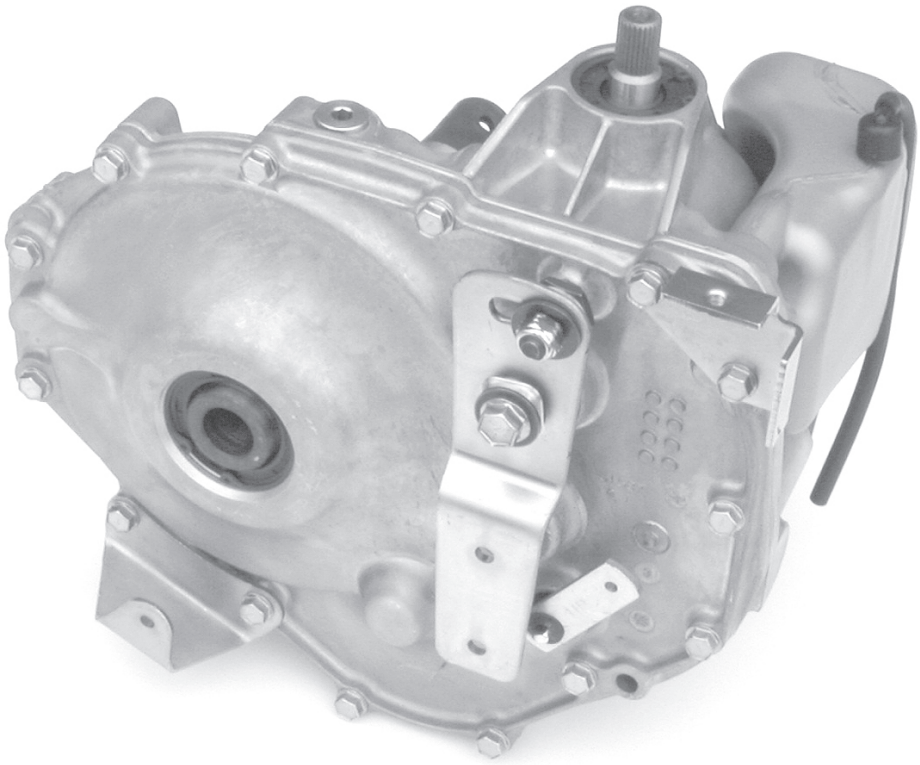
HYDRO-GEAR®

FORWARD MOTION THROUGH FORWARD THINKING



310-0410
Integrated Hydrostatic Transaxle Service and Repair Manual

BLN-51770
December 2008

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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 and troubleshooting the Hydro-Gear 310-0410 Integrated Hydrostatic Transaxle (IHT).

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

Repair procedures require that the transaxle unit 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) at (610) 363-3844 or their Hydro-Gear Distributer. 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® Integrated Hydrostatic Transaxle (IHT). This manual includes the IHT's general descriptions, hydraulic schematics, technical specifications, servicing and troubleshooting procedures.

The transaxle 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 transaxle will need to be thoroughly cleaned before beginning most procedures. Do not wash the transaxle while it is hot. Do not use a pressure washer to clean the unit.

GENERAL DESCRIPTION

The 310-0410 is a self contained unit designed for the transfer and control of power. It provides an infinitely variable speed range between zero and maximum in both forward and reverse modes of operation.

This transaxle uses a variable displacement pump with a maximum displacement of 10cc per revolution, and motor with a fixed displacement of 10cc per revolution. The variable displacement pump features a trunnion mounted swashplate with a direct-proportional displacement control. Reversing the direction of the swashplate reverses the flow of oil from the pump and thus reverses the direction of the motor output rotation. The pump and motor are of the axial piston design and utilize spherical nosed pistons which are held against a thrust race by internal compression springs.

The 310-0410 has a self contained fluid supply and an internal filter. The fluid is forced through the filter by a positive "head" on the fluid in the housing/expansion tank with an assist by the negative pressure created in the pump pistons as they operate.

The check valves in the center section are used to control the make-up flow of the fluid to the low pressure side of the loop.

A check ball lifting bypass is utilized in the 310-0410 to permit moving the vehicle for a short distance at a maximum of 2 m.p.h. (3.2 Km/h) without starting the engine.

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.

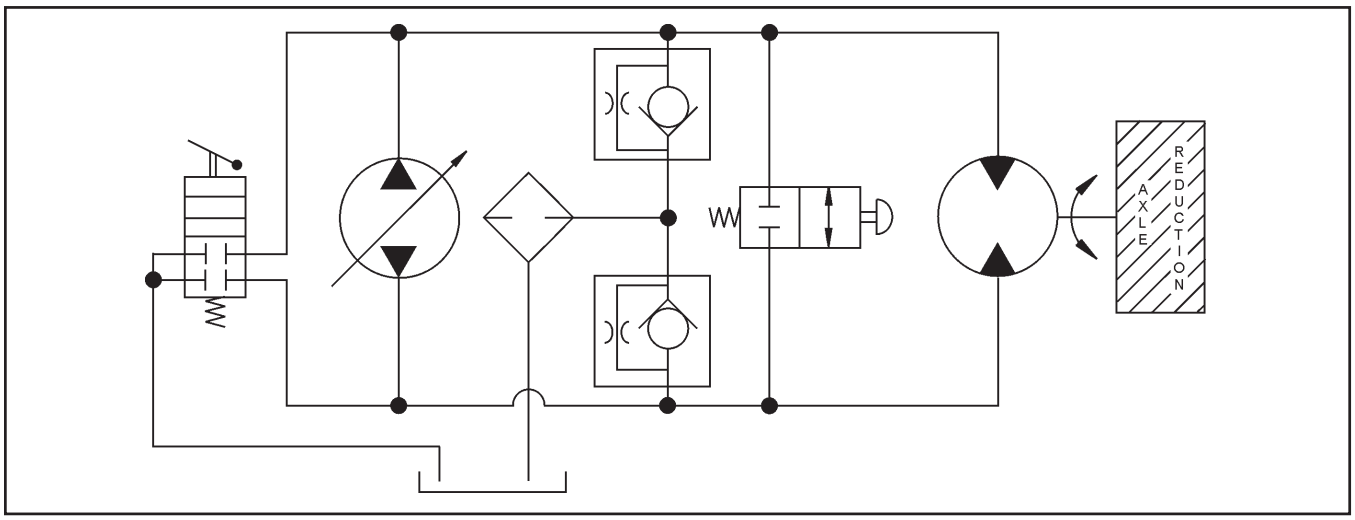


Figure 1. Hydraulic Schematic

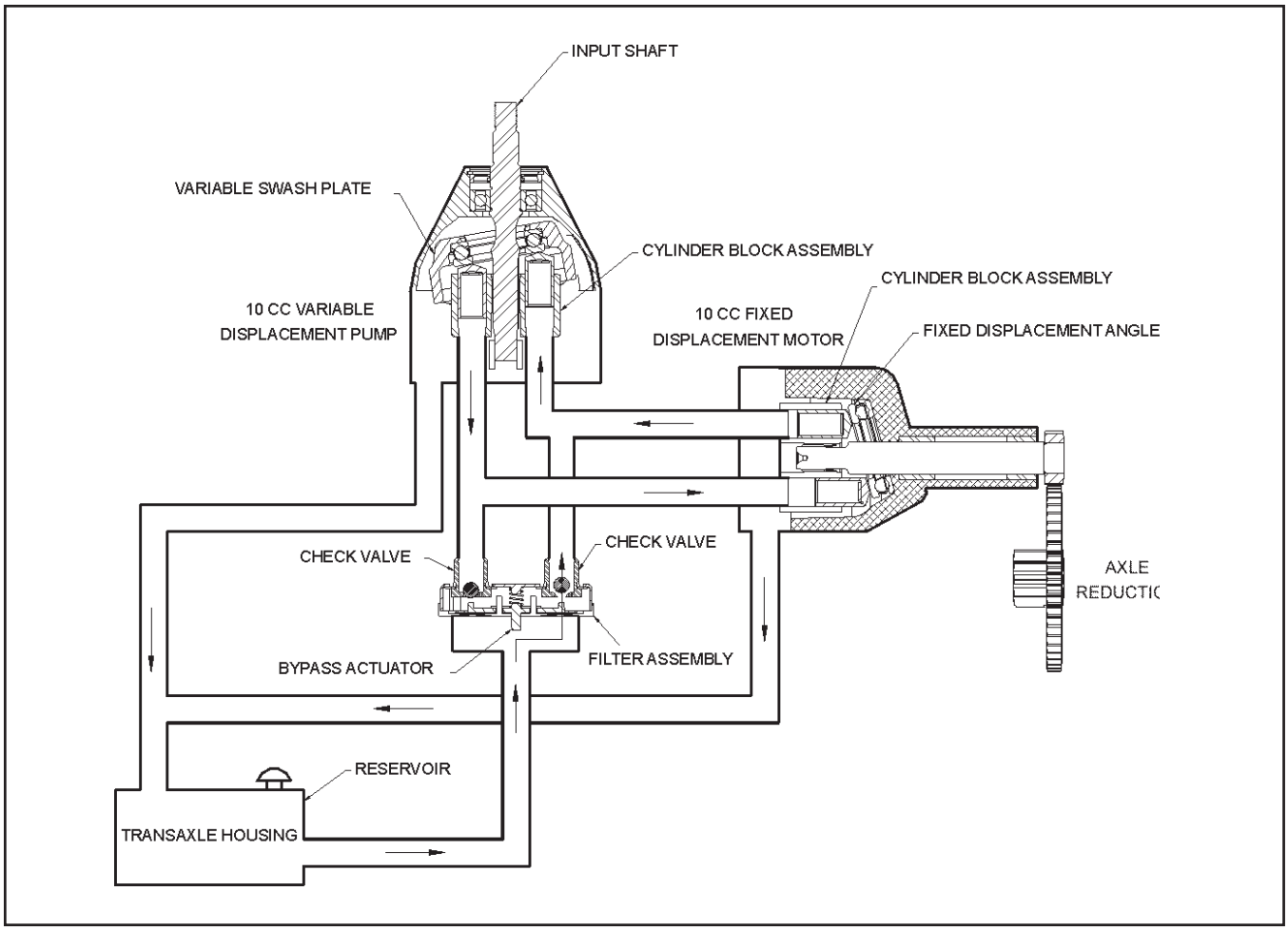


Figure 2. Hydraulic Flow Illustration

HYDRAULIC SCHEMATIC

Figure 2 provides an illustration of the hydraulic oil circuit. The oil supply for the hydraulic system of the 310-0410 IHT is also utilized for lubricating the components of the final drive assembly.

