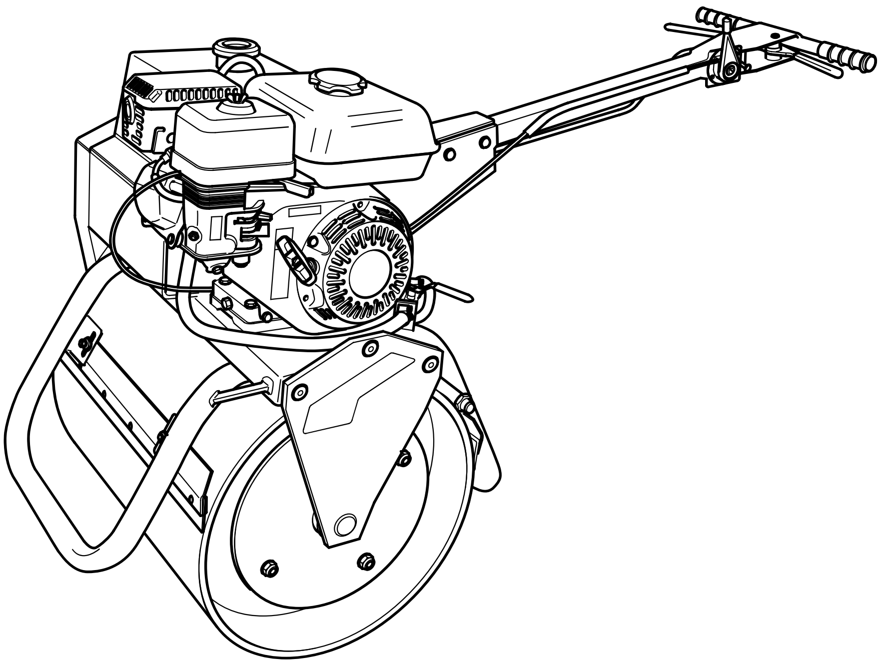
Section E

World Class
Customer Support

Hydraulics



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Technical Data

Hydraulic Pump

	Metric	Imperial
Displacement	6.1 cc/rev	0.37 cu in/rev
Input Speed		
Maximum Unloaded	3600 rpm	
Minimum Loaded	1800 rpm	
System Operating Pressure		
Continuous	51 bar	750 psi
Intermittent	120 bar	1750 psi
Peak	172 bar	2500 psi
Pump Performance		
@2400 rpm / 69 bar, (1000 psi)	13.6 l / min.	3.0 UK gal min.
@3000 rpm / 69 bar (1000 psi)	17 l / min.	3.75 UK gal min.
@3600 rpm / 69 bar (1000 psi)	20.4 l / min.	4.5 UK gal min.
Case Pressure		
Maximum at cold start	0.7 bar	10.0 psi
Maximum continuous	0.3 bar	4.0 psi
Inlet Vacuum (Maximum continuous)	101.6 mm / hg	4 inch / hg
Charge Pump Displacement	2.1 cc / rev	0.13 cu in/rev
Auxiliary Pump Displacement	3.2 cc / rev	0.19 cu in/rev
Auxiliary Pump Relief Setting	45 bar	650 psi
Auxiliary Pump Performance		
@ 3200 rpm, 500 psi, 70 SUS (13 Cst) oil, & 180° F / 82 ° C.	6.8 - 7.6 l / min.	1.5 to 1.7 UK gal min.
Control Torque Required to Stroke Pump	8.5 Nm at 70 bar	75 lb. / in at 1000 psi
(Approx. 20 ° External Stroke Angle)	6.2 Nm at 35 bar	55 lb. / in at 500 psi
Pump Oil Temperature		
Max intermittent (Hottest Point)	110 ºC	230 ºF
Normal Operating Range	-23 to 93 ºC	-10 to 200 ºF
Fluid Viscosity Limits at 110 °C (230 °F)		
Optimum SUS (cST)	13	70
Minimum (cST)	9	55
Weight of Unit	3.2 Kg	7 lbs
Inlet filtration Requirement (micron)- Nominal	25	

Table 1. Hydraulic Pump Fastener Torque Values

Item	Description	Nm	kgf m	lbf ft
	Case Drain (fitting torque)	22.6 - 28.2	2.3 - 2.9	16.7 - 20.8
	System Port (fitting torque)	41.8 - 53.1	4.3 - 5.4	30.8 - 39.2
	Inlet (fitting torque)	22.6 - 28.2	2.3 - 2.9	16.7 - 20.8
4	End Cap / Adapter Plate Bolts	20.3 - 24.9	2.1 - 2.5	15.0 - 18.3
10	Cap Screw	20.3 - 24.9	2.1 - 2.5	15.0 - 18.3
15	Bypass Valve	12.4 - 14.7	1.3 - 1.5	9.2 - 10.8
42A, 42B	Shock Valves / Check plugs	20.3 - 27.1	2.1 - 2.8	15.0 - 20.0
44	System Charge Relief Kit (Aux Chg)	20.3 - 27.1	2.1 - 2.8	15.0 - 20.0
45	Aux Relief Valve Kit	20.3 - 27.1	2.1 - 2.8	15.0 - 20.0
56	Diagnostic Plug	9.4 - 13.5	1.0 - 1.4	7.0 - 10.00
66	Filter Cover Plug	6.2 - 9.6	0.6 - 1.0	4.6 - 7.1
67	Filter Cover	22.6 - 31.1	2.3 - 3.2	16.7 - 22.9
103	Screw 5/16 x 0.875	22.6 - 27.1	2.3 - 2.8	16.7 - 20.0
106	Nut, Hex Lock 5/16-24 UNF	20.3 - 24.9	2.1 - 2.5	15.0 -1 8.3
164	Plug, Metal 7/16-20	9.4 - 13.5	1.0 - 1.4	7.0 - 10.0

Basic Operation

Component Location

The hydraulic component locations are shown in ⇒ Fig 1. (E-3) and are detailed in ⇒ Table 1. Hydraulic components (E-3).

