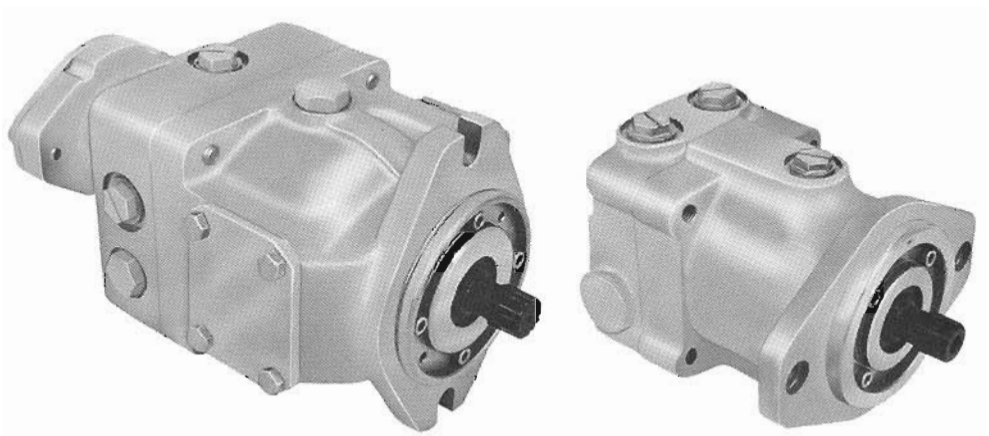
SAUER DANFOSS

Series 40



M23-Axial Piston Pumps and Motors Service Manual

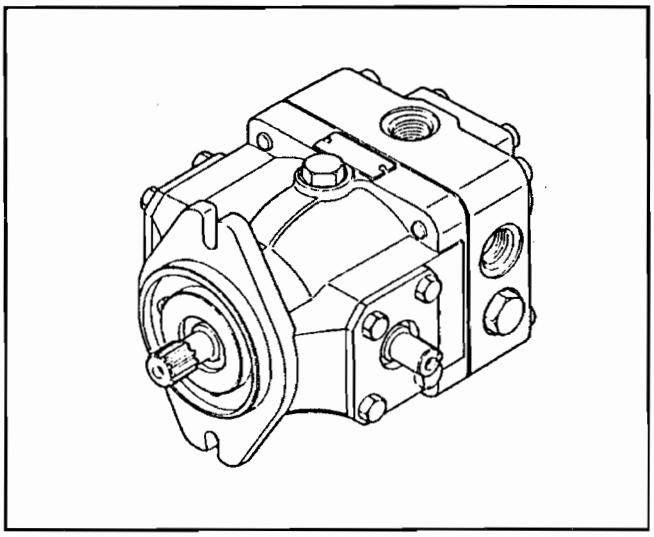
Introduction

The purpose of this manual is to provide information useful in the normal servicing of the Series 40 - M23 Hydrostatic Pumps and Motors. This manual includes unit and component description, troubleshooting, adjustment, and minor repair procedures. Following the procedures in this manual, the minor repairs may be performed without affecting the unit warranty.

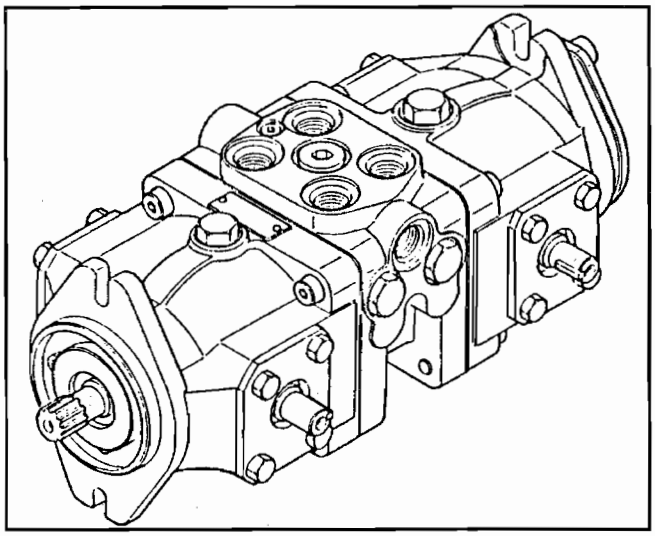
A Series 40 Transmission does occasionally require servicing, and these units have been designed with this in mind. Some repairs and adjustments can be accomplished without removing the unit from its installed location, provided that the unit is accessible and can be thoroughly cleaned before beginning any procedures. Since dirt or contamination is the greatest enemy of any hydraulic equipment, the greatest possible cleanliness is necessary.

Sauer-Sundstrand provides a complete repair service for its products. Contact any Sauer-Sundstrand Authorized Service Center for details.

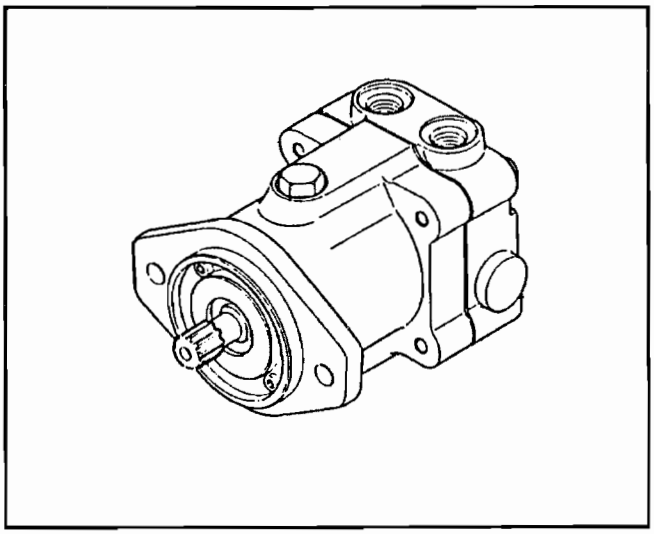
The torque values, pressures, and dimensions used throughout this manual are given in English and metric measurements.



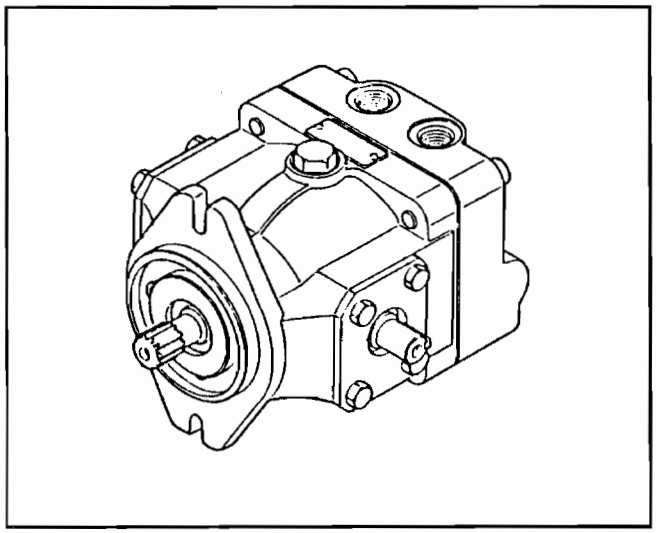
Variable Displacement Pump



Variable Displacement Tandem Pump



Fixed Displacement Motor



Variable Displacement Motor

General Description

The Series 40 - M23 pumps and motors can be applied separately or combined in a system to transfer and control power. When combined in such a system, these units provide an infinitely variable speed range between zero and maximum, in both forward and reverse modes of operation.

Series 40 - M23 variable displacement pumps are a compact, state-of-the-art design, using the parallel axial piston / slipper design in conjunction with a tiltable swashplate to vary the pump's displacement. Reversing the direction of tilt of the swashplate reverses the flow of oil from the pump and thus reverses the direction of the motor output rotation.

A direct displacement control system is used on the Series 40 - M23 variable displacement pump and tandem pump. The swashplate control shaft is connected directly to the swashplate. Movement of the control shaft causes a proportional swashplate movement and change in pump flow. This control can be located on either side of the unit.

A charge relief valve and charge check valves are included in the pump end cap to control the makeup and cooling oil flow for the system. Pumps equipped with high pressure relief valves incorporate the charge check valve function into the operation of the high pressure reliefs.

The Series 40 - M23 variable displacement pump is available with a 0.50 in^3/rev (8.2 cc/rev) integral gerotor type charge pump. The Series 40 - M23 tandem pump is not available with an integral charge pump; however, it can be equipped with an optional Sundstrand-Sauer gear pump in conjunction with the SAE "A" auxiliary mounting flange. A charge pump with a displacement of approximately 0.90 in^3/rev (14.8 cc/rev) is required for the M23 tandem pump.

The fixed and variable displacement motors also incorporate the parallel axial piston / slipper design. Fixed displacement motors utilize a fixed swashplate angle. The variable displacement motors use a variable angle swashplate with a direct displacement control system, similar to the variable displacement pumps.

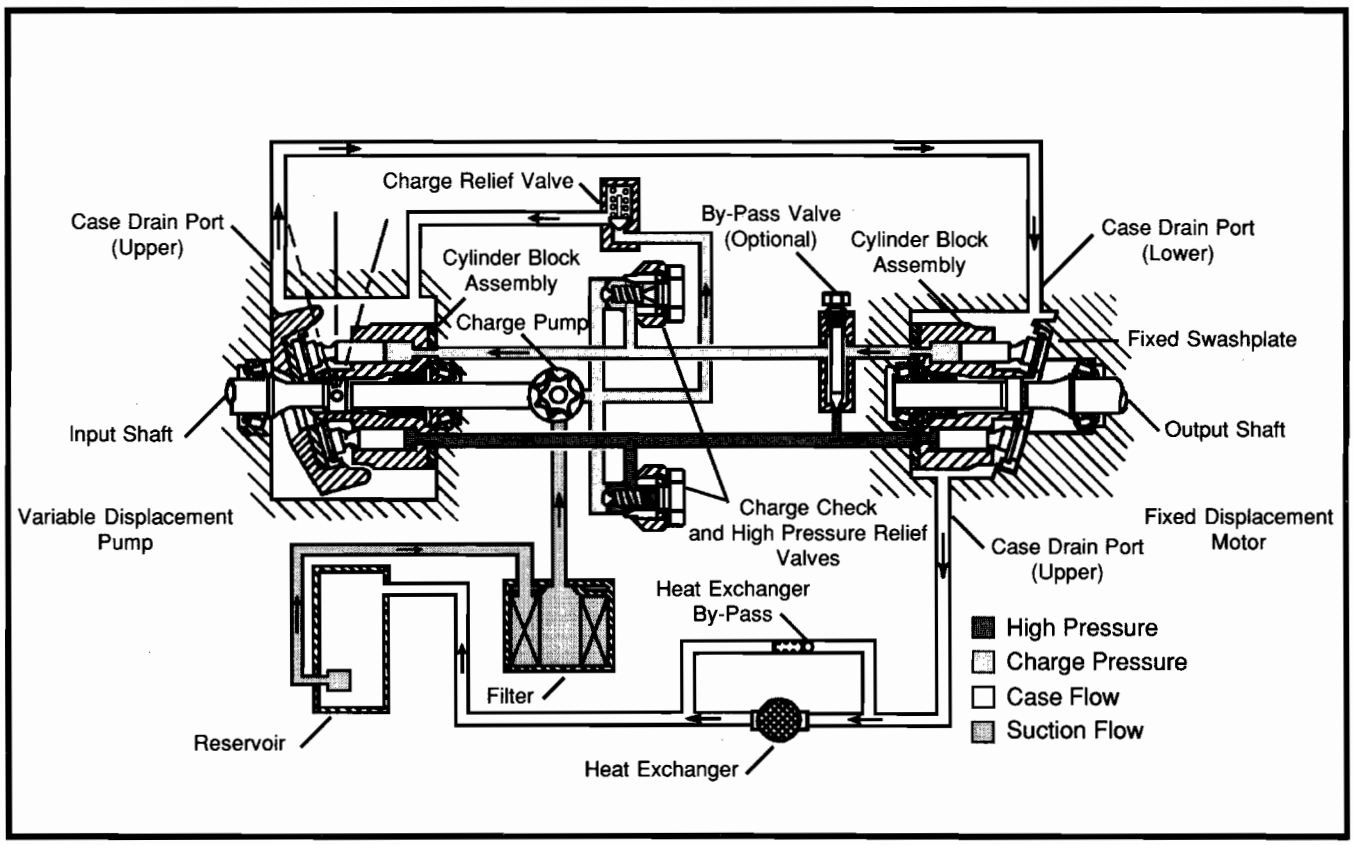


Fig. 1 - Typical Series 40 - M23 Medium Duty Variable Pump -- Fixed Motor Transmission Schematic

Transmission Hydraulic Support System

The Series 40 - M23 Pumps and Motors are easy to install, requiring no adjustments and few auxiliary components. They have their own hydraulic support system which is discussed in this section.

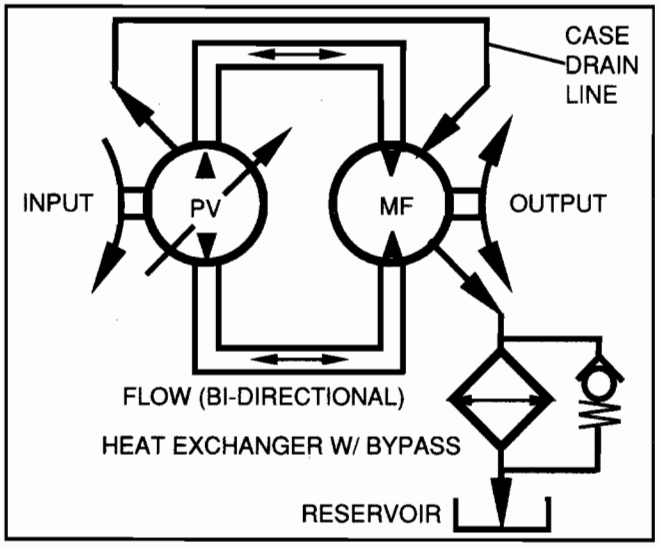


Fig. 2 - Basic Closed Circuit

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 direction and speed of fluid flow (and the motor output shaft rotation) depends on the position of the pump swashplate. The system pressure is determined by the machine load.

Case Drain and Heat Exchanger

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

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

CAUTION

Continuous case pressure should not exceed 15 PSI (1 BAR).

