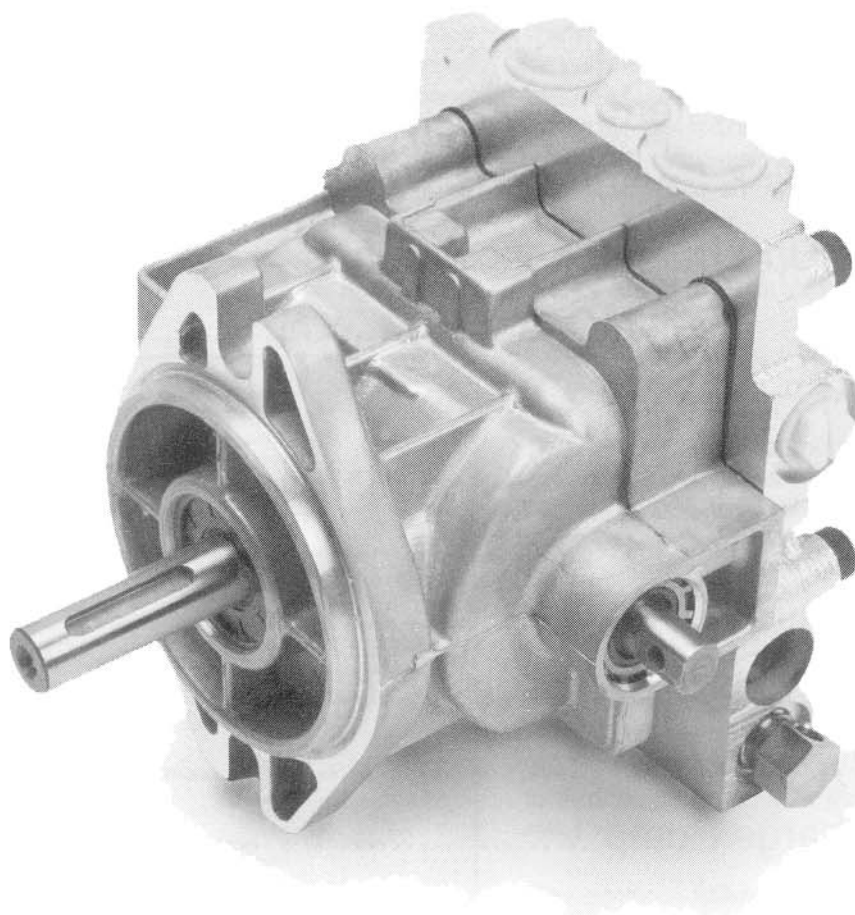


We set the wheels in motion.



BDP-10L

Hydrostatic Pump

Service and Repair Manual

BLN-50231
Revision Oct. 2000

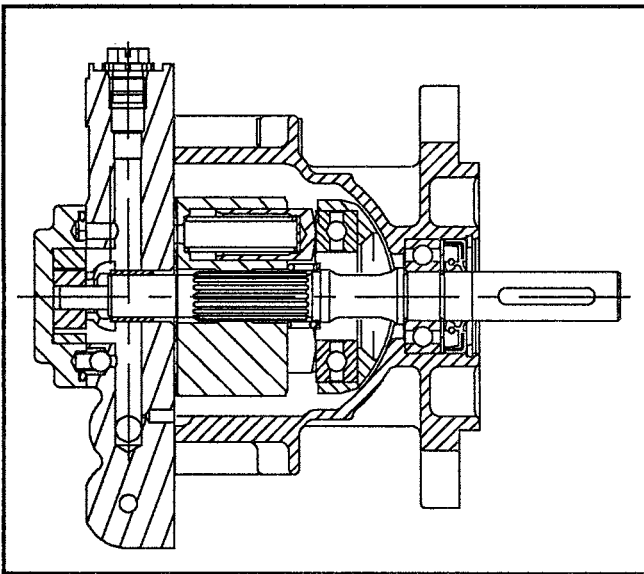
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Introduction

The purpose of this manual is to provide information useful in servicing the Bantam Duty Hydrostatic Pumps. This manual includes unit and component description, troubleshooting, minor repair procedures, and major repair procedures.

A pump normally will not require servicing during the life of the vehicle or machine in which it is installed. Should servicing be required, some repairs 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.



BDP-10L Pump

General Description

The BDP pumps can be combined with motors and other remotely located units. When used in this manner, these units provide an infinitely variable speed range between zero and maximum in both forward and reverse modes of operation.

The BDP-10L is a variable displacement pump designed for vehicle applications where up to six horsepower is required for the propel function, or for auxiliary functions where the system pressure requirements and design life can be met within the pump rating. This variable displacement pump has a maximum displacement of 0.61 in³/rev (10 cc/rev).

Pumps are of the axial piston design, utilizing spherical nosed pistons. A compression spring, located inside each piston, holds the nose of the piston against a thrust bearing race.

The variable displacement pump features a cradle swashplate with a direct-proportional displacement control. 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 fixed displacement gerotor charge pump is provided in the BDP-10L units. Oil from an external reservoir and filter is pumped into the closed loop by a charge pump. Fluid not required to replenish the closed loop flows either into the pump housing through a cooling orifice, or back to the charge pump inlet through the charge pressure relief valve.

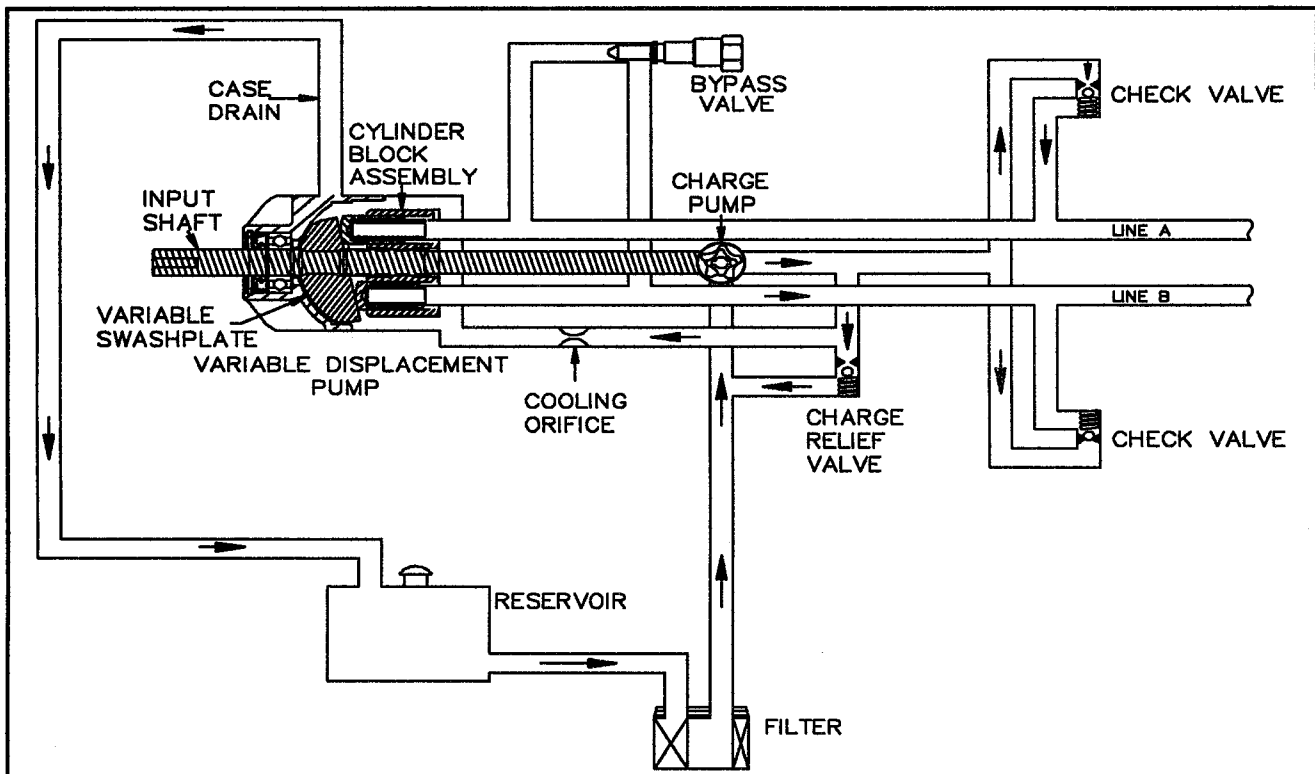
Charge check valves are included in the pump end cap to control the makeup oil flow for the system.

