REVISED 10 – 73

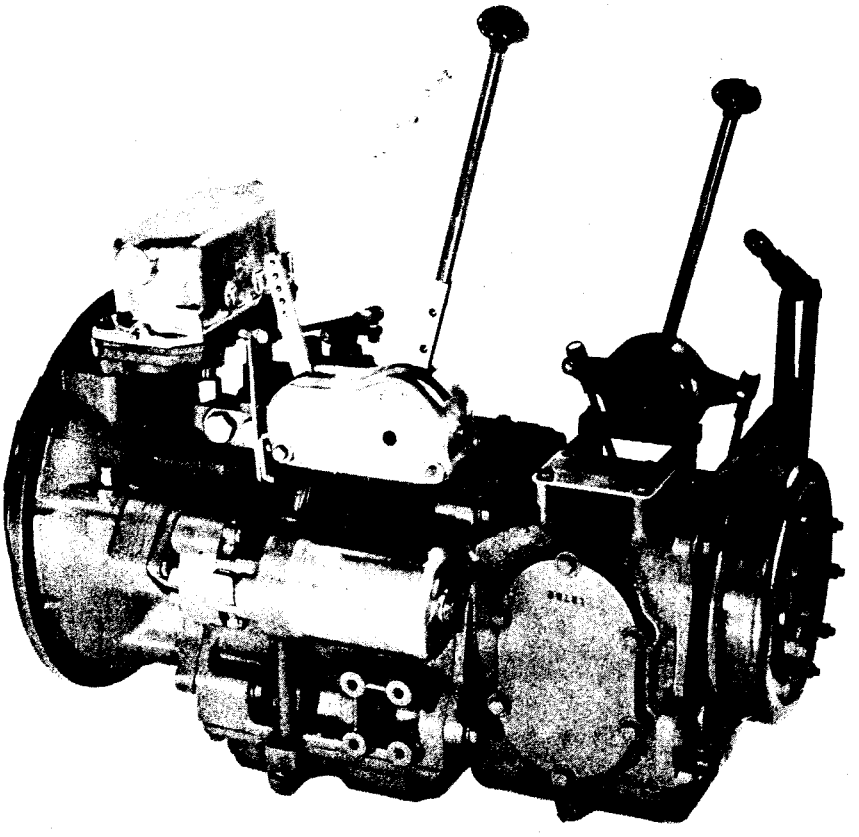
Parts List & Instruction Manual

FUNK

reversOmatic®

DRIVES

SERIES 12000



Funk MFG. CO.

ENGINEERS AND MANUFACTURERS
OF POWER TRANSMISSION EQUIPMENT

P. O. BOX 577 316 251-7500 1211 W. 12th STREET
COFFEYVILLE, KANSAS 67337

MODEL 12000

Designed specifically for off-highway, forward-reverse, and lift-lower operations; the FUNK MODEL 12000 REVERS-O-MATIC DRIVE is particularly adaptable to equipment such as road rollers, industrial locomotives, materials handling equipment, power winches, hoists, cranes, shovels, and various other types of industrial equipment. Highly compact for a unit of this type, the model 12000 can generally be installed by original equipment manufacturers without major re-design problems.

The unit is available for engines with S.A.E. Nos. 2 or 3 flywheel housings. Different converters available multiply engine torque to broaden the working power range.

The unit is also available without transmission for use on applications where variable speeds are not required. All other options such as auxiliary pump, hand lever control, brake, heat exchanger, etc. are also available on this shorter version.

FUNK SERVICE BULLETIN

#100-3
Date: 1-28-76

SUBJECT: SERIES 12000 REVERS-O-MATIC TRANSMISSION

The clutch plates used in this series transmission are being changed to use a graphitic clutch plate material. This change will also require a different separator plate.

#4002022 Clutch Plate (Graphitic) replaces #4012381 (Bronze) and #40121159 (Semi-Metallic)

#40121323 Separator Plate (Flat) replaces #4012382 (Wavy)

The new clutch plates and separator plates are interchangeable as a complete set only (8 of each).

Caution:

Do not mix old and new parts together in the same clutch pack, as this may cause premature clutch failure.

Funk

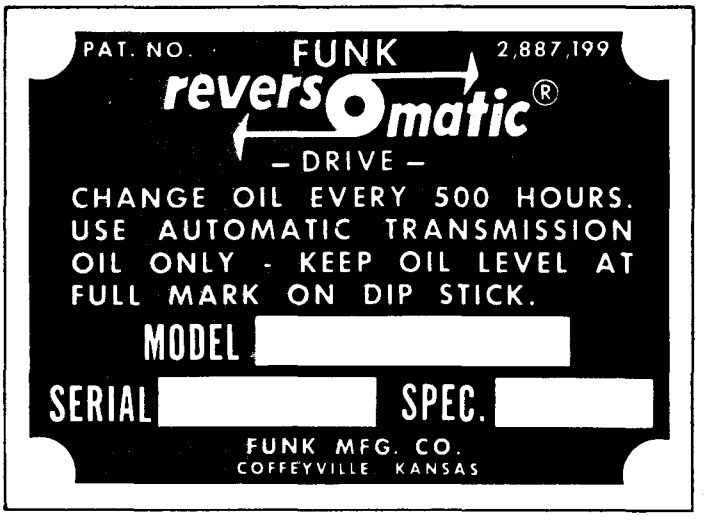
Funk Manufacturing Company
DIV. OF GARDNER-DENVER

1211 W. 12th STREET COFFEYVILLE, KANSAS 67337 (316) 251-7500

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.



YOU MAY WRITE TO:

FUNK MANUFACTURING CO.
ATTN. PARTS DEPARTMENT PLANT #2
1211 W. 12th STREET
COFFEYVILLE, KANSAS 67337

OR TELEPHONE

AREA CODE (316) 251-7500
ASK FOR PARTS DEPARTMENT.

OR TWX 910-740-1908

THANK YOU
THE FUNK MFG. CO.
DIV. OF GARDNER-DENVER

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DESCRIPTION

The MODEL 12000 REVERS-O-MATIC DRIVE is a shuttle type transmission consisting basically of (2) two hydraulically actuated multiple disc clutches. When the front clutch is engaged, the output shaft rotates enginewise and in most applications forward vehicular motion is obtained. The rear clutch is driven by an idler/countershaft gear train and its rotation is opposite to that of the front clutch. Therefore, when the rear clutch is engaged, the output shaft rotates anti-enginewise and in most applications rearward vehicular motion is obtained.

Power is transmitted from an engine to the Revers-O-Matic Drive through the use of a torque converter. Being no direct mechanical connection between power and load, a very smooth and shock-free drive is obtained with complete absence of engine stalling and lugging. Consequently the maintenance of axles, bearings, differentials, and gears is reduced to a minimum. Another feature of torque converter drive is the automatic multiplication of engine torque during the periods of heavy pull-down loads. When loads are light, the converter transmits the engine power directly at almost engine speed without torque multiplication. With the output torque automatically adjusting to the load demand, 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 along with driver fatigue.

The Model 12000 Revers-O-Matic Drive is equipped with a unified control system that regulates both the direction of travel and the speed of travel. This is generally accomplished thru the use of a single hand lever control. Sideways movement of the control lever from the neutral (center) position engaged one of the hydraulically actuated clutches; either forward or reverse. Back and forth movement of the lever controls the speed of travel. The unit is also available with a double pedal set-up. The action of the foot pedals is essentially the same as the hand lever control except that one pedal produces forward motion and the other rearward motion.

The hand lever control can be supplied in either a self-centering or three position valve design.

As the control system engages the clutches prior to engine acceleration, the clutches are not power absorbing members and cannot be subjected to slippage under load. This arrangement greatly increases the life of the clutches. The clutches are hydraulically applied and spring released.

Each clutch has (8) eight friction plates which have sintered bronze facings, and (8) eight reaction plates of polished steel. Because the clutches are hydraulically controlled, there is automatic compensation for normal wear; no adjustment is necessary.

SPECIFICATIONS AND APPLICATION DATA

Speed and Input Torque	Maximum input speed 2500 r.p.m. 11-3/4" converter 300 lb. ft. torque 12" converter 300 lb. ft. torque 13" converter 300 lb. ft. torque
Converters	Single stage units adaptable to S.A.E. 10" and 11-1/2" flywheels for drive-ring type overcenter clutches. 4045070 11-3/4" 2.54 Max. Torque Multiplication 4045098 11-3/4" 2.15 Max. Torque Multiplication 4045020 12" 2.15 Max. Torque Multiplication 4012150 13" 2.80 Max. Torque Multiplication 4012993 13" 2.80 Max. Torque Multiplication
Oil System	External mount converter charge pump Clutch operating pressure 160 p.s.i. Converter charge pressure 80 p.s.i. Converter out pressure 25 p.s.i. Oil Capacity— Without transmission—11 quarts With 4 speed transmission 15 quarts Oil—refer to "Service" section Refill capacity— Without transmission—8 quarts With 4 speed transmission—12 quarts Drop box transmissions must be serviced separately—refer to "Service" section. Shuttle transmission—pressure lubrication 4 speed transmission—splash lubrication Oil Filter—full flow

Heat Exchanger	Type—Oil to water Capacity—With 20 G.P.M. water flow at 185° F. water temperature and 250° F. oil temperature, heat exchanger will absorb approximately 1000 BTU's, equals 25 H.P. Optional—If customer elects, heat exchanger may be omitted from the unit; running lines directly from the control valve to cooler equipped engine radiator.
Gear Data	Shuttle transmission—Helical, constant mesh 4 speed transmission—spur, sliding shift
Gear Ratios	With 4 speed transmission: Low Forward 6.27 to 1, Reverse 6.27 to 1; 2nd 3.12 to 1, 3.12 to 1; 3rd 1.75 to 1, 1.75 to 1; High 1.00 to 1, 1.00 to 1
Shipping Weight	400-600 pounds depending on optional items

OPERATION

Like all mechanical equipment, the MODEL 12000 REVERS-O-MATIC DRIVE will need attention and servicing. Routine checks will help prevent down-time. The operator can aid in preventive maintenance by occasionally reading the instrument panel gauges and keeping a watchful eye; reporting weak or borderline malfunctioning.

Because the unit operates "IN" oil and "BY" oil, most of the maintenance is concerned with oil replenishment and oil cleanliness.

RULES OF OPERATION

1. Check oil level daily, stopping engine before check.

   Make sure area around oil fill is clean before removing dip stick. A drain cock or plug is provided on the oil fill side of the unit at oil level. If working conditions are severe, it is recommended that the oil level be checked using the drain cock; that is, if oil starts to drip out when opening the drain a proper oil level is being maintained. This method of checking the oil level is especially desirable on units operating in mines, sand and gravel pits, etc. where it is highly possible to have foreign material packed around the oil fill where it could fall into the unit when the dip stick is removed.

2. Always shift the Revers-O-Matic to neutral before starting the engine, or when the vehicle is parked and the engine is running.

   To move the vehicle, select the speed range desired by shifting the transmission behind the shuttle box and then engage the directional clutch (forward or reverse) in the Revers-O-Matic.

3. Engage forward and reverse clutches at idle speed only.

4. Use brakes to slow motion before applying the opposite clutch.

5. Pay particular attention to the instrument panel.

6. The oil pressure gauge should read approximately 160 P.S.I. with the engine running above 1200 R.P.M. If pressure varies more than 15 P.S.I. from the above, check per "IRREGULAR OIL PRESSURE" section on a later page. At engine idle speeds, and/or when the hydraulic clutches are engaged, the pressure will momentarily drop but should return to normal as soon as the engine is reved up.

7. If the oil temperature gauge which is the converter oil "Out" temperature rises above 250^{o} F., stop the vehicle immediately. Shift Revers-O-Matic to neutral and run the engine at 1000-1200 R.P.M. The temperature should drop rapidly to the engine water temperature within 3 or 4 minutes. If the temperature does not drop, trouble is indicated. The cause of trouble should be determined before further operation of the vehicle; refer to "TROUBLE SHOOTING" instructions to be found elsewhere in this manual.

   Generally when overheating does occur, it is due to rapid reversals in the higher gear ratios. Shifting to a lower gear will help eliminate overheating due to this cause.

8. When towing the vehicle, always place the variable speed transmission behind the Revers-O-Matic in neutral.

SERVICE

The type of service and the operating conditions will determine the maintenance interval. However as stated above, it is recommended that the oil level be checked daily; at the same time checking for oil leaks.

Because the hydraulic system is the heart of the transmission, it is especially important that the oil be kept clean.

All models of the unit have a common oil fill with the exception of the drop-box transmission version only. This means that in a majority of the applications the entire unit may be filled with lubricating oil from one oil fill location, positioned on the right hand side of the Revers-O-Matic (shuttle) transmission.

When draining for an oil change, the Revers-O-Matic and ALL variable speed transmissions must be drained separately. In all cases the drain plugs are located on the side opposite the fill; that is, the left hand side.

NOTE! ANY REFERENCE AS TO THE LEFT OR RIGHT HAND SIDE OF THE MODEL 12000 IS MADE FROM THE REAR OF THE UNIT LOOKING FORWARD TOWARD THE ENGINE.

When servicing the unit for the first time after vehicle installation and/or after overhaul, or the regular oil change, fill as follows:

1. On units without 4 speed transmission add 8 (5 if refill) quarts.

2. On units with 4 speed transmission add 12 (9 if refill) quarts.

USE AUTOMATIC TRANSMISSION FLUID TYPE "A"

NOTE! If unit is equipped with a drop-box transmission it must be serviced separately—fill to the indicated oil level with S.A.E. No. 90 gear lubricant or S.A.E. No. 50 engine oil.

3. Start engine and run at idle speed for (2) two minutes with unit in neutral. This is to let the hydraulic system charge.

4. Stop engine and add automatic transmission fluid type "A" to the shuttle transmission to bring the oil level up to the full mark on dip stick, or until oil starts to drip out opened drain cock. This will generally take approximately 3 quarts providing the unit was completely drained.

5. Start engine and run at idle speed for (2) minutes with unit in neutral. Stop engine and check oil level again.

SERVICE PROCEDURE AND RECOMMENDATIONS

1. Stop engine before checking or adding oil.

2. Clean around oil fill before checking or adding oil.

3. It is recommended that all lubricating oil and oil filter be changed after the first 50 hours of operation and/or after overhaul.

4. Thereafter and under normal operating conditions, it is recommended that all lubricating oil and oil filter be changer after every 500 hours of operation.

   The oil in the system must be changed whenever the oil shows traces of dirt or the effects of high operating temperature evidence by discoloration or strong odor.

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

5. Drain dirty oil while unit is still warm, examining for contamination as described above.

6. Clean all magnetic drain plugs before replacing.

7. Replace oil filter element. Use AC TYPE PF 141 which is generally available at most gas stations.

8. Always use clean oil and clean containers.

9. Do not overfill.

10. Keep all joints in the shuttle box and transmission controls properly lubricated with heavy grease.

11. If radiator is drained during winter storage, the heat exchanger on the Model 12000 should also be drained, using the drain plug provided on the left hand side.

TROUBLE SHOOTING

The diagnosis of trouble in the transmission always should start by making certain preliminary checks before it is assumed that the transmission is at fault, or before carrying out any other trouble-shooting procedures.

1. Check the coolant level in engine radiator.

2. Check the oil level in transmission. A low oil level can affect the operation of the transmission, and may indicate fluid leaks that could cause transmission damage. A high level can cause foaming of the oil which, in turn, may result in clutch slippage or leakage at the breather or filler tube.

3. Check the oil pressure gauge on instrument panel. This should be as described under "OPERATION" on a previous page.

4. Check the oil temperature gauge on instrument panel. This should never exceed 250° F.; refer to "OPERATION" section on a previous page.

5. Check the adjustment of the control and governor linkages. Make sure that the engine starts to rev up immediately after the pedal or lever leaves the neutral zone, and that the governor is being held wide open with pedal or lever in the full throttle position. All interferences that limit top R.P.M. should be remedied.

   The linkage rod from the shuttle control box to the valve lever must be adjusted so that equal tension or pressure is applied to the spring on top of the valve lever. This is to insure that the valve is always open to it's fullest extent in either direction.

   If the unit starts with a jerk, check the engine idle speed which is recommended at 450 to 550 R.P.M. If idle speed is lower than this, unit will die too easily in rapid reversals; and if higher than this, the converter will transmit too much torque for smooth starts. Any external interferences in the control linkages that enables the engine to accelerate prior to clutch engagement must be eliminated if smooth starts are to be expected.

6. Upon complaint of engine-transmission performance, first check the engine to see if it is performing satisfactory.

PERFORMANCE AND STALL TEST

If all preliminary checks are satisfactory, make a performance and stall test as described below.

1. Run the engine at 1000-1200 R.P.M. with the unit in neutral until normal engine operating temperature is reached.

2. Attach a tachometer to the engine and position the instrument so that it can be read from the driver's seat.

3. Apply the service and parking brakes firmly.

4. With a steady pressure, depress the forward pedal or lever to the wide open throttle position. Observe the tachometer reading. The engine should turn up to the TOP governed R.P.M. as shown on the torque curve sheet. If engine speed is below the minimum requirements, it is an indication that the engine is not operating at peak efficiency. Take all necessary steps to correct the engine deficiency, and again perform the test. Check the R.P.M. with the reverse pedal or lever fully depressed. The engine speed should be the same as above.

5. Next, place the transmission behind the Revers-O-Matic (shuttle box) in high gear leaving all brakes applied.

   With a steady pressure, depress the forward pedal or lever to the wide open throttle position. Make note of the tachometer reading. The engine should turn up to the "MINIMUM" static R.P.M. as shown on the torque curve sheet. If engine speed is below the minimum requirements, it is an indication that the engine is at fault and should be checked out as described in (4) above. If a drop in stall speed persists, it indicates trouble in the transmission. If the stall speed is considerably below the minimum specified, it is an indication that the trouble is more likely in the converter. The remedy is to disassemble the converter and examine the converter parts for wear and any irregularities. Check out the stator making sure it is not in backwards, and examine the one way clutch if your unit is equipped with a 11¾" or 12" converter.

If the engine speed is over the "MAXIMUM" static R.P.M. as shown on the torque curve sheet, or if engine runaway is apparent, release the accelerator pedal or return the lever to neutral immediately to prevent possible damage to the transmission. This is an indication of transmission malfunction, and should be checked out per the "CHECKLIST" instructions following. Repeat the same test, with the reverse pedal or lever depressed to the wide open throttle position.

Stall test tachometer readings require careful interpretation. During a stall test, the engine, torque converter, and hydraulic clutches are all under test at the same time.

CAUTION: Because of the rapid rise in oil temperature, the stall condition should be maintained only long enough for the tachometer reading to stabilize. Five seconds is usually adequate time for an accurate reading. Under no circumstances should the stall period exceed 30 seconds at a time. Between test, run the engine for at least (2) two minutes at 1000-1200 R.P.M. with the Revers-O-Matic in neutral. This will permit the converter oil to flow into the heat exchanger and back to the transmission sump.

CHECK LIST

When trouble shooting the model 12000 Revers-O-Matic Drive, the items listed below are the most likely source of trouble.
NOTE: Never disassemble any hydraulic fitting or connection until the pressure gauge on the instrument panel has returned to a "O" zero pressure reading.

LOW ENGINE SPEED AT CONVERTER STALL

Conduct stall test previously described, checking the following:

1. CHECK ENGINE FOR LOW OUTPUT TORQUE – Tune engine and check output.
2. CHECK FOR CONVERTER ELEMENT INTERFERENCE – Listen for noise at stall, overhauling converter if necessary.
3. CHECK STATOR FOR IMPROPER INSTALLATION – Disassemble converter and examine parts affected, making sure stator is not in backwards. Examine one way clutch if your unit is equipped with a 12" converter.

HIGH ENGINE SPEED AT CONVERTER STALL

Conduct stall test previously described, checking the following:

1. CHECK TRANSMISSION FOR LOW OIL LEVEL – Add oil; refer to "SERVICE" section.
2. CHECK FOR LOW CONVERTER "OUT" PRESSURE – (This is a pressure of approximately 25 P.S.I. and is not normally checked with a pressure gauge). For indication of malfunction due to this cause check the following:

   (A) Check for leakages.

   (B) Disassemble the third regulator valve (one closest to the front, on right hand side looking from the rear; refer to exploded view on a later page) by first removing the oil temperature line. Inspect ball, ball seat in valve body, and spring. Ends of spring must be free of burrs and sharp edged.

   (C) Check for clogged or dirty lines in the hydraulic system, cleaning as required.

   (D) Check for defective oil pump, replacing worn or defective parts.

3. CHECK UNIT FOR HIGH OIL TEMPERATURE – Observe oil temperature gauge on instrument panel; refer to the "HIGH OIL TEMPERATURE" section below.
4. CHECK FOR CLUTCH SLIPPAGE – Observe the oil pressure gauge on instrument panel, checking per the "IRREGULAR OIL PRESSURE" section below. If unit is still malfunctioning, disassemble clutch stack and inspect for worn or defective parts.

IRREGULAR OIL PRESSURE

If the instrument panel indicates the oil pressure is running at pressures outside those previously specified under "OPERATION":

1. CHECK TRANSMISSION OIL LEVEL – Add oil if required; refer to "SERVICE" section. Drain to full mark by using drain cock or plug at oil level if overfilled.

2. CHECK FOR OIL AND AIR LEAKS – Inspect for oil leaks around external oil pressure tubes and for air leaks on suction side of pump; making corrections as required. Check for gasket leaks, tightening cap screws to required torque as necessary.

3. CHECK FOR FOAMING OIL – Oil foaming is generally the result of improper oil level, air leaks, or worn parts in oil pump. Check for water in oil. Refer to "LOSS OF POWER" section.

4. CHECK HIGH PRESSURE VALVE – Before making a complete tear-down of the high pressure valve (one closest to the rear; refer to exploded view on a later page) first remove the cap on the right hand side of control valve, looking from the rear of the unit. This cap will have some spring tension on it. With cap completely removed and spring tension released, joggle the valve part projecting from the valve body. This should release any torsional twist in the spring at the opposite end of the valve. Slowly replace the end cap.

   If the above procedure does not alleviate the condition, proceed with the following:

   (A) Disassemble the high pressure valve, removing end caps from both sides of valve body.

   (B) Remove all high pressure valve parts from valve body bore and inspect for defective parts. Pay particular attention for rubbed places which is an indication that the valve is not working freely. Remove any burrs or sharp edges, examining the spring very closely.

   (C) Blow the valve body bore out with air pressure and inspect for burrs and defects in valve bore.

   (D) Wash all parts thoroughly, replacing defective parts.

   (E) Coat all parts with light oil and assemble in valve body bore. Check for valve stickiness by moving valve back and forth in bore. If parts do not move freely, disassemble and inspect again. If everything appears to be satisfactory, replace end caps, the one on the left first.

