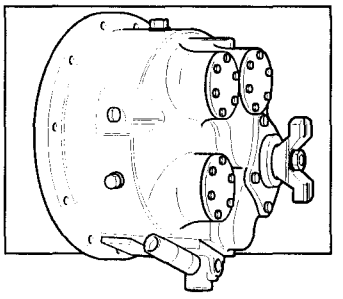
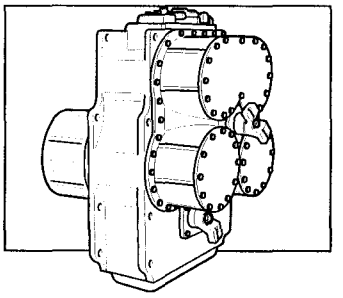
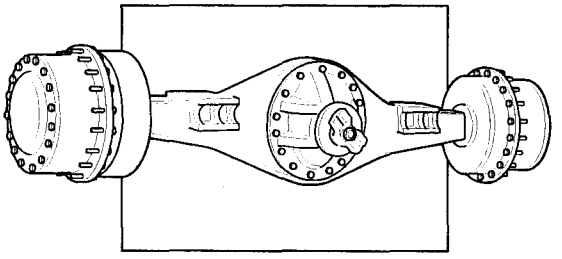
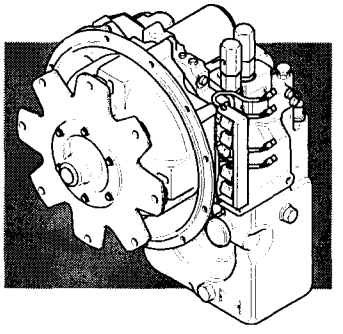
Maintenance and Service Manual









T12000
Powershift Transmission

3, 4 & 6 SPEED INTERMEDIATE DROP

SPICER® OFF HIGHWAY-PRODUCTS™

People Finding A Better Way®

814967

TOWING OR PUSHING

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

Note

IF THE TRANSMISSION HAS 4 WHEEL DRIVE, DISCONNECT BOTH FRONT AND REAR DRIVELINES. BECAUSE OF THE DESIGN OF THE HYDRAULIC SYSTEM, THE ENGINE CANNOT BE STARTED BY PUSHING OR TOWING.

FOREWORD

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

Table of Contents

6. OPERATION OF THE TRANSMISSION

7. TROUBLESHOOTING GUIDE FOR THE T12000 TRANSMISSION

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.

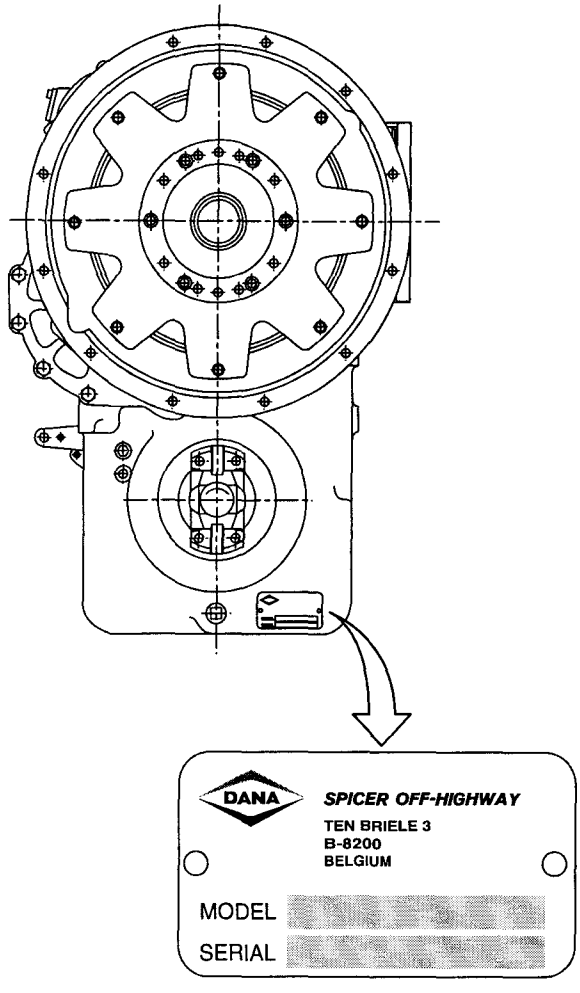
Inspect housings, covers and bearing caps to ensure that they are thoroughly clean and that mating surfaces, bearing bores, etc..., are free from nicks or burrs. Check all parts carefully for evidence of cracks or conditions which would cause subsequent oil leaks or failures.

2.3 LEGEND SYMBOLS

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

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

3. TECHNICAL SPECIFICATIONS



3.1 IDENTIFICATION OF THE UNIT

1. Model and type of the unit.
2. Serial number.

3.2 WEIGHT, DIMENSIONS, OIL CAPACITY

Weight (dry): ±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]

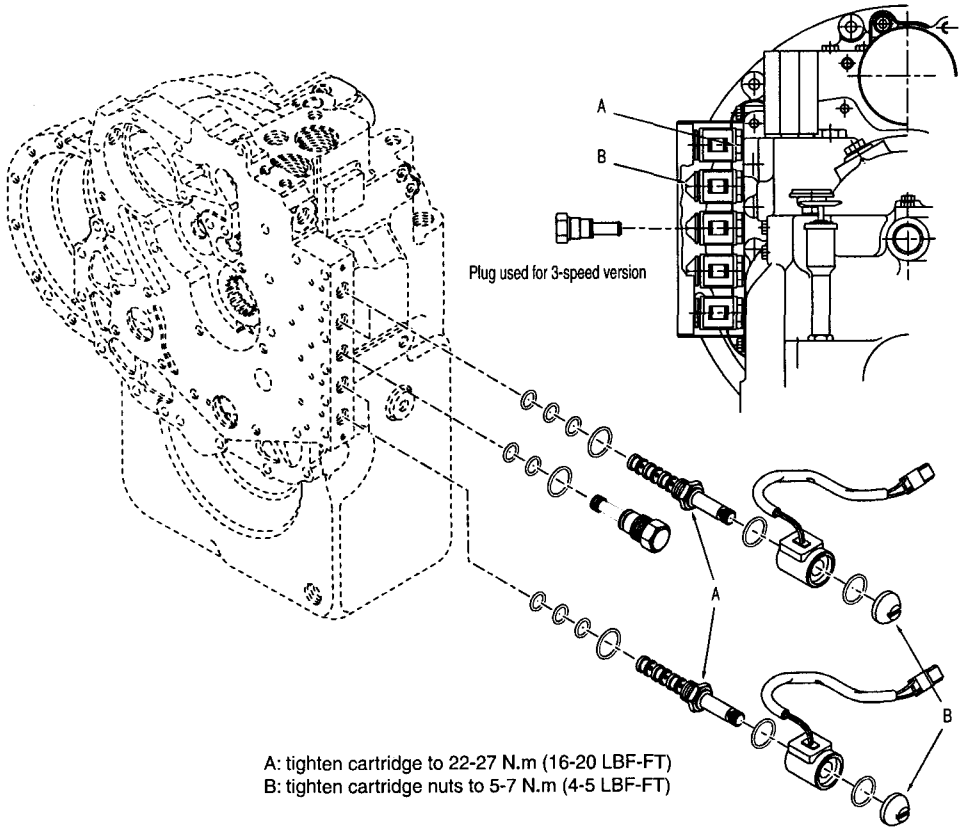
3.3.2 Pipe plug torque chart

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



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

3.4 PRESSURE AND TEMPERATURE SPECIFICATIONS

- Normal operating temperature 70 - 120 °C (158 - 248 F) measured at temperature check port converter out (port 71 - **).
- Maximum allowed transmission temperature 120 °C (248 F).
- Transmission regulator pressure (*) - (neutral) - port 31 (**).
  - At 600 RPM min. 12.76 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 (±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 (±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 ±0.5 Ω.
  - 24V: 39.3 Ω ±2 Ω.

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

3.6 HYDRAULIC COOLER AND FILTER LINE SPECIFICATIONS

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

4. MAINTENANCE

4.1 OIL SPECIFICATION

4.1.1 Recommended lubricants

1. Caterpillar — TO-4.
2. John Deere — J20 C, D.
3. Military — MIL-PRF-2104G.
4. Allison — C-4.
5. Dexron* — II Equivalent - See note below.

Note

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

Caution

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

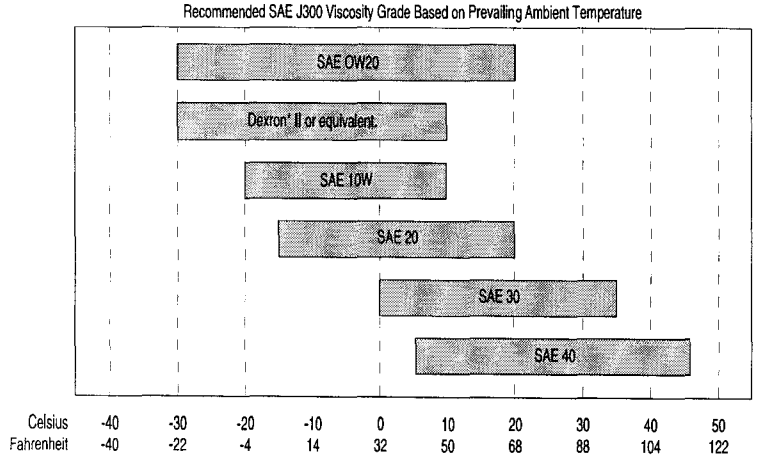
PREFERRED OIL VISCOSITY

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

Caution

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

FOR FIRE RESISTANT FLUID RECOMMENDATIONS PLEASE CONTACT ***SPICER OFF-HIGHWAY 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

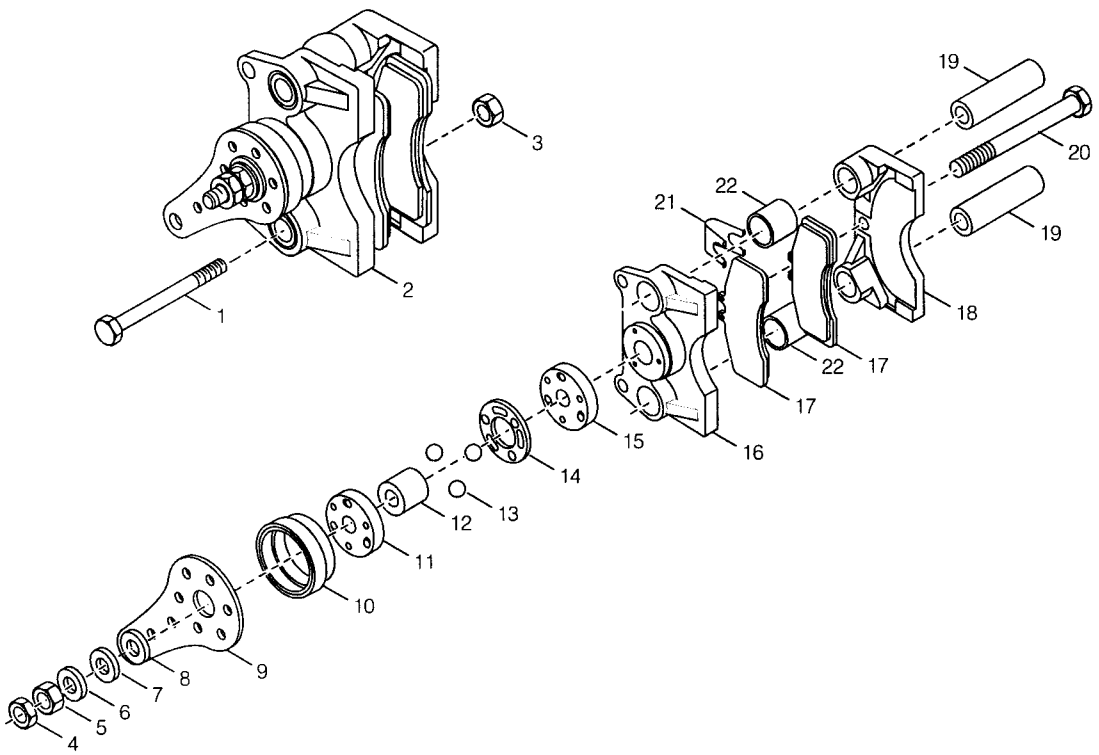
IF THE DIPSTICK IS NOT ACCESSIBLE OIL LEVEL CHECK PLUGS ARE PROVIDED.

- 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

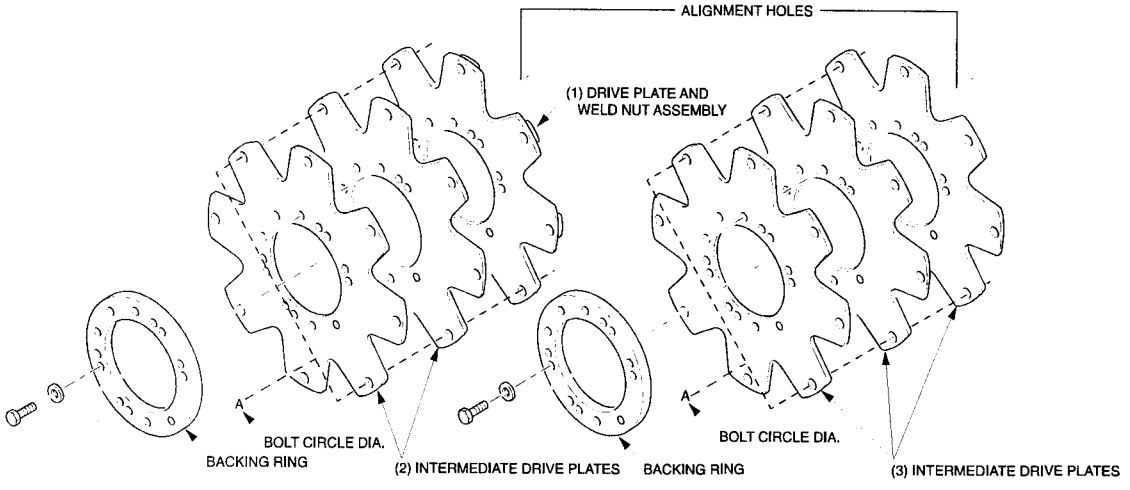
1. Loosen two adjustment locking nuts (4 & 5) enough to slide each torque plate (16 & 18) away from disc far enough to provide clearance to remove old carrier and lining assemblies and install new ones. (It may be necessary to remove one or both nuts).
2. Collapse lining retraction spring (21) and remove 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 retention 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.

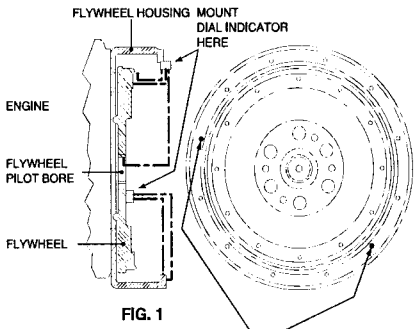


FIG. 1

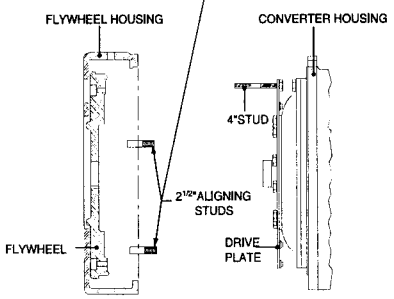


FIG. 2

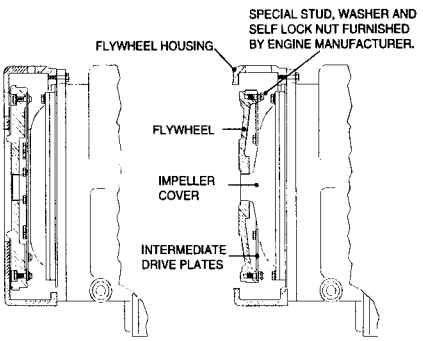


FIG. 3

FIG.4

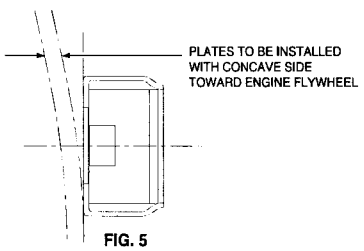
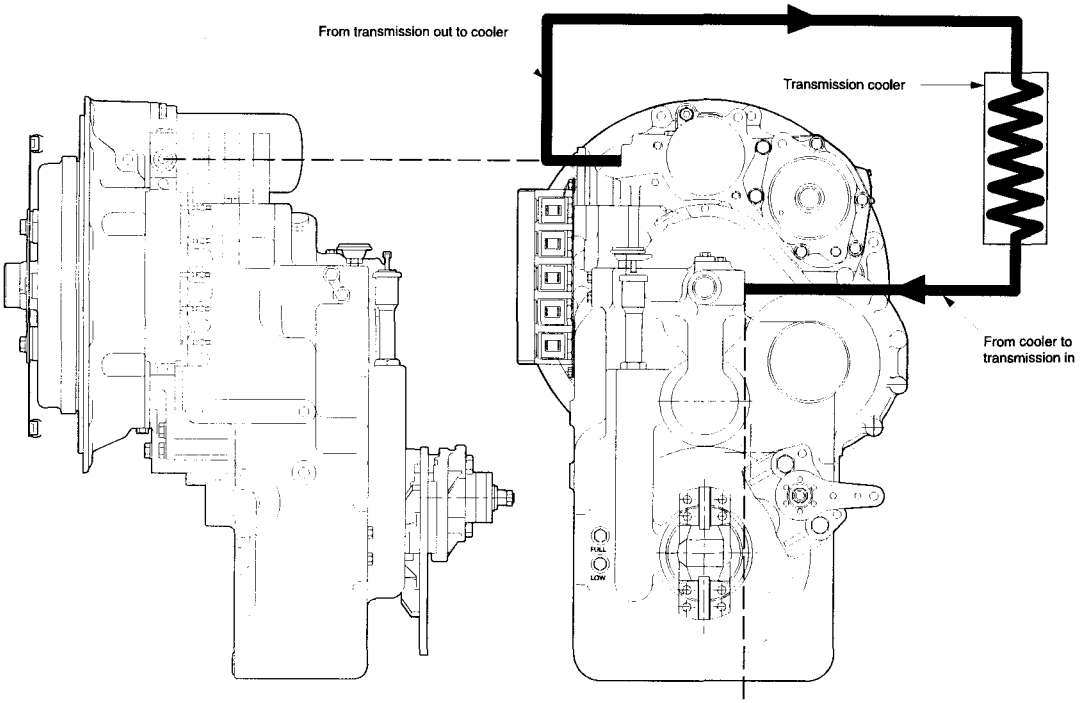
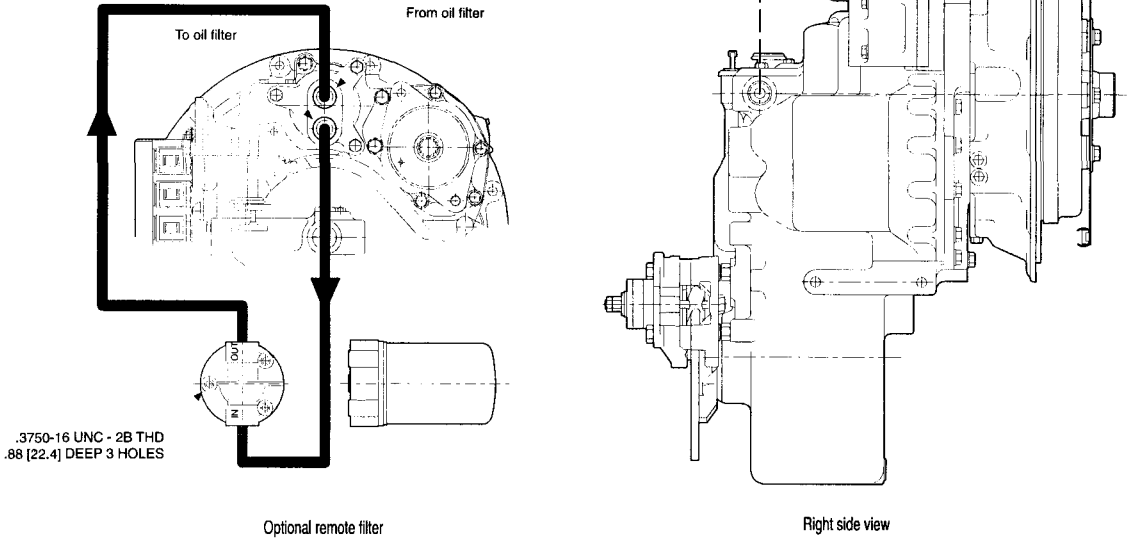


FIG. 5

5.3 EXTERNAL PLUMBING



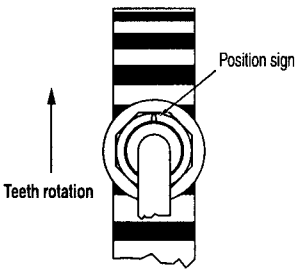
5.3.1 Optional remote filter



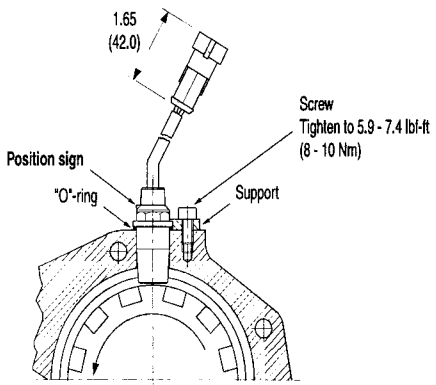
5.3.2 Cooler & filter lines specifications

- 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.

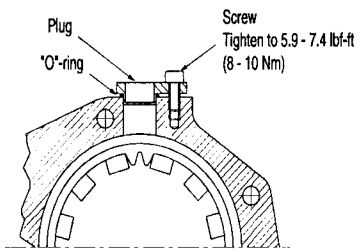
5.4 SPEED SENSOR INSTALLATION



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 gearteeth (Teeth rotation as shown).

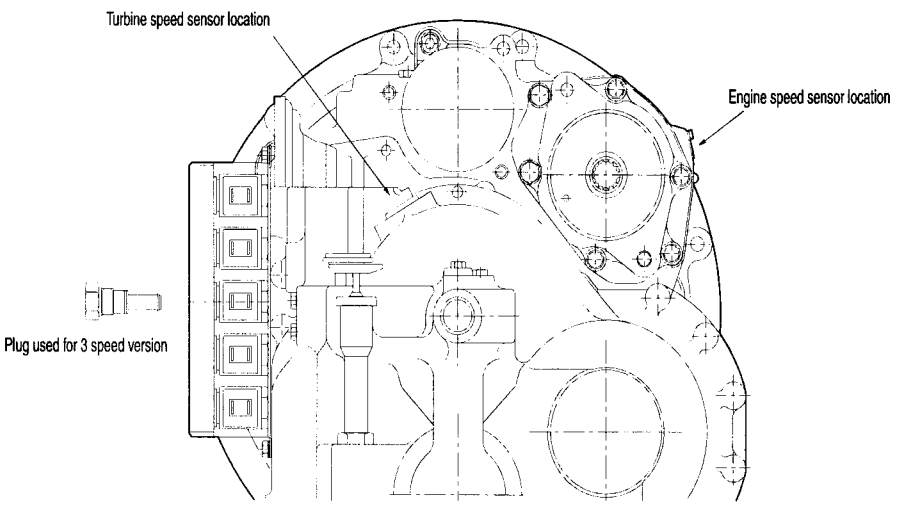


Sensor installed

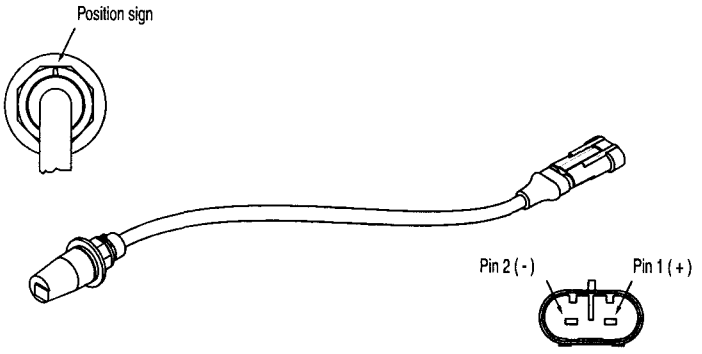


Hole plugged

Sensor position on transmission



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.

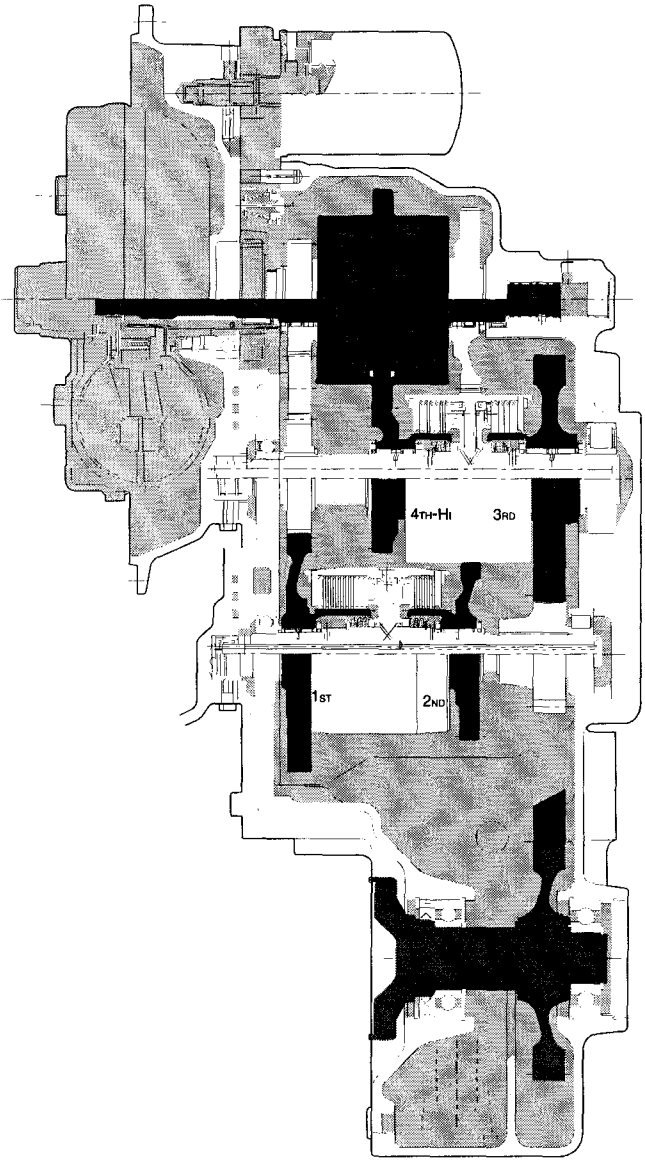
BE SURE TO CORRECTLY OBSERVE SENSOR POLARITIES, AS WRONG CONNECTIONS WILL DEACTIVATE THE SENSOR !

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.

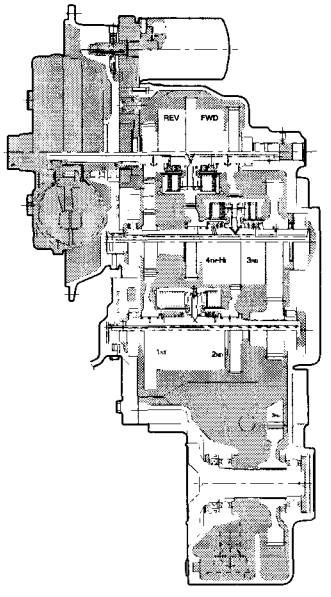
The torque multiplication is function of the blading (impeller, turbine and reaction member) and the converter output speed (turbine speed). The converter will multiply engine torque to its designed maximum multiplication ratio when the turbine shaft is at zero RPM (stall).

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.

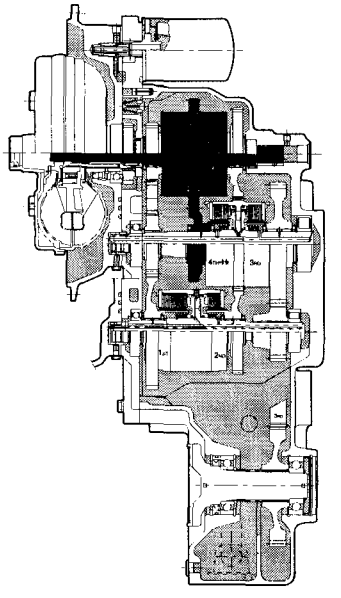
When the clutch is released, a return spring will push the piston back and oil will drain back via the solenoid, the bleed valve or holes in the clutch piston into the transmission sump.

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

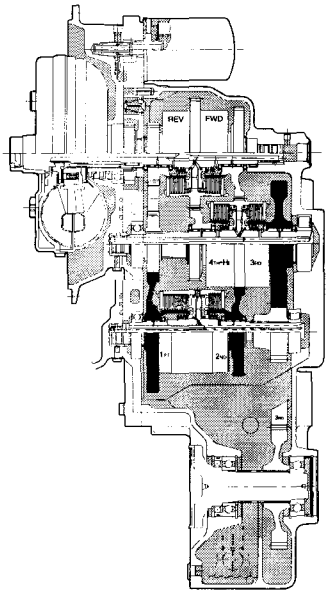
6.1.3 The range clutches

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.

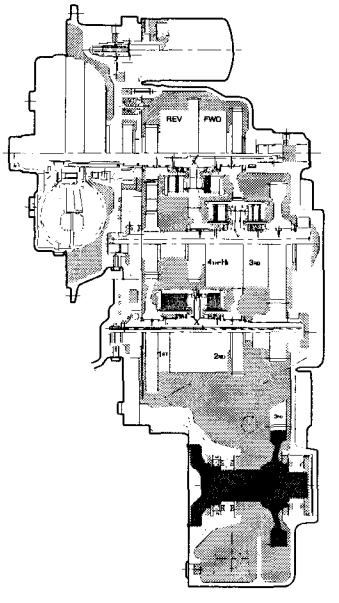
6.1.4 The output section

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.



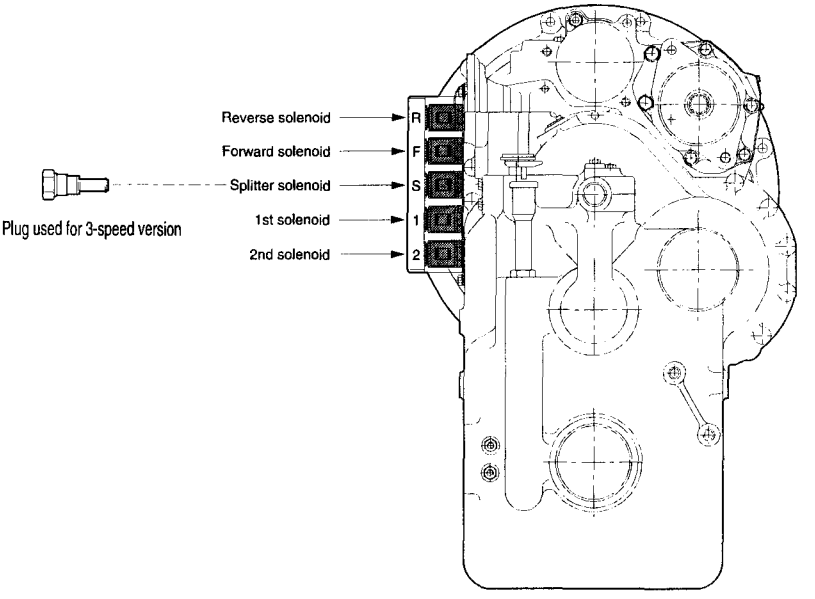
THE RANGE CLUTCHES



THE OUTPUT SECTION

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.



