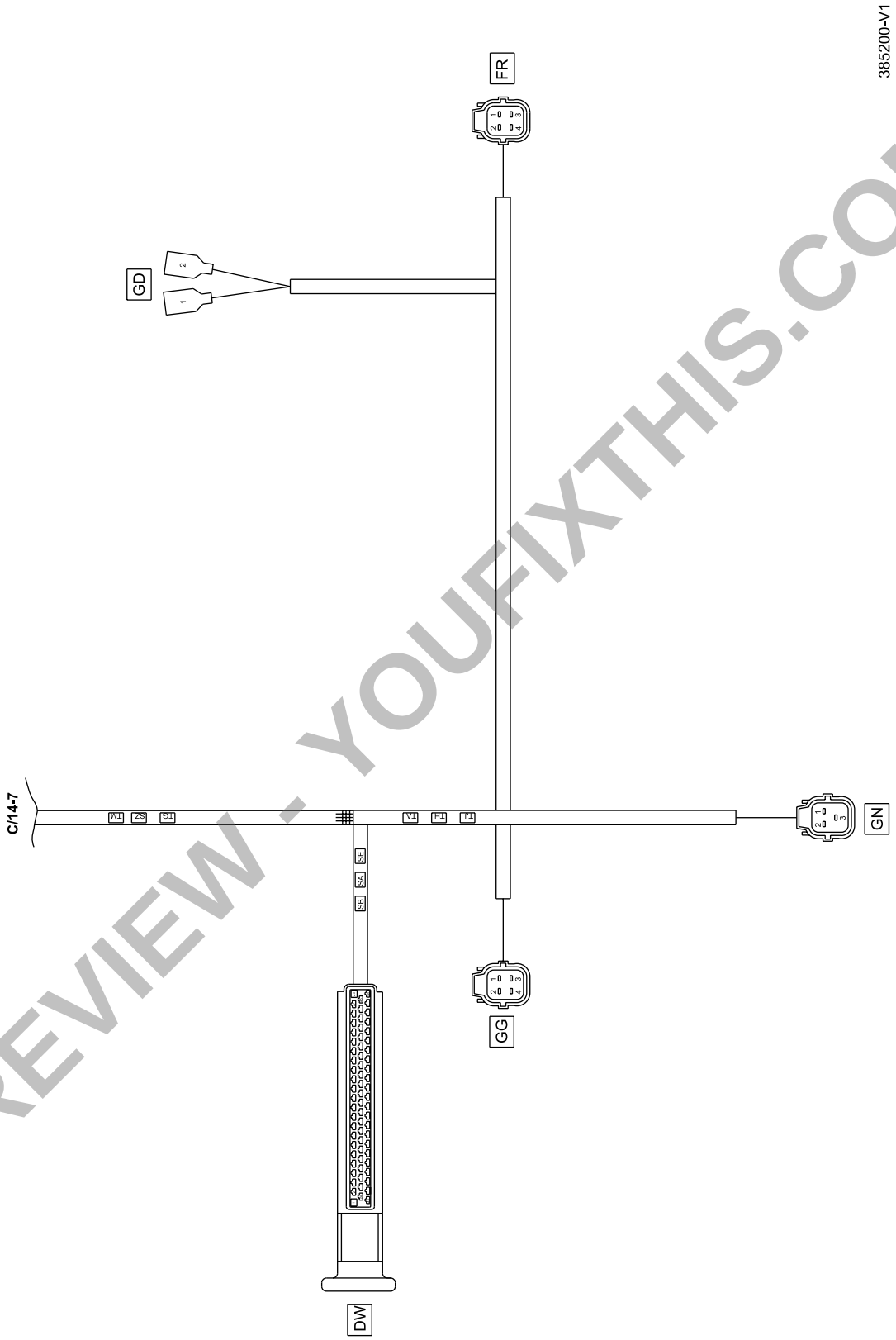


Fig 121.

