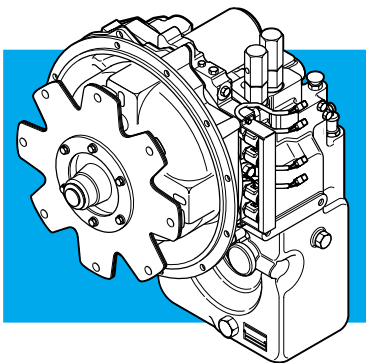
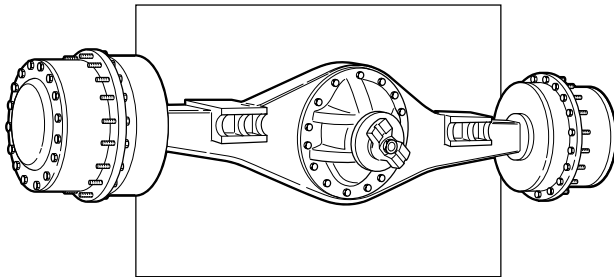
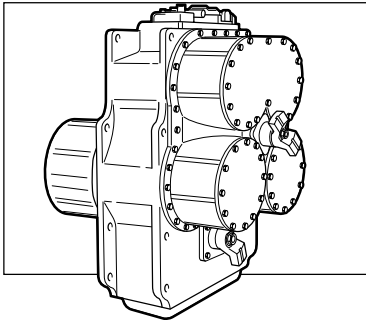
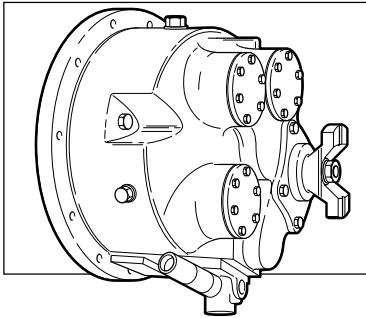


Maintenance and Service Manual

T12000 Powershift Transmission

3, 4 & 6 SPEED INTERMEDIATE DROP



SPICER® OFF HIGHWAY-PRODUCTS™

People Finding A Better Way®

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.

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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 PRODUCTS** 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 PRODUCTS** 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 PRODUCTS** 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 PRODUCTS**.



IMPORTANT

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

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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 PRODUCTS**, 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 'NOTICES' 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 'NOTICES' 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.

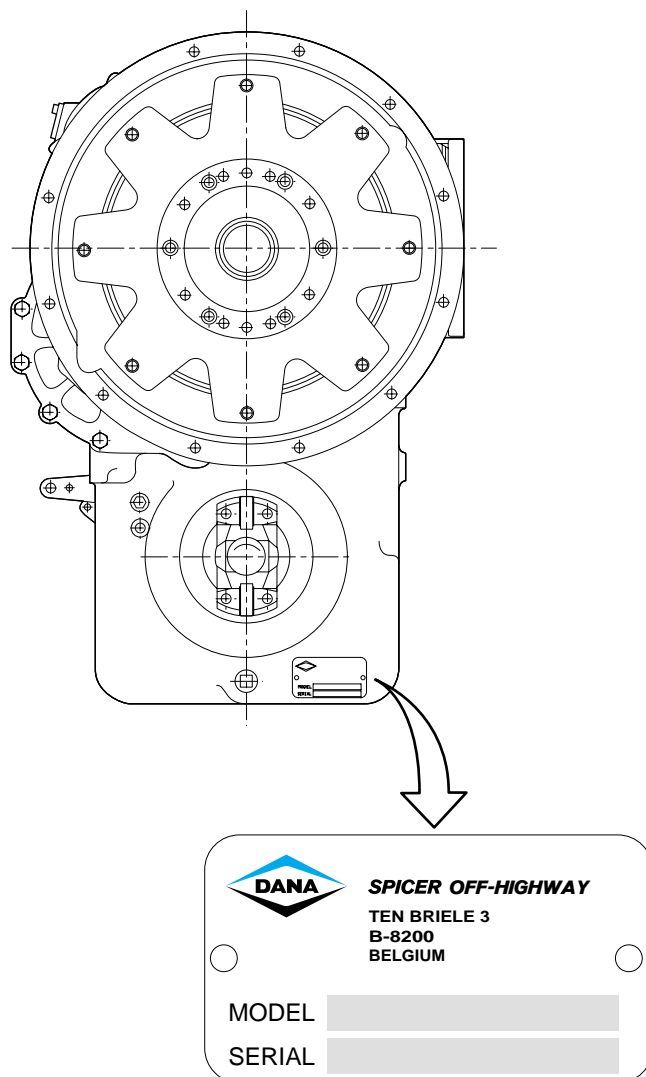
2.2.4 Housing, Covers, etc.

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		Sostituire con ogni montaggio Renew at each reassembly
	Montaggio di sottogruppi Reassemble to from assembly group		Togliere - mettere la sicura Unlock - lock e.g. split pin, locking plate, etc.
	Smontaggio di particolari ingombranti Remove obstruction parts		Mettere la sicura, incollare (mastice liquido) Lock - adhere (liquid sealant)
	Montaggio di particolari ingombranti Reinstall - remount parts which had obstructed disassembly		Evitare danni ai materiali, danni ai pezzi Guard against material damage, damage to parts
	Attenzione, indicazione importante Attention! important notice		Marchiare prima dello smontaggio (per il montaggio) Mark before disassembly, observe marks when reassembl.
	Controllare regolare p.e. coppie, misure, pressione etc. Check - adjust e.g. torque, dimensions, pressures etc.		Carricare riempire (olio - lubrificante) Filling - topping up - refilling e.g. oil, cooling water, etc.
	T = Attrezzature speciali P = Pagina T = Special tool P = Page		Scarricare olio, lubrificante Drain off oil, lubricant
	Rispettare direzione di montaggio Note direction of installation		Tendere Tighten - clamp ; tightening a clamping device
	Controllare esaminare controllo visuale Visual inspection		Inserire pressione nel circuito idraulico Apply pressure into hydraulic circuit
	Eventualmente riutilizzabile (sostituire se necessario) Possibly still serviceable, renew if necessary		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): ± 174.6 kg (385 lb.)


	T-model	MT-model
Maximum length:	623.1 mm (24.53")	712.5 mm (28.05")
Maximum width:	477.0 mm (18.78")	477.0 mm (18.78")
Maximum height:	701.1 mm (27.60")	701.1 mm (27.60")


Oil capacity

± 12.9 l (3.4 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]

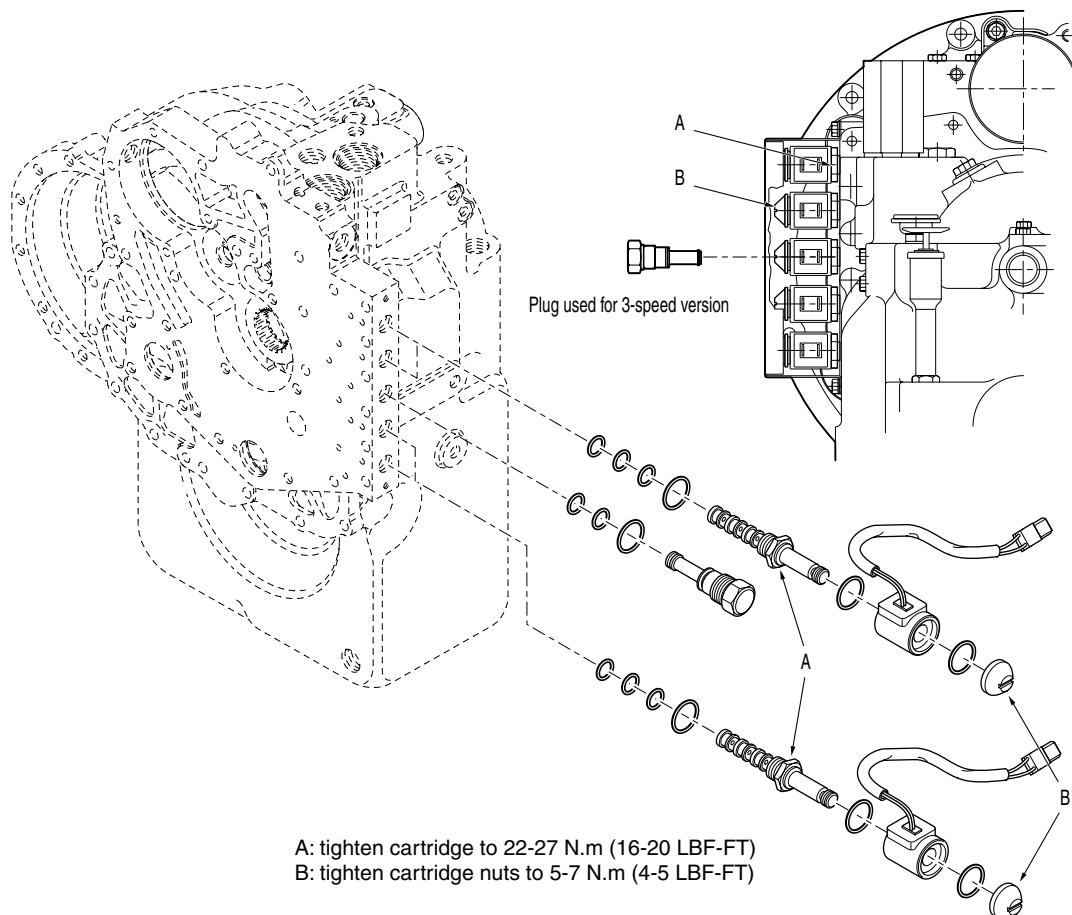
NOM. SIZE	GRADE 8.8 or 9.8		GRADE 10.9	
	COARSE THREAD		COARSE THREAD	
	LBF - FT	[N.m]	LBF - FT	[N.m]
M10	30 - 37	[40 - 50]	44 - 48	[60 - 65]
M12	50 - 55	[65 - 75]	74 - 81	[100 - 110]

3.3.2 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]

3.3.3 Permanent metric plug torque chart

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

3.3.4 Coil and cartridge torque

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. 12.76 bar (185 PSI) minimum.
 - At 2000 RPM: 19.31 bar (280 PSI) maximum.

- Pump flow (*)
 - At 2000 RPM in neutral: 53 l/min. minimum (14 GPM).

- Clutch pressures (*)
 - 1st clutch: port 41 (**).
 - 2nd clutch: port 42 (**).
 - 3rd clutch: port 43 (**).
 - Forward High clutch: port 44 (**).
 - Forward clutch: port 45 (**).
 - Reverse clutch: port 46 (**).

At 1800 RPM :

- 16.5 - 19.3 bar (240 - 280 PSI) clutch activated.
- 0 - 0.2 bar (0 - 3 PSI) clutch released.

- Filter bypass valve set at 2.1 - 3.5 bar (*) (30 - 50 PSI).
- Lube pressure (*) (port 33) 2.9 - 4.0 bar (42 - 58 PSI) at 49 l/min. (13 GPM) pump flow (\pm 1850 RPM).
- Safety valve: cracking pressure (*) 8.27 - 10.20 bar (120 - 148 PSI), measured at port 32 with convertor out shut off.
- Transmission out pressure (*) (port 32) 2.9-6.41 bar (42-93 PSI) at 49 l/min, (13 GPM) pump flow (\pm 1850 RPM), and max. 8.27 bar (120 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, 2nd and splitter).
Coil resistance:
 - 12V: 9.79 Ω \pm 0.5 Ω .
 - 24V: 39.3 Ω \pm 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.

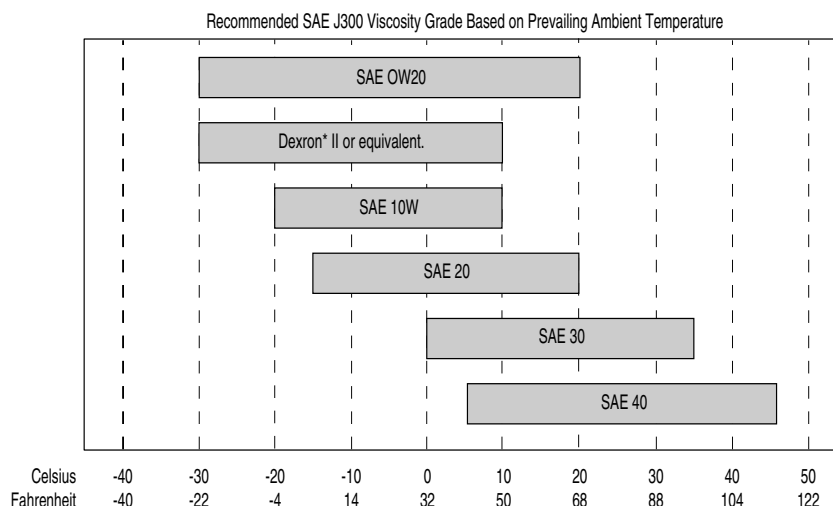


Caution

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 PRODUCTS**.



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 1000 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 1000 hours

Change oil filter element.

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 FULL 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.



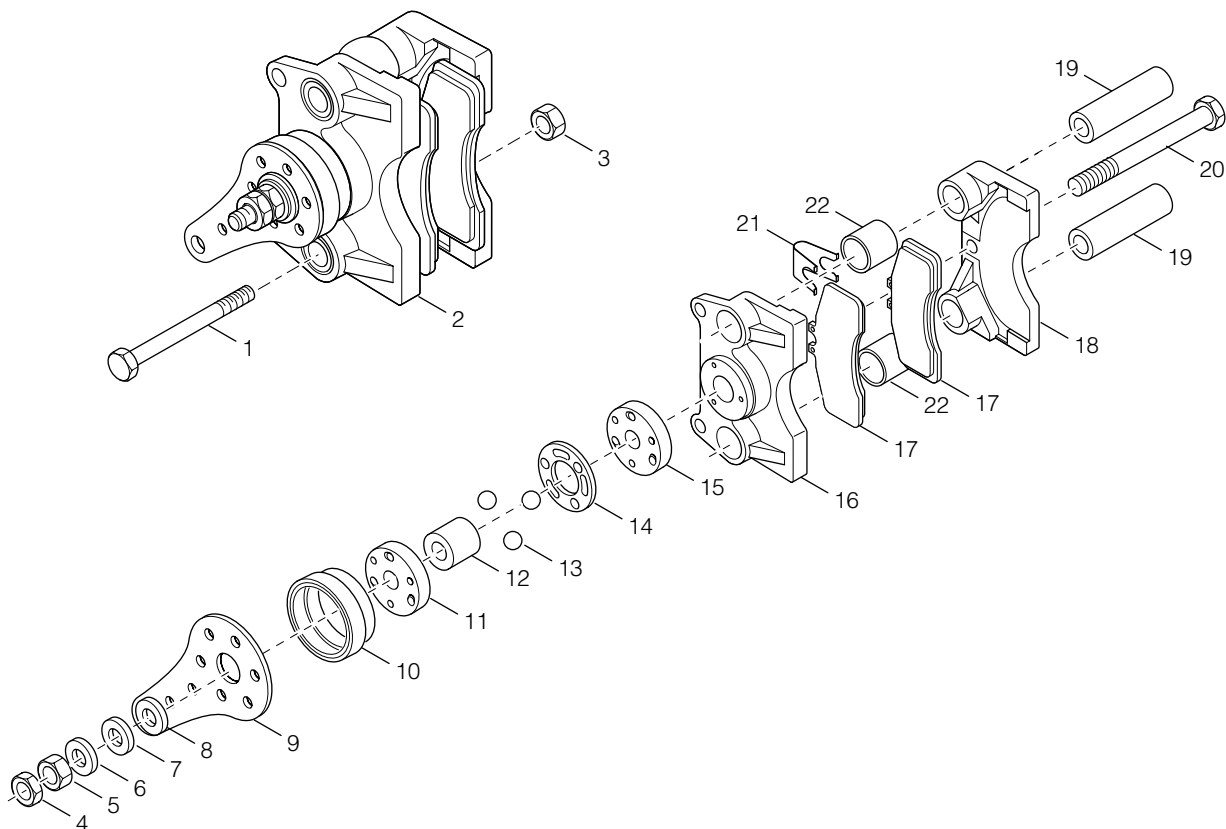
Note

IF THE DIPSTICK IS NOT ACCESSIBLE OIL LEVEL CHECK PLUGS ARE PROVIDED.

- Remove check plug, fill until oil runs from oil hole. Relift filler and level plug.
 - 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 FULL mark on dipstick or runs from oil level check plug hole.
 - Install oil level plug of dipstick.
 - Recheck with hot oil 82.2 - 93.3 °C (180 - 200 F).
 - Adjust oil level to FULL mark on dipstick or runs freely from oil level plug.
6. Recheck all drain plugs, lines, connections, etc..., for leaks and tighten where necessary.

4.4 INSTRUCTIONS FOR LINING REPLACEMENT AND ADJUSTMENT OF PARKING BRAKE ASSEMBLY

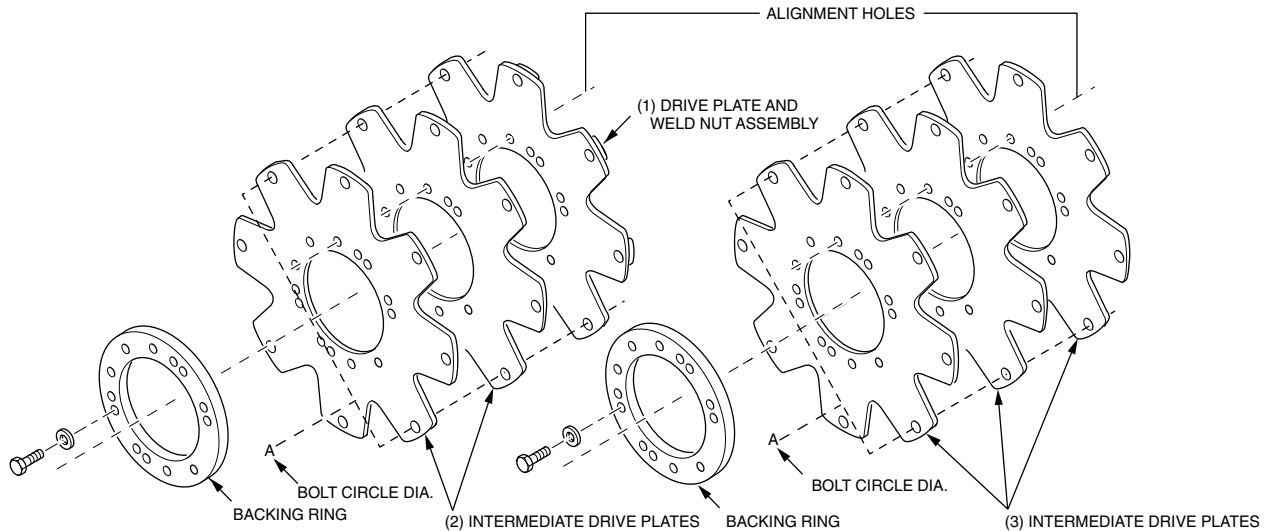
1. Loosen two adjustment locking nuts (4 & 5) enough to slide each torque plate (16 & 18) away from disc far enough to provide clearance to remove old carrier and lining assemblies and install new ones. (It may be necessary to remove one or both nuts).
2. Collapse lining retraction spring (21) and remove from brake head assembly.
3. Slide torque plates (16 & 18) away from disc, move carrier and lining assemblies (17) out of pockets, and remove from the brake head assembly from the side.
4. Install new carrier and lining assemblies (17) in each torque plate (16 & 18).
5. Install lining retraction spring (21) into brake head assembly.
Be sure spring's "feet" are positioned properly in holes in both lining carrier assemblies (17).
6. Tighten inner adjusting nut (5) until firm contact is made with the disc by the linings.
Torque to (100 lbs.-inch) 11 N.m make certain lever is in proper operating position for application.
7. Back off inner adjusting nut 4 (5) to 5 flats and check that disc is free to move (total clearance 0.8 - 1.1 mm (0.031" - 0.043")).
8. Tighten outer locking nut (4) against inner adjusting nut to lock adjustment bolt in place.
Torque to (45 to 55 lb.-ft.) 61 - 75 N.m.



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. 802501.
- 13.125” (333.38 mm) diameter
Kit No. 802424.
- 13.500” (342.90 mm) diameter
Kit No. 802425.

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. 802543.
- 13.125” (333.38 mm) diameter
Kit No. 802426.
- 13.500” (342.90 mm) diameter
Kit No. 802427.

Each kit will include the following parts:

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



Note

TO FACILITATE ASSEMBLY, ALIGN SMALL HOLES IN DRIVE PLATES - SEE ILLUSTRATION ABOVE - ALIGNMENT HOLES.

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 35 - 39 N.M. (26 - 29 LB. FT.).

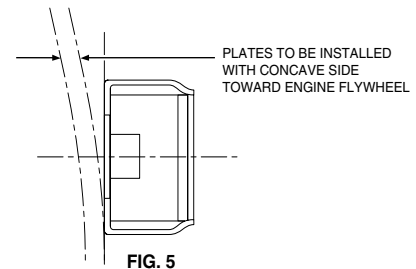
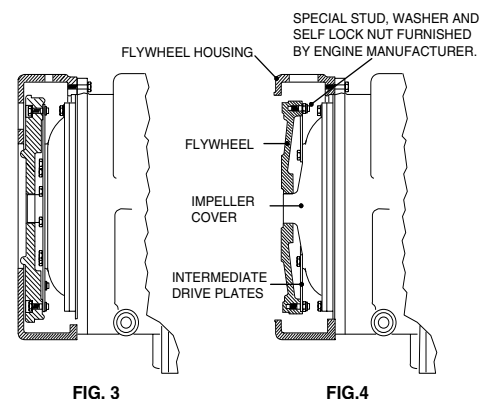
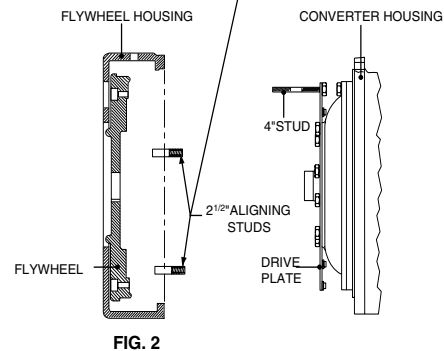
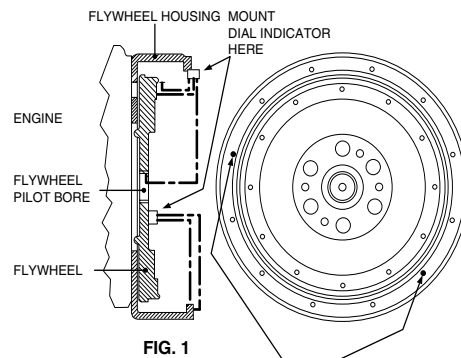
5.2 TRANSMISSION TO ENGINE INSTALLATION PROCEDURE

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.

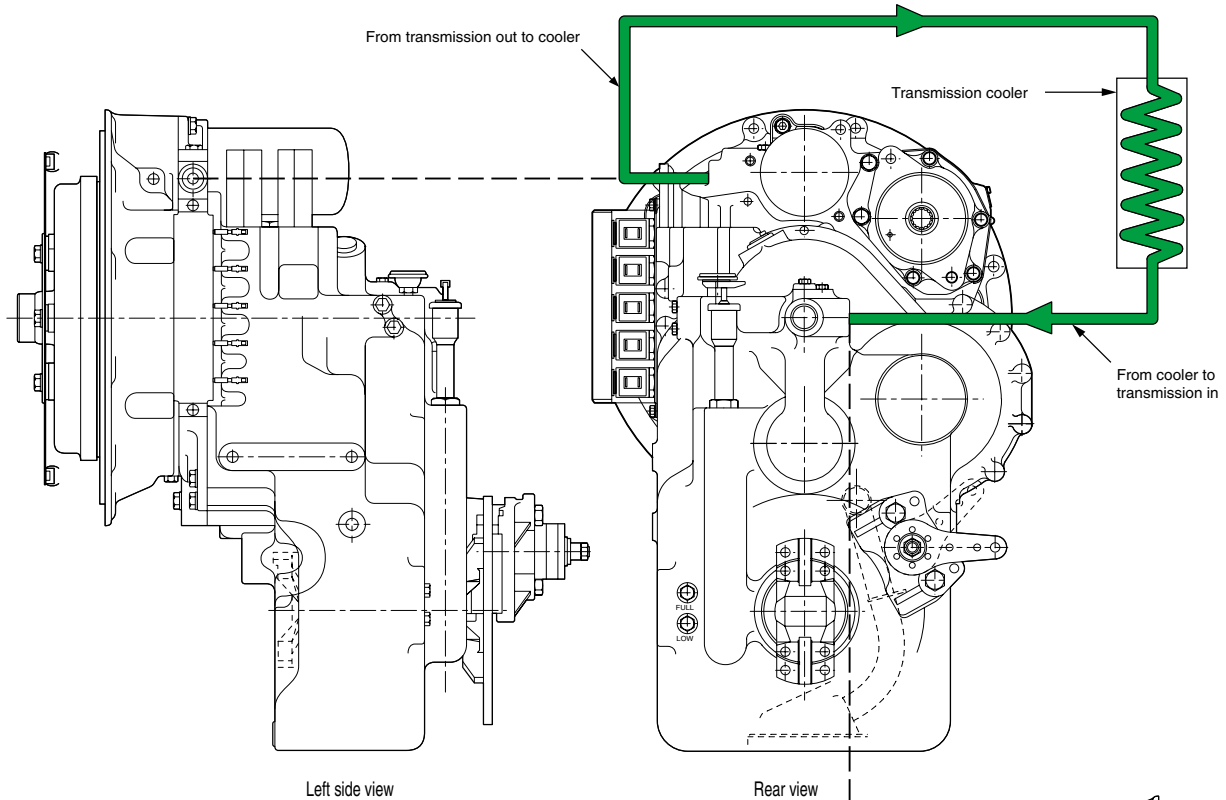
Aligning drive plate to flywheel and transmission to flywheel housing guide studs. Install transmission to flywheel housing screws. Tighten screws to specified torque. Remove transmission to engine guide studs. Install remaining screws and tighten to specified torque.

- *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.

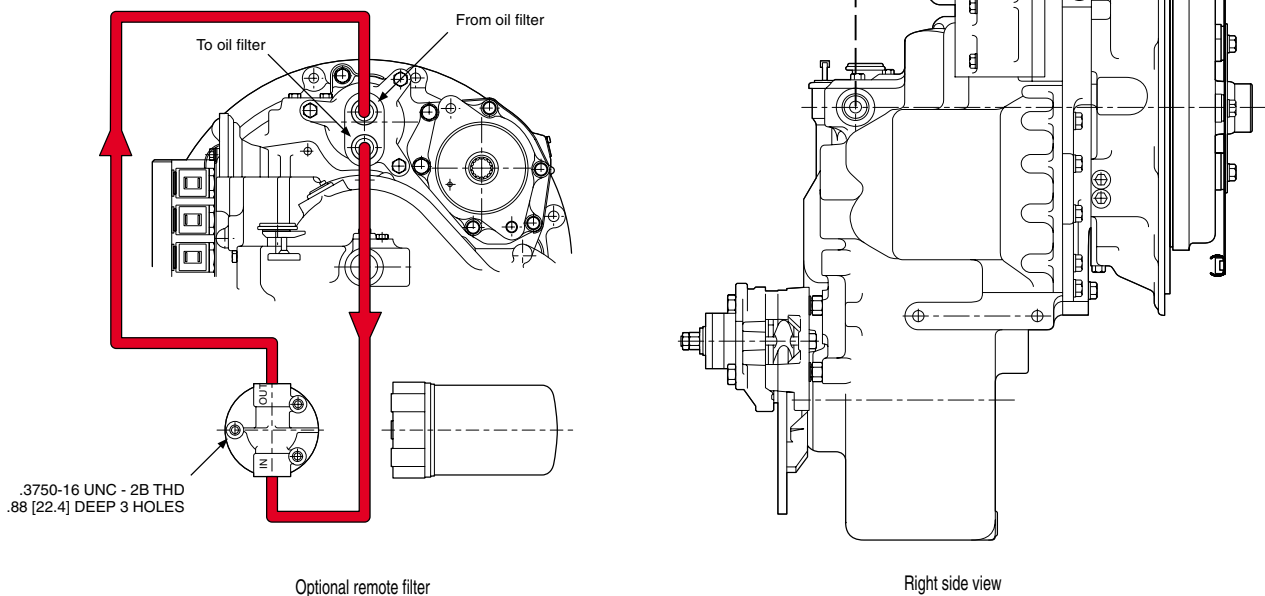
* Does not apply to units having 3 intermediate drive plates. See Fig.4.



5.3 EXTERNAL PLUMBING



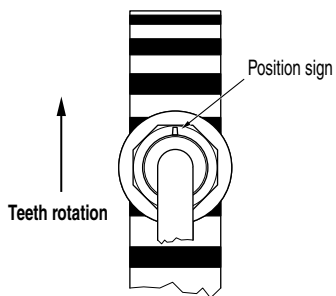
5.3.1 Optional remote filter



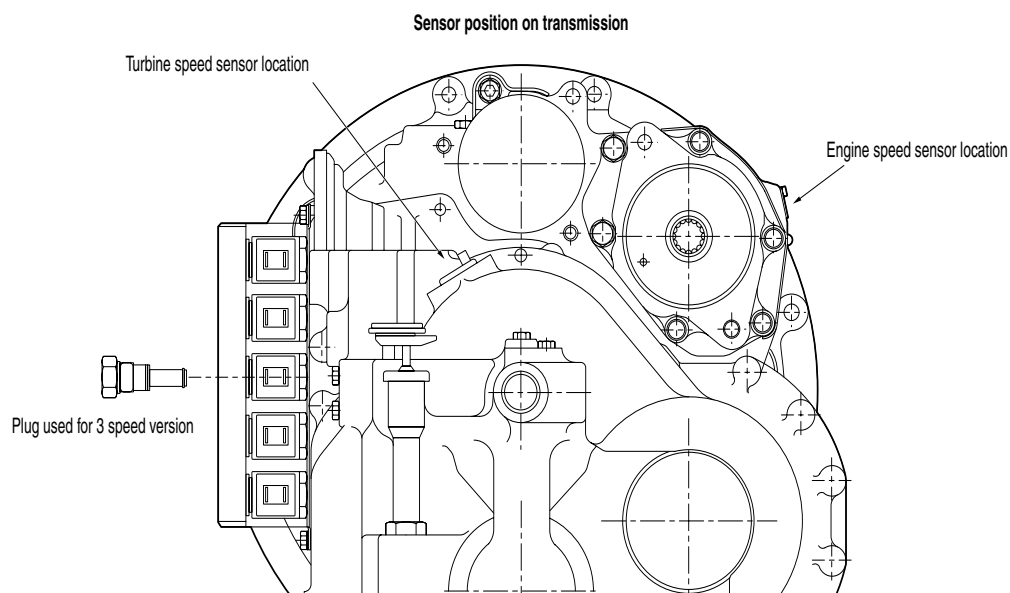
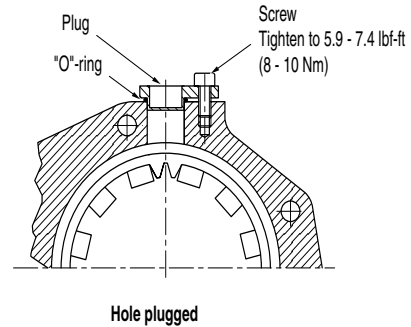
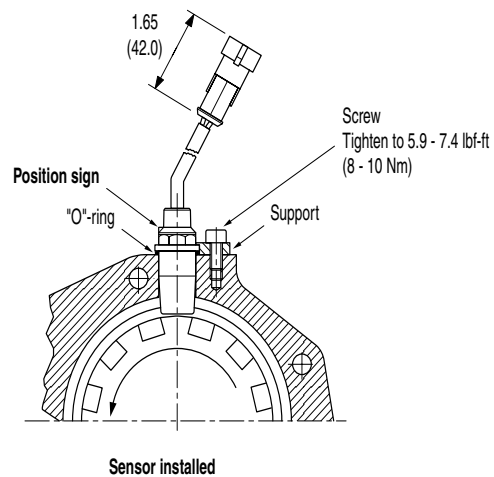
5.3.2 Cooler & filter lines specifications

- 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.

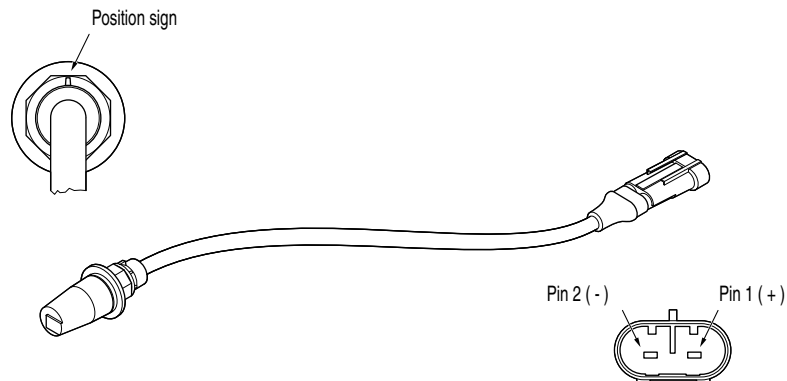
5.4 SPEED SENSOR INSTALLATION



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 gear teeth (Teeth rotation as shown).



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.

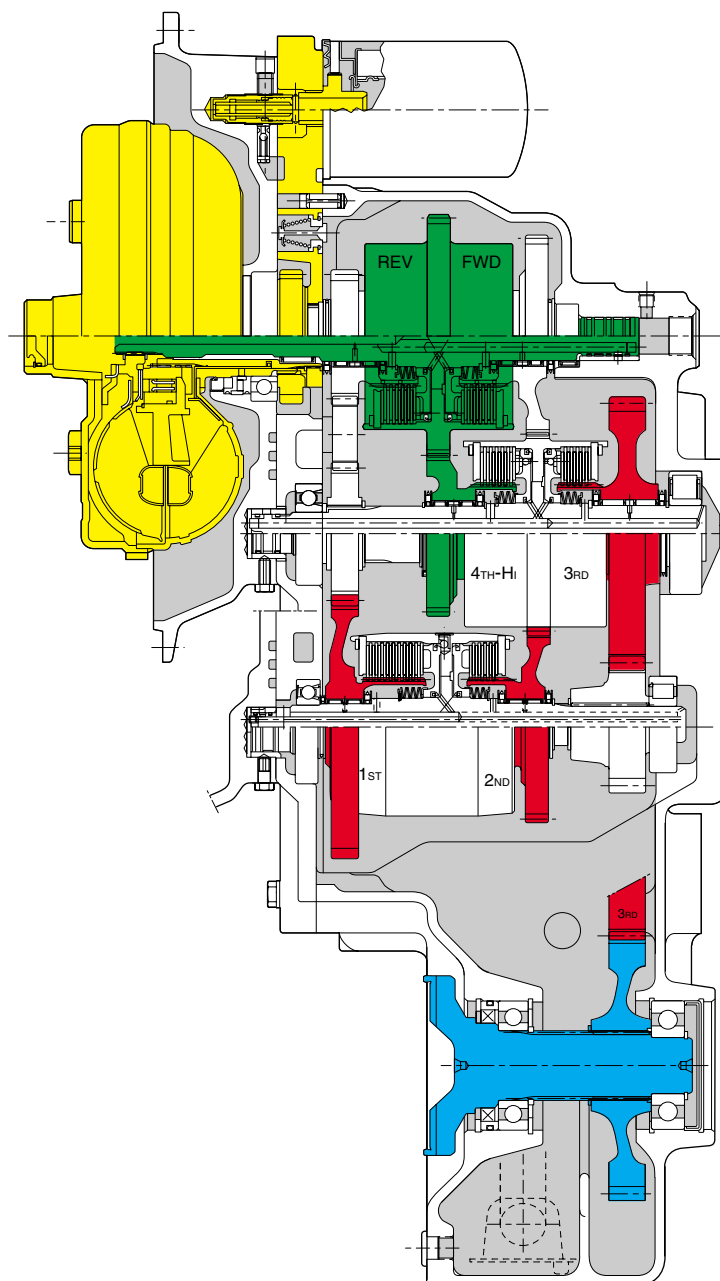
BE SURE TO CORRECTLY OBSERVE SENSOR POLARITIES, AS WRONG CONNECTIONS WILL DEACTIVATE THE SENSOR !

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 solenoids.



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).

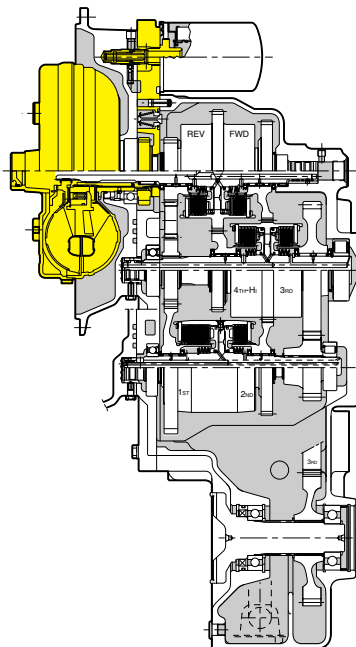
Therefore we can say that as the turbine shaft is decreasing in speed, the torque multiplication is increasing.

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 IS 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, 4th-High 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.

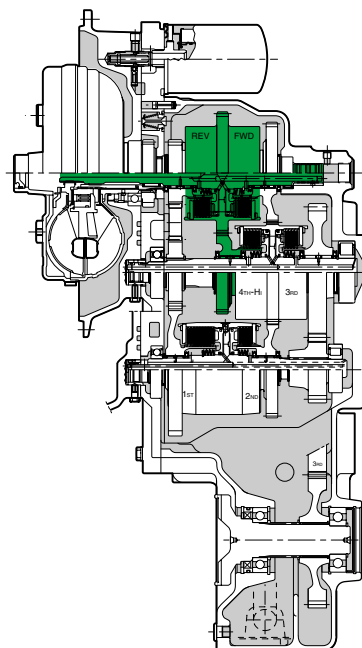
When the clutch is released, a return spring will push the piston back and oil will drain back via the solenoid, the bleed valve or holes in the clutch piston into the transmission sump.

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

The T12000 transmission, 3-speed version, has one reverse clutch and one forward clutch. This in combination with the 3 range clutches results in the transmission having 3 forward and 3 reverse speeds.

The T12000 transmission, 4- and 6-speed versions, have one reverse clutch and two forward clutches (forward and 4th-High). This in combination with the 3 range clutches results in the transmission having 4 forward (for the 4-speed) or 6 forward (for the 6-speed) and 3 reverse speeds.

The engagement of the directional clutches (forward and reverse) are 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

Operation of the transmission

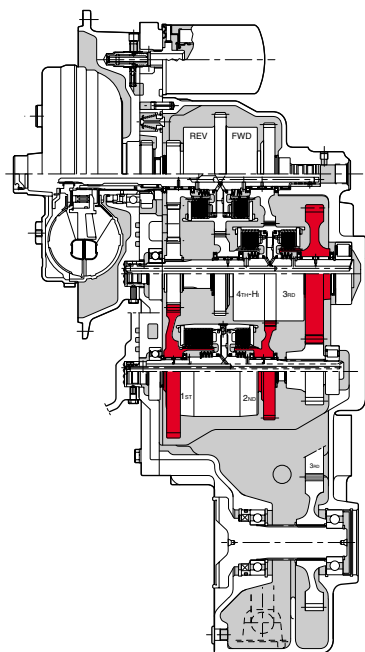
6.1.3 The range clutches

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 is not modulated.

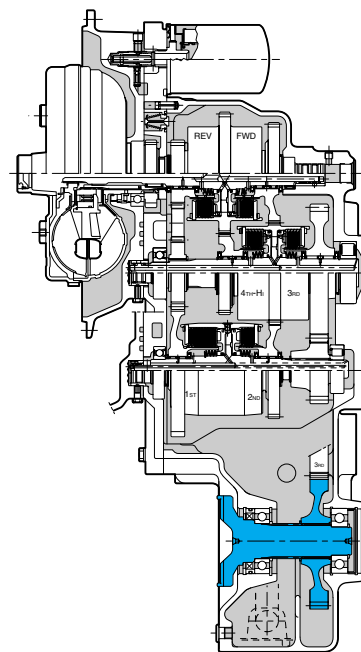
6.1.4 The output section

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

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



 THE RANGE CLUTCHES

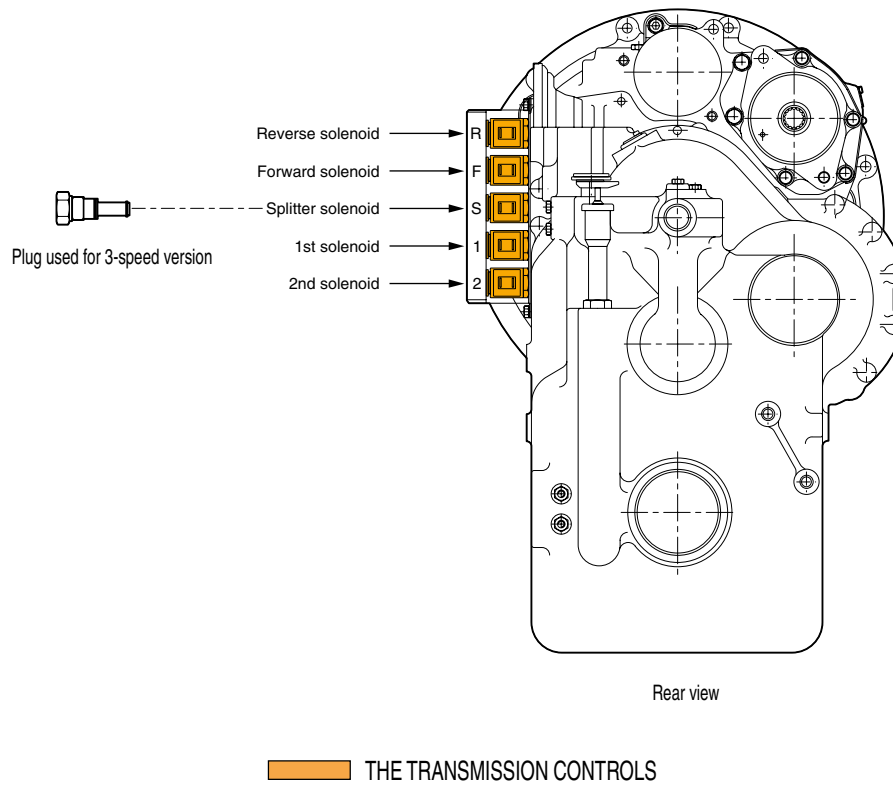


 THE OUTPUT SECTION

Operation of the transmission

6.1.5 The transmission controls (refer to hydraulic diagram)

The transmission is controlled by the direction and range solenoids. The solenoids are mounted on the left side of the transmission case. When the selected direction and range solenoids are energised, oil under pressure will flow through tubes and passages to the selected clutch shafts. Oil sealing rings are located on the clutch shafts. These rings direct oil under pressure through a drilled passage way in the shaft to the desired clutch.



6.2 ELECTRIC SOLENOID CONTROLS**6.2.1 3-Speed transmission**

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

**Note**

FOR THE 3-SPEED TRANSMISSION, THE SPLITTER SOLENOID DOES NOT EXIST.

6.2.2 4-speed transmission**6.2.2.1 Standard 4-speed transmission (1, 3, 5, 6 ≈ 6-speed)**

Transmission gear	Activated solenoids	Activated clutches
Forward 4 Forward 3 Forward 2 Forward 1	Forward, Splitter Forward Forward, 2nd Forward, 1st, 2nd	4th-High, 3rd Forward, 3rd Forward, 2nd Forward, 1st
Neutral 3 Neutral 2 Neutral 1	— 2nd 1st, 2nd	3rd 2nd 1st
Reverse 3 Reverse 2 Reverse 1	Reverse Reverse, 2nd Reverse, 1st, 2nd	Reverse, 3rd Reverse, 2nd Reverse, 1st

Operation of the transmission

6.2.2.2 Alternative 4-speed transmission, model T12496 only (1, 3, 4, 5 ≈ 6-speed)

Transmission gear	Activated solenoids	Activated clutches
Forward 4	Forward	Forward, 3rd
Forward 3	Forward, Splitter, 2nd	4th-High, 2nd
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

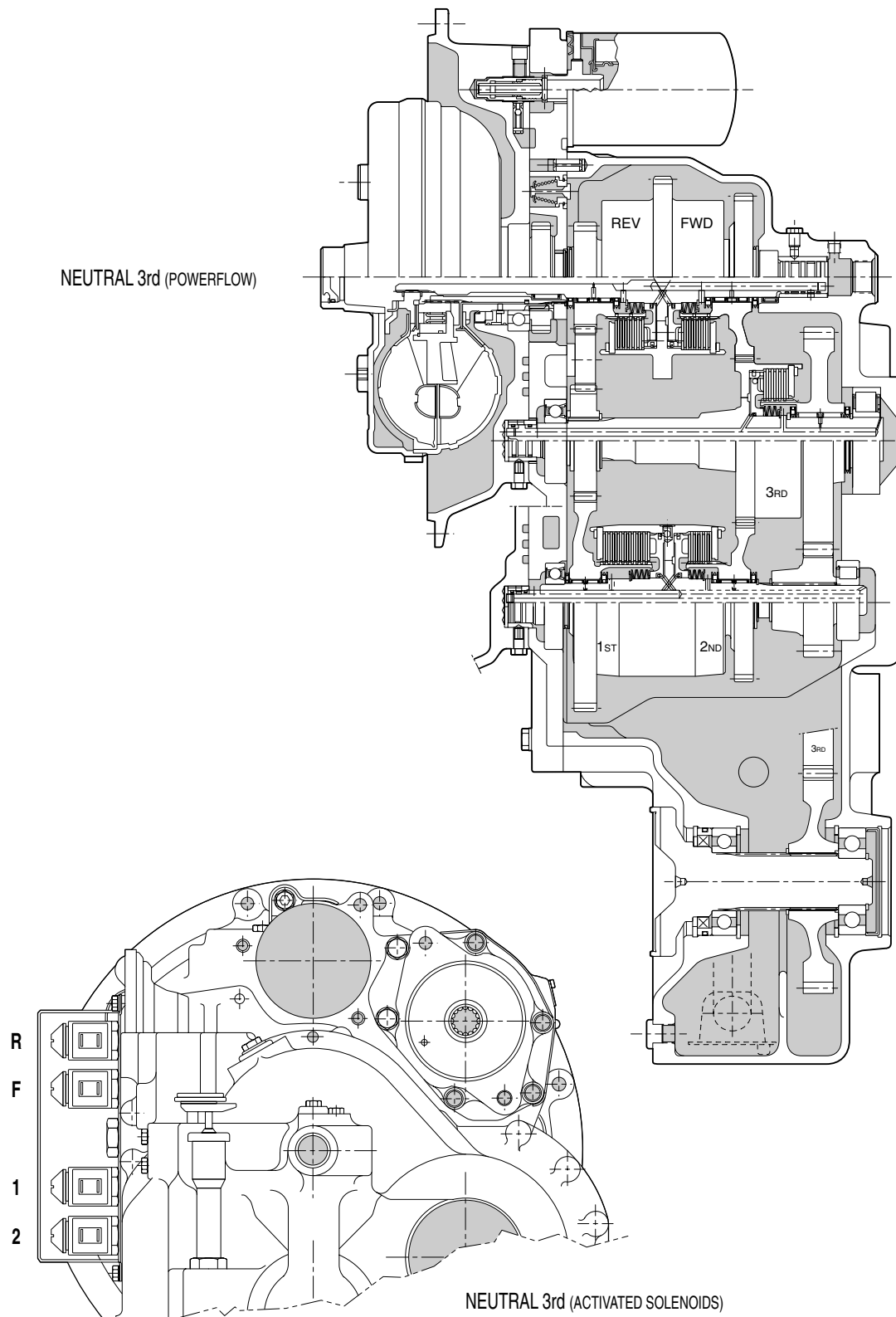
6.2.3 6-Speed transmission

Transmission gear	Activated solenoids	Activated clutches
Forward 6	Forward, Splitter	4th-High, 3rd
Forward 5	Forward	Forward, 3rd
Forward 4	Forward, Splitter, 2nd	4th-High, 2nd
Forward 3	Forward, 2nd	Forward, 2nd
Forward 2	Forward, Splitter, 1st, 2nd	4th-High, 1st
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

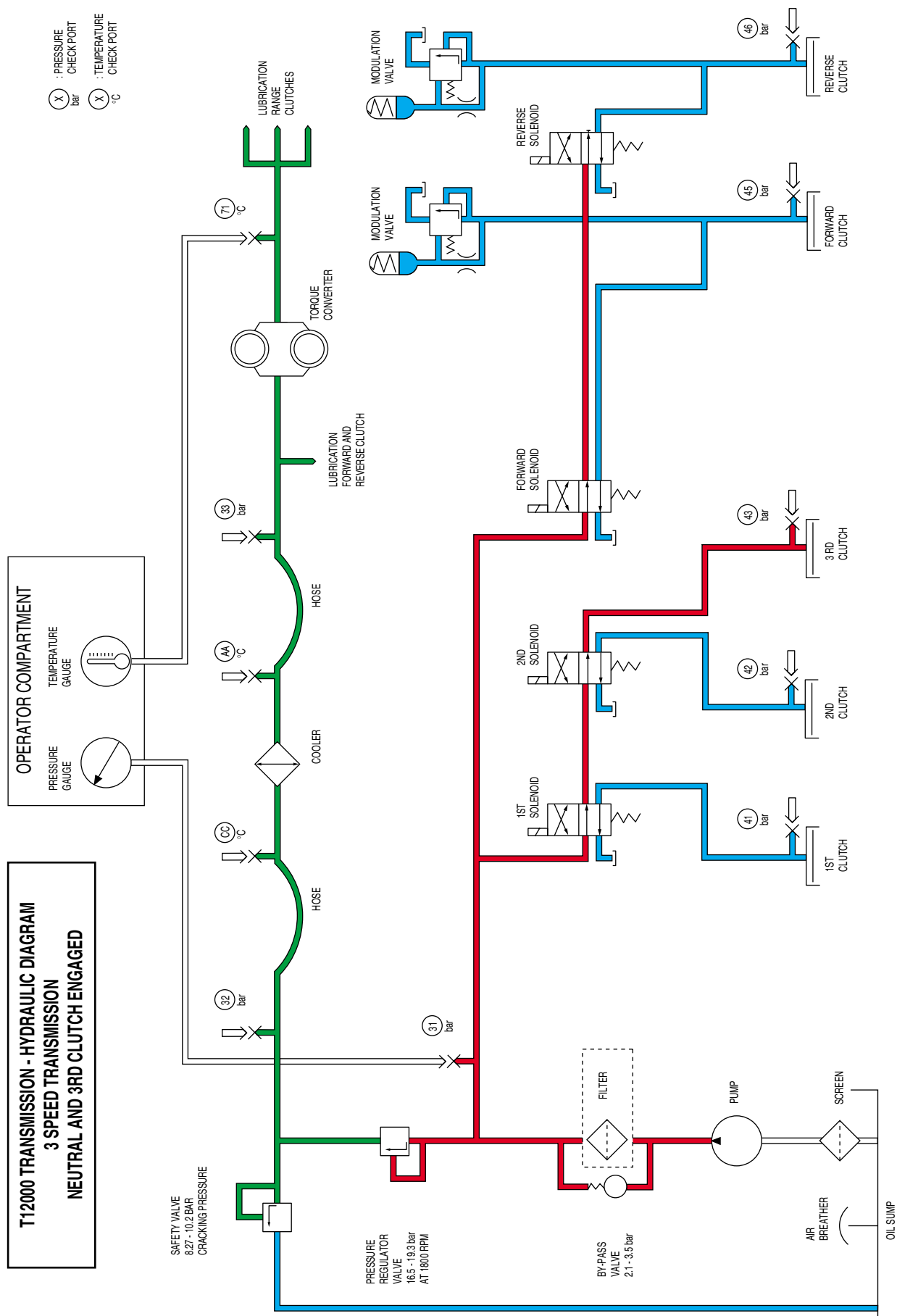
6.3 POWERFLOWS, ACTIVATED SOLENOIDS AND HYDRAULIC CIRCUIT

6.3.1 3-Speed transmission

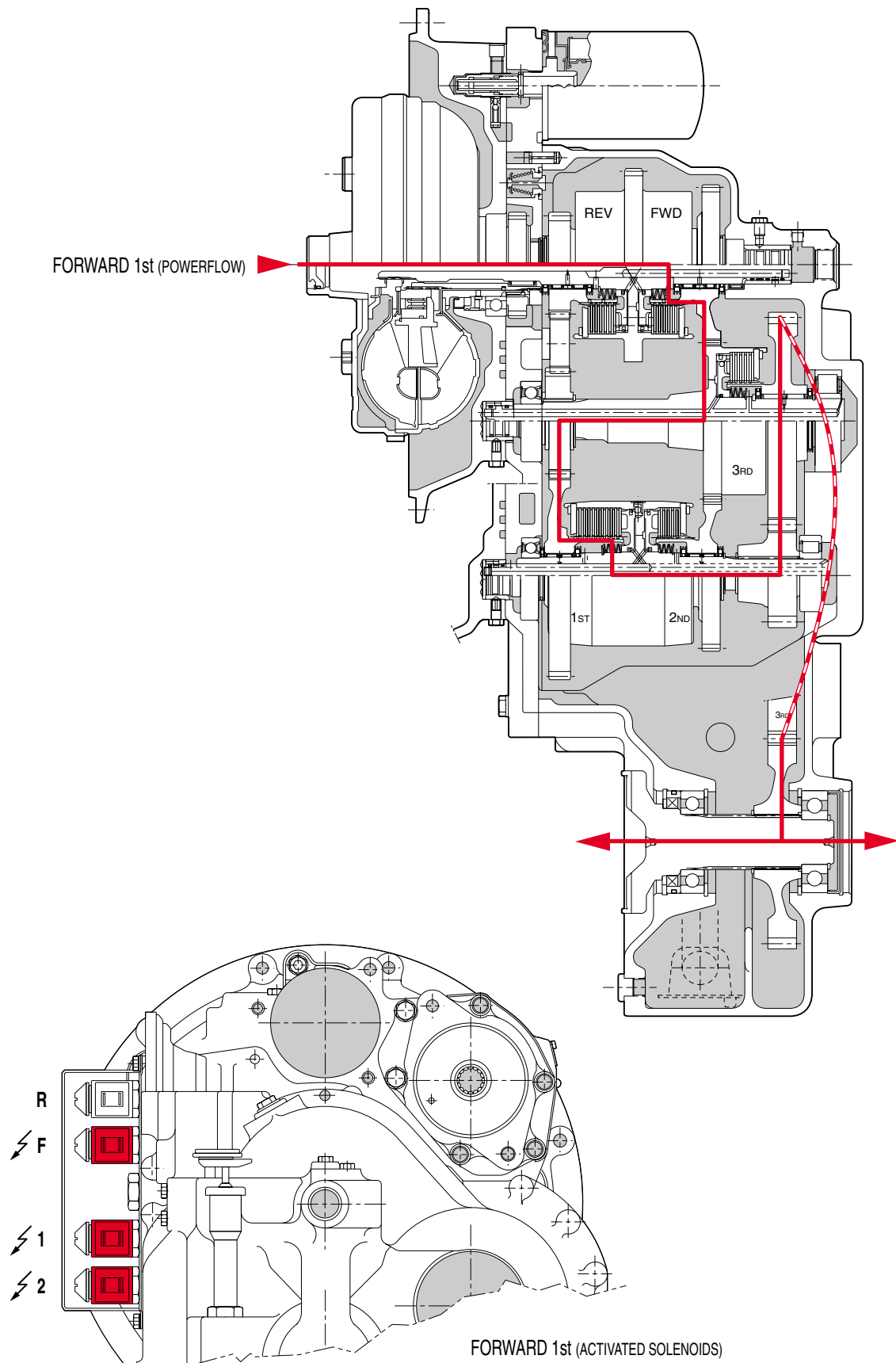
6.3.1.1 Neutral and 3rd clutch engaged



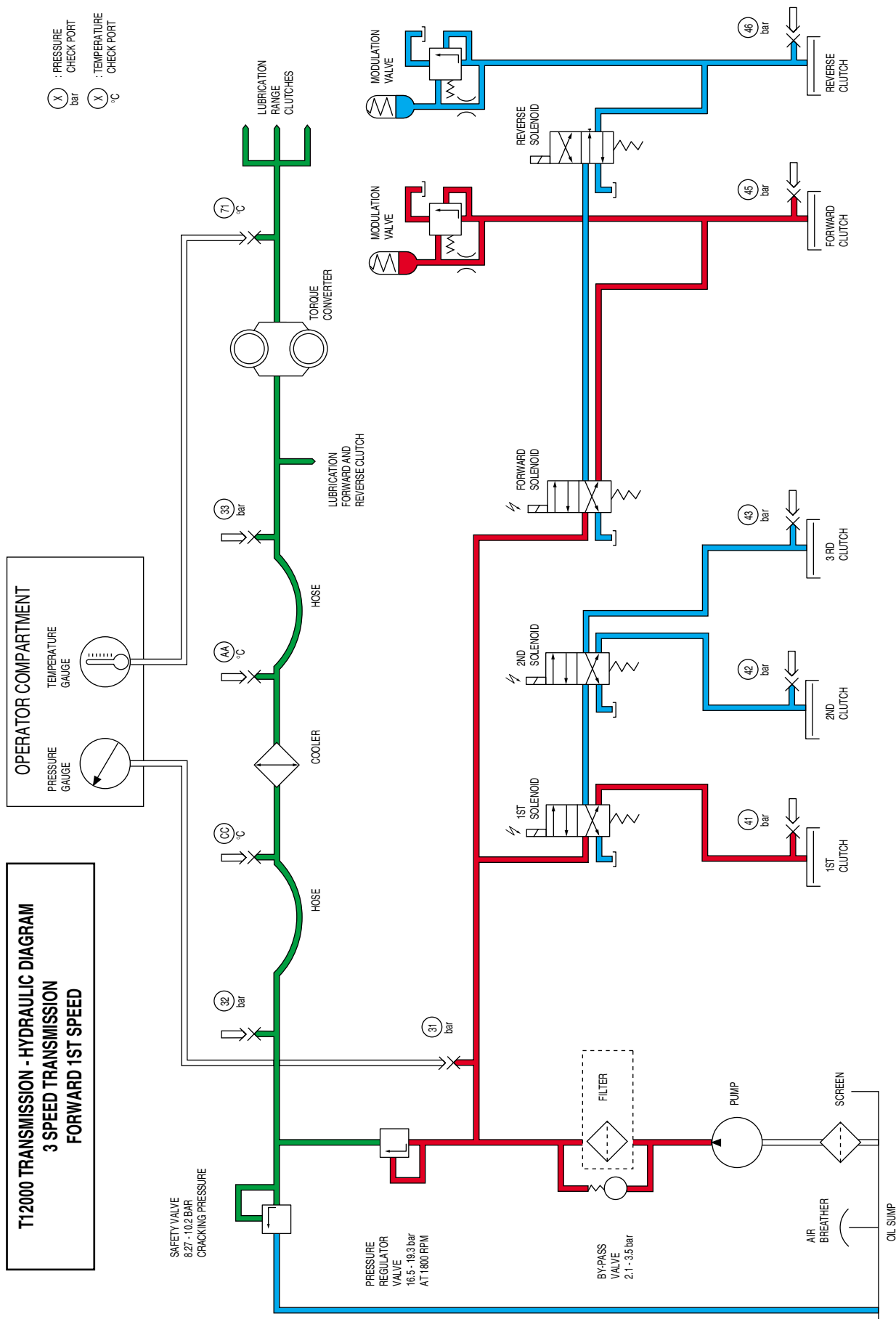
6.3.1.1 Neutral and 3rd clutch engaged (continued)



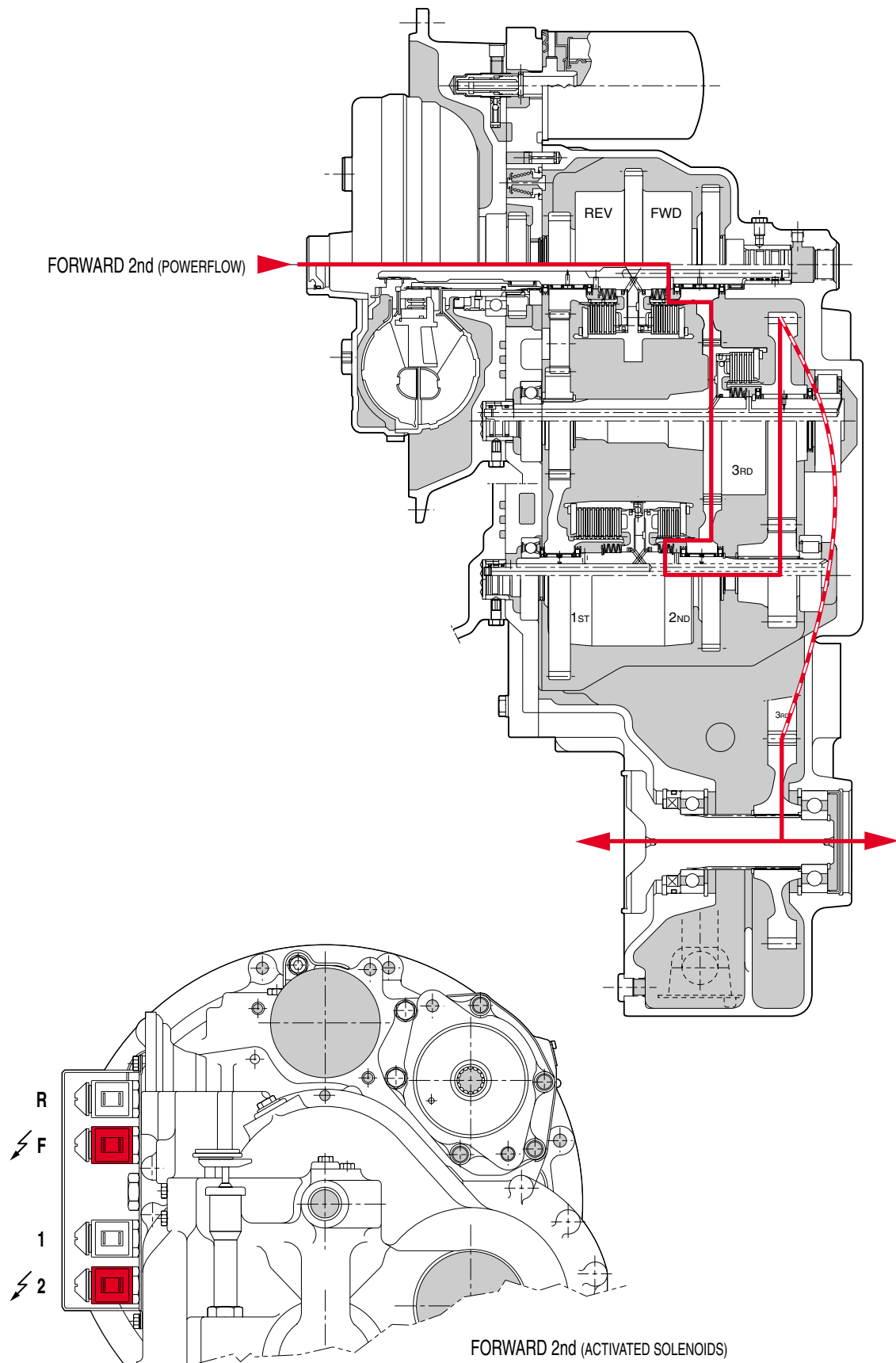
6.3.1.2 Forward 1st speed



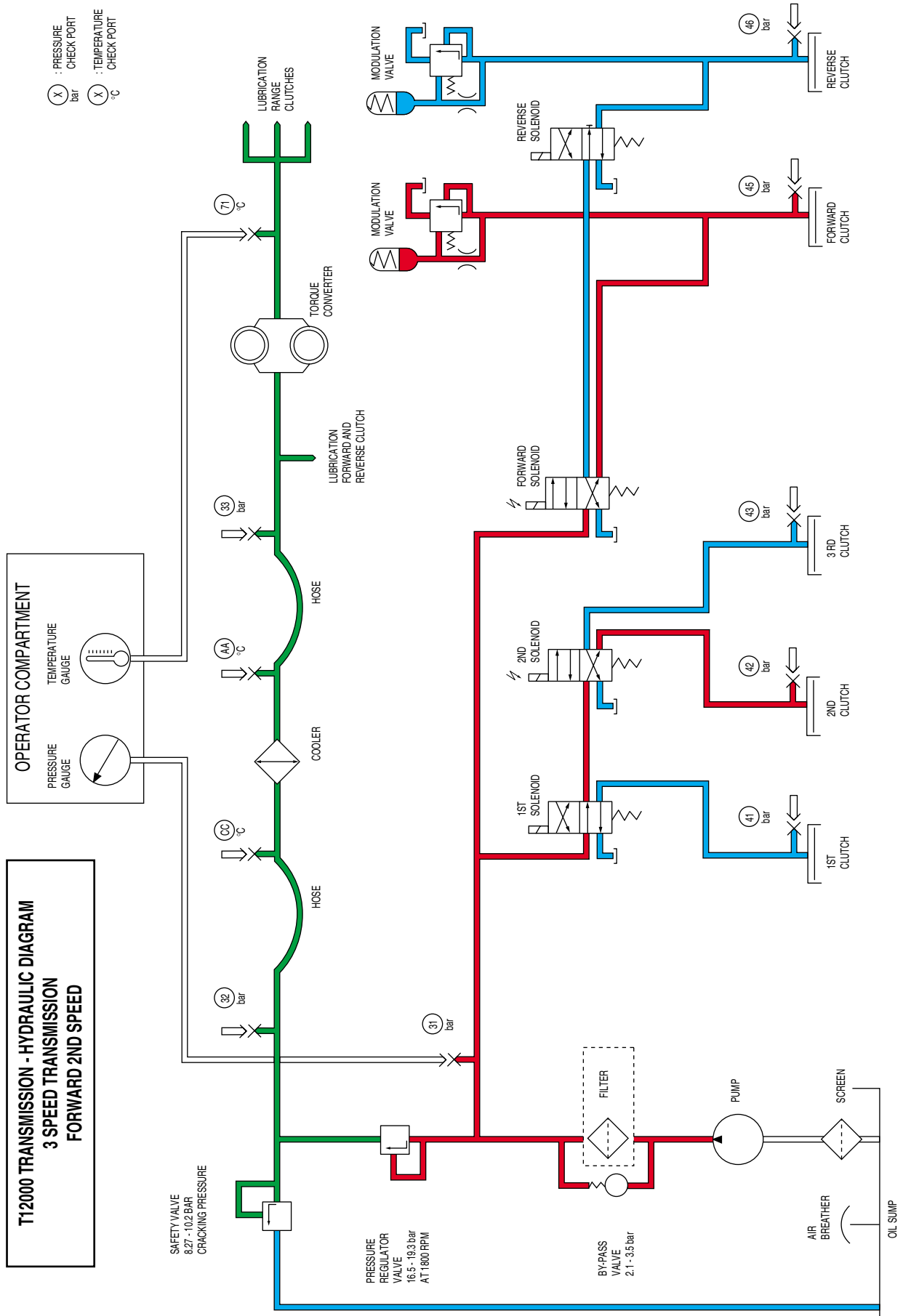
6.3.1.2 Forward 1st speed (continued)