5. CHECK FOR INTERNAL OIL LEAKS – Inspect closely for broken seal rings throughout the system, replacing as required.

6. CHECK FOR CLOGGED OR DIRTY LINES IN THE HYDRAULIC SYSTEM – Clean as required.

7. CHECK FOR PLUGGED OIL FILTER – Replace if necessary.

8. CHECK FOR DEFECTIVE OIL PUMP – Inspect for wear, replacing worn parts.

HIGH OIL TEMPERATURE

If the oil temperature gauge on the instrument panel indicates that the oil temperature is running above normal as specified under the "OPERATION" section:

1. CHECK TRANSMISSION OIL LEVEL – Add oil if required; refer to "SERVICE" section. Drain to full mark by using drain cock or plug at oil level if overfilled.

2. CHECK WATER LEVEL IN ENGINE COOLING SYSTEM – Add water if required and inspect for leaks.

3. CHECK FOR LOW CONVERTER "OUT" PRESSURE – Refer to the "HIGH ENGINE SPEED AT CONVERTER STALL" section.

4. CHECK FOR CLOGGED OR DIRTY HEAT EXCHANGER – Clean or replace as necessary.

5. CHECK POSSIBILITY OF OPERATING TOO LONG IN AN INEFFICIENT CONVERTER RANGE –

Shift transmission, adjusting work cycle to allow operation in a more efficient range.

6. CHECK FOR LOW STALL SPEED – Check for lack of power at converter stall; refer to "LOW ENGINE SPEED AT CONVERTER STALL" section.

BUZZING VALVE

A buzzing valve is closely related to "IRREGULAR OIL PRESSURE" and "HIGH OIL TEMPERATURE", and as such, these two items must be checked out if the buzzing condition exists. Pay particular attention to the high pressure valve check and inspect for foaming oil.

LOSS OF POWER

If unit appears to be suffering from lack of power after engine performance has proven satisfactory:

1. CHECK STATOR FOR IMPROPER INSTALLATION – Disassemble converter and examine parts affected, making sure stator is not in backwards. Examine one way clutch if your unit is equipped with a 12" converter.

2. CHECK FOR LOW STALL SPEED – Refer to "LOW ENGINE SPEED AT CONVERTER STALL" section.

3. CHECK FOR CLUTCH PLATE SLIPPAGE – If slippage is suspected:

   (A) Check for low clutch pressure; refer to the "IRREGULAR OIL PRESSURE" section.

   (B) Check unit for worn piston seals; disassemble clutch stack and check piston seals for nicks, cuts, or wear, using drain cock or plug at oil level if overfilled.

4. CHECK FOR FOAMING OIL – If foaming oil is prevalant:

   (A) Check for improper oil level, adding oil if required; refer to "SERVICE" section. Drain to full mark by using drain cock or plug at oil level if overfilled.

   (B) Check for water in oil, replacing oil if necessary.

   (C) Check for air leaks around oil tubes, making corrections per "LEAKY OIL TUBE" section on a later

   (D) Check oil pump for worn parts, replacing defective parts as required.

NO POWER TRANSMITTED IN EITHER CLUTCH

If this condition exists:

1. CHECK CLUTCH SELECTOR VALVE FOR PROPER OPERATION.

   (A) Inspect linkages from shuttle control box to valve for proper adjustment.

   (B) Remove valve cover and inspect arm that actuates the clutch selector valve for proper operation.

   (C) Disassemble the clutch selector valve (one in center, on left hand side looking from the rear; refer to exploded view on a later page) by removing end cap. NOTE: valve cover must be off in order to accomplish this. Inspect parts and bore for wear, replacing worn parts as necessary. Parts must be free from burrs and sharp edges.

2. CHECK FOR LOW CLUTCH PRESSURE – Refer to the "IRREGULAR OIL PRESSURE" section on a previous page.

POWER TRANSMITTED IN ONLY ONE CLUTCH

If this condition is apparent:

1. FIRST CHECK UNIT OUT AS UNDER "NO POWER TRANSMITTED IN EITHER CLUTCH" above.

2. DISASSEMBLE CLUTCH STACK AND CHECK FOR BROKEN SEAL RINGS ON INPUT SHAFT, OUTPUT SHAFT, AND OIL SLEEVE DISTRIBUTOR TUBE – Replace broken seal rings.

3. WITH CLUTCH STACK DISASSEMBLED, CHECK PARTS IN INOPERATIVE CLUTCH FOR WEAR AND MALFUNCTION – Replace worn or damaged parts, checking closely for defective piston seals.

SLOW CLUTCH ENGAGEMENT

If either clutch appears to suffer from slow clutch engagement:

1. CHECK FOR FOAMING OIL – Refer to "IRREGULAR OIL PRESSURE" and "LOSS OF POWER" sections.

2. CHECK FOR LOW CLUTCH PRESSURE – Refer to "IRREGULAR OIL PRESSURE" section.

3. CHECK FOR WORN PISTON SEALS – Disassemble and inspect seals for wear, replacing as required.

VEHICLE DRIVES IN FORWARD, AND CREEPS FORWARD IN NEUTRAL, BUT STALLS WHEN SHIFTED TO REVERSE

1. CHECK FOR FAILED FORWARD CLUTCH – Overhaul forward clutch replacing all worn and defective parts.

If oil and filter show contamination, the entire system must be thoroughly washed and cleaned; changing oil and filter.

VEHICLE DRIVES IN REVERSE, AND CREEPS BACKWARD IN NEUTRAL, BUT STALLS WHEN SHIFTED TO FORWARD

1. CHECK FOR FAILED REVERSE CLUTCH – Overhaul reverse clutch replacing all worn and defective parts.

If oil and filter show contamination, the entire system must be thoroughly washed and cleaned; changing oil and filter.

NOISY TRANSMISSION

If the noise level of the unit appears to be excessive:

1. CHECK FOR IMPROPER OIL LEVEL – Add oil if required; refer to "SERVICE" section. Drain to full mark by using drain cock or plug at oil level if overfilled.

2. CHECK FOR CLOGGED OIL FILTER – Replace filter if necessary.

3. CHECK FOR AIR LEAKS – Inspect around oil tubes, seals, and gaskets.

4. CHECK FOR LOOSE MOUNTING BOLTS – Tighten bolts to proper torque.

5. CHECK FOR DAMAGED GEAR TEETH – Replace as necessary.

6. CHECK FOR FLAWS IN GEAR SHAFT – Replace as necessary.

7. CHECK FOR FLYWHEEL HOUSING MISALIGHMENT – Realign using indicator if required.

EXCESSIVE VIBRATION

If vibration appears to be excessive:

1. CHECK FOR LOOSE MOUNTING BOLTS – Tighten bolts to proper torque.

2. CHECK FOR DAMAGED GEAR TEETH – Replace as necessary.

3. CHECK FOR FAULTY GEARBOX BEARINGS – Inspect and replace bearings as necessary.

If any difficulty is experienced when shifting gears:

1. CHECK FOR PROPER LUBRICANT – Replace if necessary; refer to "SERVICE" section for recommended types.

2. CHECK TRANSMISSION LINKAGE FOR BENT, WORN, OR BROKEN PARTS – Replace faulty parts and re-adjust linkage.

3. CHECK FOR ENGAGED CLUTCH IN REVERS-O-MATIC (SHUTTLE BOX) – Return pedal or lever to neutral.

4. CHECK FOR CLUTCH DRAG IN REVERS-O-MATIC (SHUTTLE BOX) – If transmission will not shift gears without raking teeth with vehicle stationary:

   (A) First check for proper control linkage adjustment between control box and control valve on Revers-O-Matic.

   (B) If clutch drag is still prevalent, disassemble clutch stack and inspect parts in clutch affected for malfunction.

TRANSMISSION WILL NOT STAY IN PROPER RATIO

If the transmission has developed the habit of jumping out of gear:

1. CHECK TRANSMISSION LINKAGE FOR BENT, WORN, OR BROKEN PARTS – Replace faulty parts and readjust linkage.

2. CHECK FOR EXCESSIVE ENDPLAY DUE TO WEAR IN THE SHIFT FORKS, SLIDING GEAR, FORK GROOVES, THRUST WASHERS, OUTPUT SHAFT OR COUNTERSHAFT BEARINGS – Replace faulty parts and readjust for faulty endplay.

FOAMING OIL BREATHER

If oil is foaming out the breather:

1. FIRST CHECK FOR IMPROPER OIL LEVEL, OIL AND AIR LEAKS, PUMP SUCTION TUBE LEAKS, WORN PUMP PARTS, AND WATER IN OIL – Refer to "IRREGULAR OIL PRESSURE" and "LOSS OF POWER" section.

2. IF UNIT CONTINUES TO FOAM THRU THE BREATHER, CHECK FOR BROKEN CONVERTER HUB GEAR SEAL RING – Break unit at engine flywheel housing mounting face by removing (12) twelve 3/8 capscrews. Pull unit off engine and inspect seal ring, replacing if necessary.

   CAUTION! WHEN REASSEMBLING (STABBING) UNIT BACK ON ENGINE

   (A) First apply heavy grease to the stator support hub and input shaft splines (the (2) two splines projecting out into the converter housing) and the converter hub gear seal ring.

   (B) Center the converter hub gear seal ring in it's groove. The grease should hold the ring in position.

The above procedures will greatly aid in the installation of the unit, and will insure the seal ring to a high degree against breakage.

WET CONVERTER HOUSING

If oil is leaking out of the air vent holes in the bottom of the converter housing:

1. FIRST, BREAK UNIT AT ENGINE FLYWHEEL HOUSING MOUNTING FACE – Inspect converter hub gear seal ring for breakage as directed under "FOAMING OIL BREATHER" section above.

2. CHECK CONVERTER FOR LEAKS – Examine the converter, especially where the hub gear bolts onto the converter.

3. CHECK OIL SEAL INSIDE CONVERTER HOUSING – Replace if defective.

LEAKY OIL TUBE

If oil is leaking out around oil tube:

Straight tubes may be rotated back and forth using a pair of channel-lock pliers. This will generally seat the "O" ring on the end of the tube sufficient to seal off the leak.

REFER TO REAR OF BOOK FOR DISASSEMBLY AND ASSEMBLY HINTS, AND PROPER BOLT TORQUE VALUES.

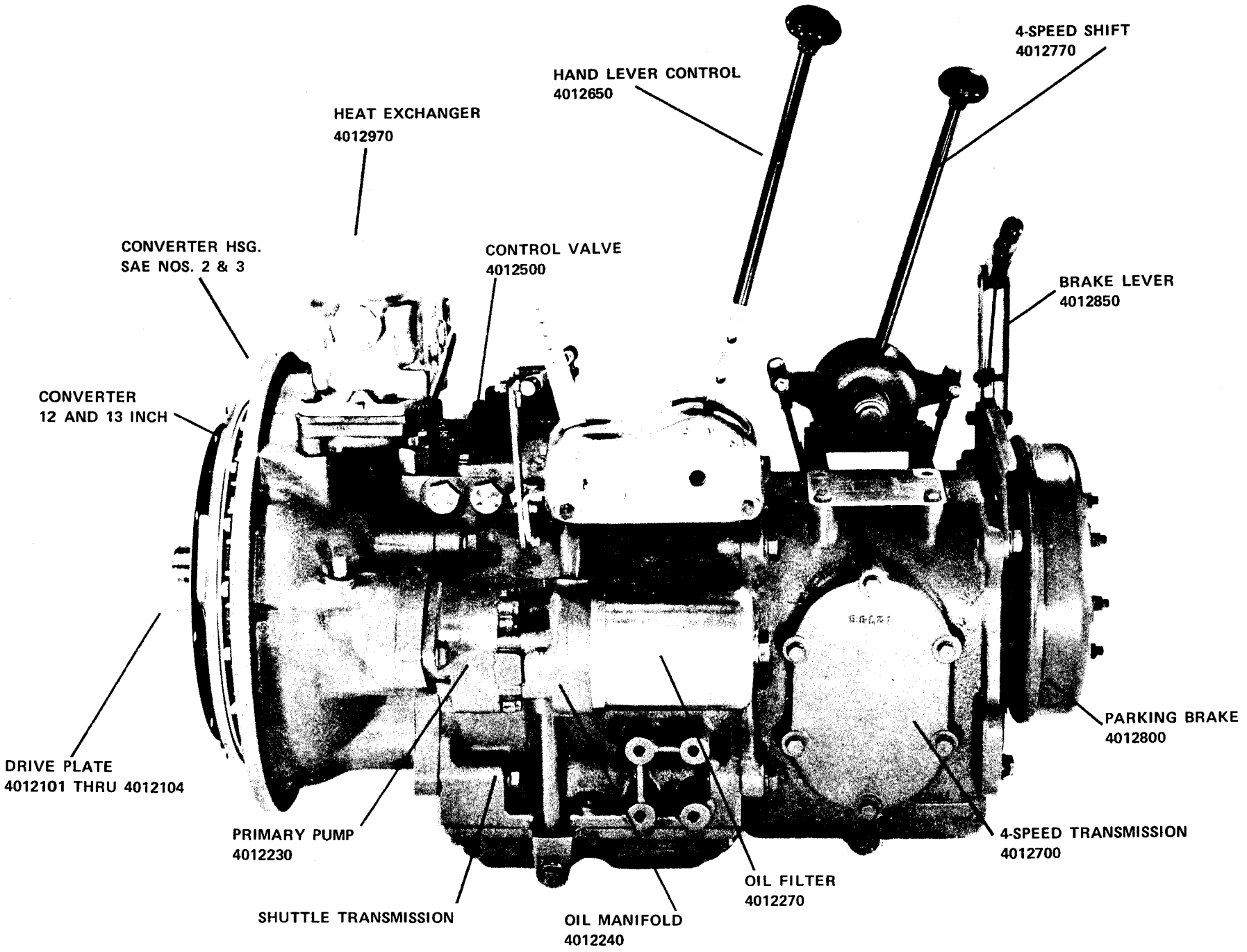
PICTORIAL VIEWS

AND

PARTS LIST

SECTION

MODEL IDENTIFICATION SHEET



CONVERTER INSTALLATION DATA

When installing this unit on a new or different engine, it is imperative that the following steps be taken to insure proper installation.

1. Refer to your specification sheet and determine the part number of your converter drive plate assembly. Then refer to your instruction manual, page No. 13, and find the table of dimensions that is matched up with your drive plate assembly number.

2. Check the flywheel on the engine to see if the dimensions match those shown in the tables which correspond with your converter drive assembly number.

3. After determining that you have the correct flywheel to match your converter drive plate, the following procedure should be followed when installing the Revers-O-Matic to the engine.

   a. Remove drive plate assembly and converter from Revers-O-Matic by pulling straight out.

   b. Detach drive plate assembly from converter by removing the eight socket head capscrews holding the drive plate.

   c. Fasten drive plate assembly to the engine flywheel with capscrews and lockwashers provided in parts bag.

   d. Fasten converter to drive plate assembly with eight socket head capscrews previously removed.

   e. Center converter hub gear seal ring in its grove. Grease should hold ring in position.

   f. Align Revers-O-Matic with converter and mate together.

CAUTION: Unit should be supported by hoist so that it can be positioned directly in line with converter hub. Carefully insert input shaft into bore of converter keeping shaft well centered in bore. Advance unit toward engine slowly in order to feel when splines begin to mate. If unit stops advancing at this point, rock gently to permit splines to line up. DO NOT USE BRUTE FORCE AT ANY TIME. When all splines and gear teeth line up, unit will close up easily.

   g. Install bolts holding unit to engine bell housing.

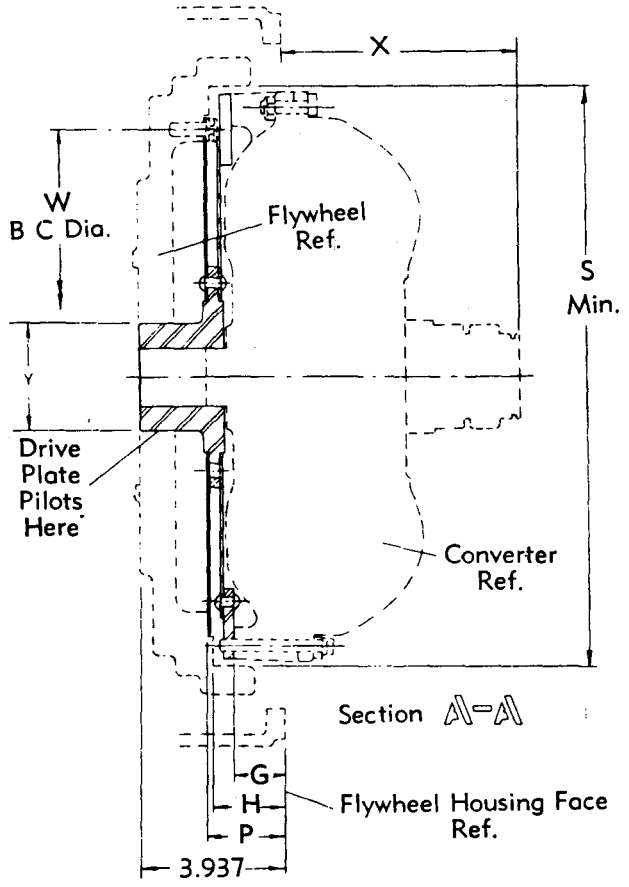
   h. Install water hoses between heat exchanger and engine cooling system.

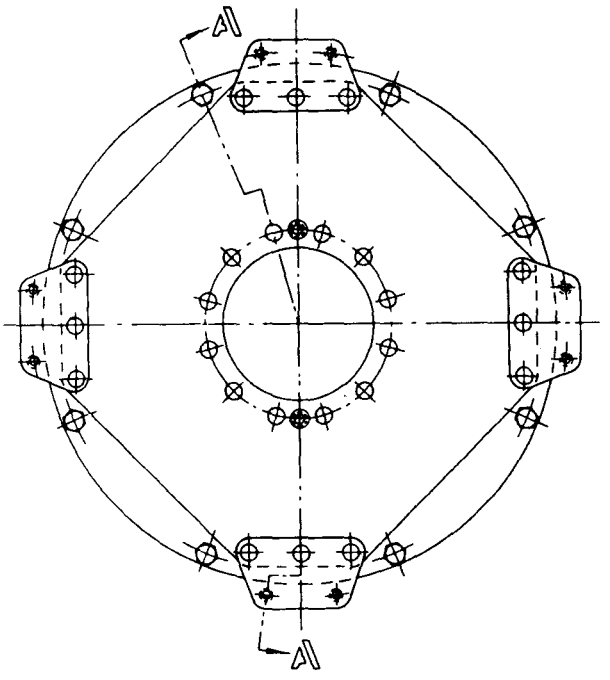
NOTE: To aid in converter installation, the stator support hub spline, input shaft spline, and converter hub gear seal ring are heavily greased prior to shipment.

TORQUE SPECIFICATIONS

11 3/4"	Converter Cover Bolts	22 lbs. ft.
12"	Converter Cover Bolts	22 lbs. ft.
13"	Converter Cover Bolts	18 lbs. ft.
1/4"	Diameter Bolts or Cap Screws	8 lbs. ft.
5/16"	Diameter Bolts or Cap Screws	16 lbs. ft.
3/8"	Diameter Bolts or Cap Screws	24 lbs. ft.
7/16"	Diameter Bolts or Cap Screws	40 lbs. ft.
1/2"	Diameter Bolts or Cap Screws	60 lbs. ft.
9/16"	Diameter Bolts or Cap Screws	90 lbs. ft.
Regular Caps (Control Valve)		25 lbs. ft.

DRIVE PLATE MASTER SHEET





THE 6 DRIVE PLATE ASSEMBLIES LISTED BELOW ARE STANDARDS

	FLYWHEEL	CONVERTER	DIM. Y	DRIVE PLATE ASSY. NO.	DIM. W	DIM. S	DIM. H	DIM. P	DIM. G	DIM. P-G	DIM. X
HOUSING	S. A. E. 10"	11 3/4"	2.4395"	4012101-K	11 5/8"	14 1/4"	1 15/16"	2 1/8"	1 3/8"	3/4"	6 1/2"
FLYWHEEL	S. A. E. 10"	12"	or	4012101	11 5/8"	14 1/4"	1 15/16"	2 1/8"	1 3/8"	3/4"	6 1/2"
S.A.E. #3	S. A. E. 10"	13"	2.8332"	4012103	11 5/8"	15 3/16"	1 15/16"	2 1/8"	1 3/8"	3/4"	6 1/2"
	S. A. E. 11 1/2"	11 3/4"	2.4395"	4012102-K	13 1/8"	14 1/4"	1 3/8"	1 9/16"	13/16	3/4"	7 1/16"
S.A.E. #2	S. A. E. 11 1/2"	12"	or	4012102	13 1/8"	14 1/4"	1 3/8"	1 9/16"	13/16	3/4"	7 1/16"
	S. A. E. 11 1/2"	13"	2.8332"	4012104	13 1/8"	15 3/16"	1 3/8"	1 9/16"	13/16	3/4"	7 1/16"

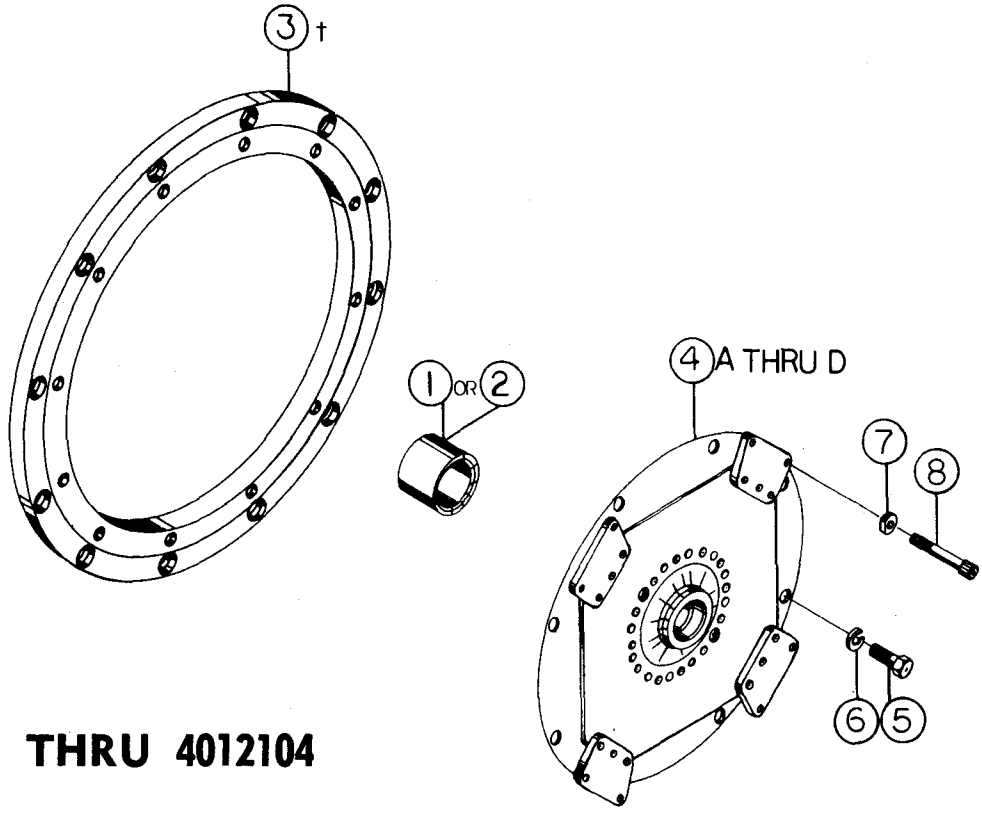
Flywheels called out are for S.A.E. standard 10" and 11-1/2" drive-ring type overcenter clutches. S.A.E. size may be verified by checking dimensions "P" and "W". Flywheel modification may be required to clear converter as per dimensions "S" and "H" as shown on print.