THE TRANSMISSION CONTROLS

6.2 ELECTRIC SOLENOID CONTROLS

6.2.1 3-Speed transmission

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

Note

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

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, Splitter	4th-High, 3rd
Forward 3	Forward	Forward, 3rd
Forward 2	Forward, 2nd	Forward, 2nd
Forward 1	Forward, 1st, 2nd	Forward, 1st
Neutral 3	—	3rd
Neutral 2	2nd	2nd
Neutral 1	1st, 2nd	1st
Reverse 3	Reverse	Reverse, 3rd
Reverse 2	Reverse, 2nd	Reverse, 2nd
Reverse 1	Reverse, 1st, 2nd	Reverse, 1st

6.2.2.2 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

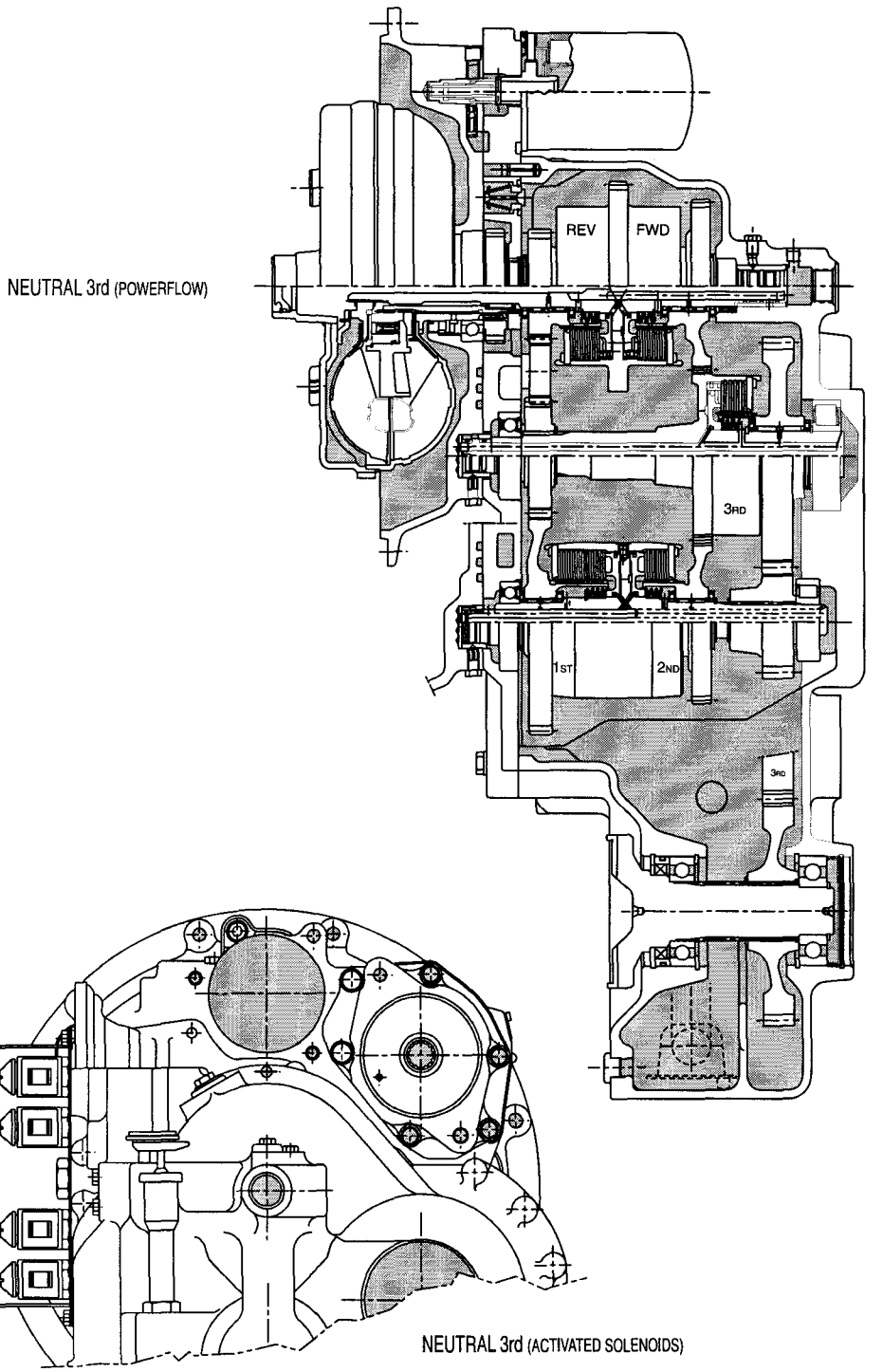
6.2.3 6-Speed transmission

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

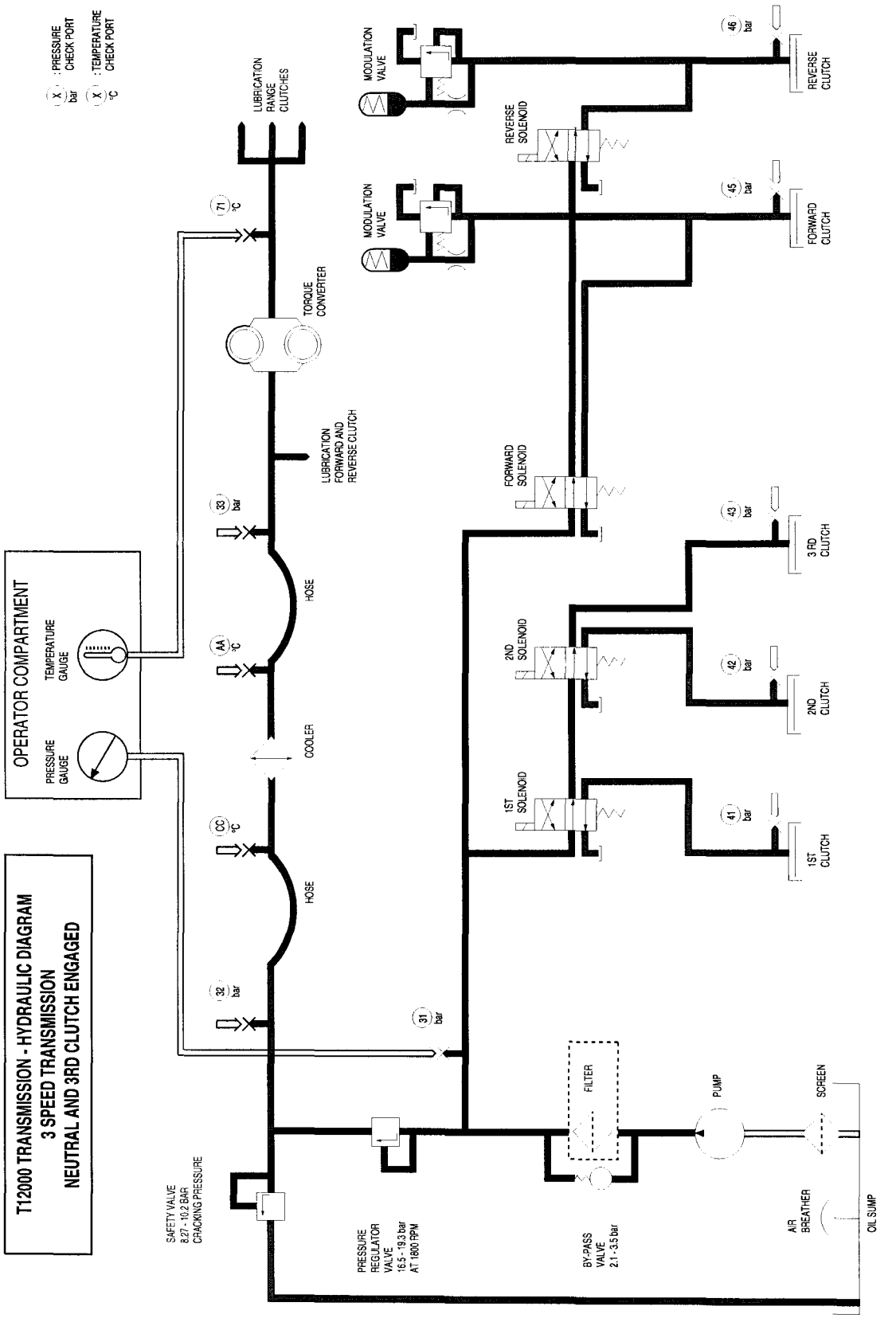
6.3 POWERFLOWS, ACTIVATED SOLENOIDS AND HYDRAULIC CIRCUIT

6.3.1 3-Speed transmission

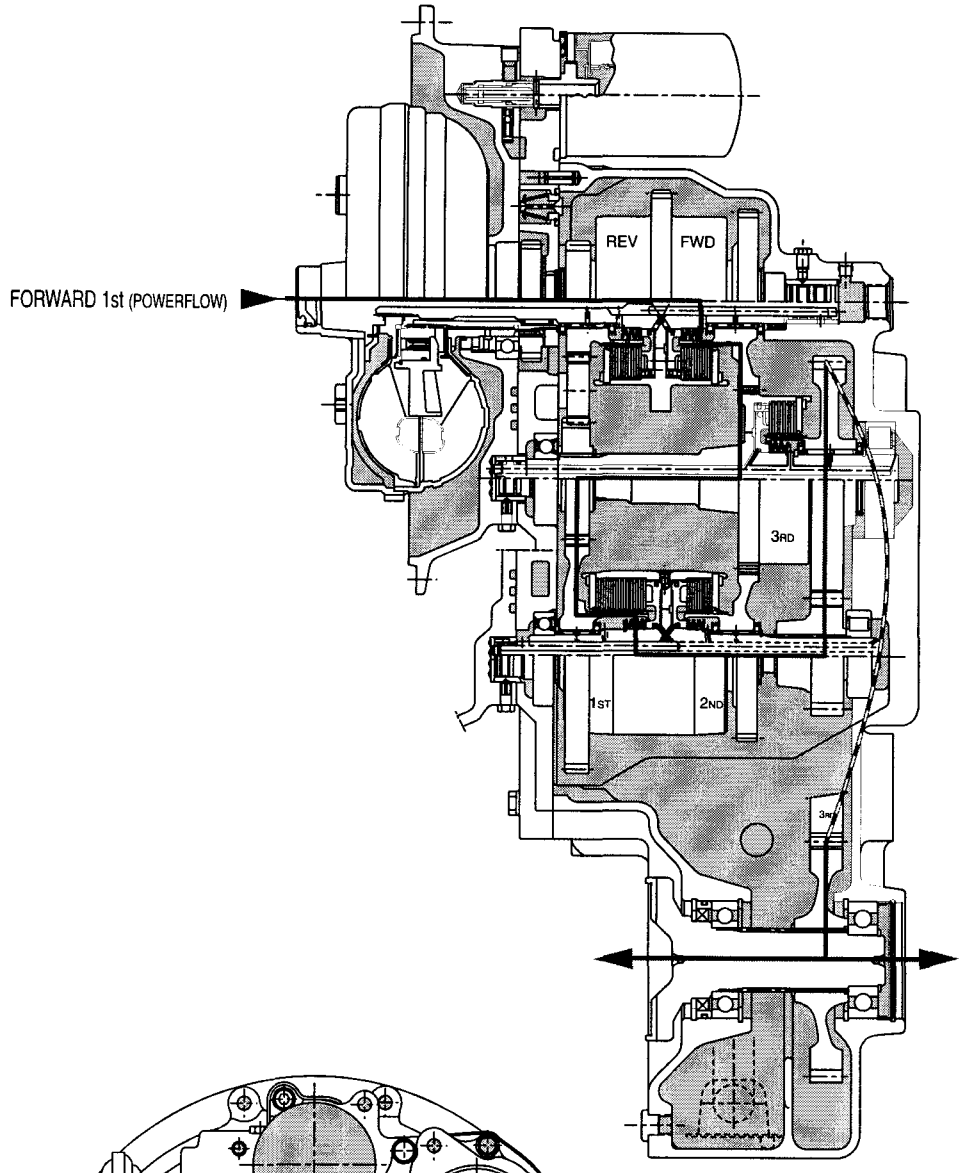
6.3.1.1 Neutral and 3rd clutch engaged



6.3.1.1 Neutral and 3rd clutch engaged (continued)

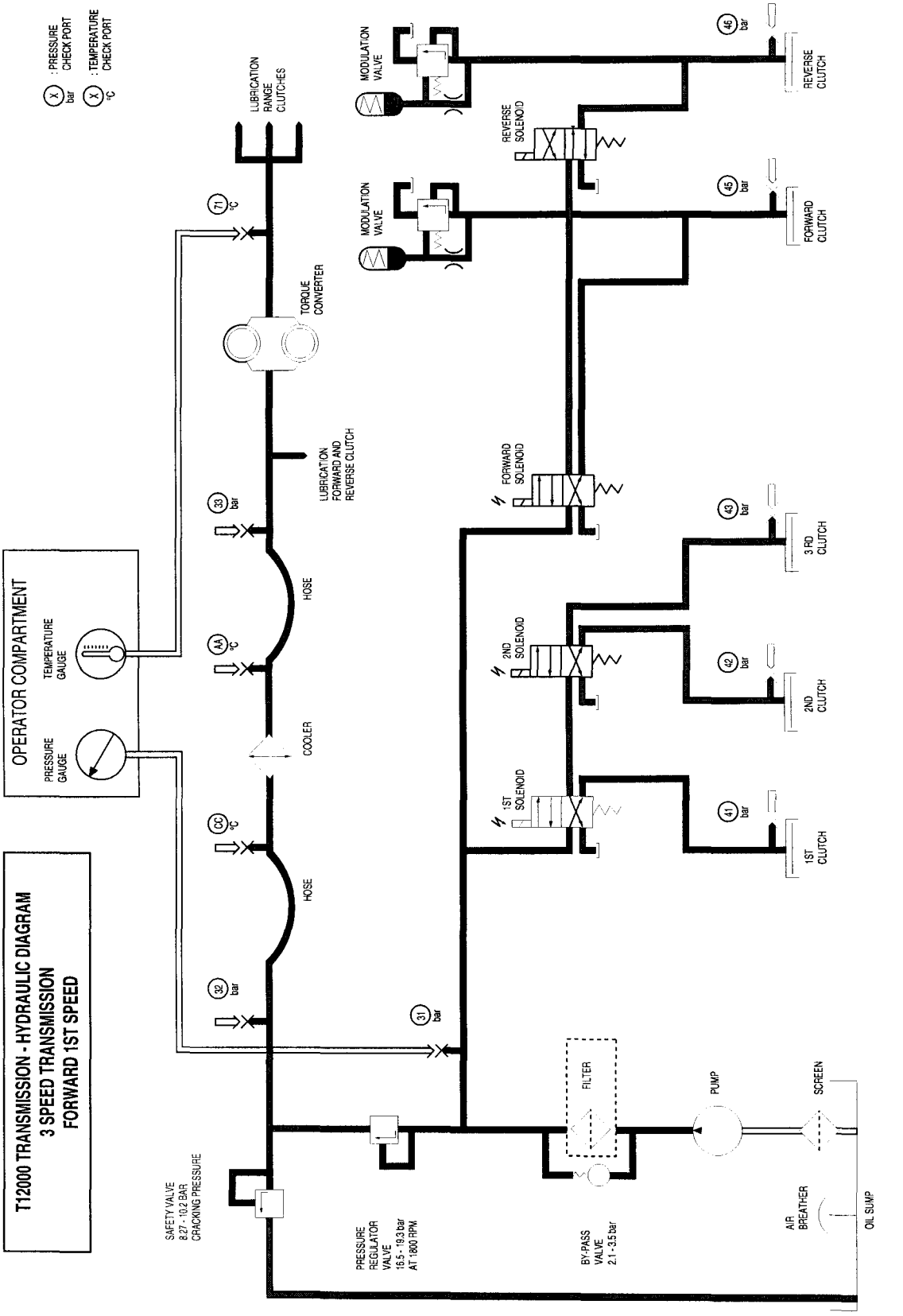


6.3.1.2 Forward 1st speed

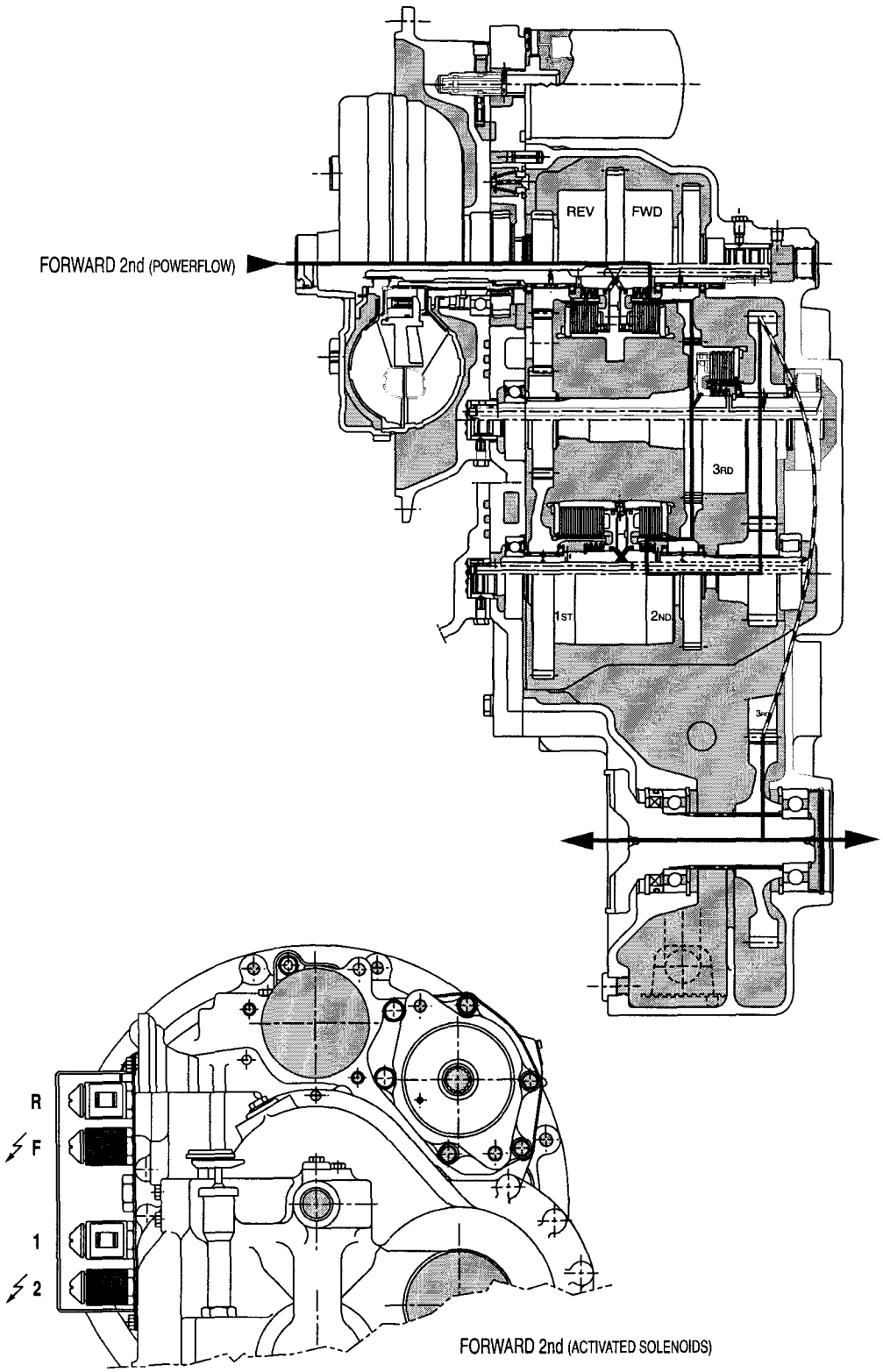


FORWARD 1st (ACTIVATED SOLENOIDS)

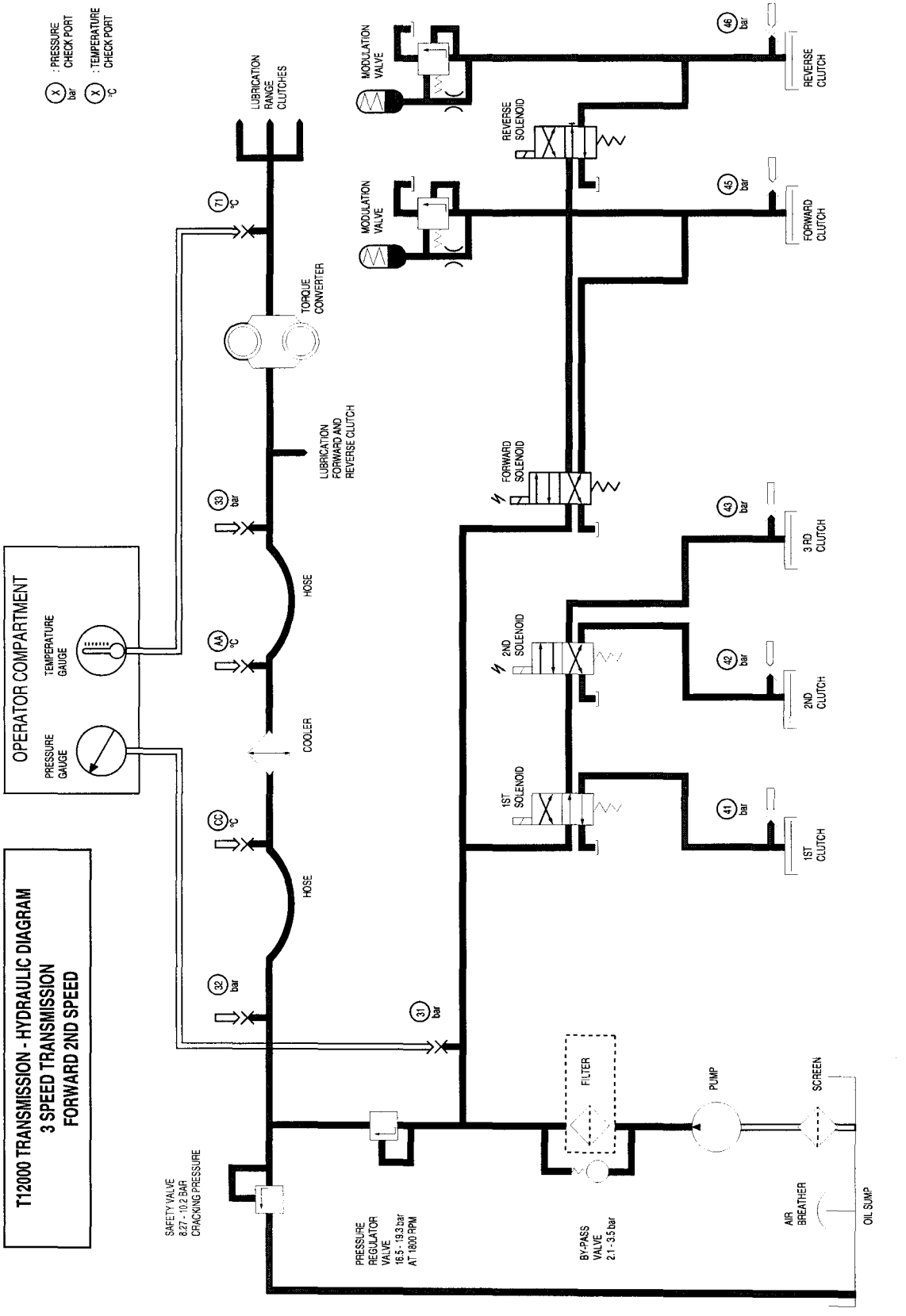
6.3.1.2 Forward 1st speed (continued)



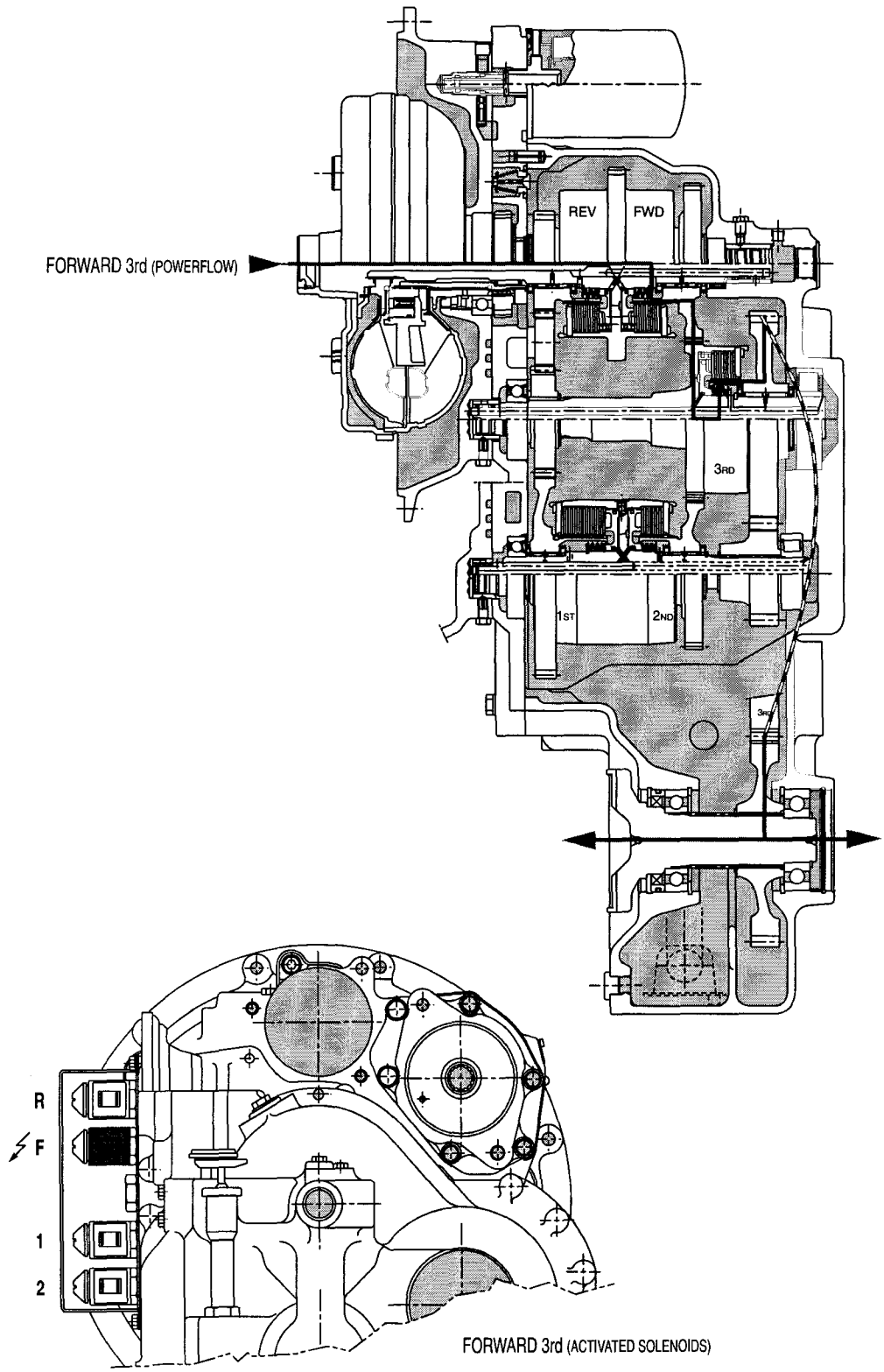
6.3.1.3 Forward 2nd speed



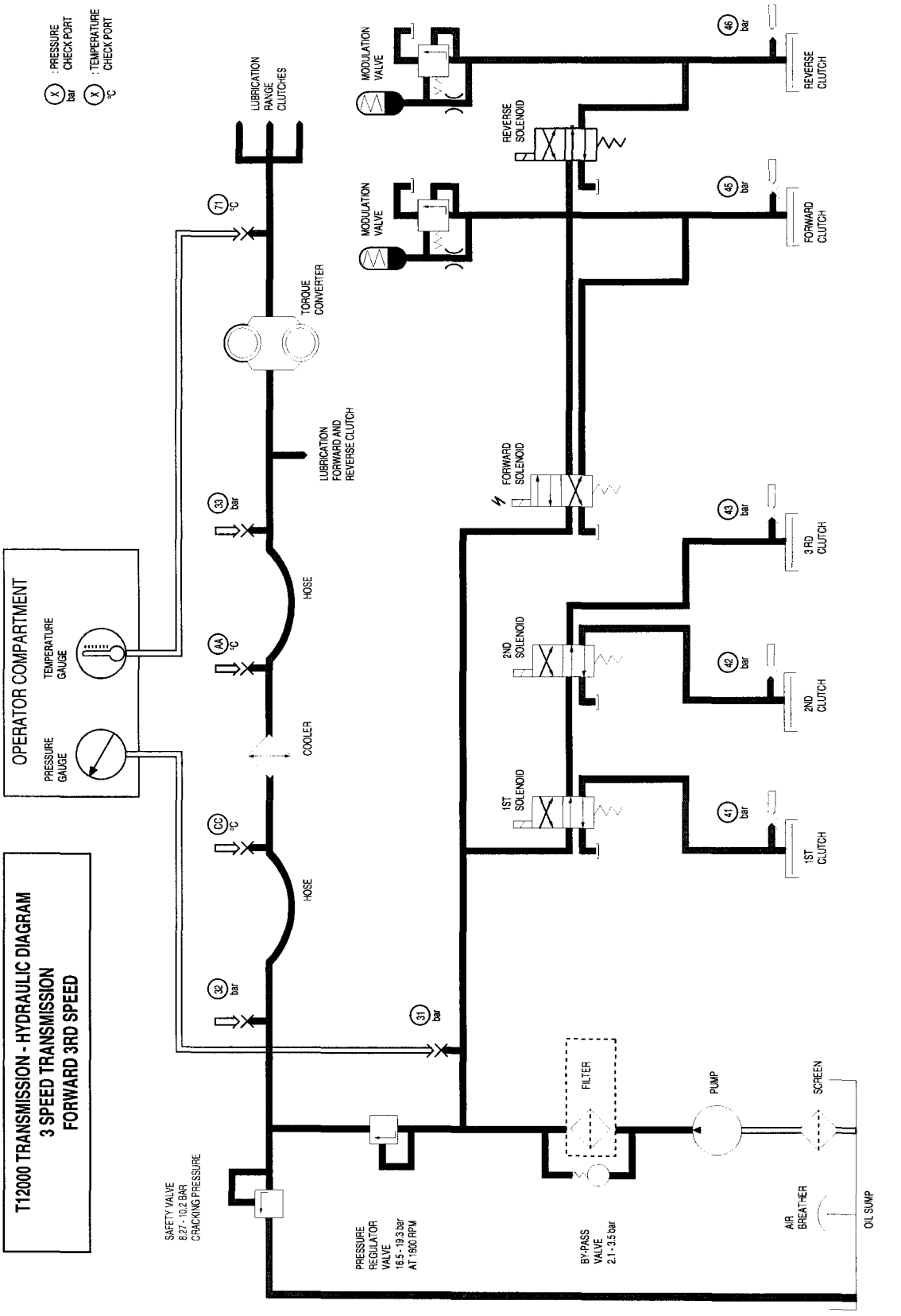
6.3.1.3 Forward 2nd speed (continued)



