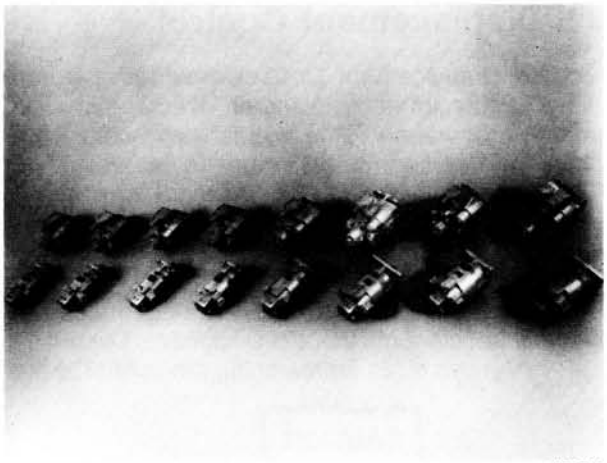
TABLE OF CONTENTS

TABLE OF CONTENTS — CONTINUED

CONFIGURATION: PUMPS AND MOTORS



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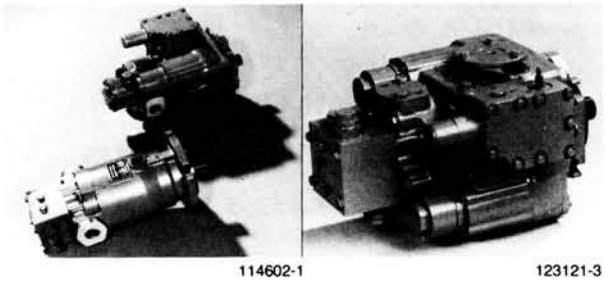

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Heavy Duty Series and Types

The Heavy Duty Family of units consists of eight (8) different frame sizes (20 through 27 Series). Pumps and motors of different series (displacements) can be combined to meet the requirements of a variety of applications.

Within each series of the Heavy Duty Family of units there are three (3) configurations available: Variable Displacement Pumps, Fixed Displacement Motors, and Variable Displacement Motors.

The Variable Displacement Pump can be operated with fixed or variable input speeds and provides an infinitely variable output flow between 0 and maximum flow in either direction. A variety of controls are available for the Variable Displacement Pumps and Motors which are described on the following pages.

The Fixed Displacement Motor can be operated in either direction of rotation with infinitely variable output speeds between its 0 and maximum speed.

The Variable Displacement Motor provides a means for varying the motor output speed and torque range. Decreasing displacement results in higher output speed and lower output torque.

Specifications and Requirements

Sauer-Sundstrand Heavy Duty Hydrostatic transmissions have certain pressures that must be maintained as well as some requirements and limitations which must be observed.

SPECIFICATIONS

Model	Displacement		Maximum Recommended Working Pressure*		Max. Speed @ Max. Disp.
	IN^3/REV.	CC/REV	PSI	BAR	(RPM)
20	2.03	33.2	5,000	345	3,800
21	3.15	51.6	5,000	345	3,500
22	4.26	69.8	5,000	345	3,200
23	5.43	89	5,000	345	2,900
24	7.24	118.6	5,000	345	2,700
25	10.12	165.8	5,000	345	2,400
26	13.87	227.3	5,000	345	2,100
27	20.36	333.6	5,000	345	1,900

*Operation of Series 20 units at 6000 PSI (414 BAR) maximum pressure requires the use of welded (non-filled) pistons.

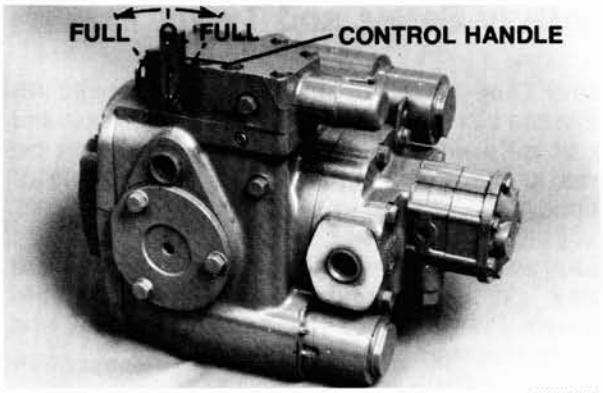
SYSTEM REQUIREMENTS

Charge Pressure* (Neutral)	190 - 210 PSI	13 - 15 BAR
Charge Pressure * (Forward or Rev)	160 - 180 PSI	11 - 12.5 BAR
Case Pressure	40 PSIG Max.	3 BAR Max.
Inlet Vacuum**	10 In. Hg. Max.	0.7 BAR (abs.)
Suction Filtration	10 Micron Nominal, No Bypass Beta 10 = 1.5 to 2.0	

* Above case pressure. Some units may have special charge pressure settings. Consult machine specifications.

**Measured at charge pump inlet. (May be exceeded during cold weather start up).

CONFIGURATION: CONTROLS



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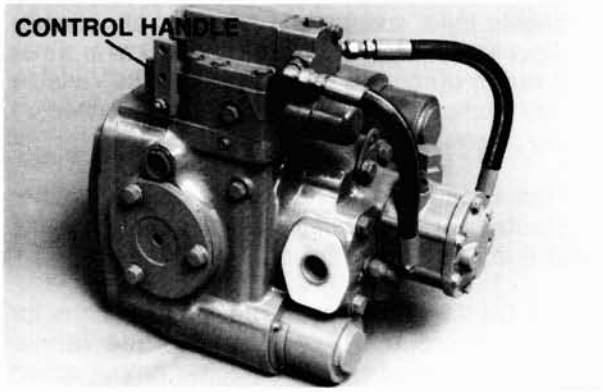

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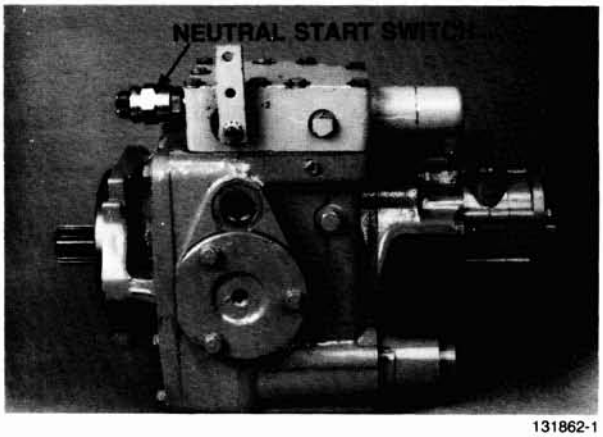

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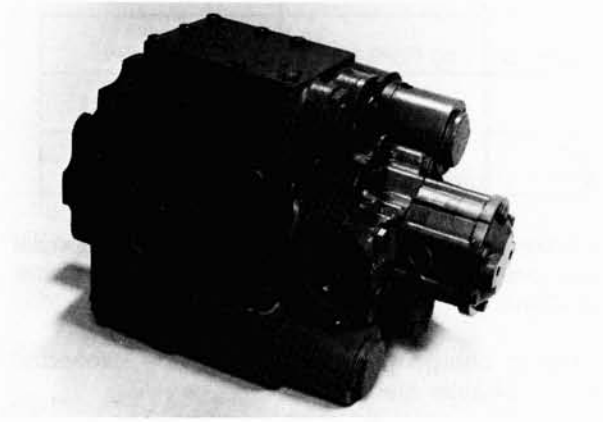


Manual Displacement Control

The Standard Displacement Control provides a pump output flow (displacement), in either direction, that is approximately proportional to the angular movement of the control handle. The control will return to neutral if the control handle is released. **The internal centering mechanism is not sufficient to overcome external control linkage friction.**

This control has an orifice for controlling maximum acceleration or deceleration (control response). The orifice is available in various sizes for matching the control to the system.

CAUTION

Torque on the Control handle shaft must not exceed 150 in. lbs.

Manual Displacement Control With Pressure Override (POR)

A Pressure Override can be added to the Standard Displacement Control to provide overload protection. This override will automatically destroke the pump once the desired maximum system pressure (load) is reached. It will maintain that system pressure so the load can be held. This prevents operation of the system relief valves for prolonged periods and helps reduce heat build up in the transmission.

Note: An Internal Pressure Override (IPOR) is available for certain pump models equipped with gerotor style charge pumps.

Neutral Start Switch

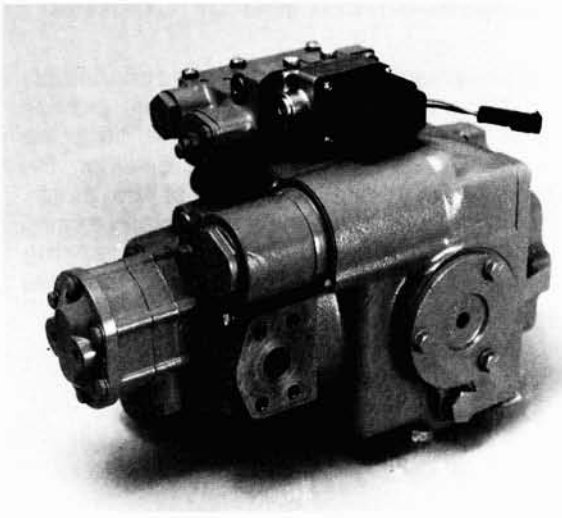
A Manual Displacement Control is available with a Neutral Start Switch which can be used to help insure that the prime mover is started only when the control is in neutral (0 flow) position. The switch provides an electrical interrupt of the starting circuit unless the control is positioned in neutral.

Hydraulic Displacement Control

This Hydraulic Displacement Control provides a pump output flow (displacement), in either direction, that is approximately proportional to an input pressure signal. This control is available with a pressure override feature.

The Hydraulic Displacement Control also has orifices (different sizes available) for controlling maximum acceleration or deceleration.

CONFIGURATION: CONTROLS



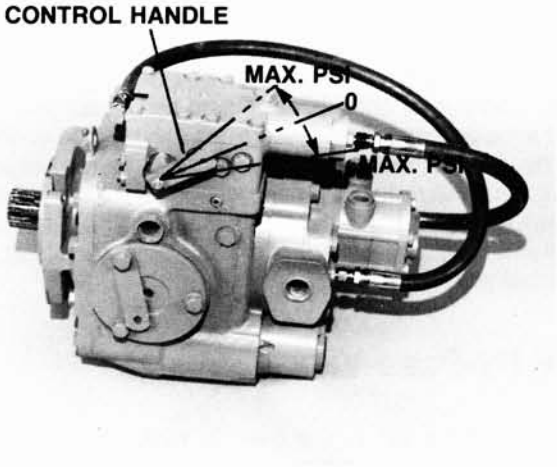
Electric Displacement Control

Electric Displacement Controls are available that provide pump output flow (displacement) in either direction that is approximately proportional to an electrical input signal. The Electric Displacement Control is available with a pressure override feature.

The control does not include the system necessary for providing the input signal.

Manual Variable Pressure Control

The Variable Pressure Control is designed to provide a differential system pressure that is approximately proportional to the angular movement of the control handle. This control can be used for high inertia loads. Pressure is used to start the load moving (control handle rotated in one direction), then shut off (handle to neutral) allowing the load to coast. Applying pressure against the load (control handle rotated in opposite direction) will stop the load. The control will return to neutral if the control handle is released. **The internal centering spring is not sufficient to overcome external control linkage friction.**



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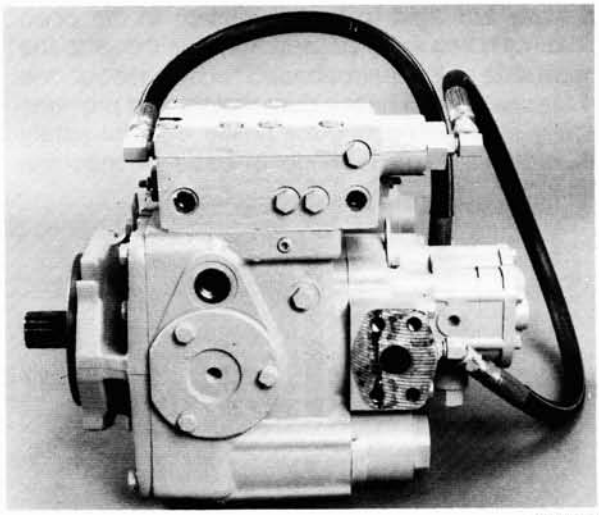
CAUTION

Torque on the control handle shaft must not exceed 150 in. lbs.

Hydraulic Variable Pressure Control



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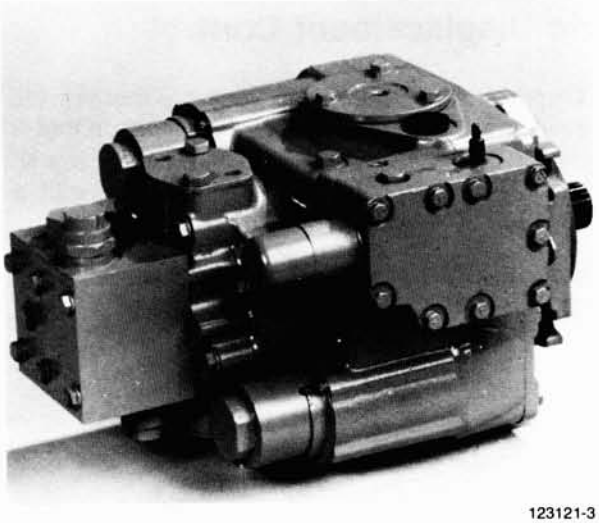
The Hydraulic Variable Pressure Control is designed to operate in a similar manner to the manually operated Variable Pressure Control except that the system pressure is proportional to a hydraulic command signal. This allows for remote machine control from a hydraulic source and eliminates mechanical linkage.

Torque (pressure) is used to start the load moving and the load is then allowed to continue movement due to its own inertia. Applying pressure in the opposite direction will stop the load.

The control is available in five different command signal ranges with all five versions being field adjustable to 5000 psi maximum system pressure.



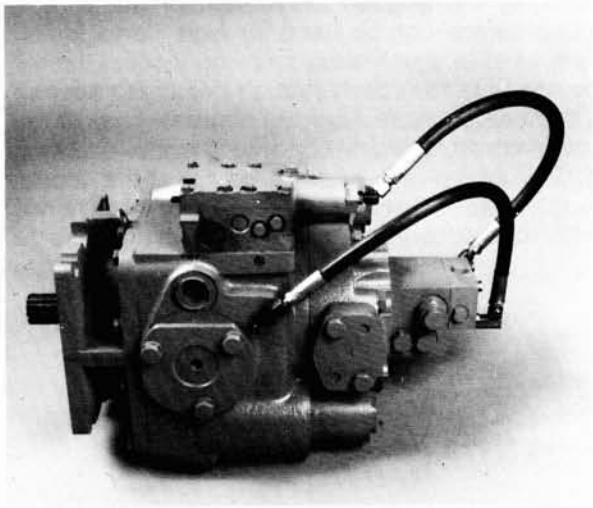
123121-3

Manual Displacement Motor Control

A Standard Displacement Control is also used on Variable Displacement Motors. This motor control will provide output speed or torque (displacement) in relation to the angular movement of the control handle between the maximum and minimum displacements of the motor. Release of the control handle results in the motor returning to its maximum displacement. **The internal spring mechanism is not sufficient to overcome external control linkage friction.**

CAUTION

Torque on the control handle shaft must not exceed 150 in. lbs.



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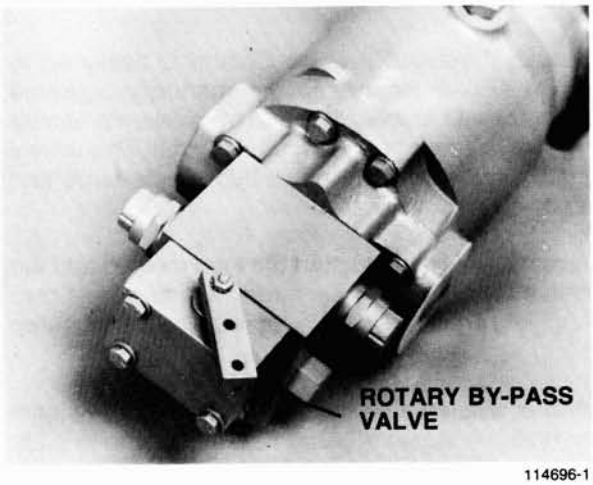
Motor Pressure Compensator Control

A Motor Pressure Compensator Control is available for the Variable Displacement Motor. The control is designed to keep the displacement of the motor at a minimum under light load conditions thereby maintaining motor output RPM's at a maximum. When a heavy load is induced on the motor, the control shifts the swashplate to maximum displacement. This reduces the motor speed but increases the torque to produce a greater load capacity. The "shift" in the position of the swashplate is made automatically at a pre-selected shift pressure.



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Rotary By-Pass-Valve

The rotary by-pass valve is a two (2) way, two position valve mounted on the motor manifold. During normal operation, the valve remains in the closed position which does not allow any fluid to be by-passed. In the open position, the main flow is by-passed from the motor to the down stream side of the main circuit. The by-pass valve is designed for use with all heavy duty motors and provides the capability of disconnecting the power train for safety purposes or moving the vehicle in case of machine malfunction.

MAINTENANCE INFORMATION

Fluids

The hydraulic fluids used with Sauer-Sundstrand products should be carefully selected following the guidelines presented in the "Fluid Quality Requirements" bulletin, BLN-9887 and in the original equipment manufacturer's specifications.

Start Up Procedure

Prior to installing both pump and motor, inspect the units for damage incurred during shipping and handling. Make certain all system components (reservoir, hoses, valves, fittings, heat exchanger, etc.) are clean prior to filling with fluid.

Fill the reservoir with recommended hydraulic fluid which should be passed through a 10 micron (nominal no bypass) filter prior to entering the reservoir. Never reuse fluid.

The inlet line leading from the reservoir to the pump must be filled prior to start up. Check inlet line for properly tightened fittings and make sure it is free of restrictions and air leaks.

Be certain to fill the main pump and motor housing with clean hydraulic fluid prior to start up by pouring filtered oil in the uppermost case drain port.

Install a pressure gauge (500 PSI) in the Charge Pressure Gauge Port (Ref: Troubleshooting Section). It is recommended the external control linkage be left disconnected until after initial start up to allow pump to remain in neutral.

Start the prime mover and run at lowest possible RPM until charge Pressure has been established. Air can be bled from the high pressure lines by using the high pressure gauge ports on the motor manifold.

CAUTION

Do not start prime mover unless pump is in neutral (0 swashplate angle). Take safety precautions to prevent machine movement in case pump is actuated during initial start up.

Once charge pressure has been established, increase speed to normal operating RPM. Charge pressure should be at 190- 210 PSI minimum. If charge pressure is not at proper value, shut down and determine cause (Ref: Troubleshooting Section).

Shut down prime mover and connect external control linkage. Start prime mover, checking to be certain pump remains in neutral. With prime mover at normal operating speed, slowly check for forward and reverse machine operation.

CAUTION

Take necessary safety precautions before moving machine.

Charge pressure should remain at 160-180 PSI minimum during forward or reverse operation. Continue to cycle slowly from forward to reverse for five (5) minutes.

Shut down prime mover, remove gauges and plug ports. Check reservoir level and add fluid if necessary.

The transmission is now ready for operation.