When ordering, specify:

1. Flywheel housing size, S.A.E. Nos. 2 or 3
2. Flywheel size, S.A.E. 10" or 11-1/2"
3. Flywheel pilot bore, dimensions "Y"
4. Make and model of engine

Non-standard drive plate assemblies are available at higher cost to adapt the 11-1/2" flywheel to No. 3 flywheel housings and the 10" flywheel to No. 2 flywheel housings. Other drive plate assemblies are available for special applications. It is requested that these non-standards be used only when all means have been exhausted to use one of the 6 standard plates.

DRIVE PLATE ASSEMBLIES



4012101 THRU 4012104

PARTS LIST

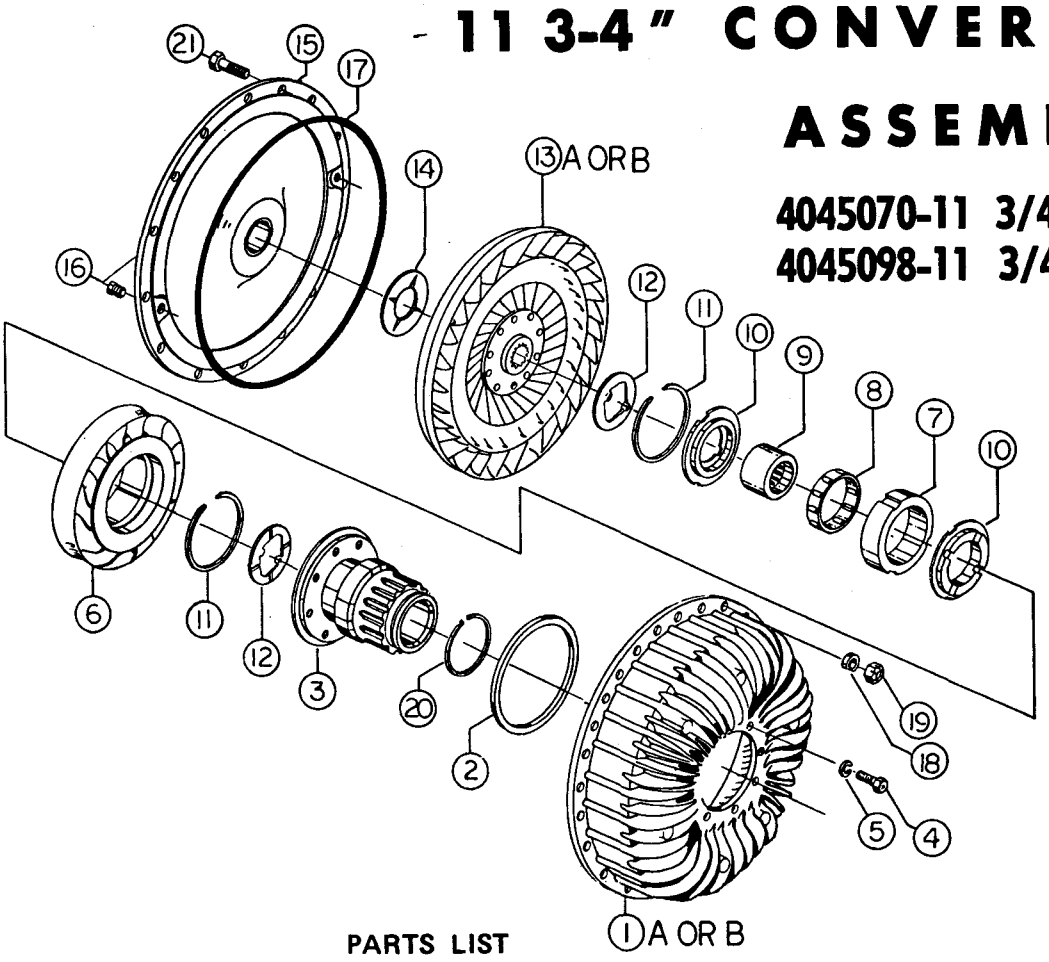
Drawing Ref. No.	New Part No.	Old Part No.	Description	No. Req.
1	40121001	12100-1	Sleeve, Drive Hub (1 3/4" Long)	
2	40121003	12100-3	Sleeve, Drive Hub (2 5/16" Long)	
3	40121002 †	12100-2	Ring, Spacer (Special)	1 as Req.
4a	4012101	12101	Drive Plate Assembly	
4b	4012102	12102	Drive Plate Assembly	1 of 4
4c	4012103	12103	Drive Plate Assembly	per Spec.
4d	4012104	12104	Drive Plate Assembly	
5	4F10030-12	12120	Capscrew 3/8 N.C. x 3/4" Hex. Hd. (H.T.)	8
6	4F16202	12120-1	Washer, 3/8 Ned. Spring Lock	8
7a	4012121	12121	Washer, Half Round 11/16" Dia. x 1/4" Thick (12" Converter)	8 of 1
7b	4012121A	12121-A	Washer, Half Round 11/16" Dia. x 1/8" Thick (13" Converter)	
8a	F11004-2	12122NY	Capscrew 5/16-NF x 1-1/4" Socket Hd. (H.T.) (12" Converter)	8 of 1
8b	F11004-44	12123NY	Capscrew 5/16-NF x 2-3/4" Socket Hd. (H.T.) (13" Converter)	

*All standard drive plate assemblies are supplied with a 2.4395" maximum diameter pilot hub. If your flywheel pilot bearing bore is larger than this, we will supply you with a No. 40121001 sleeve on units equipped No. 4012101 or No. 4012103 drive plate, or a No. 40121003 sleeve on units equipped with a No. 4012102 or No. 4012104 drive plate; thus the drive plate pilot diameter with sleeve becomes 2.8332" maximum.

†The No. 40121002 ring spacer is not required in conjunction with any standard drive plate assembly. It is used only when adapting the unit to an engine equipped with a flywheel for an S.A.E. 11½" drive-ring type over the clutch with a 1 9/16" offset and an S.A.E. No. 3 flywheel housing using 1 of 3 drive plates 4012102, 4012102-K 4012104.

11 3-4" CONVERTER ASSEMBLY

4045070-11 3/4 HI-K
4045098-11 3/4 AB



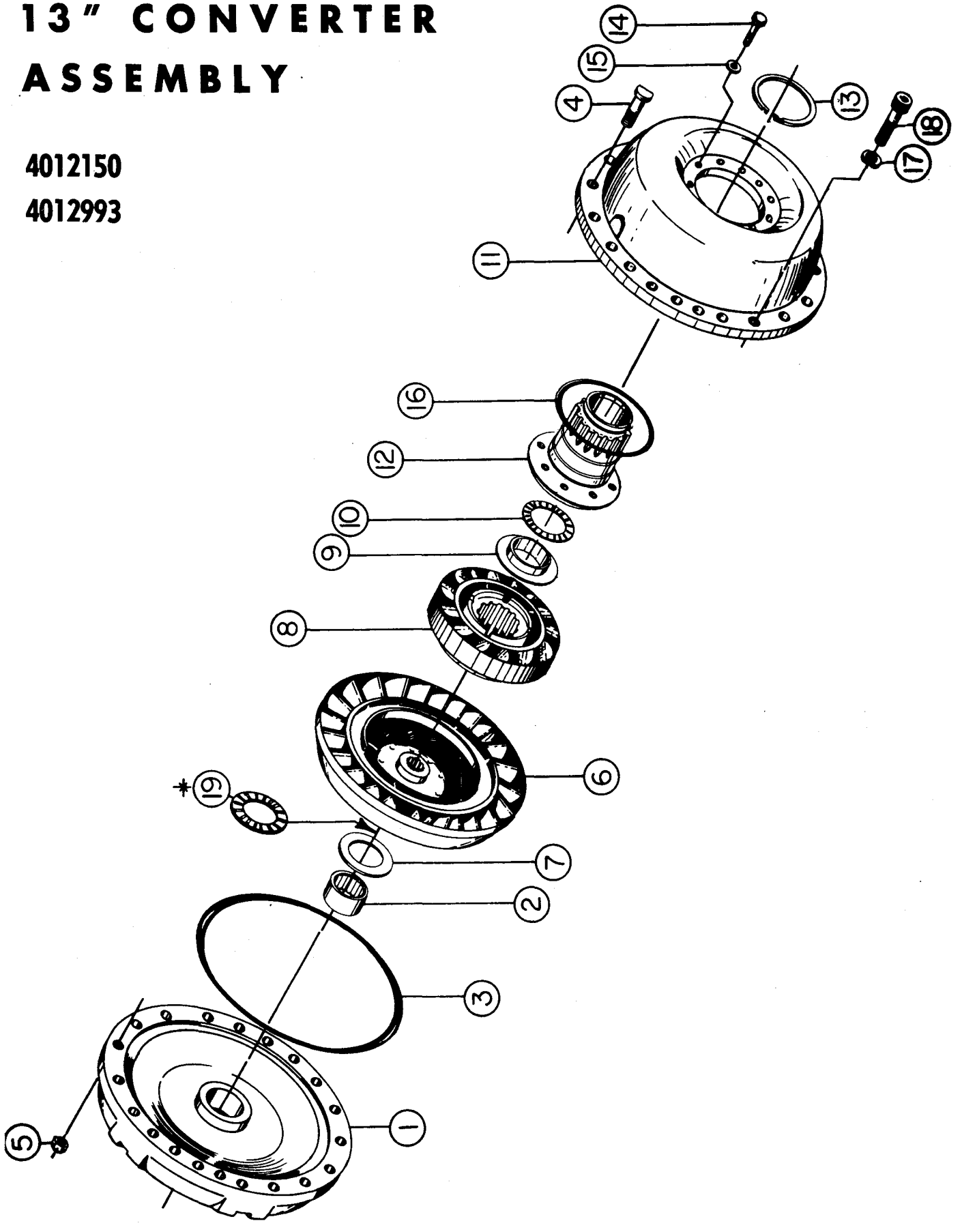
PARTS LIST

Drawing Ref. No.	Part No.	DESCRIPTION	No. Req.
1A	4045100	Impeller Assembly	1
1B	4045023	Impeller Assembly	1
2	4045006	Ring, Seal	1
3	4012128	Hub	1
4	4045004	Capscrew	8
5	4045005	Lockwasher	8
6	4045042	Stator Assembly	1
7	4045013	Outer Race	1
8	4045036	One Way Clutch Assembly	1
9	4045012	Inner Race	1
10	4045037	Washer, Stator	2
11	4045011	Snap Ring	2
12	4045038	Washer, Thrust: Impeller	2
13A	4045099	Turbine Assembly	1
13B	4045043	Turbine Assembly	1
14	4045040	Washer	1
15	4045044	Front Cover	1
16	4045015	Plug Drain	2
17	4045017	"O" Ring, Front Cover	1
18	4012121	Washer, Half Round	10
19	4045019	Hex Locknut	10
20	4012129	Ring Seal	1
21	4012144	Cover Bolt	10

NOTE: Ref. Nos. 1A and 13A are used with Assy. No. 4045098
Ref. Nos. 1B and 13B are used with Assy. No. 4045070

13" CONVERTER ASSEMBLY

4012150
4012993



13" CONVERTER ASSEMBLY—4012150

(SEE ILLUSTRATION ON OPPOSITE PAGE)

PARTS LIST

Ref. No.	Part No.	Description	No. Req.
1	4012152	Cover, Front	1
2	4F46028-12	Bearing, Pilot	1
3	4000537	"O" Ring, Front Cover Seal	1
4	4012155F	Bolt, Cover; 5/16" - N.F. (H.T.)	16
5	4012156	Nut, Lock; 5/16" N.F. Hex. Hd.	16
6	4012157	Turbine Assembly	1
7	4012161	Washer, Turbine Forward Thrust	1
8	4012161F	Stator Assembly	1
9	4012162	Pilot, Thrust Bearing	1
10	4F55036-48	Bearing, Thrust	1
11	4012164-F	Impeller (Pump)	1
12	4012166-A	Gear, Impeller Hub	1
13	4012129	Ring, Seal; Impeller Hub Gear	1
14	4F10020-14	Capscrew, 5/16" N.C. x 7/8" Hex. Hd. (H.T.)	12
15	4F18002	Washer, 5/16" Sealing	12
16	4F37030-236	"O" Ring, Hub Gear Seal	1
17	4012121-A	Washer, Half Round 1-1/16 Dia. 1/8" Thick	8
18	4012123NY	Capscrew, 5/16" N.F. x 1-3/4" Soc. Hd. (H.T.)	8

13" CONVERTER ASSEMBLY—4012993

(SEE ILLUSTRATION ON OPPOSITE PAGE)

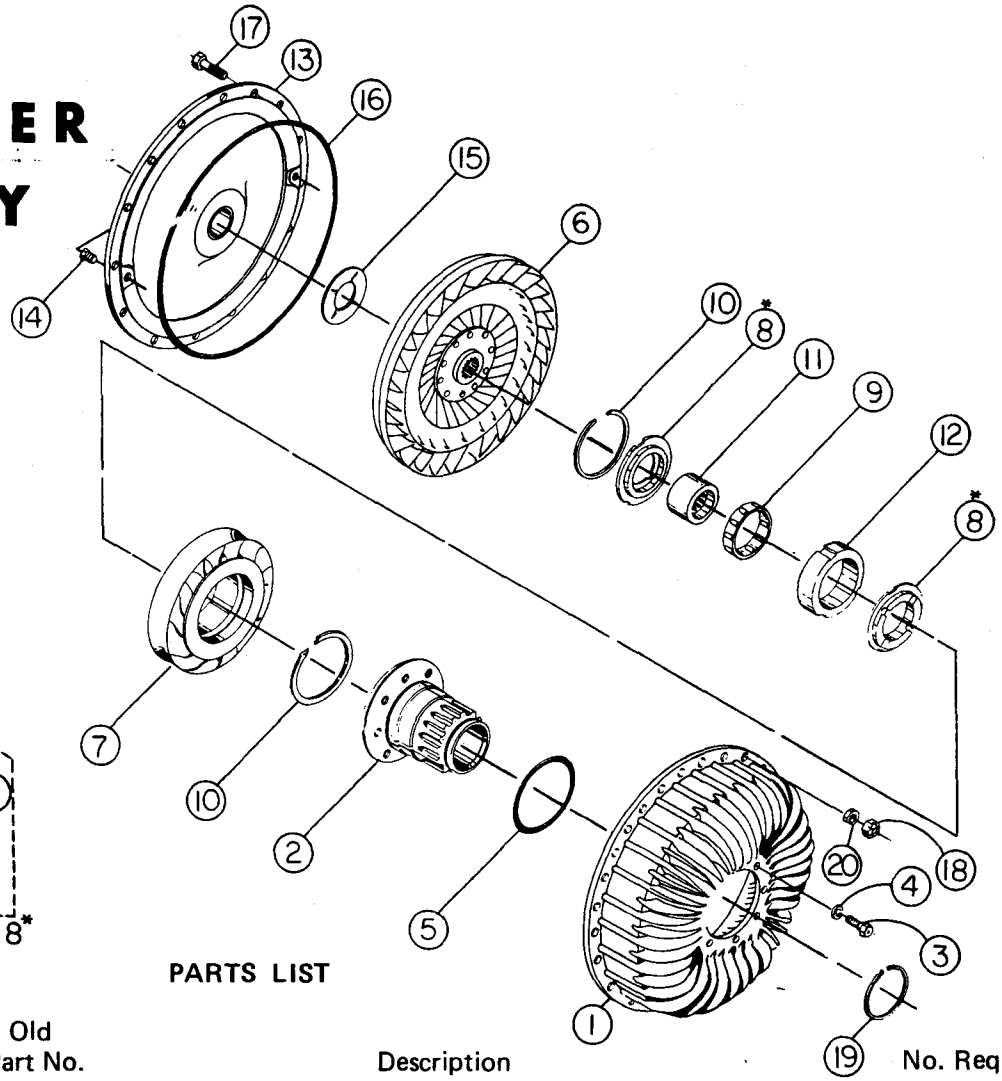
PARTS LIST

Ref. No.	Part No.	Description	No. Req.
1	4045110	Cover, Front	1
2	4F46028-12	Bearing, Pilot	1
3	4000537	"O" Ring	1
4	4012155F	Bolt, Cover	16
5	4F13111000	Locknut, Flanged	16
6	4045133	Turbine Assembly	1
7	4045129	Washer, Thrust	1
8	4012992	Stator Assembly	1
9	4045130	Thrust Washer	1
10	4F55136-50	Thrust Bearing	1
11	4012164F	Impeller	1
12	4012991	Impeller Hub	1
13	4012129	Ring, Seal	1
14	4F10420-14	Bolt, Place	12
15	4F18002	Washer, Dyna Seal	12
16	4F37030-236	"O" Ring	1
*19	4F55136-50	Thrust Bearing	1

*Ref. No. 19 not used on Assembly 4012150

12" CONVERTER ASSEMBLY

4045020

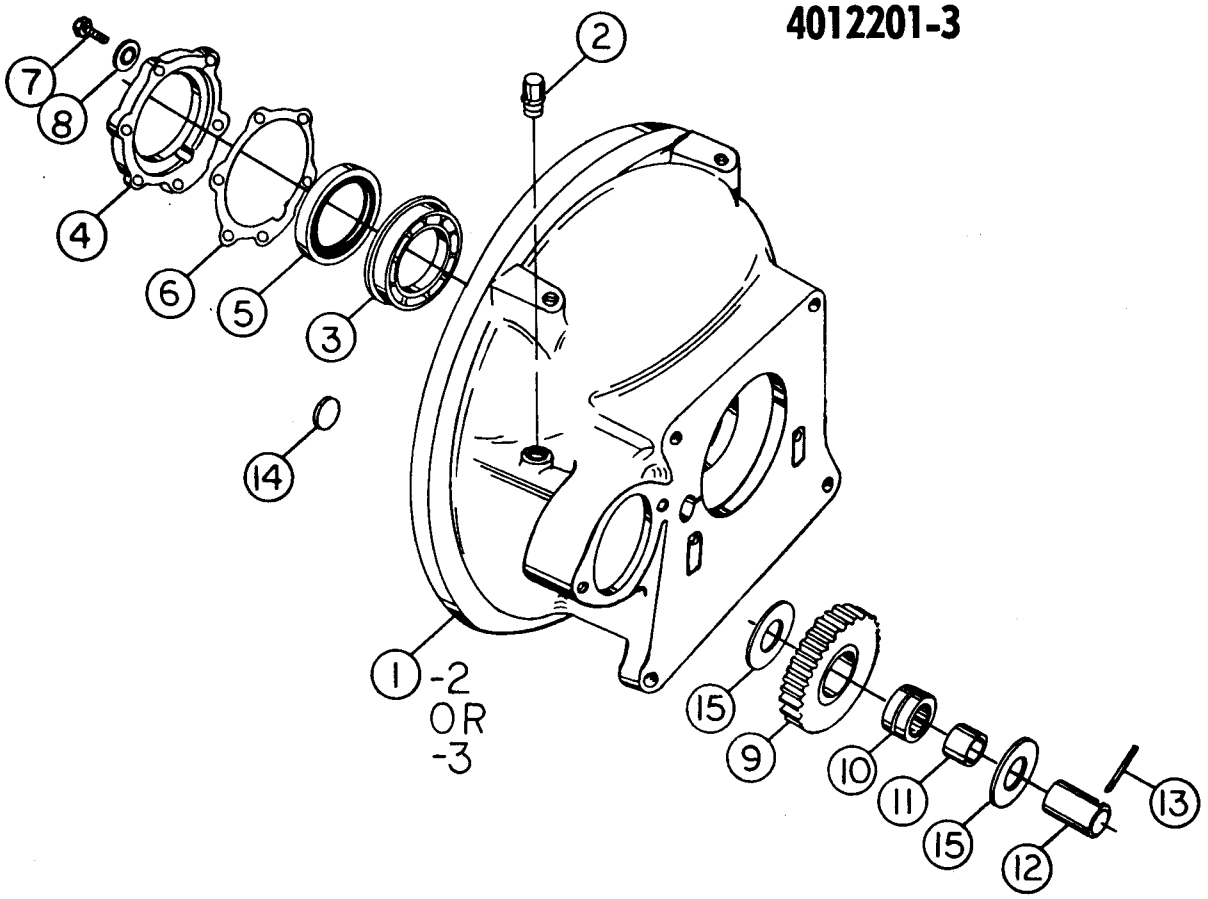


PARTS LIST

Drawing Ref. No.	New Part No.	Old Part No.	Description	No. Req.
1	4045002	45002	Impeller Assembly	1
2	4012128	12128	Gear, Impeller Hub	1
3	4045004	45004	Cap Screw, 1/4-N.C. x 5/8" Hex. Hd. (H.T.)	8
4	4045005	45005	Washer, 1/4" Medium Spring Lock	8
5	4045006	45006	"O" Ring, Square Section; Hub Gear Seal	1
6	4045021	45021	Turbine Assembly	1
7	4045008	45008	Stator Assembly	1
*8	4045009	45009	Washer, Stator Thrust	2
9	4045010	45010	Sprag, One Way Clutch	1
10	4045011	45011	Ring, Snap	2
11	4045012	45012	Race, Inner	1
12	4045013	45013	Race, Outer	1
13	4045014	45014	Front Cover Assembly	1
14	4045015	45015	Plug, Oil Drain	2
15	4045016	45016	Washer, Turbine Forward Thrust	1
16	4045017	45017	"O" Ring, Front Cover Seal	1
17	4F10025-20	12144	Bolt Cover; 5/16"-N.F. x 1-1/4" Hex. Hd. (H.T.)	10
18	4012145	12145	Nut, Lock; 5/16"-N.F. Hex. Hd.	10
19	4012129	12129	Ring, Seal, Impeller Hub Gear	1
20	4012121	12121	Washer, Half Round; 11/16" Dia. x 1/4" Thick	10
21	4045038	45038	Impeller Thrust Washer, Steel Back Bronze	2
22	4045037	45037	Aluminum Stator Thrust Washer	2

