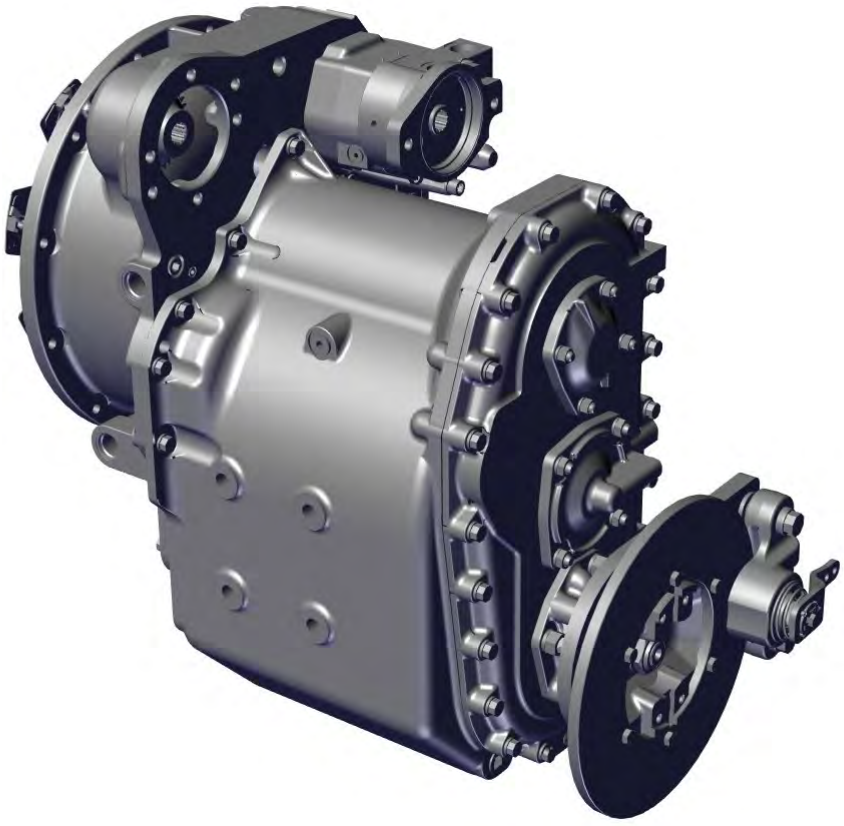
POWER SHIFT TRANSMISSION SERVICE SECTION



TOWING OR PUSHING

Before towing the vehicle, be sure to lift the rear wheels off the ground or disconnect the driveline to avoid damage to the transmission during towing.

Note:

If the transmission has 4 wheel drive, disconnect both front and rear drivelines. Because of the design of the hydraulic system, the engine cannot be started by pushing or towing.

FOREWORD

This manual has been prepared to provide the customer and the maintenance personnel with information and instructions on the maintenance and repair of the ***SPICER OFF-HIGHWAY*** product.

Extreme care has been exercised in the design, 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.

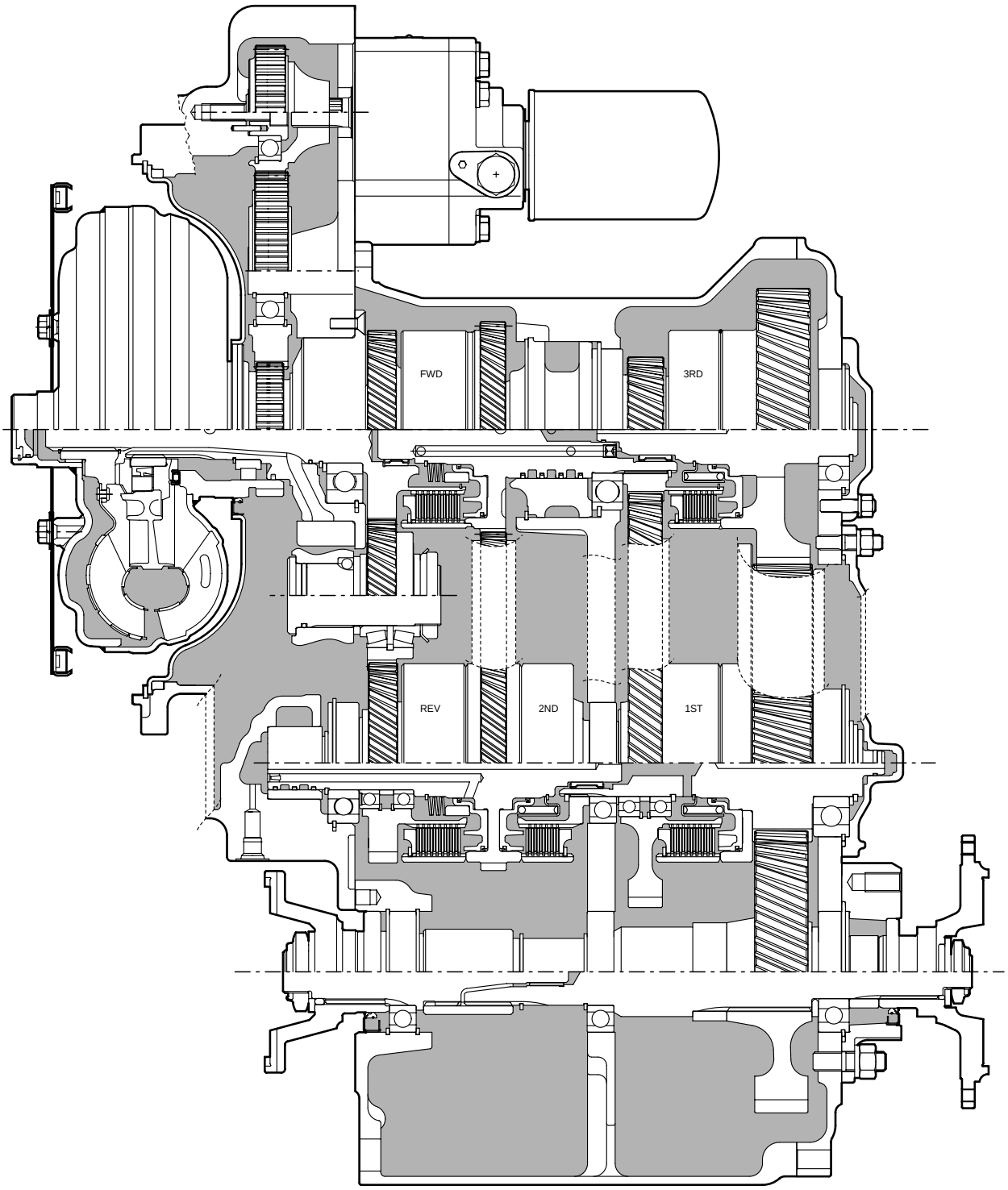
In order to become familiar with the various parts of the product, its principle of operation, troubleshooting and adjustments, it is urged that the mechanic studies the instructions in this manual carefully and uses it as a reference when performing maintenance and repair operations.

Whenever repair or replacement of component parts is required, only ***SPICER OFF-HIGHWAY*** 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. ***SPICER OFF-HIGHWAY*** does not warrant repair or replacement parts, nor failures resulting from the use of parts which are not supplied by or approved by ***SPICER OFF-HIGHWAY*** .

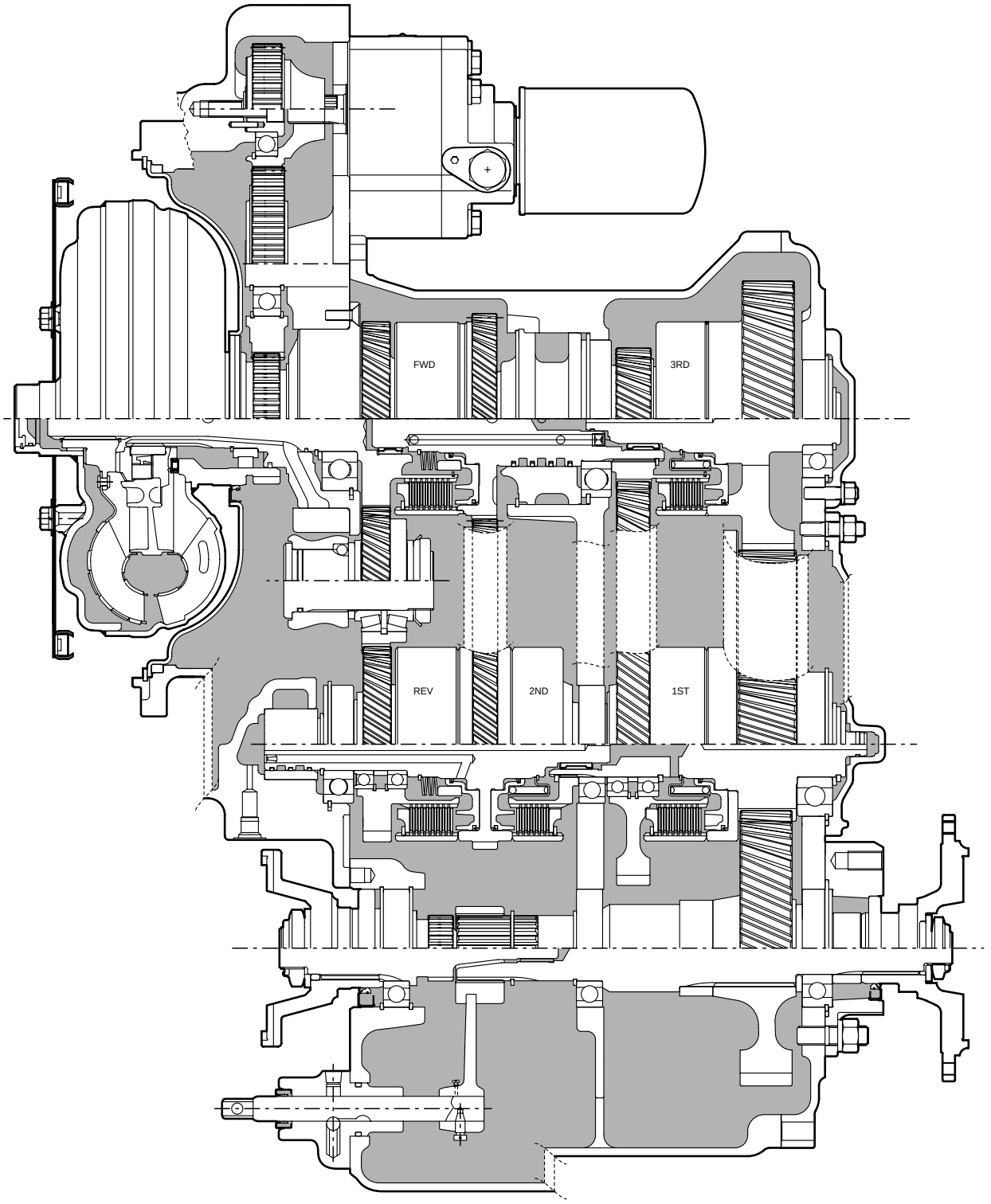
IMPORTANT

ALWAYS FURNISH THE DISTRIBUTOR WITH THE SERIAL AND MODEL NUMBER WHEN ORDERING PARTS.

WITHOUT INTERNAL DISCONNECT



WITH INTERNAL DISCONNECT



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5. INSTALLATION DETAILS

6. OPERATION OF THE TRANSMISSION

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9. ASSEMBLY INSTRUCTIONS

10. DISASSEMBLY AND REASSEMBLY T20000 INLINE TRANSMISSION

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11. OPTIONS (CONTINUED)

12. SERVICE TOOLS

1. SAFETY PRECAUTIONS

To reduce the chance of personal injury and/or property damage,
the following instruction 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 by a spare part which has the same part number or with an equivalent part. Do not use a spare part of lesser quality.

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

Accordingly, anyone who intends to use a spare part, service procedure or tool,
which is not recommended by ***SPICER OFF-HIGHWAY***, must first determine
that neither his safety nor the safe operation of the machine will be jeopardized by the spare part, service procedure or tool selected.

IMPORTANT

IT IS IMPORTANT TO NOTE THAT THIS MANUAL CONTAINS VARIOUS 'CAUTIONS' AND 'NOTES' THAT MUST BE CAREFULLY OBSERVED IN ORDER TO REDUCE THE RISK OF PERSONAL INJURY DURING SERVICE OR REPAIR, OR THE POSSIBILITY THAT IMPROPER SERVICE OR REPAIR MAY DAMAGE THE UNIT OR RENDER IT UNSAFE. IT IS ALSO IMPORTANT TO UNDERSTAND THAT THESE 'CAUTIONS' AND 'NOTES' ARE NOT EXHAUSTIVE, BECAUSE IT IS IMPOSSIBLE TO WARN ABOUT ALL THE POSSIBLE HAZARDOUS CONSEQUENCES THAT MIGHT RESULT FROM FAILURE TO FOLLOW THESE INSTRUCTIONS.

2. CLEANING, INSPECTION AND LEGEND SYMBOLS

2.1 CLEANING

Clean all parts thoroughly using solvent type cleaning fluid. It is recommended that parts be immersed in cleaning fluid and moved up and down slowly until all old lubricant and foreign material is dissolved and parts are thoroughly cleaned.

CAUTION

CARE SHOULD BE EXERCISED TO AVOID SKIN RASHES, FIRE HAZARDS, AND INHALATION OF VAPOURS WHEN USING SOLVENT TYPE CLEANERS.

2.1.1 Bearings

Remove bearings from cleaning fluid and strike 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 bearing to avoid spinning. Do not spin bearings when drying. Bearings may be rotated slowly by hand to facilitate drying process.

2.1.2 Housings

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 INHALATION OF VAPOURS AND SKIN RASHES WHEN USING ALKALI CLEANERS.

All parts cleaned must be thoroughly dried immediately by using moisture-free compressed air or soft, lintless absorbent wiping rags free of abrasive materials such as metal fillings, contaminated oil, or lapping compound.

2.2 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.

2.2.1 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 cone or cup individually without replacing the mating cup or cone at the same time. After inspection, dip bearings in Automatic Transmission Fluid and wrap in clean lintless cloth or paper to protect them until installed.

2.2.2 Oil Seals, Gaskets, Etc.

Replacement of spring load oil seals, “O”-rings, metal sealing rings, gaskets, and snap rings is more economical when unit is disassembled than premature overhaul to replace these parts at a future time. Further loss of lubricant through a worn seal may result in failure of other more expensive parts of the assembly. Sealing members should be handled carefully, particularly when being installed. Cutting, scratching, or curling under of lip of seal seriously impairs its efficiency. When assembling new metal type sealing rings, these should be lubricated with coat of chassis grease to stabilize rings in their grooves for ease of assembly of mating members. Lubricate all “O”-rings and seals with recommended type Automatic Transmission Fluid before assembly.

2.2.3 Gears and Shafts

If magna-flux process is available, use process to check parts. Examine teeth on all gears carefully for wear, pitting, chipping, nicks, cracks, or scores. If gear teeth show spots where case hardening is worn through or cracked, replace with new gear. Small nicks may be removed with suitable hone. Inspect shafts and quills to make certain they are not sprung, bent, or splines twisted, and that shafts are true.

2.2.4 Housing, Covers, etc.

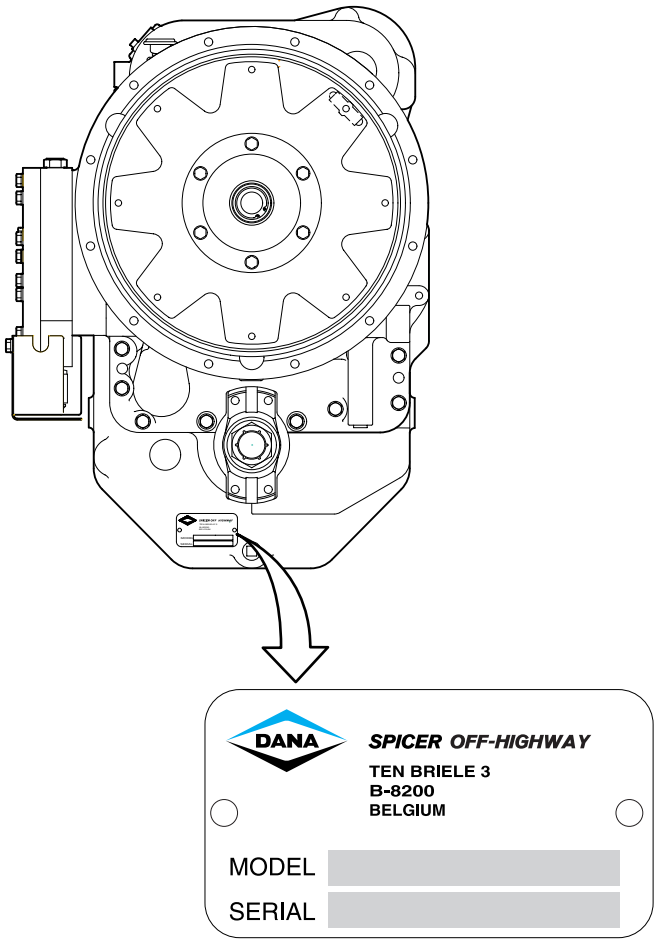
Inspect housings, covers and bearing caps to ensure that they are thoroughly clean and that mating surfaces, bearing bores, etc…, are free from nicks or burrs. Check all parts carefully for evidence of cracks or conditions which would cause subsequent oil leaks or failures.

2.3 LEGEND SYMBOLS

	Smontaggio di sottogruppi Disassembly of assembly groups
	Montaggio di sottogruppi Reassemble to from assembly group
	Smontaggio di particollari ingombranti Remove obstruction parts
	Montaggio di particollari ingombranti Reinstall - remount parts which had obstructed disassembly
	Attenzione, indicazione importante Attention! important notice
	Controllare regolare p.e. coppie, misure, pressione etc. Check - adjust e.g. torque, dimensions, pressures etc.
	T = Attrezzature speciali P = Pagina T = Special tool P = Page
	Rispettare direzione di montaggio Note direction of installation
	Controllare esaminare controllo visuale Visual inspection
	Eventualimente riutilizzable (sostituire se necessario) Possibly still serviceable, renew if necessary

	Sostituire con ogni montaggio Renew at each reassembly
	Togliere - mettere la sicura Unlock - lock e.g. split pin, locking plate, etc.
	Mettere la sicura, incollare (mastice liquido) Lock - adhere (liquid sealant)
	Evitare danni ai materiali, danni ai pezzi Guard against material damage, damage to parts
	Marchiari prima dello smontaggio (per il montaggio) Mark before disassembly, observe marks when reasembl.
	Carricare riempire (olio - lubrificante) Filling - topping up - refilling e.g. oil, cooling water, etc.
	Scarricare olio, lubrificante Drain off oil, lubricant
	Tendere Tighten - clamp ; tightening a clamping device
	Insere pressione nel circuito idraulico Apply pressure into hydraulic circuit
	Pulire To clean

3. TECHNICAL SPECIFICATIONS



3.1 IDENTIFICATION OF THE UNIT

1. Model and type of the unit.

2. Serial number.

3.2 WEIGHT, DIMENSIONS, OIL CAPACITY

Weight (dry): ±280 kg (616 lb.)

	T-model
Maximum length:	810.3 mm (31.90”)
Maximum width:	555.1 mm (21.86”)
Maximum height:	728.8 mm (28.69”)

Oil capacity

±16.0 l (4.3 US Gallon) without cooler and hydraulic lines.

Consult operator’s manual on applicable machine for system capacity.

3.3 TIGHTENING TORQUES

3.3.1 Torque specifications for lubricated or plated screw threads

NOM. SIZE	GRADE 5			
	FINE THREAD		COARSE THREAD	
	LBF - FT	[N.m]	LBF - FT	[N.m]
.2500	9 - 11	[12 - 15]	8 - 10	[11 - 14]
.3125	16 - 20	[22 - 27]	12 - 16	[16 - 22]
.3750	26 - 29	[35 - 39]	23 - 25	[31 - 34]
.4375	41 - 45	[56 - 61]	37 - 41	[50 - 56]
.5000	64 - 70	[87 - 95]	57 - 63	[77 - 85]
.5625	91 - 100	[123 - 136]	82 - 90	[111 - 122]
.6250	128 - 141	[174 - 191]	113 - 124	[153 - 168]
.7500	223 - 245	[302 - 332]	200 - 220	[271 - 298]

NOM. SIZE	GRADE 8			
	FINE THREAD		COARSE THREAD	
	LBF - FT	[N.m]	LBF - FT	[N.m]
.2500	11 - 13	[15 - 18]	9 - 11	[12 - 15]
.3125	28 - 32	[38 - 43]	26 - 30	[35 - 41]
.3750	37 - 41	[50 - 56]	33 - 36	[45 - 49]
.4375	58 - 64	[79 - 87]	52 - 57	[71 - 77]
.5000	90 - 99	[122 - 134]	80 - 88	[108 - 119]
.5625	128 - 141	[174 - 191]	115 - 127	[156 - 172]
.6250	180 - 198	[224 - 268]	159 - 175	[216 - 237]
.7500	315 - 347	[427 - 470]	282 - 310	[382 - 420]

NOM. SIZE	GRADE 8.8 or 9.8		GRADE 10.9	
	COARSE THREAD		COARSE THREAD	
	LBF - FT	[N.m]	LBF - FT	[N.m]
M8	15 - 20	[20 - 25]	22 - 26	[30 - 35]
M10	30 - 37	[40 - 50]	44 - 48	[60 - 65]
M12	50 - 55	[65 - 75]	74 - 81	[100 - 110]

3.3.2 Elastic stop nut torque

THREAD SIZE	LB - FT	[N . m]
1" - 20	150 - 200	[203.4 - 271.1]
1 1/4" - 18	200 - 250	[271.2 - 338.9]
1 1/2" - 18	300 - 350	[406.8 - 474.5]
1 3/4" - 18	400 - 450	[542.4 - 610.1]

3.3.3 "O"-ring port plug torque chart

THREAD SIZE	LBF - FT	[N . m]
9/16" - 18	12 - 15	[16 - 20]
3/4" - 16	20 - 25	[27 - 34]

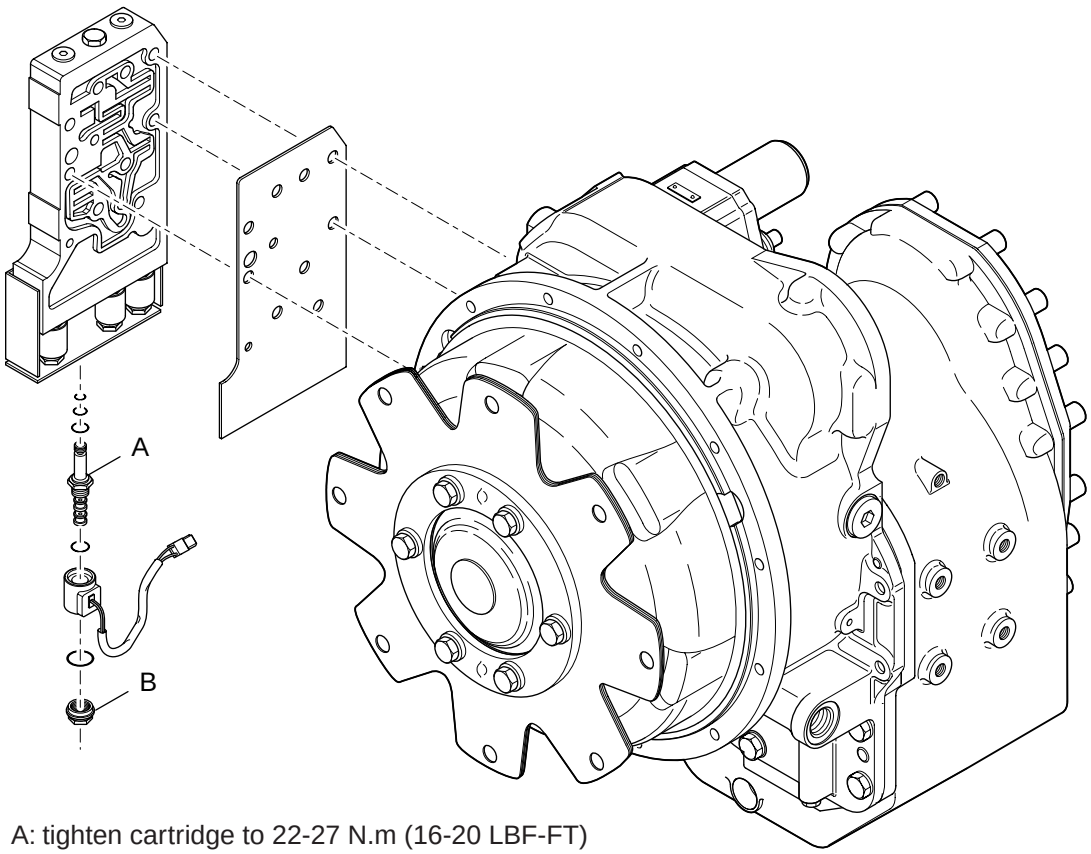
3.3.4 Pipe plug torque chart

THREAD NPTF	TORQUE	
	LBF - FT	[N.m]
1/16 - 27	5 - 7	[7 - 9]
1/8 - 27	7 - 10	[9 - 14]
1/4 - 18	15 - 20	[20 - 27]
3/8 - 18	25 - 30	[34 - 41]
1/2 - 14	30 - 35	[41 - 47]
3/4 - 10	40 - 45	[54 - 61]
1 - 11 1/2	55 - 50	[68 - 75]
1 1/4 - 11 1/2	60 - 65	[81 - 88]

3.3.5 Permanent metric plug torque chart

THREAD SIZE	TORQUE	
	LBF - FT	[N.m]
M18 x 1.5 6H	25-30	[34-41]
M26 x 1.5 6H	45-50	[61-68]

3.3.6 Coil and cartridge torque



A: tighten cartridge to 22-27 N.m (16-20 LBF-FT)
B: tighten cartridge nuts to 5-7 N.m (4-5 LBF-FT)

3.4 PRESSURE AND TEMPERATURE SPECIFICATIONS

- Normal operating temperature 70 - 120 °C (158 - 248 F) measured at temperature check port converter out (port 71 - **).
- Maximum allowed transmission temperature 120 °C (248 F).
- Transmission regulator pressure (*) - (neutral) - port 31 (**).
  - At 600 RPM min. 12.4 bar (180 PSI) minimum.
  - At 2200 RPM: 15.2 bar (220 PSI) maximum.
- Pump flow (*)
  - At 1800 RPM in neutral: 54.9 l/min. minimum (14.5 GPM).
- Clutch pressures (*)
  - 1st clutch: port 41 (**).
  - 2nd clutch: port 42 (**).
  - 3rd clutch: port 43 (**).
  - Forward clutch: port 45 (**).
  - Reverse clutch: port 46 (**).

At 2000 RPM :

- 12.4 - 15.2 bar (180 - 220 PSI) clutch activated.
- 0 - 0.2 bar (0 - 3 PSI) clutch released.

- Filter bypass valve set at 1.5 - 1.7 bar (*) (22 - 24 PSI).
- Lube pressure (*) (port 33) 0.7 - 1.4 bar (10 - 20 PSI) at 54.9 l/min. (14.5 GPM) pump flow (±1800 RPM).
- Safety valve: cracking pressure (*) 8.2 - 12.1 bar (120 - 175 PSI).
- Converter out pressure (*) (port 32) 1.7 bar min. (25 PSI) at 2000 RPM and max. 4.8 bar (70 PSI) at no load governed speed.

(*) All pressures and flows to be measured with oil temperature of 82-93 °C (180-200 F).

(**) Refer to section 7 “Troubleshooting” for check port identification.

3.5 ELECTRICAL SPECIFICATIONS

- Solenoid (forward, reverse, 1st and 2nd).

  Coil resistance:

  - 12V: 9.79 Ω ±0.5 Ω.
  - 24V: 39.3 Ω ±2 Ω.

- Speed sensor:
  - Type: magneto resistive sensor.
  - Sensing distance: 0 - 1.8 mm (0” - 0.07”).
  - Sensor signal: generates a square current with a fixed amplitude changing between 7 and 14 mA.

3.6 HYDRAULIC COOLER AND FILTER LINE SPECIFICATIONS

- Minimum 19 mm (.75”) internal diameter for lines and fittings.
- Suitable for operation from ambient to 120 °C (248 F) continuous operating temperature.
- Must withstand 20 bar (290 PSI) continuous pressure and with 40 bar (580 PSI) intermittent surges.
- Conform SAE J1019 and SAE J517, 100RI.

4. MAINTENANCE

4.1 OIL SPECIFICATION

4.1.1 Recommended lubricants

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.

Note

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

Caution

DEXRON* III, ENGINE OIL OR GL-5 OILS ARE NOT RECOMMENDED.

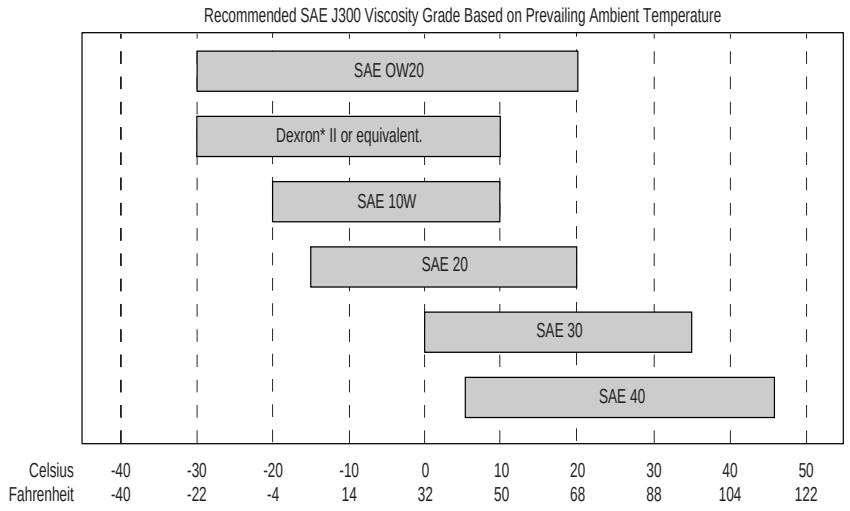
PREFERRED OIL VISCOSITY

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 stead of J20 lubricant it is recommended that the viscosity span no more than 10 points, i.e. 10W20.

Caution

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-HIGHWAY***.



SUMP PREHEATERS

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

NORMAL OIL CHANGE INTERVAL

Drain and refill system every 1000 hours for average environmental and duty cycle conditions. Severe or sustained high operating temperature or very dusty atmospheric conditions will result in accelerated deterioration or contamination. Judgement 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 based solely on this analysis.

FILTERS

Service oil filters element every 500 hours under normal environmental and duty cycle conditions.

*Dexron is a registered trademark of GENERAL MOTORS CORPORATION.

4.2 MAINTENANCE INTERVALS

4.2.1 Daily

Check oil level daily with engine running at idle (600 RPM) and oil at 82 - 93 °C (180-200 F).

Maintain oil level at full mark.

4.2.2 Normal drain period

Normal drain period and oil filter element change are for average environment and duty cycle condition.

Severe or sustained high operating temperature or very dusty atmospheric conditions will cause accelerated deterioration and contamination.

For extreme conditions judgement must be used to determine the required change intervals.

Every 500 hours

Change oil filter element.

Every 1000 hours

Drain and refill system as follows (Drain with oil at 65 - 93 °C (150 - 200 F)):

1. Drain transmission.
2. Remove and discard filter. Install new filter.
3. Refill transmission to FULL mark.
4. Run engine at 500 - 600 RPM to prime convertor and lines.
5. Recheck level with engine running at 500 - 600 RPM and add oil to bring level to LOW mark. When oil temperature is hot 82.2 - 93.3 °C (180- 200 F) make final oil level check and adjust if necessary to bring oil level to FULL mark.

Note

IT IS RECOMMENDED THAT OIL FILTER BE CHANGED AFTER 100 HOURS OF OPERATION ON NEW, REBUILT OR REPAIRED UNIT.

4.3 SERVICING MACHINE AFTER COMPONENTS OVERHAUL

The transmission, torque converter, and its allied hydraulic system are important links in the driveline 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 complete.

After the overhauled or repaired 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 judgement 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 element.
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.

IMPORTANT

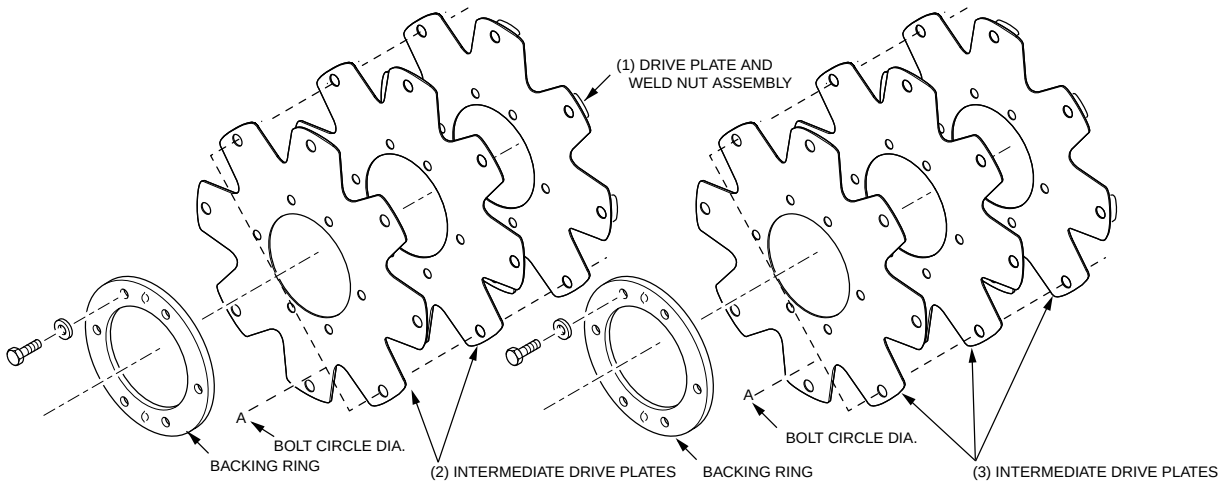
DO NOT USE FLUSHING COMPOUNDS FOR CLEANING PURPOSES.

5. Reassemble all components and use only type oil (See chapter 4.1.1 “Recommended lubricants”). Fill the transmission through filler opening until fluid comes up to FULL mark on transmission dipstick.
   - Remove filler plug and fill oil until FULL mark.
   - Run engine two minutes at 500 - 600 RPM to prime torque convertor 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.
   - Recheck with hot oil 82.2 - 93.3 °C (180 - 200 F).
   - Adjust oil level to FULL mark on dipstick.
6. Recheck all drain plugs, lines, connections, etc.…, for leaks and tighten where necessary.

5. INSTALLATION DETAILS

5.1 CONVERTER DRIVE COUPLING

Measure the “A” dimension (bolt circle diameter) and order drive plate kit listed below. Note three (3) kits have two (2) intermediate drive plates and one (1) drive plate and weld nut assembly. Three (3) kits with three intermediate drive plates.



“A” Dimension (Bolt circle diameter)

- 11.380” (288.900 mm) diameter
  Kit No. 814978.
- 13.125” (333.38 mm) diameter
  Kit No. 814977.
- 13.500” (342.90 mm) diameter
  Kit No. 814975.

Each kit will include the following parts:

- 2 Intermediate drive plates.
- 1 Drive plate and weld nut assembly.
- 1 Backing ring.
- 6 Mounting screws.
- 6 Lockwashers.
- 1 Instruction sheet.

“A” Dimension (Bolt circle diameter)

- 11.380” (288.900 mm) diameter
  Kit No. 814979.
- 13.125” (333.38 mm) diameter
  Kit No. 814980.
- 13.500” (342.90 mm) diameter
  Kit No. 814981.

Each kit will include the following parts:

- 3 Intermediate drive plates.
- 1 Backing ring.
- 6 Mounting screws.
- 6 Lockwashers.
- 1 Instruction sheet.

Position drive plate and weld nut assembly on torque converter assembly with weld nuts toward converter. Align intermediate drive plates and backing plate with holes in torque converter assembly.

Note

TWO DIMPLES 180° APART IN BACKING RING MUST BE OUT TOWARD ENGINE FLYWHEEL (HOLLOW SIDE FACING TORQUE CONVERTER ASSEMBLY). INSTALL CAP SCREWS AND LOCKWASHERS. TIGHTEN CAP SCREWS TORQUE 40 - 50 N.M. (30 - 37 LBF. FT.).

5.2 TRANSMISSION TO ENGINE INSTALLATION PROCEDURE

1. Remove all burrs from flywheel mounting face and nose pilot bore. Clean drive plate surface with solvent.
2. Check engine flywheel & housing for conformance to standard SAE No. 3 per SAE J927 and J1033 tolerance specifications for pilot bore size, pilot bore runout and mounting face flatness. Measure and record engine crankshaft end play (Fig. 1).
3. Install two 63,50 mm (2.50") long transmission 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 (Fig. 2).

*4. Install a 101,60 mm (4.00") long drive plate locating stud .3750-24 fine thread 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. Rotate the transmission torque converter to align the locating stud in the drive plate with the flywheel drive plate mounting screw hole positioned in step No. 3. Locate transmission on flywheel housing.

   Aligning drive plate to flywheel and transmission to flywheel housing guide studs. Install transmission to flywheel housing screws. Tighten screws to specified torque. Remove transmission to engine guide studs. Install remaining screws and tighten to specified torque.

*6. Remove drive plate locating stud.

7. Install drive plate attaching screw and washer. 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. Torque each one 35 to 39 N.m. (26- 29ft.lbs.). This will require tightening each screw and rotating the engine flywheel until the full amount of eight (8) screws have been tightened to specified torque.
8. Measure engine crankshaft end play after transmission has been completely installed on engine flywheel. This value must be within 0,025 mm (0.001") of the end play recorded in step No. 2.

* Does not apply to units having 3 intermediate drive plates. See Fig.4.

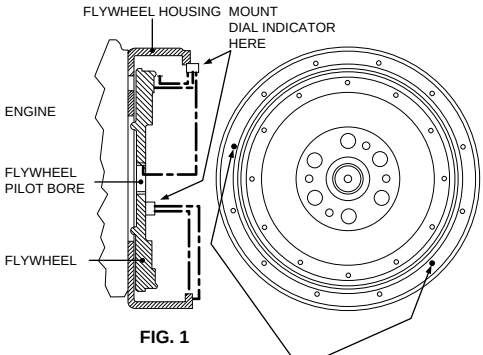


FIG. 1

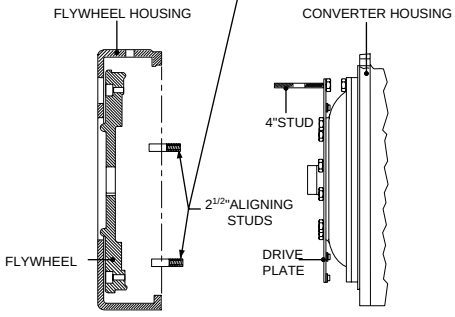


FIG. 2

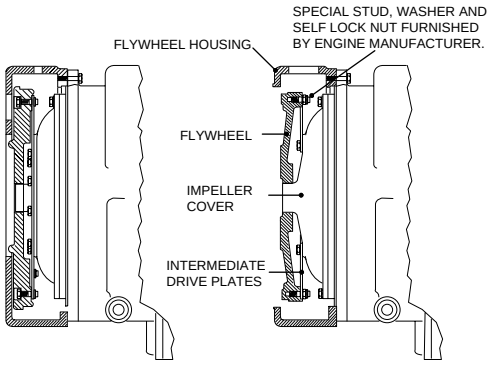


FIG. 3 FIG.4

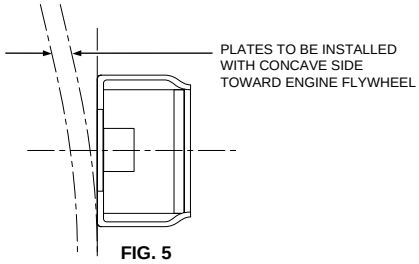
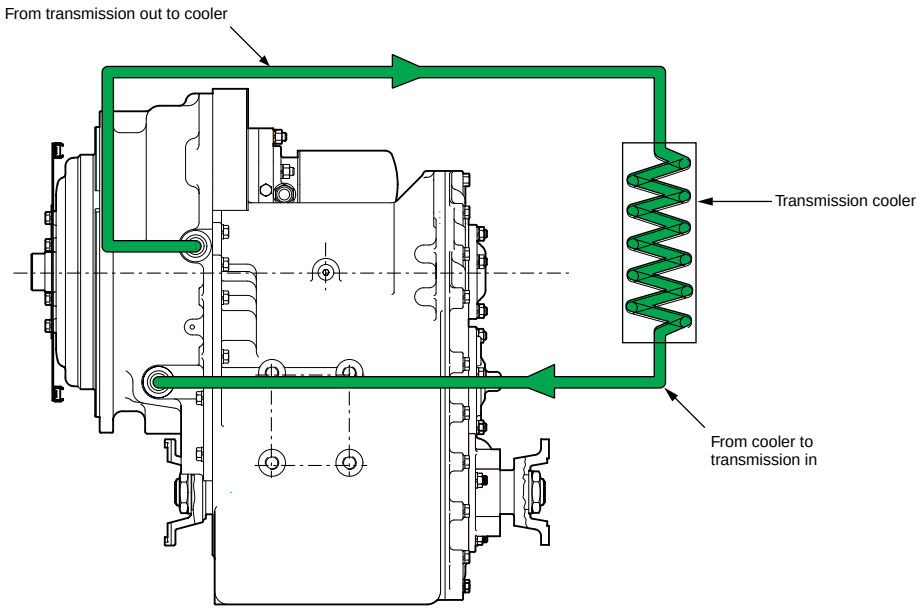


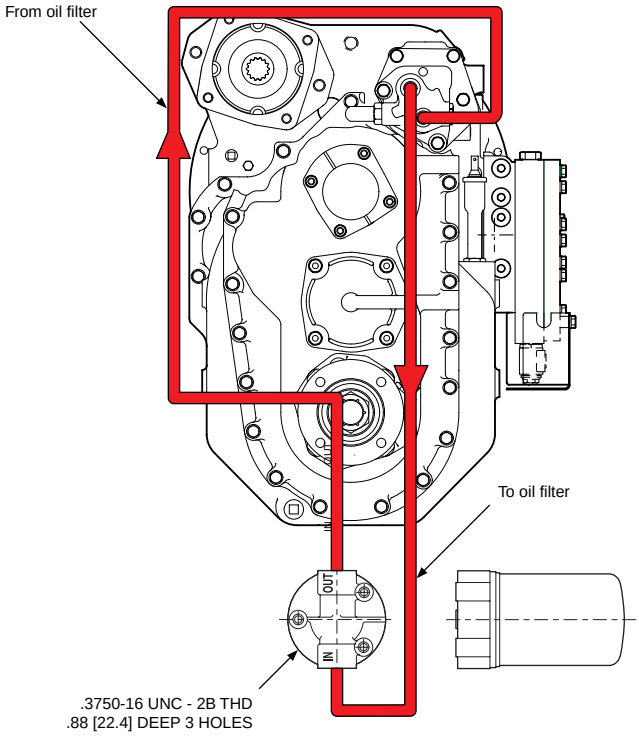
FIG. 5

5.3 EXTERNAL PLUMBING



Left side view

5.3.1 Optional: remote filter

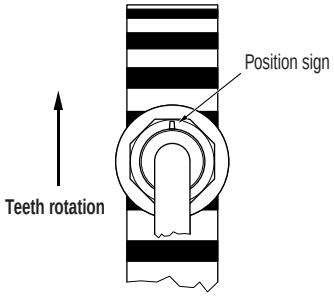


Optional remote filter

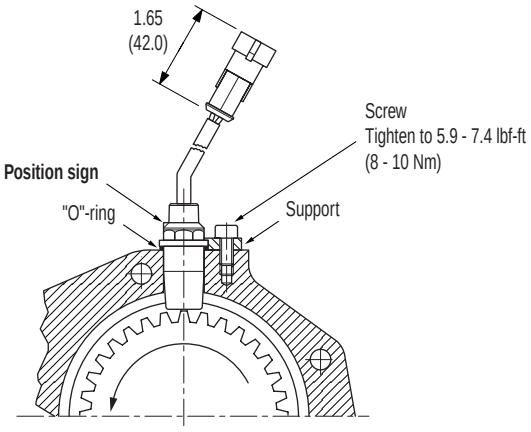
5.3.2 Cooler & filter lines specifications

- Minimum 19 mm (.75 inch) internal diameter for lines and fittings.
- Suitable for operation from ambient to 120 °C (248 F) continuous operating temperature.
- Must withstand 20 bar (290 psi) continuous pressure and with 40 bar (580 psi) intermittent surges.
- Conform SAE J1019 and SAE J517,100RI.

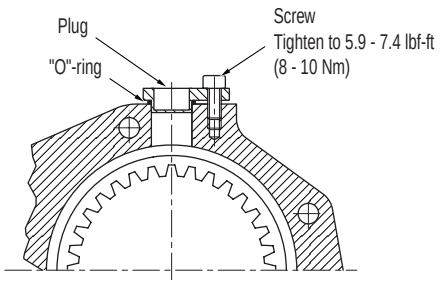
5.4 SPEED SENSOR INSTALLATION



On the sensor body there is a small plastic triangular position sign.
Make sure the position sign on the sensor points as shown below
in the direction of the movement of the gearteeth (Teeth rotation as shown).

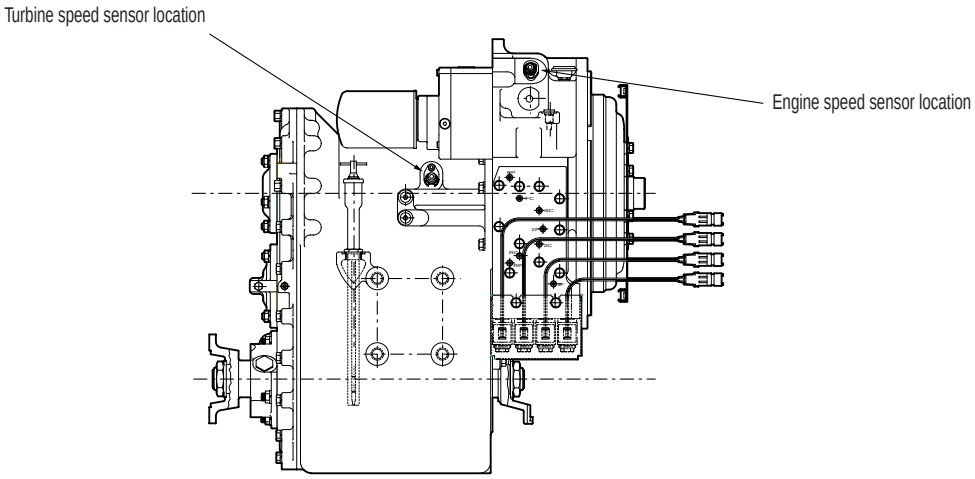


Sensor installed



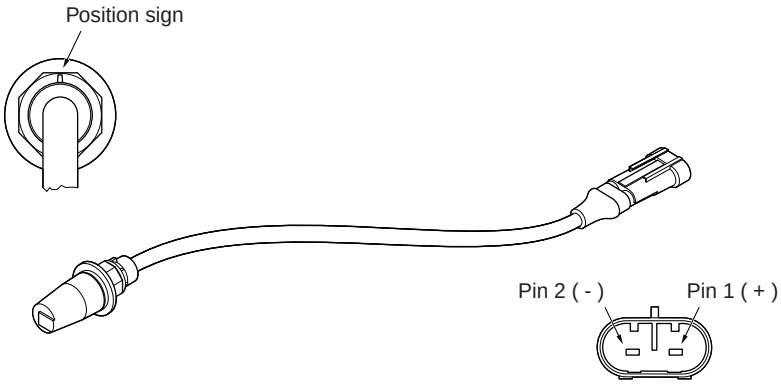
Hole plugged

Sensor position on transmission



Right side view

5.4 SPEED SENSOR INSTALLATION (CONTINUED)



The magneto resistive sensor generates a square wave current with a fixed amplitude changing between 7 mA and 14 mA.

The sensor has an integrated AMP superseal 2 pin connector.
The two pins are numbered 1 and 2.

Following table shows the relation between wire colour, pin number and connection.

COLOUR	PIN NUMBER	FUNCTION	CONNECTION
BROWN	1	Current input	Hot wire
BLUE	2	Current output	Ground wire

Note

THE SENSOR WIRES HAVE A POLARITY.

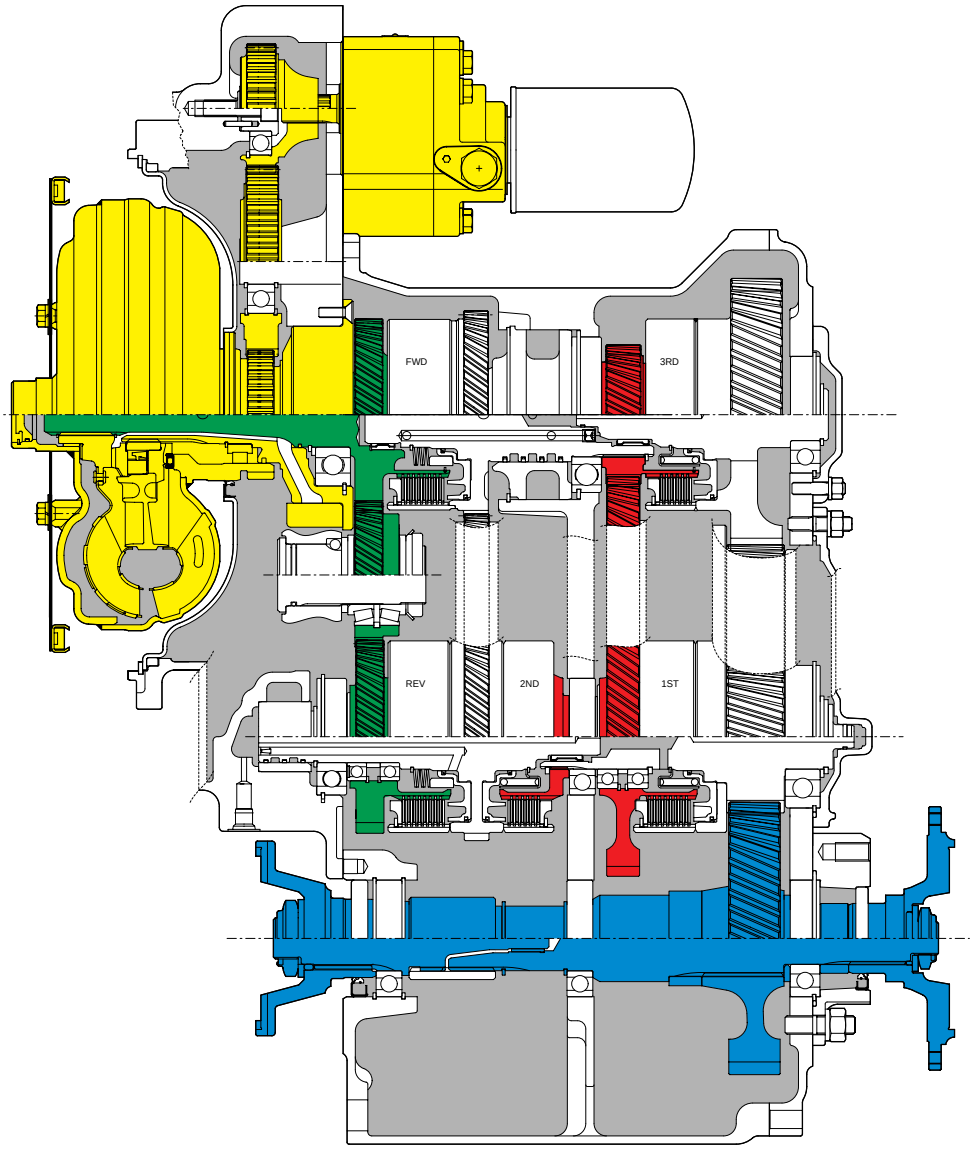
BE SURE TO CORRECTLY OBSERVE SENSOR POLARITIES, AS WRONG CONNECTIONS WILL DEACTIVATE THE SENSOR !

