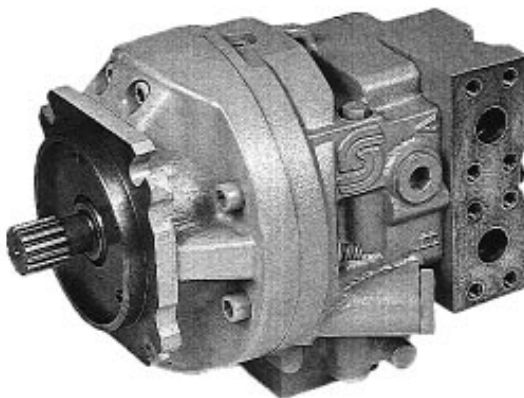
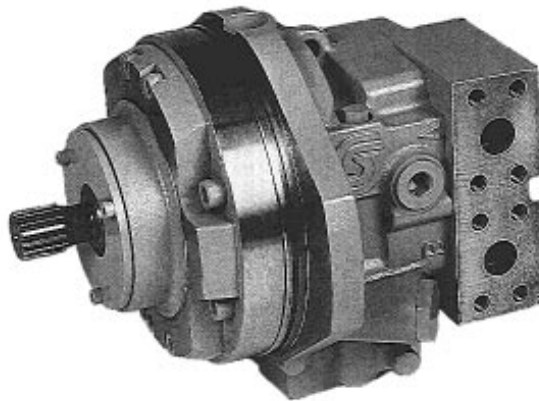


Series 90



Axial Piston

Pumps and Motors

Service Instructions



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General

Minor Repairs may be performed, following the procedures in this document, 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.

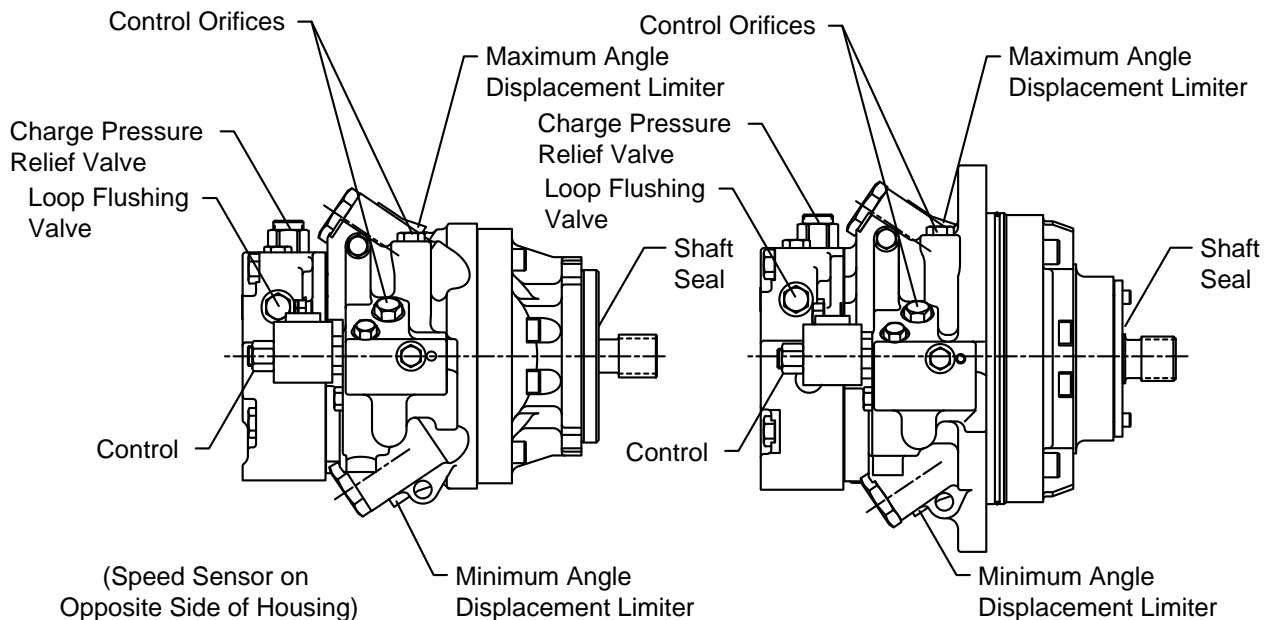
Protect all exposed sealing surfaces and open cavities from damage and foreign material.

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.

Safety Precautions

- When Series 90 units are used in vehicular hydrostatic drive systems, the loss of hydrostatic drive power in any mode (forward, reverse, or "neutral" 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 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.



