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DANA P4-400 POWERSHIFT TRANSMISSION

OPERATING INSTRUCTIONS

The P4-400 Powershift Transmission has been designed to provide ease of operation coupled with a full power shift.

The transmission is controlled with two levers located in the driver's compartment.

The directional lever contains the forward, neutral, and reverse positions. This lever should always be in the neutral position when the engine is started to avoid moving or stalling the vehicle.

The range selector lever has four positions which the operator may select at his discretion for use in both forward and reverse.

It is recommended that the operator shift from forward to reverse or reverse to forward with the vehicle at a full stop.

TRANSMISSION OPERATION

With the engine running, the converter charging pump draws oil from the transmission sump and directs it through an oil filter to the pressure regulating valve (350 psi) located in the main valve body. From the pressure regulator valve, oil is then directed to the speed and directional control assembly and to the hydraulically actuated clutches located in the transmission.

When oil pressure in the pressure regulator section exceeds 350 psi the regulator spool is forced against the back-up spring, opening a port located next to the pressure regulator spool. Oil then flows to the converter inlet port. After entering and charging the converter, oil leaves the converter and is directed to the cooler. After leaving the cooler, oil enters the lube pressure regulator section. When oil pressure in the converter regulator section

exceeds 75 psi, the regulator spool is forced open, opening a port located next to the regulator spool. This oil, along with the return oil from the cooler, flows through the lube lines in the transmission, lubricating the clutches and ball bearings. When lube pressure exceeds 30 psi, the lube regulator is forced open, opening a port located next to the lube regulator spool. The excess oil then flows back through the valve body into the transmission and back to the sump.

With the engine running and the directional control spool in neutral, oil is prevented from feeding the high or low range clutch on the input shaft, thus providing a neutral transmission position. It must be noted that with a neutral spool position on the valve body, either high or low range clutch on the range shaft will be engaged at all times.

A P.T.O. is provided which is operable in neutral and low and second gears forward.

LUBRICATION

TYPE OF OIL: Type "A" or Type "C-2" (Dexron) automatic transmission fluid or SAE 10 or 20 mineral oil.

CAPACITY: Approximately 8 U.S. gallons with torque converter and fully charged system (varies with vehicle manufacturer's power train).

OIL CHANGES:

(A) After first 50 hours of operation: Change oil, replace oil filter element, clean suction screen in transmission.
NOTE: Drain oil at 180° F. to 220° F.

(B) Every 250 hours: Replace oil filter element.
NOTE: Use 40 Micron full-flow filter.

(C) Every 500 hours: Change oil, replace oil filter element, clean suction screen in transmission.
NOTE: When draining oil, check magnetic drain plug for accumulation of metal particles; Excessive particles indicate the transmission should be disassembled and inspected.

OIL LEVEL: Check oil level daily with engine running idle and oil at 180° F. to 220° F.

OPERATING TEMPEPATURE: Normal operating temperature at lube system input should be 180° F. - 220° f.

DANA P4-400 POWERSHIFT TRANSMISSION

1. Remove drain plug M-6, and drain transmission fluid.

2. Remove tube assemblies M-10, M-11, M-12, M-14, M-15, M-16, M-19, M-20, M-37, and M-43.

3. Remove 8 capscrews G-7, 4 capscrews G-8, 1 capscrew G-9, 13 lockwashers G-13, and 13 brass washers G-12 to free control valve assembly "G" and gasket G-6 from main case M-5.

4. Remove 8 capscrews M-44 and 8 lockwashers M-45 to free cover plate M-46 and gasket M-47 from main case M-5.

5. Remove yokes or flanges A-23, C-16, E-19, and E-24.

6. Position unit horizontally with input and front output facing downward, and unbolt and remove covers A-3, B-3, D-3, E-3, and related shim packs.

7. Remove sealing rings A-11, B-11, and D-12.

8. Remove 18 bolts M-1 and lockwashers M-2, and using a suitable prying tool in the notches provided, remove main cover M-3 and main housing gasket M-4.

   NOTE: As main cover M-5 is being lifted, tap ball bearing D-13 on range shaft to prevent entire shaft assembly from being removed.

9. Remove output shaft assembly "E" by lifting straingt up.

10. Remove reverse shaft assembly "B" by lifting straight up.

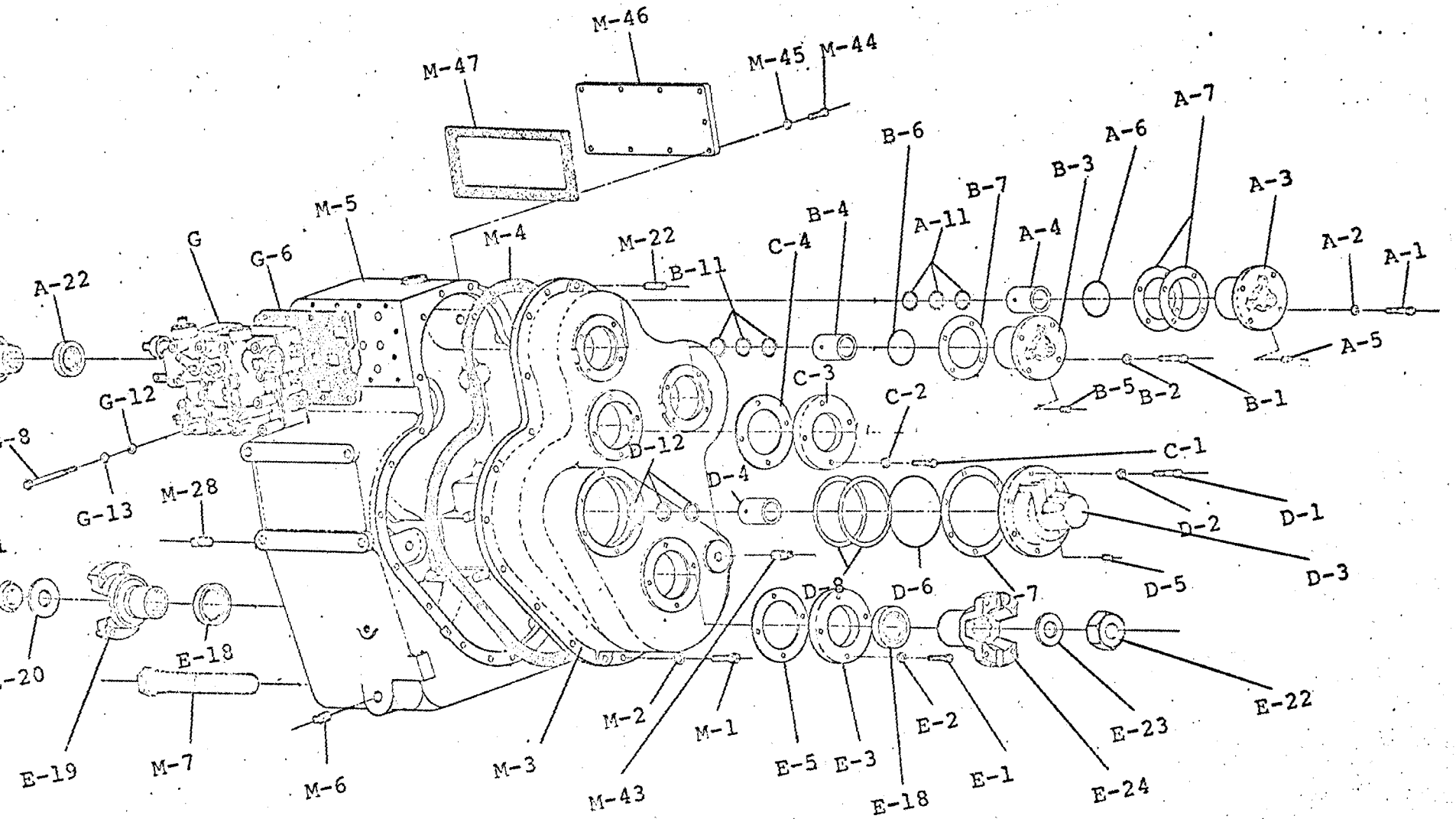
    NOTE: For ease of disassembly, use shaft lifting tool in "Tools: section.

11. Spread input shaft assembly "A" and range shaft assembly "D" apart.

12. Remove intermediate shaft assembly "C", input shaft assembly "A", and range shaft assembly "D".

13. Remove sump screen M-7 and clean throughly.

    NOTE: All oil seals, gaskets, o-rings, and sealing rings should be replaced.



P4-400 MAIN ASSEMBLY

All parts should be throughly cleaned with a suitable solvent after the complete disassembly of the P4-400.

After cleaning, all parts should be inspected, and worn or damaged parts replaced. Small nicks or burrs may be removed with a hone or crocus cloth.

NOTE: Carefully inspect all tapered roller bearing cups and cones for wear, nicks, or chips. If it is necessary to replace a cup or cone, always replace the mating cup or cone.