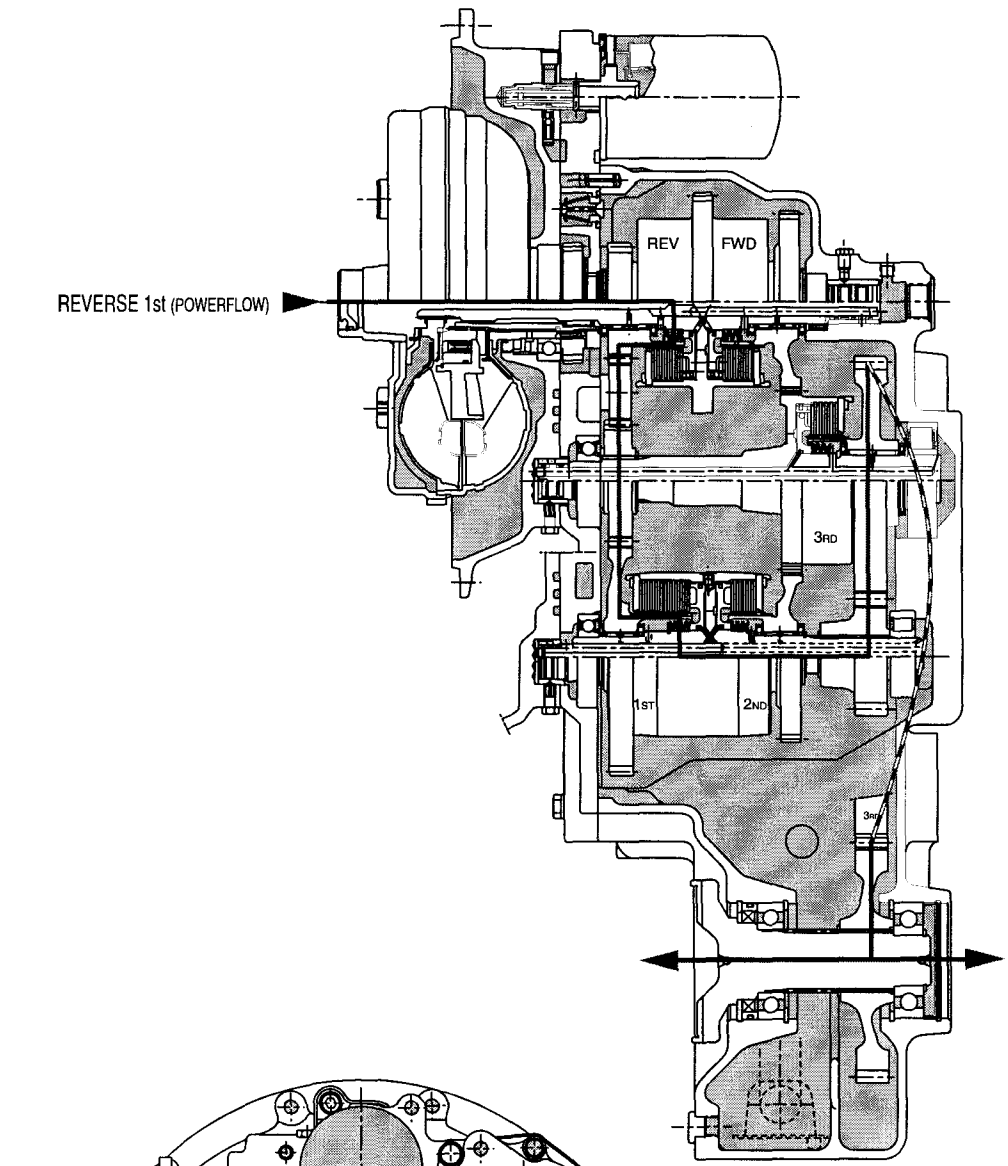
6.3.1.4 Forward 3rd speed

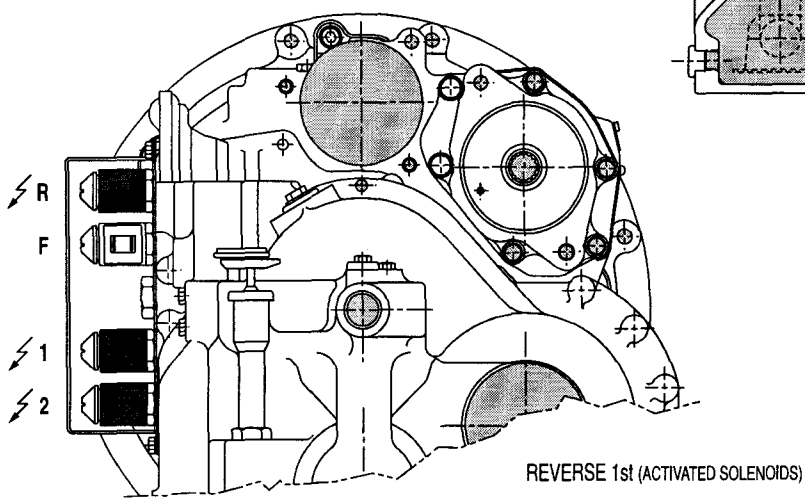


6.3.1.4 Forward 3rd speed (continued)



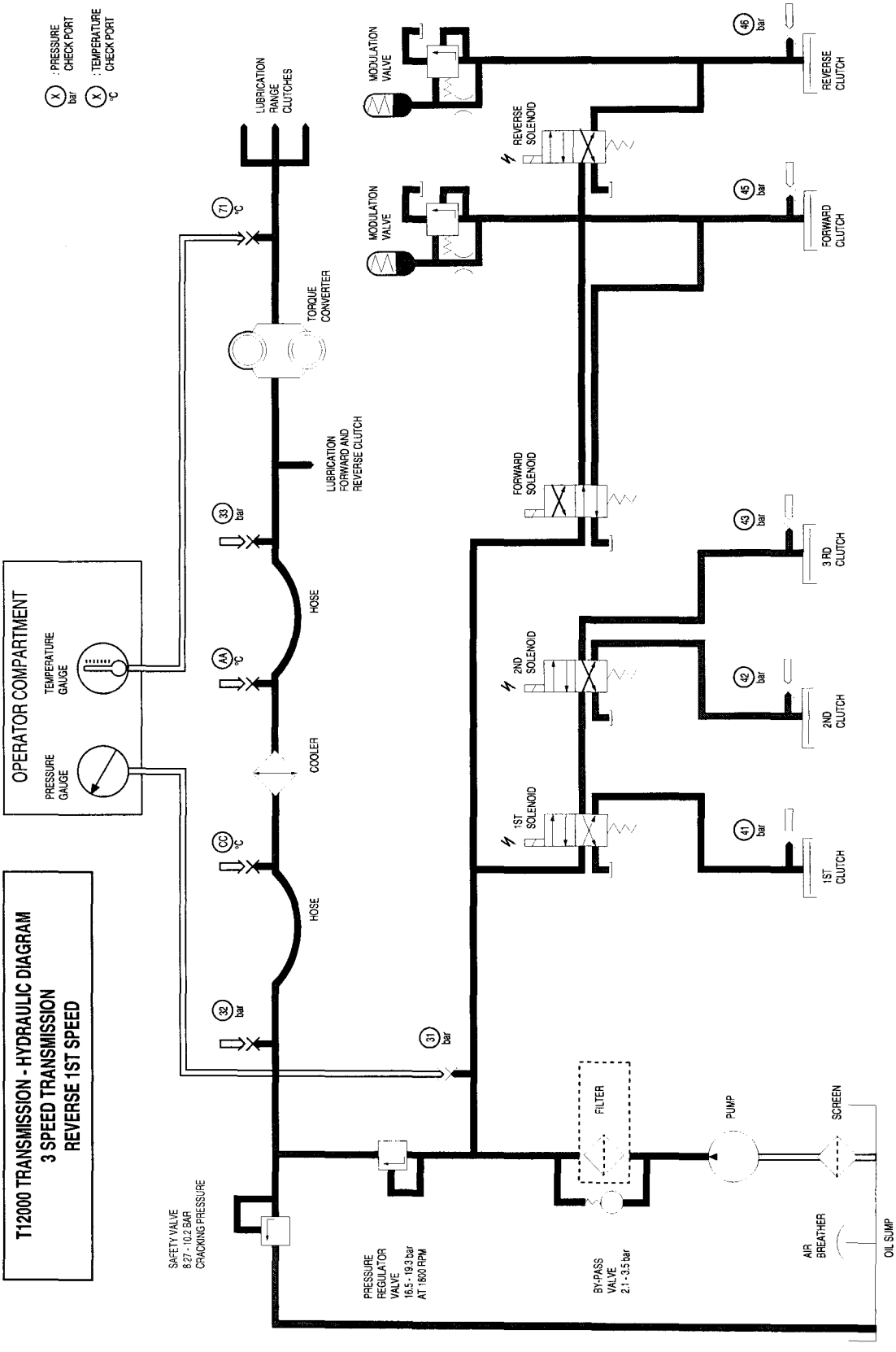
6.3.1.5 Reverse 1st speed





REVERSE 1st (ACTIVATED SOLENOIDS)

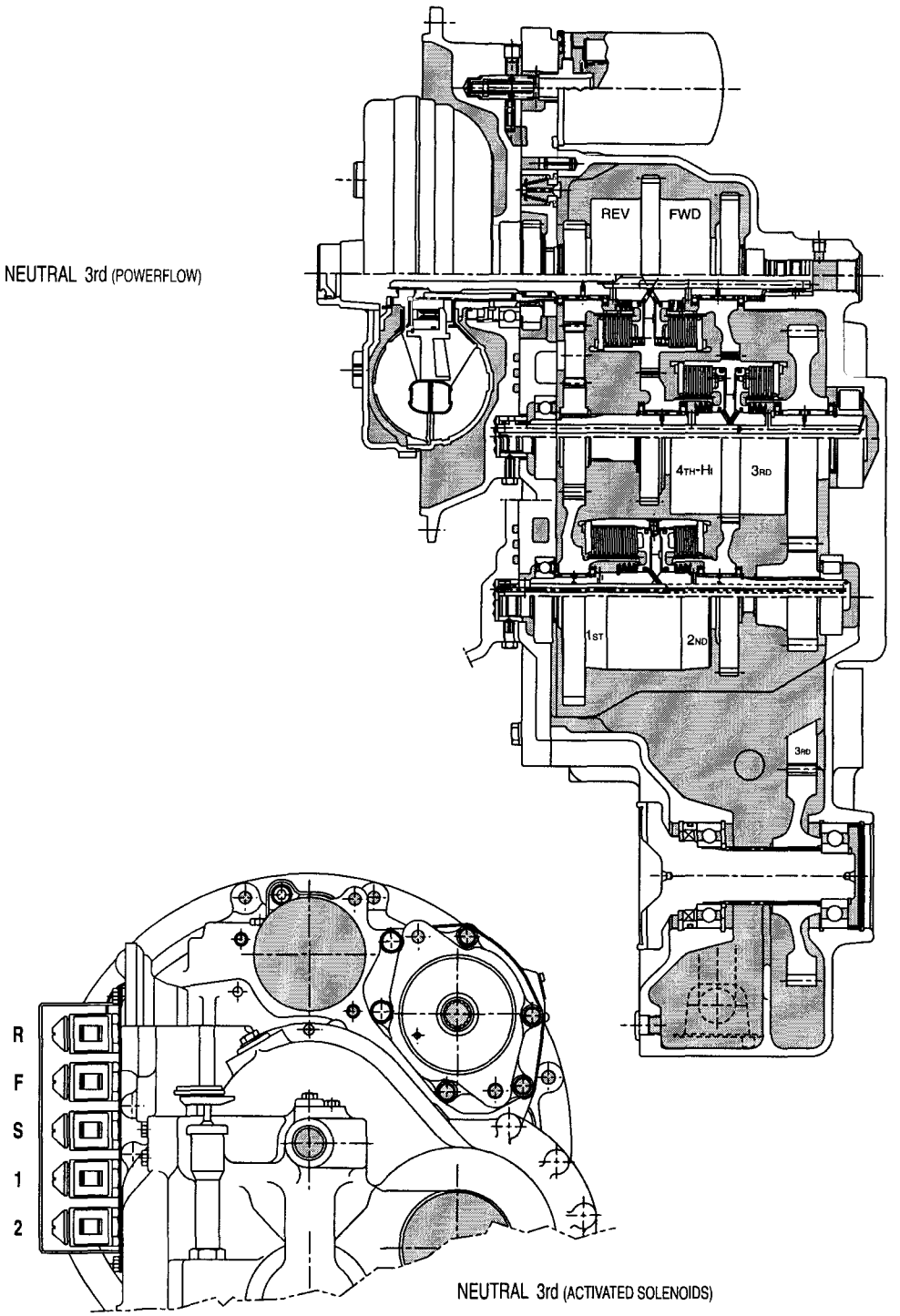
6.3.1.5 Reverse 1st speed (continued)



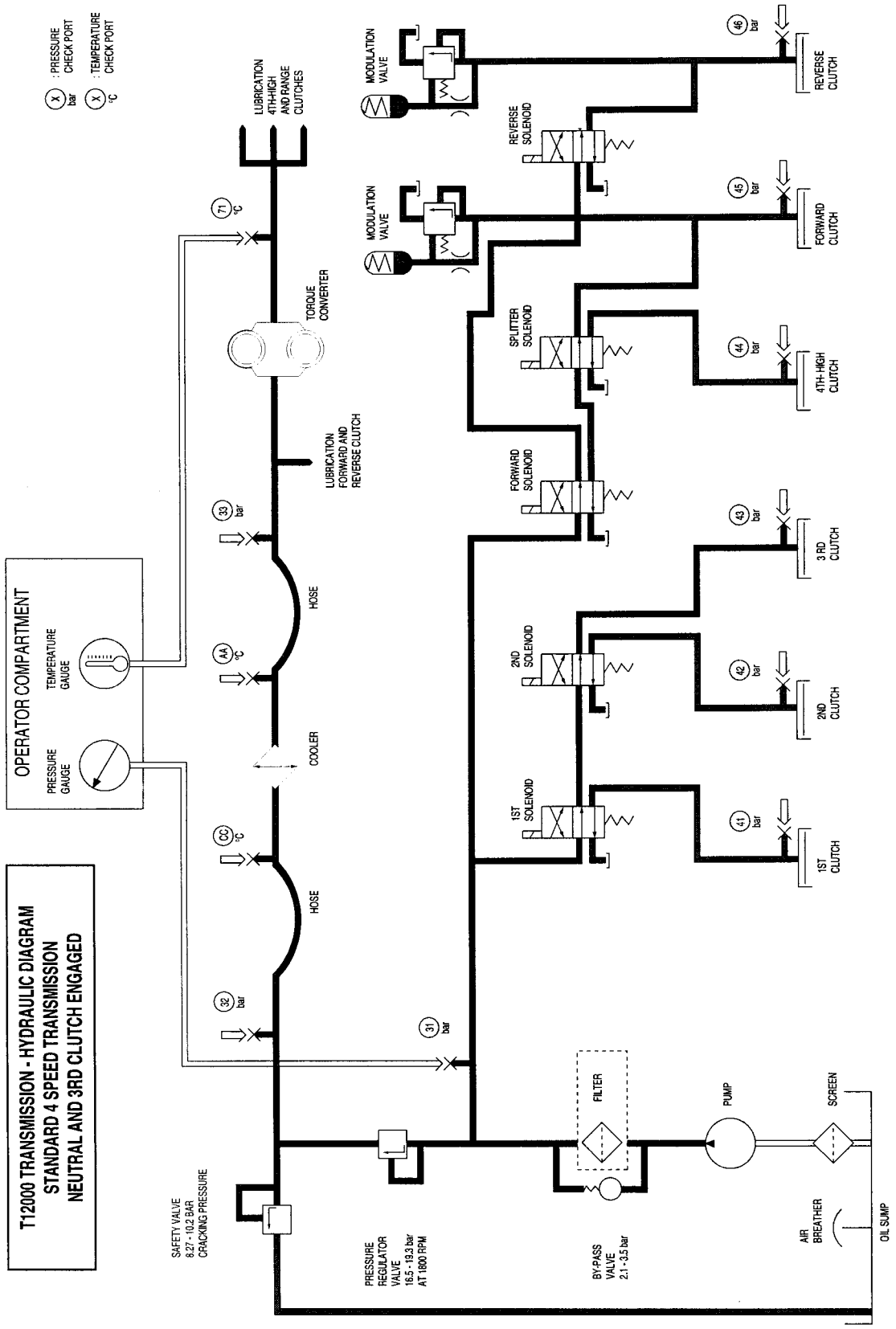
6.3.2 4-Speed transmission

6.3.2.1 Standard 4-speed transmission

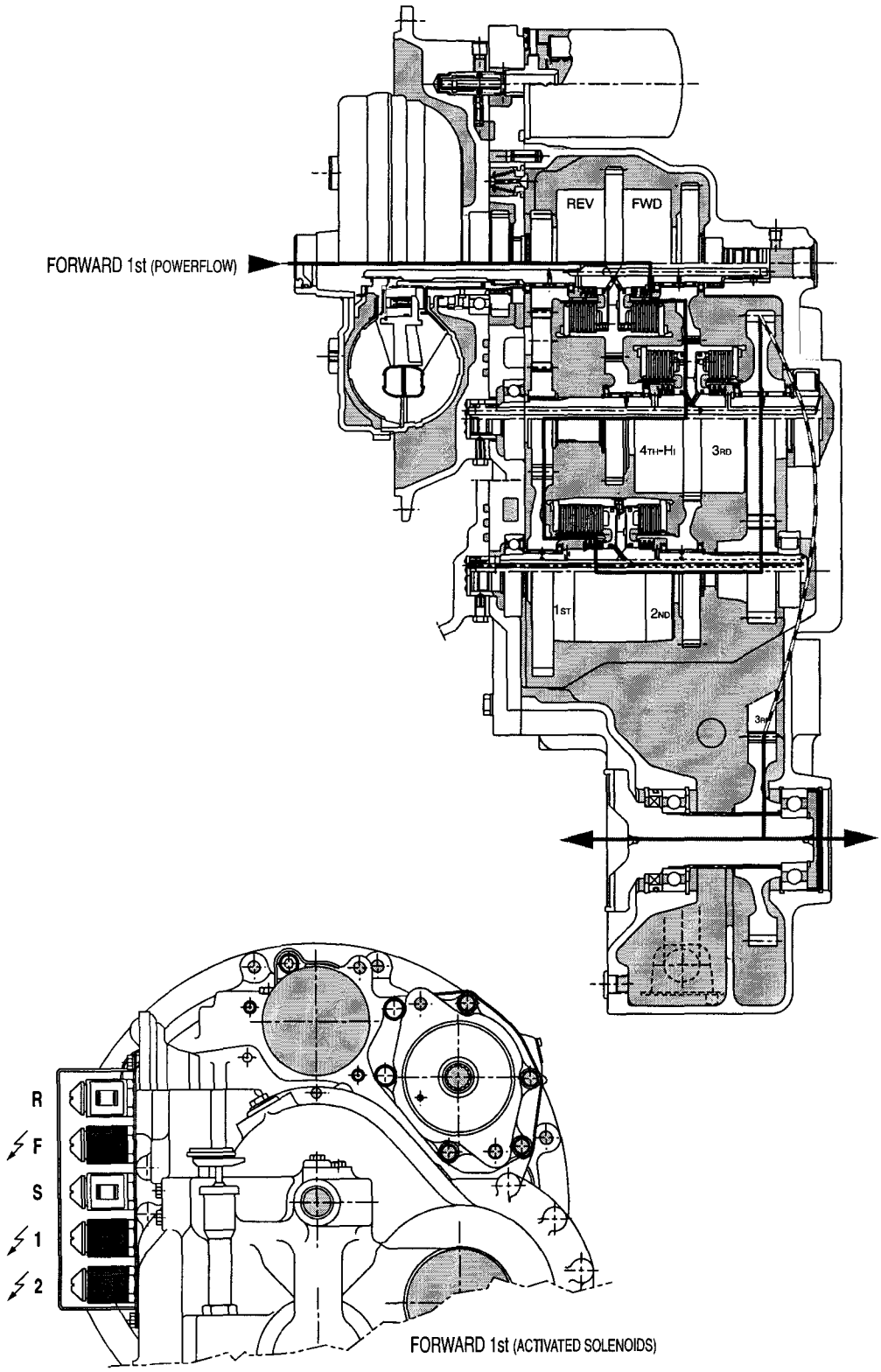
6.3.2.1.1 Neutral and 3rd clutch engaged



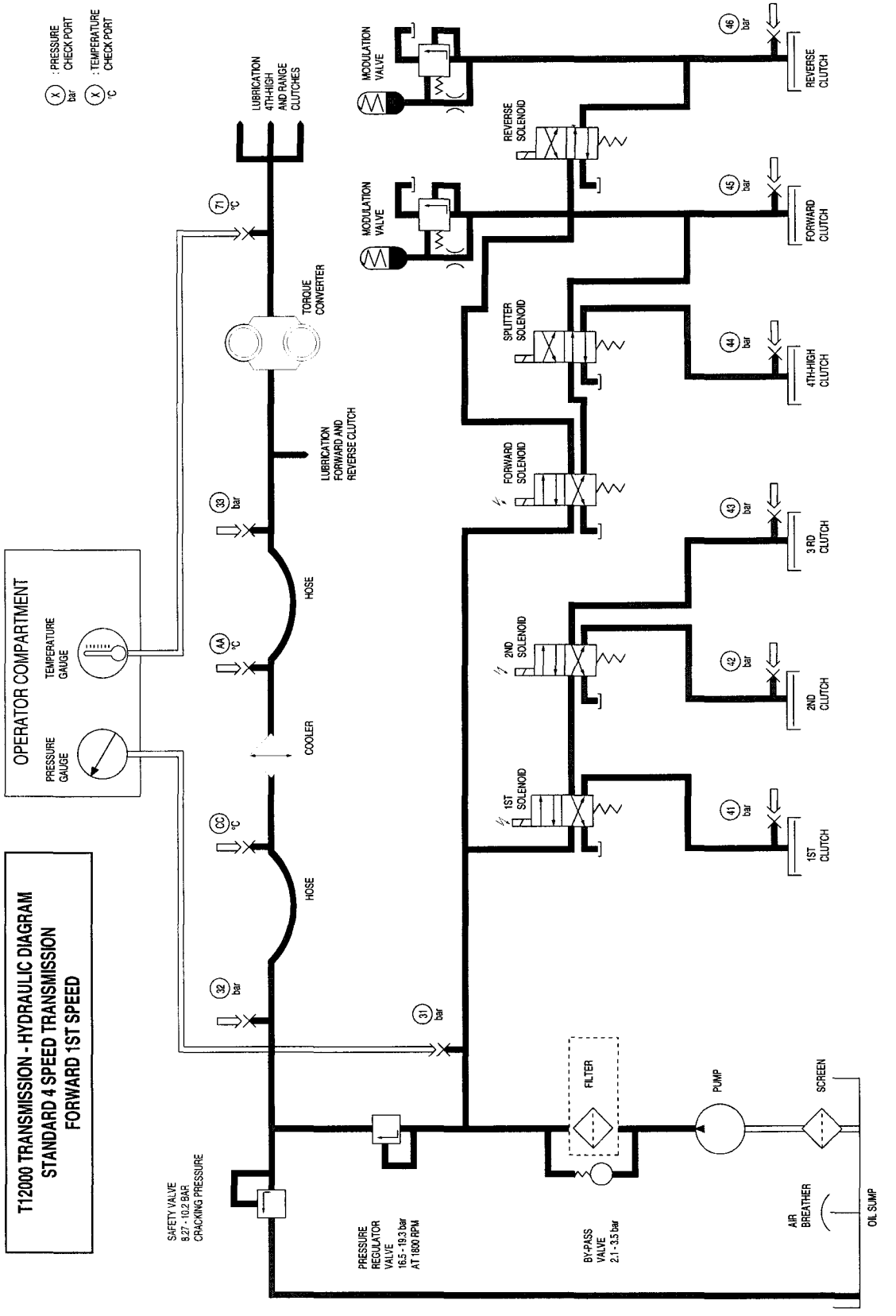
6.3.2.1.1 Neutral and 3rd clutch engaged (continued)



