Service Manual

JS115 - JS180

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Section C - Electrics

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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

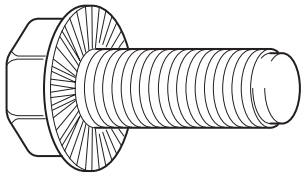


Fig 1.

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

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Schematic Diagram

JS130/JS160/JS180 - Early Machines

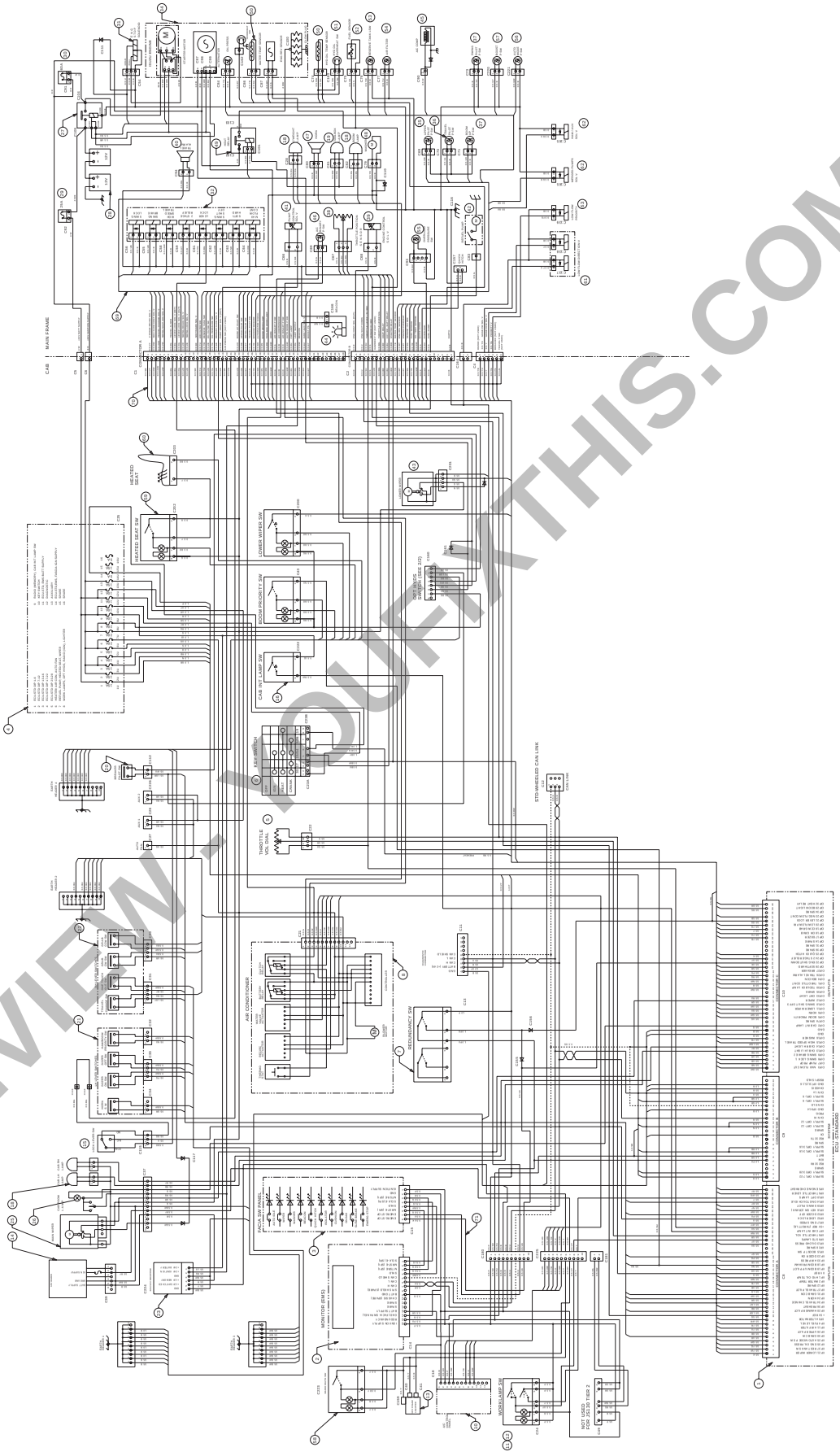


Fig 28.

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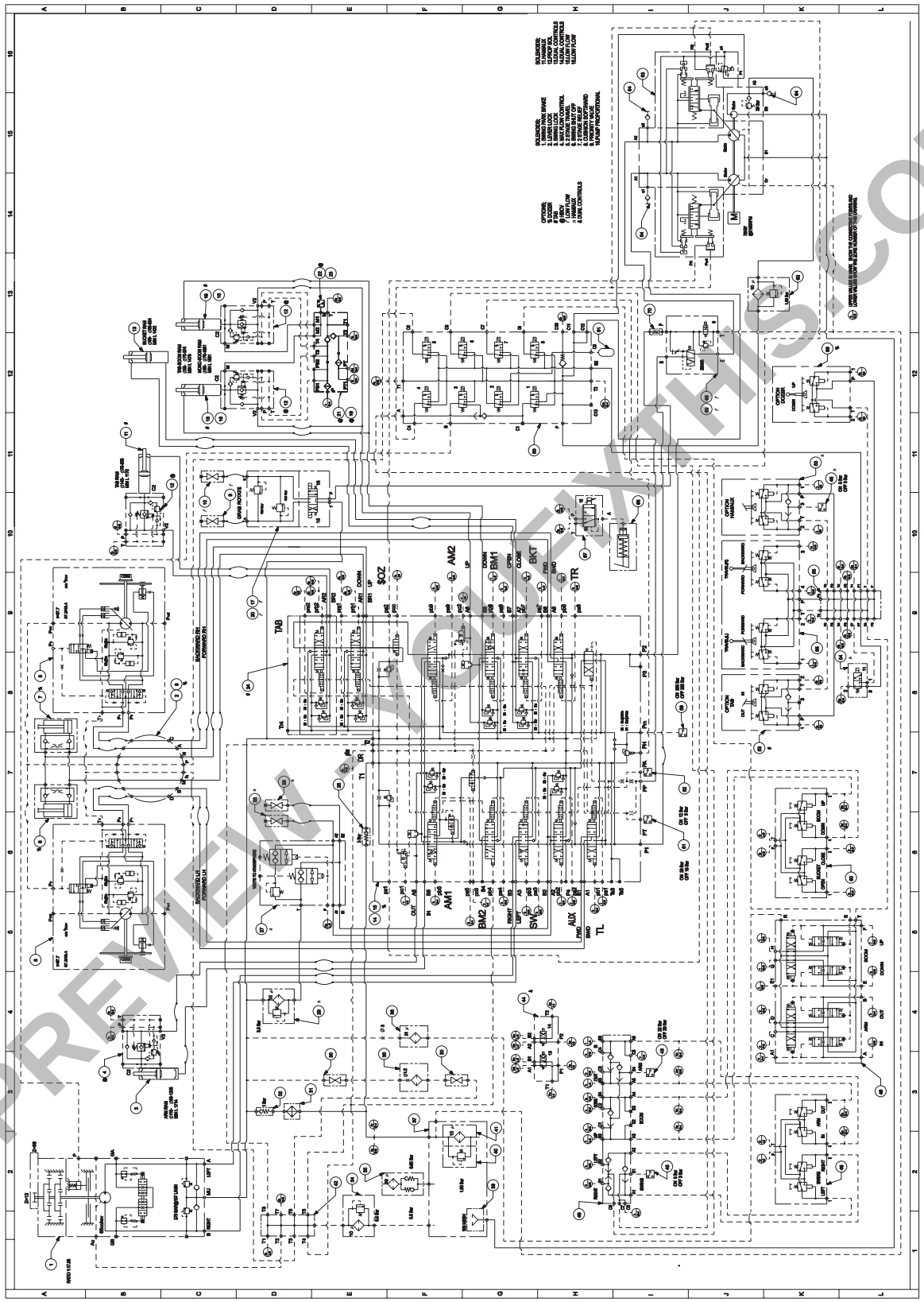


