DANA SPICER®
Off-Highway Products

Service Manual

Powershift Transmission
8000 Series 4-Speed

Allied Form # 80-981

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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-HIGWAY 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 or approved by SPICER OFF-HIGHWAY PRODUCTS.

IMPORTANT

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

TOWING OR PUSHING

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

Because of the design of the hydraulic system, the engine cannot be started by pushing or towing.

Safety Precautions

To reduce the chance of personal injury and/or property damage, the following instructions must be carefully observed.

Proper service and repair are important to the safety of the service technician and the safe reliable operation of the machine. If replacement parts are required, the parts must be replaced by spare parts which have the same part number or with equivalent parts. 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 POSSIBLE HAZARDOUS CONSEQUENCES THAT MIGHT RESULT FROM FAILURE TO FOLLOW THESE INSTRUCTIONS.

CAUTION

WHEN MAINTENANCE WORKS REQUIRE WELDING, DISCONNECT BOTH CONNECTORS FROM THE TRANSMISSION CONTROLLER AND FROM THE VALVE UNIT, BEFORE ANY WELDING IS STARTED.

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 moistere-free compressed air or soft lintless absorbant 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.

2.2.2 OIL SEALS, GASKETS, ETC.

Replacement of spring load oils seals, “O” rings, metal sealing rings, gaskets and snap rings is more economical when the 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 lips of seals seriously impairs its efficiency.
When assembling new metal type sealing rings, these should be lubricated with a coat of chassis grease to stabilise 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 & 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 spline-twisted, and that shafts are true.

2.2.4 HOUSINGS, COVERS, ETC.

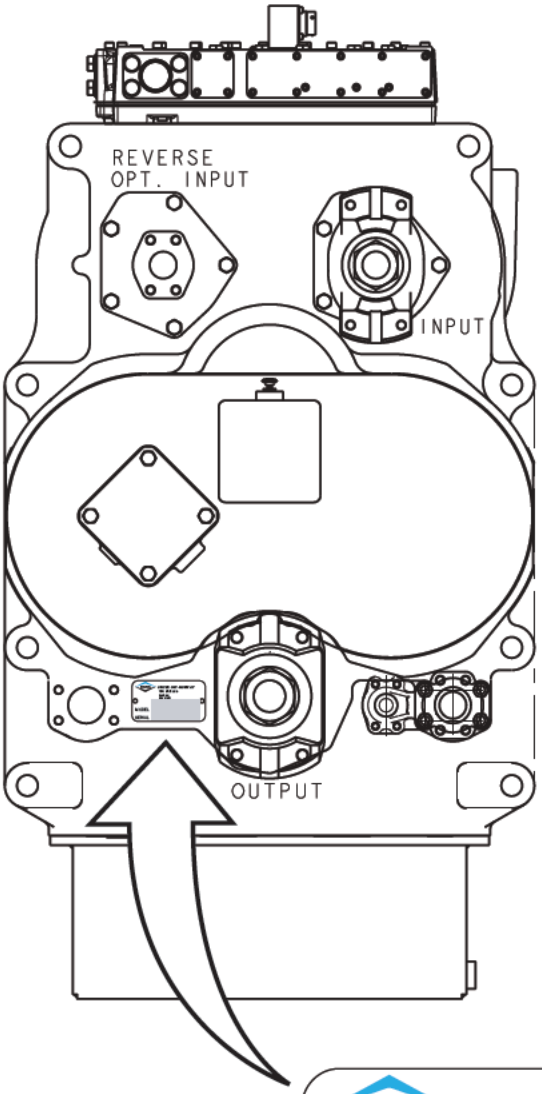
Inspect housings, covers and bearing caps to ensure that they are thoroughly clean and that mating surfaces, bearing bores, etc... are free from nicks or burrs. Check all parts carefully for evidence of cracks or conditions which would cause subsequent oil leaks or failures.

2.3 LEGEND SYMBOLS

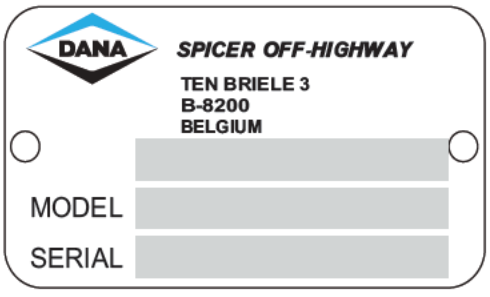
	Smontaggio di sottogruppi Disassembly of assembly groups
	Montaggio di sottogruppi Reassemble to from assembly group
	Smontaggio di particollari ingombranti Remove obstruction parts
	Montaggio di particollari ingombranti Reinstall - remount parts which had obstructed disassembly
	Attenzione, indicazione 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

3.1 IDENTIFICATION OF THE UNIT



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



3.2 WEIGHT, DIMENSIONS, OIL CAPACITY

Weight (dry): ±1327 kg [2925 lbs.]

Maximum length : 949 mm [37.36”]
Maximum width : 743 mm [29.25”]
Maximum height : Standard sump: 1187 mm [46.72”]

Oil capacity
Standard sump: ±32 l [8.5 US Gallon]
Deep sump: ±49 l [13 US Gallon]
Consult operator’s manual on applicable machine for system capacity.

3.3 TORQUE CHARTS

Torque specifications for lubricated or plated threads						
	GRADE 8.8		GRADE 10.9		GRADE 12.9	
	COARSE THREAD		COARSE THREAD		COARSE THREAD	
NOM. SIZE	LBF - FT	[N.m]	LBF - FT	[N.m]	LBF - FT	[N.m]
M5 x 0.8	3.7 - 4.4	[5 - 6]	5.2 - 5.9	[7 - 8]	5.9 - 7.4	[8 - 10]
M6 x 1	5.9 - 7.4	[8 - 10]	8.9 - 11.1	[12 - 15]	9.6 - 11.8	[13 - 16]
M8 x 1.25	14.8 - 18.4	[20 - 25]	22.1 - 25.8	[30 - 35]	25.8 - 29.5	[35 - 40]
M10 x 1.5	29.5 - 36.9	[40 - 50]	44.3 - 47.9	[60 - 65]	47.9 - 55.3	[65 - 75]
M12 x 1.75	50.2 - 55.3	[68 - 75]	73.8 - 81.1	[100 - 110]	85 - 96	[115 - 130]
M14 x 2	81 - 92	[110 - 125]	111 - 129	[150 - 175]	133 - 155	[180 - 210]
M16 x 2	125 - 140	[170 - 190]	177 - 203	[240 - 275]	207 - 236	[280 - 320]
M20 x 2.5	236 - 266	[320 - 360]	332 - 369	[450 - 500]	387 - 443	[525 - 600]
M24 x 3	420 - 479	[570 - 650]	590 - 664	[800 - 900]	664 - 774	[900 - 1050]
M30 x 3.5	848 - 959	[1150 - 1300]	1180 - 1328	[1600 - 1800]	1364 - 1549	[1850 - 2100]
M36 x 4	1475 - 1660	[2000 - 2250]	2028 - 2323	[2749 - 3149]	2397 - 2729	[3249 - 3699]

	GRADE 8.8		GRADE 10.9		GRADE 12.9	
	FINE THREAD		FINE THREAD		FINE THREAD	
NOM. SIZE	LBF - FT	[N.m]	LBF - FT	[N.m]	LBF - FT	[N.m]
M8 x 1	17 - 20	[23 - 28]	25 - 28	[34 - 39]	30 - 34	[41 - 46]
M10 x 1	35 - 42	[47 - 57]	52 - 60	[71 - 81]	62 - 69	[84 - 94]
M10 x 1.25	32 - 40	[44 - 54]	49 - 57	[67 - 77]	58 - 66	[79 - 89]
M12 x 1.25	60 - 68	[82 - 92]	89 - 96	[120 - 130]	105 - 116	[143 - 158]
M12 x 1.5	58 - 65	[78 - 88]	86 - 94	[117 - 127]	101 - 112	[138 - 153]
M14 x 1.5	94 - 105	[128 - 143]	142 - 153	[193 - 208]	162 - 184	[220 - 250]
M16 x 1.5	159 - 169	[215 - 228]	216 - 227	[293 - 308]	258 - 273	[350 - 370]
M18 x 1.5	221 - 236	[300 - 320]	319 - 330	[433 - 448]	369 - 398	[500 - 540]
M18 x 2	207 - 221	[280 - 300]	304 - 315	[413 - 428]	347 - 376	[470 - 510]
M20 x 1.5	302 - 332	[410 - 450]	439 - 476	[595 - 645]	503 - 559	[683 - 758]
M22 x 1.5	413 - 443	[560 - 600]	586 - 623	[795 - 845]	681 - 736	[923 - 998]
M24 x 1.5	531 - 590	[720 - 800]	767 - 841	[1040 - 1140]	882 - 992	[1195 - 1345]
M24 x 2	509 - 568	[690 - 770]	730 - 804	[990 - 1090]	845 - 955	[1145 - 1295]
M27 x 1.5	789 - 848	[1070 - 1150]	1129 - 1202	[1530 - 1630]	1309 - 1420	[1775 - 1925]

3.3 TORQUE CHARTS (CONTINUED)

Torque specifications for lubricated or plated threads

NOM. SIZE	GRADE 5			
	FINE THREAD		COARSE THREAD	
	LBF - FT	[N.m]	LBF - FT	[N.m]
1/4	9 - 11	[12 - 15]	8 - 10	[11 - 14]
5/16	16 - 20	[22 - 27]	12 - 16	[16 - 22]
3/8	26 - 29	[35 - 39]	23 - 25	[31 - 34]
7/16	41 - 45	[56 - 61]	37 - 41	[50 - 56]
1/2	64 - 70	[87 - 95]	57 - 63	[77 - 85]
9/16	91 - 100	[123 - 136]	82 - 90	[111 - 122]
5/8	128 - 141	[173 - 191]	113 - 124	[153 - 168]
3/4	223 - 245	[302 - 332]	200 - 220	[271 - 298]

Torque specifications for lubricated or plated threads

NOM. SIZE	GRADE 8			
	FINE THREAD		COARSE THREAD	
	LBF - FT	[N.m]	LBF - FT	[N.m]
1/4	11 - 13	[15 - 18]	9 - 11	[12 - 15]
5-16	28 - 32	[38 - 43]	26 - 30	[35 - 41]
3/8	37 - 41	[50 - 56]	33 - 36	[45 - 49]
7/16	58 - 64	[79 - 87]	52 - 57	[70 - 77]
1/2	90 - 99	[122 - 134]	80 - 88	[108 - 119]
9/16	128 - 141	[174 - 191]	115 - 127	[156 - 172]
5/8	180 - 198	[224 - 268]	159 - 175	[216 - 237]
3/4	315 - 347	[427 - 470]	282 - 310	[382 - 420]

Torque specifications for plugs

NPFT NOM. SIZE	O-ring ports	
	LBF - FT	[N.m]
5/16 x 24	3 - 5	[4 - 7]
3/8 x 24	5 - 8	[7 - 11]
7/16 x 20	7 - 10	[9 - 14]
1/2 x 20	10 - 13	[14 - 18]
9/16 x 18	12 - 15	[16 - 20]
3/4 x 16	20 - 25	[27 - 34]
7/8 x 14	30 - 35	[41 - 47]
1 1/16 x 12	45 - 50	[61 - 68]
1 5/16 x 12	65 - 75	[88 - 102]
1 5/8 x 12	75 - 85	[102 - 115]
1 7/8 x 12	75 - 85	[102 - 115]

Torque specifications for plugs

METRIC NOM. SIZE	O-ring plugs	
	LBF - FT	[N.m]
M10 x 1	6 - 7	[8 - 9]
M12 x 1.5	9 - 13	[14 - 18]
M14 x 1.5	12 - 15	[16 - 20]
M16 x 1.5	20 - 25	[27 - 34]
M18 x 1.5	25 - 30	[34 - 41]
M22 x 1.5	35 - 44	[48 - 60]
M26 x 1.5	45 - 50	[61 - 68]
M27 x 2	60 - 66	[81 - 89]
M33 x 2	83 - 103	[112 - 140]

Torque specifications for plugs

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

Torque specifications for plugs

METRIC NOM. SIZE	Permanent plugs	
	LBF - FT	[N.m]
M18 x 1.5 6H	34 - 41	[25 - 30]
M26 x 1.5 6H	61 - 68	[45 - 50]

Torque specifications

NFPT NOM. SIZE	Elastic Stop Nuts	
	LBF - FT	[N.m]
1.00 x 20	150 - 200	[542 - 610]
1.25 x 18	200 - 250	[407 - 474]
1.50 x 18	300 - 350	[271 - 339]
1.75 x 12	400 - 450	[203 - 271]

3.4 PRESSURE AND TEMPERATURE SPECIFICATIONS

- MAXIMUM ALLOWED TRANSMISSION TEMPERATURE 120 °C [248 F].
- TRANSMISSION REGULATOR PRESSURE (*) - (NEUTRAL) - PORT 31 (**).
  - AT 600 RPM MIN. 12.4 BAR [180 PSI] MINIMUM.

- CLUTCH PRESSURES (*)
  - 1ST CLUTCH: PORT 41 (**).
  - 2ND CLUTCH: PORT 42 (**).
  - 3RD CLUTCH: PORT 43 (**).
  - 4TH CLUTCH: PORT 44 (**).
  - FWD CLUTCH: PORT 45 (**).
  - REVERSE CLUTCH: PORT 46 (**).

AT 2000 RPM :

- 12.4 BAR [180 PSI] MIN. CLUTCH ACTIVATED.
- 0 - 0.2 BAR (0 - 3 PSI) CLUTCH RELEASED.

- SAFETY VALVE: CRACKING PRESSURE (*) 9 BAR [130 PSI].

- CONVERTER OUT REGULATOR 4 BAR [58 PSI].

(*) 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 HYDRAULIC COOLER LINES SPECIFICATIONS

SEE CHAPTER 5.1 EXTERNAL PLUMBING

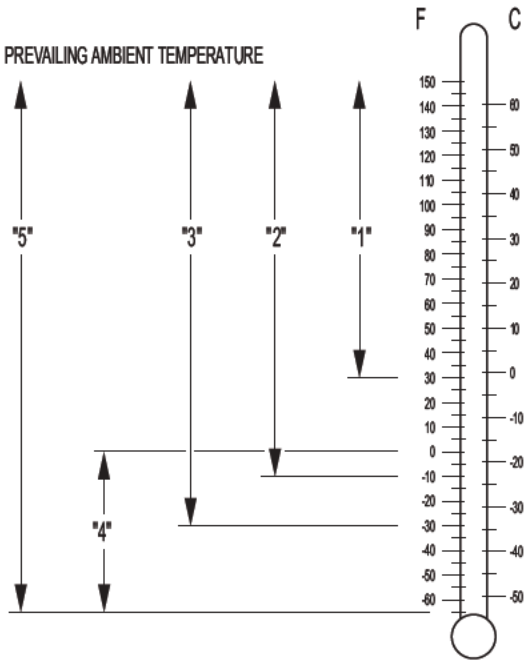
3.6 ELECTRICAL SPECIFICATIONS

- ON/OFF solenoid (FWD, REV, 1st, 2nd, 3rd & 4th)

  Coil resistance 24V 87 ± 2 Ω at 20° [68° F]

4.1 OIL SPECIFICATION

4.1.1 Recommended lubricants



Temperature range "1"
C-3 Grade 30
Engine oil grade 30 API-CD/SE or CD/SF
Mill-L-2104C Grade 30
Mil-L-2104D Grade 30

Temperature range "2"
Mil-L-2104C Grade 10
Mill-L-2104D Grade 10
C-2 Grade 10
C-3 Grade 10
Engine oil Grade 10 API-CD/SE or CD/SF
Quintolubric 822-220 (non phosphate ester fire resistant fluid)

Temperature range "3"
Dexron*
Dexron IID (See caution below)

Temperature range "4"
MIL-L-46267
MIL-L-46167A

Temperature range "5"
Conoco high performance sybthetic motor oil - spec No 6718

PREFERRED OIL VISCOSITY
Select highest oil viscosity compatible with prevailing ambient temperatures and oil application chart. Temperature ranges "2" & "3" may be used to lower ambient temperatures when sump preheaters are used. Temperature ranges "4" should only be used in ambient temperature range shown.

* DEXRON II D is not compatible with graphitic clutch plate friction material UNLESS IT MEETS THE APPROVED C-3 SPECIFICATIONS. DEXRON II D cannot be used in the 3000, 4000, 5000, 6000, 8000, 16000 with modulated shift. Use only C-3 or DEXRON.

Any deviation from this chart must have written approval from the application dept. of Dana Spicer Off-Highway.

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

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

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 .
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.
Every 1000 hours Drain and refill system as follows (Drain with oil at 65 - 93° C [150 – 200° F]):

1. Drain transmission.
2. Remove and discard filter. Install new filter.
3. Refill transmission to FULL mark.
4. Run engine at 500 - 600 RPM to prime converter, lines and to reach oil temp of 82 - 93 °C [180-200 F].
5. Check level with engine running and add oil to bring level to LOW mark.
   When oil temperature is hot 82.2 - 93.3°C [180- 200° F] make final oil level check and adjust if necessary to bring oil level to FULL mark.

NOTE

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

4.3 SERVICING MACHINE AFTER COMPONENTS OVERHAUL

The transmission, torque converter, and its allied hydraulic system are important links in the driveline between the engine and the wheels. The proper operation of either unit depends greatly on the condition and operation of the other. Therefore, whenever repair or overhaul of one unit is performed, the balance of the system must be considered before the job can be considered complete.
After the overhauled or repaired transmission has been installed in the machine, the oil cooler, and connecting hydraulic system must be thoroughly cleaned. This can be accomplished in several manners and a degree of judgement must be exercised as to the method employed.

The following are considered the minimum steps to be taken:

1. Drain entire system thoroughly.

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

3. Replace oil filter element.

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

IMPORTANT:
DO NOT use flushing compounds for cleaning purposes.

5. Reassemble all components and use only approved type oil (See chapter 4.1.1 “Recommended lubricants”).

Fill the transmission through filler opening until fluid comes up to FULL mark on transmission dipstick.

- Remove filler plug and fill oil until FULL mark.
- Run engine two minutes at 500 - 600 RPM to prime torque converter and hydraulic lines.
- Recheck level of fluid in transmission with engine running.
- Add quantity necessary to bring fluid level to LOW mark on dipstick.
- Recheck with hot oil 82.2 - 93.3°C [180 – 200° F].
- Adjust oil level to FULL mark on dipstick.

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

4.4 FILLING INSTRUCTIONS

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

NOTE:

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

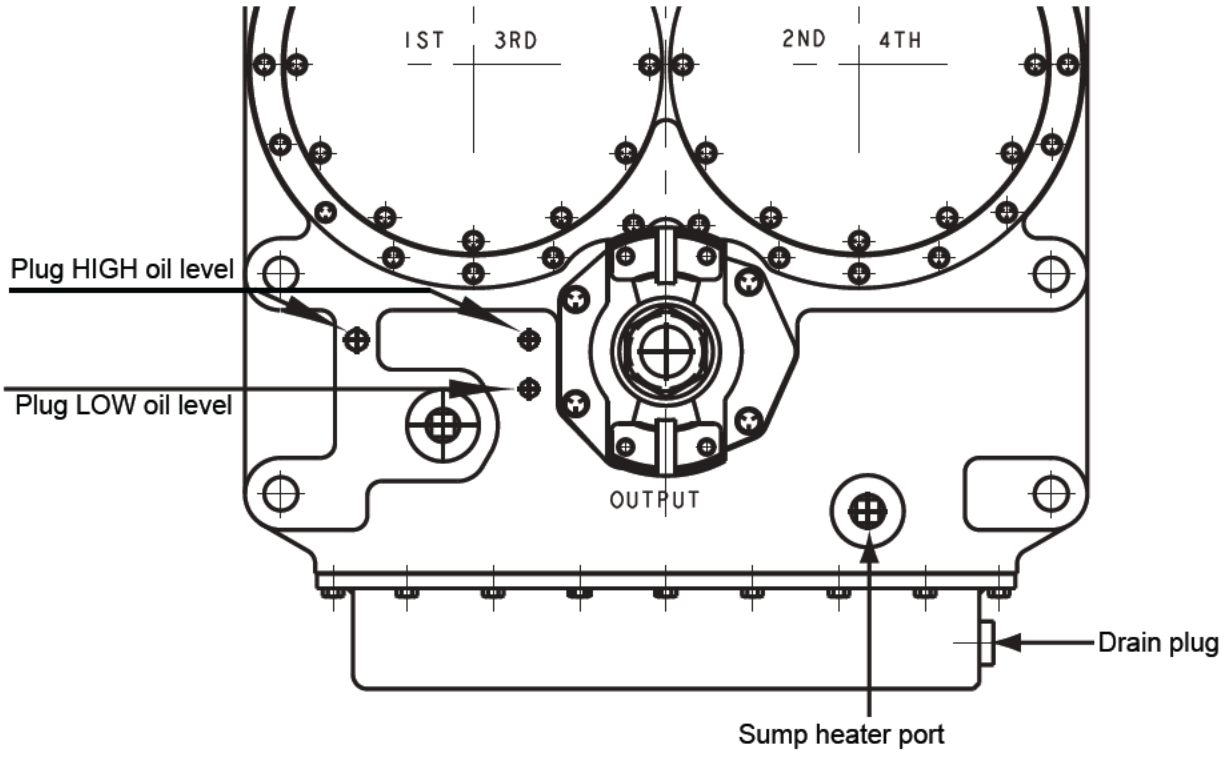
Remove LOWER check plug, fill until oil runs from LOWER oil level hole. Replace filler and level plug.

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

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

Install oil level plug or dipstick. Recheck with hot oil (82 - 93° C) [180 - 200° F]

Bring oil level to full mark on dipstick or runs freely fromm UPPER oil level plug.



4.5 PRESSURE AND OIL FLOW CHECKS

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

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

4.5.1 Oil pressure at converter out port.

Install hydraulic pressure gauge at pressure connection on converter regulator valve or at converter out pressure tap. (All models do not have pressure regulating valves.) Check and record pressure at 2000 RPM and at maximum speed (engine at full throttle)

CONVERTER MODEL	Min CONVERTER Out pressure at Idle	Max CONVERTER Out pressure at No load gov. speed
C5000, C8000, C16000	379.3 kPa [55 Psi]	482.6 kPa [70 Psi]

If a flow meter is available, install in line between converter charging pump and oil filters. Flow meter must be able to withstand 2068.4 kPa [300 Psi]

Disconnect hose between pump and filter end and using suitable fittings connect to pressure port of tester.

DO NOT USE TESTER LOAD VALVE AT ANYTIME DURING TEST.

When taking flow reading, all readings should be taken on the first (left) half of the flow gauge. Whenever the needle shows on the right half of the gauge, correct by switching to a higher scale.

If a flow meter is not available for checking converter pump output, proceed with manual transmission and converter checks. If the converter shows leakage within specifications and clutch pressures 1241.1-1516.8 kPa [180-220 Psi] are all equal within 34.5 kPa [5 Psi] refer to paragraph on low converter charging pump output.

Pump are rated at 2000 RPM - Refer to Vehicle manufacturer Manual for specific pump output.

Nominal pump ratings:	C5000	C8000	C16000
	21 GPM	21 GPM	40 GPM
	31 GPM	31 GPM	50 GPM
		40 GPM	65 GPM

Pump output listed applies to a new pump in each case. A 20% tolerance below this figure is permissable; however if pump output is more than 20% below specification the pump must be replaced or rebuild.

4.5.2 Transmission clutch leakage

Check clutch pressures at low engine idle with oil at operating temperature 82-93°C [180-200° F]. Engine speed must remain constant during entire leakage check. Shift lever into forward 4. Record pressures. Shift lever in reverse and first. Record pressure. All pressures must be equal within 34.5 kPa [5 Psi]. If clutch pressure varies in anyone clutch more than 5 PSI [34.5 KPa], repair clutch.

If a flow meter is available install in line coming out of converter pump. Check pump volume at 2000 RPM and at low engine idle. Record readings

Install flow meter in the line coming from transmission to converter. Check oil at 2000 RPM and at low idle in the following speed selections. Record readings

Forward low speed thru high
Reverse low speed

Subtract readings in each speed from pump volume reading to get transmission clutch leakage.

example:	Pump volume at idle	8 Gal	Pump volume	8 Gal.
	Forward low speed thru high	6 Gal	Forward low speed	6 Gal
	Reverse low speed	6 Gal	Clutch leakage	2 Gal

If clutch leakage varies more than 1 Gallon from one clutch to another, repair clutch.

4.5.3 Leakage in transmission clutches

Leakage in 3000 series transmission must not exceed 4 Gal. max.
in 5000 series transmission must not exceed 4 Gal. max.
in 8000 series transmission must not exceed 6 Gal. max.
in 16000 series transmission must not exceed 7 Gal. max.

4.5.4 Converter lube flow

Disconnect converter drain back line at transmission with engine running at 2000 RPM and measure oil into a gallon container. Measure oil leakage for 15 seconds and multiply the volume of oil by four to get gallons per minute leakage.

4.5.5 Leakage in converter

Leakage in C270 series converter not to exceed 2 Gal. max
in C5000 series converter not to exceed 3 Gal. max.
in C8000 series converter not to exceed 5 Gal. max.
in C16000 series converter not to exceed 5 Gal. max.

5.1 EXTERNAL PLUMBING

See drawing P235816 page 2

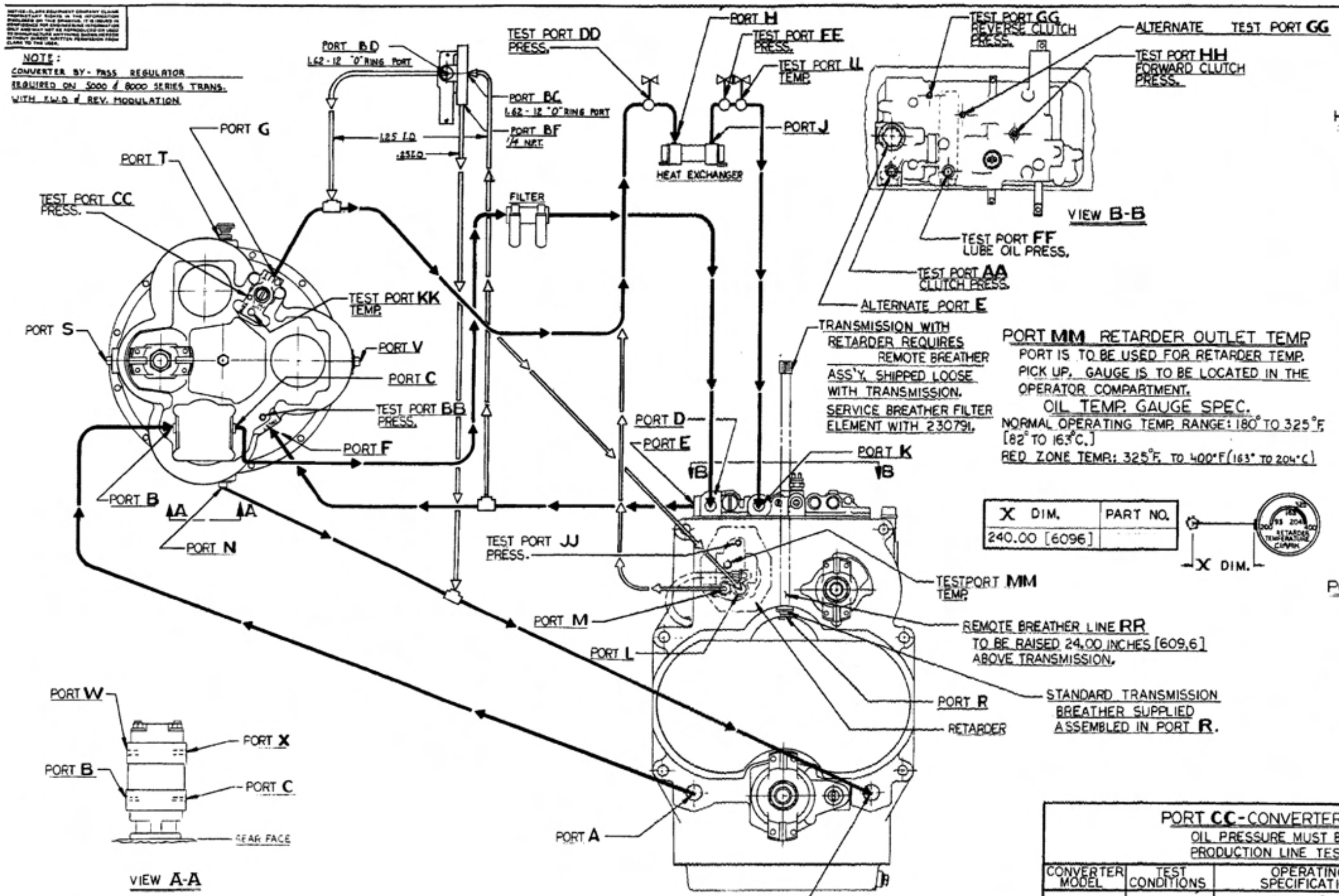
5.1.1 COOLER & FILTER LINES SPECIFICATIONS

See drawing P235816 page 1

5.1.2 SCAVENGER PUMP & BREATHER INSTALLATION.

See drawing 232693

NOTE:
CONVERTER BY-PASS REGULATOR REQUIRED ON 5000 & 8000 SERIES TRANS. WITH FWD & REV. MODULATION



HOSE LINE OPERATING REQUIREMENTS

1. PRESSURE LINES SUITABLE FOR OPERATION FROM AMBIENT TO 250°F [121°C] CONTINUOUS OPERATING TEMPERATURE. MUST WITHSTAND 300 P.S.I. [2068 kPa] INTERMITTENT SURGES. REF. S.A.E. SPEC. NO. J517, 100R1 HYDRAULIC HOSE SPECIFICATION.
2. SUCTION LINE TO BE PROTECTED FROM COLLAPSE BY INTERWOVEN STEEL WIRE. REF. S.A.E. SPEC. NO. J517, 100R4 HYDRAULIC HOSE SPECIFICATION. SUITABLE FOR OPERATION FROM AMBIENT TO 250°F [121°C] CONTINUOUS OPERATING TEMPERATURE.
3. GRAVITY DRAIN LINE SUITABLE FOR OPERATION FROM AMBIENT TO 250°F [121°C] CONTINUOUS OPERATING TEMPERATURE. REF. S.A.E. SPEC. NO. J517, 100R1 HYDRAULIC HOSE SPECIFICATION.
4. RETARDER LINES SUITABLE FOR AMBIENT TO 325°F [163°C] CONTINUOUS OPERATION WITH 350°F [177°C] INTERMITTENT OPERATION. REF. TEFLON LINED HOSE.
5. ALL HOSE LINES USED MUST CONFORM TO S.A.E. SPEC. NO. J1019 TEST PROCEDURE FOR HIGH TEMP. TRANSMISSION OIL.
6. OIL SPECIFICATIONS SEE CLARK DRAWING NO. 236647 FOR CLARK RECOMMENDATIONS FOR USE IN TORQUE CONVERTERS AND POWER SHIFT TRANSMISSIONS.