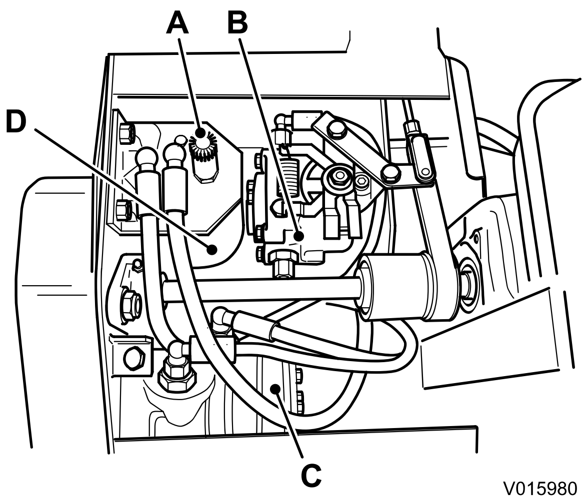


Fig 1.

Table 1. Hydraulic components

Ident	Item
A	Filler
B	Pump
C	Motor
D	Fluid reservoir and filter

Operation

Shifting the drive lever effects stepless changing of the flow rate to the hydraulic motor (speed change), and shifting the drive lever from forward beyond the zero position to reverse and vice versa effects a reversal of the flow to the hydraulic motors (reversal of driving direction). Acceleration, deceleration and reversal of the driving direction is effected smoothly and without jolting.

The input shaft and pump cylinder block are turned in one direction by the engine/drive belt/pulley.

The Output of the system oil flow is controlled by the amount that the swashplate is angled. As the pump pistons compress, they force oil into one of two passageways in the system hydraulic circuit.

Oil is supplied externally under pressure to the Hydraulic motor. As the angle of the pump swashplate is increased, the amount of oil being pumped will increase and thus the motor speed will increase.

During the operation of the pump, fluid is lost from the hydraulic loop through leak paths designed into the pump for lubrication and cooling purposes (around pistons, under the rotating cylinder block, etc). This lost fluid returns to the reservoir through the case drain.

This fluid loss is compensated for by the charge pump. The makeup flow is controlled (or directed) by the system check valves. The check valves are used to direct makeup fluid into the low pressure side of the closed loop.

Introduction to Hydraulic Schematic Symbols

TE-001

General (Basic and Functional Symbols)

Complex hydraulic components and circuits can be described to the engineer by using graphical symbols. The following pages illustrate and give a brief description for some of the more common symbols used.

There are many symbols in use and it would be impossible to include them all here. However it should be noted that most are only variations or refinements on the basic principles explained here. If more detailed information is required you are recommended to obtain a copy of BS2917 or IS01219.

Once familiar with the symbols, the engineer can use hydraulic circuit diagrams as an aid to fault finding. It will be possible to see the complete hydraulic circuit and decipher the relationship between hydraulic components.

Table 2. General

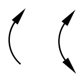
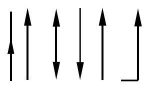
	Spring
	Flow restriction affected by viscosity
	Direction of flow
	Indication of rotation
	Indication of direction and paths of flow
	Variable control

Table 3. Rams

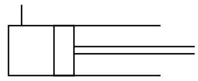
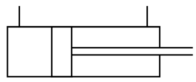
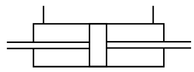
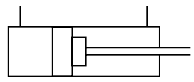
	Single acting
	Double acting
	Double ended
	Double acting with damping at rod area end

Table 4. Pumps and Motors

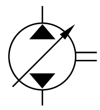
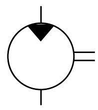
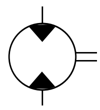
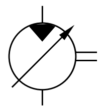
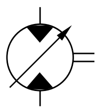
	Variable capacity pump two directions of flow
	Fixed capacity motor one direction of flow
	Fixed capacity motor two directions of flow
	Variable capacity motor one direction of flow
	Variable capacity motor two directions of flow

Table 5. Control Valves

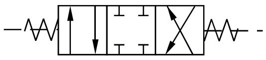
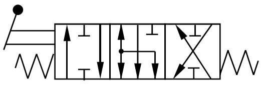
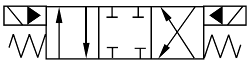
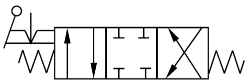
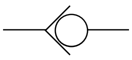
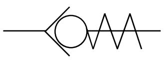
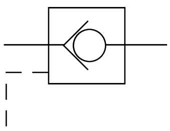
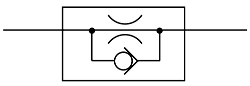
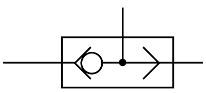
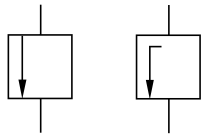
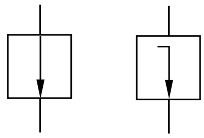
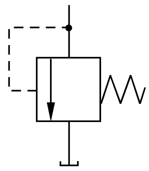
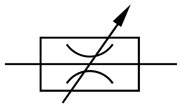
	Used to enclose several valves indicating they are supplied as one unit
	3-Position, 4-port spring centered pilot operated valve
	3-position, 6-port spring centered pilot operated valve
	3-Position, 4-port spring centered solenoid & pilot pressure operated valve
	3-Position, 4-port spring centered detent 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