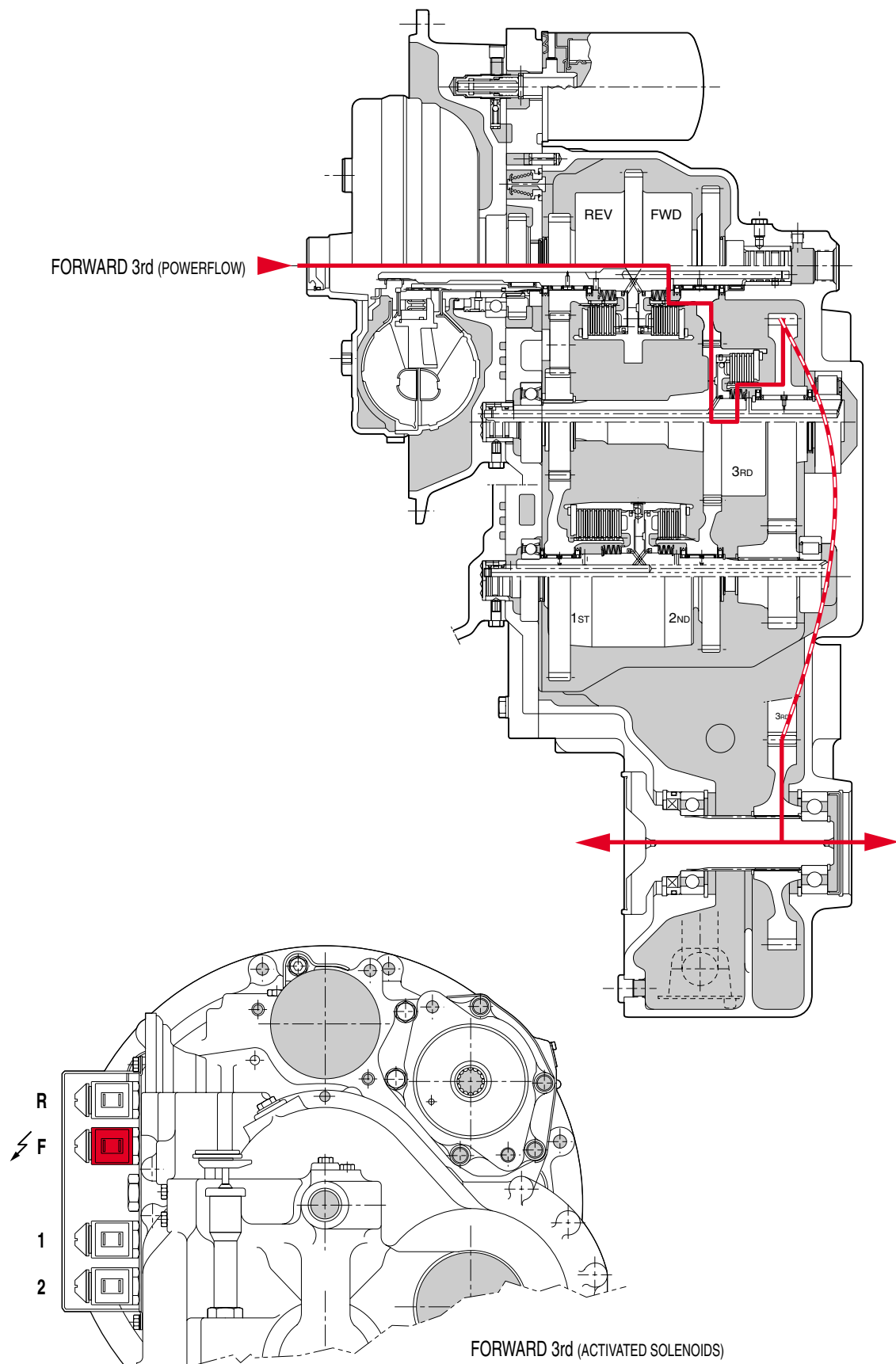
6.3.1.3 Forward 2nd speed



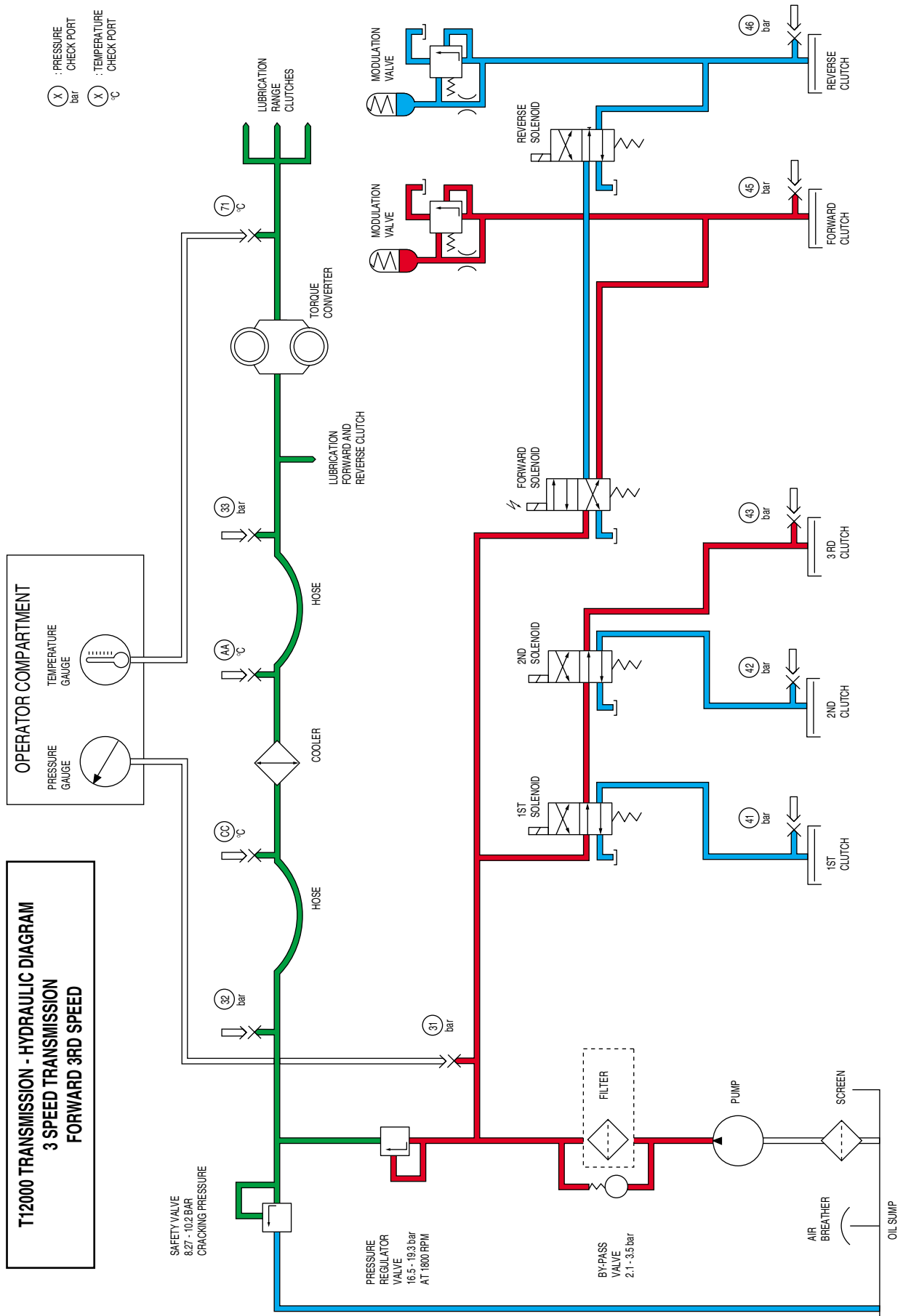
6.3.1.3 Forward 2nd speed (continued)



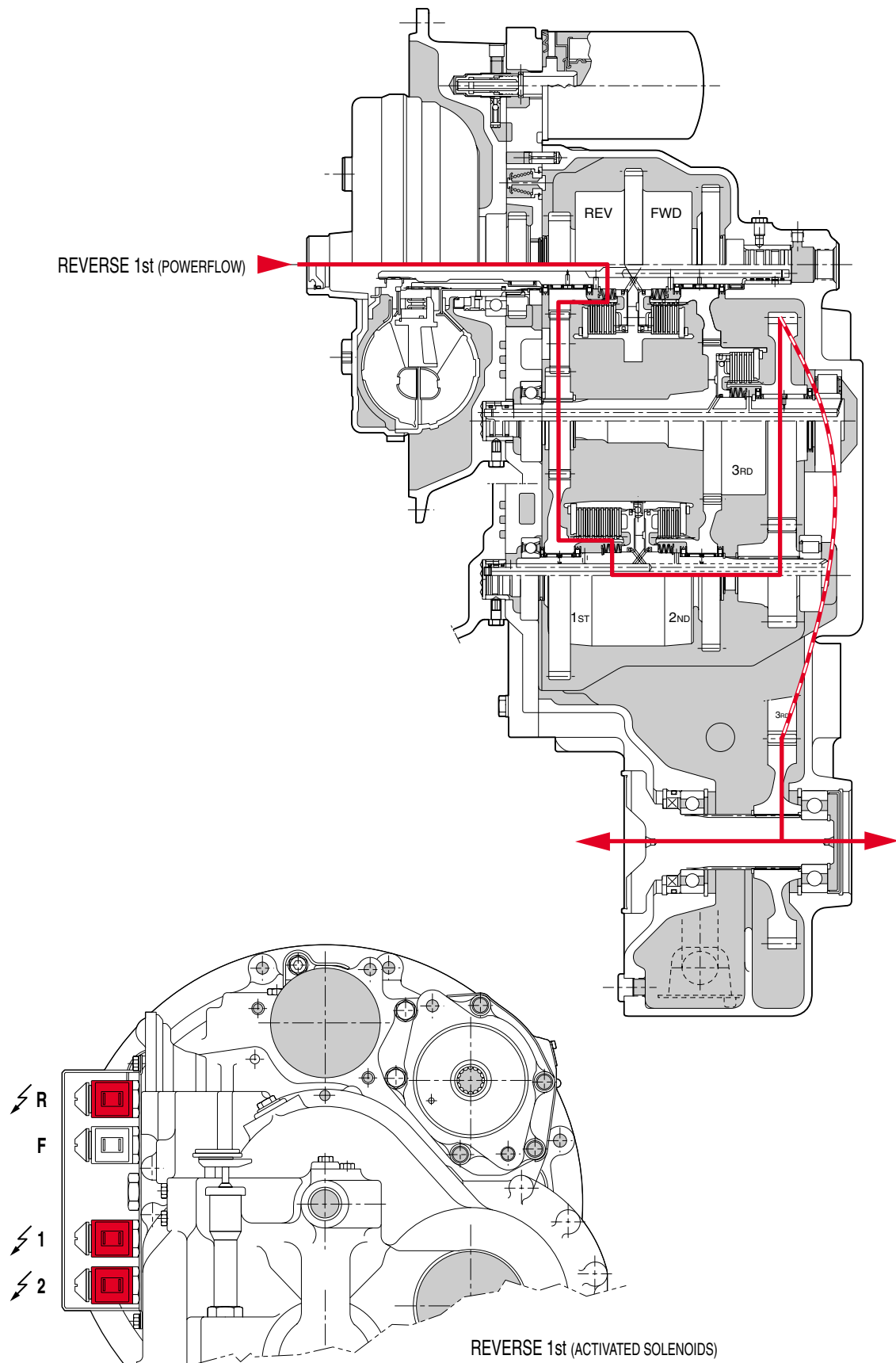
6.3.1.4 Forward 3rd speed



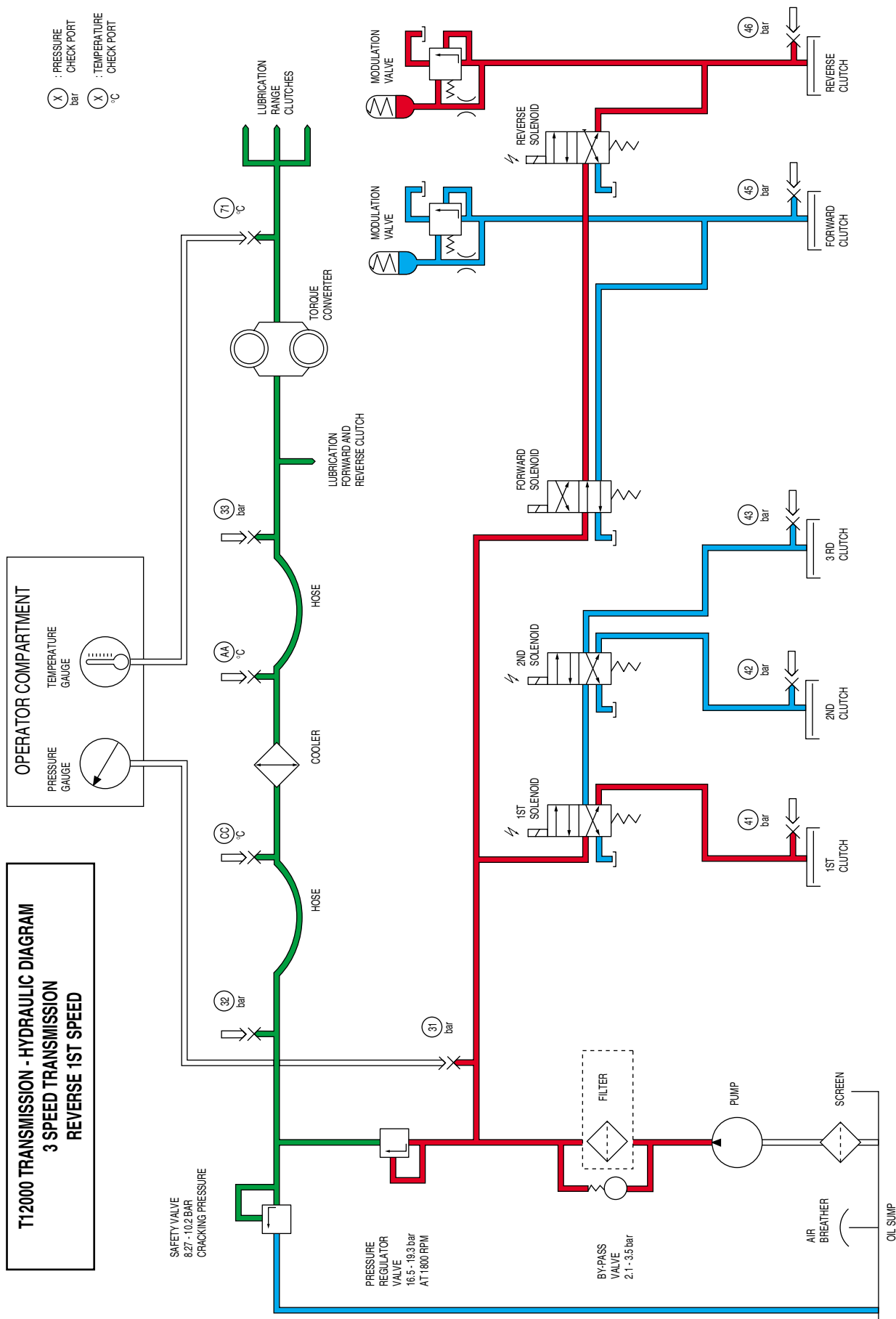
6.3.1.4 Forward 3rd speed (continued)



6.3.1.5 Reverse 1st speed



6.3.1.5 Reverse 1st speed (continued)

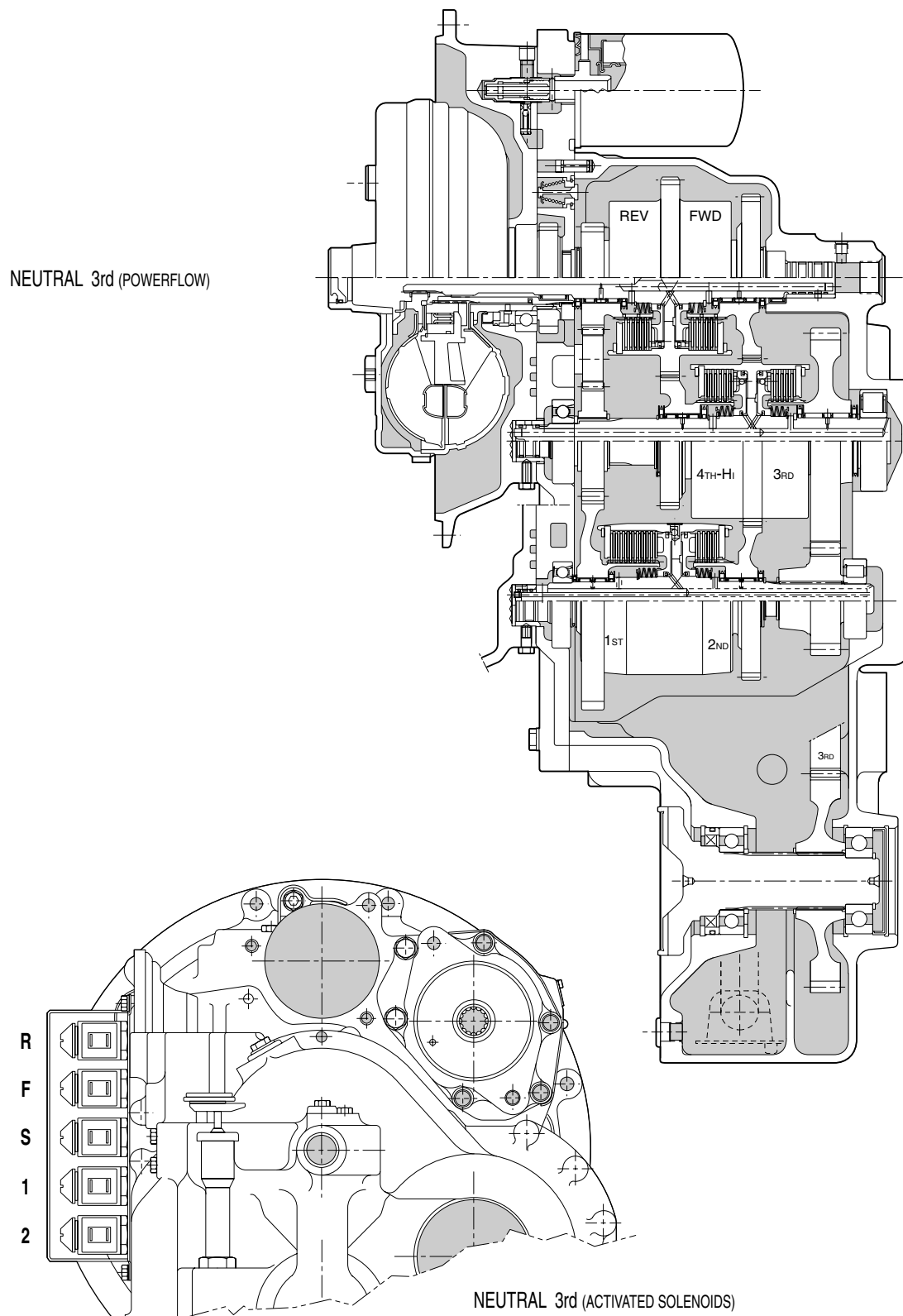


Operation of the transmission

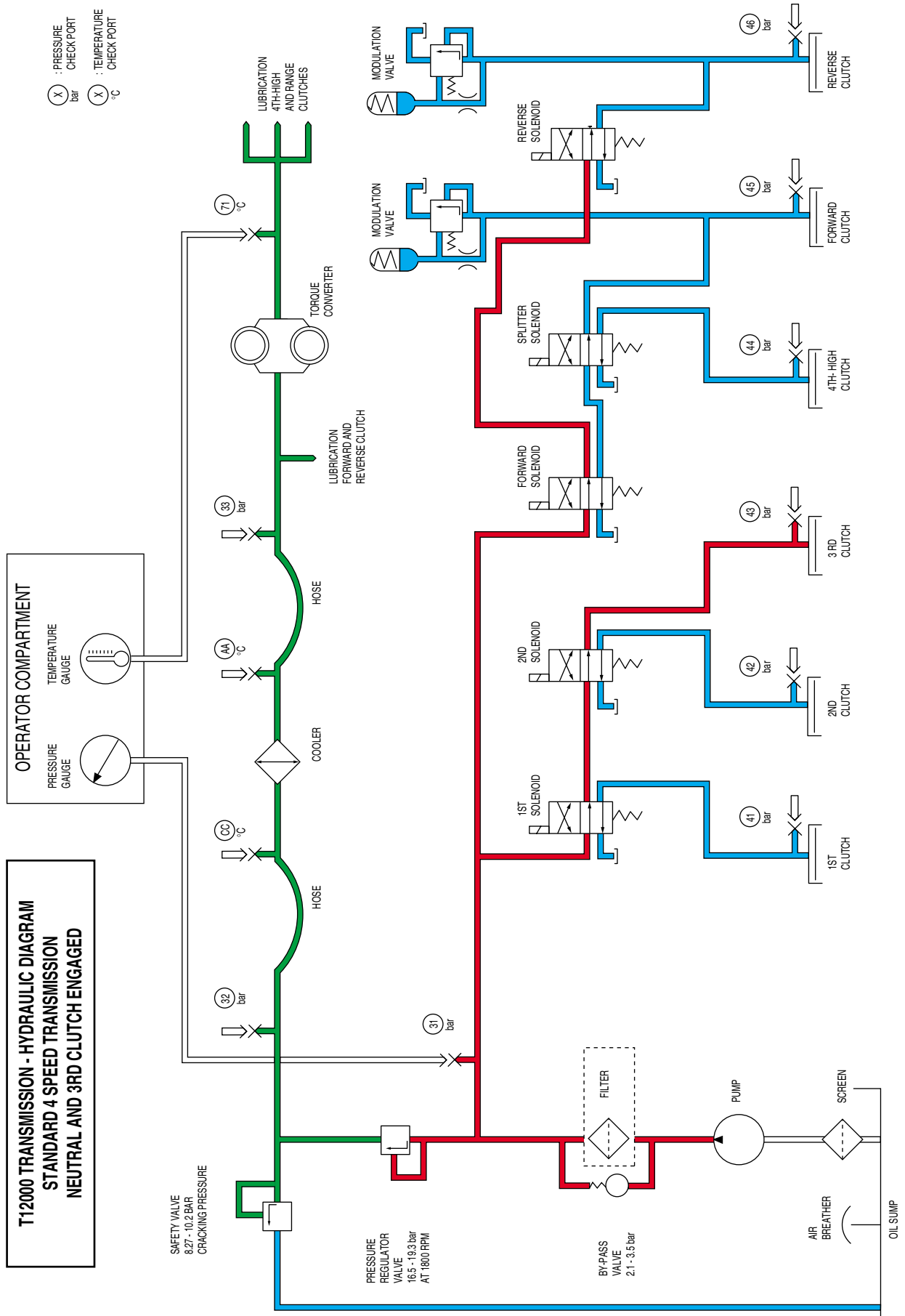
6.3.2 4-Speed transmission

6.3.2.1 Standard 4-speed transmission

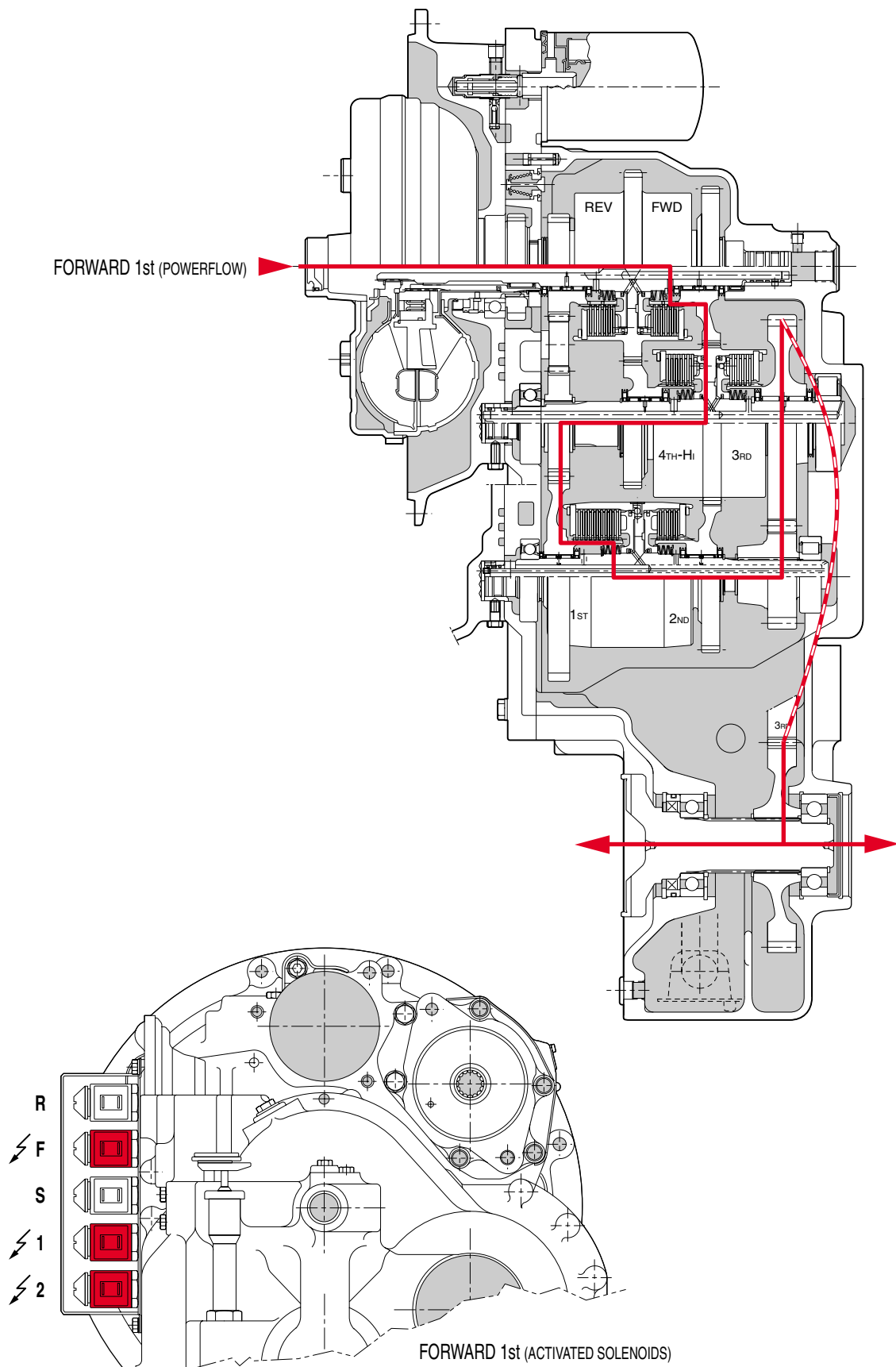
6.3.2.1.1 Neutral and 3rd clutch engaged



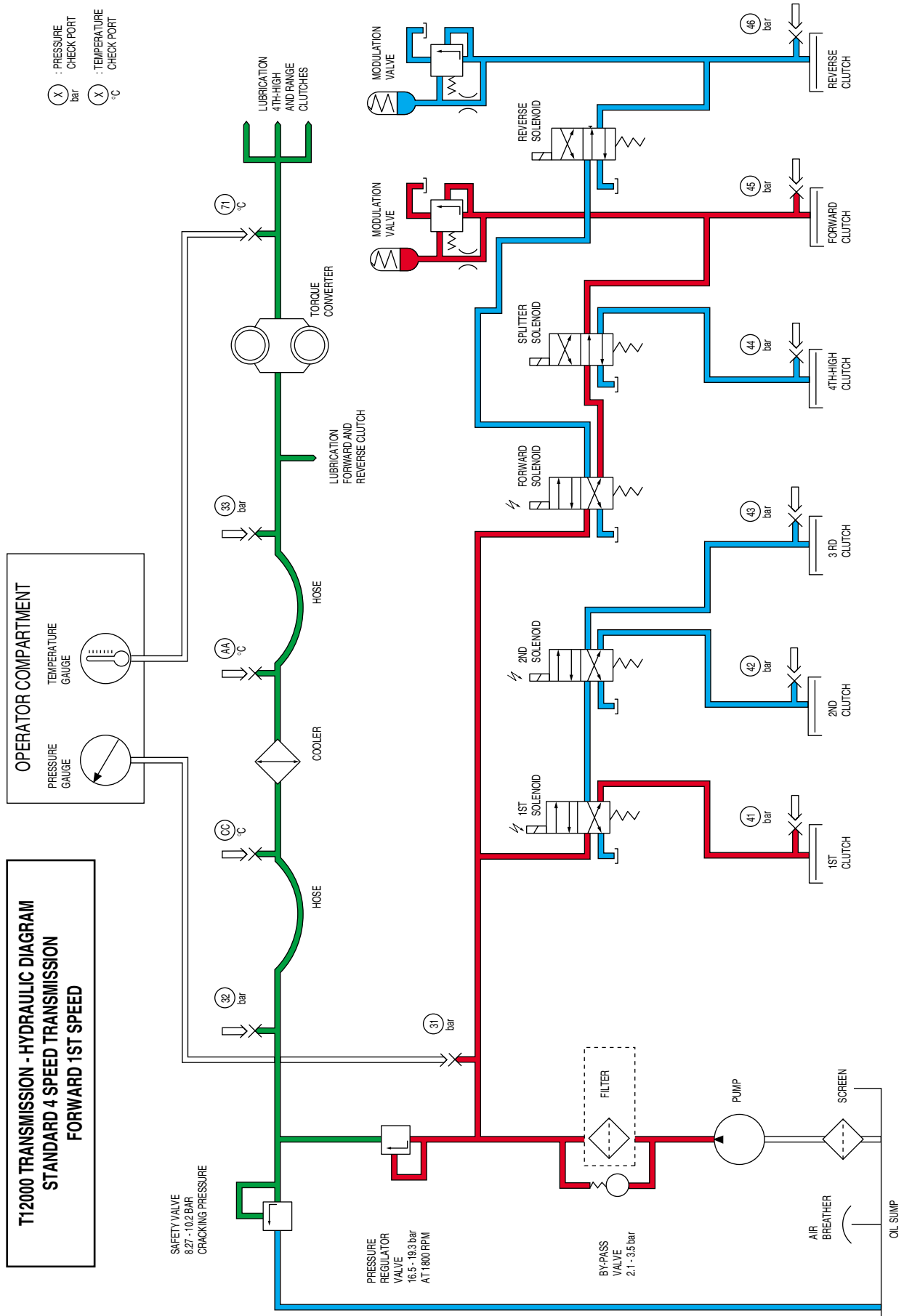
6.3.2.1.1 Neutral and 3rd clutch engaged (continued)



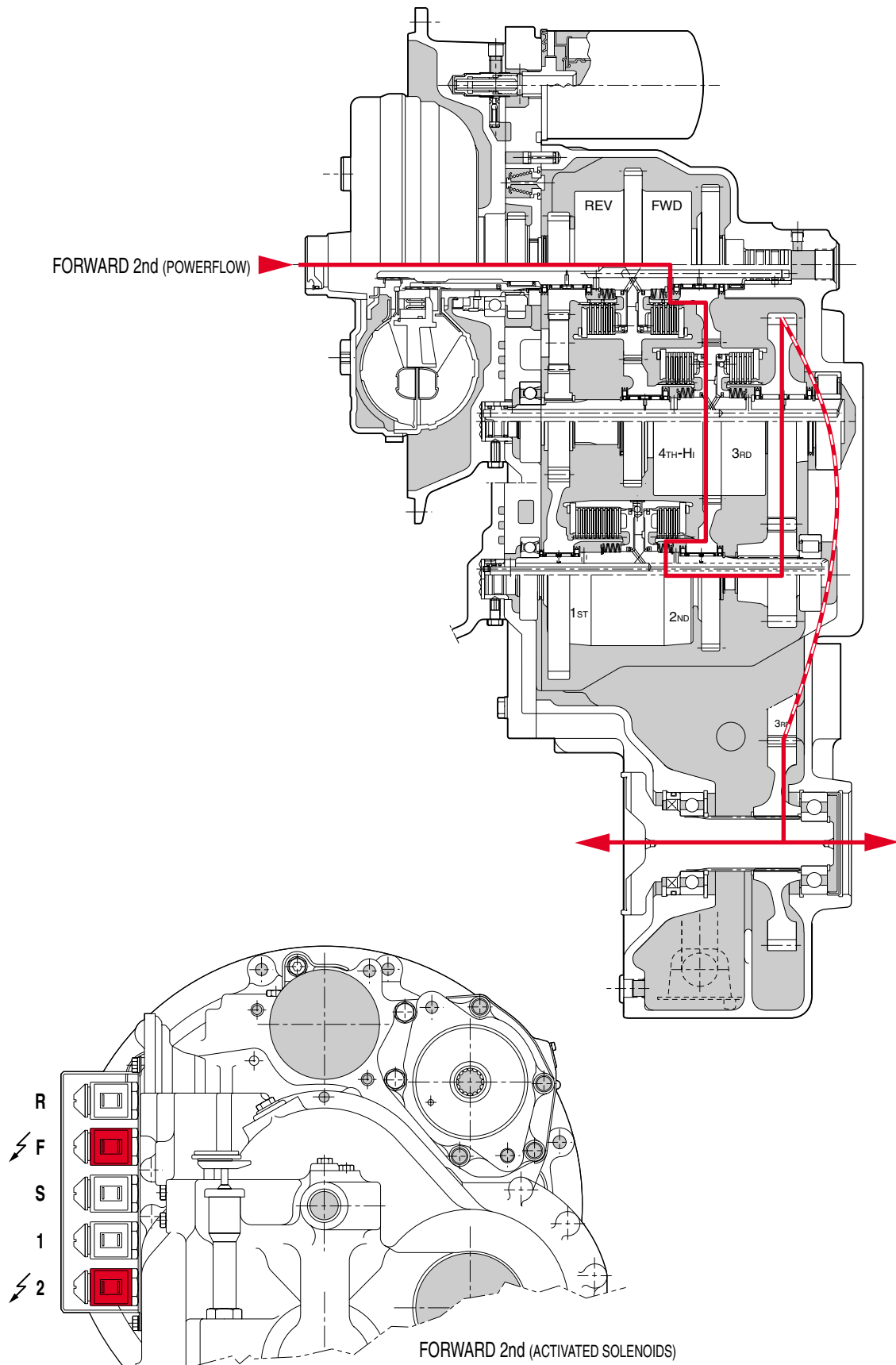
6.3.2.1.2 Forward 1st speed



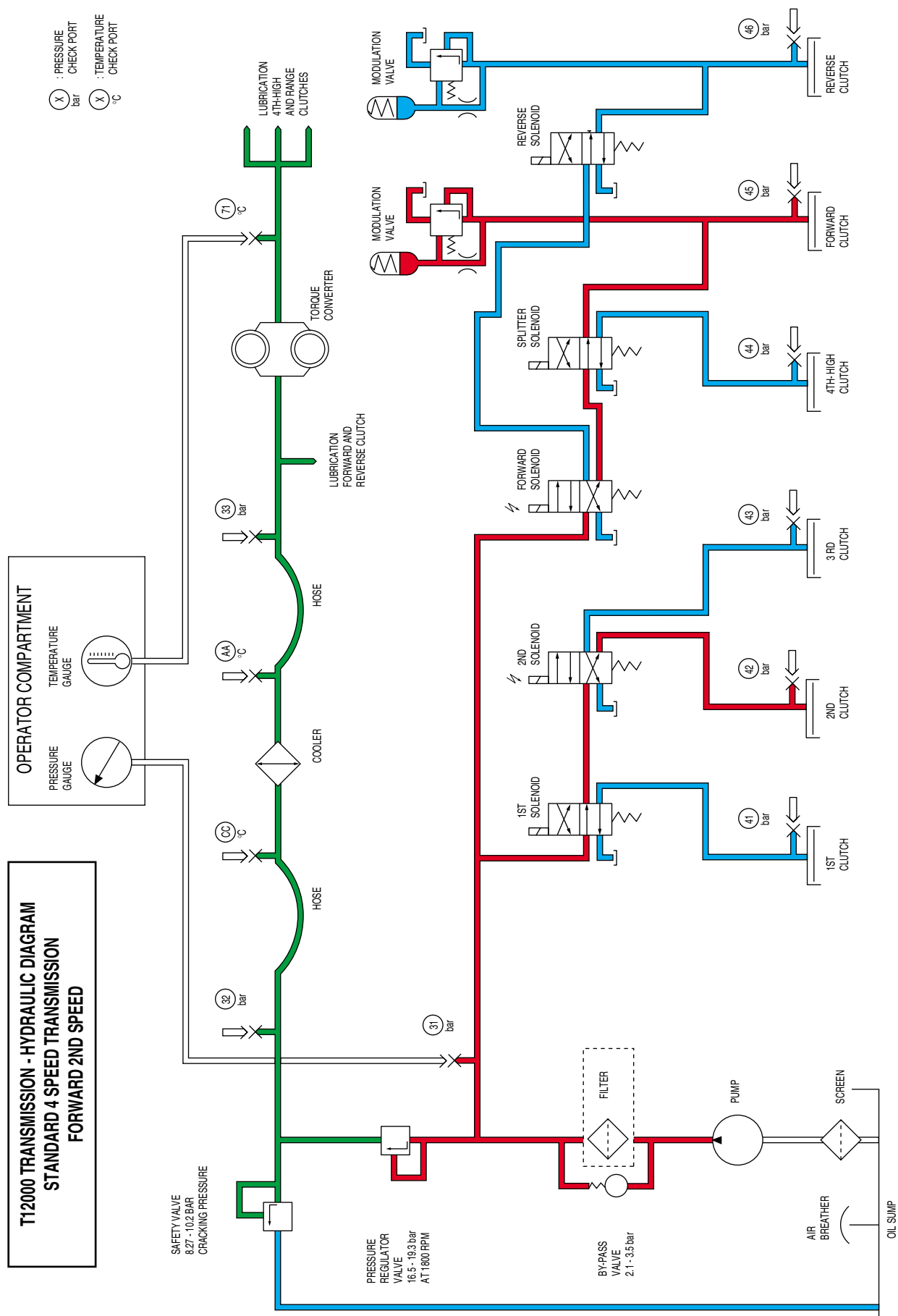
6.3.2.1.2 Forward 1st speed (continued)



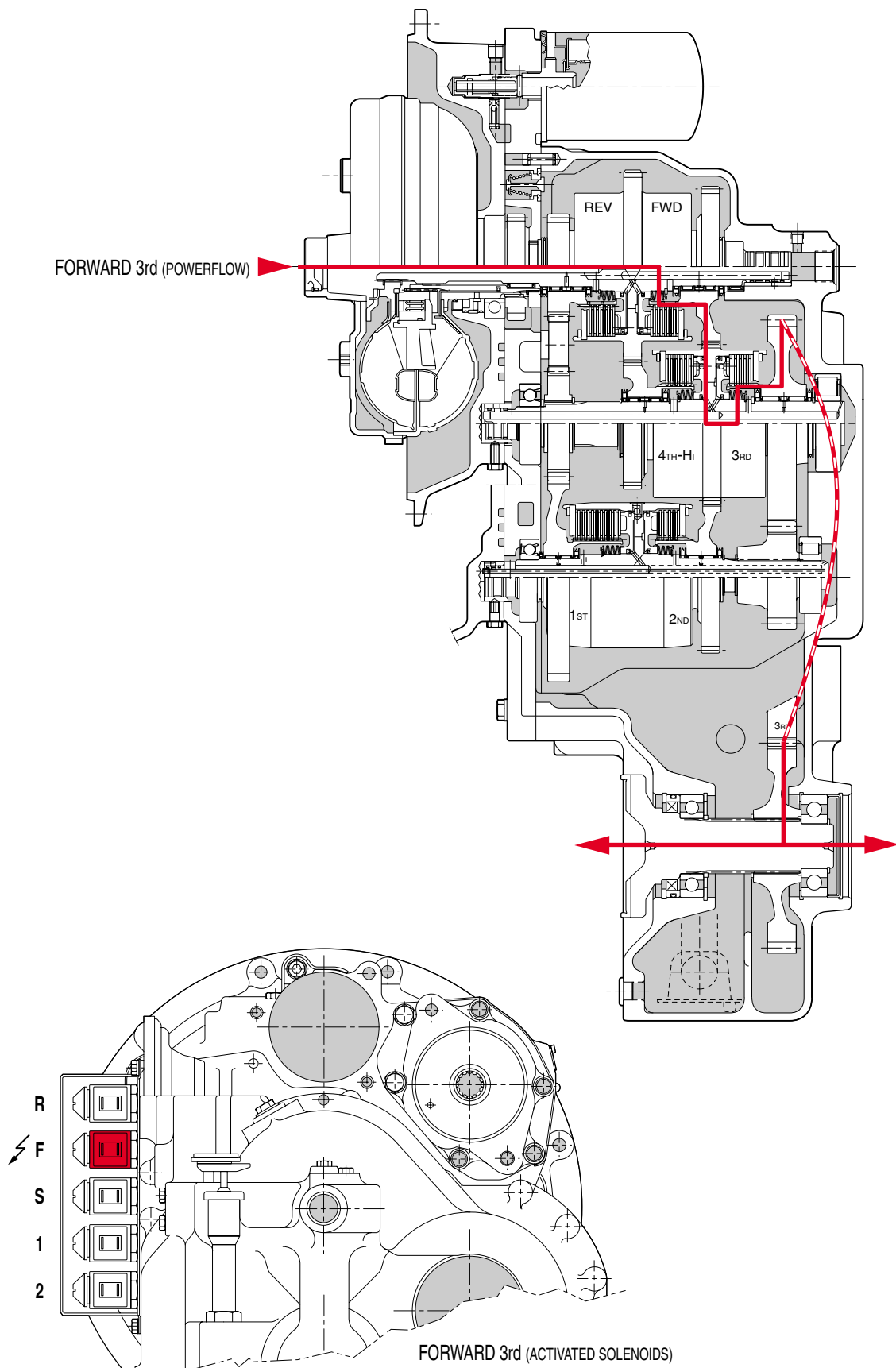
6.3.2.1.3 Forward 2nd speed



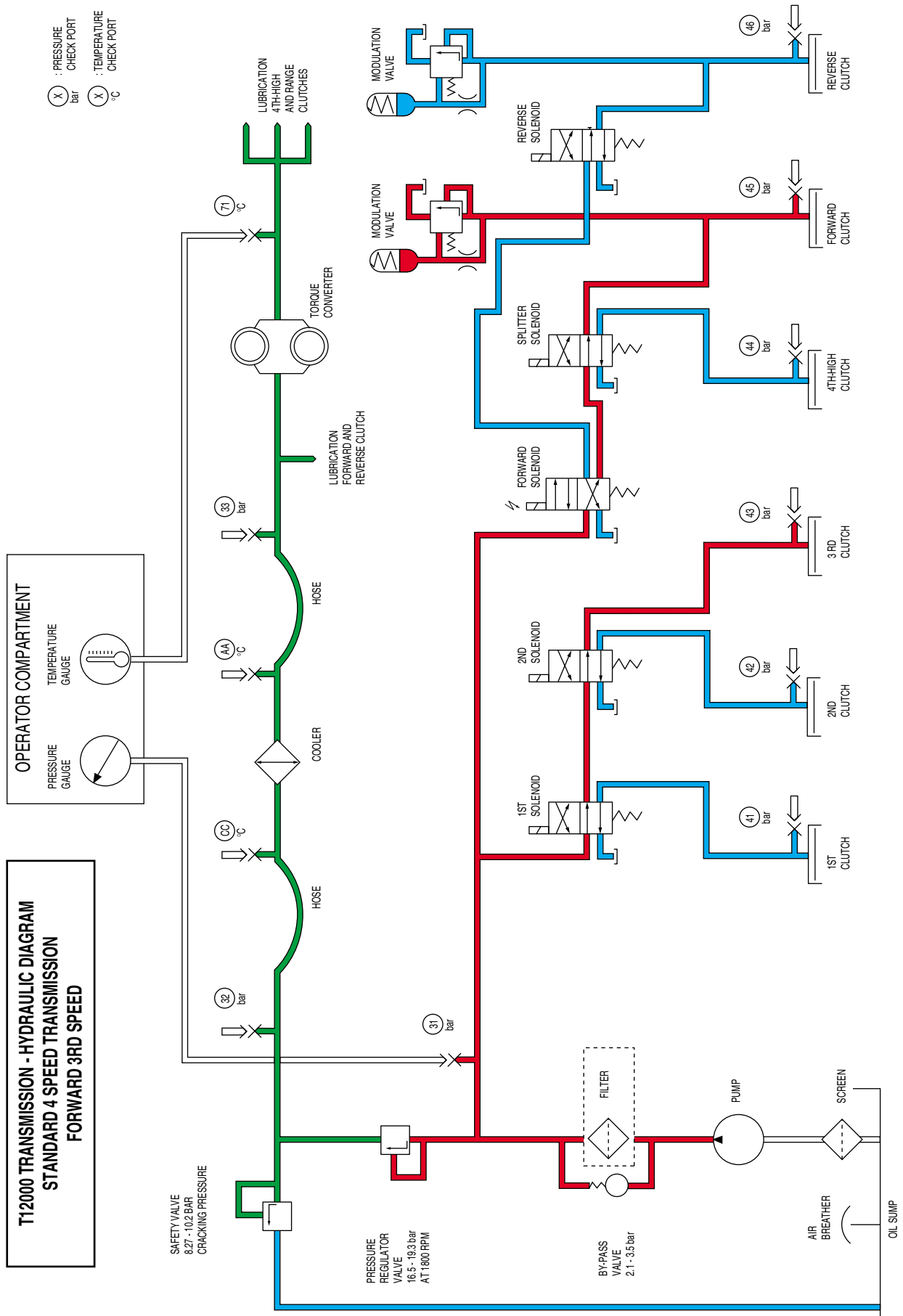
6.3.2.1.3 Forward 2nd speed (continued)



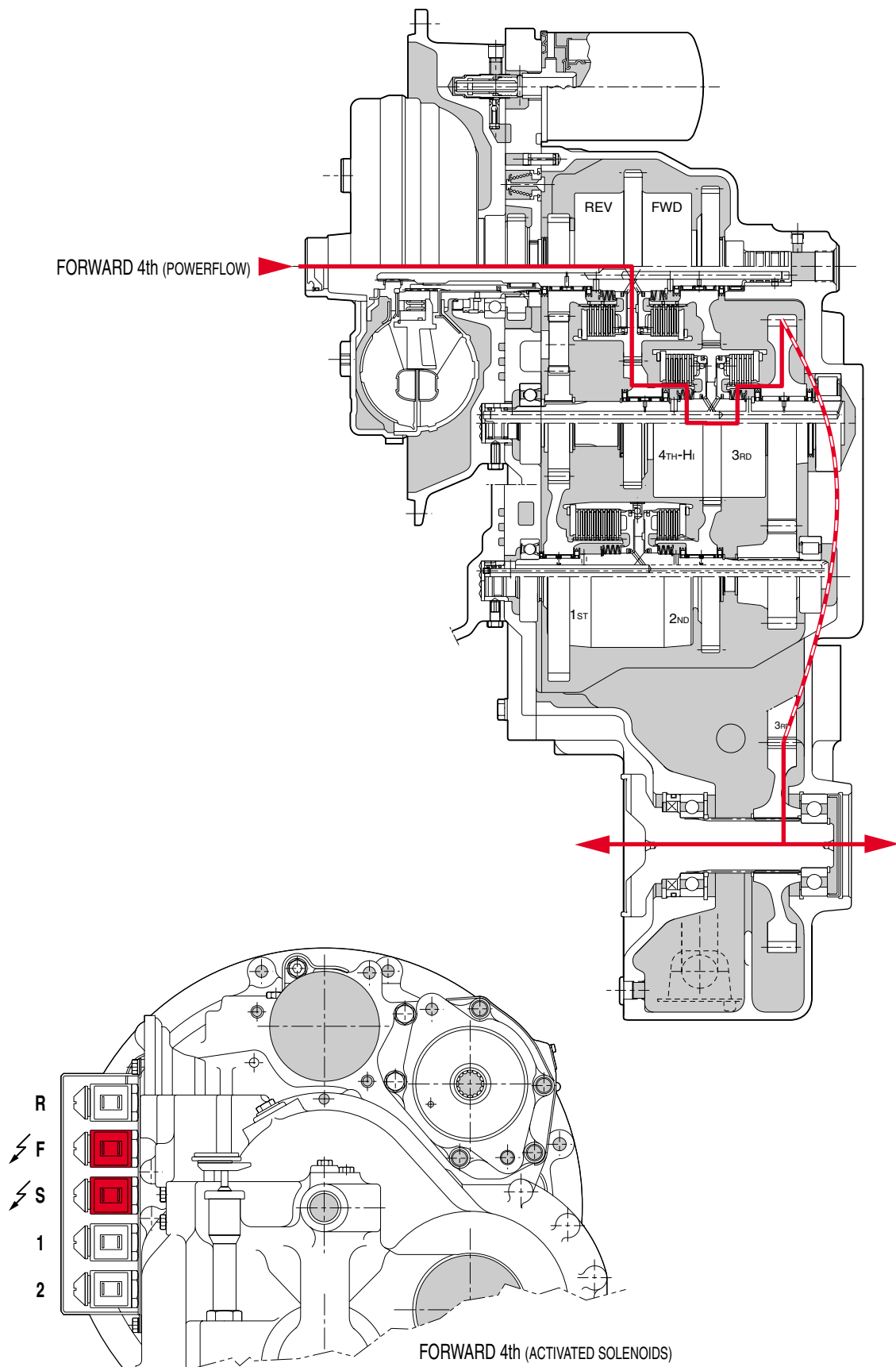
6.3.2.1.4 Forward 3rd speed



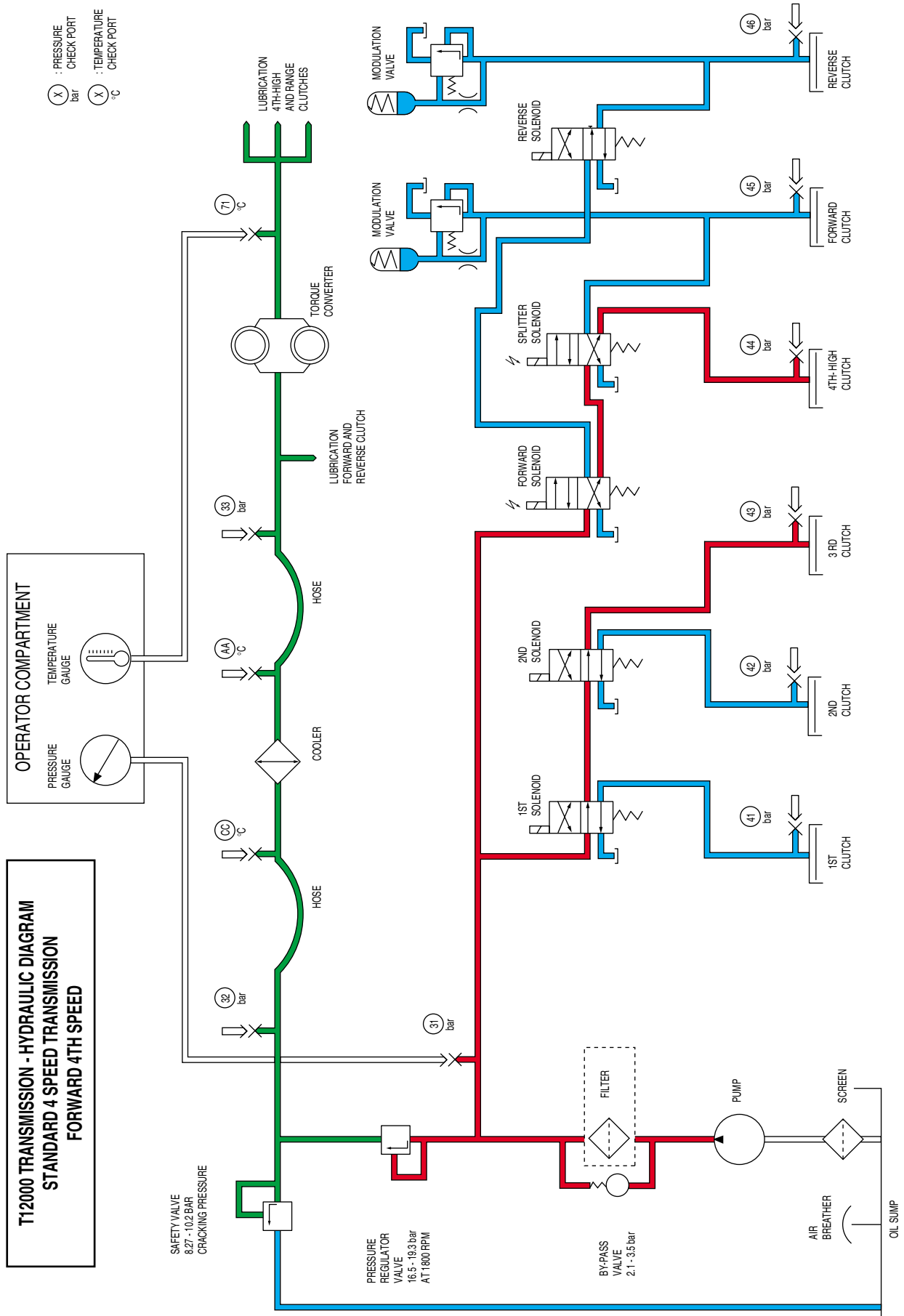
6.3.2.1.4 Forward 3rd speed (continued)



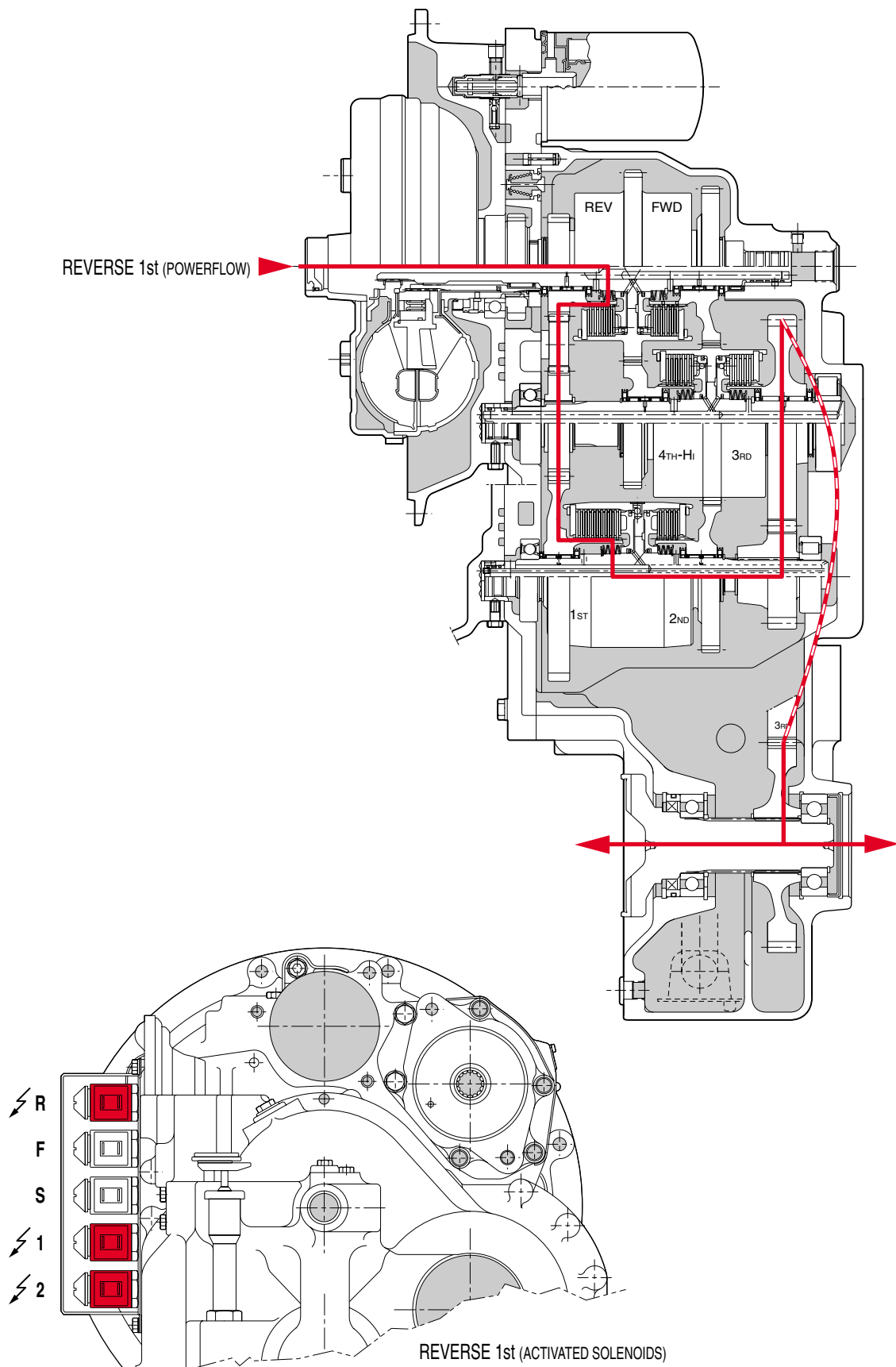
6.3.2.1.5 Forward 4th speed



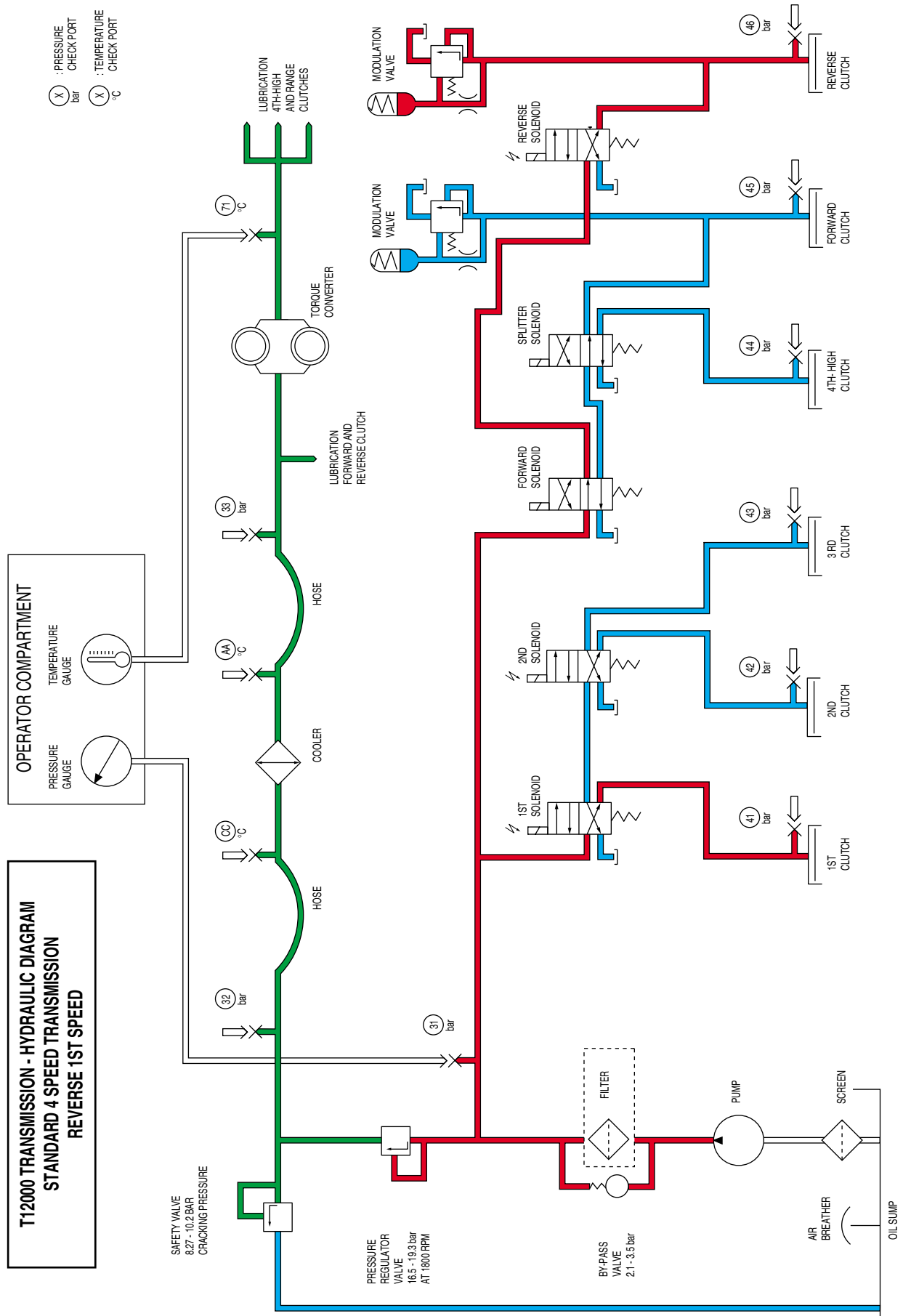
6.3.2.1.5 Forward 4th speed (continued)



6.3.2.1.6 Reverse 1st speed



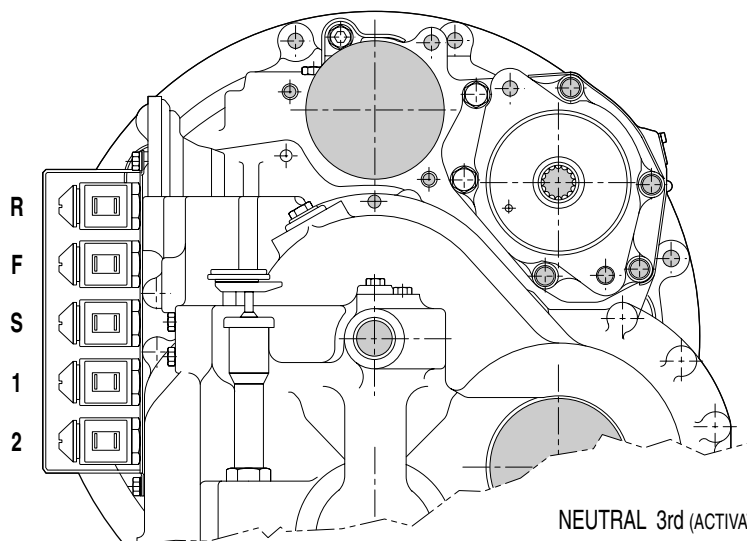
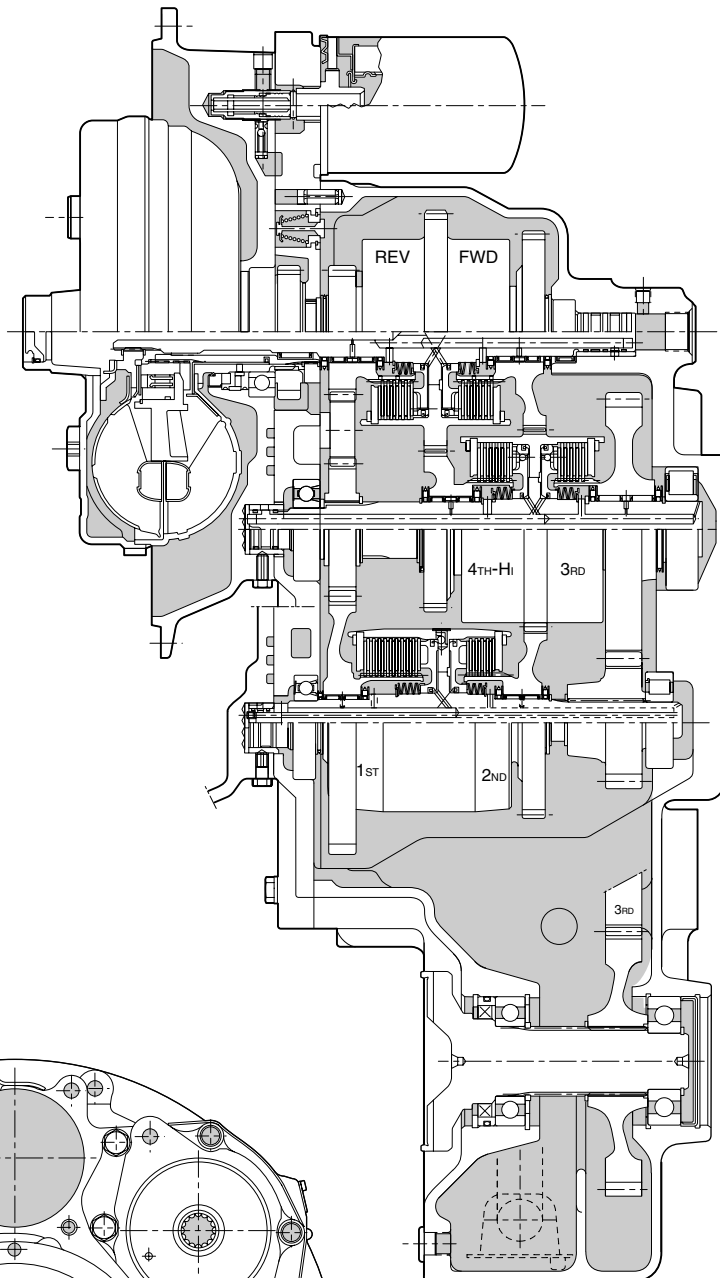
6.3.2.1.6 Reverse 1st speed (continued)



