Open front screen

Service Manual

JS200-JS260 - Tier III Auto

Publication No.

9803/6580-6

Issued by JCB Technical Publications, JCB Aftermarket Training, Woodseat, Rocester, Staffordshire, ST14 5BW, England. Tel +44 1889 591300 Fax +44 1889 591400

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Torque Settings

Zinc Plated Fasteners and Dacromet Fasteners

T11-002

Introduction

Some external fasteners on JCB machines are manufactured using an improved type of corrosion resistant finish. This type of finish is called Dacromet and replaces the original Zinc and Yellow Plating used on earlier machines.

The two types of fasteners can be readily identified by colour and part number suffix. ⇒ *Table 1. Fastener Types (1-5)*.

Table 1. Fastener Types

Fastener Type	Colour	Part No. Suffix
Zinc and Yellow	Golden finish	'Z' (e.g. 1315/3712Z)
Dacromet	Mottled silver finish	'D' (e.g. 1315/3712D)

Note: *As the Dacromet fasteners have a lower torque setting than the Zinc and Yellow fasteners, the torque figures used must be relevant to the type of fastener.*

Note: *A Dacromet bolt should not be used in conjunction with a Zinc or Yellow plated nut, as this could change the torque characteristics of the torque setting further. For the same reason, a Dacromet nut should not be used with a Zinc or Yellow plated bolt.*

Note: *All bolts used on JCB machines are high tensile and must not be replaced by bolts of a lesser tensile specification.*

Note: *Dacromet bolts, due to their high corrosion resistance are used in areas where rust could occur. Dacromet bolts are only used for external applications. They are not used in applications such as gearbox or engine joint seams or internal applications.*

Bolts and Screws

Use the following torque setting tables only where no torque setting is specified in the text.

Note: *Dacromet fasteners are lubricated as part of the plating process, do not lubricate.*

Torque settings are given for the following conditions:

Condition 1

- Un-lubricated fasteners
- Zinc fasteners
- Yellow plated fasteners

Condition 2

- Zinc flake (Dacromet) fasteners
- Lubricated zinc and yellow plated fasteners
- Where there is a natural lubrication. For example, cast iron components

Verbus Ripp Bolts

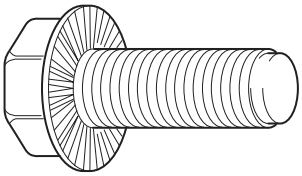
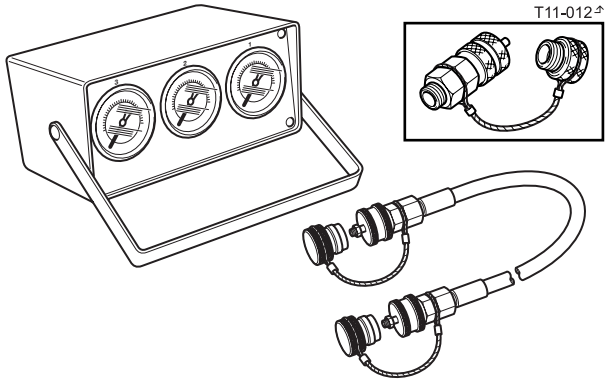


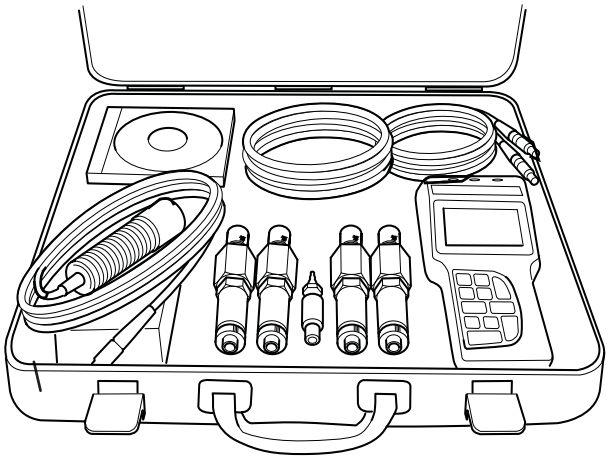
Fig 1.

Torque settings for these bolts are determined by the application. Refer to the relevant procedure for the required settings.

Numerical List

Part Number	Description	See Section
892/00041	De-glazing Tool	K

Note: *No longer available, refer to 998/11051 JCB ServiceMaster Digital Hydraulic Datalogger Pressure Test Kit.* ⇨ *Fig 35. (1-25)**.*	892/00201	Replacement Gauge 0-20 bar (0-300 lbf/in²)
 **Fig 34. 892/ 00253 Hydraulic Circuit Pressure Test Kit**	892/00202	Replacement Gauge 0-40 bar (0-600 lbf/in²)
	892/00203	Replacement Gauge 0-400 bar (0-6000 lbf/in²)
	892/00254	Replacement Hose
	993/69800	Seal Kit for 892/00254 (can also be used with probe 892/00706)
	892/00706	Test Probe
	892/00347	Connector - Hose to gauge

 **Fig 35. 998/11051 JCB ServiceMaster Digital Hydraulic Datalogger Pressure Test Kit**	998/11052	Hand Held 4-Channel ServiceMaster Unit
	998/11053	SensoWin Software Kit and PC Cable
	998/11054	Equiment Case SCC-750
	998/11055	0-600 Bar Pressure Transduce x2
	998/11056	0-100 Bar pressureTransducer x2
	998/11057	RPM Tachometer (includes fixed cable, 2 meters)
	998/11058	5 Meter Connecting Cable
	998/11059	M16 Metric Adaptors for Test Points x4
	998/11060	400mm Test Hose 90˚ HSP to M16 x2
	998/11061	400mm Test Hose Straight HSP to M16 x2

Section K - Engine

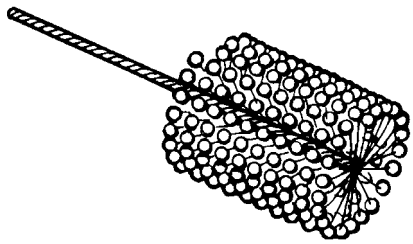


Fig 47. 892/00041 - De-glazing Tool for Cylinder Bores

To assist bedding-in of new piston rings.

Safety Check List

P11-1007_3

Safety - Yours and Others

INT-1-3-1_3

All machinery can be hazardous. When a machine is correctly operated and properly maintained, it is a safe machine to work with. But when it is carelessly operated or poorly maintained it can become a danger to you (the operator) and others.

In this manual and on the machine you will find warning messages. Read and understand them. They tell you of potential hazards and how to avoid them. If you do not fully understand the warning messages, ask your employer or JCB distributor to explain them.

But safety is not just a matter of responding to the warnings. All the time you are working on or with the machine you must be thinking what hazards there might be and how to avoid them.

Do not work with the machine until you are sure that you can control it.

Do not start any job until you are sure that you and those around you will be safe.

If you are unsure of anything, about the machine or the job, ask someone who knows. Do not assume anything.

Remember

BE CAREFUL
BE ALERT
BE SAFE

General Safety

T1-043

⚠ WARNING

To operate the machine safely you must know the machine and have the skill to use it. You must abide by all relevant laws, health and safety regulations that apply to the country you are operating in. The Operator Manual instructs you on the machine, its controls and its safe operation; it is not a training manual. If you are a new operator, get yourself trained in the skills of using a machine before trying to work with it. If you don't, you will not do your job well, and you will be a danger to yourself and others.

INT-1-4-1

⚠ WARNING

Care and Alertness

All the time you are working with or on the machine, take care and stay alert. Always be careful. Always be alert for hazards.

INT-1-3-5

⚠ WARNING

Clothing

You can be injured if you do not wear the proper clothing. Loose clothing can get caught in the machinery. Wear protective clothing to suit the job. Examples of protective clothing are: a hard hat, safety shoes, safety glasses, a well fitting overall, ear-protectors and industrial gloves. Keep cuffs fastened. Do not wear a necktie or scarf. Keep long hair restrained. Remove rings, watches and personal jewellery.

INT-1-3-6_2

⚠ WARNING

Alcohol and Drugs

It is extremely dangerous to operate machinery when under the influence of alcohol or drugs. Do not consume alcoholic drinks or take drugs before or while operating the machine or attachments. Be aware of medicines which can cause drowsiness.

INT-1-3-9_2

Safety Labels

Introduction

T1-014_2

⚠ WARNING

Safety Labels

Safety labels on the machine warn you of particular hazards. You can be injured if you do not obey the safety instructions shown.

INT-1-3-11

Safety labels are strategically placed around the machine to remind you of possible hazards.

If you need eye-glasses for reading, make sure you wear them when reading the safety labels. Do not over-stretch or place yourself in dangerous positions to read the safety labels. If you do not understand the hazard shown on the safety label, then refer to ***Safety Label Identification***.

Note: *The illustration(s) show a typical machine model. Your machine may look different from the model shown.*

Keep all safety labels clean and readable. Replace lost or damaged safety labels. Make sure replacement parts include safety labels where necessary. Each safety label has a part number printed on it, use this number to order a new safety label from your JCB distributor.

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.

Functional Test and Final Inspection

	Operation	10	50	250	500	1000	2000	4000
ENGINE								
Maximum No-Load Speed	- Check				☐	☐	☐	☐
Exhaust Smoke (excessive)	- Check	☐	☐	☐	☐	☐	☐	☐
Coolant System - Leaks	- Check			☐	☐	☐	☐	☐
Stop Control - Operation	- Check			☐	☐	☐	☐	☐
Fuel System - Leaks and Contamination	- Check	☐	☐	☐	☐	☐	☐	☐
All Fuel Hoses	- Change							☐
TRANSMISSION								
Slew Brake Operation	- Check				☐	☐	☐	☐
HYDRAULICS								
Operation All Services	- Check	☐	☐	☐	☐	☐	☐	☐
Accumulator (engine stopped)	- Check	☐	☐	☐	☐	☐	☐	☐
Hoses and Pipework - Damage/Leaks	- Check			☐	☐	☐	☐	☐
ELECTRICS								
Starter Motor - Connections	- Check/Clean			☐	☐	☐	☐	☐
Alternator - Output	- Check			☐	☐	☐	☐	☐
All Electrical Equipment Operation, (e.g. warning lights, beacon, alarms, horn, wipers etc.)	- Check	☐	☐	☐	☐	☐	☐	☐
UNDERCARRIAGE								
Track operation	- Check	☐	☐	☐	☐	☐	☐	☐
BODYWORK AND CAB								
Doors and Canopy - Fitment/Leaks	- Check				☐	☐	☐	☐
Locks	- Check				☐	☐	☐	☐
SEAT								
Seat and Seat Belts - Condition and Security	- Check					☐	☐	☐
Seat Adjustments - Correct Operation	- Check and Grease				☐	☐	☐	☐
Seat Adjustments - Correctly Setup for Operator	- Check	☐	☐	☐	☐	☐	☐	☐
ATTACHMENTS								
Teeth and Side Cutters	- Check				☐	☐	☐	☐
Attachment Circuit Pressure	- Check				☐	☐	☐	☐
Operation	- Check				☐	☐	☐	☐

JS360 and Variants

Table 11.

Item	Lubricant	International Specification	Capacity
ENGINE	⇨ *Engine Lubrication Chart (3-23)*		38 litres (8.4 UK gal) (10.1 US gal)
TRACK GEARBOX	JCB HD90 Gear Oil	API-GL-5, MIL-L-2105	2 x 5 litres (2 x 1.10 UK gal) (2 x 2.32 US gal)
SLEW GEARBOX	JCB HD90 Gear Oil	API-GL-5, MIL-L-2105	16 litres (3.52 UK gal) (4.23 US gal)
TRACK ROLLERS AND IDLER WHEEL	JCB HD90 Gear Oil	API-GL-5, MIL-L-2105	
RECOIL SPRING CYLINDER	JCB Special HP Grease	Lithium complex (NLGI) inc.extreme pressure additives	
HYDRAULIC SYSTEM	⇨ *Hydraulic Oil Chart (3-23)*		320 litres (70.4 UK gal) (84.5 US gal)
SLEW RING			
- BEARING	JCB Special HP Grease	Lithium complex (NLGI) inc. extreme pressure additives	--
- GEAR TEETH			--
ALL OTHER GREASE POINTS			--
COOLING SYSTEM	⇨ *Coolant Mixtures (3-26)*	ASTM D - 6210	38 litres (8.36 UK gal) (10 US gal)
FUEL TANK	⇨ *Fuel System (3-67)*		650 litres (143.0 UK gal) (171.7 US gal)

Pay particular attention to the cab windows. Make sure that the radiator grille is not blocked.

Do not allow mud to build up on the tracks and running gear. ⇨ *Tracks and Running Gear (3-86)*

Interior

CAUTION

Never use water or steam to clean inside the cab. The use of water or steam could damage the on-board computer and render the machine inoperable. Remove dirt using a brush or damp cloth.

8-3-4-8

Cleaning the Tracks

WARNING

If two people are doing this job make sure that the person operating the controls is a competent operator. If the wrong control lever is moved, or if the controls are moved violently, the other person could be killed or injured.

If you will be working with another person, make sure that you both understand what is to be done. Learn and use the recognised signalling procedures. Do not rely on shouting - he will not hear you.

To clean the tracks, you must turn them. When the tracks are turning, keep clear of rotating parts. Before starting this job, make sure that you have no loose clothing (cuffs, ties etc.) which could get caught in moving parts. Keep people not involved with this job well away!

MD-3-3-2

1 Prepare the Machine. ⇨ *Prepare the Machine for Maintenance (3-30)*.

Park the machine on level ground. Open the bucket and swing the boom until it is at 90° to the track. Lower the bucket to the ground.

2 Raise the Track.

Operate the boom and dipper controls so that the track on the side nearest the bucket is lifted up clear of the ground.

3 Rotate the Track.

When it is safe to do so and you are sure that everyone is clear of the machine, operate the controls to rotate the track which is off the ground. Rotate it first one way and then the other to shake off the mud. If necessary, the person outside may use water to get the mud off.

4 Inspect the Track.

When you have finished, inspect the track rollers, sprockets and idler wheels for damage and oil leaks.

5 Lower the Track.

Operate the boom and dipper controls to lower the track to the ground.

6 Repeat for the Opposite Track.

Swing the boom round to the other side and repeat steps 2 to 5 inclusive for the other track.

Cleaning the Radiator and Oil Cooler

A clogged radiator and/or oil cooler can lead to engine overheating. Regularly check for a build-up of dirt and debris and if necessary, use compressed air to clean-out the grille. At the same time check all hoses for damage or perishing, and replace if necessary.

Terminal Cleaning

1 Prepare the machine. ⇨ ***Prepare the Machine for Maintenance (3-30)***.

2 Gain access to the battery and remove the terminals. ⇨ ***Battery Disconnection/Connection (3-41)***.

3 If the terminal is dirty, clean the post. Make sure the terminals are tight.

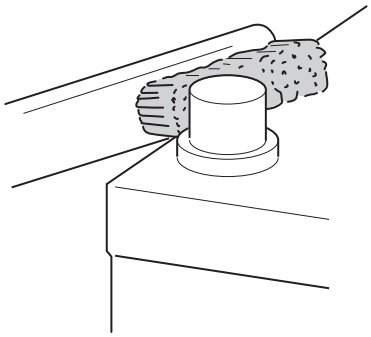


Fig 17.

4 If the terminal post is corroded and generates white powder wash the terminal with hot water. If considerable corrosion is detected, clean with a wire brush or abrasive paper.

5 After cleaning, apply a thin coat of petroleum jelly to the terminal.

6 Re-connect the terminals ⇨ ***Battery Disconnection/ Connection (3-41)***.

Checking the Electrolyte Level - Type 1 Batteries

⚠ CAUTION

Do not disconnect the alternator, the battery, or any part of the charging circuit with the engine running.

8-3-4-1

Batteries used in normal temperate climate applications should not need topping up. However, in certain conditions (such as prolonged operation in high ambient temperatures or if the alternator overcharges) the electrolyte level should be checked as described below.

1 Open the battery compartment **A**.

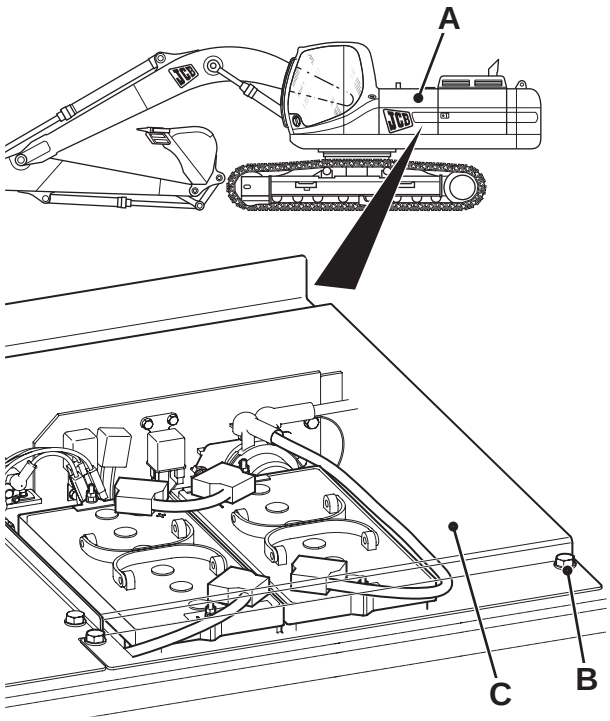


Fig 18. JS290-JS360

2 Remove bolts **B** and battery cover plate **C**, or nuts **D**, battery retainers **E** and covers **F**.

Table 21. JS290 and variants

No.	Tightening Point	Bolt Diameter	Wrench mm	Tightening Torque		Checking Torque	
				Nm	lbf ft	Nm	lbf ft
1(1)	Travel Motor	M16	24	290	213	265	195
2(1)	Drive Sprocket	M16	24	290	213	265	195
3(1)	Idler Wheel	M16	24	290	213	265	195
4(1)	Upper (Carrier) Roller	M16/M20	24/30	290/550	213/405	265/515	195/380
5(1)	Lower (Track) Roller	M16	24	290	213	265	195
6(1)	Track Guard	M16	24	290	213	265	195
7	Shoe Bolt	M20	30	765	564	689	508
8	Counter weight	M27	41	1440	1062	1335	980
9(1)	Turntable Bearing (Undercarriage)	M24	36	960	708	875	645
10(1)	Turntable Bearing (Slew Frame)	M24	36	960	708	875	645
11(1)	Slew Equipment	M24	36	950	700	900	663
12(1)	Engine (Engine Mount)	M16	24	290	213	265	195
13(1)	Engine Bracket	M10/M12	17/19	68/118	50/87	62/107	45/79
14	Radiator	M12	19	65	48	60	44
15(1)	Hydraulic Pump	M10	17	68	50	62	45
16(1)	Hydraulic Oil Tank	M16	24	250	184	225	162
18(1)	Control Valve	M16	24	290	213	265	195
19	Battery	M6	10	7	5	6	4
20(1)	Rotary Coupling	M12	19	116	85	105	80
21	Cab	M16	24	132	97	125	92

(1) Use JCB Threadlocker and sealer (High Strength) and tighten to the torque listed.

Changing The Coolant

1 Park the machine on solid, level ground.

2 Turn the engine OFF and remove the ignition key.

3 Let the engine cool down.

⚠ 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

4 Drain the system.

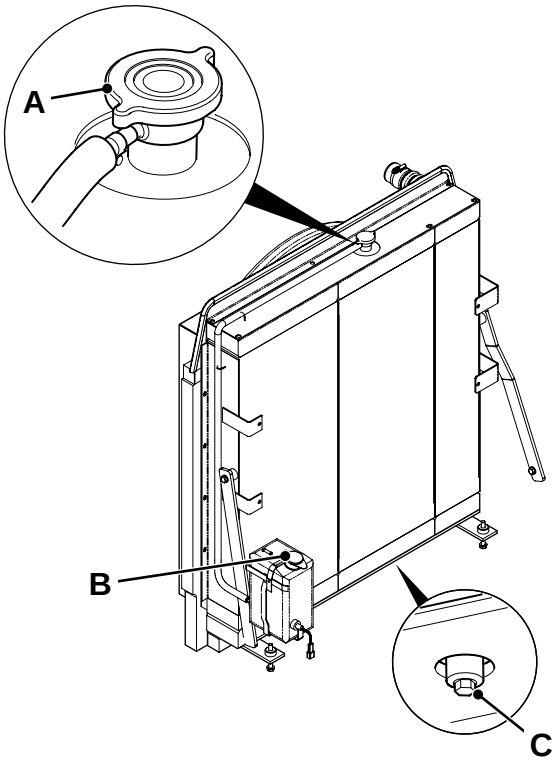


Fig 38.

a Carefully release the radiator cap **A** to release system pressure.

b Remove the radiator cap.

c Remove the expansion bottle cap **B**.

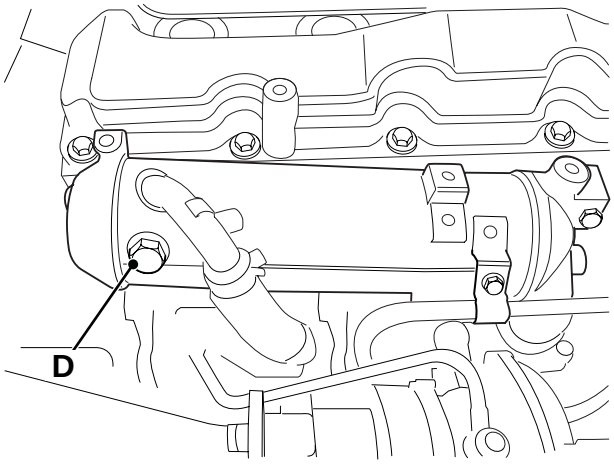


Fig 39. 4JJ Engine

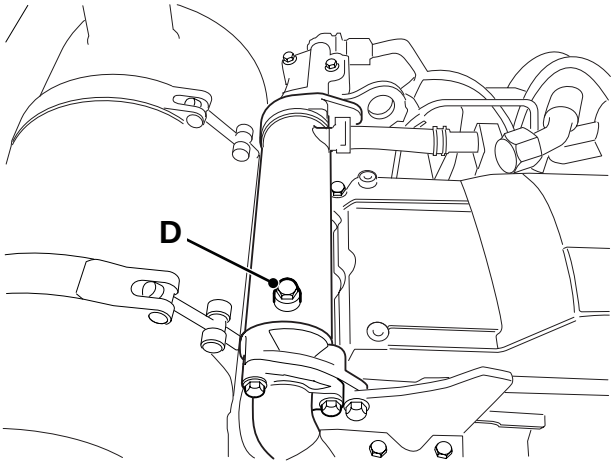


Fig 40. 4HK, 6HK Engine

d Remove the EGR cooler plug **D**.

e Open the radiator drain plug **C**, ⇒ *Fig 38. (3-62)*.

f Let the coolant drain out.

5 Flush the system if necessary. Use clean water.

6 Close the radiator drain plug **C**.

7 Fill the system with pre-mixed water/antifreeze. ⇒ *Coolant Mixtures (3-26)*.

Bleeding the System

Air in the fuel system could cause misfiring or failure to start. Air will enter the system if any part of it is disconnected or emptied.