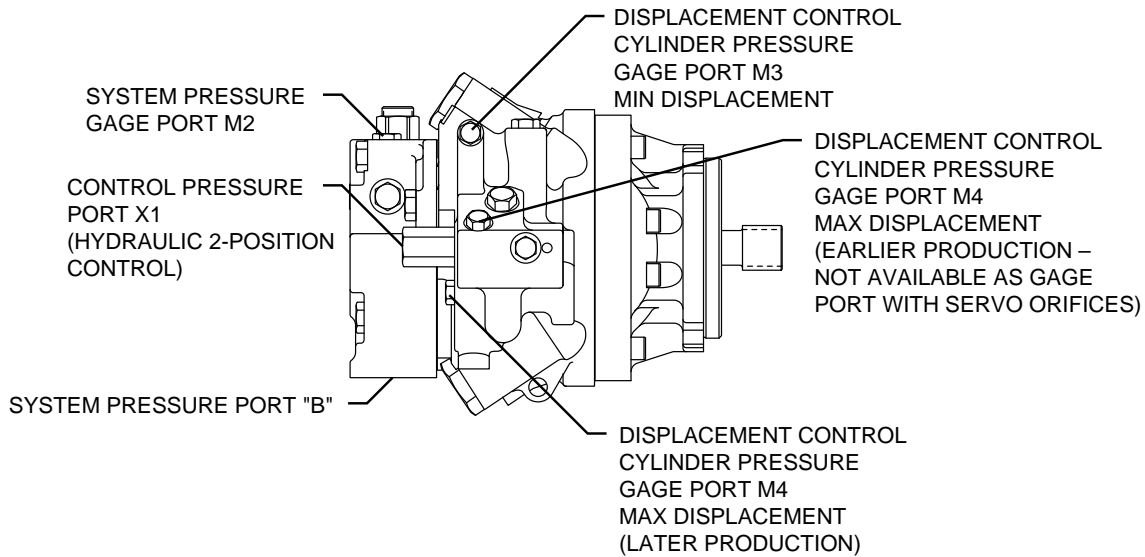
SAE Flange Version

Cartridge Flange Version

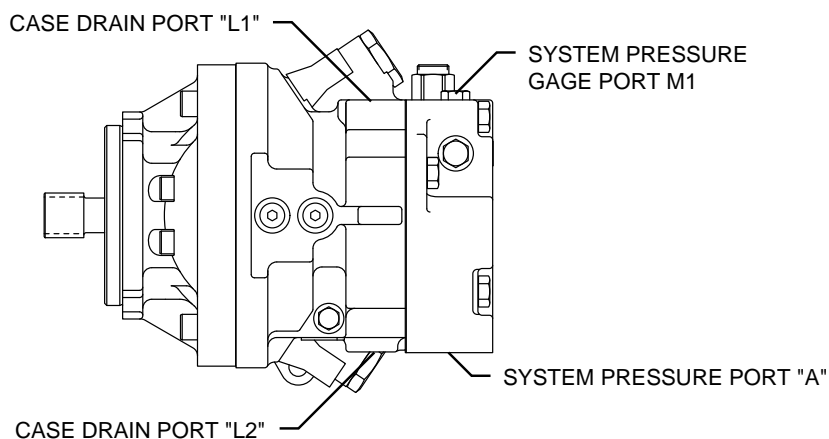
Gauge Installation

M1	System Pressure Port "A"	600 bar or 10 000 psi Gauge 9/16 — 18 O-Ring Fitting
M2	System Pressure Port "B"	600 bar or 10 000 psi Gauge 9/16 — 18 O-Ring Fitting

M3	Disp. Cylinder Pressure Min Disp.	60 bar or 1000 psi Gauge 7/16 — 20 O-Ring Fitting
M4	Disp. Cylinder Pressure Max Disp.	60 bar or 1000 psi Gauge 7/16 — 20 O-Ring Fitting
"L1"	Case Pressure	60 bar or 1000 psi Gauge 1-1/16 — 12 O-Ring Fitting
"L2"	Pressure	



LEFT SIDE VIEW
SAE FLANGE VERSION WITH HYDRAULIC 2- POSITION CONTROL
CARTRIDGE FLANGE VERSION SIMILAR



RIGHT SIDE VIEW
SAE FLANGE VERSION
CARTRIDGE FLANGE VERSION SIMILAR

1 – Shaft Seal Replacement

Lip type shaft seals are used on the Series 90 variable motors. These seals can be replaced without major disassembly of the unit.

Replacement of the shaft seal generally requires removal of the motor from the machine.

Remove the O-ring (item P800) from the pilot of cartridge motors.

Remove the screws (item L70) holding the retainer plate (item L60) and seal carrier (item L30) [or the one-piece retainer and seal carrier (item L35) for early production 075 frame size units] to the housing.

After removing the screws, the seal carrier may move out of its bore approximately 6 mm (1/4 in.) due to the cylinder block spring force on the shaft. If the seal carrier does not move out after removing the screws, pry it from its bore and/or lightly tap the end of the shaft with a soft mallet until the seal carrier can be removed from the housing.

NOTE: After the seal carrier is removed, the shaft and bearing assembly are free in the housing. Do not remove shaft unless unit is positioned with the mounting flange UP. If the unit is positioned horizontally when the shaft is removed, the cylinder block could move out of place, making shaft installation difficult.

Remove the O-ring (item L50) from the seal carrier.

Place the seal carrier in an arbor press and press out the old seal (item L40). Once removed, the seal is not reusable.

Inspect the seal carrier, 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.

Press a new seal into the seal carrier from the shaft bearing side. Be careful not to damage seal.

NOTE: The outside diameter of the new seal may be 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 grease or petroleum jelly.

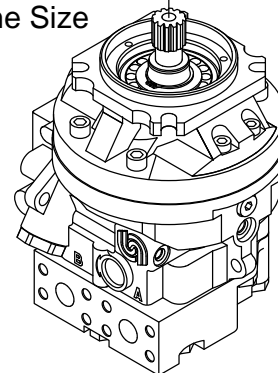
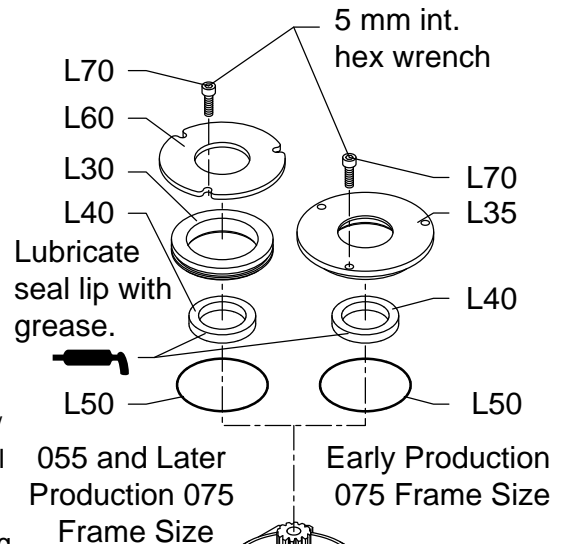
Install the O-ring onto the seal carrier and lubricate with petroleum jelly.

Slide the seal carrier assembly over the shaft and into the housing bore. Install the retainer plate (not used on early production 075 frame size units).

