Service Manual
Torque Converter

CL9000 Series

Note: This manual details a converter with lockup. Your converter may not include this feature.

wagner
A Division of Allied Systems Company

80-1211
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CONTENTS

FOREWORD

This manual has been prepared to provide the customer and maintenance personnel with information and instructions on the maintenance and repair of Dana Products.

Extreme care has been exercised in the design and selection of materials and manufacturing of these units. The slight outlay in personal attention and cost required to provide regular and proper lubrication, inspection at stated intervals and such adjustments as may be indicated will be reimbursed many times in low cost operation and trouble free service.

In order to become familiar with the various parts of the product, it's principle of operation, troubleshooting and adjustments it is urged that mechanics study the instructions in this manual carefully and use it as a reference when performing maintenance and repair operations.

Whenever repair or replacement of component parts is required, only Dana approved parts as listed in the applicable parts manual should be used. Use of “will fit” or non-approved parts may endanger proper operation and performance of the equipment. Dana does not warrant repair, replacement parts or failures resulting from the use of parts which are not supplied or approved by Dana.

IMPORTANT:

ALWAYS FURNISH SERIAL AND MODEL NUMBERS WHEN ORDERING PARTS.

SAFETY PRECAUTION

TO REDUCE THE CHANCE OF PERSONAL INJURY AND/OR PROPERTY DAMAGED, THE FOLLOWING INSTRUCTIONS MUST BE CAREFULLY OBSERVED.

Proper service and repair are important to the safety of the service technician and the safe, reliable operation of the machine. If replacement parts are required the part must be replaced with a Dana specified replacement part. Do not use a replacement part of lesser quality.

The service procedures recommended in this manual are effective methods of performing service and repair. Some of these procedures require the use of purpose designed tools.

Accordingly, anyone who intends to use a replacement part, service procedure or tool which is not recommended must first determine that neither his safety or the safe operation of the machine will be jeopardized by the replacement part, service procedure or tool selected.

It is important to note that this manual contains various “Cautions and Notices” that must be carefully observed in order to reduce the risk of personal injury during service or repair.

Improper service or repair may damage the unit or render it unsafe. It is important to understand that these “Cautions and Notices" are not exhaustive. It is impossible to warn of all possible hazardous consequences that may result from following or failing to follow these instructions.

DESCRIPTION

The torque converter portion of the power train enacts an important role in delivering power to the driving wheels. In order to properly maintain and service these units it is important to first understand their functions and how they operate.

The torque converter and transmission function together and operate through a common hydraulic system. To obtain maximum serviceability they have been designed and built as separate units. It is necessary, however, to consider both units in the study of their function and operation.

TORQUE CONVERTER ASSEMBLY

Torque converter assembly is composed of: (1) Torque Converter, (2) Output Shaft for driving the transmission, (3) Coupling and Flange to mount the converter charging pump to supply oil under pressure to operate transmission clutches and for converter cooling.

The torque converter is composed of four members: the impeller which is the driving member, the turbine which is the driven member, the reaction member which is splined on a fixed support and the drive disc which couples the converter to the engine. The impeller and drive disc members form the outer shell. The turbine runs within the outer shell and is connected to the output shaft.

The oil is the only connection between the turbine and impeller members. The reaction member is splined to the converter support which is fixed and does not rotate in either direction. A gear is splined to the impeller hub and drives through gears rotating the hydraulic pumps mounted on the converter housing.

HOW TO UNITS OPERATE

With the engine running, the converter charging pump draws oil from the transmission sump and directs it through oil filters to the regulating valve located on top of the transmission. From the regulating valve it is then directed through the control cover on the transmission to the converter and to the transmission clutches.

The pressure regulating valve mounted on the top of the transmission remains closed until required pressure is delivered to the transmission for actuating the direction and speed clutches. This regulator valve consists of a hardened valve spool operating in a closely fitted bore. The valve spool is backed up by a spring to hold the valve spool against its seat until a port is exposed along the side of the bore. The oil can then flow through this port into a distributor which directs the oil into the converter inlet port.

After entering the converter, the oil is directed through the stator support to the converter cavity and exits between the turbine shaft and converter support. The oil then passes through an oil distributor which directs the oil out of the converter by way of a down stream regulator valve and then to the oil cooler. After leaving the cooler the oil is directed through a hose to the lubrication oil inlet on the transmission, then through a series of tubes to the transmission, bearings, and clutches. The oil then returns to the transmission sump.

A safety valve is built in the transmission control cover and will open to bypass oil only if an excessive pressure is built up due to a blocked passage.

The rear compartment of the converter unit also houses the converter output shaft. A flexible hose provides an overflow to the transmission sump.

The three members of the torque converter are composed of a series of blades. The blades are curved in such a manner as to force the oil to circulate from the impeller to the turbine, through the reaction member and again into the impeller. This circulation causes the turbine to turn in the same direction as the impeller. Oil enters the inner side of the impeller and exits from the outer side into the outer side of the turbine. It then exits from the inner side of the turbine and after passing through the reaction member, again enters the inner side of the impeller.

Converter “Stall” is achieved whenever the turbine and turbine shaft are stationary and the engine is operating at full power or wide open throttle.

⚠CAUTION

Do not maintain “Stall” for more than 30 seconds at a time. Excessive heat will be generated and may cause converterm or transmission seal damage.

In converters equipped with lock-up clutches, a hydraulic clutch, similar to the transmission clutches is used to “lock” the engine mechanically to the output shaft. This is accomplished by hydraulic pressure actuating the lock-up clutch which in turn locks the impeller cover to the turbine hub. During lock-up the converter turns at 1 to 1 speed ratio.

The down stream regulator valve on the converter consists of a valve body and regulator spool. The spool is backed up by a spring to hold the valve until converter oil pressure builds up to a specified pressure. The valve is used to maintain a given converter pressure to insure proper performance under all conditions.

The control valve on the transmission consists of a valve body with selector valve spools. On certain models, this valve also contains a shut-off valve spool operated by an air or hydraulic cylinder located on the control cover. This valve is connected to the brake system by a hose line. When the wheel brakes are applied, air or hydraulic fluid enters the valve and overcomes a spring force. This forces the spool to shift over and block pressure from entering the directional clutches. In this manner a “neutral” is established without moving the control levers.

With the engine running and the directional control lever in neutral position, oil pressure is blocked at the control valve, and the transmission is in neutral. Movement of the forward and reverse spool will direct oil under pressure to either the forward or reverse direction clutch as desired and the opposite one is open to relieve pressure.

The direction or speed clutch assembly consists of a drum with internal teeth and a bore to receive a hydraulically actuated piston. A piston is inserted into the bore of the drum. This piston is “oil tight” by the use of sealing rings. A friction disc with internal teeth is inserted into the drum and rests against the piston. Next, a disc with splines at the outer diameter is inserted. Discs are alternated until the required total is achieved. After inserting the last disc, a series of springs and pins are assembled in such a manner that these springs rest on teeth of the piston. A heavy backup plate is then inserted and secured by a snap ring. A hub with I.D. and O.D. splines is inserted into the spli-

nes of discs with teeth on the inner diameter and a splined shaft extending through the clutch support. This hub is retained by a snap ring. The discs and inner shaft are free to increase in speed or rotate in the opposite direction as long as no pressure is present in the direction or speed clutch.

To engage the clutch, as previously stated, the control valve is placed in the desired position. This allows oil under pressure to flow from the control cover valve, through a tube in the transmission case, to a chosen clutch. Once into the drum, oil is directed through a drilled hole into the rear side of the piston bore. Pressure of the oil forces the piston and discs over against the heavy backup plate. The discs, with teeth on the outer diameter, clamping against discs, with teeth on inner diameter, enables the clutch drum and drive shaft to be locked together and allows them to turn as a unit.

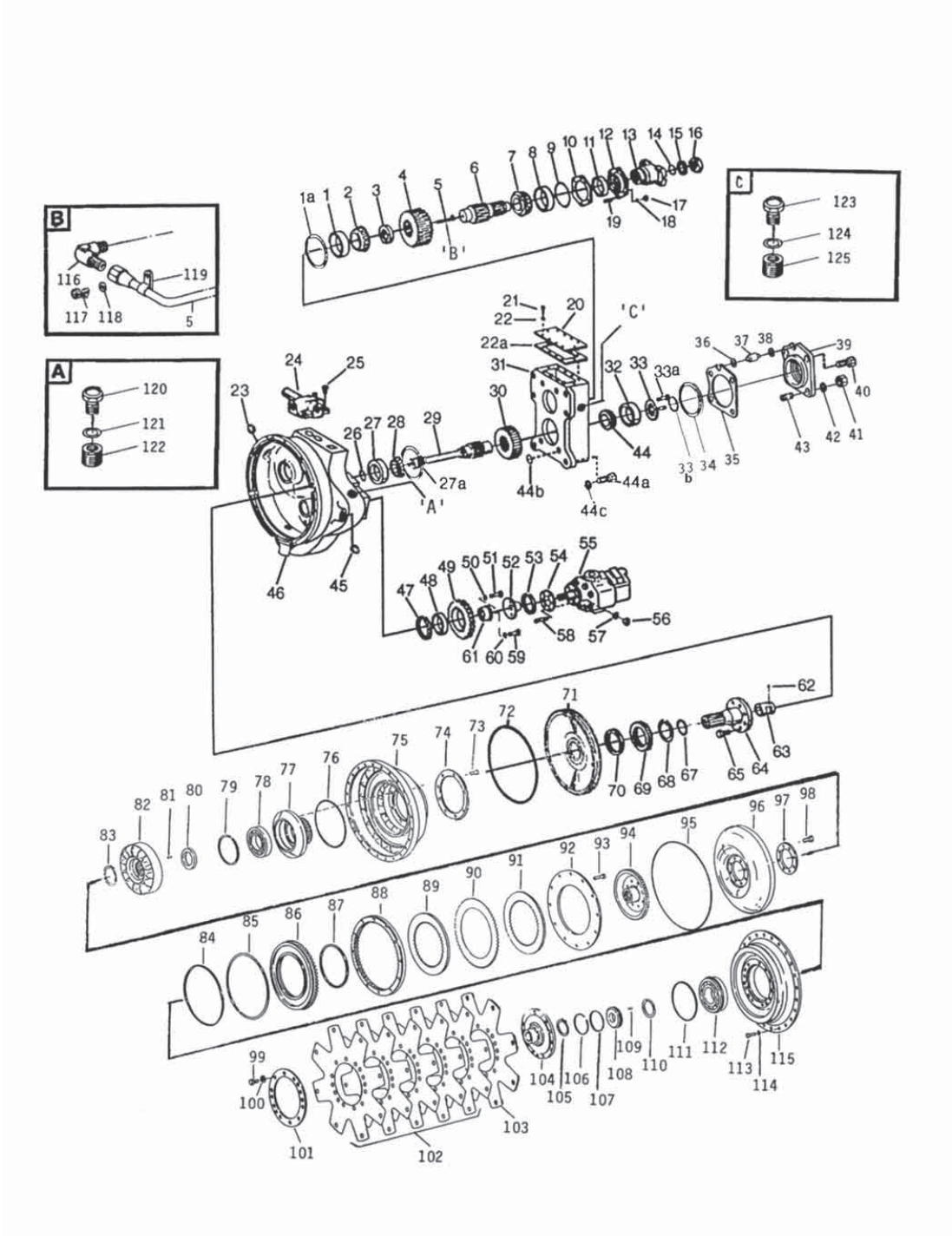
There are bleed balls in the clutch drums which allow quick escape for oil when the pressure to the piston is released.

The transmission gear train consists of six shafts: (1) Input Shaft, (2) Reverse Shaft, (3) Idler Shaft, (4) First and Third Shaft, (5) Second and Fourth Shaft, (6) Output Shaft.

A screen mounted in a frame is positioned on the bottom of the transmission case, to screen out any foreign material. This screen is covered by the sump pan. This pan is provided with magnets to catch any metallic particles.

Some transmissions may have an axle declutching unit as optional equipment. This unit consists of a split output shaft with a sliding splined sleeve to engage or disengage the axle. This is accomplished by manually shifting a lever in the operator's compartment which is mechanically connected to the shift fork on the clutching unit sliding sleeve. This unit, of course, is only used on the four wheel drive machines. On the front wheel drive only or the rear wheel drive only, the output shaft is a one piece type and an output flange is assembled only on the required end.

CONVERTER EXPLODED VIEW - 2 PLATES LOCK-UP



CONVERTER PARTS LIST

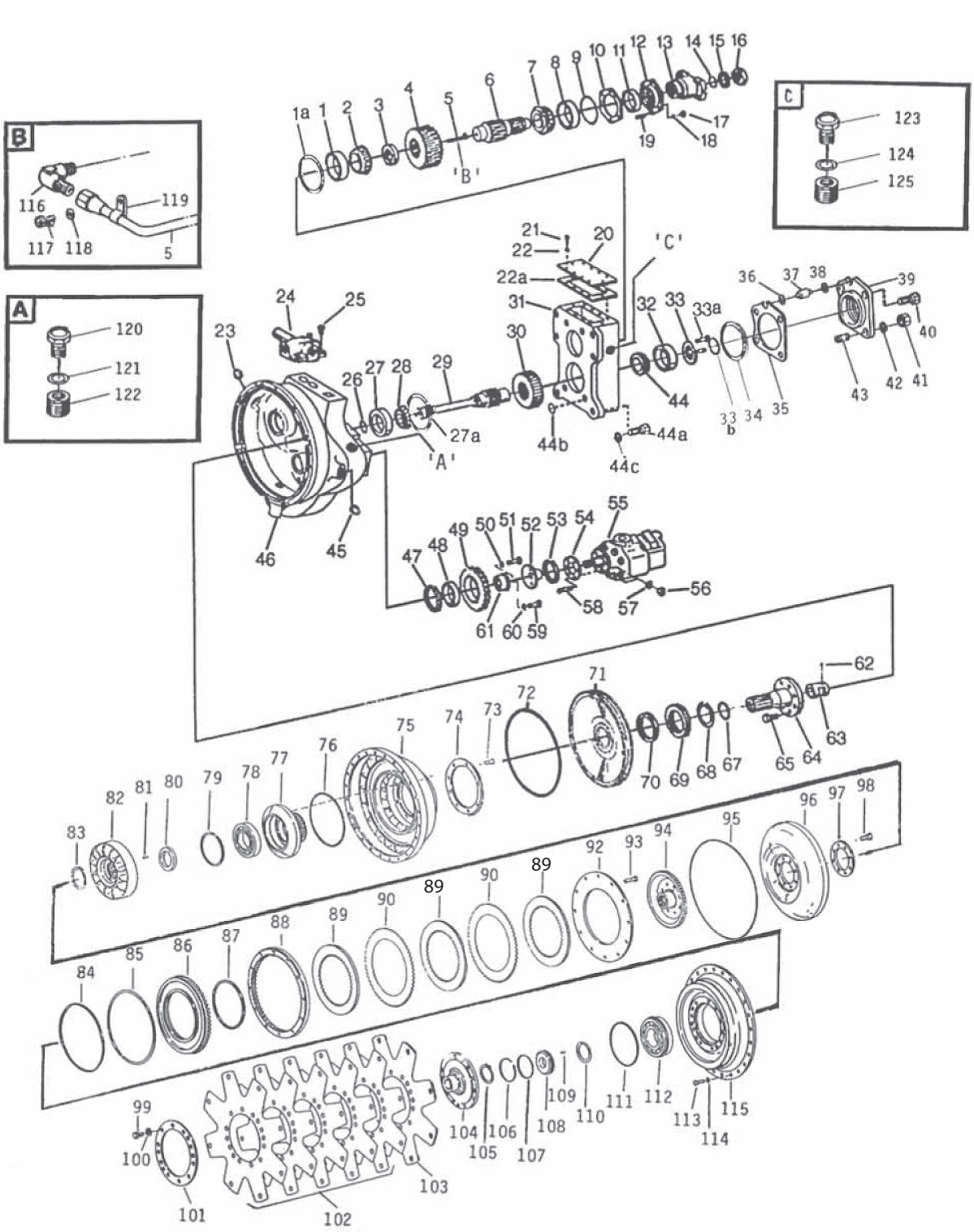
ITEM	DESCRIPTION	QTY
1	Output Bearing Cup	1
1A	Bearing O-RingBearing O-RingBearing O-Ring	1
2	Output Bearing Cone	1
3	Output Bearing Spacer	1
4	Output Shaft Gear	1
5	Lube Tube Assembly	1
6	Output Shaft	1
7	Output Bearing Cone	1
8	Output Bearing Cup	1
9	Output Bearing O-Ring	1
10	Output Bearing Cap Shim	AR
11	Output Bearing Cap Oil Seal Seal	1
12	Output Bearing Cap	1
13	Output Flange	1
14	Output Flange O-Ring	1
15	Output Flange Washer	1
16	Output Flange Locknut	1
17	Output Bearing Cap Stud Nut	4
18	Output Bearing Cap Lockwasher	4
19	Output Bearing Cap Stud	4
20	Housing Cover Plate	1
21	Housing Cover Plate Screw	10
22	Housing Cover Plate Lockwasher	10
22A	Housing Cover Gasket	1
23	Drain Plug	1
24	Pressure Regulator Valve Assembly	1
25	Pressure Regulator Valve Capscrew	4
26	Turbine Shaft Piston Ring	1
27	Turbine Shaft Bearing Cup	1
27A	Turbine Shaft Brg Cup O-Ring	1
28	Turbine Shaft Bearing Cone	1
29	Turbine Shaft	1
30	Turbine Shaft Gear	1
31	Drop Gear Housing	1
32	Turbine Shaft Bearing Cup	1
33	Lock Up Adaptor	1
33A	Lock Up Adaptor Screw	3
33B	Lock Up Adaptor Piston Ring	1
34	Turbine Shaft Bearing Cap O-Ring	1
35	Turbine Shaft Bearing Cap Shim	AR