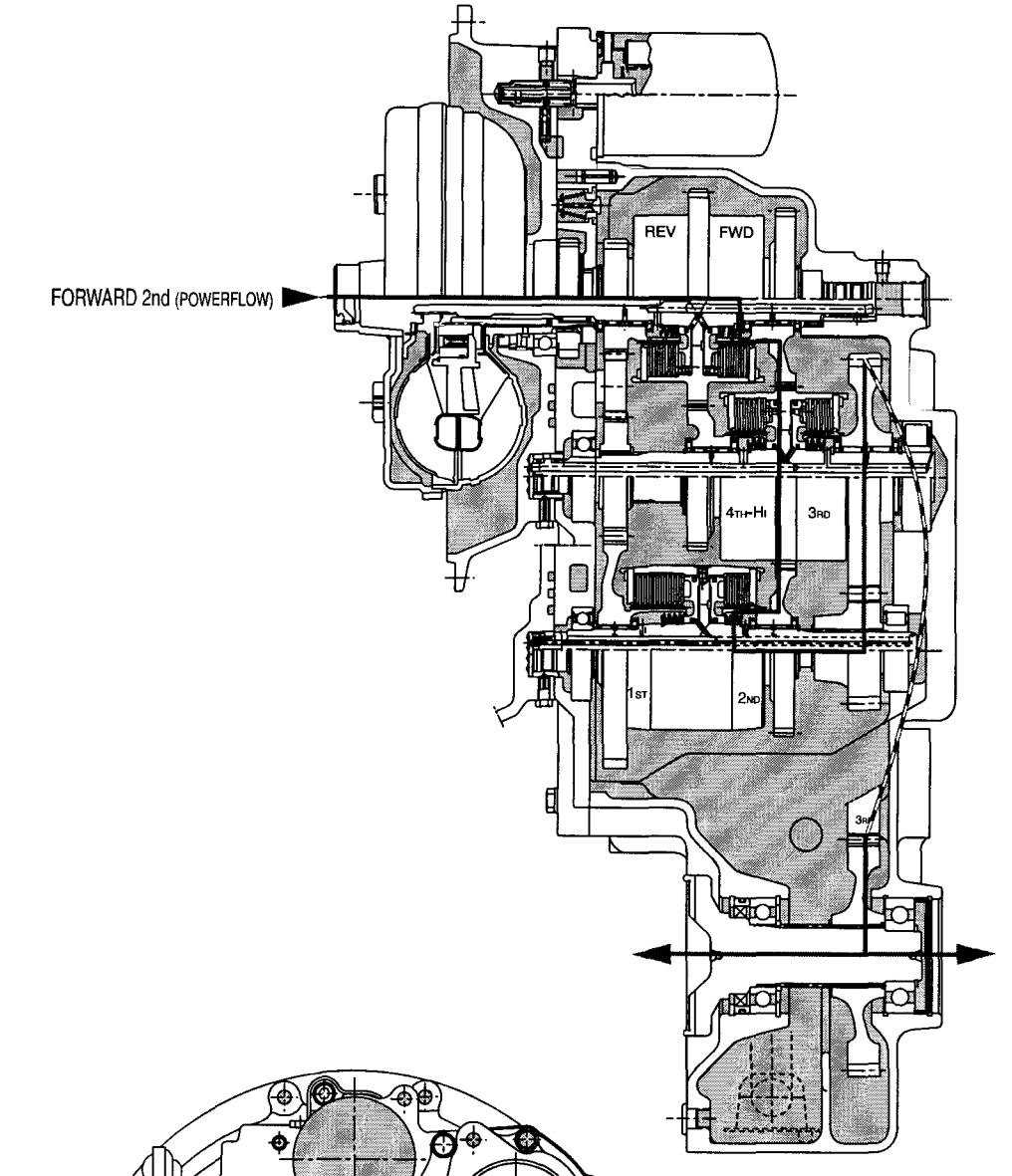
6.3.2.1.2 Forward 1st speed

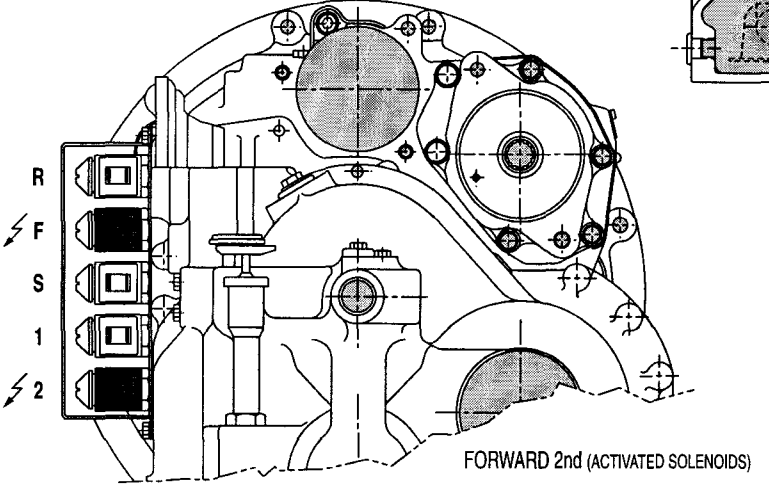


6.3.2.1.2 Forward 1st speed (continued)

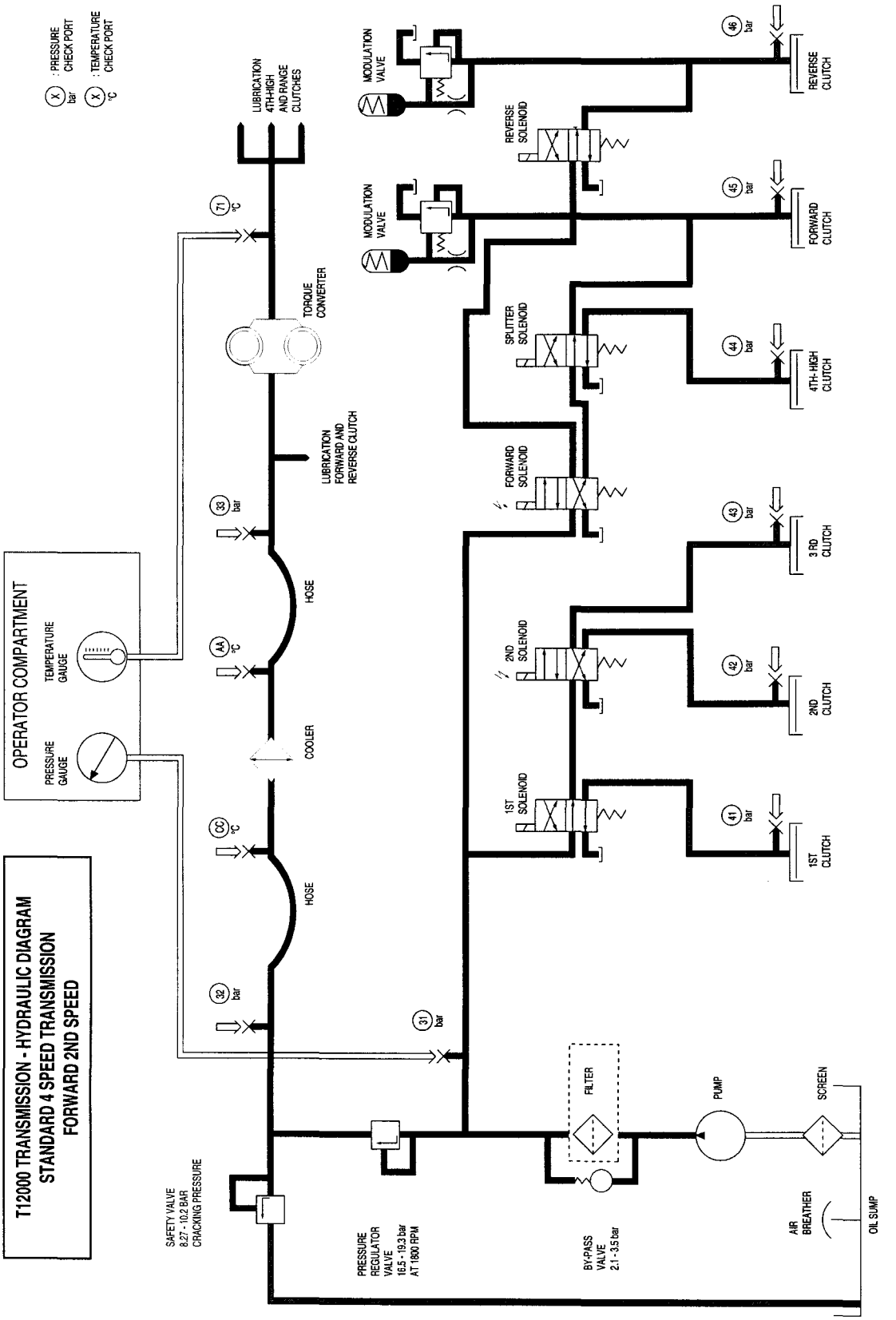


6.3.2.1.3 Forward 2nd speed

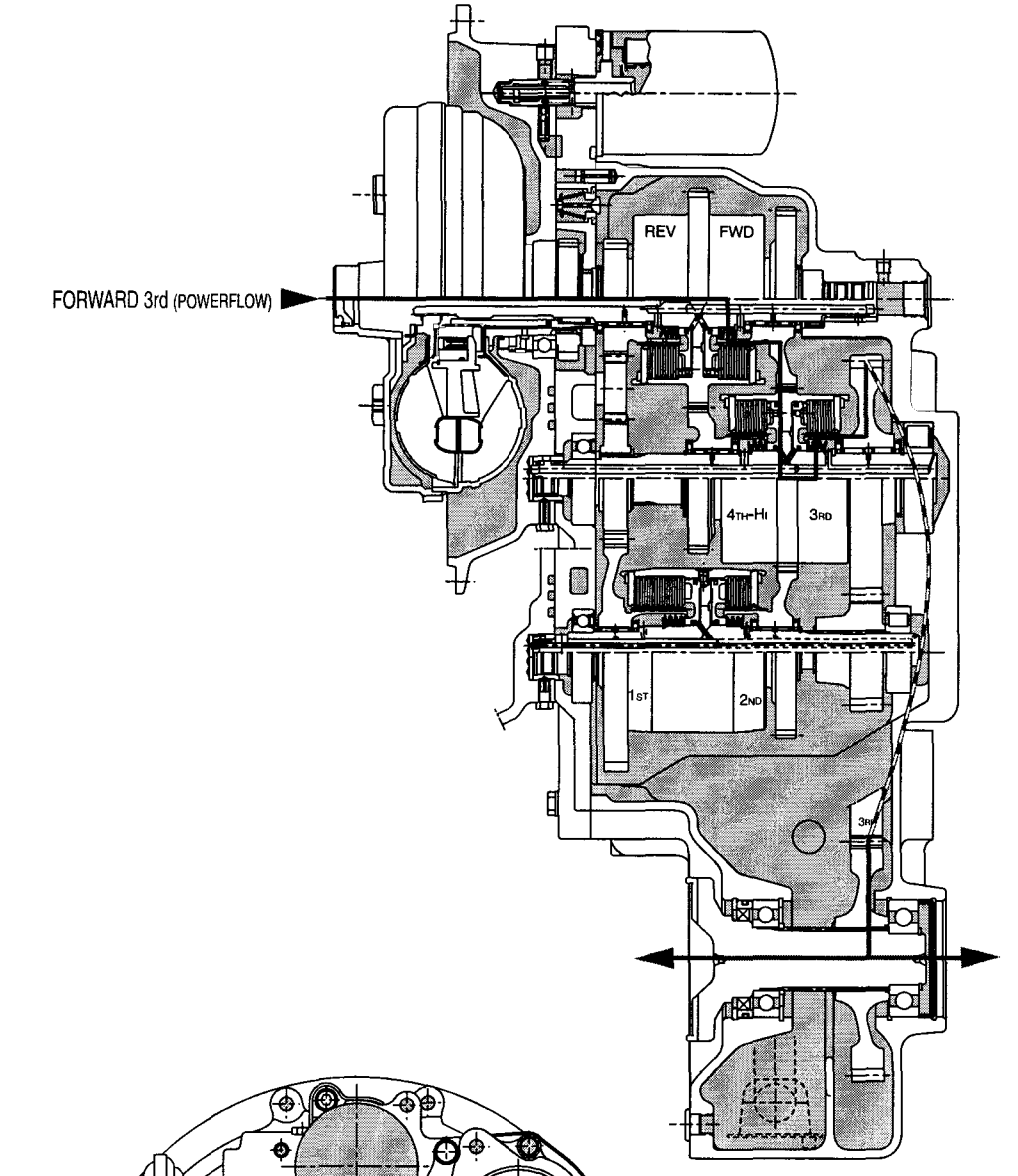


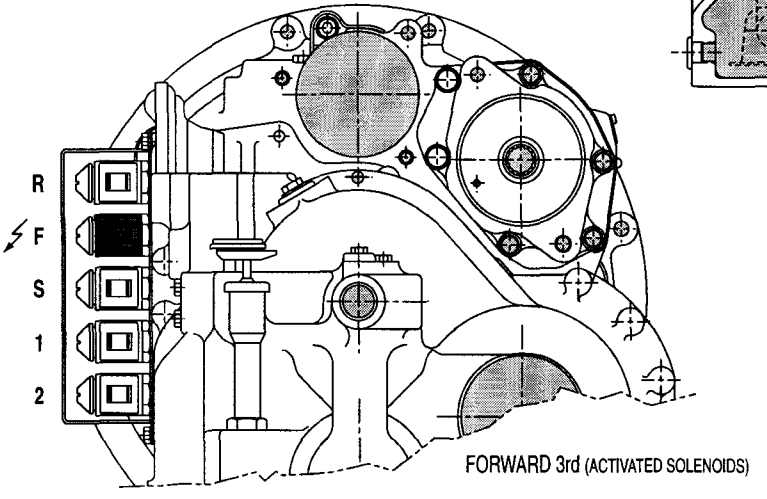


6.3.2.1.3 Forward 2nd speed (continued)

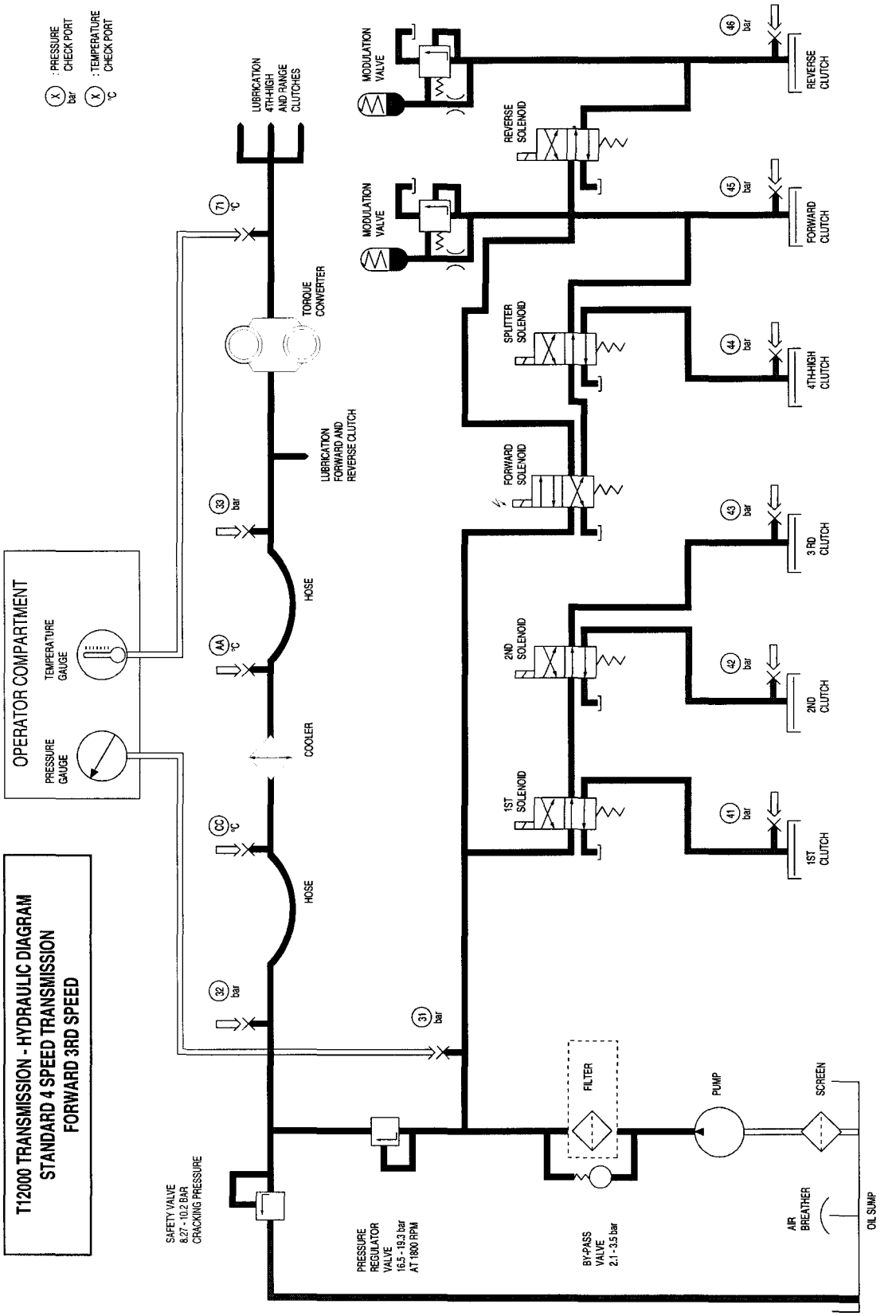


6.3.2.1.4 Forward 3rd speed

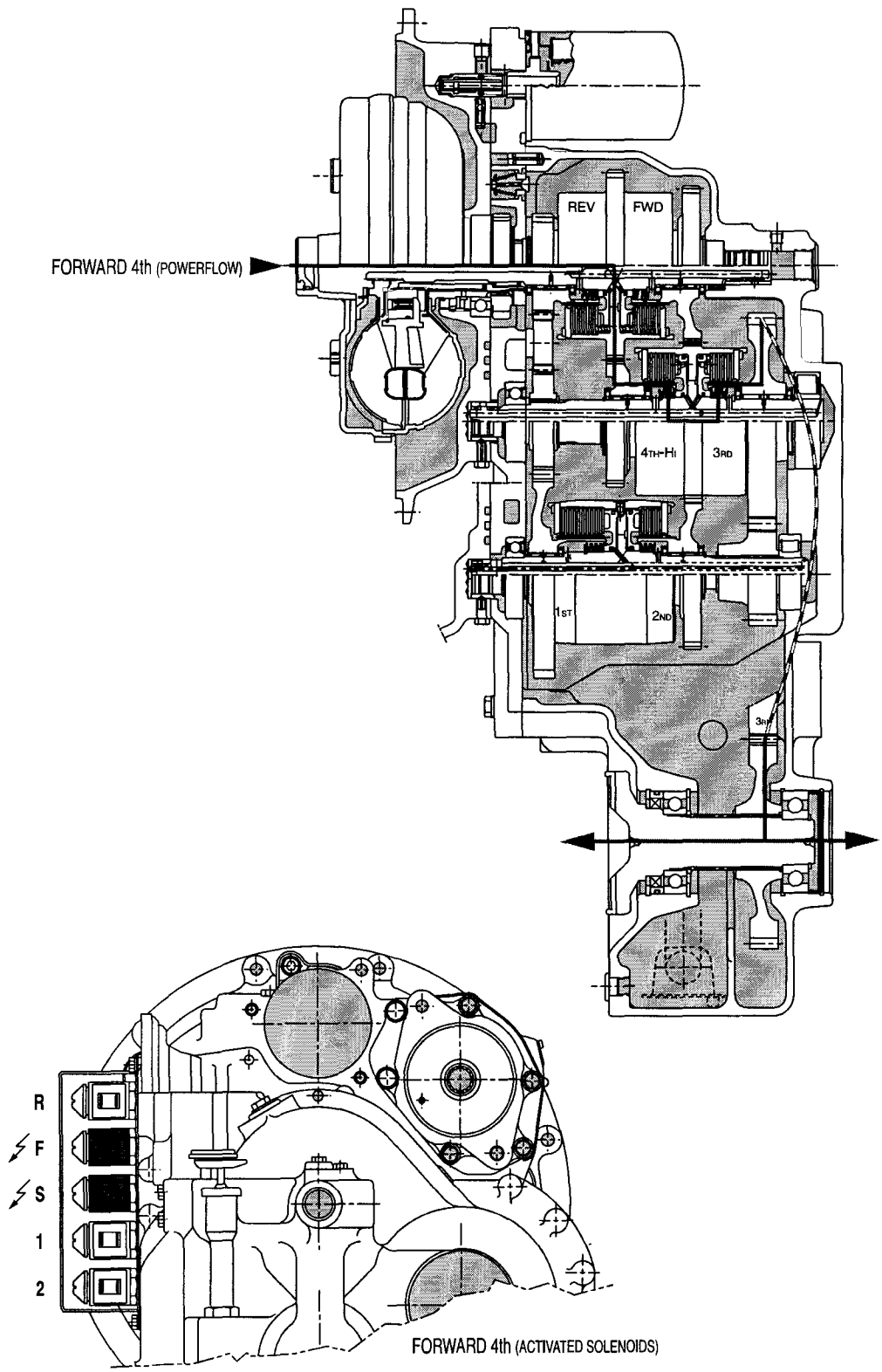




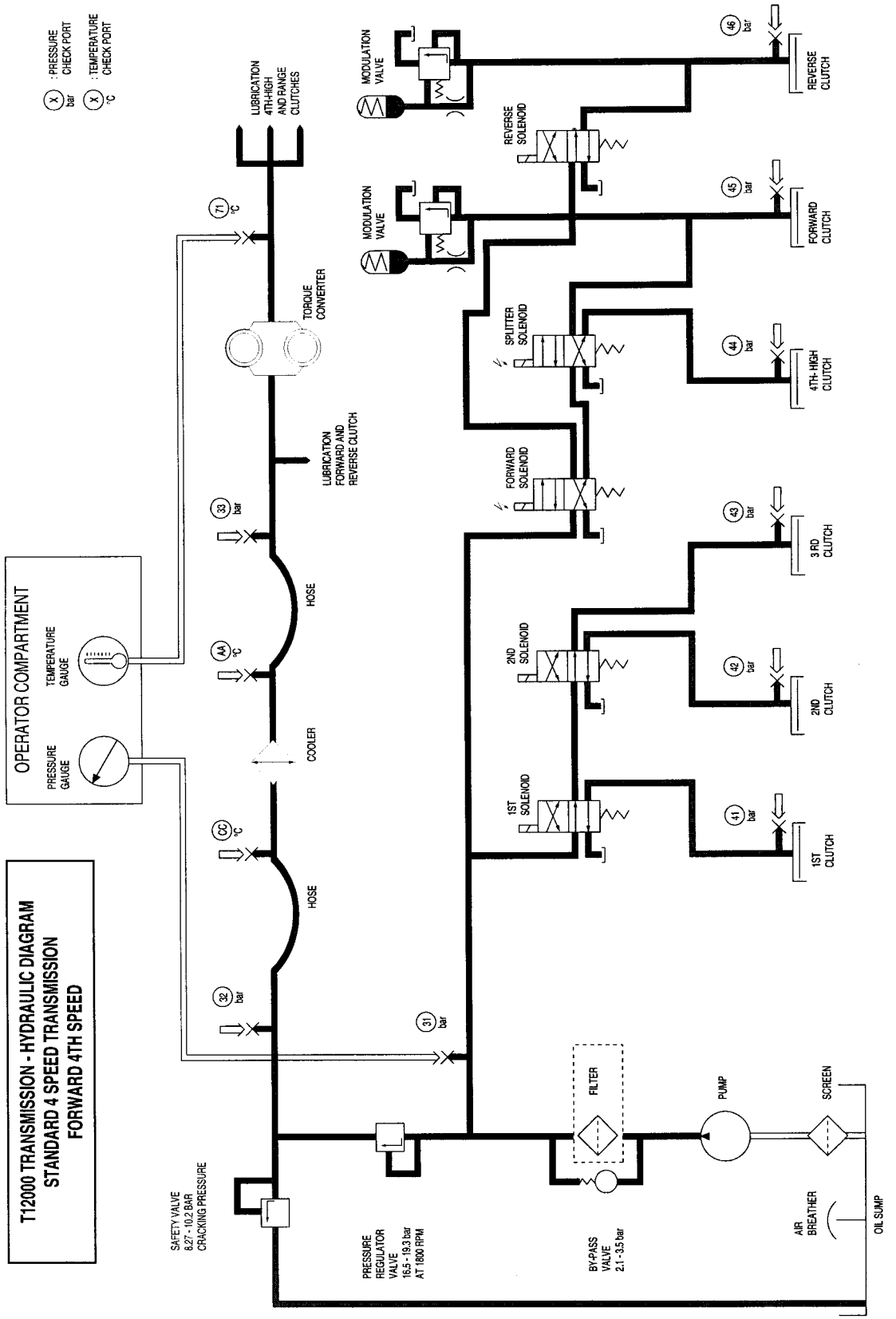
6.3.2.1.4 Forward 3rd speed (continued)



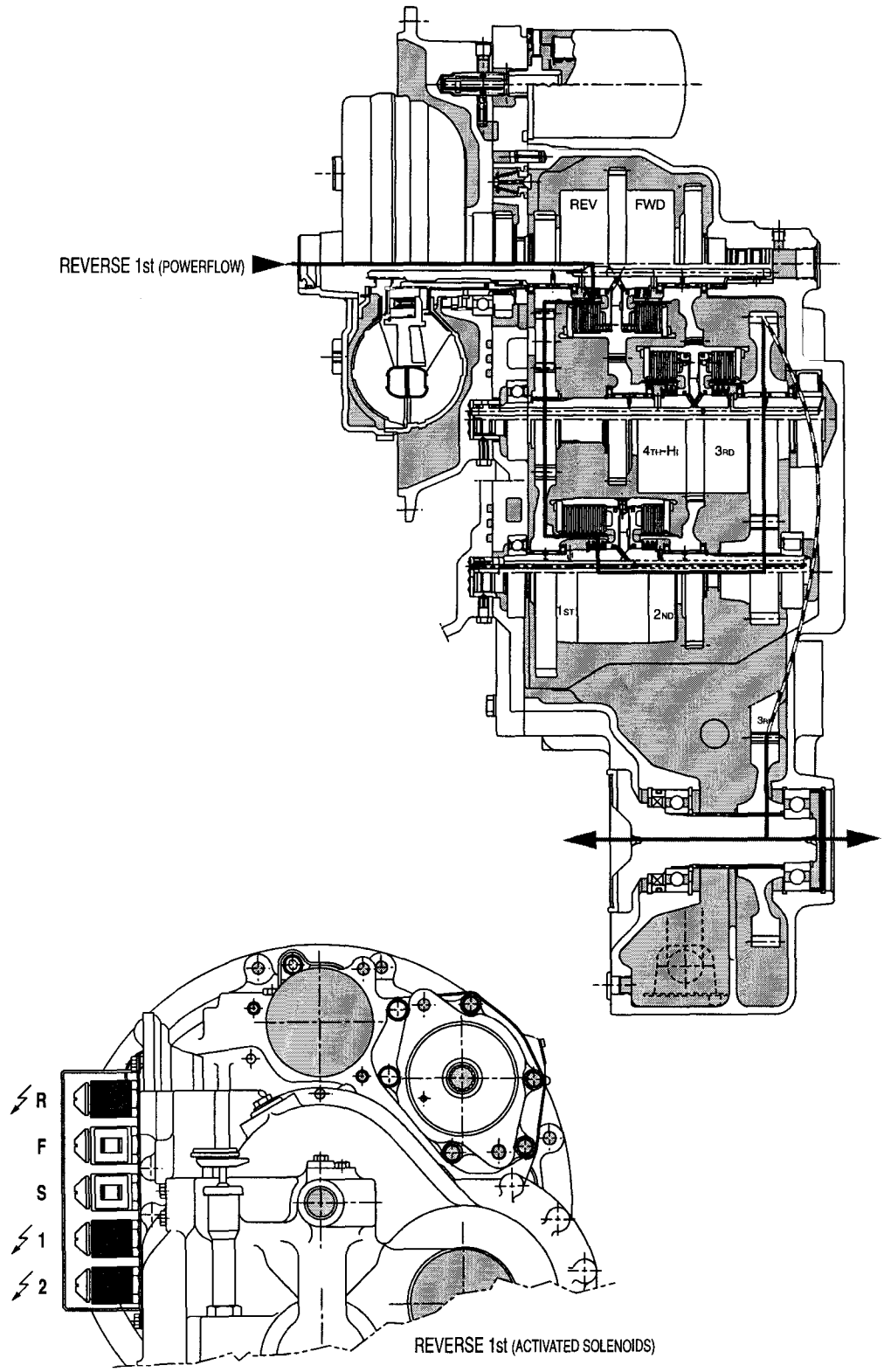
6.3.2.1.5 Forward 4th speed



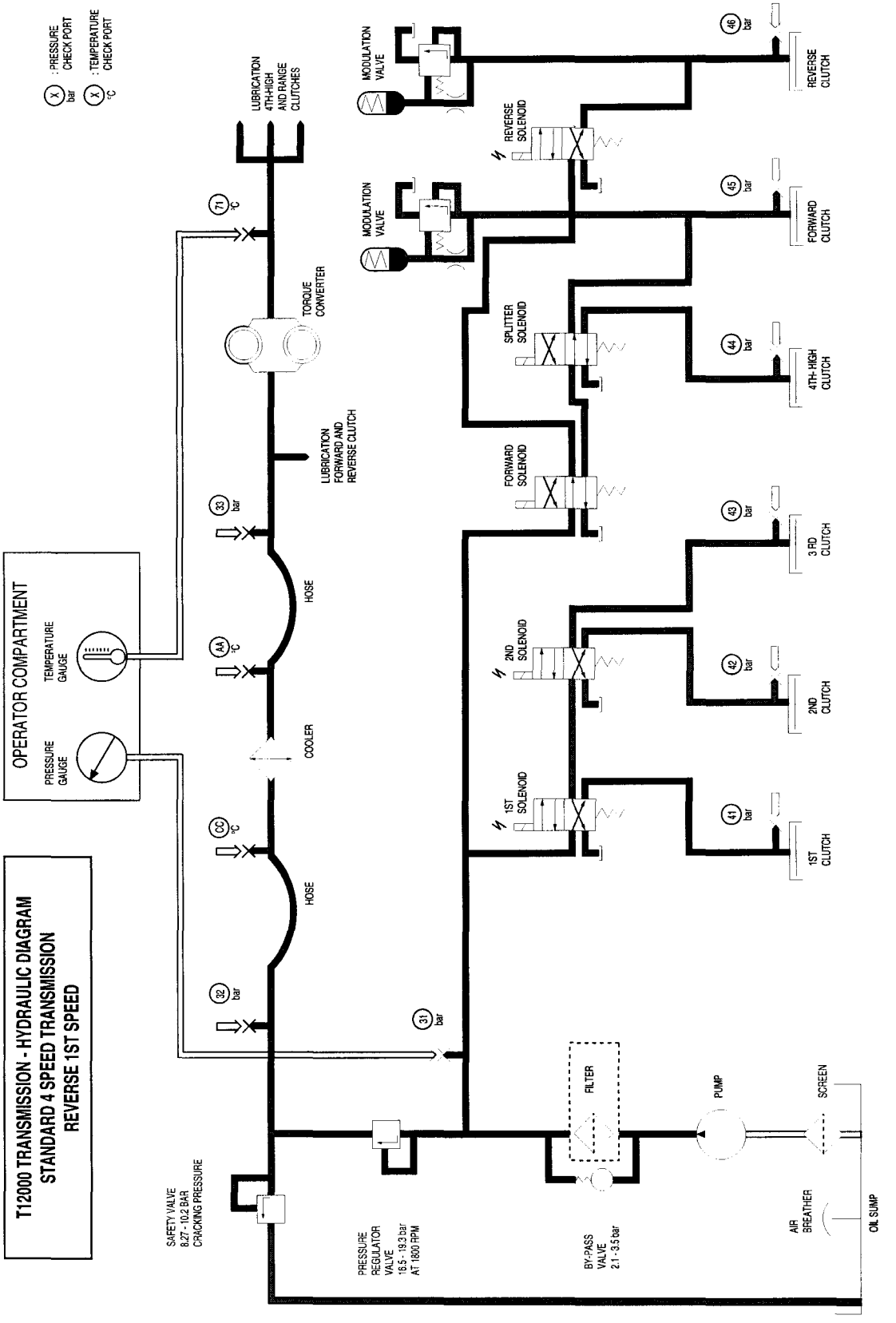
6.3.2.1.5 Forward 4th speed (continued)



6.3.2.1.6 Reverse 1st speed



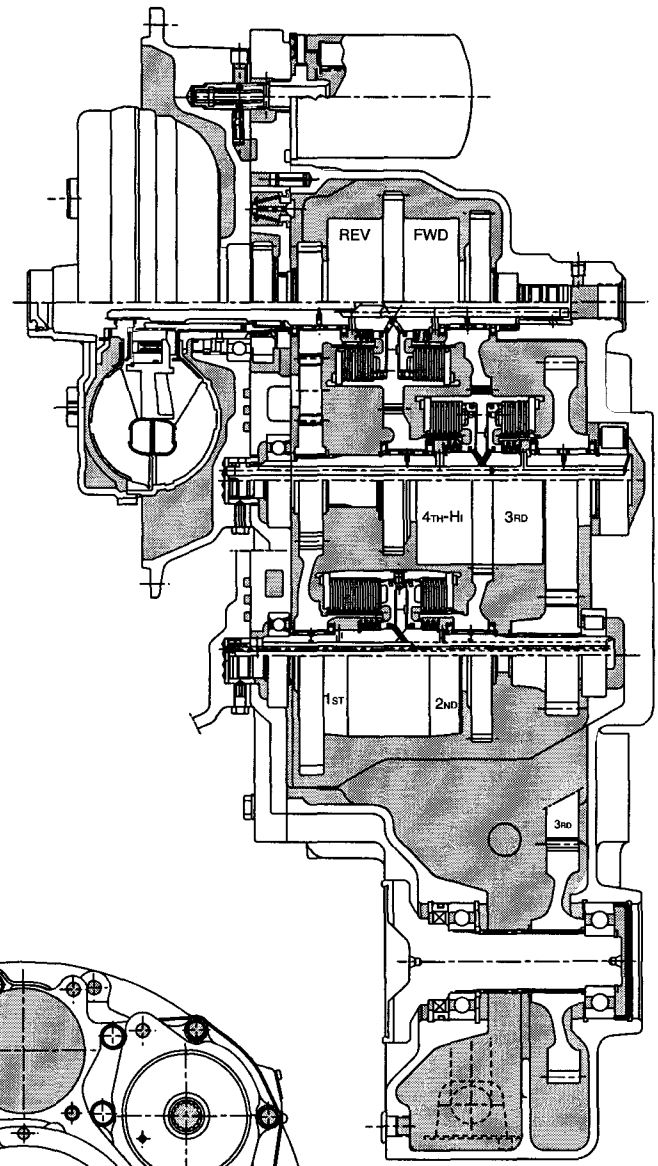
6.3.2.1.6 Reverse 1st speed (continued)

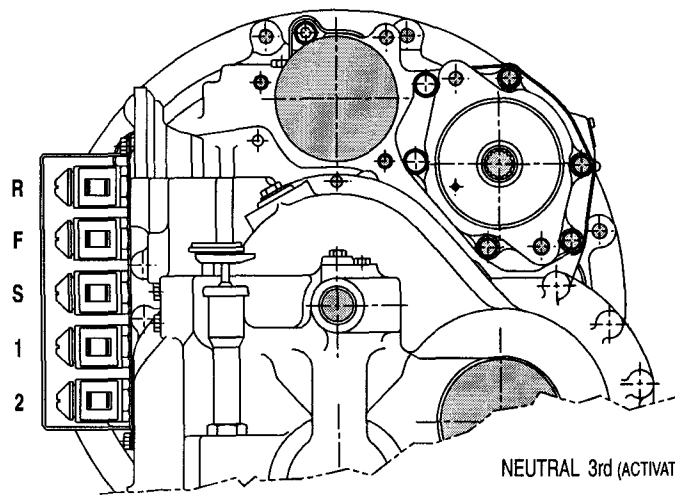


6.3.2.2 Alternative 4-speed transmission

6.3.2.2.1 Neutral and 3rd clutch engaged

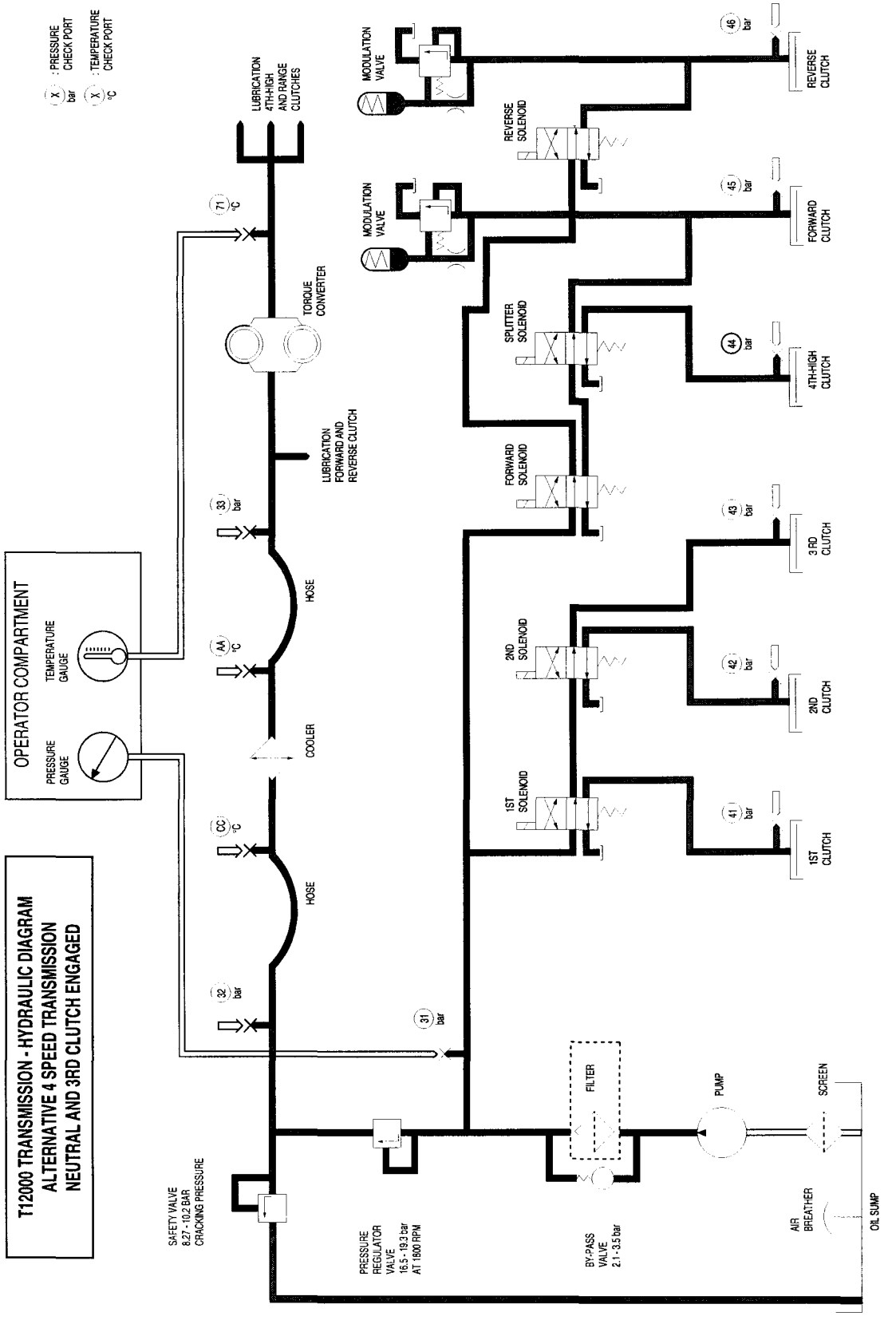
NEUTRAL 3rd (POWERFLOW)



