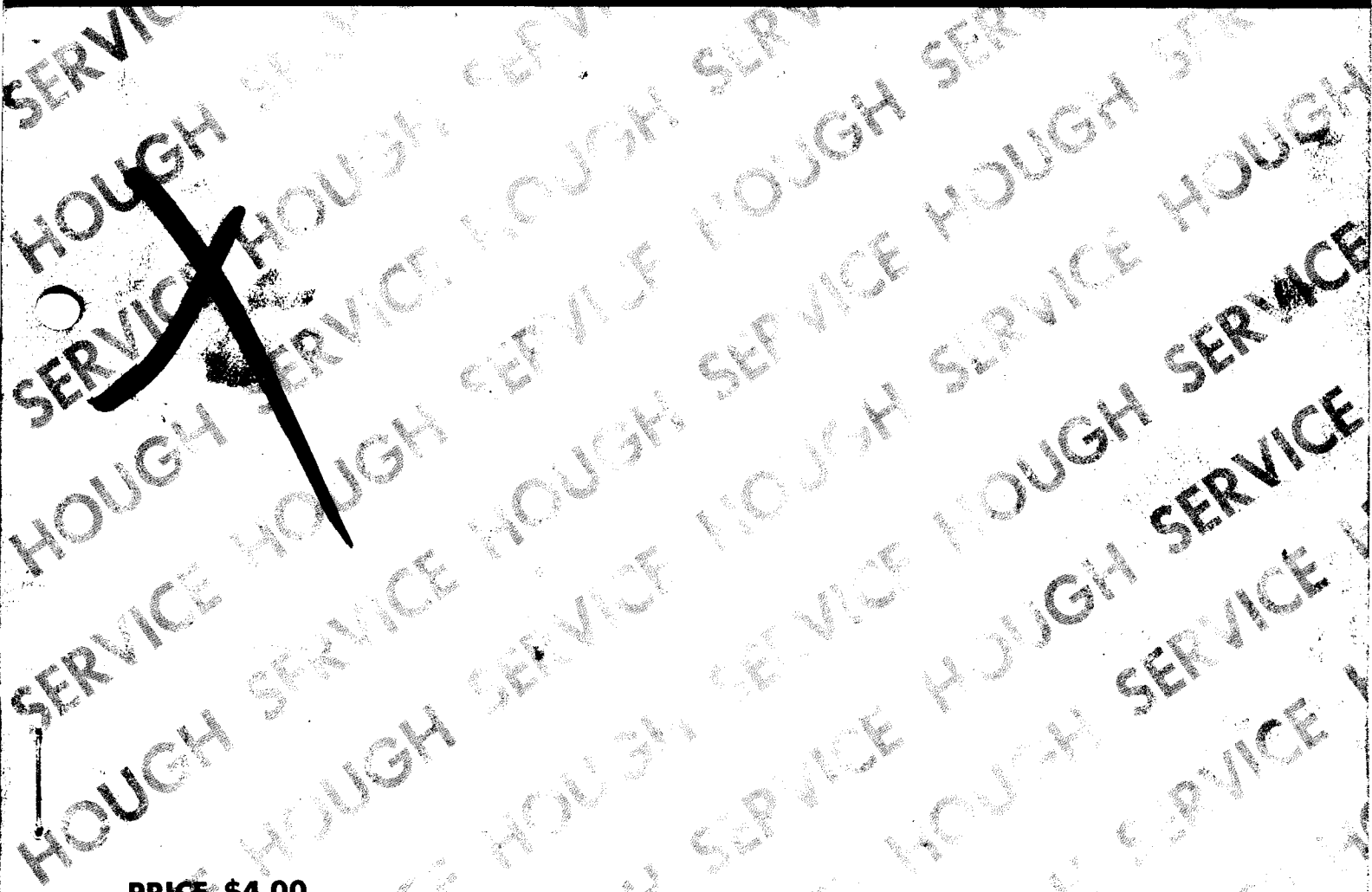
SERVICE MANUAL

TORQUE CONVERTERS AND P-6000 TRANSMISSION

P-6000



PRICE $4.00

FORM

SM-P-6000

DECEMBER 1963

SAY "NUFF"

HOUGH®

THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.®

SUBSIDIARY - INTERNATIONAL HARVESTER COMPANY

P-6000 SERVICE MANUAL

TABLE OF CONTENTS

SECTION I GENERAL INFORMATION

- SECTION I-A D-500 TORQUE CONVERTER
- SECTION I-B D-400 TORQUE CONVERTER
- SECTION I-C P-6000 TRANSMISSION

SECTION II D-500 TORQUE CONVERTER

- SECTION II-A INPUT HOUSING ASSEMBLY
- SECTION II-B END PLATE ASSEMBLY
- SECTION II-C TURBINE HOUSING ASSEMBLY
- SECTION II-D IDLER GEAR BEARING
- SECTION II-E COVER SEALS
- SECTION II-F P.T.O. GEARS & BEARINGS
- SECTION II-G INPUT HOUSING SEAL
- SECTION II-H MATING RING & WASHER
- SECTION II-J BEARING, RETAINER, & SEAL CARRIER
- SECTION II-K DISASSEMBLY & REASSEMBLY OF CHARGING PUMPS

SECTION III D-400 TORQUE CONVERTER

SECTION III DISASSEMBLY OF TORQUE CONVERTER

- SECTION III-A REMOVE & REPLACE SEAL IN SEAL RETAINER
- SECTION III-B REMOVE & REPLACE BEARING IN TURBINE ASSEMBLY
- SECTION III-C REMOVE & REPLACE BEARING IN IDLER GEAR
- SECTION III-D REPLACE SEALS INPUMP MOUNTING PLATES
- SECTION III-E REMOVE & REPLACE DRIVEN GEARS & BEARINGS
- SECTION III-F REMOVE & REPLACE SEAL IN FRONT HOUSING
- SECTION III-G DISASSEMBLY & REASSEMBLY OF CHARGING PUMP

SECTION III REASSEMBLY OF TORQUE CONVERTER

SECTION IV P-6000 TRANSMISSION

SECTION IV DISASSEMBLY OF P-6000 TRANSMISSION

- SECTION IV-A RANGE & DIRECTIONAL SELECTOR VALVE
- SECTION IV-B D-500 MAIN REGULATOR VALVE BODY
- SECTION IV-C D-400 CONTROL VALVES
- SECTION IV-D GASKET INSTALLATION FOR TRANSMISSION COVER
- SECTION IV-E DISASSEMBLY & REASSEMBLY OF ALL CLUTCH PACKS
- SECTION IV-F P-6000 OUTPUT SHAFT
- SECTION IV-G REVERSE IDLER GEAR ASSEMBLY
- SECTION IV-H P-6000 TRANSMISSION GEARS
- SECTION IV-J D-500 & D-400 TRANSMISSION COVER ASSEMBLY

SECTION IV REASSEMBLY OF P-6000 TRANSMISSION

SECTION I

GENERAL INFORMATION

TABLE OF CONTENTS

SECTION I-A D-500 TORQUE CONVERTER

Specifications	Page I-A3
General Information	Page I-A3
Trouble Shooting	Page I-A5
Torque Chart for P-6000 Transmission	Page I-A7

SECTION I-B D-400 TORQUE CONVERTER

Specifications	Page I-B11
General Information	Page I-B11
Hydraulics	Page I-B13
Preventive Maintenance	Page I-B14
Trouble Shooting	Page I-B17
Torque Chart for P-6000 Transmission	Page I-B18

SECTION I-C P-6000 TRANSMISSION

Specifications	Page I-C21
General Information	Page I-C21
Clutch Operation	Page I-C23
Transmission Operation	Page I-C25
Hydraulics	Page I-C31
Preventive Maintenance (D-400)	Page I-C32
Trouble Shooting	Page I-C35
Torque Chart for P-6000 Transmission	Page I-C37

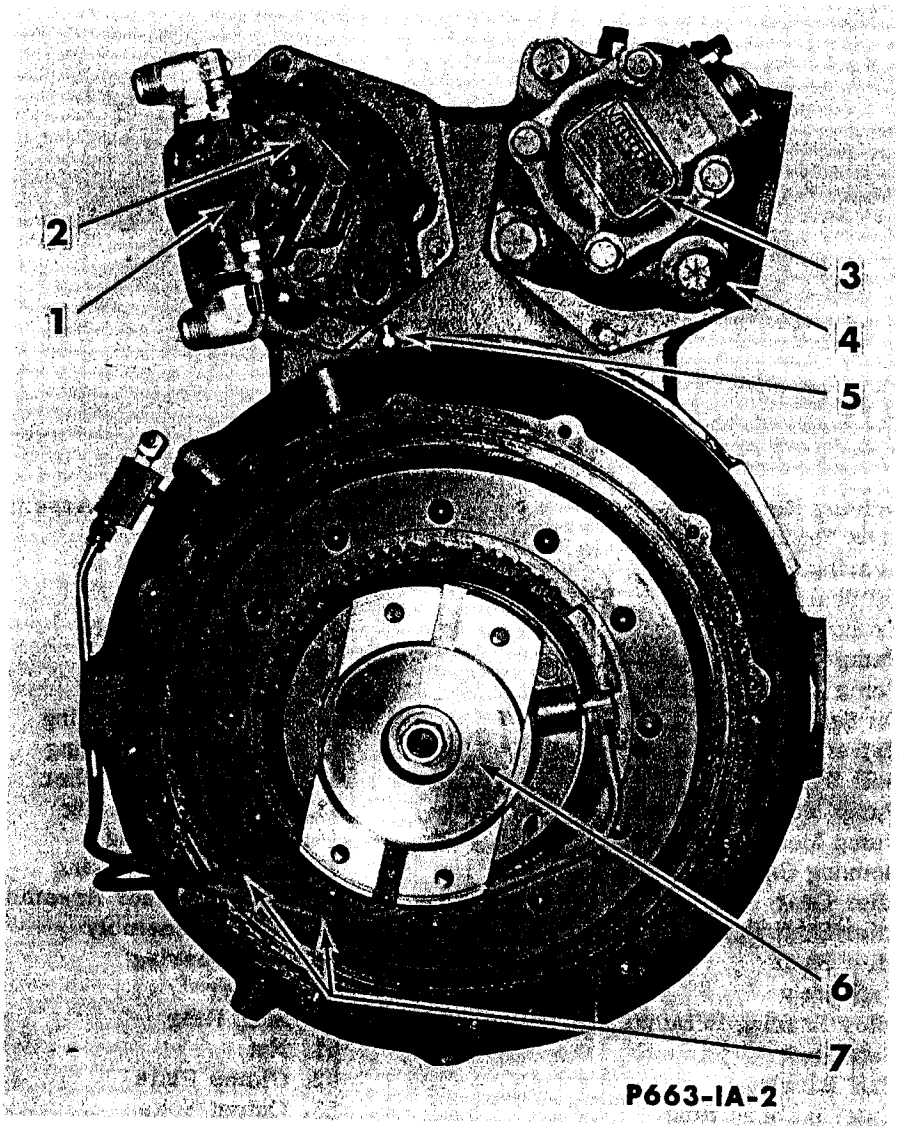


Figure IA-2 Front View of D-500 Torque Converter

1. Converter Charging Pump
2. Transmission Charging Pump
3. Steering Pump
4. Hydraulic Pump
5. Bleeder Valve
6. Output Yoke
7. Bearing Lube Tubes

D-500 TORQUE CONVERTER

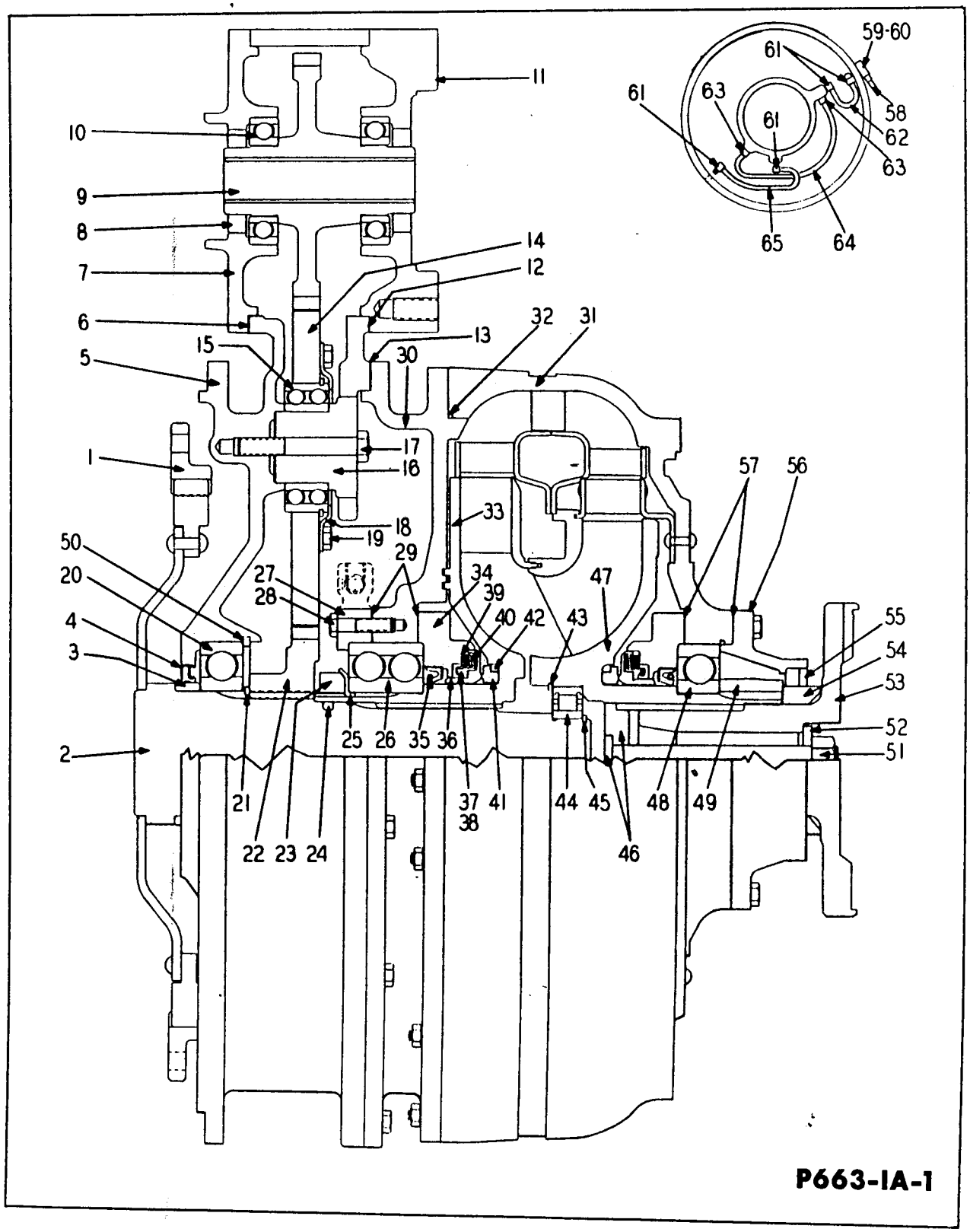


Figure IA-1 Cutaway View of D-500 Torque Converter

D-500 TORQUE CONVERTER

KEY TO FIGURE IA-1

1. Driving Ring
2. Input Shaft Assembly
3. Bearing Spacer
4. Oil Seal
5. Front Housing
6. Pump Mounting Plate Gasket
7. Pump Mounting Plate
8. Oil Seal
9. Driven Gear
10. Ball Bearing
11. Pump Mounting Plate
12. Pump Mounting Plate Gasket
13. Housing Gasket
14. Idler Gear
15. Idler Shaft Bearing
16. Idler Shaft
17. Capscrew
18. Idler Bearing Retainer
19. Capscrew
20. Ball Bearing
21. External Snap Ring
22. Driving Gear
23. Bearing Lock Nut
24. Input Shaft "O" Ring
25. Bearing Lockwasher
26. Ball Bearing
27. Impeller Bearing Retainer
28. Retainer Screw
29. Gasket
30. Plate
31. Converter Assembly Housing
32. Gasket
33. Impeller Wheel Assembly
34. Seal Carrier
35. Oil Seal
36. Nose Piece
37. Rubber Element
38. Garter Spring
39. Retainer Washer
40. Compression Spring
41. Carbon Mating Ring
42. Mating Ring Washer
43. Internal Snap Ring
44. Roller Bearing
45. External Snap Ring
46. Yoke Retainer Assembly Plug
47. Wheel Assembly
48. Ball Bearing
49. Spacer
50. Snap Ring
51. Nut
52. Clamp Plate
53. Output Yoke
54. Yoke Spacer
55. Oil Seal
56. Housing
57. Gasket
58. Tubing
59. Fitting
60. Nipple
61. Elbow
62. Tubing
63. Fitting
64. Tubing
65. Tubing

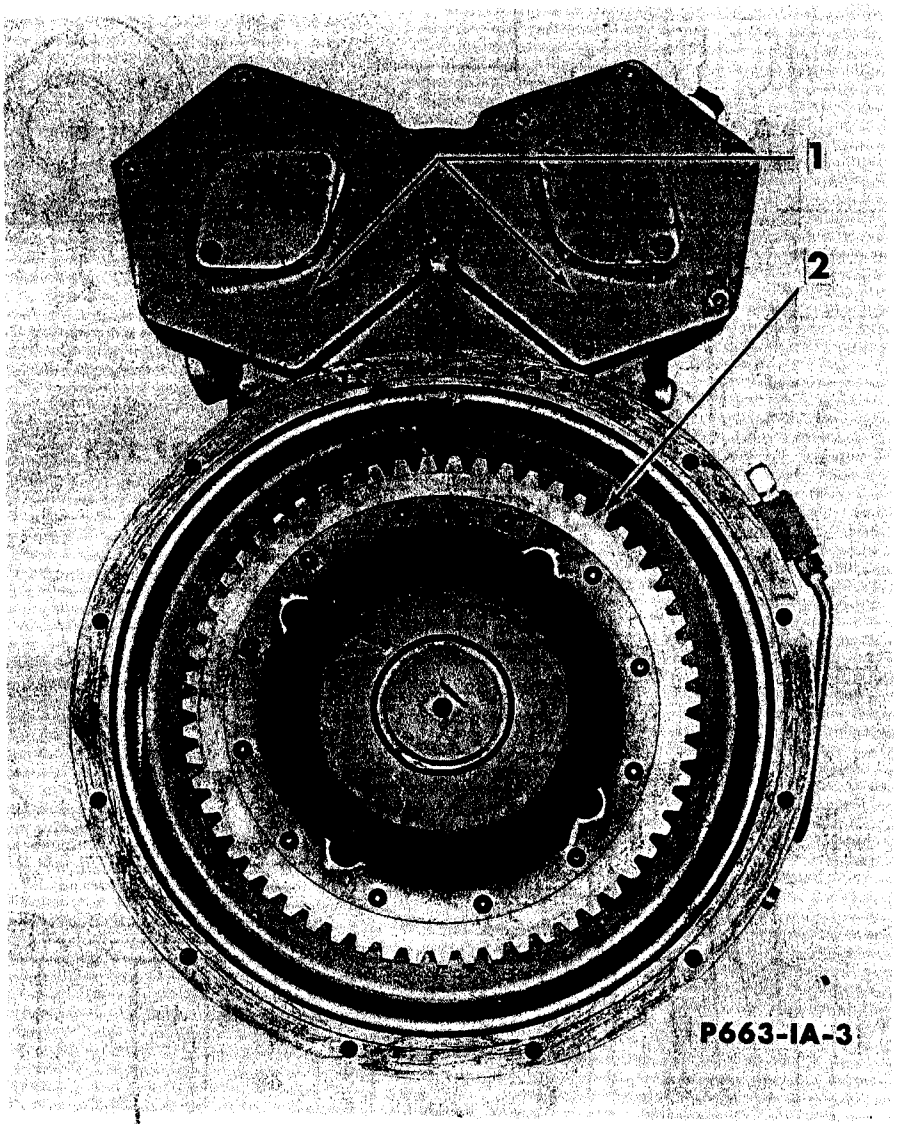


Figure IA-3 Rear View of D-500 Torque Converter

1. Power-Take-Off Covers
2. Drive Sprocket

SPECIFICATIONS

CONVERTER TYPE:

Three stage converter.

TORQUE MULTIPLICATION AT STALL:

Ratio - 4.25:1
Stall speed - 1750 RPM
Input speed - Maximum 2100 RPM

OIL SYSTEM:

Input pump: Positive displacement, gear type

OIL PRESSURE:

Converter "In" at stall 70 P.S.I. minimum, 90 P.S.I. maximum

OIL TEMPERATURE:

180° F. to 225° F. normal
250° F. maximum safe continuous duty

OIL FILTER:

Full flow - remote mounted

OIL COOLER:

Remote mounted

WEIGHT:

704 lbs. (dry)

GENERAL INFORMATION

D-500 TORQUE CONVERTER

The torque converter and fluid are used to transmit power from the engine to the top shaft of the transmission. The converter is mounted to the engine flywheel housing and flywheel. It is a three-stage torque converter. The converter input housing contains gears which are driven by the input shaft attached to the converter. These gears drive the main hydraulic pump, steering pump, converter and transmission charging pumps. The pumps are mounted on the input housing. These pumps provide oil flow any time the engine is running.

The torque converter couples the engine to the transmission. Understanding what a torque converter does and how is does it is necessary for success in isolating problems caused by the torque converter.

The purpose of a torque converter is to "multiply" the torque or twisting force produced by the engine. The amount of load or resistance that is applied to the output shaft of the torque converter determines the extent to which the engine (or input) torque is multiplied. When the load can be moved with just about the amount of torque produced by the engine, there is no torque multiplication. However, when the load is increased, a re-routing of the fluid occurs within the torque converter, resulting in an increase of torque at the output shaft.

The torque converter has three basic parts, i.e. the "impeller" or pump, which is directly driven by the engine and has a ring of metal blades which turn in the converter fluid. The "turbine" is made up of the three rings of blades and is direct-connected to the transmission. The third part is the "stator" or torque converter housing and contains two stationary sets of blades.

When the impeller blades turn in the fluid they actuate the first ring of blades in the turbine, from where the fluid is re-directed to the first set of blades in the housing. These blades in turn re-direct the fluid to the second set of blades in the turbine. Thus, the fluid is directed and re-directed through all three sets of turbine blades.

Under normal running conditions, the action of the impeller causes the turbine blades to turn almost freely and the fluid passes through the converter easily and quickly, striking each blade at a slight angle. But, when a load is encountered, the turbine slows down since it is directly connected to the transmission and the fluid strikes the turbine blades at a sharper angle. As the force of the fluid is relayed from the first to the second to the third ring of turbine blades, the output torque accumulates until it is increased up to five times the input torque.

The twisting force that accumulates as the fluid is directed and re-directed from one turbine blade to another is the output torque of the converter. It becomes greater with each increase in the angle at which the fluid successively strikes each set of blades in the turbine and housing. Thus, the torque converter selects the proper output torque for any load.

The torque converter, as covered by this manual, is composed of four major parts: the end plate, impeller, turbine wheel and the turbine housing. It also incorporates several accessory parts such as the charging pumps, oil filter, pressure and temperature gauges, the fluid cooling radiator and the connecting lines and hoses.

The converter is a flange type and is designed to be bolted directly to the flywheel housing. A driving ring gear designed to take the gear tooth drive is bolted to the engine flywheel. This ring gear meshes with the driving spider assembled to the converter input shaft. Although this type of installation is used because of its simplicity and ease of assembly, it is not intended to compensate for misalignment. Care must be taken to make sure that eccentric or angular misalignment does not occur between the engine and converter.

Inasmuch as the converter impeller absorbs negligible power at cranking speed, direct connection to the engine does not complicate starting.

POWER-TAKE-OFF

The two power-take-off gears are driven by an idler gear that is driven by a gear on the input shaft. The converter, transmission, steering and hydraulic pumps are mounted to the input housing and receives its power from this source.

FLUID SYSTEM

This torque converter is used with a diesel engine and uses diesel fuel as converter fluid. The engine supply tank, therefore, serves as the converter fluid reservoir.

Converter fluid is taken from the fuel tank by the charging pump and is supplied to the converter. There is a constant flow of fluid between the converter and the fluid cooler radiator.

Through a bleed line extending from the highest point of the fluid cooler, a small amount of fluid constantly bleeds back to the fuel tank replacing the fluid being drawn out by the charging pump. The tank is provided with an orifice connected to the bleed line which permits the expanded fluid to escape from the main fluid circuit. This also serves as a means of relieving the fluid system of any entrapped air which will naturally rise to the highest point in the system where it is forced through the bleed line to the fuel tank and then to the atmosphere.

The charging pump provides the basic pressure to the converter fluid. It also takes fluid from the fuel tank. The filter is located between the charging pump and the tank.

A relief valve is in the system set at 90 P.S.I. Pressure over 90 P.S.I. causes the relief valve to compress the spring and by-pass the excess flow of oil into the fuel tank. The relief valve is put into the system to prevent excessive pressures from being built up within the converter. The normal fluid expansion is much less than the capacity of the bleed line; consequently, some of the fluid needed for the converter operation is continually being bled into the tank. Because of this by-pass circulation system, all the converter fluid periodically passes through the filter.

A torque converter charging pressure of 75 P.S.I. to 90 P.S.I. at governed engine speed indicates normal operation. If the gauge reading flutters excessively or is less than 75 P.S.I. at high idle, check filter element in the pump supply line filter or converter pressure regulator setting.

The main fluid filter is located on the front side of the main fuel tank and filter element should be replaced every 500 hours of operation. Extreme care must be taken during reassembly of this filter. Any leak in this filter will result in pulling air into the converter fluid system while running.

When the converter is being used with a diesel engine and the engine supply tank serves as the converter fluid reservoir, the converter fluid need not be changed. The fluid in the converter is constantly being recirculated and returns to the fuel tank and is used up by the engine as fuel. Never let the fuel tank get low on fuel so the engine and converter pumps will draw air in the system. It will result in loss of power.

COOLING SYSTEM

A separate radiator has been provided to cool the converter oil. This is also called an oil cooler. The hot oil line extends from the outside diameter of the converter (where the oil pressure is high) to the inlet of the oil cooler. After passing through the oil cooler the oil returns to the converter (where oil pressure is low). The difference in oil pressure at the converter outlet and inlet points is enough to circulate the oil through the lines and oil cooler. The converter temperature gauge indicates the temperature of the oil leaving the converter. The operating temperature range is between 180° F. to 225° F.

Should temperature remain above 225° F., try to lower temperature by:

1. If the temperature rises above 250° F., decrease engine speed to 900 to 1000 R.P.M. and shift into neutral and run the engine to cool torque converter oil.

2. If the temperature rises above 250° F. with the engine throttle still wide open and the output horsepower becomes less than 70% of the input horsepower, the cooling capacity of the radiator oil cooler is exceeded. In the case of low output speed, the next lower gear should be engaged to reduce the torque requirements on the converter shaft and allow its speed to build up.

3. If already in lowest gear and converter output shaft still pulls down, in the case of too high speed on the output shaft, shift into a higher gear to increase the torque and decrease the speed requirement on this shaft. The converter will always overheat when the engine throttle is wide open and there is no load on the output shaft to pull the speed down.

TROUBLE SHOOTING FOR THE D-500 TORQUE CONVERTER

1. Poor performance and overheating of converter.

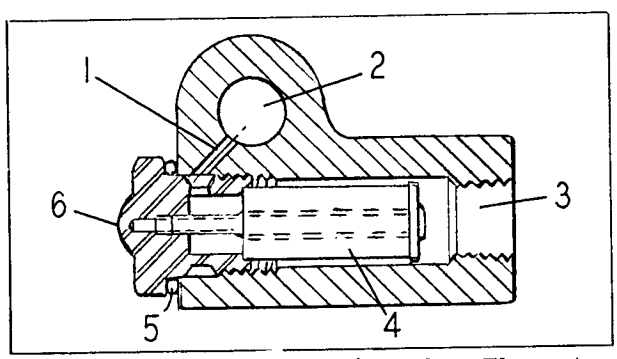
   a. Probable cause:

      1. Air in system
      2. Low basic pressure
      3. Inadequate cooling
      4. Loss of fluid
      5. Operating too long in low efficiency range, overloading or over-speeding

   b. How to determine and correct:

      1. Air in system.

         Low basic pressure, overheating and loss of pulling power are indications of air in the system. Partially open the bleed valve at the top of converter. With the unit running, close valve when a full stream of oil appears. If any air is present, the source of the air inlet to the system must be located.



1. Bleed Orifice
2. Return to tank
3. From Cooler
4. Filter Element
5. Seal
6. Cap, filter

Figure IA-4 Orfice Assembly

The orifice filter assembly is attached to the top of the fuel tank under the radiator. The filter in the orifice assembly should be cleaned after every 200 hours of operation. The orifice hole in the body of the orifice assembly is very small and demands close attention when cleaning. In addition to cleaning the filter, make sure the orifice hole is also cleaned.

Make a very close check of all points on the suction line from the tank and filter to the charging pump. It is possible to have an air leak in this line while running, which may not show as a oil leak with the unit shut down.

Check the pressure line from the charging pump through the oil regulator to the converter. A stop in this line or a defective regulator would result in depriving the converter of its regular constant supply of fluid while a portion is still bleeding out through the orifice assembly. If the stoppage should exist between the connection to the pressure gauge and the torque converter, the pressure reading would be normal or slightly high, while the actual pressure and fluid supply within the converter would be low.

WARNING

To insure proper bleeding of the system during operation, remove the orifice assembly and clean the filter and give particular attention to the orifice hole in the body of the assembly.

2. Low basic pressure

   This can be checked by direct reading or with another pressure gauge in the line. It should read between 70 P. S. I. and 90 P. S. I. Check charging pump. Check oil lines for leaks and restrictions. Check for clogged filter, dirt in

relief valve and excess leakage (a steady stream).

3. Inadequate cooling.

   Check the oil cooler. It may be clogged on the outside with dirt, bugs, leaves, etc. In such cases it should be washed and blown out with air. The fan operation should also be checked to see that there is no slipping of the fan belt.

4. Loss of fluid.

   With system under pressure, check for leaks at pipe connections, and gasket joints on converter. Check seal drains, if leakage is excessive, (a steady stream) the ground joint seal assembly is damaged and requires replacement.

   Check for leakage around input and output shafts. This may be caused by a mislocated seal gasket which will not allow the seal drain to function. The oil drain holes in the seal assembly and seal gasket must line up with the drain hole in housing.

5. Operating too long in low efficient range.

   The cooling radiator is adequate to cool the converter fluid when operating above 70% converter efficiency. However, when the output shaft speed is pulled down by being in too high a gear for the dozer application with the engine throttle wide open, overheating is developed in the converter. The cooling capacity of the radiator is exceeded. The low gear in the transmission should be engaged to reduce the torque requirements on the converter output shaft and allow its speed to build up.

NOTE

If already in lowest gear and converter output shaft still pulls down, the converter and engine are either overloaded or other trouble exists. In the case of too high speed on the output shaft, shift into a higher gear to increase the torque and decrease the speed requirement on this shaft. The converter will always overheat when the engine throttle is wide open and there is no load on the output shaft to pull the speed down. This is caused by the engine delivering full horsepower to the converter and no horsepower being transmitted out of the converter, resulting in full engine horsepower being transformed into heat in the converter.

1. Low output horsepower.

   a. Probable cause:

      1. Engine not coming up to rated performance
      2. Air in converter system
      3. Low basic pressure in converter

   b. How to determine and correct:

      1. Engine not coming up to rated performance

         Place transmission in highest gear range and dig the blade into the ground to hold the machine so that output shaft of converter is stalled and will remain stalled when engine throttle is opened wide. With the engine throttle wide open and the converter shaft stalled, measure the engine rpm by the use of a tachometer. If the engine does not climb up to full stall speed, it is not developing its full rated horsepower and should be thoroughly checked by the engine mechanic.

         The full load governor speed of the engine is 2100 R. P. M. The stall speed of engine is 1750 R. P. M. when the output shaft of converter is stalled.

      2. Air in system.

         Use procedure listed in paragraph 1-B-1. (Poor performance and overheating of converter.)

      3. Low basic pressure.

         Use procedure listed in paragraph 1-B-2. (Poor performance and overheating of converter.)

TROUBLE SHOOTING FOR THE D-500 TORQUE CONVERTER

1. Excessive pressure

   a. Probable cause:

      1. Stuck piston in relief valve in charging pump line.

NOTE

The pressure and temperature gauges provide the operator with a constant check on converter operation. Immediate recognition of an abnormal reading may prevent a breakdown. It is important, therefore, whenever a gauge is found to be faulty, it be immediately replaced.

Lubrication of the torque converter end bearings is supplied by the lube oil from the transmission oil cooler and returns to the transmission supply.

TORQUE CHART FOR P-6000 TRANSMISSION

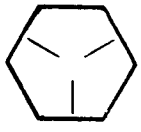
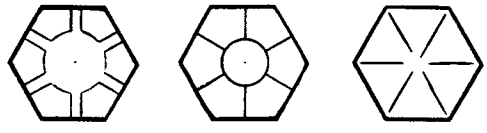
SIZE	THREADS PER INCH	TORQUE FT. LBS. FOR STD. HEAT TREATED SAE GRADE 5 ± 10 %	TORQUE FT. LBS. FOR SPECIAL HEAT TREATED SAE GRADE 8 ± 10 %
			
1/4	20	9	12
	28	10	14
5/16	18	18	25
	24	20	29
3/8	16	32	45
	24	37	50
7/16	14	52	70
	20	58	80
1/2	13	80	110
	20	90	125
9/16	12	115	160
	18	125	180
5/8	11	160	225
	18	165	230
3/4	10	280	400
	16	315	440
7/8	9	420	650
	14	460	700
1	8	625	950
	14	700	1050

Figure IA-5 Torque Chart for P-6000 Transmission

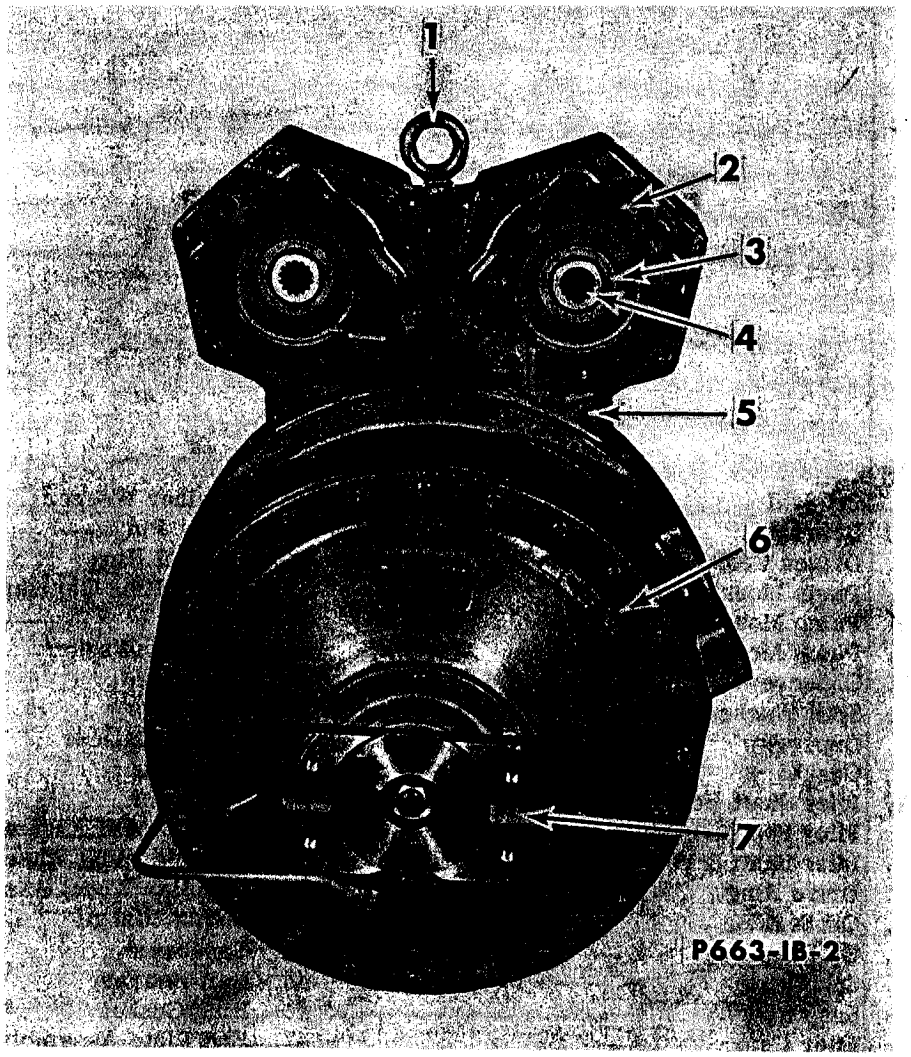


Figure IB-2 Front View of D-400 Torque Converter

1. Eye Bolt
2. Pump Mounting Plate
3. Seal
4. Driven Gear
5. Front Housing
6. End Plate Assembly
7. Yoke

D-400 TORQUE CONVERTER

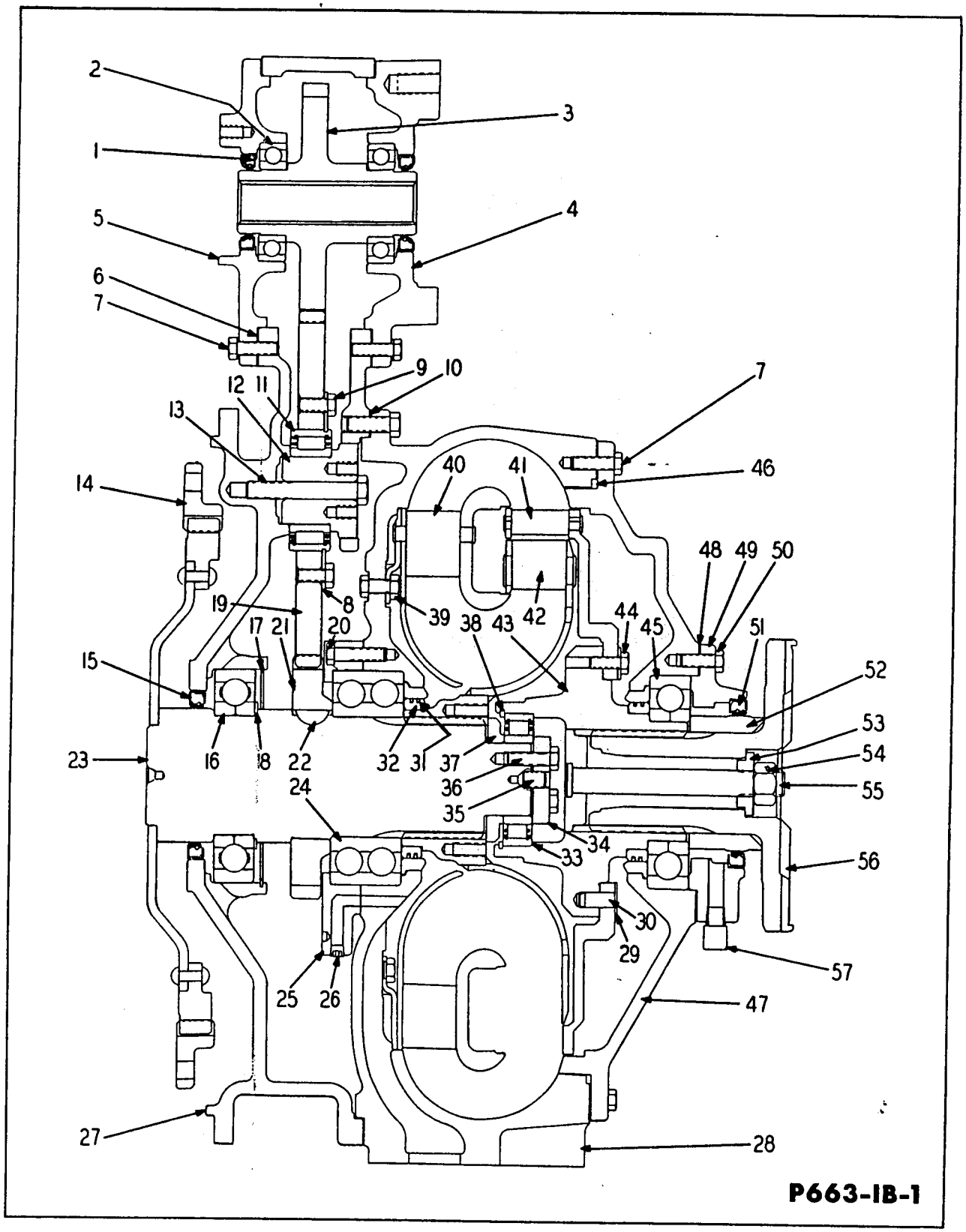


Figure IB-1 Cutaway View of D-400 Torque Converter

D-400 TORQUE CONVERTER

KEY TO FIGURE IB-1

1. Oil Seal
2. Bearing
3. Driven Gear
4. Pump Mounting Plate
5. Pump Mounting Plate
6. Pump Mounting Gasket
7. Capscrew
8. Split Washer
9. Capscrew
10. Gasket
11. Idler Shaft Bearing
12. Idler Shaft
13. Idler Shaft Screw
14. Drive Ring
15. Oil Seal
16. Ball Bearing
17. Snap Ring
18. Snap Ring
19. Idler Gear
20. Capscrew
21. Driving Gear
22. Drive Gear Key
23. Input Shaft
24. Ball Bearing
25. Bearing Retainer
26. Pipe Plug
27. Front Housing
28. Converter Housing Assembly
29. Retainer Washer
30. Dowel Pin
31. Oil Seal Ring
32. Piston Ring Carrier
33. Bearing
34. Retainer Washer
35. Setscrew
36. Capscrew
37. Bearing Spacer
38. Snap Ring
39. Capscrew
40. Guide Wheel Assembly
41. Turbine Final Wheel Assembly
42. Impeller Wheel Assembly
43. Output Flange
44. Capscrew
45. Ball Bearing
46. Ring Gasket
47. End Plate Assembly
48. Seal Gasket
49. Bearing Retainer
50. Capscrew
51. Oil Seal
52. Yoke Spacer
53. Clamp Plate
54. Nut
55. Yoke Plug
56. Yoke
57. Fitting Elbow

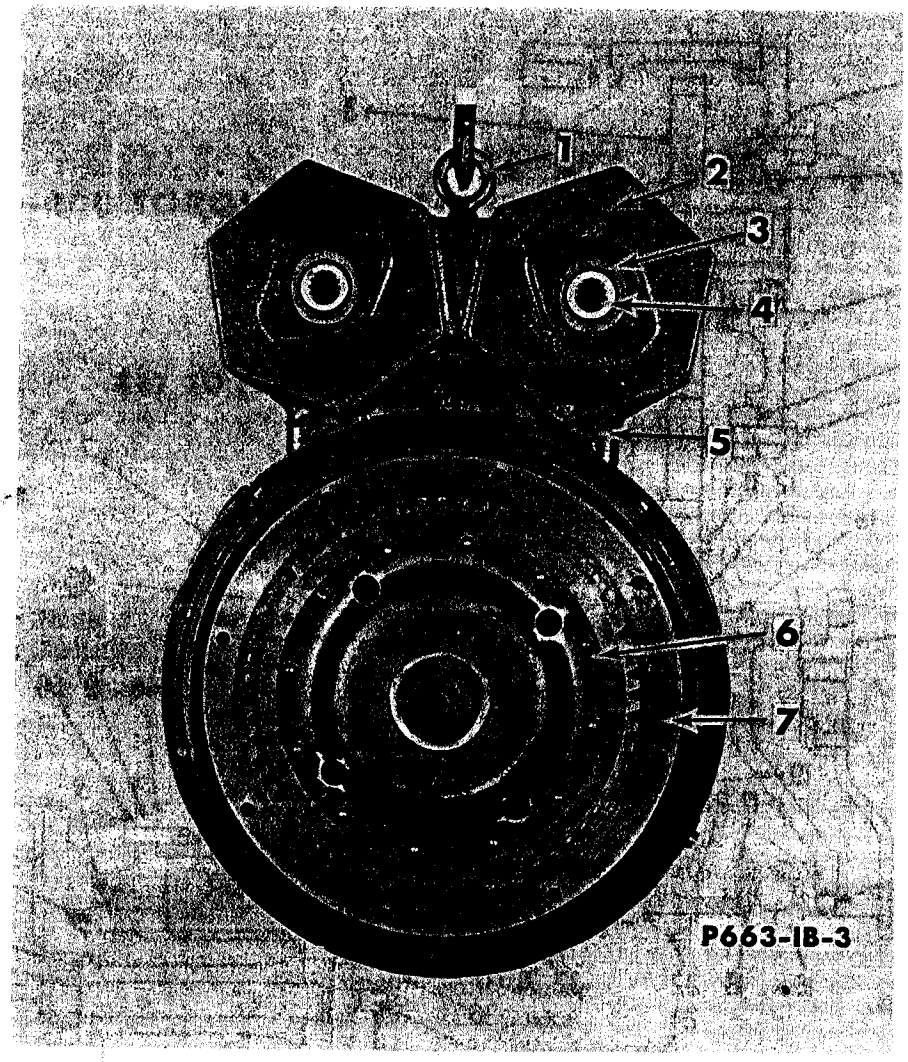


Figure IB-3 Rear View of D-400 Torque Converter

1. Eye Bolt
2. Pump Mounting Plate
3. Seal
4. Driven Gear
5. Front Housing
6. Input Gear
7. Driving Gear

SPECIFICATIONS

CONVERTER TYPE:

Single stage, three element converter.

TORQUE MULTIPLICATION AT STALL:

Ratio - 4.88:1

Stall speed - 2100 rpm
Input speed - Maximum 2100 rpm

OIL SYSTEM:

Integrated with transmission.
Input pump: Position displacement, gear type
Input pump capacity: 30 G. P. M. @ 2100 RPM

OIL PRESSURE:

Converter "In" at stall, 55 psi minimum
65 psi maximum

OIL TEMPERATURE:

180° F. to 225° F. Normal
250° F. maximum safe continuous duty

OIL FILTER:

Full flow - remote mounted

OIL COOLER:

Remote mounted

WEIGHT:

667 lbs. (dry)

GENERAL INFORMATION

D-400 TORQUE CONVERTER

GENERAL

The torque converter automatically varies the output required at the transmission to meet the changing load requirement of the machine. Engine power is transferred by the converter with little change in torque when the load is light. When a heavy load is encountered, the torque multiplication becomes greater, but with a resulting loss of "PAYDOZER" speed. It is important to note that the converter does not increase engine horsepower, but does increase the amount of torque available at the transmission.

The converter has three basic parts - the impeller, which is driven by the ring attached to the flywheel; the turbine wheel, which is connected through a flange to the output yoke; and the guide wheel, which is connected to the main housing and contains a row of stationary blades, sometimes called guide blades or reactor blades. The three parts are contained in the main housing which is filled with fluid. The fluid is maintained at a constant pressure of 55 to 65 psi to suppress vacuum pockets which form at the blades under high fluid velocities. There is no direct mechanical connection between the impeller and turbine or guide wheel.

POWER-TAKE-OFF

The two power-take-off gears are driven by an idler gear that is driven by a gear on the input shaft. The converter, transmission, steering and hydraulic pumps are mounted to the input housing and receives its power from this source.

OPERATION

The impeller draws fluid from the opening surrounding the hub and ejects it from its blades at high velocity. The turbine wheel blades completely surround the impeller and receive the full impact of this velocity. As it leaves the turbine blades, the fluid is turned by the housing and strikes the blades of the guide wheel secured to the housing. The guide wheel blades redirect the fluid to the hub of the impeller completing the cycle.

The torque multiplication is determined by the speed of the turbine in relation to the impeller. The fluid will strike the turbine with more force if the turbine is stationary then it will if the turbine is moving in the same direction as the impeller. When the turbine is rotating as fast as the impeller, the fluid passes easily through the turbine applying little or no force to the blades. As the output shaft slows down, fluid strikes the turbine blades with more force. The maximum striking force of the fluid is reached when the turbine is stopped. This occurs in the tractor when the output shaft is stalled by a heavy load.

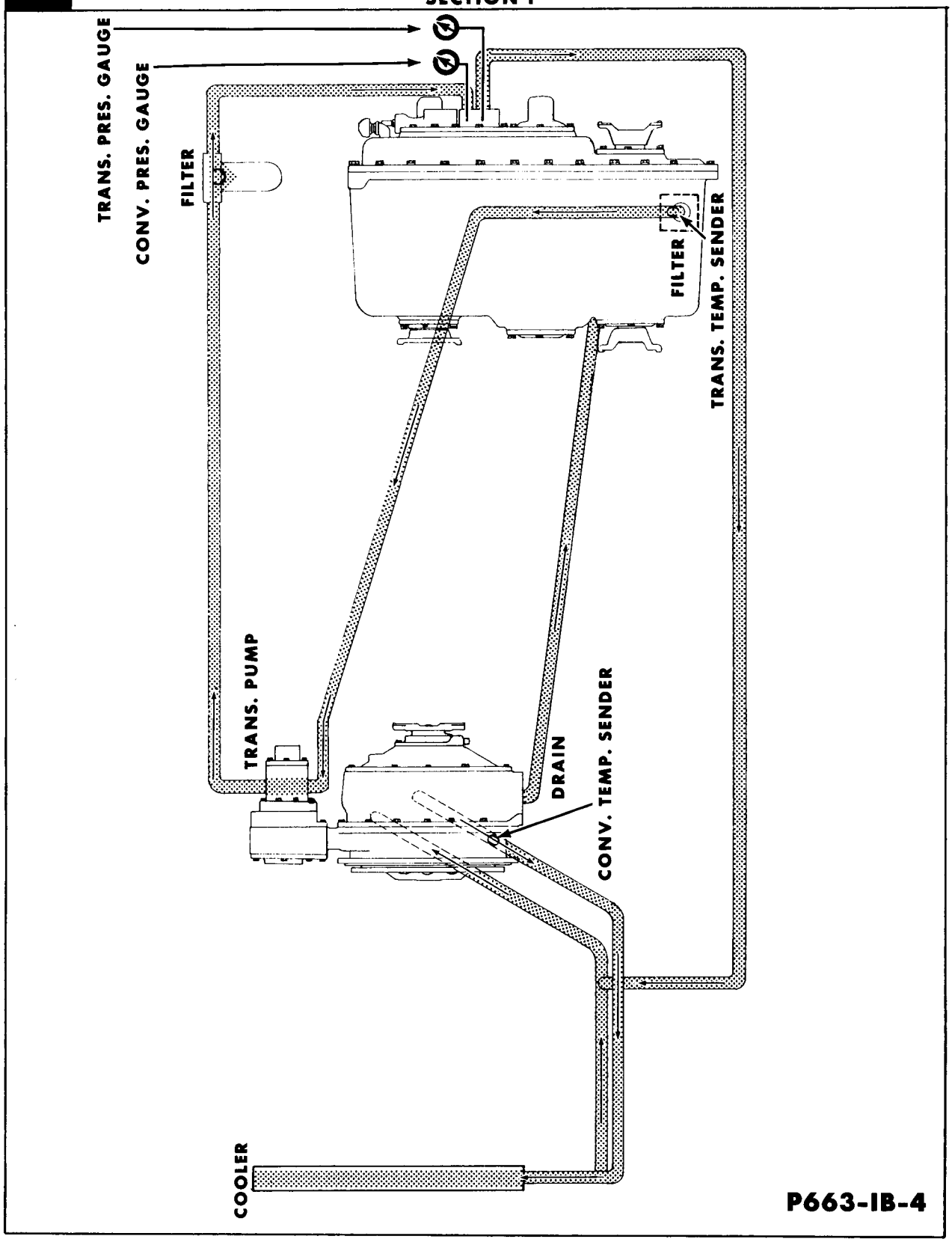


Figure IB-4 D-400 Hydraulic Diagram

HYDRAULICS

The torque converter and oil are used to transmit power from the engine to the top shaft of the transmission. The converter not only transmits engine torque but multiplies this torque thus providing greater working force at the transmission.

The converter is attached to the engine flywheel housing and is driven by a drive ring attached to the flywheel and is in motion anytime the engine is rotating.

The converter contains gears which are driven by an idler gear and a drive gear attached to the converter hub. These gears drive the main hydraulic pump, steering pump and the converter and transmission charging pump.

Before the engine is started, all controls should be in neutral position.

As soon as the engine begins to turn over, the transmission and converter pump, located on the torque converter housing, pick up the oil from the transmission sump and directs it to the primary and secondary control valve. This in turn directs the lube oil through various passages to the oil supply covers and clutch packs through the oil passages in the shafts.

The lube oil lubricates the bushings, bearings, gears, clutch plates and all working parts in the transmission. The oil also goes through the converter orifice and back to transmission sump. The clutch packs will be in neutral position until the range and directional valves have been shifted to allow high pressure oil to enter the clutch pack system.

External lines furnish the necessary connections to hydraulically integrate the transmission and converter charging pump, cooler, converter and the transmission unit. The sump of the transmission acts as a reservoir for the converter and transmission oil supply. A hose from the transmission sump and filter connects to the charging pump. The pump is mounted on the converter power-take-off housing.

The charging pump discharges the oil through a hose to a full flow filter and to the control valve. The control valve regulates the oil pressure to the directional and range valves which control the clutch packs. The by-pass oil from the transmission main control valve goes through the converter valve to the cooler pipe to the converter inlet. The converter discharges the oil through the oil cooler and back to the converter. An orifice in the converter meters oil out to lubricate the converter bearings and drains back to the transmission sump. The by-pass oil from the converter regulator valve returns to the transmission sump.

The hydraulic system (figure 1B-4) of the converter and the transmission consist of the following basic assemblies:

1. An input pump driven by a gear train and attached to the top front of the converter housing. The input pump speed is at engine speed. The input pump delivers 30 G. P. M. at 2100 RPM pump speed.

2. Two valves, bolted together on the transmission, are the control valves.
   a. Primary control valve for the clutches.
   b. Secondary control valve for the converter.

3. Two control valve bodies:
   a. Forward-reverse selector valve.
   b. Range selector valve.

4. Accessories of the system consists of:
   a. Sump filter contained in the transmission.
   b. Externally mounted full-flow filter with a by-pass valve set at 12 to 15 psi.
   c. Oil cooler mounted externally.

PREVENTIVE MAINTENANCE

A. Type refill.

Automatic Transmission Fluid Type "A"

B. Quantity for original fill - approximately 10 gallons.

C. Change periods.

(1) Oil change - 1000 hours of operation
(2) Clean transmission filter oil screen - 1000 hours of operation.
(3) Change external filter - 500 hours of operation
(4) Change the oil and filter and clean the oil screen whenever traces of dirt or the effects of high operating temperatures are present as evidenced by discoloration or strong odors.
(5) After any internal failure, change oil and completely flush and clean the transmission including filter, lines, oil cooler and valve bodies. If this is not done, there is a danger of further contamination from foreign particles and more failures.
(6) Metal particles in the oil indicate a failed or wearing part and the entire system and units should be drained, flushed and thoroughly cleaned.
(7) To drain the installation, remove the drain plug at the bottom of the transmission housing.

D. Oil level check.

1. Oil level should be checked daily or at the beginning of each shift.

2. Pre-start Check - To insure sufficient oil in the system before starting the engine, remove dipstick from oil filler tube by loosening the dipstick handle and remove the dipstick. The oil level must show on dipstick before the tractor is worked. The dipstick is located on the front of the transmission. The transmission dipstick filler tube is accessible on the right side of the tractor next to the transmission forward output shaft.

3. Start The Engine - Operate the transmission controls momentarily. Then shift to neutral. Make a second level check with the oil hot and the engine operating at a low idle speed. The oil level should not rise above the "Hot Full" mark. Drain oil down to "Full" mark if the level rises above "Full." Replace the dipstick and tighten its handle.

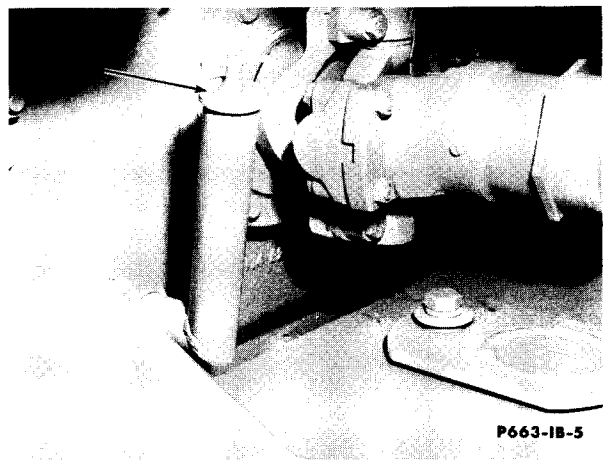


Figure IB-5 D-400 Transmission Dipstick

E. Operating Temperature.

1. Normal operating temperature - approximately 180° F.

2. Maximum operating temperature - approximately 250° F.

3. The operating temperature of the oil is registered as the oil leaves the converter and is read on the temperature gauge on the vehicle dash. Converter "Out" temperature sender is located on the converter outlet tube on the left side of the converter. (See figure 1B-6)

To cool the fluid in the converter, shift the transmission to the next lower speed range. Stall the converter in low gear by applying the brakes and decrease engine speed to idle. Shut down the engine if the converter temperature remains high. Correct conditions that cause continual high temperature readings before continuing to work the machine.

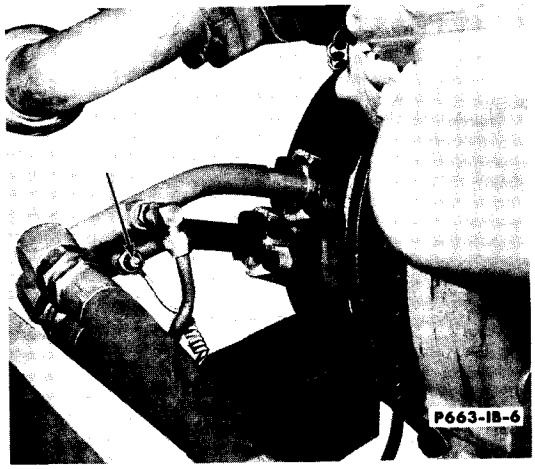


Figure IB-6 D-400 Temperature Sender

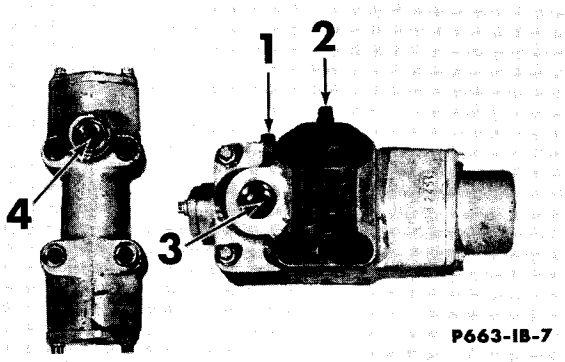
F. Operating Pressure.

1. Pressure checks should be made with engine and transmission at a normal operating temperature. Transmission oil temperature should be approximately 180° F. to 225° F.