ITEM	DESCRIPTION	QTY
36	Lube Tube O-Ring	1
37	Lube Tube	1
38	Lube Tube O-Ring	1
39	Turbine Shaft Bearing Cap	1
40	Turbine Shaft Bearing Cap Capscrew	1
41	Turbine Shaft Bearing Cap Nut	3
42	Turbine Shaft Bearing Cap Lockwasher	3
43	Turbine Shaft Bearing Cap Stud	3
44	Turbine Shaft Bearing Cone	1
44A	Housing To Converter Housing Screw	6
44B	Housing To Converter Housing O-Ring	5
44C	Housing To Converter Lockwasher	6
45	Drain Plug	2
46	Converter Housing	1
47	Bearing Snap Ring	3
48	Pump Drive Gear Bearing	3
49	Pump Drive Gear	3
50	Bearing Carrier Screw Lockwasher	3
51	Bearing Carrier to Baffle Capscrew	3
52	Pump Drive Sleeve	3
53	Pump Drive Sleeve Snap Ring	3
54	Charging Pump Gasket	1
55	Charging Pump Assembly	1
56	Charging Pump Stud Nut	4
57	Charging Pump Stud Lockwasher	4
58	Charging Pump Stud	4
59	Bearing Carrier Capscrew	6
60	Bearing Carrier Screw Lockwasher	6
61	Bearing Carrier	3
62	Stator Support Sleeve Ball	1
63	Stator Support Sleeve	1
64	Stator Support	1
65	Stator Support Capscrew	8
67	Stator Support Piston Ring	1
68	Impeller Hub Gear Snap Ring	1
69	Impeller Hub Gear	1
70	Oil Baffle Oil Seal	1
71	Oil BaffleOil Baffle	1
72	Oil Baffle O-Ring	1
73	Impeller Hub Screw	16
74	Impeller Hub Screw Backing Ring	1
75	Impeller	1

ITEM	DESCRIPTION	QTY
76	Impeller Hub O-Ring	1
77	Impeller Hub	1
78	Impeller Hub Bearing	1
79	Impeller Hub Bearing Snap Ring	1
80	Reaction Member Spacer	1
81	Reaction Member Roll Pin	1
82	Reaction Member	1
83	Reaction Member Snap Ring	1
84	L/U Piston Outer Piston Ring Expander	1
85	Lock Up Piston Outer Piston Ring	1
86	Lock Up Piston	1
87	Lock Up Piston Inner Piston Ring	1
88	Outer Drive Disc	1
89	Lock Up Inner Disc	1
90	Lock Up Outer Disc	1
91	Lock Up Inner Disc	1
92	Lock Up Backing Plate	1
93	Lock Up Backing Plate Screw	12
94	Turbine & Lock Up Hub	1
95	Impeller Cover O-Ring	1
96	Turbine	1
97	Turbine Hub Screw Backing Ring	1
98	Turbine To Hub Capscrew	8
99	Drive Plate Mounting Screw	14
100	Drive Plate Mounting Lockwasher	14
101	Drive Plate Backing Ring	1
102	Drive Plate	5
103	Drive Plate Assembly	1
104	Impeller Cover Bearing Cap	1
105	Turbine Hub Brg Retainer Snap Ring	1
106	Piston Ring Expander Spring	1
107	Piston Ring	1
108	Turbine Hub Bearing Retainer	1
109	Dowel Pin	2
110	Turbine Hub Snap Ring	1
111	Impeller Cover Bearing Cap O-Ring	1
112	Impeller Cover Bearing	1
113	Impeller To Cover Capscrew	32
114	Impeller To Cover Lockwasher	32
115	Impeller Cover	1

ITEM	DESCRIPTION	QTY
116	90 Degree Elbow Fitting	1
117	Lube Tube Clip Screw	1
118	Lube Tube Clip Screw Lockwasher	1
119	Lube Tube Clip	1
120	Speed Sensor Plug	1
121	Speed Sensor O-Ring	1
122	Speed Sensor Adjusting Bushing	1
123	Speed Sensor Plug	1
124	Speed Sensor O-Ring	1
125	Speed Sensor Adjusting Bushing	1

CONVERTER EXPLODED VIEW - 3 PLATES LOCK-UP



CONVERTER PARTS LIST

ITEM	DESCRIPTION	QTY
1	Output Bearing Cup	1
1A	Bearing O-RingBearing O-RingBearing O-Ring	1
2	Output Bearing Cone	1
3	Output Bearing Spacer	1
4	Output Shaft Gear	1
5	Lube Tube Assembly	1
6	Output Shaft	1
7	Output Bearing Cone	1
8	Output Bearing Cup	1
9	Output Bearing O-Ring	1
10	Output Bearing Cap Shim	AR
11	Output Bearing Cap Oil Seal Seal	1
12	Output Bearing Cap	1
13	Output Flange	1
14	Output Flange O-Ring	1
15	Output Flange Washer	1
16	Output Flange Locknut	1
17	Output Bearing Cap Stud Nut	4
18	Output Bearing Cap Lockwasher	4
19	Output Bearing Cap Stud	4
20	Housing Cover Plate	1
21	Housing Cover Plate Screw	10
22	Housing Cover Plate Lockwasher	10
22A	Housing Cover Gasket	1
23	Drain Plug	1
24	Pressure Regulator Valve Assembly	1
25	Pressure Regulator Valve Capscrew	4
26	Turbine Shaft Piston Ring	1
27	Turbine Shaft Bearing Cup	1
27A	Turbine Shaft Brg Cup O-Ring	1
28	Turbine Shaft Bearing Cone	1
29	Turbine Shaft	1
30	Turbine Shaft Gear	1
31	Drop Gear Housing	1
32	Turbine Shaft Bearing Cup	1
33	Lock Up Adaptor	1
33A	Lock Up Adaptor Screw	3
33B	Lock Up Adaptor Piston Ring	1
34	Turbine Shaft Bearing Cap O-Ring	1
35	Turbine Shaft Bearing Cap Shim	AR

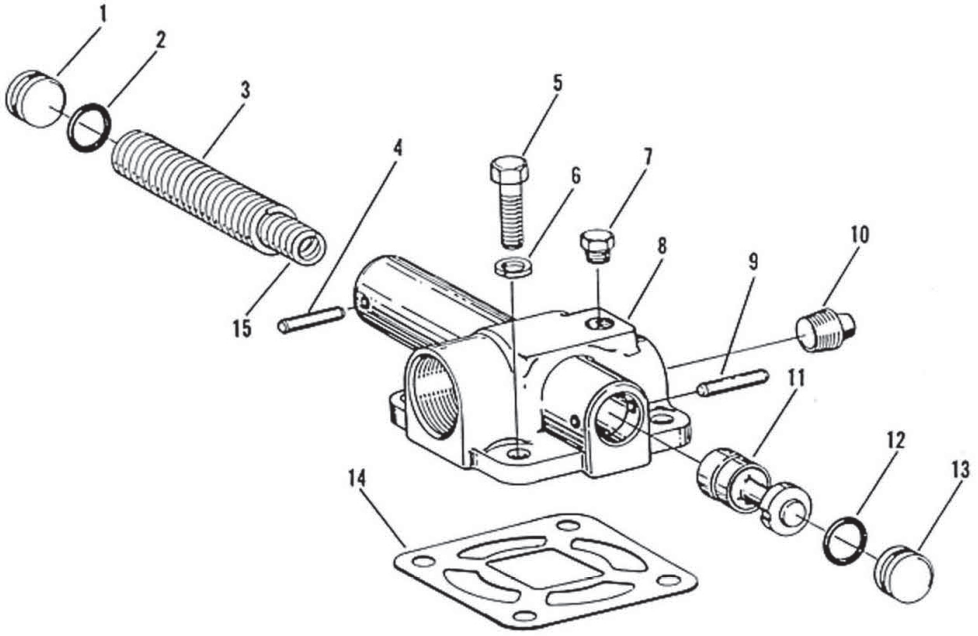
ITEM	DESCRIPTION	QTY
36	Lube Tube O-Ring	1
37	Lube Tube	1
38	Lube Tube O-Ring	1
39	Turbine Shaft Bearing Cap	1
40	Turbine Shaft Bearing Cap Capscrew	1
41	Turbine Shaft Bearing Cap Nut	3
42	Turbine Shaft Bearing Cap Lockwasher	3
43	Turbine Shaft Bearing Cap Stud	3
44	Turbine Shaft Bearing Cone	1
44A	Housing To Converter Housing Screw	6
44B	Housing To Converter Housing O-Ring	5
44C	Housing To Converter Lockwasher	6
45	Drain Plug	2
46	Converter Housing	1
47	Bearing Snap Ring	3
48	Pump Drive Gear Bearing	3
49	Pump Drive Gear	3
50	Bearing Carrier Screw Lockwasher	3
51	Bearing Carrier to Baffle Capscrew	3
52	Pump Drive Sleeve	3
53	Pump Drive Sleeve Snap Ring	3
54	Charging Pump Gasket	1
55	Charging Pump Assembly	1
56	Charging Pump Stud Nut	4
57	Charging Pump Stud Lockwasher	4
58	Charging Pump Stud	4
59	Bearing Carrier Capscrew	6
60	Bearing Carrier Screw Lockwasher	6
61	Bearing Carrier	3
62	Stator Support Sleeve Ball	1
63	Stator Support Sleeve	1
64	Stator Support	1
65	Stator Support Capscrew	8
67	Stator Support Piston Ring	1
68	Impeller Hub Gear Snap Ring	1
69	Impeller Hub Gear	1
70	Oil Baffle Oil Seal	1
71	Oil BaffleOil Baffle	1
72	Oil Baffle O-Ring	1
73	Impeller Hub Screw	16
74	Impeller Hub Screw Backing Ring	1
75	Impeller	1

CONVERTER PARTS LIST

ITEM	DESCRIPTION	QTY
76	Impeller Hub O-Ring	1
77	Impeller Hub	1
78	Impeller Hub Bearing	1
79	Impeller Hub Bearing Snap Ring	1
80	Reaction Member Spacer	1
81	Reaction Member Roll Pin	1
82	Reaction Member	1
83	Reaction Member Snap Ring	1
84	L/U Piston Outer Piston Ring Expander	1
85	Lock Up Piston Outer Piston Ring	1
86	Lock Up Piston	1
87	Lock Up Piston Inner Piston Ring	1
88	Outer Drive Disc	1
89	Lock Up Inner Disc	3
90	Lock Up Outer Disc	2
92	Lock Up Backing Plate	1
93	Lock Up Backing Plate Screw	12
94	Turbine & Lock Up Hub	1
95	Impeller Cover O-Ring	1
96	Turbine	1
97	Turbine Hub Screw Backing Ring	1
98	Turbine To Hub Capscrew	8
99	Drive Plate Mounting Screw	14
100	Drive Plate Mounting Lockwasher	14
101	Drive Plate Backing Ring	1
102	Drive Plate	5
103	Drive Plate Assembly	1
104	Impeller Cover Bearing Cap	1
105	Turbine Hub Brg Retainer Snap Ring	1
106	Piston Ring Expander Spring	1
107	Piston Ring	1
108	Turbine Hub Bearing Retainer	1
109	Dowel Pin	2
110	Turbine Hub Snap Ring	1
111	Impeller Cover Bearing Cap O-Ring	1
112	Impeller Cover Bearing	1
113	Impeller To Cover Capscrew	32
114	Impeller To Cover Lockwasher	32
115	Impeller Cover	1
116	90 Degree Elbow Fitting	1

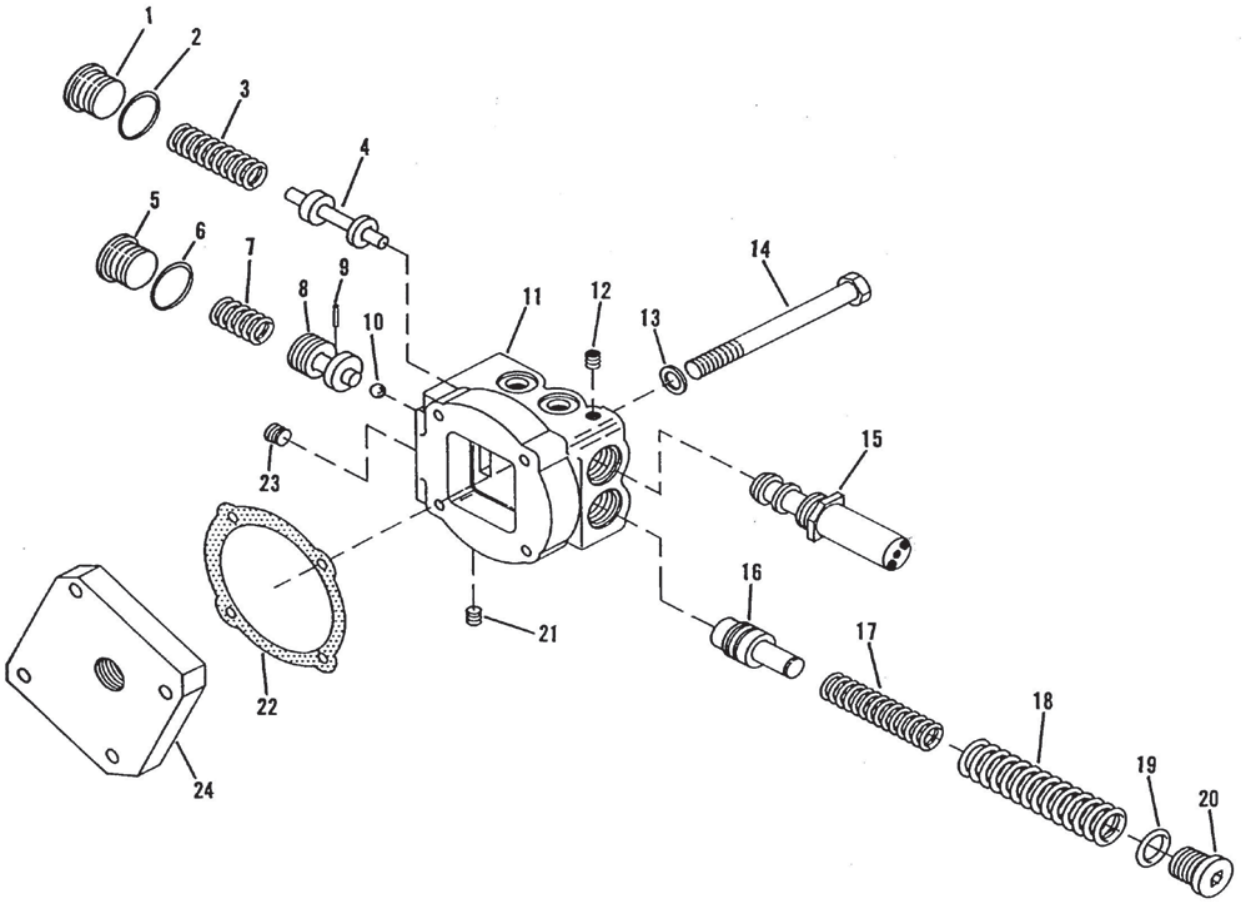
ITEM	DESCRIPTION	QTY
117	Lube Tube Clip Screw	1
118	Lube Tube Clip Screw Lockwasher	1
119	Lube Tube Clip	1
120	Speed Sensor Plug	1
121	Speed Sensor O-Ring	1
122	Speed Sensor Adjusting Bushing	1
123	Speed Sensor Plug	1
124	Speed Sensor O-Ring	1
125	Speed Sensor Adjusting Bushing	1

