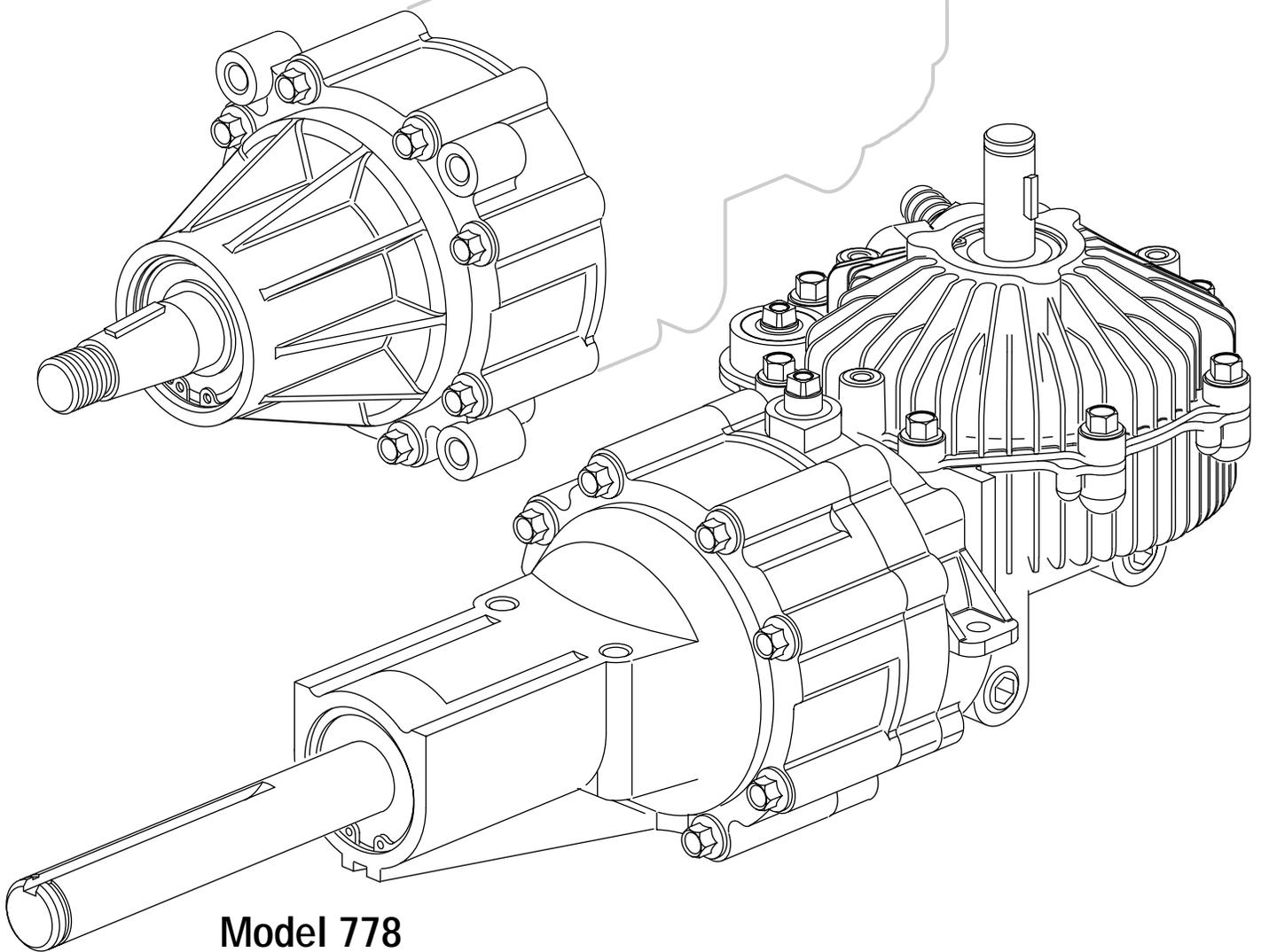


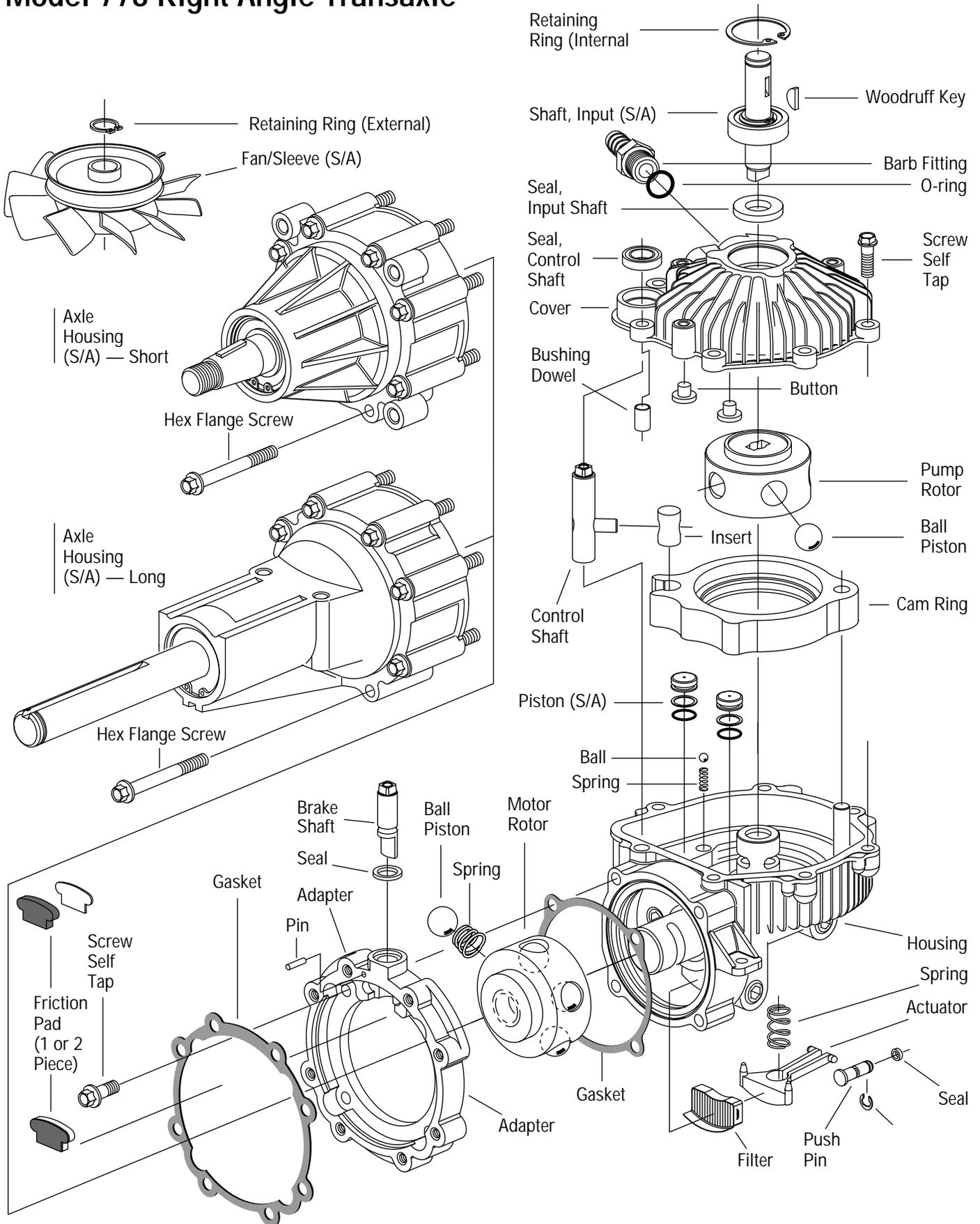


Repair Information

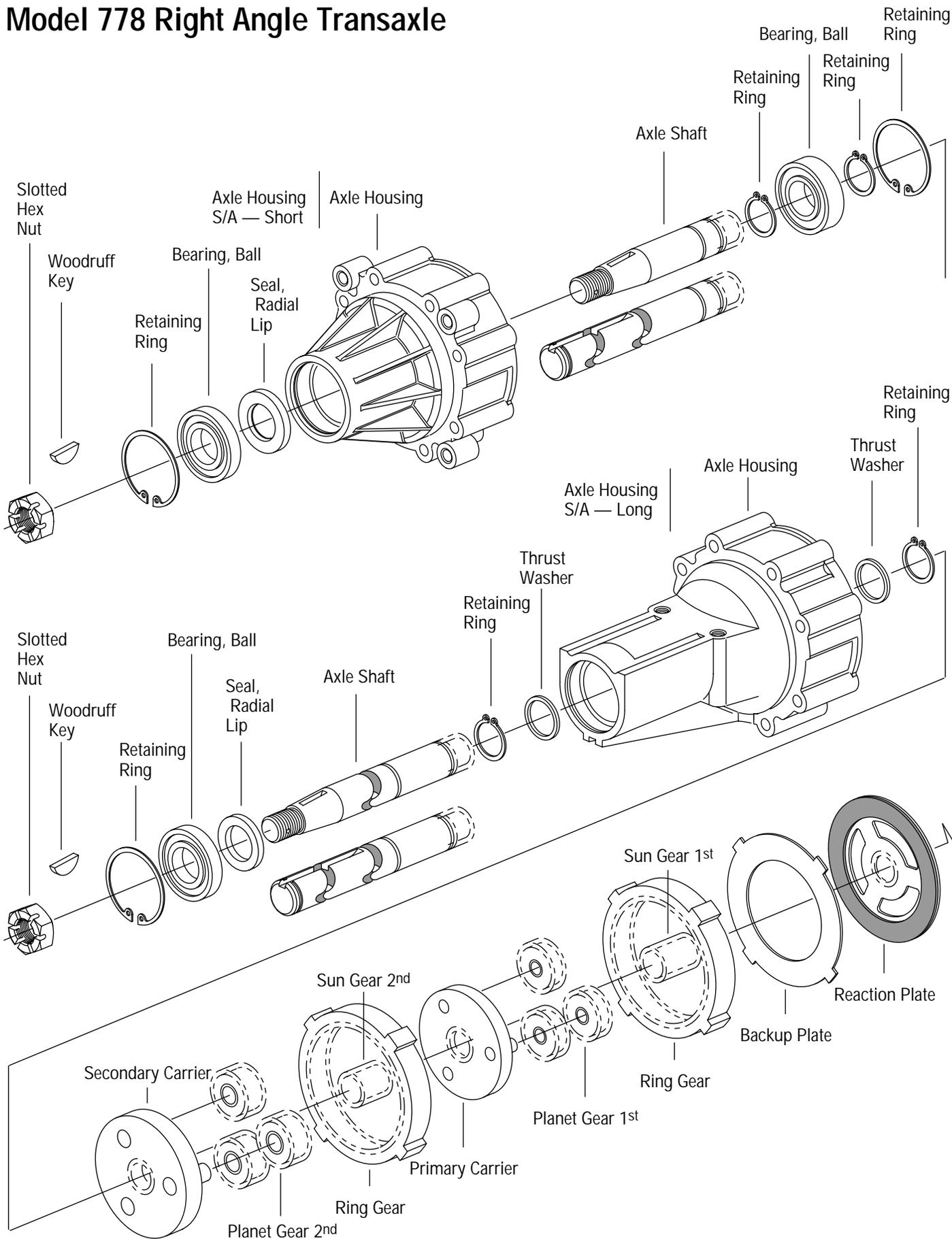


Model 778
Right Angle Transaxle

Model 778 Right Angle Transaxle

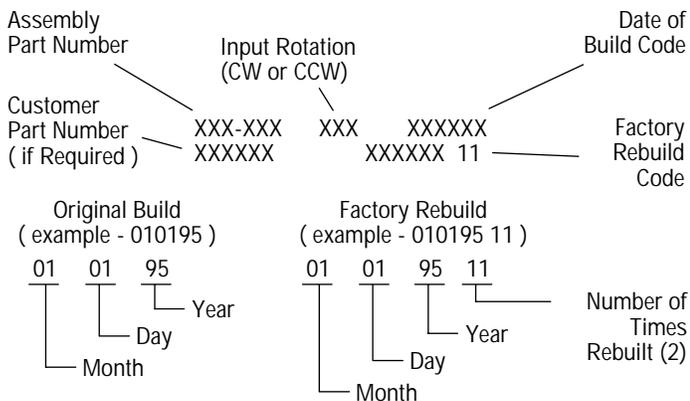


Model 778 Right Angle Transaxle



Model 778 Right Angle Transaxle

1 The following repair information applies to the Eaton 788 series hydrostatic transaxles.



2 The transaxle identification information is located opposite the input shaft, on the back of the housing assembly.

3 The build code of the transaxles identifies the month, day and year of the transaxle manufacture. This information is found in the same area as the identification code.

4 When ordering replacement parts for a transaxle, the part(s) order must include the part name, part number, quantity of parts and also the transaxle model number, input rotation and date code.

Transaxles 788

5 The following procedures describe complete disassembly and reassembly of the transaxle. The level of cleanliness maintained while servicing the transaxle could affect its performance. Work in a clean area. After disassembly, wash all parts with clean solvent and blow the parts dry with air. Inspect all mating surfaces. Replace any damaged parts that could cause internal leakage. Do not use grit paper, files or grinders on finished parts.