PORT MM RETARDER OUTLET TEMP.

PORT IS TO BE USED FOR RETARDER TEMP. PICK UP. GAUGE IS TO BE LOCATED IN THE OPERATOR COMPARTMENT.

OIL TEMP. GAUGE SPEC.

NORMAL OPERATING TEMP. RANGE: 180° TO 325°F [82° TO 163°C.]

RED ZONE TEMP.: 325°F TO 400°F (163° TO 204°C)

X DIM.	PART NO.
240.00 [6096]	

X DIM.

PORT AA-CLUTCH PRESSURE

RECOMMEND THAT THE CLUTCH PRESSURE BE MONITORED BY A GAUGE HAVING AN INDICATOR DIAL RANGE OF 0-400 P.S.I. [0-2758 kPa]. GAUGE IS TO BE LOCATED IN THE OPERATOR COMPARTMENT. REF. CLARK GAUGE PART NO. 234032

TRANSMISSION MODEL	CLUTCH PRESSURE RANGE
3000	180-220 P.S.I. [1241-1517 kPa]
4000	240-280 P.S.I. [1655-1931 kPa]
5000 8000 & 16000	180-220 P.S.I. [1241-1517 kPa]

PORT CC-CONVERTER OUTLET PRESSURE

OIL PRESSURE MUST BE MEASURED WITH NORMAL VEHICLE PRODUCTION LINE TEST.

CONVERTER MODEL	TEST CONDITIONS	OPERATING SPECIFICATIONS	HEAT EXCHANGER CIRCUIT PRESSURE SPECIFICATIONS
C 270 CL 270	CONVERTER OIL TEMP. 180°-200°F. [82°-93°C.]	25 P.S.I. [172 kPa] MINIMUM PRESSURE AT 2000 R.P.M. ENGINE SPEED AND A MAXIMUM OF 70 P.S.I. [483 kPa] OUTLET PRESSURE WITH ENGINE AT WIDE OPEN THROTTLE, NO-LOAD GOVERNED SPEED.	CONVERTER OUTLET PRESSURE EQUALS THE TOTAL PRESSURE DROP OF THE HEAT EXCHANGER, HEAT EXCHANGER LINES AND BACK PRESSURE OF THE TRANSMISSION LUBRICATION SYSTEM.
C 5000 C 8000 CL 8000 C 16000 CL 16000	TRANSMISSION IN NEUTRAL	55 P.S.I. [379 kPa] MINIMUM PRESSURE AT LOW IDLE ENGINE SPEED AND MUST RANGE BETWEEN 60 & 70 P.S.I. [414 & 483 kPa] WITH ENGINE AT WIDE OPEN THROTTLE, NO-LOAD GOVERNED SPEED.	W/O RETARDER-CIRCUIT PRESSURE DROP FROM PORT G TO PORT K IS NOT TO EXCEED 40 P.S.I. [276 kPa] WITH ENGINE AT WIDE OPEN THROTTLE, NO-LOAD GOVERNED SPEED. WITH RETARDER-CIRCUIT PRESSURE DROP FROM PORT M TO PORT K IS NOT TO EXCEED 40 P.S.I. [276 kPa] WITH ENGINE AT WIDE OPEN THROTTLE, NO-LOAD GOVERNED SPEED.

PORT T - BREATHER

ALTERNATE PORTS S, N & V - INSTALL BREATHER AND VALVE ASSEMBLY, FROM INSTRUCTION BAG AND TAG ASSEMBLY SHIPPED LOOSE WITH TORQUE CONVERTER, IN HIGHEST CONVERTER PORT NOTED.

PORT N-CONVERTER DRAIN

ALTERNATE PORTS S, T & V - SELECT LOWEST OF PORTS NOTED FOR GRAVITY DRAIN TO TRANSMISSION. LINE MUST HAVE CONTINUOUS SLOPE FROM CONVERTER TO TRANSMISSION. IF VEHICLE CONFIGURATION WILL NOT ALLOW CONTINUOUS SLOPE OF DRAIN LINE UNDER ALL OPERATING CONDITIONS, A SCAVENGER PUMP MUST BE PROVIDED. FOR SCAVENGER PUMP DATA AND INSTALLATION REQUIREMENTS, SEE DRAWING NO. 232693 DRAIN TO PORT P ONLY.

PORT KK - CONVERTER OUTLET TEMPERATURE

PORT IS TO BE USED FOR CONVERTER OUTLET TEMP. PICK-UP. GAUGE IS TO BE LOCATED IN THE OPERATOR COMPARTMENT.

OIL TEMPERATURE GAUGE SPECIFICATION

NORMAL OPERATING TEMP. RANGE: 180° TO 250°F [82° TO 121°C.]

RED ZONE TEMP.: 250°F TO 300°F (121° TO 148°C)

OIL TEMP. GAUGES	
X DIM.	PART NO.
144.00 [3657,6]	
48.00 [1219,2]	
12.00 [304,8]	

X DIM.

TEST PORTS DD, EE AND LL

THESE TEST PORTS ARE FOR INITIAL CIRCUIT TESTING. THESE FITTINGS MUST BE ON THE PROTOTYPE MACHINE.

TEST PORT AA, CC AND KK ARE USED FOR NORMAL PRODUCTION LINE TEST.

TEST PORT AA, BB, CC, FF, GG, HH, JJ, KK AND MM ARE USED FOR FIELD TROUBLE SHOOTING OR PRODUCTION LINE TEST.

DWN T McQ. CHK JSB

1000 SERIES TRANSMISSION PLUMBING DIAGRAM

CLARK P/ 235816

E 2417-10 SHEET 1 OF 2

CONVERTER CHARGE PUMP

CAPACITY G.P.M. [L/MIN.]	CLARK NUMBER	CHARGE PUMP PORT INLET B	CHARGE PUMP PORT OUTLET C	SCAVENGER PUMP PORT INLET W [2]	SCAVENGER PUMP PORT OUTLET X [2]
80 [303]		[4] 2.50 [3] [63,5]	1.50 [3] [38,1]		
65 [246]		[4] 2.00 [3] [50,8]	1.50 [3] [38,1]		
50-18 [189-68]		[5] 2.00 [3] [50,8]	1.50 [3] [38,1]	1.31-12	1.06-12
50 [189]		[5] 2.00 [3] [50,8]	1.50 [3] [38,1]		
40-18 [151-68]		[5] 1.50 [3] [38,1]	1.50 [3] [38,1]	1.31-12	1.06-12
40 [151]		1.50 [38,1] [5] 2.00 [3] [50,8]	1.00 [25,4] 1.00 [3] [25,4]		
31-18 [17-68]		[5] 1.87-12 [2]	1.62-12 [2]	1.31-12	1.06-12
31 [117]		[5] 1.25 [3] [31,8]	1.00 [3] [25,4]		
25 [95]		[5] 1.50 [3] [38,1]	1.00 [3] [25,4]		
21-18 [79-68]		[5] 1.62-12 [2]	1.31-12 [2]	1.31-12	1.06-12
21 [79]		[5] 1.25 [3] [31,8]	1.00 [3] [25,4]		

HOSE AND PORT SIZE

TRANS. SERIES	TORQUE CONVERTER	CHARGE PUMP CAPACITY G.P.M. [L/MIN]	CHARGE PUMP CLARK NUMBER	FILTER TYPE	SUCTION HOSE A-B [1]	SUCTION TRANS. PORT A [3]	TO TRANSMISSION HOSE C-D [1]	TO TRANSMISSION TRANS. PORT D [2]	TO CONVERTER HOSE E-F [1]	TO CONVERTER TRANS. PORT E [2]	TO CONVERTER CONV. PORT F [2]	TO HEAT EXCHANGER W/O RETARDER HOSE G-H [1]	TO HEAT EXCHANGER W/O RETARDER CONV. PORT G [2]	WITH RETARDER TO RETARDER HOSE G-L [1]	WITH RETARDER TO RETARDER CONV. PORT G [2]	WITH RETARDER TO RETARDER RETARD. PORT L [2]	WITH RETARDER TO HEAT EXCHANGER HOSE M-H [1]	WITH RETARDER TO HEAT EXCHANGER RETARD. PORT M [2]	WITH RETARDER TO REMOTE BREATHER BREATH LINE R-R [1]	WITH RETARDER TO REMOTE BREATHER TRANS. PORT R	TO TRANSMISSION LUBE HOSE J-K [1]	TO TRANSMISSION LUBE TRANS. PORT K [2]	CONVERTER DRAIN HOSE N-P [1]	CONVERTER DRAIN CONV. PORT N	CONVERTER DRAIN TRANS. PORT P [2]
16000	C16000 & CL16000	80 [303] 65 [246] 50-18 [189-68] 50 [189]		C	2.50 [63,5] 2.00 [50,8]	2.50 [63,5]	2.00 [50,8] 1.50 [38,1] 1.25 [31,8]	1.62-12	2.00 [50,8] 1.50 [38,1] 1.25 [31,8]	1.62-12	1.88-12	2.00 [50,8] 1.50 [38,1] 1.25 [31,8]	1.88-12	2.00 [50,8] 1.50 [38,1] 1.25 [31,8]	1.88-12	1.88-12	2.00 [50,8] 1.50 [38,1] 1.25 [31,8]	1.88-12	1.00 [25,4]	3/4" N.P.T.	2.00 [50,8] 1.50 [38,1] 1.25 [31,8]	1.62-12	1.50 [38,1]	1.88-12 [2]	2.50 [63,5]
16000	C8000 & CL8000	65 [246] 50-18 [189-68] 50 [189]		C	2.00 [50,8]	2.50 [63,5]	1.50 [38,1] 1.25 [31,8]	1.62-12	1.50 [38,1] 1.25 [31,8]	1.62-12	1.62-12	1.50 [38,1] 1.25 [31,8]	1.62-12	1.50 [38,1] 1.25 [31,8]	1.62-12	1.88-12	1.50 [38,1] 1.25 [31,8]	1.88-12	1.00 [25,4]	3/4" N.P.T.	1.50 [38,1] 1.25 [31,8]	1.62-12	1.25 [31,8]	1 1/4" N.P.T.	2.50 [63,5]
8000	C16000 & CL16000	65 [246] 50-18 [189-68] 50 [189] 40-18 [151-68] 40 [151]		C	2.00 [50,8]	2.00 [50,8]	1.50 [38,1] 1.25 [31,8]	1.62-12	1.50 [38,1] 1.25 [31,8]	1.62-12	1.88-12	1.50 [38,1] 1.25 [31,8]	1.88-12	1.50 [38,1] 1.25 [31,8]	1.88-12	1.88-12	1.50 [38,1] 1.25 [31,8]	1.88-12	1.00 [25,4]	3/4" N.P.T.	1.50 [38,1] 1.25 [31,8]	1.62-12	1.50 [38,1]	1.88-12 [2]	2.00 [50,8]
8000	C8000 & CL8000	65 [246] 50-18 [189-68] 50 [189] 40-18 [151-68] 40 [151] 31-18 [117-68] 31 [117]		C B	2.00 [50,8] 1.50 [38,1]	2.00 [50,8]	1.50 [38,1] 1.25 [31,8] 1.00 [25,4]	1.62-12	1.50 [38,1] 1.25 [31,8] 1.00 [25,4]	1.62-12	1.62-12	1.50 [38,1] 1.25 [31,8] 1.00 [25,4]	1.62-12	1.50 [38,1] 1.25 [31,8] 1.00 [25,4]	1.62-12	1.88-12	1.50 [38,1] 1.25 [31,8] 1.00 [25,4]	1.88-12	1.00 [25,4]	3/4" N.P.T.	1.50 [38,1] 1.25 [31,8] 1.00 [25,4]	1.62-12	1.25 [31,8]	1 1/4" N.P.T.	2.00 [50,8]
8000	C5000	50-18 [189-68] 50 [189] 40-18 [151-68] 40 [151] 31-18 [117-68] 31 [117]		C B	2.00 [50,8] 1.50 [38,1]	2.00 [50,8]	1.25 [31,8] 1.00 [25,4]	1.62-12	1.25 [31,8] 1.00 [25,4]	1.62-12	1.31-12	1.25 [31,8] 1.00 [25,4]	1.31-12	NOT APPLICABLE							1.25 [31,8] 1.00 [25,4]	1.62-12	1.00 [25,4]	1" N.P.T.	2.00 [50,8]
5000	C8000 & CL8000	50-18 [189-68] 50 [189] 40-18 [151-68] 40 [151] 31-18 [117-68] 31 [117]		C B	2.00 [50,8] 1.50 [38,1]	1.50 [38,1]	1.25 [31,8] 1.00 [25,4]	1.31-12	1.25 [31,8] 1.00 [25,4]	1.31-12	1.62-12	1.25 [31,8] 1.00 [25,4]	1.62-12	1.25 [31,8] 1.00 [25,4]	1.62-12	1.88-12	1.25 [31,8] 1.00 [25,4]	1.88-12	1.00 [25,4]	3/8" N.P.T.	1.25 [31,8] 1.00 [25,4]	1.31-12	1.25 [31,8]	1 1/4" N.P.T.	1.50 [38,1]
5000	C5000	50-18 [189-68] 50 [189] 40-18 [151-68] 40 [151] 31-18 [117-68] 31 [117]		C B	2.00 [50,8] 1.50 [38,1]	1.50 [38,1]	1.25 [31,8] 1.00 [25,4]	1.31-12	1.25 [31,8] 1.00 [25,4]	1.31-12	1.31-12	1.25 [31,8] 1.00 [25,4]	1.31-12	NOT APPLICABLE							1.25 [31,8] 1.00 [25,4]	1.31-12	1.00 [25,4]	1" N.P.T.	1.50 [38,1]
3000 4000	C8000 & CL8000	40-18 [151-68] 40 [151] 31-18 [117-68] 31 [117] 25 [95] 21-18 [79-68] 21 [79]		C B	2.00 [50,8] 1.50 [38,1] 1.25 [31,8]	1.50 [38,1]	1.25 [31,8] 1.00 [25,4]	1.31-12	1.25 [31,8] 1.00 [25,4]	1.31-12	1.62-12	1.25 [31,8] 1.00 [25,4]	1.62-12	NOT APPLICABLE							1.25 [31,8] 1.00 [25,4]	1.31-12	1.25 [31,8]	1 1/4" N.P.T.	1.50 [38,1]
3000 4000	C5000	40-18 [151-68] 40 [151] 31-18 [117-68] 31 [117] 25 [95] 21-18 [79-68] 21 [79]		C B	2.00 [50,8] 1.50 [38,1] 1.25 [31,8]	1.50 [38,1]	1.25 [31,8] 1.00 [25,4]	1.31-12	1.25 [31,8] 1.00 [25,4]	1.31-12	1.31-12	1.25 [31,8] 1.00 [25,4]	1.31-12	NOT APPLICABLE							1.25 [31,8] 1.00 [25,4]	1.31-12	1.00 [25,4]	1" N.P.T.	1.50 [38,1]
3000 4000	C 270 & CL 270	31-18 [117-68] 31 [117] 25 [95] 21-18 [79-68] 21 [79]		B	1.50 [38,1] 1.25 [31,8]	1.50 [38,1]	1.00 [25,4]	1.31-12	1.00 [25,4]	1.31-12	1.06-12	1.00 [25,4]	1.06-12	NOT APPLICABLE							1.00 [25,4]	1.31-12	1.00 [25,4]	1" N.P.T.	1.50 [38,1]

1. INSIDE DIAMETER
2. S.A.E. "O" RING FITTING
3. SPLIT FLANGE
4. FOUR BOLT S.A.E. CHARGING PUMP MOUNTING
5. SIX BOLT CHARGING PUMP MOUNTING

D	[illegible] 23 AUG 84
C	[illegible]
B2	REVISED NOTES — MAY 79
A	[illegible] APR 79

DIM ARE IN INCHES. DIM IN [ ] ARE MM. UNITS IN [ ] ARE ISO METRIC EXCEPT AS NOTED

DWN T. McQ — CHK JSB — REL

1000 SERIES TRANSMISSION PLUMBING DIAGRAM

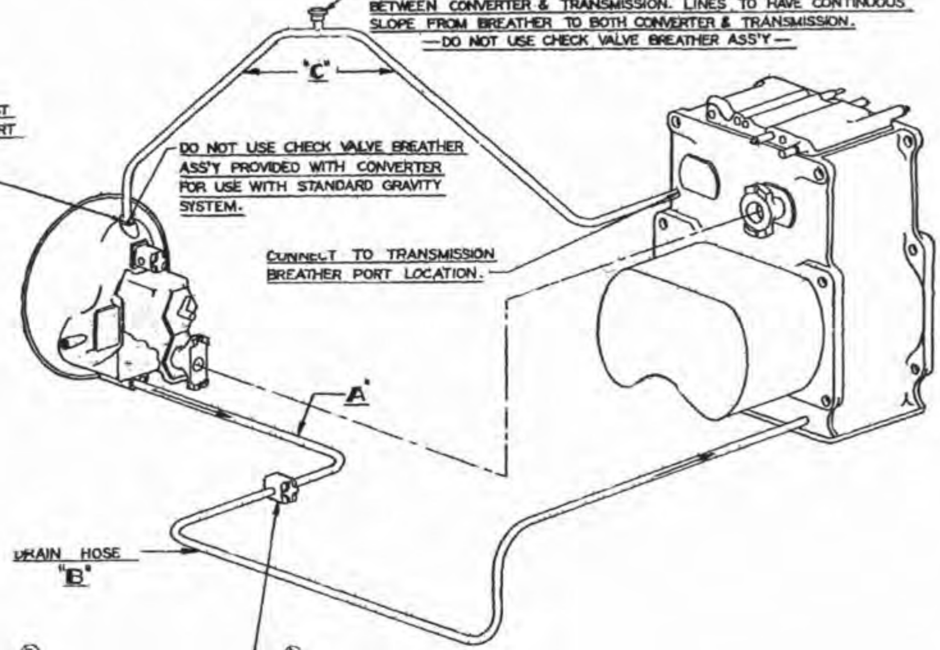
CLARK P/ 235816

GENERAL HOSE LINE OPERATING REQUIREMENTS:

1. 250°F [121°C] TEMP. RANGE FOR CONTINUOUS OPERATING WITH 300°F [149°C] INTERMITTENT RANGE.
2. SUCTION LINE - SUMP TO PUMP - TO BE PROTECTED FROM COLLAPSE BY INTERWOVEN SPIRAL STEEL WIRE.
3. ALL HOSE LINES USED MUST CONFORM TO S.A.E. SPEC. NO. J1019 TEST PROCEDURE FOR HIGH TEMP. TRANSMISSION OIL HOSE.
4. OIL SPECIFICATION - SEE CLARK DRAWING NO. 236647 FOR CLARK RECOMMENDATIONS FOR USE IN TORQUE CONVERTERS AND POWER SHIFT TRANSMISSIONS.

232693

REVISIONS			
LTR.	DESCRIPTION		
A	REVISED PUMP		
B	ADDED CHARTS & REVISED NOTES		
C	ADDED 20 GPM TO CHART		
D	CHANGED DRAWING NO.		



232693

(A) GEAR PUMP: SCAVENGER PUMP CAN BE A SEPARATE UNIT, SECTION OF THE MAIN OR STEERING PUMP, OR A COMBINATION TORQUE CONVERTER TRANSMISSION CHARGING - SCAVENGER PUMP ASSEMBLY.

SCAVENGER PUMP REQUIREMENTS; SEPARATE UNIT OR SECTION OF MAIN OR STEERING PUMP.

TORQUE CONVERTER SERIES	MINIMUM PUMP CAPACITY @ 500 RPM	MINIMUM LINE SIZE INSIDE DIAMETER "A"	"B"	"C"
C & CF 2000	4 GPM [15,1 L/MIN]	1.00 [25,4]	.75 [19,1]	.75 [19,1]
C & CL 270	(B) 4 GPM [15,1 L/MIN]	1.00 [25,4]	.75 [19,1]	.75 [19,1]
C 5000	3 GPM [11,4 L/MIN]	1.00 [25,4]	.75 [19,1]	.75 [19,1]
C & CL 8000	5 GPM [18,9 L/MIN]	1.00 [25,4]	1.00 [25,4]	1.00 [25,4]
C & CL 16000	5 GPM [18,9 L/MIN]	1.00 [25,4]	1.00 [25,4]	1.00 [25,4]

(B)

COMBINATION CHARGING-SCAVENGER PUMP ASSEMBLY INFORMATION:

CHARGING SECTION CAPACITY @ 2000 RPM	SCAVENGER SECTION CAPACITY @ 2000 RPM	PUMP ASSEMBLY PART NO.	PUMP ASSEMBLY INSTALLATION DRAWING	PORT CONNECTIONS: CHARGING SECTION INLET	CHARGING SECTION OUTLET	SCAVENGER SECTION INLET	SCAVENGER SECTION OUTLET
21 GPM [79,5 L/MIN]	18 GPM [68,1 L/MIN]		I/PFR 21-31-40	1.6250-12 TH'D SAE "O" RING	1.3125-12 TH'D SAE "O" RING	1.3125-12 TH'D SAE "O" RING	1.0625-12 TH'D SAE "O" RING
31 GPM [117,3 L/MIN]	18 GPM [68,1 L/MIN]		I/PFR 21-31-40	1.8750-12 TH'D SAE "O" RING	1.6250-12 TH'D SAE "O" RING	1.3125-12 TH'D SAE "O" RING	1.0625-12 TH'D SAE "O" RING
40 GPM [151,4 L/MIN]	18 GPM [68,1 L/MIN]		I/PFR 21-31-40	1.500 [38,10] SPLIT FLANGE	1.500 [38,10] SPLIT FLANGE	1.3125-12 TH'D SAE "O" RING	1.0625-12 TH'D SAE "O" RING
50 GPM [189,3 L/MIN]	18 GPM [68,1 L/MIN]			2.000 [50,80] SPLIT FLANGE	1.500 [38,10] SPLIT FLANGE	1.3125-12 TH'D SAE "O" RING	1.0625-12 TH'D SAE "O" RING
20 GPM	15 GPM			1.3125-12 THD SAE "O" RING	1.3125-12 THD SAE "O" RING	1.3125-12 THD SAE "O" RING	1.0625-12 THD SAE "O" RING

DO NOT SCALE DRAWING

DUG ROSSMAN

CLARK

SCAVENGER PUMP AND BREATHER INSTALLATION.

D 232693

6.1 HOW THIS UNITS OPERATES

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

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

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

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

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

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

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

CAUTION:

DO NOT MAINTAIN “STALL” FOR MORE THAN 30 SECONDS AT THE TIME. EXCESSIVE HEAT WILL BE GENERATED AND MAY CAUSE CONVERTER OR TRANSMISSION DAMAGE.

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

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

The transmission is controlled by the control valve. The control valve is mounted on top of the transmission. The function of the control valve assembly is to direct oil under pressure to the desired directional and speed clutches.
The control valve has 5 On/Off solenoids and 5 shift spools.
1st gear can be selected by activating the 1st solenoid.The 1st solenoid will then allow a pilot pressure of

8,5 bar to move the 1st shift spool.
Due to this movement of the shift spool, the 1st clutch is fed with oil under 12.4 bar regulator pressure. The same priciple is valid for 2nd, 3rd & 4th gear.

There is one 3-position shift spool for FWD, Neutral, or Rev.To ensure that only 1 direction can be selected. The directional shift spool is held in Neutral by means of springs as a safety feature. You need to apply pressure to select either FWD or REV. When both FWD & REV are selected the resulting force is 0 and the spool stays in Neutral position.

When the pressure is directed to one of the direction positions, the oil is guided to the modulator before entering the clutch. The modulator achieves a gradual pressure increase instead of an abrupt increase.

When pressure is applied initially a spool moves and uncovers a vent, which, because if its discharge or bleeding of fluid produces a low pressure. At the same time, fluid flows through a restrictor passageway to an accumulator and as the pressure builds up in the accumilator, it moves the spool back towards its initial position, causing a gradual increase in pressure.

The direction or speed clutch assembly consists of a drum with internal gear teeth and a bore to receive a hydraulically actuated piston. A piston is inserted into the bore of the drum. The piston is “oil tight” by the use of sealing rings. A friction disc with internal teeth is inserted into the drum and rests against the piston. Next, a disc with splines at the outer diameter is inserted. Discs are alternated until the required total is achieved. After inserting the last disc, a series of springs and pins are assembled in such a manner that these springs rest on theeth of the piston. A heavy backup plate is then inserted and secured by a snap ring. A hub with ID and OD splines is inserted into the splines of the discs with theeth on the inner diameter and the splined shaft extending through the clutch support. This hub is retained by a snap ring. The discs and inner shaft are free to increase in speed or rotated in the opposite direction as long as no pressure is present in the direction or speed clutch.