Table 6. Energy Transmissions and Conditioning

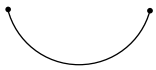
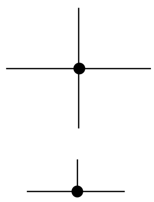
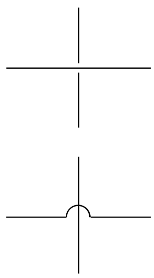
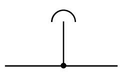
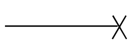
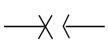
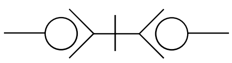
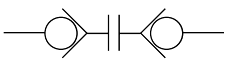
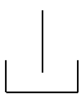
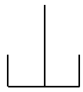
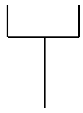
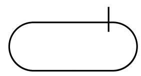
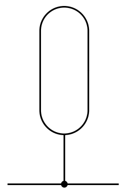
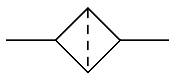
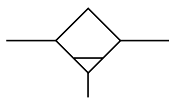
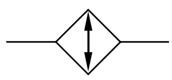
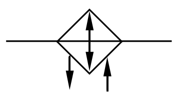
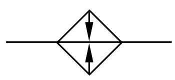
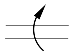
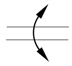
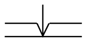
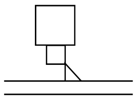
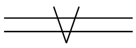
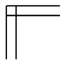
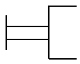
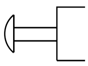
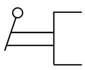
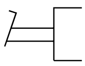
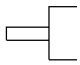
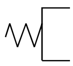
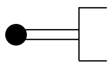
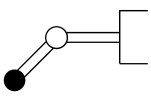
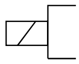
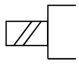
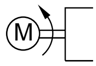
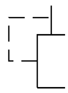
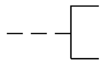
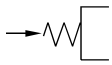
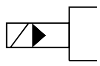
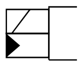
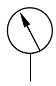
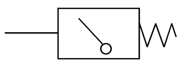
———	Working line, return or feed
– – – – – –	Pilot control
- - - - - - - - - - -	Drain lines
	Flexible pipe
	Line junction
	Crossing lines
	Air bleed
	Line plugged, also pressure test point
	Line plugged with take off line
	Quick release couplings - connected
	Quick release couplings - disconnected
	Reservoir - return line above fluid level
	Reservoir - return line below fluid level
	Header tank
	Pressure sealed tank
	Accumulator
	Filter or strainer
	Water trap
	Cooler - with no indication of coolant flow
	Cooler - indicating direction of coolant flow
	Heater

Table 7. Control Mechanisms

	Rotating shaft - one direction
	Rotating shaft - two directions
	Detent
	Locking device
	Over centre device
	Simple linkage
	General control
	Push button operated
	Lever operated
	Pedal operated
	Stem operated
	Spring operated
	Roller operated
	Roller trip operated (one directional)
	Solenoid one winding
	Solenoid two windings
	Electric motor operated
	Internal pressure pilot operated
	External pressure pilot operated
	Pressure operated spring release
	Pilot operated by solenoid pilot valve
	Pilot operated by a solenoid or seperate pilot valve
	Pressure guage
	Pressure switch

Control Valves

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

⇒ *Fig 2. (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).

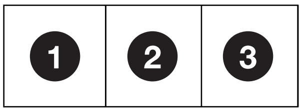


Fig 2.

⇒ *Fig 3. (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).

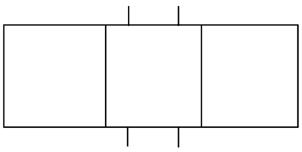


Fig 3.

⇒ *Fig 5. (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.

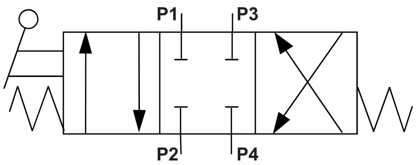


Fig 4.

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 5. (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 5. (E-8)*.

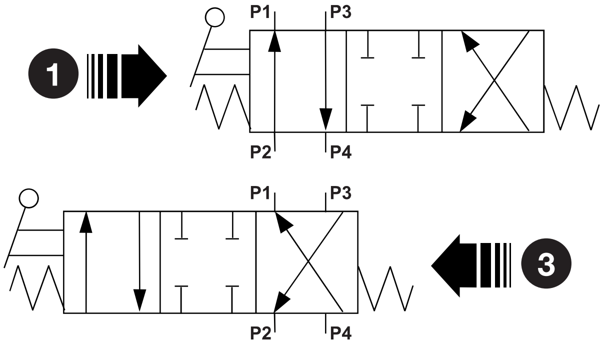


Fig 5.

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 5. (E-8)* shows a 'D' type spool.

⇒ *Fig 6. (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'.

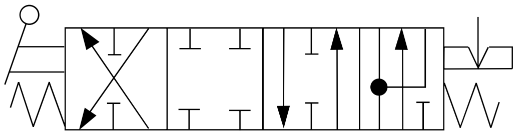


Fig 6.

⇒ *Fig 7. (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

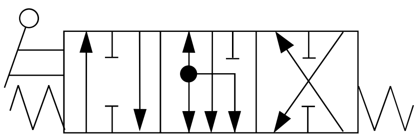


Fig 7.