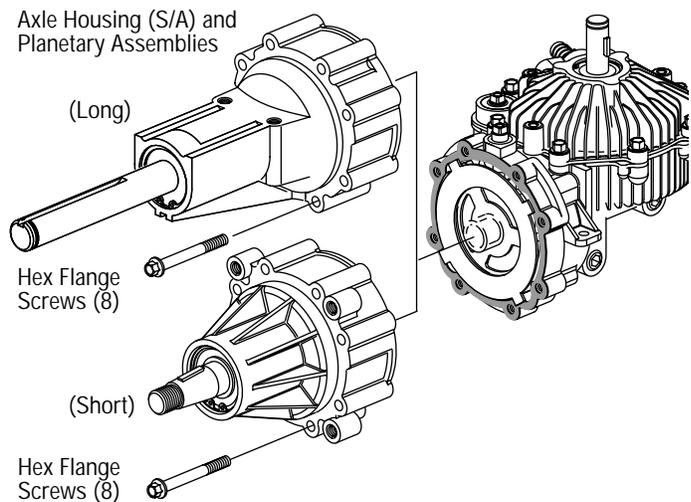
Note: Whenever a transaxle is disassembled, our recommendation is to replace all seals. Lubricate the new seals with petroleum jelly before installation. Use only clean, recommended hydraulic fluid on the finished surfaces at reassembly.

6 The following tools are required for disassembly and reassembly of the transaxle.

- 3/8 in. Socket or End Wrench
- 1 in. Socket or End Wrench
- Ratchet Wrench
- Torque Wrench 300 lb-in [34 Nm]
- 5/32 Hex Wrench
- Small screwdriver (4 in. [102 mm] to 6 in. [150 mm] long)
- No. 5 or 7 Internal Retaining Ring Pliers
- No. 4 or 5 External Retaining Ring Pliers
- Piece of Pipe or Hydraulic Tubing (1 in. O.D. x 6 inches long)
- Piece of Pipe or Hydraulic Tubing (1-1/8 in. [29 mm] O.D. x 6 in. [150 mm] long)
- Small Arbor or Hydraulic Press
- 3 or 4 Large Rubber Bands
- Light Petroleum Jelly (such as Vaseline)
- Molybdenum Grease
- Loctite 518 Master Gasket

7 Seal all open ports before cleaning. Thoroughly clean the transaxle exterior.

Note: It is best to drain the transaxle through the case drain port with the input shaft in the horizontal position.