INPUT SHAFT DISASSEMBLY AND ASSEMBLY

DISASSEMBLY

1. Using a suitable puller, remove taper bearing cone A-20 from input shaft A-15.

2. Press shaft A-15 from clutch assembly A-16, freeing clutch gear A-18.

3. Press shaft A-15 from remaining clutch gear A-13, freeing taper bearing cone A-9.

4. Remove ball bearings A-17 and A-19 from clutch gear A-18, and bearings A-12 and A-14 from clutch gear A-13.

ASSEMBLY

1. Place clutch gear A-13 with ball bearings A-12 and A-14 pressed into each end, with bearing snap rings facing outward, into either end of assembled clutch pack A-16 by turning the clutch gear from side to side until the four clutch discs have mated with the clutch hub.

2. Push input shaft A-15 into clutch pack A-16 and clutch gear A-13 assembly carefully noting the alighment of the two oil holes in the shaft to the two holes in the clutch housing splines.

3. Press ball bearing A-17 onto opposite end of input shaft A-15 noting the downward position of the bearing's snap ring.

4. Center and align clutch discs using a pencil or suitable straight edge.

5. Insert and tap clutch gear A-18 until properly seated on ball bearing A-17.

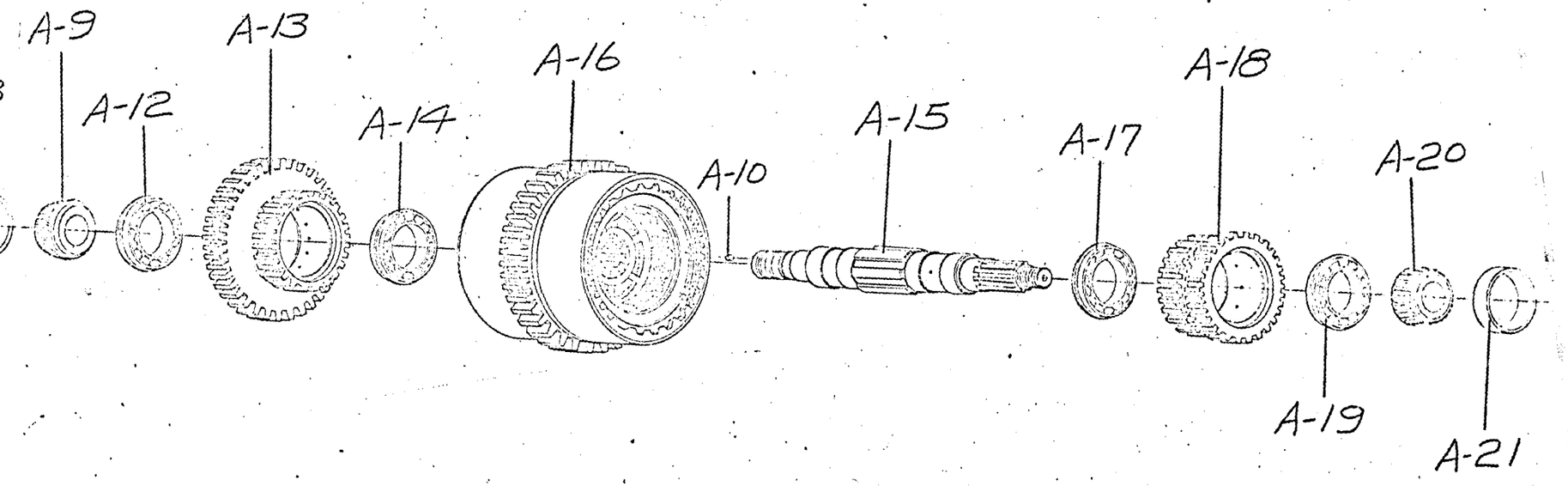
6. If assembled properly, the space between clutch assembly A-16 and clutch gear A-18 will be 1/8 inch.

7. Air test (30 psi min.) both clutches utilizing the oil inlet holes on the shaft. Actuation of the clutches may be observed at lube outlet holes in the clutch housing. Engage each clutch four or five times to assure proper engagement and disengagement of clutches.

8. Press ball bearing A-19 into clutch gear A-18.

9. Press taper bearing cones A-9 and A-20 onto their respective shaft ends.

*NOTE: See "Clutch Disassembly" for further breakdown of clutches.



P4-400
INPUT SHAFT

DISASSEMBLY

1. Remove taper bearing cone B-9 from reverse shaft B-15 using a suitable puller.

2. Press shaft B-15 from clutch assembly B-16, freeing clutch gear B-13.

3. Press shaft B-15 from remaining clutch gear B-18, freeing taper bearing cone B-20.

4. Remove ball bearings B-17 and B-19 from clutch gear B-18, and ball bearings B-12 and B-14 from clutch gear B-13.

NOTE: See "Clutch Disassembly" for further breakdown of clutches.

ASSEMBLY

1. Place clutch gear B-13 with ball bearings A-12 and A-14 pressed into either end, with bearing snap rings facing outward, into either end of assembled clutch pack B-16 by turning the clutch gear from side to side until the four clutch discs have mated with the clutch hub.

2. Push input shaft B-15 into clutch pack B-16 and clutch gear B-13 assembly carefully noting the alignment of the two oil holes in the shaft to the two holes in the clutch housing splines.

3. Press ball bearing B-17 with bearing snap ring facing into clutch assembly onto opposite end of shaft B-15.

4. Center and align clutch discs using a pencil or suitable straight edge.

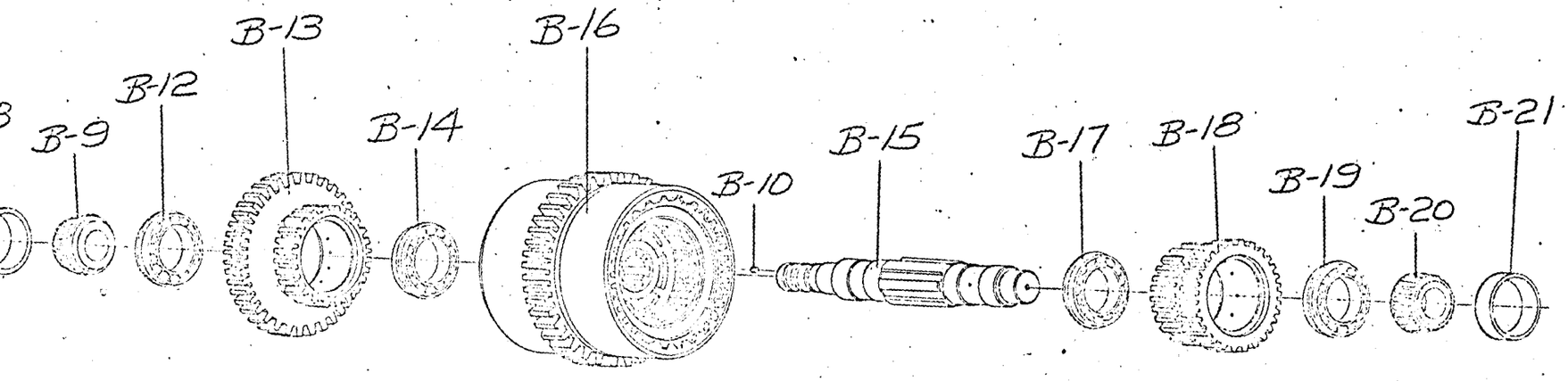
5. Insert and tap clutch gear B-18 until properly seated on ball bearing B-17.

6. If properly assembled, the space between clutch pack B-16 and clutch gear B-18 will be 1/8 inch.

7. Air test clutch (30 psi min.) four or five times utilizing oil inlet hole at top of shaft and observing operation of clutch through lube outlet holes in clutch housing.

8. Press ball bearing B-19 into clutch gear B-18.

9. Press taper bearing cones B-9 and B-20 onto their respective shaft ends.



P4-400
REVERSE SHAFT

DISASSEMBLY

1. Using a suitable puller, remove taper bearing cones C-7 and C-12 from intermediate shaft C-10.

2. Slide gears C-8, C-9, and C-11 from shaft C-10.

ASSEMBLY

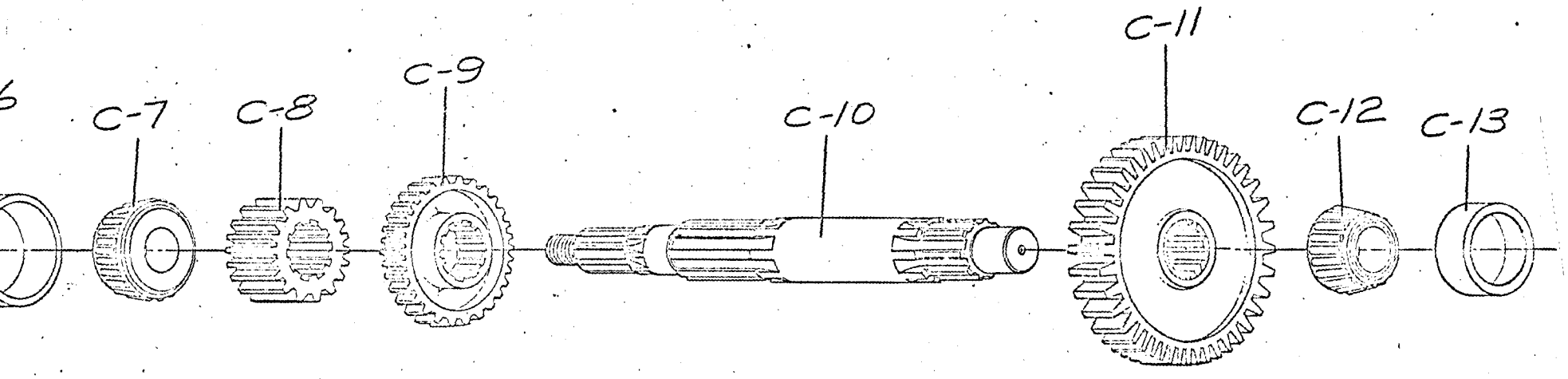
1. Slide gear C-9 with long hub end facing inward onto long spline end of intermediate shaft C-10.