Note: *Running the engine with air in the system could damage the fuel injection pump. After maintenance, remove air from the fuel system as detailed below.*

1 Prepare the machine. ⇨ ***Prepare the Machine for Maintenance (3-30)***.

2 Locate the fuel filter **A**, ⇨ ***Fig 51. (3-72)***.

3 Loosen the air bleeder plug **B** and operate the priming pump **C** until fuel appears at plug **B**.

4 Tighten plug **B** and operate pump **C** until the fuel filter is filled with fuel.

5 Wait approximately one minute and loosen air bleeder plug **B** to bleed any air from the fuel filter.

6 Repeat the previous three steps until no air comes from the bleeder plug **B**.

7 Tighten the plug **B** securely and wipe off any spilt fuel.

8 Start the engine but do not increase engine speed. If the engine fails to start repeat procedure from step 5.

9 After engine start up, keep at idle speed for five seconds before increasing speed slowly for three minutes.

10 Use throttle dial to operate the machine at maximum speed.

11 Stop machine and check for leaks.

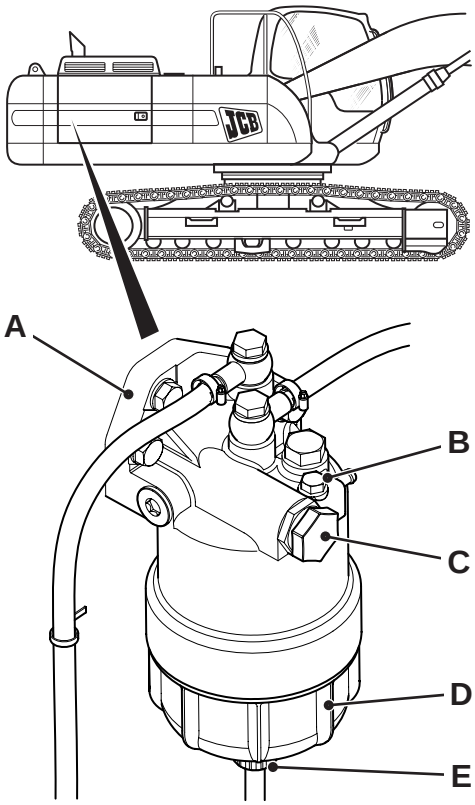


Fig 51.

Draining Water and Sediment from the Hydraulic Tank

1 Prepare the machine. ⇨ ***Prepare the Machine for Maintenance (3-30)***.

2 Release tank pressure, ⇨ ***Releasing Tank Pressure (3-74)***.

3 Draining the water and sediment. Carefully loosen the drain plug **C** on the bottom of the tank and drain the sediment and water accumulated at the bottom of the tank.

Note: *Have a drain pan ready. The task is complete when clean hydraulic oil flows out.*

4 Seal the system. Tighten the drain plug **C**.

Air Bleeding Procedures

After replacing the hydraulic oil or repairing or replacing hydraulic components or removing hydraulic pipes, bleed air from the hydraulic circuit

Bleeding Air from the Hydraulic Pump

1 Prepare the machine. ⇨ ***Prepare the Machine for Maintenance (3-30)***.

2 Locate the hydraulic pump, ⇨ ***Machine Description (1-5)***.

3 Temporarily loosen the hose connection at **A** to check that oil does not come out of the pump.

4 If oil comes out re-tighten the connection, if it does not come out remove the hose and pour hydraulic oil into the pump case through the port. When oil comes out of the port refit the hose connection.

5 Run the machine at idle for five minutes.

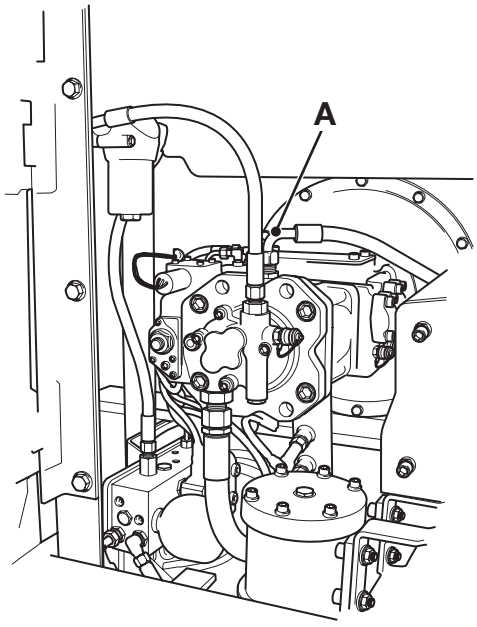


Fig 63. JS115-190

Troubleshooting

To extend the service life and improve the operation of the machine, daily inspection and lubrication are necessary as well as immediately isolating any problem found and dealing with it. If the machine is operated with the problem uncorrected, it may lead to larger trouble and possibly to a big accident.

If trouble occurs, search for the cause in the items below and make adjustments, repairs, etc. as necessary. If the cause cannot be isolated, contact your JCB distributor.

Engine and Related Area

Table 26. Engine does not start

Cause	Remedy
Defective starter switch	Connect, repair connection
Defective rotation of starter (Starter rotates slowly)	Discharged battery, starter problems, contaminated or loose wiring connection
Improper viscosity of engine oil	Inspect and replace as necessary
Excessive cooling of engine (Cold weather)	Preheat with air heater. Warm up the coolant (add hot water)
Possible seizure in engine	Repair(1)
Incomplete air bleeding of fuel system	Completely bleed air
No fuel in fuel tank	Refill
Fuel quality unsuitable	Inspect and replace as necessary
Fuel filter clogged	Clean or replace
Low compression	Repair(1)
Defective fuel injection system	Repair(1)

Table 27. Engine stops during operation

Cause	Remedy
No fuel in fuel tank	Refill
Fuel filter clogged	Clean and replace
Air is mixed in the fuel system	Retighten fuel pipe connections and bleed system

Table 28. Low oil pressure

Cause	Remedy
Low oil	Refill
Defective oil pressure switch	Replace(1)
Oil filter clogged	Replace element
Low oil viscosity	Replace with oil of viscosity matching temperature
Improper operation of oil pump	Replace parts(1)
Oil leakage at connections	Tighten connections

Section B

Body & Framework

Service Manual - JS200-JS260 - Tier III Auto

Publication No.

9803/6580-6

Issued by JCB Technical Publications, JCB Aftermarket Training, Woodseat, Rocester, Staffordshire, ST14 5BW, England. Tel +44 1889 591300 Fax +44 1889 591400

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Shipping Weight

Approximate weight when equipped with monoboom, medium length dipper, bucket, operator and full fuel tank except where indicated otherwise.

Model	Track shoe width	Weight
JS200NC	500mm	19845 kg
JS200NC	600mm	20095 kg
JS200NC	700mm	20350 kg
JS200SC	500mm	19925 kg
JS200SC	600mm	20180 kg
JS200SC	700mm	20430 kg
JS200LC	600mm	20605 kg
JS200LC	700mm	20870 kg
JS200LC	800mm	21140 kg
JS200LC	900mm	21190 kg

Model	Track shoe width	Weight
JS210LC	600mm	21090 kg
JS210LC	700mm	21355 kg
JS210LC	800mm	21625 kg
JS210LC	900mm	21675 kg

Model	Track shoe width	Weight
JS220NC	500mm	21144 kg
JS220NC	600mm	21396 kg
JS220NC	700mm	21648 kg
JS220SC	500mm	21227 kg
JS220SC	600mm	21479 kg
JS220SC	700mm	21731 kg
JS220LC	600mm	21904 kg
JS220LC	700mm	22172 kg
JS220LC	800mm	22440 kg
JS220LC	900mm	22490 kg

Model	Track shoe width	Weight
JS220NC TAB	500mm	22194 kg
JS220NC TAB	600mm	22446 kg

Model	Track shoe width	Weight
JS220NC TAB	700mm	22698 kg
JS220SC TAB	500mm	22277 kg
JS220SC TAB	600mm	22529 kg
JS220SC TAB	700mm	22781 kg
JS220LC TAB	600mm	22954 kg
JS220LC TAB	700mm	23222 kg
JS220LC TAB	800mm	23490 kg
JS220LC TAB	900mm	23540 kg

Model	Track shoe width	Weight
JS235HD	550mm	22920 kg

Model	Track shoe width	Weight
JS240SC	600mm	23750 kg
JS240NC	600mm	24270 kg
JS240LC	700mm	24620 kg

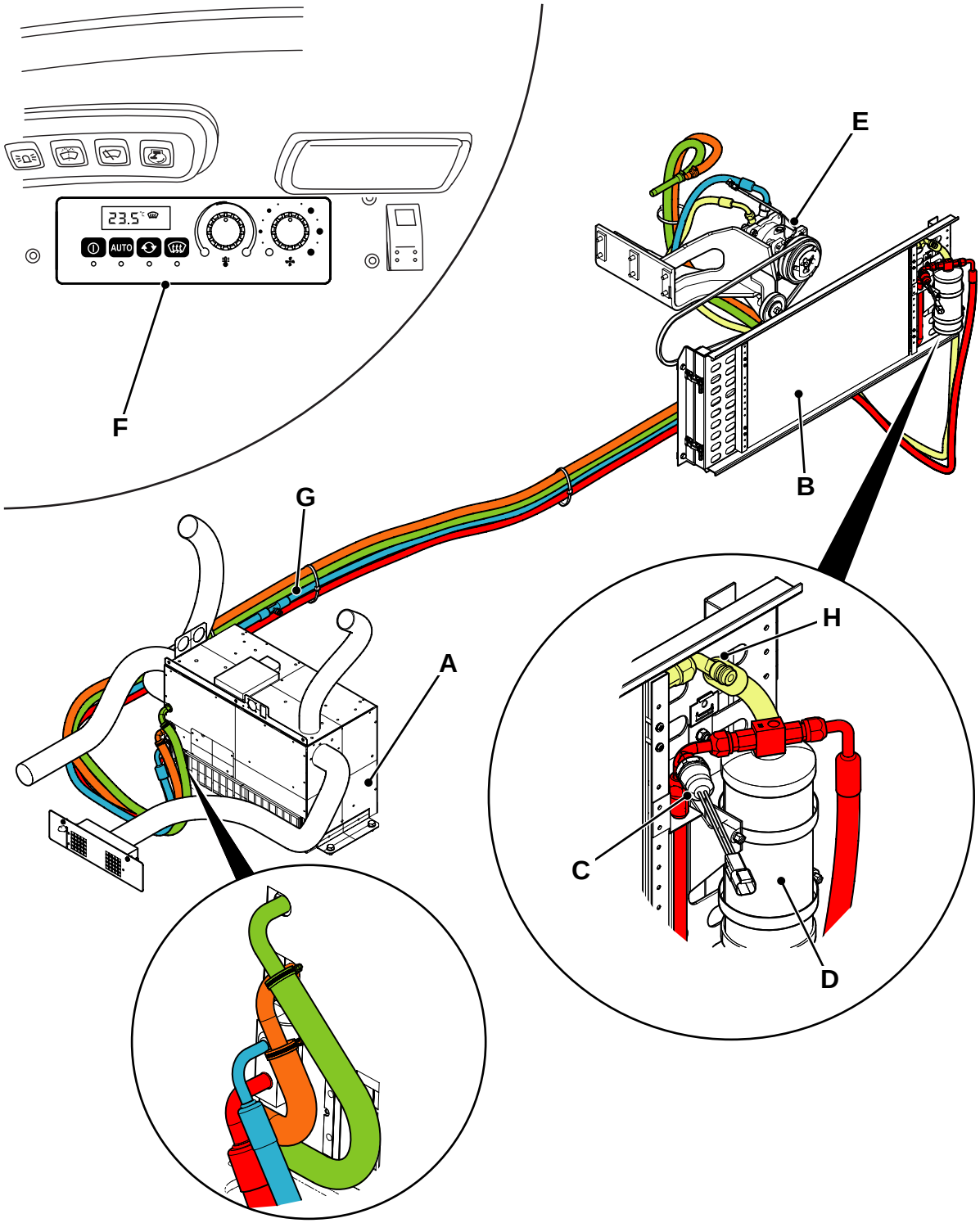
Model	Track shoe width	Weight
JS260SC	600mm	24920 kg
JS260NC	600mm	25440 kg
JS260LC	700mm	25790 kg

Model	Track shoe width	Weight
JS260SC TAB	600mm	26320 kg
JS260NC TAB	600mm	26840 kg
JS260LC TAB	700mm	27190 kg

Basic Operation

Automatic Temperature Control (ATC) System

TB-011



716480-C3

Fig 1.

Table 3. Error Code 3 - Blower Potentiometer Error (User Interface / Control Panel)

Effect	Causes	Remedy
The Blower motor speed is irregular in Auto mode.The Blower motor speed is fixed or cannot be changed in manual mode.	Wiring Error (open or short-circuit).	Check for 24V at blower motor.
		Check the continuity from blower motor earth to Pin 7 on PWM.
	There is no blower speed signal from the user interface to the ATC Control Module.	Check the continuity from pin C15 on user interface to pin 28 on ATC control module. (Expected reading on Pin 28 0.5V to 3.0 V).
	There is no signal from the ATC control module to the PWM.	Check the continuity from Pin 5 on ATC control module to Pin 6 on PWM unit.
	Bad earth on blower motor / PWM.	Check for good earth as shown on schematic.
	Defective potentiometer.	Replace user interface / control panel.

Table 4. Error Code 4 - Water Valve Potentiometer Error (User Interface / Control Panel)

Effect	Causes	Remedy
The temperature shown on the display cycles between 22 degrees and error code 4.There is no temperature change There is no fan speed in Manual Mode.There is no temperature change / the fan speed operates correctly in Auto mode.	There is no temperature signal from the user interface to the ATC control module.	Check the continuity from Pin D1 on the user interface to pin 29 on ATC control Module. (Expected reading on Pin 29 - 0.5V to 3.0 V).
	There is no temperature signal from the ATC control module to the PWM.	Check the continuity from Pin 3 on ATC control module to Pin D on water valve.
		Check the continuity from Pin A on water valve to Pin 5 on PWM.
	There is a bad earth on water valve / PWM.	Check for good earth as shown on schematic.
	Defective potentiometer.	Replace user interface / control panel.

Table 5. Error Code 7 - Cab Air Sensor Error (Air Inlet Temperature Sensor)

Effect	Causes	Remedy
The unit cannot cool the cab. The compressor disengages.The Demist mode does not work / The Recirculation Mode is O.K.There is no temperature change / the fan speed operates correctly in Auto mode. The temperature changes on LCD display. The cab temperature does not correspond.	There is no temperature signal from the sensor to the ATC control module.	Check the continuity between pin1 on the cab temperature sensor to pin 21 on ATC control module.
	There is a bad earth on the cab air sensor.	Check for good earth as shown on schematic.
	There is a defective sensor.	Replace the cab air sensor.

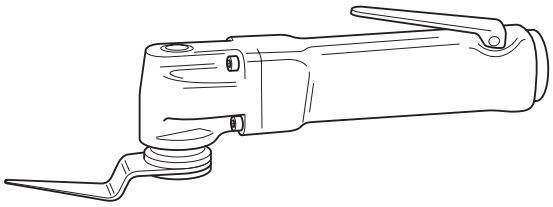


Fig 4. Pneumatic Knife

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 5. (B-37)***. This method uses a 3-core wire, a wire starter tube and two handles.

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

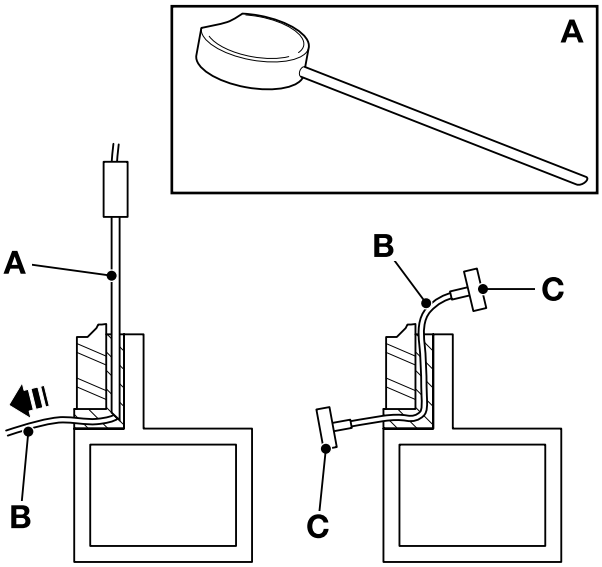


Fig 5. Braided Cutting Wire and Handles

ii Insert the braided cutting wire **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 **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 6. (B-37)***. The cut-out knife can be used as a left handed or right handed tool.

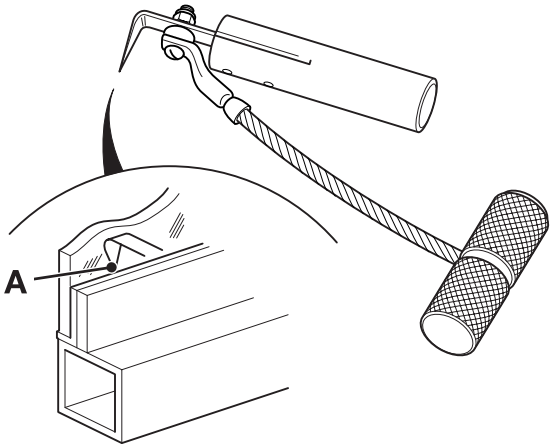


Fig 6. Cut-out Knife

i Insert the knife blade into the sealant.

ii Make sure that the blade of the knife is against the glass **A**. ⇒ ***Fig 6. (B-37)***.

iii Use the 'pull-handle' to pull the knife along and cut out the old sealant.

d Craft Knife. ⇒ ***Fig 7. (B-38)***. The blades **A** are replaceable.

i Insert the knife blade into the sealant.

ii Pull the knife along and cut out the old sealant.

Section C

Electrics

Service Manual - JS200-JS260 - Tier III Auto

Publication No.
9803/6580-6

Issued by JCB Technical Publications, JCB Aftermarket Training, Woodseat, Rocester, Staffordshire, ST14 5BW, England. Tel +44 1889 591300 Fax +44 1889 591400

World Class
Customer Support

A.M.S (Advanced Management System)

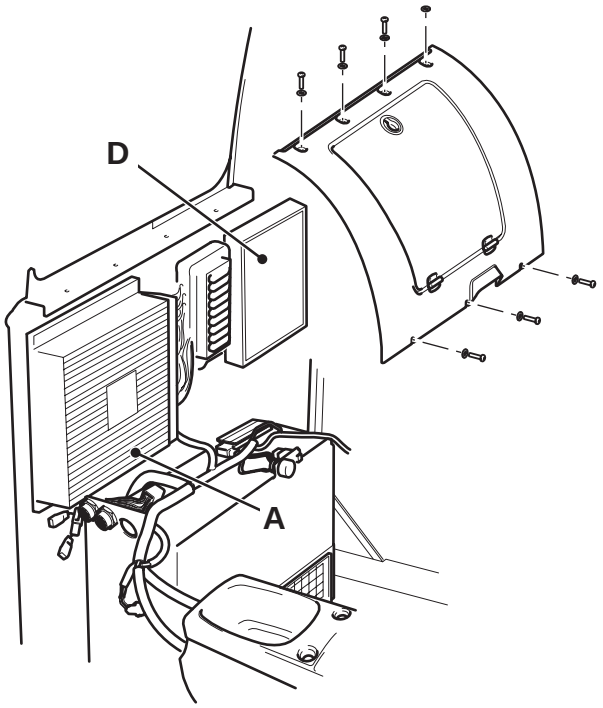
TC-011

Operation

The JCB A.M.S system is a whole machine electronic control system. The system controls engine speed, pump power, transmission, excavator functions, lights, wiper, auxiliary circuits, warning lamps, etc. The system is a 'CAN BUS' system which links Electronic Control Units (ECUs) on the vehicle. This stands for 'Controlled Area Network' and uses a special cable in the vehicle harness which consists of two signal wires twisted together covered by a metal foil to prevent any electrical interference. These signal wires form the CAN -BUS. The CAN - BUS is used to send text and fault codes between the ECUs. The electronic units receive inputs from switches and sensors and drive outputs such as solenoids, lamp bulbs and motors. The outputs of the ECUs are rated to the current requirement of the actuator.

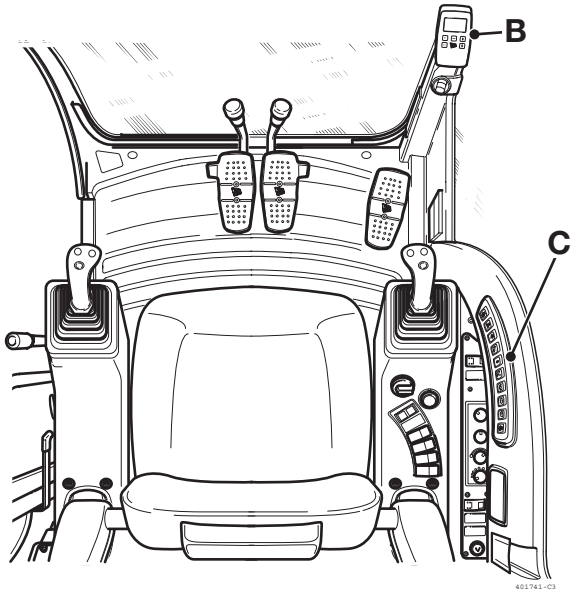
The system comprises of the following main electronic components.

- **A** Electronic Control Unit -1 (ECU-1)
- **B** Electronic Monitoring System (EMS)
- **C** Fascia switch panel (FSP).
- **D** Engine Control Module (ECM)



C030670-C3

Fig 6.



401741-C4

Fig 7.

Engine Throttle Control for Each Mode

Operation

The machine can operate in one of four different modes, depending upon the application required. The modes are selected by the "MODE" button on the EMS. The EMS displays the selected mode alongside the power mode legend. Selecting the different modes has the effect of setting the maximum possible engine speed for each working mode. Successive presses of the mode switch will cycle through the different modes in the order as shown below.

Note: *The last operating mode when the machine was stopped will be restored when the machine is restarted.*

Fig 21.

E	Economy
A	Auto
P	Precision
L	Lifting

"A" Auto Mode

In Auto mode the EMS displays "AUTO" and the letter "A" next to the power mode icon. The engine is allowed to operate over its selected rev range as defined by its programmed rev limit. The maximum rev limit is the same as the maximum permissible engine revolutions.

When in auto mode the auto idle feature is permanently active, if the throttle dial position is changed, the engine speed will not change until either the travel pressure switch (i/p 27), the upper pressure switch (i/p 26) or the auto mode pressure switch (i/p 25) are closed.

When the upper pressure switch is closed the engine speed will rise to full speed less 100 rpm (or in proportion to the throttle target input if less than 100%). When the upper pressure switch re-opens the engine speed will remain at this position for 3 seconds and then drop to 70% of the difference between auto and idle speed (plus idle speed) for the set auto idle time, after which it will drop to idle.

When the auto mode pressure switch is closed, the engine speed will rise to the full available engine speed. When the auto mode pressure switch re-opens the engine speed will drop to the full speed less 100 rpm for three seconds and then down to 70% of the difference between auto and idle speed (plus idle speed) for the set auto idle time, after which it will drop to idle.

When the travel pressure switch is closed, the engine speed will rise to the full available engine speed. When the travel pressure switch re-opens the engine speed will remain at full for three seconds, then will drop to the full speed less 100 rpm for the pre-set auto idle time, after which it will drop to idle

"E" Economy mode.

In standard mode the EMS displays "ECONOMY" and the letter "E" next to the power mode icon. The engine is allowed to operate over its selected rev range as defined by its programmed rev limit in direct proportion to the throttle input. However the maximum rev limit of 100 rpm less than the maximum permissible is imposed. Thus for a full throttle potentiometer setting the engine revolutions is 100 lower than it would be in the auto mode.

"P" Precision

In Precision mode the EMS displays "PRECISION" and the letter "P" next to the power mode icon. The engine is allowed to operate over its selected rev range as defined by its programmed rev limit in direct proportion to the throttle input. However the maximum rev limit of 200 rev/min less than the maximum permissible is imposed. Thus for a full throttle potentiometer setting the engine revolutions is 200 lower than it would be in the auto mode, the same as it is for lifting mode.