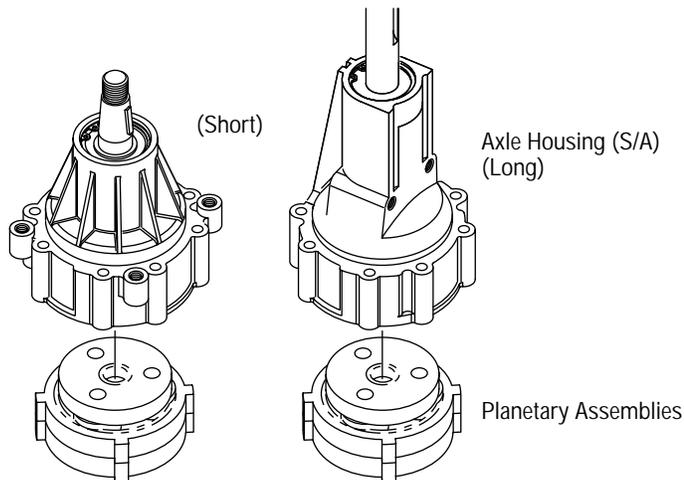
Axle Housing Disassembly

8 Use a 3/8 inch socket or end wrench to remove the eight hex flange screws from the axle housing assembly.

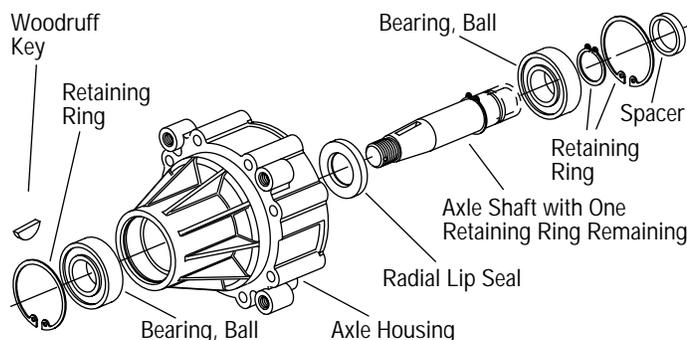
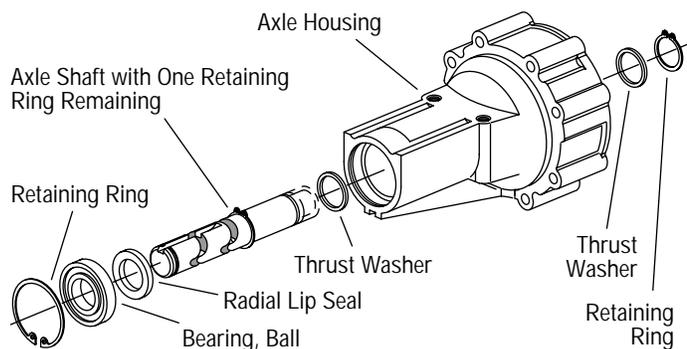
9 After removing the flange screws, carefully remove the axle housing assembly from the housing assembly.

Caution: Retain the planetary assemblies in the axle housing assembly during removal.

Model 778 Right Angle Transaxle



10 To disassemble the axle housing assembly, carefully position the axle housing assembly on a clean flat surface, then separate axle housing from the planetary assemblies as shown.



11 Position the axle housing assembly with the output end of the axle shaft in the up position. Using a No. 5 or 7 internal retaining ring pliers, remove the ball bearing retaining ring from the axle housing.

Axle Housing Disassembly—Long

12 Reposition the axle housing with the splined end of the axle in the up position. Using a No. 4 or 5 external retaining ring pliers, remove the retaining ring and thrust washer from the axle shaft.

13 Remove the axle from the axle housing by using a small press or by tapping the splined end of the axle shaft with a plastic head hammer. This will dislodge the seal and bearing from the axle housing.

14 After separating the axle shaft from the axle housing, remove the ball bearing, seal and thrust washer from the axle shaft. The thrust washer may be in the axle housing.

Note: The retaining ring remaining on the axle shaft need not be removed.

Axle Housing Disassembly—Short

15 Position the axle housing assembly with the output end of the axle shaft in the up position. Using a No. 5 or 7 internal retaining ring pliers, remove the ball bearing retaining ring from the axle housing.

16 Position the axle housing assembly with the output end of the axle shaft in the down position. Remove the spacer from the splined end of the axle shaft

17 Using a No. 5 or 7 internal retaining ring pliers, remove the bearing retaining ring from the inside of the axle housing.

18 Remove the axle from the axle housing by using a small press or by tapping the output end of the axle shaft with a plastic head hammer. This will dislodge the inside bearing from the axle housing.

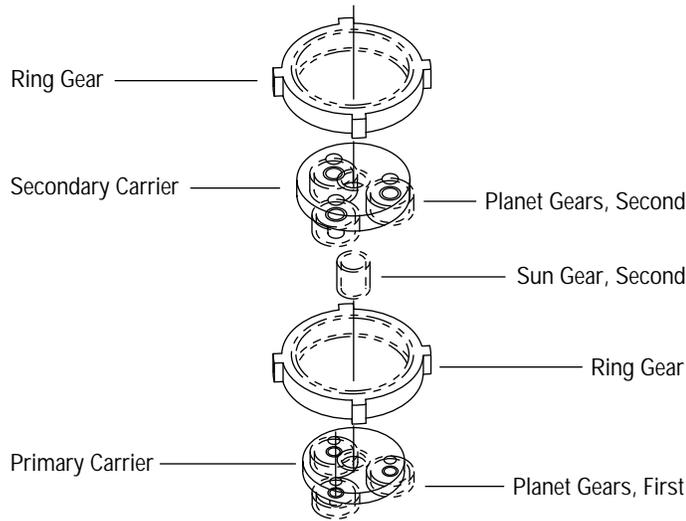
19 After removing the axle shaft out the back side of the axle housing, drive the remaining bearing out the front of the axle housing.

20 Remove seal from the axle housing, drive seal toward and out the back side of housing.

21 Remove and replace bearing if necessary using a No. 4 or 5 external retaining ring pliers, remove one retaining ring from axle shaft then drive bearing off of the shaft.

Note: The retaining ring remaining on the axle shaft need not be removed.

Model 778 Right Angle Transaxle



22 To disassemble the planetary assemblies for inspection and cleaning, first remove the ring gear (from the secondary carrier/planet gears).

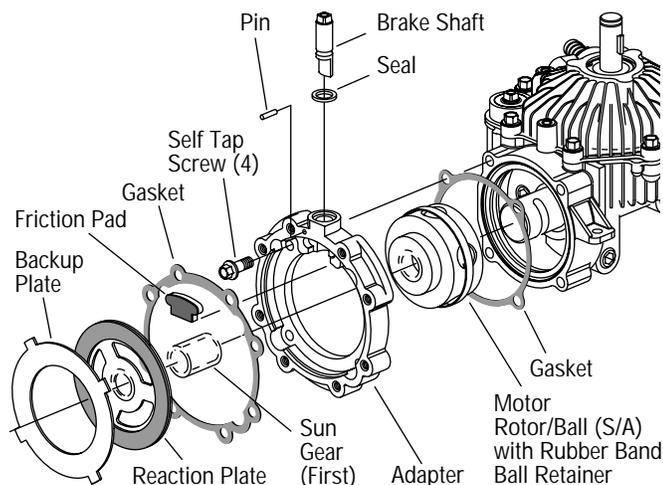
23 Next, putting a slight squeeze on the secondary carrier planet gears, remove the three secondary planet gears and carrier.

24 Turn the assembly over and remove the secondary planet gears for inspection and cleaning.

25 Remove the sun gear and remaining ring gear.

26 Again, putting a slight squeeze on the remaining carrier planet gears, remove planet gears and carrier from the backup plate.

27 Shown above are both the primary and secondary carrier assemblies. The planet gears may be removed for inspection and cleaning.



28 Next, remove the backup plate and reaction plate from the primary sun gear.

29 Remove the primary sun gear from the motor rotor assembly.

30 Remove the small friction brake pad assembly from its recessed pocket located in the adapter (brake shaft section).

31 Shown in previous drawings are the three major parts used in the Eaton transaxle wet brake assembly: the friction pad assembly, reaction plate and backup plate. When the brake is applied, the rotating reaction plate is squeezed between the stationary friction pad and the backup plate.

32 Remove the gasket from the adapter (brake shaft section).

Note: This gasket may have remained on the axle housing.

33 Remove the 4 self tap screws from the adapter (brake shaft section), and remove this section and the gasket from motor rotor end of housing.

34 This adapter (brake shaft section) contains a pin to retain the brake shaft; drive this pin out and remove brake shaft. Shaft seal can be removed and replaced. Install brake shaft and pin.

Motor Rotor Disassembly

35 Important: Be extremely careful when removing the motor rotor assembly. The ball pistons are spring loaded in the bores and must remain intact because each ball piston is matched to its respective bore.

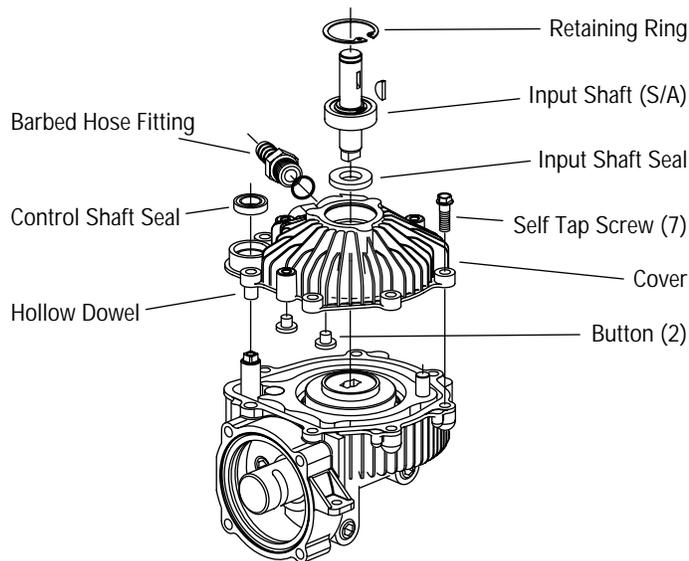
The best way to remove the motor rotor assembly is to place a separate motor race on top of the existing motor race in the housing assembly. Hold the separate race securely in position. Then carefully pull the motor rotor assembly outward until the ball pistons are fully engaged in the groove located in the center of the separate race. Carefully remove the rotor assembly and race together as a set, handling the motor rotor assembly only.