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

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

The transmission gear train consists of six shafts: 1 Input shaft
2 Reverse shaft
3 Idler shaft
4 First & third shaft
5 Second & fourth shaft
6 Output shaft

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

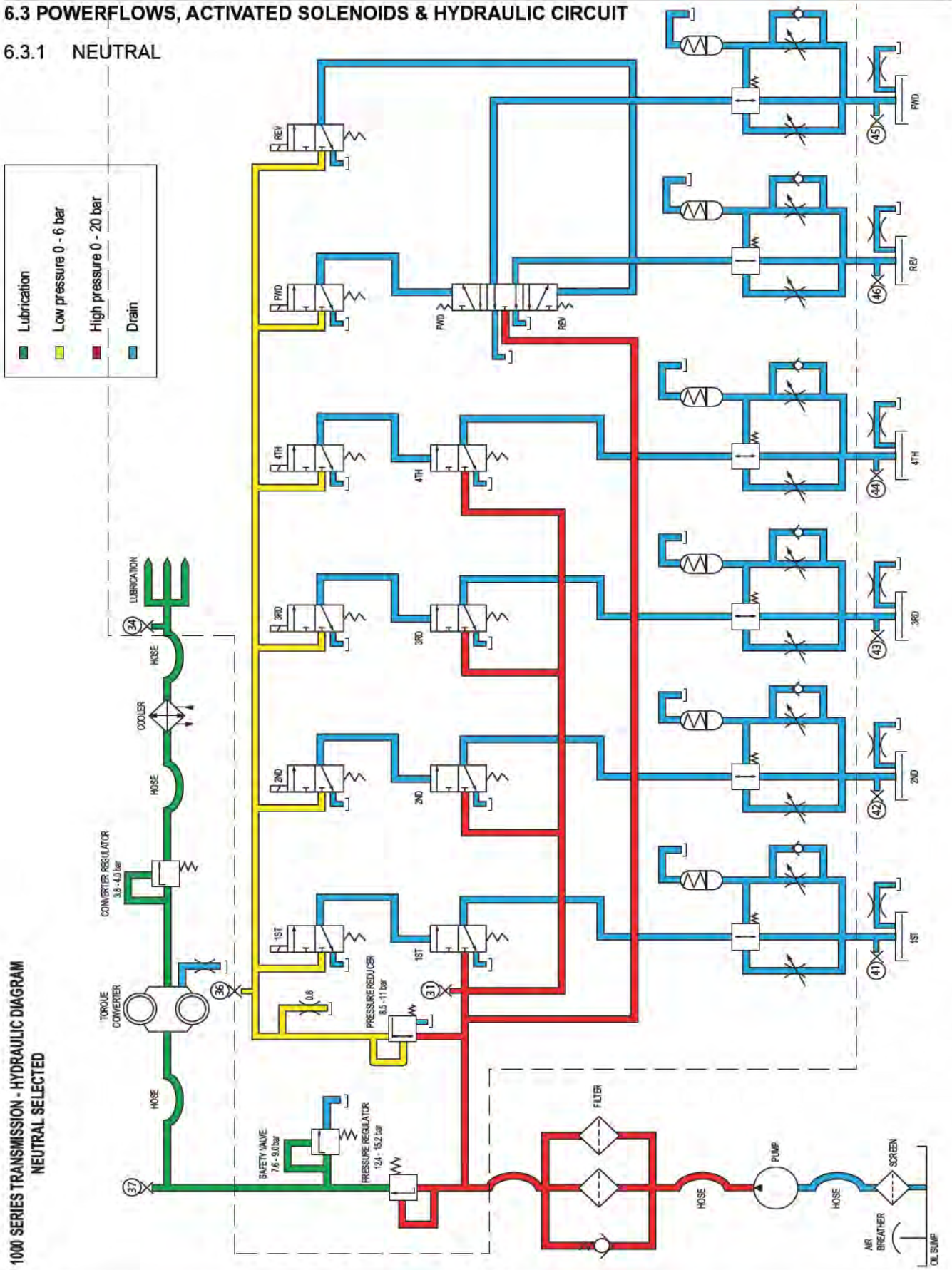
Some transmissions may have an axle declutching unit as optional equipment. This unit consists of a split output shaft with a sliding splined sleeve to engage or disengage the axle. This is accomplished by manually shifting a lever in the operator compartiment, which is mechanically connected to the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

6.2 NUMBERING OF PORTS FOR HYDRAULIC CIRCUIT DIAGRAMS

PORTS	PRESSURE CHECK PORTS	TEMPERATURE CHECK PORTS
1	31 Regulated Clutch	71 To Cooler
2	32 To Cooler	72
3	33 From Cooler	73
4	34 Lube (& Safety Valve)	74
5	35 Pump	75
6	36 Solenoid	76
7	37 Converter In	77
8	38	78
9	39	79
10	40	80
11 To Cooler	41 1st Clutch	81
12 From Cooler	42 2nd Clutch	82
13 To Remote Filter (on Transmission)	43 3rd Clutch	83
14 From Transmission (on Remote Filter)	44 FWD High - 4th Clutch	84
15 To Transmission (on Remote Filter)	45 FWD Clutch	85
16 From remote Filter (on Transmission)	46 REV Clutch	86
17 Air/Hydr Disconnect - 4WD	47 Disconnect Clutch	87
18 To Pump	48 Clutch Return Line	88
19 Air/Hydr Inching	49 SAHR Brake Release	89
20 Air/Hydr Disconnect - 2WD	50 VFS 1st	90
21 From Pump	51 VFS 2nd	
22 Drain	52 VFS 3rd	
23 From Regulator	53 VFS FWD High - 4th	
24 SAHR brake Release	54 VFS FWD	
25 Range - Shift	55 VFS REV	
26 Diff. Lock	56 System Pressure (after Total Neutral)	
27 Power Brake Supply	57 Pilot Pressure	
28 Clutch Return Line	58 Pressure Check Range Clutches	
29 From Pump for Brake Release	59 Pressure Check Direct. Clutches	
30	60 Pressure Intensifier 1st	
	61 Pressure Intensifier 2nd	
	62 Pressure Intensifier 3rd	
	63 Press. Intensifier FWD High - 4th	
	64 Pressure Intensifier FWD	
	65 Pressure Intensifier REV	
	66	