A screw type bypass valve is utilized in the pumps to permit movement of the machine for short distances at low speeds without starting the engine.

Transmission Hydraulic Support System

The charge pump incorporated into the BDP-10L units supplies fluid to keep the closed loop charged, preventing cavitation and providing cooling oil flow for the system. An inlet filter is required to insure that only clean fluid enters the system. The charge relief valve is designed to maintain the charge pressure at 25 to 70 PSI at 3600 RPM input speed.

Since either of the main hydraulic passages can be at high pressure, two (2) charge check valves are used to direct make-up fluid into the low pressure side of the closed loop. These check valves are located in the pump end cap.



BDP-10L Hydraulic Flow Illustration

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.

Controls and Features

Direct Displacement Control

The direct-proportional displacement control (DDC) provides a simple method of control. Movement of the swashplate control shaft produces a proportional swashplate movement and change in pump flow and/or direction.

If difficulties are encountered with the control, inspect the connection of the control linkage to the swashplate control shaft to insure that the linkage is properly attached. The vehicle/machine control system determines the neutral position of the linkage.

Charge Pumps

A fixed displacement gerotor type charge pump is provided as part of the BDP-10L.

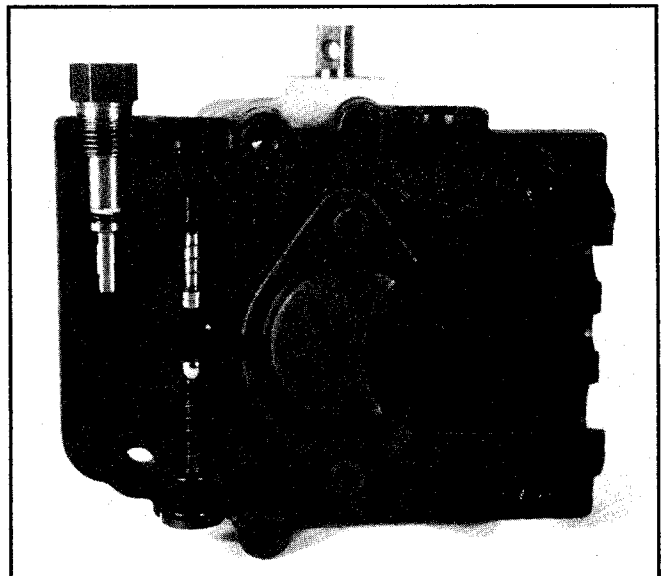
Bypass Valve

In some applications, it is desirable to move the machine for short distances at low speeds without operating the engine. A bypass valve allows oil to be routed from one side of the pump/motor circuit to the other, thus allowing the motor to turn with little resistance.

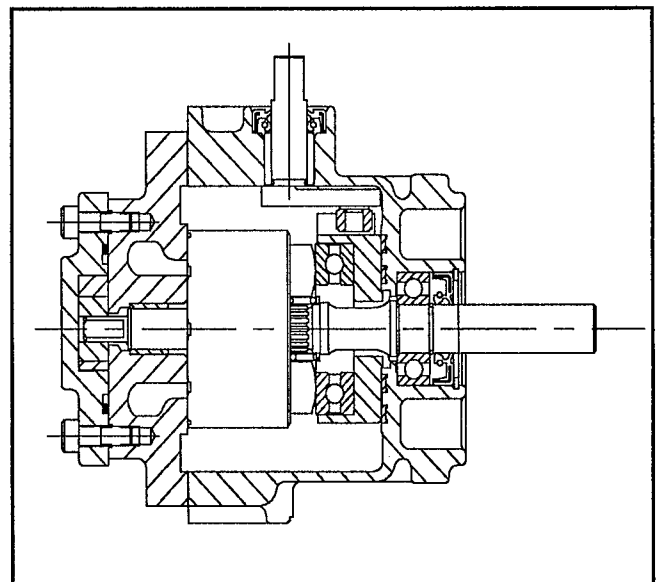
The BDP variable pumps utilize a screw type bypass valve which is fully open when unscrewed two (2) turns maximum. The bypass valve must be fully closed during normal vehicle operation.

WARNING

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



BDP-10L Variable Pump with Charge Pump



BDP-10L Pump

Start-Up & Maintenance

Fluids

Fluids used with Hydro-Gear products should be carefully selected with assistance from a reputable supplier.

Typically, an API classification SG/CD engine oil is used with a viscosity range equivalent to 20W50.

Start-Up Procedure

The following start-up procedure should always be followed when starting a new installation or when restarting an installation in which the BDP 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 starting the BDP, make certain all system components (reservoir, fittings, etc.) are clean prior to filling with fluid.

Be certain to fill the BDP housing with clean fluid prior to start-up. Fill the housing by pouring filtered oil into the upper case drain port, if possible.

Fill the reservoir with recommended fluid which should be filtered prior to entering the reservoir.

The inlet line and filter leading from the reservoir to the charge 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.

Pressurizing the inlet 2-4 PSI will aid in start-up. "Jog" or slowly rotate the engine with the swashplate in its neutral (0 angle) position until charge pressure starts to rise (charge pressure is defined as low side loop pressure).

WARNING

Do not start engine unless pump is in the neutral position (0 swashplate angle) or the drive wheels are off the ground.

Start the engine and run at the lowest possible RPM.

With the bypass valve closed, slowly move the displacement control in both the forward and reverse directions. As air is purged from the unit, the oil level in the reservoir will drop and bubbles may appear in the fluid. Refill the reservoir as necessary.

Place the displacement control in the neutral position and open the bypass valve. Slowly move the displacement control in both the forward and reverse directions to purge the air from the closed circuit.

Close the bypass valve and run the unit in both directions for several minutes until any remaining air is purged from the unit. Refill the reservoir as necessary.