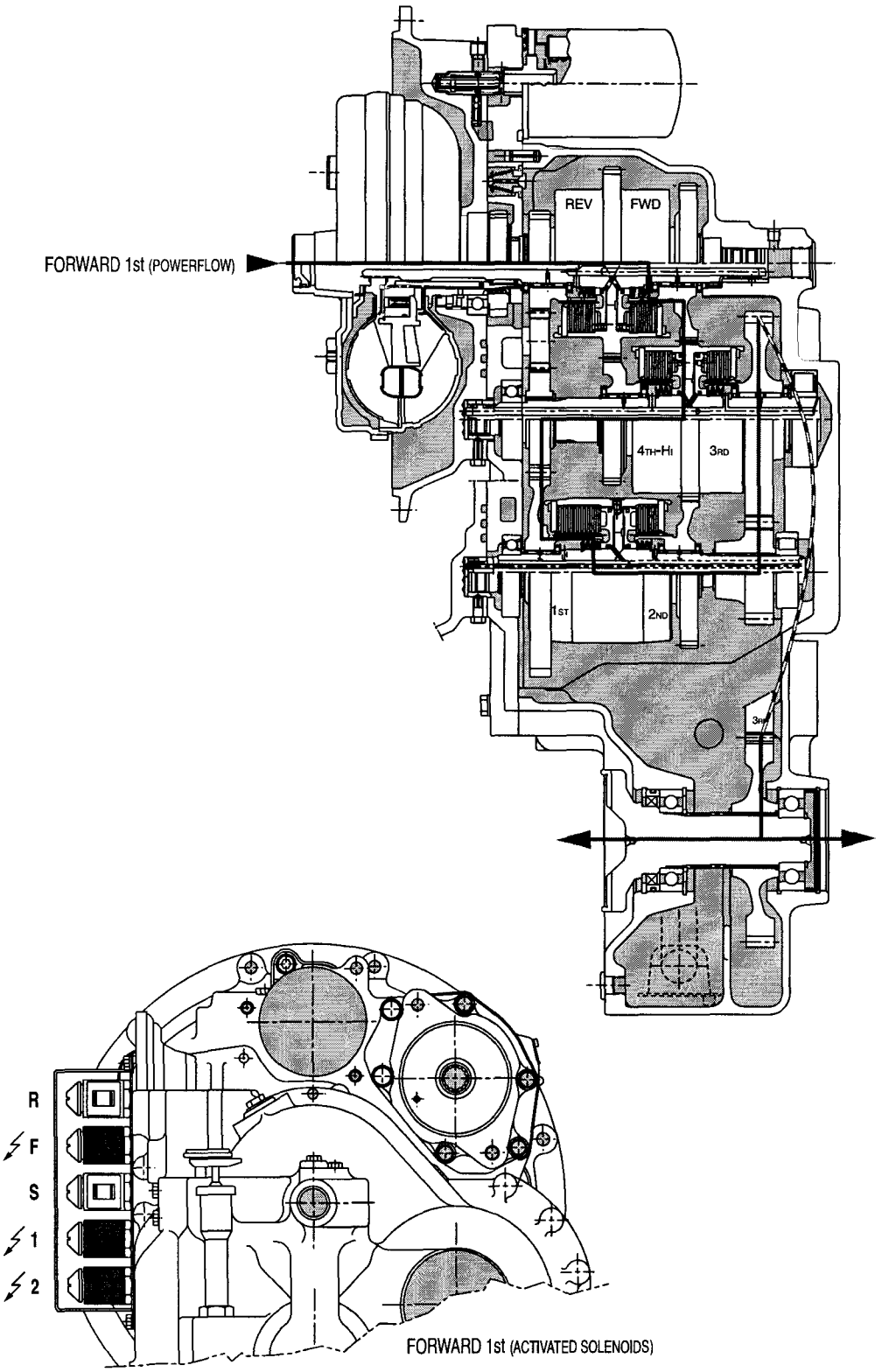


NEUTRAL 3rd (ACTIVATED SOLENOIDS)

6.3.2.2.1 Neutral and 3rd clutch engaged (continued)



6.3.2.2.2 Forward 1st speed



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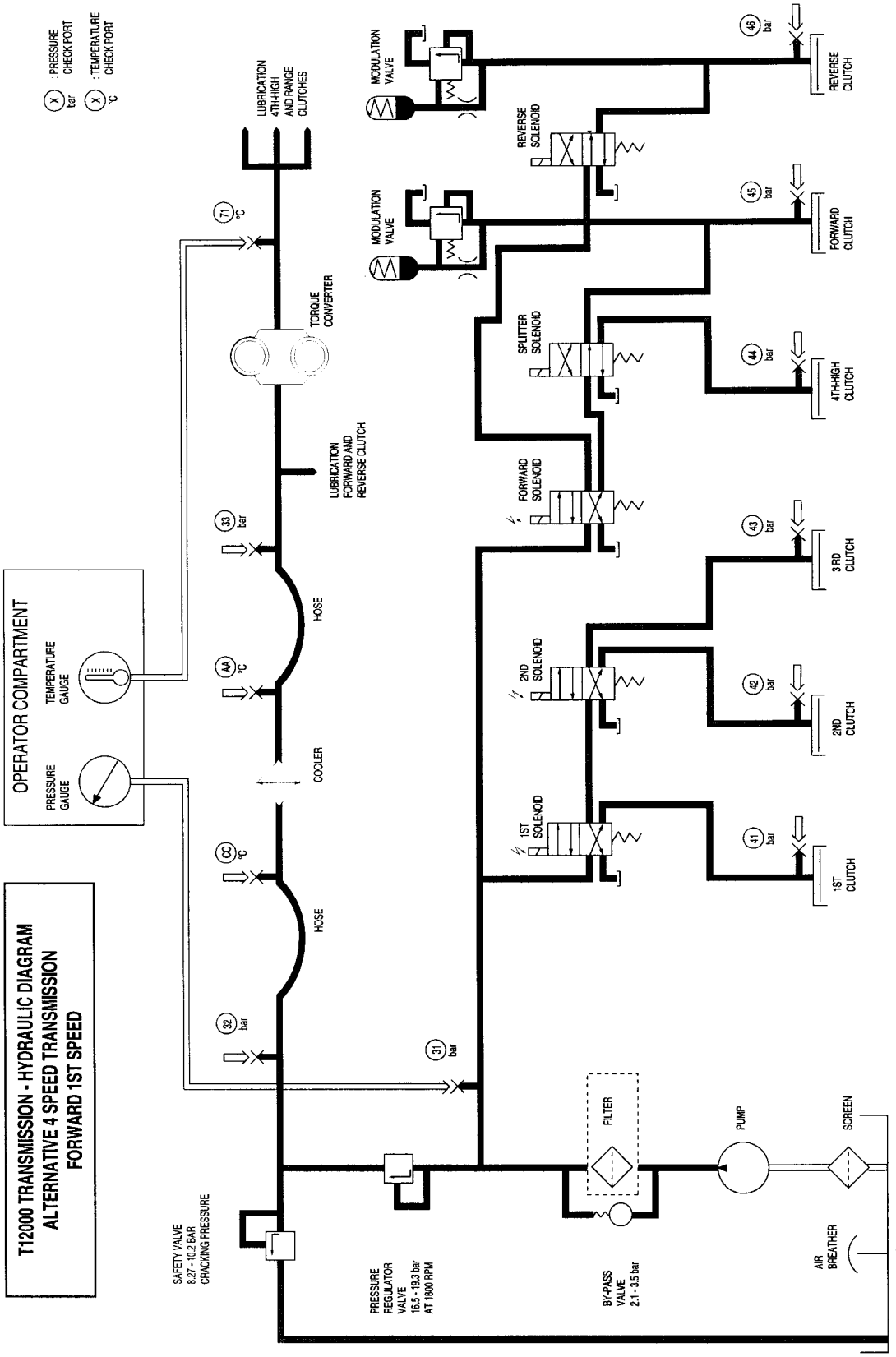
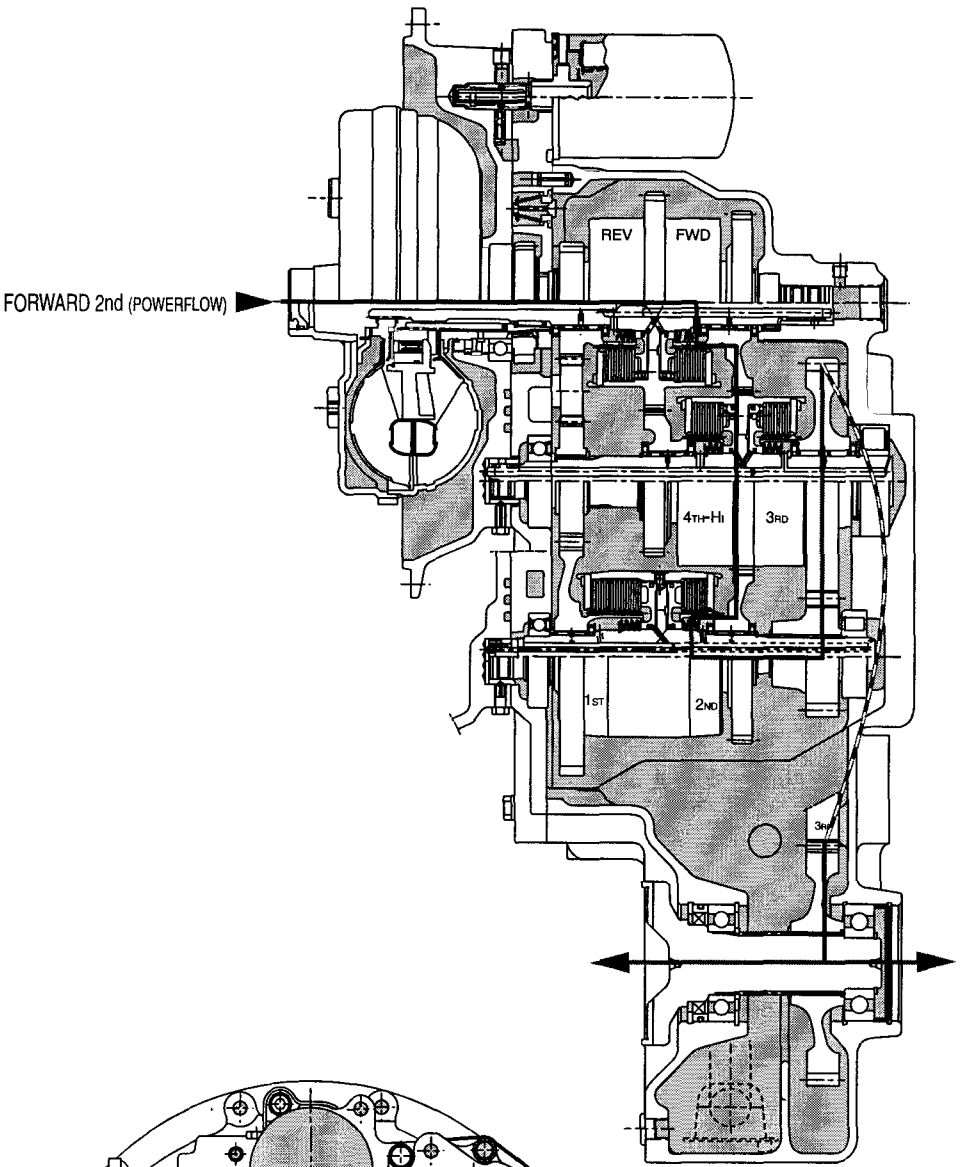
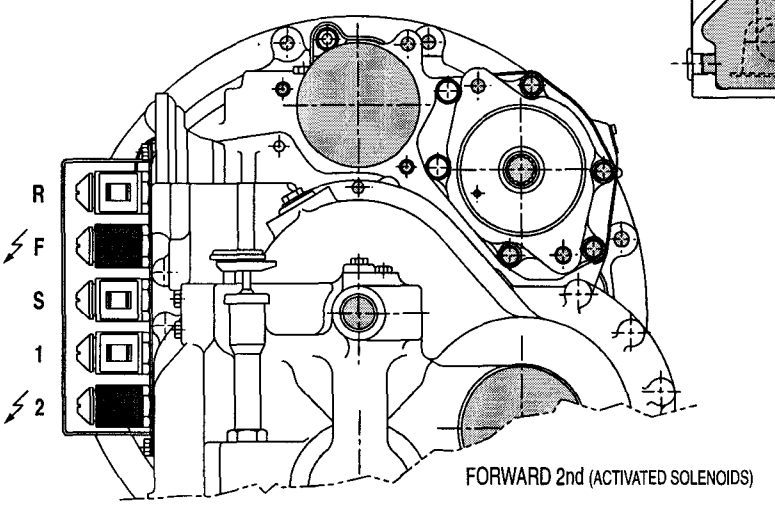
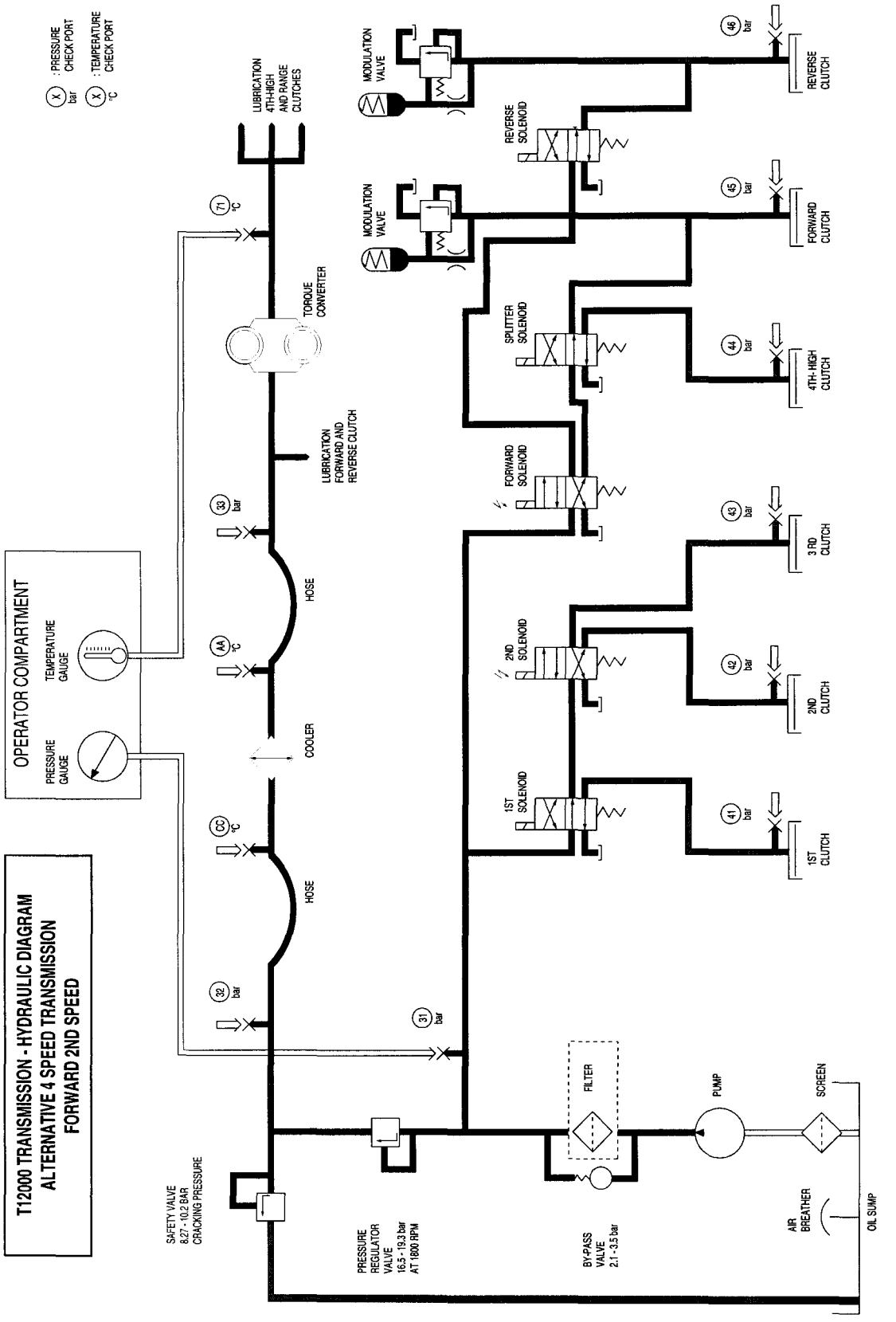


6.3.2.2.3 Forward 2nd speed

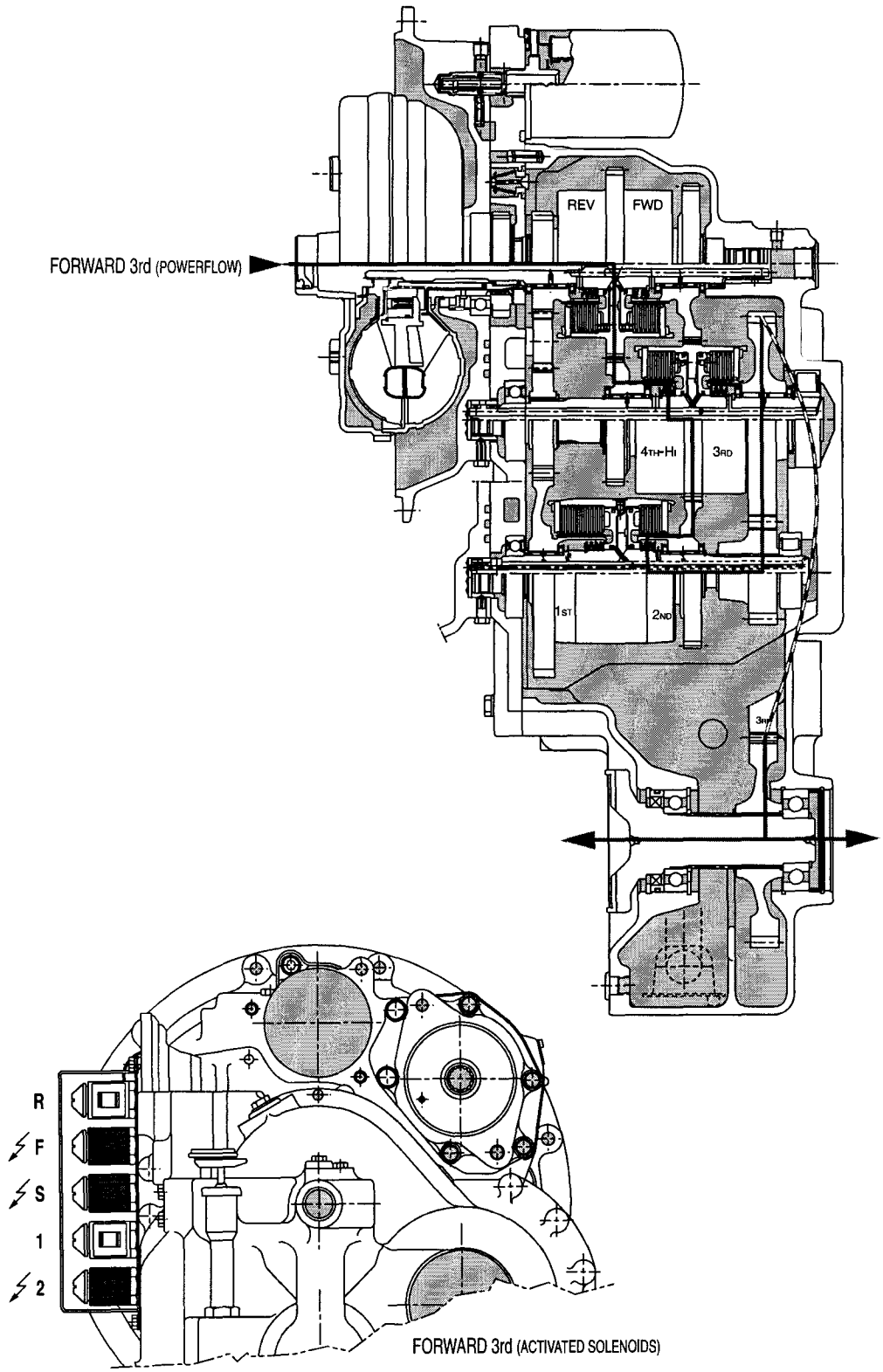




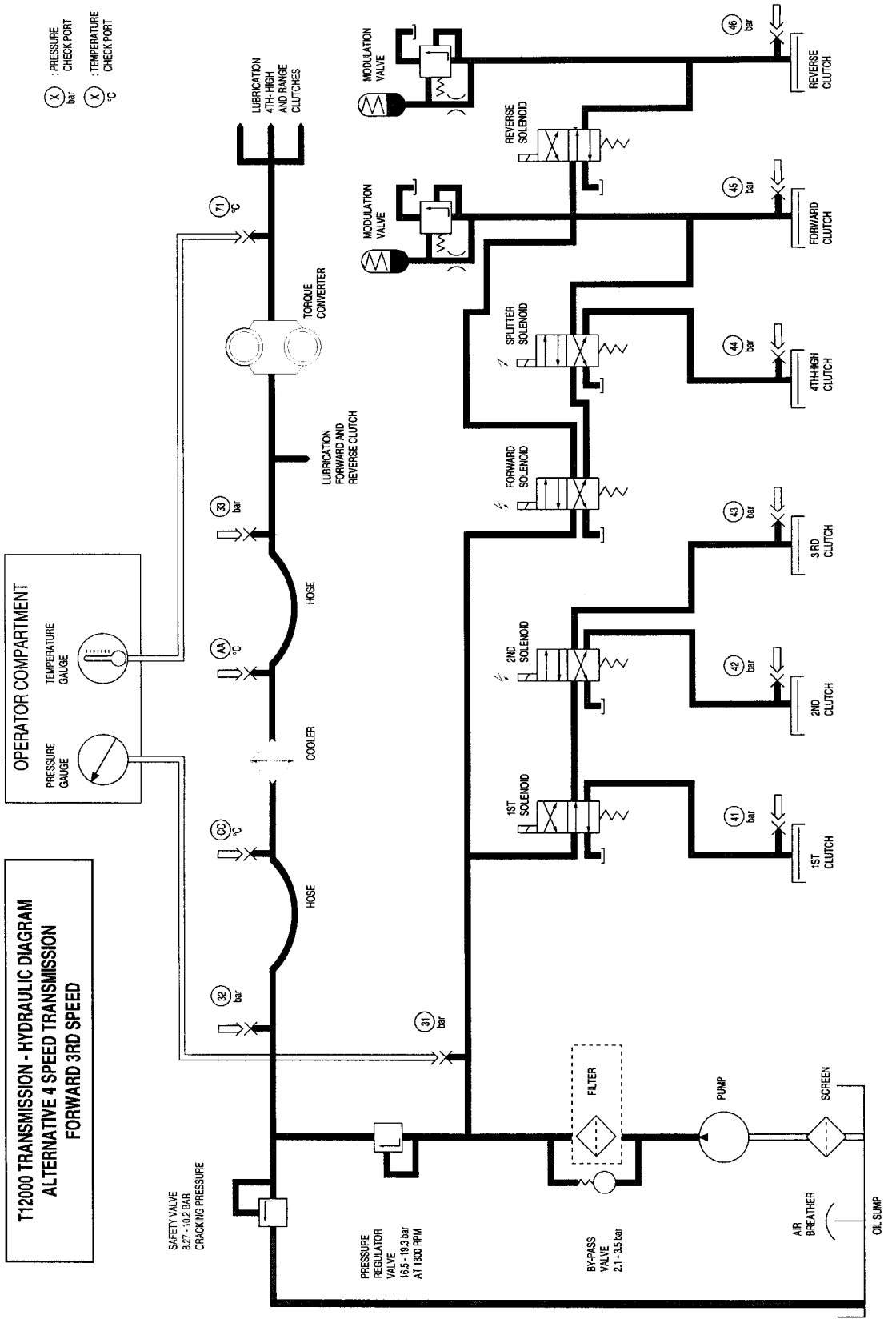
6.3.2.2.3 Forward 2nd speed (continued)



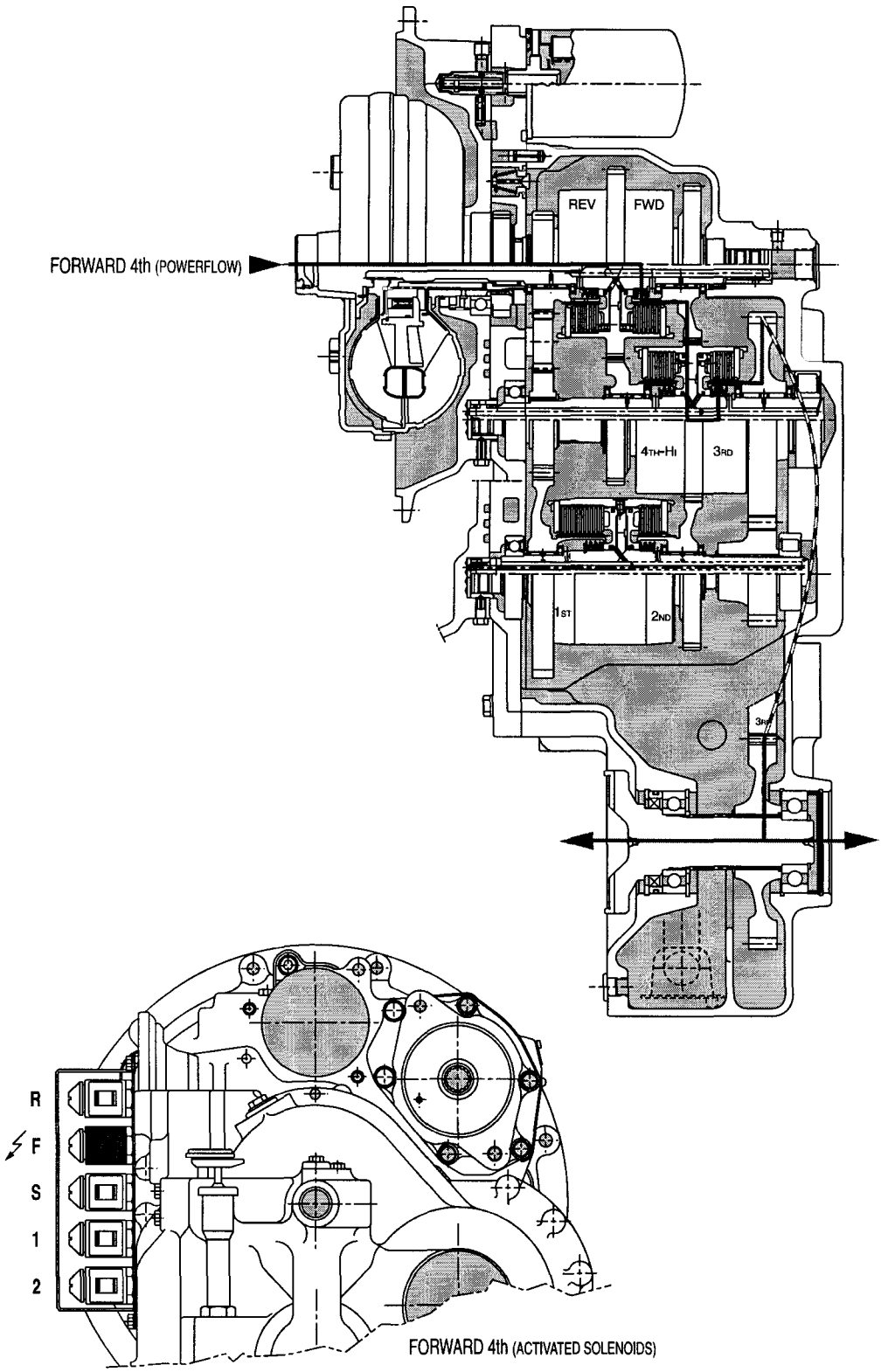
6.3.2.2.4 Forward 3rd speed



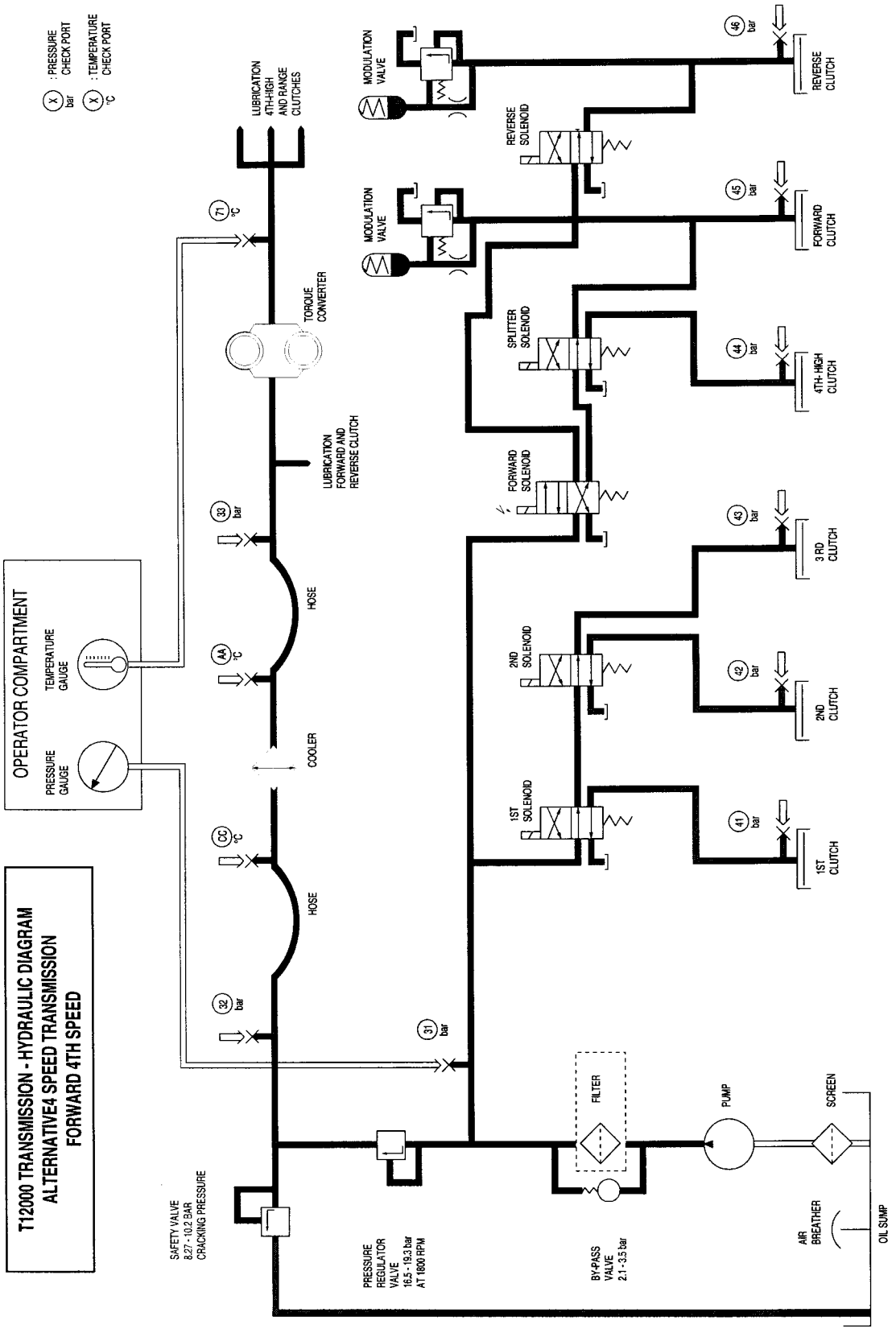
6.3.2.2.4 Forward 3rd speed (continued)