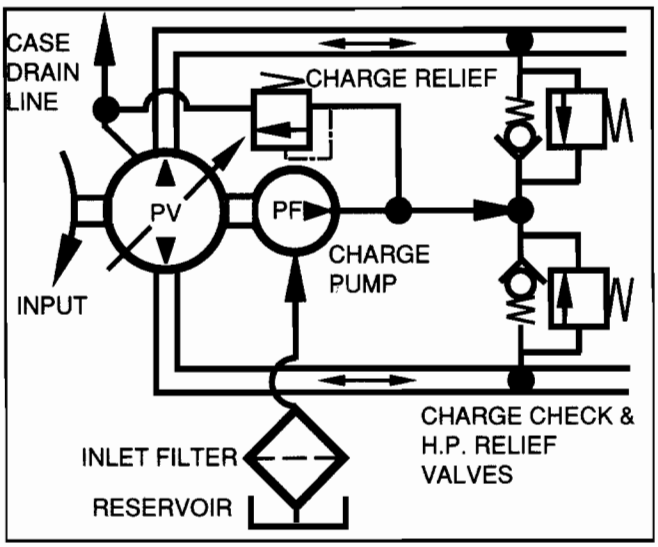


Fig. 3. - Charge System

Charge System and Inlet Filter

The charge pump supplies cool fluid to the system and keeps the closed loop charged to prevent cavitation. The charge pump draws its fluid from the system reservoir. An inlet filter is required to insure that only clean fluid enters the system.

CAUTION

The inlet vacuum, measured at the charge pump inlet should not exceed 5 in. Hg (.8 BAR abs.), except during cold starts.

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. These check valves are usually incorporated into the high pressure relief valves in the pump end cap. Any charge flow not being used for the closed circuit is discharged over a direct operating charge relief valve, through the pump and motor housings, and back to the system reservoir. The charge pressure relief valve is factory set for 58-87 ΔPSI (4-6 BAR) above case pressure at 1800 RPM.

NOTE: Certain M23 pumps have a charge pressure relief valve setting of 87-116 ΔPSI (6-8 BAR)

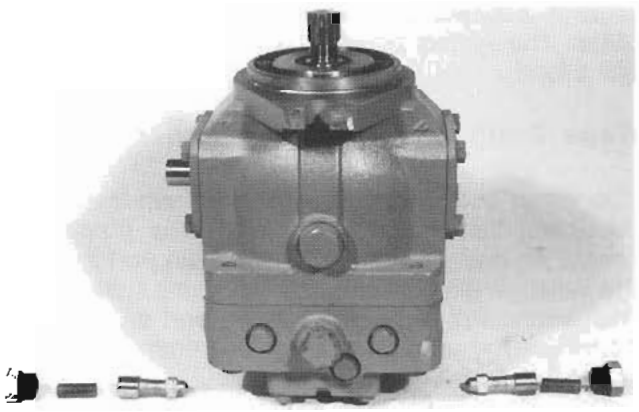


Fig. 4 - Charge Check and High Pressure Relief Valves

High Pressure Relief Valves

Two (2) optional combination check / high pressure relief valves may be provided in the pump or motor end cap for overload protection. These cartridge type relief valves are factory set, and are not field adjustable. Changing the maximum system pressure can be accomplished by installing different cartridges with the desired setting.

NOTE. Earlier production M23 units use a check and relief valve assembly with an enclosed valve cartridge spring, a straight check valve spring, and a short plug. Later production units have an exposed valve cartridge spring, a cone check valve spring, and a plug with integral guide.

Safety Precautions

• The loss of hydrostatic drive line power in any mode of operation may cause a loss of hydrostatic braking capacity. A braking system, redundant to the hydrostatic transmission must, therefore, be provided which is adequate to stop and/or hold the system should the condition develop.

• Certain service procedures may require the vehicle/machine to be disabled (wheels raised off the ground, work function disconnected, etc.) while performing them in order to prevent injury to the technician and bystanders.

• 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.

• 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.

Technical Data - Variable Displacement Pump / Tandem Pump

Product Type		M23 Variable Pump	M23 Tandem Pump
Displacement			
In^3/Rev		1.4	1.4 (each section)
cc/Rev		23	23 (each section)
Input Speed			
Max - RPM (Full Angle)		5300	ALL UNITS
Continuous - RPM (Full Angle)		4200	
Input Mounting Flange (per SAE J744)			
		SAE B	SAE B
NOTE: No counterbore is provided in the face of the pilot, as described in SAE standard J744.			
Input Shaft (Std. Spline)			
Number of Teeth		13	ALL UNITS
Pitch		16/32	
Weight			
LBS		46	83
KG		21	38
Pressure			
Maximum	PSI	5000	ALL UNITS
	BAR	345	
Continuous	PSI	3000	ALL UNITS
	BAR	210	
Case Pressure			
Continuous	PSI	15	ALL UNITS
	BAR	1	
Maximum	PSI	45	ALL UNITS
(Cold Start)	BAR	3.1	
Temperature at Hottest Point in Transmission (normally at case drain)			
Maximum	°F	220	ALL UNITS
	°C	104	
Continuous	°F	180	ALL UNITS
	°C	82	
Fluid Viscosity Limits -- SUS (CST)			
Optimum		70 (13)	
Min. Continuous		55 (9.0)	
Min. Intermittent		47 (6.4)	ALL UNITS
Max. Continuous		500 (110)	
Max. Cold Start		7500 (1600)	
Suggested Filtration			
Dedicated Reservoir		Beta 10 = 1.5 to 2.0	ALL UNITS
Common Reservoir		Beta 10 = 10 to 20	
Charge Inlet Vacuum at Sea Level			
Normal	in. Hg	5*	
	BAR (abs.)	.8*	Refer to specifications for specific
Cold Start	in. Hg	10*	Charge Pump being used.
	BAR (abs.)	.7*	

*For units with integral charge pump.

Technical Data - Fixed Displacement Motor / Variable Displacement Motor

Product Type		M23 Fixed Motor	M23 Variable Motor
Displacement			
In^3/Rev		1.4	1.4 (Maximum)
cc/Rev		23	23 (Maximum)
Output Speed			
Full Angle (17°)	Max - RPM	5300	5300
	Continuous - RPM	4200	4200
Low Angle (< 11°)	Max - RPM	----	6000
	Continuous - RPM	----	4800
Output Mounting Flange (per SAE J744)			
		SAE B	SAE B

NOTE: No counterbore is provided in the face of the pilot, as described in SAE standard J744.

Output Shaft (Std. Spline)			
Number of Teeth		13	ALL UNITS ▸
Pitch		16/32	
Weight			
LBS		25	44
KG		11.5	20
Pressure			
Maximum	PSI	5000	ALL UNITS ▸
	BAR	345	
Continuous	PSI	3000	ALL UNITS ▸
	BAR	210	
Case Pressure			
Continuous	PSI	15	ALL UNITS ▸
	BAR	1	
Maximum	PSI	45	ALL UNITS ▸
(Cold Start)	BAR	3.1	
Temperature at Hottest Point in Transmission (normally at case drain)			
Maximum	°F	220	ALL UNITS ▸
	°C	104	
Continuous	°F	180	ALL UNITS ▸
	°C	82	
Fluid Viscosity Limits -- SUS (CST)			
Optimum		70 (13)	
Min. Continuous		55 (9.0)	
Min. Intermittent		47 (6.4)	ALL UNITS ▸
Max. Continuous		500 (110)	
Max. Cold Start		7500 (1600)	
Suggested Filtration			
Dedicated Reservoir		Beta 10 = 1.5 to 2.0	ALL UNITS ▸
Common Reservoir		Beta 10 = 10 to 20	

Controls and Options

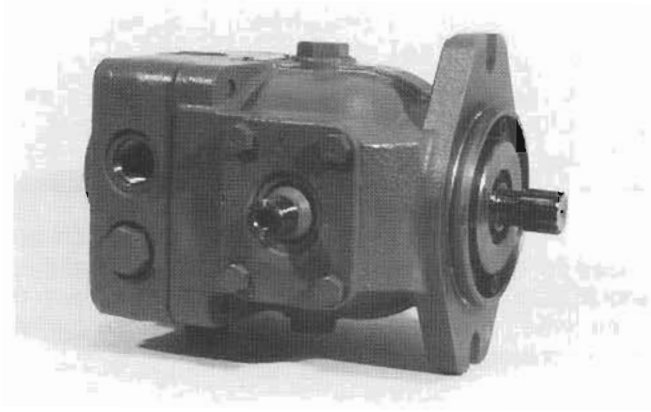


Fig. 5 - Variable Displacement Pump with Direct Displacement Control

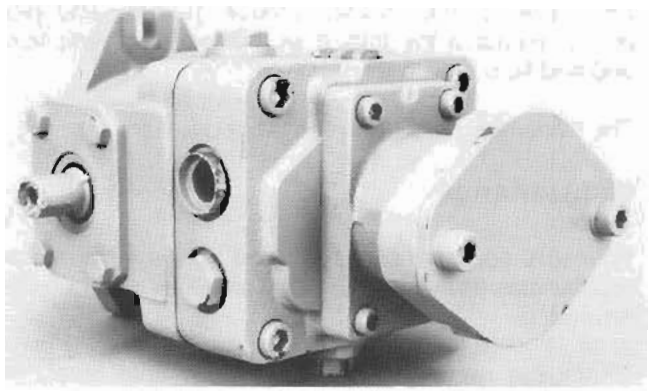


Fig. 6 - Variable Displacement Pump with Auxiliary Mounting Pad

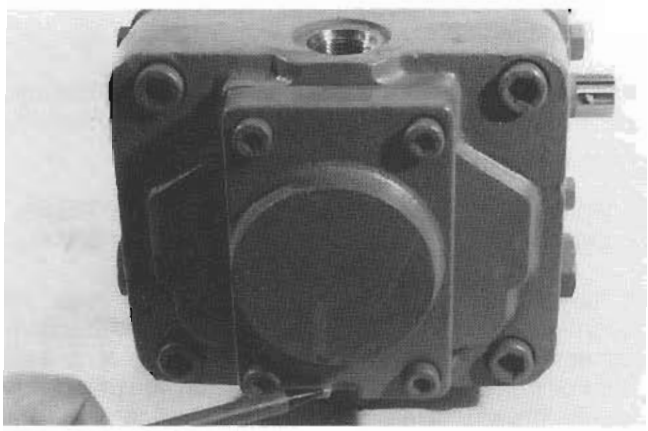


Fig. 7 - Variable Displacement Pump with Charge Pump

Direct Displacement Control

The direct displacement control (DDC) may be located on either side of the unit, and provides a simple method of control. Movement of the swashplate control shaft produces a proportional swashplate movement and change in pump flow and/or motor shaft speed / direction.

The vehicle/machine control system should be designed to return the swashplate to its neutral position. The DDC is available on variable pumps, tandem pumps, and variable motors

Auxiliary Mounting Pads

An SAE "A" auxiliary mounting pad is available on Series 40 - M23 variable pumps and is standard on M23 tandem pumps. This pad is used for mounting an auxiliary hydraulic pump or separate charge pump.

Charge Pumps

A fixed displacement, gerotor type charge pump may be provided as a part of the variable pump. Tandem pumps (and variable pumps without an integral charge pump) require that a separate, fixed displacement pump be provided as part of the system.

Bypass Valve

In some applications it is desirable to bypass fluid around the variable displacement pump allowing, for example, a vehicle to be moved short distances at low speeds without running the prime mover. This is accomplished by an optional, manually operated bypass valve installed in the motor end cap. When open (unscrewed 2 turns maximum), this valve connects both sides of the pump/motor closed circuit and allows the motor to turn. This valve must be fully closed for normal operation. The system prime mover should be shut down when opening or closing the bypass valve.

NOTE: Opening the bypass valve more than 2 turns may result in external leakage

WARNING

Opening the bypass valve will result in a loss of hydrostatic braking capacity. Take precautions to prevent machine movement when opening the valve.

Start-Up & Maintenance

Fluids

Hydraulic fluids used with Sauer-Sundstrand products should be carefully selected with assistance from a reputable supplier, following the guidelines presented in the "Fluid Quality Requirements" bulletin, BLN-9887.

Start-Up Procedure

The following start-up procedure should always be followed when starting-up a new installation or when restarting an installation in which either the pump or motor had been removed from the system.

WARNING

The following procedure may require the vehicle/machine to be disabled (wheels raised off the ground, work function disconnected, etc.) while performing the procedure in order to prevent injury to the technician and bystanders.

Prior to installing the pump and/or 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.

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 pump and/or motor housing with clean hydraulic fluid prior to start up. Fill the housing by pouring filtered oil into the upper case drain port.

Install a 0 to 500 PSI (35 BAR) pressure gauge in the charge pressure gauge port to monitor the charge pressure during start-up.

With the pump swashplate in its neutral (0 angle) position, start the prime mover and run at the lowest possible RPM until charge pressure has been established.

WARNING

Do not start prime mover unless pump is in neutral position (0 swashplate angle). Take 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 57 PSI (4 BAR) minimum. If charge pressure is incorrect, shut down and determine cause for improper pressure.

With motor output shaft disconnected or drive wheels raised off of the ground, run system at full input and output speeds in both directions. Operate system for at least fifteen (15) minutes.

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

The transmission is now ready for operation.

Maintenance

To insure optimum service life on Series 40 products, regular maintenance of the fluid and filter must be performed.

Check the reservoir daily for proper fluid level, the presence of water (noted by a cloudy to milky appearance, or free water in bottom of reservoir), and rancid fluid odor (indicating excessive heat). When adding fluid to the reservoir, use only the fluid recommended for the equipment.

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

- System with a sealed type reservoir - 2000 hrs.
- System with a breathing type reservoir - 500 hrs.

It may be necessary to change the fluid more frequently than the above intervals if the fluid becomes contaminated with foreign matter (dirt, water, grease, etc.) or if the fluid has been subjected to temperature levels greater than the maximum recommended. Never reuse fluid.

The filter should be changed whenever the fluid is changed or whenever the filter indicator shows that it is necessary to change the filter.

