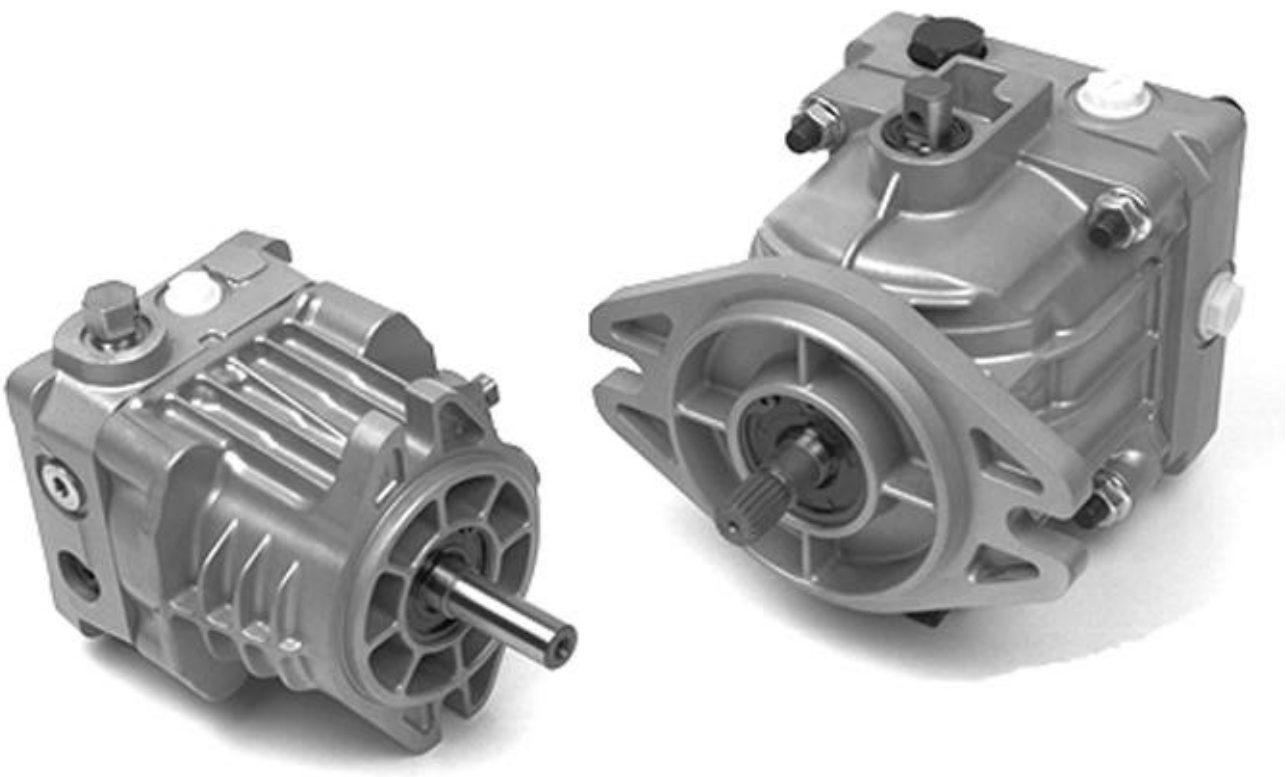
Hydro-Gear®

We set the wheels in motion.



BDP-10A/21L
Hydrostatic Pumps
Service and Repair Manual

BLN-51337
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FOREWORD

Headquartered in Sullivan, Illinois, Hydro-Gear is a world leader in the design, manufacture, and service of quality hydrostatic transaxles for the lawn and garden industry. The mission of our company is to be recognized by our customers and the industry as a world-class supplier and the quality leader in everything we do.

This Service and Repair Manual is designed to provide information useful in servicing the Hydro-Gear 10cc Bantam Duty Pump (BDP-10A) and 21cc Bantam Duty Pump, referred to as the (BDP-21L).

Also included is a glossary of terms that are frequently used throughout the industry and in Hydro-Gear service publications. Understanding terminology is very important!

It is necessary, and good shop practice, that your service area be equipped with proper tools and the mechanics to be supplied with the latest information available. All repair procedures illustrated in this guide are suggested, but preferred methods of repair.

Some repair procedures require that the BDP be removed from the vehicle.

This is not a certification, test or study guide for a certification test. If a technician is interested in certification they should contact an agent representing the ESA (Engine Service Association) (610) 363-3844 or their Hydro-Gear Distributor. Many distributors will be hosting certification testing. These study guides will cover most of the products and manufacturers in our industry.

For more information about Hydro-Gear or our products, please contact your Central Service Distributor, or call our Customer Service Department at (217) 728-2581.

SECTION 1. DESCRIPTION AND OPERATION

INTRODUCTION

The purpose of this manual is to provide information useful in servicing the Hydro-Gear Bantam Duty Pumps (BDP's). This manual includes the BDP's general descriptions, hydraulic schematics, technical specifications, servicing and troubleshooting procedures for BDP models 10A and 21L.

The BDP's normally will not require servicing during the life of the vehicle in which it is installed. Should other servicing be required, the exterior of the BDP's will need to be thoroughly cleaned before beginning most procedures.

The models BDP -10A and 21L differ from the BDP model 10L. The physical distinction in appearance of the BDP-10A and 21L is signified by the design of an aluminum end cap. This end cap improves versatility in the application of these products.

GENERAL DESCRIPTION

The BDP's can be combined with wheel motors and other remotely located units. These pumps provide an infinitely variable speed range between zero and full displacement in both forward and reverse modes of operation.

The BDP-10A and 21L 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 the angle of the swashplate reverses the flow of oil from the pump and thus reverses the direction of motor output rotation.

Movement of the directional control shaft produces a proportional swashplate movement and a change in pump flow and/or direction.

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

Check valves are included in the pump end cap to control the makeup oil flow for the system. The size and type of check valve can play an important role on the system pressure, response, and amount of heat generated, due to the recirculation of makeup oil flow. Additionally, some BDP's may be equipped with System Check Reliefs (SCR's). SCR's are factory preset pressure regulating check valves.

In some applications of the BDP's, it is desirable to move the machine for short distances at low speeds without operating the engine. An increase in resistance will occur with movement at higher speeds. A screw type bypass valve is utilized in the pumps to permit movement of the machine. The bypass valve is fully opened when unscrewed two (2) turns maximum. The bypass valve allows oil to be routed from one side of the pump/motor circuit to the other, thus allowing the motor to turn with minimal resistance. The bypass valve must be fully closed during normal operation.

WARNING

Actuating the bypass will result in the loss of hydrostatic braking capacity. The machine must be stationary on a level surface and in neutral when actuating the bypass.

Additionally, some BDP's may be equipped with an Auxiliary Pump. The Auxiliary incorporates the principles of the charge gerotor assembly and provides the capability of an external auxiliary flow for an alternate hydraulic circuit to operate accessories without loss of drive.