2. Slide gear C-8 onto shaft C-10 next to gear C-9.

3. Press taper bearing cone C-7 onto shaft C-10.

4. Slide gear C-11 with long hub end facing inward onto opposite end of shaft C-10.

5. Press taper bearing cone C-12 onto shaft C-10.



P4-400
P.T.O. SHAFT

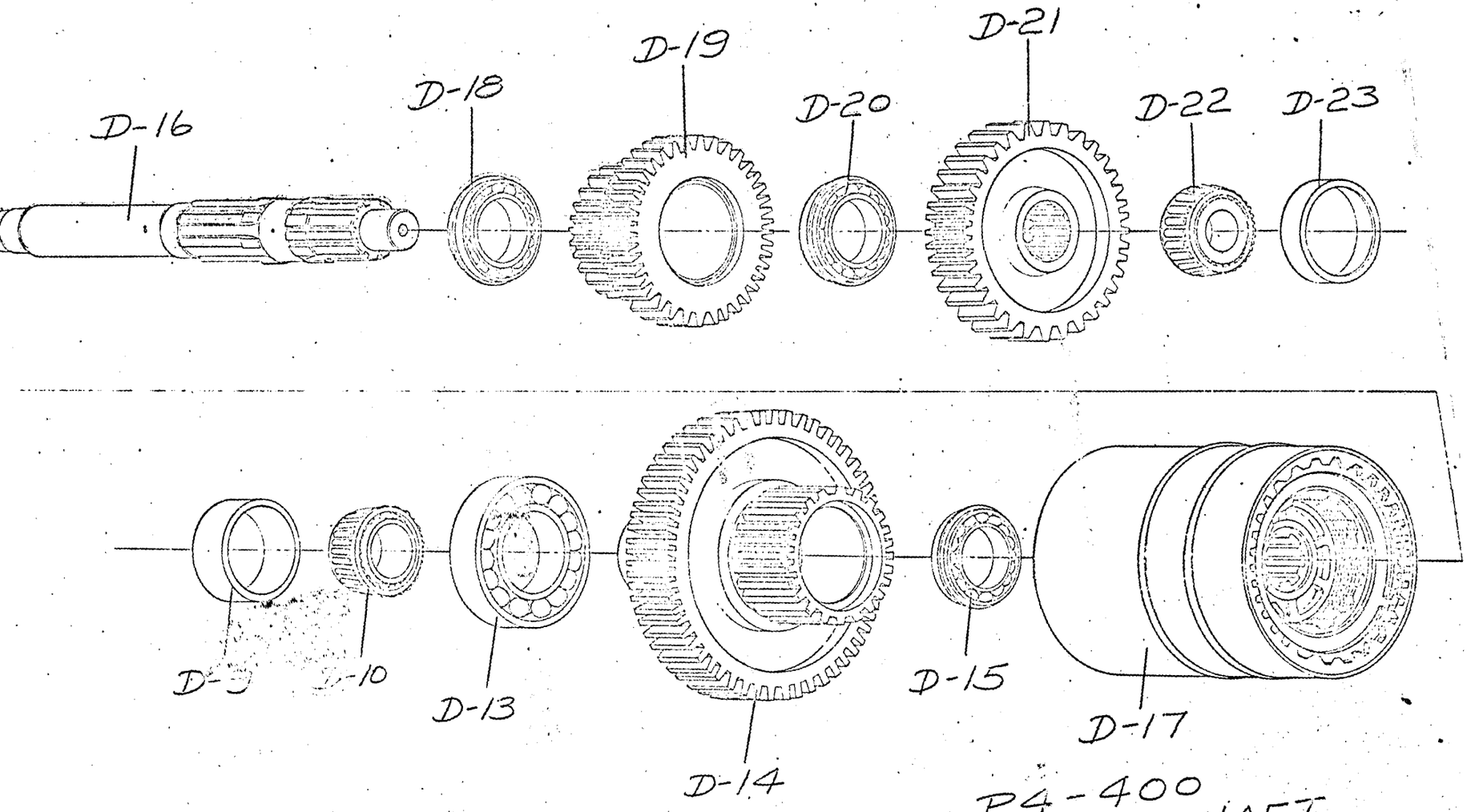
DISASSEMBLY

1. Using a suitable puller, pull taper bearing cone D-10 from range shaft D-16.
2. Remove gear D-14 along with ball bearings D-15 and D-13.
3. Remove clutch assembly D-17 from shaft D-16.
4. Pull taper bearing cone D-22 from shaft D-16.
5. Slide gear D-21 from shaft D-16.
6. Remove clutch gear D-19 with ball bearings D-18 and D-20 from shaft D-16.
7. Remove ball bearings D-15, D-18, and D-20 from their respective clutch gears.

NOTE: See "Clutch Disassembly" fur further breakdown of clutches.

ASSEMBLY

1. Insert clutch gear D-19 with ball bearings D-18 and D-20 installed, into short end of clutch assembly D-17 by turning clutch gear D-19 from side to side until the four clutch discs have been engaged onto the hub.
2. Push range shaft D-16 into clutch assembly D-17 carefully noting the alighment of two holes in shaft splines to the mating holes in the clutch housing splines.
3. Press ball bearing D-15 with snap ring facing inward into opposite end of clutch assembly.
4. Using a pencil or suitable straight edge, center and align clutch discs.
5. Insert and tap gear D-14 until eight clutch discs have engaged hub.
6. If properly assembled, the space between clutch assembly D-17 and the large gear of D-14 will be 1/8 inch.
7. Press taper bearing cone D-10 onto end of shaft D-16 nearest oil inlet holes.
8. Slide gear D-21 (with longer hub end facing inward) onto shaft D-16.
9. Press taper bearing cone D-22 onto shaft D-16.



P4-400
RANGE SHAFT

10. Air test (30 psi min.) both clutches utilizing the oil inlet holes, Actuation of the clutches may be observed at lube outlet holes in the clutch housing. Engage each clutch four or five times to assure proper actuation.

DISASSEMBLY

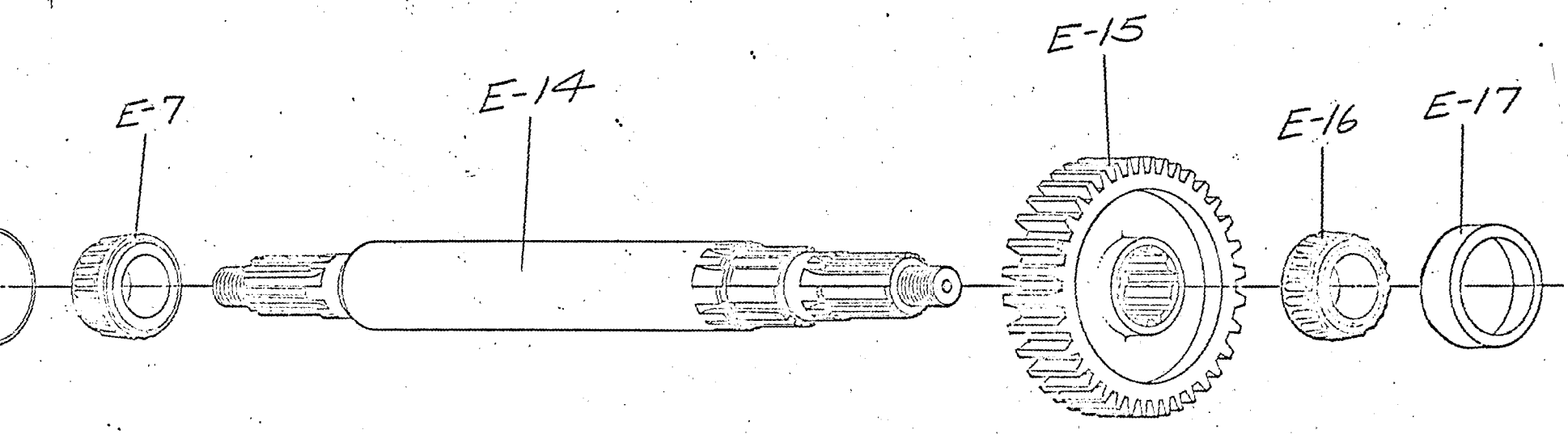
1. Using a suitable puller, remove taper bearing cones E-7 and E-16 from output shaft E-14.