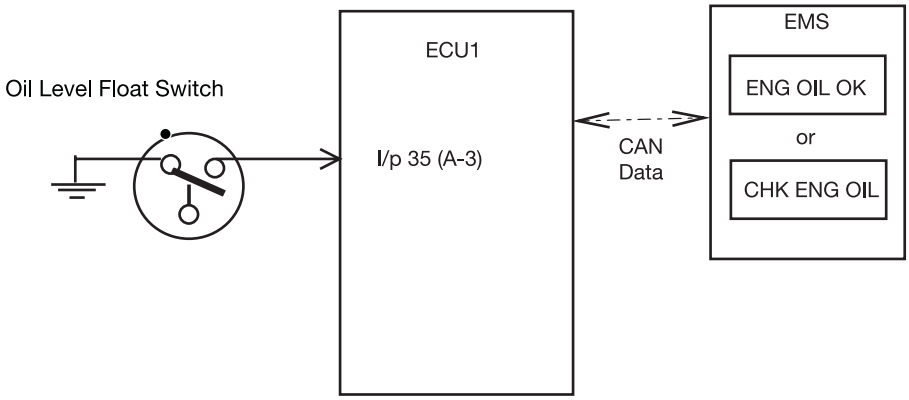
"L" Lifting mode

In Lifting mode the EMS displays "LIFTING" and the letter "L" next to the power mode icon. The engine is allowed to operate over its selected rev range as defined by its programmed rev limit in direct proportion to the throttle input. However the maximum rev limit of 200 rev/min. less than the maximum permissible is imposed. Thus for a full throttle potentiometer setting the engine revolutions is 200 lower than it would be in the auto mode, the same as it is for precision mode.

The engine speed will vary according to the following characteristic: ⇨ *Fig 22. (C-18)*

Engine Oil Level Warning

Operation



C049930-1

Fig 33.

The oil level float switch is positioned in the side of the engine.

When the engine oil level is at an acceptable level, the float switch is closed, applying an earth to the ECU1 i/p 35 (A-3)

When the engine oil level drops below the acceptable level, the float switch is opened, removing the earth from the i/p.

The i/p is only checked on machine ignition on.

The oil level check should occur before other machine or engine faults are raised.

When the EMS receives a CAN message from the ECU1 indicating that the oil level is OK, the EMS displays the message "ENG OIL OK" for 5 seconds.

When the EMS receives a CAN message from the ECU1 indicating that the oil level is low, the EMS displays the message "CHK ENG OIL" for 5 seconds and the buzzer sounds for 1.5 seconds.

Engine Start/Stop

Operation

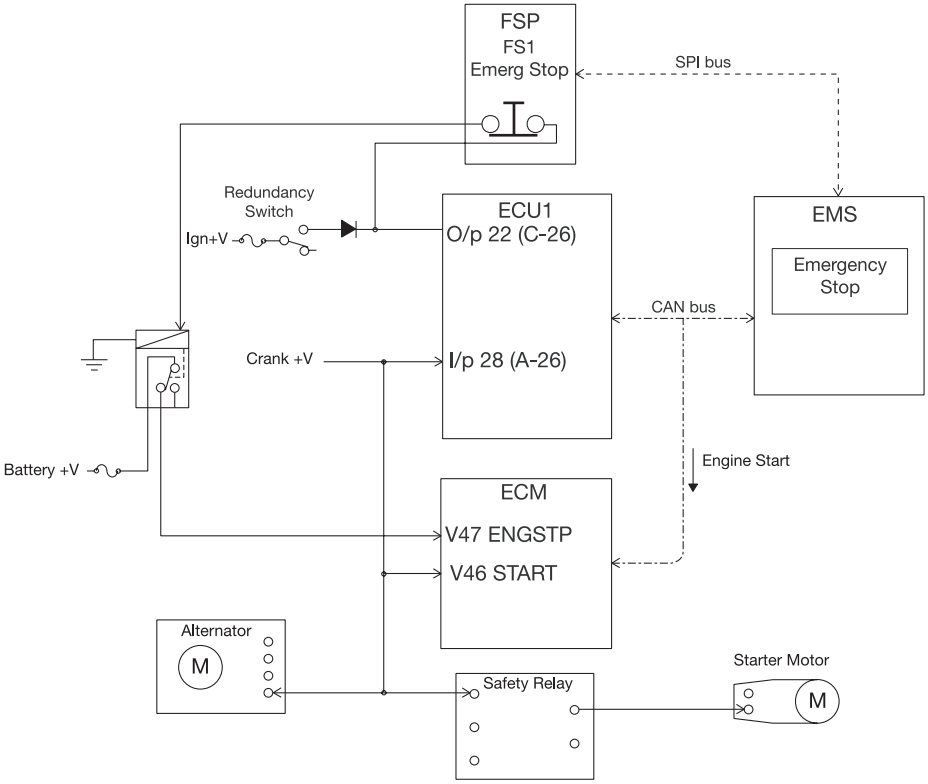


Fig 42.

Starting/Stopping the engine

When the ignition key is turned to the crank position, 24v is fed to:

- the ECU on i/p 28, (A-26) - Crank,
- the ECM on i/p V46 - START,
- the Safety Relay.

The ECU provides 24v from o/p 22 (C-26), through the closed contacts of the Emergency Stop button on the FSP to the coil of the emergency stop selay. The relay is energized, removing 24v from the ECM i/p V47 - ENGSTP.

The safety relay provides an output to the starter motor, and the ECM starts the engine.

When the engine is running, if the ignition key is switched off, the 24v from ECU o/p 22 (C-26) to the emergency stop relay is removed. The relay is de-energized, feeding 24v from the battery to the ECM i/p V47 - ENGSTP, and the engine is stopped.

Pressing the Emergency Stop Button

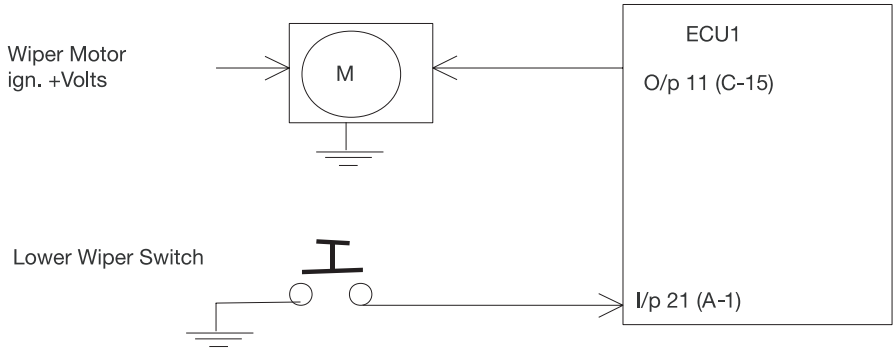
If the emergency stop button on the FSP is pressed whilst the engine is running, the 24v from ECU o/p 22, (C-26) to the Emergency Stop Relay is stopped. The relay is de-energized, feeding 24v from the battery to the ECM i/p V47 - ENGSTP, and the engine is stopped.

At the same time the EMS will display the message 'EMER STOP'. If the ignition is switched off and then back on, the system retains the emergency stop function until the emergency stop button on the FSP is pressed again.

Engine start is disabled unless the lever lock arm is raised. if the ignition is switched on and the lever lock arm is raised, the emergency stop remains off and the engine will not start. If cranking is attempted while the lever lock arm is down, the LIFT_LEVER message is displayed on the EMS and the servo isolator LED will flash on the EMS for the duration of the cranking.

Lower Wiper (option)

Operation



C027310GB-2

Fig 51.

The lower wiper is a customer selected option and is fitted to the lower glass panel at the front of the operator's cab.

The wiper has three modes of operation intermittent, continuous and off. Timing for the intermittent function is performed by ECU1. The same timer as utilised for the standard wiper is used to synchronise both wipers together.

When the lower wiper button is operated the ECU1 output number o/p 11 (C-15) is energised to start the wiper stroke. A hold on contact within the motor assembly retains power for the return stroke of the blade. A time delay equal to that set for the main wiper is activated before the output is energised again, giving intermittent operation.

A second press of the switch enables the wiper to operate continuously and the output is permanently energised.

A third press of the switch disables wiper operation.

Note: *If the upper (main) wiper is energised then the lower wiper output is energised at the same time, synchronising both wipers.*

Slew Brake (100%)

Operation

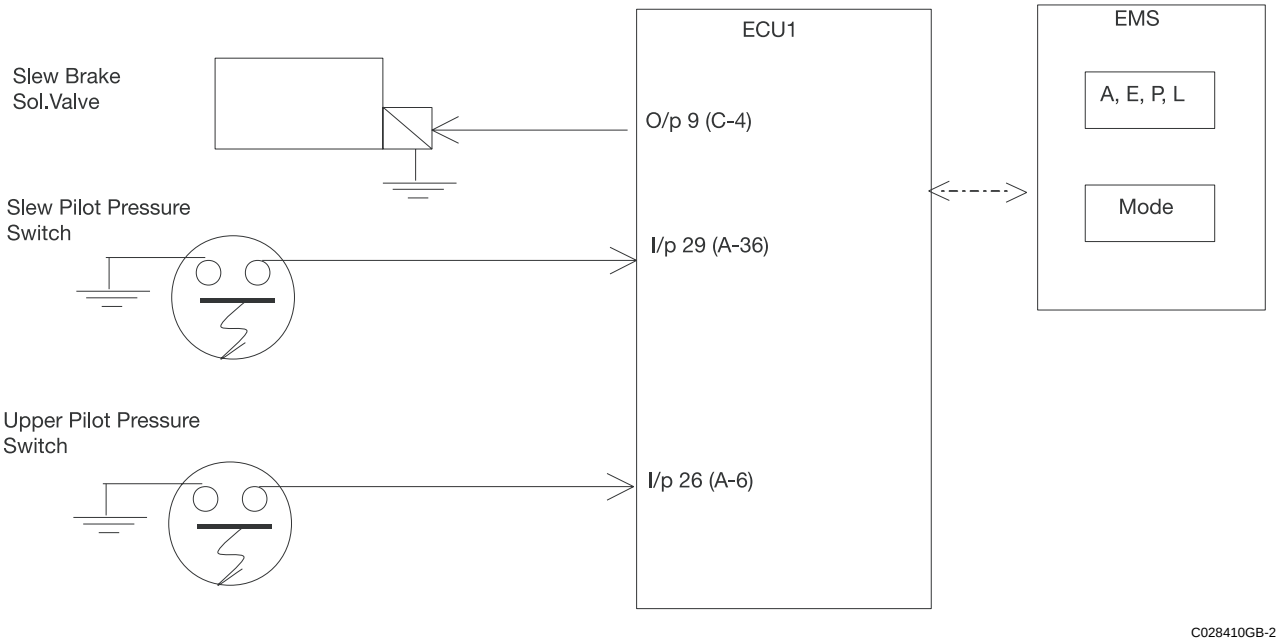


Fig 61.

The slew parking brake holds the current slew position of the machine and prevents slew drift.

This is the default operation with the engine running.

The operator signals for slew movement by moving the left hand joystick. This results in the slew pilot pressure switch being activated. This signals the ECU1 to energise the slew parking brake solenoid valve, thus enabling slew.

The slew pilot pressure switch is de-activated, by returning the joysticks to neutral, and the upper structure comes to a stop using a hydrostatic brake (cross lines relief valve). If this condition exists for 5 seconds then the slew parking brake solenoid is de-energised. Thus applying the slew brake.

To prevent any damage to the slew brake occurring when excavating the slew brake solenoid will remain energised and the slew brake remain off, if the upper pilot pressure switch is activated or re-activated within 5 seconds of the slew pressure switch closing.

If however the upper pilot pressure switch remains de-activated for 5 seconds or longer, the slew brake solenoid will de-energise (brake on). The slew brake solenoid will remain de-energised until the slew pilot pressure switch is activated.

When L mode (lifting) is selected, the upper pilot pressure switch is ignored and 100% brake applied. When the slew pilot switch is energised the slew parking brake is lifted.

By Default Slew parking brake is automatically applied at start up.

3-Speed Travel

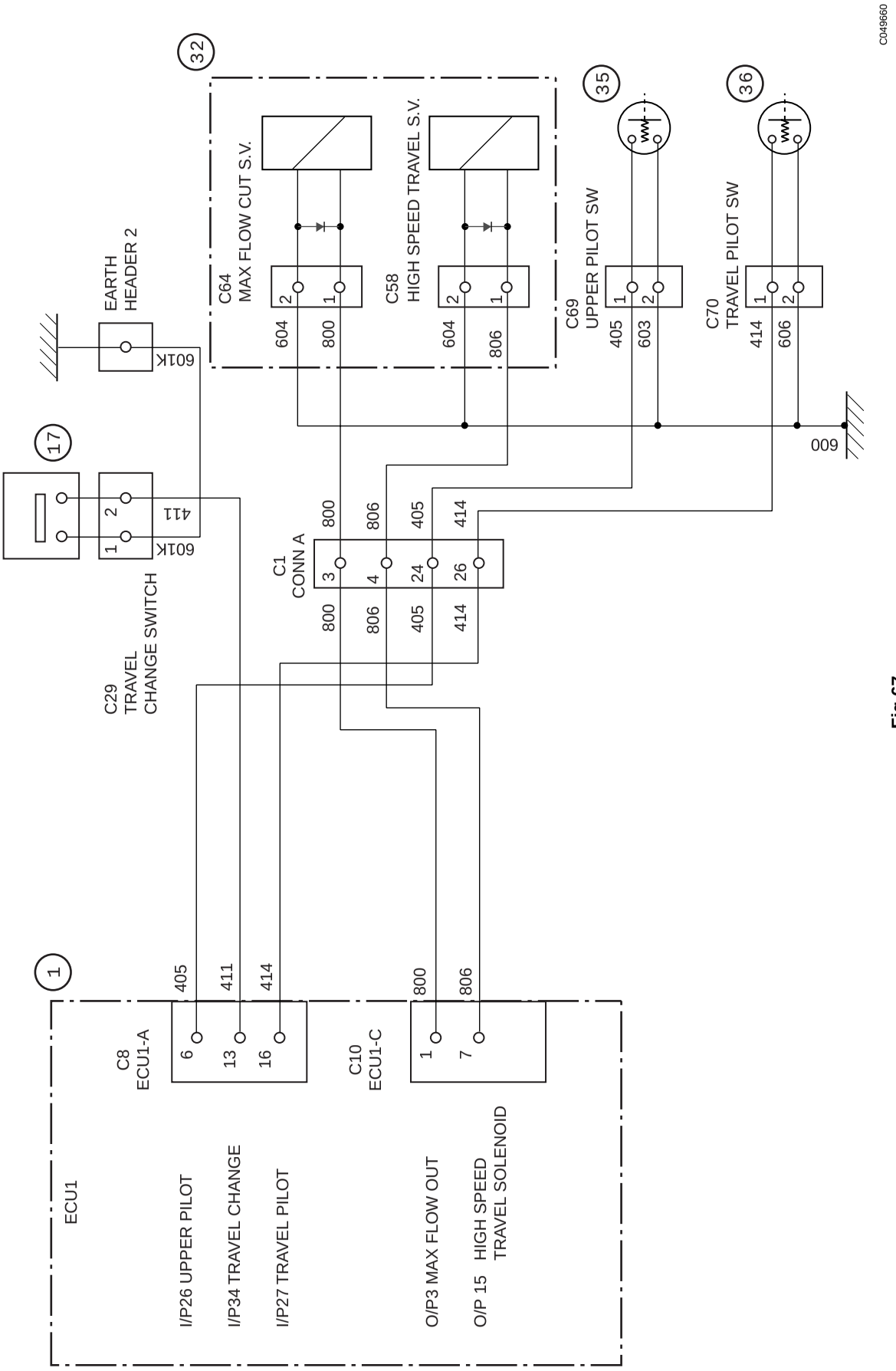


Fig 67.

Table 2.

Auto Tier 3										
Bar No	**Colour**	**Temp On**	**Temp Off**	**Water Temp LED**	**Caution LED**	**Reduces to E Mode**	**Flashing Bar graph**	**Buzzer**	**WATER TEMP**	**LOW POWER**
1	Green	50	48							
2	Green	60	58							
3	Green	70	68							
4	Green	75	73							
5	Green	80	78							
6	Green	82	80							
7	Green	84	82							
8	Green	86	84							
9	Green	88	86							
10	Green	89	87							
11	Green	90	88							
12	Green	92	90							
13	Green	93	91							
14	Green	95	93							
15	Green	97	95							
16	Green	99	97							
17	Red	101	99	☐						
18	Red	103	101	☐		☐				
19	Red	105	103	☐		☐	☐	☐	☐	
20	Red	108	106	☐	☐	☐	☐	☐	☐	☐
Overheat switch		105	91+/-4	☐		☐	☐	☐	☐	
Engine Control Module - Overheat control		108		Derated performance (50%)						

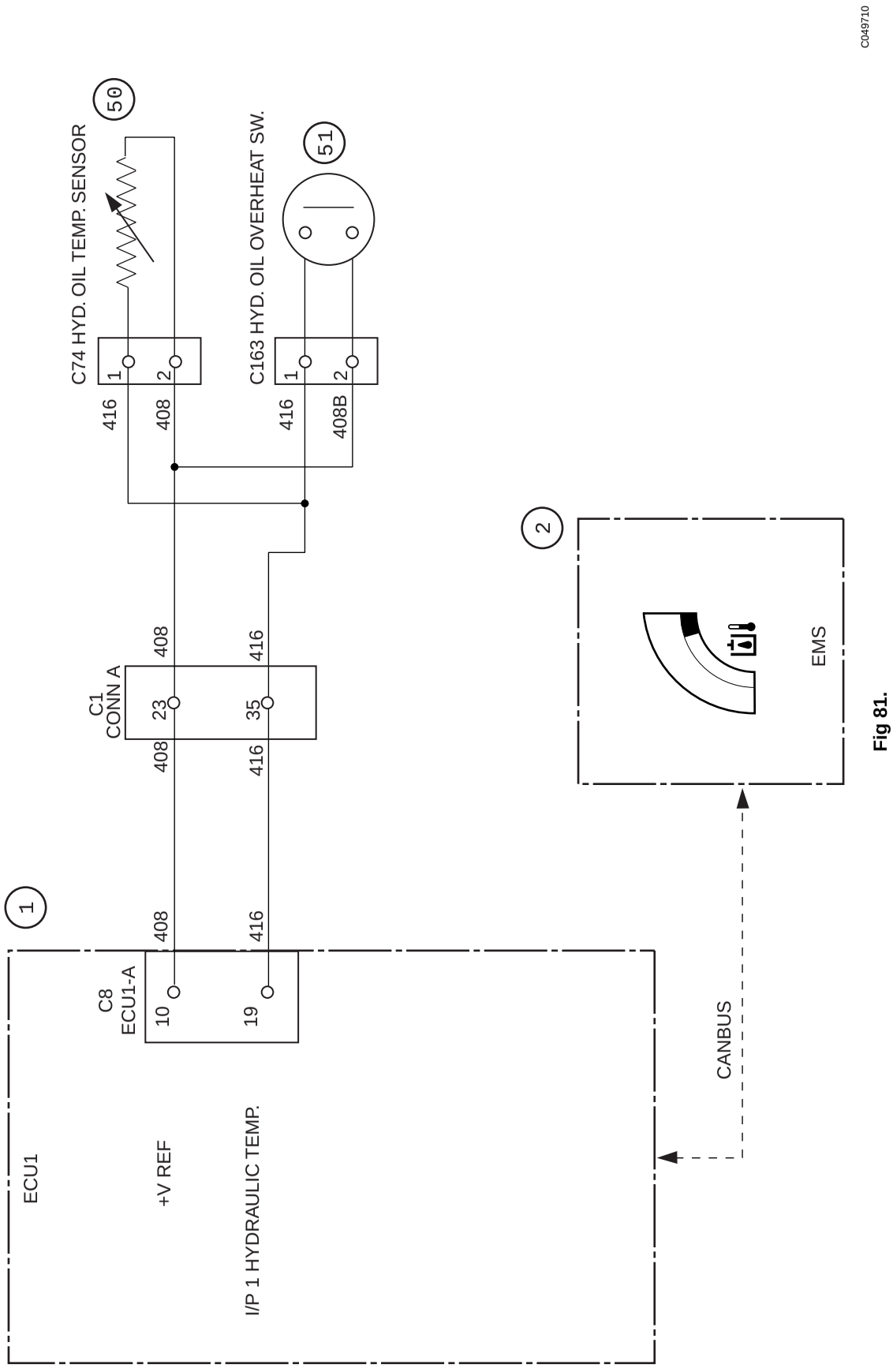

C049710
50
C74 HYD. OIL TEMP. SENSOR
1
2
416
408
51
C163 HYD. OIL OVERHEAT SW.
1
2
416
408B
C1
CONN A
408
23
416
35
408
416
2
EMS
1
C8
ECU1-A
408
10
416
19
ECU1
+V REF
I/P 1 HYDRAULIC TEMP.
CANBUS

Fig 81.

Hammer Only

Operation

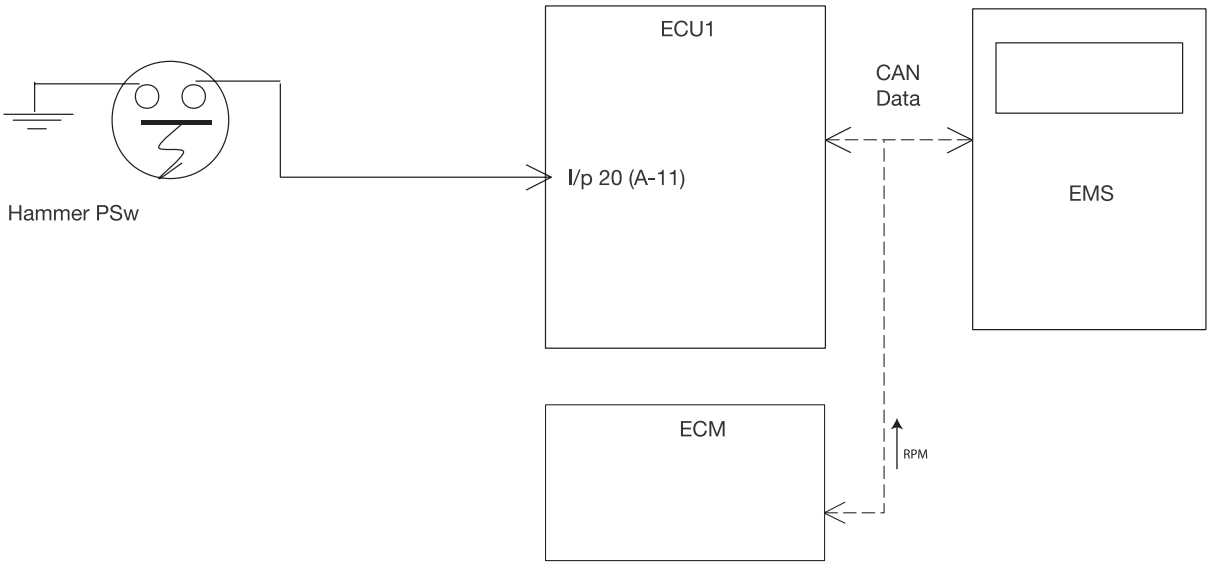


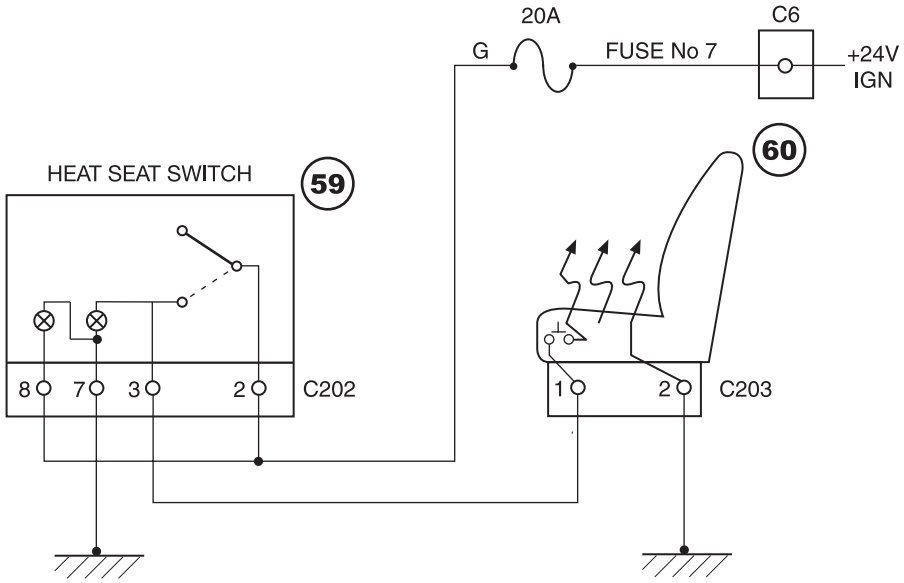
Fig 90.