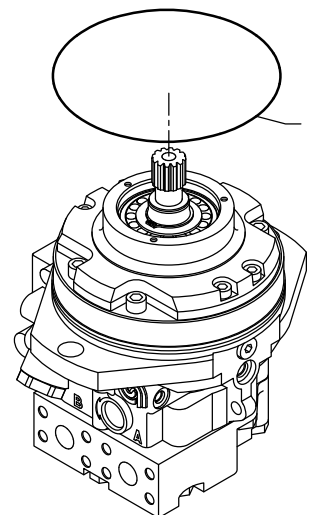
Install the screws and torque evenly to avoid damaging the carrier O-ring.

Install a new O-ring on the pilot of cartridge motors.

Torque for item L70: 13.6 Nm (10 lbs•ft)
[16.3 Nm (12 lbs•ft) for grade 12.9 screws]



SAE Flange Version



Cartridge Version

2 – Charge Relief and Loop Flushing Valve

Loop Flushing Valve

Remove the special hex plugs (item H50W) from both sides of the motor end cap. Remove the O-rings (item H40W) from the plugs.

Remove the loop flushing valve springs (item H30W), shoulder washers (item H20W), and the loop flushing valve spool (item H10W) from the end cap. Note the orientation of the stepped washers.

Inspect the parts for damage or foreign material,

Install the loop flushing valve spool into the end cap. Install the shoulder washers (the shoulder should face OUT, toward each valve spring) and the valve springs. Install new O-rings on the spool bore plugs, and install the plugs in the end cap. Torque the plugs as indicated.

Charge Pressure Relief Valve

Before removing the screw adjustable relief valve, mark the plug, lock nut, and end cap so as to be able to maintain the original pressure adjustment when reassembling the valve.

Loosen the lock nut (item H68W) and unscrew the adjusting plug (item H60W) with a large screwdriver. Remove the O-ring (item H62W) from the plug.

Remove the spring (item H64W) and poppet (item H66W).

Inspect the poppet and the mating seat in the end cap for damage or foreign material.

Install the poppet and spring into the end cap. Install the adjusting plug with a new O-ring and install the lock nut. Align the marks made at disassembly, and torque the lock nut.

Check, and adjust if necessary, the charge pressure before putting the motor into service.

One full turn of the adjusting plug will change the charge pressure by approximately 3.4 bar (50 psi).

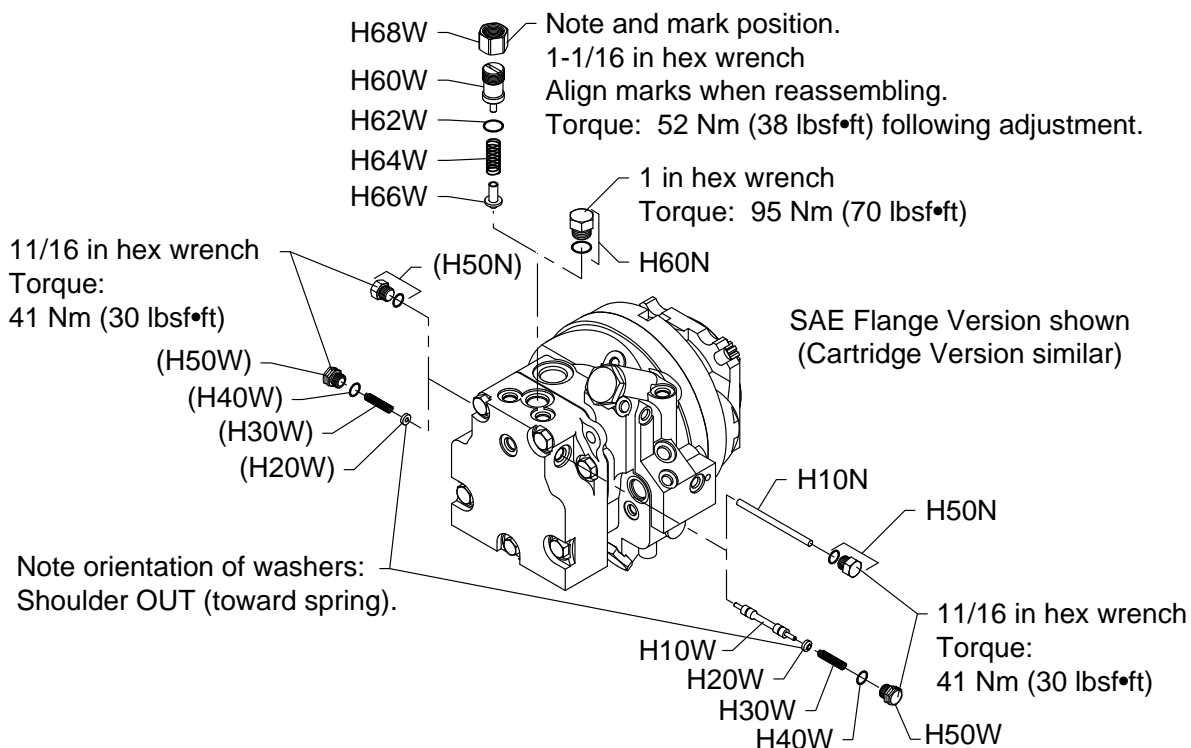
Defeating Loop Flushing

Remove the loop flushing valve from the end cap.

Install the defeat spool (item H10N) into the spool bore in the end cap. Install the plain plugs with O-rings (item H50N) into the end cap, and torque.

Remove the charge relief valve (these parts are not necessary).

Install the plain hex plug with O-ring (item H60N) into the end cap, and torque.



Limiters

Remove the tamper-resistant cap (item E15) from the displacement limiter. Loosen the seal lock nut (item E35) and remove the nut and the limiter screw (item E25 or E26) from the motor housing.

Install the limiter screw and seal lock nut. Do not install a new tamper-resistant cap until the limiter has been adjusted.

The displacement limiter should be initially adjusted so the motor swashplate contacts the limiter screws BEFORE it contacts the internal stops. Hold the swashplate in its maximum or minimum angle position and turn the appropriate limiter screw clockwise until it contacts the swashplate. Then turn the screw an additional 1/4 turn clockwise and tighten the seal lock nut.

