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PARTS ORDERING INSTRUCTIONS

Should repair parts be required, please specify the model, specification, and serial numbers of your unit as well as the name and number of the parts accompanying your purchase order.

This information tag is attached to your unit.

 SHIFT -  - MATIC	
MODEL	<input type="text"/>
SPEC	<input type="text"/>
SERIAL	<input type="text"/>
MANUFACTURED BY FUNK MANUFACTURING COFFEYVILLE, KANSAS U.S.A.	

You may write to:

Funk Manufacturing
Attn: Parts Department Plant #2
1211 W. 12th Street
Coffeyville, Kansas 67337

Or Telephone:

Area Code (316) 251-3400
Ask for Parts Department

Or TWX 910-740-1908

Thank You
Funk MFG.

DESCRIPTION

The 4000, 1700, 1000 and 1500 Series powershift transmissions all operate on the same principle, the difference being the horsepower rating. However, the 4000 series, having a different pump and valve body, has different pressure ranges that are described in a separate section.

The 1000, 1700 and 1500 Series are forward and reverse transmissions, with the option of 3, 4 or 6 speeds in either direction. Forward motion, reverse motion, and the speeds are obtained through the use of hydraulically actuated multiple disc clutches. These clutches are power absorbing members that can be engaged at full engine power. Shifting under full engine power makes these models a full power shift for the forward and reverse motion in all speeds.

The clutches in these units are hydraulically applied and spring released. Because the clutches are hydraulically controlled, there is automatic compensation for normal wear, which eliminates the need for adjustment. Each clutch uses a paper graphitic friction plate and a polished steel reaction plate.

The power from the engine is transmitted to the Shift-O-Matic™ through a torque converter. The use of the torque converter has two distinct advantages; (1) The converter is essentially a fluid drive, there being no direct mechanical connection through it. This feature creates a very smooth and shock-free drive eliminating engine stalling and lugging. (2) The converter multiplies torque during heavy pull-down loads. When loads are light, the converter transmits the engine power directly at almost engine speeds, and there is no torque multiplication. The net result is an action like a transmission, with infinitely variable and automatic speed ratios. The need for shifting gears, although present, is greatly reduced.

OPERATION

Like all mechanical equipment, the Shift-O-Matic™ Drive will need attention and servicing. Routine checks will help prevent down time. The operator can aid in preventative maintenance by reporting weak or borderline malfunctions.

Because the unit operates "in" oil and "by" oil, most of the maintenance is concerned with oil replenishment and oil cleanliness. The type of service and operating conditions shall determine the maintenance interval. However, as previously stated, it is especially important that the oil be kept clean.

RULES OF OPERATION

1. Check oil level daily, with engine at idle speed and Shift-O-Matic[™] in neutral. Make sure the area around oil level check plug is clean before removing plug.
2. The Shift-O-Matic[™] should always be in the neutral position before starting the engine, or when the vehicle is parked and the engine is running.
3. If the vehicle is to be towed, it will be necessary to run the engine at idle speed to lubricate the clutches.
4. If the oil temperature gauge, which is the converter oil out temperature, rises above 250°F. (121.1°C.) or the warning light comes on, stop the vehicle immediately. Shift to neutral and run the engine at 1000-1200 RPM. The temperature should drop rapidly to the engine water temperature. If the temperature does not drop, trouble is indicated. The trouble should be determined before the vehicle is operated again. Overheating generally occurs due to working in too high of a gear ratio.
5. Do not shut off engine when unit is overheating.

SERVICE

1. When servicing the unit for the first time after vehicle installation and/or after repair, the unit is filled as follows:
 - A. Fill the unit with 5 gallons (18.93 liters) of the recommended lubricant.
 - B. Start engine and run at idle speed to let the hydraulic system charge.
 - C. With the engine at idle speed, finish filling unit to full level. This will take approximately 3 quarts (2.84 liters), but will vary with each application.

NOTE: The oil level is always checked with the engine running at idle speed and the Shift-O-Matic[™] in neutral.

2. Lubrication Recommendations, Series Shift-O-Matic[™] Transmissions. (powershift)

LUBRICANT TYPE:

Commercial Powershift Transmissions Prevailing Ambient Temperature

Recommended Oil Specification

Above -10°F. (-23.3°C.)

Hydraulic Transmission Fluid.
Type C-3 (except Grade 30).

Below -10°F. (-23.3°C)

Hydraulic Transmission Fluid. Type C-3 (except grade 30). Auxiliary preheat required to raise temperature in the sump to a temperature above -10°F. (-23.3°C).

Above 32°F. (0°C)

Hydraulic Transmission Fluid Type C-3, or Type C-3 Grade 30.

**Military Transmissions
Prevailing Ambient
Temperature**

Above -10°F. (-23.3°C)

-10°F. (-17.8°C) to -65°F.
-53.9°C)

Recommended Oil Specification

MIL-L-2104 Grade 10 to latest specification or Hydraulic Transmission Fluid Type C-3.

MIL-L-10295 to latest specification.

NOTE: If auxiliary preheating equipment is available and the sump temperature can be raised to -10°F. (-23.3°C.), it is recommended that MIL-L-2104 Grade 10 oil be used. When changing to oil of different grade, thoroughly flush system with grade oil to be used before refilling.

CAUTION: Do not use MIL-L-10295 when the ambient temperature is consistently above -10°F. (-23.3°C.).

3. It is recommended the oil and oil filter be changed whenever the oil shows traces of contamination, or the effects of high operating temperature evidenced by discoloration or strong odor.

If the oil in the system has become contaminated with metal particles, all the components of the system (oil lines, oil pump, oil filter, control valve, clutches, converter, heat exchanger) must be thoroughly cleaned. Generally this means a tear down of the unit. The metal particles in the oil is evidence of a damaged part.

LUBRICANT AND OIL FILTER CHANGE INTERVALS:

Time:

20 Hours New or overhauled unit drained and refilled with new fluid. (Do not use a flushing fluid.)

50 Hours Operation in severe dust, sand, or in underground environment.

75 Hours Operation in normal off-highway conditions, rapid changes in ambient or unit temperature, or in the presence of chemical fumes.

