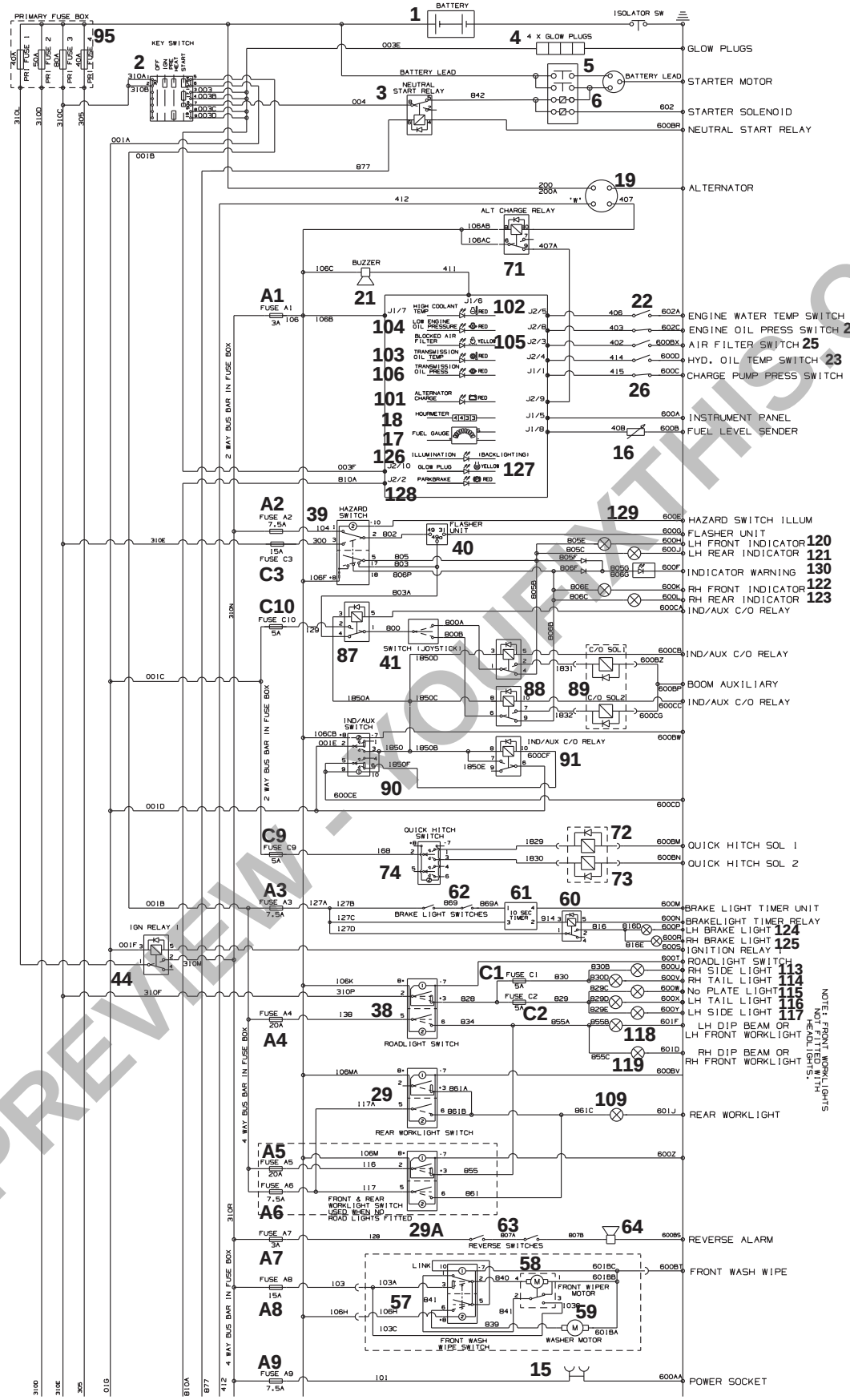


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Fig 12. Circuit Diagram Sheet 1