System Maintenance

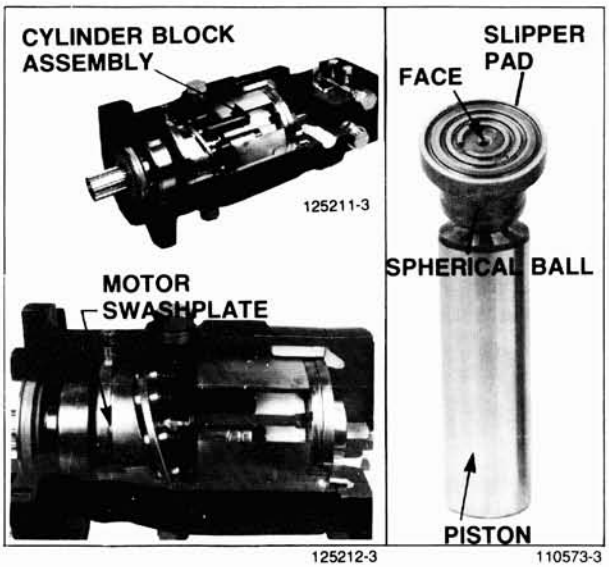
It is recommended that the fluid and filter be changed per the vehicle/machine manufacturer's recommendations or at the following intervals:

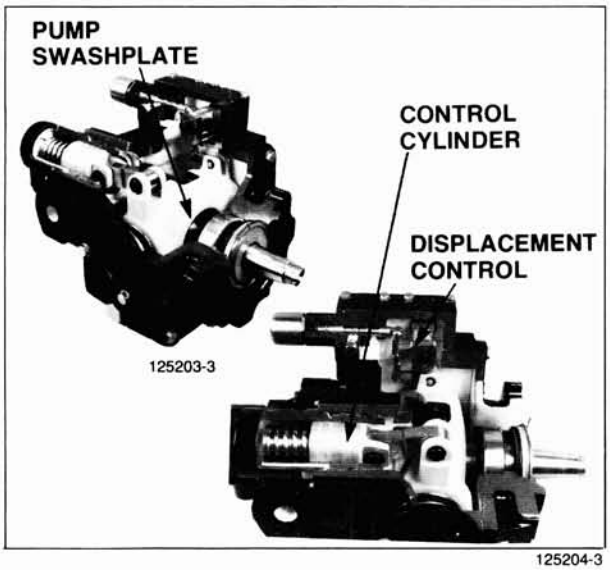
Sealed Type Reservoir:	2000 hrs.
Air Breathing Type Reservoir	500 hrs.

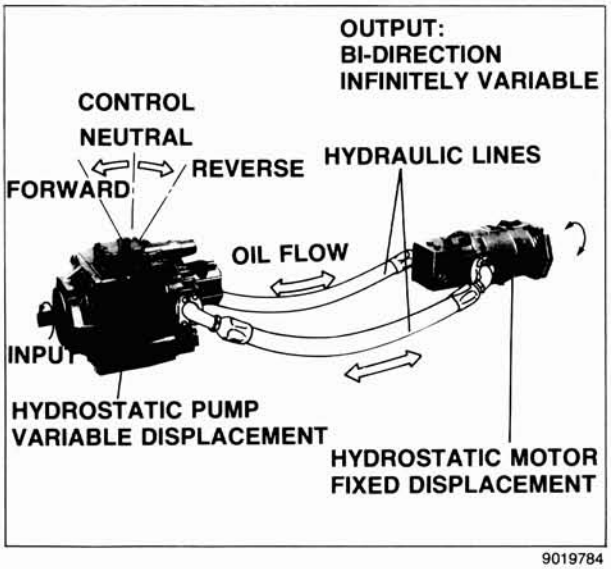
Check fluid level daily. Change fluid more often if it becomes contaminated with any foreign matter (dirt, water, grease, etc.).

Change inlet filter whenever fluid is changed and whenever filter indicator shows a change is necessary. Replace all fluid lost during filter change.

BASIC OPERATION:
HYDROSTATIC TRANSMISSION







Axial Piston, Slipper Pad Design

Sauer-Sundstrand hydrostatic pumps and motors are an axial piston, slipper pad design. There are nine (9) pistons mounted in the cylinder block. As the cylinder block rotates, these pistons are forced in and out of their bores by the angle of the swashplate. This results in a specific amount of fluid being displaced for every revolution of the cylinder block. In a pump, the fluid is forced out as the angle of the swashplate pushes the pistons into the bores. In a motor, system pressure against the piston causes it to slide down the inclined face of the swashplate resulting in output rotation.

The slipper pad attaches to a spherical ball on the end of the piston forming a ball and socket joint. This allows the slipper pad to tilt at any angle and make contact with the swashplate. The face of the slipper pad slides on a hydrostatic fluid film which uses fluid pressure to balance internal forces.

Variable Pump Tilting Swashplate

The variable displacement pumps use a tiltable swashplate to vary displacement (output flow). The swashplate is mounted on trunnion bearings and is connected to hydraulic control (servo) cylinders. The control directs fluid to and from the servo cylinders causing the swashplate to tilt and change displacement of the pump. The swashplate can be tilted in either direction from 0 angle and provide pump flow in either direction.

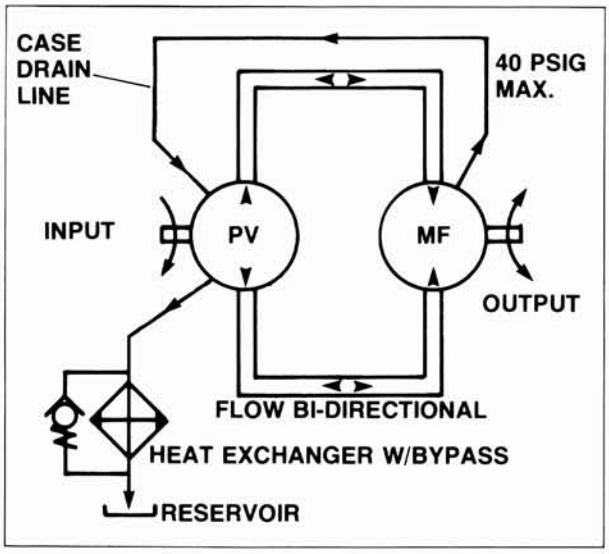
Since the angle of the swashplate cuases the pistons to stroke in and out of the cylinder block bores as it is rotated, changing this angle varies the piston stroke and, therefore, the amount of fluid being displaced (pumped) to the motor. This results in a change in the output speed of the motor. Tilting the swashplate in the opposite direction reverses fluid flow to the motor and its direction of rotation. Since each servo control cylinder is spring loaded, loss of control pressure or charge pressure will cause the swashplate to return to neutral position.

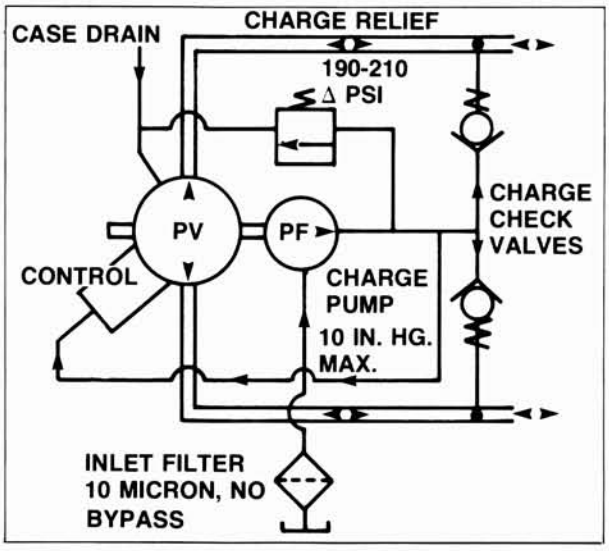
Hydrostatic Transmission

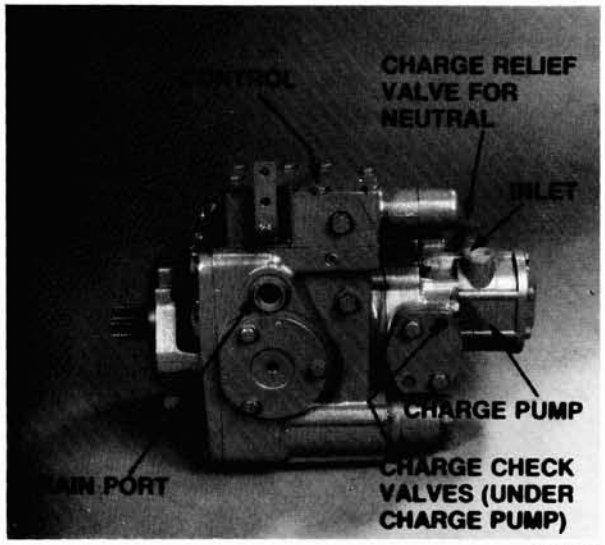
The hydrostatic transmission consists of a variable displacement pump connected by hydraulic lines to either a fixed or variable displacement motor. The pump rotates in one direction and requires a change of internal parts to rotate in the opposite direction. The motor rotates in either direction.

With the hydrostatic transmission, machine control can be achieved with a single operator control which provides smooth, stepless speed and direction changes. Placing the control in neutral (0 swashplate angle) stops transmission (motor) output which usually eliminates the need for clutching mechanisms. **This feature, however, does not eliminate the need for a service brake or parking brake.**

BASIC OPERATION:
HYDRAULIC SUPPORT SYSTEM







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The Sauer-Sundstrand hydrostatic transmission is easy to install, requiring no adjustments and few auxiliary components. It has its own hydraulic support system which is discussed in this section.

Basic Closed Circuit

The main ports of the pump are connected by hydraulic lines to the main ports of the motor. Fluid flows, in either direction, from the pump to the motor then back to the pump in this closed circuit. Either of the hydraulic lines can be under high pressure. The position of the swashplate determines which line is high pressure as well as the direction of fluid flow.

Case Drain and Heat Exchanger

The pump and motor require case drain lines to remove hot fluid from the system. The motor should be drained from its topmost drain port to insure the case remains full of fluid. The motor case drain is then connected to the lower drain port on the pump housing and out the upper port.

A heat exchanger, with a bypass valve, is required to cool the case drain fluid before it returns to the reservoir.

CAUTION

Case pressure should not exceed 40 PSIG.

Charge System and Inlet Filter

A fixed displacement (gear or gerotor type) charge pump is mounted on the variable displacement pump and driven off the main pump shaft. The charge pump supplies cool fluid to the system, keeps the system charged and supplies fluid to operate the control system. Charge pressure, with the pump in neutral (0 flow), is limited by a relief valve which is normally factory set for 190-210 ΔPSI (above case pressure).

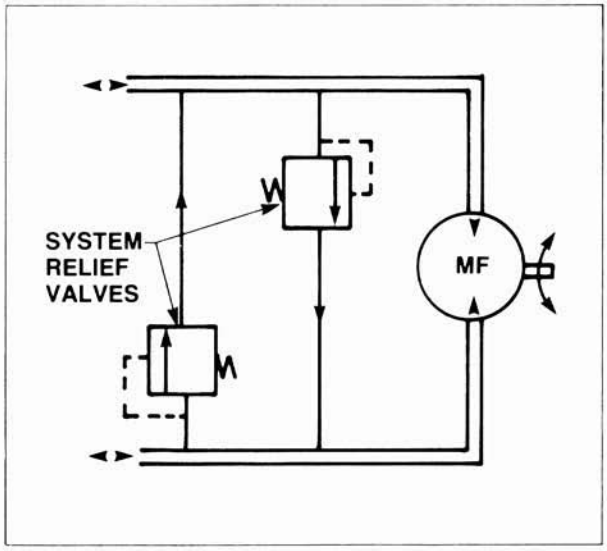
Since either of the main hydraulic lines can be high pressure, two (2) charge check valves are used to direct the charge supply into the low pressure line. The check valves are contained in the pump end cap beneath the charge pump.

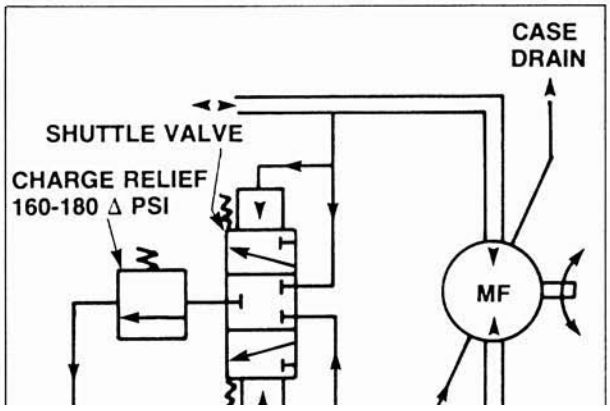
The charge pump draws the fluid from the reservoir. An inlet filter is required to insure that only clean fluid enters the system. This filter should have a 10 micron (nominal) rating and should not have a bypass.

CAUTION

The inlet vacuum, measured at the charge pump inlet should not exceed 10 in. hg. except during cold starts.

BASIC OPERATION: HYDRAULIC SUPPORT SYSTEM





System Relief Valves

Two (2) System Relief Valves are provided for overload protection and are located in the Manifold Assembly mounted on the motor. These relief valves are factory set and are of the pilot operated, cartridge type. Changing the setting of these relief valves can be accomplished by installing cartridges with the desired setting. The first two (2) digits of the pressure setting are stamped on the end of the relief valve cartridge.

CAUTION

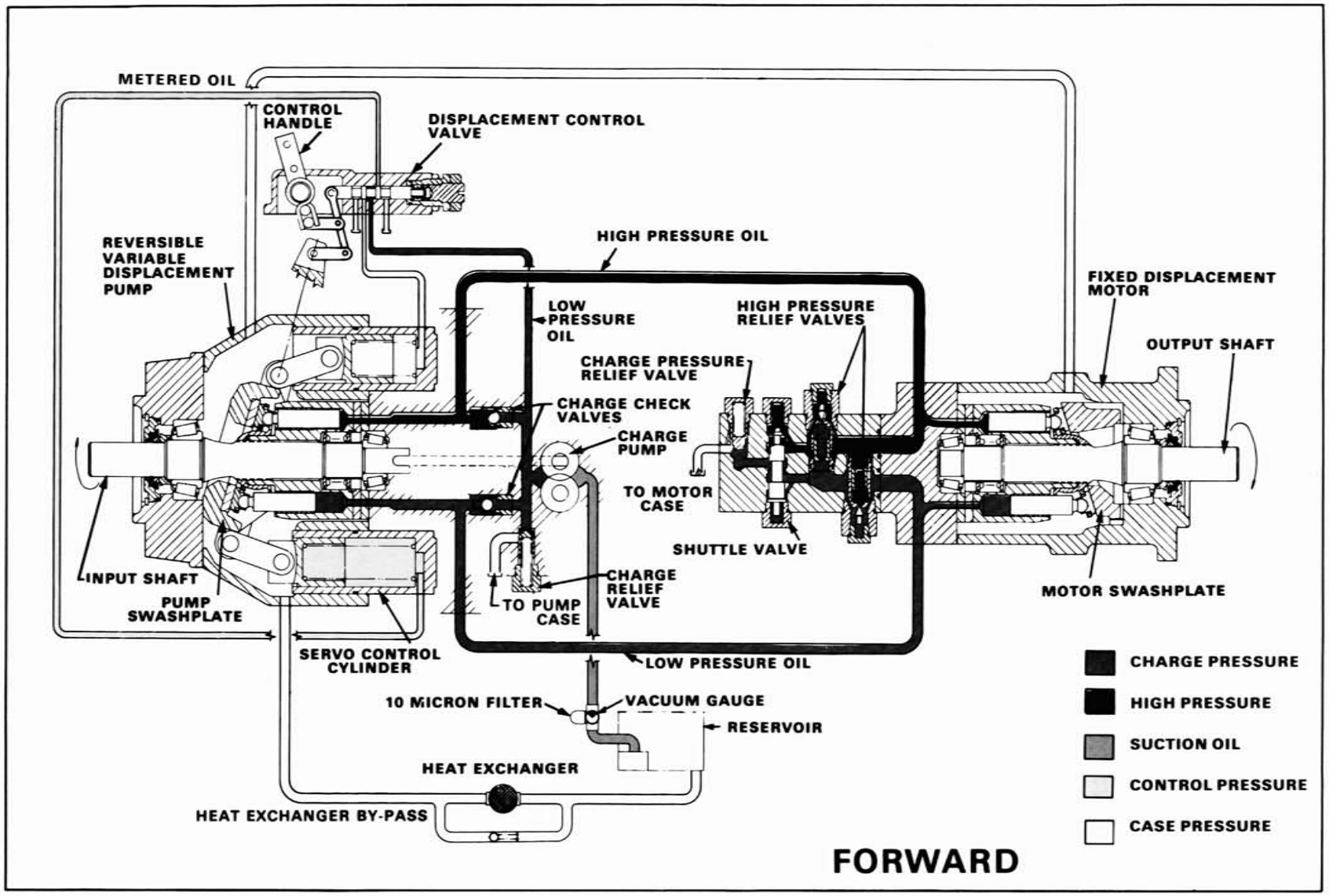
The relief valves are factory set and should not be tampered with except to replace the entire cartridge.

Cooling Circuit

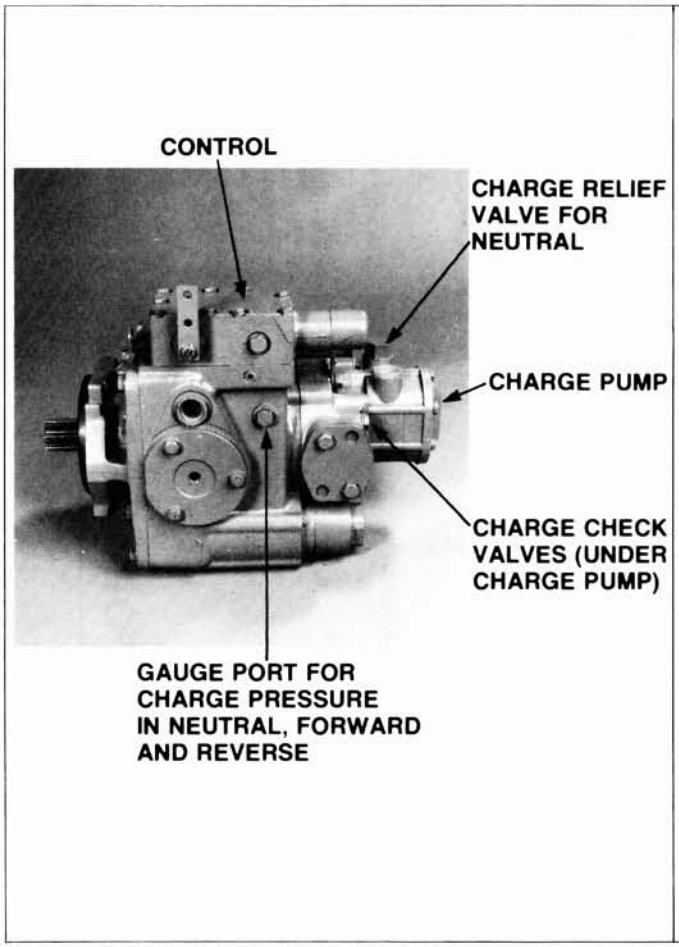
A Shuttle Valve and a second Charge Relief Valve are included in the Manifold Assembly. The Shuttle Valve provides a circuit between the low pressure hydraulic line of the closed circuit to the second Charge Relief Valve. This Charge Relief Valve is set at a lower pressure (160-180 Δ PSI) than the relief valve located in the Charge Pump. This Charge Relief Valve limits Charge Pressure when the pump is in forward or reverse (swashplate stroked out of neutral).

This system provides a means of removing hot fluid from the main closed circuit so that cooler fluid entering from the charge pump can be used to help reduce heat build-up.