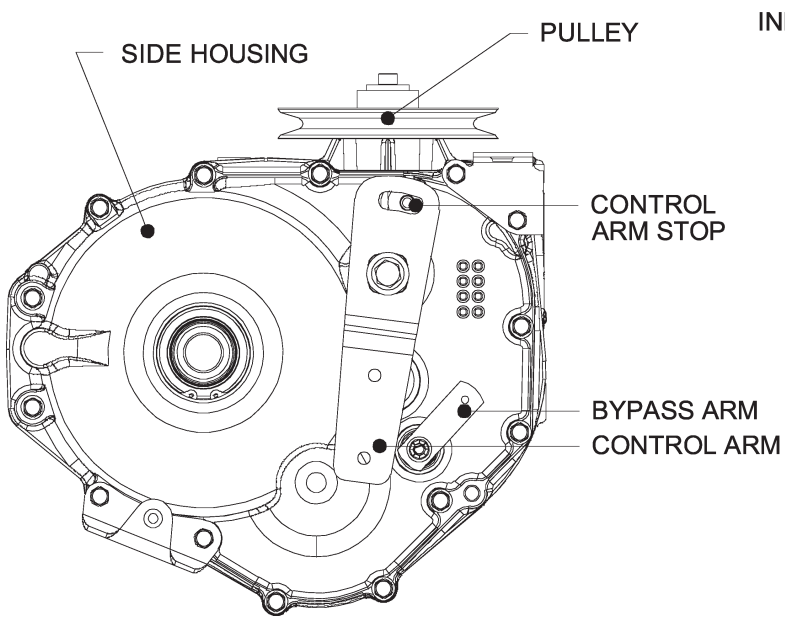
The input shaft and pump cylinder block are turned in one direction only by the engine/drive belt/pulley combination. Output of the oil flow is controlled by the direction and amount that the variable swashplate is angled. As the pump pistons compress they force the oil to flow through one of two passageways (forward or reverse) in the center section to the motor cylinder block and motor shaft. Since the motor has a fixed displacement angle it is forced to turn with the flow of oil. 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 motor. Reversing the angle of the swashplate will reverse the direction of oil flow.

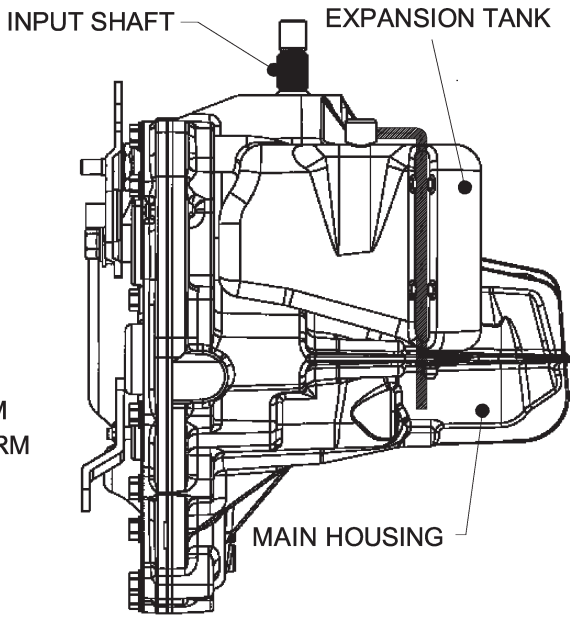
During the operation of the transaxle, fluid is “lost” from the hydraulic loop through leak paths designed into the product for lubrication purposes (around pistons, under the rotating cylinder blocks, etc.). This “lost” fluid returns to the transaxle housing, then is pulled back into one of the check valves depending upon the direction of vehicle operation. All of this oil must pass through an internal filter.

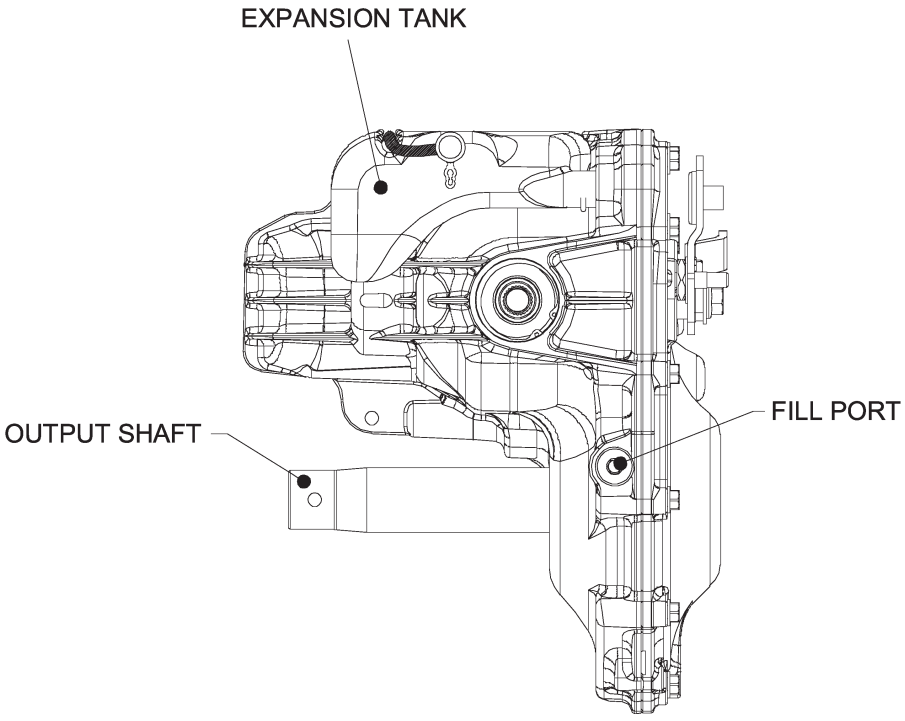
The motor cylinder block mounts onto a splined motor shaft which drives the gear train.

The bypass feature in the 310-0410 has a mechanical lever which lifts the check valve balls off their seat. This allows oil flow from the cylinder blocks to be discharged.

EXTERNAL FEATURES 310-0410







TECHNICAL SPECIFICATIONS

Technical specifications for the 310-0410 IHT are listed in Table 1.

Table 1. Technical Specifications

Overall Transaxle Reduction 22.2:1	**Maximum Tire Diameter** 16 inch; 406 mm
Input Speeds Maximum: 3000 RPM Minimum: 1800 RPM	**Maximum Weight on Drive Tires** 350 lbs. (159 Kg)
Weight of Unit 25.05 lbs. (11.36 Kg)	

PRODUCT IDENTIFICATION

The model and configuration of the 310-0410 IHT can be determined from the label shown in Figure 3.

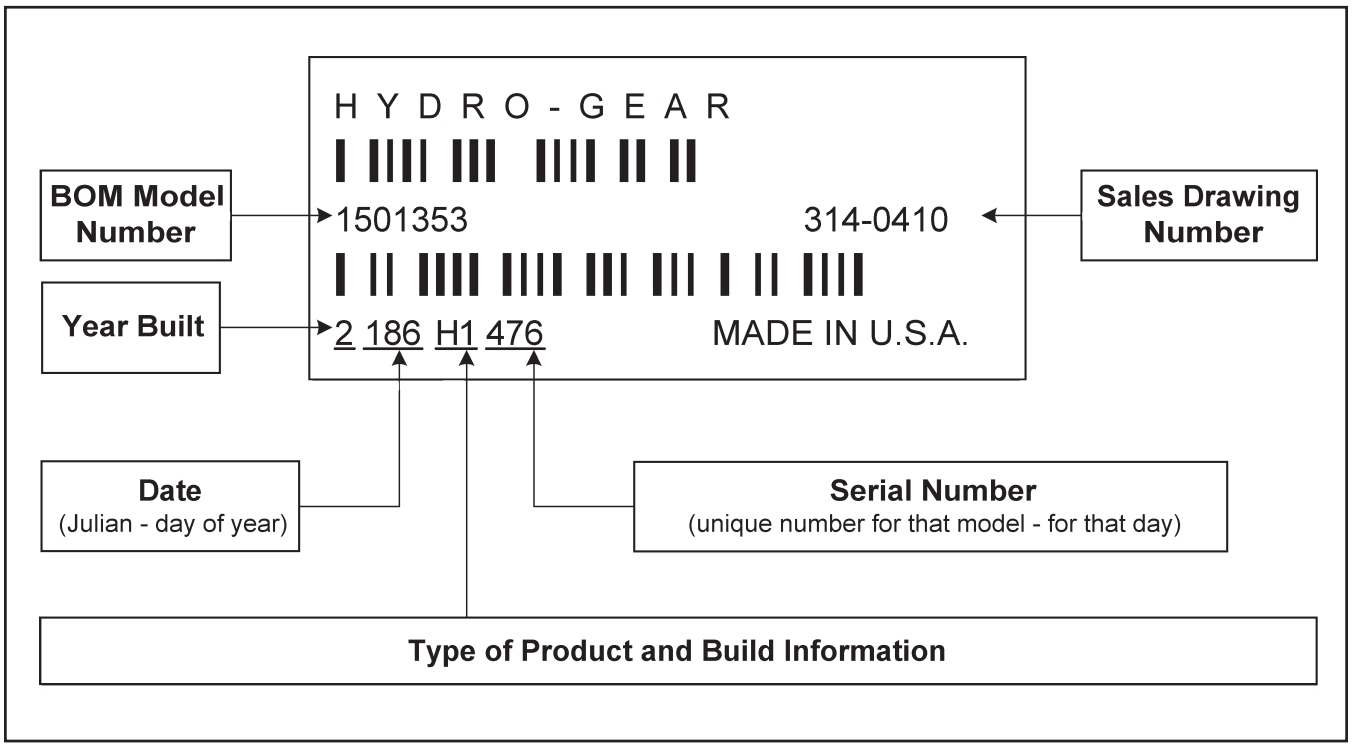


Figure 3. Configuration Label

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 transaxle. 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 310-0410 IHT, fully read and understand the safety precautions described in this section.