100 Hours Operation in clean environment. (hard surface roads, minimum dust, etc.)

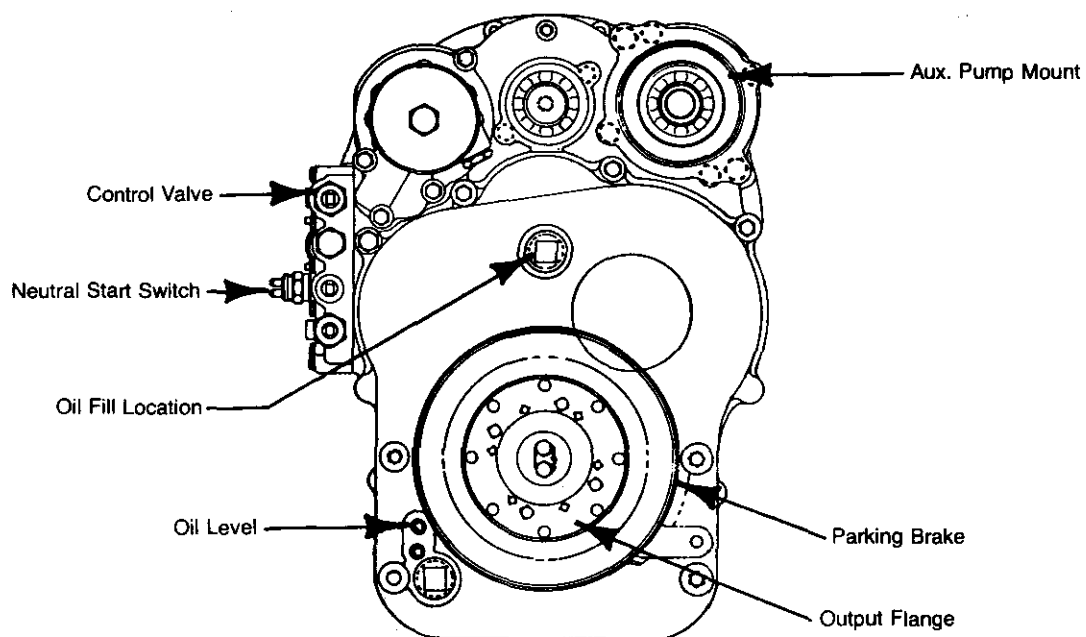
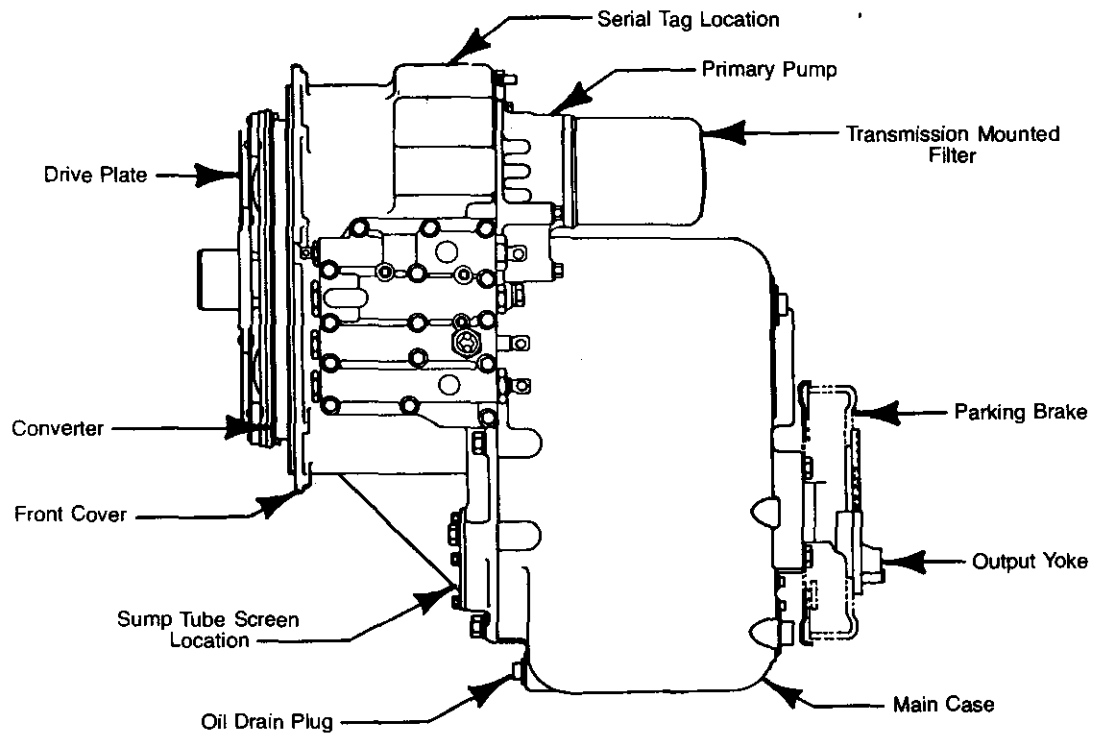
4. When changing the oil, the dirty oil should be drained while the unit is warm, examining for contamination as described above.

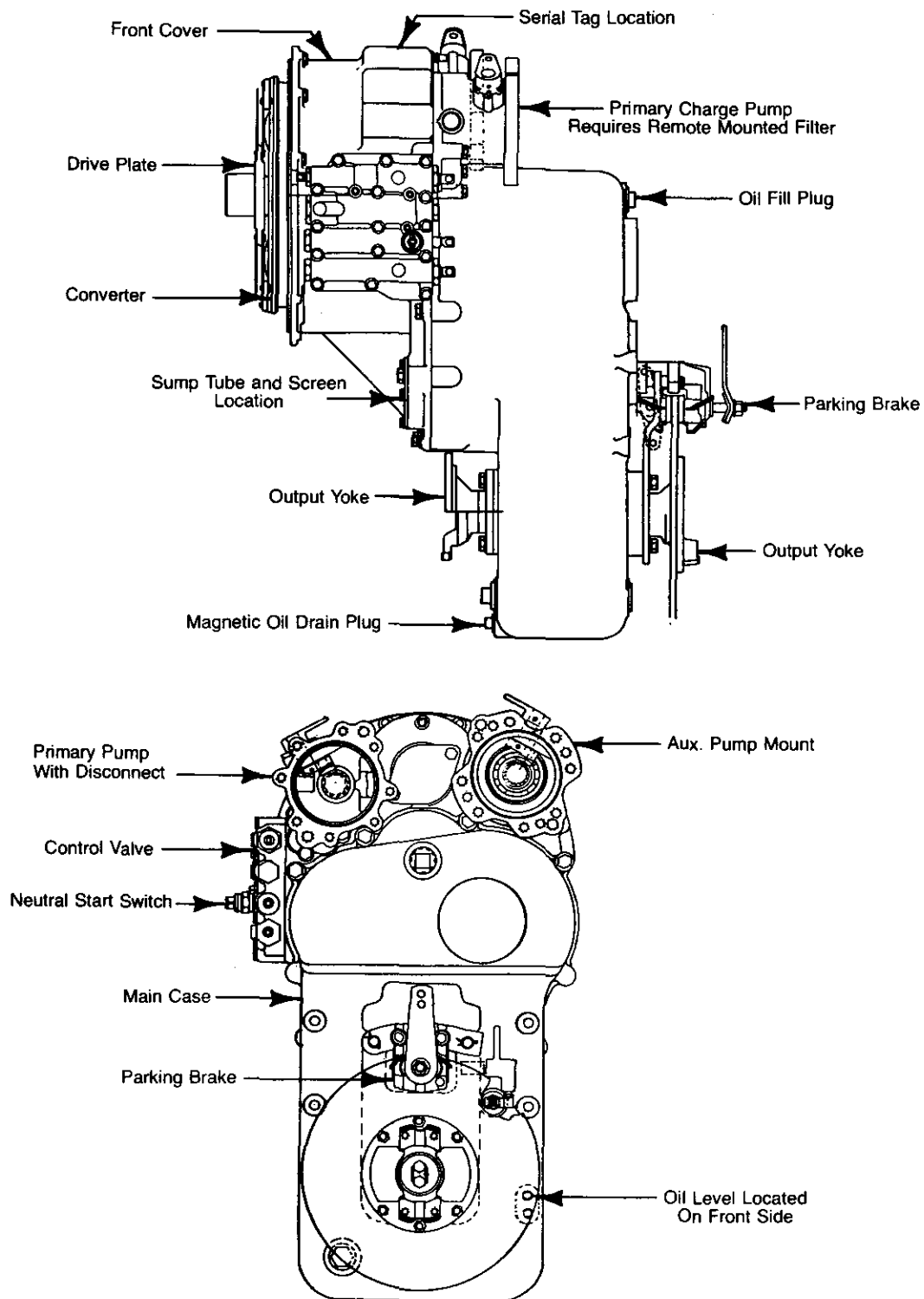
5. Keep all controls properly lubricated.