EXTERNAL FEATURES BDP-10A

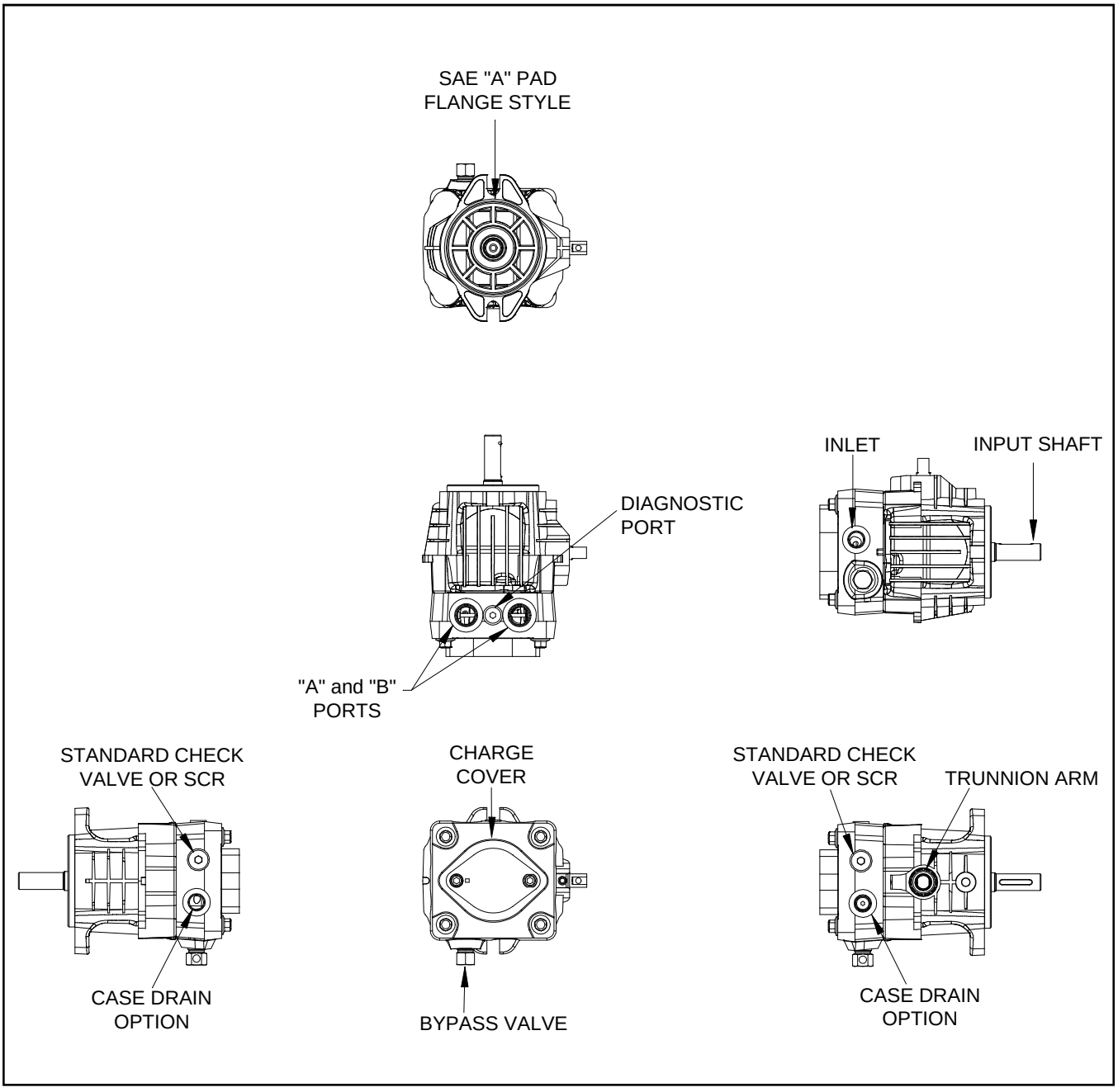


Figure 1. BDP-10A With Standard Charge Pump

EXTERNAL FEATURES BDP-21L

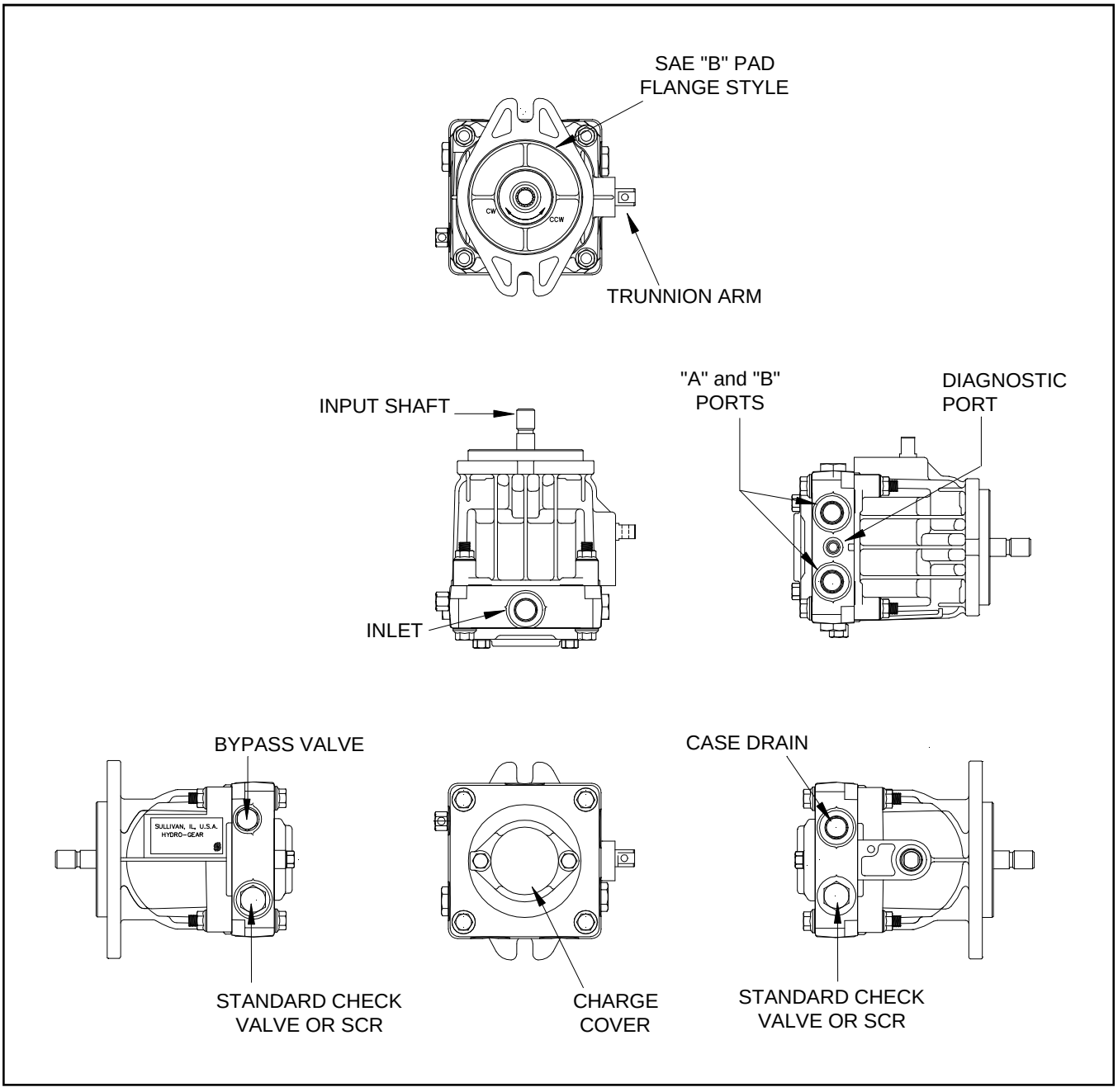


Figure 2. BDP-21L With Standard Charge Pump

HYDRAULIC SCHEMATIC

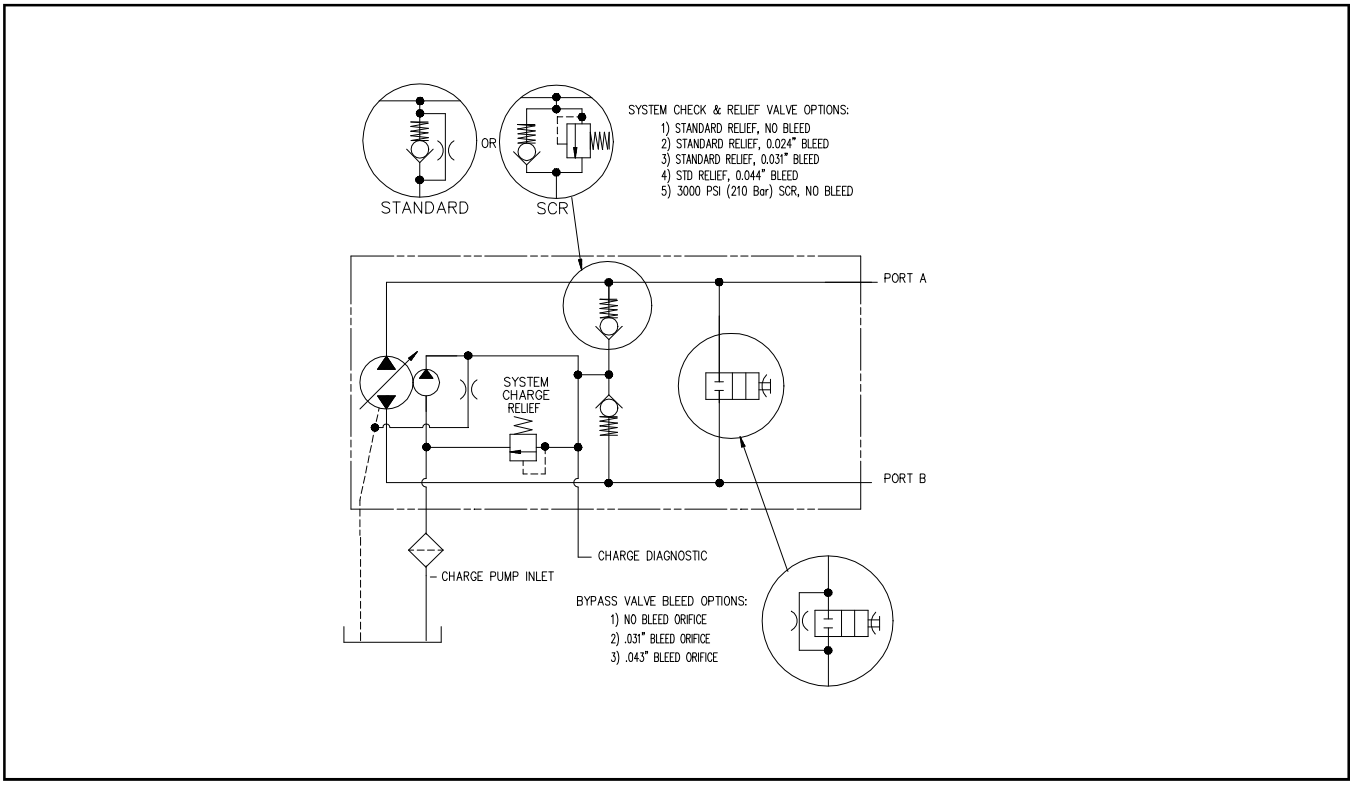


Figure 3. BDP-10A/21L Standard With Charge Pump Hydraulic Schematic

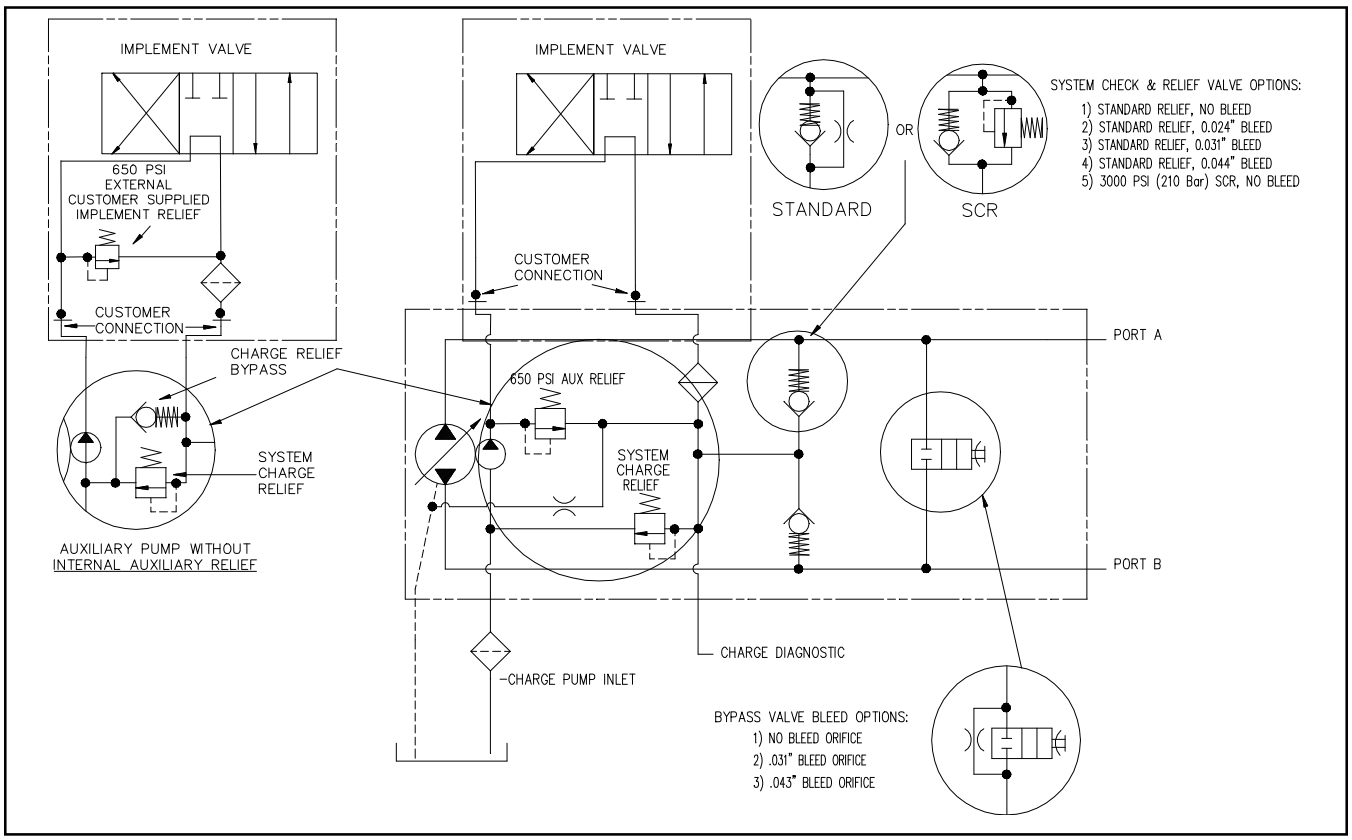


Figure 4. BDP-10A/21L With Auxiliary Charge Pump Hydraulic Schematic

GRAPHICAL SCHEMATIC

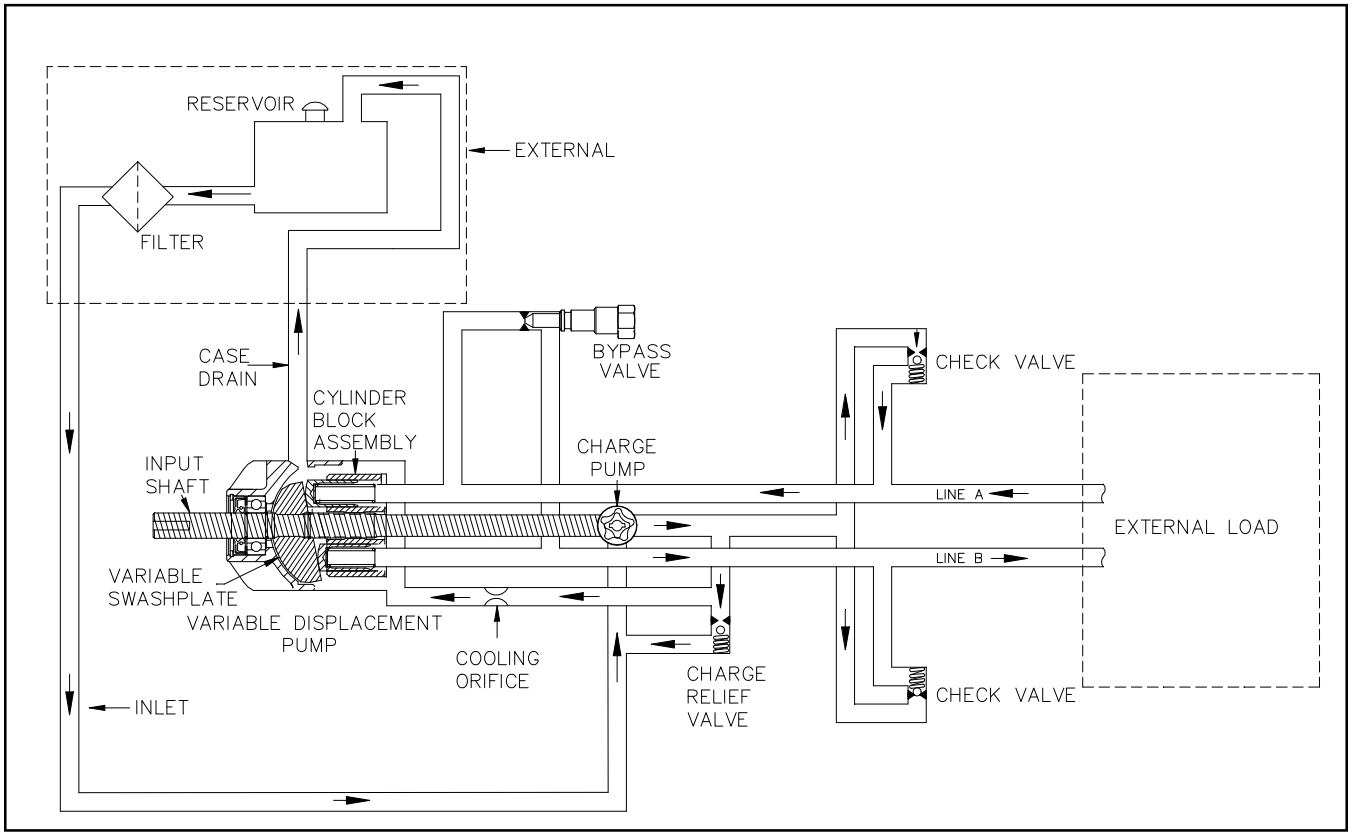


Figure 5. BDP-10A/21L Standard Charge Pump Graphical Schematic

Figures 3. and 4. represent hydraulic schematics of the standard charge and auxiliary charge pump. Figure 5. provides a graphical illustration of the hydraulic oil circuit.

The input shaft and pump cylinder block are turned in one direction only by the engine/ drive belt/ pulley combination or direct drive gear box.

The oil is drawn through an external filter that prevents contaminants within the reservoir from entering into the charge pump gerotor.

The charge pump supplies fluid to keep the closed loop pressurized, preventing cavitation and providing cooling oil flow for the system.

The charge relief valve is used to maintain charge at a predetermined pressure.

Output of the system oil flow is controlled by the direction and amount that the swashplate is angled. As the pump pistons compress, they force oil into one of two passageways ("A" or "B") in the system hydraulic circuit. Oil is supplied externally under pressure to an external load, (e.g., a vehicle wheel motor). As the angle of the pump swashplate is increased, the amount of oil being pumped will increase and cause a higher speed output of the wheel motor. Reversing the angle of the swashplate will reverse the direction of the oil flow. During the operation of the pump, fluid is "lost" from the hydraulic loop through leak paths designed into the product for lubrication purposes (around pistons, under the rotating cylinder block, etc.). This "lost" fluid returns to the reservoir through the case drain. This fluid must be made up in the loop. The charge pump makes up this fluid loss.

The makeup flow is controlled (or directed) by the system check valves. The check valves are used to direct makeup fluid into the low pressure side of the closed loop. Each check valve will either be held open or closed, depending upon the direction of the vehicle operation: Closed in a pressurized system passage, open in a low pressure, "charged" system passage.

TECHNICAL SPECIFICATIONS

BDP-10A	BDP-21L
Displacement: 0.623 in^3 / rev (10.2 cc / rev) 8.09 gpm@3000 rpm	Displacement: 1.33 in^3 / rev, (21.8 cc / rev) 17.3 gpm@3000 rpm
Input Speeds	**Input Speeds**
Maximum: 3600 rpm	Maximum: 3600 rpm
Minimum: 1800 rpm	Minimum: 1800 rpm
System Operating Pressure	**System Operating Pressure**
Intermittent: 2100 psi (145 bar)	Intermittent: 2500 psi (172 bar)
Continuous: 1000 psi (70 bar)	Continuous: 1250 psi (86 bar)
Oil Temperature	**Oil Temperature**
Maximum Intermittent: 230˚F (110˚C)	Maximum Intermittent: 230˚F (110˚C)
Normal Operating Range: -10˚ to 200˚F (-23˚C to 93˚C)	Normal Operating Range: -10˚ to 200˚F (-23˚C to 93˚C)
Fluid Viscosity Limits	**Fluid Viscosity Limits**
@ 212˚F (100˚C) Optimum: 70 SUS (13 cSt)	@ 212˚F (100˚C) Optimum: 70 SUS (13 cSt)
@ 212˚F (100˚C) Minimum: 55 SUS (9.0 cSt)	@ 212˚F (100˚C) Minimum: 55 SUS (9.0 cSt)
Weight	**Weight**
8 lbs / 3.6 kg	14 lbs / 6.3 kg

Table 1. BDP-10A/21L Technical Specifications

PRODUCT IDENTIFICATION

The label in Figure 6. can be located on the pump housing. It identifies the model and configuration of the BDP.