Shut down the engine, check for and correct any fluid leaks, and check the reservoir level. Add fluid if necessary. The transmission is now ready for operation.

Maintenance

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).

The BDP-10L units normally do not require regular fluid changes. The system filter should be changed per the vehicle/machine manufacturer's recommendations. The fluid and filter should be changed and the system cleaned if the fluid becomes contaminated with foreign matter (water, dirt, grease, etc.) or if the fluid has been subjected to temperature levels greater than the maximum recommended.

Troubleshooting Chart

Symptom	Probable Cause	Suggested Remedy
Vehicle will not attain normal maximum speed.	Engine not operating at correct speed. Control linkage damaged or binding. Bypass valve stuck partially open. Charge check valve held open. (Problem in one direction only)	Repair engine governor. Repair control linkage. Repair bypass valve. Remove foreign material from valve.
Vehicle will not move when vehicle control is moved.	Control linkage damaged or not connected. Drive between engine and transmission damaged. Transmission low on fluid.	Repair or reconnect control linkage. Repair drive (replace broken belt, repair sheared key, repair splined coupling, etc.) Refill reservoir. Purge air from transmission.
Vehicle jerky or operating erratic.	Plugged filter. Inlet air leak.	Inspect inlet condition and filter.
Vehicle is "sluggish" under load (operates OK on level surface).	Loose drive belt between engine and transmission. Transmission low on fluid. Large amount of water in transmission fluid (evaporates when hot, resulting in low fluid level).	Tension drive belt (replace if necessary). Refill reservoir. Purge air from transmission if necessary. Drain fluid from reservoir and unit, replace filter element and refill with new fluid.

Minor Repair

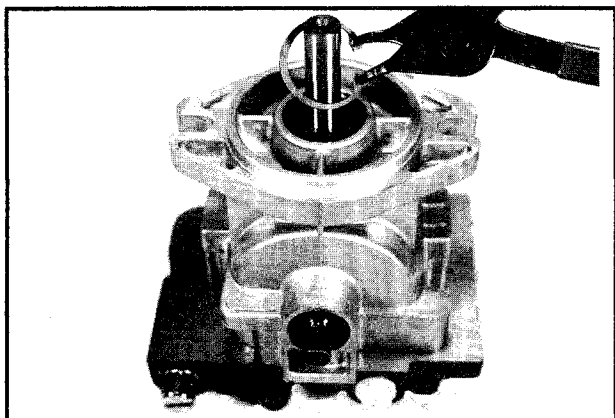
General

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

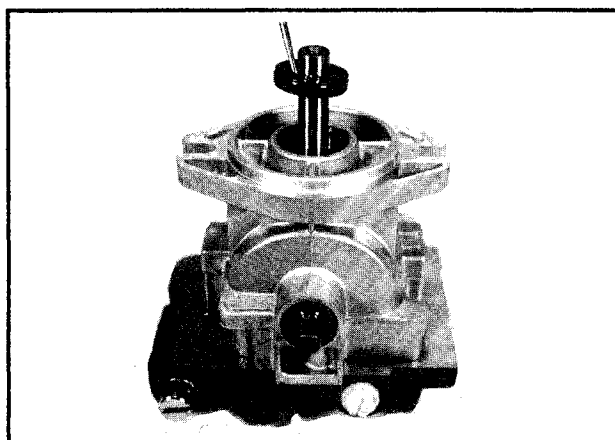
Cleanliness is a primary means of assuring satisfactory life on either new or repaired units. Cleaning parts by using a clean solvent wash and air drying is usually adequate. As with any precision equipment, all parts must be kept free of foreign materials and chemicals.

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

It is recommended that all O-rings be replaced. Lightly lubricate all O-rings with clean petroleum jelly prior to assembly.



Input Shaft Seal Retaining Ring Removal

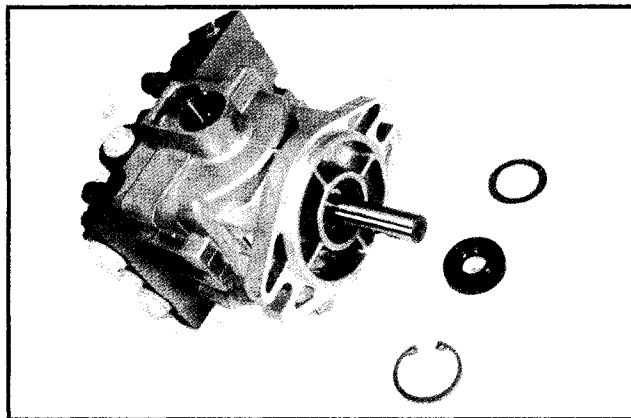


Input Shaft Seal Removal

Plug/Fitting Torques

If any plugs are removed from the housing or end cap during servicing, they should be torqued as indicated in the accompanying tables:

Item	Torque
Case Drain Fitting (9/16-18 O-Ring)	15-20 ft. lbs.
System Ports (3/4-16 O-Ring)	15-20 ft. lbs.
Inlet Fitting/Plug (7/16-20 O-Ring)	8-10 ft. lbs.
Check Valve Plugs (9/16-18 O-Ring)	15-20 ft. lbs.
Bypass Valve	7-10 ft. lbs.



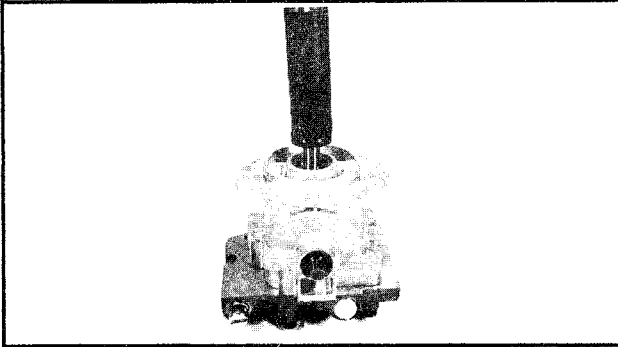
Input Shaft Seal, Spacer Washer, and Retaining Ring Removed

Shaft Seals

Lip type seals are used on the input shaft and displacement control shaft of the BDP-10L variable pumps. These seals can be replaced without major disassembly of the unit. However, replacement of these seals generally requires removal of the pump from the machine.

To replace the pump input shaft seal, first remove the retaining ring from the housing.

Carefully pull the seal out of the housing bore. A "hook" type tool may be used to grasp the seal and pull it out, or a slide hammer type puller may be used to re-move the seal. Care must be taken so as not to damage the housing bore, shaft sealing surface, or bearing. Once removed, the seal is not reusable.



Install Input Shaft Seal

Note: Once the pump input shaft seal is removed, the pump block spring may push the shaft partially out of the housing. Do not attempt to pull the shaft out of the housing. Internal parts could move out of alignment or fall into the transmission, requiring major disassembly of the unit.