6. If the radiator of the vehicle is drained for winter storage, the heat exchanger on the Shift-O-MaticTM must also be drained.

SERIES
1000
1500
1700

SHORT DROP





SERIES
1000
1500
1700

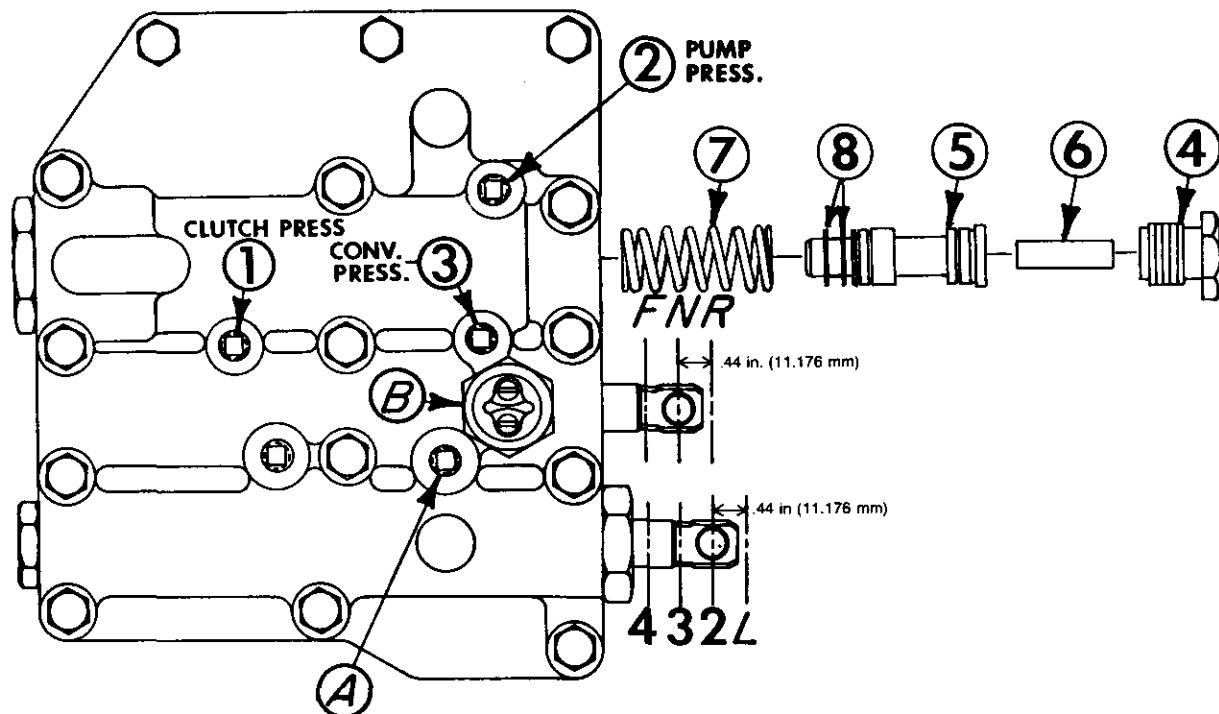
POWER SHIFT TROUBLE SHOOTING

PROBLEM	POSSIBLE CAUSE	REMEDY
1. Erratic oil pressure	A. Low oil level B. Oil strainer cover gasket not sealing C. Oil sump tube cracked D. "O" ring on sump tube not sealing E. Oil passage cover plate leaking	A. Add oil to proper level B. Replace gasket C. Replace oil sump tube and clean screen. D. Replace "O" ring and cover gasket E. See parts or assembly manual
2. Excessive oil pressure at high speeds	A. Sticking main regulator valve B. Faulty spring C. Main regulator valve orifice plugged	A. Check main regulator for contamination and clean orifice B. Change spring C. Clean orifice hole in main regulator valve
3. Low oil pressure in all gears	A. Sticking main regulator valve. B. Oil pressure set too low C. Faulty main regulator valve spring D. Control valve body cracked E. Primary pump defective F. "O" ring on primary pump mount defective	A. Check main regulator valve spring B. Add adjusting washers C. Replace spring D. Replace control valve body E. Replace pump F. Replace "O" ring
4. Low oil pressure in one gear but alright in other gears.	A. Broken seal ring on input end of clutch weld assembly piston shaft. B. Outer or inner piston seal not sealing	A. Replace seal ring B. Replace piston seals
5. Low converter pressure	A. Converter bypass valve defective B. Converter hub seal ring not sealing.	A. Inspect converter bypass valve Replace if necessary B. Replace seal ring
6. Remote filter oil lines blow-out	A. Hose bends too sharp in routing B. Defective hose C. Low pressure hose D. Hoses not connected correctly E. Main regulator valve orifice plugged	A. Re-route hoses B. Replace hose C. Use high pressure hose D. Connect hose correctly E. Clean main regulator valve orifice
7. Clutch selected pressure does not return to normal	A. Excessive internal leakage to clutch B. Main regulator valve spring weak C. Accumulator spring too strong D. Primary pump defective	A. Complete tear down of transmission B. Replace main regulator spring C. Replace spring D. Replace primary pump
8. Clutch does not release when brake cut-off valve is activated	A. No brake line pressure B. Brake cut-off piston sticking	A. Check brake system B. Inspect and replace if necessary

PROBLEM	POSSIBLE CAUSE	REMEDY
9. Clutch does not release when feathering valve is activated	A. Feathering stem not pulled to full travel B. Feathering valve sticking C. Feathering valve spring too strong	A. Adjust linkage B. Clean valve C. Replace spring
10. Excessive noise at engine idle	A. Primary pump defective B. Excessive back-lash in gear train	A. Replace pump B. Replace bearings and inspect for defective gears
11. Excessive gear noise at high speed (R.P.M.)	A. Same as item #10	A. Same as item #10
12. Transmission mounted filter blows out or "O" ring on filter blows out	A. Orifice on main regulator valve plugged B. "O" ring faulty	A. Clean orifice on main regulator valve B. Replace filter
13. Blows oil out of breather on top of transmission	A. Converter seal ring broken	A. Remove transmission and install new seal ring on converter hub
14. Transmission Overheating	A. Converter stalling B. Oil level too high C. Engine overheating D. Water lines defective on heat exchanger E. Heat exchanger dirty F. Low clutch oil pressure	A. Shift to lower gear B. Drain to proper level C. Check engine coolant D. Replace water lines E. Flush and clean heat exchanger F. Check clutch oil pressure
15. Transmission pressure check okay, but unit has no power	A. Converter sprag clutch jammed B. Converter sprag clutch installed wrong	A. Disassemble converter and inspect B. See parts manual or assembly manual for correct information

SERIES
1000
1500
1700

SHIFT-O-MATIC™ CONTROL VALVE, FUNCTION AND PRESSURE CHECK



The pressure checks are to be made with the trans. oil temp at 100°F. (37.7°C.) to 140°F. (60°C.).