6. OPERATION OF THE TRANSMISSION

6.1 THE TRANSMISSION ASSEMBLY

Basically the transmission is composed of five main assemblies:

1. The converter, pump drive section and pressure regulating valve.
2. The input shaft and directional clutches.
3. The range clutches.
4. The output section.
5. The transmission control valve.



6.1.1 The converter, pump drive section and pressure regulating valve

Engine power is transmitted from the engine flywheel to the impeller through the impeller cover.

This element is the pump portion of the hydraulic torque converter and is the primary component which starts the oil flowing to the other components which results in torque multiplication. This element can be compared to a centrifugal pump, that picks up fluid at its centre and discharges it at the outer diameter.

The torque converter turbine is mounted opposite the impeller and is connected to the turbine shaft of the torque converter. This element receives fluid at its outer diameter and discharges it at its centre.

The reaction member of the torque converter is located between and at the centre of the inner diameters of the impeller and turbine elements. Its function is to take the fluid which is exhausting from the inner portion of the turbine and change its direction to allow correct entry for recirculation into the impeller element. This recirculation will make the converter to multiply torque.

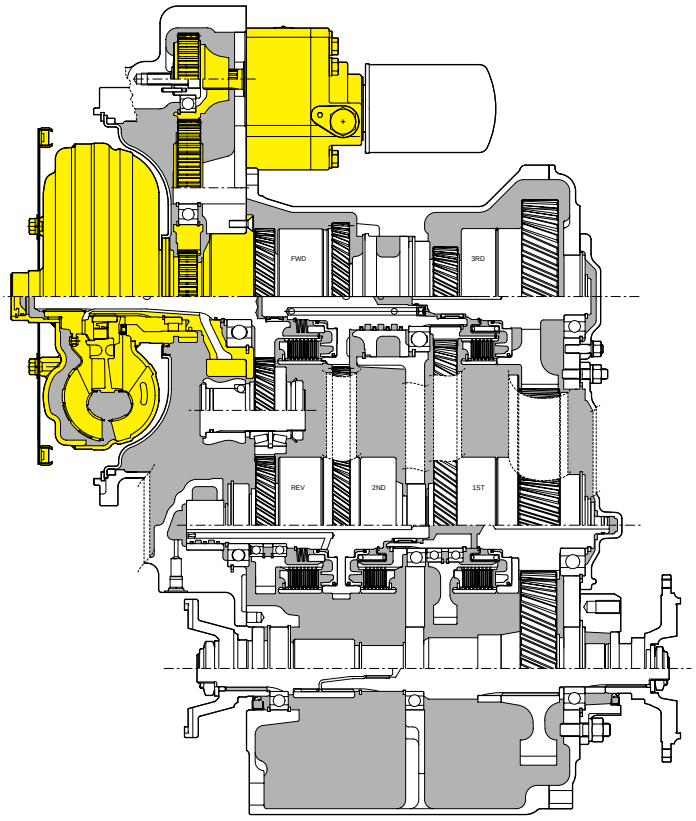
The torque multiplication is function of the blading (impeller, turbine and reaction member) and the converter output speed (turbine speed). The converter will multiply engine torque to its designed maximum multiplication ratio when the turbine shaft is at zero RPM (stall).

Therefore we can say that as the turbine shaft is decreasing in speed, the torque multiplication is increasing.

The hydraulic pump is connected with the pump drive gear. This pump drive gear is driven by the impeller hub gear. Since the impeller hub gear is connected with the impeller cover, the pump speed is in direct relation with the engine speed.

Note

THE PRESSURE REGULATOR VALVE AND SAFETY VALVE ARE MOUNTED BEHIND THE FILTER, IN THE FILTER ADAPTER HOUSING.



THE CONVERTER, PUMP DRIVE SECTION AND PRESSURE REGULATING VALVE

6.1.2 The input shaft and directional clutches

The turbine shaft driven from the turbine transmits power to the forward or reverse clutch.

These clutches consist of a drum with internal splines and a bore to receive a hydraulic actuated piston. The piston is oil tight by the use of sealing rings. The steel discs with external splines, and friction discs with internal splines, are alternated until the required total is achieved.

A back-up plate is then inserted and secured with a retainer ring. A hub with outer diameter splines is inserted into the splines of discs with teeth on the inner diameter. The discs and hub are free to increase in speed or rotate in the opposite direction as long as no pressure is present in that specific clutch.

To engage the clutch, the solenoid will direct oil under pressure through tubes and passages to the selected clutch shafts.

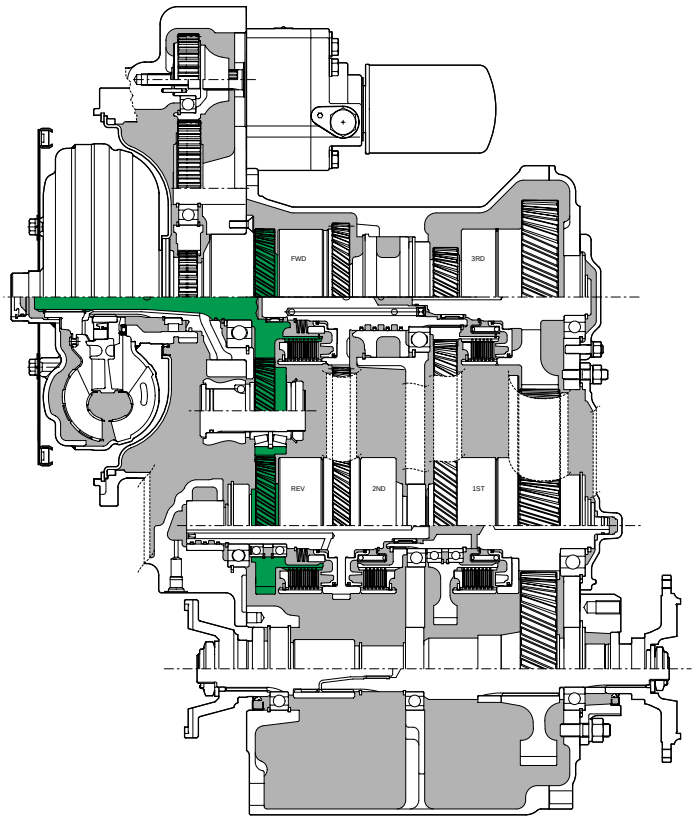
Oil sealing rings are located on the clutch shafts. These rings direct the oil through a drilled passage in the shaft to the desired clutch.

Pressure of the oil forces the piston and discs against the back-up plate. The discs with splines on the outer diameter clamping against discs with teeth on the inner diameter enables the drum and hub to be locked together and allows them to drive as one unit.

When the clutch is released, a return spring will push the piston back and oil will drain back via the shift spool, the bleed valve or holes in the clutch piston into the transmission sump.

These bleed valves will only allow quick escape of oil when the pressure to the piston is released.

As an option the engagement of the directional clutches can be modulated. This means that clutch pressure is built up gradually. This will enable the unit to make forward, reverse shifts while the vehicle is still moving and will allow smooth engagement of drive. The modulation is done hydraulically.



THE INPUT SHAFT AND DIRECTIONAL CLUTCHES

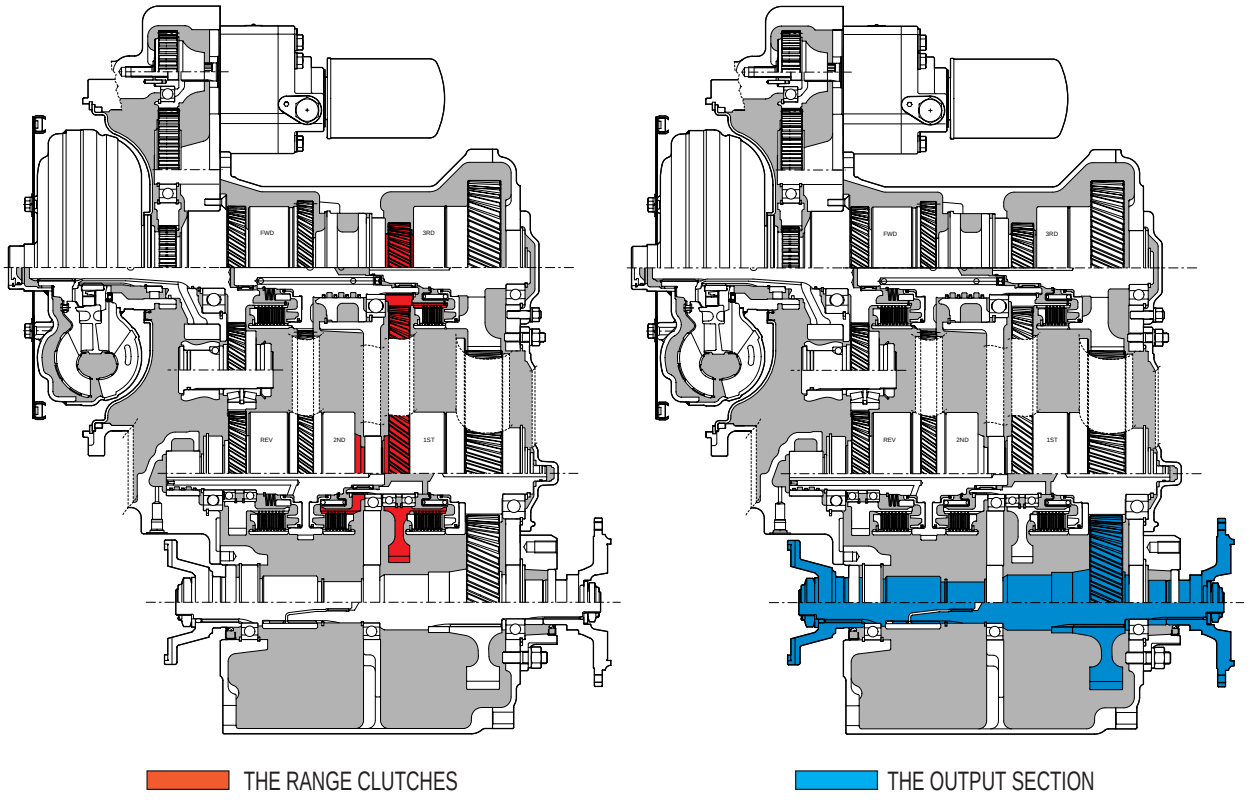
6.1.3 The range clutches

Once a directional clutch is engaged power is transmitted to the range clutches (1st, 2nd or 3rd).
Operation and actuation of the range clutches is similar to the directional clutches.
The engagement of the range clutches are not modulated.

6.1.4 The output section

With a range clutch engaged, power is finally transmitted to the output shaft.
Output rotation is opposite as the engine rotation when the forward clutch is engaged.

A front and/or rear axle disconnect is optional and is located on the output shaft. The drive to the front and/or rear axle can be disconnected or connected by manual shifting.



6.1.5 The transmission controls (refer to hydraulic diagram)

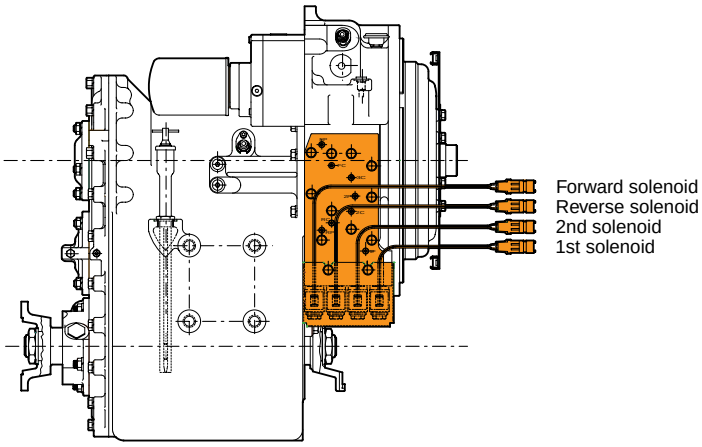
The transmission is controlled by the control valve. The control valve assembly is mounted directly on the side of the converter housing. The function of the control valve assembly is to direct oil under pressure to the desired directional and speed clutch. A provision is made on certain models for inching or declutch when the brakes are applied.
This is accomplished through use of a brake actuated valve.

Operation of the valve

Forward can be selected by activating the forward solenoid. The forward solenoid will then allow pilot pressure to move the forward shift spool. Due to this movement of the shift spool, the forward clutch is fed with oil pressure.

When the reverse solenoid is activated, pilot pressure will move the reverse shift spool.
The reverse clutch will be fed with oil pressure.

The shift spools of forward and reverse are located opposite each other separated by a return spring. This ensures that only one direction can be selected.



THE TRANSMISSION CONTROLS

Selection of range

If the range solenoids 1st and 2nd are activated, regulated pressure is fed through the shift spools to the 1st clutch.

If the range solenoid 2nd is activated, regulated pressure is fed through the shift spools to the 2nd clutch.

If no range solenoids are activated, the regulated pressure is fed to the 3rd clutch.

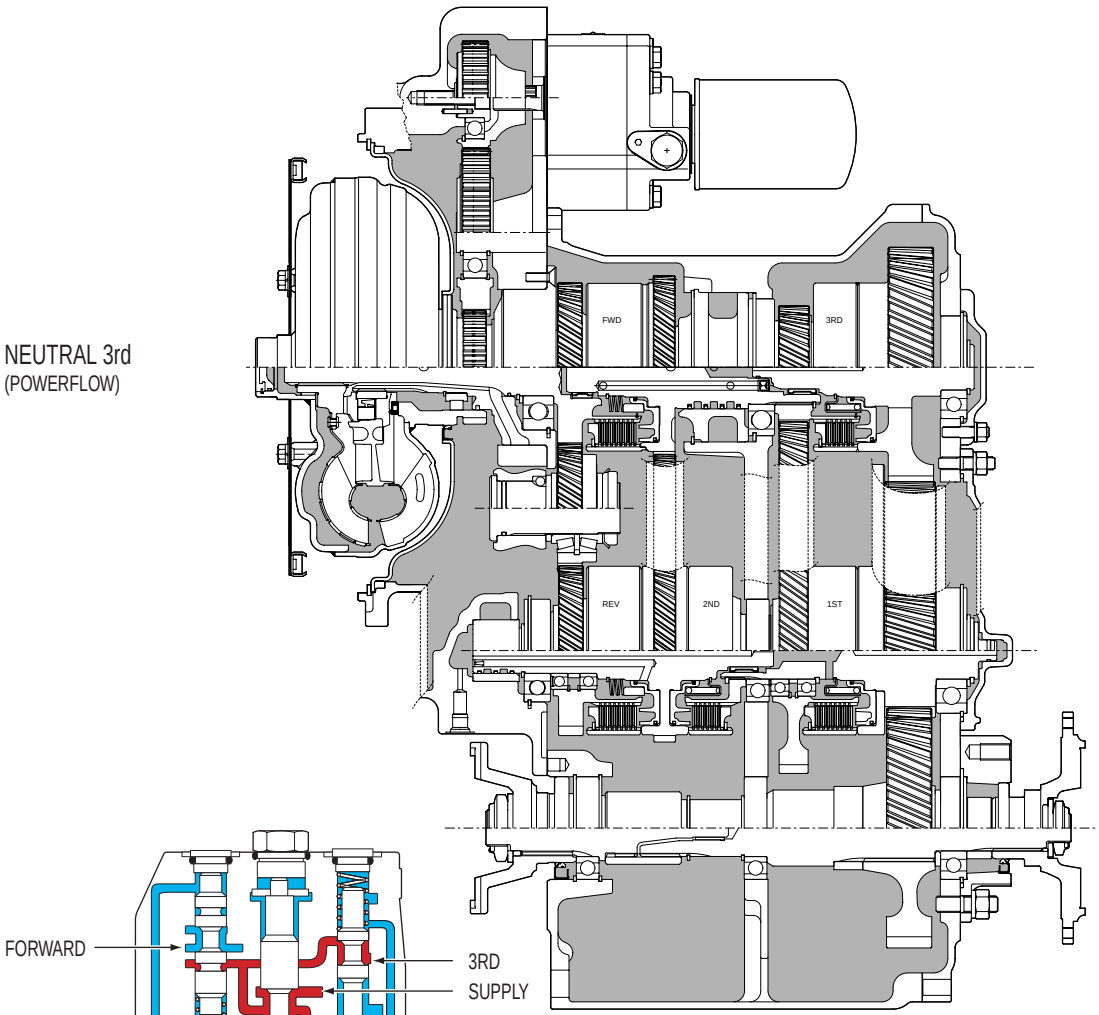
6.2 ELECTRIC SOLENOID CONTROLS

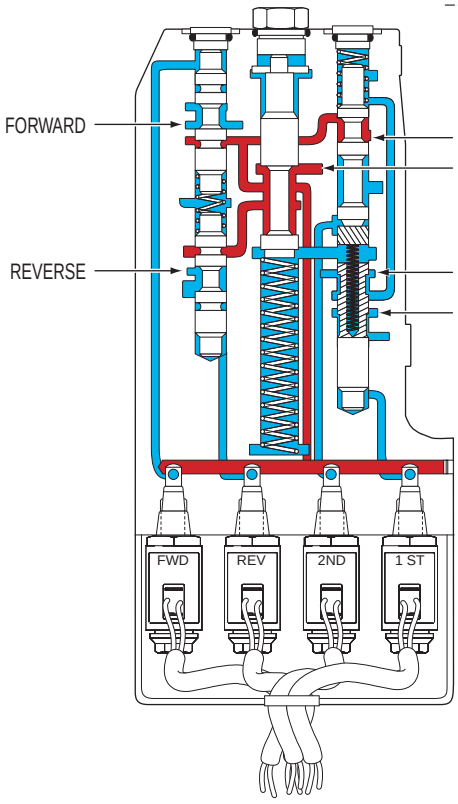
Transmission gear	Activated solenoids	Activated clutches
Forward 3	Forward	Forward, 3rd
Forward 2	Forward, 2nd	Forward, 2nd
Forward 1	Forward, 1st, 2nd	Forward, 1st
Neutral 3	-	3rd
Neutral 2	2nd	2nd
Neutral 1	1st, 2nd	1st
Reverse 3	Reverse	Reverse, 3rd
Reverse 2	Reverse, 2nd	Reverse, 2nd
Reverse 1	Reverse, 1st, 2nd	Reverse, 1st

6.3 POWERFLOWS, ACTIVATED SOLENOIDS AND HYDRAULIC CIRCUIT

6.3.1 Neutral and 3rd clutch engaged

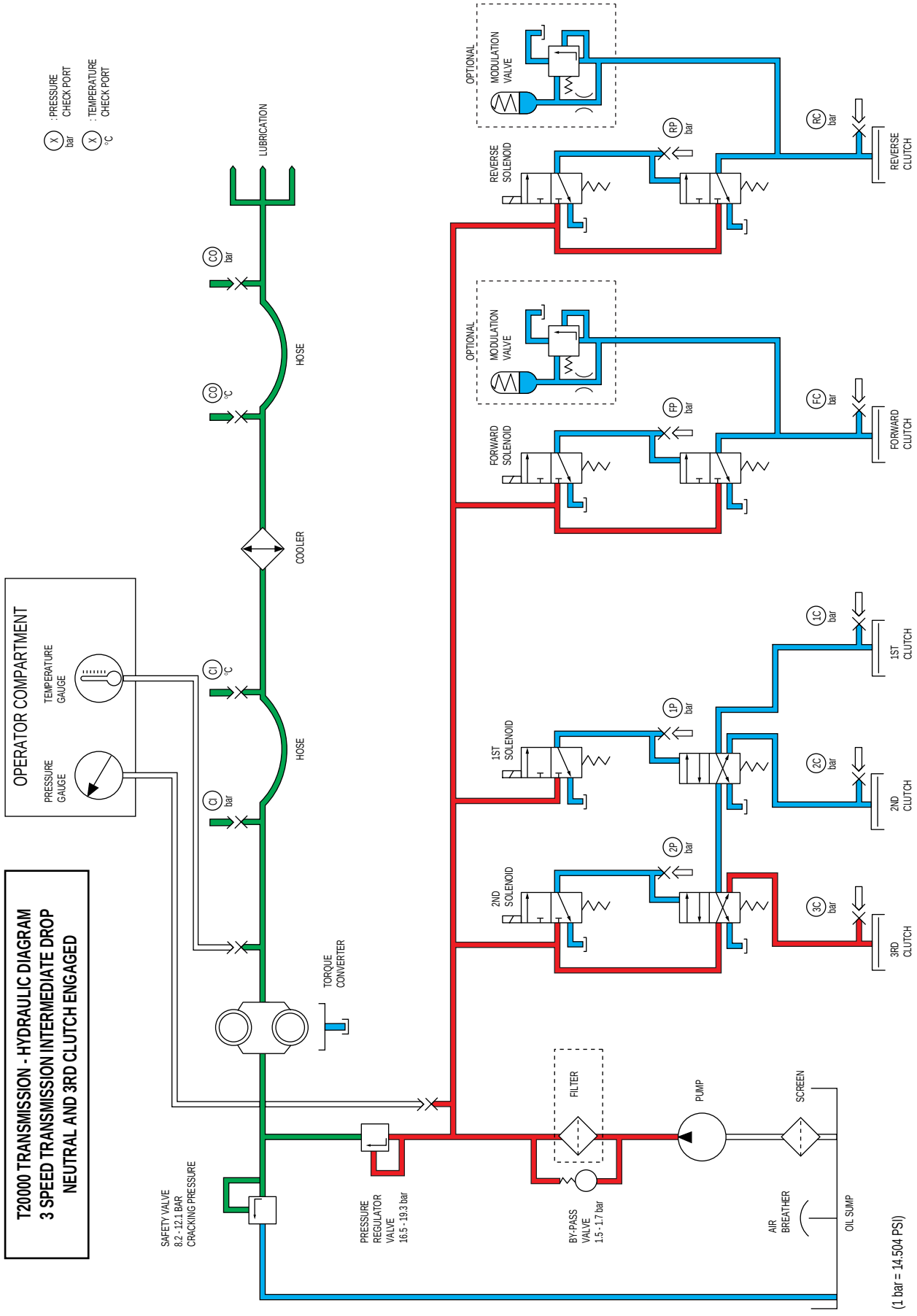
NEUTRAL 3rd
(POWERFLOW)



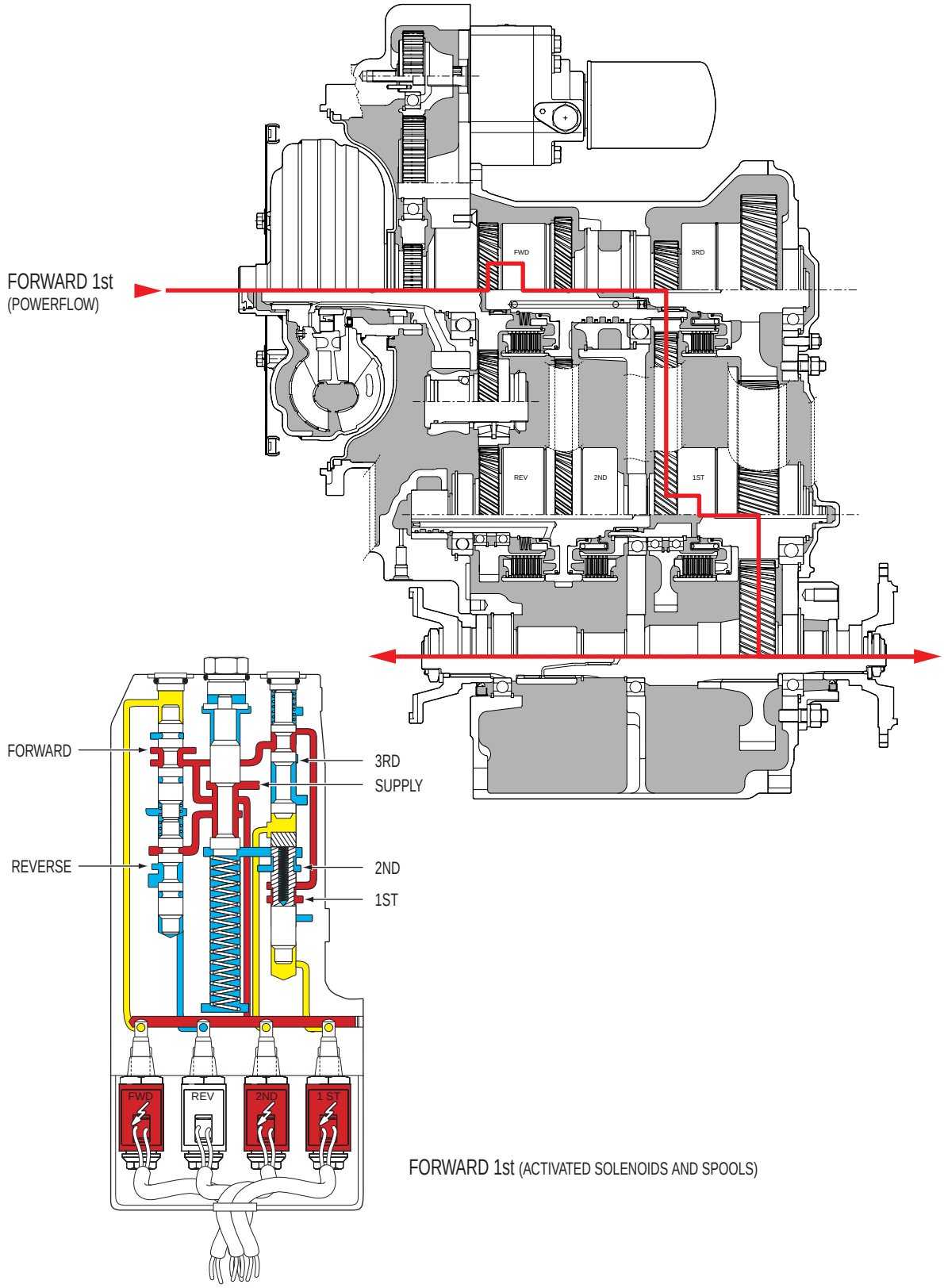


NEUTRAL 3rd (ACTIVATED SOLENOIDS AND SPOOLS)

6.3.1 Neutral and 3rd clutch engaged (continued)

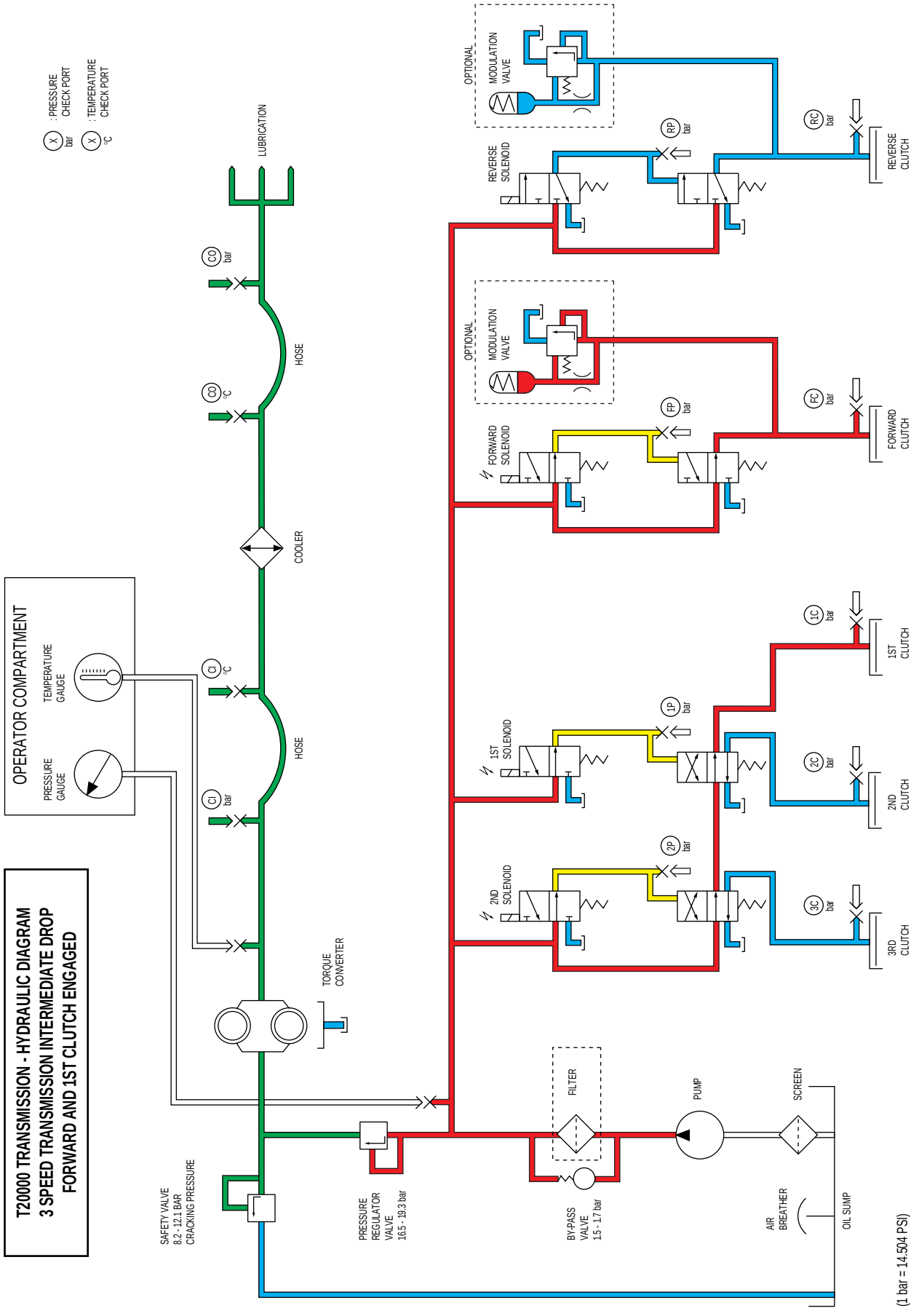


6.3.2 Forward 1st speed

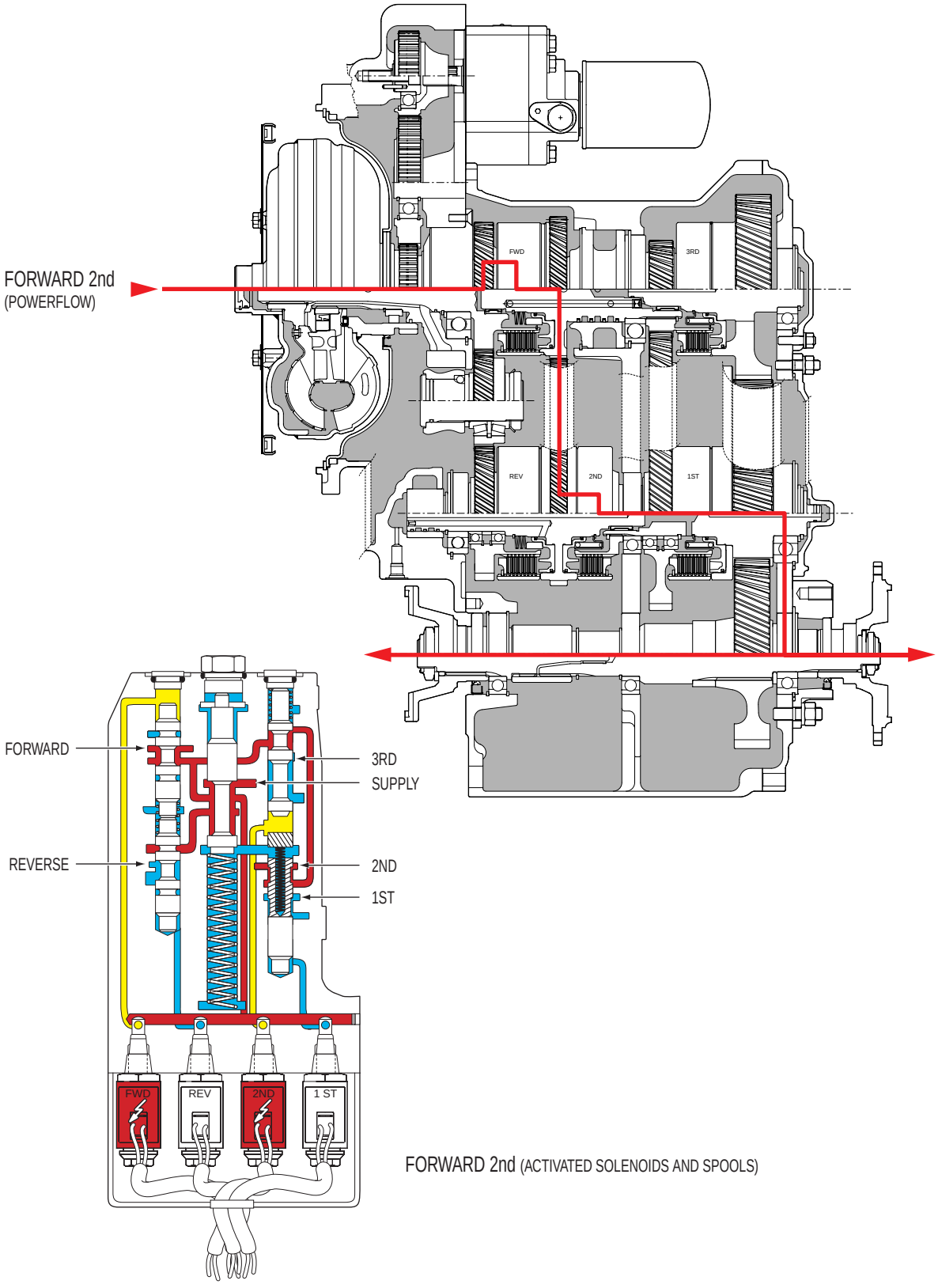


FORWARD 1st (ACTIVATED SOLENOIDS AND SPOOLS)

6.3.2 Forward 1st speed (continued)

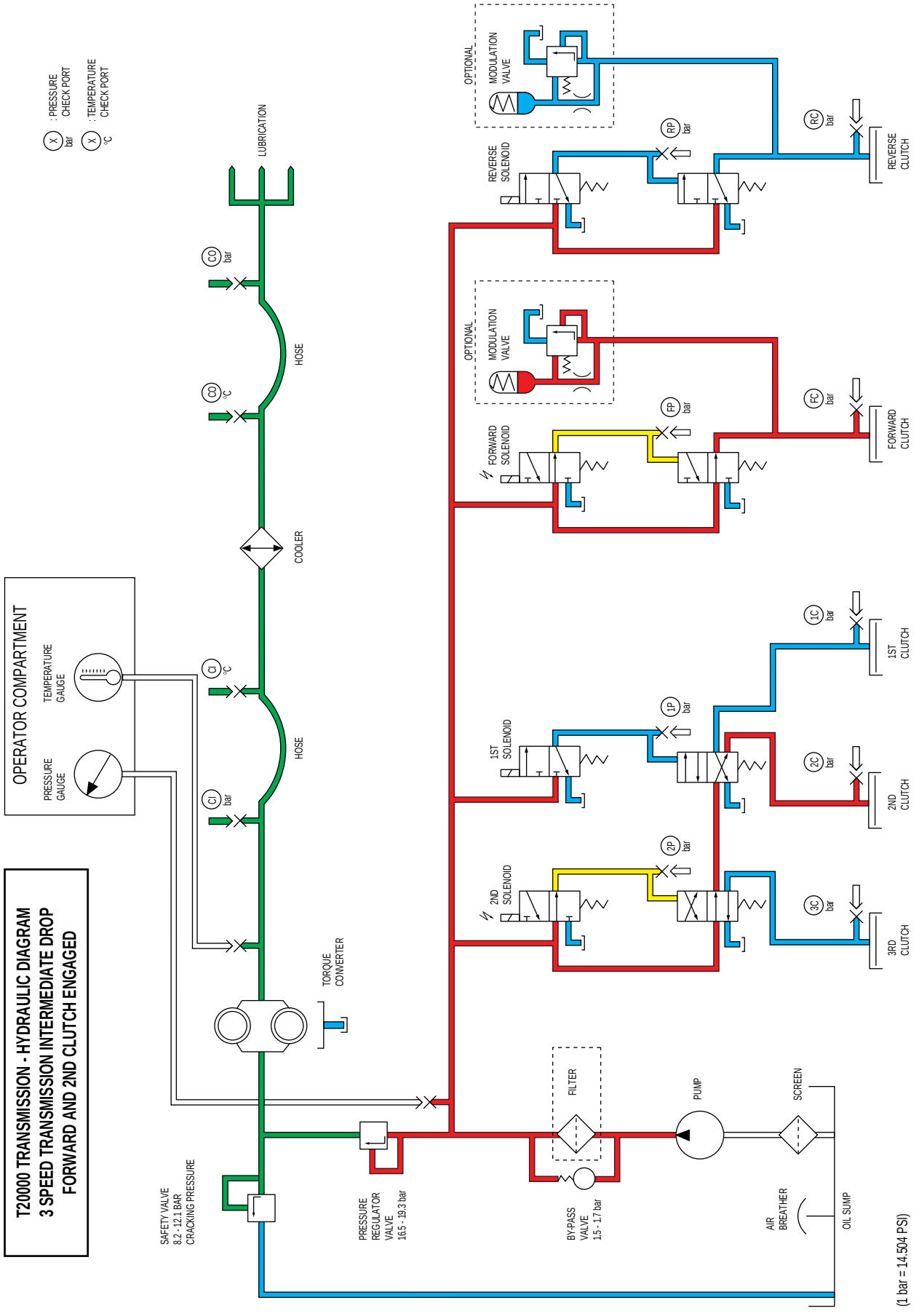


6.3.3 Forward 2nd speed

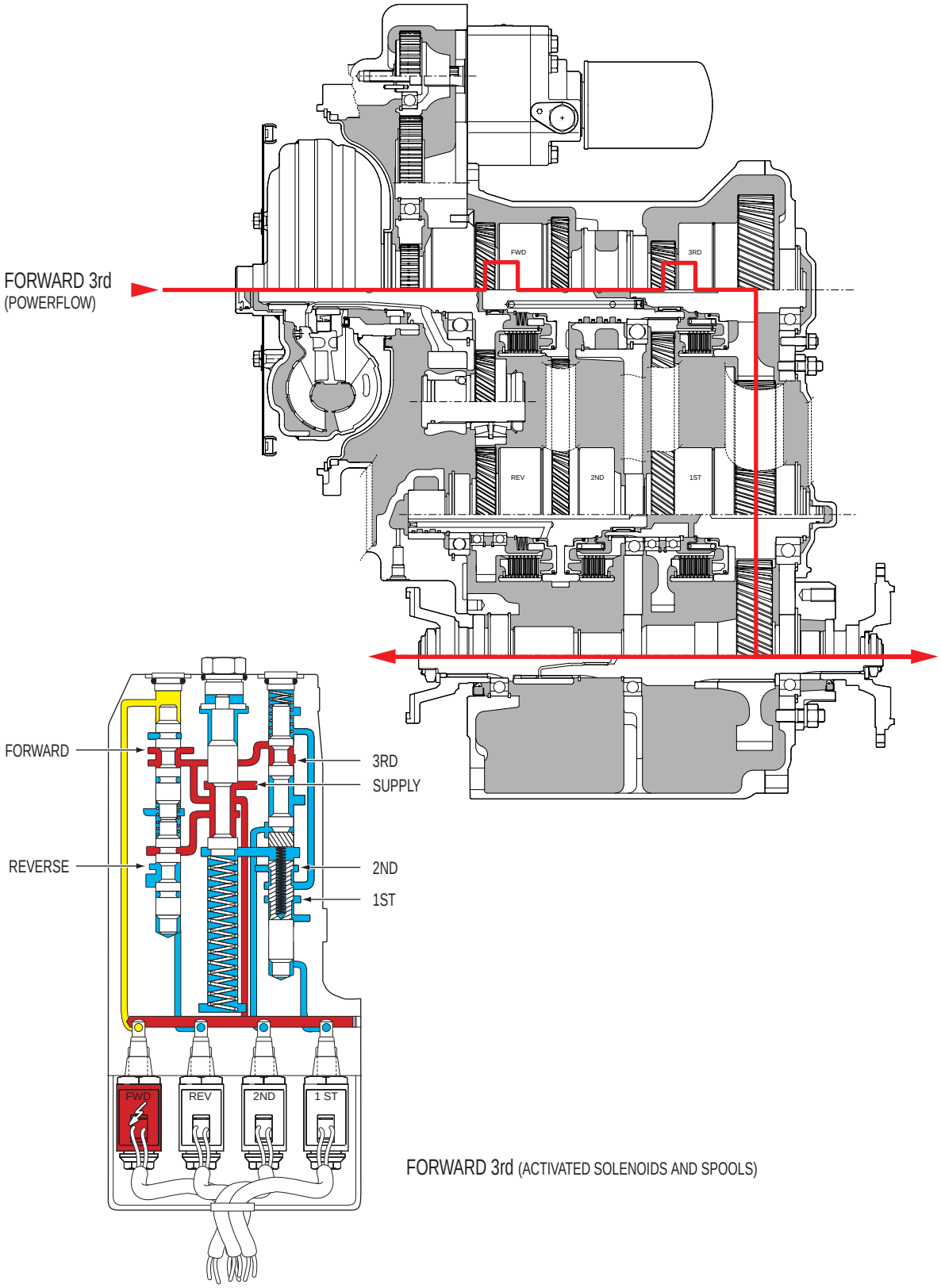


FORWARD 2nd (ACTIVATED SOLENOIDS AND SPOOLS)

6.3.3 Forward 2nd speed (continued)

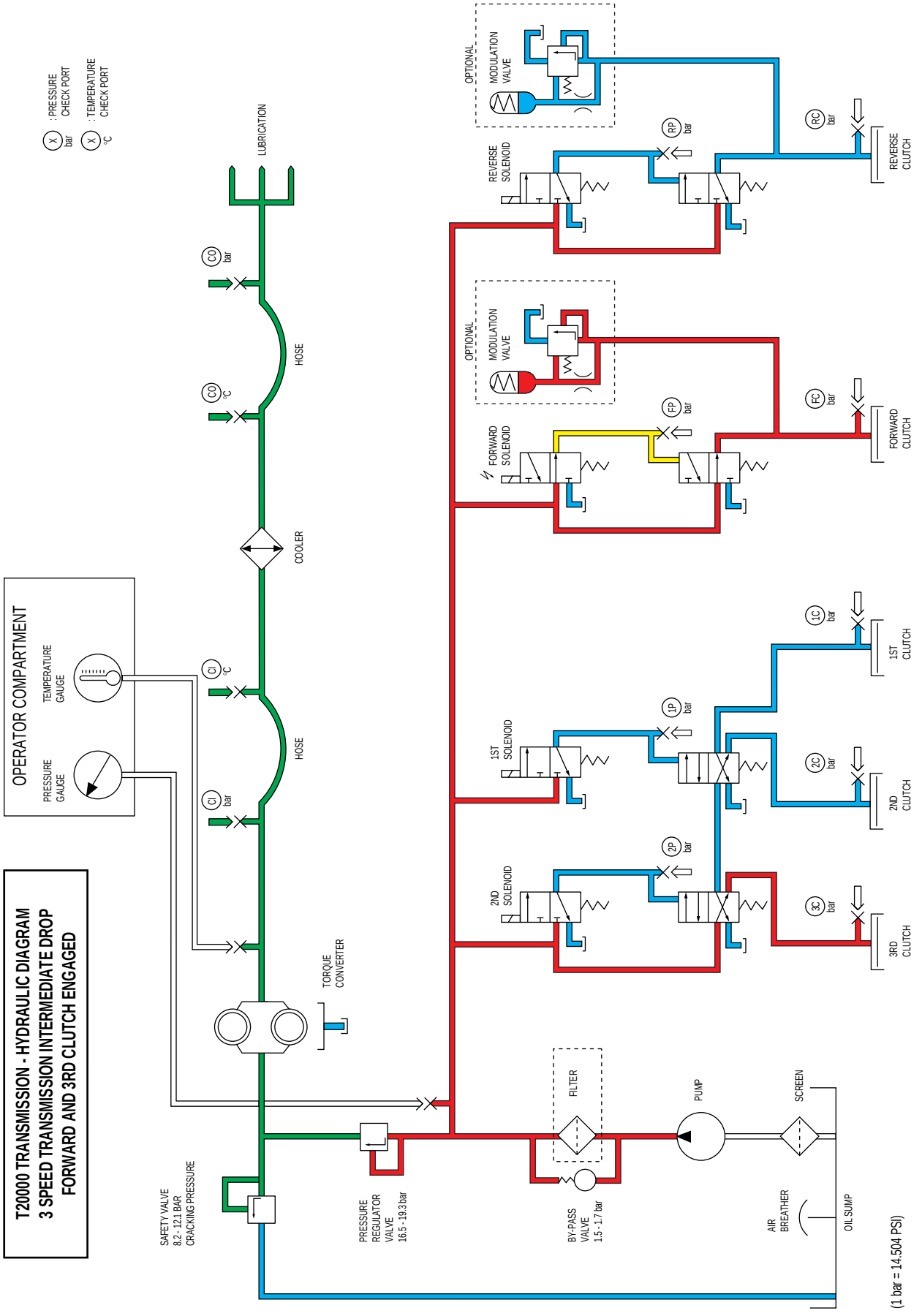


6.3.4 Forward 3rd speed

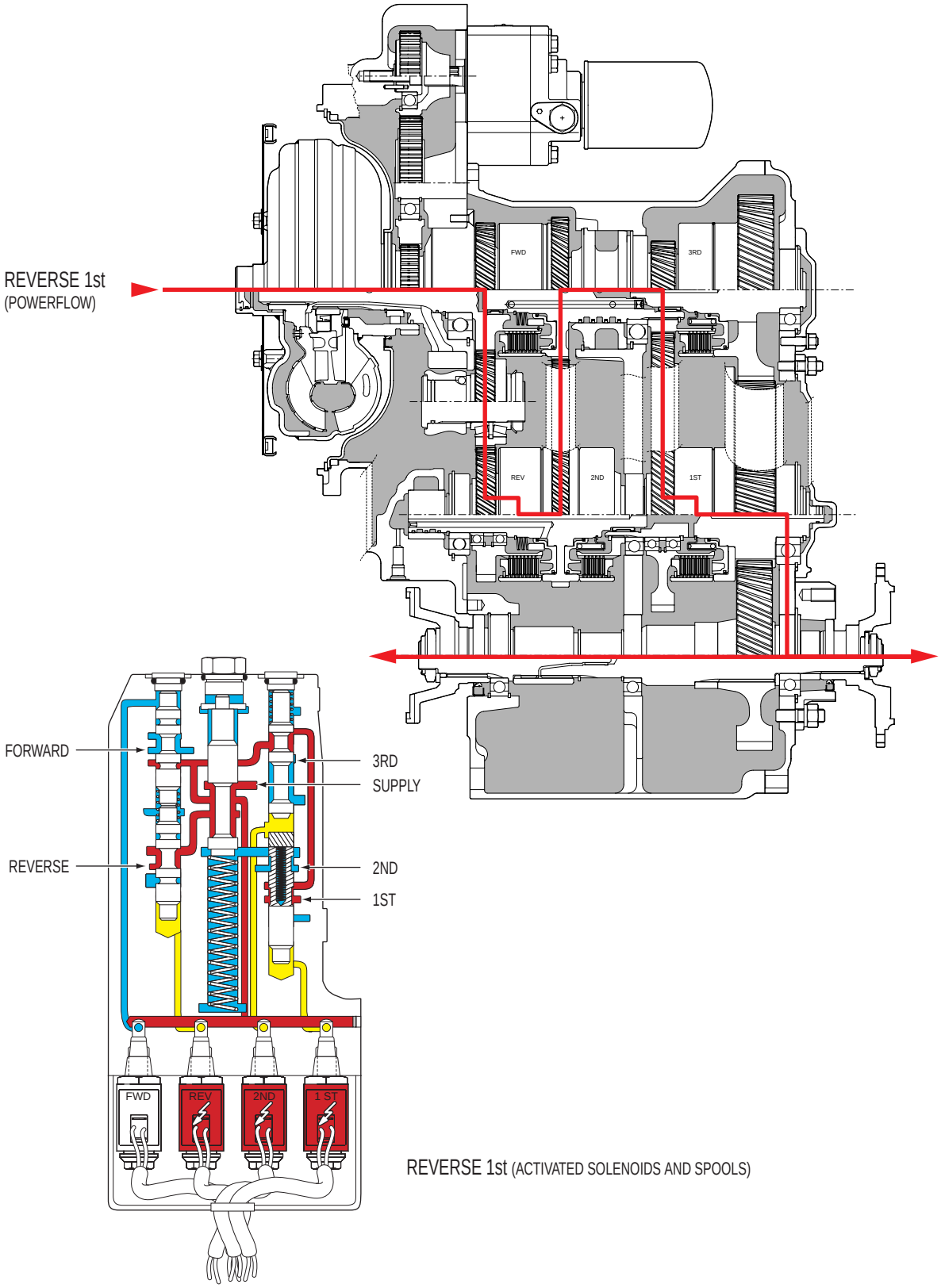


FORWARD 3rd (ACTIVATED SOLENOIDS AND SPOOLS)

6.3.4 Forward 3rd speed (continued)

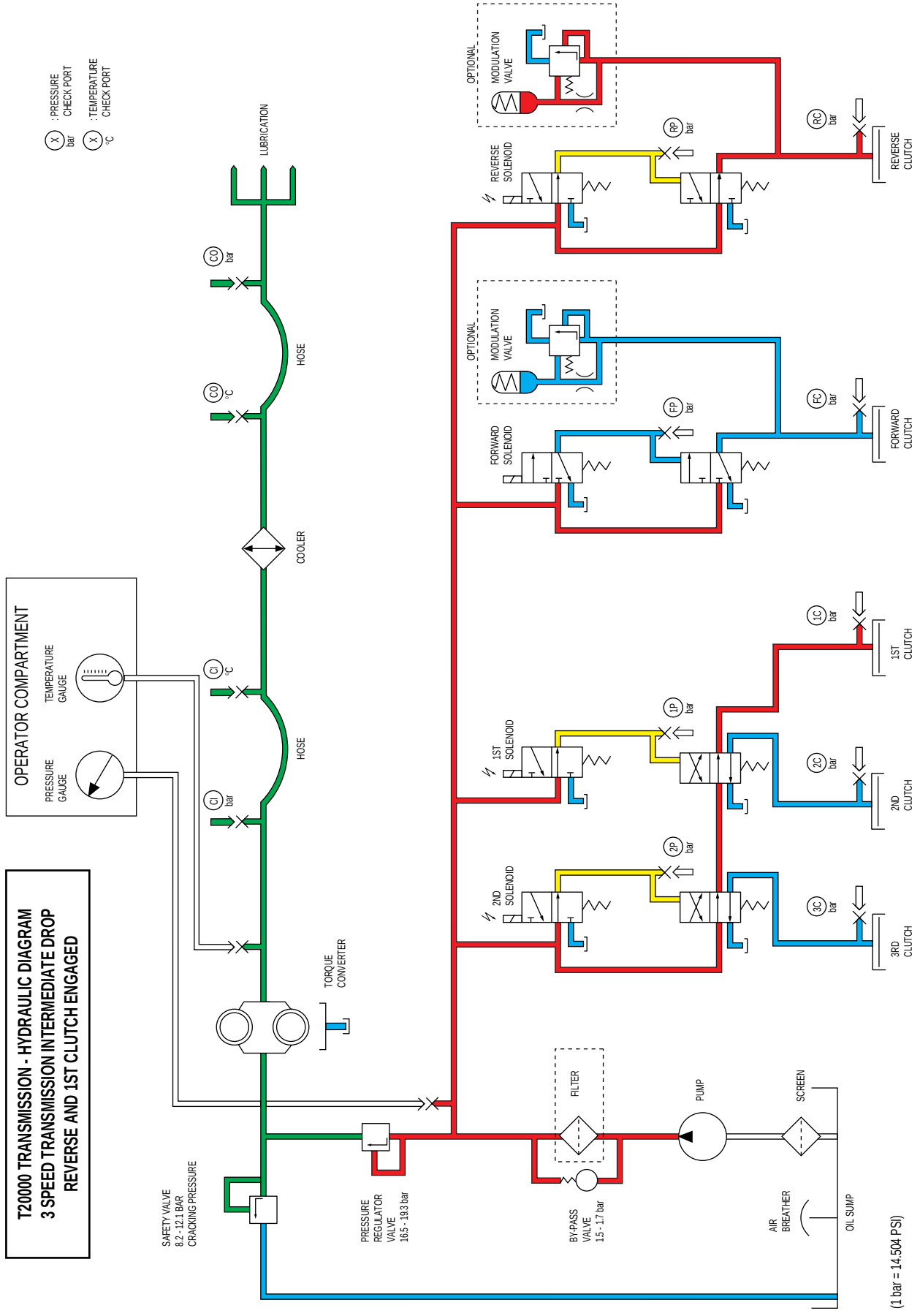


6.3.5 Reverse 1st speed

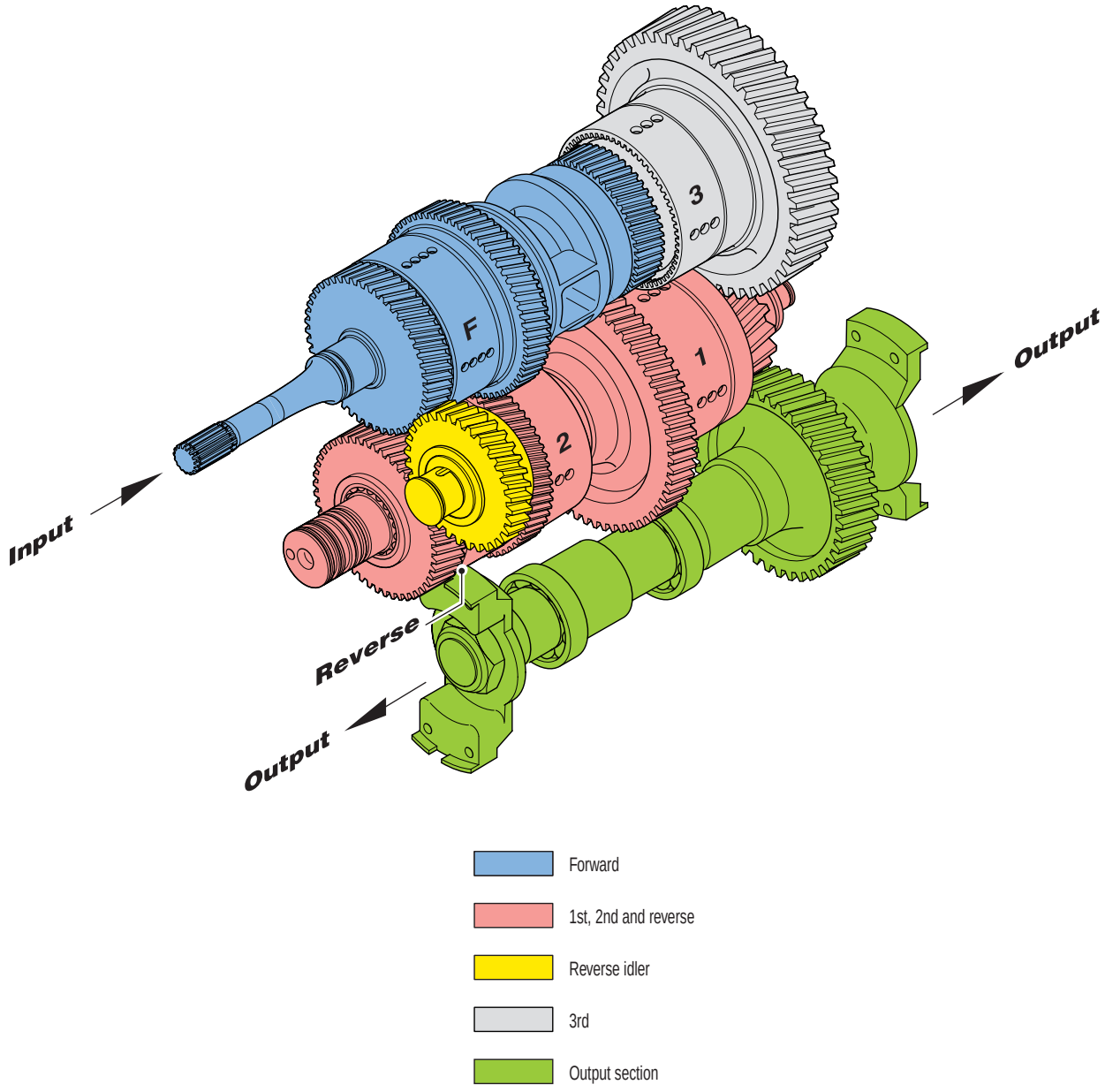


REVERSE 1st (ACTIVATED SOLENOIDS AND SPOOLS)

6.3.5 Reverse 1st speed (continued)



6.4 GEAR AND CLUTCH LAY-OUT



7. TROUBLESHOOTING GUIDE FOR THE T20000 TRANSMISSION

The following information is presented as an aid to isolating and determining the specific problem area in a transmission that is not functioning correctly.