Fig 9.

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Hydraulic Pump

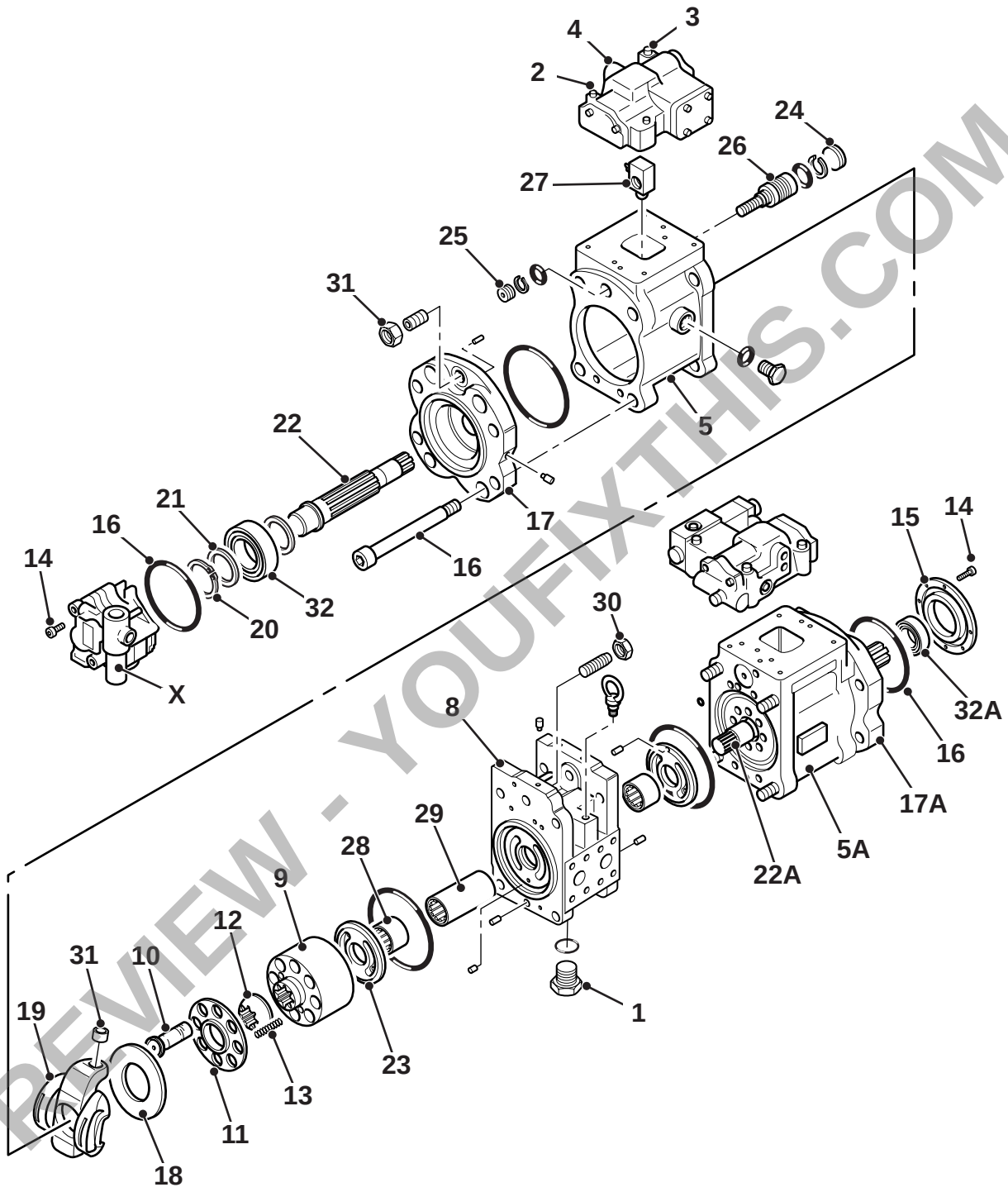


Fig 80.

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List of text messages displayed on the EMS.

Table 1: Error messages

MESSAGE	DESCRIPTION
Air Filter	Air Filter Blocked
Air Pressure	Low Air Pressure
Alternator	No / Low Charge
Brake Fail	No Brake pressure
Comms Fault	Can/ SPI network fault.
Coolant low	Coolant level
Elec Fault	ECUs / Harness Fault
Hyd oil low	Hydraulic oil level
Oil Filter	Oil filter blocked
Oil Press	Engine Oil pressure
Over heat	Engine/ Hydraulic temperature high.
Overload	Overload caution reached
Low Fuel	2nd Low fuel warning
No Throttle	Throttle system fault
Res Fuel	1st Low fuel warning

Table 2: Status messages

MESSAGE	DESCRIPTION
Auto warm	Engine automatic warm up sequence
Emer Stop	Engine Emergency Stop activated
Limp mode	Limp mode system activated
Low idle	Engine speed
Overload on	Overload caution activated (option)
Power up	One touch digging force up activated
Pre Heat	Engine preheat activated
Q/H Discon	Quick hitch status
Q/H Discon?	Quick hitch disconnect
Service Rqd.	Service required indicator
Soft mode	Cushion status
Slew lock	Slew Lock engaged