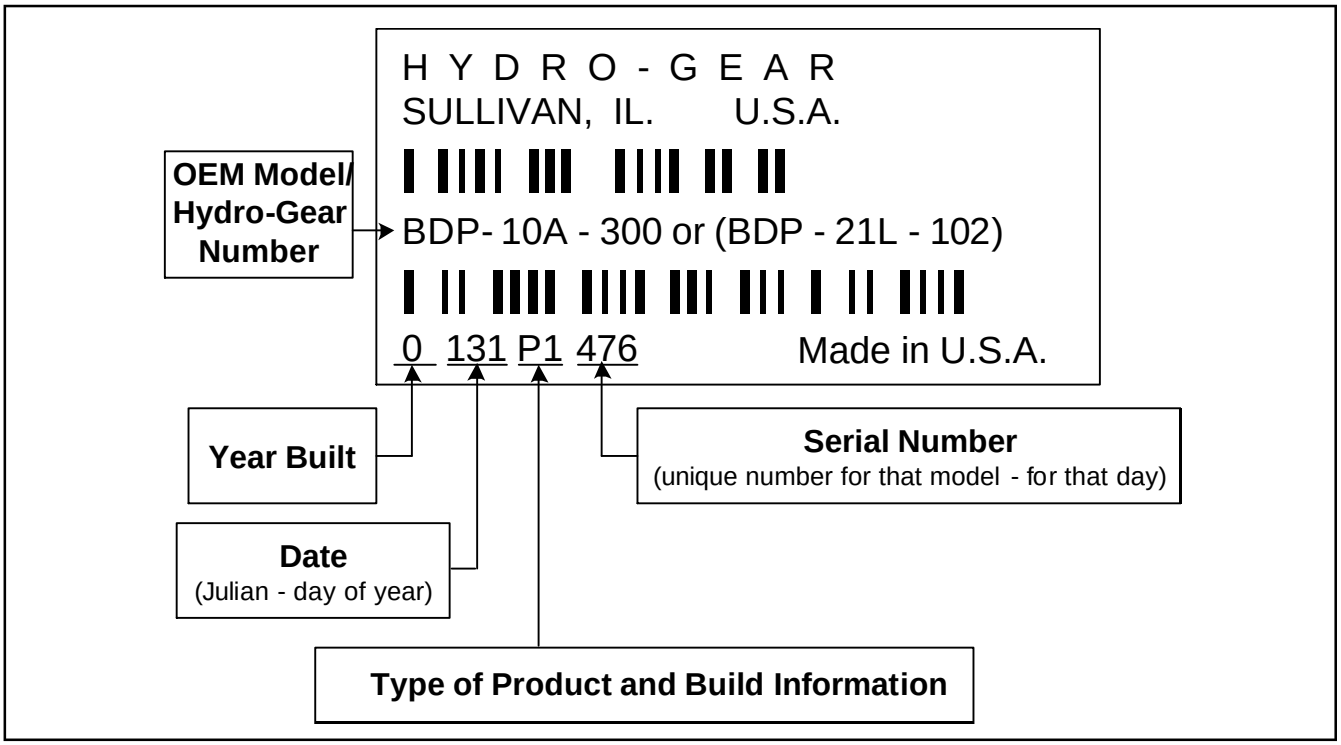


Figure 6. BDP Configuration Label

SECTION 2. SAFETY

This symbol points out important safety instructions which, if not followed, could endanger the personal safety and/or property of yourself and others. Read and follow all instructions in this manual before attempting maintenance on your BDP's. When you see this symbol - **HEED ITS WARNING.**

WARNING

POTENTIAL FOR SERIOUS INJURY

Inattention to proper safety, operation, or maintenance procedures could result in personal injury, or damage to the equipment. Before servicing or repairing the BDP-10A/21L, fully read and understand the safety precautions described in this section.

PERSONAL SAFETY

Certain safety precautions must be observed while servicing or repairing the BDP-10A/21L. This section addresses some of these precautions but must not be considered an all-inclusive source on safety information. This section is to be used in conjunction with all other safety material which may apply, such as:

Other manuals pertaining to this machine
Local and shop safety rules and codes
Governmental safety laws and regulations

Be sure that you know and understand the equipment and the hazards associated with it. Do not place speed above safety.

Notify your supervisor whenever you feel there is any hazard involving the equipment or the performance of your job.

Never allow untrained or unauthorized personnel to service or repair the equipment.

Wear appropriate clothing. Loose or hanging clothing or jewelry can be hazardous. Use the appropriate safety equipment, such as eye and hearing protection, and safety-toe and slip-proof shoes.

Never use compressed air to clean debris from yourself or your clothing.

TOOL SAFETY

Use the proper tools and equipment for the task.

Inspect each tool before use and replace any tool that may be damaged or defective.

WORK AREA SAFETY

Keep the work area neat and orderly. Be sure it is well lit, that extra tools are put away, trash and refuse are in the proper containers, and dirt or debris have been removed from the working areas of the machine.

The floor should be clean and dry, and all extension cords or similar trip hazards should be removed.

SERVICING SAFETY

Certain procedures may require the vehicle to be disabled in order to prevent possible injury to the servicing technician and/or bystanders.

The loss of hydrostatic drive line power may result in the loss of hydrostatic braking capability.

Some cleaning solvents are flammable. Use only approved cleaning materials: Do not use explosive or flammable liquids to clean the equipment.

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

Discard used cleaning material in the appropriate containers.

SECTION 3. TROUBLESHOOTING

WARNING

Do not attempt any servicing or adjustments with the engine running. Use extreme caution while inspecting the drive belt assembly and all vehicle linkage!

Follow all safety procedures outlined in the vehicle owner's manual!

In many cases problems with the BDP-10A/21L are not related to a defective pump but are caused by slipping drive belts, partially engaged bypass valves, and loose or damaged control linkages. Be sure to perform all operational checks and adjustments outlined in Section 3. before assuming the pump is malfunctioning. Table 2. below provides a troubleshooting check list to help determine the cause of operational problems.

Table 2. BDP 10A/21L Troubleshooting Checklist

Possible Cause	Corrective Action
VEHICLE DOES NOT DRIVE/TRACK STRAIGHT	
Vehicle tires improperly inflated	Refer to vehicle manufacturer suggested pressure
Control linkage bent, loose or out of adjustment	Repair, adjust or replace vehicle linkage
Bypass loose	Tighten bypass per page 11
Inlet leak	Check all externals to BDP inlet
UNIT IS NOISY	
Excessive input speed	Adjust input above 1800 rpm and below 3600 rpm
Oil level low or contaminated oil	Fill to proper level or change oil
Excessive loading	Reduce vehicle load
Air trapped in hydraulic system	Purge hydraulic system per page 12
Bypass loose	Tighten bypass per page 11
Inlet leak, line or filter partially blocked or damaged	Check all externals to BDP inlet
UNIT HAS NO/ LOW POWER	
Engine RPM low	Adjust to correct setting
Control linkage bent, loose or out of adjustment	Repair or replace vehicle linkage
Drive belt slipping or pulley damaged	Repair or replace drive belt or pulley
Oil level low or contaminated oil	Fill to proper level or change oil per page 11
Excessive loading	Reduce vehicle load
Bypass loose	Tighten bypass per page 11
Air trapped in hydraulic system	Purge hydraulic system per page 12
Inlet leak	Check all externals to BDP inlet
Inlet filter clogged	Replace filter per page 12
Suspected internal damage	Check per page 9
UNIT OPERATING HOT	
Debris buildup	Remove debris
Cooling fan or heat exchanger damaged	Repair or replace cooling fan or heat exchanger
Oil level low or contaminated oil	Fill to proper level or change oil per page 11
Excessive loading	Reduce vehicle load
Air trapped in hydraulic system	Purge hydraulic system per page 12
Inlet leak	Check all externals to BDP inlet
BDP LEAKS OIL	
Damaged seals or gaskets	Remove debris, replace seals
Air trapped in hydraulic system	Purge hydraulic system per page 12

(This Instruction Sheet supersedes all previous flow testing instructions)

Description: BDP Flow Test Kit (Part Number's 70511/ 70661)

(Part Number 70511/ 70661 Supersedes Part Number BB-76810)

Purpose: The design purpose of the BDP Flow Test Kit is to allow the dealer to isolate the BDP from the wheel motor and determine if the BDP is faulty. The following information can be used to install and test the BDP by simulating a wheel motor load.

WARNING

Certain procedures require the vehicle engine to be operated and the vehicle to be raised off of the ground. To prevent possible injury to the servicing technician and/or bystanders, insure the vehicle is properly secured.

WARNING

Do not attempt any adjustments with the engine running. Use extreme caution while working in or around all vehicle linkage! High temperatures can be generated. Follow all safety procedures outlined in the vehicle owner's manual!

INSTALLATION AND TESTING PROCEDURES:

1. Disconnect the system hoses at the wheel motor, or system hoses from the BDP and connect the BDP Flow TestKit. (Special care should be taken to prevent contamination debris from entering pump or wheel motor system ports).

Note: Using the Bi-Directional Flow Test Kit, determination of directional flow is not necessary. The flow meter may be connected in either direction into the forward and reverse high pressure system lines.

CAUTION: Ensure all fittings and hoses are attached securely. This test is being completed on the vehicle's high pressure system lines. Failure to perform this properly could result in bodily injury.

TESTING PROCEDURES:

1. Raise the drive tires off the ground. Block the remaining tires on the ground to prevent accidental vehicle movement.

2. Open the restriction valve all the way.

3. Make certain all external BDP directional control stops are removed or backed off on the vehicle linkage to obtain full pump directional control arm travel.

4. Start the engine and engage the drive pulley if necessary.

5. Bring the engine to maximum operating speed.
(This should not exceed 3600 rpm input speed on the BDP 10A/10L)
(This should not exceed 2800 rpm input speed when testing the BDP 21L)
Engine speed adjustment may be necessary to obtain 2800 rpm.

CAUTION: Damage to the flow meter and/or re-calibration may result from testing the BDP 21L at input speeds that exceed 2800 rpm.

6. With the directional control lever (on the vehicle) for the pump being tested, move the control arm in full forward motion. (It may be necessary to lock the control arm into full forward position to prevent false readings).

7. Operate without any load for approximately 30 seconds to 1 minute, this allows the system oil temperature to rise.

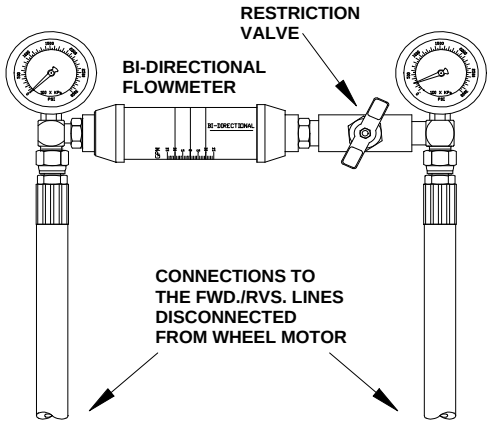
Note: Raising the system oil temperature will make a difference in the readings you receive. It has been determined that to complete this test accurately, the oil temperature must be near system operating temperatures. Suggested temperature range 160°- 210°F (71.1° - 98.9°C)

8. (On the BDP-10L), tighten the restriction valve until you read 300 psi (21 bar).
(On the BDP-21L), tighten the restriction valve until you read 500 psi (34 bar).
Record the flow reading from the Bi-Directional Flow Meter.

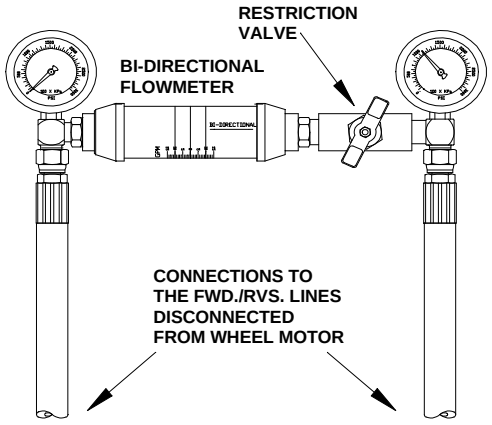
9. Increase the pressure to 1100 PSI (76 bar) for both models (BDP-10L & BDP -21L).
Record the flow reading from the Bi-Directional Flow Meter.

10. The **acceptable gpm "flow droop" or (difference)** is:
BDP-10A/10L 1.5 gpm (5.6 l/min)
BDP-21L 2.0 gpm (7.6 l/min)
If the difference exceeds these values the pump would not be acceptable.

TEST EXAMPLE:



300 psi (21 bar) reading **5 gpm (19 l/min) (1st reading)**



1100 psi (76 bar) reading **3 gpm (11 l/min) (2nd reading)**

(BDP-10A/10L)
300 psi (21 bar) reading **5 gpm (19 l/min) (1st reading)**
1100 psi (76 bar) reading **– 3 gpm (11 l/min) (2nd reading)**
2 gpm (8 l/min) (the difference)

Subtract the 1st reading from the 2nd.
(In this example, 2 gpm difference would indicate a defective pump).

SECTION 4. SERVICE AND MAINTENANCE

NOTE: Any servicing dealer attempting a warranty repair must have prior approval before conducting maintenance of a Hydro-Gear product unless the servicing dealer is a current Authorized Hydro-Gear Service Center.

EXTERNAL MAINTENANCE

Regular external maintenance of the BDP should include the following:

1. **Check the vehicle operator's manual for the recommended load ratings. Insure the current application does not exceed load rating.**
2. Check fluid level in reservoir in accordance with vehicle manufacturer's recommendations.

NOTE: After oil has been drained and maintenance has been performed, clean oil should be poured directly into the pump inlet and high pressure ports prior to plumbing reconnection and start-up.

3. Inspect the vehicle drive belt, idler pulley(s), and idler spring(s). Insure that belt slippage is not causing low input rpm to the pump.
4. Inspect all external plumbing for possible leaks or loose fittings. An air leak may be difficult to detect on the "suction side" or inlet line to the pump. See purging procedures page 12.
5. Insure correct inlet filter(s) has been installed in accordance with the vehicle manufacturer.
6. Insure the reservoir is free of contaminants and is properly vented.
7. Inspect the BDP cooling fan (if applicable) for broken or distorted blades and remove any obstructions (grass clippings, leaves or dirt). Inspect oil cooler (if applicable) for damaged fins and debris.
8. Inspect the vehicle control linkage to the directional control arm on the BDP. Also, insure the control arm is securely fastened to the trunnion arm.
9. Inspect the bypass on the BDP to insure it is properly engaged for operation. If the bypass is not fully engaged (rotated fully clockwise) it will not function properly. For vehicle movement, the bypass may be backed out (2) turns maximum. This is recommended for movement of short distances at low speeds.

WARNING

Loosening the bypass will result in loss of hydraulic braking capability.

SERVICE AND MAINTENANCE PROCEDURES

NOTE: Damage to BDP's may result from external or internal contamination: Heat from excess debris or lack of lubrication and over-pressurization of the product. Follow guidelines established in this manual and the vehicle manufacturer's recommendations.

All the service procedures presented on the following pages can be performed while the BDP is mounted on the vehicle. Any servicing beyond those given must be performed after the unit has been removed from the vehicle.

FLUIDS

The fluids used in Hydro-Gear products have been carefully selected, and only equivalent, or better products should be substituted.

Typically, an engine oil with a minimum rating of 55 SUS (9.0 cSt) at 210° F (98.9C) maximum operating temperature and an API classification of SH/ CD is allowed. Refer to the vehicle manufacturer for recommended oil.

FLUID VOLUME AND LEVEL

Certain situations may require additional fluid to be added or even replaced. Refer to the vehicle manufacturer's recommendations for the proper fill location and level. After maintenance or oil change, follow purging procedures below and recheck the fluid level once the unit has been operated for approximately 1 minute.

FLUID CHANGE

In the event of oil contamination or degradation, oil addition or change may alleviate certain performance problems. Refer to the vehicle manufacturer's recommended oil change frequency. Refer to purging procedures below.

FILTERS

An inlet filter is required to insure that only clean fluid enters the system. Refer to the vehicle manufacture for approved filter replacement.

PURGING PROCEDURES

Due to the effects air has on efficiency in hydrostatic drive applications, it is critical that air is purged from the system.

These purge procedures should be implemented anytime a hydrostatic system has been opened to facilitate maintenance or any additional oil has been added to the system.

Air creates inefficiency because it has compression and expansion rates that are higher than that of oil.

Entrained air in the oil may cause the following symptoms:

1. Noisy operation
2. Lack of power or drive after short-term operation
3. High operation temperature and excessive expansion of oil.

Before starting, make sure the reservoir is at the proper oil level. If it is not, fill to the vehicle manufacturer's specifications.

The following procedures should be performed with the vehicle drive wheels off the ground, then repeated under normal operating conditions.