When troubleshooting a “transmission” problem, it should be kept in mind that the transmission is only the central unit of a group of related powertrain components. Proper operation of the transmission depends on the condition and correct functioning of the other components of the group. Therefore, to properly diagnose a suspected problem in the transmission, it is necessary to consider the transmission fluid, charging pump, torque converter, transmission assembly, oil cooler, filter, connecting lines, and controls, including the engine, as a complete system.

By analysing the principles of operation together with the information in this section, it should be possible to identify and correct any malfunction which may occur in the system.

7.1 T20000 TRANSMISSION

T20000 (power shift with torque converter transmission) troubles fall into three general categories:

1. Mechanical problems.
2. Hydraulic problems.
3. Electrical problems.

In addition to the mechanical and electrical components, all of which must be in the proper condition and functioning correctly, the correct functioning of the hydraulic circuit is most important. Transmission fluid is the “life blood” of the transmission. It must be supplied in an adequate quantity and delivered to the system at the correct pressures to ensure converter operation, to engage and hold the clutches from slipping, and to cool and lubricate the working components.

7.2 TROUBLESHOOTING PROCEDURES

7.2.1 Stall Test

A stall test to identifies transmission, converter, or engine problems.

Use following procedure:

1. Put the vehicle against a solid barrier, such as a wall, and/or apply the parking brake and block the wheels.
2. Put the directional control lever in FORWARD (or REVERSE, as applicable).
3. Select the highest speed.
   With the engine running, slowly increase engine speed to approximately one-half throttle and hold until transmission (converter outlet) oil temperature reaches the operating range.

CAUTION

DO NOT OPERATE THE CONVERTER AT STALL CONDITION LONGER THAN 30 SECONDS AT ONE TIME, SHIFT TO NEUTRAL FOR 15 SECONDS AND REPEAT THE PROCEDURE UNTIL DESIRED TEMPERATURE IS REACHED.
EXCESSIVE TEMPERATURE 120 °C (250 F) MAXIMUM WILL CAUSE DAMAGE TO TRANSMISSION CLUTCHES, FLUID, CONVERTER, AND SEALS.

7.2.2 Transmission pressure checks

Transmission problems can be isolated by the use of pressure tests. When the stall test indicates slipping clutches, then measure clutch pack pressure to determine if the slippage is due to low pressure or clutch plate friction material failure.

In addition, converter charging pressure and transmission lubrication pressure can also be measured.

7.2.3 Mechanical and electrical checks

Prior to checking any part of the system for hydraulic function (pressure testing), the following mechanical and electrical checks should be made:

- Check the parking brake and inching pedal for correct adjustment.
- Be sure all lever linkage is properly connected and adjusted in each segment and at all connecting points.
- The controls are actuated electrically. Check the wiring and electrical components.
- Be sure that all components of the cooling system are in good condition and operating correctly. The radiator must be clean to maintain the proper cooling and operating temperatures for the engine and transmission. Air clean the radiator, if necessary.
- The engine must be operating correctly. Be sure that it is correctly tuned and adjusted to the correct idle and maximum no-load governed speed specifications.

7.2.4 Hydraulic checks

Also, before checking the transmission clutches, torque converter, charging pump, and hydraulic circuit for pressure and rate of oil flow, it is important to make the following transmission fluid check:

Check oil level in the transmission. The transmission fluid must be at the correct (full level). All clutches and the converter and its fluid circuit lines must be fully charged (filled) at all times.

Note

THE TRANSMISSION FLUID MUST BE AT OPERATING TEMPERATURE OF 82 - 93 °C (180 - 200 F) TO OBTAIN CORRECT FLUID LEVEL AND PRESSURE READINGS.
DO NOT ATTEMPT TO MAKE THESE CHECKS WITH COLD OIL.

To raise the oil temperature to this specification it is necessary to either operate (work) the vehicle or run the engine with converter at “stall” (Refer to 7.2.1 “Stall test”).

CAUTION

BE CAREFUL THAT THE VEHICLE DOES NOT MOVE UNEXPECTEDLY WHEN OPERATING THE ENGINE AND CONVERTER AT STALL RPM.

7.3 TROUBLESHOOTING GUIDE

Refer to the following troubleshooting guide for the diagnosis of typical transmission troubles.

7.3.1 Low clutch pressure

Cause	Remedy
1. Low oil level.	1. Fill to proper level.
2. Clutch pressure regulating valve stuck open.	2. Clean valve spool and housing.
3. Faulty charging pump.	3. Replace pump.
4. Broken or worn clutch shaft or piston sealing rings.	4. Replace sealing rings.
5. Clutch piston bleed valve stuck open.	5. Clean bleed valves thoroughly.

7.3.2 Low charging pump output

Cause	Remedy
1. Low oil level.	1. Fill to proper level.
2. Suction screen plugged.	2. Clean suction pump.
3. Defective charging pump.	3. Replace pump.

7.3.3 Overheating

Cause	Remedy
1. Worn oil sealing rings.	1. Remove, disassemble, and rebuild converter assembly.
2. Worn charging pump.	2. Replace charging pump.
3. Low oil level.	3. Fill to proper level.
4. Dirty oil cooler.	4. Clean cooler.
5. Restriction in cooler lines.	5. Change cooler lines.

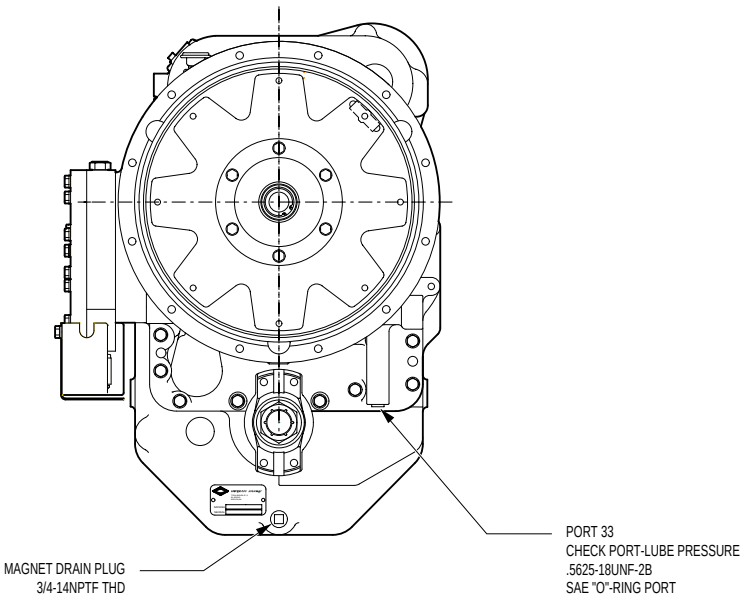
7.3.4 Noisy converter

Cause	Remedy
1. Worn charging pump.	1. Replace charging pump.
2. Worn or damaged bearings.	2. A complete disassembly will be necessary to determine which bearing is faulty.

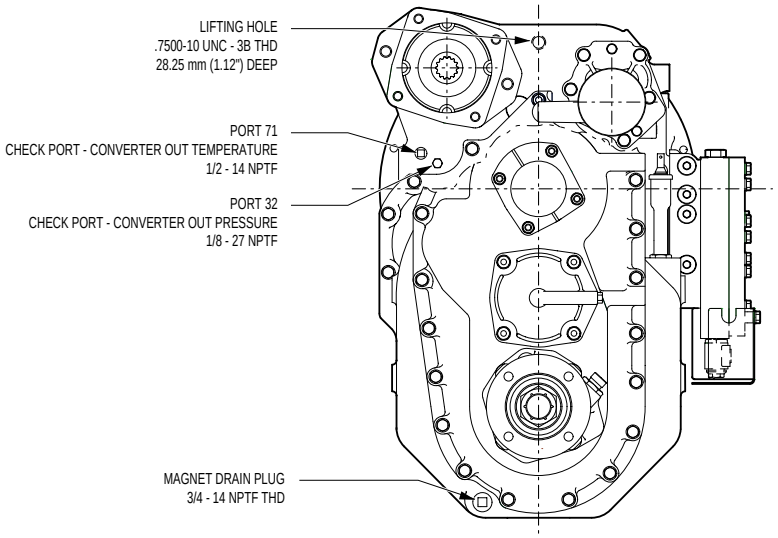
7.3.5 Lack of power

Cause	Remedy
1. Low engine RPM at converter stall.	1. Tune engine check governor.
2. See “Overheating” and make same checks.	2. Make corrections as explained in “Overheating”.

7.4 CHECK POINTS

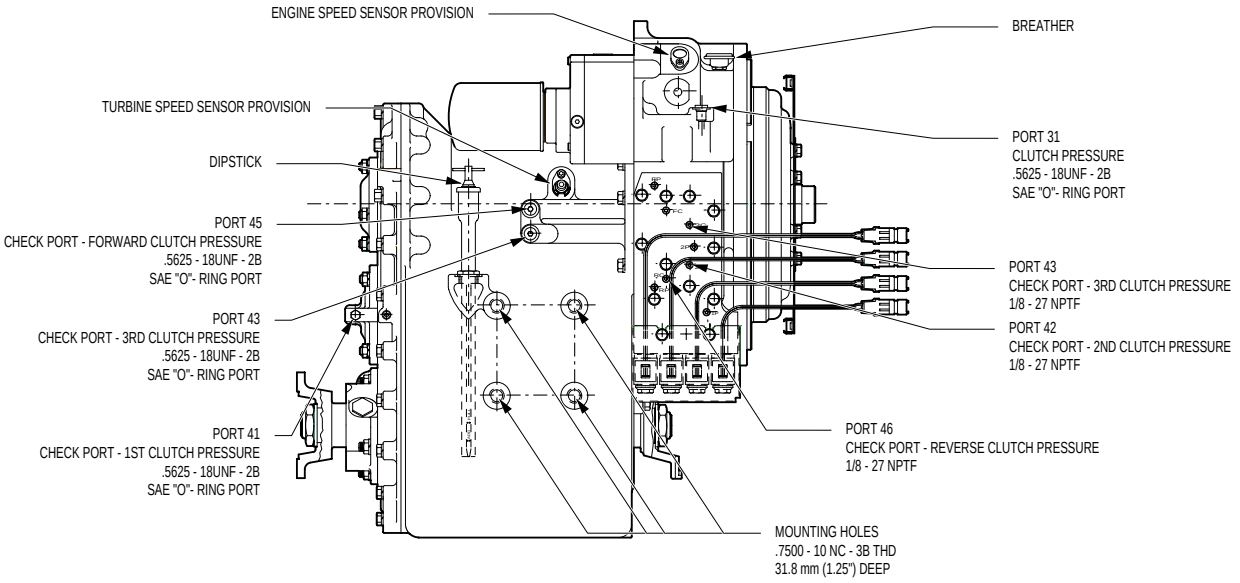


FRONT VIEW

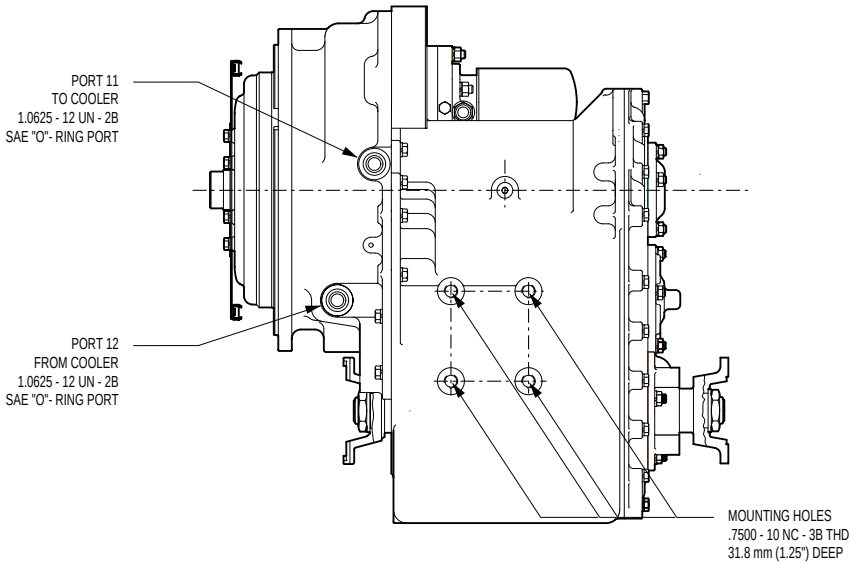


REAR VIEW

7.4 CHECK POINTS (CONTINUED)

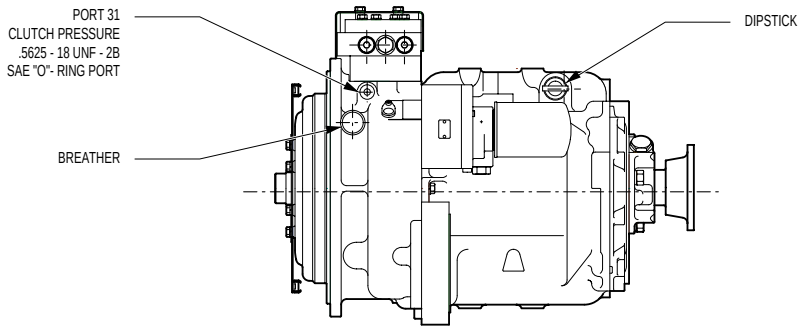


RIGHT SIDE VIEW



LEFT SIDE VIEW

7.4 CHECK POINTS (CONTINUED)



TOP VIEW

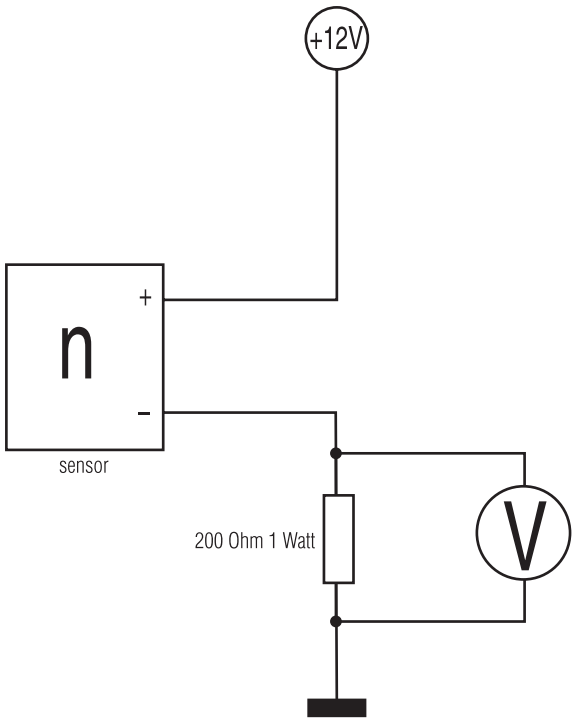
7.5 SPEED SENSOR - STATIC STANDALONE TEST

In order to be able to sense the currents, a series resistor of e.g. 200 Ohms must be used. This resistor is integrated in the controller, but when the sensor is to be tested, it must be connected externally.

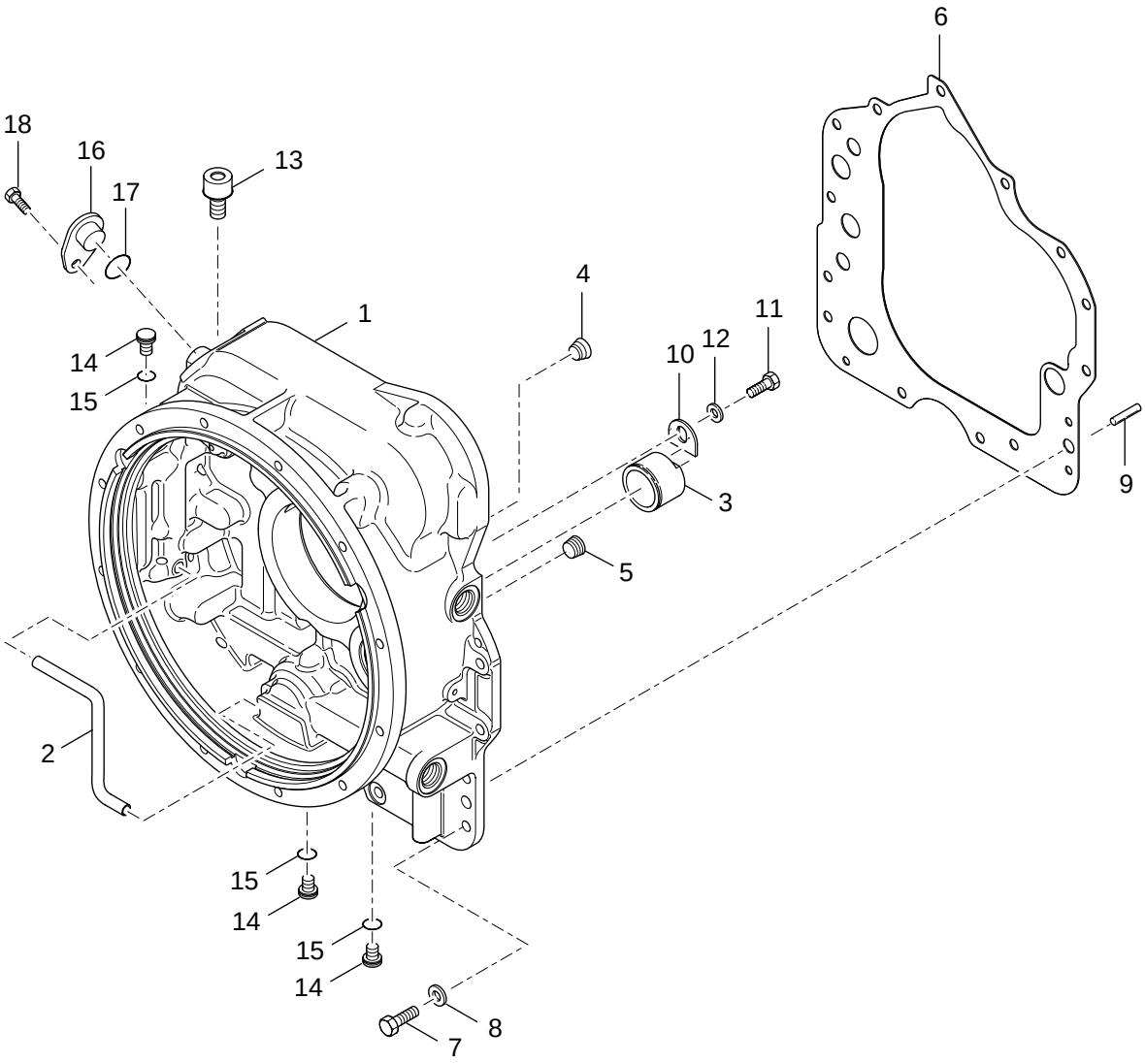
The idea is to connect the sensor to an external power source and measure the DC voltage across the series resistor.

The voltage reading should be either 1.2V-1.6V (for the 7mA ± 1mA current level) or 2.6-3.0V (for the 14mA ± 1mA current level)

If the teeth can be moved slowly, distinct toggling between the two levels should be noticed.

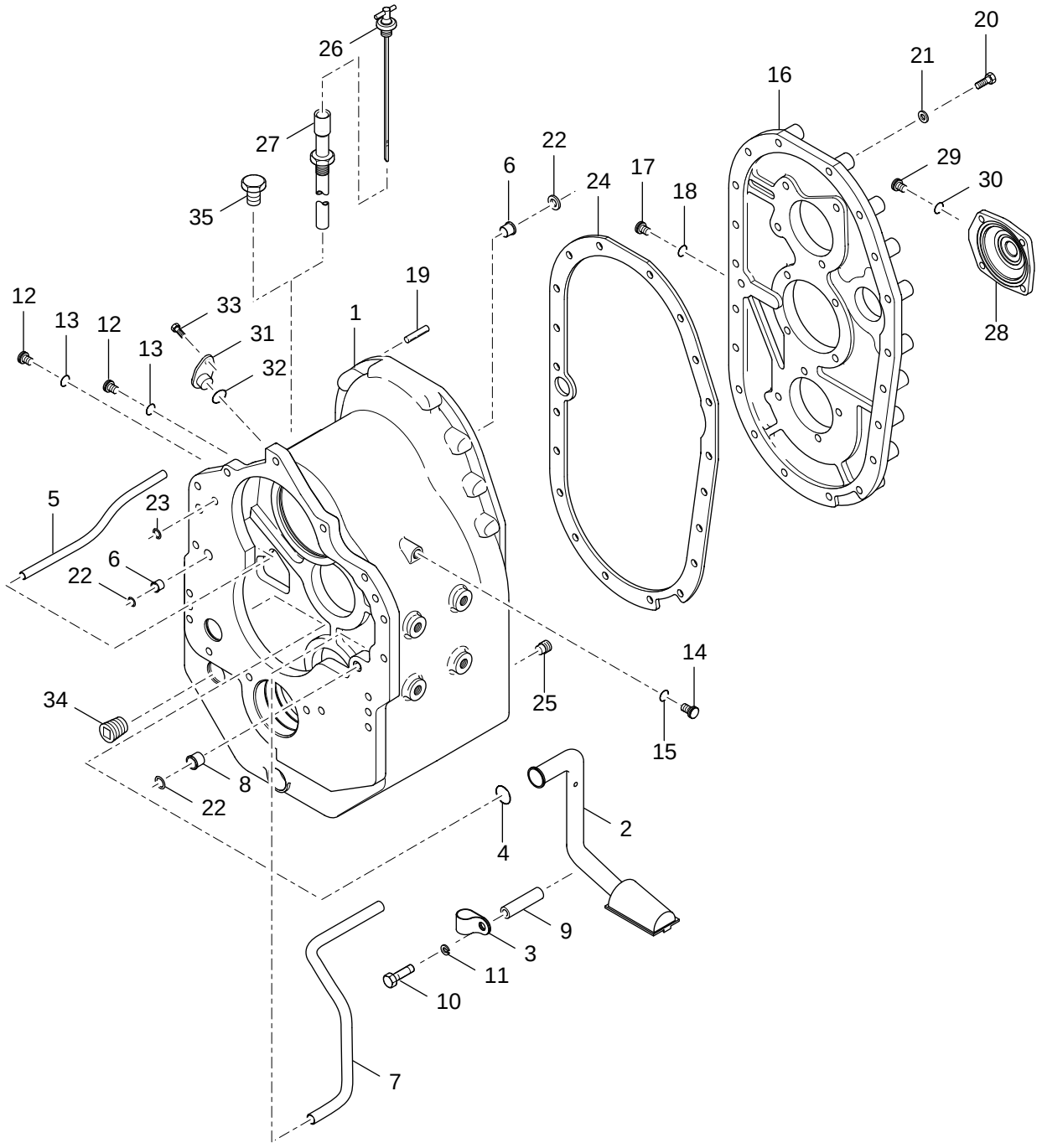


8. SECTIONAL VIEWS AND PARTS IDENTIFICATION


18
16
17
13
6
1
4
11
10
12
14
15
3
9
5
2
15
14
15
14
8
7

GROUP - CONVERTER HOUSING

Item	Description	Quantity
1	Housing - Converter	1
2	Tube - Lube	1
3	Sleeve - Converter housing	1
4	Plug - Pipe	1
5	Plug - Pipe	1
6	Gasket - Converter housing to to transmission case	1
7	Screw - Converter housing to transmission case	16
8	Lockwasher - Converter housing to transmission case screw	16
9	Pin - Converter housing to transmission case dowel	1
10	Clip	1
11	Screw - Clip	1
12	Lockwasher - Clip screw	1
13	Air - Breather	1
14	Plug	3
15	“O”-ring	3
16	Plug - Speed sensor port	1
17	“O”-ring - Speed sensor	1
18	Screw - Speed sensor	1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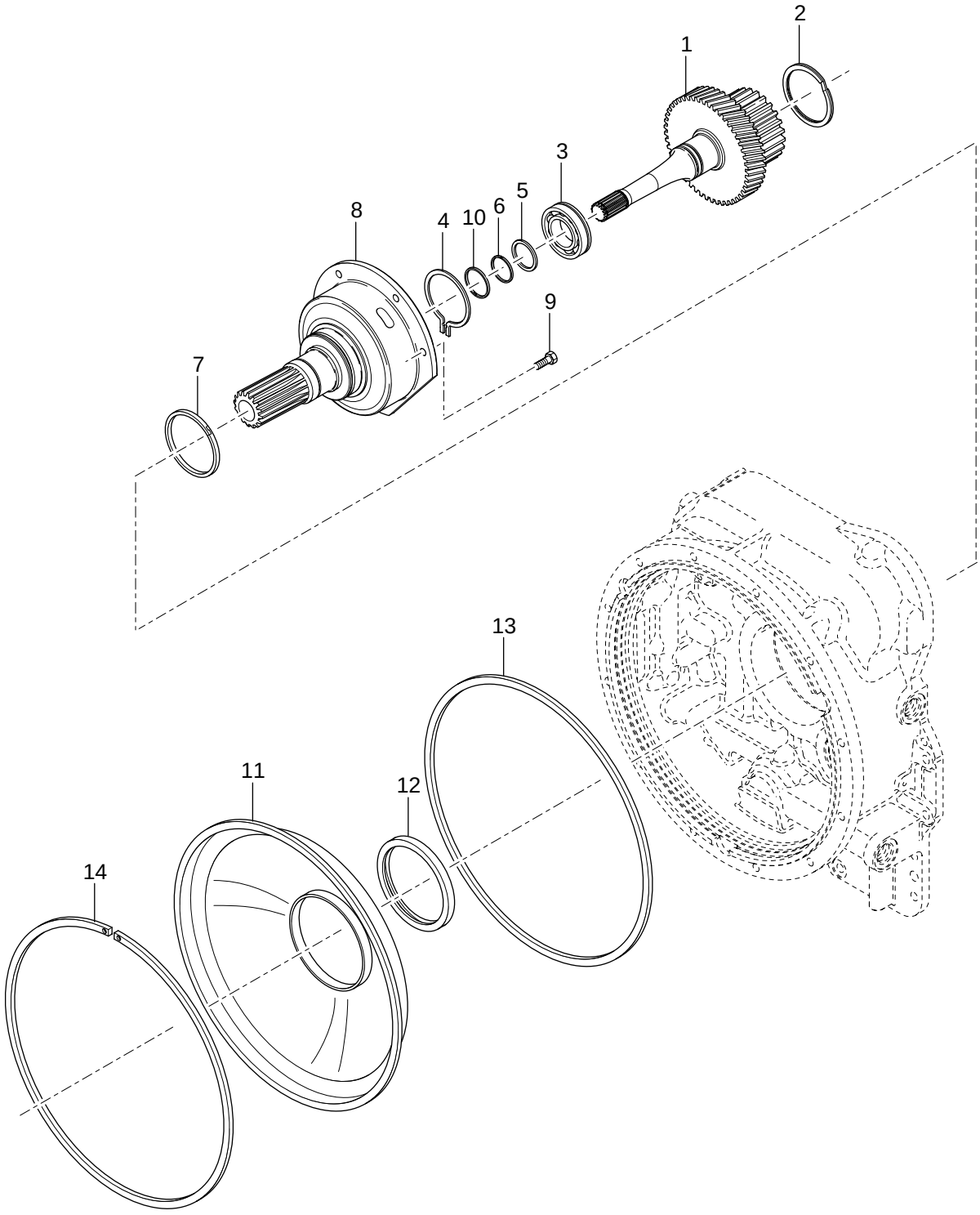
GROUP -TRANSMISSION CASE AND REAR COVER

Item	Description	Quantity
1	Case - Transmission	1
2	Assembly - Suction tube	1
3	Clip - Tube	1
4	“O”-ring - Suction tube assembly	1
5	Tube - Low speed pressure	1
6	Sleeve - Clutch pressure tube	2
7	Tube - Lube	1
8	Sleeve - Tube	1
9	Spacer - Tube clip	1
10	Screw - Tube clip	1
11	Lockwasher - Tube clip screw	1
12	Plug	2
13	“O”-ring	2
14	Plug	1
15	“O”-ring	1
16	Cover - Rear	1
17	Plug	1
18	“O”-ring	1
19	Pin - Transmission case to rear cover dowel	1
20	Screw - Rear cover to transmission case	20
21	Lockwasher - Rear cover to transmission case screw	20
22	“O”-ring - Clutch pressure tube	3
23	“O”-ring - Clutch pressure	2
24	Gasket - Transmission case to rear cover	1
25	Plug - Magnetic drain	2
26	Dipstick	1
27	Assembly - Dipstick tube	1
28	Cap - Low shaft bearing	1
29	Plug	1
30	“O”-ring	1
31	Plug - Speed sensor port	1
32	“O”-ring - Speed sensor port plug	1
33	Screw - Speed sensor port plug	1
34	Plug	1
35	Plug - Dipstick hole	1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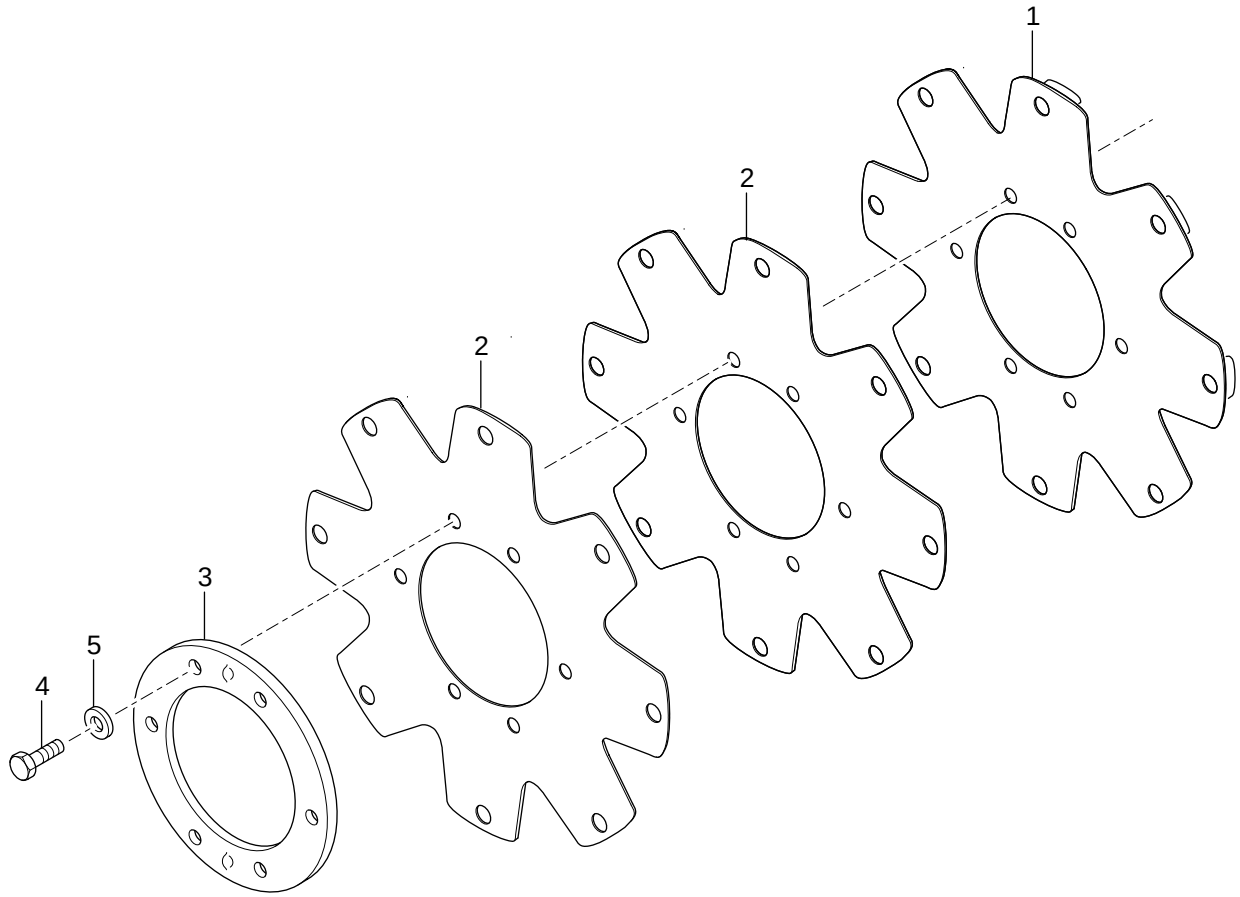
GROUP - TURBINE SHAFT

Item	Description	Quantity
1	Assembly - Turbine shaft & hub	1
2	Ring - Retaining	1
3	Bearing - Ball	1
4	Snap ring - Bearing	1
5	Washer - Bearing support	1
6	Ring - Bearing retaining	1
7	Ring - Piston	1
8	Support - Stator	1
9	Screw - Stator support	6
10	Ring - Piston	1
11	Baffle - Oil	1
12	Seal - Oil baffle	1
13	Ring - Oil baffle seal	1
14	Ring - Oil baffle retaining	1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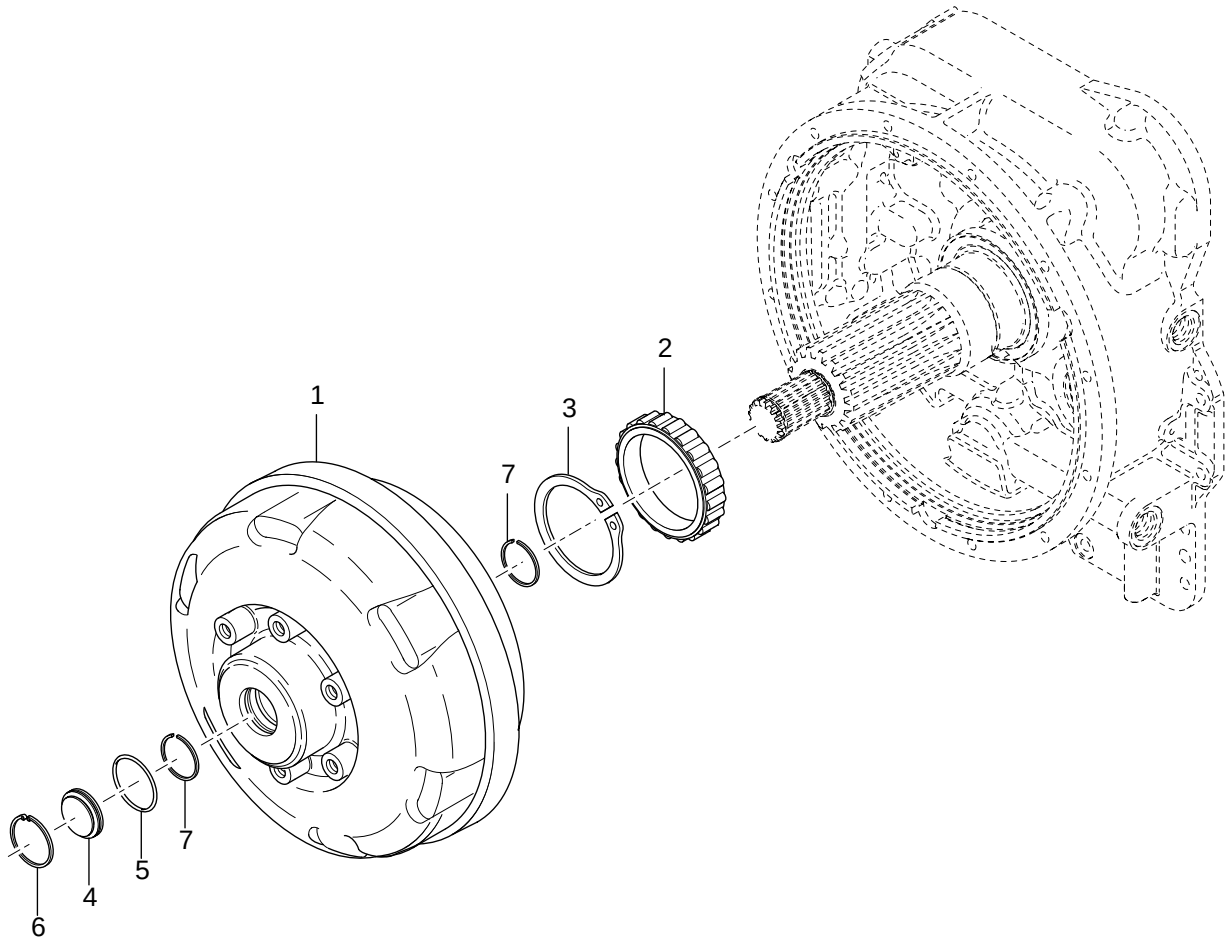
GROUP - DRIVE PLATE

Item	Description	Quantity
1	Assembly - Drive plate	1
2	Drive - Plate	2
3	Ring - Drive plate backing	1
4	Screw - Drive plate mounting	6
5	Lockwasher - Drive plate mounting	6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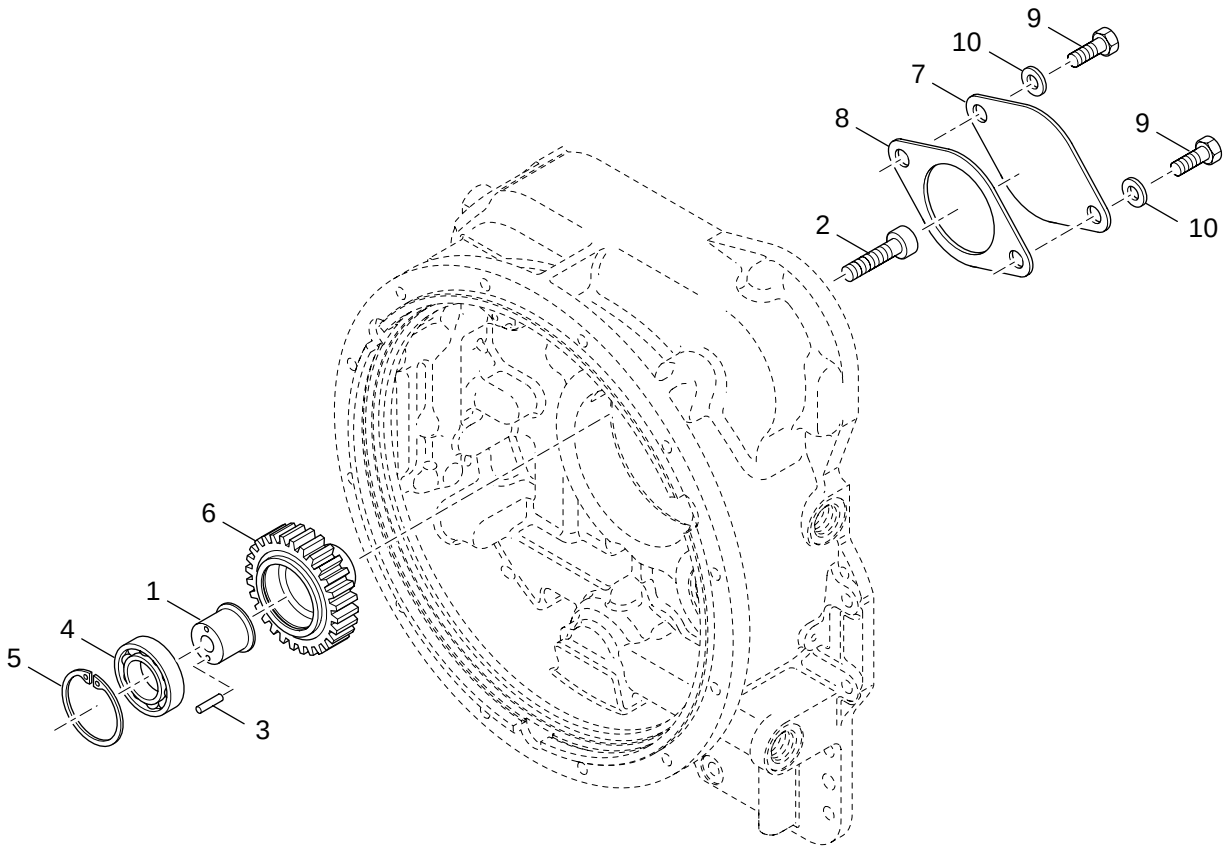
GROUP - TORQUE CONVERTER

Item	Description	Quantity
1	Assembly - Torque converter	1
2	Bearing - Impeller hub gear	1
3	Ring - External snap	1
4	Plug - Torque converter	1
5	“O”-ring - Torque converter plug	1
6	Ring - Snap	1
7	Ring - Turbine retaining	2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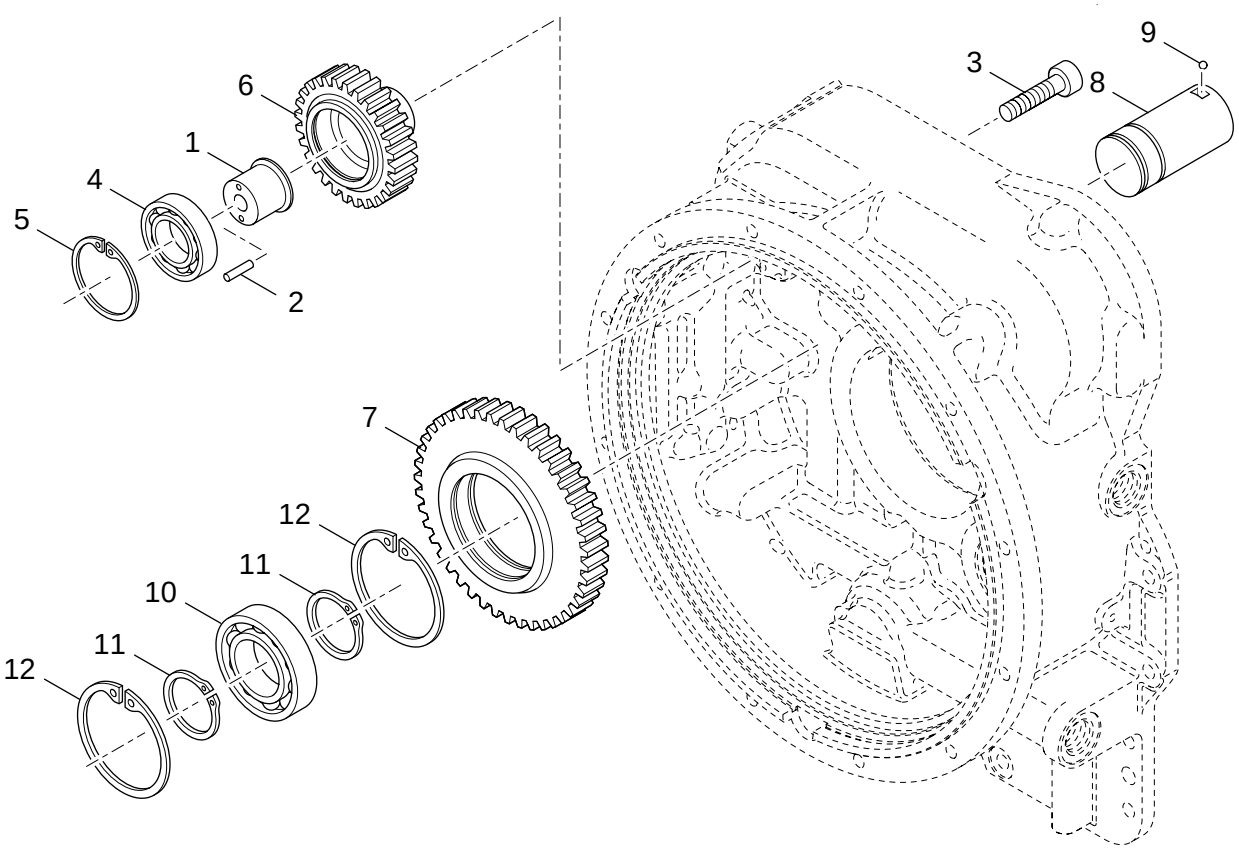
GROUP - AUXILIARY PUMP DRIVE

Item	Description	Quantity
1	Support - Pump drive bearing	1
2	Screw - Bearing support	1
3	Pin - Bearing support	1
4	Bearing - Ball	1
5	Ring - Drive gear bearing retaining	1
6	Gear - Auxiliary pump drive	1
7	Cover - Pump mounting permanent	1
8	Gasket - Shipping cover	1
9	Screw - Pump mounting permanent cover	2
10	Lockwasher - Pump cover screw	2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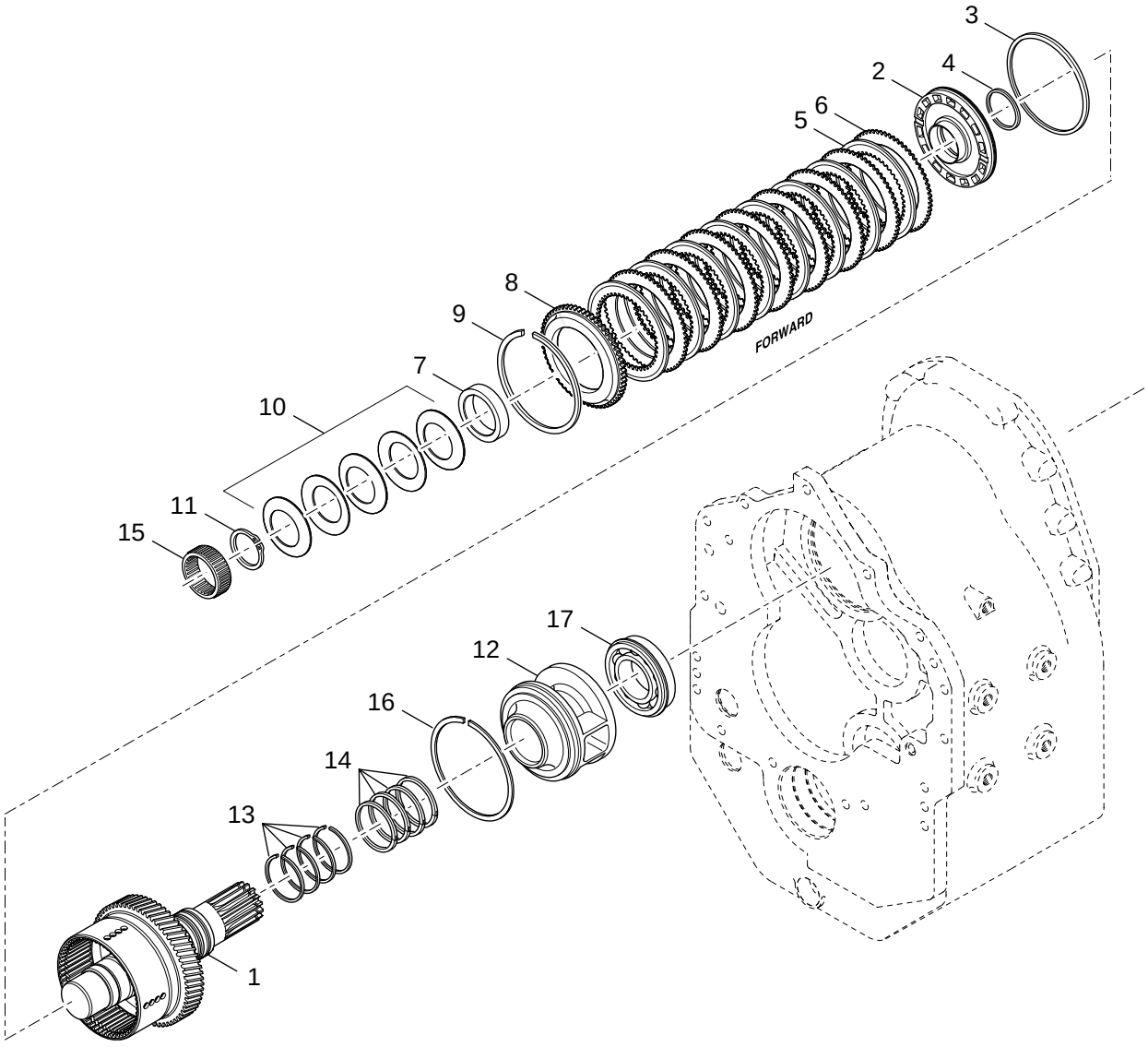
GROUP - PUMP DRIVE