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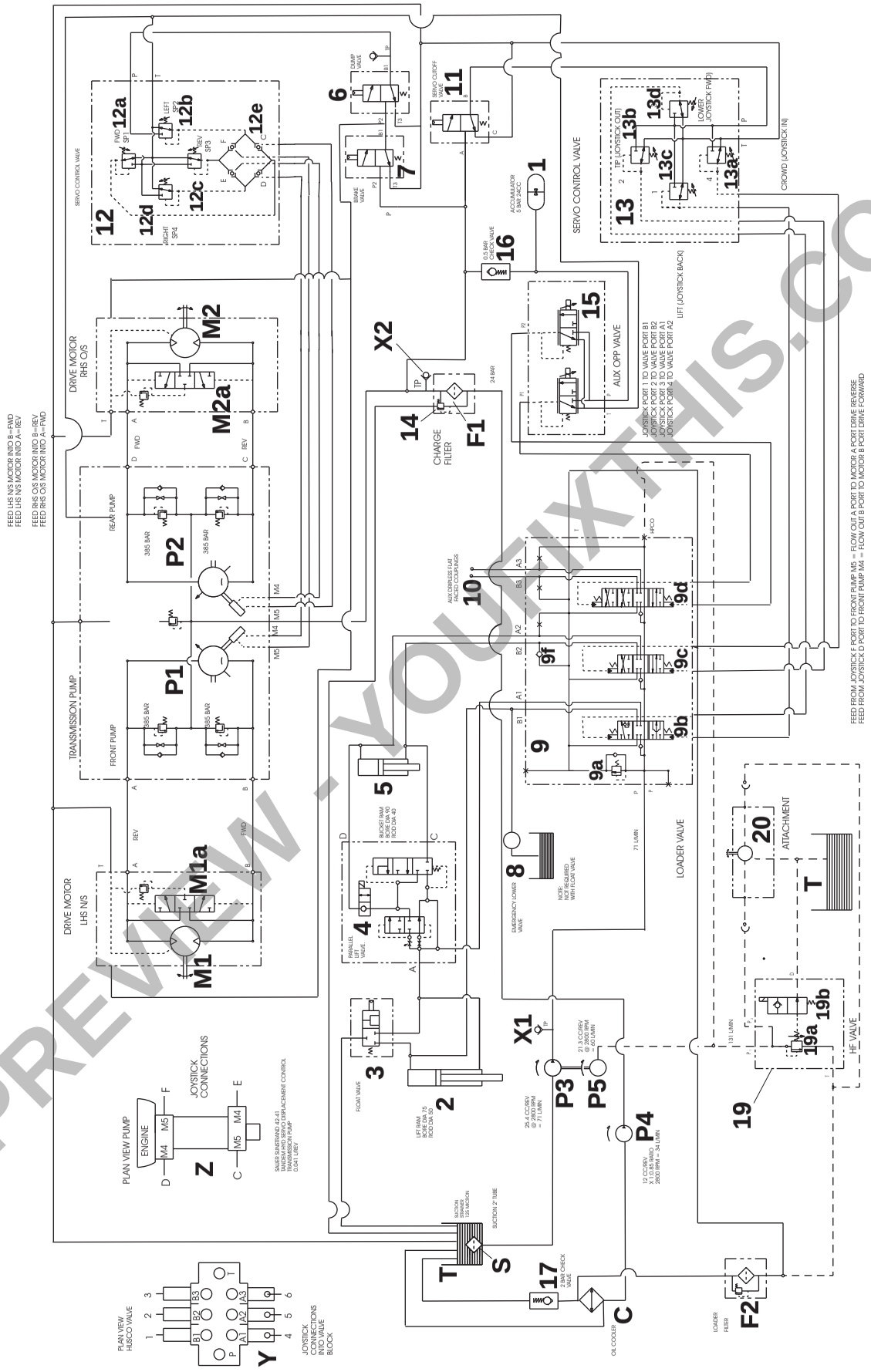


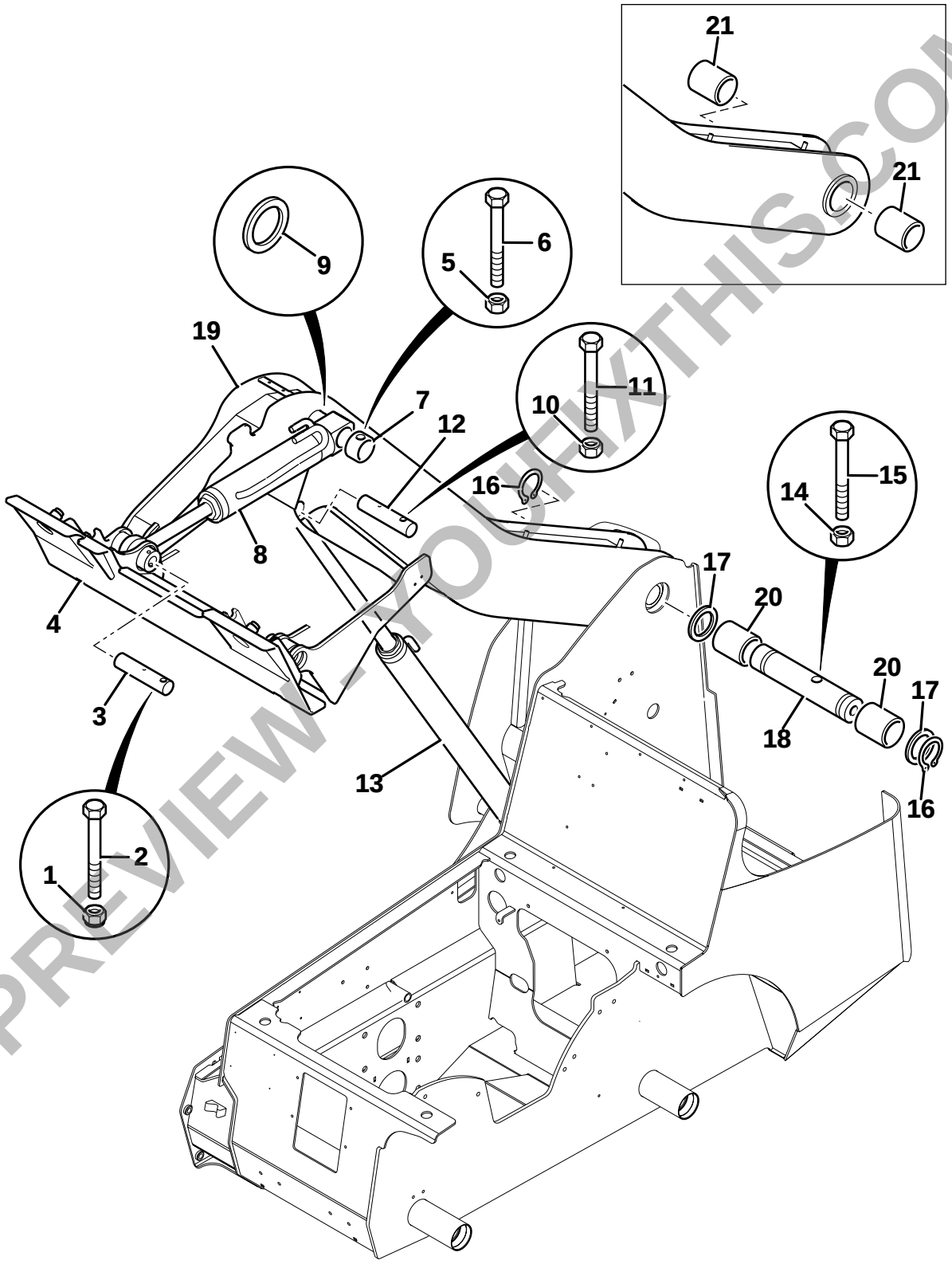
Fig 42.