6.3.2.2 Alternative 4-speed transmission

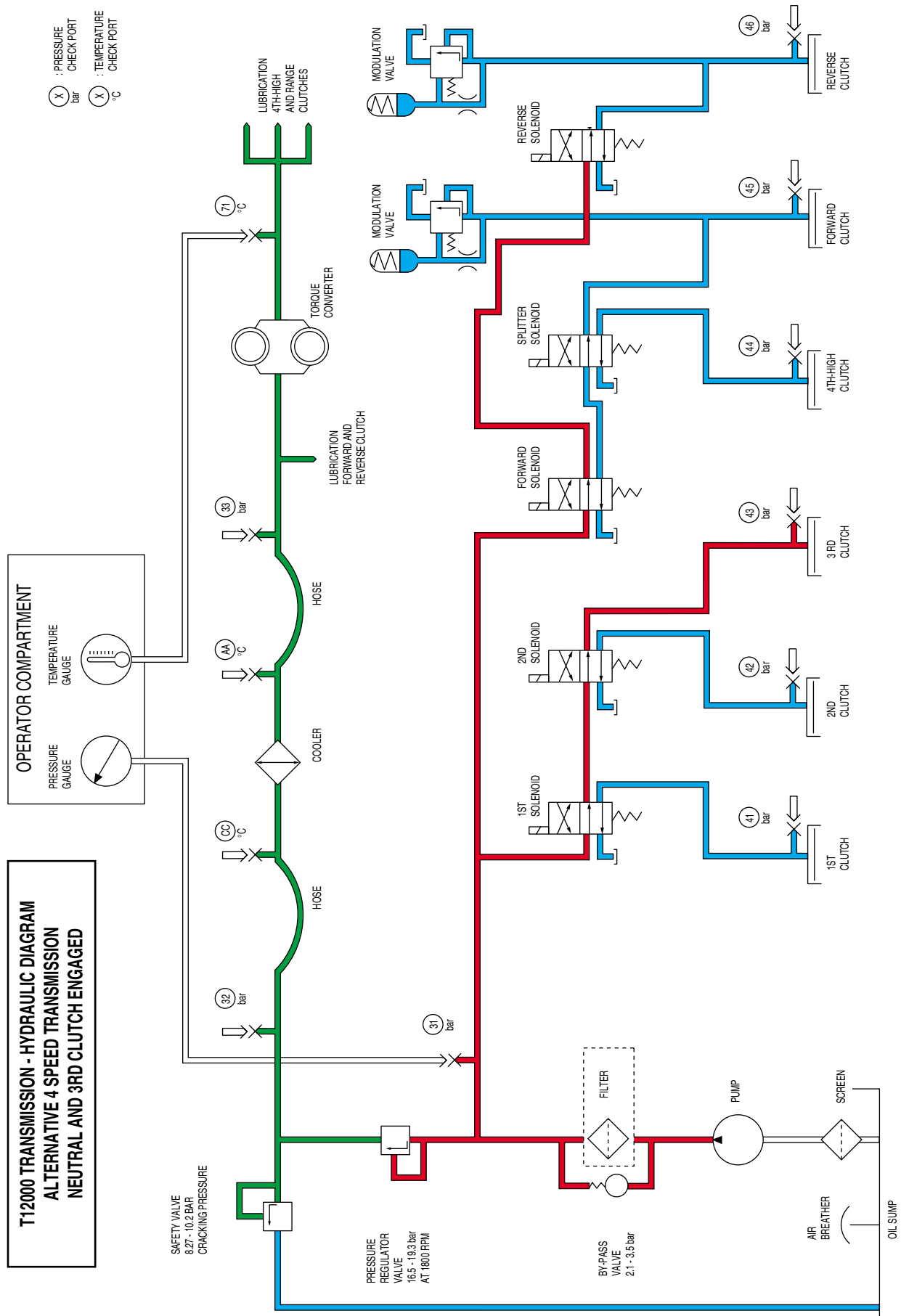
6.3.2.2.1 Neutral and 3rd clutch engaged

NEUTRAL 3rd (POWERFLOW)

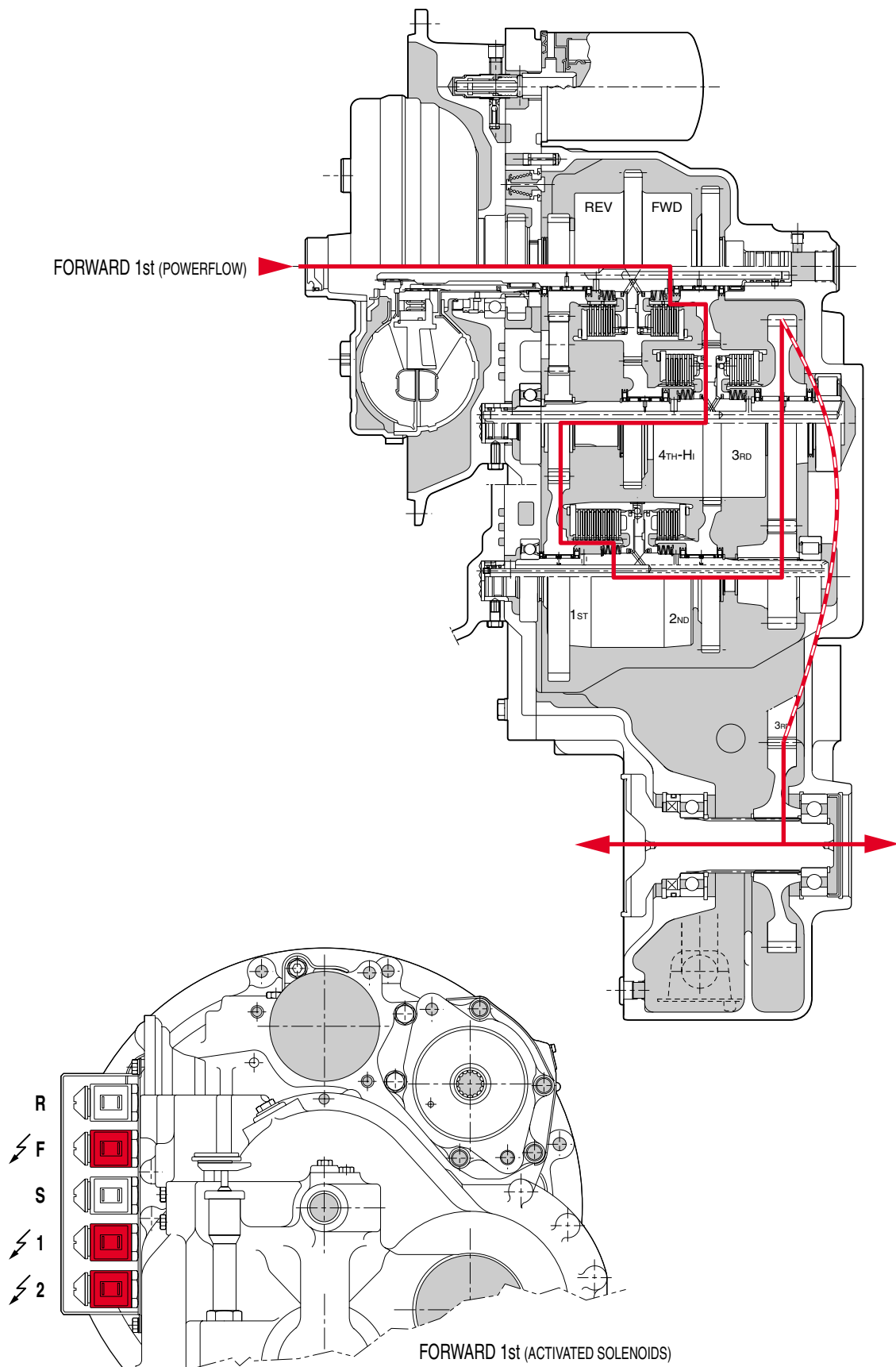


NEUTRAL 3rd (ACTIVATED SOLENOIDS)

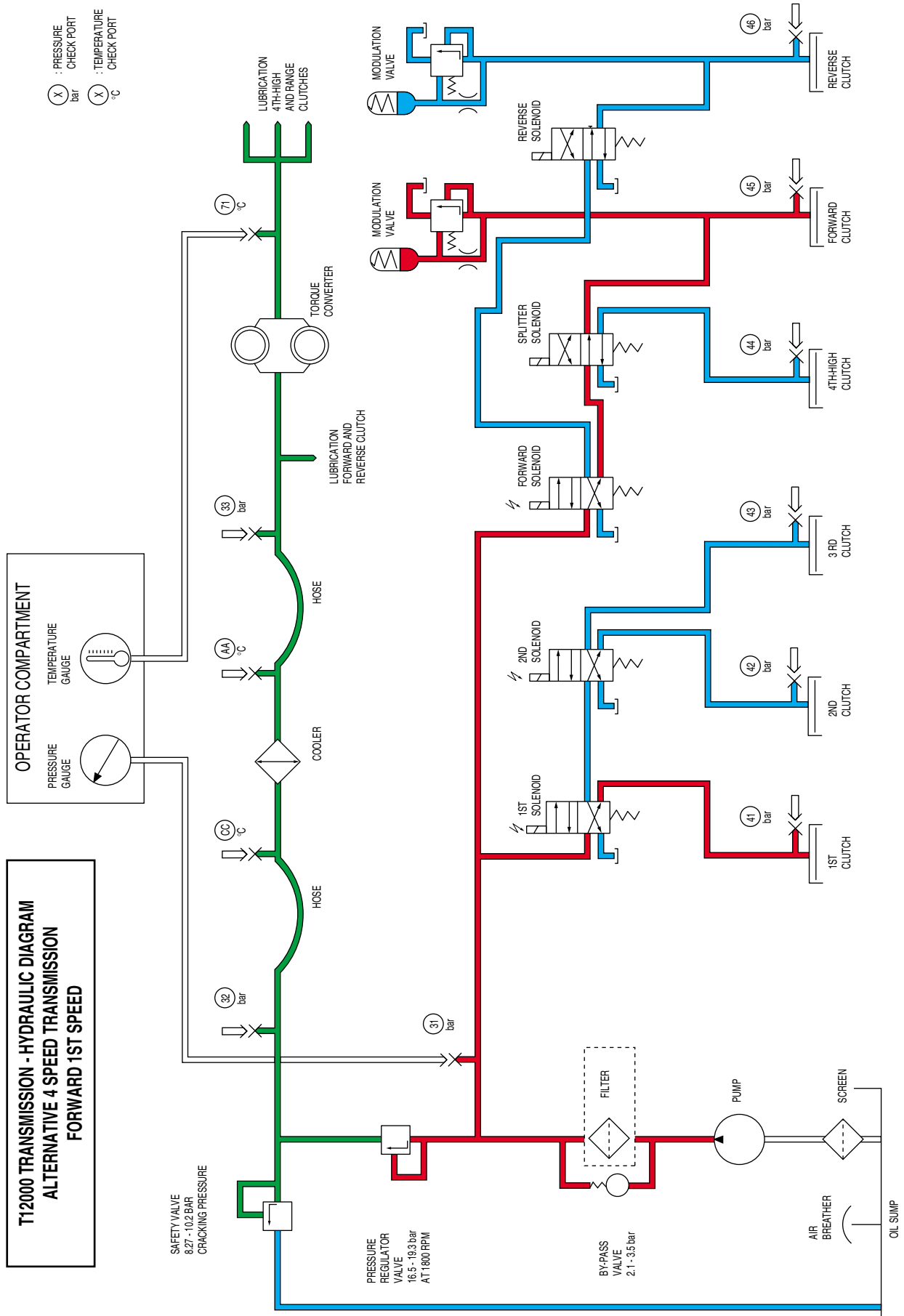
6.3.2.2.1 Neutral and 3rd clutch engaged (continued)



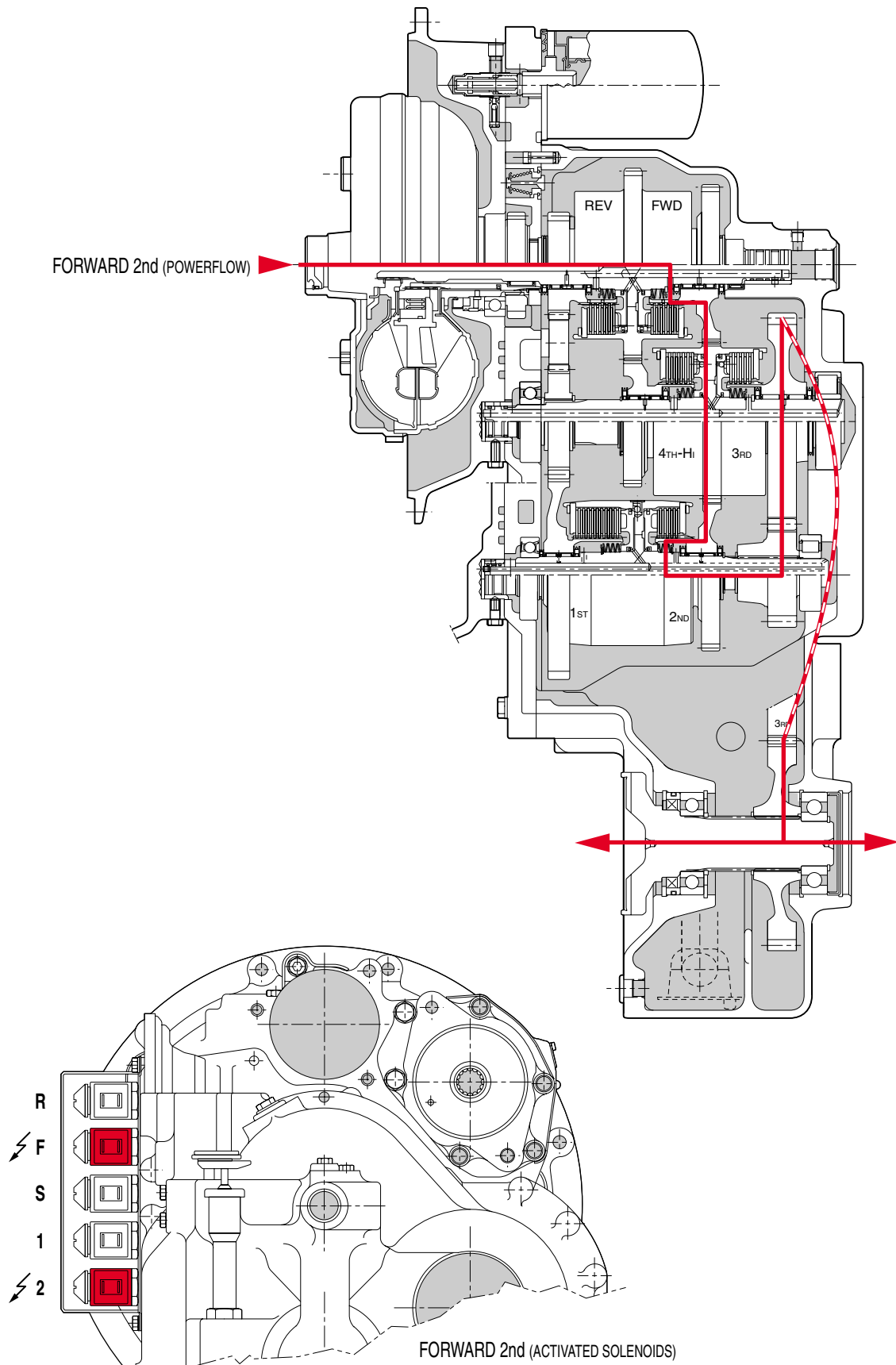
6.3.2.2.2 Forward 1st speed



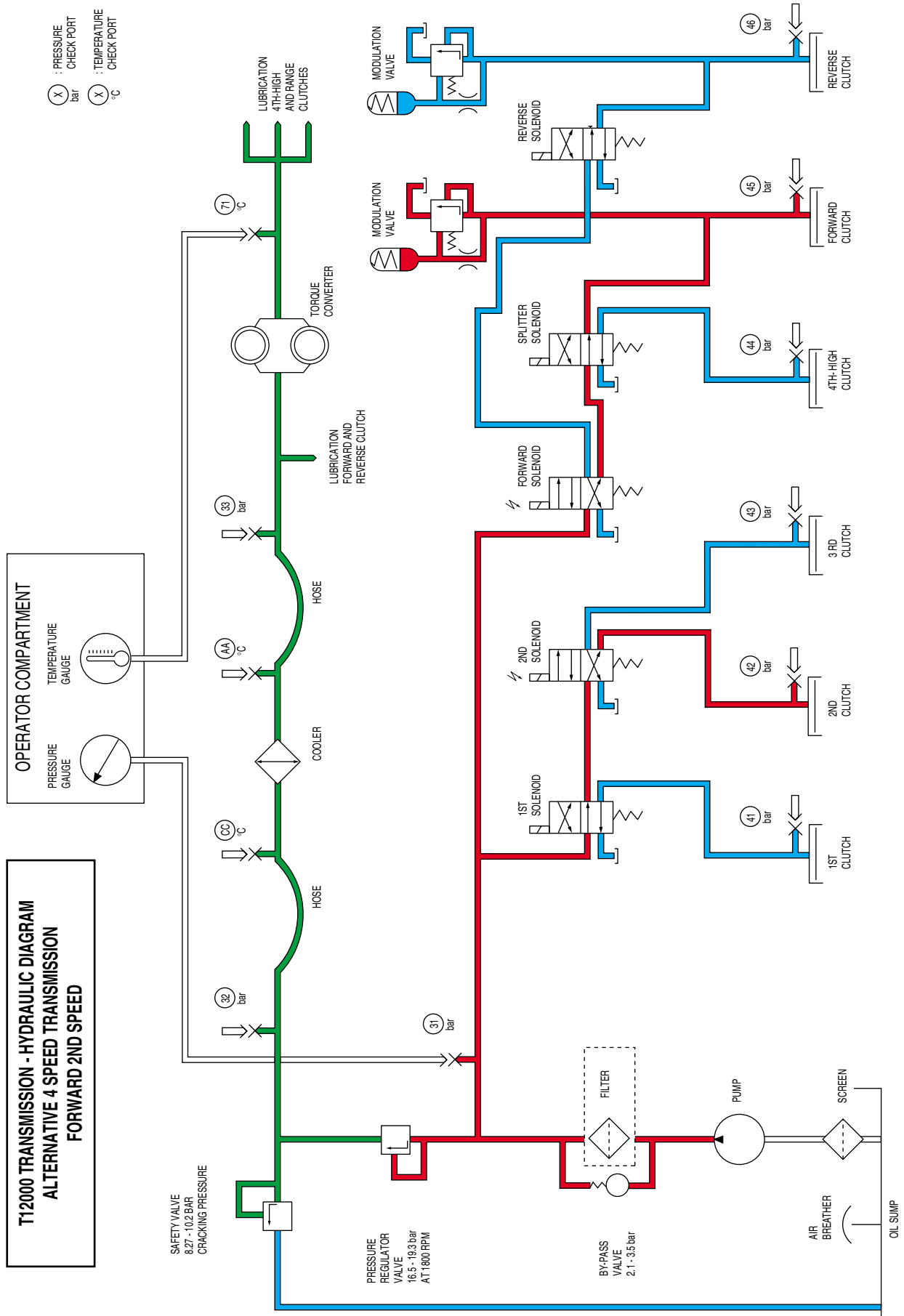
6.3.2.2.2 Forward 1st speed (continued)



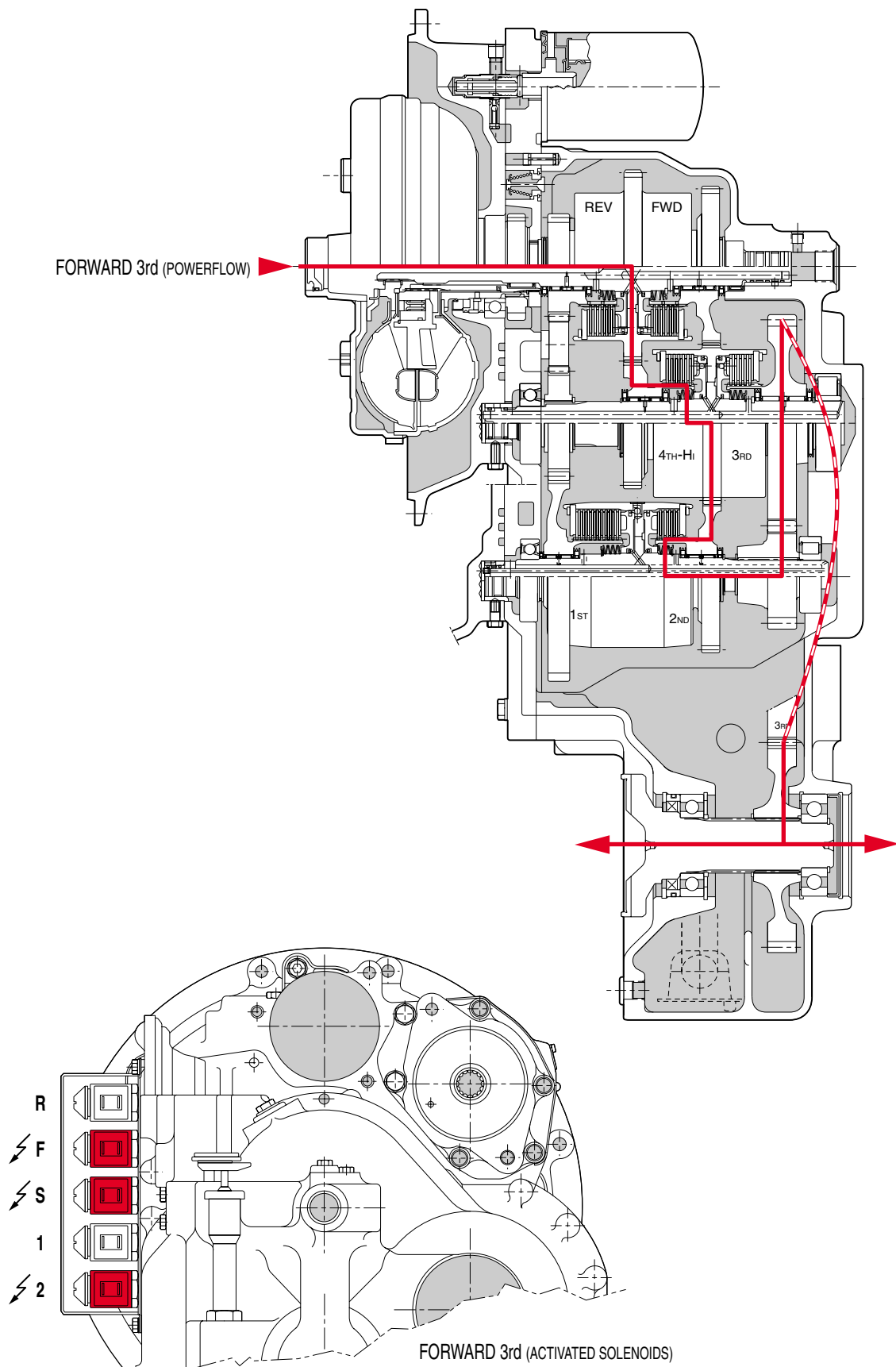
6.3.2.2.3 Forward 2nd speed



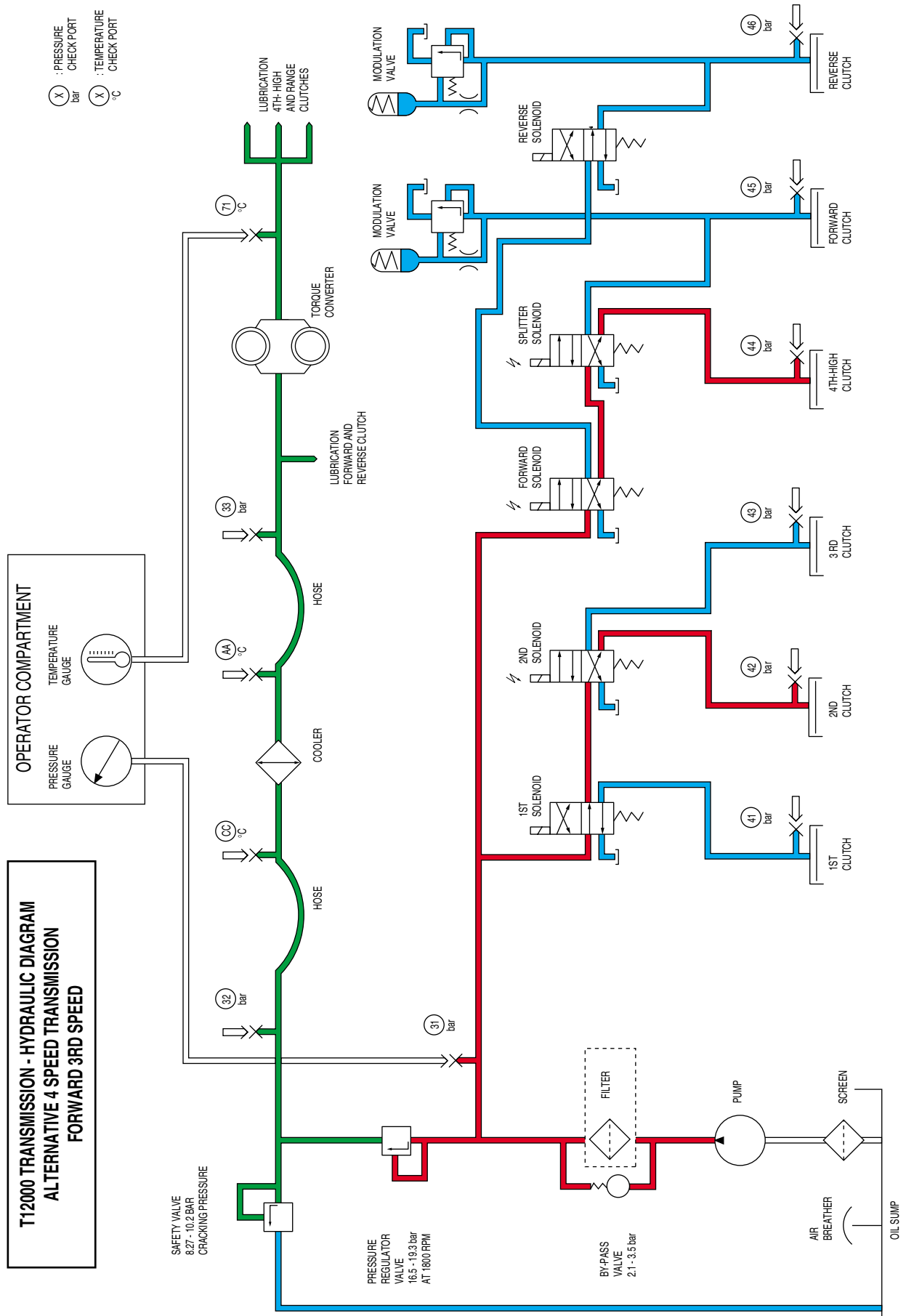
6.3.2.2.3 Forward 2nd speed (continued)



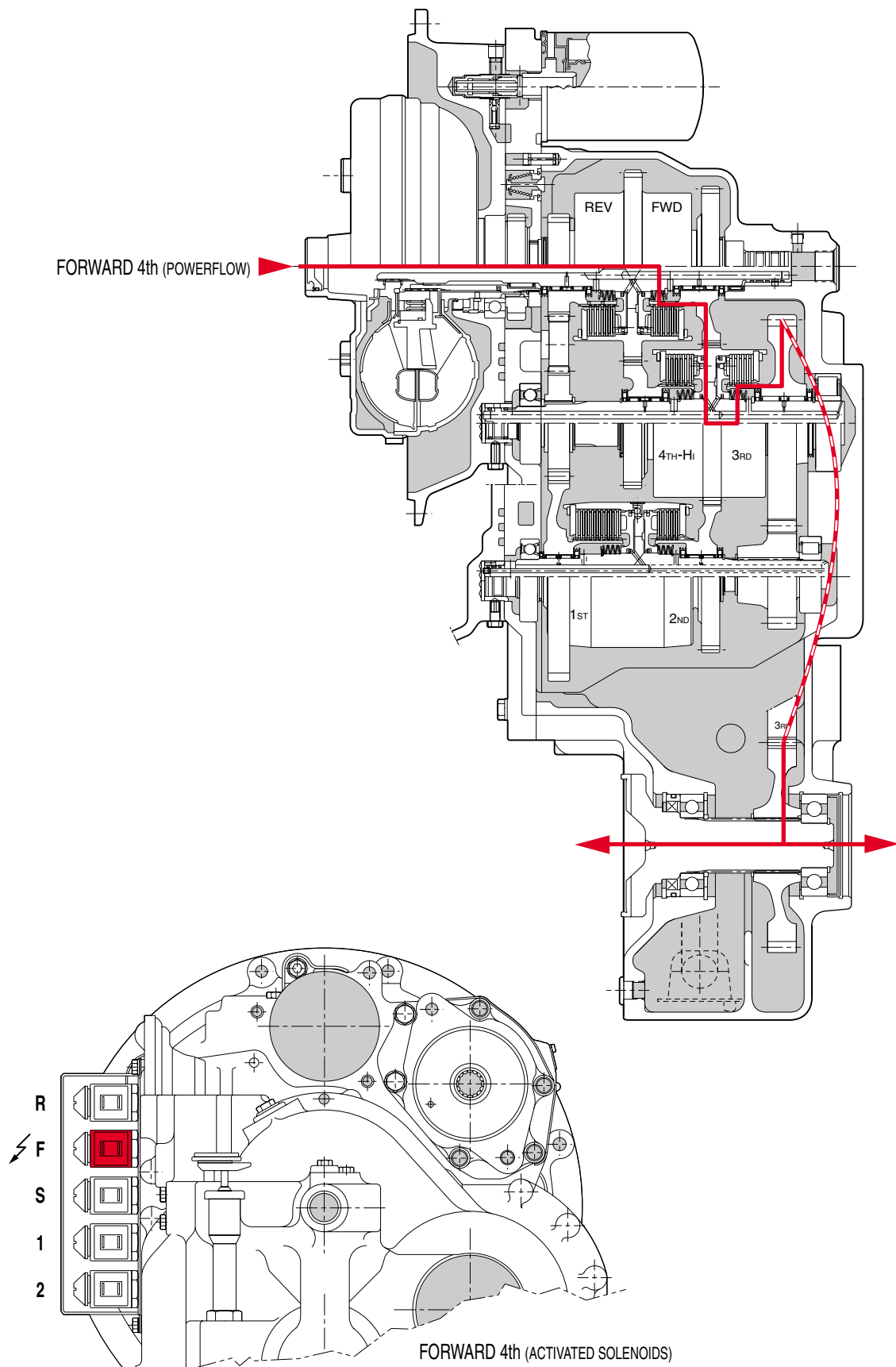
6.3.2.2.4 Forward 3rd speed



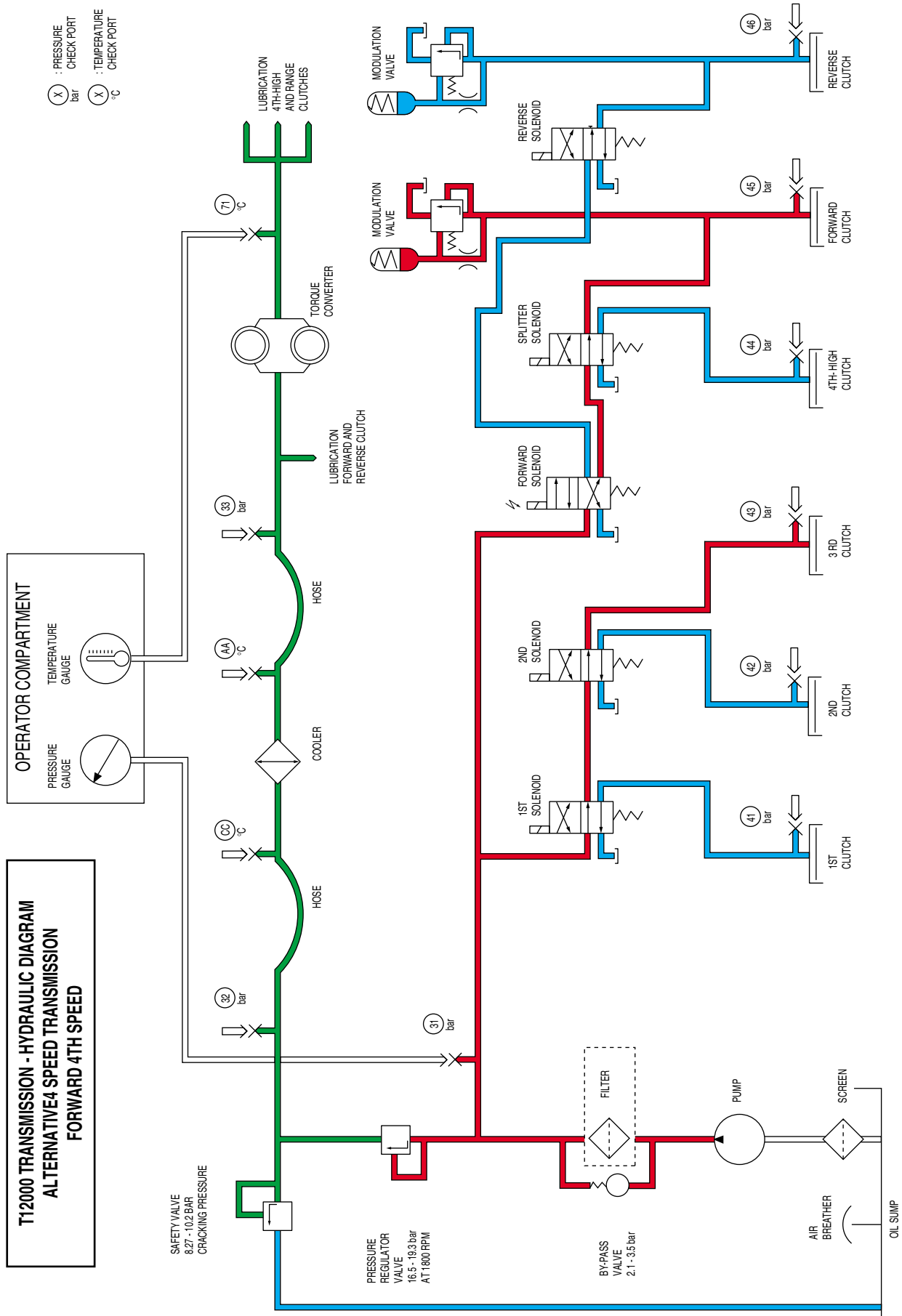
6.3.2.2.4 Forward 3rd speed (continued)



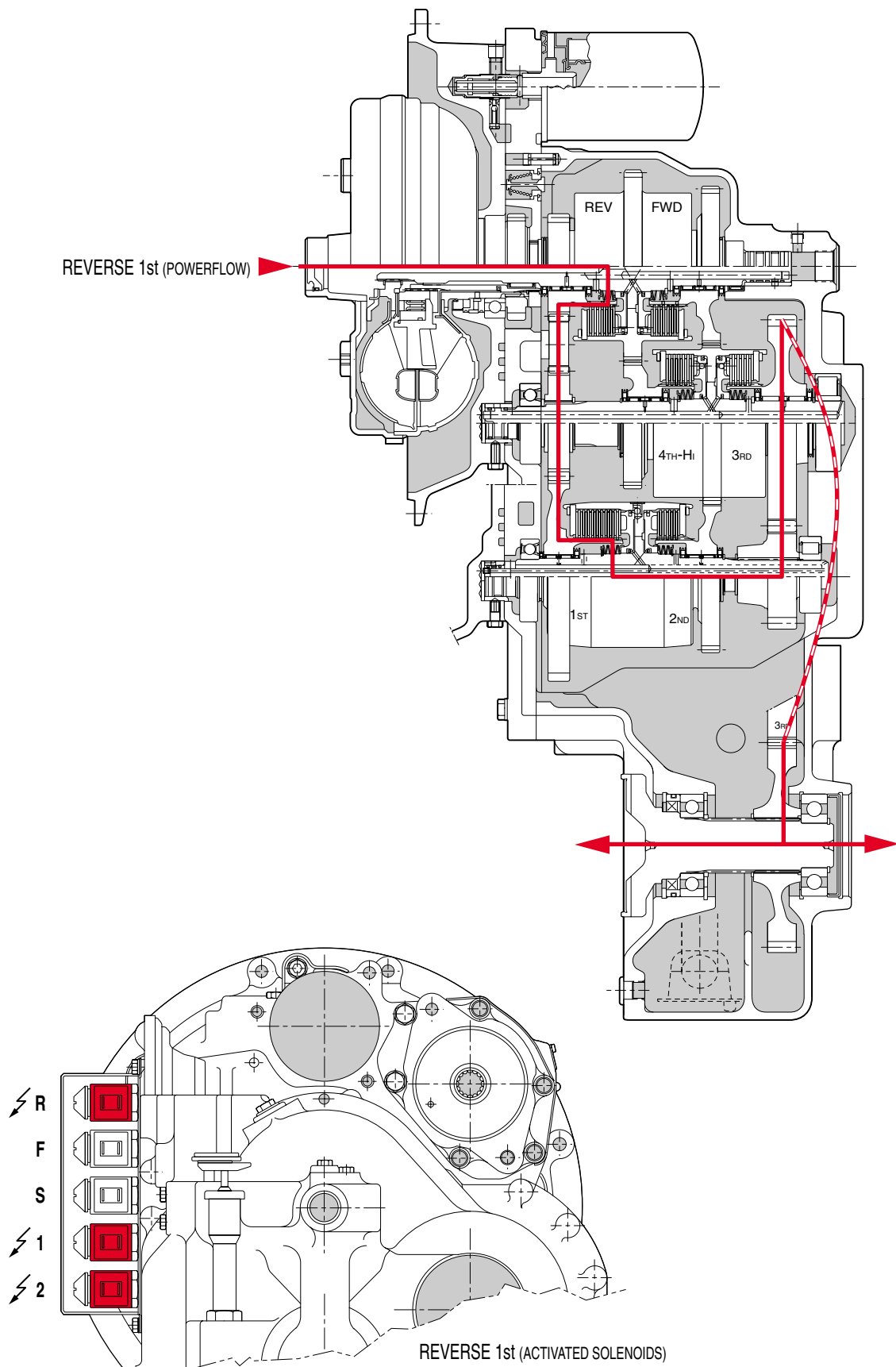
6.3.2.2.5 Forward 4th speed



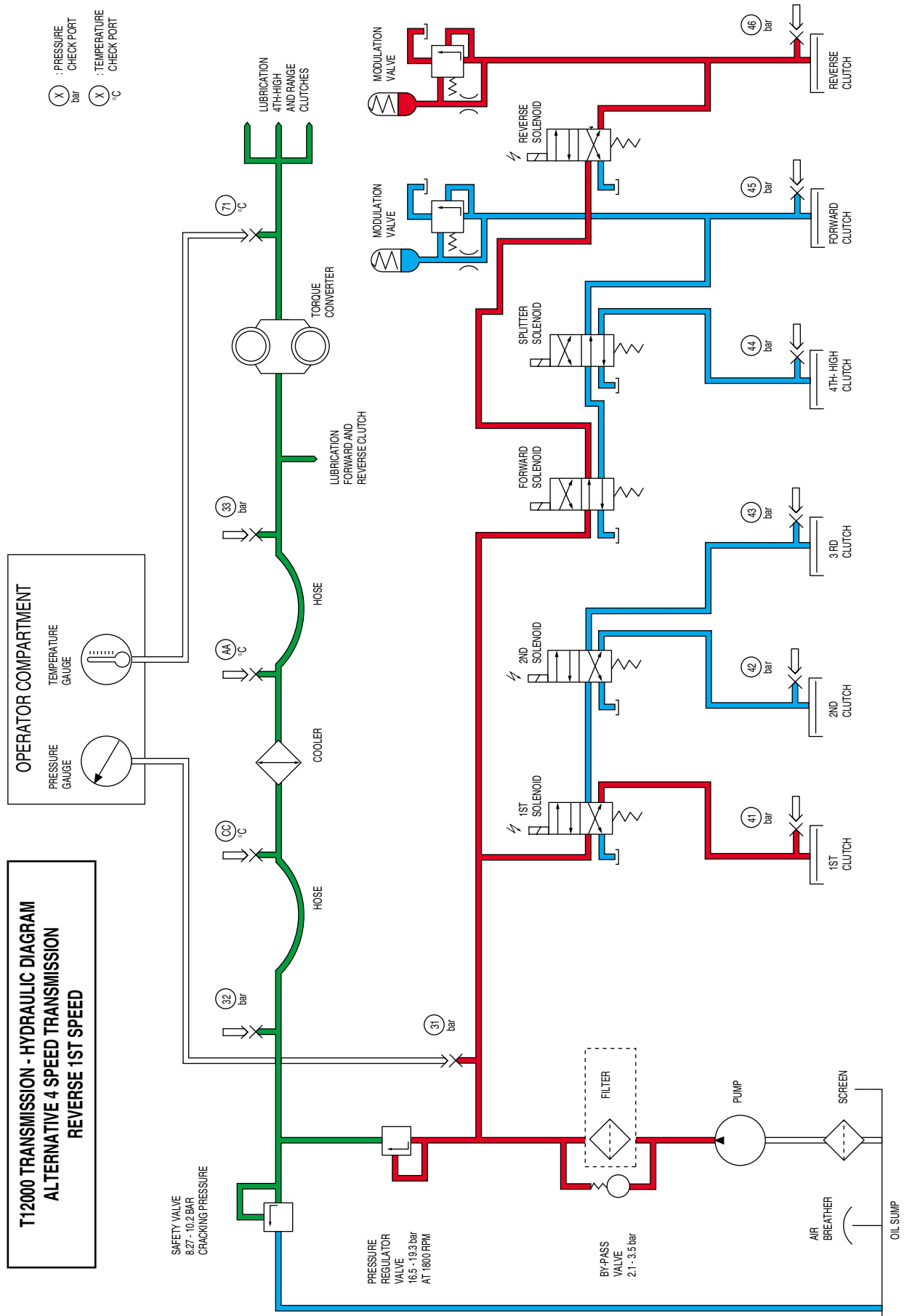
6.3.2.2.5 Forward 4th speed (continued)



6.3.2.2.6 Reverse 1st speed

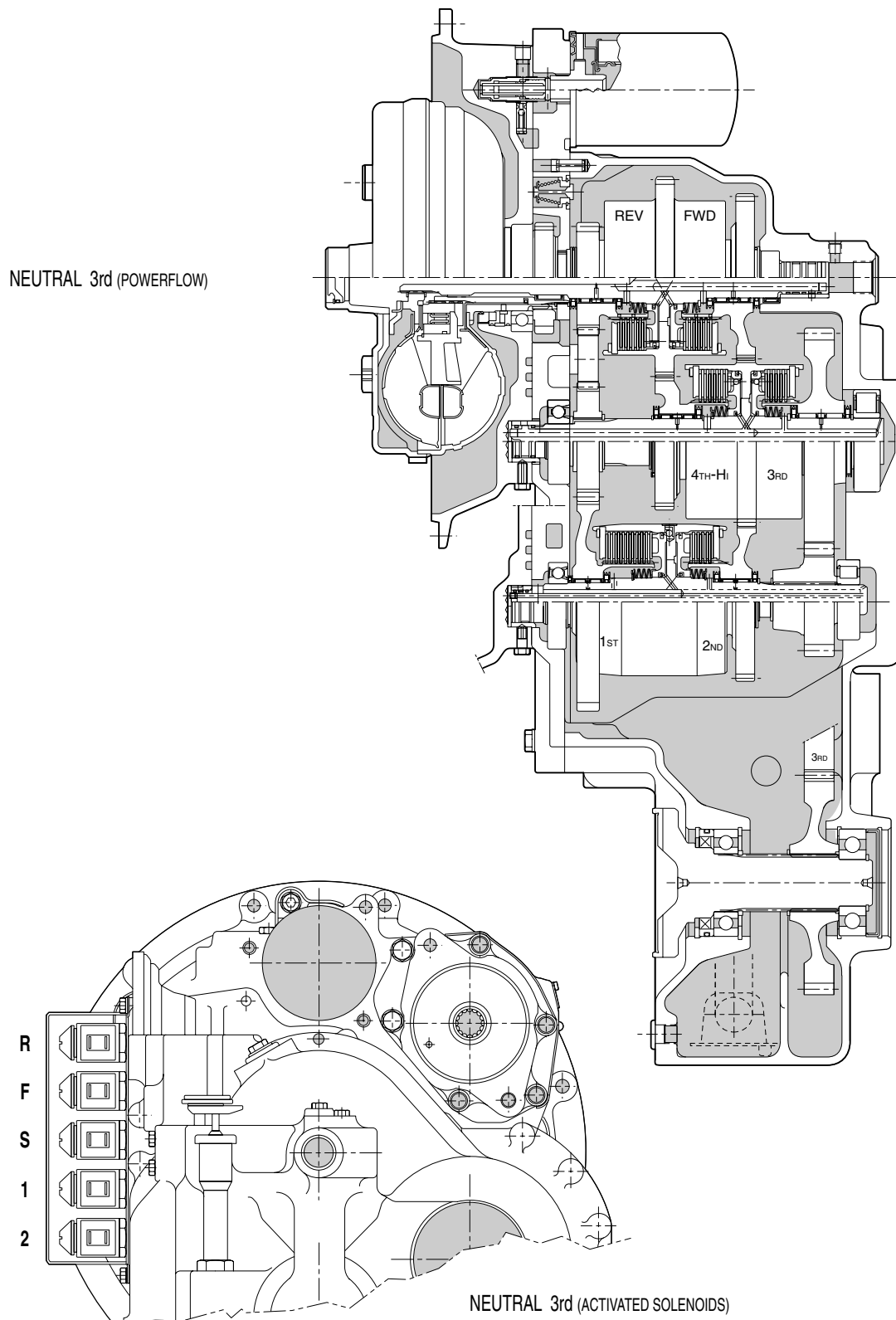


6.3.2.2.6 Reverse 1st speed (continued)

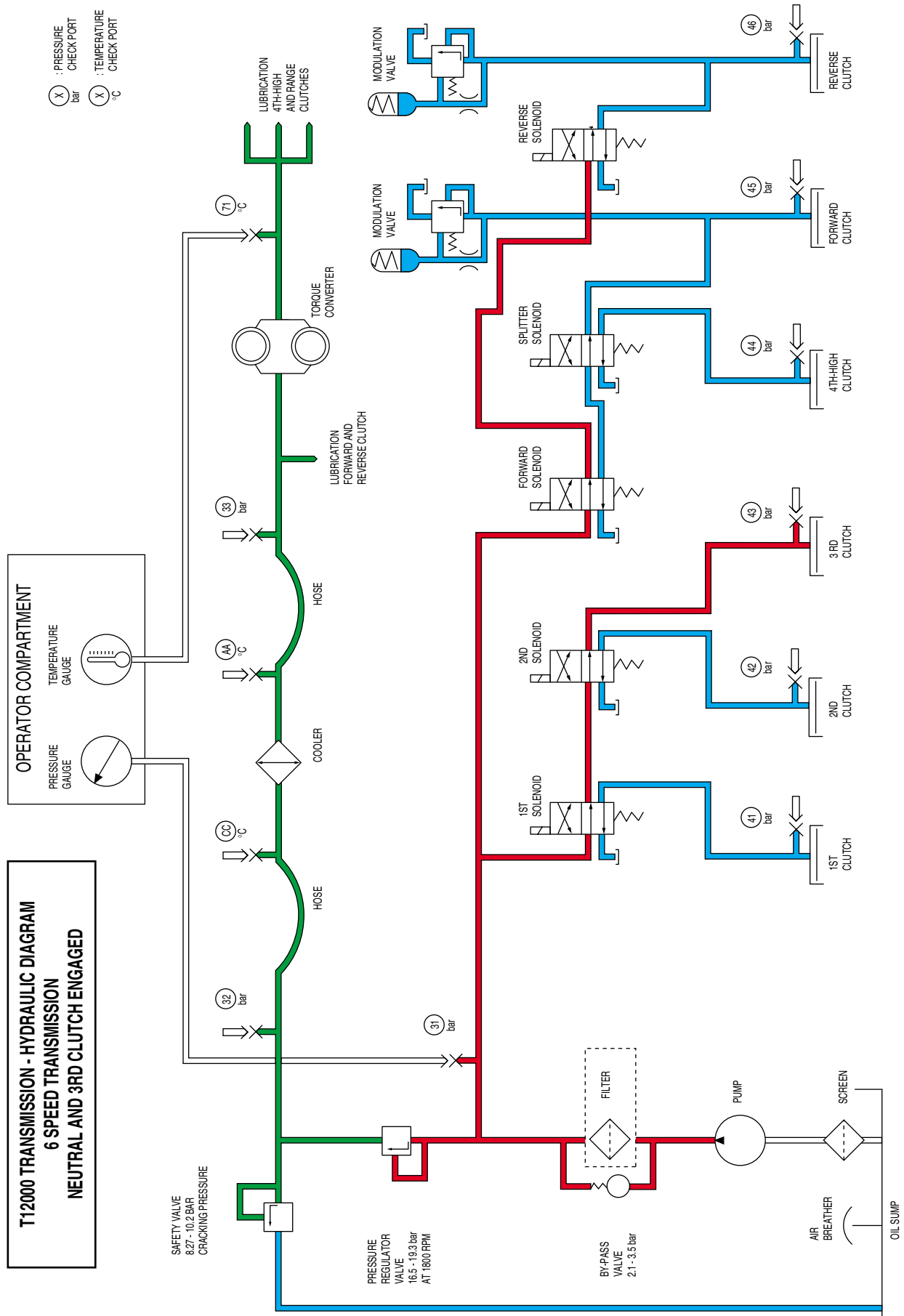


6.3.3 6-Speed transmission

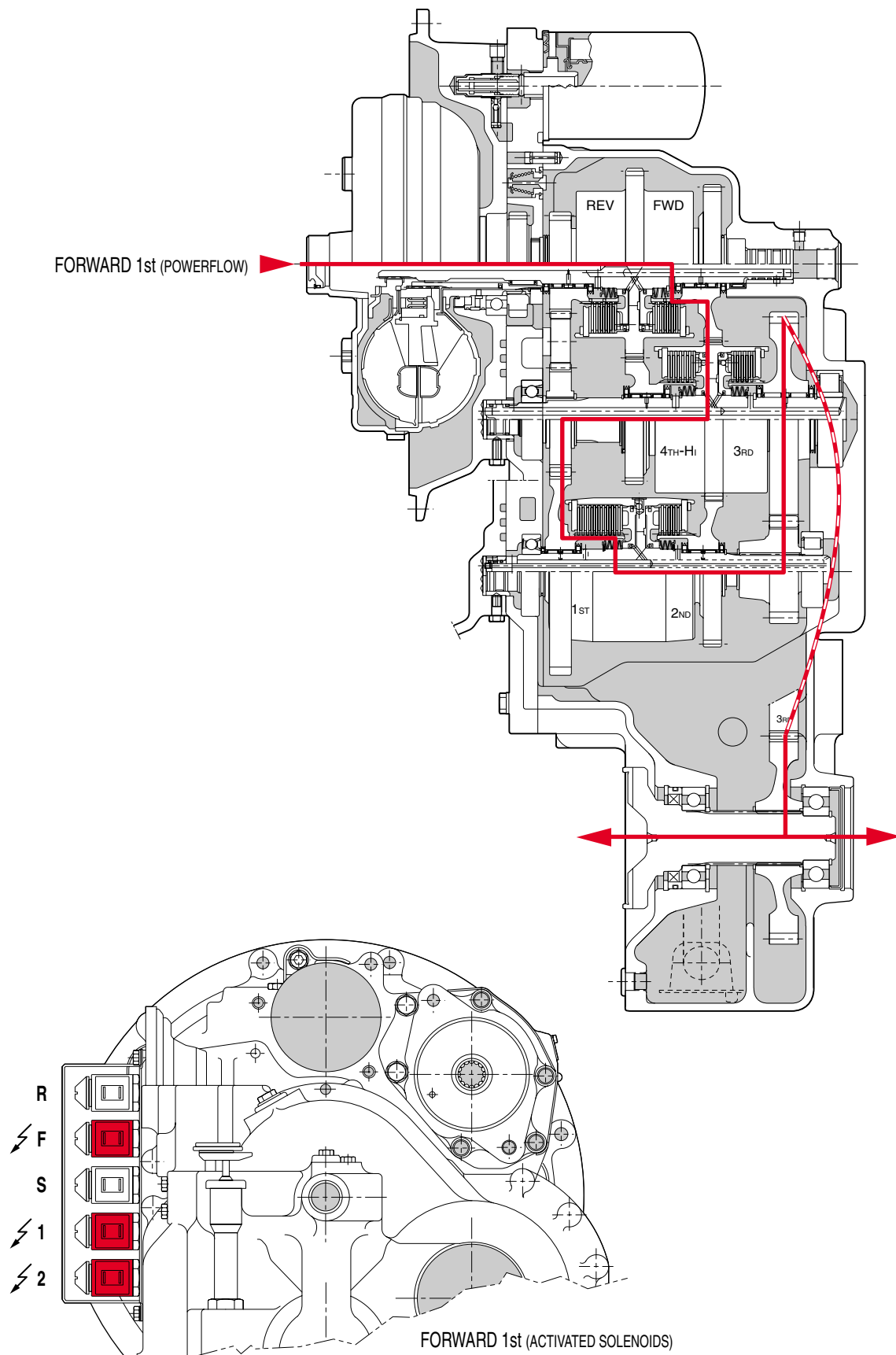
6.3.3.1 Neutral and 3rd clutch engaged



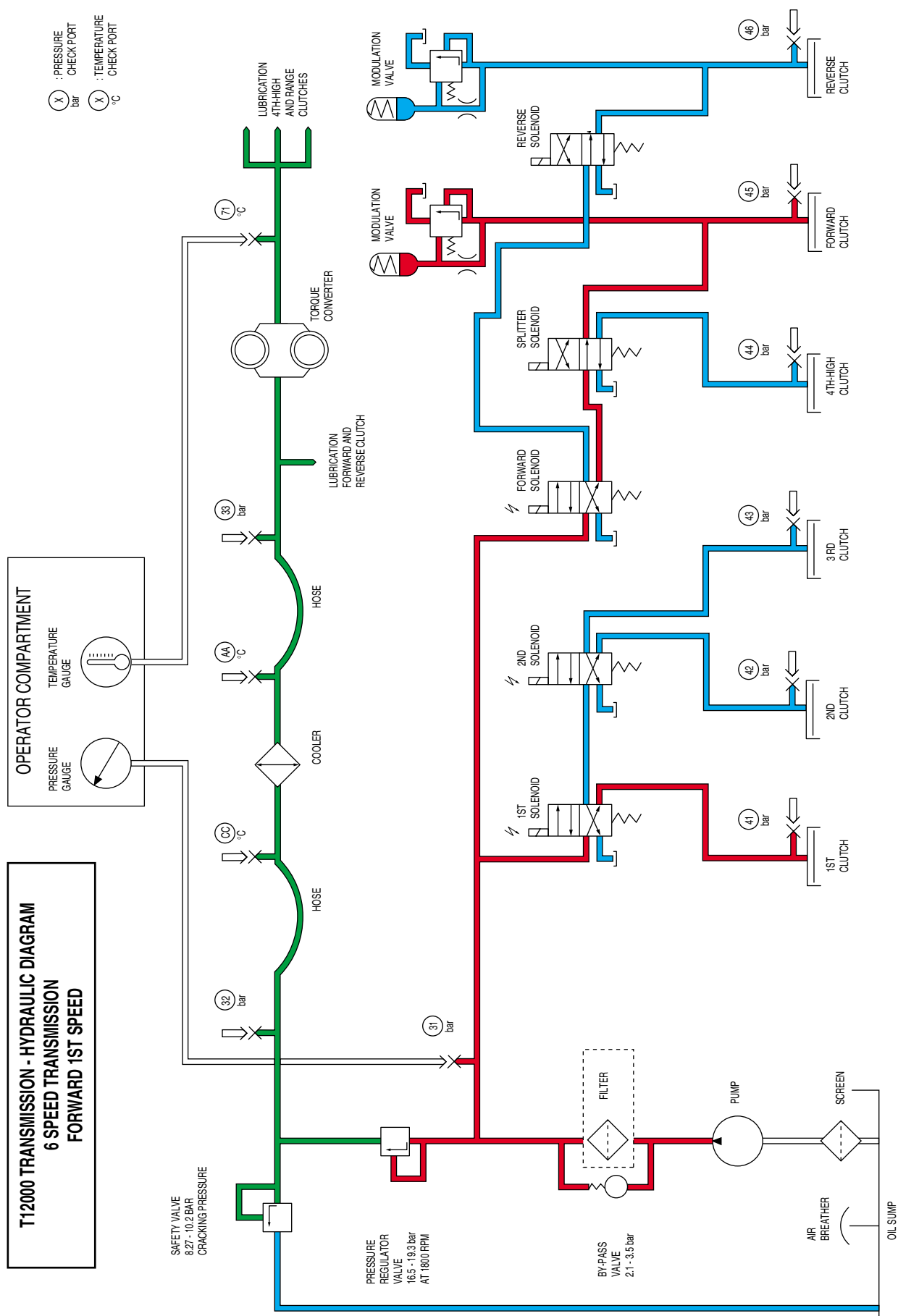
6.3.3.1 Neutral and 3rd clutch engaged (continued)



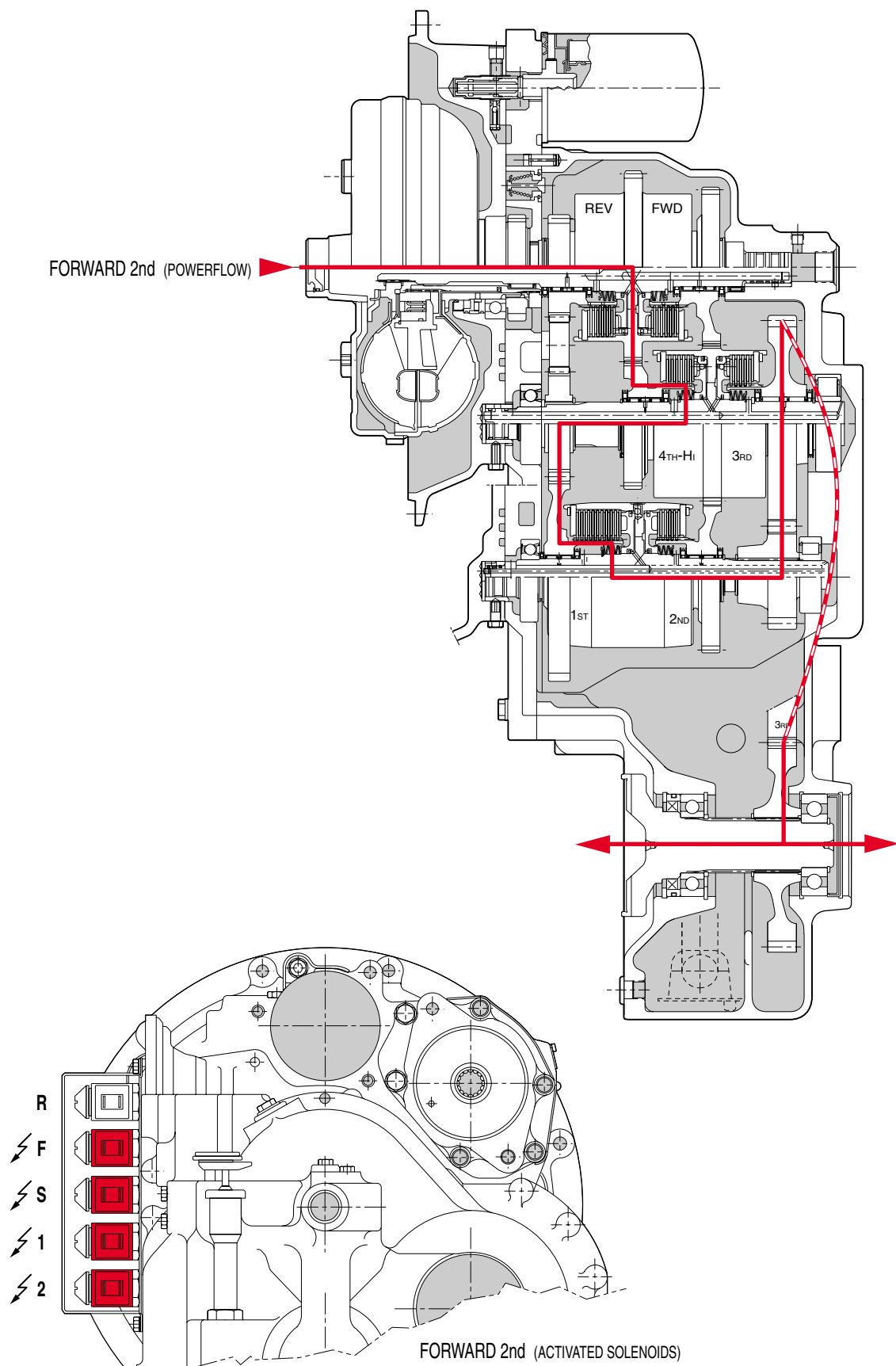
6.3.3.2 Forward 1st speed



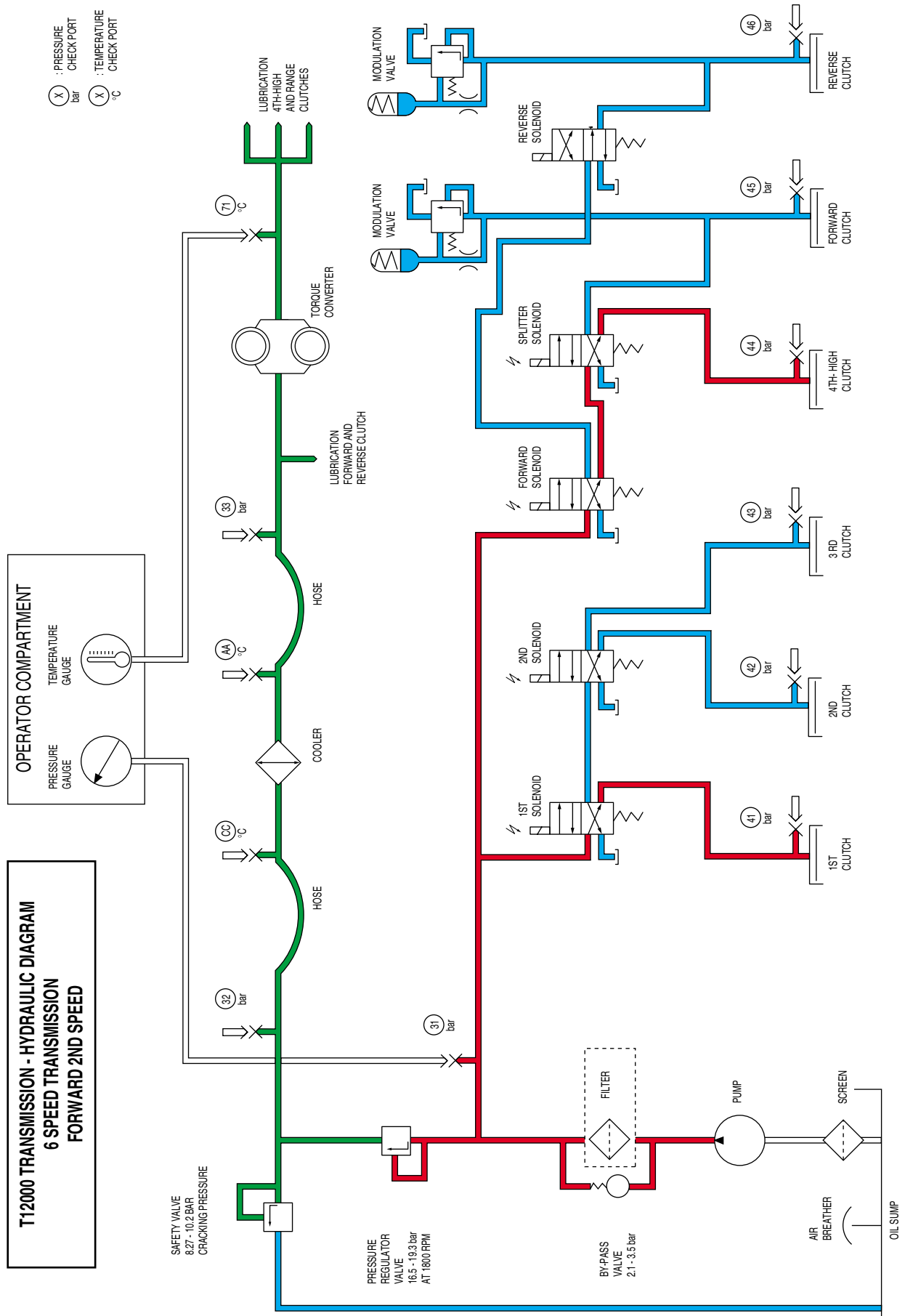
6.3.3.2 Forward 1st speed (continued)