Item	Description	Quantity
1	Support - Pump drive bearing	1
2	Pin - Bearing support	1
3	Screw - Bearing support	1
4	Bearing - Ball	1
5	Ring - Drive gear bearing retaining	1
6	Gear - Charging pump drive	1
7	Gear - Pump drive idler	1
8	Shaft - Idler gear stub	1
9	Ball - Idler shaft lock	1
10	Bearing - Ball	1
11	Ring - Idler gear bearing location	2
12	Ring - Idler gear bearing retaining	2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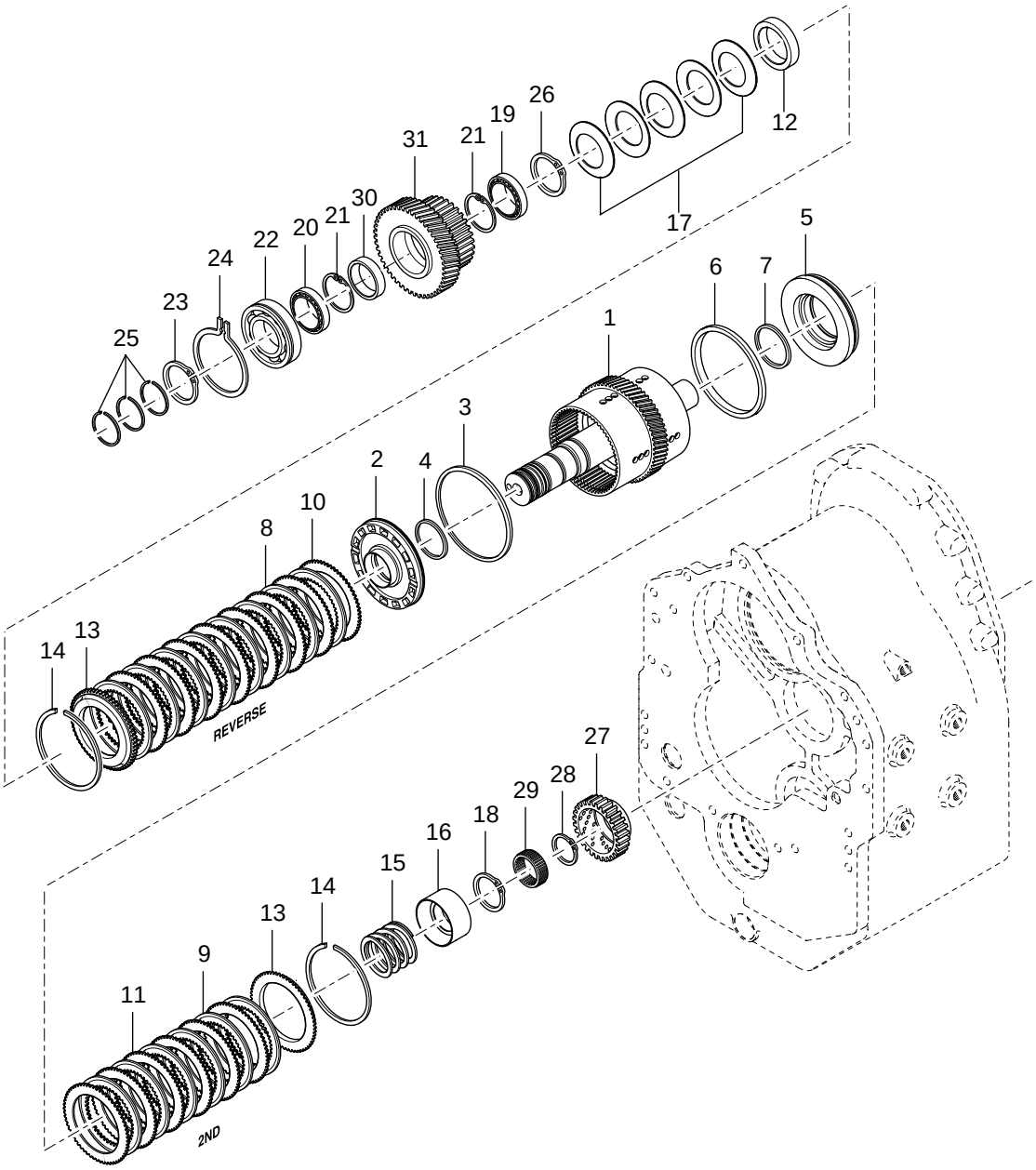
GROUP - FORWARD SHAFT

Item	Description	Quantity
1	Assembly - Forward shaft, drum and plug	1
2	Piston - Clutch	1
3	Seal - Clutch piston (Outer)	1
4	Seal - Clutch piston (Inner)	1
5	Disc - Clutch (Inner)	8
6	Disc - Clutch (Outer)	8
7	Spacer - Piston return spring	1
8	Plate - Clutch disk backing	1
9	Snap ring - Backing plate	1
10	Assembly - Disc spring	1
11	Snap ring - Spring retaining	1
12	Sleeve - Piston ring	1
13	Spring - Piston ring expander	4
14	Ring - Piston	4
15	Bearing - Forward shaft front	1
16	Snap ring	1
17	Bearing - Forward shaft rear	1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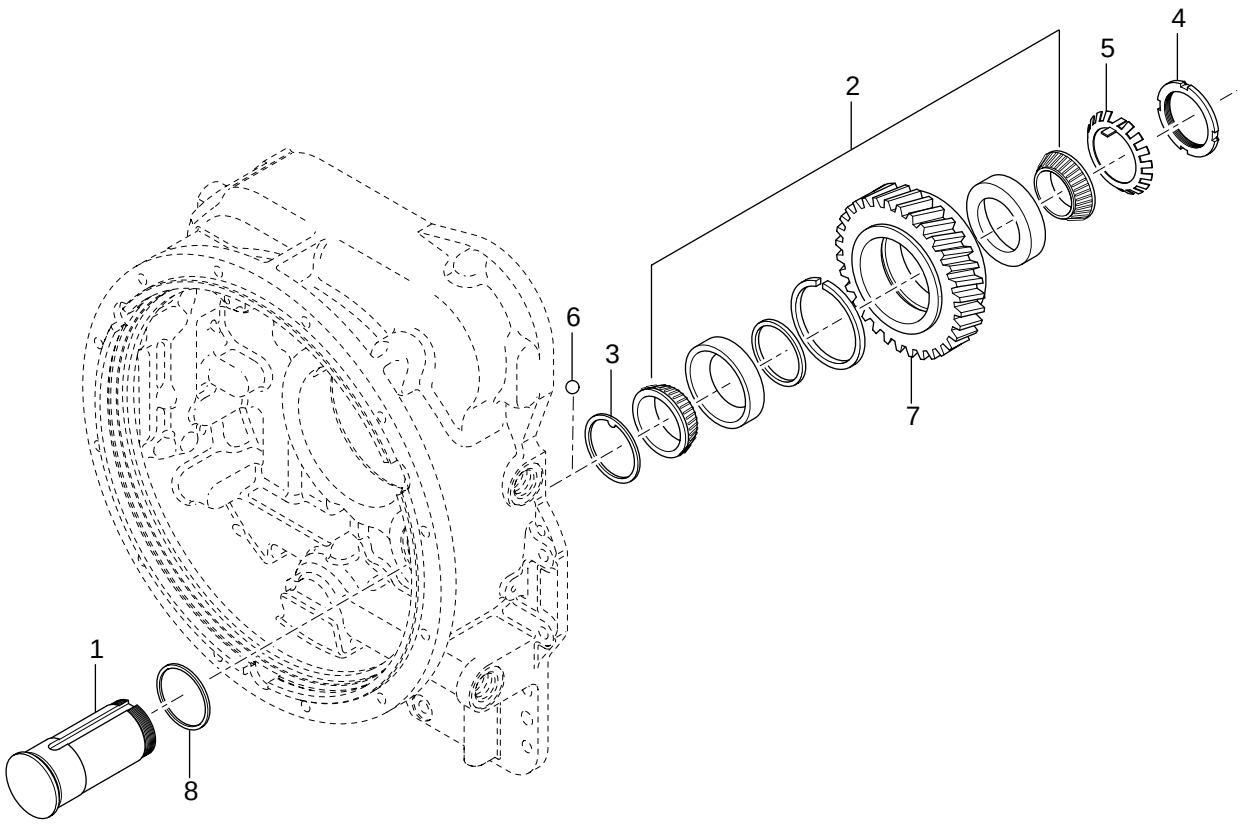
GROUP - REVERSE AND 2ND SHAFT

Item	Description	Quantity
1	Assembly - Reverse, 2nd shaft & drum	1
2	Piston - Clutch	1
3	Seal - Clutch piston (Outer)	1
4	Seal - Clutch piston (Inner)	1
5	Piston - Clutch	1
6	Seal - Clutch piston (Outer)	1
7	Seal - Clutch piston (Inner)	1
8	Disc - Clutch (Inner)	8
9	Disc - Clutch (Inner)	6
10	Disc - Clutch (Outer)	8
11	Disc - Clutch (Outer)	6
12	Spacer - Piston return spring	1
13	Plate - Clutch disc backing	2
14	Snap ring - Backing plate	2
15	Spring - Piston return	1
16	Retainer - Spring	1
17	Assembly - Disc spring	1
18	Snap ring - Spring retaining	1
19	Bearing - Clutch driven gear	1
20	Bearing - Clutch driven gear	1
21	Ring - Reverse clutch gear bearing	2
22	Bearing - Ball	1
23	Ring - Front bearing retaining	1
24	Snap ring - Front bearing	1
25	Ring - Piston	3
26	Snap ring - Spring retaining	1
27	Hub - 2nd clutch	1
28	Ring - 2nd clutch disc hub retaining	1
29	Bearing - Needle	1
30	Spacer - Reverse clutch gear	1
31	Gear - Reverse clutch	1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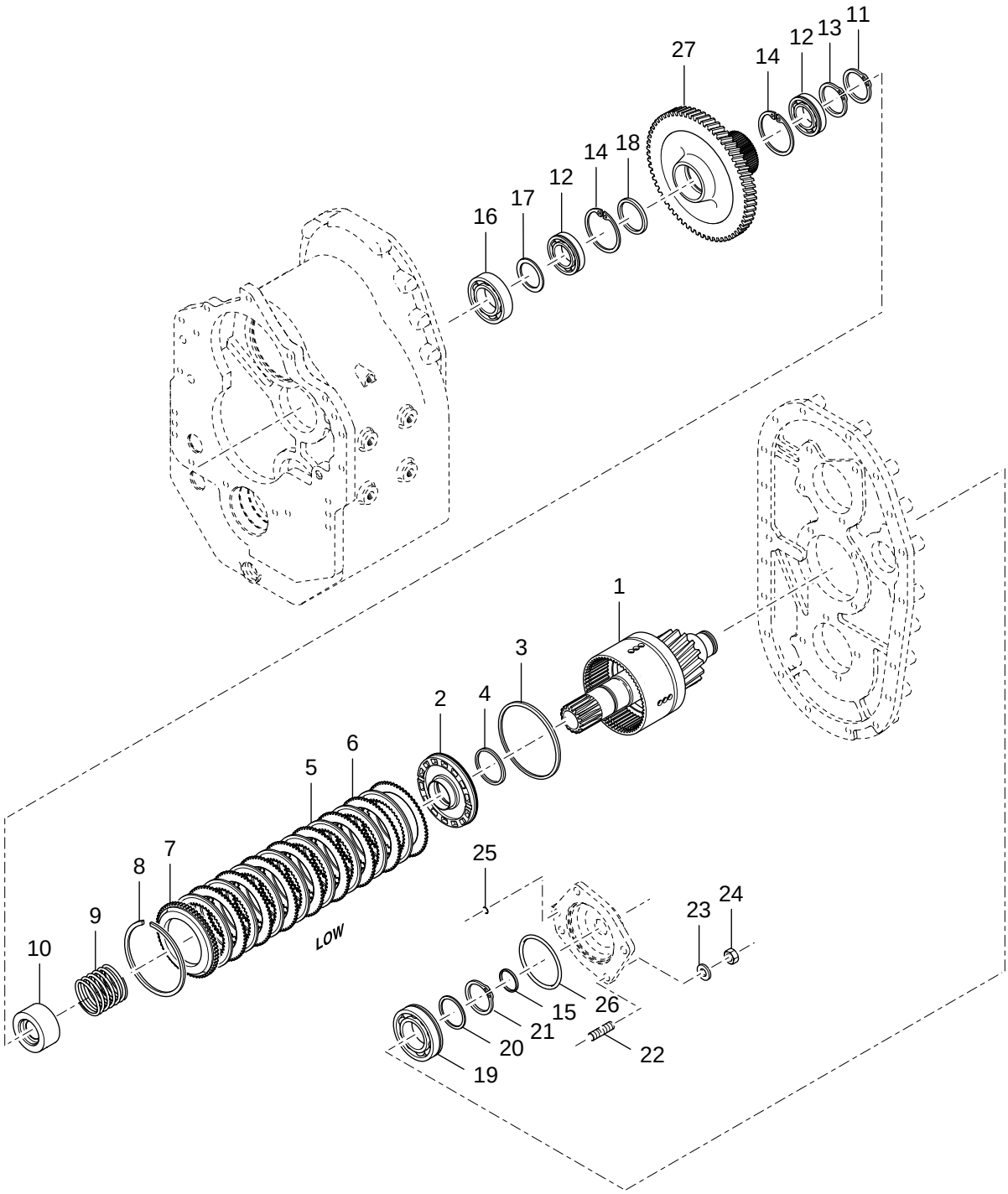
GROUP - REVERSE IDLER

Item	Description	Quantity
1	Shaft - Reverse idler	1
2	Assembly - Reverse idler bearing	1
3	Washer	1
4	Nut - Bearing retaining	1
5	Washer - Bearing retaining	1
6	Lockball - Idler shaft	1
7	Gear - Reverse idler	1
8	“O”-ring - Idler shaft	1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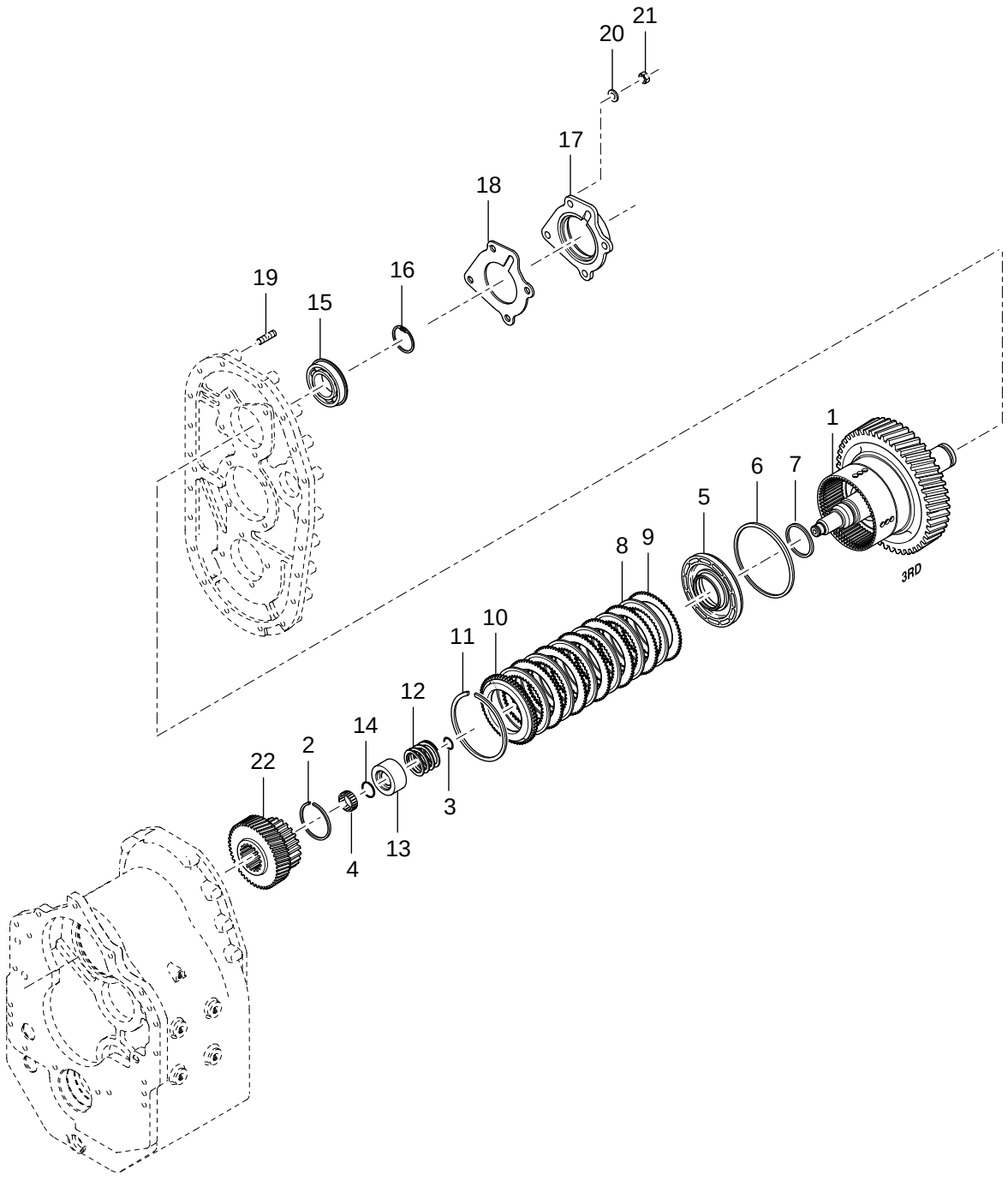
GROUP - LOW SPEED SHAFT

Item	Description	Quantity
1	Assembly - Low shaft drum	1
2	Piston - Clutch	1
3	Seal - Clutch piston (Outer)	1
4	Seal - Clutch piston (Inner)	1
5	Disc - Clutch (Inner)	8
6	Disc - Clutch (Outer)	8
7	Plate - Clutch disc backing	1
8	Ring - Backing plate retaining	1
9	Spring - Piston return	1
10	Retainer - Spring	1
11	Snap ring - Spring retainer	1
12	Bearing - Low speed gear	2
13	Ring - Low speed gear bearing retainer	1
14	Ring - Low speed gear bearing locating	2
15	Ring - Low shaft piston	1
16	Bearing - Low speed clutch shaft front	1
17	Spacer - Low speed shaft front bearing	1
18	Spacer - Low speed gear	1
19	Bearing - Low speed shaft rear	1
20	Washer - Rear bearing support	1
21	Ring - Rear bearing retainer	1
22	Stud - Bearing cap	4
23	Lockwasher - Bearing cap stud	4
24	Nut - Bearing cap stud	4
25	“O”-ring - Rear bearing cap	1
26	“O”-ring - Rear bearing cap	1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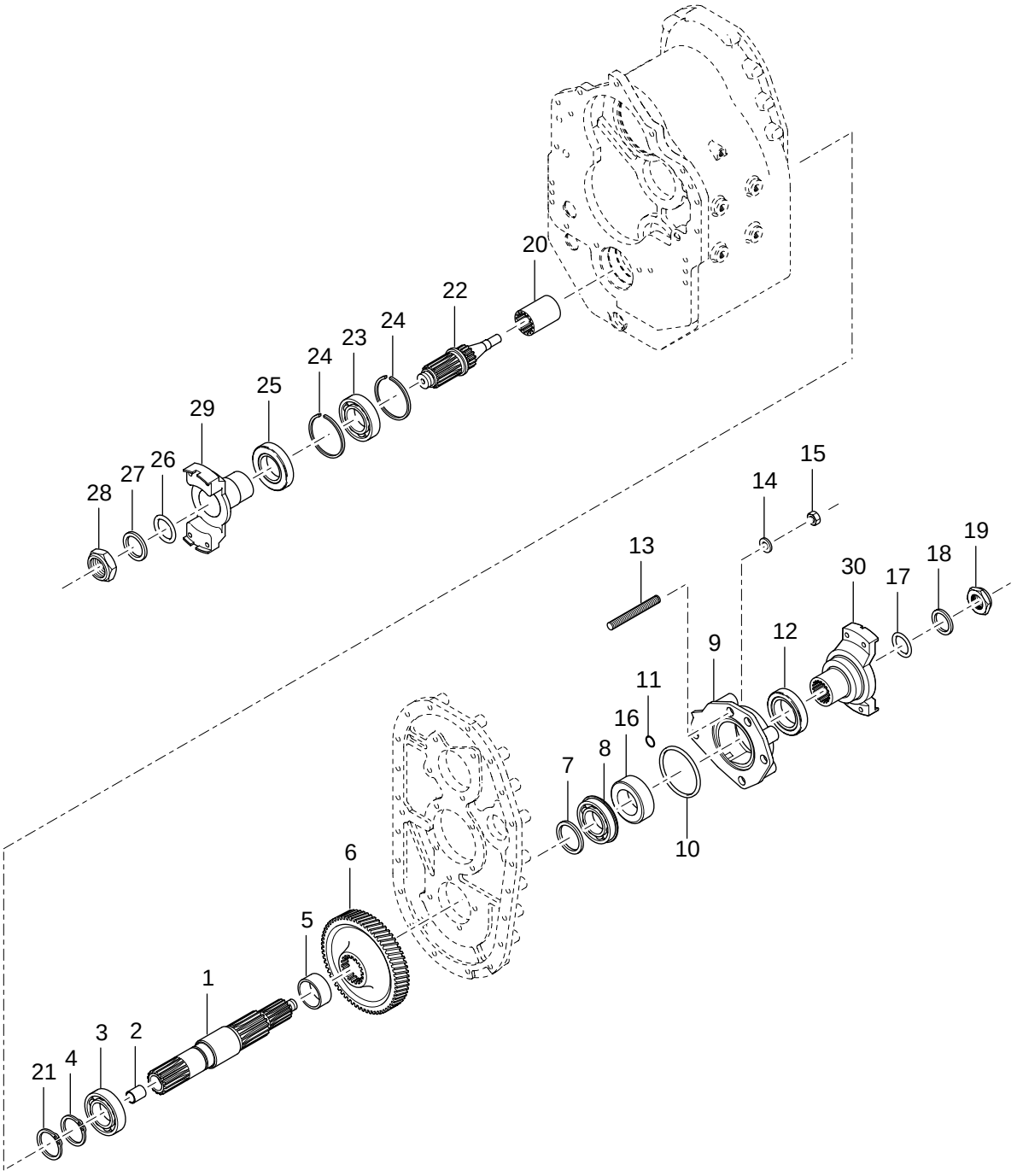
GROUP - 3RD SHAFT

Item	Description	Quantity
1	Assembly - 3rd clutch shaft and drum	1
2	Ring - 3rd clutch gear and hub retaining	1
3	Ring - 3rd shaft piston	1
4	Bearing - 3rd shaft pilot	1
5	Piston - Clutch	1
6	Seal - Clutch piston (Outer)	1
7	Seal - Clutch piston (Inner)	1
8	Disc - Clutch (Inner)	6
9	Disc - Clutch (Outer)	6
10	Plate - Clutch disc backing	1
11	Snap ring - Backing plate	1
12	Spring - Piston return	1
13	Retainer - Spring	1
14	Snap ring - Spring retainer	1
15	Bearing - 3rd shaft rear	1
16	Ring - 3rd shaft rear bearing retaining	1
17	Cap - 3rd shaft rear bearing	1
18	Gasket - 3rd shaft bearing cap	1
19	Stud - Rear bearing cap	4
20	Lockwasher - Rear bearing cap stud nut	4
21	Nut - Rear bearing cap stud	4
22	Gear - 3rd clutch	1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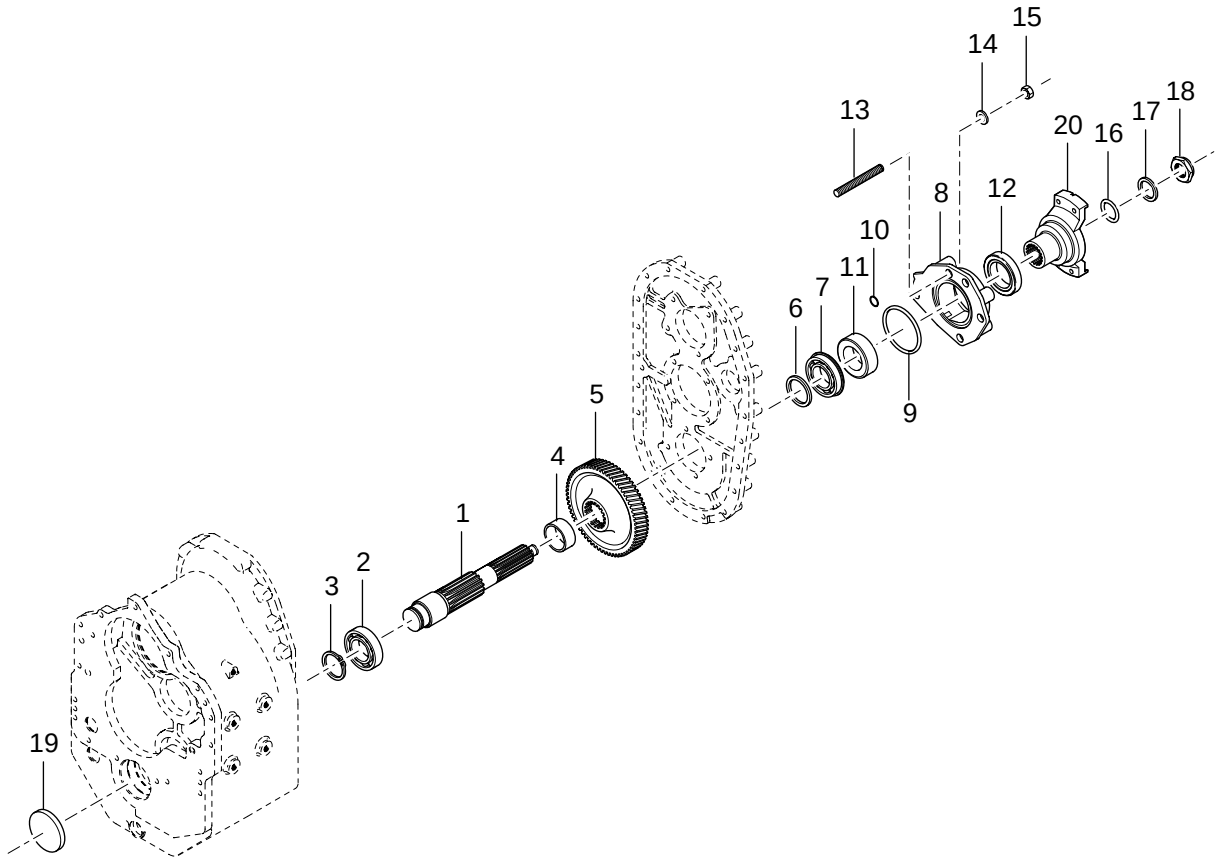
GROUP - OUTPUT SHAFT (FRONT & REAR OUTPUT)

Item	Description	Quantity
1	Shaft - Output	1
2	Bushing - Output shaft	1
3	Bearing - Output shaft front	1
4	Ring - Bearing retaining	1
5	Spacer - Output shaft gear	1
6	Gear - Output shaft	1
7	Washer - Thrust	1
8	Bearing - Output shaft rear	1
9	Cap - Output shaft rear bearing	1
10	“O”-ring - Output shaft bearing cap	1
11	“O”-ring - Output shaft bearing cap	1
12	Seal - Rear bearing cap oil	1
13	Stud - Rear bearing cap	4
14	Lockwasher - Rear bearing cap stud nut	4
15	Nut - Rear bearing cap stud	4
16	Spacer - Bearing to flange	1
17	“O”-ring - Flange	1
18	Washer - Flange	1
19	Nut - Flange	1
20	Coupling - Drive	1
21	Snap ring - Drive coupling stop	1
22	Shaft - Disconnect	1
23	Bearing - Disconnect shaft	1
24	Ring - Bearing retaining	2
25	Seal - Front oil	1
26	“O”-ring - Flange	1
27	Washer - Flange	1
28	Nut - Flange	1
29	Flange - Front	1
30	Flange - Rear	1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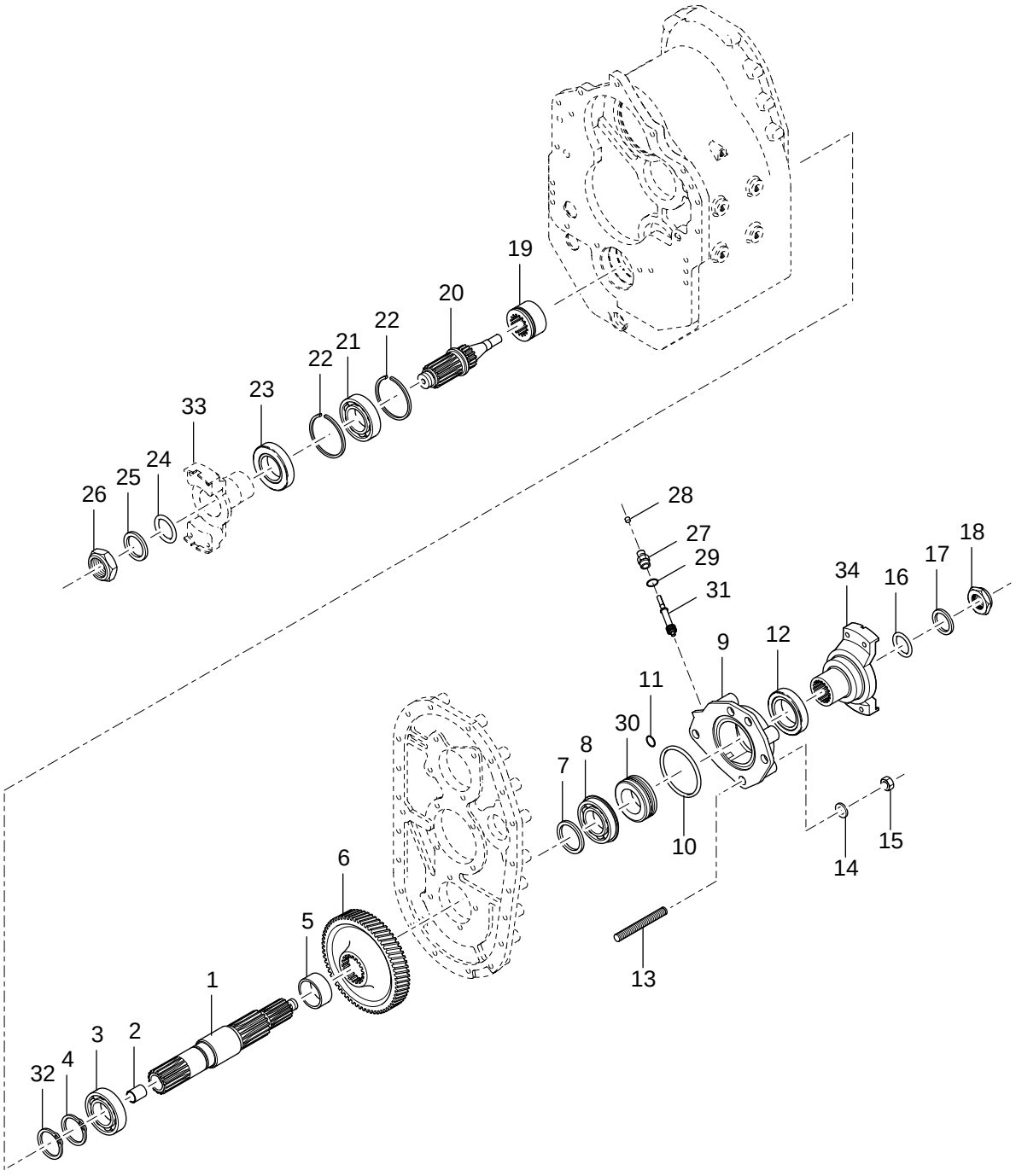
GROUP - OUTPUT SHAFT (REAR OUTPUT)

Item	Description	Quantity
1	Shaft - Output	1
2	Bearing - Output shaft front	1
3	Ring - Bearing retaining	1
4	Spacer - Output shaft gear	1
5	Gear - Output shaft	1
6	Washer - Thrust	1
7	Bearing - Output shaft rear	1
8	Cap - Output shaft rear bearing	1
9	“O”-ring - Output shaft bearing cap	1
10	“O”-ring - Output shaft bearing cap	1
11	Spacer - Bearing to flange	1
12	Seal - Rear bearing cap oil	1
13	Stud - Rear bearing cap	4
14	Lockwasher - Rear bearing cap stud nut	4
15	Nut - Rear bearing cap stud	4
16	“O”-ring - Flange	1
17	Washer - Flange	1
18	Nut - Flange	1
19	Plug - Front output bore	1
20	Flange - Rear	1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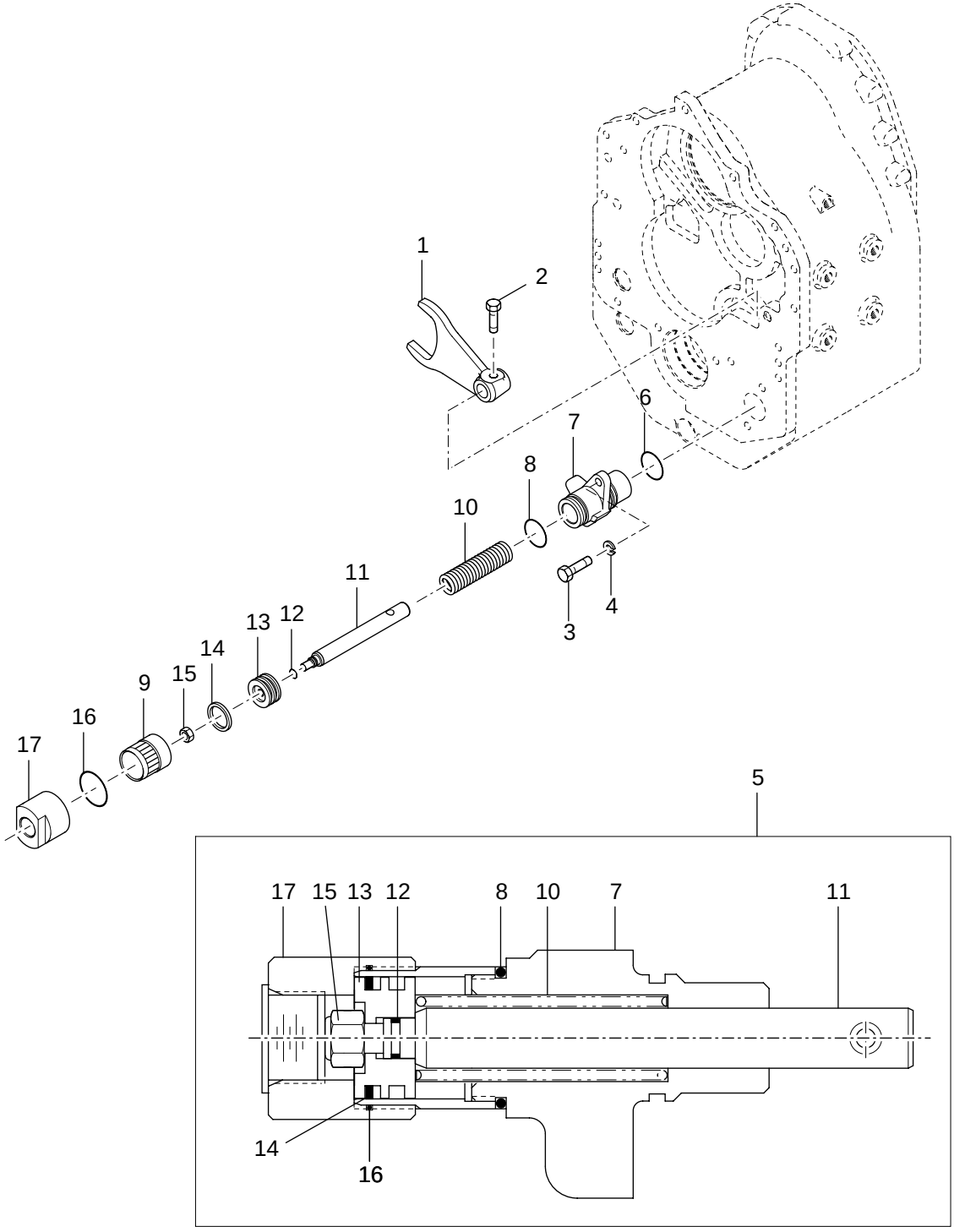
GROUP - OUTPUT SHAFT (INTERNAL DISCONNECT)

Item	Description	Quantity
1	Shaft - Output	1
2	Bushing - Output shaft	1
3	Bearing - Output shaft front	1
4	Ring - Bearing retaining	1
5	Spacer - Output shaft gear	1
6	Gear - Output shaft	1
7	Washer - Thrust	1
8	Bearing - Output shaft rear	1
9	Cap - Output shaft rear bearing	1
10	“O”-ring - Output shaft bearing cap	1
11	“O”-ring - Output shaft bearing cap	1
12	Seal - Rear bearing cap oil	1
13	Stud - Rear bearing cap	4
14	Lockwasher - Rear bearing cap stud nut	4
15	Nut - Rear bearing cap stud	4
16	“O”-ring - Flange	1
17	Washer - Flange	1
18	Nut - Flange	1
19	Hub - Disconnect shift	1
20	Shaft - Front disconnect	1
21	Bearing - Disconnect shaft	1
22	Ring - Bearing retaining	2
23	Seal - Front oil	1
24	“O”-ring - Flange	1
25	Washer - Flange	1
26	Nut - Flange	1
27	Nut - Speedo tube	1
28	Seal - Speedo oil	1
29	“O”-ring - Speedo tube nut	1
30	Gear - Speedo drive	1
31	Gear - Speedo driven	1
32	Ring - Hub retaining (only used with mechanical disconnect)	1
33	Flange - Front	1
34	Flange - Rear	1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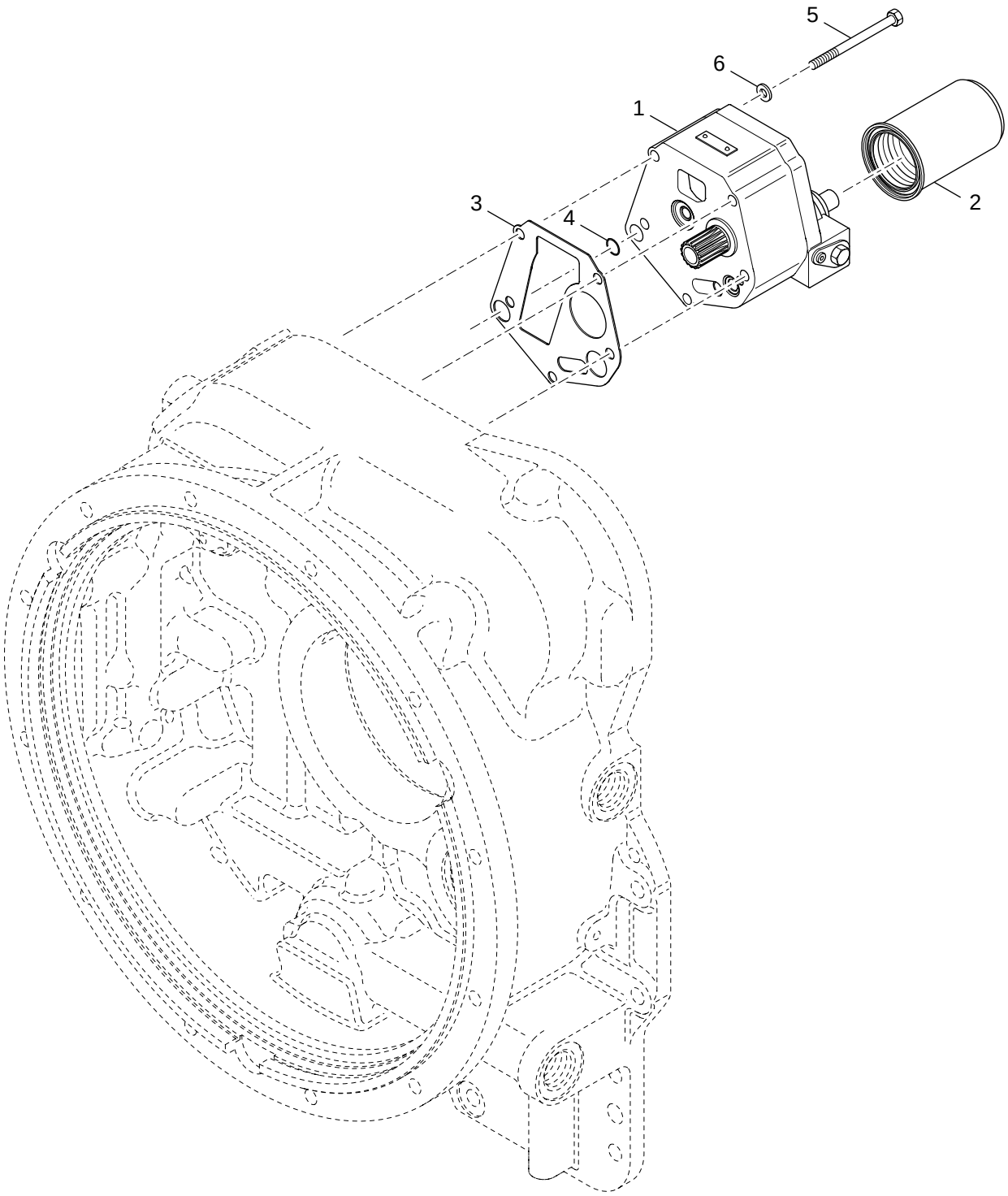
GROUP - INTERNAL DISCONNECT (AIR - HYD. ACTUATED)

Item	Description	Quantity
1	Fork - Disconnect shift	1
2	Lockscrew - Shift fork	1
3	Screw - Mounting	2
4	Lockwasher - Mounting screw	2
5	Assembly - Shift cylinder	1
6	“O”-ring - Shift cylinder	1
7	Body - Cylinder	1
8	“O”-ring - Tube cylinder	1
9	Tube - Cylinder	1
10	Spring - Cylinder	1
11	Rod - Piston	1
12	“O”-ring - Rod	1
13	Piston	1
14	Cup - Seal	1
15	Nut	1
16	“O”-ring - Cylinder end cap	1
17	Cap - Cylinder end	1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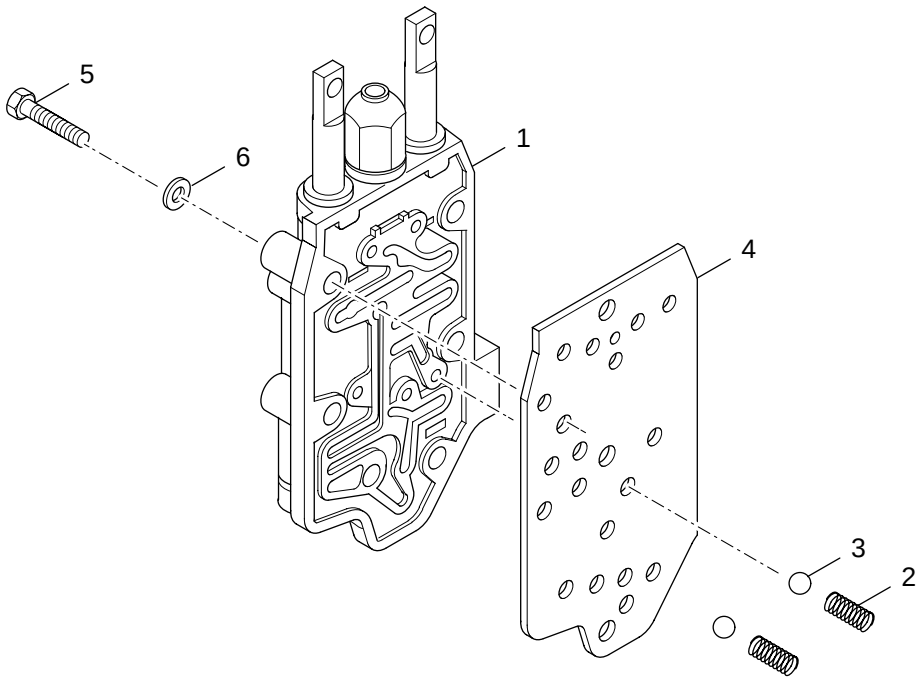
GROUP - CHARGING PUMP & FILTER

Item	Description	Quantity
1	Pump - Charging	1
2	Assembly - Hydraulic spin on filter	1
3	Gasket - Pump assembly to converter housing	1
4	“O”-ring	1
5	Screw - Pump mounting	5
6	Lockwasher - Pump mounting screw	5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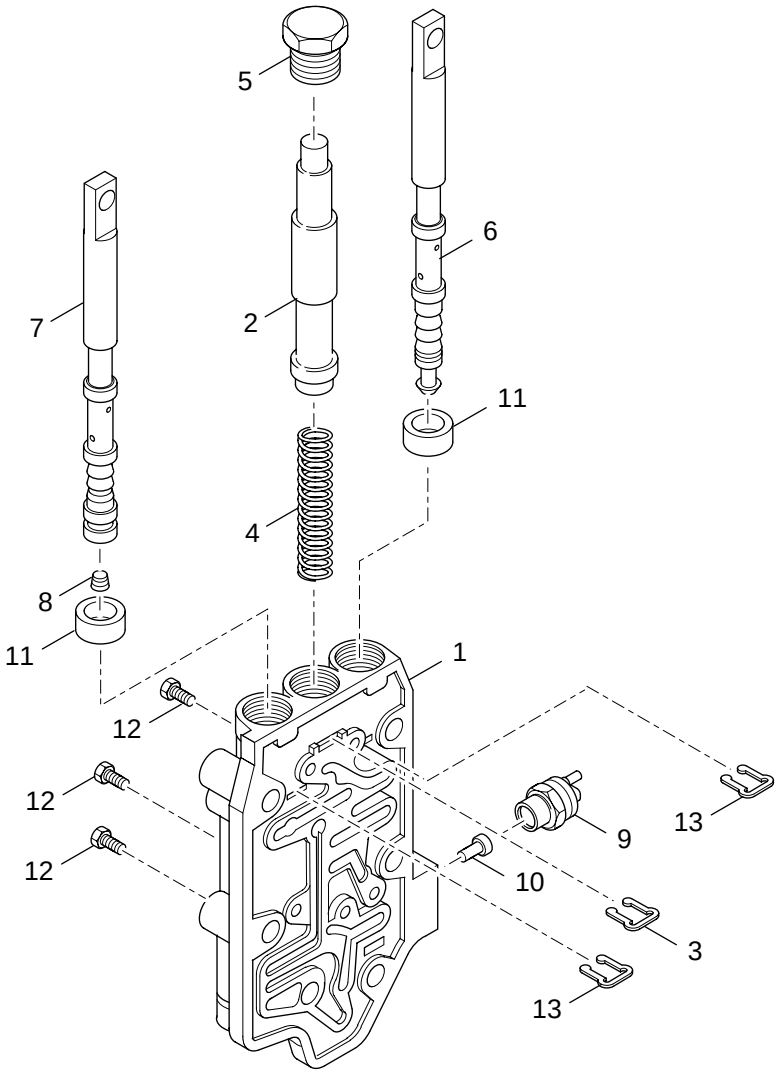
GROUP - CONTROL VALVE (MECHANICAL)

Item	Description	Quantity
1	Assembly - Control valve	1
2	Spring - Detent	2
3	Ball - Detent	2
4	Gasket - Control valve	1
5	Screw - Control valve mounting	9
6	Lockwasher - Control valve mounting screw	9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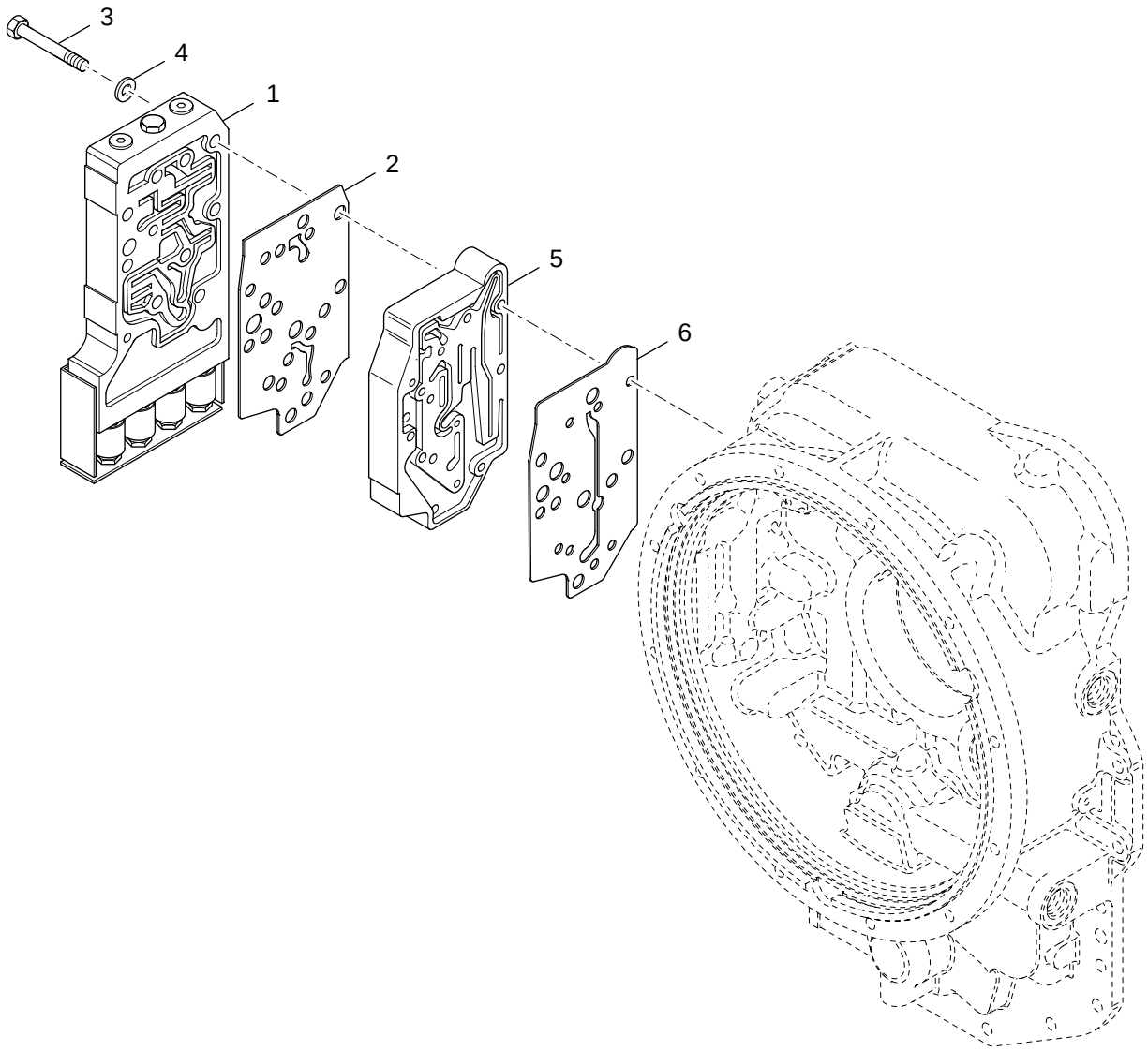
GROUP - CONTROL VALVE ASSEMBLY (MECHANICAL)