Final adjustment of the displacement limiters should be performed on a test stand. **DO NOT TURN THE LIMITER SCREWS COUNTERCLOCKWISE PAST THEIR INITIAL ADJUSTMENT POSITIONS.**

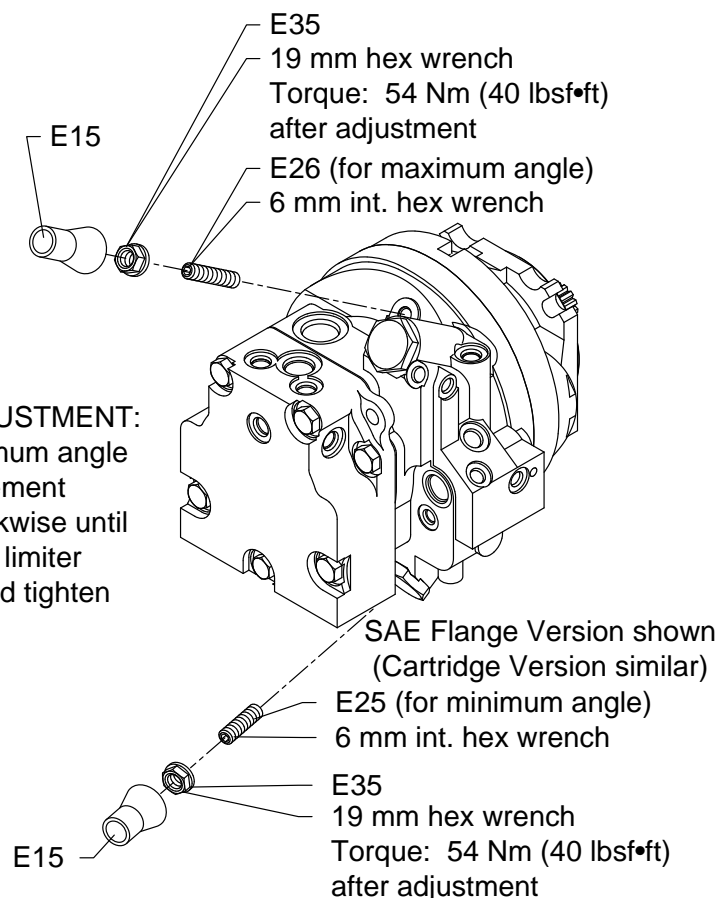
WARNING

Care should be taken in adjusting displacement limiters to avoid undesirable speed conditions. The seal lock nut must be retorqued after every adjustment to prevent an unexpected change in operating conditions and to prevent external leakage during unit operation.

One full turn of the displacement limiter adjustment screw will change the displacement of the 055 frame size motor by approximately 5.6 cc / revolution (0.34 in³ / revolution).

One full turn of the displacement limiter adjustment screw will change the displacement of the 075 frame size motor by approximately 7.1 cc / revolution (0.43 in³ / revolution).

Following the final adjustment, install new tamper resistant caps.



INITIAL DISPLACEMENT LIMITER ADJUSTMENT: Hold swashplate in its maximum or minimum angle position and turn the appropriate displacement limiter screw (item E25 or item E26) clockwise until it contacts the swashplate. Then turn the limiter screw an additional 1/4 turn clockwise and tighten the seal lock nut (item E35).

Controls

Electrohydraulic 2-Position Control (Types NA, NB, NC, and ND)

Thoroughly clean external surfaces prior to removal of the control.

Disconnect the external electrical signal connection. Remove the hex nut and solenoid from the control valve (item M1NX). Remove the orifice check valve for the maximum angle control cylinder (items Y70, Y71, and Y72), if equipped. Remove the control valve from the motor housing. Remove the O-ring from the valve.

Remove the housing plugs (items P400, P402, P600, P602, P700, and P702) if necessary. Install new O-rings, reinstall, and torque as indicated.

Install a new O-ring on the control valve. Install the valve into the motor housing and torque.

Over-torquing the control valve may result in the valve spool sticking. **DO NOT OVER-TORQUE THE CONTROL VALVE.**

Install the solenoid onto the valve and torque the hex nut. **DO NOT OVER-TORQUE THE NUT.** If previously removed, reinstall the orifice check valve. Reconnect the external electrical signal connection.

Hydraulic 2-Position Control (Type PT)

Thoroughly clean external surfaces prior to removal of the control.

Disconnect the external hydraulic signal line. Remove the orifice check valve for the maximum angle control cylinder (items Y70, Y71, and Y72), if equipped. Remove the control valve (item M1PT) from the motor housing. Remove the O-ring from the valve.

Remove the housing plugs (items P400, P402, P600, P602, P700, and P702) if necessary. Install new O-rings, reinstall, and torque as indicated.

Install a new O-ring on the control valve. Install the valve into the motor housing and torque.

Over-torquing the control valve may result in a stuck valve spool. **DO NOT OVER-TORQUE THE CONTROL VALVE.**

If previously removed, reinstall the orifice check valve. Reconnect the external signal line.