2. Pressure checks should be made at full power stall.

3. Clutch Pressure At Stall -

   a. 220 psi minimum - 250 psi maximum
   b. Registered by gauge on vehicle dash
   c. Service gauge can be attached to clutch pressure tap located on main regulator valve body front transmission cover. (See figure 1B-7)



1. Clutch pressure
2. Converter pressure
3. Inlet from pump
4. Outlet to converter

Figure IB-7 D-400 Regulator & Control Valve

4. Converter "IN" Pressure At Stall -

   a. 55 psi minimum - 65 psi maximum

5. Lube Pressure At Stall -

   a. 15 psi minimum - 40 psi maximim
   b. Service gauge can be attached to lube pressure at outer 1/8 pipe plug on center oil supply cap. See figure 1B-8.

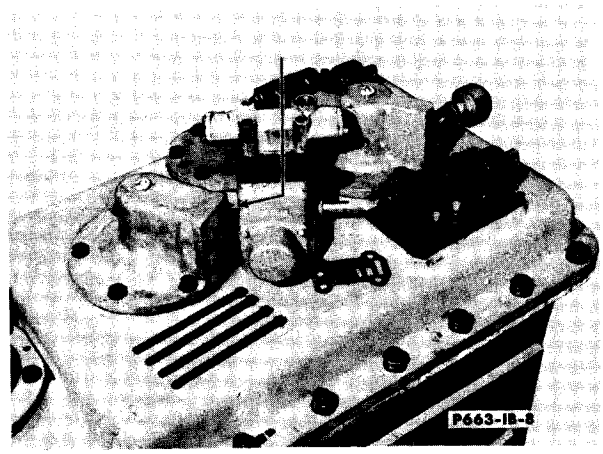


Figure IB-8 D-400 Lube Pressure

G. Stall Check.

1. A full power stall check is made to determine that the engine has rated power and whether the converter and transmission are operating correctly.

CAUTION

Before making a stall check, accelerate the engine to 1000 rpm with transmission in neutral. At 1000 rpm clutch pressure should read 220 psi minimum. If it does not, Do Not Make A Stall Check. If clutch pressure is below this minimum, the clutch will slip and burn at full stall.

2. A Stall Check Is Accomplished By -

   a. Engine, converter and transmission operating at proper temperature.

   b. Attach tachometer to engine tachometer drive receptacle.

1. Cummins V12-525-CI located on fuel injection pump.
2. GM - 12-Y-71 located on the end of the blower housing above the flywheel.

3. Lower blade to the ground. Apply brakes.

4. Run the engine to see that it will operate at high idle.

   a. Cummins (V12-525-CI) 2250 RPM
   b. GM (12-Y-71) 2250 RPM

NOTE

The given values have a plus or minus of 50 rpm.

5. Shift transmission to forward direction and second range.

6. Depress the accelerator to its maximum position and record the engine rpm.

   a. Stall speeds:

   Cummins V12-525-CI 2100 rpm
   GM 12-Y-71 2100 rpm

NOTE

The given values have a plus or minus of 50 rpm.

7. Observe converter temperature gauge. Do not exceed 250° F. maximum converter temperature.

H. Linkage Adjustments.

1. Range selector valve.

2. Forward and reverse selector valve.

   a. The linkage should be adjusted to allow free movement and a definite "detent" feel as the lever is moved from one position to another. Linkage should not bind or hold valves or levers between "detent" position. Never position Between Detents.

I. External Lines.

1. All external lines should be periodically inspected for:

   a. Loose fittings which allow oil leaks or air leaks.
   b. Damaged, collapsed or worn hoses.

J. External Wiring.

1. All external wiring should be periodically inspected for loose connections and broken or damaged wires.

TROUBLE SHOOTING FOR THE D-400 TORQUE CONVERTER

Diagnostic Checks to be made when trouble occurs:

(1) Transmission sump oil level.
(2) Cleanliness of oil and oil filter.
(3) Air flow through oil cooler.
(4) Condition of all oil lines and fittings.
(5) Condition of all wiring and connections.
(6) Engine-converter stall speed.
(7) Proper linkage positioning of all valves and levers.
(8) Converter and transmission oil pressures.
(9) All drive lines and mounting brackets for tightness.

TROUBLE	POSSIBLE CAUSE	REMEDY
High engine speed at converter stall.	1. Low transmission sump oil level. 2. Low converter "IN" pressure at stall. 3. Slipping direction or range clutch. 4. Foaming oil.	1. Add oil to proper level. 2. (a) Check external lines for leaks. (b) See low converter "IN" pressure. 3. (a) Cross check direction and range clutches by applying other clutches to varify slipping. (b) Observe movement in drive line between converter and transmission. 4. (a) Low oil level. (b) Water in oil. (c) Oil line suction leak. (d) Improper oil. (e) Use type "A" Transmission Fluid.
Low engine speed at converter stall.	1. Low engine output. 2. Excessive oil in converter housing. 3. Plugged or restricted torque converter housing drain line.	1. Tune engine and check output. 2. (a) Converter pump hub seal worn. (b) Input pump seal failure. (c) Excessive input pump wear. 3. Clean or replace drain line.
High oil temperature	1. Low transmission sump oil level. 2. High transmission sump oil level. 3. Foamed oil. 4. Clogged oil cooler. 5. Low converter "IN" pressure. 6. Improper vehicle operation. 7. Low oil flow thru converter.	1. Add oil to proper level. 2. Drain oil to proper level. 3. (a) Check oil level. (b) Air leaks in suction lines. (c) Use type "A" Transmission Fluid. 4. Clean oil cooler. 5. See low converter "IN" pressure. 6. (a) Operate in correct range. (b) Downshift into lower range. (c) Remaining in stall too long. 7. Check input pump for excessive wear.
Low converter "IN" pressure.	1. Low transmission sump oil level. 2. External oil leak. 3. Converter regulator valve sticking. 4. Internal oil leak.	1. Add oil to proper level. 2. Check external lines for leaks. 3. (a) Clean and inspect valve body bore. (b) Inspect valve spring. 4. Overhaul converter.

TROUBLE	POSSIBLE CAUSE	REMEDY
High converter "IN" pressure.	1. Stuck converter regulator valve.	1. (a) Clean and inspect valve body bore. (b) Inspect valve spring.
Low lube pressure.	1. Low oil level. 2. Worn input pump. 3. Internal leaks.	1. Correct oil level. 2. Overhaul input pump. 3. Overhaul transmission.
High lube pressure.	1. Stuck main pressure regulator valve.	1. (a) Clean and inspect valve body bore. (b) Inspect valve spring.
Loss of power.	1. Low engine output. 2. Low converter "IN" pressure	1. See low engine speed at converter stall. 2. See low converter "IN" pressure.

TORQUE CHART FOR P-6000 TRANSMISSION

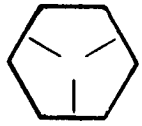
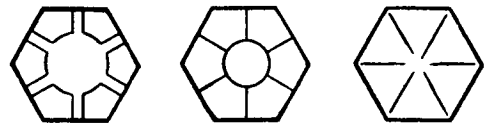
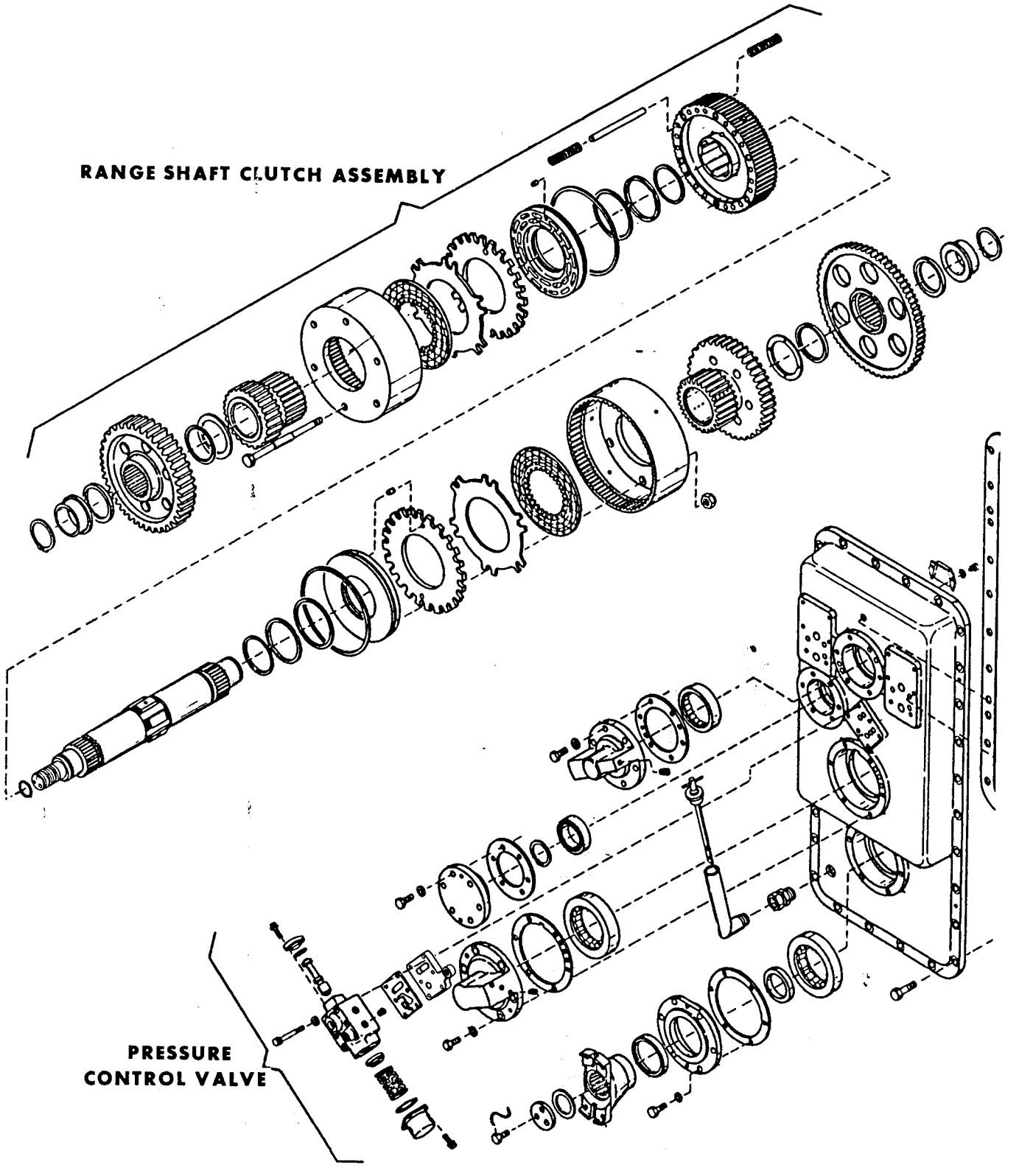
SIZE	THREADS PER INCH	TORQUE FT. LBS. FOR STD. HEAT TREATED SAE GRADE 5 ± 10 %	TORQUE FT. LBS. FOR SPECIAL HEAT TREATED SAE GRADE 8 ± 10 %
			
1/4	20 28	9 10	12 14
5/16	18 24	18 20	25 29
3/8	16 24	32 37	45 50
7/16	14 20	52 58	70 80
1/2	13 20	80 90	110 125
9/16	12 18	115 125	160 180
5/8	11 18	160 165	225 230
3/4	10 16	280 315	400 440
7/8	9 14	420 460	650 700
1	8 14	625 700	950 1050

Figure IB-9 Torque Chart for P-6000 Transmission


RANGE SHAFT CLUTCH ASSEMBLY
PRESSURE
CONTROL VALVE

P-6000 TRANSMISSION

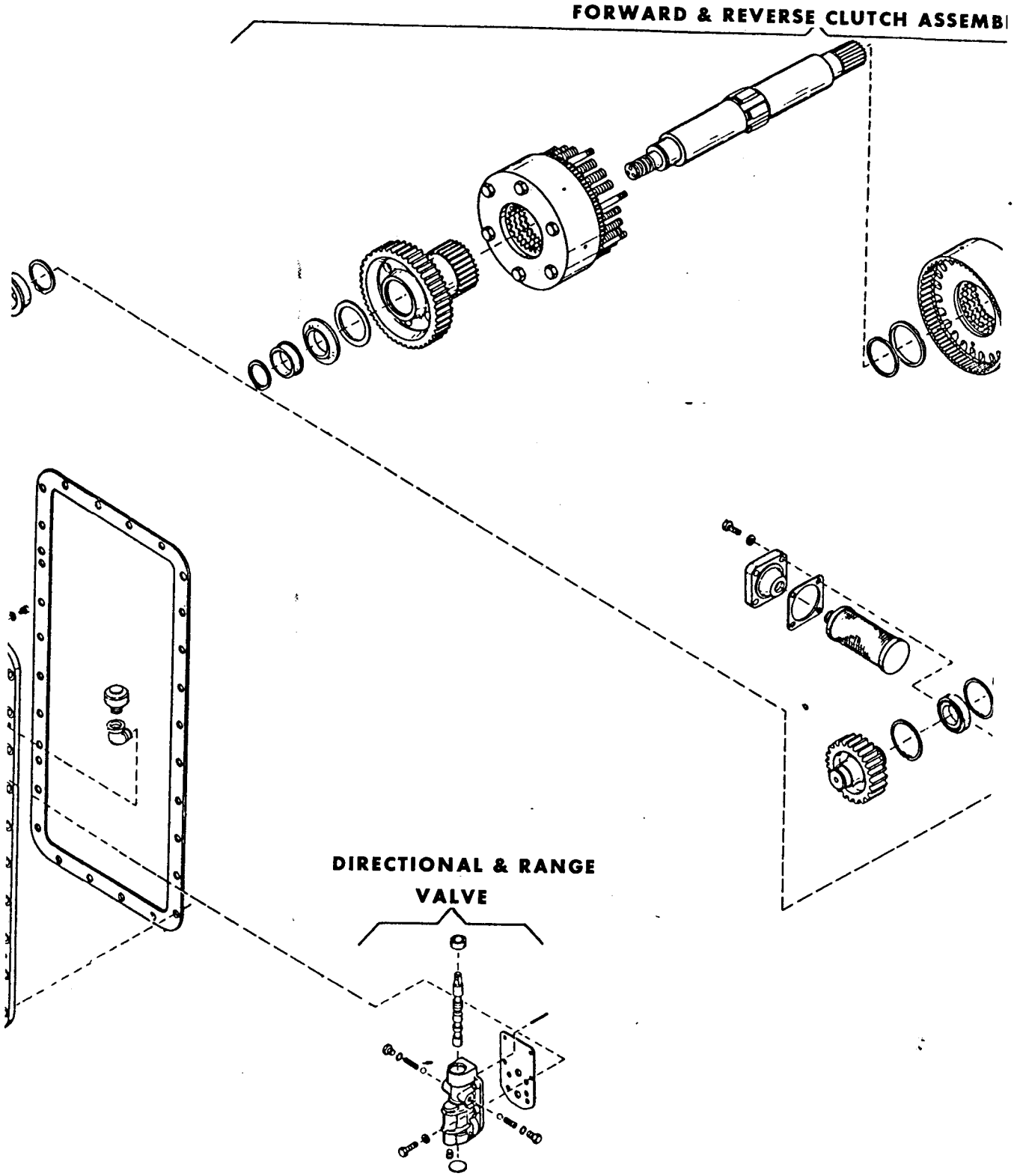
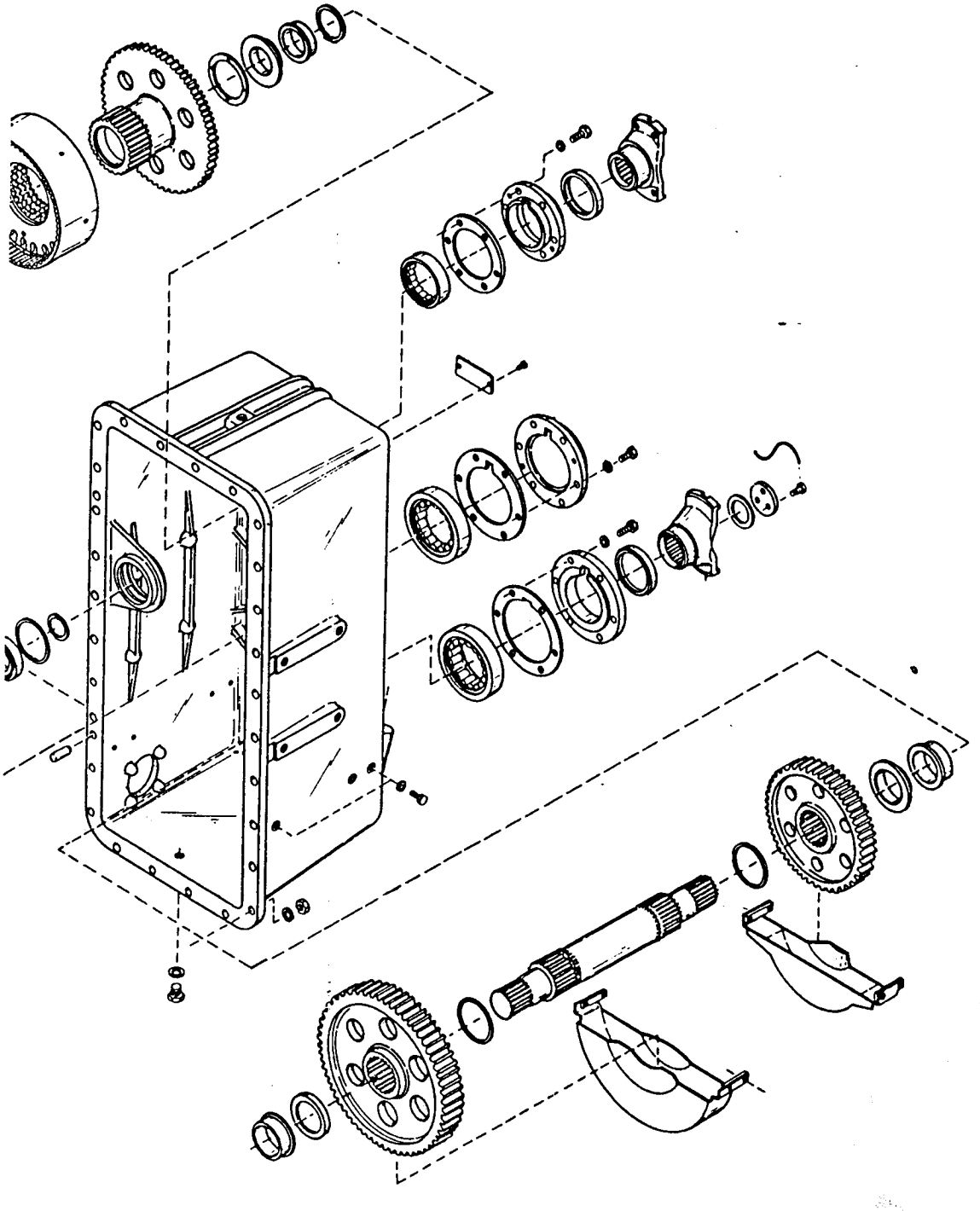


Figure IC-1 Exploded View of the P-6000 Transmission

:MBLY



P663-IC-1

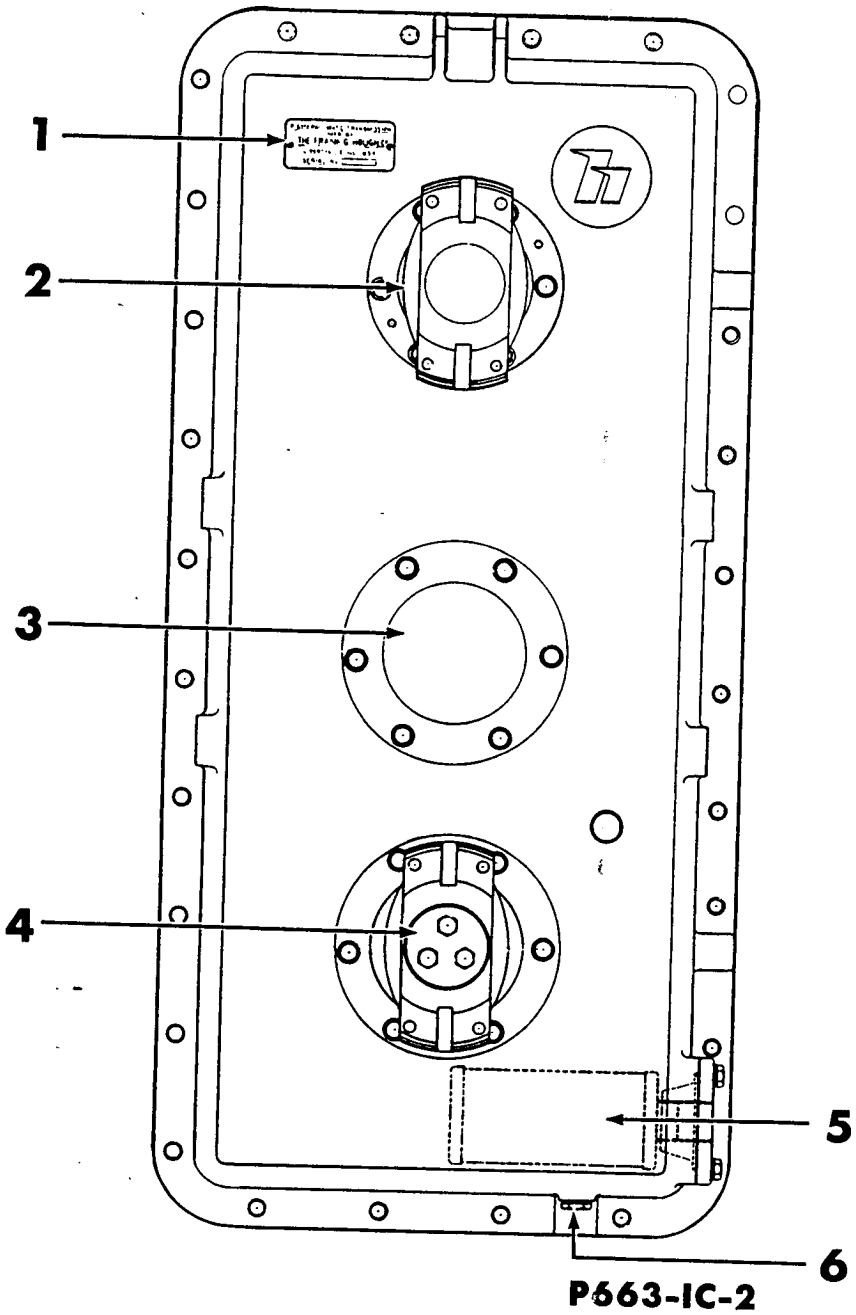
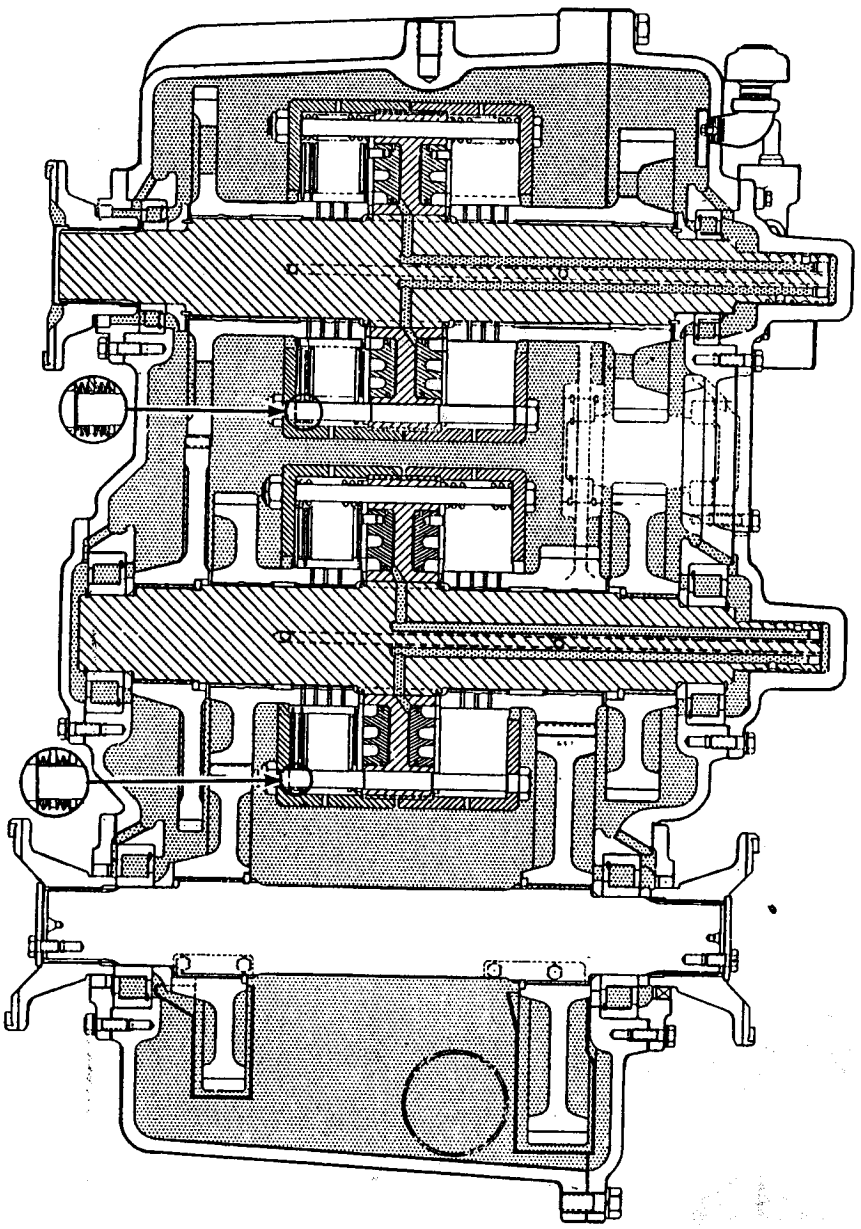


Figure IC-2 Front View of the P-6000 Transmission

1. Nameplate
2. Input Flange
3. Range Pack Bearing Cov
4. Rear Output Flange
5. Sump Oil Screen
6. Transmission Drain



P663-IC-3

Figure IC-3 Cutaway View of the P-6000 Transmission

ver

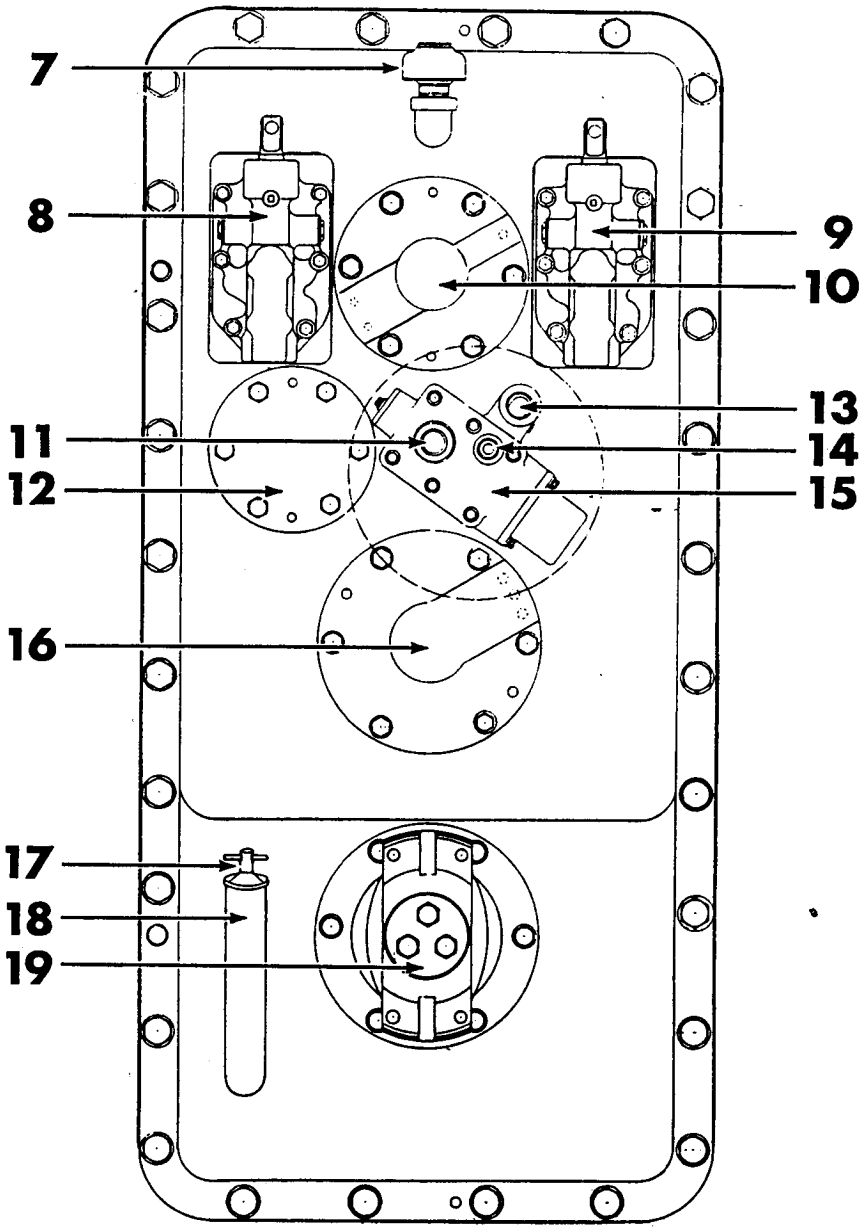


Figure IC-4 Rear View of the P-6000 Transmission

7. Breather
8. Forward & Reverse Control Valve
9. Range - 1st & 2nd Control Valve
10. Forward & Reverse Oil Supply Cover
11. Pump Discharge
12. Reverse Idler Bearing Cover
13. From Cooler
14. To Cooler
15. Main Control Valve
16. Range Oil Supply Cover
17. Oil Level Dipstick
18. Filler Tube
19. Front Output Flange

SPECIFICATIONS

ROAD SPEEDS (MPH) **D-500**

Range	Forward	Reverse
1	7.5	7.5
2	15.0	15.0

ROAD SPEED (M.P.H.) **D-400**

RANGE	FORWARD	REVERSE
1	7	7
2	17	17

Rating:

Maximum governed input speed - 2100 RPM

Clutches:

Two pair of self-adjusting multiple disc, oil-cooled clutches, containing sintered bronze plates on steel backing.

Clutch Size:

1st and 2nd range clutch - 10.500
Directional clutch - 10.500

Gearing:

Constant mesh-spur gear type.

Hydraulic System:

Oil Sump - Integral
Capacity - 10 gal.
Type Oil - SAE Automatic Transmission Fluid Type "A"
Oil Temperature - Operating 180° F. to 225° F.
Maximum - 250° F.
Oil Pressure - Clutch - 220 - 250 P.S.I.
Lube - 15 to 40 P.S.I.
Regulator Valve - Integral

Control Valve (converter) D-400

Control Valves - Directional - Integral
Range - Integral
Oil Filter - Integral in Sump
Oil Filter - Full Flow - Remote Mounted
Oil Cooler - Remote Mounted

Rear Outputs:

Double drop front and rear output flange.

Weight:

2400 lbs. (dry)

GENERAL INFORMATION

P-6000 Transmission

The P-6000 full power shift transmission is designed to increase the useful range of the torque converter by using the constant mesh method of gearing with hydraulic actuated clutches. In low range the converter and transmission can deliver the most torque to the drive train. As the torque demand grows less on the converter, the transmission can be shifted into the high range. The Frank G. Hough Co. has attained flexibility in gear ratio selection along with simplicity of construction and operation. The P-6000 transmission incorporates gearing ruggedly designed to "Take It" in the extreme wide ranges and types of work performed in the construction industry.

The P-6000 transmission has two speeds, forward and two speeds reverse and has full power shift in all ranges.

The P-6000 transmission makes use of the countershaft type of design. This merely means that shafts are provided parallel to and driven by the input shaft for transfer of power to the output shaft. Gears mounted on the parallel shafts run free unless "clutched" to the shaft and thereby transmit power into the power-flow, developing a particular ratio or speed.

Two pair of self-adjusting multiple disc, oil cooled clutches, containing sintered bronze plates on steel backing.

P-6000 RANGE CLUTCH

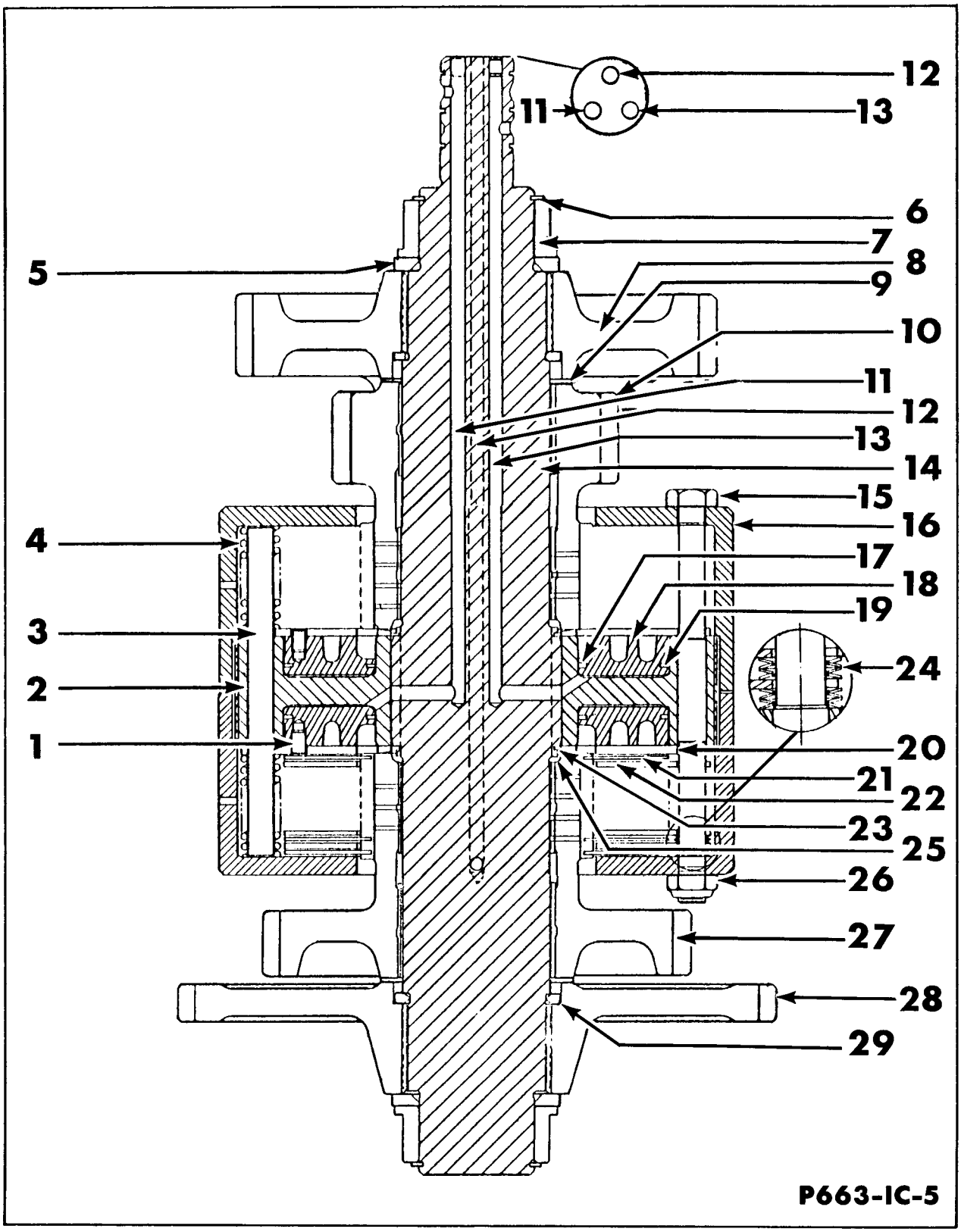


Figure IC-5 Cutaway View of the P-6000 Range Clutch

KEY TO FIGURE IC-5

1. Dowel pin
2. Cylinder
3. Spring guide pin
4. Piston return spring
5. Spacer
6. Snap ring
7. Bearing
8. Gear (range input)
9. Thrust washer
10. Gear (low range)
11. High gear oil passage
12. Lube oil passage
13. Low gear oil passage
14. Shaft
15. Bolt
16. Backing plate
17. Ring inner
18. Piston (low range)
19. Ring outer
20. Spring retaining plate
21. Bronze plate
22. Steel plate
23. Snap ring
24. Belleville springs
25. Thrust washer
26. Nut
27. Gear (high range)
28. Gear (range input)
29. Retainer

CLUTCH OPERATION

In order that we may fully understand the operation of the P-6000 clutch packs, we must first know the component parts which make up a clutch pack and their function.

Each clutch pack assembly is actually two clutches on one shaft (14). This shaft has three oil passages, one for first gear clutch (13), one for second gear clutch (11), and one for lube oil (12). The lube oil lubricates the gears, bushings and bearings (7). It also cools the component parts in the clutch packs and the transmission.

There are two sets of clutches in the transmission. Forward and reverse directional clutches are on the top shaft. The first and second range clutches are in the center of transmission. The lower shaft is the output shaft. All the gears are in mesh all the time.

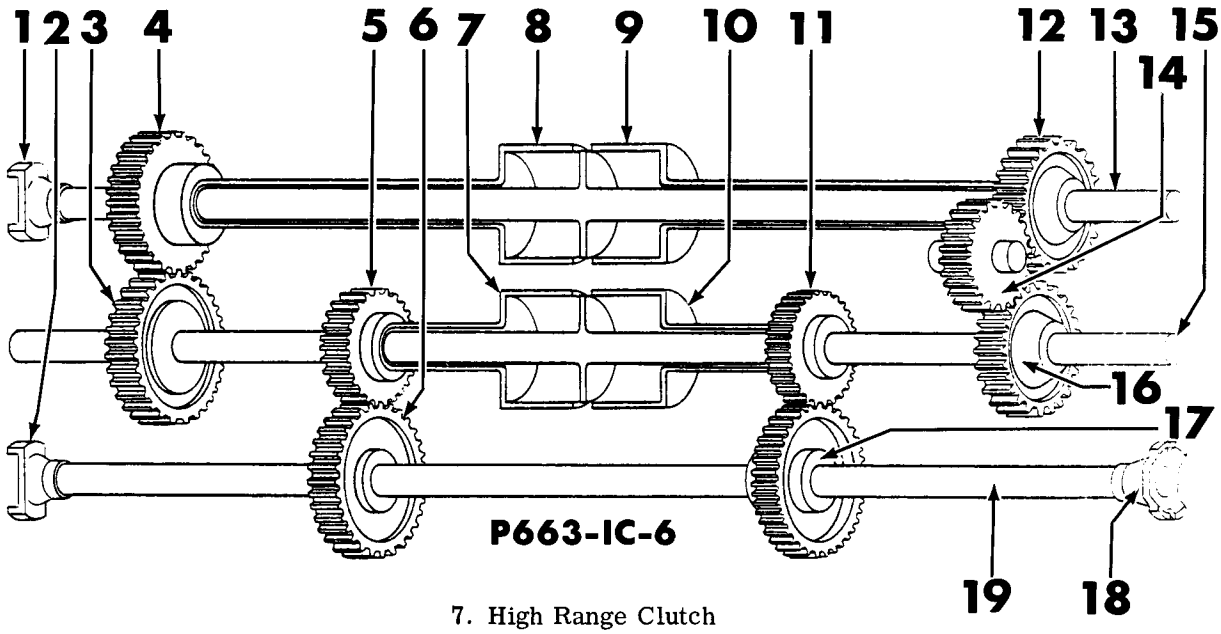
Splined to the shaft is a double cylinder (2). It is held in place by two snap rings. The cylinder has a hole in each side with a ball check to hold pressure in the cylinder cavity when under pressure.

With no pressure in the cylinder, the ball drops off of its seat and throws the oil from the cylinder cavity. Before the piston is assembled into the cylinder, it is fitted with steel Multiseal rings in the ID (17) and OD (19) grooves with expanders behind the steel rings to hold the rings out against the cylinder to form a perfect seal. The piston return springs (4) are to push the piston back into the cylinder and push the oil out of the cylinder cavity.

Each clutch has a cylinder (2), a piston (18) with the seal rings (17 - 19), gears (10-27), bronze (21) and steel (22) plates.

Upon application of a clutch, the range selector valve or the directional valve, depending on which clutch is to be applied, directs high pressure oil through the oil supply passage into the clutch shaft (14) to the piston and cylinder cavity. This piston immediately moves toward the spring retaining plate (20) and compresses the piston return springs (4). This pushes the stack of clutch plates against the backing plate (16). There are a total of ten bronze plates and nine steel plates per clutch. One bronze, one steel, etc., the last plate would be bronze.

The bronze plates are splined to the clutch gears (10-27). The clutch gear is supported on the shaft by bushings. Whenever the clutch is not under pressure, the bronze plates and clutch gears turn independent of the shaft. There are twelve Belleville springs (24) between each pair of steel plates, stacked on three bolts (15) (120° apart). The Belleville springs separate the steel plates. The bronze plates are free to spin with the gear whenever the clutch is released. The backing plates (16) are assembled on the splines of the OD of the cylinder. Six bolts are used to hold the clutches together. Each clutch shaft has three sealing rings at the end of the clutch shaft. The clutch oil supply and bearing cap supplies the oil to the clutch shaft, sealed by the sealing rings.



1. Input Yoke
2. Output Yoke
3. Range Input Gear
4. Input Forward Gear
5. High Range Gear
6. High Range Output Gear
7. High Range Clutch
8. Forward Clutch
9. Reverse Clutch
10. Low Range Clutch
11. Low Range Gear
12. Reverse Input Gear
13. Input Shaft
14. Idler Gear
15. Range Shaft
16. Range Input Gear
17. Low Range Output Gear
18. Output Yoke
19. Output Shaft

Figure IC-6 Gear Train

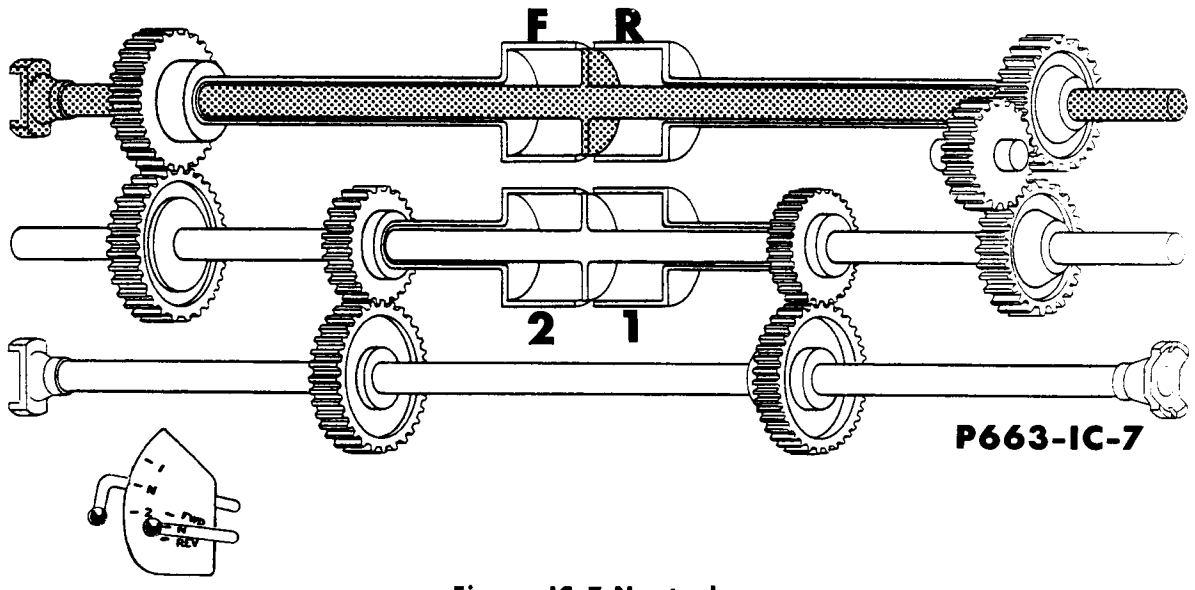


Figure IC-7 Neutral

TRANSMISSION OPERATION

The P-6000 transmission utilizes two double clutches, one directional clutch assembly and one range clutch assembly, mounted between the necessary gears and shafts to produce two speeds forward and two speeds reverse. Identical gear ratios exist in each range regardless of the direction. Engagement of two clutches, a direction clutch and a range clutch is necessary to achieve a particular overall drive ratio. Directional clutches impart either clockwise input rotation or counter clockwise input rotation to the range clutches. Range clutches impart through their respective gear ratios and rotation to the output shaft.

This is a full power shifting transmission and is designed to be shifted from range to range under full power.

A. Forward To Reverse Shift. A directional shift should be made after the vehicle movement has stopped. Before making a shaft change direction, STOP!

B. Upshifting. To start the vehicle moving, select a range sufficient to give satisfactory movement as the vehicle approaches its maximum speed in that range. Then shift to the next range. As an example: To move the tractor without trying to work it, there is no need to start in first range.

C. Downshifting. Downshifting under load is done under full power. Whenever vehicle speed is reduced below the maximum speed of the lower range, downshift to the lower range. If a down shift is required and the vehicle speed is above the maximum speed of the lower range, apply the vehicle service brake until the vehicle speed is less than the maximum speed of the range to which you are shifting. Never downshift to a range at a higher speed than that range can obtain.

The two forward and two reverse paths through the transmission are as follows:

NEUTRAL

In "neutral" no power is imparted from the transmission input to the output. See Figure (IC-7). Engagement of a direction and a range clutch is necessary for a particular drive ratio. "Neutral" does not allow main oil pressure to engage either a direction or range clutch. Therefore, a drive through the transmission does not exist in the neutral position.

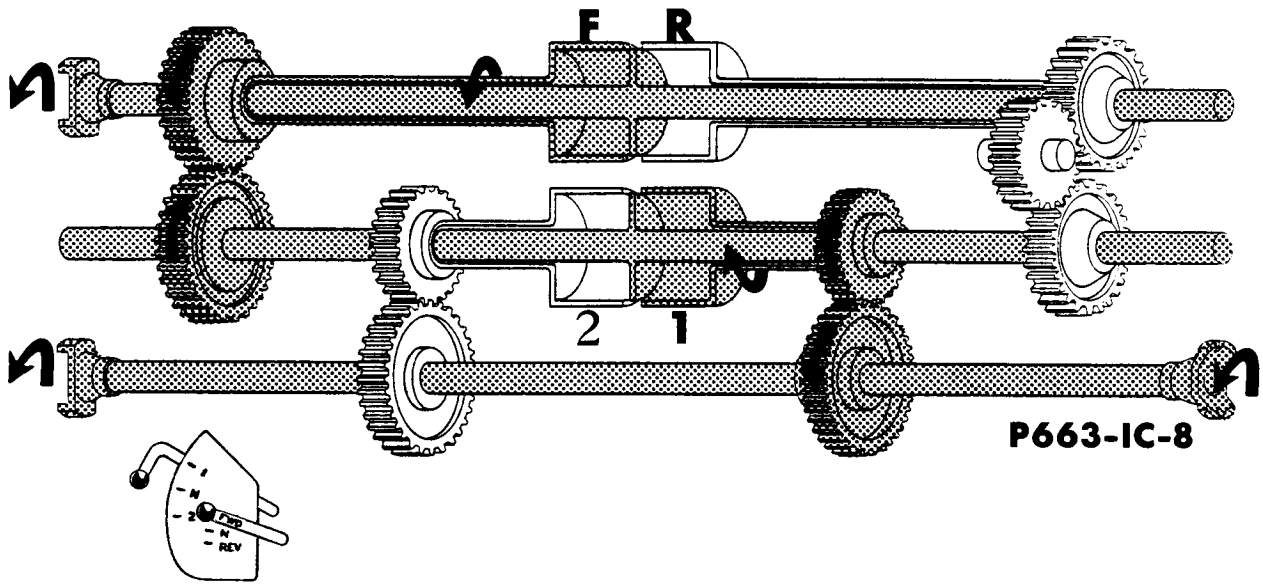


Figure IC-8 Forward, 1st Gear

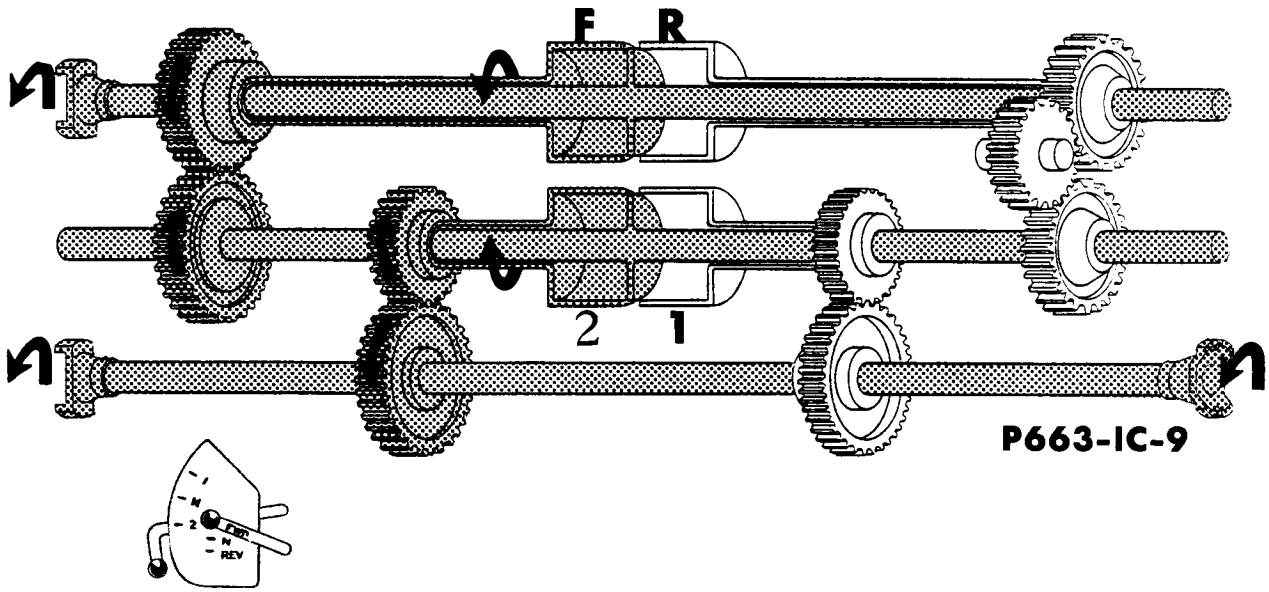


Figure IC-9 Forward, 2nd Gear

TRANSMISSION OPERATION

FORWARD, 1st GEAR

Input rotation is received through the input shaft by the forward clutch cylinder (See Figure IC-8). Forward clutch engaged imparts input rotation to the forward clutch gear which drives the first range input gear, first range clutch shaft and clutch cylinder counter input rotation.

First range clutch engaged sends counter engine rotation to the first clutch gear. First clutch gear drives the output shaft gear and output shaft engine rotation.

FORWARD, 2nd GEAR

Input rotation is received through the input shaft by the forward clutch cylinder. (See Figure IC-9).

Forward clutch engaged imparts input rotation to the forward clutch gear which drives the second range input gear, second range clutch shaft and clutch cylinder counter input rotation.

Second range clutch engaged sends counter engine rotation to the second clutch gear. Second clutch gear drives the output shaft gear and output shaft engine rotation.

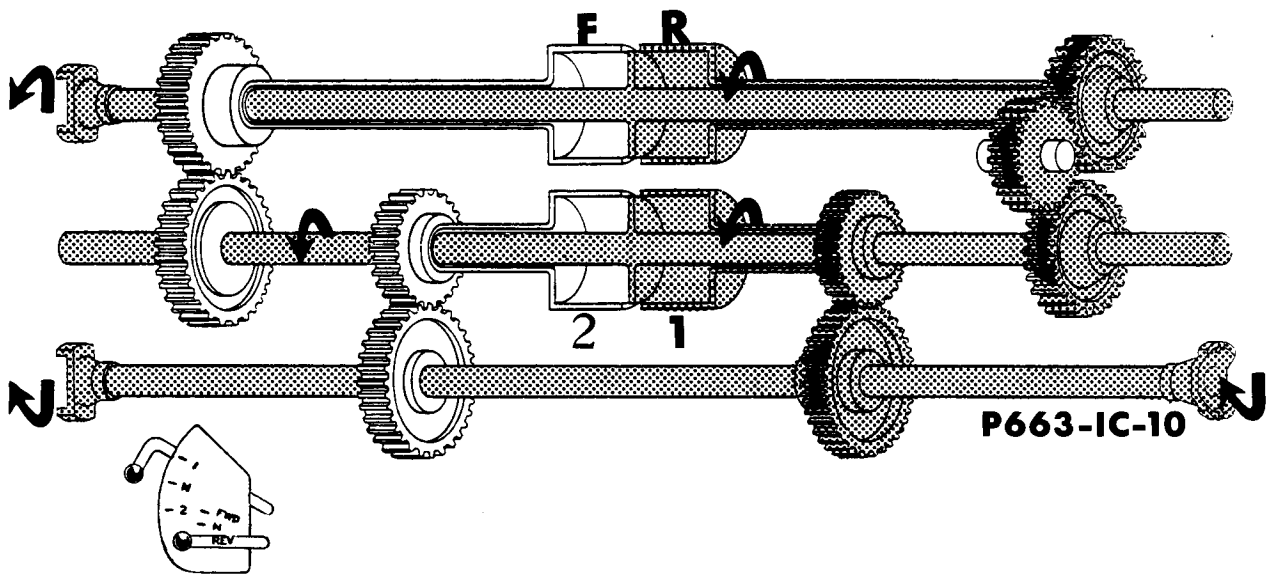


Figure IC-10 Reverse, 1st Gear

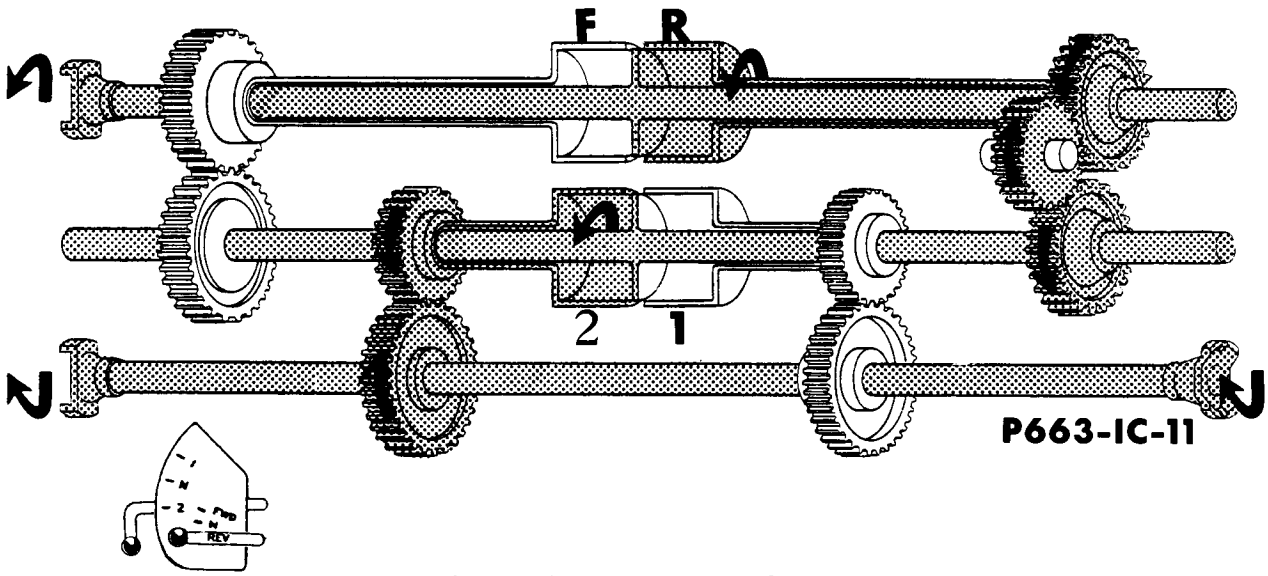


Figure IC-11 Reverse, 2nd Gear

TRANSMISSION OPERATION

REVERSE, 1st GEAR

Input rotation is received by the input shaft. Reverse clutch is engaged and reverse clutch gear drives the reverse idler gear. (See Figure IC-10). The reverse idler sends input rotation into the first shaft drive gear. The first shaft drive gear delivers input rotation to the first range clutch cylinder and first range engagement delivers input rotation to the first clutch gear. First clutch gear imparts counter input rotation to the output shaft.

REVERSE, 2nd GEAR

Input rotation is received by the input shaft. Reverse clutch is engaged and reverse clutch gear drives the reverse idler gear. (See Figure IC-11). The reverse idler sends input rotation into the second shaft drive gear. The second shaft drive gear delivers input rotation to the second range clutch cylinder and second range engagement delivers input rotation to the second clutch gear. Second clutch gear imparts counter input rotation to the output shaft.