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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 13. 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 pump	Repair(1)

Table 14. 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 15. 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

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Lubricants and Capacities

JS115 - JS145 and Variants

Item	Lubricant	International Specification	Capacity
ENGINE	⇨ *Engine Lubrication Chart (🗋 3-16)*		13.2 litres (2.9 UK gal) (3.5 US gal)
TRACK GEARBOX	JCB HD90 Gear Oil	API-GL-5, MIL-L-2105	2 x 5.1 litres (2 x 1.1 UK gal) (2 x 1.4 US gal)
SLEW GEARBOX	JCB HD90 Gear Oil	API-GL-5, MIL-L-2105	2.2 litres (0.5 UK gal) (0.6 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	JCB Hydraulic Fluid 46	ISO VG46	124 litres (27.3 UK gal) (32.8 US gal)
SLEW RING - BEARING - GEAR TEETH	 JCB Special HP Grease JCB Special HP Grease	 Lithium complex (NLGI) inc. extreme pressure additives Lithium complex (NLGI) inc. extreme pressure additives	 -- 11 kg (24.25 lb)
ALL OTHER GREASE POINTS	JCB Special HP Grease	Lithium complex (NLGI) inc. extreme pressure additives	--
COOLING SYSTEM	JCB HP Coolant ⇨ *Coolant Mixtures (🗋 3-43)*	ASTM D - 6210	16.4 litres (3.8 UK gal) (4.3 US gal)
FUEL TANK	⇨ *Types of Fuel (🗋 3-45)*		253 litres (55.6 UK gal) (66.7 US gal)

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Service Schedules

Introduction

A poorly maintained machine is a hazard. Doing the regular maintenance and lubrication jobs listed in these schedules will help keep the machine in safe running order.

⚠ WARNING

Maintenance must be done only by suitably qualified and competent persons.

Before doing any maintenance make sure the machine is safe, it should be correctly parked on level ground.

To prevent anyone starting the engine, remove the starter key. Disconnect the battery when you are not using electrical power. If you do not take these precautions you could be killed or injured.

8-3-1-1

A Service History Record Book is supplied with every machine to enable you to plan your service requirements and keep a service history record. This record book should be dated, signed and stamped by your Distributor at machine installation and each time your machine is serviced.

2-3-1-9

Apart from the daily jobs, the schedules are based on machine running hours. Keep a regular check on the hour meter reading. Do not use a machine which is due for a regular service. Rectify any defects found during regular maintenance before clearing the machine for use.

Calendar equivalents:

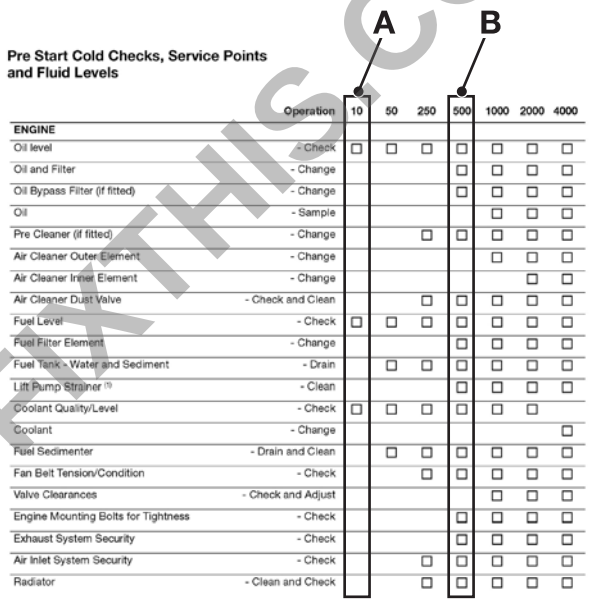
Every 10 Hours	=	Daily
Every 50 Hours	=	Weekly
Every 250 Hours	=	Monthly
Every 500 Hours	=	Three Months
Every 1000 Hours	=	Six Months
Every 2000 Hours	=	1 Year
Every 4000 Hours	=	2 Years
Every 5000 Hours	=	2 Years 6 Months

Note: *Services should be carried out at either the hourly interval or calendar interval, whichever occurs first.*

How to Use the Service Schedules

T3-012_2

In the example shown, **A** shows all service requirements to be carried out every 10 hours and **B** shows the requirements to be carried out every 500 hours.



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Daily Checking

It is vital to check certain machine functions and components daily to ensure that the machine can be operated safely and efficiently.

1 Engine (Inspection before Starting)

Follow steps 1-3 of daily checking.

2 Prepare the machine

Park the machine on level ground, lower the bucket to the ground.

3 Locate the components to be checked, ***see Machine Description in Introduction section***.

4 Stop the engine, remove the starter key.

5 Visual check. Check the machine for the following:

a Oil, fuel and coolant leakage.

b Fasteners properly attached.

c Wire breakage, short circuit of cables and terminal anchorage.

d Oil cleanliness.

e Dust accumulation.

f Engine oil level check and refilling. Check the oil level before starting the engine and 30 minutes or more after stopping the engine.Use dipstick **A** to check that the oil level is correct. If low, refill with engine oil through oil filler port **B**. Re-check the oil level about 10-15 minutes after refilling.

⚠ WARNING

Hot Coolant

The cooling system is pressurised when the coolant is hot. Hot coolant will burn you. Make sure the engine is cool before checking the coolant level or draining the system.

2-3-3-3

g Coolant level check and refilling. Check the level of coolant in the reserve tank **C**. If low, remove the reserve tank cap **D** and refill with coolant. The correct level is between the FULL and LOW markings.