Troubleshooting

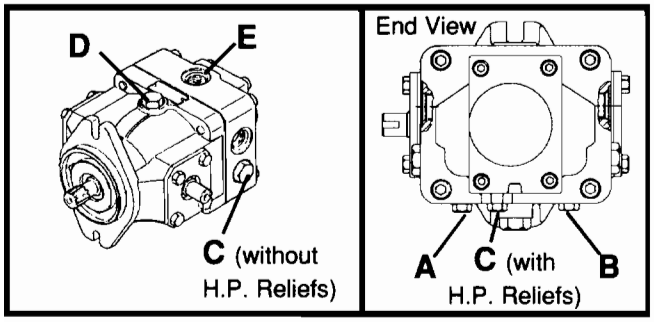


Fig. 8 - Gauge Connections -- Variable Pump

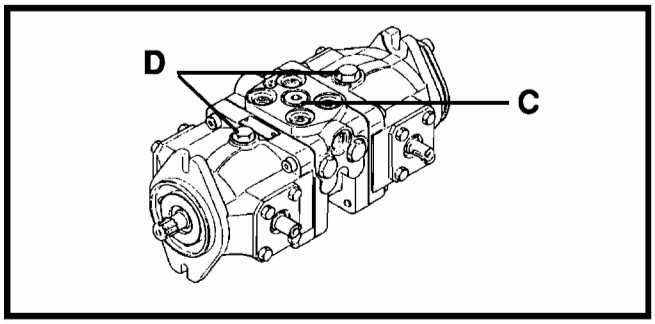


Fig. 9 - Gauge Connections -- Tandem Pump

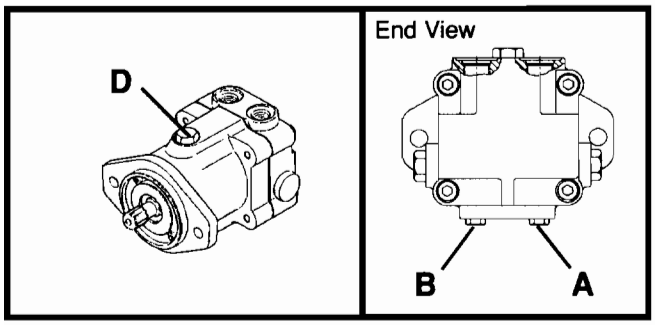


Fig. 10 - Gauge Connections -- Fixed Motor

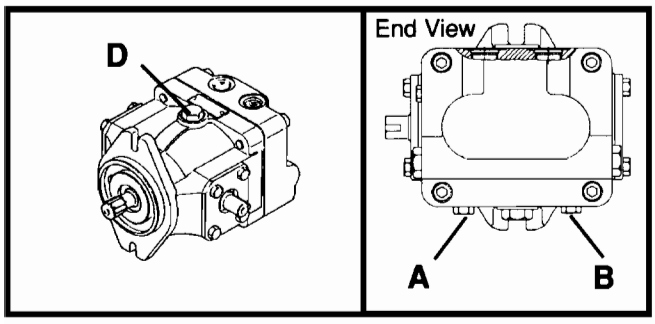


Fig. 11 - Gauge Connections -- Variable Motor

Gauge Installation

Various pressure and vacuum gauge readings can be a great asset in troubleshooting problems with the Series 40 - M23 transmission or support system.

It will be necessary to install a high pressure gauge into the system pressure gauge ports (or tee into the high pressure lines) to check the setting of the system pressure relief valves.

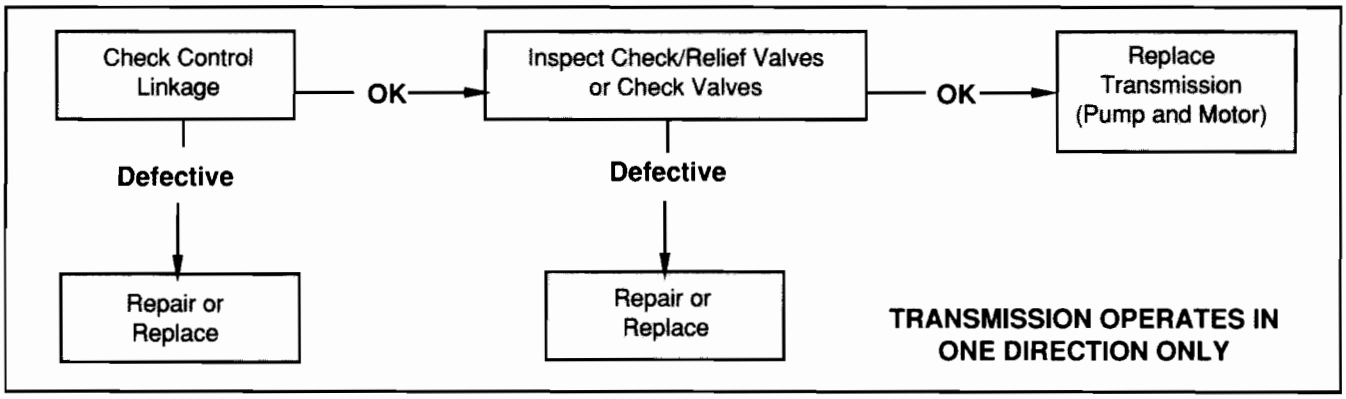
Measuring the charge pump inlet vacuum will help locate restrictions in the inlet lines, filter, etc.

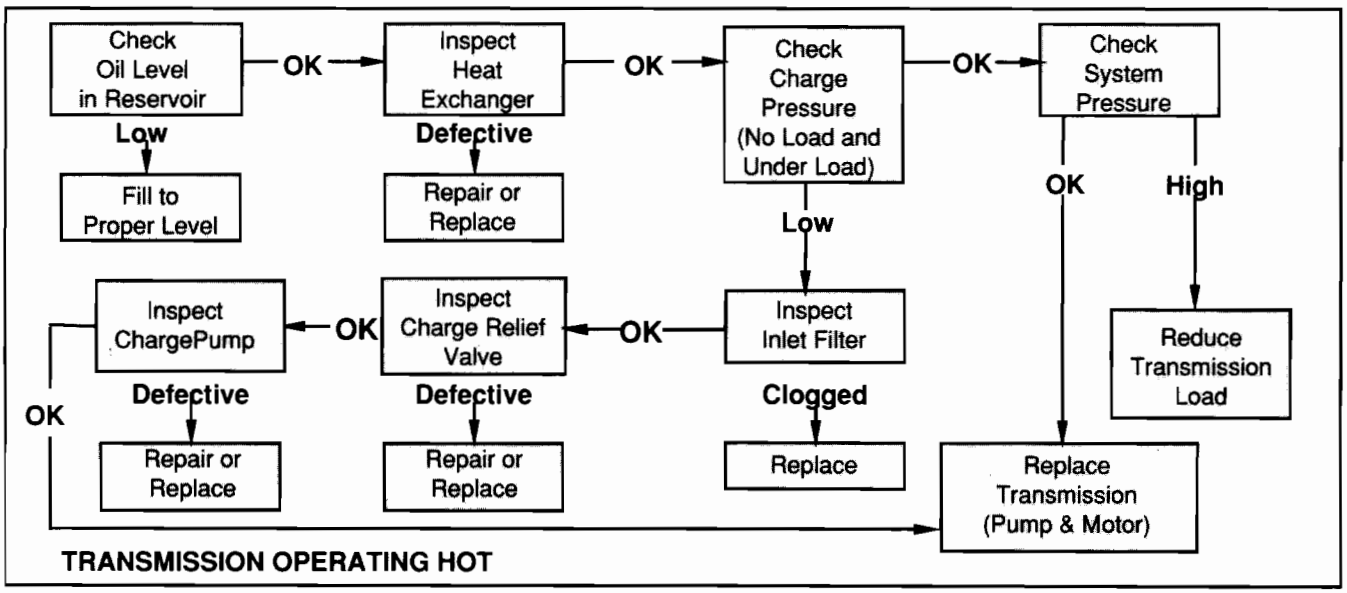
Case pressure readings can help locate restrictions in the return lines, oil cooler, and return filter.

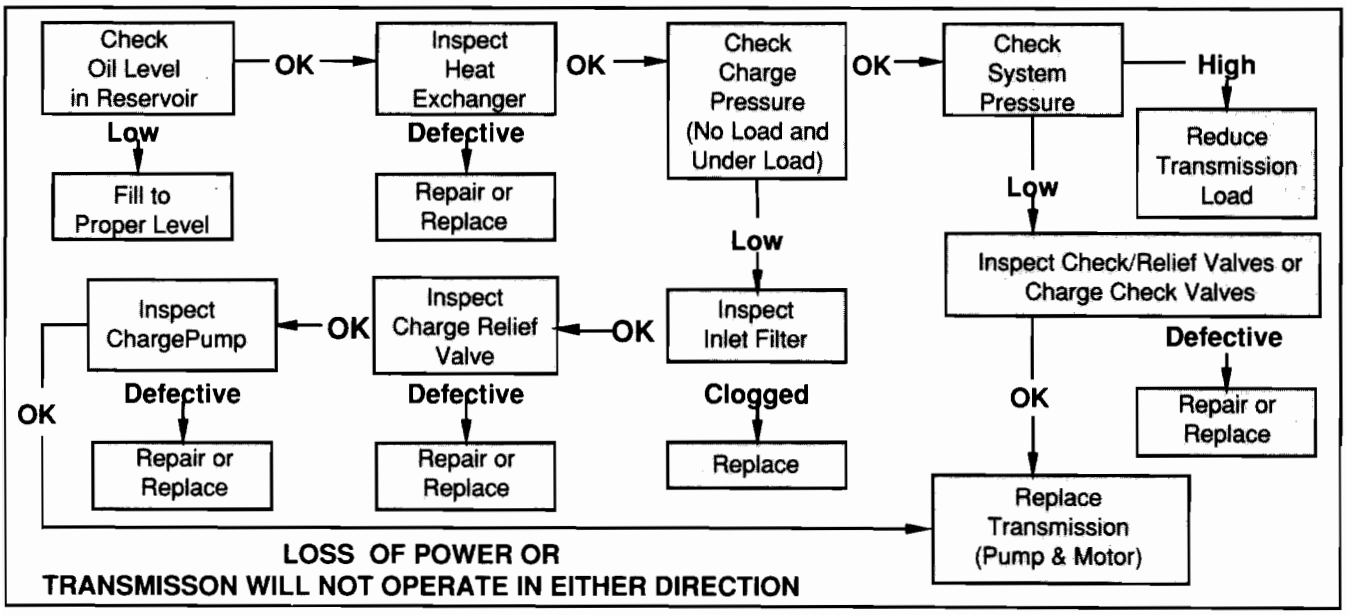
Gauge Information		
A	System Pressure Port "A"	10,000 PSI (690 BAR) - Gauge 7/16 - 20 O-Ring Fitting
B	System Pressure Port "B"	10,000 PSI (690 BAR) - Gauge 7/16 - 20 O-Ring Fitting
C	Charge Pressure	500 PSI (35 BAR) - Gauge 7/16 - 20 O-Ring Fitting (PV) 7/8 - 14 O-Ring Fitting (PT)
D	Case Pressure	500 PSI (35 BAR) - Gauge 3/4 - 16 O-Ring Fitting
E	Charge Pump Inlet Vacuum	Vacuum Gauge Tee into Charge Pump Inlet Line

Snubbers are recommended to protect pressure gauges. Frequent gauge calibration is necessary to insure accuracy.

Fault-Logic Diagrams







Inspections and Adjustments

Fig. 12 - Check / High Pressure Relief Valves

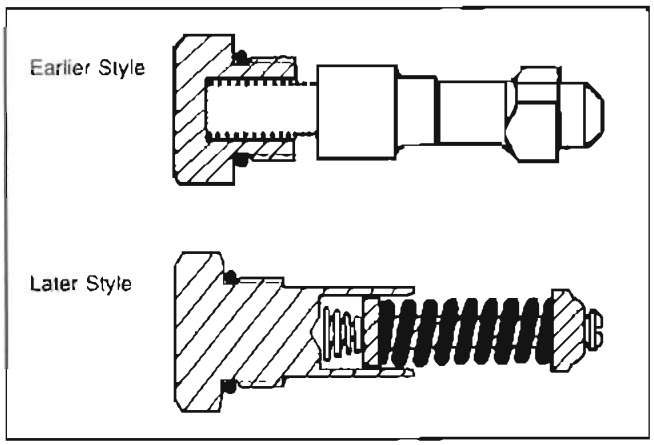


Fig. 13 - Check / High Pressure Relief Valves (Earlier and Later Styles)

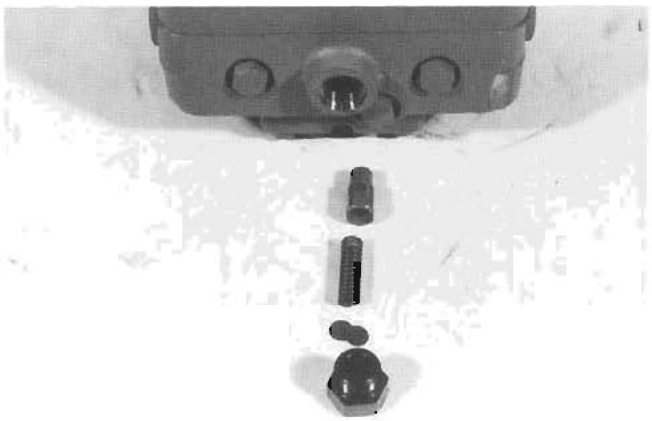


Fig. 14 - Pump Charge Relief Valve

Direct Displacement Control

Inspect the connection of the control linkage to the swashplate control shaft to insure that the linkage is properly attached. Neutral position of the swashplate is determined by the vehicle/machine control linkage.

Check / High Pressure Relief Valves

When a problem occurs in one direction, interchange the charge check or check/relief valves to see if the problem changes to the other direction. If so, one valve is malfunctioning or the check/relief valve cartridge does not have the proper setting.

The check/relief valve cartridges are factory set and should not be tampered with except for replacing the entire cartridge. The pressure setting of the valve is indicated by a two (2) digit code stamped on the cartridge.

NOTE: Earlier production M23 units use a check and relief valve assembly with an enclosed valve cartridge spring, a straight check valve spring, and a short plug. Later production units have an exposed valve cartridge spring, a cone check valve spring, and a plug with integral guide.
Tandem pumps with the earlier style valves may have a higher rate check valve spring installed to provide improved dynamic braking. These units will also have a higher charge relief valve setting.

Pump Charge Relief Valve

If charge pressure is low, the charge relief valve should be inspected. Inspect for foreign material holding the poppet open, and for scoring or wear on the poppet and seat in the housing.

Adjustment of the charge pressure is accomplished by changing the shim thickness behind the spring. The charge relief valve is factory set for 58-87 ΔPSI (4-6 BAR) above case pressure at 1800 RPM.

NOTE: Certain M23 pumps have a charge pressure relief valve setting of 87-116 ΔPSI (6-8 BAR).

Motor Bypass Valve

If a motor with the optional bypass valve is operating hot, check that the bypass is fully closed. To close the bypass, screw the valve into the end cap until the valve is seated. Then torque the valve to 7 to 10 ft.lbs. (9 to 14 Nm).

If the bypass valve appears to be leaking internally, remove the valve from the motor end cap. Inspect the valve and mating seat in the end cap for damage or foreign material.