STEP 1 — CLUTCH PRESSURE

- A. Install a 200 PSI (1378 kPa) gauge in Port #1.
- B. Run engine at approximately 2000 RPM.
- C. Engage each speed clutch forward and reverse, the clutch pressure should be within the span of 155 (1068 kPa) to 180 (1240 kPa) PSI for all clutches.
- D. If all clutches have low pressure, the pressure regulator valve should be checked, and adjusted if necessary.
 1. Remove cap (Ref. #4) and remove the pressure regulator valve (Ref. #5), dowel pin (Ref. #6) and spring (Ref. #7).
2. Check valve to be sure it works freely in the valve body.
3. The pressure can be raised by adding the #4001651 spacer ring (Ref. #8) as required, on the end of the valve next to the spring.

STEP 2 — CONVERTER CHARGE PRESSURE

- A. Install a 100 (689 kPa) PSI gauge in Port #3.
 - B. Run engine at approximately 2000 RPM.
 - C. The pressure should be within the span of 80 (551 kPa) to 90 (620 kPa) PSI.
- PORT A. Reverse warning switch for long (18½) drop.
- PORT B. Neutral start switch.

CONVERTER INSTALLATION FOR ALL SERIES SHIFT-O-MATICS™

All series transmissions are shipped with a small parts bag attached to the unit with a copy of this memo and the following parts included.

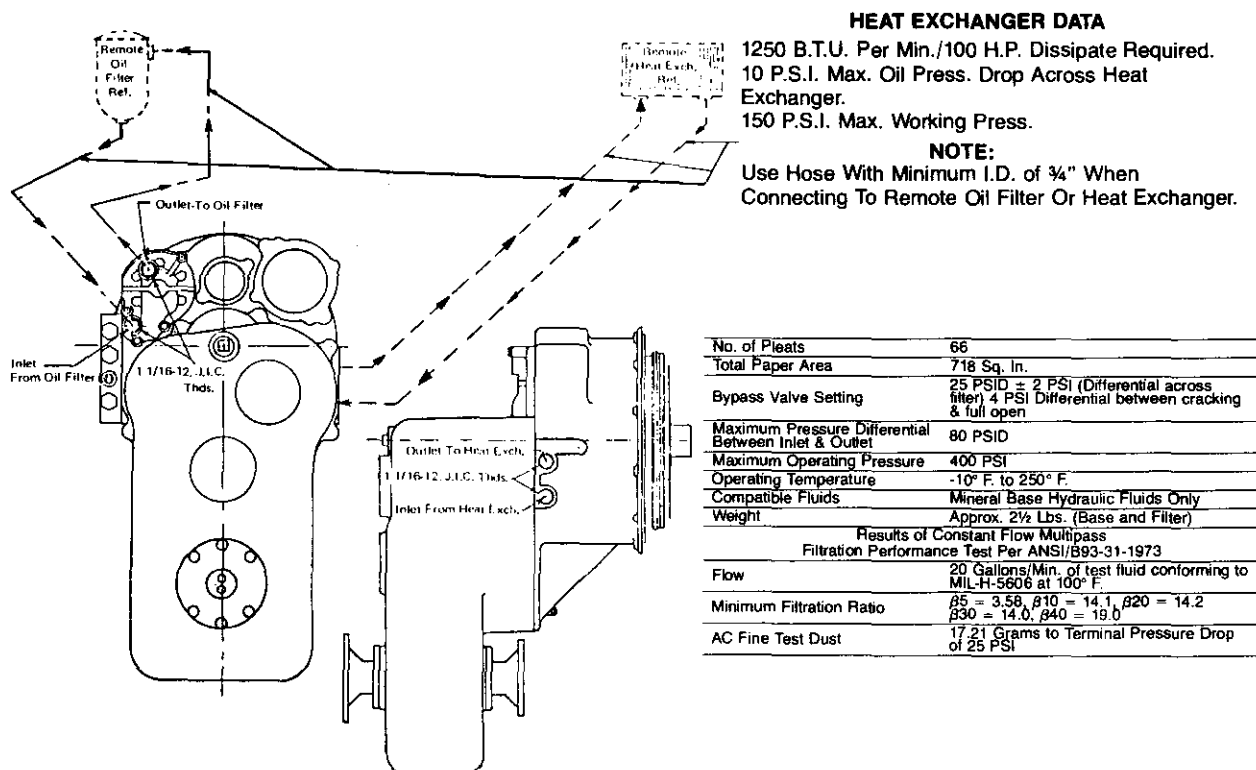
1. The following parts are for attaching the drive plate assembly to the engine flywheel: 8-F1003012 Capscrew ($\frac{3}{8}$ -16 x $\frac{3}{4}$ " hex. head H.T.) 8 - F16202 Lockwasher ($\frac{3}{8}$ Medium Spring)
2. The following group is for attaching the converter to the drive plate assembly. Group #40121191 - supplied with the 11 $\frac{3}{4}$ " converter
8 each F1100420NY Capscrew ($\frac{5}{16}$ N.F. x 1 $\frac{1}{4}$ " Socket head H.T.)
8 each 4012121 Washer, Half Round ($\frac{1}{16}$ " Dia. x $\frac{1}{4}$ " thick)
3. The following group is for attaching the converter to the drive plate assembly. Group #40121192 — supplied with the 12 $\frac{3}{4}$ " and 13" converters.
8 each F1100444NY Capscrew ($\frac{5}{16}$ -24 x 2 $\frac{3}{4}$ Socket Head H.T.)
8 each 4012121-A Washer, Half Round ($\frac{1}{16}$ " Dia. x $\frac{1}{8}$ " thick)

CONVERTER INSTALLATION INSTRUCTIONS

1. Remove drive plate assembly and converter from unit by pulling straight out.
2. Attach drive plate assembly to the engine flywheel using capscrew and lockwashers provided in parts bag. Refer to No. 1
3. Attach converter to the drive plate assembly using the socket head capscrews and the half round washers provided in the parts bag. Refer to No. 2. The half round washer is used under the head of the socket head capscrew.
4. Center the converter hub gear seal ring in its groove, grease will help hold ring in position.
5. Align unit with converter and mate together.