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Loader Arm

Removal and Replacement



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Zinc Plated Fasteners and Dacromet Fasteners

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

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

Table 3. Torque Settings - Metric Grade 8.8 Fasteners

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

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Power Management System (P.M.S.)

Warning Light Indications

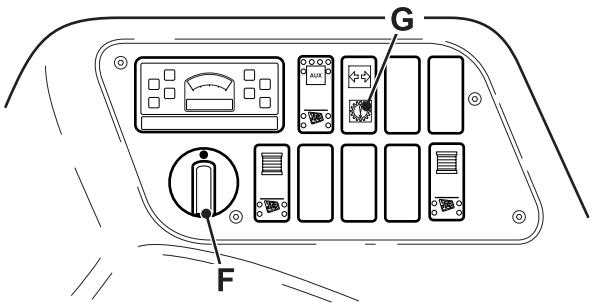


Fig 38.

When the ignition is turned on the warning light **G** should come on to indicate that the PMS is live. When the engine is started the light should go off.

Blink Codes

If a PMS fault occurs, light **G** may flash one of the following blink codes:

Blink Code		Fault
1	One long flash followed by one short flash	Signal from alternator **W** terminal absent or incorrect.
2	One long flash followed by two short flashes	Sensitivity control **F** not working (if fitted)
3	One long flash followed by three short flashes	Dump valve solenoid short circuit
4	One long flash followed by four short flashes	Dump valve solenoid open circuit

⇨ *Fault Tracing (E-51)*

System Check

1 Make sure that the hydraulic fluid is at correct working temperature (50 °C, 122 °F).

2 Remove the seat and seat base.

3 Connect a 0 - 40 bar (0 - 600 lb/in^2) pressure gauge to test connector **A**.

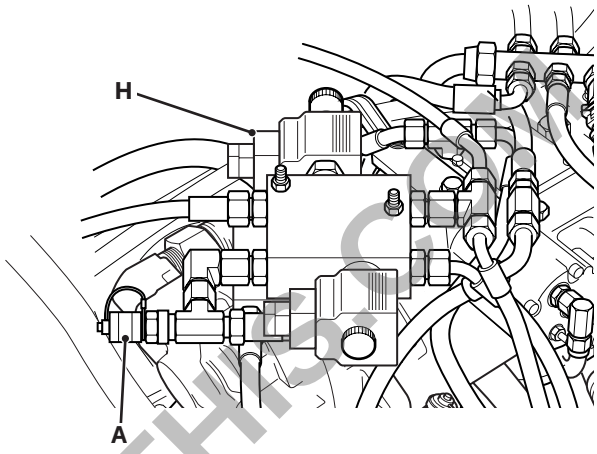


Fig 39.

4 Set up a tachometer to read engine speed from either the crankshaft pulley or the fan pulley. If a tachometer is not available, the speeds can be approximated.

Note: *The tachometer reading on the fan pulley will be higher than crankshaft speed* ⇨ *Table 11. (E-50)*.

5 On machines fitted with control **F**, turn the control fully anti-clockwise.

6 Start engine. Gradually increase engine speed from idle to maximum speed. The pressure gauge reading should rise with engine speed and show the pressures given in the table ⇨ *Table 11. (E-50)*. If the readings are not correct ⇨ *Calibration Procedure (E-63)*.

Table 11.

