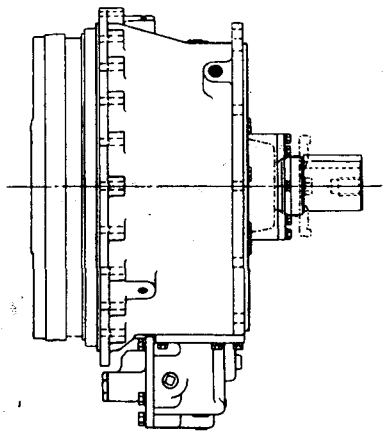
Allison

TORQMATIC® CONVERTERS

MODEL TC-500

TORQMATIC®

SERVICE MANUAL



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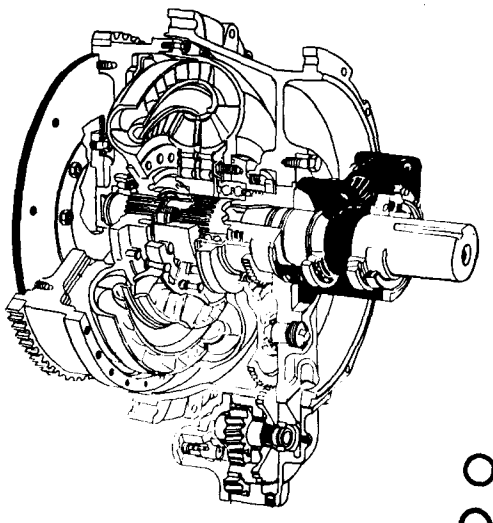

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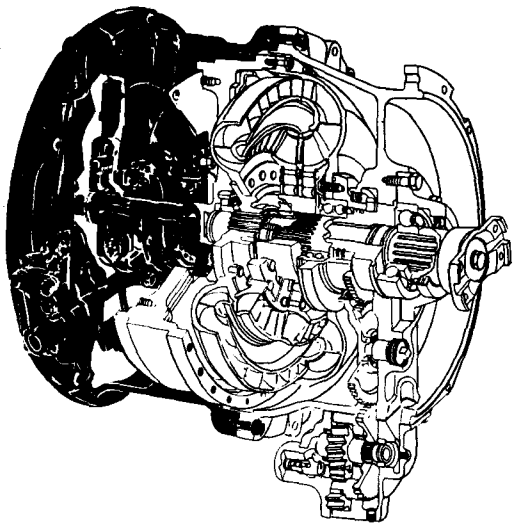

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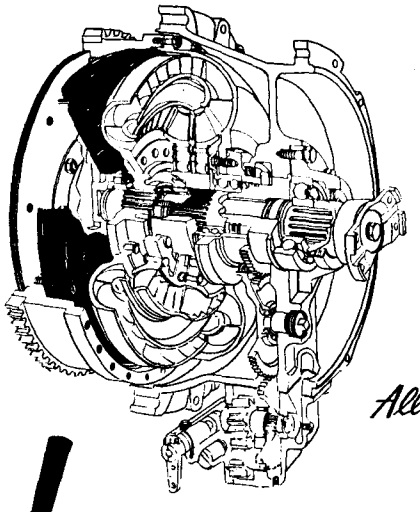
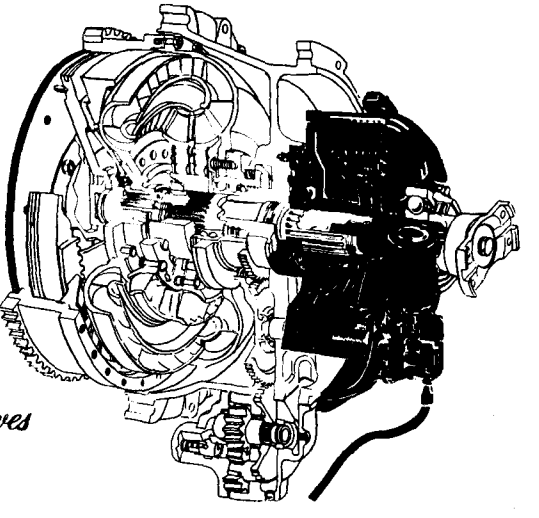


HYDRAULIC INPUT-LOCKUP CLUTCH

Allison TORQMATIC® Drives



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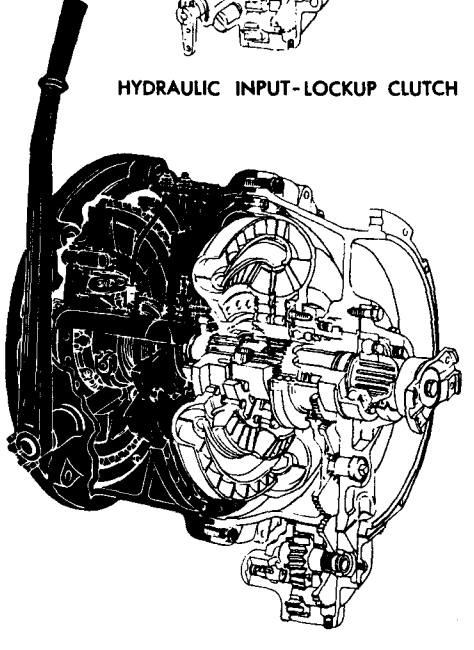