Item	Description	Quantity
1	Housing - Control valve	1
2	Spool - Declutch	1
3	Stop - Spool	1
4	Spring - Spool	1
5	Plug	1
6	Spool - Forward and reverse	1
7	Spool - Speed selector	1
8	Plug	1
9	Switch - Start	1
10	Pin	1
11	Oil - Seal	2
12	Pipe plug	4
13	Stop - Spool	2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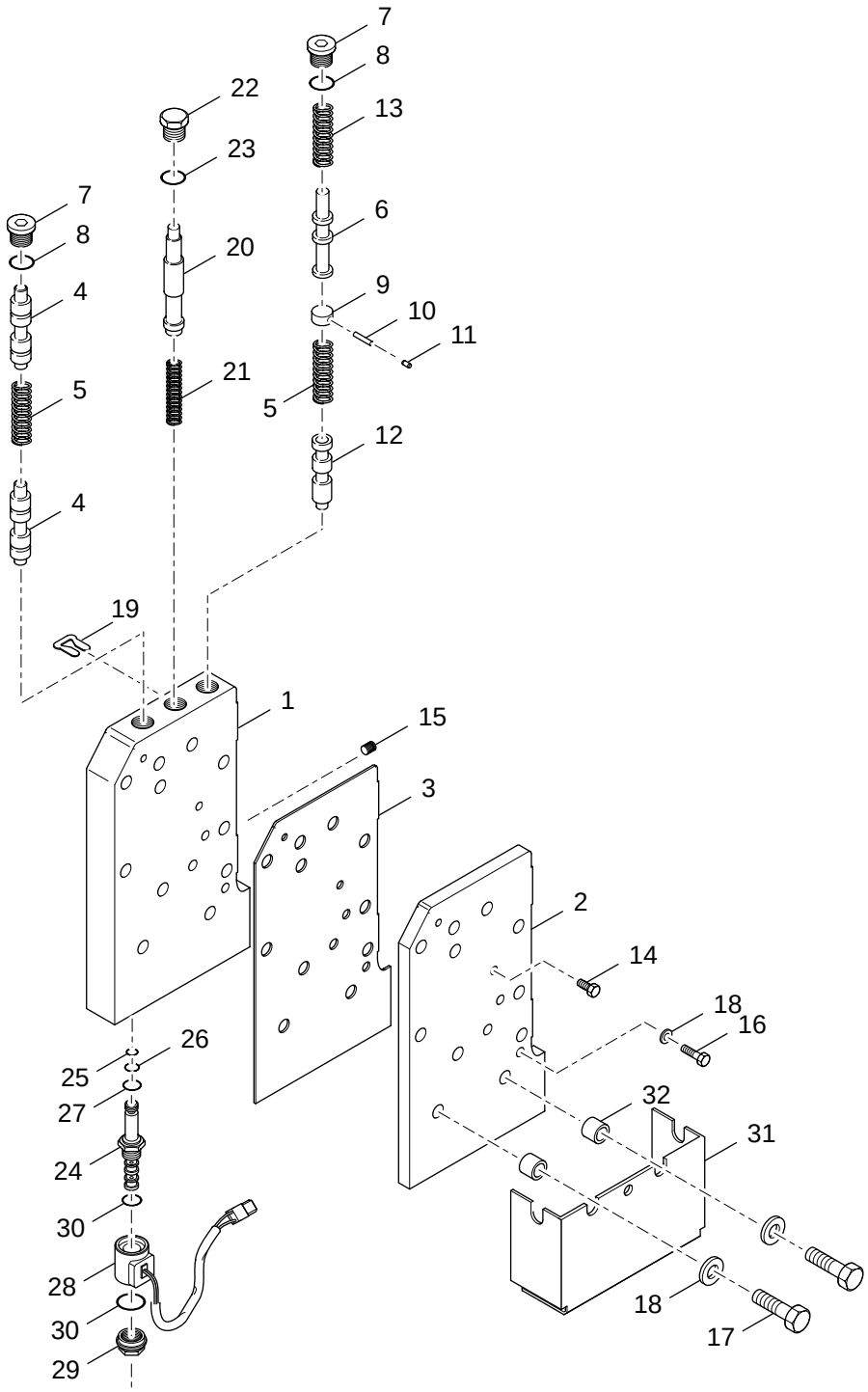
GROUP - ELECTRIC CONTROL VALVE MOUNTING

Item	Description	Quantity
1	Assembly - Electric control valve	1
2	Gasket - Control valve to front cover	1
3	Screw - Valve to converter housing	9
4	Lockwasher - Valve to converter housing screw	9
5	Assembly - Modulator valve	1
6	Gasket - Modulator valve to control valve	1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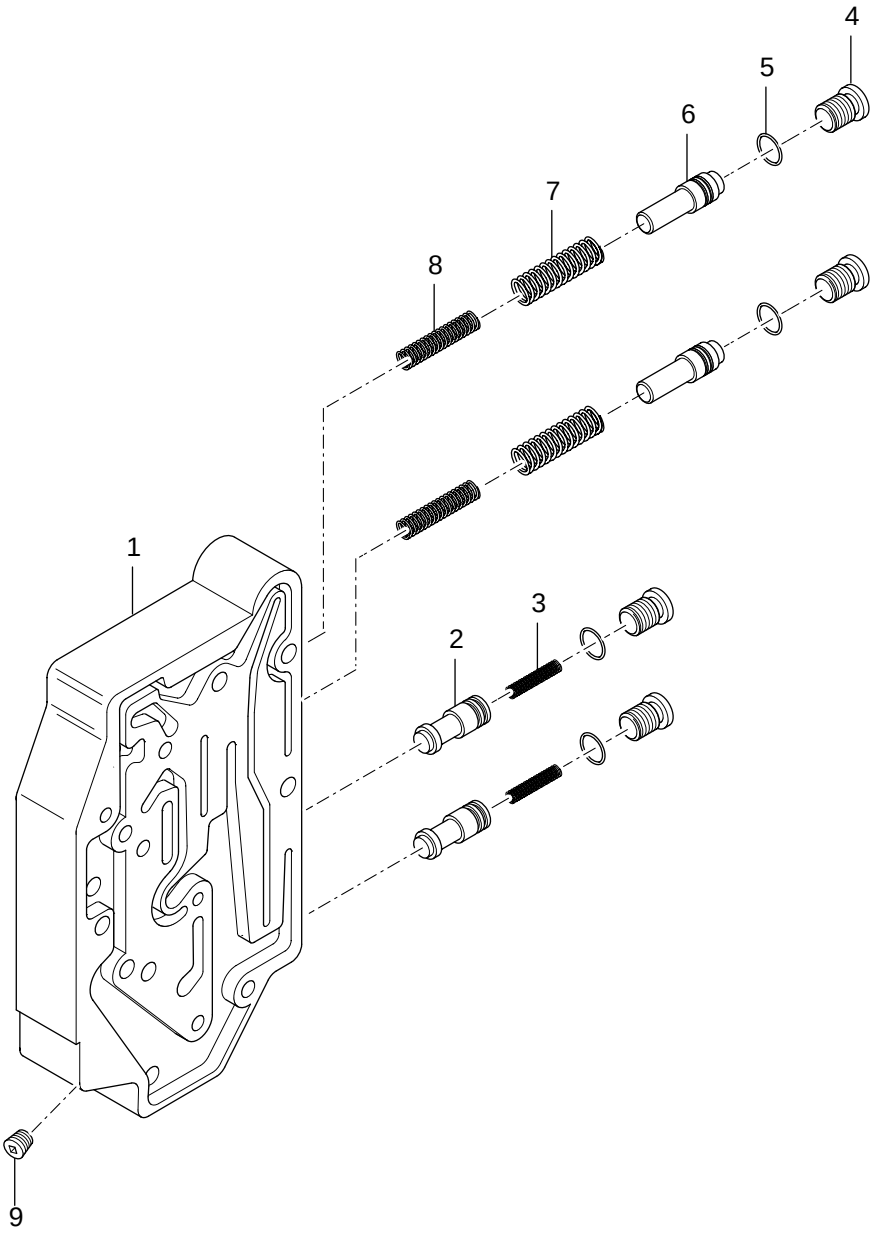
GROUP - ELECTRIC CONTROL VALVE ASSEMBLY

Item	Description	Quantity
1	Housing control valve	1
2	Cover - Control valve	1
3	Gasket - Control valve cover	1
4	Spool - Forward and reverse shift	2
5	Spring	2
6	Spool - Range (3rd)	1
7	Valve housing plug	2
8	Valve housing plug “O”-ring	2
9	Spool stop	1
10	Pin	1
11	Plug stop	1
12	Spool - Range (1st and 2nd)	1
13	Spring	1
14	Pipe plug	8
15	Plug	1
16	Screw	1
17	Screw	2
18	Lockwasher	3
19	Stop - Spool	1
20	Forward and reverse declutching spool	1
21	Spring - Declutch	1
22	Plug	1
23	“O”-ring - Plug	1
24	Cartridge - Ball valve	4
25	“O”-ring - Cartridge	4
26	“O”-ring - Cartridge	4
27	“O”-ring - Cartridge	4
28	Coil 12V	4
29	Nut - Solenoid	4
30	“O”-ring	8
31	Cover - Solenoid	1
32	Spacer - Cover	2

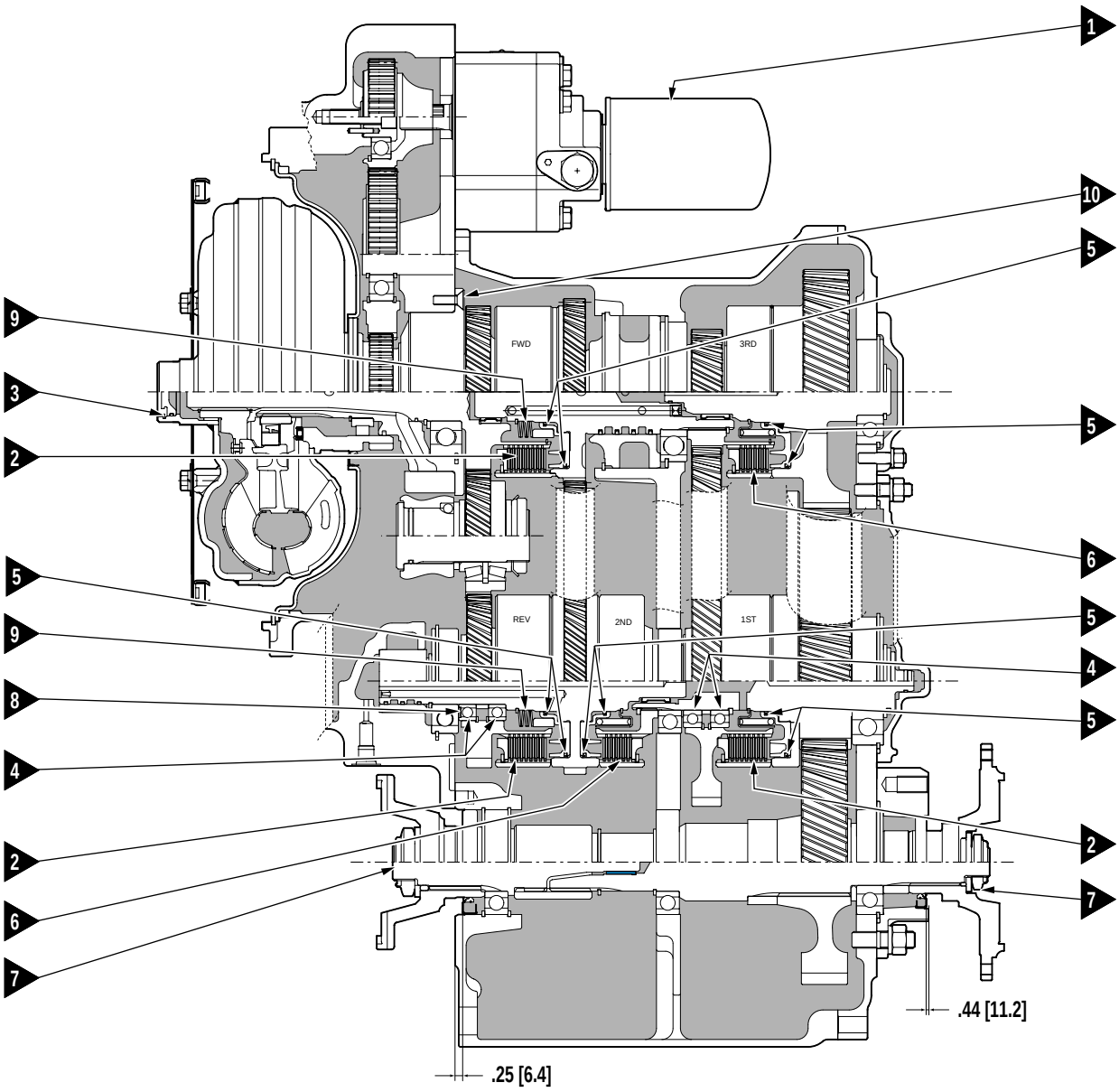

4
5
6
7
8
1
3
2
9

GROUP - MODULATOR VALVE

Item	Description	Quantity
1	Housing - Modulator	1
2	Spool - Regulator	2
3	Spring - Regulator	2
4	Plug	4
5	“O”-ring - Plug	4
6	Spool - Accumulator	2
7	Spring - Accumulator (Outer)	2
8	Spring - Accumulator (Inner)	2
9	Plug - Pipe	1

9. ASSEMBLY INSTRUCTIONS

9. ASSEMBLY INSTRUCTIONS (CONTINUED)



9. ASSEMBLY INSTRUCTIONS (CONTINUED)

All lead in chamfers for oil seals, piston rings, and “O”-rings must be smooth and free from burrs. Inspect at assembly.

Lubricate all piston ring grooves and “O”-rings with oil before assembly.

Apply a thin coating of grease between seal lips on lip type seals prior to assembly.

Use only precoated pipe plugs. On uncoated pipe plugs apply a light coat of Loctite no. 592.

After assembly of parts using Loctite, there must not be any free or excess material which might enter the oil circuit.

Apply a light coat of Loctite no. 262 or no. 270 to all thru hole stud holes.

1. Tighten oil filter to 20-25 lbf.ft [27-34 N.m].

2. Fwd. and rev. with standard piston & low clutch. 8 Outer steel discs and 8 inner friction discs. Insert one (1) Steel disc. Insert one (1) friction disc. Alternate steel and friction discs until proper amount of discs are installed. First disc next to the piston is steel, last disc installed is friction.

3. Snap ring is to be assembled with sharp edges to front.

4. Must be loose internal fit bearing with a no. 3 etched on the bearing.

5. Seals must be sized prior to assembly.

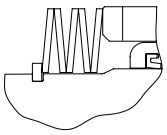
6. Two clutches (2nd & 3rd). 6 Outer steel discs and 6 inner friction discs.

   Start with outer steel disc alternate friction and steel.

7. Tighten to 200 - 250 lbf.ft [271.2 - 339.0 N.m].

8. Shielded bearing, be sure that bearing shield is on the outside.

9. Forward and reverse clutch springs concave side of first belleville spring to be placed against clutch piston. Remaining four springs of each clutch to be stacked alternatly reversed as shown.



10. Stator support screw assembly:

    1. Clean stator support mounting surface and tapped holes with solvent. Dry thoroughly. Being certain tapped holes are clean and dry.
    2. Install 6 special stator support screws. Tighten screws to 12 - 16 lbf.ft [16.3 - 21.7 N.m] torque.

9. ASSEMBLY INSTRUCTIONS (CONTINUED)

Note

ASSEMBLY OF STATOR SUPPORT TO CONVERTER HOUSING MUST BE COMPLETED WITHIN A 15 MINUTE PERIOD FROM START OF SCREW INSTALLATION. THE SPECIAL SCREW IS TO BE USED FOR ONE INSTALLATION ONLY. IF SCREW IS REMOVED FOR ANY REASON IT MUST BE REPLACED. THE LOCTITE LEFT IN THE HOLES MUST BE REMOVED WITH THE PROPER TAP AND CLEANED WITH SOLVENT. DRY HOLE THOROUGHLY AND USE A NEW SCREW FOR REINSTALLATION.

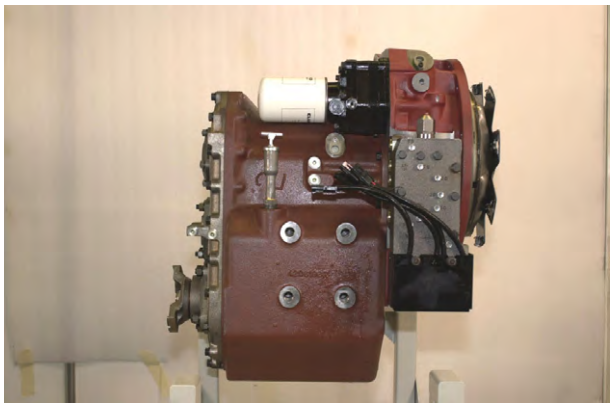


Figure 1
Sideview of T2000 3 speed ID transmission.

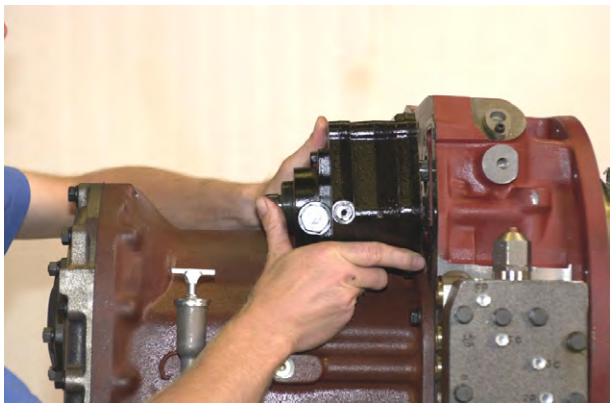


Figure 4
Remove valve and pump assembly.

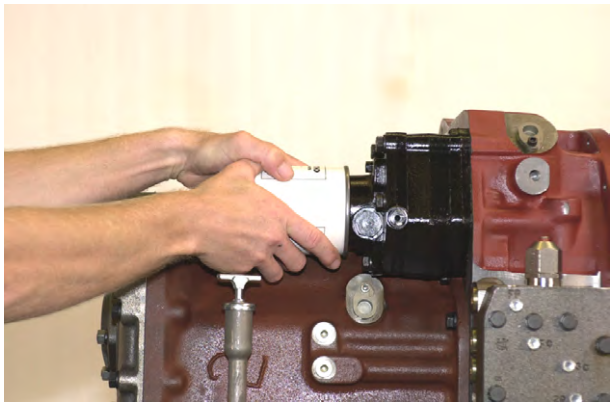


Figure 2
Remove filter element.
It is recommended a small pan be used to catch the oil left in the filter element.

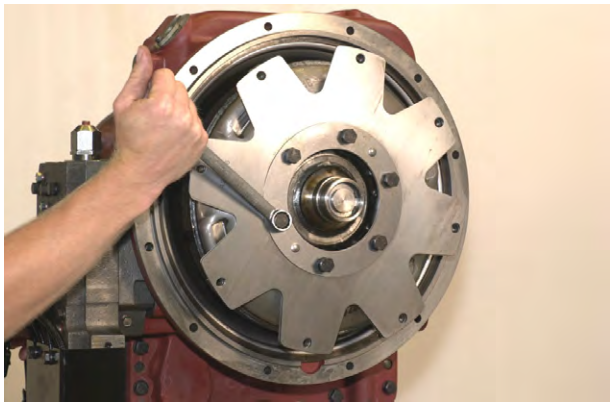


Figure 5
Remove drive plate mounting screws and lockwashers.

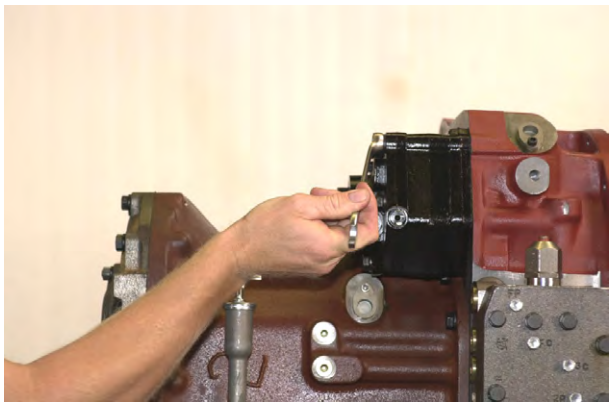


Figure 3
Remove pressure regulating valve and charging pump bolts.

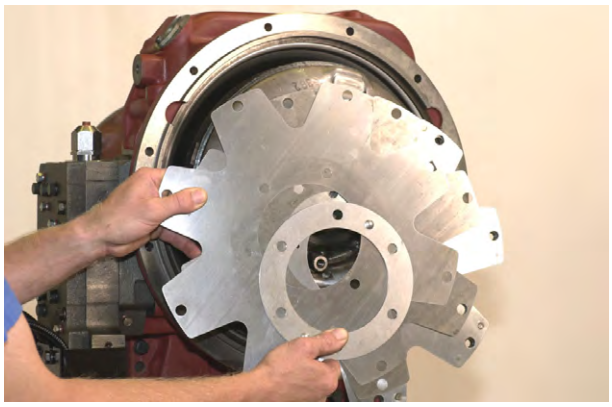


Figure 6
Remove drive plates and backing ring.

Figure 7
Remove impeller cover bore plug retaining ring.

Figure 10
Remove torque converter assembly.

Figure 8
Using 2 small screwdrivers as shown, remove bore plug.

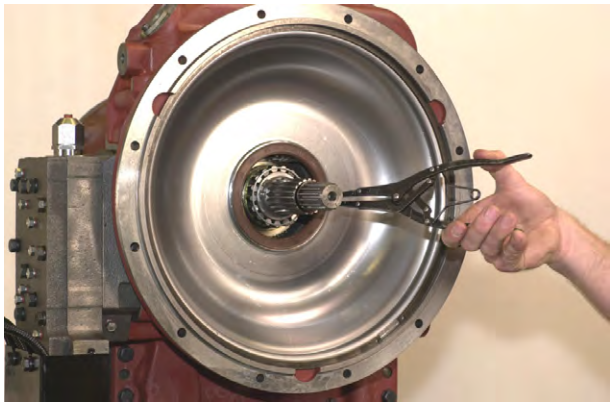


Figure 11
Remove turbine locating ring.

Figure 9
Through the bore plug hole, remove turbine retaining ring.

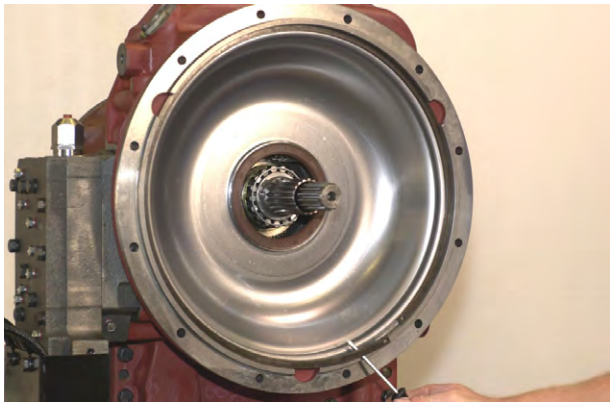


Figure 12
Using slots provided in converter housing, remove oil baffle retaining ring.

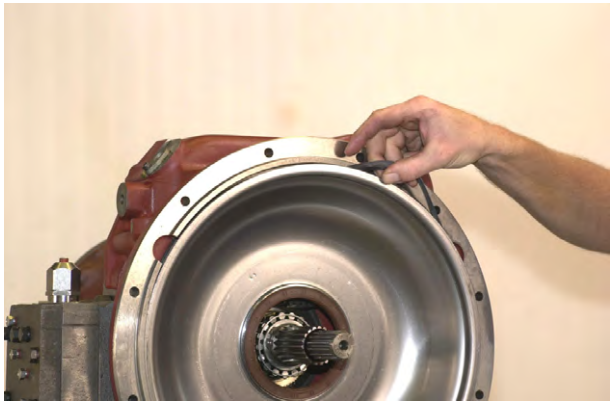


Figure 13
Baffle and sealing ring removed.

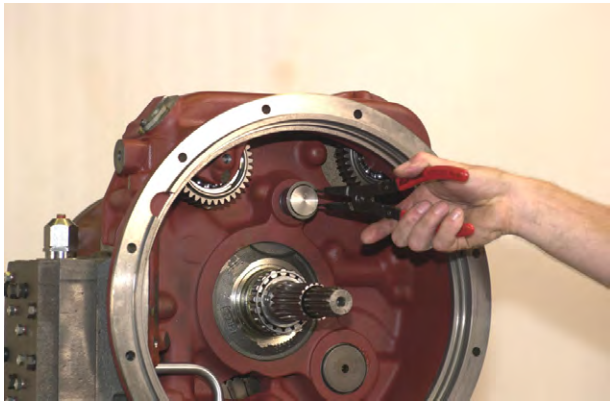


Figure 16
Remove pump drive idler gear locating ring.

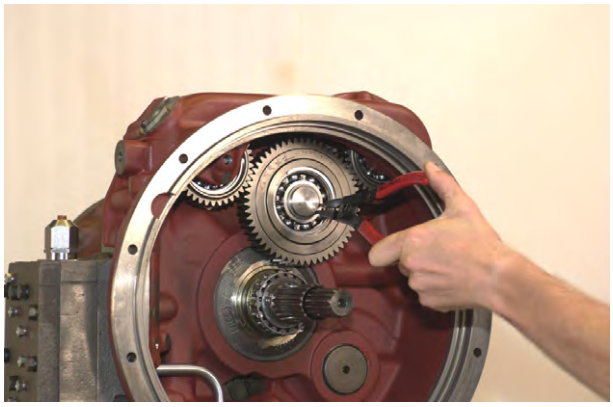


Figure 14
Remove pump drive idler gear retaing ring.

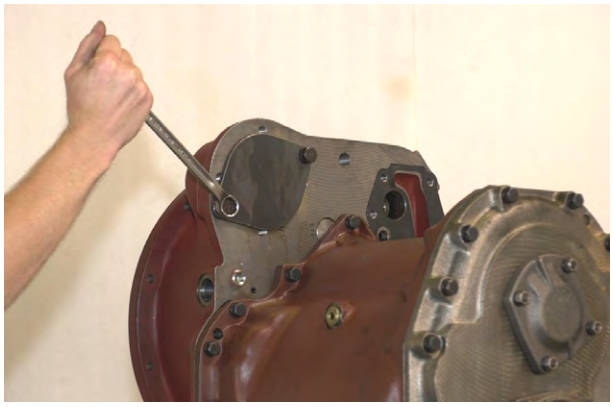


Figure 17
From the rear, remove pump hole cover screws and lockwashers.

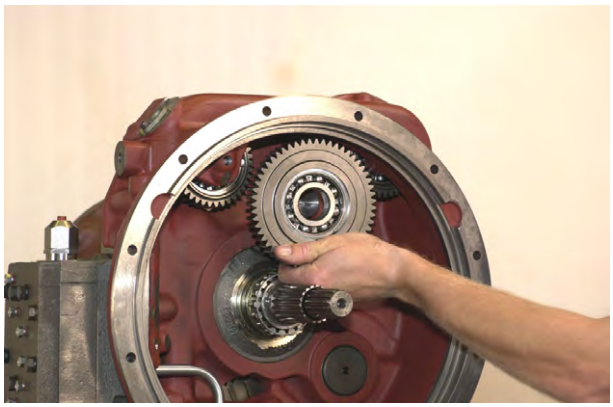


Figure 15
Remove idler gear and bearing assembly.

Figure 18
Remove pump hole cover and gasket.

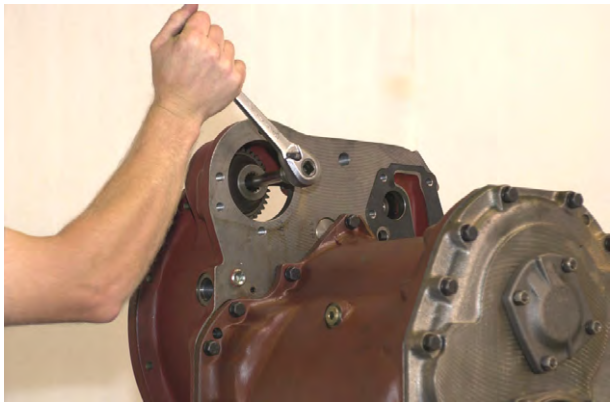


Figure 19
Remove auxliliary pump drive bearing support screw. See figure 20.

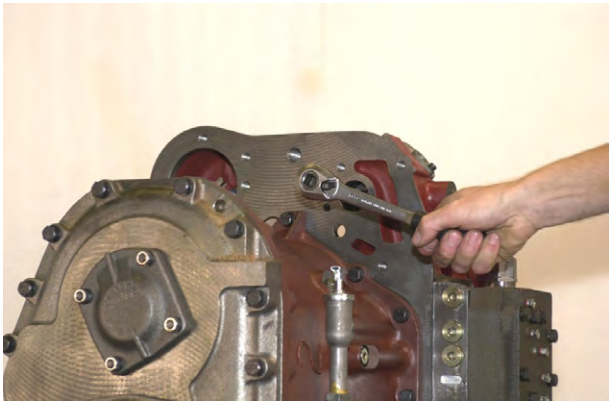


Figure 22
From the rear, through the pump drive hole, remove pump drive bearing support screw. See figure 23.

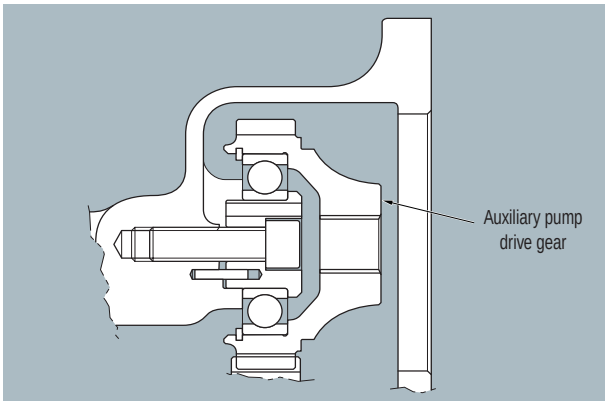


Figure 20

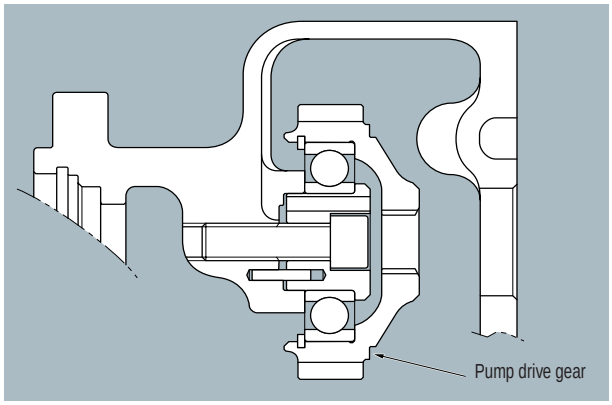


Figure 23

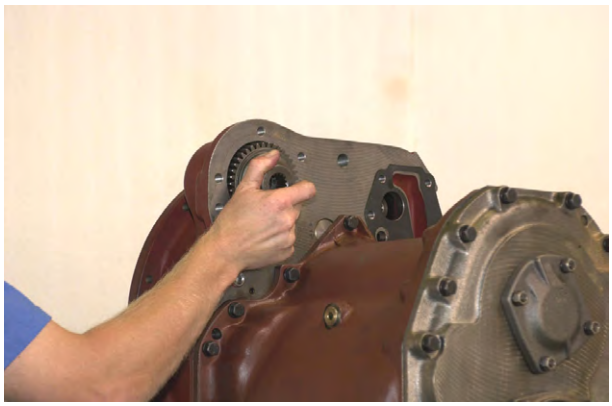


Figure 21
Remove auxiliary pump drive gear.

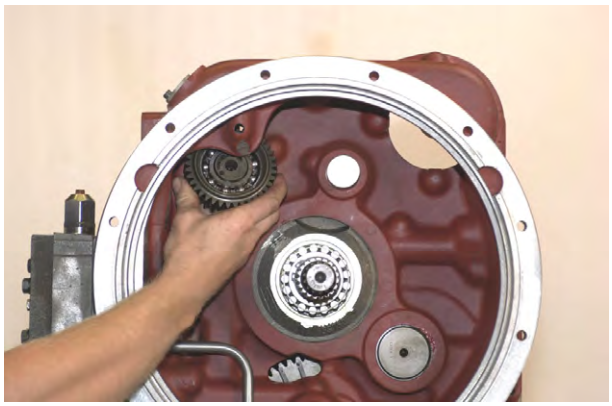


Figure 24
From the front, tap pump drive gear and bearing support from housing.

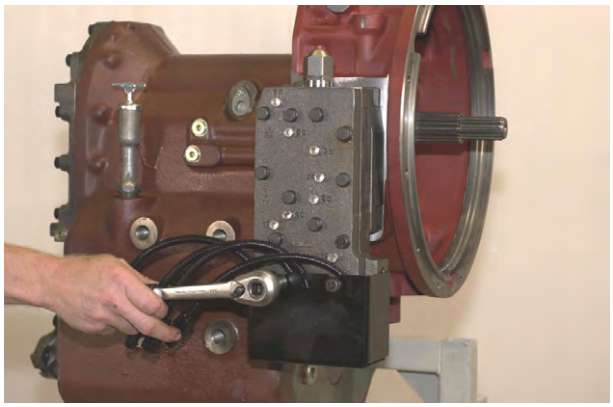


Figure 25
Remove solenoid protection cover screws and lockwashers and remove protection cover.

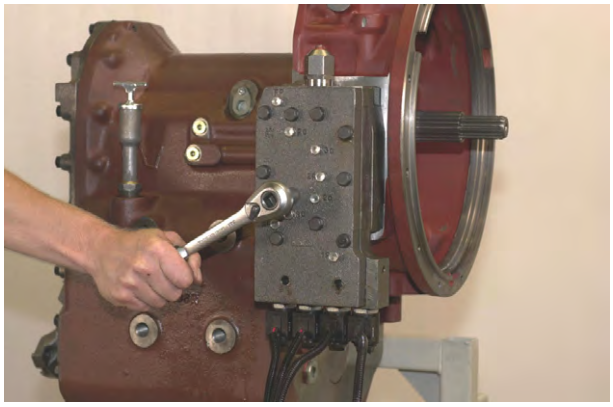


Figure 26
Remove control valve mounting bolts and lockwashers.

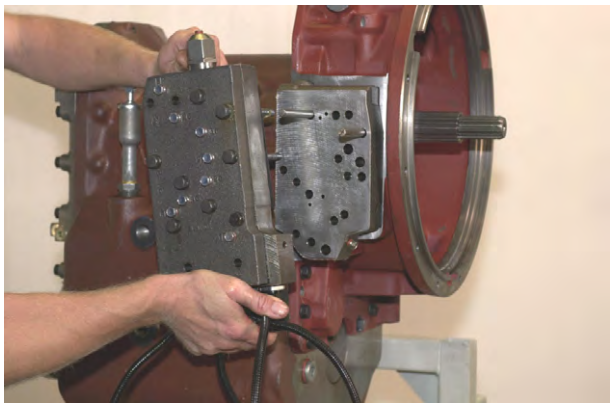


Figure 27
Remove control valve assembly and gasket.

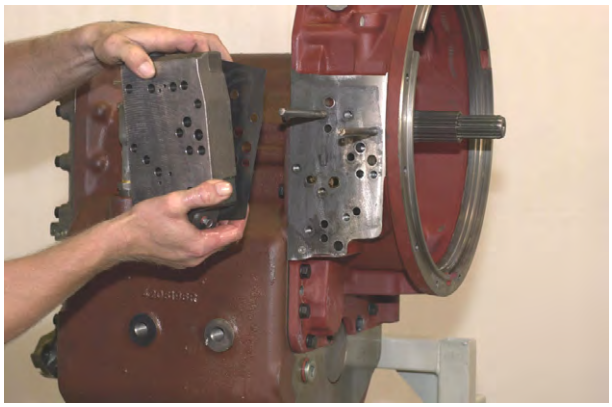


Figure 28
Remove modulator valve assembly and gasket. (If used).

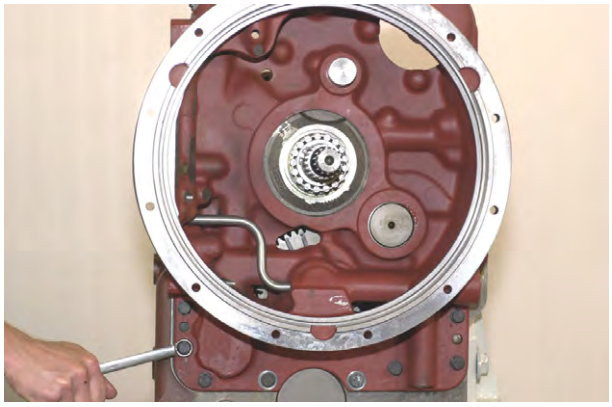


Figure 29
Remove all bolts but one, securing transmission case to converter housing.

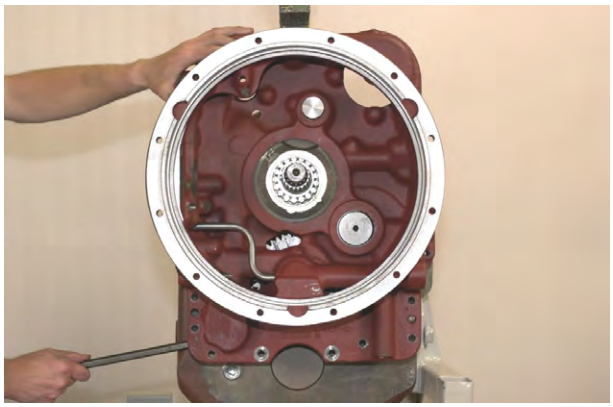


Figure 30
Support converter housing with a chain hoist. Remove remaining bolt and pry converter housing from transmssion case.

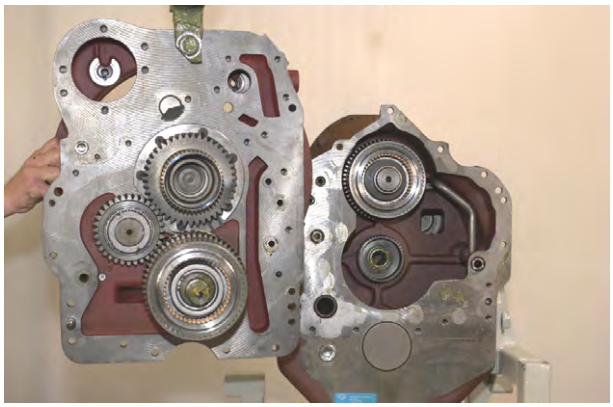


Figure 31
Seperated converter housing from transmission case.
Note:
reverse & 2nd clutch will remain in converter housing.

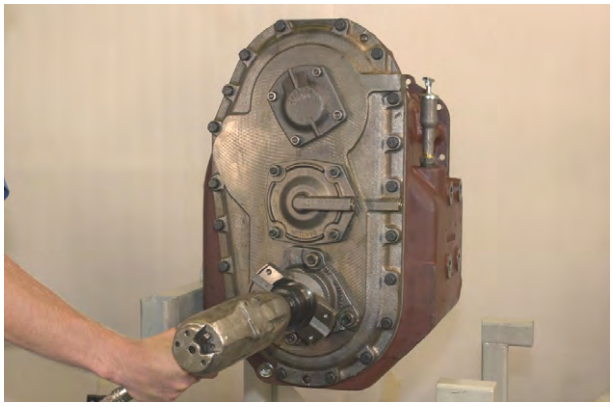


Figure 32
Remove output shaft flange nut, washer, “O” ring and flange.

Figure 33
Output flange, “O” ring, washer and nut removed.

Figure 34
Remove 3rd speed clutch rear bearing cap stud nuts and lockwashers.

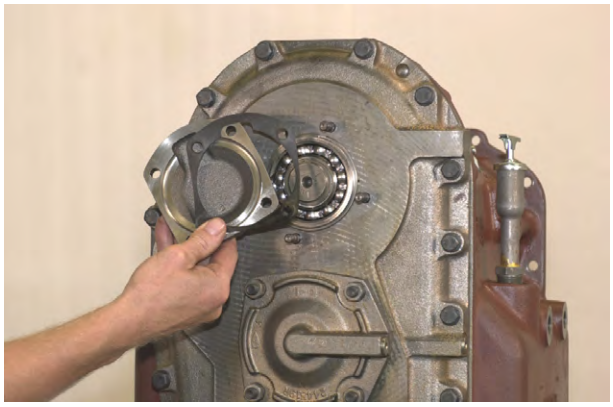


Figure 35
3rd shaft bearing cap and gasket removed.

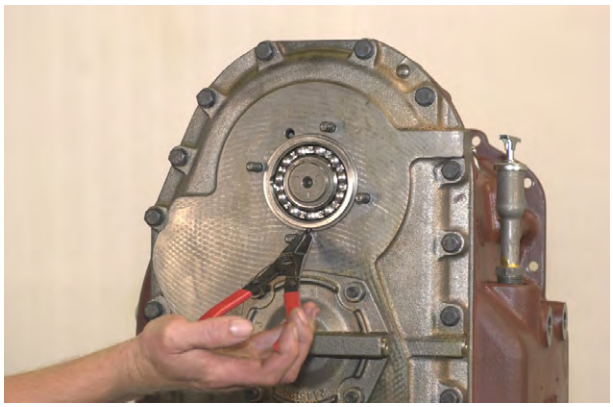


Figure 36
Remove 3rd shaft rear bearing locating ring.

Figure 37
Remove low clutch shaft rear bearing cap nuts and lockwashers.

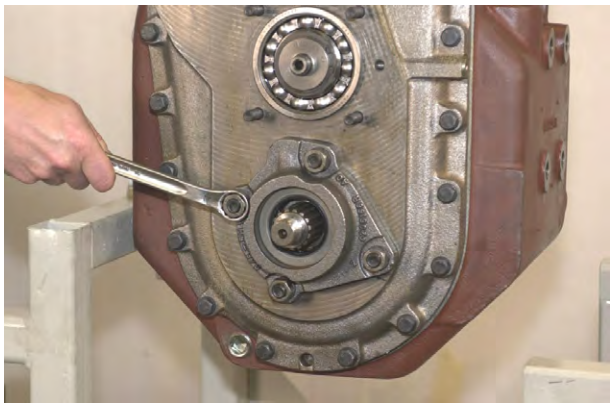


Figure 40
Remove output shaft rear bearing cap nuts and lockwashers.

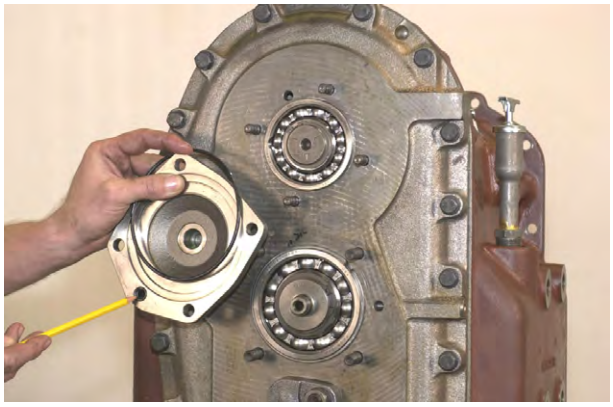


Figure 38
Remove bearing cap and “O” rings.

Figure 41
Remove output shaft bearing cap and gasket.

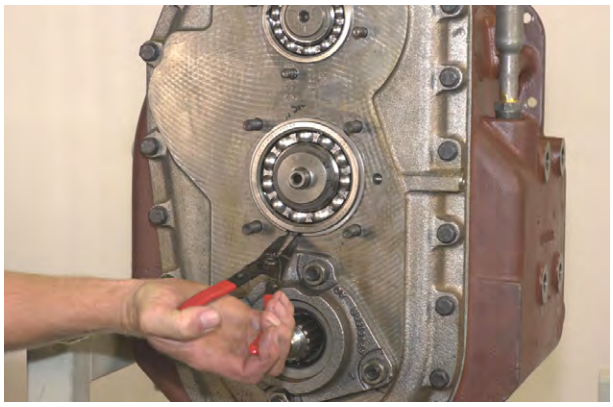


Figure 39
Remove low shaft rear bearing locating ring.

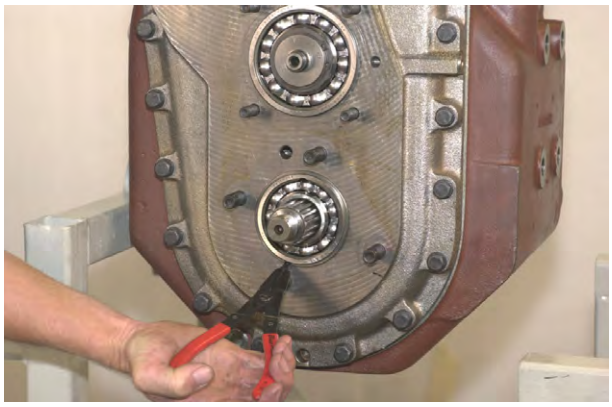


Figure 42
Remove output shaft rear bearing locating ring.

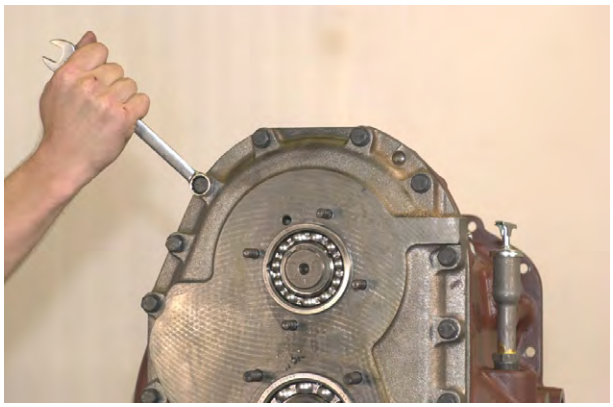


Figure 43
Remove rear cover screws and lockwashers.

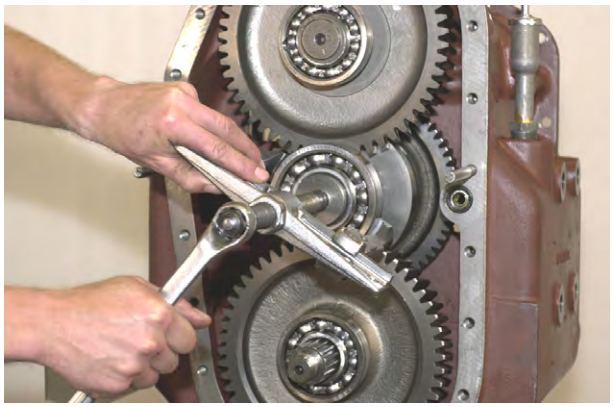


Figure 46
Remove low clutch shaft rear bearing.

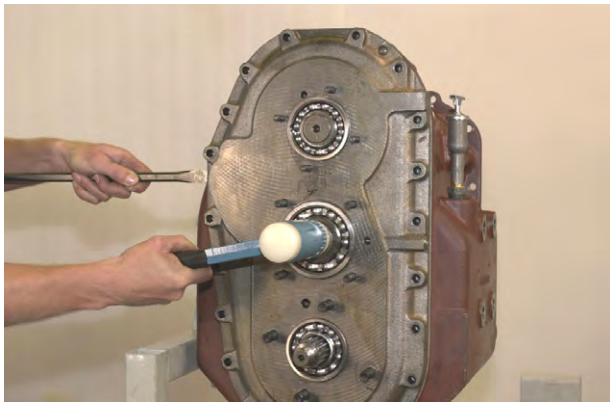


Figure 44
Using pry slots provided, pry cover from transmission housing. Tapping on clutch and output shaft will allow cover to be removed without shafts bending.
Note:
The use of alignment studs will facilitate cover removal.

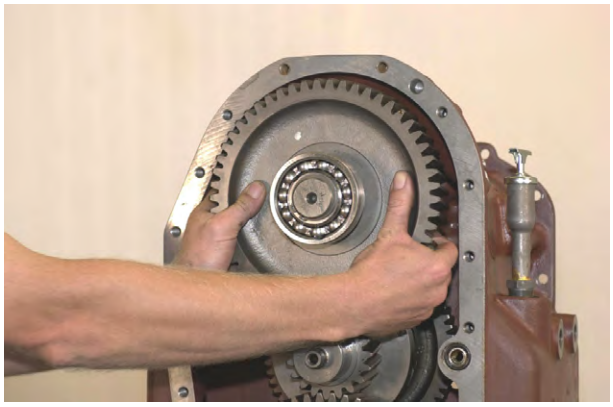


Figure 47
Remove 3rd speed clutch assembly.

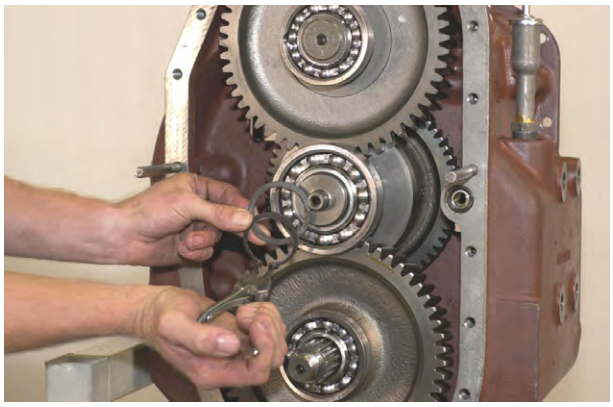


Figure 45
Remove low clutch shaft rear bearing washer and retaining ring.

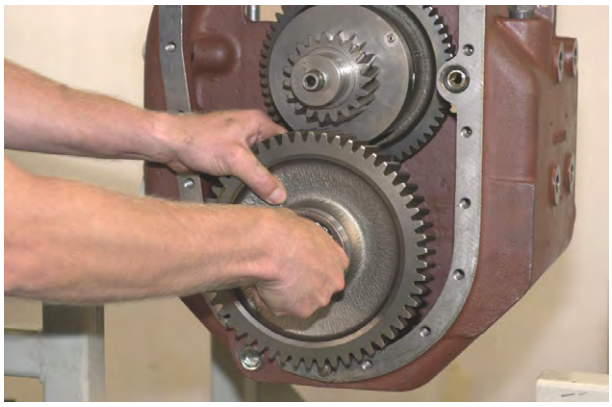


Figure 48
Remove output shaft and gear assembly.