Crankshaft Speed	Fan Speed	Pressure
Idle to 1800	Idle to 1980	10 bar (145 lb/in^2)
2400 to maximum	2680 to maximum	20 bar (290 lb/in^2)

7 On machines fitted with control **F**, keep the engine running at maximum speed and turn control **F** clockwise slowly. The pressure should fall from 20 bar

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Changing the Oil and Filter

⇨ *Health and Safety (3-3)*

⚠ WARNING

Oil

Oil is toxic. If you swallow any oil, do not induce vomiting, seek medical advice. Used engine oil contains harmful contaminants which can cause skin cancer. Do not handle used engine oil more than necessary. Always use barrier cream or wear gloves to prevent skin contact. Wash skin contaminated with oil thoroughly in warm soapy water. Do not use petrol, diesel fuel or paraffin to clean your skin.

INT-3-2-3

Drain the oil when the engine is warm as contaminants held in suspension will then be drained with the oil.

1 Park the machine on level ground and lower the attachments to the ground.

2 Stop the engine and remove the starter key.

3 Open the engine compartment top cover. ⇨ *Engine Cover (3-24)*.

⚠ WARNING

Make the machine safe before getting beneath it. Park the machine on level ground and lower the attachments. Stop the engine and remove the starter key. Make sure the park brake is engaged. Disconnect the battery to prevent the engine being started. Block all four wheels before getting under the machine.

3-3-1-1

4 Remove the access plate **C** at the back of the machine to expose the drain plug.

5 Place a suitable container beneath the machine to catch the oil.

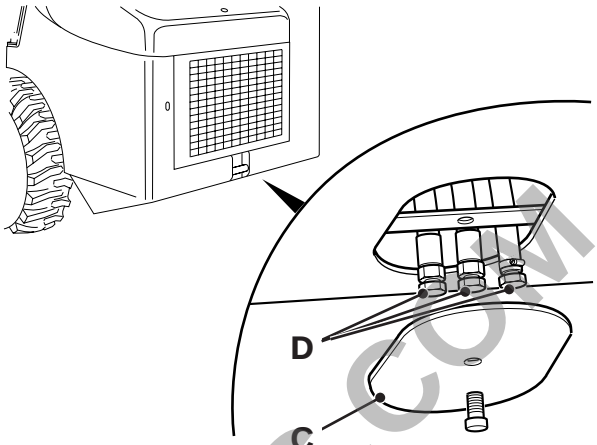


Fig 18.

⚠ CAUTION

It is illegal to pollute drains, sewers or the ground. Clean up all spilt fluids and/or lubricants.

Used fluids and/or lubricants, filters and contaminated materials must be disposed of in accordance with local regulations. Use authorised waste disposal sites.

INT-3-2-14

⚠ CAUTION

Oil will gush from the hole when the drain plug is removed. Hot oil and engine components can burn you. Keep to one side when you remove the plug.

13-3-1-15

Note: *There are three drain plugs **D** located behind the access plate. The engine oil drain is the one which is NOT coloured (zinc plated).*

6 Taking care to select the correct one of the three drain plugs **D**, remove the plug to allow oil to flow into the container.

7 After emptying the sump, replace the drain plug **D** and refit the access plate **C**.

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Control Valves

Control valves are usually represented by one or more square boxes.

⇒ *Fig 1. (E-8)* shows a control valve represented by three boxes. The number of boxes indicates the number of possible valve operating positions, (3 boxes - 3 positions etc).

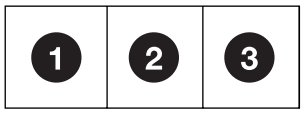


Fig 1.

⇒ *Fig 2. (E-8)* - In circuit diagrams the pipework is usually shown connected to the box which represents the unoperated condition. (Hydraulic circuit diagrams are usually shown in the unoperated condition).

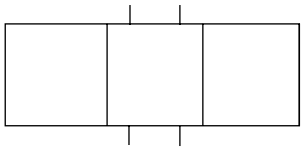


Fig 2.

⇒ *Fig 4. (E-8)* shows a valve described as a 3-position, 4-port control valve. Port describes the openings to and from the valve by which the hydraulic fluid enters or leaves. In the fig shown, Position **2** indicates that in an unoperated condition all 4 ports are blocked.

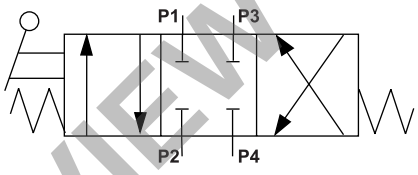


Fig 3.

If the valve spool was moved to Position **1**, movement of the spool would connect Port **P1** to Port **P2**, and Port **P3** to Port **P4**. ⇒ *Fig 4. (E-8)*.

If the valve spool was moved to Position **3**, movement of the spool would connect Port **P1** to Port **P4**, and Port **P3** to Port P2. ⇒ *Fig 4. (E-8)*.