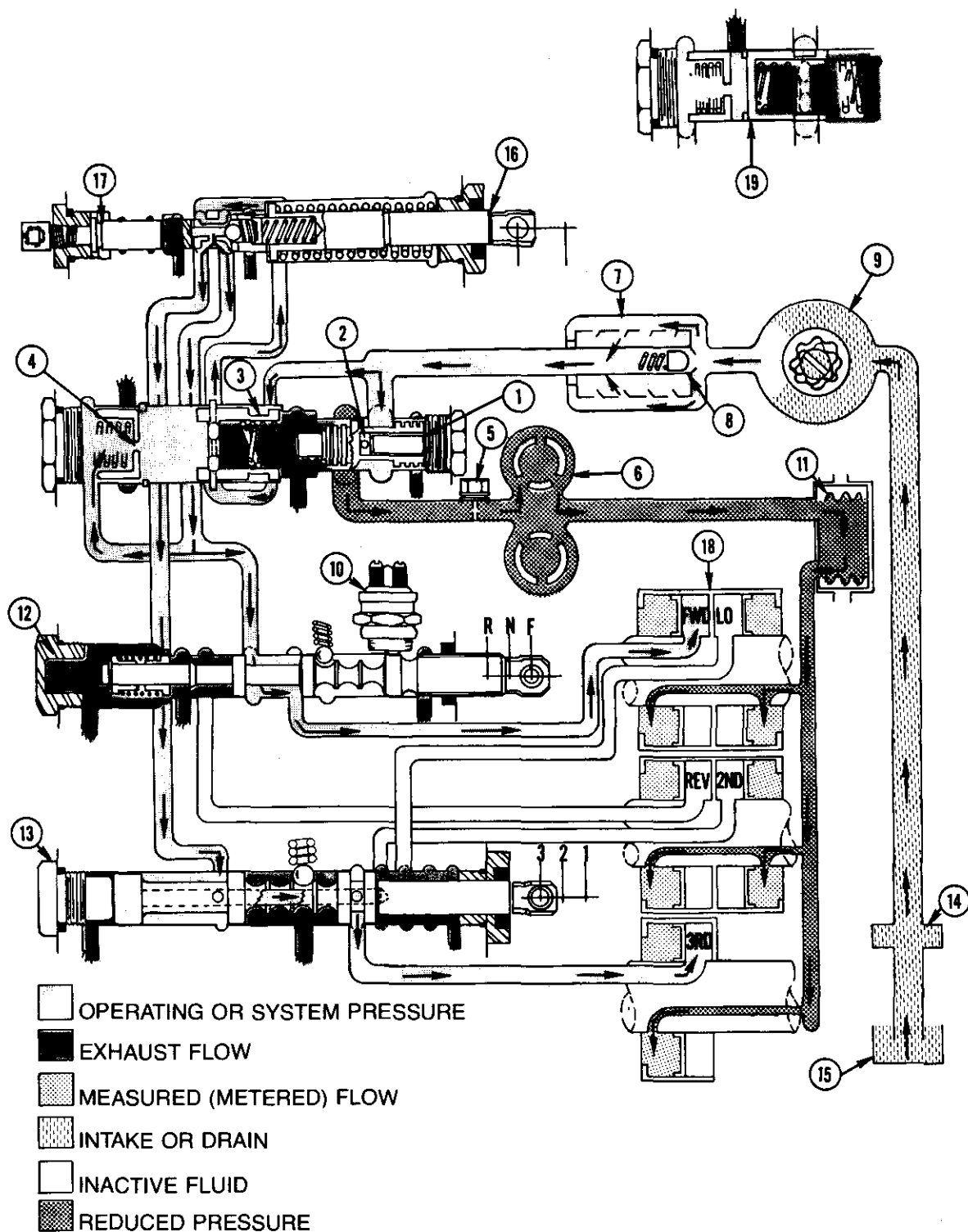
NOTE: To aid in installation, the stator support tube spline, the input shaft spline, and converter hub gear seal ring should be lightly greased.

REMOTE OIL FILTER AND HEAT EXCHANGER INSTALLATION DATA



MODEL
1000
1500
1700

HYDRAULIC CIRCUIT RANGE: FORWARD-THIRD



HYDRAULIC CIRCUIT
3 SPEED, 9-5/8 DROP
RANGE: FORWARD-THIRD

1. Main Pressure Regulator
2. Main Orifice
3. By-Pass Orifice
4. Modulator Orifice
5. Converter By-Pass Valve
80 PSI (551 kPa)
6. Converter
7. Filter
8. Filter By-Pass Valve
9. Pump
10. Neutral Starter Switch
11. Heat Exchanger
12. Directional Control Valve
13. Range Control Valve
14. Screen
15. Sump
16. Feathering Valve
17. Brake Cut-Off
18. Clutches
19. Modulator Valve
By-Pass Position

DESCRIPTION

The Series 4000 Shift-O-Matic™ Drive is a forward and reverse transmission, with three speeds in either direction. Forward motion, reverse motion, and the three speeds are obtained through the use of hydraulically actuated multiple disc clutches. These clutches are power absorbing members that can be engaged at full engine power. Shifting under full power makes this model a full power shift for the forward and reverse motion in all three speeds.

The clutches in this unit are hydraulically applied and spring released. Because the clutches are hydraulically controlled, there is automatic compensation for normal wear which eliminates the need for adjustment. Each clutch uses paper graphitic friction plates and polished steel reaction plates.

The power from the engine is transmitted to the Shift-O-Matic™ through a torque converter. The use of the torque converter has two distinct advantages; (1) The converter is essentially a fluid drive, there being no direct mechanical connection through it. This feature creates a very smooth and shock-free drive eliminating engine stalling and lugging. (2) The converter multiplies torque during heavy pull down loads. When loads are light the converter transmits the engine power directly at almost engine speeds, and there is no torque multiplication. The net result is an action like a transmission, with infinitely variable and automatic speed ratios. The need for shifting gears, although present, is greatly reduced.

OPERATION

Like all mechanical equipment, the Shift-O-Matic™ Drive will need attention and servicing. Routine checks will help prevent down time. The operator can aid in preventative maintenance by reporting weak or borderline malfunctions.

Because the unit operates "in" and "by" oil, most of the maintenance is concerned with oil replenishment and oil cleanliness. The type of service and operating conditions shall determine the maintenance interval. However, as previously stated, it is especially important that the oil be kept clean.

RULES OF OPERATION

1. Check oil level daily, with engine at idle speed and Shift-O-Matic™ in neutral. Make sure the area around oil level check plug is clean before removing plug.
2. The Shift-O-Matic™ should always be in the neutral position before starting engine, or when the vehicle is parked and the engine is running.
3. If the vehicle is to be towed, it will be necessary to run the engine at idle speed to lubricate the clutches.
4. Normal operating oil temperature is 160°F. (71.1°C.) to 190°F. (87.8°C.).
5. If the oil temperature gauge, which is the converter oil out temperature, rises above 250°F. (121.1°C.) or the warning light comes on, stop the vehicle immediately.

Shift to neutral and run the engine at 1000-1200 RPM. The temperature should drop rapidly to the engine water temperature. If the temperature does not drop, trouble is indicated. The trouble should be determined before the vehicle is operated again. Overheating generally occurs due to working in too high of a gear ratio. Shifting to a lower gear will help eliminate overheating.