WARNING

POTENTIAL FOR SERIOUS INJURY

Certain procedures require the vehicle engine to be operated and the vehicle to be raised off of the ground. To prevent possible injury to the servicing technician and/or bystanders, insure the vehicle is properly secured.

1. With the bypass valve open and the engine running, slowly move the directional control in both forward and reverse directions (5 to 6 times), as air is purged from the unit, the oil level will drop.
2. With the bypass valve closed and the engine running, slowly move the directional control in both forward and reverse directions (5 to 6 times). Check the oil level, and add oil as required after stopping engine.
3. It may be necessary to repeat Steps 1 and 2 until all the air is completely purged from the system. When the BDP's move forward and reverse at normal speed purging is complete.

Cleanliness is a key factor in the successful repair of BDP's. Thoroughly clean all exposed surfaces prior to any type of maintenance. Cleaning of all parts by using a solvent wash and air drying is usually adequate. As with any precision equipment, all parts must be kept free of foreign material and chemicals. Protect all exposed sealing areas and open cavities from damage and foreign material.

Upon removal, all seals, O-rings, and gaskets should be replaced. During installation, lightly lubricate all seals, O-rings, gaskets with clean petroleum jelly prior to assembly. Also protect the inner diameter of seals by covering the shaft machined features with plastic wrap or equivalent.

SECTION 5. REPAIR

HOW TO USE THIS MANUAL

Each assembly is provided with an exploded view showing the parts involved. The complete exploded views and items lists are provided at the end of the repair section in this manual.

All figures show item references for assembly instructions only. See pages 31, 32, 33 and 34 for item and kit availability.

TOOLS AND TORQUES

Table 3. Required Tools

Miscellaneous	**Sockets**
BDP-10A/21L Service & Repair Manual	3/8" Drive Ratchet
Torque Wrench	9/16"
Scribe, Paint Pen, or Marker	1/2"
Seal Hook with a Magnet	5/8"
Flat Blade Screw Driver	10 mm
Pliers	**Combination Wrenches**
Internal Snap Ring	9/16"
Allen Wrenches	1/2"
5 mm	5/8"
3/16"	7/8"
1/4"	10 mm

Table 4. BDP-10A Plug Fitting Torque Values

Item # or Description	Torque
Case Drain (fitting torque)	200-250 lb-in (22.6-28.2 N-m)
System Port (fitting torque)	370-470 lb-in (41.8-53.1 N-m)
Inlet (fitting torque)	200-250 lb-in (22.6-28.2 N-m)
42A, 42B, Check Valves	180-240 lb-in (20.3-27.1 N-m)
42A, 42B, Check Reliefs (cap)	200-275 lb-in (22.6-31.0 N-m)
15, Bypass Valve	84-120 lb-in (9.5-13.6 N-m)
56, Diagnostic Plug	84-120 lb-in (9.5-13.6 N-m)
10, Cap Screw (non-auxiliary)	87-118 lb-in (9.8-13.3 N-m)
4, End Cap Bolts	167-217 lb-in (18.8-24.5 N-m)

Table 5. BDP-21L Plug Fitting Torque Values

Item # or Description	Torque
Case Drain fitting (fitting torque)	370-470 lb-in (41.8-53.1 N-m)
System Port (fitting torque)	370-470 lb-in (41.8-53.1 N-m)
Inlet (fitting torque)	370-470 lb-in (41.8-53.1 N-m)
42A, 42B, Check Valves	180-240 lb-in (20.3-27.1 N-m)
42A, 42B, Check Reliefs (cap)	200-275 lb-in (22.6-31.0 N-m)
50, Bypass Valve	84-120 lb-in (9.5-13.6 N-m)
52, Diagnostic Plug	84-120 lb-in (9.5-13.6 N-m)
56, Charge Cover Cap Screw(non-auxiliary)	200-275 lb-in (22.6-31.0 N-m)
58, End Cap Bolts	255-345 lb-in (28.8-38.9 N-m)

Use only original Hydro-Gear replacement parts found listed in BLN-50937 (microfiche).

Lip type seals (shaft seals) are used on the input shaft and directional control shaft of the BDP-10A/21L. 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.

REMOVAL, INSPECTION AND/OR REPLACEMENT OF INPUT SHAFT SEAL BDP-10A

Refer to Figure 7.

Disassembly BDP-10A

1. Remove retaining ring (22) from housing.

2. Remove lip seal (20). Care must be taken to prevent damage to the housing bore, shaft sealing surface, or bearing. Once removed, the seal is not reusable.

Inspection BDP-10A

1. With seal removed inspect the spacer (21), input shaft bearing (19) and housing (1) bore for damage, corrosion or wear.

Assembly BDP-10A

1. Lubricate the new lip seal (20) with petroleum jelly.

2. Wrap the input shaft (18) with plastic wrap to prevent damage to the inner surface of the lip seal (20).

3. Slide seal (20) over shaft (18) so that lettering on the seal faces out.

4. Press the lip seal (20) into the housing bore. Insure the lip seal (20), shaft (18) or housing (1) bore does not become damaged.

5. Install the retaining ring (22) into the housing (1) bore groove.

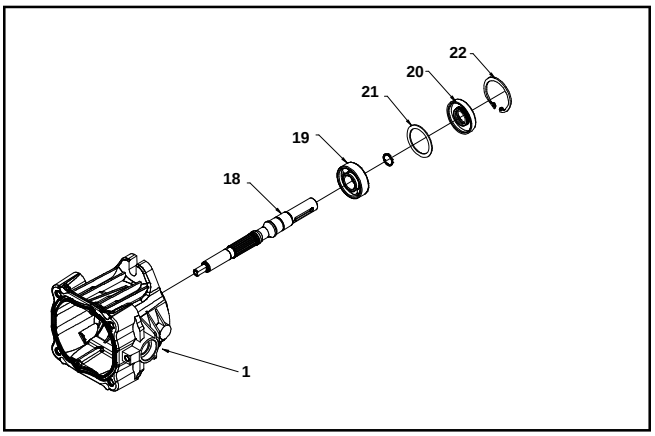


Figure 7 . BDP-10A

REMOVAL, INSPECTION AND/OR REPLACEMENT OF INPUT SHAFT SEAL BDP-21L

Refer to Figure 8.

Disassembly BDP-21L

1. Remove retaining ring (3) from housing (15).

2. Remove lip seal (6). Care must be taken to prevent damage to the housing bore, shaft, sealing surface, or bearing. Once removed the seal is not reusable.

Inspection BDP-21L

1. With the lip seal (6) removed, inspect the spacer (4) the shaft bearing (5) and housing (15) bore.

Assembly BDP-21L

1. Lubricate the new lip seal (6) with petroleum jelly.

2. Wrap the input shaft (1) with plastic wrap to prevent damage to the inner surface of the lip seal (6).

3. Slide the seal (6) over shaft (1) so that lettering on the seal (6) faces out.

4. Press the lip seal (6) into the housing (15) bore. Insure seal (6), shaft (1) or housing (15) bore does not become damaged.

5. Install the retaining ring (3) into the housing (15) bore groove.

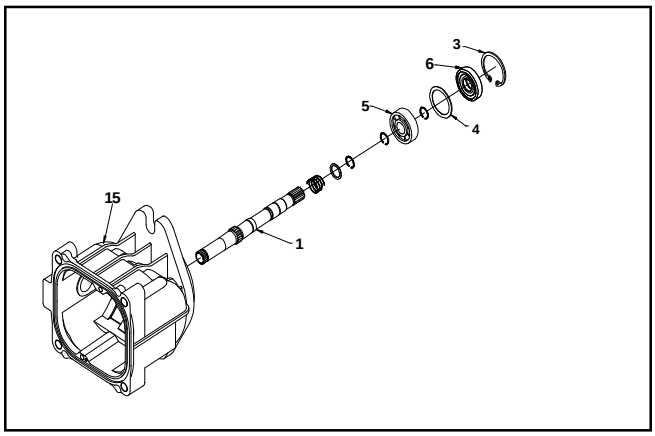


Figure 8 . BDP-21L

REMOVAL, INSPECTION AND/OR REPLACEMENT OF TRUNNION ARM (CONTROL ARM) SEAL BDP-10A

Refer to figure 9.

Disassembly BDP-10A

1. Remove the retainer and lip seal (49) from the housing (1). Care must be taken to prevent damage to the housing trunnion bore, trunnion arm (37) and sealing surface. Once removed the retainer and lip seal is not reusable.

Inspection BDP-10A

1. With the lip seal (49) removed, inspect the area for corrosion and wear. Inspect the trunnion bore area sealing surface for damage or wear.

Assembly BDP-10A

1. Lubricate the new lip seal (49) with petroleum jelly.

2. Wrap the trunnion arm (37) with plastic wrap to prevent damage to the inner surface of the lip seal (49).

3. Slide the lip seal (49) over the trunnion arm (37) so that the lettering on the seal (49) faces out.

4. Press the lip seal (49) into the housing bore (1). Insure the seal (49), trunnion arm (37), and housing bore does not become damaged.

5. Install the retainer from (49) over the trunnion arm (37) on top of the lip seal from (49). Press into the trunnion seal bore in the housing until it mates against the trunnion seal.

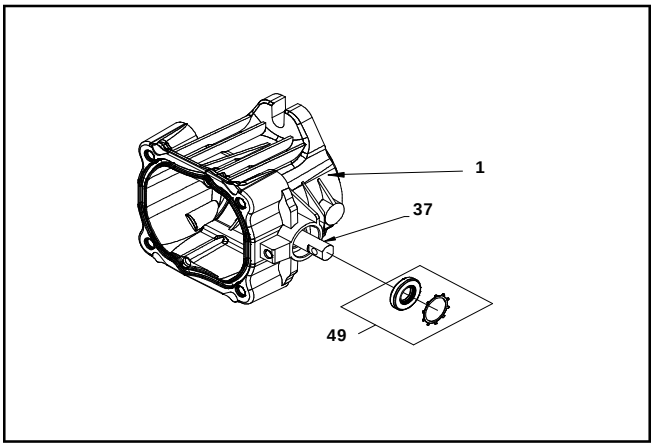


Figure 9 . BDP-10A

REMOVAL, INSPECTION AND/OR REPLACEMENT OF TRUNNION ARM (CONTROL ARM) SEAL BDP-21L

Refer to figure 10.

Disassembly BDP-21L

1. Remove the retainer (10) and lip seal (2). Care must be taken to prevent damage to the housing trunnion bore, trunnion arm (13) and sealing surface. Once removed lip seal (12) is not reusable.

Inspection BDP-21L

1. With the lip seal (12) removed, inspect the area for corrosion and wear. Inspect the trunnion bore area sealing surface for damage or wear.

Assembly BDP-21L

1. Lubricate the new lip seal (12) with petroleum jelly.

2. Wrap the trunnion arm (13) with plastic wrap to prevent damage to the inner surface of the lip seal (12).

3. Slide the lip seal (12) over the trunnion arm (13) so that lettering on the seal (13) faces out.

4. Press the lip seal (12) into the housing bore (15). Insure the seal (12), trunnion arm (13), and housing bore does not become damaged.

5. Install the retainer (10) over the trunnion arm (13) on top of the lip seal (12). Press into the trunnion seal bore in the housing (15) bore ring groove.

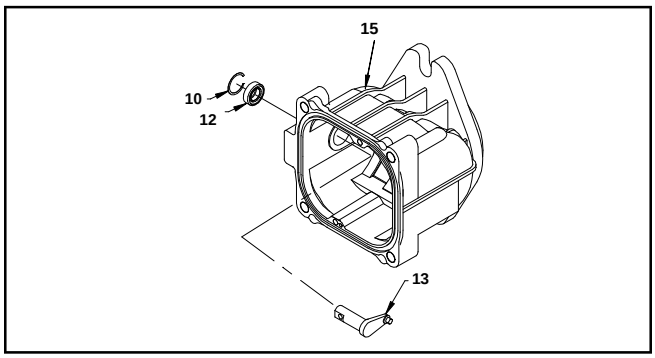


Figure 10 . BDP-21L

REMOVAL, INSPECTION AND/OR REPLACEMENT OF CHECK VALVES BDP-10A

Refer to Figure 11.

Disassembly BDP-10A

Perform disassembly, inspection and assembly on check valves one side at a time. Some units vary in “A” side to “B” side check configuration.

1. Remove the check valve (42) with 1/4” allen wrench.

2. Remove the valve spring and poppet from the BDP end cap (2).

Inspection BDP-10A

1. Inspect the poppets and mating seats in the end cap (2) for damage or foreign material.

Assembly BDP-10A

1. Lay the BDP on its side, so the check plug port is horizontal.

2. Insert the check plug, spring and poppet (42) as one assembly into the check plug port. Tighten, reference Table 4, page 13, for torque values.

Repeat disassembly, inspection and assembly for the opposite port side.

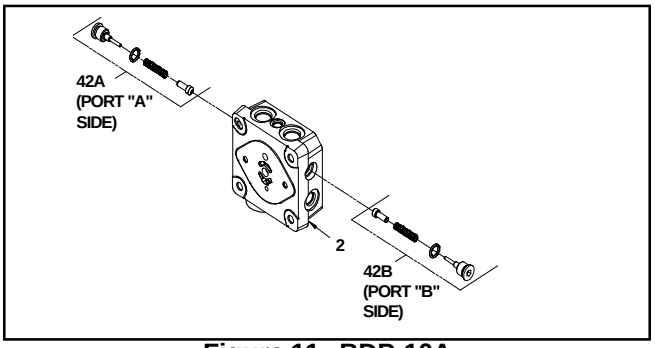


Figure 11 . BDP-10A

REMOVAL, INSPECTION AND/OR REPLACEMENT OF CHECK VALVES BDP-21L

Refer to Figure 12.

Disassembly BDP-21L

Perform disassembly, inspection and assembly on check valves one side at a time. Some units vary in “A” side to “B” side check configuration.

1. Remove the check valve (42) with 1/4” allen wrench.

2. Remove the valve spring and poppet from the BDP end cap (25).

Inspection BDP-21L

1. Inspect the poppet and mating seats in the end cap (25) for damage or foreign material.

Assembly BDP-21L

1. Lay the BDP on its side, so the check plug port is horizontal.

2. Insert the check plug, spring and poppet (42) as one assembly into the check plug port. Tighten, reference Table 5, page 13, for torque values.

Repeat disassembly, inspection and assembly for the opposite port side.

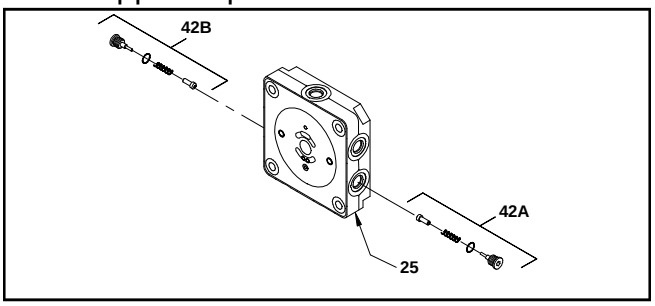


Figure 12 . BDP-21L

REMOVAL, INSPECTION AND/OR REPLACEMENT OF SYSTEM CHECK RELIEFS (SCR's) BDP-10A

Refer to Figure 13.