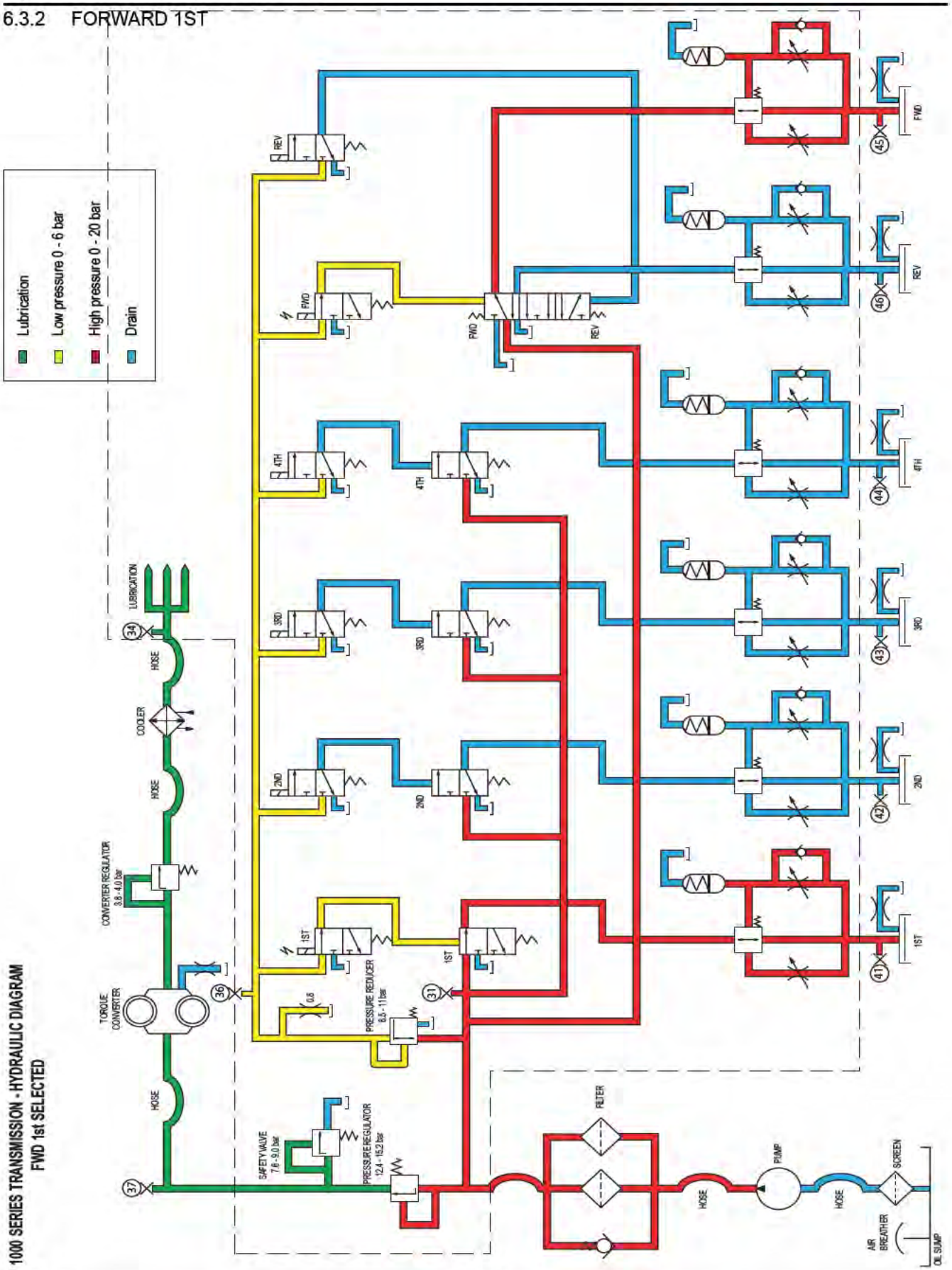
6.3 POWERFLOWS, ACTIVATED SOLENOIDS & HYDRAULIC CIRCUIT

6.3.1 NEUTRAL

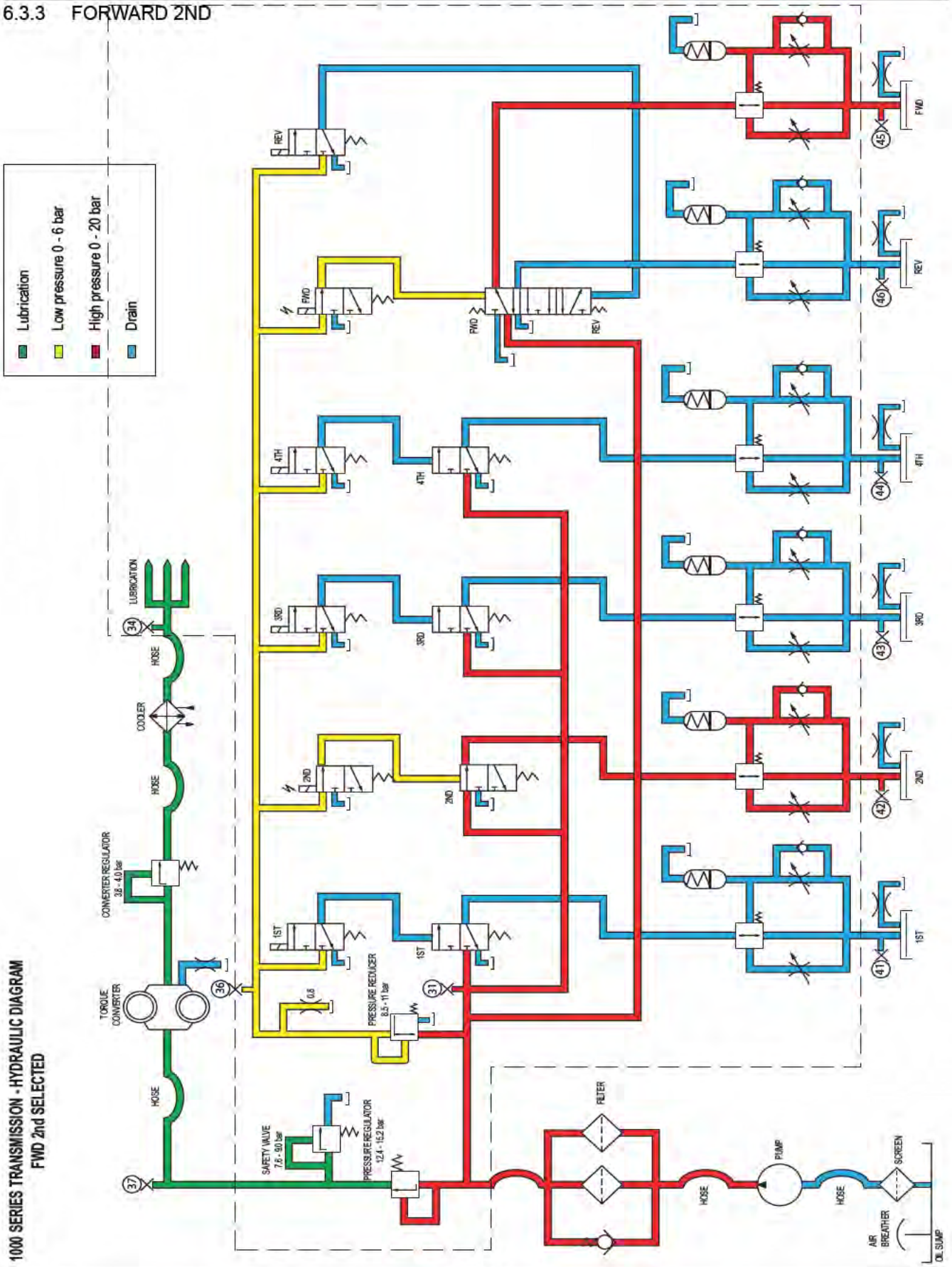


1000 SERIES TRANSMISSION - HYDRAULIC DIAGRAM
NEUTRAL SELECTED

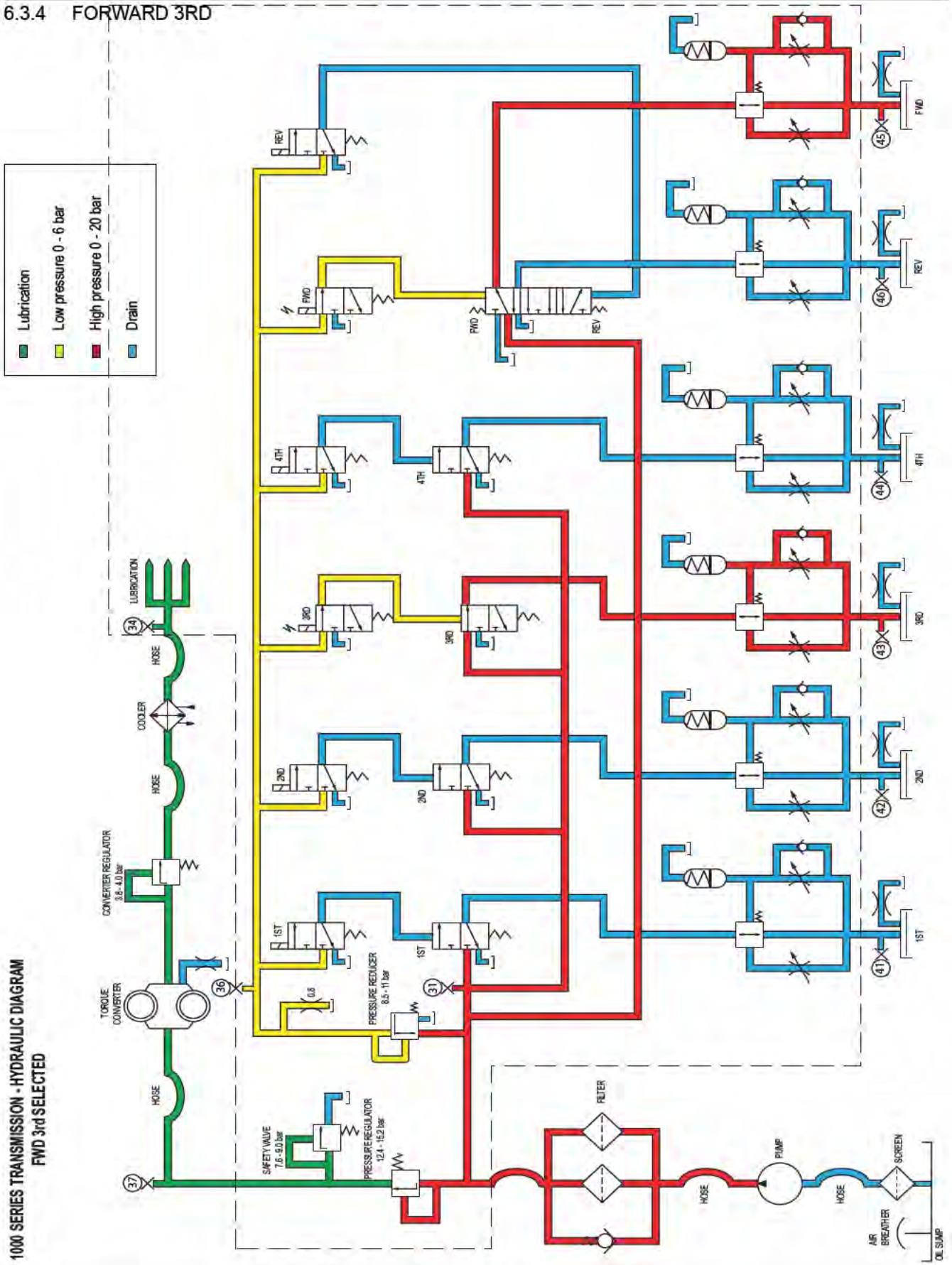
6.3.2 FORWARD 1ST



6.3.3 FORWARD 2ND

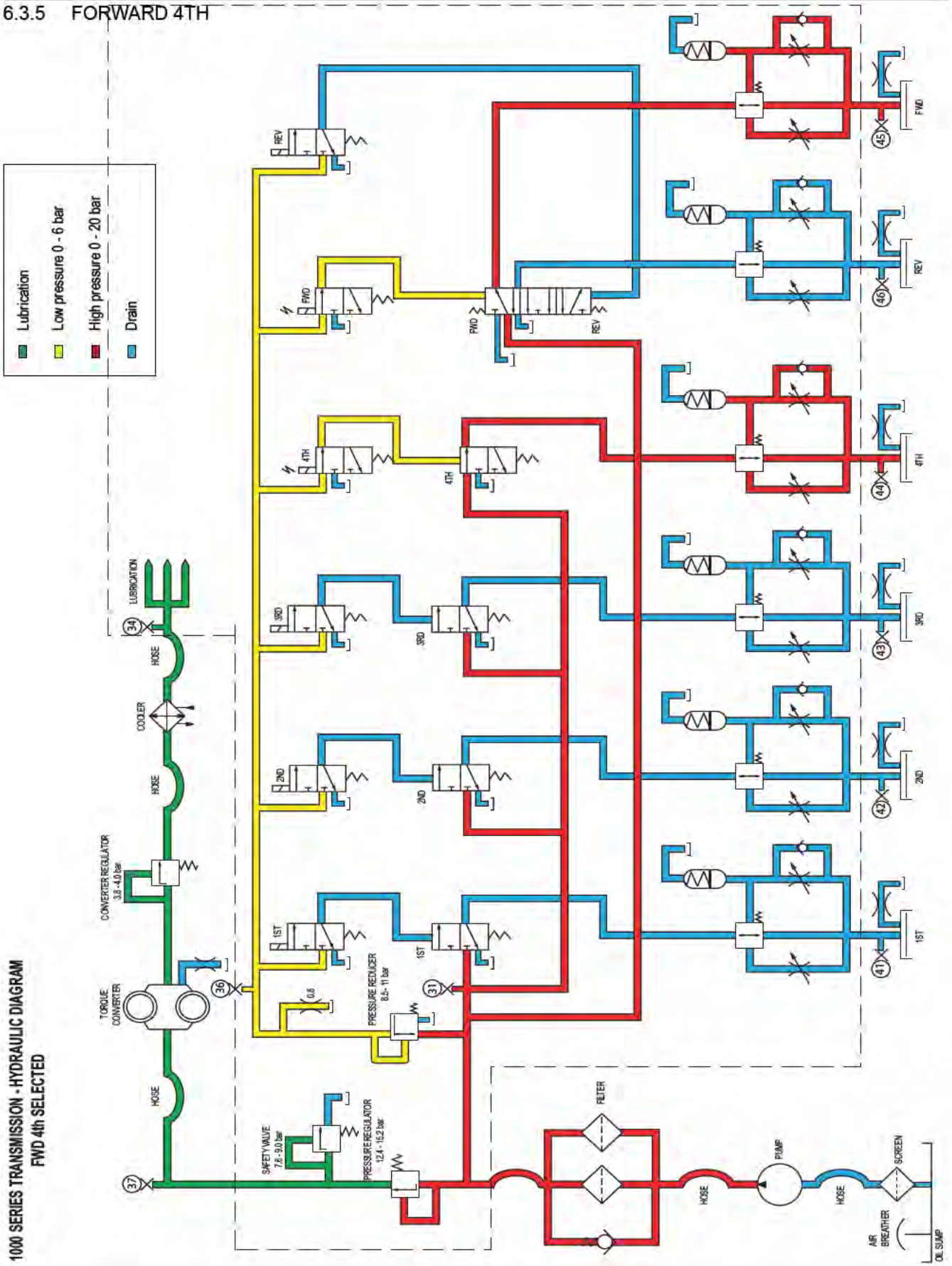


6.3.4 FORWARD 3RD

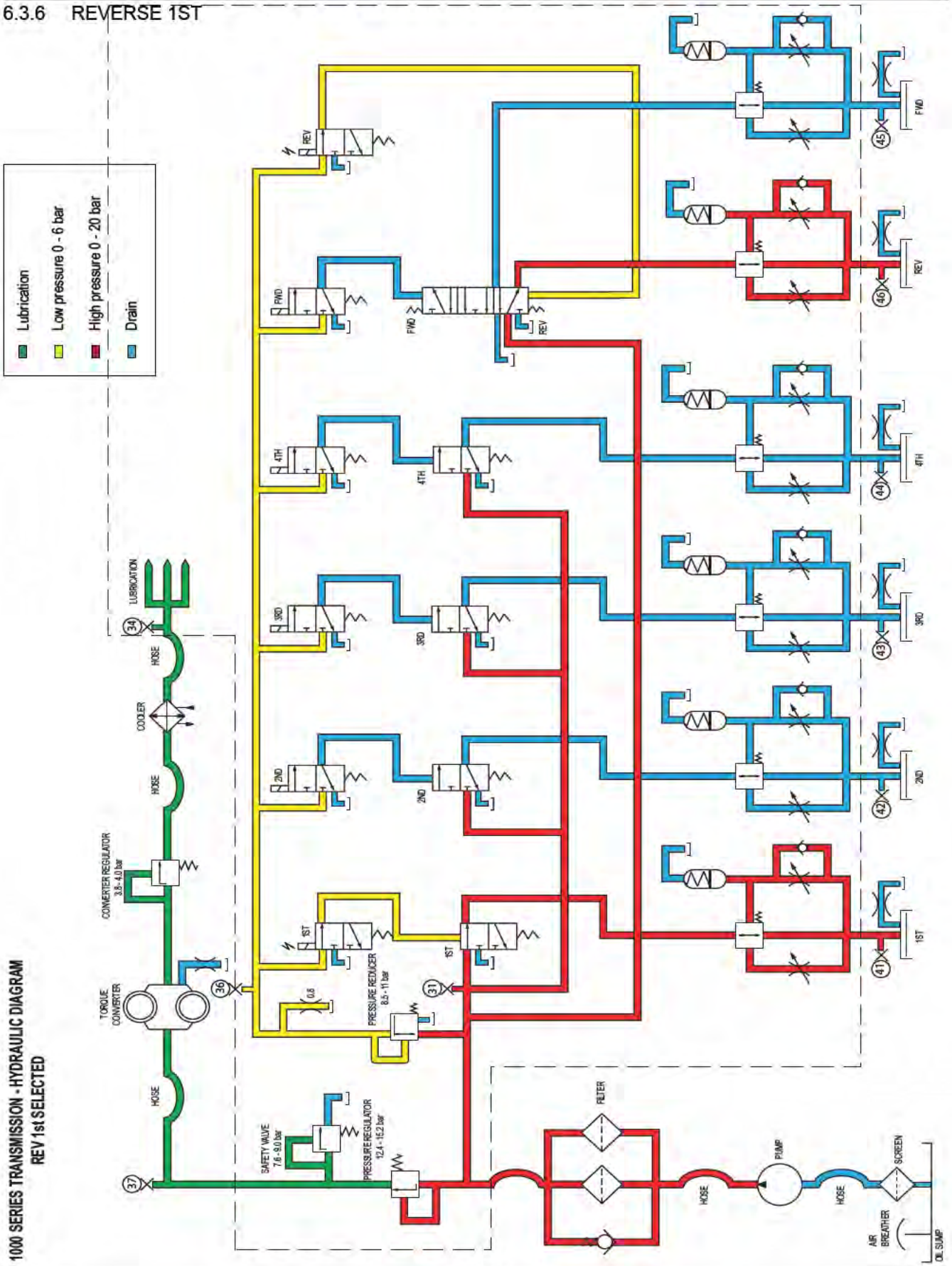


1000 SERIES TRANSMISSION - HYDRAULIC DIAGRAM
FWD 3rd SELECTED

6.3.5 FORWARD 4TH

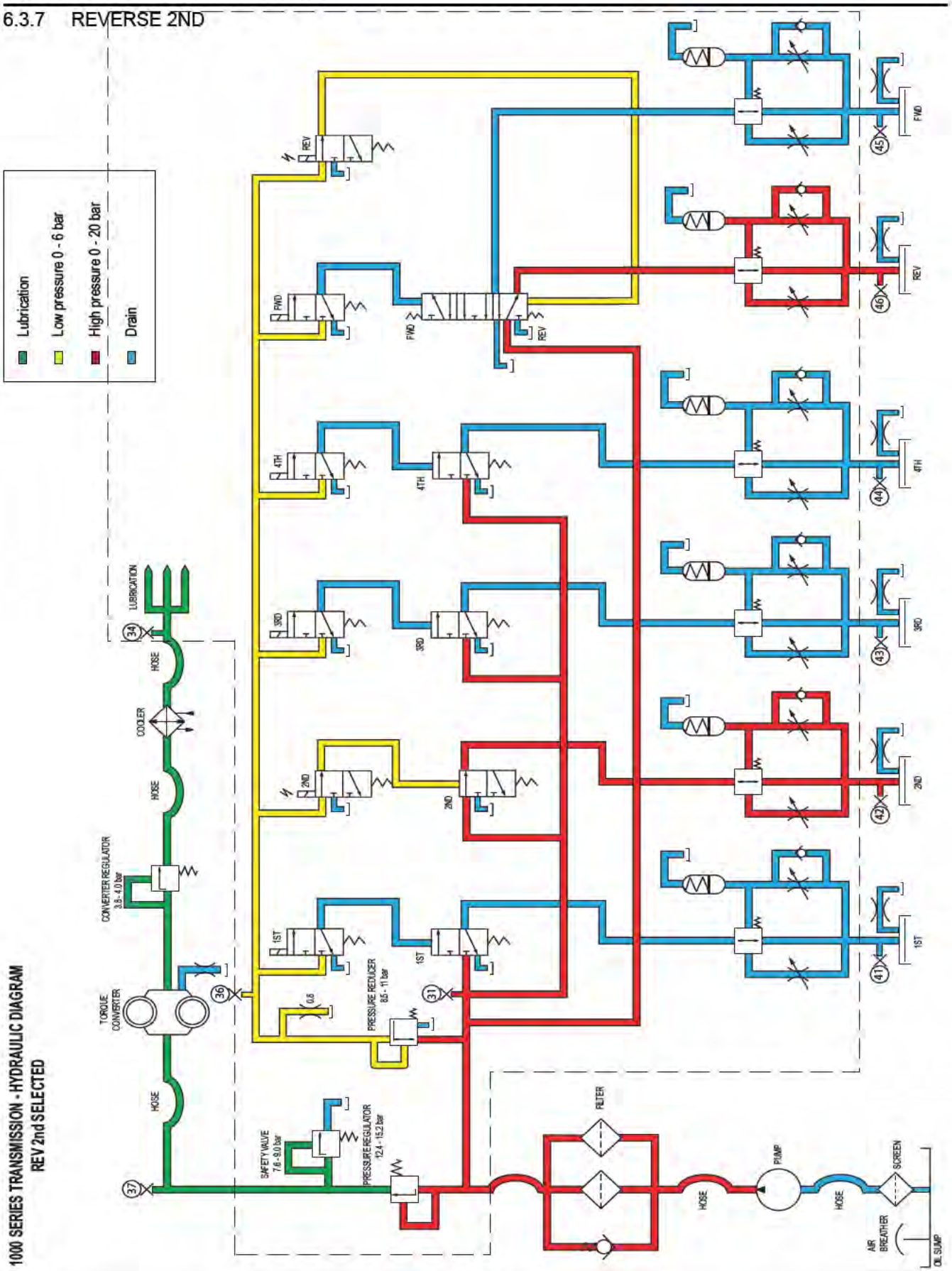


6.3.6 REVERSE 1ST

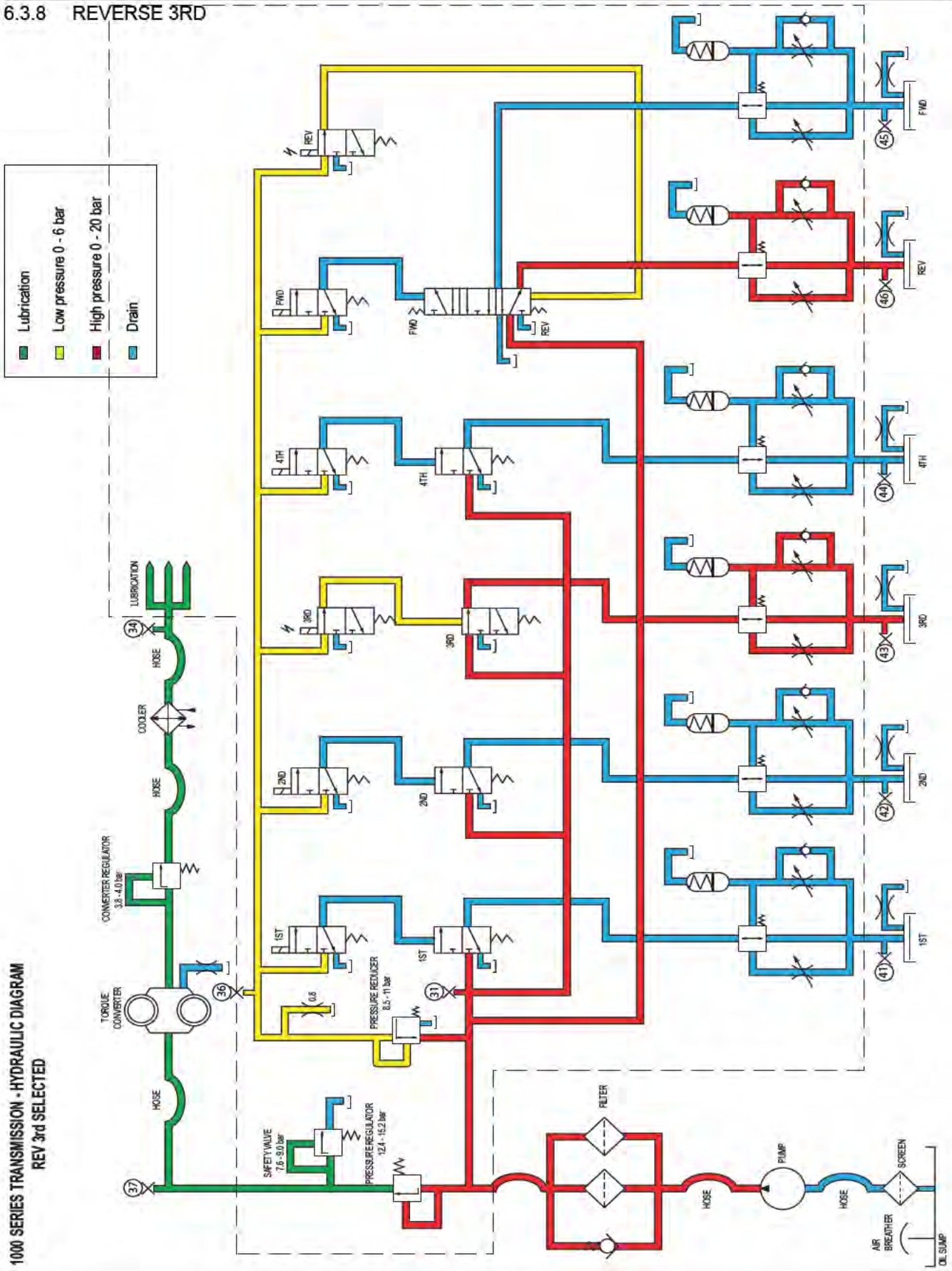


1000 SERIES TRANSMISSION - HYDRAULIC DIAGRAM
REV 1st SELECTED

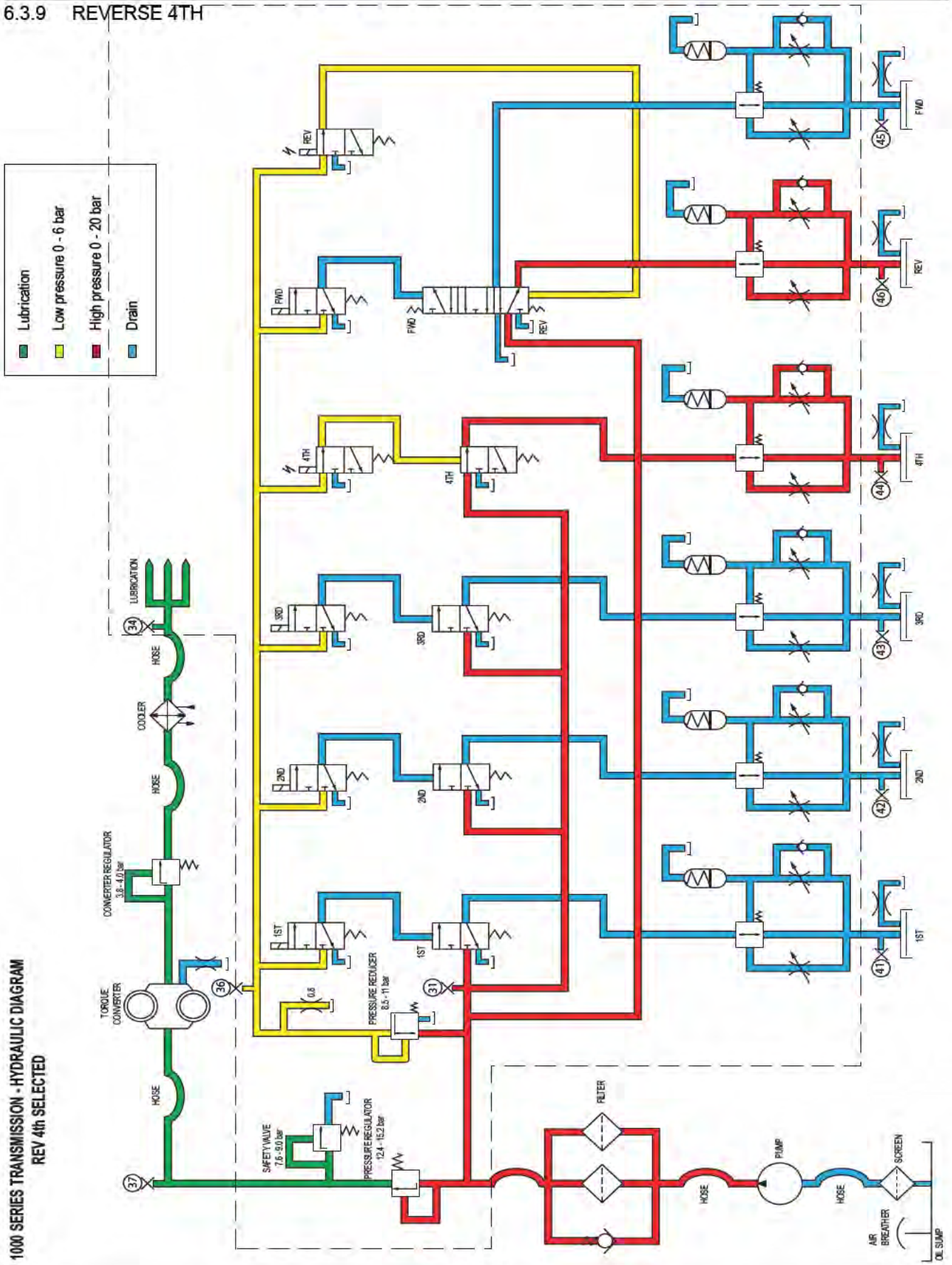
6.3.7 REVERSE 2ND



6.3.8 REVERSE 3RD



6.3.9 REVERSE 4TH



The following information is presented as an aid to isolate and determine the specific problem areas 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 8000 TRANSMISSION

8000 transmission troubles fall into four 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 in manual mode
   Run the engine to max speed..

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:

- A check should be made to be sure all control lever linkage is properly connected and adjusted at all connecting points.
- Check the wiring and electronic components. Be sure that all components of the cooling system are in good condition and operating correctly.
  The radiator must be clean to maintain proper cooling and operating temperatures for the engine and transmission. Air clean the radiator, if necessary.
- Check shift levers and rods for binding or restrictions in travel that would prevent full engagement. Shift levers by hand at transmisison case, if full engagement cannot be obtained, difficulty may be in control cover and valve assembly.

7.2.4 HYDRAULIC CHECKS

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

- Check oil level in the transmission. this should be done with oil temperatures of 82° - 93° C [180° - 200° F].
  DO NOT ATTEMPT THIS CHECK WITH COLD OIL.
  To bring oil temperaure to this specification, it is necessary to either work the machine or “stall” out the converter. Where the former means is impractical, the latter means should be employed as follows. Engage shift levers in forward high speed and apply brakes. Accelerate engine half to three-quarter throttle for about 30 seconds at the time. Hold stall until desired converter outlet temperature is reached.

CAUTION:

FULL THROTTLE STALL SPEED FOR AN EXCESSIVE LENGHT OF TIME WILL OVERHEAT THE CONVERTER.

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

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

7.3 TROUBLESHOOTING GUIDE

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

7.3.1 LOW CLUTCH PRESSURE WITH NORMAL CLUTCH LEAKAGE

Cause	Remedy
1. Low oil level.	1. Fill to proper level.
2. Clutch pressure regulating valve stuck open.	2. Clean valve spool and sleeve.
3. Faulty charging pump.	3. See paragraph on charging pump output.
4. Broken spring in transmission regulator valve.	4. Replace spring.

7.3.2 LOW CLUTCH PRESSURE WITH EXCESSIVE CLUTCH LEAKAGE

Cause	Remedy
1. Broken or worn piston sealing rings.	1. Replace sealing rings.
2. Broken or worn sealing rings on clutch support.	2. Replace sealing rings.
3. Low converter charging pump output.	3. See paragraph on charging pump output.

7.3.3 LOW CONVERTER CHARGING PUMP OUTPUT

Cause	Remedy
1. Low oil level.	1. Fill to proper level.
2. Sump screen plugged	2. Clean screen & sump.
3 Excessive converter internal leakage See paragraph on converter lube flow.	3. Remove, disassemble and rebuild converter assembly, replacing all worn or damaged parts
4. Broken or worn sealing rings in transmission clutches.	4. See paragraph on clutch leakage

7.3.4 LOW FLOW THROUGH COOLER WITH LOW PRESSURE IN CONVERTER

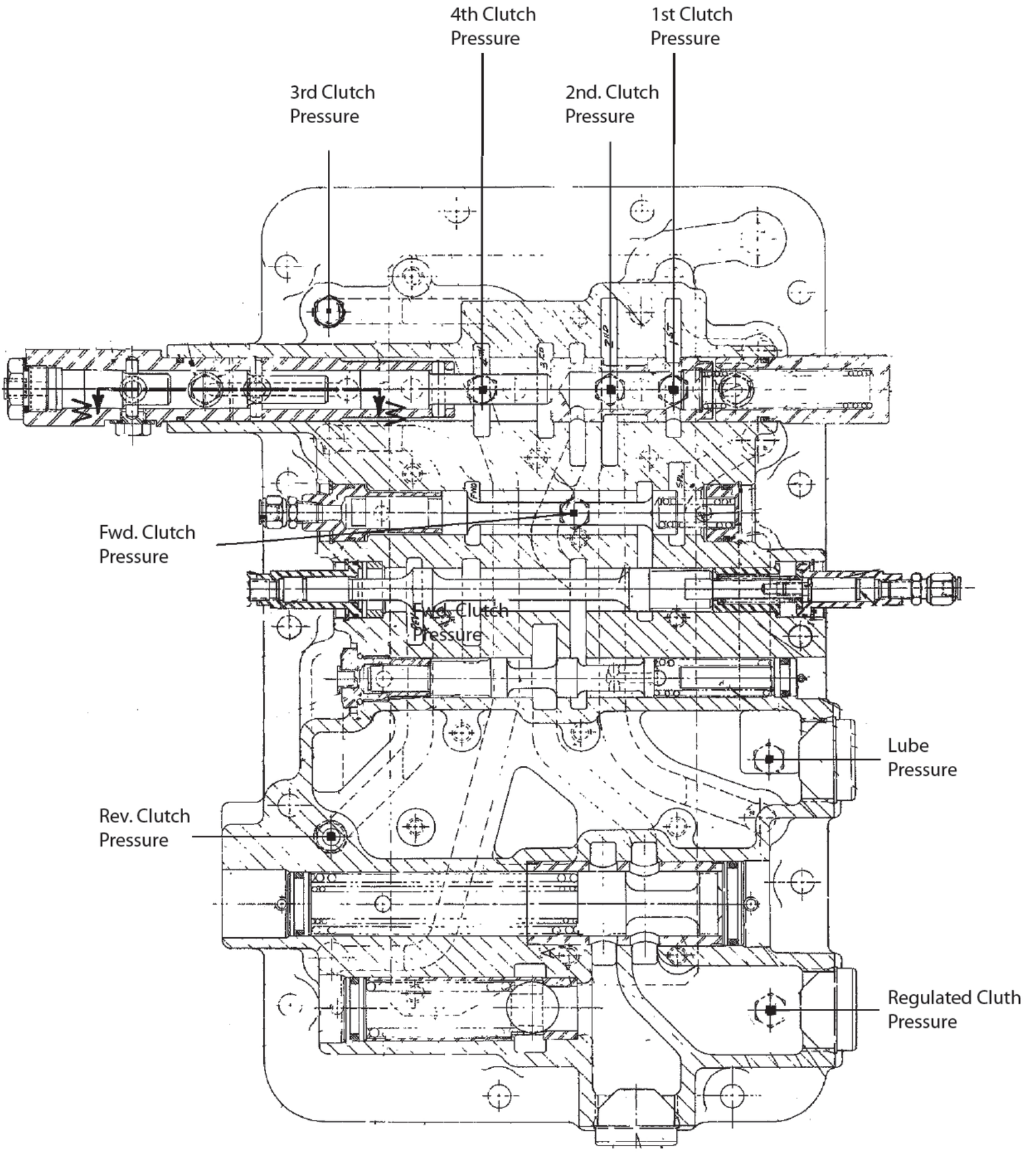
Cause	Remedy
1. Plugged oil cooler. Indicated if transmission lube pressure is low.	1. Back flush and clean oil cooler.
2. Restricted cooler return line.	2. Clean out line.
3. Lube oil ports in transmission plugged	3. Check lube lines for restrictions.

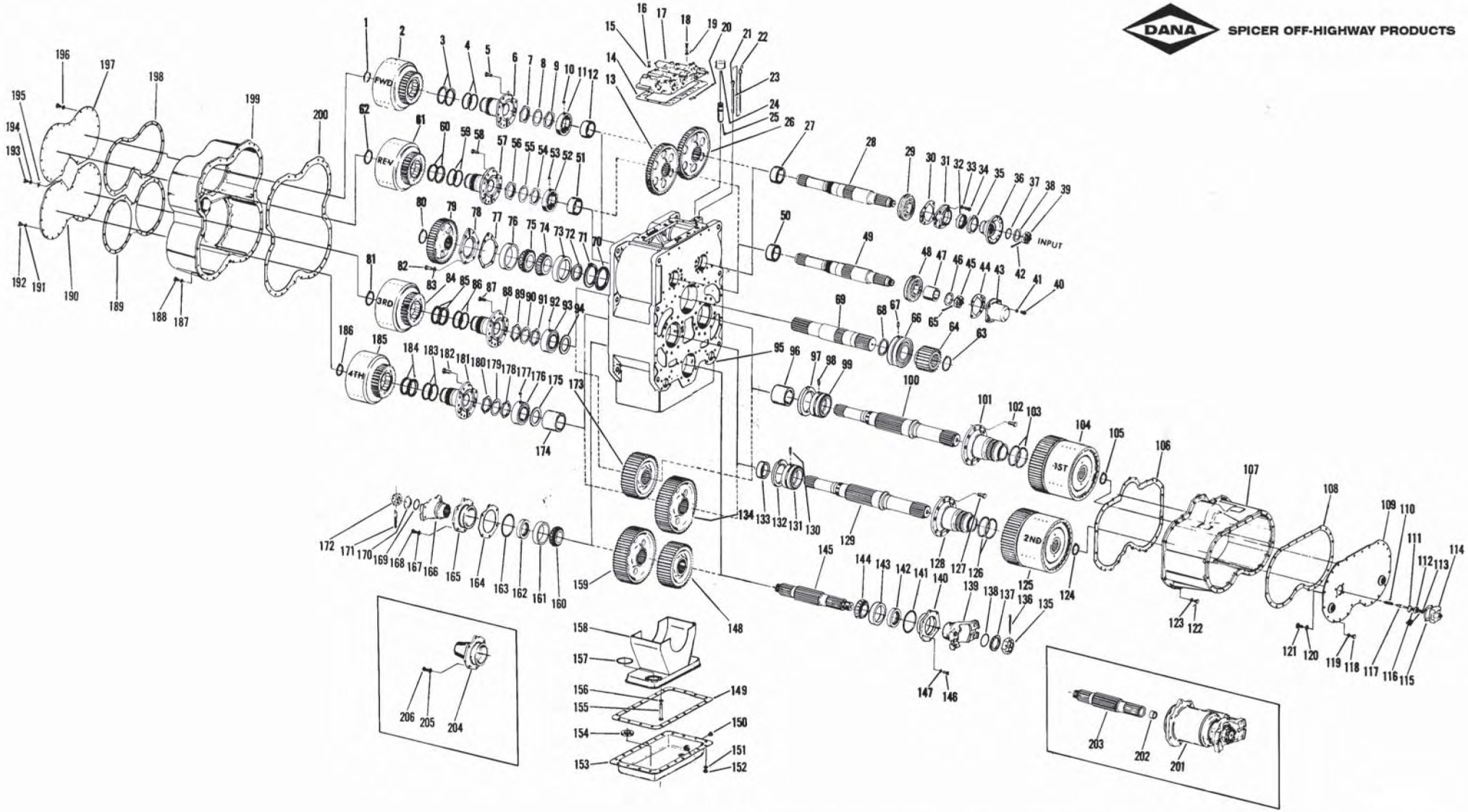
7.3.5 OVERHEATING

Cause	Remedy
1. Worn oil seal rings	1. Remove, disassemble and rebuild transmission.
2. Worn oil pump	2. Replace
3. Low oil level	3. Fill to proper level
4. Pump suction line intaking air	4. Check oil line connections and tighten securely.

7.3.6 NOISY CONVERTER

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”


4th Clutch Pressure
1st Clutch Pressure
3rd Clutch Pressure
2nd. Clutch Pressure
Fwd. Clutch Pressure
Fwd. Clutch Pressure
Lube Pressure
Rev. Clutch Pressure
Regulated Cluth Pressure



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1293 GLENWAY DRIVE STATESVILLE, NC 28525 TEL: (704) 878-5608
WWW.DANA.COM

Item	Description	Qty
1	Snapring - Disc hub	1
2	Assembly - Clutch	1
3	Spring - Piston ring expander	2
4	Ring - Clutch support piston	2
5	Screw - Clutch support to case	8
6	Support - Clutch	1
7	Locknut - Bearing	1
8	Lockplate - Bearing nut	1
9	Locknut - Bearing	1
10	Ball - Bearing lock	1
11	Bearing	1
12	Spacer - Bearing	1
13	Gear	1
14	Gasket - Control valve to transmission case	1
15	Lockwasher - Control valve to transmission case screw	11
16	Screw - Control valve to transmission case	11
17	Control valve assembly	1
18	Screw - Control valve to transmission case	2
19	Lockwasher - Control valve to transmission case screw	2
20	O-ring	8
21	Housing - Dipstick	1
22	Dipstick	1
23	Tube - Dipstick	1
24	Cap - Oil filler pipe	1
25	Pipe - Oil filler	1
26	Gear - Input shaft	1
27	Spacer - Input shaft gear	1
28	Shaft - Input	1
29	Bearing - Input shaft front	1
30	Gasket - Bearing cap	1
31	Cap - Input bearing	1
32	Seal - Input oil	1
33	Lockwasher - Bearing cap screw	5
34	Screw - Bearing cap	5
35	Seal -Oil	1
36	Flange - Input	1
37	O-ring	1
38	Washer - Input flange	1
39	Nut - Input flange	1
40	Screw - Bearing cap	5
41	Lockwasher - Bearing cap screw	5
42	Not used on this model	
43	Cap - Input bearing	1
44	Gasket - Bearing cap	1
45	Nut - Retaining	1

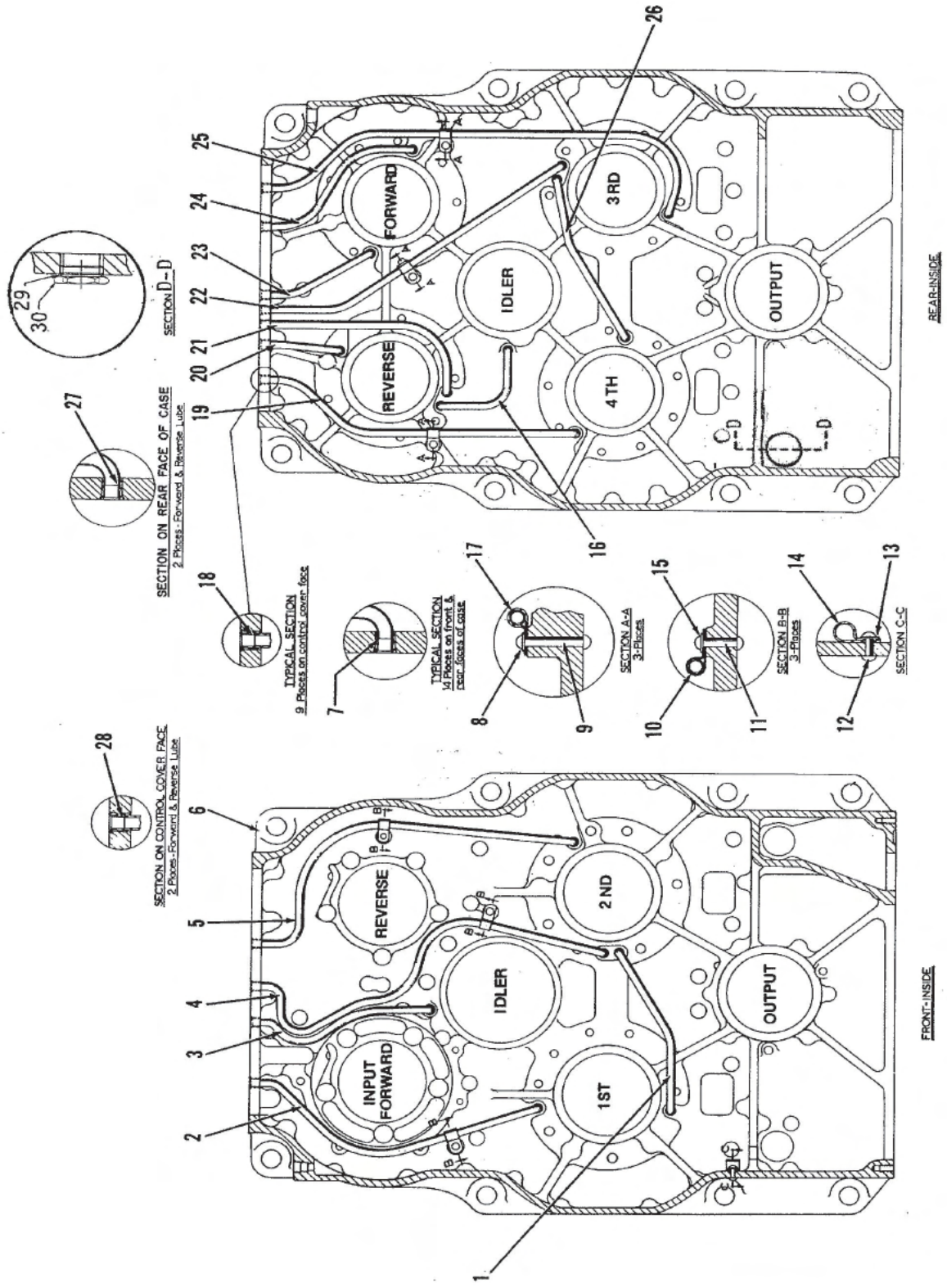
Item	Description	Qty
46	Washer - Retaining nut	1
47	Spacer - Bearing	1
48	Bearing - reverse shaft front	1
49	Shaft - Reverse	1
50	Spacer - Gear	1
51	Spacer - Gear	1
52	Bearing - Reverse shaft rear	1
53	Ball - Rear bearing lock	1
54	Nut - Bearing lock	1
55	Lockplate - Bearing nut	1
56	Nut - Bearing lock	1
57	Support - Clutch	1
58	Screw - Clutch support to transmission case	8
59	Ring - Clutch support piston	2
60	Spring - Piston ring expander	2
61	Assembly - Clutch (Reverse)	1
62	Snapring - Disc hub	1
63	Snapring - Gear	1
64	Gear - Idler shaft	1
65	Not used on this model	
66	Bearing - Idler shaft	1
67	Lockpin - Bearing	1
68	Snapring	1
69	Shaft - Idler	1
70	Shield - Oil	1
71	Snapring - Bearing	1
72	Not used on this model	
73	Cup - Bearing	1
74	Cone - Bearing	1
75	Cone - Bearing	1
76	Cup - Bearing	1
77	Shim - Bearing cap .004	AR
77A	Shim - Bearing cap .007	AR
77B	Shim - Bearing cap .010	AR
78	Cap - Bearing	1
79	Gear - Idler	1
80	Snapring - Idler gear	1
81	Snapring - Disc hub	1
82	Screw - Bearing cap	6
83	Lockwasher - Bearing cap	6
84	Assembly - Clutch (3rd speed)	1
85	Spring - Piston ring expander	2
86	Ring - Piston	2
87	Screw - Clutch support to transmission case	8
88	Support - Clutch	1

Item	Description	Qty
89	Locknut - Bearing	1
90	Lock - Bearing nut	1
91	Locknut - Bearing	1
92	Ball - Bearing lock	1
93	Bearing -Roller	1
94	Spacer - Gear	1
95	Case - Transmission	1
96	Spacer - Gear	1
97	Snapring - Bearing	1
98	Lockpin - Bearing cup	1
99	Bearing	1
100	Shaft - 1st & 3rd	1
101	Support - Clutch	1
102	Screw - Clutch support to transmission case	9
103	Ring - Clutch support piston	2
103A	Spring - Piston ring expander	2
104	Assembly - Clutch (1st speed)	1
105	Snapring - Disc hub	1
106	Gasket - Clutch cover	1
107	Cover - 1st & 2nd clutch	1
108	Not used on this model	
109	Not used on this model	
110	Spring - Speedo drive	1
111	Snapring - Bearing	1
112	Bearing - Speedo drive	1
113	Seal - Speedo drive shaft oil	1
114	Housing - Speedo drive	1
115	Gasket - Speedo drive housing	1
116	Snapring - Bearing	2
117	Shaft - Speedo drive	1
118	Not used on this model	
119	Not used on this model	
120	Washer - Housing to transmission case sealing	4
121	Screw - Housing to transmission case	4
122	Screw - Clutch cover to transmission case	23
123	Washer - Clutch cover to transmission case screw	23
124	Snapring - Disc hub	1
125	Assembly - Clutch (2nd speed)	1
126	Ring - Clutch support piston	2
126A	Spring - Piston ring expander	2
127	Screw - Clutch support to transmission case	9
128	Assembly - Clutch	1
129	Shaft - 2nd & 4th	1
130	Lockpin - Bearing cup	1
131	Bearing	1