PERSONAL SAFETY

Certain safety precautions must be observed while servicing or repairing the 310-0410 IHT. 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:

1) Other manuals pertaining to this machine,
2) Local and shop safety rules and codes,
3) 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 310-0410 are not related to a defective transaxle, 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 4, Service and Maintenance, before assuming the pump is malfunctioning. Table 2 below provides a troubleshooting checklist to help determine the cause of operational problems.

Table 2. Troubleshooting Checklist

Possible Cause	Corrective Action
UNIT OPERATES IN ONE DIRECTION ONLY	
Control linkage bent or out of adjustment	Repair or replace linkage, Page 8
Drive belt slipping or pulley damaged	Repair or replace drive belt or pulley, Page 8
VEHICLE DOES NOT DRIVE/TRACK STRAIGHT	
Vehicle tires improperly inflated	Refer to vehicle manufacturer suggested pressure
UNIT IS NOISY	
Oil level low or contaminated oil	Fill to proper level or change oil, Page 9
Excessive loading	Reduce vehicle loading, Page 8
Loose parts	Repair or replace loose parts
Bypass assembly sticking	Repair or replace linkage
Air trapped in hydraulic system	Purge hydraulic system, Page 10
UNIT HAS NO/LOW POWER	
Engine speed low	Adjust to correct setting
Control linkage bent or out of adjustment	Repair or replace linkage, Page 8
Drive belt slipping or pulley damaged	Repair or replace drive belt or pulley, Page 8
Oil level low or contaminated oil	Fill to proper level or change oil, Page 9
Excessive loading	Reduce vehicle loading, Page 8
Bypass assembly sticking	Repair or replace linkage
Air trapped in hydraulic system	Purge hydraulic system, Page 10
UNIT IS OPERATING HOT	
Debris buildup around transaxle	Clean off debris, Page 8
Cooling fan damaged (if applicable)	Repair or replace cooling fan
Oil level low or contaminated oil	Fill to proper level or change oil, Page 9
Excessive loading	Reduce vehicle loading, Page 8
Air trapped in hydraulic system	Purge hydraulic system, Page 10
TRANSAXLE LEAKS OIL	
Damaged seals, housing, or gaskets	Replace damaged component
Air trapped in hydraulic system	Purge hydraulic system, Page 10

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 310-0410 IHT should include the following:

1. **Check the vehicle operator's manual for the recommended load ratings. Insure the that current application does not exceed load rating.**
2. Check oil level in accordance with Figure 4 Page 9.
3. Inspect the vehicle drive belt, idler pulley(s), and idler spring(s). Insure that no belt slippage can occur. Slippage can cause low input speed to the transmission.
4. Inspect the vehicle control linkage to the directional control arm on the transaxle. Also insure that the control arm is securely fastened to the trunnion arm of the transaxle.
5. Inspect the bypass mechanism on the transaxle and the vehicle linkage to insure that both actuate and release fully.

SERVICE AND MAINTENANCE PROCEDURES

Some of the service procedures presented on the following pages can be performed while the 310-0410 is mounted on the vehicle. Any repair procedures as mentioned in the repair section of this manual 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 45 SUS (5.6 cSt) at 210° F (100° C) and an API classification of SL is recommended. A 5W-30 engine oil has been selected for use by the factory and is recommended for normal operating procedures.

FLUID VOLUME AND LEVEL

Fluid volume information is provided in Table 3.

Certain situations may require additional fluid to be added or even replaced. Refer to Page 4 and Figure 4 for the proper fill port location.

Fill the 310-0410 to within 1" of the oil fill port.

Recheck the fluid level once the unit has been operated for approximately 1 minute.

Purging may be required. Refer to the purging procedures on Page 10.

FLUID CHANGE PROCEDURE

This transaxle is factory filled, sealed and does not require oil maintenance. However, in the event of oil contamination or degradation, oil addition or change may alleviate certain performance problems.

1. Remove the transaxle from the vehicle.
2. Clean the expansion tank and oil fill port areas of any debris.
3. Remove the oil fill port fitting.
4. Position the transaxle so the oil will drain completely out of the housing.
5. After all the oil is drained from the transaxle, remove the expansion tank by carefully removing the retaining ring from the tab on the bottom of the tank and lifting the rear of the tank until the tab clears the slot in the main housing.
6. Remove the tank and drain the oil from the tank. DO NOT remove the vent cap from the tank. DO NOT remove the tank hose or o-ring unless a replacement is needed.
7. Install the tank by first inserting the hose into the opening in the expansion tank. Push the tank opening over the o-ring until it contacts the main housing to ensure a proper seal.
8. Install the tank tab through the slot in the main housing. Press the retaining ring over the tab and against the housing until the tab is fully seated in the housing chamfer.
9. Fill the transaxle at the oil fill port according to Figure 4.
10. Install the oil fill port fitting.

Table 3. Fluid Volumes for the 310-0410 IHT

Fluid Description	Volume
5W-30 engine oil	59.2 fl.oz. (1750 ml) to 62.6 fl.oz. (1850 ml)

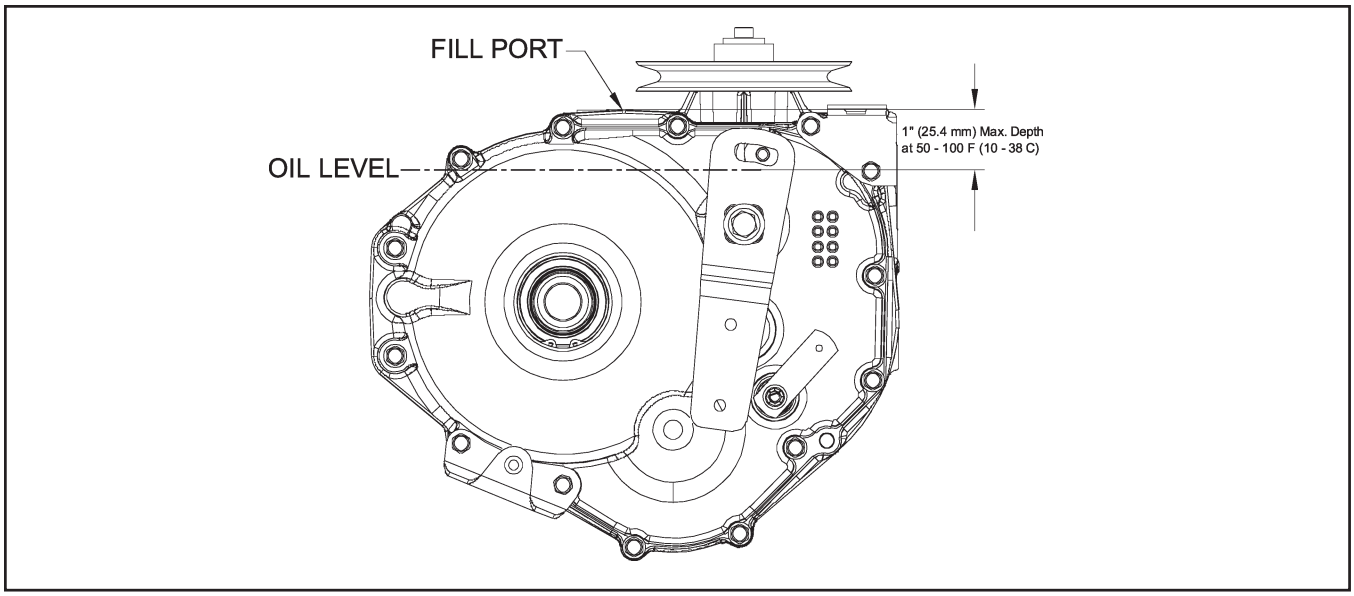


Figure 4. Fluid Level and Fill Port

EXPANSION TANK FUNCTION

The expansion tank allows the 310-0410 to operate free of air entrainment and provides maximum lubrication to the mechanical and hydraulic components in the transaxle.

As the 310-0410 transaxle is operated, oil in the transaxle housing heats up which causes the oil to expand. The oil flows through an internal hose to the bottom of the vented expansion tank. As the oil cools, the oil in the transaxle housing contracts, causing the oil level to go down in the housing. This creates a negative pressure in the housing causing the oil to be drawn back into the case. This keeps the transaxle housing full of oil at specified operating temperatures.

PURGING PROCEDURES

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

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

Air creates inefficiency because its compression and expansion rate is higher than that of the oil approved for use in hydrostatic drive systems.

The resulting symptoms in hydrostatic systems may be:

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 transaxle/transmission is at the proper oil level. If it is not, fill to the specifications outlined on Page 9, Figure 4.

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

1. With the bypass valve open and the engine running, slowly move the directional control in both forward and reverse directions (5 or 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 the engine.
3. It may be necessary to repeat Steps 1 and 2 until all the air is completely purged from the system. When the transaxle moves forward and reverse at normal speed purging is complete.

SECTION 5. REPAIR

HOW TO USE THIS MANUAL

Each subassembly illustrated in this section is illustrated with an exploded view showing the parts involved. The **item reference numbers in each illustration are for assembly instructions only.** See pages 27 for part names and descriptions. A complete exploded view and item list of the pump is provided at the end of this section.

GENERAL INSTRUCTIONS

Cleanliness is a primary means of assuring satisfactory life on repaired units. 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 surfaces and open cavities from damage and foreign material. The external surfaces should be cleaned before beginning any repairs.

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 a clean petroleum jelly prior to assembly. Also protect the inner diameter of seals by covering the shaft with a cellophane (plastic wrap, etc.) material.

Parts requiring replacement must be replaced from the appropriate kits identified in the Items Listing, found at the end of this manual. Use only original Hydro-Gear® replacement parts found in BLN-51427 (CD).