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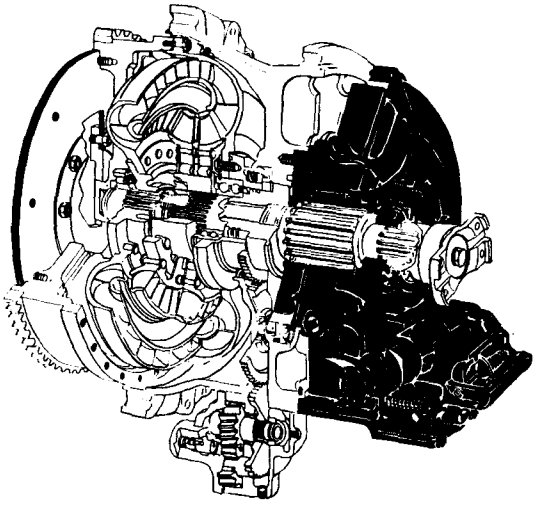

TORQMATIC RETARDER

SERVICE MANUAL

Allison

500 series

TORQMATIC CONVERTERS

PRICE $3.00 PER COPY

C. 1960

Prepared
by

SALES AND SERVICE PUBLICATIONS

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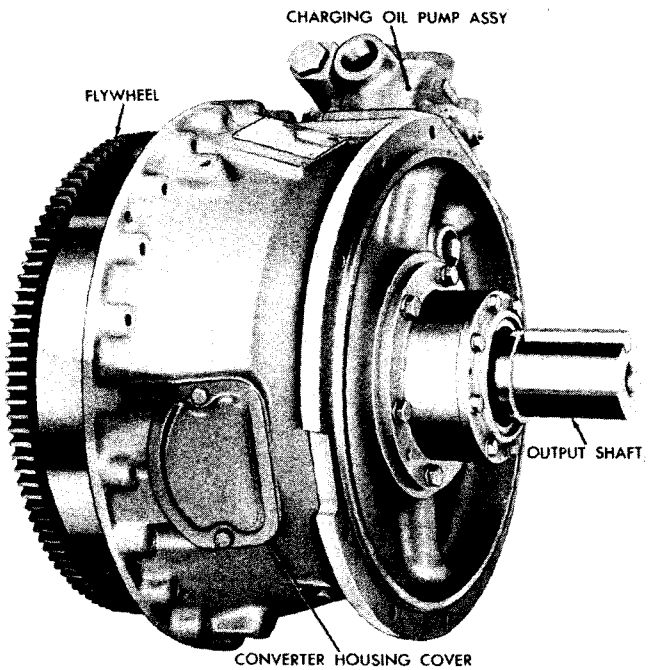