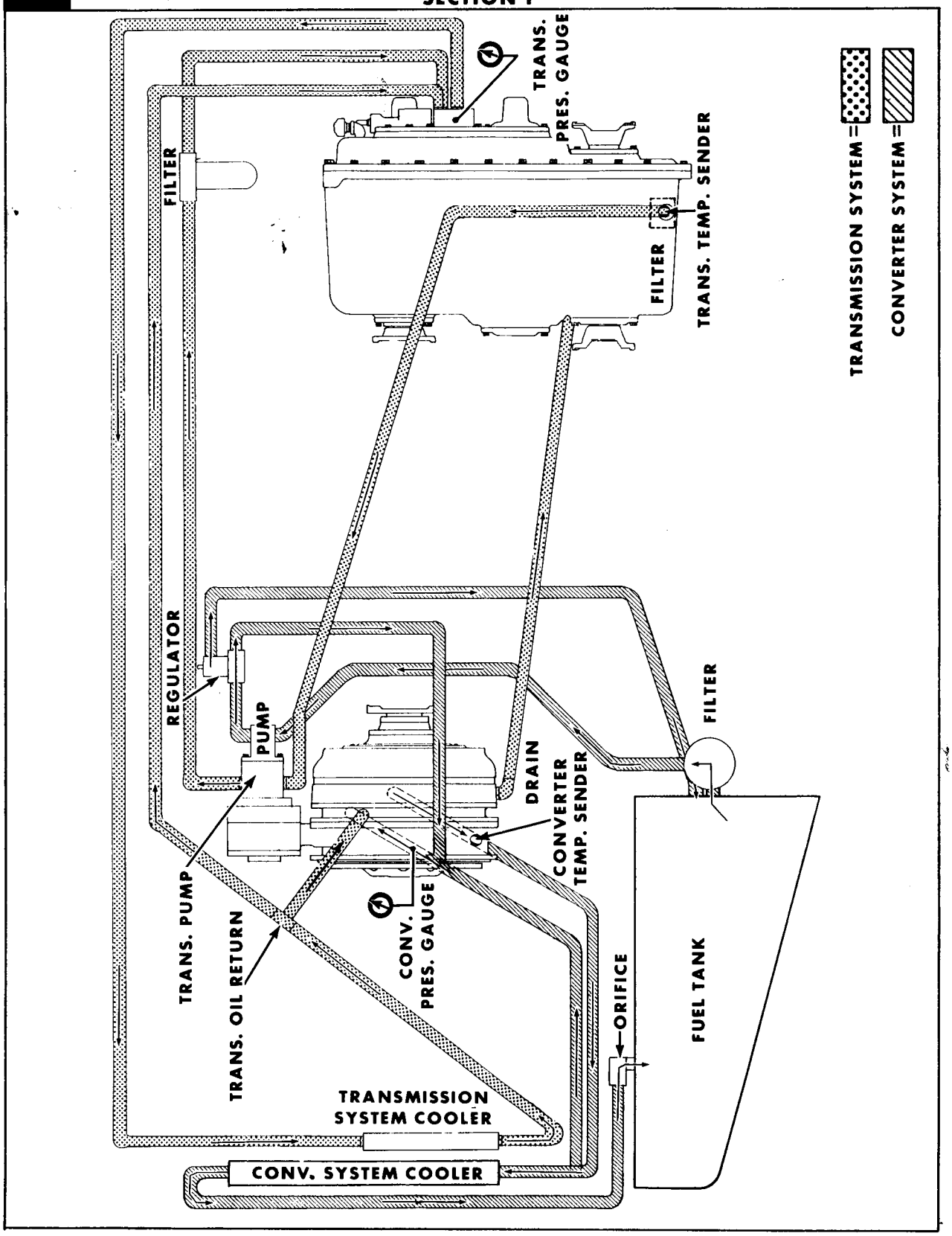


Figure IC-12 D-500 Hydraulic Diagram

HYDRAULICS

External lines furnish the necessary connections to hydraulically integrate the separately mounted transmission charging pump, cooler, converter bearings and the transmission unit. The sump of the transmission acts as a reservoir for the system's oil supply. A hose from the transmission sump and filter connects to the charging pump opening. The pump is mounted on the converter power-take-off housing. The charging pump discharges the oil through a hose to a full flow filter and to the control valve. The control valve regulates the oil pressure to the directional and range valves which control the clutch packs. The bypassed oil from the control valve goes to the oil cooler, then returns to the control valve adapter and to the transmission lube system. The converter bearings are lubricated by lube oil. The hose is connected to a tee in the cooler to control valve line. Oil from the converter bearings drains back to the transmission sump.

Gears are splash lubricated. Lube oil is directed through the main valve. The main valve furnishes lube oil and lube pressure for all range and direction clutch plates. The lube oil lubricates and cools the clutch plates as it passes through the holes in the clutch gear into the backing plate cavity and through the passage holes in the backing plate to sump.

Before the engine is started, all controls should be placed in the neutral position. As soon as the engine begins to turn over, the transmission pump, located on the torque converter housing, picks up the oil from the transmission sump and directs it to the main control valve. This in turn directs the lube oil through various passages to the oil supply covers and clutch packs through the oil passages in the shafts.

The lube oil lubricates the bushings, bearings, gears, clutch plates and all working parts in the transmission. The lube oil also lubricates the bearings in the torque converter. The lube oil also goes through the oil cooler, where it is cooled and returns to the control valve and back to the transmission sump. The clutch packs will be in neutral position until the range and directional valves have been shifted to allow high pressure oil to enter the clutch pack system.

When the range selector valve is positioned in one of two ranges, main oil pressurizes the piston of that range to engage the clutch plates. By positioning the forward-reverse selector valve to either forward or reverse, main pressure actuates the piston of the direction clutch desired for the proper directional movement of the vehicle.

Shifting from range to range or from forward to reverse redirects main oil to the range or direction desired.

1. The charging pump is driven by a gear train in the converter input housing. The pump speed is the same as engine speed. The charging pump delivers 15 GPM at 2100 R. P. M. pump speed(D-500). 30 GPM at 2100 RPM (D-400)

2. One control valve regulates the transmission clutch pressure.

   a. Clutch pressure regulator valve.
   b. By-pass oil from the control valve flows through the lube system.

3. Two control valve bodies.

   a. Forward-reverse selector valve.
   b. Range selector valve.

4. Accessories of the system consists of:
   a. Sump filter contained in the transmission sump.
   b. A full flow filter mounted externally.
      (1) Full flow filter contains a bypass valve set at 12 to 15 psi bypass pressure.

   c. Oil cooler mounted externally(D-500).

PREVENTIVE MAINTENANCE

1. OIL

A. Basic.

Description: Should be a Automatic Transmission Fluid Type "A"

B. Quantity for original fill - approximately 10 gallons.

C. CHANGE PERIODS

(1) Oil change - 1000 hours of operation
(2) Clean transmission filter oil screen - 1000 hours of operation.
(3) Change external filter - 500 hours of operation
(4) Change the oil and filter and clean the oil screen whenever traces of dirt or the effects of high operating temperatures are present as evidenced by discoloration or strong odors.
(5) After any internal failure, change oil and completely flush and clean the transmission including filter, lines, oil cooler and valve bodies. If this is not done, there is a danger of further contamination from foreign particles and more failures.
(6) Metal particles in the oil indicate a failed or wearing part and the entire system and units should be drained, flushed and thoroughly cleaned.
(7) To drain the installation, remove the drain plug at the bottom of the transmission housing.

D. OIL LEVEL CHECK

1. Oil level should be checked daily or at the beginning of each shift.

2. Pre-start Check - To insure sufficient oil in the system before starting the engine, remove dipstick from oil filler tube by loosening the dipstick handle and remove the dipstick. The oil level must show on dipstick before the tractor is worked. The dipstick is located on the front of the transmission. The transmission dipstick filler tube is accessible on the right side of the loader next to the transmission forward output shaft.

3. Start The Engine - Operate the transmission controls momentarily. Then shift to neutral. Make a second level check with the oil hot and the engine operating at a low idle speed. The oil level should not rise above the "Hot Full" mark. Drain oil down to "Full" mark if the level rises above "Full." Replace the dipstick and tighten its handle.

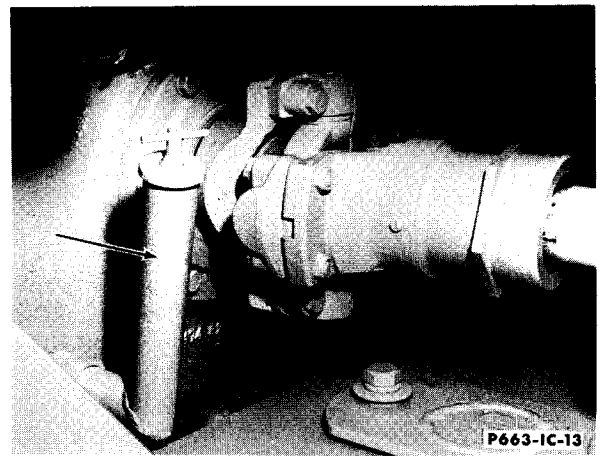


Figure IC-13 Transmission Dipstick

E. Operating Temperature.

1. Normal operating temperature - approximately 180° F. to 225° F.

2. Maximum operating temperature - approximately 250° F.

3. The operating temperature of the oil is registered as the oil leaves the conver-

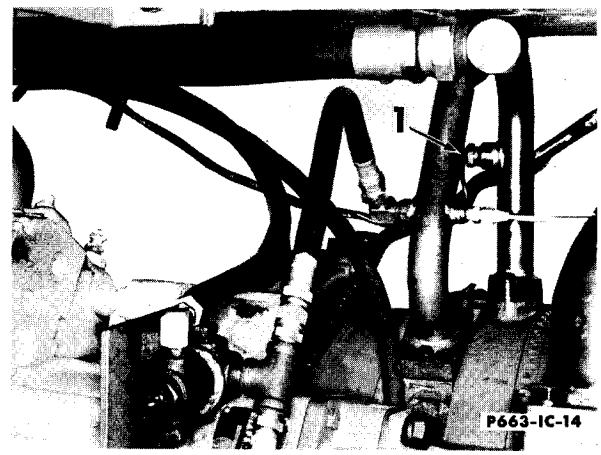


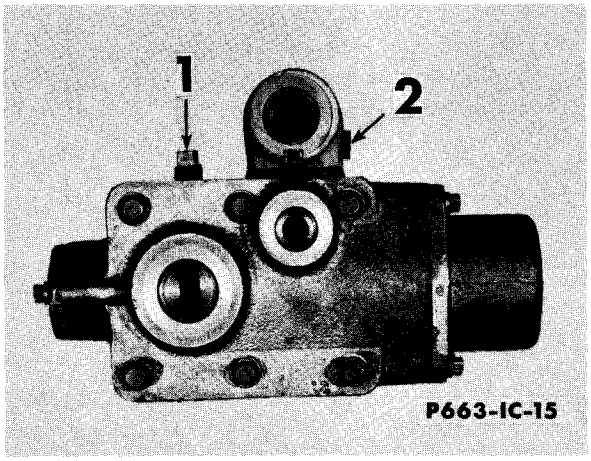
Figure IC-14 D-500 Temperature Check Point

ter and is read on the temperature gauge on the vehicle dash. Converter "Out" temperature check is located on the converter outlet tube on the left side of the converter. (See figure IC-14)

4. To cool the fluid in the converter, shift the transmission to the next lower speed range. Stall the converter in low gear by applying the brakes and decrease engine speed to idle. Shut down the engine if the converter temperature remains high. Correct conditions that cause continual high temperature readings before continuing to work the machine.

F. Operating Pressure

1. Pressure checks should be made with



1. Clutch pressure 2. Lube pressure

Figure IC-15 D-500 Main Regulator Valve

engine and transmission at a normal operating temperature. Transmission oil temperature should be approximately 180° F. to 225° F.

2. Pressure checks should be made at full power stall.

3. Clutch Pressure at Stall -
   a. 220 psi minimum - 250 psi maximum
   b. Registered by gauge on vehicle dash
   c. Service gauge can be attached to clutch pressure tap located on main regulator valve body front transmission cover. (See figure IC-15).

4. Converter "IN" Pressure At Stall -
   a. 70 psi minimum - 90 psi maximum

5. Lube Pressure At Stall -
   a. 15 psi minimum - 40 psi maximum
   b. Service gauge can be attached to lube pressure tap on right top side of the adapter plate back of main regulator valve. (See (2) figure IC-15).

G. Stall Check

1. A full power stall check is made to determine that the engine has rated power and whether the converter and transmission are operating correctly.

CAUTION

Before making a stall check, accelerate the engine to 1000 rpm with transmission in neutral. At 1000 rpm clutch pressure should read 220 psi minimum. If it does not, Do Not Make A Stall Check. If clutch pressure is below this minimum, the clutch will slip and burn at full stall.

2. A Stall Check Is Accomplished By -
   a. Engine, converter and transmission operating at proper temperature.

   b. Attach tachometer to engine tachometer drive receptacle.

      1. Cummins VT-12 located on fuel injection pump.
      2. GM - 16V71 located on the end of the blower housing above the flywheel.

3. Lower blade to the ground. Apply brakes.

4. Run the engine to see that it will operate at high idle.

   a. Cummins VT-12, 2250 RPM
   b. GM 16V71, 2250 RPM

NOTE

The given values have a plus or minus of 50 rpm.

5. Shift transmission to forward direction and second range.

6. Depress the accelerator to its maximum position and record the engine rpm.
   a. Stall speeds:

Cummins VT-12,	1750 rpm
GM 16V71,	1750 rpm

NOTE

The given values have a plus or minus of 50 rpm.

7. Observe converter temperature gauge and do not exceed 250° F. maximum converter temperature.

H. Linkage Adjustments.

1. Range selector valve.

2. Forward and reverse selector valve.
   a. The linkage should be adjusted to allow free movement and a definite "detent" feel as the lever is moved from one position to another. Linkage should not bind or hold valves or levers between "detent" position. Never position between detents.

I. External Lines.

1. All external lines should be periodically inspected for:
   a. Loose fittings which allow oil leaks or air leaks.
   b. Damaged, collapsed or worn hoses.

J. External Wiring.

1. All external wiring should be periodically inspected for loose connections and broken or damaged wires.

TROUBLE SHOOTING FOR THE P-6000 TRANSMISSION

Diagnostic Checks to be Made When Trouble Occurs:

(1) Transmission sump oil level.
(2) Cleanliness of oil and oil filter.
(3) Air flow through oil cooler.
(4) Condition of all oil lines and fittings.
(5) Condition of all wiring and connections.
(6) Engine-converter stall speed.
(7) Proper linkage positioning of all valves and levers.
(8) Converter and transmission oil pressures.
(9) All drive lines and mounting brackets for tightness.

TROUBLE	POSSIBLE CAUSE	REMEDY
High engine speed at converter stall.	1. Low transmission sump oil level.	1. Add oil to proper level.
	2. Slipping direction or range clutch.	2. (a) Cross check direction and range clutches by applying other clutches to varify slipping. (b) Observe movement in drive line between converter and transmission.
	3. Foaming oil.	3. (a) Low oil level. (b) Water in oil. (c) Oil line suction leak. (d) Improper oil. Use type "A" transmission fluid.
Low engine speed at converter stall.	1. Low engine output.	1. Tune engine and check output.
High oil temperature	1. Low transmission sump oil level.	1. Add oil to proper level.
	2. High transmission sump oil level.	2. Drain oil to proper level.
	3. Foamed oil.	3. (a) Check oil level. (b) Air leaks in suction lines. (c) Use type "A" transmission fluid.
	4. Clogged oil cooler	4. Clean oil cooler.
	5. Improper vehicle operation.	5. (a) Operate in correct range. (b) Downshift into lower range. (c) Remaining in stall too long.
	6. Low oil flow thru converter.	6. Check input pump for excessive wear.
Slow or erratic clutch engagement.	1. Low transmission sump oil level.	1. Add oil to proper level.
	2. Clogged oil filter screen.	2. Remove and clean.
	3. Foamed oil.	3. Eliminate air leak into pump suction line.
	4. Improper linkage adjust ment.	4. (a) Free linkage and adjust. (b) Check selector valve positioning.
	5. Low clutch pressure.	5. See low clutch pressure.
	6. Clutch pressure regulator valve stuck.	6. (a) Clean and inspect valve body bore. (b) Inspect valve spring.
	7. Internal oil leaks.	7. (a) Cross check clutches by applying other clutches. (b) Damaged or worn seals in clutch pack. (c) Damaged oil transfer tubes. (d) Damaged or worn shaft seals. (e) Overhaul transmission.

TROUBLE	POSSIBLE CAUSE	REMEDY
High clutch pressure.	1. Improper main pressure regulator valve operation.	1. (a) Clean and inspect. (b) Inspect spring. (c) Inspect valve bore.
Low clutch pressure.	1. Low transmission sump oil level. 2. Clogged oil filter or transmission sump oil screen. 3. Foamed oil. 4. External oil leaks. 5. Improper clutch pressure regulator valve operation. 6. Worn input oil pump. 7. Internal oil leaks.	1. Add oil to proper level. 2. Clean and/or replace. 3. (a) Eliminate air leaks in suction line. (b) Tighten fittings. (c) Check oil level. (d) Use type "A" transmission fluid. 4. Check external oil lines. 5. (a) Clean and inspect. (b) Inspect spring. (c) Check valve body bore. 6. Overhaul input oil pump. 7. (a) Watch for excessive pressure drop in a specific direction or range clutch. (b) Overhaul transmission.
Low lube pressure.	1. Low oil level. 2. Worn input pump. 3. Internal leaks.	1. Correct oil level. 2. Overhaul input pump. 3. Overhaul transmission.
Loss of power.	1. Air in converter system. 2. Low engine output. 3. Low converter pressure. 4. Direction or range selector valves inoperative. 5. Improper vehicle operation. 6. Foaming oil. 7. Slipping clutches. 8. Vehicle brakes dragging.	1. Bleed converter system. 2. See low engine speed at converter stall. 3. Check converter system. 4. (a) Check linkage. (b) Disassemble valve bodies and inspect. 5. Operate in proper range for load and terrain. 6. (a) Correct oil level. Use type "A" transmission fluid. (b) Check for air leak in suction line. 7. See low clutch pressure. 8. (a) Adjust brakes. (b) Check brake linkages.
Vehicle drives in one direction and creeps in that direction in neutral but stalls when shifted to the opposite direction.	1. Failed directional clutch.	1. Overhaul transmisssion.
Vehicle drives in one range but stalls when shifted to another range.	1. Failed range clutch.	1. Overhaul transmission.

TROUBLE	POSSIBLE CAUSE	REMEDY
All range pressures normal in one direction but all low in opposite direction.	1. Directional selector valve linkage out of adjustment. 2. Internal oil leaks in forward or reverse clutch.	1. Adjust linkage. 2. Overhaul transmission.
Low clutch pressure in one range clutch in either direction.	1. Linkage out of adjustment. 2. Internal oil leaks in clutch.	1. Adjust linkage. 2. Overhaul transmission.

TORQUE CHART FOR P-6000 TRANSMISSION

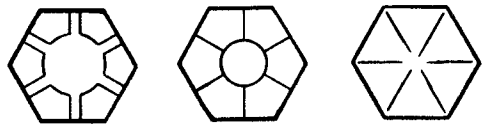
SIZE	THREADS PER INCH	TORQUE FT. LBS. FOR STD. HEAT TREATED SAE GRADE 5 ± 10 %	TORQUE FT. LBS. FOR SPECIAL HEAT TREATED SAE GRADE 8 ± 10 %
			
1/4	20 28	9 10	12 14
5/16	18 24	18 20	25 29
3/8	16 24	32 37	45 50
7/16	14 20	52 58	70 80
1/2	13 20	80 90	110 125
9/16	12 18	115 125	160 180
5/8	11 18	160 165	225 230
3/4	10 16	280 315	400 440
7/8	9 14	420 460	650 700
1	8 14	625 700	950 1050

Figure IC-16 Torque Chart for P-6000 Transmission Torque

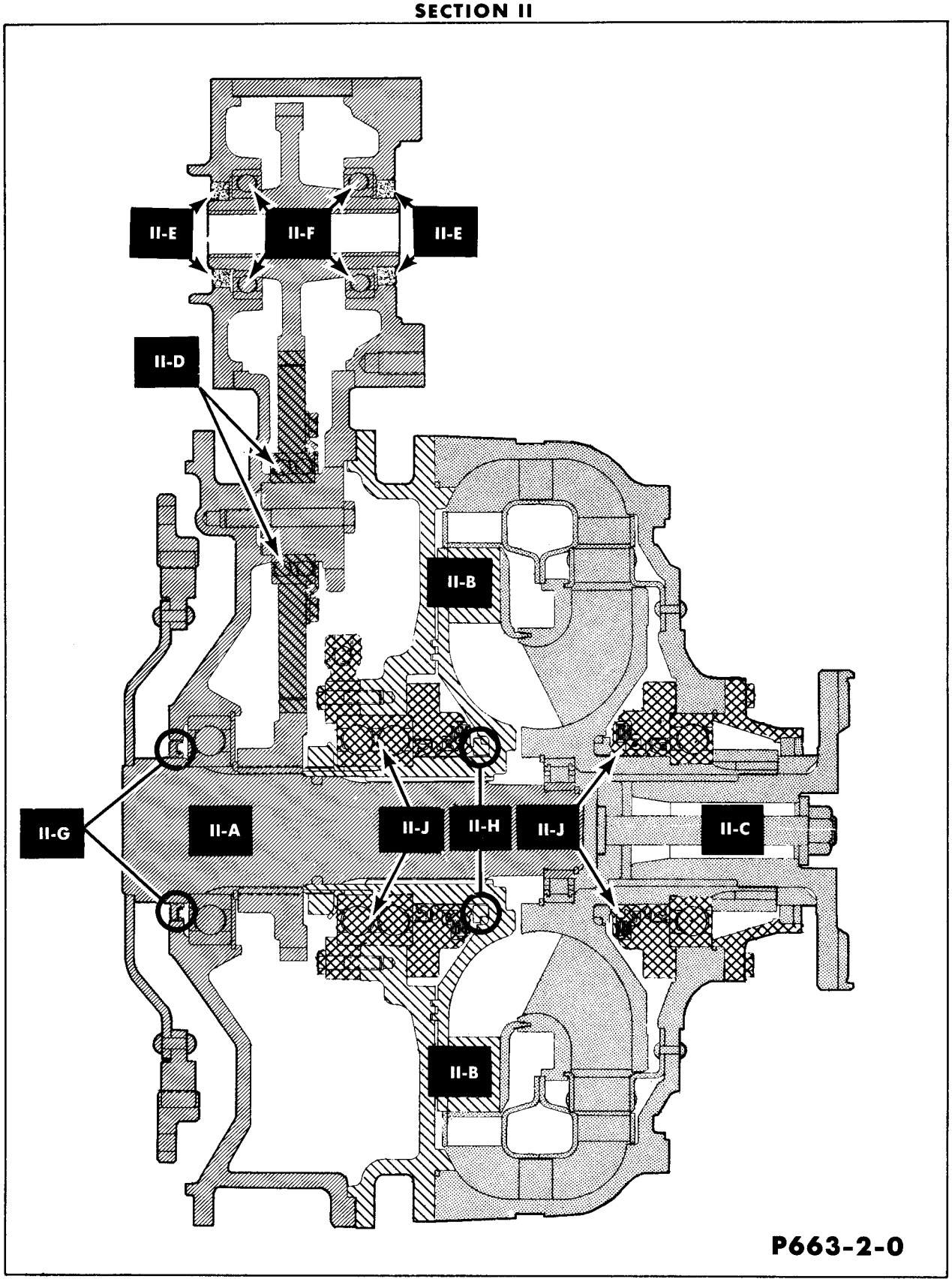


Figure 2-0 Pictorial Index

SECTION II

D-500 TORQUE CONVERTER

TABLE OF CONTENTS

SECTION II-A **INPUT HOUSING ASSEMBLY**

Disassembly — Pages II-2A thru II-6A
Reassembly — Pages II-7A thru II-8A

SECTION II-B **END PLATE ASSEMBLY**

Disassembly — Pages II-10B thru II-12B
Reassembly — Page II-13B

SECTION II-C **TURBINE HOUSING ASSEMBLY**

Disassembly — Pages II-14C thru II-17C
Reassembly — Pages II-18C thru II-19C

SECTION II-D **IDLER GEAR BEARING**

Disassembly — Pages II-20D thru II-21D
Reassembly — Page II-22D

SECTION II-E **COVER SEALS**

Disassembly — Page II-23E
Reassembly — Page II-24E

SECTION II-F **P.T.O. GEARS & BEARINGS**

Disassembly — Page II-25F
Reassembly — Page II-26F

SECTION II-G **INPUT HOUSING SEAL**

Disassembly — Page II-27G
Reassembly — Page II-28G

SECTION II-H **MATING RING & WASHER**

Disassembly and Reassembly — Page II-29H

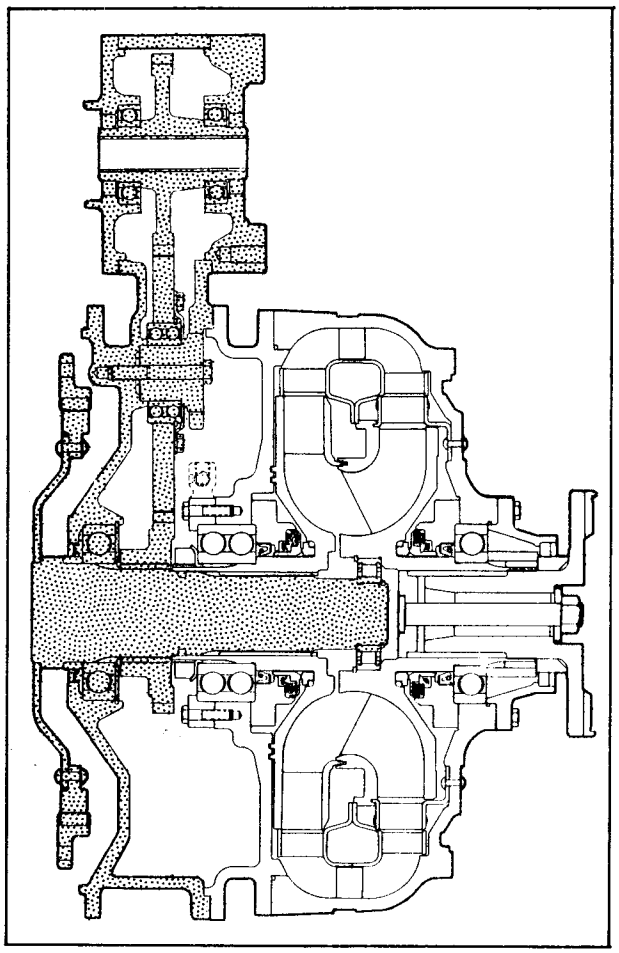
SECTION II-J **BEARING, RETAINER, & SEAL CARRIER**

Disassembly — Pages II-30J thru II-31J
Reassembly — Pages II-32J thru II-33J

SECTION II-K **DISASSEMBLY & REASSEMBLY CHARGING PUMPS**

Converter Charging Pump (Cummins) — Page II-34K
Transmission Charging Pump (Cummins) — Page II-35K
Converter Charging Pump (G. M. C.) — Page II-36K
Transmission Charging Pump (G. M. C.) — Page II-37K

PICTORIAL INDEX — Page II-1



SECTION II-A

INPUT HOUSING

TABLE OF CONTENTS

Disassembly	Pages II-3A thru II-6A
Reassembly	Pages II-7A thru II-8A

DISASSEMBLY of Input Housing

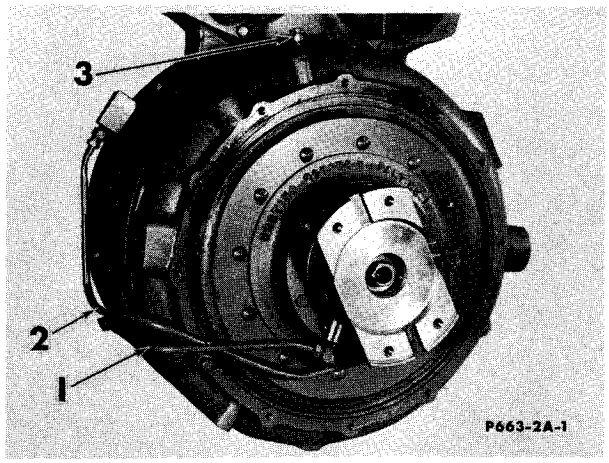


Figure 2A-1

Remove two tubings (1 & 2) on outside of the converter. Remove the bleeder valve (3).

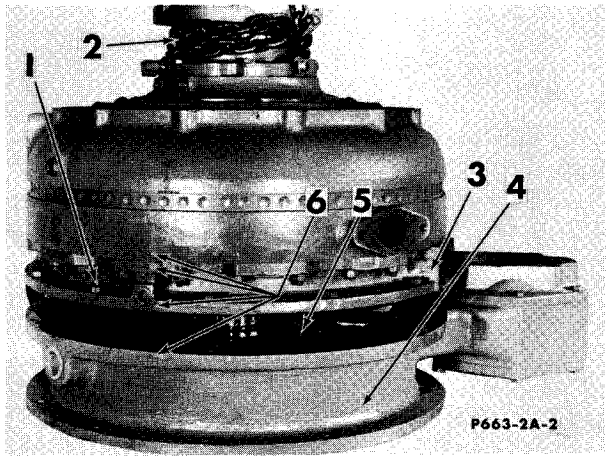


Figure 2A-2

Remove twelve capscrews (1) retaining the input housing (4) to the end plate (3). Center punch mark (6) as shown, all housings to assure proper location of the housings when they are assembled. Use a suitable hoist and small chain (2) to remove turbine housing and block up the input housing (4) on a clean bench with the input drive gear down, as shown in Figure 2-A3. Remove old gasket (5).

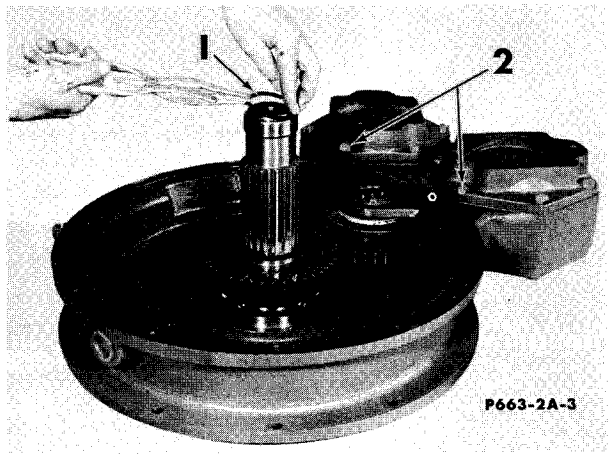


Figure 2A-3

Remove external snap ring (1). Remove capscrews on power-take-off covers (2).

SECTION II

DISASSEMBLY of Input Housing

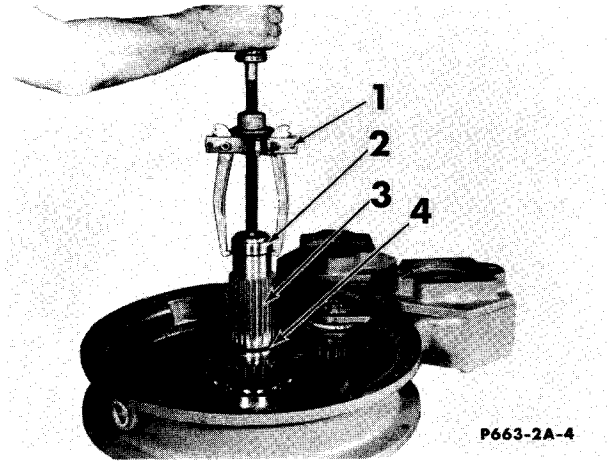


Figure 2A-4

Use a suitable puller (1) to remove the inner bearing race (2) from input shaft (3). Remove large "O" ring (4).

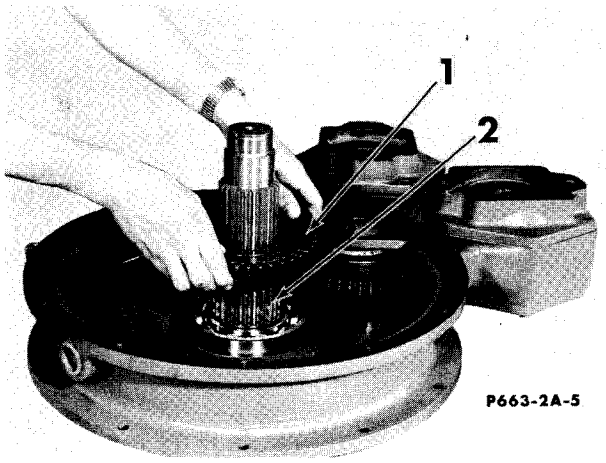


Figure 2A-5

Remove the driving gear (1) from input shaft (2).

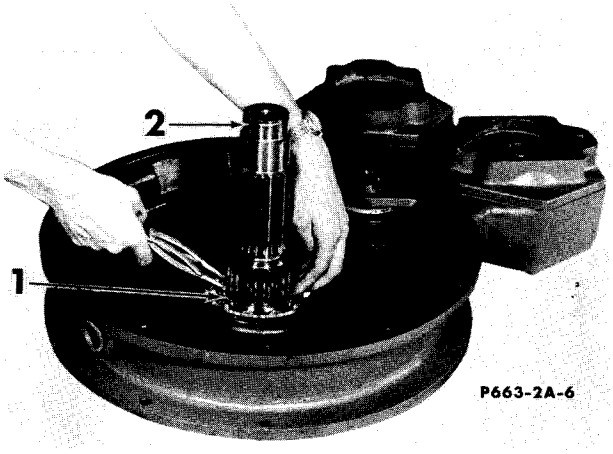


Figure 2A-6

Remove snap ring (1) from the input shaft (2).

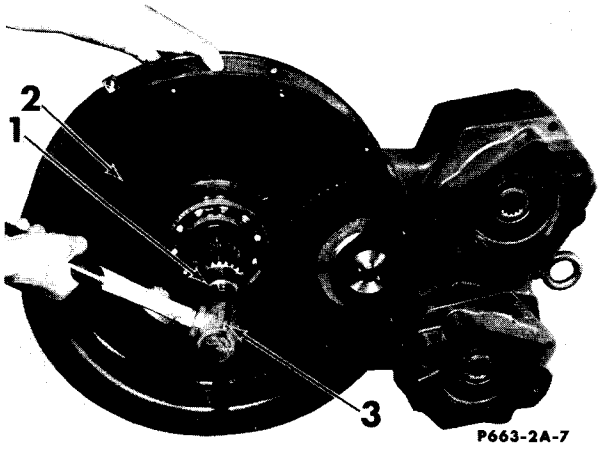


Figure 2A-7

Tap or press the input shaft assembly (1) from the input housing (2) using a plastic hammer (3) or an arbor press.

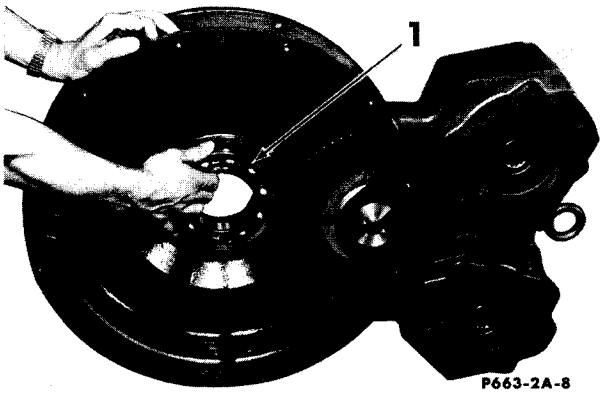


Figure 2A-8

Remove input shaft bearing (1). (On later models, a snap ring must be removed before bearing can be removed.)

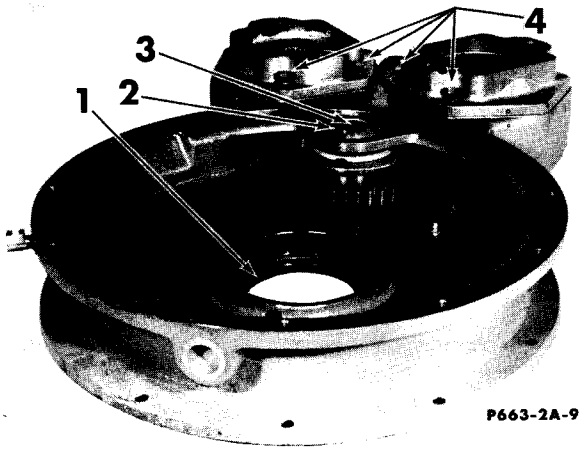


Figure 2A-9

Remove oil seal (1). Remove 1/2 inch capscrew (3) retaining the idler shaft (2). Remove the capscrews (4) on the pump mounting plates. The capscrews shown have copper washers on them to seal the oil from seeping through the capscrew threads.

DISASSEMBLY of Input Housing

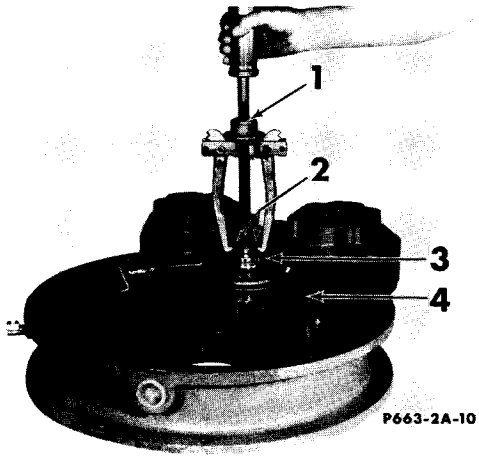


Figure 2A-10

Screw two capscrews (2) into idler shaft (3) so puller (1) can be attached to the shaft while shaft (3) is being pulled. Remove idler gear (4).

Overhaul if bearing or gear are to be replaced. Refer to Section D, Page II-21D.

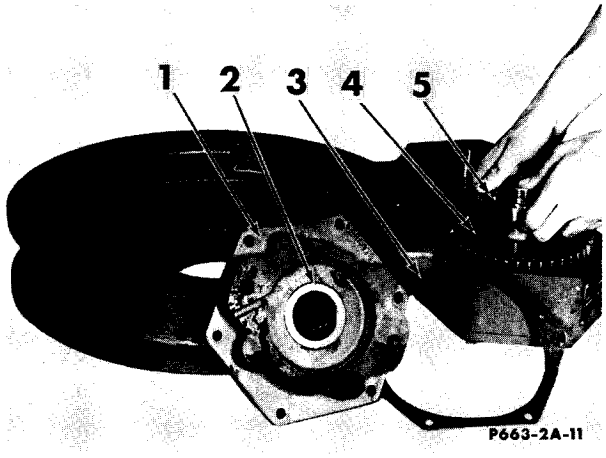


Figure 2A-11

When removing the pump mounting plates (1), punch mark all four plates and housing to identify their location when reassembling. Remove covers (1), gaskets (3) and gear assemblies (4). To remove and replace oil seals (2) from covers (1), refer to Section E, Page II-23E.

If gears (4) or bearings (5) are to be replaced, refer to Section F, Page II-25F.

REASSEMBLY of Input Housing

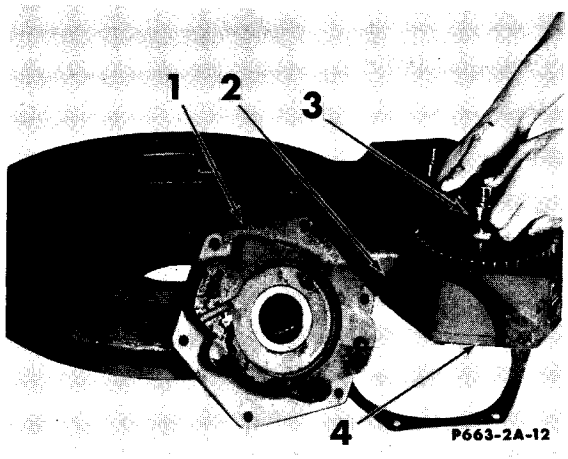


Figure 2A-12

The lower covers (4) can now be installed with new seals, gears, bearings and upper covers. Install capscrews and washers. Apply a liberal amount of grease to lips of seals. Install gear assembly (3) into housing, enter into seal. Install gaskets (2), cover (1) and capscrews. Install two copper washers on lower two capscrews on each cover. Torque to 32 ft. lbs.

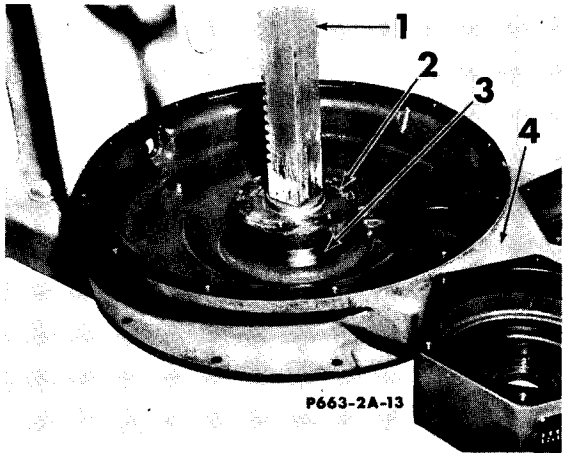


Figure 2A-13

Place input housing (4) in arbor press (1). Install bearing (3) in housing with press attachment (2) on outer race of bearing, press the bearing to the bottom of the bore in the housing (4). Install a snap ring in the later housing to secure the bearing.

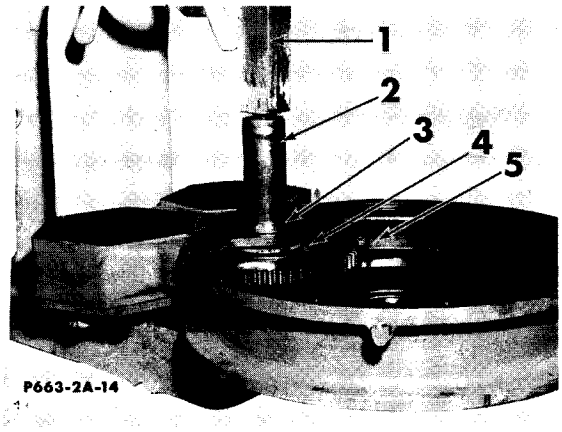


Figure 2A-14

Place input housing (5) in arbor press (1). Install idler gear assembly (4) in housing. Line up idler shaft (3) through housing and gear bearing. Place press attachment (2) on idler shaft (3). Press shaft to the bottom of the housing bore. Install the shaft bolt and torque to 80 ft. lbs.

SECTION II

REASSEMBLY of Input Housing

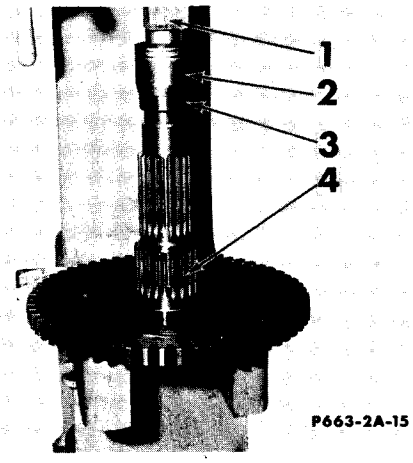


Figure 2A-15

Place input shaft (4) in arbor press (1). Install bearing inner race (3) on shaft (4) with press attachment (2). Press inner race on shaft.

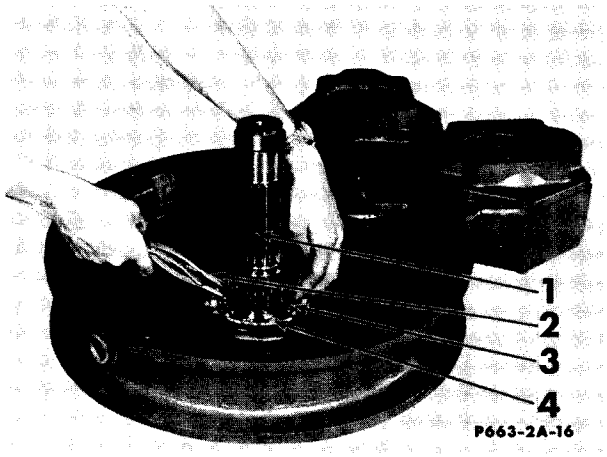


Figure 2A-16

Install input shaft (1) into housing bearing (4). Install snap ring (3) with a snap ring pliers (2). Block housing up with blocks.

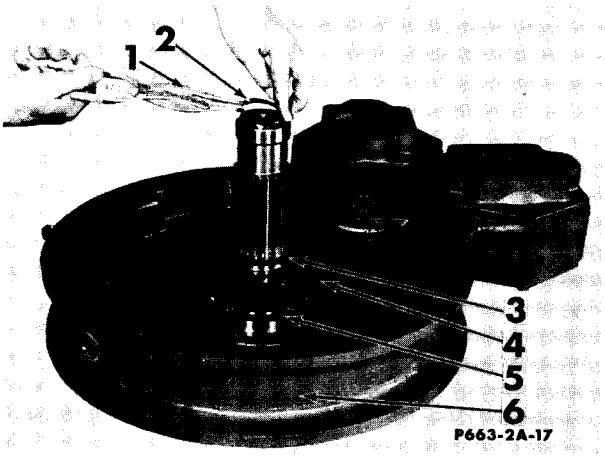
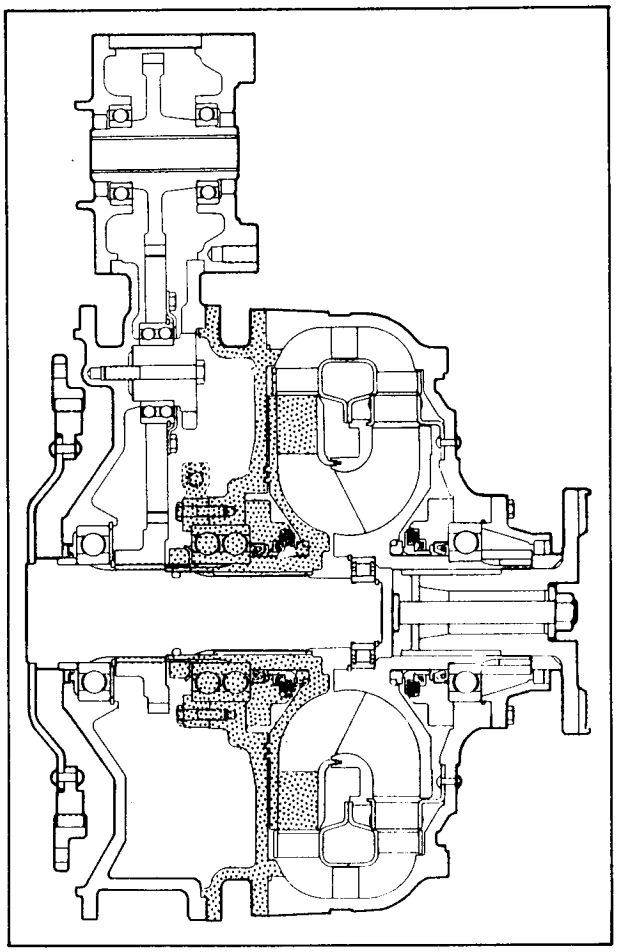


Figure 2A-17

Install drive gear (4) on shaft splines. Install "O" ring (3) into groove in shaft. Install snap ring (2) with a snap ring pliers (1) to secure bearing race.

The housing (6) should be placed on blocks or shaft and bearing (5) will push up as the photograph indicates.

NOTES:



SECTION II-B

END PLATE

TABLE OF CONTENTS

Disassembly	Pages II-11B thru II-12B
Reassembly	Page II-13B

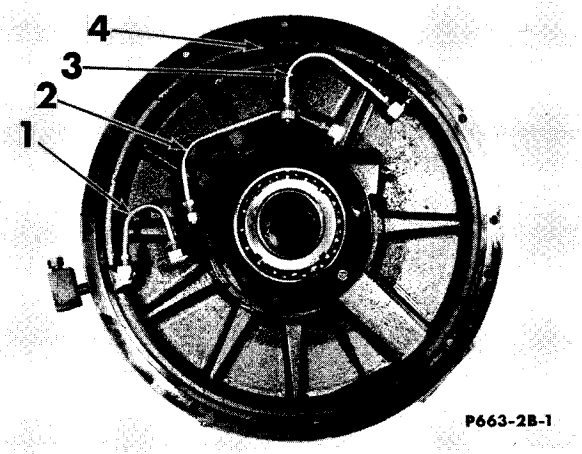


Figure 2B-1

Remove three lube tubings from end plate (4):

1. Retainer to end plate tubing.
2. Impeller bearing lube tubing.
3. Front seal drain tubing.
4. End plate.

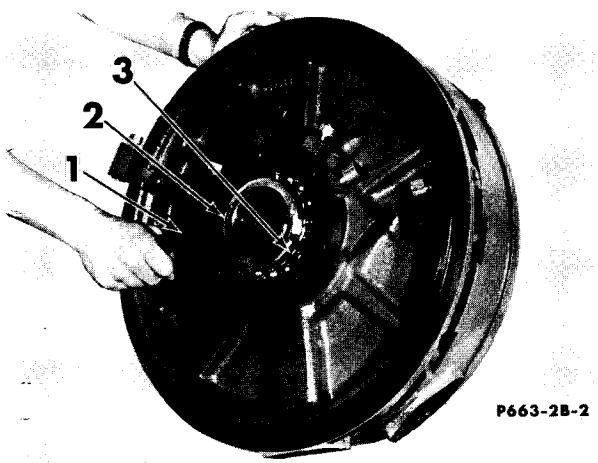


Figure 2B-2

Unlock the bearing lockwasher (3). Install spanner wrench (1) to nut (2). Tap wrench with bronze hammer if necessary to loosen lock nut (2).

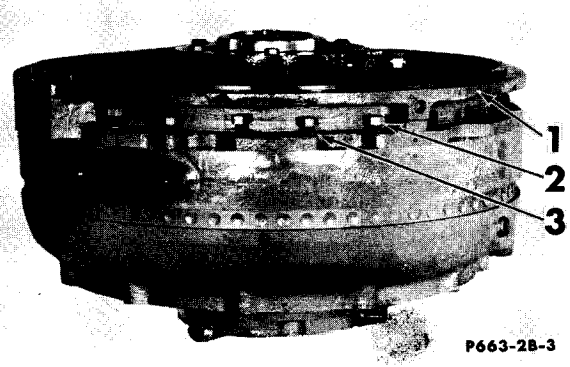


Figure 2B-3

To remove end plate (1), remove twenty-two nuts (2) and washers (3) and two special bolts.

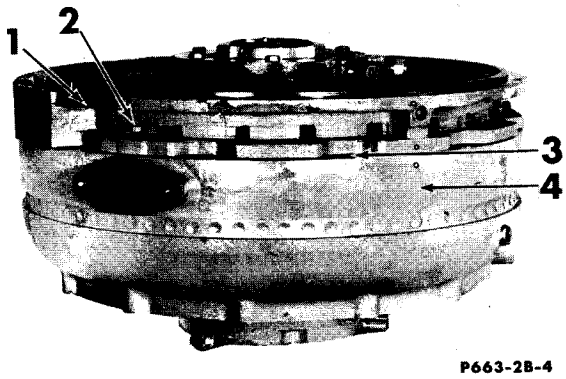


Figure 2B-4

Install two capscrews as jackscrews (2) to remove the end plate (1) from the turbine housing (4). Discard "O" ring gasket (3) when end plate is removed.

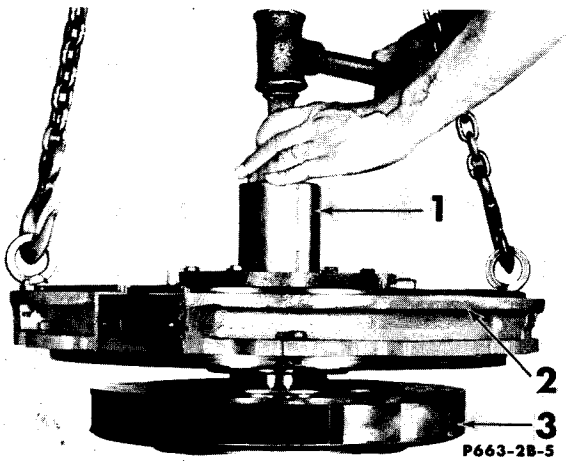


Figure 2B-5

To remove impeller wheel (3), remove nut and lockwasher. Drive or press the impeller wheel from end plate (2) with a driver (1) and/or a press or a brass hammer. Do not let impeller wheel drop or bend.

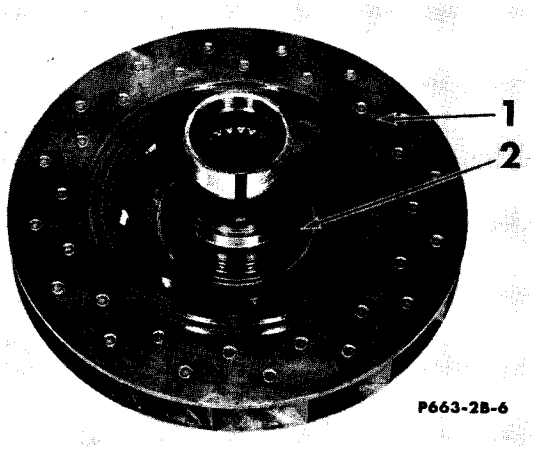


Figure 2B-6

The impeller wheel has a carbon mating ring (2) and a rubber mating ring washer to be serviced. Refer to Section H, Page II-29H.

Check seal carrier, if seal needs servicing. Refer to Section J, Page II-33J.

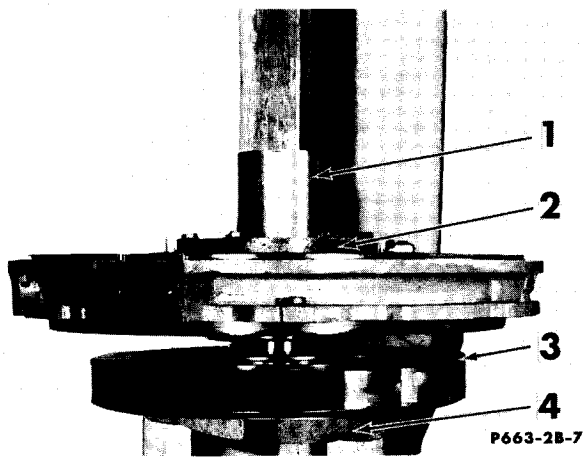


Figure 2B-7

Support impeller wheel assembly (3) in press (4). Lower end plate assembly (2) over impeller assembly. Press attachment (1) on inner race of bearing until the bearing seats.

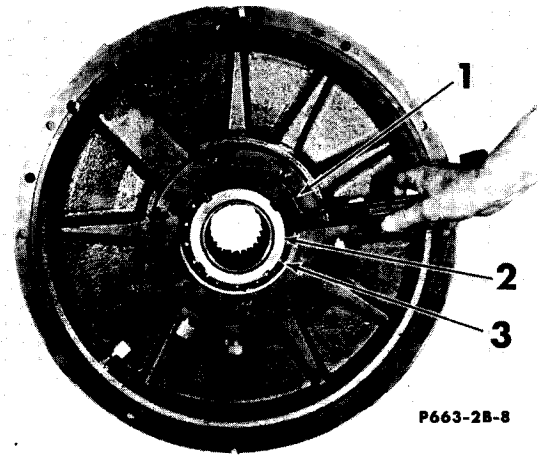


Figure 2B-8

Install the impeller lockwasher (3) with lock nut (2). Tighten the lock nut (2) securely with spanner wrench (1). Torque nut to 900 ft. lbs. and lock the washer in slot in nut.

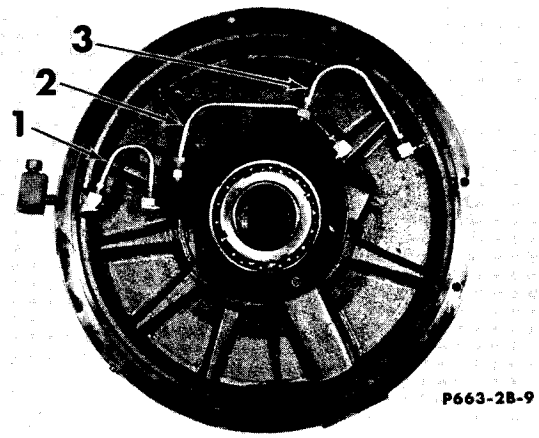
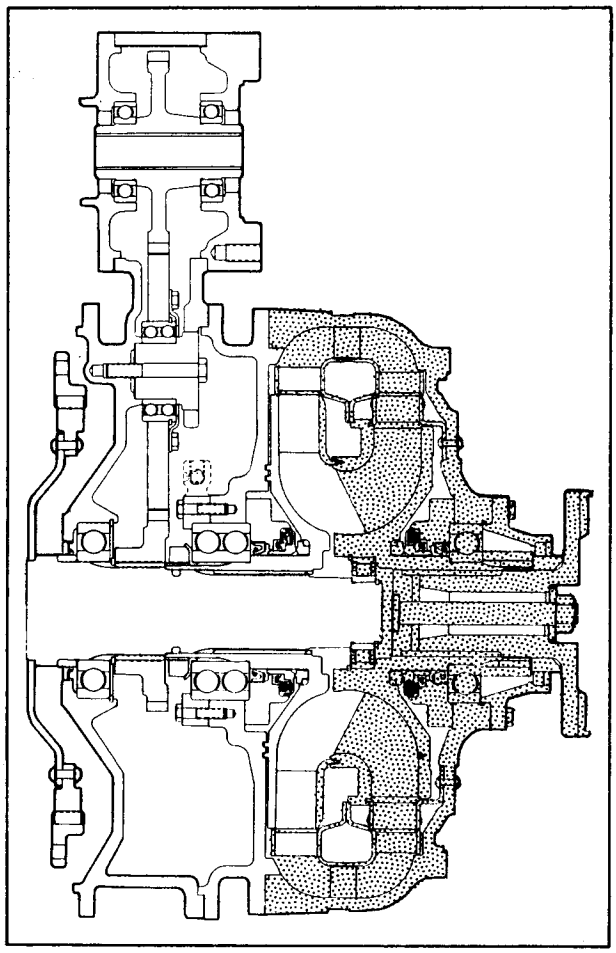


Figure 2B-9

Install the three tubings:

1. Retainer to end plate tubing.
2. Impeller bearing lube tubing.
3. Front seal drain tubing.



SECTION II-C

TURBINE ASSEMBLY

TABLE OF CONTENTS

Disassembly	Pages II-15C thru II-17C
Reassembly	Pages II-18C thru II-19C

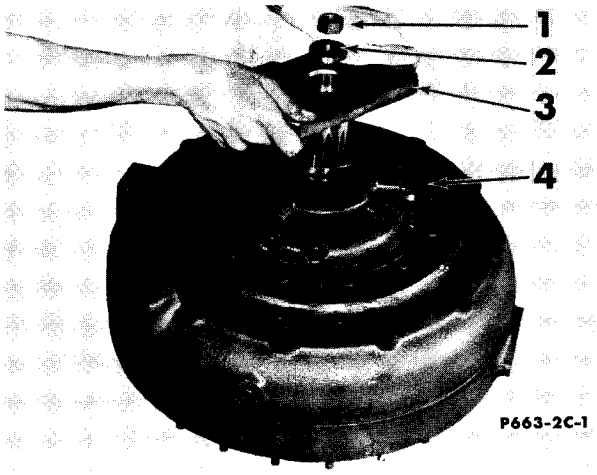


Figure 2C-1

Remove the yoke nut (1) and washer (2). Remove the yoke (3) from the converter housing (4).

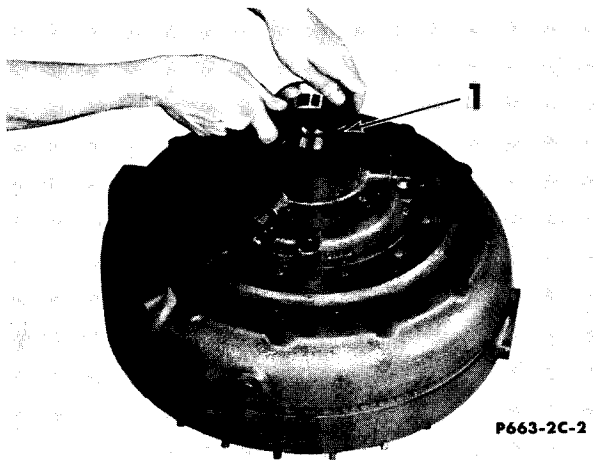


Figure 2C-2

Remove the yoke spacer (1).