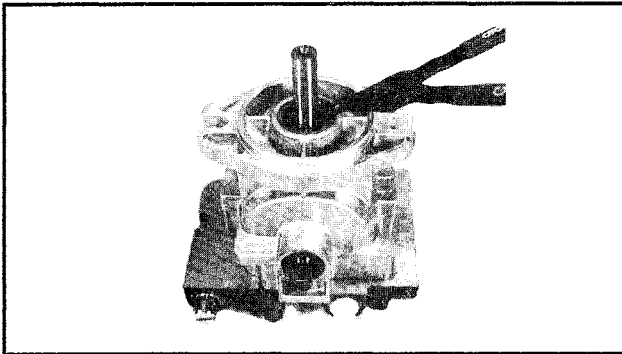
Inspect the sealing area on the shaft for rust, wear or contamination. Polish the sealing area on the shaft if necessary.

Lubricate the new seal with petroleum jelly.

Wrap the spline or key end of the shaft with thin plastic to prevent damage to the seal lip during installation.

Slide the seal over the shaft and press it into the housing bore. Be careful not to damage the seal.

Install the seal retaining ring in the housing.

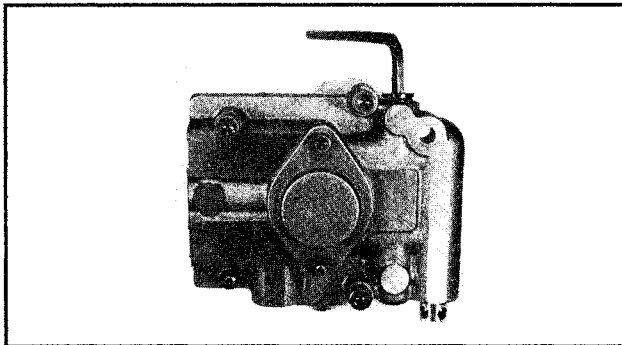


Install Input Shaft Seal Retaining Ring

Charge Check Valves

Remove the check valve plug with a 1/4" internal hex wrench.

Remove the valve spring and check ball (or poppets) from the pump end cap.



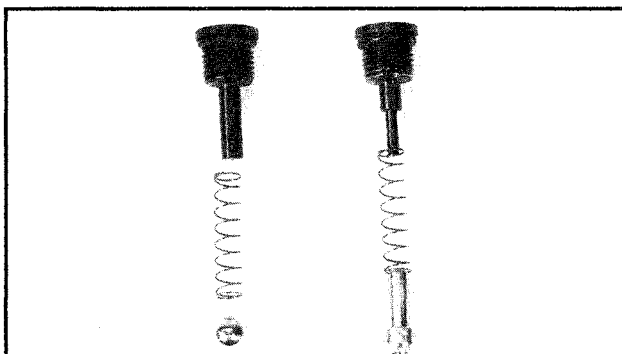
Remove Charge Check Valve Plugs

CAUTION

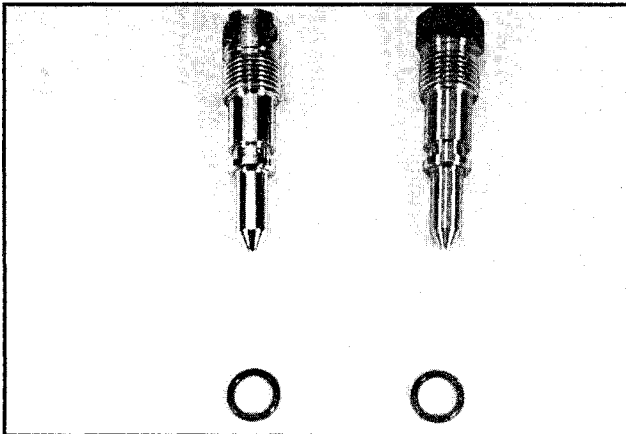
Do not allow the check balls to fall into the closed loop passages in the end cap.

Inspect the check balls (or poppets) and mating seats in the end cap for damage or foreign material.

Lay the pump on its side and reinstall the check ball (or poppets), spring, and plug (with O-ring) into the end cap. Be certain the check ball does not fall into the closed loop passage. Torque the plug to 15-20 ft.lbs. Turn the unit over and repeat for the other check valve.



Charge Check Valve Components (Poppets Opt., Balls Std.)

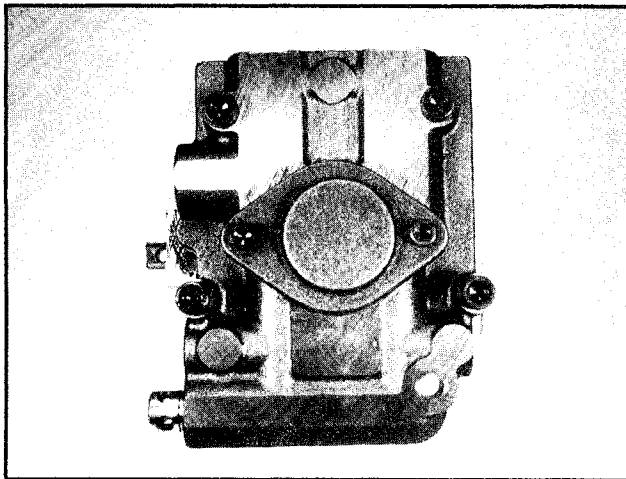
**Bypass Valve Kit Variations****Bypass Valve**

Unscrew the bypass valve from the end cap.

NOTE: Some valves have a 5/8" hex end while others have a cross hole.

Inspect the valve and mating seat in the end cap for damage or foreign material. It is recommended that the O-ring and backup ring be replaced.

Reinstall the bypass valve into the end cap. Torque to 7-10 ft.lbs.

**Orienting Charge Pump Cover (CCW Rotation)****Charge Pump**

The charge pump rotation is determined by the orientation of the charge pump cover on the end cap. The cast boss on the charge pump cover indicates the orientation.

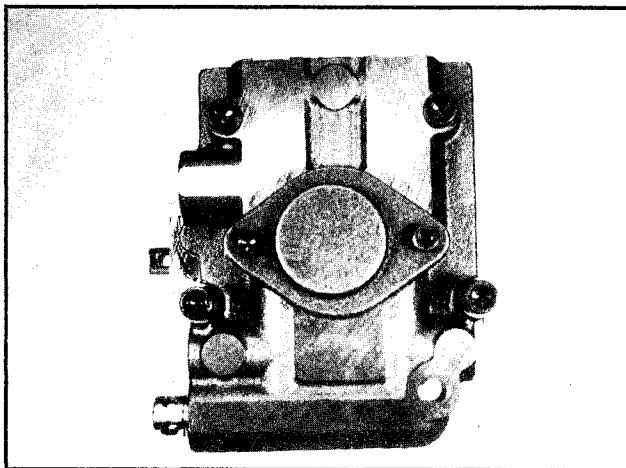
Make note of the correct orientation prior to removing the charge pump cover.

Using a 5 mm internal hex wrench, remove the two (2) screws holding the charge pump cover to the end cap.

Remove the charge pump cover and O-ring.