Item	Description	Qty
132	Snapring - Bearing	1
133	Spacer - Gear	1
134	Gear - 2nd & 4th	1
135	Nut - Flange	1
136	Pin - Cotter	1
137	Washer - Flange	1
138	O-ring - Flange	1
139	Flange - Output	1
140	Cap - Output bearing	1
141	O-ring	1
142	Seal - Oil	1
143	Cup - Output bearing	1
144	Cone - Output bearing	1
145	Shaft - Output	1
146	Screw - Output bearing cap	6
147	Lockwasher - Bearing cap screw	6
148	Gear - output	1
149	Gasket -Oil sump	1
150	Plug - Drain	2
151	Not used on this model	
152	Screw - Sump to transmission case	22
153	Sump - Oil	1
154	Magnet -Sump	2
155	Screw - Screen assembly to transmission case	4
156	Lockwasher -Screen assembly to transmission case	4
157	Gasket - Screen assembly to transmission case	1
158	Assembly - Oil sump frame & screen	1
159	Gear - Output	1
160	Cone - Output bearing	1
161	Cup - Output bearing	1
162	Seal - Bearing cap oil	1
163	O-ring	1
164	Shim - Output .004	AR
164A	Shim - Output .007	AR
164B	Shim - Output .010	AR
165	Cap - Bearing	1
166	Flange - Front output	1
167	Lockwasher - Bearing cap screw	6
168	Screw - Bearing cap	6
169	O-ring - Flange	1
170	Washer - Flange	1
171	Pin - Cotter	1
172	Nut - Flange	1
173	Gear - 1st & 3rd	1
174	Spacer - Gear	1

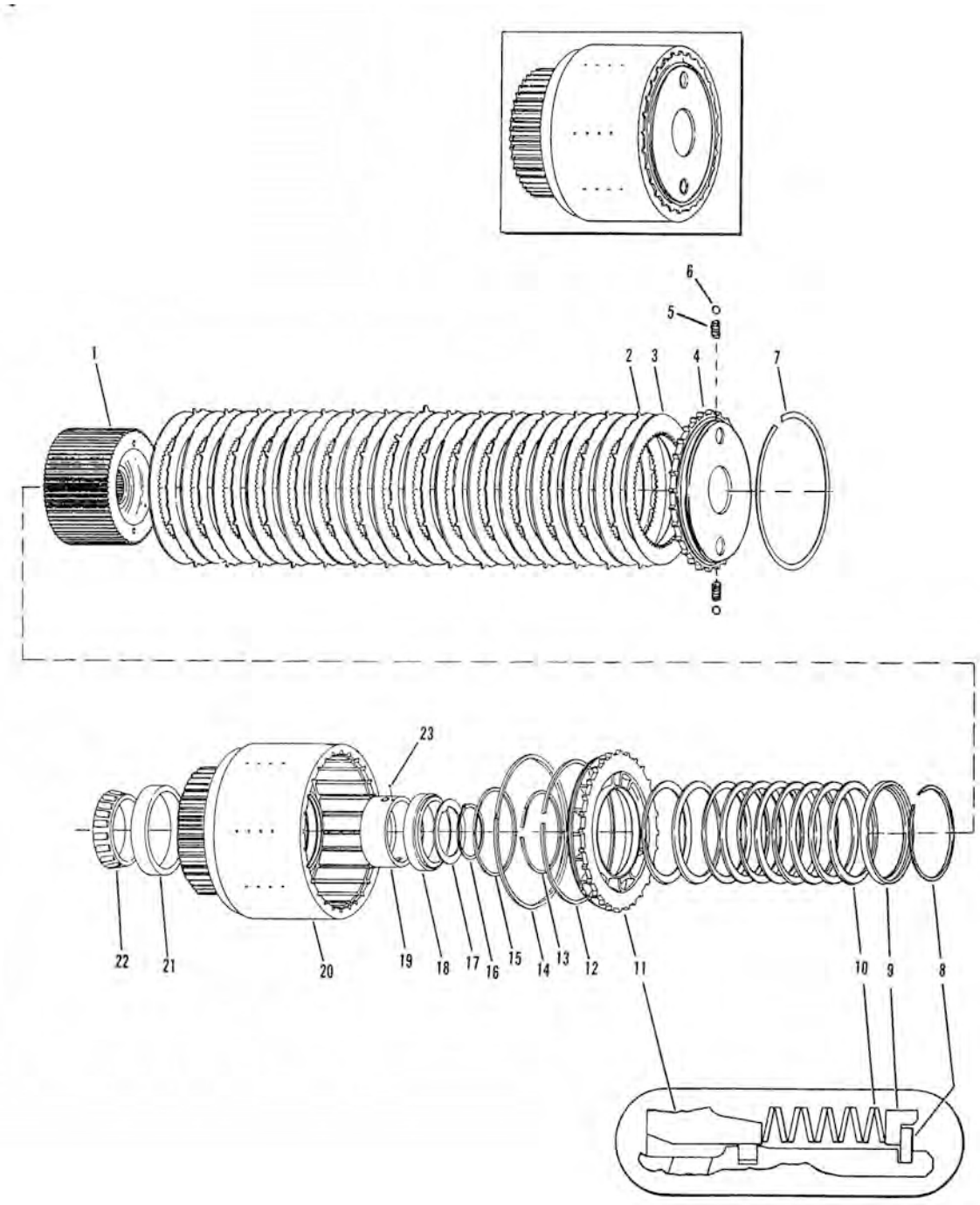
Item	Description	Qty
175	Gear - Spazcer	1
176	Bearing	1
177	Ball - Bearing lock	1
178	Locknut - Bearing	1
179	Lock - Bearing nut	1
180	Locknut - Bearing lock	1
181	Support - Clutch	1
182	Screw - Clutch support to transmission case	8
183	Ring - Clutch support sealing	2
184	Spring - Piston ring expander	2
185	Assembly -Clutch 4th	1
186	Snapring -Disc hub	1
187	Lockwasher - Clutch cover to transmission case	33
188	Screw - Clutch cover to transmission case	33
189	Gasket - 3rd & 4th cover plate	2
190	Plate - 3rd & 4th cover	2
191	Lockwasher - Clutch cover to transmission case	24
192	Screw - Clutch cover to transmission case	24
193	Not used on this model	
194	Not used on this model	
195	Not used on this model	
196	Screw - Cover plate	20
196A	Lockwasher - Cover plate	20
197	Plate - Cover	1
197A	Spacer - Cover plate (NI)	1
198	Gasket - Cover plate to spacer & spacer to transmission case	2
199	Cover - Fwd, Rev, 3rd & 4th clutch	1
200	Gasket - Clutch cover	1
201	Not used on this model	
202	Not used on this model	
203	Not used on this model	
204	Not used on this model	
205	Not used on this model	
206	Not used on this model	
	Breather - Air (NI)	1
	Plug - Pipe (NI)	1
	Adaptor - Air breather	1
	Plug - Oil level	2
	Plug - Pipe	2

AR = As Required
NI = Not Illustrated


INPUT FORWARD
REVERSE
IDLER
2 ND
1ST
OUTPUT
FRONT-INSIDE
FORWARD
REVERSE
IDLER
3RD
4TH
OUTPUT
REAR-INSIDE
SECTION ON CONTROL COVER FACE
2 Places - Forward & Reverse Lube
SECTION ON REAR FACE OF CASE
2 Places - Forward & Reverse Lube
SECTION D-D
TYPICAL SECTION
9 Places on control cover face
TYPICAL SECTION
w/ Places on front &
rear faces of case
SECTION A-A
3 Places
SECTION B-B
3 Places
SECTION C-C

8000 SERIES TUBE ASSEMBLY

Item	Description	Qty
1	Tube - 2nd to 1st crossover lube	1
2	Tube - 1st clutch pressure	1
3	Tube - Idler shaft front bearing lube	1
4	Tube - 2nd clutch lube	1
5	Tube - 2nd clutch pressure	1
6	Assembly - Transmission case	1
7	Sleeve - Tube	14
8	Washer	3
9	Rivet	3
10	Clip - Tube	3
11	Rivet	3
12	Rivet	1
13	Washer	1
14	Clip - Tube	1
15	Washer	3
16	Tube - Rev to idler crossover lube	1
17	Clip - Tube	3
18	Sleeve - Tube	9
19	Tube - 4th clutch pressure	1
20	Tube - Rev clutch pressure	1
21	Tube - Rev clutch lube	1
22	Tube - 3rd clutch lube	1
23	Tube - Fwd clutch lube	1
24	Tube - Fwd clutch pressure	1
25	Tube - 3rd clutch pressure	1
26	Tube - 4th to 3rd crossover lube	1
27	Sleeve - Tube	2
28	Sleeve - Tube	2
29	O-ring - Oil level sight glass	1
30	Sight glass - Oil level	1


6
5
1
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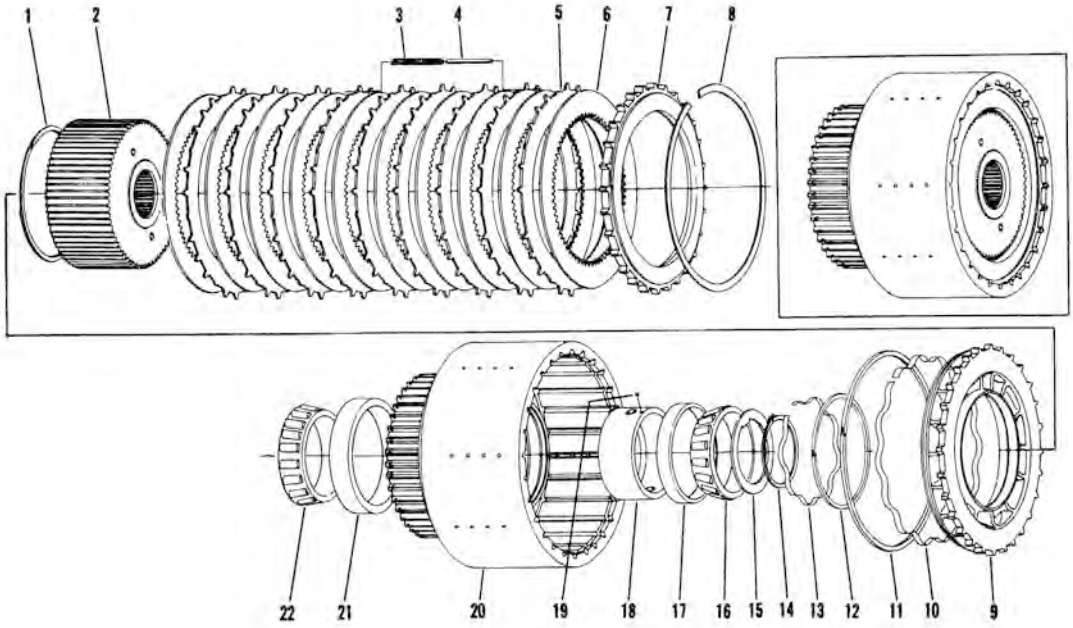
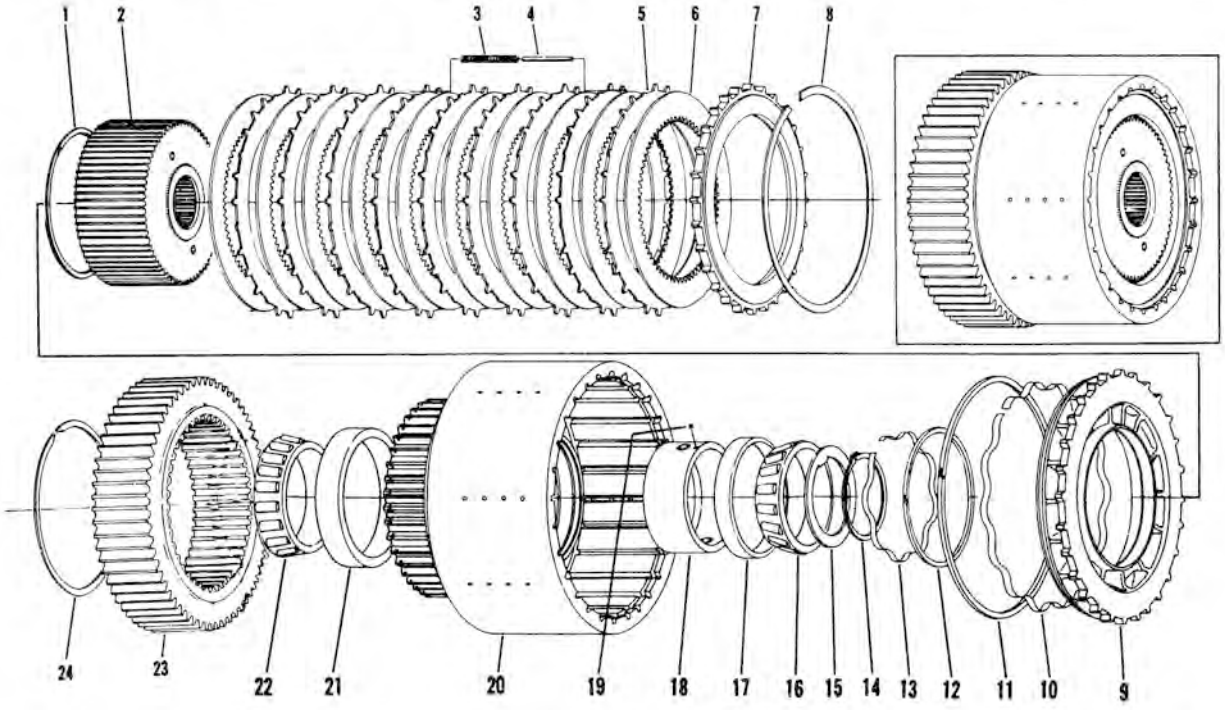
Item	Description	Qty
1	Hub	1
2	Disc - Outer	15
2A	Shim - Outer clutch disc	AR
3	Disc - Inner	16
4	Plate - End	1
5	Spring - End plate	2
6	Ball - End plate spring retaining	2
7	Snapring - End plate retaining	1
8	Snapring - Spring retainer	1
9	Washer - Snapring retainer	1
10	Spring - Disc	10
11	Piston - Clutch	1
12	Ring - Outer clutch piston expander	1
13	Ring - Inner clutch piston expander	1
14	Ring - Outer clutch piston	1
15	Ring - Inner clutch piston	1
16	Washer - Snapring 0.100 / 0.101 thick	AR
16A	Washer - Snapring 0.094 / 0.095 thick	AR
17	Washer - Keyed 0.124 / 0.125 thick	AR
17A	Washer - Keyed 0.122 / 0.123 thick	AR
17B	Washer - keyed 0.120 / 0.121 thick	AR
18	Bearing	1
19	Race - Piston ring outer	1
20	Assembly - Drum	1
21	Cup - Bearing cup	1
22	Cone - Bearing	1
23	Ball - Outer race lock	1

1ST & 2ND CLUTCH



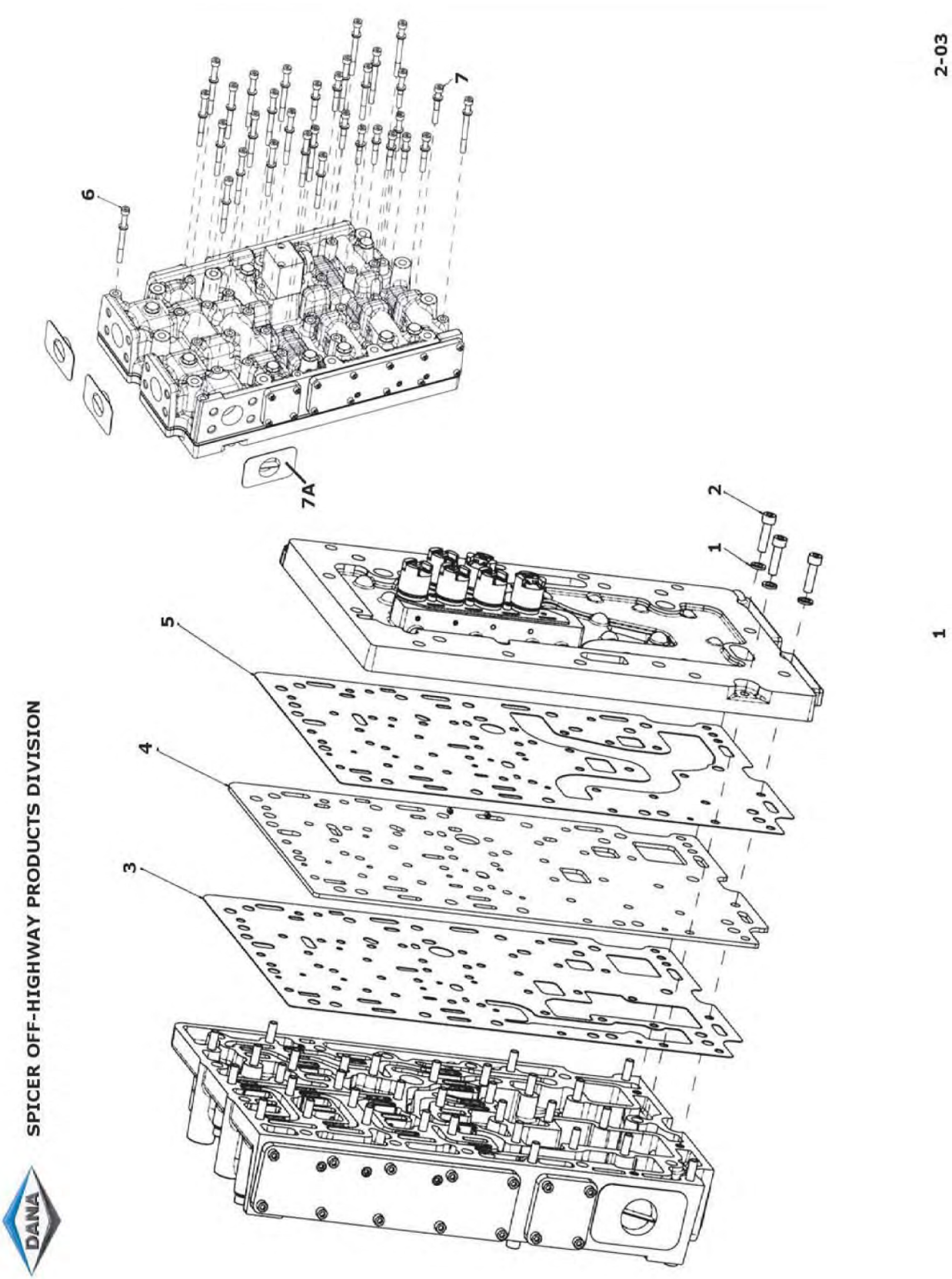
1st & 2nd CLUTCH GROUP

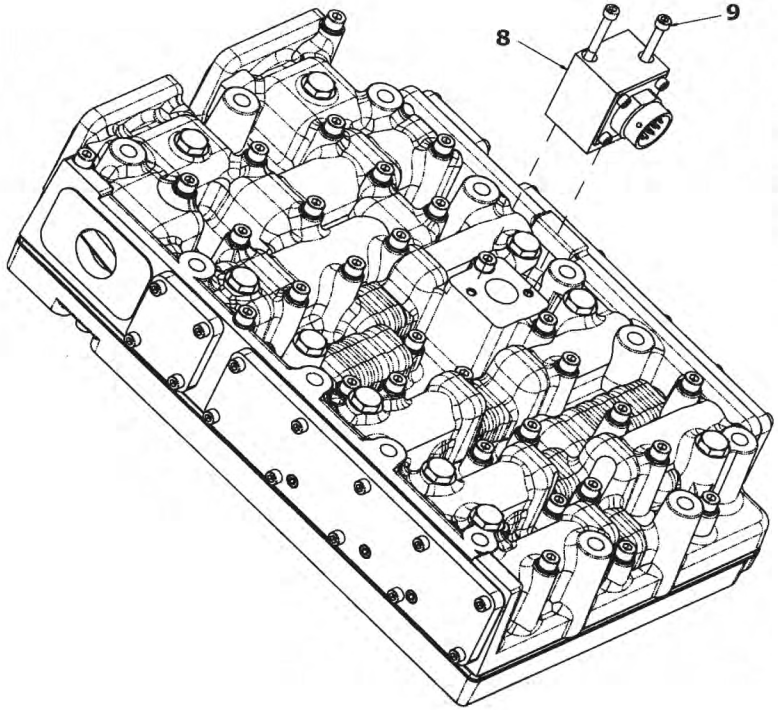


1ST & 2ND CLUTCH

Item	Description	Qty
1	Ring - Disc hub oil baffle	1
2	Hub assembly	1
3	Spring - Psiton return	21
4	Pin - Piston return spring	21
5	Disc - Outer clutch	9
5A	Shim - Outer clutch disc	AR
6	Disc -Inner clutch	10
7	Plate - End	1
8	Snapring - End plate	1
9	Piston - Clutch	1
10	Spring - Outer piston ring expander	1
11	Ring - Outer piston	1
12	Ring - Inner piston	1
13	Spring - Inner piston ring expander	1
14	Snapring - Bearing .119 / .125	AR
14A	Snapring - Bearing .111 / .117	AR
14B	Snapring - Bearing .102 / .108	AR
15	Washer - Bearing	1
16	Cone - Outer support bearing	1
17	Cup - Outer support bearing	1
18	Race - Piston ring outer	1
19	Ball - Piston ring outer race lock	1
20	Drum assembly	1
21	Cup - Inner support bearing	1
22	Cone -Inner support bearing	1
23	Gear - Clutch hub	1
24	Snapring - Gear	1

AR = As required


2-03
1
SPICER OFF-HIGHWAY PRODUCTS DIVISION
DANA
1
2
3
4
5
6
7
7A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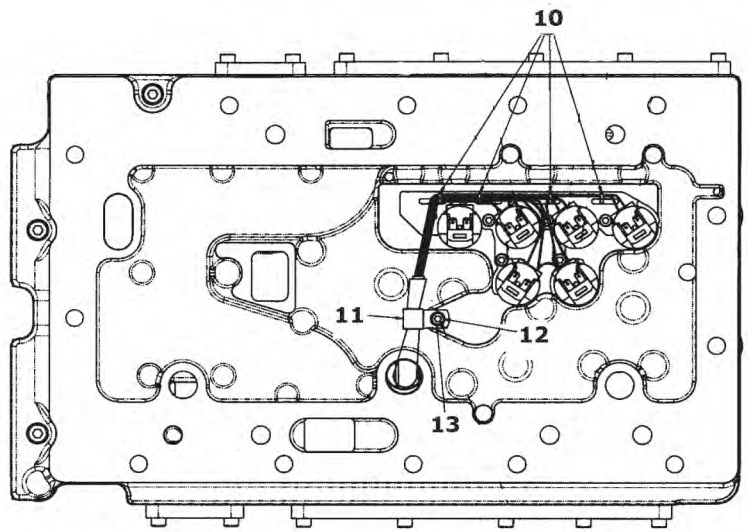
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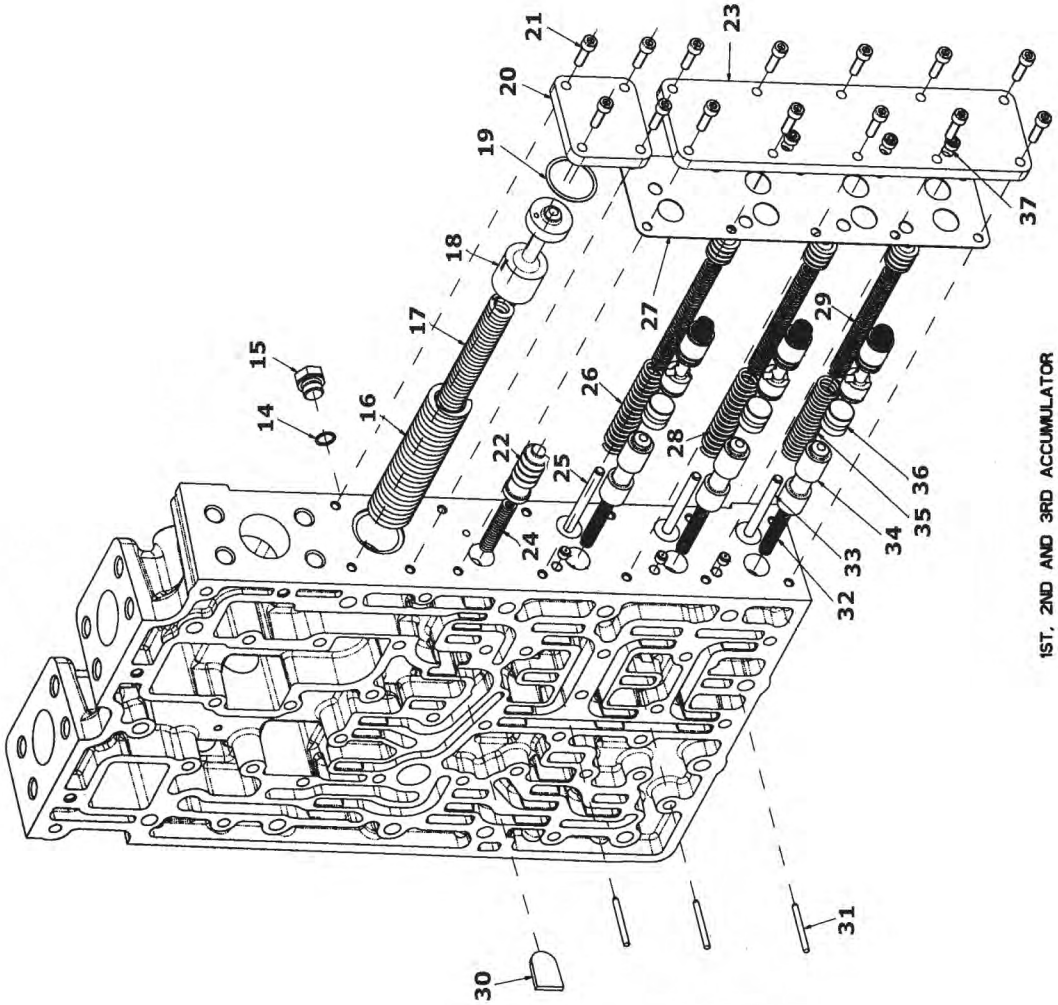


1ST, 2ND AND 3RD ACCUMULATOR

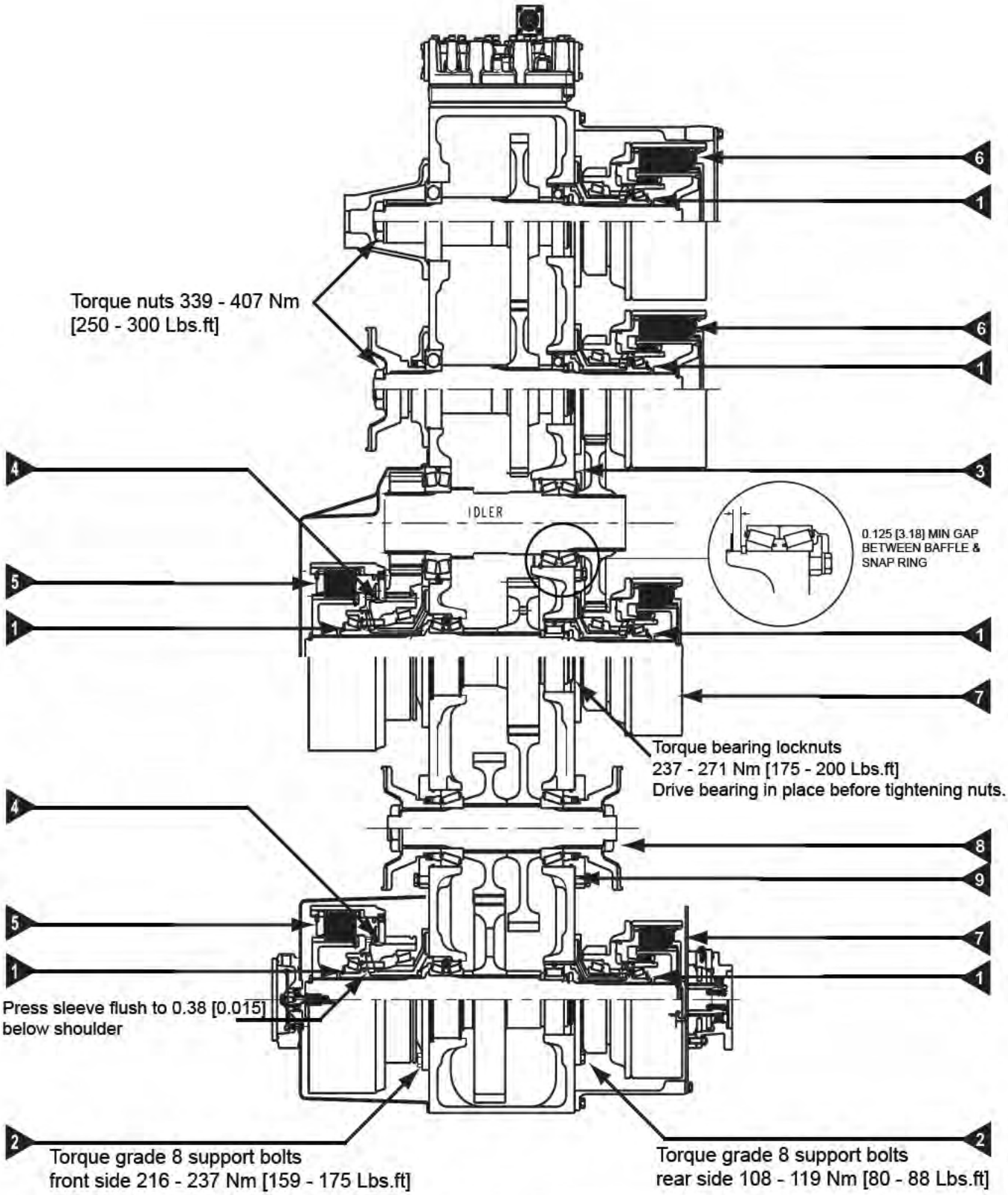
2-03

SPICER OFF HIGHWAY PRODUCTS DIVISION

Item	Description	Qty
1	Lockwasher	36
2	Screw-Cap	3
3	Gasket - Control valve	1
4	Plate - Spacer	1
5	Gasket - Spcaer Plate	1
6	Screw - Cap	22
7	Screw - Cap	11
7A	Plug - Shipping	3
8	Adaptor - Wiring Harness	1
9	Screw - Cap	2
10	Strap	4
11	Clip	1
12	Screw - Cap	1
13	Washer	1
14	O-ring	10
15	Plug	10
16	Spring - Outer regulator pressure	1
17	Spring - Inner regulator pressure	1
18	Spool - Pressure regulator	1
19	O-ring	1
20	Cover - Pressure regulator	1
21	Screw - Cap	14
22	Spool - Pressure reducer	1
23	Cover - Range spool	1
24	Spring - Pressure reducer	1
25	Pin - Stop	1
26	Spring - Outer accumulator	1
27	Gasket - Range spool cover	1
28	Spring - Outer accumulator	1
29	Spring - Inner accumulator	3
30	Plate - Separator	1
31	Pin - Parallel	3
32	Spring	3
33	Pin - Stop	2
34	Spool - On/Off	3
35	Spring - Accumulator	1
36	Spool - Stop	3
37	Plug - Pressure	3
38	Screw - Cap	14
39	Cover - Saferty valve	1
40	O-ring	1
41	Valve - Spring safety	1
42	Valve - Spring safety	1
43	Ball	1
44	Seat - Valve safety	1

Item	Description	Qty
45	Spring - Accumulator	1
46	Spring	1
47	Spool - Stop	1
48	Spool - On/Off	1
49	Spool - DWD/NEU/REV	1
50	Spring - Spool selector	2
51	Cover - Spool	1
52	Plug - Pressure	3
53	Gasket - Spool cover	1
54	Spring - Outer accumulator	2
55	Spring - Inner accumulator	3
56	Pin - Stop	3
57	Pin - Parallel	1
58	Screw - Cap	5
59	Clamp - Solenoid	1
60	Snapring	6
61	Solenoid	6
62	Filter - Disc	6
63	Screw	3
64	Plug - Restrictor dia 0.8	1

Note:
Parts shown in the illustration without an item nr are not sold seperately.