Disassembly BDP-10A

Perform disassembly, inspection and assembly on SCR one side at a time. Some units vary in "A" side to "B" side check configuration.

1. Remove the system check relief (SCR) (42) with a 7/8" wrench.

2. Remove the check relief spring and the check relief from the BDP end cap (2).

Inspection BDP-10A

1. Inspect the check relief (42) and mating seat in the end cap (2) for damage or foreign material.

Assembly BDP-10A

1. Lay the BDP on its side, so the check plug port is horizontal.

2. Insert the system check relief spring and check relief as one assembly into the check plug port. Tighten, reference Table 4, page 13, for torque values.

Repeat disassembly, inspection and assembly for the opposite port side.

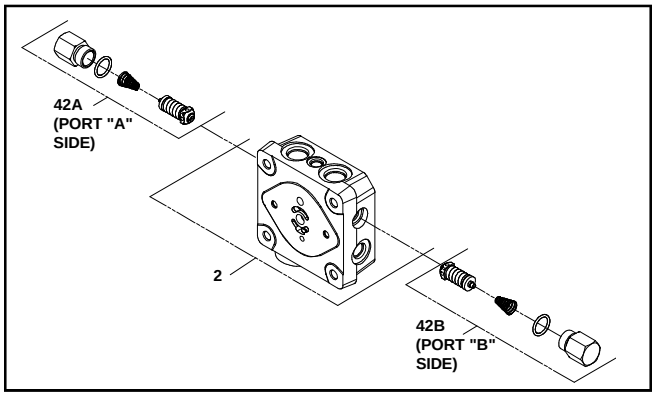


Figure 13 . BDP-10A

REMOVAL, INSPECTION AND/OR REPLACEMENT OF SYSTEM CHECK RELIEFS (SCR's) BDP-21L

Refer to Figure 14.

Disassembly BDP-21L

Perform disassembly, inspection and assembly on SCR one side at a time. Some units vary in "A" side to "B" side check configuration.

1. Remove the system check relief (SCR) (42) with a 7/8" wrench.

2. Remove the check relief spring and the check relief from the BDP end cap (25).

Inspection BDP-21L

1. Inspect the check relief (42) and mating seats in the end cap (25) for damage or foreign material.

Assembly BDP-21L

1. Lay the BDP on its side, so the check plug port is horizontal.

2. Insert the system check relief spring and check relief (42) as one assembly into the check plug port. Tighten, reference Table 5, page 13, for torque values.

Repeat disassembly, inspection and assembly for the opposite port side.

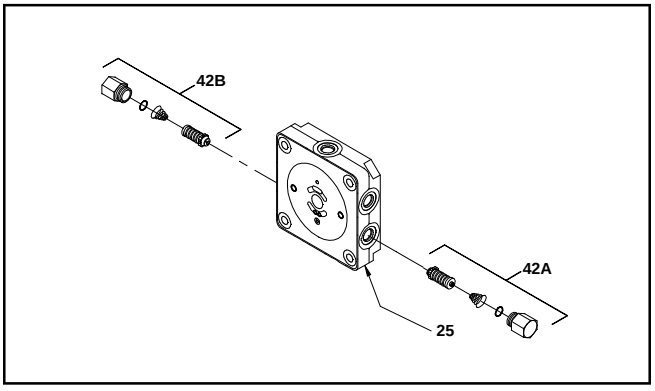


Figure 14 . BDP-21L

REMOVAL, INSPECTION AND/OR REPLACEMENT OF THE BYPASS BDP-10A

Refer to Figure 15.

Disassembly BDP-10A

1. Loosen the bypass valve (15) using a 5/8" wrench.

2. Remove the bypass (15) from the BDP end cap (2).

Inspection BDP-10A

1. Inspect the bypass O-rings and mating seats in the end cap (2) for damage or foreign material.

2. If damaged or worn replace bypass (15).

Assembly BDP-10A

1. Lay the BDP on its side, so the bypass port is horizontal.

2. Insert the bypass (15) into the bypass port on the end cap (2). Tighten, reference Table 4, page 13, torque values.

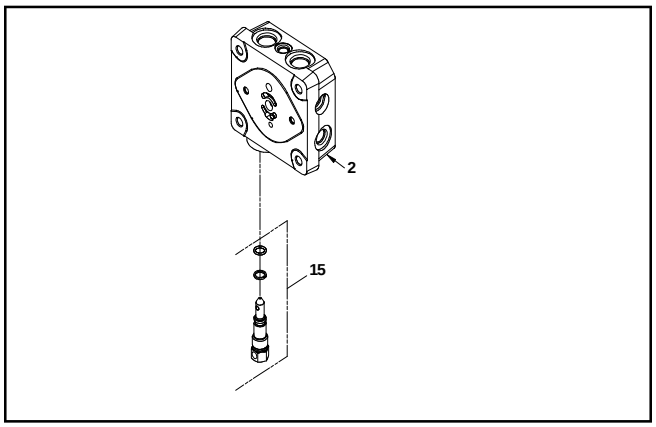


Figure 15 . BDP-10A

REMOVAL, INSPECTION AND/OR REPLACEMENT OF THE BYPASS BDP-21L

Refer to Figure 16.

Disassembly BDP-21L

1. Loosen the bypass valve (50) using a 5/8" wrench.

2. Remove the bypass (50) from the BDP end cap (25).

Inspection BDP-21L

1. Inspect the bypass O-rings and mating seats in the end cap (25) for damage or foreign material.

2. If damaged or worn replace bypass (50).

Assembly BDP-21L

1. Lay the BDP on its side, so the bypass port is horizontal.

2. Insert the bypass (50) into the bypass port on the end cap (25). Tighten, reference Table 5, page 13, torque values.

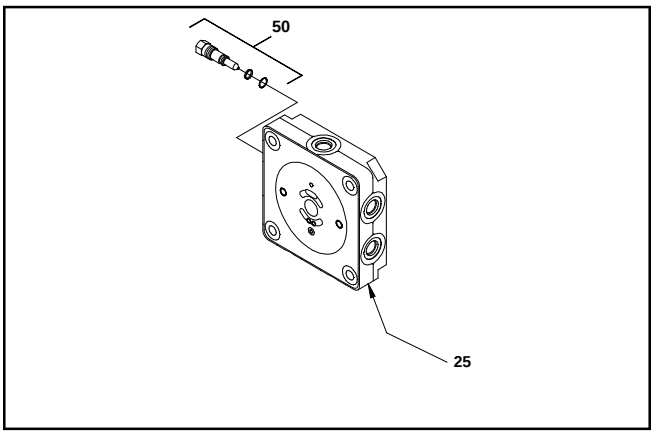


Figure 16 . BDP-21L

REMOVAL, INSPECTION OF THE STANDARD CHARGE PUMP BDP-10A

Refer to Figure 17.

Disassembly BDP-10A

1. Prior to removal of the charge cover, place a mark on the charge cover and end cap for re-alignment.

2. Using a 5 mm allen wrench, loosen the charge cover bolts (10) from the BDP end cap (2). While holding the charge cover in place, remove the charge cover bolts (10).

3. Remove the charge cover, O-ring, gerotor items (6), charge spring and charge ball (44).

Inspection BDP-10A

1. Inspect the charge cover O-ring and running surfaces for damage. Inspect the spring , check ball (44), and mating seat in the end cap (2) for damage or foreign material.

Note: If end cap (2) is to be removed, delay charge components reassembly.

Assembly BDP-10A

1. Lay the BDP (input shaft down), so the end cap (2) is horizontal. Place the charge ball (44) in the end cap (2) charge pocket so it mates to the end cap (2) charge ball seat. Place the charge spring, also identified as item (44), on top of the charge ball.

2. Insert the inner gerotor over input shaft (18).

3. Align the outer gerotor to fit over the inner gerotor.

4. Insert the O-ring into the charge cover.

5. Position the charge cover and O-ring with the aligning mark on the end cap. Place the charge cover and O-ring as one piece over the charge spring and gerotor assembly. Insure the spring fits into the charge cover spring retaining groove.

6. Align and insert the allen screws (6) into the end cap (2). Tighten, reference Table 4, page 13, torque values.

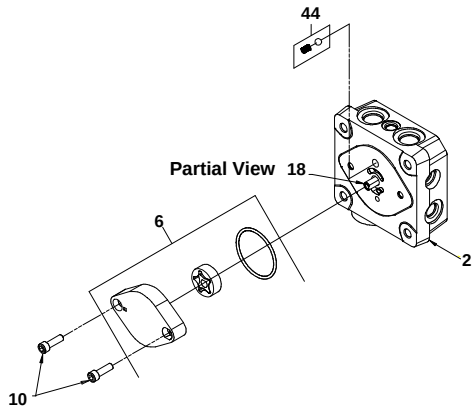


Figure 17 . BDP-10A

REMOVAL, INSPECTION AND ASSEMBLY OF THE STANDARD CHARGE PUMP BDP-21L

Refer to Figure 18.

Disassembly BDP-21L

1. Prior to removal of the charge cover, place a mark on the charge cover and end cap for re-alignment.

2. Using a 1/2" wrench loosen the charge cover bolts from the BDP end cap (25). While holding the charge cover in place, remove the charge cover bolts (56).

3. Remove the charge cover, O-ring, gerotor items (40), charge spring and charge ball (44).

Inspection BDP-21L

1. Inspect the charge cover O-ring and running surfaces for damage. Inspect the spring , check ball (44), and mating seat in the end cap (25) for damage or foreign material.

2. If damaged or worn, replace O-ring and gerotor assembly (40), charge spring and charge ball (44) and end cap (25).

Note: If end cap (25) is to be removed, delay charge components reassembly.

Assembly BDP-21L

1. Lay the BDP (input shaft down), so the end cap is horizontal. Place the charge ball in the end cap (25) charge pocket so it mates to the end cap (25) charge ball seat. Place the charge spring on top of the charge ball.

2. Insert the inner gerotor over input shaft (1).

3. Align the outer gerotor to fit over the inner gerotor.

4. Insert the O-ring into the charge cover.

5. Position the charge cover and O-ring with the aligning mark on the end cap (25). Place the charge cover and O-ring as one piece over the charge spring and gerotor assembly. Insure the spring fits into the charge cover spring retaining groove.

6. Align and insert the cap screws (58) into the end cap. Tighten, per Table 5, page 13, torque values.While holding the charge cover in place, remove the charge cover bolts (56).

3. Remove the charge cover, O-ring, gerotor items (40), charge spring and charge ball (44).

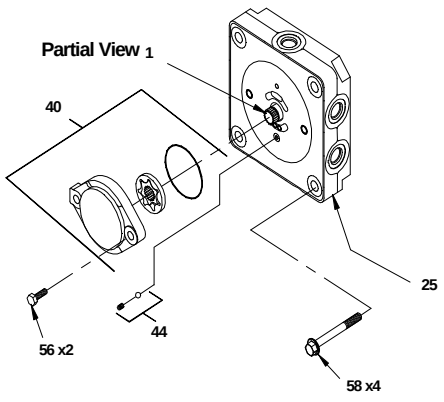


Figure 18 . BDP-21L

REMOVAL, INSPECTION AND ASSEMBLY OF THE END CAP AND VALVE PLATE BDP-10A

Refer to Figure 19.

Disassembly BDP-10A

1. Using a 10 mm wrench, loosen the end cap bolts (4) evenly.

2. Keeping the end cap (2) held in place, remove the four end cap bolts (4).

3. Slowly remove the end cap (2).

4. Remove the valve plate (31).

5. Remove housing alignment pins (3).

6. Remove housing gasket (5).

Inspection BDP-10A

1. Inspect the end cap (2) body for damage, nicks or unusual wear patterns. Replace if necessary.

2. Inspect the bronze side of the valve plate (31). The running surface may show evidence of minor abrasive rings. This is normal. Grooving in the plate, or material transfer that is evident when the surface is checked by dragging a fingernail across it, would be cause for replacement of the valve plate.

3. Inspect and replace alignment pins (3) if bent or distorted.

4. Replace the housing gasket (5) with a new gasket before reassembly.

Assembly BDP-10A

1. Install housing gasket (5) into housing gasket seat in housing (1).

2. Install alignment pins (3) into housing (1).

3. Install valve plate (31) with bronze side down on top of cylinder block.

4. Install end cap (2). Before installing the four end cap bolts (4), push down on end cap (2) verifying alignment and insuring that the cylinder block pistons spring back and forth. Install end cap bolts (4). Tighten, reference Table 4, page 13, torque values.

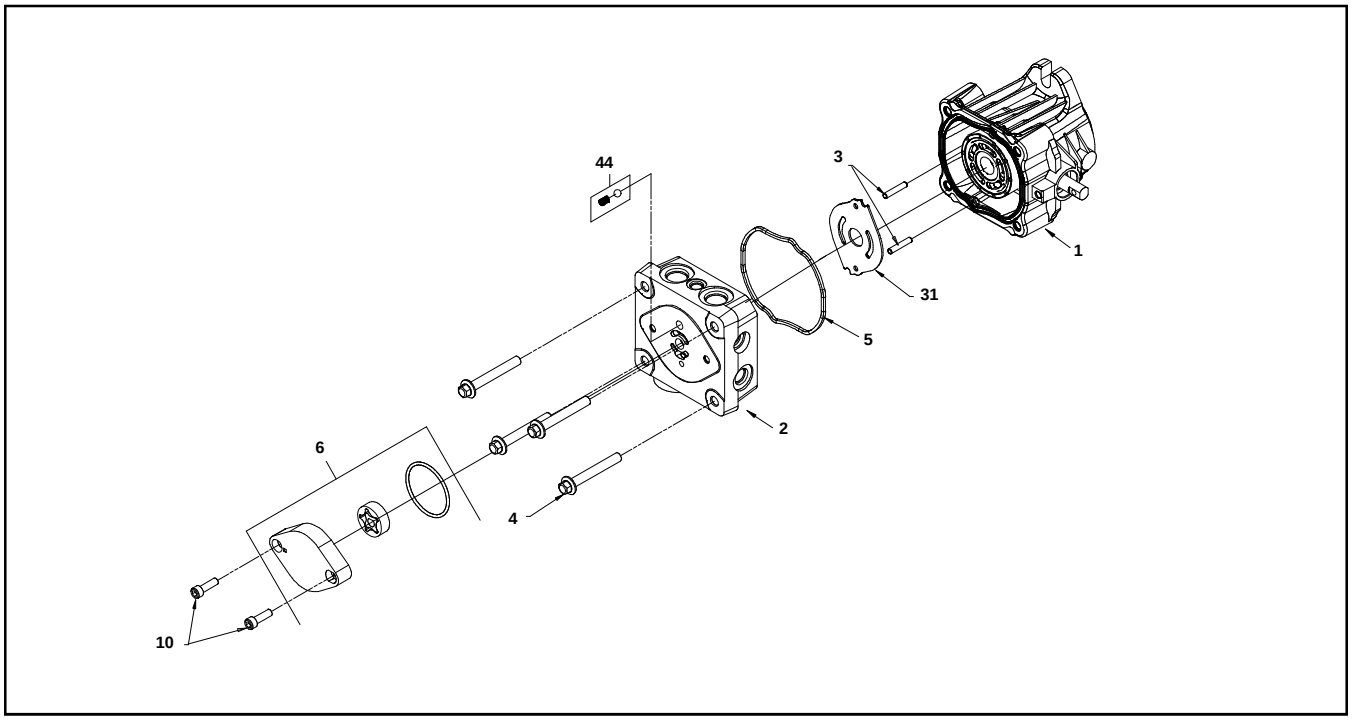


Figure 19 . BDP-10A

REMOVAL, INSPECTION AND ASSEMBLY OF THE END CAP AND VALVE PLATE BDP-21L

Refer to figure 20.