2. Slide gear E-15 from shaft E-14.

ASSEMBLY

1. Slide gear E-15 onto output shaft E-14 with chamfered gear hub facing outward.

2. Press taper bearing cones E-7 and E-16 onto respective shaft ends.



P4-400
OUTPUT SHAFT.

CLUTCH DISASSEMBLY AND ASSEMBLY

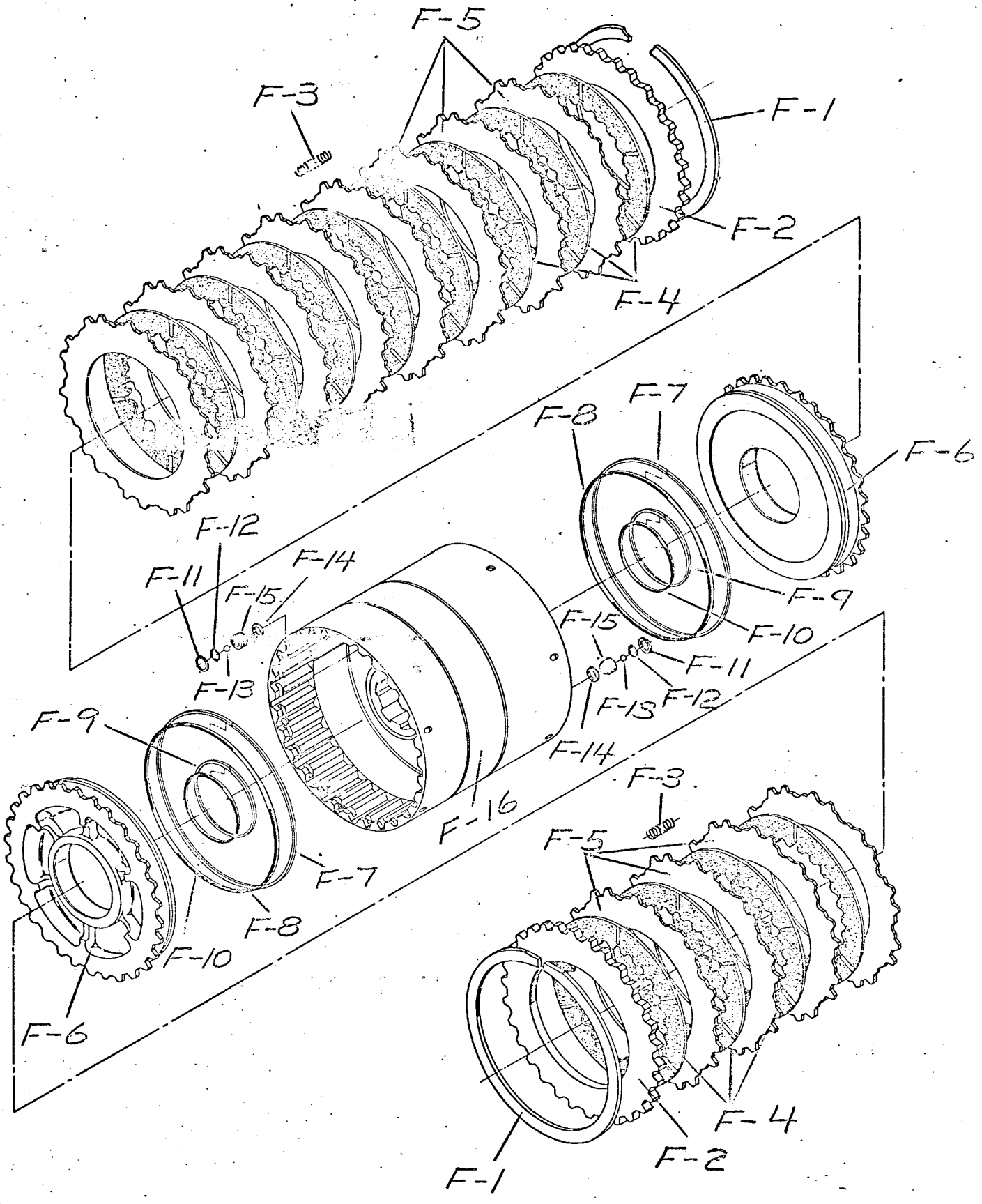
This procedure is to be followed for all clutches:

DISASSEMBLY

1. Remove snap ring F-1.
2. Remove pressure plate F-2, springs F-3, clutch discs F-4, and driving plates F-5 from clutch housing F-16.
3. Remove piston F-6 by turning clutch housing F-16 upside down and tapping housing on bench.
4. Remove sealing ring F-7 and O-ring F-8 from piston.
5. Remove sealing ring F-9 and O-ring F-10 from hub of clutch housing.
6. Remove bleeder assembly by removing snap ring F-11, screen F-12, ball F-13, and retainer F-15 with O-ring F-14.

ASSEMBLY

1. Install retainer F-15 with O-ring F-14, ball F-13, screen F-12 and snap ring F-11 in clutch housing.
2. Install O-ring F-10 and then sealing ring F-9 on hub of clutch housing. (See Tools Section for compression tool for teflon sealing rings.)
3. Install O-ring F-8 and sealing ring F-7 on piston F-6.
4. Install piston F-6 into clutch housing.
5. Install driving plate F-5 and then disc F-4 into clutch housing.
6. Install 10 release springs F-3 and then continue to alternate driving plates F-5 and clutch discs F-4 until four (or eight) of each are assembled into clutch housing.
7. Install pressure plate F-2 with chamfer on I.D. facing up.
8. Press pressure plate F-2 down to allow installation of snap ring F-1.


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

1. Remove 4 capscrews G-10, 4 lockwashers G-13, and 4 brass washers G-12 to separate upper (G-1) and lower valve (G-5) bodies, separator plate G-3 and gaskets G-2 and G-4.

UPPER VALVE BODY (G-1)

2. Remove roll pins, G-33, G-38, and G-43 from each regulator retaining plug.

   CAUTION: Face regulator retaining plugs downward while removing roll pins to avoid sudden release of spring pressure.

3. Remove pressure regulator plugs G-35, G-40, and G-45; springs G-36, G-41, and G-46; and piston G-37, G-42, and G-47.

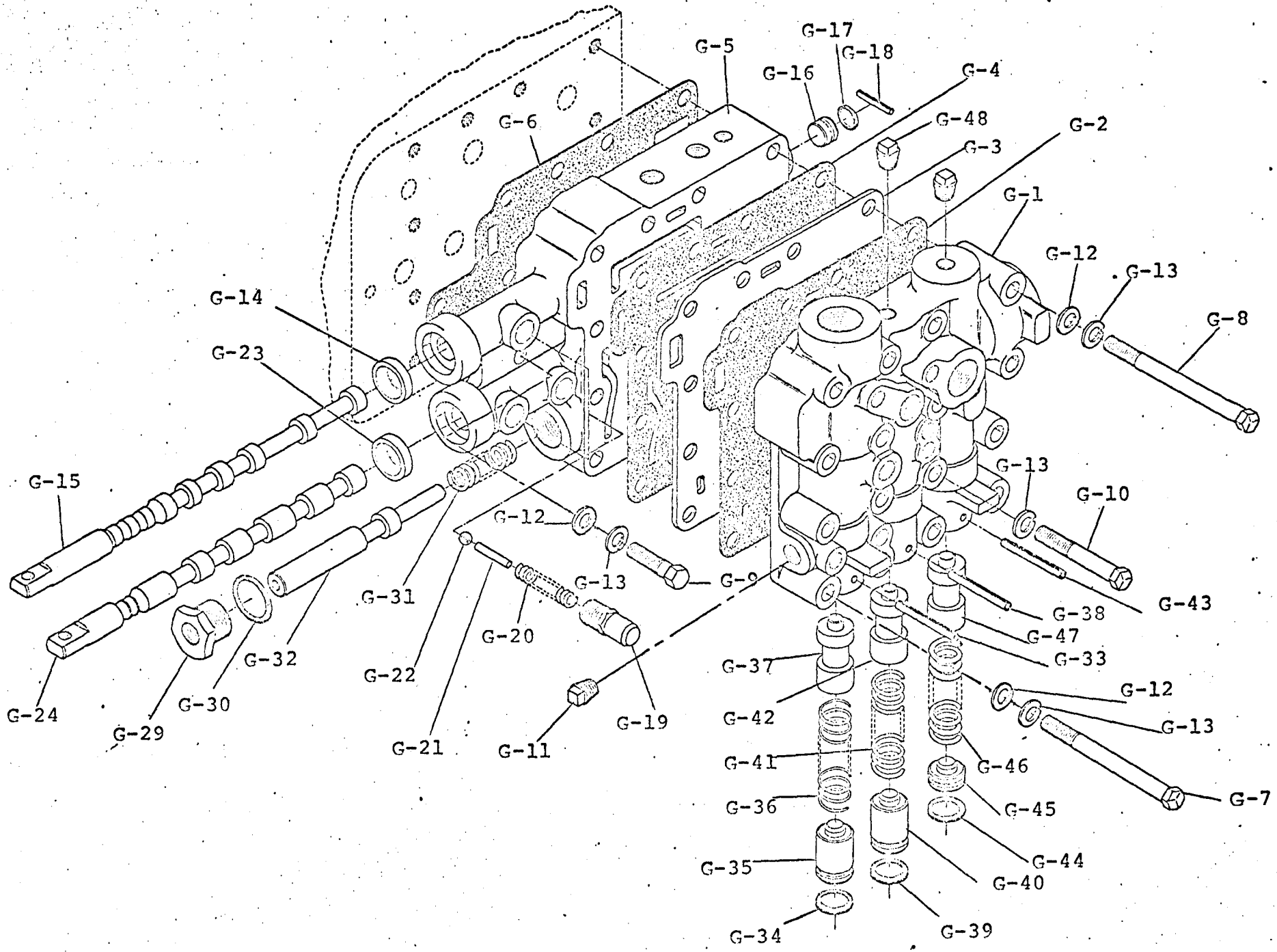
4. Remove 9 pressure check port plugs G-48 and any remaining elbows etc. from upper valve body.