Torque nuts 339 - 407 Nm
[250 - 300 Lbs.ft]
IDLER
0.125 [3.18] MIN GAP
BETWEEN BAFFLE &
SNAP RING
Torque bearing locknuts
237 - 271 Nm [175 - 200 Lbs.ft]
Drive bearing in place before tightening nuts.
Press sleeve flush to 0.38 [0.015]
below shoulder
Torque grade 8 support bolts
front side 216 - 237 Nm [159 - 175 Lbs.ft]
Torque grade 8 support bolts
rear side 108 - 119 Nm [80 - 88 Lbs.ft]

9.1 ASSEMBLY INSTRUCTIONS TRANSMISSION

All lead in chamfer for oil seals. piston rings and O-rings must be smooth and free from burrs. Inspect as assembled.

Prelube before assembly. All piston ring grooves and O-rings with Multi-Purpose grease Grade 2.

Apply a thin coat of Loctite #638 to outer diameter of all oil seals, bore plugs and bores. They are to be installed in before assembly. use extreme care not to allow sealant to come in contact with seal lip material.

Apply a thin coat of Loctite #638 or Loctite #270 to all thru hole stud threads.

Use only precoated pipe plugs. On uncoated pipe plugs apply a thin coat of Loctite #638.

If grease is required for positioning gasket during assembly. Use Multi purpose grease grade 2.

After assembly of parts using sealant or thread locking compound, there must not be any free or excess material which might enter the oil circuit. Only use thread locking compound where specified.

Apply a small bead of Loctite #510 around dowel holes to both sides of the gasket.

Apply a thin coat of Multu-purpose grease Grade 2 between seal lips on lip type seals, prior to assembly.

1 Adjust taper bearing 0.000 - 0.127 [0.000 - 0.05] end play by selecting variable thickness washer and snapring at assembly.

2 Adhesive lockscrew assembly procedure.
Clean support mounting surface with solvent. Dry thoroughly being certain tapped holes are clean and dry. Install support and tighten screws to specified torque.
Assembly of support must be completed within a 15 minute period from start of screw installation. The special screws are used for one installatiion only. If the screw is removed for any reason it must be replaced. The adhesive left in the tapped holes must be removed with the proper tap and cleaned with solvent. Dry the hole thoroughly and use a new screw for installation.

9.2 ASSEMBLY PROCEDURE

9.2.1 ASSEMBLY PROCEDURE IDLER SHAFT

3

Assembl Procedure Idler Bearing		
AVG Rolling Torque	Shim Addition	Assembl Procedure
Nm [Lbs.in]	Add to internal shim pack	1. Assemble components with shim pack to achieve 3-14 Nm [30-120 Lbs-in] Torque. Suggested shim pack is 0.89 [0.035].
3 [30]	0.13 [0.005]	2. Torque all capscrews to assembly specifications.
5 [40]	0.15 [0.006]	3. Rotate shaft to seat bearings.
6 [50]	0.18 [0.007]	4. Measure shaft rolling torque. Use avg value.
7 [60]	0.20 [0.008]	5. Determine shim pack from chart.
8 [70]	0.23 [0.009]	6. Remove cover and initial shim pack.
9 [80]	0.25 [0.010]	7. Rap end of shaft to be sure there is end play in bearings.
10 [90]	0.28 [0.011]	8. Reassemble unit with final shim pack.
11 [100]	0.30 [0.012]	9. Chack end play. Final end play to be 0.000 - 0.076 [0.000 - 0.003] loose.
12 [110]	0.33 [0.013]	
14 [120]	0.36 [0.014]	

Modulated clutch pistons to have no step or to have tapered clearance step. Inspect at assembly.

4

9.3 CLUTCH ADJUSTMENT PROCEDURE

5 9.3.1 ADJUSTMENT PROCEDURE 1ST & 2ND

Assemble piston, outer and inner plates. End plate and snap ring per parts list, without clutch return springs or pins.

Measure clutch free play and adjudt as required using additional plates per parts list.

Adjusting plates to be located next to the psiton and oriented so that the clutch return springs are in contact with the piston and end plate teeth.

1st & 2nd Clutch Adjustment Procedure

Measured clutch free play		Adjusting Plate		Final Free Play	
		Production outer plate	Production adjusting plate		
Min	Max	0.1026 [2.606]	0.077 [1.956]	Ref. Min	Ref Max
0.439 [11.15]	0.465 [11.67]	2	2	0.080 [2.03]	0.106 [2.69]
0.414 [10.52]	0.439 [11.15]	1	3	0.080 [2.03]	0.106 [2.69]
0.388 [9.85]	0.414 [10.52]	3	0	0.080 [2.03]	0.106 [2.69]
0.362 [9.19]	0.388 [9.85]	2	1	0.080 [2.03]	0.106 [2.69]
0.337 [8.56]	0.362 [9.19]	1	2	0.080 [2.03]	0.106 [2.69]
0.311 [7.90]	0.337 [8.56]	0	3	0.080 [2.03]	0.106 [2.69]
0.285 [7.24]	0.311 [7.90]	2	0	0.080 [2.03]	0.106 [2.69]
0.260 [6.60]	0.285 [7.24]	1	1	0.080 [2.03]	0.106 [2.69]
0.234 [5.94]	0.260 [6.60]	0	2	0.080 [2.03]	0.106 [2.69]
After adjusting free play. Add clucth return springs and pins to assembly.					

6 9.3.2 ADJUSTMENT PROCEDURE FWD & REV

Assemble piston, outer and inner plates. End plate and snap ring per parts list.
Measure clutch free play and adjudt by adding and/or removing outer plates as indicated on chart.
Adjusting plates to be located next to the psiton.

Fwd & Rev Clutch Adjustment Procedure					
Measured clutch free play		Adjusting Plate		Final Free Play	
		Production outer plate	Production adjusting plate		
Min	Max	0.1026 [2.606]	0.077 [1.956]	Ref. Min	Ref Max
0.396 [10.05]	0.421 [10.70]	1	2	0.139 [3.53]	0.165 [4.18]
0.370 [9.39]	0.396 [10.05]	0	3	0.139 [3.53]	0.165 [4.18]
0.344 [8.74]	0.370 [9.39]	2	0	0.139 [3.53]	0.165 [4.18]
0.319 [8.09]	0.344 [8.74]	1	1	0.139 [3.53]	0.165 [4.18]
0.293 [7.44]	0.319 [8.09]	0	2	0.139 [3.53]	0.165 [4.18]
0.267 [6.79]	0.293 [7.44]	-1	3	0.139 [3.53]	0.165 [4.18]
0.242 [6.14]	0.267 [6.79]	1	0	0.139 [3.53]	0.165 [4.18]
0.216 [5.49]	0.242 [6.14]	0	1	0.139 [3.53]	0.165 [4.18]
0.190 [4.83]	0.216 [5.49]	-1	2	0.139 [3.53]	0.165 [4.18]
Note: Do not shim tighter than 0.70 to allow assembly of clutch end plate and retaining ring.					

7 9.3.3 ADJUSTMENT PROCEDURE 3RD & 4TH

Assemble piston, outer and inner plates. End plate and snap ring per parts list.
Measure clutch free play and adjudt by adding and/or removing outer plates as indicated on chart.
Adjusting plates to be located next to the psiton.

3rd & 4th Clutch Adjustment Procedure					
Measured clutch free play		Adjusting Plate		Final Free Play	
		Production outer plate	Production adjusting plate		
Min	Max	0.1026 [2.606]	0.077 [1.956]	Ref. Min	Ref Max
0.336 [8.54]	0.362 [9.19]	1	2	0.080 [2.03]	0.105 [2.68]
0.311 [7.89]	0.336 [8.54]	0	3	0.080 [2.03]	0.105 [2.68]
0.285 [7.24]	0.311 [7.89]	2	0	0.080 [2.03]	0.105 [2.68]
0.259 [6.59]	0.285 [7.24]	1	1	0.080 [2.03]	0.105 [2.68]
0.234 [5.94]	0.259 [6.59]	0	2	0.080 [2.03]	0.105 [2.68]
0.208 [5.29]	0.234 [5.94]	-1	3	0.080 [2.03]	0.105 [2.68]
0.182 [4.63]	0.208 [5.29]	1	0	0.080 [2.03]	0.105 [2.68]
0.157 [3.98]	0.182 [4.63]	0	1	0.080 [2.03]	0.105 [2.68]
0.131 [3.33]	0.157 [3.98]	-1	2	0.080 [2.03]	0.105 [2.68]
0.131 [3.33]	0.157 [3.98]	-2	3	0.080 [2.03]	0.105 [2.68]
Note: Do not shim tighter than 0.70 to allow assembly of clutch end plate and retaining ring.					

9.4 OTPUT SHAFT

Torque output shaft nuts 542 - 610 Nm [400 - 450 Lbs.ft]

Note: Models with single output flange or models with output disconnect plus an opposite end output flange, are to be assembled by pressing the inner race on the threaded end firmly against the shoulder on the shaft. After assembly in case, with gears positioned. Drive opposite bearing race on output shaft until bearing shoulders against gear hub.

Shim output shaft bearings to produce 0.68 - 0.90 Nm [6 - 8 Lbs.in] preload.

Note: Models with single output flange or models with output disconnect plus an opposite end output flange, are to be assembled by pressing the inner race on the threaded end firmly against the shoulder on the shaft. After assembly in case, with gears positioned,drive opposite bearing race on output shaft until bearing shoulders against gear hub.

WARNING

For disassembly and reassembly of this unit you will need, besides normal workshop tools the special tools mentioned in the last chapter of this manual; an induction heater of minimum 3.5 Kw to heat bearings up to 120° C [248° F]

NOTE

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

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

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

Figure 1
Front view of the 8000 4 speed transmission.

Figure 2
Remove sump pan bolts, lockwashers and oil sump pan.

Figure 3
Remove oil screen bolts and lockwashers.

Figure 4
Remove oil sump frame and screen.

Figure 5
Remove control valve bolts and lochwashers.

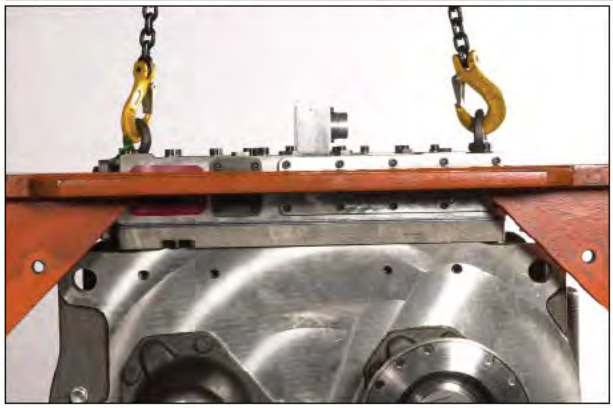


Figure 6
Using a hoist remove the control valve as an assembly.

Figure 7
Remove input flange nut, washer and O-ring.

Figure 8
Remove input flange.

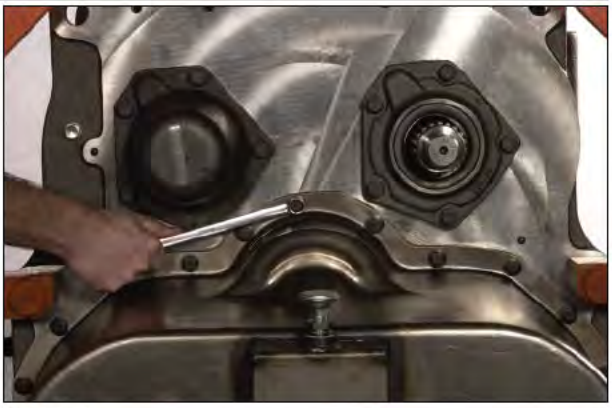


Figure 9
Use aligning studs to hold cover in place, remove 1st & 2nd clutch cover screws and lockwashers.

Figure 10
1st & 2nd clutch cover removed.

NOTE

All clutches are disassembled in a simular manner. Clutches shown being disassembled are 1st & 2nd. Forward, reverse, 3rd & 4th.

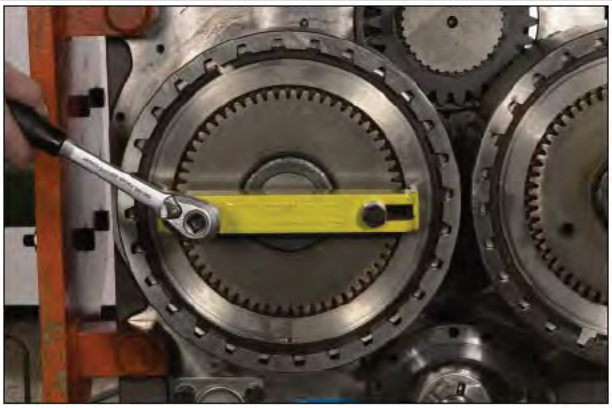


Figure 11
Using a special tool depress end plate by turning the bolts as shown.

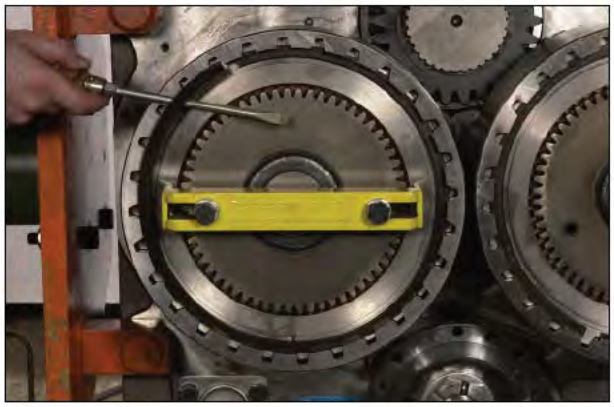


Figure 12
Remove end plate retaining ring

Figure 13
Remove end plate. Remove springs and pins.

Figure 14
Remove clutch disc hub retaining ring.

Figure 15
Remove disc hub. Remove inner and outer clutch discs.

Figure 16
Install 2 bolts as shown and remove clutch piston.

Figure 17
Remove clutch drum retaining ring and retainer spacer.

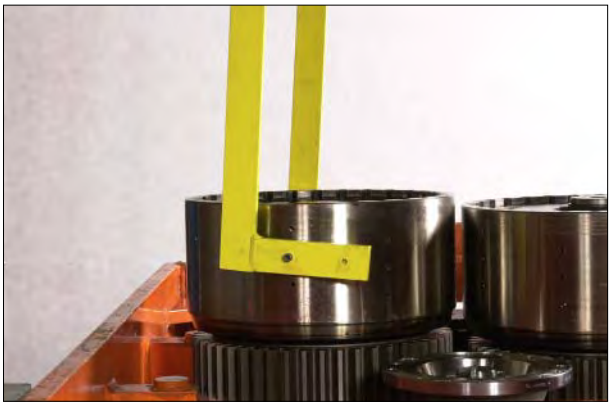


Figure 18
Using a special tool and a hoist remove clutch drum from clutch support.

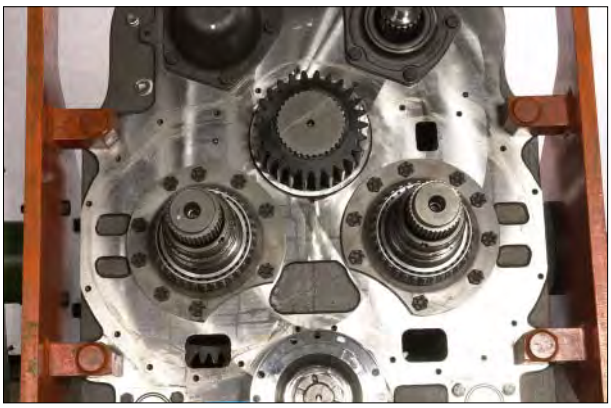


Figure 19
1st and 2nd clutch drums removed.

Figure 20
Remove cotter pin, output flange nut, washer and o-ring.

Figure 23
Remove idler gear retainnig ring.

Figure 21
Remove output flange.

Figure 24
Remove idler gear.

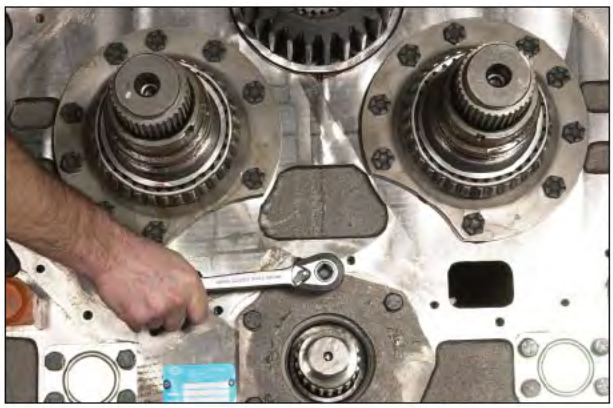


Figure 22
Remove output flange bearing cover.

Figure 25
Remove reverse shaft bearing cap.

Figure 26
Remove reverse shaft nut washer and spacer.

Figure 27
Remove input shaft bearing cap bolts, lockwashers and bearing cap. Remove bearing cap and oil seal.

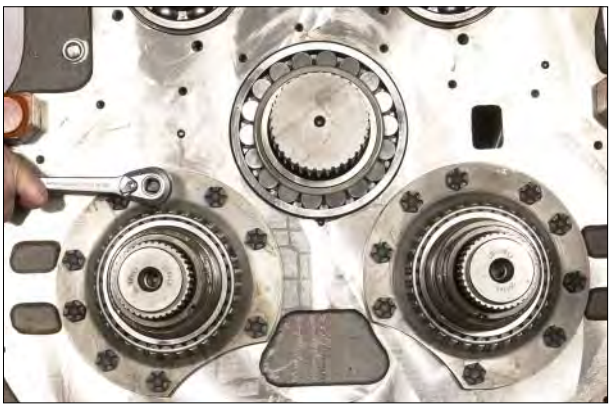


Figure 28
Remove clutch supports (1st and 2nd)

Figure 29
On other side of transmission, remove output flange nut, washer and o-ring.

Figure 30
Remove output flange.

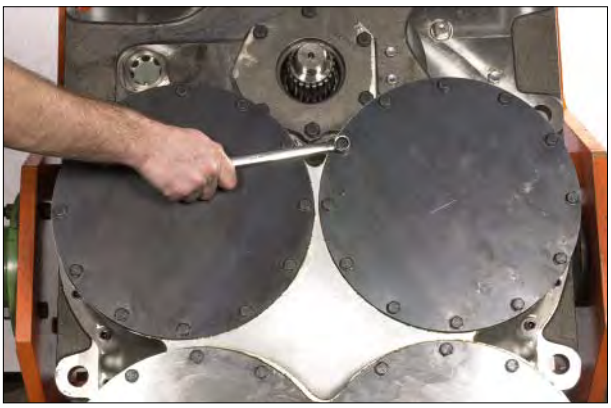


Figure 31
Remove forward, reverse, 3rd and 4th clutch cover bolts and lockwashers.

Figure 32
Covers removed

Figure 33
Remove cover base bolts, lockwashers and hoist cover base from transmission case.

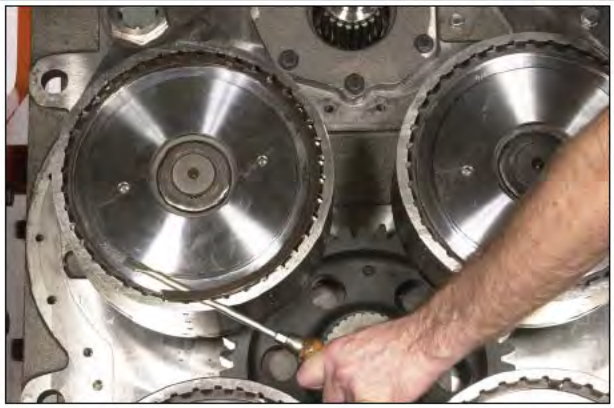


Figure 34
Remove clutch drum end plate retaining ring, and remove end plate. Take care not to loose the 2 balls and springs. See figure 35.

Figure 35
Locating ball and spring on either side of the end plate.

Figure 36
Remove clutch disc hub retaining snap ring.

Figure 37
Remove clutch disc hub.

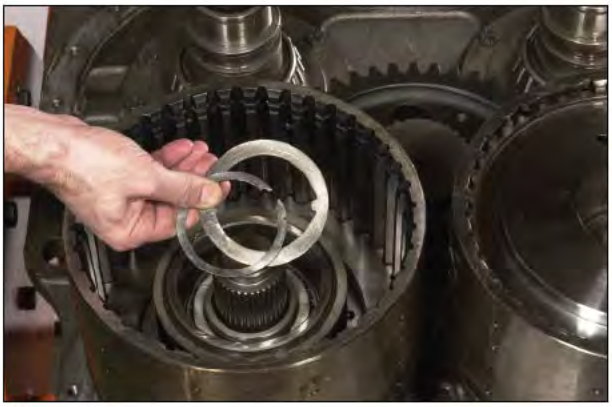


Figure 38
Remove clutch drum retainer ring and spacer.

Figure 39
Hoist clutch drum from clutch support using a special tool as illustrated.

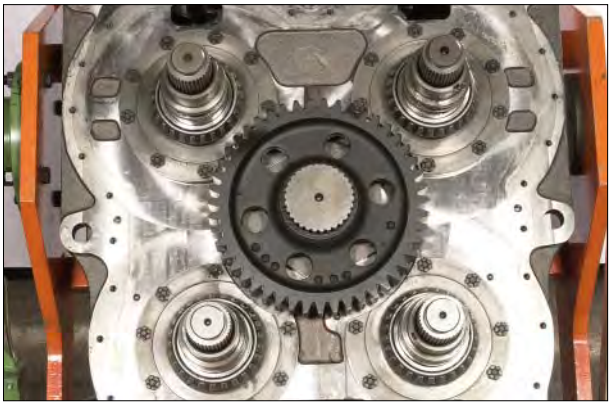


Figure 40
Clutch drums removed.

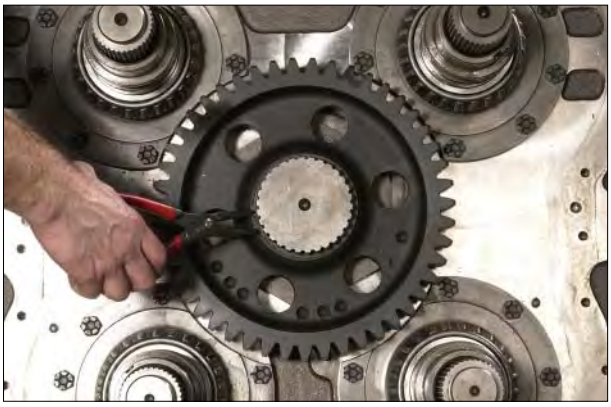


Figure 41
Remove idler gear retaining ring.

Figure 42
Remove idler gear.

Figure 43
Remove rear output flange bearing cap.

Figure 44
Press output shaft from case. Output shaft may be removed or installed from eiter side. Be carefull inner transmission case gears are heavy.

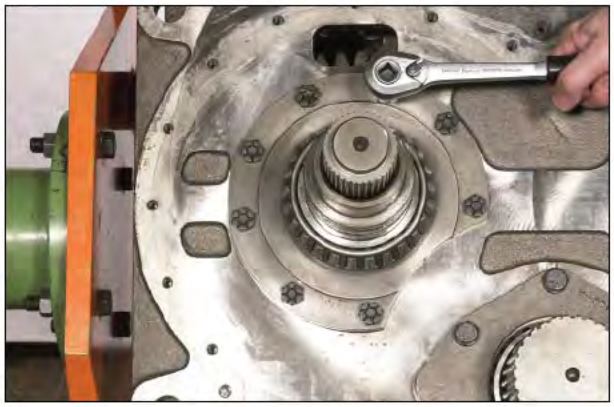


Figure 45
Remove clutch supports.

Figure 46
Straighten tongs on shaft nut locks. Lock gears with a soft bar and remove outer lock nut, nut lock and inner lock nut.

Figure 47
Using a suitable pusher tool, remove clutch shafts. Remove gears and spacers from inside of transmission case.

Figure 48
Remove idler shaft bearing cap.

Figure 49
Use a suitable pusher tool and push idler shaft out of transmission case.

Figure 50
Remove bearing locating snap ring

Figure 51
Remove oil shield.

Figure 52
Remove input shaft and bearing as an assembly

Figure 53
From other side remove bearing cup

Figure 54
Use this procedure for all drums.Remove Remove clutch hub gear snap ring.

Figure 55
Remove clutch hub gear.

Figure 56
Remove piston ring outer race and outer support bearing cup.

Figure 57
Press return springs and remove spring retaining snap ring.