The hammer is operated by pressing the foot pedal forward which supplies a pilot pressure signal to close the pressure switch and operate the option spool in the main control valve (MCV). When the pressure switch is closed, ECU 1 i/p 20 (A-11) senses the grounding of the pressure switch, which reduces the engine rpm to a level preset in the SET menu.

The throttle potentiometer normally increases/decreases the engine rpm from idle to max engine speed but will not exceed the preset hammer value, regardless of its position. The maximum "hammer revs" (engine rpm) can be set by the operator via the SET menu on the EMS. The up and down buttons will increase/decrease the rev/min value, by 25 rpm for each press. Whatever value is set by the operator is stored and becomes the new default value. The original default value for "Hammer RPM" is 1200 rev/min.

Heated Seat

Operation



C030500GB-2

Fig 99.

When the heated seat switch is selected, an electrical current passes over the seat thermostat to the heating element. The element will then warm the seat.

The thermostat is set to 20°C - ON and 30°C - OFF.

On initial starting when the heated seat switch is selected, the heated seat element will turn on only if the thermostat is below 30°C. Once the thermostat reaches 30°C the heater will turn off. The element will only be re-heated if the thermostat temperature falls below 20°C.

Horse Power Control Data Logging Facility

When selected this function will log information on engine speed, pump milliamps and mode over a selectable period up to 15 mins and display the data as a graph.

- Press and hold the "SET" and "MODE" buttons on the EMS simultaneously for 20 seconds, until the "SERVICE OFF" message is displayed.
- Use the scroll arrows until the "HRSEPWR MON" message is displayed.
- Press the "ACK" button. You are now in the datalog function. This is confirmed by the message "MINUTES 1".
- The time period for logging can now be adjusted from 1 to 15 minutes using the arrow keys.
- Press 'ACK' to start recording, the EMS will display "RUNNING" When complete the display will return to normal.
- The results of this test are then viewed through the Servicemaster, Data logging application using a laptop.

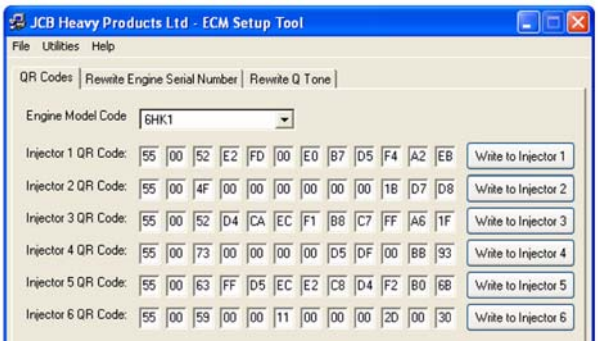
Throttle Calibration

Throttle calibration is obtained via the Set + Mode (20 sec) menu on the EMS. The throttle calibration should be performed on every new machine, when the throttle linkage parts are replaced or when the "NO THROTTLE" warning appears on the EMS.

To enter throttle calibration the following procedure must be followed:

- The engine must be started, and warmed up to normal operating temperatures.
- Press and hold the "SET" and "MODE" buttons on the EMS simultaneously for 20 seconds, until the "SERVICE OFF" message is displayed.
- Use the scroll arrows until the "CALIBRATE" message is displayed.
- Press the "ACK" button. You are now in the throttle calibration routine and the message "T VOL MIN" will appear in the display.
- Rotate the throttle volume dial to the minimum position.
- Press "ACK". The "T VOL MAX" message will then be displayed.
- Rotate the throttle volume dial to the maximum position.
- Press "ACK".
- When complete throttle control will be restored to the throttle volume dial. "CAL DONE" is displayed. The EMS will revert to the normal display

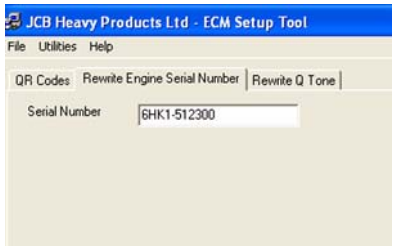
Note: *If the engine is stopped during the calibration, the "RECALIBRATE" message is displayed and the procedure has to be restarted. If the throttle volume dial minimum and maximum values are the same, or the wrong way round, then "RECALIBRATE" is also displayed.*



860903-1

Fig 12.

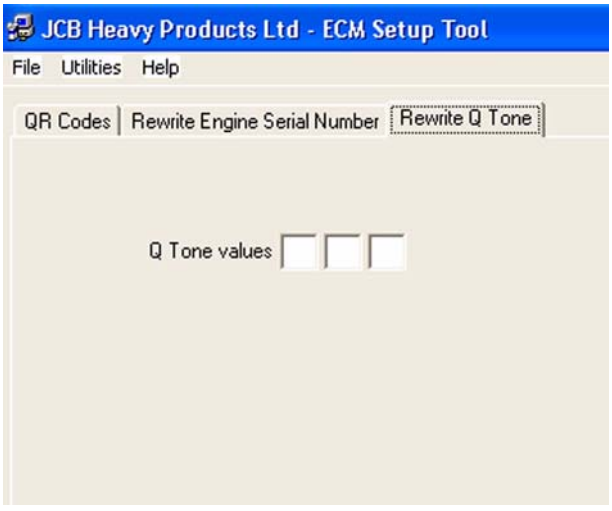
b Engine Serial Number. ⇒ ***Fig 13. (C-127)***.



860904

Fig 13.

c Q Tone. ⇒ ***Fig 14. (C-127)***.



T011600

Fig 14.

5 Select `Disconnect' from the `File' menu pull down or select button **B**.

6 To copy the details on to a new ECM follow the next procedure. ⇒ ***Write Engine Details (C-127)***.

Important: *DO NOT switch the laptop off, close the ECM setup tool or disconnect the DLA when reading or writing to a new ECM.*

Note: *If the details can not be read from the ECM contact JCB Service.*

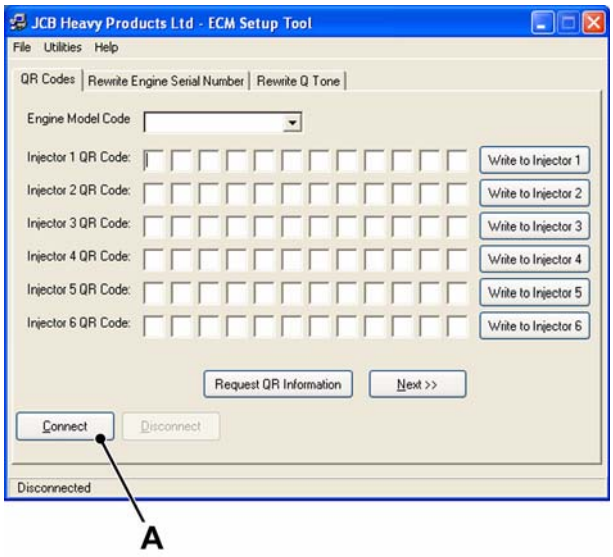
Write Engine Details

Copy details from existing ECM. ⇒ ***Read Engine Details (C-126)***.

Important: *DO NOT switch the laptop off, close the ECM setup tool or disconnect the DLA when reading or writing to a new ECM.*

1 Turn ignition off.

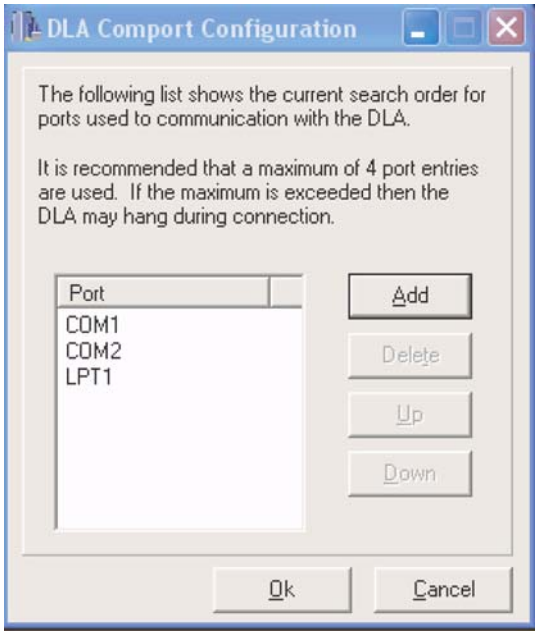
2 Remove ECM unit and replace with new unit.



860900-1

Fig 15.

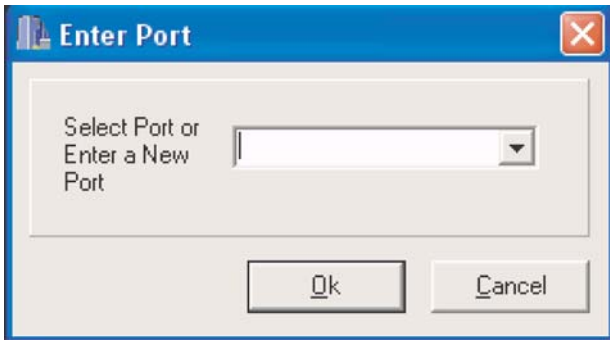
3 Select the connect button **A**.



C043730

Fig 26.

4 To add a new communication port to the list click "Add". Enter the new port number as required. ⇒ *Fig 27. (C-137)*



C043740

Fig 27.

Note: *It is recommended that no more than four ports are identified in the list, as this may cause Servicemaster to hang when connecting to a vehicle.*

Data Link Adaptor

The DLA is a universal device for connecting several data communications mediums to the PC via a single piece of hardware. HPSetup uses the J1939 CAN specification for on vehicle network and communications. Being one of the cheapest methods to connect the PC to the vehicle bus the DLA has proven its ability in applications such as diagnostics, data logging and vehicle setup procedure tools like HPSetup. Power for the DLA is taken from the vehicle power supply via the 15 way connector so it requires no internal source of power and is self regulating up to +40V, giving great protection and versatility because it can be connected to most forms of automotive machinery operating between 5 and 40V DC. Once connected to the PC the DLA is auto detected and initialised by software eliminating any need for the user to determine port settings, data transfer rates.

DLA Trouble Shooting

Failure of the software to initialise the DLA will prevent any read/write operations. This section will help debug the error and get the DLA working. Follow this list of checks to perform to help diagnose the problem.

1 Cables, ensure that the correct cables are used between the PC/DLA/On-Vehicle connector.

2 Inspect cables for possible damage, replace if necessary.

3 Check that good firm connections have been made between all devices.

4 Power up the vehicle and make sure the power LED on the DLA is ON, if the LED is not illuminated there may be a problem with the power supplied to the unit or the DLA regulator system is not working. To check the power to the DLA unplug the DLA from the vehicle, use a digital multi-meter to check the voltage between pins 6 and 8. There should be a minimum of 12 V DC (or IGNITION Voltage, see vehicle specifications) between these two pins. Suspect the vehicle power supply if there is not, else the DLA should be replaced because of a problem with it's internal circuitry.

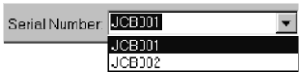
5 With the Vehicle power ON, start HPSetup application and visually observe the CAN activity LED and note the error message displayed by the PC. If the LED does not flash off/ON several times after it has been initialised by the PC then there is probably a hardware

Printing Service History

The service history of any vehicle can be printed using the default printer settings of the PC running the application.

How to Print Service History:

Use the vehicle serial number selection box to select a set of History Records.



6JUL3

Fig 53.

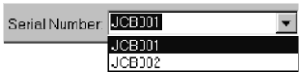
Click the "Print" button. ⇨ *Using HP Service (C-145)*.

Delete Service History

The currently selected vehicle service history may be deleted at any time.

How to Delete a Service History:

Use the vehicle serial number selection box to select a set of History Records.



6JUL3

Fig 54.

Click the "Delete" button. ⇨ *Using HP Service (C-145)*.

Add Service History Record

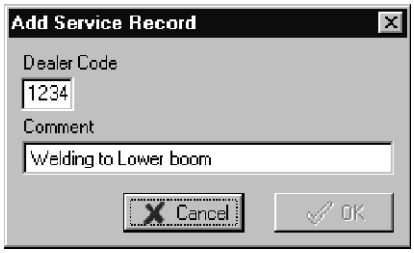
At some point in time a vehicle may undergo some form of service operation that is outside of the normal preset service intervals. This option allows the service engineer to include into the vehicles current service history list an entry for a non-scheduled service event. The special significance of this event is two fold, firstly because the scheduled hours are 'unscheduled' then we must set the service interval to zero and because we have the ability to enter text into the comments field the service engineer can associate text with the unscheduled service event.

To Add A Service History Record

Connect the vehicle, power up and make sure the PC has logged onto the vehicle network.

Click the "Add Service History Record" button. ⇨ *Using HP Service (C-145)*.

In the form below enter the dealership code and a comment (up to 30 characters maximum) relating to the nature of the unscheduled service.



6JUL11

Fig 55.

Click the "OK" button to send the record to the vehicles internal service history table. The "OK" button is only enabled when valid data is entered into the dealer code and comment fields.

Closing HPService

To close HPService use the exit menu item on the HPService main window menu bar.

Error Codes	Error String	Description
217	HORN	The horn output is short-circuit.
218	HYD PMP	"The hydraulic pump is short-circuit. Because this is a proportional valve, this error can only be detected when the engine is not running."
219	SLW LCK	The slew lock solenoid is short-circuit.
220	HYD FAN	The hydraulic fan solenoid is short-circuit. The fault can only be detected when the engine is not running.
221	SLW BRK	The slew brake solenoid is short-circuit.
222	SLW ST	The slew shut off solenoid is short-circuit.
223	LW WIPR	The lower wiper motor is short-circuit.
224	WIPER	The wiper motor is short-circuit.
225	LH CAB LT	The boom work light is short-circuit.
226	RH CAB LT	The toolbox work light is short-circuit.
227	TL CHNG	The travel change solenoid is short-circuit.
228	WASHER	The washer motor is short-circuit.
229	DOZER	The dozer solenoid is short-circuit.
230	GRB CW	The grab/rotate clockwise solenoid is short-circuit.
231	GRB CCW	The grab/rotate counter-clockwise solenoid is short-circuit.
232	LW FLOW	The low flow solenoid is short-circuit.
233	ISOL	The isolator solenoid is short-circuit.
234	EMG STP	The emergency stop solenoid is short-circuit.
235	2 STAGE	The 2nd stage relief solenoid is short-circuit.
236	QK HTCH	The quick hitch solenoid is short-circuit.
237	TL ALRM	The travel alarm output is short-circuit.
238	HAMMER	The hammer solenoid is short-circuit.
239	CUSHION	The hard/soft cushion solenoid is short-circuit.
240	BOOM LT	The boom work light is short-circuit.
241	TLBX LT	The toolbox work light is short-circuit.
242	ENG SD	The engine shutdown solenoid is short-circuit.
243	GLW PLG	The glow plugs are short-circuit.
244	CNT LT	The counter-weight work light is short-circuit.
245	LH IND	The LH turn indicator is short-circuit.
246	LH SIDE	The LH sidelight is short-circuit.
247	LH FOG	The LH fog light is short-circuit.
248	LH MAIN	The LH main beam is short-circuit.
249	LH DIP	The LH dip beam is short-circuit.
250	RH IND	The RH turn indicator is short-circuit.
251	RH SIDE	The RH sidelight is short-circuit.
252	RH FOG	The RH fog light is short-circuit

Using a Multimeter

TC-002

In order to obtain maximum benefit from the fault finding information contained in Section C it is important that the technician fully understands the approach to fault finding and the use of the recommended test equipment, in this case a FLUKE 85 or AVO 2003 digital multimeter, or a moving pointer (analogue) multimeter. The approach is based on a fault finding check list. In tracing the fault from the symptoms displayed you will be directed to make measurements using a multimeter.

These instructions are intended to cover the use of the recommended multimeters.

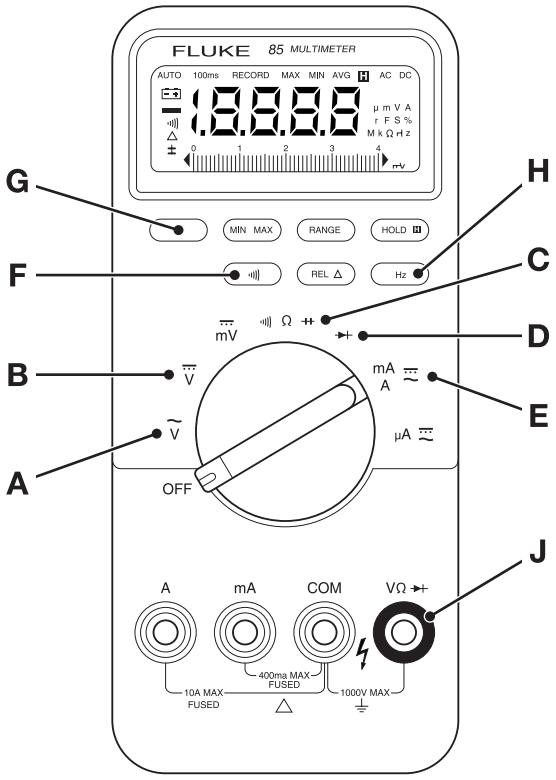


Fig 7. FLUKE 85

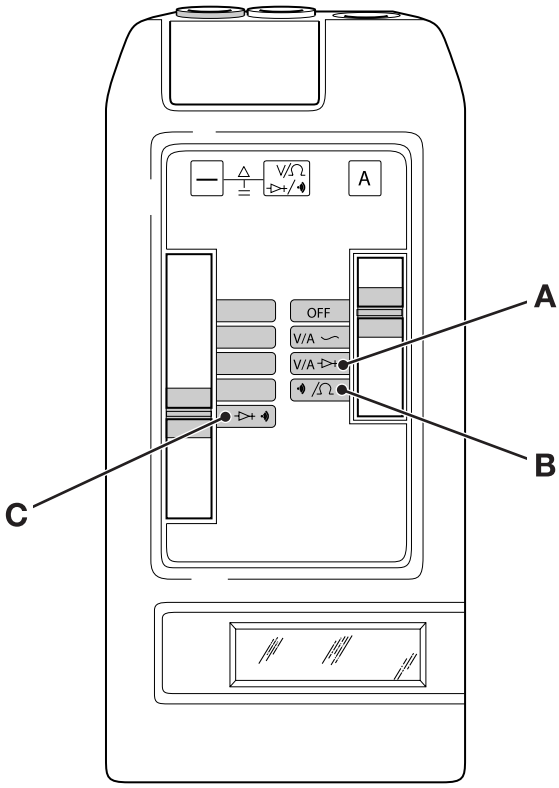


Fig 8. AVO 2003

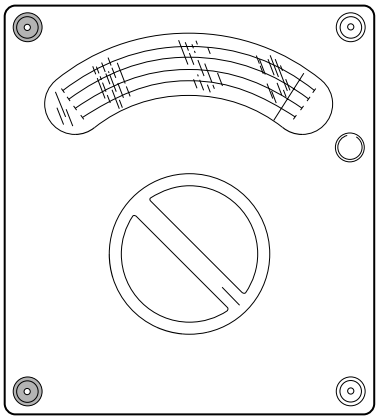


Fig 9. A Typical Analogue Meter

1 Make sure that the test leads are plugged into the correct sockets. The black test lead should be

Harness Data

Harness Interconnection

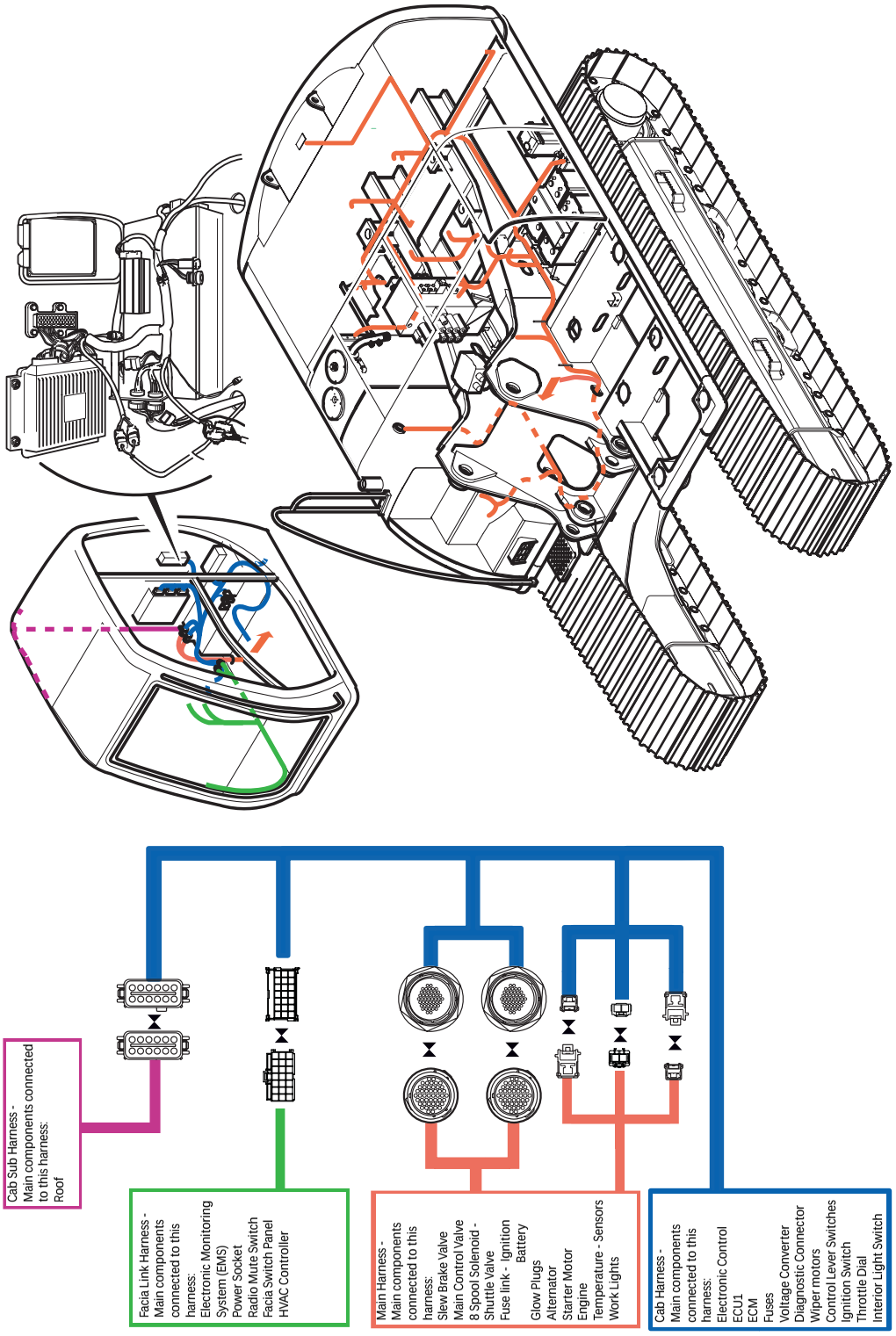
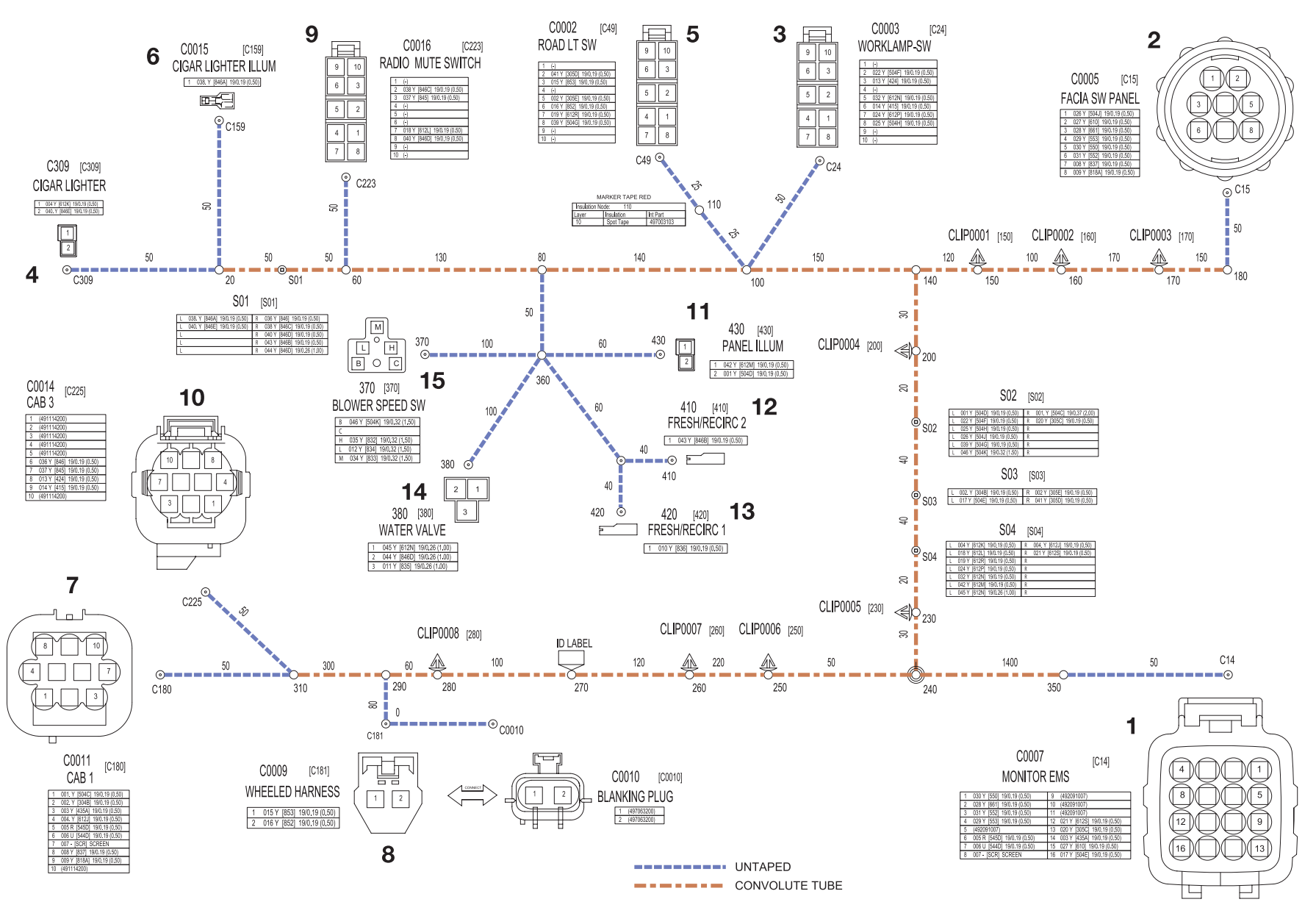