LOWER VALVE BODY (G-5)

5. Remove 2 poppet assemblies which include poppet retainer G-19 and G-25, poppet spring G-20 and G-26, poppet pin G-21 and G-27, and poppet ball G-22 and G-28.

6. Pull speed selector piston G-15 and F-N-R piston G-24 from valve body G-5 along with oil seals G-14 and G-23.

7. Remove roll pin G-18 and plug G-16 with O-ring G-17.



MAIN VALVE A. EMBLY

MAIN VALVE ASSEMBLY

1. After thoroughly cleaning all valve parts, coat valve body bores with the same fluid to be used in transmission.

UPPER VALVE BODY (G-1)

2. Insert pistons G-37, G-42, and G-47 into pressure regulator bores and work pistons in and out to insure free operation.

   NOTE: Do not break sharp edges on pistons. Use only crocus or emery cloth to remove scratches or eliminate tight fits.

3. Insert springs G-36 (color coded yellow), G-41 (color coded blue), and G-46 (color coded green) into proper bores.

4. Replace retaining plugs G-35, G-40, and G-45 with o-rings G-34, G-39, and G-44 into proper bores.

5. Compress springs and retaining plugs to insert roll pins G-33, G-38, and G-43.

6. Replace 9 pressure check port plugs G-48, elbows, and miscellaneous hardware.

LOWER VALVE BODY (G-5)

7. Replace plug G-16 with O-ring G-17 and insert roll pin G-18.

8. Replace speed selector piston G-15, F-N-R piston G-24 and work in and out to insure free operation.

9. Press oil seals G-14 and G-23 into place.

10. Replace 2 poppet assemblies, poppet ball G-22 and G-28, poppet spring G-20, and G-26, poppet pin G-21 and G-27, and poppet retainer G-19 and G-25.

11. Bolt upper valve body G-1, separator plate G-3 with gaskets G-2 and G-4 on proper side, to lower valve body G-5 using 4 capscrews G-10, 4 lockwashers G-13, and 4 brass washers G-12.

    NOTE: Brass washer G-12 to be under lockwashers G-13.

If it is necessary to replace any of the wear sleeves A-4, B-4, or D-4 in the oil inlet covers A-3, B-3, or D-3, proceed as follows:

A. Remove set screw A-5, B-5, or D-5.

B. Heat sleeve and oil inlet cover to 500°F. and separate parts while hot.

C. Clean bore of oil inlet cover with mineral spirits.

To reinstall sleeve:

A. Insure that oil inlet cover and sleeve are free of greese and oil.

B. Coat bore of oil inlet cover and outside diameter of sleeve with a light application of "Locktite" retaining compound.

C. Assemble sleeve into oil inlet cover and align parts to accept set screw.

D. Install set screw and allow compound to harden four hours before using.

Shaft sub-assemblies will now be installed into main case M-5 as follows:

1. Press taper bearing cups A-21, B-21, C-13, D-23, and E-17 into main case M-5.

2. Press oil seals A-22 and E-18 into main case M-5.

3. Press taper bearing cups A-8, B-8, C-6, E-6 into main cover M-3.

4. Press ball bearing D-13 into main cover M-3 and taper bearing cup D-9 into oil inlet cover D-3.

5. Install intermediate shaft assembly (C) into main housing M-5.

6. Install main case gasket M-4 and dowel pins M-22 and M-23. Bolt main cover M-3 into place using 6 cap-screws M-1 and 6 lockwashers M-2 in random locations. Torque bolts from 70-100 ft. lbs.

7. Install bearing cover C-3 (without O-ring C-5) and 4 bolts C-1 and 4 lockwashers C-2. Tighten bolts until bearings bind slightly in rotation.

8. Measure gap between bearing cover C-3 and main cover using a feeler gage, and provide shims C-4 to give .003"-.005" end play.

9. Remove bearing cover C-3 and main cover M-3. Also remove shaft assembly (C).

10. Install 4 remaining shaft assemblies (A), (B), (D), and (E) into main case M-5, and bolt main cover M-3 and gasket M-2 back into position.

11. Bolt remaining covers A-3, B-3, D-3, and E-3 into place using respectively capscrews A-1, B-1, D-1, and E-1 and lockwashers A-2, B-2, D-2, and E-2. Shim each shaft as in steps 7 and 8. Loosen individual cover bolts after completion of each shaft.

12. Remove all covers and insure that the proper shim packs remain with their respective covers.

13. To adjust end play for ball bearing D-13 on range shaft assembly (D), measure the length of the pilot on oil inlet cover D-3. IMPORTANT: Include shim pack D-7 when measuring.

14. Measure depth of ball bearing D-13 in main cover M-3, and shim accordingly using shims D-8 to give .010"-.015" end play.

15. Remove main cover M-3 again, tapping on ball bearing D-13 to prevent range shaft assembly (D) from being lifted out with cover.

16. Remove reverse shaft assembly (B).

17. Lift input shaft assembly (A) slightly and install intermediate shaft assembly (C).

18. Re-install reverse shaft assembly (B) and bolt main cover M-3 and main gasket M-2 to main case M-5 using 18 capscrews M-1 and 18 lockwashers M-2.

19. Install sealing rings A-11, B-11, and D-12 onto their respective shafts.

20. Place O-rings A-6, B-6, and D-6 onto their respective covers.

21. Install 5 covers A-3, B-3, C-3, D-3, and E-3 and shim packs A-7, B-7, C-4, D-7, D-8, and E-5 being careful not to damage O-rings or sealing rings on shafts.

22. Install gasket G-6 onto main case M-5 and bolt main valve body (C) into position using 8 capscrews G-7, 4 capscrews G-8, 1 capscres G-9, 13 lockwashers G-13, and 13 brass washers G-12.

    NOTE: Brass washers G-12 to be under lockwashers G-13.

23. Install gasket M-47 and cover plate M-46 onto main case M-5 using 8 capscrews M-14, 8 lockwashers M-44.

24. Replace tube assemblies M-10, M-11, M-12, M-14, M-15, M-16, M-19, M-20, M-37, and M-43.

25. Replace sump screen M-7, magnetic drain plug M-6.

26. Replace yokes or flanges A-23, C-16, E-19, and E-24.

CHART OF TORQUE LOADS

ITEM	TORQUE (FT. LBS.)
3/8 - 16 Bolt	27 - 32
1/2 - 13 Bolt	70 - 100
Input Yoke Nut	150 - 180
Output Yoke Nut	270 - 300