CONVERTER HOUSING ASSEMBLIES

CONVERTER HOUSING ASSEMBLIES
4012201-2
4012201-3



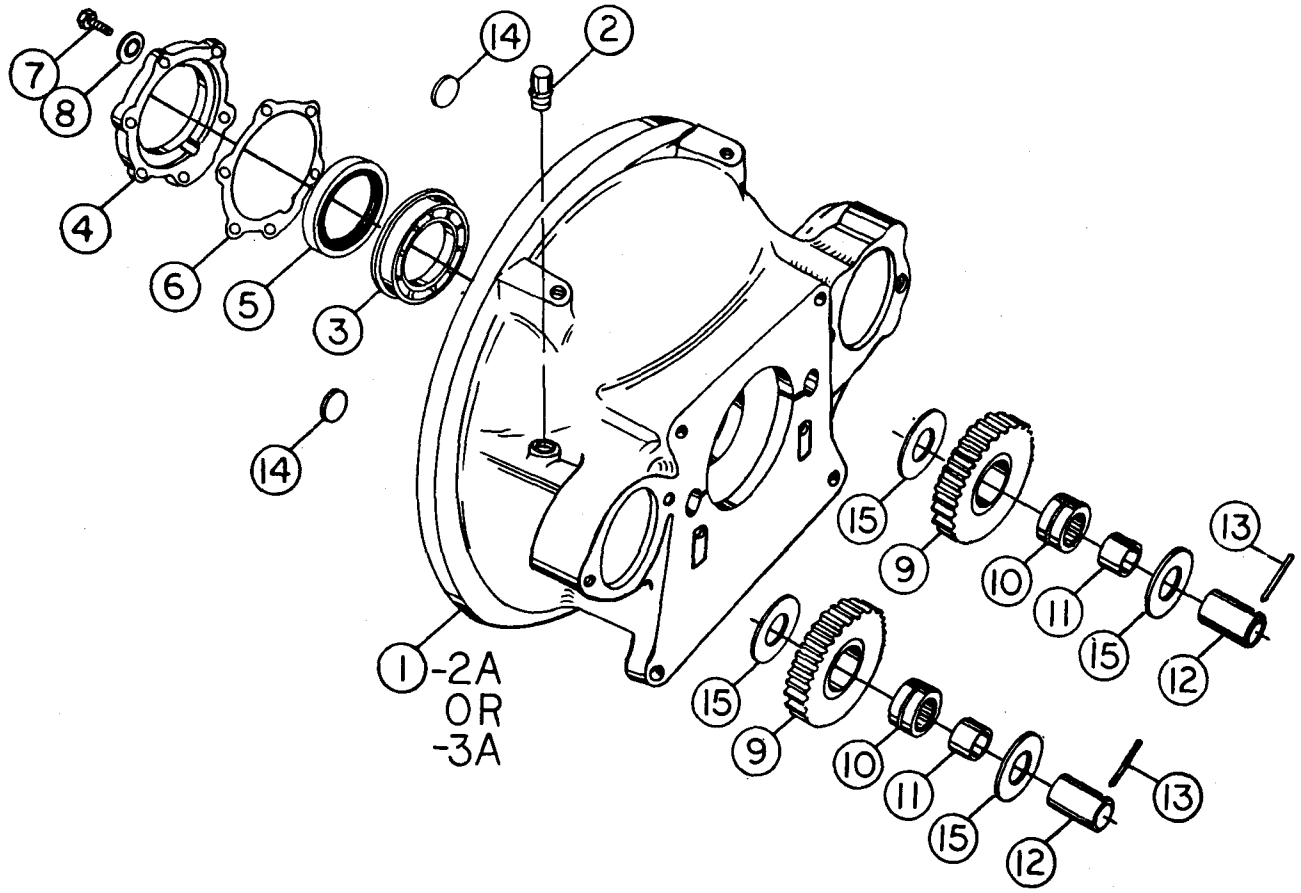
PARTS LIST

Ref. No.	Part No.	Description	No. Req.
1-2	40122052	Housing, Converter; No Auxiliary Pump Flange	1 of 2
1-3	40122053	Housing, Converter; No Auxiliary Pump Flange	
2	4F68203	Breather, Converter Housing	1
3	4F40114-R	Bearing, Converter Pilot	1
4	4012211	Retainer, Converter Pilot Bearing	1
5	4F65015	Seal, Oil; Converter Hub Gear Seal	1
6	4012213	Gasket, Converter Pilot Bearing Retainer	1
7	4F10020-14	Capscrew, 5/16"-N.C. x 7/8" Hex. Hd. (H.T.)	6
8	4F18002	Washer, 5/16" Sealing	6
9	4012217	Gear, Idler; Primary Pump Drive	1
10	4F52072-34	Bearing, Idler Gear	1
11	4F54072-34	Race, Inner; Idler Gear Bearing	1
12	4012219	Shaft, Idler Gear	1
13	4F25187-14	Roll Pin, Shaft Retainer	1
14	4F22015	Plug, Expansion: 1-1/8" Dia. Standard	1
15	4012222	Washer, Idler Gear; Thrust	2

CONVERTER HOUSING ASSEMBLIES

4012201-2A

4012201-3A

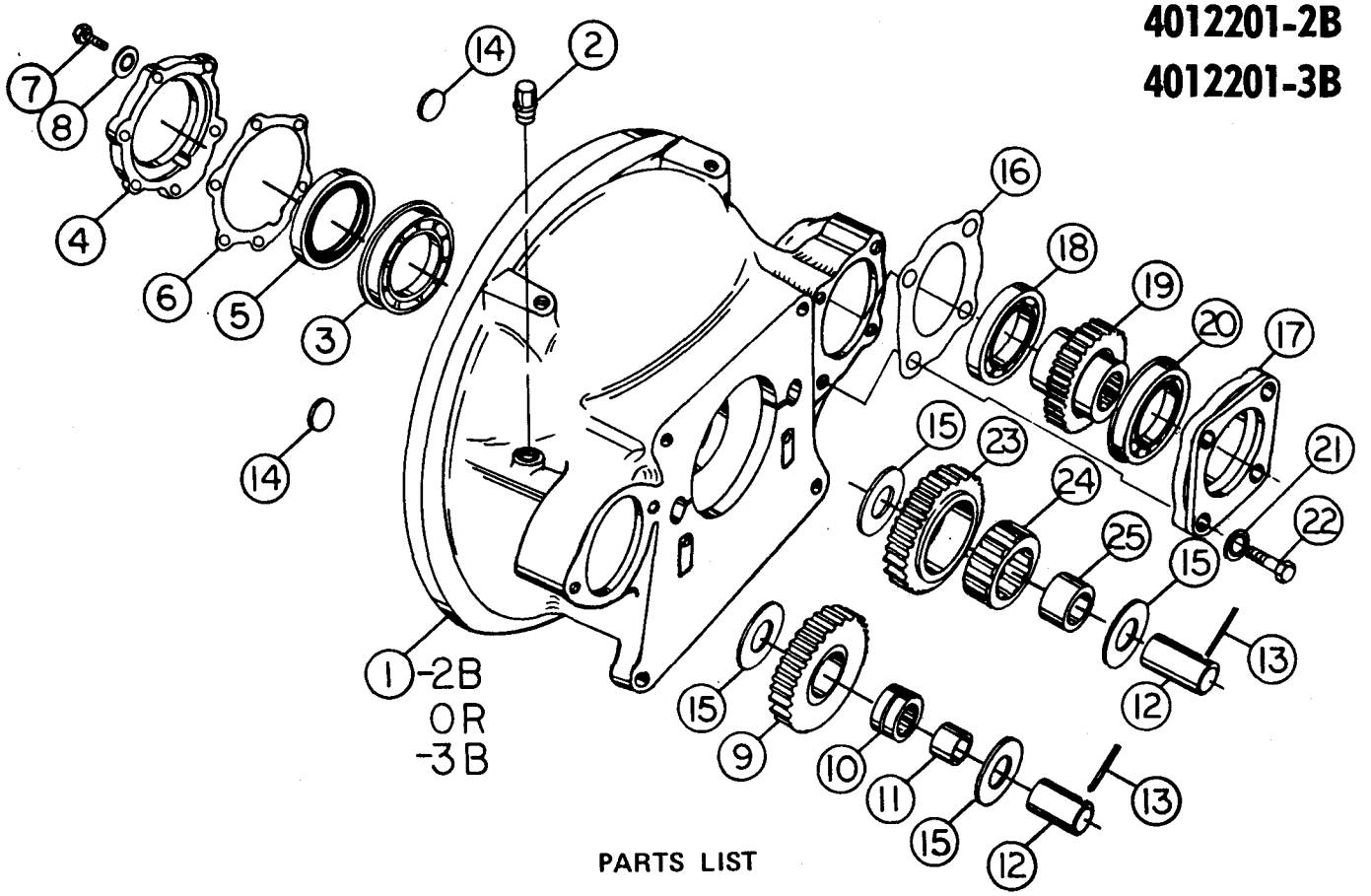


PARTS LIST

Ref. No.	Part No.	Description	No. Req.
1-2A	40122052A	Housing, Converter; S.A.E. "A" Aux. Pump Flange	1 of 2
1-3A	40122053A	Housing, Converter; S.A.E. "A" Aux. Pump Flange	
2	4F68203	Breather, Converter Housing	1
3	4F40114R	Bearing, Converter Pilot	1
4	4012211	Retainer, Converter Pilot Bearing	1
5	4F65015	Seal, Oil; Converter Hub Gear Seal	1
6	4012213	Gasket, Converter Pilot Bearing Retainer	1
7	4F10020-14	Capscrew, 5/16-N.C. x 7/8" Hex. Hd. (H.T.)	6
8	4F18002	Washer, 5/16 Sealing	6
9	4012217	Gear, Idler; Primary Pump Drive	2
10	4F52072-34	Bearing, Idler Gear	2
11	4F54072-34	Race, Inner; Idler Gear Bearing	2
12	4012219	Shaft, Idler Gear	2
13	4F25187-14	Roll Pin; Shaft Retainer	2
14	4F22015	Plug, Expansion; 1-1/8" Dia. Standard	2
15	4012222	Washer, Idler Gear Thrust	4

CONVERTER HOUSING ASSEMBLIES

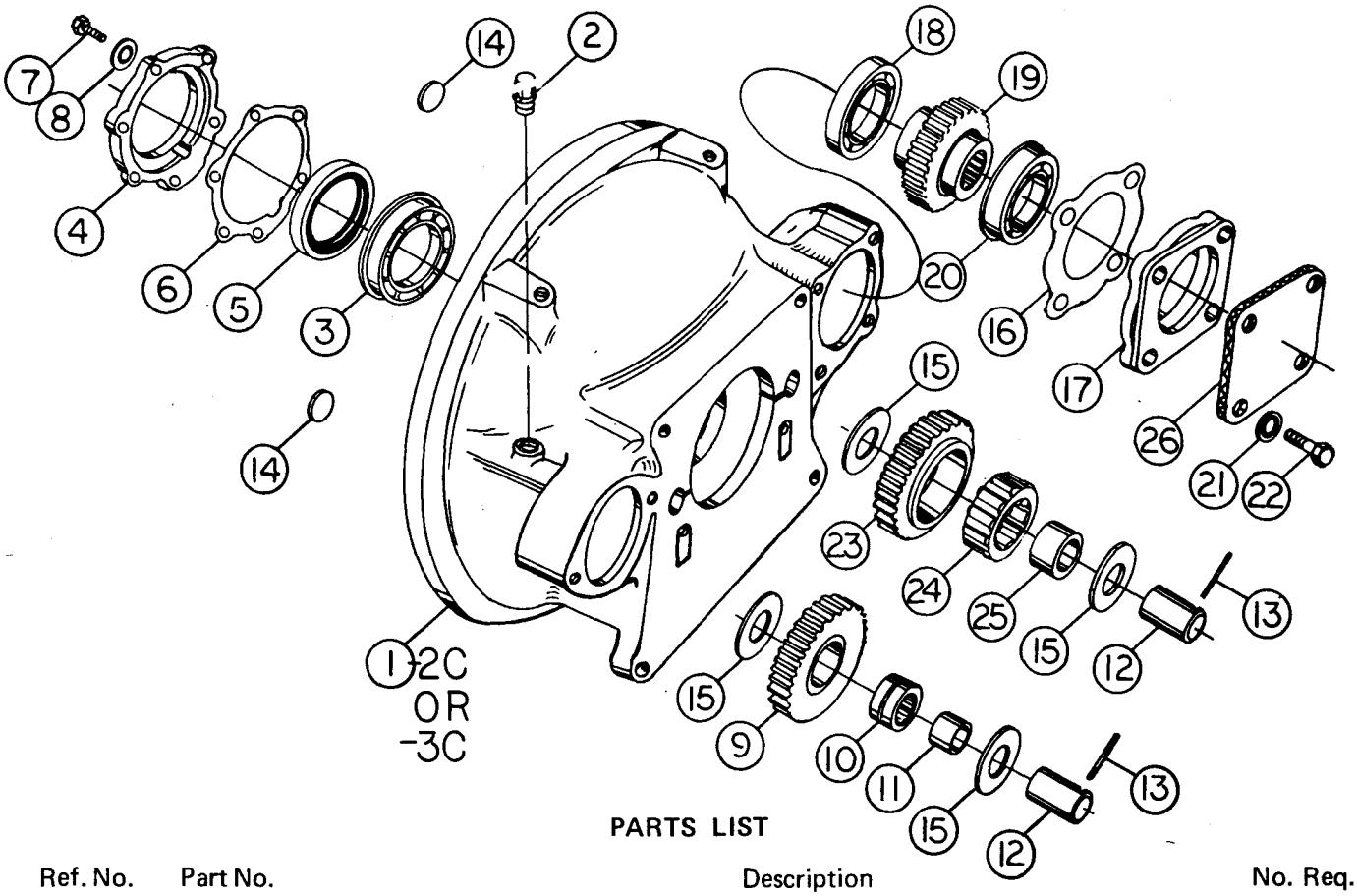
4012201-2B
4012201-3B



PARTS LIST

Ref. No.	Part No.	Description	No. Req.
1-2B	40122052B	Housing, Converter; S.A.E. "B" Aux. Pump Flange	1 of 2
1-3B	40122053B	Housing, Converter; S.A.E. "B" Aux. Pump Flange	
2	4F68203	Breather, Converter Housing	1
3	4F40114R	Bearing, Converter Pilot	1
4	4012211	Retainer, Converter Pilot Bearing	1
5	4F65015	Seal, Oil: Converter Hub Gear Seal	1
6	4012213	Gasket, Converter Pilot Bearing Retainer	1
7	4F10020-14	Capscrew, 5/16-N.C. x 7/8" Hex. Hd. (H.T.)	6
8	4F18002	Washer, 5/16 Sealing	6
9	4012217	Gear, Idler; Primary Pump Drive	1
10	4F52072-34	Bearing, Idler Gear	1
11	4F54072-34	Race, Inner; Idler Gear Bearing	1
12	4012219	Shaft, Idler Gear	2
13	4F25187-14	Roll Pin, Shaft Retainer	2
14	4F22015	Plug, Expansion; 1-1/8" Dia. Standard	2
15	4012222	Washer, Idler Gear; Thrust	2
16	4012295	Gasket, Pump Mount; S.A.E. "B" Flange	1
17	4012-1182	Adapter, Pump	1
18	4F40208	Bearing, Drive Gear	1
19	4012-1181	Gear, Aux. Pump Drive	1
20	4F40208-R	Bearing, Drive Gear	1
21	4F18004	Washer, 7/16 Sealing	2
22	4F10040-16	Capscrew 7/16-N.C. x 1" Hex. Hd. (H.T.)	2
23	40121180	Gear Idler; Aux. Pump Drive	1
24	4F61482-040	Bearing Aux. Pump Drive	1
25	40122182C	Bearing, Innerrace Aux. Pump Drive	1

CONVERTER HOUSING ASSEMBLIES 4012201-2C 4012201-3C

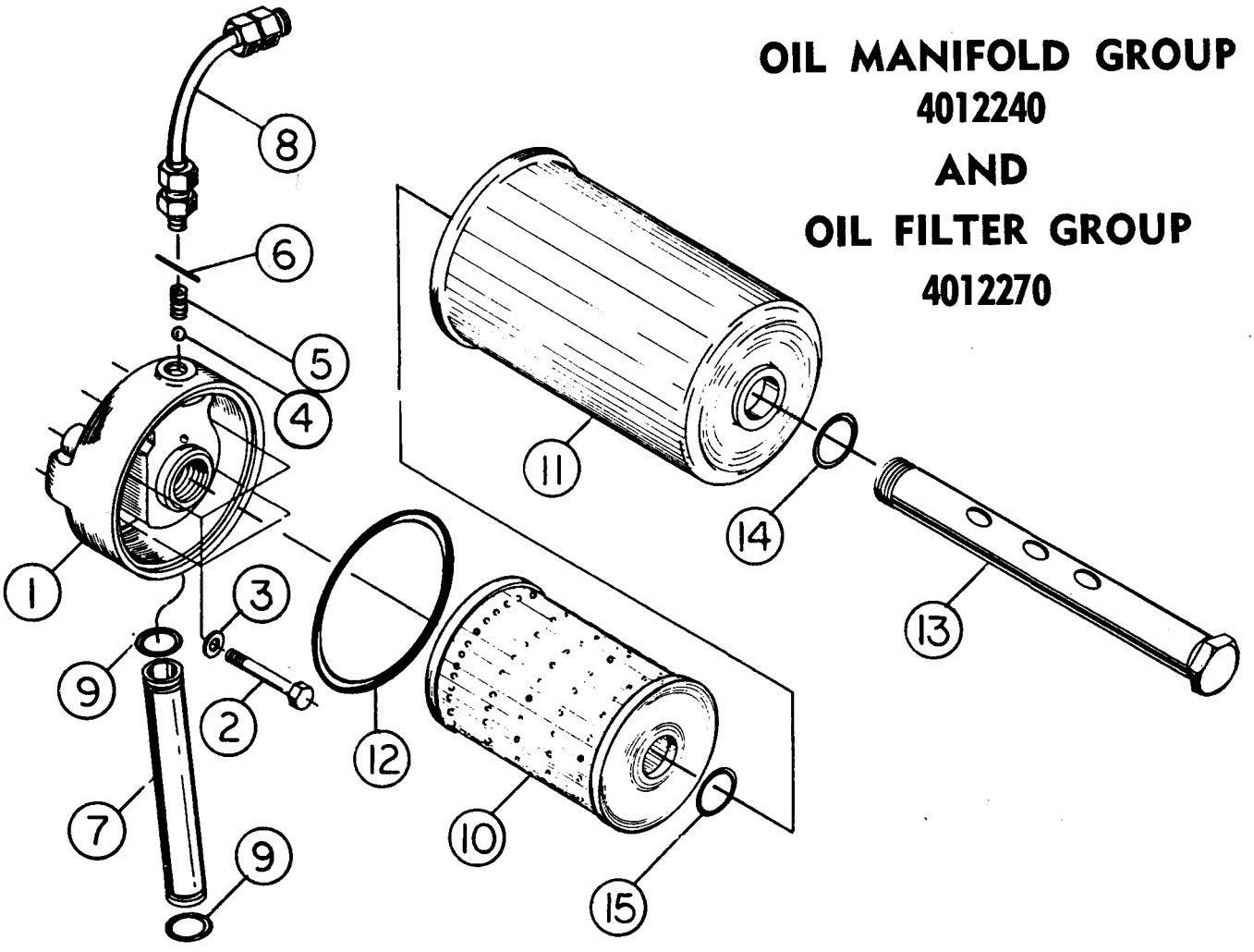


PARTS LIST

Ref. No.	Part No.	Description	No. Req.
1-2C	40122052C	Housing, Converter; S.A.E. "C" Aux. Pump Flange	1 of 2
1-3C	40122053C	Housing, Converter; S.A.E. "C" Aux. Pump Flange	
2	4F68203	Breather, Converter Housing	1
3	4F40114R	Bearing, Converter Pilot	1
4	4012211	Retainer, Converter Pilot Bearing	1
5	4F65015	Seal, Oil; Converter Hub Gear Seal	1
6	4012213	Gasket, Converter Pilot Bearing Retainer	1
7	4F10020-14	Capscrew, 5/16 - N.C. x 7/8" Hex. Hd. (H.T.)	6
8	4F18002	Washer, 5/16 Sealing	6
9	4012217	Gear, Idler; Primary Pump Drive	1
10	4F52072-34	Bearing, Idler Gear	1
11	4F54072-34	Race, Inner; Idler Gear Bearing	1
12	4012219	Shaft, Idler Gear	2
13	4F25187-14	Pin, Spring; Idler Gear Shaft Retainer	2
14	4F22015	Plug, Expansion; 1-1/8" Dia. Standard	2
15	4012222	Washer, Idler Gear; Thrust	4
16	4012295C2	Gasket, Plate Mount; S.A.E. "C" Pump Flange	1
17	4012294C	Adapter Plate, Aux. Pump	1
18	4F40208	Bearing, Drive Gear	1
19	4012293-C	Gear, Aux. Pump Drive	1
20	4F40208R	Bearing, Drive Gear	1
21	4F18005	Washer, 1/2" Sealing	2
22	4F10050-16	Capscrew 1/2 x 13 x 1	2
23	4012217-C	Gear, Idler; Aux. Pump Drive	1
24	4F61482-040	Bearing, Aux. Pump Drive	1
25	4012218-2C	Inner Race; Aux. Pump Drive Brng.	1
26	4012299-CP	Shipping Protector Plate	1