Fig 1. Harness Location and Interconnection (Type 2 Fascia Harness and Type C Cab Harness Shown)



721/12510

Fig 9. Machines with Heater 721/12510 issue 1

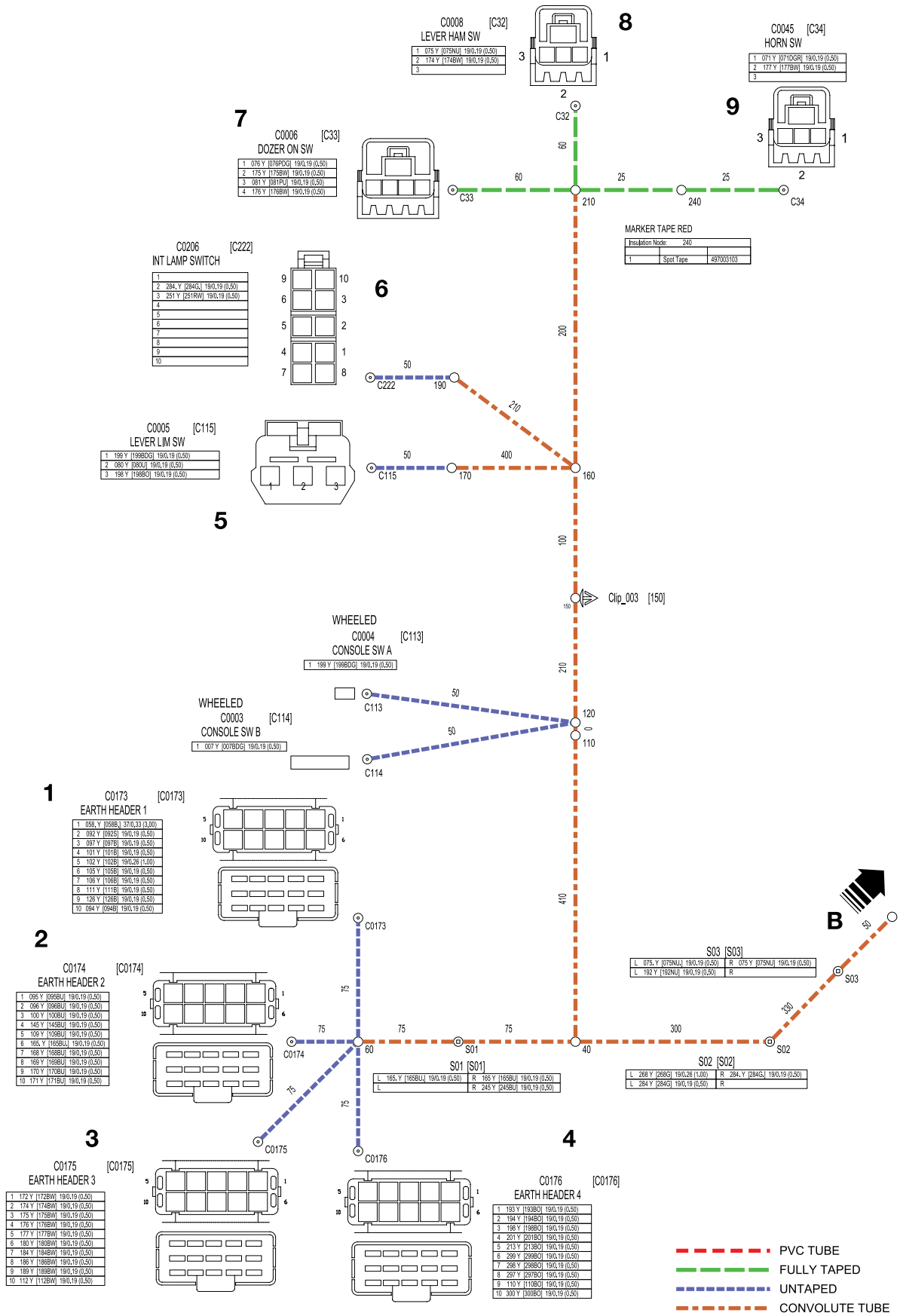


Fig 18. Cab Harness `A' 721/12522 - Issue 1

Cab Harness (includes Engine Harness) - Type B

Connector Identification

Table 7.

Item	Connector	Function
1 - 10 ⇨ *Cab Harness `A' 332/J3663 - Issue 1 (C-209)*		
1	C0173	Earth Header
2	C0174	Earth Header
3	C0175	Earth Header
4	C0176	Earth Header
5	C115	Lever Limit Switch
6	C222	Interior Lamp Switch
7	C33	(Dozer On Switch (wheeled only))
8	C32	Lever Hammer Switch
9	C34	Horn Switch
10	EH	Earth Header
11 - 25 ⇨ *Cab Harness `B' 332/J3663 - Issue 1 (C-210)*		
11	C219	Auxiliary 1
12	C226	Auxiliary 2
13	C224	Voltage Converter
14	C11	Diagnostic Connector
15	C13	Redundancy Switch
16	C228	Lower Wiper
17	C227	Wiper 2
18	C110	Diode 1 Washer
19	C161	Diode 5
20	C155	Diode 3 Redundancy 1
21	C156	Diode 4 Redundancy 2
22	C320	Int Lamp Diode
23	C0256	ECM Engine
24	C0009	Auto Fan
25	C318	Qualcom Tracking
26 - 33 ⇨ *Cab Harness `C' 332/J3663 - Issue 1 (C-211)*		
26	C296	Fuse Box
27	C254	Lift Pump
28	C230	Refuel Pump Relay
29	C271	Emergency Stop
30	C0251	Main Relay
31	C0257	ECM Engine
32	C263	Barometric
33	C252	Teir III Link

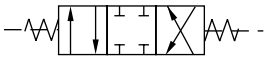
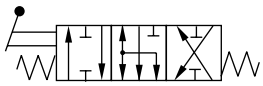
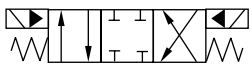
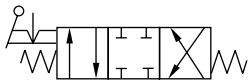
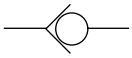
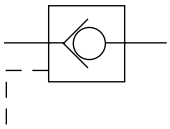
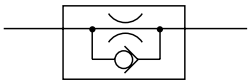
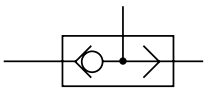
Item	Connector	Function
34 - 39 ⇨ *Cab Harness `D' 332/J3663 - Issue 1 (C-212)*		
34	C258	Cab Connector C
35	C1	Connector A
36	C0218	HVAC Unit Connector
37	C8	ECU Connector A
38	C164	Earth Connector
39	C4	Wheeled Option Cab
40 - 47 ⇨ *Cab Harness `E' 332/J3663 - Issue 1 (C-213)*		
40	C180	Fascia Link 1
41	C811	Fascia Link 3
42	C10	ECU Connector C
43	C9	ECU Connector B
44	C6	24V Supply
45	C5	24V Supply (battery)
46	C0250	
47	C0214	Cab Roof Harness
48 - 62 ⇨ *Cab Harness `F' 332/J3663 - Issue 1 (C-214)*		
48	C112	Breaker Pilot Switch
49	C172	Blanking Connection
50	C0232	Merge Flow Solenoid B
51	C167_1	Plug
52	C163	Merge Solenoid Valve C
53	C163_1	Plug
54	C169	Ham/Aux/Sol V C
55	C169_1	Plug
56	C204	Boom Up Pressure Switch
57	C71_1	Plug
58	C73	Swing Pilot Switch
59	C221	Auto Mode Pressure Switch
60	C57	Boom Priority
61	C201	Lower Wiper
62	C201_1	Plug
63 - 72 ⇨ *Cab Harness `G' 332/J3663 - Issue 1 (C-215)*		
63	C22	Throttle Dial
64	C0027	Lever Switch
65	C30	Grab CCW/CW
66	C184	Key Switch A
67	C43	Boom Priority Switch
68	C202	Heated Seat Switch

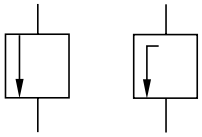
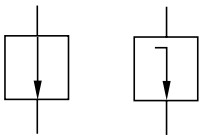
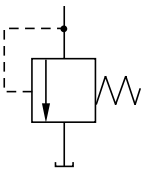
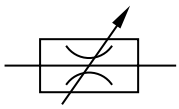
Cab Harness (includes Engine Harness) - Type C

Item	Connector	Function
68	C202	Heated Seat Switch
69	C185	Key Switch B
70	C0220	Lower Wiper Switch
71	C203	Heated Switch
72	C160	Options Hydraulic Switch

Notes:

Table 4. Control Valves

	Used to enclose several valves indicating they are supplied as one unit
	3-Position, 4-port spring centered pilot operated valve
	3-position, 6-port spring centered pilot operated valve
	3-Position, 4-port spring centered solenoid & pilot pressure operated valve
	3-Position, 4-port spring centered detent hand operated valve
	Non-return valve
	Non-return valve with back pressure spring
	Pilot operated non-return valve
	One way restrictor
	High pressure selector (shuttle valve)

	Throttling orifice - normally closed
	Throttling orifice - normally open
	Relief valve
	Variable restrictor

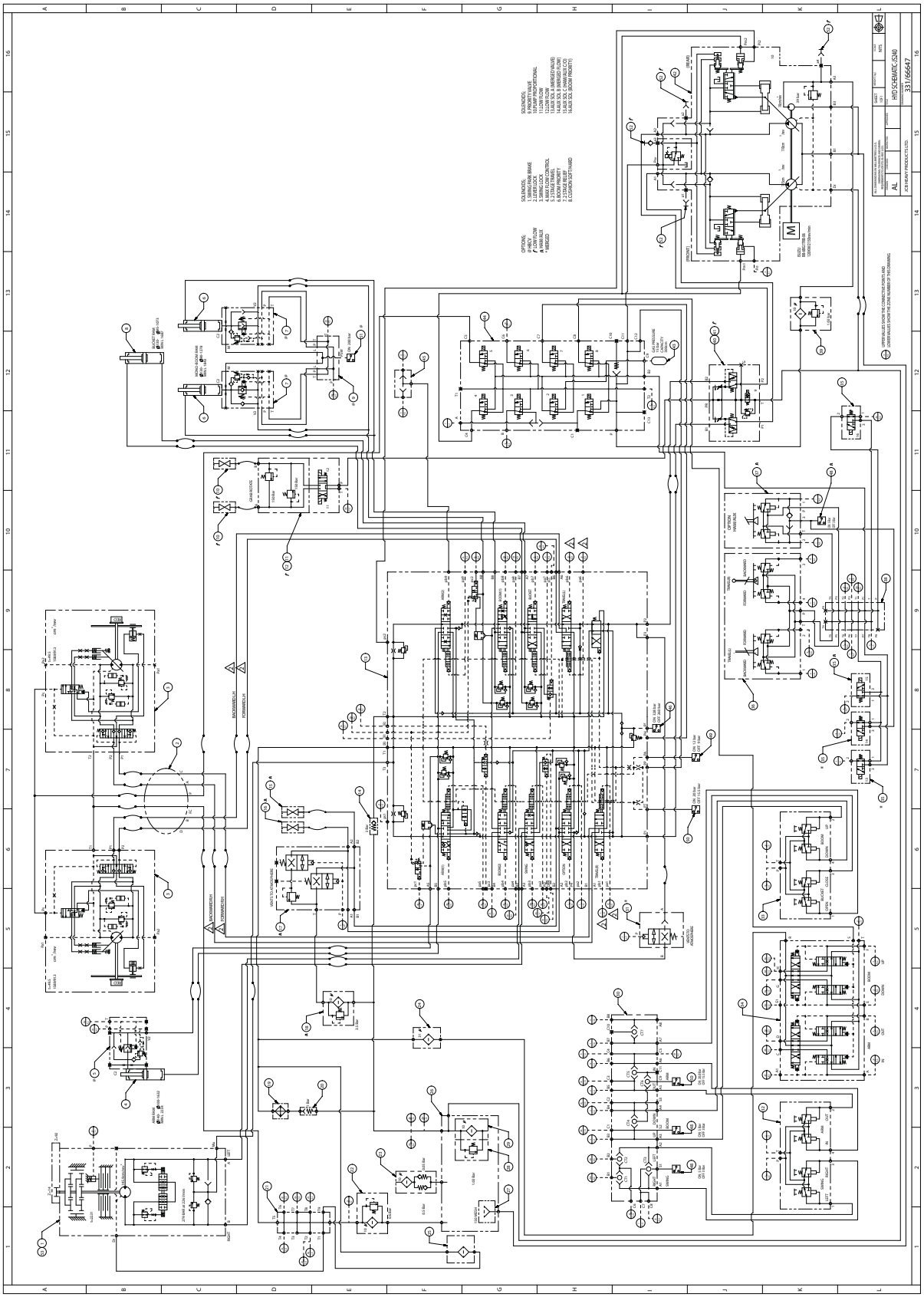


Fig 2. 331/66647 issue 3

Neutral Circuit

For Schematic, ⇒ *Fig 7. (E-27)* .

With all the controls in the neutral position, flow from pump **A1** enters the main control valve at port **P1** and flow from pump **A2** enters the main control valve at port **P2**.

Oil is allowed to flow across all of the spools via the neutral gallery when all controls are in the neutral position. Oil from pump **A1** exits port **Ps1** and oil from pump **A2**, exits port **Ps2** at the top of the main control valve. Both flows of oil meet a separate restrictor and relief valve. Some oil will pass through the restrictor and back to tank, creating back pressure in the line. Oil is exhausted across the relief valves at 40 bar (580 lb/in^2). The back pressure is sensed at ports **Ps1** and **Ps2** and ports **Pt1** and **Pt2** of the pumps, holding the pumps on minimum flow.

Flow from the servo pump enters the valve block at port **Pp**, where it meets 3 restrictors. These maintains the pressure on the input side at full servo pressure. Oil that crosses the restrictors, is allowed back to tank after passing over the neutral gallery of the spools. No pressure is created in this line whilst all controls are in neutral, allowing all pressure switches to remain in the open position.

⇒ *Fig 7. (E-27)*

- **a** Dipper (1) spool
- **b** Boom (2) spool
- **c** Slew spool
- **d** Option spool
- **e** Travel (left) spool
- **f** Dipper (2) spool
- **g** Boom (1) spool
- **h** Bucket spool
- **i** Travel (right) spool
- **k** Linear Travel spool

Dipper Out

For schematic, ⇒ *Fig 12. (E-37)*

Servo pressure from the Hand controller **32** is sent to port **A5** of the shuttle valve **30** and is disributed to:

1 Port **C9** to activate the Auto mode pressure switch **47.**

2 Port **C3** to port **Pa9** of the Main control valve to activate the Dipper (2) spool.

3 Port **B5** to port **B** of the Cushion valve **34**, through the valve leaving at port **D**. The signal is sent to port **Pa5** on the Main control valve activating the Dipper.(1) spool.

Flow from pump **A1** is available at the Dipper (1) spool via the left hand neutral passage and the Linear travel spool via the parallel working passage. Flow from pump **A2** is blocked at the Dipper (2) spool and joins the flow from pump **A1** just after the Dipper (1) spool.

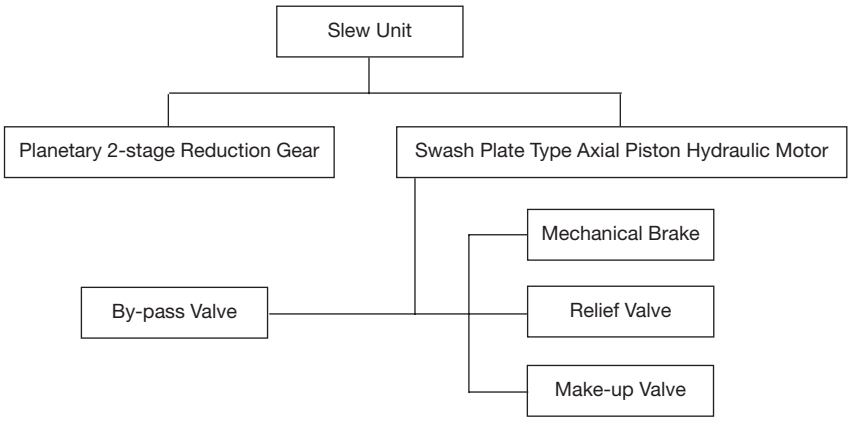
Exhaust oil from the ram enters the Main control valve at port **B5** and has a path to tank via the Dipper (1) and Dipper (2) spools.

⇒ *Fig 12. (E-37)*

- **a** Dipper (1) spool
- **b** Boom (2) spool
- **c** Slew spool
- **d** Option spool
- **e** Travel (left) spool
- **f** Dipper (2) spool
- **g** Boom (1) spool
- **h** Bucket spool
- **i** Travel (right) spool
- **k** Linear Travel spool

Slew Circuit

Slew Motor Configuration



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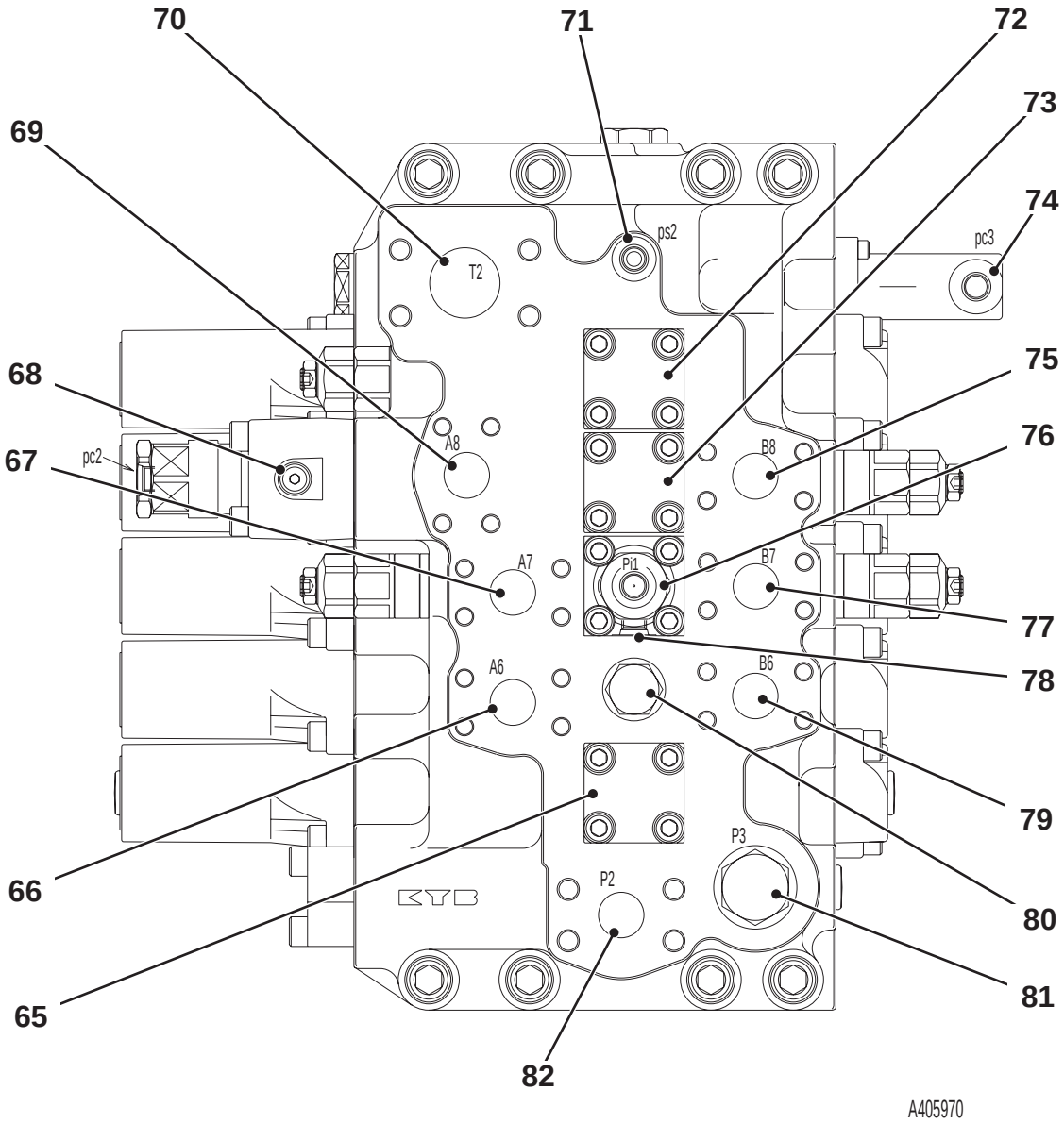


Fig 6. Main Control Valve viewed from left of machine

For port location, ⇒ *Table 4. (E-67)*

Replacement

Replacement is the reversal of removal procedure but note the following:

- When fitting a new pump, the shaft end spline may be coated with a anti-rust coating. Remove this coating with a suitable cleaning agent and apply a lubricant to the shaft being careful not to get either on to the oil seal of the pump.
- The bevelled edge of the pump coupling **4** must be fitted facing the pump.
- To prevent the rubber flange **5** from twisting on installation, apply a small amount of lubricant to the under face axial and radial screws
- Locate the rubber flange **5** of the pump into the four engine studs **8**.
- Before fastening pump flange **2** to engine, make sure the mating surfaces are fully together.
- Apply JCB Threadlocker to bolts **3** and **6**.
- Fill the pump casing inside fully with oil and operate at low engine revs with no services selected for 3 minutes.