Example of Schematic Circuit

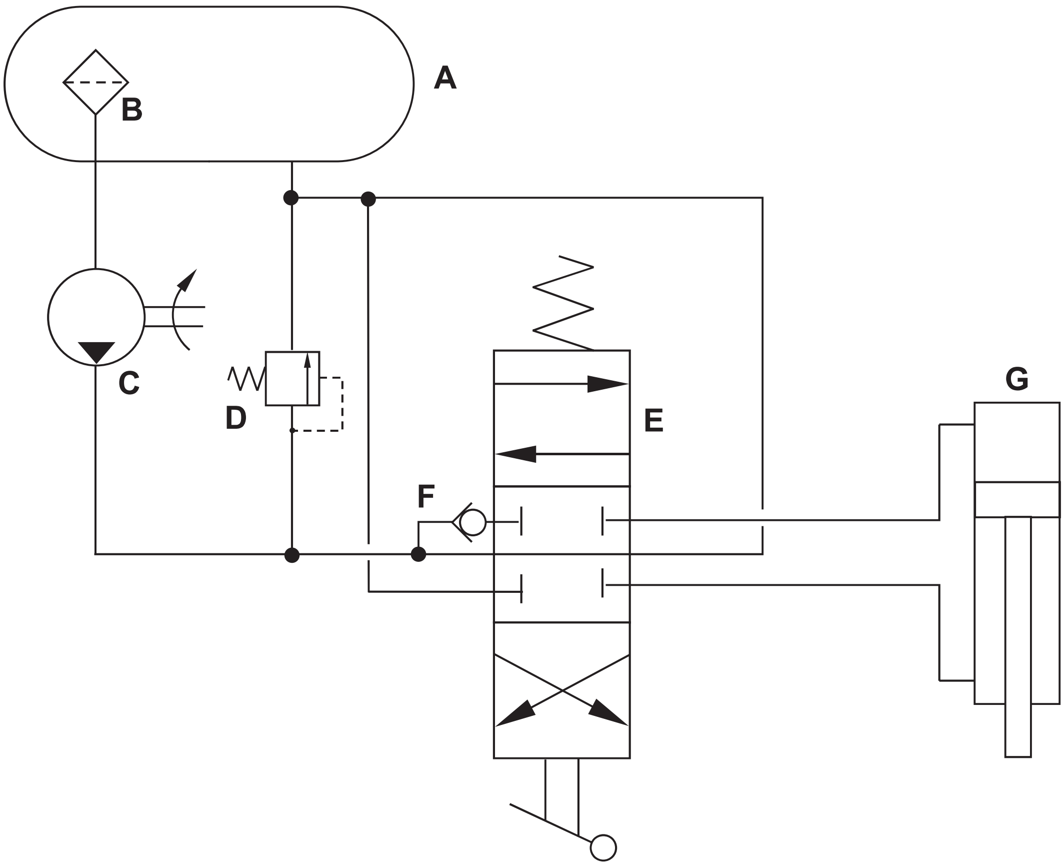


Fig 8. Simple Schematic Circuit

Some of the symbols described on the preceding pages have been arranged into a simple schematic circuit. ⇨ *Fig 8. (E-9)*.

Hydraulic tank **8-A** is a pressurised tank with an internally mounted strainer **8-B** on the suction line to the fixed displacement pump **8-C**. System pressure is limited to the setting of relief valve **8-D**.

Valve spool **8-E** is an open-centre spool that is in neutral position; flow from the pump passes through the spool and returns to the hydraulic tank.

If the lever operated spool is moved away from neutral position hydraulic fluid is directed to either head side or rod side of hydraulic ram **8-G**. Notice that the fluid must first open one way valve **8-F** before flowing to the ram.

Example Circuit Key

8-A	Hydraulic Tank
8-B	Strainer
8-C	Fixed Displacement Pump
8-D	Relief Valve
8-E	Spool
8-F	One Way Valve
8-G	Double Acting Hydraulic Ram

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Schematic Circuits

Hydraulic Circuit Diagram

The complete hydraulic schematic diagram is shown in
⇨ Fig 1. (E-12).

Key to ⇨ Fig 1. (E-12).

Ident	Item
A	Motor
B	Bypass Valve
C	Non-return Valve
D	Non-return Valve
E	Relief Valve
F	Water Trap
G	Filter
H	Pump

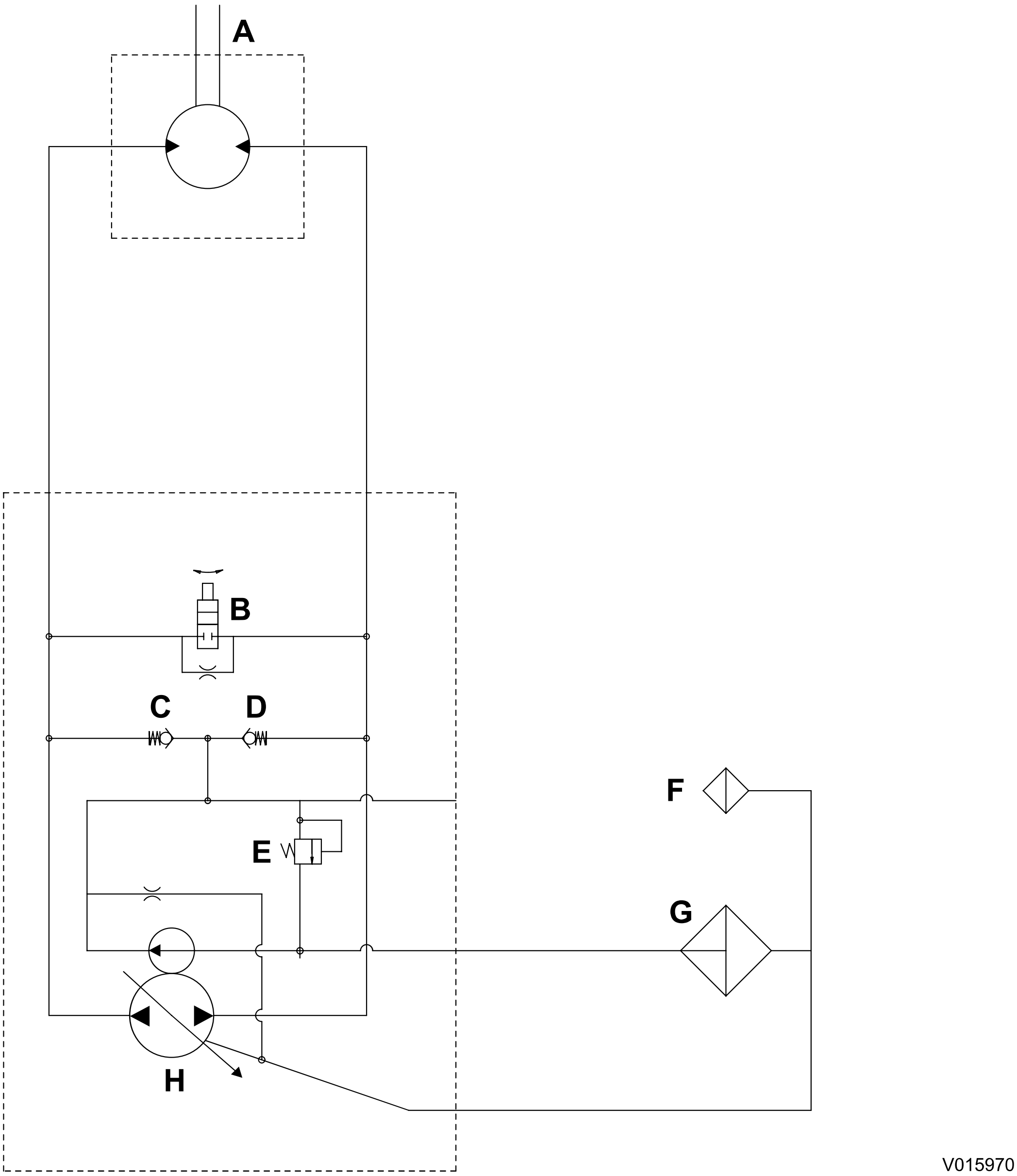

Fig 1. Hydraulic schematic diagram

Fault Finding

Drive System

Internal Leakage

All hydrostatic systems require charge pressure to function properly. This is because a hydrostatic system cannot operate at a negative pressure. The charge pump provides a positive pressure to the hydrostatic pump inlet. Hydrostatic systems are designed to leak a small amount of oil from the pumps and motors for lubrication of parts and cooling, and in some instances, leakage is strictly due to operating clearances while in others a flushing valve may be designed into the system. The greater the system pressure the higher the leakage rate. Fresh charge oil will make up for normal system losses including the oil discharged through the flushing valve.