PRIMARY PUMP, OIL MANIFOLD AND OIL FILTER GROUP

OIL MANIFOLD GROUP 4012240 AND OIL FILTER GROUP 4012270



OIL MANIFOLD GROUP

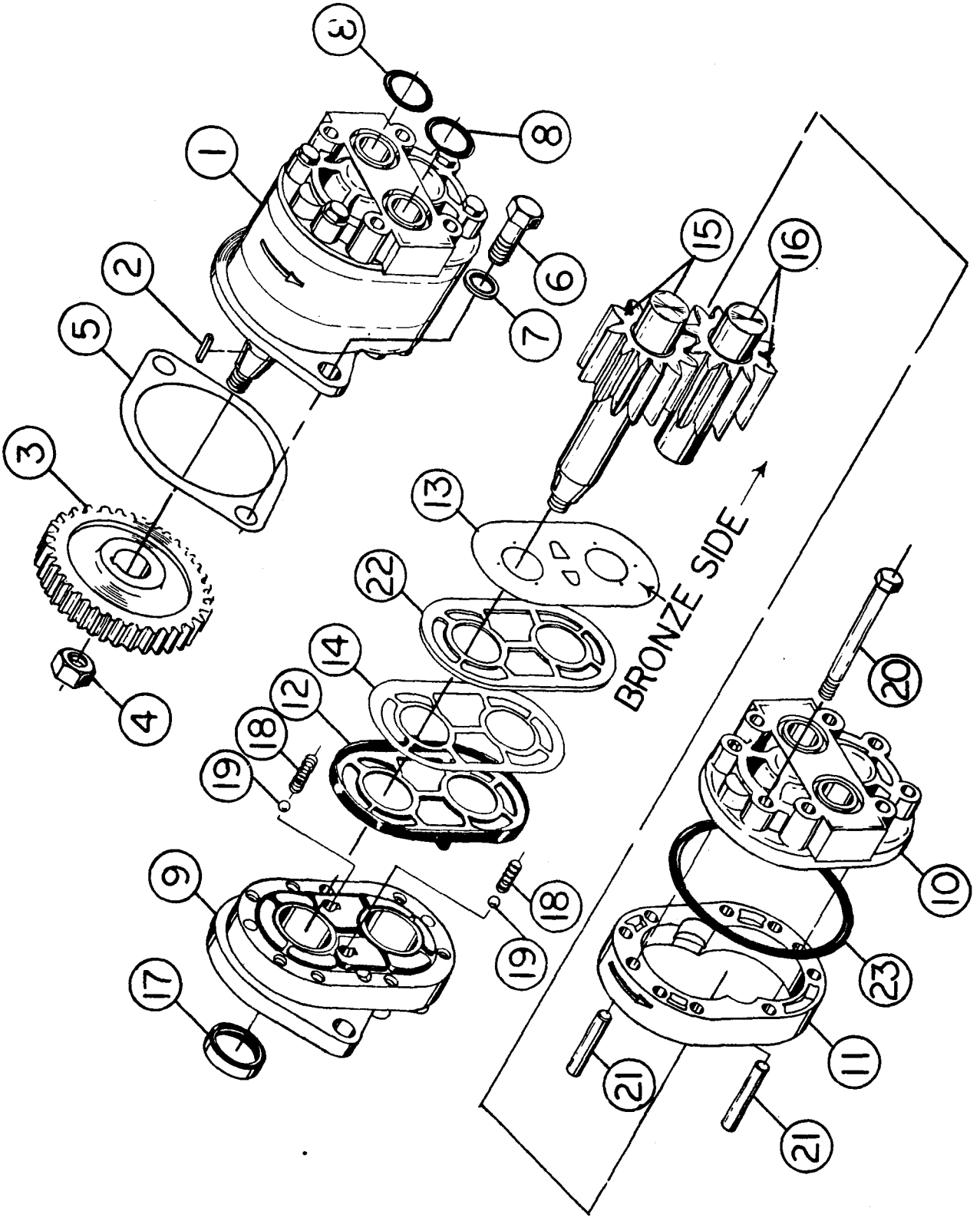
Drawing Ref. No.	New Part No.	Old Part No.	Description	No. Reqd.
1	4012241	12241	Body, Oil Manifold	1
2	F10020-68	12242	Cap Screw, 5/16"-N.C. x 4-1/2" Hex. Hd. (H.T.)	4
3	4F18002	12168	Washer, 5/16" Dyna-Seal	4
4	F74000-16D	12245	Ball, By-Pass Valve; 1/2" Dia. x 2" Long	1
5	4012246	12246	Spring, By-Pass Valve Spring Retainer	1
6	F25125-16	12247	Pin, Spring; By-Pass Valve Spring Retainer	1
7	4012248B	12248-B	Tube, Oil; Sump to Manifold	1
8	4000668	12-1175	Tube, Oil; Assembly Manifold to Valve	1
9	F37020-116	12249-1	"O" Ring, Oil Tube Seal	2

OIL FILTER GROUP

10	4012271	12271	Element, Oil Filter; AC Type PF-141	1
11	4012272	12272	Cover, Oil Filter	1
12	F37030-243	12273	"O" Ring, Oil Filter Cover Seal	1
13	4012274	12274	Stud, Oil Filter Cover	1
14	F37020-116	12249-1	"O" Ring, Stud Seal	1
15	F37030-218	12276	"O" Ring, Oil Filter Element Bumper	1

PRIMARY PUMP ASSEMBLY

4012230



PRIMARY PUMP ASSEMBLY
4012230

PARTS LIST (SEE ILLUSTRATION ON OPPOSITE PAGE)

Drawing Ref. No.	New Part No.	Old Part No.	Description	No. Req.
1	40121245	12231	Pump, Primary	1
2	4000456	12231-14	Key, Primary Pump Shaft	1
3	4000595	12233	Gear, Primary Pump Drive	1
4	4F82076-14D	12234	Nut, Lock; 7/16" -N.C. Hex. Hd.	1
5	4012235	12235	Gasket, Pump Mount	1
6	4F10040-16	12236	Cap Screw, 7/16"-N.C. x 1" Hex. Hd. (H.T.)	2
7	4F18004	12237	Washer, 7/16" Dyna-Seal	2
8	F37020-120	12238	"O" Ring, Back Plate Seal	2
9	40122311	12231-1	Front Plate Assembly	1
10	4000496	12231-2	Back Plate Assembly	1
11	4000043	12231-3	Body	1
12	40122314	12231-4	Seal, Diaphragm	1
13	40122315	12231-5	Diaphragm	1
14	40122316	12231-6	Gasket, Back-Up	1
15	4000044	12231-7	Drive Gear Assembly	1
16	4000045	12231-8	Idler Gear Assembly	1
17	40122319	12231-9	Seal, Oil; Shaft	1
18	4000453	12231-10	Spring	2
19	4000454	12231-11	Ball, 7/32" Diameter Steel	2
20	4000455	12231-13	Cap Screw, 5/16"-N.C. x 2-3/4" Hex. Hd. (H.T.)	4
21	4000047	12231-15	Pin, Dowel; 5/16" x 1-3/4" Long	2
22	4000457	12231-16	Gasket Protector	1
23	4000046		"O" Ring	1

GENERAL SPECIFICATIONS ON ABOVE PUMP

Working Pressure (in unit)	160 P.S.I.
Maximum operating revolutions per minute (in unit)	2500 R.P.M.
Displacement	1.50 Cu. In. Per. Rev.
Gallonage (1800 R.P.M.)	10.9 G.P.M. @ 2000 P.S.I.
Mounting	S.A.E. 2 bolt "A" size

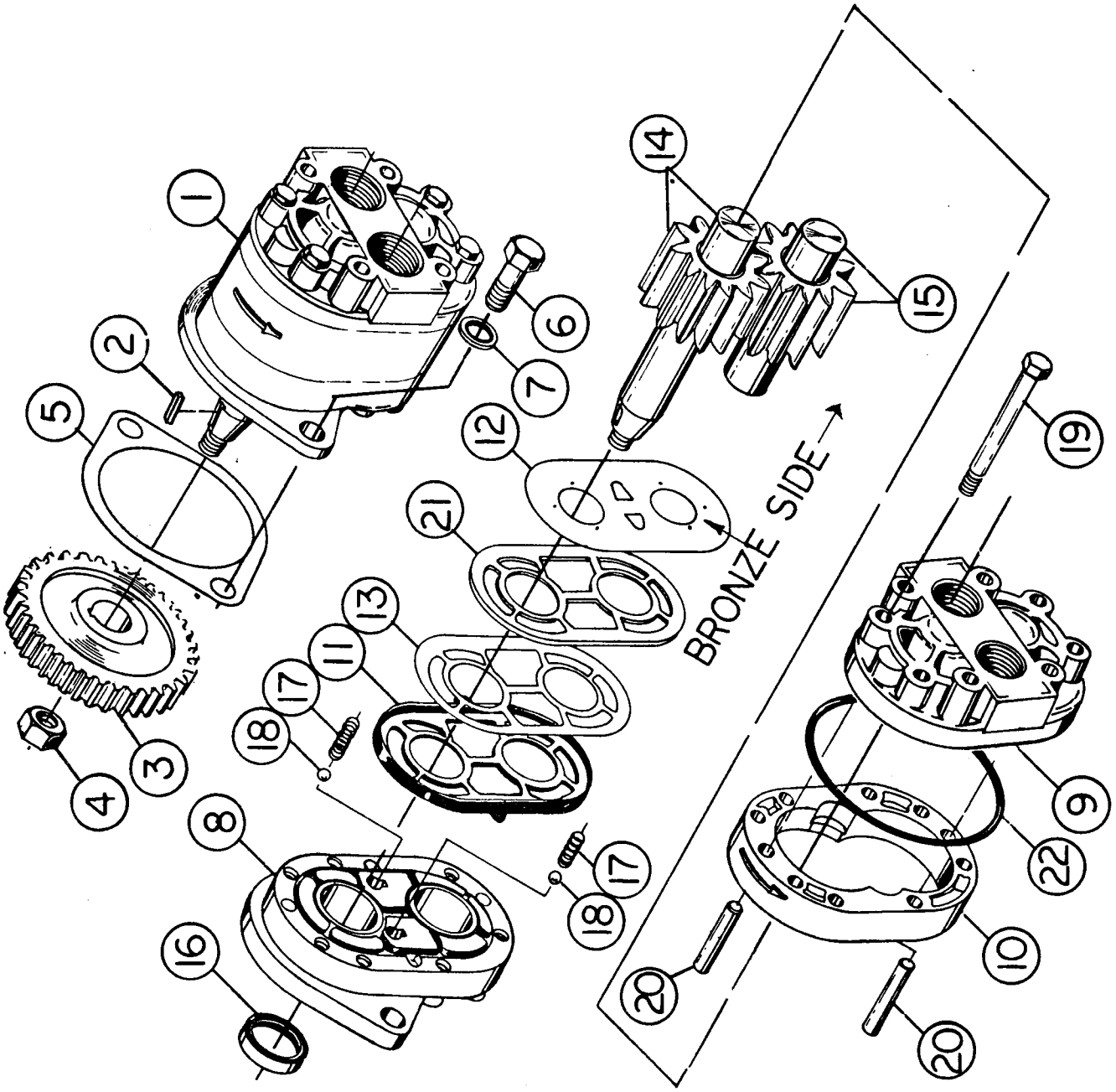
CAUTION: REPAIRS, IF ANY, SHOULD BE MADE BY SOMEONE EXPERIENCED IN HYDRAULIC PUMP OVERHAUL; OTHERWISE IT IS RECOMMENDED THAT THE PUMP BE RETURNED TO THE FUNK MFG. COMPANY FOR THE NECESSARY REPAIRS.

---

1. Prior to dis-assembly, make an identification mark across front plate, body, and rear plate. This will aid in proper assembly once repairs have been made.
2. Install bronze side of No. 40122315 diaphragm next to gears.
3. Install No. 4000043 body with port contours opening toward No. 4000496 back plate.
4. Arrow at top of pump must agree with drive shaft rotation.
5. Bolt torque – 27 to 30 ft. lbs.

AUXILIARY PUMP ASSEMBLY, SMALL

4012280



AUXILIARY PUMP ASSEMBLY, SMALL
4012280

PARTS LIST (SEE ILLUSTRATION ON OPPOSITE PAGE)

Drawing Ref. No.	New Part No.	Old Part No.	Description	No. Reqd.
1	40121243	12281-B	Pump, Aux. Small (J.I.C. Port Thds.)	1
2	4000456	12231-14	Key, Aux. Pump Shaft	1
3	4012283	12283	Gear, Aux. Pump Drive: Small	1
4	4F82076-14D	12234	Nut, Lock; 7/16" N.C. Hex. Hd.	1
5	4012235	12235	Gasket, Pump Mount	1
6	4F10040-16	12236	Capscrew, 7/16"-N.C. x 1" Hex. Hd. (H.T.)	2
7	4F18004	12237	Washer, 7/16" Dyna-Seal	2
8	40122311	12231-1	Front Plate Assembly	1
9	40122812-B	12281-2B	Back Plate Assembly (J.I.C. Port Thds.)	1
10	4000043	12231-3	Body	1
11	40122314	12231-4	Seal, Diaphragm	1
12	40122315	12231-5	Diaphragm	1
13	40122316	12231-6	Gasket, Back-Up	1
14	4000044	12231-7	Drive Gear Assembly	1
15	4000045	12231-8	Idler Gear Assembly	1
16	40122319	12231-9	Seal, Oil; Shaft	1
17	4000453	12231-10	Spring	2
18	4000454	12231-11	Ball, 7/32" Diameter Steel	2
19	4000455	12231-13	Capscrew, 5/16"-N.C. x 2-3/4" Hex. Hd. (H.T.)	4
20	4000047	12231-15	Pin, Dowel; 5/16" x 1-3/4" Long	2
21	4000457	12231-16	Gasket, Protector	1
22	4000046		"O" Ring	2

GENERAL SPECIFICATIONS ON ABOVE PUMP

Working Pressure (continuous)	2000 P.S.I.
Maximum operating revolutions per minute (in unit)	2100 R.P.M.
Displacement	1.50 Cu. In. Per. Rev.
Gallonage (1800 R.P.M.)	10.9 G.P.M. @ 2000 P.S.I.
Mounting	S.A.E. 2 bolt "A" size

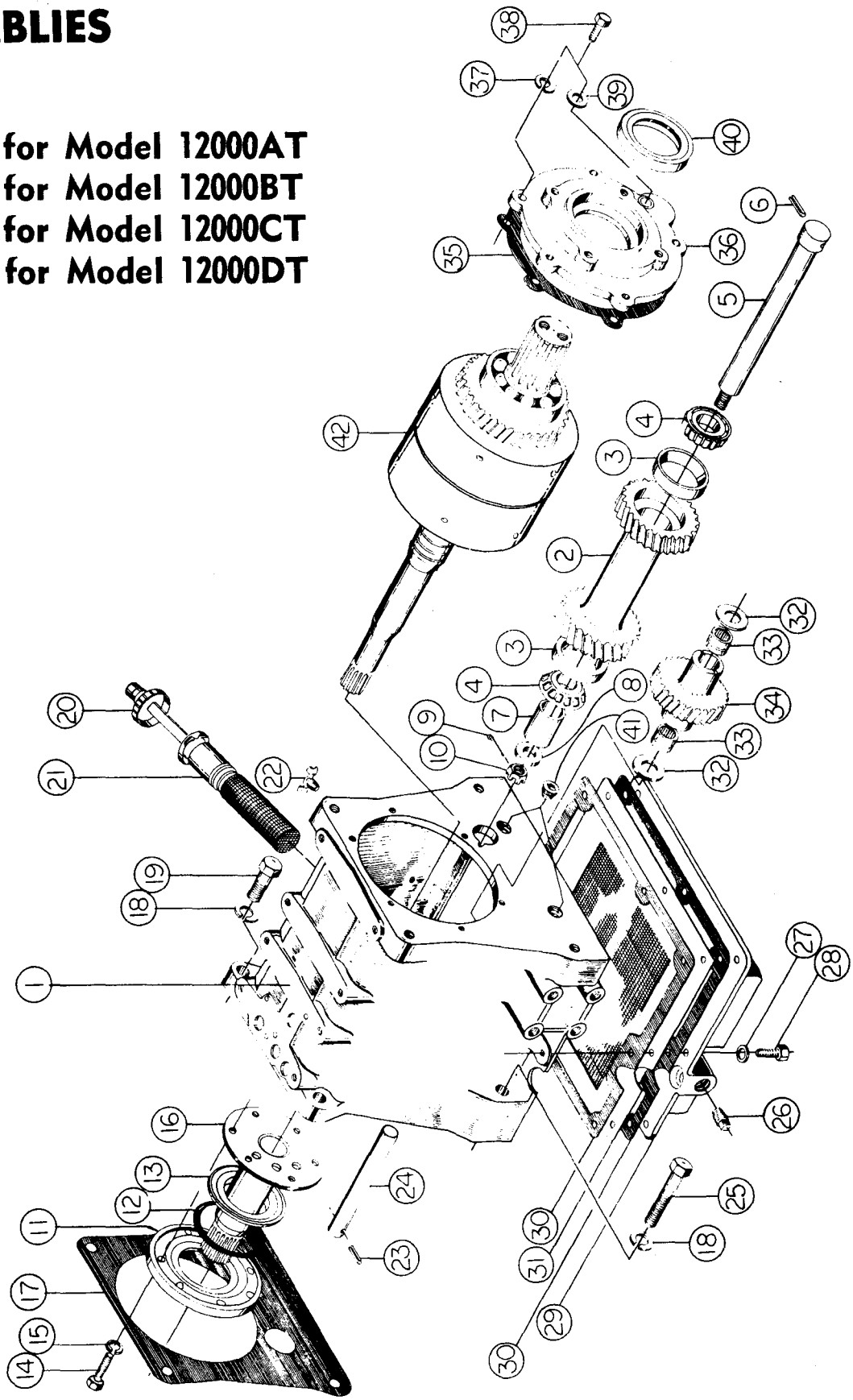
CAUTION: REPAIRS, IF ANY, SHOULD BE MADE BY SOMEONE EXPERIENCED IN HYDRAULIC PUMP OVERHAUL; OTHERWISE IT IS RECOMMENDED THAT THE PUMP BE RETURNED TO THE FUNK MFG. COMPANY FOR THE NECESSARY REPAIRS.

---

1. Prior to dis-assembly, make an identification mark across front plate, body, and rear plate. This will aid in proper assembly once repairs have been made.
2. Install bronze side of No. 40122315 diaphragm next to gears.
3. Install No. 4000043 body with port contours opening toward No. 40122812 (A or B) back plate.
4. Arrow at top of pump must agree with drive shaft rotation.
5. Bolt torque – 27 to 30 ft. lbs.

SHUTTLE TRANSMISSION ASSEMBLIES

40121266 for Model 12000AT
40121281 for Model 12000BT
40121283 for Model 12000CT
40121279 for Model 12000DT



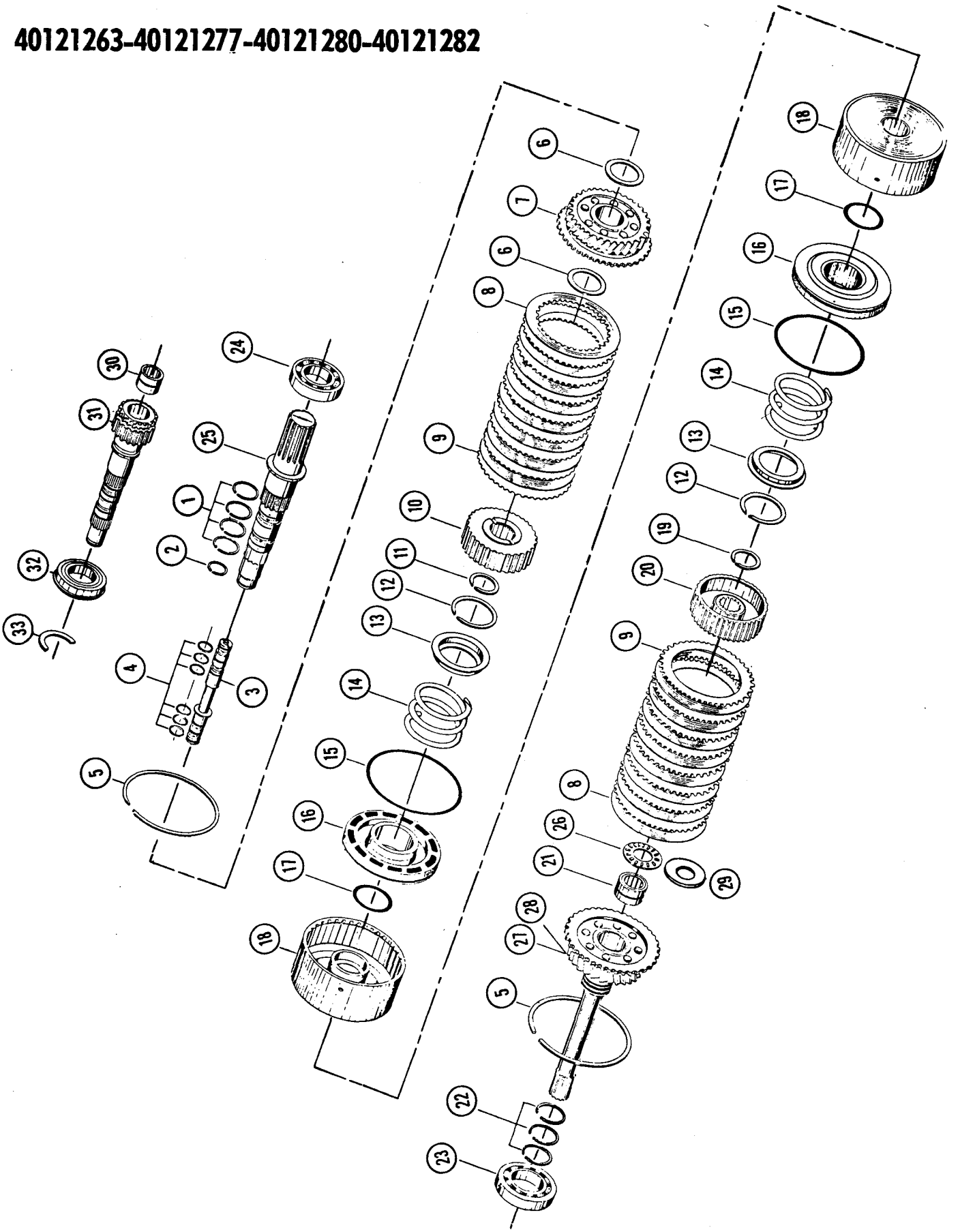
40121266 for Model 12000AT
40121281 for Model 12000BT
40121283 for Model 12000CT
40121279 for Model 12000DT

PARTS LIST (SEE ILLUSTRATION ON OPPOSITE PAGE)

Ref. No.	Part No.	Description	No. Req.
1	40121221	Case	1
2	40121222	Counter Gear	1
3	4F58520	Cup, Bearing	2
4	4F58024	Cone, Bearing	2
5	40121223	Shaft, Counter Gear	1
6	4F25219-14	Roll Pin	1
7	40121224	Spacer, Countershaft	1
8	40121225	Washer, Countershaft	1
9	4F26005-12	Cotter Pin, Countershaft	1
10	4F72006-12	Nut, Castle	1
11	4012436A	Cover	1
12	4F37030-233	"O" Ring	1
13	40121259	Seal, Floating	1
14	4F10020-20	Capscrew	6
15	4F16201	Lockwasher	6
16	4012431	Asm. Tube, Stator Support 12" Converter	1 of 2
	4012433	Asm. Tube, Stator Support 13" Converter	
17	4012405	Gasket	1
18	4F16205	Lockwasher	4
19	4F10060-32	Capscrew	2
20	4012417	Cap/Dip Stick Assembly	1 of 2
	4012417T	Cap/Dip Stick Assembly, top fill	
21	4012410	Asm. Oil Fill Tube and Strainer	1 of 2
	4012411	Asm. Oil Fill Tube and Strainer, top fill	
22	4012403	Cock, Drain; Oil level check, shown	1 of 2
	4F19001-2	Plug, Pipe; Oil level check	
23	4F25219-14	Roll Pin	1
24	4012389	Shaft, Idler Gear	1
25	4F10060-60	Capscrew	2
26	4F20000-4	Plug, Drain	1
27	4F16203	Lockwasher	8
28	4F10040-20	Capscrew	8
29	4012421	Sump, Shuttle Transmission	1
30	4012423	Gasket, Sump	2
31	4012422	Sump Screen Assembly	1
32	4012388	Washer, Idler Gear Thrust	2
33	4F52071-54	Bearing, Idler Gear	2
34	4012385	Gear, Idler	1
35	4012443	Gasket, Rear Bearing Retainer	1 to 3
36	4012441	Retainer, Rear Bearing	1
37	4F16202	Lockwasher	5
38	4F10030-16	Capscrew	6
39	4F18003	Washer, Sealing	1
40	4F65013	Oil Seal	1
41	4F19005-8	Plug Transfer Hole (not req. with 4 speed)	2
42	40121263	Clutch Stack (Shuttle only with a 12" converter or 11¾" converter)	1 of 4
	40121282	Clutch Stack (4 speed trans. with a 12" converter or 11¾" converter)	
	40121280	Clutch Stack (Shuttle only with a 13" converter)	
	40121277	Clutch Stack (4 speed trans. with a 13" converter)	