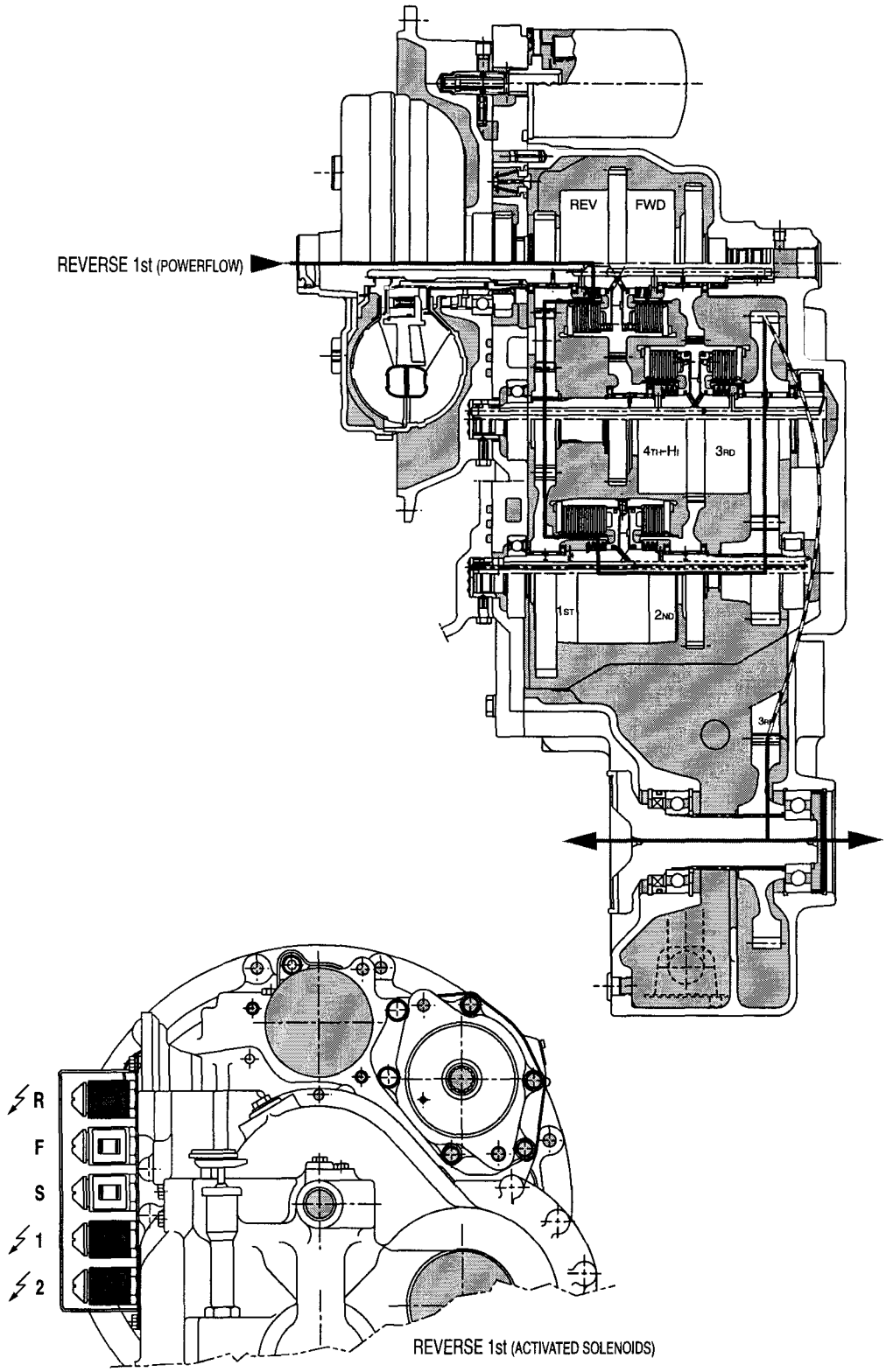
6.3.2.2.5 Forward 4th speed



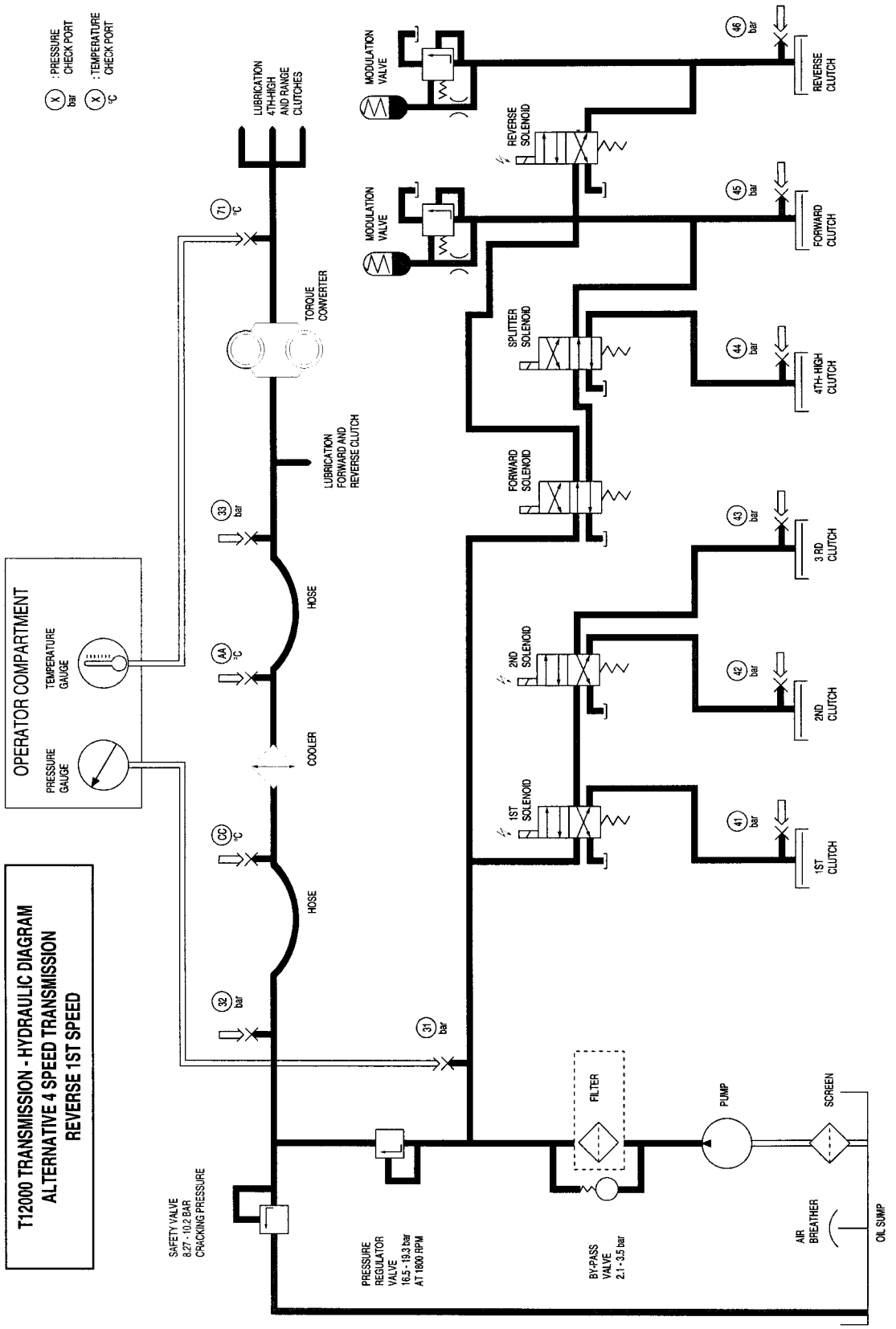
6.3.2.2.5 Forward 4th speed (continued)



6.3.2.2.6 Reverse 1st speed

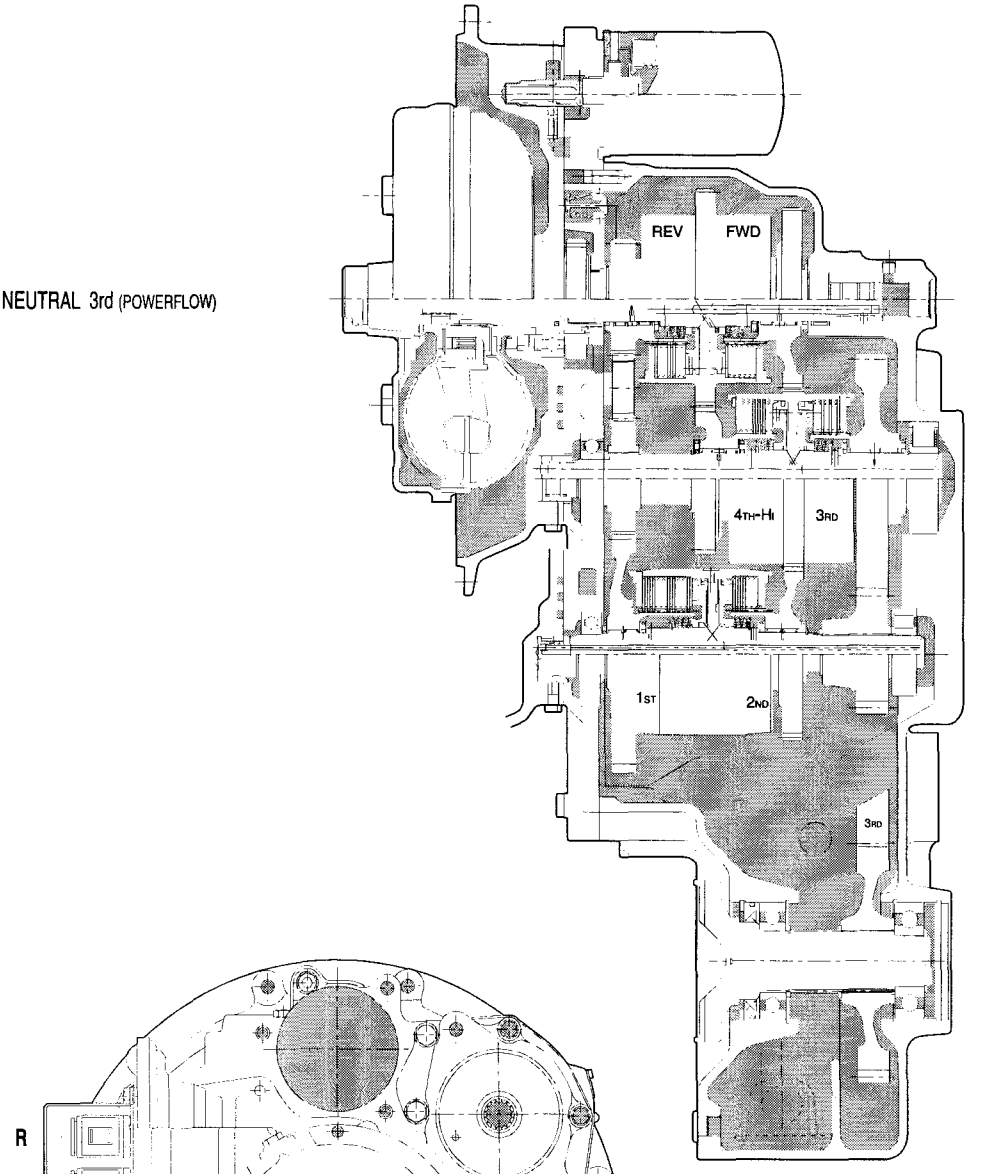


6.3.2.2.6 Reverse 1st speed (continued)

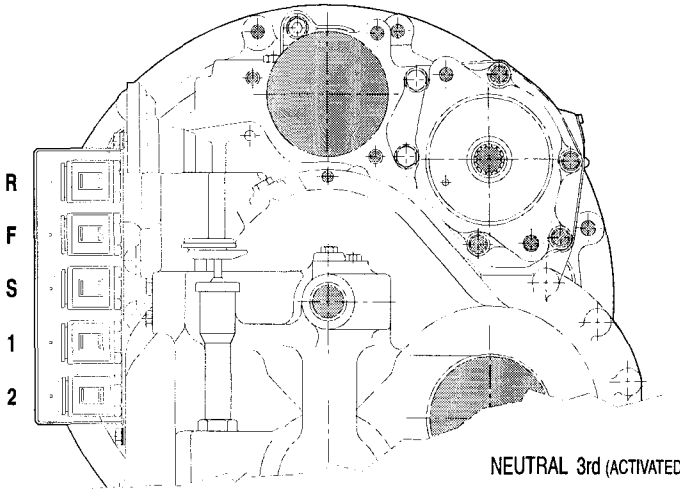


6.3.3 6-Speed transmission

6.3.3.1 Neutral and 3rd clutch engaged

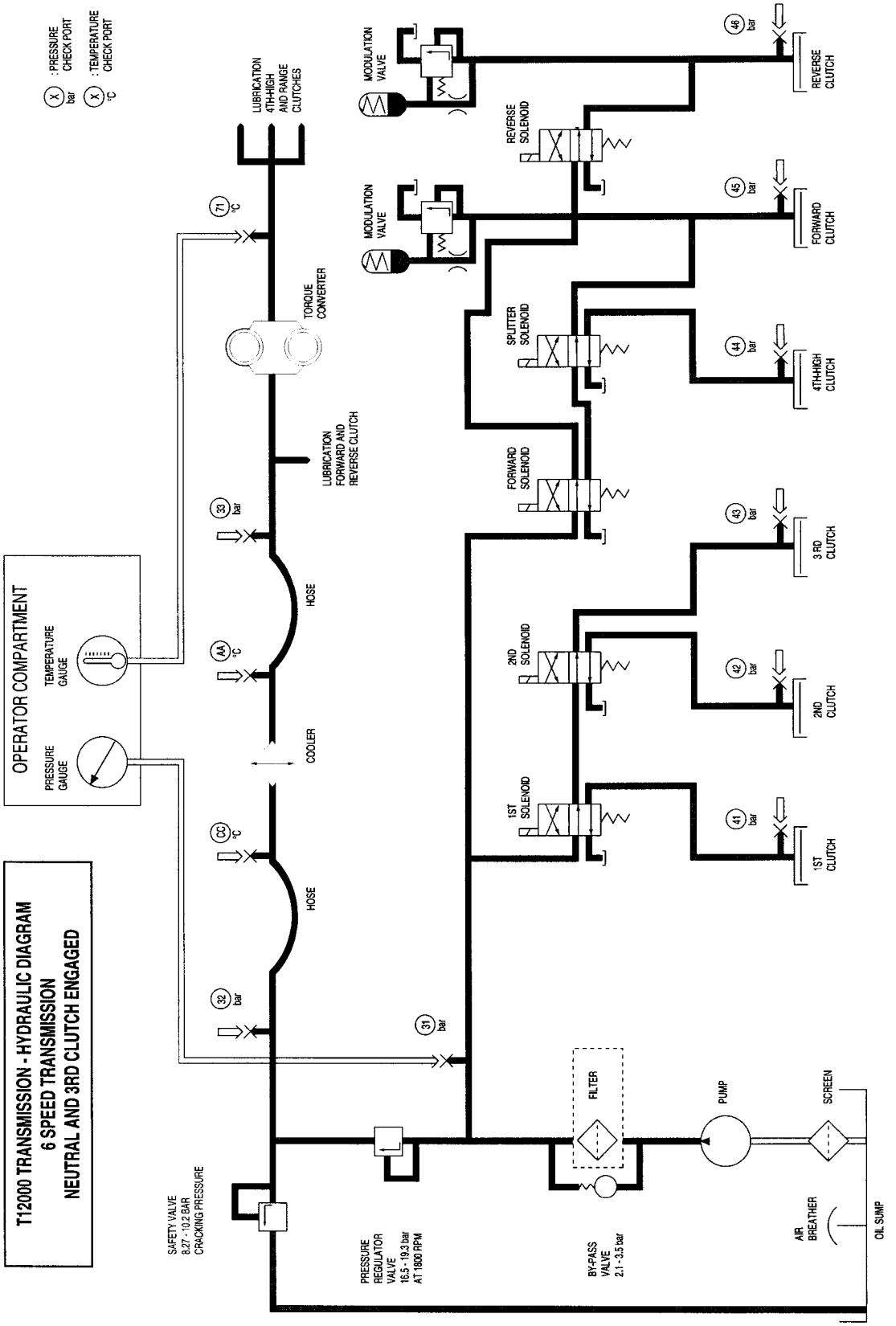


NEUTRAL 3rd (POWERFLOW)

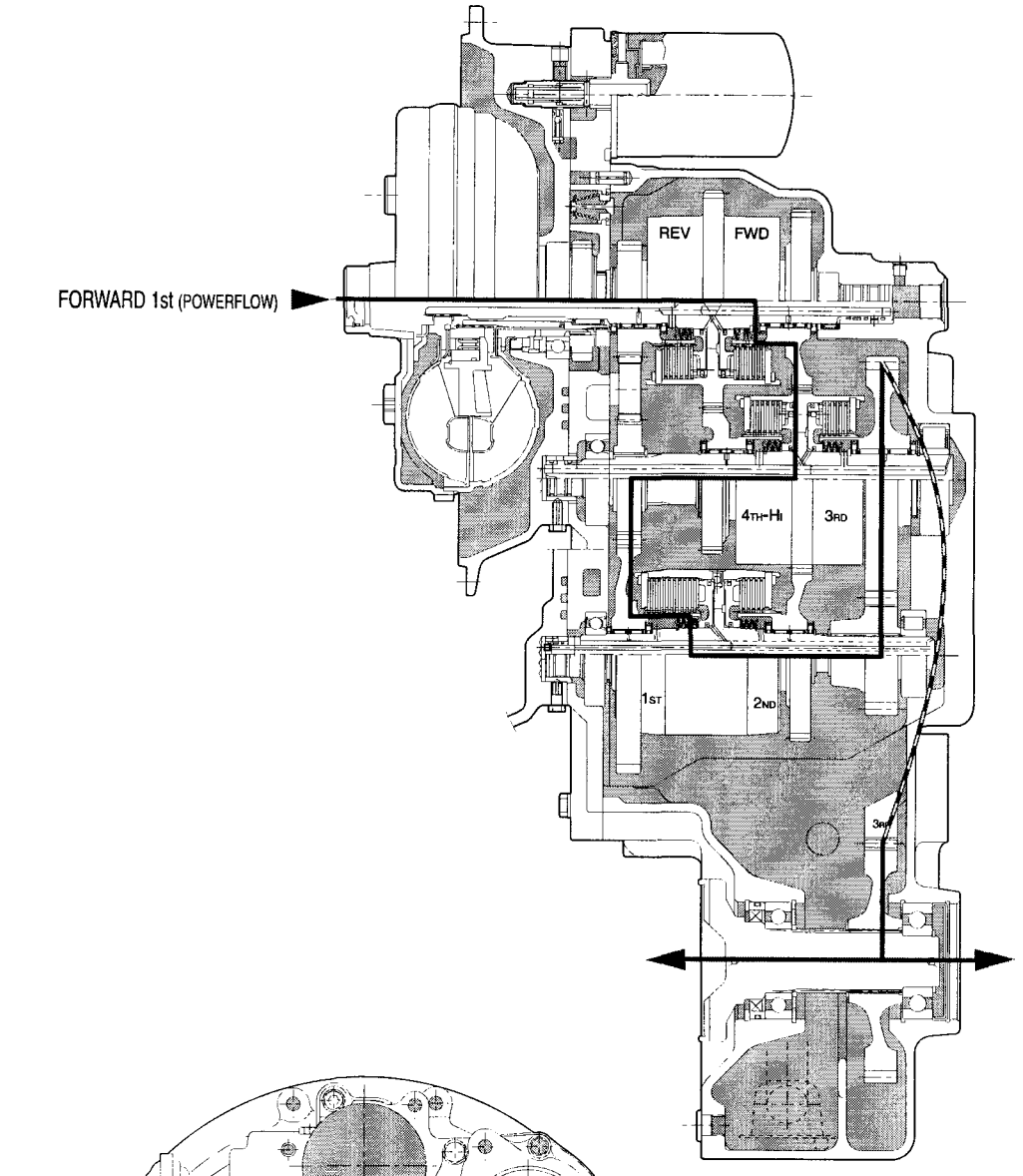


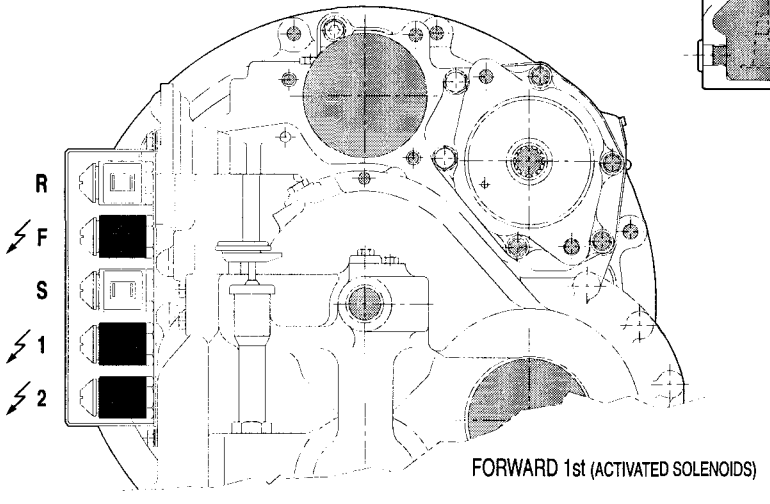
NEUTRAL 3rd (ACTIVATED SOLENOIDS)

6.3.3.1 Neutral and 3rd clutch engaged (continued)



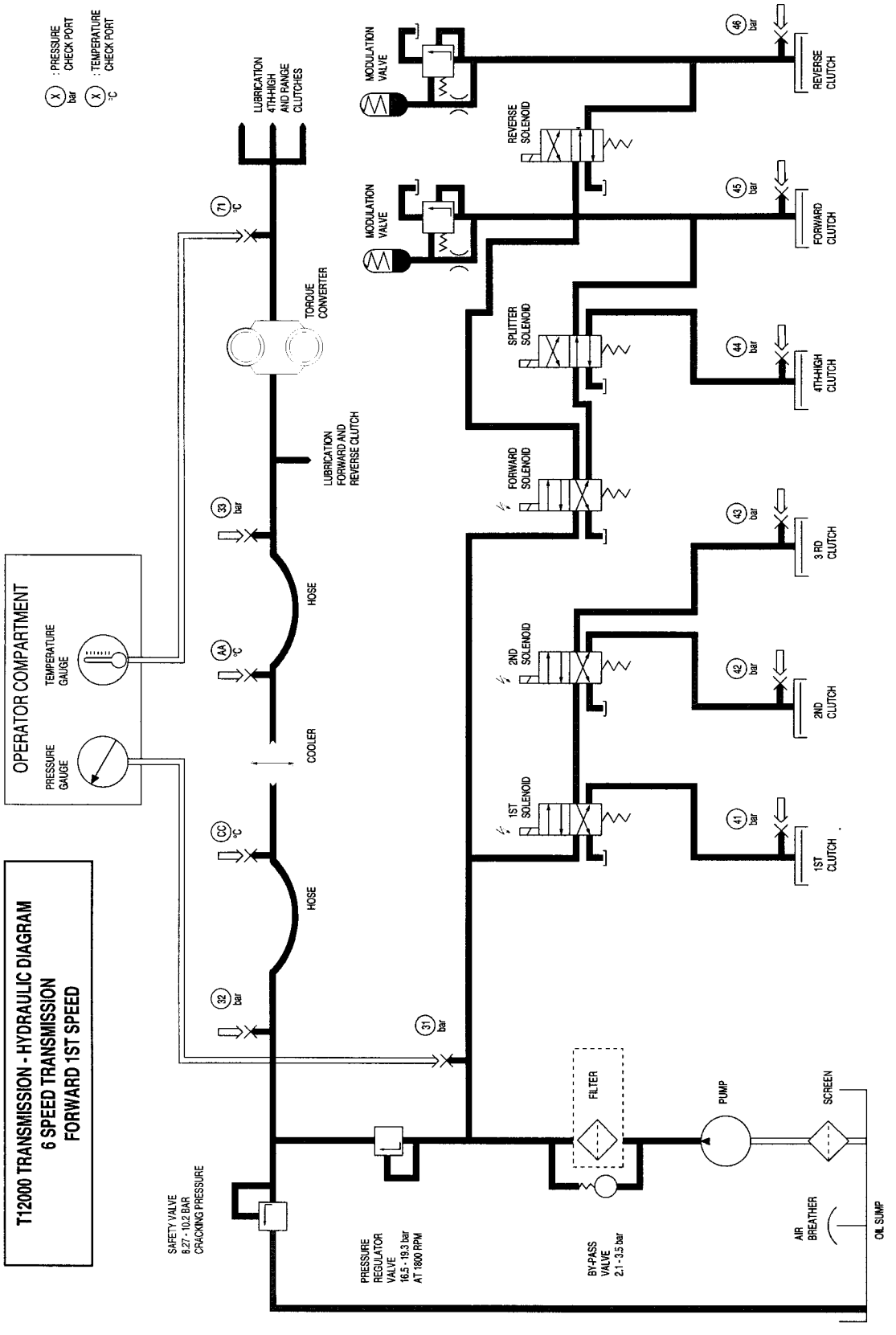
6.3.3.2 Forward 1st speed



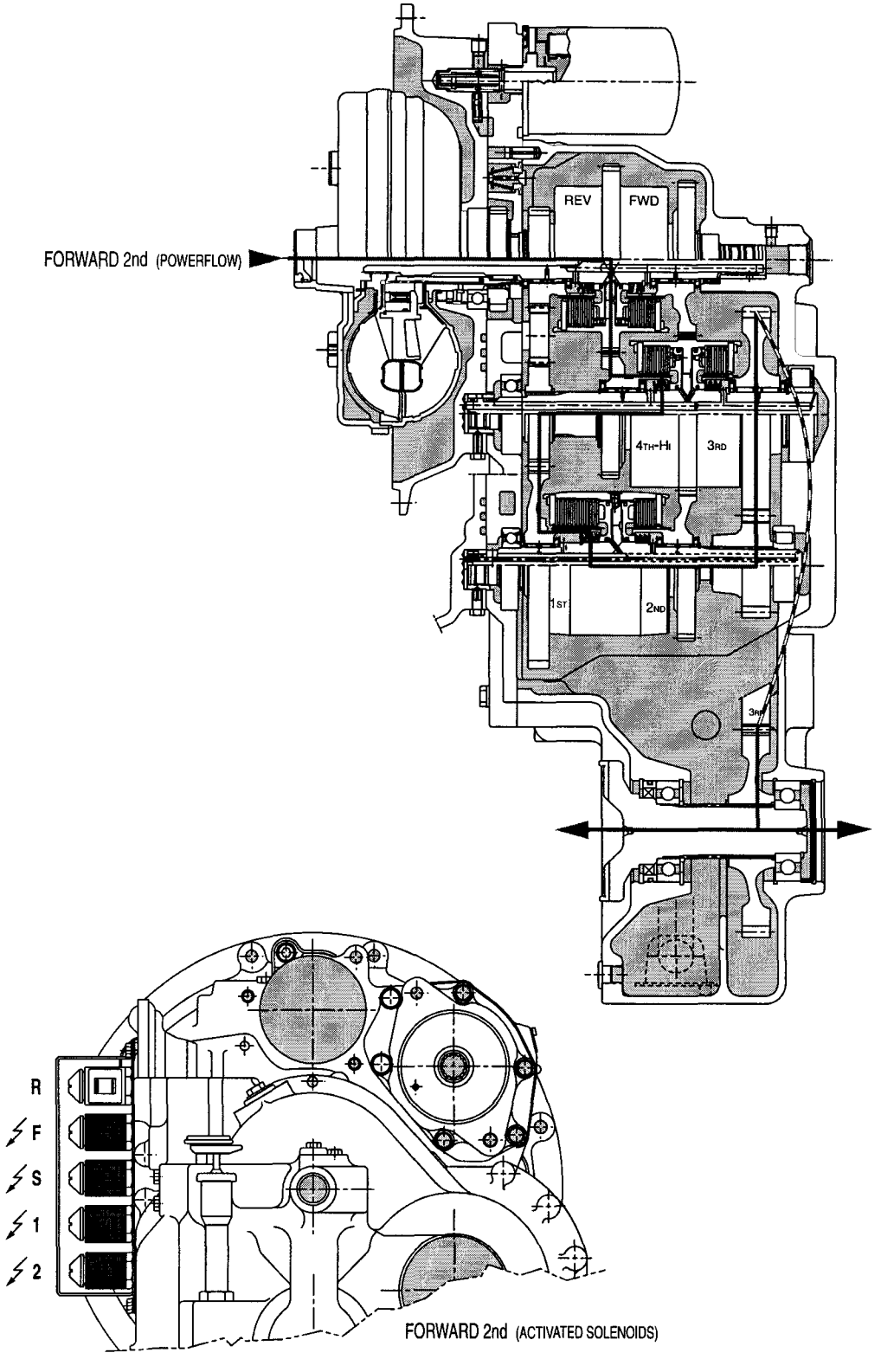


FORWARD 1st (ACTIVATED SOLENOIDS)

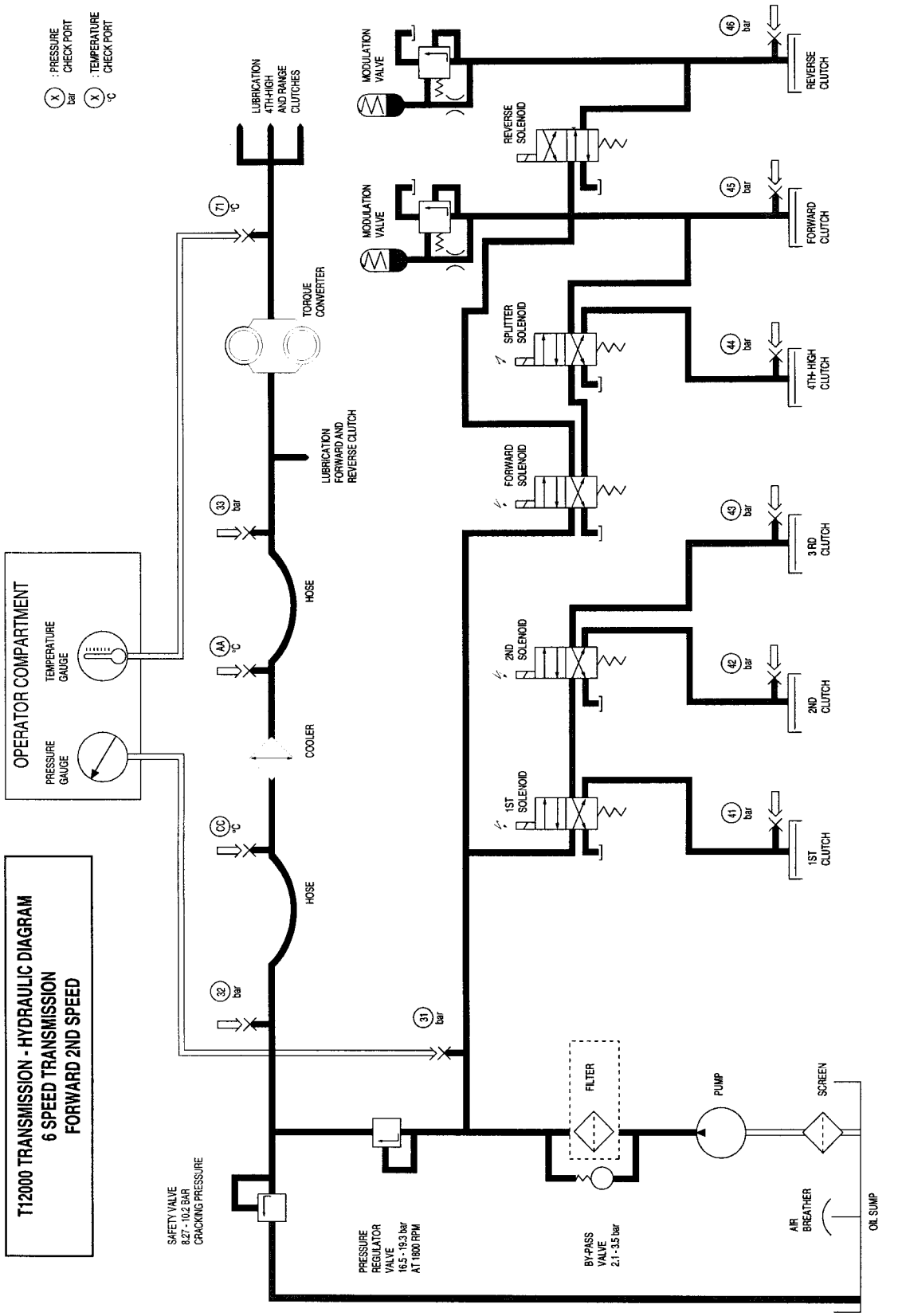
6.3.3.2 Forward 1st speed (continued)