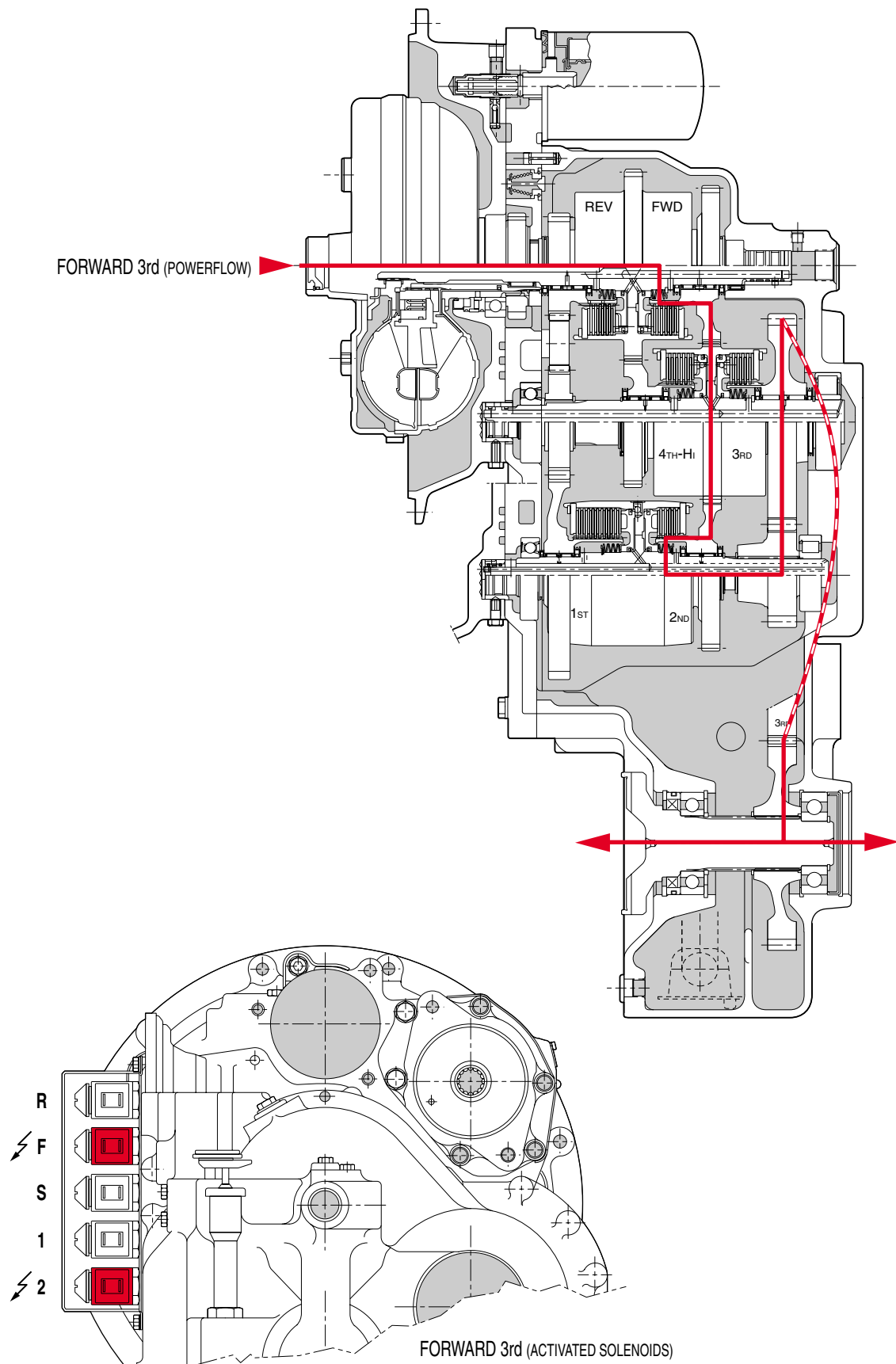
6.3.3.3 Forward 2nd speed



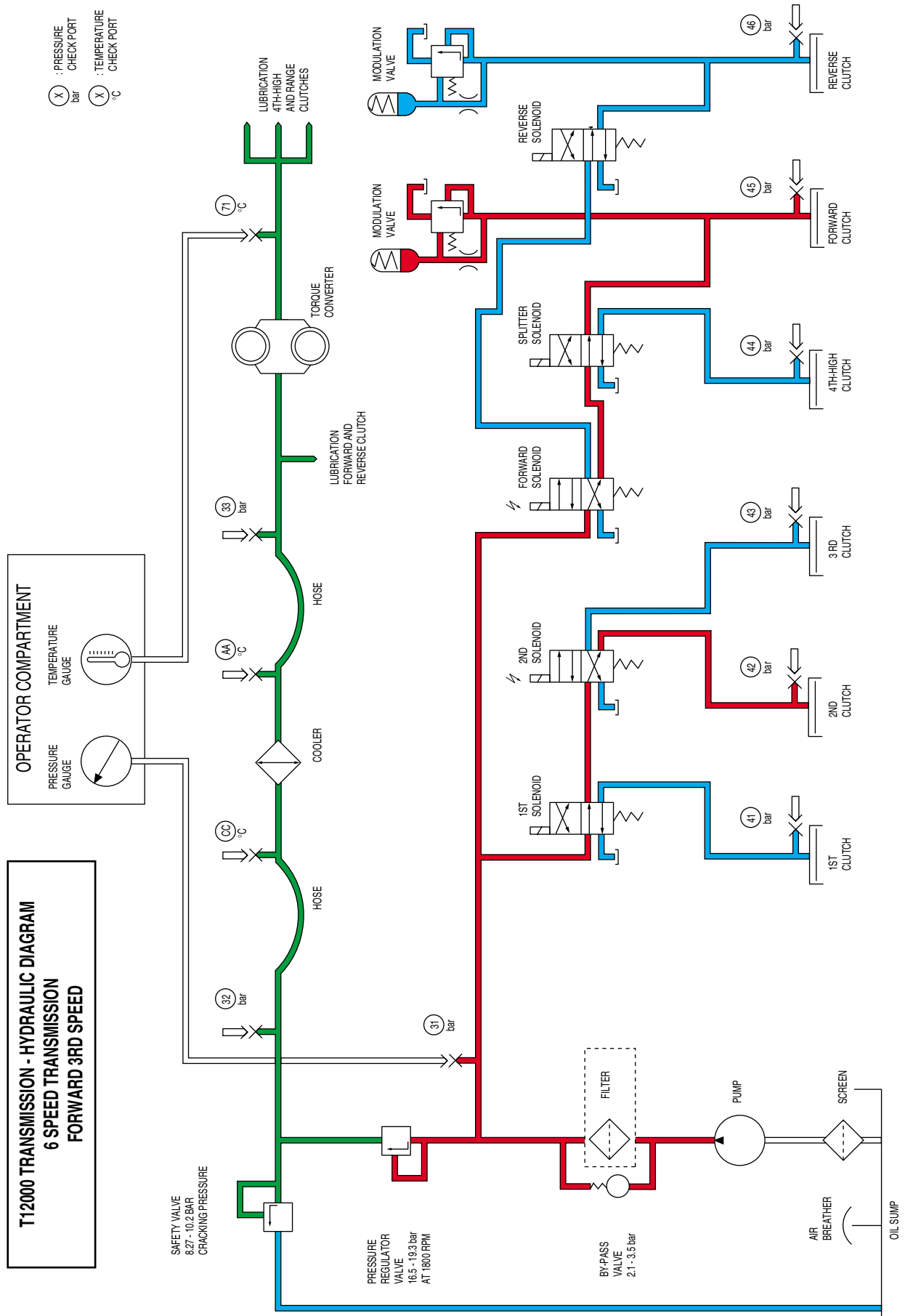
6.3.3.3 Forward 2nd speed (continued)



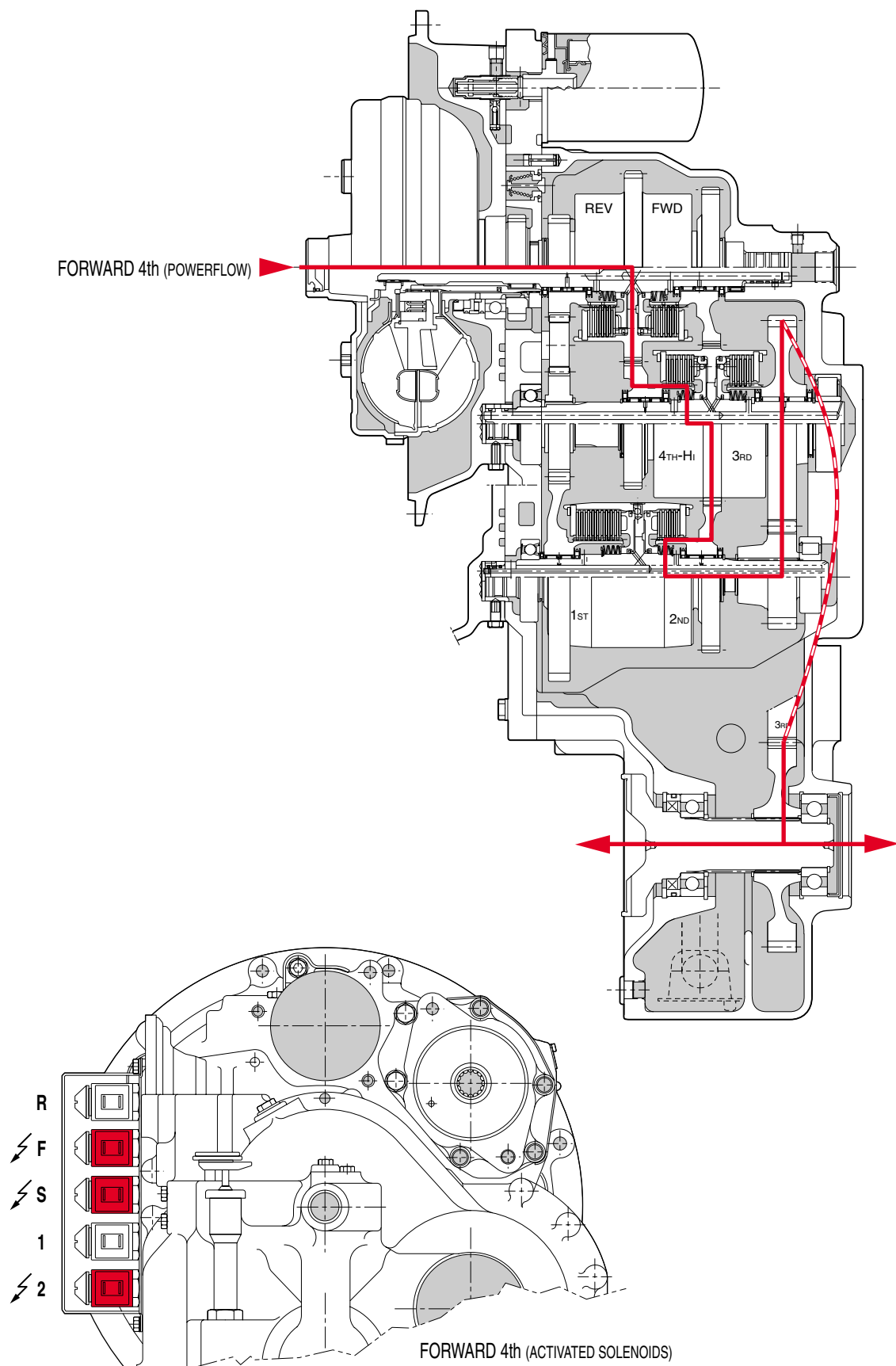
6.3.3.4 Forward 3rd speed



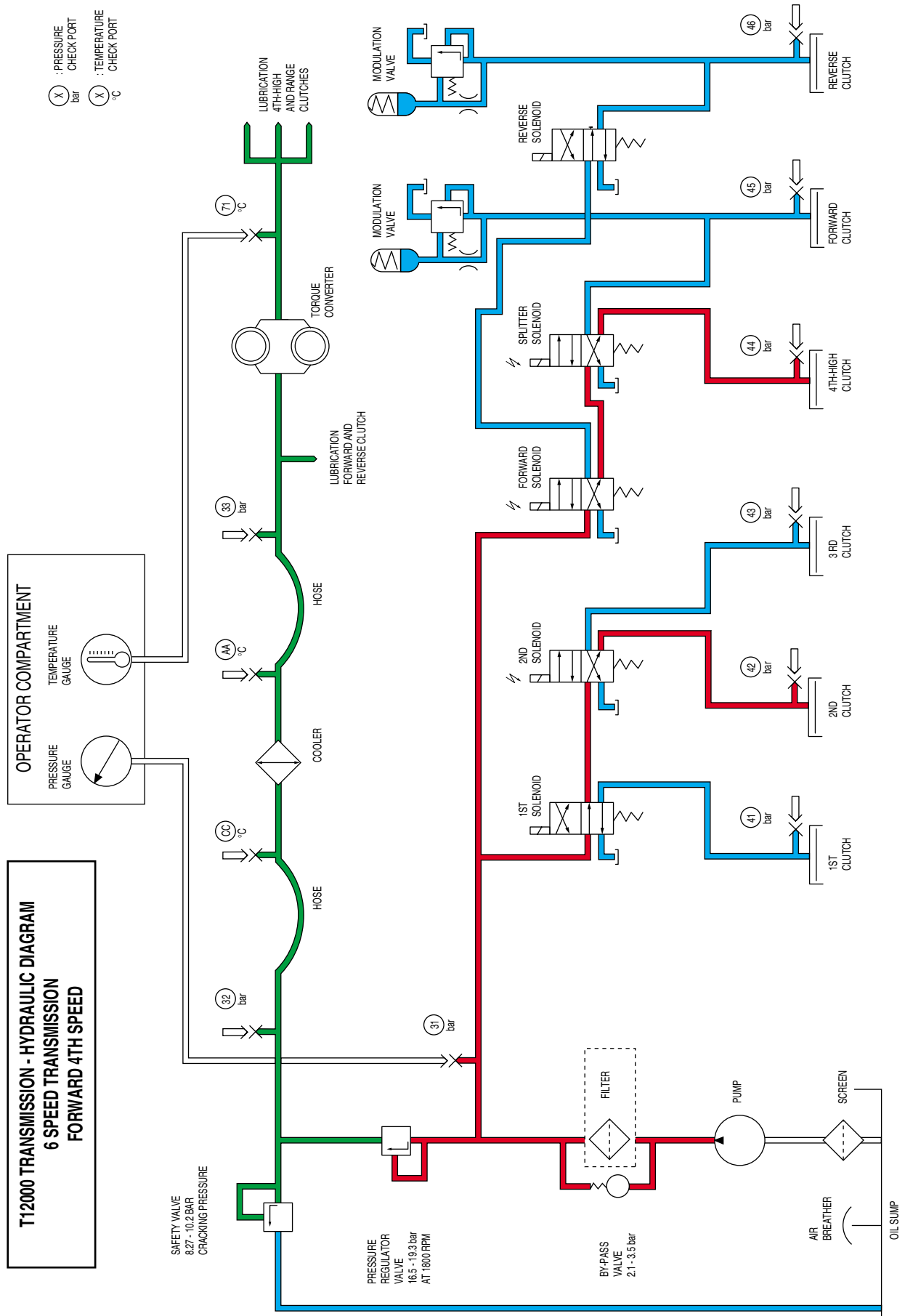
6.3.3.4 Forward 3rd speed (continued)



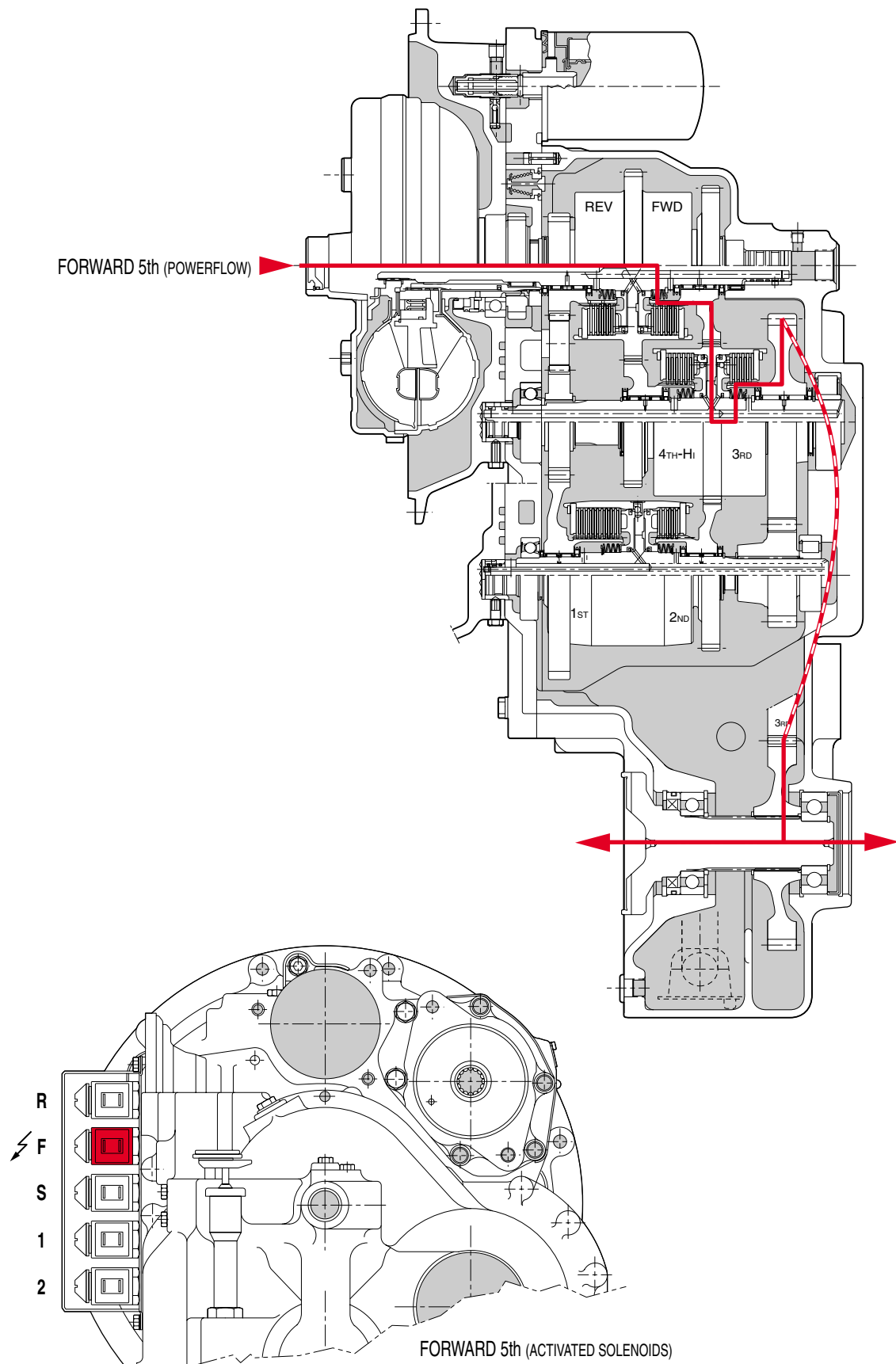
6.3.3.5 Forward 4th speed



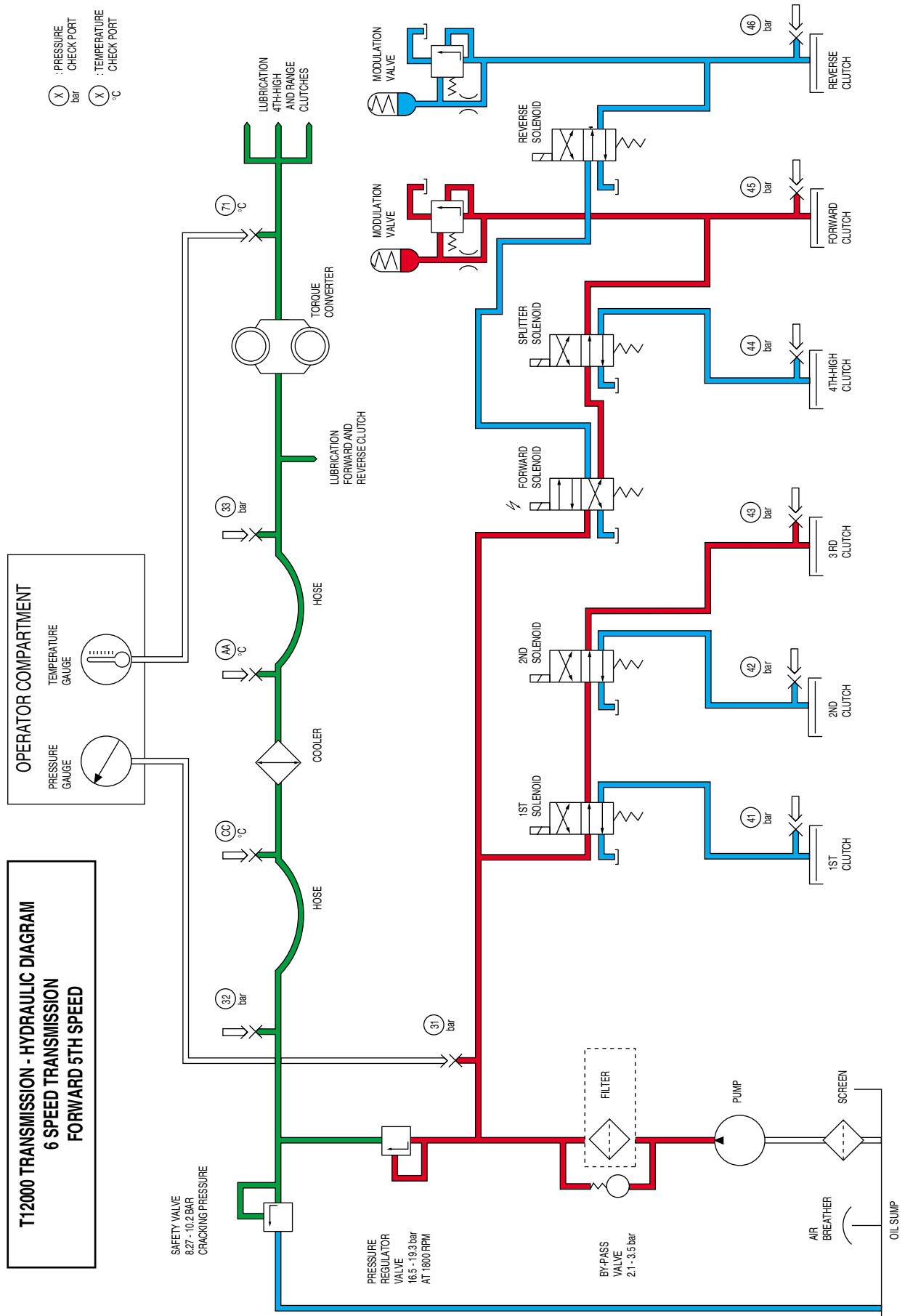
6.3.3.5 Forward 4th speed (continued)



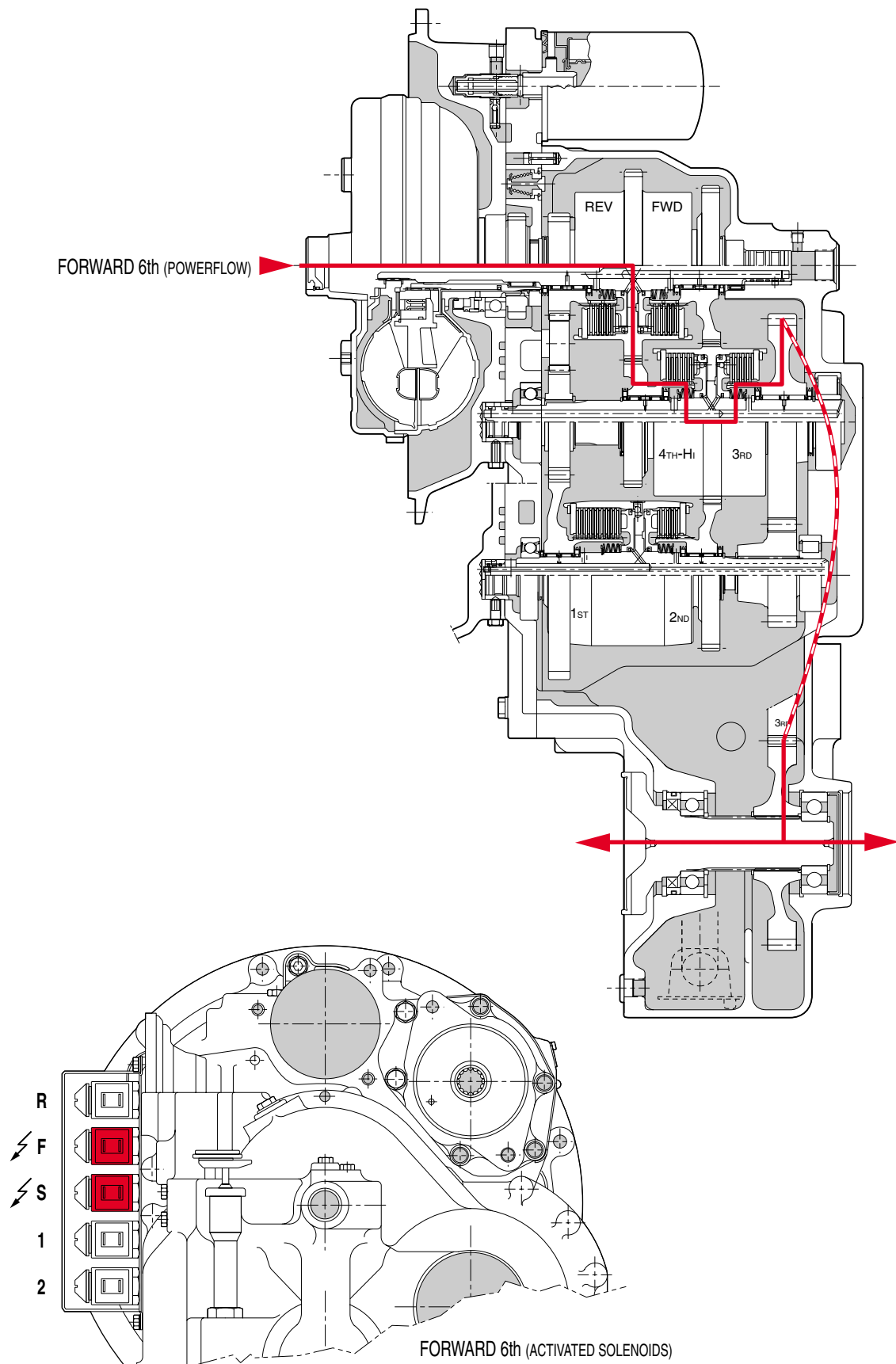
6.3.3.6 Forward 5th speed



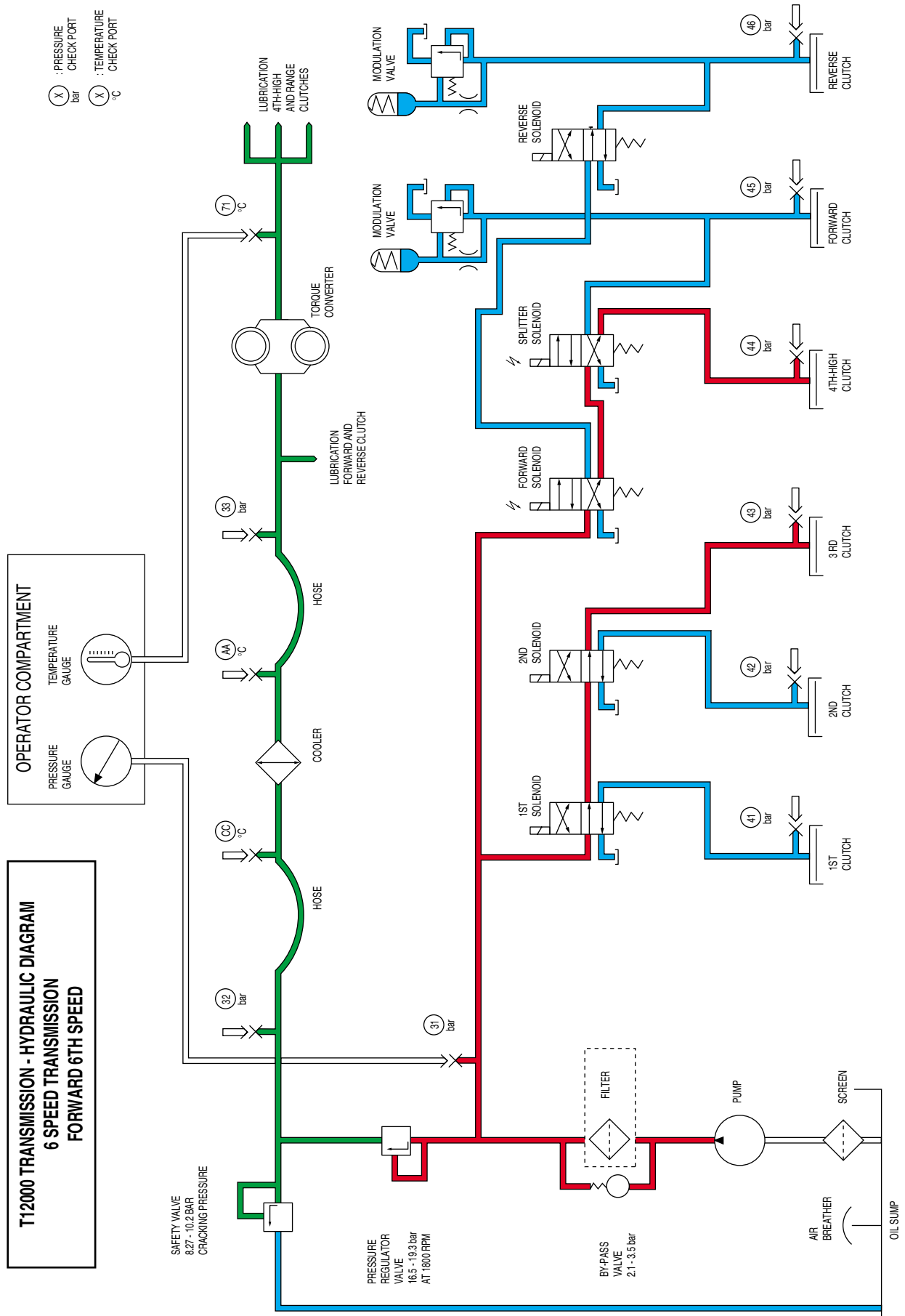
6.3.3.6 Forward 5th speed (continued)



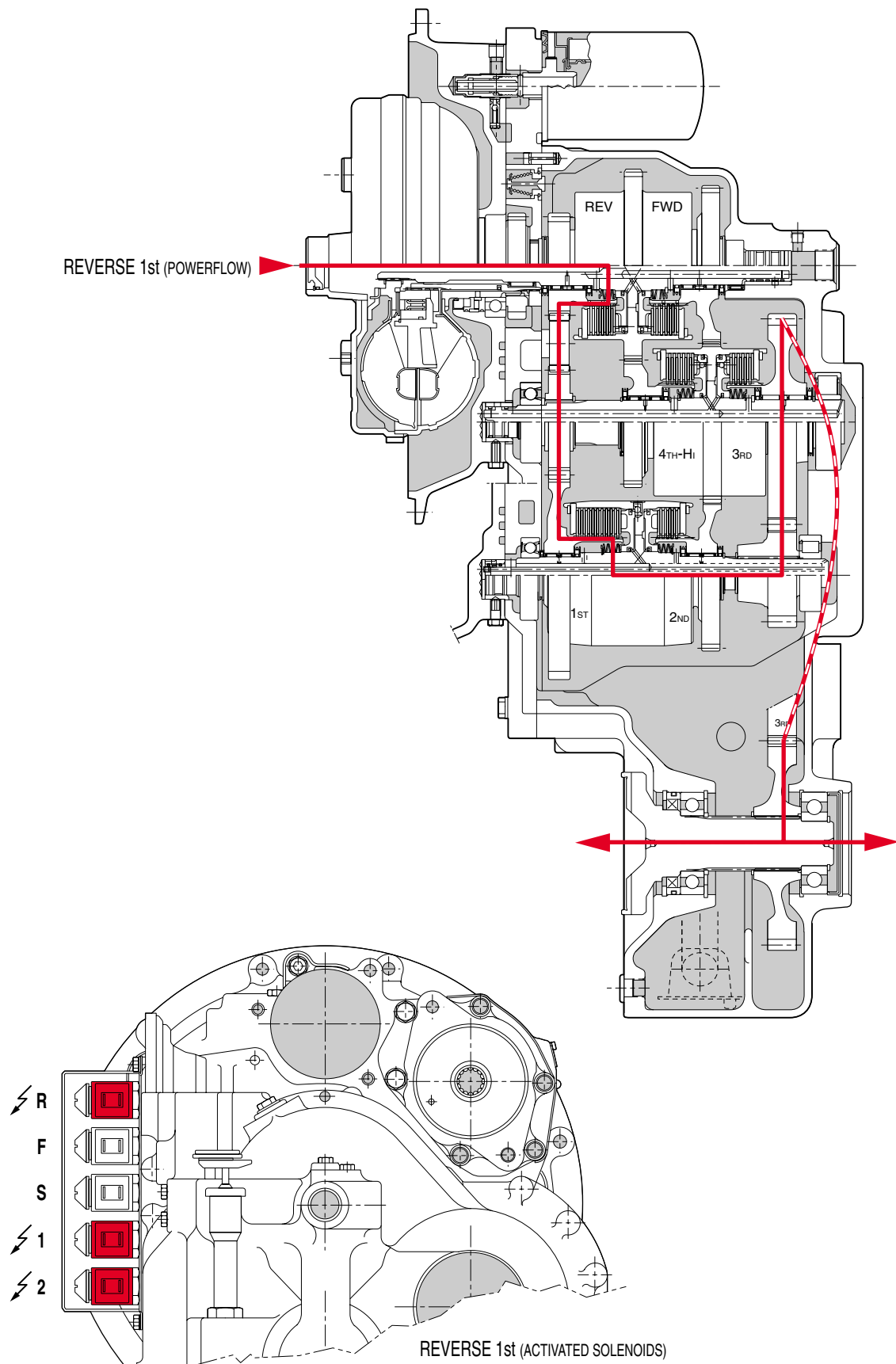
6.3.3.7 Forward 6th speed



6.3.3.7 Forward 6th speed (continued)



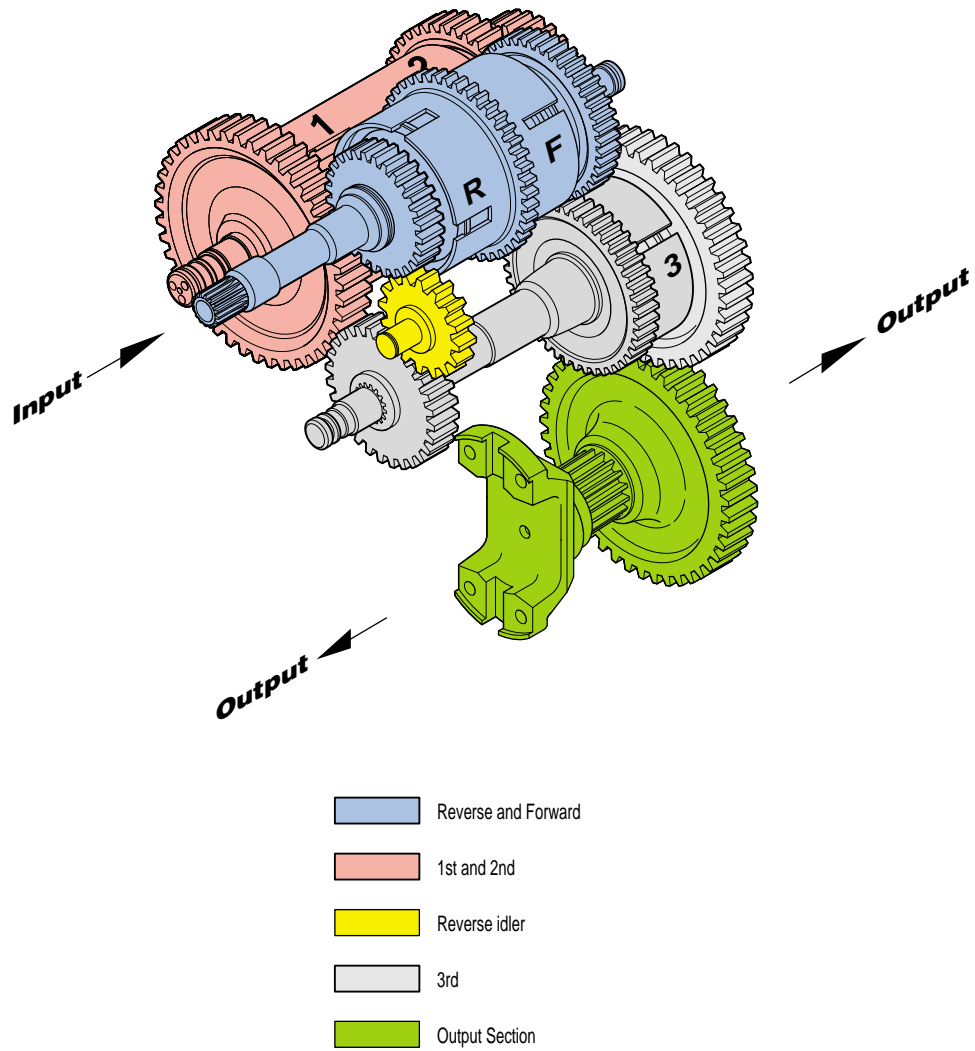
6.3.3.8 Reverse 1st speed



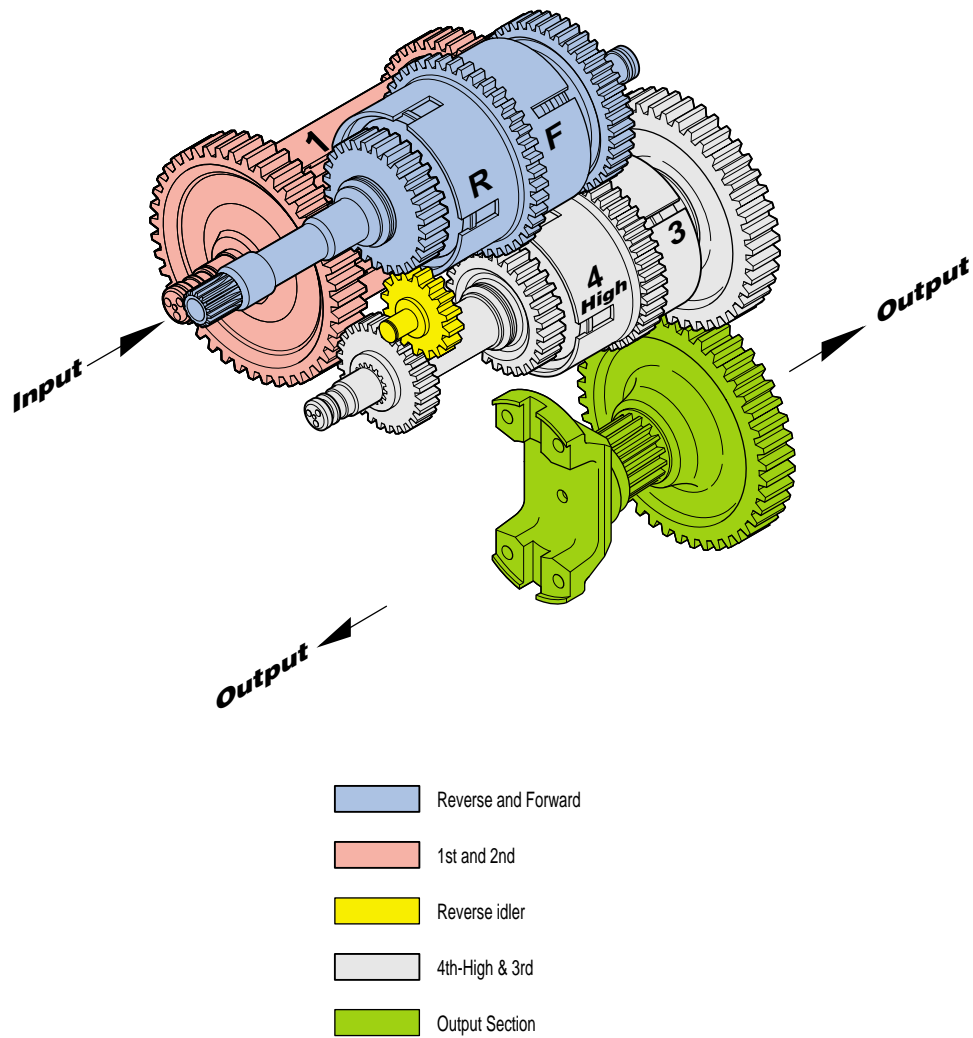
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6.4 GEAR AND CLUTCH LAY-OUT (3-SPEED)



6.4 GEAR AND CLUTCH LAY-OUT (4-SPEED AND 6-SPEED)



7. TROUBLESHOOTING GUIDE FOR THE T12000 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 T12000 TRANSMISSION

T12000 (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.

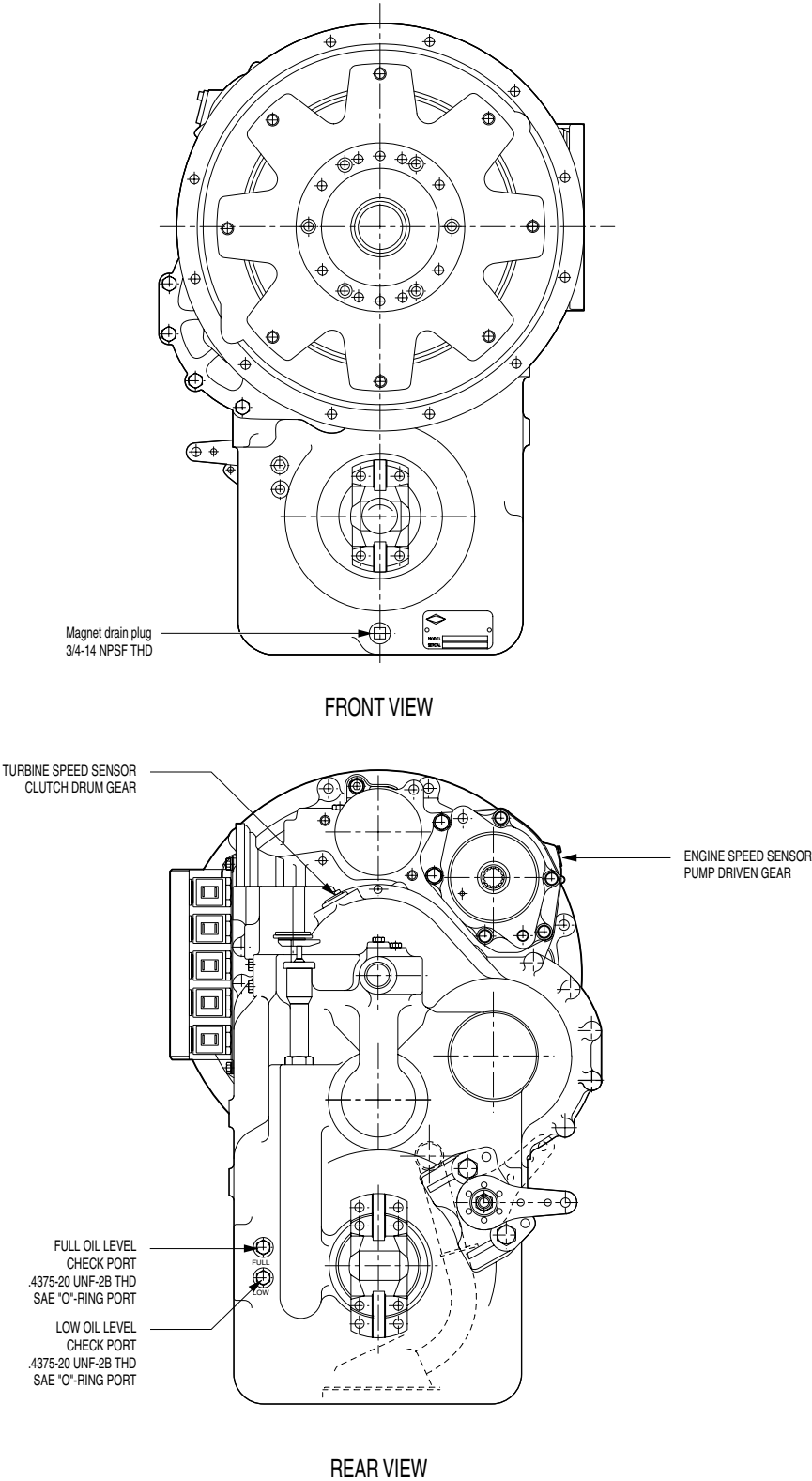
7.3.4 Noisy converter

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.

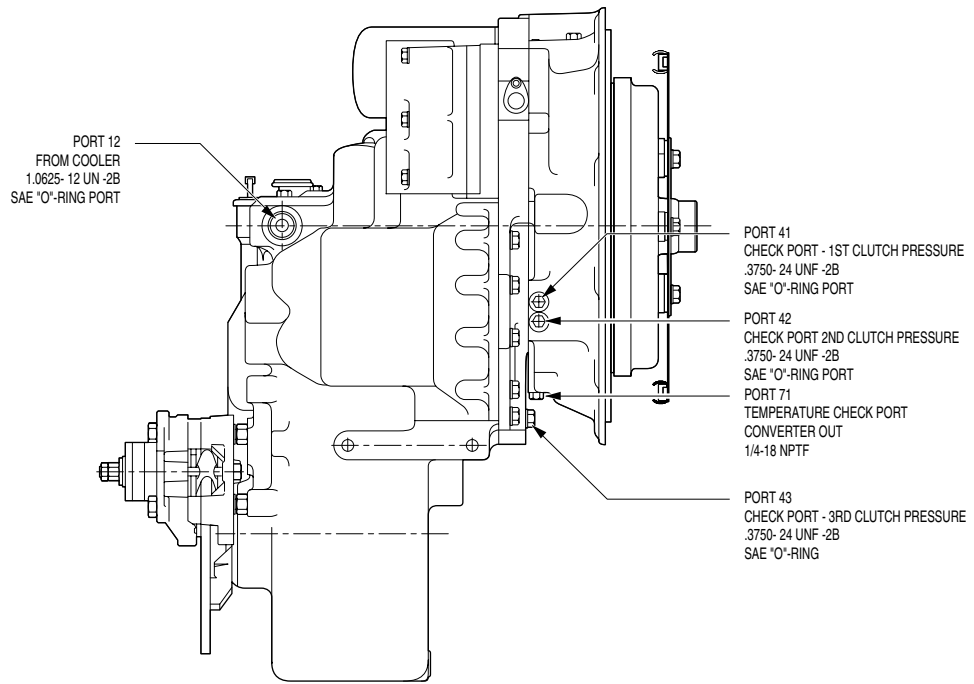
7.3.5 Lack of power

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".

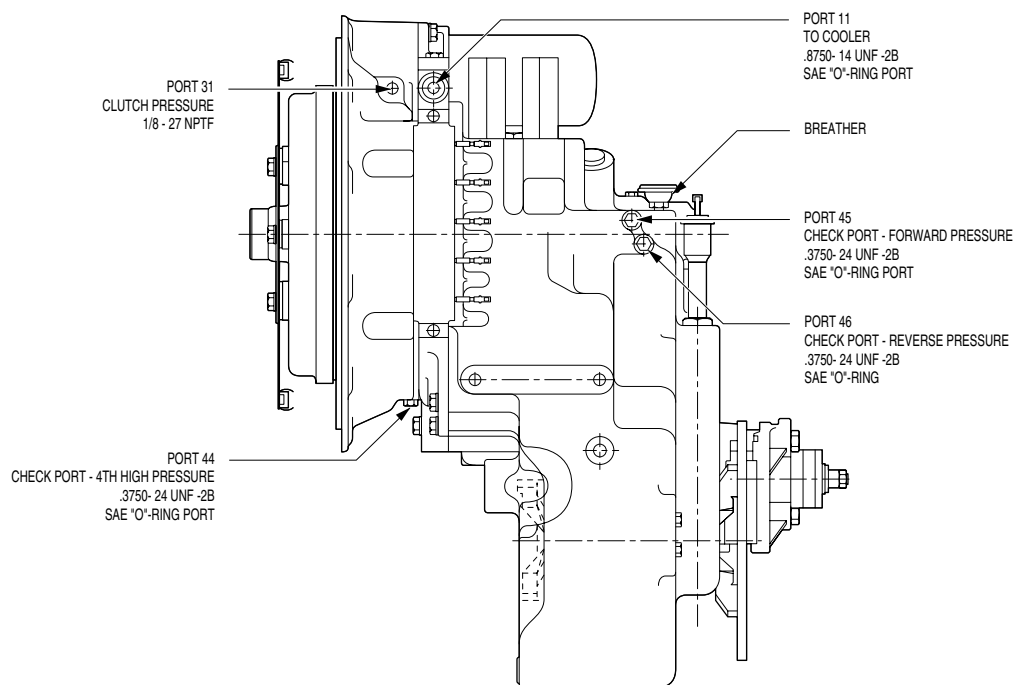
7.4 CHECK POINTS



7.4 CHECK POINTS (CONTINUED)

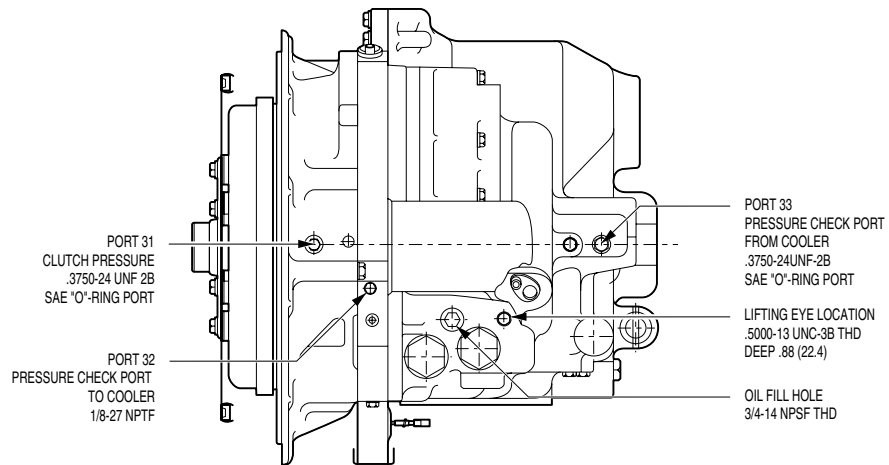


RIGHT SIDE VIEW



LEFT SIDE VIEW

7.4 CHECK POINTS (CONTINUED)



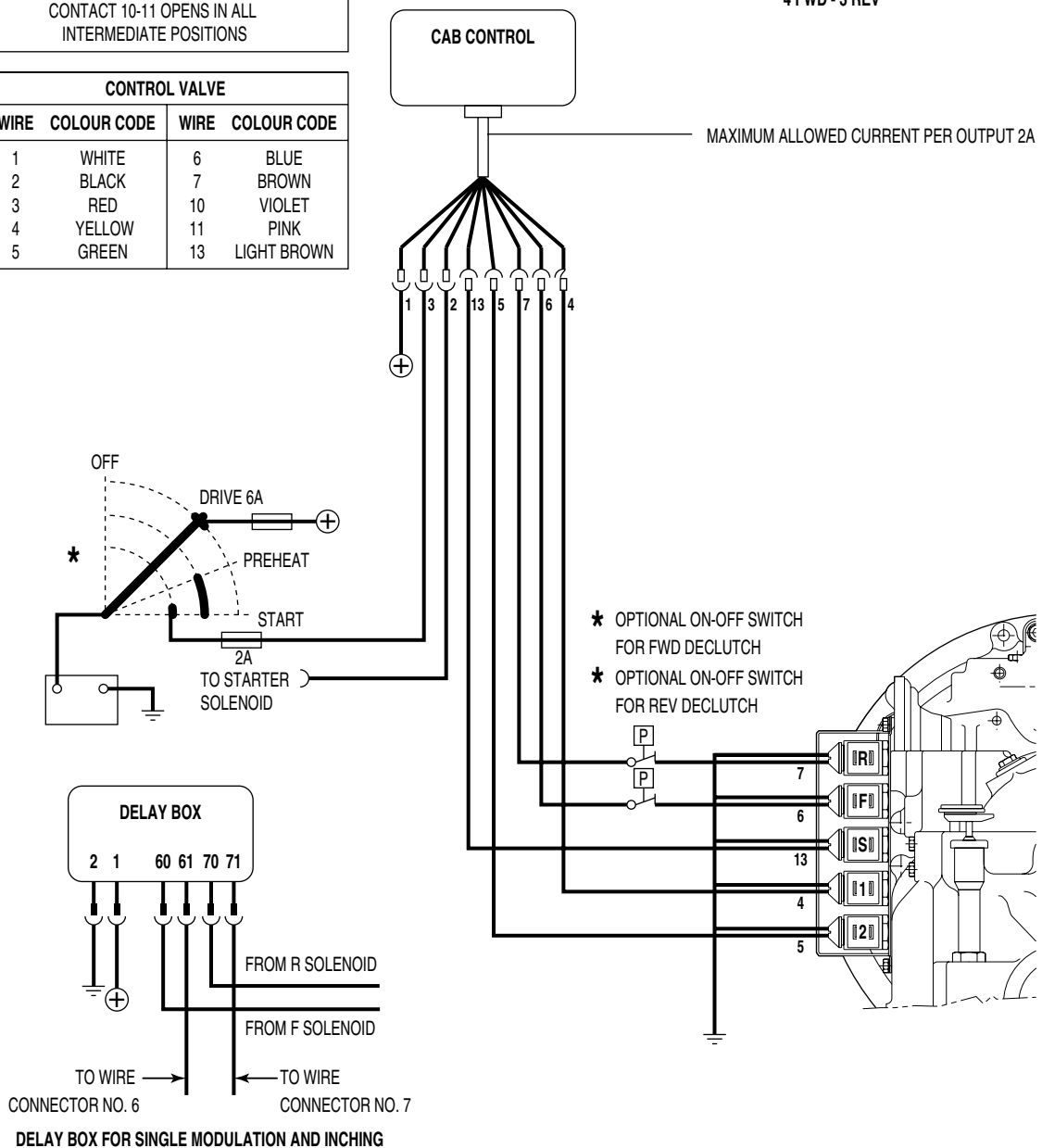
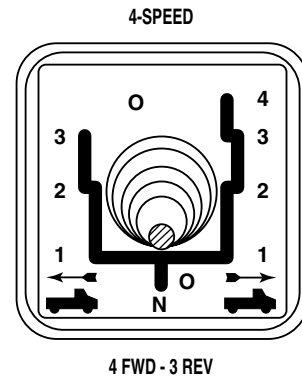
TOP VIEW

7.5.2 Standard 4-Speed transmission (1-3-5 ≈ 6 Speed)

SPICER OFF-HIGHWAY WILL NOT SUPPLY ITEMS INDICATED WITH *

CAB CONTROL	
CAB CONTROL POSITION	CONTACTS CLOSED BETWEEN WIRES
F4	1-6 / 1-13
F3	1-6
F2	1-5 / 1-6
F1	1-4 / 1-5 / 1-6
N	2-3 / 1-4 / 1-5
R1	1-4 / 1-5 / 1-7
R2	1-5 / 1-7
R3	1-7
CONTACT 10-11 OPENS IN ALL INTERMEDIATE POSITIONS	

CONTROL VALVE			
WIRE	COLOUR CODE	WIRE	COLOUR CODE
1	WHITE	6	BLUE
2	BLACK	7	BROWN
3	RED	10	VIOLET
4	YELLOW	11	PINK
5	GREEN	13	LIGHT BROWN



7.5.3 Alternative 4-Speed transmission (1-3-4-5 ≈ 6 Speed)



Note

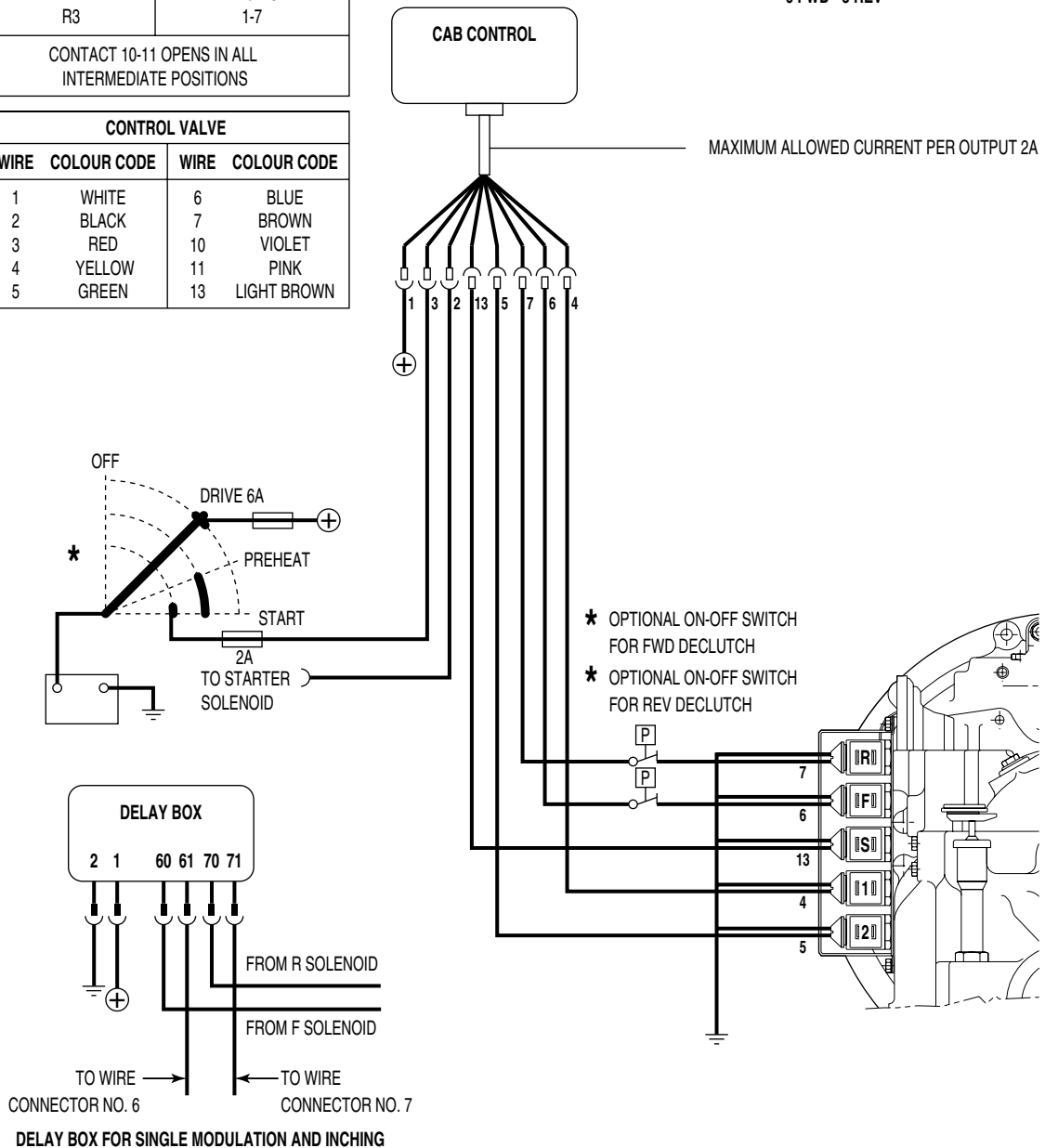
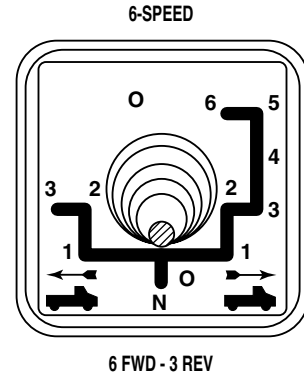
ALTERNATIVE 4-SPEED TRANSMISSION IS ONLY AVAILABLE WITH EGS OR APC.
ELECTRIC SOLENOID CONTROL WIRING DIAGRAM FOR ALTERNATIVE 4-SPEED TRANSMISSION:
REFER TO WIRING DIAGRAM OF CORRESPONDING CONTROLLER.

7.5.4 6-Speed transmission

SPICER OFF-HIGHWAY WILL NOT SUPPLY ITEMS INDICATED WITH *

CAB CONTROL	
CAB CONTROL POSITION	CONTACTS CLOSED BETWEEN WIRES
F6	1-6 / 1-13
F5	1-6
F4	1-6 / 1-5 / 1-13
F3	1-6 / 1-5
F2	1-6 / 1-5 / 1-4 / 1-13
F1	1-6 / 1-5 / 1-4
N	2-3 / 1-4 / 1-5
R1	1-7 / 10-5 / 1-4
R2	1-7 / 1-5
R3	1-7
CONTACT 10-11 OPENS IN ALL INTERMEDIATE POSITIONS	

CONTROL VALVE			
WIRE	COLOUR CODE	WIRE	COLOUR CODE
1	WHITE	6	BLUE
2	BLACK	7	BROWN
3	RED	10	VIOLET
4	YELLOW	11	PINK
5	GREEN	13	LIGHT BROWN



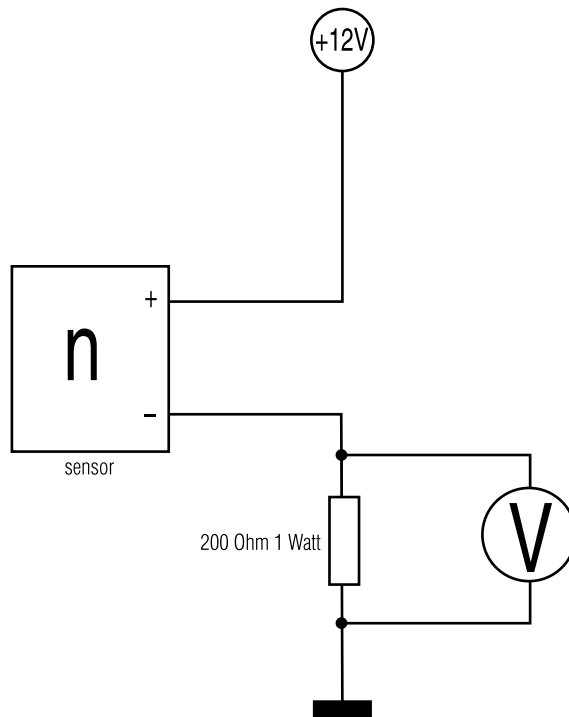
7.6 SPEED SENSOR - STATIC STANDALONE TEST

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.

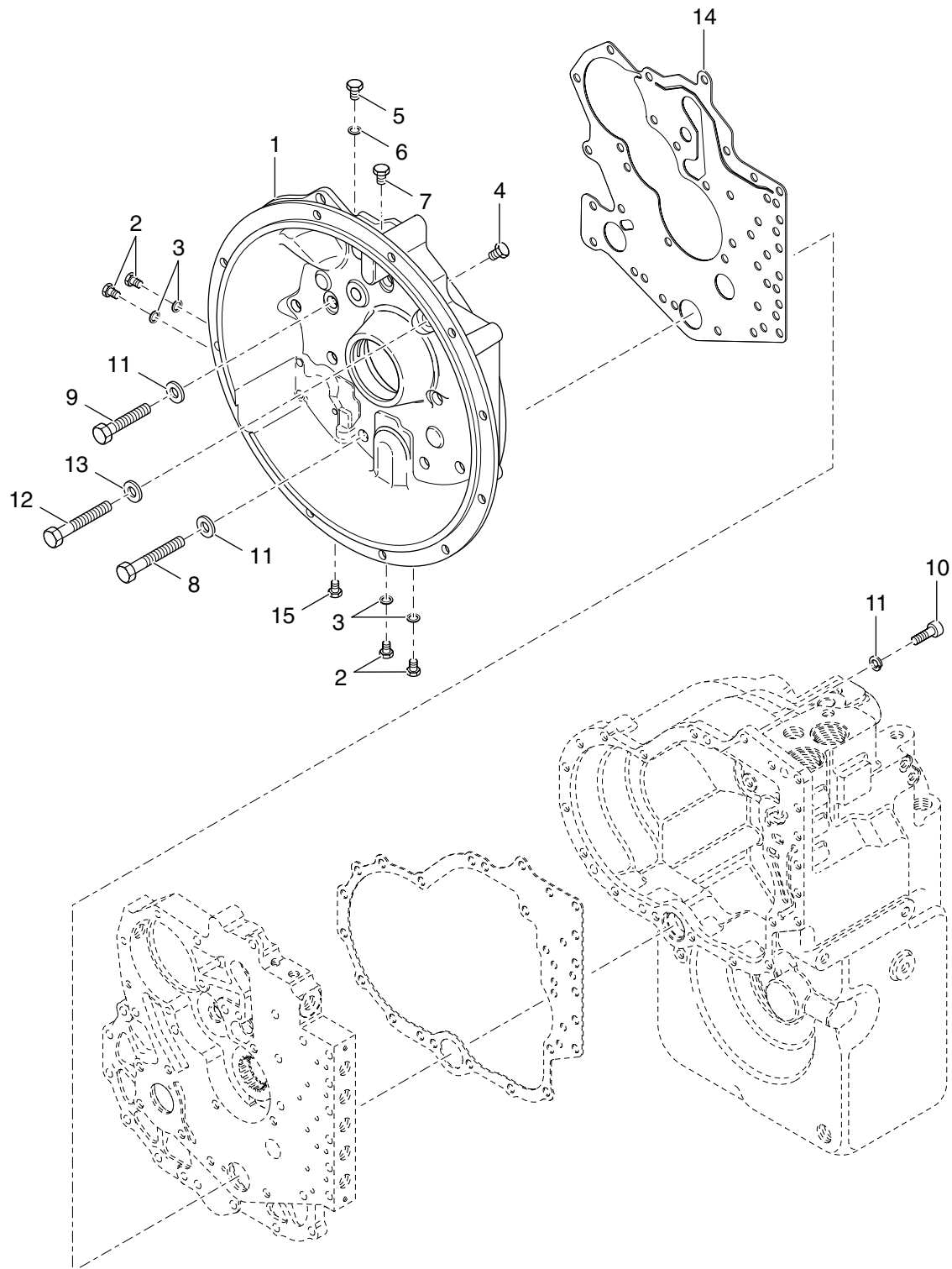
The idea is to connect the sensor to an external power source and measure the DC voltage across the series resistor.