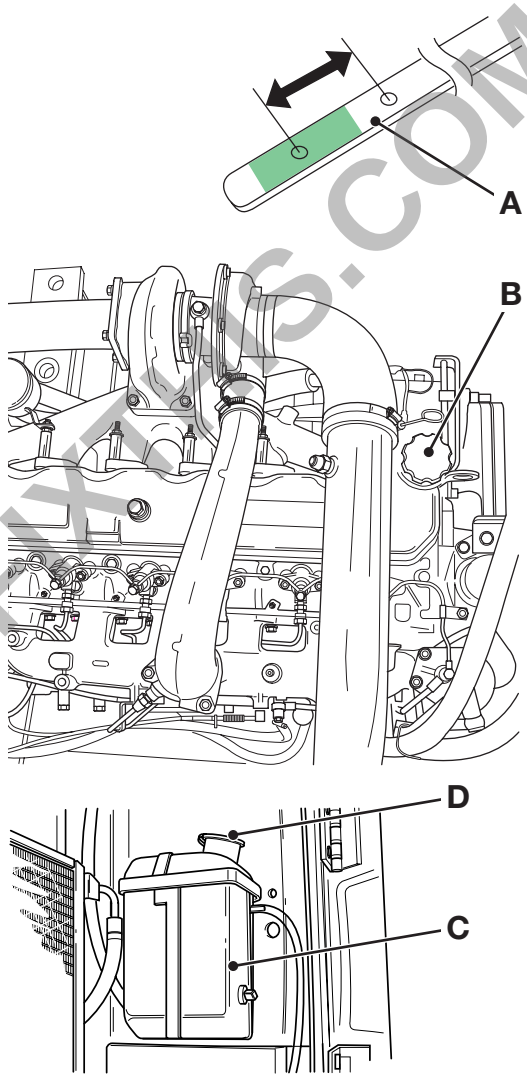


Fig 1.

6 Checking after initial start-up

a Operation of horn and gauges.

b Ease of engine starting, abnormal noise and exhaust gas colour.

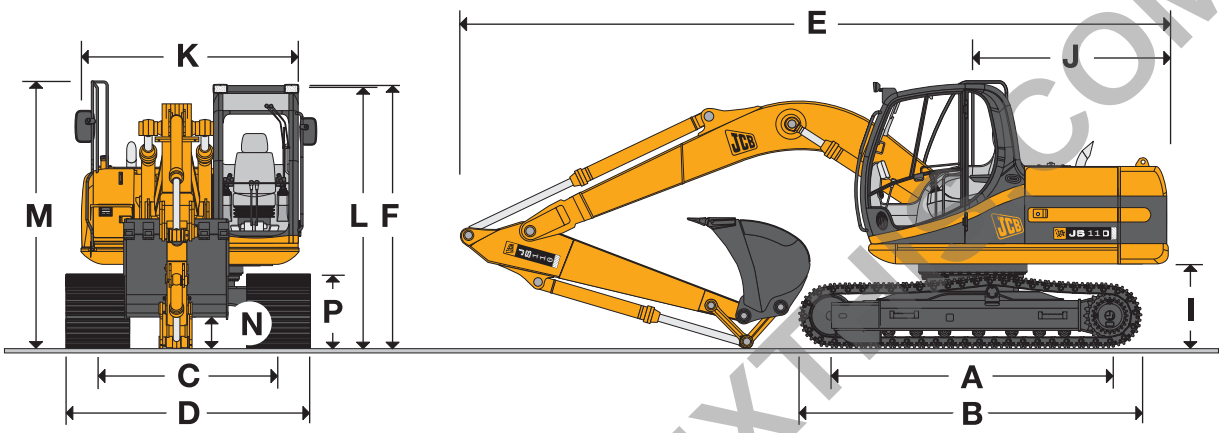
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Technical Data

Static Dimensions

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Dimensions in millimetres (ft. in)	
A Track length on ground	2580 (8 ft 6 in)
B Undercarriage overall length	3317 (10 ft 11 in)
C Track gauge	1990 (6 ft 6 in)
D Width over tracks (500 shoes)	2490 (8 ft 2 in)
D Width over tracks (600 shoes)	2590 (8 ft 6 in)
D Width over tracks (700 shoes)	2690 (8 ft 10 in)

Dipper lengths	1.95m	2.25m	2.8m
E Transport length	7272 (23 ft 10 in)	7272 (23 ft 10 in)	7307 (24 ft 0 in)
F Transport height	2864 (9 ft 5 in)	2864 (9 ft 5 in)	2864 (9 ft 5in)

Dimensions in millimetres (ft. in)	
I Counterweight clearance	905 (3 ft 0 in)
J Tailswing radius	2050 (6 ft 9 in)
K Width of superstructure	2410 (7 ft 11 in)
L Height over cab	2839 (9 ft 4 in)
M Height over grab rail	2864 (9 ft 5in)
N Ground clearance	464 (1 ft 6 in)
P Track height	767 (2 ft 6in)

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Driver Controls and Switches

Right Console

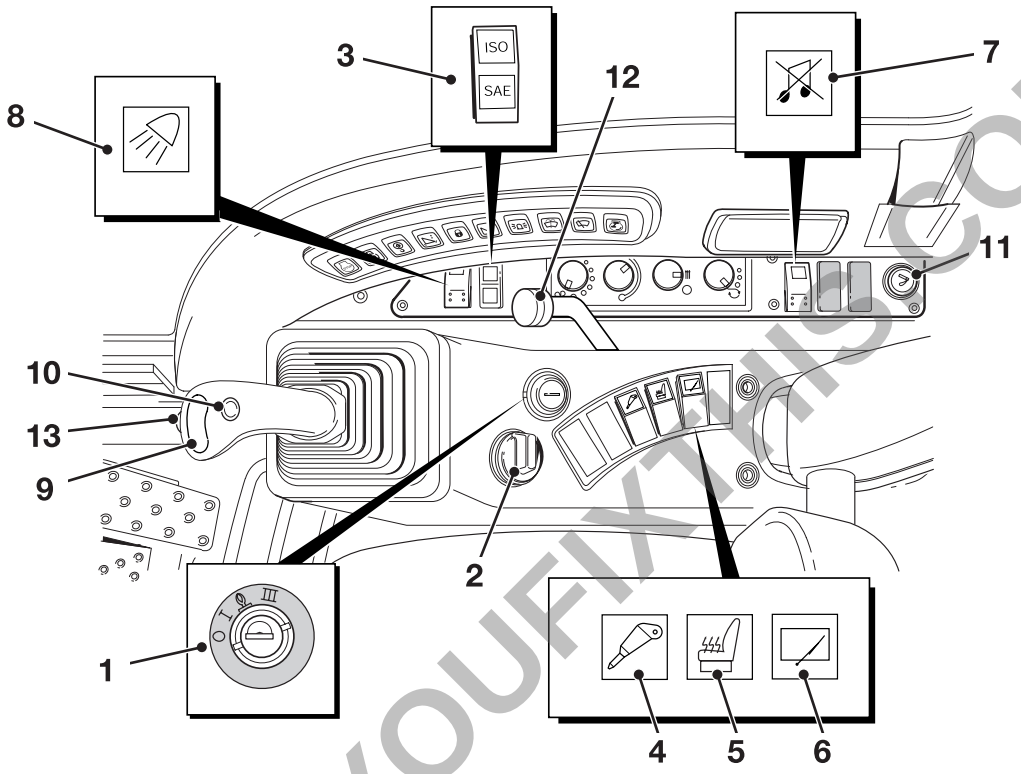


Fig 6.