6. Do not shut off engine when unit is overheating.
7. Pressure checks at control valve are made at approximately 180°F. (82.2°C.) oil temperature.
8. Normal clutch pressure is 240 PSI (1654 kPa) to 250 PSI (1723 kPa) at 2000 RPM.
9. Pump pressure is 245 PSI (1688 kPa) to 255 PSI (1757 kPa) at 2000 RPM.
10. The converter by-pass pressure is 30 PSI (207 kPa) to 40 PSI (276 kPa) at 2000 RPM.

SERVICE

1. When servicing the unit for the first time after vehicle installation and/or after repair, the unit is filled as follows:
 - A. Fill the unit with 4 gallons (15.4 liters) of the recommended lubricant.
 - B. Start the engine and run at idle speed (approximately 500-700 RPM) for one minute to let the hydraulic system charge.
 - C. With engine at idle speed, finish filling unit to the full level. This will take between 3 and 4 quarts (2.87 and 3.79 liters), but varies with different applications.

NOTE: The oil level is always checked with the engine running at idle speed and the Shift-O-Matic™ in neutral.

2. Lubrication Recommendations, Series 4000 Shift-O-Matic™ Transmission. (powershift)

LUBRICANT TYPE:**Commercial Powershift
Transmissions Prevailing
Ambient Temperature**

Above -10°F. (-23.3°C.)

Below -10°F. (-23.3°C.)

Above 32°F. (0°C.)

**Military Transmissions
Prevailing Ambient
Temperature**

Above -10°F. (-23.3°C.)

0°F. (-17.8°C.) to -65°F.
(-53.9°C.)**Recommended Oil Specification**

Hydraulic Transmission Fluid. Type C-3 (except Grade 30).

Hydraulic Transmission Fluid. Type C-3 (except Grade 30). Auxiliary preheat required to raise temperature in the sump to a temperature above -10°F. (-23.3°C.)

Hydraulic Transmission Fluid. Type C-3, or Type C-3 Grade 30.

**Recommended Oil
Specification**

MIL-L-2104 Grade 10 to latest specification or Hydraulic Transmission Fluid Type C-3.

MIL-L-10295 to latest specification.

NOTE: If auxiliary preheating equipment is available and the sump temperature can be raised to -10°F. (-23.3°C.), it is recommended that MIL-L-2104 Grade 10 oil be used. When changing to oil of different grade, thoroughly flush system with grade oil to be used before refilling.

CAUTION: Do not use MIL-L-10295 when the ambient temperature is consistently above -10°F. (-23.3° C.).

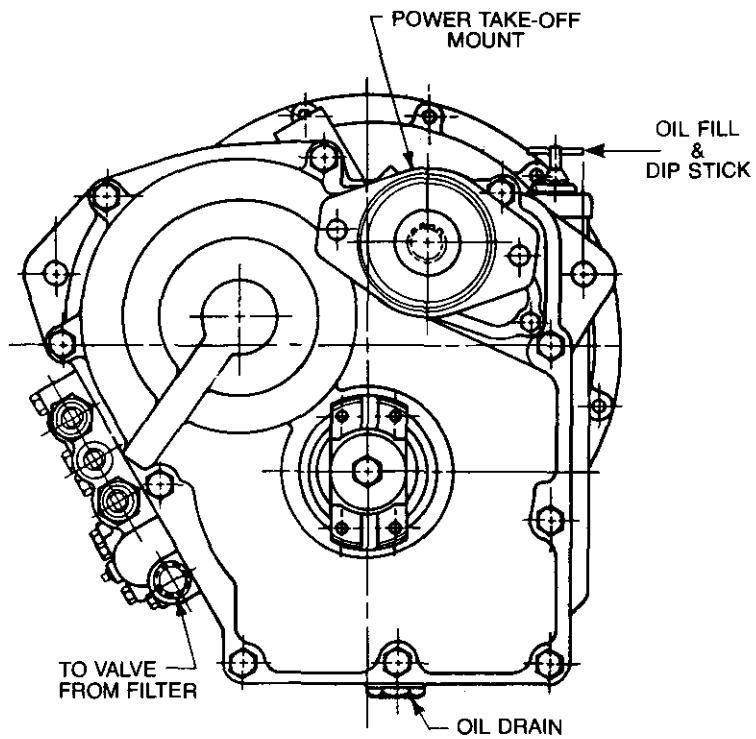
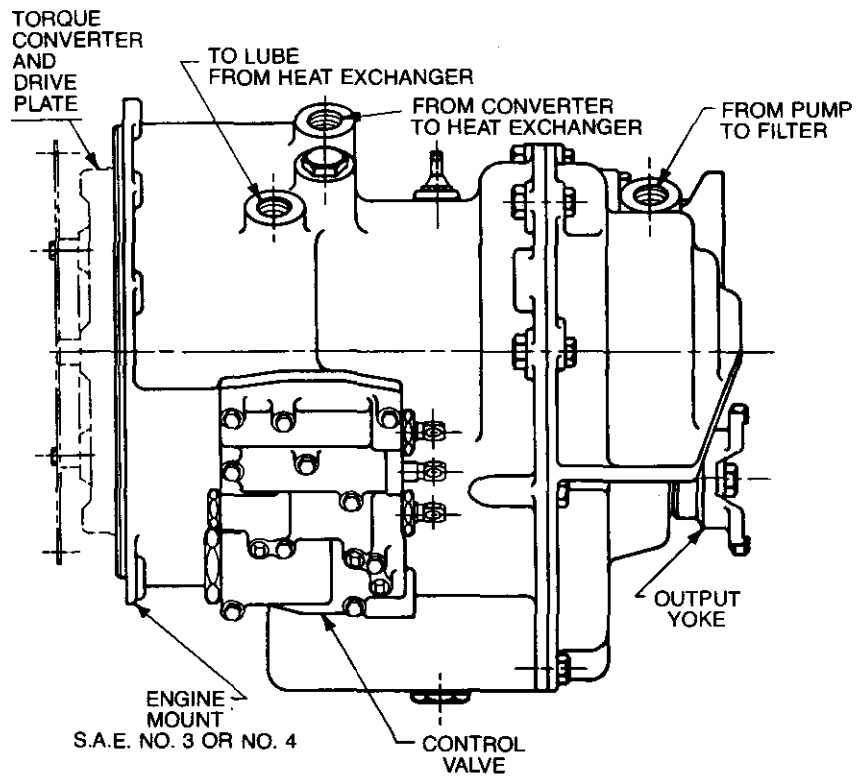
3. It is recommended the oil and oil filter be changed whenever the oil shows traces of contamination, or the effects of high operating temperature evidenced by discoloration or strong odor.