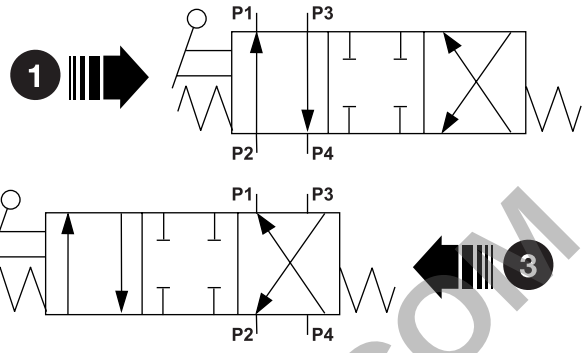


Fig 4.

It must be noted that not all spools are of the same type. Their operating designs can be seen by following the path the flow arrows take in their respective operating squares.

Three typical JCB style spools are known as 'D' spools, 'F' spools and 'N' spools.

The 'D' spools generally control rams because when in the neutral position the outlet ports are blocked, preventing ram movement. ⇒ *Fig 4. (E-8)* shows a 'D' type spool.

⇒ *Fig 5. (E-8)* - 'F' spools are often shown as four position spools with the three normal positions for neutral and service control; and the forth position, which has a detent, connects both sides of the ram together to allow the service to 'float'.

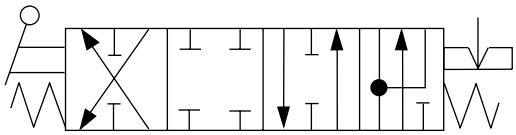


Fig 5.

⇒ *Fig 6. (E-8)* - 'N' spools are sometimes used to control hydraulic motors, and it can be seen from the flow arrows, that in neutral position both service ports are connected to the exhaust oil port

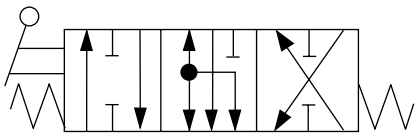


Fig 6.

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Problem Solving

Symptom	Possible cause
Engine will not turn over	Check state of charge and voltage of battery
	Check integrity of 80 amp primary fuse
	Check battery leads are tightly fastened
	Ensure High-flow system (if fitted) is switched off
	Check connections on ignition switch
	Check connections on neutral start relay
	Check connection on starter motor solenoid
Engine will turn over but not run	Check fuse B8 (5 amp)
	Check connection on ESOS (engine shut off solenoid)
Loader arm will not move	Ensure ignition switch is on
	Ensure isolator bar and armrest are down
	Check fuse B6 (15 amp)
	Check connections at operation solenoid
Horn will not operate	Check integrity of 80 amp primary fuse
	Check fuse C4 (5 amp)

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Specification

Technical Data

Type (Robot 160 and 170)	400 Series 4 cylinder in-line, compression ignition, naturally aspirated.
Type (Robot 180 and 180T)	400 Series 4 cylinder in-line, compression ignition, turbocharged.
Bore (nominal)	84 mm (3.31 in)
Stroke	100 mm (3.94 in)
Swept Volume	2216 cm^3 (135.2 in^3)
Compression Ratio	23.3 : 1
Injection Sequence	1,3,4,2
Valve Clearance - Cold - Inlet and Exhaust	0.2 mm (0.0078 in)
Oil Pressure	1 bar (15 lbf/in^2) min

Speeds

Robot 160	
- Rated Speed	2600 rev/min
- Idling Speed	830 - 950 rev/min
Robot 170	
- Rated Speed	2800 rev/min
- Idling Speed	830 - 950 rev/min

Fuel System

Governing	Mechanical
Static Timing	19 - 21 BTDC
Injector Codes	131 406 360
Injector Setting Pressure	147 bar (2133 lbf/in^2)

Cooling System

Fan Type	Mechanical
Coolant Pressure	1 bar (14.5 lbf/in^2)
Thermostat operating temperature	
- opens at:	82 °C (180 °F)
- fully open at:	95 °C (202 °F)
Temperature Warning Light operates at	104 - 110 °C (207 - 217 °F)

Note: *For further details of the engine refer to Engine Service Manual 9806/2190.*

Note: *If at anytime during the life of a machine it is necessary to fit a new engine, then after the first 50 operating hours a new engine oil filter must be fitted and the engine oil changed. Failure to complete this could damage the engine.*

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Power Management System (P.M.S.)

Calibration Procedure

It is necessary to do this procedure if you have fitted a new P.MS. controller (E.C.U. 4)

1 Make sure that the hydraulic fluid is at correct working temperature (50 °C, 122 °F).

2 Remove the seat and seat base.

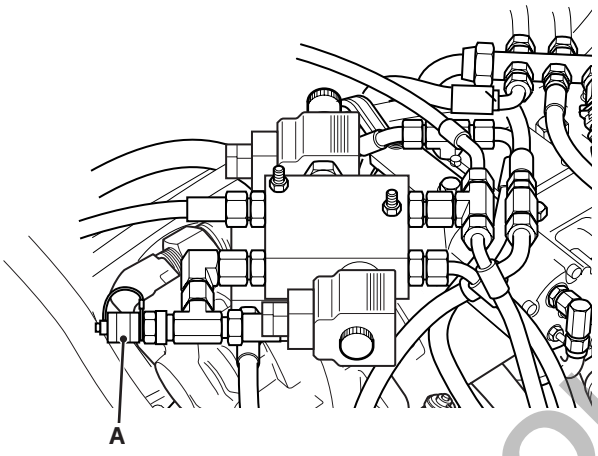


Fig 51.