Note: If a separate motor race is not available, work a wide rubber band around the outside of the motor rotor to hold the ball pistons in their bores.

36 It is essential that the ball pistons be retained in their bores during handling. This is especially true for the motor rotor(s), as the motor ball pistons are spring loaded in the bores.

Model 778 Right Angle Transaxle



37 Reposition the housing assembly. Using a 3/8 inch socket or end wrench, remove the self tap flange screws from the cover assembly.

38 Turn cover assembly over and remove the two buttons (some units do not have these buttons).

39 With all self tap screws removed (7), carefully separate and remove the cover from the housing assembly.

40 Using a No. 5 or 7 internal retaining ring pliers, remove the input shaft retaining ring.

41 Reposition and support the cover allowing room for shaft removal. With the input shaft in the down position, use a plastic head hammer or press to remove the input shaft assembly from the cover.

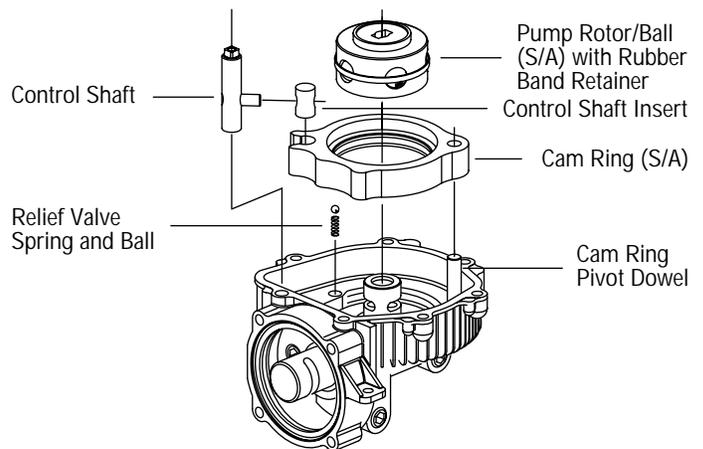
42 No further disassembly of the shaft and bearing assembly is required as they are serviced as an assembly.

43 Using a screwdriver or similar tool, drive the input shaft seal from the cover.

44 To remove the control shaft seal, reposition the cover. Using a small screwdriver or similar tool, pry the control shaft seal from the cover.

45 Remove the Master Gasket material from the cover and housing. Carefully remove the the flange sealant by using a scraper or cleaning solvent.

Important: When using a scraper to remove sealant, do not damage the sealing surfaces.



46 Remove the control shaft and insert from the housing and cam ring assembly.

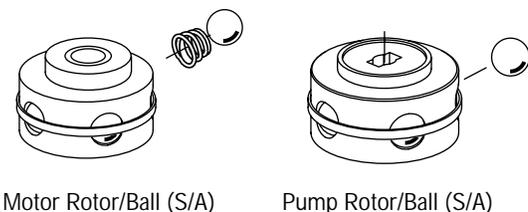
47 Remove the cam ring insert from the control shaft.

48 Remove the cam ring assembly. Do not remove the dowel pin pivot from the housing.

49 Carefully remove the pump rotor assembly from the housing, making sure the ball pistons are not dislodged from their bores.

Important: It is essential that the pump rotor assembly remain intact during handling as each ball piston is matched to its respective bore.

50 Install a wide rubber band around the pump rotor to retain the ball pistons in their bores.



Pump and Motor Rotor Inspection

51 Disassemble and inspect the rotor assembly in the following manner. Remove the piston balls from the rotor, one at a time, working clockwise from the letter stamped in the rotor face. Place the piston balls in a prepared container (use a container such as an egg carton or ice cube tray to hold the balls).

Note: The balls must be replaced in the same bores from which they were removed because they are all select fit.

Model 778 Right Angle Transaxle

Check for broken or collapsed springs in the motor rotor. When broken or collapsed springs are found with no other irregularities, the springs may be replaced individually without replacing the complete motor rotor assembly.

Inspect the piston balls. They must be smooth and completely free of any irregularities.

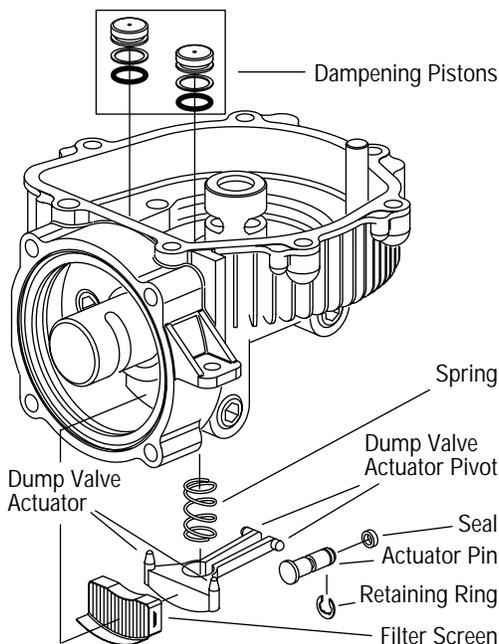
Inspect the rotor bores, rotor bushing and pintle journals for irregularities or excessive clearance. The ball piston to rotor bore clearance is select fit electronically from .005 mm [.0002 inch] to .015 mm [.0006 inch]. When irregularities are noted, replace the complete rotor assembly.

Install the ball pistons in their matching bores. Hold them in place with a rubber band or separate race.

52 The pump and motor journals cannot be removed from the housing.

Note: Inspect the pump and motor journals for any irregularities. If any are found, the housing must be replaced.

53 In most cases, we do not recommend removal of the dampening pistons for inspection or cleaning. Normal flushing should be all that is required for cleaning.



Transaxle Dump Valve

Note: Remove the dump valve assembly only if actuator is broken or actuator pin seal leaks.

54 Remove the filter unit from inside the housing cavity.

55 The actuator has two pivot pins that must be forced together, releasing it and the spring from the housing.

56 Remove the retaining ring from the actuator pin. This will allow the actuator pin to be removed from inside the housing cavity.

Transaxle Reassembly

57 Before reassembling the transaxle, clean all parts and assemblies with clean solvent and blow them dry with compressed air. Inspect and replace all scratched or damaged parts. Replace all gaskets, seals and seal rings. Lubricate all seals with petroleum jelly (Vaseline) for retention during reassembly. **Gasket must be assembled Dry.** Freely lubricate all bearings and finished part surfaces with clean hydraulic fluid to provide lubrication at start-up.

58 Start reassembly with dump valve actuator if this valve needed repair; if no repairs were needed to these dump valve parts skip steps 59-63.

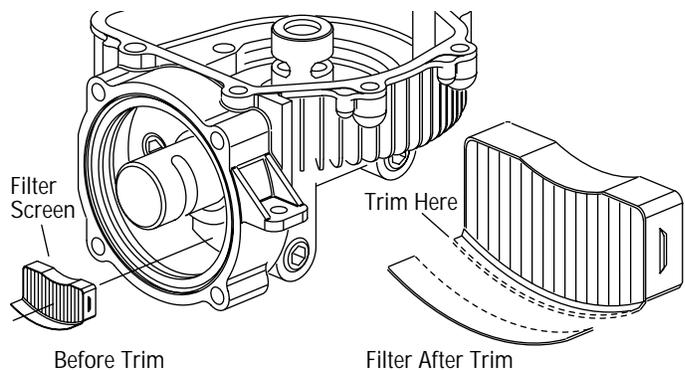
59 Prelubricate actuator pin with hydraulic oil or petroleum jelly prior to installation onto actuator pin.