TYPICAL HEAVY DUTY VARIABLE PUMP–FIXED MOTOR TRANSMISSION SCHEMATIC



TROUBLESHOOTING



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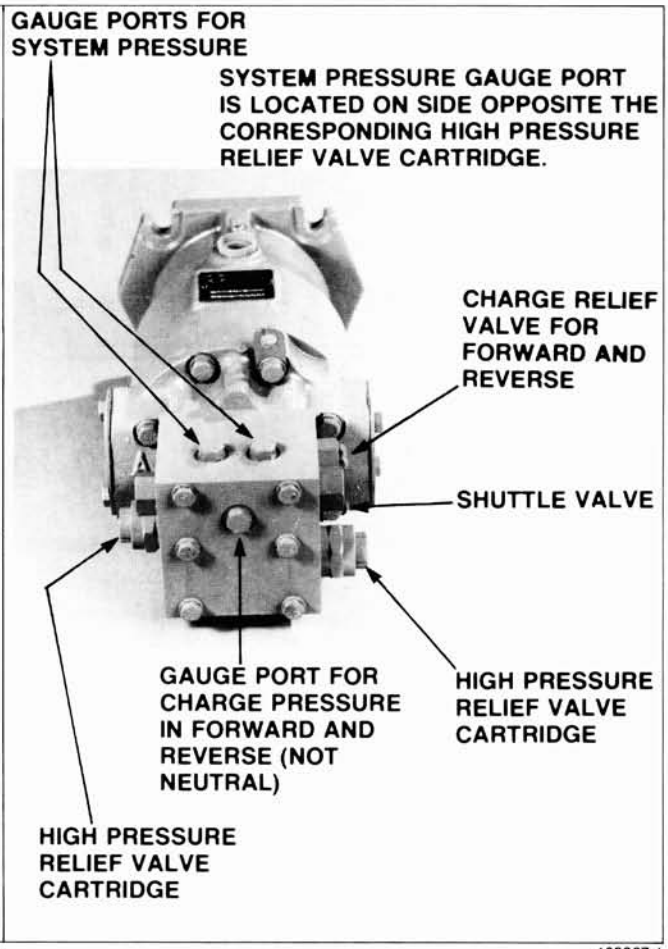

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Instructions

The areas indicated in these troubleshooting procedures may be inspected, adjusted or replaced, following the procedures in this manual, without voiding the warranty. For specific instructions on adjustments, removal and replacement, refer to the appropriate sections in this manual.

The information contained in this section provides a guide for troubleshooting the Sauer-Sundstrand Heavy Duty hydrostatic transmissions. It is a problem solving tool aimed at eliminating unnecessary machine downtime.

WARNING

Use caution when dealing with hydraulic fluid under pressure. Escaping hydraulic fluid under pressure can have sufficient force to penetrate your skin causing serious injury. This fluid may also be hot enough to burn. Serious infection or reactions can develop if proper medical treatment is not administered immediately.

Following the fault-logic approach should result in the expedient correction of transmission problems.

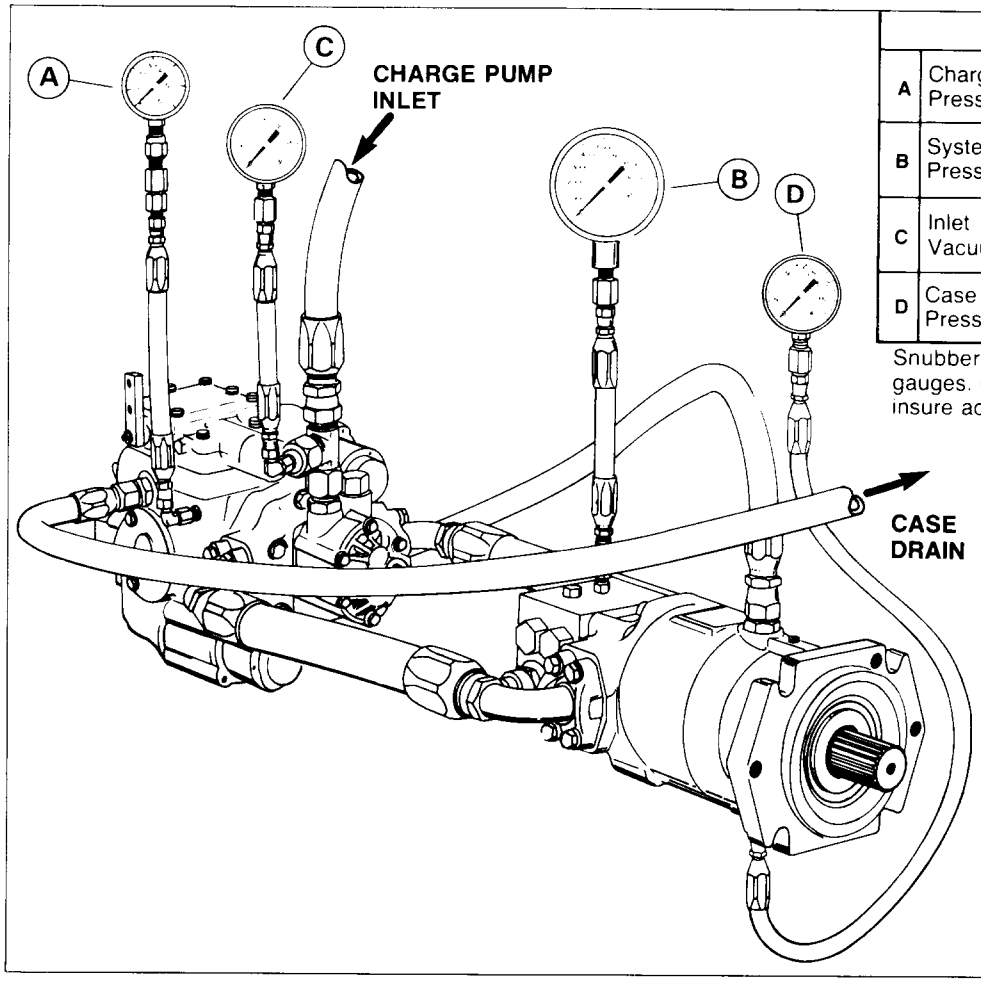
Our experience shows that there are five (5) problem statements that cover the majority of problems encountered with these transmissions. These problem statements have been set up in fault-logic diagrams on the following pages.

Following the fault-logic diagrams are descriptions of some of the action steps shown in the diagrams. Where applicable, a number for this description appears in the action block of the diagram.

Cleanliness is a primary means of insuring satisfactory transmission life, on either new or repaired units. Cleaning parts by using a solvent wash and air drying is adequate, providing clean solvent is used. As with any precision equipment, the internal mechanism and related items must be kept free of foreign materials and chemicals.

Protect all exposed sealing surfaces and open cavities from damage and foreign material.

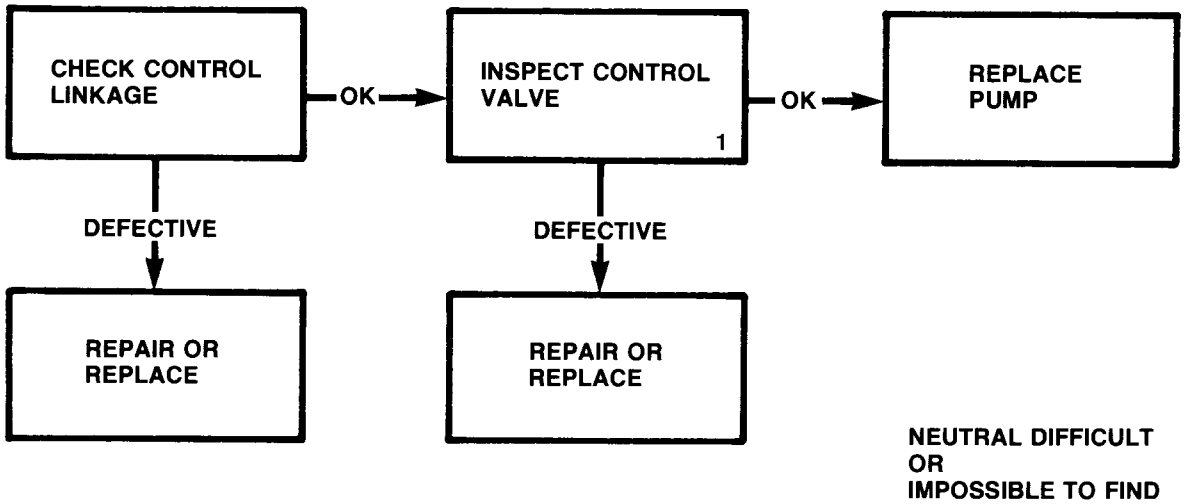
TROUBLESHOOTING



GAUGE INFORMATION		
A	Charge Pressure	500 PSI - Gauge 7/16-20 O-Ring Fitting
B	System Pressure	10,000 PSI Gauge 7/16-20 O-Ring Fitting
C	Inlet Vacuum	Vacuum Gauge Tee into Inlet Line
D	Case Pressure	500 PSI Gauge Adapt to Bottom Drain Port

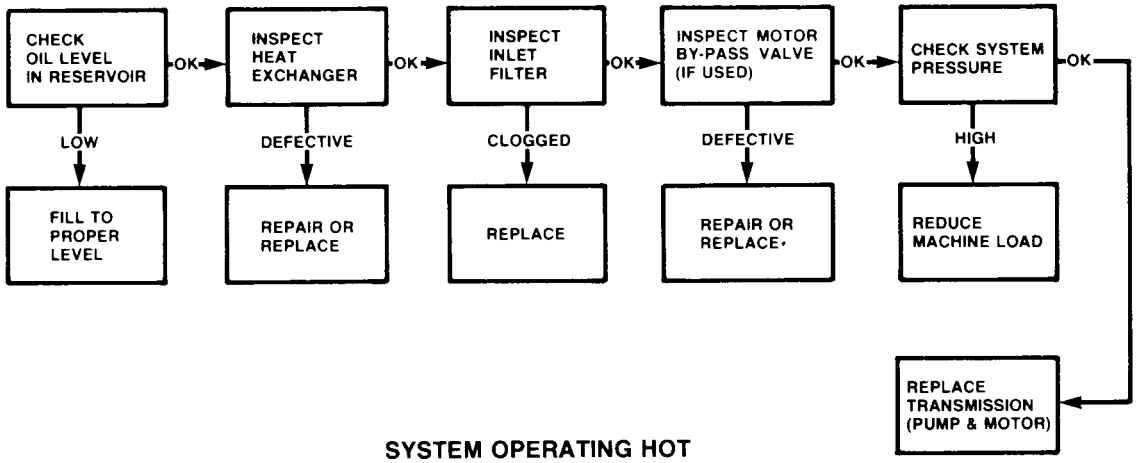
Snubbers are recommended to protect gauges. Gauge calibration is necessary to insure accuracy of readings.

TROUBLESHOOTING GAUGE INSTALLATION AND INFORMATION

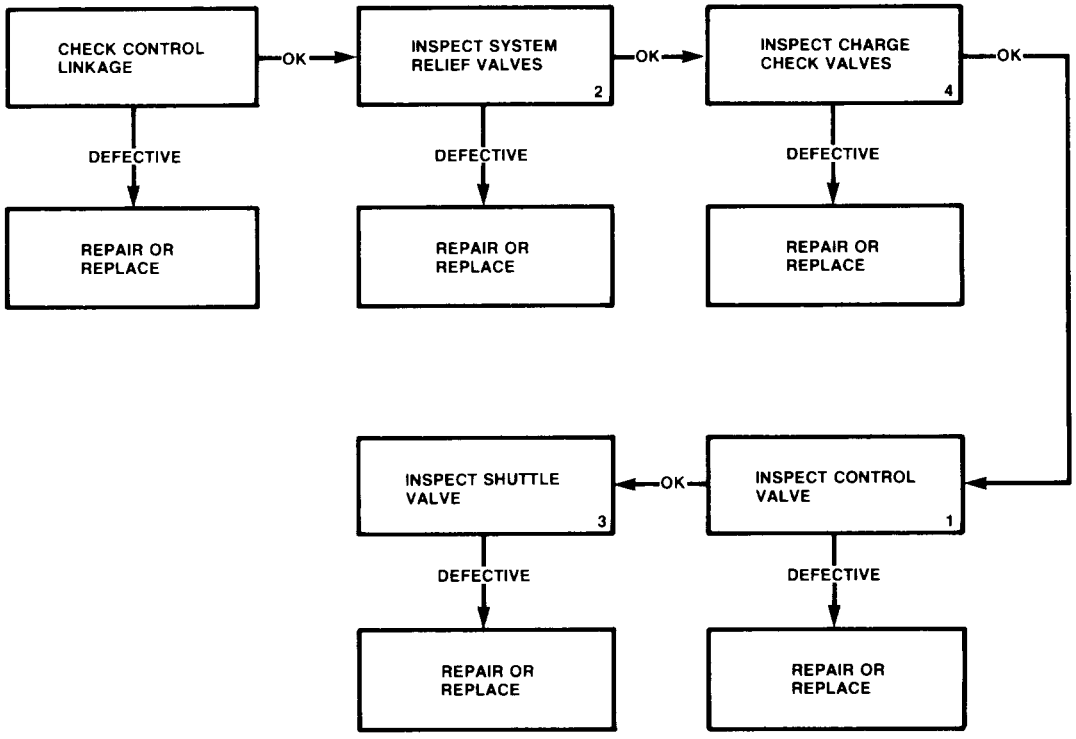


NEUTRAL DIFFICULT OR IMPOSSIBLE TO FIND

TROUBLESHOOTING

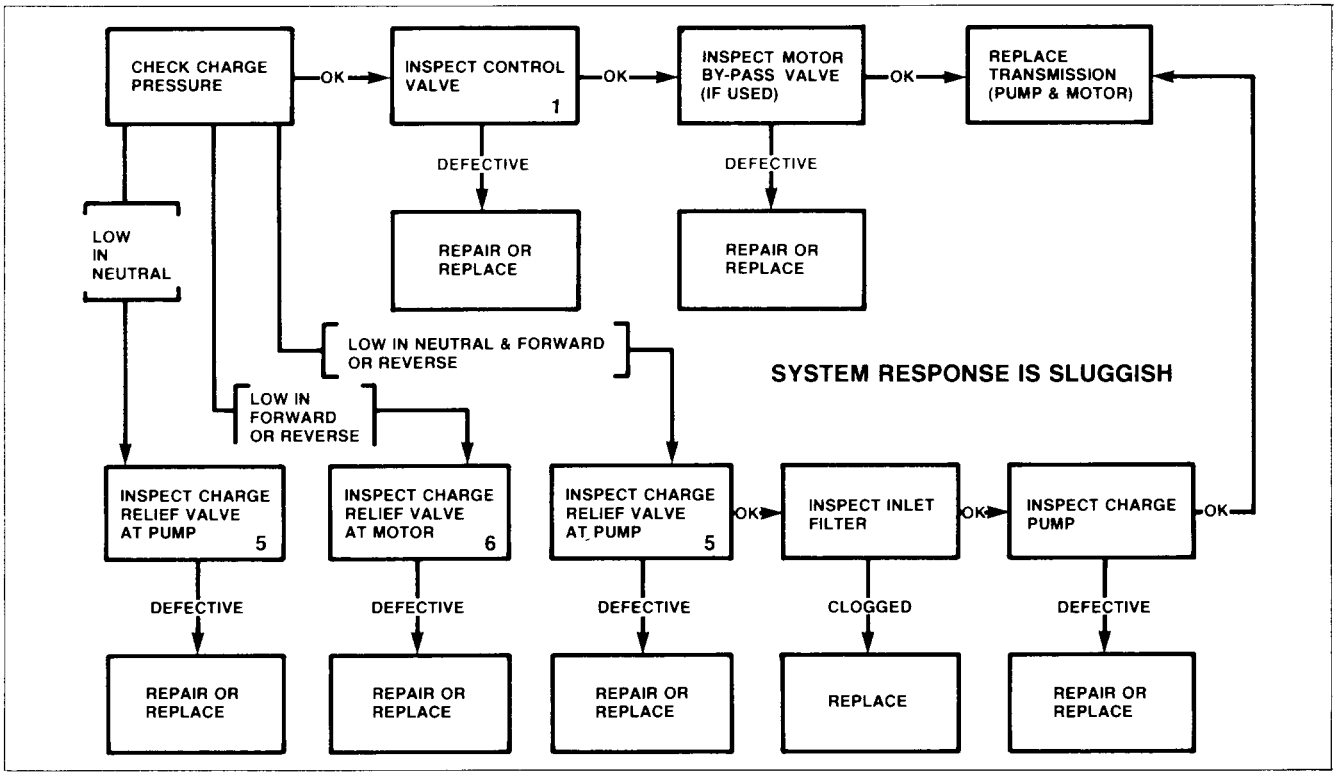


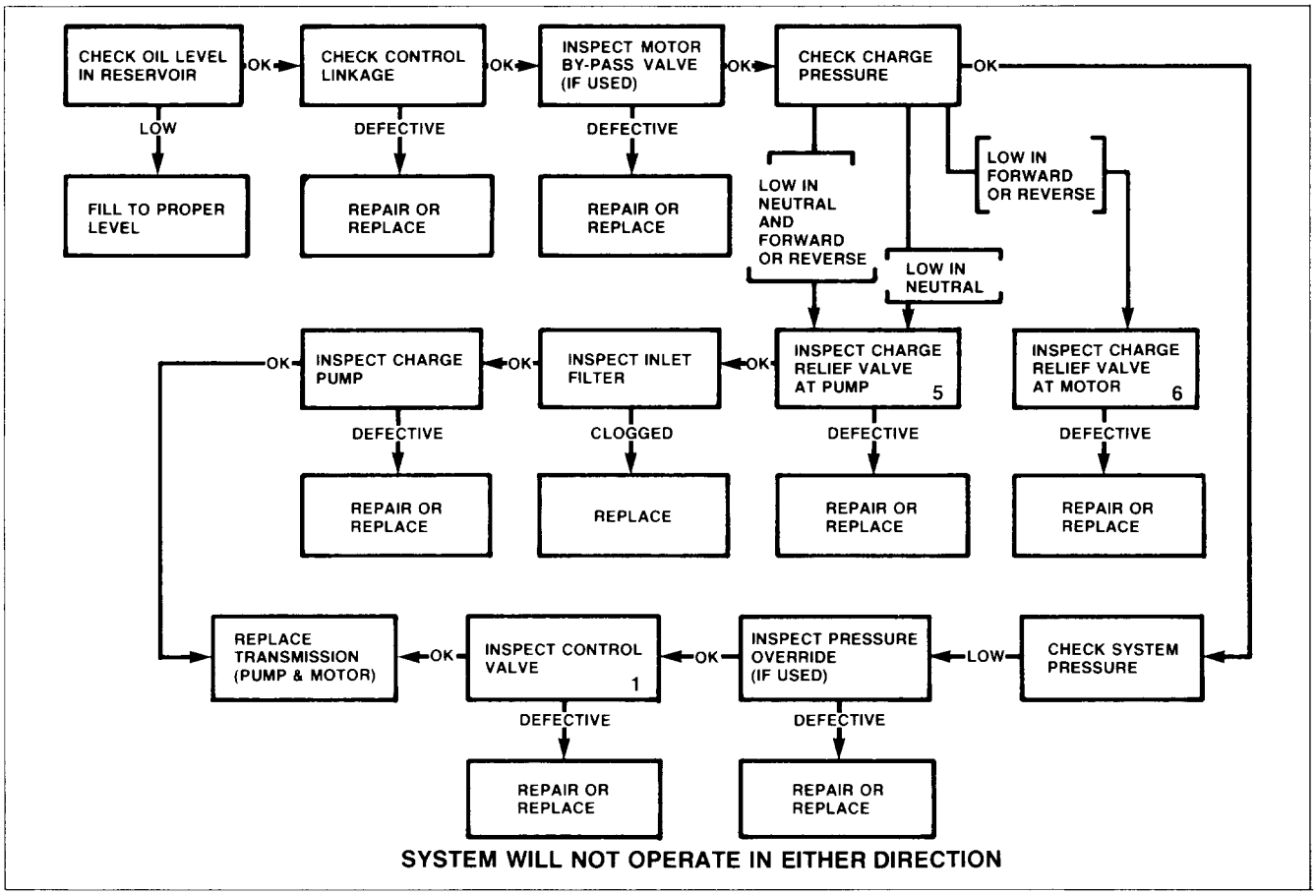
SYSTEM OPERATING HOT

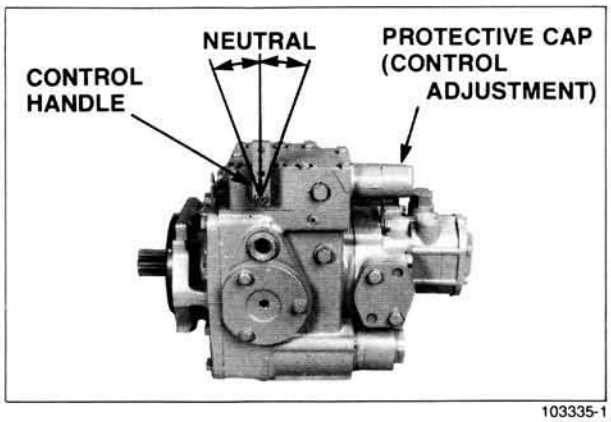


TRANSMISSION OPERATES IN ONE DIRECTION ONLY

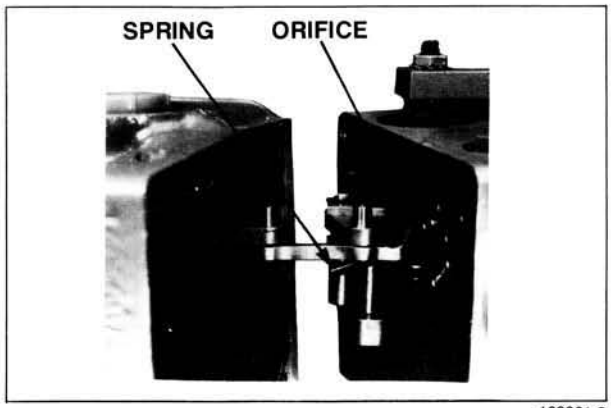
TROUBLESHOOTING







103335-1



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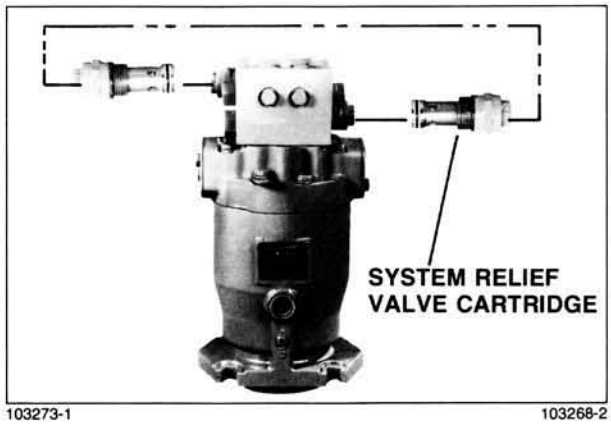