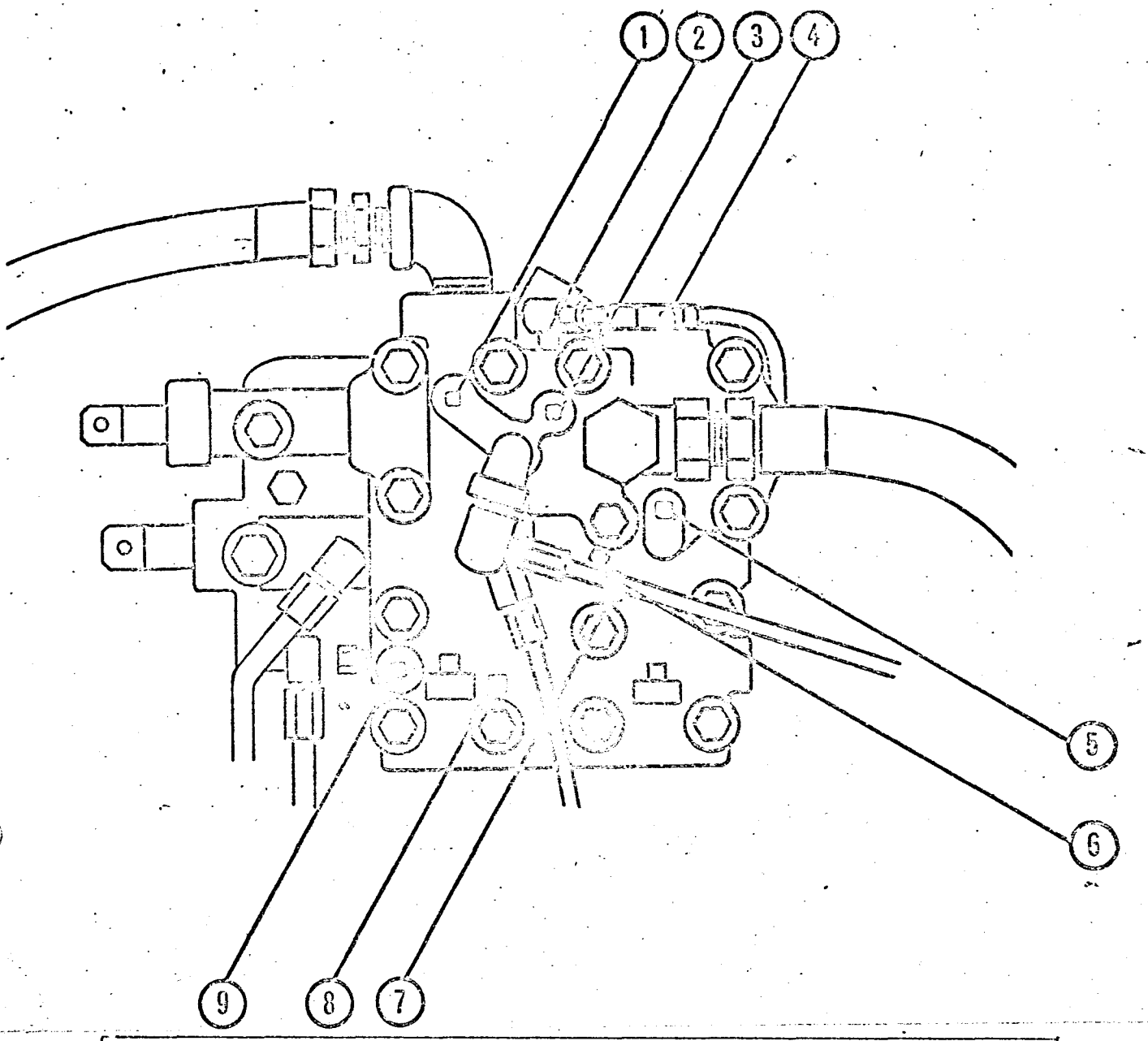
The following information is given as an aid in locating and correcting transmission problems. In determining the source of trouble it is necessary to consider the torque converter charging pump, transmission, oil cooler, and connecting hydraulic lines as a complete system.

If remote control linkages are used, a check should be made to make sure that all linkage is properly adjusted and that balls are properly seated in value spool detents. Many times improper linkage adjustment is responsible for the transmission failing to transmit power.

Whenever improper transmission performance is evident the following pressure checks should be made on the main valve body. (See next page.)

Pressure checks should not be attempted when the oil is cold. Oil temperature should be 180 degrees F. to 220 degrees F. and engine running at idle.

The following chart will aid in solving problems which have been found by improper pressure recordings.



P4-400 PRESSURE CHECK POINTS
ON VALVE ASSEMBLY (G) FOR 4 SPEEDS REVERSE

1. Lube pressure - 30 psi
2. Clutch 4 (1st & 2nd For.) (1st & 2nd Rev.) 350 psi
3. Converter pressure - 75 psi
4. Clutch 3 (3rd & 4th For.) (3rd & 4th Rev.) 350 psi
5. High pressure - 350 psi
6. Clutch 2 (2nd & 4th For.) 350 psi
7. Clutch 1 (1st & 3rd For.) 350 psi
8. Clutch 5 (1st & 3rd Rev.) 350 psi
9. Clutch 6 (2nd & 4th Rev.) 350 psi

2-10-70

LOW CLUTCH PRESSURE

	CAUSE		REMEDY
A.	Low oil level	A.	Fill to proper level
B.	Clutch pressure regulator spool stuck in open position.	B.	Remove spool from valve body - clean spool and valve body bore.
C.	Clutch pressure regulator spring broken	C.	Replace spring
D.	Broken or worn sealing ring on shaft	D.	Replace sealing rings
E.	Broken or worn sealing ring on clutch piston	E.	Replace sealing ring
F.	Excessively worn sleeve in oil inlet cap	F.	Replace sleeve
G.	Broken or worn sealing ring on clutch housing hub	G.	Replace sealing ring
H.	Bleeder valve in clutch housing in open position or plugged	H.	Clean bleeder valve. Check holes in clutch housing to see if they are plugged.
I.	Shuttle valve leaking	I.	Replace shuttle valve
J.	Internal leakage in valve body	J.	Replace gaskets
K.	Loose valve body bolts	K.	Tighten bolts

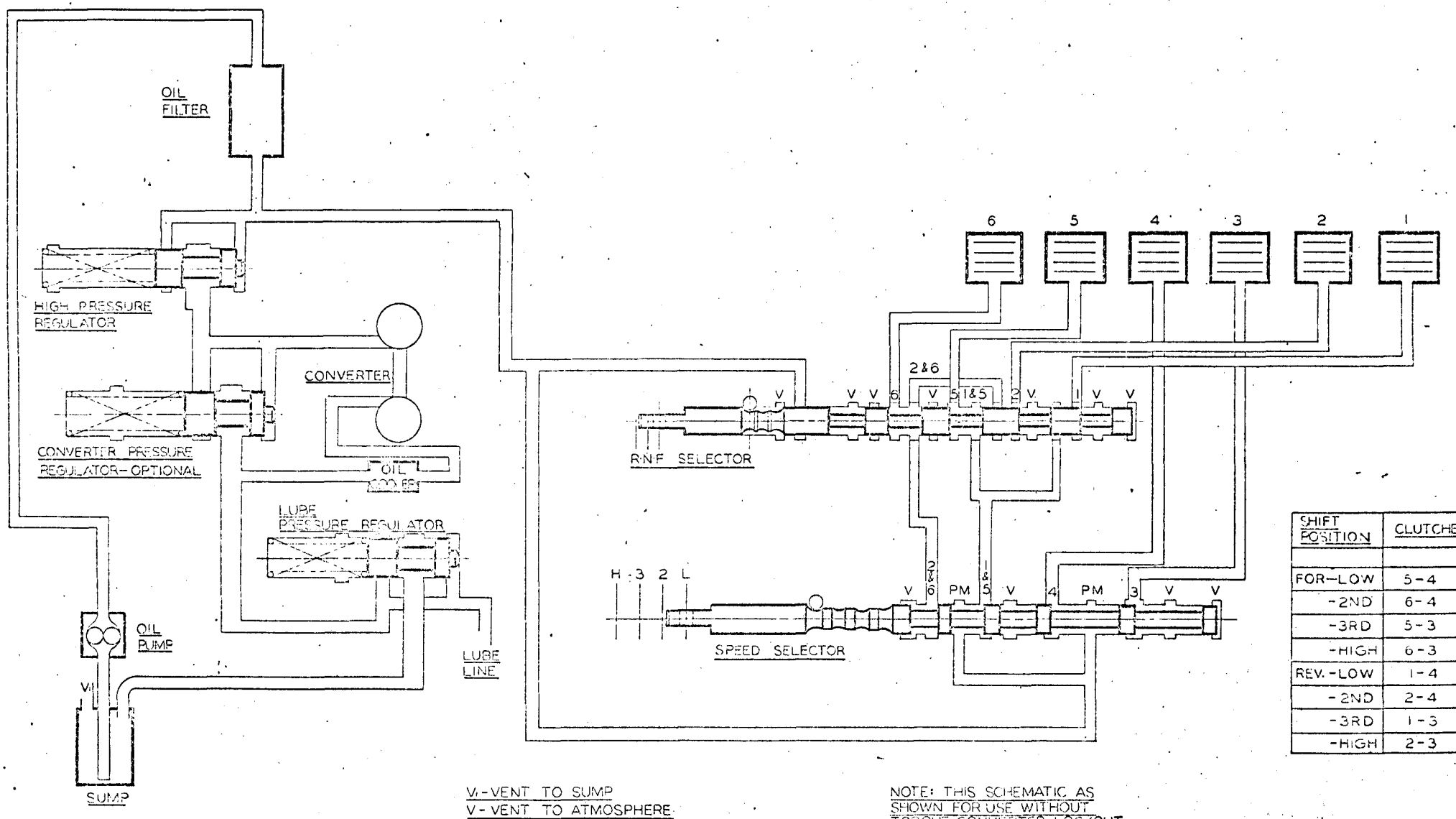
LOW PRESSURE AT "CONVERTER PRESSURE" PORT

CAUSE	REMEDY
A. Low oil level	A. Fill to proper level
B. Converter pressure regulator spool stuck in open position	B. Remove spool from valve body - clean spool and valve body bore.
C. Converter pressure regulator spring broken	C. Replace spring
D. Internal leakage in valve body	D. Replace gaskets
E. Loose valve body bolts	E. Tighten bolts

LOW PRESSURE AT LUBE CHECK PORT

	CAUSE		REMEDY
A.	Low oil level	A.	Fill to proper level
B.	Lub. pressure regulator spool stuck in open position	B.	Remove spool from valve body - clean spool and valve body bore.
C.	Lub. pressure regulator spring broken	C.	Replace spring
D.	Internal leakage in valve body	D.	Replace gaskets
E.	Loose valve body bolts	E.	Tighten bolts