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

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

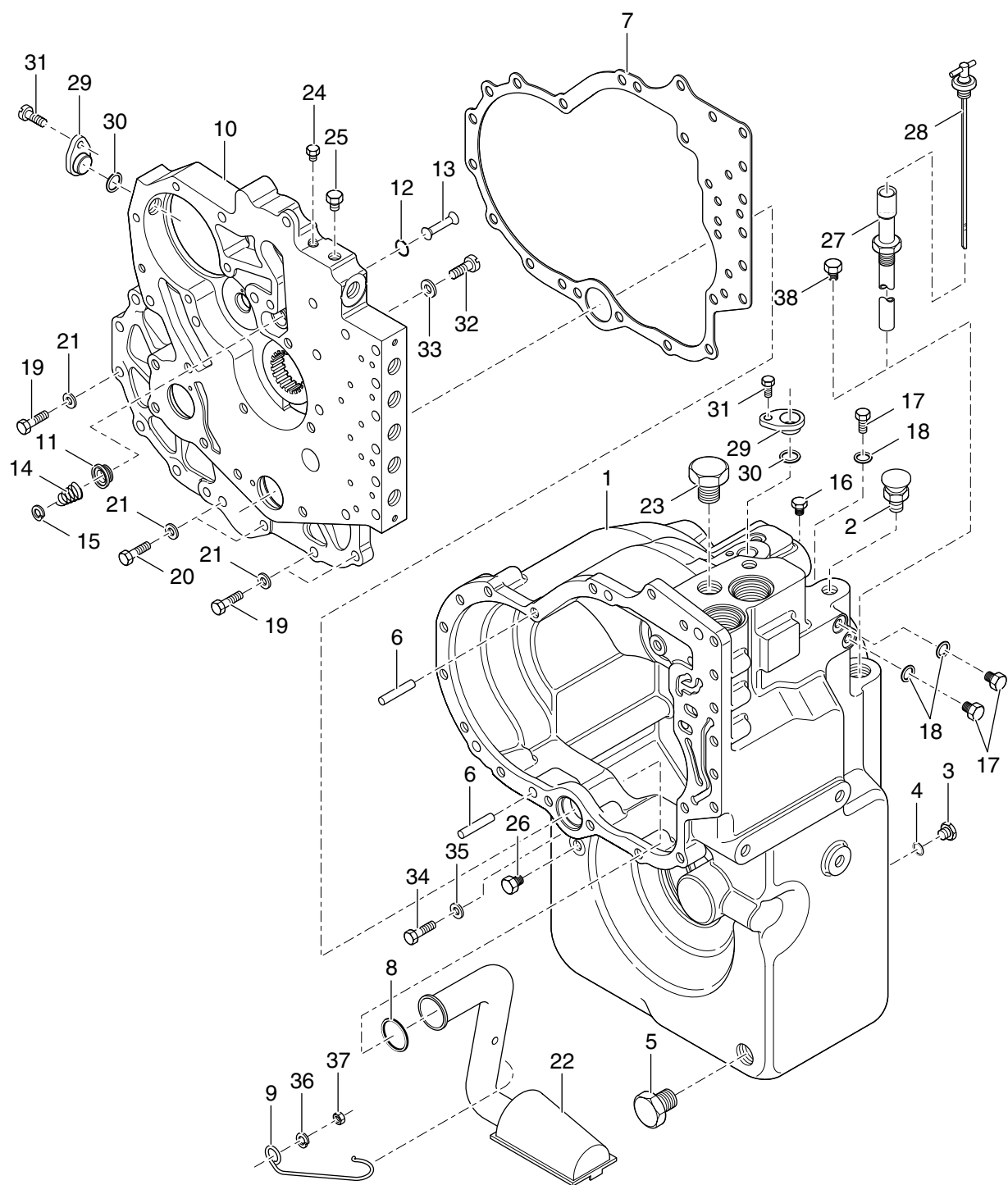


8. SECTIONAL VIEWS AND PARTS IDENTIFICATION



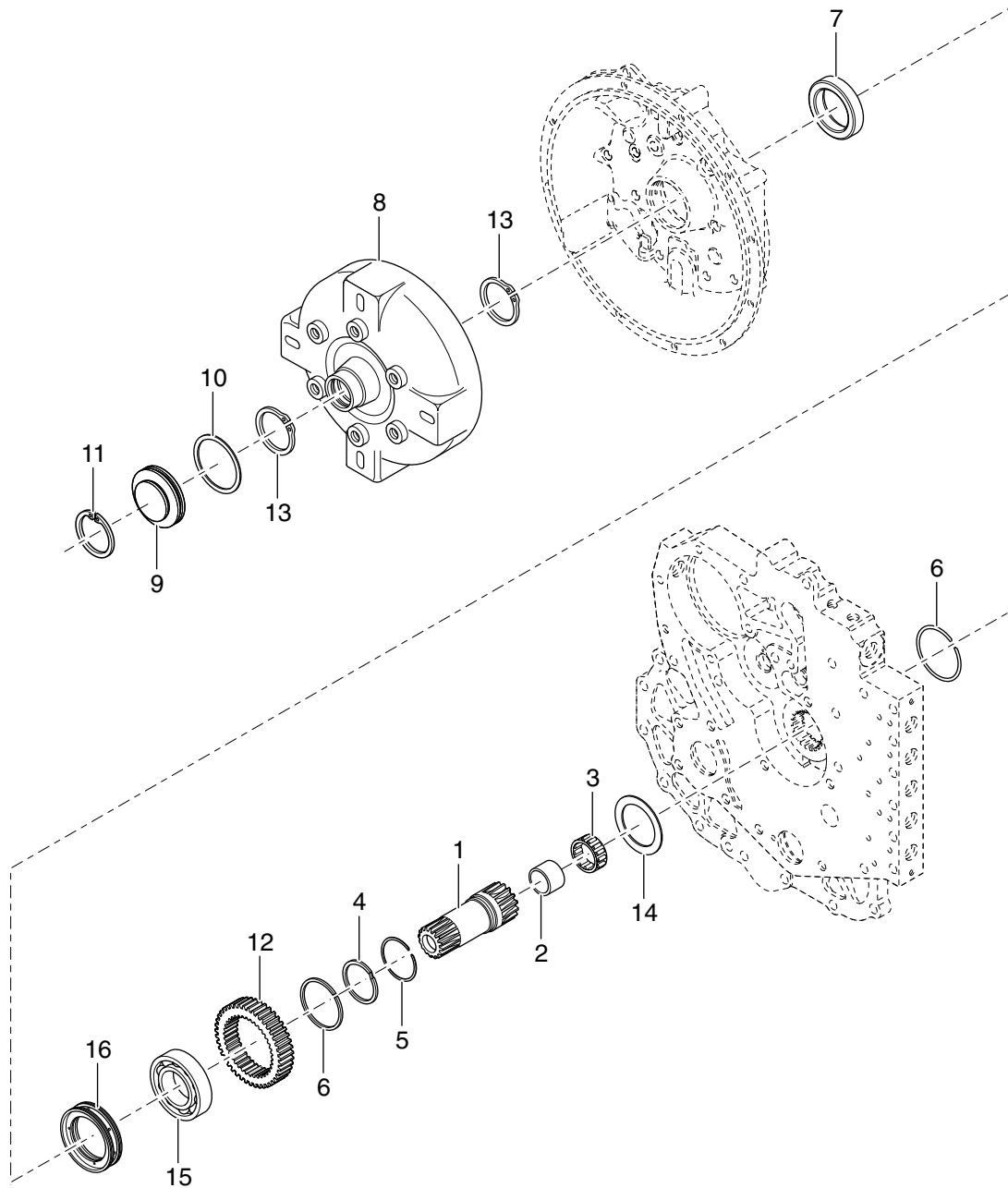
GROUP - CONVERTER HOUSING

Item	Description	Quantity
1	Housing - Converter	1
2	Plug	4
3	"O"-ring	4
4	Plug	1
5	Plug	1
6	"O"-ring	1
7	Plug	1
8	Screw - Converter housing to plate	6
9	Screw - Converter housing to plate	3
10	Screw - Converter housing to plate	1
11	Lockwasher - Converter housing to plate screw	10
12	Screw - Converter housing to transmission case	13
13	Lockwasher - Converter housing to transmission case screw	13
14	Gasket - Converter housing to plate	1
15	Plug	1



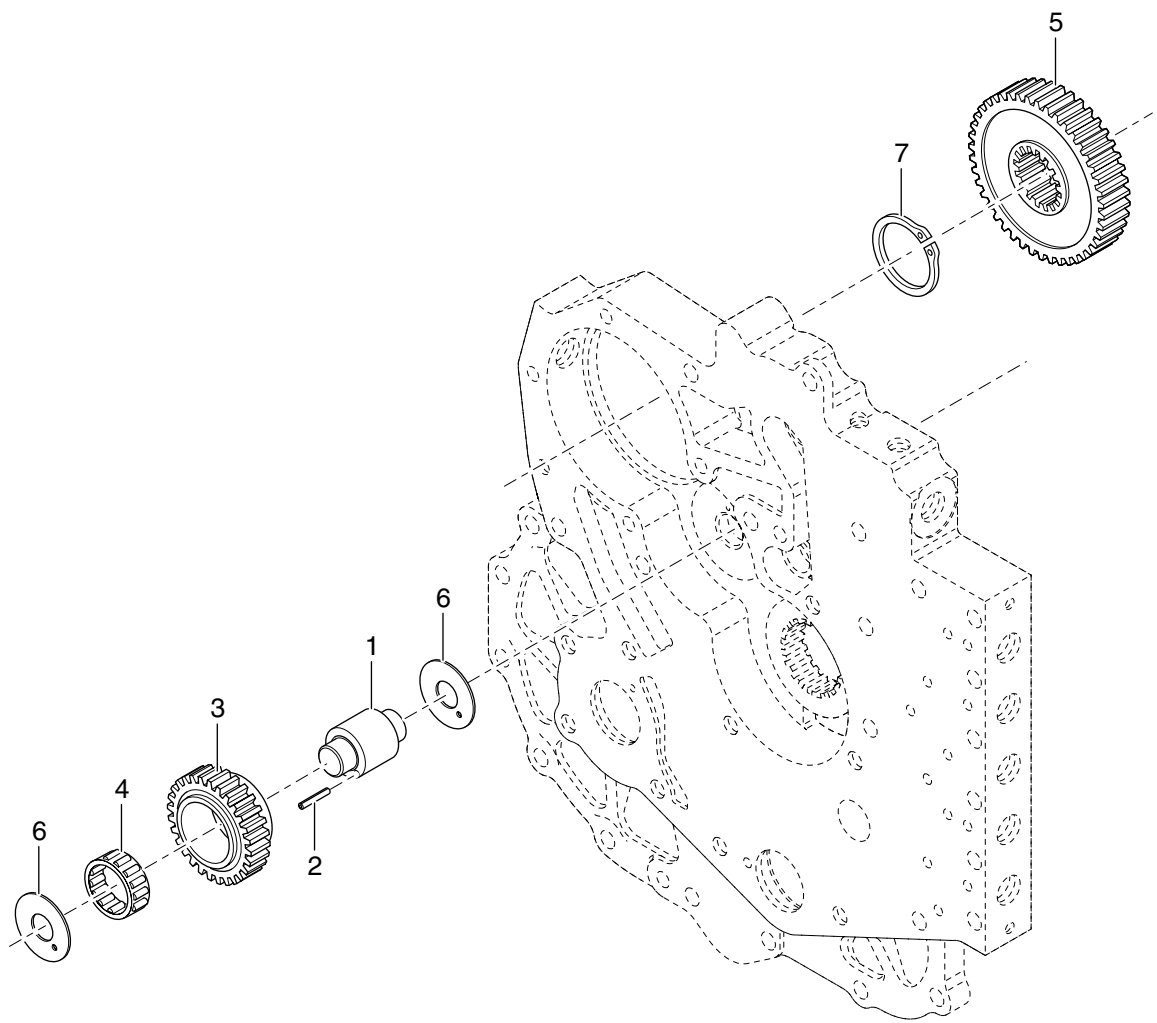
GROUP -TRANSMISSION CASE AND PLATE

Item	Description	Quantity
1	Case - Transmission	1
2	Breather - Air	1
3	Plug - Oil level	1
4	"O"-ring	1
5	Plug - Magnetic drain	1
6	Pin - Plate to transmission case dowel	2
7	Gasket - Plate to transmission case	1
8	Ring - Oil supply tube seal	1
9	Clip - Oil supply tube retainer	1
10	Spacer - Plate	1
11	Seat - Safety valve	1
12	Snap ring - Seat	1
13	Poppet - Converter safety valve	1
14	Spring - Converter safety valve	1
15	Washer - Poppet retaining	1
16	Plug	1
17	Plug	3
18	"O"-ring	3
19	Screw - Plate to transmission case	7
20	Screw - Plate to transmission case	2
21	Lockwasher - Plate to transmission case screw	9
22	Assembly - Tube & screen	1
23	Plug - Filler	1
24	Plug	1
25	Plug	1
26	Plug - Drain back port	1
27	Tube - Dipstick	1
28	Assembly - Dipstick	1
29	Plug - Speed sensor port	2
30	"O"-ring - Speed sensor	2
31	Screw - Speed sensor	2
32	Screw - Baffle hole	1
33	Washer - Baffle seal	1
34	Screw	1
35	Washer - Seal	1
36	Washer	1
37	Nut	1
38	Plug - Dipstick hole	1



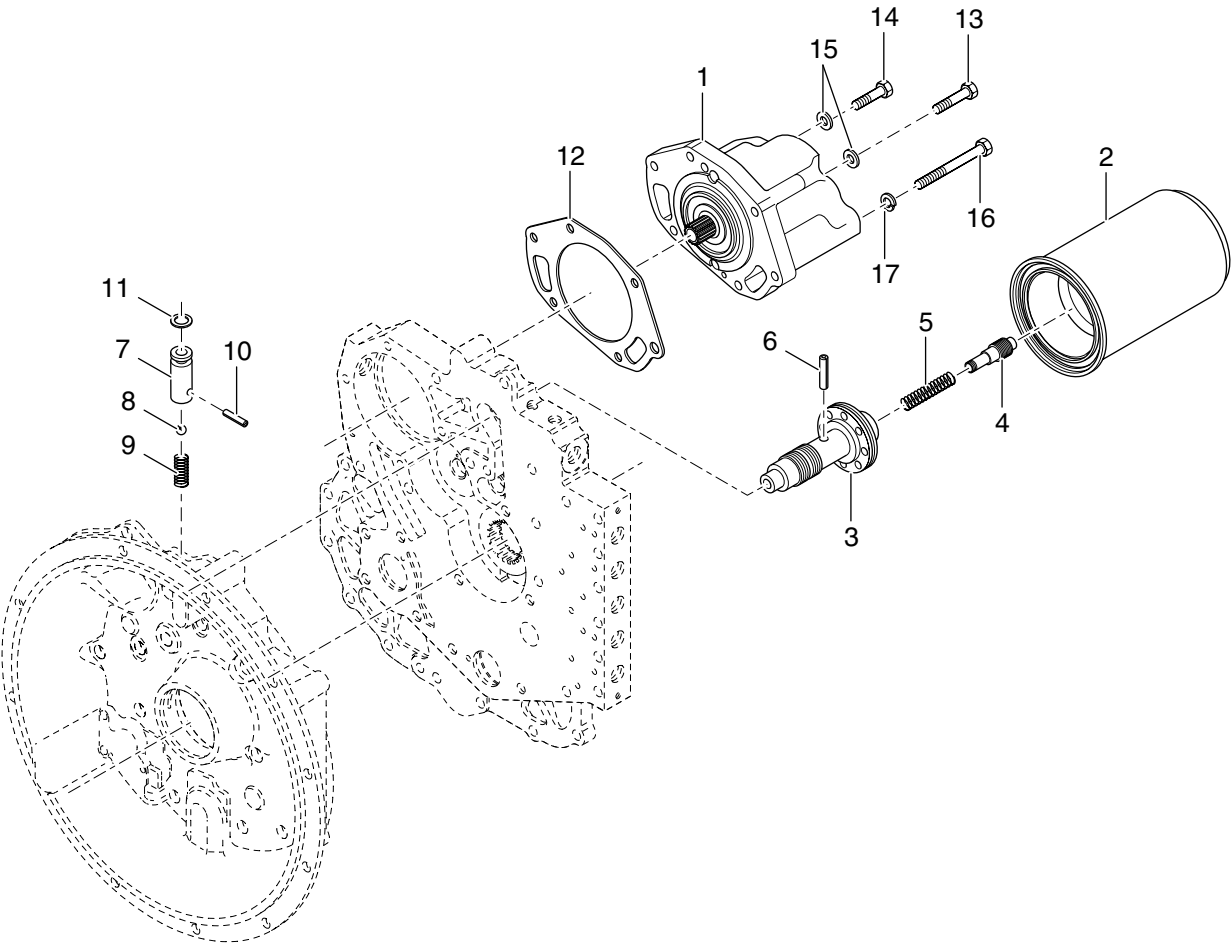
GROUP - TORQUE CONVERTER

Item	Description	Quantity
1	Stator support	1
2	Bushing	1
3	Bearing	1
4	Ring - Stator support piston	1
5	Expander - Stator support piston ring	1
6	Snap ring - Stator support	2
7	Seal - Converter housing oil	1
8	Assembly - Torque converter	1
9	Plug - Torque converter	1
10	"O"-ring - Torque converter plug	1
11	Snap ring - Torque converter plug	1
12	Gear - Impeller hub	1
13	Snap ring - Impeller hub	2
14	Washer - Impeller hub gear	1
15	Bearing - Torque converter	1
16	Ring - Oil distributor	1



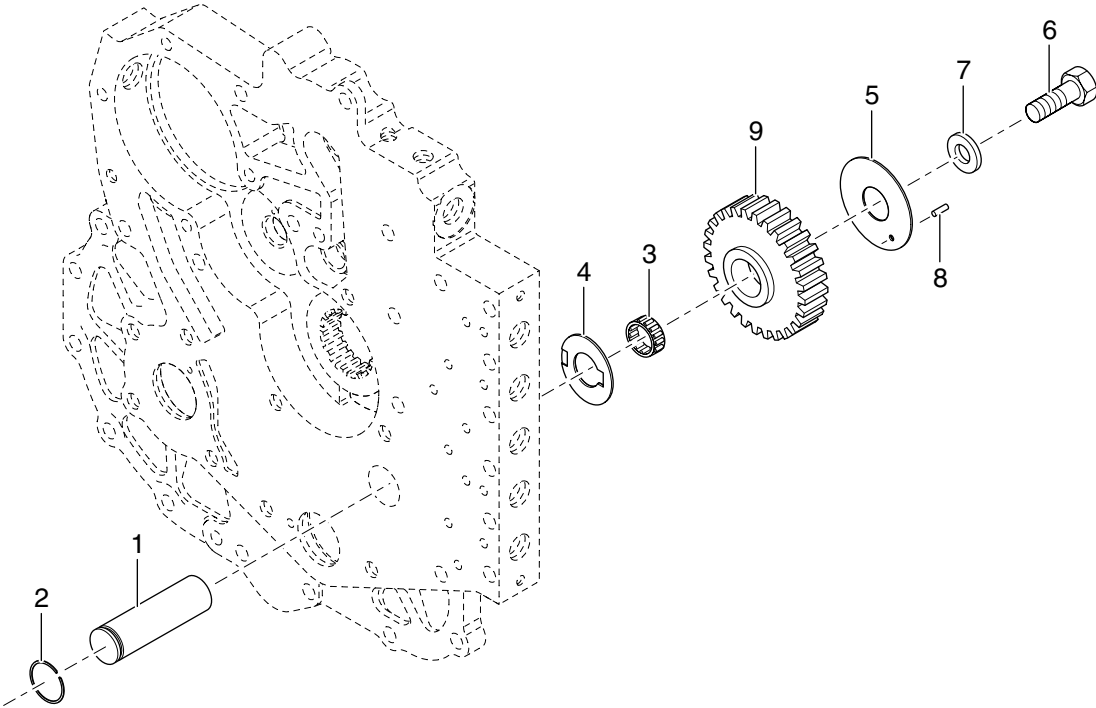
GROUP - PUMP DRIVE

Item	Description	Quantity
1	Shaft - Pump drive idler & pilot	1
2	Pin - Roll	1
3	Gear - Pump drive idler	1
4	Bearing - Idler gear	1
5	Gear - Pump drive	1
6	Washer - Pump drive idler thrust	2
7	Snap ring - Pump drive gear retaining	1



GROUP - CHARGING PUMP

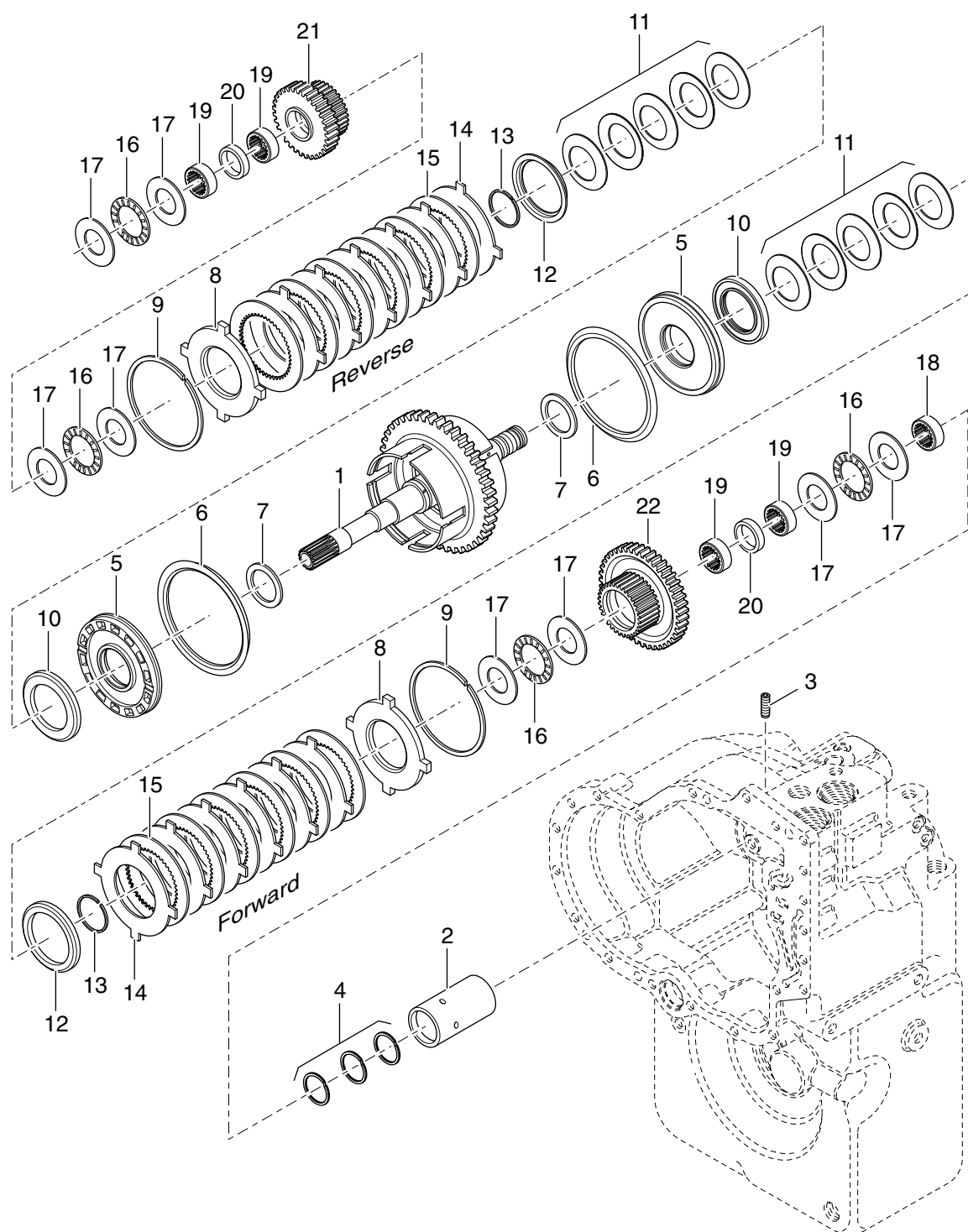
Item	Description	Quantity
1	Assembly - Charge pump	1
2	Assembly - Hydraulic spin filter	1
3	Sleeve - Regulator valve	1
4	Piston - Regulator valve	1
5	Spring - Regulator valve	1
6	Pin	1
7	Body - Check valve	1
8	Ball	1
9	Spring - Check valve	1
10	Pin - Check valve	1
11	"O"-ring	1
12	Gasket - Charging pump	1
13	Screw - Pump mounting	4
14	Screw - Pump mounting	1
15	Lockwasher - Pump mounting screw	5
16	Screw - Pump mounting	1
17	Lockwasher - Pump mounting screw	1



GROUP - REVERSE IDLER

Item	Description	Quantity
1	Shaft - Idler & pilot	1
2	Snap ring - Idler shaft	1
3	Bearing - Reverse idler gear	1
4	Washer - Thrust	1
5	Plate - End	1
6	Capscrew - Reverse idler end plate	1
7	Washer - End plate cap screw	1
8	Roll pin - End plate to shaft	1
9	Gear - Reverse idler	1

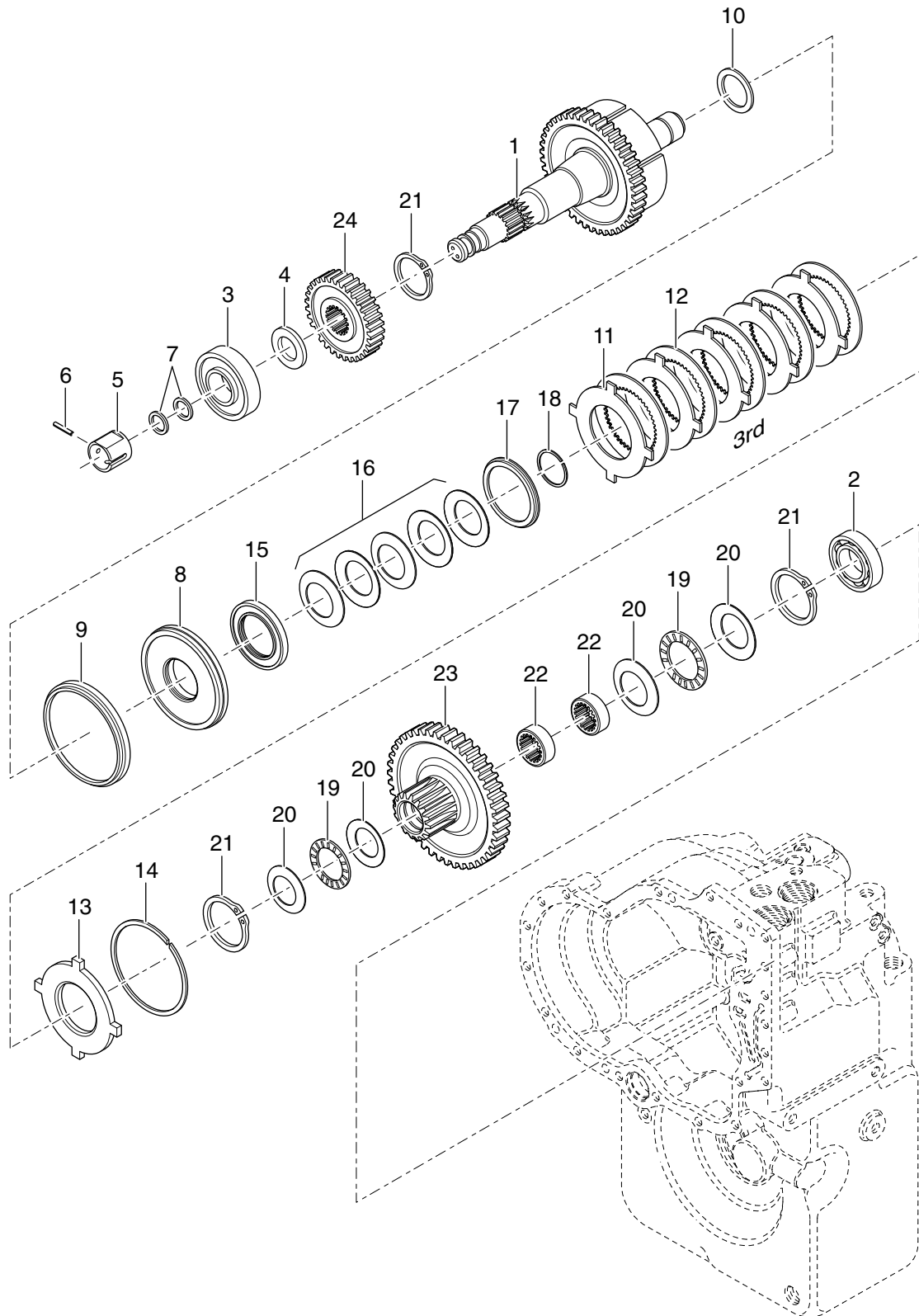
GROUP - FORWARD AND REVERSE SHAFT



GROUP - FORWARD AND REVERSE SHAFT

Item	Description	Quantity
1	Assembly - Turbine shaft, drum & plug	1
2	Sleeve - Oil distributor	1
3	Screw - Retainer	1
4	Ring - Piston	3
5	Piston - Clutch	2
6	Seal - Clutch piston (Outer)	2
7	Seal - Clutch piston (Inner)	2
8	Plate - End	2
9	Snap ring - End plate	2
10	Plate - Clutch piston wear	2
11	Assembly - Disc spring	2
12	Retainer - Snap ring	2
13	Snap ring - retainer	2
14	Disc - Outer (6 forward - 6 reverse)	12
15	Disc - Inner (6 forward - 6 reverse)	12
16	Bearing - Clutch gear thrust	4
17	Washer - Clutch gear thrust	8
18	Bearing - Turbine shaft rear	1
19	Bearing	4
20	Spacer	2
21	Gear - Reverse clutch	1
22	Gear - Forward clutch	1

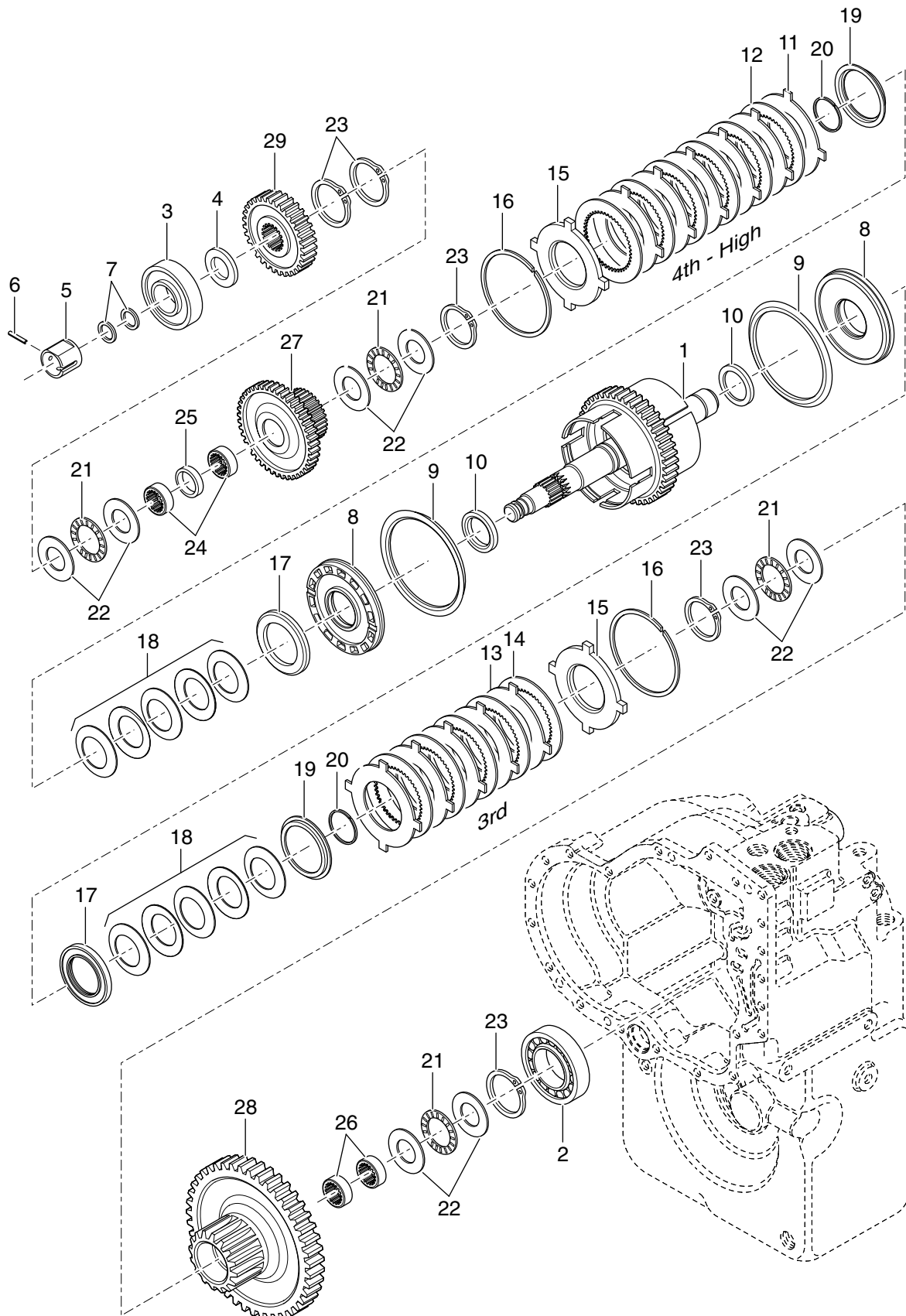
GROUP - 3RD SHAFT (FOR 3-SPEED TRANSMISSION ONLY)



GROUP - 3RD SHAFT (FOR 3-SPEED TRANSMISSION ONLY)

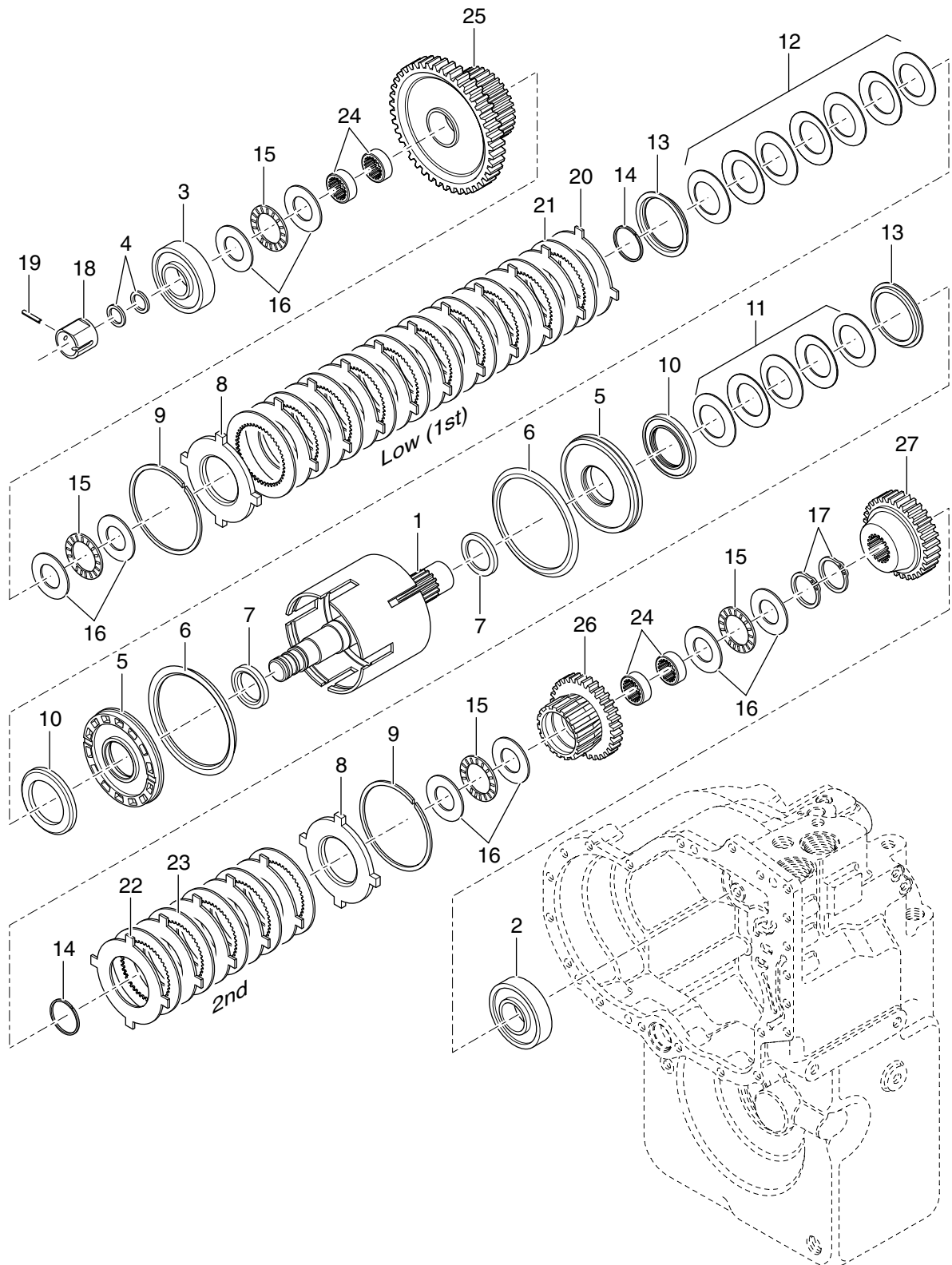
Item	Description	Quantity
1	Assembly - 3rd shaft, drum and plug	1
2	Bearing - Roller	1
3	Assembly - Bearing and seal	1
4	Washer - Bearing support	1
5	Sleeve - Oil distributor	1
6	Screw - Sleeve retaining	1
7	Ring - Piston	2
8	Clutch - Piston	1
9	Seal - Clutch piston (Outer)	1
10	Seal - Clutch piston (Inner)	1
11	Disc (Outer)	5
12	Disc (Inner)	5
13	Plate - End	1
14	Snap ring - end plate	1
15	Plate - Clutch piston wear	1
16	Assembly - disc spring	1
17	Retainer - Snap ring	1
18	Snap ring - Retainer	1
19	Bearing - Thrust needle roller	2
20	Washer - Clutch gear thrust	4
21	Snap ring - External	3
22	Bearing - 3rd clutch gear	2
23	Gear - 3rd clutch	1
24	Gear - First drive	1

GROUP - HIGH (4TH) AND 3RD SHAFT



GROUP - HIGH (4TH) AND 3RD SHAFT

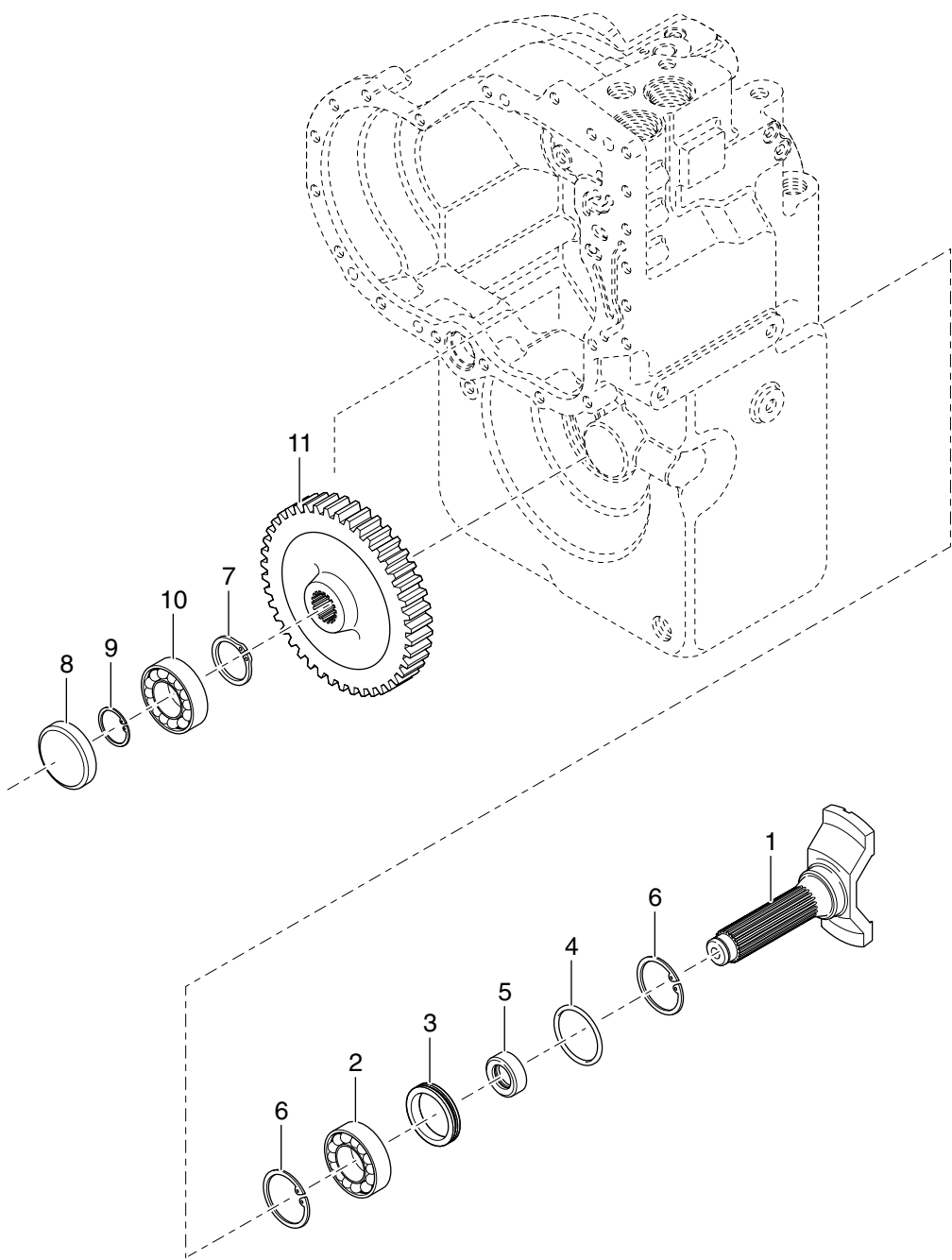
Item	Description	Quantity
1	Assembly - High and 3rd shaft, drum and plug	1
2	Bearing - Roller	1
3	Assembly - Bearing and seal	1
4	Washer - Bearing support	1
5	Sleeve - Oil distributor	1
6	Screw - Sleeve retaining	1
7	Ring - Piston	2
8	Clutch - Piston	2
9	Seal - Clutch piston (Outer)	2
10	Seal - Clutch piston (Inner)	2
11	Disc (Outer) Hi	6
12	Disc (Inner) Hi	6
13	Disc (Outer) 3rd	5
14	Disc (Inner) 3rd	5
15	Plate - End	2
16	Snap ring - End plate	2
17	Plate - Clutch piston wear	2
18	Assembly - Disc spring	2
19	Retainer - Snap ring	2
20	Snap ring - Retainer	2
21	Bearing - thrust needle roller	4
22	Washer - Clutch gear thrust	8
23	Snap ring - Gear hub	5
24	Bearing - 4th clutch gear	2
25	Spacer	1
26	Bearing - 3rd clutch gear	2
27	Gear 4th clutch	1
28	Gear 3rd clutch	1
29	Gear - First drive	1



GROUP - 1ST AND 2ND SHAFT

Item	Description	Quantity
1	Assembly 1st and 2nd shaft, drum, plug and seat	1
2	Bearing - Roller	1
3	Assembly - Bearing and seal	1
4	Ring - Piston	2
5	Piston - Clutch	2
6	Seal - Clutch piston (Outer)	2
7	Seal - Clutch piston (Inner)	2
8	Plate - End	2
9	Snap ring - End plate	2
10	Plate - Clutch piston wear	2
11	Assembly - Disc spring	1
12	Assembly - Disc spring	1
13	Retainer - Snap ring	2
14	Snap ring - Retainer	2
15	Bearing - Clutch gear thrust	4
16	Washer - Clutch gear thrust	8
17	Snap ring - 2nd clutch gear hub	2
18	Sleeve - Oil distributor	1
19	Screw - Sleeve retaining	1
20	Disc (Outer) 1st	10
21	Disc (Inner) 1st	10
22	Disc (Outer) 2nd	5
23	Disc (Inner) 2nd	5
24	Bearing	4
25	Gear - 1st clutch	1
26	Gear - 2nd clutch	1
27	Gear - 3rd driven	1

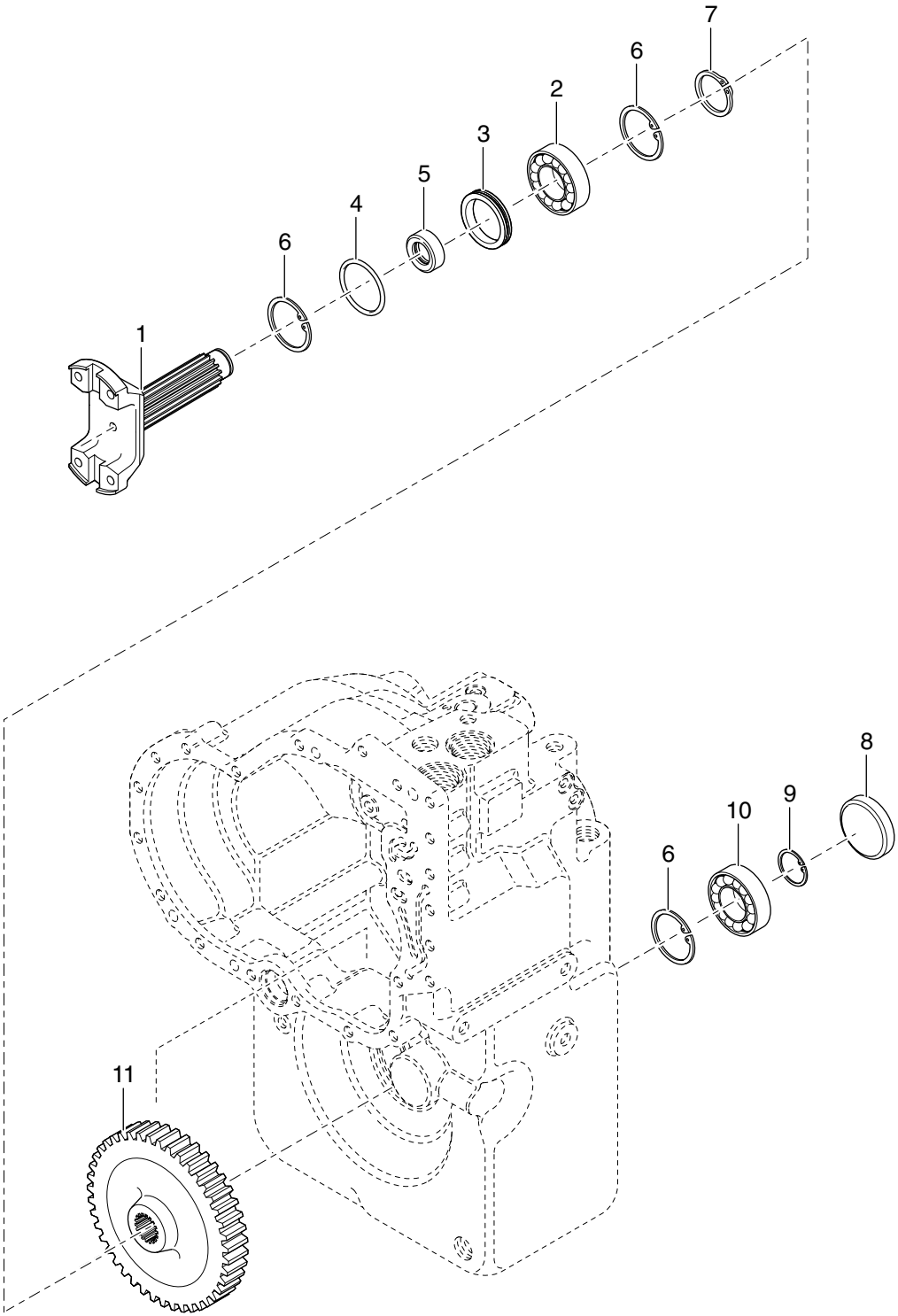
GROUP - OUTPUT SHAFT (REAR ONLY)



GROUP - OUTPUT SHAFT (REAR ONLY)

Item	Description	Quantity
1	Shaft - Output	1
2	Bearing - Output shaft	1
3	Sleeve - Oil seal	1
4	"O"ring - Oil seal sleeve	1
5	Seal - Output shaft oil	1
6	Snap ring - Output shaft bearing	2
7	Snap ring - Gear & bearing retaining	1
8	Plug - End	1
9	Snap ring - Bearing retainer	1
10	Bearing - Output shaft	1
11	Gear - Output shaft	1

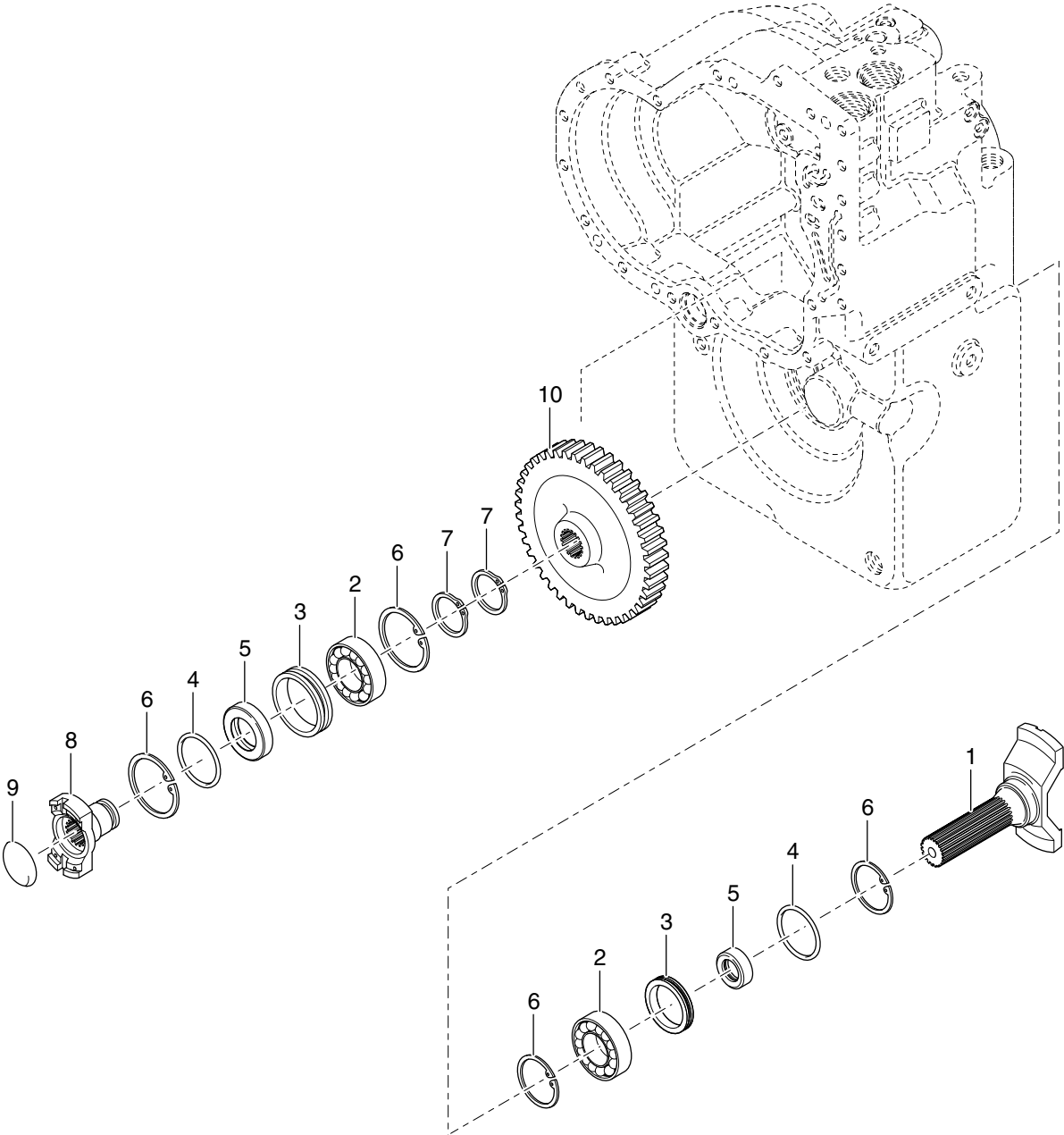
GROUP - OUTPUT SHAFT (FRONT ONLY)



GROUP - OUTPUT SHAFT (FRONT ONLY)

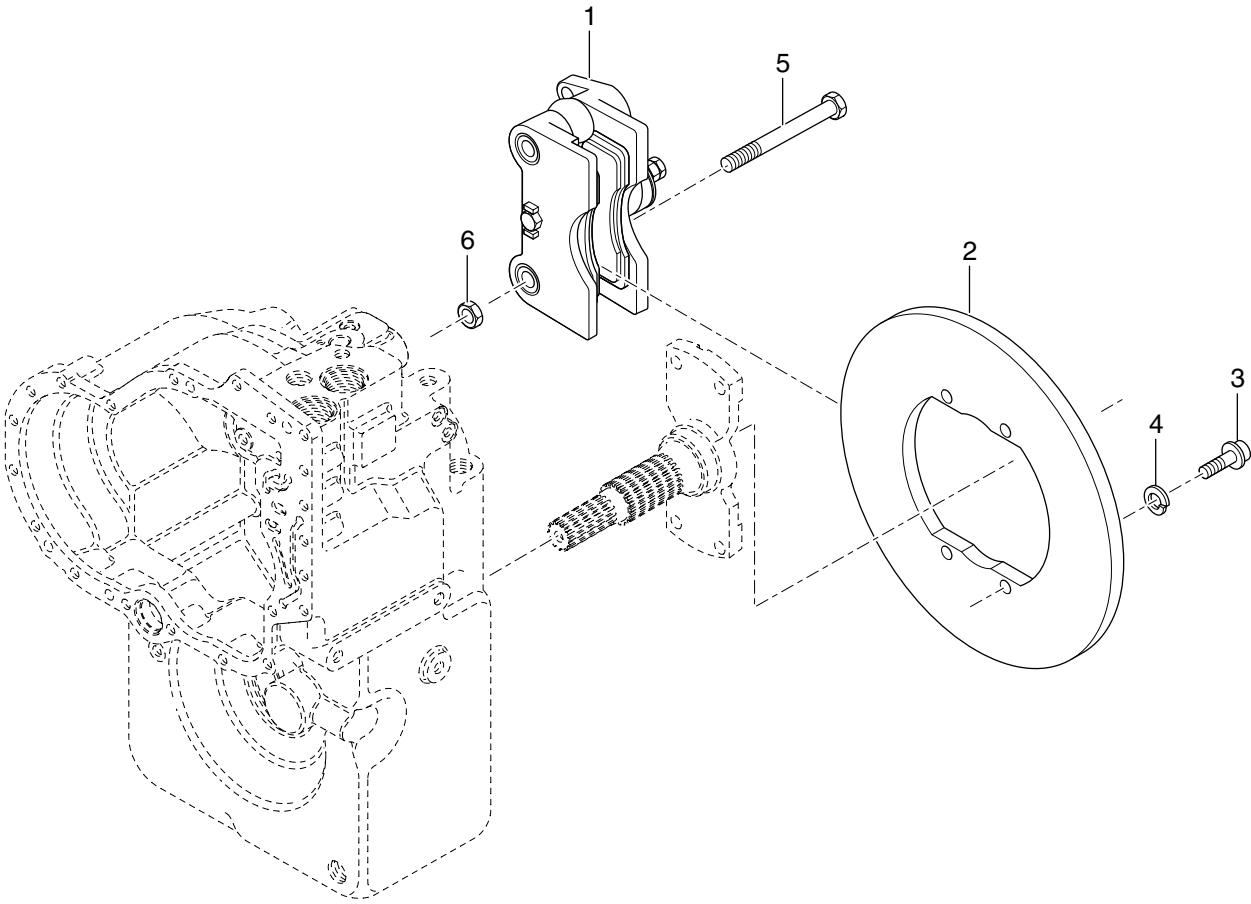
Item	Description	Quantity
1	Shaft - Output	1
2	Bearing - Output shaft	1
3	Sleeve - Oil seal	1
4	"O"ring - Oil seal sleeve	1
5	Seal - Output shaft bearing	1
6	Snap ring - Output shaft bearing	3
7	Snap ring - Gear & bearing retaining	1
8	Plug - End	1
9	Snap ring - Bearing retainer	1
10	Bearing - Output shaft	1
11	Gear - Output shaft	1

GROUP - OUTPUT SHAFT (FRONT & REAR)



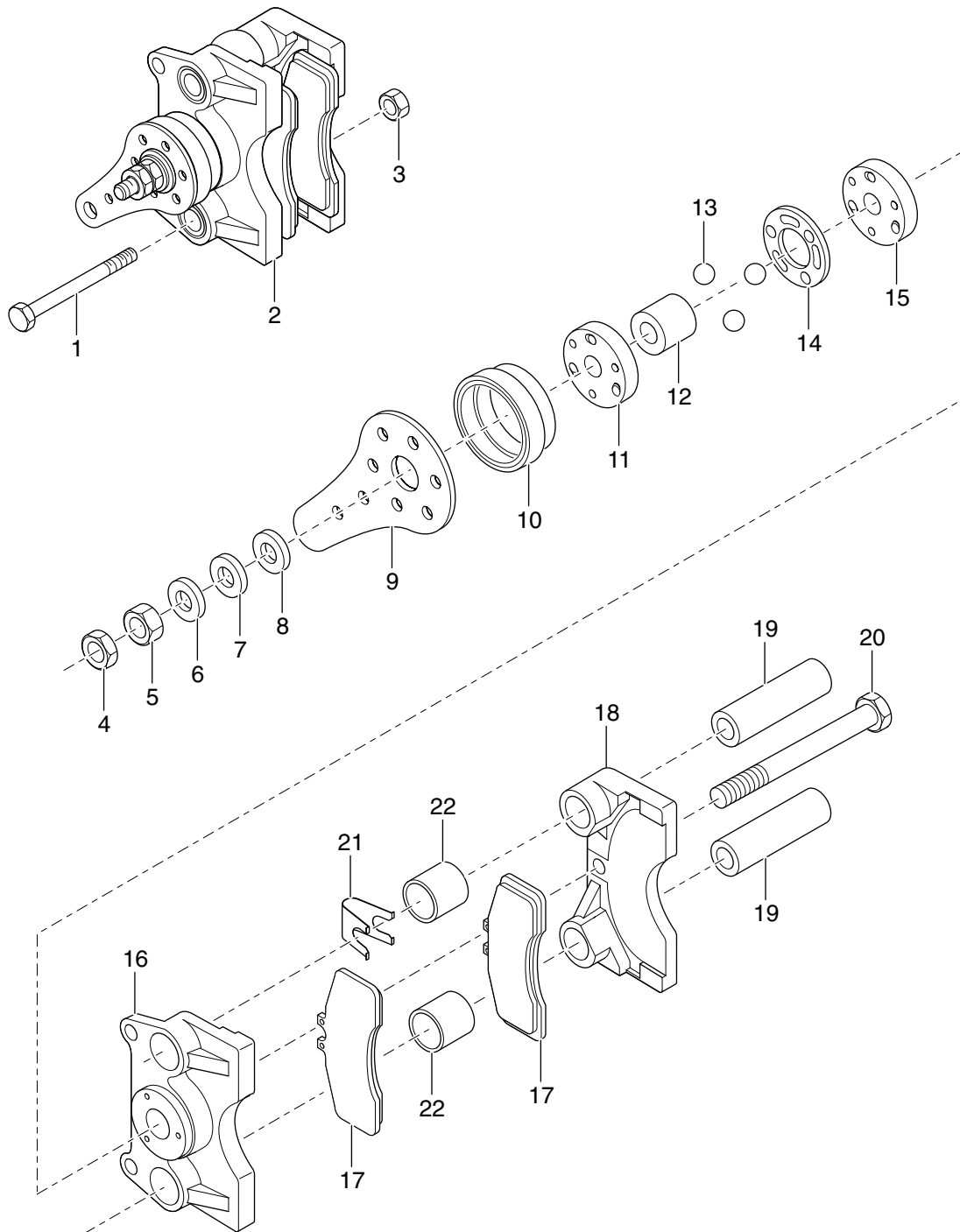
GROUP - OUTPUT SHAFT (FRONT & REAR)

Item	Description	Quantity
1	Shaft - Output	1
2	Bearing - Output shaft	2
3	Sleeve - Oil seal	2
4	"O"-ring - Oil seal sleeve	2
5	Seal - Output shaft oil	2
6	Snap ring - Output shaft bearing	4
7	Snap ring - Gear & bearing retaining	2
8	Flange - Output	1
9	Plug - Flange	1
10	Gear - Output shaft	1



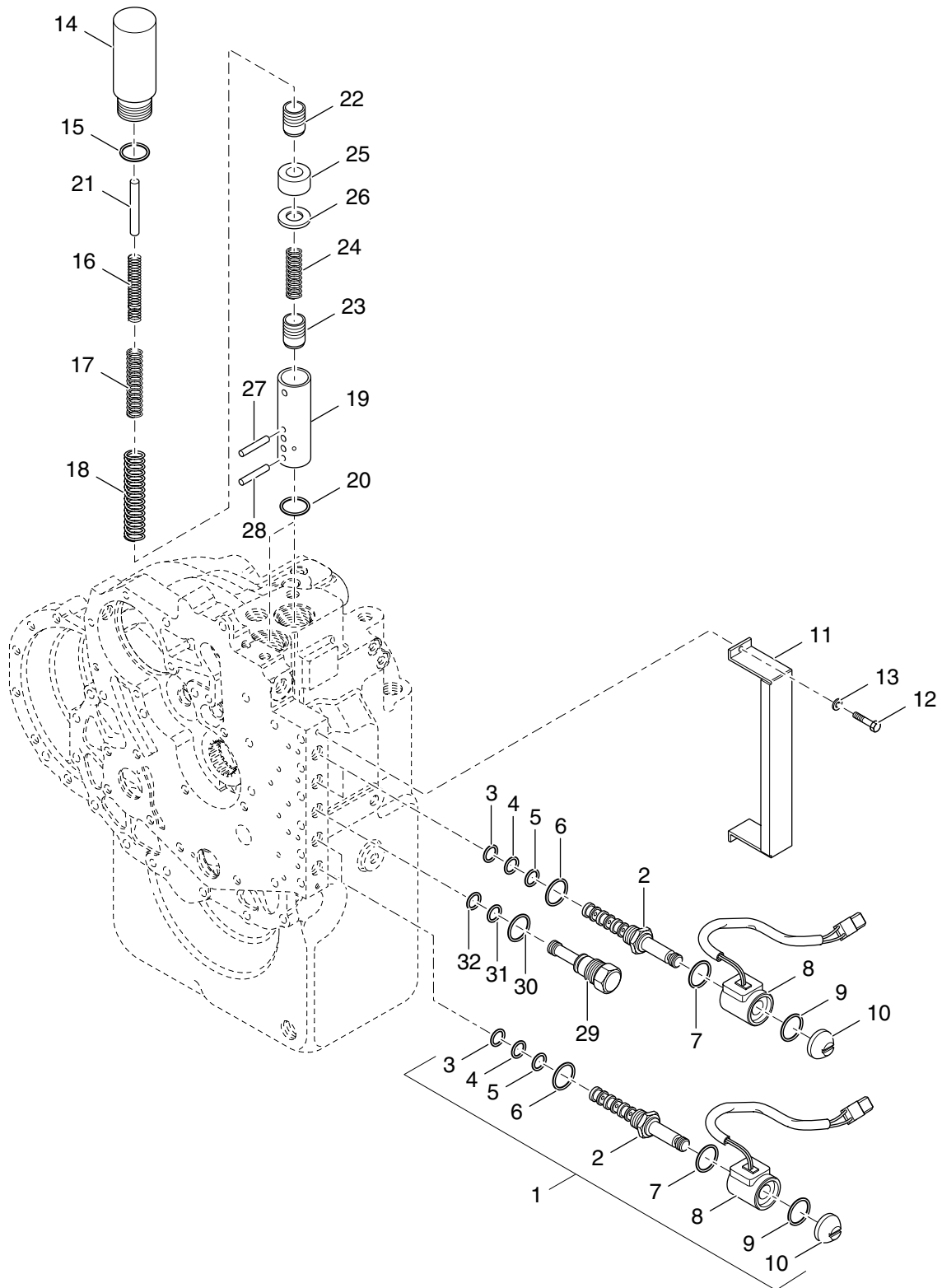
GROUP - DISK BRAKE

Item	Description	Quantity
1	Assembly - Caliper	1
2	Disc - Brake	1
3	Capscrew - Brake disc	4
4	Lockwasher	4
5	Capscrew - Caliper assembly mounting	2
6	Nut - Caliper assembly capscrew locking	2



GROUP - CALIPER ASSEMBLY

Item	Description	Quantity
1	Screw - Brake mounting	2
2	Assembly - Caliper	1
3	Nut - Brake mounting screw	2
4	Nut - Jam adjustment	1
5	Nut - Adjustment	1
6	Washer - Hardened	1
7	Washer - Stainless steel	1
8	Washer - Thrust	1
9	Lever	1
10	Boot	1
11	Cam	1
12	Id seal	1
13	Ball bearing	3
14	Plastic retainer	1
15	Cam	1
16	Torque plate (Front)	1
17	Carrier and lining assembly	2
18	Torque plate (Rear)	1
19	Sleeve mounting	2
20	Bolt - Adjusting	1
21	Spring	1
22	Seal - Sleeve	2

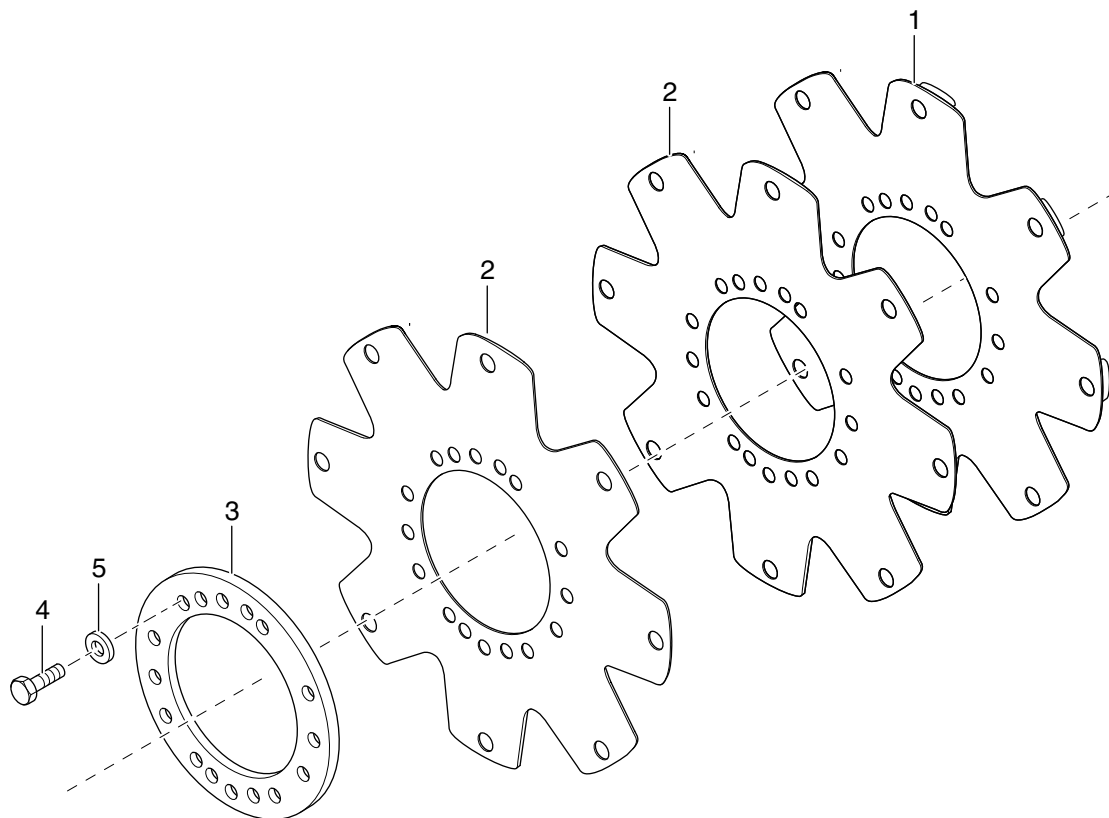


GROUP - ELECTRIC CONTROL

Item	Description	Quantity
1	Assembly - Solenoid cartridge	5*
2	Cartridge - Valve 4-way including items 3, 4, 5 and 6	5*
3	"O"-ring - Cartridge	5*
4	"O"-ring - Cartridge	5*
5	"O"-ring - Cartridge	5*
6	"O"-ring - Cartridge	5*
7	"O"-ring - Cartridge to coil	5*
8	Coil - Solenoid	5*
9	"O"-ring - Coil to nut	5*
10	Nut - Valve cartridge retainer	5*
11	Cover - Protective	1
12	Screw - Protective cover	2
13	Lockwasher - Protective cover screw	2
14	Housing - Modulation valve	2
15	"O"-ring - Modulation housing	2
16	Spring (Inner)	2
17	Spring (Middle)	2
18	Spring (Outer)	2
19	Sleeve - Modulation valve	2
20	"O"-Ring - Sleeve	2
21	Pin - Stop	2
22	Spool - Accumulator	2
23	Spool - Regulator	2
24	Spring - Modulation valve	2
25	Retainer - Spring	2
26	Spacer - Spring	2
27	Pin (Upper)	2
28	Pin (Lower)	2
29	Plug - Solenoid bore plug, used at forward high and low	1**
30	"O"-ring - Plug	1**
31	"O"-ring - Plug	1**
32	"O"-ring - Plug	1**

* - Quantity = 4, with 3-speed.