IMPORTANT: When internal repair is performed on the 310-0410 IHT, the filter assembly must be replaced.

TRANSAXLE REMOVAL

It is necessary to remove the 310-0410 from the vehicle before performing the repair procedures presented in this section.

LIMITED DISASSEMBLY

The following procedures are presented in the order in which they must be performed to completely disassemble the unit. Do not disassemble the unit any farther than is necessary to accomplish the required repairs. Each disassembly procedure is followed by a corresponding assembly procedure.

Reassembly is accomplished by performing the “Assembly” portions of the procedures. If the unit has been completely disassembled, a summary of the assembly procedures, in the order in which they should occur, is given on page 24.

TOOLS AND TORQUES

Table 4. Required Tools

Miscellaneous	**Sockets**
310-0410 Service & Repair Manual	1/2”-3/8” Adapter
Flat Blade Screw Driver (2)	1/2” Deep
Torque Wrench	7/16” Deep
Air Impact Wrench	9/16” Deep
Rubber Mallet	3/4” Deep
Breaker Bar	7/8”
Side Cutters/Snips	10 mm
Pliers	T-25 Torx Head
Needle Nose	
Large External Snap Ring	

Table 5. Required Torque Values

Operation	Torque	Item	Description
Side Housing Screws	135-185 lb-in [15-21 Nm]	41	Screw 1/4-20 x 1.25
Control Arm Screw	230-310 lb-in [26-35 Nm]	19	Screw 5/16-24 x 0.75
Control Arm Stop Stud	135-155 lb-in [15-18 Nm]	11	Stud 5/16-24
Center Section Bolts	525-700 lb-in [60-80 Nm]	5	Screw 3/8-24 x 2.5
Check Plugs	200-360 lb-in [23-41 Nm]	45	Check Plug Assembly
Expansion Tank Hose Fitting	96-120 lb-in [11-14 Nm]	35	Fitting 5/16 SAE, 5/32 Tube
Fan/Pulley Screw	80-145 lb-in [9-16 Nm]	62	Socket Hd CS M6 x 1-12

CONTROL ARM AND BYPASS ARM

Refer to Figure 5.

Disassembly

1. Loosen and remove the lock nut (9) and flat washer (1). Discard the lock nut (9) and flat washer (1).
2. Remove the hex head screw (19) from the directional control.
3. Remove the flat washer (1) and control arm (59).
4. Remove the bypass arm retaining ring (27) and bypass arm (51). Discard the retaining ring.
5. If necessary, remove and replace the control arm stop stud (11) and puck (7).

Inspection

1. Inspect the puck (7).
2. Inspect the control arm stop stud (11) for wear or damage.
3. Inspect the control arm (59) for wear or damage.
4. Inspect the bypass arm (51) for wear or damage.

Assembly

1. Install the bypass arm (51) onto the bypass rod. Secure the bypass arm with a new retaining ring (27).
2. Replace the control arm stop stud (11) if removed. Torque according to specifications in Table 5 on page 12.
3. Install the puck (7) onto the control arm stop stud (11).
4. Install the control arm (59).
5. Install the flat washer (1) and control arm screw (19). Refer to Table 5 for screw torque specifications.

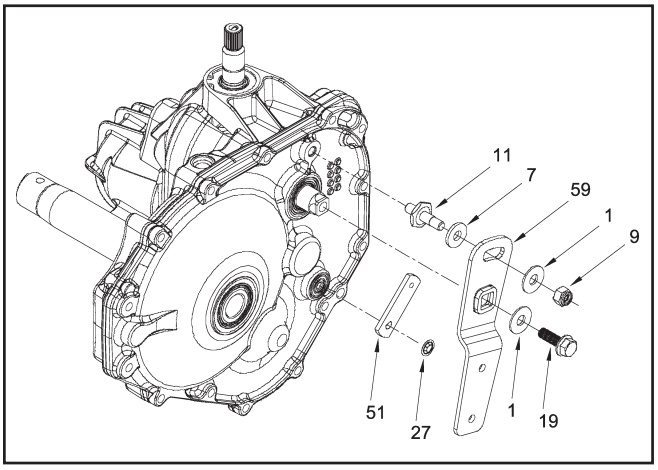


Figure 5. Control Arm and Bypass Arm

SEAL KIT REPLACEMENT

Before disassembly, wipe the unit free of any debris to avoid contamination.

Refer to Figure 6.

Input Seal

1. Remove the input pulley from the input shaft.
2. Remove the seal retaining ring (10).
3. Carefully pull the input seal (38) out of the housing bore with a “hook” type tool. Care must be taken to avoid damage to the housing bore or shaft sealing area.
4. Lubricate the new seal with petroleum jelly prior to installation.
5. Wrap the shaft keyway (splines) with cellophane to prevent damage to the seal lip during installation.
6. Slide the seal over the shaft and press it into the housing bore.
7. The seal should seat against the spacer.
8. Install the seal retaining ring (10) and make sure it is fully seated in its groove.

Output Seal

1. The seals (52) can be replaced by following steps 2-6 of the procedure used to replace the input seal.
2. Install the retaining rings (57) and make sure they are fully seated in the grooves.

Trunnion Seal

1. Remove the control arm and any attachments to the control arm. See page 13.
2. The seal (34) can be replaced by following steps 3-6 of the procedure used to replace the input shaft.

Bypass Seal

1. Remove the bypass arm and any attachments to the bypass arm. See page 13.
2. The seal (21) can be replaced by following steps 3-6 of the procedure used to replace the input shaft.

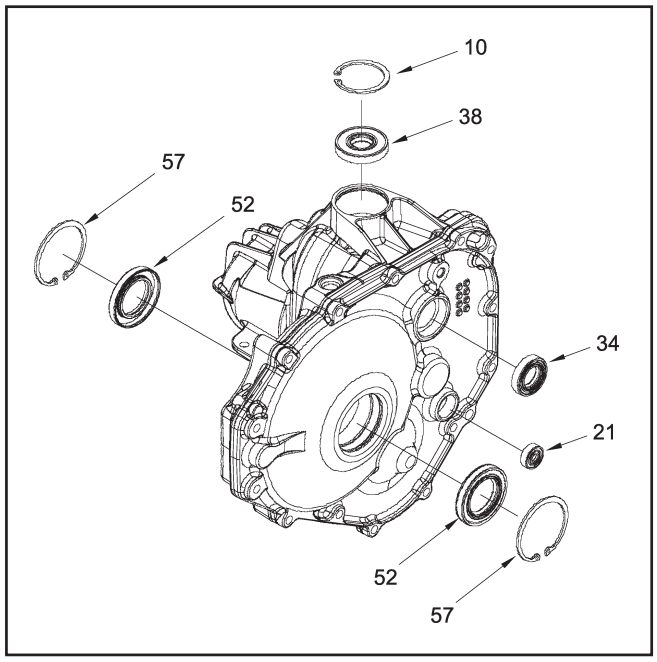


Figure 6. Seal Kit Replacement

Refer to Figure 7.

Disassembly

1. Remove the control arm and bypass arm. See page 13.
2. Remove the oil from the transaxle. See page 9.
3. After all of the oil has been removed from the transaxle, remove the housing screws (41).
4. Pull the side housing (44), leaving the axle assembly (49, page 16) in the main housing. It may be necessary to use screwdrivers at the pry points to break loose the sealant (positions E-F, H-J and K-M, Figure 7).
5. Remove all seals in the side housing. See Page 14.
6. Clean off all the old sealant on the side and main housings. Take care not to damage the sealing surfaces. A wire brush and solvent is effective.

Inspection

1. Inspect the bearing and bushing areas in the side housing.

Assembly

1. Apply a bead of sealant around the perimeter of the side housing face. See sealant pattern on page 25.
2. Install the locating pins (70), if not already installed.
3. Install the side housing (44) while aligning the bypass rod into its side housing bore. Use care not to smear the sealant bead.
4. Install the side housing screws (41). Refer to the screw tightening pattern in Figure 7 and torque specification in Table 5 on page 12.
5. Install the remaining seals. Refer to page 14. Remember to use a seal protector during installation.
6. Fill the transaxle with new oil. See page 9.
7. Install the bypass arm and control arm. See page 13.

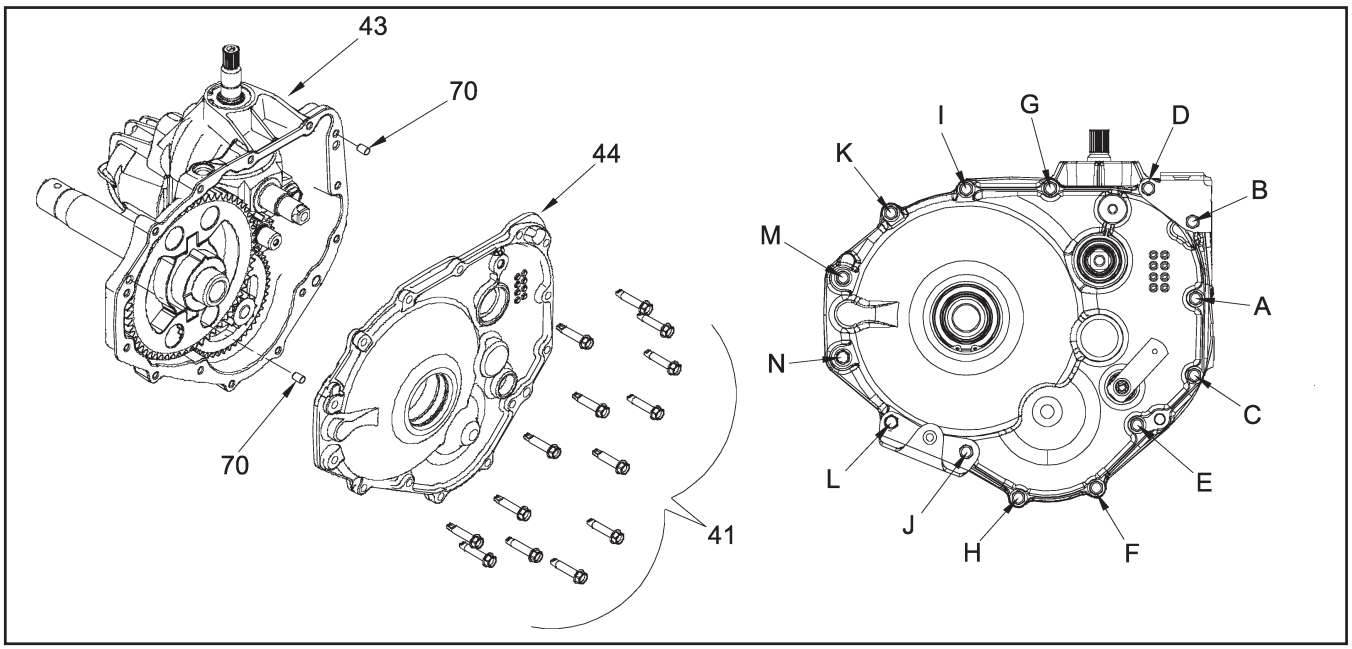


Figure 7. Side Housing Assembly

REDUCTION GEARS

Refer to Figure 8.