1 Starter Switch.

This is operated by the starter key. It has four positions. The key can only be removed when in the **'O'** position.

`O' Off/Stop Engine. Turn the key to this position to stop the engine. Make sure the controls are in neutral and the excavator and dozer are lowered before stopping the engine.

I - On. Turning the key in this position connects the battery to the electrical circuits The key will spring back to this position when released from II.

II - Heat Position. Holding the key in this position switches on the glow plugs. The glow plugs warm the engine combustion chambers for cold weather starting. Do not hold in this position for more than 60 seconds. The key will spring back to I when released.

III - Start. Operates the starter motor to turn the engine. The starter switch has an inhibitor to stop the switch being turned ON when the engine is running

Note: *Do not operate the starter for more than 20 seconds at one time.*

2 Throttle Dial.

This rotary control provides progressive engine speed control over the full range.

If the engine is started with the throttle dial not at the minimum position, no engine speed control will be

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Basic Operation

Air Conditioning

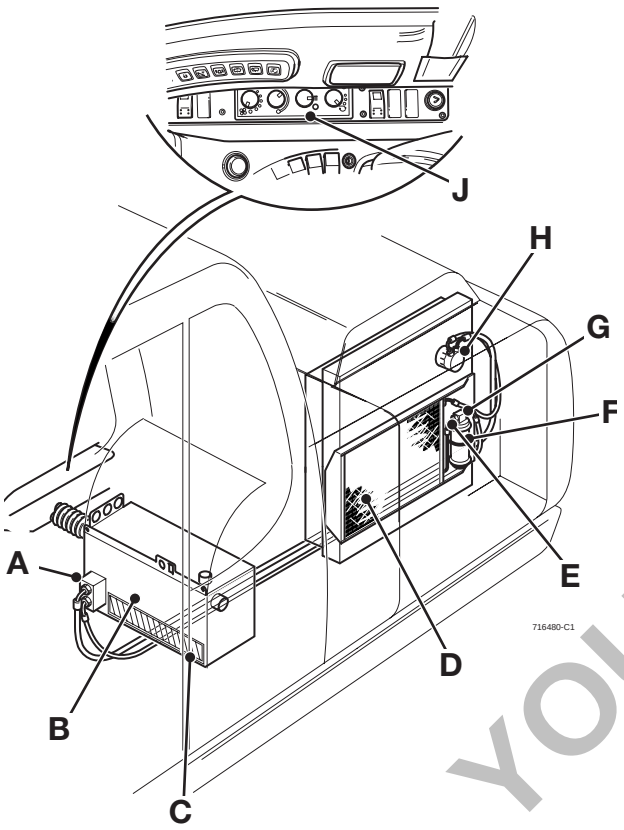


Fig 13.

A Thermostatic Expansion Valve (TEV)
B Evaporator Matrix
C Air Filter
D Condenser
E Binary Switch
F Receiver/Drier
G Sight Glass (moisture indicator)
H Compressor
J Control Panel

Operation

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

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

The major components of the system are the compressor **13-H** condenser **13-D**, receiver drier **13-F**, expansion valve **13-A** and evaporator matrix **13-B**.

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General Safety

⚠ WARNING

Operator Manual

You and others can be injured if you operate or maintain the machine without first studying the Operator Manual. Read the safety instructions before operating the machine. If you do not understand anything, ask your employer or JCB dealer to explain it. Keep the Operator Manual clean and in good condition. Do not operate the machine without an Operator Manual in the cab, or if there is anything on the machine you do not understand.

INT-1-3-2_2

⚠ 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.

INT-1-3-6

⚠ 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

⚠ WARNING

Feeling Unwell

Do not attempt to operate the machine if you are feeling unwell. By doing so you could be a danger to yourself and those you work with.

8-1-2-4

⚠ WARNING

Mobile Phones

Switch off your mobile phone before entering an area with a potentially explosive atmosphere. Sparks in such an area could cause an explosion or fire resulting in death or serious injury.

Switch off and do not use your mobile phone when refuelling the machine.

INT-3-3-9

⚠ WARNING

Lifting Equipment

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

INT-1-3-7

⚠ WARNING

Raised Equipment

Raised equipment can fall and injure you. Do not walk or work under raised equipment unless safely supported.

13-1-1-6

⚠ WARNING

Raised Machine

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

INT-3-3-7_1

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Cleaning the Machine

Exterior

Clean the exterior of the machine using water and/or steam.

If steam is used the machine must be completely greased afterwards. ⇨ *Greasing (3-30)*

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 (3-64)*

Interior

CAUTION

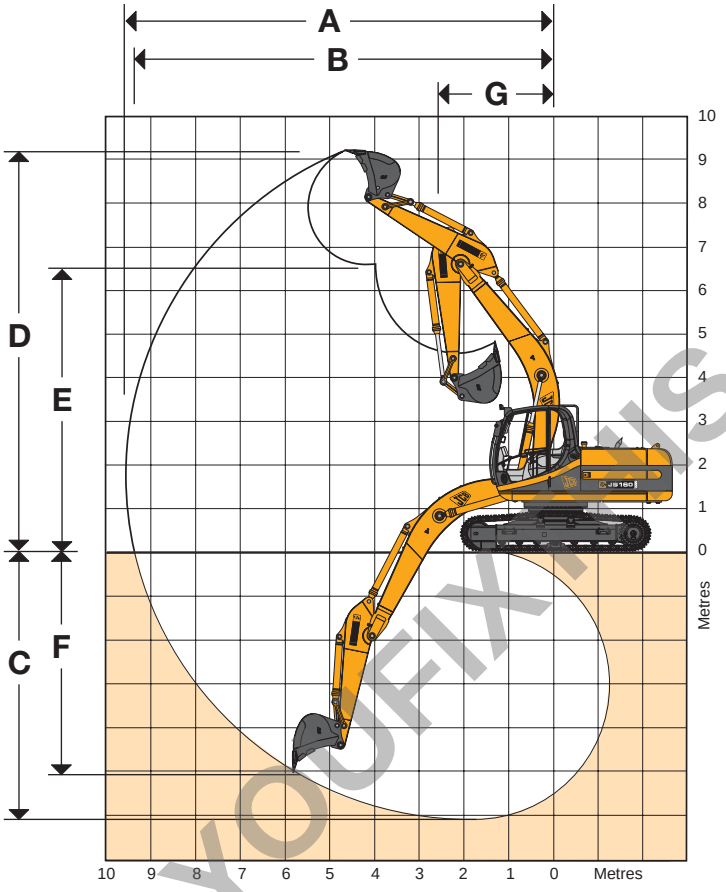
Never use water or steam to clean inside the cab. The use of water or steam could damage the on-board computer and render the machine inoperable. Remove dirt using a brush or damp cloth.