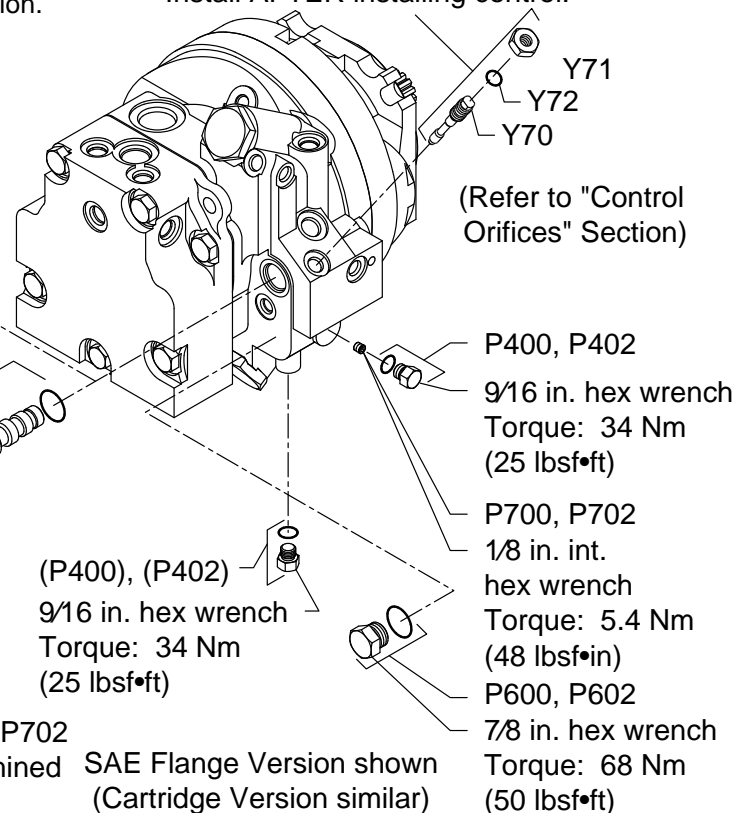
1 in. hex wrench
Torque: 47 Nm (35 lbf•ft)
DO NOT OVER-TORQUE!

M1PT
Control Port X1
Torque for mating fitting:
20 Nm (15 lbf•ft)

11/16 in. hex wrench
Torque: 6.8 Nm (60 lbf•in)
DO NOT OVER-TORQUE!

Items P400, P402, P600, P602, P700, and P702 are used only with housings which are machined for the pressure compensator option.

Remove **BEFORE** removing control.
Install **AFTER** installing control.



Control Orifices

Control Cylinder Drain Orifice or Orifice Check Valves

Remove the minimum angle control cylinder drain orifice (item Y100 or Y101) or the orifice check valve (item Y102) from the motor housing. Remove the O-ring (item Y40).

Remove the O-ring (item Y60) and the backup washers (item Y50). Check that the orifice is not plugged. Check that the check valve seat is secure in the body and that the check ball is free.

Install new backup washers and O-rings onto the orifice body. Install the orifice into the motor housing and torque.

Remove the seal lock nut (item Y71) and the maximum angle control cylinder orifice check valve (item Y70) from the motor housing. Remove the O-ring (item Y72). The check ball in the valve must be free.

Reinstall the check valve and torque. Install a new O-ring. Install the seal lock nut with the seal toward the motor housing. Hold the check valve from turning while torquing the seal lock nut.

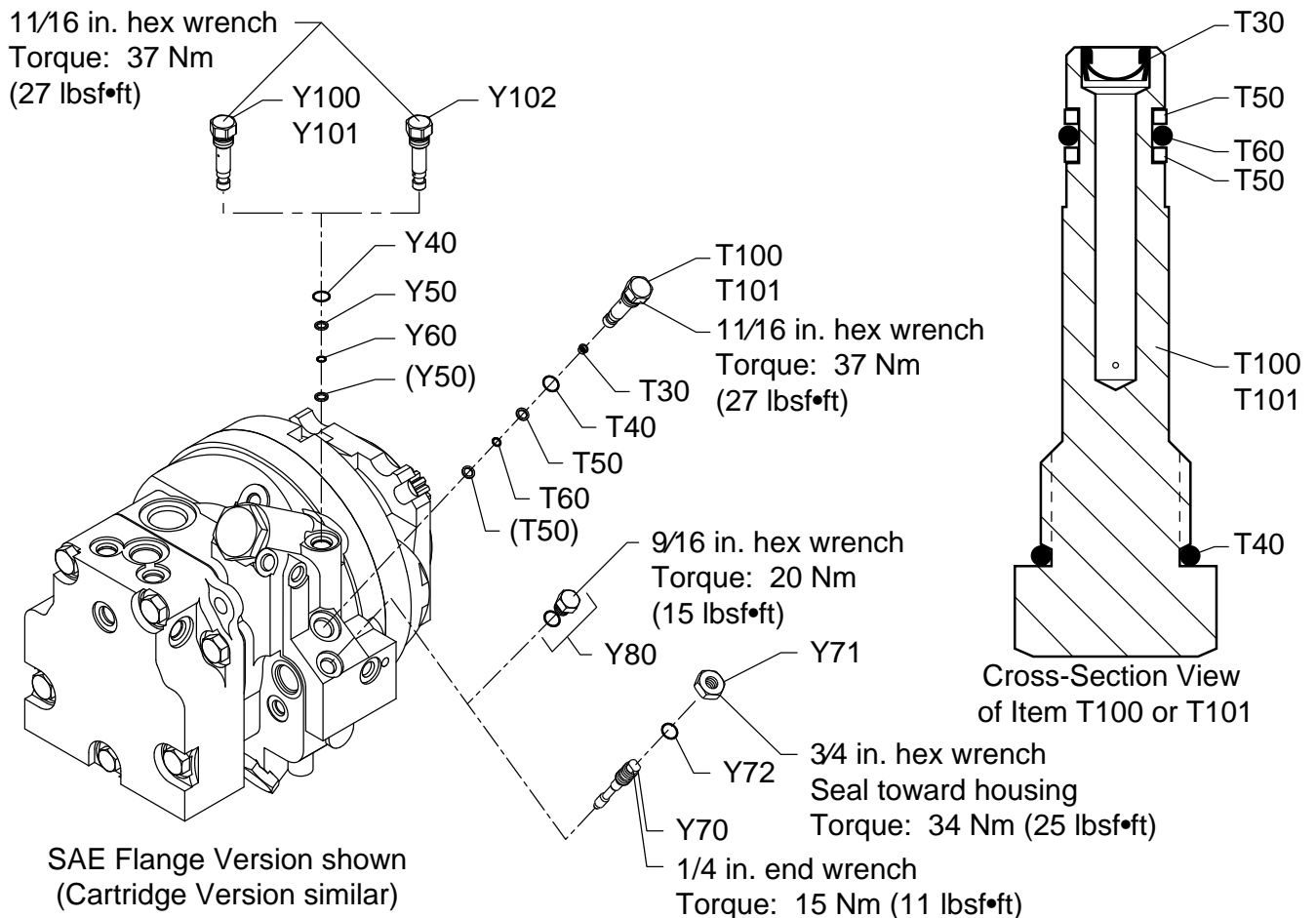
If no orifice check valve is installed, remove the plug (item Y80) and its O-ring. Install a new O-ring. Reinstall the plug and torque as indicated.