60 Coat quad seal with molybdenum grease after installation onto the actuator pin and before installation into housing.

61 Install spring and dump valve actuator into housing.

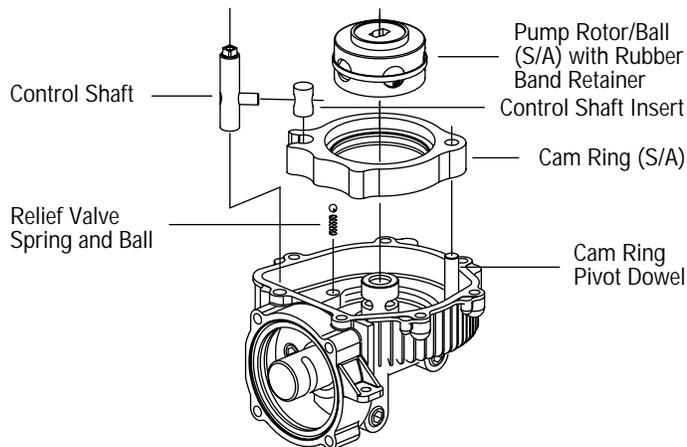
62 Test action of actuator pin and dump valve actuator. Actuator pin should force dump valve actuator to the maximum height of opening.

63 We do not recommend removal of the check valves for inspection or cleaning. Once again, normal flushing should be all that is required to clean the valves.



64 Insert a new filter unit inside the housing cavity, **filter will have to be trimmed because of bearing race interference.** Press on metal edge only, avoiding damage to filter element. The filter unit has a raised locking tab on two sides. These tabs will hold the filter in place only if filter unit is forced into the cavity far enough to lock filter into side grooves of the housing cavity.

Model 778 Right Angle Transaxle

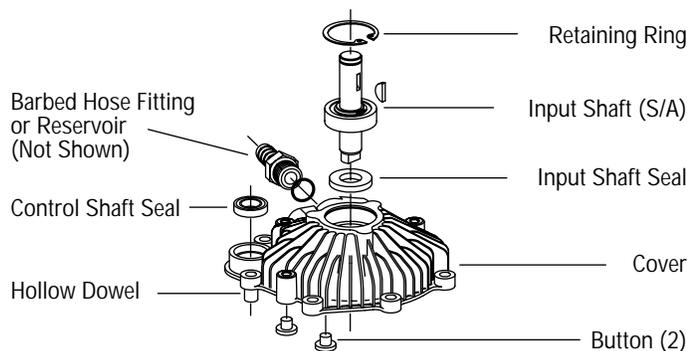


65 Install the cam ring pivot dowel, cam ring (S/A) and pump rotor in the pump journal side of the housing.

66 Remove the rubber band from the pump rotor assembly.

67 Install the cam ring insert on the control shaft pivot dowel.

68 Install the control shaft assembly, first aligning the cam ring insert with the cam ring assembly and then with the housing.



Cover Reassembly

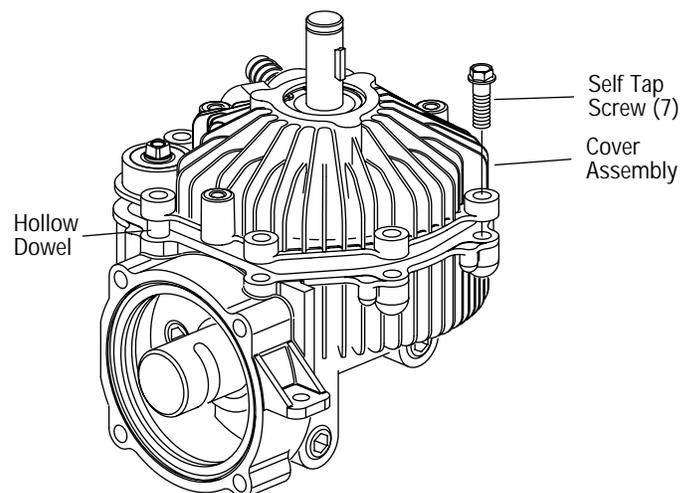
69 Lubricate and install the control shaft oil seal with the seal lip pointing inward. Press or drive the seal into the seal counterbore to shoulder.

70 Lubricate and install the input shaft seal with the seal lip pointing inward. Press or drive the seal to bottom of seal pocket.

71 Press or drive the input shaft (S/A) into the cover counterbore to shoulder.

72 Install the input shaft (S/A) retaining ring, making sure it is firmly seated in the retaining ring groove. After installation of input shaft (S/A) and retaining ring, shaft must turn freely by hand.

73 To help retain the buttons (if required) during reassembly, apply a small amount of petroleum jelly to them. Install the buttons in the holes located in the cover.

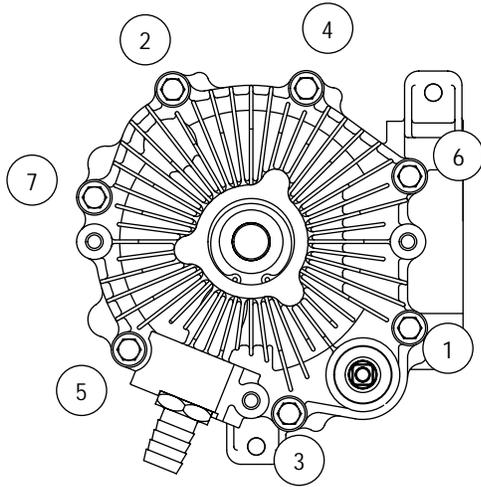


74 Dry up oil on the main housing and cover gasket surfaces using a small towel and rubbing alcohol, wipe the gasket surfaces dry, free of all oil residue.

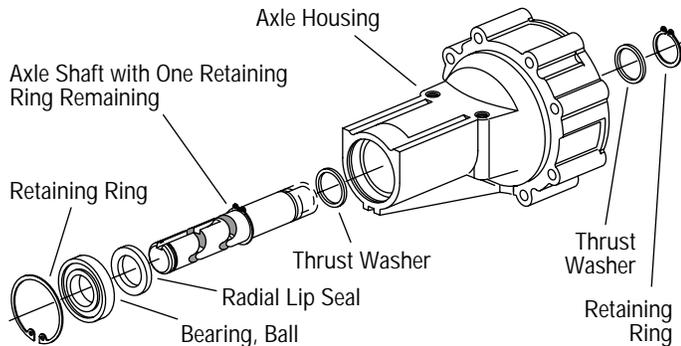
Note: Apply a continuous bead of liquid gasket (Loctite 518 Master Gasket) to the housing surface. The continuous bead size diameter should be 1,6 to 3,2 mm [1/16 to 1/8 inch]. Sealant curing time is one hour minimum before test and installation.

75 Install the cover assembly by carefully aligning it with the control shaft, cam ring pivot dowel and pump rotor drive. After engaging the control shaft and pivot dowel in the cover assembly, carefully rotate the input shaft to engage the pump rotor drive tang. When all mating parts are aligned and engaged, the cover assembly with hollow dowel installed will correctly position the cover and housing.

Model 778 Right Angle Transaxle



76 With the cover assembly in the proper position, and install the self tap screws (7), and alternately tighten to 14 Nm [125 lb-in]. Torque each screw a second time to compensate for the Master Gasket compression set.



Axle Housing Reassembly—Long

77 Lubricate and install the thrust washer in the axle housing.

78 Lubricate and install the axle shaft into the axle housing.

79 Reposition the axle housing with the output end of axle pointing downward. Install the inner thrust washer and axle shaft retaining ring.

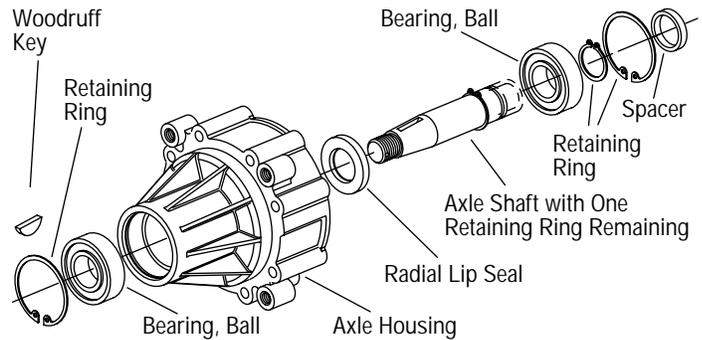
Important: Position retaining ring with flat side (opposite of die rolled side) towards spline.

80 Reposition the axle housing with the output end pointing upward. **Protecting the lip of the axle seal from the retaining ring groove and keyway**, lubricate and install the seal with the lip pointing inward towards the axle housing.

81 Using a piece of pipe or hydraulic tubing (38mm [1.5 inch] O.D. x 150mm [6 inch] long), press the seal into the counterbore.