Fig I-1. Model TC-555 Torqmatic converter with industrial shaft, left-rear view

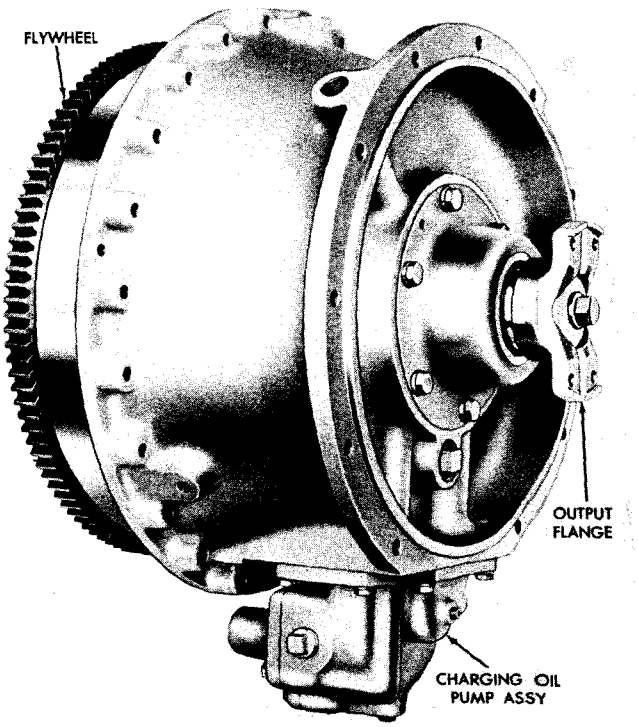


Fig I-2. Model TC-554 Torqmatic converter with automotive flange, left-rear view

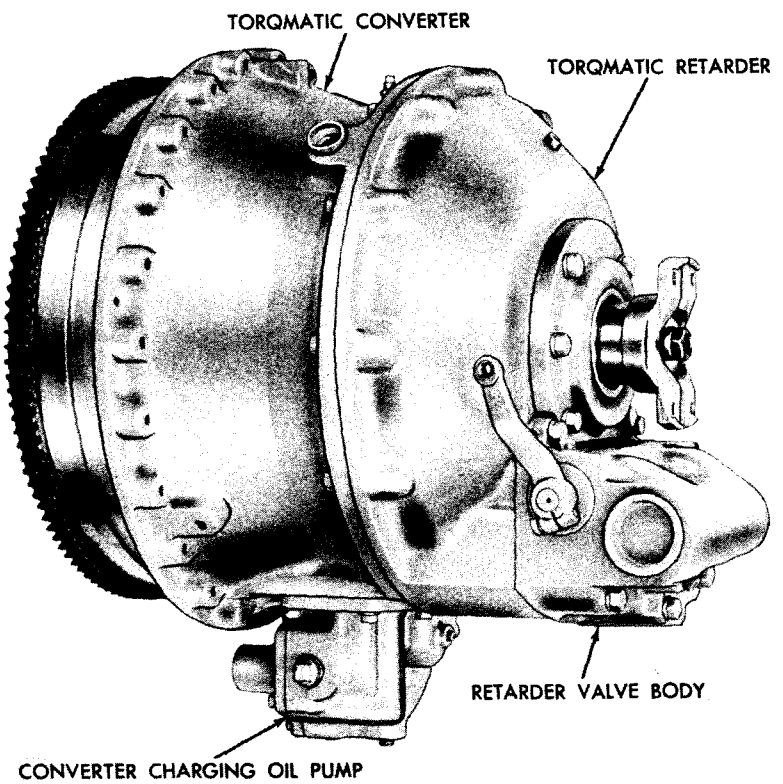


Fig I-3. Model TCB-544 Torqmatic converter with Torqmatic retarder

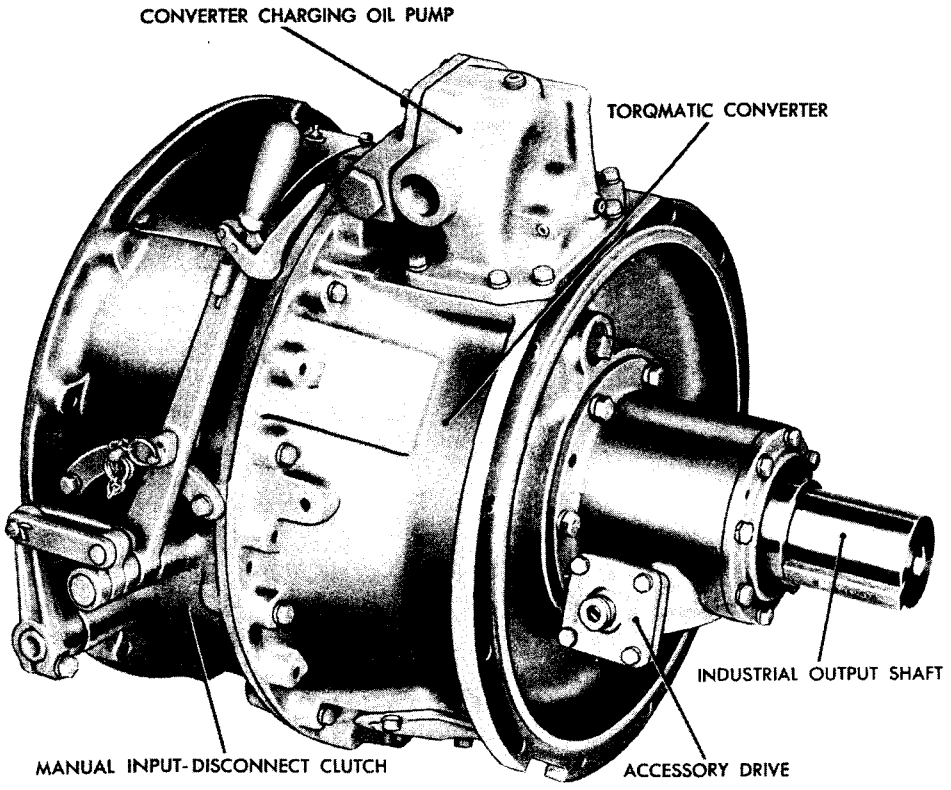


Fig I-4. Model TCDA-555 Torqmatic converter with manual, spring-loaded, input-disconnect clutch and accessory drive

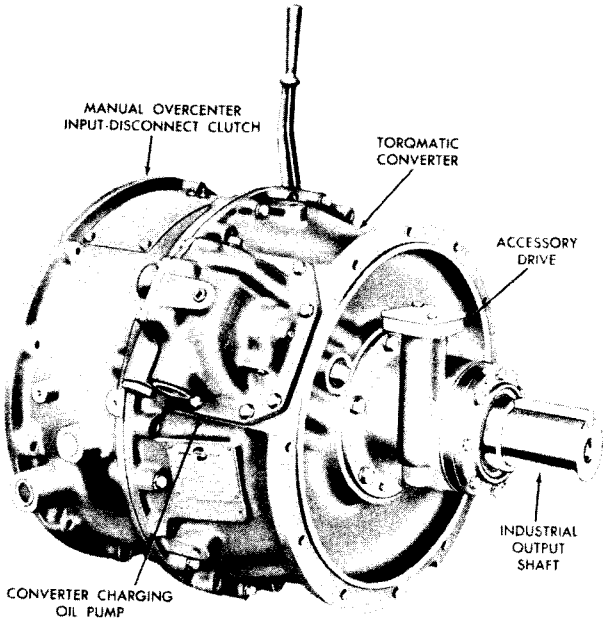


Fig I-5. Model TCDA-575 Torqmatic converter with manual, overcenter, input-disconnect clutch and accessory drive