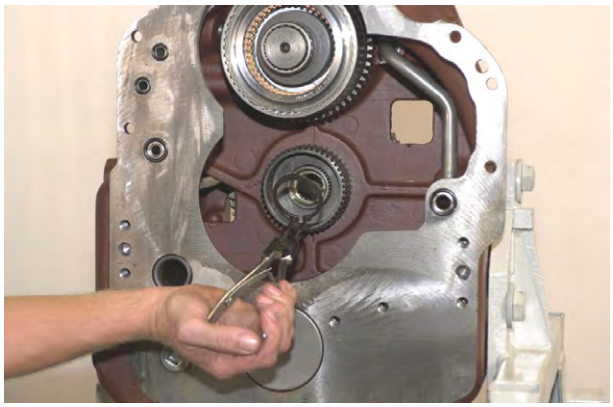


Figure 49
Remove 2nd clutch disc hub retaining ring.

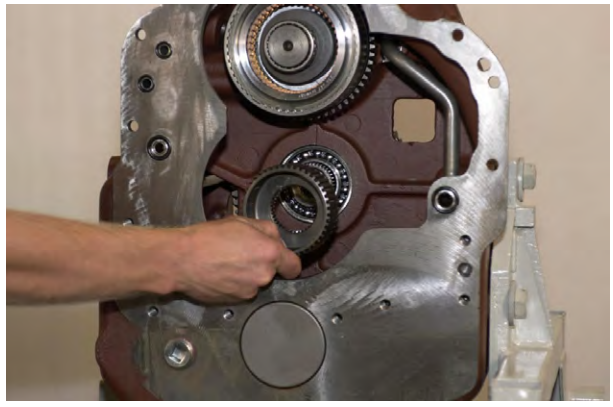


Figure 50
Remove 2nd clutch disc hub.

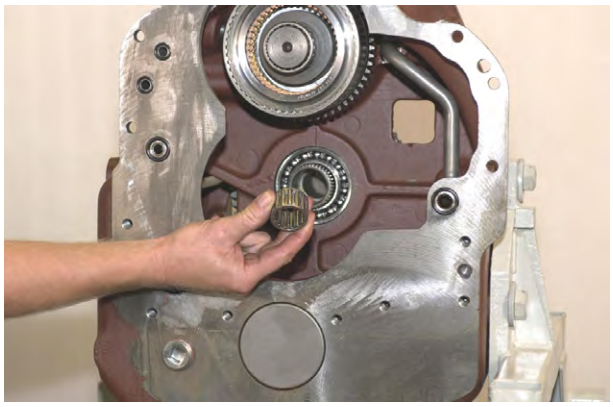


Figure 51
Remove 2nd clutch shaft pilot bearing.

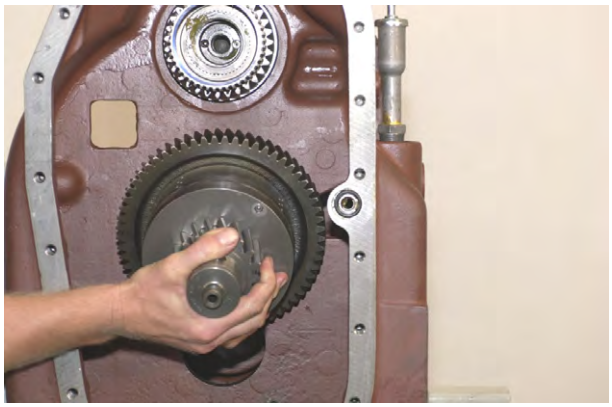


Figure 52
Remove low clutch assembly.

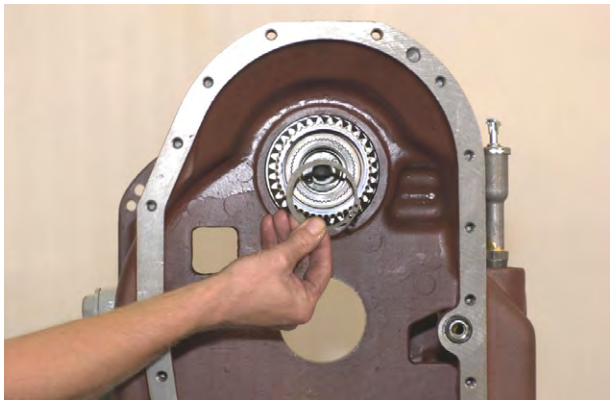


Figure 53
Remove 3rd clutch disc hub retaining ring.

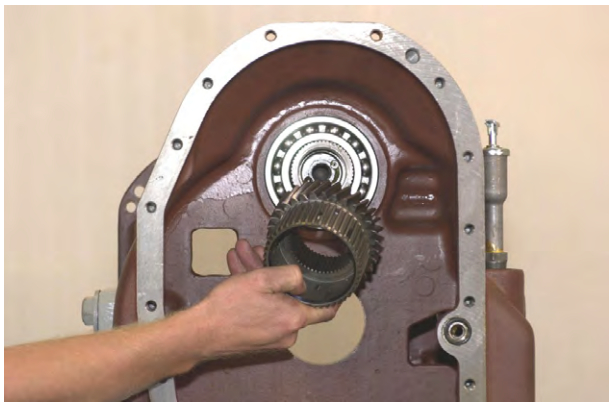


Figure 54
Remove 3rd clutch disc hub.

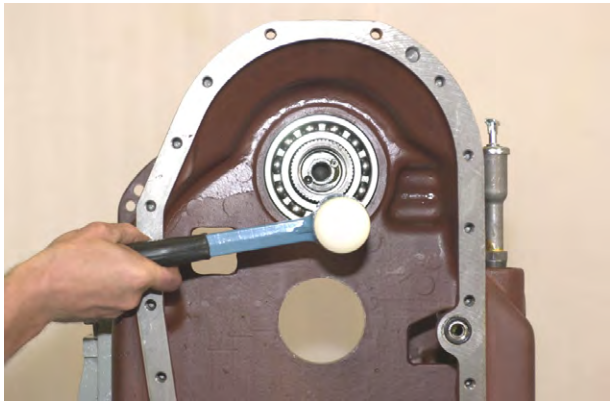


Figure 55
Tap forward clutch assembly from bearing.

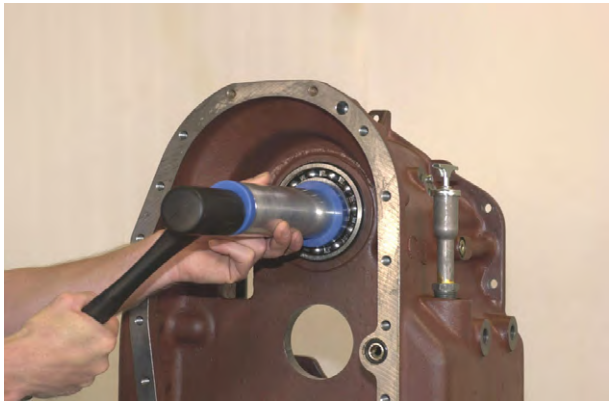


Figure 58
From the rear, tap forward clutch bearing and sleeve from housing.

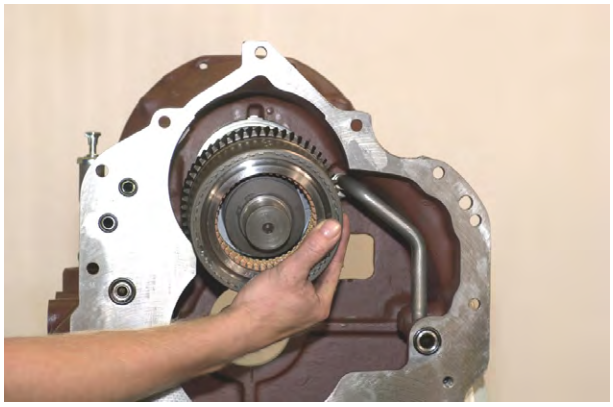


Figure 56
Remove forward clutch assembly.

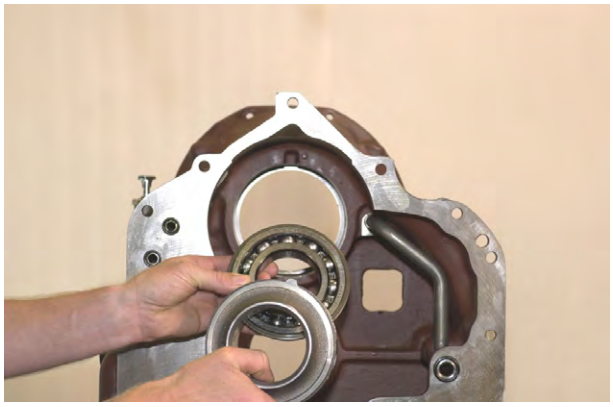


Figure 59
Sleeve and bearing removed.

Figure 57
Remove forward clutch oil sealing ring sleeve retaining ring.

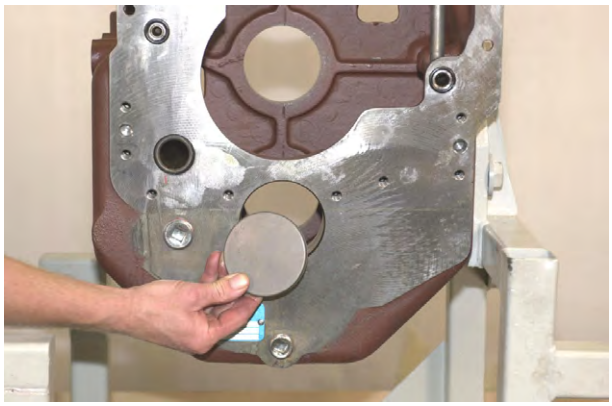


Figure 60
Removeoutput front bore plug.
(If used).

Figure 61
Remove suction tube and “O” ring.

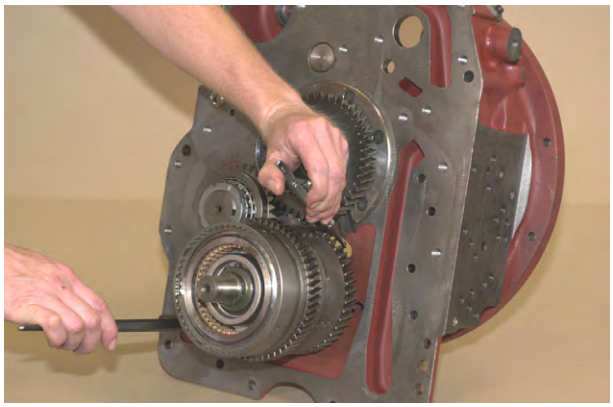


Figure 62
Using spreading type snapring pliers, spread ears on the reverse front bearing retaining ring and remove reverse & 2nd clutch assembly.

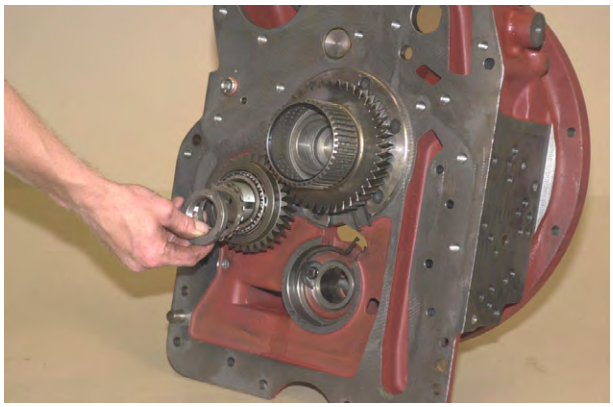


Figure 65
Retainer nut and lockplate removed.

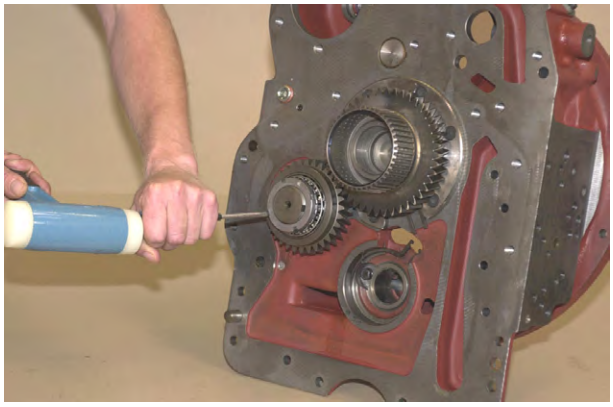


Figure 63
Straighten tang on reverse idler bearing retainer nut lockplate.

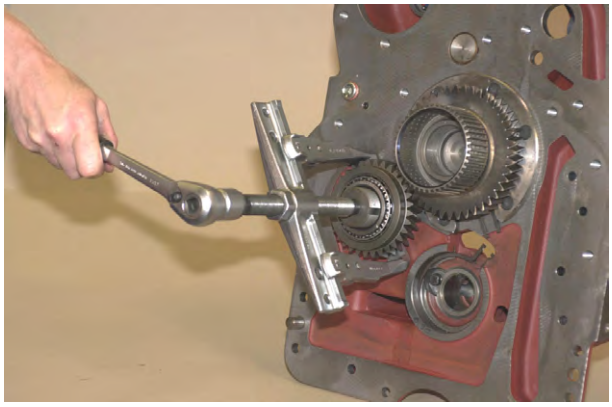


Figure 66
Remove idler gear and outer taper bearing from idler shaft.

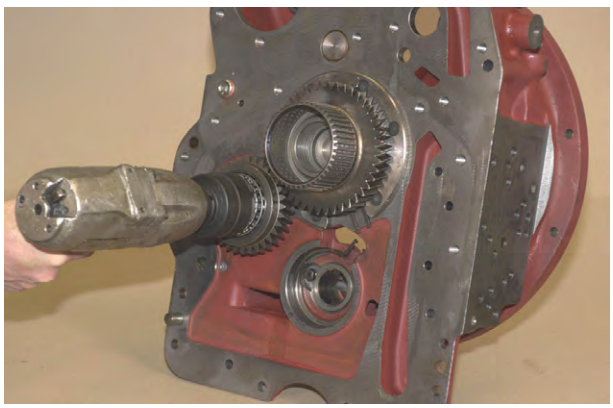


Figure 64
Remove idler bearing retainer nut.
Use special tool TG1304-54
(See section 12: Service Tools - page 12-1).

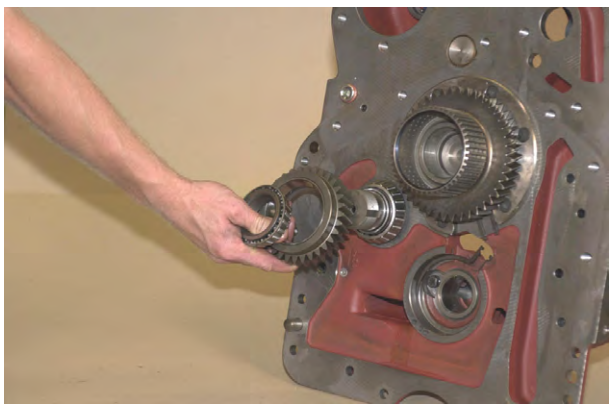


Figure 67
Outer taper bearing and idler gear removed.

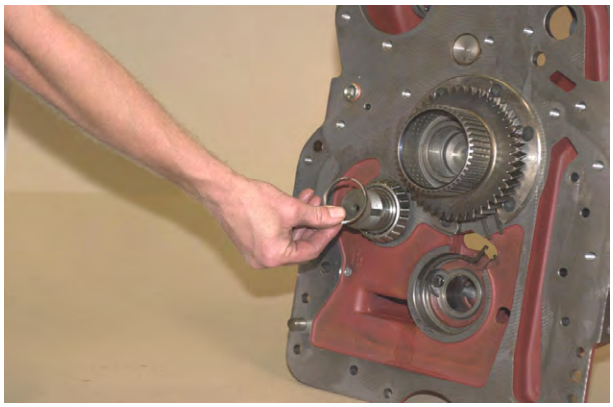


Figure 68
Remove idler gear bearing spacer.

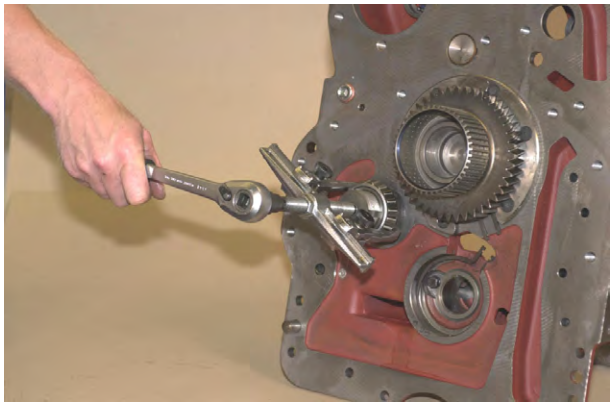


Figure 69
Remove idler gear inner taper bearing.

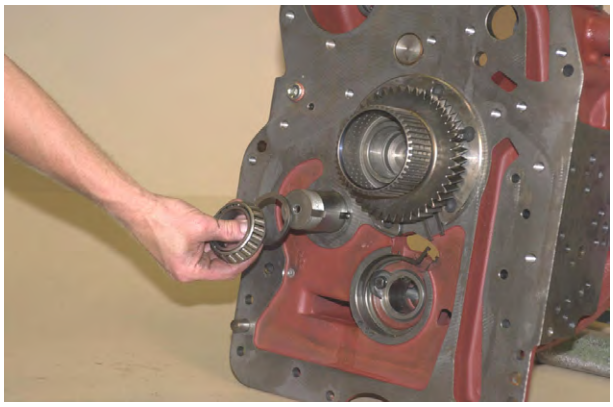


Figure 70
Idler gear inner taper bearing and spacer removed.

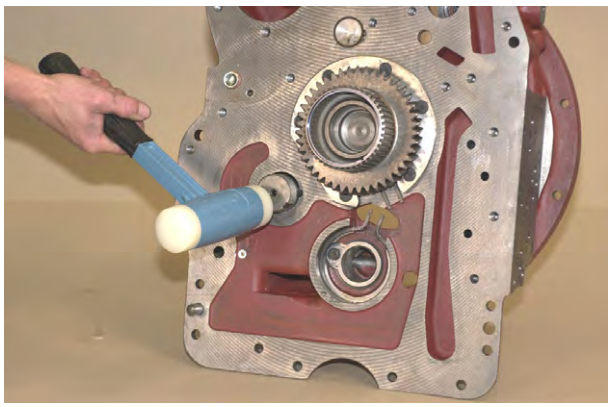


Figure 71
Remove idler shaft lock ball and tap idler shaft from converter housing.

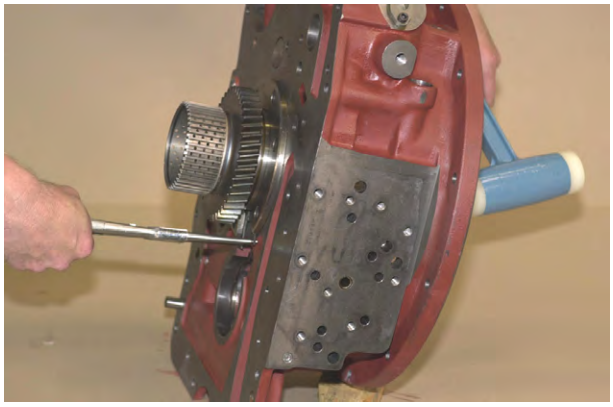


Figure 72
Using spreading type pliers, spread ears on the turbine shaft bearing snap ring and tap turbine shaft and bearing from converter housing.

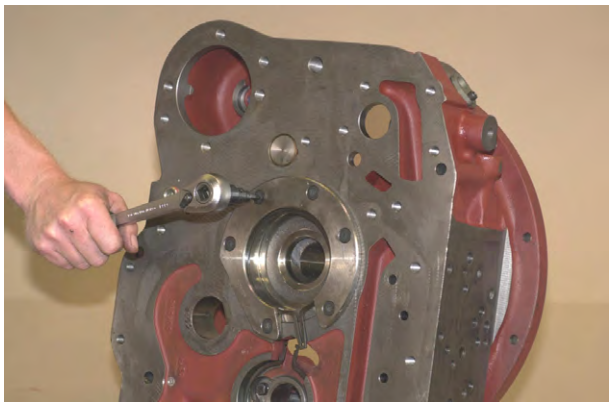


Figure 73
Remove stator support screws.

Figure 74
Tap stator support from converter housing.

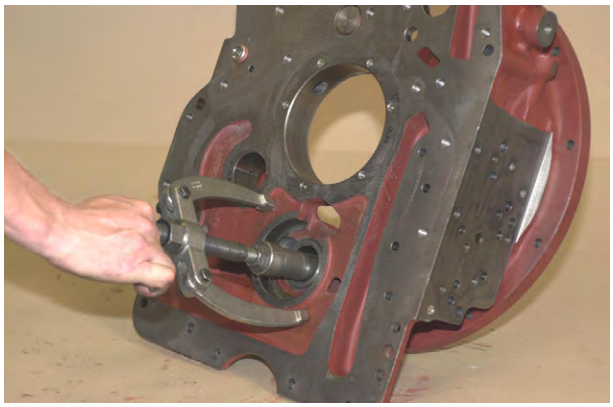


Figure 77
Using a sleeve puller as shown, remove sleeve.

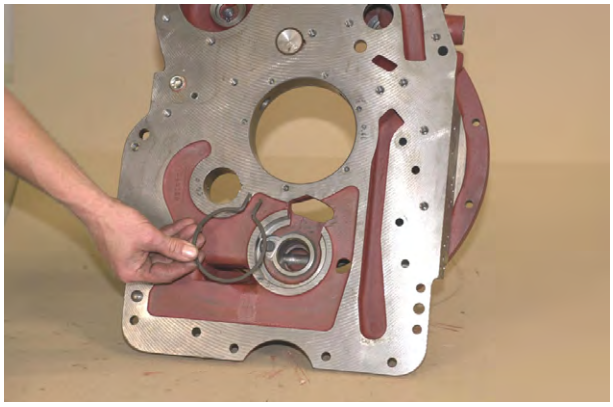


Figure 75
Remove clutch shaft front bearing locating ring.

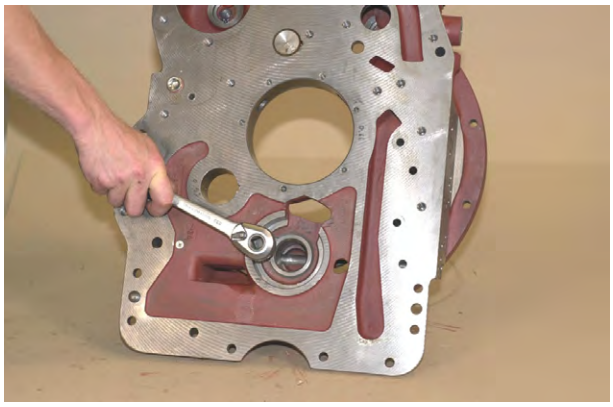


Figure 76
Remove oil sealing ring sleeve retainer screw and lockwasher. Remove sleeve lock.

Figure 78
Remove stator support bearing retaining ring.

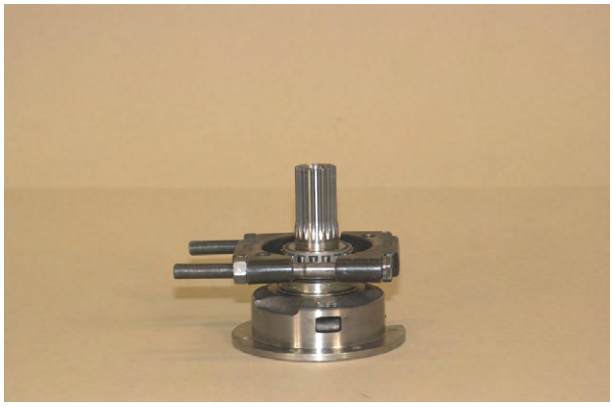


Figure 79
Remove bearing from stator support.
Remove oil sealing ring.

Figure 80
Remove turbine shaft oil sealing ring.

Figure 81
Remove turbine shaft bearing retaining ring and washer.

Figure 82
Remove turbine shaft bearing.

Figure 83
Remove clutch shaft piston rings.

Figure 86
Pry reverse gear from clutch assembly far enough to use a gear puller.

Figure 84
Remove clutch shaft front bearing retaining ring.

Figure 87
Remove reverse clutch gear and outer bearing.

Figure 85
Remove clutch shaft front bearing.

Figure 88
Remove clutch gear bearing spacer.

Figure 89
Remove end plate retaining ring.

Figure 90
Remove end plate.

Figure 91
Remove inner and outer discs.

Figure 92
Remove clutch gear inner bearing.

Figure 93
Compress spring and through opening remove spring retainer snap ring. Release tension on spring and remove clutch piston return spring.
A sleeve with a portion removed is recommended for removing the clutch piston spring, washer and retainer ring.

Sleeve shown is a common pipe,
with a 1-1/2 x 1 [39,0 x 26,0 mm] opening.
The pipe is 6 x 3-1/4 x 2-3/4
[155,0 x 85,0 x 78,0 mm]

Figure 94
Remove piston disc springs and piston spacer.

Note:
Do not mix disc springs with any other disc springs, as they are matched spring packs.
See page 10-60.

Figure 95
Remove clutch piston.

Figure 96
Remove end plate retaining ring.

Figure 99
Compress piston return spring and remove retainer ring.

Figure 97
Remove end plate.

Figure 100
Remove return spring, spring retainer and retainer ring.

Figure 98
Remove inner and outer clutch discs.

Figure 101
Remove clutch piston.

Figure 102
Refer to the “Cleaning and Inspection” pages. The bleed valve (if used) must be clean and free of any foreign materials. Install the clutch piston outer seal ring.

Note:
Ring must be sized before installing in clutch drum. Sizing is best accomplished by rotating clutch piston while holding a round object against the new seal. Rotate piston until seal is flush with outer diameter of piston.

Figure 104
Position piston in 2nd clutch drum as shown. Use caution not to damage inner and outer seal rings.

Figure 105
Position piston return spring, spring retainer and snap ring in clutch drum.

Figure 103
Insert clutch piston inner seal ring and size as described in figure 102.

Figure 106
Compress spring and spring retainer and install retainer snap ring in groove.

Figure 107
Install one steel disc.

Figure 108
Install one friction disc. Alternate steel and friction discs until the proper amount of discs are installed.
First disc next to piston is steel, last disc installed is friction.

Figure 109
Install end plate.

Figure 110
Install end plate retainer ring.

Figure 111
Refer to the “Cleaning and Inspection” pages.
Install clutch piston outer seal ring.
Size as described in figure 102.

Figure 112
Install clutch piston inner seal ring.
Size as described in figure 102.

Figure 113
Install clutch piston in clutch drum.
Use caution not to damage sealing rings.

Figure 114
Position spring spacer and piston return spring with large diameter towards spacer. (See figure 115).
Alternate five (5) springs, see note figure 94.

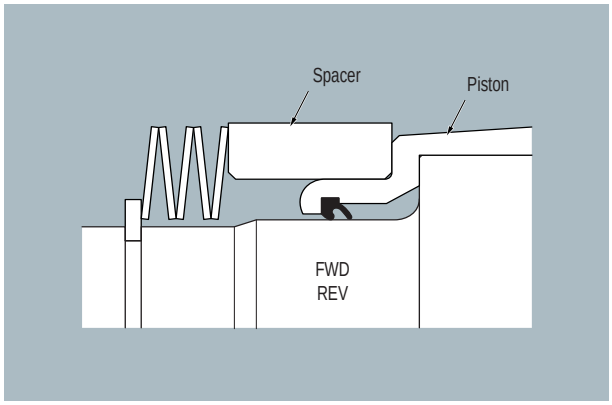


Figure 115

Figure 116
Position spring snapring. Compress spring and install snapring.

Figure 117
Install one (1) steel disc.

Figure 120
Install end plate retaining ring.

Figure 118
Install one (1) friction disc.
Alternate steel and friction discs until proper amount of discs are installed.
First disc next to the piston is steel, last disc installed is friction.

Figure 121
Install clutch gear inner bearing.
Note:
This bearing does not have a shield in it.

Figure 119
Install end plate.

Figure 122
Install clutch gear bearing spacer.

Figure 123
Install reverse gear into clutch drum.
Align splines in reverse gear with internal teeth of friction discs.
DO NOT FORCE THIS OPERATION.
Gear splines must be in full position with internal teeth of all friction discs.

Figure 126
Install bearing retainer ring.

Figure 124
Install clutch gear outer bearing.
Note:
Outer bearing has a shield in it. This shield must be up.

Figure 127
Install clutch shaft piston rings.

Figure 125
Install clutch shaft front bearing.
Note:
Bearing outer diameter locating ring groove must be up.

Figure 128
Remove clutch shaft sealing rings.

Figure 131
Remove inner and outer clutch discs.

Figure 129
Remove end plate retainer ring.

Figure 132
Compress piston return disc springs and remove retainer ring.

Figure 130
Remove end plate.

Figure 133
Remove piston return disc springs and piston spacer. See note figure 94.

Figure 134
Remove clutch piston.

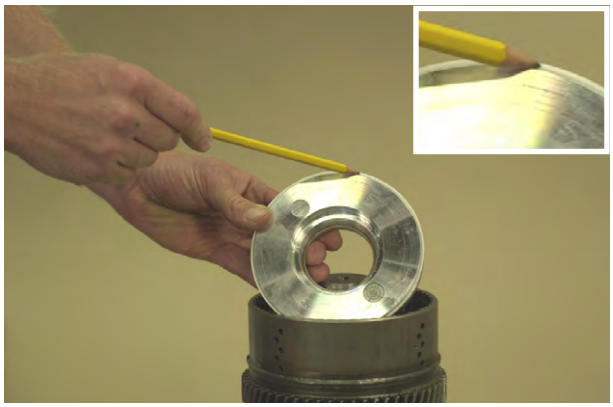


Figure 135
Refer to the “Cleaning and Inspection” pages.
Install clutch piston outer sealing ring.
Size as described in figure 102.

Figure 138
Position spring spacer, piston return springs and retainer ring.
First spring with large diameter towards spacer.
See figure 139.
Alternate five (5) springs. See note figure 94.

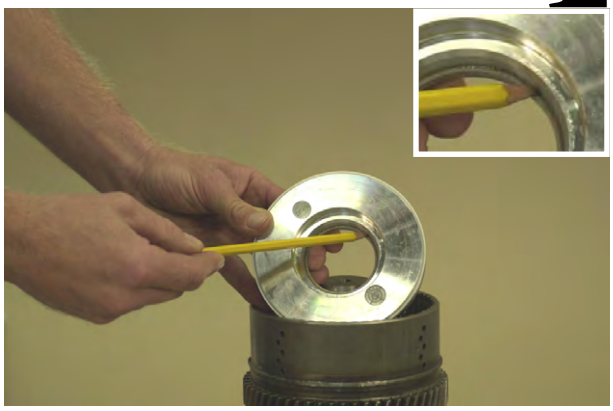


Figure 136
Install clutch piston inner sealing ring.
Size sealing ring as described in figure 102.

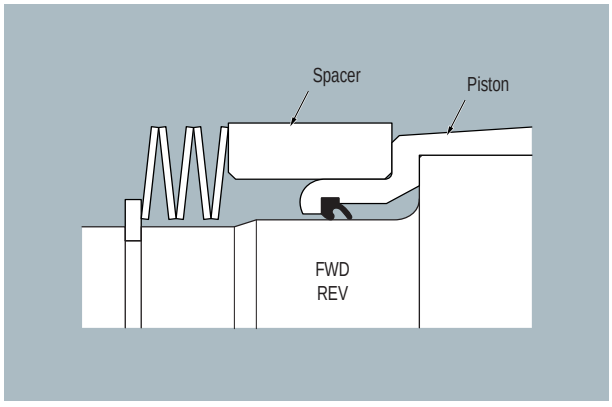


Figure 139

Figure 137
Install clutch piston in clutch drum.
Use caution not to damage sealing rings.

Figure 140
Compress piston return disc springs and install return spring retainer ring.

Figure 141
Install one (1) steel disc.

Figure 142
Install one (1) friction disc.
Alternate steel and friction discs until proper amount of discs are installed.
First disc next to piston is steel, last disc installed is friction.

Figure 143
Install end plate.

Figure 144
Install end plate retainer ring.

Figure 145
Install clutch shaft sealing rings.

Figure 146
Remove clutch shaft pilot bearing.

Figure 147
Remove end plate retaining ring.

Figure 148
Remove end plate.

Figure 149
Remove inner and outer clutch discs.

Figure 150
Compress piston return spring and spring retainer. Remove retainer ring.

Figure 151
Remove return spring, spring retainer and retainer ring.

Figure 152
Remove clutch piston.

Figure 155
Remove 3rd clutch shaft rear bearing.

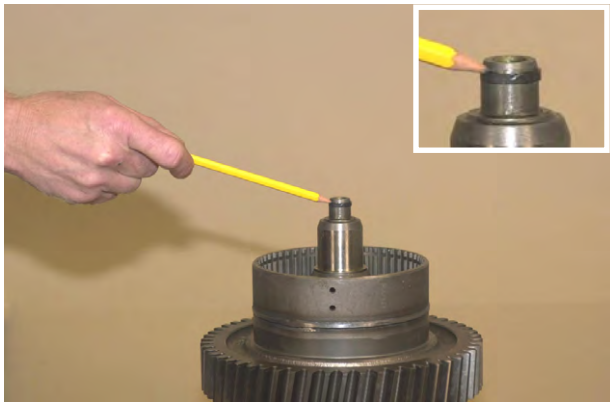


Figure 153
Remove sealing ring.

Figure 154
Remove 3rd clutch shaft rear bearing retaining ring.

Figure 156
Refer to the “Cleaning and Inspection” pages. Install 3rd clutch shaft rear bearing.
Note:
Bearing outer diameter locating ring groove must be up.

Figure 157
Install rear bearing retaining ring.

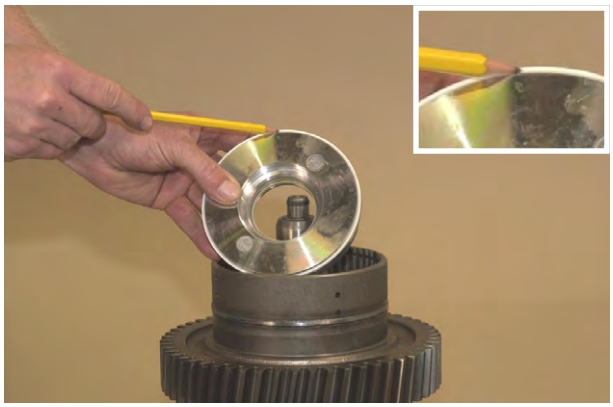


Figure 158
Refer to the “Cleaning and Inspection” pages. The bleed valve in the clutch piston must be clean and free from any foreign material. Install clutch piston outer seal ring.
Size as described in figure 102.

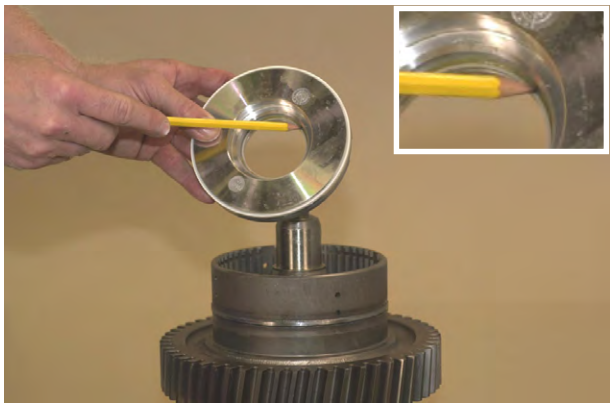


Figure 159
Install clutch piston inner seal ring. Size sealing ring as described in figure 102.

Figure 160
Install clutch piston in clutch drum. Use caution as not to damage sealing rings.

Figure 161
Install one (1) steel disc.

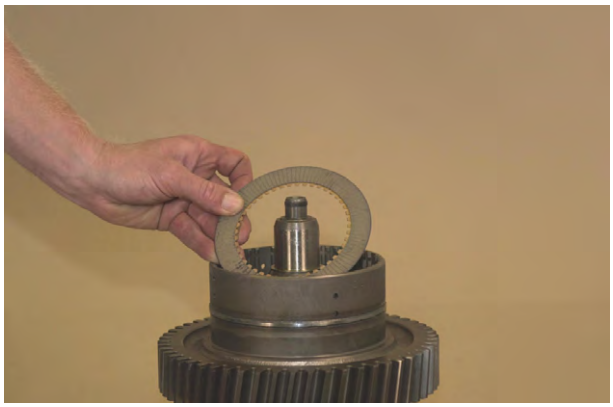


Figure 162
Install one (1) friction disc.
Alternate steel and friction discs until the proper amount of discs are installed. First disc next to the piston is steel, last disc installed is friction.

Figure 163
Install end plate.

Figure 164
Install end plate retaining ring.

Figure 165
Position piston return spring, spring retainer and retaining ring.

Figure 166
Compress return spring and install retaining ring.

Figure 167
Install clutch shaft pilot bearing.

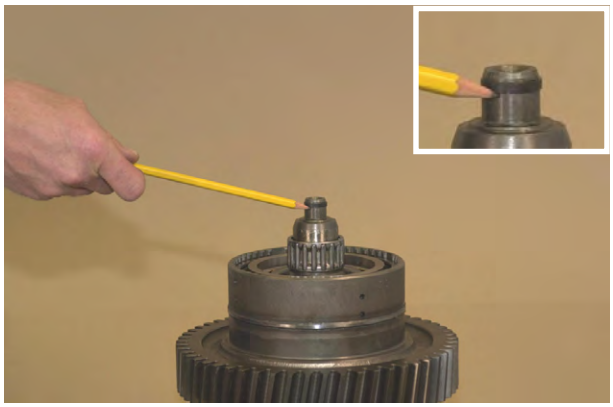


Figure 168

Install new oil seal ring on output shaft.

Note:

New ring must be sized before shaft can be assembled in the transmission housing. A sizing tool can be made for ease of sizing oil sealing rings. See section 12 “Service Tools” (page 12-2).

Figure 169
Remove low gear and hub, low shaft front bearing, bearing spacer and clutch gear outer bearing.

Figure 172
Remove end plate.

Figure 170
Remove low speed gear bearing spacer.

Figure 173
Remove inner and outer clutch discs.
Do not mix low clutch friction discs with friction discs in other clutches.

Figure 171
Remove end plate retaining ring.

Figure 174
Remove low speed gear inner bearing.

Figure 175
Remove inner bearing locating ring.

Figure 178
Remove clutch piston.

Figure 176
Compress piston return spring and spring retainer. Remove retainer ring.

Figure 179
Remove clutch shaft piston ring.

Figure 177
Remove spring retainer ring, spring retainer and spring.

Figure 180
Refer to the “Cleaning and Inspection” pages. The bleed valve in the clutch drum must be clean and free of any foreign material.
Install clutch piston outer seal. Size as described in figure 102.

Figure 181
Install clutch piston inner seal ring and size as described in figure 102.

Figure 182
Position piston in clutch drum as shown. Use caution not to damage inner and outer piston seal rings.

Figure 183
Position piston retainer spring, spring retainer and snap ring in clutch drum.

Figure 184
Compress spring and spring retainer and install spring retainer retaining ring.

Figure 185
Install clutch inner bearing locating ring.

Figure 186
Install one (1) steel disc.

Figure 188
Install clutch disc end plate.

Figure 187
Install one friction disc. Alternate steel and friction discs until proper amount of discs are installed.
First disc next to the piston is steel, last disc installed is friction.

Note:
The friction discs in the low clutch have a higher coefficient rating than the friction discs in the other clutches, therefore the discs must not be mixed.
The low clutch friction discs have a yellow mark of non-soluble paint on the outer diameter for permanent identification.

Figure 189
Install end plate retainer ring.

Figure 190
Install low speed gear inner bearing.

Figure 191
Install low speed gear bearing spacer.

Figure 194
Position low gear front bearing spacer.

Figure 192
Install clutch driven gear and hub into the clutch drum. Align splines on the clutch hub with the internal teeth of the friction discs. Tap gear into position. **DO NOT FORCE THIS OPERATION**. Gear splines must be in full position with internal teeth of all the friction discs.

Figure 195
Install low clutch shaft front bearing.

Figure 193
Install low speed gear outer bearing.

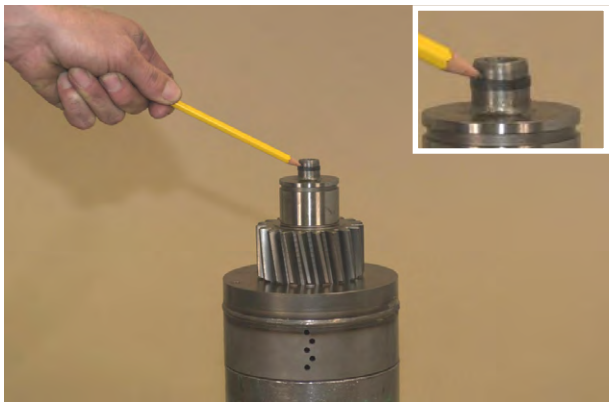


Figure 196
Install new oil seal ring on low clutch shaft.
Note:
New ring must be sized before installing low shaft bearing cap. A sizing tool can be made for ease of sizing oil sealing rings.
See section 12 “Service Tools” (page 12-2).

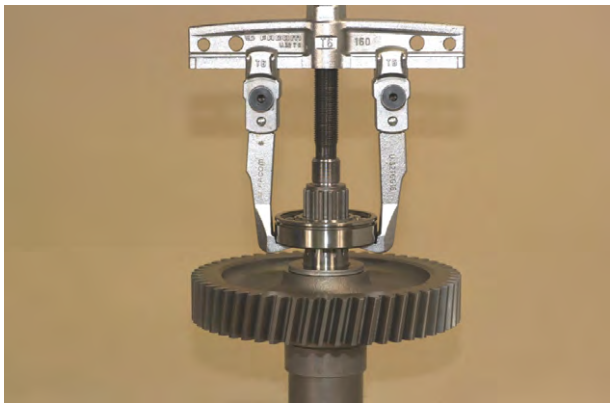


Figure 197
Remove output shaft rear bearing.

Figure 200
Remove output shaft gear spacer.

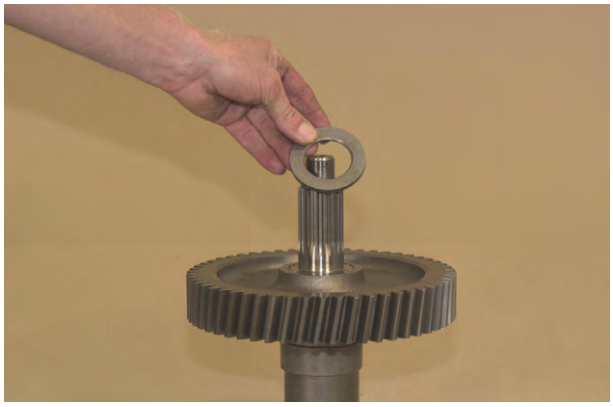


Figure 198
Remove output shaft rear bearing washer.

Figure 201
Remove output shaft front bearing retaining ring.

Figure 199
Remove output shaft gear.

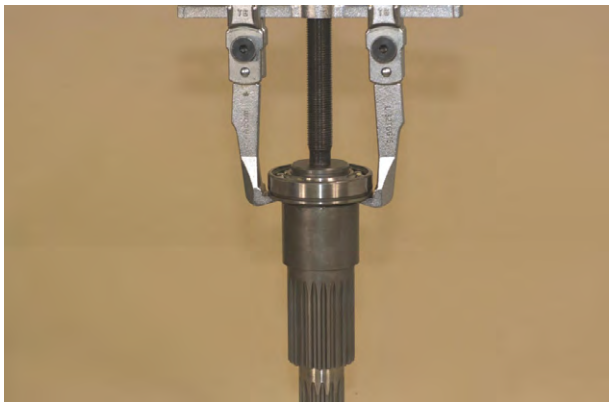


Figure 202
Remove output shaft front bearing.

Figure 203
Tap front bearing into place.

Figure 204
Install output shaft front bearing retaining ring.

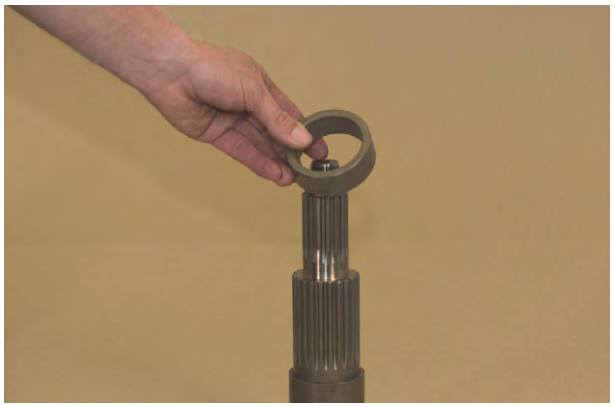


Figure 205
Position output shaft gear spacer.

Figure 206
Install output gear (long hub down).

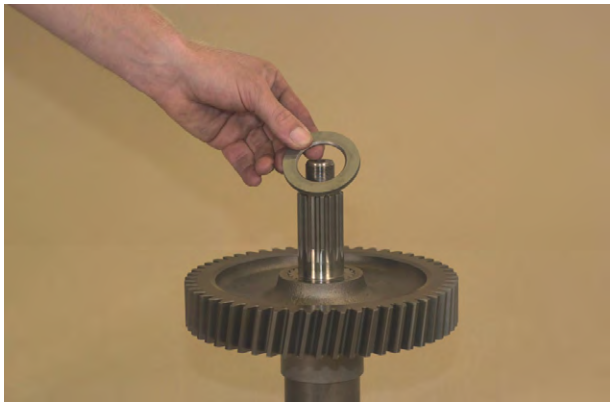


Figure 207
Install output shaft rear bearing washer.

Figure 208
Install output shaft rear bearing.
Note:
Rear bearing locating ring groove must be up.

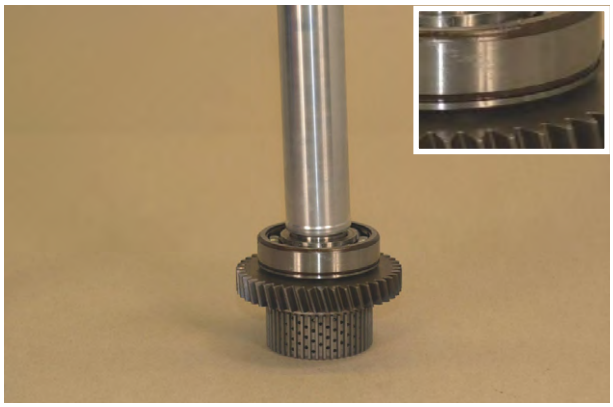


Figure 209
Refer to the “Cleaning and Inspection” pages.
Press turbine shaft bearing into position.
Note:
Bearing groove must be down.

Figure 210
Position bearing spacer and install bearing retaining ring.

Figure 211
Install new turbine shaft oil sealing ring.

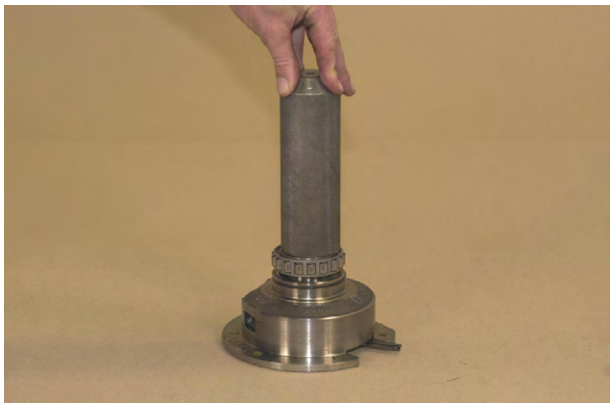


Figure 212
Press support bearing into position.
Note
Bearing partnumber must be up.

Figure 213
Install bearing retaining ring.

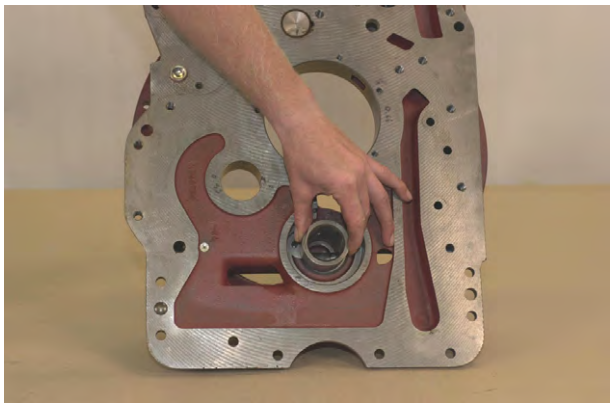


Figure 214
When installing a new sleeve, it is recommended that a press or driver be used to prevent damage to the sleeve. Be sure the notch in the sleeve is aligned with the sleeve lock notch.

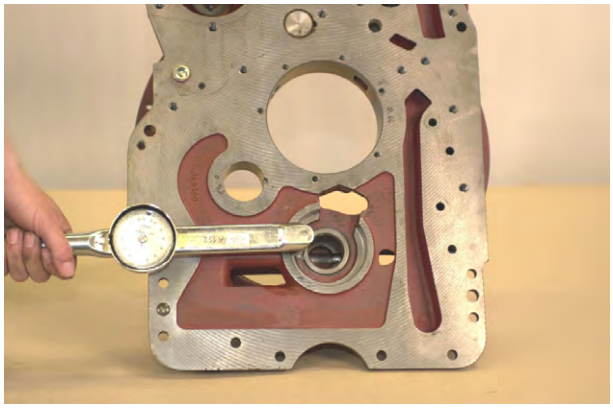


Figure 215
Install sleeve lock and capscrew. Tighten screw to specified torque (See torque chart).

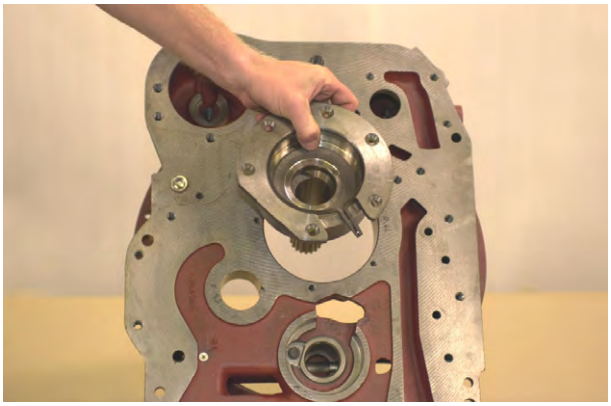


Figure 216
Clean stator support mounting face and tapped holes with solvent. Dry thoroughly. Make sure tapped holes are clean and dry.
Position support in converter housing and align holes in support with holes in housing. Tap into position.

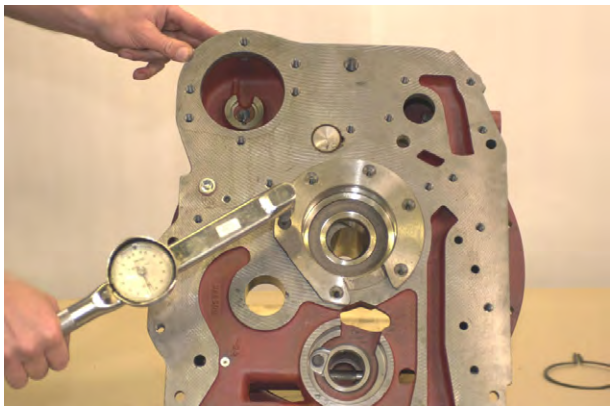


Figure 217
Install six (6) special stator support screws. Tighten screws to 12-16 Lbs.Ft. [16.3 - 21.6Nm].
Note:
Assembly of stator support to converter housing must be completed within a 15 minutes period, from the start of the screw installation. The special screws are to be used for one installation only. The Loctite left in the holes must be removed with a proper tap and cleaned with solvent. Dry holes thoroughly and use new screws for reinstallation.