82 Again, using a piece of pipe or hydraulic tubing (29mm [1.125 inch] O.D. x 150mm [6 inch] long), press the ball bearing over the axle shaft and into the axle housing.

83 Using a pair of No. 5 or 7 internal retaining ring pliers, install the ball bearing retaining ring in the axle housing.



Axle Housing Reassembly—Short

84 Press one bearing on axle shaft against remaining retaining ring. Using a No. 4 or 5 external retaining ring pliers, install retaining ring in groove on axle shaft next to the bearing.

85 Lubricate and install the axle shaft seal with the seal lip pointing up. **Protecting the lip of the axle seal from the retaining ring groove and keyway**, press or drive seal into counterbore of axle housing.

86 Using a piece of pipe or hydraulic tubing (38mm [1.5 inch] O.D. x 150mm [6 inch] long), press lubricated shaft with one bearing into and out axle housing through axle seal.

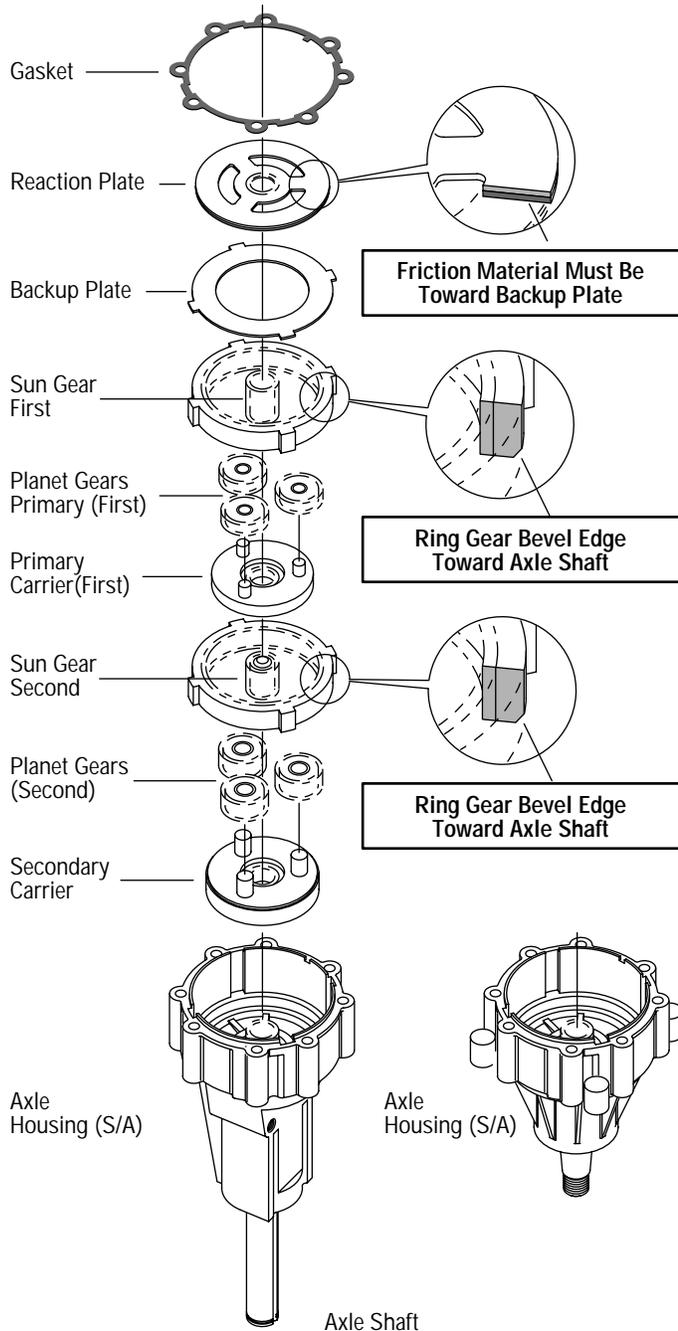
87 Using a pair of No. 5 or 7 internal retaining ring pliers, install retaining ring into axle housing groove next to bearing.

Important: Position retaining ring with flat side (opposite of die rolled side) towards spline.

88 Position the axle housing assembly with the output end of axle shaft in the up position. Again, using a piece of pipe or hydraulic tubing (29mm [1.125 inch] O.D. x 150mm [6 inch] long), press the bearing over the axle shaft and into the axle housing.

89 Using a pair of No. 5 or 7 internal retaining ring pliers, install retaining ring next to the bearing in the axle housing.

Model 778 Right Angle Transaxle



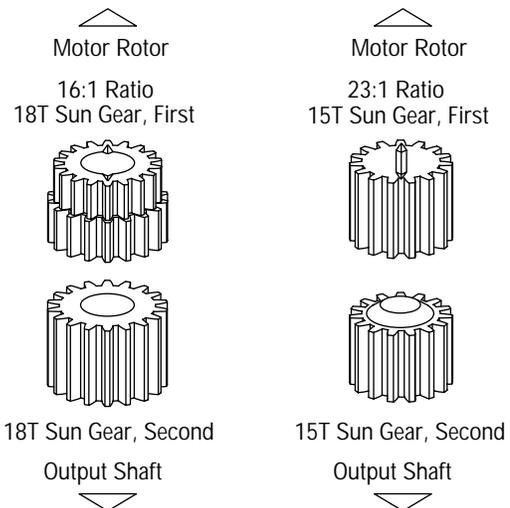
90 Lubricate and assemble the three planetary gears on the secondary carrier assembly.

91 Aligning the splines, install the secondary carrier assembly on the splined end of the axle shaft located in the housing assembly.

92 Please note that one side of each ring gear has a bevel on one side. This bevel side of the ring gear must be toward the output end of the axle shaft.

93 Install one of the two ring gears into the axle housing. Install by aligning the ears on the outside of the ring gear with the notches in the housing assembly.

94 Rotate the secondary carrier assembly planet gears to align with the ring gear teeth. When they are all in alignment, the ring gear will fall into place.



95 Shown here are the first and second sun gears for 16:1 and 23:1 gear ratios.

96 Install the sun gear (second) into the secondary Planetary assembly.

97 Lubricate and assemble the three planetary gears on the primary carrier assembly.

98 Aligning the splines, install the primary carrier assembly on the sun gear (second).

99 Install the next ring gear into the axle housing. Install by again aligning the ears on the outside of the ring gear with the notches in the housing assembly.

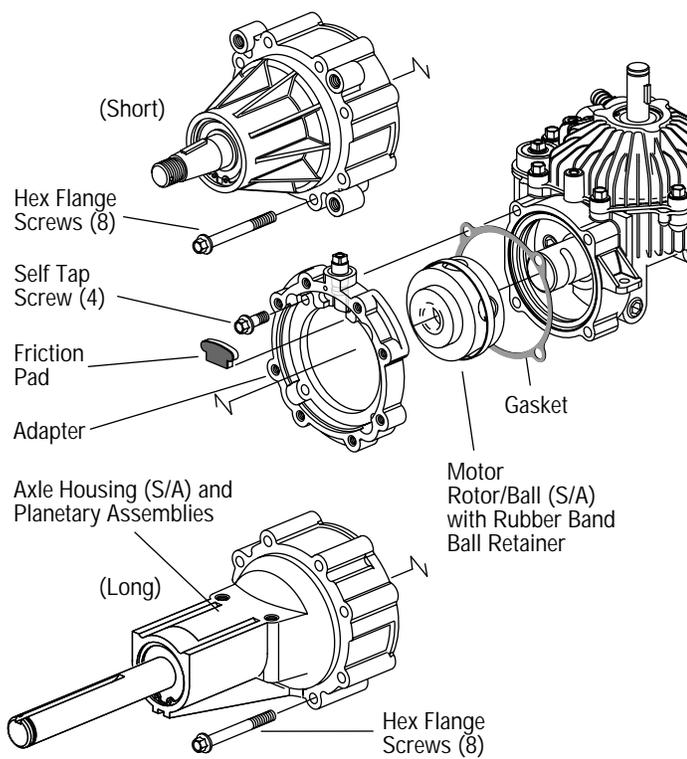
Note: Rotate the primary carrier assembly and the ring gear will fall into position.

100 Install the primary sun gear (first) into the primary planetary assembly.

101 Lubricate and install the backup plate in the axle housing assembly. Install by aligning the ears with the notches in the axle housing.

102 Aligning the splines, install the reaction plate on the primary sun gear (**friction material must be toward backup plate**).