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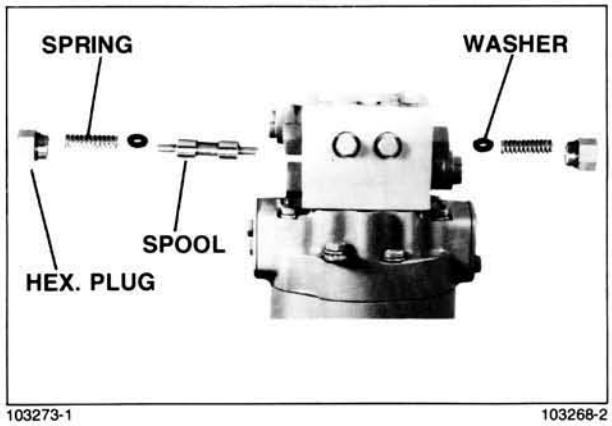


103273-1 103268-2

1. Inspect Manual Displacement Control

Disconnect the external control linkage from the control handle and check for neutral operating with control handle. Releasing control handle should allow the pump to return to neutral. If operation is satisfactory with external control linkage disconnected, the problem is not in the hydrostatic transmission.

If operation is not satisfactory with external control linkage disconnected from control handle, the control may be misadjusted. Adjustment procedures are contained in this manual.

NOTE:

Before proceding with control adjustment the following inspection is recommended.

Remove the cap screws holding the control in place, and swing it away from housing and remove. Inspect visible linkages, torsion spring, and O-rings. Inspect for missing, plugged, or improper orifice.

2. Inspect System Relief Valves

When the problem occurs in one direction only, interchange the relief valve cartridges to see if the problem changes to the other direction. If so, one relief valve cartridge is either malfunctioning or does not have the proper setting. The first two (2) digits of the pressure setting are stamped on the end of the cartridge. Compare to machine specification.

CAUTION

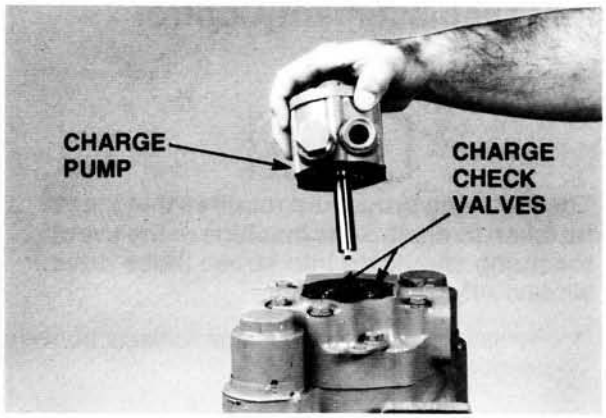
The relief valves are factory set and should not be disassembled further.

3. Inspect Shuttle Valve

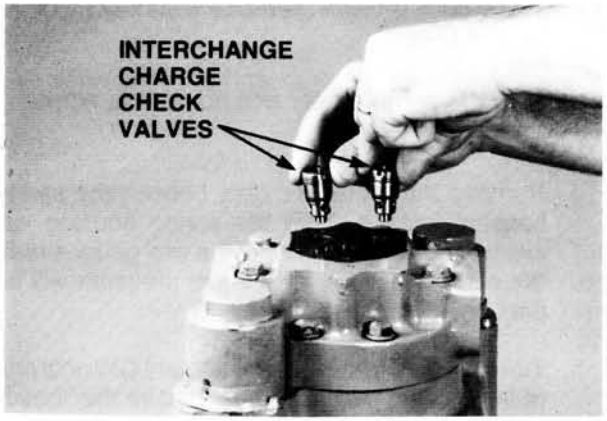
Remove the two (2) hex plugs and the shuttle valve parts. Inspect for broken or damaged parts and proper orientation. Washers must go between spool and springs. Inspect to see if spool moves smoothly in its bore.

NOTE:

The spool and manifold are matched and cannot be replaced separately.



103334-1



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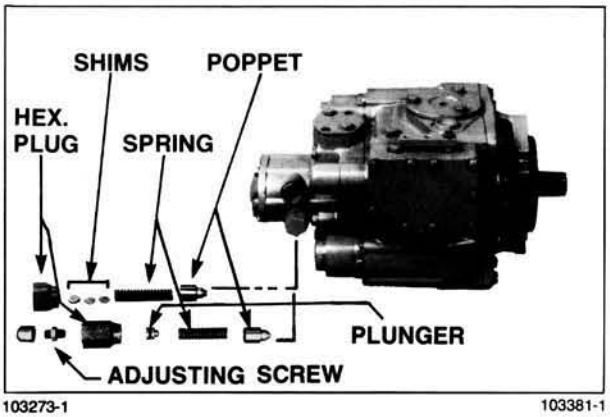

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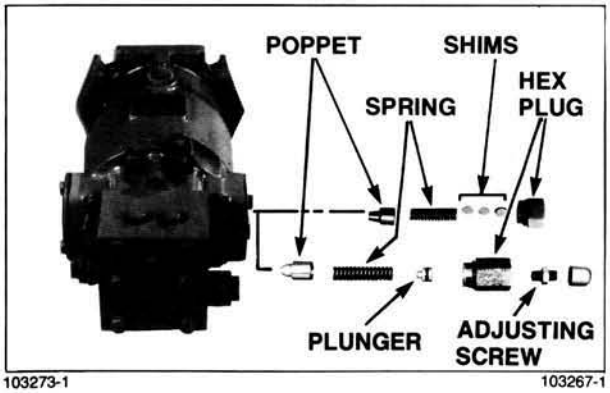


103273-1 103267-1

4. Inspect Charge Check Valves

The Charge Check Valves are located in the pump end cap, under the Charge Pump. Following the procedures in the Minor Repair Section of this manual, remove the Charge Pump. Remove both Charge Check Valves and keep in same relation to the end cap.

CAUTION

Protect exposed cavities into pump from foreign material.

Inspect the check valve for spring loading by pushing against the internal ball. A slight resistance should be felt as the ball is pushed off its seat. The internal spring should return the ball to its seat when force is removed. Check for any foreign material inside valve.

When the problem occurs in one direction only, interchange the check valves and see if the problem changes to the other direction. If so, one check valve is malfunctioning and should be replaced.

5. Inspect Pump Charge Relief Valve

If Charge Pressure is low (below 190 Δ PSI) in neutral only (okay in forward and reverse), the Charge Relief Valve located in the Charge Pump should be inspected. Remove the hex plug and relief valve parts. Inspect for foreign material holding poppet open, and for galling or wear on poppet and seat in the charge pump.

Adjustment of Charge Pressure in Neutral is accomplished by changing the shims behind the spring (earlier units) or by turning the external adjusting screw (later units).

6. Inspect Motor Charge Relief Valve

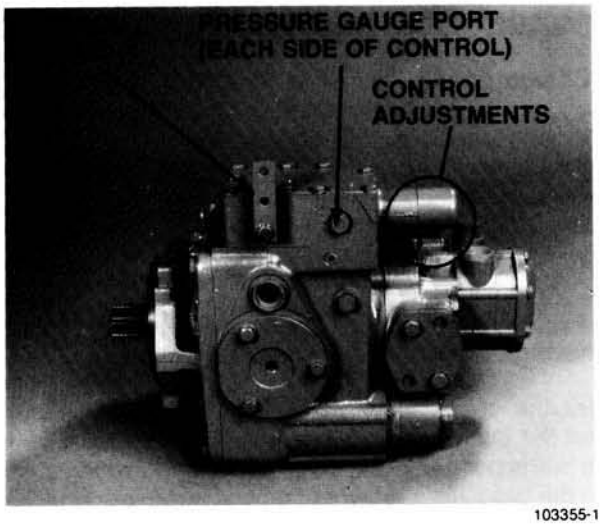
If Charge Pressure is low (below 160 Δ PSI) in forward and reverse (okay in neutral), the Charge Relief Valve located in the motor manifold should be inspected. Remove the hex plug and relief valve parts. Inspect for foreign material holding poppet open, and for galling or wear on poppet and seat in the manifold.

Adjustment of Charge Pressure in forward and reverse is accomplished by changing the shims behind the spring (earlier units) or by turning the external adjusting screw (later units).

CAUTION

Make certain the pressure setting of the motor charge relief valve is below the pressure setting of the pump charge relief valve. Otherwise the cooling circuit will not function properly.

CONTROL ADJUSTMENTS



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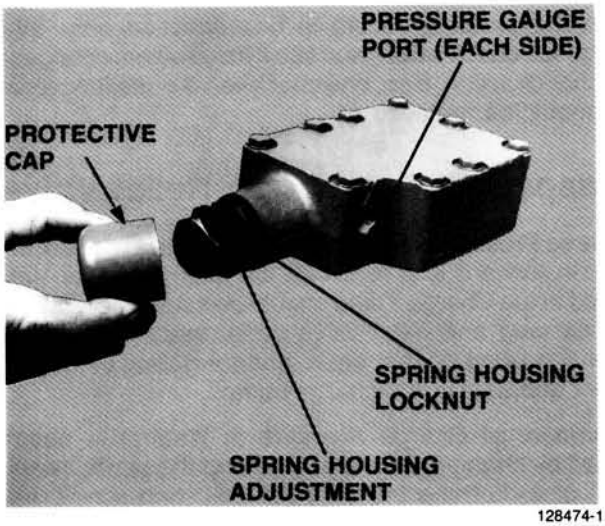


128474-1

Manual Displacement Control

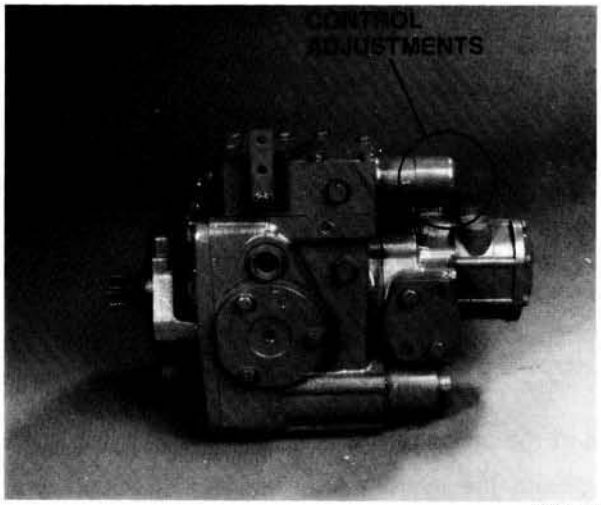
Spool Centering

CAUTION

The following procedure requires that steps be taken to disable the machine in the event the pump should go into stroke (raise drive wheels off ground, etc.)

1. Remove the external control linkage from the control handle.
2. Install two 300 PSI gauges into the pressure gauge ports on either side of the control (7/16-12 str. thd O-ring).
3. Start the prime mover and operate at normal speed.
4. Remove the protective cap. Loosen the spring housing locknut. Turn the spring housing adjustment CW or CCW until the two gauges read the same pressure. This equal pressure will be the "base" pressure.
5. Turn the spring housing adjustment CW until one of the gauges begins to raise above the "base" pressure. Note the amount of adjustment rotation.
6. Keeping track of the amount of rotation, turn the adjustment CCW until the other gauge begins to raise above the "base" pressure.
7. Note the amount of rotation from the previous adjustment position (amount turned CCW in Step 6). Turn the adjustment CW by one-half (1/2) that amount.
8. Holding the adjustment in place, tighten the spring housing locknut to 60-100 ft. lbs.
9. If the pump consistently returns to neutral, after cycling the control several times, the neutral adjustment is complete.
10. If the pump does not consistently return to neutral, stop the prime mover and refer to the procedure on the following page.
11. Stop the prime mover, install protective cap, remove the two (2) pressure gauges and install the pressure port plugs. Torque to 10-20 ft. lbs.

    Install and adjust, if necessary, the external directional control linkage.



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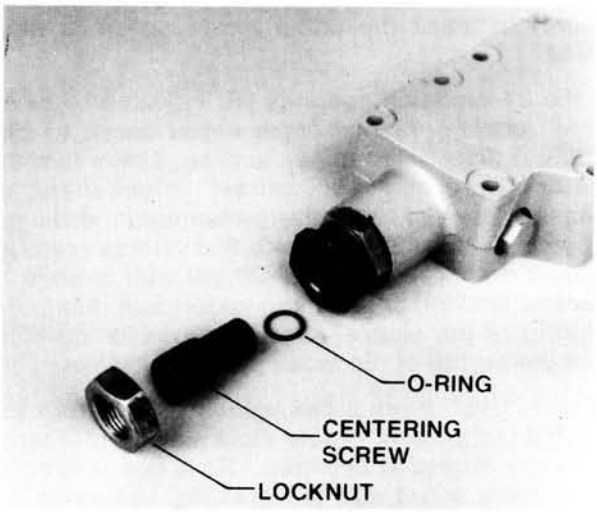

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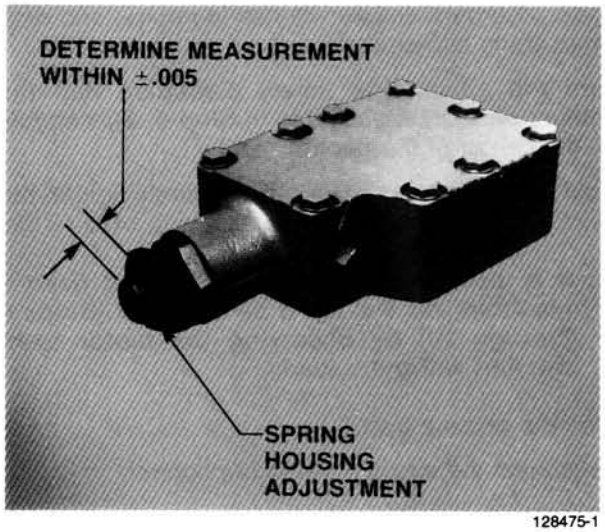


128475-1

Centering Spring

12. Holding the spring housing adjustment in place, loosen and remove the centering screw locknut. Remove the centering screw.

13. Remove the O-ring from centering screw and discard.

14. Install the centering screw, back into the control, until it just contacts the internal centering mechanism.

CAUTION

Care must be taken not to compress the internal centering spring. The centering screw should just make contact.

15. Measure accurately the distance the centering screw extends beyond the end of the spring housing adjustment.

CAUTION

Measurement must be accurate to ±.005".

16. Remove the centering screw and install a new O-ring.

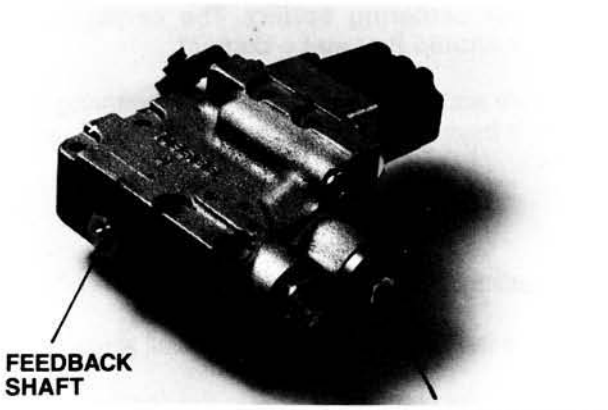
17. Re-install the centering screw to the depth measured in Step 5. Install and torque centering screw locknut to 30-50 ft. lbs.

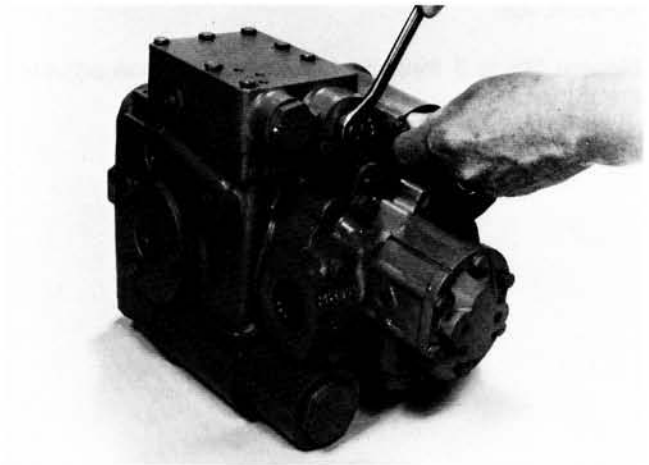
18. Repeat Steps 3 through 11 to complete the adjustment procedure.

CONTROL ADJUSTMENTS

WARNING

To adjust neutral requires operating the pump. Take necessary safety precautions. Keep unnecessary personnel away from the machine. Maximum system pressure may occur upon startup, and the machine may move. Ensure the operator is not in a position to be injured should the machine move.





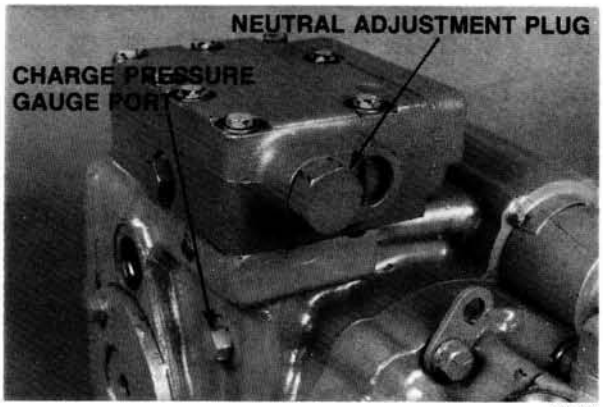
Electric Displacement Control (EDC) and Hydraulic Displacement Control (HDC)

1. Install a 300 psi gauge into the charge pressure gauge port.
2. Using a 9/16″ wrench, loosen the hext lock nut on the neutral adjustment screw.
3. Disconnect the electrical signal input (EDC) or hydraulic signal input (HDC) from the control.
4. Start the prime mover and run at low idle.
5. Operate the system for several minutes to warm fluid and bleed air.
6. Slowly increase the prime mover speed to rated RPM.
7. If the transmission operates (as indicated by motor shaft rotation), reduce prime mover speed to idle. Using a 3/16″ internal hex wrench, slowly turn the neutral adjustment screw clockwise or counterclockwise until the transmission does not operate. Repeat Step 6. Note that charge pressure should drop approximately 20 psi with forward or reverse stroking of the pump swashplate due to the shifting of the shuttle valve in the motor manifold and the setting of the motor charge relief.
8. With a 3/16″ internal hex wrench, slowly turn the neutral adjustment screw clockwise until charge pressure begins to decrease. Then slowly turn the adjustment screw counterclockwise, observing the angle of rotation, until charge pressure decreases again (charge pressure will rise in neutral and drop when going into stroke).
9. Turn the adjustment screw clockwise half the amount of rotation observed in Step 8. This should be the center of the neutral band.
10. Hold the adjustment screw and securely tighten the hex lock nut on the adjustment screw to 14 to 18 lbs.