When components fail, leakage under pressure increases tremendously and is noted by a drop in charge pressure (the charge pump is not capable of keeping up with the hydrostatic system leakage rate). The condition of a hydrostatic pump/motor circuit can be determined by a simple charge pressure test at maximum engine RPM and normal operating temperature. Under the previously mentioned conditions (RPM and temperature), compare the charge pressure readings with the hydrostatic system engaged at no load and maximum load. If these two charge pressure readings show a difference of more than 10%, between the loaded and no load conditions, the hydrostatic system has higher than desired leakage.

Remember, the failure of one component in a hydrostatic system can cause contamination throughout the entire system. Prior to installing the new or rebuilt components, the entire system must be disassembled and cleaned. This includes all pumps, motors, valves, coolers, hoses, and reservoirs.

Fault Descriptions		
1	No drive	⇨ Table 1. No drive (E-14)
2	Unit is noisy	⇨ Table 2. Unit is noisy (E-14)
3	Unit has no or low power	⇨ Table 3. Unit has no or low power (E-14)
4	Unit operating hot	⇨ Table 4. Unit operating hot (E-15)
5	Pump leaks oil	⇨ Table 5. Pump leaks oil (E-15)
6	Vibration system fault diagnosis table	⇨ Table 6. Vibration System Faults (E-16)

Hydraulic Pump Fault Diagnosis Tables

Table 1. No drive

Fault	Probable Cause	Action
No drive	Control linkage bent, loose or out of adjustment	Repair, adjust or replace linkage
	Bypass loose	Tighten pump bypass
	Inlet leak	Check all external lines and connections to pump inlet

Table 2. Unit is noisy

Fault	Probable Cause	Action
Unit is noisy	Excessive input speed	Adjust input speed above 1800 rpm and below 3600 rpm
	Oil level low or oil is contaminated	Fill reservoir to proper level or change oil
	Excessive loading	End the cause of excessive loading
	Air trapped in hydraulic system	Purge hydraulic system as per procedure
	Bypass loose	Tighten pump bypass
	Inlet leak, line or filter partially blocked or damaged	Check all external lines and connections and filter to pump inlet.

Table 3. Unit has no or low power

Fault	Probable Cause	Action
Unit has no or low power	Engine speed low	Adjust to correct rpm setting
	Control linkage bent, loose or out of adjustment	Repair, adjust or replace linkage
	Drive belt slipping or pulley damaged	Repair or replace drive belt pulley
	Oil level low or oil is contaminated	Fill reservoir to proper level or change oil
	Excessive loading	End the cause of excessive loading
	Air trapped in hydraulic system	Purge hydraulic system as per procedure
	Inlet leak	Check all external lines and connections to pump inlet
	Inlet filter clogged	Replace inlet filter
	Suspected internal damage	Check pump by performing a flow test

Table 4. Unit operating hot

Fault	Probable Cause	Action
Unit operating hot	Build up of debries	Remove debries from pump area
	Oil level low or oil is contaminated	Fill reservoir to proper level or change oil
	Excessive loading	End the cause of excessive loading
	Air trapped in hydraulic system	Purge hydraulic system as per purge procedure
	Inlet leak	Check all external lines and connections to pump inlet

Table 5. Pump leaks oil

Fault	Probable Cause	Action
Pump leaks oil	Damaged seals and gaskets	Remove debries, replace seals
	Air trapped in hydraulic system	Purge hydraulic system as per purge procedure

Vibration System Fault Diagnosis Table

Table 6. Vibration System Faults

Fault	Probable Cause	Action
Vibrator clutch does not rotate at full engine speed	Faulty drive coupling	Check condition of drive coupling and replace as necessary
	Clutch shoes worn	Replace as necessary
Vibrator clutch rotates but roller does not vibrate	Vibrator drive belt	Check vibrator belt tension (3 Kg force at mid span to give 6mm deflection).
	Roller antivibration mounts	Check roller antivibration mounts (especially if vibrator shaft is in contact with or close to the drive hub).
Vibrator will not disengage	Excessive engine speed	Reduce engine speed
	Faulty clutch springs	Replace springs in clutch

Service Procedures

Hydraulic Contamination

TE-002_2

Hydraulic Fluid Quality

Construction machinery uses a large volume of fluid in the hydraulic system for power transmission, equipment lubrication, rust prevention and sealing. According to a survey conducted by a pump manufacturer, seventy per cent of the causes of problems in hydraulic equipment were attributable to inadequate maintenance of the quality of the hydraulic fluid. Therefore, it is obvious that control of the quality of the hydraulic fluid helps prevent hydraulic equipment problems and greatly improves safety and reliability. Furthermore from an economic angle it extends the life of the hydraulic fluid if quality is maintained.

Effects of Contamination

Once inside the system, hydraulic circuit contaminants greatly effect the performance and life of hydraulic equipment. For example, contaminants in a hydraulic pump develop internal wear to cause internal leakage and hence lower discharges. Wear particles generated will circulate with the hydraulic fluid to cause further deterioration in the performance of this and other equipment. Contaminants also enter principal sliding sections of the equipment causing temporary malfunction, scuffing, sticking and leakage and can lead to major problems.The main contaminants can be classified as follows:

1 **Solid Particles** - sand, fibres, metallic particles, welding scale, sealing materials and wear particles etc.