PRESSURE REGULATING VALVE



ITEM	DESCRIPTION	QTY
1	Piston Stop	1
2	Piston Stop O-Ring	1
3	Pressure Spring	1
4	Piston Stop Roll Pin	1
5	Valve to Housing Screw	4
6	Valve to Housing Screw Lockwasher	4
7	Pressure Tap Pipe Plug	1
8	Valve Body	1
9	Piston Stop Roll Pin	1
10	Pipe Plug	1
11	Regulating Valve Piston	1
12	Piston Stop O-Ring	1
13	Piston Stop	1
14	Gasket	1
15	Regulating Spring	1

LOCK-UP MODULATOR VALVE ASSEMBLY



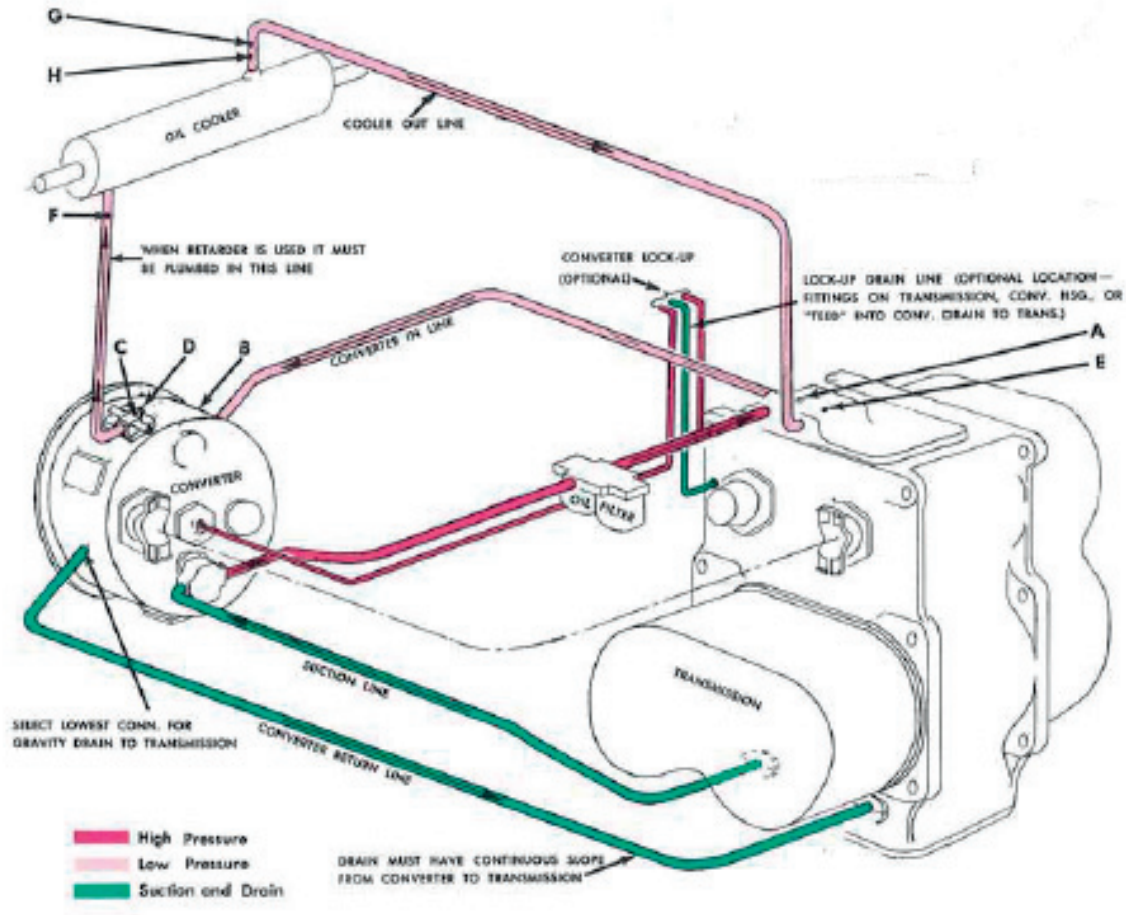
ITEM	DESCRIPTION	QTY
1	Spool Stop Plug	1
2	Spool Stop Plug O-Ring	1
3	Spool Stop Spring	1
4	Spool	1
5	Regulator Spool Stop Plug	4
6	Regulator Spool Stop Plug O-Ring	1
7	Regulator Spool Spring	1
8	Regulator Spool	1
9	Spool Plug	1
10	Relief Ball	1
11	Modulator Valve Housing	1
12	Plug	1

ITEM	DESCRIPTION	QTY
13	Valve Mounting Screw Lockwasher	4
14	Valve Mounting Screw	4
15	Solenoid	1
16	Accumulator Valve Spool	1
17	Accumulator Inner Spring	1
18	Accumulator Outer Spring	1
19	Stop Plug O-Ring	1
20	Accumulator Spool Stop plug	1
21	Plug	1
22	Valve to Mounting Plate Gasket	1
23	Plug	1
24	Valve Mounting Plate	1

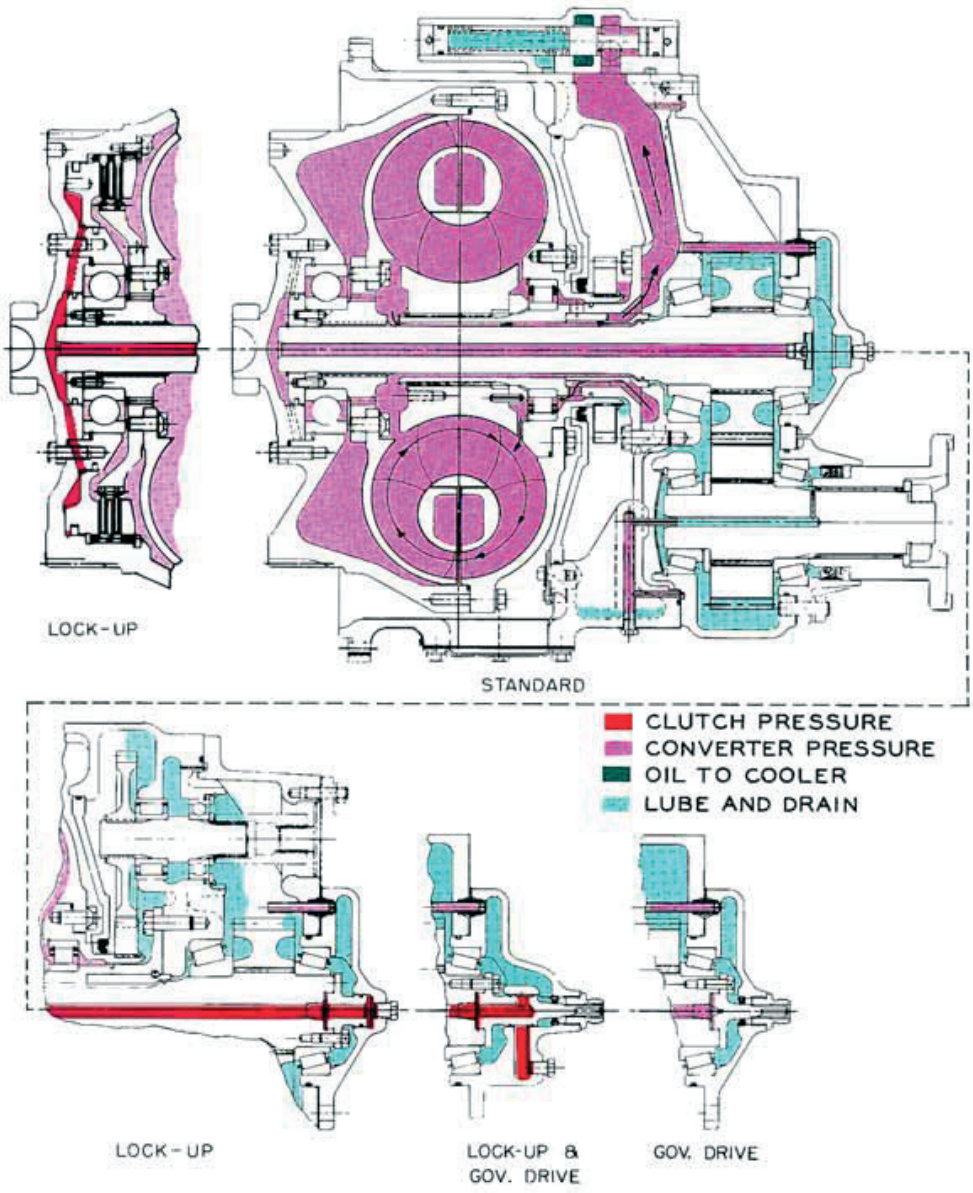
PLUMBING DIAGRAM

CHECK POINTS

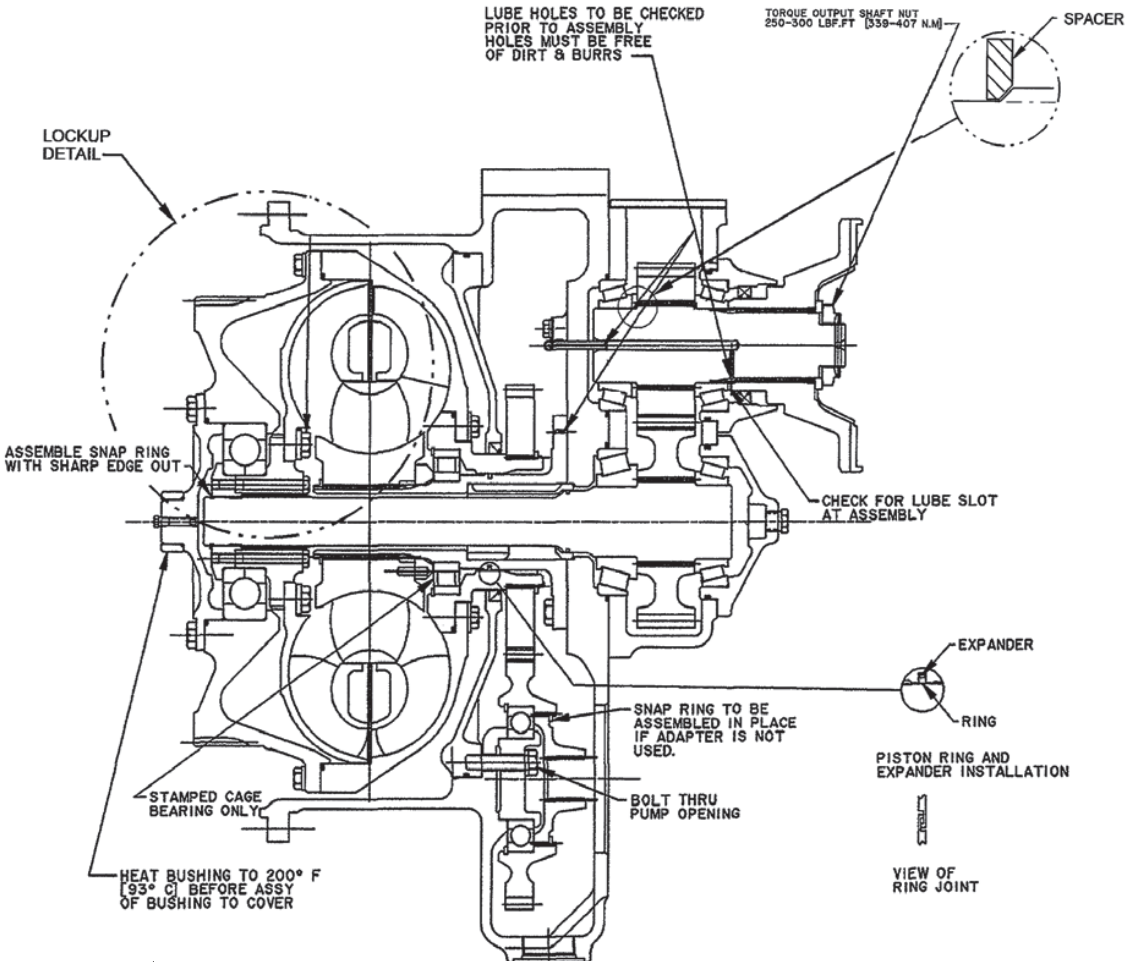
a - Clutch Pressure
b - Converter Inlet
c - Converter Outlet
d - Converter Outlet Temperature
e - Lube Pressure
f - Cooler Inlet Pressure
g - Cooler Outlet Pressure
h - Cooler Outlet Temperature