3 Connect a 0 - 40 bar (0 - 600 lb/in²) pressure gauge to test connector **A**.

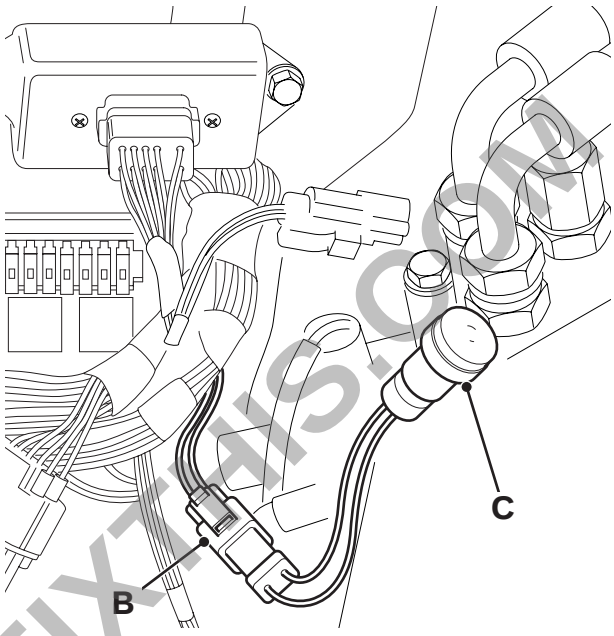


Fig 52.

4 Remove fuse and relay cover. Remove blanking plug from connector **B** (fed by wire numbers 144A and 508). Connect test button **C** (part number 701/80490) into the harness as shown.

Note: *The next step is for non High Flow machines that do not have sensitivity control* ***F*** *⇨ Fig 53. (E-64). If you need to fit this control as a permanent fixture ⇨ To fit Sensitivity Control to Non High Flow Machines (E-66)*

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Pre-start Cold Checks, Service Points and Fluid Levels

	Operation	10	50	500	1000	2000
ENGINE						
Coolant Quality and Level	- Check	☐	☐	☐	☐	☐
Cooling System	- Drain and Refill					☐
Oil level	- Check	☐	☐	☐	☐	☐
Oil and Filter(1)(2)	- Change			☐	☐	☐
Air Cleaner Dust Valve(3)	- Change			☐	☐	☐
Air Cleaner Outer Element	- Change			☐	☐	☐
Air Cleaner Inner Element	- Change					☐
Engine Fuel Filter	- Change			☐	☐	☐
Front End Accessory Drive (FEAD) Belt Condition	- Check			☐	☐	☐
All Hoses - Condition	- Check	☐	☐	☐	☐	☐
Radiator	- Clean			☐	☐	☐
Breather Gauze	- Clean					☐
Valve Clearances	- Check and Adjust					☐
Oil Filler and Dipstick Seals	- Check and Adjust					☐
Rocker Cover and Injector Seals	- Change					☐
Injectors	- Change					
Injector(s) Leak Off Rail	- Change					
High Pressure Fuel Lines	- Inspect					
TRANSMISSION, AXLES AND STEERING						
Motor Bearing	- Check					☐
Motor Mounting Bolts	- Check			☐	☐	☐
Wheel Nut Security	- Check	☐	☐	☐	☐	☐
Wheel Hub Mounting Nut - Tightness	- Check			☐	☐	☐
Wheel Hub Bearing Clearance	- Check					☐
Tyre Pressure	- Check	☐	☐	☐	☐	☐
Drive Chain Case Oil Level	- Check			☐	☐	☐
Drive Chain Case Oil	- Change				☐	☐
Drive Chain Tension	- Check/Adjust				☐	☐

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Manual Control Linkage - Foot Operated Loader