Disassembly BDP-21L

1. Using any combination of two, 9/16" wrenches or 9/16" socket and rachet drive, loosen the end cap bolts (58) evenly.

2. Keeping the end cap (25) held in place remove the four end cap bolts (58).

3. Slowly remove the end cap (25).

4. Remove the valve plate (29).

5. Remove housing alignment pins (26).

6. Remove housing gasket (28).

Inspection BDP-21L

1. Inspect the end cap (25) body for damage, nicks or unusual wear patterns. Replace if necessary.

2. Inspect the bronze side of the valve plate (29). The running surface may show evidence of minor abrasive rings. This is normal. Grooving in the plate, or material transfer that is evident when the surface is checked by dragging a fingernail across it, would be cause for replacement of the valve plate.

3. Inspect and replace alignment pins (26) if bent or distorted.

4. Replace the housing O-ring (28) with a new O-ring before reassembly.

Assembly BDP-21L

1. Install housing O-ring (28) into housing O-ring seat in housing (15).

2. Install alignment pins (26) into housing (15).

3. Install valve plate (29) with bronze side down on top of cylinder block.

4. Install end cap (25). Before installing the four end cap bolts (58), push down on end cap (25) verifying alignment and insuring that the cylinder block pistons spring back and fourth. Install end cap bolts. Tighten, per Table 5, page 13, torque values.

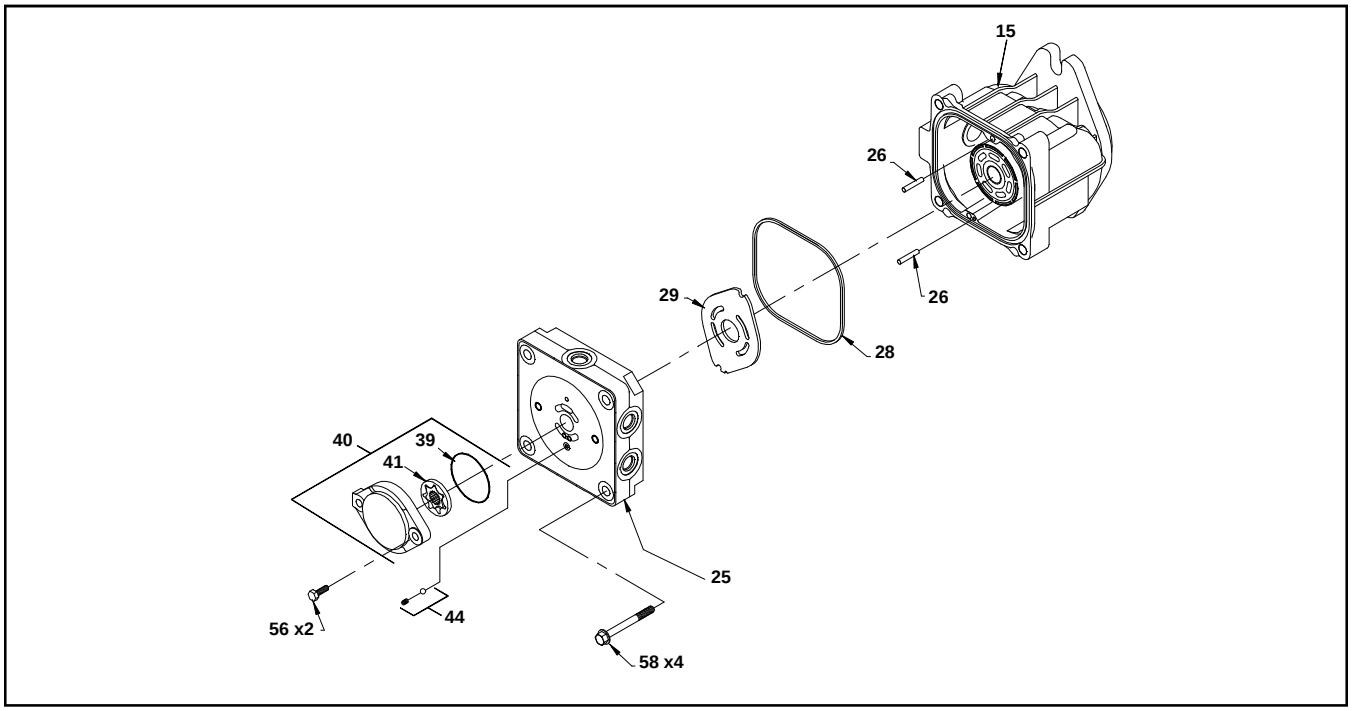


Figure 20 . BDP-21L

REMOVAL, INSPECTION AND ASSEMBLY OF THE CYLINDER BLOCK BDP-10A

Refer to Figure 21.

Disassembly BDP-10A

1. Tilt the BDP on its side, drain remaining oil. Lift out the cylinder block assembly (25).

2. Remove the pistons, springs and piston seats.

Inspection BDP-10A

1. Inspect the running surface of the cylinder block and piston ends for damage, nicks or unusual wear patterns. The running surface may show evidence of minor abrasion . This will be a normal wear. If grooved or smeared, replace with a new cylinder block assembly.

2. Inspect the piston springs for distortion or breakage. If necessary, replace with new cylinder block kit.

3. Inspect the piston seats. Residual oil may cause these to remain stuck to the inside of the pistons.

Assembly BDP-10A

1. Install piston seats into the end of the pistons.

2. Install springs into the pistons.

3. Install one at a time, pistons, springs and seats as one assembly into the cylinder block.

4. With the BDP housing tilted on its side, install the cylinder block assembly (25) with pistons contacting the thrust bearing.

NOTE: To check that piston placement is correct, push downward on the cylinder block assembly (25). If it results with a spring action, the block has been assembled correctly without pistons slipping out. If this cannot be accomplished, place a rubber band around the cylinder block pistons to hold them in position during installation. Then, after installation, cut the rubber band and remove it. Check for piston spring action.

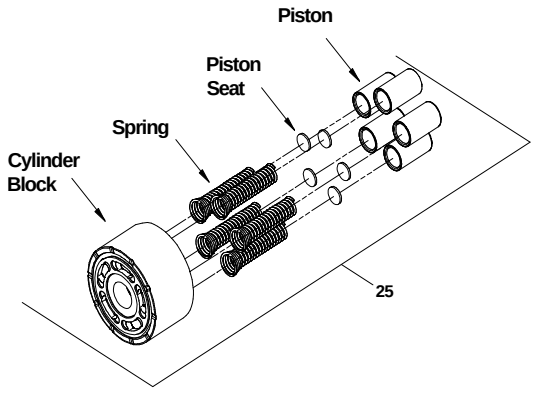


Figure 21 . BDP-10A

REMOVAL, INSPECTION AND ASSEMBLY OF THE CYLINDER BLOCK BDP-21L

Refer to Figure 22.

Disassembly BDP-21L

1. Tilt the BDP on its side, drain remaining oil. Lift out the cylinder block assembly (38).

2. Remove the pistons, springs and piston seats.

Inspection BDP-21L

1. Inspect the running surface of the cylinder block and piston ends for damage, nicks or unusual wear patterns.

The running surface may show evidence of minor abrasion . This will be normal wear. If grooved or smeared, replace with a new cylinder block assembly.

2. Inspect the piston springs for distortion or breakage. If necessary, replace with new cylinder block kit.

3. Inspect the piston seats. Residual oil may cause these to remain stuck to the inside of the pistons.

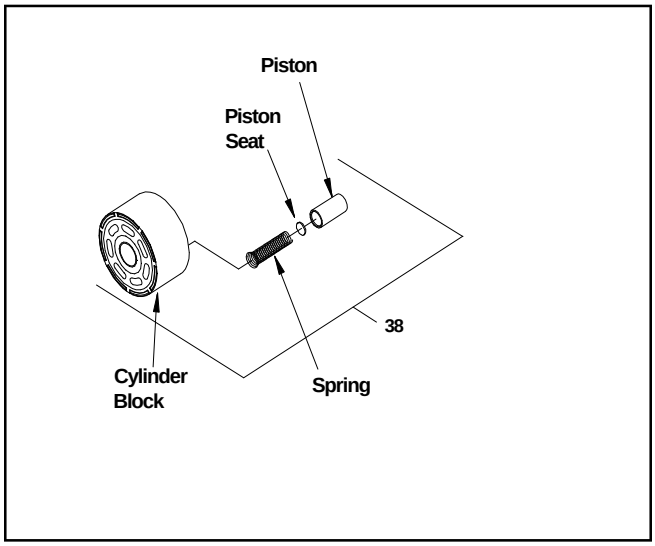


Figure 22 . BDP-21L

Assembly BDP-21L

1. Install piston seats into the end of the pistons.

2. Install springs into the pistons.

3. Install one at a time, pistons, springs and seats as one assembly into the cylinder block.

4. With the BDP housing tilted on its side, install the cylinder block assembly (38) with pistons contacting the thrust bearing.

NOTE: To check piston placement is correct, push downward on the cylinder block assembly (38). If it results with a spring action the block has been assembled correctly without pistons slipping out. If this cannot be accomplished, place a rubber band around the cylinder block pistons to hold them in position during installation. Then after installation cut the rubber band and remove it. Check for piston spring action.

REMOVAL, INSPECTION AND ASSEMBLY OF BLOCKSPRING, THRUST WASHER, AND THRUST BEARING, BDP-10A

Refer to Figure 24.

Disassembly BDP-10A

1. Remove the block spring (29).

2. Remove the thrust washer (30).

3. Remove the thrust bearing and race (34).

Inspection BDP-10A

1. Inspect and replace the block spring (29) and thrust washer (30) if they are distorted or broken.

2. Inspect the running surface of the bearing race for damage, nicks or unusual wear patterns. The running surface may show evidence of minor abrasion . This will be normal wear. Inspect the bearings for free movement. Inspect the bearing cage for distortion or damage. Replace if necessary.

Assembly BDP-10A

1. Install thrust bearing and race assembly (34).

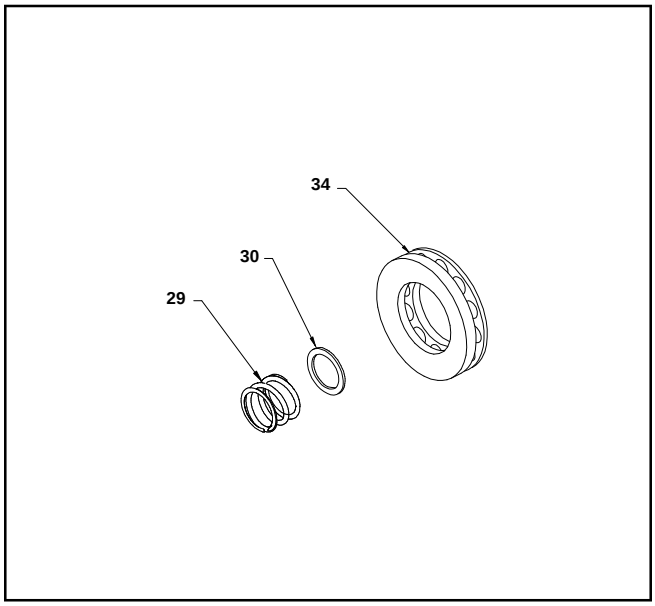


Figure 24 . BDP-10A

NOTE: The difference in race thickness: The thin race seats into the swashplate (32). The thicker race will be installed toward the piston noses.

2. Install thrust washer (30).

3. Install block spring (29).

REMOVAL, INSPECTION AND ASSEMBLY OF THRUST BEARING, BDP-21L

Refer to Figure 25.

Disassembly BDP-21L

1. Remove the thrust bearing and race (17).

Inspection BDP-21L

1. Inspect the running surface of the bearing race for damage (17), nicks or unusual wear patterns. The running surface may show evidence of minor abrasion . This will be normal wear. Inspect the bearings for free movement. Inspect the bearing cage for distortion or damage. Replace if necessary.

Assembly BDP-21L

1. Install bearing and race assembly (17).

NOTE: The difference in race thickness: The thin race seats into the swashplate. The thicker race will be installed toward the piston noses.

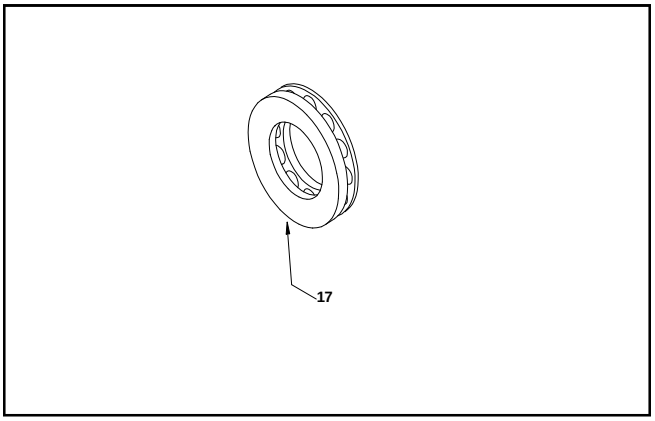


Figure 25 . BDP-21L

REMOVAL, INSPECTION OF SWASHPLATE, INSPECTION OF CRADLE BEARINGS BDP-10A

Refer to Figure 26.

Disassembly BDP-10A

1. Remove the swashplate(32).

Inspection BDP-10A

1. Inspect the running surface of the bearing pocket for damage (32), nicks or unusual wear patterns. The running surface may show evidence of minor abrasion . This will be normal wear. Inspect the cradle bearing side of the swashplate (32) for damage. Replace if necessary.
2. Inspect the cradle bearings attached to the inside of housing (1) for normal wear patterns, placement, and insure they are staked in place. If damaged, replace housing (1).

NOTE: The cradle bearings will have discoloration due to normal wear. This, under normal circumstances, will not warrant replacement.

Assembly BDP-10A

1. Install swashplate (13) by holding trunnion arm's (37) slot guide (38) with the aide of a flat tip screwdriver. Use the screwdriver to hold the slot guide (38) in place while positioning the swash plate (32) onto the cradle bearing in the housing (1).

2. Rotate trunnion arm (13) to assure swashplate pivoting action.

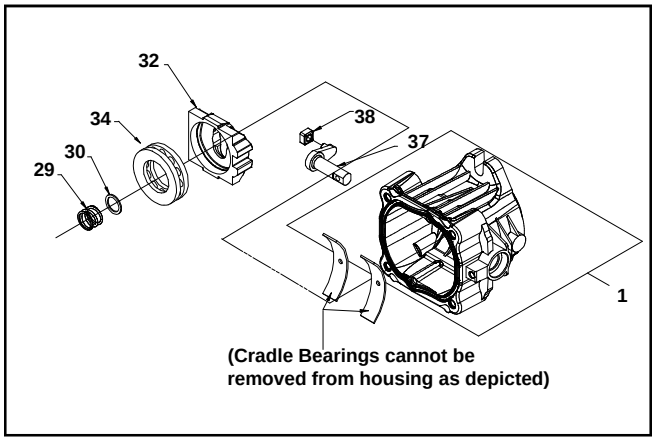


Figure 26 . BDP-10A

REMOVAL, INSPECTION AND ASSEMBLY OF SWASHPLATE, AND CRADLE BEARINGS, BDP-21L

Refer to Figure 27.