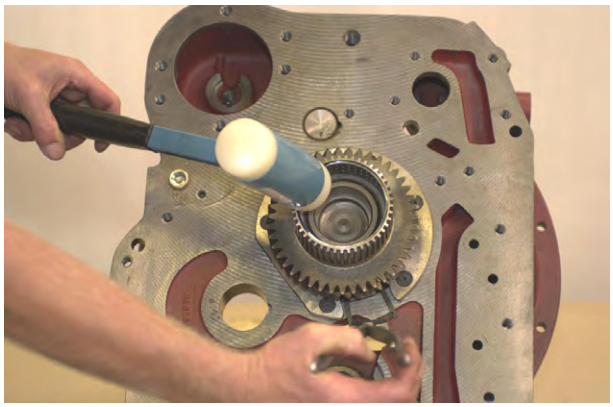


Figure 218
Spread ears on turbine shaft bearing retainer ring located in reaction member support. Tap turbine shaft and bearing into position. Check that the bearing snap ring is in full position in the snap ring groove.

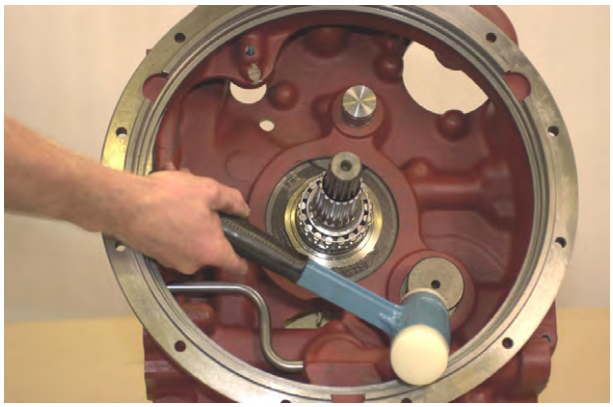


Figure 219
With new “O” ring on shaft, position idler shaft in converter housing. Tap shaft into position.

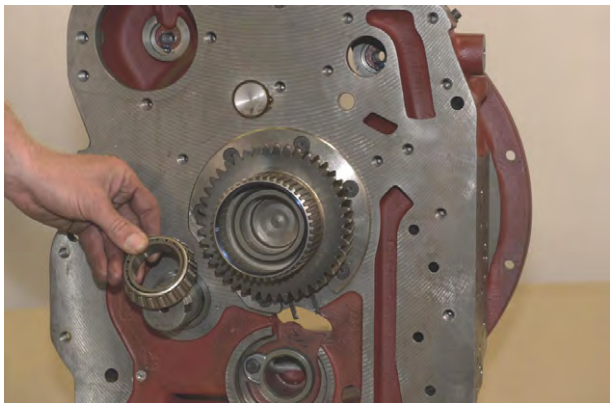


Figure 222
Install idler shaft gear inner taper bearing on shaft wit large diameter of taper down.

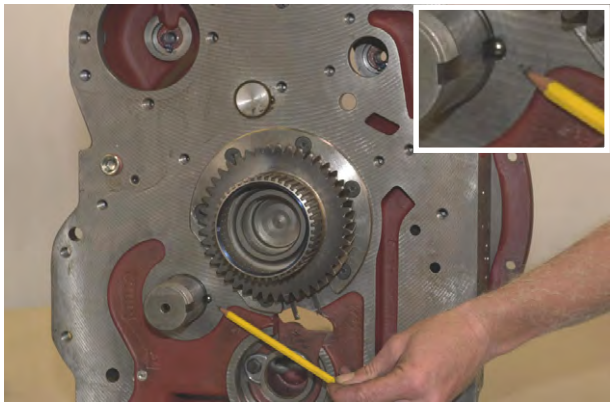


Figure 220
Install idler shaft lock ball.

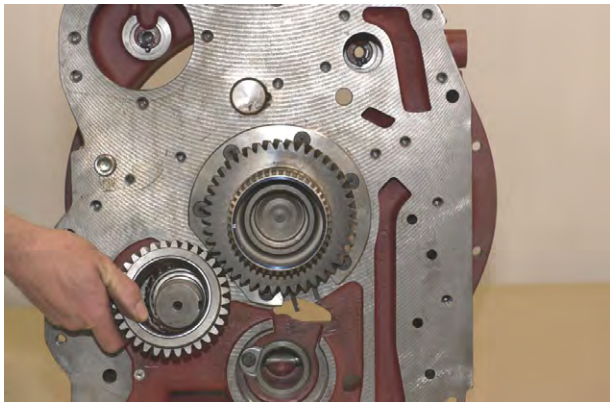


Figure 223
Position idler gear on bearing with hub of gear up.

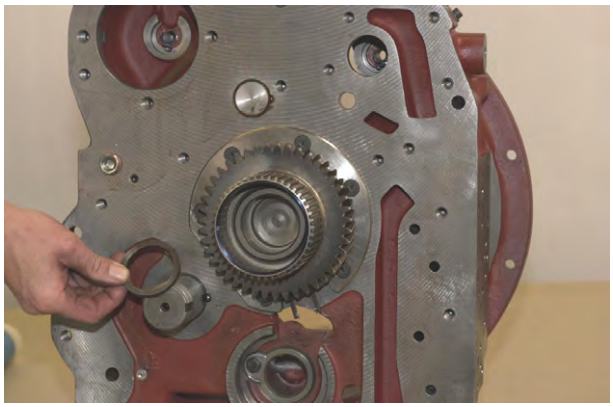


Figure 221
Install idler shaft spacer.

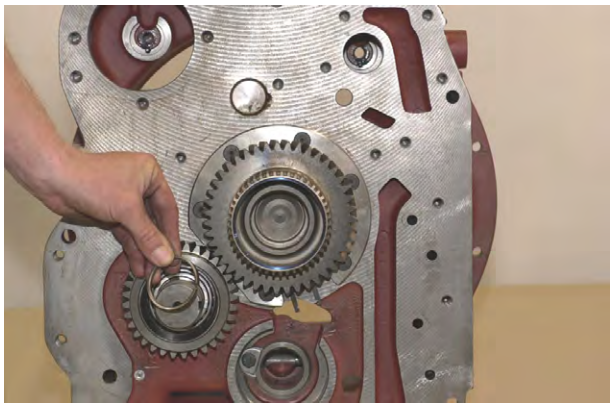


Figure 224
Position bearing spacer on shaft.

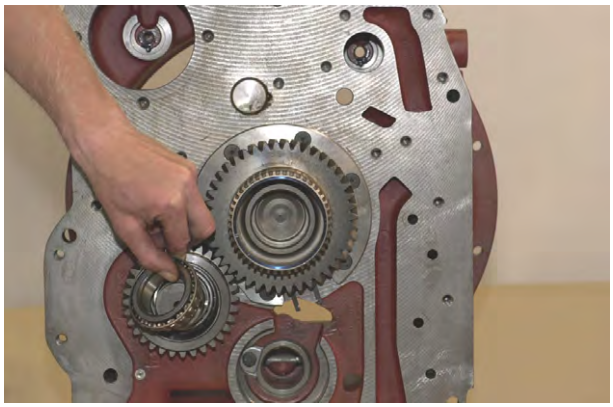


Figure 225
Install taper bearing on shaft with large diameter of taper up.

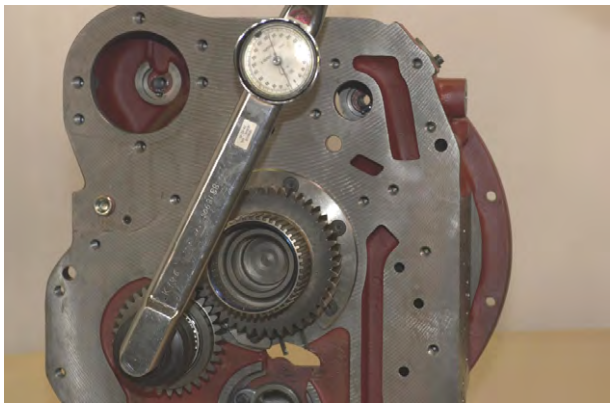


Figure 228
Tighten nut 200-250 Ft.Lbs. torque [271.2-338.8Nm].
Use special tool TG1304-54. See page 12-1.

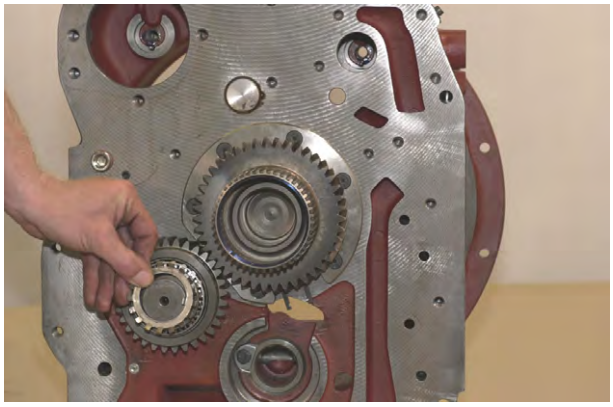


Figure 226
Install reverse idler bearing retainer nut lock plate as shown.

Figure 229
Bend over tag of lock plate which aligns with one of the slots of the lock nut to secure it. See figure 230.

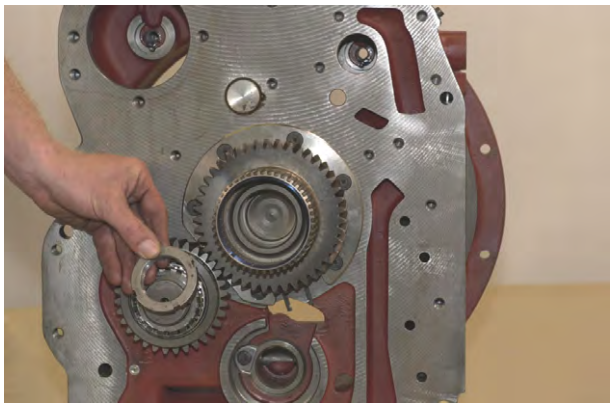


Figure 227
Install reverse idler bearing nut with shamfer down.

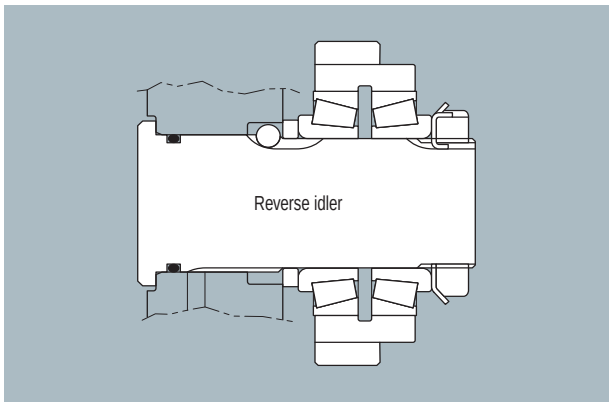


Figure 230

Figure 231
Install suction tube and new “O” ring.

Figure 234
Install piston ring sleeve retainer ring.

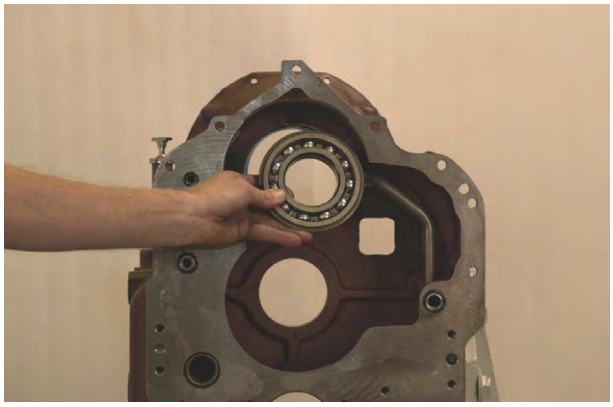


Figure 232
Tap forward shaft rear bearing into position.

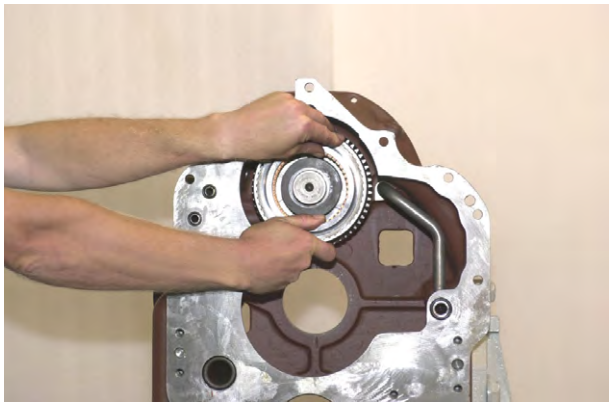


Figure 235
Position forward clutch assembly into transmission housing. Use caution not to damage forward shaft pistion rings.

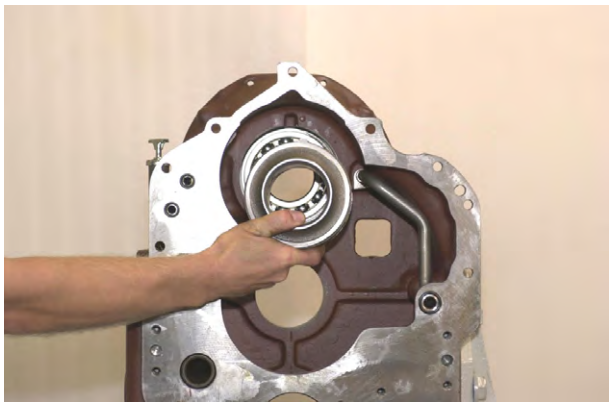


Figure 233
Tap forward shaft piston ring sleeve into position.

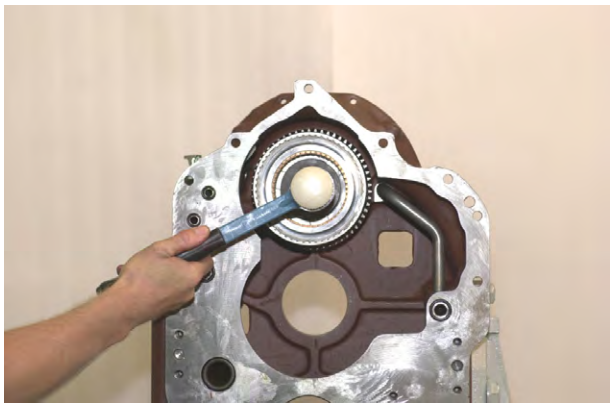


Figure 236
Tap clutch assembly into position.

Figure 237
From the rear locate 3rd gear and clutch disc hub on forward shaft.

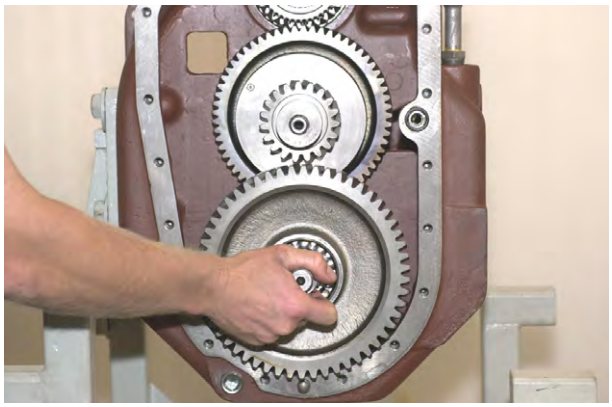


Figure 240
Position output shaft assembly in housing.

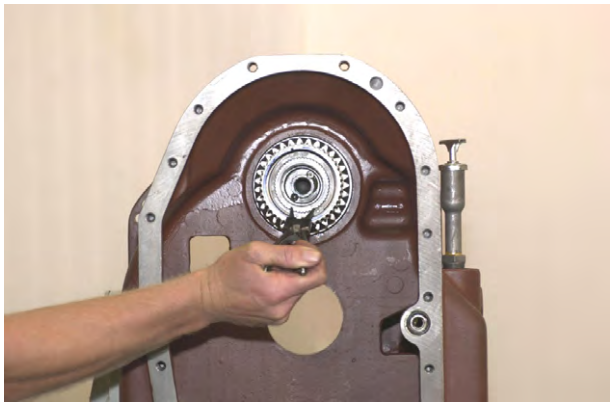


Figure 238
Install clutch gear retainer ring.

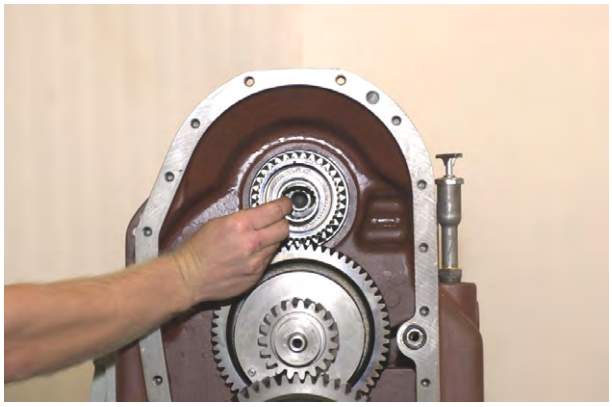


Figure 241
Position 3rd speed clutch front pilot bearing in forward clutch shaft.

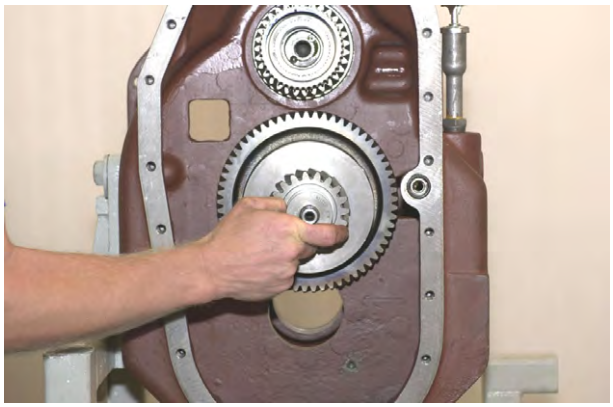


Figure 239
Locate low clutch assembly in housing. Tap into position.

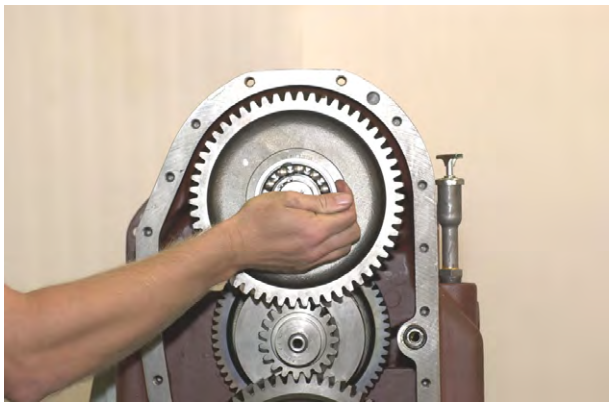


Figure 242
Position 3rd speed clutch assembly in pilot bearing. Use caution not to damage pilot bearing.

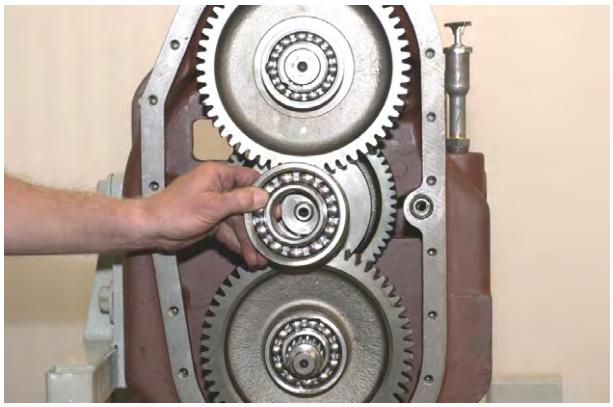


Figure 243
Install low clutch rear bearing with bearing locating ring groove to the rear.

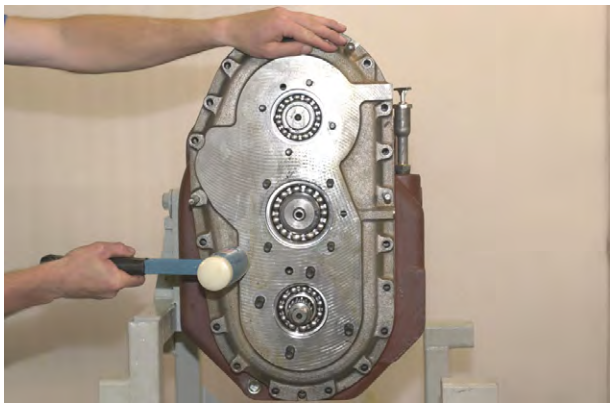


Figure 246
Tap cover into place. The use of aligning studs will facilitate rear cover installation.

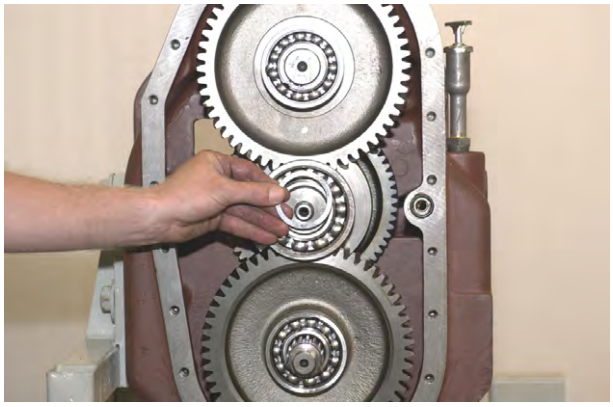


Figure 244
Position rear bearing washer and retaining ring on shaft.

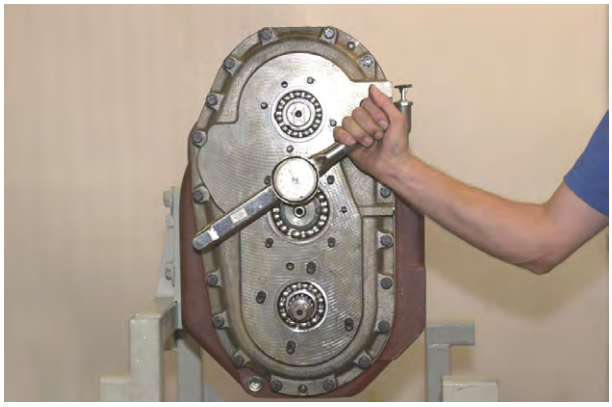


Figure 247
Install rear cover bolts and lockwashers. Tighten bolts to specified torque. (See torque chart).

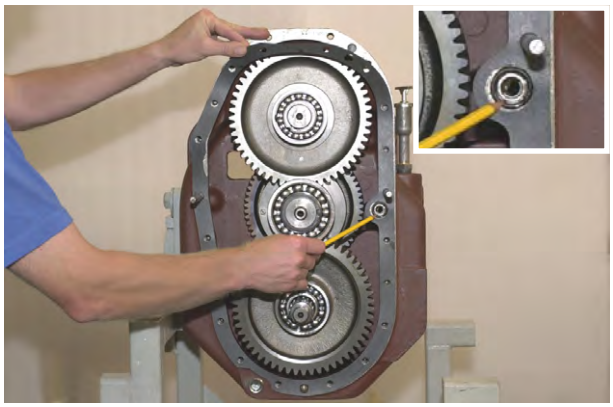


Figure 245
Position new gasket and “O” ring on rear of transmission case. A light coat of grease will hold the gasket in place.

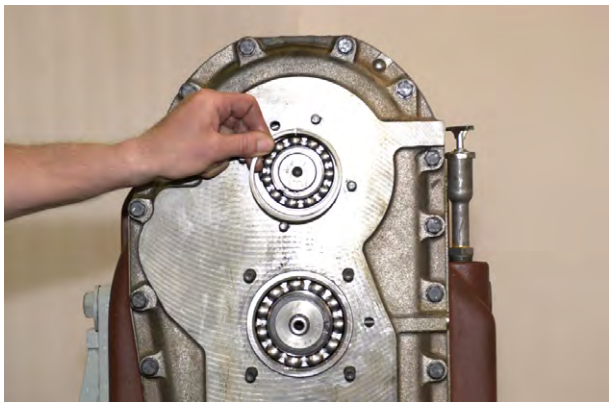


Figure 248
From the front, tap on the low clutch shaft.
The low clutch will move to the rear and hit 3rd clutch gear and output gear. Tap on the rear cover until all 3 rear shaft locating ring grooves are visible. Install 3rd clutch shaft rear bearing loacating ring.

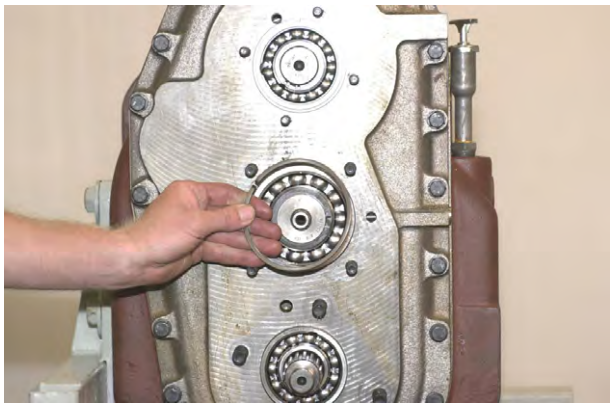


Figure 249
Install low clutch shaft rear bearing locating ring.

Figure 250
Install output shaft rear bearing locating ring.

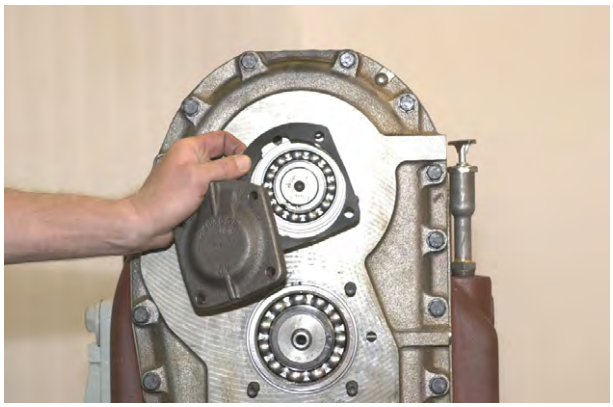


Figure 251
Install new gasket and position 3rd shaft rear bearing cap.

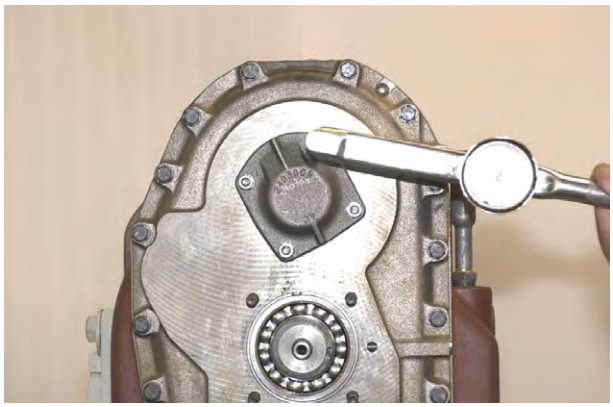


Figure 252
Install lockwashers and stud nuts. Tighten nuts to specified torque. (See torque chart).

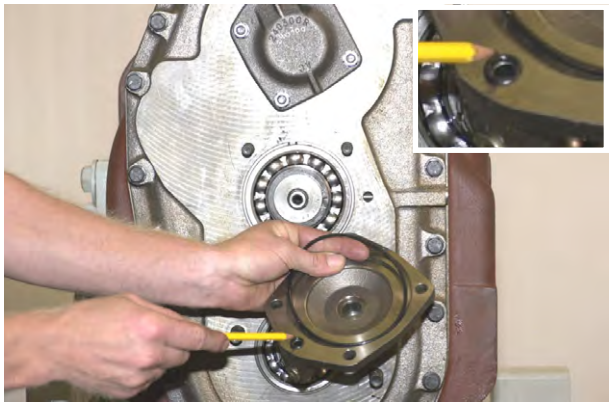


Figure 253
Position new “O” ring on the low clutch shaft rear bearing cap.

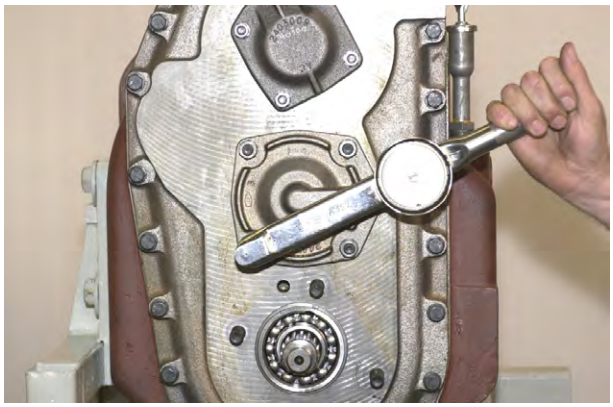


Figure 254
Install lockwashers and stud nuts. Tighten nuts to specified torque. (See torque chart).

Figure 255
Apply a light coat of Loctite© 638 to the outer diamater of the output oil seal.With the lip of the seal down, press seal in bearing cap to a depth of .44 [11.2mm] from outer face of bearing cap. Position new gasket on bearing cap. Install bearing cap.
Note:
Some units will have “O” rings between the cap and the cover.

Figure 257
Position output flange on output shaft. Install new “O” ring, washer and flange nut.

Figure 258
Block flange to prevent turning. Thighten flange nut 200-250 Ft.Lbs. torque. [271.2-339.0Nm].

Figure 256
Install lockwashers and stud nuts.
Tighten nuts to specified torque. (See torque chart).

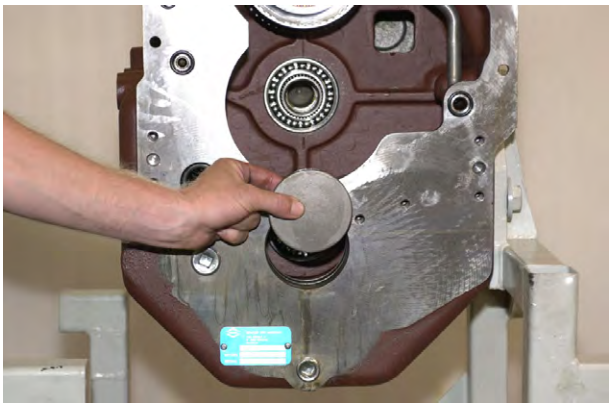


Figure 259
Tap plug into position.

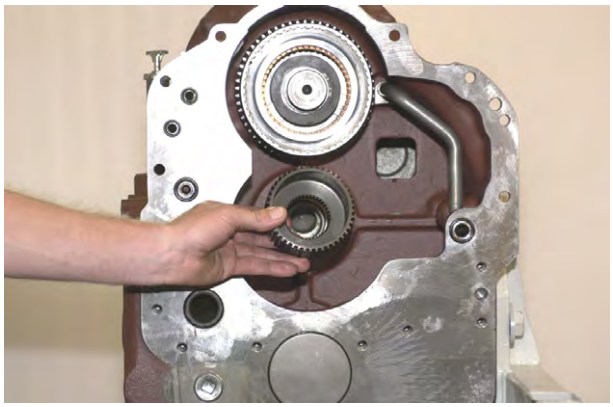


Figure 260
Position 2nd clutch disc hub on low clutch shaft.

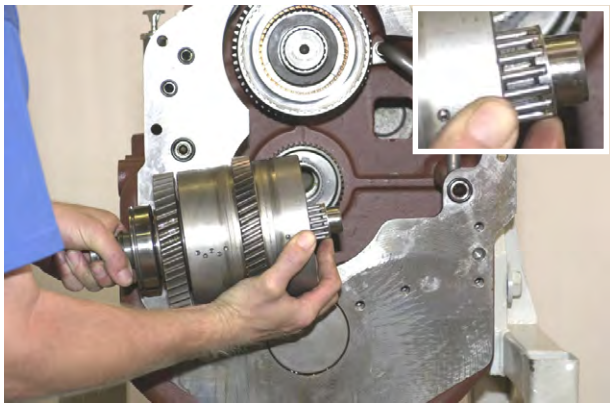


Figure 263
Install 2nd clutch shaft rear pilot bearing on shaft.

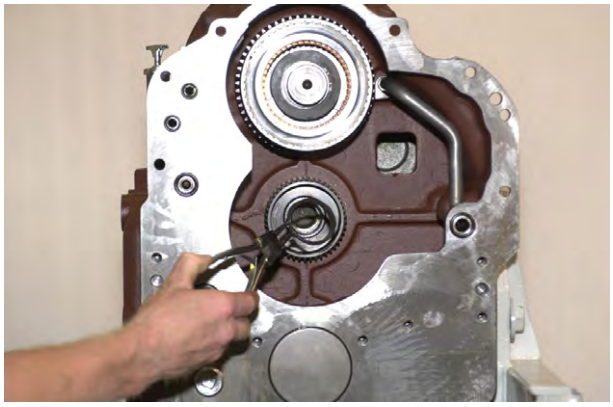


Figure 261
Install 2nd clutch disc hub retaining ring.

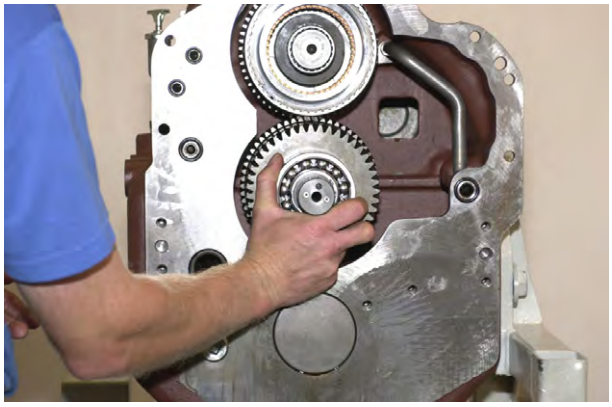


Figure 264
Position reverse and 2nd speed clutch on disc hub, align splines of disc hub with internal teeth of 2nd speed clutch friction discs. Disc hub must be in full position with friction discs.
DO NOT FORCE THIS OPERATION.

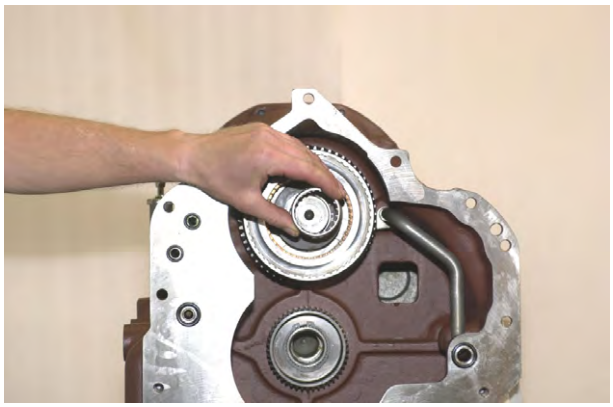


Figure 262
Position pilot bearing on forward clutch shaft.

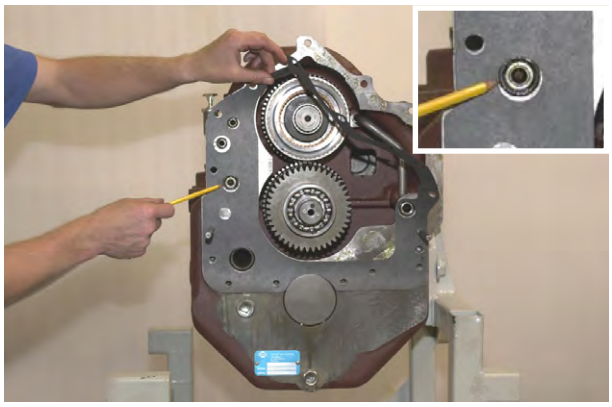


Figure 265
Position new gasket and “O” rings on front of transmission housing. A thin coat of chassis grease will hold the gasket and “O” rings in place.

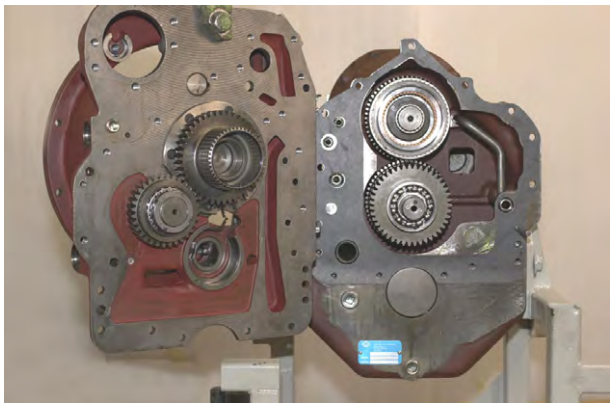


Figure 266
The use of two aligning studs will facilitate aligning the converter housing to the transmission housing.
Install converter housing assembly using extreme caution as to align the clutch pilots into the clutch hubs.
As the pilots enter the disc hubs, turn the turbine shaft and output shaft back and forth. This will help aligning all the clutch inner discs with the disc hubs.
DO NOT FORCE THIS OPERATION.

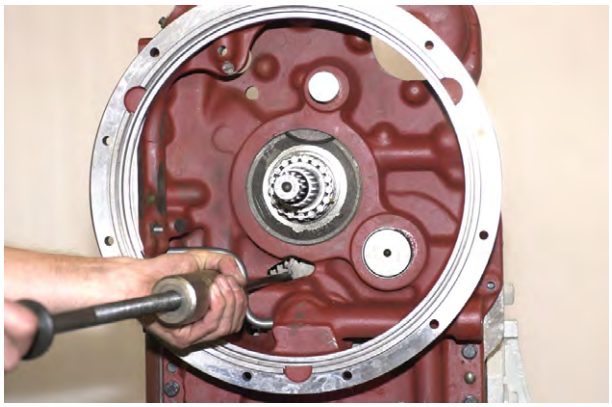


Figure 268
Install a capscrew in the front and in the rear of the converter housing and snug up but do not tighten. This will hold the converter housing to the transmission housing. Using a hook type hammer puller, as shown, pull the reverse clutch gear toward the front of the converter housing. This will move the reverse and 2nd clutch assembly forward to align the snap ring groove in the bearing with the snap ring in the housing.
Check that bearing snap ring is in full position in the snap ring groove.

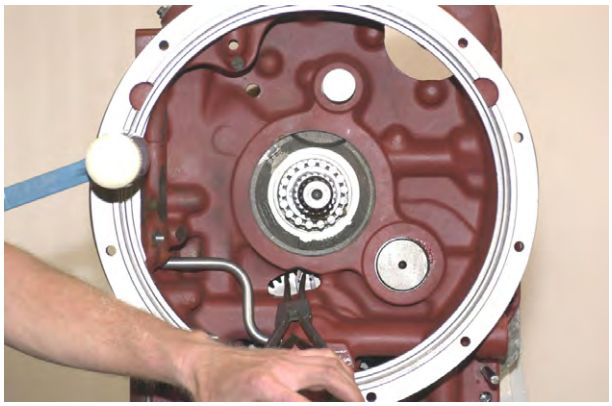


Figure 267
Spread ears on the reverse clutch front bearing snap ring. Open lock pliers to hold snap ring open. Tap converter housing into place.
Use caution as not to damage reverse clutch front piston rings.

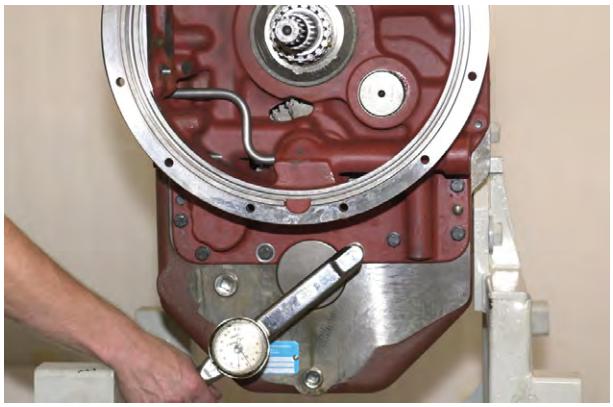


Figure 269
Remove converter housing aligning studs. Install converter housing to transmission housing cap screws. Tighten screws to specified torque. (See torque chart).

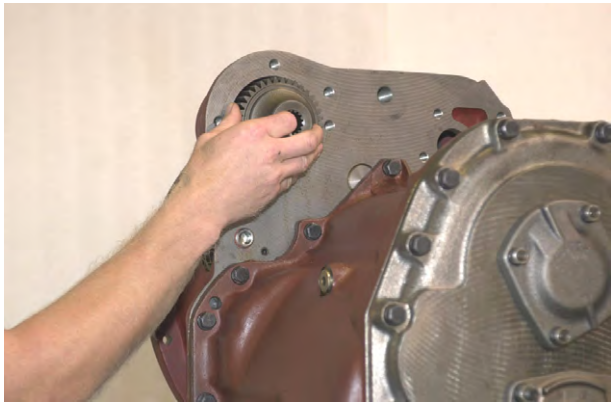


Figure 270
Position auxiliary pump drive gear in converter housing. See figure 271.

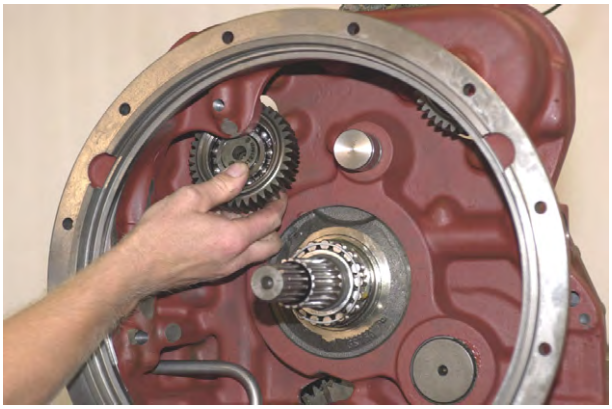


Figure 273
Position charging pump drive gear. See figure 274.

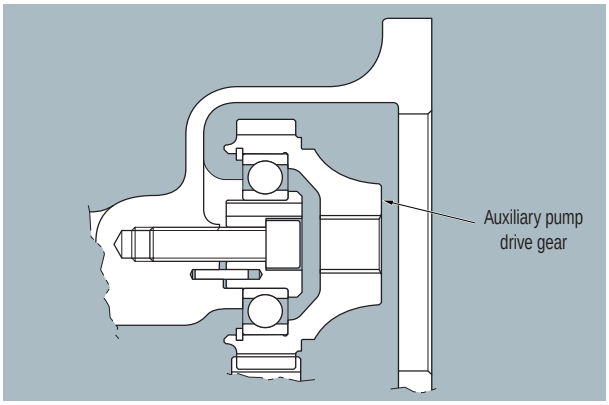


Figure 271

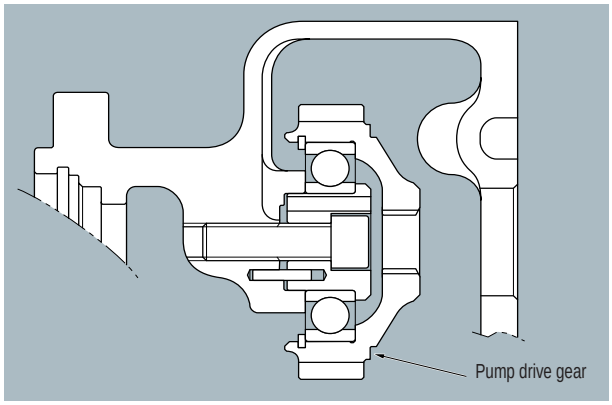


Figure 274

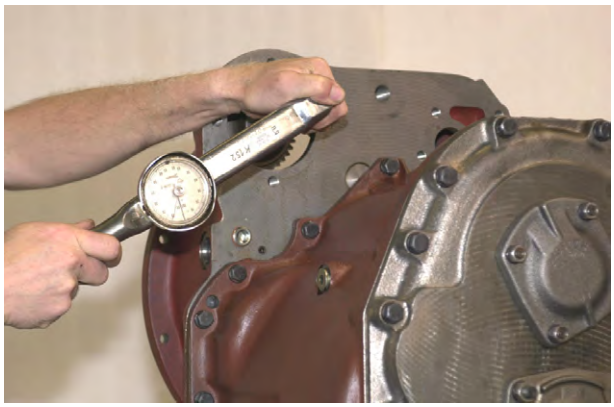


Figure 272
Install cap screw with Loctite® 243. Tighten cap screws 80-88 Ft.Lbs. [108-119Nm].

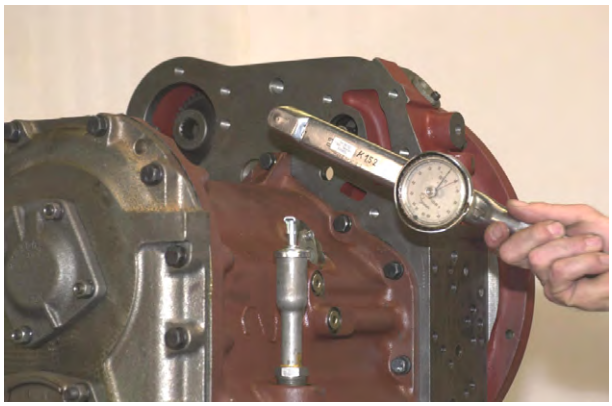


Figure 275
Install cap screws with Loctite® 243.
Tighten cap screws 80-88 Ft.Lbs. [108-119Nm].

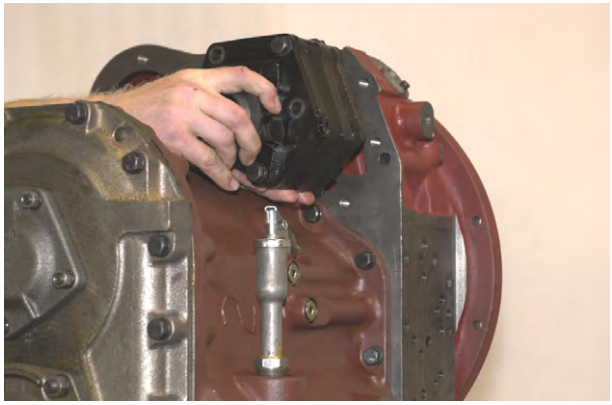


Figure 276
Using a new gasket and “O” ring, position charging pump assembly. Install cap screws and lockwashers.

Figure 279
Install pump hole cover, new gasket, screws and lockwashers. Tighten screws to specified torque. (See torque chart).

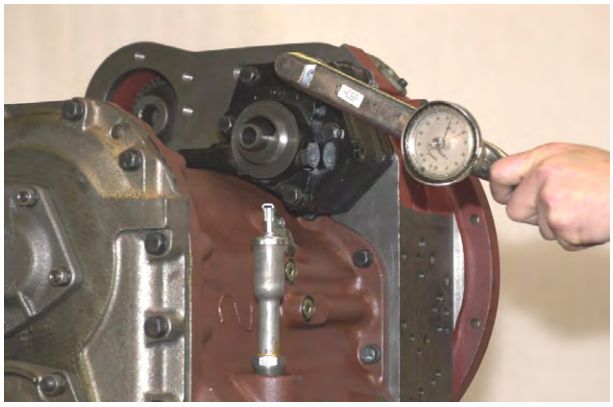


Figure 277
Tighten screws to specified torque. (See torque chart).

Figure 280
Install idler gear bearing retaining ring.

Figure 278
Install new oil filter. Tighten to 20-25 Ft.Lbs. [27.1-33.9Nm].
Note:
It is recommended that the filter cartridge be changed after the first 100 hours of operation on new or repaired units.

Figure 281
Position pump idler gear and bearing.

Figure 282
Install idler gear bearing locating ring.

Figure 285
Position converter assembly on stator support and turbine shaft.

Note:
Use extreme caution as not to cut, break or unhook the piston ring in the stator support.

Figure 283
Press new seal in baffle with lip of seal towards impeller hub bearing. Position new sealing ring on oil baffle.

Figure 286
Install converter assembly retaining ring.

Figure 284
Position oil baffle in housing and install retaining ring. Make certain ring is in full position in ring groove.

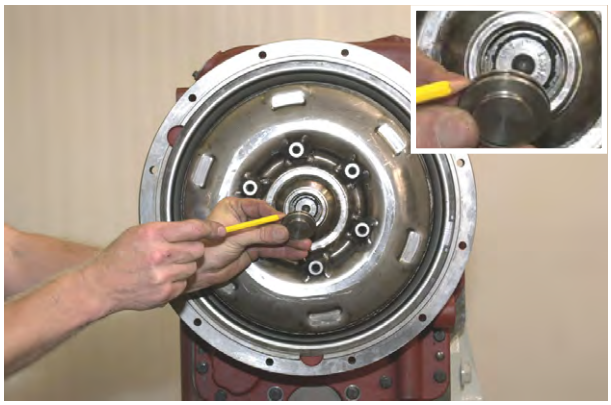


Figure 287
With a new “O” ring in place, install bore plug.

Figure 288
Install bore plug retaining ring.

Figure 289
See special secction on page 5-1 for drive plate installation.

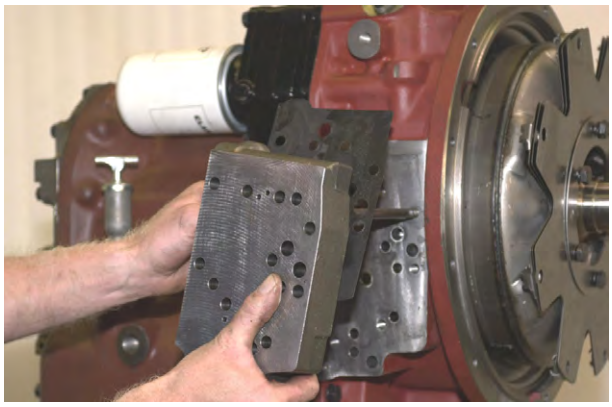


Figure 290
To install the control valve assembly, it is recommended that 2 aligning studs be used. Position new modulator valve to housing gasket. Position modulator assembly (if used) on aligning studs.

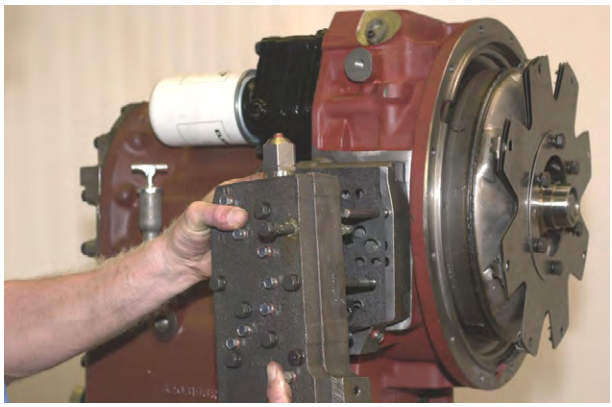


Figure 291
Position new modulator valve to control valve gasket. Position control valve on aligning studs.

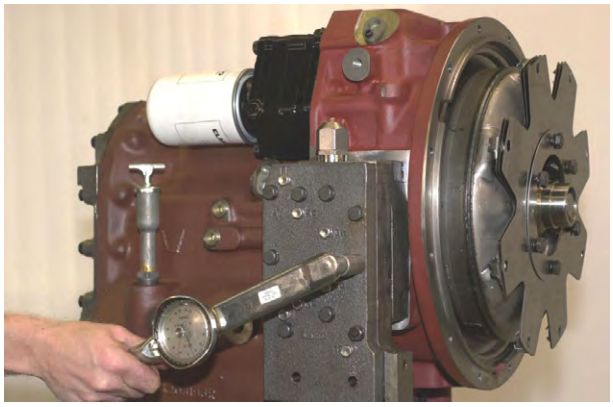


Figure 292
Install control valve to converter housing screws and lockwashers. Tighten screws to specified torque. (See torque chart).