2 **Liquid** - usually water and incompatible oils and greases.

3 **Gases** - Air, sulphur dioxide etc. which can create corrosive compounds if dissolved in the fluid.

These contaminants can appear during manufacture, assembly and operation.

Cleaning Operation

The purpose of cleaning oil is to remove contaminants of all types and sludge by filtering hydraulic fluid through a cleaning unit. ⇒ *Fig 1. (E-17)*. General Bulletin 011 also refers.

Procedure

Connect the cleaning unit in place of the hydraulic filter. ⇒ *Fig 1. (E-17)*. Run the system for sufficient time to pump all the hydraulic fluid through the unit. Disconnect the cleaning unit and reconnect the filter. Top up the system with clean hydraulic fluid as required.

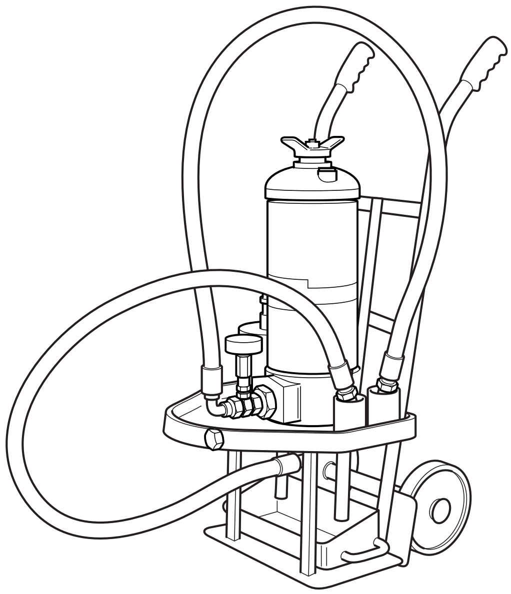

Fig 1. Cleaning Unit

Contaminant Standards

Dirt that damages your system is in many cases too small to be seen with the eye. The particle size is measured in microns.

1 micron = 0.001 mm (0.0000394 in).

Listed below are a few typical comparisons:

– Red Blood Cell = 8 microns (0.008 mm, 0.000315 in)
– Human Hair = 70 microns (0.07 mm, 0.00275 in)
– Grain of Salt = 100 microns (0.1 mm, 0.00394 in)

Smallest particle visible to the naked eye is 40 microns (0.00157) approximately.

Standards will often be quoted to ISO (International Standards Organisation) for which literature can be obtained.

Filters

The filter assembly fitted to all product ranges is designed to filter all the contamination that is generated through use to the required level of cleanliness. The filter must be serviced to the requirements of the machine Service Schedules.

To ensure optimum performance and reliability it is important that the machines hydraulic system is serviced periodically in accordance with the manufacturers requirements.

'Positional Type' Hydraulic Adaptors

Fitting Procedure

On a typical machine, some hydraulic components may utilise `Positional Type' SAE Hydraulic Adaptors. When fitting `Positional Type' Hydraulic Adaptors it is important to adopt the following procedure. If this procedure is not followed correctly, damage to the `O' ring seal **2A** can occur resulting in oil leaks.

1 Ensure the locknut **2B** is screwed back onto the body of the adaptor as far as possible as shown.

2 Check the `O' ring backing washer **2C** is a tight fit on the adaptor. Note that the washer should not move freely, if the washer is slack do not use the adaptor.

3 Check the `O' ring **2A** is fitted and that it is free from damage or nicks. Before fitting the adaptor, smear the `O' ring with clean hydraulic fluid.

***Note:** The dimensions and shore hardness of the `O' ring is critical. Should it become necessary to replace the `O' ring, ensure that only JCB Genuine Parts are used.*

4 Screw the adaptor into the port of the hydraulic component as far as possible, so that ALL the threads engage and the `O' ring is correctly seated against the sealing face.

5 Set the angular position of the adaptor as required, then secure by tightening the locknut **2**-**B**.

***Note:** When fitted correctly no more than one thread should be visible at **3Z** as shown.*

6 Torque tighten the locknut to 81 Nm (60 lbf ft).

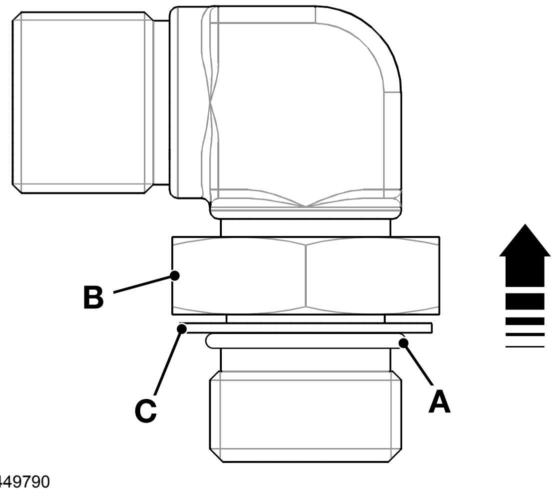

Fig 2.

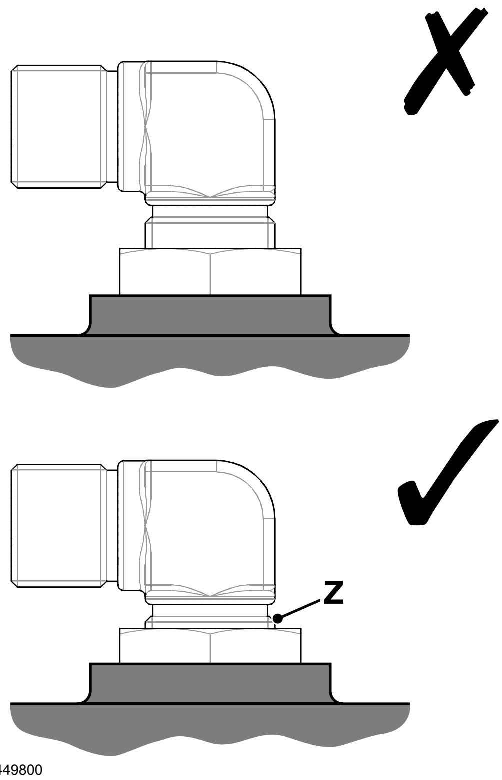

Fig 3.