Disassembly

1. Remove the bypass arm and control arm. See page 13.
2. Remove oil from the transaxle. See page 9.
3. Remove the side housing. See page 15.
4. Remove the seal retaining ring (57) and seal (52).
5. Remove the bull gear (49), bearings (46) and washers (55).
6. Remove the reduction gears (28 & 15), jack shaft pin (22) and washers (6).

Inspection

1. Inspect the bull gear for wear or damage.
2. Inspect the reduction gears, shaft and washers.
3. Inspect the housing bores.

Assembly

1. Reassemble and install the reduction gears (22 & 15), jack shaft pins (22) and washers (6).
2. Install the bull gear (49) with bearings (46) and washers (55).
3. Install the axle seal (see page 15) and retaining ring (57).
4. Install the side housing. See page 15.
5. Install all remaining seals. See page 14.
6. Install the bypass arm and control arm. See page 13.

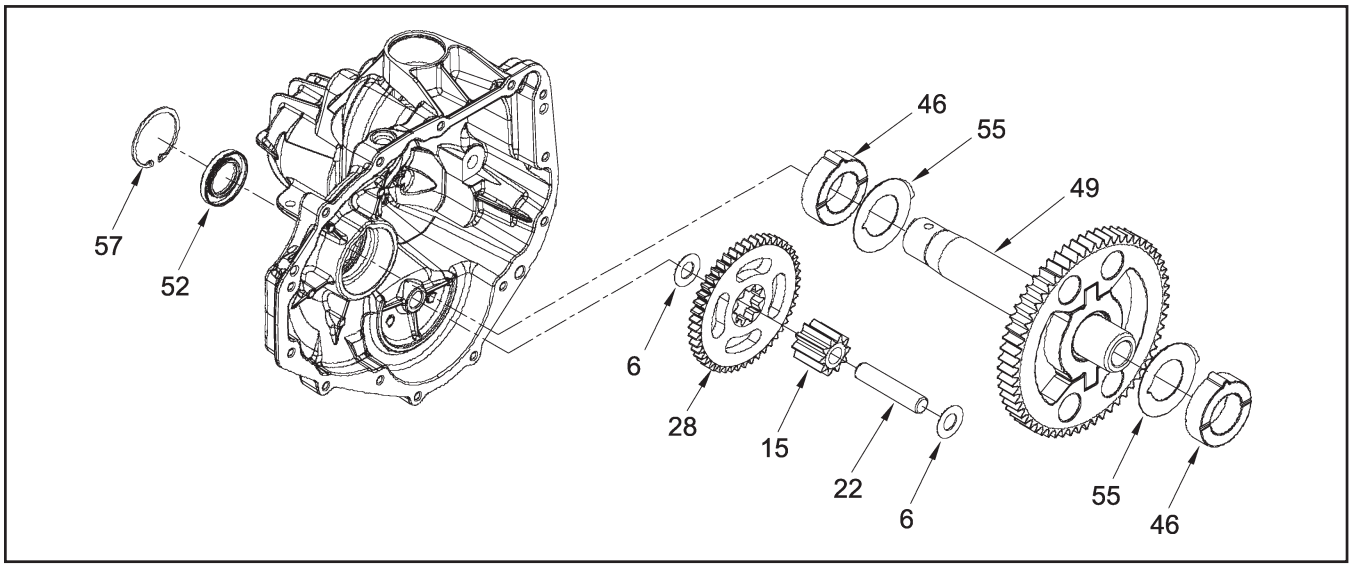


Figure 8. Reduction Gears

MOTOR SHAFT AND BYPASS ROD

Refer to Figure 9.

Disassembly

1. Remove the control arm and bypass arm. See page 13.
2. Drain the oil from the transaxle. See page 9.
3. Remove the side housing. See page 15.
4. Remove the reduction gears. See page 16.
5. Remove flat washer (4), motor shaft and pinion gear (47 & 29) and flat washer (20).
6. Remove the bypass rod (50). Clean the magnet (26) of any foreign material.

Inspection

1. Inspect the motor shaft (47), pinnion gear (29) and flat washers (4 & 20) for wear or damage.
2. Inspect the bypass rod (50) for wear or damage.

Assembly

1. Insert the bypass rod's (50) short end into the housing while aligning the rod's flat with the bypass actuator. Confirm proper bypass function.
2. Insert the motor shaft (47) with the pinnion gear (29) and flat washers (4 & 20) into the center section (43).
3. Install the reduction gears. See page 16.
4. Install the side housing. Refer to page 15.
5. Install new seals. Refer to page 14.
6. Fill the transaxle with oil. See page 9.
7. Install the bypass arm and control arm. See page 13.

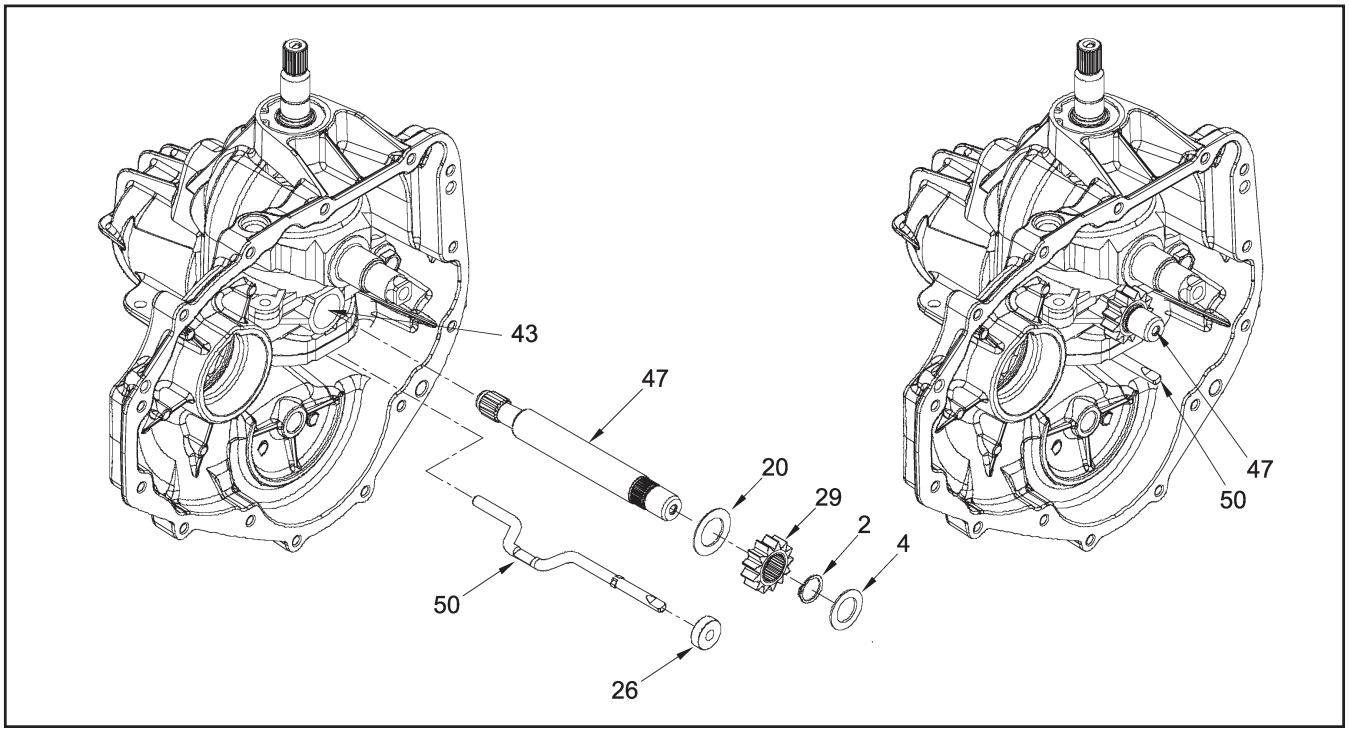


Figure 9. Motor Shaft & Bypass Rod Assemblies

INPUT SHAFT

Refer to Figure 10.

Disassembly

1. Remove the control arm and bypass arm. See page 13.
2. Drain the oil from the transaxle. See page 9.
3. Remove the side housing. See page 15.
4. Remove the reduction gears. See page 16.
5. Remove the motor shaft and bypass rod. See page 17.
6. Remove the retaining ring (10) and shaft seal (38). Discard the seal.
7. Remove the spacer (13) and input shaft assembly (65, 8, 48).

Inspection

1. Inspect the input shaft components for wear or damage.

Assembly

1. Ensure that the pump block is aligned concentrically with the center section running face.
2. Insert the input shaft (48), with bearing (8) and retaining ring (65), into the pump block assembly. NOTE: Do not force the shaft and bearing as damage may occur. If alignment is correct, the shaft assembly will fit into place.
3. Install the washer (13), seal (38) and retaining ring (10). Use a seal protector when installing the input shaft seal.
4. Install the motor shaft and bypass rod. See page 17.
5. Install the reduction gears. See page 16.
6. Install the side housing. See page 15.
7. Install new seals in the side housing. See page 14.
8. Fill the transaxle with oil. See page 9.
9. Install the bypass arm and control arm. See page 13.