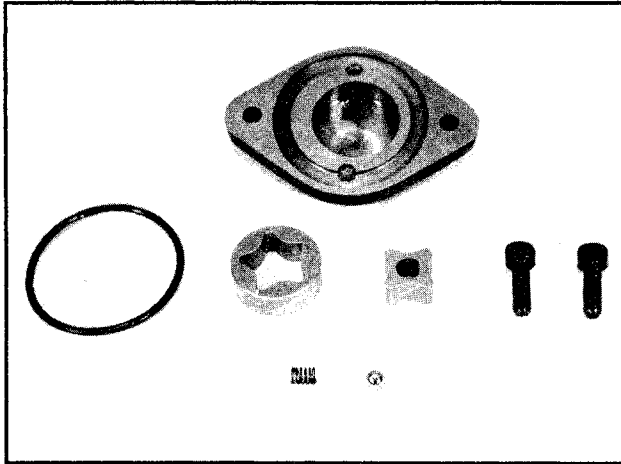
Remove the charge pump gerotor assembly.

Remove the charge relief valve spring and ball.

**Orienting Charge Pump Cover (CW Rotation)**

Minor Repair

BDP-10L Variable Pump



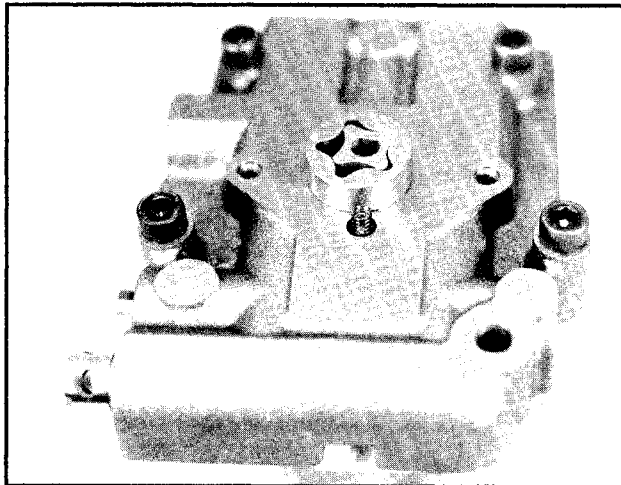
Charge Pump Components

Inspect the gerotor assembly, charge pump cover, and end cap for abnormal wear, damage or foreign material. Inspect the charge relief valve ball and spring. Inspect the charge relief valve seat in the end cap for damage or foreign material.

Prior to installing the charge pump, apply a small quantity of petroleum jelly to the I.D., O.D., and side faces of the gerotor assembly.

Install the charge relief valve ball and spring.

Install the charge pump gerotor assembly.



Install Gerotor Assembly and Charge Relief Valve

Install the charge pump cover and O-ring. The charge relief valve spring must enter the recess in the cover.

Install the charge pump cover screws. Torque each screw to 7-10 ft. lbs.

Major Repair

General

The procedures on the following pages are for the complete disassembly and reassembly (Major Repair) of the BDP-10L variable pump.

Again, cleanliness is a primary means of assuring satisfactory hydraulic unit 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.

During reassembly of the pump all surfaces which have relative motion between two parts must be coated with a film of clean oil or a lubricant such as petroleum jelly. This will assure that these surfaces will be lubricated during start-up.

It is recommended that all O-rings and gaskets 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.

Disassembly Procedures for Variable Pump

Prior to performing Major Repairs on the pump, remove the external components as described in the "Minor Repair" section of this manual. These include the following:

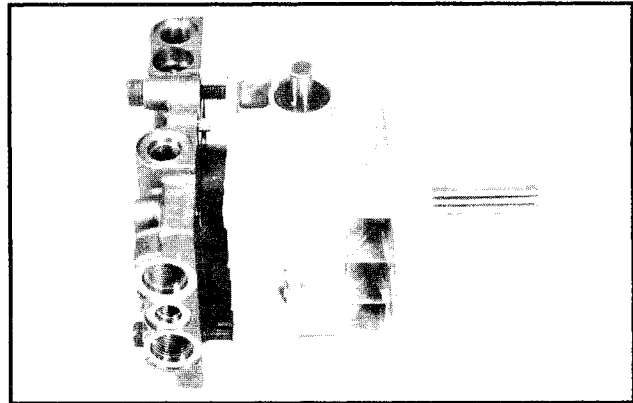
Bypass valve
Charge Check Valves
Charge Pump

Lay the unit on its side. Using a 6 mm internal hex wrench, remove the four (4) screws which retain the end cap to the pump housing.

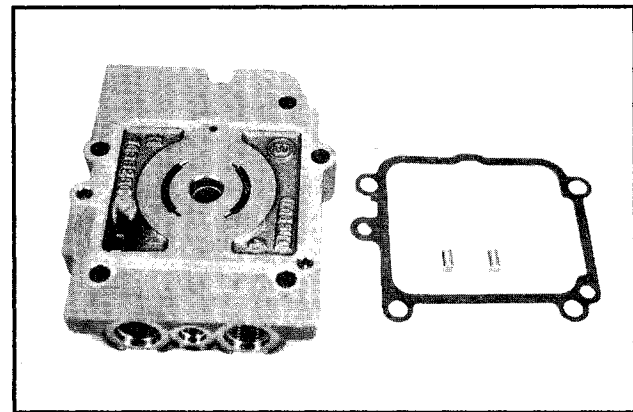
The internal springs should separate the end cap from the housing. Remove the end cap from the housing.

CAUTION

The pump cylinder block will stick to the surface of the end cap. Exercise caution to prevent damage to the end cap and cylinder block sealing surfaces.



Remove End Cap from Housing

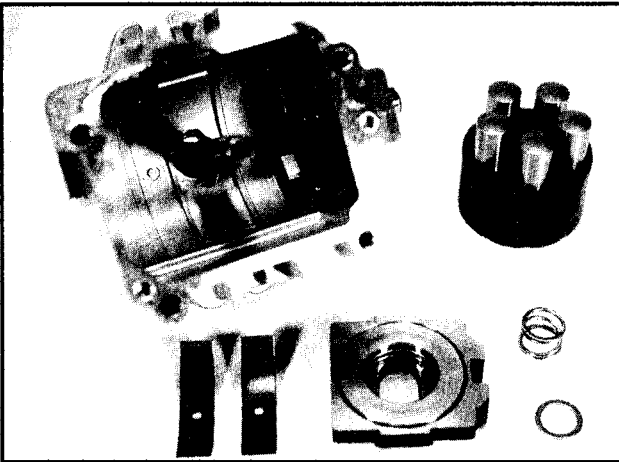


Remove Gasket and Aligning Pins

Remove the gasket and two (2) alignment pins from the housing.

Remove the pump cylinder block kit from the pump shaft.

Remove the pump cylinder block spring and washer from the pump shaft.



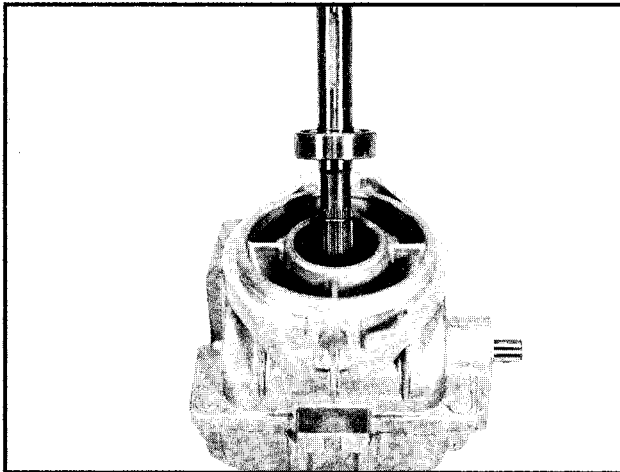
Remove Pump Cylinder Block Kit, Block Spring and Washer, Swashplate and Cradle Bearings from Housing

Remove the thrust bearing from the swashplate.