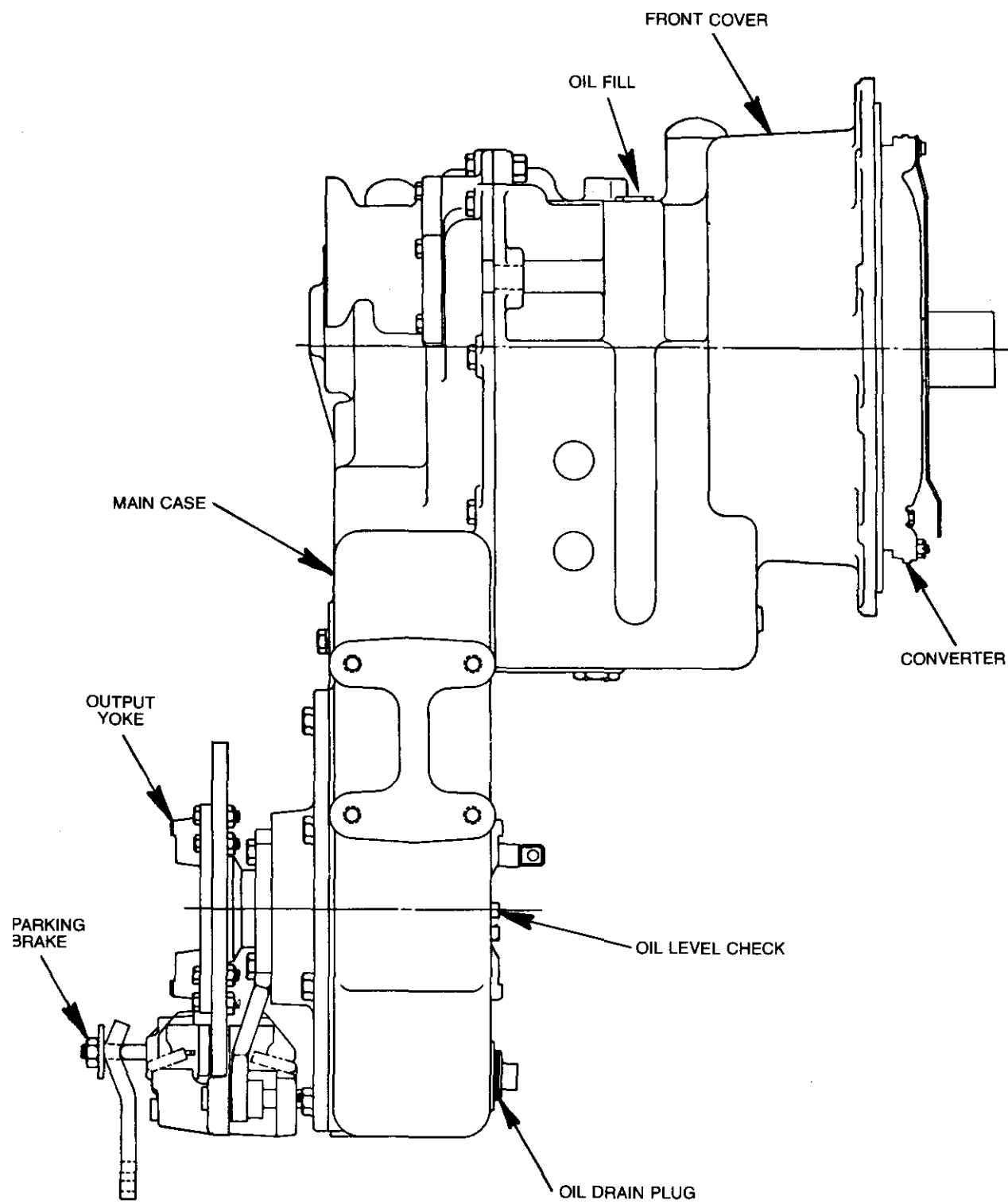
If the oil in the system has become contaminated with metal particles, all the components of the system (oil lines, oil pump, oil filter, control valve, clutches, converter, heat exchanger) must be thoroughly cleaned. Generally this means a tear down of the unit. The metal particles in the oil is evidence of failure of some part.

LUBRICANT AND OIL FILTER CHANGE INTERVALS:**TIME:**

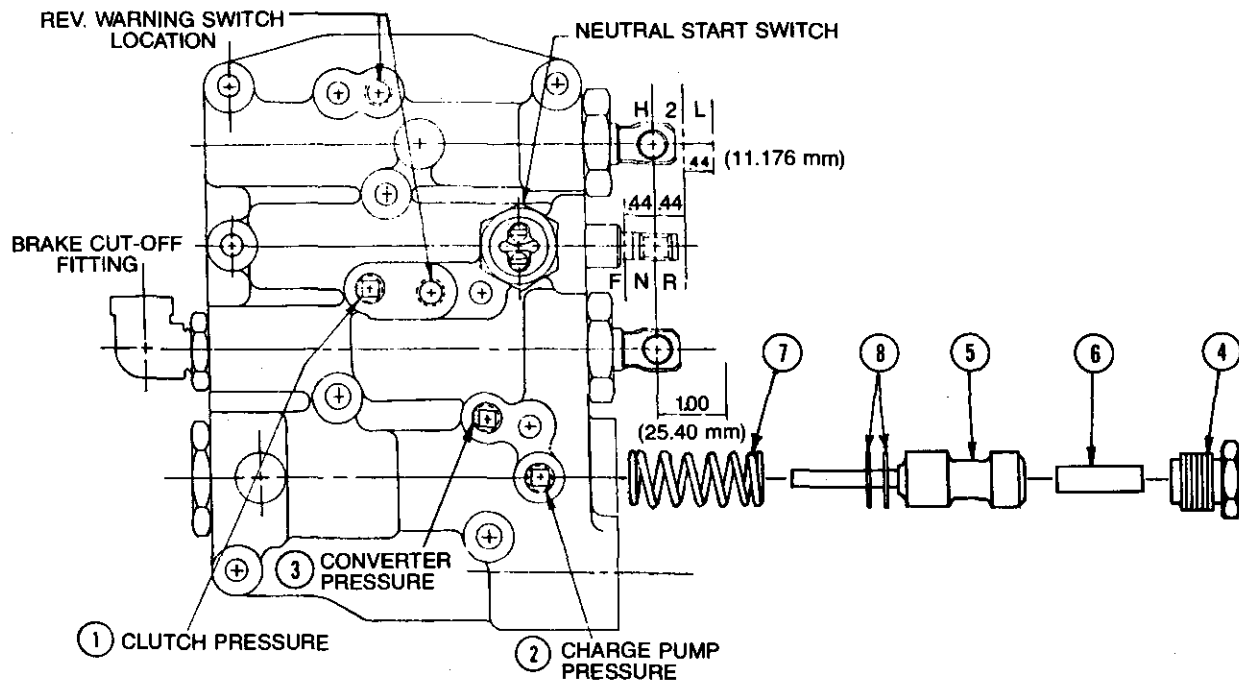
20 Hours	New or overhauled unit drained and refilled with new fluid. (Do not use a flushing fluid.)
250 Hours	Operation in severe dust, sand, or in underground environment.
375 Hours	Operation in normal off-highway conditions, rapid changes in ambient or unit temperature, or in the presence of chemical fumes.
500 Hours	Operation in clean environment. (hard surface roads, minimum dust, etc.)

4. When changing the oil, the dirty oil should be drained while the unit is warm, examining for contamination as described above.
5. Keep all controls properly lubricated.
6. If the radiator on the vehicle is drained for winter storage, the heat exchanger on the Shift-O-Matic[®] must also be drained.