HYDRAULIC SCHEMATIC



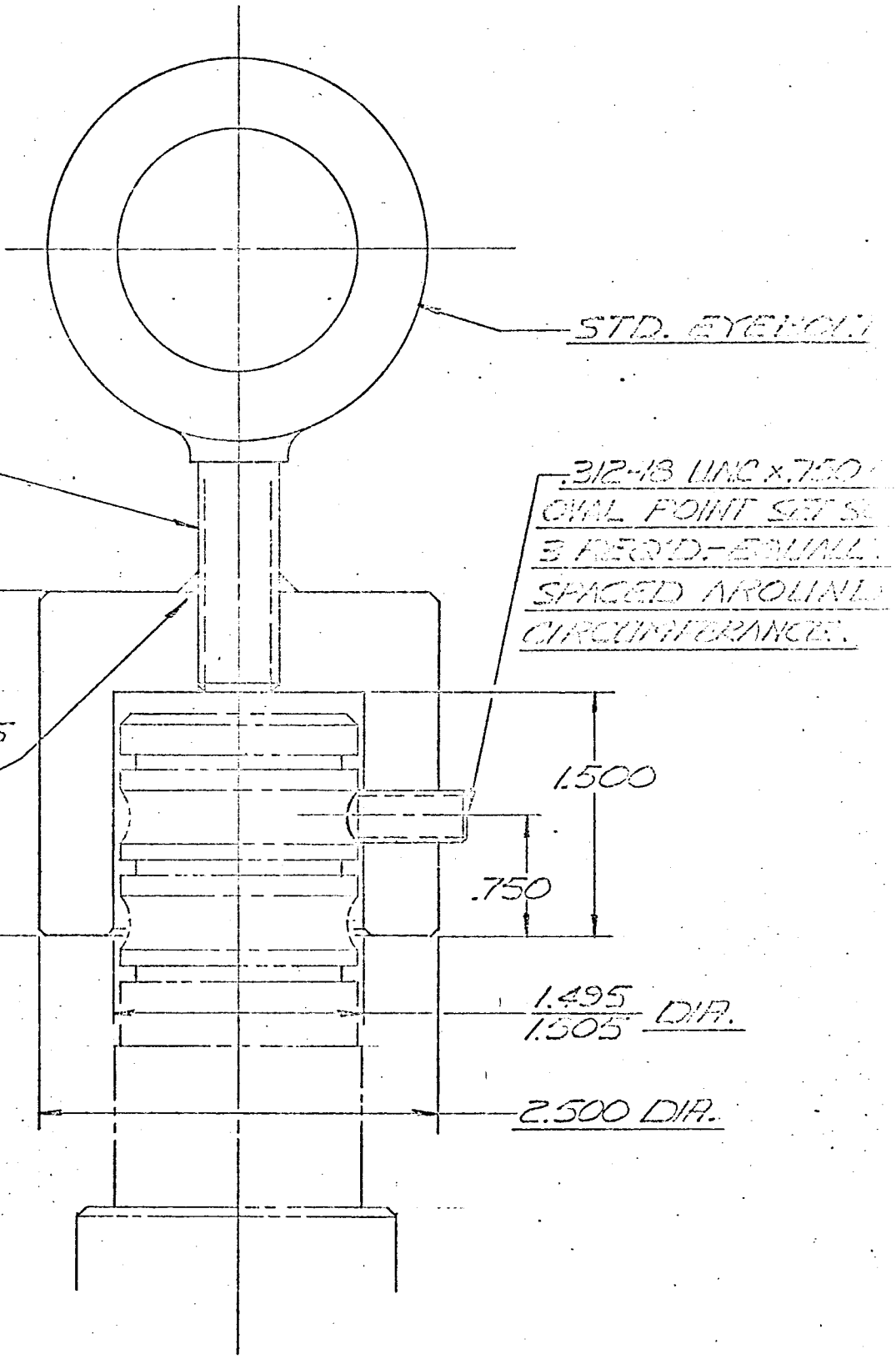
SHIFT POSITION	CLUTCHES
FOR-LOW	5-4
-2ND	6-4
-3RD	5-3
-HIGH	6-3
REV.-LOW	1-4
-2ND	2-4
-3RD	1-3
-HIGH	2-3

V-VENT TO SUMP
V-VENT TO ATMOSPHERE

NOTE: THIS SCHEMATIC AS SHOWN FOR USE WITHOUT TORQUE CONVERTER LOCKOUT CLUTCH.

SELECTORS SHOWN IN FORWARD LOW POSITION

SHAFT LIFTING TOOL



For teflon Ring Compressors:

Snap-on Tools Corp.
Kenosha, Wisconsin 53140

RCL-30 2⅛"-5"
RC-50C 3½"-7"

405067-3 BILL OF MATERIAL
INPUT SHAFT ASSEMBLY (A)

ITEM	PART NAME	PART NO.
A-1	CAPSCREW, HEX HEAD (.375-16 X 1.250)	500398-12
A-2	LOCKWASHER (.375 DIA.)	500357-11
A-3	COVER, OIL INLET - INPUT	748-22-3
A-4	SLEEVE, OIL INLET COVER	745-203-1
A-5	SET SCREW, SELF-LOCKING	500953-4
A-6	O-RING, OIL INLET COVER	748-463-3
A-7	SHIM, INPUT COVER (.005") (.007") (.020")	745-228-1-1 745-228-1-2 745-228-1-3
A-8	TAPER BEARING CUP	550765
A-9	TAPER BEARING CONE	550764
A-10	PLUG, C'SUNK HEX (.062-27)	500131-3
A-11	SEALING RING	745-381-2
A-12	BALL BEARING	550541
A-13	CLUTCH GEAR, High (44T)	748-196-2
A-14	BALL BEARING	550541
A-15	SHAFT, INPUT	748-30-1
A-16	DUAL HYDRAULIC CLUTCH ASSEMBLY (COMPLETE)	420146-2X
A-17	BALL BEARING	550541
A-18	CLUTCH GEAR, Low & Reverse (31T)	748-196-1
A-19	BALL BEARING	550541
A-20	BEARING CONE	550764
A-21	BEARING CUP	550765
A-22	OIL SEAL, INPUT SHAFT	735-463-11

405067-3 BILL OF MATERIAL
INPUT SHAFT ASSEMBLY (A)

ITEM	PART NAME	PART NO.
A-23	END YOKE, INPUT	450226
A-24	WASHER (1.000 DIA.)	500365-55
A-25	LOCKNUT (1.000-14)	501120-1

405067-3 BILL OF MATERIAL
REVERSE SHAFT ASSEMBLY (B)

ITEM	PART NAME	PART NO.
B-1	CAPSCREW, HEX HEAD (.375-16 X 1.250)	500398-12
B-2	LOCKWASHER (.375 DIA.)	500357-11
B-3	COVER, OIL INLET - REVERSE	748-22-3
B-4	SLEEVE, OIL INLET COVER	745-203-1
B-5	SET SCREW, SELF-LOCKING	500953-4
B-6	O-RING, OIL INLET COVER	748-463-3
B-7	SHIM, REVERSE COVER (.005") (.007") (.020")	745-228-1-1 745-228-1-2 745-228-1-3
B-8	TAPER BEARING CUP	550765
B-9	TAPER BEARING CONE	550764
B-10	PLUG, C'SUNK HEX (.062-27)	500131-3
B-11	SEALING RING	745-381-2
B-12	BALL BEARING	550541
B-13	CLUTCH GEAR, High (44T)	748-196-2
B-14	BALL BEARING	550541
B-15	SHAFT, REVERSE	748-30-12
B-16	DUAL HYDRAULIC CLUTCH ASSEMBLY (COMPLETE)	420146-2X
B-17	BALL BEAPING	550541
B-18	CLUTCH GEAR, Low & Reverse (31T)	748-196-1
B-19	BALL BEARING	550541
B-20	TAPER BEARING CONE	550764
B-21	TAPER BEARING CUP	550765

405067-3 BILL OF MATERIAL
INTERMEDIATE SHAFT ASSEMBLY (C)

ITEM	PART NAME	PART NO.
C-1	CAPSCREW, HEX HEAD (.375-16 X 1.250)	500398-10
C-2	LOCKWASHER (.375 DIA.)	500357-11
C-3	COVER, INTERMEDIATE SHAFT	748-22-7
C-4	SHIM, INTERMEDIATE SHAFT COVER (.005")	748-228-4-1
	(.007")	748-228-4-2
	(.020")	748-228-4-3
C-6	TAPER BEARING CUP	555901
C-7	TAPER BEARING CONE	555902
C-8	GEAR, LOW RANGE (18T)	748-196-4
C-9	GEAR, INTERMEDIATE (28T)	745-196-4
C-10	SHAFT, INTERMEDIATE	748-30-16
C-11	GEAR, INTERMEDIATE (41T)	748-196-3
C-12	TAPER BEARING CONE	555900
C-13	TAPER BEARING CUP	550216

405067-3 BILL OF MATERIAL
RANGE SHAFT ASSEMBLY (D)