Model 778 Right Angle Transaxle



Fluid Recommendations

Use premium hydraulic oil having a viscosity equivalent to SAE 20w-20, SAE 30 or SAE 40.

The fluid should be chemically stable, incorporating rust and oxidation inhibitors.

A reputable supplier can help you make the best selection of hydraulic fluid for use in your Eaton transaxle.

Note: If the natural color of the fluid has become black or milky, it is possible that an overheating or water contamination problem exists.

Transaxle Parts Lists

Hydrostatic Transaxle Series 778— No. 6-431

103 Install the motor rotor assembly.

104 Install the adapter with gasket and attach with flange screws (4). Torque screws to 14Nm [125 lb-in].

105 Install the friction brake pad into its recess located in the adapter.

106 Aligning the screw holes and notches, install the axle gasket on the axle housing assembly.

107 Carefully retain the planetary assemblies in position, and install the axle housing assembly on the pump housing. Install by first aligning the teeth of the primary sun gear with the teeth in the pump rotor assembly and then rotate the axle housing assembly to align the retaining screw holes.

108 Install the axle housing flange screws and torque to 14Nm [125 lb-in].

109 Fill transaxle with an approved hydraulic fluid. The transaxle is now ready for test and installation.

Model 778 Right Angle Transaxle

Fault-Logic Troubleshooting

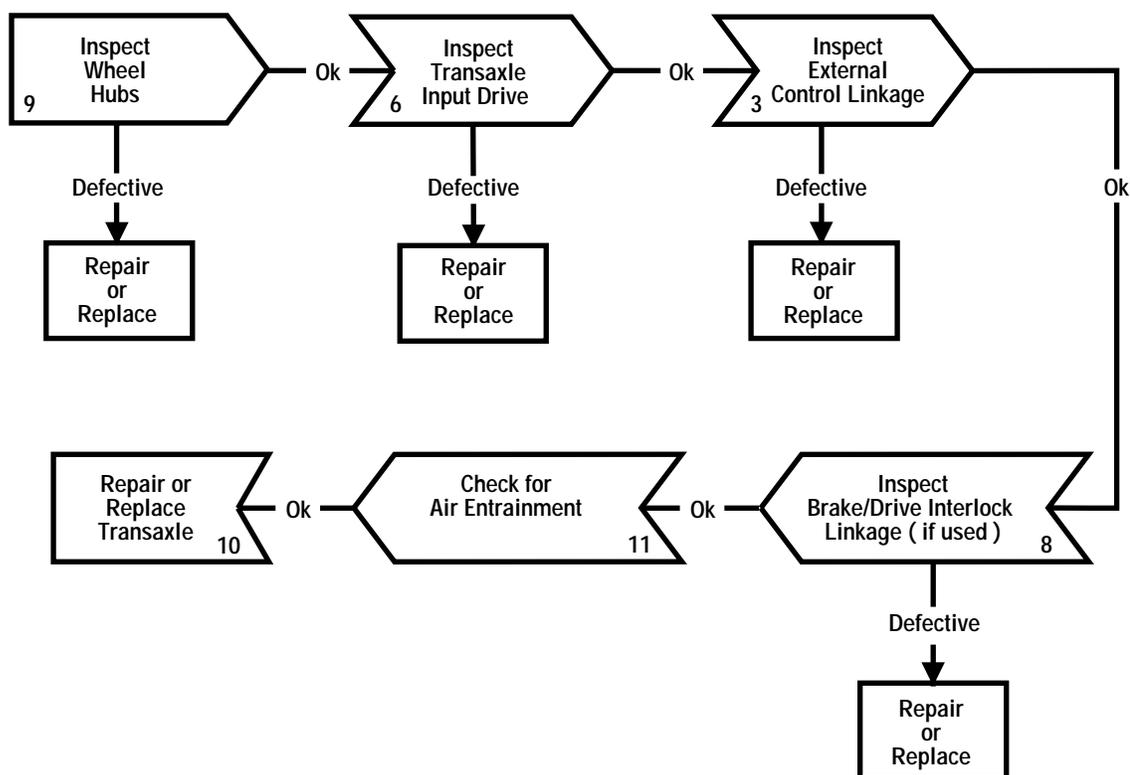
This Fault-Logic Troubleshooting Guide is designed as a diagnostic aid in locating possible transaxle problems by the user.

To use this Fault-Logic Troubleshooting Guide, simply match the transaxle symptoms with the problem statements and follow the action steps shown in the box diagrams. This will give the user unnecessary machine down time.

Following the fault-logic diagrams are diagram action comments to further help explain the action steps shown in the diagrams.

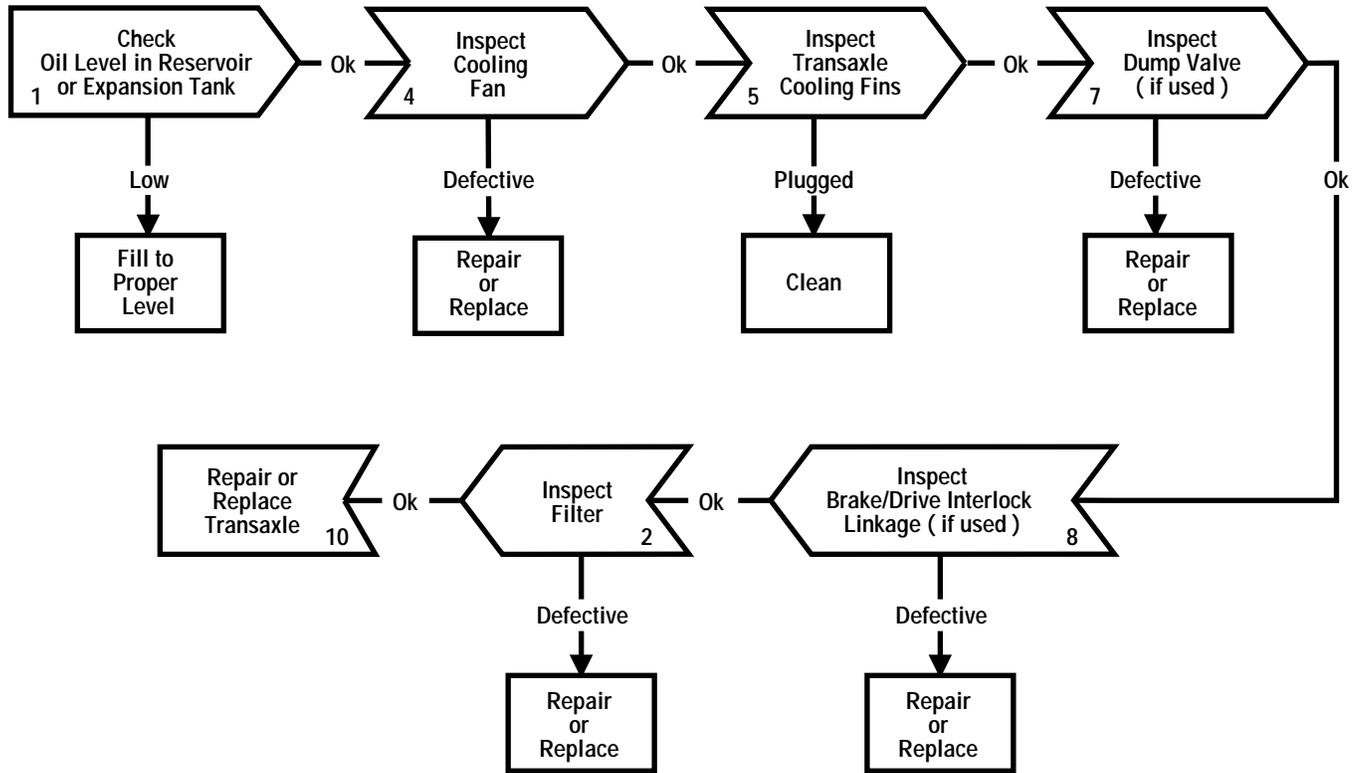
Where applicable, the comment number of the statements appear in the action block of the diagrams.