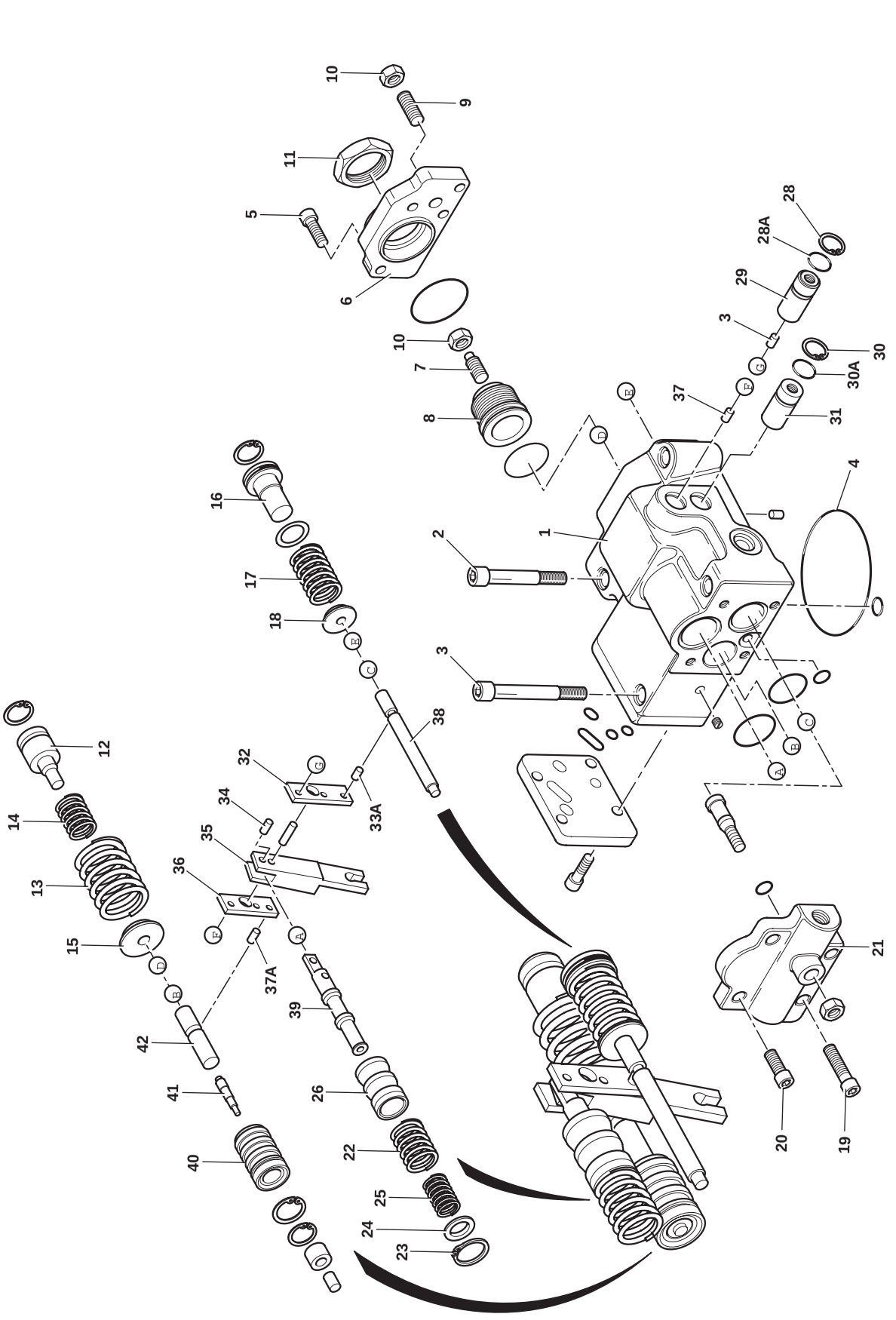
⚠ WARNING

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

- If there is any air left in the circuit or pump, this may cause faulty operation or damage so be sure to bleed the air completely.
- It is not desirable to leave the pump motor unused for a long period of time (more than one year.) At intervals, start the engine even if for short periods of time. When left unused by itself, rotating the shaft end by hand can be effective. If left unused for an extended period of time, inspection for overhaul will become necessary.


379670-C1
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41
40
32
34
35
36
37A
33A
39
26
22
25
24
23
28
28A
29
3
30
30A
37
31
4
1
2
3
21
20
19

Fig 29.

17 Remove seals **9** and **10** from guide **8** and discard.

Note: *Leave all parts to soak in suitable solvent until dirt is loosened. Using clean solvent wash all parts and allow to air dry. Apply rust inhibitor to all parts.*

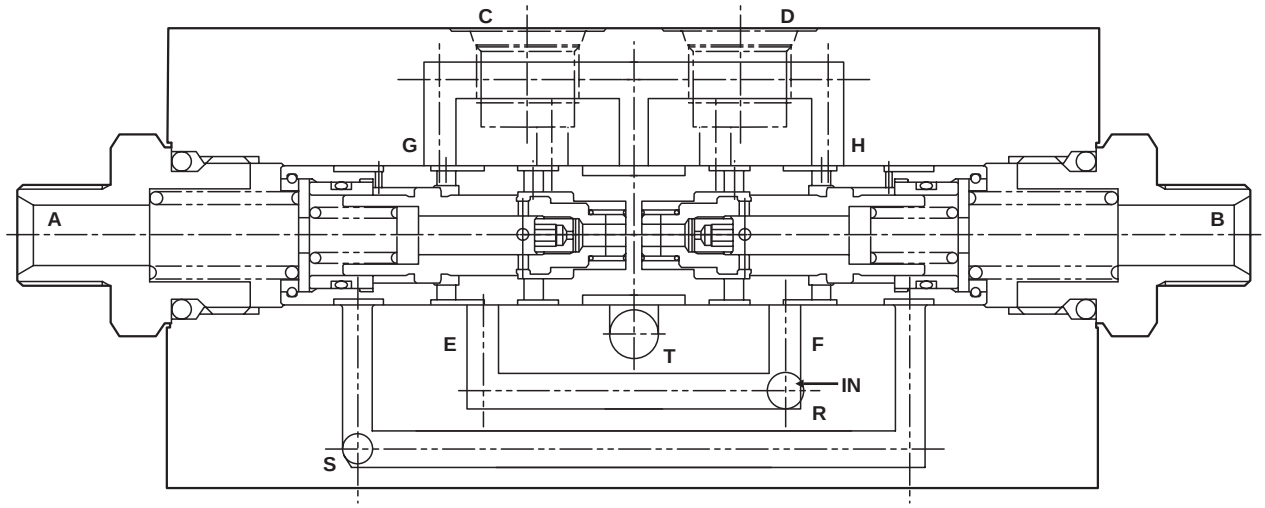
Table 1.

Solenoid	Function	Electrical Harness Tape Colour	Hydraulic hose colour
CT1	Slew Brake	No Tape	No hose
CT2	Servo Isolator	White	No hose
CT3	Slew Lock	Orange	Orange
CT4	Max Flow Cut	Green	Light Green
CT5	2 Stage Travel	Blue	Blue
CT6	Boom Priority	Red	Light Blue
CT7	2 Stage Relief	Yellow	Yellow
CT8	Cushion Control	Green	Green

The 8 station solenoid valve distributes servo pressure to activate machine functions automatically or when selected by the operator.

For hose connections,

Cushioned Mode - Hand Controller In Neutral



A409220-C1

Fig 3. Cushioned Mode - Hand Controller in Neutral

When the nand control is in neutral, hot oil is taken from the pressurised oil cooler line, entering port **R** of the cushion valve, through the outer spool and around the inner spool, via the galleries **E** and **F**, around the middle of the outer, via galleries **G** and **H**, returning to the tank via port **T**. ⇨ *Fig 3. (🗋 E-116)*

Motor Brake Working Poorly

Symptom	Cause	Remedy
Low brake torque.	The friction plate is worn out.	Dismantle and renew worn parts.
	The brake piston is sticking.	Dismantle and clean.
	The brake releasing pressure is low.	Check and repair the supply circuit.
	The spline of the friction plate is broken.	Dismantle and renew the broken parts.

Motor is Driven by Exterior Torque

Symptom	Cause	Remedy
Slip volume is high.	The relief valve is not set correctly.	Set to correct value or renew.
	Relief valve plunger not seating cleanly.	Renew.
	The reversal protecting valve does not work properly.	Renew.
	Drain volume exceeds 500 cc/mm.	Dismantle and check for signs of wear. Renew suspect parts.

Oil Leakage

Symptom	Cause	Remedy
Oil leaking from around the drive shaft oil seal.	Oil seal lip damaged.	Renew the oil seal.
	The shaft is damaged or worn.	Repair or renew the shaft.
	High pressure in casing, causing the lip of the oil seal to become rolled.	Clear the drain pipes.
	The drive shaft is corroded.	Dismantle and repair.
Oil leaking from mating surfaces of main housing and valve housing.	O-ring not fitted or damaged.	Fit or renew the O-ring.
	The seal surface is damaged.	Dismantle and repair.
	The securing bolts are damaged or loose.	Renew and/or tighten to the required torque.

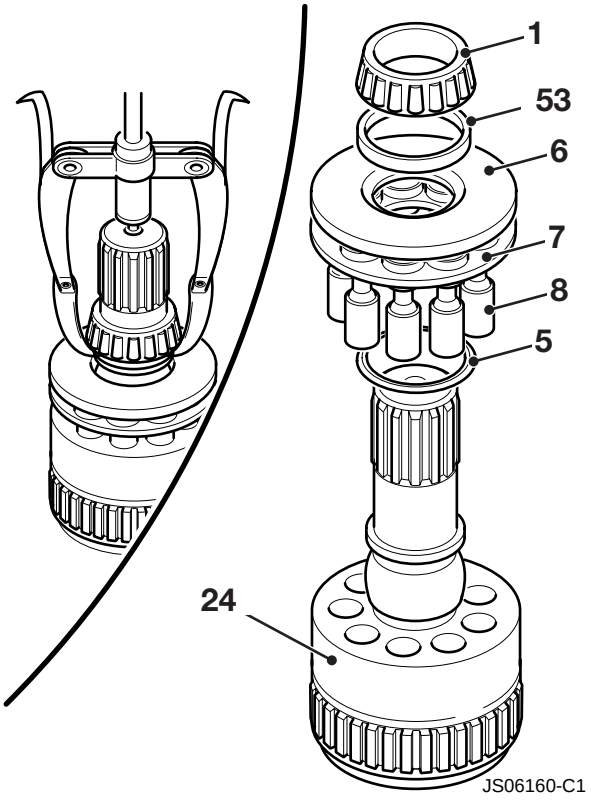


Fig 15.

22 Slide swash plate **6** from the sliding faces of the piston assemblies.

Note: *Take care not to damage the swash plate during handling.*

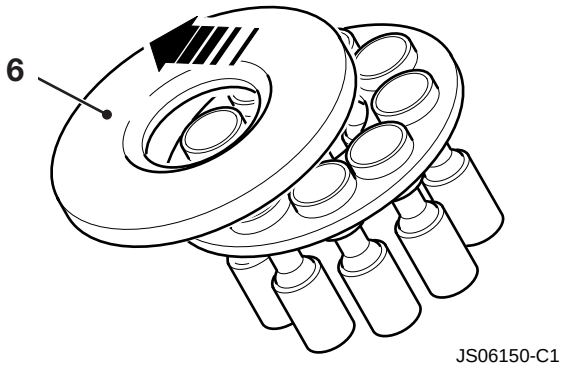


Fig 16.

23 Remove spring **5** from cylinder **24**.

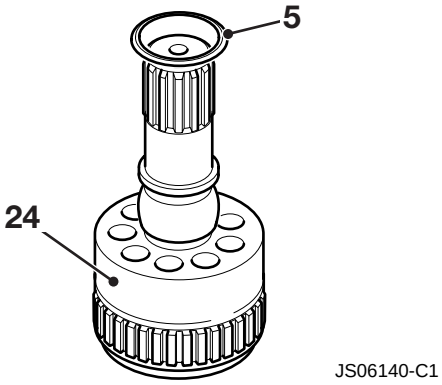


Fig 17.

Assembly

1 Press fit seat **44** into sleeve **39** which has an 'O'-ring **41**.

2 Mount poppet **43**, spring **42**, shim **40**, piston **38**, liner **51** onto sleeve **39**.

3 Screw cap 37 (with a 14 mm A/F hexagonal socket) with 'O'-ring **36** and back-up **35** mounted, on to sleeve **39** and tighten to a torque of 157 Nm (116 lbf ft).

Check the relief set pressure.

The correlation between the set pressure of the relief valve and the adjusting shims is shown below. However, adjustment must not be attempted if the pressure cannot be checked.

A 0.1 mm (0.003 in) shim equals 5 kgf/cm^2 (71 lbf/in^2) approximately.

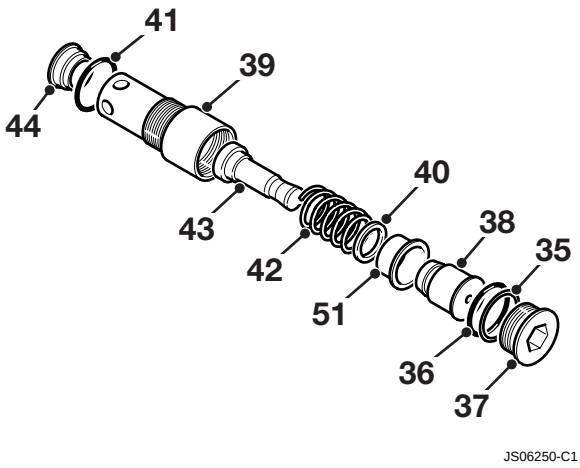


Fig 36.

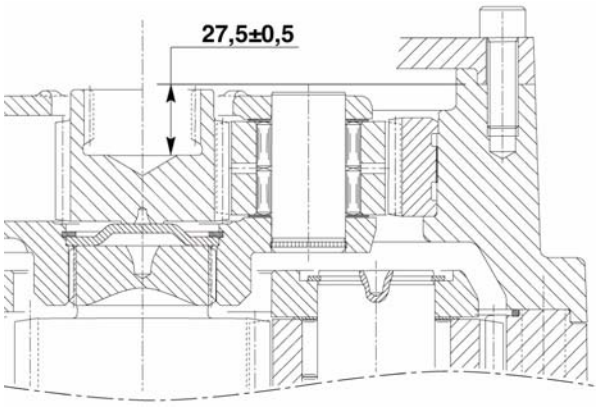


Fig 27.

12 If the dimension is incorrect adjust using the following procedure.

a With a higher value :

Reduce the width of the 1st reduction sun gear **B** in the axial direction flattening the support plate (reduction side).

b With a lower value :

Introduce adjusting spacers between the 1st reduction solar gear **B** and the 1st reduction planet gear set **A.**

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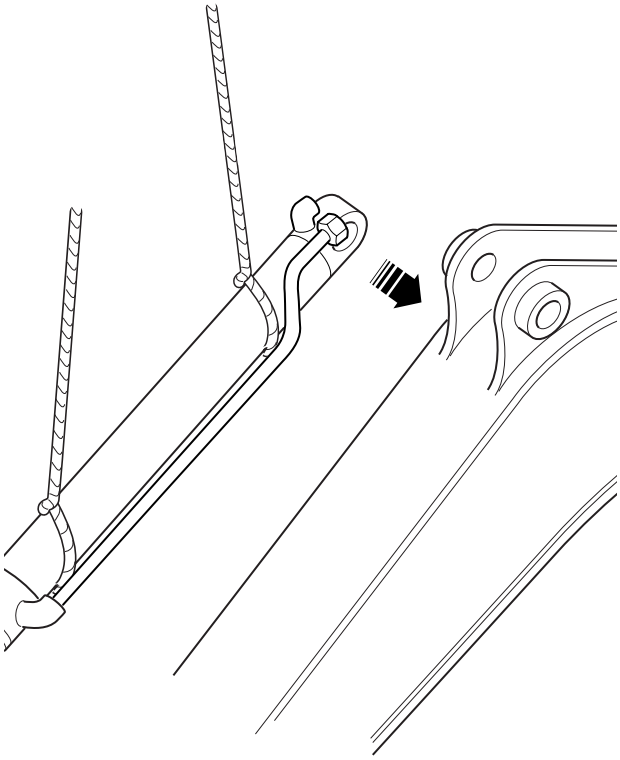

803181-1

Fig 24.

2 Install the pin, bolts and nuts.

⚠ WARNING

Metal Splinters

You can be injured by flying metal splinters when driving metal pins in or out. Use a soft faced hammer or copper pin to remove and fit metal pins. Always wear safety glasses.

INT-3-1-3_2

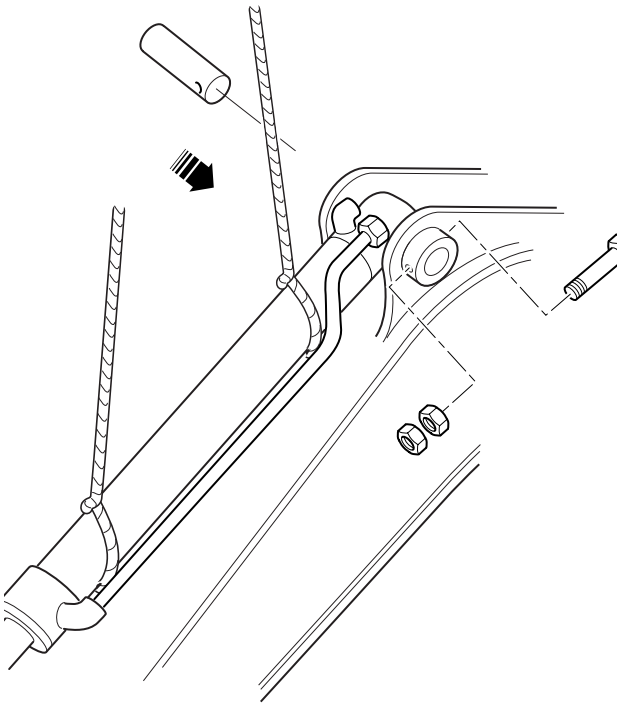

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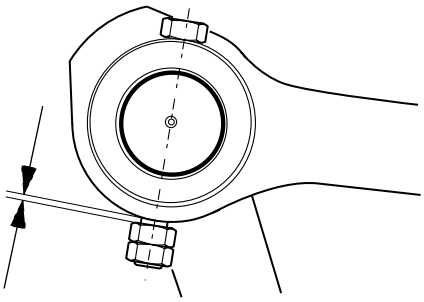
Fig 25.



A409820-C2

Fig 26.

Note: *When checking or refitting JS machine pivot pins, the retaining nuts and bolts should not be fastened up tight to the pivot boss but must have approximately 3mm of play so that the pin is free from tension.*

3 Install the grease tube and connect the hoses.

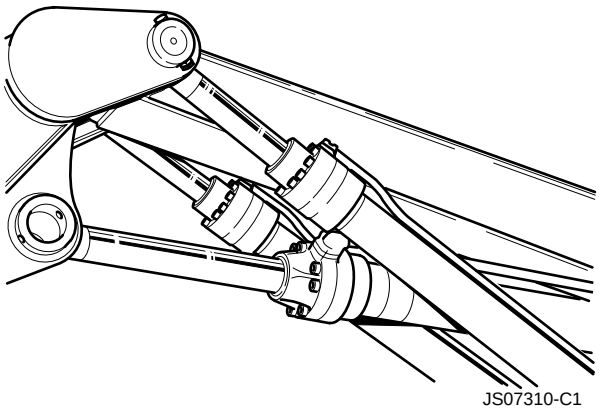


Fig 58.

5 Install the pivot pin and retaining bolt and nuts.

⚠ WARNING

Metal Splinters

You can be injured by flying metal splinters when driving metal pins in or out. Use a soft faced hammer or copper pin to remove and fit metal pins. Always wear safety glasses.

INT-3-1-3_2

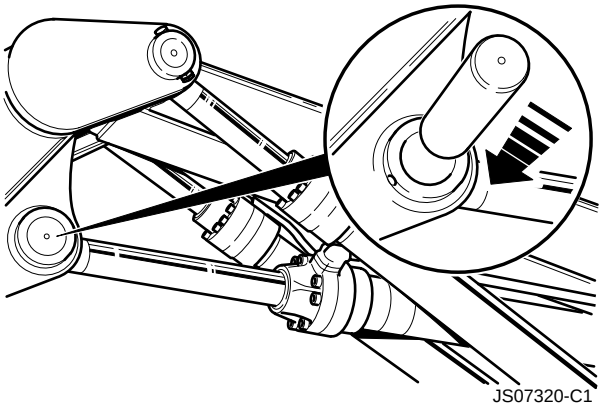


Fig 59.

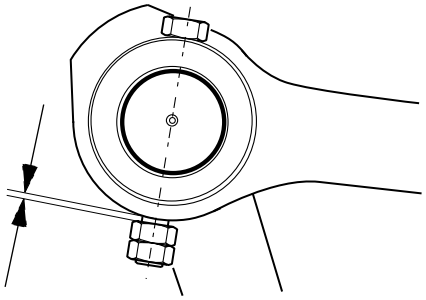


Fig 60.

Note: *When checking or refitting JS machine pivot pins, the retaining nuts and bolts should not be fastened up tight to the pivot boss but must have approximately 3mm of play so that the pin is free from tension.*

6 Once the installation is complete, start the engine and raise the boom fully. Under no load conditions, expel any trapped air by operating the ram to full stroke in both directions several times. Check for oil leaks.

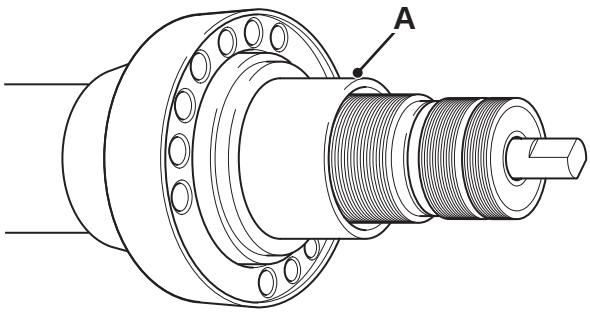
Assembly of the Piston Rod

The cylinder components must be cleaned before assembly. The piston and cylinder head must be cleaned before seal assembly and be kept clean up until this stage. Do not clean piston or cylinder head with seals fitted.

1 Secure the piston rod pack on the bench, brace the piston rod head.

2 Carefully fit the cylinder head onto the piston rod ensuring that the threads are not damaged.

3 Fit the cushion ring **A**



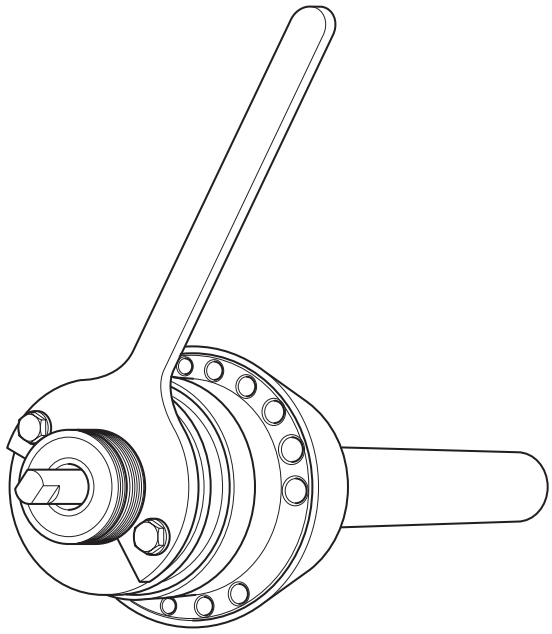
C030730-C1

Fig 93.

4 Assemble the piston head onto the piston rod. Fit the Jig to piston and torque tighten the piston to stated torque value.⇨ *Table 1. (E-196)*.

Table 1.