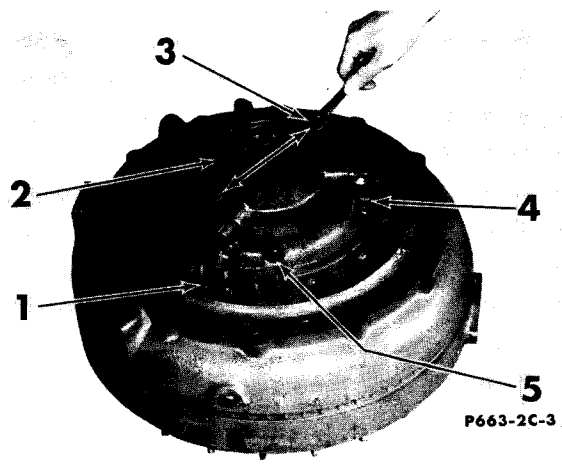


Figure 2C-3

Remove six capscrews (1) from the seal retainer (2). Install two capscrews into the jackscrew tapped holes in the retainer (2). Screw jackscrews (3) into the seal retainer (2). Remove long spacer not shown. Clean drain pipe (5) in converter assembly housing.

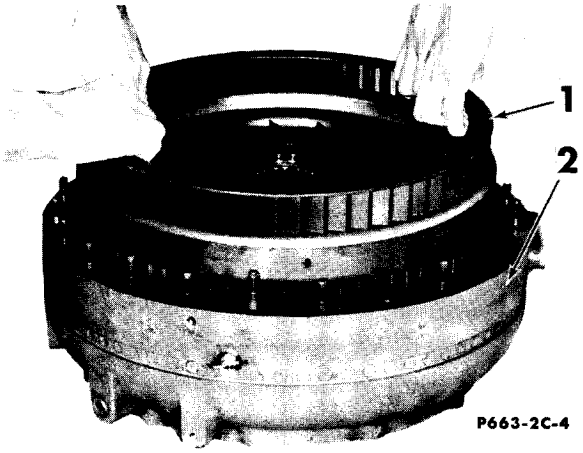


Figure 2C-4

Turn converter assembly housing (2) over. Then lift the final turbine wheel assembly (1) from the converter assembly housing (2).

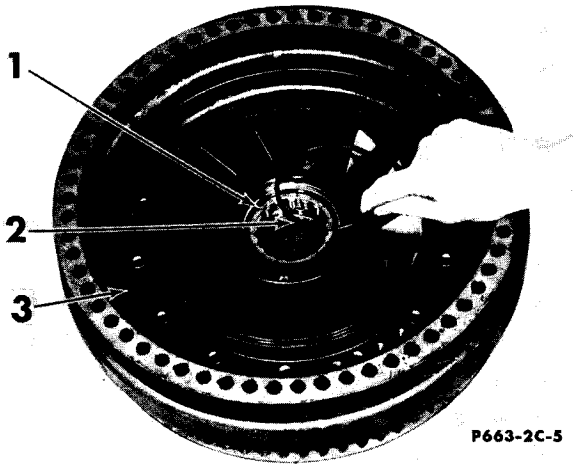


Figure 2C-5

Check the input shaft pilot bearing, if bearing is to be replaced. Remove the retainer snap ring (2) and input shaft pilot bearing outer race (1) with the roller bearings.

To replace, install pilot bearing outer race into the hub of the turbine wheel assembly (3). Install the retaining snap ring (2).

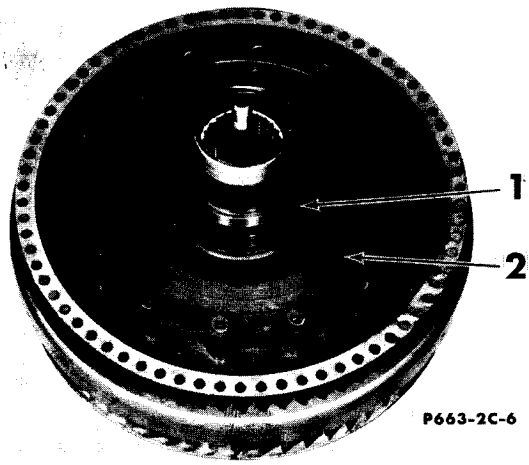


Figure 2C-6

The turbine wheel (2). If the seals are leaking and the carbon mating rings (1) are to be replaced or removed, to replace the rubber mating ring washer, refer to Section H, Page II-29H.

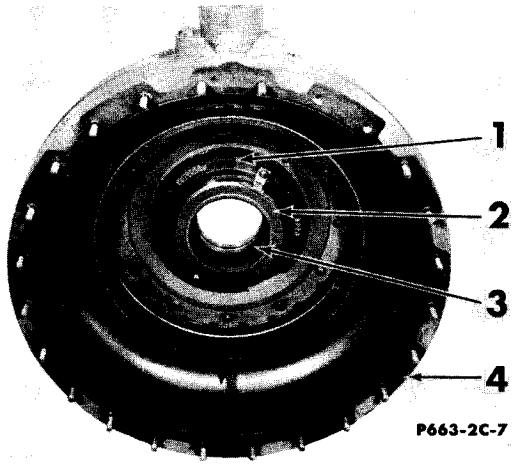


Figure 2C-7

To remove and replace the seal carrier, remove six socket head capscrews (1), retaining the seal carrier (2) to the turbine housing assembly (4). The seal carrier (2) may be removed from the turbine housing (4) by tapping on the opposite side of the turbine bearing (3). To replace and overhaul seal carrier, refer to Section J, Page II-30J.

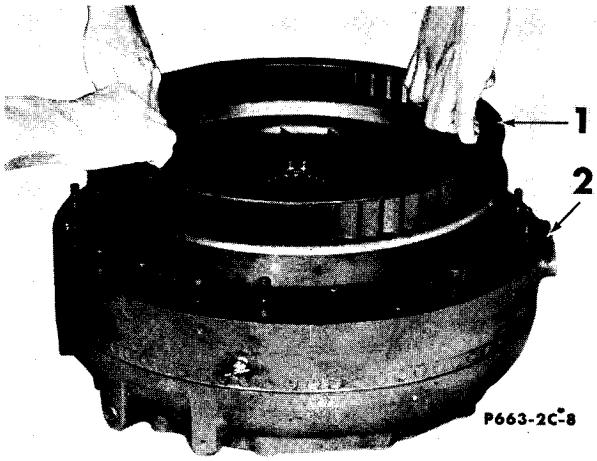


Figure 2C-8

After seal assembly and carbon mating ring have been installed, lift the final turbine wheel assembly (1) and set it into the converter assembly housing (2).

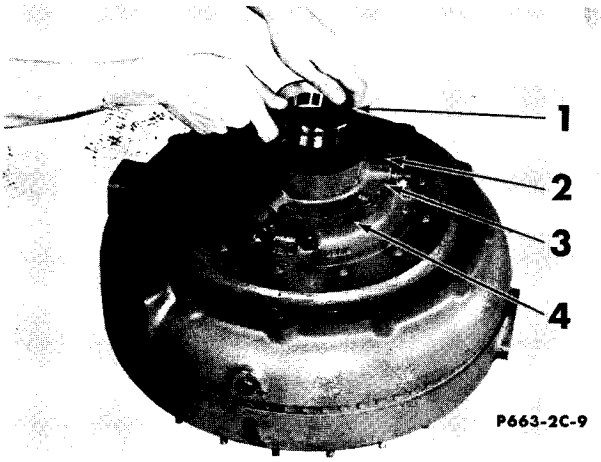


Figure 2C-9

Turn housing over and install long spacer (not shown) on turbine wheel assembly. Install gasket (4) but make sure the holes line up properly with the seal drain passages. Install seal retainer (3), short spacer (1) and capscrews (2). Torque to 32 ft. lbs.

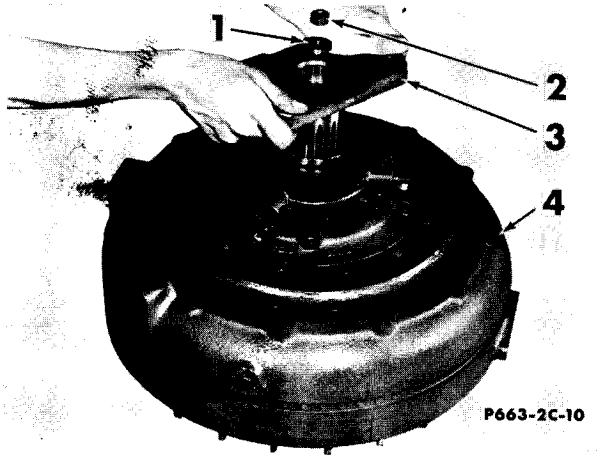


Figure 2C-10

To install the yoke to the converter housing (4), install yoke (3), washer (1) and nut (2). Torque to 225 ft. lbs.

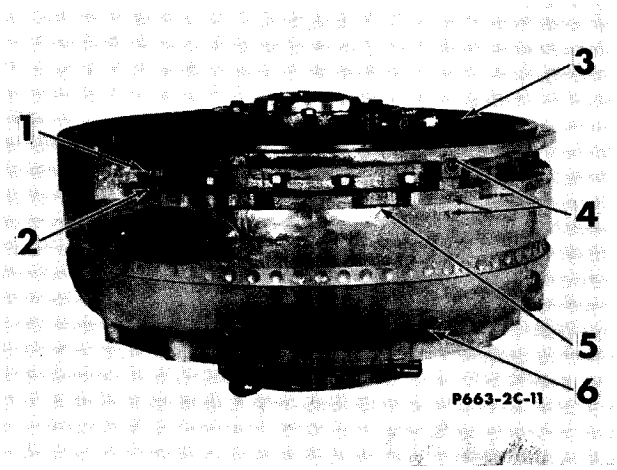


Figure 2C-11

Place converter assembly housing (6) on blocks with the output flange down. Install rubber gasket (5) on the flange face of the end plate (3). Install end plate assembly (3) on the converter assembly (6). Match punch marks of both housings. (Watch that rubber gasket (5) does not roll up as it enters the square cut in the converter assembly.) Install two special bolts, twenty-two nuts (1) and washers (2). Torque to 32 ft. lbs.

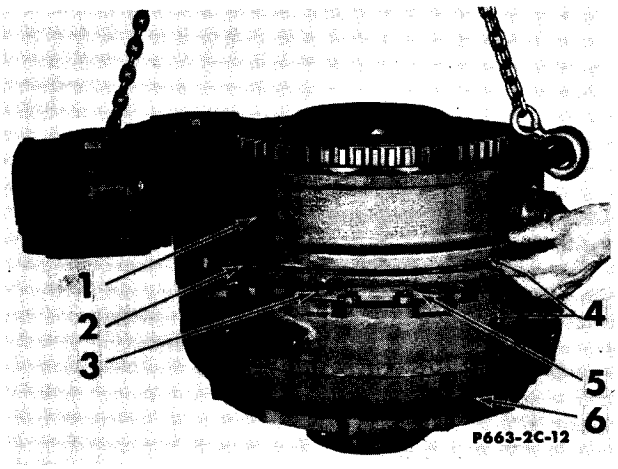


Figure 2C-12

Install gasket (2) and input housing (1) on end plate assembly (5) with all punch marks (4) matched up. Check that the input shaft assembly splines line up with mating parts in converter (6). Install capscrews (3). Torque to 32 ft. lbs.

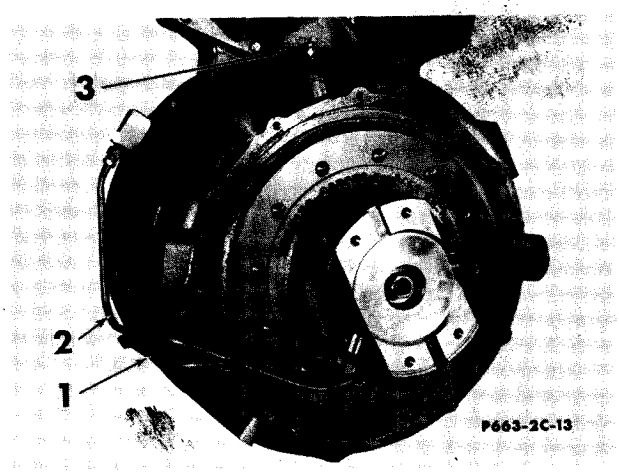
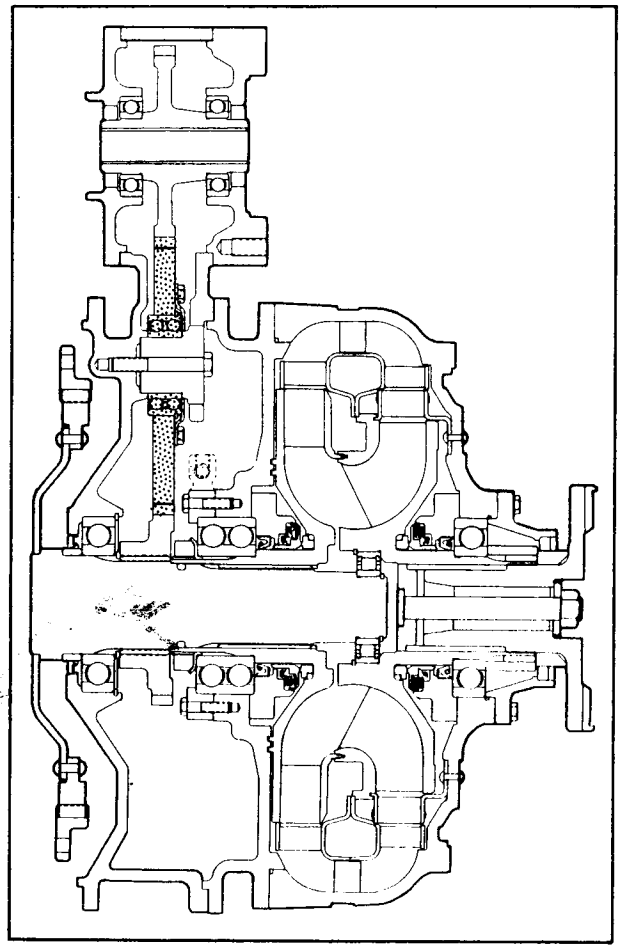


Figure 2C-13

Install the two tubings (1 - 2) on the outside of the converter. Install the bleeder valve (3).



SECTION II-D

IDLER GEAR BEARING

TABLE OF CONTENTS

Disassembly	Page II-21D
Reassembly	Page II-22D

DISASSEMBLY of Idler Gear Bearing

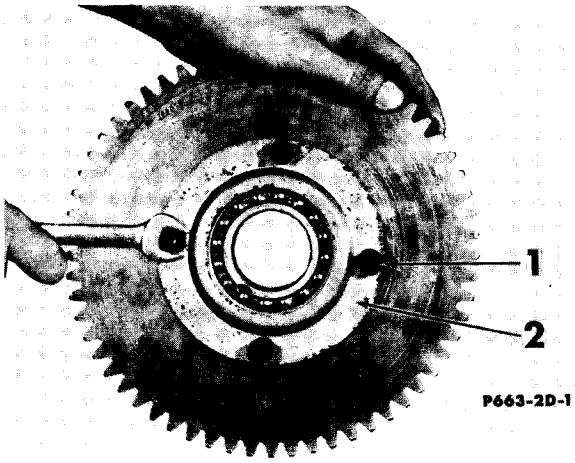


Figure 2D-1

To remove the idler bearing, remove four capscrews (1) and bearing retainer (2).

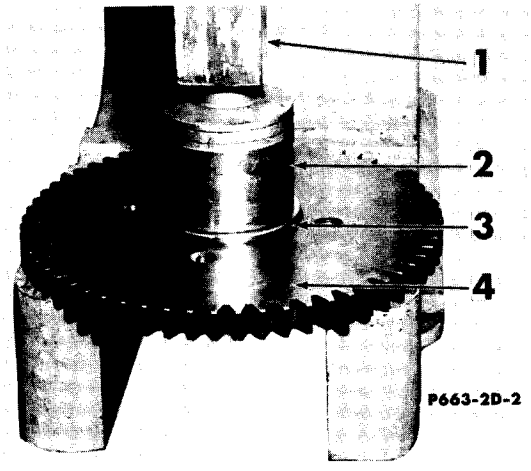


Figure 2D-2

Place idler gear (4) in press (1). Use press attachment (2) over outer bearing race (3). Press bearing (3) out of gear (4).

REASSEMBLY of Idler Gear Bearing

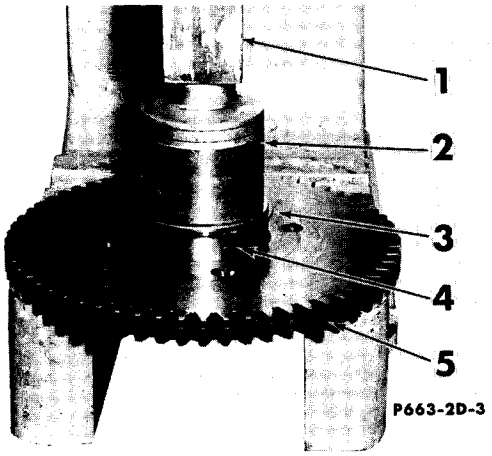
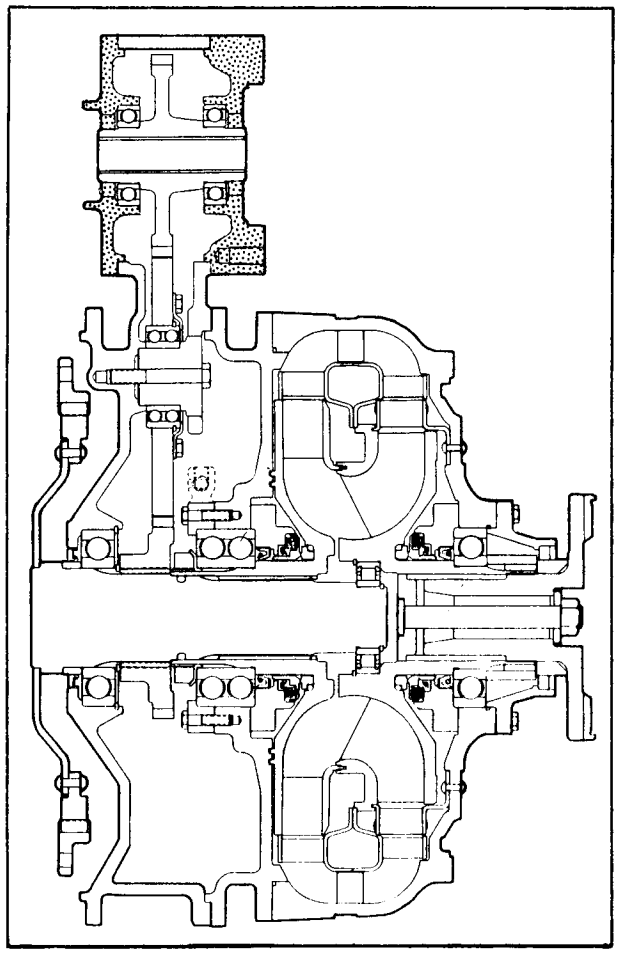


Figure 2D-3

To replace bearing, install snap ring (3) on bearing (4). Place gear into press (1). Install bearing (4) into gear (5) with press attachment (2) on outer race of the bearing. Press bearing down into gear to the snap ring (3).

Assemble bearing retainer (2) and four cap-screws (1) to gear. Torque to 32 ft. lbs. See Figure 2-D1.



SECTION II-E

COVER SEALS

TABLE OF CONTENTS

Disassembly	Page II-23E
Reassembly	Page II-24E

DISASSEMBLY of Cover Seals

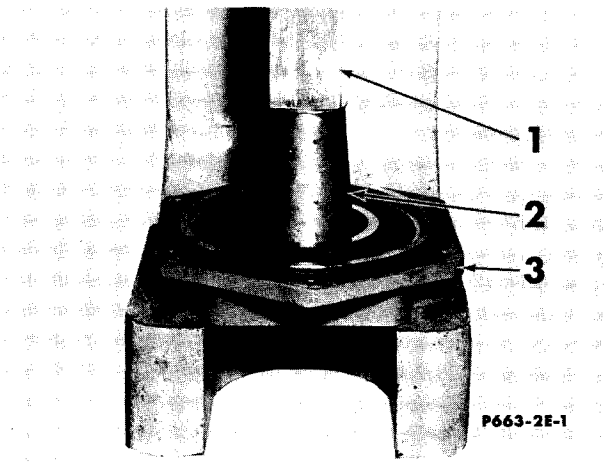


Figure 2E-1

Press seal out of cover (3) with press attachment (2) in arbor press (1).

REASSEMBLY of Cover Seals

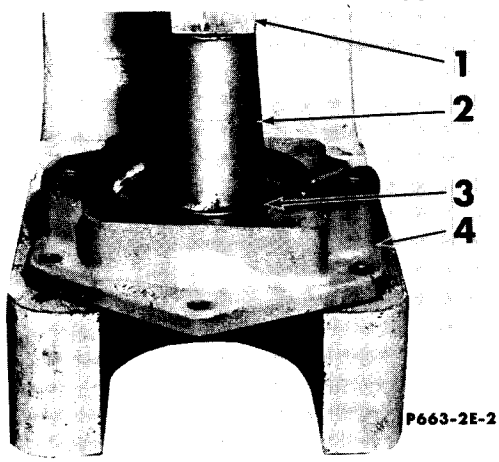
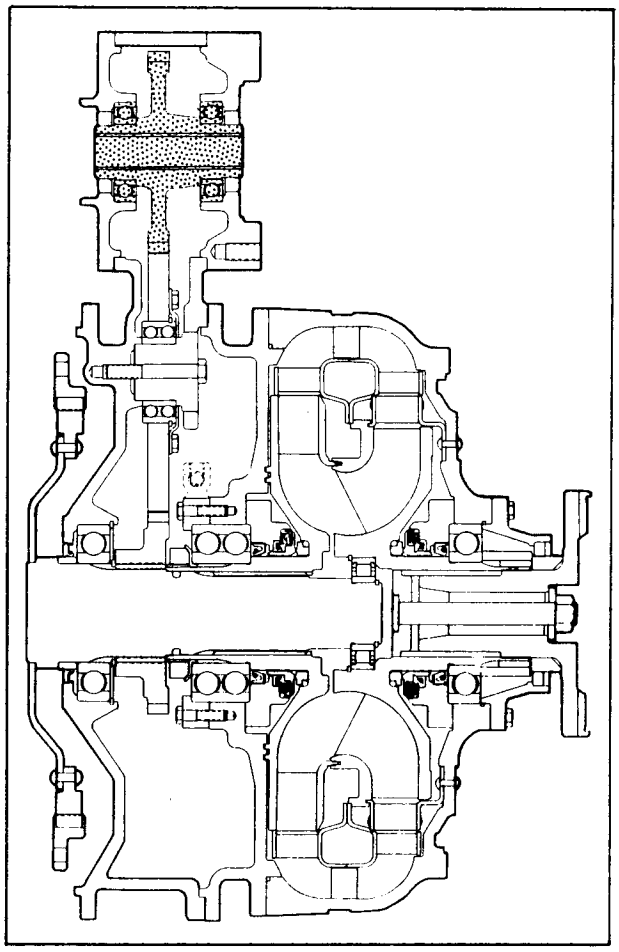


Figure 2E-2

Coat O. D. of seal (3) with Mar-Seal or a comparable sealant. Press seal (3) into cover (4) with the lip down or toward bearings. Use a press attachment (2) and arbor press (1) to press seal flush with face of cover (4).



SECTION II-F

P.T.O. GEARS & BEARINGS

TABLE OF CONTENTS

Disassembly	Page II-25F
Reassembly	Page II-26F

DISASSEMBLY of P.T.O. Gears & Bearings

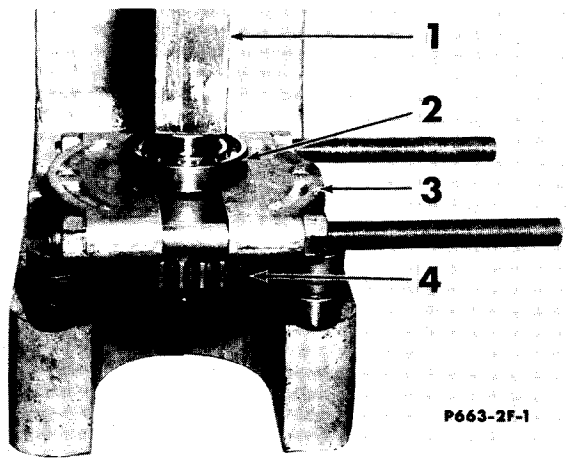


Figure 2F-1

Install puller attachment (3) onto the gear (4). Block up in press (1) and press bearing (2) from gear (4).

REASSEMBLY of P.T.O. Gears & Bearings

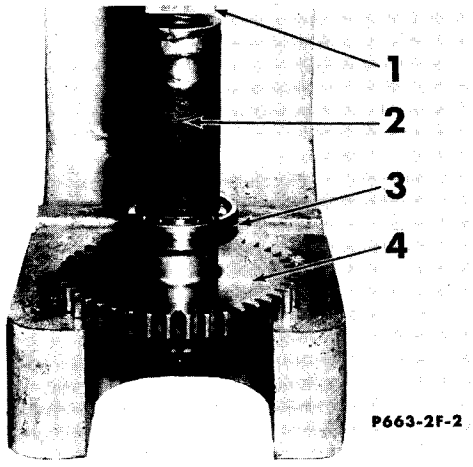
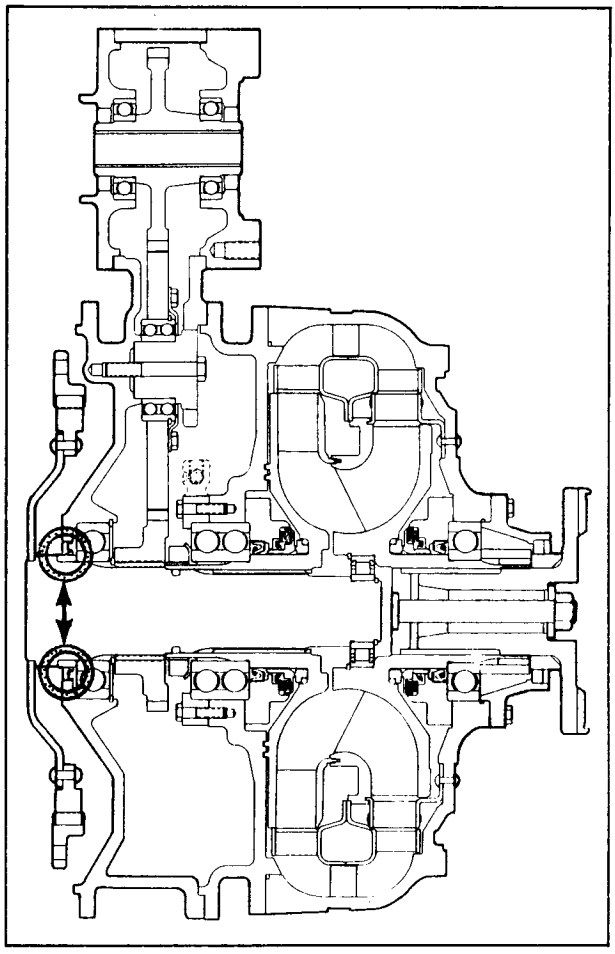


Figure 2F-2

Install gear (4) into press (1). Install bearing (3) with press attachment (2). Press on inner race of bearing down to shoulder on gear.



SECTION II-G

INPUT HOUSING SEAL

TABLE OF CONTENTS

Disassembly	Page II-27G
Reassembly	Page II-28G

DISASSEMBLY of Input Housing Seal

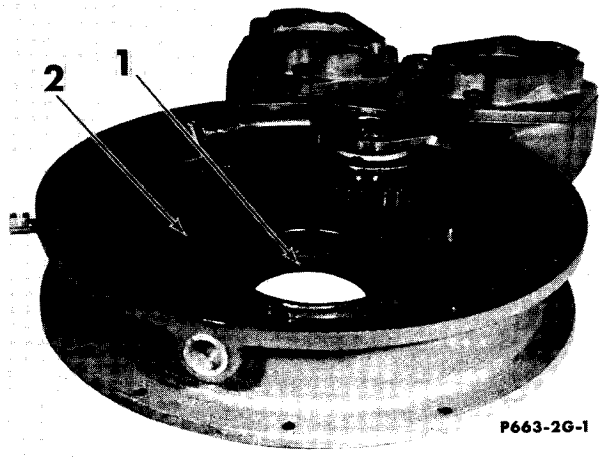


Figure 2G-1

Remove oil seal (1) from input housing (2).

REASSEMBLY of Input Housing Seal

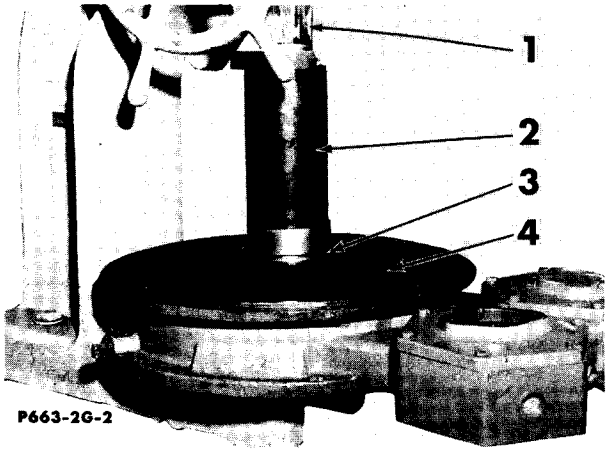
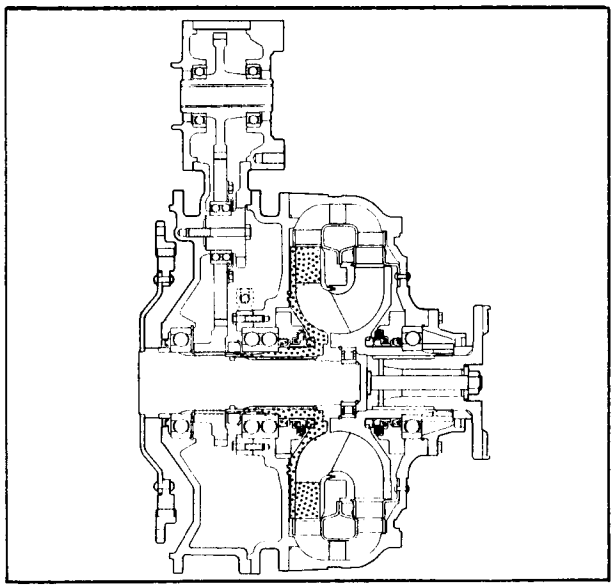


Figure 2G-2

Place input housing (4) into arbor press (1). Coat O. D. of seal (3) with Mar-Seal or a comparable sealant. Place seal into bore of housing using the press attachment (2). Press seal (3) flush with face of housing (4).



SECTION II-H

MATING RING & WASHER

DISASSEMBLY & REASSEMBLY of Mating Ring & Washer

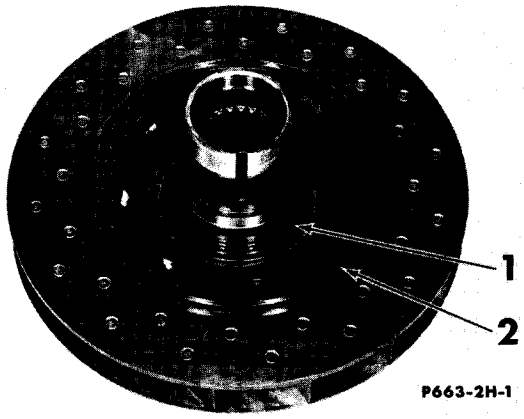


Figure 2H-1

If the carbon mating ring is damaged or scratched, it should be changed. Care should be taken when the carbon mating ring (1) is removed from the impeller wheel (2). The rubber mating ring washer is below the carbon mating ring. It is a rubber seal for the carbon mating ring.

The turbine final wheel assembly has the same type carbon mating ring and is serviced the same way. See Figure 2-C6, Page II-16C.

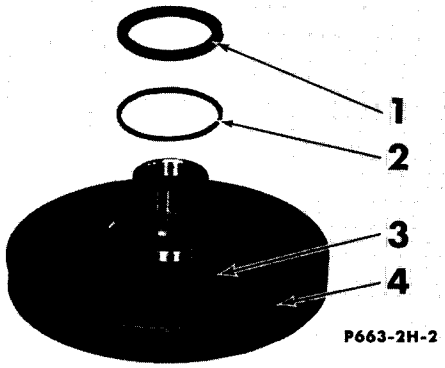
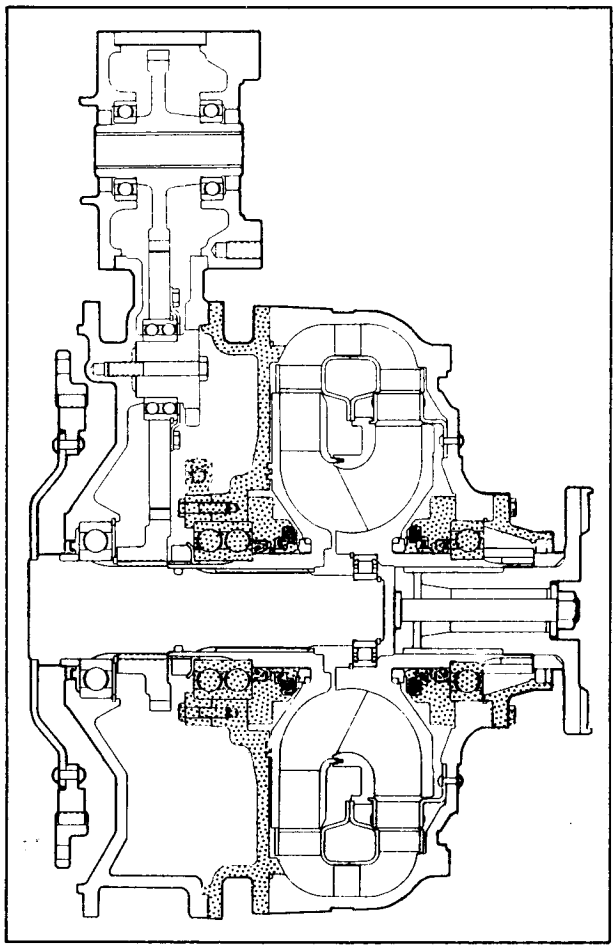


Figure 2H-2

Remove the carbon mating ring (1) and rubber mating ring washer (2) from impeller wheel (4). Replace worn or damaged parts. The rubber mating ring washer (2) has a round and flat side to it. The round side fits into the radius in the impeller wheel and turbine wheel groove (3). The flat side must be placed toward the carbon mating ring. The carbon mating ring has a hand press fit into the groove. See Figure 2-B6 and Figure 2-C6, Page II-16C.



SECTION II-J

BEARING, RETAINER, & SEAL CARRIER

TABLE OF CONTENTS

Disassembly	Page II-31J
Reassembly	Pages II-32J thru II-33J

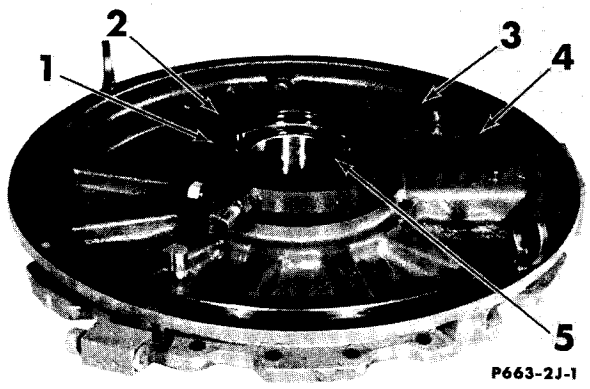


Figure 2J-1

Center punch mark end plate (3) and impeller bearing retainer (2). Remove six capscrews (4). Install two capscrews in jackscrew holes (1) to remove the impeller bearing retainer (2) and gasket.

Check the bearing (5). If it is to be replaced, remove and replace bearing as in Figure 2-J1 thru Figure 2-J6.

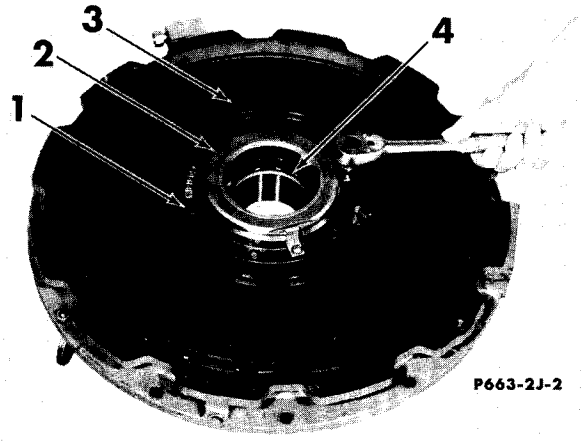


Figure 2J-2

Turn housing over. Remove six socket head capscrews (1) retaining the seal carrier (2) to the end plate (3). The seal carrier (2) may be removed from the end plate (3) by tapping on the opposite side of the impeller wheel bearing (4). To overhaul seal carrier (2), see Figure 2-J7.

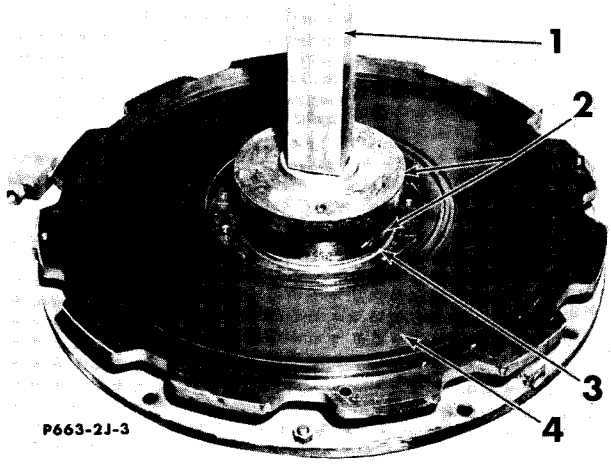


Figure 2J-3

Place end plate (4) in press (1). Place press attachment (2) on bearing (3). Press bearing out of end plate.

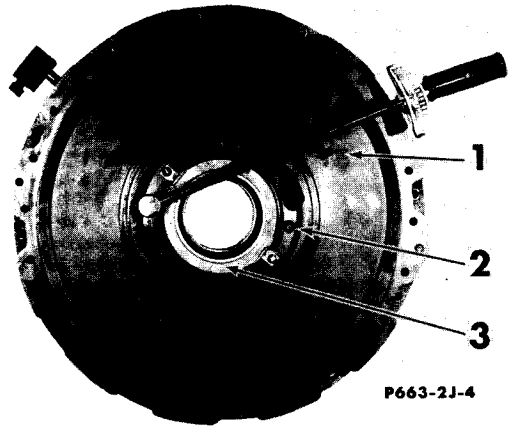


Figure 2J-4

Soak the gasket (not shown) briefly in clean converter fluid before installing. Make sure the holes line up properly with the seal drain passages. Install seal carrier (3). Line the holes with gasket and end plate or turbine housing. Install the six socket head capscrews. Torque to 32 ft. lbs.

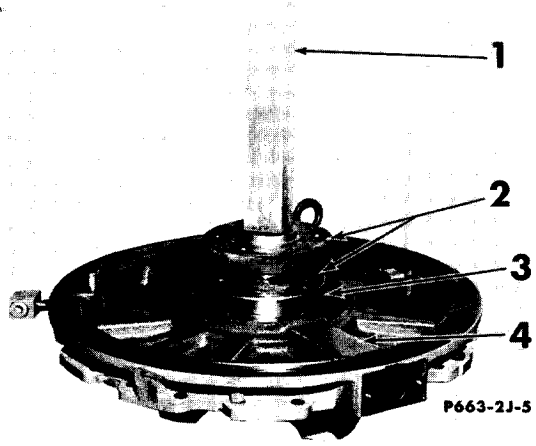


Figure 2J-5

Block end plate (4) up in press (1) so seal carrier does not touch press. Install bearing (3) with press attachments (2) in bore of end plate (4). Press bearing (3) in bore to seal carrier.

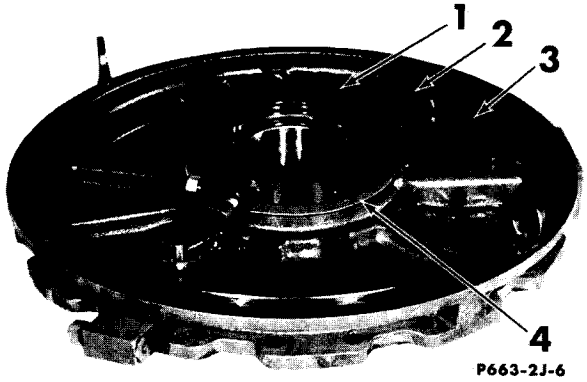


Figure 2J-6

Remove end plate (2) from press. Install bearing retainer (1) with gasket (4) soaked in converter fluid briefly before installing. Make sure the holes line up properly with the seal drain passages. Install the six capscrews (3). Torque to 32 ft. lbs.

SEAL ASSEMBLY

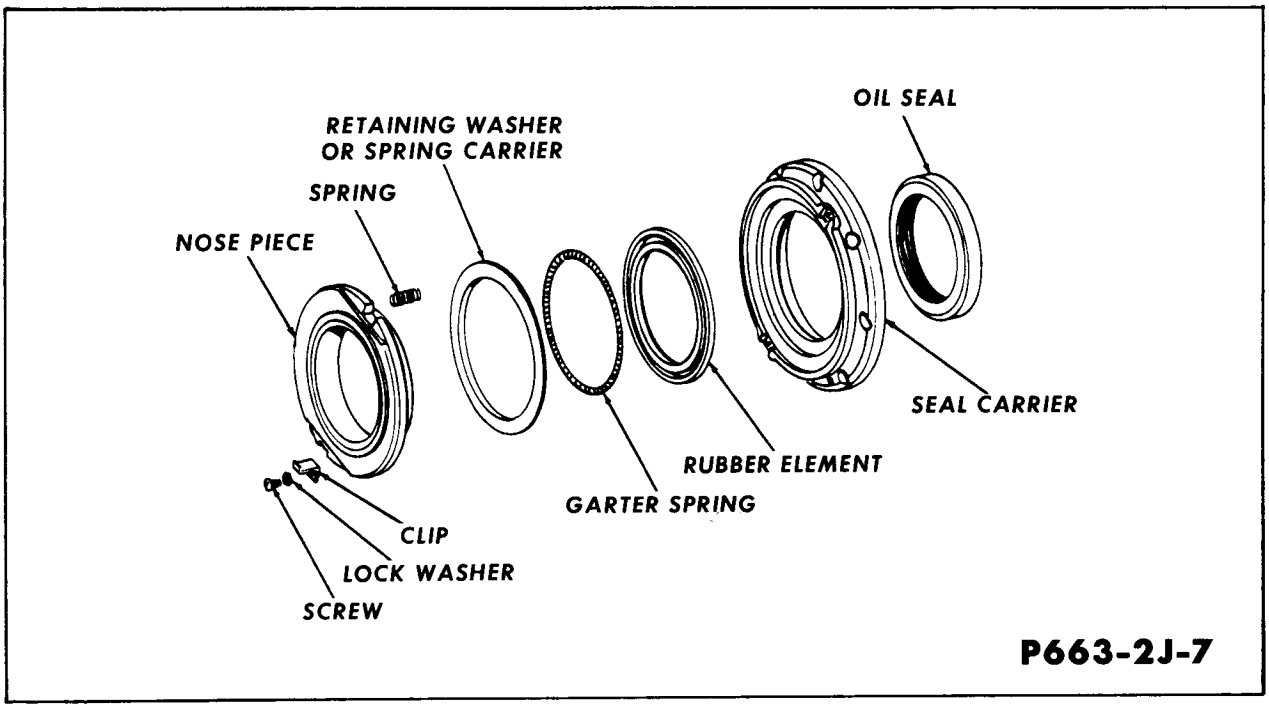


Figure 2J-7

1. Install the lip type oil seal in its bore on the bearing side of the seal carrier. The lip of this seal will face the bearing.

2. Lay the seal carrier on a clean surface, oil seal side down.

3. Place the garter spring in the rubber element and install the rubber element in its bore in the seal carrier, garter spring side up. Lubricate the side of the rubber element with clean oil.

4. Install the retaining washer, or spring carrier, shoulder side down in the mating bore of the rubber element.

5. Fill the spring counterbores in the nose piece with grease. Place the compression springs in the grease filled counterbores. Lubricate the skirt of the nose piece with clean oil.

6. Invert the nose piece and install it in the seal carrier. Exercise care in entering the skirt of the nose piece into the lip of the rubber element. Line up the clip slots in the nose piece with the clip slots in the seal carrier.

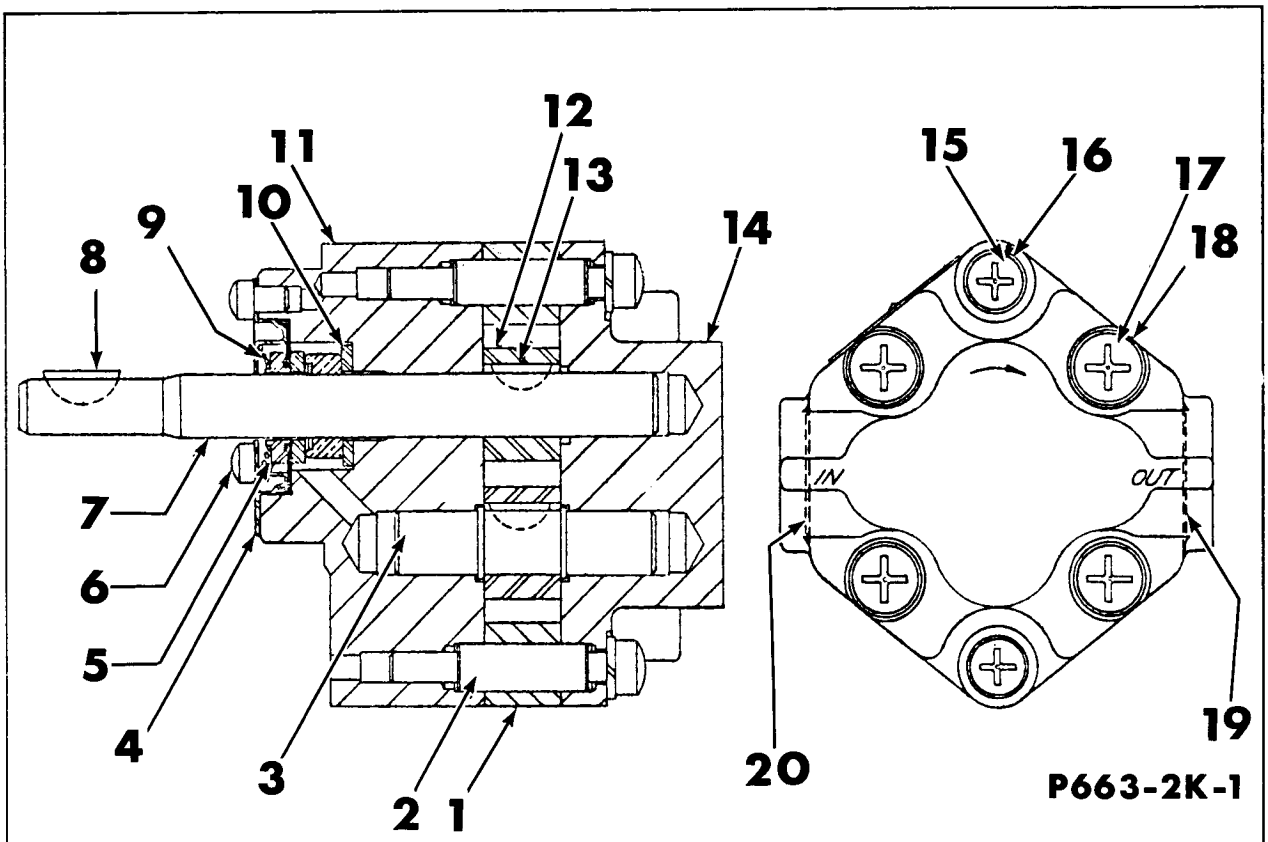
7. Compress the nose piece to the carrier and install the two clips and screws retaining the nose piece to the seal carrier. Check for free movement of the steel nose piece.

8. Place a new gasket with the seal assembly and bolt the assembly to the housing with the socket head capscrews.

NOTE: Soak this gasket briefly in clean converter fluid before installing. Make sure the holes line up properly with the gasket and seal drain passages.

EXTREME CARE MUST BE EXERCISED IN ASSEMBLY TO MAKE CERTAIN THAT THE LAPPED SURFACES OF THE CARBON MATING RING AND STEEL NOSE PIECE ARE FREE FROM ALL PARTICLES OF DUST OR GRIT AS THIS WILL RESULT IN SCRATCHES ON THE LAPPED SURFACES AND CAUSE FLUID LEAKAGE. THESE SURFACES ARE ORIGINALLY LAPPED SMOOTH WITHIN TWELVE MILLIONTHS OF AN INCH.

CONVERTER CHARGING PUMP(CUMMINS)



1. Gear plate	5. Diaphragm	9. Spring	13. Key	17. Screw
2. Dowel pin	6. Screw	10. Thrust washer	14. Cover	18. Washer
3. Idler gear assy.	7. Shaft assy.	11. Body	15. Screw	19. Outlet
4. Seal clamp	8. Key	12. Drive gear	16. Washer	20. Inlet

Figure 2K-1

DISASSEMBLY OF CHARGING PUMP

Remove two 1/4" fillister head screws (15) and lockwasher (16). Remove four 5/16" fillister head screws (17) and lockwasher (18). Remove cover (14), drive gear (12) and idler shaft assembly (3). Remove gear plate (1) with dowels (2). Remove drive shaft keys (13-8). Remove three screws (6), seal clamp (4), spring (9) and diaphragm (5). Remove drive shaft (7) with seal nose attached. Remove thrust washer (10) from shaft bore.

Clean all parts thoroughly in mineral spirits. Inspect pump body, gear plate, cover, gears and shafts for excessive wear and scoring.

REASSEMBLY OF CHARGING PUMP

Install thrust washer (10) into shaft bore. Install drive shaft (7) with seal nose attached. Install diaphragm (5), spring (9), seal clamp (4), three screws (6) and both keys (13-8). Install the gear plate (1), idler shaft assembly (3), drive gear (12) and cover (14). Install four 5/16" fillister head screws (17) and lockwashers (18). Torque to 18 ft. lbs. Install two 1/4" fillister head screws (15) and lockwashers (16). Torque to 9 ft. lbs.

Lubricate shafts and gears with light oil while assembling. Make sure the input drive shaft turns freely.

TRANSMISSION CHARGING PUMP(CUMMINS)

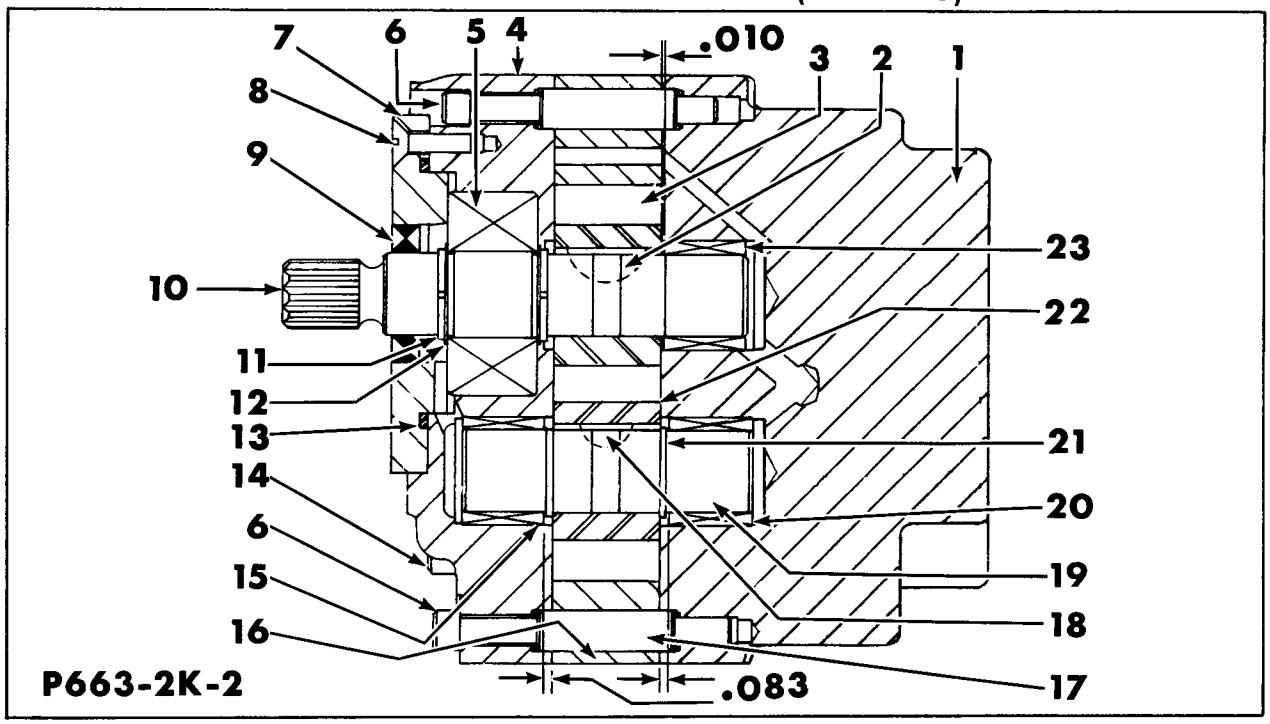


Figure 2K-2

DISASSEMBLY OF CHARGING PUMP

Remove three flat head screws (8). Remove pilot plate (7) with seal (9) and "O" ring (13). Press seal (9) from pilot plate (7). Remove the drive shaft assembly (10). To disassemble, remove the key (2), retainer ring (11) and flat washer (12). Press the ball bearing (5) from the shaft (10). Remove the six 5/16" Allen screws (14). Remove two 1/4" Allen screws (6). Remove the body assembly (4), drive gear (3) and idler gear assembly (19).

To remove the gear (22) from the idler shaft (19), remove two retaining rings (21), gear (22) and key (18) from the shaft. Remove the gear plate (16) and two dowels (17) from gear plate (16). Remove needle bearings (15, 20 & 23), if worn. Clean all parts thoroughly in mineral spirits. Inspect pump body, gear plate, cover, bearings, gears, and shafts for excessive wear and scoring. Replace seal and "O" ring and gasket. Inspect bearings for wear and fatigue.

REASSEMBLY OF CHARGING PUMP

If the bearings are to be replaced, the top needle bearing (23) should be removed and replaced into the cover (1) bore so the bearing (23) is .010 inch below the gear face of the cover. The lower or idler shaft needle bearings (15 & 20) should be .083 inch below the gear surface of the cover (1) and body assembly (4) to allow clearance for the retaining rings (21) on the idler shaft (19). The ball bearing (5) should not have any end play when assembled into the pump.

Install the gear plate (16) with the two dowels (17) to cover assembly (1). Press the key (18) into the idler shaft (19). Install retaining ring (21), idler gear (22) and another retaining ring. Insert shaft assembly into cover assembly (1). Install the drive gear (3) into gear plate (16). Install the body assembly (4) to the gear plate (16). Install two 1/4" capscrews (6). Torque to 9 ft. lbs. Install six 5/16" Allen head screws (14). Torque to 18 ft. lbs.

To assemble the drive shaft, install a retaining ring (11) and a flat washer (12). Press bearing (5) on the shaft (10). Install another flat washer (12) and retaining ring (11). Press the key into shaft (10). Install shaft assembly into body assembly (4) and drive gear (3) on shaft. Line up the key (2) with the gear keyway.

Install a new seal (9) and "O" ring in pilot plate (7). The seal (9) must be pressed in flush with the spring, large lip toward the bearing (5). Install the pilot plate (7) to the body assembly. Install three flat head screws (8). Tighten to 9 ft. lbs.

All working parts should be assembled with clean type "A" oil.

CONVERTER CHARGING PUMP(GMC)

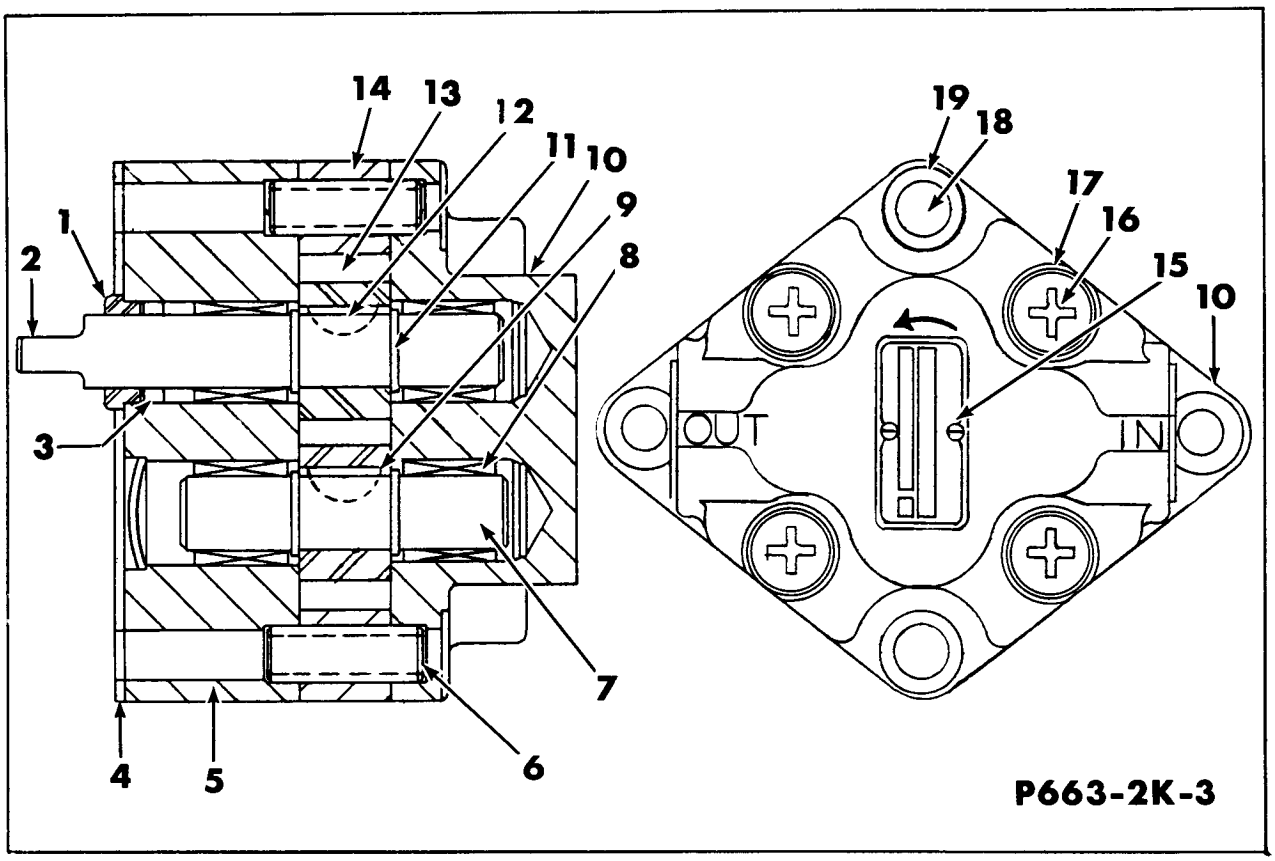


Figure 2K-3

DISASSEMBLY OF CHARGING PUMP

Remove four 1/4" fillister head screws (18) and washers (19) to remove the converter charging pump from the transmission charging pump. Remove gasket (4). Remove four 5/16" fillister head screws (16) and washers (17). Remove cover (10), drive gear assembly (13) with the shaft (2) and idler gear assembly (7). Remove the gear plate (14) with dowels (6) from mounting plate assembly (5). Remove pilot ring (1) and seal (3).