Remove the pump swashplate from the housing.

Remove the swashplate cradle bearings from the housing.

Remove the slot guide block from the displacement control shaft.

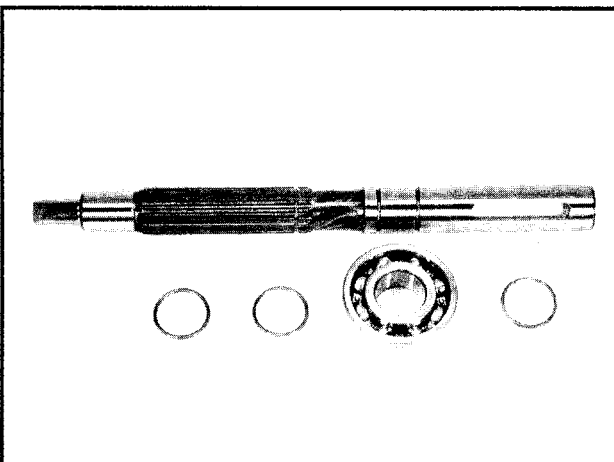


Remove Input Shaft Retaining Ring, Seal and Input Shaft from Housing

Remove the input shaft seal retaining ring.

Carefully pull the input shaft seal out of the housing bore. A hook may be used to pry the seal out, or a slide hammer type puller may be used to remove the seal. Care must be taken so as not to damage the housing bore, shaft sealing surface or bearing. Once removed, the seal is not reusable.

Remove the bearing spacer washer.

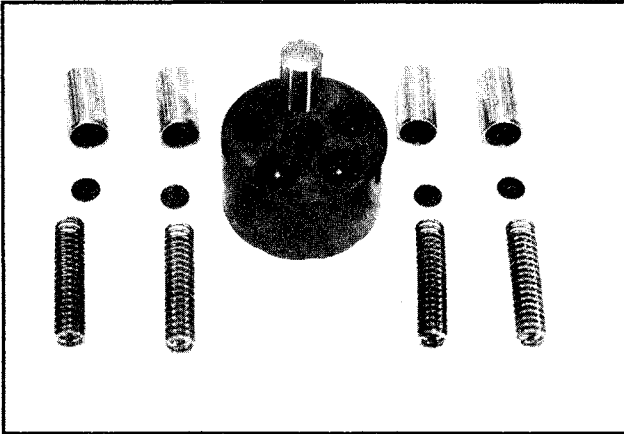


Remove Bearing from Input Shaft

Remove the pump shaft and bearing assembly from the housing.

Remove the outer bearing retaining ring (and washer, if used) and press the shaft out of the bearing.

NOTE: An inner bearing retaining ring is used on most shafts. Remove it from the shaft if necessary.



Cylinder Block Kit Components

If the pump block spring retaining ring requires replacement, remove it from the pump shaft.

Remove the displacement control shaft seal out of the housing. Care must be taken so as not to damage the housing bore.

Reconditioning and Replacement of Parts

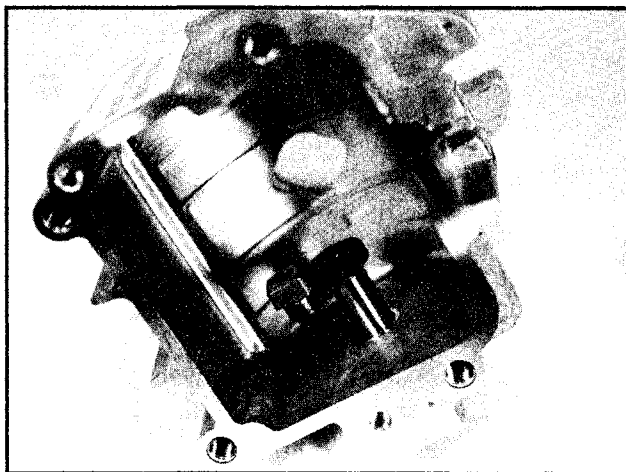
After disassembly, all parts should be thoroughly cleaned in a suitable solvent. Replace all O-rings, gaskets and shaft seals.

Inspect all parts for damage, nicks or unusual wear patterns. Replace all parts having unusual or excessive wear or discoloration.

Inspect the seal surfaces, bearing surfaces and shaft splines. Polish the sealing areas on the shafts if necessary. Replace any worn or damaged parts.

The pump shaft bushing is pressed into the end cap and should not be removed.

The running surfaces of the cylinder blocks **MUST** be flat and free from scratches. If scratches or wear are found on the running surface of the cylinder block or end cap, ~~polish or replace the parts. When polishing these surfaces, up to 0.0004 in. may be removed. If this is not sufficient to obtain a flat surface, free of scratches, the part should be replaced.~~



Install Displacement Control Shaft

Assembly Procedures for Variable Pump

Clean and lightly oil parts prior to assembly of the variable pump. Be sure to torque all threaded parts to recommended torque levels.

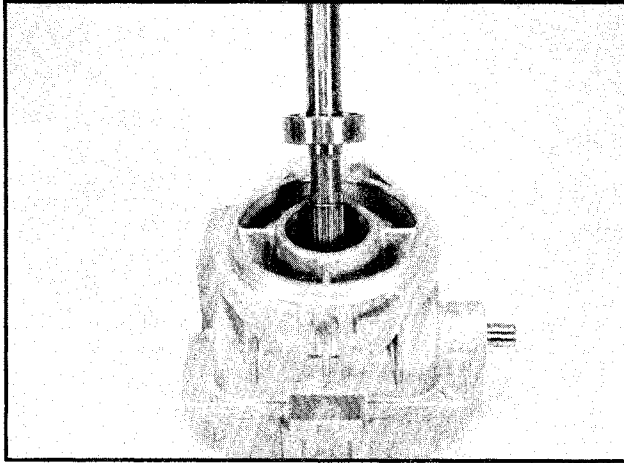
CAUTION

Most parts have critical, high tolerance surfaces. Caution must be exercised to prevent damage to these surfaces during assembly. Protect exposed surfaces, openings, and ports from damage and foreign material.

Install the displacement control shaft into the housing.

CAUTION

Do not damage the shaft sealing surface.



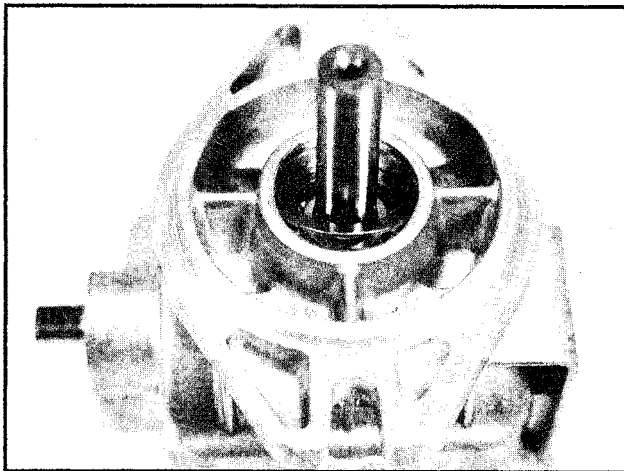
Install Input Shaft

If the block spring retaining ring was removed from the pump shaft, install a new retaining ring onto the shaft.