Minor Repair and Replacement

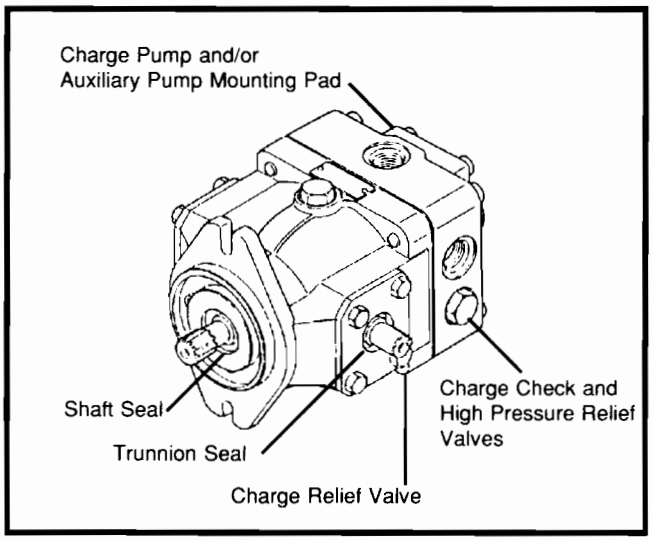
General

Minor Repairs may be performed, following the procedures in this section, without voiding the unit warranty.

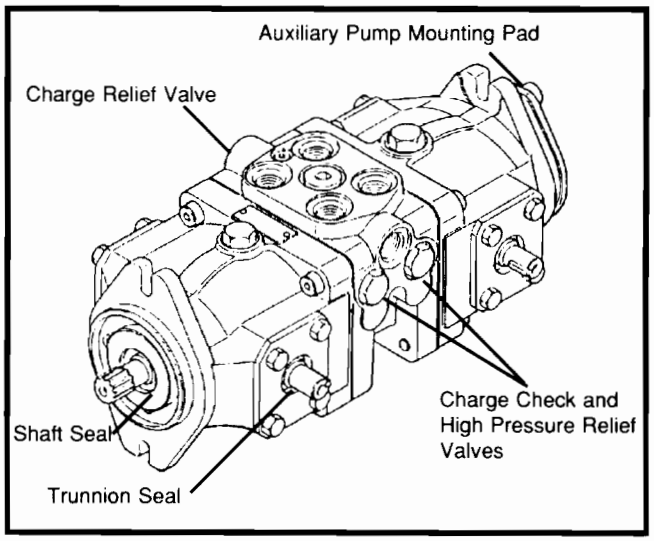
Cleanliness is a primary means of assuring satisfactory transmission life, on either new or repaired units. Cleaning parts by using a clean solvent wash and air drying is usually adequate. As with any precision equipment, all parts must be kept free of foreign materials and chemicals.

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

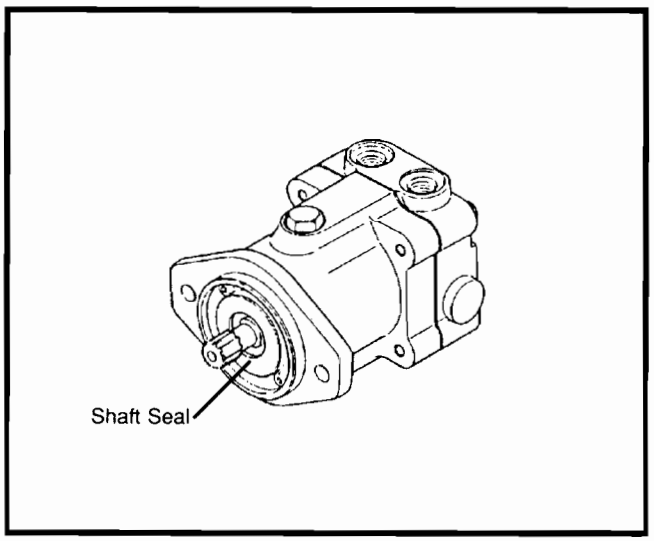
It is recommended that all gaskets and O-rings be replaced. Lightly lubricate all O-rings with clean petroleum jelly prior to assembly. All gasket sealing surfaces must be cleaned prior to installing new gaskets.



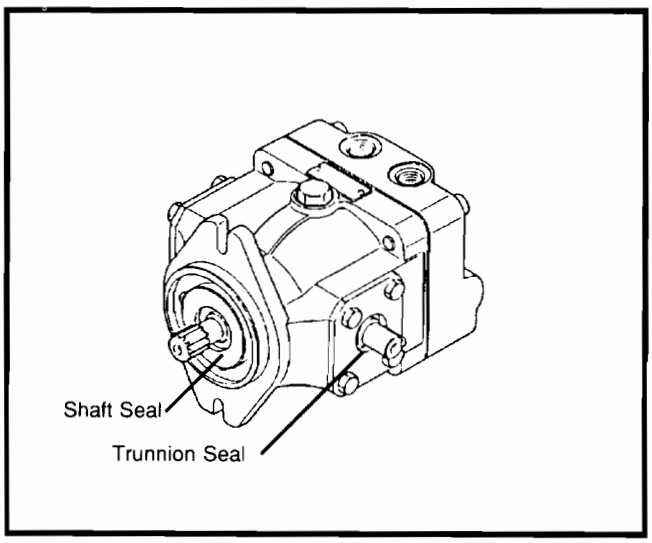
Variable Displacement Pump



Variable Displacement Tandem Pump



Fixed Displacement Motor



Variable Displacement Motor

Fig. 15 - Minor Repairs

Fig. 16 - Remove Seal Cover (PV, PT, MV)

Fig. 17 - Remove Seal Cover (MF)

Fig. 18 - Remove Seal from Cover

Fig. 19 - Install Seal Cover O-ring (PV, PT, MV)

Fig. 20 - Install Seal Cover O-ring (MF)

Fig. 21 - Torque Seal Cover Screws

Shaft Seal

Note: Replacement of the shaft seal generally requires removal of the pump or motor from the machine.

With a 5 mm internal hex wrench, remove the socket head screws retaining the seal cover to the unit housing.

On variable pumps, tandem pumps, and variable motors, use two (2) of the socket head screws as puller screws to remove the seal cover from the housing.

On fixed motors, carefully pry the seal cover out of the housing using two (2) screwdrivers Care must be taken so as not to damage the housing bore or shaft.

CAUTION

After the seal cover is removed, the shaft may be free in the housing. DO NOT PULL SHAFT OUT. The valve plate could become dislodged, requiring major disassembly of the unit.

Remove the O-ring from the seal cover or the motor housing.

Place the seal cover in an arbor press and press out the old seal . An appropriately sized pipe spacer or socket wrench can be used as a press tool. Once removed, the seal is not reusable.

Inspect the seal cover, the new seal, and the O-ring for damage. Inspect the sealing area on the shaft for rust, wear, or contamination. Polish the sealing area on the shaft if necessary.

Using the arbor press, press the new seal into the seal cover. Be careful not to damage seal.

Note. The outside diameter of the seal may be lightly coated with a sealant (such as Loctite High Performance Sealant #59231) prior to installation.

Wrap the spline or key end of shaft with thin plastic to prevent damage to the seal lip during installation. Lubricate the inside diameter of the new seal with petroleum jelly.

Install the O-ring into the seal cover, or motor housing and retain with petroleum jelly.

Slide the seal cover assembly over the shaft and into the housing bore. Install the socket head screws and torque to 9 to 12 ft.lbs. (12 to 16 Nm).

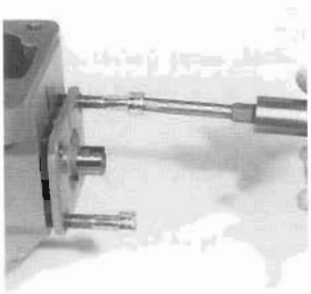


Fig. 22 - Remove Trunnion Seal Carrier

Fig. 23 - Remove Trunnion Bearing Cup and Shims

Fig. 24 - Remove Seal from Carrier

Fig. 25 - Install Trunnion Seal Carrier O-ring

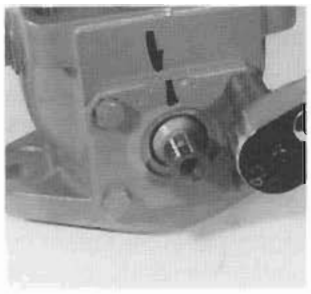


Fig. 26 - Install Trunnion Seal Carrier

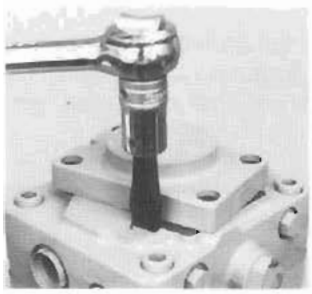


Fig. 27 - Remove Charge Check Valves

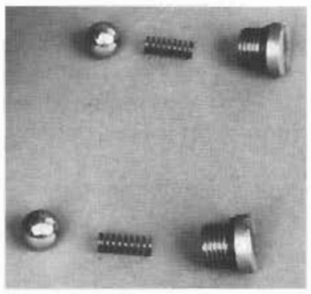


Fig. 28 - Charge Check Valve Components

Trunnion Seal

Remove the control linkage and square key from the swashplate control shaft. With a 13 mm wrench, remove the hex screws retaining the trunnion seal carrier to the unit housing. Note the position of the seal carrier for reassembly.

Use two (2) 10 mm puller screws in the threaded holes to remove the trunnion seal carrier from the housing.

The trunnion seal carrier assembly includes the bearing cup, trunnion shims, O-ring, and lip seal. Remove these parts from the carrier. Do not alter the shim thickness.

Place the carrier in an arbor press and press out the old seal An appropriately sized pipe spacer or socket wrench can be used as a press tool. Once removed, the seal is not reusable.

Inspect the seal cover, the new seal, and the O-ring for damage. Inspect the sealing area on the shaft for rust, wear, or contamination. Polish the sealing area on the shaft if necessary.

Using the arbor press, press the new seal into the seal carrier Be careful not to damage seal.

Wrap the key end of the swashplate control shaft with thin plastic to prevent damage to the seal lip during installation. Lubricate the inside diameter of the new seal with petroleum jelly.

Install the the trunnion shims and bearing cup into the seal carrier, and retain with petroleum jelly.

Install the O-ring onto the seal carrier, and lubricate with petroleum jelly.

Slide the seal carrier assembly over the swashplate control shaft and into the housing bore. Install the hex head screws and torque to 16 to 18 ft.lbs. (22 to 24 Nm). Reinstall the square key and control linkage onto the swashplate control shaft.

Charge Check Valves for Variable Pump without High Pressure Relief Valves

Remove the four (4) screws retaining the charge pump housing to the pump and carefully rotate it out of the way. Be certain to keep the proper orientation of the charge pump housing in order to insure correct rotation. Remove the charge check valve plugs with a "drag link" (screwdriver type) socket wrench.

Remove the spring and ball from the end cap. Inspect the ball and mating seat in the end cap for damage or foreign material.

Reinstall the ball, spring, and plug (with O-ring) into the end cap. Torque the plugs to 15 to 25 ft.lbs. (20 to 34 Nm). Replace the charge pump housing screws and torque to 18 to 21 ft.lbs. (24 to 28 Nm). Refer to the charge pump installation instructions in this section for more information.

Fig. 29 - Remove Check and Relief Valve Plug (PV)

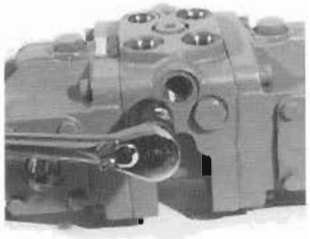


Fig. 30 - Remove Check and Relief Valve Plug (PT)

Fig. 31 - Remove Check and Relief Valves (PT Shown)

Fig. 32 - Check and Relief Valve Components

Fig. 33 - Remove Charge Relief Valve Plug (PV)

Fig. 34 - Remove Charge Relief Valve Plug (PT)

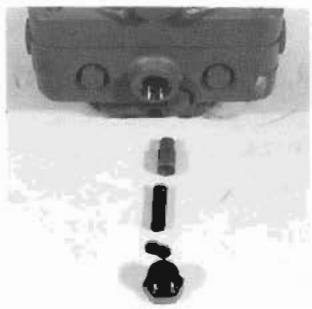


Fig. 35 - Charge Relief Valve Components (PV)

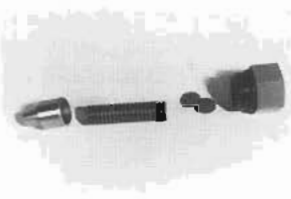


Fig. 36 - Charge Relief Valve Components (PT)

Check and High Pressure Relief Valves

Remove check and high pressure relief valve hex plug with a 7/8" wrench (24 mm wrench for later production units and all tandem pumps).

Remove the spring and valve cartridge from the end cap. Inspect the cartridge and mating seat in the end cap for damage or foreign material.

NOTE: Tandem pumps without high pressure relief valves use a solid poppet in place of a relief valve cartridge.

NOTE: Earlier production M23 units use a check and relief valve assembly with an enclosed valve cartridge spring, a straight check valve spring, and a short plug. Later production units have an exposed valve cartridge spring, a cone check valve spring, and a plug with integral guide. The later production parts will interchange with the earlier parts as a group. Do not attempt to mix early and late style parts.

Reinstall the valve cartridge, spring, and plug (with O-ring) into the end cap. Torque the plug to 30 to 70 ft.lbs. (41 to 95 Nm).

CAUTION

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

Charge Pressure Relief Valve

Remove charge relief valve hex plug with a 7/8" wrench (1" wrench for tandem pump).

Remove the spring and poppet from the end cap. Do not alter the shims or interchange parts with another valve. Inspect the poppet and mating seat in the end cap for damage or foreign material.

NOTE: The design of the charge relief valve poppet is different for variable pumps and tandem pumps.

Reinstall the poppet, spring, and plug (with shims and O-ring) into the end cap. Torque the plug to 30 to 70 ft.lbs. (41 to 95 Nm) on variable pumps, and 40 to 100 ft.lbs. (54 to 135 Nm) on tandem pumps.