Side Console Harness

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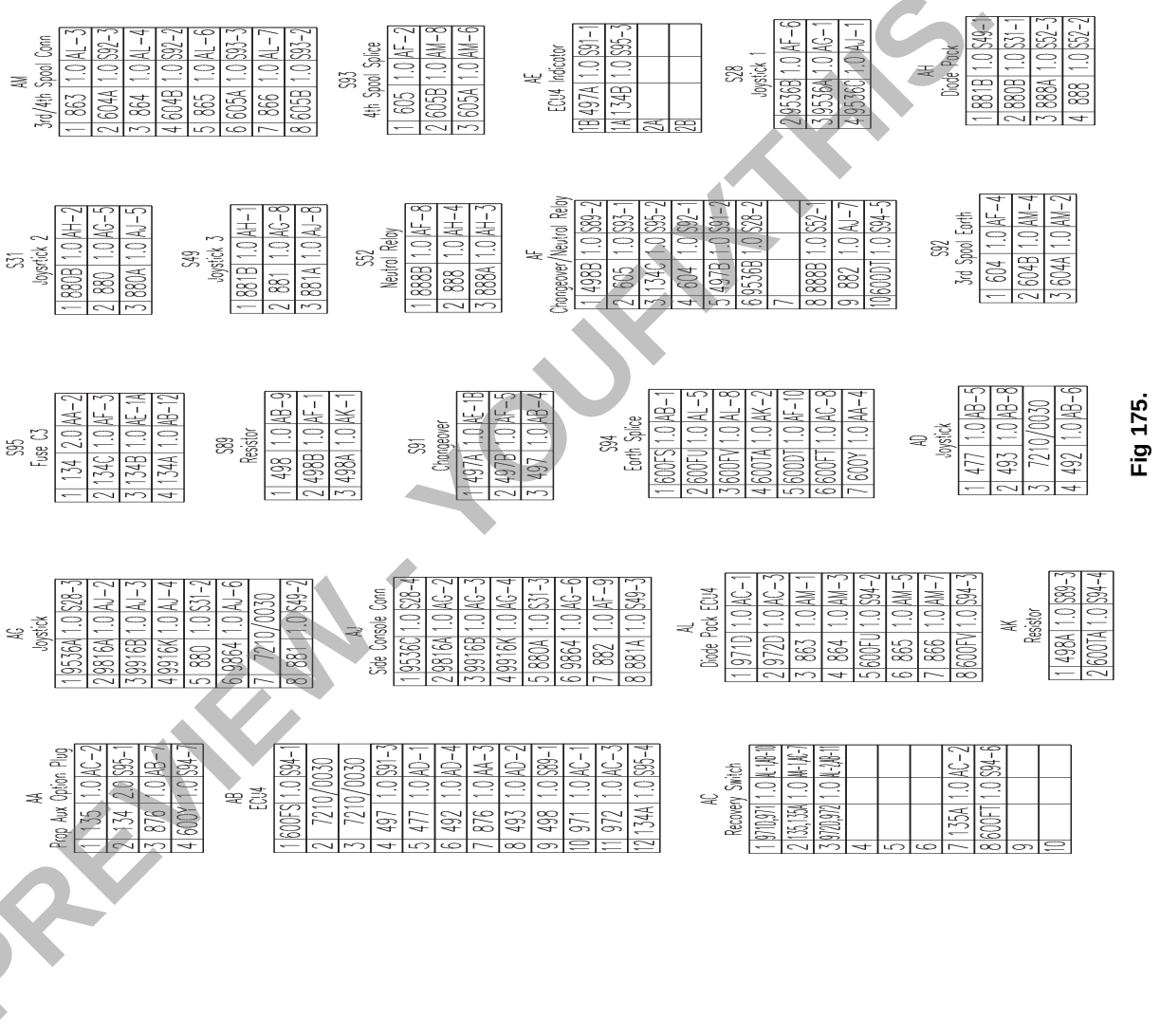
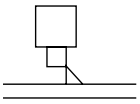
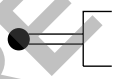
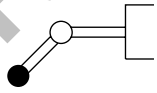


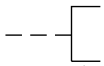
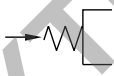
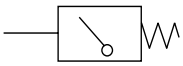
Fig 175.