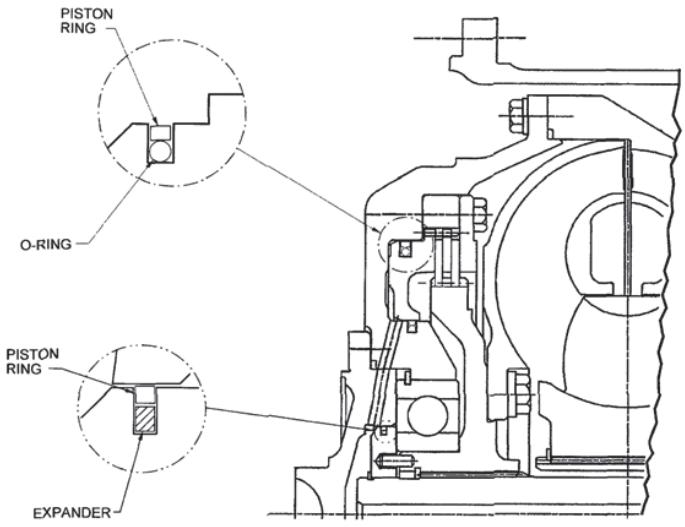


CONVERTER POWER FLOW



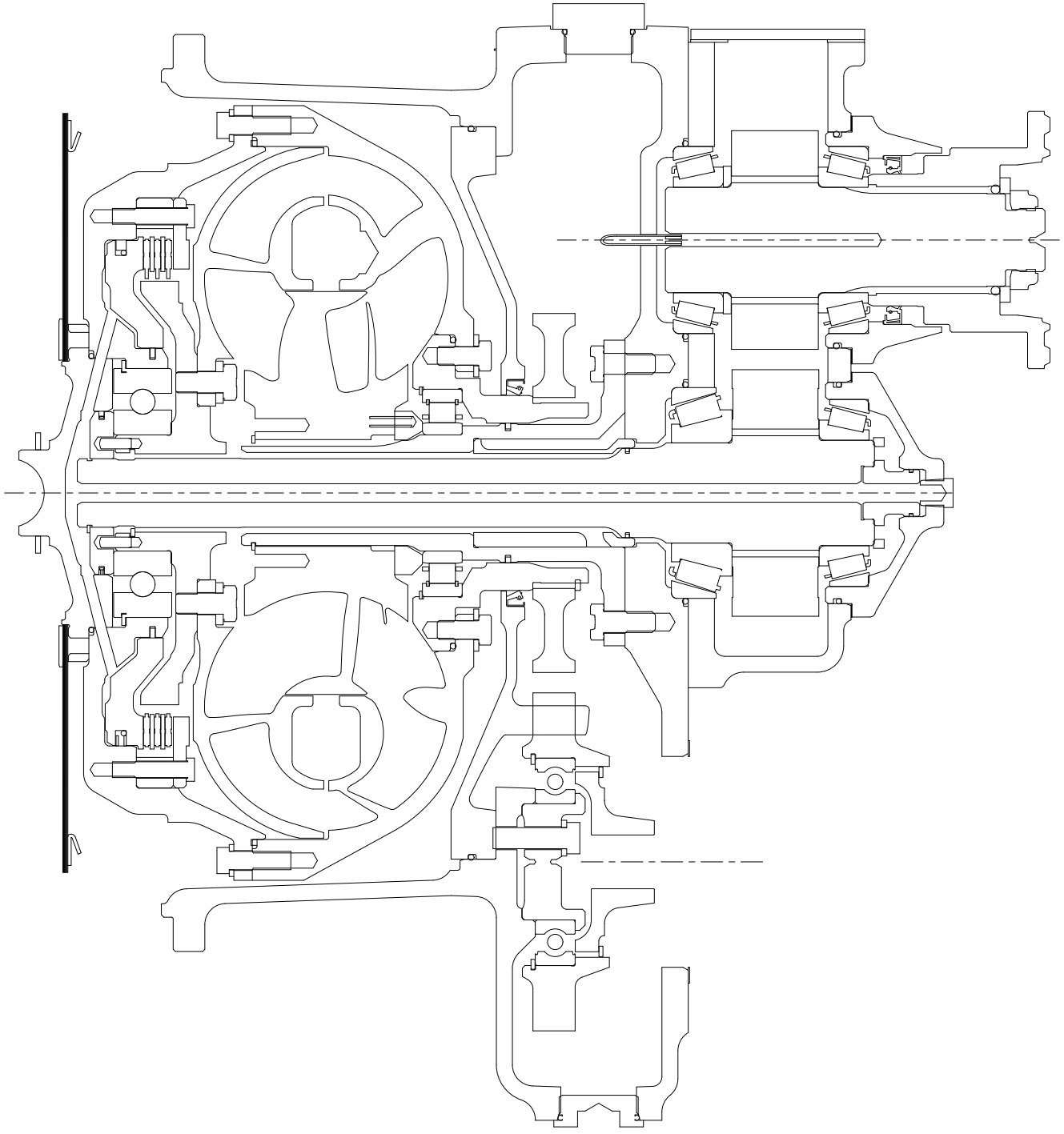
CONVERTER CROSS SECTION





Cross section showing 2 plates Lock-up configuration

3 PLATES CONVERTER LOCK-UP



OIL FILLING AND CHECKING PROCEDURE

Refer to the transmission maintenance manual or lubrication chart. Use only specified transmission fluid.

Fill torque converter and transmission through the filler opening until fluid comes up to LOW mark on the transmission dipstick.

NOTE:

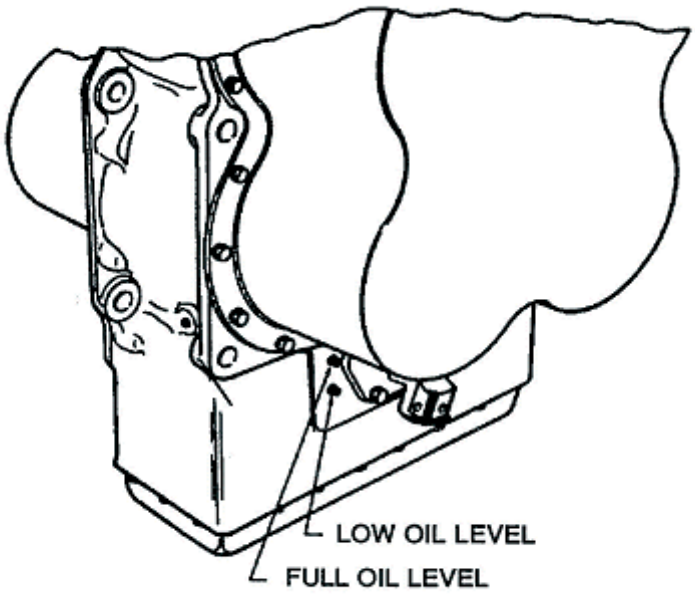
If the dipstick is not accessible, oil level check plugs are provided. (See Below).

Remove LOWER check plug, fill until oil runs from LOWER oil hole. Replace filler and level plugs.

Run engine two minutes at 500-600 RPM to prime torque converter and hydraulic lines. Recheck level of fluid in the transmission with engine running at idle (500-600 RPM).

Add quantity necessary to bring fluid level to LOW mark on dipstick or until oil runs freely from the LOWER oil level check plug hole. Install oil level plug or dipstick.

Recheck with hot oil 180-200°F (82 - 93°C). Bring oil level to the FULL mark on dipstick, or until oil runs freely from the UPPER oil level plug.



RECOMMENDED LUBRICANTS FOR TORQUE CONVERTERS AND POWERSHIFT TRANSMISSION

Torque Converter / Transmission Lubricant Must Be Qualified By One of the Following Specifications.

ORDER OF PREFERENCE:

1 - Caterpillar TO-4

2 - John Deere J20 C, D

3 - Military Mil-Prf-2104G

4 - Allison C-4

5 - Dexron II Equivalent - See note below

IMPORTANT:

DEXRON II EQUIVALENT IS ACCEPTABLE; HOWEVER, IT IS NOT COMPATIBLE WITH TORQUE CONVERTERS OR TRANSMISSIONS EQUIPPED WITH GRAPHITIC FRICTION MATERIALS CLUTCH PLATES.

LUBRICANTS NOT RECOMMENDED: DEXRON III, ENGINE OIL, ANY GL-5 OILS

OIL VISCOSITY:

It is recommended that the highest viscosity monograde lubricant available be used for the anticipated ambient temperature. Typically this will be a Cat TO-4 qualified lubricant. When large swings in ambient temperature are probable J20 C, D multigrades are recommended. Multigrade lubricants should be applied at the lower viscosity rating for the prevailing ambient temperature i.e. a 10W20 should be used where a 10W monograde is used. If a C-4 multigrade is used in place of J20 lubricant it is recommended that the viscosity span no more than 10 points, i.e. 10W20.

SYNTHETIC LUBRICANTS ARE APPROVED IF QUALIFIED BY ONE OF THE ABOVE SPECIFICATIONS. OIL VISCOSITY GUIDELINES APPLY, BUT SYNTHETIC MULTIGRADES MAY SPAN MORE THAN 10 POINTS.

FOR FIRE RESISTANT FLUID RECOMMENDATIONS PLEASE CONTACT SPICER OFF-HIGHWAYN PRODUCTS.

SUMP PREHEATERS:

Preheat the transmission fluid to the minimum temperature for the oil viscosity used before engine startup.

NORMAL OIL CHANGE INTERVAL:

Drain and refill system every 1000 hours for average environmental and duty conditions. Severe or sustained high operating temperature or very dusty atmospheric conditions will result in accelerated deterioration or contamination. Judgment must be used to determine the required change intervals for extreme conditions.

EXTENDED OIL CHANGE INTERVAL:

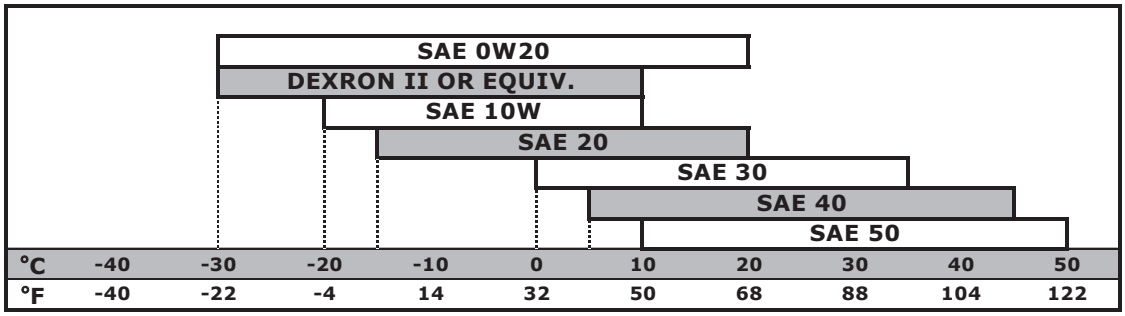
Extended oil service life may result when using synthetic fluids. Appropriate change intervals should be determined for each transmission by measuring oil oxidation and wear metals over time to determine a baseline. Wear metal analysis can provide useful information, but a transmission should not be removed from service solely on this basis.

FILTERS:

Service oil filter element every 500 hours under normal environmental and duty cycle conditions. Service the High Performance Extended Life filter every 1000 hours. Or upon warning indication from the filter backpressure sensor.

This recommended lubricant bulletin does not apply to transmissions with electronic modulation where separate approved oils are identified.

ANY DEVIATION FROM THIS RECOMMENDATION MUST HAVE WRITTEN APPROVAL FROM THE APPLICATION ENGINEERING DEPARTMENT OF SPICER OFF-HIGHWAY PRODUCTS.



RECOMMENDED J300 VISCOSITY GRADE BASED ON PREVAILING AMBIENT TEMPERATURE

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CONVERTER CHARGE PUMP REPLACEMENT AND PRIMING PROCEDURE

1 - The cause for pump failure must be found and corrected before a replacement pump is installed. Check all of the hoses, tubes, o-rings, adaptors and split flanges.

2 - Replace any collapsed or damages hoses, damaged split flange o-rings, tube

3 - o-rings and adaptors.

4 - After all checks have been made and corrections completed install replacement pump.

5 - See oil level checking and filling procedure.

6 - Start the engine. Run engine at low idle for two minutes, watch the clutch pressure gauge and listen for signs of cavitation from the pump.

7 - If pressure does not come up, check the oil level and bleed off air from the system as follows.

8 - To bleed off air from the system, loosen the pressure gauge line at the pressure regulating valve or loosen the pressure hose at the oil filter or pressure regulating valve. Crank the engine over until the air is displaced with oil. DO NOT START ENGINE.

9 - If bleeding the lines does not correct the problem it may be necessary to prime the pump. Disconnect the suction hose or pressure hose, whichever is higher, and fill the port with transmission oil, reconnect the hose and tighten.

10 - Start the engine and check pressure.

11 - Recheck oil level with hot oil 180-200° F [82-93° C] with engine at idle. Add oil as necessary to bring oil level to full mark.

SERVICING MACHINE AFTER CONVERTER OVERHAUL

The transmission, torque converter and its allied hydraulic systems are important links in the drive line between the engine and the wheels. The proper operation of either unit depends greatly on the condition and operation of the other. Therefore, whenever repair or overhaul of one unit is performed, the balance of the system must be considered before the job can be considered completed.

After the overhauled or repaired converter or transmission has been installed in the machine, the oil cooler, and connecting hydraulic system must be thoroughly cleaned.

This can be accomplished in several manners and a degree of judgment must be exercised as to the method employed.

THE FOLLOWING ARE CONSIDERED THE MINIMUM STEPS TO BE TAKEN:

1 - Drain entire system thoroughly.

2 - Disconnect and clean all hydraulic lines. Where feasible, hydraulic lines should be removed from machine for cleaning.

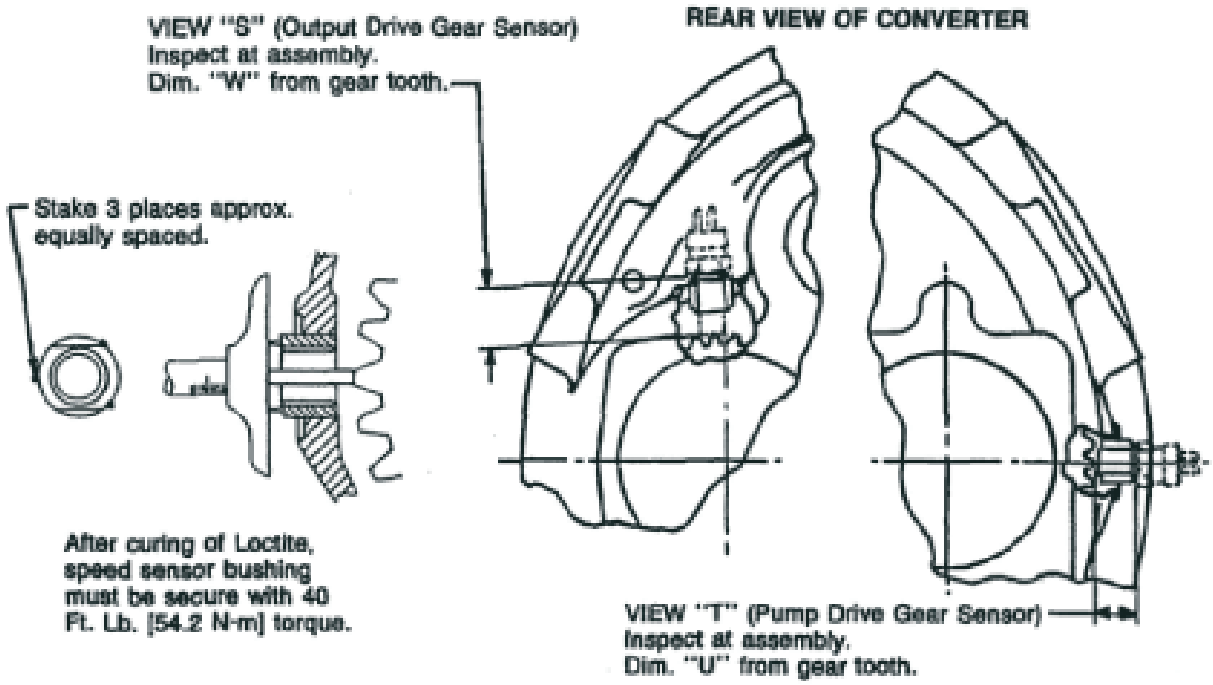
3 - Replace oil filter elements, cleaning out filter cases thoroughly.

4 - The oil cooler must be thoroughly cleaned. The cooler should be “back flushed” with oil and compressed air until all foreign material has been removed. Flushing in direction of normal oil flow will not adequately clean the cooler. If necessary, cooler assembly should be removed from machine for cleaning, using oil, compressed air and steam cleaner for that purpose. DO NOT use flushing compounds for cleaning purposes.

5 - Reassemble all components and use only oil recommended in lubrication section. Fill transmission through filler opening until fluid comes up to LOW mark on dipstick. NOTE: If the dipstick is not accessible oil level check plugs are provided. Remove LOWER check plug, fill until oil runs from LOWER hole. Replace filler and level plug. Run engine two minutes at 500-600 RPM to prime torque converter and hydraulic lines. Recheck level of fluid in transmission with engine running at idle (500-600 RPM). Add quantity necessary to bring fluid level to LOW mark on dipstick or runs freely from LOWER oil level check plug hole. Install oil level plug or dipstick. Recheck with hot oil 180-200° F [82.2- 93.5° C]. Bring oil level to FULL mark on dipstick or runs freely from UPPER oil level plug hole.

6 - Recheck all drain plugs, lines, connections, etc., for leaks and tighten where necessary.

SPEED SENSOR BUSHING INSTALLATION



PUMP DRIVE RATIO

RATIO	DRIVE GEAR NO. OF TEETH	DRIVEN GEAR NO. OF TEETH	SPEED SENSOR BUSHING DEPTH "U" PER VIEW "T"
0.944	54	51	1.383-1.397 [35.14-35.50]

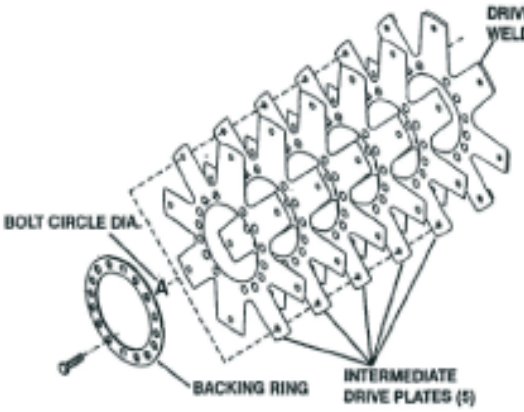
OUTPUT GEAR RATIO

RATIO	TURBINE SHAFT GEAR NO. OF TEETH	OUTPUT SHAFT GEAR NO. OF TEETH	SPEED SENSOR BUSHING DEPTH "W" PER VIEW "S"
1.323	31	41	1.053-1.067 [26.73-27.07]
1.000	36	36	1.383-1.397 [35.14-35.50]
0.846	39	33	1.383-1.397 [35.14-35.50]
0.775	40	31	1.383-1.397 [35.14-35.50]

TORQUE CONVERTER DRIVE PLATE INSTALLATION INSTRUCTIONS

Proper Identification by Bolt Circle Diameter

Measure the "A" dimension (Bolt Circle diameter) and order Drive Plate Kit listed below.