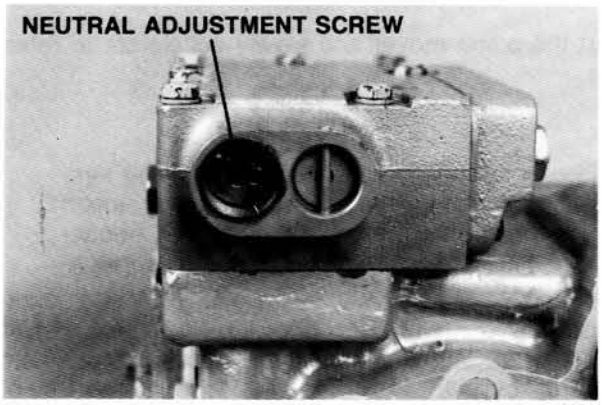
NOTE: If a motor is used which does not have a manifold, neutral must be adjusted (Steps 8 through 10) by observing the motor shaft rotation without a load.

11. Stop the prime mover.
12. Reconnect the signal input to the control.
13. Operate the system to ensure that it operates proportionately on both sides of neutral. Swashplate movement can be verified by watching the movement of the swashplate feedback shaft.

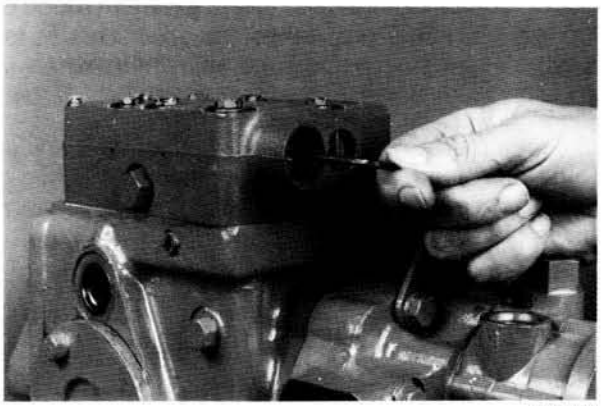
CONTROL ADJUSTMENTS



129066



129067-1



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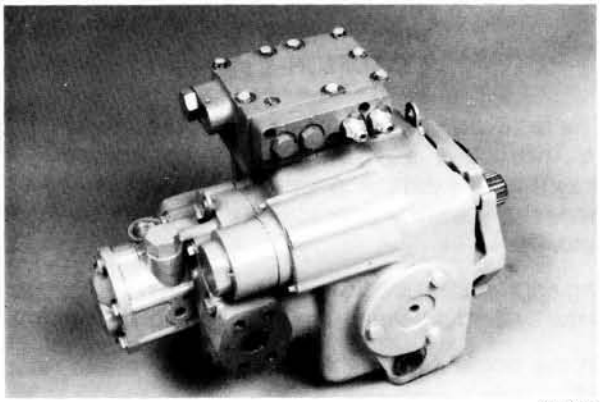


129055-1

Hydraulic Displacement Control (Crawler Style)

The adjustment of the control may be accomplished following these procedures without voiding the pump warranty.

1. Install a 300 psi gauge into the charge pressure gauge port.
2. Using a 1" wrench, remove the neutral adjustment plug on the neck of the control.
3. Make certain the command signal console is in the neutral position (0 psi command signal).

WARNING

To adjust the neutral requires operating the pump. Take necessary safety precautions. Maximum system pressure may occur on start up. Machine may move.

4. Start prime mover and run at low idle.
5. Bleed air from the system by loosening a fitting, preferrably at the highest possible point of the control system.
6. Slowly increase prime mover speed to rated RPM.
7. If transmission operates while command signal console is in neutral, reduce speed to idle. Using a 1/8" internal hex wrench, slowly turn the neutral adjustment screw clockwise (CW) or counterclockwise (CCW) until transmission does not operate. Repeat Step 6.

   NOTE:

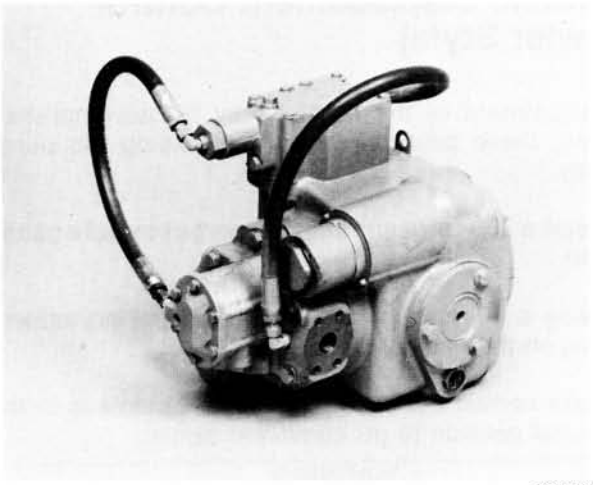
   Charge pressure should be approximately 200 PSI when the control is in the neutral position but will drop to approximately 180 PSI when it is in forward or reverse due to the shifting of the shuttle valve in the motor manifold.

8. With a 1/8" internal hex wrench, slowly turn the neutral adjustment screw CW until charge pressure begins to decrease. Then slowly turn the adjustment screw CCW, while counting the turns, until charge pressure decreases again (charge pressure will rise in neutral and drop when going into stroke).
9. Turn the Adjustment screw CW half the amount of turns counted. This should be the approximate center of neutral.
10. Install the hex head plug assembly and torque to 30-40 ft. lbs.

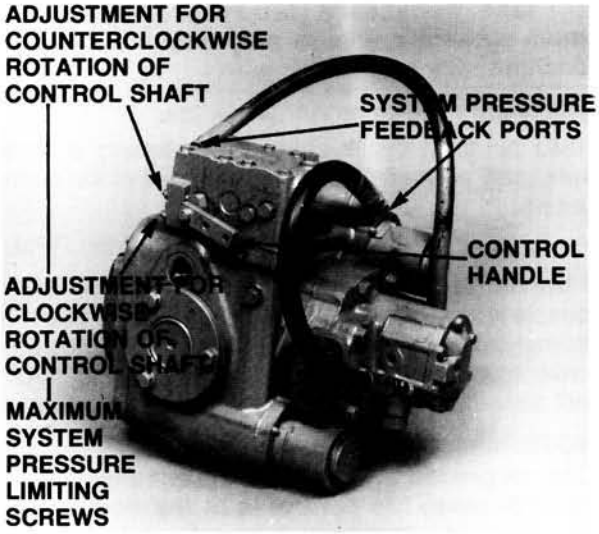
    NOTE:

    If a motor is used which does not have a manifold, adjust neutral (Steps 8-10) by observing the motor output shaft rotation without load.

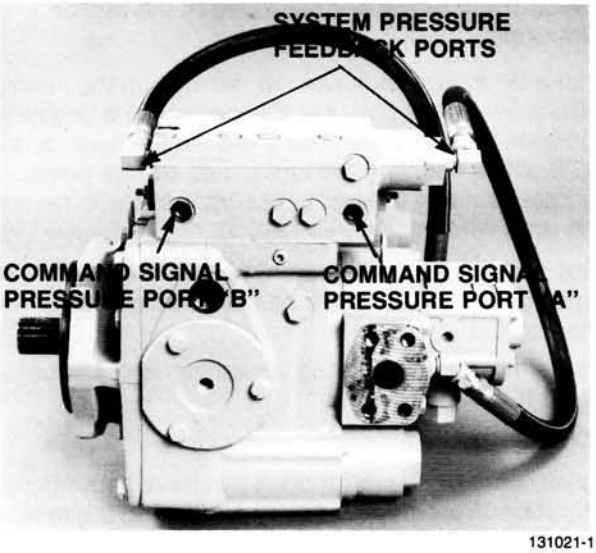
CONTROL ADJUSTMENTS



116799-3



103264-1



131021-1

Manual Variable Pressure Control

Maximum Pressure Adjustment

CAUTION

The following procedure requires the ability to induce a sufficient load to create maximum system pressures. Take the necessary safety precautions for your application.

1. Using appropriate adaptors, tee two 10,000 PSI gauges into the system pressure feedback ports of the control.
2. Start the prime mover and slowly accelerate to rated rpm.

CAUTION

Due to linkage bias, etc. there may be system pressure created immediately upon starting the prime mover. Take the necessary safety precautions for your application.

3. Stroke the control in one direction and, using a 1/8" internal hex wrench, adjust the maximum pressure limiting screw clockwise for less pressure or counterclockwise for more pressure until the desired pressure reading is achieved. The adjustment range is 3,000 to 5,000 PSI. Consult machine specifications for proper pressure setting. Lock the adjustment screw in place with the 7/16" hex lock nut; torque to 8-11 ft. lbs.
4. Stroke the control in the opposite direction and adjust the other maximum pressure limiting screw to achieve the desired pressure reading. Lock the adjustment screw in place.
5. Stop the prime mover, remove the gauges and adapters, and reconnect hoses to their original locations.

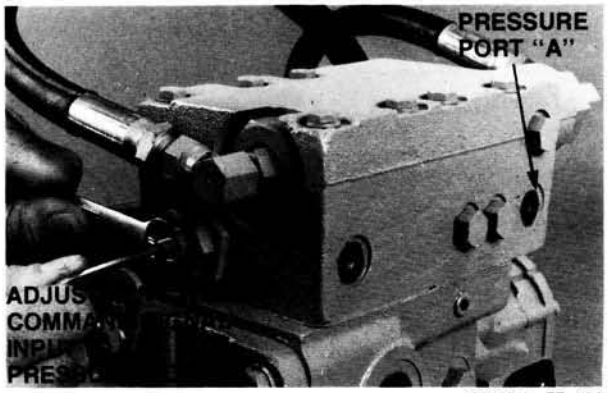
Hydraulic Variable Pressure Control

Maximum Pressure Adjustment

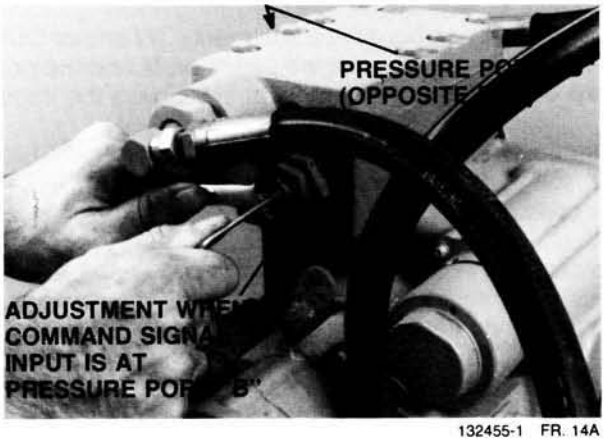
CAUTION

The following procedure requires the ability to induce a sufficient load to create maximum system pressures. Take the necessary safety precautions for your application.

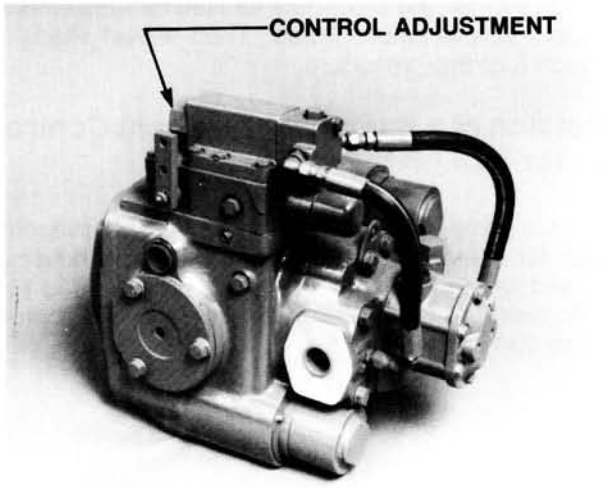
1. Using appropriate adaptors, tee two 10,000 PSI gauges into the system pressure feedback ports of the control.
2. Start the prime mover and slowly accelerate to rated RPM.



132455-1 FR. 10A



132455-1 FR. 14A



114700-3

3. Stroke the command console in the direction which supplies the command signal to port "A" on the control (see photo). Stroking the command console will activate the control and stroke the pump to create system pressure.
4. Note the pressure gauge reading. Refer to machine specifications for proper pressure setting.
5. Using a 7/16" wrench and 1/8" internal hex wrench, loosen the locknut and turn adjusting screw CW to decrease setting or CCW to increase setting. (See photo with command signal to port "A").
6. Once desired setting (shown on the pressure gauge) is obtained hold adjustment screw in place and tighten locknut.
7. To adjust the maximum pressure for the opposite direction slowly stroke the command console in the direction which supplies the command signal to port "B" on the control.
8. Follow Steps 4 through 6 above, but this time turn the adjustment screw on the opposite end of the control (see photo with command signal to port "B").
9. After adjustments have been completed, remove all gauges.

Pressure Override (POR)

Maximum Pressure Adjustment

CAUTION

The following procedure requires the ability to induce a sufficient load to create maximum system pressures. Take the necessary safety precautions for your application.

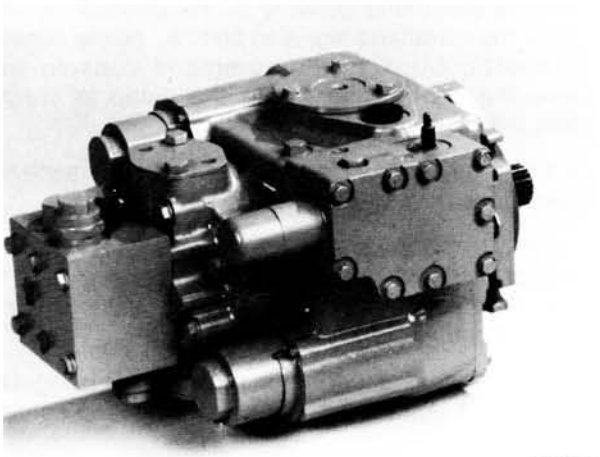
1. Install pressure gauge (10,000 PSI) in the system pressure gauge port located in the motor manifold (Ref. Troubleshooting Section). Consult machine specifications for correct pressure setting.
2. Holding the adjustment screw in place with a 3/16" internal hex wrench, loosen the locknut (use 9/16" wrench).
3. Start the prime mover and load the system. Turn adjustment screw until desired setting is reached. The setting will vary approximately 1000 PSI per turn of screw.

NOTE

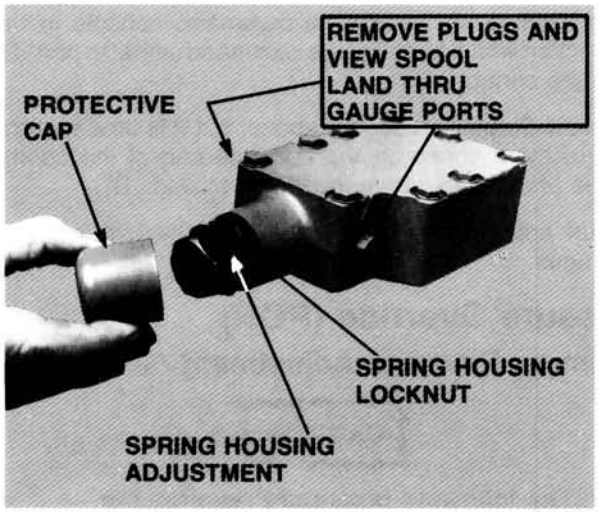
System Relief Valves in motor manifold must be set at least 1000 PSI above Pressure Override Setting.

4. Hold adjusting screw in place and torque locknut to 6-10 ft. lbs.

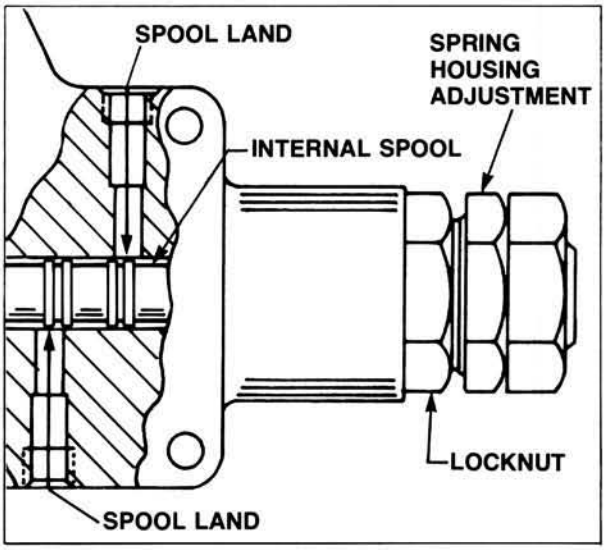
CONTROL ADJUSTMENTS



123121-3



128474-1



Manual Displacement Motor Control

Control Adjustment

The prime mover must not be operating during the initial adjustment steps.

1. Remove the two (2) gauge port plugs and the protective cap from the control. The spool lands on the internal spool can be observed through the exposed gauge ports. Remove the external control linkage from the control handle.

2. Using a 1'' wrench, loosen the spring housing locknut. Turn the spring housing adjustment (CW and/or CCW) until the areas between the spool lands and the ports are equal (turning this adjustment moves the spool).

3. After adjusting the spool lands in the gauge ports, turn the spring housing adjustment $90^0 \pm 15^0$ in a CW direction.

4. Holding the adjustment in place, torque the spring housing locknut to 60-100 ft. lbs. Install two (2) gauge port plugs and torque to 10-20 ft. lbs.

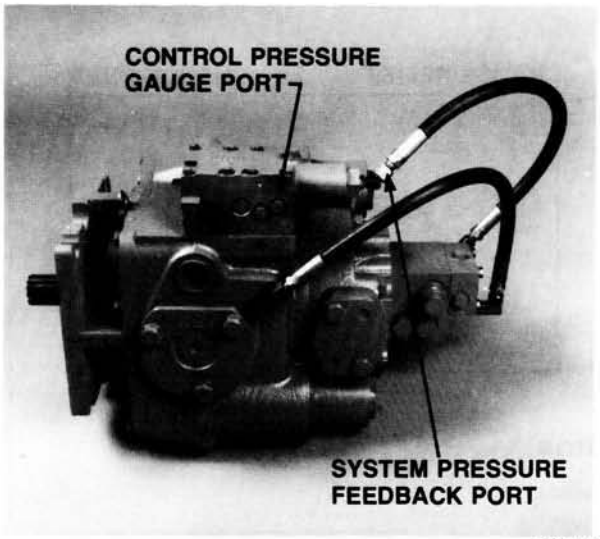
5. Start the prime mover and operate at normal speed. When operating the machine, the motor should be at full displacement when the control handle is released.

6. If the control functions satisfactorily, stop the prime mover, install the protective cap and re-install (adjust if necessary) the external control linkage.

7. If the control does not function properly, follow Steps 12 through 17 from the procedure for Neutral Adjustment, Variable Displacement Pump. Then repeat Steps 1 through 6 of this procedure.

Conversion of a Pump Displacement Control for Motor Use

To convert a pump displacement control, which is properly adjusted, for use on a motor; loosen the spring housing locknut and turn the spring housing adjustment $90^0 \pm 15^0$ in a CW direction. Hold adjustment in place and torque locknut to 60-100 ft. lbs.



128544-1

129058-1

Motor Pressure Compensator Control

Shift Pressure Adjustment

CAUTION

The following procedure requires the ability to induce a sufficient load to create maximum system pressures. Take the necessary safety precautions for your application.

Refer to machine specifications for proper pressure setting and how to induce load.