Install a new inner bearing retaining ring (if used) onto the pump shaft. Press the bearing onto the shaft. Install the washer (if used) and a new outer bearing retaining ring.

NOTE: Do not stretch or deform the retaining ring.

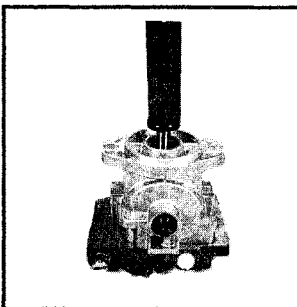
Install the pump shaft and bearing assembly into the housing.



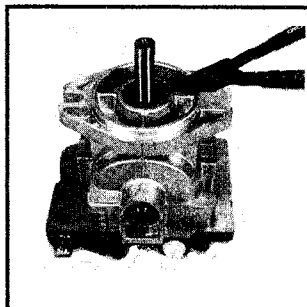
Install Bearing Spacer Washer

Install the bearing spacer washer.

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



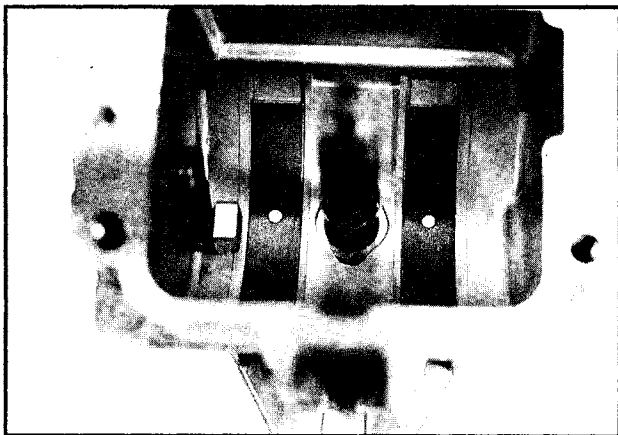
Install Input Shaft Seal



Install Input Shaft Seal Retaining Ring

Slide the seal over the shaft and press it into the housing bore. Be careful not to damage seal.

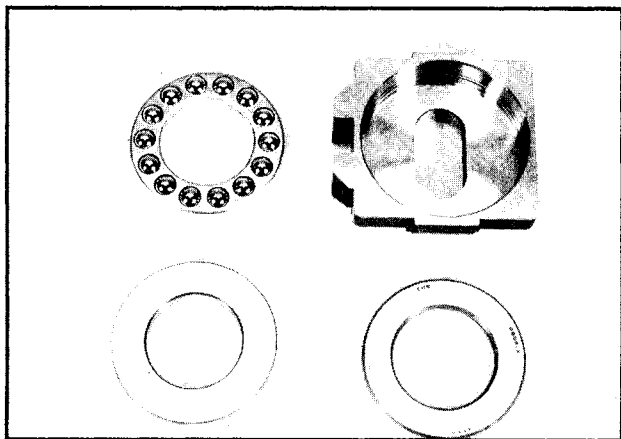
Install the retaining ring.



Install Cradle Bearings and Guide Block

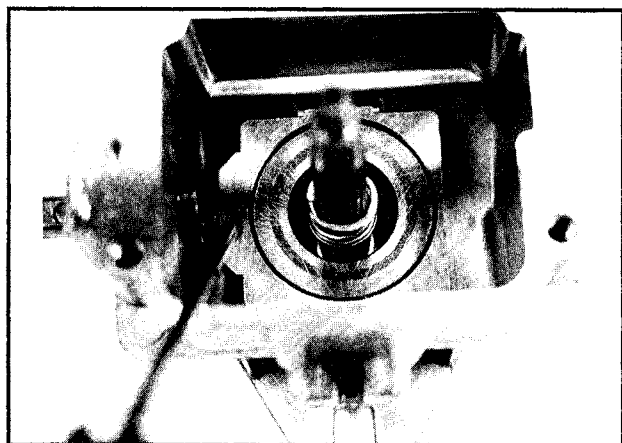
Install the swashplate cradle bearings into the housing, making sure they are located on the cast-in pins in the housing.

Install the slot guide block onto the displacement control shaft.



Swashplate Kit Components

Install the swashplate into the housing. The slot on the swashplate must engage the guide block on the displacement control shaft. Use a tool such as a screwdriver or magnet to hold the guide block in position while installing the swashplate.



Install Swashplate, Thrust Washer and Block Spring

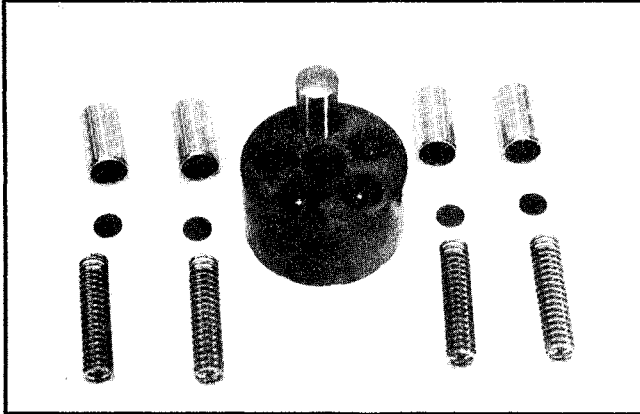
Hold the swashplate in position and measure the side play of the displacement control shaft using a dial indicator or depth gauge. Using a suitable sleeve, press the control shaft bearing into the housing until the control shaft end play is between 0.020 and 0.060 in.

Install the thrust washer and pump cylinder block spring onto the pump shaft.

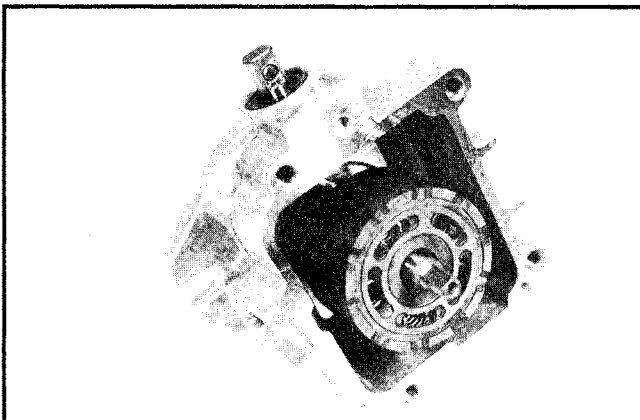
Major Repair

BDP-10L Variable Pump

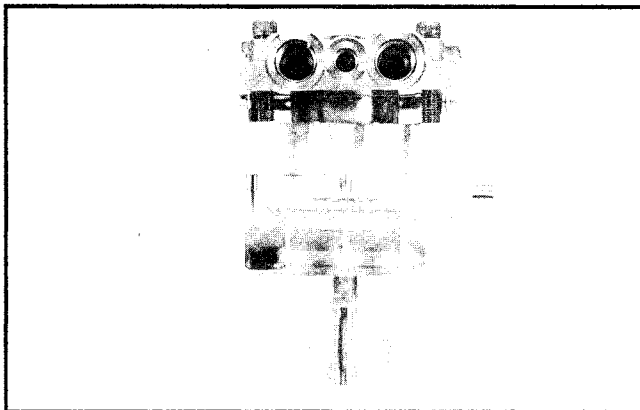
Install the springs, piston washers and pistons into the cylinder block. The pistons must move freely in their bores.