8-3-4-8

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	5.15 m		
Dipper	**2.25**	**2.7**	**3.05**
	m (ft in)	m (ft in)	m (ft in)
A Maximum digging reach	8.51 (27 11)	8.91 (29 3)	9.23(30 3)
B Maximum digging reach (on ground)	8.33 (27 4)	8.74 (28 7)	9.06 (29 8)
C Maximum digging depth	5.48 (17 11)	5.94 (19 6)	6.29 (20 7)
D Maximum digging height	8.86 (29 1)	9.05 (29 8)	9.22 (30 3)
E Maximum dumping height	6.54 (21 5)	6.73 (22 1)	6.89 (22 2)
F Maximum vertical wall cut depth	4.91 (16 1)	5.37 (17 7)	5.65 (18 6)
G Maximum swing radius	3.00 (9 10)	3.00 (9 10)	3.00 (9 10)

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Pulse Width Modulation (PWM)

Ohms law states that, the amount of current flow in a circuit is determined by the voltage, and the resistance. A 24v circuit with a resistance of 6 ohms, would draw a current of 4 amps. This would be the case for a standard solenoid, which is either on or off.

Once the voltage is applied to the circuit, it is present 100% of the time. This would be known as a 100% duty cycle. Therefore the circuit will draw 4 amps constantly.

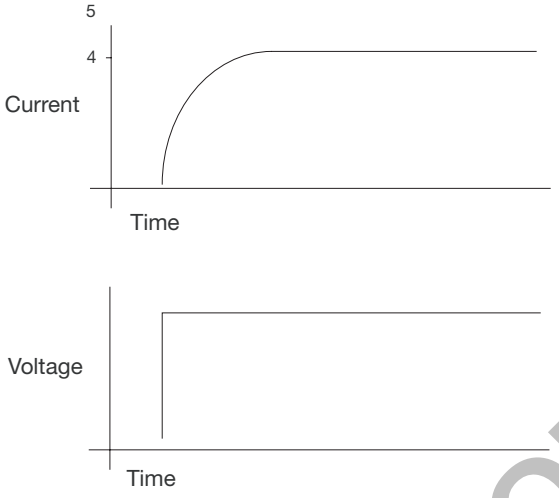


Fig 39.

A proportional solenoid requires differing amounts of current, depending on its condition. As the coil has a fixed resistance, changing the current rating can be done in either of two ways,

1 Having lots of different resistors switched in and out of the circuit at different times to change the current flowing.

2 To change the duty cycle of the solenoid.

It is easier, more economical, and more reliable to change the duty cycle of the circuit, especially using today's computer/ controller technology.

The duty cycle is the amount of time a component is switched on compared to the time it is switched off. If a solenoid is on for three seconds, then off for one second, on for three, off for one etc. this would be a 75% duty cycle.

The graph A although unstable would give a current rating of three amps. To stabilize the current in the circuit, the frequency would need to be increased. If the timescale on the graph A was one second, the frequency would be 4Hz (Hertz (cycles per second)). The graph B shows the same duty cycle, but at a higher frequency of 32 Hz. The proportional solenoids fitted to JS machines operate at a frequency of 125 Hz.

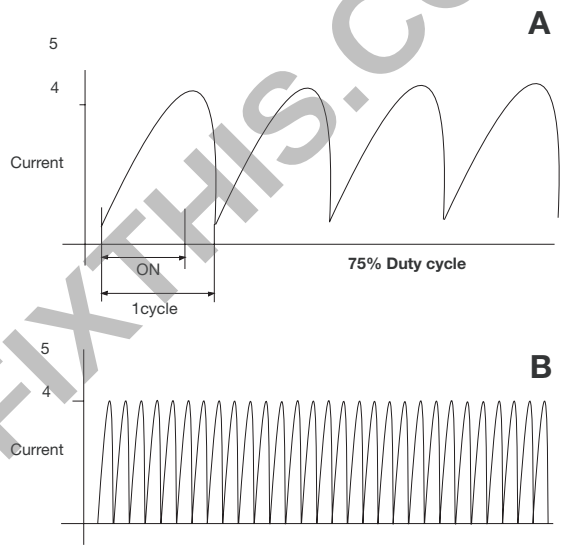


Fig 40.

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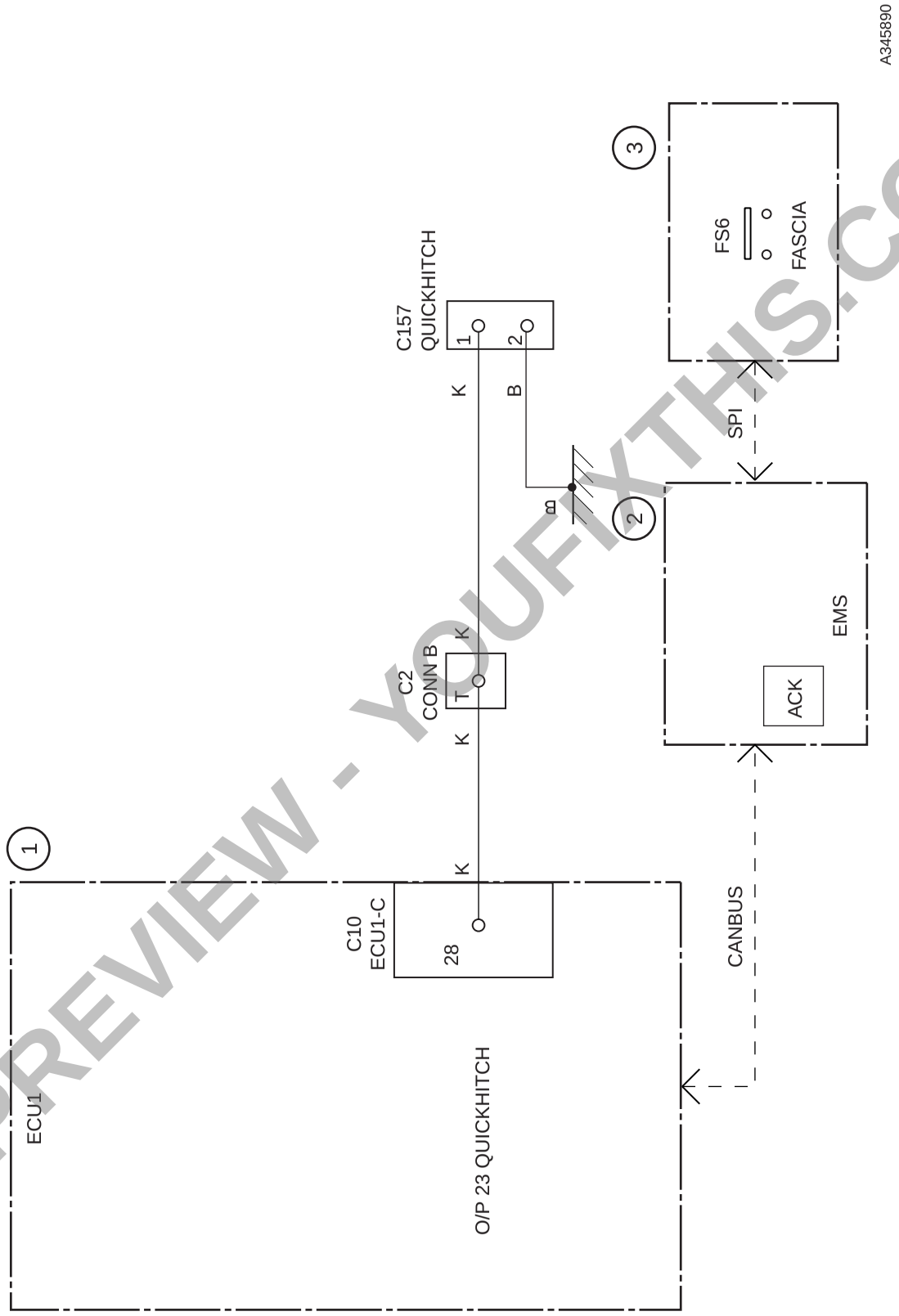