Fig. 37 - Remove Charge Pump Housing Screws

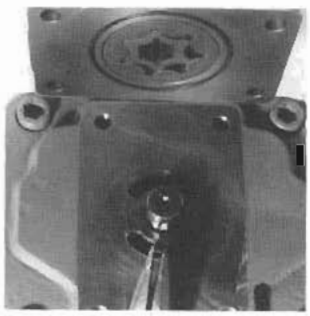


Fig. 38 - Remove Charge Pump and Drive Key

Fig. 39 - Install New Drive Key

Fig. 40 - Install Gerotor Assembly

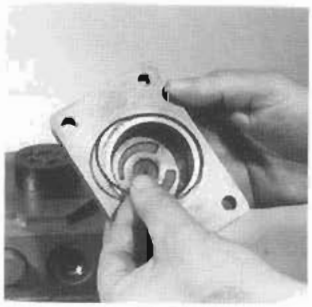


Fig. 41 - Install Charge Pump Housing O-ring

Fig. 42 - Install Charge Pump Housing

Fig. 43 - Orienting Charge Pump Housing (CW)

Fig. 44 - Orienting Charge Pump Housing (CCW)

Integral Charge Pump (Variable Pump Only)

If the unit is equipped with an auxiliary pump mounting pad, remove the two (2) socket head screws and washers retaining the flange cover or auxiliary pump using an 8 mm internal hex wrench. Remove the flange cover or auxiliary pump and O-ring. If an auxiliary pump was installed, remove the drive coupling and retaining ring .

With a 6 mm internal hex wrench, remove the four (4) socket head screws retaining the charge pump housing to the end cap. Note the orientation of the charge pump housing for reassembly

Remove the charge pump housing, O-ring, and gerotor assembly. Remove the woodruff key from the shaft.

Each part should be inspected separately if they are to be reused. If either of the gerotor assembly parts needs to be replaced, they must both be replaced. The woodruff key should always be replaced. Always replace the O-ring.

Prior to assembly, lubricate the gerotor assembly with clean hydraulic oil.

Install a new woodruff key into the drive shaft, then slide the gerotor assembly into place.

Install the O-ring into the housing, then install housing into position over gerotor assembly.

Orient the charge pump housing to the main pump for the proper input shaft rotation direction. The cast notch on the charge pump housing should be closest to the charge relief valve for clock-wise input rotation, and closest to the charge pump inlet port for counter clock-wise input rotation.

Reinstall the socket head screws and torque to 18 to 21 ft.lbs. (24 to 28 Nm). Check for proper internal assembly by slowly rotating the pump shaft while tightening these screws.

If the unit is equipped with an auxiliary pump, install the drive coupling and retaining ring. If the unit is equipped with an auxiliary pump mounting pad, install the O-ring and flange cover or auxiliary pump and secure with the washers and screws. Torque the screws to 35 to 45 ft.lbs. (47 to 61 Nm).

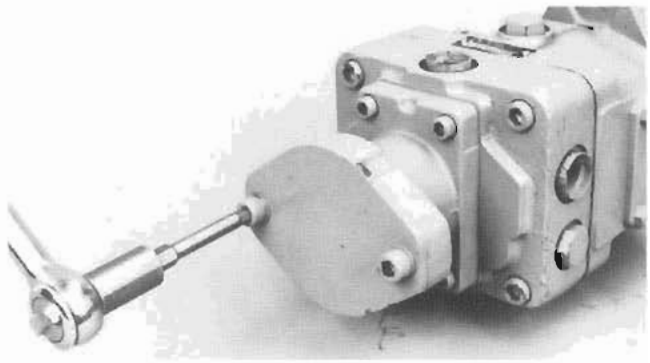


Fig. 45 - Remove Cover

Fig. 46 - Install Adapter O-ring (PV)

Fig. 47 - Install Adapter O-ring (PT)

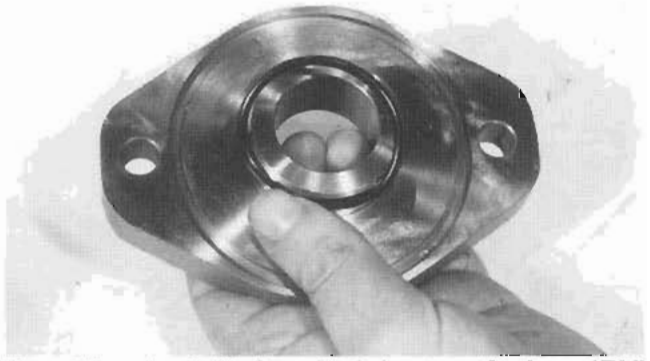


Fig. 48 - Install Small Adapter O-ring (PV)

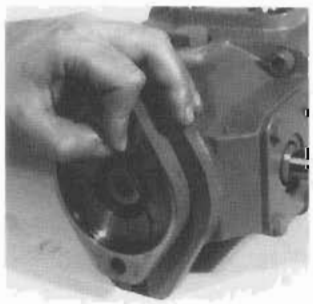


Fig. 49 - Install Cover O-ring

Fig. 50 - Install Cover

Auxiliary Pump Mounting Pad

Remove the two (2) socket head screws and washers retaining the flange cover or auxiliary pump using an 8 mm internal hex wrench (5/16" internal hex wrench for tandem pump).

Remove the flange cover or auxiliary pump and O-ring. If an auxiliary pump was installed on a variable pump, remove the drive coupling and its retaining ring.

On variable pumps with integral charge pumps, remove the charge pump housing. Refer to the charge pump removal instructions in this section.

Remove the adapter plate from the end cap or unit housing of units without integral charge pumps. Remove the large O-ring from the plate. On variable pumps, also remove the small O-ring.

For variable pumps with integral charge pumps, reinstall the charge pump housing. Refer to the charge pump installation instructions in this section.

For units without integral charge pumps, install the large O-ring onto the adapter plate and retain with petroleum jelly. On variable pumps, also install the small O-ring. Reinstall the adapter plate onto the end cap or unit housing.

If an auxiliary pump is to be installed on a variable pump, install the drive coupling and retaining ring. Install the O-ring and flange cover or auxiliary pump and secure with the washers and screws. Torque the screws to 35 to 45 ft.lbs. (47 to 61 Nm) on variable pumps, and to 45 to 55 ft.lbs. (61 to 75 Nm) on tandem pumps.

Bypass Valve (Motor)

Using a 10 mm wrench or a 3/16" internal hex wrench, unscrew the bypass valve from the end cap.

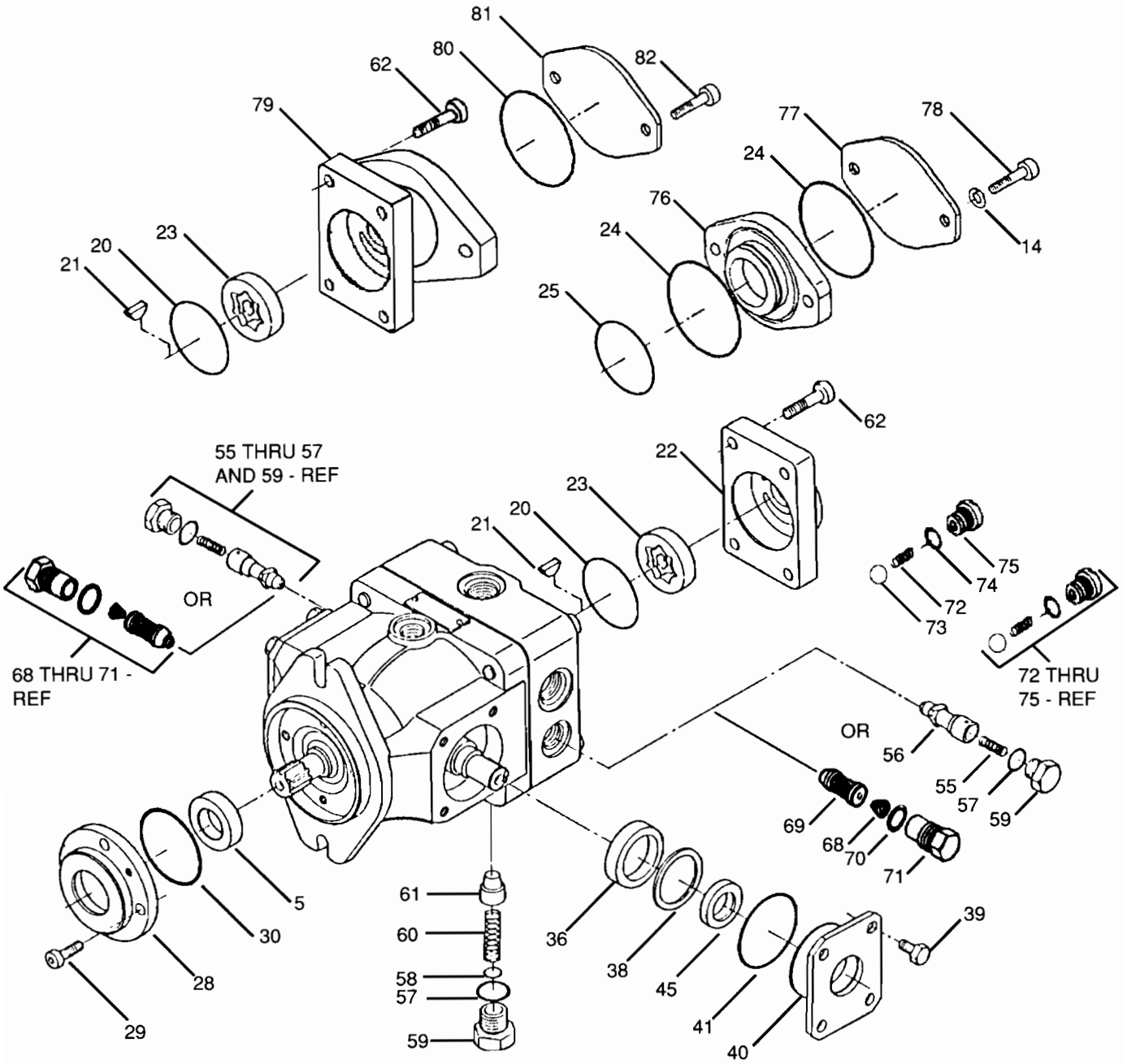
Inspect the valve and mating seat in the end cap for damage or foreign material. Install a new O-ring and back up ring onto the valve.

Reinstall the bypass valve into the end cap and torque to 7 to 10 ft.lbs. (9 to 14 Nm).

General Parts Identification

The following Information is for general parts identification ONLY. Refer to the applicable Service Parts List when ordering service parts

M23 Variable Displacement Pump -- PV (Minor Repair)

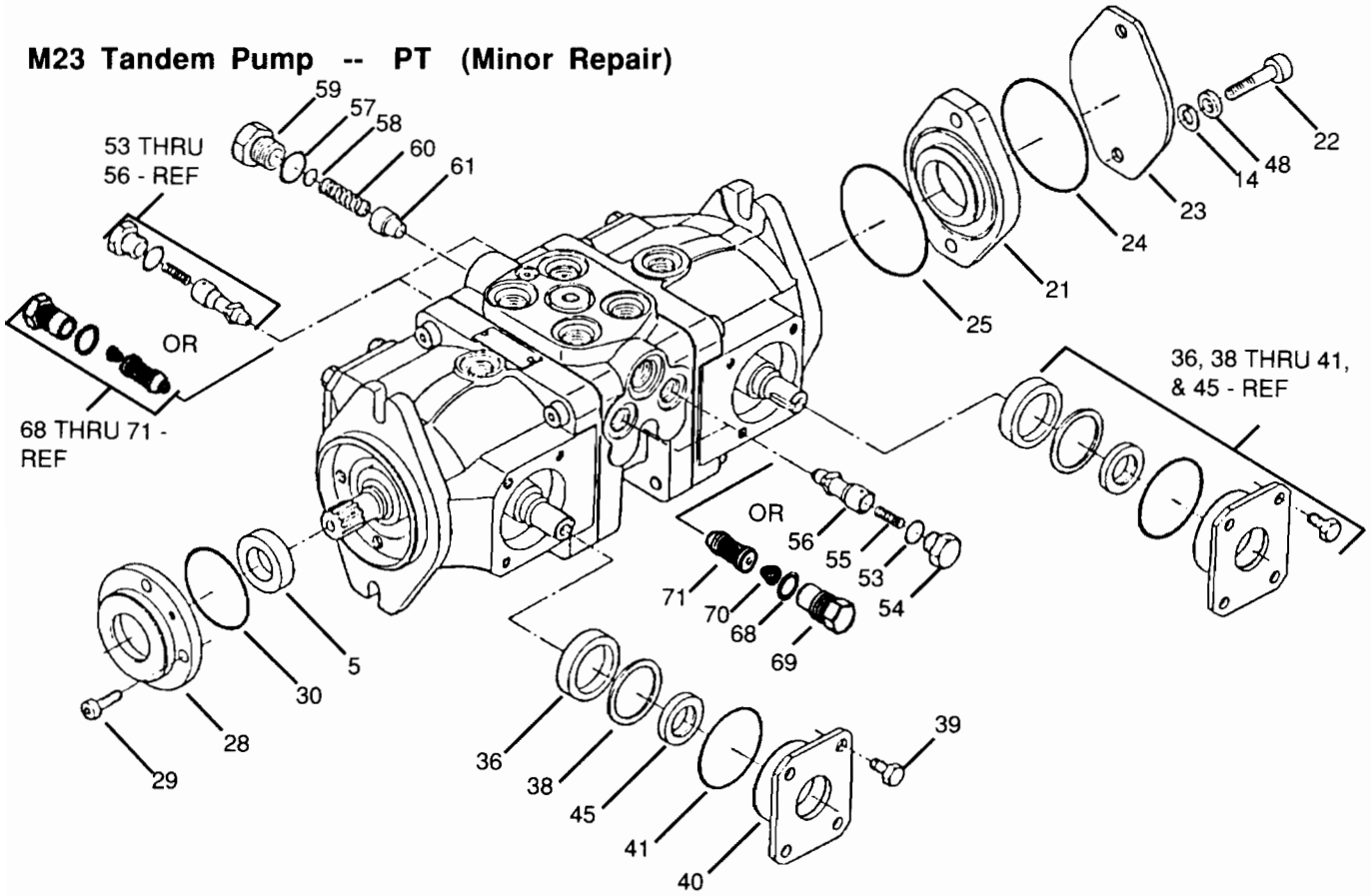


M23 Variable Displacement Pump -- PV (Minor Repair)

ITEM	DESCRIPTION
	SHAFT SEAL ASSEMBLY
5	LIP SEAL
28	SEAL COVER
29	CAPSCREW
30	O-RING
	TRUNNION SEAL ASSEMBLY
36	BEARING CUP
38	SHIM
39	CAPSCREW
40	TRUNNION COVER
41	O-RING
45	LIP SEAL
	CHARGE RELIEF VALVE
57	O-RING
58	SHIM
59	PLUG
60	SPRING
61	VALVE POPPET
	CHARGE CHECK VALVES WITHOUT HIGH PRESSURE RELIEF VALVES - OPTION - 2 PER UNIT
72	SPRING
73	BALL
74	O-RING
75	PLUG
	CHARGE CHECK AND HIGH PRESSURE RELIEF VALVE (EARLIER PRODUCTION) - 2 PER UNIT
53	O-RING
54	PLUG - SHORT
55	SPRING - STRAIGHT
56	VALVE CARTRIDGE - ENCLOSED SPRING
	CHARGE CHECK AND HIGH PRESSURE RELIEF VALVE (LATER PRODUCTION) - 2 PER UNIT
68	SPRING - CONE
69	VALVE CARTRIDGE - EXPOSED SPRING
70	O-RING
71	PLUG - LONG