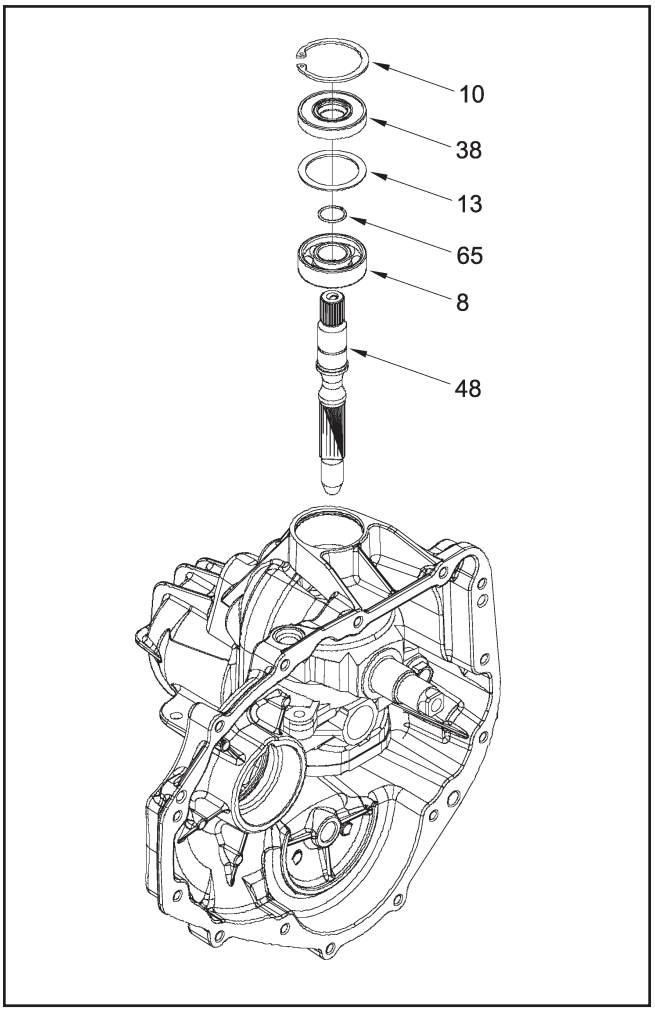


Figure 10. Input Shaft Assembly

Refer to Figures 11-20.

Disassembly

1. Remove the bypass arm and control arm. See page 13.
2. Drain the oil from the transaxle. See page 9.
3. Remove the side housing. See page 15.
4. Remove the seals in the side housing. See page 14.
5. Remove the reduction gears. See page 16.
6. Remove the motor shaft and bypass rod. See page 17.
7. Remove the input shaft. See page 18.
8. **(See Figure 11)** Remove the swashplate (17) and pump cylinder block (14) as one assembly. NOTE: Removal will be aided by applying a small amount of pressure on the trunnion mounted swashplate towards the center section. Also note that the control arm (59, page 26) may be loosely assembled at this point to assist in swashplate removal. While gently removing the swashplate and block assembly, keep the block face flush with the center section to minimize damage to the running surface.
9. **(See Figure 12)** Disassemble the pump cylinder block (14) from the swashplate (17).
10. **(See Figure 13)** Check each piston for proper operation by pressing the pistons in and releasing them in the block bore. Disassemble the pump cylinder block. Check for piston/block wear in the cylinder bore. Inspect the pistons (69), piston springs (15), spring (66), washer (67) and piston seats (64) for excessive wear or damage. NOTE: Piston seats may be held in place in the piston by residual oil.
11. Reassemble the pistons, springs and seats into the cylinder block and set aside.
12. **(See Figure 14)** Remove the thrust bearing assembly (12) from the swashplate (17).

(Center Section/Filter)

13. **(See Figure 15)** Remove the center section mounting screws (5). NOTE: The center section is under motor block piston spring pressure. These screws are factory installed to 700 lb-in (80 Nm) and use an anaerobic thread adhesive. A breaker bar will be required at this step. Clean the internal threads of the mounting holes with compressed air.
14. Remove the center section and filter assembly (42, Figure 16).
15. **(See Figure 17)** Remove the filter (30) from the filter base (31) by snipping the four posts with side cutters or applicable tool. NOTE: This filter cannot be reused.
16. Remove and inspect the deflector (32), bypass actuator (25) and bypass spring (33).
17. Note the location of both check plugs (45) before removal for correct replacement during reassembly. Remove and inspect the check plug assemblies (45) for debris or damage.
18. Remove the filter base (31) and discard it. NOTE: The filter base is included in the filter kit to be installed during reassembly of the unit.

(Motor Block)

19. **(See Figure 18)** Remove the motor cylinder block assembly (14) from the housing (43).
20. Disassemble the motor cylinder block assembly (14). Check each piston for proper operation by pressing the pistons in and releasing them in the block bore. Disassemble the motor cylinder block. Check for piston/block wear in the cylinder bore. Inspect the pistons, piston springs and piston seats for excessive wear or damage. NOTE: Piston

seats may be held in place in the piston by residual oil.

21. Reassemble the pistons, springs and seats into the cylinder block and set aside.

22. Remove the thrust bearing assembly (12) from the housing (43). Inspect the thrust bearing and thrust bearing cavity in the housing.

Inspection

1. Inspect the pump cylinder block running surface for wear or damage.

2. Inspect the swashplate and thrust bearing assemblies for wear or damage.

3. Inspect the center section block running surfaces. NOTE: These “sealing” surfaces should be smooth in appearance without scratches, scoring, nicks or abrasions. Drag a fingernail across the surface to detect uneven wear or scratches which may not be visible.

4. Inspect the threaded check plug ports of the center section for debris or damage.

5. Inspect the motor cylinder block running surface for damage and wear.

6. Inspect all bearing, bushing and wear areas in the housing.

Assembly

(Motor Block)

1. **(See Figure 19)** Turn the housing (43) so the thrust bearing cavity is facing up. This will assist in the installation of the thrust bearing assembly (12) keeping it in the bearing cavity during installation of the center section assembly.

2. Insert the thrust bearing (12) in the housing (43). NOTE: Place the thin race of the bearing towards the housing bearing cavity. The thick race must face the pistons.

(Center Section/Filter)

3. **(See Figure 17)** Install the new filter base (31) onto the center section (42).

4. Install the check plugs (45), in their correct location, into the center section (42). Tighten the check plugs according to Table 5.

5. Install the bypass spring (33) into the filter base (31).

6. Install the deflector (32) into the underside of the filter (30).

7. Install the bypass actuator (25) into the underside of the deflector (32).

8. Hold the stem of the bypass actuator (25) from the top of the filter (30) to retain the deflector (32) and bypass actuator (25) in place when snapping the filter (30) onto the filter base (31). NOTE: Filter installation is best accomplished by using a spacer as an assembly tool over each of the (4) snaps while lightly tapping with a rubber mallet. Excessive force will result in damage to the plastic filter components.

9. **(See Figures 9 & 19)** Install the motor shaft (47), pinion gear (29) and flat washers (4 & 20) into the center section.

10. Assemble the motor block assembly (14) onto the motor shaft (47).

11. **(See Figure 19)** Install the motor shaft, center section and motor block assembly so that the motor block pistons contact the thrust bearing race. NOTE: Hold in place and insure all pistons are still positioned correctly in the cylinder bore by confirming spring bias against the center section.

12. **(See Figure 15)** After applying thread adhesive, insert the center section mounting screws (5) while holding downward pressure on the center section assembly (42, Figure 19).

13. Tighten the center section mounting screws (5) to the proper torque. Refer to Table 5.

(Swashplate/Pump Block)

14. **(See Figure 14)** Install the pump thrust bearing (12) in the trunnion machined swashplate (17). NOTE: Place the thin race of the bearing towards the swashplate. The thick race must face the pistons.

15. **(See Figure 12)** Place the pump block assembly (14), pistons down, on top of the thrust bearing in the swashplate (17).

16. Coat the pump running surface with clean motor oil.

17. *Care must be taken to prevent the scaring or scratching of the center section sealing face during this step.* Insert the short shaft side of the swashplate/pump block assembly (Figure 20) into the housing while simultaneously compressing the pistons in the block. NOTE: To assist in the installation of these components, insert the assembly until 3/4 of the pump block is covered by the center section. Then slightly angle the trunnion shaft end away while pressing the short swashplate shaft into its pocket.