"A" Dimension (Bolt Circle Diameter)

15.00" [381,000 mm] diameter
Kit No. 802587-10mm

16.00" [406,400 mm] diameter
Kit No. 802558-10mm

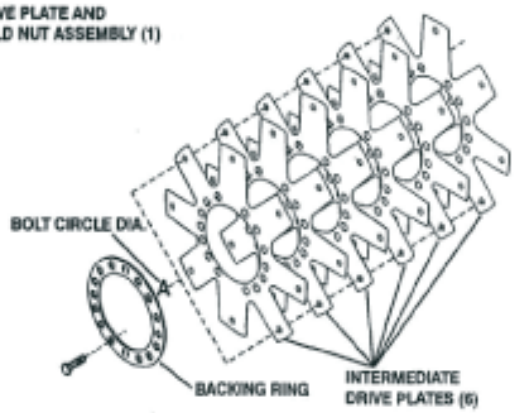
16.00" [406,400 mm] diameter
Kit No. 802590-7/16-20

16.875" [428,625 mm] diameter
** Kit No. 802609-7/16-20

17.00" [431,800 mm] diameter
Kit No. 802593-10mm

17.00" [431,800 mm] diameter
Kit No. 802562-7/16-20

Each kit will include the following parts:
- 5 Intermediate Drive Plates
- 1 Drive Plate Assembly
- 1 Backing Plate
- 14 Drive Plate Mounting Capscrews
- Instruction Sheet
- ** 1 pc. Drive Plate Mounting Spacer is included in Kit No. 802609.



"A" Dimension (Bolt Circle Diameter)

16.00" [406,400 mm] diameter
Kit No. 802594 W/O Nuts

Each kit will include the following parts:
- 6 Intermediate Drive Plates
- 1 Backing Plate
- 14 Drive Plate Mounting Capscrews
- Instruction Sheet

NOTE: Assembly of flexplates must be completed within a 15 minute period from start of screw installation. If the screw is removed for any reason it must be replaced. The adhesive left in the tapped holes must be removed with the proper tap and cleaned with solvent. Dry the hole thoroughly and use a new screw for reinstallation.

Position drive plate and weld nut assembly on Impeller cover with weld nuts toward cover. Align intermediate drive plate and backing ring with holes in impeller cover. NOTE: Two dimples 180° apart in backing ring must be out (toward engine flywheel). Install capscrews. Tighten capscrews 52-57 ft·lbs torque [70.4 - 77.1 N·m].

TORQUE CONVERTER TO ENGINE INSTALLATION PROCEDURE

1. Remove all burrs from flywheel mounting face and nose pilot bore. Clean drive plate surface with solvent. Dry thouroughly.
2. Check engine flywheel and housing for conformance to standard S.A.E. #1 - S.A.E J-927 and J-1033 tolerance specifications for pilot bore size, pilot bore runout and mounting face flatness. Measure and record engine crankshaft end play.
3. Install two 3.50 [88,90 mm] long converter to flywheel housing guide studs in the engine flywheel housing as shown. Rotate the engine flywheel to align a drive plate mounting screw hole with the flywheel housing access hole.
4. Install a 4.00 [101,60 mm] long drive plate locating stud in a drive plate nut. Align the locating stud in the drive plate with the flywheel drive plate mounting screw hole positioned in Step No. 3.
5. Locate converter on flywheel housing aligning drive plate to flywheel and converter to flywheel housing.

   Install converter to flywheel housing screws. Tighten screws to specified torque. Remove converter to engine guide studs. Install remaining screws and tighten to specified torque.
6. Remove drive plate locating stud.
7. Install drive plate attaching screw. Snug screw but **do not tighten.** Some engine flywheel housings have a hole located on the flywheel housing circumference in line with the drive plate screw access hole. A screwdriver or pry bar used to hold the drive plate against the flywheel will facilitate installation of the drive plate screws. Rotate the engine flywheel and install the remaining seven (7) flywheel to drive plate attaching screws. Snug screws but do not tighten. After all eight (8) screws are installed, tighten each capscrew to the following torque- 7/16 capscrew 58-64 ft. lbs torque [78-86 N.m]:M-10 capscrews 48-55 ft. lbs torque [65-75 N.m]. This will require rotating the engine flywheel until the full amount of eight (8) screws have been tightened.
8. Measure engine crankshaft end play after converter has been completely installed on engine flywheel. This value must be within .001 [0,025 mm] of the end play recorded in Step No. 2.

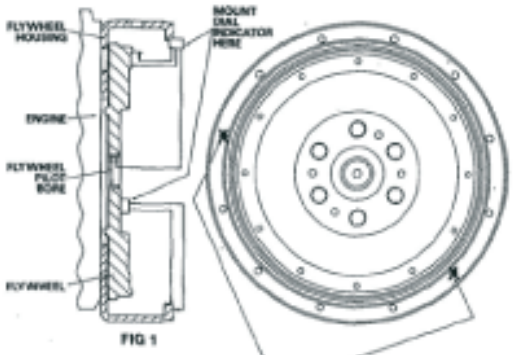


FIG 1

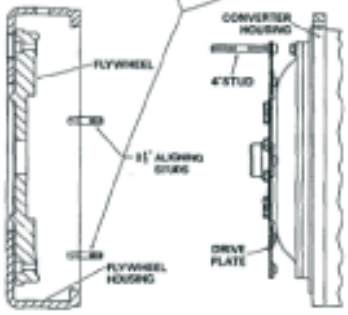


FIG 2

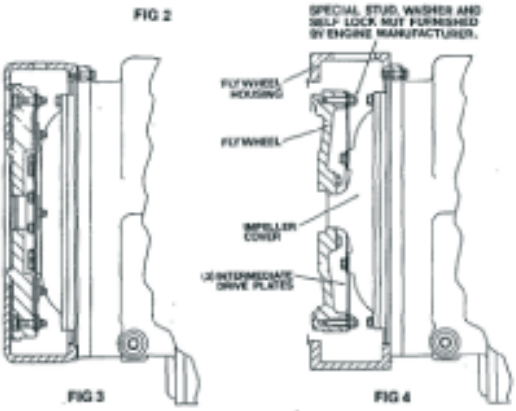
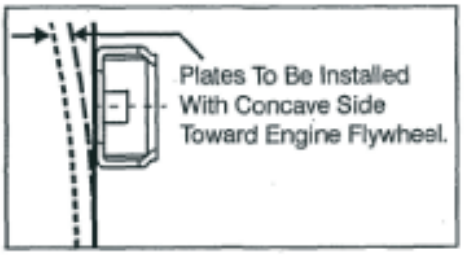


FIG 3 FIG 4



TROUBLESHOOTING GUIDE AND SPECIFICATIONS

The following data is presented as an aid to locating the source of difficulty in a malfunctioning unit. It is necessary to consider the torque converter charging pump, transmission, oil cooler and connecting oil lines as a complete system when running down the source of trouble. The proper operation of any unit depends greatly on the condition and operation of the others. By studying the principles of operation together with data in this section, it may be possible to correct any malfunction which may occur in the system.

MECHANICAL / ELECTRICAL CHECKS

Prior to checking any part of the system from a hydraulic standpoint the following mechanical and electrical checks should be made.

1 - A check should be made to be sure all control lever linkage and/or wiring is properly connected and functioning properly. See appropriate transmission or controls service manual.

2 - Check shift levers and rods for binding or restrictions in travel that would prevent full engagement. Shift levers by hand at transmission case, if full engagement cannot be obtained difficulty may be in control cover and valve assembly.

HYDRAULIC CHECKS

Before checking the torque converter, transmission and associated hydraulic systems for pressures and rate of flow, it is essential that the following preliminary checks be made.

Check oil level in transmission. This should be done with oil temperatures of 180-220° F [82-93° C]. DO NOT ATTEMPT THESE CHECKS WITH COLD OIL. To bring the oil temperature to this specification it is necessary to either work the machine or “stall” out the converter. Where the former means is impractical, the latter means should be employed as follows:

Engage shift levers in forward and high speed and apply brakes. Accelerate engine half to threequarter throttle. Hold stall until desired outlet temperature is reached.

⚠CAUTION

Full throttle stall speeds for an excessive length of time will overheat the converter.

PRESSURE AND OIL FLOW CHIECK

Whenever improper performance is evident, the following basic pressure and oil flow checks should be performed and recorded. It is also recommended that these checks be taken periodically as a preventative maintenance measure. Doing so will permit possible detection of difficulties in advance of an actual breakdown, thus permitting scheduling of repair operation. Likewise, repair of minor difficulties can be made at considerably less cost and downtime than when delayed until major and complete breakdowns occur.

Analyzing the results of these checks by comparison with specifications and with other will indicate in most cases the basic item or assembly in the system as the source of difficulty. Further checking of that assembly will permit isolation of the specific cause of trouble.

(SEE PLUMBING AND CHECK POINT DIAGRAM).

CONVERTER OUT PRESSURE

Install hydraulic pressure gauge at PRESSURE connection “C” on Converter Regulating Valve. Check and record oil pressure at 2000 RPM and at maximum speed (engine at full throttle).

Converter out pressure should be minimum 55 PSI [379 kPa] maximum 70 PSI [483 kPa].

CHARGING PUMP FLOW

If a flow meter is available, install in line between converter charging pump and oil filters. Flow meter must be able to withstand 300 PSI [2068 kPa].

If a flow meter is not available for checking converter pump output, proceed with manual transmission and converter checks. If the converter shows leakage within specifications and clutch pressures 180-220 PSI [1241-1517 kPa] are all equal within 5 PSI [35 kPa] refer to paragraph on Low Converter Charging Pump Output.

Charging pump flow rating for a new pump, at 2000 RPM should be 50 GPM [189 LPM]. A 20% tolerance below this figure is permissible; however, if pump output is more than 20% below specification it must be replaced.

CONVERT LOCK UP & TRASNMISSION CLUTCH LEAKAGE

Check clutch pressures at low engine idle with oil at operating temperature 180-200° F [35° C]. Engine speed must remain constant during entire leakage check. Shift lever into forward 1st thru 4th or 8th and reverse 1st. Record each pressure reading. All pressures must be equal within 5 PSI [35.5kPa]. If clutch pressure varies in any one clutch more than 5 PSI [35 kPa], repair the clutch.

If a flow meter is available, install it in line coming out of converter charging pump. Check and record pump flow at engine low idle and at 2000 RPM.

Install flow meter in line coming from transmission to converter. Check and record oil flow at low idle and at 2000 RPM in the following speed selections and lock up clutch.

Forward – 1st through Highest speed	Reverse – 1st

Subtract readings in each clutch combination from pump flow to get individual clutch leakage.

Example:

Pump flow at idle	8 GPM [30 LPM]
Forward – 1st	6 GPM [23 LPM]
Reverse – 1st	6 GPM [23 LPM]
Clutch Leakage	2 GPM [8 LPM] (2 Clutches Applied)

If leakage varies more than 1 GPM [3.8 LPM] from one clutch to another, repair clutch. See appropriate transmission service manual for total allowable leakage.

CONVERTER DRAIN BACK LEAKAGE

Disconnect converter drain back line at transmission and with engine running at 2000 RPM measure oil into a gallon container. Measure oil leakage for 15 seconds and multiply the volume of oil by four to get gallons per minute leakage. Leakage must not exceed 5 GPM (9 LPM).

LOW CLUTCH PRESSURE WITH NORMAL CLUTCH LEAKAGE

CAUSE	REMEDY
Low oil level.	Fill to proper level.
Clutch drum bleed valve ball stuck open.	Clean bleed valve thoroughly.
Broken or worn sealing rings on clutch support.	Replace sealing rings.
Low converter charging pump flow.	See paragraph on charging pump flow.

LOW CONVERTER CHARGING PUMP OUTPUT

CAUSE	REMEDY
Low oil level.	Fill to proper level.
Broken spring in transmission regulator valve.	Replace Spring.
Pressure regulator valve spool stuck open.	Clean valve spool and sleeve.
Faulty charging pump.	See paragraph on charging pump flow.

LOW CLUTCH PRESSURE WITH EXCESSIVE CLUTCH LEAKAGE

CAUSE	REMEDY
Broken or worn clutch piston sealing ring.	Replace sealing rings.
Sump screen plugged.	Clean screen and sump.
Air leaks at pump suction hose or collapsed hose.	Tighten connections or replace hose.
Defective charging pump.	Replace pump.

LOW FLOW THROUGH COOLER WITH LOW CONVERTER IN PRESSURE

CAUSE	REMEDY
Defective safety by-pass valve spring.	Replace spring.
Converter by-pass valve partially open.	Check for worn by-pass ball seat.
Excessive converter internal leakage. See paragraph on converter drain back leakage.	Remove, disassemble, and rebuild converter.
Broken or worn seal rings in transmission clutches.	See paragraph on clutch leakage.

LOW FLOW THROUGH COOLER WITH HIGH CONVERTER OUT PRESSURE

CAUSE	REMEDY
Plugged oil cooler. Indicated if transmission lube pressure is low.	Back flush and clean oil cooler.
Restricted cooler return line.	Clean out lines.
Lube oil ports in transmission plugged. Indicated if lube pressure is high.	Check lube lines for restrictions.

OVERHEATING

CAUSE	REMEDY
Worn sealing rings.	Remove and rebuild converter.
Worn oil pump.	Replace pump.
Low oil level.	Fill to proper level.
Pump suction line taking air.	Check oil line connections and tighten.

NOISY CONVERTER

NOISY CONVERTER

CAUSE	REMEDY
Worn coupling gears.	Replace
Worn oil pump.	Replace
Worn or damaged bearings.	Remove and rebuild converter.

LACK OF POWER

CAUSE	REMEDY
Low engine RPM at converter stall.	Tune engine and check governor.
See "Overheating"	See "Overheating"

BEARING HEATING AND FREEZING GUIDELINES

Tapered roller bearings often must be cooled or heated to aid in assembly or removal from housings or shafts with a press fit. Since temperature extremes can cause permanent bearing metallurgical damage, it is important to take proper precautions and use correct methods when heating and cooling bearings.

Cups that are to be assembled in hubs or housings with a press fit may be shrunk in a deep freeze unit. Standard class bearings should not be cooled below -65° F (-54° C). In addition to cooling the bearing cup it may be necessary to heat the housing.

To control temperature, it is best to use a thermostat along with a freezer unit or a properly calibrated thermometer. If a suitable freezer or thermometer is not available, your Timken service representative can suggest liquid combinations that freeze the bearing cup at the optimal temperatures. Regardless of the method, check the cup's final seating against the housing shoulder with feeler gauges.

Take extreme care that standard product bearings are never heated above 149° C [300° F]. If bearings are heated above this temperature, their metallurgical structure may soften, rendering them unsuitable for use.

There are a number of recommended methods for heating bearings. Electric ovens or electrically heated oil baths may be used, but only when accompanied by proper thermostatic control. If you use a hot plate to heat the oil, never rest bearings directly on the bottom of the pan. Instead, protect bearings from the heat source with a simple wire screen holder or similar device.

Use heat-resistant gloves to handle heated cones. Hold the hot cone solid against the cold shoulder on the shaft until the cone grabs the shaft. The hot cone will pull away from the cold shoulder unless it is held in position. Use .002 [.05 mm] feeler gages to make sure the cone is fully seated against the shoulder after the parts are cooled. Many loose bearing settings (excessive end play) are caused by an unseated cone working back against the shoulder in service.