ITEM	DESCRIPTION
	CHARGE PUMP ASSEMBLY
20	O-RING
21	KEY
22	CHARGE PUMP HOUSING
23	GEROTOR ASSEMBLY
62	CAPSCREW
	CHARGE PUMP ASSEMBLY WITH AUXILIARY PUMP MOUNTING PAD - OPTION
20	O-RING
21	KEY
23	GEROTOR ASSEMBLY
62	CAPSCREW
79	CHARGE PUMP HOUSING
80	O-RING (AUXILIARY PAD)
81	FLANGE COVER (AUXILIARY PAD)
82	CAPSCREW (AUXILIARY PAD)
	COUPLING (NOT SHOWN)
	RETAINING RING (NOT SHOWN)
	AUXILIARY PUMP MOUNTING PAD (WITHOUT CHARGE PUMP) - OPTION
14	WASHER
24	O-RING
25	O-RING
76	ADAPTER PLATE
77	FLANGE COVER
78	CAPSCREW
	COUPLING (NOT SHOWN)
	RETAINING RING (NOT SHOWN)

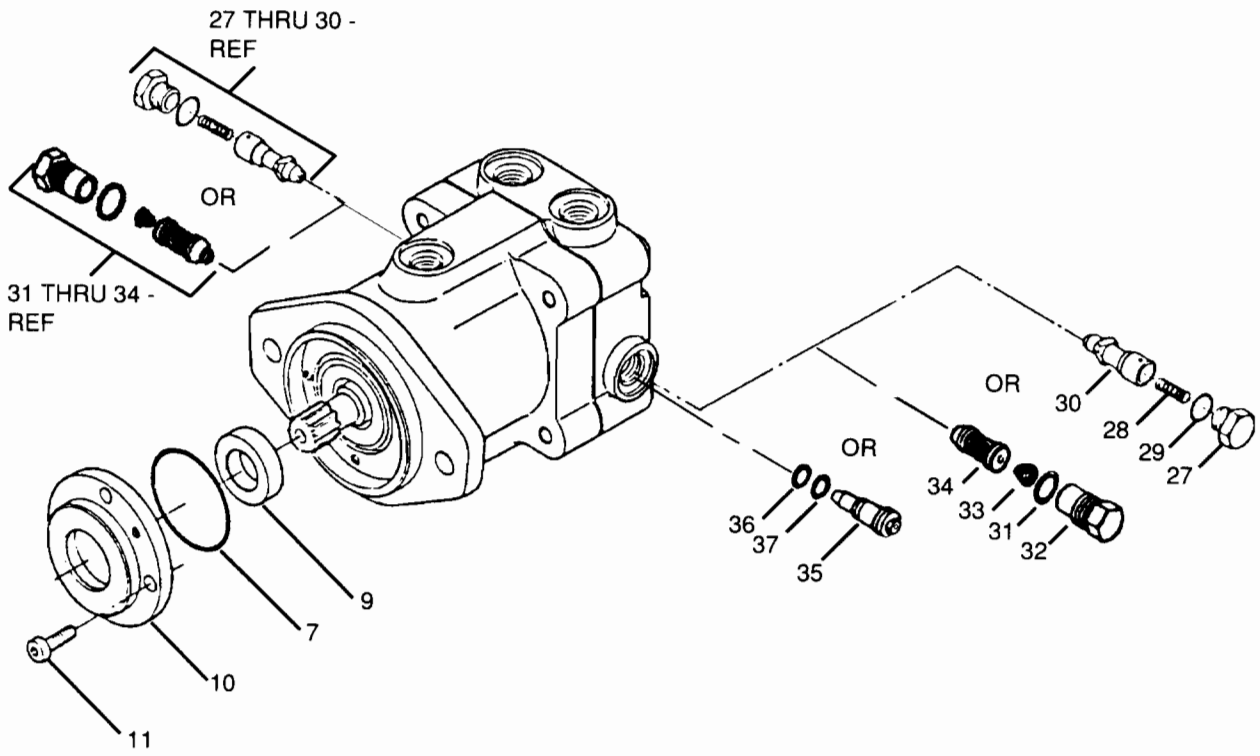
M23 Tandem Pump -- PT (Minor Repair)



ITEM	DESCRIPTION
	SHAFT SEAL ASSEMBLY
5	LIP SEAL
28	SEAL COVER
29	CAPSCREW
30	O-RING
	TRUNNION SEAL ASSEMBLY - 2 PER UNIT
36	BEARING CUP
38	SHIM
39	CAPSCREW
40	TRUNNION COVER
41	O-RING
45	LIP SEAL
	CHARGE RELIEF VALVE
57	O-RING
58	SHIM
59	PLUG
60	SPRING
61	VALVE POPPET

ITEM	DESCRIPTION
	CHARGE CHECK AND HIGH PRESSURE RELIEF VALVE (EARLIER PRODUCTION) - 4 PER UNIT
53	O-RING
54	PLUG - SHORT
55	SPRING - STRAIGHT
56	VALVE CARTRIDGE - ENCLOSED SPRING
	CHARGE CHECK AND HIGH PRESSURE RELIEF VALVE (LATER PRODUCTION) - 4 PER UNIT
68	SPRING - CONE
69	VALVE CARTRIDGE - EXPOSED SPRING
70	O-RING
71	PLUG - LONG
	AUXILIARY PUMP MOUNTING PAD
14	WASHER
21	ADAPTER PLATE
22	CAPSCREW
23	FLANGE COVER
24	O-RING
25	O-RING
48	SPACER

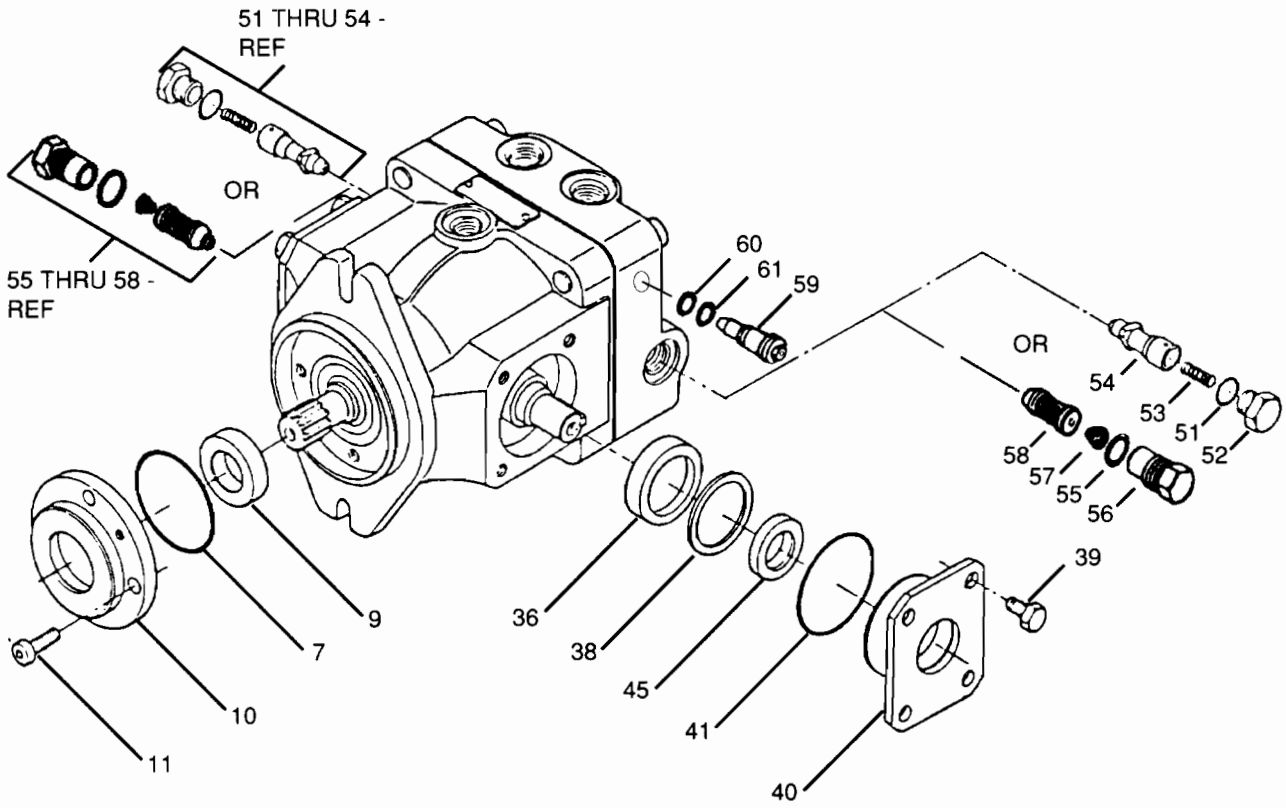
M23 Fixed Displacement Motor -- MF (Minor Repair)



ITEM	DESCRIPTION
	SHAFT SEAL ASSEMBLY
7	O-RING
9	LIP SEAL
10	SEAL COVER
11	CAPSCREW
	HIGH PRESSURE RELIEF VALVE - OPTION (EARLIER PRODUCTION) - 2 PER UNIT
27	PLUG - SHORT
28	SPRING - STRAIGHT
29	O-RING
30	VALVE CARTRIDGE - ENCLOSED SPRING

ITEM	DESCRIPTION
	HIGH PRESSURE RELIEF VALVE - OPTION (LATER PRODUCTION) - 2 PER UNIT
31	O-RING
32	PLUG - LONG
33	SPRING - CONE
34	VALVE CARTRIDGE - EXPOSED SPRING
	BYPASS VALVE ASSEMBLY - OPTION
35	BYPASS VALVE
36	O-RING
37	BACK UP RING

M23 Variable Displacement Motor -- MV (Minor Repair)



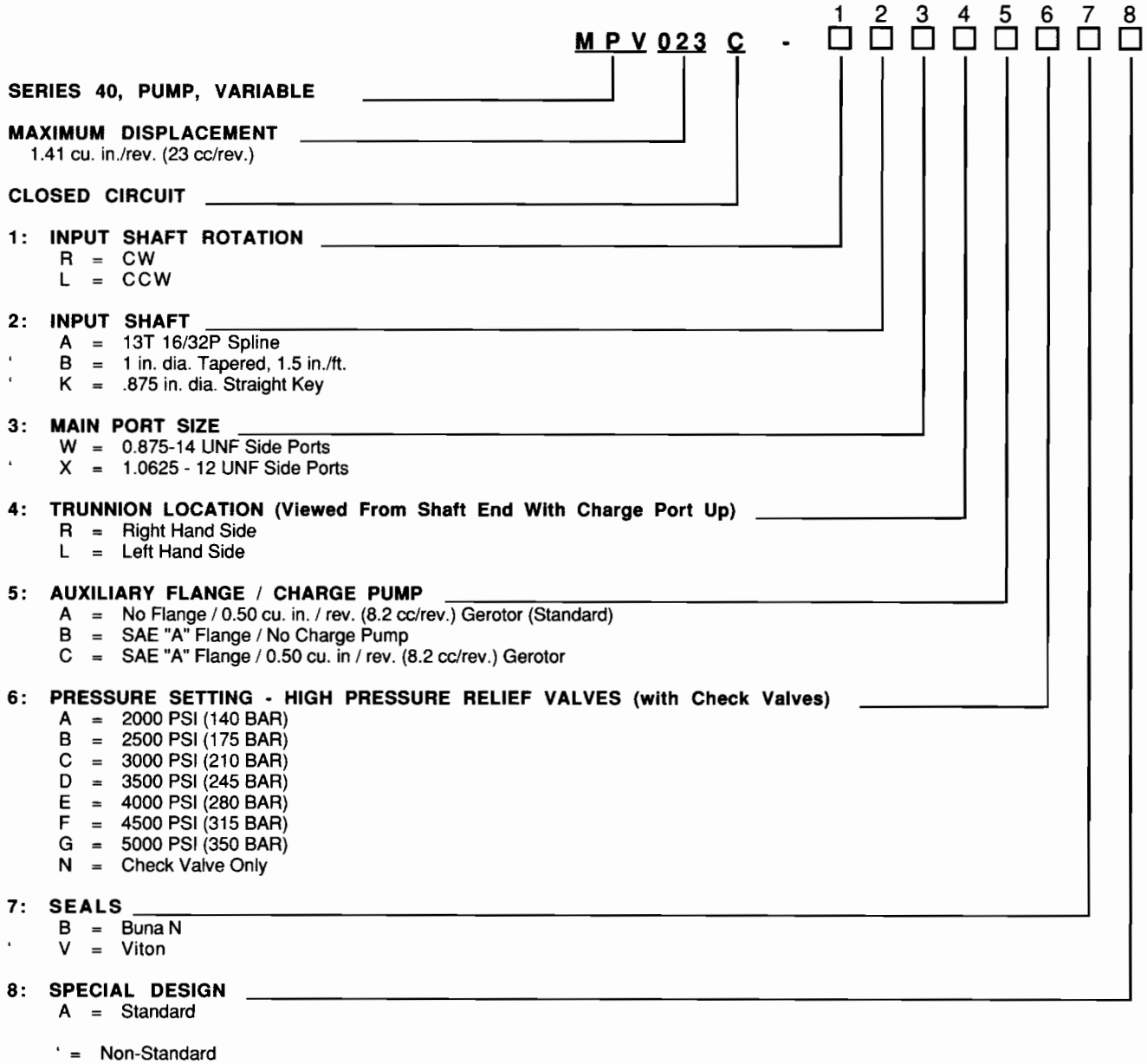
ITEM	DESCRIPTION
	SHAFT SEAL ASSEMBLY
5	LIP SEAL
28	SEAL COVER
29	CAPSCREW
30	O-RING
	TRUNNION SEAL ASSEMBLY
36	BEARING CUP
38	SHIM
39	CAPSCREW
40	TRUNNION COVER
41	O-RING
45	LIP SEAL

ITEM	DESCRIPTION
	HIGH PRESSURE RELIEF VALVE - OPTION (EARLIER PRODUCTION) - 2 PER UNIT
51	O-RING
52	PLUG - SHORT
53	SPRING - STRAIGHT
54	VALVE CARTRIDGE - ENCLOSED SPRING
	HIGH PRESSURE RELIEF VALVE - OPTION (LATER PRODUCTION) - 2 PER UNIT
55	O-RING
56	PLUG - LONG
57	SPRING - CONE
58	VALVE CARTRIDGE - EXPOSED SPRING
	BYPASS VALVE ASSEMBLY - OPTION
59	BYPASS VALVE
60	O-RING
61	BACK UP RING

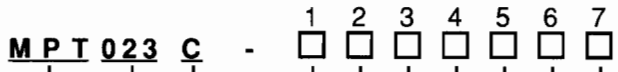
Notes

Model Code

M23 Variable Displacement Pump -- PV



M23 Tandem Pump -- PT



SERIES 40, PUMP, TANDEM

MAXIMUM DISPLACEMENT
1.41 cu. in./rev. (23 cc/rev.) per section

CLOSED CIRCUIT

1: INPUT SHAFT ROTATION
R = CW
L = CCW

2: INPUT SHAFT
A = 13T 16/32P Spline
' B = 1 in. dia. Tapered, 1.5 in./ft.
' K = .875 in. dia. Straight Key

3: TRUNNION LOCATION (Viewed From Shaft End With Main Ports Up)

	Front Pump	Rear Pump
A =	Right Hand Side	Left Hand Side
B =	Left Hand Side	Right Hand Side
C =	Right Hand Side	Right Hand Side
D =	Left Hand Side	Left Hand Side

4: AUXILIARY PUMP MOUNTING FLANGE
B = SAE "A" Flange with No Charge Pump - 9T Spline
D = SAE "A" Flange with No Charge Pump - 11T Spline
NOTE: Cover provided on all units for use when no auxiliary pump is required.