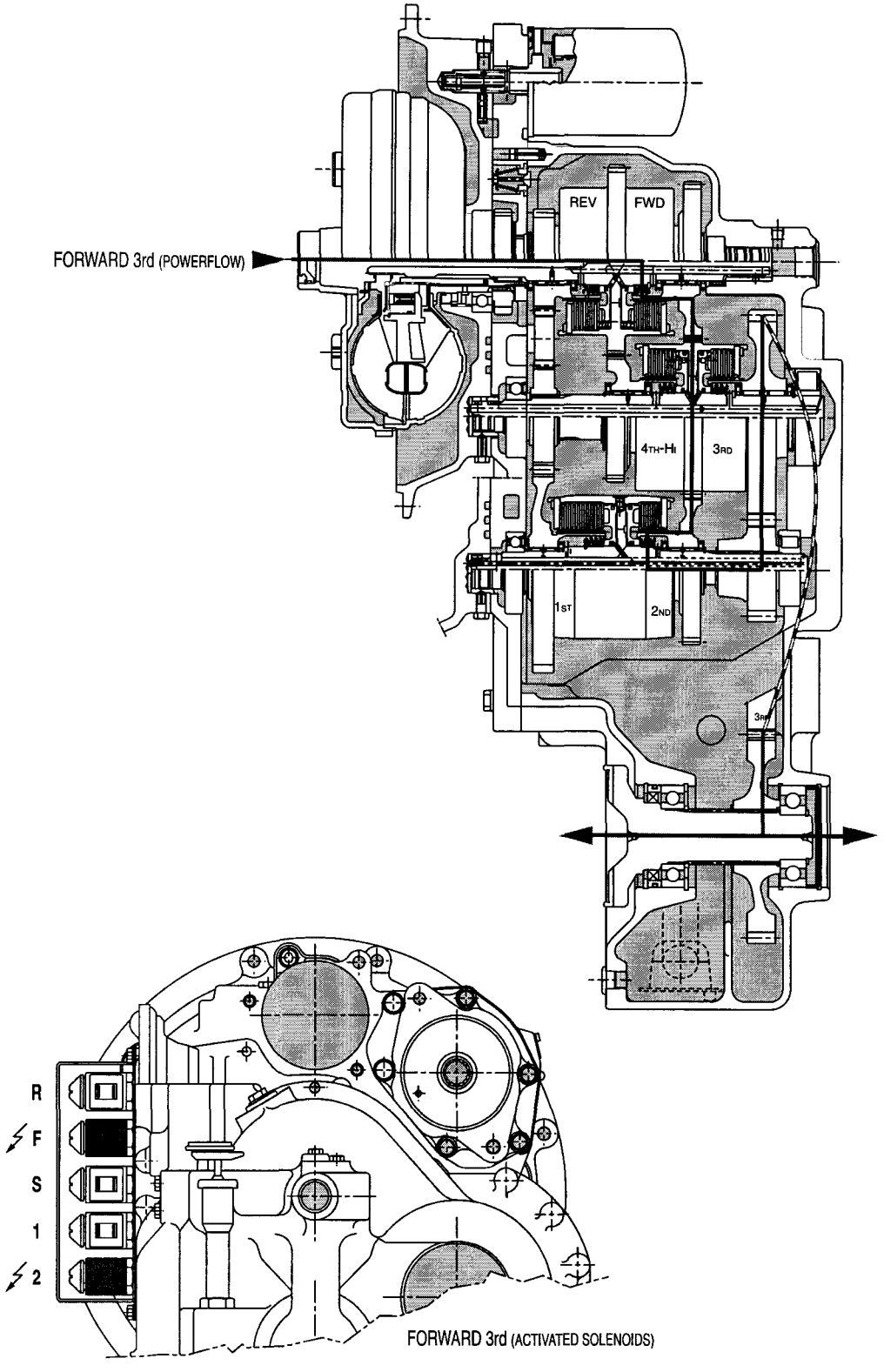
6.3.3.3 Forward 2nd speed



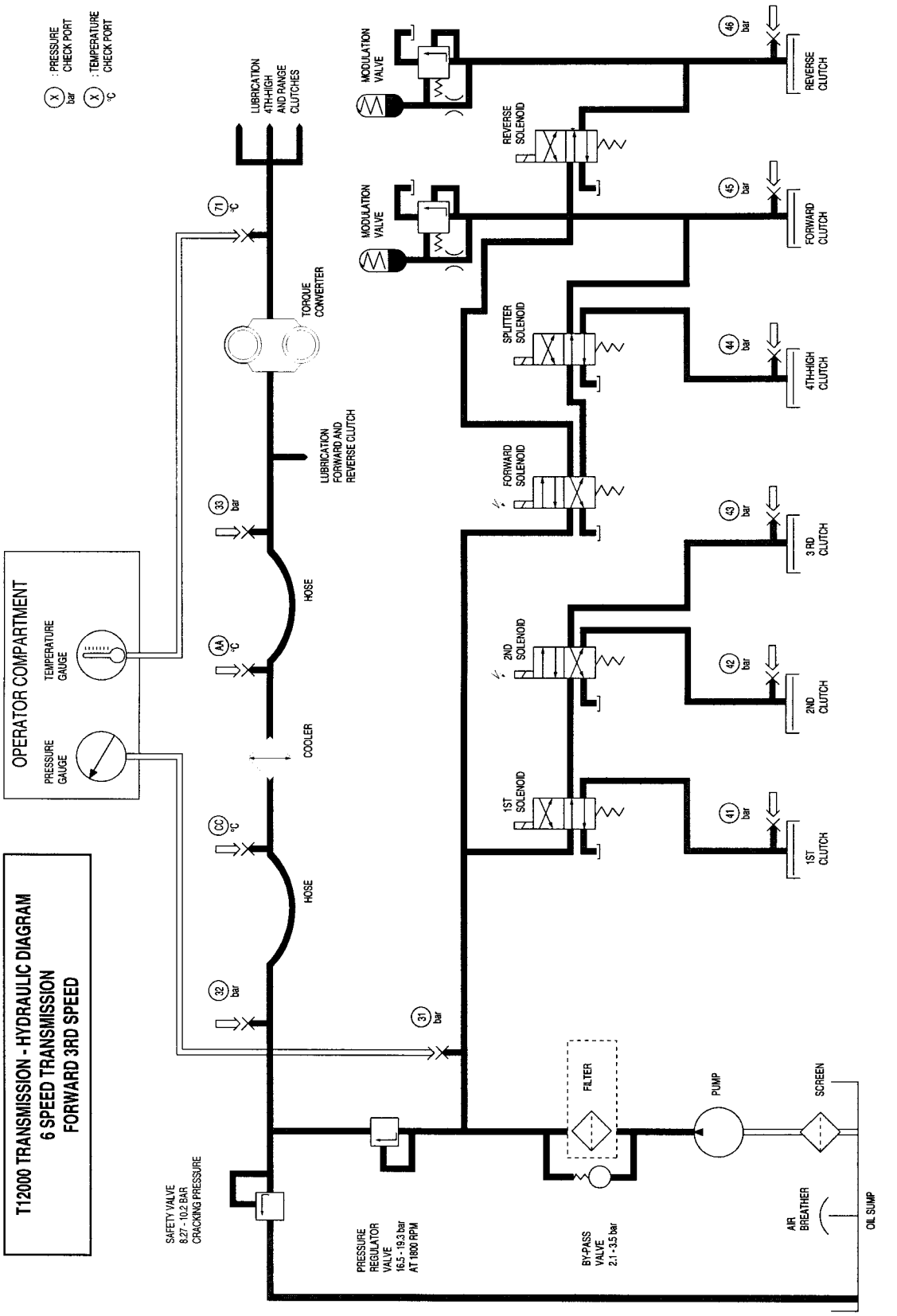
6.3.3.3 Forward 2nd speed (continued)



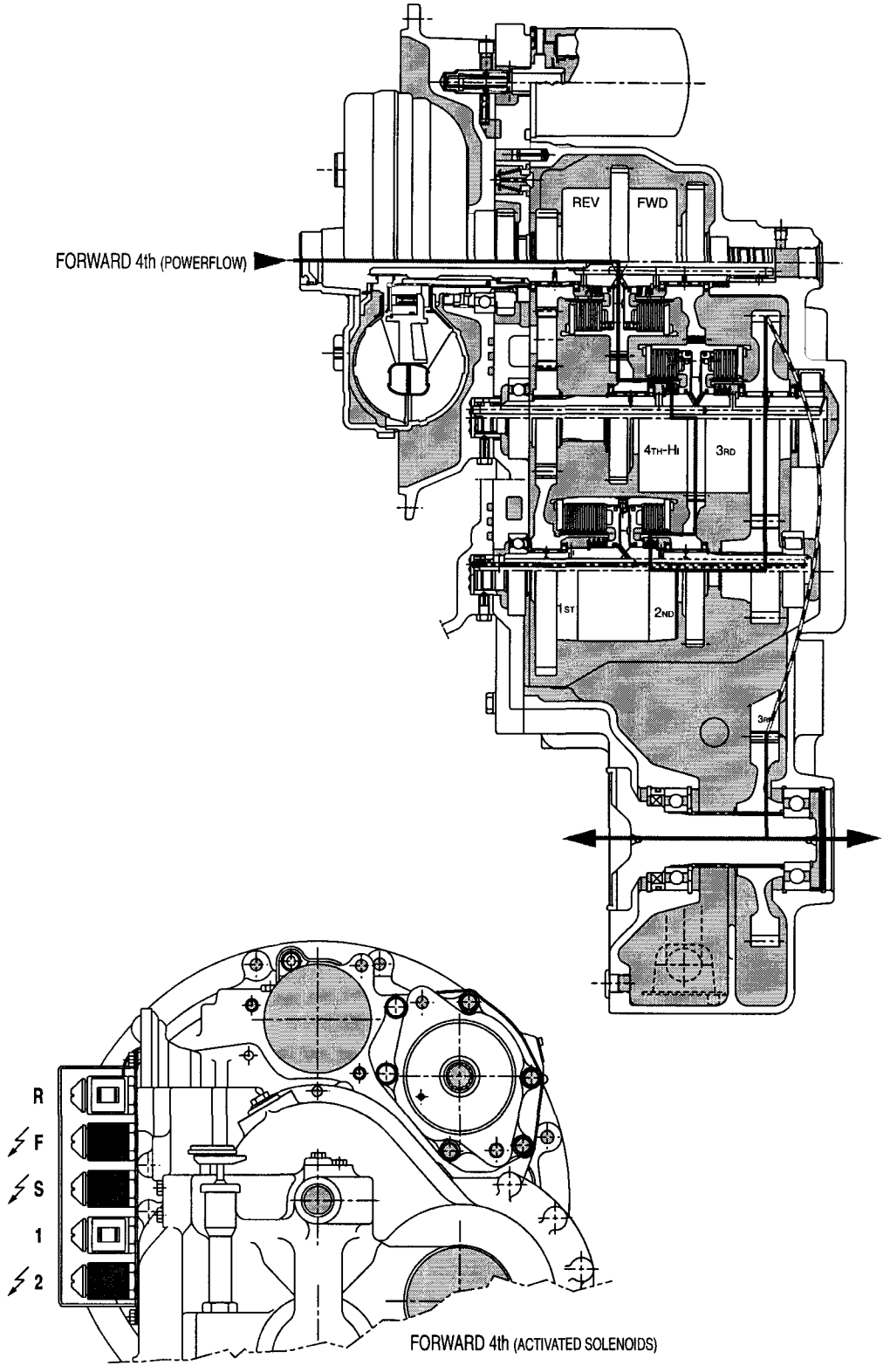
6.3.3.4 Forward 3rd speed



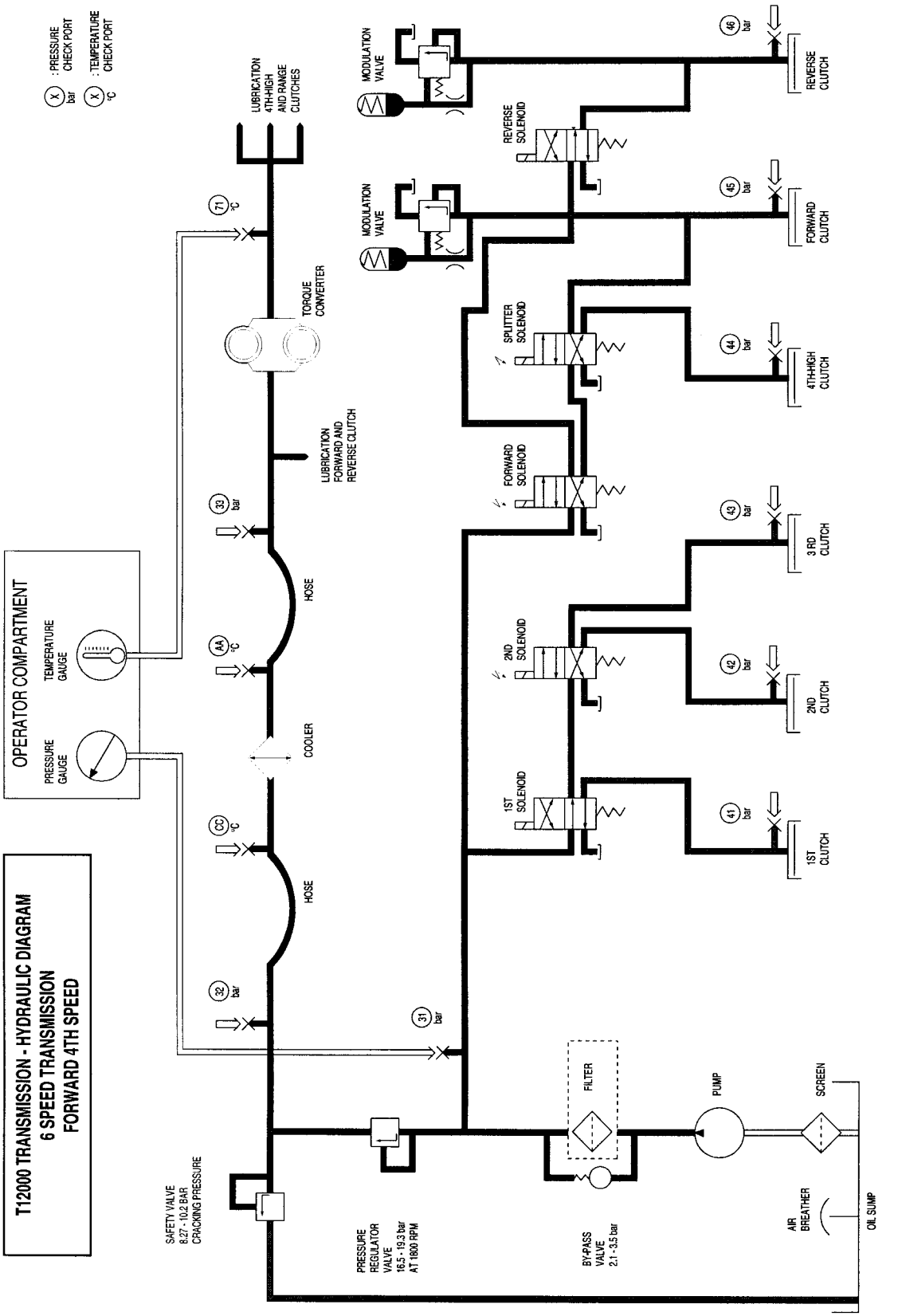
6.3.3.4 Forward 3rd speed (continued)



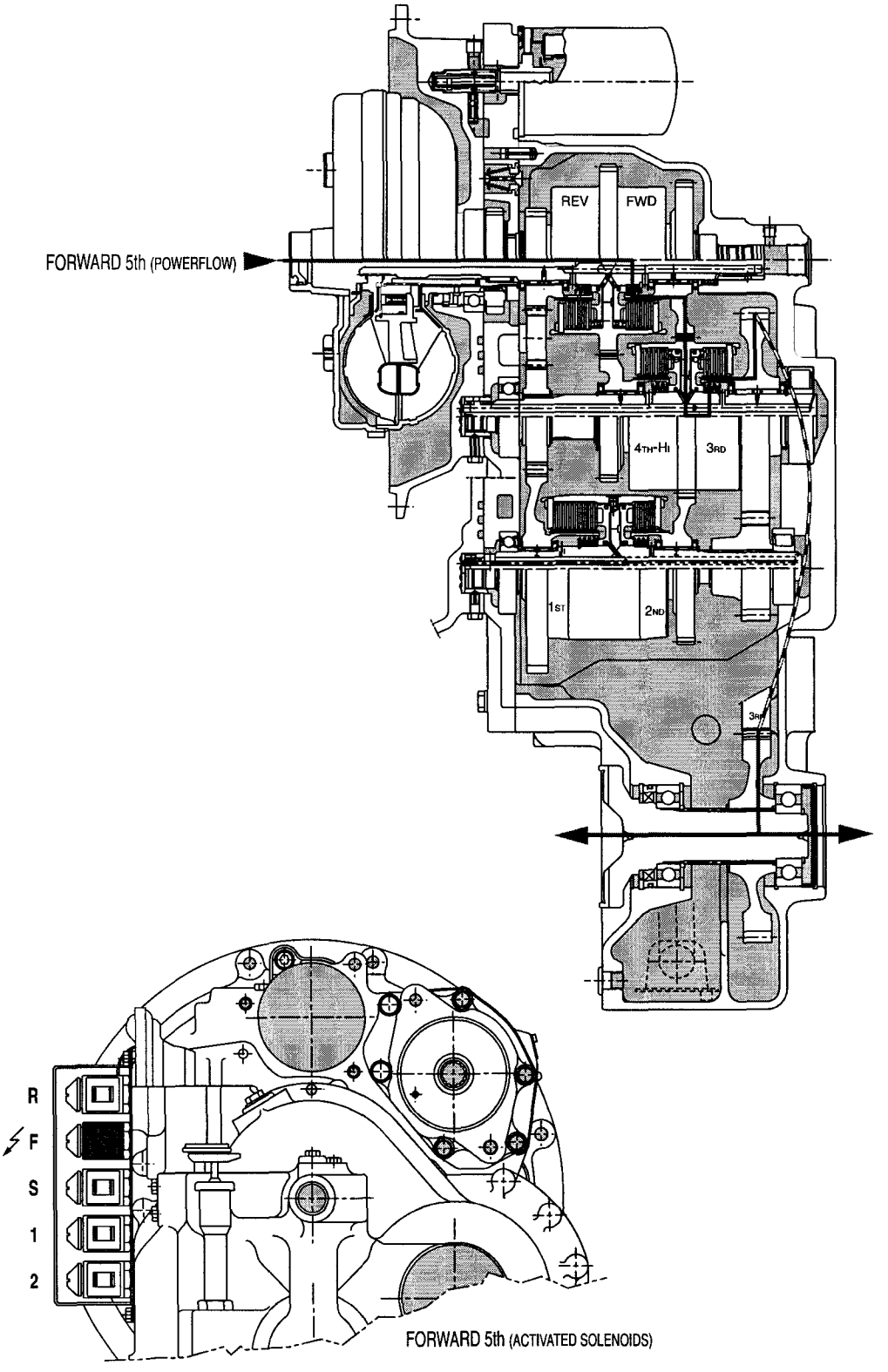
6.3.3.5 Forward 4th speed



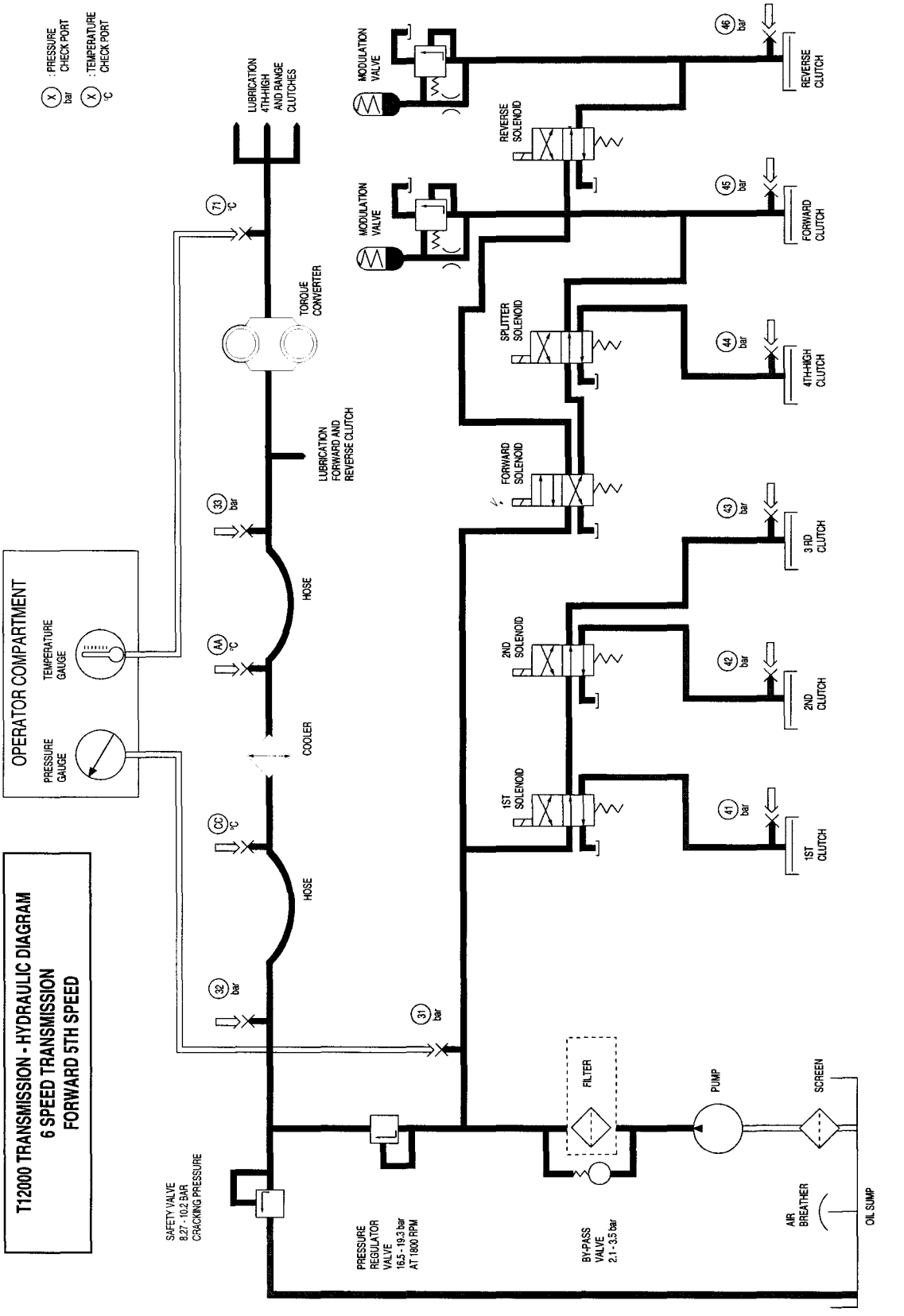
6.3.3.5 Forward 4th speed (continued)