ITEM	PART NAME	PART NO.
D-1	CAPSCREW, HEX HEAD (.375-16 X 1.000)	500398-10
D-2	LOCKWASHER (.375 DIA.)	500357-11
D-3	COVER, OIL INLET - RANGE	748-22-5
D-4	SLEEVE, OIL INLET COVER	745-203-1
D-5	SET SCREW, SELF-LOCKING	500953-4
D-6	O-RING, OIL INLET COVER	748-463-5
D-7	SHIM, OIL INLET COVER (.005") (.007") (.020")	748-228-2-1 748-228-2-2 748-228-2-3
D-8	SHIM, OIL INLET COVER	748-228-3
D-9	TAPER BEARING CUP	550615
D-10	TAPER BEARING CONE	550766
D-11	PLUG, C'SUNK HEX (.062-27)	500131-3
D-12	SEALING RING	745-381-2
D-13	BALL BEARING	550740
D-14	CLUTCH GEAR, LOW (22 & 61 T)	748-196-6
D-15	BALL BEARING	550541
D-16	SHAFT, RANGE	748-30-4
D-17	DUAL HYDRAULIC CLUTCH ASSEMBLY (COMPLETE)	420145-1X
D-18	BALL BEARING	550738
D-19	GEAR, HIGH RANGE (39T)	748-196-5
D-20	BALL BEARING	550738
D-21	GEAR, RANGE DRIVE (27T)	748-196-13
D-22	TAPER BEARING CONE	550766
D-23	TAPER BEARING CUP	550615

405067-3 BILL OF MATERIAL
OUTPUT SHAFT ASSEMBLY (E)

ITEM	PART NAME	PART NO.
E-1	CAPSCREW, HEX HEAD (.375-16 X 1.000)	500398-10
E-2	LOCKWASHER (.375 DIA.)	500357-11
E-3	COVER, OUTPUT SHAFT	748-19-2
E-5	SHIM, OUTPUT SHAFT COVER (.005")	745-228-4-1
	(.007")	745-228-4-2
	(.020")	745-228-4-3
E-6	TAPER BEARING CUP	550763
E-7	TAPER BEARING CONE	550525
E-14	SHAFT, OUTPUT	748-30-14
E-15	GEAR, OUTPUT (46T)	748-196-14
E-16	TAPER BEARING CONE	550762
E-17	TAPER BEARING CUP	555907
E-18	OIL SEAL, OUTPUT SHAFT	720-463-1
E-19	END YOKE, FRONT OUTPUT	450348
E-20	WASHER (1.250 DIA.)	184-W
E-21	LOCKNUT (1.250-18)	500729
E-22	LOCKNUT (1.250-18)	500729
E-23	WASHER (1.250 DIA.)	184-W
E-24	END YOKE, REAR OUTPUT	450225

405067-3 BILL OF MATERIAL
HYDRAULIC CLUTCH ASSEMBLY (F)

ITEM	PART NAME	PART NO.
F-1	SNAP RING, PRESSURE PLATE	745-381-1
F-2	PLATE, CLUTCH PRESSURE	745-548-2
F-3	SPRING, CLUTCH RETURN	745-72-2
F-4	CLUTCH DISC	420149
F-5	PLATE, CLUTCH DRIVE	745-548-1
F-6	PISTON, CLUTCH	745-136-1
F-7	SEALING RING, CLUTCH PISTON	745-463-3
F-8	O-RING, CLUTCH PISTON	745-463-2
F-9	SEALING RING, CLUTCH PISTON	719-381-2
F-10	O-RING, CLUTCH PISTON	745-463-1
F-11	SNAP RING, CLUTCH VALVE	743-381-4
F-12	SCREEN, CLUTCH VALVE	184-505-2
F-13	BALL, CLUTCH VALVE	52-80-1
F-14	O-RING, CLUTCH VALVE	184-463-13
F-15	RETAINER, CLUTCH VALVE	450178
F-16	CLUTCH HOUSING ASSEMBLY (8 Plate) (DUAL)	420147-1X 420148-2X

405067-3 BILL OF MATERIAL
420224-2X CONTROL VALVE ASSEMBLY (G)

ITEM	PART NAME	PART NO.
G-1	BODY, CONTROL VALVE - UPPER	743-501-5
G-2	GASKET, SEPARATOR PLATE - UPPER	743-223-17
G-3	PLATE, SEPARATOR	743-215-2
G-4	GASKET, SEPARATOR PLATE - LOWER	743-223-18
G-5	BODY, CONTROL VALVE - LOWER	743-501-7
G-6	GASKET, CASE & LOWER BODY	743-223-16
G-7	CAPSCREW, HEX HEAD (.375-16 X 4.250)	500398-31
G-8	CAPSCREW, HEX HEAD (.375-16 X 4.500)	500398-32
G-9	CAPSCREW, HEX HEAD (.375-16 X 1.000)	500398-16
G-10	CAPSCREW, HEX HEAD (.375-16 X 2.500)	500398-22
G-12	WASHER (.375 DIA.)	450000
G-13	LOCKWASHER (.375 DIA.)	972-W
G-14	OIL SEAL, SELECTOR PISTON	768-463-5
G-15	PISTON, SELECTOR VALVE	748-136-3
G-16	PLUG, SELECTOR PISTON	743-39-5
G-17	O-RING, SELECTOR PISTON PLUG	183-463-6
G-18	ROLL PIN, SELECTOR PISTON PLUG	500595-15
G-19	RETAINER, POPPET	743-39-2
G-20	SPRING, SELECTOR POPPET	44-72-4
G-21	PIN, SELECTOR POPPET STOP	743-63-2

405067-3 BILL OF MATERIAL
420224-2X CONTROL VALVE ASSEMBLY (G)

ITEM	PART NAME	PART NO.
G-22	BALL, SELECTOR POPPET	50-80-1
G-23	OIL SEAL, SELECTOR PISTON	768-463-5
G-24	PISTON, F-N-R VALVE	743-136-8
G-25	RETAINER, POPPET	743-39-2
G-26	SPRING, F-N-R POPPET	44-72-4
G-27	PIN, F-N-R POPPET STOP	743-63-2
G-28	BALL, F-N-R POPPET	50-80-1
G-33	ROLL PIN, PRESSURE REGULATOR PLUG	500597-22
G-34	O-EING, PRESSURE REGULATOR PLUG	743-463-6
G-35	PLUG, PRESSURE REGULATOR	743-39-4
G-36	SPRING, PRESSURE REGULATOR (30 PSI)	748-72-6
G-37	PISTON, PRESSURE REGULATOR	743-136-6
G-38	ROLL PIN, PRESSURE REGULATOR PLUG	500597-22
G-39	O-RING, PRESSURE REGULATOR PLUG	743-463-6
G-40	PLUG, PRESSURE REGULATOR	743-39-4
G-41	SPRING, PRESSURE REGULATOR (125 PSI)	743-72-6
G-42	PISTON, PRESSURE REGULATOR	743-136-6
G-43	ROLL PIN, PRESSURE REGULATOR PLUG	500597-22

405067- 3BILL OF MATERIAL
420224-2X CONTROL VALVE ASSEMBLY (G)

ITEM	PART NAME	PART NO.
G-44	O-RING, PRESSURE REGULATOR PLUG	743-463-6
G-45	PLUG, PRESSURE REGULATOR	743-39-3
G-46	SPRING, PRESSURE REGULATOR (350 PSI)	743-72-3
G-47	PISTON, PRESSURE REGULATOR	743-136-6
G-48	PLUG, PRESSURE TAP (.125-27)	500118-3

405067-3 BILL OF MATERIAL
MAIN PARTS GROUP (M)

ITEM	PART NAME	PART NO.
M-1	CAPSCREW, HEX HEAD (.500-13 X 1.500)	500400-14
M-2	LOCKWASHER (.500 DIA.)	500357-13
M-3	MAIN COVER	748-16-3
M-4	GASKET, MAIN HOUSING	748-155-1
M-5	MAIN HOUSING	748-15-4
M-6	DRAIN PLUG, MAGNETIC (.750-14)	21-39-1
M-7	SUCTION SCREEN	420278
M-10	TUBE ASSEMBLY, LUBE TEE TO INPUT LUBE	420285X
M-12	TUBE ASSEMBLY, LUBE LINE - INPUT TO REVERSE	420288X
M-15	TUBE ASSEMBLY, LUBE TEE TO RANGE LUBE	420286X
M-22	DOWEL PI (.500 X 1.500)	450065-11
M-23	DOWEL PI (.500 X 1.500)	450065-11
M-27	PLUG (.750-14)	500115-3
M-28	PLUG (.750-14)	500115-3
M-29	PLUG (.50-14)	500114-3
M-30	CONNECTOR, STRAIGHT	501183-9

405067- 3 BILL OF MATERIAL
MAIN PARTS GROUP (M)

ITEM	PART NAME	PART NO.
M-34	90° ELBOW	450278
M-35	SIDE TEE	450279
M-36	TUBE TEE	450349
M-41	PLUG (.250-18)	500133-3
M-44	CAPSCREW, HEX HEAD (.375-16 X 1.000)	500398-10
M-45	LOCKWASHER (.375 DIA.)	500357-11
M-46	PLATE, COVER	748-215-1
M-47	GASKET, COVER PLATE	748-223-1