CLEANING AND INSPECTION

CLEANING

Clean all parts thoroughly using solvent type cleaning fluid. It is recommended that parts be immersed in cleaning fluid and agitated slowly until parts are thoroughly cleaned of all old lubricants and foreign materials.

⚠CAUTION

Care should be exercised to avoid skin rashes, fire hazards and inhalation of vapors when using solvent type cleaners.

BEARINGS

Remove bearings from cleaning fluid and strike larger side of cone flat against a block of wood to dislodge solidified particles of lubricant. Immerse again in cleaning fluid to flush out particles. Repeat above operation until bearings are thoroughly clean. Dry bearings using moisture free compressed air. Be careful to direct air stream across bearings to avoid spinning. Bearings may be rotated slowly by hand to facilitate the drying process.

HOUSING, COVERS AND CAPS

Clean interior and exterior of housings, bearing caps, etc., thoroughly. Cast parts may be cleaned in hot solution tanks with mild alkali solutions, providing these parts do not have ground or polished surfaces. Parts should remain in solution long enough to be thoroughly cleaned and heated. This will aid the evaporation of the cleaning solution and rinse water. Parts cleaned in solution tanks must be thoroughly rinsed with clean water to remove all traces of alkali. Cast parts may also be cleaned with steam cleaner.

⚠CAUTION

Care should be exercised to avoid skin rashes and inhalation of vapors when using alkali cleaners. Thoroughly dry all parts cleaned immediately by using moisture-free compressed air or soft lintless absorbent wiping rags free of abrasive materials such as metal filings, contaminated oil or lapping compound.

INSPECTION

The importance of careful and thorough inspection of all parts cannot be overstressed. Replacement of all parts showing indication of wear or stress will eliminate costly and avoidable failures at a later date.

BEARINGS

Carefully inspect all rollers, cages and cups for wear, chipping or nicks to determine fitness of bearings for further use. Do not replace a bearing without replacing the mating cup or cone at the same time. After inspection, dip bearings in clean light oil and wrap in clean lint free cloth or paper to protect them until installed.

OIL SEALS, GASKETS AND RETAINING RINGS

Replacement of spring loaded oil seals, gaskets, and snap rings is more economical when unit is disassembled than to risk premature overhaul to replace these parts at a future time. Loss of lubricant through a worn seal may result in failure of other more expensive parts of the assembly. Sealing member should be handled carefully, particularly when being installed. Cutting, scratching or curling under lip of seal seriously impairs its efficiency. At reassembly, lubricate lips of oil seals with Multipurpose Lithium grease “Grade 2”.

GEARS AND SHAFTS

If Magna-Flux or dye penetrate process is available use process to check parts. Examine teeth and ground polished surfaces of all gears and shafts carefully for wear, pitting, chipping, nicks, cracks, or scoring. If gear teeth are cracked or show spots where case hardening is worn through, replace with new gear. Small nicks may be removed with suitable hone stone. Inspect shafts to make certain they are not sprung, bent or have twisted splines.

HOUSINGS, COVERS AND CAPS

Inspect housings and covers to be certain they are thoroughly cleaned and that mating surfaces, bearing bores, etc. are free from nicks or burrs. Check all parts carefully for evidence of cracks or conditions which can cause oil leaks or failures.

FASTENER TORQUE CHART

STANDARD FASTENERS

LUBRICATED AND PLATED BOLTS, CAPSCREWS, AND STUDS

	GRADE 5 3 RADIAL DASHES ON BOLT HEAD		GRADE 8 6 RADIAL DASHES ON BOLT HEAD	
Size	LBF/FT	[Nm]	LBF/FT	[Nm]
1/4-20	10	14	11	15
1/4-28	11	15	13	18
5/16-18	16	22	30	41
5/16-24	20	27	32	43
3/8-16	25	34	36	49
3/8-24	29	39	41	56
7/16-14	41	56	57	77
7/16-20	45	61	64	87
1/2-13	63	85	88	119
1/2-20	70	95	99	134
9/16-12	90	122	127	172
9/16-18	100	136	141	191
5/8-11	124	168	175	237
5/8-18	141	191	198	268
3/4-10	220	298	310	420
3/4-16	245	332	347	470

METRIC FASTENERS

LUBRICATED AND PLATED BOLTS, CAPSCREWS, AND STUDS

	CLASS 8.8 8.8 ON BOLT HEAD		CLASS 10.9 10.9 ON BOLT HEAD		CLASS 12.9 12.9 ON BOLT HEAD	
Size	LBF/FT	[Nm]	LBF/FT	[Nm]	LBF/FT	[Nm]
M4	2.2	3	3.2	4.4	7.4	10
M5	4.4	5.9	6.4	8.7	7.4	10
M6	7.4	10	11	15	13	18
M8	18	25	26	36	32	43
M10	36	49	51	72	62	84
M12	63	85	92	125	107	145
M14	100	135	147	200	173	235
M16	155	210	229	310	269	365
M18	221	300	317	430	369	500
M20	313	425	450	610	524	710
M22	428	580	605	820	708	960
M24	538	730	774	1050	900	1220

PLUG AND ELASTIC STOP NUT TORQUE CHARTS

O-RING PLUGS			
P/N	Size	LBF/FT	[Nm]
5/16-24	24K-1	5	7
3/8-24	24K-2	8	11
7/16-20	24K-3	10	14
1/2-20	24K-4	13	18
9/16-18	24K-5	15	20
3/4-16	24K-6	25	34
7/8-14	24K-7	35	47
1 1/16-12	24K-8	50	68
1 3/16-12	24K-9	60	81
1 5/16-12	24K-10	75	102
1 5/8-12	24K-11	85	115
1 7/8-12	24K-12	85	115

PIPE PLUGS		
Size (NPTF)	LBF / FT	[Nm]
1/16-27	7	9
1/8-27	10	14
1/4-18	20	27
3/8-18	30	41
1/2-14	35	47
3/4-14	45	61
1-11 1/2	55	75
1 1/4-11 1/2	65	88

ELASTIC STOP NUTS		
Size	LBF / FT	[Nm]
1-20	200	270
1 1/4-18	250	340
1 1/2-18	350	475
1 3/4-12	450	610

TORQUE CONVERTER

The following instructions will cover the disassembly and reassembly of the torque converter in a sequence that would normally be followed after the unit is removed from the machine to be completely overhauled.

IMPORTANT:

CLEANLINESS IS OF EXTREME IMPORTANCE AND AN ABSOLUTE MUST IN THE REPAIR AND OVERHAUL OF THIS UNIT. BEFORE ATTEMPTING ANY REPAIRS THE EXTERIOR OF THE UNIT MUST BE THOROUGHLY CLEANED TO PREVENT THE POSSIBILITY OF CONTAMINATION ENTERING THE MECHANISM.

FIGURE 1: Remove (14) drive plate mounting screws and drive plates, if installed.

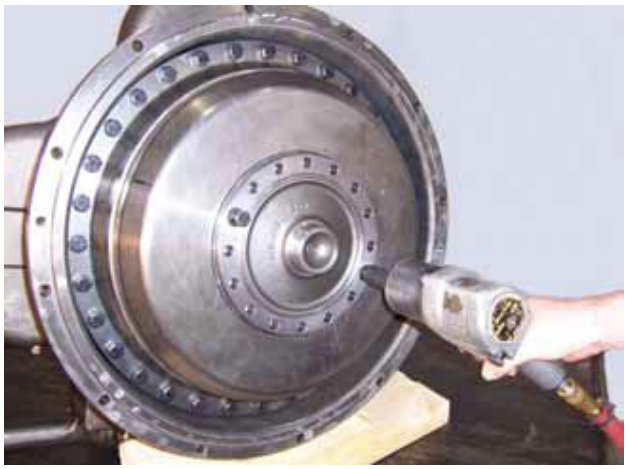


FIGURE 2: Install (2) pusher screws in threaded holes. Tighten screws evenly to remove bearing cap.

FIGURE 3: Remove impeller cover bearing cap.

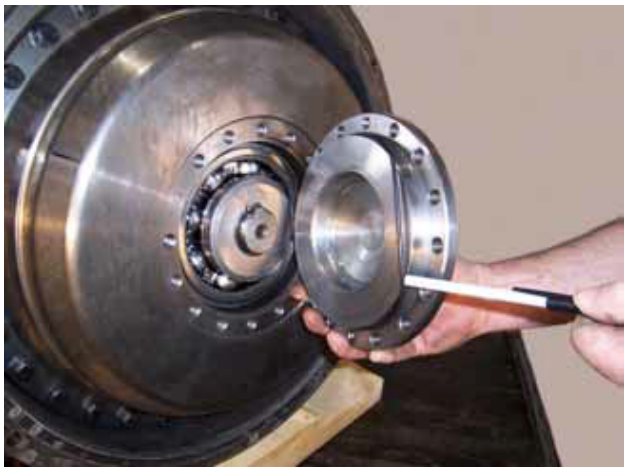


FIGURE 4: Remove impeller cover bearing cap o-ring.

IMPELLER AND TURBINE

FIGURE 1: Remove bearing retainer snap ring.

FIGURE 2: Remove piston ring and piston ring expander.

FIGURE 3: Remove bearing retainer.

FIGURE 4: Remove (32) impeller cover screws.

FIGURE 5: Support weight of impeller cover assembly with a chain attached to hoist before attempting to remove.

FIGURE 6: Remove impeller cover by pulling outward.

FIGURE 7: Remove impeller cover seal ring.

FIGURE 8: Remove turbine and hub assembly from cover.

FIGURE 9: Remove (8) turbine hub screws and backing ring.

FIGURE 10: Remove turbine hub.

FIGURE 11: Remove turbine hub bearing.

LOCK-UP

FIGURE 1: Remove (12) lock-up backing plate screws.

FIGURE 2: Remove lock-up backing plate.

FIGURE 3: Remove inner and outer lock-up clutch discs.

FIGURE 4: Remove outer drive disc.

FIGURE 5: Remove lock-up piston

FIGURE 6: Remove lock-up piston outer piston ring and ring expander.

FIGURE 7: Remove lock-up piston inner piston ring.

FIGURE 8: Remove reaction member snap ring.

FIGURE 9: Remove reaction member and spacer.

NOTE:

Normally reaction member can be removed by hand. If not (2) threaded puller holes are provided to assist in removal. Spacer is retained to reaction member with (1) roll pin. Removal from reaction member is not necessary unless replacement is required.

CHARGE PUMP

FIGURE 1: Remove (4) pump mounting stud nuts and lock washers.

FIGURE 2: Remove pump.

NOTE:

Record or mark pump and housing to identify correct positioning of pump for reassembly.

FIGURE 3: Remove pump gasket.

FIGURE 4: Remove (1) drive sleeve snap ring from each pump drive position.

FIGURE 5: Remove (1) drive sleeve from each pump drive position.

FIGURE 6: Remove (1) carrier to baffle screw from each pump drive position.

NOTE:

Screw to remove will be located closest to center of converter and will have different markings on head than other two within same pump drive.

PRESSURE REGULATING VALVE

FIGURE 1: Remove (4) mounting screws, lock washers, and pressure regulating valve.

FIGURE 2: Remove pressure regulating valve gasket.

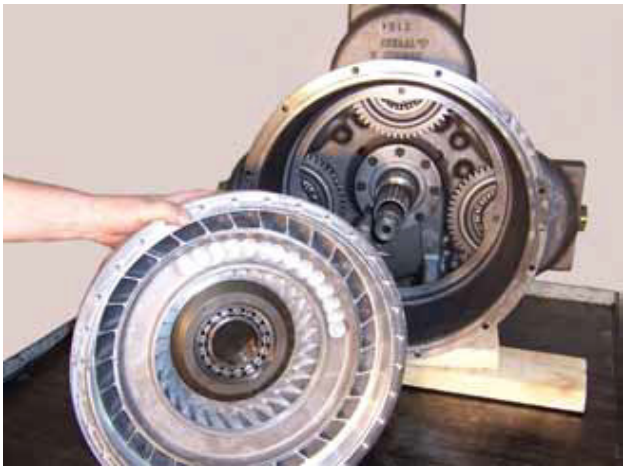


FIGURE 3: Remove impeller and baffle assembly.

IMPELLER HUB GEAR

FIGURE 1: Remove impeller hub gear snap ring.

FIGURE 2: Remove impeller hub gear.

BAFFLE

FIGURE 1: Remove baffle o-ring.

FIGURE 2: Remove baffle from impeller hub.

FIGURE 3: Remove baffle seal.

IMPELLER HUB

FIGURE 1: Remove (16) impeller hub screws.

FIGURE 2: Remove backing ring.

FIGURE 3: Remove impeller hub.

FIGURE 4: Remove impeller hub o-ring.

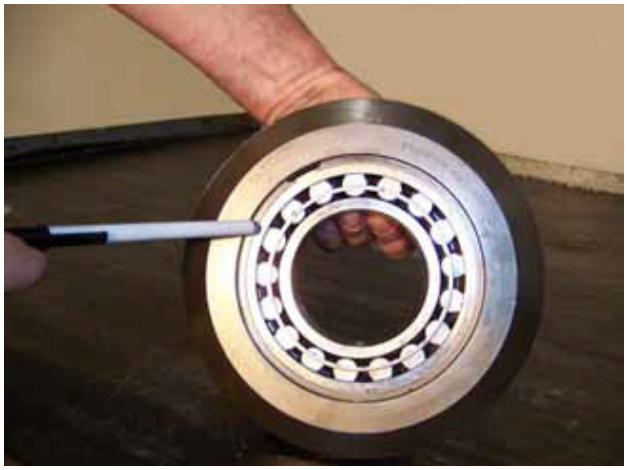


FIGURE 5: Remove impeller hub bearing snap ring and bearing.

STATOR SUPPORT

FIGURE 1: Remove stator support piston ring.

FIGURE 2: Remove (8) stator support screws.

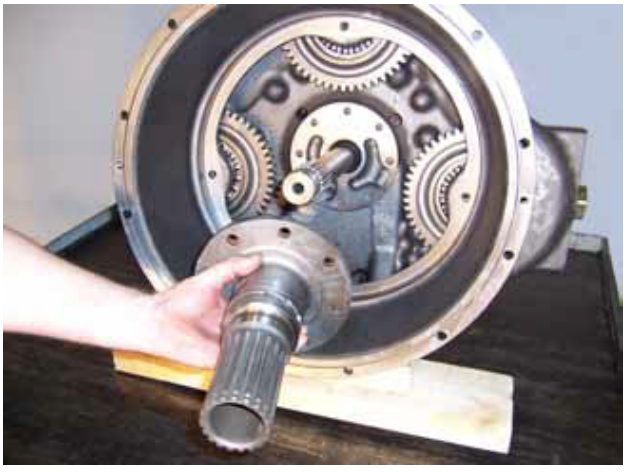


FIGURE 3: Remove stator support.

FIGURE 4: Remove stator support sleeve and lock ball.

FIGURE 5: Remove (2) bearing carrier to housing screws from each pump drive position.

OUTPUT FLANGE

FIGURE 1: Remove output flange nut and washer.

FIGURE 2: Remove output flange o-ring.

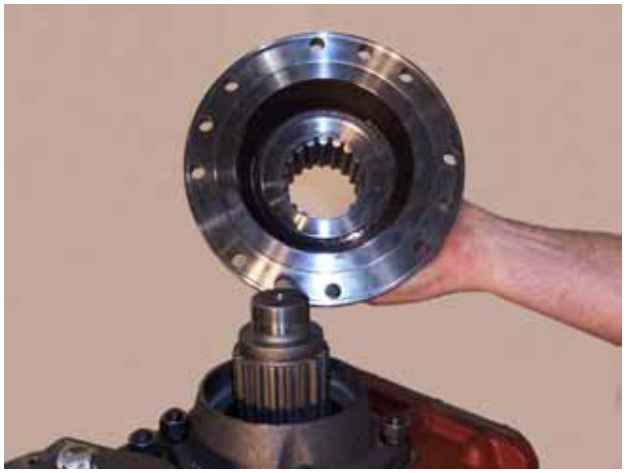


FIGURE 3: Remove output flange.

TURBINE AND OUTPUT BEARING CAP

FIGURE 1: Remove (3) turbine shaft bearing cap stud nuts, lock washers, and (1) screw.