SHAFT AND CLUTCH ASSEMBLIES

40121263-40121277-40121280-40121282



40121263 ASSEMBLY FOR SHUTTLE ONLY WITH 11¾" OR 12" CONVERTER

40121277 ASSEMBLY FOR 4-SPEED TRANSMISSION WITH 12" CONVERTER

40121280 ASSEMBLY FOR SHUTTLE ONLY WITH 13" CONVERTER

40121282 ASSEMBLY FOR 4-SPEED TRANSMISSION WITH 11¾" OR 12" CONVERTER

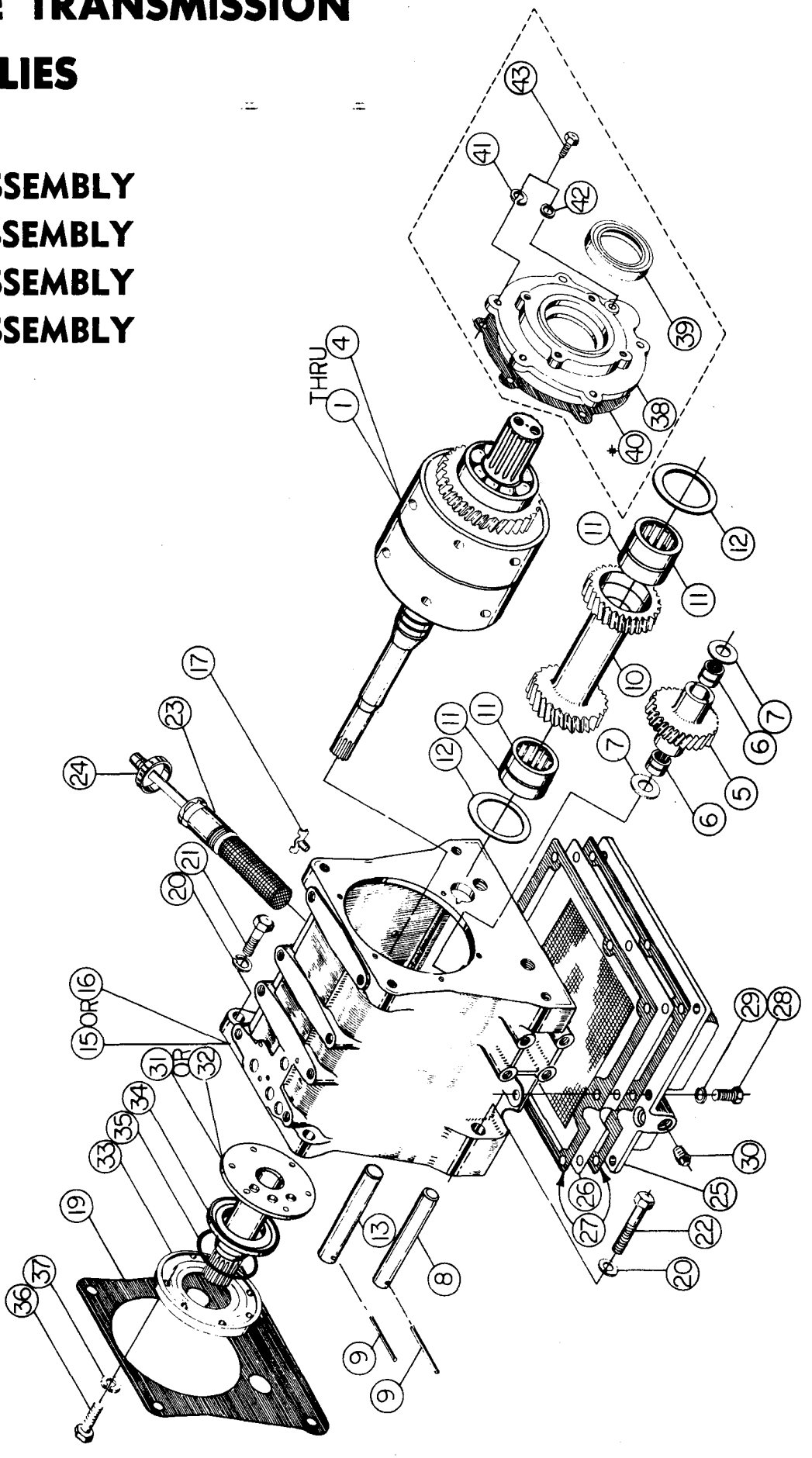
PARTS LIST (SEE ILLUSTRATION ON OPPOSITE PAGE)

Ref. No.	Part No.	Description	No. Req.
1	4012365	Ring, Seal, Output Shaft	4
2	4012365-1	Ring, Seal, Output Shaft	1
3	4012340	Asm. Tube, Oil	1
4	4012347	Ring, Seal, Oil Tube	6
5	4012383	Ring, Retaining	2
6	4012336	Washer, Thrust, Output Gear	2
7	4012330	Asm. Gear Output	1
8	40121159	Plate, Clutch, Friction Int. Spline	16
9	4012382	Plate, Clutch, Reaction Ext. Spline	16
10	40121205	Hub, Rear Clutch	1
11	4F39010-150	Ring, Retainer Hub Rear	1
12	4F80500-[illegible]250	Retainer Ring, Clutch Spring	2
13	4012378A	Retainer, Clutch Return Spring	2
14	4012377	Spring, Clutch Return	2
15	4012376A	Seal, Piston Outer	2
16	4012374E	Piston	2
17	F37040-333	"O" Ring, Piston, Inner	2
18	4012370A	Assembly, Clutch Cylinder	2
19	F39010-143	Ring, Retainer, Hub Front	1
20	40121204	Hub, Front Clutch	1
21	F52072-44	Bearing, Pilot, Input Shaft	1
22	4012328	Seal Ring	3
23	4F41210	Bearing, Ball	1
24	4F41209	Bearing, Ball	1
25	4012351	Shaft, Output	1
26	40121212	Asm. Bearing Thrust	1
27	40121250	Shaft Assembly, Input	1
28	40121249	Shaft Assembly, Input	1
29	4012329	Washer, Thrust	1
30	4F52072-35	Pilot Bearing	1
31	4012356	Shaft, Output	1
32	4F41211-RHH	Ball Bearing	1
33	4F81200-261	Retainer Ring, Rear Bearing	1

All Assemblies use Ref. Nos. 1 thru 23.
Assembly No. 40121263 – Use Ref. Nos. 1 thru 23 Plus 24 thru 27.
Assembly No. 40121277 – Use Ref. Nos. 1 thru 23 Plus 28 thru 33.
Assembly No. 40121280 – Use Ref. Nos. 1 thru 23 Plus 24, 25, 26 and 28.
Assembly No. 40121282 – Use Ref. Nos. 1 thru 23 Plus 27, 29, 30, 31, 32 and 33.

SHUTTLE TRANSMISSION ASSEMBLIES

4012300 ASSEMBLY
4012301 ASSEMBLY
4012302 ASSEMBLY
4012303 ASSEMBLY



4012300 ASSEMBLY FOR 12" OR 11¾" CONVERTER SHUTTLE ONLY OR DROP TRANS.

4012301 ASSEMBLY FOR 13" CONVERTER SHUTTLE ONLY OR DROP TRANS.

4012302 ASSEMBLY FOR 12" OR 11¾" CONVERTER SHUTTLE ONLY OR 12700 TRANS.

4012303 ASSEMBLY FOR 13" CONVERTER SHUTTLE ONLY OR 12700 TRANS.

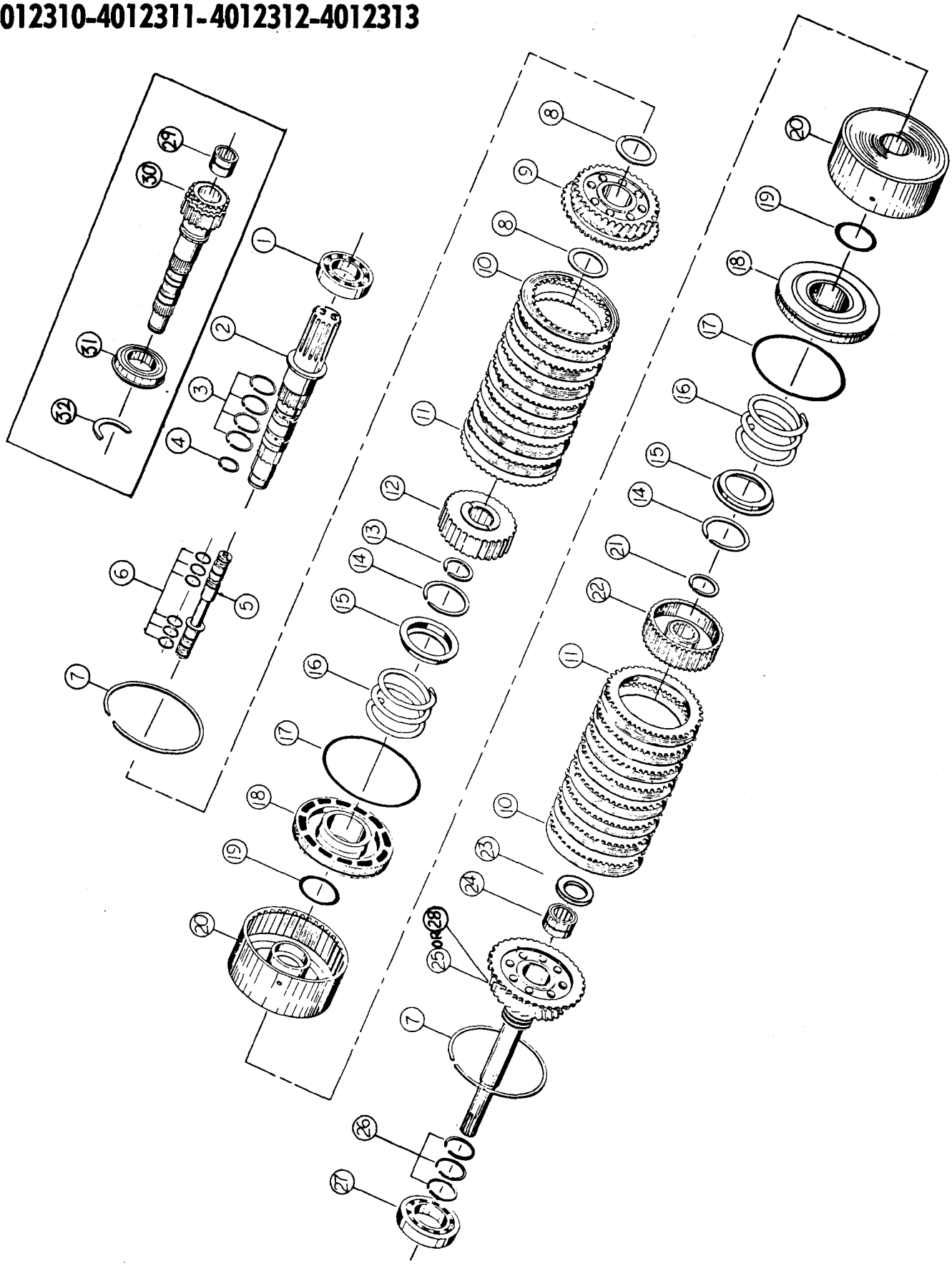
PARTS LIST

(SEE ILLUSTRATION ON OPPOSITE PAGE)

Drawing Ref. No.	New Part No.	Old Part No.	Description	No. Req.
1	4012310	12310	Shaft and Clutch Assy., Shuttle Only, 12" or 11¾" converter	1 of 4
2	4012311	12311	Shaft and Clutch Assy., Shuttle Only, 13" converter.	
3	4012312	12312	Shaft and Clutch Assy; 4 Speed Trans. 12" or 11¾" converter	
4	4012313	12313	Shaft and Clutch Assy; 4 Speed Trans; 13" Converter	
5	4012385	12385	Gear, Idler	1
6	4F52071-54	12386	Bearing, Idler Gear	2
7	4012388	12388	Washer, Idler Gear Thrust	2
8	4012389	12389	Shaft, Idler Gear	1
9	4F25219-14	12391	Pin, Spring; Idler Gear Shaft Retainer	2
10	4012393A	12393-A	Gear, Countershaft	1
11	4F52072-35	12359	Bearing, Countershaft Gear	4
12	4012396	12396	Washer, Countershaft Gear Thrust	2
13	4012397	12397	Shaft, Countershaft Gear	1
15	4012400-A	12400-A	Shuttle Trans. Case Assy; Shuttle Only	1 of 2
16	4012400-B	12400-B	Shuttle Trans. Case Assy; Attached Trans. (Shown)	
17	4012403	12403	Cock, Drain; Oil Level Check (Shown)	1
19	4012405	12405	Gasket, Shuttle Trans. to Conv. Housing	1
20	4F16205	12406	Washer, 9/16" Medium Spring Lock	4
21	4F10060-32	12407	Cap Screw, 9/16"-N.C. x 2" Hex. Hd. (H.T.)	2
22	4F10060-60	12408	Cap Screw, 9/16"-N.C. x 3-1/2" Hex Hd. (H.T.)	2
23	4012409	12409	Oil Fill Tube and Strainer Assembly	1
24	4012417	12417	Cap/Dip Stick Assembly	1
25	4012421	12421	Sump, Shuttle Transmission	1
26	4012422	12422	Sump, Screen Assembly	1
27	4012423	12423	Gasket, Sump	2
28	4F10040-20	12424	Cap Screw, 7/16"-N.C. x 1-1/4" Hex. Hd. (H.T.)	8
29	4F[illegible]16203	12425	Washer, 7/16" Medium Spring Lock	8
30	4F20000-4	12426	Plug, Pipe; Shuttle Trans. Drain, 1/2" N.P.T. Sq. Hd. Magnetic	1
31	4012431	12432	Tube, Stator Supt.; 12" Conv. (Shown)	1 of 2
32	4012433	12433	Tube, Stator Support, 13" Converter	
33	4012436-A	12436	Plate, Cover; Front Index	1
34	40121259		Floating Seal	1
35	4F37030-233		"O" Ring	1
36	4F10020-20	12437	Cap Screw 5/16"-N.C. x 1-1/4" Hex. Hd. (H.T.)	6
37	4F16201	12438	Washer, 5/16" Medium Spring Lock	6
38	4012441	12441	Retainer, Rear Bearing	1
39	4F65013	12442	Seal, oil; Output Shaft Seal	1
*40	4012443	12443	Gasket, Rear Bearing Retainer	1 to 3
41	4F16202	12120-1	Washer, 3/8" Medium Spring Lock	5
42	4F18003	12445	Washer, 3/8" Sealing	1
43	4F10030-16	12446	Capscrew, 3/8"-N.C. x 1" Hex Hed. (H.T.)	6

SHAFT AND CLUTCH ASSEMBLIES

4012310-4012311-4012312-4012313



SHAFT AND CLUTCH ASSEMBLIES

4012310-4012311-4012312-4012313

CHANGE SHEET FOR PAGE 37 12000 SERIES MANUAL

PARTS LIST (SEE ILLUSTRATION ON OPPOSITE PAGE)

Use with Assy's - 4012310, 4012311

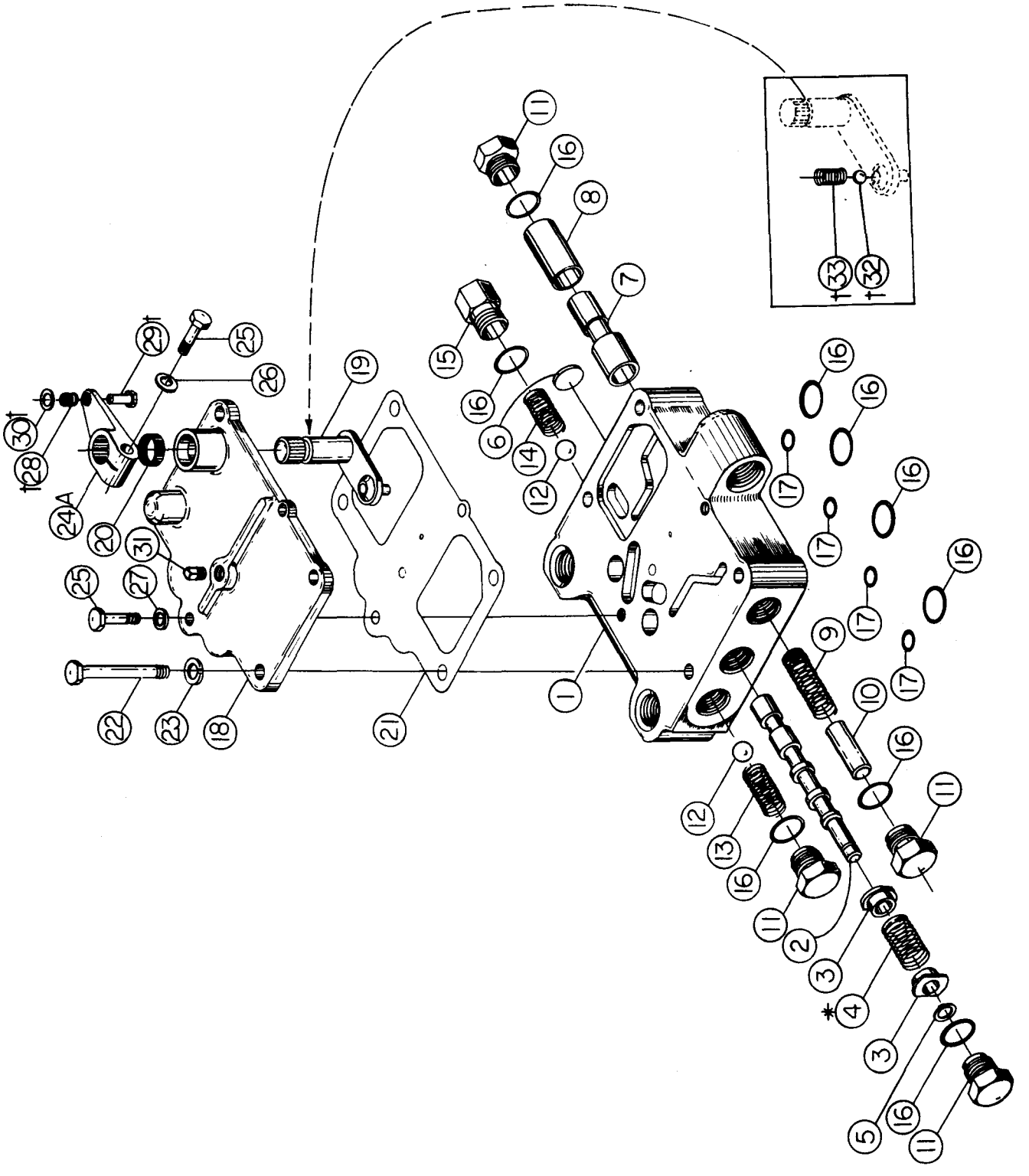
Ref. No.	Part No.	Description	No. Req.
1	4F41209	Bearing, Ball	1
2	4012351	Shaft, Output	1
25	40121250	Shaft, Assy., Input (11 3/4 &12 Converter)	1
25A	40121249	Shaft Assm. (13" Converter)	1
		Use with Assy's.-4012310, 4012311, 4012312, 4012313	
3	4012365	Ring Seal Output Shaft	4
4	4012365-1	Ring Seal Output Shaft	1
5	4012340	Asm. Tube, Oil	1
6	4012347	Ring, Seal, Oil Tube	6
7	4012383	Ring, Retaining	2
8	4012336	Washer, Thrust, Output Gear	2
9	4012330	Asm. Gear Output	1
10	4012381	Plate, Clutch, Friction (Internal Spline)	16
11	4012382	Plate, Clutch, Reaction (External Splint)	16
12	4012368	Hub, Rear Clutch	1
13	4F39010-150	Ring, Retainer, Hub, Rear	1
14	4F80500-250	Retainer, Ring, Clutch Spring	2
15	4012378A	Retainer, Clutch, Return Spring	2
16	4012377	Spring, Clutch Return	2
17	4012376A	Seal, Piston Outer	2
18	4012374E	Piston	2
19	4F37040-333	"O" Ring, Piston, Inner	2
20	4012370A	Assy.,Clutch Cylinder	2
21	4F39010-143	Ring, Retaining, Hub Front	1
22	4012366	Hub, Front Clutch	1
23	4012329	Washer, Thrust, Input Shaft	1
24	4F52072-44	Bearing, Pilot, Input Shaft	1
26	4012328	Seal, Ring	3
27	4F41210	Bearing, Ball	1
		Use with Assy's.-4012312,4012313	
28	40121250	Asm. Input Shaft 11 3/4-12 Converter	1
28A	40121249	Asm. Input Shaft 13" Converter	1
29	4F52072-35	Pilot Bearing, Output Shaft	1
30	4012356	Shaft, Output	1
31	4F41211-RHH	Bearing, Ball	1
32	4F81200-261	Ring, Retaining	1

12320 INPUT ASM. 12" CONVERTER
12321 INPUT ASM. 13" CONVERTER

Assemblies assembled complete with Items 26 & 27

CONTROL VALVE ASSEMBLIES

40012500 (SELF CENTERING)
40012500-A (3 POSITION)



CONTROL VALVE ASSEMBLIES

40012500 (SELF CENTERING)
40012500-A (3 POSITION)