** - Used with 3-speed only.



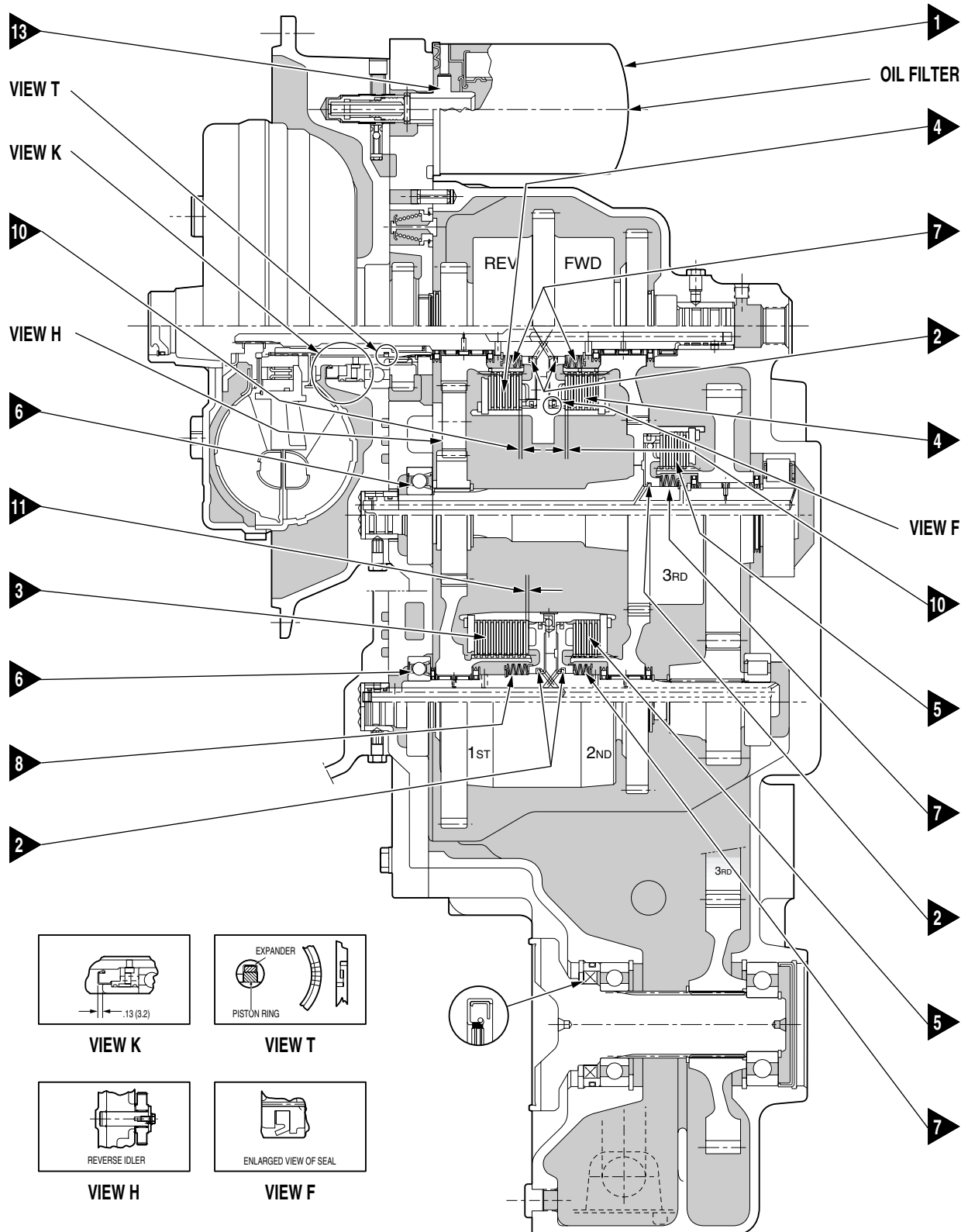
GROUP - DRIVE PLATE

Item	Description	Quantity
1	Assembly - Drive plate and (when used) weld nut	1
2	Plate - Drive	2
3	Ring - Drive plate backing	1
4	Screw - Drive plate mounting	6
5	Lockwasher - Drive plate mounting screw	6

9. ASSEMBLY INSTRUCTIONS

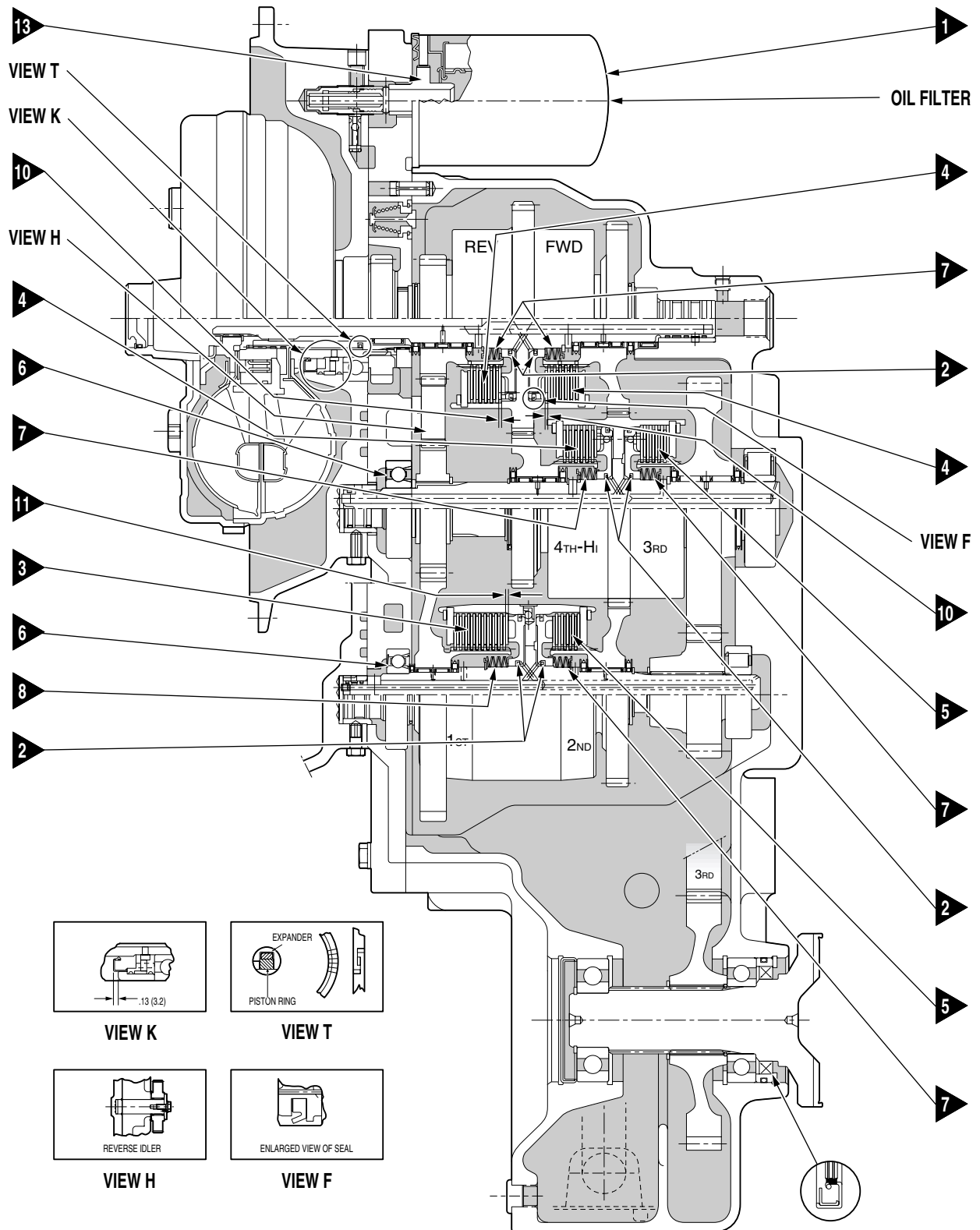
9. ASSEMBLY INSTRUCTIONS (CONTINUED)

3-Speed cross section

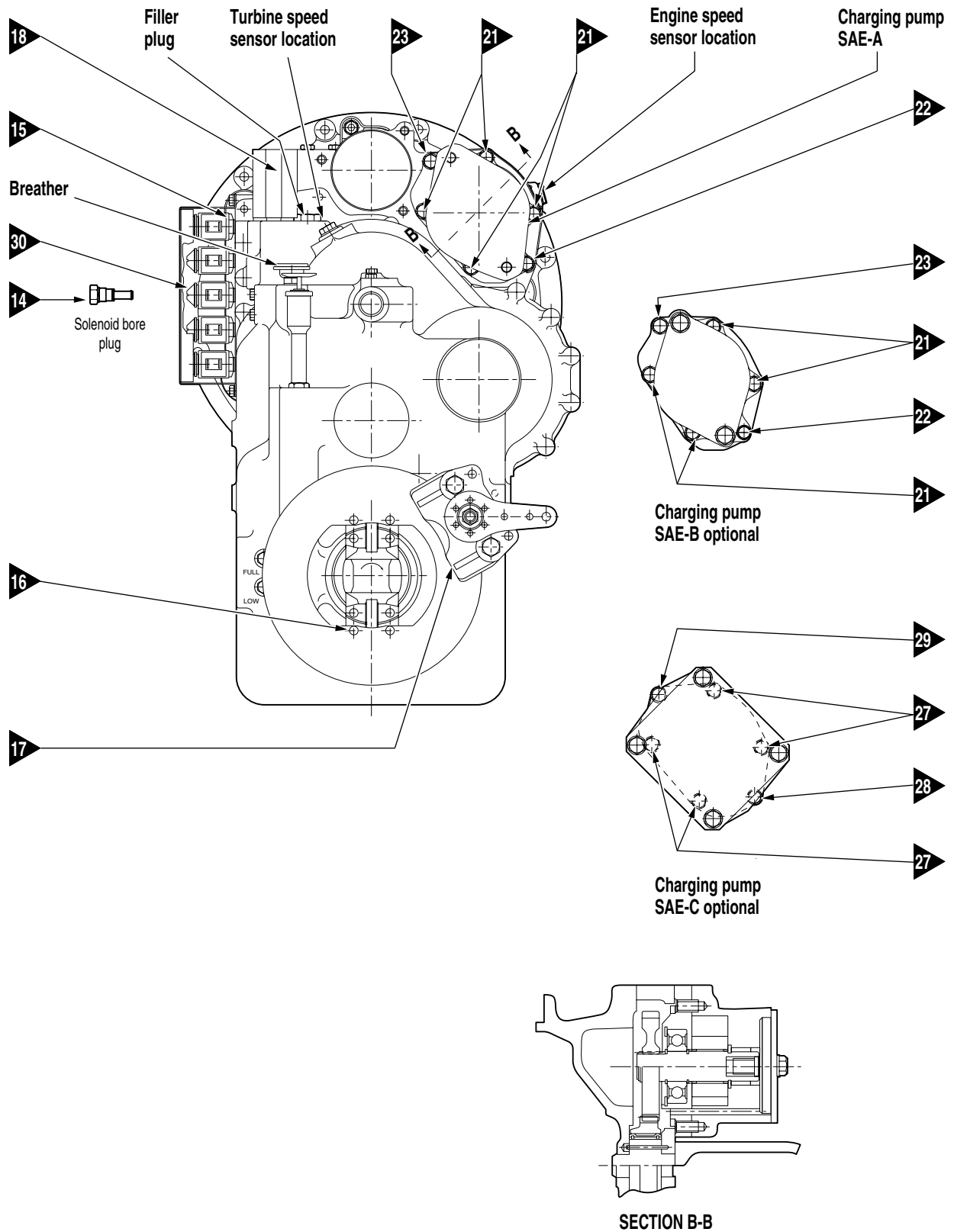


9. ASSEMBLY INSTRUCTIONS (CONTINUED)

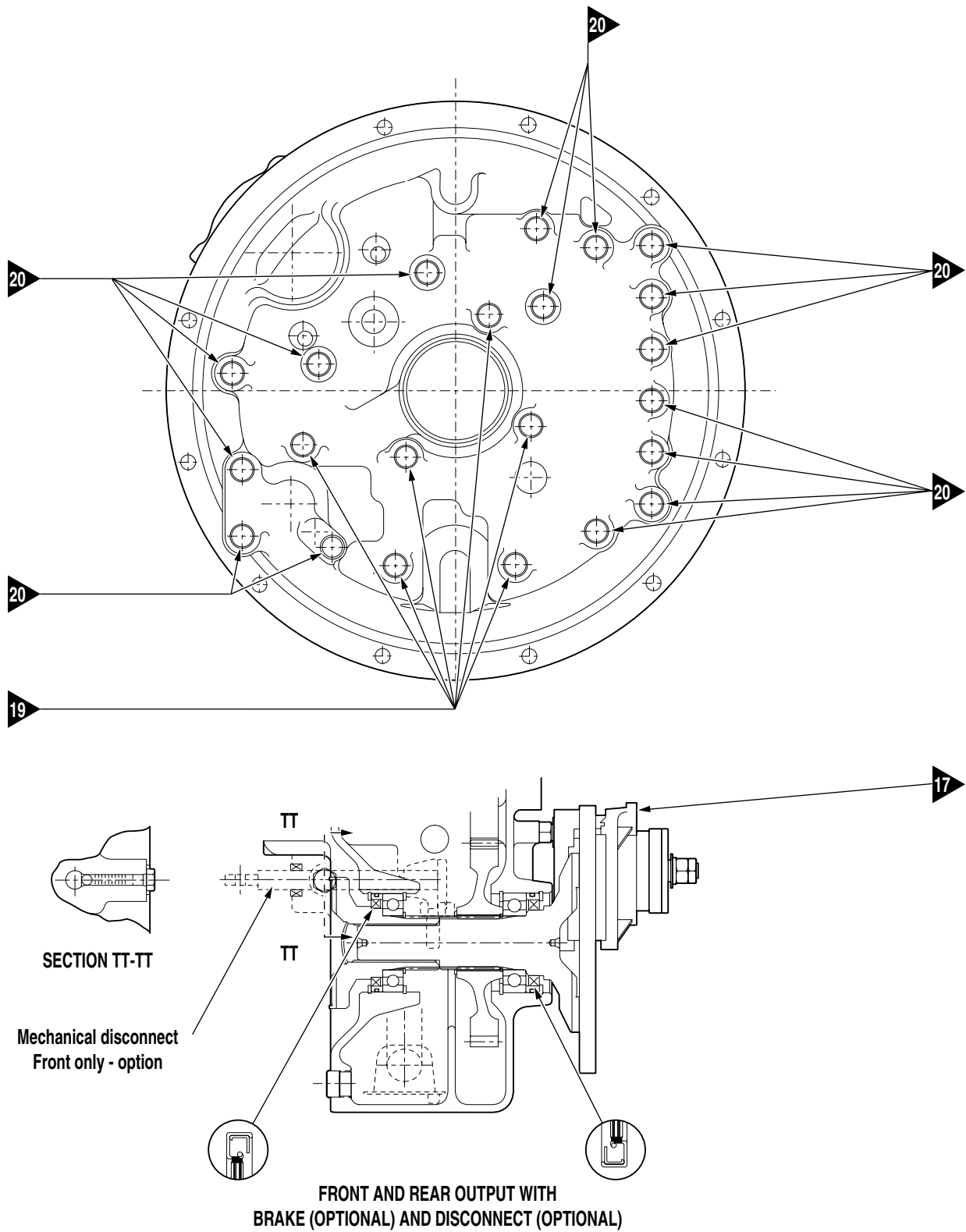
4 and 6-speed cross section



9. ASSEMBLY INSTRUCTIONS (CONTINUED)



9. ASSEMBLY INSTRUCTIONS (CONTINUED)



Assembly instructions

9. ASSEMBLY INSTRUCTIONS (CONTINUED)

Use Permatex and Loctite only where specified.

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

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

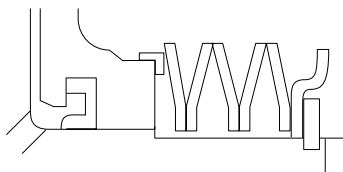
Apply a thin coat of grease between seal lips on lip type seals prior to assembly.

Apply a thin coat of Permatex No. 2 or Loctite No. 641 to O.D. of all oil seals before assembly.

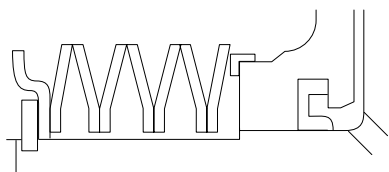
Apply a thin coat of Loctite No. 592 or 506 Dryseal to all pipe plugs.

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

- 1 Assemble oil filter and tighten to 20-25 lbf.ft [27-34 N.m].
- 2 Teflon seals must be sized prior to assembly.
- 3 10 outer steel plates, 10 inner plates, alternately assemble, starting with outer steel plate.
- 4 6 outer steel plates, 6 inner plates, alternately assemble, starting with outer steel plate.
- 5 5 outer steel plates, 5 inner plates, alternately assemble, starting with outer steel plate.
- 6 Shield bearing, assembly with shield as shown.
Add a coating of Loctite 641 to outer diameter of bearings.
- 7 Fwd. ,Rev., 2nd and 3rd. clutch return disc springs. Concave side of first disc spring to be placed against clutch piston wear sleeve. Remaining four springs to be stacked alternately as shown.



- 8 Low clutch return disc springs concave side of first disc spring to be placed against clutch piston wear sleeve. Remaining six springs to be stacked alternately as shown.



- 10 Clearance between clutch piston and steel separator plate to be .048-.108 [1.22-2.74]. If over .108 [2.74] clearance, add one steel outer disc under end plate.

9. ASSEMBLY INSTRUCTIONS (CONTINUED)

- 11** ▶ Clearance between clutch piston and steel separator plate to be .080-.135 [2.03-3.43]. If over .135 [3.43] clearance, add one steel outer disc under end plate.
- 13** ▶ Tighten regulator sleeve to 45-50 lbf.ft [61-68 N.m].
- 14** ▶ Use solenoid bore plug in middle position for 3-speed version only.
- 15** ▶ Solenoid cartridge to be assembled and tightened to 16-20 lbf.ft [22-27 N.m].
- 16** ▶ Apply Loctite No. 243 to thread of disc mounting screws.
- 17** ▶ See page 4-4 for brake information.
- 18** ▶ Tighten modulation valve and inching valve to 60-65 lbf.ft [81-88 N.m].
- 19** ▶ M10 x 1.17 - 1.20. [M10 x 30].
- 20** ▶ M10 x 2.32 - 2.4. [M10 x 60].
- 21** ▶ Use 5/16-18 x 5.00 screw.
- 22** ▶ Use 5/16-18 x 3.500 screw.
- 23** ▶ Use 3/8-16 x 5.00 screw.
- 24** ▶ Use 5/16-18 x 3.250 screw.
- 25** ▶ Use 5/16-18 x 2.00 screw.
- 26** ▶ Use 3/8-18 x 3.250 screw.
- 27** ▶ Use 5/16-24 nut.
- 28** ▶ Use 5/16-24 nut.
- 29** ▶ Use 3/8-24 nut.
- 30** ▶ Tighten all cartridge nuts to 4-5 lbf.ft [5-7 N.m].

10. Disassembly and reassembly of T12000 ID transmission

Disassembly T12000 ID transmission



Figure 1

Side view of T12000 intermediate drop transmission.



Figure 4

Remove torque converter plug retainer ring.



Figure 2

Rear view showing disc brake and electric control.



Figure 5

Remove plug and "O"-ring.

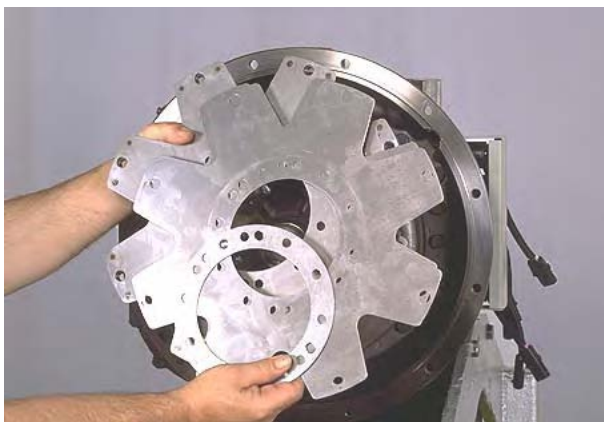


Figure 3

Remove drive plate attaching capscrews and washers. Remove drive plate and backing ring.



Figure 6

Remove torque converter to turbine shaft retainer ring.

Disassembly T12000 ID transmission



Figure 7

Remove torque converter assembly.



Figure 10

Remove charging pump permanent pump hole cover (not used when auxiliary pump is used).



Figure 8

Remove torque converter to shaft locating ring.

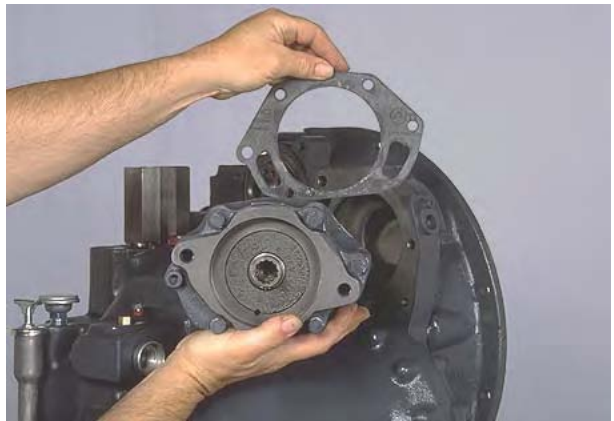


Figure 11

Remove pump mounting bolts and washers. Remove pump and gasket.



Figure 9

Remove filter assembly.



Figure 12

Remove pressure regulator and regulator sleeve.

NOTE: special tool can be fabricated. See Figure 427.



Disassembly T12000 ID transmission



Figure 13
Remove sensor port plug and "O"-ring.



Figure 16
Remove impeller hub gear.



Figure 14
Remove converter housing to transmission case bolts and washers.

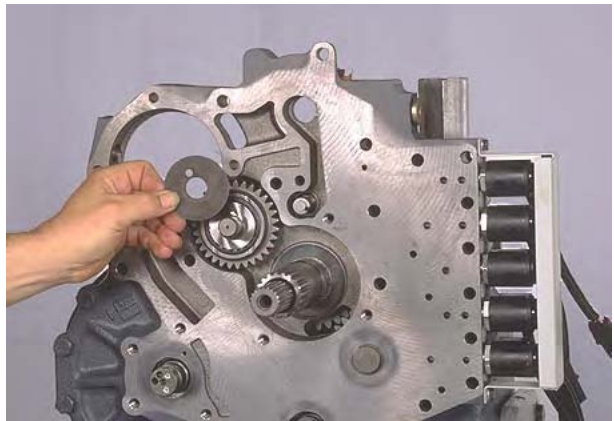


Figure 17
Remove pump drive idler gear washer.

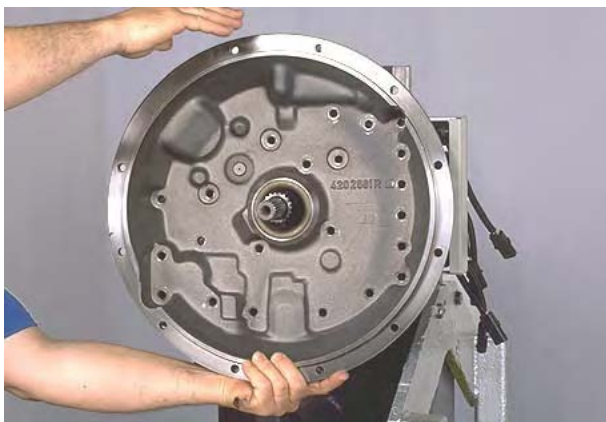


Figure 15
Remove converter housing and gasket.

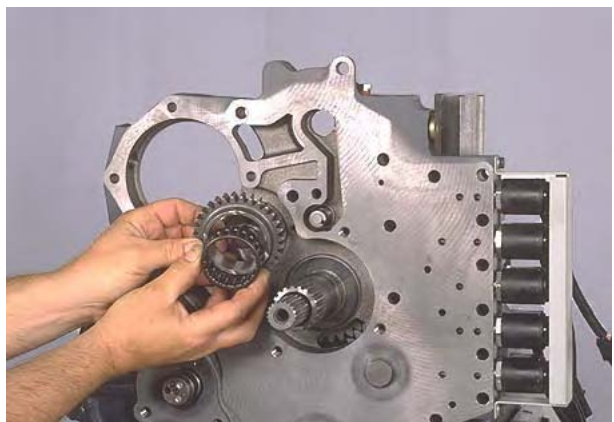


Figure 18
Remove pump drive gear and bearing.

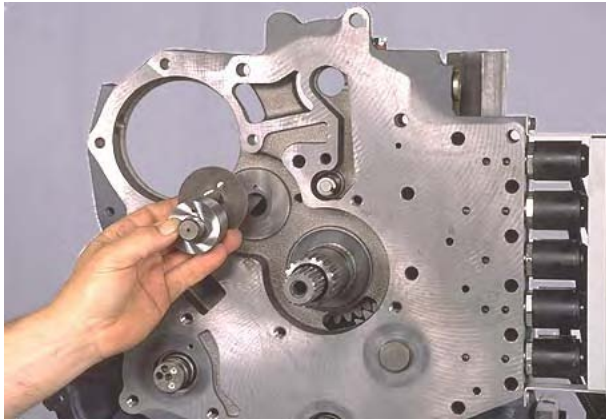


Figure 19

Remove pump drive idler shaft and washer.

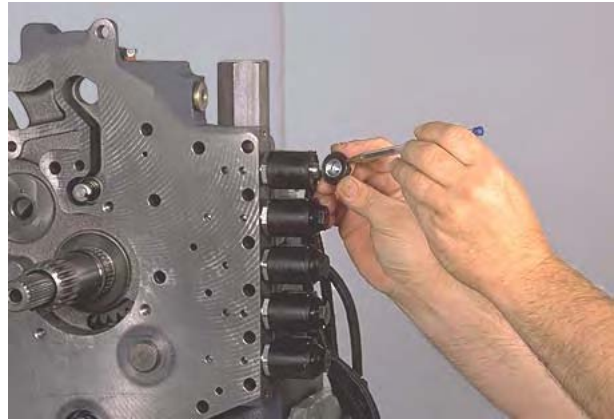


Figure 22

Remove solenoid valve cartridge retainer nut and "O"-ring.

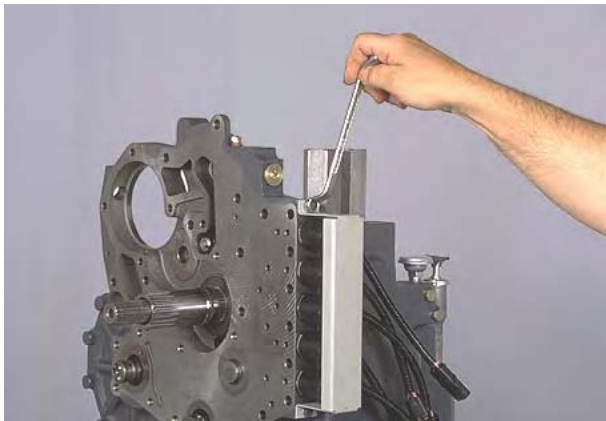


Figure 20

Remove solenoid protection cover screws.

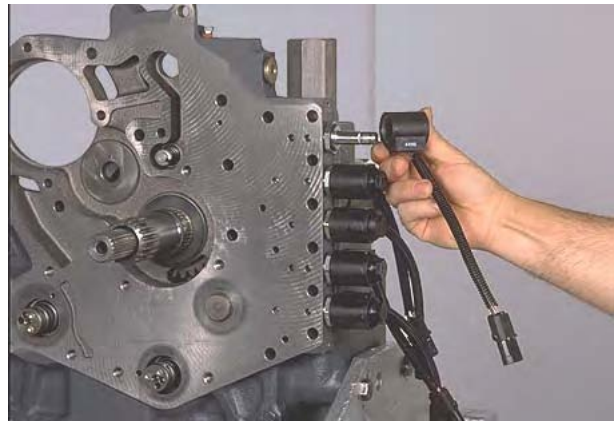


Figure 23

Remove solenoid coil and "O"-ring.

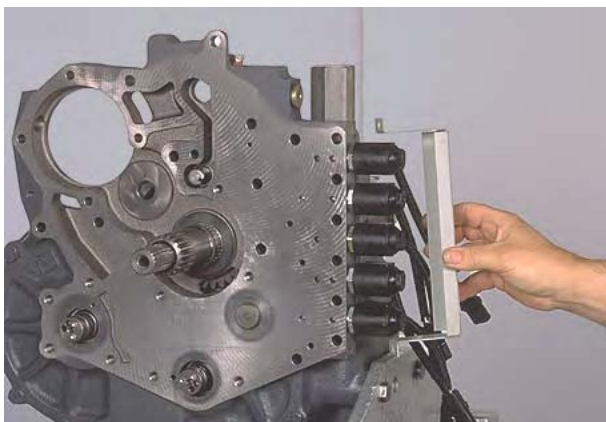


Figure 21

Remove solenoid protection cover .

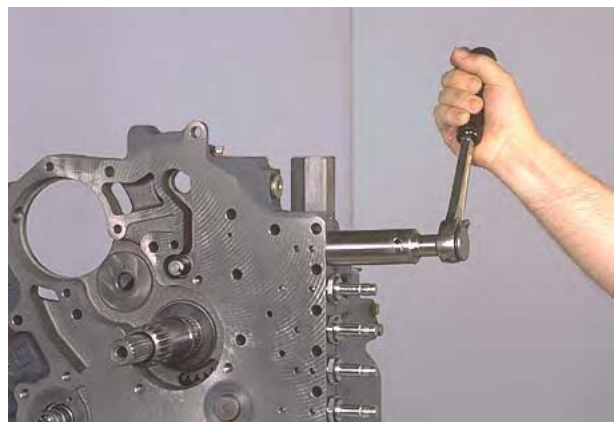


Figure 24

Remove valve cartridge and "O"-ring.

Disassembly T12000 ID transmission

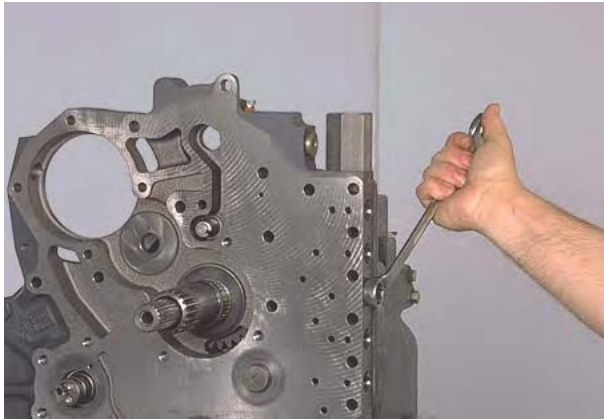


Figure 25

Repeat procedures figures 22 through 25 for remaining solenoid valves.

NOTE: A 3-speed will have a bore plug in the center box. Remove bore plug.



Figure 28

Remove spacer plate and gasket.



Figure 26

Remove spacer plate bolts and washers.



Figure 29

Remove 1st and 2nd clutch assembly.



Figure 27

Pry spacer plate away from transmission case at dowel pin holes.

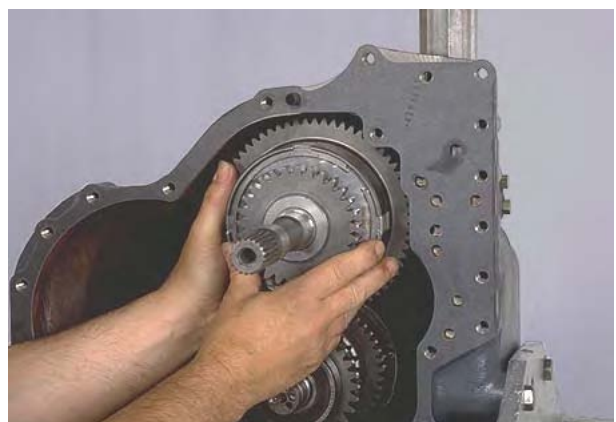


Figure 30

Remove forward and reverse clutch assembly.



Disassembly T12000 ID transmission



Figure 31

Remove high and 3rd clutch assembly.

NOTE: A 3-speed will only have 3rd clutch.



Figure 34

Remove brake caliper assembly.

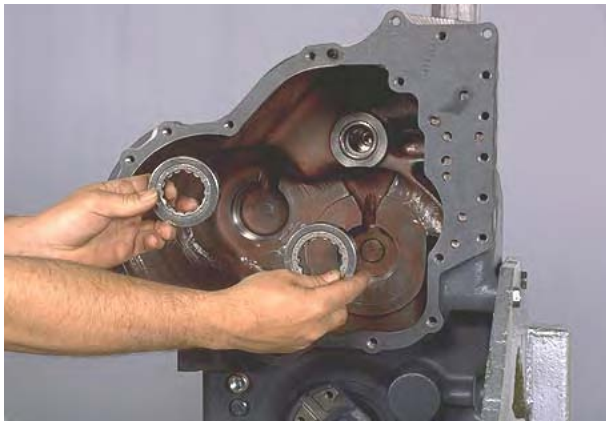


Figure 32

Remove clutch shaft rear bearing outer races.



Figure 35

Turn front output flange as shown. Remove retainer ring from ring groove and pry output flange from housing.



Figure 33

Remove brake disc assembly bolts from brake and housing.

NOTE: brake is an option and will not be on all units.



Figure 36

Output flange, oil seal sleeve and front bearing removed.



Disassembly T12000 ID transmission



Figure 37
Remove bearing locating ring.



Figure 40
Flange removed.
NOTE: brake disc is optional and was removed with flange.



Figure 38
Remove output gear to shaft retainer ring.



Figure 41
Remove output gear.



Figure 39
Tap output shaft and flange from housing.



Figure 42
Remove flange oil seal sleeve retainer ring.



Figure 43
Remove sleeve and "O"-ring.



Figure 46
Remove modulator valve housing.
NOTE: for single modulation and hydraulic inching.
See section 11.1.



Figure 44
Remove output shaft rear bearing.



Figure 47
Remove inner, middle and outer springs.
Remove valve stop pin and accumulator spool.
Remove regulator spool and sleeve assembly.



Figure 45
Remove bearing locating ring.



Figure 48
Remove sensor hole plug and "O"-ring.

Disassembly T12000 ID transmission



Figure 49
Remove dipstick and dipstick tube.

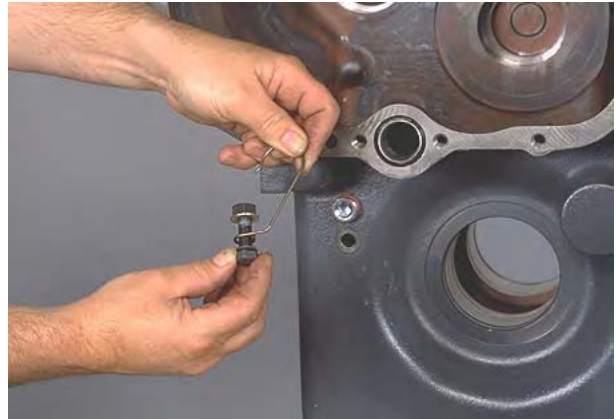


Figure 52
Tube retainer, screw, sealwasher, clip, washer and nut removed as shown.



Figure 50
Remove air breather.



Figure 53
Remove supply tube "O"-ring.



Figure 51
Remove supply tube retainer screw.



Figure 54
Remove supply tube and screen assembly.



Figure 55

Remove oil sleeve distributor lock screw plug.
Remove lock screw.

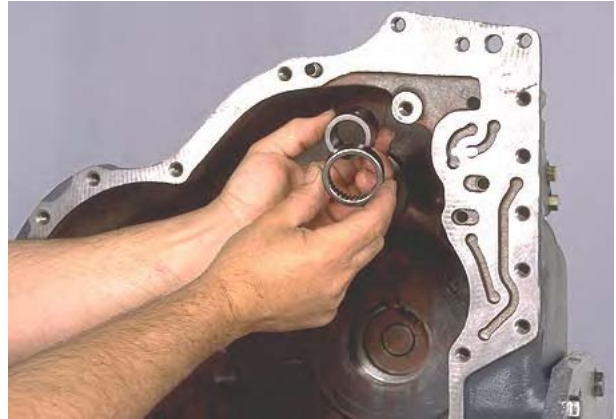


Figure 58

Pilot bearing and oil distributor sleeve removed.



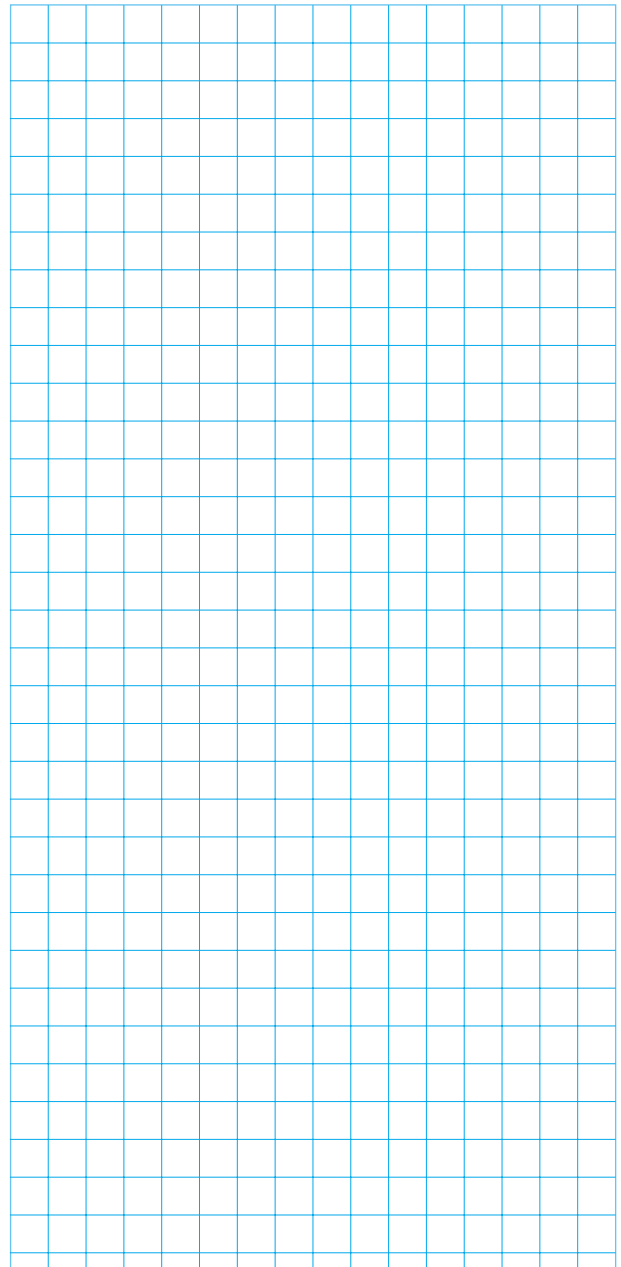
Figure 56

Use a hammer puller as shown to remove distributor sleeve.



Figure 57

Sleeve being removed. Remove pilot bearing.



Disassembly low (1st) clutch



Figure 59
Remove clutch shaft oil sealing rings.



Figure 62
Remove clutch gear and disc hub.

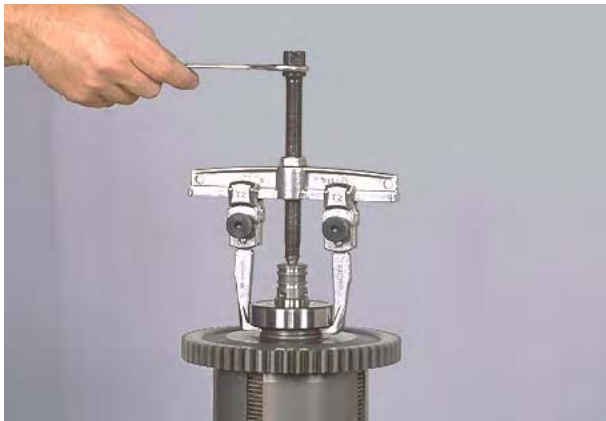


Figure 60
Remove front bearing.



Figure 63
Clutch gear and pilot bearings removed.



Figure 61
Remove outer thrust washer, bearing and inner thrust washer.



Figure 64
Remove outer thrust washer, thrust bearing and inner thrust washer.

Disassembly low (1st) clutch



Figure 65
Remove clutch disc end plate retainer ring.



Figure 68
Compress disc springs and remove retainer ring.



Figure 66
Remove clutch disc end plate.



Figure 69
Remove retainer ring.



Figure 67
Remove inner and outer clutch discs.



Figure 70
Remove retainer ring retainer.

Disassembly low (1st) clutch



Figure 71

Remove disc spring.

NOTE: See page 10-85.



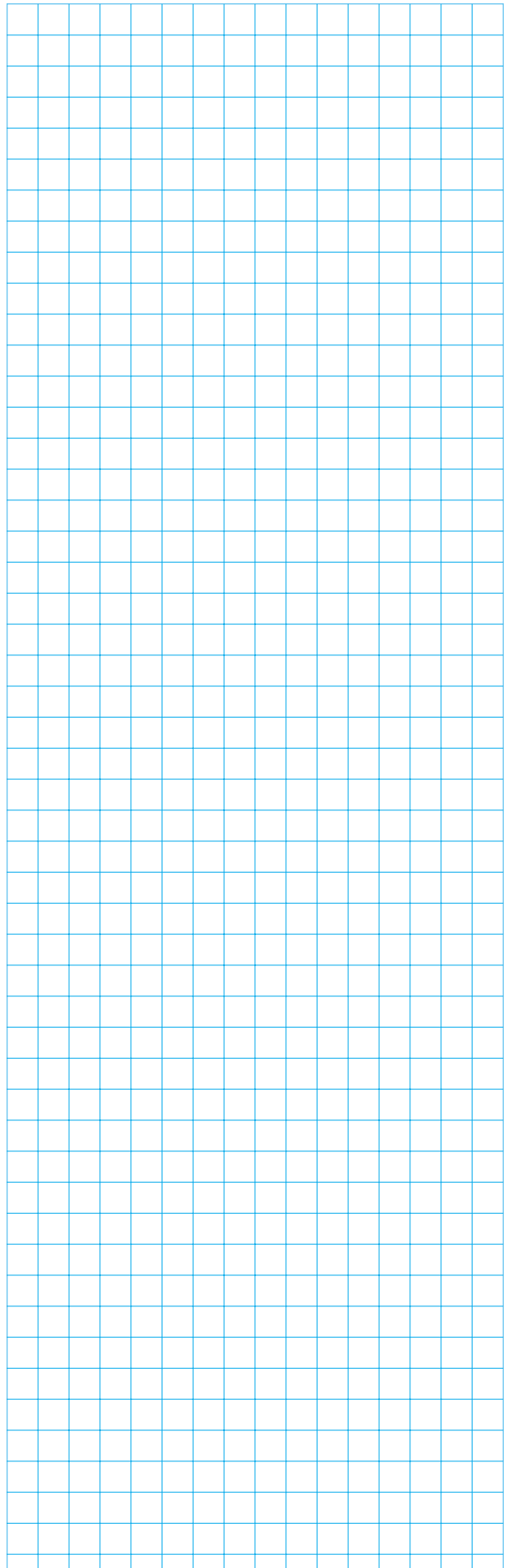
Figure 72

Remove clutch piston wear plate.



Figure 73

Turn clutch over and tap clutch shaft on a block of wood to remove clutch piston.



Disassembly 2nd clutch



Figure 74
Remove clutch shaft rear bearing outer race.



Figure 77
Remove gear from shaft.



Figure 75
Using a gear puller as shown, remove gear and rear bearing inner race.



Figure 78
Remove gear locating ring from shaft.



Figure 76
Remove inner race from shaft.



Figure 79
Remove thrust bearing and clutch gear retainer ring.

Disassembly 2nd clutch



Figure 80

Remove outer thrust washer, thrust bearing and inner thrust washer.



Figure 83

Remove clutch disc and end plate retainer ring.



Figure 81

Remove clutch gear and hub and gear bearings.



Figure 84

Remove end plate.



Figure 82

Remove outer thrust washer, thrust bearing and inner thrust washer.

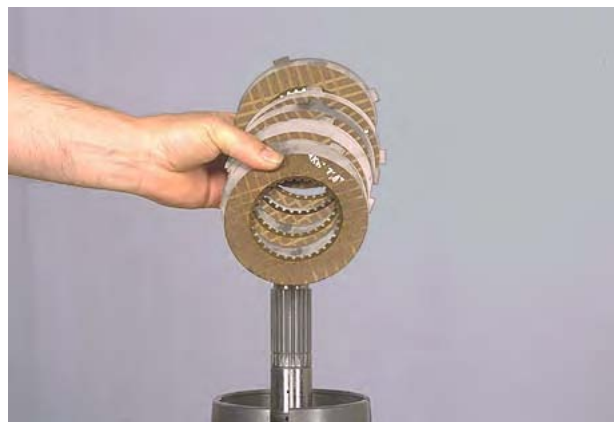


Figure 85

Remove inner and outer clutch discs.

Disassembly 2nd clutch



Figure 86
Compress disc springs and remove retainer ring.



Figure 89
Remove disc springs.
NOTE: see page 10-85.



Figure 87
Remove retainer ring.



Figure 90
Remove clutch piston wear plate.



Figure 88
Remove retainer ring retainer.



Figure 91
Remove clutch piston.

Reassembly 1st clutch



Figure 92

The two bleed valves in the clutch drum must be clean and free of any foreign material. Refer to the "Cleaning and inspection" pages. Install clutch piston outer seal ring.



Figure 95

Position clutch piston wear plate on piston.



Figure 93

Install clutch piston inner seal ring.

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



Figure 96

Install piston return disc springs. First spring with large diameter of bevel toward wear plate. Alternate seven (7) springs. **NOTE:** see page 10-85.



Figure 94

Position piston in low clutch drum as shown. Use caution as not to damage inner and outer piston sealing rings.



Figure 97

Position return spring retainer on clutch shaft.

Reassembly 1st clutch



Figure 98

Start ring on shaft with snap ring pliers.



Figure 101

Install first friction (inner) clutch disc.
Alternate steel and friction until ten (10) steel and ten (10) friction discs are in position.



Figure 99

Use a sleeve with the proper inner diameter to fit over shaft and against retainer ring. A sharp blow with a soft hammer will compress springs and seat retainer ring. Be sure ring is in full position in groove.



Figure 102

Install clutch disc end plate.



Figure 100

Install first steel outer clutch disc.



Figure 103

Install end plate retainer ring.

Reassembly 1st clutch

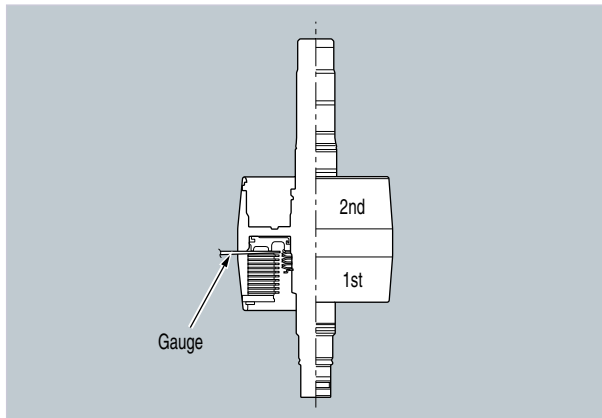


Figure 104

NOTE: Low (1st) clutch pack must be checked for clutch disc clearance. Stand the clutch assembly on end. The clutch discs on the bottom will fall to the end plate. Measure the distance between the clutch piston and the first steel disc by inserting a feeler gauge or taper gauge through the slots in the clutch drum. The required clearance is .080-.135 [2.03-3.43]. If the clearance is greater than .135 [3.43], add one steel disc under the end plate.



Figure 107

Install outer thrust bearing washer against bearing.



Figure 105

Position thrust bearing inner washer on clutch shaft.



Figure 108

Press bearings in clutch gear and disc hub, being certain bearings are pressed flush with face of gear on both sides.



Figure 106

Position thrust bearing on clutch shaft against inner thrust bearing washer.



Figure 109

Install clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs.

Be sure the clutch hub is in full position in the clutch assembly. Do not force this operation.



Reassembly 1st clutch



Figure 110

Position inner thrust washer on shaft.



Figure 113

Install clutch shaft front bearing.

NOTE: bearing has a shield in it.
This shield must be up.



Figure 111

Position thrust bearing on shaft.



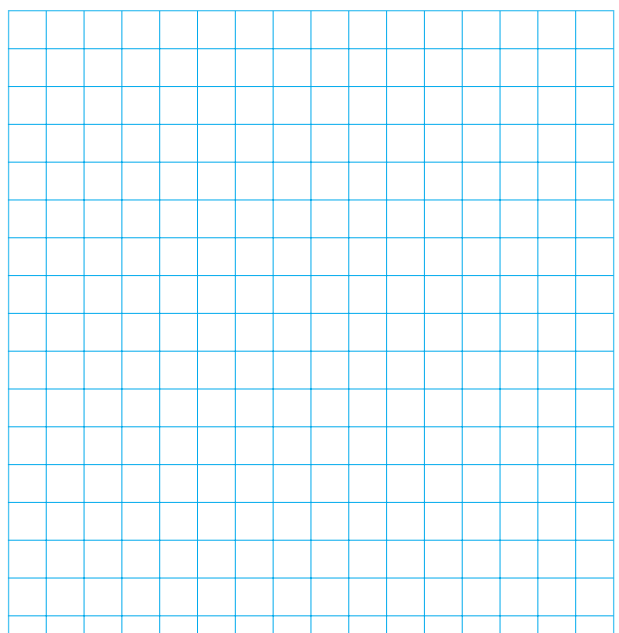
Figure 114

Install clutch shaft oil sealing rings.
Grease rings to facilitate reassembly into front housing.



Figure 112

Position outer thrust washer on shaft.



Reassembly 2nd clutch



Figure 115

Install inner and outer clutch piston seal rings. Size inner ring as explained in figure 93. Refer to the cleaning and inspection pages.



Figure 118

Install piston return disc springs. First spring with large diameter of bevel towards wear plate. Alternate (5) springs. **NOTE:** see page 10-85.



Figure 116

Position piston in clutch drum, using caution as not to damage piston sealing rings.



Figure 119

Position return spring ring retainer on clutch shaft.



Figure 117

Install clutch piston wear plate.



Figure 120

Start ring on shaft with snap ring pliers.

Reassembly 2nd clutch



Figure 121

Use a sleeve with the proper inner diameter to fit over shaft and against retainer ring. A sharp blow with a shaft hammer will compress springs and seat retainer ring. Be sure ring is in full position in groove.



Figure 124

Install clutch disc end plate.



Figure 122

Install first steel (outer) clutch disc.



Figure 125

Install end plate retainer ring.



Figure 123

Install first friction (inner) clutch disc. Alternate steel and friction until five (5) steel and five (5) friction discs are in position.



Figure 126

Position thrust bearing inner washer on clutch shaft.

Reassembly 2nd clutch



Figure 127

Position thrust bearing on clutch shaft against inner thrust bearing washer.



Figure 130

Install the clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Be sure the clutch hub is in full position in the clutch assembly. Do not force this operation.



Figure 128

Install outer thrust bearing washer against thrust bearing.



Figure 131

Position thrust bearing inner washer on clutch shaft.



Figure 129

Press needle bearings in clutch gear and disc hub, being certain bearings are pressed with face of gear on both sides.



Figure 132

Position thrust bearing on clutch shaft against inner thrust bearing washer.

Reassembly 2nd clutch



Figure 133

Install outer thrust bearing washer against bearing.



Figure 136

Install clutch shaft gear on clutch shaft with long hub of gear down.



Figure 134

Install thrust washer retainer ring.



Figure 137

Install rear bearing inner race on clutch shaft with bearing race shoulder down.



Figure 135

Install clutch shaft gear locating ring.



Figure 138

Position rear bearing on bearing race.



Figure 139

Remove clutch shaft oil sealing rings.

NOTE: The 4th clutch is only used on the 4 and 6 speed models.



Figure 140

Using a gear puller as shown, remove first drive gear and front bearing.



Figure 141

Remove first drive gear locating ring.
For 3-speed models, proceed to figure 155.

Disassembly 4th (high) clutch



Figure 142
Remove outer thrust washer retainer ring.



Figure 145
Remove bearings and spacer from clutch gear.



Figure 143
Remove outer washer, thrust bearing and inner thrust washer.



Figure 146
Remove outer thrust washer, thrust bearing and inner thrust washer.



Figure 144
Remove clutch gear and disc hub.



Figure 147
Remove end plate retainer ring.

Disassembly 4th (high) clutch



Figure 148
Remove end plate.



Figure 151
Remove retainer ring retainer.

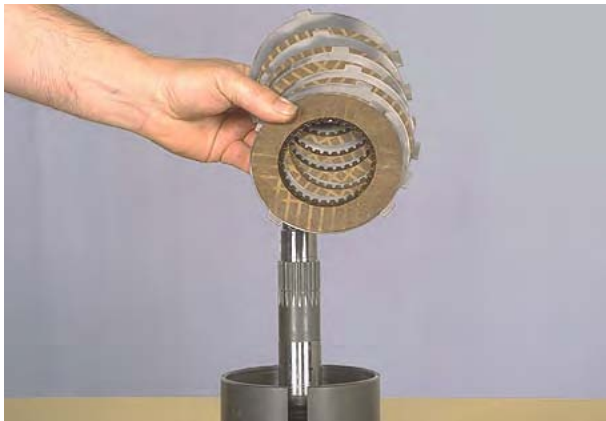


Figure 149
Remove clutch discs.



Figure 152
Remove disc springs.
NOTE: see page 10-85.



Figure 150
Compress disc springs and remove retainer ring.



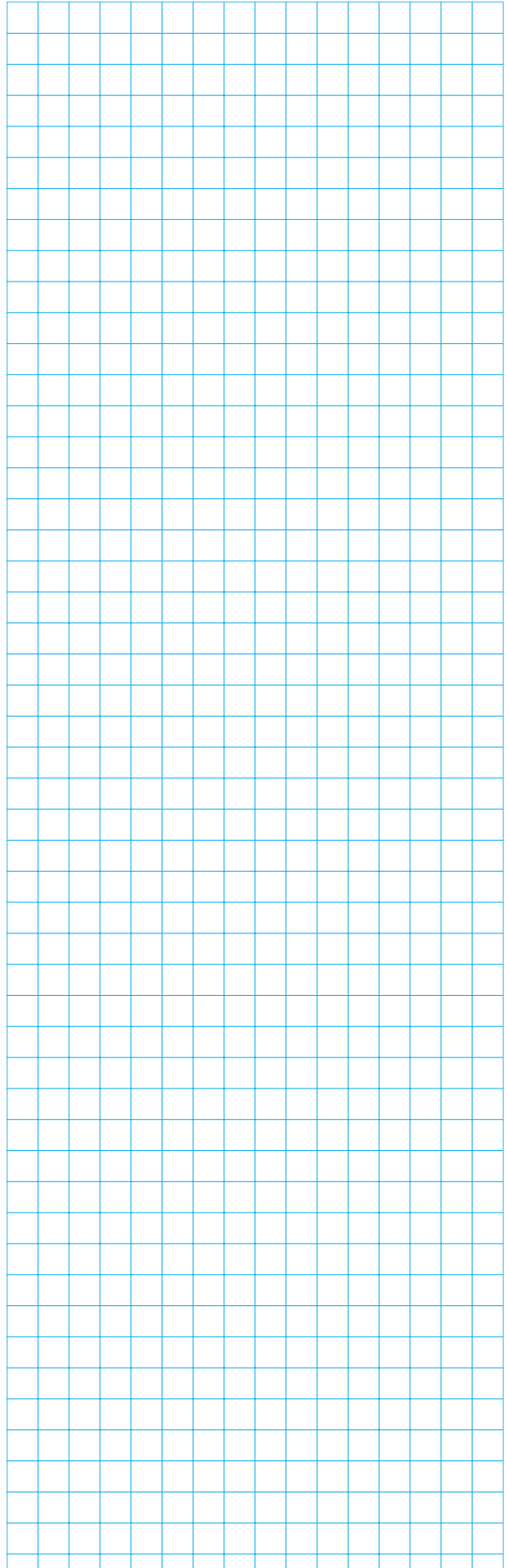
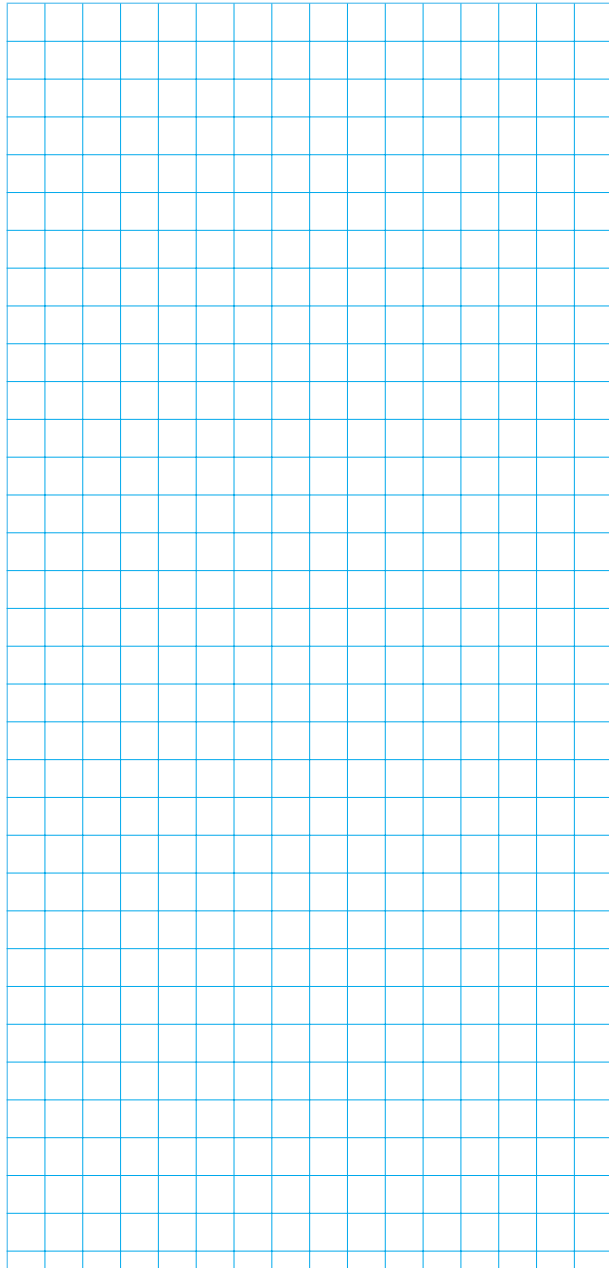
Figure 153
Remove clutch piston wear plate.

Disassembly 4th (high) clutch



Figure 154

Remove clutch piston.



Disassembly 3rd clutch



Figure 155

Remove clutch shaft rear bearing outer race.



Figure 158

Remove outer thrust washer, thrust bearing and inner thrust washer.