FIGURE 2: Remove (4) output shaft bearing cap stud nuts and lock washers.

FIGURE 3: Remove turbine shaft bearing cap.

FIGURE 4: Remove o-ring and bearing cup from turbine shaft bearing cap.

FIGURE 5: Remove lube tube and o-rings.

FIGURE 6: Remove turbine shaft bearing cap shims.

FIGURE 7: Remove output shaft bearing cap.

FIGURE 8: Remove o-ring and bearing cup from output shaft bearing cap.

FIGURE 9: Remove output shaft bearing cap shims.

DROP GEAR HOUSING

FIGURE 1: Remove (6) drop gear housing screws and lock washers.

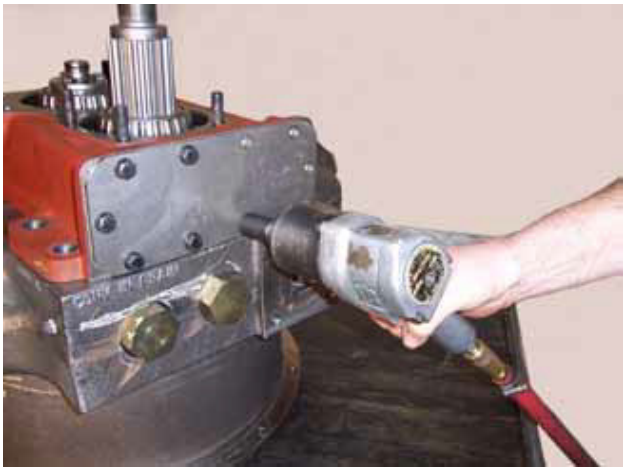


FIGURE 2: Remove (10) drop gear housing cover plate screws and lock washers.

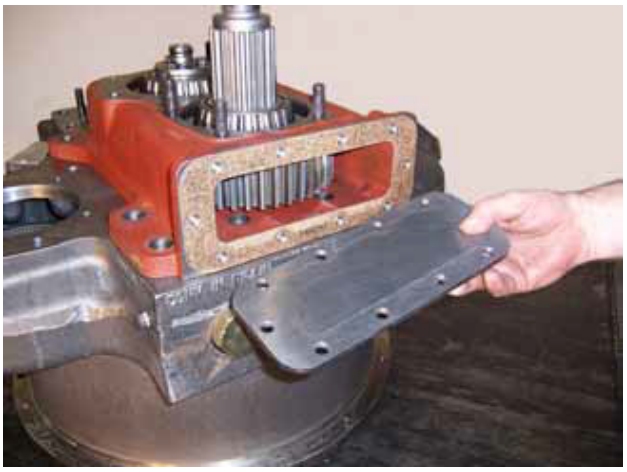


FIGURE 3: Remove cover plate.

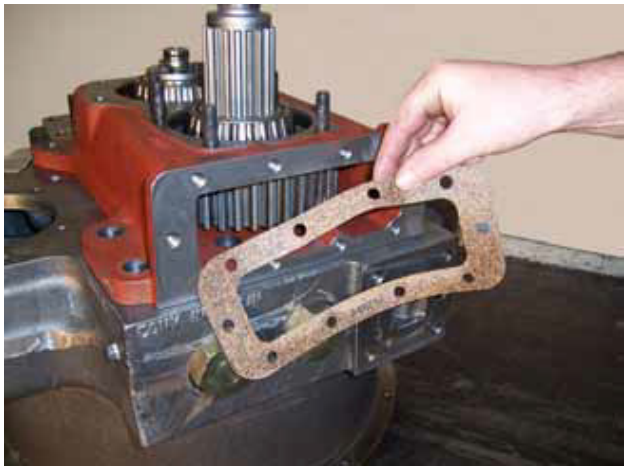


FIGURE 4: Remove cover plate gasket.

FIGURE 5: Attach lifting chain securely to bearing cap mounting studs with flat washers and nuts. Remove drop gear housing assembly with hoist.

FIGURE 6: Inspect lube tube for damage or plugged orifice.

NOTE:

Do not remove lube tube unless replacement is required.

FIGURE 7: Remove (7) drop gear housing to converter housing o-rings.

PUMP DRIVE GEAR

FIGURE 1: Carefully tap (3) pump drive gear bearing supports out of converter housing counter bores.

FIGURE 2: Remove (3) pump drive gear and bearing assemblies.

FIGURE 3: Remove (3) pump drive gear bearing snap rings.

FIGURE 4: Remove (3) pump drive gear bearings and supports.

LOCK-UP ADAPTER

FIGURE 5: Remove lock wire from lock-up adapter screws.

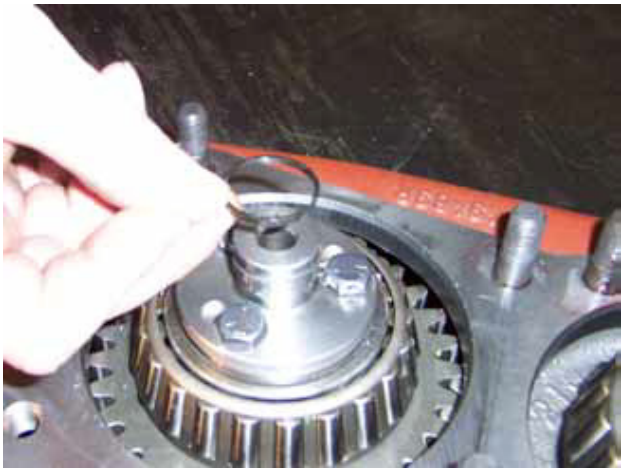


FIGURE 6: Remove lock-up adapter piston ring.

FIGURE 7: Remove (3) lock-up adapter to turbine shaft screws.

FIGURE 8: Remove lock-up adapter.

TURBINE AND OUTPUT SHAFT

FIGURE 1: Remove turbine shaft and output shaft inner bearing cups.

FIGURE 2: Remove turbine shaft piston ring.

FIGURE 3: Using press or appropriate device remove output shaft.

FIGURE 4: Remove turbine shaft with same procedure used on output shaft.

FIGURE 5: Remove output shaft outer bearing cone.

FIGURE 6: Remove output shaft gear.

FIGURE 7: Remove turbine shaft outer bearing cone.

FIGURE 8: Remove turbine shaft gear.

FIGURE 9: Remove turbine shaft inner bearing cone.

FIGURE 10: Remove output shaft inner bearing cone and spacer.

PUMP DRIVE GEAR

FIGURE 1: Using appropriate driver install (3) pump drive gear bearings.

FIGURE 2: Install (3) pump drive gear bearing snap rings.

FIGURE 3: Install (3) pump drive gear bearing supports.

FIGURE 4: Install (3) pump drive gear and bearing assemblies.

FIGURE 5: Install (2) bearing carrier to housing screws in each pump drive location.

FIGURE 6: Tighten (6) bearing carrier to housing screws to 57-63 LBF/FT (77-85 Nm).

TURBINE AND OUTPUT SHAFT

FIGURE 1: Install turbine shaft and output shaft bearing cups and lubricate with oil.

FIGURE 2: Heat and install turbine shaft bearing cone. Install turbine shaft piston ring.

FIGURE 3: Coat piston ring and housing bore with grease. Center ring in groove.

FIGURE 4: Install turbine shaft.

FIGURE 5: Coat with grease and install (5) drop gear housing to converter housing o-rings.

FIGURE 6: Coat with grease and install o-rings around turbine shaft and output shaft bearing cups.

FIGURE 7: Install output shaft bearing spacer. Heat and install output shaft bearing cone. Carefully install output shaft.

NOTE:

Spacer must be installed with chamfer towards shaft splines, See Cross Section inset. Inspect housing lube tube and lube passage in output shaft for damage or blockage.

DROP GEAR HOUSING

FIGURE 1: Install turbine shaft and output shaft gears in drop gear housing in their approximate running position.

NOTE:

If replacing housing studs in through holes apply Loctite 270/271 or equivalent to threads.

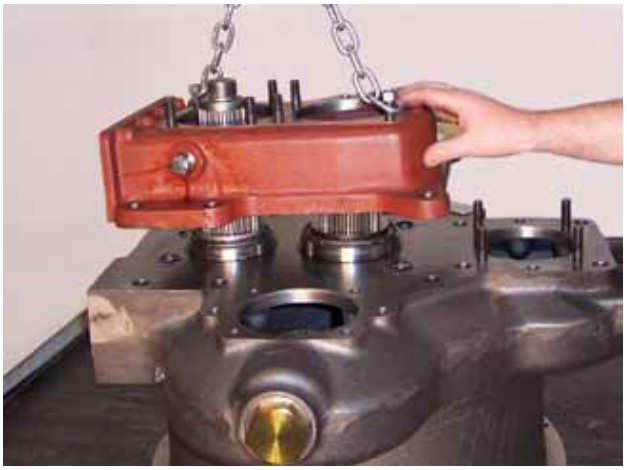


FIGURE 2: Align gear splines with shaft splines and install drop gear housing.

NOTE:

Recheck positioning of housing o-rings.

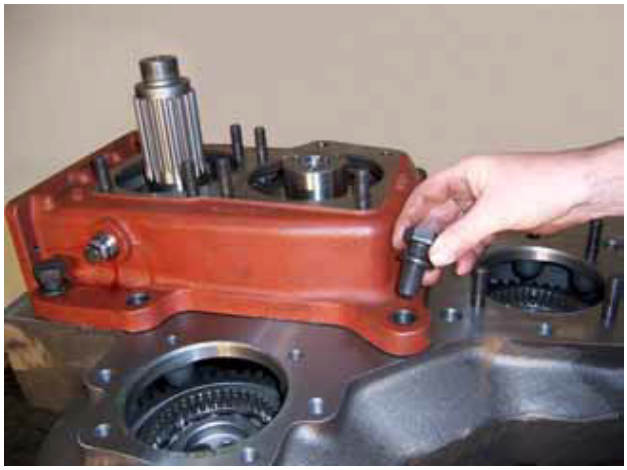


FIGURE 3: Install (6) drop gear housing screws and lock washers.

FIGURE 4: Tighten drop gear housing screws to 282-310 LBF/FT (*282-420 Nm*).

FIGURE 5: Install drop gear housing cover and gasket.

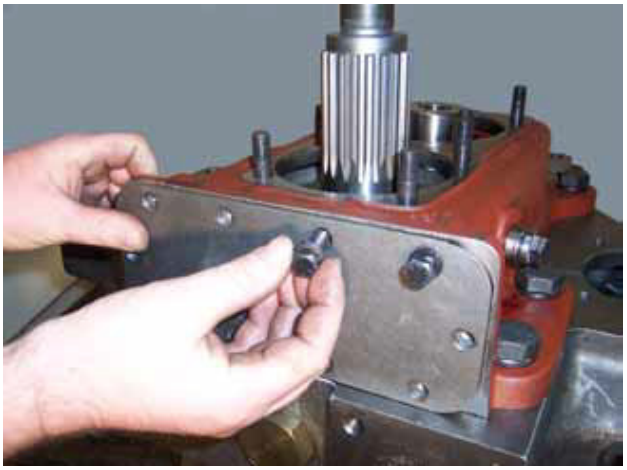


FIGURE 6: Install (10) drop gear housing cover screws and lock washers.

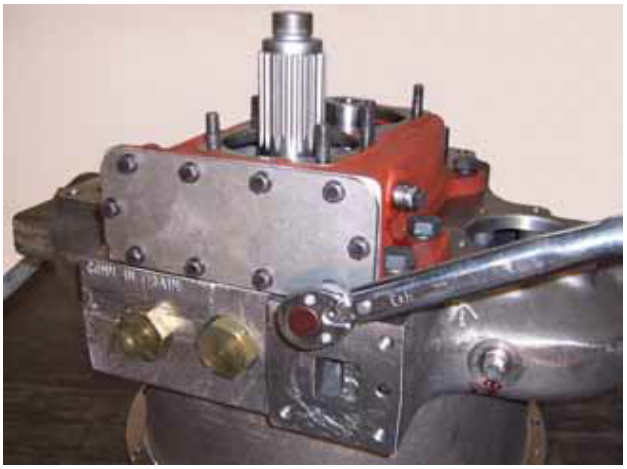


FIGURE 7: Tighten cover screws to 23-25 LBF/FT (31-34 Nm).

FIGURE 8: Heat and install turbine shaft and output shaft bearing cones.

LUBE TUBE AND LOCK-UP ADAPTER

FIGURE 9: Coat lube tube o-rings and housing bore with grease and install lube tube with large opening (shown) in bore.

FIGURE 10: Lube tube shown correctly installed with orifice exposed.

FIGURE 11: Install lock-up adapter.

FIGURE 12: Install (3) lock-up adapter to turbine shaft screws.

FIGURE 13: Tighten lock-up adapter screws to 26-29 LBF/FT (35-39 Nm).

FIGURE 14: Lock wire heads of lock-up adapter screws.

IMPORTANT:

LOCK WIRE MUST NOT PROTRUDE ABOVE SCREW HEADS.

TURBINE SHAFT BEARING SETTING PROCEDURE

1 - Install turbine shaft rear bearing cup into turbine shaft bearing cap.

2 - Install turbine shaft bearing cap with (3) stud nuts and (1) screw, tightened securely. Rap bearing cap while turning shaft to insure proper alignment of bearings.

3 - Loosen bearing cap nuts and screw. Retighten nuts and screw evenly “finger tight”.

4 - Check gap between bearing cap and drop gear housing with shims used as a feeler gage. ADD sufficient shims to produce a .002” (.051mm) loose condition.

EXAMPLE:

Gap is .010” (.25mm); final shim pack thickness is .012” (.30mm).

NOTE:

O-ring, adapter piston ring and lube tube should be assembled after shimming of bearings to prevent damage to various parts.

TURBINE AND OUTPUT SHAFT BEARING CAP

FIGURE 1: Install lock-up adapter piston ring.

FIGURE 2: Coat lock-up piston ring with grease and center ring in groove.

FIGURE 3: Install turbine shaft bearing cap shims.

NOTE:

See figure 28 to determine shim pack thickness.

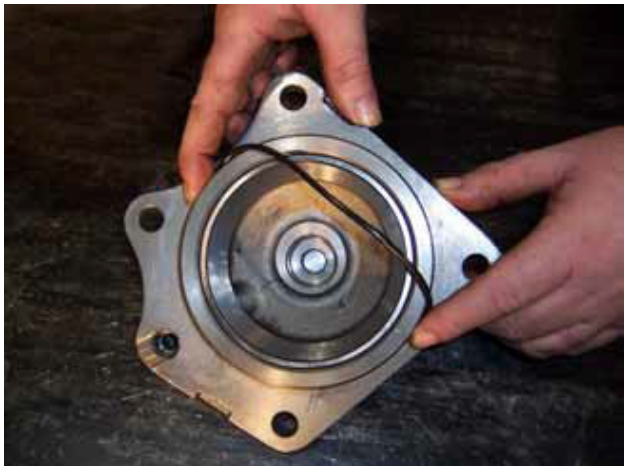


FIGURE 4: Install turbine shaft bearing cap o-ring.

FIGURE 5: Coat turbine shaft bearing cap o-ring, lube tube o-ring, and piston ring bore with grease.

FIGURE 6: Install turbine shaft bearing cap.

FIGURE 7: Install (3) turbine shaft bearing cap stud lock washers.

FIGURE 8: Install (3) turbine shaft bearing cap stud nuts.

FIGURE 9: Install (1) turbine shaft bearing cap screw.

FIGURE 10: Tighten nuts to 64-70 LBF/FT (87-95 Nm) and screw to 57-63 LBF/FT (77-85 Nm).

OUTPUT SHAFT BEARING SETTING PROCEDURE

1 - Install output shaft rear bearing cup into output shaft bearing cap.

2 - Install output shaft bearing cap with (4) stud nuts, tightened securely. Rap bearing cap while turning shaft to insure proper alignment of bearings.

3 - Loosen bearing cap nuts and retighten evenly “finger tight”.

4 - Check gap between bearing cap and drop gear housing with shims used as a feeler gage. REMOVE sufficient shims to produce a .002” (.051mm) tight condition.

EXAMPLE:

Gap is .010” (.25mm); final shim pack thickness is .008” (.20mm).