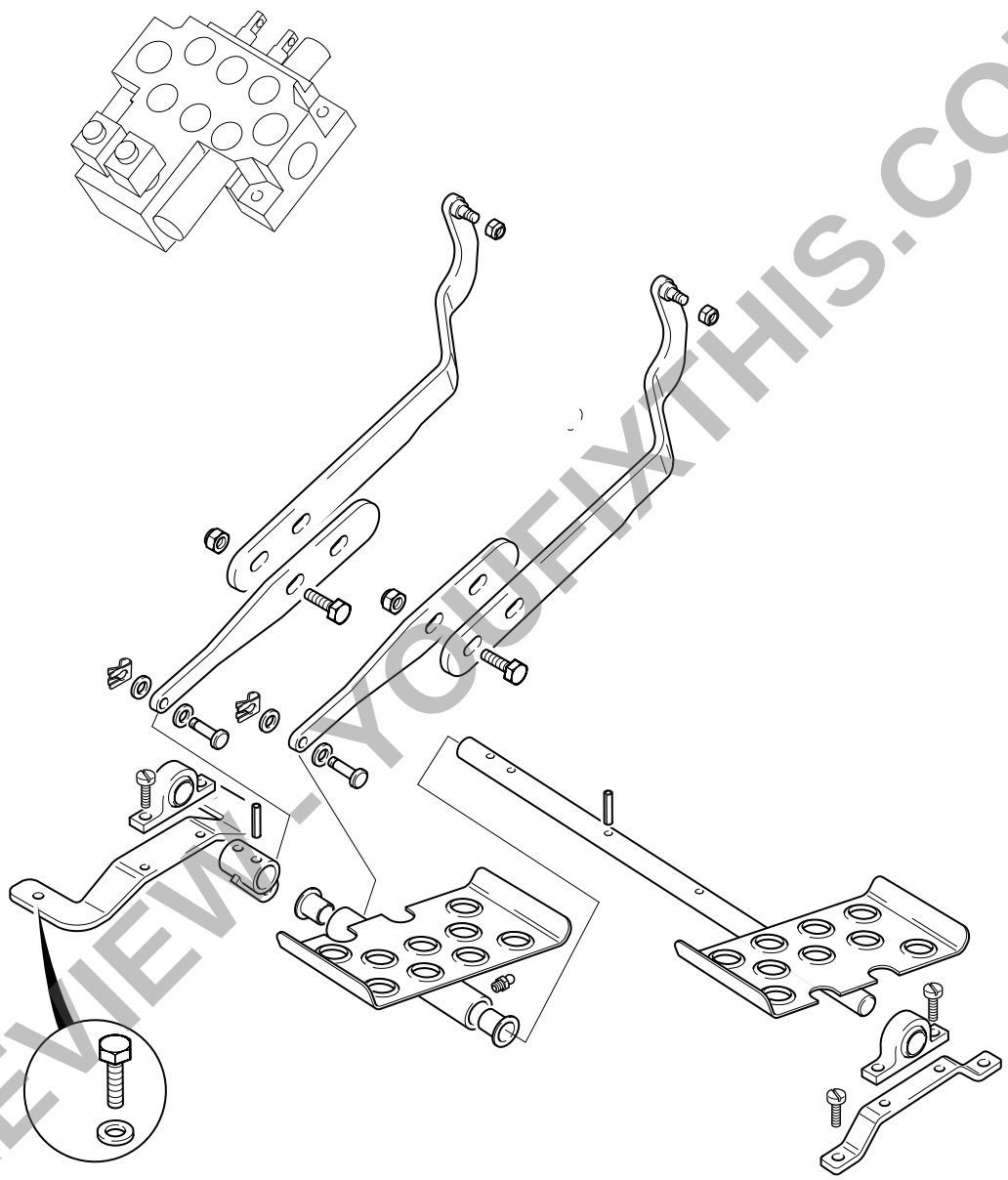


Fig 1.

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Maintenance

Shovels

General Purpose and Light Duty Shovels

Daily Maintenance

1 Clean with the rest of the machine (if fitted).

2 Ensure that the Quickhitch framework is not damaged or badly worn. Repair if necessary.

3 Check for damage. Repair or replace as necessary.

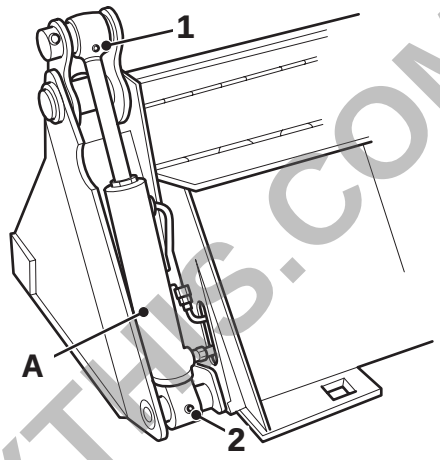


Fig 2.

6-in-1 Shovel

Daily Maintenance

1 Clean with the rest of the machine.

2 Check for damage. Repair or replace as necessary.

3 Check for signs of hydraulic leaks at hoses, adapters and rams. Should the rams **A** and **B** require service see ***Section E***.

⚠ 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. 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_2

4 Grease at the points indicated.

Total of 4 grease points. (1 and 2 as illustrated, 3 and 4 at opposite end).

Note: *Only one ram A is illustrated, ram B is at the opposite end.*

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Safety Check List

Safety - Yours and Others

INT-1-3-1_3

All machinary 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

T1-007

⚠ 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

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Checking the Coolant Level

⚠ 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 checking the coolant level or checking the system.

9-3-3-1_1

1 Park the machine on level ground. Stop the engine and let it cool down. Open the engine compartment top cover.

2 Check the level of coolant in the expansion bottle **A**. If necessary remove the filler cap **B** and top up to the level indicated.

3 Refit the filler cap and make sure it is tight.

4 Run the engine for a while to raise the coolant to working temperature and pressure. Stop the engine and checks for leaks.