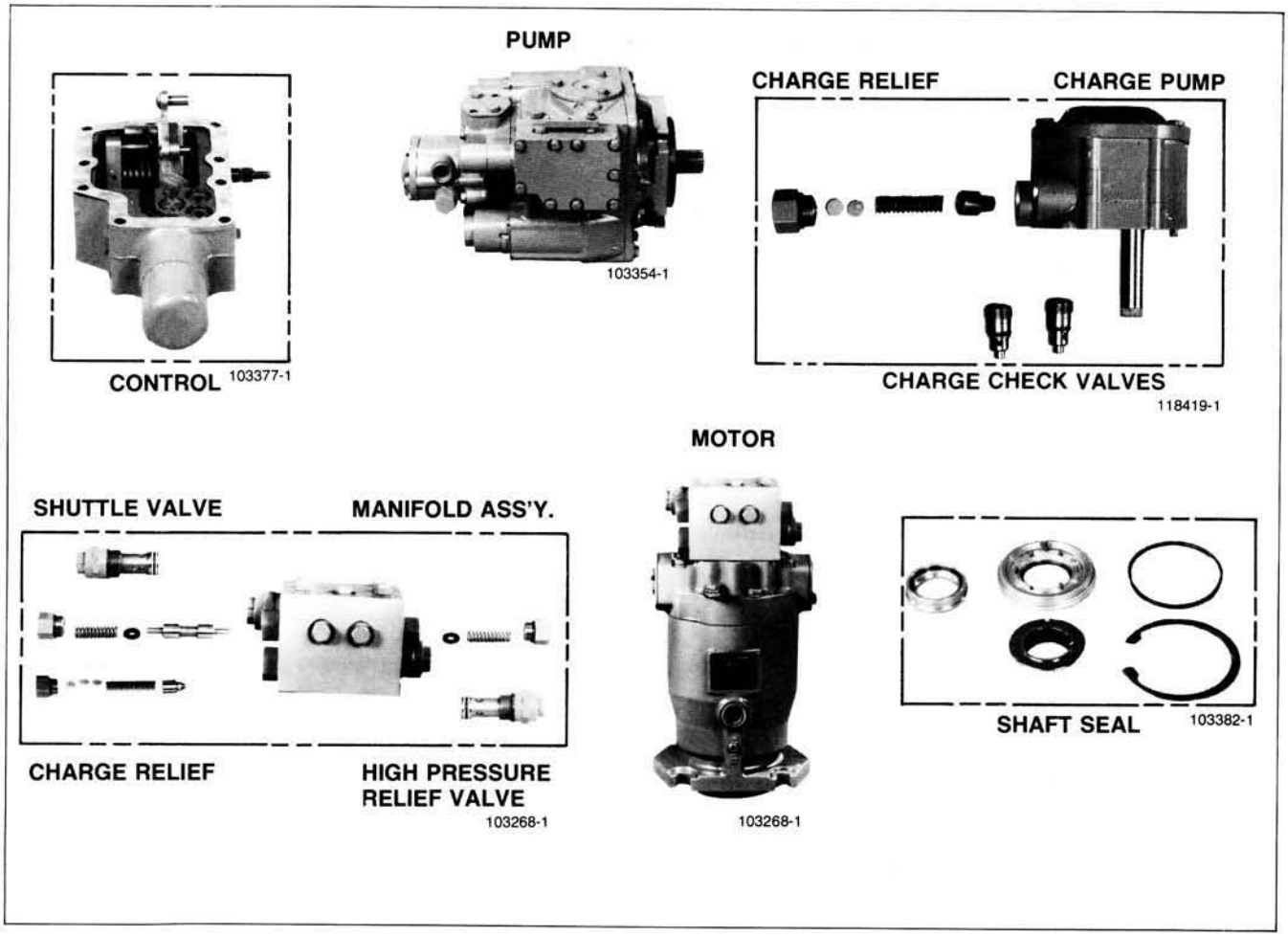
1. Using an appropriate adaptor, tee a 10,000 PSI gauge into the system pressure feedback port.
2. Install a 0-300 PSI gauge into the control pressure gauge port.
3. Start prime mover and slowly accelerate to rated RPM while leaving the pump in neutral.

CAUTION

Due to control adjustment setting bias etc., there may be system pressure created immediately upon starting the prime mover. Take the necessary safety precautions for your application.

4. The control pressure and system pressure should be reading approximately 200 PSI (charge pressure).
5. Stroke the pump control and slowly induce load on the motor to raise system pressure to the desired "shift" pressure (refer to machine specifications for proper shift pressure).
6. The control pressure should drop to a minimum pressure (approximately 25-75 PSI) at the same time the desired "shift" pressure is reached.
7. If the control pressure drops before the desired shift pressure is obtained, loosen the adjustment screw locknut with a 1/2" wrench and using a 5/32" internal hex wrench, turn the adjustment screw CW to obtain desired shift pressure.
8. If desired shift pressure is obtained before control pressure drops, turn the adjustment screw CCW to obtain desired proper shift pressure.
9. Stop the prime mover, remove the gauges and adaptors, and reconnect the feedback hose to the original location.

MINOR REPAIRS



Introduction

The areas of repair indicated are classed as minor repairs and may be performed, following the procedures in this section, without voiding the unit warranty. Although specific units are illustrated, these procedures apply to all series and types of units in the Heavy Duty Family.

General

Cleanliness is a primary means of insuring satisfactory transmission life, on either new or repaired units. Cleaning parts by using a solvent wash and air drying is adequate, providing clean solvent is used. As with any precision equipment, the internal mechanism and related items must be kept free of foreign materials and chemicals.

WARNING

Some cleaning solvents are flammable. To avoid possible fire, do not use cleaning solvents in an area where a source of ignition may be present.

Protect all exposed sealing surfaces and open cavities from damage and foreign material.

It is recommended that all gaskets and O-rings be replaced. All gasket sealing surfaces must be cleaned prior to installing new gasket. Lightly lubricate all O-rings with clean petroleum jelly prior to assembly.

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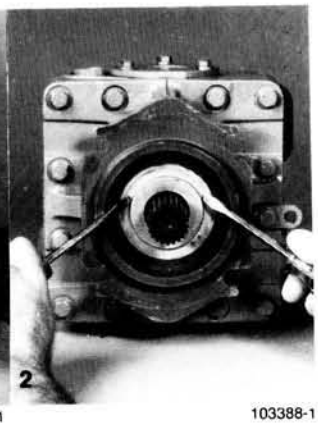

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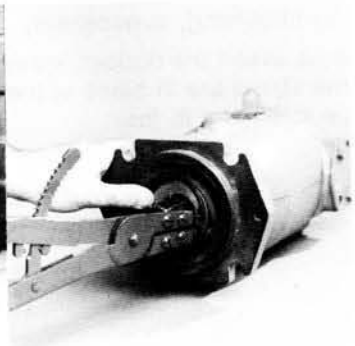


103279-1

Shaft Seal

It is recommended that all shaft seal parts be replaced. If parts are to be reused, they must be protected from being damaged by the shaft during removal.

1. Remove the large retaining ring (Truarc #7 Retaining Ring Pliers) located on the shaft end of the unit. Remove side opposite the tangs from the groove first.

2. The aluminum housing is removed next. It is held in place by the friction of the O-ring on its O.D. Pry the housing toward the end of the shaft until the O-ring is free.

3. The bronze sealing ring is also held in place by internal O-ring friction. Using hand force only, work this part free and carefully slide it over the shaft.

CAUTION

This part is easily damaged. Use care in handling.

4. Each part should be inspected separately if parts are to be reused. Always replace the three (3) O-rings.

5. Prior to assembly, lubricate the small O-ring with petroleum jelly and insert into the I.D. of the bronze sealing ring. Insert the other small O-ring (lubricate) and insert into the aluminum housing.

6. Slide the bronze sealing ring over the shaft and onto the shaft pilot diameter with the O-ring facing the unit. Work the O-ring into place using hand force only until it snaps into place.

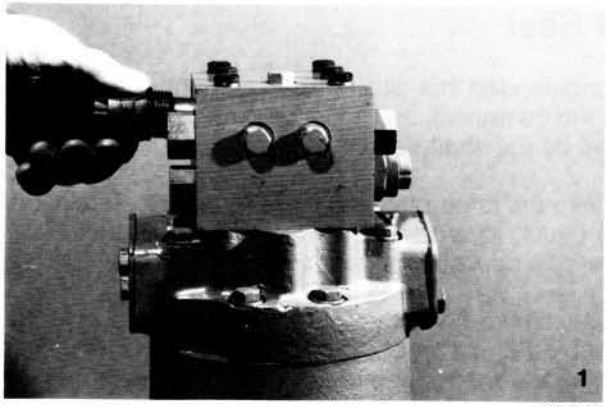
CAUTION

Protect parts from damage by the shaft.

7. Insert the stationary seal pilot into the aluminum housing, locating the notch in the stationary seal over the pin in the housing. Lubricate the large O-ring and place on the housing. The stationary seal should have a slight spring load due to the springs in the housing. Make certain all six (6) springs are in place in the aluminum housing before sliding it into position.

8. Slide the aluminum housing into place against the bronze sealing ring using hand force only.

9. Compress the aluminum housing to expose the retaining ring groove. Install the retaining ring, with the beveled side out, putting the side opposite the tangs into the groove first. Be certain that the retaining ring has snapped into its groove completely.



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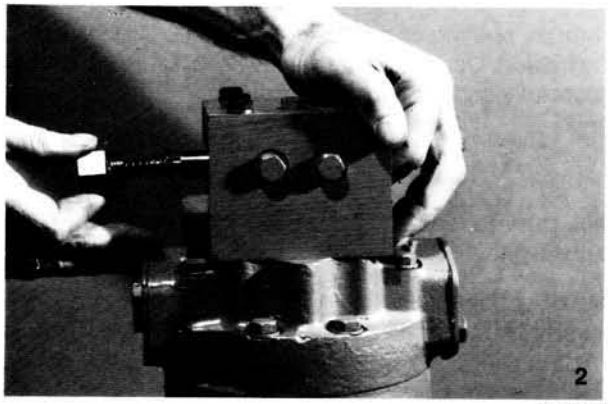

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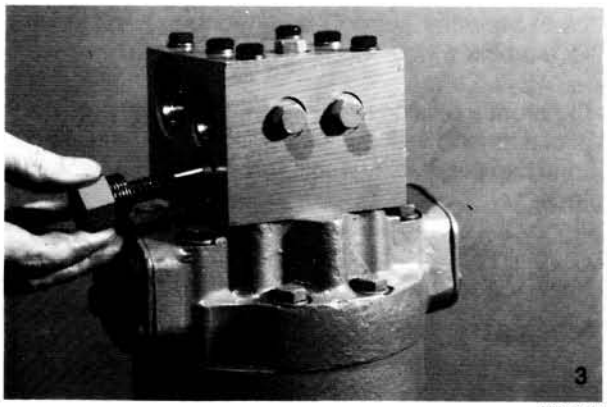

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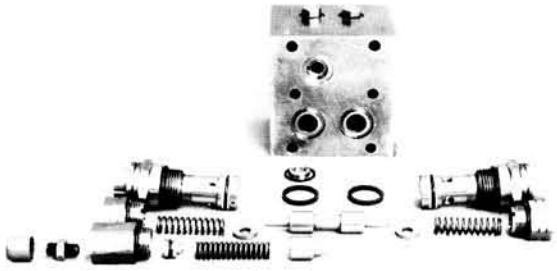


Manifold Assembly Components

System Relief Valve

1. The System Relief Valves are cartridges that can be removed from the manifold (using 1 3/8" wrench) for inspection or replacement. These valves are interchangeable in either side of the manifold, providing the pressure settings are the same. The first two (2) digits of the pressure setting are stamped on the end of the valve.

CAUTION

The relief valves are factory set and should not be disassembled further.

When replacing, torque the cartridge to 30-70 ft. lbs.

Shuttle Valve

2. The Shuttle Valve can be removed for inspection by removing the two (2) hex plugs (using 1" wrench) and sliding out the springs, spacers, and spool. These parts are interchangeable and can be installed from either side. When assembling be certain the spacers are placed between the spool and springs. Torque the hex plugs to 60-100 ft. lbs.

NOTE:

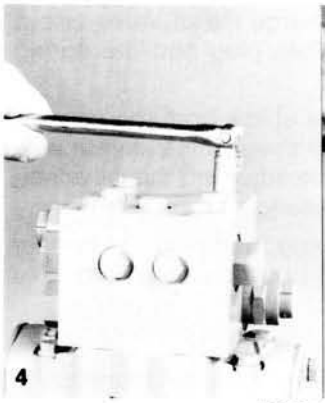
The spool and manifold are matched and cannot be replaced separately.

Charge Relief Valve

3. To inspect or replace the Charge Relief Valve, remove the hex plug (use 1" wrench) and the spring and poppet.

   On earlier units, remove the shims from the counter bore of the plug. Do not alter these shims unless new parts are used, in which case adjusting the valve setting, by shimming, is necessary.

   To install, insert the poppet, spring, and plug. Be certain the shims are in place in the plug (earlier units). Torque to 60-100 ft. lbs.



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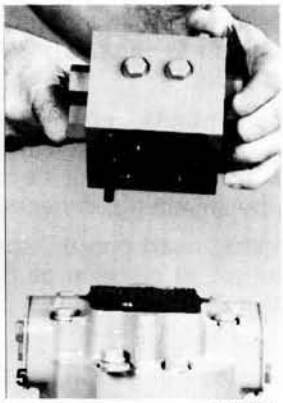

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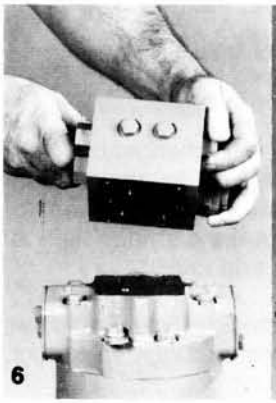

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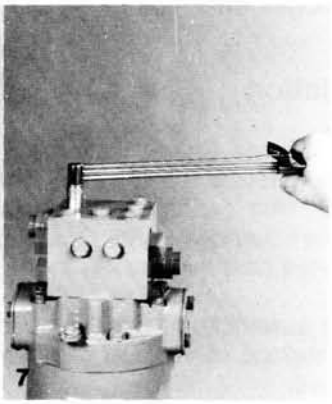


103270-1

Motor Manifold

Manifold Removal

Using a 1/2″ wrench, remove the four (4) corner capscrews holding manifold to motor end cap. Hold manifold to prevent it from dropping and remove remaining two (2) mounting capscrews.

Remove manifold from motor end cap. There is no gasket between the manifold and motor end cap. Sealing is accomplished by O-Rings with back-up rings, or by square-cut seal rings.

Manifold Installation

Use new seal rings. Lubricate seal rings with petroleum jelly to retain them in their grooves. Install the two larger seal rings in the grooves for the two side-by-side ports on the manifold. Install the smaller seal ring in the port with the counterbore for the orifice. If a flushing flow limiter orifice is used, install it into its counterbore.

Place manifold against motor end cap. Install capscrews while being certain the seal rings do not slip from their grooves. Torque capscrews to 16 to 21 ft.-lbs. (22 to 28 Nm)

103454-1

103455-1

Gear Style Charge Pump and Charge Check Valves

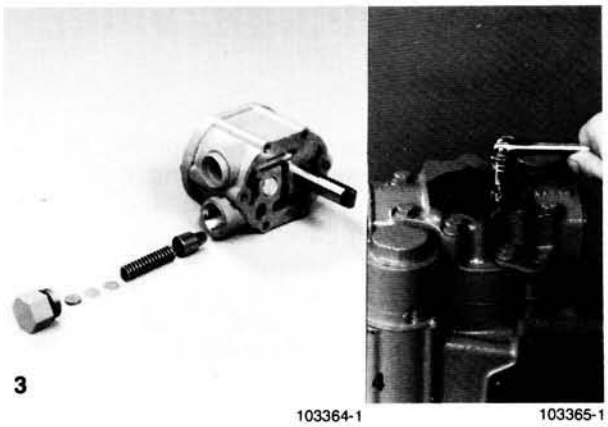
Removal

1. To remove the Charge Pump, loosen the four (4) cap screws that form a rectangular pattern. Do not remove the screws at the top and bottom as these hold the segments of the pump together.

CAUTION

Protect exposed surfaces and cavities from damage and foreign material.

2. Lift the Charge Pump off the pump end cap. There is a spacer in the idler shaft bore that can slip out as the pump is removed. Do not allow it to fall into the main pump. There is a gasket between the Charge Pump and end cap that should be discarded.



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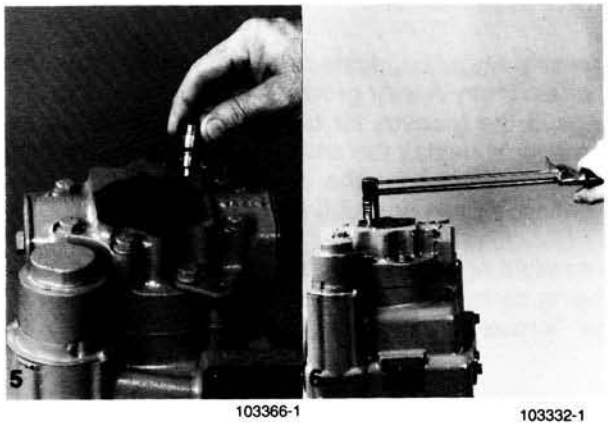

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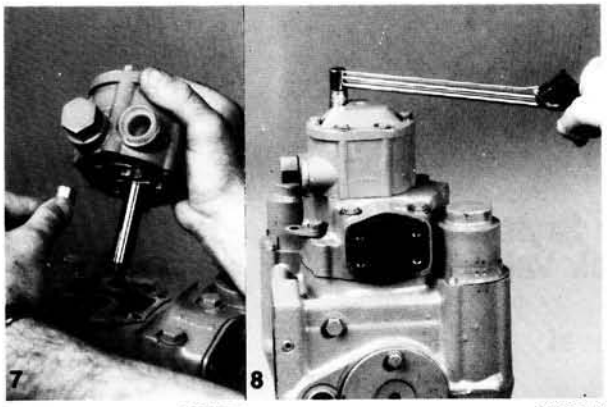

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3. To inspect or replace the Charge Relief Valve, use a 1'' wrench to remove the hex plug and the spring and poppet.

   On earlier units, remove the shims from the counter bore of the plug. Do not alter these shims unless new parts are used, in which case adjusting the valve setting, by shimming, is necessary.

   To install, insert poppet, spring, and plug. Be certain shims are in place in plug (earlier units). Torque to 30-60 ft. lbs.

4. The removal of the Charge Check Valves requires the use of a draglink socket. These check valves are cartridges which are threaded into the end cap.

Installation

5. The Charge Check Valves are interchangeable with each other. It is suggested that they be replaced in pairs. Use caution when installing these valves to prevent damage to the O-ring on the cartridge as it is inserted past the threads in the end cap.

6. After assembly, be certain the check valves are below the surface of the end cap. Torque check valves as follows:

   20-23 Series to 30-40 ft. lbs.
   24 Series to 80-90 ft. lbs.
   25-27 Series to 125-135 ft. lbs.

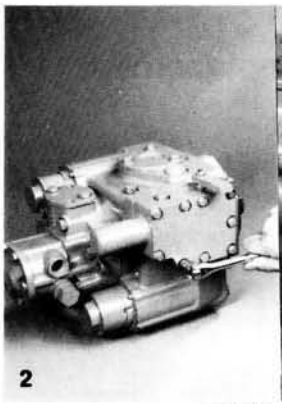
7. When installing the Charge Pump, align the new gasket so that the small relief valve port is open. Be certain the port in the charge pump and the end cap are aligned. Rotate the charge pump shaft so its tang aligns approximately with the slot in the end of the main pump drive shaft. Hold the idler spacer in place and install the charge pump onto the end cap. Rotate the pump slightly until the tang and slot on the shafts engage and the pump is solidly on the end cap.

8. Insert the four (4) cap screws and torque to these values:

   20-23 Series to 10-11 ft. lbs.
   24-27 Series 27-37 ft. lbs.