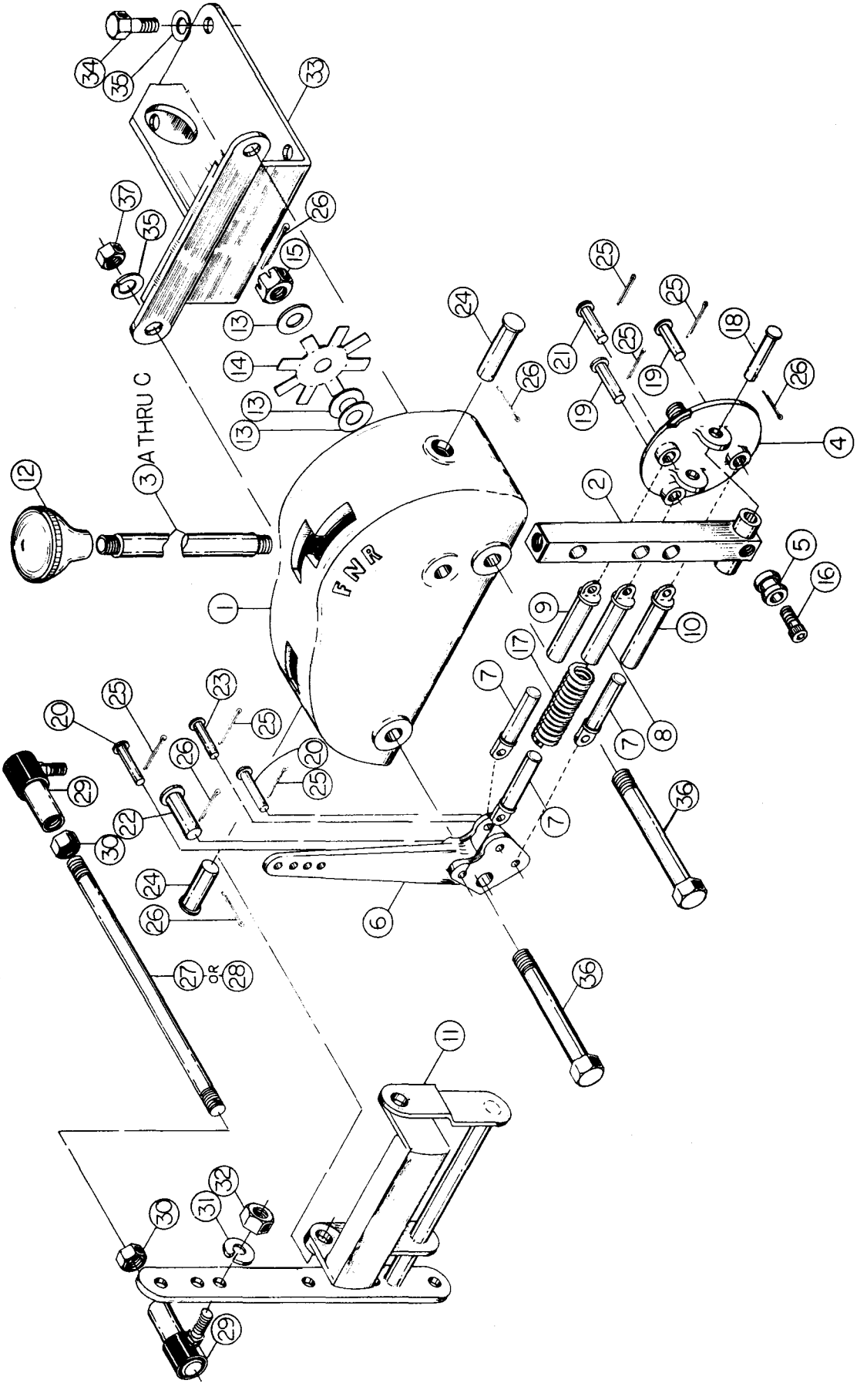
PARTS LIST (SEE ILLUSTRATION ON OPPOSITE PAGE)

Drawing Ref. No.	New Part No.	Old Part No.	Description	No. Reqd.
1	4012501	12501	Body, Control Valve	1
2	4012502	12502	Valve, Clutch Selector	1
3	4012503	12503	Spacer, Clutch Selector Valve	2
* 4	4012504	12504	Spring, Valve Centering 19/32" Dia. x 2" Long	1
5	4F39010-37	12505	Ring, Snap; Space Retainer	1
6	4F22007	12402	Plug, Expansion: 3/4" Dia. Standard	1
7	4012511	12511	Valve, High Pressure; Male	1
8	4012512	12512	Valve, High Pressure; Female	1
9	4012513	12513	Spring, High Pressure Valve: 19/32" Dia. x 4-1/4" Long	1
10	4F27105-40	12513-1	Pin, Spring Guide; 7/16" Dia. x 2-1/2" Long	1
11	4TRC-7225	12514	Cap, Regulator Valve	4
12	4F74000-20D	12515	Ball, Valve Seat; 5/8" Dia. Steel	2
13	4012516	12516	Spring, Second Regulator Valve 19/32" Dia. x 3" Long	1
14	4012517A	12517A	Spring, Third Regulator Valve 19/32" Dia. x 2-1/2" Long	1
15	4012-1232	12518	Cap, Third Regulator Valve	1
16	4F37020-116	12249-1	"O" Ring	9
17	4F37010-012	12522	"O" Ring	4
18	4012526	12526	Cover, Control Valve	1
19	4012527	12527	Arm, Clutch Selector Valve	1
20	4F65086	12428	Seal, Oil	1
21	4012531	12531	Gasket, Control Valve Cover	1
22	4F10030-44	12532	Capscrew, 3/8"-N.C. x 2-3/4" Hex. Hd. (H.T.)	4
23	4F16202	12120-1	Washer, 3/8" Medium Spring Lock	4
24	4012535	12535	Arm Control Valve, 21/64" End Hole Dia.	1
24A	4012535-A	12535-A	Arm, Control Valve, 1/2" End Hole Dia.	1
25	4F10020-16	12536	Cap Screw, 5/16" - N.C. x 1" Hex. Hd. (H.T.)	3
26	4F16201	12438	Washer, 5/16" Medium Spring Lock	1
27	4F18002	12168	Washer, 5/16" Dyna-Seal	2
†28	4012680	12680	Spring, Control Valve Arm	1
†29	4012681	12681	Stud, Control Valve Arm	1
†30	4F17002-W		Washer, 5/16" Std. Flat	1
31	4F19001-2		1/8" Pipe Plug	1
†32	4F74000-12D	12529	Ball, Clutch Selector Valve Detent; 3/8" Dia. Stl.	1
†33	40TR-7204	12530	Spring, Clutch Selector Valve Detent; 3/8" Dia. x 1-1/2" Long	1

† Parts used only in 3 position control valve
* This part not used in 3 position control valve

HAND LEVER ASSEMBLY

4012650



HAND LEVER ASSEMBLY

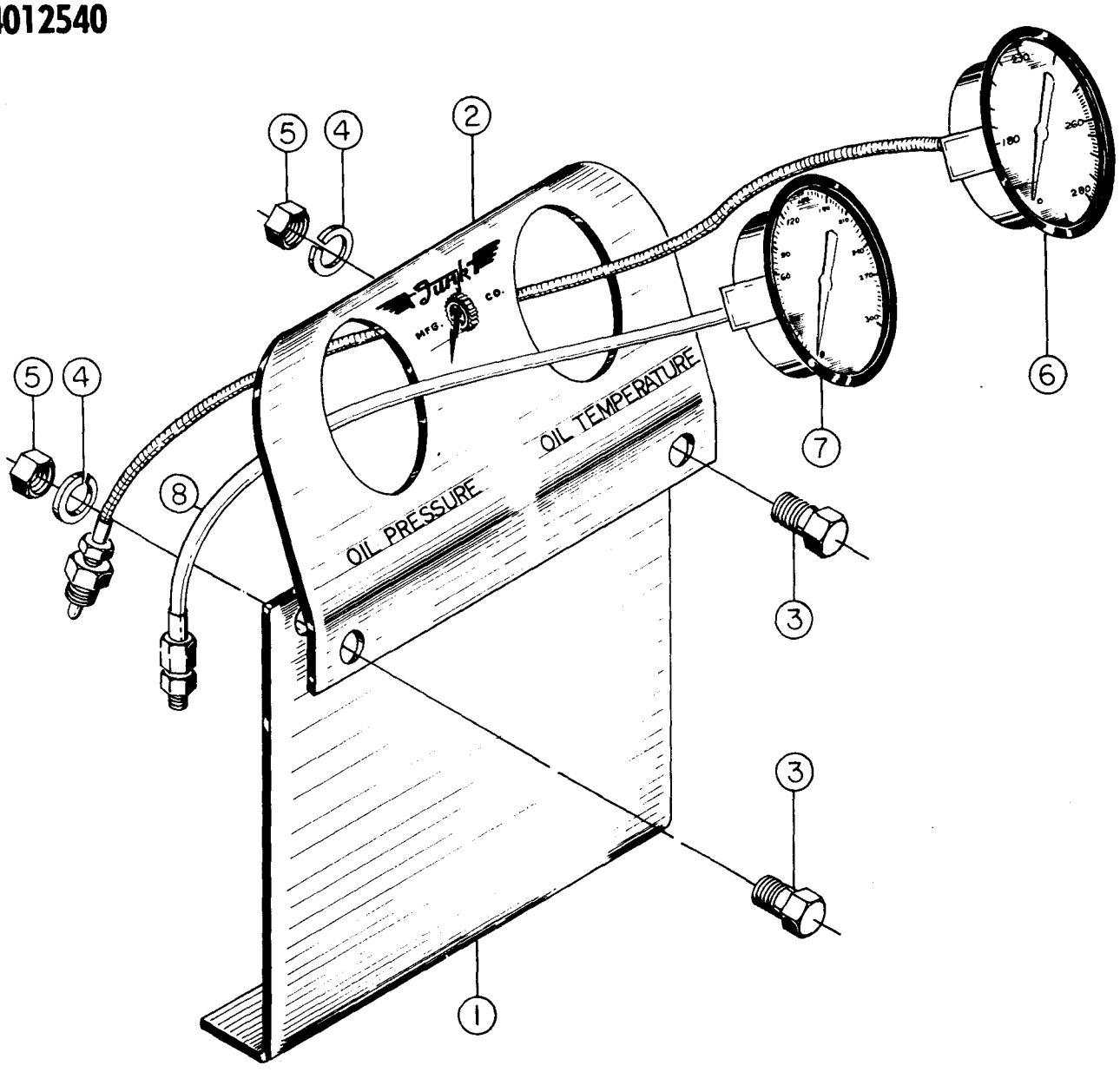
4012650

PARTS LIST (SEE ILLUSTRATION ON OPPOSITE PAGE)

Drawing Ref. No.	New Part No.	Old Part No.	Description	No. Req.
1	4012651	12651	Body, Hand Control	1
2	4012652	12652	Lever, Hand	1
3A	4012652-A	12652-A	Hand Lever, 12" Stick	
3B	4012652-B	12652-B	Hand Lever, 18" Stick (Standard Unless Specified)	1 of 3
3C	4012652-C	12652-C	Hand Lever 24" Stick	
4	4012653	12653	Friction Plate	1
5	4012654	12654	Stud, Ball	1
6	4012655	12655	Lever, Throttle	1
7	4012656	12656	Strut, Male	3
8	4012657	12657	Strut, Female Balance	1
9	4012658	12658	Strut, Female Forward	1
10	4012659	12659	Strut, Female Reverse	1
11	4012661-A	12661-A	Valve Lever Assembly	1
12	4F83000	12663	Ball, Hand Lever	1
13	4F17030-816	12664	Washer, S.A.E. 7/16" Flat	3
14	4012665	12665	Spring	1
15	4F75320-7	12666	Nut, Castle Shear: 7/16"-N.F. Hex. Hd.	1
16	4F10010-16	12667	Capscrew, 1/4-N.C. x 1" Socket Hd. (H.T.)	1
17	4012668	12668	Spring, Balance Strut	1
18	4F24004-69	12670	Pin, Clevis; 3/8" Dia. x 2-5/32" Long	1
19	4F24002-21	12671	Pin, Clevis; 1/4" Dia. x 21/32" Long	2
20	4F24002-29	12672	Pin, Clevis; 1/4" Dia. x 29/32" Long	2
21	4F24002-37	12673	Pin, Clevis; 1/4" Dia. x 1-5/32" Long	1
22	4F24004-65	12674	Pin, Clevis; 3/8" Dia. x 2-1/32" Long	1
23	4F24002-17	12675	Pin, Clevis; 1/4" Dia. x 17/32" Long	1
24	4F24004-29	12676	Pin, Clevis; 3/8" Dia. x 29/32" Long	2
25	4F26003-12	12677	Pin, Cotter; 1/16" Dia. x 1/2" Long	6
26	4F26005-12	12678	Pin, Cotter; 3/32" Dia. x 3/4" Long	5
27	4012683	12683	Rod, Control Valve Linkage, Left Hand	1 of 2
28	4012684	12684	Rod, Control Valve Linkage; Right Hand	
29	4F35100-3R	12685	Joint, Ball; 5/16"-N.F.	2
30	4F79103	12686	Nut, Jam; 5/16"-N.F. Hex. Hd.	2
31	4F16201	12438	Washer, 5/16" Medium Spring Lock	1
32	4F13004	12688	Nut, 5/16"-N.F. Hex. Hd. (Full)	1
33	4012689	12689	Bracket, Hand Lever Control Mount	1
34	4F10030-16	12446	Capscrew, 3/8"-N.C. x 1" Hex. Hd. (H.T.)	4
35	4F16202	12120-1	Washer, 3/8" Medium Spring Lock	6
36	4F10030-68	12693	Bolt, 3/8"-N.C. x 4-1/4" Hex. Hd. (H.T.)	2
37	4F13005	12543	Nut, 3/8" - N.C. Hex. Hd. Full	2

INSTRUMENT PANEL ASSEMBLY

4012540

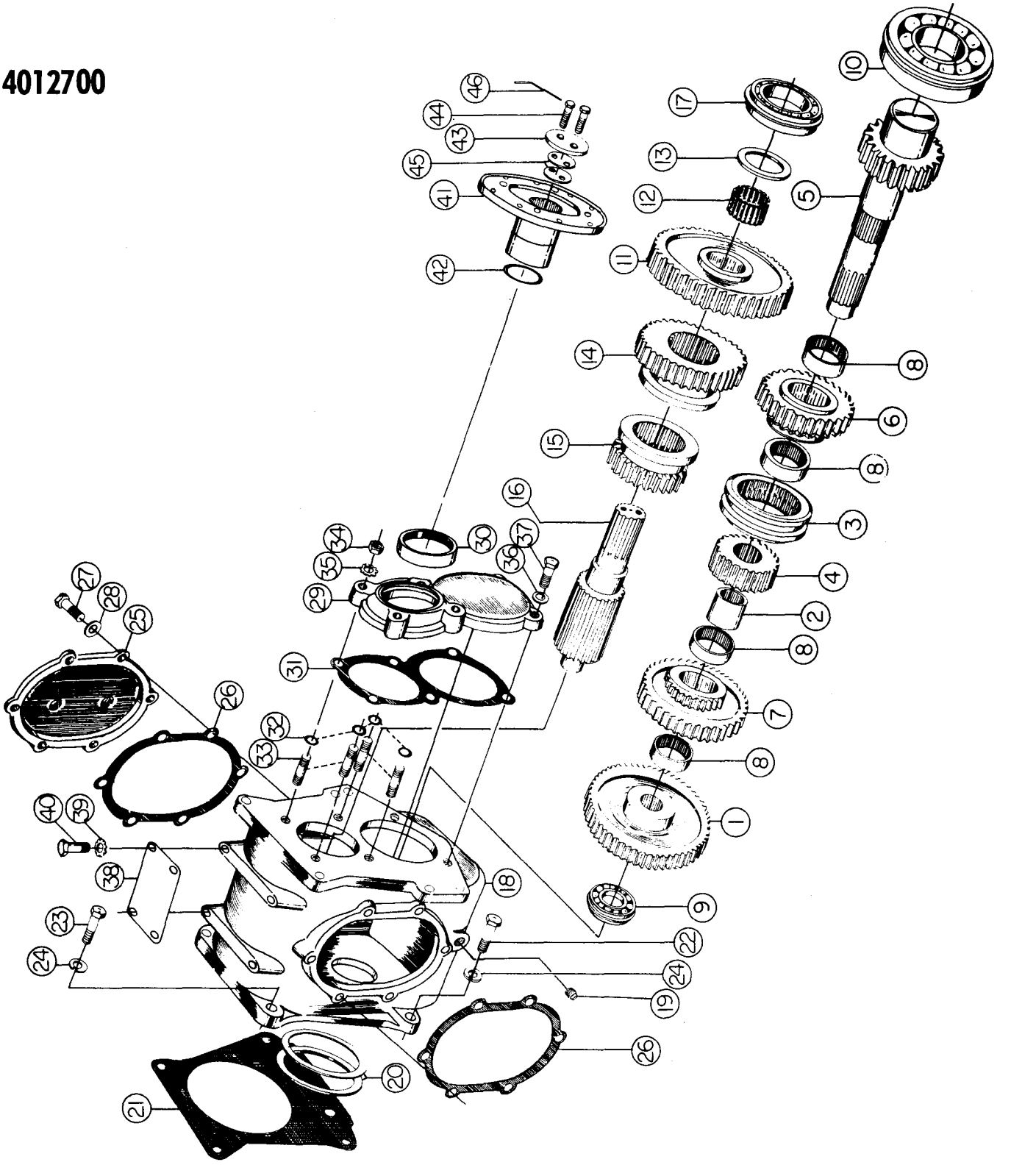


PARTS LIST

Drawing Ref. No.	New Part No.	Old Part No.	Description	No. Req.
1	4012541	12541	Plate, Elevator	1
2	4012542	12542	Panel, Instrument	1
3	4F10030-12	12120	Capscrew, 3/8"-N.C. x 3/4" Hex. Hd. (H.T.)	2
4	4F16202	12120-1	Washer, Medium Spring Lock	2
5	4F13005	12543	Nut, 3/8"-N.C. Hex. Hd. Full	2
6	4000620	12544	Oil Temperature Gauge Assembly	1
7	4012546	12546	Oil Pressure Gauge Assembly	1
8	4012548	12548	Oil Pressure Line Assembly	1

4-SPEED TRANSMISSION ASSEMBLY

4012700



4-SPEED TRANSMISSION ASSEMBLY

4012700

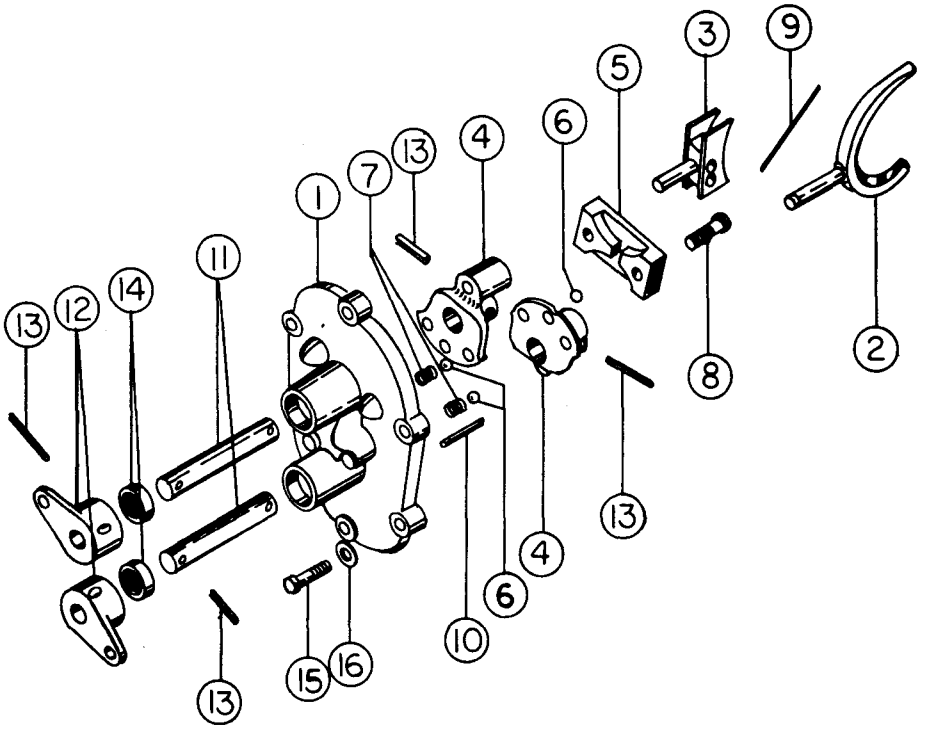
PARTS LIST (SEE ILLUSTRATION ON OPPOSITE PAGE)

Drawing Ref. No.	New Part No.	Old Part No.	Description	No. Req.
1	4012701	12701	Gear, Countershaft Drive	1
2	4012702	12702	Sleeve, Bearing; Countershaft Third Gear	1
3	4012704	12704	Collar, Shifting: Countershaft Second and Third	1
4	4012708	12708	Hub, Shifting Collar	1
5	4012709	12709	Countershaft	1
6	4012712	12712	Gear, Second; Countershaft	1
7	4012714	12714	Gear, Third; Countershaft	1
8	4F46028-12	12153	Bearing, Second and Third Gear, Countershaft	4
9	4F41207R	12718	Bearing, Countershaft Front	1
10	4F41311-RH	12719	Bearing, Countershaft Rear	1
11	4012721	12721	Gear, Low; Main Shaft	1
12	4F56770	12722	Roller, Loose; Main Shaft Low Gear Bearing	34
13	4012723	12723	Washer, Thrust; Main Shaft Low Gear	1
14	4012725	12725	Gear, Second; Main Shaft	1
15	4012726	12726	Gear, Third; Main Shaft	1
16	4012727	12727	Shaft, Main (Output)	1
17	4F41309R	12729	Bearing, Transmissin Output	1
18	4012731	12731	Case, Transmission	1
19	4F20000-4	12426	Plug, Transmission Drain; 1/2" N.P.T. Magnetic	1
*20	4012733	12733	Shim, Clutch Stack Adjustment	1 to 3
21	4012734	12734	Gasket, Transmission to Shuttle Case	1
22	4F10060-32	12407	Cap Screw, 9/16-N.C. x 2" Hex. Hd. (H.T.)	2
23	4F10060-36	12736	Cap Screw, 9/16-N.C. x 2-1/4" Hex. Hd. (H.T.)	2
24	4F16205	12406	Washer, 9/16" Medium Spring Lock	4
25	4012738	12738	Cover, Side	1
26	4012739	12739	Gasket, Side Cover and Cap	2
27	4F10030-16	12446	Capscrew, 3/8-N.C. x 1" Hex. Hd. (H.T.)	6
28	4F18003	12445	Washer, 3/8" Sealing	6
29	4012742	12742	Retainer, Rear Bearing	1
30	4F65013	12442	Seal, Oil; Companion Flange Seal	1
31	4012744	12744	Gasket, Rear Bearing Retainer	1
32	4F37020-112	12745	"O" Ring, Stud Seal	4
33	4012746	12746	Stud, Transmission Brake Mount	4
34	4F13009	12747	Nut, 1/2" - N.C. Hex. Hd.	4
35	4F15005	12748	Washer, 1/2" External Shakeproof	4
36	4F18005	12297	Washer, 1/2" Sealing	2
37	4F10050-24	12749	Cap Screw, 1/2"-N.C. x 1-1/2" Hex. Hd. (H.T.)	2
38	4012795	12795	Shift Pattern, 4-Speed Transmission	1
39	4F15003	12796	Washer, 3/8" External Shakeproof	2
40	4F10030-12	12120	Cap Screw, 3/8"-N.C. x 3/4" Hex Hd. (H.T.)	2
41	4012815	12815	Flange, Companion	1
42	4F37030-224	12816	"O" Ring, Out-Put Shaft Seal	1
43	4012817	12817	Washer, Companion Flange Retainer	1
44	4F10045-16R	12819	Cap Screw, Drilled Hd. 7/16"-N.F. x 1" Hex. Hd. (H.T.)	2
45	4012818	12818	Shim, Companion Flange Adjustment	0 to 5
46	4012759	12759	Wire, Safety; .040 x 4" Long	1

* Use Part No. 4012733 shims as required to obtain proper clutch stack end-play (.020 to .035 is recommended). End-play may be checked by bumping and pulling the input shaft of the assembled unit.