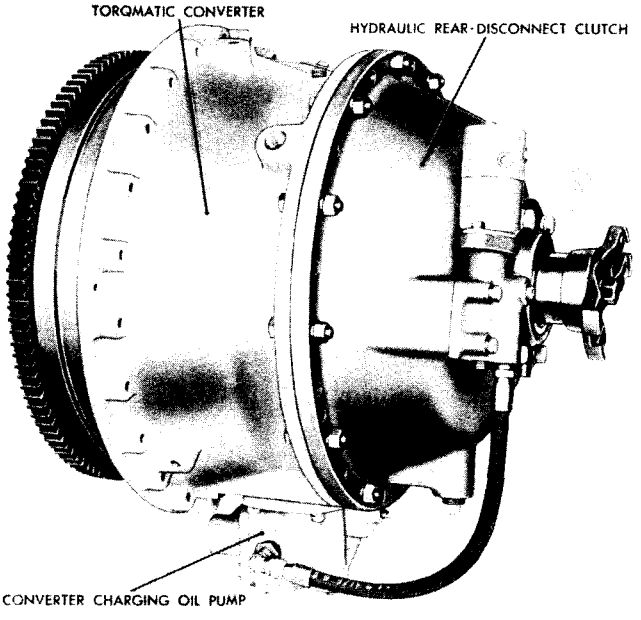


Fig I-6. Model TCRD-554 Torqmatic converter and hydraulic rear-disconnect clutch

SECTION I GENERAL INFORMATION

1. SCOPE

a. Models Covered. This service manual covers the TC-500 series Torqmatic converters and Allison-equipped options. Figs. I-1 through I-6 illustrate the basic models and their options (par. 4).

b. Keeping Manual Current. Service Information Letters and other supplemental information, to be used in conjunction with this manual, will be issued from time to time. This information will cover new models and changes in design or service procedures.

2. TC-500 TORQMATIC CONVERTERS

a. Horsepower Range.

(1) The TC-500 series Torqmatic converters are designed for heavy-duty operation with either Diesel or gasoline engines in the 150 to 350 horsepower range, depending upon the installation and type of service. There are seven models in this series. The only difference between them is in their torque absorption capacities (see specifications at the end of this section).

(2) The various torque absorption capacities are obtained by changing the blade angles of the stators and the converter pump for each of the seven models. There are three stators and four converter pumps with different blade angles. By combining each of the stators with each of the converter pumps, different torque absorption capacities are procured.

b. Torque Multiplier and Fluid Coupling. The Allison Torqmatic converter combines all the desirable characteristics of a hydraulic torque multiplier and a fluid coupling to transmit engine power to automotive or stationary equipment. The Torqmatic converter automatically adjusts the output torque to the load demand, and permits the engine to operate at its most effective output.

c. Type Converter. The TC-500 series Torqmatic converter employs the rotating housing principle. It is a single stage, polyphase type of converter with four elements: pump, turbine, and two stators. How the Torqmatic converter works is fully explained in sec. II, Torqmatic Converter Principles. For detailed specifications see the Specifications and Data chart at the end of this section.

d. Extending Torque Ratio. The Allison quick-shift Torqmatic transmission is designed to operate with the Torqmatic converter in applications that need the advantages of Torqmatic Drive with high torque ratio. The Torqmatic Drive combination of the Allison converter and the full-power shifting transmission provides torque ratios up to 16:1.

e. Torqmatic Drive Advantages.

(1) The Torqmatic converter permits the engine to operate at its most effective output. It protects the engine from damaging shock loads and harmful engine lugging and stalling, thereby increasing the life of engine and equipment — and their service availability. Because torque is multiplied hydraulically and automatically, engine power is fitted to the load more efficiently. This eliminates gear shift guess and reduces driver fatigue.

(2) The Torqmatic transmission quick-shifts under full load at wide-open throttle without interrupting the power flow from engine to load. Torqmatic Drive provides infinitely variable torque ratios within the design range. The transmission provides finger-tip hydraulic control in both single and multiple installations. The conventional clutch is eliminated — and with it goes double-clutch pedal pumping and periodic clutch overhaul. Only one hydraulic system for both converter and transmission is necessary.

3. DESIGN FEATURES

a. Compact Design.

(1) The Torqmatic converter occupies no more space than the conventional power

take-off and is available with either automotive flange or industrial shaft (figs. I-1 and I-2). There are only four major moving parts — the charging pump is integral with the converter housing and can generally be placed in any position at least 30 degrees above or below the horizontal center line.