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Table 6. Control Mechanisms

	Rotating shaft - one direction
	Rotating shaft - two directions
	Detent
	Locking device
	Over centre device
	Simple linkage
	General control
	Push button operated
	Lever operated
	Pedal operated
	Stem operated
	Spring operated
	Roller operated
	Roller trip operated (one directional)

	Solenoid one winding
	Solenoid two windings
	Electric motor operated
	Internal pressure pilot operated
	External pressure pilot operated
	Pressure operated spring release
	Pilot operated by solenoid pilot valve
	Pilot operated by a solenoid or seperate pilot valve
	Pressure guage
	Pressure switch

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Hydraulic Rams

Precautions During Use

TE-006

Installation

1 Precautions when installing the ram on the machine.

a When installing and removing from the machine, suspend the ram safely.

b Suspending the ram by the piping is not only dangerous, but can also cause damage to the cylinder.

c Secure the piston rod with a band. It is very dangerous if the rod extends unexpectedly. Also, the rod can be damaged and become unusable.

2 Welding after installing the ram may result in damage.

a If electric welding is done even at a point away from the ram, there may be sparking inside the ram and it will become necessary to replace the ram with a new one.

3 When painting the machine, mask the ram.

a If paint adheres to the rod surface or to the wiper ring and the ram is operated, the wiper ring will not function properly and foreign matter and paint can easily enter the ram. This will cause damage to the seals, drastically shortening the life of the ram.

4 Install the ram only when it is clean.

Caution During Use

1 Use only under designated conditions.

a If hydraulic oil other than the designated oil is used, the seals quickly degenerate and become damaged. If the relief valve is set at a value higher than specified, it may cause ram damage and is dangerous.

b In high temperature environments (approx. 90°C and above) or low temperature environments (below -20°C), seals quickly become damaged. Special seal materials are necessary so check to see if the ram that you are using is suitable or not.

c The number one cause of ram oil leakage is rod damage. Be careful not to damage the rod.

2 Warm up sufficiently before beginning work.

a In cold conditions the rod seals may be frozen, so if the ram is operated at maximum pressure and maximum speed, the seals will be damaged.

b There is a large amount of air in a new ram or one which has been left for a long time, so the ram will not operate smoothly. Also, if pressure is applied suddenly without bleeding the air, high temperatures will be generated due to adiabatic compression and the seals may burn.

c Before beginning work, always move the ram at full stroke with no load and expel air from the cylinder.

3 When stopping or storing, do it at a safe and fixed position.

a The installed ram cannot maintain the same position for a long period of time, because the oil inside the ram may leak and the hydraulic oil volume decreases as it cools. Stop or store the machine in a safe and fixed position.

Maintenance, Inspection Points

1 Carry out daily maintenance and inspection.

a The key point for correct long-term ram function is daily maintenance and inspection. Carry out maintenance and inspection so that the ram functions fully at all times. Always remove any mud, water, dust or oil film adhering to the rod and keep it in normal condition. However, when cleaning the wiper ring and seals, do not get them wet with water but wipe clean with a rag. To prevent rust forming during storage, the amount of exposed ram piston rod should be kept to a

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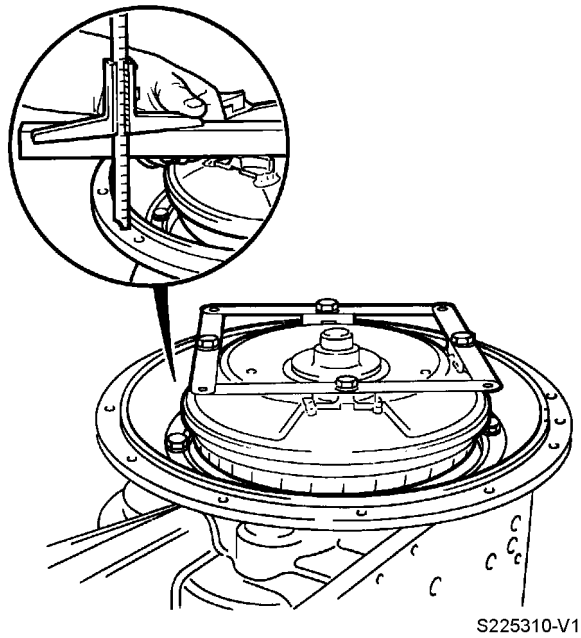


Fig 78.