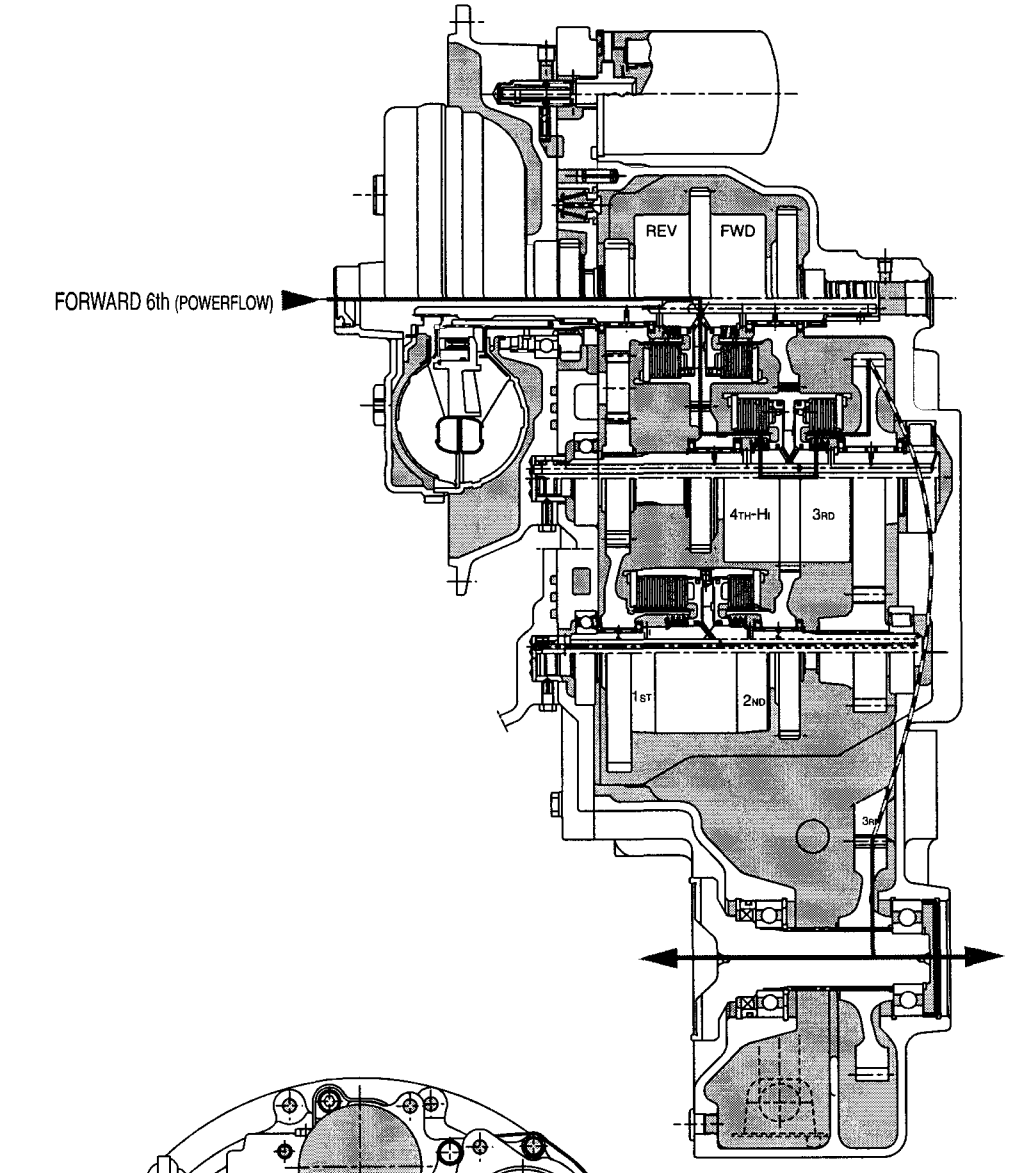
6.3.3.6 Forward 5th speed

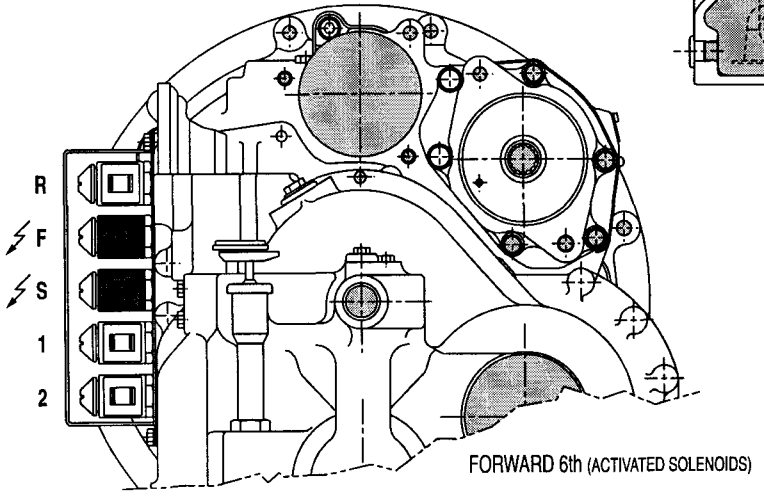


6.3.3.6 Forward 5th speed (continued)

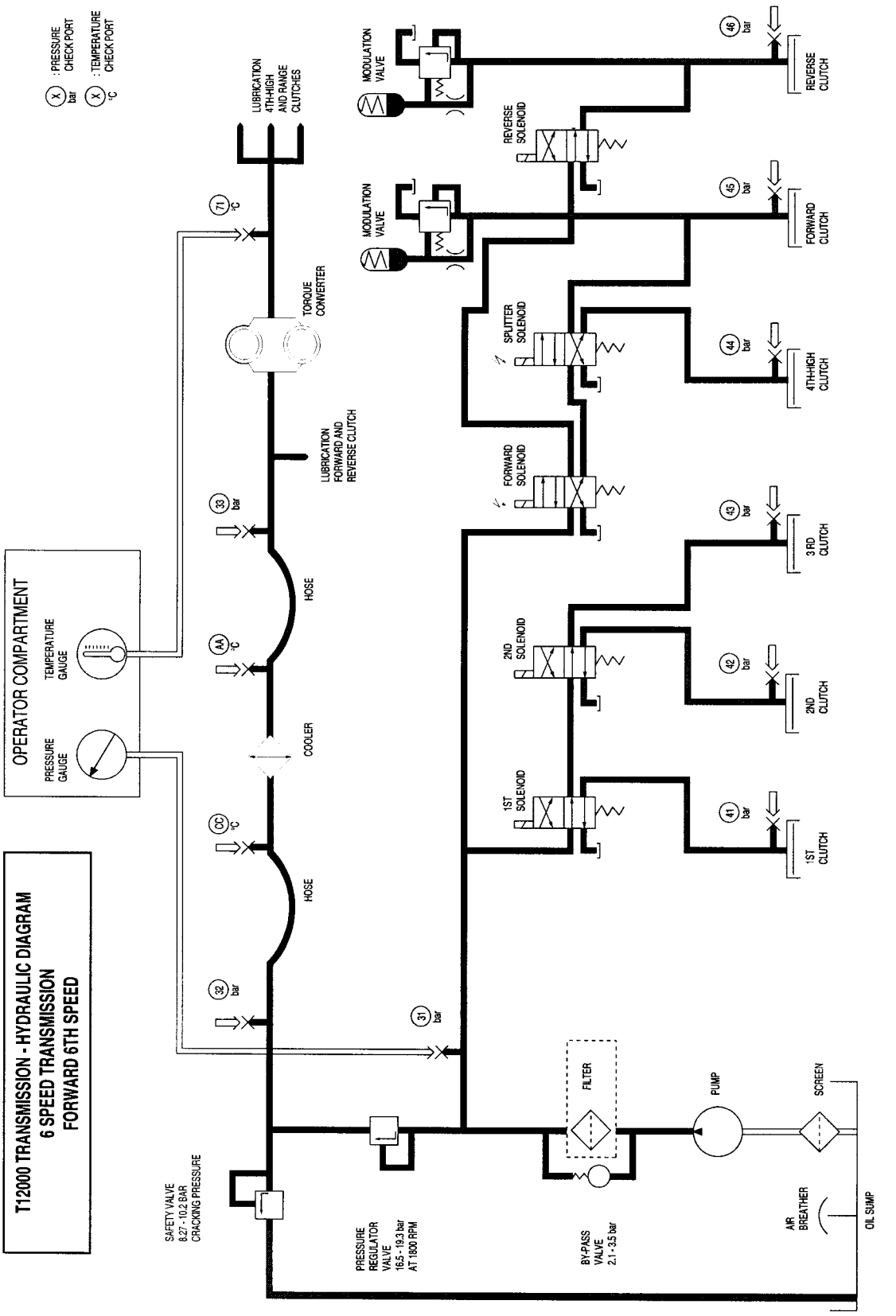


6.3.3.7 Forward 6th speed

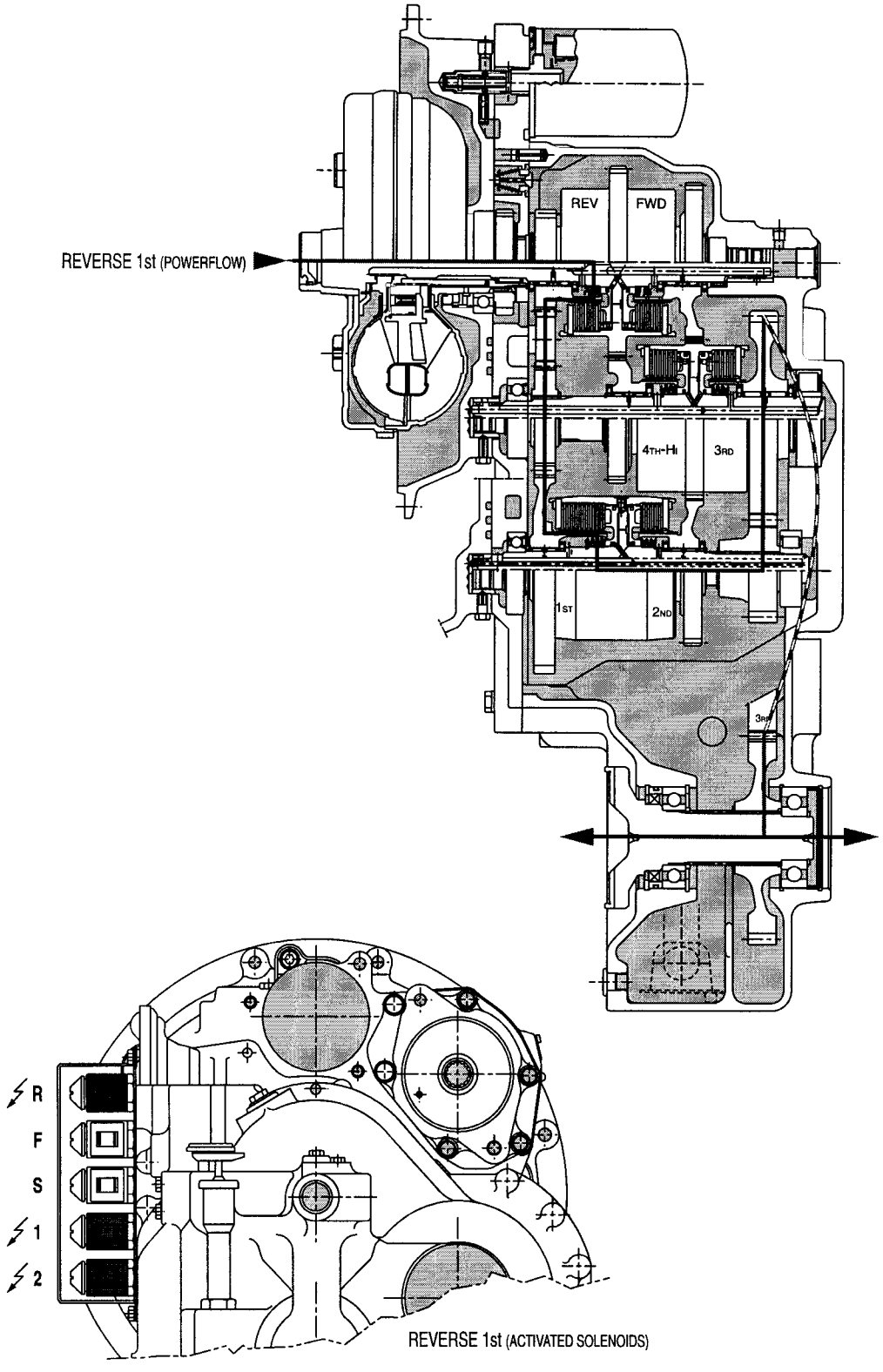




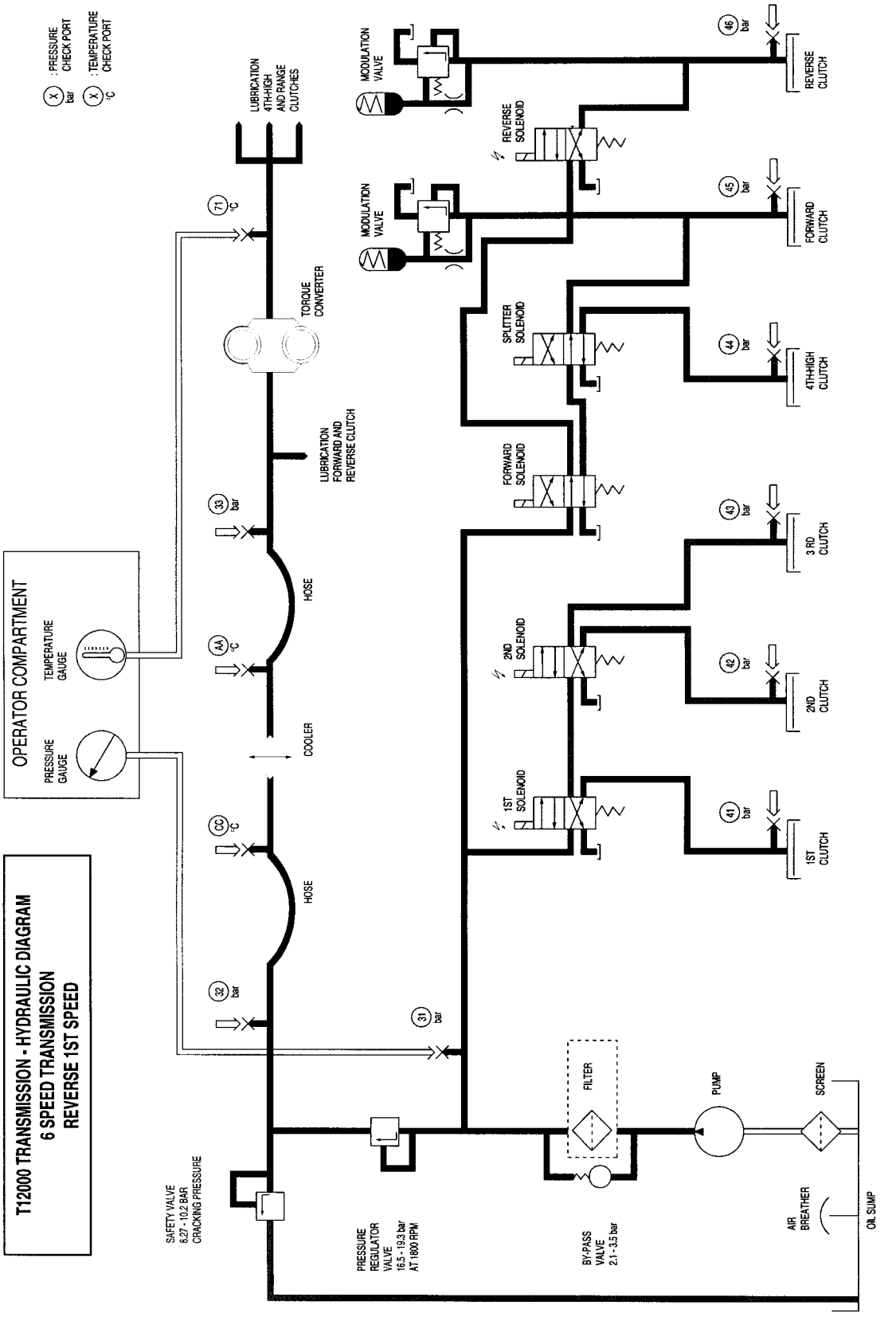
6.3.3.7 Forward 6th speed (continued)



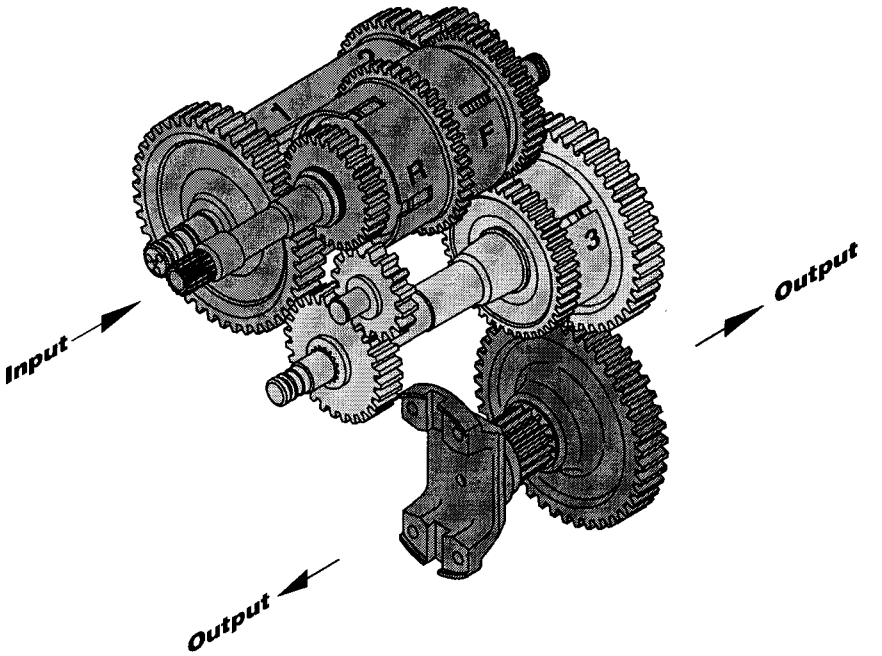
6.3.3.8 Reverse 1st speed



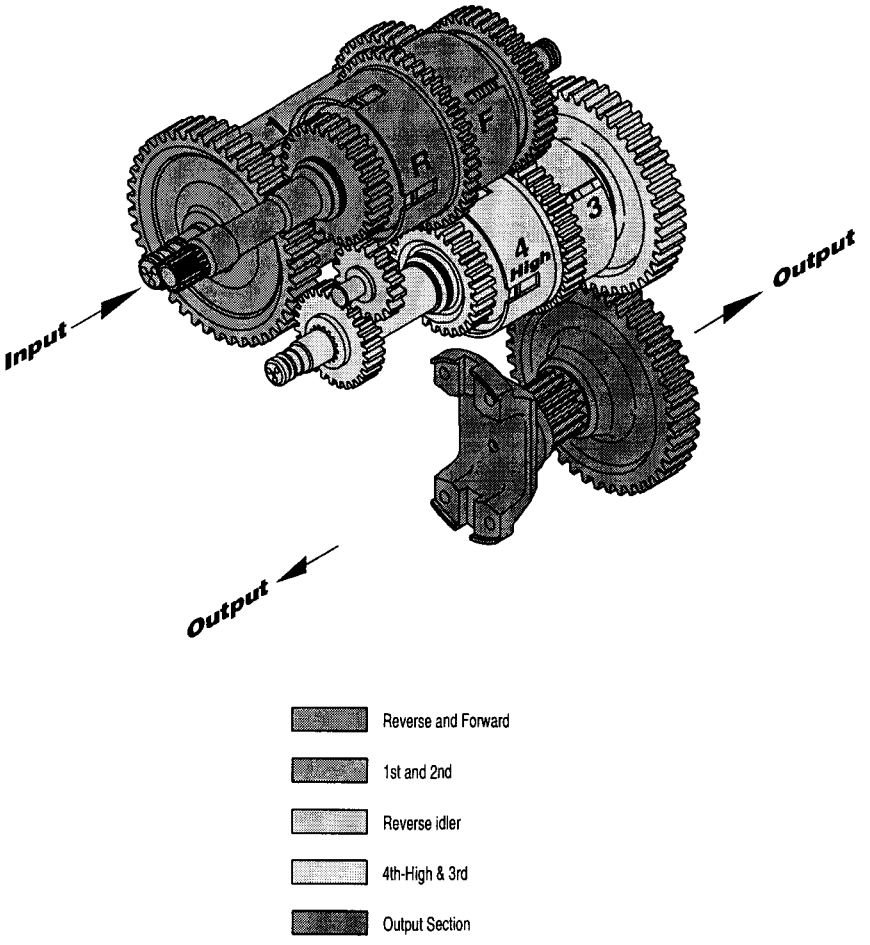
6.3.3.8 Reverse 1st speed (continued)



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.

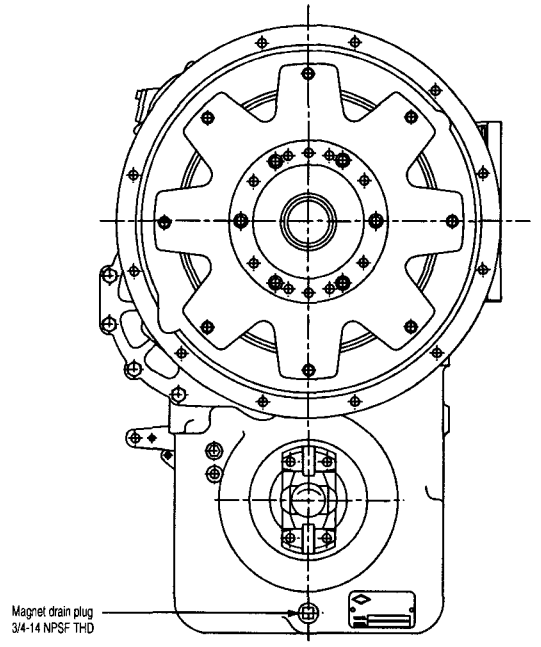
7.3.4 Noisy converter

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.

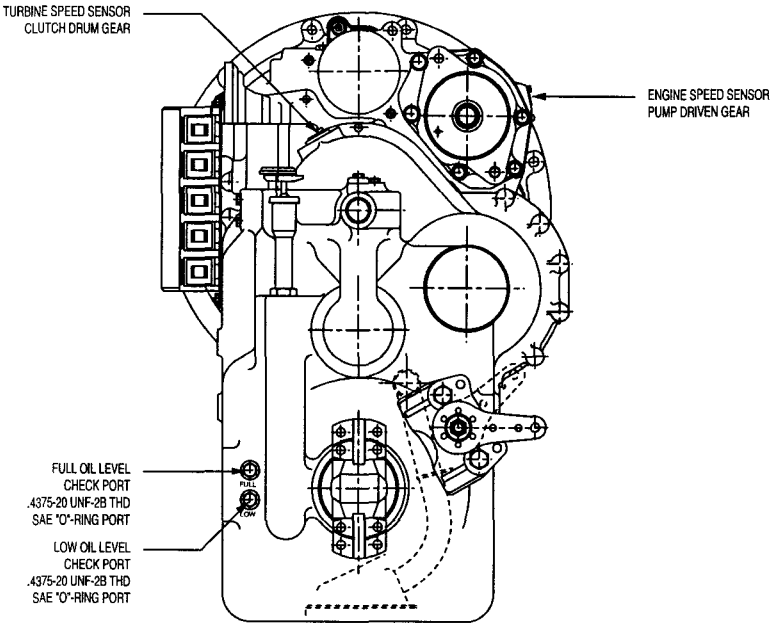
7.3.5 Lack of power

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

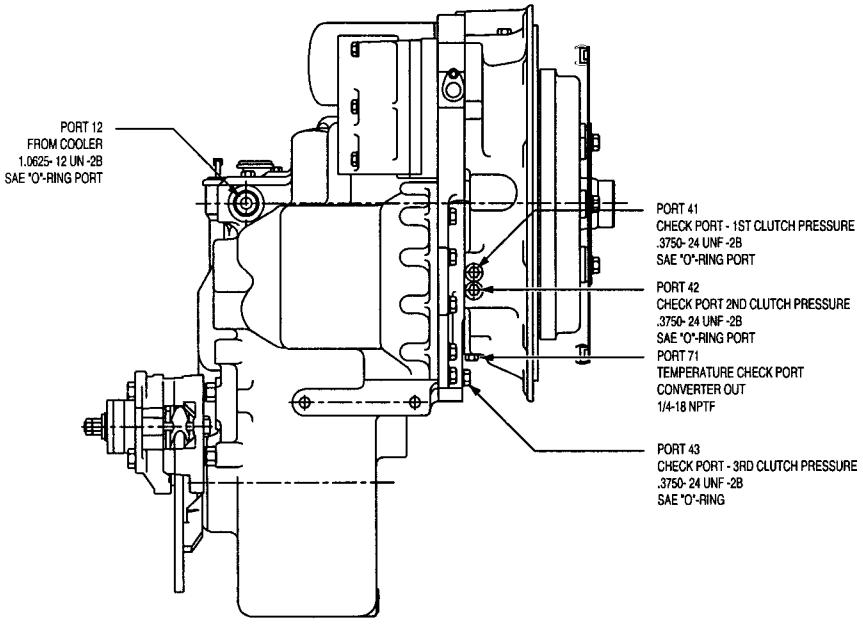


FRONT VIEW

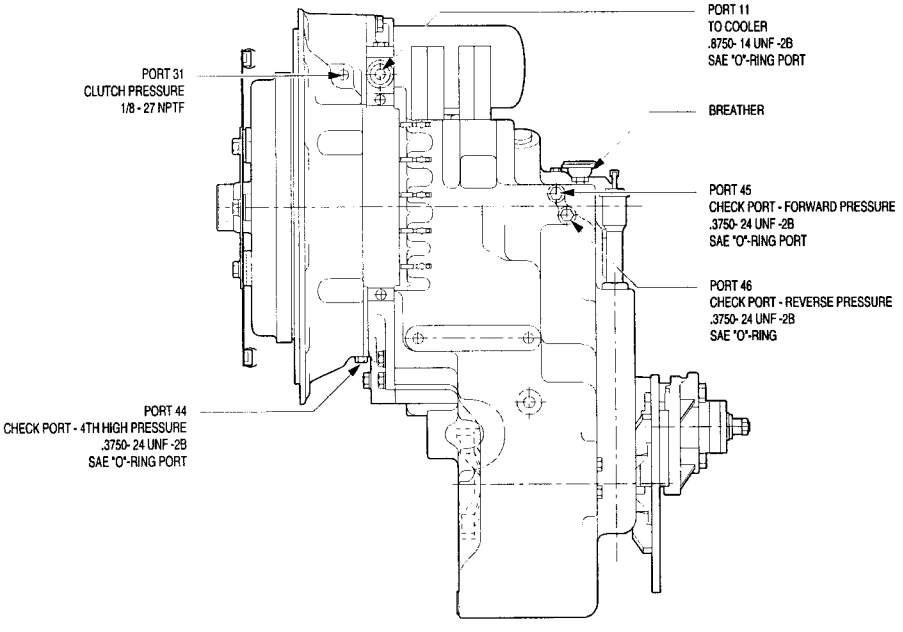


REAR VIEW

7.4 CHECK POINTS (CONTINUED)

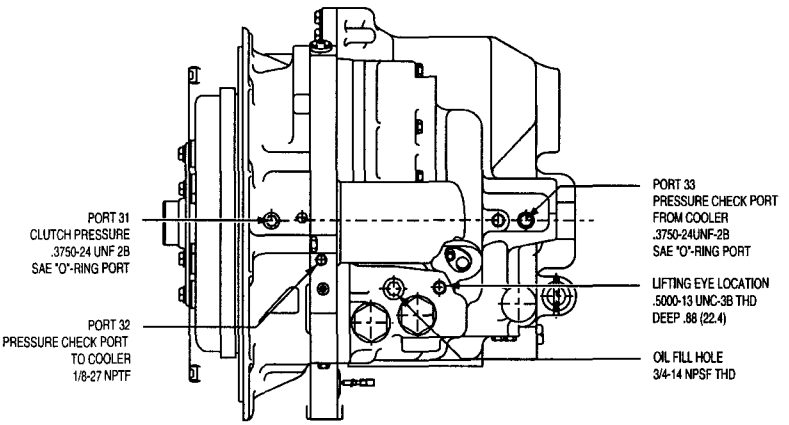


RIGHT SIDE VIEW



LEFT SIDE VIEW

7.4 CHECK POINTS (CONTINUED)



TOP VIEW

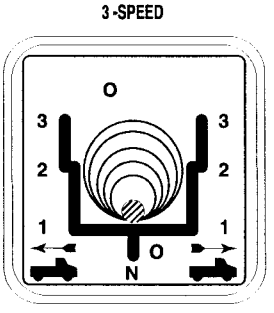
7.5 ELECTRICAL WIRING

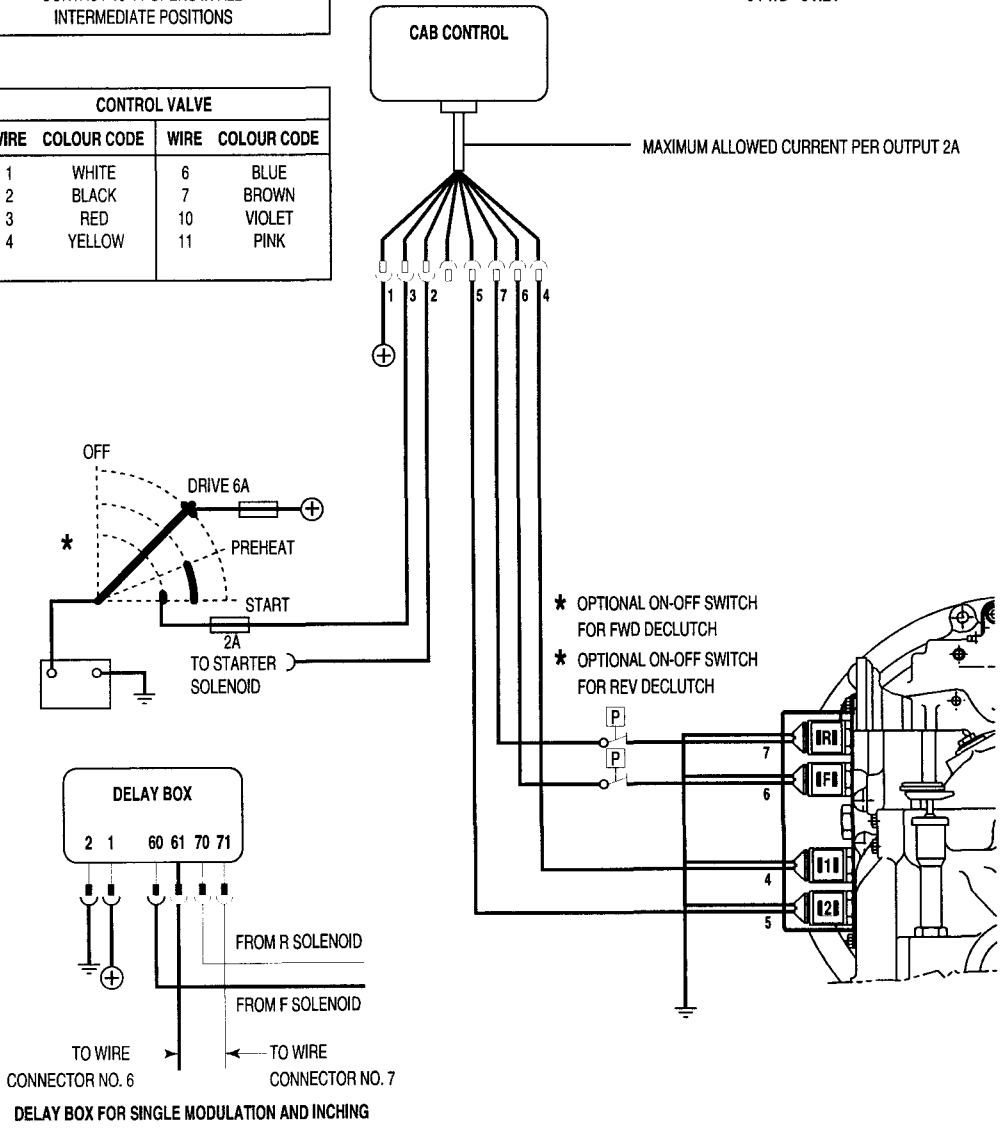
7.5.1 3-Speed transmission

SPICER OFF-HIGHWAY WILL NOT SUPPLY ITEMS INDICATED WITH ✱

CAB CONTROL	
CAB CONTROL POSITION	CONTACTS CLOSED BETWEEN WIRES
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





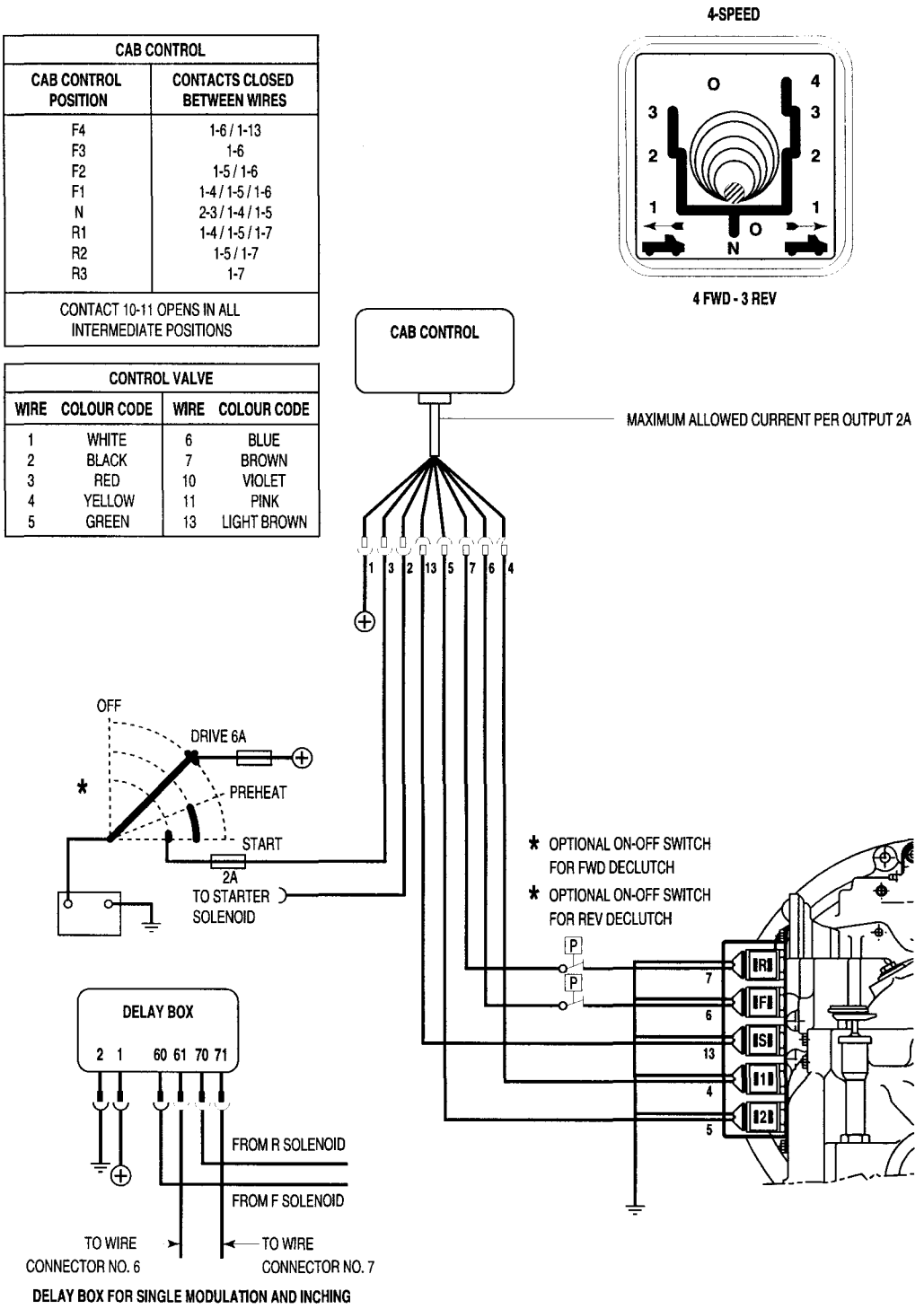
DELAY BOX FOR SINGLE MODULATION AND INCHING

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



DELAY BOX FOR SINGLE MODULATION AND INCHING

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

Note

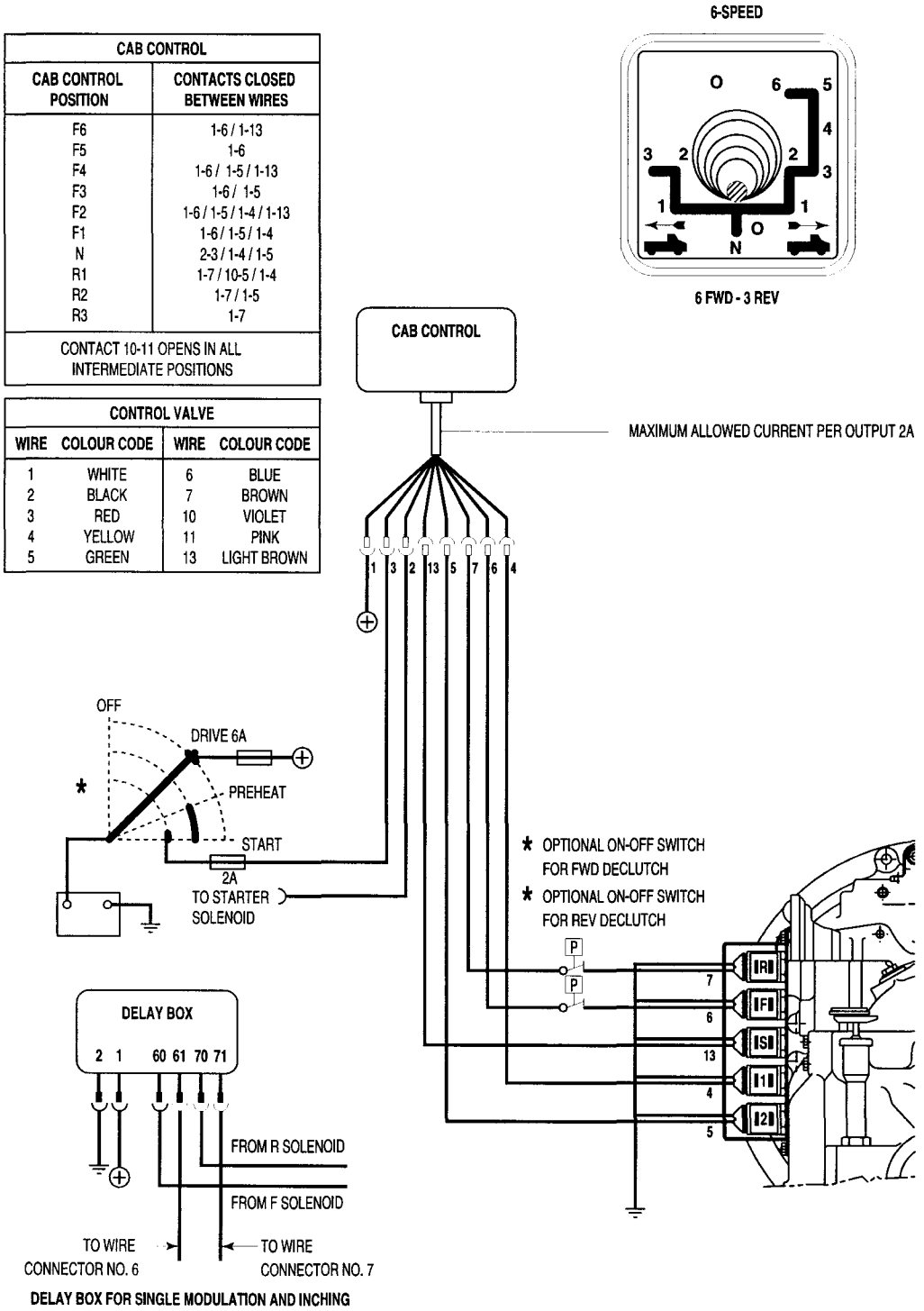
ALTERNATIVE 4-SPEED TRANSMISION IS ONLY AVAILABLE WITH EGS OR APC.
ELECTRIC SOLENOID CONTROL WIRING DIAGRAM FOR ALTERNATIVE 4-SPEED TRANSMISSION:
REFER TO WIRING DIAGRAM OF CORRESPONDING CONTROLLER.

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



DELAY BOX FOR SINGLE MODULATION AND INCHING

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 ± 1mA current level) or 2.6-3.0V (for the 14mA ± 1mA current level)

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