(2) The TCA models require that the charging pump and accessory drive tower be mounted in a predetermined relationship with each other. The position of the drive tower will be dependent upon the installation in which it is used.

(3) Versatility of installation is also made possible through the use of the optional accessories available. Figs. I-1 through I-6 illustrate some of the options available.

b. Manual Input-Disconnect Clutch. Provisions have been made for an input-disconnect clutch for applications requiring complete isolation of the engine power from the converter. This input-disconnect clutch is a standard, dry-type, clutch plate and is manually operated. The disconnect clutch can be serviced independently of the converter (figs. I-4 and I-5).

c. Accessory Drive. An accessory drive operated by the converter output shaft is available. This accessory can be adapted to drive a speedometer or to serve as a governor drive for controlling converter output-shaft speed. The accessory drive is contained in the bearing housing mounted on the rear of the converter.

d. Hydraulic Rear-Disconnect Clutch. For installations requiring disconnect of the converter output from the load, a clutch assembly is provided. A rear-disconnect clutch is needed for an installation with a selective gear transmission requiring shifts while the vehicle is in motion (fig. I-6).

e. Hydraulic Input-Lockup Clutch. To obtain direct drive through the converter, a single disk, oil-cooled lockup clutch is available. The clutch, located inside the flywheel, locks the converter pump element to the turbine element — in other words, locks input to output (fig. VII-5). A manually operated valve controls the hydraulic pressure which engages the clutch. The clutch is designed to transmit engine torque but is not designed for the shock loading which accompanies high-load shifting; therefore, the clutch should be disengaged before shifting the transmission. The clutch is used to the best advantage where it will be engaged with the transmission for a period of time in a pre-selected range.

f. Torqmatic Retarder. This drive-line retarder is available as an integral part of the Torqmatic converter and provides constant braking power on downhill hauls (fig. I-3). There are only three major parts: The rotor, splined to the output shaft; the stator vanes, cast into the housing which encloses the rotor; and the control valve which provides various degrees of dynamic retarding. The Torqmatic retarder uses the same hydraulic system as the Torqmatic Drive. No extra charging oil pumps are required. The operation is explained in sec. II, Torqmatic Converter Principles.

4. MODEL DESIGNATION

a. Letter, Number Code. For your convenience, a Model Designation Chart is shown at the back of this section. This chart explains the letter and number code used to identify this series of Torqmatic converters.

b. Ordering Parts. All parts orders or service information requests should be directed to your dealer. The model number alone should not be used when ordering parts, or requesting service information. Use the transmission part number — the A/N number found on the name plate shown in fig. I-7. Refer to the TC-500 PARTS CATALOG when ordering parts. Do not use exploded view reference numbers from this service manual. To help you get the right information or parts quickly, be sure always to include the assembly part number (A/N number) of your Torqmatic converter.

5. HYDRAULIC SYSTEM

a. Oil Reservoir.

(1) The hydraulic system of the Torqmatic converter is essentially the same whether the installation includes a Torqmatic

Fig I-7. Torqmatic converter name plate

transmission or the Torqmatic converter is used alone (figs. I-8, I-9, III-3, III-4, and III-6). See sec. III, pars. 5 and 6.

(2) When the Torqmatic converter is used alone, a separate tank serves as the oil reservoir for the converter. A breather is usually provided for expansion and contraction of the oil. A dipstick may be used to check the oil level (sec. III, par. 5).

(3) When the Torqmatic converter is used with a Torqmatic transmission, the transmission sump serves as the oil reservoir for both the converter and the transmission. Incorporated in the transmission is a breather and an oil level check plug (sec. III, par. 6).

b. Oil Flow Within Hydraulic System. The flow of oil in the system is from the oil reservoir through the oil pump to the converter and back to the oil reservoir. Incorporated in this circuit are: an oil filter, an oil cooler, one or more pressure regulating valves and pressure and temperature gages (figs. I-8 and I-9). A gravity drain line from the con-