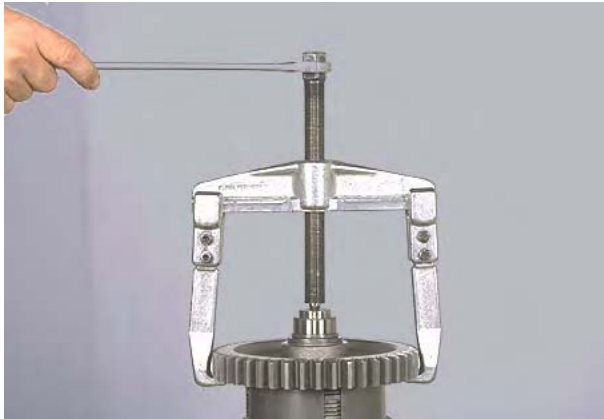


Figure 156

Use gear puller to remove clutch gear and bearing inner race.



Figure 159

Remove clutch gear and hub and gear bearings.



Figure 157

Remove clutch shaft rear bearing inner race.



Figure 160

Remove outer thrust washer, thrust bearing and inner thrust washer.

Disassembly 3rd clutch



Figure 161
Remove end plate retainer ring.



Figure 164
Compress disc springs and remove retainer ring.



Figure 162
Remove end plate.



Figure 165
Remove retainer ring retainer.



Figure 163
Remove clutch discs.



Figure 166
Remove disc springs.
NOTE: See page 10-85.

Disassembly 3rd clutch



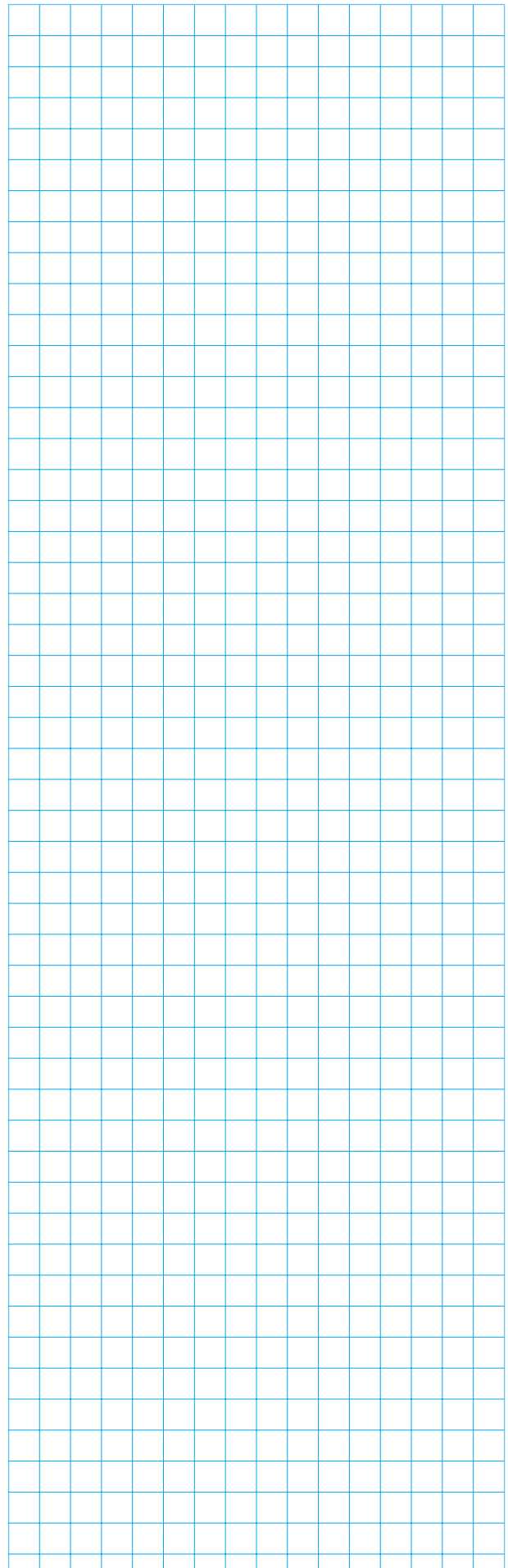
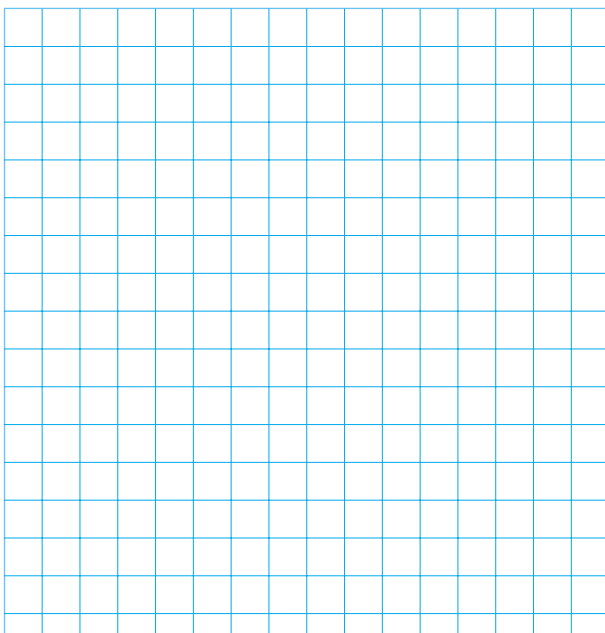
Figure 167

Remove clutch piston wear plate.



Figure 168

Remove clutch piston.



Reassembly 4th clutch



Figure 169

Clutch piston bleed ball must be clean and free of any foreign material. Refer to the cleaning and inspection page. For the 3-speed version, proceed to figure 189



Figure 172

Install piston return disc springs. First spring with large diameter of bevel towards wear plate. Alternate five (5) springs. **NOTE:** see page 10-85.



Figure 170

Install inner and outer clutch piston seal rings. Size inner ring as explained in figure 93. Install clutch piston in clutch drum. Use caution as not to damage sealing rings.



Figure 173

Position return spring ring retainer on clutch shaft.



Figure 171

Install clutch piston wear plate.



Figure 174

Start ring on shaft with snap ring pliers.

Reassembly 4th clutch



Figure 175

Use a sleeve with the proper inner diameter to fit over shaft and against retainer ring. A sharp blow with a soft hammer will compress springs and seat retainer ring; be sure ring is in full position in groove.



Figure 178

Install clutch disc end plate.



Figure 176

Install first steel (outer) clutch disc.



Figure 179

Install end plate retainer ring.



Figure 177

Install first friction (inner) clutch disc. Alternate steel and friction until six (6) steel and six (6) friction discs are in position.

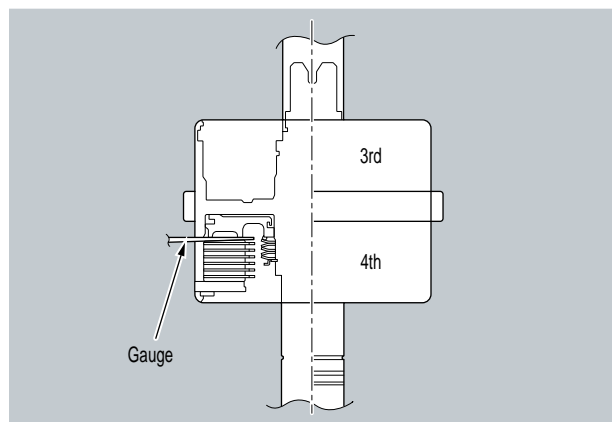


Figure 180

NOTE: 4th (high) clutch pack must be checked for clutch disc clearance. Stand the clutch assembly on end. The clutch discs on the bottom will fall to the end plate. Measure the distance between the clutch piston and the first steel disc by inserting a feeler gauge or taper gauge through the slots in the clutch drum. The required clearance is .048-.108 [1,22-2,74]. If the clearance is greater than .108 [2,74], add one steel disc under the end plate.



Reassembly 4th clutch



Figure 181

Position thrust bearing inner washer on clutch shaft.



Figure 184

Press one bearing in clutch gear. Install bearing spacer next to bearing. Press second bearing in gear, being certain bearings are pressed flush with face of gears on both sides. Install the clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Be sure the clutch hub is in full position in the clutch assembly. Do not force this operation.



Figure 182

Position thrust bearing on clutch shaft against inner thrust bearing washer.



Figure 185

Position thrust washer on shaft.



Figure 183

Install outer thrust bearing washer against bearing.



Figure 186

Position thrust bearing on shaft.

Reassembly 4th clutch



Figure 187

Position thrust washer on shaft.



Figure 190

Position gear on clutch shaft.



Figure 188

Install thrust washer retainer ring

NOTE: 3-speed clutch drum not as shown.



Figure 191

Install clutch shaft front bearing. Note bearing has a shield in it. This shield must be up.



Figure 189

Install clutch shaft gear locating ring.



Figure 192

Install clutch shaft oil sealing rings. Grease rings to facilitate reassembly into front housing.



Reassembly 3rd clutch



Figure 193

Clutch piston bleed ball must be clean and free of any foreign material. Refer to the cleaning and inspection pages.



Figure 196

Install piston return disc springs. First spring with large diameter of bevel towards wear plate. Alternate five (5) springs. **NOTE:** see page 10-85.



Figure 194

Install inner and outer clutch piston seal rings. Size inner ring as explained in figure 93. Install clutch piston in clutch drum. Use caution as not to damage sealing rings.



Figure 197

Position return spring ring retainer on clutch shaft.



Figure 195

Install clutch piston wear plate.



Figure 198

Start ring on shaft with snap ring pliers.

Reassembly 3rd clutch



Figure 199

Use a sleeve with the proper inner diameter to fit over shaft and against retainer ring. A sharp blow with a soft hammer will compress springs and retainer ring; be sure ring is in full position in groove.

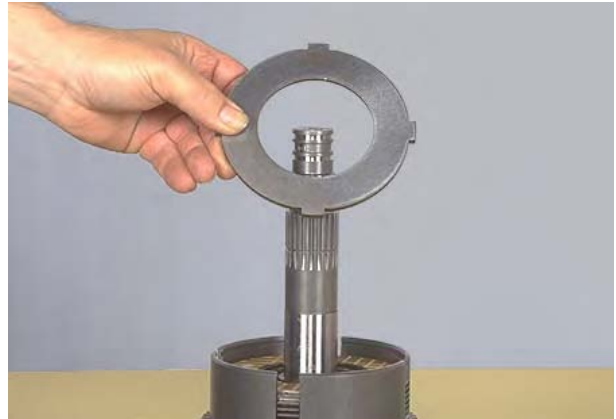


Figure 202

Install clutch disc end plate.



Figure 200

Install first steel (outer) clutch disc.



Figure 203

Install end plate retainer ring.



Figure 201

Install first friction (inner) clutch disc. Alternate steel and friction until five (5) steel and five (5) friction discs are in position.



Figure 204

Position thrust bearing inner washer on clutch shaft.

Reassembly 3rd clutch



Figure 205

Position thrust bearing on clutch shaft against inner thrust bearing washer.



Figure 208

Install clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Be sure the clutch hub is in full position in the clutch assembly. Do not force this operation.



Figure 206

Install outer thrust bearing washer against thrust bearing.



Figure 209

Position thrust bearing inner washer on clutch shaft.



Figure 207

Press needle bearings in clutch gear and disc hub, being certain bearings are pressed flush with face of gear on both sides.



Figure 210

Position thrust bearing on clutch shaft against inner thrust bearing washer.

Reassembly 3rd clutch



Figure 211

Install outer thrust bearing washer against thrust bearing.



Figure 212

Install clutch shaft rear bearing inner race.



Figure 213

Install clutch shaft rear bearing outer race.

Disassembly reverse clutch



Figure 214

Remove outer thrust washer, thrust bearing and inner thrust washer. **Note:** a 3-speed transmission will not have external gear teeth on the forward and reverse clutch drum.



Figure 217

Remove outer thrust washer, thrust bearing and inner thrust washer.



Figure 215

Remove clutch gear and disc hub.



Figure 218

Remove end plate retainer ring.



Figure 216

Remove bearings and spacer from clutch gear.



Figure 219

Remove end plate.

Disassembly reverse clutch



Figure 220
Remove clutch discs.



Figure 223
Remove disc springs.
NOTE: see page 10-85.



Figure 221
Compress disc springs and remove retainer ring.



Figure 224
Remove clutch piston wear plate.



Figure 222
Remove retainer ring retainer.



Figure 225
Remove clutch piston.

Disassembly forward clutch



Figure 226
Remove clutch shaft oil sealing rings.



Figure 229
Remove bearings and spacer from clutch gear.



Figure 227
Remove outer thrust washer, thrust bearing and inner thrust washer.



Figure 230
Remove outer thrust washer, thrust bearing and inner thrust washer.



Figure 228
Remove clutch gear and disc hub.



Figure 231
Remove end plate retainer ring.

Disassembly forward clutch



Figure 232
Remove end plate.



Figure 235
Remove retainer ring retainer.



Figure 233
Remove clutch discs.



Figure 236
Remove disc springs.
NOTE: see page 10-85.



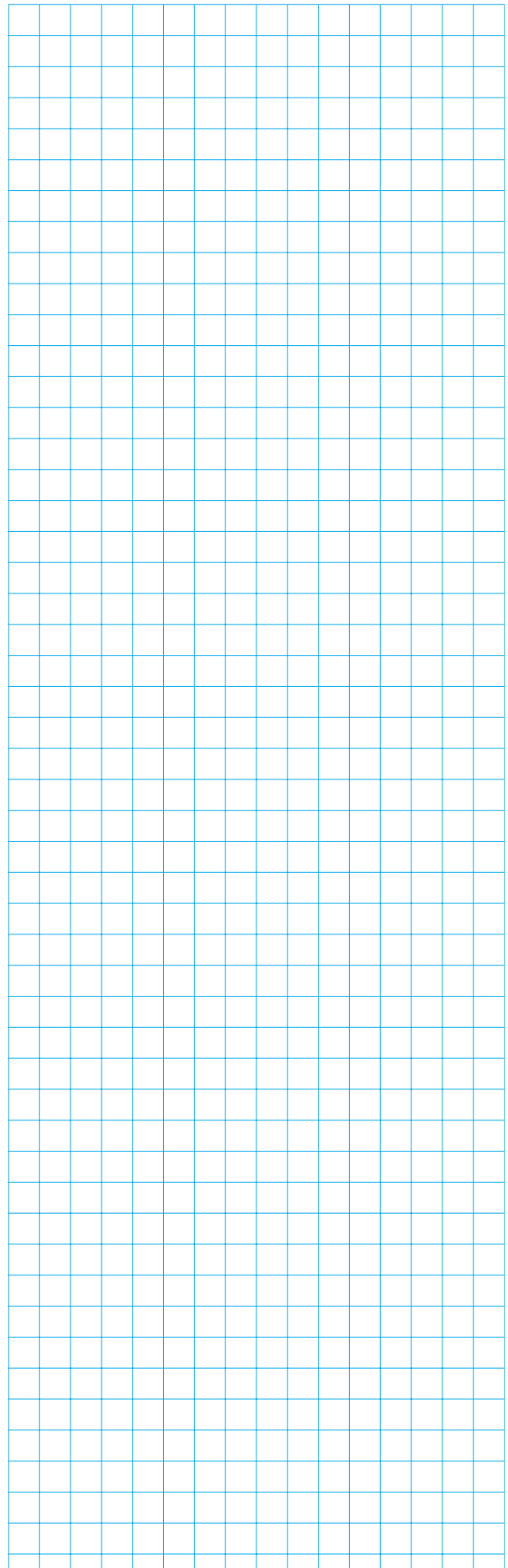
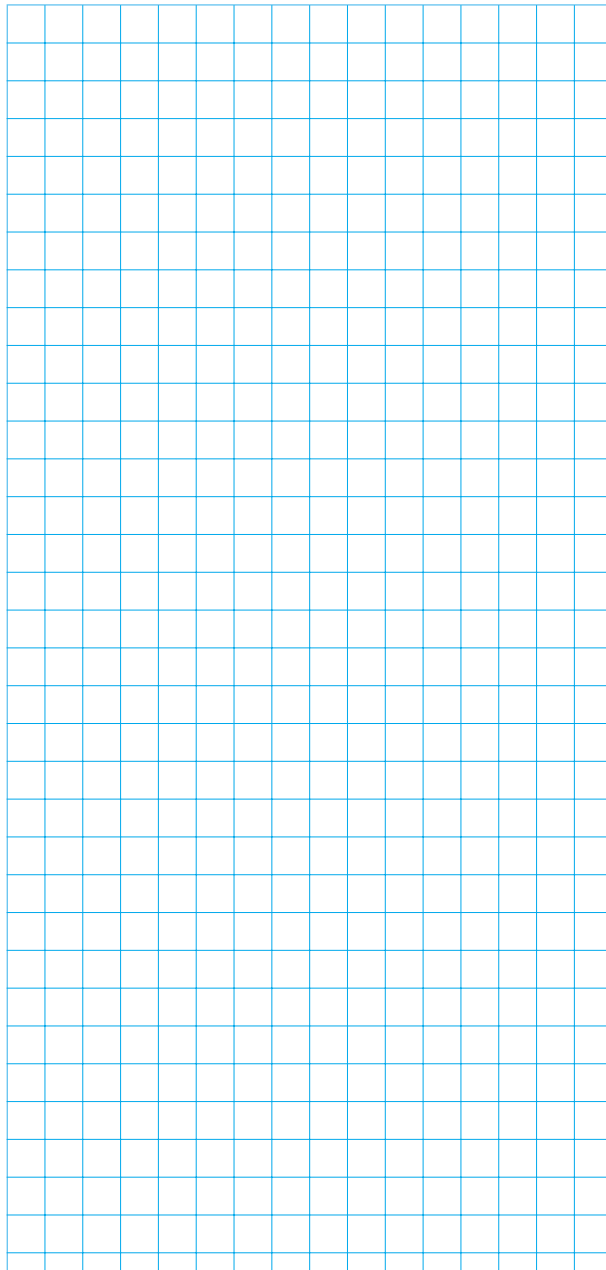
Figure 234
Compress disc springs and remove retainer ring.



Figure 237
Remove clutch piston wear plate.



Figure 238
Remove clutch piston.



Reassembly forward clutch



Figure 239

Clutch piston bleed orifice must be clean free of any foreign material. Refer to the cleaning and inspection pages.



Figure 242

Install piston return disc springs. First spring with large diameter of bevel towards wear plate. Alternate five (5) springs. **NOTE:** see page 10-85.



Figure 240

Install inner and outer clutch piston seal rings. Size inner ring as explained in figure 93. Install clutch piston in clutch drum. Use caution as not to damage sealing rings.



Figure 243

Position return spring ring retainer on clutch shaft.



Figure 241

Install clutch piston wear plate.



Figure 244

Start ring on clutch with snap ring pliers.

Reassembly forward clutch



Figure 245

Use a sleeve with the proper inner diameter to fit over shaft and against retainer ring. A sharp blow with a soft hammer will compress springs and seat retainer ring. Be sure ring is in full position in groove.



Figure 248

Install clutch disc end plate.



Figure 246

Install first steel (outer) clutch disc.



Figure 249

Install end plate retainer ring.



Figure 247

Install first friction (inner) clutch disc. Alternate steel and friction until six (6) steel and six (6) friction discs are in position.

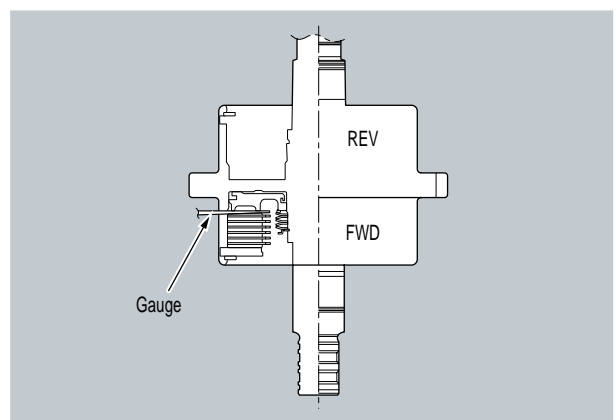


Figure 250

NOTE: forward clutch pack must be checked for clutch disc clearance. Stand the clutch assembly on end. The clutch discs on the bottom will fall to the end plate. Measure the distance between the clutch piston and the first steel disc by inserting a feeler gauge or taper gauge through the slots in the clutch drum. The required clearance is .048-.108 [1.22 - 2.74]. If the clearance is greater than .108 [2.74], add one steel disc under the end plate.

Reassembly forward clutch



Figure 251

Position thrust bearing inner washer on clutch shaft.



Figure 254

Press one bearing in clutch gear, flush with face of gear. Install bearing spacer next to bearing, press second bearing in gear, flush with face of gear. Install the clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Be sure the clutch hub is in full position in the clutch assembly. Do not force this operation.



Figure 252

Position thrust bearing on clutch shaft against inner thrust bearing washer.



Figure 255

Position inner thrust washer on shaft.



Figure 253

Install outer thrust bearing washer against thrust bearing.



Figure 256

Position thrust bearing on shaft.

Reassembly forward clutch



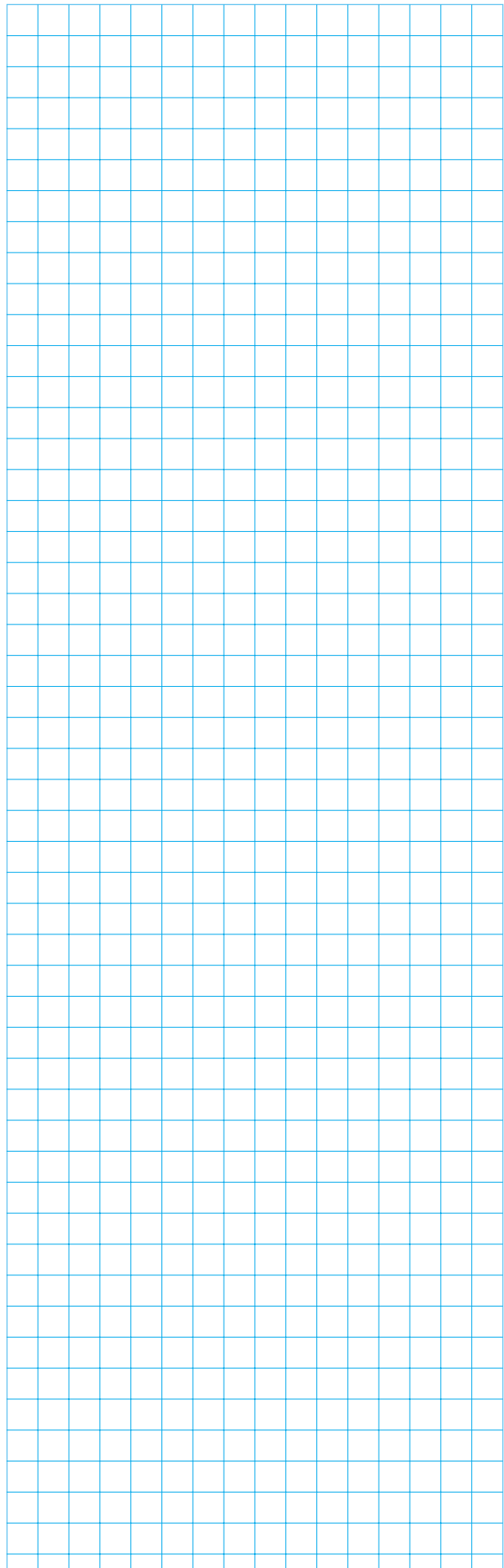
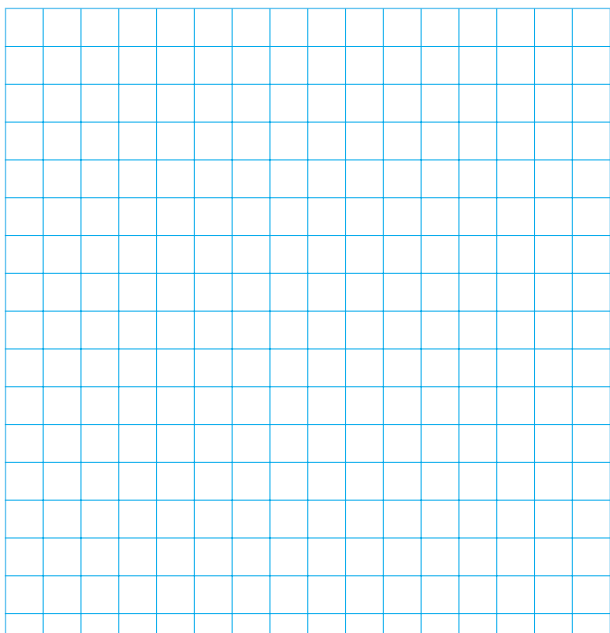
Figure 257

Position outer thrust washer on shaft.



Figure 258

Install clutch shaft oil sealing rings.
Grease rings to facilitate reassembly into
front housing.



Reassembly reverse clutch



Figure 259

Clutch piston bleed orifice must be clean and free of any foreign material. Refer to the cleaning and inspection pages.



Figure 262

Install piston return disc springs. First spring with large diameter of bevel towards wear plate. Alternate five (5) springs. **NOTE:** see page 10-85.



Figure 260

Install inner and outer clutch piston seal rings. Size inner ring as explained in figure 93. Install clutch piston in clutch drum. Use caution as not to damage sealing rings.



Figure 263

Position return spring ring retainer on clutch shaft.



Figure 261

Install clutch piston wear plate.



Figure 264

Start ring on shaft with snap ring pliers.

Reassembly reverse clutch



Figure 265

Use a sleeve with the proper inner diameter to fit over shaft and against retainer ring. A sharp blow with a soft hammer will compress springs and seat retainer ring. Be sure ring is in full position in groove.



Figure 268

Install clutch disc end plate.



Figure 266

Install first steel (outer) clutch disc.



Figure 269

Install end plate retainer ring.



Figure 267

Install first friction (inner) clutch disc. Alternate steel and friction until six (6) steel and six (6) friction discs are in position.

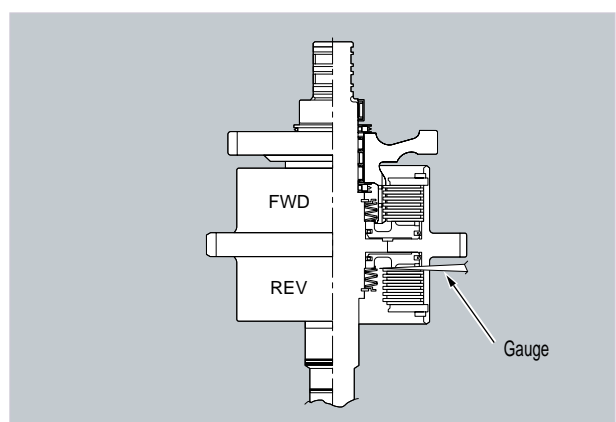


Figure 270

NOTE: reverse clutch pack must be checked for clutch disc clearance. Stand the clutch assembly on end. The clutch disc on the bottom will fall to the end plate. Measure the distance between the clutch piston and the first steel disc by inserting a feeler gauge or taper gauge through the slots in the clutch drum. The required clearance is .048-.108 [1,22-2,74]. If the clearance is greater than .108 [2,74] add one steel disc under the end plate.

Reassembly reverse clutch



Figure 271

Position thrust bearing inner washer on clutch shaft.



Figure 274

Press one bearing in clutch gear, flush with face of gear. Install bearing spacer next to bearing. Press second bearing in gear, flush with face of gear. Install the clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Be sure the clutch hub is in full position in the clutch assembly. Do not force this operation.



Figure 272

Position thrust bearing on clutch shaft against inner thrust bearing washer.



Figure 275

Position inner thrust washer on shaft.



Figure 273

Install outer thrust bearing washer against bearing.



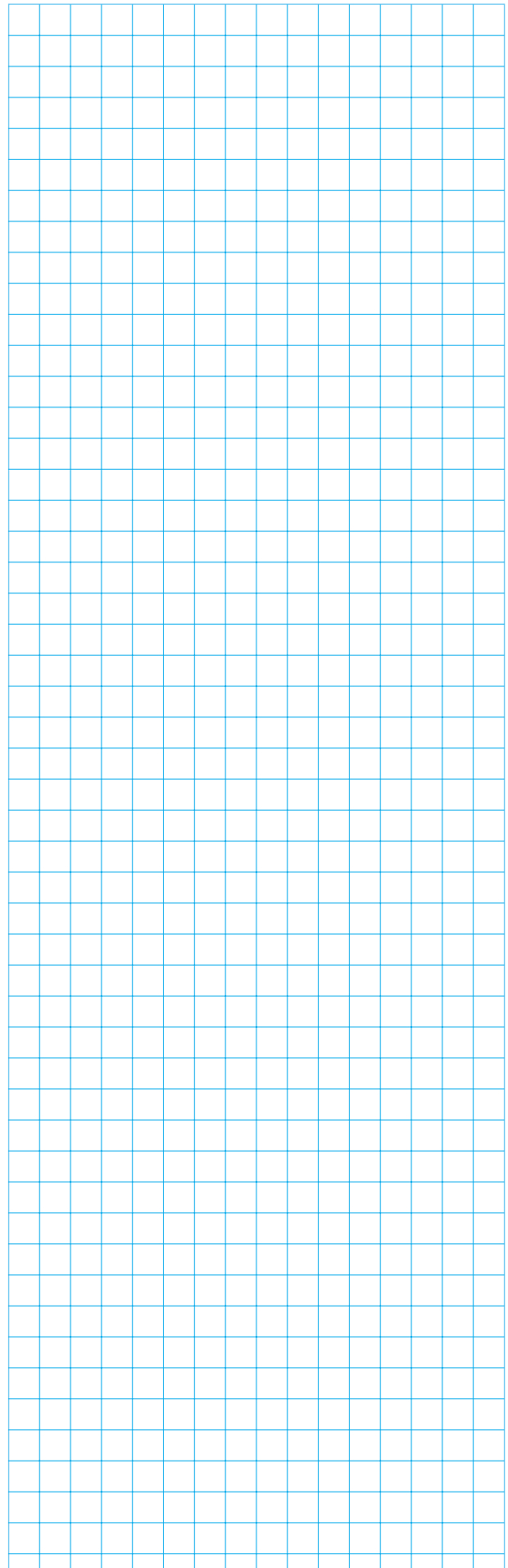
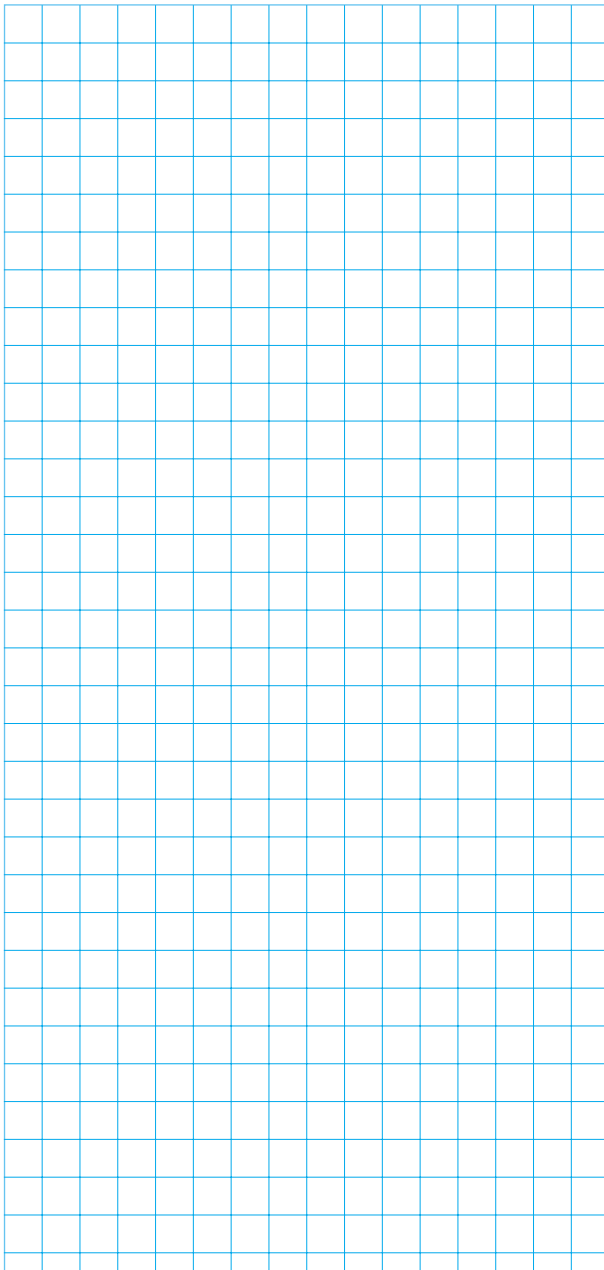
Figure 276

Position thrust bearing on shaft.



Figure 277

Position outer thrust washer on shaft.



Disassembly regulator valve



Figure 278

Tap pin from regulator valve sleeve. Use caution as valve spool is under spring pressure.



Figure 279

Remove regulator valve piston and pressure regulator valve spring.



Figure 280

Spring and piston removed.

Reassembly regulator valve



Figure 281

Position pressure regulator valve spring into regulator valve piston. Refer to the cleaning and inspection pages.



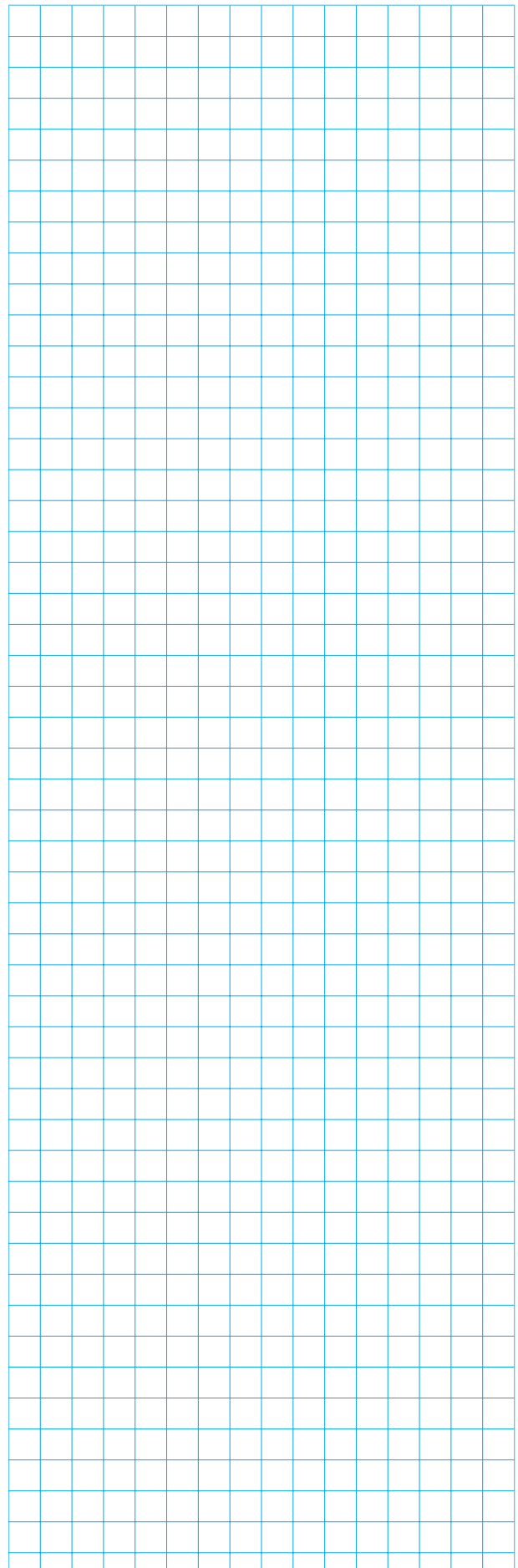
Figure 282

Install pressure regulator valve spring and regulator valve piston as an assembly into regulator valve sleeve.



Figure 283

Compress valve spring and valve and install pin into regulator valve sleeve.



Disassembly dual modulated valve assembly



Figure 284

Remove inner, middle and outer spring and stop pin from modulation housing sleeve. Reference figure 47.

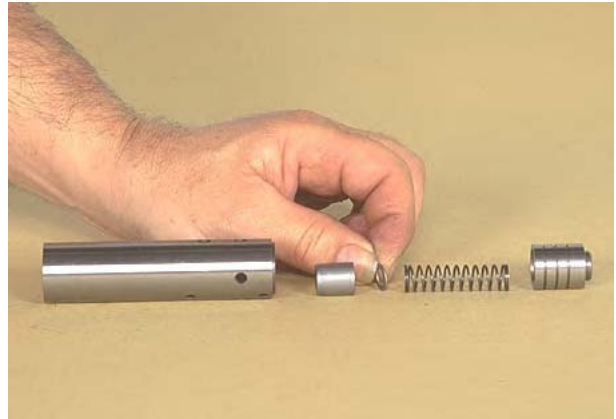


Figure 287

Remove regulator spool, spring, retainer spring and spacer spring from housing sleeve.



Figure 285

Remove accumulator spool. Reference figure 47.

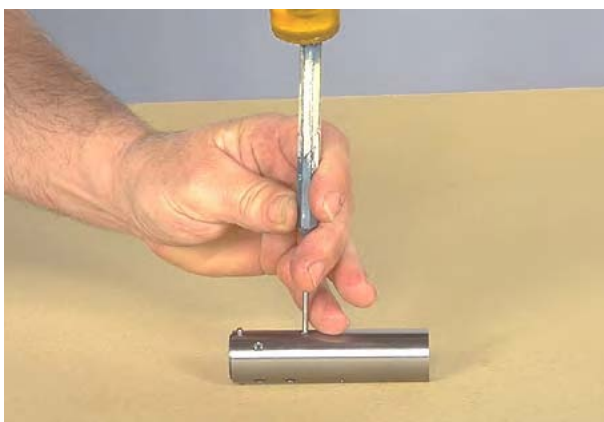
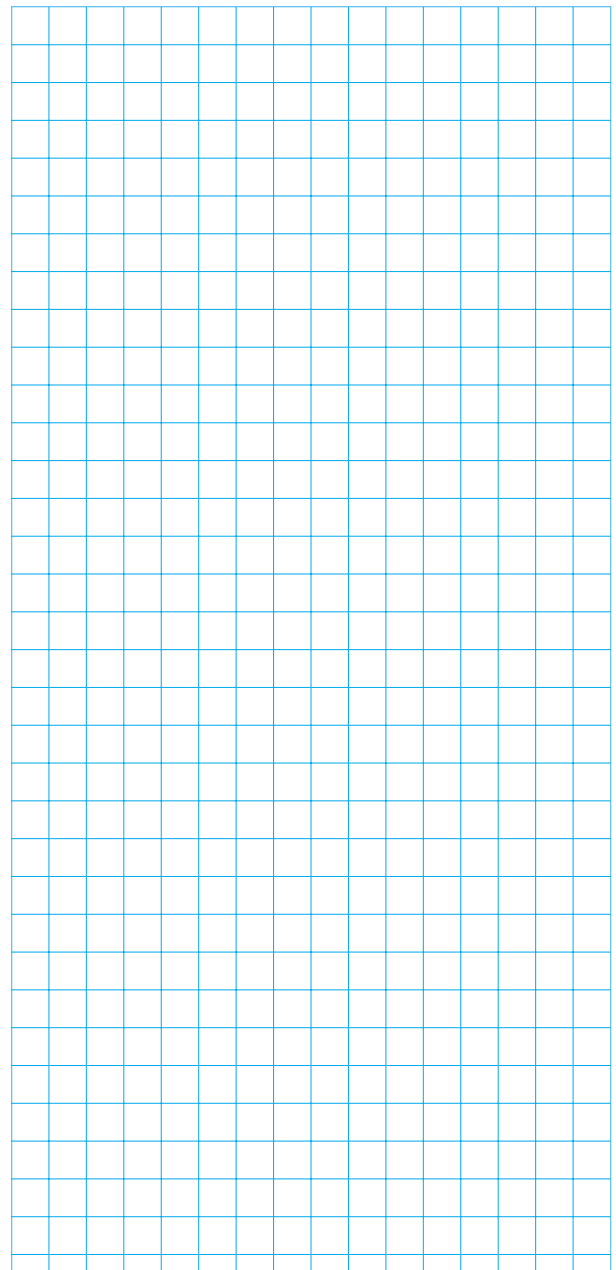


Figure 286

Remove cross pin from sleeve

NOTE: Some units will have two cross pins the same length. Some units will have two pins of different lengths. The longest pin goes in the bottom hole.



Reassembly dual modulated valve assembly



Figure 288

Install spring spacer in spring retainer.
Refer to the cleaning and inspection pages.



Figure 291

Install spring retainer, spring and regulator valve in sleeve against inner cross pin.



Figure 289

Install spring in spring retainer.



Figure 292

Compress regulator spool and spring in sleeve far enough to install cross pin.



Figure 290

Check orifice in regulator spool to be free and clear of any foreign material.



Figure 293

Install cross pin.

NOTE: Some units will have two cross pins the same length. Some units will have two pins of different lengths. The longest pin goes in the bottom hole.

Reassembly dual modulated valve assembly



Figure 294

From opposite end, position accumulator spool in sleeve as shown.



Figure 297

Install inner spring.



Figure 295

Install outer accumulator spring.



Figure 298

Install stop pin in inner spring.



Figure 296

Install middle spring.



Figure 299

If charging pump or pump drive gear are to be replaced, remove retainer ring and drive gear.

Disassembly spacer plate



Figure 300

Remove reverse idler gear end plate capscrew and washer.



Figure 303

Remove reverse idler gear bearing.



Figure 301

Remove end plate and dowel pin.



Figure 304

Remove idler gear tangential thrust washer.



Figure 302

Remove reverse idler gear.

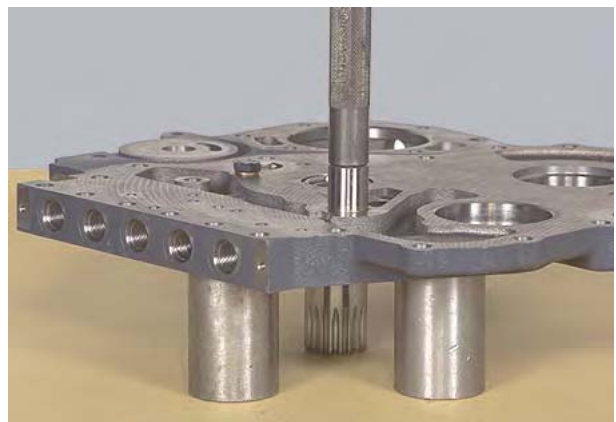


Figure 305

If reverse idler shaft is to be replaced, support spacer plate around idler shaft opening and press idler shaft from spacer.

Disassembly spacer plate



Figure 306

Idler shaft and locating ring removed.



Figure 309

Remove pump drive idler shaft and thrust washer.



Figure 307

Remove locating ring from idler shaft.



Figure 310

The stator support is held in place by two retaining rings. Remove converter end retainer ring from groove.



Figure 308

Tap pump drive idler shaft from spacer plate.



Figure 311

Push support towards transmission side far enough to expose retainer ring. Remove retainer ring.

Disassembly spacer plate



Figure 312

From converter end, remove stator support and thrust washer.



Figure 315

If support bushing or bearing is to be replaced, remove from stator support.



Figure 313

Remove stator support oil sealing ring.

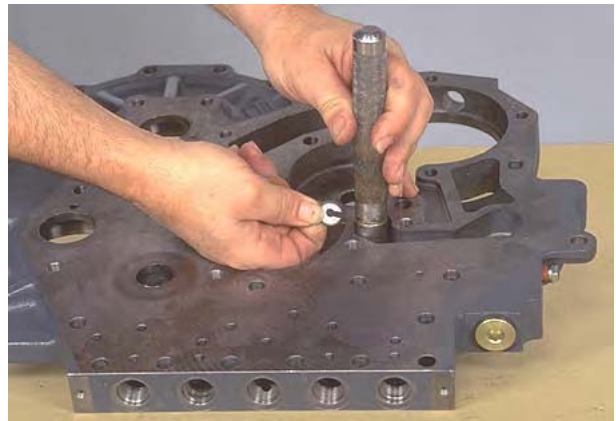


Figure 316

Compress converter safety valve spring and remove retaining washer.



Figure 314

Remove sealing ring expander ring.



Figure 317

Remove safety valve spring.

Disassembly spacer plate

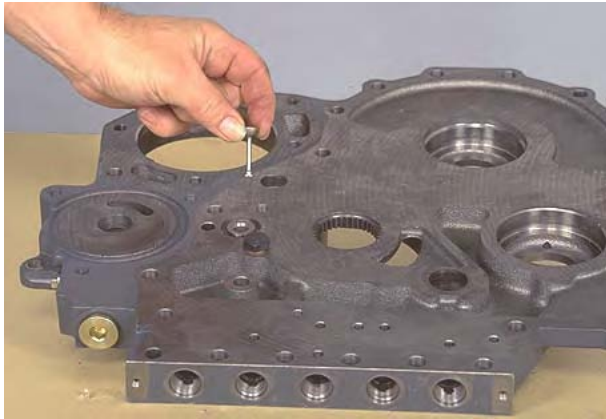


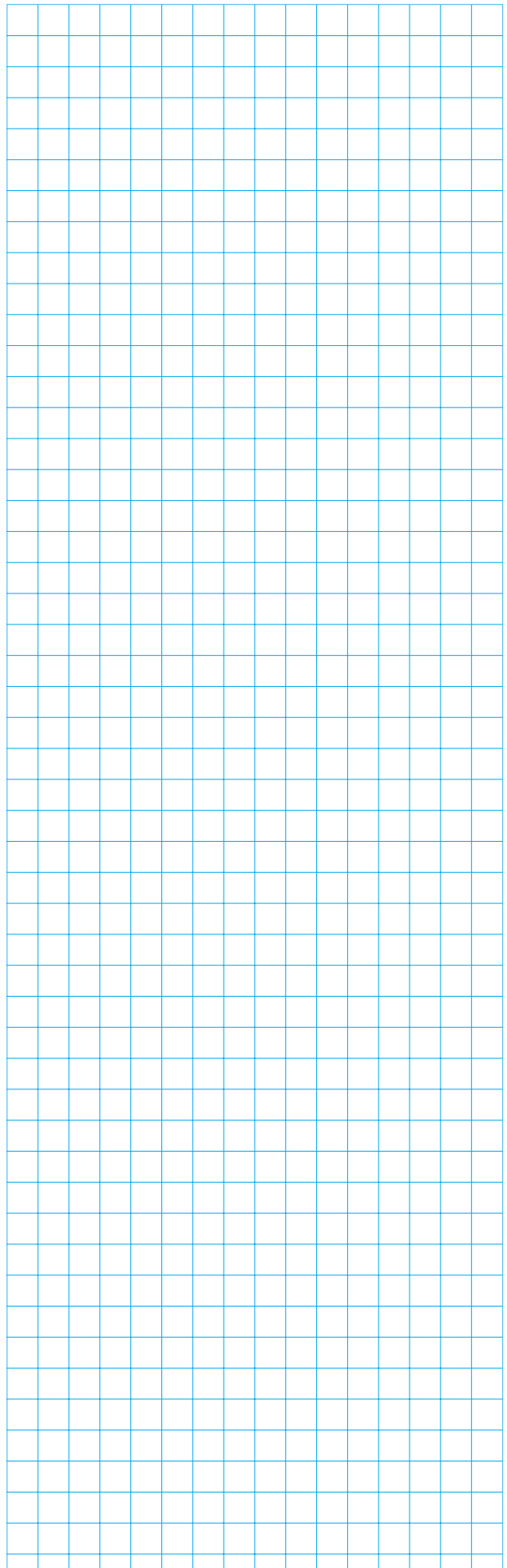
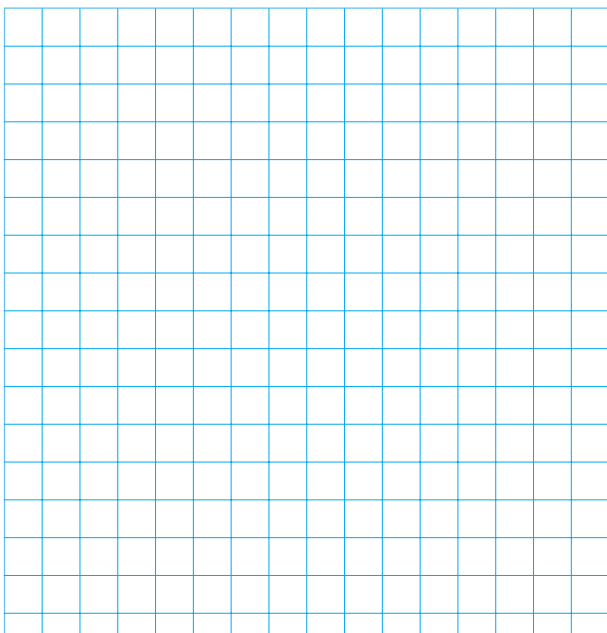
Figure 318

Turn spacer plate over and remove safety valve poppet.



Figure 319

Remove plug and seal washer from spacer plate.



Reassembly spacer plate



Figure 320

From transmission side of spacer plate, position converter safety valve poppet in bore in spacer. Refer to the cleaning and inspection pages.



Figure 323

Install plug and seal washer.



Figure 321

Turn spacer over and position safety valve spring on poppet.



Figure 324

If stator support bushing was removed, install bushing in support. Install needle bearing in stator support.

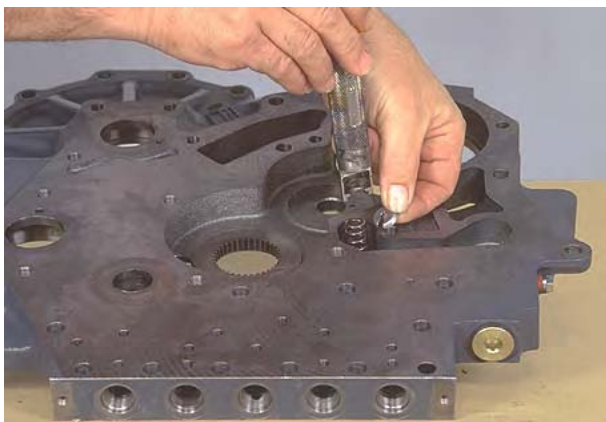


Figure 322

Compress spring and install poppet retaining washer.
NOTE: end of spring must go in recessed side of washer.



Figure 325

Install stator support oil sealing ring expander ring.

Reassembly spacer plate

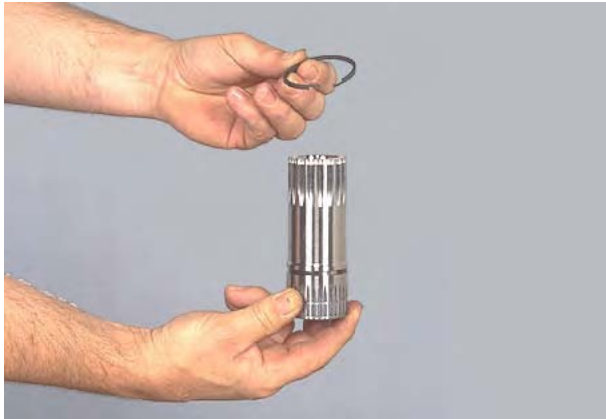


Figure 326

Install oil sealing ring on expander ring.

NOTE: Expander spring gap to be 180 degrees from sealing ring hook joint.

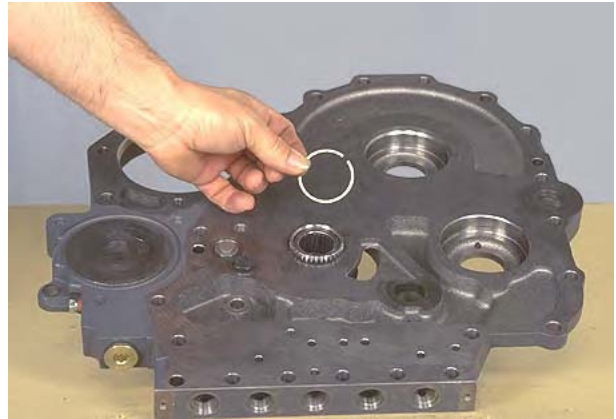


Figure 329

Install stator support locating ring.



Figure 327

Position impeller hub gear washer on spacer plate.



Figure 330

Push support back through spacer until locating ring shoulders in support bore.
Turn spacer plate over and install support retaining ring.



Figure 328

Install stator support through washer and spacer plate.



Figure 331

Position pump drive idler shaft washer on spacer plate.

Reassembly spacer plate



Figure 332

Position pump drive shaft through washer and into spacer plate. Align roll pin in spacer plate.



Figure 335

Support spacer plate and press reverse idler shaft into position and tight against locating ring.



Figure 333

Tap shaft into place.



Figure 336

Turn spacer plate over and position tangential thrust washer on shaft, being certain tang in washer is in notch in spacer plate.



Figure 334

Install locating ring on reverse idler shaft.



Figure 337

Position idler gear needle bearing on shaft. Lubricate bearing.

Reassembly spacer plate



Figure 338

Position idler gear on bearing.



Figure 341

Tighten capscrew to specified torque (see torque chart).



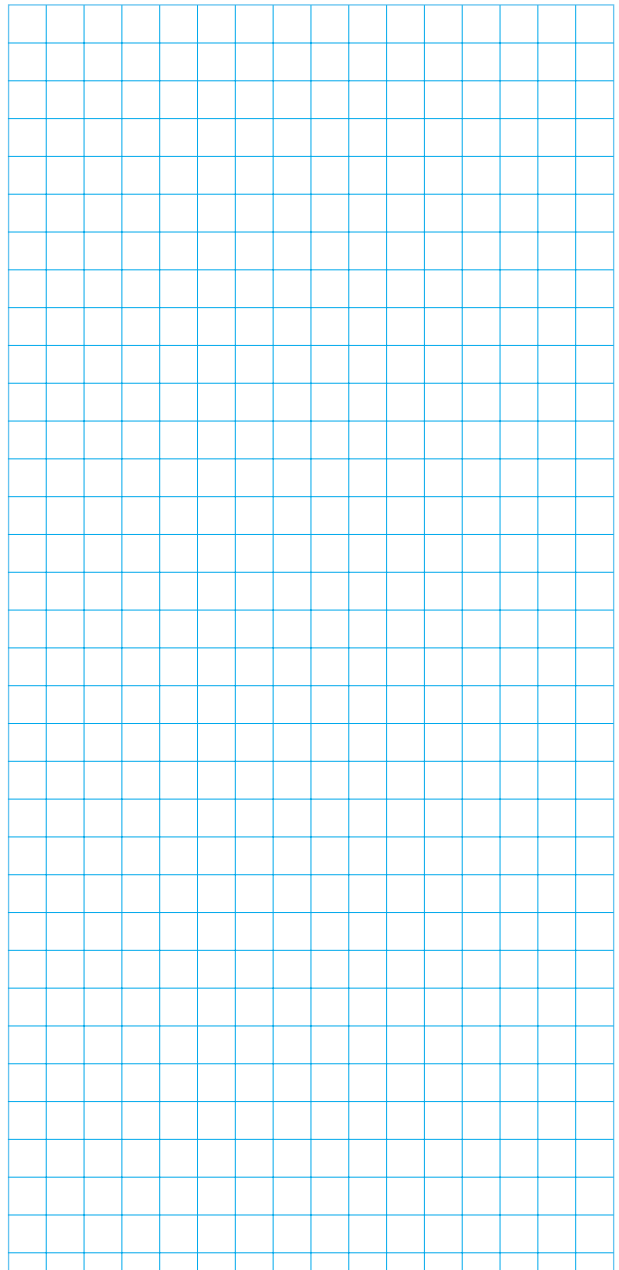
Figure 339

Position idler gear end plate and roll pin on idler shaft aligning roll pin with hole in idler shaft.



Figure 340

Install end plate capscrew and washer.



Disassembly front output flange



Figure 342

Remove flange to bearing retainer ring.

NOTE: do not remove expansion plug unless it is being replaced.



Figure 345

Oil seal sleeve and "O"-ring removed.



Figure 343

Using a bearing puller as shown, remove bearing.



Figure 346

Remove oil seal from sleeve.



Figure 344

Bearing removed.



Figure 347

Remove oil seal retainer ring from output flange.

Reassembly front output flange



Figure 348

Position bearing retainer ring on output flange. Refer to the cleaning and inspection pages.



Figure 351

Press bearing on output flange.



Figure 349

Apply a very light coat of permatex #2 to the outer diameter of the output flange oil seal, press oil seal in oil seal sleeve. Oil seal must be flush with one side of face of oil seal sleeve, and lip of seal must be in.



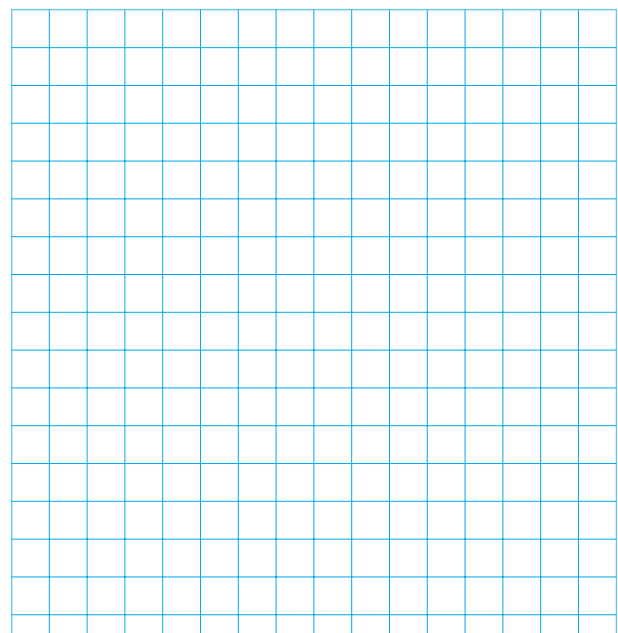
Figure 352

Install bearing to flange retainer ring.



Figure 350

Install new "O"-ring on oil seal sleeve. Position oil seal sleeve assembly on output flange. **NOTE:** recessed position of oil seal and sleeve must be up, with lip of seal up. This leaves a space between oil seal and output bearing.



Disassembly converter housing assembly



Figure 353
Remove torque converter bearing.



Figure 356
Remove converter housing plug
(high and 3rd clutch shaft).



Figure 354
Remove oil distributor.



Figure 357
Remove oil distributor sleeve set screw.



Figure 355
Remove converter oil seal.



Figure 358
Using a hammer puller as shown, remove oil
distributor sleeve (high and 3rd).

Disassembly converter housing assembly



Figure 359
Sleeve removed.



Figure 362
Using a hammer puller as shown, remove oil distributor sleeve (1st and 2nd).



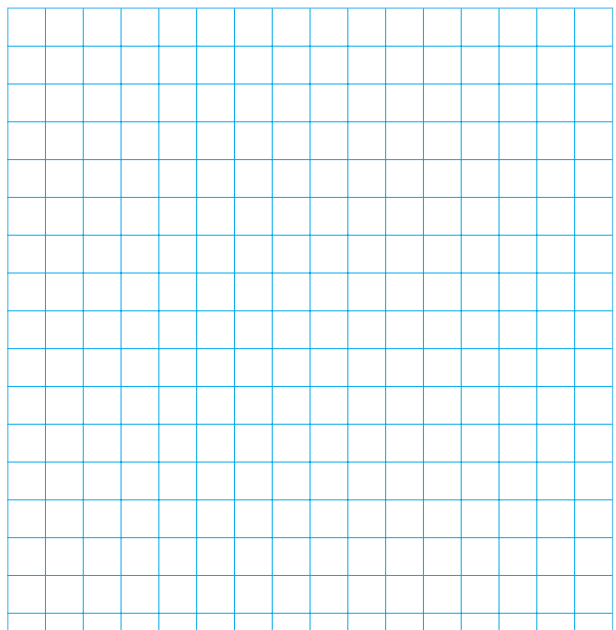
Figure 360
Remove converter housing plug
(1st and 2nd clutch shaft).



Figure 363
Sleeve removed.



Figure 361
Remove oil distributor sleeve set screw.



Reassembly converter housing



Figure 364

Apply a very light coat of Permatex #2 to the outer diameter of the converter housing oil seal. Press seal in housing with lip of seal in. Refer to the cleaning and inspection pages.



Figure 367

Install 1st and 2nd clutch shaft oil distributor sleeve in converter housing, with inside diameter chamfer up, and the notch in the distributor aligned up with the retaining set screw hole in the converter housing.



Figure 365

Install oil distributor in converter housing with long hub towards oil seal.



Figure 368

Apply Loctite #243 to threads of sleeve set screw (**NOTE:** this screw has a hole in it. Use caution as not to allow any loctite to plug hole). Install set screw in converter housing and in oil distributor.



Figure 366

Press converter bearing in housing against shoulder.



Figure 369

Install set screw plug.

Reassembly converter housing



Figure 370

Install high-3rd clutch shaft oil distributor sleeve in converter housing with inside diameter chamfer up and the notch in the distributor aligned up with the retaining set screw hole in the converter housing.



Figure 371


Apply loctite #243 to threads of sleeve set screw. 
(**NOTE:** this set screw has a hole in it. Use caution as not to allow any loctite to plug hole). Install set screw in converter housing and in oil distributor.



Figure 372

Install set screw plug.

Reassembly transmission



Figure 373

Install forward - reverse oil distributor sleeve in transmission case with inside diameter chamfer out (towards front of transmission) and the notch in the distributor aligned up with the retaining set screw hole in the transmission case. Refer to the cleaning and inspection pages.



Figure 376

Install reverse and forward clutch shaft rear bearing in transmission case.



Figure 374

Apply Loctite #243 and install set screw in transmission case and in oil distributor sleeve.

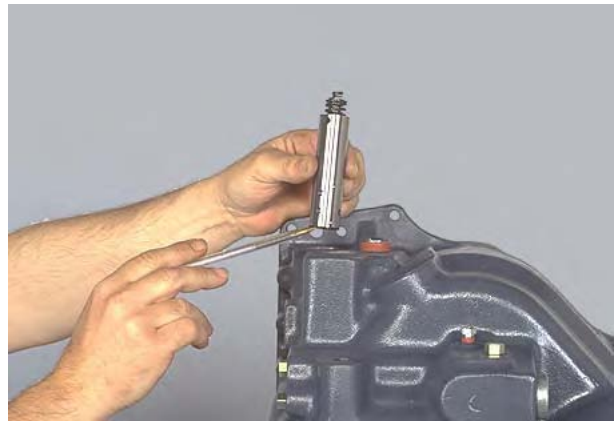


Figure 377

Position a new "O"-ring on lower end of the modulation valve sleeve and spring assembly. Install "O"-ring on other valve sleeve.

NOTE: for single modulation and hydraulic inching see section 11.1.



Figure 375

Install set screw plug.



Figure 378

Install valve or valves in transmission case.

Reassembly transmission



Figure 379

Position a new "O"-ring on modulator valve housing.



Figure 382

Push supply tube through opening in case and install "O"-ring.



Figure 380

Install housing over sleeve and spring assembly and tighten to 60-65 LBF-FT [81-88 N.m].



Figure 383

Install supply tube mounting screw, seal washer, clip, washer and nut. Tighten mounting screw securely (see figure 384).



Figure 381

Position supply tube and screen assembly in transmission case sump.

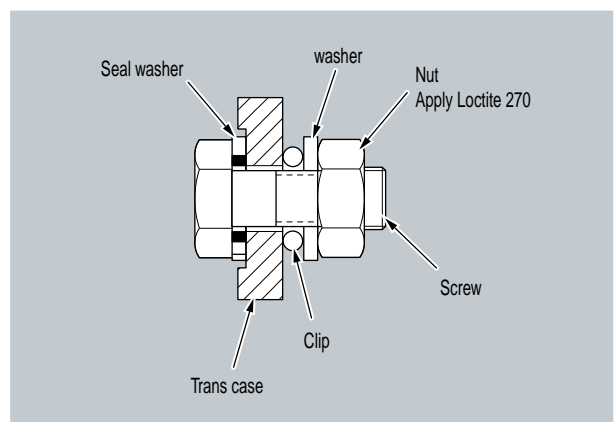


Figure 384

Reassembly transmission



Figure 385

Install sensor hole plug and "O"-ring.



Figure 388

Install output shaft inner bearing locating ring in rear of transmission.



Figure 386

Install air breather.



Figure 389

Install rear bearing in case against locating ring.



Figure 387

Install dipstick tube and dipstick.



Figure 390

Install new "O"-ring on rear oil seal sleeve.



Reassembly transmission



Figure 391

Apply a very light coat of Permatex #2 to the outer diameter of the output flange oil seal, press oil seal in oil seal sleeve. Oil seal must be flush with one side of face of oil seal sleeve and lip of seal must be in. Position oil seal sleeve in transmission case with recessed portion of oil seal towards output bearing. This leaves space between oil seal and output bearing.



Figure 394

Install rear output flange and shaft through output oil seal. Align splines on shaft with splines on output gear. Install shaft through gear. Use caution as not to damage oil seal. Brake disc is an option and will not be on all units.



Figure 392

Install oil seal sleeve retainer ring.



Figure 395

Install output shaft to output gear retainer ring.



Figure 393

From front of transmission case, position output gear with long hub of gear towards front.



Figure 396

Install front output shaft bearing locating ring.

Reassembly transmission



Figure 397

Position front output flange and bearing assembly on output shaft. Using snap ring pliers as shown. Squeeze snap ring ends together and tap flange assembly into case until snap ring can seat in snap ring groove.