Disassembly BDP-21L

1. Remove the swashplate (31).

Inspection BDP-21L

1. Inspect the running surface of the bearing pocket for damage (31), nicks or unusual wear patterns. The running surface may show evidence of minor abrasion . This will be normal wear. Inspect the cradle bearing side of the swashplate (31) damage. Replace if necessary.

2. Inspect the cradle bearings attached to the inside of housing (15) for normal wear patterns, placement, and insure they are staked in place. If damaged, replace housing (15).

NOTE: The cradle bearings will have discoloration due to normal wear. This under normal circumstances will not warrant replacement.

Assembly BDP-21L

1. Install swashplate (31) by holding trunnion arm's (13) slot guide (14) with the aide of a flat tip screwdriver. Use the screwdriver to hold the slot guide (14) in place while positioning the swash plate (31) onto the cradle bearing in the housing (15).

2. Rotate trunnion arm (13) to assure swashplate pivoting action.

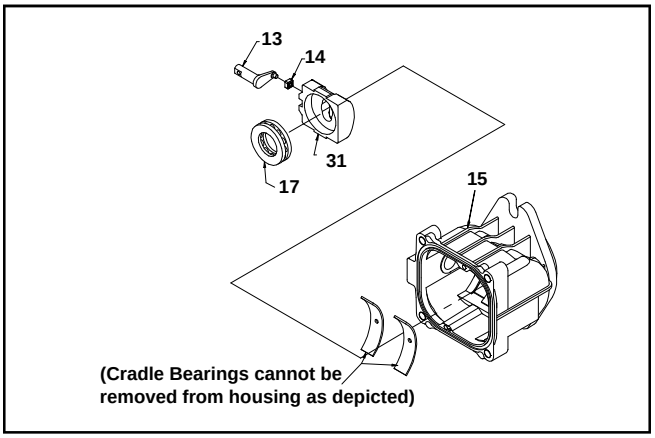


Figure 27 . BDP-21L

REMOVAL, INSPECTION AND ASSEMBLY OF INPUT SHAFT BDP-10A

Refer to Figure 28.

Disassembly BDP-10A

1. Remove the retaining ring (22).
2. Remove the lip seal (20).
3. Remove the spacer (21).
4. Remove the shaft assembly (18) from the BDP.

Inspection BDP-10A

1. Inspect the input shaft (18) for worn splines, surface damage, or keyway damage. Replace shaft assembly if necessary.
2. Inspect the bearing (19) for evidence of scoring, corrosion, or damage. Replace shaft assembly if necessary.
3. Inspect and replace the spacer (21) if it is bent or broken.
4. Inspect and replace the retaining ring (22) if it is bent or broken.

Note: Replace the input shaft seal (20) after removal.

Note: If trunnion arm is to be removed, delay reassembly of input shaft assembly.

Assembly BDP-10A

Note: Upon removal, it is recommended that all seals, O-rings, and gaskets be replaced. During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also, protect the inner diameter of seals by covering the shaft with plastic wrap.

1. Install input shaft assembly (18) into the housing (1) bore. Light tapping with a rubber mallet may be necessary on the input shaft (18) once the bearing is aligned with the housing (1) bore. Rotate the input shaft (18) to insure free movement.
2. Install spacer (21).
3. Install new lip seal (20).
4. Install retaining ring (22).

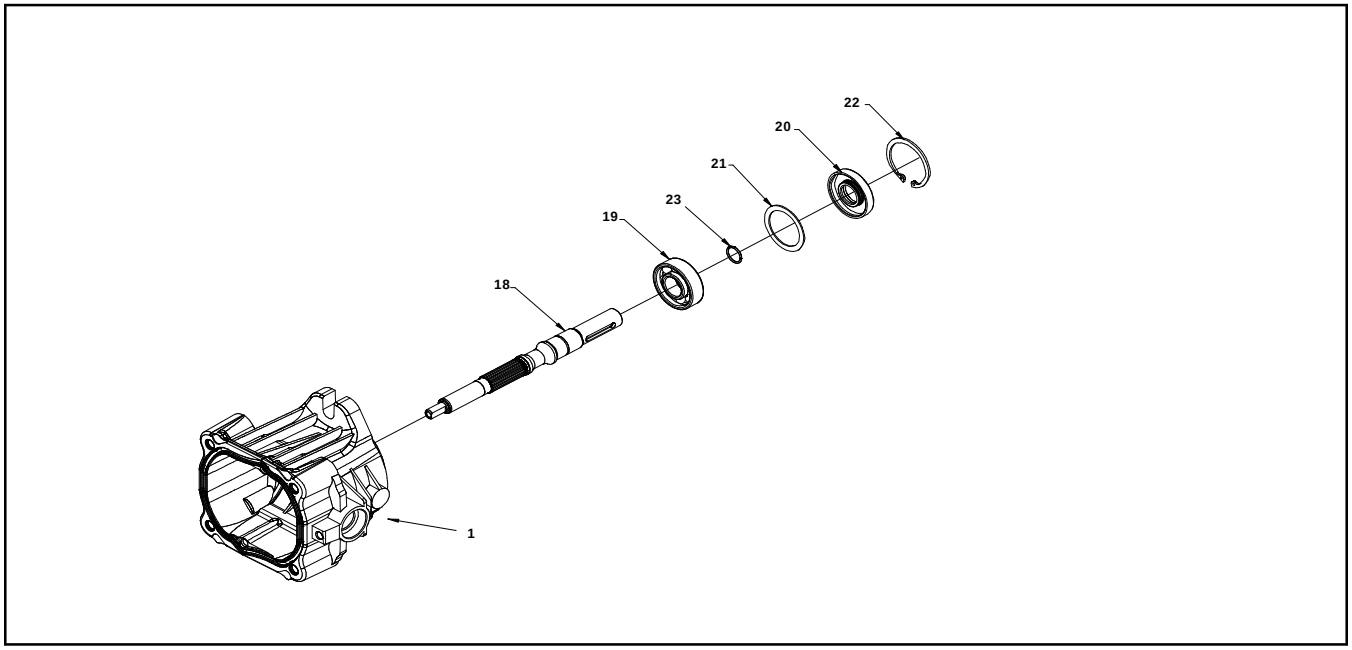


Figure 28 . BDP-10A

REMOVAL, INSPECTION AND ASSEMBLY OF INPUT SHAFT, BDP-21L

Refer to Figure 29.

Disassembly BDP-21L

1. Remove the retaining ring (3).
2. Remove the lip seal (6).
3. Remove the spacer (4).
4. Remove the shaft assembly (1) from the BDP.

Inspection BDP-21L

1. Inspect the input shaft (1) for worn splines, damage, or keyway damage. Replace shaft assembly if necessary.
2. Inspect the bearing (5) for evidence of scoring, corrosion, or damage. Replace shaft assembly if necessary.
3. Inspect and replace the spacer (4) if it is bent or broken.

Note: Replace the input shaft seal (6) after removal.

4. Inspect and replace the retaining ring (3) if it is bent or broken.

Note: If trunnion arm is to be removed, delay reassembly of input shaft assembly.

5. Inspect and replace the thrust spring (20) and thrust washer (19) if they are distorted or broken.

Assembly BDP-21L

Note: Upon removal, it is recommended that all seals, O-rings, and gaskets be replaced. During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also, protect the inner diameter of seals by covering the shaft with plastic wrap.

1. Install the shaft (1) assembly, into the housing **(15) bore.** Light tapping with a rubber mallet may be necessary on the input shaft (1) once the bearing is aligned with the housing bore (15). Rotate the input shaft (1) to insure free movement.
2. Install spacer (4).
3. Install new lip seal (6).
4. Install retaining ring (3).

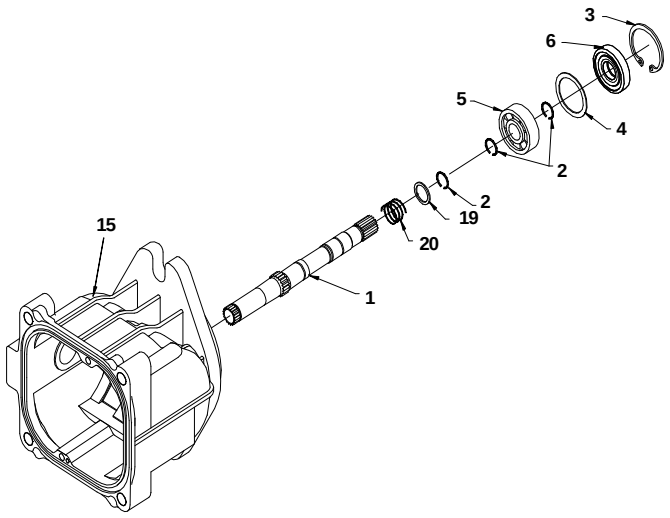


Figure 29 . BDP-21L

REMOVAL, INSPECTION TRUNNION ARM BDP-10A

Refer to Figure 30.

Disassembly BDP-10A

1. Remove trunnion seal retainer and seal (49).

2. Remove slot guide (38).

3. Remove trunnion arm (37).

I**nspection** BDP-10A

1. Inspect the trunnion arm (37) for wear or damage. Replace trunnion if necessary.

Note: Replace the trunnion shaft seal and retainer (49) after removal.

Assembly BDP-10A

1. Install the trunnion arm (37) into the housing (1) bore. Rotate the trunnion arm to insure free movement.

2. Install new seal and retainer from seal kit.

3. Refer to Figure 33, page 33. Install input shaft (18), bearing (19), swashplate (32), bearing race assembly. (34), cylinder block assembly (25), end cap (2), valve plate and charge cover (4). Tighten fasteners, reference Table 4, page 13, for torque values.

Note: Upon removal, it is recommended that all seals, O-rings, and gaskets be replaced. During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also protect the inner diameter of seals by covering the shaft with plastic wrap.

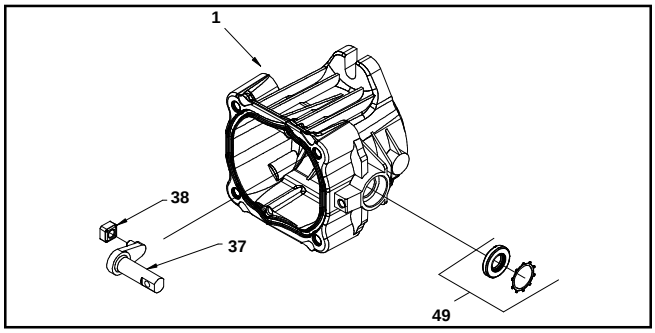


Figure 30 . BDP-10A

REMOVAL, INSPECTION TRUNNION ARM BDP-21L

Refer to Figure 31.

Disassembly -BDP-21L

1. Remove trunnion seal retainer (10) and seal (12).

2. Remove slot guide (14).

3. Remove trunnion arm (13).

Inspection- BDP-21L

1. Inspect the trunnion arm (13) for wear or damage. Replace trunnion if necessary.

Note: Replace the trunnion shaft seal (12) after removal.

Assembly - BDP-21L

1. Install the trunnion arm (13) into the housing (15) bore. Rotate the trunnion arm to insure free movement.

2. Install new seal and retainer from seal kit.

3. Refer to Figure 32, page 31. Install input shaft (1), swashplate (31), bearing race assembly (17), cylinder block assembly (38), end cap (25), valve plate and charge cover (40). Tighten fasteners, reference Table 5, page 13, for torque values.

Note: Upon removal, it is recommended that all seals, O-rings, and gaskets be replaced. During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also, protect the inner diameter of seals by covering the shaft with plastic wrap.

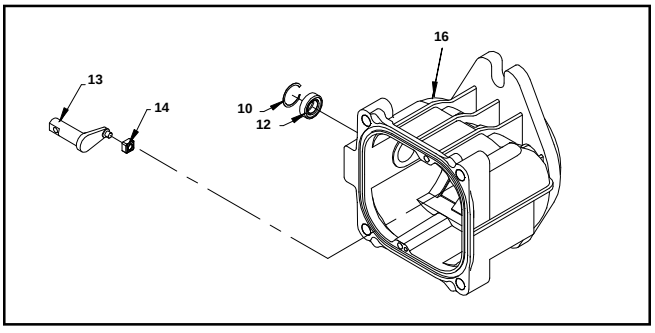


Figure 31 . BDP-21L

NOTES

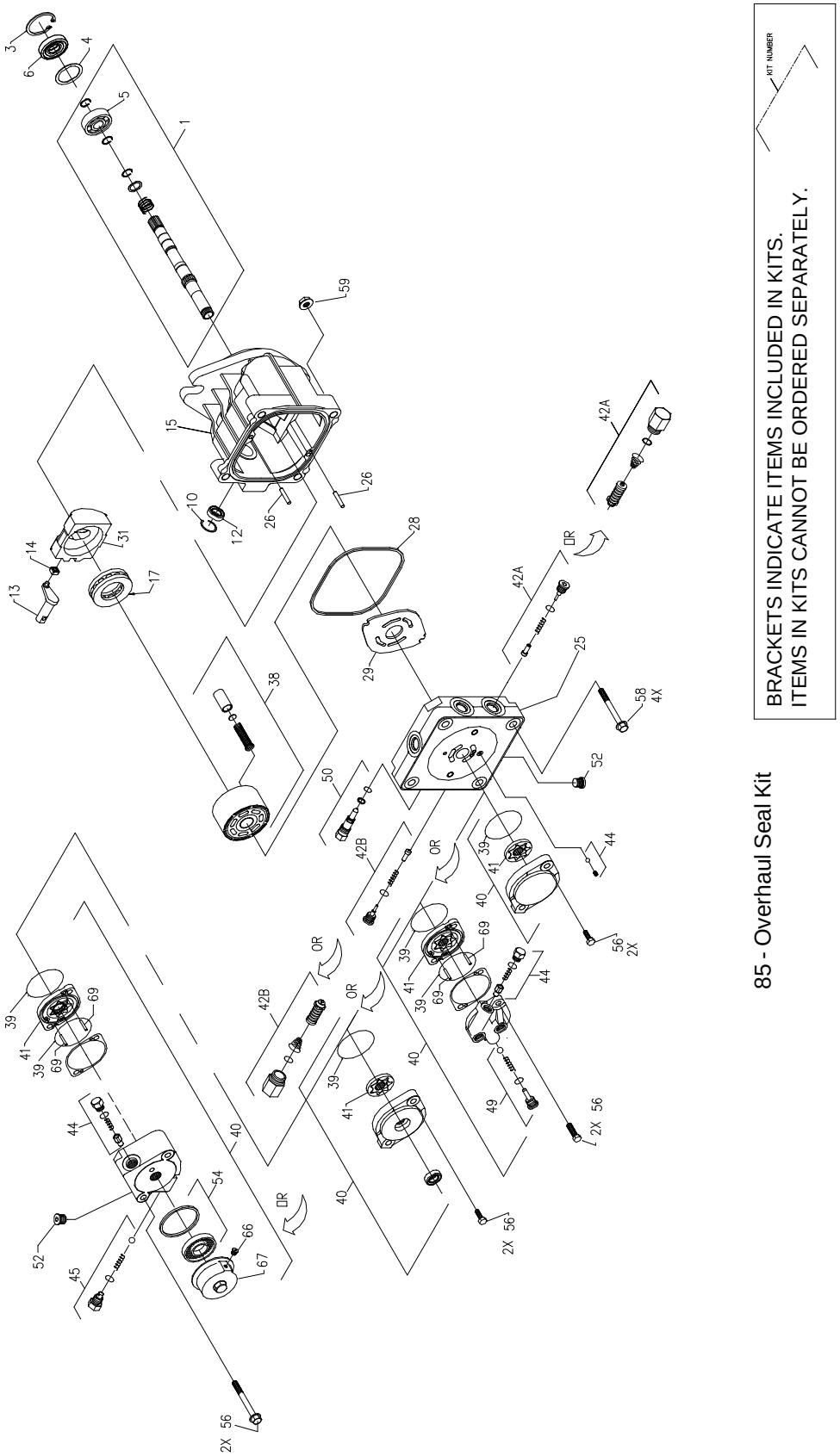


Figure 32 . BDP-21L

ITEMS LIST BDP 21L

Part numbers are not provided in this manual. See microfiche or parts manual for part numbers.