Connecting/Disconnecting Hydraulic Hoses

Introduction

The following paragraphs describe how to connect and disconnect hydraulic hoses safely.

Connecting the Hoses

1 Connect the hoses.

a For Quick Release Couplings, see ***Service Procedures***, Section A.

b For all other hose connections, use correct tools and ensure that connections are not cross-threaded. Support the weight of the hose until the connection is made. Do not exceed the recommended torque loading.

⚠ 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

2 Check for leaks as follows:

a Start the engine.

b Operate the controls to pressurise the required hose.

c Switch off the engine. Remove the starter key. Check for signs of leakage at the hose connections.

Disconnecting the Hoses

1 Vent the hydraulic pressure.

2 Disconnect the hoses.

a For Quick Release Couplings, see ***Service Procedures***, Section A.

b For all other hose connections, plug both sides of the connection to prevent loss of fluid.

3 Check for leaks. See step 2, ⇒ ***Connecting the Hoses (E-20)***.

Purging Procedure

Hydraulic Oil Purging Procedure

⚠ 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

⚠ WARNING

Hydraulic fluid at system pressure can injure you. Relieve the system pressure before changing the Hydraulic filter element.

15-1-1-7

⚠ CAUTION

Do not run the engine with the hydraulic tank filler cap removed.

5-3-4-1

⚠ CAUTION

Ensure that dirt etc. does not enter the hydraulic system during this job.

5-3-4-4

Anytime that the hydraulic system has been opened for maintenance or repair, it is critical that air is removed (or purged) from the system.

1 Before starting the engine, remove the hexagonal level plug **A** in the top of the filter housing and fill with hydraulic oil though the filler neck **B** until oil is seen at the level plug hole **A**. ⇒ *Fig 4. (E-21)*

2 Refit the level plug and filler cap.

3 With the engine running at idle speed, slowly move the directional control in both forward and reverse directions.

4 Stop engine, unscrew the level plug **A** and the breather / filler cap **B**. Fill via the filler neck **B** until oil emerges through the level hole **A**. Refit the level plug and filler cap.

5 Restart the engine and slowly move the directional control in both forward and reverse directions with the engine idling.

6 It may be necessary to repeat the above steps 4 - 5 until there is no more air in the hydraulic system This is indicated when the drive motor works smoothly in all directions. This will also be indicated by no further changes in the level of the hydraulic oil.

7 Ensure that the level plug and filler cap are refitted.

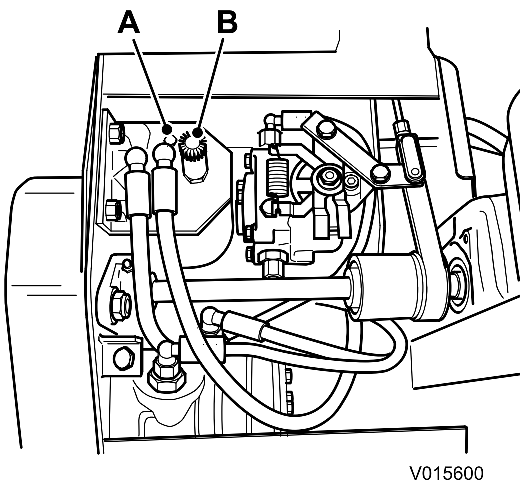

Fig 4. Hydraulic system oil filling point

⚠ CAUTION

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

12-5-1-4

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Hydraulic Pump

General Information

The JCB Vibromax VMS 55 is equipped with a Hydro-Gear PC hydrostatic axial piston pump. It features a cradle swashplate with a direct proportional displacement control and a gear rotor charge pump.

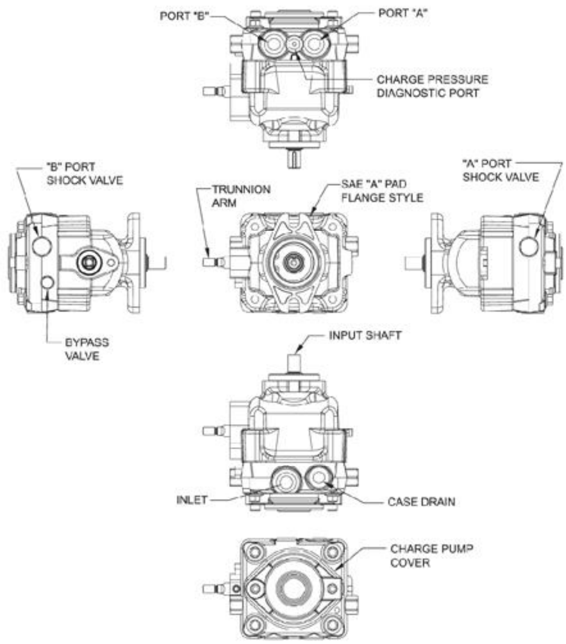
A fixed displacement gerotor charge pump is provided in the Pump. Oil from an external reservoir and filter is pumped into the closed loop by a charge pump. Fluid not required to replenish the closed loop flows either into the pump housing through a cooling orifice, or back to the charge pump inlet through the charge pressure relief valve.

Check or shock valves are included in the pump end cap to control the makeup oil flow for the system.

A screwtype bypass valve is utilized in the pumps to permit movement of the hydraulic motor. The bypass valve is fully opened when unscrewed two (2) turns maximum.

The bypass valve allows oil to be routed from one side of the pump/motor circuit to the other, thus allowing the motor to turn with minimal resistance.

The bypass valve must be fully closed during normal operation.