Clean all parts thoroughly in mineral spirits. Inspect pump body, gear plate, cover, bearings, gears and shafts for excessive wear and scoring. Replace seal and gasket. Inspect needle bearings for wear and fatigue.

REASSEMBLY OF CHARGING PUMP

If needle bearings are to be changed, pull bearings from housings. When pressing bearings into housings, be sure there is .065" clearance from end of bearing to gear surface of the mounting plate (5) and cover (10) to allow clearance for the retaining rings (11) on the gear shafts (2-7). Install drive shaft assembly (2) and idler gear assembly (7). Install gear plate (14) with two dowel pins (6). Install cover assembly (10). Install four 5/16 fillister screws (16) and washers (17). Torque to 18 ft. lbs.

Install new seal with the lip toward the bearing. Place seal (3) over shaft (2) without cutting the lip. Press seal into seal bore until .140 inch is obtained from the seal to the mounting face of the mounting plate assembly (5). Install pilot ring (1) over shaft (2), press into the mounting plate (5) when mounting the pump to the transmission charging pump. Install a new gasket (4) between the pumps.

TRANSMISSION CHARGING PUMP(GMC)

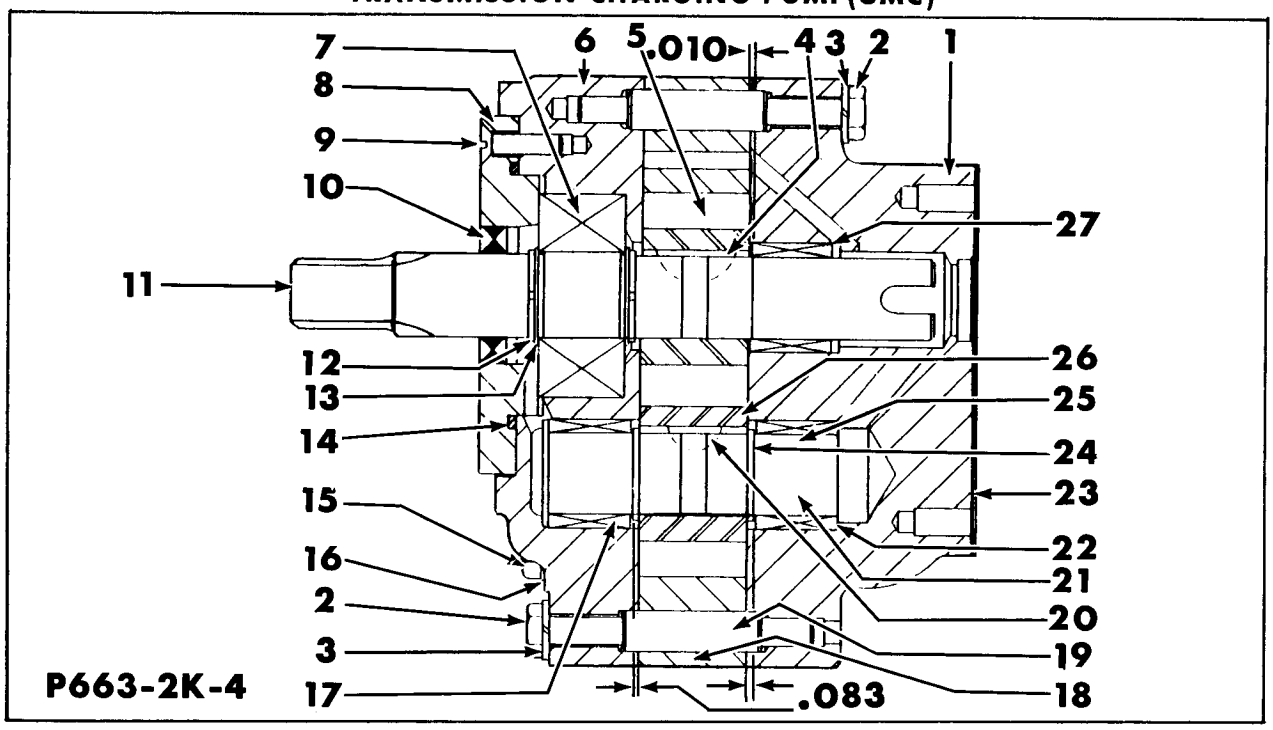


Figure 2K-4

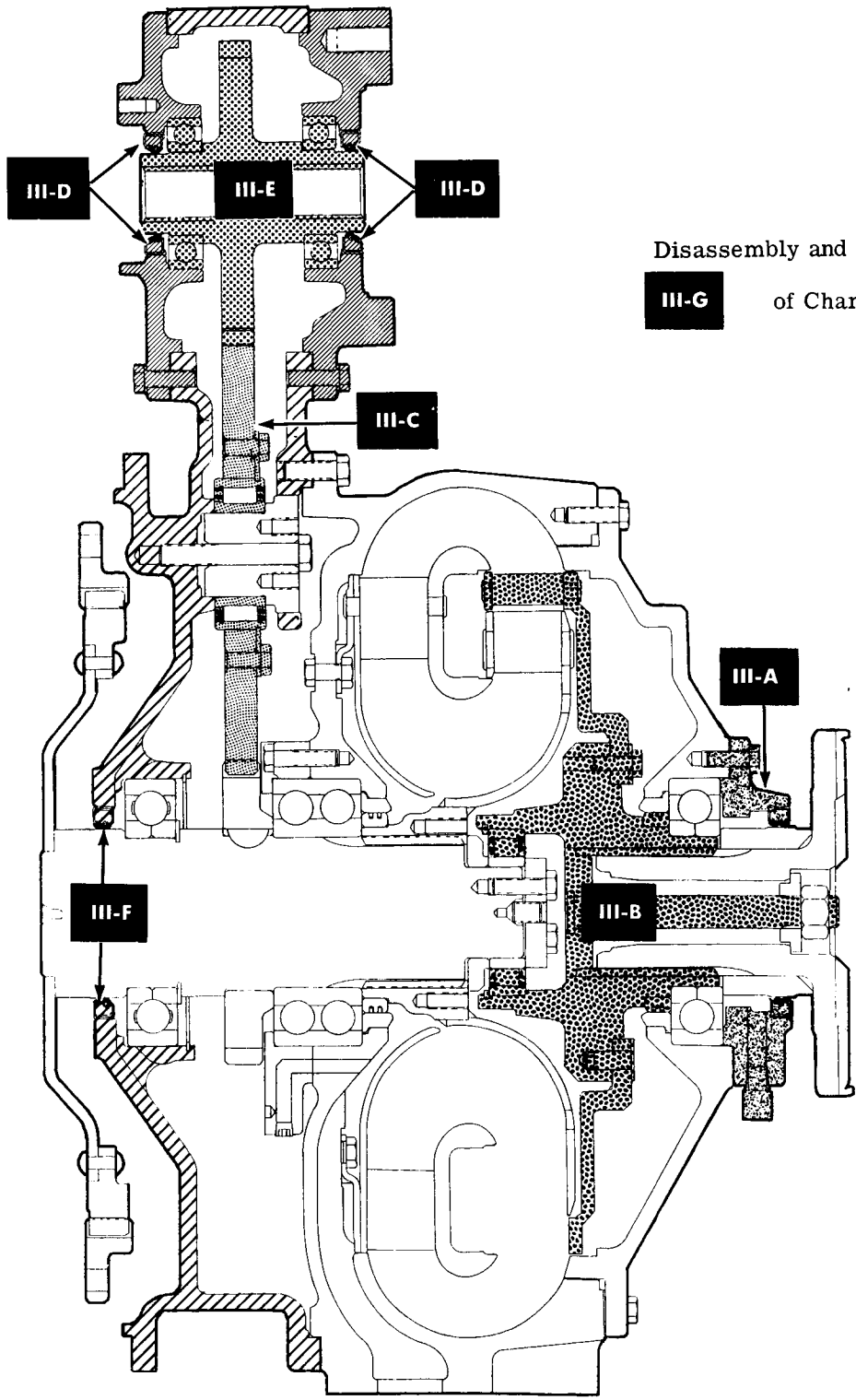
DISASSEMBLY OF CHARGING PUMP

Remove three flat head screws (9). Remove pilot plate (8) with seal (10) and "O" ring (14). Press seal (10) from pilot plate (8). Remove the drive shaft assembly (11). To disassemble, remove the key (4), retainer ring (12) and flat washer (13). Press the ball bearing (7) from the shaft (11). Remove the four Allen screws. Remove two 1/4" capscrews (2) and lockwashers (3). Remove two 5/16" capscrews (15) and washers (16). Remove the body assembly (6), drive gear (5) and idler gear assembly (21). To remove the gear (26) from the idler shaft (25), remove two retaining rings (24), gear (26) and key (20) from the shaft. Remove the gear plate (18) and two dowels (19) from gear plate (18). Remove needle bearings (17-22-27), if worn. Clean all parts thoroughly in mineral spirits. Inspect pump body, gear plate, cover, bearings, gears and shafts for excessive wear and scoring. Replace seal and gasket. Inspect bearings for wear and fatigue.

REASSEMBLY OF CHARGING PUMP

If the bearings are to be replaced, the top needle bearing (27) should be removed and replaced into the cover (1) bore so the bearing (27) is .010 inch below the gear face of the cover. The lower or idler shaft needle bearings (17-22) should be .083 inch below the gear surface of the cover (1) and body assembly (6) to allow clearance for the retaining rings (24) on the idler shaft (25). The ball bearing (7) should not have any end play when assembled into the pump. Install the gear plate (18) with two dowels (19) to the cover assembly (1). Press the key (20) into the idler shaft (25). Install retaining ring (24), idler gear (26) and another retaining ring. Insert shaft assembly into cover assembly (1). Install the drive gear (5) into the gear plate (18). Install the body assembly (6) to the gear plate (18). Install two 1/4" capscrews (2) with two lockwashers (3). Torque to 9 ft. lbs. Install four 5/16" Allen head screws, two 5/16" capscrews (15) and washers (16). Torque to 18 ft. lbs. To assemble the drive shaft, install a retaining ring (12) and a flat washer (13). Press bearing (7) on the shaft (11). Install another flat washer (13) and retaining ring (12). Press the key into shaft (11). Install shaft assembly into body assembly (6) and drive gear (5) on shaft. Line up the key (4) with the gear keyway. Install a new seal (10) and "O" ring in pilot plate (8). The seal (10) must be pressed in flush with the spring, large lip toward the bearing (7). Install the pilot plate (8) to the body assembly. Install three flat head screws (9). Tighten to 9 ft. lbs.

All working parts should be assembled with clean type "A" oil. A gasket (23) is used between this pump and the converter charging pump.



Disassembly and Reassembly

III-G of Charging Pumps

Figure 3-0 Pictorial Index

SECTION III

D-400 TORQUE CONVERTER

TABLE OF CONTENTS

SECTION III DISASSEMBLY OF TORQUE CONVERTER

Preparation — Page III-2
Disassembly — Pages III-3 thru III-8

SECTION III-A REMOVE AND REPLACE SEAL IN SEAL RETAINER

Remove and Replace — Page III-9A

SECTION III-B REMOVE AND REPLACE BEARING IN TURBINE ASSEMBLY

Remove and Replace — Page III-10B

SECTION III-C REMOVE AND REPLACE BEARING IN IDLER GEAR

Remove Bearing — Page III-11C
Replace Bearing — Page III-12C

SECTION III-D REPLACE SEALS IN PUMP MOUNTING PLATES

Replace Seals — Page III-13D

SECTION III-E REMOVE AND REPLACE DRIVEN GEARS & BEARINGS

Remove and Replace — Page III-14E

SECTION III-F REMOVE AND REPLACE SEAL IN FRONT HOUSING

Remove and Replace — Page III-15F

SECTION III-G DISASSEMBLY AND REASSEMBLY OF CHARGING PUMP

Disassembly and Reassembly — Page III-16G

SECTION III REASSEMBLY OF TORQUE CONVERTER

Preparation — Page III-17
Reassembly — Pages III-18 thru III-22

PICTORIAL INDEX — Page III-1

SECTION III

PREPARATION FOR DISASSEMBLY

OF

D400 TORQUE CONVERTER

In preparation for disassembly of the D-400 torque converter, the following should be done:

A. Disconnect all external lines from the housing.

B. Using plain steam (no caustic soda), clean the outside of the converter housing thoroughly.

C. Prepare a dirt-free area at least 12 feet square.

D. A hoist should be available to aid in lifting.

E. Gathering the following:

1. Low table or bench for disassembly use.
2. Shop press.
3. Solvent for cleaning parts.
4. Standard set of mechanic's hand tools - Including:
   a. Snap ring pliers
   b. 250 ft. lb. torque wrench
   c. Mallet (perferable plastic)
   f. Pans for holding small parts and oil during disassembly
   g. Gear puller

DISASSEMBLY of Torque Converter

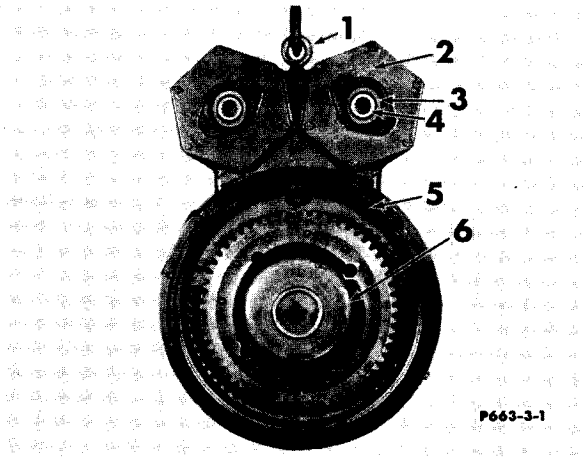


Figure 3-1

Complete Converter.

1. Eye Bolt
2. Pump Mounting Plate
3. Seal
4. Driven Gear
5. Front Housing
6. Input Shaft Assembly

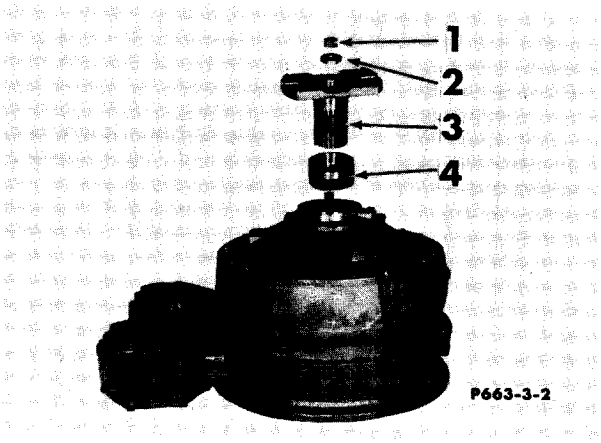


Figure 3-2

Lay the converter on the input gear. Remove nut (1) clamp plate (2), remove the yoke (3) and yoke spacer (4).

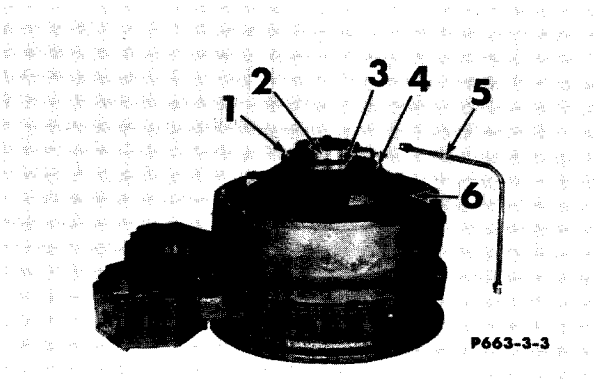


Figure 3-3

Remove six capscrews (4). Remove the bearing retainer (1) and gasket (3). Use jack screws (2) to assist you in removing retainer (1) from end plate (6). Remove the oil tube (5) from the converter. For further disassembly of retainer, see Section III-A, Page III-9A

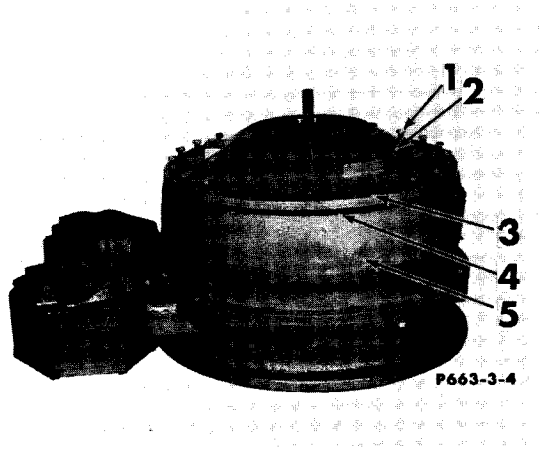


Figure 3-4

Remove twenty-four capscrews (1) from the end plate assembly (2). Use jack screws in the jack screw holes (3) to remove the end plate assembly (2) from converter assembly (5). Remove ring gasket (4).

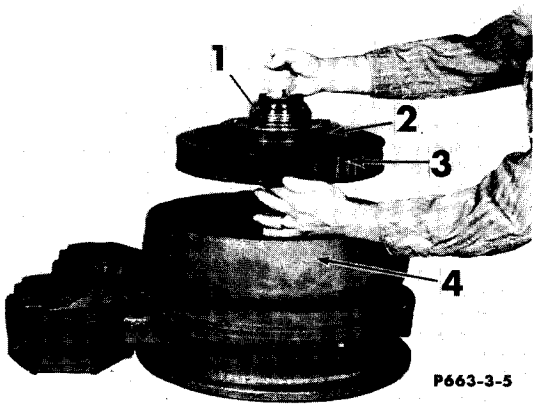


Figure 3-5

Remove turbine (3) with output flange (2) from the housing assembly (4). To remove the piston rings (1) from the piston ring carrier and to remove the bearing on other side of the turbine, see Section III-B, Page III-10B

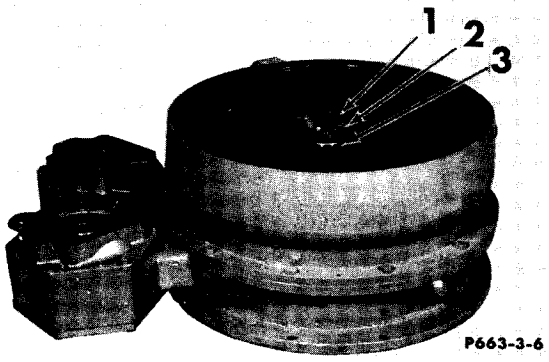


Figure 3-6

Remove three capscrews (1) from end of the input shaft (3). Remove retainer washer (2). Loosen set screw in center of the retainer washer (2).

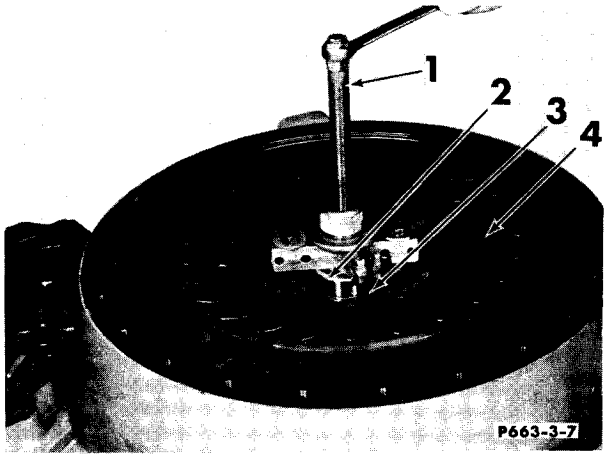


Figure 3-7

Remove bearing spacer (3) with the bearing race (2) from the input shaft with a puller (1). The puller will pull the impeller wheel assembly (4).

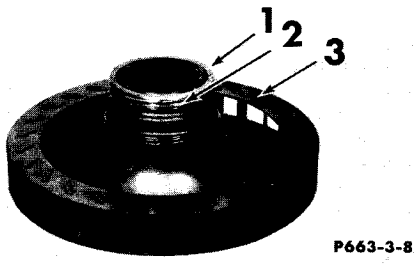


Figure 3-8

Remove the piston rings (2) from the piston ring carrier (1) mounted on the impeller wheel assembly (3).

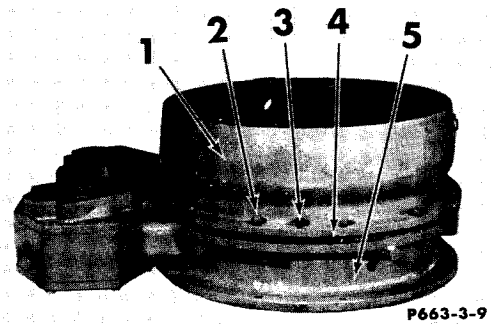


Figure 3-9

Remove twelve capscrews (2) with the help of the jack screws (3). Remove the converter housing assembly (1) from the front housing (5). Remove and discard gasket (4).

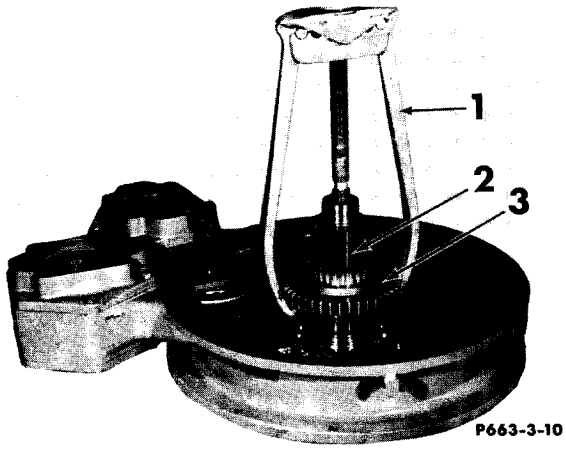


Figure 3-10

Remove the driving gear (3) from input shaft (2) with a hydraulic or a good puller (1).

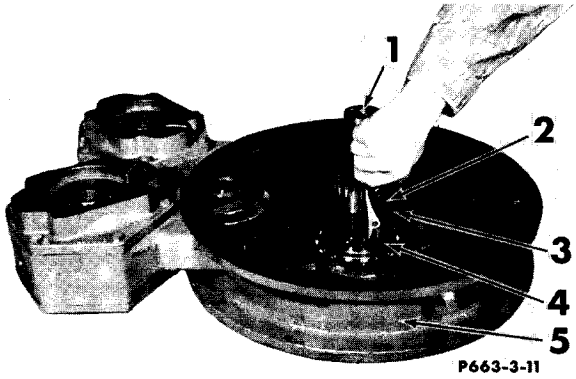


Figure 3-11

Remove the key (3) from the input shaft (1). Remove snap ring (4) with snap ring pliers (2) from the input shaft (1) to remove shaft from the front housing (5).

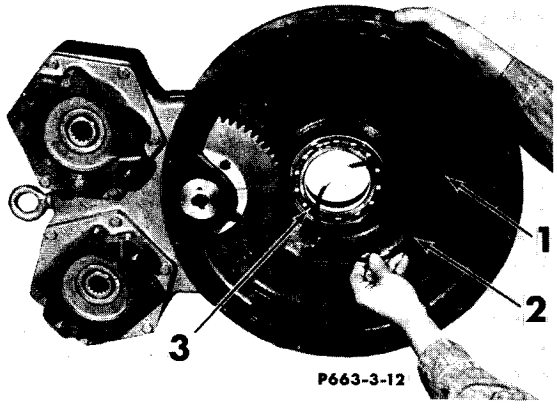


Figure 3-12

Drive or press input shaft out of the bearing (3) in the front housing (1). Remove the snap ring (2) and bearing (3).

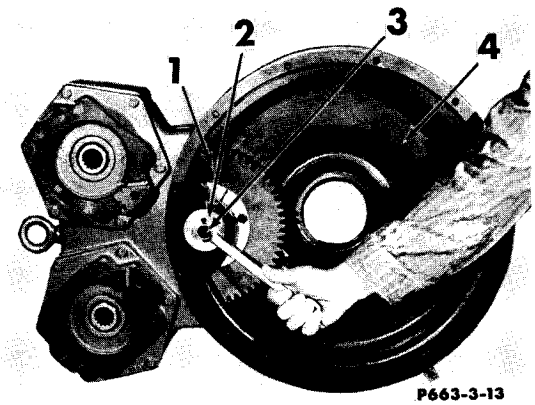


Figure 3-13

Remove one capscrew (3) from idler shaft (2) before removing idler gear (1) from housing (4).

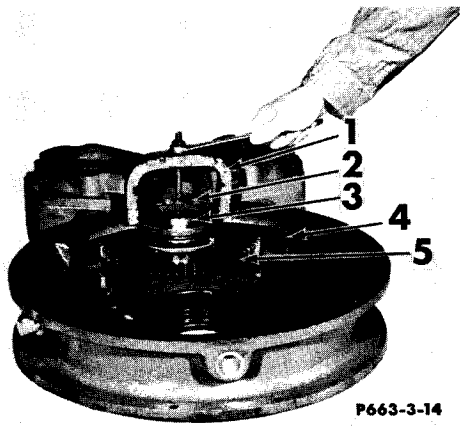


Figure 3-14

Place a puller (1) on idler shaft (3). Fasten it to shaft with two capscrews (2). Tighten nut on puller to pull shaft. Remove shaft (3) and gear (5) from front housing (4).

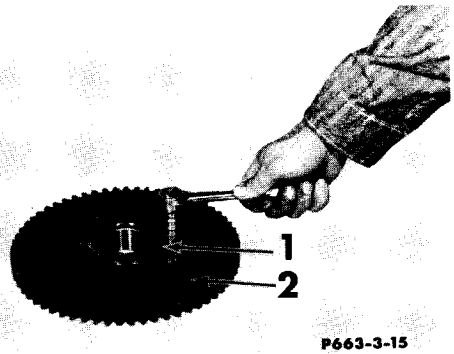


Figure 3-15

To remove bearing (1) from idler gear (2), see Section III-C, Page III-11C

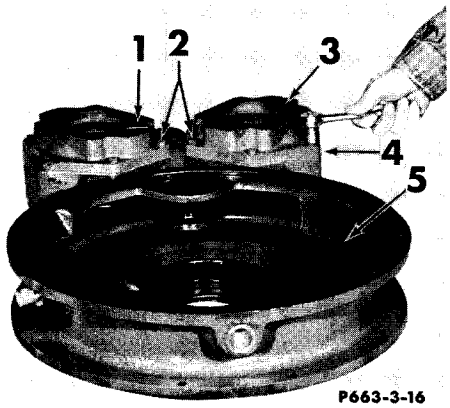


Figure 3-16

Remove the capscrews (2) from the pump mounting plates (1 & 3). There are two copper washers on two capscrews on each plate to prevent oil from seeping through threads. Remove pump mounting plates (1 & 3) and gaskets (4) from input housing (5). Remove gears and bearings.

To replace seals in covers, see Section III-D, Page III-13D

To replace gears or bearings, see Section III-E, Page III-14E

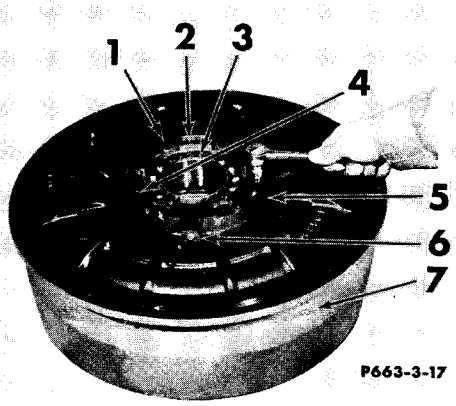


Figure 3-17

Remove capscrews (1) from bearing retainer (2). Remove bearing retainer (2) and gasket (5). Use capscrews as jack screws in threaded holes (4). Remove plug (6), clean oil passage and replace plug. Bearing (3) can be removed and replaced in housing (7).

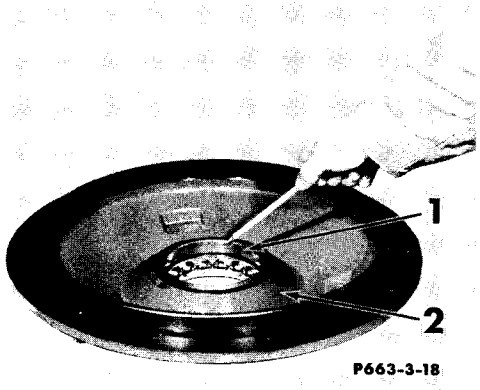
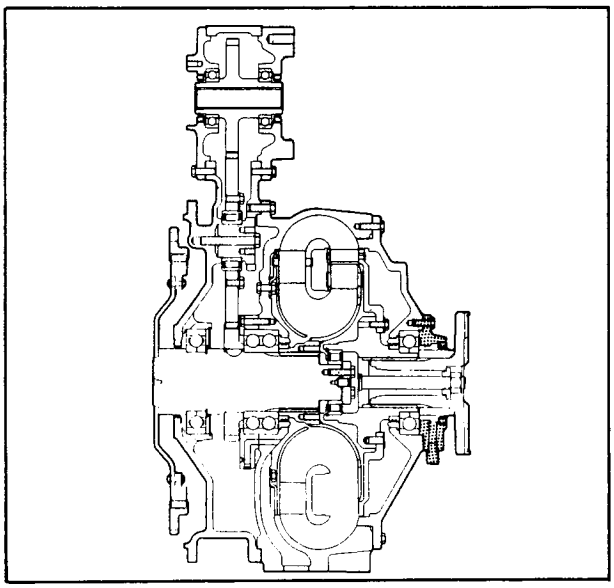


Figure 3-18

Check oil ring race (1) in end plate (2).



SECTION III-A

REMOVE AND REPLACE SEAL IN SEAL RETAINER

REMOVE & REPLACE Seal in Seal Retainer

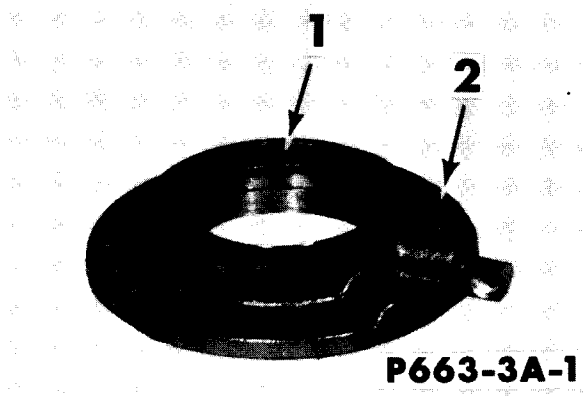


Figure 3A-1

Remove seal (1) from retainer (2). Seal can be driven out or pressed out of retainer.

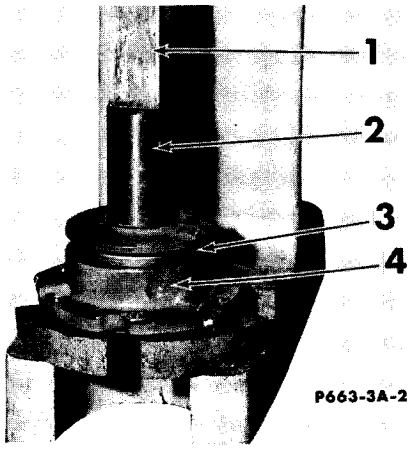
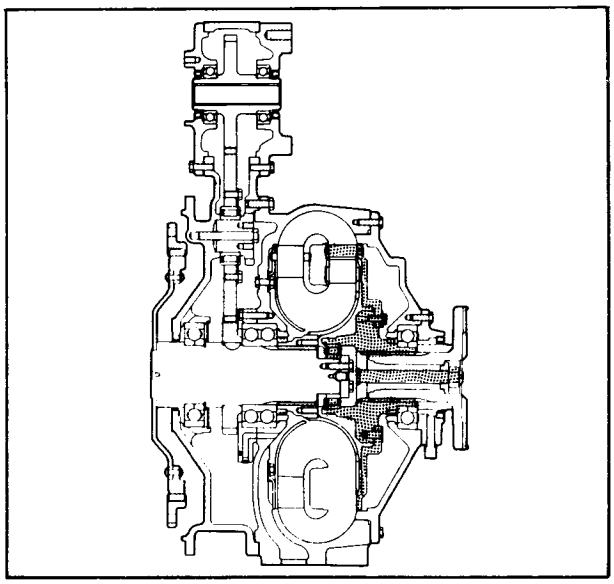


Figure 3A-2

Place seal retainer (4) in arbor press (1). Coat O. D. of seal (3) with Mar-Seal or a comparable sealant. Press seal (3) into retainer with lip down or toward bearing. Use a press attachment (2) and arbor press to press seal flush with face of retainer.



REMOVE & REPLACE Bearing in Turbine Assembly

SECTION III-B

REMOVE AND REPLACE BEARING IN TURBINE ASSEMBLY

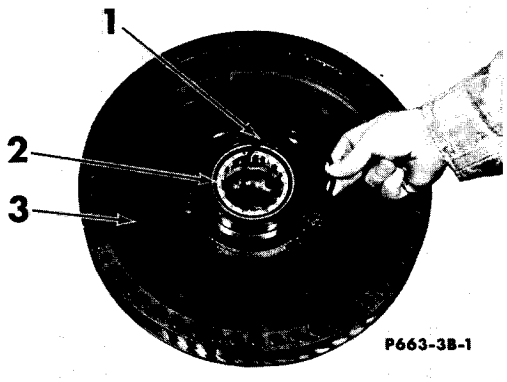


Figure 3B-1

To disassemble the turbine wheel (3), remove the snap ring (1) and remove the bearing (2).

Replace bearing (2) and snap ring (1).

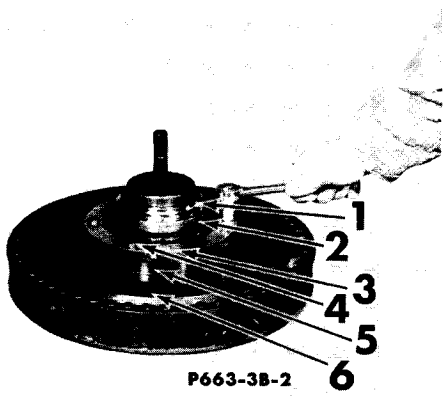


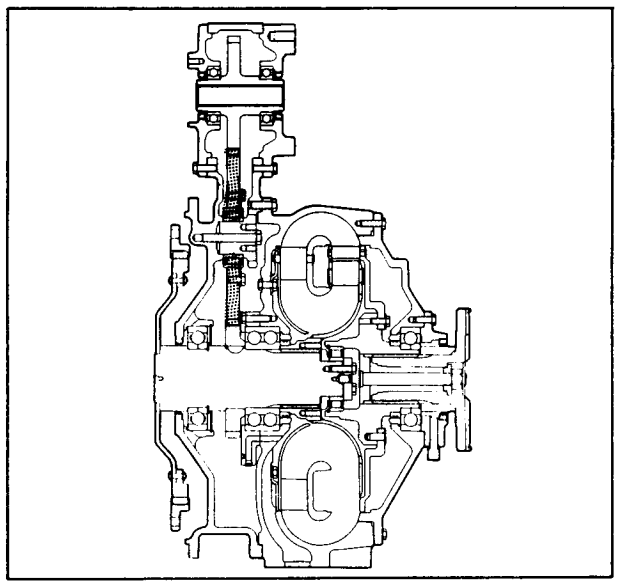
Figure 3B-2

Check bearing race (1). If worn, replace race. Remove piston rings (2) from the piston ring carrier. Check carrier before installing piston rings (2). Grooves must be clean and not damaged.

Install piston rings with ends of rings hooked and 180° apart.

The flange (5) can be removed from turbine wheel (6). Remove six capscrews (4), retainer washer (3) and remove flange from dowel pins by using two capscrews in turbine wheel as jack screws.

Assemble flange (5) to turbine wheel (6). It can only be assembled one way. Six dowels are installed into the flange (5). One dowel is not equally spaced with others. Install retainer washer (3) and six capscrews (4). Torque to 37 ft. lbs.



REMOVE Bearing in Idler Gear

SECTION III-C

REMOVE AND REPLACE BEARING IN IDLER GEAR

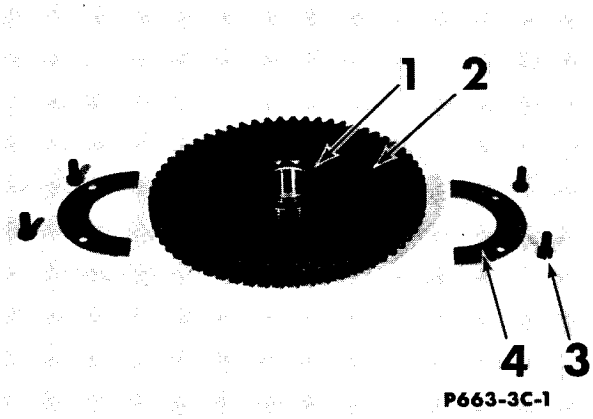


Figure 3C-1

To remove the idler shaft bearing (1), remove four capscrews (3) and bearing split washer (4) from gear (2).

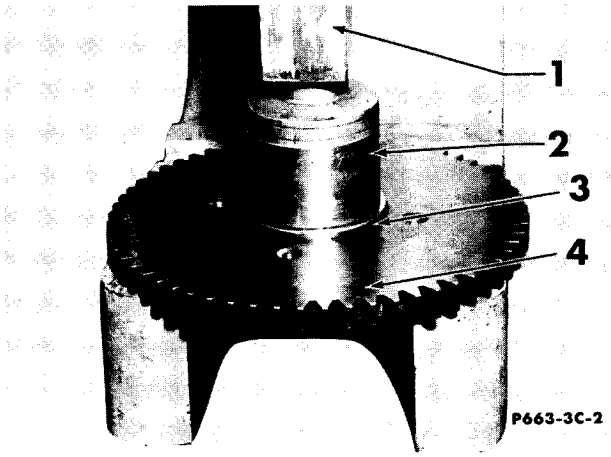


Figure 3C-2

Place idler gear (4) in press (1). Use press attachment (2) over outer bearing race (3). Press bearing (3) out of gear (4).

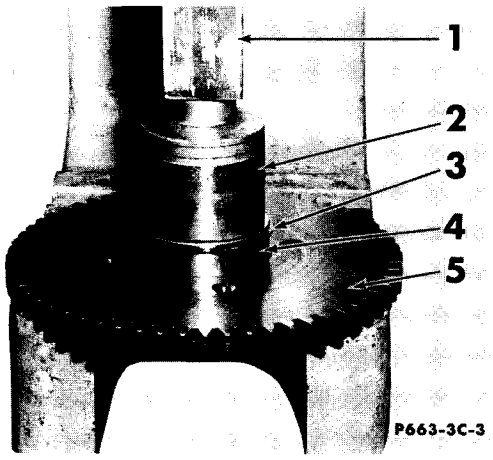


Figure 3C-3

To replace bearing (4), install a snap ring (3) on bearing (4). Place gear (5) into press (1). Install bearing in gear (5) with press attachment (2) on outer race of the bearing. Press bearing down into gear to the snap ring (3). Remove snap ring (3). The split washer can be used in place of the snap ring for assembly in press. Do not press bearing (4) down in the gear (5) too far with the split washers in place. The split washer halves may get bent and not locate bearing properly. Snap ring (3) must be removed when used as a guide on the bearing (4).

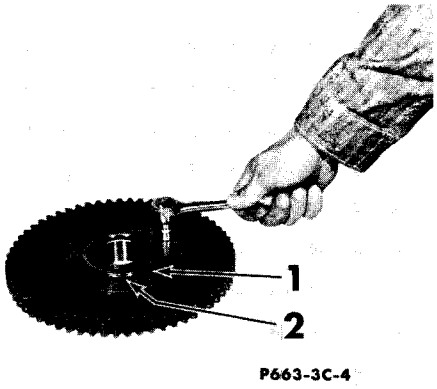
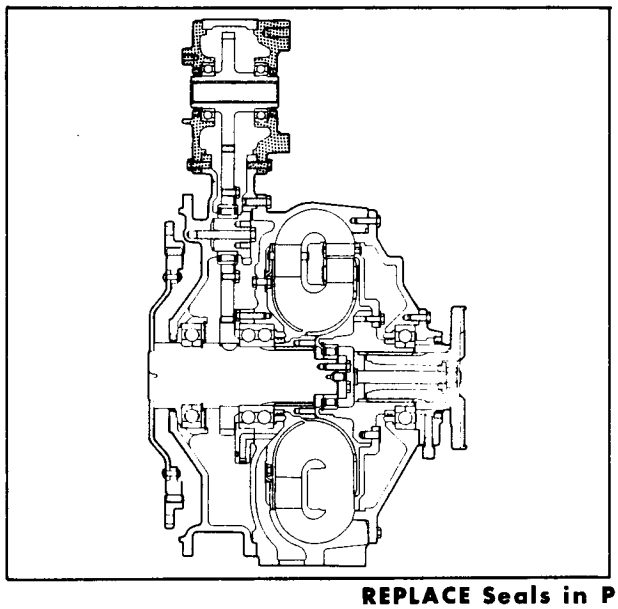


Figure 3C-4

Install split washers (2) and four capscrews (1). Torque to 37 ft. lbs.



REPLACE Seals in Pump Mounting Plates

SECTION III-D

REPLACE SEALS IN PUMP MOUNTING PLATES

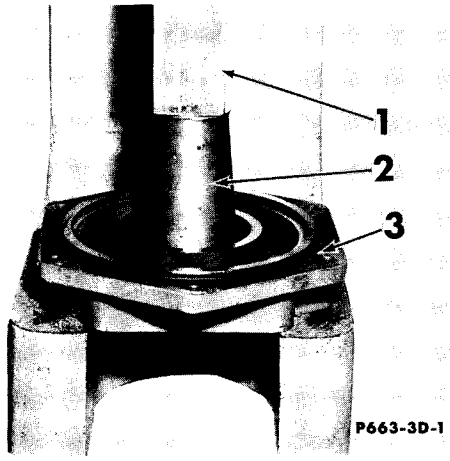


Figure 3D-1

Press seal out of cover (3) with press attachment (2) in arbor press (1).

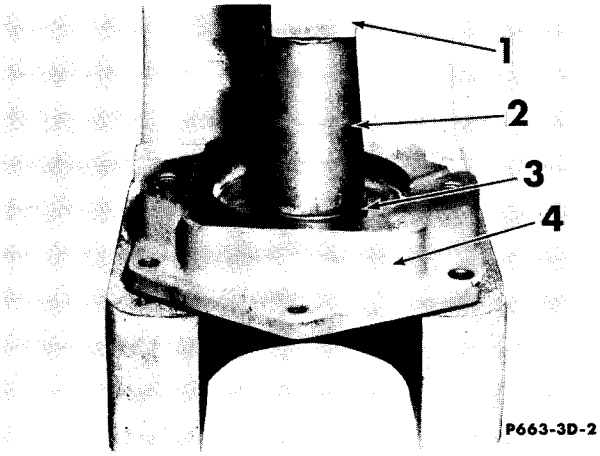
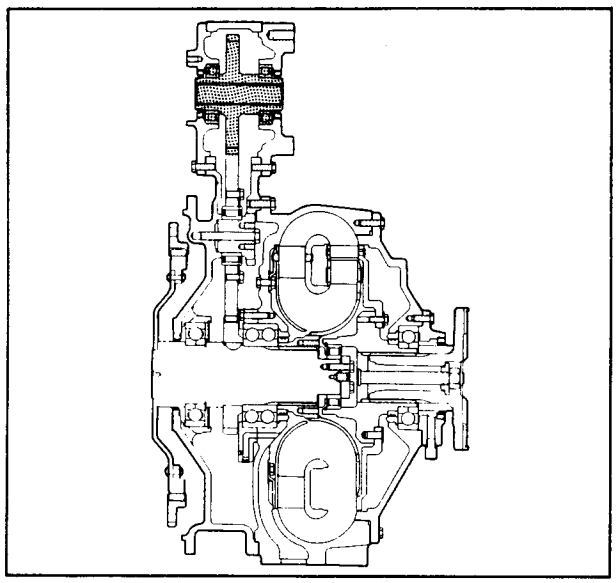


Figure 3D-2

Coat O. D. of seal (3) with Mar-Seal or a comparable sealant. Press seal (3) into cover (4) with the lip down or toward bearings. Use a press attachment (2) and arbor press (1) to press seal flush with face of cover.



SECTION III-E

REMOVE AND REPLACE DRIVEN GEARS & BEARINGS

REMOVE & REPLACE Driven Gears & Bearings

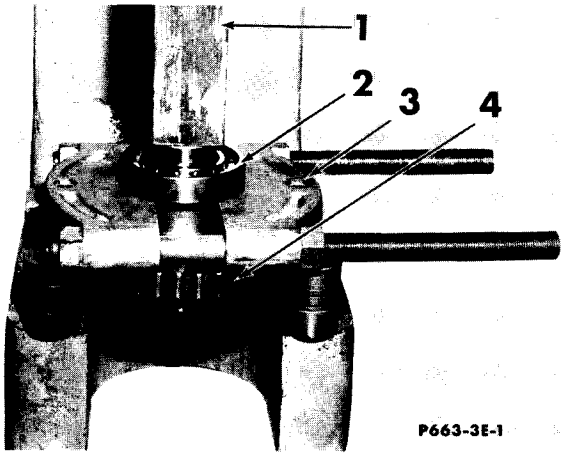


Figure 3E-1

Install puller attachment (3) onto the gear (4). Blockup in press (1) and press bearing (2) from gear (4).

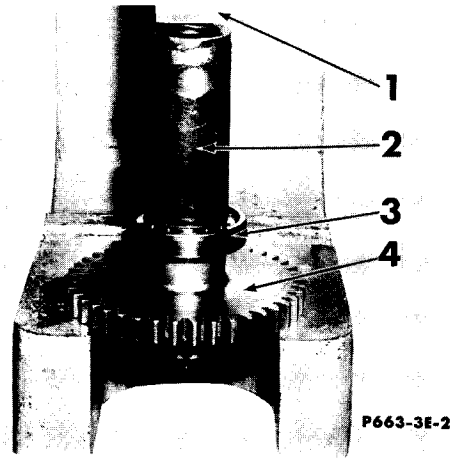
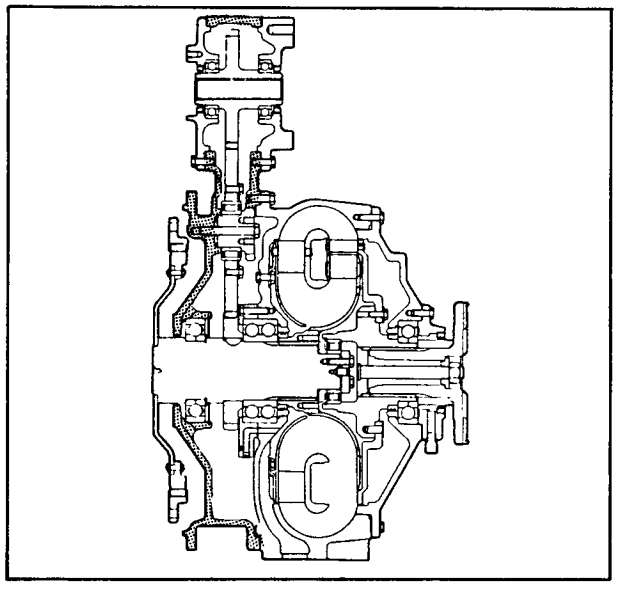


Figure 3E-2

Install gear (4) into press (1). Install bearing (3) with press attachment (2). Press on inner race of bearing down to shoulder on gear (4).



SECTION III-F

REMOVE AND REPLACE SEAL IN FRONT HOUSING

REMOVE & REPLACE Seal in Front Housing

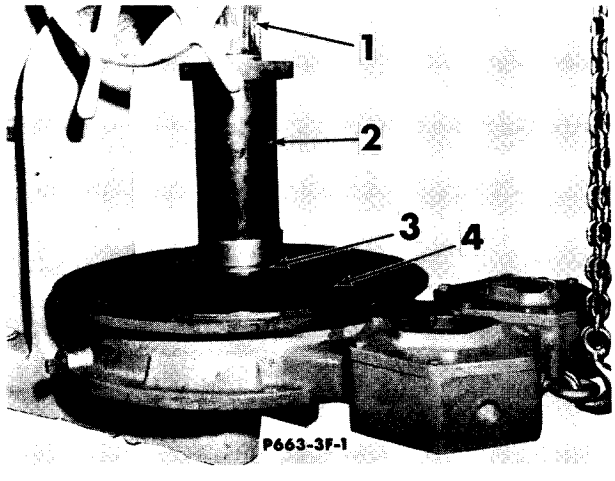


Figure 3F-1

Place input housing (4) into arbor press (1). Coat O. D. of seal (3) with Mar-Seal or a comparable sealant. Place seal into bore of housing using the press attachment (2). Press seal (3) flush with face of housing.

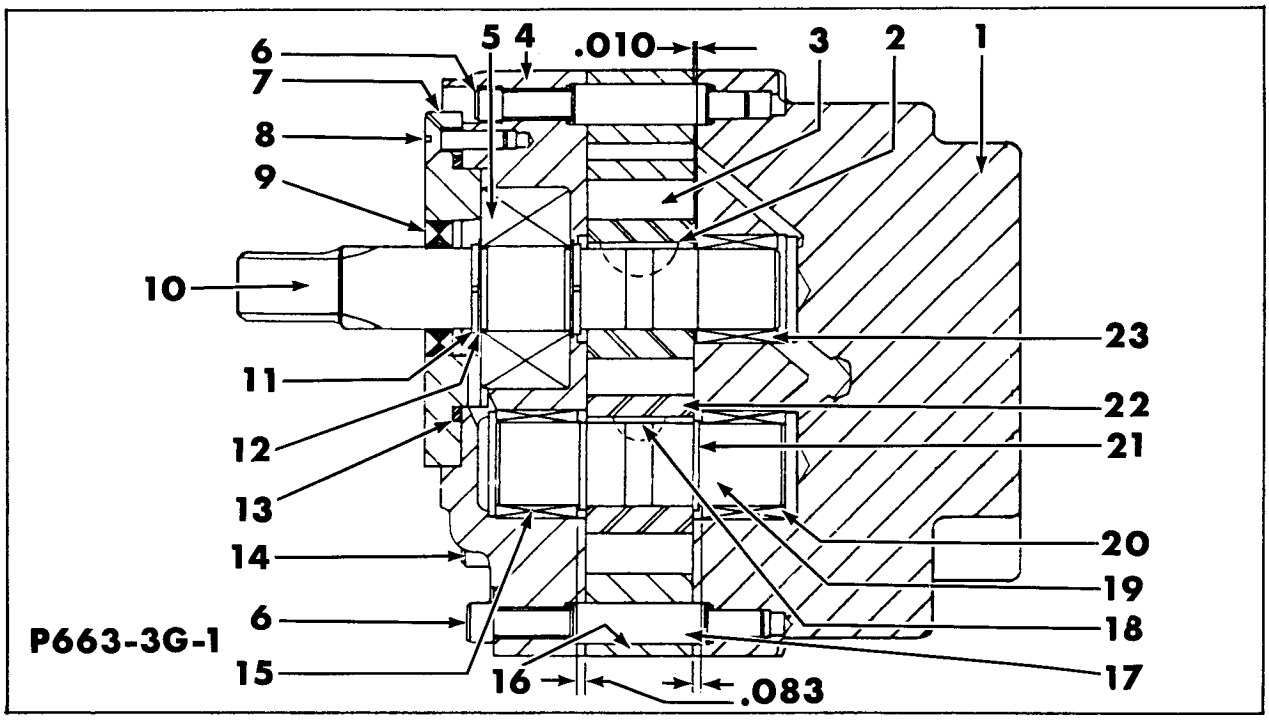


Figure 3G-1

DISASSEMBLY OF CHARGING PUMP

Remove three flat head screws (8). Remove pilot plate (7) with seal (9) and "O" ring (13). Press seal (9) from pilot plate (7). Remove the drive shaft assembly (10). To disassemble, remove the key (2), retainer ring (11) and flat washer (12). Press the ball bearing (5) from the shaft (10). Remove the six 5/16" Allen screws (14). Remove two 1/4" Allen screws (6). Remove the body assembly (4), drive gear (3) and idler gear assembly (19).

To remove the gear (22) from the idler shaft (19), remove two retaining rings (21), gear (22) and key (18) from the shaft. Remove the gear plate (16) and two dowels (17) from gear plate (16). Remove needle bearings (15, 20 & 23), if worn. Clean all parts thoroughly in mineral spirits. Inspect pump body, gear plate, cover, bearings, gears, and shafts for excessive wear and scoring. Replace seal and "O" ring and gasket. Inspect bearings for wear and fatigue.

REASSEMBLY OF CHARGING PUMP

If the bearings are to be replaced, the top needle bearing (23) should be removed and replaced into the cover (1) bore so the bearing (23) is .010 inch below the gear face of the cover. The lower or idler shaft needle bearings (15 & 20) should be .083 inch below the gear surface of the cover (1) and body assembly (4) to allow clearance for the retaining rings (21) on the idler shaft (19). The ball bearing (5) should not have any end play when assembled into the pump.

Install the gear plate (16) with the two dowels (17) to cover assembly (1). Press the key (18) into the idler shaft (19). Install retaining ring (21), idler gear (22) and another retaining ring. Insert shaft assembly into cover assembly (1). Install the drive gear (3) into gear plate (16). Install the body assembly (4) to the gear plate (16). Install two 1/4" capscrews (6). Torque to 9 ft. lbs. Install six 5/16" Allen head screws (14). Torque to 18 ft. lbs.

To assemble the drive shaft, install a retaining ring (11) and a flat washer (12). Press bearing (5) on the shaft (10). Install another flat washer (12) and retaining ring (11). Press the key into shaft (10). Install shaft assembly into body assembly (4) and drive gear (3) on shaft. Line up the key (2) with the gear keyway.

Install a new seal (9) and "O" ring in pilot plate (7). The seal (9) must be pressed in flush with the spring, large lip toward the bearing (5). Install the pilot plate (7) to the body assembly. Install three flat head screws (8). Tighten to 9 ft. lbs.

All working parts should be assembled with clean type "A" oil.

PREPARATION FOR REASSEMBLY

OF

D400 TORQUE CONVERTER

In preparation for reassembly of the converter, the following should be done:

A. Clean all parts thoroughly in solvent. Use compressed air to dry parts. Carefully inspect all parts for excessive wear, cracks and/or breakage.

B. Inspect all bearings for pits and spalled areas. Replace bearings which are pitted and/or spalled.

C. Inspect splines on all shafts for excessive wear.

D. Inspect all sealing surfaces for wear and/or grooving.

E. Replace all seals, hook type seal rings, gaskets, "O" rings and snap rings.

F. In assembly, use a heavy non-fibrous grease with a low melting point.

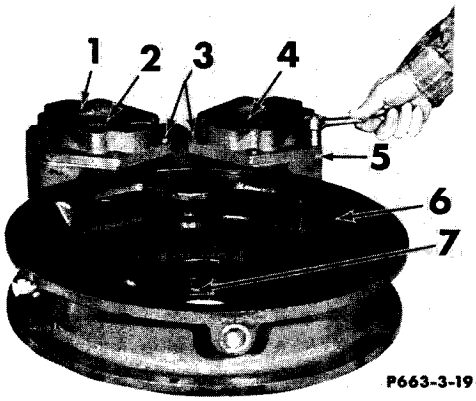


Figure 3-19

After the seals (4) have been installed into four P. T. O. covers (1) and oil seal (7) has been installed into front housing (6), use a non-fibrous grease on seal lips. Install two covers (1) with gaskets (5) on lower side of front housing. Install gear assemblies (2). The short end of gear assembly should be toward input gear and shaft assembly. Install other two covers (1) and gaskets (5). Use two copper washers on each cover on lower center capscrews (3). Install capscrews and torque to 32 ft. lbs.

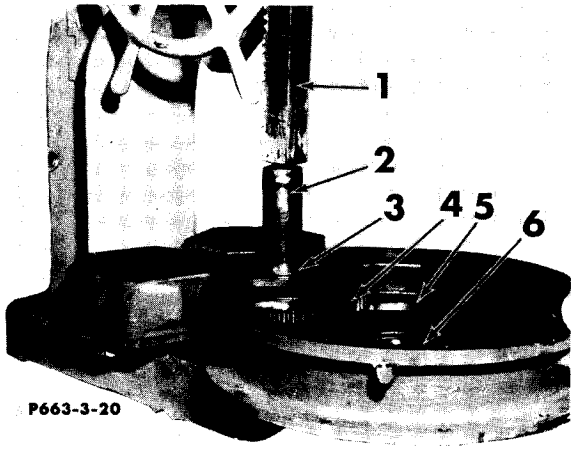


Figure 3-20

Install idler gear (4) into front housing (5). The idler gear (4) and shaft (3) can be pressed into front housing when the seal is installed. Place front housing (5) in press (1) using press attachment (2) on idler shaft (3). Press shaft to the bottom of housing bore.

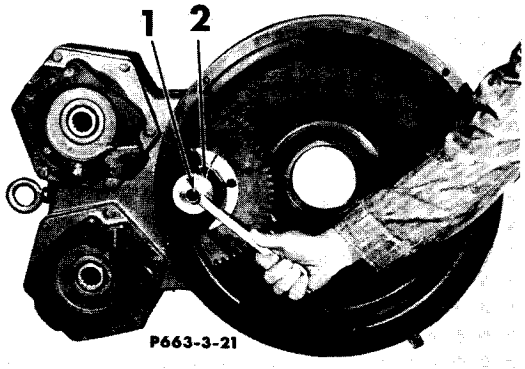


Figure 3-21

Install capscrew (1) in idler shaft (2). Torque to 90 ft. lbs.

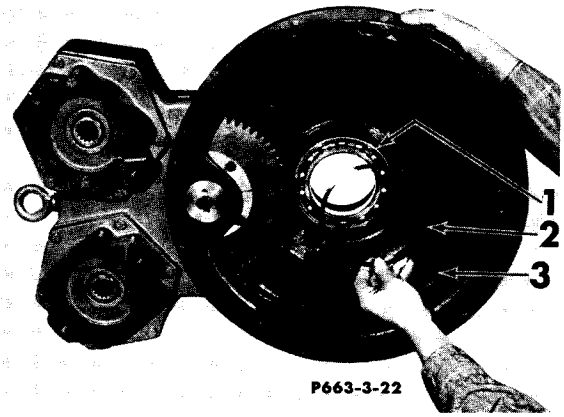


Figure 3-22

Install bearing (1) into front housing (3). Install snap ring (2) into groove in housing. The snap ring is used to hold the bearing in bore during assembly.