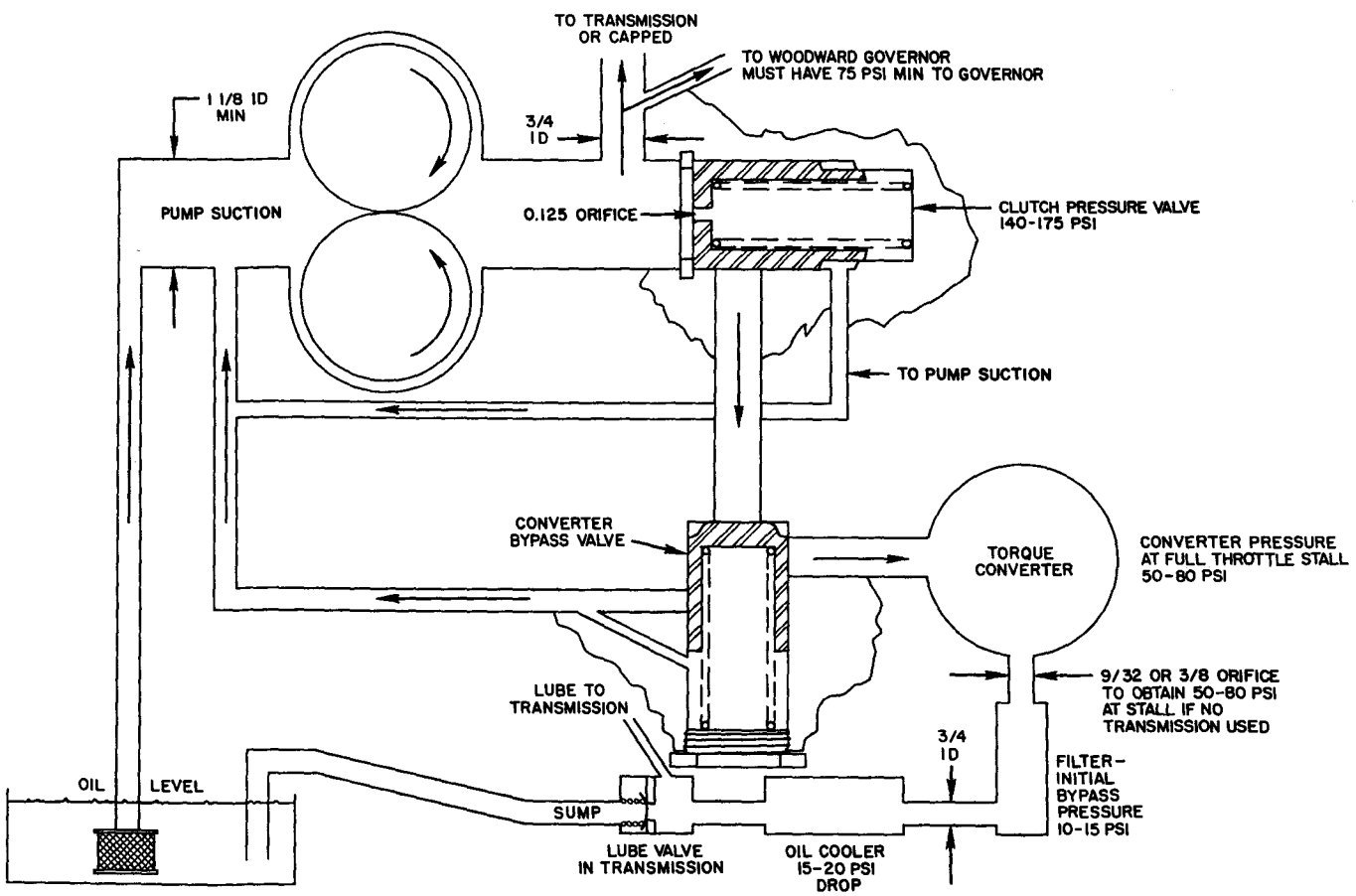


Fig I-8. TC-500 Oil system — schematic

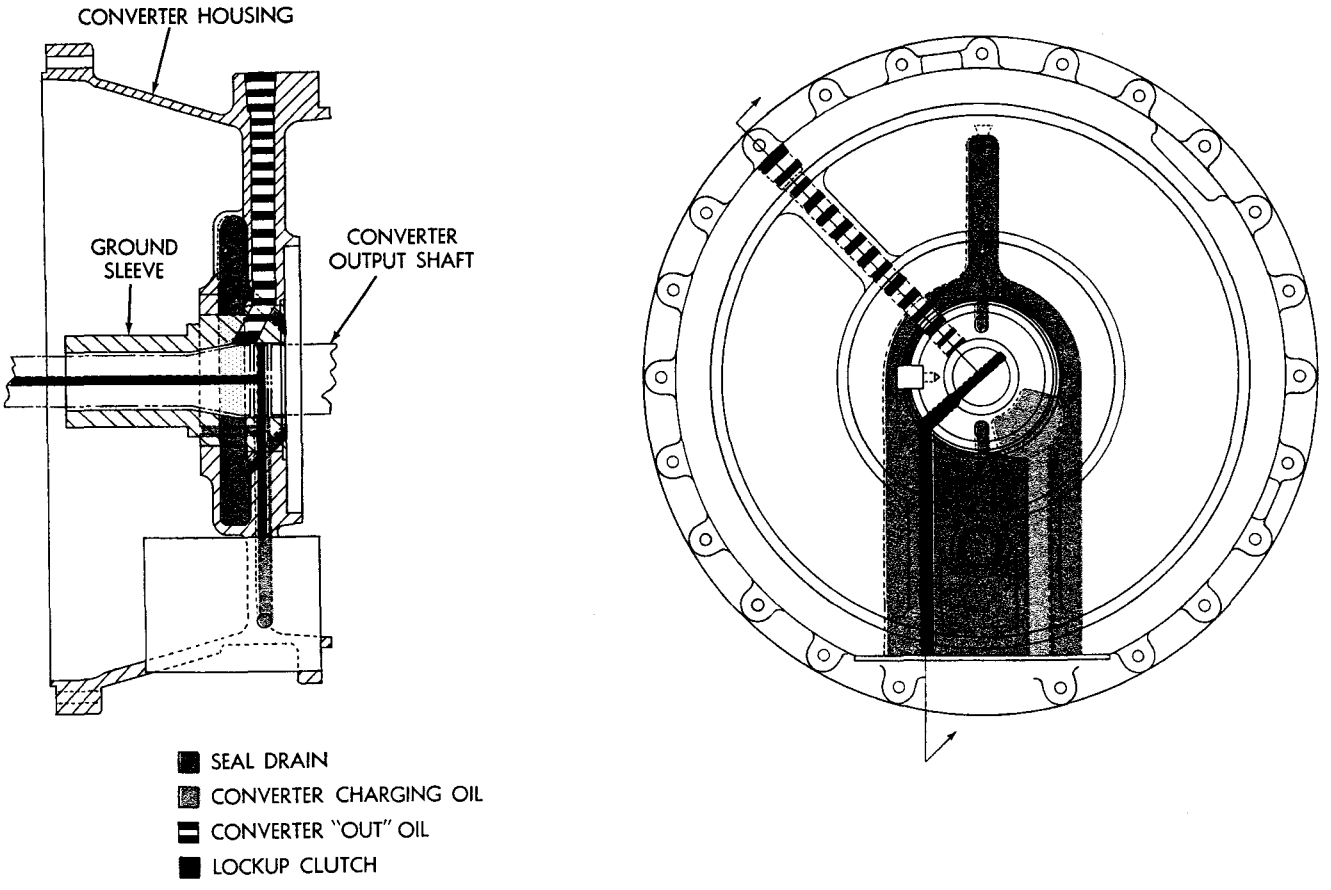


Fig I-9. TC-500 Oil flow passage

verter to the oil reservoir must be installed to drain the normal lubricating flow from the oil pump drive gear cavity. The drain line must have at least 3/8 of an inch inside diameter and must be installed 3-1/2 inches or more below the center line of the converter at every point in the line. Improper installation will result in excess leakage past the converter pump hub seal or the output shaft oil and dust seals (figs. III-3 and III-4).

c. Torqmatic Retarder.

(1) The standard Torqmatic Drive hydraulic circuit is used except for such changes as are necessary to make the retarder hydraulic circuit integral with the converter-transmission circuit (fig. III-6).

(2) The oil that actuates the retarder is stored in a reservoir when the brake is not in use. Because the reservoir is elevated for gravity feed, air from the vehicle service brake system is used to scavenge the converter drain cavity and to maintain the proper oil level in the transmission. To cool the oil at maximum retarder application, a heat exchanger is included (fig. III-6).

(3) Cool oil for both the converter and transmission comes directly from the oil reservoir. Oil enters the brake from both the converter pressure circuit — to assist in the initial prime — and from the gravity feed line from the reservoir.

6. SPECIFICATIONS AND DATA

The specifications and data included in this section are subject to change. Whether your installation is new or old, be sure you have the latest data.

SPECIFICATIONS AND DATA