CAUTION

When reinstalling the vacuum inlet hose on the charge pump, do not tighten to more than 14 to 21 ft. lbs. torque.



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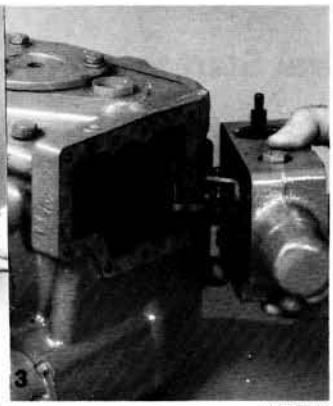

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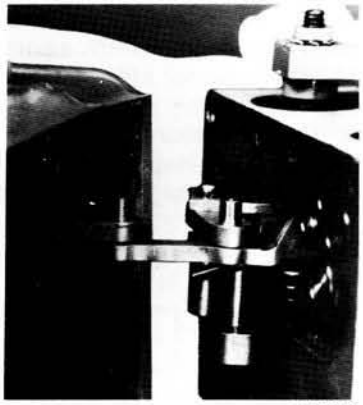

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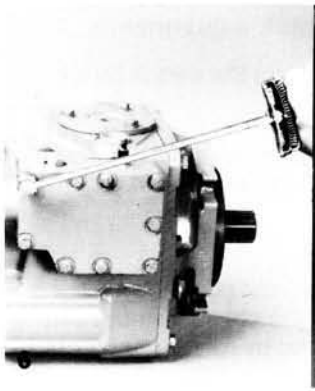

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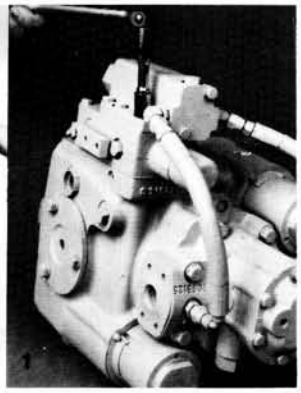

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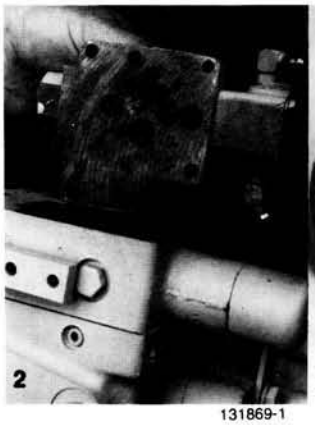

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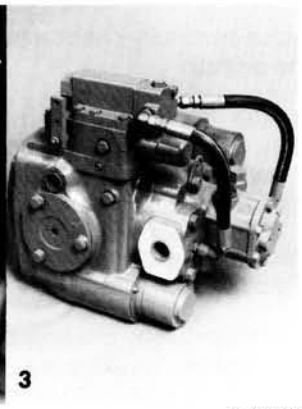


114700-3

Control

Removal

1. Thoroughly clean external surfaces with steam or clean solvent and blow dry.

2. Remove the nine (9) cap screws (using 7/16" wrench) and swing control away from housing.

CAUTION

Protect exposed surfaces and cavities from damage and foreign material. Use caution so that the rings and orifice plate remain in place and do not fall into the pump housing.

3. Slip the pin on control linkage out of the link attached to the swashplate and remove control. The area is sealed with both a gasket and three (3) O-rings. The Variable Pressure Control does not have a linkage to disengage.

Installation

4. In preparation for installing the control, place a new gasket on the housing. Insert the orifice plate and three (3) O-rings into the control ports.

5. Engage the pin on the control linkage in the mating hole in the link attached to the swashplate. Use caution so that the O-rings and orifice plate remain in place and do not fall into the pump housing.

6. Swing the control into place against the pump housing. Install cap screws and torque to 10-11 ft. lbs.

IMPORTANT: If the control being removed or replaced is equipped with a neutral start switch, accomplish the "Neutral Start Switch Check" procedure following control installation.

Pressure Override (POR)

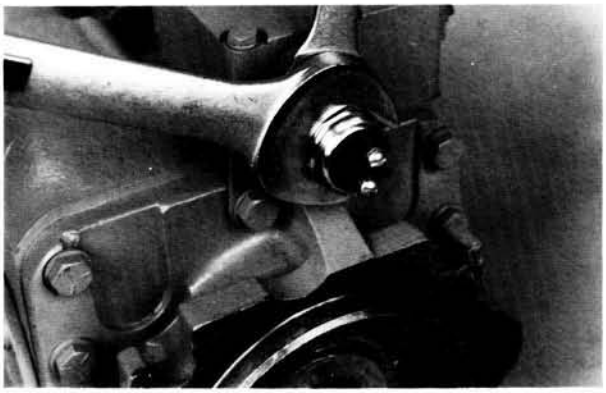
Removal

1. If a Pressure Override is mounted on top of the Manual Displacement Control, it can be removed by disconnecting the two (2) hose lines and removing its six (6) cap screws (use 7/16" wrench). Lift the Pressure Override from the control. This will expose the three (3) remaining cap screws which hold the Standard Displacement Control in place.

2. The Pressure Override seals with four (4) O-rings. Protect the exposed surfaces.

Installation

3. With the four (4) O-rings in place, install the Pressure Override on the control valve. Insert the six (6) cap screws and torque to 10-11 ft. lbs. Connect and tighten the two (2) hose fittings.



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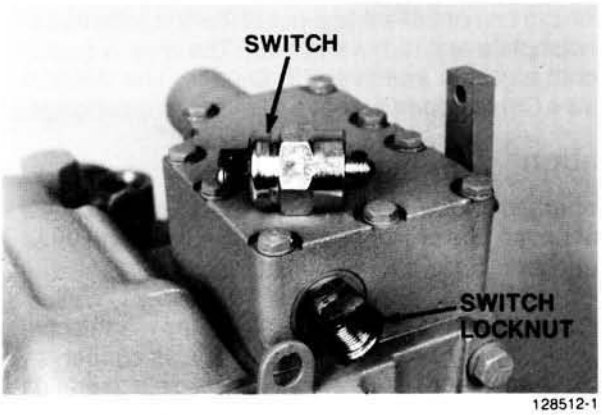

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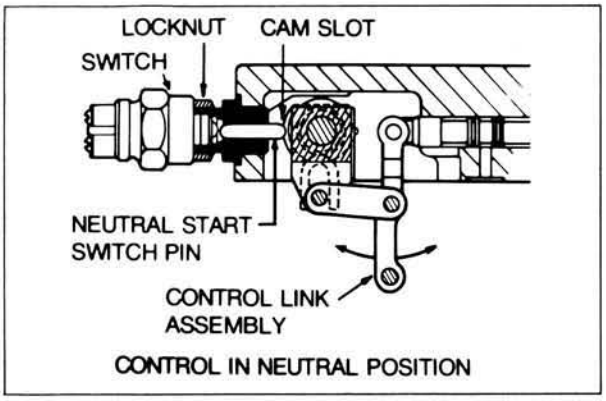
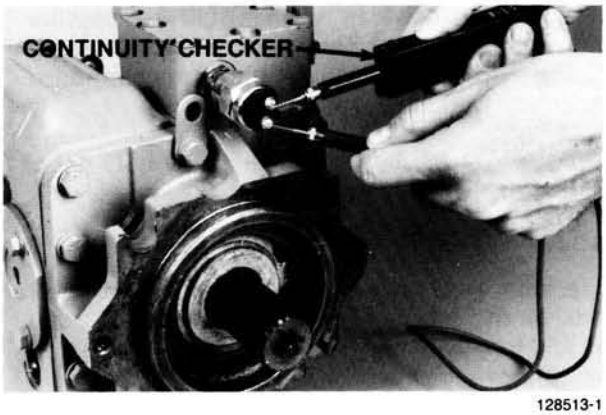


CONTROL IN NEUTRAL POSITION



128513-1

Neutral Start Switch Replacement

Removal/Installation

Replacement of the neutral start switch may be accomplished with the control on the machine providing a space of .38 in. (9.65 mm) is available for switch removal.

CAUTION

Do not disturb any locknuts or adjustments on the Neutral Start Switch other than those described in these procedures. Disturbing other components may result in the prime mover starting in other than the neutral (0 flow) position. If other adjustments are disturbed during replacement, perform the "Neutral Start Switch Check" procedure in the following section.

1. Holding the switch in place with a 1⅛" wrench, loosen the locknut with a ⅞" wrench.

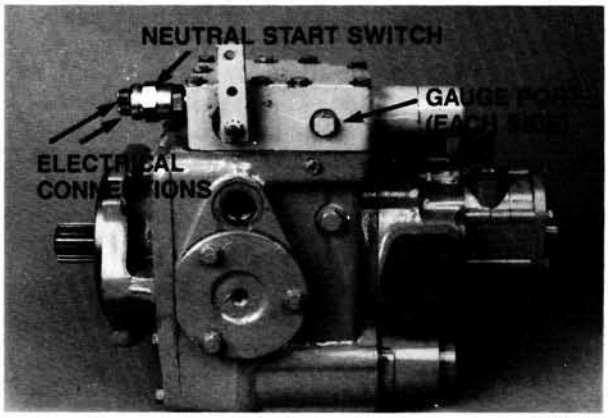
CAUTION

Do not allow the switch to turn when loosening the locknut. Turning the switch may change other critical switch adjustments.

2. After the locknut is loose, remove the switch by turning the switch CCW.
3. Install the new switch by turning the switch clockwise until finger tight. Leave the locknut loose.

Switch Adjustment

1. Make certain control is in the neutral position. If the switch is being replaced with the control removed from the unit, neutral can be verified by rotating the control link assembly until the Neutral Start Switch pin is engaged in the slot on the cam assembly.
2. Attach a continuity checker to the two screws on the end of the switch.
3. With the control in the neutral position, turn the switch CCW until electrical continuity is obtained. Turn switch CCW an additional 1/8 turn after continuity has been obtained.
4. Holding the switch in place with a 1⅛" wrench, tighten the locknut with a ⅞" wrench.
5. With the continuity checker attached to the switch, rotate the control lever (or the control link) in each direction to assure continuity is broken when the control is not in the neutral position.



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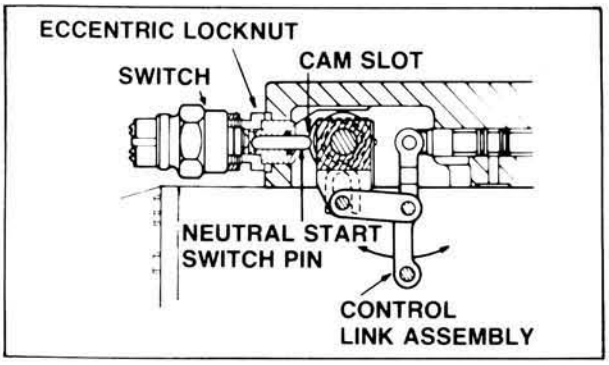
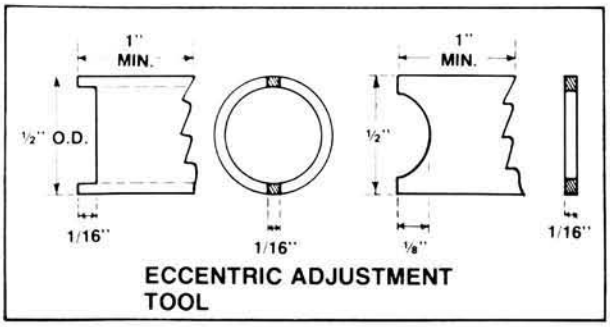
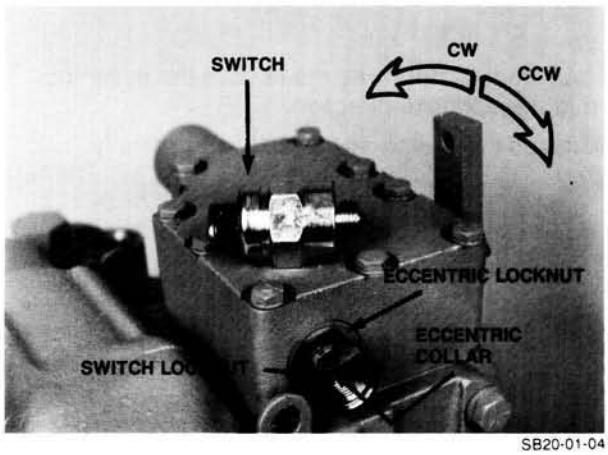






SB20-01-04

NEUTRAL START SWITCH CHECK

Proper switch operation must be checked prior to installing the external control linkage.

1. **Install a 300 PSI gauge into the pressure gauge port on each side of the control (7/16"-12 str. thd. O-ring).**

2. Connect a continuity checker to the screws on the end of the neutral start switch.

3. Make certain the control is in neutral (zero flow) position. Electrical continuity should now be attained; verify by observing the continuity checker.

   For the switch to operate properly and continuity to be established, a pin located in the switch mounting collar must engage in a cam slot in the internal control mechanism. When the control handle is moved in either direction, the pin comes out of the slot and actuates the switch to interrupt the circuit. The continuity should be interrupted with an equal amount of handle rotation in both directions.

   If the continuity is attained in neutral and satisfactorily interrupted in each direction, proceed to step 8.

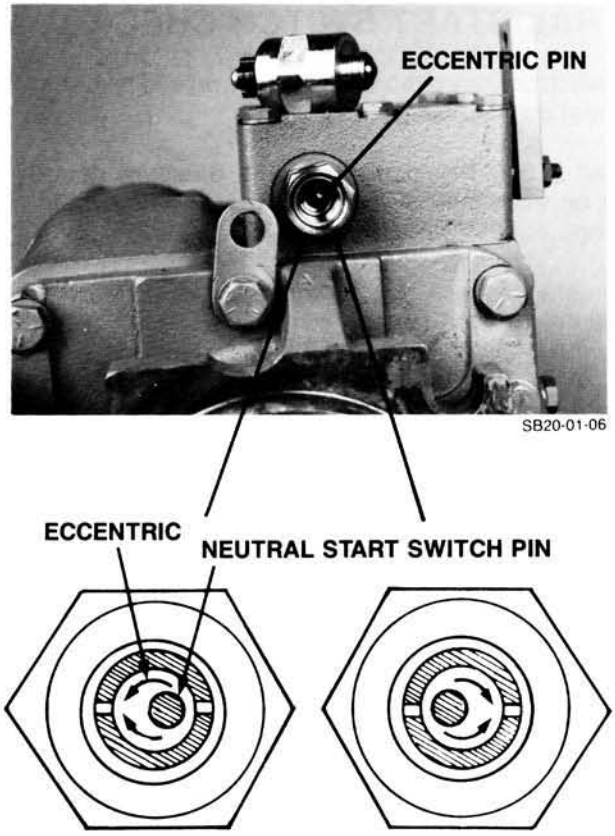
4. If continuity can not be verified in neutral, determine the direction of handle rotation (CW or CCW) necessary to establish continuity.

   The pin which engages in the slot is mounted in an eccentric which allows for adjustment. It is recommended that an adjustment tool be constructed to the dimensions shown at left for rotation of the eccentric.

   While holding the switch, loosen the switch locknut and remove the neutral start switch. Note the slotted eccentric adjustment within the switch collar. Loosen the eccentric locknut while holding the eccentric in place with the adjustment tool.

CAUTION

Do not start the prime mover while the neutral start switch is removed from the control. Damage to the control will result.



Adjust eccentric to move pin toward pump or away from pump as required.

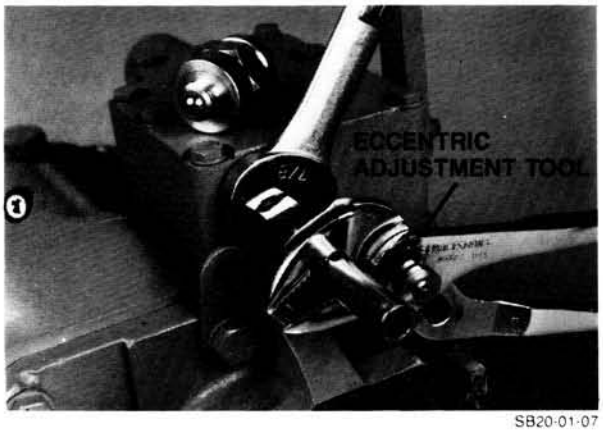
5. If it was necessary to rotate the control handle clockwise to obtain continuity, turn the eccentric adjustment to move the pin down (or toward the pump). If a counterclockwise rotation of the handle was necessary to obtain continuity, rotate the eccentric to move the pin up (or away from the pump). Only a small amount of adjustment in either direction is needed to center the pin in the internal mechanism cam slot.

   Turn the eccentric a maximum of ¼ of a turn while frequently stopping to check maximum pin depth into the eccentric collar. In most cases it can be determined that the pin has engaged in the slot, either by feel or depth gauge, within the first ¼ turn.

6. While holding the eccentric in place, tighten eccentric locknut to 20-35 ft. lbs. Reinstall the switch as outlined in the Neutral Start Switch replacement and adjustment portion of this manual.

7. Repeat steps 3 and 4 to determine whether additional adjustment of the eccentric is necessary.

   If further adjustment is required, continue rotation up to ¼ additional turn.

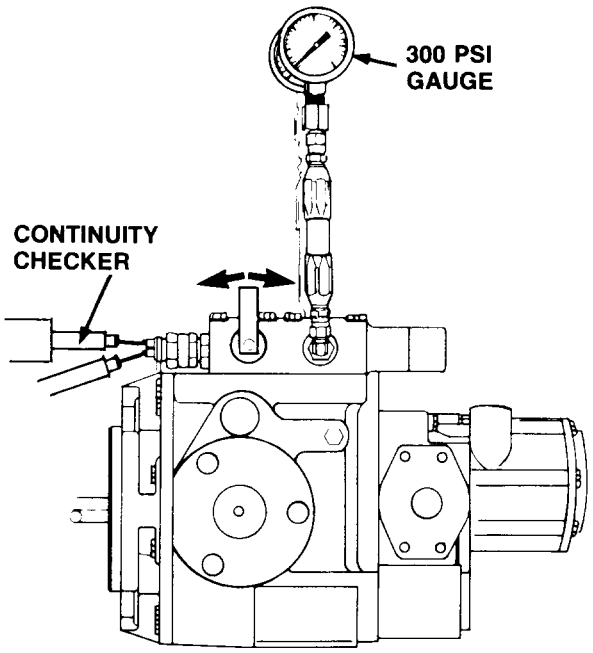


CAUTION

Do not exceed ½ turn total or 180° from the initial pin position. Doing so will turn the eccentric into or out of the housing beyond specifications.

If too much adjustment was made, turn the eccentric ⅛ turn in the opposite direction.

Again, install the switch and check for continuity.



CAUTION

The following procedure requires that steps be taken to disable the machine in the event the pump should go into stroke (raise drive wheels off ground, etc.).

8. Connect the electrical leads from the machine starter relay to the electrical connections on the switch.

9. Start the prime mover and operate at normal speed.

10. Note pressure reading on the gauges at this time. The reading should be noted as base pressure.

11. Slowly move the control handle in one direction while observing the pressure gauge and the continuity checker. Continuity must be broken before the gauge pressure increases more than 12 PSI from the base pressure obtained at neutral.

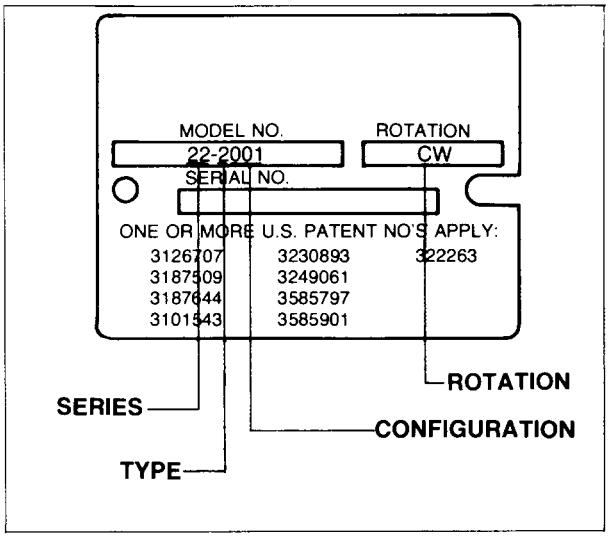
12. Slowly move the control handle in the opposite direction. Again, continuity must be broken before the gauge pressure increases more than 12 PSI from base pressure.