Fig 111.

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Service Procedure

Testing of ECU Inputs + Outputs

Remove panel behind drivers seat, for access to the ECU **A**.

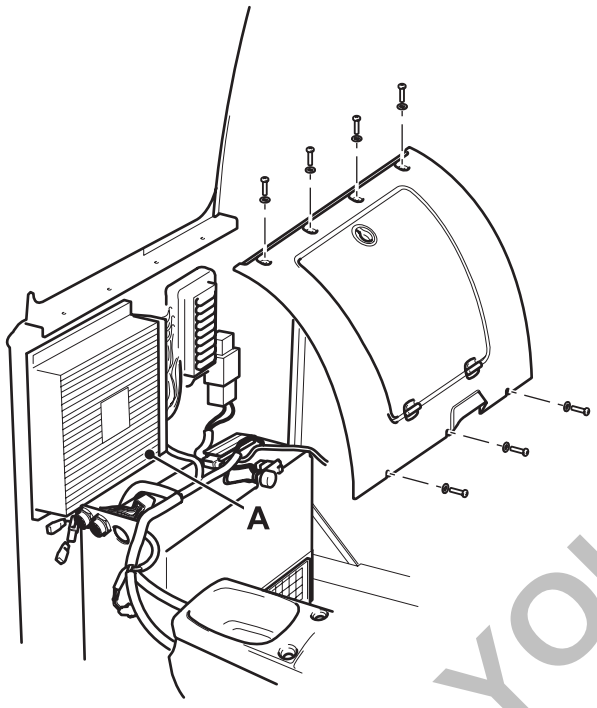


Fig 184.

Care should be taken when testing the inputs + outputs of the ECU to ensure that correct test method is used to determine if the ECU is functioning normally.

Note: *Inputs/outputs should be checked with engine running or in solenoid overide mode (**See Basic System Operation**, set + mode menu 20 secs).*

Testing low side input

With the switch open the meter will read 0v.

With the switch closed the meter will read 24-28v.

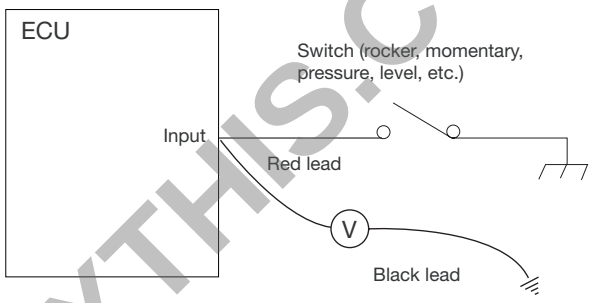


Fig 185.

Testing High side input

With the switch open the meter will read 0v.

With the switch closed the meter will read 24-28v.

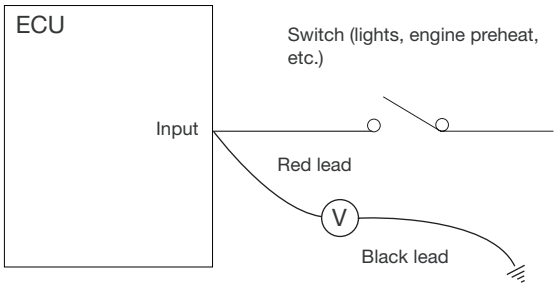


Fig 186.

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Travel - Middle Speed

For schematic, ⇒ *Fig 30. (E-51)* .

When both tracks are selected, servo pressure from port **2** (LH travel lever),and port **4** (RH travel lever) **55** enters the main control valve **14** at Pb1 and Pb6 respectively, selecting the left and right hand travel spools.

Flow from pump A2 is available at the LH travel spool and is directed to the LH travel motor via port **B1** of the Main control valve **10**, through the rotary coupling and in to port P2 on the LH travel motor. Exhaust oil from the motor enters the main control valve **14** at port **A1** and is directed by the LH travel spool to the tank port.

Flow from pump **A1** is available at the RH travel spool and is directed to the RH travel motor via port **B6** of the main control valve **14**, through the rotary coupling and in to port P2 on the RH travel motor. Exhaust oil from the motor enters the Main control valve **14** at port **A6** and is directed by the RH travel spool to the tank port.

The servo oil flowing over restrictors **R1** and **R2** is available to tank causing the excavator pressure switch **52** to stay open and the straight line travel spool to remain un-selected.

Servo Pressure to **R3** is prevented from reaching the tank Port by the LH travel spool. This creates equal pressure across the restrictor orfice, and closes the travel pressure switch **51**.

Pressure is lost on both negative control ports **Ps1** and **Ps2**, which is sensed at the pumps which come into full flow.

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

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Assembly

Note: *O-rings and other sealing materials should preferably be replaced each time the valve is disassembled but they may be re-used provided a careful check is made that they are undamaged.*

Note: *When hexagonal socket (hex) bolts* ***125*** *are loosened the seal washers* ***121*** *must be replaced.*

Note: *Fit all components in the same positions as before disassembly*

⚠ WARNING

Always wear safety glasses when dismantling assemblies containing components under pressure from springs. This will protect against eye injury from components accidentally flying out.