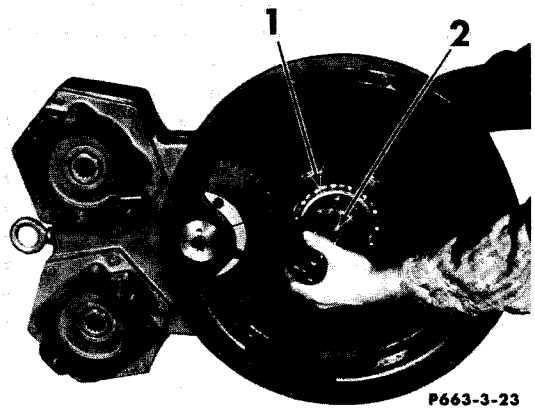


Figure 3-23

Install input shaft (2) into bearing (1). Tap shaft through bearing, hold shaft straight so it does not bind in bearing (1).

Figure 3-24

Install snap ring (4) in shaft groove with snap ring pliers (2) to hold bearing to shaft. Install woodruff key (3) in shaft (1). Secure key in groove so key will not come out when gear is put on shaft (1).

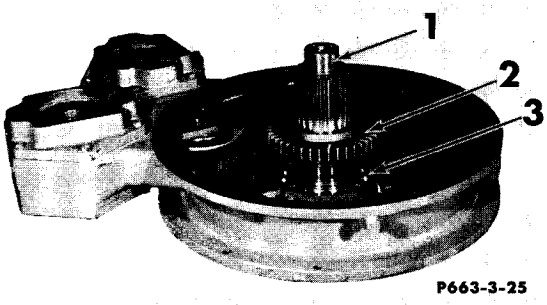


Figure 3-25

Before installing driving gear (2), heat gear in oil or in oven to 250 to 300° F. and drop over key to the shoulder on shaft (1). The gear (2) must be installed with flat side of gear toward housing bearing (3).

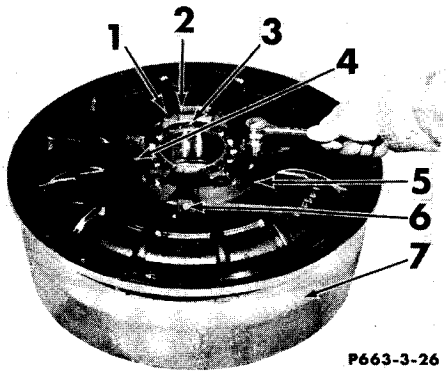


Figure 3-26

If the bearing is to be replaced, remove capscrews (1) from bearing retainer (2). Remove bearing retainer (2) and gasket (5). Use capscrews as jack screws in threaded holes (4). Remove plug (6), clean oil passages and replace plug. Bearing (3) can be removed and replaced in housing (7).

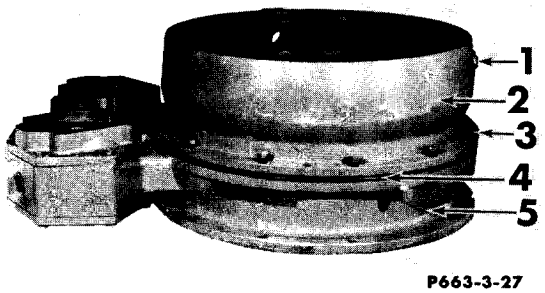


Figure 3-27

Install converter housing (2) with gasket (4) on to front housing (5) with the drain plug (1) to the bottom of the front housing (5). Install the twelve capscrews (3). Torque to 32 ft. lbs.

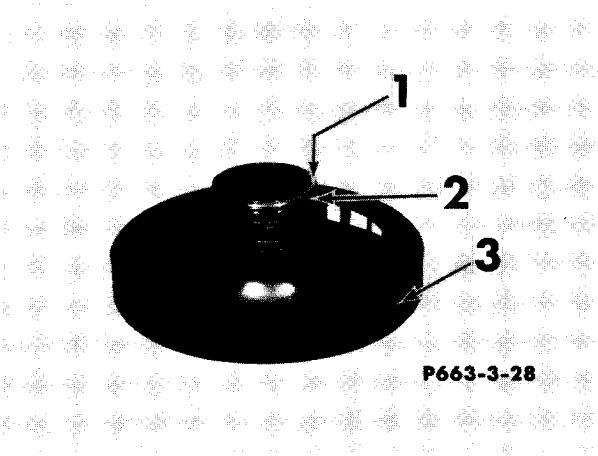


Figure 3-28

Install new piston rings (2) in the grooves of the piston ring carrier (1) on impeller wheel assembly (3).

Line up piston rings, the ends of the rings should be about 180° apart. Be sure rings are not broken or unhooked while assembling. Use a non-fibrous grease to hold the rings in place while assembling.

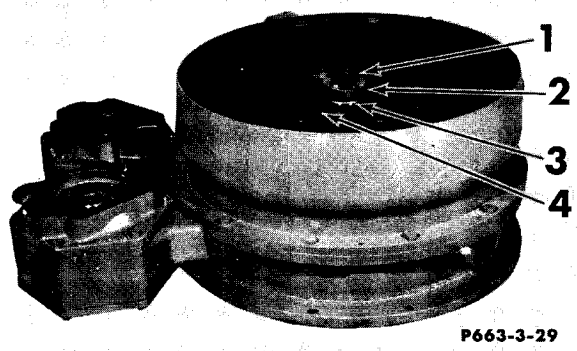


Figure 3-29

Install the impeller wheel assembly (4). Install bearing spacer, bearing inner race (3). Install retainer washer (2) with a setscrew in the center. Back setscrew out part way. Install three 3/8" capscrews (1). Torque to 38 ft. lbs. Release torque to 10 ft. lbs. Torque center screw to 10 ft. lbs., retorque 3/8" capscrews to 38 ft. lbs. DO NOT RESET CENTER SETSCREW. Stake threads behind setscrew.

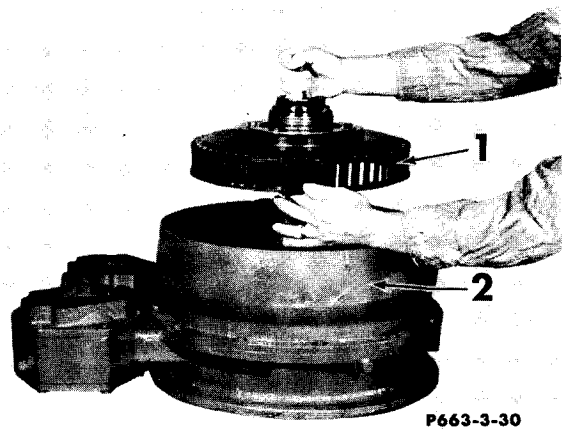


Figure 3-30

Install turbine wheel final assembly (1) into the converter housing (2).

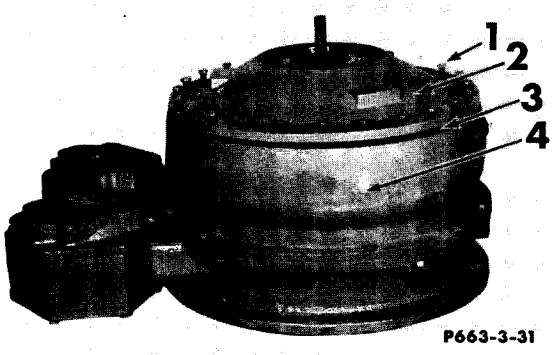


Figure 3-31

Install ring gasket (3) on end plate assembly (2). Put a small amount of non-fibrous grease on the recess on the converter housing (4) to keep the ring gasket from turning while end plate is assembled. End plate has TOP marked on casting. Install twenty-four capscrews (1) in end plate assembly (2). Torque to 32 ft. lbs.

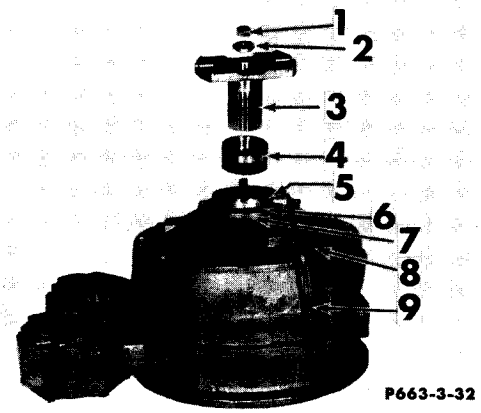


Figure 3-32

Install gasket (7), seal retainer (5) and capscrews (6) to end plate (8). Torque to 32 ft. lbs. Seal retainer tubing fitting should be toward the bottom of the converter. The seal retainer is marked TOP on the casting. Install yoke spacer (4), yoke (3), clamp plate (2) and nut (1). Torque nut to 225 ft. lbs. Install tube (9) from rear bearing retainer to gear housing.

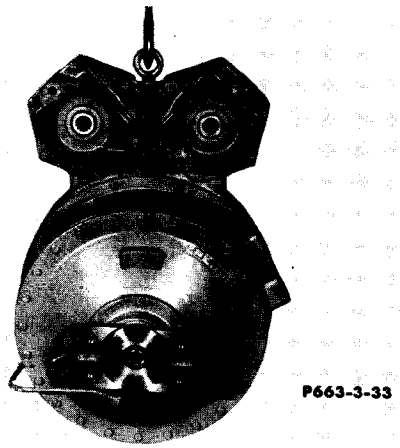
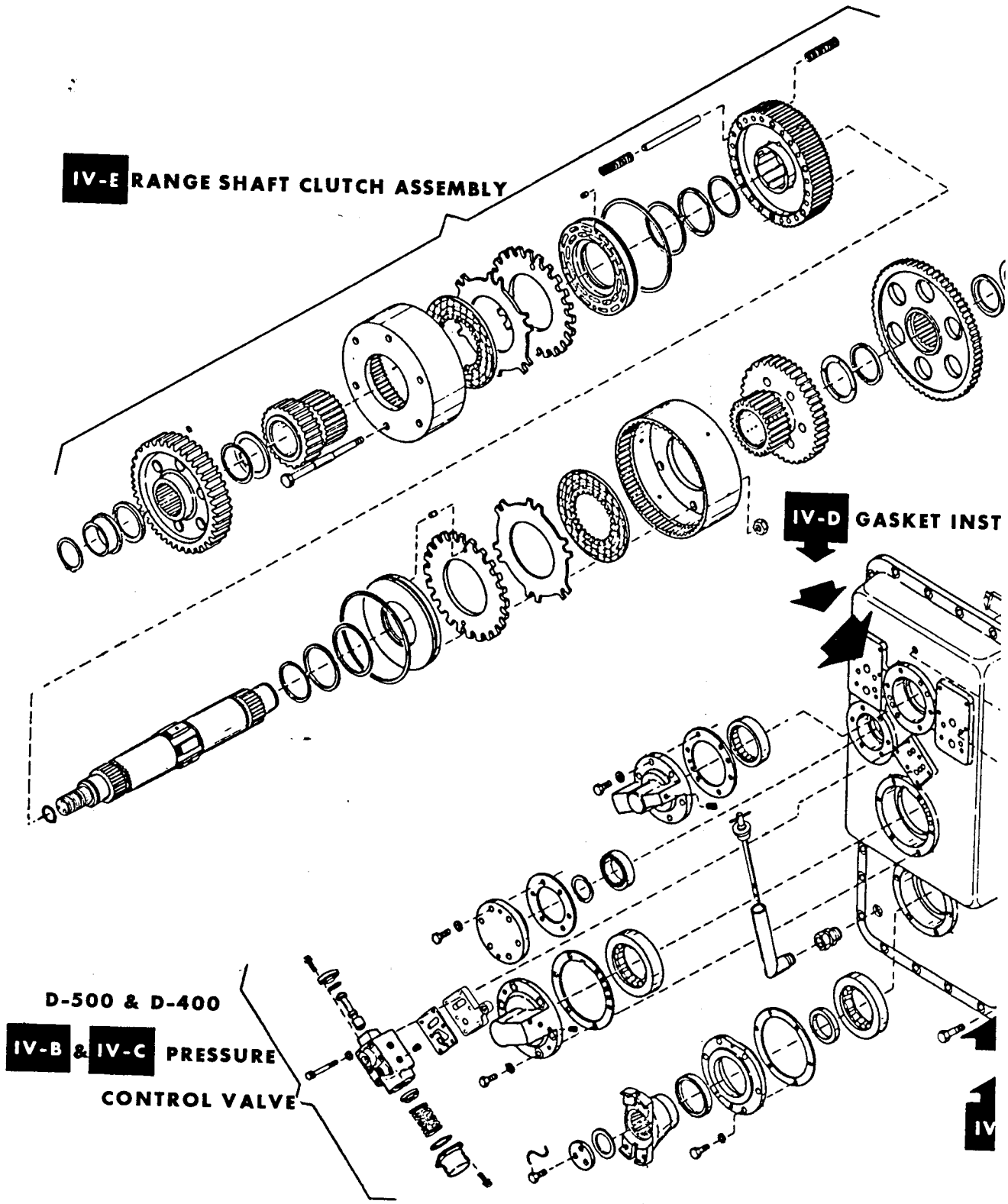


Figure 3-33

Completed converter. Close all openings on converter until it is installed into the machine.


IV-E RANGE SHAFT CLUTCH ASSEMBLY
IV-D GASKET INST
D-500 & D-400
IV-B & IV-C PRESSURE
CONTROL VALVE

P-6000 TRANSMISSION ASSEMBLY

PICTORIAL INDEX

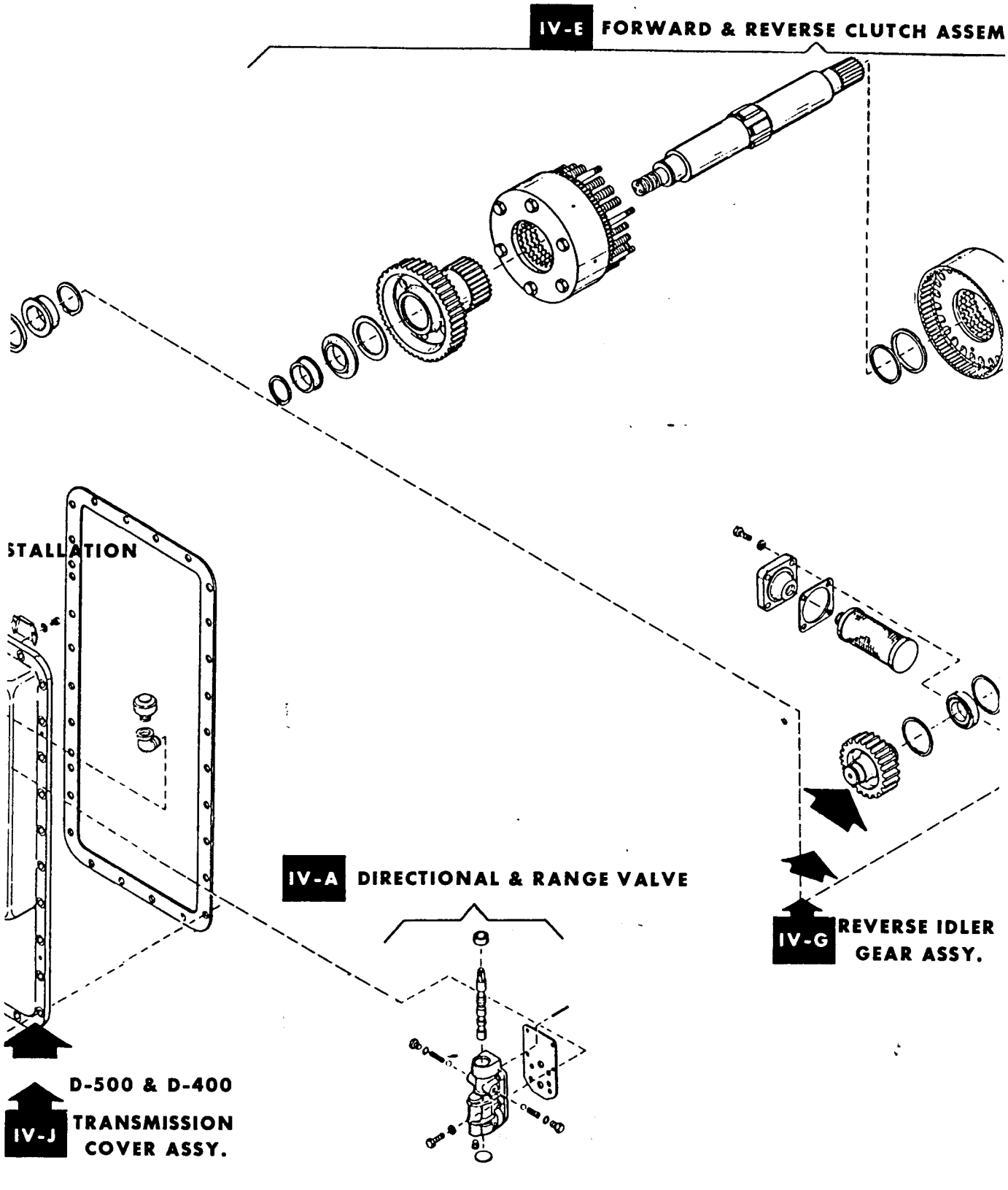
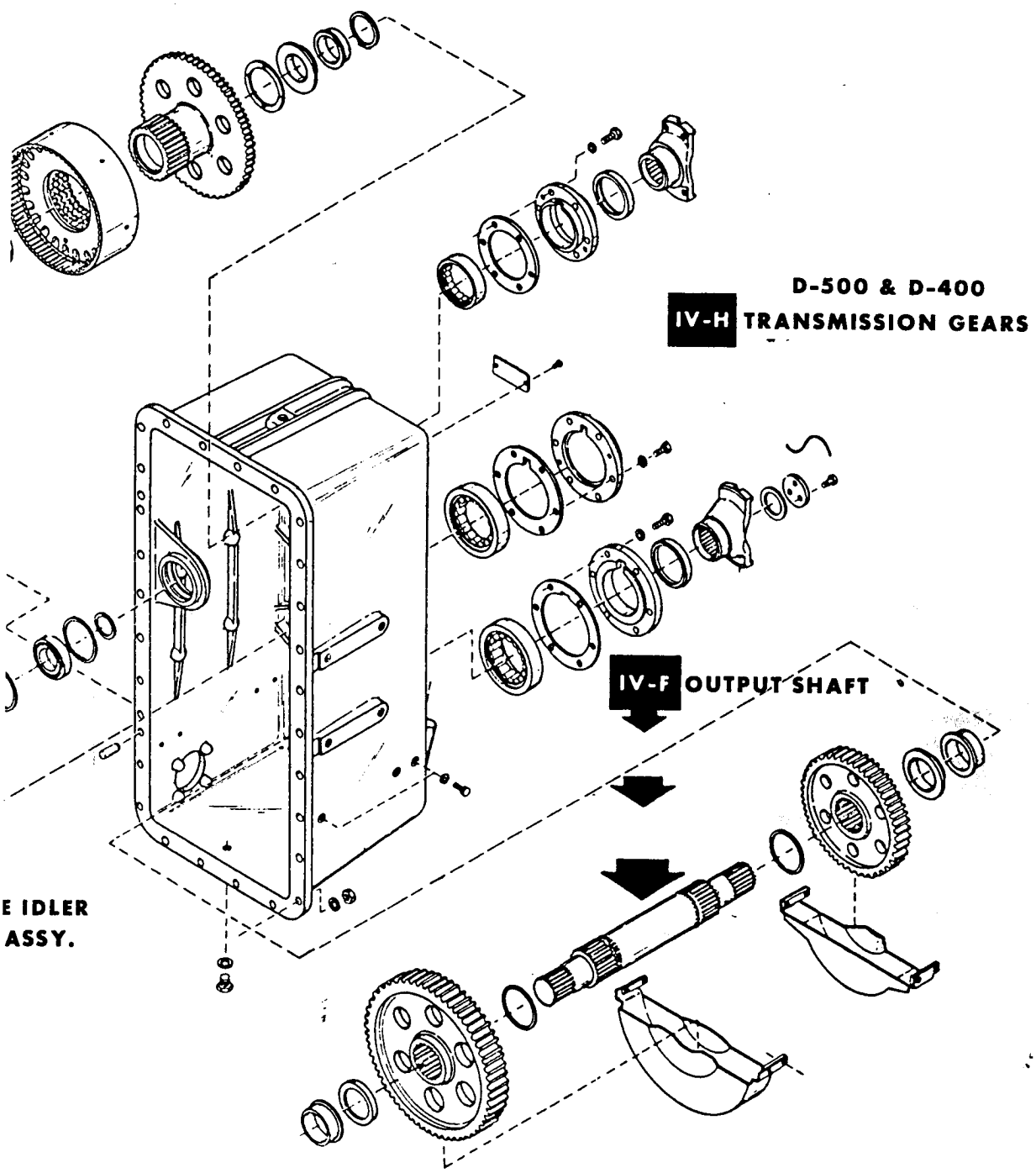


Figure 4-0 Pictorial Index


D-500 & D-400
IV-H TRANSMISSION GEARS
IV-F OUTPUT SHAFT
E IDLER
ASSY.

P663-4-0

SECTION IV

P-6000 TRANSMISSION
D-400 AND D-500

TABLE OF CONTENTS

SECTION IV DISASSEMBLY OF THE P-6000 TRANSMISSION

Preparation — Page IV-1
Special Tools — Pages IV-2 thru IV-7
Disassembly — Pages IV-8 thru IV-13

SECTION IV-A RANGE & DIRECTIONAL SELECTOR VALVE

Disassembly & Reassembly — Page IV-14A

SECTION IV-B D-500 MAIN REGULATOR VALVE BODY

Disassembly & Reassembly — Page IV-15B

SECTION IV-C D-400 CONTROL VALVE

Disassembly & Reassembly — Page IV-17C

SECTION IV-D GASKET INSTALLATION FOR TRANSMISSION COVER

D-500 Installation — Page IV-19D
D-400 Installation — Page IV-21D

SECTION IV-E DISASSEMBLY & REASSEMBLY OF ALL CLUTCH PACKS

Disassembly — Pages IV-22E thru IV-28E
Piston & Ring Assembly — Page IV-28E
Clutch Stacking Procedure — Page IV-31E
Preparation for Reassembly — Page IV-32E
Reassembly — Pages IV-33E thru Page IV-38E

SECTION IV-F P-6000 OUTPUT SHAFT

Explanation — Page IV-39F

SECTION IV-G REVERSE IDLER GEAR ASSEMBLY

Remove & Replace — Page IV-40G

SECTION IV-H P-6000 TRANSMISSION GEARS

Low Range Output Gears — Page IV-41H
Pack Low Range Gears — Page IV-41H

SECTION IV-J D-500 & D-400 TRANSMISSION COVER ASSY.

Disassembly & Reassembly — Page IV-42J
Transmission Cover (Inside View) — Page IV-43J

SECTION IV REASSEMBLY OF P-6000 TRANSMISSION

Preparation — Page IV-45
Reassembly — Pages IV-46 thru IV-53

PICTORIAL INDEX — Page IV-1

SECTION IV

PREPARATION FOR DISASSEMBLY

OF

P-6000 TRANSMISSION

In preparation for disassembly of the P-6000 transmission, the following should be done:

A. Disconnect all external lines from the transmission housing.

B. Using plain steam (no caustic soda), clean the outside of the transmission housing.

C. Prepare a dirt-free work area at least 12 ft. square.

D. A hoist should be available to aid in lifting.

E. Gather the following:

1. Low table or stand for disassembly use.
2. Shop press.
3. Hydraulic gear and bearing puller set, rated at 17 tons minimum.
4. Mechanical type gear and bearing puller set.
5. Solvent for cleaning parts.
6. Standard set of mechanic's hand tools including:

   a. Snap ring pliers
   b. Brake spring pliers
   c. 100 ft. lb. torque wrench
   d. Mallet (perferably plastic)
   e. Transmission work stand (see page IV-2)
   f. Output shaft lifting tool (see page IV-3)
   g. Clutch lifting tool (see page IV-4)
   h. Clutch pack work stand (see page IV-5)
   i. Clutch pack lifting nut (see page IV-6)
   j. Clutch assembly locating pin (see page IV-7)

F. Provisions for heating bearing inner race either in oil or an oven. (Used in reassembly).

G. Pans for holding small parts during disassembly.

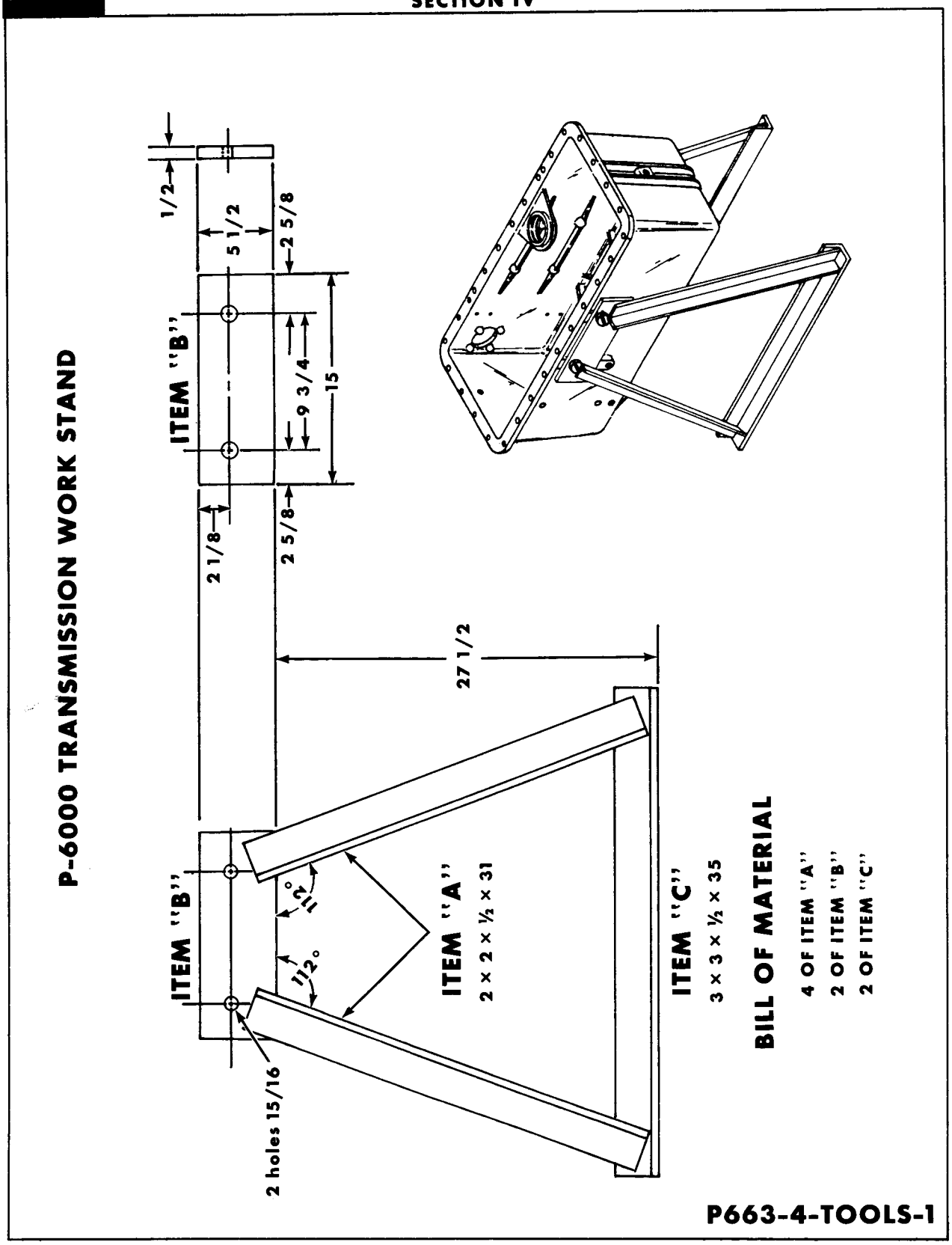


Figure 4-Tools-1 Transmission Work Stand

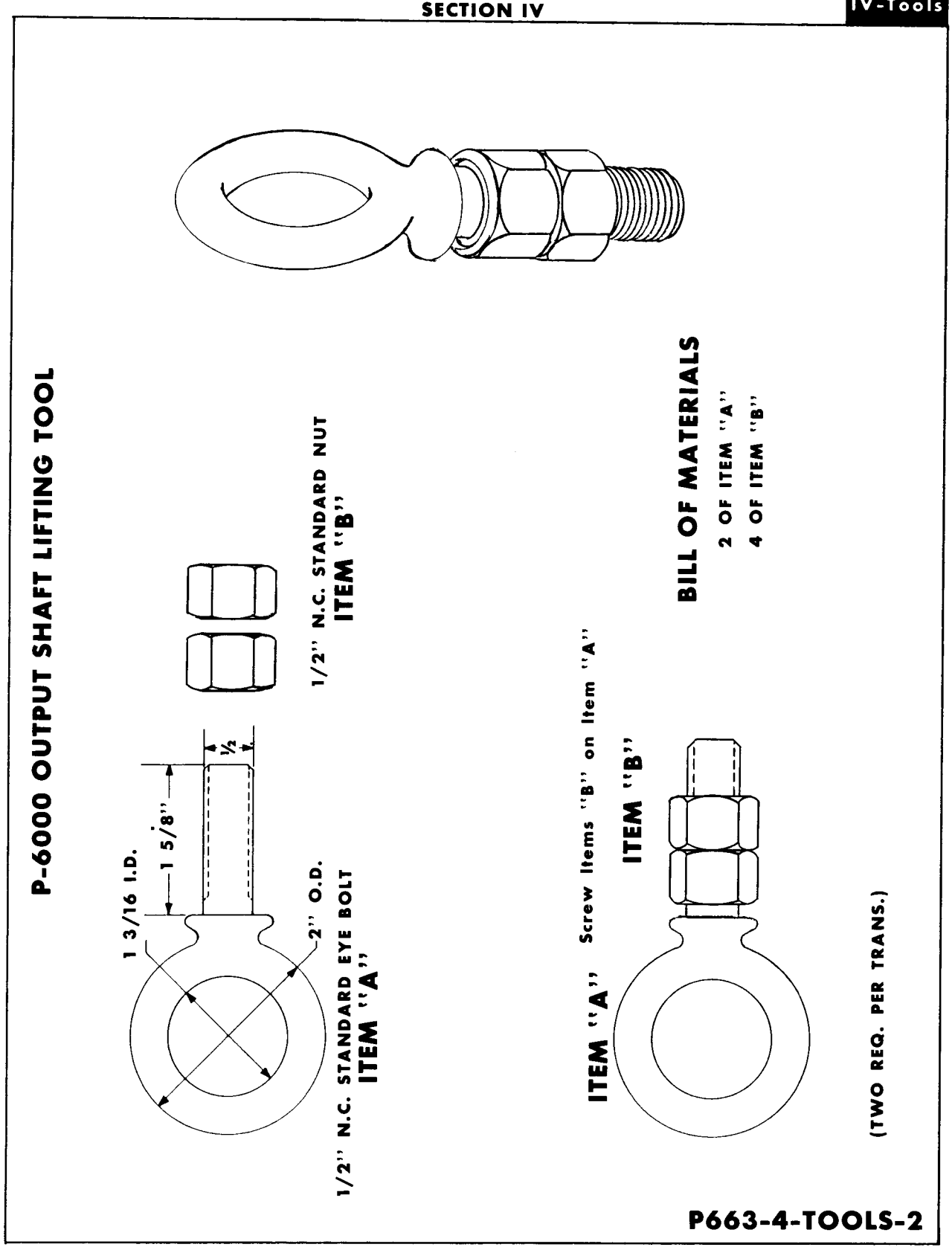


Figure 4-Tools-2 Output Shaft Lifting Tool

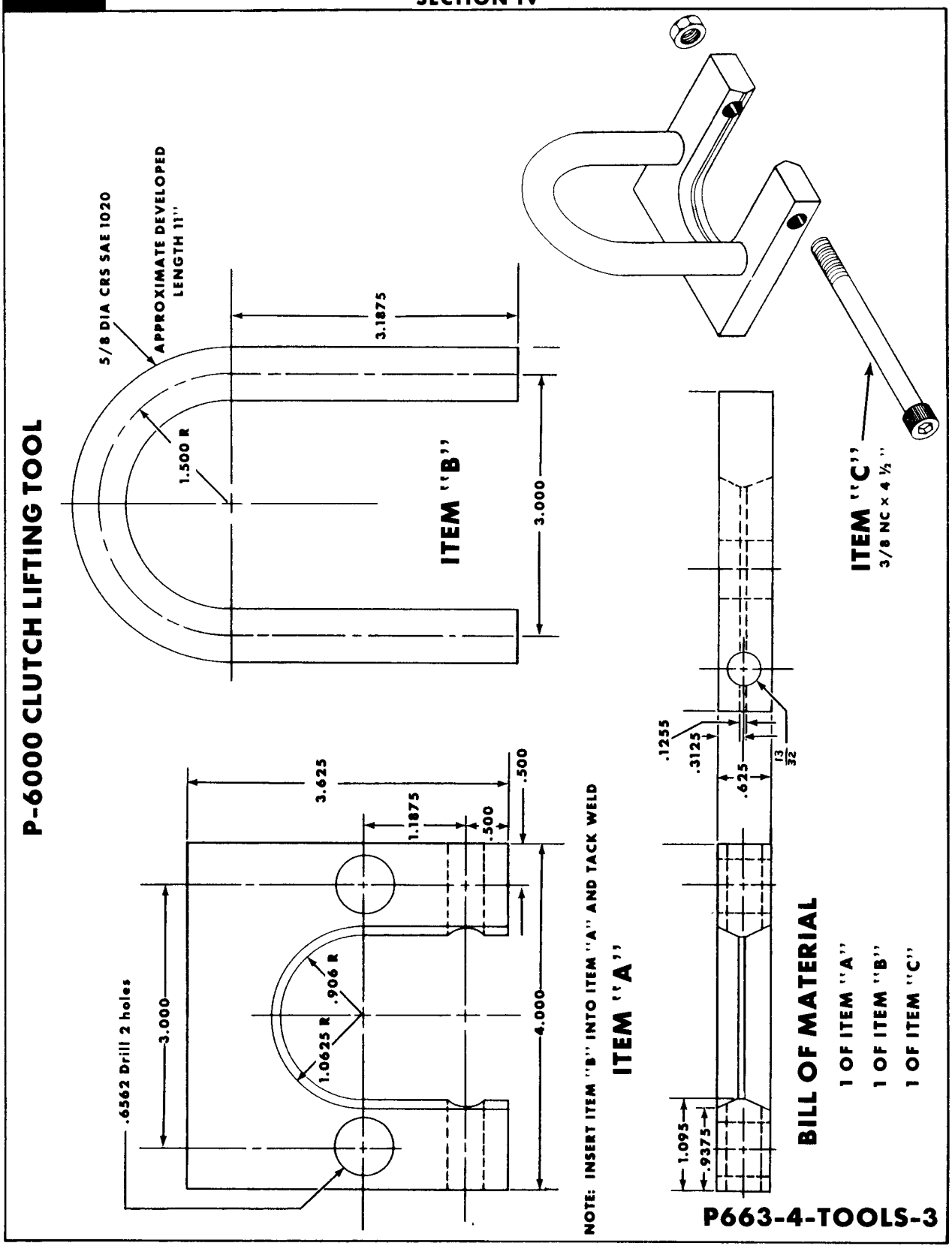


Figure 4-Tools-3 Clutch Lifting Tool

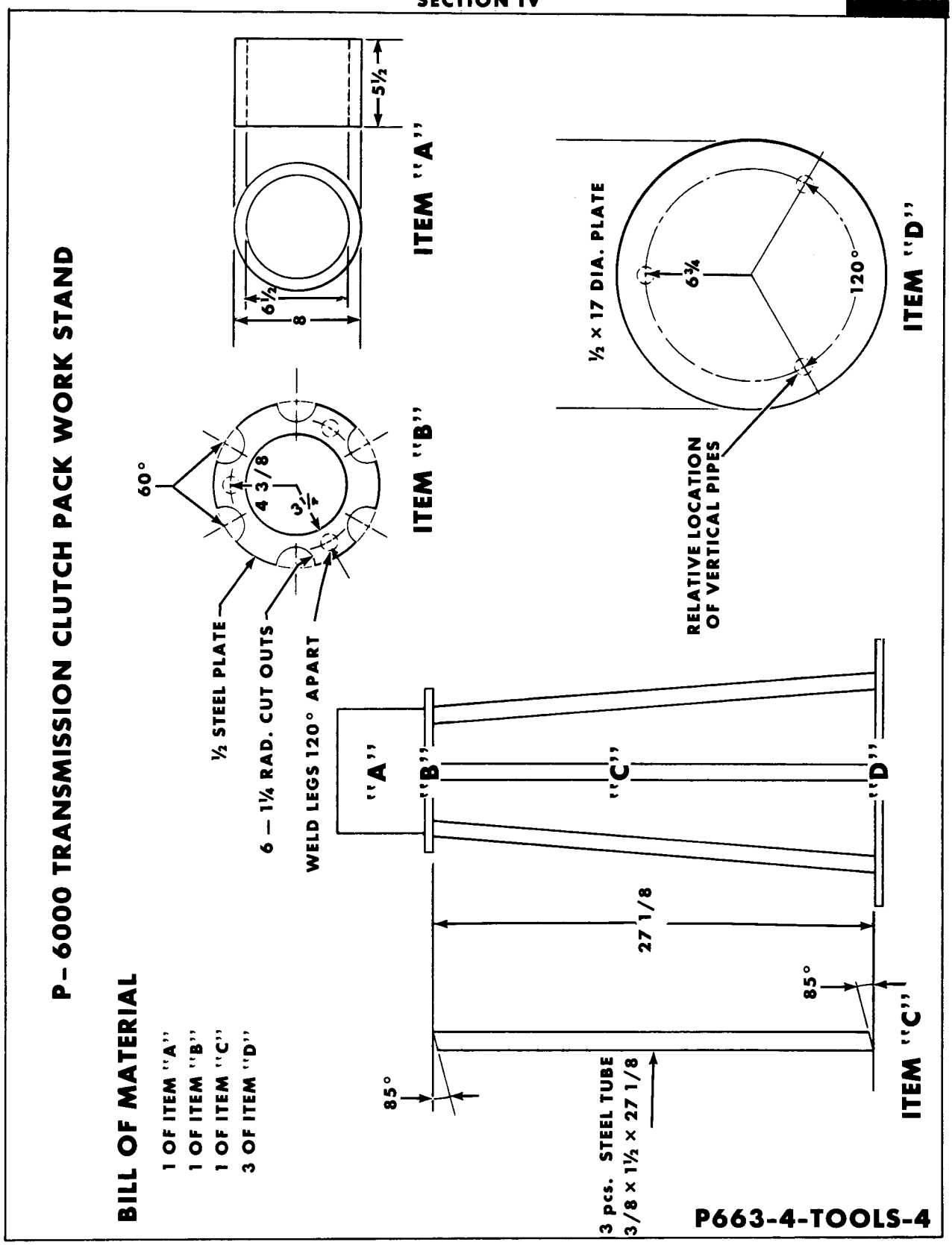


Figure 4-Tools-4 Clutch Pack Work Stand

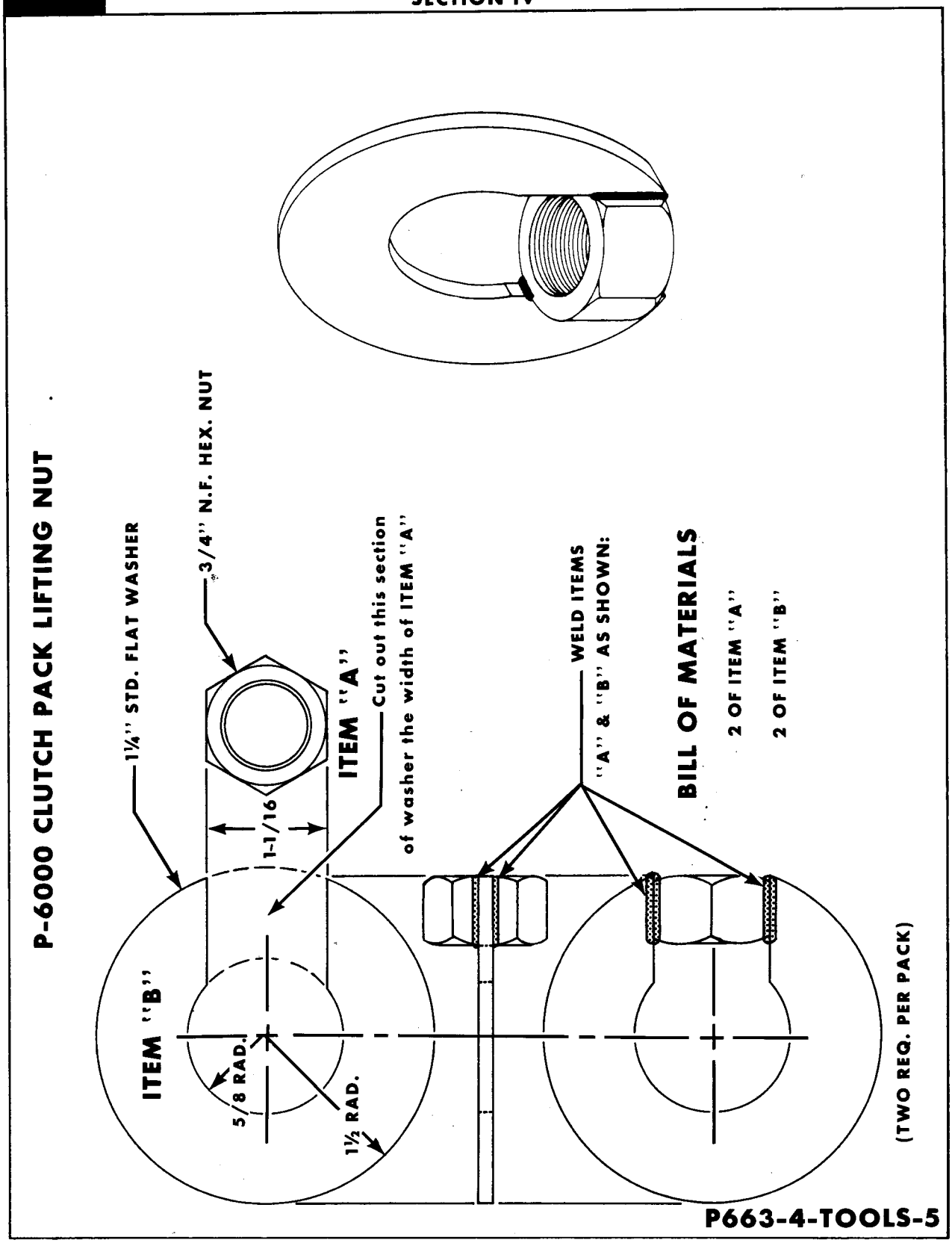


Figure 4-Tools-5 Clutch Pack Lifting Nut

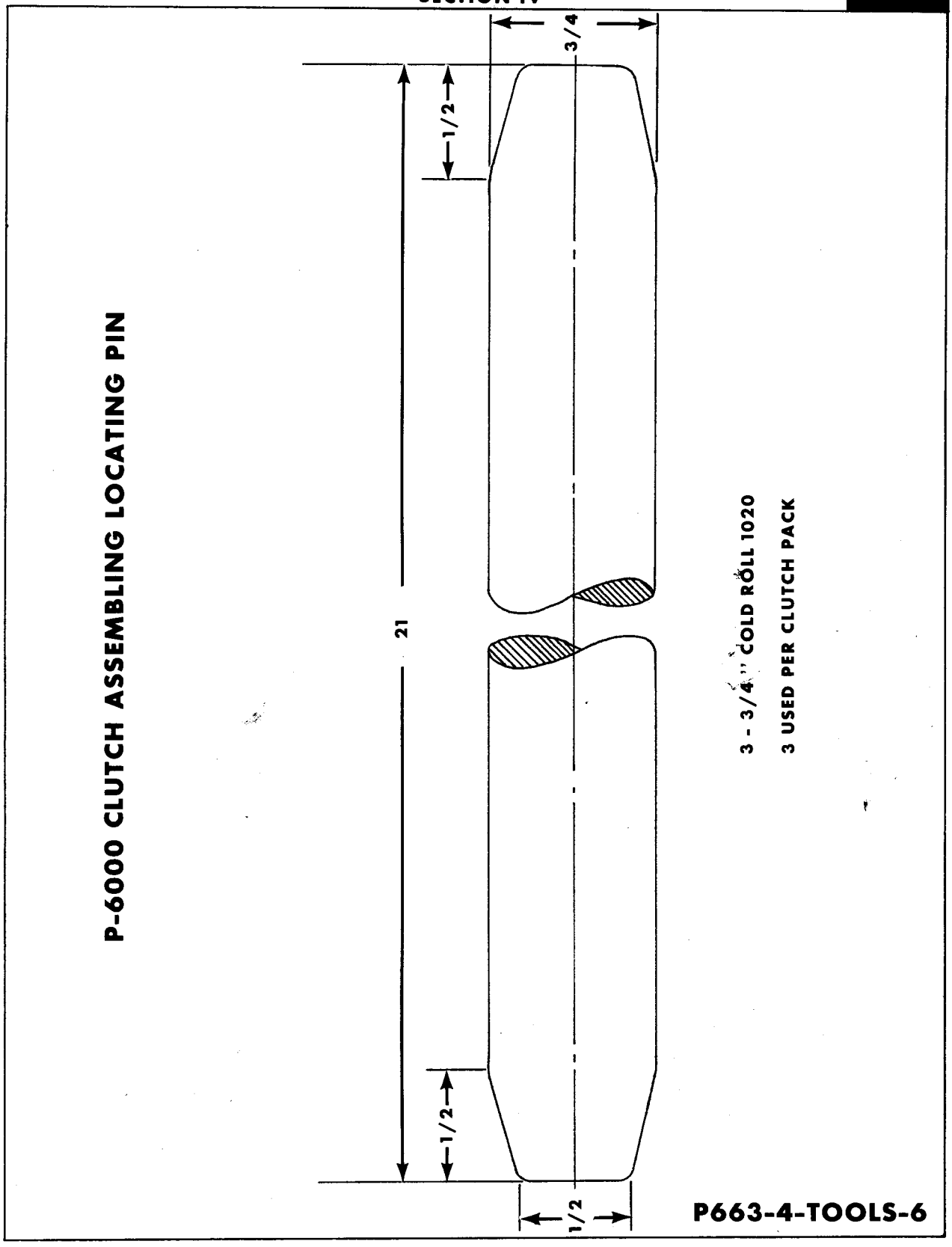


Figure 4-Tools-6 Clutch Assembly Locating Pin

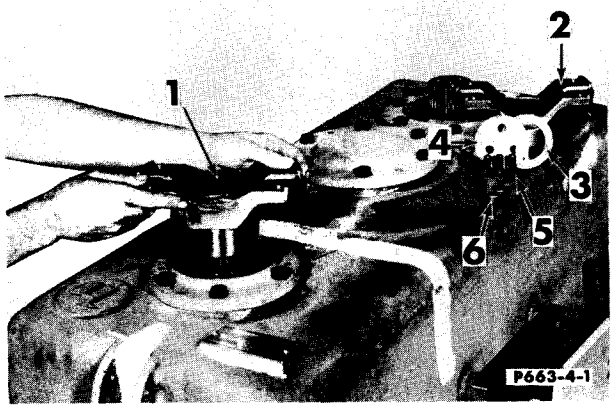


Figure 4-1

Remove input yoke (1). Remove lockwire, capscrews (5) with Dynaseal washers (6) from output yoke (2). Remove yoke retaining washer (4) with gasket (3). Remove output yoke (2).

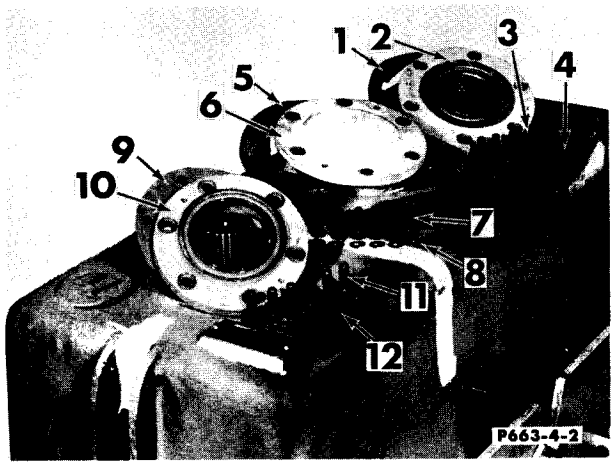


Figure 4-2

Remove capscrews (3), washers (4), retainer (2) and gasket (1).

Remove capscrews (7), washers (8), cap (6) and gasket (5).

Remove capscrews (11), washers (12), retainer (10) and gasket (9).

Remove and replace seals. Coat O. D. of seal with Mar-Seal or a comparable sealant. Press seal into bearing retainer. Large lip down or toward bearing.

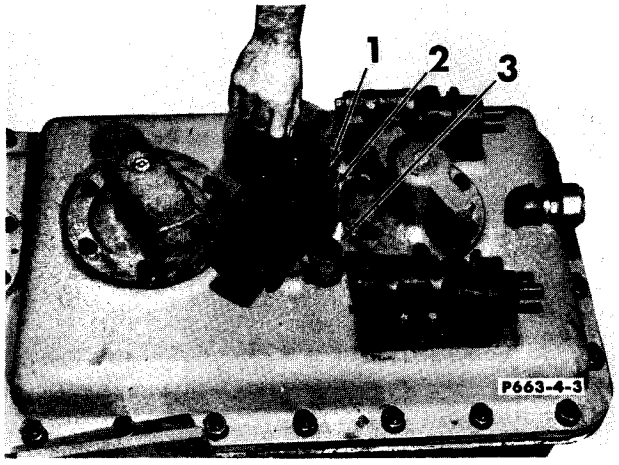


Figure 4-3

Turn transmission over in stand. Remove six capscrews (1), valve (2), gasket, adapter (3) and another gasket.

SeeSection IV-Bfor disassembly and reassembly of main regulator valve.

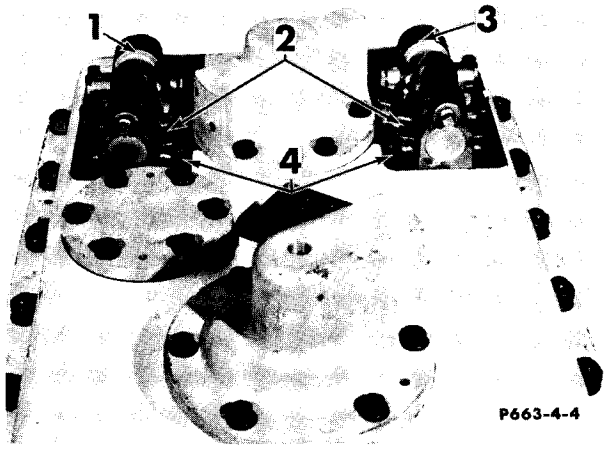


Figure 4-4

Remove twelve capscrews (2). Remove directional (1) and range (3) valves. Discard both gaskets (4).

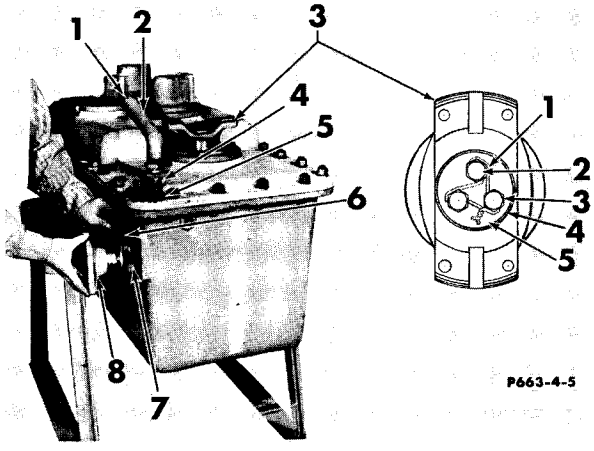


Figure 4-5

Remove lock wire (1) and capscrews (2) and washers (3) that secure the yoke to output shaft. Remove the washer (5). Discard the gasket (4). Remove the yoke.

Remove four capscrews (4) securing the filter cap (8) to the transmission housing. Discard the gasket (6), remove the filter (7), discard if it is damaged or filled. Remove filler tube (1 & 2) and fitting from cover.

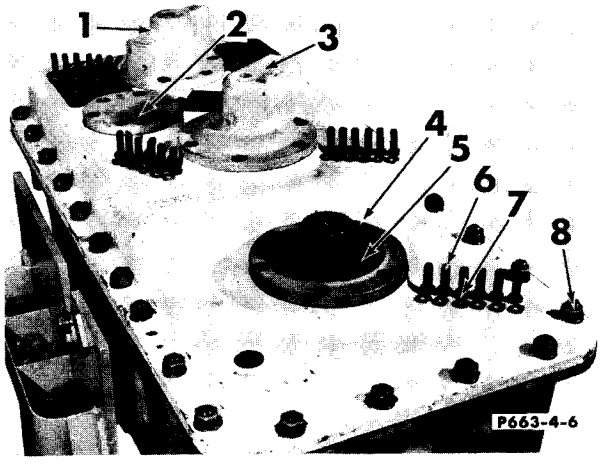


Figure 4-6

Remove all 3/8" capscrews (6) and washers (7) that secure all bearing caps. Remove all caps (1, 2, 3 and 4). Discard all gaskets. Remove all 3/4" capscrews (8), washers and nuts that secure the cover onto the transmission.

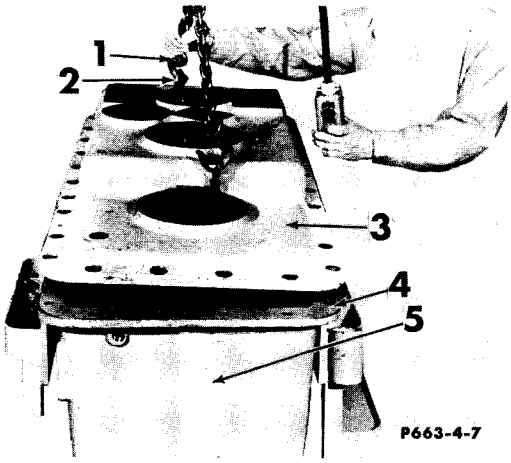


Figure 4-7

Screw two eye bolts (2) into two capscrew holes. Use a chain, twist one chain (1) to level cover (3) so bearing bores will not damage the clutch pack shafts. Lift cover (3) from transmission. Discard cover gasket (4). If cover does not come off of dowel pins, screw capscrews into jack screw holes and raise cover from transmission housing (5).

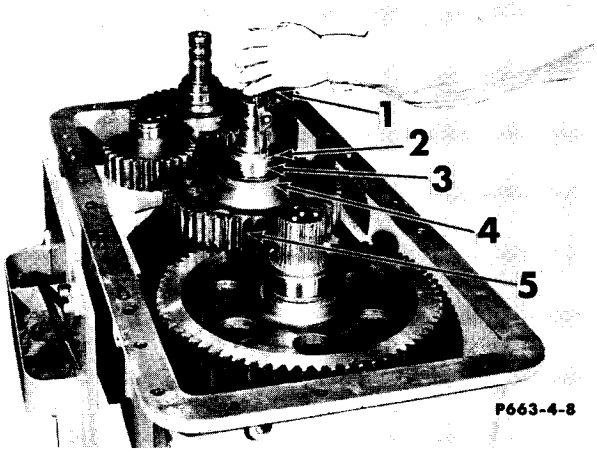


Figure 4-8

Remove snap ring (2) with snap ring pliers (1). Remove the gear (5) with a large gear puller to remove the bearing race (3) and washer (4). Place a thick piece of metal between the puller thread end and the end of the shaft to protect the shaft.

Remove the gear (5).

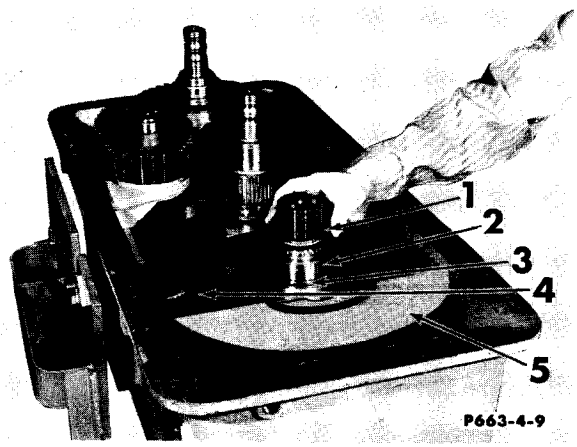


Figure 4-9

Remove the four capscrews holding the oil baffle (5) in housing. Remove the spacer (1), pull the gear (4) with a gear puller as the gear will remove the bearing race (2) and spacer (3).

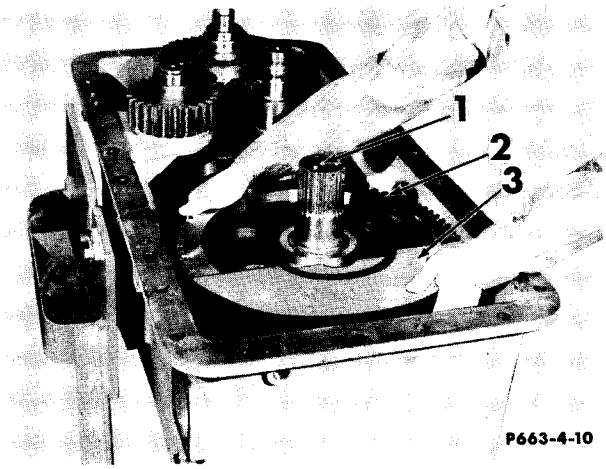


Figure 4-10

Remove the gear (2) and baffle (3) from output shaft (1).

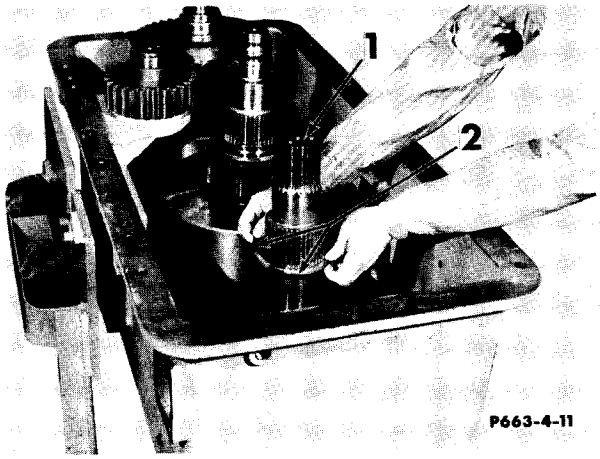


Figure 4-11

Remove retainer washer halves (2) from output shaft (1).

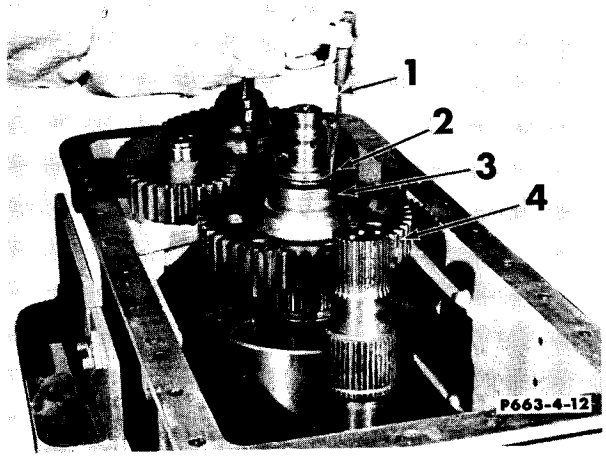


Figure 4-12

Install range pack gear (4), five spacers (3) and snap ring (2) with snap ring pliers (1).