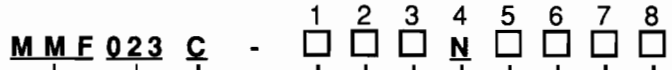
5: PRESSURE SETTING - HIGH PRESSURE RELIEF VALVES (with Check Valves)
A = 2000 PSI (140 BAR)
B = 2500 PSI (175 BAR)
C = 3000 PSI (210 BAR)
D = 3500 PSI (245 BAR)
E = 4000 PSI (280 BAR)
F = 4500 PSI (315 BAR)
G = 5000 PSI (350 BAR)
N = Check Valve Only

6: SEALS
B = Buna N
' V = Viton

7: SPECIAL DESIGN
A = Standard

' = Non-Standard

M23 Fixed Displacement Motor -- MF



SERIES 40, MOTOR, FIXED

DISPLACEMENT
1.41 cu. in./rev. (23 cc/rev.)

CLOSED CIRCUIT

1: OUTPUT SHAFT
- A = 13T 16/32P Spline
- ' B = 1 in. dia. Tapered, 1.5 in./ft.
- ' K = .875 in. dia. Straight Key

2: MAIN PORT SIZE
- W = 0.875-14 UNF Twin Top Ports
- ' X = 0.875-14 UNF End Ports

3: THROUGH SHAFT
- N = Not Applicable
- ' Y = 9T 16/32P Spline

4: N = Not Applicable

5: PRESSURE SETTING - HIGH PRESSURE RELIEF VALVES
- N = No Relief Valve
- A = 2000 PSI (140 BAR)
- B = 2500 PSI (175 BAR)
- C = 3000 PSI (210 BAR)
- D = 3500 PSI (245 BAR)
- E = 4000 PSI (280 BAR)
- F = 4500 PSI (315 BAR)
- G = 5000 PSI (350 BAR)

NOTE: Relief Valves not available with Bypass Valve.

6: BYPASS VALVE
- N = Not Applicable
- ' Y = With Bypass

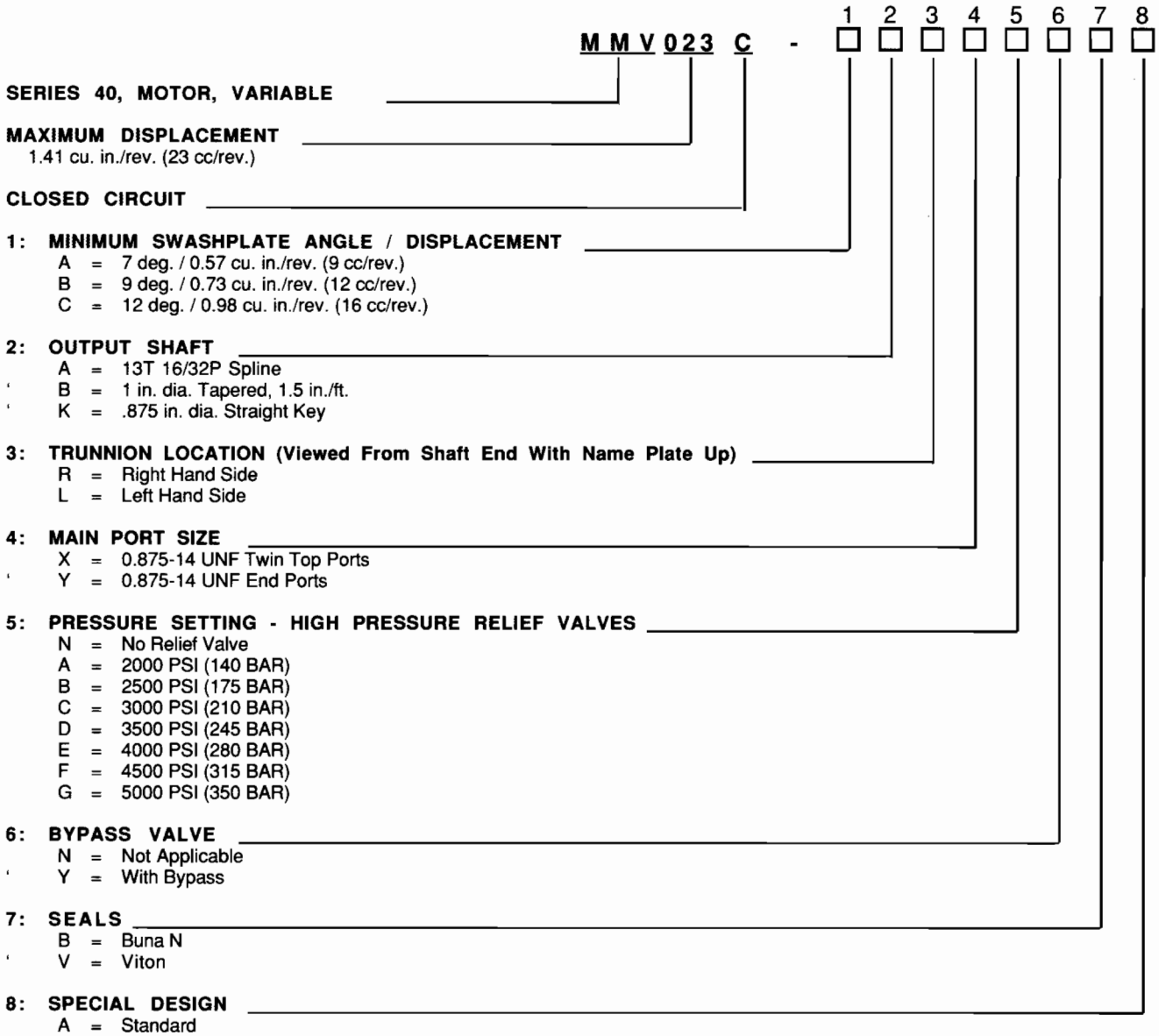
NOTE: Bypass Valve not available with Relief Valves.

7: SEALS
- B = Buna N
- ' V = Viton

8: SPECIAL DESIGN
- A = Standard

' = Non-Standard

M23 Variable Displacement Motor -- MV



SERIES 40, MOTOR, VARIABLE

MAXIMUM DISPLACEMENT
1.41 cu. in./rev. (23 cc/rev.)

CLOSED CIRCUIT

1: MINIMUM SWASHPLATE ANGLE / DISPLACEMENT
- A = 7 deg. / 0.57 cu. in./rev. (9 cc/rev.)
- B = 9 deg. / 0.73 cu. in./rev. (12 cc/rev.)
- C = 12 deg. / 0.98 cu. in./rev. (16 cc/rev.)

2: OUTPUT SHAFT
- A = 13T 16/32P Spline
- ' B = 1 in. dia. Tapered, 1.5 in./ft.
- ' K = .875 in. dia. Straight Key

3: TRUNNION LOCATION (Viewed From Shaft End With Name Plate Up)
- R = Right Hand Side
- L = Left Hand Side

4: MAIN PORT SIZE
- X = 0.875-14 UNF Twin Top Ports
- ' Y = 0.875-14 UNF End Ports

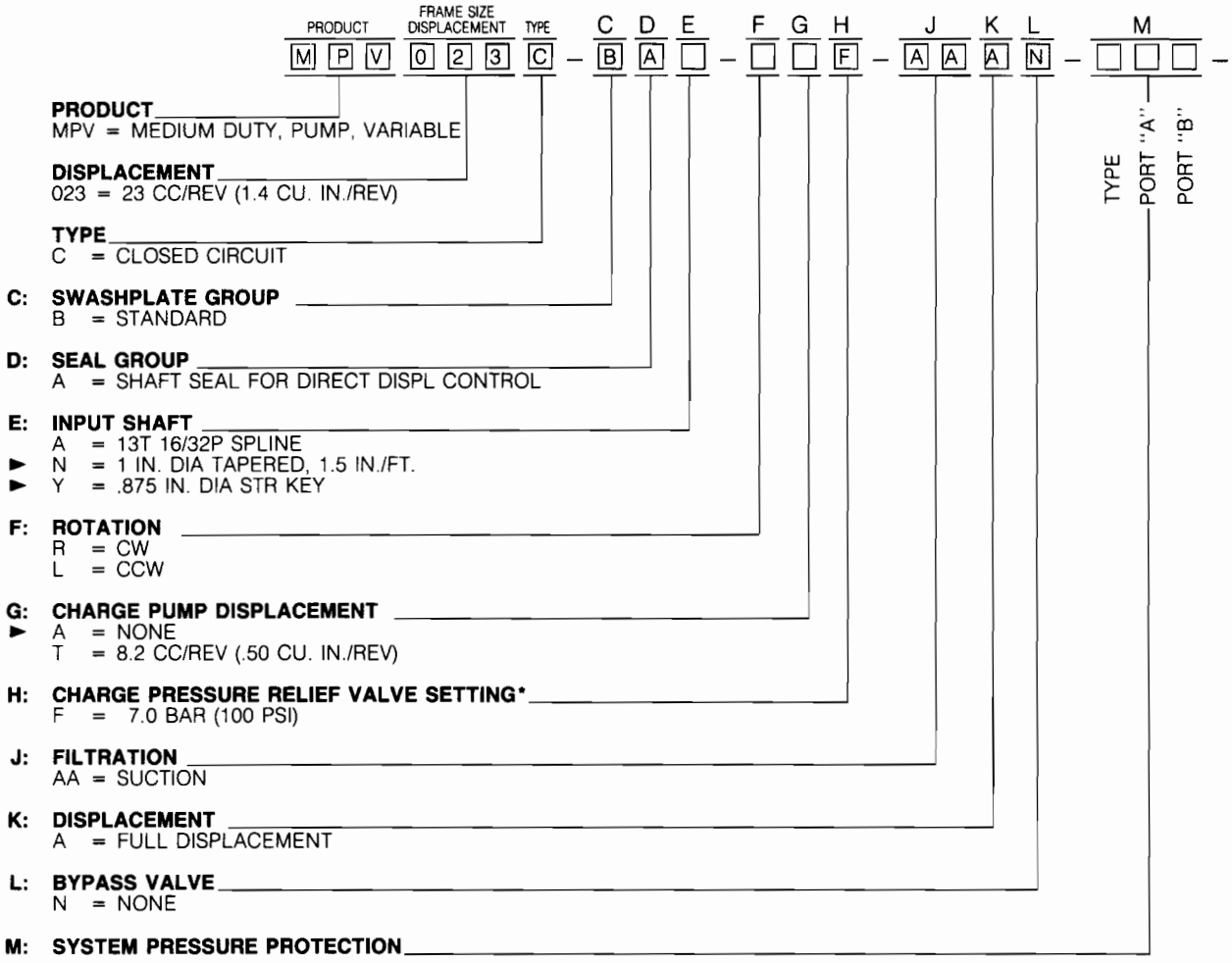
5: PRESSURE SETTING - HIGH PRESSURE RELIEF VALVES
- N = No Relief Valve
- A = 2000 PSI (140 BAR)
- B = 2500 PSI (175 BAR)
- C = 3000 PSI (210 BAR)
- D = 3500 PSI (245 BAR)
- E = 4000 PSI (280 BAR)
- F = 4500 PSI (315 BAR)
- G = 5000 PSI (350 BAR)

6: BYPASS VALVE
- N = Not Applicable
- ' Y = With Bypass

7: SEALS
- B = Buna N
- ' V = Viton

8: SPECIAL DESIGN
- A = Standard
- ' = Non-Standard

M23 Variable Displacement Pump -- PV
(Consolidated Series 40 Model Code)



PRODUCT
MPV = MEDIUM DUTY, PUMP, VARIABLE

DISPLACEMENT
023 = 23 CC/REV (1.4 CU. IN./REV)

TYPE
C = CLOSED CIRCUIT

C: SWASHPLATE GROUP
B = STANDARD

D: SEAL GROUP
A = SHAFT SEAL FOR DIRECT DISPL CONTROL

E: INPUT SHAFT
A = 13T 16/32P SPLINE
► N = 1 IN. DIA TAPERED, 1.5 IN./FT.
► Y = .875 IN. DIA STR KEY

F: ROTATION
R = CW
L = CCW

G: CHARGE PUMP DISPLACEMENT
► A = NONE
T = 8.2 CC/REV (.50 CU. IN./REV)

H: CHARGE PRESSURE RELIEF VALVE SETTING*
F = 7.0 BAR (100 PSI)

J: FILTRATION
AA = SUCTION

K: DISPLACEMENT
A = FULL DISPLACEMENT

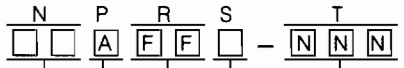
L: BYPASS VALVE
N = NONE

M: SYSTEM PRESSURE PROTECTION

	PROTECTION	
TYPE	**PORT "A"**	**PORT "B"**
A =	NONE	NONE
B =	PRESS. RELIEF	PRESS. RELIEF
C =	PRESS. RELIEF	NONE
D =	NONE	PRESS. RELIEF