GEN-6-2

1 Assemble washer **313**, shim **217**, secondary pressure setting spring **324** and spring washer, in that order, onto spool **301**

2 Push spool **301** through the larger hole of spring washer **311** and assemble by sliding the spring washer sideways while bending the secondary pressure spring

3 Fix casing **101** in a vice. Fit return spring **335** into casing.

4 Fit the pressure reduction valve sub-assembly, assembled in 1 and 2 above, into casing **101**. When fitting the pressure reduction valve sub assembly, take care not to hit the lower end of the spool against the edge of the casing, ⇨ *Fig 119. (E-126)*.

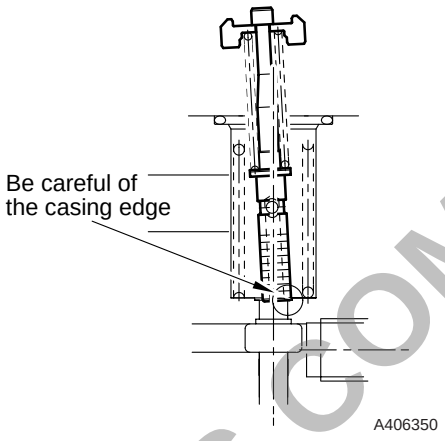


Fig 119.

5 Fit O-rings **211**,**213** into the casing.

6 Fix upper casing **102** in a vice and fit steel balls **225**.

7 Fit spring washer **218** into casing **102** using tweezers etc.

8 Fit damping spring **336** into casing **102**.

9 Fit piston **224** into casing **102**.

10 Fit O-ring **212** to plug **202**.

11 Fit packing **210** to plug **202**. Be careful of the direction when fitting the packing **A**, ⇨ *Fig 120. (E-126)*. Apply a light coating of grease before fitting packing.

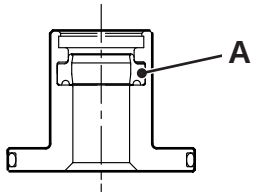


Fig 120.

12 Fit grease cap **203** to plug **202**.

13 Fit push-rod **214** to plug **202**. Apply working oil to surfaces before fitting push-rod.There is a risk of damage to the rib part of packing **210** do not use excessive force when fitting.

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Ram Piston Head Nut

Removal and Fitting

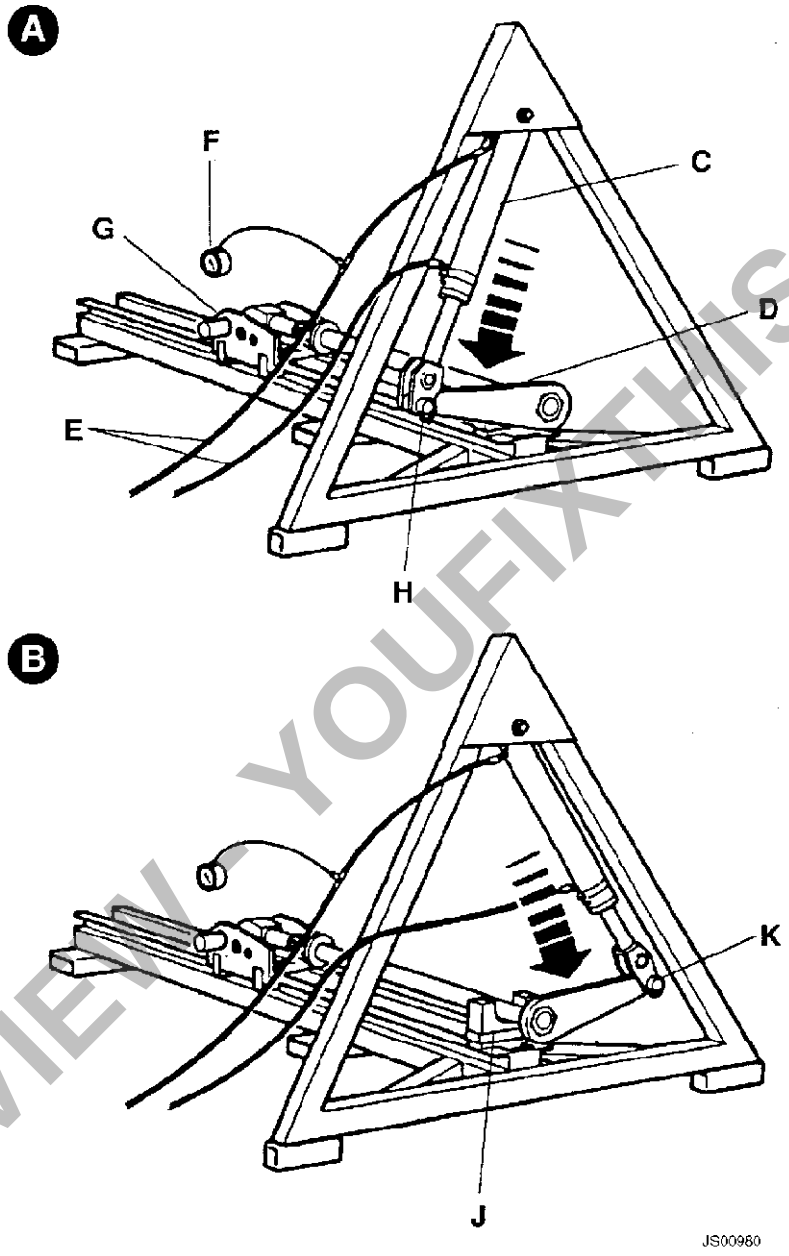


Fig 310.

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18 Apply grease through the check valve to adjust the track tension (see **Tracks and Running Gear, Checking/Adjusting the Track Tension, Section 3**).

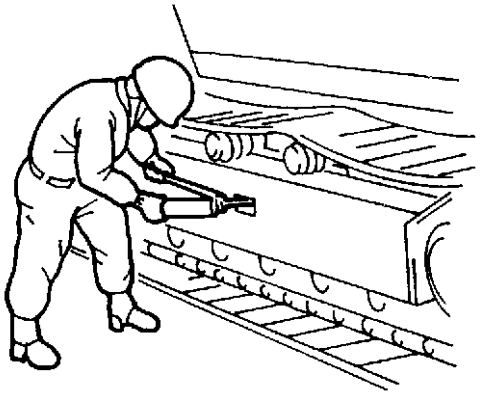


Fig 18.

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