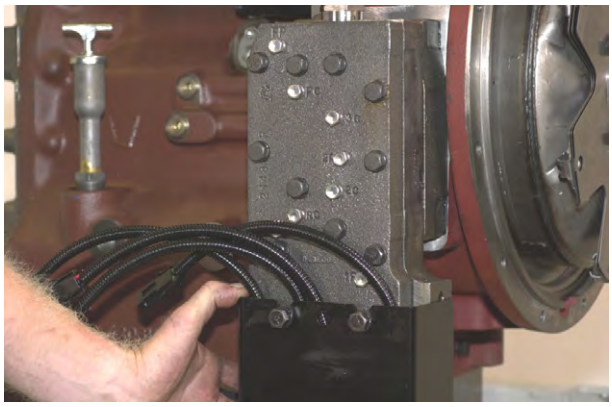


Figure 293
Install protection cover, screws and lockwashers.

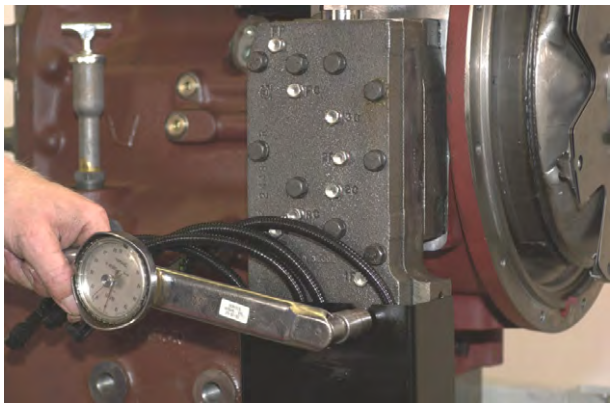


Figure 294
Tighten protection cover screws to specified torque. (See torque chart).

NOTE:

CLUTCH RETURN SPRING PACKS ARE CERTIFIED ACCORDING TO COMPRESSION WEIGHT SPECIFICATIONS AND ARE PRE-PACKED IN QUANTITIES TO REPAIR ONE (1) SPECIFIC CLUTCH.

The disc spring packs are to be used as complete assemblies and care should be taken not to intermix the individual disc springs with disc springs in another clutch or disc spring pack.

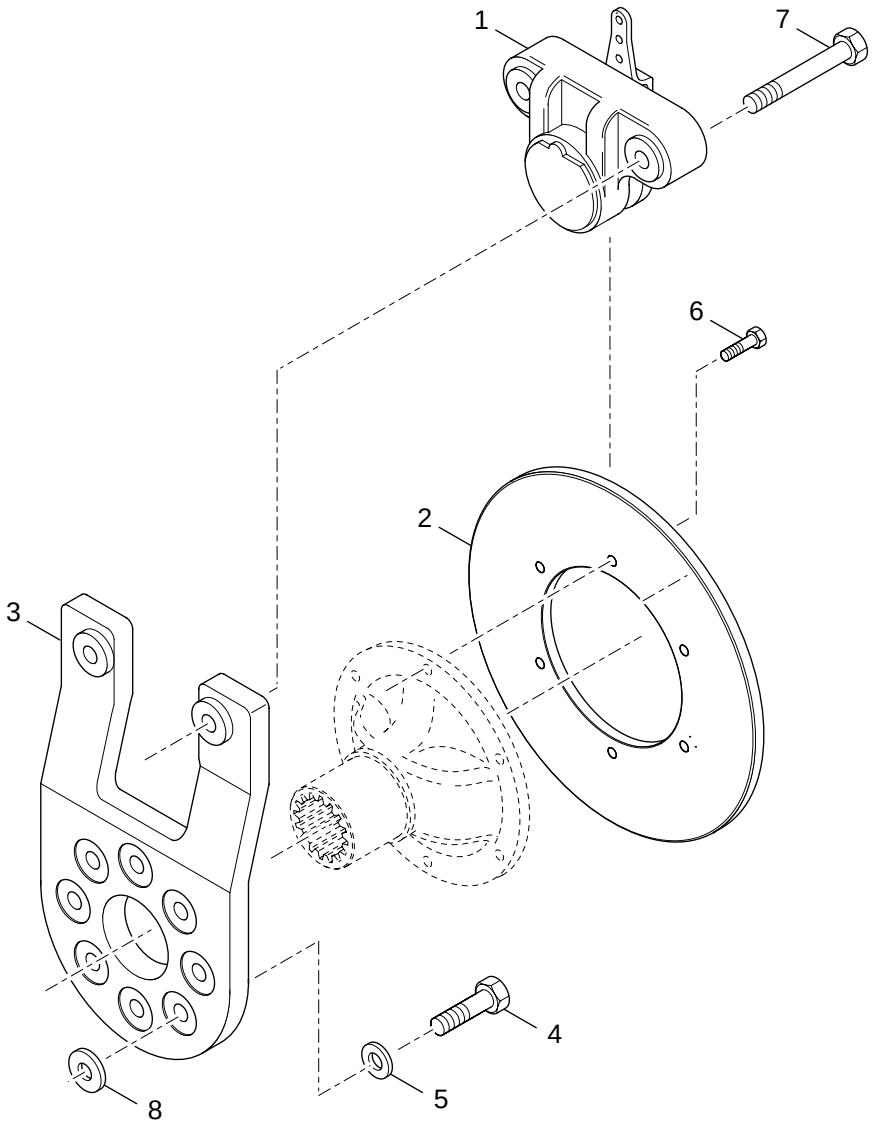
Each disc spring assembly is made up of selected springs to precisely match each part within this assembly. Failure to replace all piston return springs can result in unequal deflection within the spring pack. The result of this inbalance may adversely affect overall life of springs.

11. OPTIONS

11.1 PARKING BRAKES

11.1.1 Mechanical Brake

11.1.1.1 Sectional views and parts identification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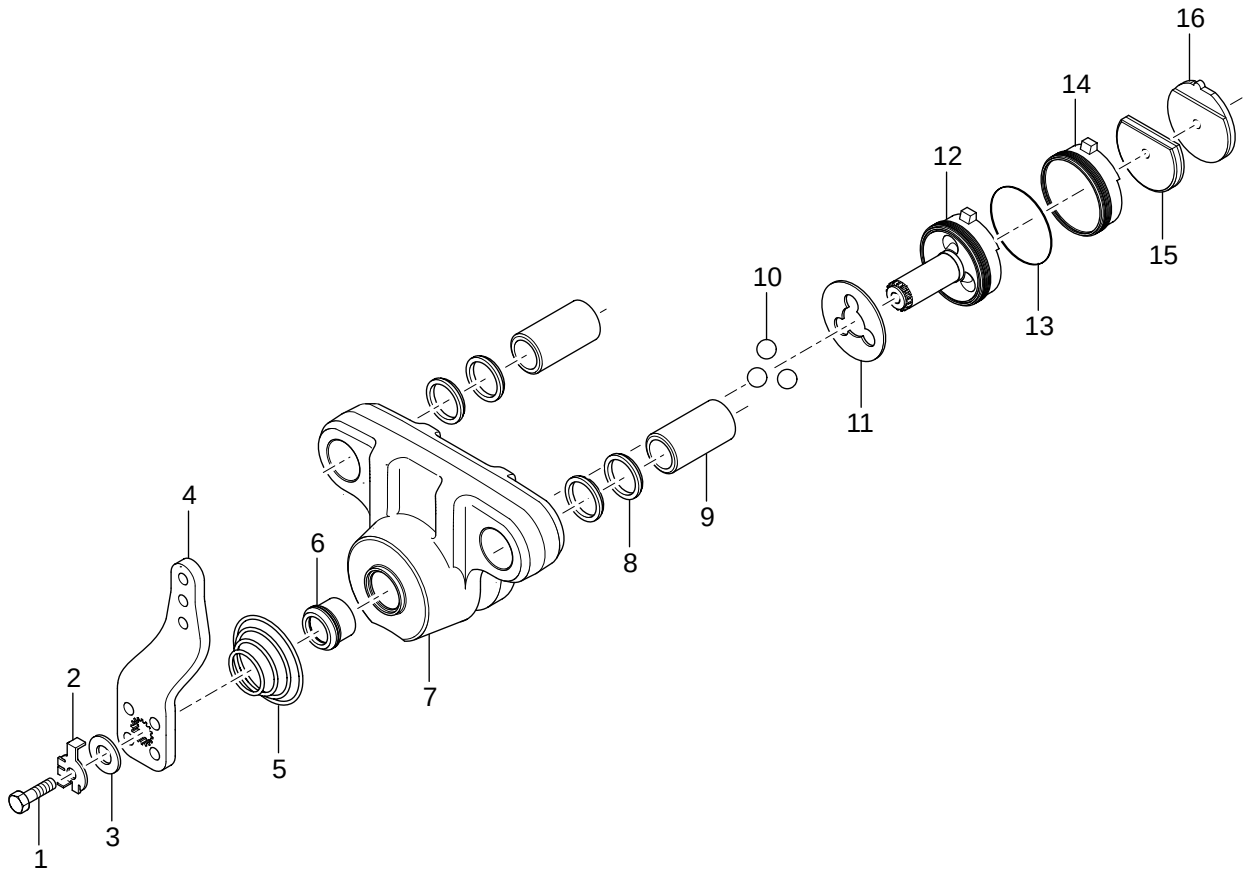
GROUP - DISC BRAKE (MECHANICAL BRAKE)

Item	Description	Quantity
1	Caliper - Parking brake	1
2	Disc - Brake	1
3	Assembly - Mounting bracket	1
4	Screw - Bracket assembly to bearing cap mounting	4
5	Washer - Bracket assembly to bearing cap mounting flat screw	4
6	Screw - Flange	6
7	Screw - Caliper to mounting bracket	2
8	Spacer	2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GROUP - MECHANICAL BRAKE

Item	Description	Quantity
1	Screw	1
2	Anti-rotation clip	1
3	Washer	1
4	Lever	1
5	Spring	1
6	Shaft - Seal	1
7	Housing	1
8	“O”-ring	4
9	Bushing	2
10	Ball	3
11	Ball - Spacer	1
12	Rotor	1
13	Plain bearing	1
14	Rotor - Seal	1
15	Lever side pad	1
16	Carrier side path	1

11.1.1.2 Adjustment and rebuild criteria

1. Check to insure floating parts move freely and that all other parts are mounted securely. Tighten hardware as required.
2. Check actuator linkage to insure that there is adequate freedom of movement for positive brake operation. Adjustment of pad gap is to be accomplished by adjusting the actuating cable or linkage. If adjustment is used up, back off cable or linkage. Unbend tab on anti-rotation clip and loosen screw enough to disengage lever spline. Rotate the lever one tooth, in the direction opposite the actuation direction, and retorque the screw making sure the spline teeth are properly engaged. Bend up a tab that aligns with one of the screw head flats, to prevent screw rotation. Both lever and linkage must be free to return to home position. An external return spring is required.
3. Check disc surface condition. Replace if it is badly warped, pitted, or below minimum recommended thickness. Check for loose mount bolts. Retighten if necessary.
4. Check to insure friction pads are not worn to less than .039” (1.0mm) thick. Replace worn friction pads. Generally, if the disc is still running true and the pad clearance is still adjustable, no other maintenance is required. To check for wear, measure the distance from the carrier side casting face to disc face. If the distance is less than .060” (1.5mm), replace the friction pads.

11.1.1.3 Replacing friction pads

Note

Stamped on the back of each friction pad is a code. The first 1 or 2 characters is a number that specifies the friction material type. Check to insure new pads are the same as the worn pads removed. Replace friction pads only in pairs.

To replace the friction pads it is necessary to release the brake and disconnect the actuator from the brake lever.

1. Remove one brake mounting bolt. Swing the brake up over the disc to expose the brake pads. In close clearance applications the brake may be removed from the vehicle. Using a flat bladed screw driver, pry out the used brake pads from their respective positions. The lever side friction pad is snapped onto the plastic actuator cover. Care should be used in removing the friction pad from the plastic actuator cover so as not to break off the center snap tabs.
2. Place the new friction pads in their respective positions. The lever side friction pad has a center hole which snaps over the plastic snap tabs of the actuator cover. The flat on the lever side pad must align with the flat on the plastic rotor cover, allowing the pad to sit flat. If the snap tabs are gone dab some silicone gasket adhesive around the back edge of the friction pad and press firmly into place aligned as described above. Before placing the carrier pad in postition, clean out excisting pad glue from the pad compartment. Place a layer of silicone gasket adhesive all along the back edge of the carrier friction pad and press firmly in place. Push the lever side pad into the brake as far as possible.
3. Swing the brake over the disc and install the mounting bolt and tighten all mounting bolts.
4. After friction pad replacement, the brake actuating lever is no longer in the correct position for the actuating linkage. Unbend tab on anti-rotation clip and loosen screw enough to disengage the lever spline. Rotate the lever to the OEM and torque screw to 110 - 140 in.lbs.(12.4 -15.8 Nm). Bend up a tab on the antirotation clip that aligns with one of the screw head flats, to prevent screw rotation. Attach actuating cable or linkage to the lever. Adjustment of pad gap is accomplished by adjusting the actuating cable or linkage.

11.1.1.4 Disassembly

Perform disassembly on a clean work bench.

1. Disconnect the actuator cable or linkage and remove brake from its mounting.
2. Remove friction pads. (see “Replacing Friction Pads”)
3. Unbend anti-rotation clip tab away from lever holding screw. Remove screw, anti-rotation clip, washers, lever, and spring.
4. Push out rotor assembly from the casting.

Caution

BALL SPACER AND 3 BALL BEARINGS MAY COME OUT WITH THE ROTOR ASSEMBLY.
(FOR ROTOR DISASSEMBLY SEE “SERVICING ROTOR ASSEMBLY”).

5. Remove 3 ball bearings and ball spacer.
6. Shaft seal need only be replaced if excessively wom or cracked. If replacement is necessary, press out the plastic shaft seal from inside the casting, using a steel spacer block 1.078"(27.38mm) diameter by 2.5” (63.5mm) long and an arbor press.

Note

POPULAR BRAND NAME 3/8" DRIVE 13/16" HEX DEEP SOCKET WORKS WELL AS A SPACER BLOCK.

7. After the shaft seal is pressed out, remove the sliver of plastic that may be left in the groove in the casting.

This completes disassembly of the brake.

11.1.1.5 Cleaning and inspection

1. Clean all parts with denatured alcohol and either wipe dry with a clean lint free cloth or blow dry with an air hose.
2. Examine all parts carefully for signs of excessive wear, damage, or corrosion. Replace any parts found to be damaged.
3. Check rotor assembly for cracks. Replace if necessary.
4. Inspect the casting ball pockets for scoring, pitting, cracks or corrosion. A corroded or deeply scored casting should be replaced. Light scoring and stains may be removed.
5. Check to see that the disc is not bent or misshaped.
6. Check lever spring for breakage.

11.1.1.6 Assembly

Prior to assembly make sure all parts are clean and serviceable.

1. Install a new shaft seal by inserting the seal from the outside of the casting with the extended smooth surface inserted first. Using an arbor press, with a protective spacer block between the arbor press and the seal, gently press the seal in until it snaps into the groove in the casting.
2. Coat with grease, the ball pockets in the casting, the shaft and ball pockets of the rotor assembly.
3. Insert 3 ball bearings and ball spacer into the pockets in the casting.
4. From the inside of the casting slide the shaft of the rotor assembly thru the shaft seal and seat the ball pockets against the ball beanrings.
5. PIace the spring over the large diameter pilot on the outside of the castıng.
6. Install the lever, making sure the small diameter of the spring is piloted on the outside of the 4 pins in the lever. Set the lever in the OEM position.
7. Install the washers and anti-rotation clip with its tab inserted into the lower hole in the lever.
8. Insert screw into rotor assembly shaft and tighten to 110 - 140 in.lbs.(12.4 - 15.8Nm), while guiding lever over rotor assembly spline.
9. After the proper torque is achieved and the lever is in the OEM position, bend up a tab on the anti-rotation clip that aligns with one of the screw head flats, to prevent screw rotation.
10. Install the friction pads onto the rotor assembly and carrier. (see ‘’Replacing Friction Pads”).
11. Stroke lever in its proper direction. The lever must rotate thru 60 degrees of rotation. Return lever to the OEM position and make sure the lever side friction pad is fully rerurned.

11.1.1.7 Replacing mount bushings

1. Push mount bushings completely out of the brake casting.
2. Remove the four (4) “O”-rings from the grooves in the casting, being carefull not to damage the grooves. Clean the grooves and the bore with denatured alcohol or cleaning solvent. Let dry. Lubricate the grooves and “O”-rings with the grease furnished with the service kit. Install the “O”-rings into the grooves.
3. Coat the bushings with kit grease. Insert bushing through the “O”-ring. Wipe off any excess grease.

11.1.1.8 Servicing rotor assembly

Disassemble brake as previously described.

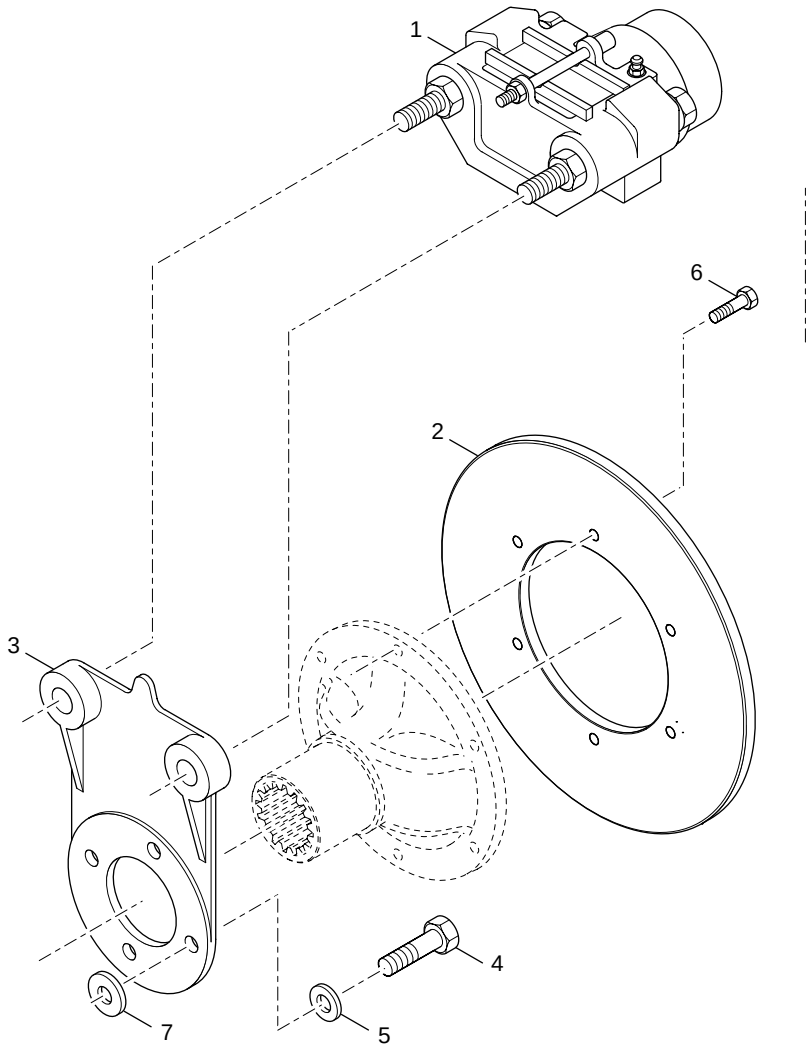
1. Using a sharp knife, make several cuts through the outside diameler of the rigid plastic rotor cover. Break apart the plastic, remove and discard.
2. Discard the plain bearing from under the plasic cover
3. Thoroughly clean all dirt and grease residue from the rotor.
4. Amply grease one face of the new plain bearing and place it into the new rotor cover, grease to plastic. Amply grease the other face of the insert.
5. To assemble the new plastic rotor cover a bench vise is necessary. Snap a friction pad onto the plastic cover. Place the plastic cover over rte rotor, place in a vice, and slowly squeeze the cover and rotor until the cover snaps in place. Remove the friction pad and reassemble the brake as previously described.

11.1.2 Spring applied hydraulic released brake (high pressure)

Note

PLEASE READ INSTRUCTIONS BELOW BEFORE ATTEMPTING ANY WORK ON THE BRAKE.

11.1.2.1 Sectional views and parts identification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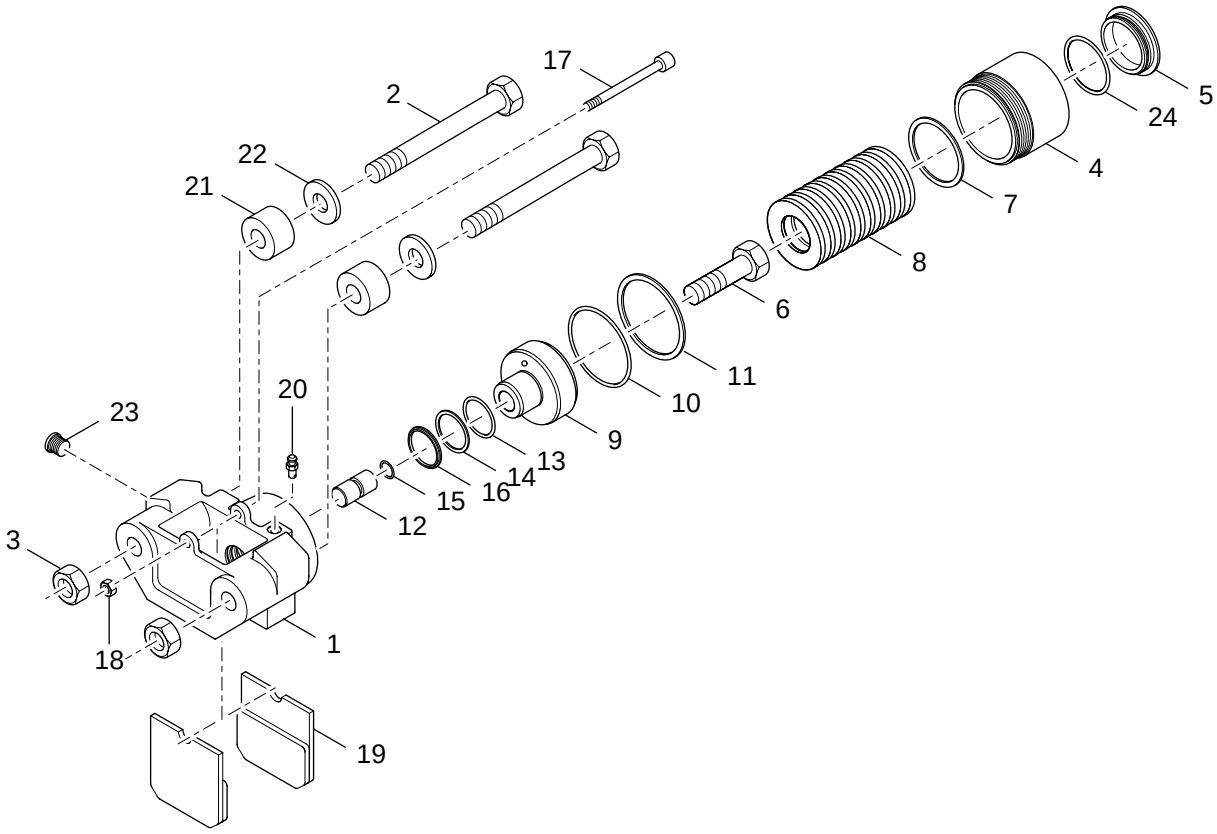
GROUP - DISC BRAKE (SPRING APPLIED HYDRAULIC RELEASED BRAKE (HIGH PRESSURE))

Item	Description	Quantity
1	Caliper - Parking brake	1
2	Disc - Brake	1
3	Assembly - Mounting bracket	1
4	Screw - Bracket assembly to bearing cap mounting	4
5	Washer - Bracket assembly to bearing cap mounting flat screw	4
6	Screw - Flange	6
7	Spacer	4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SPRING APPLIED HYDRAULIC RELEASED BRAKE (HIGH PRESSURE)

Item	Description	Quantity
1	Torque plate	1
2	Bolt - Hex	2
3	Jamnut	2
4	Housing - Spring	1
5	Plug	1
6	Bolt - Adjustment	1
7	Shim	AR*
8	Spring disc	10
9	Piston	1
10	Seal - “O”-ring	1
11	Back-up ring	1
12	Piston	1
13	Seal - “O”-ring	1
14	Back-up ring	1
15	Seal - “O”-ring	1
16	Wiper	1
17	Bolt	1
18	Nut	1
19	Lining	2
20	Bleeder	1
21	Spring - Urethane	2
22	Washer - Flat	2
23	Cap - Plug	1
24	Seal - “O”-ring	1

AR*: As Required

11.1.2.2 Operation

Ten disc springs (8) are used to hold the park brake in the actuated state.
The springs (8) push the pistons (9,12) into the lining and carrier assembly (19) which squeezes a driveline mounted disc. The brake is released by fluid entering a SAE 7/16-20 threaded inlet in the side of the torque plate (1) which pushes the pistons back and compresses the springs (8).

11.1.2.3 Adjustment and rebuild criteria

1. Apply hydraulic pressure to the brake.
2. Remove plug (5) and set running clearance (.020” - .030”) using the adjustment bolt (6).
3. Replace plug (5).
4. Even up running clearance on each side of the disc by adjusting the carrier retaining bolt (17).

The brake should be rebuilt when one or more of the following criteria are met:

1. Any signs of fluid leakage.
2. Lining thickness less than .031".
3. Cracked or chipped linings.

11.1.2.4 Replacing friction pads

1. Apply hydraulic pressure to the brake and remove plug (5) and carrier bolt (17).
2. With pressure applied, back-off adjustment bolt (6) until piston (12) is flush with piston (9).
3. Release hydraulic pressure from the brake and remove lining and carrier assemblies (19).

11.1.2.5 Disassembly

Caution

IF THE PARK BRAKE IS BEING DISASSEMBLED WHILE ON THE VEHICLE, IT IS IMPORTANT TO FOLLOW THE DIRECTIONS REGARDING THE REMOVAL OF THE SPRING HOUSING (4) AND THE LINING AND CARRIERS (19) VERY CLOSELY.

1. Apply hydraulic pressure to the brake and remove plug (5) and carrier bolt (17).
2. With pressure applied, back-off adjustment bolt (6) until piston (12) is flush with piston (9).
3. Release hydraulic pressure from the brake and remove lining and carrier assemblies (19).
4. Using a press, compress springs (8) to reduce the force on the spring housing (4).
5. Use a spanner wrench to remove the spring housing (4) (counter-clockwise direction).
6. The springs (8) will be accessible when the spring housing is removed.

Note

THE SPRING HOUSING (4) MAY BE REMOVED WITHOUT COMPRESSING THE SPRINGS (8), HOWEVER IT IS NOT RECOMMENDED DUE TO THE HIGH TORQUE REQUIRED.

7. The adjustment bolt (6) threaded part of the way into the hydraulic piston (9) may be used to remove the pistons (9 and12) if brake is mounted on the vehicle.
8. If brake is not mounted to the vehicle it is easier to press the pistons out from the lining and carrier (19) side of the torque Plate (1).

Caution

DO NOT DAMAGE SEALS (10,13,15) OR BACK-UP RINGS (11,14) OR THE WIPER (16) WHEN REMOVING THE PISTONS (9 AND12).

9. Piston (12) may be removed from piston (9) by pushing on piston (12) through adjustment bolt hole with a small nut-river or similar device.

11.1.2.6 Cleaning and inspection

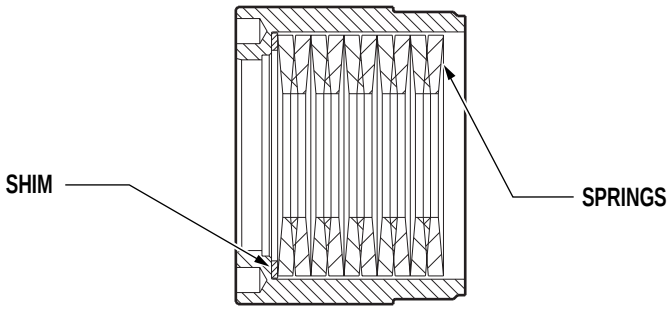
1. Clean all metal parts prior to assembly.
2. Blow excess cleaning solution off of all parts and out of all fluid passages.

11.1.2.7 Assembly

1. Apply a thin coat off fluid (compatible with mineral oil based hydraulic fluid) to seals (10,13,15), Back-up rings (11,14) and the wiper (16).
2. Install seal (15) in seal groove on piston (12).
3. Slide the adjustment piston (12) into the bore located in the hydraulic piston (9) until it hits the bottom of the bore.
4. Install wiper (16), back-up ring (14), and seal (13) in the grooves located in the small hole in the torque plate (1).
5. Install seal (10) and back-up ring (11) in larger grooves in torque plate (1).
6. Install piston assembly into torque plate. (1).
7. Thread adjustment bolt (6) into the hydraulic piston (9) until the bolt contacts the adjustment piston (12).
8. Place springs (8) in the torque plate (1).
   Springs should be placed in an alternating cupped face to cupped face orientation.
   The springs on the outside ends of the stack should be oriented cupped face out.
9. If the brake contained a shim (7) when it was disassembled, place the shim (7) so it will be in the bottom of the spring housing (4) when it is installed.
   See illustration below for a graphical representation.

Note

SPRINGS ARE MATCHED AND PRETESTED. IF NEW SPRINGS ARE BEING INSTALLED ADD A SHIM ONLY IF THE NEW SPRINGS ARE SHIPPED WITH ONE.



10. Thread spring housing (4) into torque plate (1) about 3 turns or until it makes contact, with the springs (8).
11. Using a press, compress springs (8) to reduce the force on the spring housing (4).
12. Use a spanner wrench to tighten spring-housing until the face bottoms out on the counterbore face in the torque plate (1). Tighten to 500 - 600 lb.-in torque.
13. Assemble washer (22) and the urethane spring (21) on the mounting bolt (2) then slide mounting bolts through bolt holes in the torque Plate (1).
14. Thread jam nut/sleeve (3) onto mounting bolt.
    The cylindrical part of the jam nut/sleeve should extend into the torque plate.

15. Install lining and carrier assemblies (19).
    Thread lining and carrier adjustment bolt into hex nut (8) located in the slot in the back side of the torque plate (1).
16. Install the bleeder (20) in the port located on the top side of the torque plate (1).
17. After brake is mounted and adjusted, snap plug (5) onto spring housing (4).

11.1.2.8 Installation

1. Slide brake over disc and into the mounting position.
2. Start mounting bolts (2) into mounting surface far enough to just support the brake.
3. Remove plug (5) and tighten adjustment bolt (6) until linings (19) are clamped to the disc.
4. Tighten mounting bolts (2) until they make contact with the urethane springs (21), then tighten 1 to 2 flats more.
5. Tighten jam nut/sleeve (3) against mounting surface to torque shown in section 11.1.2.9.

Caution

BRAKE LININGS ARE SUSCEPTIBLE TO CONTAMINATION.
WHEN INSTALLING OR SERVICING BRAKES KEEP ALL OIL AND FLUIDS AWAY FROM THE LININGS.
POOR BRAKE PERFORMANCE MAY RESULT.

6. Attach brake line to inlet port located on the side of the torque plate (1).
7. Bleed brake system to remove trapped air as follows.

Note

USE BLEEDER HOSE ON BLEEDER SCREWS (PREFERABLY CLEAR TUBING) TO ROUTE FLUID AWAY FROM THE BRAKE AND LININGS.

Caution

BRAKE USES HIGH PRESSURE, OPEN BLEEDER SCREW (20) VERY SLOWLY WHEN PERFORMING BLEEDING PROCEDURE.

8. Apply pressure to brake and slowly open the bleeder screw (20) observe any air bubbles that flow from the brake.
9. Repeat above paragraph until no air is observed in the fluid from the bleeder screw (20).

11.1.2.9 Torque specs

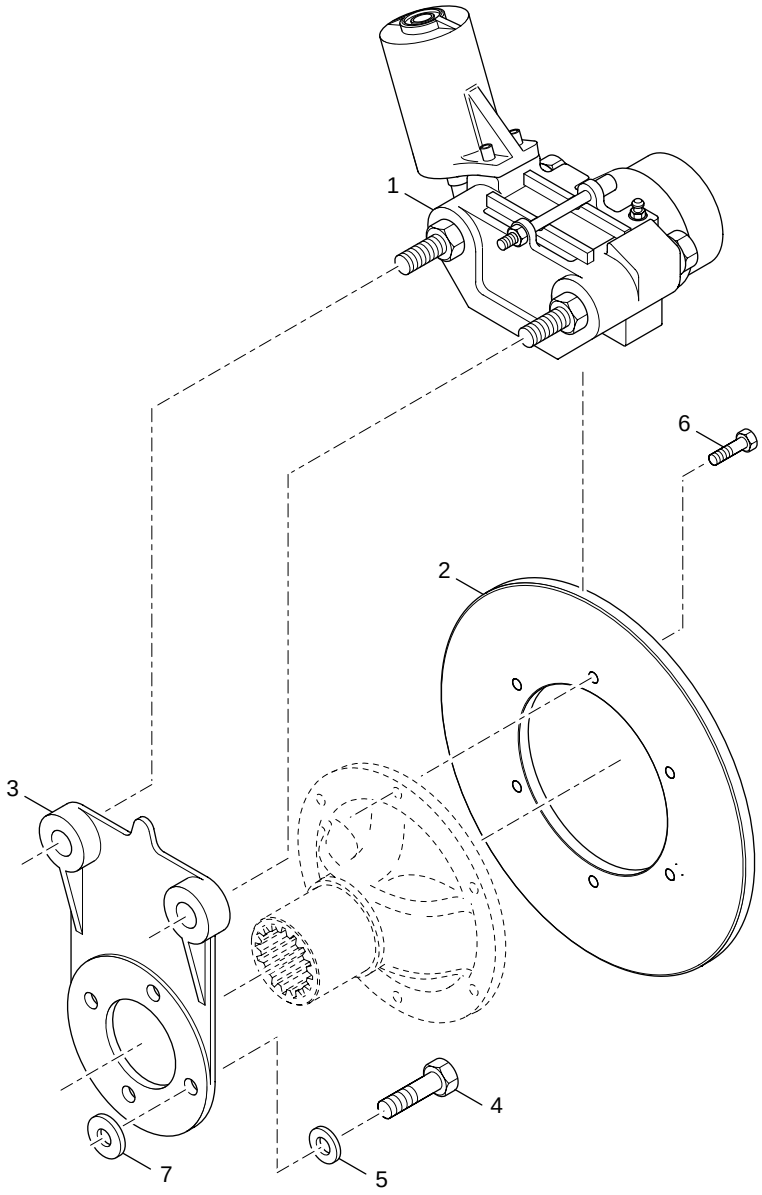
PART (ITEM NO.)	THREAD SIZE	DRY TORQUE
BLEEDER SCREW (20)	7/16 - 20	200 - 250 (LB-IN)
JAMNUT/SLEEVE (3)	3/4 - 10	200 (LB-IN)

11.1.3 Spring applied hydraulic released brake (low pressure)

Note

PLEASE READ INSTRUCTIONS BELOW BEFORE ATTEMPTING ANY WORK ON THE BRAKE.

11.1.3.1 Sectional views and parts identification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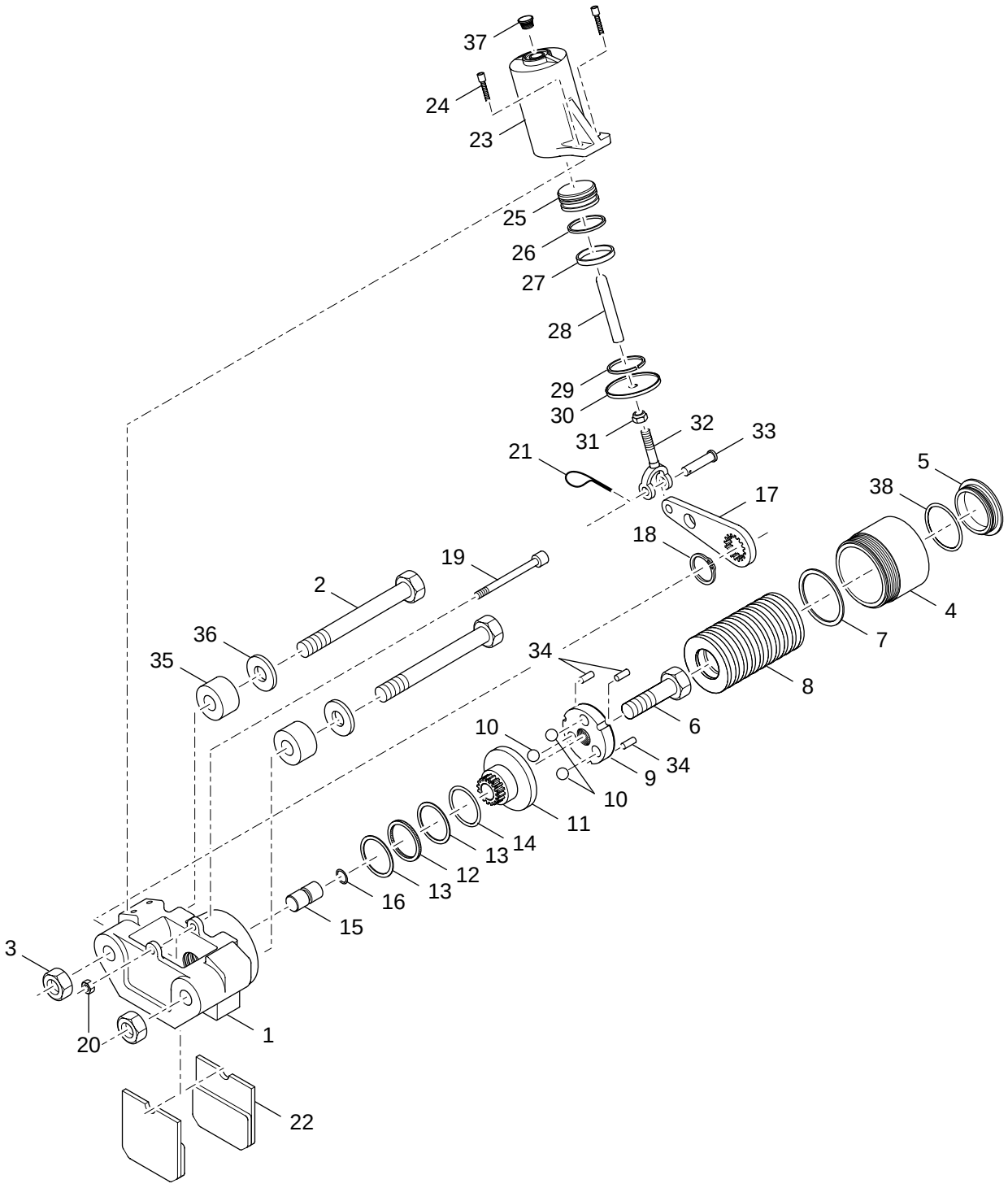
GROUP - DISC BRAKE (SPRING APPLIED HYDRAULIC RELEASED BRAKE (LOW PRESSURE))

Item	Description	Quantity
1	Caliper - Parking brake	1
2	Disc - Brake	1
3	Assembly - Mounting bracket	1
4	Screw - Bracket assembly to bearing cap mounting	4
5	Washer - Bracket assembly to bearing cap mounting flat screw	4
6	Screw - Flange	6
7	Spacer	4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SPRING APPLIED HYDRAULIC RELEASED BRAKE (LOW PRESSURE)

Item	Description	Quantity
1	Torque plate	1
2	Bolt - Hex	2
3	Jamnut	2
4	Housing - Spring	1
5	Plug	1
6	Bolt - Adjustment	1
7	Shim	AR*
8	Spring disc	10
9	Cam	1
10	Ball - Bearing	3
11	Cam	1
12	Bearing - Needle	1
13	Washer - Hardened	2
14	Seal - “O”-ring	1
15	Piston	1
16	Seal - “O”-ring	1
17	Lever	1
18	Ring - Retainer	1
19	Bolt	1
20	Nut	1
21	Pin - Cotters	1
22	Lining and carrier assembly	2
23	Cylinder - Hydraulic	1
24	Screw	2
25	Piston	1
26	Seal - STD poly pack	1
27	Sliding ring	1
28	Rod	1
29	Ring - Retaining	1
30	Rod excluder	1
31	Jamnut	1
32	Clevis	1
33	Clevis pin	1
34	Pin - Dowel	3
35	Spring - Urethane	2
36	Washer - Flat	2
37	Cap - Plug	1
38	Seal - “O”-ring	1

AR*: As Required

11.1.3.2 Operation

Ten disc springs (8) are used to hold the park brake in the actuated state.
The springs push the cams (9,11) and piston (15) into the lining and carrier assembly (22) which squeezes a driveline mounted disc.
The brake is released by fluid entering a SAE 7/16-20 threaded inlet in the top of the hydraulic cylinder (23) which pushes the piston (25) down, thereby rotating the lever (17) and cam (11), compressing the springs (8).

11.1.3.3 Adjustment and rebuild criteria

1. Apply hydraulic pressure to the brake.
2. Remove plug (5) and set running clearance (.020” - .030”) using the adjustment bolt (6).
3. Replace plug (5).
4. Even up running clearance on each side of the disc by adjusting the carrier retaining bolt (19).

The brake should be rebuilt when one or more of the following criteria are met:

1. Any signs of fluid leakage.
2. Lining thickness less than .031”.
3. Cracked or chipped linings.

11.1.3.4 Replacing friction pads

1. Apply hydraulic pressure to the brake and remove plug (5) and carrier retaining bolt (19).
2. With pressure applied remove adjustment bolt (6).
3. Release hydraulic pressure from the brake and remove lining and carrier assemblies (22).

11.1.3.5 Disassembly

Caution

If the park brake is being disassembled while on the vehicle, it is important to follow the following directions regarding the removal of the Spring Housing (4) and the Lining & Carriers (22) very closely.

1. Apply hydraulic pressure to the brake and remove plug (5) and carrier retaining bolt (19).
2. With pressure applied remove adjustment bolt (6).
3. Release hydraulic pressure from the brake and remove lining and carrier assemblies (22).
4. Use a spanner wrench to remove the spring housing (4) (counter-clockwise direction).
5. The springs (8) will be accessible when the spring housing is removed.
6. Remove hair pin (21) and pin (33) from the clevis (32).
7. Remove hydraulic cylinder (23) from torque plate (1) by removing cylinder mounting bolts (24).
8. Remove retaining ring (18) and lever (17) from the spline on the cam (11).
9. The opposing cams (9, 11), adjustment piston (15) and dowel pins (34) can be removed by pressing them out of the torque plate (1) from the lining and carrier (22) side.
10. Remove balls (10) and adjustment piston (15) from cams (9, 11).
11. The “O”-ring seal (16) can be removed from the adjustment piston (15) if necessary.
12. Remove needle bearing (12), hardened washers (13), and “O”-ring seal (14) from the torque plate (1) once the cams (9, 11) are removed.
13. Slide the rod (28) and clevis (32) out of the hydraulic cylinder (23).
14. Remove the rod excluder (30) from the hydraulic cylinder (23) by prying with a small screwdriver.
15. The retaining ring (29) may be removed once the rod excluder (30) has been removed.
16. Press piston (25) out of the hydraulic cylinder (23) by pushing on the top of the piston with a long slender rod.

Note

DO NOT SCAR CYLINDER WALLS OR NICK THE PISTON DURING REMOVAL.

11.1.3.6 Cleaning and inspection

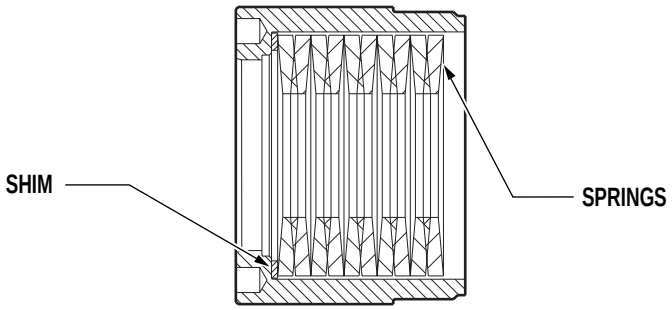
1. Clean all metal parts prior to assembly.
2. Blow excess cleaning solution off of all parts and out of all fluid passages.

11.1.3.7 Assembly

1. Apply a thin coat of fluid to seals (14,16).
2. Install seal (16) in seal groove on adjustment piston (15).
3. Slide the adjustment piston (12) into the bore located in the cam (11) until the seal (16) is inside the bore.
4. Install seal (14) in the grooves located in the small hole in the torque plate (1).
5. Install needle bearing (12) between the two hardened washers (13).
6. With bearing and washers (12,13) in place, install cam (11) and balls (10) into torque plate (1).
7. Install cam (9) and dowel pins (34) into torque plate (1).
8. Thread adjustment bolt (6) into the cam (9) until the bolt contacts the adjustment piston (15).
9. Place springs (8) in the torque plate (1).
   Springs should be placed in an alternating cupped face to cupped face orientation.
   The springs on the outside ends of the stack should be oriented cupped face out.
10. Replace the shim (7) in the bottom of the spring housing (4) before adding the springs if the brake contained a shim when it was disassembled. See illustration below for a graphical representation.

Note

SPRINGS ARE MATCHED AND PRETESTED.
IF NEW SPRINGS ARE BEING INSTALLED ADD A SHIM ONLY IF THE NEW SPRINGS ARE SHIPPED WITH ONE.



11. Apply a thin coat of Never-Seez to the spring housing (4) threads.
12. Screw spring housing (4) onto torque plate (1). Tighten with a spanner wrench until the spring housing face bottoms out on the counterbore face in the torque plate (1).
13. Assemble washer (36) and the urethane spring (35) on the mounting bolt (2) then slide mounting bolts through bolt holes in the torque plate (1).
14. Thread jam nut/sleeve (3) onto mounting bolt.
    The cylindrical part of the jam nut/sleeve should extend into the torque plate.
15. Apply a thin coat of fluid to seal (25) and sliding ring (27).
16. Install seal (25) and the sliding Ring (27) on the Piston (25).

17. Install piston (25) into the hydraulic cylinder (23) with the flat side facing the top of the cylinder.
18. Push the piston (25) to the top of the hydraulic cylinder (23) and install the retaining ring (29) in the groove at the bottom of the cylinder.

Note

MAKE SURE INLET PORT IS UNCAPPED WHEN INSTALLING PISTON (25).

19. Press rod excluder (30) with the rubber side facing out of the hydraulic cylinder (23).
20. Thread clevis (32) with the 3/8-16 jam nut installed into the rod (28).
21. Insert the rod (28) and clevis (32) through the rod excluder (30) into the hydraulic cylinder (23).
22. Position assembled hydraulic cylinder (23) onto torque plate (1) and install the cylinder mounting bolts (24) into their respective holes.
23. Pin clevis (32) to the lever (17) with clevis pin (33) and hair pin (21).
24. Adjust rod (28) until it contacts the rod retaining hole in piston (25) and tighten the jam nut.
25. Install lever (17) on the spline of cam (11).
    The centerline of the lever should be oriented parallel to the top of the torque plate (1).
26. Install retaining ring (18) in groove on the cam (11).
27. Install lining and carrier assemblies (22).
28. Thread carrier adjustment bolt (19) into hex nut (18) located in the slot in the back side of the torque plate (1).
29. After brake is mounted and adjusted, snap plug (5) onto spring housing (4).

11.1.3.8 Installation

1. Slide brake over disc and into the mounting position (per vehicle specification).
2. Start mounting bolts (2) into mounting surface far enough to just support the brake.
3. Remove plug (5) and tighten adjustment bolt (6) until linings (22) are clamped to the disc.
4. Tighten mounting bolts (2) until they make contact with the urethane springs (35), then tighten 1 to 2 flats more.
5. Tighten jam nut / sleeve (3) against mounting surface to torque shown in section 11.1.3.9.

Caution

BRAKE LININGS ARE SUSCEPTIBLE TO CONTAMINATION.
WHEN INSTALLING OR SERVICING BRAKES KEEP ALL OIL AND FLUIDS AWAY FROM THE LININGS.
POOR BRAKE PERFORMANCE MAY RESULT.

6. Attach brake line to inlet port located on the top of the hydraulic cylinder (23).

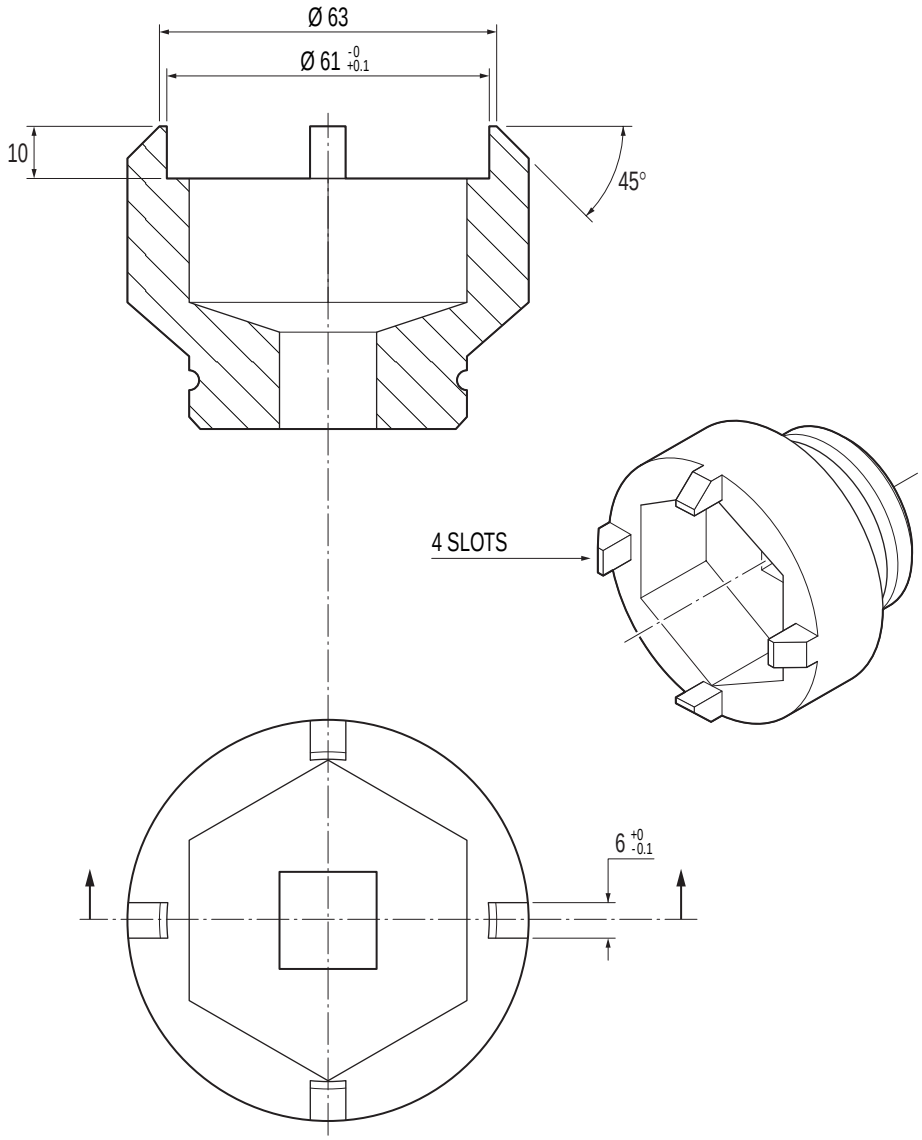
11.1.3.9 Torque specs

PART (ITEM NO.)	THREAD SIZE	DRY TORQUE
PLUG-INLET (37)	7/16 - 20	12/17 (LB-IN)
JAM NUT/SLEEVE (3)	3/4 - 10	200 (LB-IN)

12. SERVICE TOOLS

12.1 REVERSE IDLER SHAFT NUT SOCKET (TG 1304 - 54)

Made from Snap-on IM662A Socket 2 1/16” drive 3/4”.



12.2 OIL SEALING RING SIZING TOOL