NOTE:

O-ring and oil seal should be assembled after shimming of bearings to prevent damage to various parts.

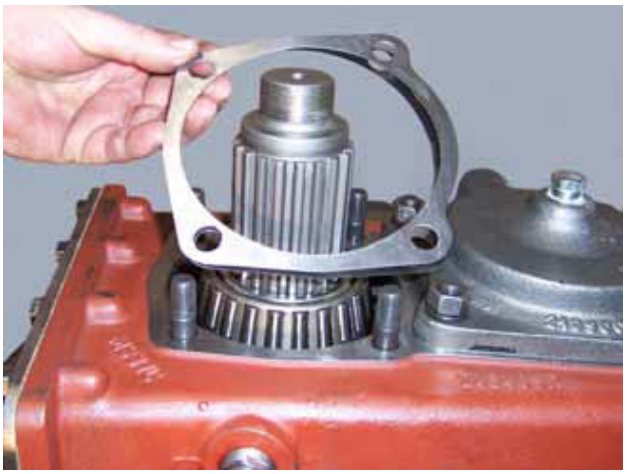


FIGURE 11: Install output shaft bearing cap shims.

NOTE:

See figure 39 to determine shim pack thickness.

FIGURE 12: Apply a continuous coat of Loctite 620 or equivalent to output cap oil seal and seal bore. Using appropriate driver install seal.

FIGURE 13: Install output shaft bearing cap o-ring.

FIGURE 14: Coat output shaft bearing cap oil seal lip and o-ring with grease.

FIGURE 15: Install output shaft bearing cap.

FIGURE 16: Install (4) output shaft bearing cap stud lock washers.

FIGURE 17: Install (4) output shaft bearing cap stud nuts.

FIGURE 18: Tighten output shaft bearing cap stud nuts to 64-70 LBF/FT (87-95 Nm).

OUTPUT FLANGE

FIGURE 1: Install output flange.

FIGURE 2: Install output flange o-ring.

FIGURE 3: Install output flange nut washer.

FIGURE 4: Install output flange nut.

FIGURE 5: Tighten output flange nut to 250-300 LBF/FT (339-407 Nm).

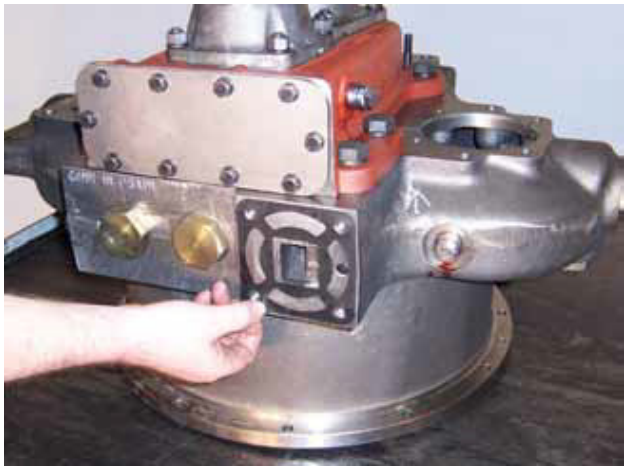


FIGURE 6: Install pressure regulating valve gasket.

NOTE:

Use grease to hold in position if necessary.

PRESSURE REGULATING VALVE

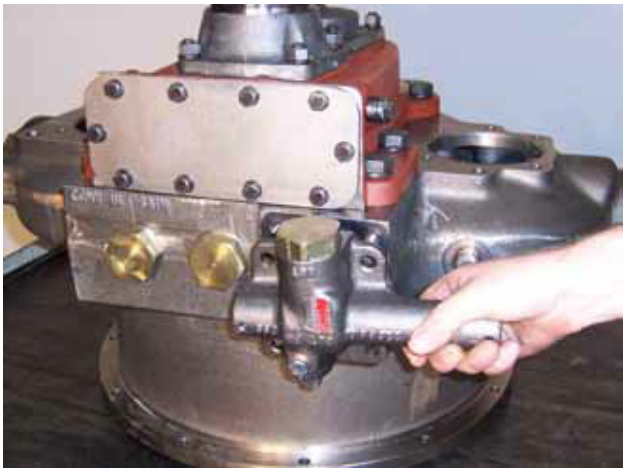


FIGURE 1: Install pressure regulating valve.

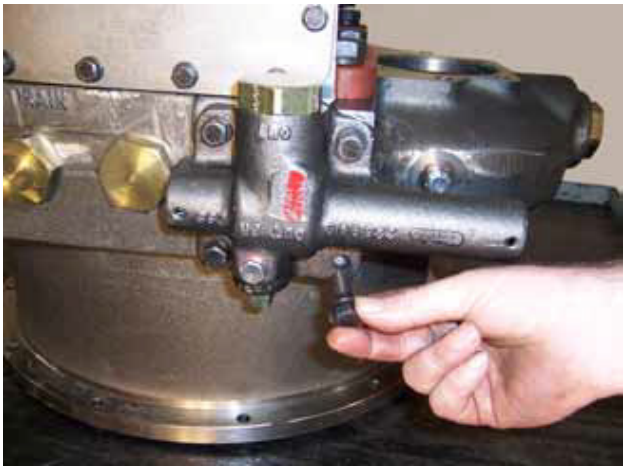


FIGURE 2: Install (4) pressure regulating valve screws and lock washers.

FIGURE 3: Tighten pressure regulating valve screws to 37-41 LBF/FT (50-56 Nm).

IMPELLER HUB

FIGURE 4: Install impeller hub o-ring.

IMPORTANT:

CURED THREAD LOCKING COMPOUND MUST BE REMOVED FROM THREADED HOLES WITH A TAP AND SOLVENT PRIOR TO REASSEMBLY.

FIGURE 5: Coat impeller hub o-ring with grease.

FIGURE 6: Install impeller on impeller hub.

IMPORTANT:

TAKE CARE TO NOT DISTURB O-RING.

FIGURE 7: Install impeller hub screw backing ring.

FIGURE 8: Install (16) NEW impeller hub screws.

NOTE:

Screws have thread locking compound pre-applied to threads and cannot be reused.

FIGURE 9: Tighten impeller hub screws to 58-64 LBF/FT (79-87 Nm).

IMPORTANT:

ASSEMBLY MUST BE COMPLETED WITHIN A 15 MINUTE PERIOD FROM START OF SCREW INSTALLATION.

BAFFLE

FIGURE 1: Apply thin continuous coat of Loctite 620 or equivalent to baffle oil seal and seal bore. Using appropriate driver install seal.

FIGURE 2: Install baffle o-ring.

FIGURE 3: Coat baffle o-ring and seal lip with grease.

FIGURE 4: Install oil baffle on impeller hub.

IMPELLER HUB GEAR

FIGURE 1: Install impeller hub gear.

FIGURE 2: Install impeller hub gear snap ring.

FIGURE 3: Using appropriate driver install impeller hub bearing and snap ring.

STATOR SUPPORT

FIGURE 4: Install stator support sleeve and lock ball.

FIGURE 5: Install stator support assembly.

IMPORTANT:

CURED THREAD LOCKING COMPOUND MUST BE REMOVED FROM THREADED HOLES WITH A TAP AND SOLVENT PRIOR TO REASSEMBLY.

NOTE:

Screws have thread locking compound pre-applied to threads and cannot be reused.

FIGURE 6: Install (8) NEW stator support screws.

FIGURE 7: Tighten stator support screws to 80-88 LBF/FT (108-119 Nm).

IMPORTANT:

ASSEMBLY MUST BE COMPLETED WITHIN A 15 MINUTE PERIOD FROM START OF SCREW INSTALLATION.

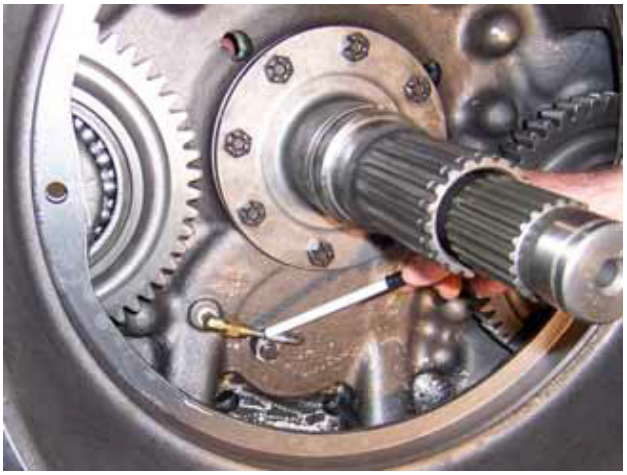


FIGURE 8: Inspect lube tube for damage.

NOTE:

Do not remove lube tube unless replacement is required.

FIGURE 9: Install stator support piston ring.

FIGURE 10: Coat stator support piston ring and baffle o-ring with grease. Center piston ring in groove.

FIGURE 11: Install impeller and baffle assembly.

NOTE:

Align (3) threaded holes in baffle with holes in housing.

PUMP DRIVE

FIGURE 1: Install (1) bearing carrier to baffle screw and lock washer in each of (3) pump drive positions.

FIGURE 2: Tighten bearing carrier to baffle screws to 57-63 LBF/FT (77-85 Nm).

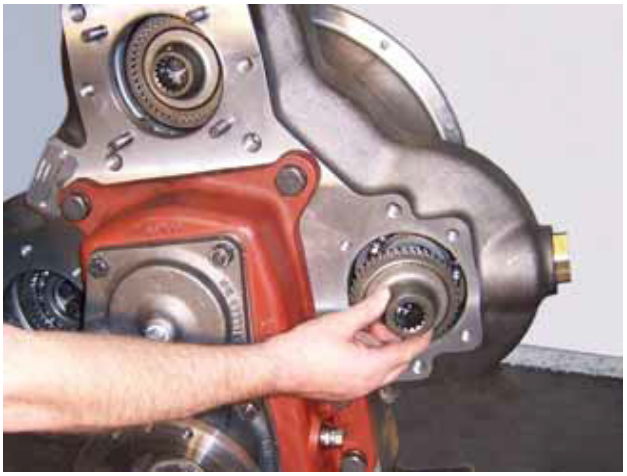


FIGURE 3: Install pump drive sleeves.

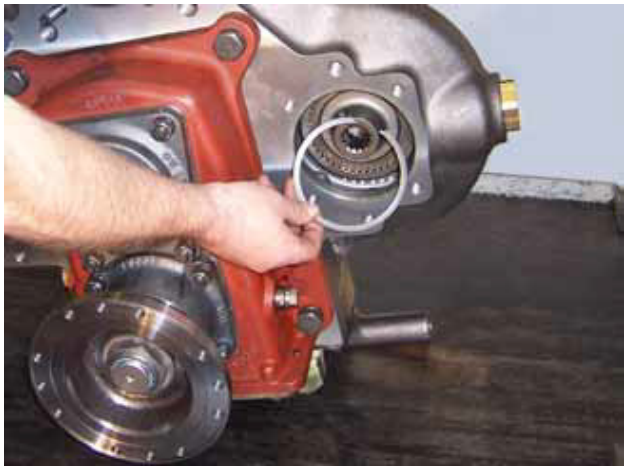


FIGURE 4: Install pump drive sleeve snap rings.

NOTE:

Install snap rings in all pump drive positions, even if a drive sleeve is not used.

CHARGE PUMP

FIGURE 5: Install charge pump gasket.

FIGURE 6: Install charge pump.

NOTE:

Refer to notes or marks made during disassembly for positioning of pump.

FIGURE 7: Install (4) charge pump stud lock washers.

FIGURE 8: Install (4) charge pump stud nuts.

FIGURE 9: Tighten charge pump stud nuts to 64-70 LBF/FT (87-95 Nm).

LOCK-UP ASSEMBLY AND INSTALLATION

FIGURE 10: Install lock-up piston inner piston ring.

FIGURE 1: Coat lock-up piston inner piston ring with grease.

FIGURE 2: Install lock-up piston outer expander ring, piston ring and coat with grease.

FIGURE 3: Install turbine shaft bearing.

FIGURE 4: Install outer drive disc.

FIGURE 5: Install lock-up piston.

FIGURE 6: Install turbine and lock-up hub.

FIGURE 9: Install lock-up inner clutch disc.

FIGURE 7: Install lock-up inner clutch disc.

FIGURE 10: Install lock-up backing plate.

FIGURE 8: Install lock-up outer clutch disc.

FIGURE 11: Install (12) lock-up backing plate screws.

FIGURE 12: Tighten lock-up backing plate screws to 33-36 LBF/FT (45-49 Nm).

TURBINE AND REACTION MEMBER

FIGURE 13: Install turbine.

FIGURE 1: Install turbine hub screw backing ring.

FIGURE 2: Apply Loctite 262 or equivalent to (8) turbine hub screws and install.

NOTE:

Apply Loctite in a thin coat evenly along entire length and around entire circumference of threads.

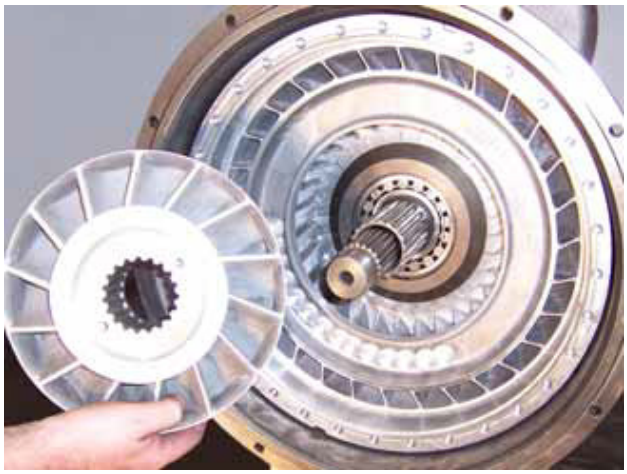


FIGURE 3: Install reaction member and spacer.

NOTE:

Spacer is retained to reaction member with a roll pin.

FIGURE 4: Install reaction member snap ring.

FIGURE 5: Install impeller cover seal ring.

FIGURE 6: Coat impeller cover seal ring with grease.

FIGURE 7: Install impeller cover and turbine assembly.

FIGURE 8: Install (32) impeller to cover screws and lock washers.

FIGURE 9: Tighten impeller to cover screws in a criss cross pattern to 37-41 LBF/FT (50-56 Nm).

FIGURE 10: Install turbine hub bearing retainer.

NOTE:

Line up (2) dowel pins with retainer holes.

FIGURE 11: Install turbine hub bearing snap ring.

NOTE:

Assemble snap ring with sharp edge facing out.

FIGURE 12: Install bearing retainer piston ring expander.

FIGURE 13: Install bearing retainer piston ring.

NOTE:

Expander gap should be opposite from piston ring hook joint.

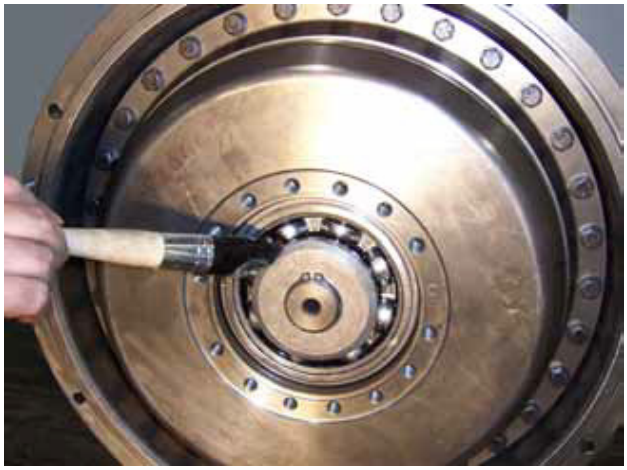


FIGURE 14: Coat bearing retainer piston ring with grease and center ring in groove.

FIGURE 15: Coat impeller cover bearing cap bore and O-Ring with grease and install o-ring.

FIGURE 16: Install impeller cover bearing cap.

FIGURE 17: Install (4) equally spaced impeller cover bearing cap screws and lock washers. Tighten to 37-41 LBF/FT (50-56 Nm).

NOTE:

If installing drive plates see drive plate instructions.

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