Control Supply Orifice

Remove the control supply orifice (item T100 or T101) from the motor housing. Remove the O-ring (item T40).

Remove the O-ring (item T60) and the backup washers (item T50). Check that the filter screen (item T30) is secure in the orifice body and that the screen and the orifice are not plugged.

Install new backup washers and O-rings onto the orifice body. Install the orifice into the motor housing and torque.



Speed Sensor

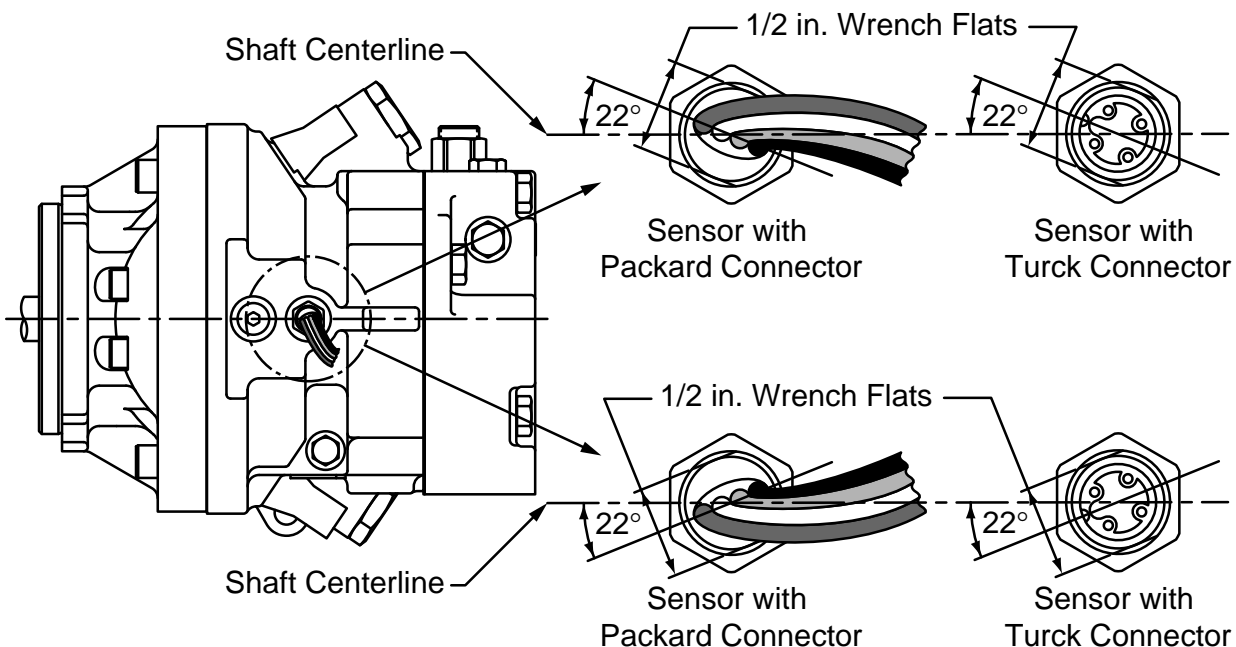
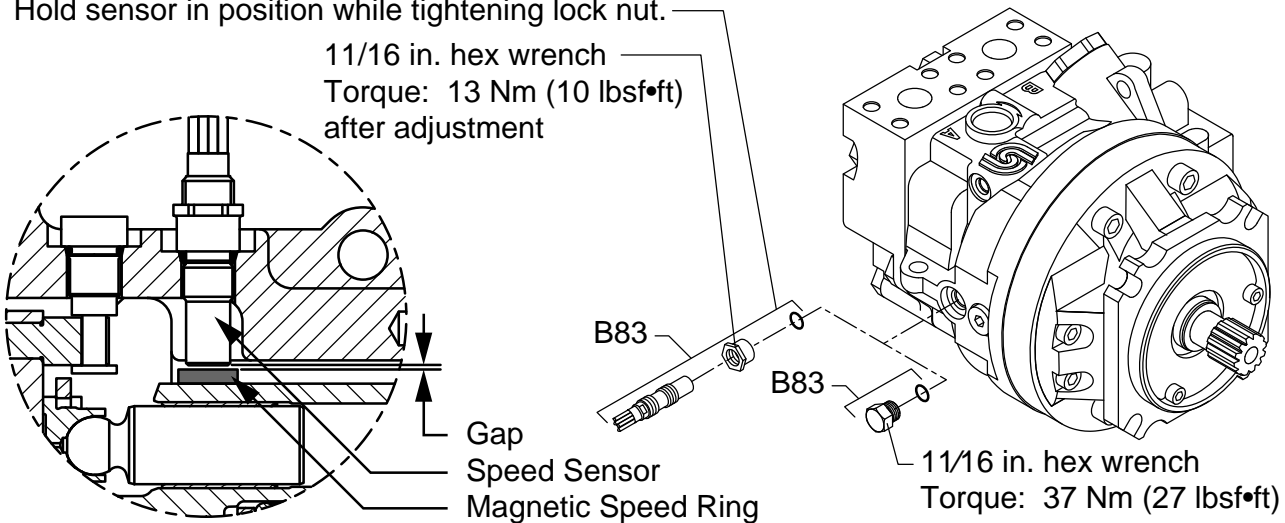
Remove the speed sensor (item B83) by disconnecting the electrical connector, loosening the lock nut, and unscrewing the speed sensor from the motor housing.

Always install a new O-ring before installing the sensor.

Reinstall the speed sensor (with lock nut and O-ring) into the housing. Adjust the gap between the sensor and the magnetic speed ring as instructed below and torque the sensor lock nut.