TC-500 SERIES ALLISON TORQMATIC CONVERTER

Rotation	Designed to operate with right hand rotating engine
Torque multiplication ratios available at stall	
TC-520	2.87
TC-530	3.53
TC-540	2.77
TC-550	3.40
TC-560	2.54
TC-570	3.13
TC-580	2.70
Maximum input speed - rpm	2500
Maximum input torque - lb-ft	850
Integral charging oil pump capacity	19 gpm at 1600 rpm converter input speed
Integral charging oil pump pressure	
(minimum at full-throttle stall condition, refer to sec. III, par. 14)	50 psi
(maximum at full-throttle stall)	80 psi
(maximum at full-throttle no load)	120 psi
Converter oil outlet maximum temperature	250 degrees F
Oil cooled by	Heat exchanger
Oil type	Hydraulic transmission fluid type C-1
Converter oil capacity	5 1/2 gal
Number of stages	1
Number of phases	3
Number of elements	4 (pump, turbine, 1st stator, 2nd stator)
Output shaft	Automotive or industrial
Flywheel housing	SAE 1
Weight (dry)	420 to 650 lb, depending on model and accessory option

MODEL DESIGNATION CHART
(500 Series)

BASIC TORQMATIC CONVERTERS: LETTERS

TC = Torqmatic Converter
TCD = Torqmatic Converter with manual input-disconnect clutch
TCL = Torqmatic Converter with hydraulic input-lockup clutch
TCA = Torqmatic Converter with accessory drive
TCB = Torqmatic Converter with Torqmatic retarder
TCRD = Torqmatic Converter with hydraulic rear-disconnect clutch

SERIES DESIGNATION: FIRST DIGIT

First digit (5) designates series of converter

ABSORPTION CAPACITY AND TORQUE RATIO: SECOND DIGIT

Second digit (2 through 8) designates converter absorption capacity and torque ratio.

Converter absorption capacity increases progressively from the lowest digit (2) through to the highest digit (8).