SHIFT-O-MATIC™ CONTROL VALVE, FUNCTION AND PRESSURE CHECK



The pressure checks are to be made with the transmission oil temperature at 170° or (76.7°C) to 185°F. (85°C)

STEP 1 - CLUTCH PRESSURE

- Install a 300 PSI (2067 kPa) gauge in Port #1.
- Run engine at approximately 2000 RPM.
- Engage each speed clutch forward and reverse, the clutch pressure should be within the span of 240 (1654 kPa) to 255 PSI (1757 kPa) for all clutches.
- If all clutches have low pressure, the pressure regulator valve should be checked, and adjusted if necessary.
 - Remove cap (Ref. #4) and remove the pressure regulator valve (Ref. #5) dowel pin (Ref. #6) and spring (Ref. #7).
 - Check valve to be sure it works freely in the valve body.
 - The pressure can be raised by adding the #4004245 spacer ring (Ref. #8) as required, on the end of the valve next to the spring.

STEP 2 - CONVERTER CHARGE PRESSURE

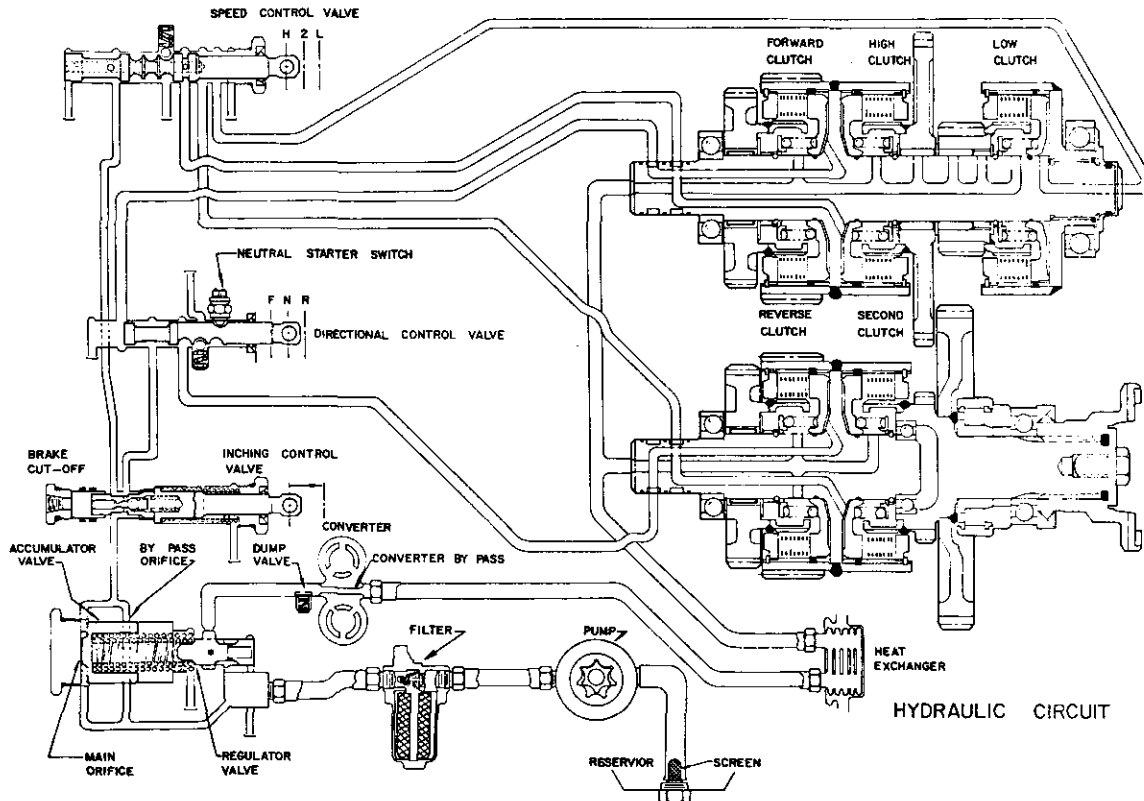
- Install a 100 PSI (689 kPa) gauge in Port #3.
- Run engine at approximately 2000 RPM.
- The pressure should be within the span of 50 PSI (345 kPa) warm to 90 PSI (620 kPa) cold.

STEP 3 - FEATHERING VALVE (IF USED)

- Install a 300 PSI (2067 kPa) gauge in Port #1.
- Run engine at approximately 2000 RPM
- Pull stem to full out position (1"), clutch pressure should be between 5 to 7½ PSI (34.5 kPa to 51.7 kPa).

STEP 4 - BRAKE CUTOFF VALVE (IF USED)

- Install a 300 PSI (2067 kPa) gauge in Port #1.
- Run engine at approximately 2000 RPM
- Apply 325-375 PSI (2239 kPa - 2584 kPa) to cut off valve, clutch pressure should be between 5 to 7½ PSI (34.5 kPa to 51.7 kPa).



BOLT-TORQUE SPECIFICATIONS S.A.E. GRADE 5

BOLT SIZE	LOAD	TORQUE
1/4 - 20	2,000 lbs. (8,900 N)	8 ft. lbs. (11 N.m)
1/4 - 28	2,300 lbs. (10,230 N)	10 ft. lbs. (14 N.m)
5/16 - 18	3,350 lbs. (14,900 N)	17 ft. lbs. (23 N.m)
5/16 - 24	3,700 lbs. (16,460 N)	19 ft. lbs. (26 N.m)
3/8 - 16	4,950 lbs. (22,020 N)	30 ft. lbs. (41 N.m)
3/8 - 24	5,600 lbs. (24,910 N)	35 ft. lbs. (47 N.m)
7/16 - 14	6,800 lbs. (30,250 N)	50 ft. lbs. (68 N.m)
7/16 - 20	7,550 lbs. (33,580 N)	55 ft. lbs. (75 N.m)
1/2 - 13	9,050 lbs. (40,250 N)	75 ft. lbs. (102 N.m)
1/2 - 20	10,200 lbs. (45,370 N)	85 ft. lbs. (115 N.m)
9/16 - 12	11,600 lbs. (51,600 N)	110 ft. lbs. (149 N.m)
9/16 - 18	13,000 lbs. (57,830 N)	120 ft. lbs. (163 N.m)
5/8 - 11	14,500 lbs. (64,500 N)	150 ft. lbs. (203 N.m)
5/8 - 18	16,300 lbs. (72,500 N)	170 ft. lbs. (230 N.m)
3/4 - 10	21,300 lbs. (94,750 N)	270 ft. lbs. (366 N.m)
3/4 - 16	23,800 lbs. (105,870 N)	300 ft. lbs. (407 N.m)
7/8 - 9	29,500 lbs. (131,220 N)	430 ft. lbs. (583 N.m)
7/8 - 14	32,400 lbs. (144,120 N)	475 ft. lbs. (644 N.m)
1" - 8	38,000 lbs. (169,030 N)	645 ft. lbs. (875 N.m)
1" - 12	42,300 lbs. (188,160 N)	705 ft. lbs. (956 N.m)
1" - 14	43,300 lbs. (192,610 N)	720 ft. lbs. (976 N.m)