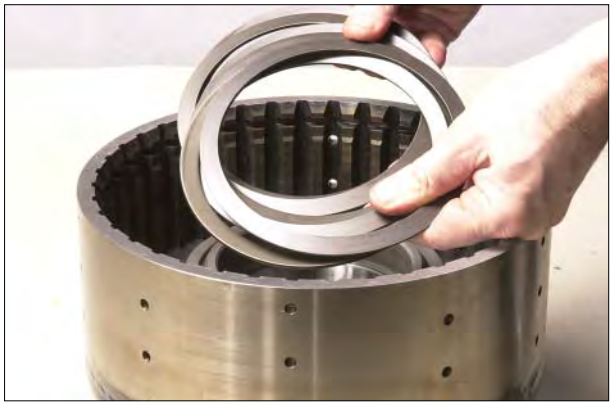


Figure 58
Remove return springs

Figure 59
Use 2 bolts to remove clutch piston.

Figure 60
Install piston

Figure 61

Install return springs. See figure 62

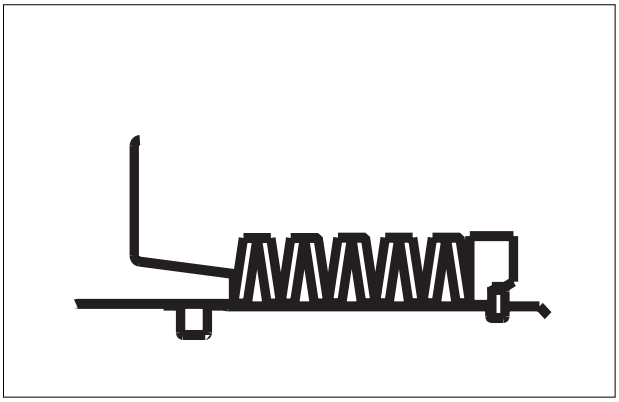


Figure 62

Figure 63
Install spring retaining snapring.

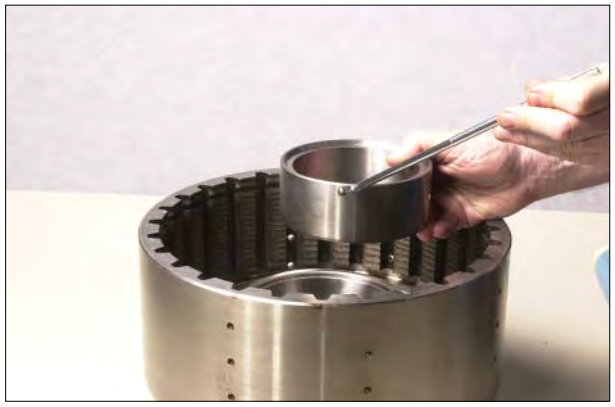


Figure 64
Install piston ring outer race and locking ball.

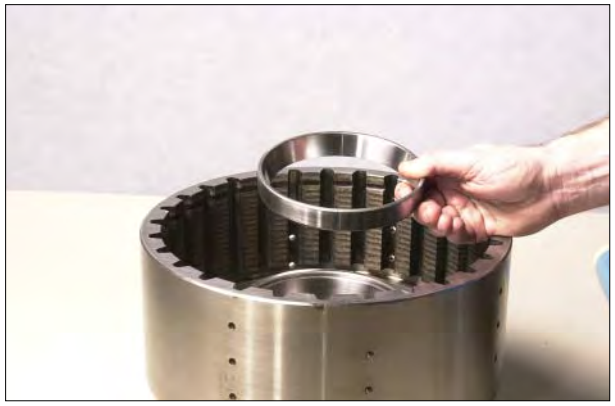


Figure 65
Install clutch inner bearing cup.

Figure 66
Install new sealing expander ring and sealing ring.

Figure 67
Install clutch outer bearing cup.

Figure 68
Install clutch hub gear.

Figure 69
Instal clutch hub gear retaining snapring.

Figure 70
Remove clutch support bearing come.

Figure 71
Remove clutch support piston rings

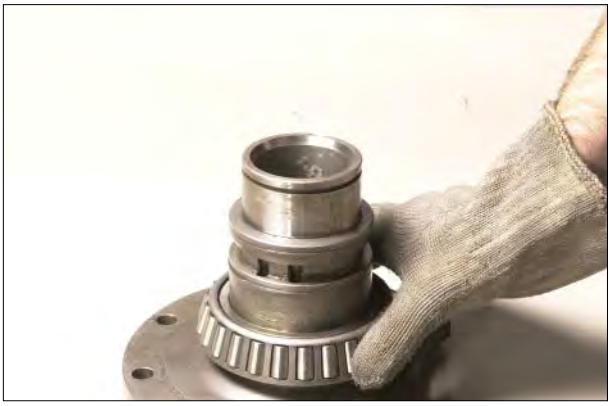
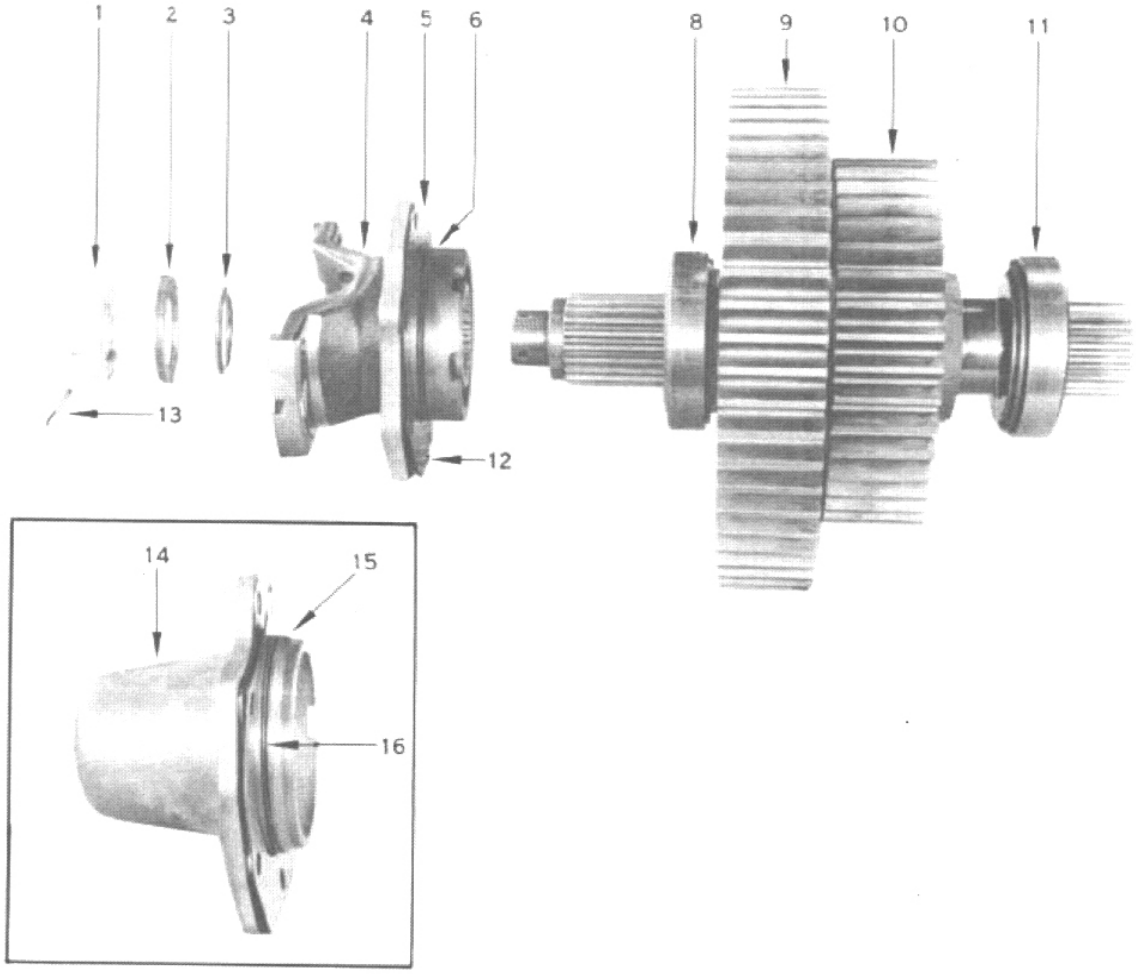


Figure 72
Warm bearing cone to 120° C [248° F] and install on clutch support

Figure 73
Install clutch support piston rings.



OUTPUT SHAFT GROUP

Item	Description	Qty
1	Flange nut	1
2	Flange washer	1
3	Flange O-ring	1
4	Companion flange	1
5	Bearing cap	1
6	Bearing cap O-ring	1
7	Output shaft	1
8	Output shaft tapered bearing	1
9	Output gear	1
10	Output gear	1
11	Output shaft tapered bearing	1
12	Bearing cap shims	AR
13	Flange nut cotter pin	1
14	Optional bearing cap	AR
15	Bearing cap shims	AR
16	Bearing cap O-ring	AR

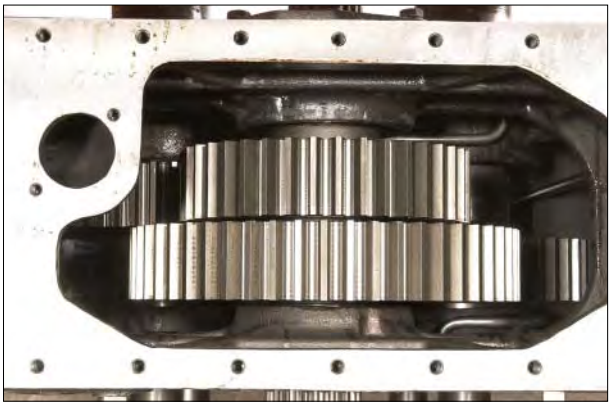
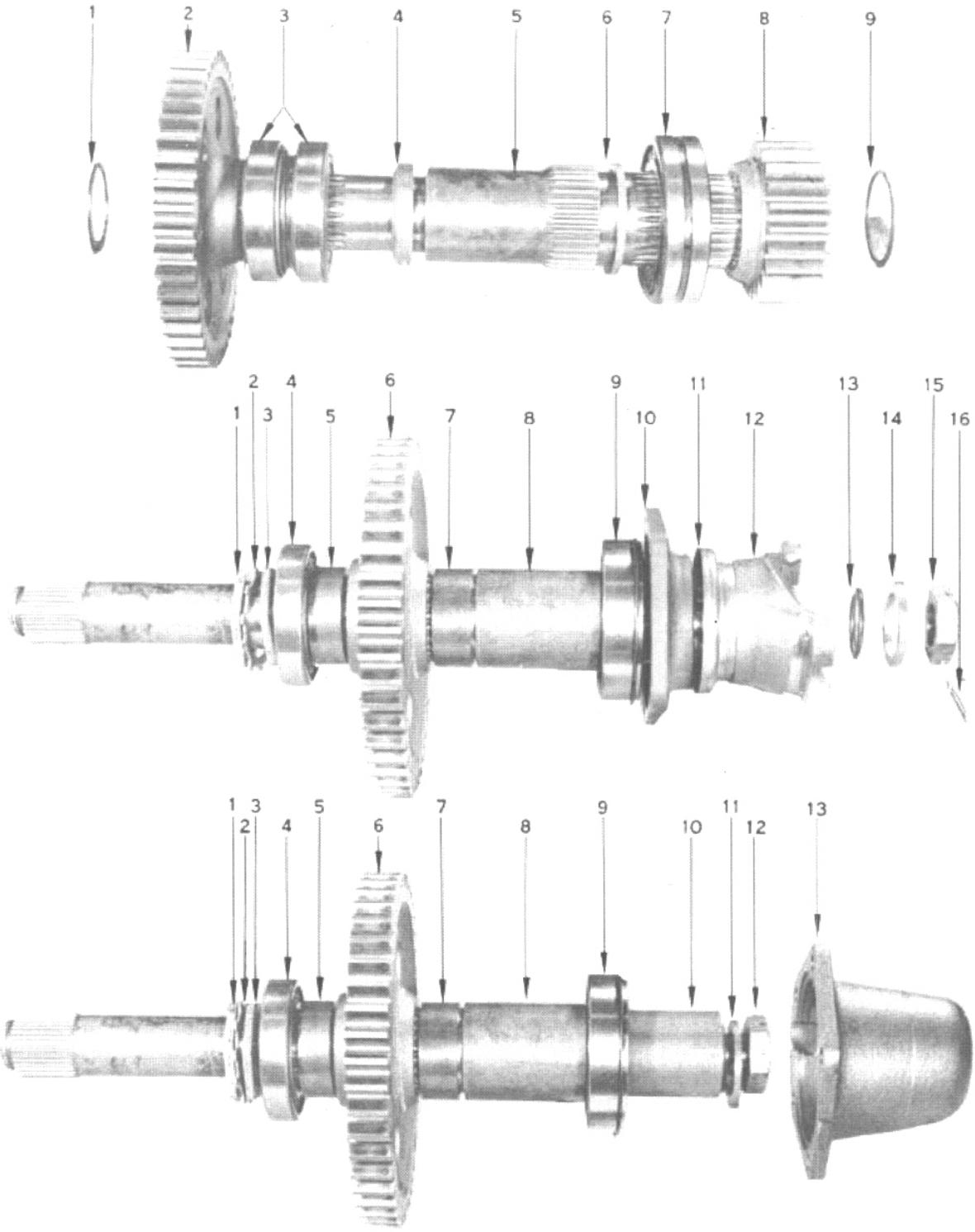


Figure 74
Install output shaft with the treaded end of the output shaft to the rear. Warm bearing to 120°C [248°F] and press taper bearing (larger diameter of taper inward) over threaded end of output shaft against shoulder on shaft. Position small output shaft gear in transmission case to the front. With longer offset of gear hub towards the front. Position large output shaft gear in transmission to the rear. Insert output shaft through rear bore of case and through small and larger output gears. Drive front tapered bearing (large diameter of taper inward) on output shaft until bearing shoulder is against smaller gear. Install bearing cups over front and rear bearings.

Figure 75
Install new O-ring on output shaft bearing cap. Install bearing cap and shims.

Figure 76
Install output shaft bearing cap bolts and lockwashers. See installation instructions for proper shim procedure.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IDLER SHAFT GROUP

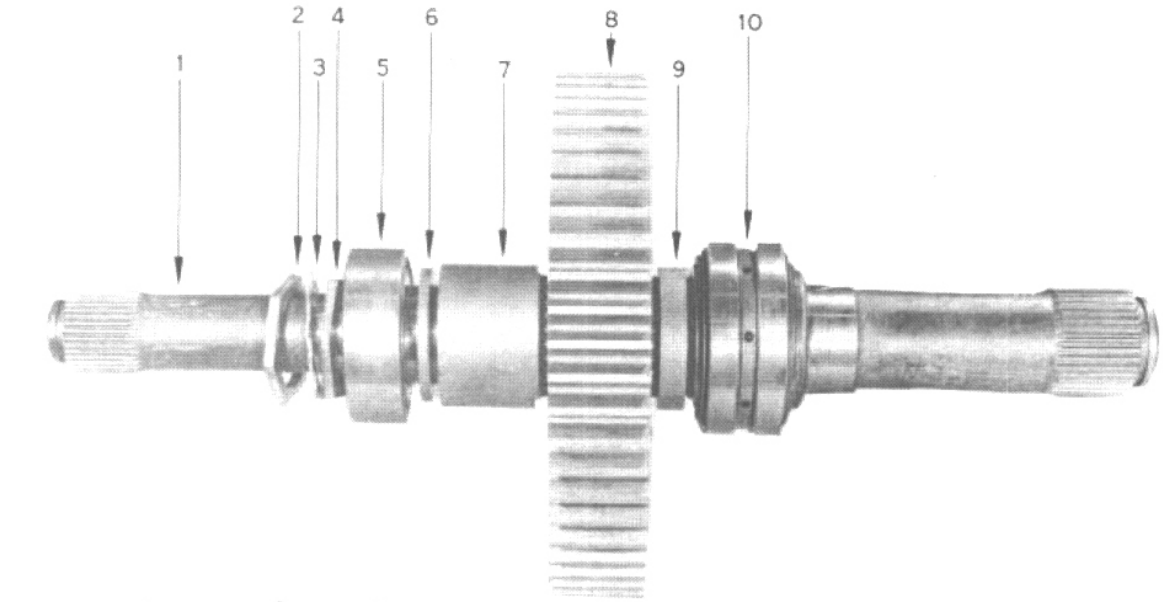
Item	Description	Qty
1	Gear snap ring	1
2	Idler gear	1
3	Tapered bearing	1
4	Tapered bearing spacer	1
5	Idler shaft	1
6	Roller bearing spacer	1
7	Roller bearing	1
8	Idler gear	1
9	Gear snap ring	1

INPUT SHAFT GROUP

Item	Description	Qty
1	Outer bearing lock nut	1
2	Bearing nut lock	1
3	Inner bearing lock nut	1
4	Ball bearing	1
5	Gear spacer (short)	1
6	Input gear	1
7	Gear spacer (long)	1
8	Input shaft	1
9	Ball bearing	1
10	Bearing cap	1
11	Flange deflector	1
12	Comapnion flange	1
13	Flange O-ring	1
14	Flange washer	1
15	Flange nut	1
16	Flange nut cotter pin	1

REVERSE SHAFT GROUP

Item	Description	Qty
1	Outer bearing lock	1
2	Bearing nut lock	1
3	Inner bearing nut lock	1
4	Ball bearing	1
5	Gear spacer (short)	1
6	Reverse gear	1
7	Gear spacer (long)	1
8	Reverse shaft	1
9	Ball bearing	1
10	Bearing spacer	1
11	Reverse nut washer	1
12	Reverse nut	1
13	Bearing cap	1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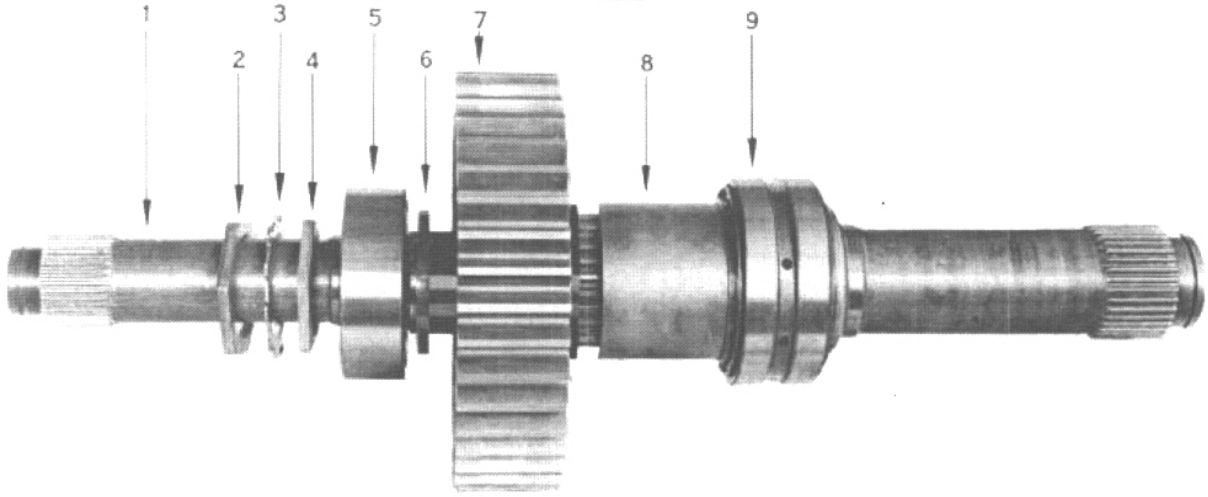
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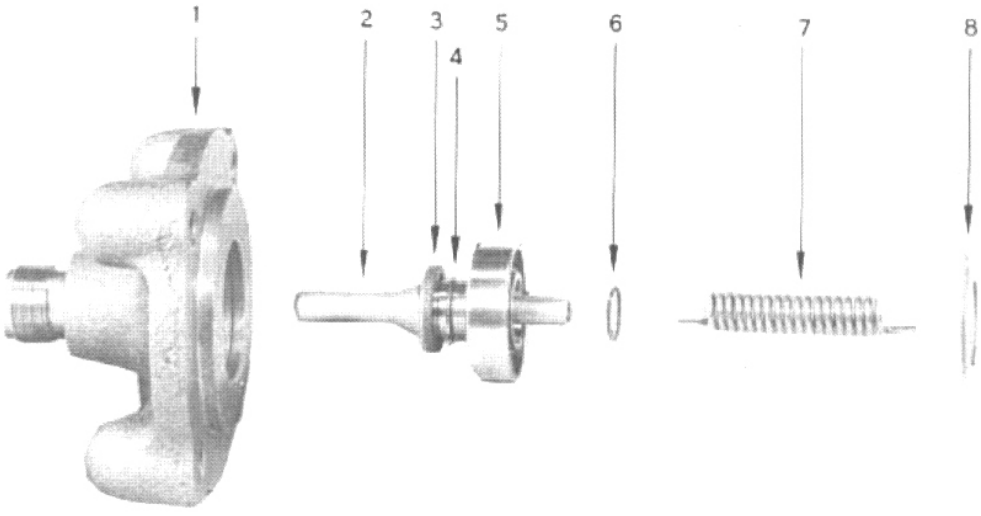
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2nd & 4th SHAFT GROUP

Item	Description	Qty
1	2nd & 4th shaft	1
2	Outer bearing lock nut	1
3	Bearing nut lock	1
4	Inner bearing lock nut	1
5	Roller bearing	1
6	Gear spacer (thin)	1
7	Gear spacer (long)	1
8	2nd & 4th gear	1
9	Gear spacer (short)	1
10	Tapered bearing assembly	1

1st & 3rd SHAFT GROUP

Item	Description	Qty
1	1st & 3rd shaft	1
2	Outer bearing lock nut	1
3	Bearing nut lock	1
4	Inner bearing lock nut	1
5	Roller bearing	1
6	Gear spacer (Thin)	1
7	1st & 3rd gear	1
8	Gear spacer long	1
9	Tapered bearing assembly	1

SPEEDOMETER DRIVE GROUP

Item	Description	Qty
1	Speedometer drive housing	1
2	Speedometer drive shaft	1
3	Drive shaft oil seal	1
4	Bearing snap ring	1
5	Speedometer drive bearing	1
6	Bearing snap ring	1
7	Speedometer drive spring	1
8	Bearing snap ring	1

Figure 77

Install oil shield.

Figure 78
Install bearing locating snap ring.

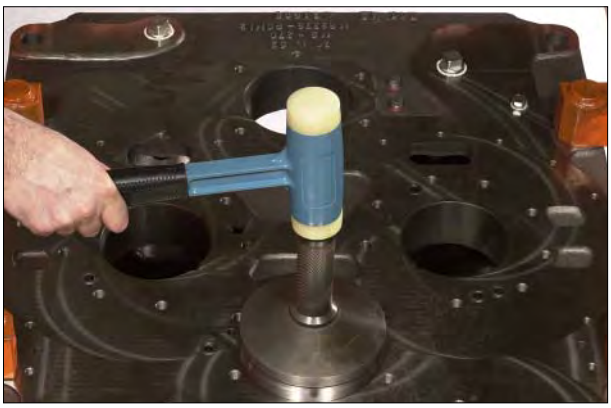


Figure 79
Tap idler shaft bearing cup into place.

Figure 80
From the other side install idler shaft and bearings as an assembly.

Note:

Don’t loose locking ball.

Figure 81
Warm idler shaft bearing cone to 120° C [248° F] and install on idler shaft.

Install 2nd bearing in the same manner. See figure 81 bis for installation sequence.

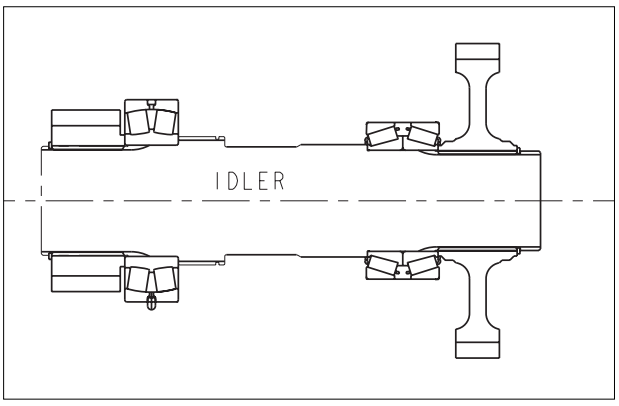


Figure 81 bis

Figure 82
Install bearing cap and shims and torque bolts to specified torque. See installation procedure for shim procedure.

Figure 83
Install clutch drum shafts & gears.Install bearing lock nut, nut lock and lock nut.

Figure 84
Torque to specified torque

Figure 85
Secure nut loc by bending 2 lips.

Figure 86
Install clutch support, clutch support lockwashers and screws and torque to specified torque.

Figure 87
Install idler gear

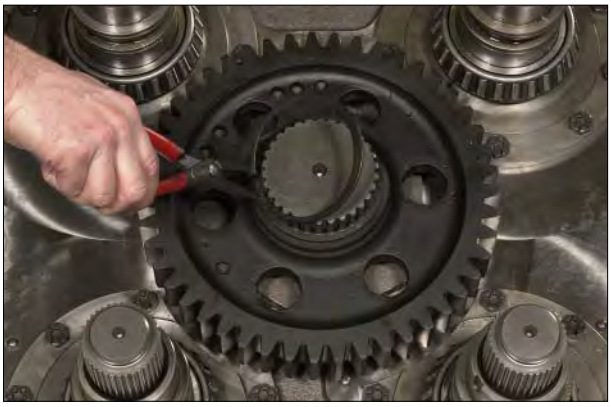


Figure 88
Install idler gear retaining snap ring

Figure 89
Install clutch drum on clutch drum support.

Figure 90
Install tapered roller bearing.

Figure 91
Install keyed washer and washer retaining snapring.

Figure 92
Install disc hub.

Figure 93
Install disc hub retaining ring.

Figure 94
Install one friction plate.

Figure 95
Install one outer clutch plate. Alternate friction and clutch plates till proper amount is reached.

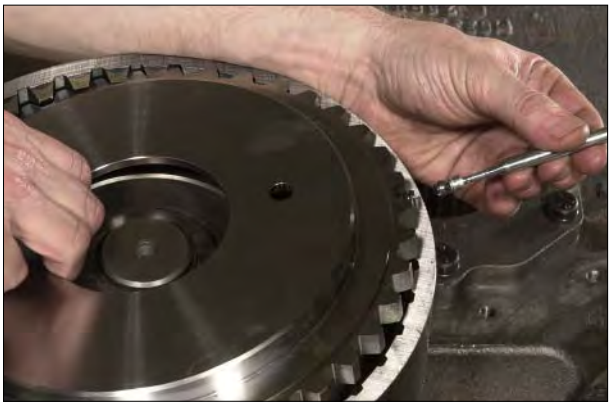


Figure 96
Install 2 springs and balls in end plate and install end plate into drum.

Figure 97
Install end plate retaining snapring.

Figure 98
Install new gasket.

Figure 101
Install 2 new gaskets.

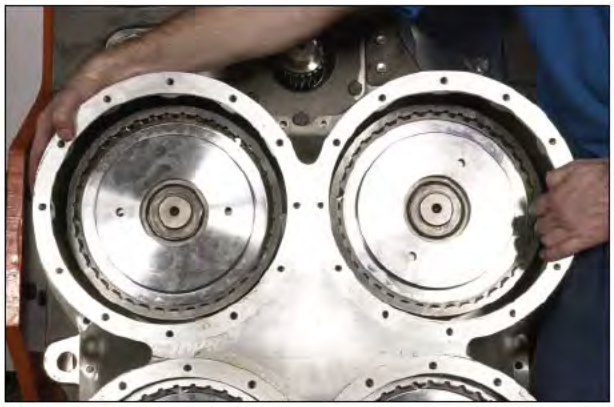


Figure 99
Use 2 aligning studs and install clutch drum cover.

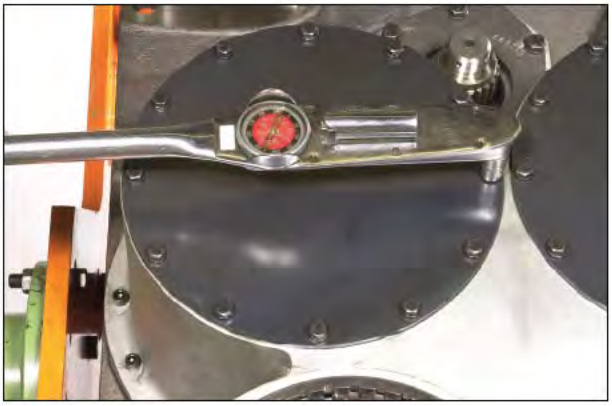


Figure 102
Install cover plates, lockwashers and screw and torque to half the specified torque.