SIDE CAP ASSEMBLY, 4-SPEED TRANSMISSION

4012750

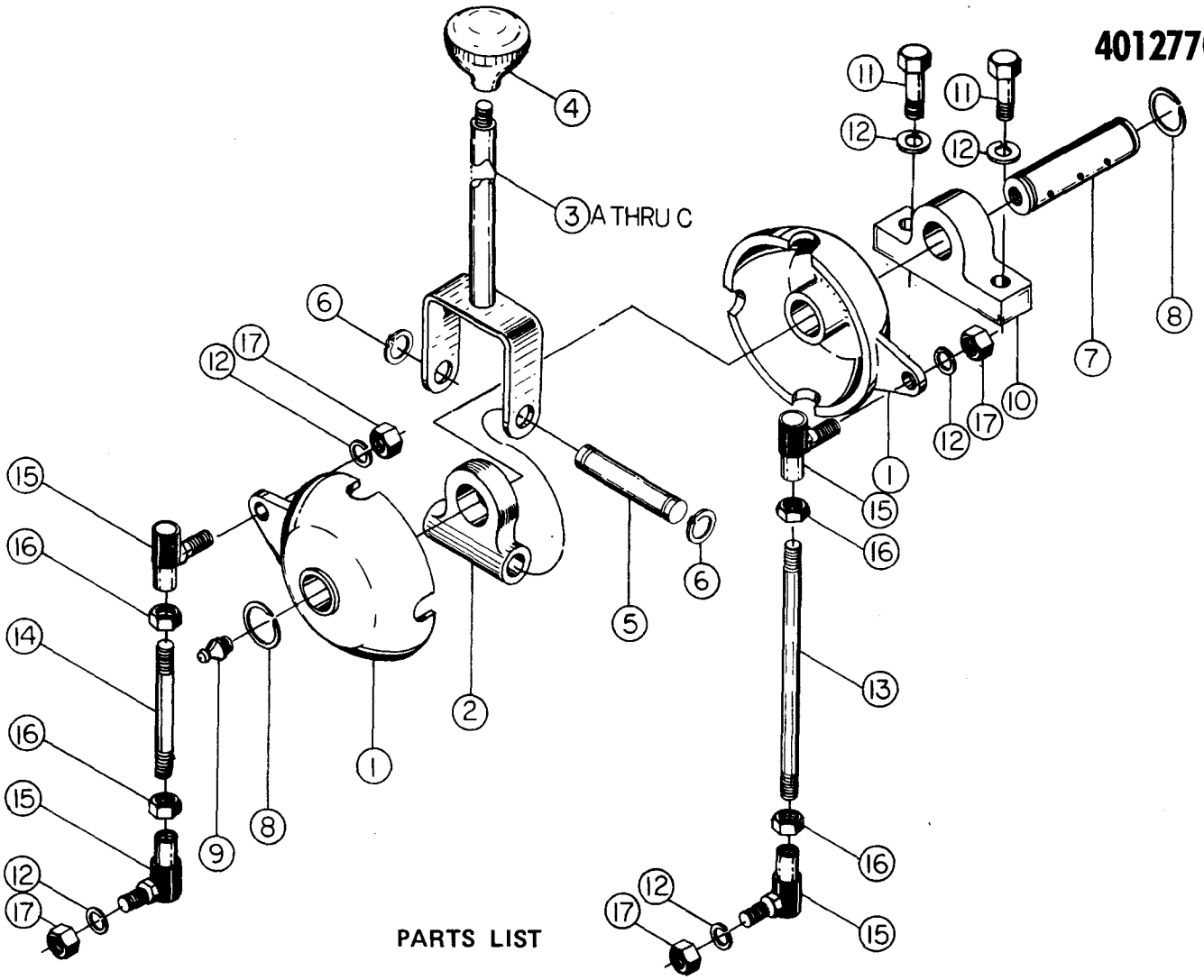


PARTS LIST

Drawing Ref. No.	New Part No.	Old Part No.	Description	No. Req.
1	4012751	12751	Cap, Side; Transmission Shift	1
2	4012752	12752	Fork, Second and Third Shfiter	1
3	4012753A	12753	Fork, Low and High Shifter	1
4	4012754	12754	Selector, Shift	2
5	4012755	12755	Block, Inhibitor	1
6	4F74000-12D	12529	Ball, 3/8" Diameter, Steel	3
7	4TR-7204	12530	Spring, Transmission Shift Detent; 3/8" Dia. x 1-1/8" Long	2
8	4F10030-20R	12758	Capscrew, Drilled Hd; 3/8"-N.C. x 1-1/4" Hex. Hd. (H.T.)	2
9	4012759	12759	Wire, Safety; .040 x 4" Long	1
10	4F25375-16	12760	Pin, Retainer; Overshift Stop	4
11	4012761	12761	Shaft, Shift Sector	2
12	4012762	12762	Arm, Transmission Shift	2
13	4F25312-24	12764	Pin, Retainer; Shifter and Arm	4
14	4F65021	12765	Seal, Oil; Shift Sector Shaft	2
15	4F10030-16	12446	Capscrew, 3/8" - N.C. x 1" Hex. Hd. (H.T.)	6
16	4F18003	12445	Washer, Sealing: 3/8"	6

SHIFT CONTROL ASSEMBLY, 4-SPEED TRANSMISSION

4012770

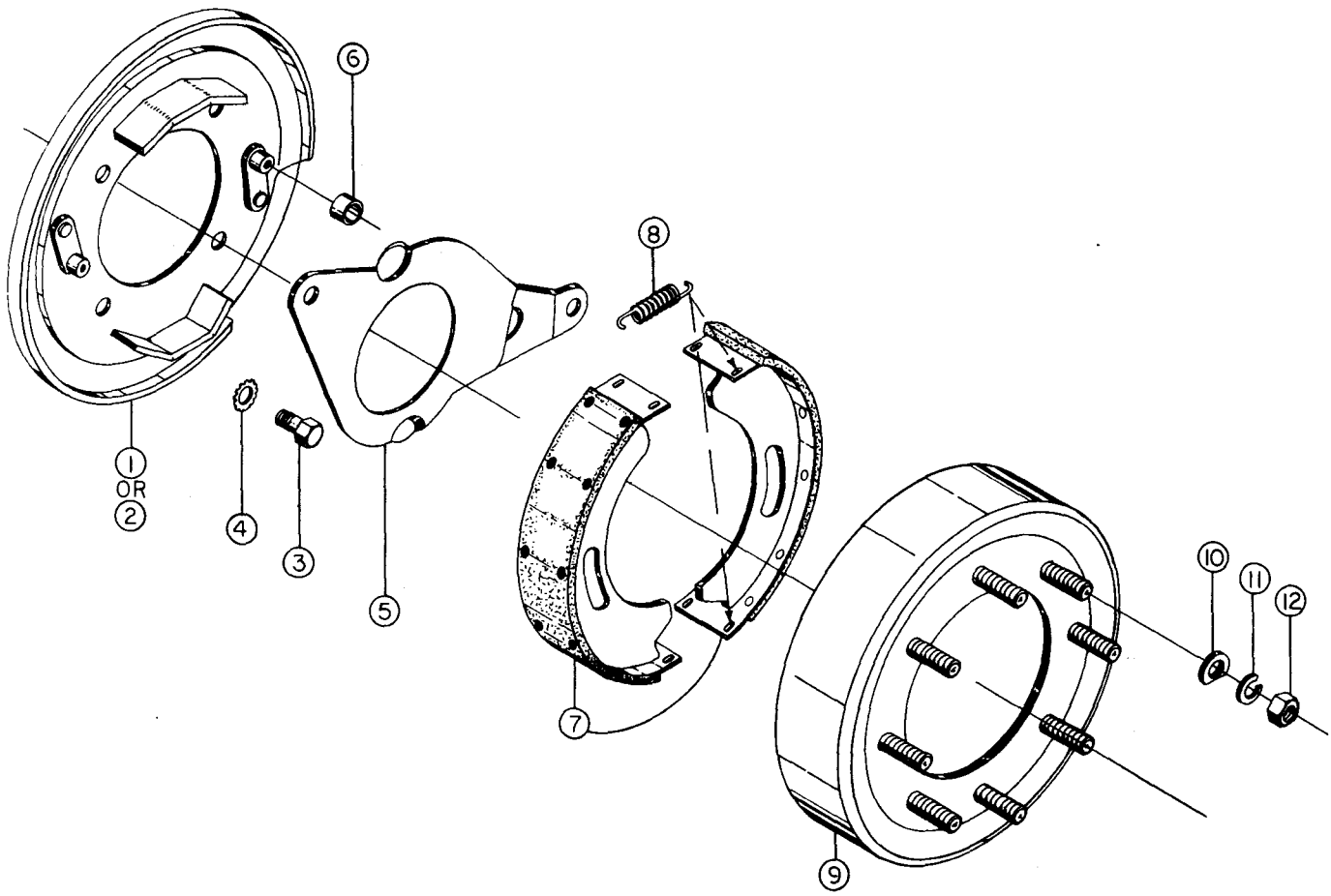


PARTS LIST

Drawing Ref. No.	New Part No.	Old Part No.	Description	No. Req.
1	4012771	12771	Shell, Shift Control	2
2	4012772	12772	Knuckle, Shift Control	1
3A	4000516	12773-A	Hand Lever Assembly, 12" Stick	
3B	4000517	12773-B	Hand Lever Assembly 18" Stick	1 of 3
3C	4000518	12773-C	Hand Lever Assembly, 24" Stick (Standard Unless Spec.)	Per Spec.
4	4F83000	12663	Ball, Hand Lever	1
5	4012775	12775	Pin, Hand Lever	1
6	4F39010-50	12776	Ring, Snap; Hand Lever Pin Retainer	2
7	4012777	12777	Pin, Fulcrum	1
8	4F81490-73	12778	Ring, Snap; Fulcrum Pin Retainer	2
9	4F66010	12781	Fitting, Grease	1
10	4012782	12782	Bracket, Shift Control Mount	1
11	4F10030-24	12783	Capscrew, 3/8"-N.C. x 1-1/2" Hex. Hd. (H.T.)	2
12	4F16202	12120-1	Washer, 3/8" Medium Spring Lock	6
13	4012785	12785	Rod, Shifter; Second and Third	1
14	4012786	12786	Rod, Shifter; Low and High	1
15	4F35100-4R	12787	Joint, Ball; 3/8"-N.F.	4
16	4F79105	12788	Nut, Jam; 3/8" - N.F. Hex. Hd.	4
17	4F13006	12790	Nut, 3/8" - N.F. Hex. Hd. Full	4

PARKING BRAKE ASSEMBLY

4012800

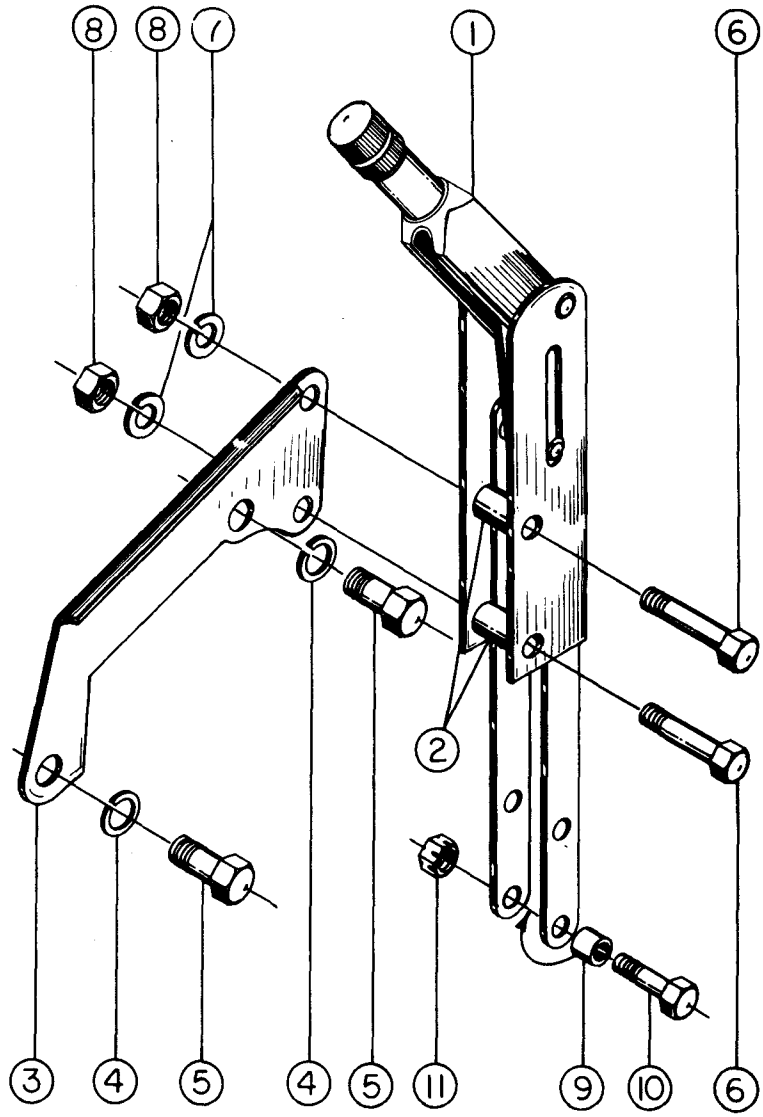


PARTS LIST

Drawing Ref. No.	New Part No.	Old Part No.	Description	No. Req.
1	4012801	12801	Backing Plate Assembly Shuttle Transmission	1 of 2
2	4012802	12802	Backing Plate Assembly 4-Speed Transmission	
3	4F10050-14	12803	Capscrew, 1/2 - N.C. x 7/8" Hex. Hd. (H.T.)	4
4	4F15005	12748	Washer, 1/2" External Shakeproof	4
5	4012806	12806	Bellcrank, Operating Cam Lever	1
6	4012807	12807	Washer, Spacer	1
7	4012808	12808	Shoe, Brake	2
8	4012809	12809	Spring, Return	2
9	4012810	12810	Drum Assembly	1
10	4012821	12821	Washer, Clipped	8
11	4F16202	12120-1	Washer, 3/8" Medium Spring Lock	8
12	4F13006	12790	Nut, 3/8" N.F. Hex. Hd. Full	8

BRAKE LEVER ASSEMBLY

4012850



PARTS LIST

Drawing Ref. No.	New Part No.	Old Part No.	Description	No. Req.
1	4012851	12851	Lever, Brake	1
2	4012852	12852	Spacer, Brake Lever	2
3	4012854	12854	Bracket, Brake Lever Mount	1
4	4F16205	12406	Washer, 9/16" Medium Spring Lock	2
5	4F10060-20	12856	Cap Screw, 9/16"-N.C. x 1-1/4" Hex. Hd. (H.T.)	2
6	4F10030-28	12859	Capscrew, 3/8-N.C. x 1-3/4" Hex. Hd. (H.T.)	2
7	4F16202	12120-1	Washer, 3/8" Medium Spring Lock	2
8	4F13005	12543	Nut, 3/8" - N.C. Hex. Hd. Full	2
9	4012863	12863	Bushing	1
10	4F10020-14	12167	Capscrew, 5/16" - N.C. x 7/8" Hex. Hd. (H.T.)	1
11	4F82056-18D	12865	Nut, Lock; 5/16" - N.C. Hex. Hd. Full	1

GASKET and SEAL KITS

11¾" HI K Converter Assembly Part 4045070
11¾" AB Converter Assembly Part 4045098
12" Converter Assembly Part 4045020

Group	Part No.	Description	No. Req.
4000426	4012129	Ring, Seal	1
	4045006	"O" Ring	1
	4045017	"O" Ring	1

13" Converter Assembly Part 4012150 and 4012993

4000427	4012129	Ring, Seal	1
	4045017	"O" Ring	1
	4F18002	Washer	12
	4F37030-236	"O" Ring	1

Converter Housing Assembly Part 4012201-2 thru 4012201-3C

4000428	4F18002	Washer	6
	4F65015	Seal, Oil	1
	4012213	Gasket	1

Primary Pump Assembly Part 4012230

4000429	4012235	Gasket	1
	4F18004	Washer	2
	4F37020-120	"O" Ring	2

Oil Manifold Assembly Part 4012240

4000430	4F18002	Washer	4
	4F37020-116	"O" Ring	2

Oil Filter Assembly Part 4012270

4000431	4F37020-116	"O" Ring	1
	4012271	Element	1
	4F37030-244	"O" Ring	1
	4F37030-218	"O" Ring	1

Auxiliary Pump Assembly, Small Part 4021280

4000432	4012235	Gasket	1
	4F18004	Washer	2

Shuttle Transmission Assembly Part 4012300 & 4012301

4000433	4012405	Gasket	1
	4012432	Gasket	2

GASKET and SEAL KITS

If your unit consists of a shuttle transmission only, that is, without 4-speed or drop box transmission, the following parts will be required.

4012302 & 4012303

Group	Part No.	Description	No. Req.
4000434	4F65013	Seal, Oil	1
	4012443	Gasket	3
	4F18003	Washer	1

Shaft and Clutch Assemblies Part 4012310 thru 4012313

4000435	4012328	Ring, Seal	3
	4012347	Ring, Seal	6
	4012365	Ring, Seal	4
	4012365-1	Ring, Seal	1
	4F37030-333	"O" Ring	2
	4012376-A	Seal Ring	2

Control Valve Assembly Part 4012500 and 4012500-A

4000436	4F37020-116	"O" Ring	9
	4F37010-012	"O" Ring	4
	4F65001	Seal, Oil	1
	4012531	Gasket	1

Four-Speed Transmission Assembly Part 4012700

4000437	4F18005	Washer	2
	4F65013	Seal, Oil	1
	4F18003	Washer	12
	4012734	Gasket	1
	4012739	Gasket	2
	4012744	Gasket	1
	4F37020-112	"O" Ring	4
	4F65021	Seal, Oil	2

Parking Brake Assembly Part 4012800

4000438	4F37030-224	"O" Ring	1

Heat Exchanger Assembly Part 4012970

4000439	4F37020-116	"O" Ring	6
	4012972	Gasket	2
	4012975	Gasket	2

DISASSEMBLY AND ASSEMBLY HINTS

If it should ever be required to overhaul this unit and repair parts be required, please specify the model, specification, and serial numbers of your unit as well as the number and name of the parts accompanying your purchase order. The above information will greatly facilitate the handling of your service order.

In addition to the ordinary line of hand tools, the following items will be required when overhauling the Model 12000 Revers-O-Matic Drive.

1. Suitable hoist.
2. Small arbor press.
3. Double solvent cleaning tank; one for preliminary cleaning and the other for final cleaning of parts.
4. Snap ring pliers.
5. Air pressure hose with squirt nozzle (approximately 100 lb. pressure required).
6. Oil can filled with automatic transmission fluid Type "A".
7. A closely graduated scale rule or a depth mike to check end clearance in final assembly.

CAUTION: Cleanliness is of extreme importance and an absolute MUST in the repair and overhaul of this unit. Before attempting any repairs, the exterior of the unit must be thoroughly cleaned to prevent the possibility of dirt and foreign matter entering the mechanism.

After disassembly, all the parts should be thoroughly cleaned in a solvent tank; then they should be cleaned again with clean solvent before reassembling.

— Handle all transmission parts with care. Nicks, scratches, or dents caused by careless handling of parts can cause subsequent transmission failure.

— Never dry bearings with compressed air. Do not spin bearings while they are not lubricated.

— When assembling ball bearings, pressure should be applied against the member being assembled (inner ring on shaft or outer ring in housing). Bearing must be started squarely on shaft or in housing, and seated squarely against shoulder. Check housing and shaft for nicks and scratches prior to bearing installation. Always oil bearings and bushings during assembly as this will assure lubrication during the first few moments of operation.

— Parts incorporating bushings should be replaced if total radial clearance exceeds .0035. Parts incorporating roller bearings should be replaced if total radial clearance exceeds .0025.

— Before installing oil seals, check shafts and bores for nicks and scratches. Make sure that the seals are started squarely. Always press seals on the outside diameters; using a thin piece of shim stock around the shaft to protect the sealing edge of the seal against possible damage when it is required that the seal slide over splines or keyways. Prelubricate all oil seals and "O" rings immediately before installation.

— Grease all seal rings and center in grooves prior to installation. Be particularly careful against breakage when installing steel rings.

— Check all snap rings after installation making sure that they are securely seated in their grooves.

— Check all cap screws and bolts for proper (torque) tightness.

— Check all rotating parts for free motion.

DISASSEMBLY AND ASSEMBLY HINTS

—— When assembling the shaft and clutch assembly it is very important that a smooth external tooth steel reaction plate be installed against the aluminum piston. Do not, under any circumstances place a grooved internal tooth bronze friction plate in first against the aluminum piston. Alternate steel and bronze plates until each clutch has eight (8) of each.

CAUTION: The steel plates are slightly conical (not flat) and the slope on these plates when installed in the unit should be parallel, with the "dished" side toward the open end of the cylinder. In addition, the missing teeth on the external tooth steel reaction plates must align with the oil drain holes in the clutch cylinder.

—— On units not equipped with variable speed transmission, the clutch stack end-play must be adjusted by using the proper number of rear bearing retainer gaskets, part No. 12443. If these gaskets are in need of replacement, be sure that the same number or total thicknesses are used that were originally installed. Check clutch stack end-play (.020 to .035 recommended) by bumping and pulling either the input or output shaft.

—— On units equipped with variable speed transmissions, the clutch stack end-play is adjusted with clutch stack adjustment shims, part No. 12733. Check end-play (.020 to .035 recommended) by bumping and pulling input shaft.

—— The clutch pistons can be removed from the clutch cylinders by applying an air pressure nozzle to the oil holes in the bore of the cylinders and forcing the pistons out with air pressure.

NOTES

CONVERTER AND VALVE FLOW DIAGRAM