18. Install the input shaft. See page 18.

19. Install the bypass rod. See page 17.

20. Install the reduction gears. Refer to page 16.

21. Install the side housing. See page 15.

22. Install the seals in the side housing. See page 14.

23. Fill the transaxle with new oil. See page 9.

24. Install the bypass arm and control arm. See page 13.

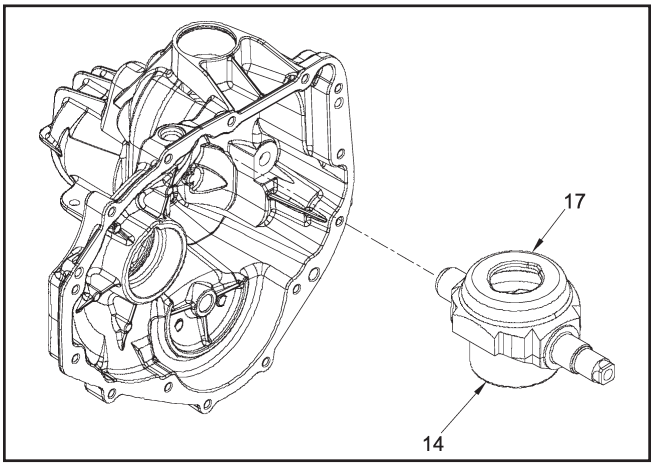


Figure 11

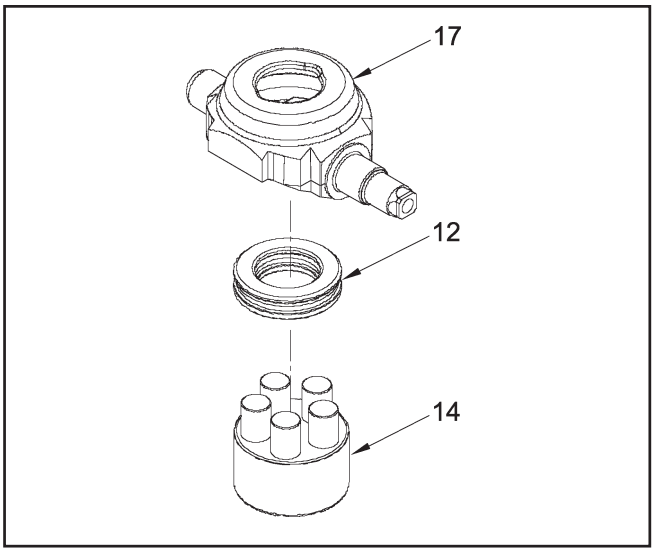


Figure 12

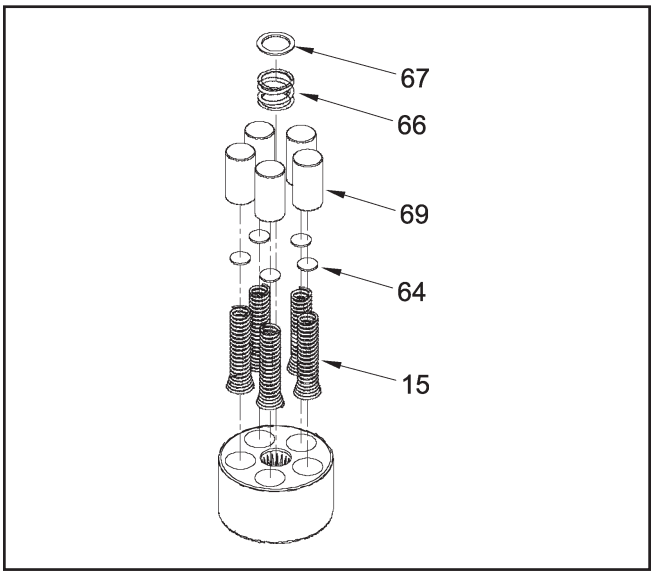


Figure 13

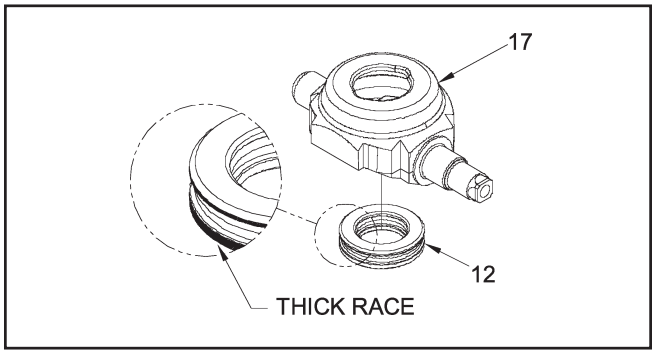


Figure 14

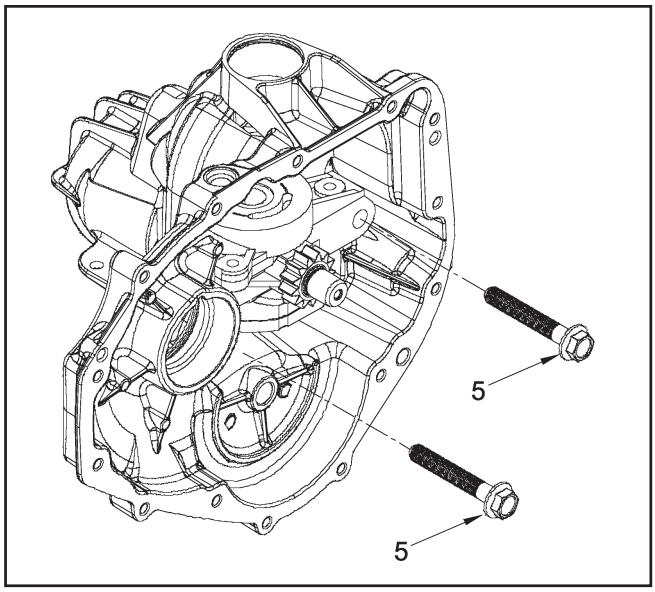


Figure 15

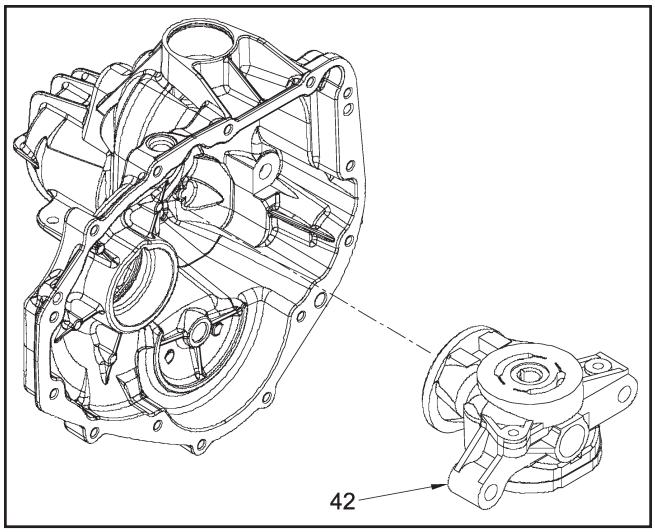


Figure 16

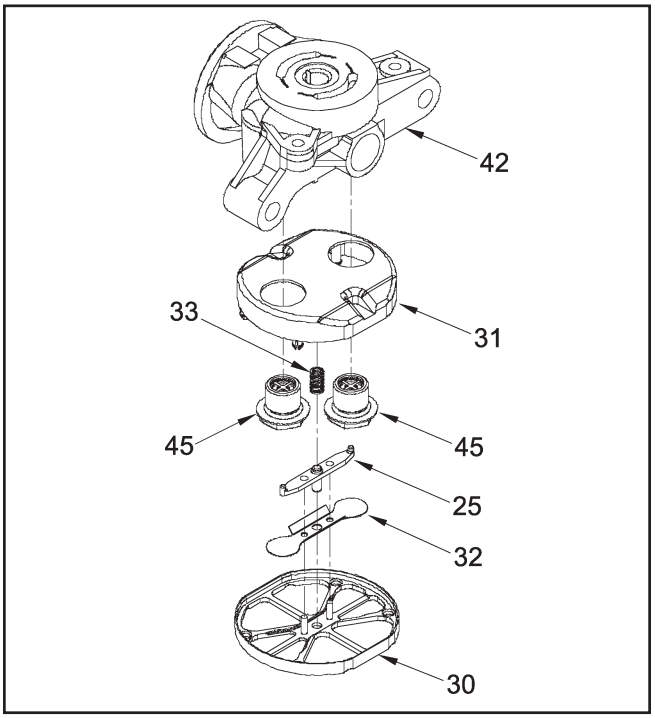


Figure 17

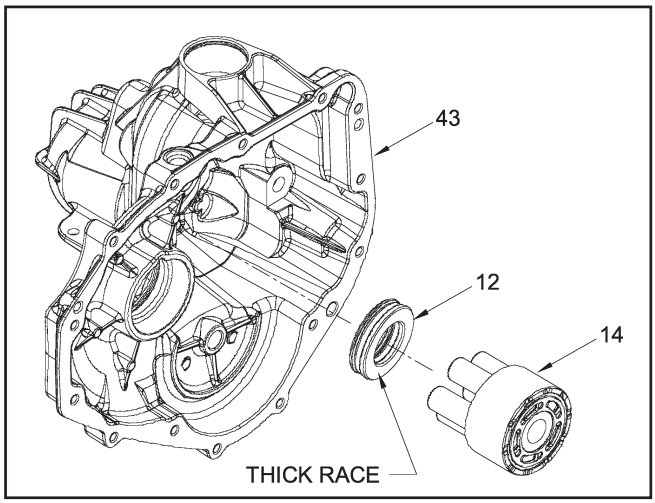


Figure 18

TRANSAXLE INSTALLATION

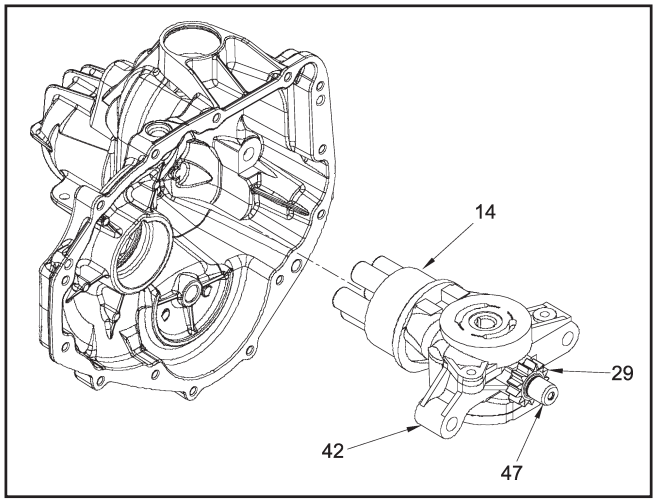


Figure 19

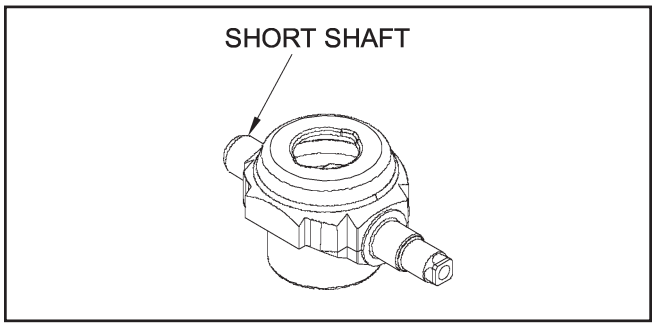


Figure 20

Use the following procedure to complete the installation of the transaxle on the vehicle.