No.	Description
1	Kit Pump Shaft (19T Spline)
	Kit Pump Shaft (Closed Key)
	Kit Pump Shaft (Thru Shaft Spline)
	Kit Pump Shaft (Tapered Thru Shaft)
	Kit Pump Shaft (Shaft - Thru Pump)
	Retaining Ring
4	Spacer
5	Shaft Ball Bearing
6	Lip Seal 17 x 47 x 8 PTCN1
10	Trunion Seal Retaining Ring
12	Lip Seal 15 x 27 x 7
13	Trunnion Arm
14	Slot Guide
15	Housing Kit
17	Thrust Ball Bearing Assembly
19	Block Thrust Washer
20	Block Spring
25	Endcap Kit (W/Poppets)
	End Cap Kit (W/ Poppets, .078” Cooling Orifice)
	End Cap Kit (W/SCR'S)
	End Cap Kit (Aux W/ Poppets)
	End Cap Kit (Aux W/ SCR'S)
	End Cap Kit (Aux W/LH:SCR and RH: Poppet)
	End Cap Kit (W/LH: Poppet and RH:SCR)
26	Pin
28	O-Ring
29	Valve Plate
31	Variable Swashplate
38	Cylinder Block Kit
39	O-Ring
	R-Ring -144
40	Charge Pump Kit (0.19 STD Splined)
	Charge Pump Kit (0.13 STD Splined)
	Charge Pump Kit (0.13 STD Thru Shaft)
	Charge Pump Kit (0.13 STD Spline,Clear Zinc Cover)
	Charge Pump Kit (CW - Splined Aux, 40-70 psi)
	Charge Pump Kit (CW - Splined Aux, 135-165 psi)
	Charge Pump Kit (CCW - Splined Aux, 40-70 psi)
	Charge Pump Kit (AL Aux, 7/16 SAE Port, 40-70 psi)
	Charge Pump Kit (AL Aux, 7/16 SAE Port, (75-105 psi)
41	Gerotor Assembly (0.19 in^3/rev)
	Aux Gerotor & HSG Assembly (0.19 in^3/rev)
	Gerotor Assembly (0.13 in^3/rev)
42	Check Valve Kit (0.031")
	Check Valve Kit (0.044")
	Check Valve Kit (Blank)
	System Check/Relief Kit
44	Charge Relief Kit (W/ 1/2 SAE Valve Plug, 40-70 PSI)
	Charge Relief Kit (W/ 1/2 SAE Valve Plug, 135-165 PSI)
	Charge Relief Kit (W/ 9/16 SAE Valve Plug)
	(W/ 9/16 SAE Valve Plug, 75-105 PSI)
	(7/32" Plastic Ball & 2000029 Spring)
	(1/4 Plastic Ball & 50654 Spring)
45	Aux Relief Valve Kit
49	Aux Bypass/Check Kit
50	Bypass Valve Kit (Blank)
	Bypass Valve Kit (0.031")
54	Auxiliary Filter Kit
56	Hex Screw, 5/16-18 x 1.0
	Hex HD CAP Screw, 5/16-18 x 1.38
	Flange HD Screw, 5/16-18 x 2.5
58	Hex Screw, Flanged Head
59	Hex Flange Nut
69	Pin
85	Overhaul Seal Kit

Table 6. BDP-21L

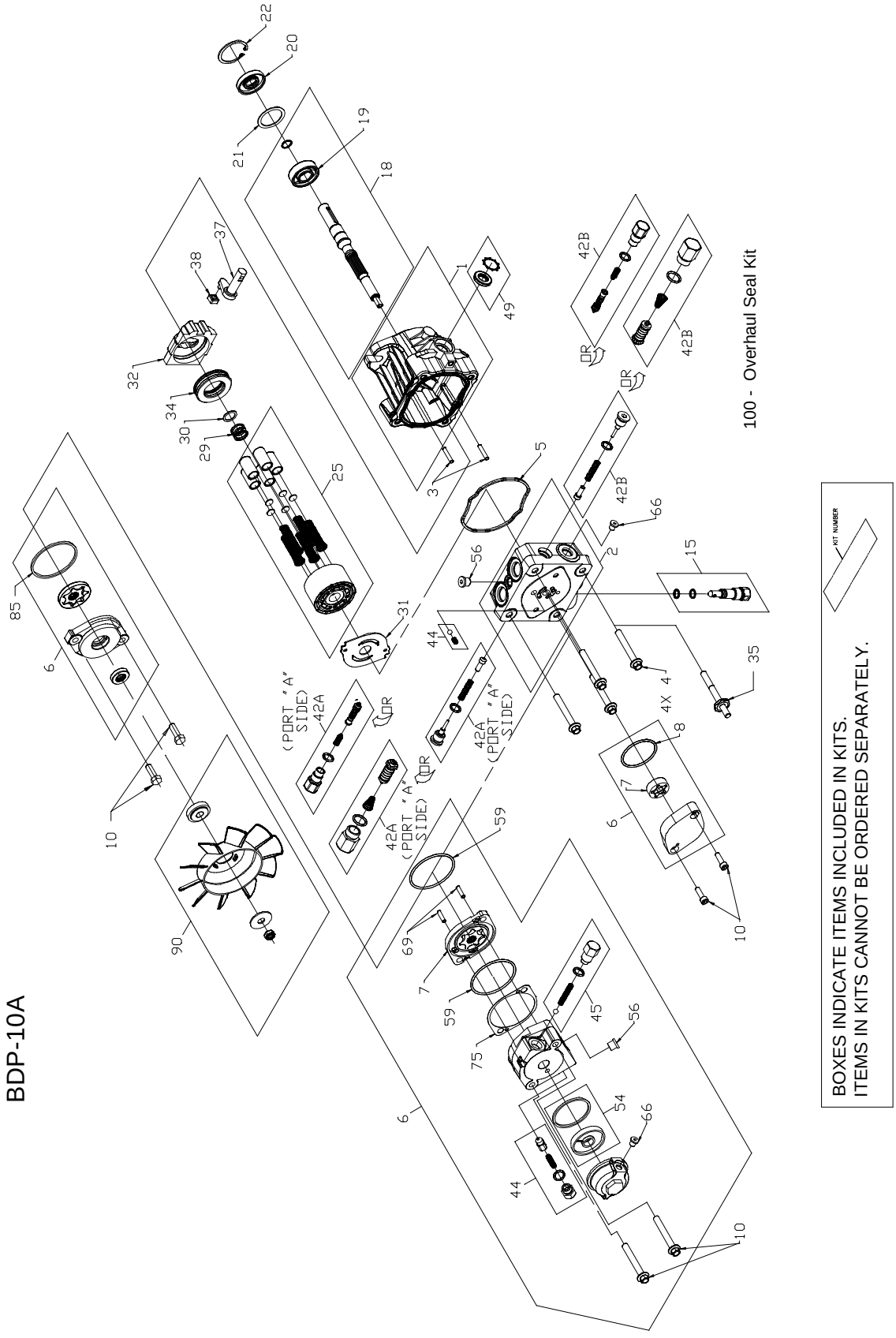


Figure 33 . BDP-10A

ITEMS LIST BDP 10A

Part numbers are not provided in this manual. See microfiche or parts manual for part numbers.

No.	Description
1	Housing Kit
2	End Cap Kit (W/ Poppets, Standard Charge)
	End Cap Kit (W/ SCR'S, Standard Charge)
	End Cap Kit (W/ Poppets, Auxiliary Charge)
	End Cap Kit (W/ SCR'S & Auxiliary Charge)
	End Cap Kit (STD CHG) LH:SCR / RH:Poppet
	End Cap Kit (STD CHG) LH:Poppet / RH:SCR
	End Cap Kit (AUX CHG) LH:SCR / RH:Poppet
	End Cap Kit (AUX CHG) LH:Poppet / RH:SCR
	End Cap Kit (STD CHG) LH:SCR / RH:Poppet,Thru
	End Cap Kit (STD CHG) W/Poppets, Thru
	End Cap Kit (STD CHG) W/SCR's, Thru
	End Cap Kit (STD CHG) LH:Poppet/ RH:SCR,Thru
3	Straight Headless Pin
4	Hex Flange Bolt M8-1.25 X 60mm LG
5	Housing O-Ring
6	Charge Pump Kit (STD)
	Charge Pump Kit (STD CHG), Thru
	Aux Pump Kit (AL., 15T Splined, 2-7/16 SAE Ports)
7	STD Gerotor Assy (.11 cu. In/rev D-Drive)
	Auxiliary Gerotor & Housing Assembly
8	O-Ring
10	Socket Head Screw M6 x 1.0-20mm Lg (STD Chg)
	Hex Flange Bolt 8M-1.25 x 60mm (Aux Chg)
	Cap Screw, Hex 5/16-18 x 1.00 (Thru Chg) Supplied with item #2 only
15	Bypass Valve Kit (Blank)
	Bypass Valve Kit (0.031")
	Bypass Valve Kit (0.043")
18	Pump Shaft Kit (Blind 15mm Keyway W/ Std Chg)
	Pump Shaft Kit (Blind 15mm Keyway W/Aux Chg)
	Pump Shaft Kit (9 Tooth W/Std Chg)
	Pump Shaft Kit (9 Tooth W/Aux Chg)
	Pump Shaft Kit (15mm Keyed, Std Chg, Thru)
	Pump Shaft Kit (9 tooth Thru Chg)
	Pump Shaft Kit (Tapered)
19	Ball Bearing 17 x 40 x 12
20	Lip Seal 17 x 40 x 7 PTC
21	Spacer
22	Retaining Ring
25	Cylinder Block Kit
29	Block Spring

No.	Description
30	Block Thrust Washer
31	Valve Plate (Steel N-Tec:Black)
32	Swashplate
34	Ball Thrust Bearing
35	Stud, Torque
37	Trunnion Arm
38	Slot Guide
42	Check Valve Kit (Blank Orifice)
	Check Valve Kit (0.024"Orfice)
	Check Valve Kit (0.031"Orfice)
	Check Valve Kit (0.044"Orfice)
	System Check / Relief Kit
	System Check Relief Kit (.031" Orifice)
44	Charge Relief Valve Kit (1/4" Plastic Ball & 50654 Spring)
	Charge Relief Valve Kit (9/16" SAE Plug & 3101536 Spring)
45	Aux Relief Valve Kit (1/4" Steel Ball)
	Aux Relief Valve Kit (Aux Poppet)
49	Trunnion Seal/ Retainer Kit
54	Auxiliary Filter Kit
56	Straight Thread Plug
59	O-Ring
66	5/16" SAE Plug
67	Filter Cover
69	Straight Headless Pin
75	Shim - Charge Pump (.002-Red)
85	R-Ring -144
90	Hub / 6" Fan Kit
	Hub / 7" Fan Kit
100	Overhaul Seal Kit

Table 7 . BDP-10A

GLOSSARY OF TERMS

Axial Piston: Type of design for hydraulic motors and pumps in which the pistons are arranged parallel with the spindle (input or output shaft).

Bantam Duty: A descriptive term relating to the product capacity (meaning: light duty).

Bypass Valve: A valve whose primary function is to open a path for the fluid to bypass the motor or pump. Also referred to occasionally as the freewheel valve or dump valve.

Case Drain Line (Return Line): A line returning fluid from the component housing to the reservoir.

Cavitation: A phenomenon of boiling in a flowing liquid at normal temperatures, as a result of low pressure condition. The gas liberated from the fluid implodes rapidly and damages pump components.

Center Section: A device which acts as the valve body and manifold of the transmission.

Charge Pump: A device which supplies replenishing fluid to the fluid power system (closed loop).

Charge Pressure: The pressure at which replenishing fluid is forced into a fluid power system.

Charge Relief Valve: A pressure control valve whose primary function is to limit pressure in the charge circuit.

Check Valve: A valve whose primary function is to restrict flow in one direction.

Closed Loop: A sealed and uninterrupted circulating path for fluid flow from the pump to the motor and back.

Decay Rate: The ratio of pressure decay over time.

End Cap: See “Center Section”

Entrained Air: A mechanically generated mixture of air bubbles having a tendency to separate from the liquid phase.

Gerotor: A fixed displacement pump frequently used as a charge pump.

Hydraulic Motor: A device which converts hydraulic fluid pressure and flow into mechanical force and motion.

Hydraulic Pump: A device which converts mechanical force and motion into hydraulic fluid pressure and flow.

Hydrostatic Motor: See “Hydraulic Motor”

Hydrostatic Pump: See “Hydraulic Pump”

Hydrostatic Transaxle: A multicomponent assembly including a gear case and a hydrostatic transmission.

Hydrostatic Transmission: The combination of a hydraulic pump and motor in one housing to form a device for the control and transfer of power.

Inlet Line: A supply line to the pump.

Integrated Hydrostatic Transaxle (IHT): The combination of a hydrostatic transmission and gear case in one housing to form a complete transaxle.

Manifold: A conductor which provides multiple connection ports.

Neutral: Typically described as a condition in which fluid flow and system pressure is below that which is required to turn the output shaft of the motor.

Pressure Decay: A falling pressure.

Priming: The filling of the charge circuit and closed loop of the fluid power system during start up, frequently achieved by pressurizing the fluid in the inlet line.

Purging: The act of replacing air with fluid in a fluid power system.

Rated Flow: The maximum flow that the power supply system.

Scoring: Scratches in the direction of motion of mechanical parts caused by abrasive contaminants.

Swash Plate: A mechanical device used to control the displacement of the pump pistons in a fluid power system.

System Charge Check Valve: A valve controlling the replenishing flow of fluid from a charge circuit to the closed loop in a fluid power system.

System Pressure: The pressure which overcomes the total resistance in a system, including all efficiency losses.

Valve: A device which controls fluid flow direction, pressure, or flow rate.

Variable Displacement Pump: A pump in which the displacement per revolution can be varied.

Volumetric Displacement: The fluid volume for one revolution.