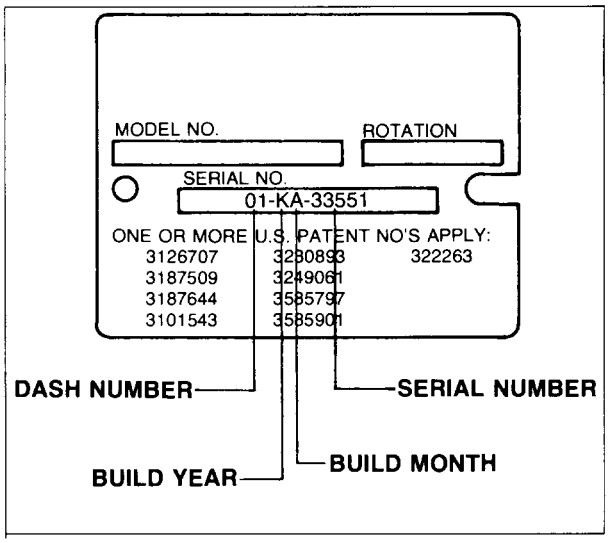
13. Continuity must again be verified when the control is returned to neutral.

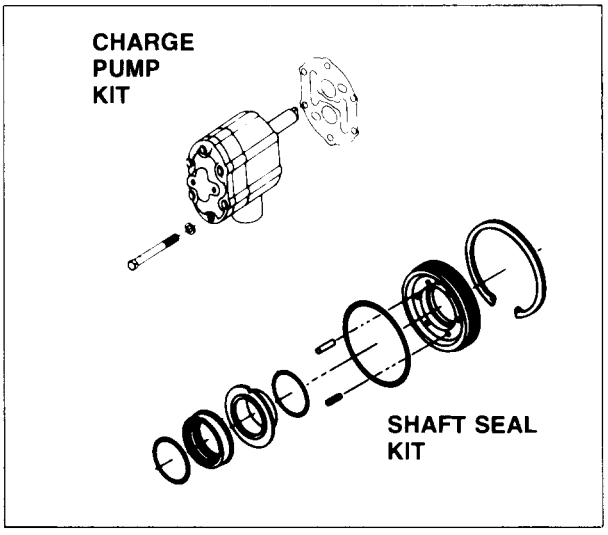
    If continuity is not broken at base pressure +0-12 PSI in either direction, stop the prime mover and readjust the eccentric as described in step 5. If the pressure difference is equal in each direction but greater than 12 PSI loosen the switch locknut and turn the switch in 1/16 of a turn to increase the sensitivity. Retighten the locknut and recheck pressure differences and continuity.

14. After verifying proper control and switch operation, stop the prime mover. Remove the continuity checker and pressure gauges. Install pressure port plugs and torque to 10-20 ft. lbs. Install and adjust, if necessary, the external control linkage.

GENERAL PARTS IDENTIFICATION







Model Number

The Sauer-Sundstrand Model Number is necessary for identification of the specific unit. The Model Number must be used when ordering service parts.

The first two (2) digits identify the series size (20 through 27 Series).

The next digit identifies the unit type.

2 = Variable Displacement Pump
3 = Fixed Displacement Motor
4 = Variable Displacement Motor

The last three (3) digits (and the following letters on later model units) specifically identify such items as control, shaft, pressure settings, rotation, etc., in the records maintained by Sauer-Sundstrand.

Non-standard models will also have a non-standard model number on the identification plate.

Serial Number

The Sauer-Sundstrand Serial Number can be used to identify design configuration, build date, and units sequence in build.

The first two (2) digits are termed the dash number and are used to identify significant configuration changes (product improvements, etc.). Changes which affect interchangeability of parts are identified with a dash number change.

The year and month (earlier units) or year and week (later units) of build are also included in the serial number.

The Serial Number provides Sauer-Sundstrand with a tool to further identify a unit and should be included in communications regarding the servicing of the unit.

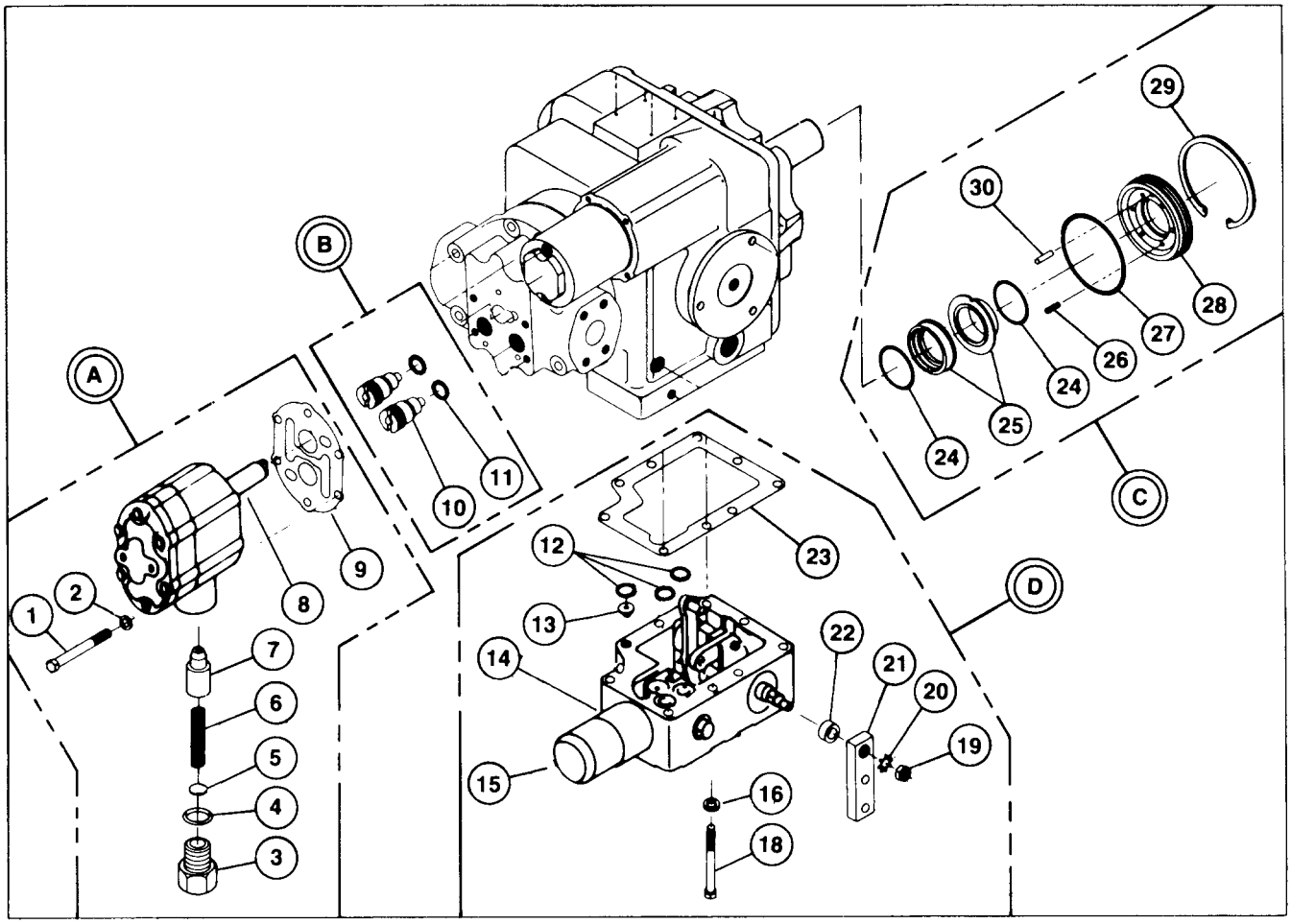
Parts Kits

Parts kits are available from Sauer-Sundstrand which contains all the parts necessary for replacement. The following kits are available, see parts list for specific model parts lists for kit numbers.

Charge Pump	Manifold
Shaft Seal	Control

Other kits are available on specific models.

GENERAL PARTS IDENTIFICATION

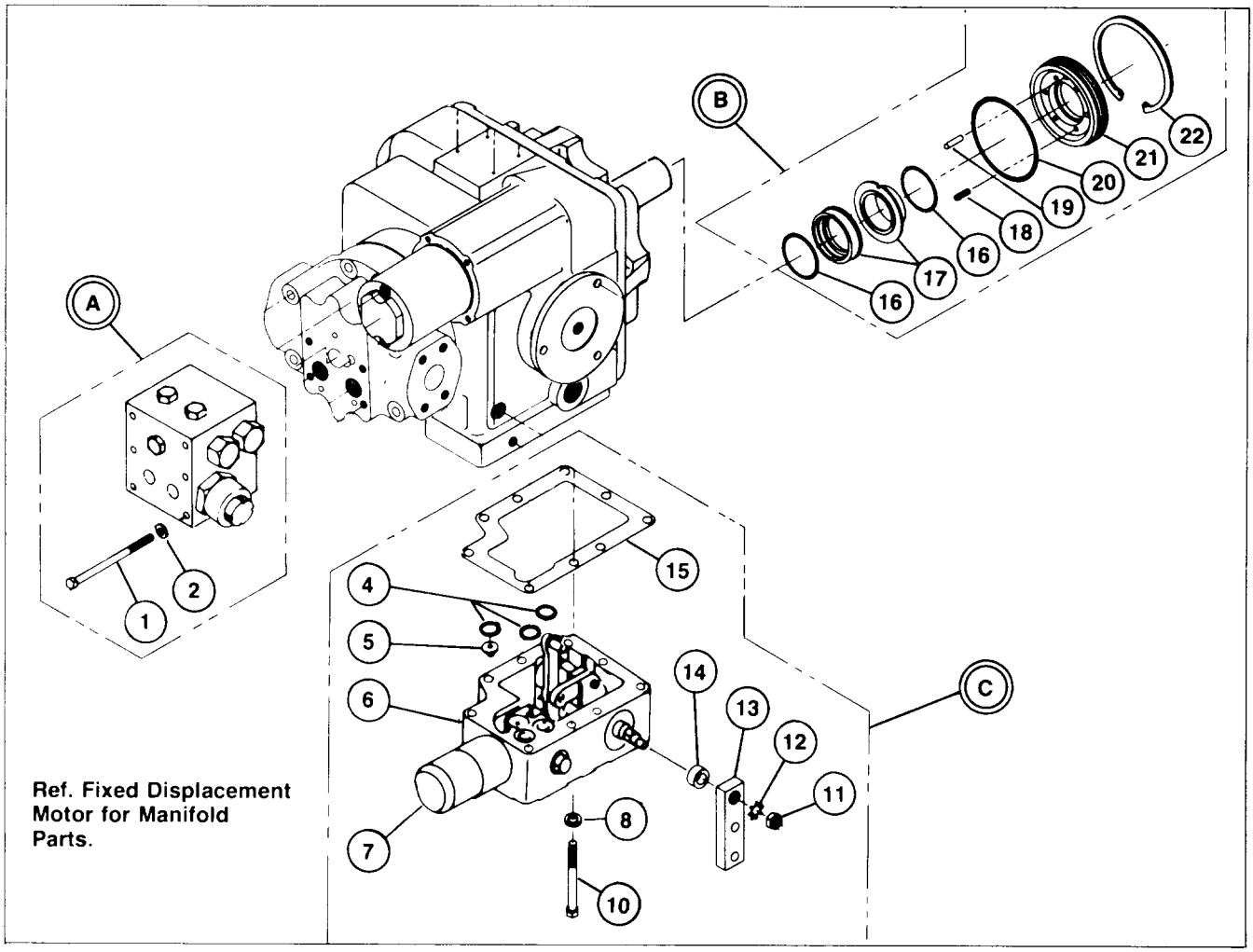


This information is for general parts identification only.
For part numbers consult Parts List for specific model number.

Variable Displacement Pump

NO/LTR	DESCRIPTION	QTY	NO/LTR	DESCRIPTION	QTY
A	Charge Pump Kit	1	14	Control	1
B	Charge Check Valve Kit (2 Valves)	1	15	Protective Cap	1
C	Shaft Seal Kit	1	16	Washer - Lock	9
D	Control Kit	4	18	Screw - Hex. Hd. Cap	1
1	Screw - Hex. Hd. Cap	4	19	Nut - Hex.	1
2	Washer - Lock	1	20	Washer - Lock	1
3	Plug - Hex	1	21	Control Handle	1
4	O-ring	1	22	Spacer	1
5	Shim Package	1	23	Gasket	1
6	Spring	1	24	O-Ring	2
7	Poppet	1	25	Sealing Ring and Stationary Seal	1
8	Charge Pump	1	26	Spring	6
9	Gasket	2	27	O-Ring	1
10	Charge Check Valve	2	28	Aluminum Housing	1
11	O-Ring	3	29	Retaining Ring	1
12	O-Ring	1	30	Spring Pin	1
13	Orifice				

GENERAL PARTS IDENTIFICATION

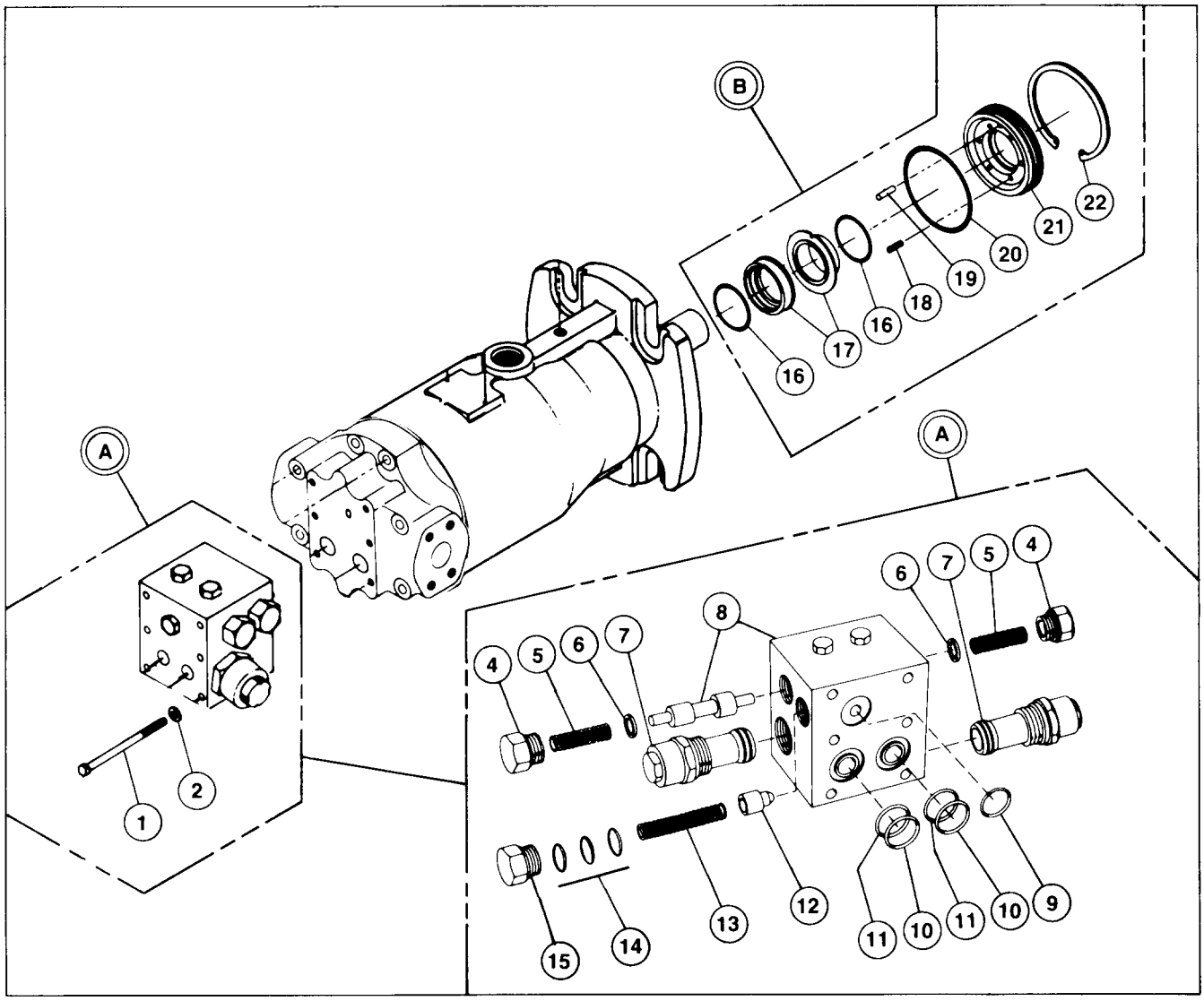


This information is for general parts identification only.
For part numbers consult Parts List for specific model number.

Variable Displacement Motor

NO/LTR	DESCRIPTION	QTY	NO/LTR	DESCRIPTION	QTY
A	Manifold Kit	1	12	Nut - Hex	1
B	Shaft Seal Kit	1	13	Control Handle	1
C	Control Kit	1	14	Spacer	1
1	Screw - Hed. Hd. Cap	6	15	Gasket	1
2	Washer - Lock	6	16	O-Ring	2
4	O-Ring	3	17	Sealing Ring & Stationary Seal	1
5	Orifice	1	18	Spring	6
6	Control	1	19	Spring Pin	1
7	Protective Cap	1	20	O-Ring	1
8	Washer - Lock	9	21	Aluminum Housing	1
10	Screw - Hex. Hd. Cap		22	Retaining Ring	1
11	Screw - Hex. Hd. Cap	1			

GENERAL PARTS IDENTIFICATION



This information is for general parts identification only.
For part numbers consult Parts List for specific model number.

Fixed Displacement Motor

NO/LTR	DESCRIPTION	QTY	NO/LTR	DESCRIPTION	QTY
A	Manifold Kit	1	11	O-Ring	2
B	Shaft Seal Kit	1	12	Poppet	1
1	Screw - Hex. Hd. Cap	6	13	Spring	1
2	Washer - Lock	6	14	Shim Package	1
4	Hex. Plug (w/O-Ring)	2	15	Hex. Plug (w/O-Ring)	1
5	Spring	2	16	O-Ring	2
6	Spacer	2	17	Sealing Ring & Stationary Seal	1
7	System Relief Valve	2	18	Spring	6
8	Housing & Shuttle Valve Spool	1	19	Spring Pin	1
9	O-Ring	1	20	O-Ring	1
10	Back-up Ring	2	21	Aluminum Housing	1
			22	Retaining Ring	1

METRIC CONVERSIONS

TORQUE VALUES			PRESSURES (Pressure Settings and Troubleshooting Gauges)		
150 in. lbs.	—	17 N·m			
			25-75 PSI	—	1.7-5 BAR
6-10 ft. lbs.	—	8-13.5 N·m	40 PSI	—	2.7 BAR
8-11 ft. lbs.	—	11-15 N·m	160 PSI	—	11 BAR
10-11 ft. lbs.	—	13.5-15 N·m	180 PSI	—	12.5 BAR
10-20 ft. lbs.	—	13.5-27 N·m	190 PSI	—	13 BAR
16-21ft. lbs.	—	22-28 N·m	200 PSI	—	14 BAR
20-30 ft. lbs.	—	27-40 N·m	210 PSI	—	15 BAR
27-37 ft. lbs.	—	36-50 N·m	300 PSI	—	20 BAR
30-40 ft. lbs.	—	40-54 N·m	500 PSI	—	35 BAR
30-50 ft. lbs.	—	40-68 N·m	1000 PSI	—	69 BAR
60-100 ft. lbs.	—	81-136 N·m	3000 PSI	—	207 BAR
80-90 ft. lbs.	—	108-122 N·m	5000 PSI	—	345 BAR
125-135 ft. lbs.	—	169-183 N·m	10,000 PSI	—	690 BAR