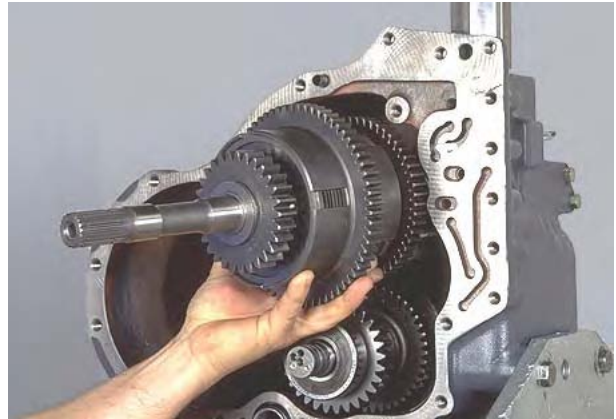


Figure 400

Install forward and reverse clutch assembly.



Figure 398

Install high and 3rd clutch shaft rear bearing outer race.



Figure 401

Install 1st and 2nd clutch shaft rear bearing outer race.

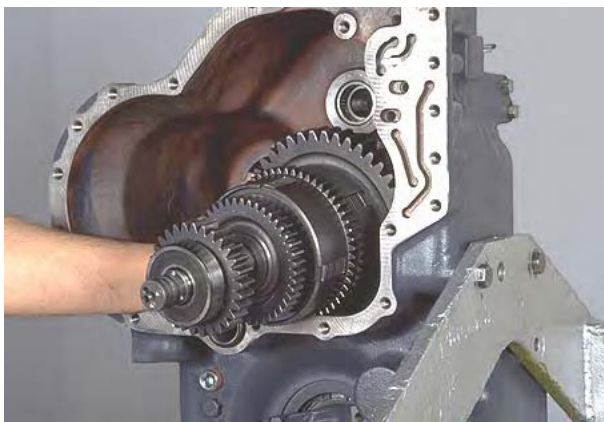


Figure 399

Install high and 3rd clutch assembly.



Figure 402

Install 1st and 2nd clutch assembly.



Reassembly transmission

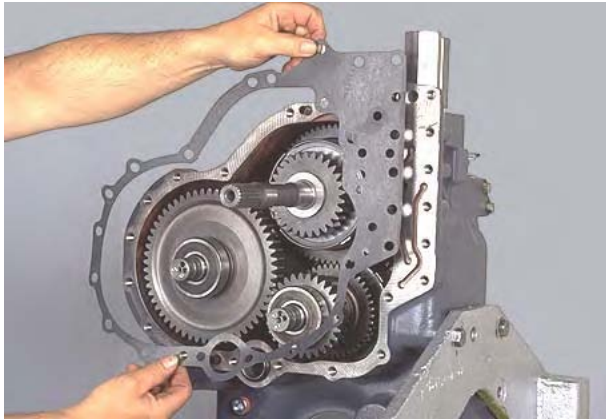


Figure 403

Position new transmission case to converter housing gasket on transmission case. A light coat of grease will hold gasket in position.

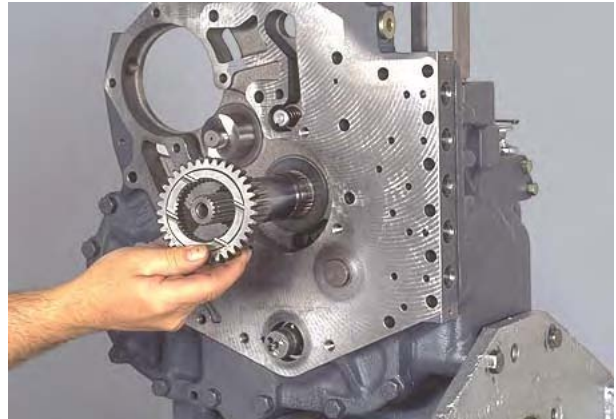


Figure 406

Position impeller hub gear on stator support.

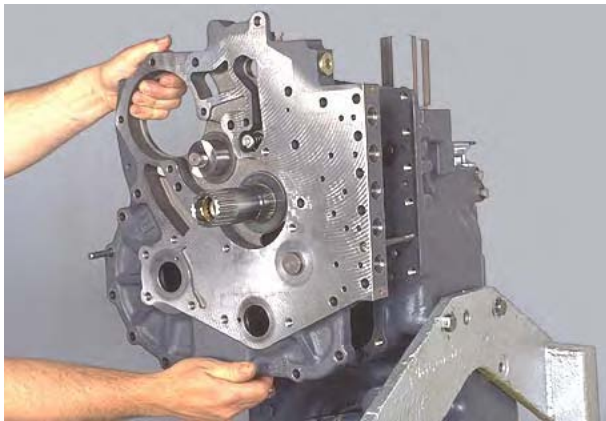


Figure 404

Install spacer plate assembly on transmission, aligning clutch shaft with openings in spacer plate. Use caution as not to damage oil sealing rings.



Figure 407

Install pump idler gear bearing on idler shaft.



Figure 405

Spacer plate must be tight against transmission case. Do not use bolts to pull spacer plate and case together. Tap spacer plate into position at dowel pins. Install spacer plate to transmission case cap screws. Tighten cap screws to specified torque.



Figure 408

Install pump idler on bearing.

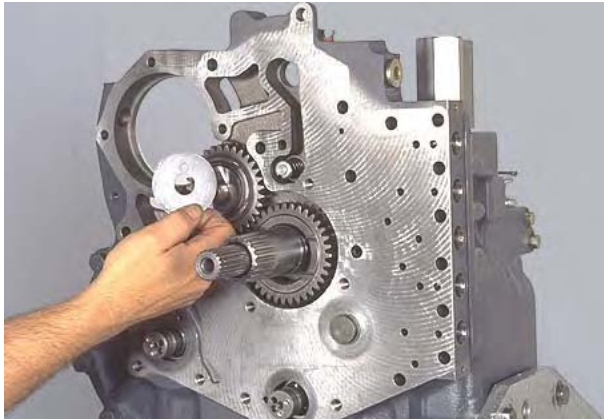
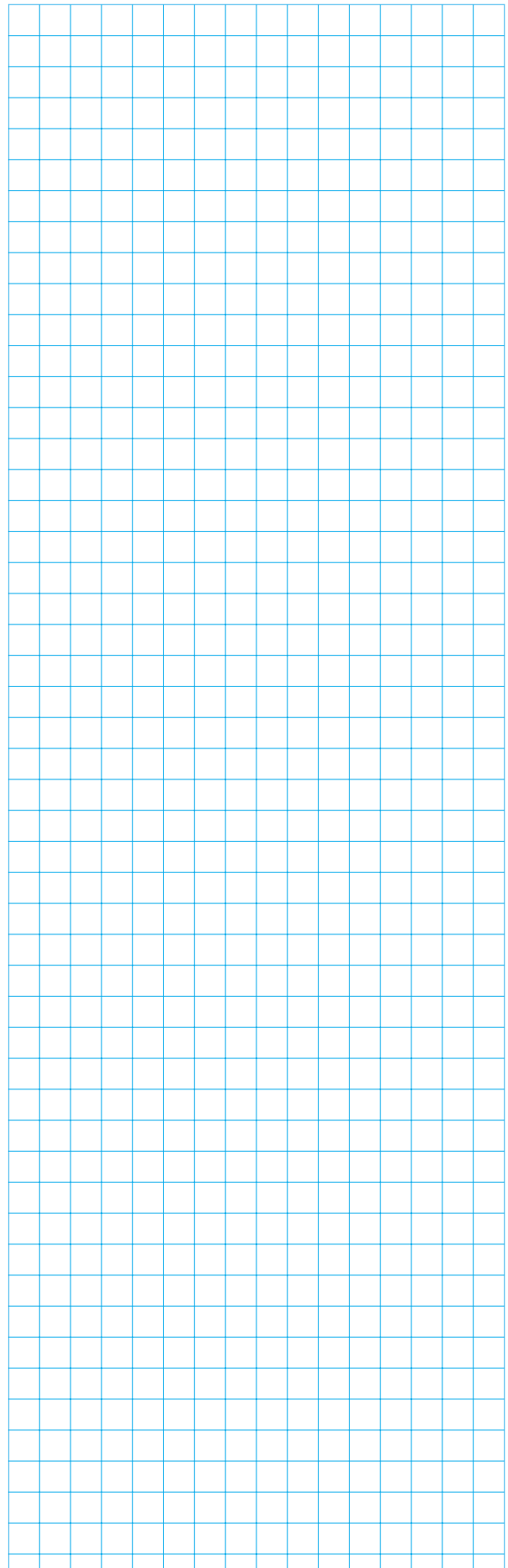
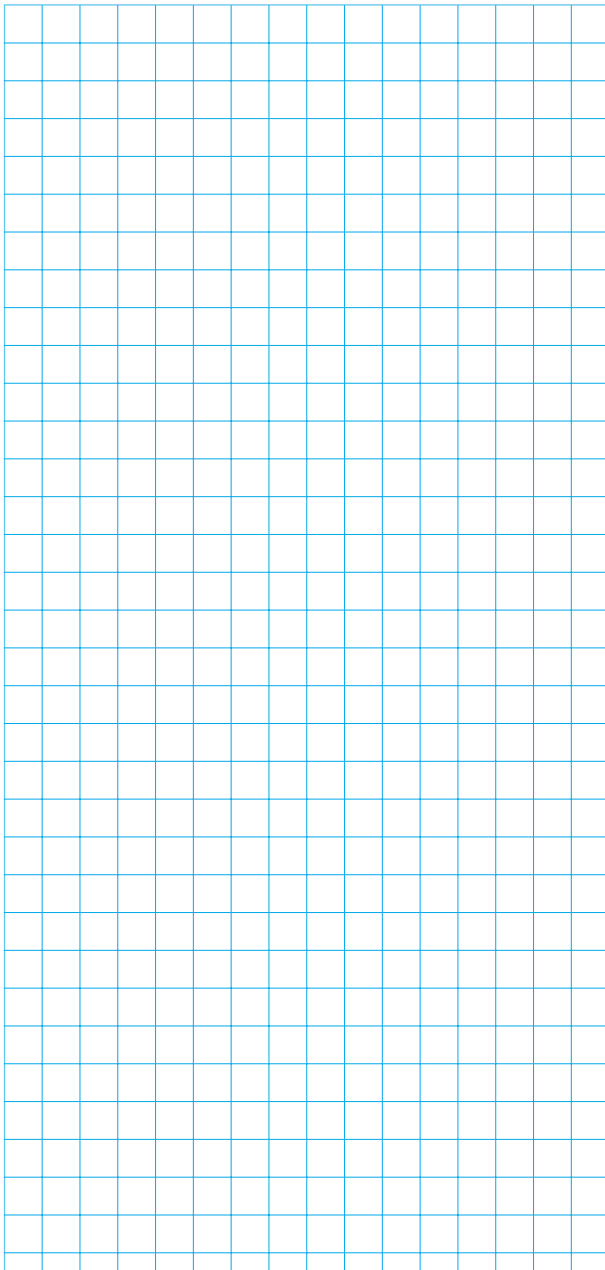


Figure 409

Install idler gear thrust washer, aligning hole with roll pin.



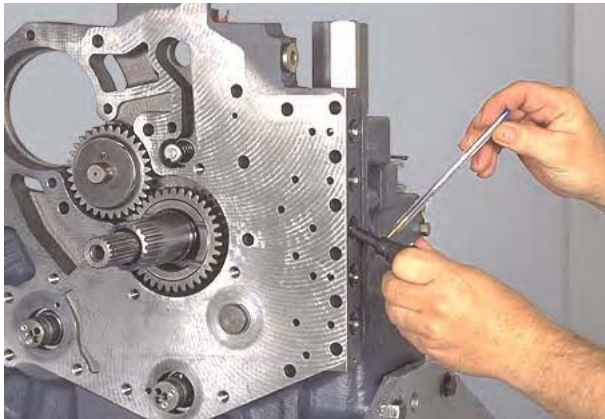


Figure 410

Install bore plug and "O"-rings in center hole on 3-speed transmissions only. Refer to the cleaning and inspection pages.

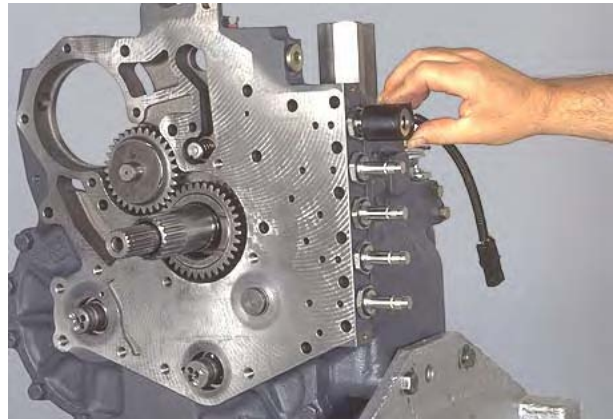


Figure 413

With cartridge to coil "O"-ring in place, position solenoid coil on cartridge.

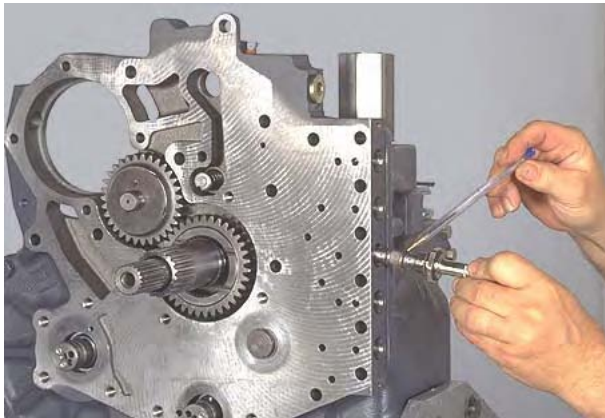


Figure 411

With "O"-rings in position, install solenoid cartridges.

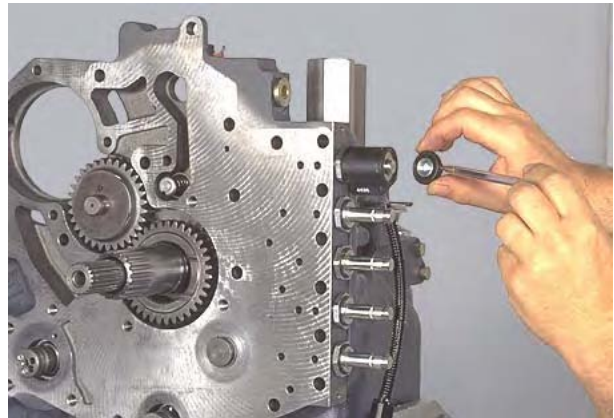


Figure 414

With new "O"-ring in position, install coil to cartridge nut. Tighten cartridge nut per assembly instruction drawing.

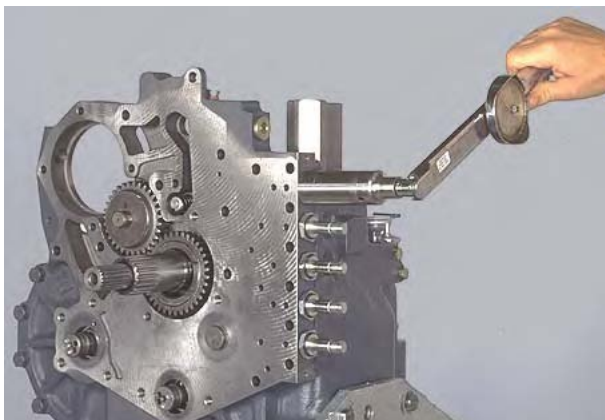


Figure 412

Tighten cartridges to specified torque. See assembly instruction drawing.

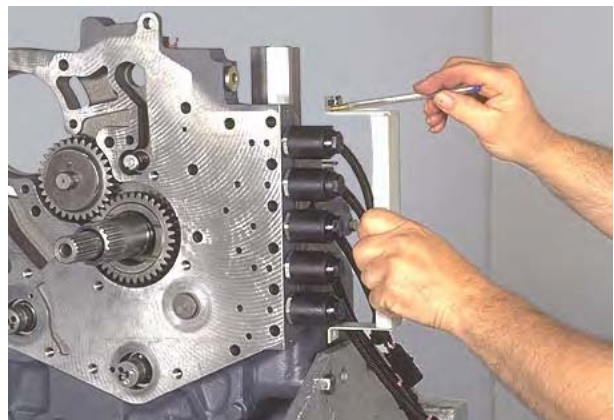


Figure 415

Install solenoid protection cover and mounting screws. Tighten screws to specified torque.

Reassembly transmission

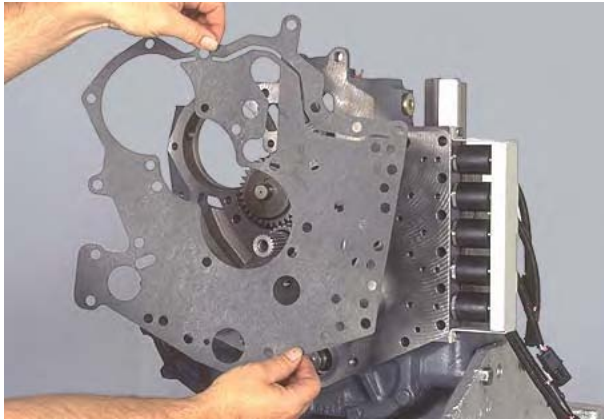


Figure 416

Position spacer to converter housing gasket on spacer. A light coat of grease will hold gasket in place.

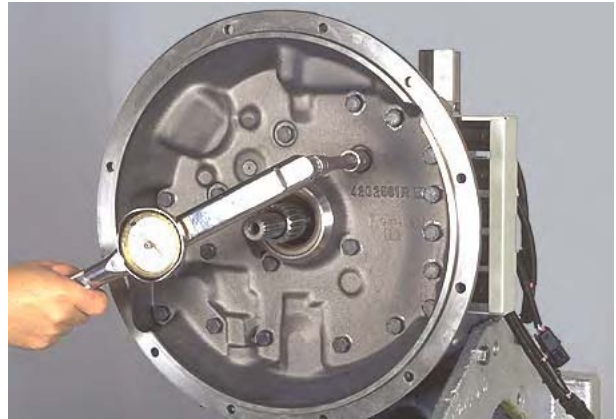


Figure 419

Tighten bolts to specified torque. See note in figure 417.

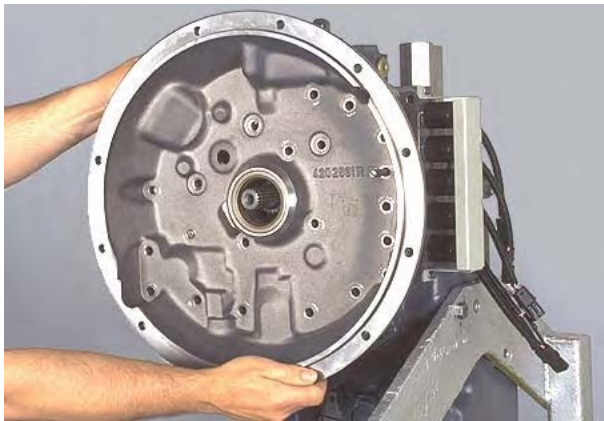


Figure 417

The use of aligning studs will facilitate converter housing to spacer installation. The transmission could be laid down to align the end of the clutch shafts into sealing ring sleeves in converter housing. Do not force this operation. Converter housing must be tight against transmission spacer.

NOTE: Do not use bolts to pull converter housing in place.



Figure 420

Install converter locating ring on turbine shaft.



Figure 418

Install converter housing to transmission case screws and lockwashers. See assembly instructions for proper screw location and installation.



Figure 421

Position converter assembly on stator support and turbine shaft.



Reassembly transmission



Figure 422
Install converter assembly retainer ring.



Figure 425
Install sensor hole plug end "O"-ring.



Figure 423
With new "O"-ring in place, install bore plug in converter assembly.



Figure 426
Install regulator sleeve assembly in converter housing.



Figure 424
Install bore plug retainer ring.

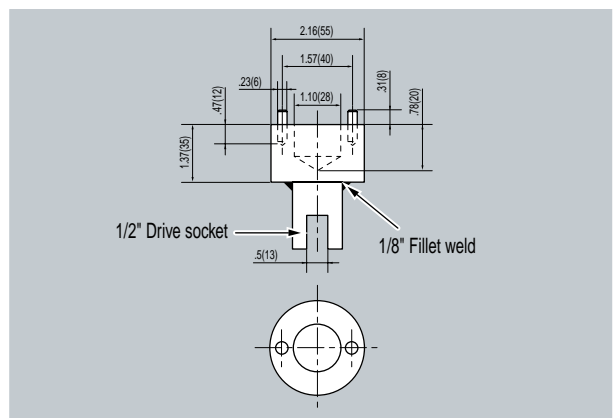


Figure 427
Using a special tool tighten sleeve to 45-50 lbf.ft [61.1-67.7 N.m].

Reassembly transmission



Figure 428

Position new charging pump to converter housing gasket.



Figure 431

If auxiliary pump is used, it is not necessary to install the permanent pump hole cover. With new gasket in place, install pump hole cover on charging pump. Install bolts and washers and tighten to specified torque. See torque chart.



Figure 429

Install charging pump in converter housing.



Figure 432

Install oil filter on regulating valve. Tighten filter to 20-25 lbf. ft [27-34 N.m]. If parking brake is not used proceed to figure 436.



Figure 430

Install charging pump to converter housing bolts and washers and tighten to specified torque. See torque chart.



Figure 433

Position calliper brake assembly on brake disc.



Figure 434

Install calliper brake mounting screw through brake assembly and through lock nut. Apply Loctite #262 to threads and install screw in transmission case.



Figure 435

Mounting screws to be installed to allow free movement of calliper pads to disc. Tighten jam nut. See torque chart. See page 4-4 for brake information.



Figure 436

See special section on page 5-1 for drive plate installation.

Reassembly transmission

NOTE: The disc springs 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. Service replacement assemblies are banded together and must be replaced as assembly.

11. OPTIONS

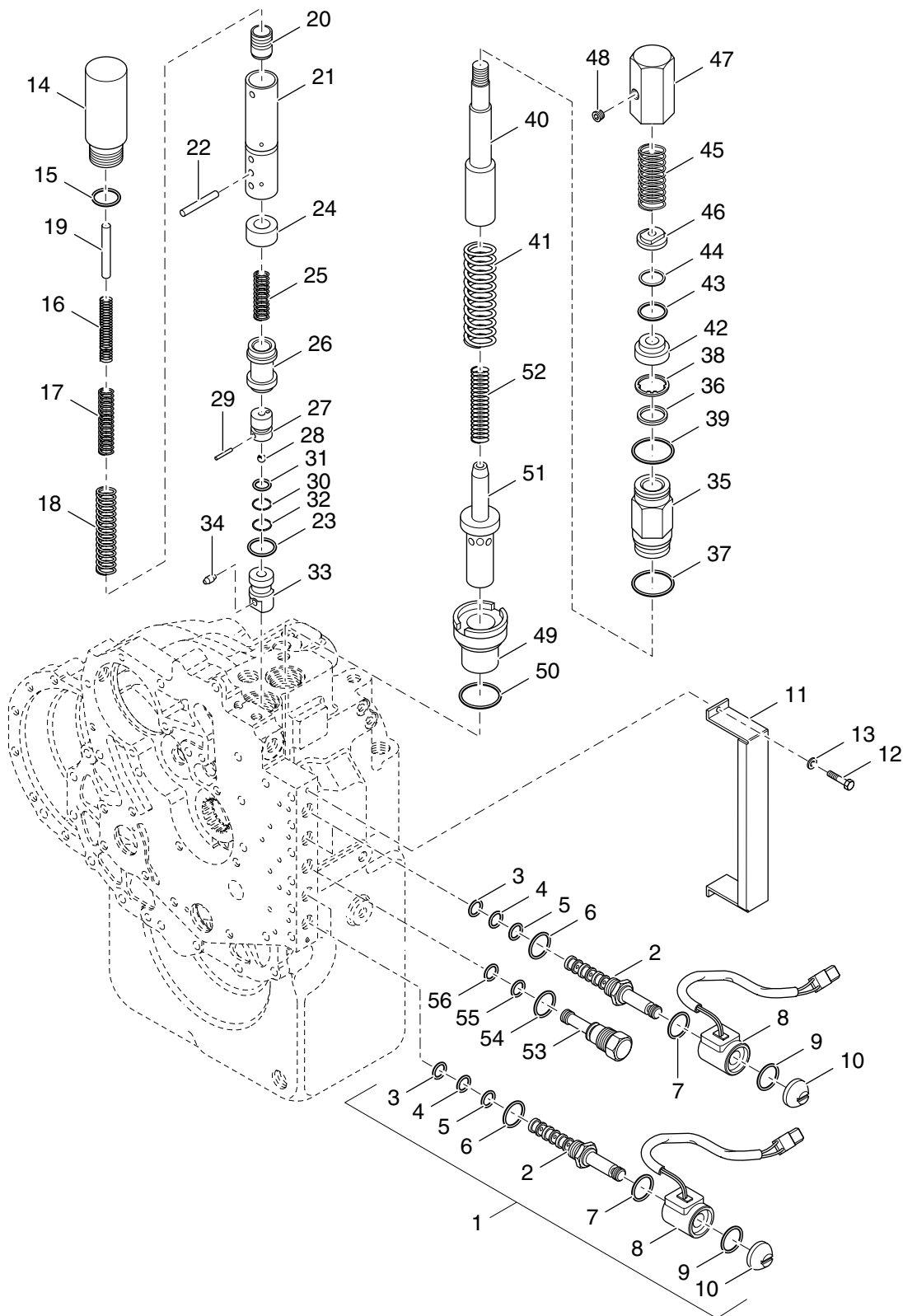
11.1 ELECTRIC CONTROL-SINGLE MODULATION HYDRAULIC ACTUATED INCHING

The information contained herein must be used in conjunction with a T12000 ID section.

11.1.1 Sectional views and parts identification

Refer to following pages.

GROUP - ELECTRIC CONTROL- SINGLE MODULATION HYDRAULIC ACTUATED INCHING



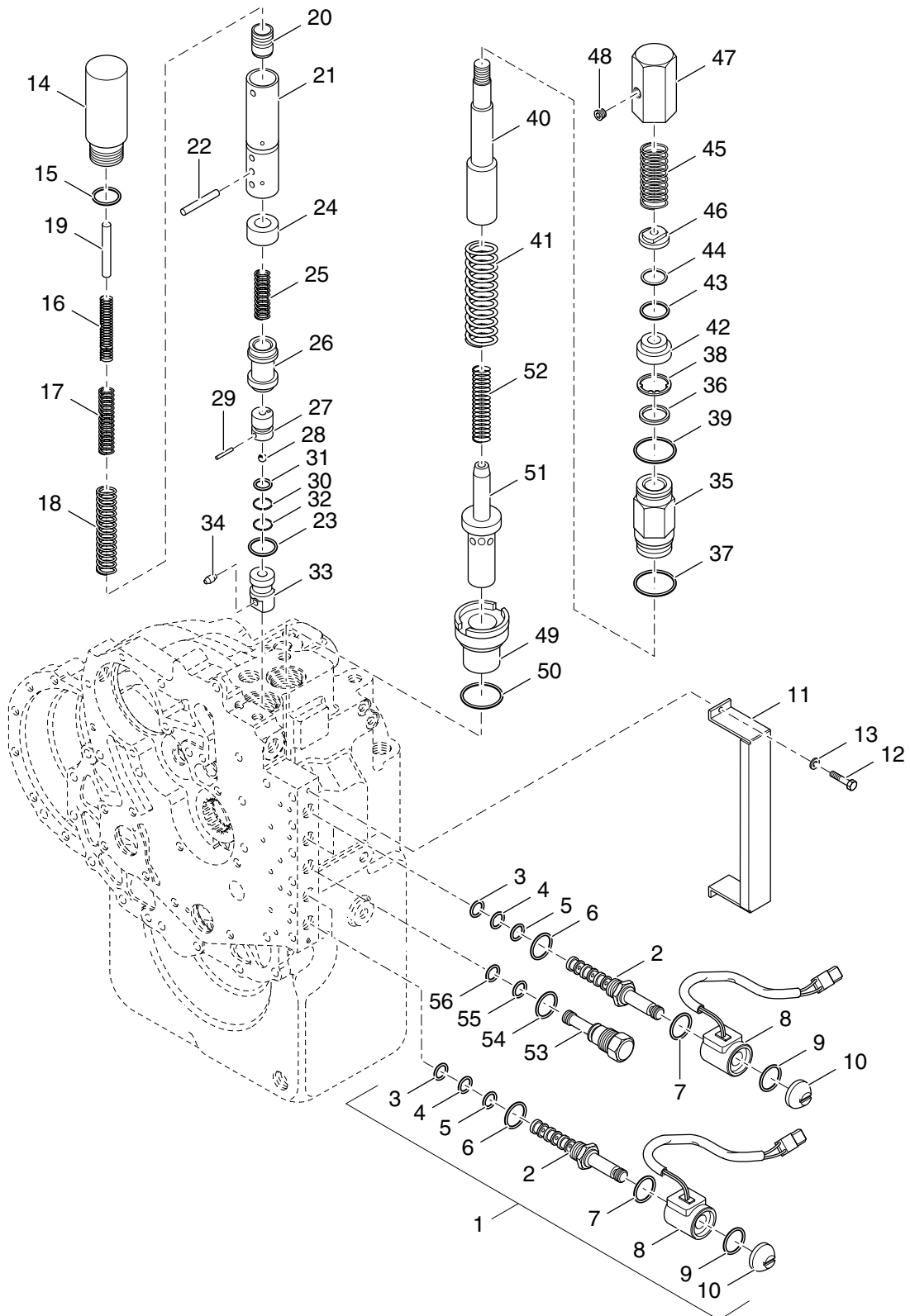
GROUP - ELECTRIC CONTROL- SINGLE MODULATION HYDRAULIC ACTUATED INCHING

Item	Description	Quantity
1	Assembly - Solenoid cartridge	5*
2	Cartridge - Valve 4-way including items 3, 4, 5 and 6	5*
3	"O"-ring - Cartridge	5*
4	"O"-ring - Cartridge	5*
5	"O"-ring - Cartridge	5*
6	"O"-ring - Cartridge	5*
7	"O"-ring - Cartridge to coil	5*
8	Coil-Solenoid	5*
9	"O"-ring-Coil to nut	5*
10	Nut - Valve cartridge retainer	5*
11	Cover - Protective	1
12	Screw - Protective cover	2
13	Lockwasher - Protective cover screw	2
14	Housing - Modulation valve	1
15	"O"-ring - Modulation housing	1
16	Spring (Inner)	1
17	Spring (Middle)	1
18	Spring (Outer)	1
19	Pin-Stop	1
20	Spool - Accumulator	1
21	Sleeve - Modulation housing	1
22	Pin - Modulation sleeve	1
23	"O"-ring - Modulation sleeve	1
24	Stop - Regulator spool	1
25	Spring - Regulator spool	1
26	Regulator - Spool	1
27	Sleeve - Regulator	1
28	Ball	1
29	Pin - Regulator spool sleeve	1
30	Snap ring	1
31	"O"-ring - Regulator spool sleeve	1
32	Snap ring	1
33	Sleeve - Shuttle	1
34	Spool - Shuttle	1
35	Body - Hydraulic inching	1
36	Seal - Hydraulic inching body	1
37	"O"-ring - Hydraulic inching body to case	1
38	Snap ring - Hydraulic inching body to cover	1
39	"O"-ring - Hydraulic inching body to cover	1
40	Rod - Hydraulic inching actuator	1
41	Spring - Inching return	1
42	Piston - Hydraulic inching (Lower)	1
43	Seal - Hydraulic inching piston	1
44	"O"-ring - Piston	1
45	Spring - Piston	1
46	Piston - Hydraulic inching (Upper)	1
47	Cover - Hydraulic inching	1
48	Plug - Hydraulic inching conver	3
49	Sleeve - Inching	1
50	"O"-ring - Inching sleeve	1

* quantity= 4, with 3-speed.

** used with 3-speed only.

GROUP - ELECTRIC CONTROL- SINGLE MODULATION HYDRAULIC ACTUATED INCHING



GROUP - ELECTRIC CONTROL- SINGLE MODULATION HYDRAULIC ACTUATED INCHING

Item	Description	Quantity
50	"O"-ring - Inching sleeve	1
51	Spool - Inching	1
52	Spring - Inching regulator	1
53	Plug - Solenoid bore plug, used at forward-High and Low	1**
54	"O"-ring - Plug	1**
55	"O"-ring - Plug	1**
56	"O"-ring - Plug	1**

* quantity= 4, with 3-speed.

** used with 3-speed only.

Single modulation and hydraulic inching removal

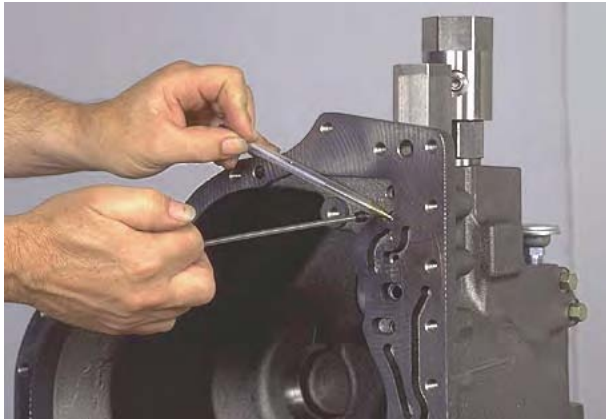


Figure 1

If inching is used install plug as shown.



Figure 4

Remove inching spool.

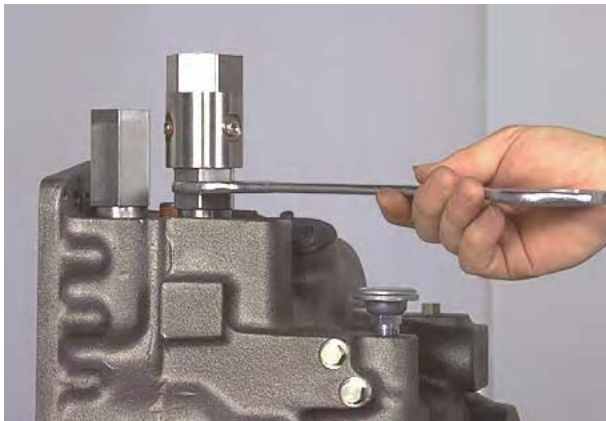


Figure 2

Remove hydraulic inching actuator.



Figure 5

Remove inching sleeve and "O"-ring.



Figure 3

Remove inching regulator spring.

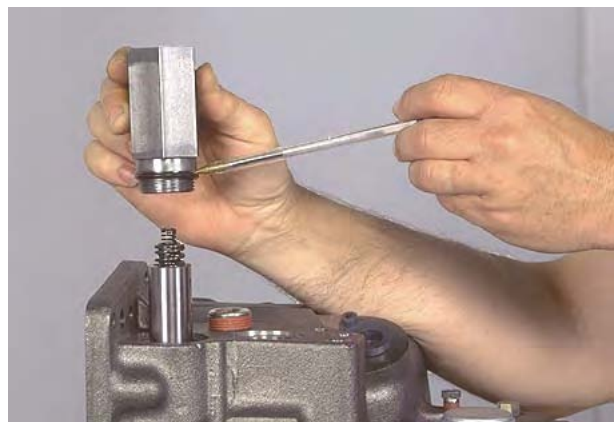


Figure 6

Remove modulator valve housing and "O"-ring.

Single modulation and hydraulic inching removal



Figure 7

Remove modulator valve outer, middle, and inner springs and spring stop.



Figure 8

Remove modulation housing sleeve and accumulator spool.



Figure 9

Remove shuttle sleeve and spool.

Disassembly single modulator valve assembly



Figure 10
Remove modulator valve body "O"-ring.



Figure 13
Remove modulator sleeve pin.



Figure 11
Remove modulator valve outer, middle and inner springs and spring stop ref. figure 7.



Figure 14
Remove regulator spool assembly retainer ring.



Figure 12
Remove accumulator spool. Ref. figure 8.



Figure 15
Remove regulator spool stop, spring and spring and sleeve assembly .

Disassembly single modulator valve assembly



Figure 16
Remove regulator spool sleeve retainer ring.



Figure 19
Remove check ball.



Figure 17
Remove regulator spool sleeve assembly.
Remove "O"-ring.

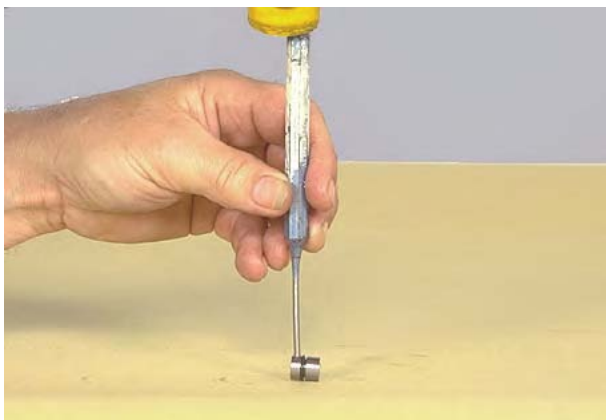
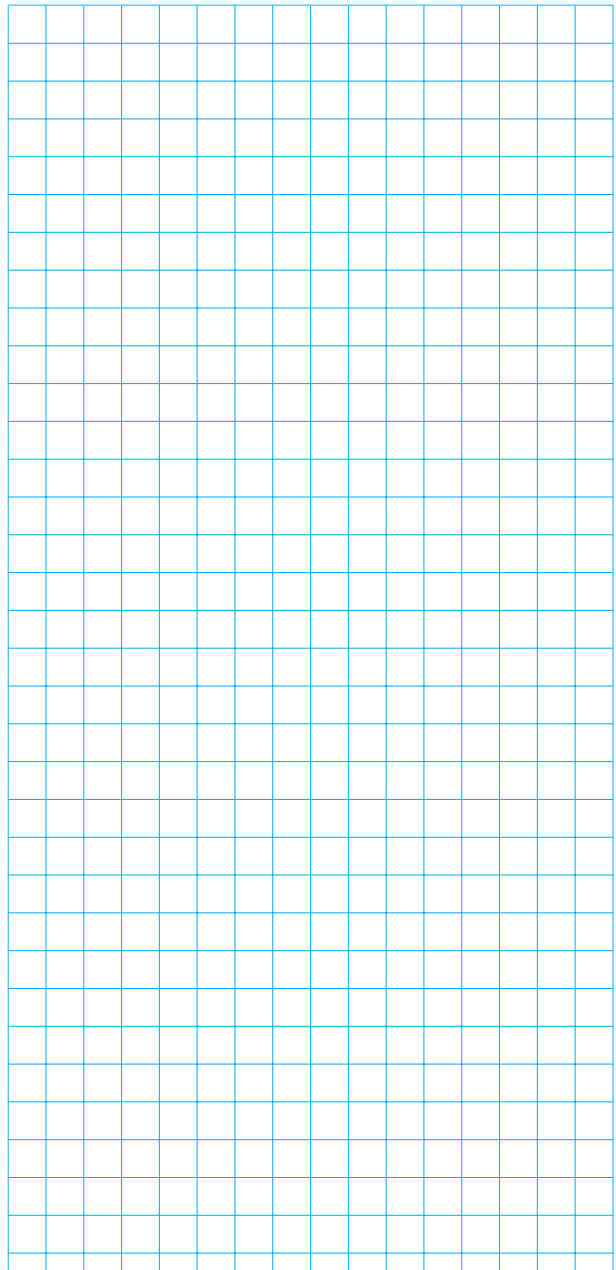


Figure 18
Remove sleeve check ball retainer pin.



Reassembly single modulator valve assembly



Figure 20

Install a new "O"-ring on regulator spool sleeve.
Position check ball in sleeve.
Refer to the cleaning and inspection pages.



Figure 23

Install sleeve retainer ring.

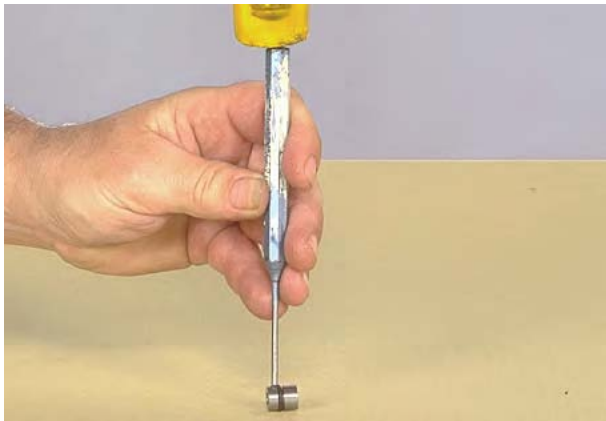


Figure 21

Install check ball retainer pin.



Figure 24

Install housing sleeve pin.



Figure 22

Position sleeve and ball assembly in regulator spool with check ball retainer pin up.



Figure 25

Install regulator spool stop, spring and regulator spool and sleeve assembly in housing sleeve.

Reassembly single modulator valve assembly



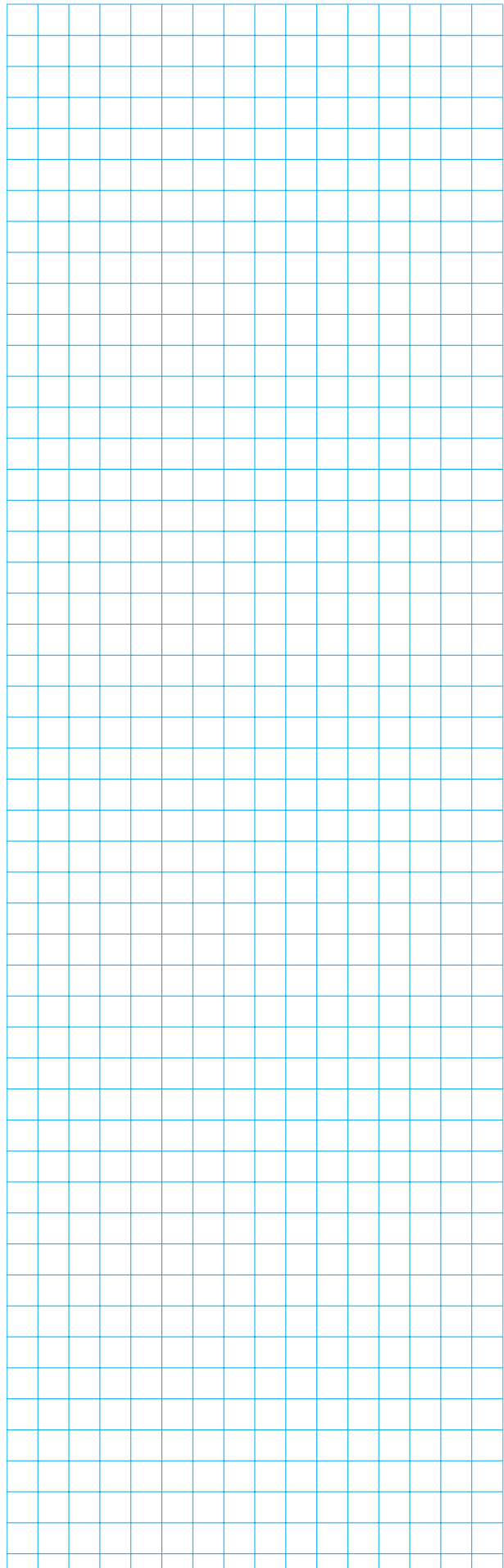
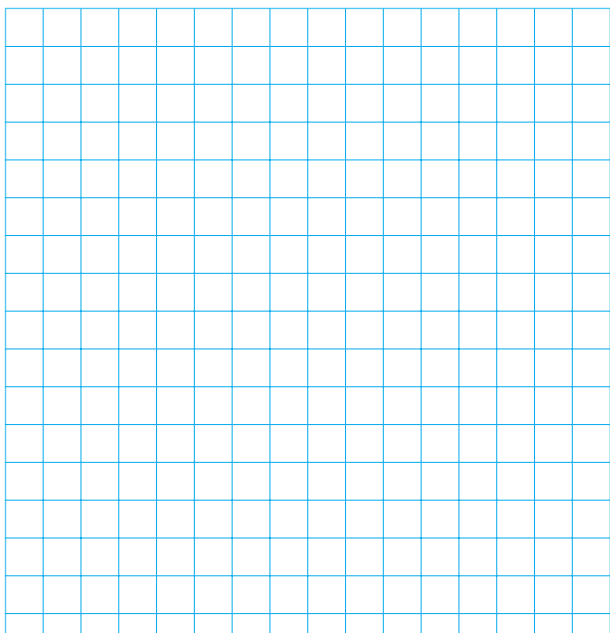
Figure 26

Compress regulator spool spring and install retainer ring.



Figure 27

Position new "O"-ring on modulation sleeve.



Disassembly hydraulic inching actuator



Figure 28
Remove hydraulic inching cover.



Figure 31
Inching upper piston removed.



Figure 29
Remove inching return spring.



Figure 32
Remove hydraulic piston seal.



Figure 30
Remove hydraulic inching upper piston.



Figure 33
Remove inching lower piston and "O"-ring.

Disassembly hydraulic inching actuator



Figure 34
Remove snap ring.



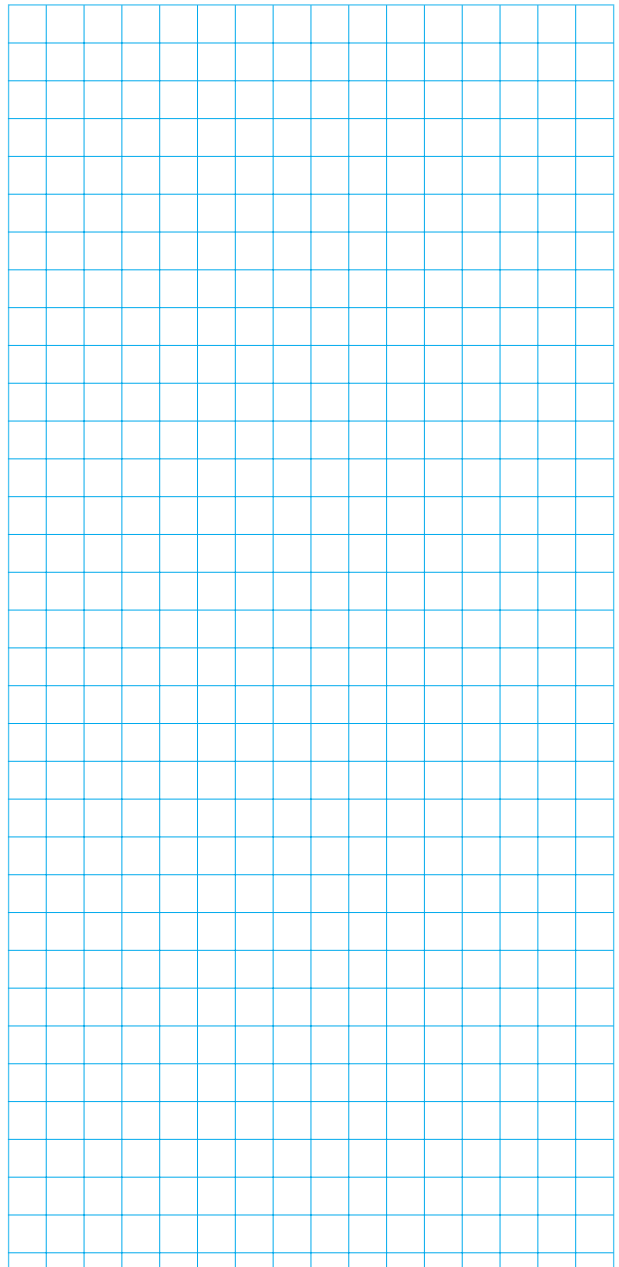
Figure 37
Remove inching return spring.



Figure 35
Remove hydraulic inching body seal.



Figure 36
Remove hydraulic inching body and "O"-rings.



Reassembly hydraulic inching actuator



Figure 38

Install inching return spring.
Refer to the cleaning and inspection pages.

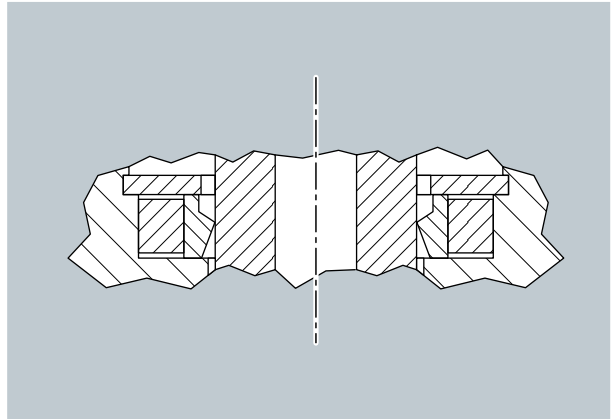


Figure 41



Figure 39

Install hydraulic inching body and "O"-rings.



Figure 42

Install snap ring.



Figure 40

Install inching body seal. Be sure seal is mounted correctly. See figure 41.



Figure 43

Install inching lower piston and "O"-ring.





Figure 44
Install hydraulic piston seal.



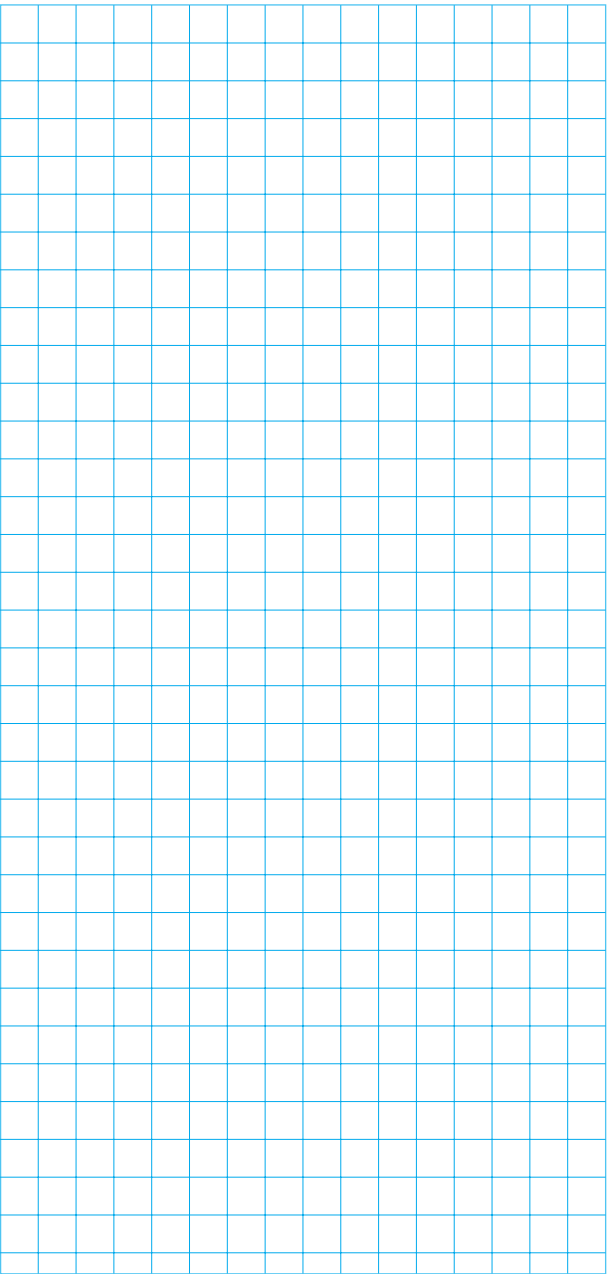
Figure 47
Install inching cover.



Figure 45
Apply Loctite nr. 243 to thread of inching actuator rod, install inching upper piston.



Figure 46
Install inching return spring.



Single modulation and hydraulic inching installation



Figure 48

Position shuttle spool in shuttle sleeve.
Install spool and sleeve in modulator valve bore.
Refer to the cleaning and inspection pages.



Figure 51

Install stop pin, inner, middle and outer springs in
accumulator and housing sleeve.



Figure 49

With new "O"-ring in position, install modulation
housing sleeve assembly in bore.

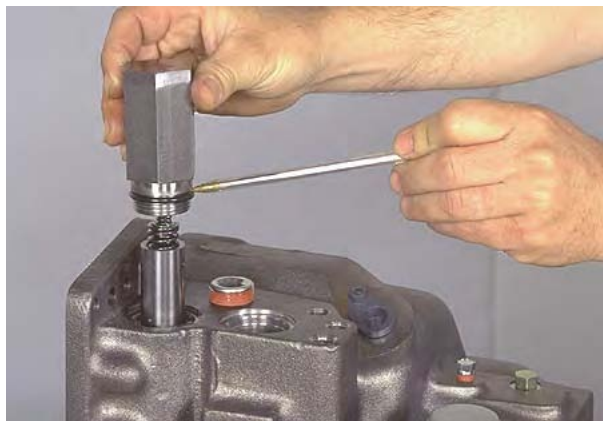


Figure 52

Position a new "O"-ring on modulator valve housing.
Thread housing into valve bore.



Figure 50

Install accumulator spool in housing sleeve as
shown.



Figure 53

Tighten modulator valve housing to specified torque.
See assembly instruction drawing. Ref. to figure 380.

Single modulation and hydraulic inching installation



Figure 54

Install inching sleeve and "O"-ring.



Figure 57

Tighten inching actuator to specified torque.
See assembly instruction drawing. Ref. to figure 380.

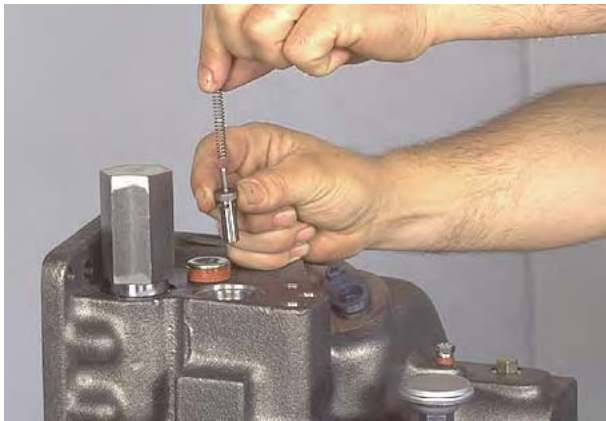


Figure 55

Install inching spool and regulator spring.

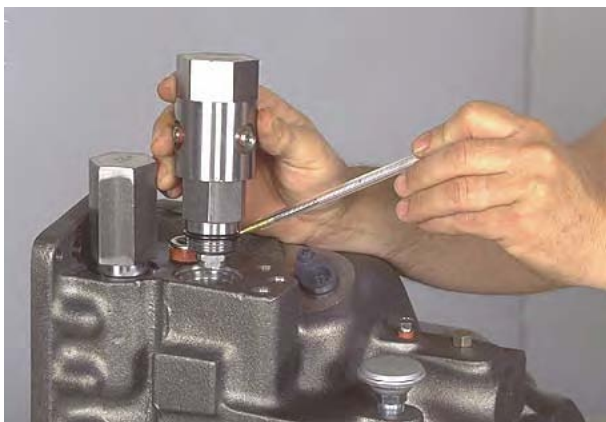
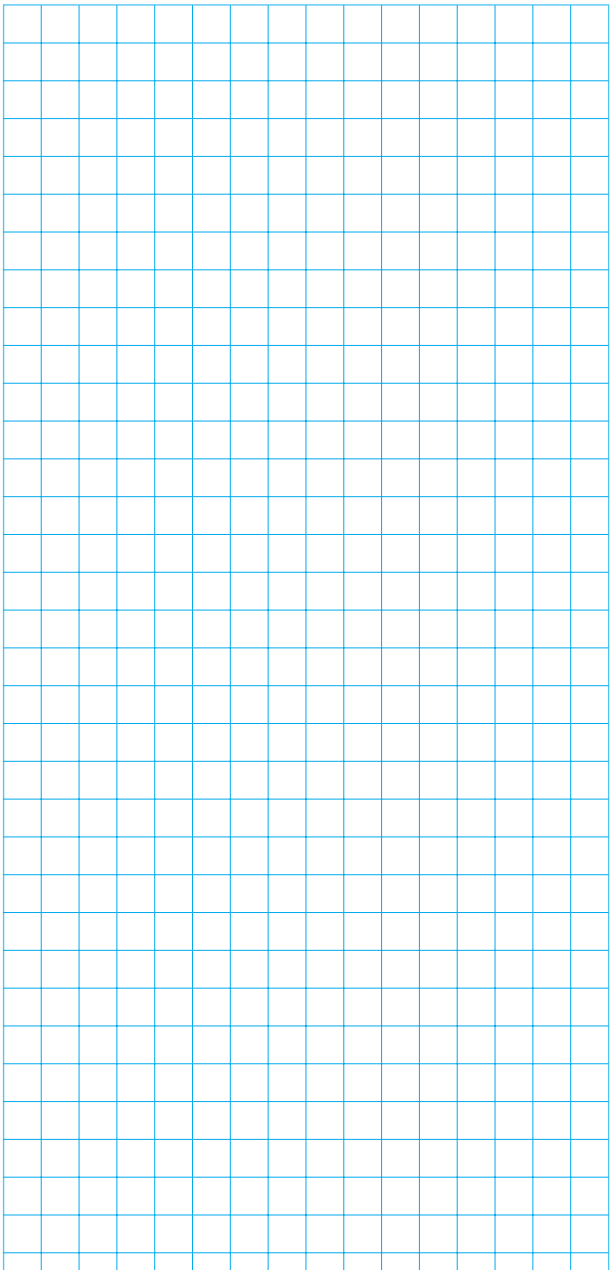


Figure 56

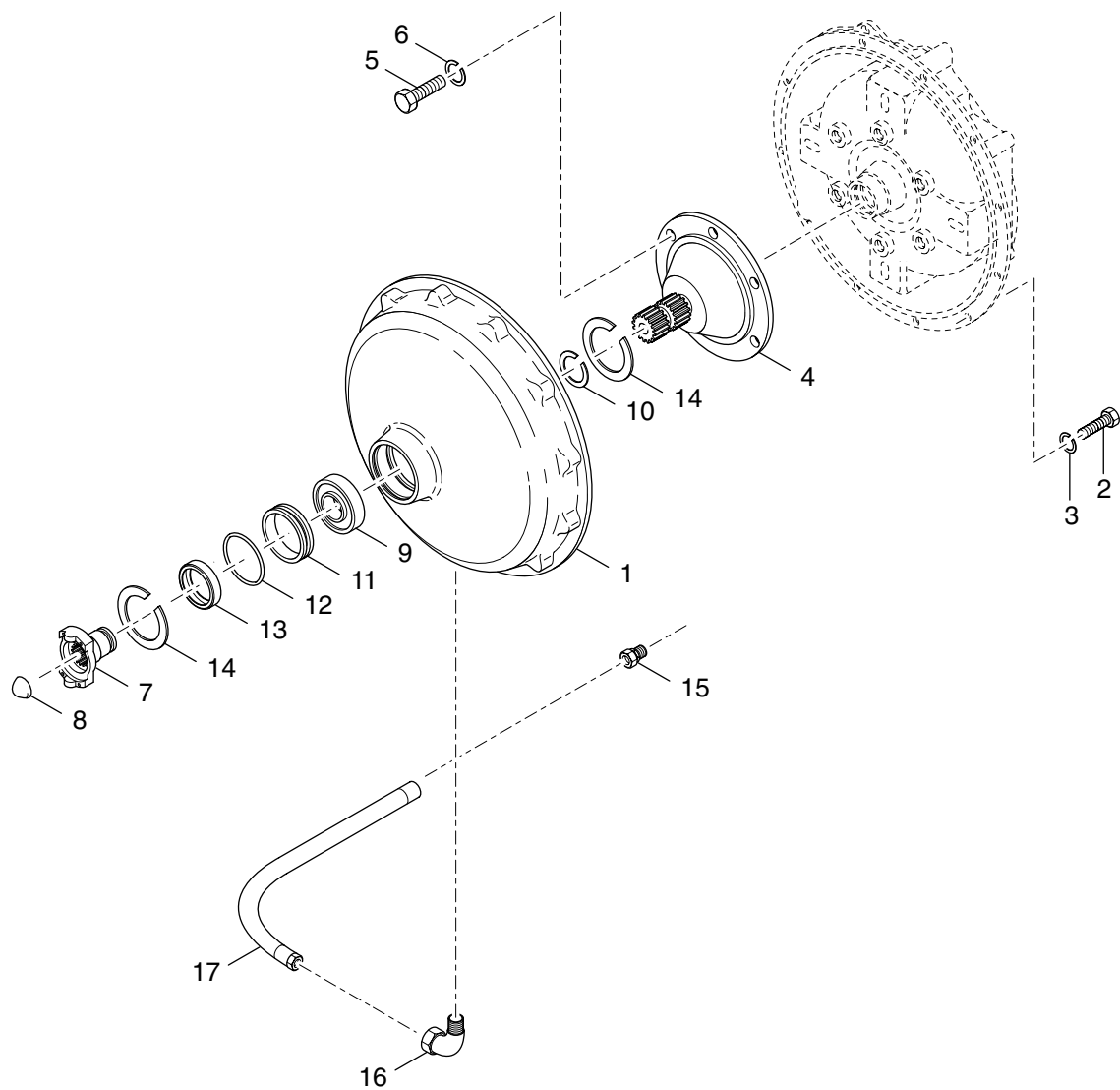
Install hydraulic inching actuator and "O"-ring.



11.2 MT SECTION

The information contained herein must be used in conjunction with a T12000 ID section. The MT model is the midship mounted T12000 series transmission with an integral convertor unit.

11.2.1 Sectional views and parts identification**11.2.2 Assembly instructions**

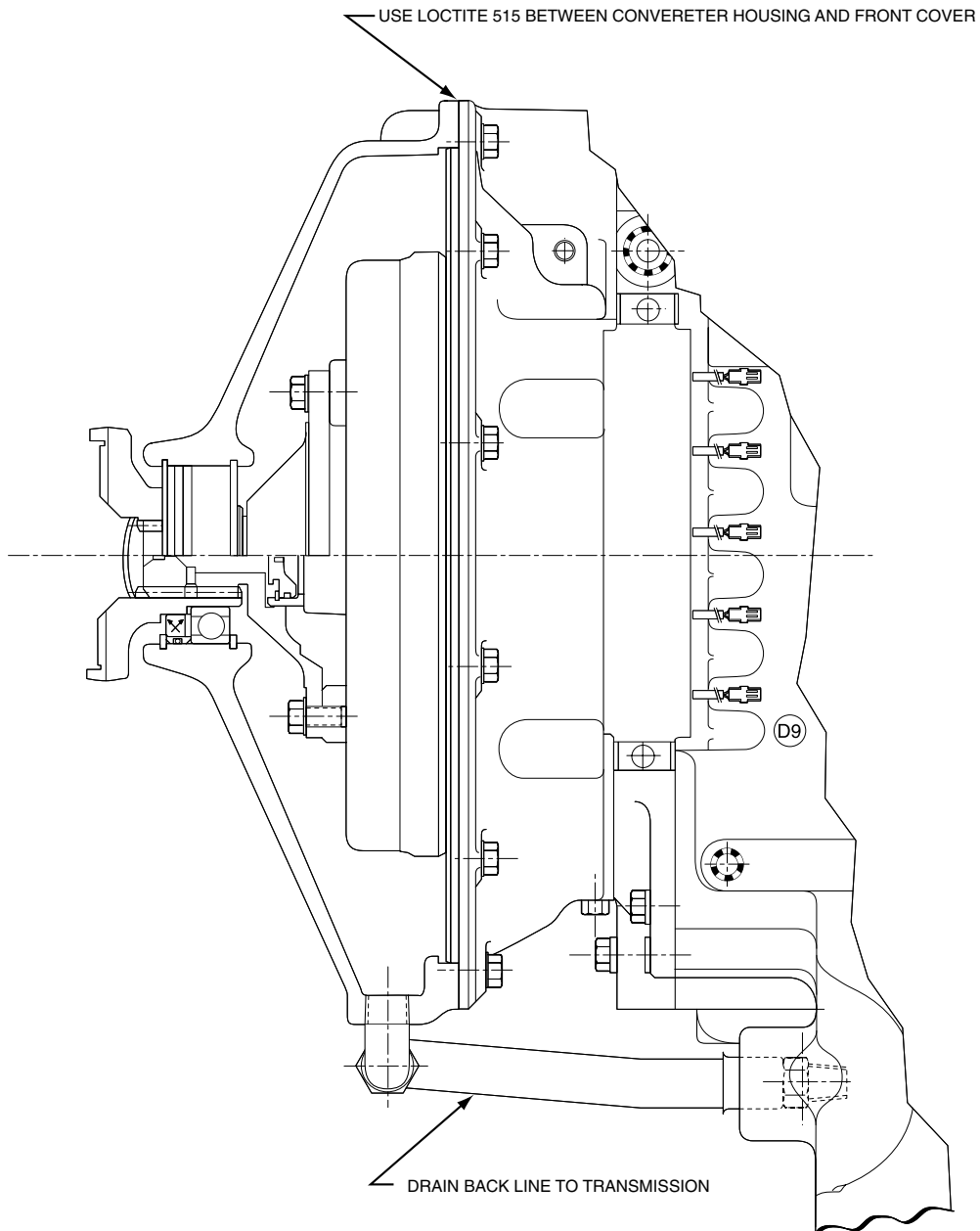


11.2.1 Parts identification

GROUP - FRONT COVER & INPUT DRIVE

Item	Description	Quantity
1	Cover - Front	1
2	Screw - Front cover to converter housing	12
3	Lockwasher - Front cover to converter housing	12
4	Shaft - Input Drive	1
5	Screw - Input drive shaft to torque converter	6
6	Lockwasher - Input drive shaft to torque converter	6
7	Flange - Input	1
8	Plug - Flange	1
9	Bearing - Input shaft	1
10	Snap ring - Flang retainer	1
11	Sleeve - Oil seal	1
12	"O"-ring - Oil seal sleeve	1
13	Seal - Input shaft oil	1
14	Snap ring - Input Shaft Bearing	2
15	Fitting	1
16	Fitting	1
17	Tube - Drain	1

11.2.2 MT cross section and assembly instructions





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