Spacers and gear are installed to keep pack from damaging when it is turned over to disassemble.

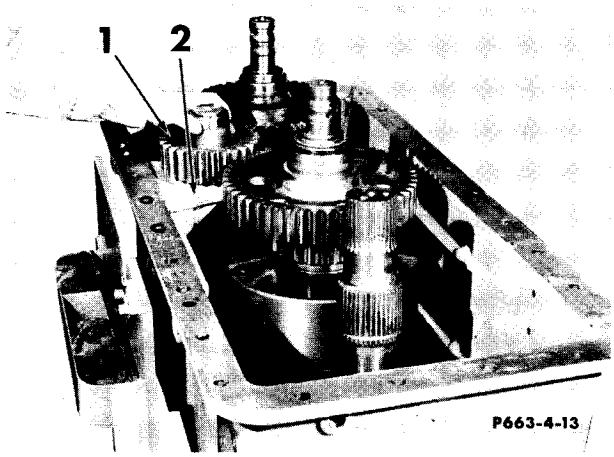


Figure 4-13

Remove reverse idler gear (1) from bearing in idler support (2).

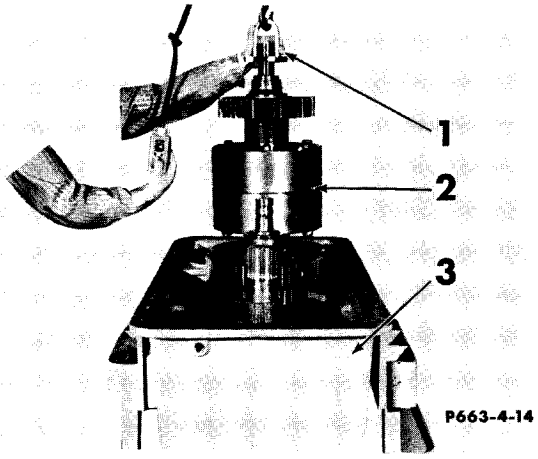


Figure 4-14

Install lifting tool (1) (Figure 4-Tool-3) to directional clutch pack (2) shaft. Lift pack out of housing (3).

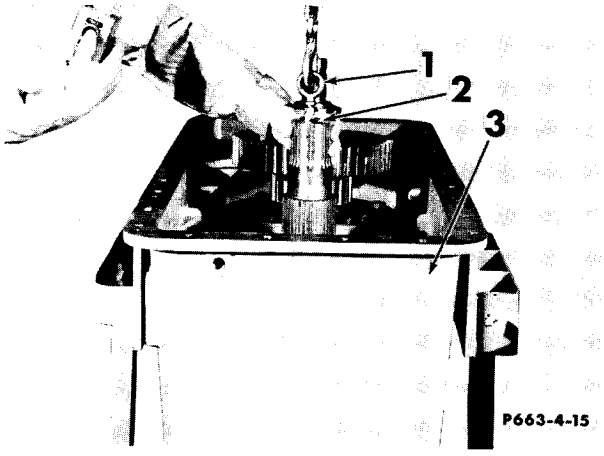


Figure 4-15

Install eye bolt lifting ring (1) (Figure 4-Tool-2) to output shaft (2). Raise it up so cap-screws can be removed from outside of the housing (3) to remove gear baffle.

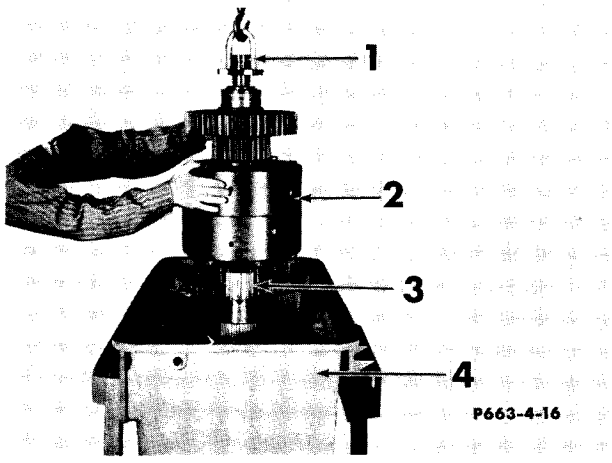


Figure 4-16

Install lifting tool (1) to range pack shaft (2). Lift range pack, also pull the output shaft (3) toward the bottom of the transmission to let the range gear clear the output gear and clear shaft in bearing hole in housing (4).

Set pack on pack stand or on clean bench.

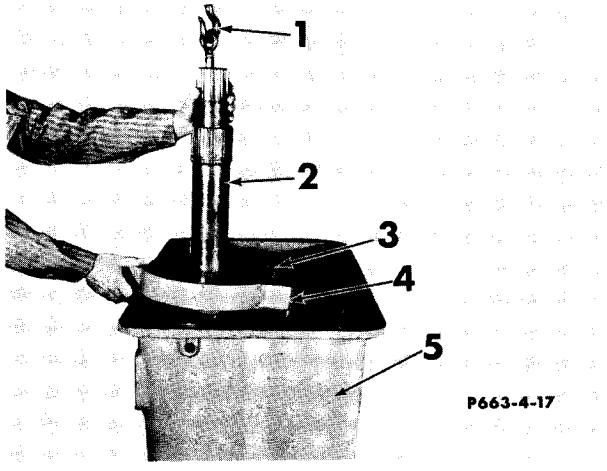


Figure 4-17

Install eye bolt (1) to output shaft (2). Lift output shaft assembly with gear (3) and oil baffle (4) from housing (5).

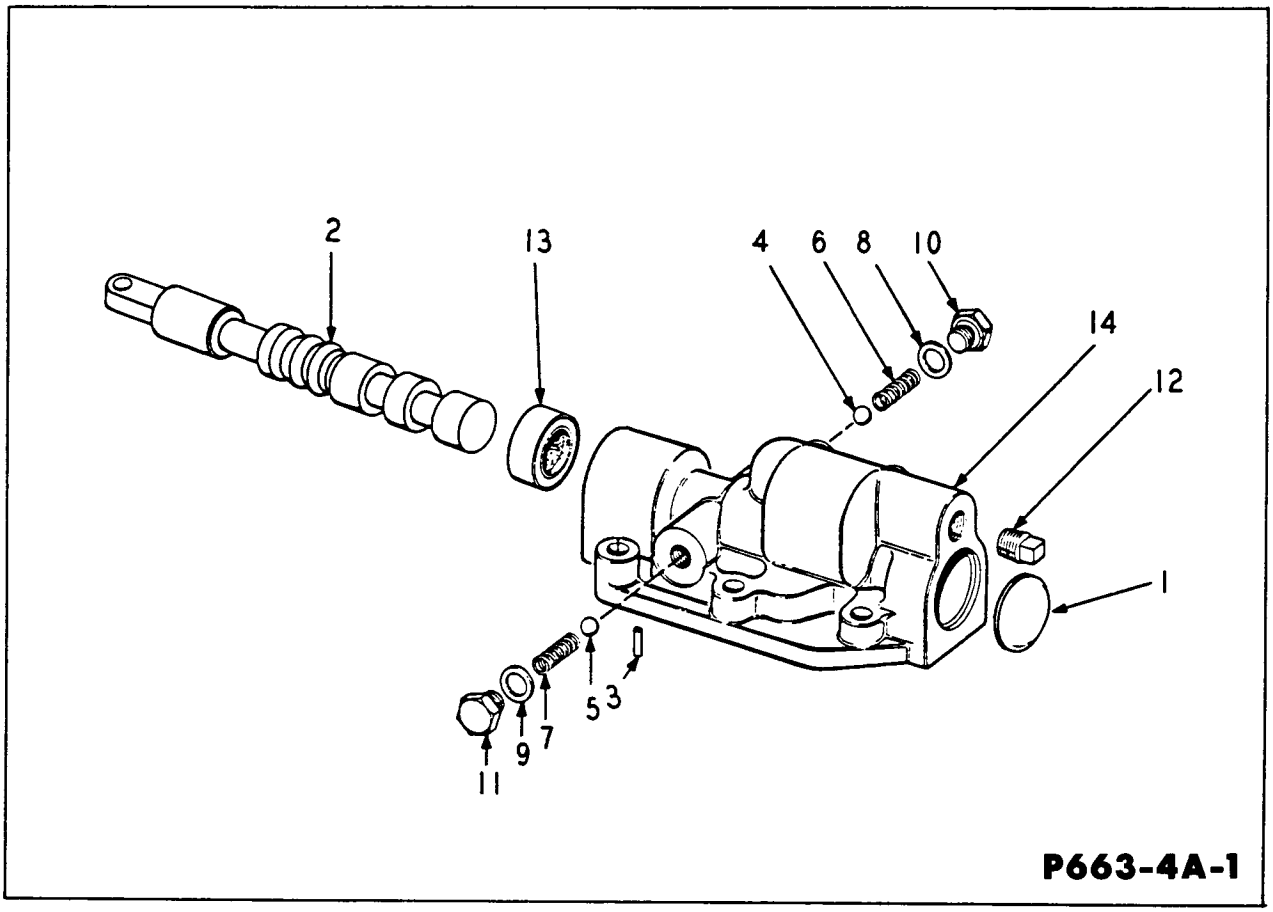


Figure 4A-1 Directional Selector Valve

DISASSEMBLY OF DIRECTIONAL SELECTOR VALVE.

Remove detent plugs (10) and (11) with annular gaskets (8) and (9). Remove springs (6) and (7) and balls (4) and (5). Remove roll pin-stop (3) from bottom of valve body (14). If the pin does not come out freely, insert an "Easy-Out" and screw the pin out.

This operation should be performed cautiously to prevent breaking off the "Easy-Out" in the pin. Remove plunger (2) and seal (13). Remove expansion plug (1), only if damaged or leaking, and plug (12) for cleaning.

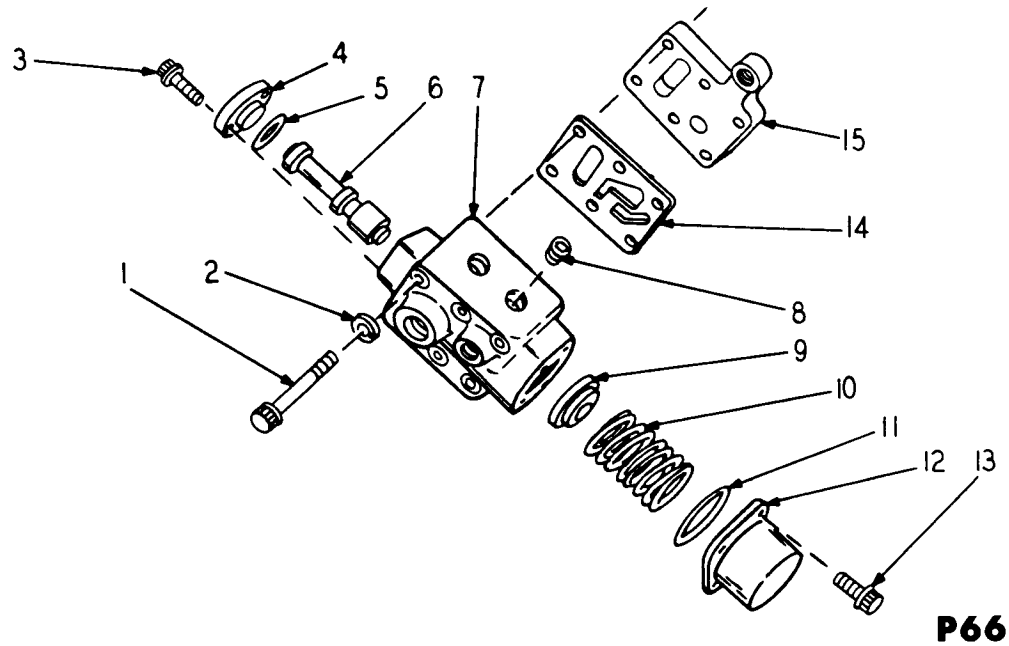
Clean all parts thoroughly in solvent. Dry with compressed air. Inspect plunger and valve body bore for scoring and/or excessive wear. Use a liberal amount of oil on plunger when reassembling valve. Replace all seals and gaskets.

REASSEMBLY OF DIRECTIONAL SELECTOR VALVE.

Install expansion plug (1), plunger (2) and drive roll pin-stop (3) into bottom of valve body (14). The pin should stick out approximately 3/8 of an inch from valve body. Plunger should move freely in valve body bore. Install balls (5) and (4), springs (7) and (6), annular gaskets (8) and (9) with plugs (10) and (11) and tighten plug (12) into valve body.

Pull plunger out until detent is in last land. Apply a liberal amount of grease to lips of seal (13). Coat O. D. of seal with Mar-Seal or a comparable sealant. Start seal on plunger with lips toward valve body. Use a suitable driver to drive seal flush with body bore.

DISASSEMBLY & REASSEMBLY OF D-500 MAIN REGULATOR VALVE BODY



1. Capscrew
2. Lockwasher
3. Capscrew
4. Spool Retainer
5. "O" Ring
6. Spool Assembly
7. Valve Body
8. Pipe Plug
9. Retainer
10. Spring
11. "O" Ring
12. Spring Retainer
13. Capscrew
14. Gasket
15. Adapter

Figure 4B-1 D-500 Main Regulator Valve

DISASSEMBLY OF MAIN REGULATOR VALVE BODY.

Remove the three capscrews (3), spool retainer (4), "O" ring (5) and valve spool assembly (6).

Remove the three capscrews (13), spring retainer (12), "O" ring (11), spring (10) and retainer (9). Remove plug (8) from valve body.

To disassemble the valve spool assembly (6), drive out the roll pin, remove the spring and ball.

Clean all parts thoroughly in a clean solvent. Dry with compressed air.

Inspect the valve bore for scoring and/or excessive wear. Replace all unserviceable parts, "O" rings and gaskets. Use a liberal amount of oil on plunger when reassembling.

REASSEMBLY OF MAIN REGULATOR VALVE BODY.

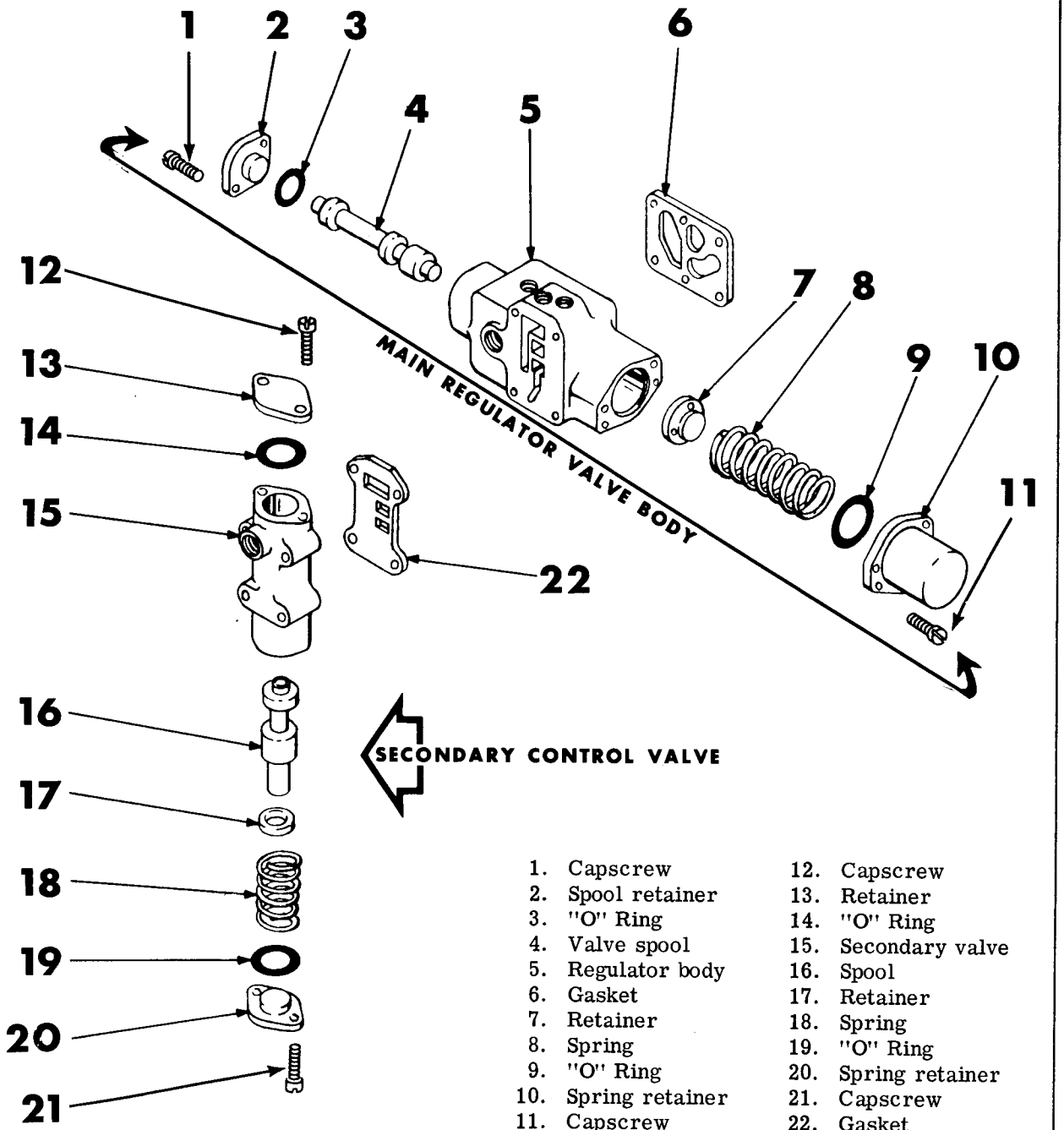
To reassemble the valve spool assembly, install the ball and spring into spool, drive the roll pin into the hole in valve spool (6).

Install spool (6) with long land in or towards center of valve body (7). Install "O" ring (5), spool retainer (4) and capscrews (3). Torque to 18 ft. lbs. Install plug (8) in proper hole and tighten.

Install retainer (9), spring (10), "O" ring (11), spring retainer (12) and capscrews (13) into other end of the valve body (7). Torque capscrews to 18 ft. lbs.

When the control valve is mounted to the transmission, a gasket (14) is installed, then the adapter (15), another gasket (14), control valve and six capscrews (1) and lockwashers (2). Torque to 32 ft. lbs.

D-400 CONTROL VALVE



1. Capscrew
2. Spool retainer
3. "O" Ring
4. Valve spool
5. Regulator body
6. Gasket
7. Retainer
8. Spring
9. "O" Ring
10. Spring retainer
11. Capscrew
12. Capscrew
13. Retainer
14. "O" Ring
15. Secondary valve
16. Spool
17. Retainer
18. Spring
19. "O" Ring
20. Spring retainer
21. Capscrew
22. Gasket

P663-4C-1

Figure 4C-1 D-400 Control Valve

DISASSEMBLY & REASSEMBLY OF D-400 MAIN REGULATOR VALVE BODY
(Refer to Figure 4C-1)

DISASSEMBLY OF MAIN REGULATOR VALVE BODY.

Remove two capscrews (1), spool retainer (2) and "O" ring (3).

Remove valve spool assembly (4).

Remove the four capscrews (11), spring retainer (10), "O" ring (9), spring (8) and retainer (7).

To disassemble the valve spool assembly (4), drive out the roll pin, remove the spring and ball.

Clean all parts thoroughly in a clean solvent. Dry with compressed air.

Inspect the valve bore for scoring and/ or excessive wear. Replace all unserviceable parts, "O" rings and gaskets. Use a liberal amount of oil on plunger when reassembling.

REASSEMBLY OF MAIN REGULATOR CONTROL VALVE.

To reassemble the valve spool assembly, install the ball and spring into the spool, drive the roll pin into the hole in the valve spool (4).

Install spool (4) with long land in or toward center of valve body (5). Install "O" ring (3), spool retainer (2) and capscrews (1). Torque to 18 ft. lbs.

Install spring retainer (7), spring (8), "O" ring (9), spring retainer (10) and capscrews (11) into end of valve body (5). Torque capscrews to 32 ft. lbs.

When the gasket (6) is being installed between the main regulator valve body (5) and the transmission cover, care should be taken to line up the openings in the gasket with the ones in the valve and cover of the transmission. Gaskets could be installed improper and cause damage to the transmission.

DISASSEMBLY & REASSEMBLY OF SECONDARY CONTROL VALVE
(Refer to Figure 4C-1)

DISASSEMBLY OF SECONDARY CONTROL VALVE.

Remove the four capscrews that hold the secondary control valve to the primary control valve.

Remove secondary valve (15) and gasket (22) primary valve (5).

Remove two capscrews (12) and retainer (13) from valve end with "O" ring (14).

Remove two capscrews (21), spring retainer (20) with "O" ring (19) and spring (18).

Remove spring guide retainer (17) with the spool assembly (16).

The spool has a spring and ball relief valve inside. To disassemble the spool assembly (16), drive out the roll pin. Remove the spring and ball.

Clean all parts thoroughly in a clean solvent. Dry with compressed air.

Inspect the valve bore for scoring and/or excessive wear. Replace all unserviceable parts, "O" rings and gaskets. Use a liberal amount of oil on plunger when reassembling.

REASSEMBLY OF SECONDARY CONTROL VALVE.

Assemble the spring, ball and roll pin into the spool (16). Drive the roll pin into the hole in valve spool.

Install spool so small land enters valve body (15) first as shown. Install spring guide retainer (17).

Install spring (18), "O" ring (19), spring retainer (20) and two capscrews (21). Torque to 18 ft. lbs.

Install "O" ring (14), retainer (13) and two capscrews (12) on other end of the valve. Torque to 18 ft. lbs.

When the gasket is being installed between the secondary valve and regulator body, care should be taken to line up the openings in the gasket with the ones in the valves. Gaskets could be installed improperly and cause damage to transmission.

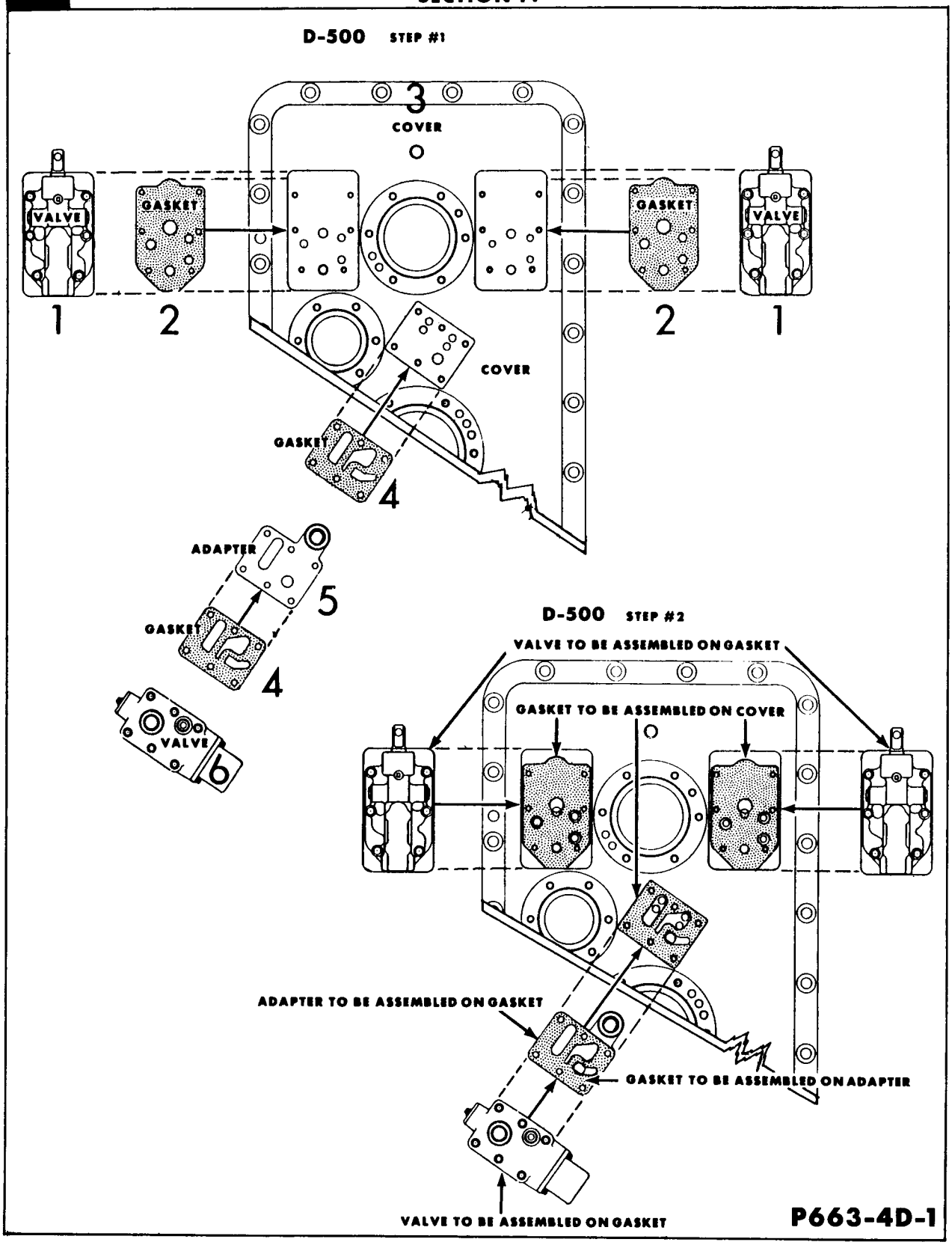


Figure 4D-1 D-500 Gasket Installation for Trans. Cover

D-500 GASKET INSTALLATION

FOR TRANS. COVER

When installing the valve gaskets on the transmission cover, care must be taken to install them correctly. The gaskets (2) must be installed on cover so the holes in the cover match the gasket. Install the valves (1). They are both the same kind of valves and gaskets.

The main regulator valve has two gaskets that are the same. The gasket (4) must be installed on the transmission as illustrated in diagram on opposite page. The adapter (5) is then installed, another gasket (4) is installed like the other gasket.

Install the main regulator valve (6) onto the second gasket (4) as shown, tighten the capscrews.

NOTE

Wrong installation of these gaskets may result in marginal systems pressures and lubrication failures. Double check all assemblies during installation of parts.The later model valves and gaskets will use a dowel pin to locate valve and gasket.

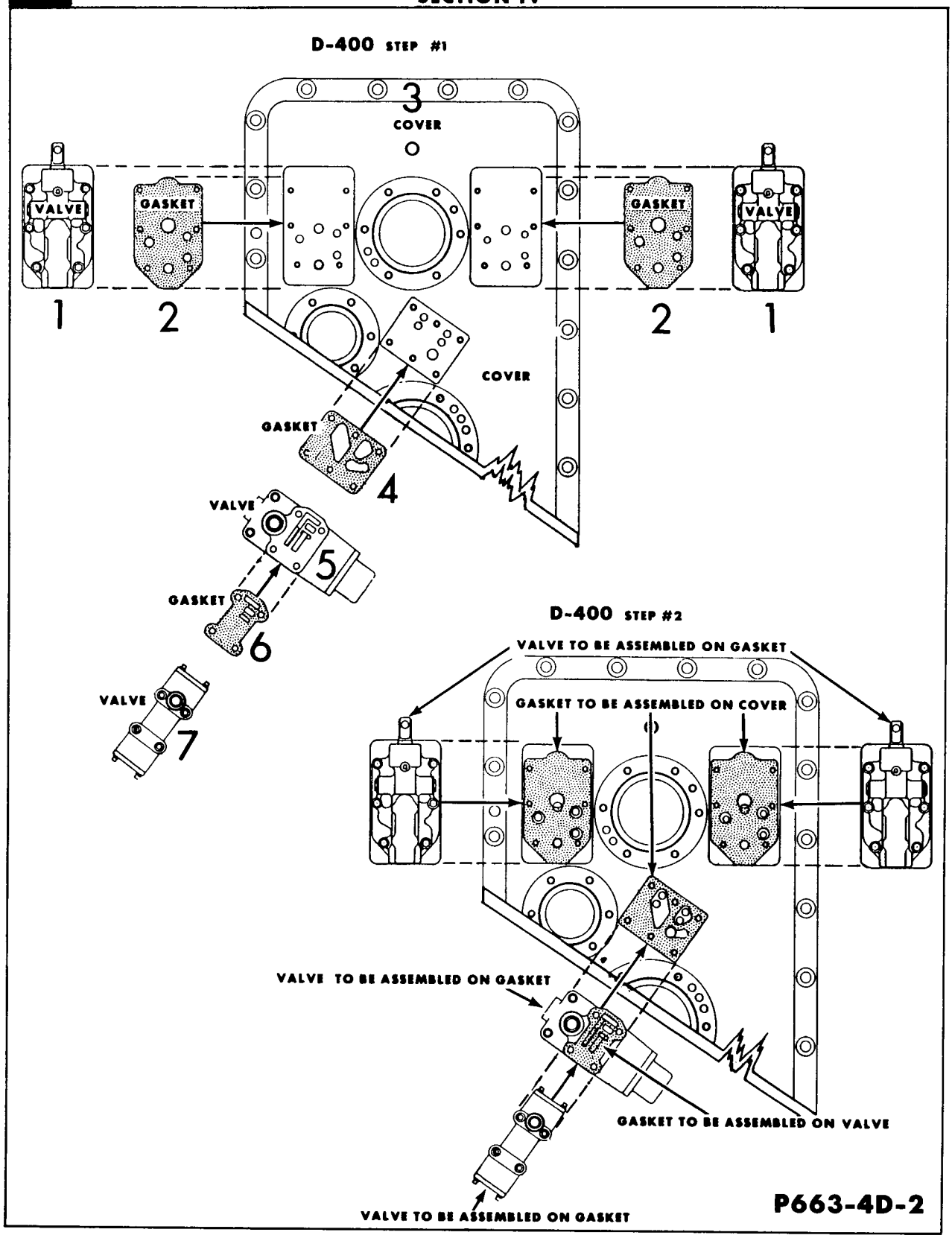


Figure 4D-2 D-400 Gasket Installation for Trans. Cover

D-400 GASKET INSTALLATION

FOR TRANS. COVER

When installing the valve gaskets on the transmission cover, care must be taken to install them correctly. The gaskets (2) must be installed on cover so the holes in the cover match the gasket. Install the valves (1). They are both the same kind of valves and gaskets.

The main regulator valve (5) has a gasket (4) that can be put on different ways, but will not operate correctly unless it is installed as illustrated on opposite page. Install gasket (4) correctly, then install main regulator valve (5) with capscrews.

Install gasket (6) correctly as illustrated, then install secondary (converter) valve (7) with four capscrews.

NOTE

Wrong installation of these gaskets may result in marginal system pressures and lubrication of parts. The later model valves and gaskets will use a dowel pin to locate valve and gasket.

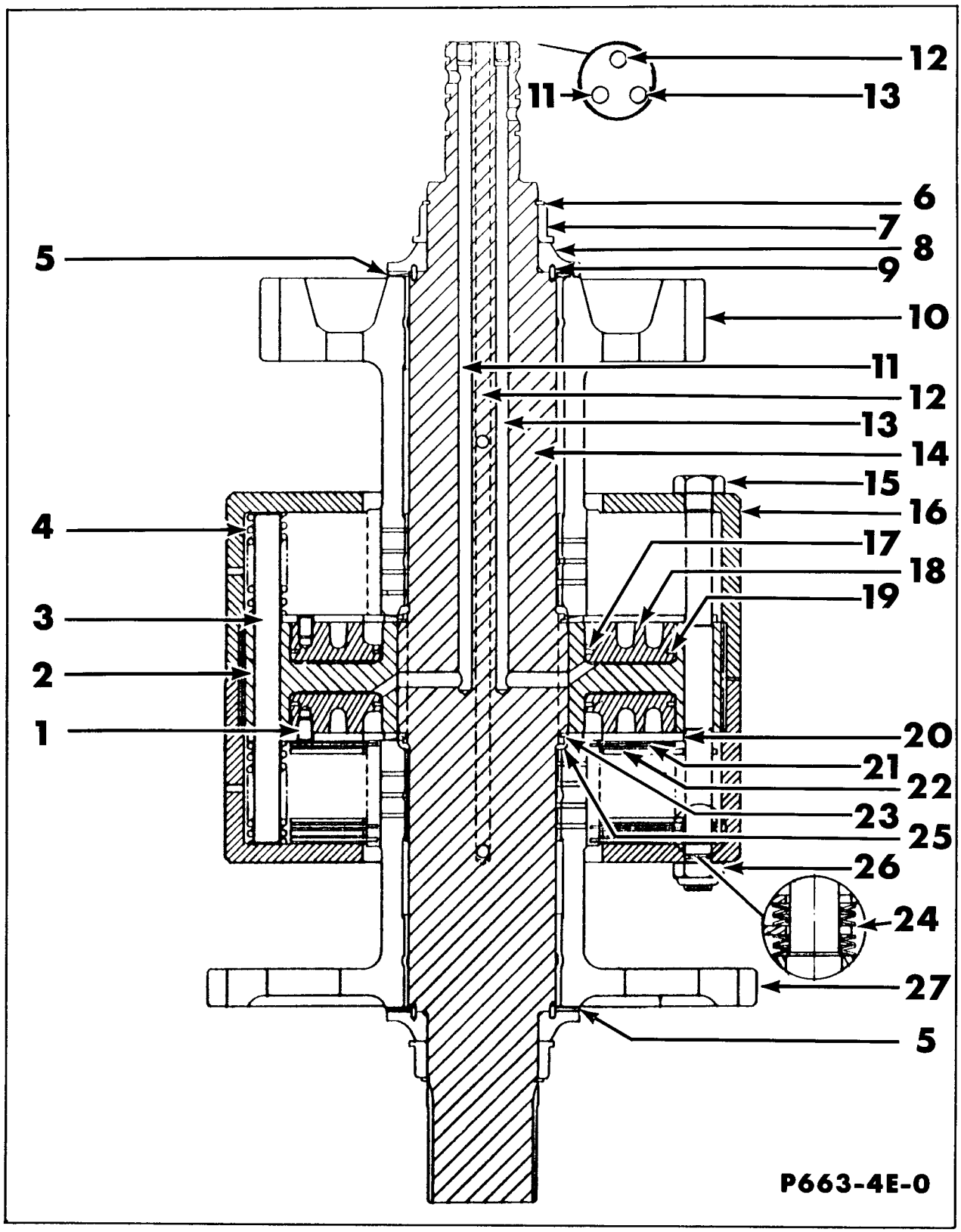


Figure 4E-0 Forward & Reverse Clutch

KEY TO FIGURE 4E-0

1. Pin, dowel
2. Cylinder
3. Pin, spring guide
4. Spring, piston return
5. Thrust washer
6. Snap ring
7. Race, inner bearing
8. Spacer
9. Roll pin
10. Gear, input - reverse
11. Oil port - forward
12. Oil port - lube
13. Oil port - reverse
14. Shaft - input
15. Bolt - clutch pack
16. Backing plate
17. Rings - inner
18. Piston
19. Rings - outer
20. Plate - spring retainer
21. Plate - bronze
22. Plate - steel
23. Snap ring
24. Belleville washers
25. Thrust washer
26. Nut
27. Gear, input - forward

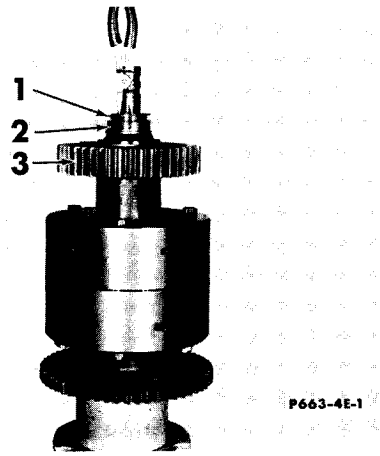


Figure 4E-1

Remove snap ring (1). Remove bearing race (2) by using puller over gear (3). The end of puller screw should not gall the center in the end of shaft. A plate should be used to protect the end of the shaft.

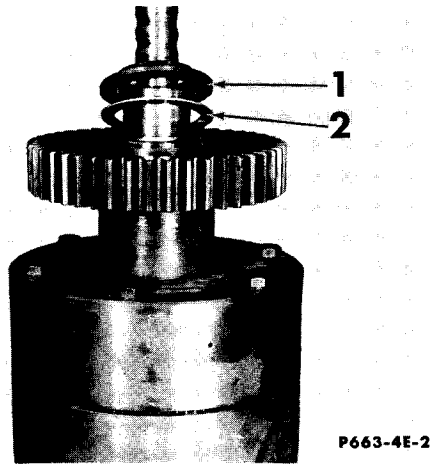


Figure 4E-2

Remove spacer (1) and thrust washer (2).

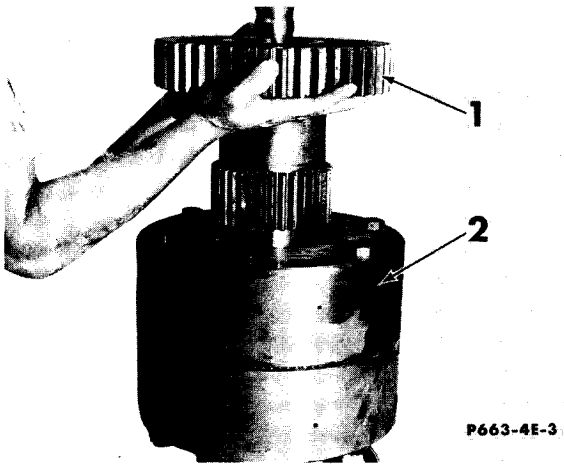


Figure 4E-3

Remove the gear (1) from the pack assembly (2).

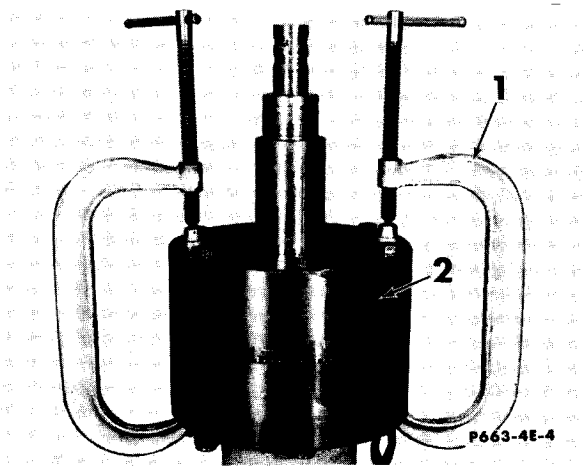


Figure 4E-4

Place two 12" clamps (1) over pack (2). Tighten hold pack together.

Tighten clamps to hold pack together.

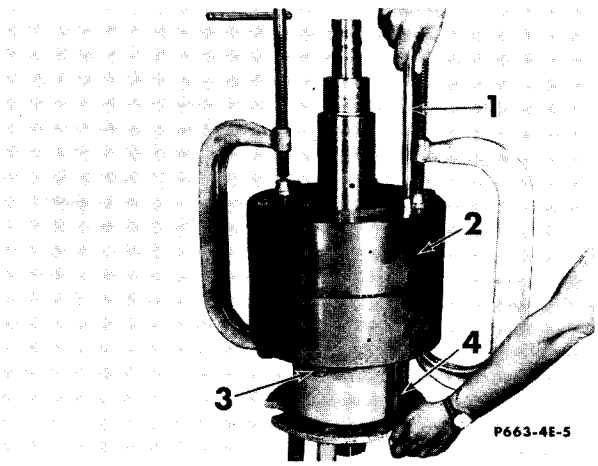


Figure 4E-5

Remove nuts (3) from bolts (1). Three bolts have punch marks on the heads of the bolts. Remove these three bolts by pushing them out with the special locating pins (4) (Figure 4-Tool-6) pushing the bolt out to line up the plates and Belleville washers while disassembling pack. Remove backing plate (2) from one side of pack.

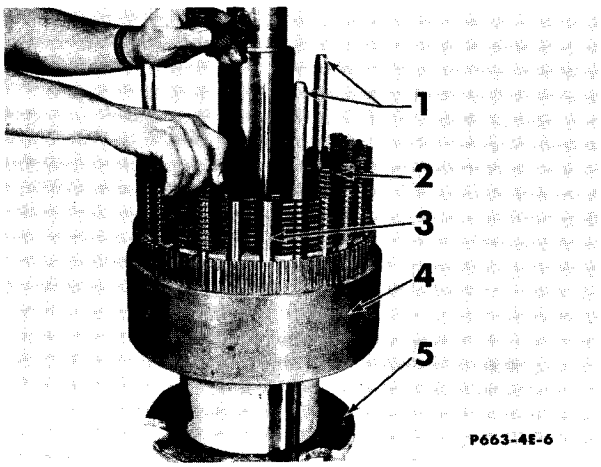


Figure 4E-6

When pins (1) are in pack (4), turn the pack around from notch in pack stand (5) so pins (1) will not fall out. Remove spring (2) from spring guide pins (3).

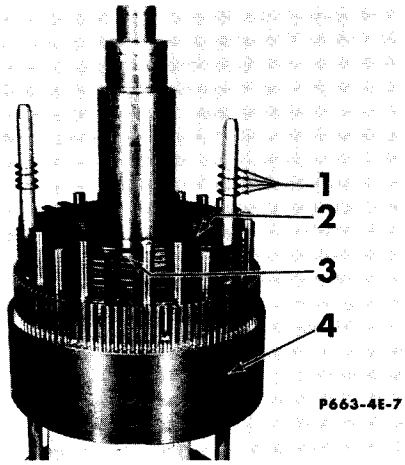


Figure 4E-7

Remove the bronze (2) plates and steel (3) plates from clutch pack (4). Between each steel plate there are twelve Belleville springs (1) stacked as shown on the pins (120° apart) per clutch (240 springs per pack).

Check clutch plates for straightness. They must be flat within .008 T. I. R.

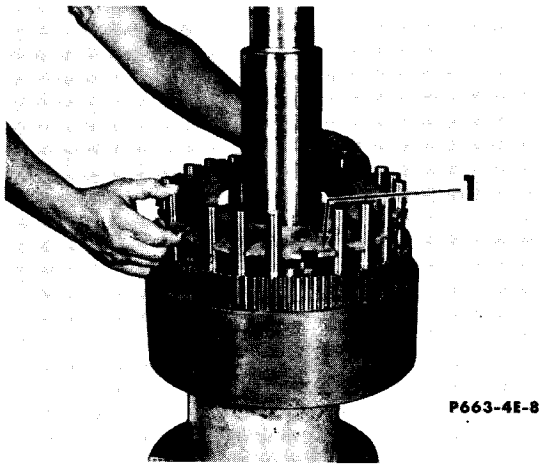


Figure 4E-8

Remove the spring retaining plate (1).

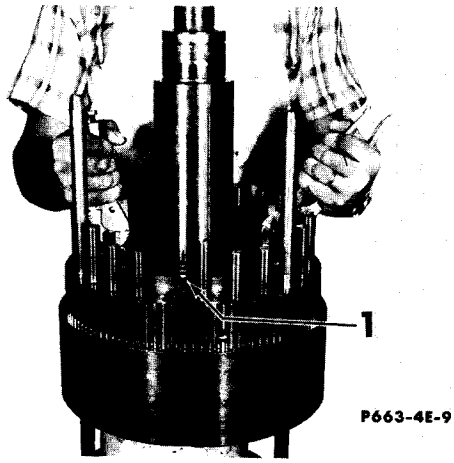


Figure 4E-9

Remove piston (1) from cylinder with two pairs of pliers on center rib of piston. All burrs must be removed from piston if they develop from pliers.

Remove piston rings from ID and OD grooves of piston.

DISASSEMBLY of All Clutch Packs

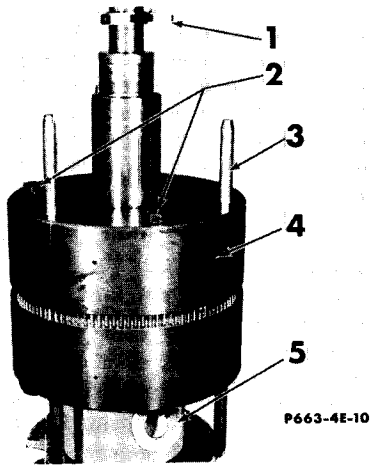


Figure 4E-10

Replace backing plate (4). Install two bolts (2) to hold pack together. Leave locating pins (3) in clutch pack.

Use two special lifting nuts (5) on bolts.

Lift the pack from stand with special lifting tool (1). Lay pack on bench. Hook lifting chain on special nuts (5). Set pack in stand so other end can be disassembled.

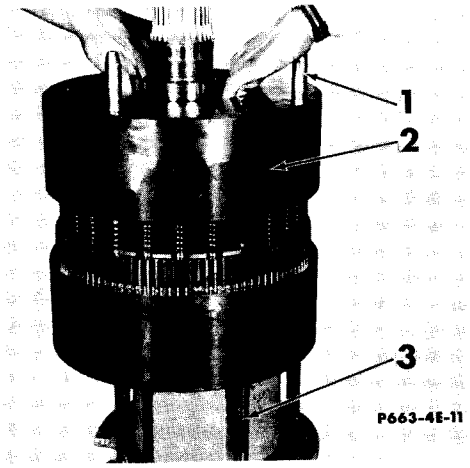


Figure 4E-11

Remove special nuts from bolts (3). Leave bolts in pack. Use locating pins (1) for disassembly. Remove backing plate (2) from pack.

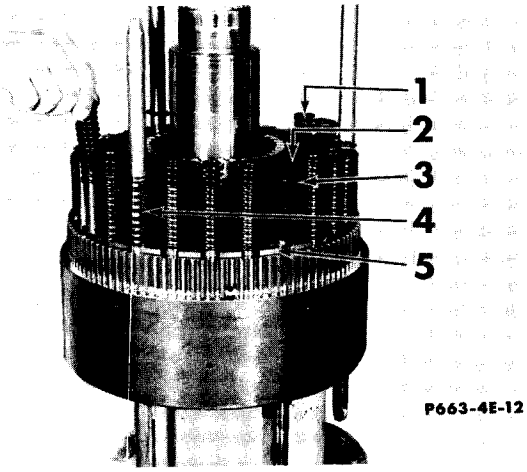


Figure 4E-12

Remove the springs (1), bronze (2) and steel plates (3), Belleville springs (4), spring retaining plate (5) and piston as we did on the other end of the pack. (See Figure 3E-6 thru Figure 3E-9)

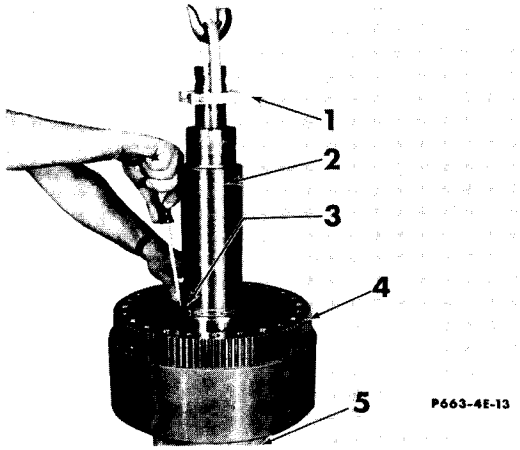


Figure 4E-13

If the cylinder (4) is to be removed from shaft (2), remove snap ring (3).

The stand (5) can be used to hold the shaft assembly while removing the snap ring. Place special lifting tool (1) on shaft to hold it from falling thru cylinder. Lift shaft (2) and cylinder (4) to bench and disassemble and reassemble shaft and cylinder. Be sure the shaft oil pressure holes line up with holes in cylinder.

PISTON AND RING ASSEMBLY

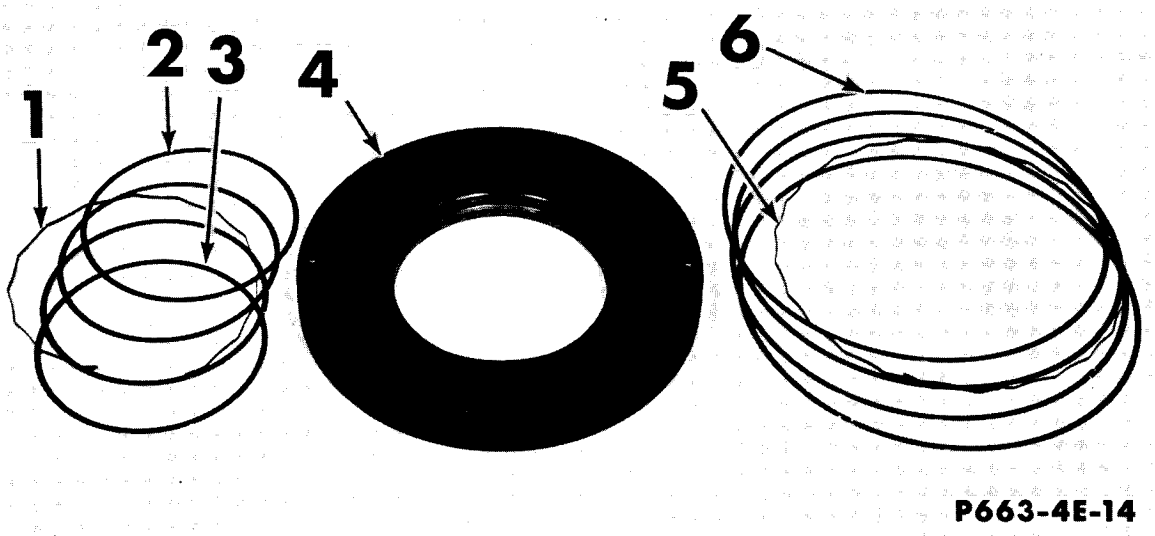


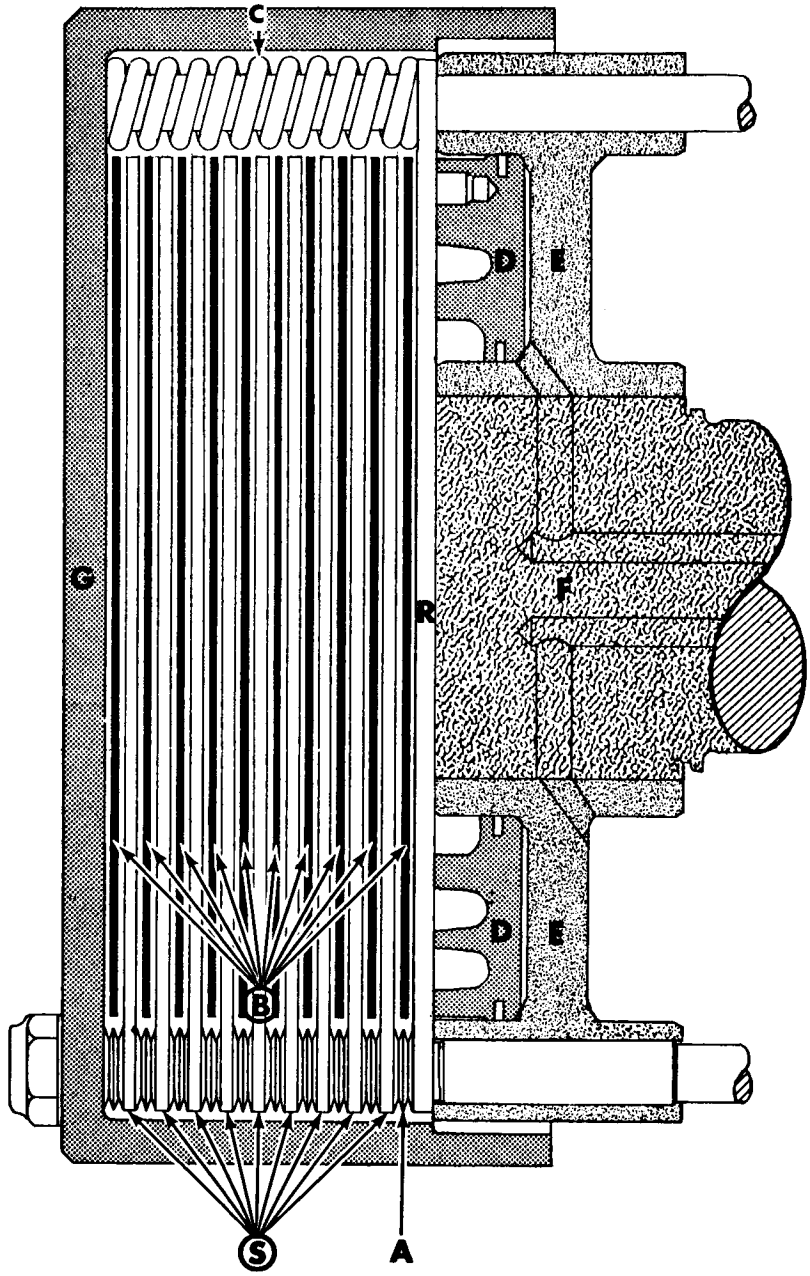
Figure 4E-14

The piston (4) has two sets of piston rings. The set on the OD are all alike with a step cut. Install the expander (5) in OD groove. Install four rings (6). Stagger the ring ends.

Install the ID expander (1) in groove. Place three step cut rings (2) in grooves. To set the three step cut rings, place piston rings in piston (4). Place piston in cylinder. It will expand rings. Then remove piston from cylinder. Place the flat end ring (3) on bottom of the three step cut rings (2). While assembling, use transmission oil on all internal parts - rings, between plates, pistons and bushings.

NOTES:

CLUTCH STACKING DIAGRAM



A= BELLEVILLE SPRINGS
B= BRONZE PLATES
C= SPRING
D= PISTON
E= CYLINDER
F= SHAFT
G= BACKING PLATE
R= SPRING RETAINING PLATE
S= STEEL PLATES

TOTAL: 10 BRONZE, 9 STEEL PLATES PER CLUTCH

P663-4E-15

Figure 4E-15 Clutch Stacking Diagram

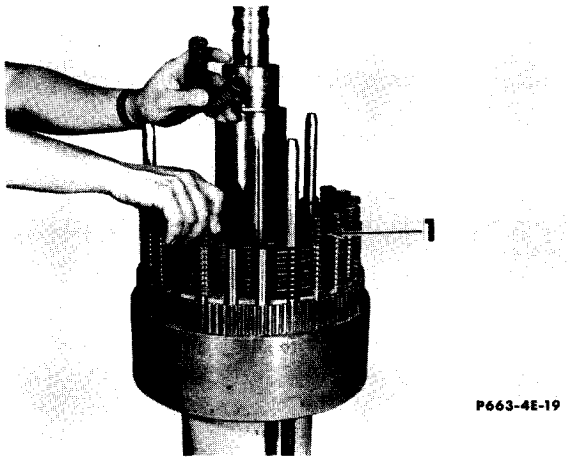


Figure 4E-19

Install clutch piston return springs (1). Check the length of the springs before assembling.

Free length 3.930 ± 10% to support 106 lbs. @ 2.687".

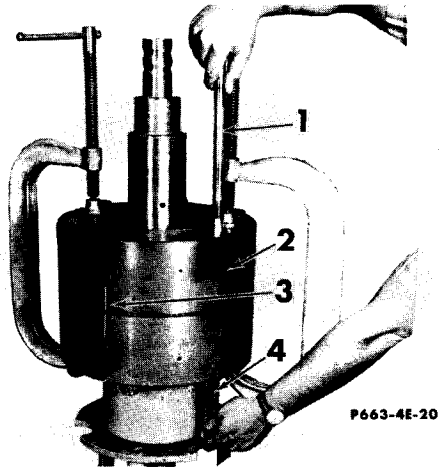


Figure 4E-20

Check the marks (3) on backing plates (2) and cylinder. They must line up. Install backing plate (2) and two 12" clamps. Clamp pack so bolts (1) can be installed.

NOTE Do not pull the locating pins (4) out. Push them out with the clutch pack bolts (1). Do not tap the bolt through pack. Belleville springs may catch onto the bolt threads and break the spring.

Care must be taken to install bolts (1). Six bolts must go into clutch pack one way to allow clearance for gears to pass into transmission. The three bolts going through the Belleville springs must be punch marked to indicate Belleville spring bolts. Install special lifting nuts on two bolts. See Figure 4-Tool-5.

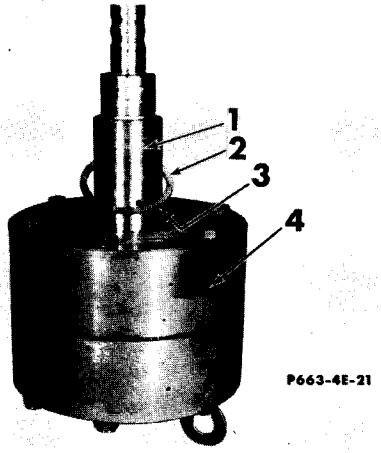


Figure 4E-21

Install thrust washer (2) over shaft (1) into clutch pack (4).

The grooves (3) must be facing the clutch gear.

REASSEMBLY of All Clutch Packs

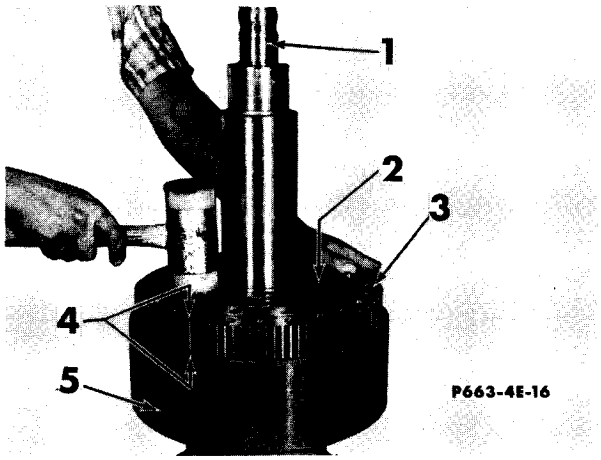


Figure 4E-16

Clean and check all parts. Blow dry with air. Place backing plate (5) on stand. Install special lifter on shaft (1) with cylinder (3) attached. Cylinder (3) and backing plate (5) are stamp marked. Use chalk or ink pencil to mark the locating marks (4) so they can be seen during assembly.

Install piston (2). Start rings in cylinder with screwdriver or flat tool. Do not damage surface or rings. Tap piston (2) into cylinder (3) with plastic hammer.

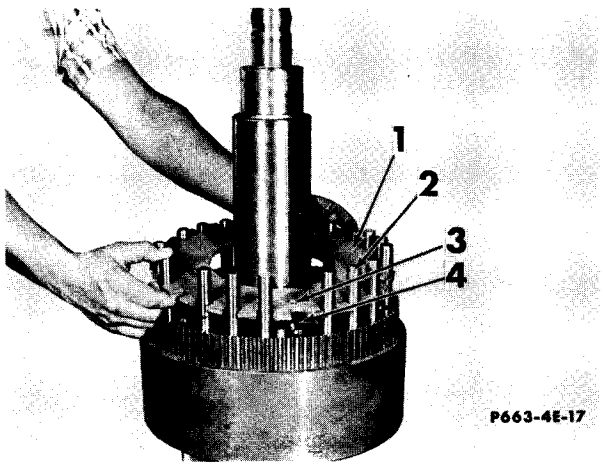


Figure 4E-17

Install spring guide pins (2). Install spring retaining plate (1) and line up the plate with guide pins (2) and dowel pins (4) with the dowel pin holes (3).