1. Install and secure the transaxle on the vehicle according to the instructions in the vehicle owner's manual.
2. With the vehicle raised, install the wheels on the axles, and snug the wheel hardware.
3. Lower the vehicle wheels to the ground and torque the wheel hardware per the vehicle owner's manual.

ASSEMBLY AFTER A COMPLETE TEARDOWN

If the unit has been torn down completely, the following summary identifies the assembly procedures necessary to completely assemble the unit. Each assembly procedure is located by a page reference.

The part reference numbers provided in each assembly procedure are keyed to the individual exploded views, and are also keyed to the complete unit exploded view on page 26.

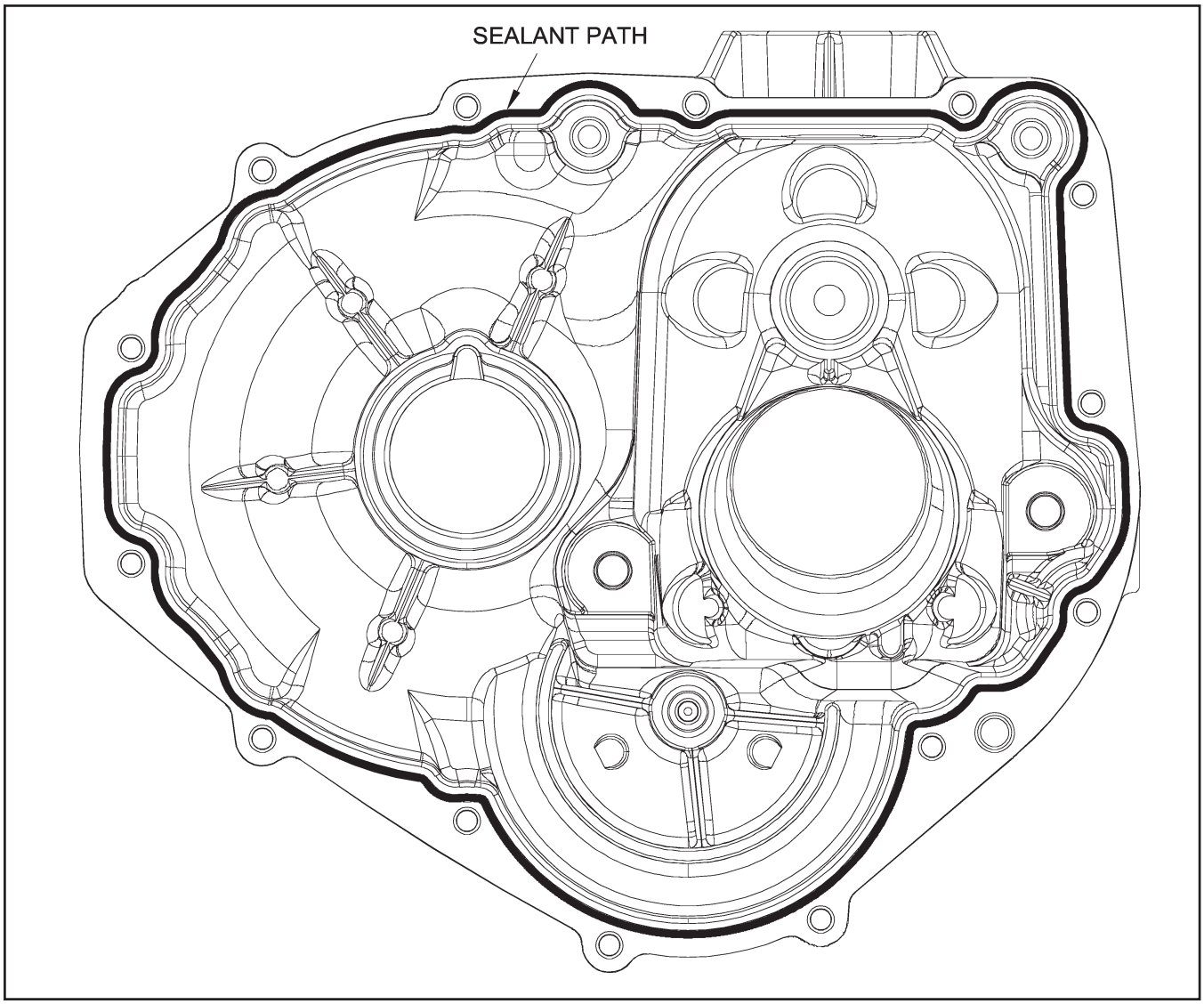
1. Install the hydraulic components. See pages 19-22.
2. Install the input shaft. See page 18.
3. Install the bypass rod. See page 17.
4. Install the reduction gears. See page 16.
5. Install the side housing. See page 15.
6. Install new seals in the side housing. Refer to page 14.
7. Fill the transaxle with new oil. See page 9.
8. Install the bypass arm and control arm. See page 13.
9. Install the transaxle onto the vehicle.
10. Perform the purge procedures listed on page 10.

SEALANT APPLICATION

NOTE: Prior to applying the new sealant, the old sealant must be removed from all surfaces.

A small consistent bead of the sealant around the housing face will be sufficient. Use sparingly.

The illustration below indicates the correct areas.



310-0410 EXPLODED VIEW

Figure 21. 310-0410

310-0410 ITEMS LIST

No.	DESCRIPTION
1	FLAT - WASHER 11/32 ID X 7/8 OD
2	RETAINING RING
3	WASHER, 7/8 OD X .260ID X 1/8 THK
4	FLAT WASHER 5/8 IDX 1.0 OD X .05 THK
5	HYDRO MTG SCREW 3.8-24 X 2.5 LONG
6	WASHER, HT .5 ID X 1 O.D. X .032
7	PUCK, FRICTION
8	BALL BEARING 17 MM ID X 40MM OD 12MM
9	HEX LOCKNUT, 5/16-24 UNJF (NYLON INSERT)
10	RING, RETAINING
11	STUD 5/16-24
12	BEARING, THRUST 30 X 52 X 13
13	SPACER
14	BLOCK - CYLINDER
	SPRING, COMPRESSION
	WASHER - THRUST
	PISTON
16	GEAR, 10T JACK SHAFT
17	SWASHPLATE, TRUNNION MACHINED
19	BOLT, HEX FLANGE HEAD 5/16 -24 X .94 (PATCH)
20	WASHER, MOTOR SHAFT .71 ID X 1.6 OD X .04 THK
21	LIP SEAL .250 X .750 X .250 TC
22	PIN, JACKSHAFT
25	BYPASS ACTUATOR
26	MAGNET, RING
27	RETAINING RING 0.250 EXTERNAL
28	10T / 48T GEAR
29	GEAR - PINION 13T
30	FILTER
31	FILTER BASE
32	DEFLECTOR
33	SPRING, BYPASS
34	LIP SEAL 18 X 32 X 7
35	FITTING 5/16 SAE, 5/32 TUBE
36	O-RING .103 X .299 ID
37	HOSE, EXPANSION TANK
38	SEAL, LIP 17 X 40 X 7
39	PULLEY Ø4.40 X .665
40	SEALANT
41	HEX WASHER SCREW 1/4-20 X 1.125
42	CENTER SECTION
	BUSHING 0.707 X 0.786 X 0.591
43	MAIN HOUSING ASSEMBLY
	HOUSING, MAIN
	BUSHING 0.865 X 0.985 X 0.790
44	SIDE HOUSING ASSEMBLY
	HOUSING, SIDE
	BUSHING 0.624 X 0.719 X 0.562
	BUSHING 0.865 X 0L985 X 0.790
45	PLUG, CHECK .027 WASHER SPRING

No.	DESCRIPTION
46	BEARING, SLEEVE (INBOARD)
47	SHAFT, MOTOR
48	SHAFT, INPUT
49	TUBE-BULL GEAR WELDED ASSEMBLY
50	ROD, BYPASS ACTUATOR
51	ARM, BYPASS
52	SEAL, LIP 1.220 X 1.929 X .276
53	HOSE, EXPANSION TANK 3/16
54	WEIGHT, 5/32 BARBED
55	WASHER, 2.225 X 1.280 X .138
56	TANK, EXPANSION
57	RING, RETAINING
58	BRACKET, TORQUE
59	ARM, CONTROL
60	BRACKET, TORQUE
61	CAP, BARBED EXPANSION
62	SCREW, SOCKET HEAD CAP M6 X 1.0-12 (PATCH)
63	OIL, SAE 5W30
65	RING, RETAINING
66	SPRING, HELICAL COMPRESSION
67	WASHER
70	PIN, STRAIGHT HEADLESS
71	PLUG, STRAIGHT THREAD SOCKET HEAD
120	CENTER SECTION - FILTER - BYPASS ASSEMBLY
	CENTER SECTION
	PLUG, CHECK 0.027 WASHER SPRING
	FILTER
	FILTER BASE
	DEFLECTOR
	SPRING, BYPASS
	BYPASS ACTUATOR
121	FILTER ASSEMBLY
	FILTER
	FILTER BASE
	DEFLECTOR
	SPRING, BYPASS
	BYPASS ACTUATOR
122	SEAL - O-RING KIT
	LIP SEAL 0.250 X 0.750 X 0.250 TC
	LIP SEAL 18 X 32 X 7
	O-RING 0.103 X 0.299 ID
	SEAL, LIP 1.220 X 1.929 X 0.276
	SEAL, LIP 17 X 40 X 7
128	KIT, EXPANSION TANK
	CAP, BARBED EXPANSION
	HOSE, EXPANSION TANK
	CLUNKER
	RETAINING RING 0.250 EXTERNAL
129	CAP, EXPANSION TANK SHIPPING

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 concentrated gaseous condition within the fluid causing the rapid implosion of a gaseous bubble.

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 positive displacement pump frequently used as a charge pump.

Hydraulic Motor: A device which converts hydraulic fluid power into mechanical force and motion by transfer of flow under pressure.

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

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 by forcing fluid into all of the components and allowing the air a path of escape.

Rated Flow: The maximum flow that the power supply system is capable of maintaining at a specific operating pressure.

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 volume for one revolution.

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