SETTINGS (SELECT FOR PORT "A" & "B")*
A = NONE
M = 140 BAR (2030 PSI)
B = 175 BAR (2540 PSI)
D = 210 BAR (3045 PSI)
F = 250 BAR (3625 PSI)
G = 280 BAR (4060 PSI)
J = 345 BAR (5000 PSI)

M23 Variable Displacement Pump -- PV (Continued)



T: SPECIAL HARDWARE FEATURES
NNN = NONE

S: AUXILIARY MOUNTING PAD
A = SAE "A" 9T SPLINE
C = NONE (WITH CHARGE PUMP ONLY)

R: CONTROL ORIFICE DIA

SUPPLY	DRAIN
F = NONE	F = NONE

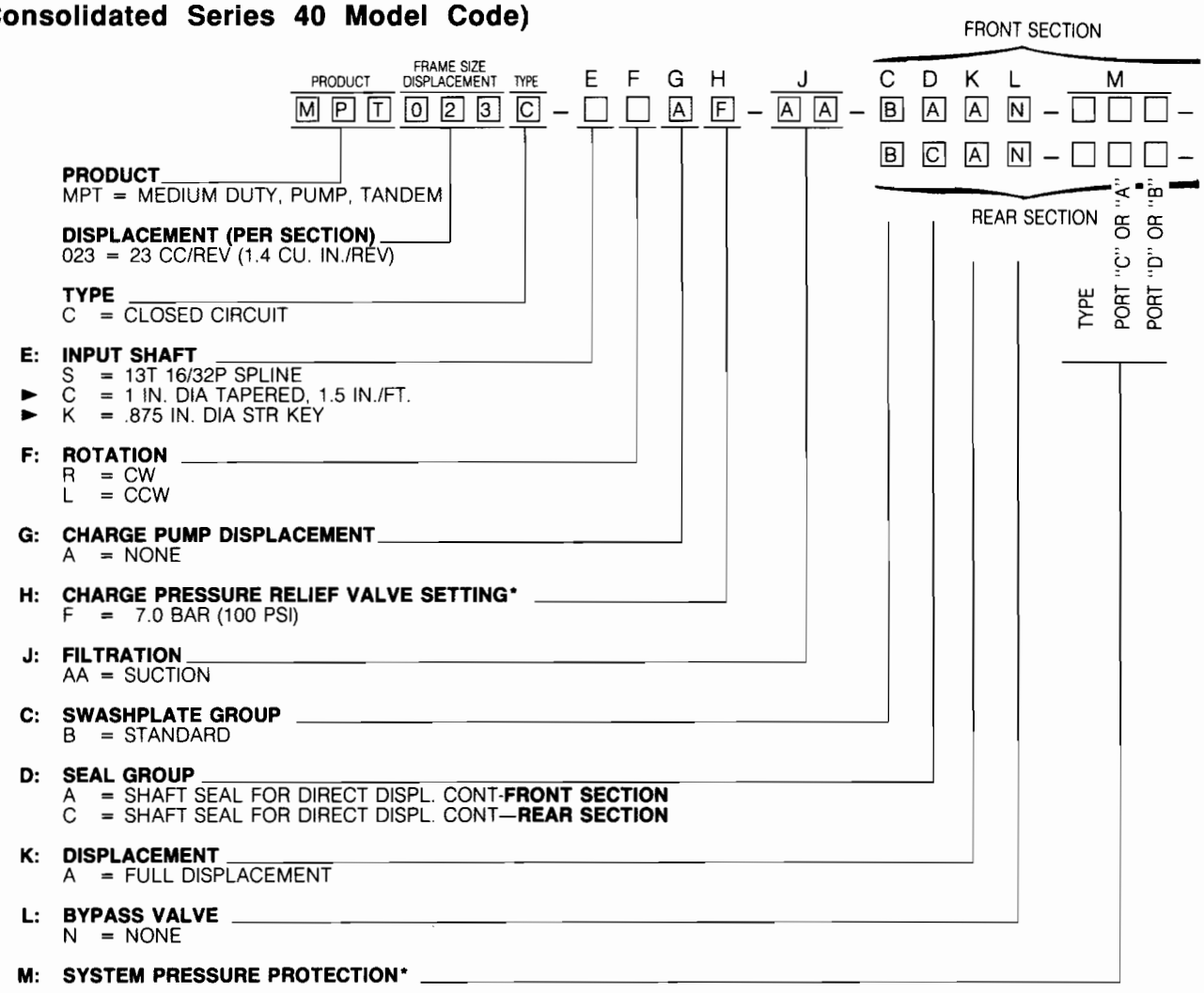
P: HANDLE POSITION
A = NOT APPLICABLE

N: CONTROL
DR = DIRECT DISPLACEMENT CONTROL, RIGHT SIDE
DL = DIRECT DISPLACEMENT CONTROL, LEFT SIDE

► = Non-Standard

*All pressure settings above are nominal set pressure at factory test conditions. Actual pressures will vary due to actual conditions.

M23 Tandem Pump -- PT
(Consolidated Series 40 Model Code)



PRODUCT
MPT = MEDIUM DUTY, PUMP, TANDEM

DISPLACEMENT (PER SECTION)
023 = 23 CC/REV (1.4 CU. IN./REV)

TYPE
C = CLOSED CIRCUIT

E: INPUT SHAFT
S = 13T 16/32P SPLINE
► C = 1 IN. DIA TAPERED, 1.5 IN./FT.
► K = .875 IN. DIA STR KEY

F: ROTATION
R = CW
L = CCW

G: CHARGE PUMP DISPLACEMENT
A = NONE

H: CHARGE PRESSURE RELIEF VALVE SETTING*
F = 7.0 BAR (100 PSI)

J: FILTRATION
AA = SUCTION

C: SWASHPLATE GROUP
B = STANDARD

D: SEAL GROUP
A = SHAFT SEAL FOR DIRECT DISPL. CONT-**FRONT SECTION**
C = SHAFT SEAL FOR DIRECT DISPL. CONT—**REAR SECTION**

K: DISPLACEMENT
A = FULL DISPLACEMENT

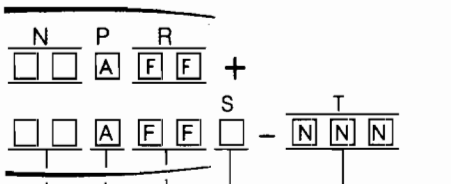
L: BYPASS VALVE
N = NONE

M: SYSTEM PRESSURE PROTECTION*

	PROTECTION	
TYPE	PORT "A" or "C"	PORT "B" or "D"
A =	NONE	NONE
B =	PRESS. RELIEF	PRESS. RELIEF
C =	PRESS. RELIEF	NONE
D =	NONE	PRESS. RELIEF

SETTINGS (SELECT FOR PORT "A" & "B" AND "C" & "D")
A = NONE
M = 140 BAR (2030 PSI)
B = 175 BAR (2540 PSI)
D = 210 BAR (3045 PSI)
F = 250 BAR (3625 PSI)
G = 280 BAR (4060 PSI)
J = 345 BAR (5000 PSI)

M23 Tandem Pump -- PT (Continued)



T: SPECIAL HARDWARE FEATURES
NNN = NONE

S: AUXILIARY MOUNTING PAD
A = SAE "A" 9T SPLINE
Note - Permanent cover provided on all units for use when no auxiliary pump is required.

R: CONTROL ORIFICE DIA

SUPPLY	DRAIN
F = NONE	F = NONE

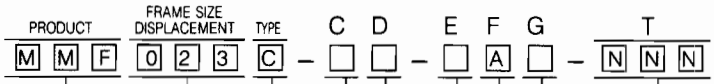
P: HANDLE POSITION
A = NOT APPLICABLE (EDC OR HDC OR DDC)

N: CONTROL
DR = DIRECT DISPLACEMENT CONTROL, RIGHT SIDE
DL = DIRECT DISPLACEMENT CONTROL, LEFT SIDE

► = Non-Standard

*All pressure settings above are nominal set pressure at factory test conditions. Actual pressures will vary due to actual conditions.

M23 Fixed Displacement Motor -- MF (Consolidated Series 40 Model Code)



PRODUCT
MMF = MEDIUM DUTY, MOTOR, FIXED

DISPLACEMENT
023 = 23 CC/REV (1.4 CU. IN./REV)

TYPE
C = CLOSED CIRCUIT

C: SEAL GROUP
A = SHAFT SEAL
► B = SHAFT SEAL & SEAL FOR AUXILIARY DRIVE SHAFT

D: OUTPUT SHAFT/AUXILIARY DRIVE CONFIGURATION
A = 13T 16/32P SPLINE/NONE
► B = 13T 16/32P SPLINE/9T 16/32P SPLINE
► N = 1 IN. DIA TAPERED, 1.5 IN./FT./NONE
► S = .875 IN. DIA STR KEY/NONE

E: END CAP
B = AXIAL PORTS
G = RADIAL (TWIN) PORTS
► H = RADIAL (TWIN) PORTS W/AUXILIARY DRIVE

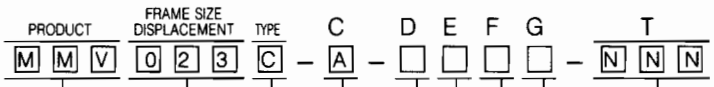
F: CYLINDER BLOCK GROUP
A = STANDARD BLOCK ASSEMBLY

G: BYPASS VALVE
B = NO BYPASS VALVE
► Y = WITH BYPASS VALVE

T: SPECIAL HARDWARE FEATURES
NNN = NONE

► = Non-Standard

M23 Variable Displacement Motor -- MV
(Consolidated Series 40 Model Code)



PRODUCT
MMV = MEDIUM DUTY, MOTOR, VARIABLE

DISPLACEMENT
023 = 23 CC/REV (1.4 CU. IN./REV)

TYPE
C = CLOSED CIRCUIT

C: SEAL GROUP
A = SHAFT SEAL

D: OUTPUT SHAFT
A = 13T 16/32P SPLINE
► J = 1 IN. DIA TAPERED, 1.5 IN./FT

E: MINIMUM DISPLACEMENT
B = 7 DEGREE SWASHPLATE ANGLE, 9 CC/REV (.57 CU. IN./REV)
F = 9 DEGREE SWASHPLATE ANGLE, 12 CC/REV (.73 CU. IN./REV)
K = 12 DEGREE SWASHPLATE ANGLE, 16 CC/REV (.98 CU. IN./REV)

F: CONTROL FEATURES

	CONTROL TRUNNION LOCATION
L =	LEFT SIDE
R =	RIGHT SIDE

G: HOUSING/END CAP CONFIGURATION
R = END CAP-RADIAL (TWIN) PORTS W/O BYPASS VALVE
► Y = END CAP-RADIAL (TWIN) PORTS W/ BYPASS VALVE

T: SPECIAL HARDWARE FEATURES
NNN = NONE

► = Non-Standard

Description Page

SAUER DANFOSS

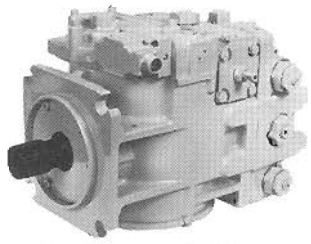
Hydraulic Power Systems

SAUER-SUNDSTRAND Hydraulic Power Systems - Market Leaders Worldwide

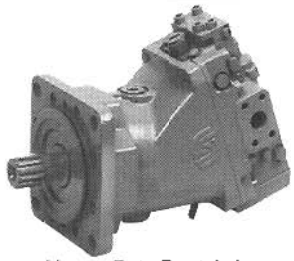
SAUER-SUNDSTRAND is a world leader in the design and manufacture of Hydraulic Power Systems. Research and development resources in both North America and Europe enable SAUER-SUNDSTRAND to offer a wide range of design solutions utilizing hydraulic power system technology.

SAUER-SUNDSTRAND specializes in integrating a full range of system components to provide vehicle designers with the most advanced total-design system.

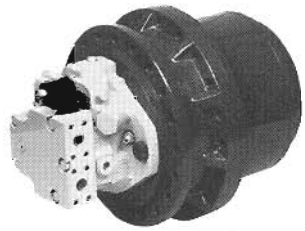
SAUER-SUNDSTRAND is Your World Source for Controlled Hydraulic Power Systems.



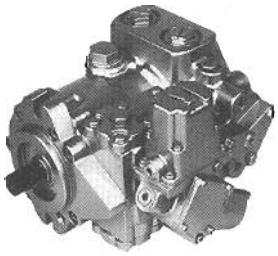
Heavy Duty Axial Piston Pumps and Motors



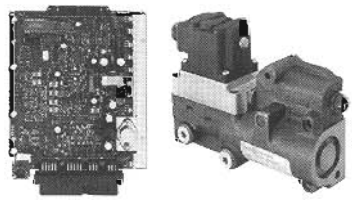
Heavy Duty Bent Axis Variable Motors



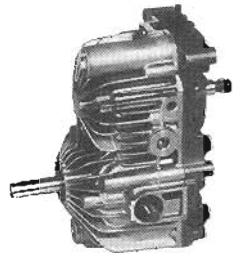
Cartridge Motors/ Compact Wheel Drives



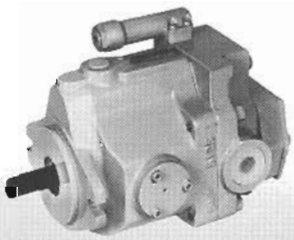
Medium Duty Axial Piston Pumps and Motors



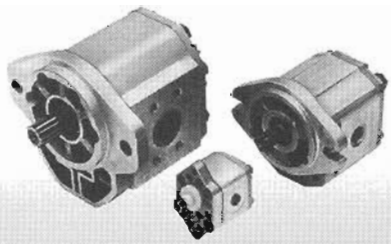
Microcontrollers and Electrohydraulic Controls



Hydrostatic Transmission Packages



Open Circuit Axial Piston Pumps



Gear Pumps and Motors

Genuine Service Parts

Worldwide Service Support

SAUER-SUNDSTRAND provides comprehensive worldwide service for its products through an extensive network of Authorized Service Centers strategically located in all parts of the world.

Look to SAUER-SUNDSTRAND for the best in WORLDWIDE SERVICE.

SAUER DANFOSS

SAUER-SUNDSTRAND COMPANY
2800 East 13th Street • Ames IA 50010 • U.S.A.
Telephone: (515) 239-6000 • Telefax: (515) 239-6318
Telex: 9105201150

SAUER-SUNDSTRAND GMBH & CO.
Krokamp 35 • D-2350 Neumünster • Germany
Telephone: (04321) 871-0 • Telefax: (04321) 871122
Telex: 299708 • Teletex: 432119

BLN-9986, Rev. B
August, 1992