Ram	Piston
Boom	981 Nm +/- 98 Nm (723 lbf ft +/- 72 lbf ft) (100 kgf m +/- 10 kgf m)
Bucket	981 Nm +/- 98 Nm (723 lbf ft +/- 72 lbf ft) (100 kgf m +/- 10 kgf m)
Dipper	981 Nm +/- 98 Nm (723 lbf ft +/- 72 lbf ft) (100 kgf m +/- 10 kgf m)



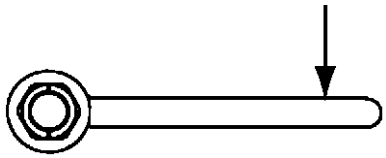
C030720

Fig 94.

5 Assemble the nut onto the piston rod and torque tighten to stated torque value.⇨ *Table 2. (E-196)*.

Table 2.

Ram	Piston Rod Nut
Boom	1860 Nm +/- 186 Nm (1374 lbf ft +/- 137 lbf ft) (190 kgf m +/- 19 kgf m)
Bucket	1860 Nm +/- 186 Nm (1374 lbf ft +/- 137 lbf ft) (190 kgf m +/- 19 kgf m)
Dipper	1860 Nm +/- 186 Nm (1374 lbf ft +/- 137 lbf ft) (190 kgf m +/- 19 kgf m)



373460B-V2

Fig 95.

6 Locate and fasten the stop screw **X** and torque tighten to stated torque value.⇨ *Table 3. (E-197)*.

Table 2.

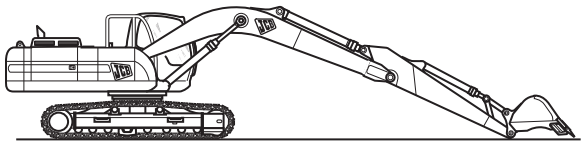
1	Main Relief Valve (MRV)
2	Tab/Dozer Relief Valve
3	Arm Out Relief Valve
4	Option Relief Valve
5	Boom Up Relief Valve
6	Bucket Close Relief Valve
7	Option Relief Valve
8	Arm In Relief Valve
9	T.A.B./Dozer Relief Valve
10	Boom Down Relief Valve
11	Bucket Open Relief Valve
⇨ ***Fig 2. (E-205)***.	

Slew Motor Pressure Relief

TE-015

1 Prepare the machine

a Operate the dipper out and lower the boom to set the bucket on the ground.



C030150-1

Fig 23.

b Make the machine safe, refer to ***Section E, Service Procedures.***

2 Connect a 0-400 bar (0 - 6000 lb/in^2) pressure gauge and adaptor to test point **TP2**.

3 Initiate slew lock procedures.

a Remove the water-proof connector on the slew lock solenoid valve.

b Press the slew lock switch which is on the right hand console inside the cab, and confirm that the slew lock symbol appears on the monitor.

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c Start the engine, (error codes may appear for disconnected solenoid) and operate the engine at around 1000 rpm, then operate the slew lever slowly. Listen to confirm that the relief sound is heard and that the machine does not slew.

d Run the engine at minimum no-load speed and in the E mode.

e Operate the slew lever.

4 The pressure gauge reading should be compared to the technical data at the start of this section. If it is outside the limits adjust the slew motor relief valve as below.

Note: *If the water-proof slew lock solenoid valve is not removed. Full slew pressure can not be read.*

Note: *Pressure measurement is also possible on the slew motor, upper section.*

5 If the readings are outside the limits, continue as below.

6 Pressure Adjustment

a Make the machine safe, refer to ***Section E, Service Procedures.***

b Remove relief valve to be adjusted.

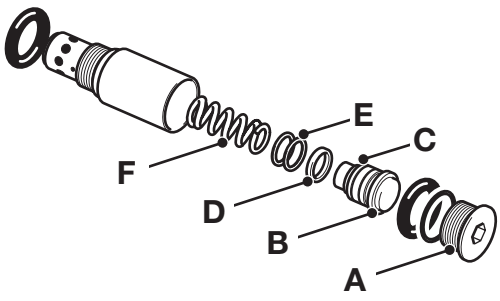
c The difference between the set pressure and the present pressure determines the number of shims **E** required for adjustment.

7 Remove the relief valve assembly from the slew motor.

Note: *If both relief valves are removed at the same time, mark them left and right to facilitate re-assembly in the correct position.*

8 Disassembly

a Place the relief valve in a vice and remove the cap **A** with a 14 mm hexagonal socket, take out the piston **C**, liner **B** poppet **E**, spacer **D**, shims **E** and spring **F**.



A405850-C1

Fig 24.

b Add shim to increase pressure. Remove shim to decrease pressure.

Hydraulic Pump

Often the regulator and attendant valves or pump are combined which makes it very difficult to discover the reason for the trouble. Inspect the following categories which will assist in discovering the abnormal point.

1 **Filter and Drain Oil Inspection.** Inspect the filter element. Check to see whether there is an abnormally large amount of foreign matter. There will be a small amount of metallic powder due to wear of the shoe or cylinder, but if there is a large amount of metallic powder in the filter, it may be due to trouble with the shoe. Also check the drain oil in the pump casing.

2 **Abnormal Vibration and Sound.** Check to see if there is any abnormal vibration or sound in the pump main body. Check to see if it is like the regular frequency sound of the regulator's working or attendant valve relief working. If it is an abnormal vibration or sound, it is possible that there is damage or cavitation inside the pump.

3 **Measure Pressure of Each Part.** When it is a control problem, do not unnecessarily open ports for inspection purposes, measure the pressure for each section and find the abnormal item.

Table 6. Prime Mover Overload

Cause	Treatment	Note
Are the revolutions - pressure higher than pre-determined values?	Set to pre-determined value.	
Is the regulator torque setting too high?	Re-inspect regulator.	Refer to regulator instructions.
Seizure or damage of pumps internal parts	Replace damaged parts.	Check the filter or drain oil for signs of abnormal wear.
Wrong regulator hose connection.	Correct hose lines.	

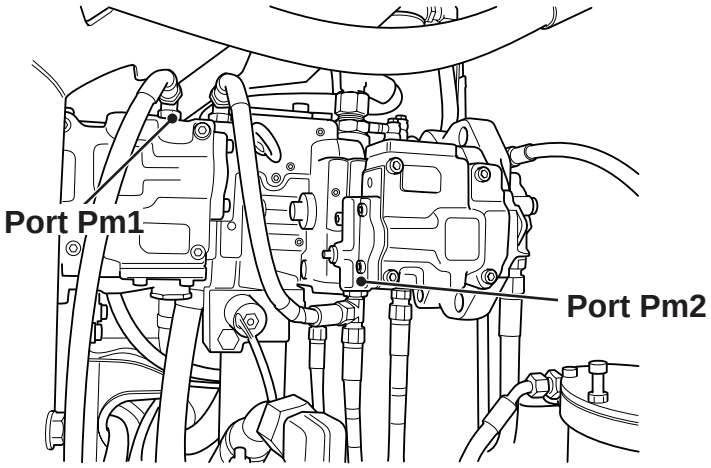
Table 7. When pump flow is extremely low, delivery pressures does not increase

Cause	Treatment	Note
Regulator breakdown	Repair the regulator	Refer to regulator instructions
Seizure or damage of pump internal parts.	Replace damaged parts.	Check filter, drain oil.
Pump breakdown.	Replace damaged parts.	Remove pump and inspect shaft coupling.
Attendant valve breakdown.	Inspect attendant valve.	
Incorrect regulator hose connection.	Correct hose lines.	

Table 8. Abnormal Sound and Vibration

Cause	Treatment	Note
Cavitation.	Prevent cavitation. Check to see if hydraulic oil is white and cloudy.	Boost pressure is low. Pump is broken. Air is sucked by suction pipe. Suction resistance is high.
Damage of shoe caulking part.	Replace piston, shoe, shoe plate.	
Crack in cylinder.	Replace cylinder	
Bad installation of pump.	Correct installation.	
Relief valve bouncing.	Repair relief valve.	Refer to relief valve instructions.

Test 002: Test Max Flow Signal



C068630-C2

Fig 3.

1 Fit test gauges (0 - 60 bar, 10 - 1000lb in^2) into hose connections to ports **Pt1** and **Pt2** with tee-piece adapter.

2 Warm up machine hydraulic temperature to 50 °c (122° f).

3 ⇒ *Table 12. (E-236)*

Table 12.

	(expected Pressures)	
	Port Pm1	**Port Pm2**
With max engine rpm's and no services selected record max flow cut control pressure in E mode	(0 - 1.5 bar)	(0 - 1.5 bar)
	0 -21.8 lb/in^2	0 -21.8 lb/in^2
Select L mode and record pressure	(40 bar)	(40 bar)
	580.2 lb/in^2	580.2 lb/in^2
Select standard mode, select low speed tracking (tortoise on monitor) then select track service record pressure	(40 bar)	(40 bar)
	580.2 lb/in^2	580.2 lb/in^2

Test 007: Testing Engine Speed Settings

Warm Engine water temperature above 50 °C (122°F).

Press SET and MODE at the same time (On the EMS).

Use the up and down arrows to scroll to the RPM value.

Press ACK to view engine speed.

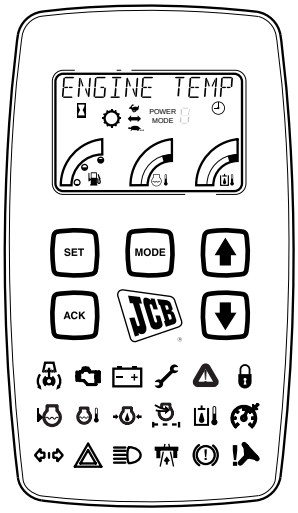


Fig 11.

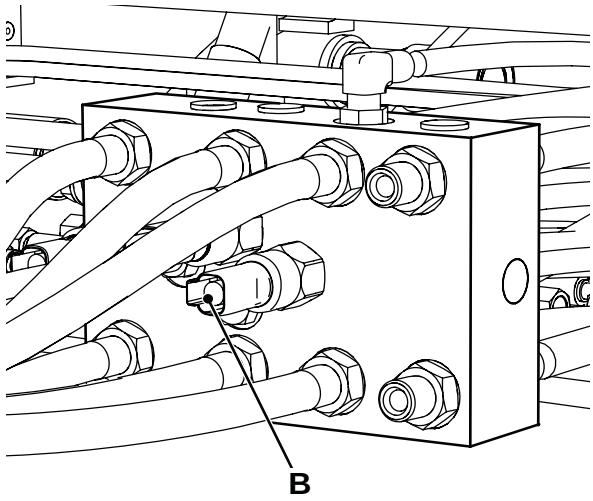


Fig 12.

B Auto Power Boost Pressure Switch

Note: *The Harness Connector should be labelled with a green marker tape*

Mode	Expected RPM No Service Selected	Expected RPM Dipper Close stalled	Expected RPM Bucket Close stalled
"A" mode with the auto pressure switch shorted out	2050 +/- 20 RPM (JS200-260)	2050 +/- 20 RPM (JS200-260)	2050 +/- 20 RPM (JS200-260)
"A" mode with the auto pressure switch connected	900 +/- 20 RPM (JS200-260)	2050 +/- 20 RPM (JS200-260)	1950 +/- 20 RPM (JS200-260)
"E" mode.	1950 +/- 20RPM (JS200-260)	1950 +/- 20 RPM (JS200-260)	1950 +/- 20 RPM (JS200-260)
"L" & "P" mode	1850 +/- 20RPM (JS200-260)	1850 +/- 20 RPM (JS200-260)	1850 +/-20 RPM (JS200-260)

Test 015: High Gear Selection, Monitor Displays Another Travel Gear

If machine selects high tracking gear `by itself' even though the operator has not selected high gear and the monitor display has not changed carry out following checks:

What pressure is seen at pilot port **D** when:

1 middle tracking gear is selected?

2 middle tracking gear is selected and tracking service is stalled, forwards and backwards on both left and right hand tracks?

3 high tracking gear is selected?

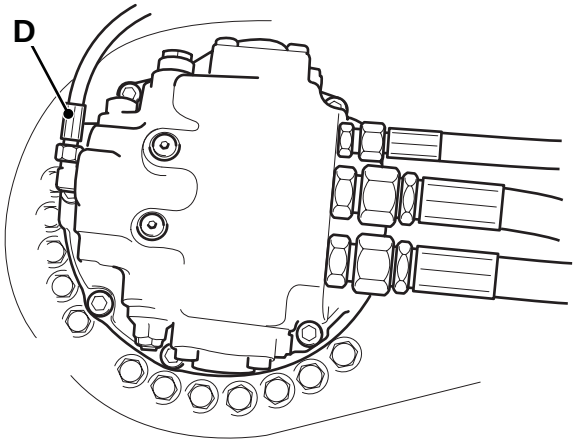


Fig 24.

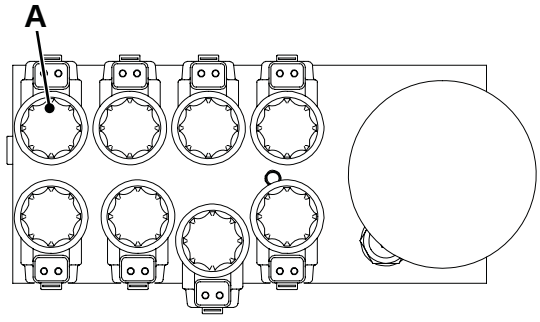


Fig 25. Front View of 8 spool valve

What electrical voltage is seen at high speed tracking solenoid **A** when:

1 Middle tracking gear is selected?

2 High tracking gear is selected?

Notes:

Brake Valve

Brake Function

When control valve **A** is returned to neutral, the pressurised oil from the pump is blocked, and pressure at **P1** and **P2** becomes equal, and the plunger tries to return to neutral position by the spring. When the plunger moves, the plunger diaphragm opening becomes smaller and because the piston motor continues to rotate due to inertia (motor pumping function), the pressure at **M2** port side rises and braking occurs. At this time, when the **M2** port side pressure attains the relief valve set pressure, the relief valve works and allows oil to escape to **M1** port side, absorbs shock pressure caused by inertia of **M2** port side while also preventing **M1** port side cavitation.

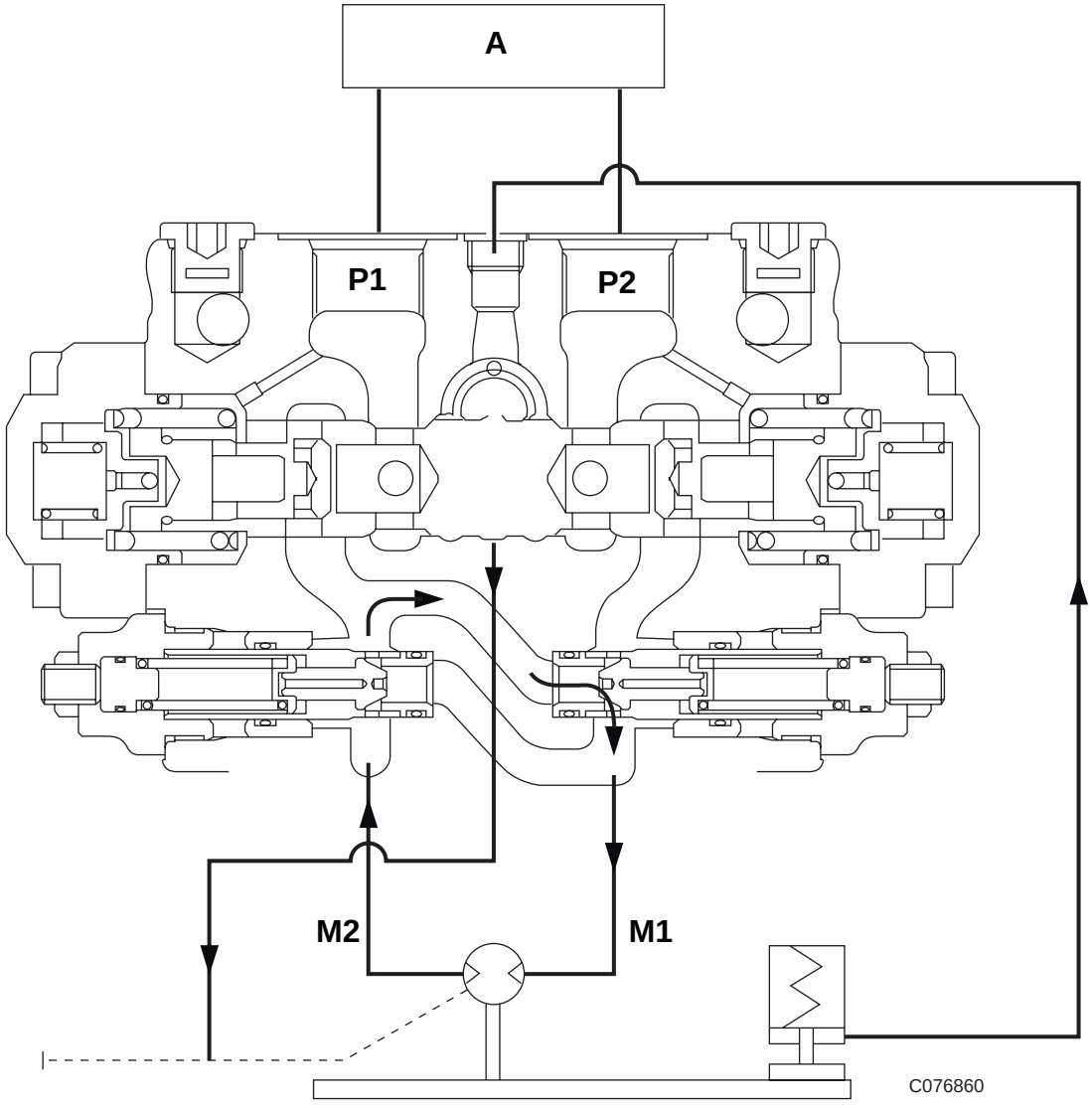


Fig 4.

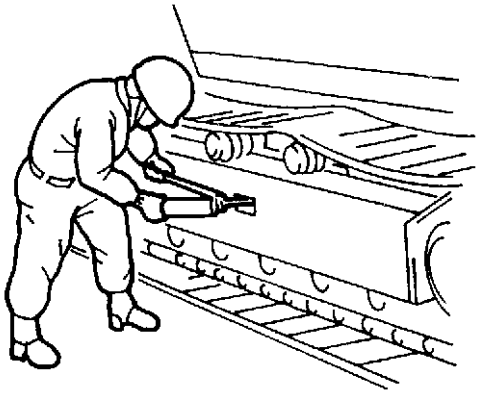


Fig 27.

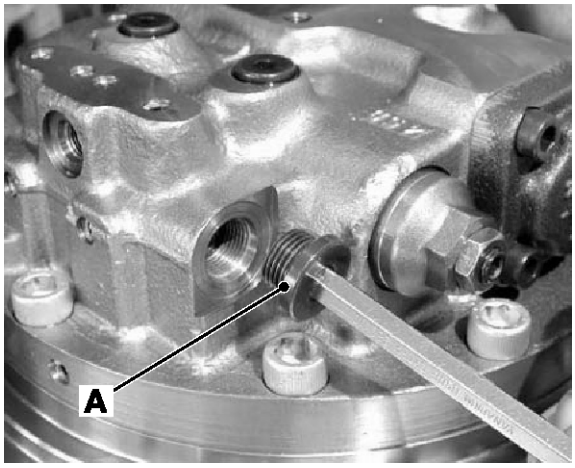


Fig 4.

e Slide out the two speed spool **A**.

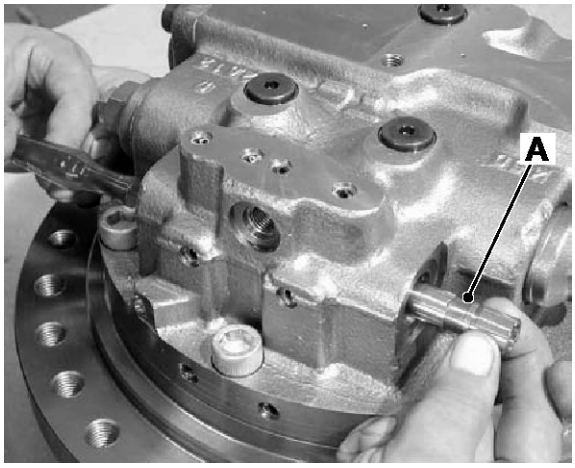


Fig 5.

2 Remove the Relief Valve.

a Unscrew the relief valve **A**.

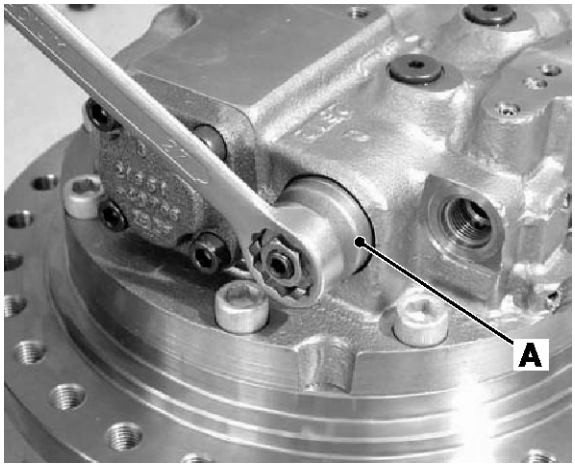


Fig 6.

b Take out the free piston **B** from the relief valve **A**.

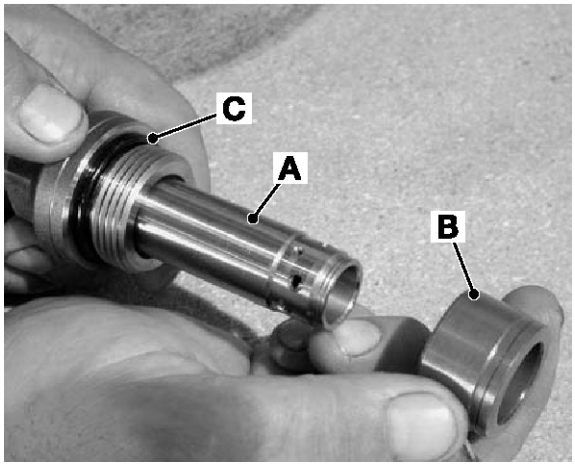


Fig 7.

c Remove the O-ring **A** and backup rings **B** from their seats in the free piston and the O-ring **C** from the relief valve **A**.

Key

1	Hydraulic Motor Hub	34	Spring Seat
2	O-Ring	35	Spring
3	Orifice	36	O-Ring
4	O-Ring	37	Flanged Plug
5	Motor Seal ring	38	Screw
6	Bearing	39	Backup Ring
7	Motor Shaft Assembly	40	O-Ring
8	Steel Ball	41	Backup ring
9	Two Speed Spring	42	O-Ring
10	Two Speed Control Piston	43	O-Ring
11	Swash Plate	44	O-Ring
12	Piston	45	Relief Valve Assembly
13	Retainer Plate	46	Plug
14	Spherical Retainer Plate Holder	47	O-Ring
15	Pin	48	Spring Seat
16	Cylinder Block	49	Spool
17	Spring Holder	50	Spring
18	Spring	51	Plug
19	Collar Washer	52	Backup Ring
20	Circlip	53	O-Ring
21	Valve Plate	54	O-Ring
22	Bearing	55	Backup Ring
23	Brake Disc	56	Spool
24	Backup ring	57	Plug
25	O-Ring	58	Orifice
26	O-Ring	59	Orifice
27	Backup Ring	60	Orifice
28	Brake Piston	61	Plug
29	Pin	62	O-Ring
30	Spring	63	Screw
31	Pin	64	Orifice
32	O-Ring	65	O-Ring
33	Counterbalance Spool	66	Plug

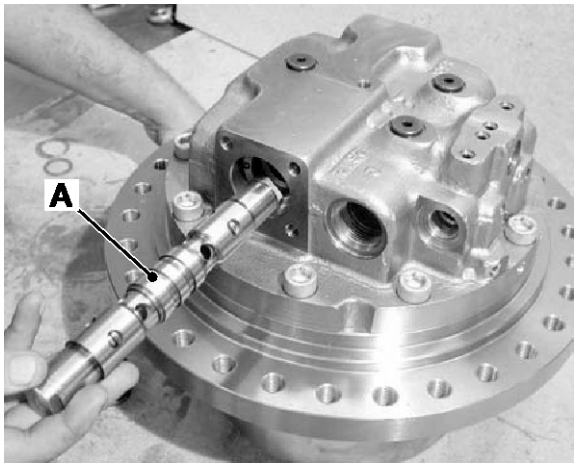


Fig 74.

c Insert the first spring seat **A** on to the counter balance valve spool **B**.