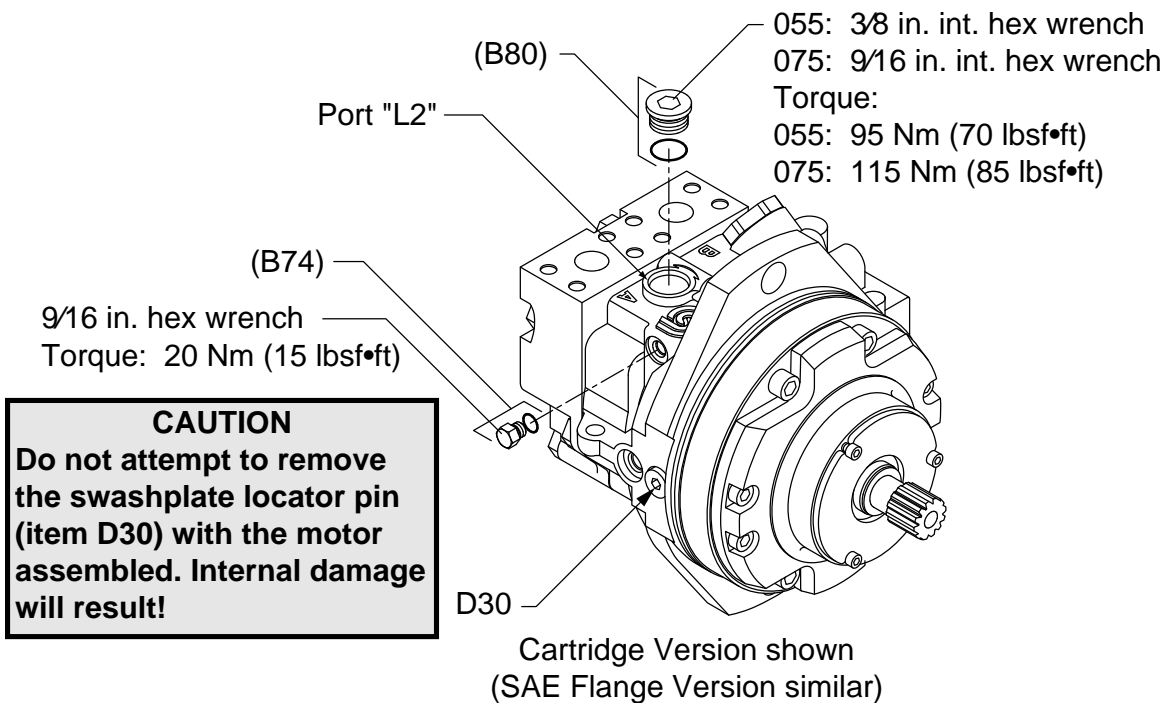
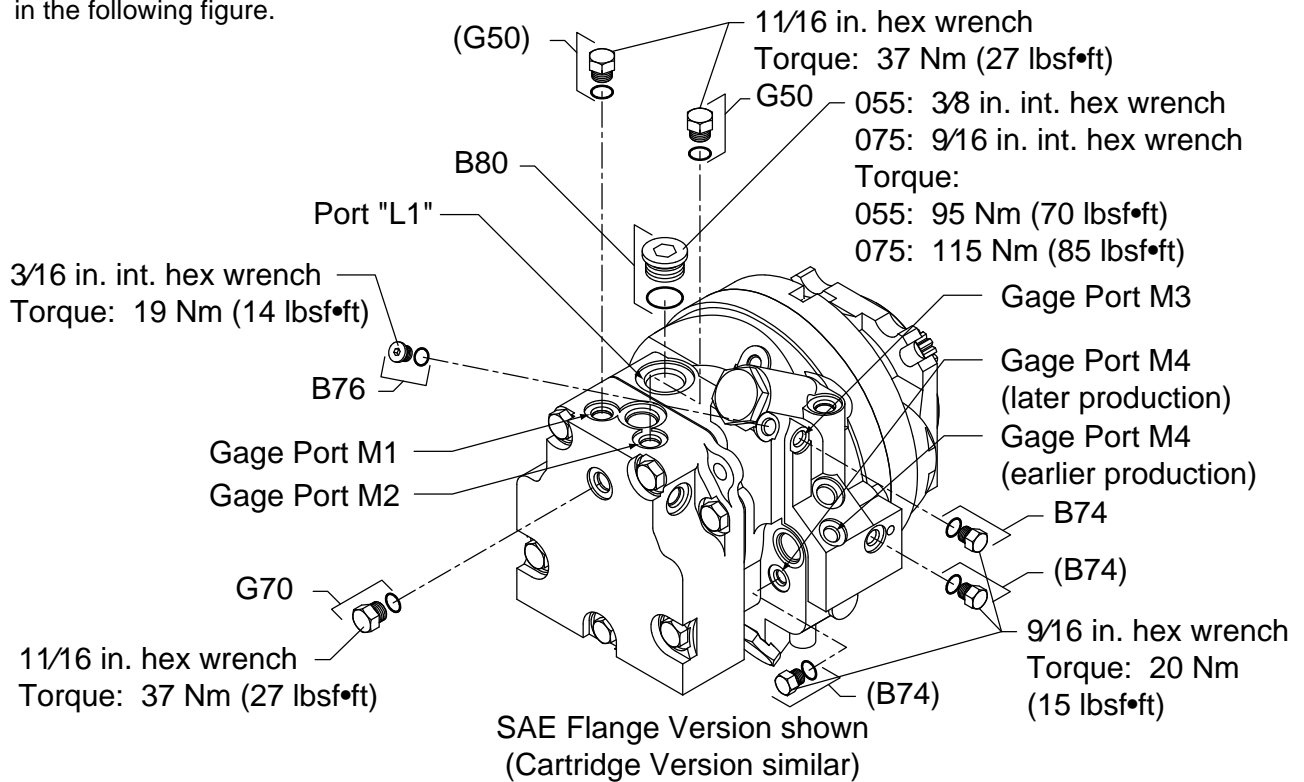
If a speed sensor is not installed, the housing plug (item B83) should be torqued as indicated in the accompanying figure.