Figure 100
Install lockwashers and bolts and torque to specified torque.

Figure 103
Install new gasket.

Figure 104
Place spacer.

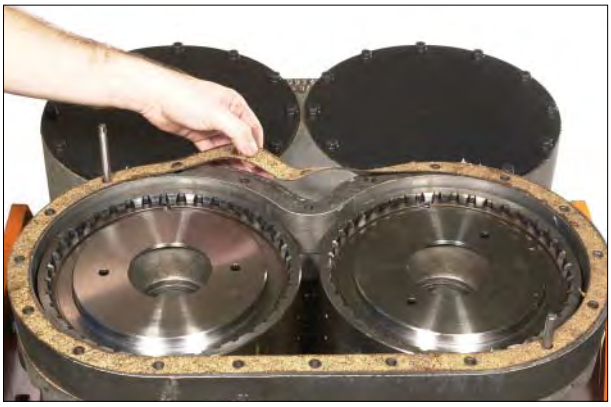


Figure 105
Turn shaft and using a puller remove bearing

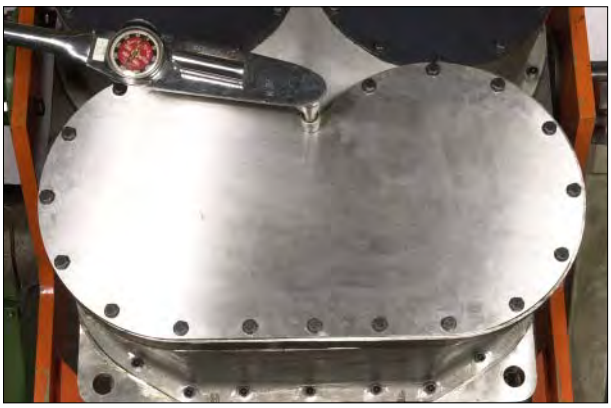


Figure 106
Place cover, lockwashers and bolts and torque to half the specified torque.

Figure 107
Install output flange on output shaft.

Figure 108
Install o-ring, washer and flange lock nut.

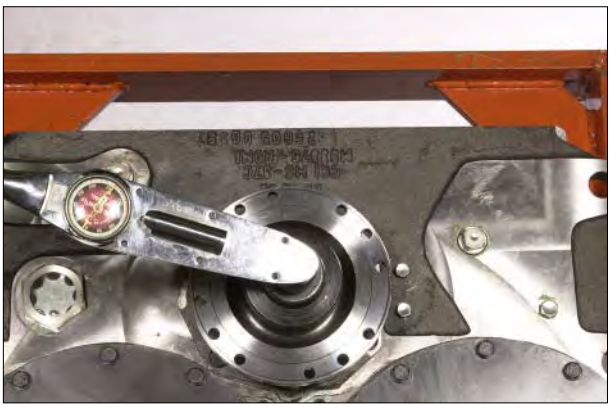


Figure 109
Torque to specified torque.

Figure 110
Install cotter pin and bend lips to secure.

Figure 113
Install new gasket and input shaft bearing cap.

Figure 111
Install reverse shaft bearing cap gasket and bearing cap.

Figure 114
Install lockwashers and bolts and torque to specified torque.

Figure 112
Place lockwashers and bolts and torque to specified torque.

Figure 115
Install input flange.

Figure 116
Install o-ring, washer and nut on input shaft and torque to specified torque.

Figure 117
Install spacer, retainer and retaining nut on reverse shaft.

Figure 118
Torque to specified torque

Figure 119
Install idler gear.

Figure 120
Install idler gear retaining snapring.

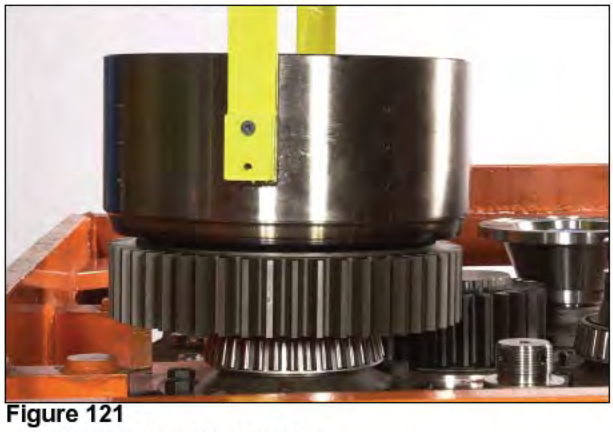


Figure 121
Install drum on drum support.

Figure 122
Install drum inner bearing cone.

Figure 123
Install bearing washer and bearing snap ring.

Figure 124
Install clutch piston.

Figure 125
Install disc hub. Check that disc hub oil baffle ring is in place and intact. (See inset)

Figure 126
Install disc hub retaining snapring.

Figure 127
Install outer disc.

Figure 130
Install end plate.

Figure 128
Install friction disc. Alternate outer disc and friction disc until proper amount is installed.

Figure 131
Use special tool to press end plate donw and install end plate retaining ring.

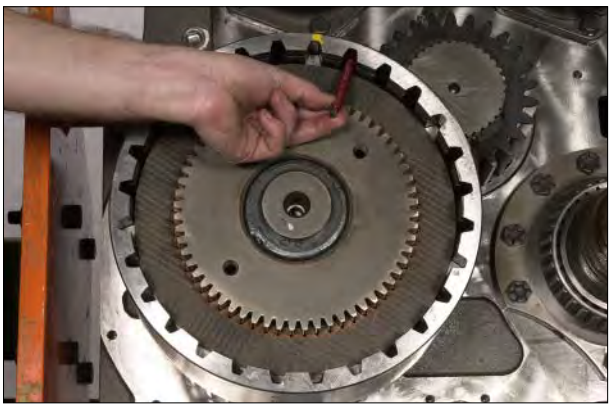


Figure 129
Install piston return springs and pins.

Figure 132
Remove speedo drive spring.

Figure 133
Speedo drive housing to case screws and sealing washers and gently tap speedo drive housing from cover.

Figure 134
Remove speedo gear centre bolt

Figure 135
Remove speedo bearing retaining snapring.

Figure 137
Remove speedo axle and bearing as an assembly.

Reassembly of speedo drive

Figure 138
Install speedo drive axle and bearing.

Figure 139
Install bearing locating snapring.

Figure 140
Install speedo drive gear.

Figure 141
Install bolt and torque to specified torque.

Figure 142
Install new seal and install speedo onto cover.

Figure 143
Install sealing washers and bolts. Torque to specified torque.

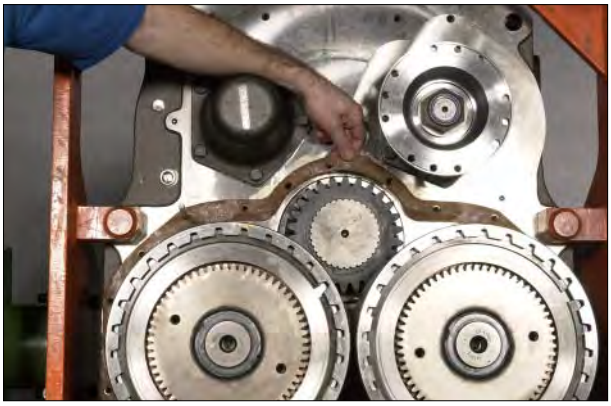


Figure 144
Install new gasket.

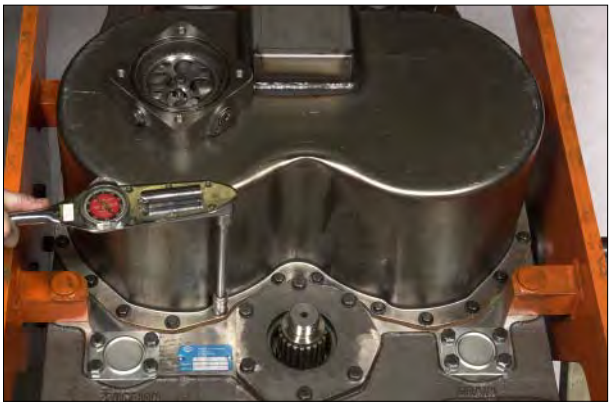


Figure 145
Install clutch cover, lockwashers and bolts and torque to specified torque.

Figure 146
Install gasket and speedo drive cover. Place bolts and torque to specified torque.

Figure 147
Install output flange.

Figure 148
Install Flange o-ring, washer and lock nut.

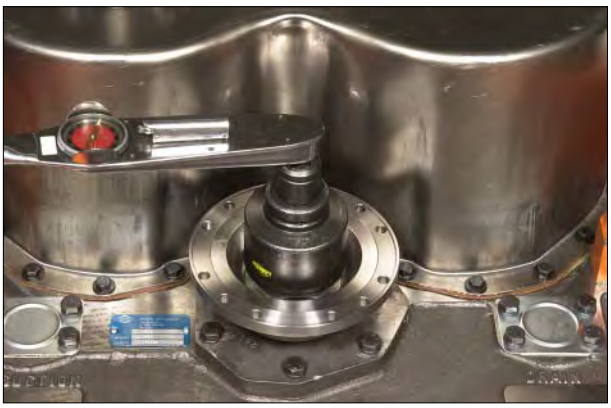


Figure 149
Torque nut to specified torque.

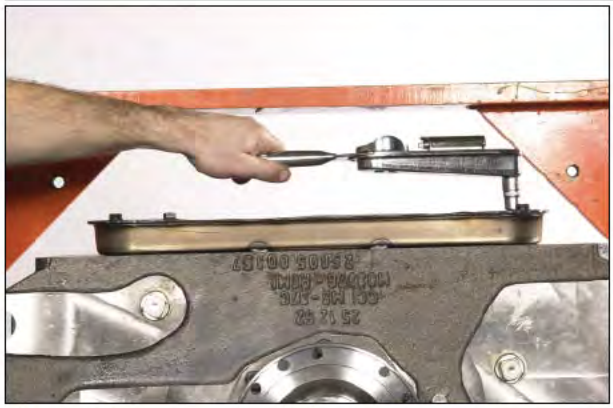


Figure 150
use new screen assembly gasket, place and screen assembly on transmission case. Place bolts and lockwashers and torque to specified torque.

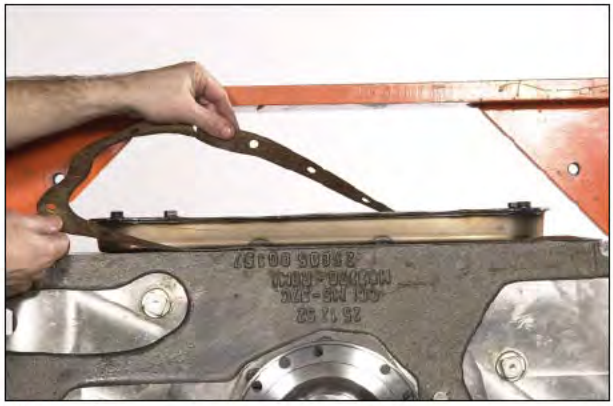


Figure 151
Install new oils sump gasket.

Figure 152
Clean and replace magnets in oil sump.

Figure 153
Install screws and lockwashers and torque to specified torque.

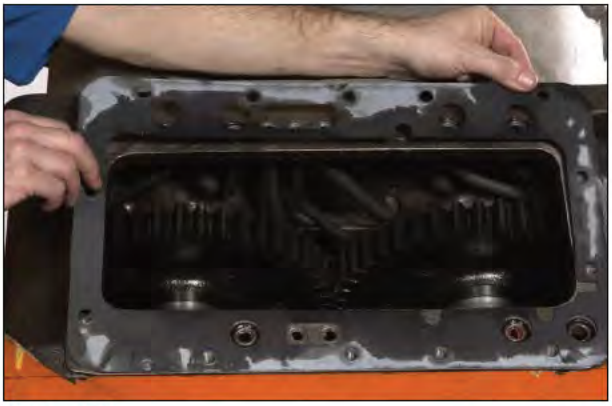
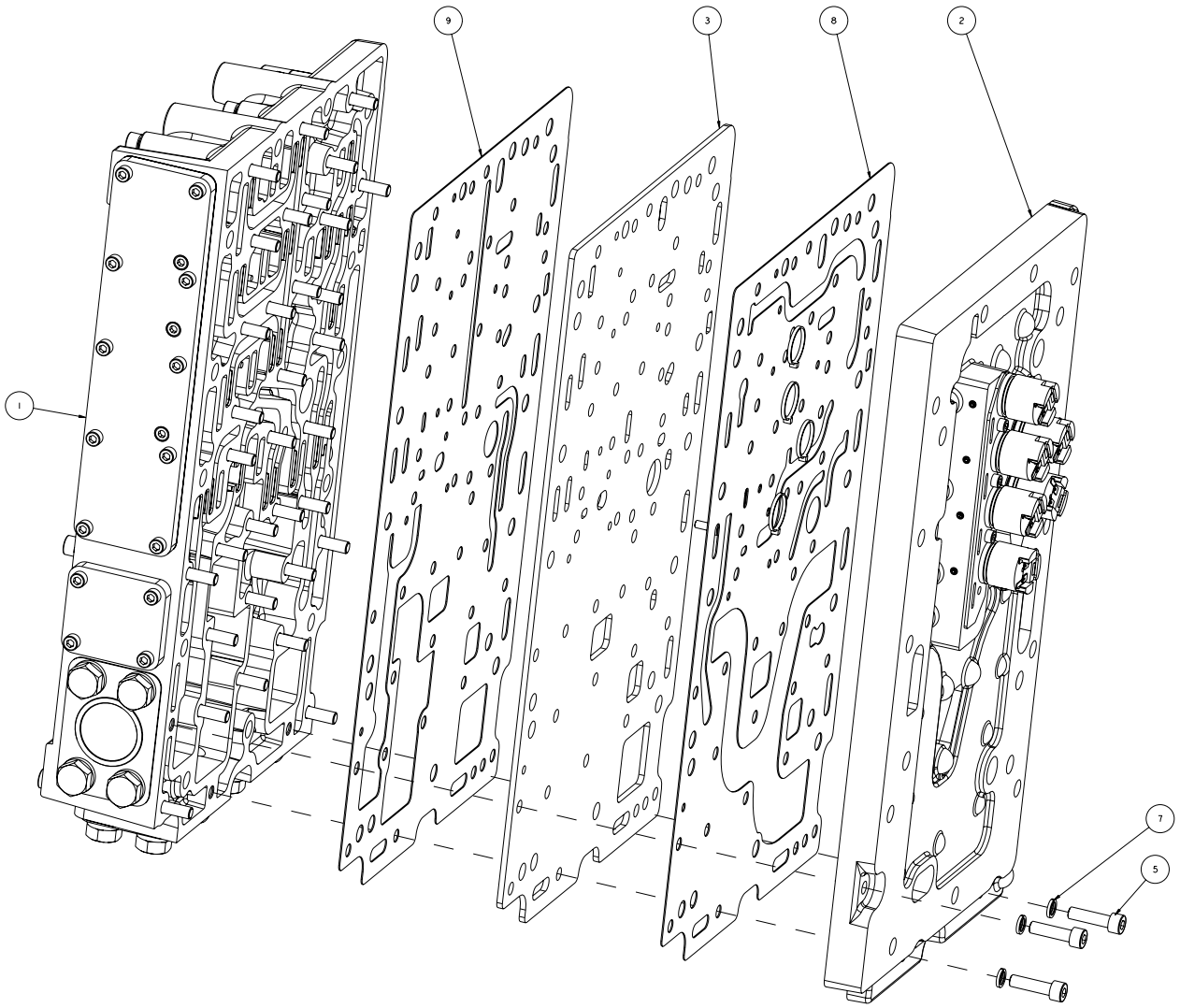
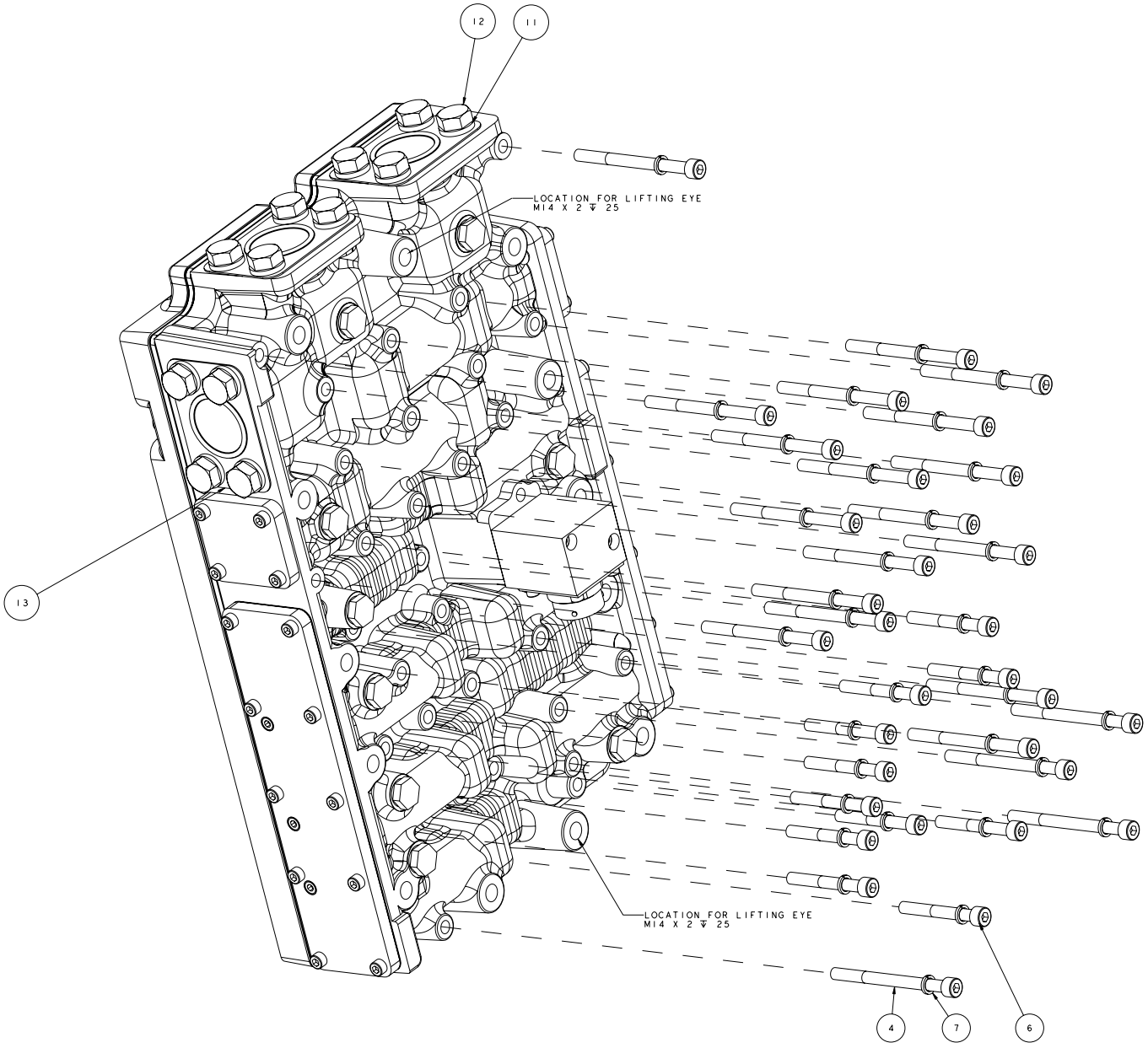


Figure 154
Install new control valve to transmission case gasket.

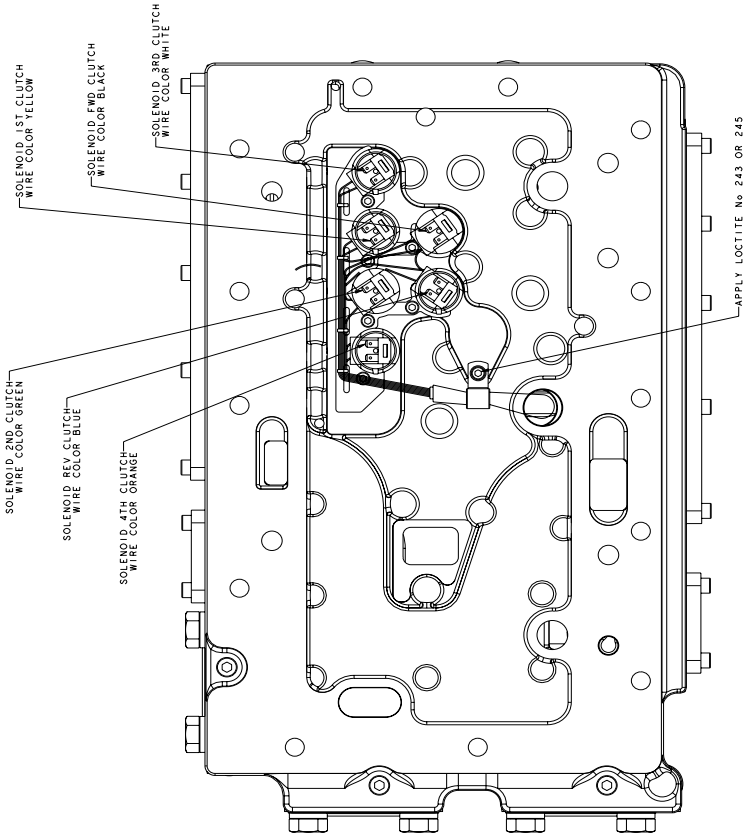
Figure 155
Install screws and torque to specified torque.



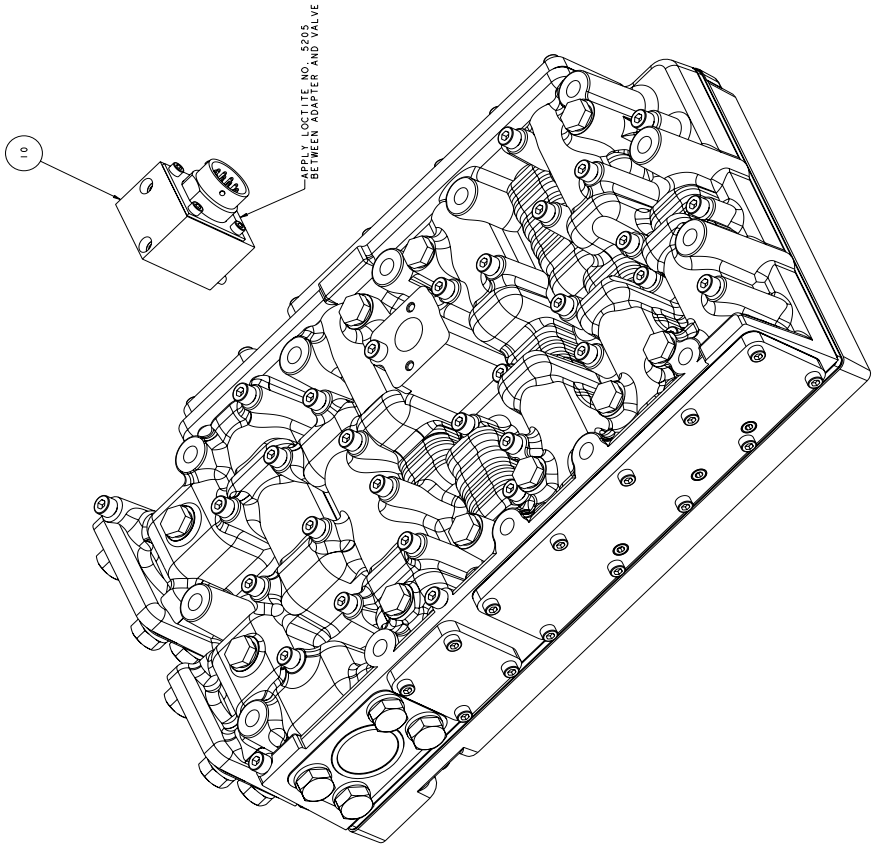
Item	Description	Qty
1	Assy - Control valve	1
2	Assy - Accumulator	1
3	Plate - Spacer	1
5	Screw - Cap	3
7	Lockwasher	3
8	Gasket - Spacer	1
9	Gasket - Control valve	1

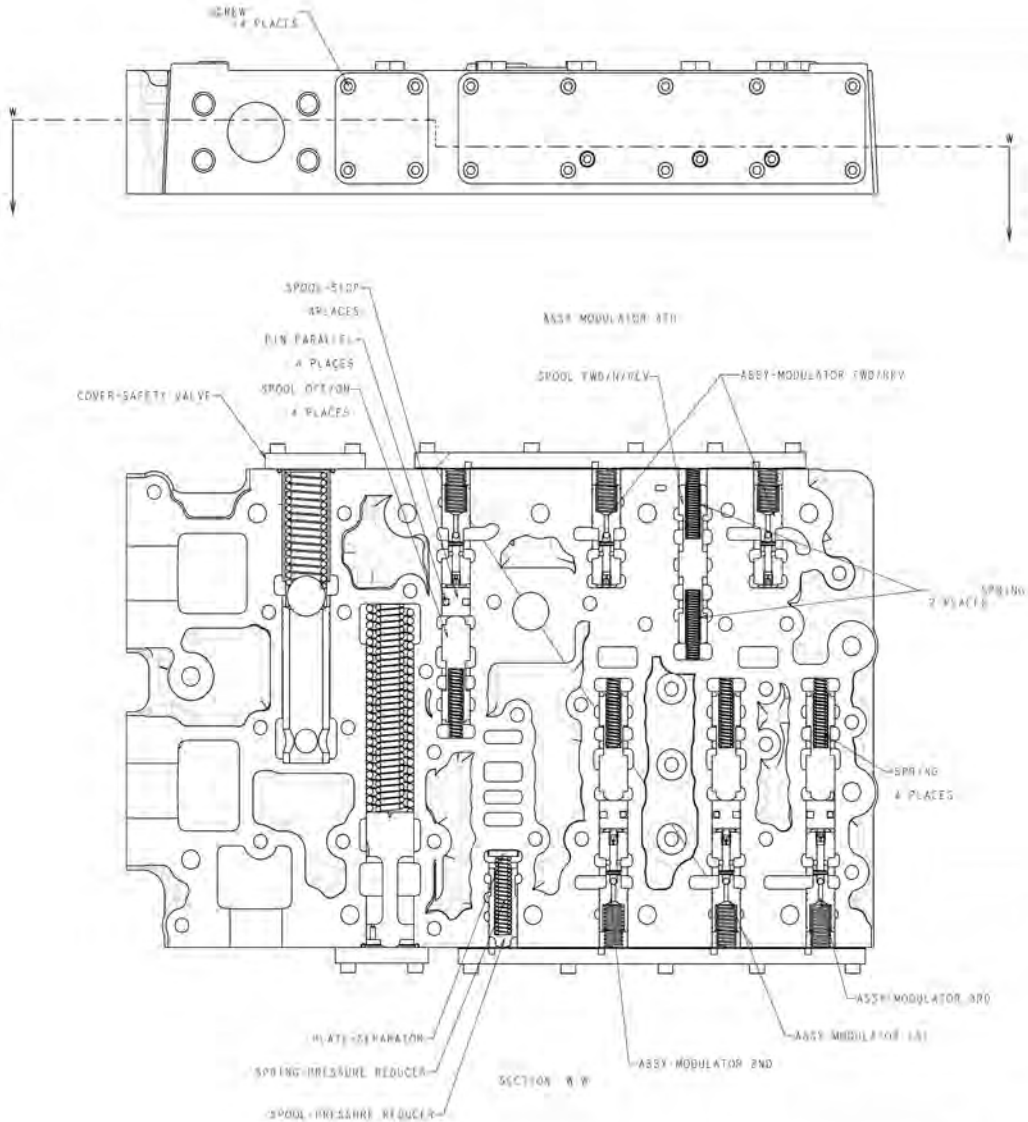


Item	Description	Qty
4	Screw - Cap	22
6	Screw - Cap	11
7	Lockwasher	33
11	Cover - Shipping	2
12	Not used on this model	
13	Cover - Shipping	1



Item	Description	Qty
10	Adaptor - Wiring harness.....	1





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