Cylinder Block Kit Components



Install Pump Cylinder Block Kit



Install End Cap

With the pump swashplate in the "neutral" (0 angle) position and the pump housing laying on its side, install the pump cylinder block kit onto the pump shaft in the housing.

Check that the piston springs are centered in the cylinder block bores. If necessary, position them with a small screwdriver.

CAUTION

Do not damage the running surfaces of the cylinder blocks.

Install the two (2) aligning pins, and install a new end cap gasket onto the housing.

Lubricate the running surfaces of the end cap and cylinder blocks. Position the housing with the housing opening UP, and install the end cap onto the housing.

CAUTION

Be certain all parts are properly aligned. Do not force the end cap into position on the housing. Caution must be exercised to prevent damage to the end cap and cylinder block sealing surfaces.

When the end cap is properly installed, the internal springs will hold it away from the housing approximately 3/8 in.

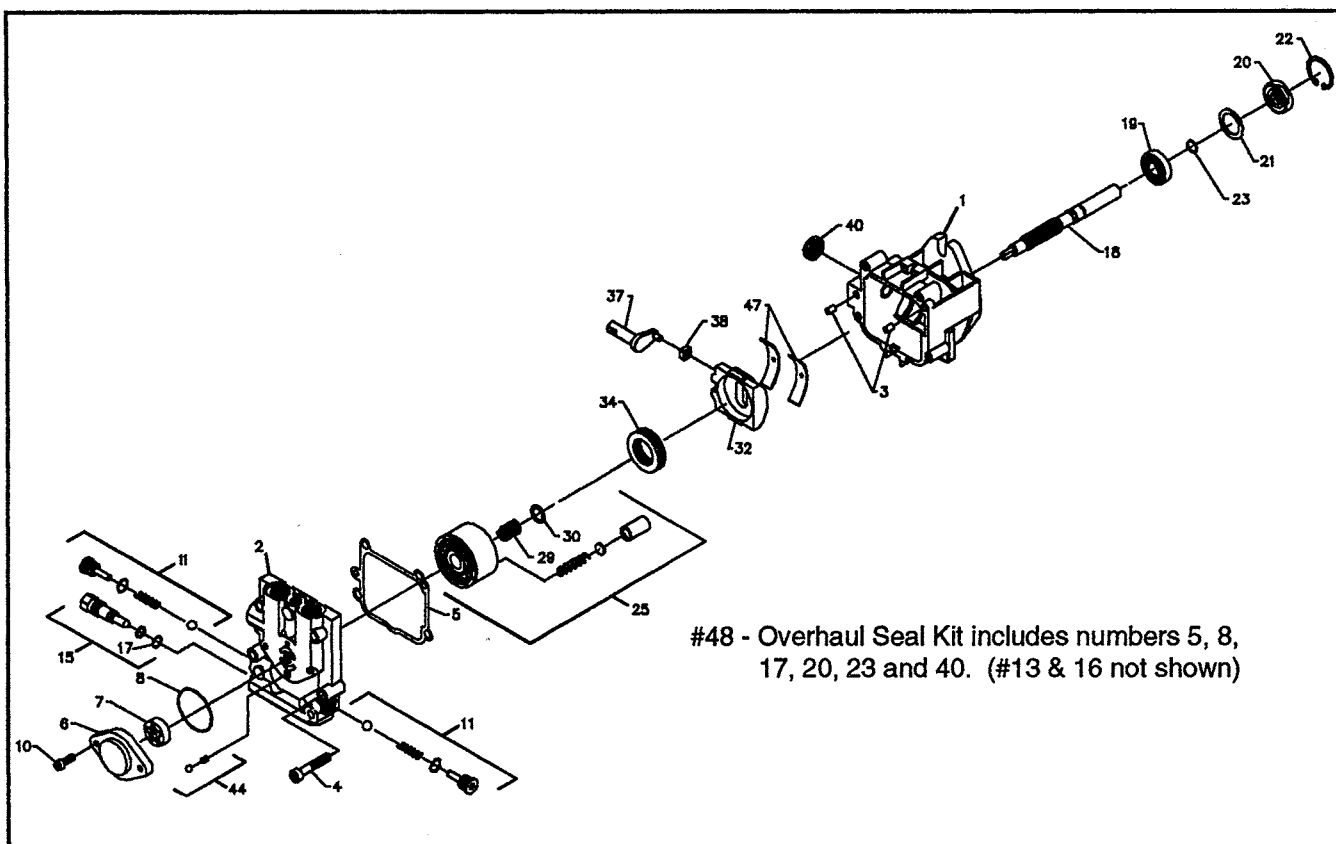
Install the four (4) screws which retain the end cap to the variable pump housing. Torque the screws evenly to 10-15 ft. lbs.

Rotate the shaft to assure correct assembly. When properly assembled, minimal torque should be required to turn the shaft.

Wrap the end of the displacement control shaft with thin plastic to prevent damage to the seal lip during installation. Lubricate the new displacement control shaft seal with petroleum jelly. Slide the seal over the shaft and press it into the housing bore. Be careful not to damage the seal.

Assemble the following components as described in the "Minor Repair" section of this manual:

Charge Pump
Charge Check Valves
Bypass Valve



PARTS LIST

No.	Description	No.	Description
1	Housing Kit	17	Ring, Back Up
	Sea - Lip	18	Shaft - Pump
	Housing	19	Bearing - Ball
	Bearing - Journal	20	Seal - Lip
2	End Cap Kit	21	Spacer
	End Cap	22	Ring - Retaining
	Bearing - Journal	23	Ring - Retaining
3	Pin, St. Headless	25	Cylinder Block Kit
4	Screw - Socket Head		Cylinder Block
5	End Cap Gasket		Piston
6	Charge Pump Kit		Spring - Piston
	Charge Pump		Washer - Piston
	Assembly		Spring - Block
	Gerotor Assembly		Washer - Block Thrust
	O-Ring		Ring - Retaining
7	Gerotor Assembly	29	Spring - Block
8	O-Ring	30	Washer - Block Thrust
10	Screw - Socket Head	32	Swashplate
11	Check Valve Kit	34	Bearing - Roller Thrust
	Spring	37	Trunnion Arm
	Check Plug	38	Guide Slot
	Ball (or)	40	Seal - Lip
	Check Valve Orifice	44	Charge Relief Valve Kit
15	Bypass Valve Kit		Spring - Check Relief
	Bypass Valve	47	Ball
	Backup Ring		Bearing - Cradle
	O-Ring	48	Overhaul Seal Kit