System Jerky when Starting

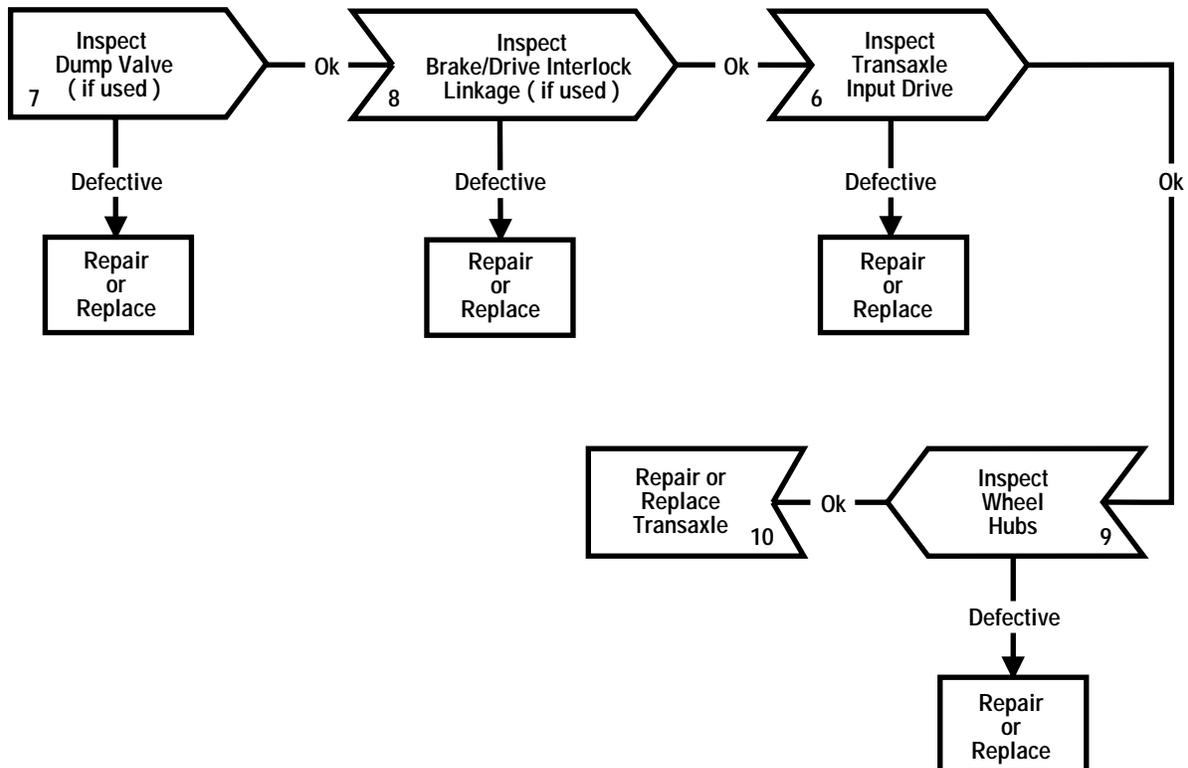


Model 778 Right Angle Transaxle

System Operating Hot



System will not Hold or Free Wheels on Incline



Model 778 Right Angle Transaxle

Loss of Power or System (Will not operate in either direction)

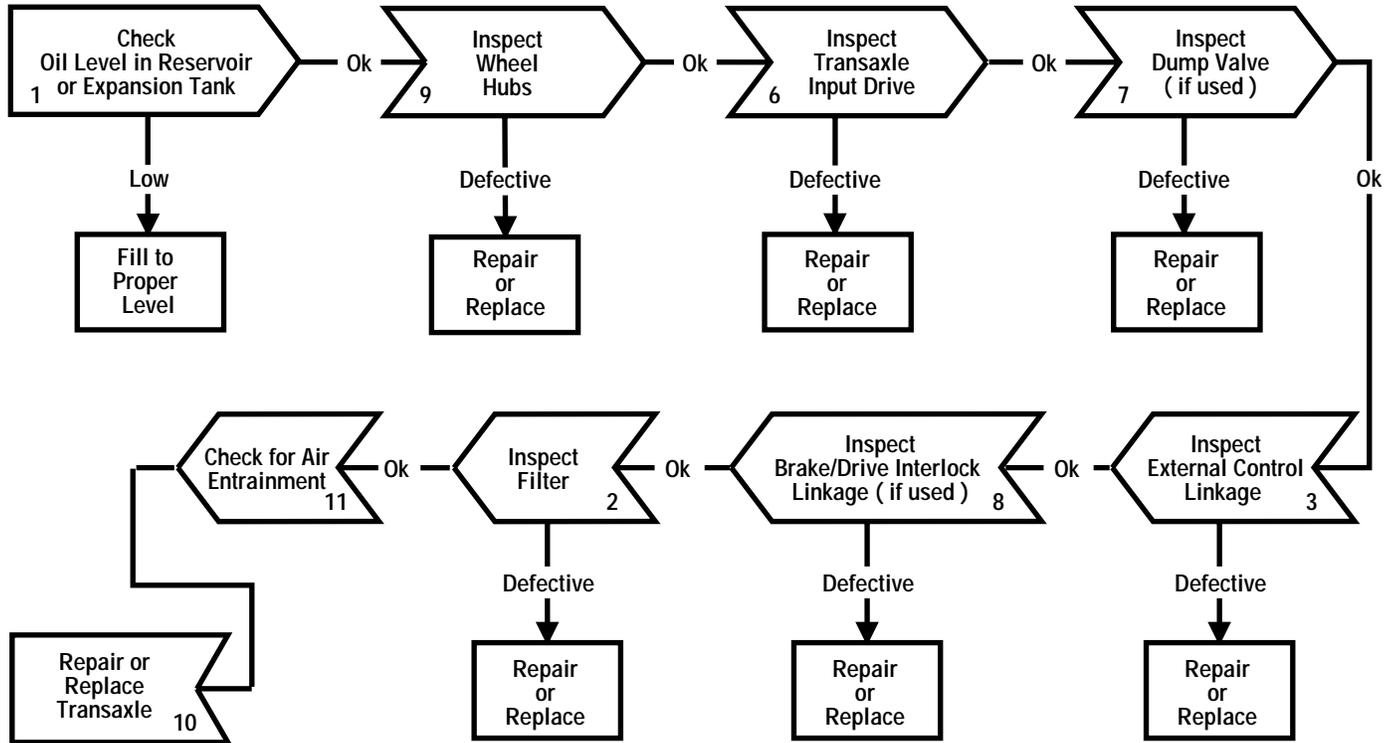


Diagram Action Step Comments

- 1 Check Oil Level in Reservoir or Expansion Tank for:**
 - A Consult owners/operators manual for the proper type fluid and level
- 2 Inspect Filter for:**
 - A Plugged or clogged filter element (see Transaxle Repair Information for filter location)
- 3 Inspect External Control Linkage for:**
 - A Misadjusted or disconnected
 - B Worn, binding, bent or broken
- 4 Inspect Transaxle Cooling Fan for:**
 - A Sheared or missing drive screws
 - B Broken or missing fan blades
- 5 Inspect Transaxle Cooling Fins for:**
 - A Plugged or clogged cover cooling fins
- 6 Inspect Transaxle Input Drive for:**
 - A Drive belt worn, loose or broken
 - B Drive pulley key sheared or missing
- 7 Inspect Dump Valve for:**
 - A Misadjusted or disconnected
 - B Drive pulley key sheared or missing
- 8 Inspect Brake/Drive Interlock Linkage for:**
 - A Misadjusted or disconnected
 - B Worn, binding, bent or broken
- 9 Inspect Wheel Hubs for:**
 - A Drive key worn, sheared or missing
- 10 Repair or Replace Transaxle**
 - A When Transaxle is under warranty return to dealer for warranty consideration
 - B All non warranty repairs should be performed by trained personnel
- 11 Check for Air Entrainment**
 - A Fill unit with oil slowly to allow air to escape, run engine, after 5 minutes of running time stroke the transaxle forward and drive unit for five minutes, set controls to neutral and shut off engine. Allow to sit for 15 minutes minimum, this will allow air to escape to reservoir. Check oil level and repeat these steps if unit still feels soft or spongy.

Hydrostatic Transaxle

Model 778 Right Angle Transaxle

How to Order Replacement Parts

Each Order Must Include the Following:

1. Product Number
2. Date Code
3. Part Name
4. Part Number
5. Quantity of Parts

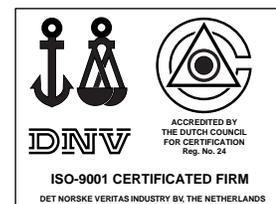
For More Detailed Information Contact Eaton Corp. Hydraulics Division 15151 Highway 5 Eden Prairie, MN 55344.

- Specifications and performance data, Catalog No. 11-701
- Replacement part numbers and kit information — Parts Information No. 6-431

Eaton Corporation
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15151 Hwy. 5
Eden Prairie, MN 55344
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Fax: 612/937-7130

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Hydraulics Products
Am Schimmersfeld 7
40880 Ratingen, Germany
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