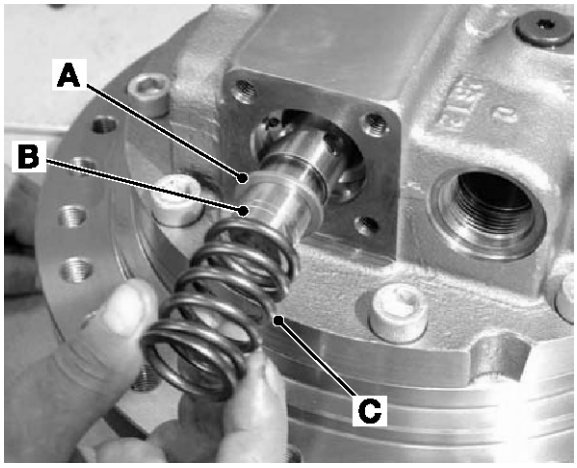


Fig 75.

d Insert the first spring **C** on to the counterbalance spool valve.

e Assemble the flanged plug **A** assembly on to the base plate and tighten the four socket head screws **B**. Torque tighten to 59 Nm (43.5 lb/ft).

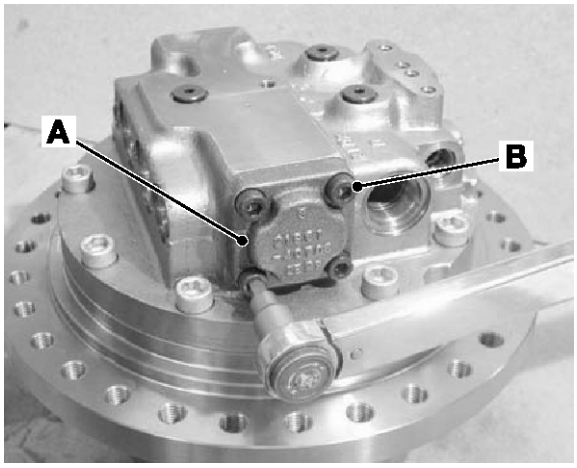


Fig 76.

f Repeat steps 4c to 4e for the second assembly.

5 Relief Valve Assembly.

a Assemble the O-ring **A** in its seat in the relief valve **B**.

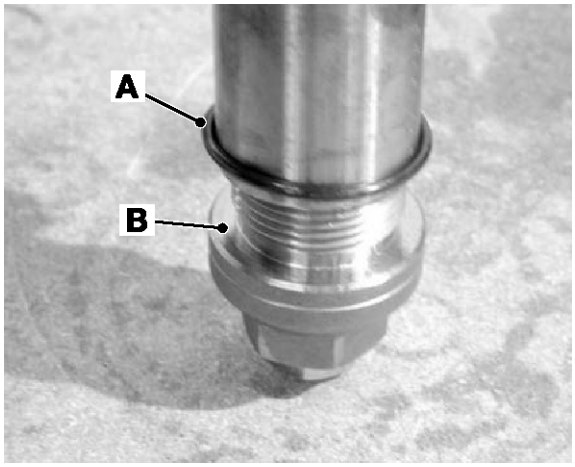


Fig 77.

b Assemble the first backup ring **A** into it's seat in the free piston followed by the O-ring **B** and then the second backup ring **C** as shown.

Assembly

Assembly is a reversal of the Dismantling procedure. Numbers refer to the illustration, ⇒ *Fig 17. (F-56)*.

Note: *Exchange or repair all parts that are found to be damaged. In the case of a damaged planet gear, do not replace the single gear but the whole reduction stage.*

Note: *Ensure that all the parts are cleaned in the appropriate solvent and dried with compressed air.*

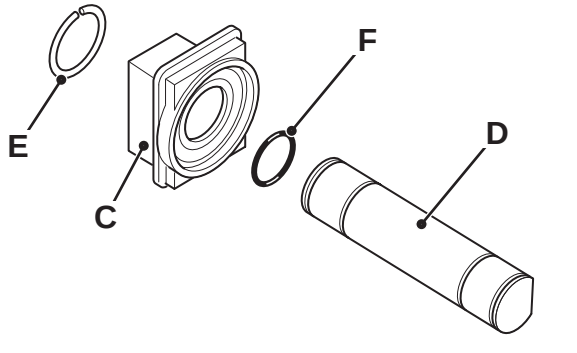
Note: *Apply a thin film of hydraulic fluid to all sliding parts, bearings and other contact surfaces before assembly.*

Note: *Replace all O-rings and seals and thoroughly clean the grooves that they sit in. Cover the O-rings and seals with petroleum jelly.*

1 Fit the lower ball bearings c in the housing, holding the inner raceway **b** in position with the spacer tools **a** and **d**

2 Remove spacer **a**. Place the bearing spacer **e** into position and drop the upper ball bearing sets into position. Then fit the inner race.

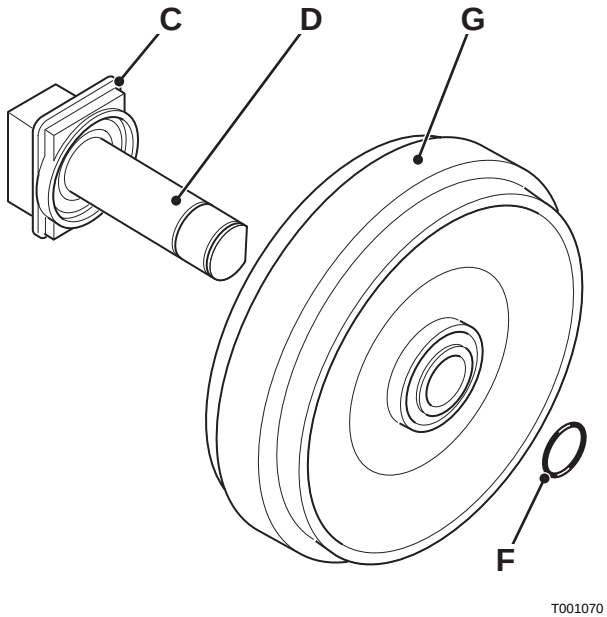
Contents Page No.



T001080

Fig 9.

4 Coat shaft **D** with grease. Clean the metallic face of the seal, coat the metallic face with engine oil and insert the shaft into the idler wheel **G**.



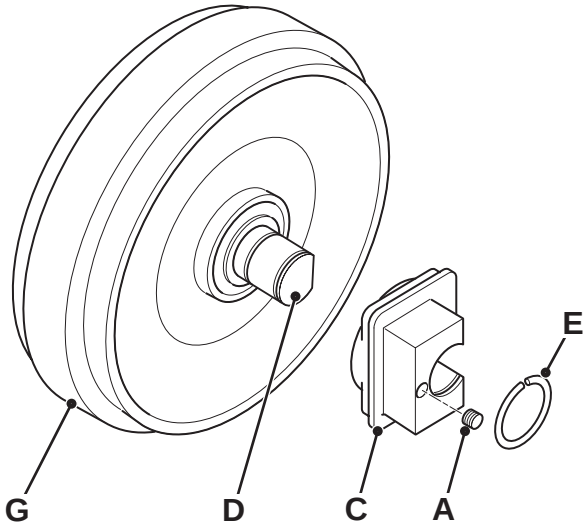
T001070

Fig 10.

5 Apply grease to a new 'O'-ring **F** and install it on the shaft **D**.

Clean the metallic face of the seal, coat the metallic face with engine oil and install the hub **C** onto the shaft **D**. Fit new wire clip **E** or roll pin (later machines).

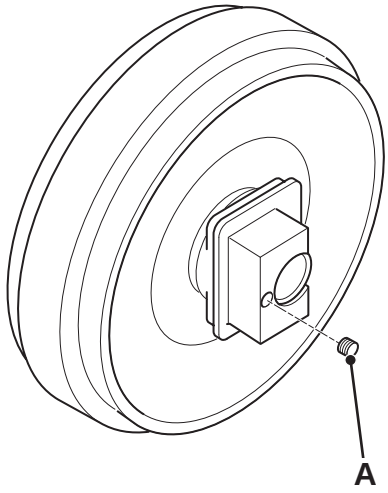
Wrap sealing tape around the plug **A** with one thread remaining uncovered. Insert this plug but leave the other one out until after testing.



T001061

Fig 11.

6 Add the specified oil, refer to ***Section 3, Lubricants and Capacities***. Install plug using an appropriate pipe sealant.

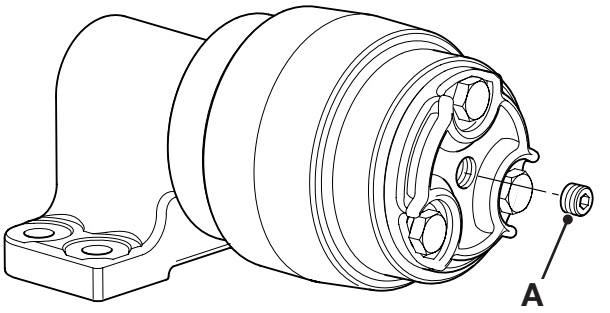


T001051

Fig 12.

Replacement

1 Before fitting the roller, check the oil level and, if necessary, top up, see Section 3, ***Fluids and Lubricants,*** . Install the plug **A** using an appropriate pipe thread sealant.

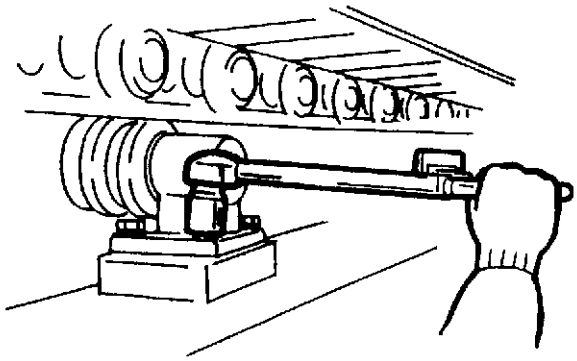


802958

Fig 5.

2 With the track supported as shown under Removal, step 2, install the roller.

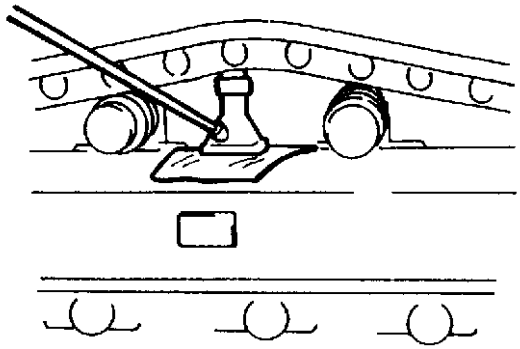
3 Apply JCB Threadseal to the threads and install the mounting bolts. Tighten to a torque of 259 Nm (191 lbf ft).



C004790

Fig 6.

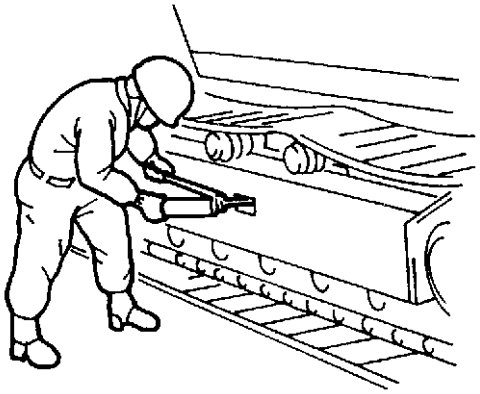
4 Remove the wooden blocks and jack.



C004800

Fig 7.

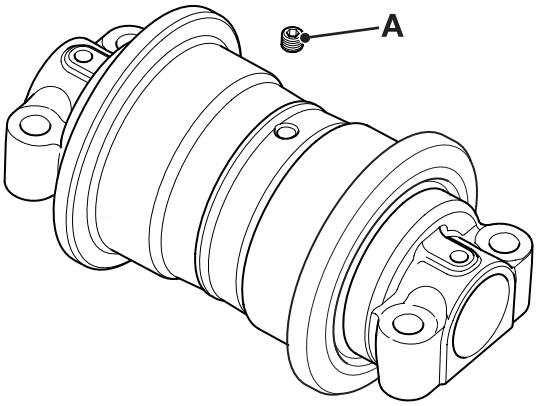
5 Apply grease through the check valve to adjust the track tension, see ***Section 3, Checking/Adjusting the Track Tension***.



C004330

Fig 8.

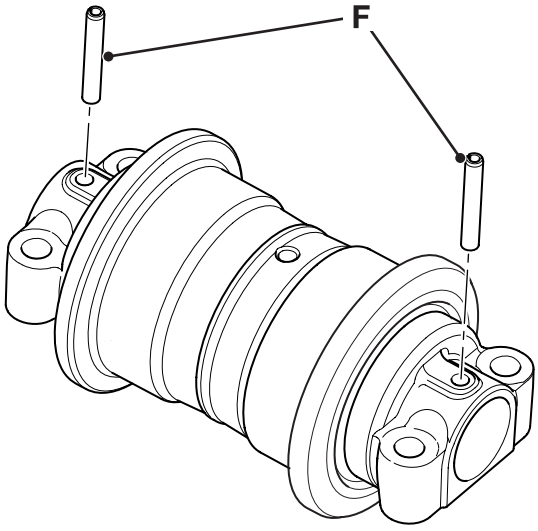
1 Clean the roller with a suitable solvent. Remove the plug **A** and drain the oil.



802961

Fig 10.

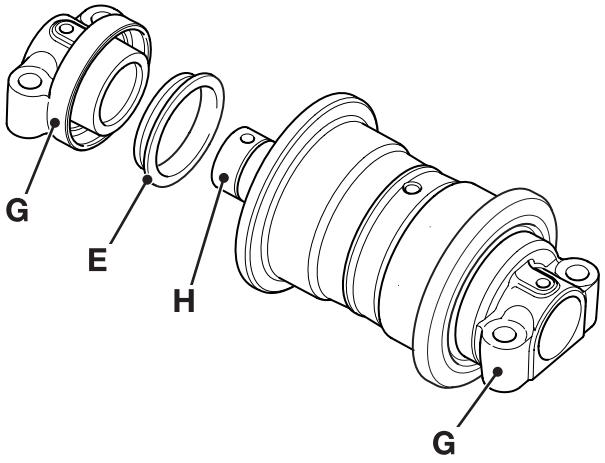
2 Remove locking pins **F** from each end of assembly.



802962

Fig 11.

3 Remove mounting brackets **G** from shaft **H**.

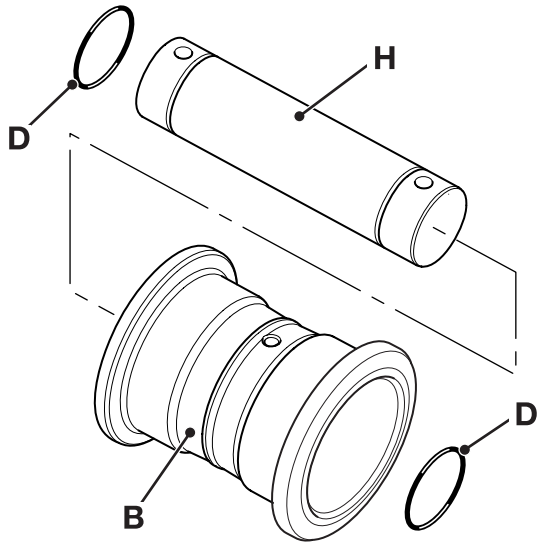


802963

Fig 12.

Using a pry bar, remove floating seals **E** from brackets **G** and discard.

4 Remove and discard 'O'-rings **D** from shaft **H**. Pull out shaft **H** from roller **B**.



802964

Fig 13.

Technical Data

JS200-260

Table 1.

Type	Isuzu 4HK1 4-cycle/water cooled type, inline 4 cylinder OHC
Model	4HK1X-Tier III
Bore	115mm (4.53 in)
Stroke	125mm (4.92 in)
Displacement	5193 cm^3 (317 in^2)
Compression Ratio	17.5 : 1
Compression Pressure at 200 rev/min	3.23 MPa (468 lbf/in^2)
Firing Order	1, 3, 4, 2
Valve Clearance (cold)	
Inlet	0.40 mm (0.016 in)
Exhaust	0.40 mm (0.016 in)
Dry Weight (approximately)	478 kg (1053 lb)

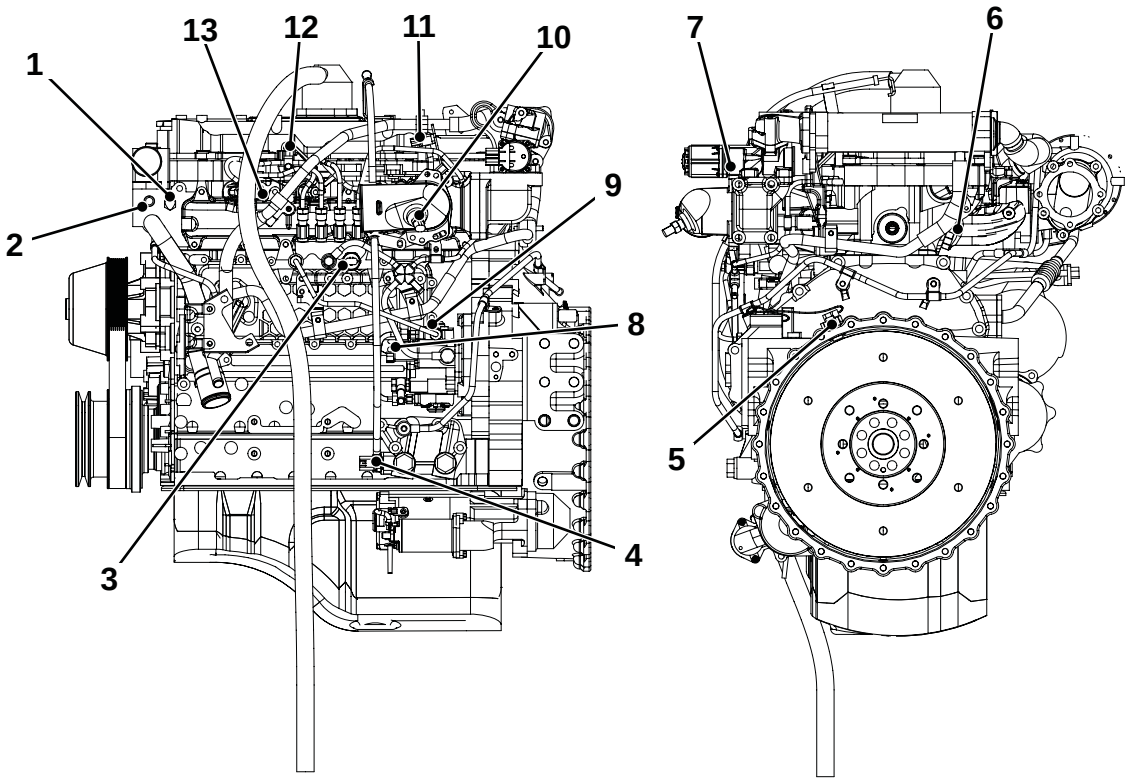
For further details, see Tier 3 Engine Service Manual, Publication No. 9806/3010

Fault Finding

Engine Components

TK-002

4HK/6HK



T049120

Fig 1.

Item	Description
1	Engine Coolant Temp Sensor (ECT). ⇨ *Engine Coolant Temp Sensor (K-13)*
2	Overheating Switch. ⇨ *Overheat Switch (K-15)*.
3	Common Rail Pressure Sensor. ⇨ *Common Rail Pressure Sensor (K-16)*.
4	Engine Oil Pressure Sensor. ⇨ *Engine Oil Pressure Sensor (K-18)*.
5	Crankshaft Position (CKP) Sensor. ⇨ *Crankshaft Position (CKP) Sensor - 4HK/6HK (K-20)*.
6	Camshaft Position (CMP) Sensor. ⇨ *Camshaft Position (CMP) Sensor - 4HK/6HK (K-24)*.
7	Exhaust Gas Re-circulation (EGR) Valve. ⇨ *Exhaust Gas Re-circulation (EGR) Valve (K-28)*.
8	Suction Control Valve. ⇨ *Suction Control Valve (K-31)*.

Item	Description
9	Fuel Temperature (FT) Sensor. ⇨ *Fuel Temperature (FT) Sensor (K-33)*.
10	Boost Temperature Sensor. ⇨ *Boost Temperature Sensor (K-35)*.
11	Boost Pressure Sensor. ⇨ *Boost Pressure Sensor (K-37)*.
12	Injector. ⇨ *Injector (K-39)*.
13	Glow Plug. ⇨ *Glow Plug (K-40)*.
14	Engine Oil Level Sensor. ⇨ *Engine Oil Level Sensor (K-42)*.
15	Air Intake Temperature (in battery bay - early models, in cab - late models). ⇨ *Air Intake Temperature Sensor (K-43)*.
16	Barometric Pressure Sensor (in air intake hose behind air filter). ⇨ *Barometric Pressure Switch (K-45)*.

⇨ *Schematics (K-46)*

Checking Circuit Resistance

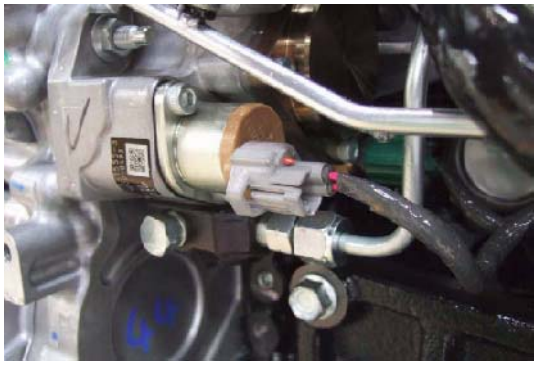
Table 11.

Terminal No.	Normal Value	Abnormal Value
106 - Sensor connector (-) terminal 107 - Sensor (+) terminal	100 ohms or less	10 M ohms or more
106 - Ground 107 - Ground	10 M ohms or more	100 ohms or less
106 - 107	10 M ohms or more	100 ohms or less
106 - Ground 107 - Ground	0 Volt	18V or more

Suction Control Valve

T049230

Fig 39. 4HK/6HK

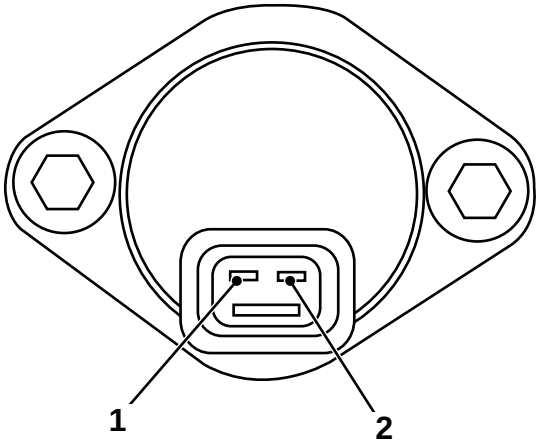


T049730

Fig 40. 4JJ

The SCV (suction control valve) is installed on the supply pump section and controls the flow of fuel to the high pressure pump. The engine control module (ECM) regulates the voltage supply to the SCV to regulate the fuel flow and determines the pressure in the common rail.

Connector



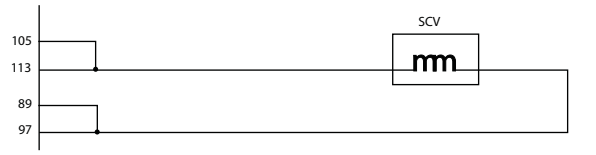
T049390

Fig 41.

Table 29.

1	SCV - High
2	SCV - Low

Schematic



T049400

Fig 42.