34 Install the channel plate and shift unit as follows:

Apply Loctite 241 to the M10 threaded plug **79-19** and install.

35 Fit the converter relief valve.

Note: *Deviations from the prescribed opening pressure 9+1 bar (determined during bench testing) can be corrected by means of a corresponding shim **79-20**.*

Note: *If required install the ball **79-21** during the re-assembly of the channel plate. See step 38.*

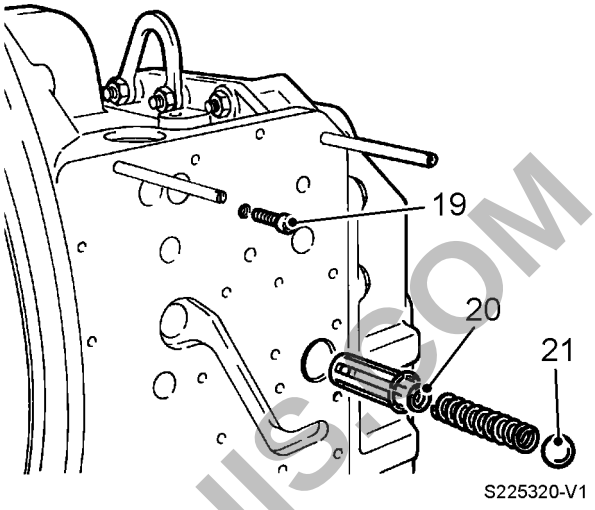


Fig 79.

36 Grease both check valves and insert into bores.

37 Fit two M8 adjusting screws **80-22**. Position the 1st gasket, adapter plate, 2nd gasket and pre-assembled channel plate against the housing until contact is obtained.

Note: *Position the ball of the converter relief valve.*

38 Fasten the channel plate using M8 socket head screws and washers as follows:

M8 screws DIN 6912 **80-23** (3 off). Torque tighten to 16Nm (12 lbf ft).

M8 screws DIN 912 **80-24** (7 off). Torque tighten to 23Nm (17 lbf ft).

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Removal and Replacement of Control Lever

1 Prise out centre of steering wheel **6-D** using a fine bladed screwdriver.

2 Remove steering wheel securing nut **6-E** and withdraw steering wheel.

3 Release the two column cover securing bolts, **6-F** and remove column cover **6-G**.

4 Disconnect connector **6-SE** and gently pull the control lever sideways to clear the locating spigot, **6-H** from the steering column.

5 Assembly is reverse of removal procedure.

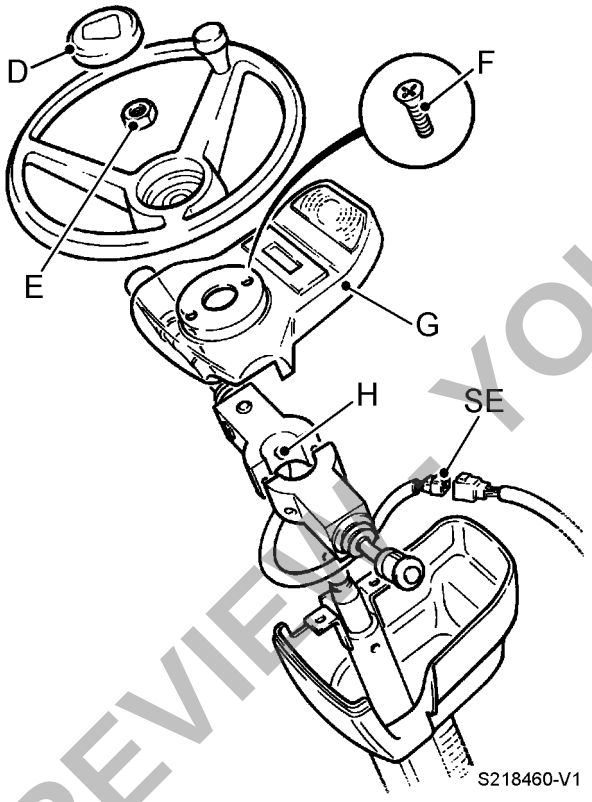


Fig 6.

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