Turn sensor clockwise (CW) by hand until it contacts speed ring.
Turn counterclockwise (CCW) 1/2 turn to establish nominal gap of 0.71 mm (0.028 in.).
Then turn clockwise (CW) until wrench flats on sensor body are positioned at a 22° angle to the motor shaft center line, as shown below. (Many adjustable wrenches have a 22° handle offset.)
Hold sensor in position while tightening lock nut.



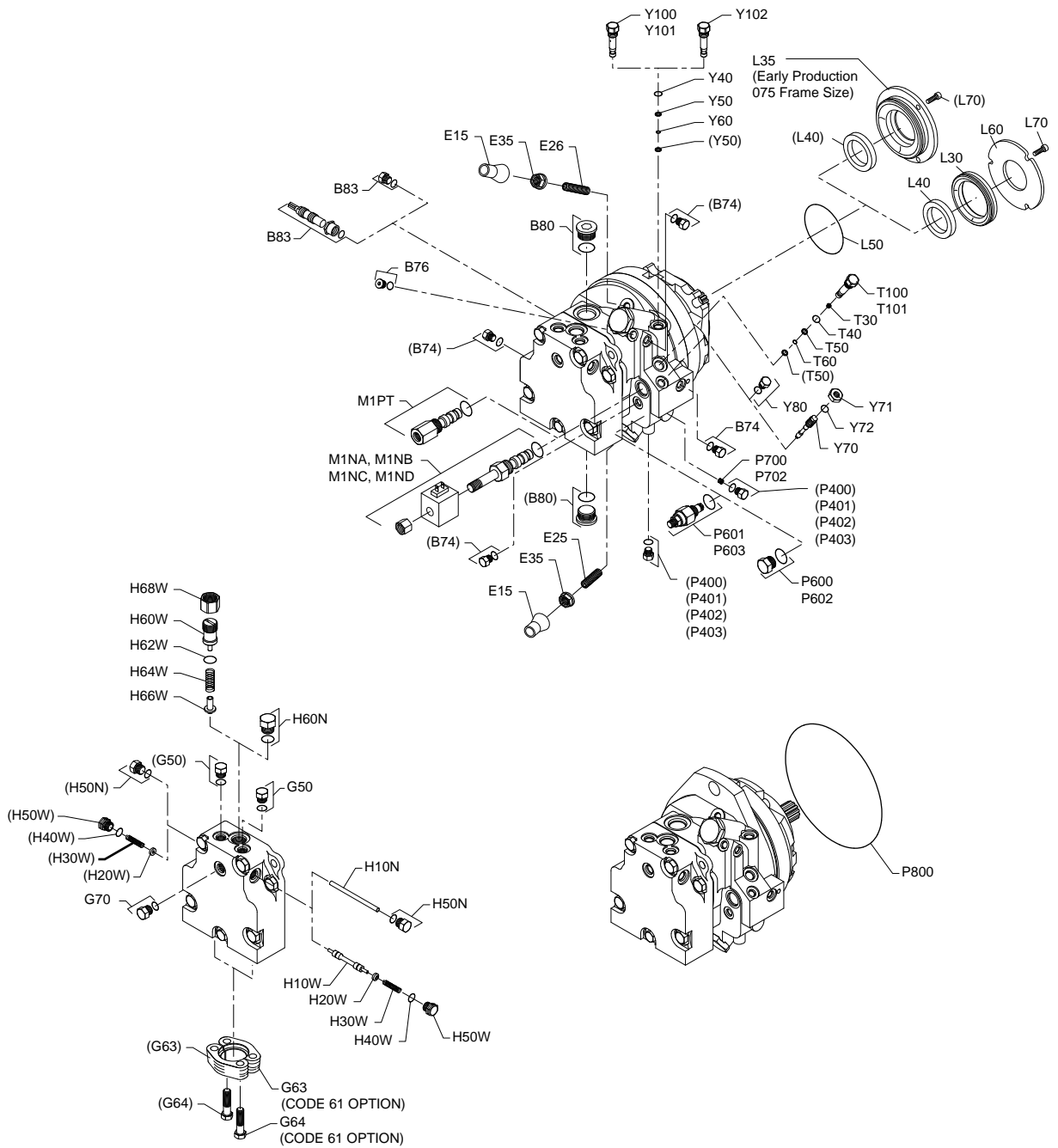
Plug and Fitting Torques

If any plugs or fittings are removed from the unit during servicing, they should be torqued as indicated in the following figure.



CAUTION
 Do not attempt to remove the swashplate locator pin (item D30) with the motor assembled. Internal damage will result!

Exploded View



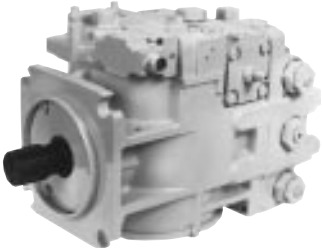


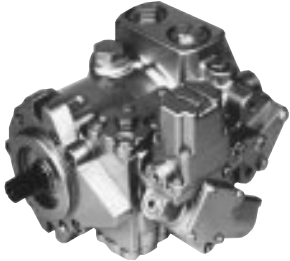
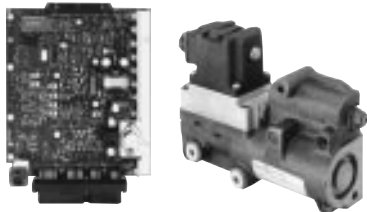
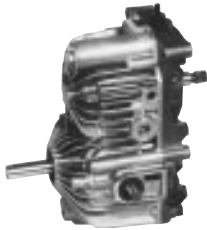

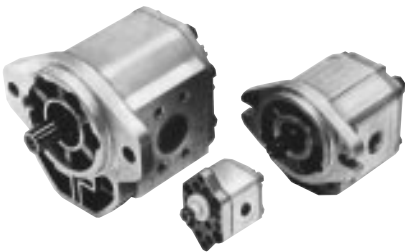

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