5 Close and lock the engine compartment top cover.

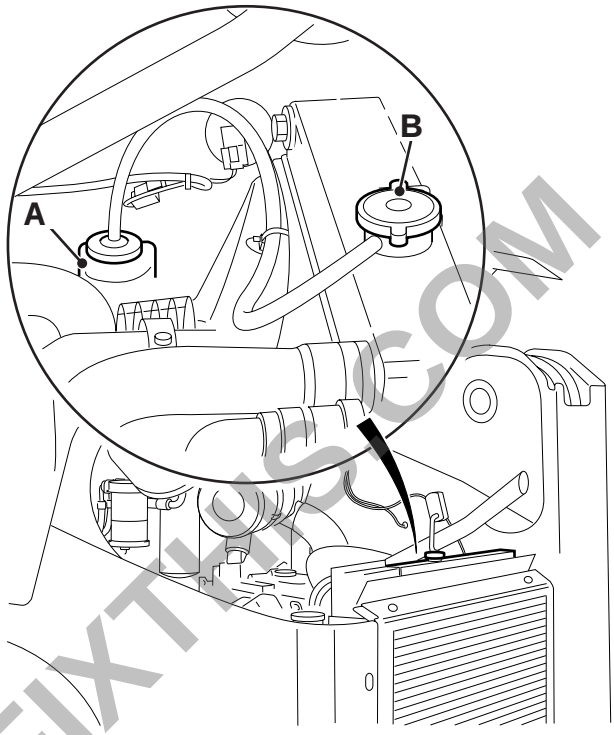
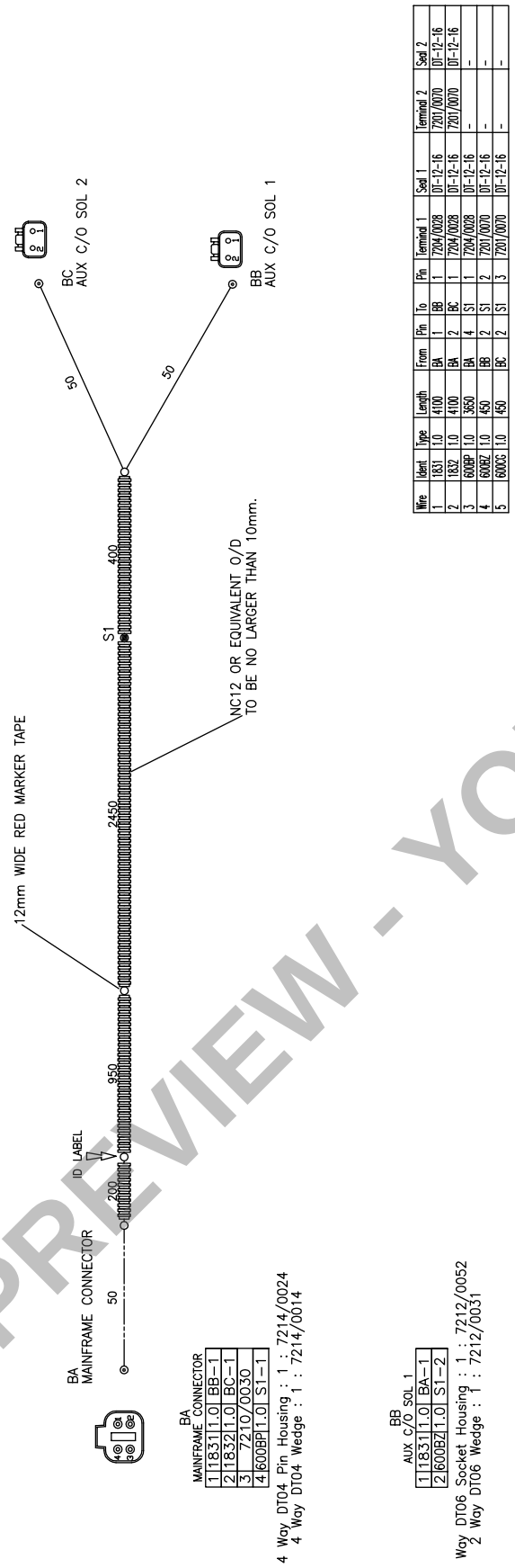


Fig 20.

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Wire	Ident.	Type	Length	From	Pin	To	Pin	Termind 1	Seal 1	Termind 2	Seal 2
1	11831	1.0	4100	BA	1	BB	1	7204/0028	01-12-16	7201/0070	01-12-16
2	11832	1.0	4100	BA	2	BC	1	7204/0028	01-12-16	7201/0070	01-12-16
3	6008P	1.0	3650	BA	4	S1	1	7204/0028	01-12-16	-	-
4	6008Z	1.0	450	BB	2	S1	2	7201/0070	01-12-16	-	-
5	6000G	1.0	450	BC	2	S1	3	7201/0070	01-12-16	-	-

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Fig 38.

Attachment Changeover Solenoid Harness Sheet 1

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Table 16. Torque Settings

Item	Nm	kgf m	lbf ft
E	150	15.3	111
Motor feed hoses	88	9.2	66
Motor feed adapters	200	20.4	148
Servo hoses	35	3.6	26
Servo port adapters	27	2.8	20

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