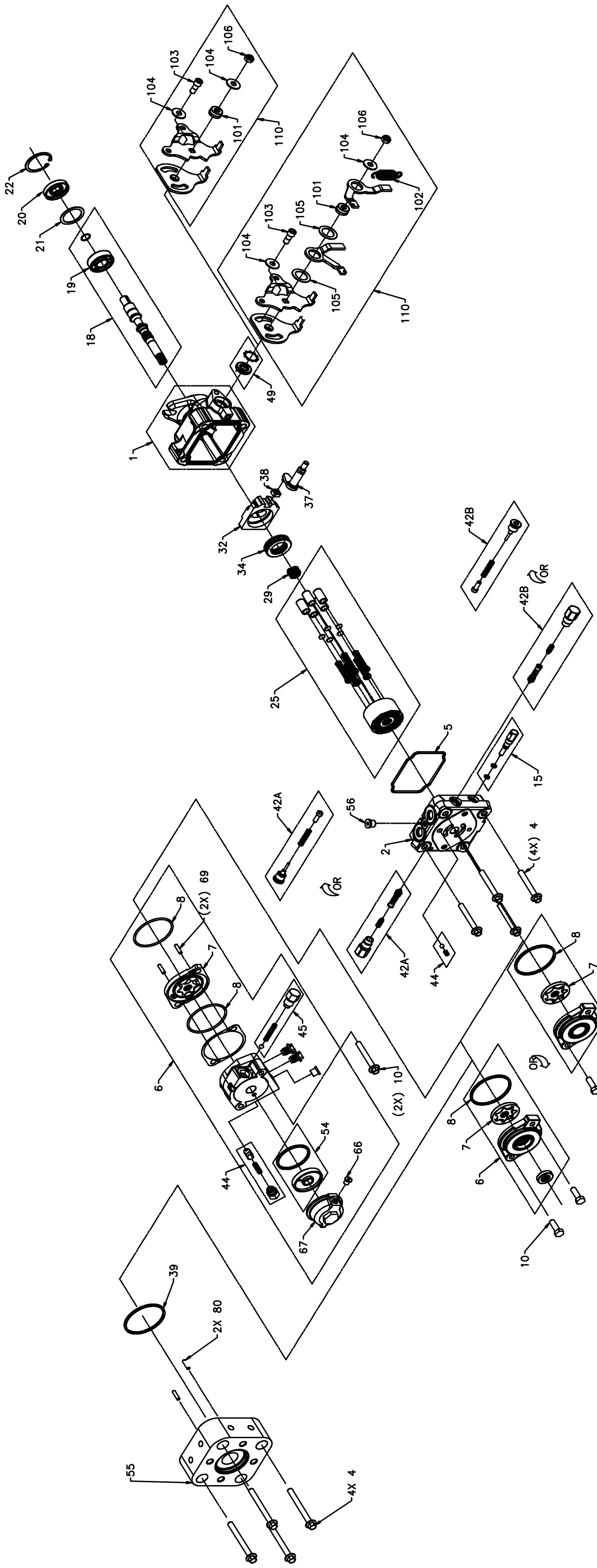


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Fig 1.

Component List - Hydraulic Pump

Items listed for information purposes only and may only be available from the pump manufacturer.

Table 1. Key to Fig 1 Hydraulic Pump Exploded View

Number	Description
1	Housing Kit
2	End Cap
4	Screw, Hex Flange, M8 x 1.25
5	Housing O-Ring
6	Charge pump Kit
7	STD Gerotor Assembly (0.11 cu in / rev)
8	O-Ring
10	Cap Screw, Hex 5/16 - 18 x 1.0
15	Bypass Valve Kit (No Bleed Orifice)
18	Pump Shaft Kit
19	Ball bearing, 17 x 40 x 12 mm
20	Lip Seal, 17 x 40 x 7 PTC
21	Spacer
22	Retaining Ring
23	Retaining Ring
25	Cylinder Block Kit
29	Block Spring
32	Swashplate
34	Ball Thrust Bearing
37	Trunnion Arm
38	Slot Guide
42	Shock Valve Kit
44	Charge relief Valve Kit
45	Auxiliary Relief Valve Kit
49	Trunnion Seal / Retainer Kit
54	Filter Kit
55	Plate Adaptor (Gear AA)
56	Plug, 5 / 16 - 24
66	Plug
67	Filter Cover
69	Pin, Straight Headless
80	Pin, Straight Headless
100	Overhaul Seal Kit
101	Spacer, Return
102	Spring, Extension
103	Screw, 5 / 16 x 0.875 in (Patch)
104	Washer, 0.34 x 0.88 x 0.06 in
105	Washer, Nylon
106	Nut, Hex Lock, 5 / 16 - 24 UNF
110	Return to Neutral Kit

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Pump Swash Plate

Adjustment

Important: **Adjustment of machinery when running can result in personal injury or death. It is reccomended that adjustments are carried out only when the engine is not running and that the engine is restarted each time to check the results of the adjustment**

To stop the machine creeping:

1 Park the machine and stop the engine.

2 Slacken screw **A**.

3 Rotate the swash control assembly as required to stop the machine creeping. Make a note of the direction and amount of adjustment.

4 Tighten screw **A** ⇨ *Fig 1. (E-27)*.

5 Restart the engine to check that the adjustment has eliminated any creeping.

6 Repeat the above steps should the machine still creep, with reference to the previous adjustment so that the direction and amount of adjustment can be determined more easily.

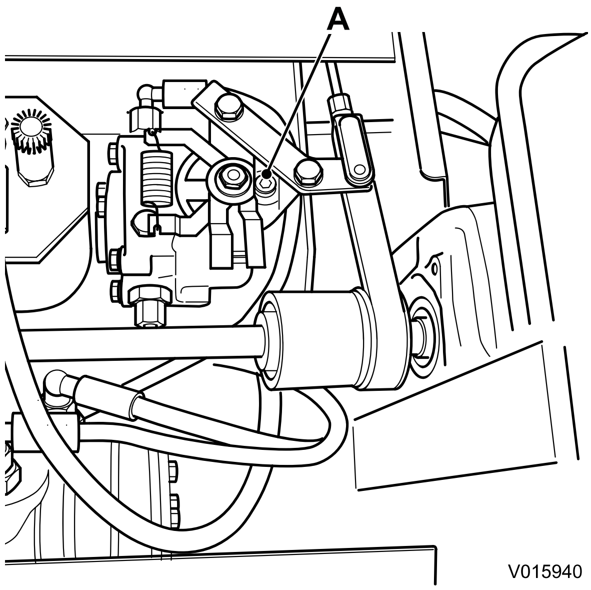

Fig 1.

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