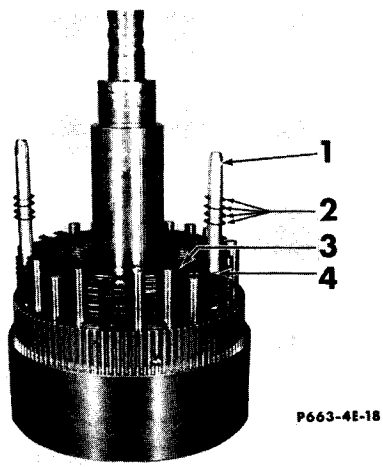


Figure 4E-18

Insert three locating pins (1) into bolt holes. Let them rest on stand. Assembly four Belleville springs (2) on each locating pin, twelve per steel plate. Install bronze plate (3), twelve Belleville springs, one steel plate (4), one bronze plate (3), Belleville springs, steel plate (4), bronze plate, twelve Belleville springs (2), one steel plate (4), one bronze plate (3), etc. ending with a bronze plate and twelve Belleville springs. Check plates before assembly. They must be flat within .008 T.I.R.

PREPARATION FOR REASSEMBLY

OF

ALL CLUTCH PACKS

In preparation for reassembly of the clutch packs, the following should be done:

A. Clean all parts thoroughly in solvent. Use compressed air to dry parts. Carefully inspect all parts for excessive wear, cracks and breakage.

B. Inspect splines on all shafts and drive gears for excessive wear.

C. Inspect all sealing surfaces for wear and/or grooving.

D. Inspect bearing inner races and bushings for pits and spalled areas. Replace bearings and bushings which are pitted or spalled.

E. Inspect the sintered bronze and steel plates for wear or signs of being burnt and/or warped. Replace plates if any of these conditions exist.

F. Replace all seals, hook type seal rings, "O" rings and snap rings.

G. In assembly, use a heavy non-fibrous grease with a low melting point.

CLUTCH STACKING PROCEDURE

(All Clutches)

Opposite is the clutch plate stacking procedure for directional and range clutches in both the D-400 and the D-500 P-6000 transmissions. Starting at the cylinder end of the clutch, assemble clutch plates as follows:

There are a total of 10 bronze and 9 steel plates per clutch. In assembling, starting at the cylinder (E), the piston (D) assembles into the cylinder with ID and OD piston rings with expanders behind them. Assemble one spring retaining plate (R), one bronze plate (B), twelve Belleville springs (A) and four springs 120° apart. A steel plate (S), another bronze plate (B), Belleville springs (A), etc. until 10 bronze and 9 steel plates have been assembled. 120 Belleville springs are assembled in each side of the clutch pack assembly.

NOTE

The bronze plates should be oiled prior to reassembly. Plates that are dry or only lightly oiled are subject to overheating the first time the clutch is applied.

Because the bronze clutch plate facings are porous and absorb oil, a light oiling with an oil can may not be sufficient. Bronze clutch plates should be pre-soaked for at least two minutes in a container of clean transmission oil before assembly into a clutch pack or transmission case.

Different type oils are frequently incompatible. It is important that the oil used for pre-soaking is the same as the oil used in the transmission.

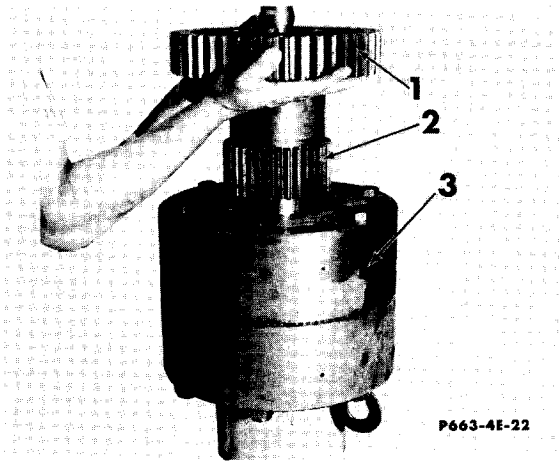


Figure 4E-22

Install reverse gear (1). Do not drop gear into clutch pack (3). Insert gear into clutch plates, turn gear so splines (2) will enter teeth of bronze plates. Do not bend bronze plate teeth.

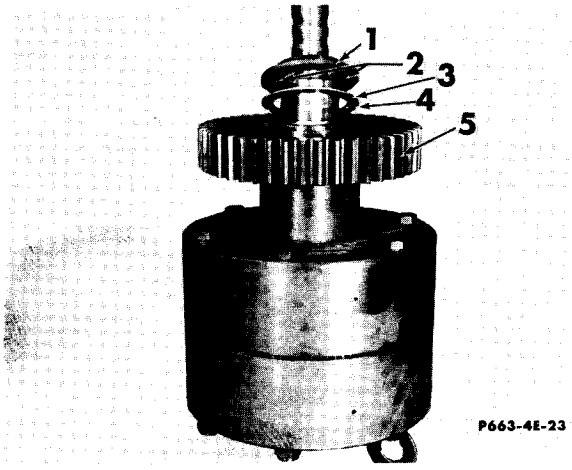


Figure 4E-23

Install thrust washer (3) with the oil grooves (4) toward the gear (5). Install spacer (1), large diameter toward thrust washer. Be sure spacer has two pins (2) in large flat surface that enters into shaft end surface.

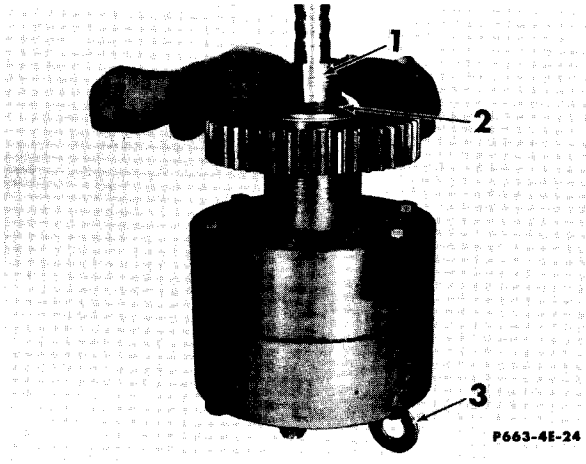


Figure 4E-24

Install a heated bearing race (1) over shaft against spacer washer (2).

Heat bearing race to 250 to 300 degrees fahrenheit. Install snap ring to retain the bearing.

Install lifting (Figure 4-Tool-3) to end of pack shaft. Lift pack with hoist, set on bench or clean floor. Unhook hoist chain, remove special lifter. Hook chain to special lifting nuts (3) (Figure 4-Tool-5). Lift pack into pack stand (Figure 4-Tool-4).

SECTION IV

REASSEMBLY of All Clutch Packs

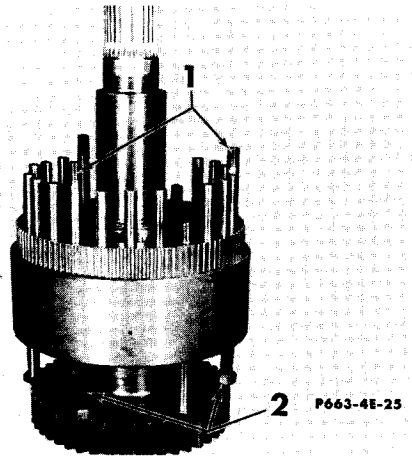


Figure 4E-25

Remove nuts and special nuts. Remove backing plate. Pull the bolts (1) with the marked head up and support them with three bolts and nuts (2) 3/4" x 2-1/2" lg. Install the piston rings in the piston as in Figure 3G-14. Install piston, spring retaining plate, with dowel pins lined up with hole in plate. Install bronze plate, Belleville springs, steel plate etc. ending up with Belleville washers and bronze plate. See Figure 4E-15 for Belleville spring stacking procedure.

Install clutch piston return springs. Check length of the springs before assembling. Free length 3.930 $\pm$ 10% to support 106 lbs. @2.687".

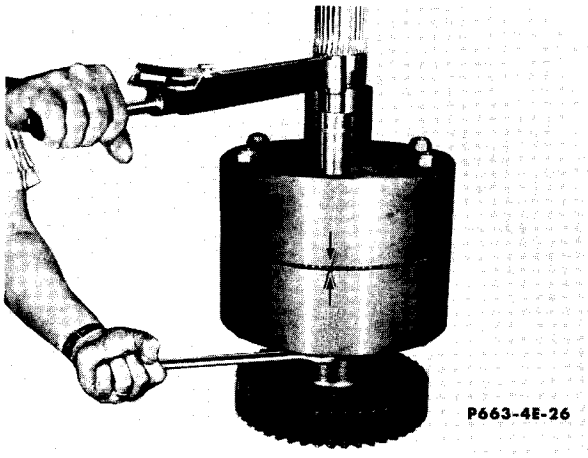


Figure 4E-26

Install backing plate. Insert the three bolts. Install nuts on bolts. Torque to 80 ft. lbs.

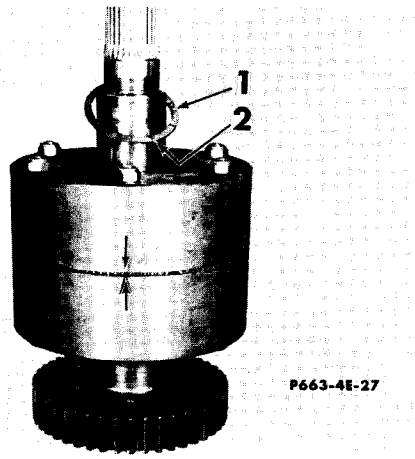


Figure 4E-27

Install thrust washer (1) over shaft into clutch pack. The grooves (2) must be facing the clutch gear.

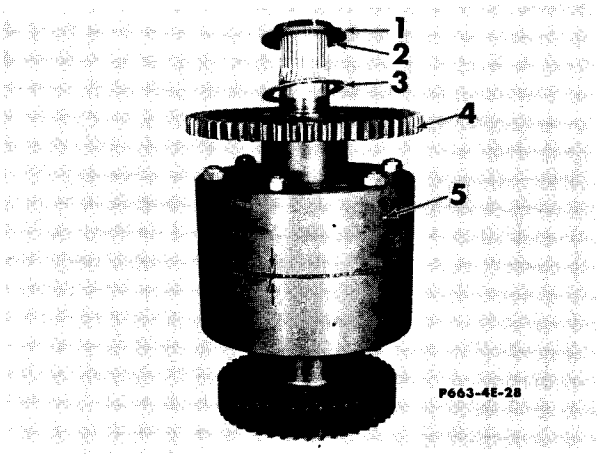


Figure 4E-28

Install forward gear (4). Do not drop gear into clutch pack (5). Insert gear into clutch plates. Turn gear so splines will enter teeth of bronze plates. Do not bend bronze plate teeth. Install thrust washer (3) with oil groove toward the gear (4). Install spacer (1) large diameter towards the thrust washer. Be sure spacer has two pins (2) in large flat surface and enter into shaft end surface.

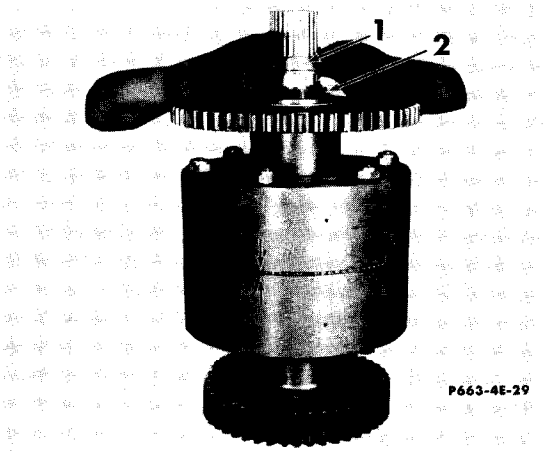


Figure 4E-29

Install a heated bearing race (1) over shaft against spacer washer (2).

Heat bearing race to 250 to 300 degrees fahrenheit.

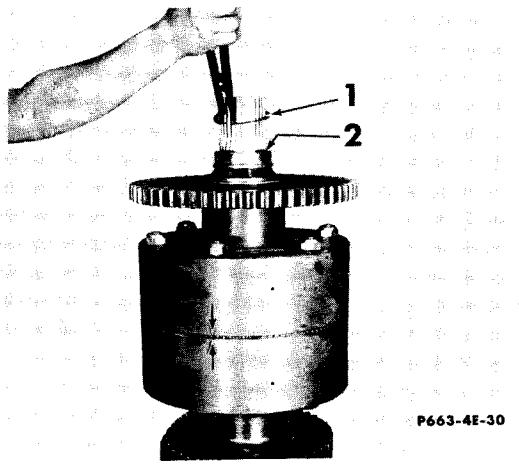


Figure 4E-30

Install snap ring (1) in groove (2) in shaft to secure bearing race.

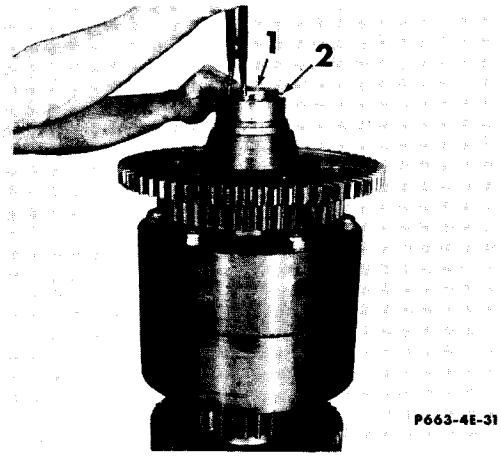


Figure 4E-31

Remove snap ring (2) from shaft (1) on range pack.

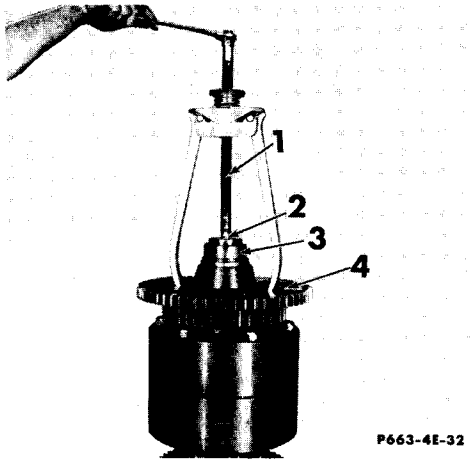


Figure 4E-32

Install gear puller (1) screw on end of shaft center hole (2). Hook clamps into holes (4) in gear. Tightening puller screw will pull the gear off of the shaft pushing bearing race (3) from shaft.

The range clutch pack should be disassembled and reassembled using the same procedure as the forward and reverse pack. When assembling clutch pack, leave bearing race off of the range clutch pack, add spacers to substitute for bearing race until pack is installed into transmission housing.

P-6000 OUTPUT SHAFT

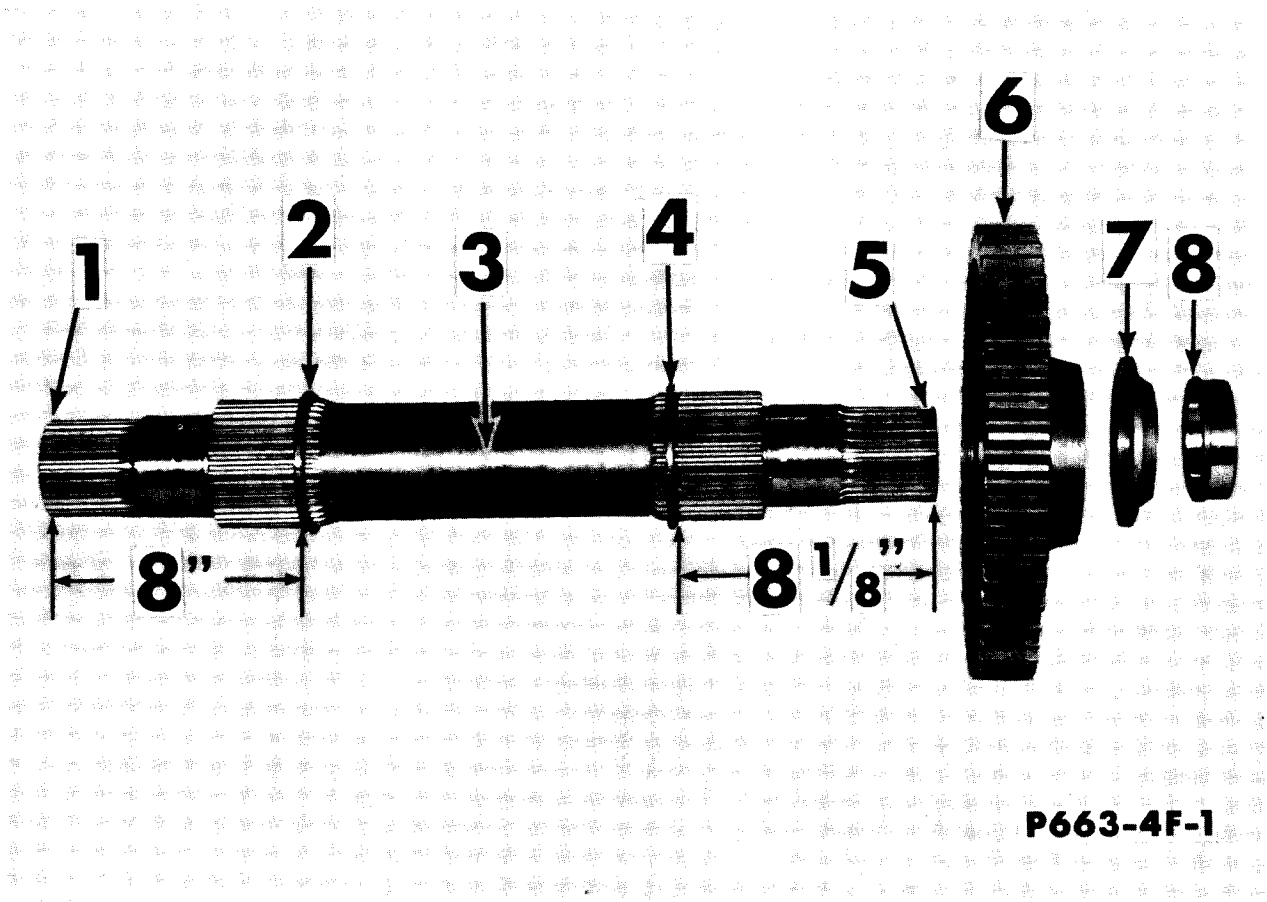


Figure 4F-1 Output Shaft

1. Shaft End
2. Retainer Ring
3. Output Shaft
4. Retainer Ring
5. Shaft End
6. Gear
7. Spacer
8. Bearing Inner Race

OUTPUT SHAFT.

The output shaft (3) must be assembled so the long end of the shaft is in the housing. When measuring shaft (3), install two retainers (2 - 4) on shaft, measure from retainers (2 - 4) to end of shaft (1 - 5). The short end is 8 inches, the long end is 8-1/8 inches.

Assemble shaft (3), retainer halves (4), gear (6), spacer (7) and bearing inner race (8).

REVERSE IDLER GEAR ASSEMBLY

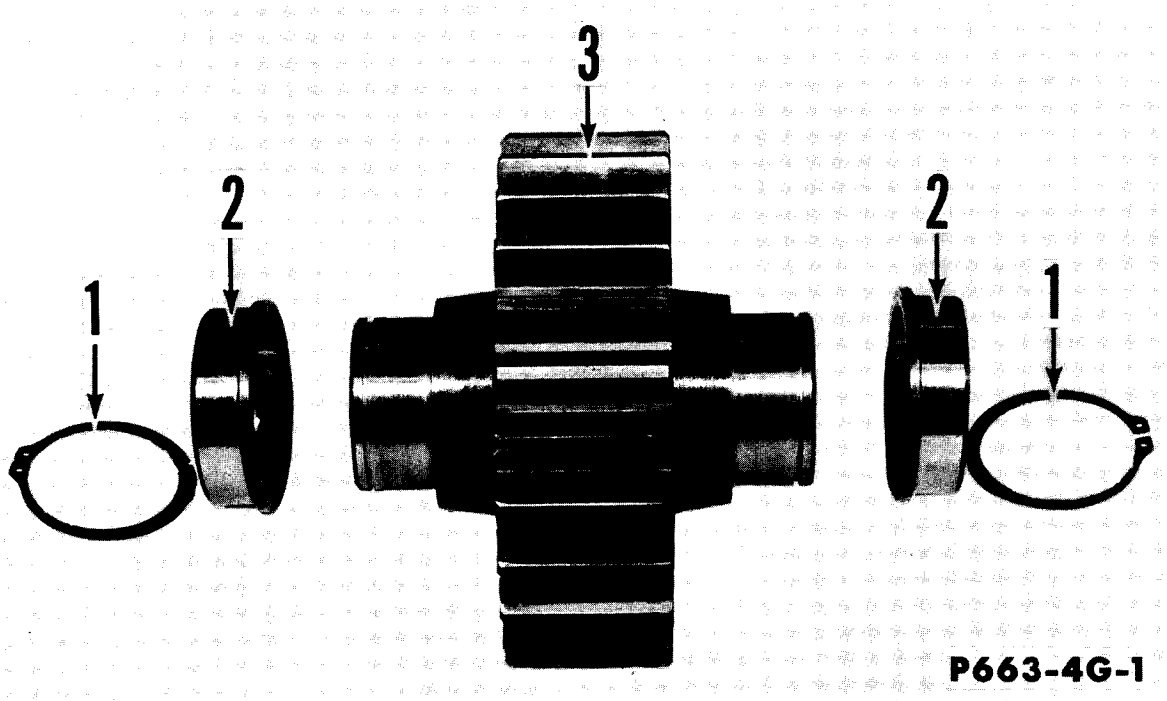


Figure 4G-1 Reverse Idler Gear Assembly

To remove the bearing races (2) from the idler gear (3), remove the two snap rings (1). Clamp a puller behind the bearing race on idler gear. Block up gear puller in press and press gear (1) out of bearing race (2).

NOTE

When assembling idler gear into housing, be sure the short end of the gear is down toward the housing.

To install the bearing races (2) onto the idler gear (3), set the gear on the bench. Install the bearing races (2) over the end of the idler gear (3). Be sure they are down to the shoulder of the gear. Install the two snap rings.

NOTE

Prior to reassembly, heat bearing races (2) to 250° F - 300° F. in oil or in an oven.

D-500 & D-400 TRANSMISSION GEARS

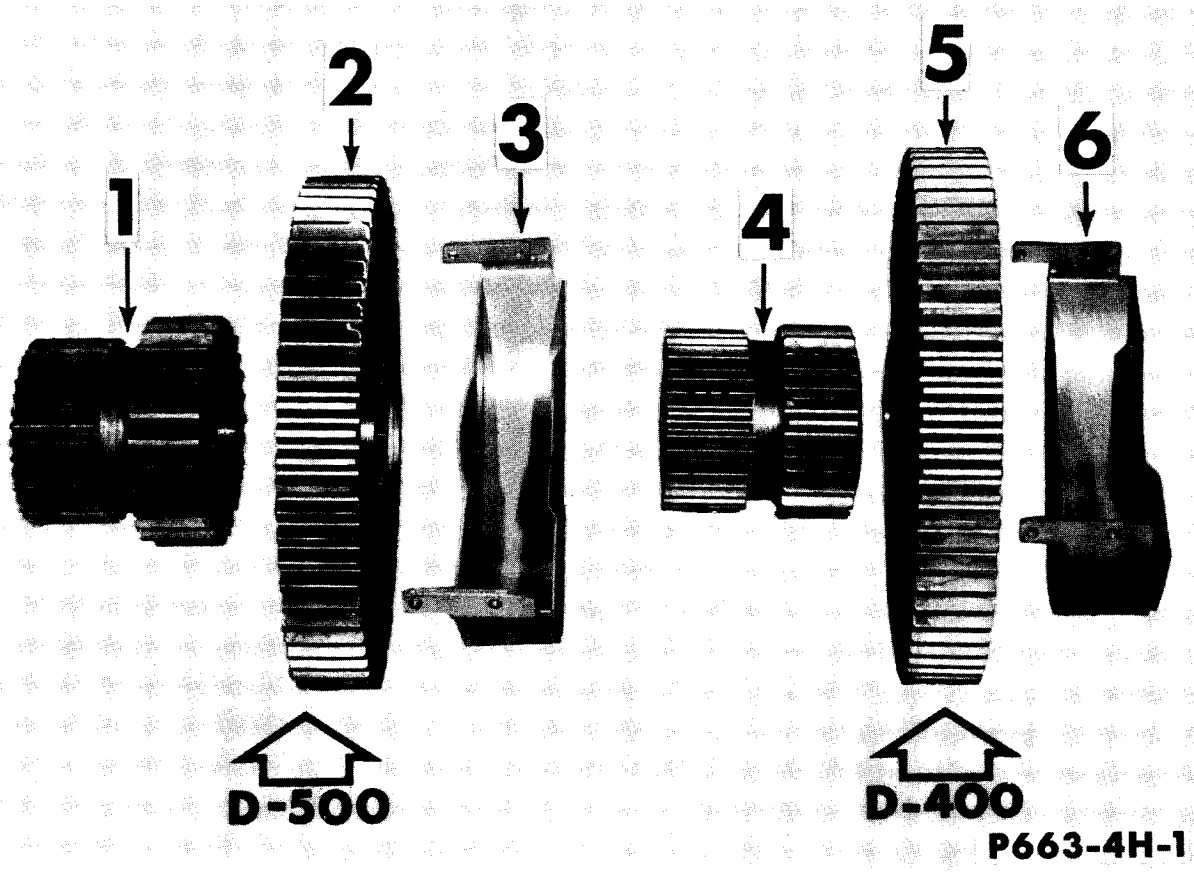


Figure 4H-1 Low Range Output Gears & Pack Low Range Gear

D-500

1. Low Range Clutch Pack Gear
2. Low Range Output Gear
3. Low Range Output Gear Baffle

D-400

4. Low Range Clutch Pack Gear
5. Low Range Output Gear
6. Low Range Output Gear Baffle

P-6000 TRANSMISSION.

The D-500 "PAYDOZER" transmission uses a low range clutch pack gear (1), a low range output gear (2) and a low range output gear oil baffle (3).

The D-400 "PAYDOZER" transmission is a P-6000 transmission except for replacement of the following parts, the low range clutch pack gear (4), a low range output gear (5) and a low range output gear oil baffle (6).

This was done to match the ratio of the power train.

The D-400 and D-500 transmissions cannot be exchanged, they are not interchangeable.

D-500 & D-400 TRANSMISSION COVER ASSEMBLIES

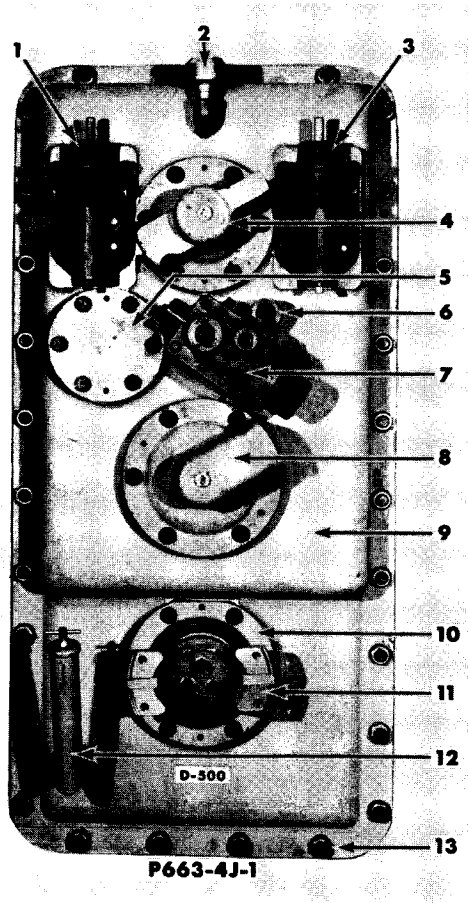


Figure 4J-1 D500 Trans. Cover

1. Directional valve
2. Breather
3. Range valve
4. Directional clutch oil supply cap
5. Reverse idler bearing retainer
6. Valve adapter
7. Main regulator valve
8. Range clutch oil supply cap
9. Cover
10. Output bearing cap with seal
11. Yoke
12. Filler pipe
13. Capscrew, nut and lockwasher

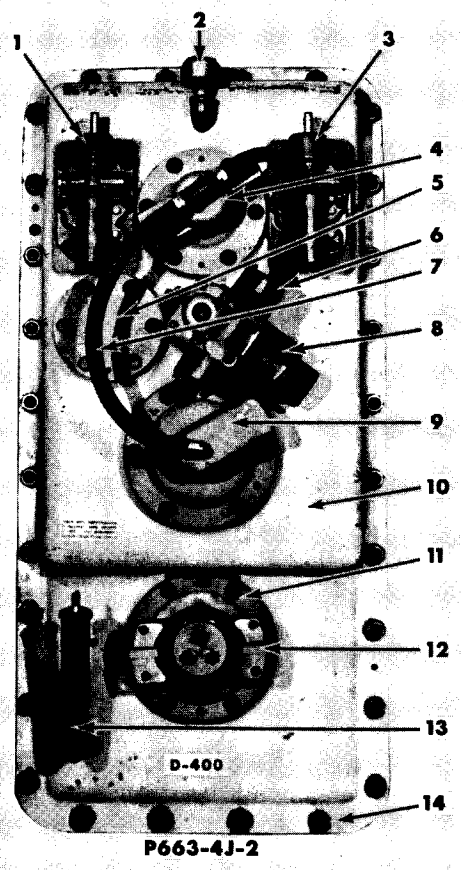


Figure 4J-2 D400 Trans. Cover

1. Directional valve
2. Breather
3. Range valve
4. Directional clutch oil supply cap
5. Reverse idler bearing retainer
6. Converter control valve
7. Lube hose
8. Main regulator valve
9. Range clutch oil supply cap
10. Cover
11. Output bearing cap with seal
12. Yoke
13. Filler pipe
14. Capscrew, nut and lockwasher

DISASSEMBLY OF FRONT COVER.

In the event any of the roller bearings have to be removed and/or replaced after the cover is removed from the transmission, use a suitable soft drift to drive bearing from cover.

CAUTION

Drive on bearing outer race only.

Bearings are a light drive fit. To reinstall bearings, use a soft drift or mallet to drive bearings into bearing bore.

NOTE

Oil supply tubes are not replaceable. They are serviced with cover. Care must be taken not to damage oil supply tubes.

P-6000 TRANSMISSION COVER(Inside view)

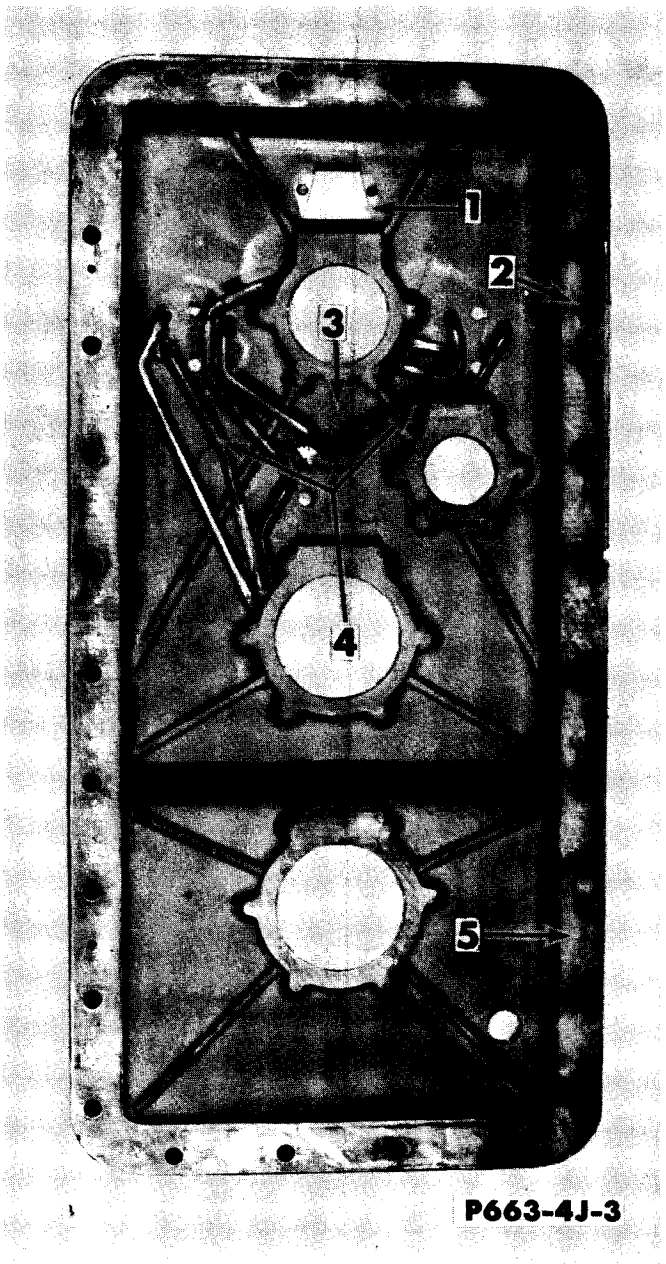


Figure 4J-3 Transmission Cover(Inside view)

COVER ASSEMBLY

(1) Install breather baffle (1) with two capscrews

(2) Dowel holes

(3) Cover

(4) Oil tubes, non-serviceable.

(5) Jack screw holes

NOTES:

PREPARATION FOR REASSEMBLY OF P-6000 TRANSMISSION

Preparation For Reassembly of P-6000 Transmission.

In preparation for reassembly of the P-6000 transmission, the following should be done:

A. Clean all parts thoroughly in solvent or plain steam. (Do not use caustic soda in the steam.) Use compressed air to dry parts. If steam is used to clean parts, oil immediately thereafter. Carefully inspect all parts for excessive wear, cracks and/or breakage.

B. Inspect all bearings for pits and spalled areas. Replace bearings which are pitted and/or spalled.

C. Replace all seals, hook type seal rings, gaskets, "O" rings and snap rings.

D. Inspect all sealing surfaces for wear and/or grooving.

E. Inspect housings for dirt particles, and flush all passageways thoroughly.

F. Inspect splines on all shafts and drive gears for wear.

G. In assembly, use a heavy non-fibrous grease with a low melting point.

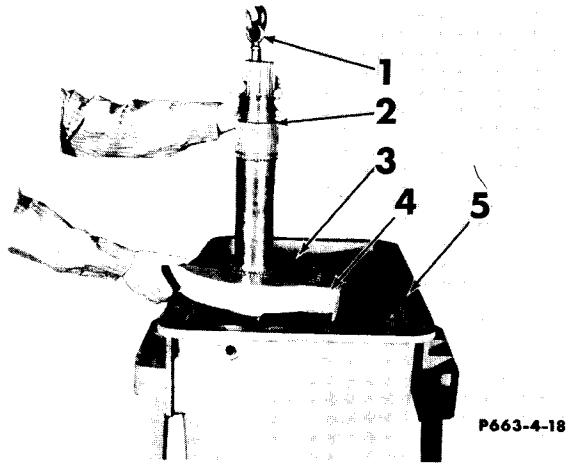


Figure 4-18

Screw eye bolt (1) into end of output shaft (2). Lower into transmission housing (5) with oil baffle (4) onto gear (3).

Be sure the output shaft assembly has been assembled as in Section IV-F.

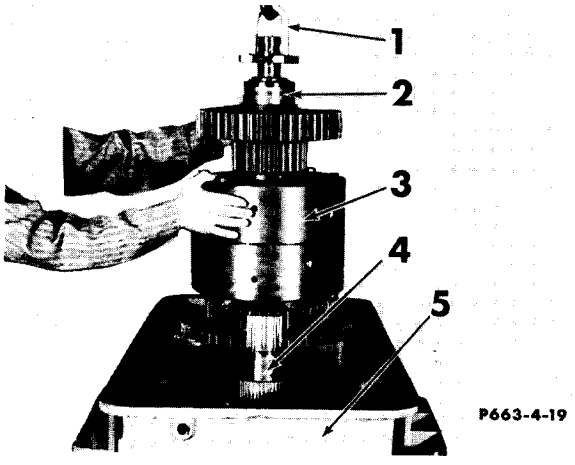


Figure 4-19

Install lifting tool (1) to range clutch pack (3) with spacer washers (2) on shaft instead of bearing race. Gear has to be taken off when output shaft gear is installed. Lean output shaft (4) toward bottom of transmission housing (5) to let the pack shaft enter bearing hole in housing and let pack gear pass the output shaft gear.

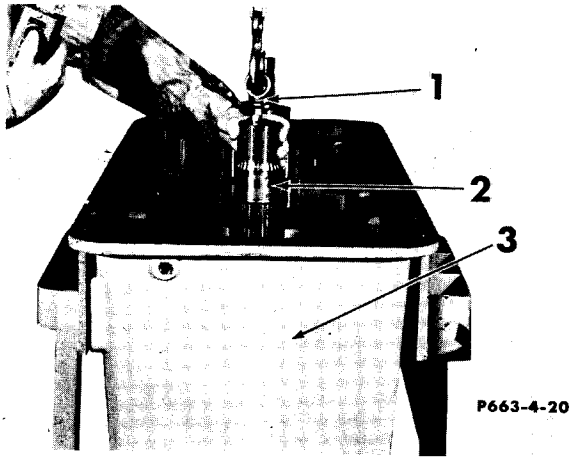


Figure 4-20

Screw eye bolt (1) into output shaft (2). Raise shaft high enough to install the oil baffle with dynaseal washers on the capscrews. Torque to 37 ft. lbs.

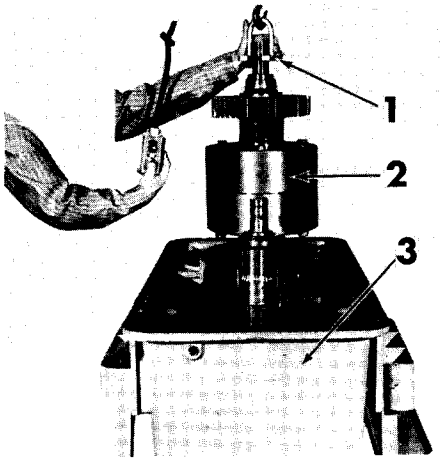


Figure 4-21

Install lifting tool (1) onto directional clutch pack (2). Lower it down into transmission housing (3).

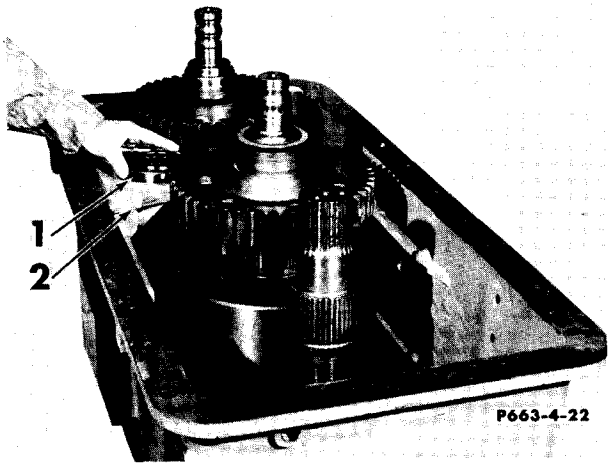


Figure 4-22

Install lower snap ring into the idler support (2) in housing. Insert bearing (1) into idler support (2). Install top snap ring to secure the bearing (1) (oil bearing).

The races are installed on the idler gear subassembly Section IV-G

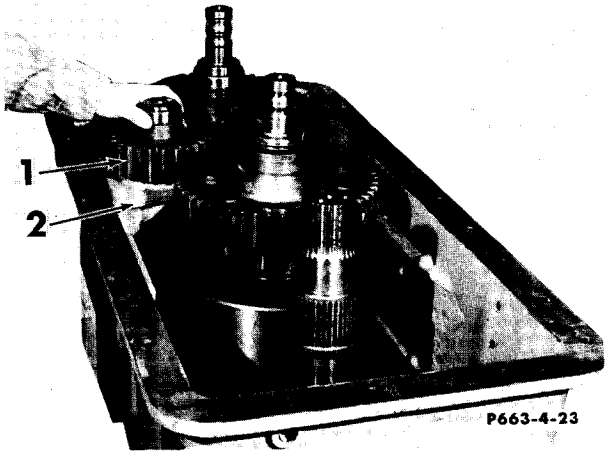


Figure 4-23

Install idler gear assembly (1) in bearing in idler support (2).

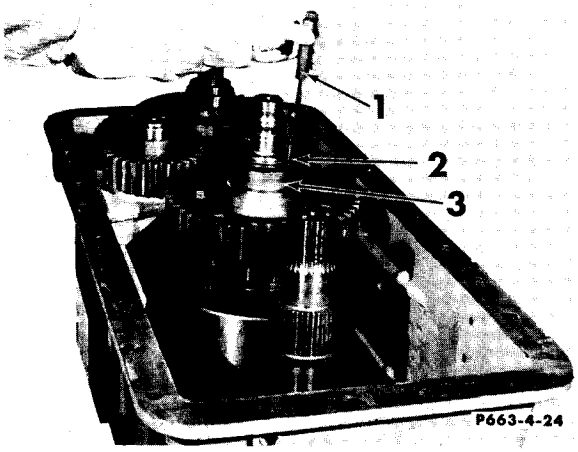


Figure 4-24

Remove snap ring (2) with snap ring pliers (1). Remove the spacer washers (3).

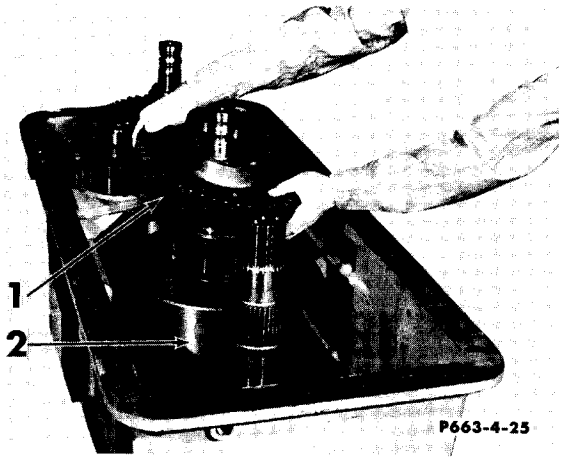


Figure 4-25

Remove the range gear (1) from the range pack (2).

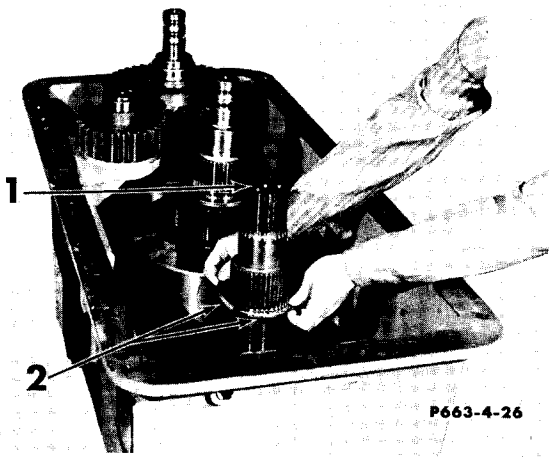


Figure 4-26

Install the two retainer halves (2) into the groove in the output shaft (1).

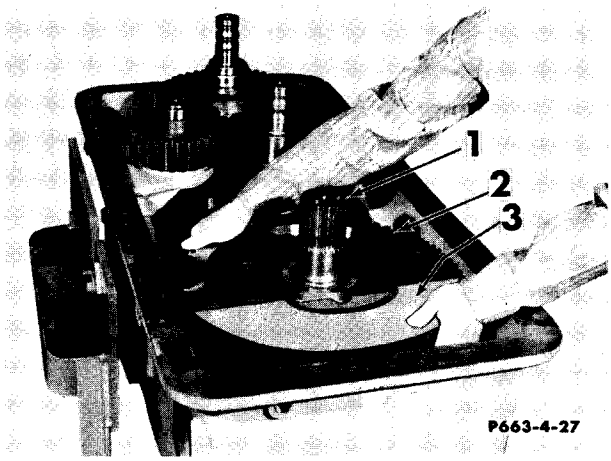


Figure 4-27

Install gear (2) and oil baffle (3) on output shaft (1). Make certain long end of gear fits over retainers. Install four capscrews with dynaseal washers through the transmission housing to secure oil baffle.

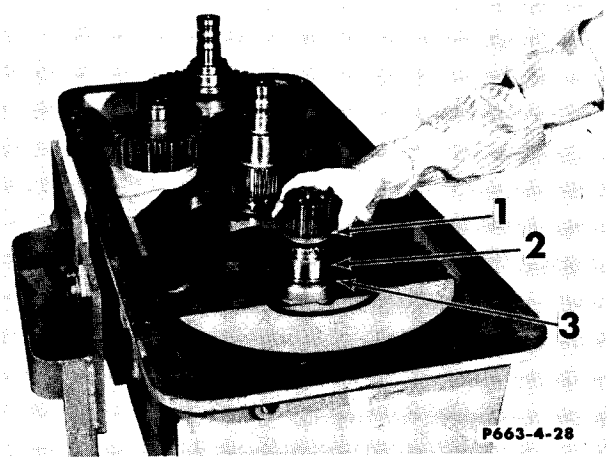


Figure 4-28

Install spacer (3) and heated bearing race (2) on output shaft with another spacer (1).

NOTE Prior to reassembly, heat bearing inner race to 250° F. - 300° F. in oil or in oven.

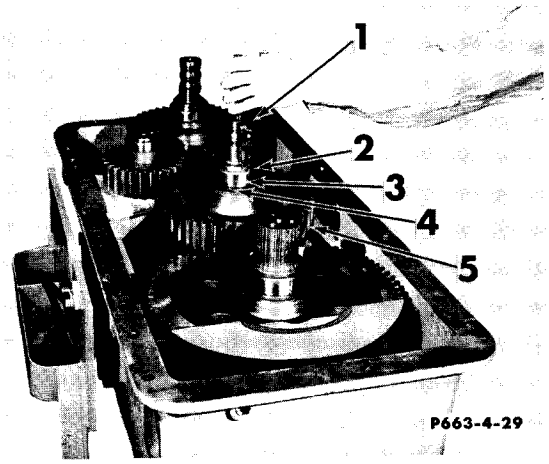


Figure 4-29

Install range pack gear (5) (short hub down). Make certain that retainers are in place.

Install spacer (4) and bearing race (3) and snap ring (2) with snap ring pliers (1).

NOTE Prior to reassembly, heat bearing inner race to 250° F. - 300° F. in oil or in oven.

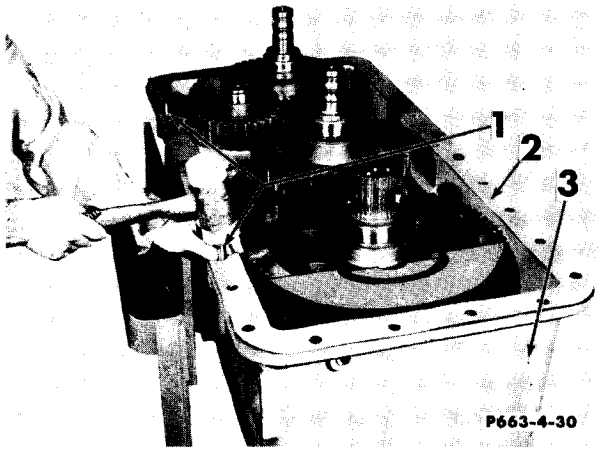


Figure 4-30

Place heavy grease on housing before gasket is installed to the housing. It will hold the gasket in place. Install gasket (2). Check holes in gasket. Install dowel pins (1).

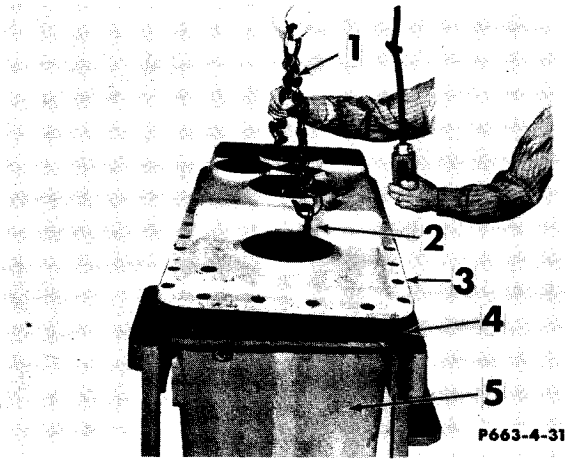


Figure 4-31

Use eye bolts (2) to install cover (3) with chain (1) on transmission (5). Care must be taken not to damage the oil seal grooves on the two clutch packs when lowering the cover on the transmission housing (5) with gasket (4). Center cover over dowel pins.

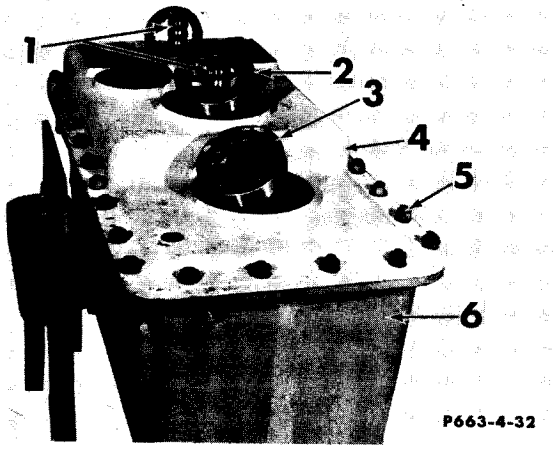


Figure 4-32

Install the capscrews (5), washers and nuts to secure the cover (4). Torque to 280 ft. lbs.

Be sure the bearings are installed properly. Number 3 indicates bearing is going on correctly. Number 2 indicates bearing is not correct. The end thrust on the rollers should be against the outer race, not the washer. After the bearings have been driven into the bearing bore, install the seal rings into the grooves (1) of both clutch pack shafts.

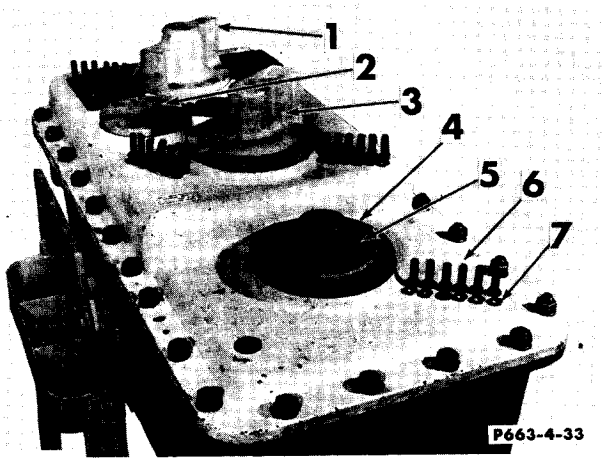


Figure 4-33

Coat ID of the bearing cap (4) with Mar-Seal or a comparable sealant. Install seal (5) in output bearing cap (4). Install gasket, cap (4), capscrews (6) and washers (7). When assembling (1 & 3) caps, line up the gaskets and caps for the oil flow. Install caps (1, 2 & 3). Install all lockwashers and capscrews. Torque to 32 ft. lbs.

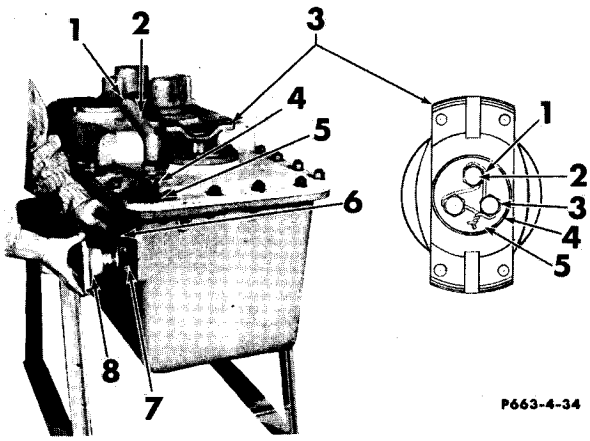


Figure 4-34

Install oil filler tube fitting into transmission cover, screw filler pipe (2) into fitting, place in a upright position and tighten nut on fitting. Install dipstick (1), tighten. Install filter (7) in the cap (8). Install in transmission with gasket (6), washers (5) and capscrews (4). Torque to 32 ft. lbs.

To install yoke, grease the seal, slide yoke (3) on the output shaft. Install gasket (4), washers (5), dynaseal washers (3) and capscrews (2). Torque to 65 ft. lbs., then wire (1) the capscrews to secure them from getting loose.

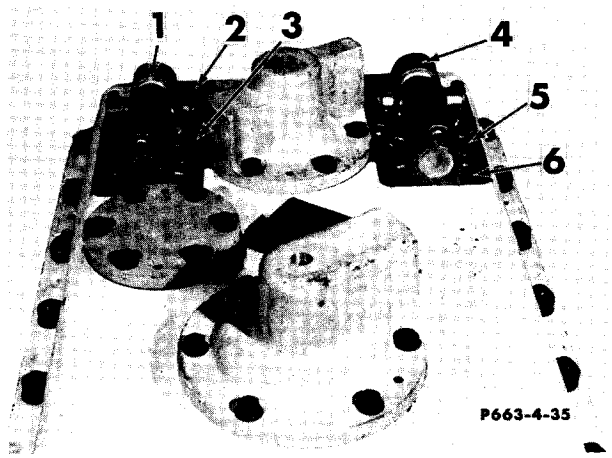


Figure 4-35

Install two valve gaskets (3 & 6). Install directional (1) and range valve (4). Be sure gasket (3 & 6) fit all openings on the valves. Install capscrews (2 & 5) with lockwashers. Torque to 32 ft. lbs.

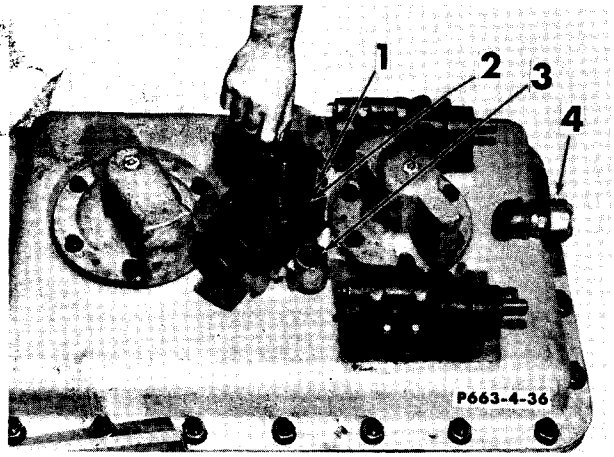


Figure 4-36

Install main regulator valve gasket, the adapter (3) and then another gasket. Install the main regulator valve (2). Install the capscrews (1). Torque to 32 ft. lbs. Install breather (4).

NOTE Install valve and gaskets as illustrated in Section IV-D.

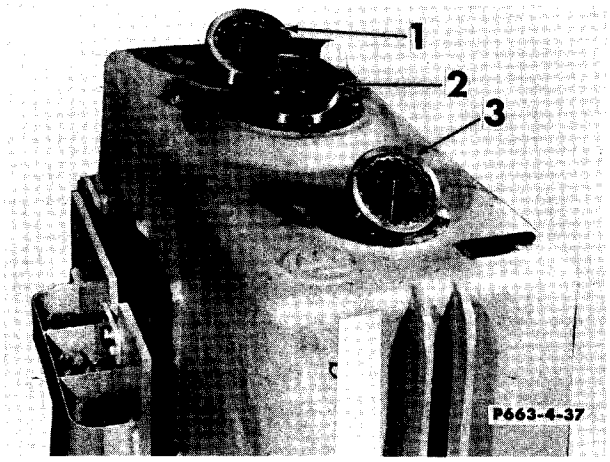


Figure 4-37

Turn transmission over in stand. Install bearings (1, 2 & 3) in transmission housing.

1. Output shaft bearing.
2. Range clutch pack bearing.
3. Direction clutch pack bearing.

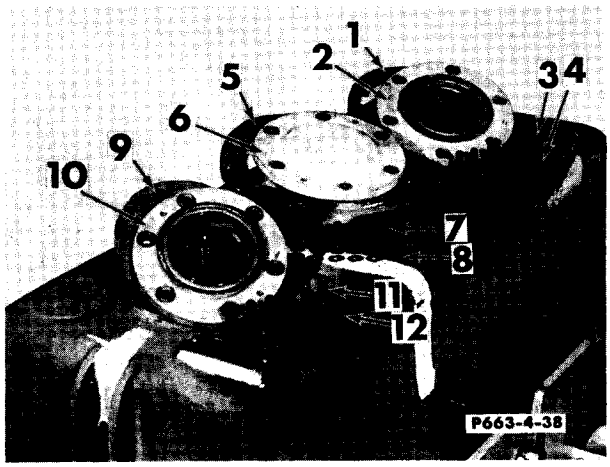


Figure 4-38

Install gasket (1), seal retainer (2) with seal installed. Install lockwashers (4) and capscrews (3).

Install gasket (5), cover (6), lockwashers (8) and capscrews (7).

Install gasket (9), seal retainer (10), lockwashers (12) and capscrews (11). Torque capscrews to 32 ft. lbs.

NOTE When installing gaskets, line up oil channels with cover and housing.

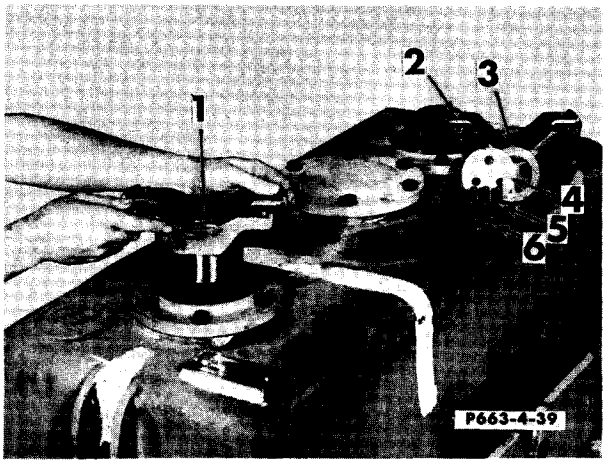


Figure 4-39

Install input yoke (1). Install output yoke (2), gasket (3), retaining washer (4), Dynaseal washers (6) and capscrews (5). Torque to 50 ft. lbs. Thread lock wire through holes in capscrews.

NOTE Before installing the yokes (1 & 2) on shafts, place a non-fibrous grease on the oil seals to let the yoke slide into seals. Check lip of seal. Be sure it is not turned over. If so, insert a flat tool past seal lip to bring lip into place. (Do not damage lip of seal.)