Even numbers (2, 4, 6 and 8) denote low-stall torque ratio.

Odd numbers (3, 5 and 7) denote high-stall torque ratio.

OUTPUT SHAFT: THIRD DIGIT

Third digit (4 or 5) designates type of output shaft. 4 denotes automotive output flange. 5 denotes industrial output shaft.

Example: TCLB-584. The model designation shows this unit is a Torqmatic Converter (TC) with a hydraulic input-lockup clutch (L) and a Torqmatic retarder (B). It is a 500 series converter (first digit 5), has a high capacity (second digit - high number) and a low-stall torque ratio (even number). This converter has an automotive output flange (third digit - 4).

SECTION II TORQMATIC CONVERTER PRINCIPLES

1. WHAT IS A TORQMATIC CONVERTER?

Simply, a Torqmatic converter provides a unique method of multiplying engine torque hydraulically. Hydraulic means liquid; torque means twist; convert means change. The Torqmatic converter changes or multiplies the twisting force of a gasoline or Diesel engine by the use of oil instead of by the use of gears.

2. WHAT IS TORQUE MULTIPLICATION?

Torque multiplication means an increase in twisting or rotating effort — the multiplication of force. A good example of multiplying force may be found in the fulcrum and lever principle. A simple explanation of torque multiplication is to consider the Torqmatic converter a "floating" fulcrum (par. 10). Following is a quick review of the function of the fulcrum and lever, and how it applies to the hydraulic torque converter.

3. FULCRUM, LEVER PRINCIPLE

The fulcrum and lever principle illustrates how a force can be multiplied. In fig. II-1, diagram A, the loads at x and y are in balance because the fulcrum f is equally distant from x and y, and the load at x is equal to that at y. In diagram B, because of the load increase at x, balance is maintained by positioning the fulcrum closer to x and farther from y. Shown in diagrams C and D are two alternate ways to move the load at x: the force at y may be multiplied (diagram C), or the force at y may be increased by moving the fulcrum closer to x (diagram D). Note, in each case illustrated, the relationship of distances between lever travel on both sides of the fulcrum. To multiply the force in D, the distance of lever travel must be increased. This same relationship applies to gears. A conventional step-gear transmission employs the principle of the fulcrum and lever to multiply the torque of the engine. (Gears are spinning levers). However, when we think of spinning levers we must consider two other terms in connection with multiplying force — torque and speed.

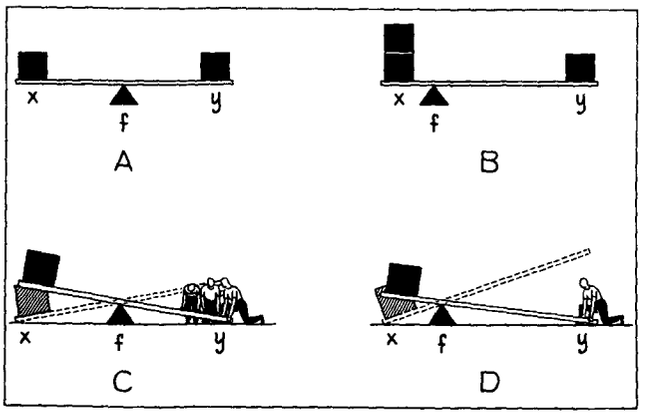


Fig II-1. Fulcrum and lever multiplying force or distance

4. TORQUE, SPEED

a. One-to-One Ratio. The accompanying diagrams (fig. II-2), illustrate a one-to-one speed ratio and a one-to-one torque ratio (Part One). Note first that the output speed (rpm) at B will be the same as the input speed (rpm) at A. Whatever torque or twisting effort is put into the input A will be transmitted through the output B. If 20 pound-feet of torque go into A, 20 pound-feet of torque will come out at B, or if there is 30 pound-feet input, there will be 30 pound-feet output — no more, no less — so the torque ratio is one-to-one.

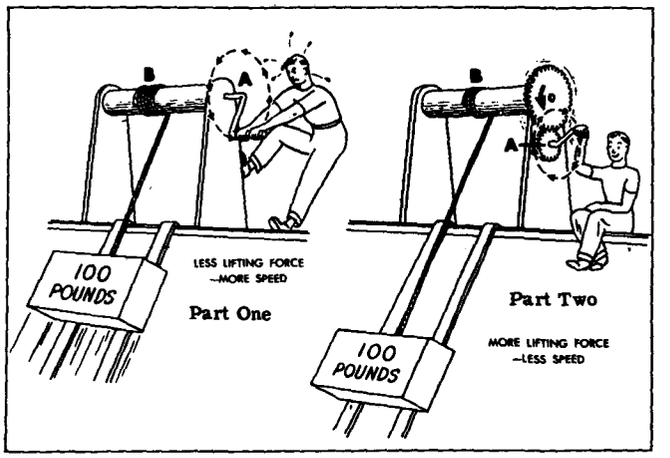


Fig II-2. Gears (spinning levers) multiplying torque or speed

b. Increasing Torque Ratio. Suppose it becomes necessary to double the lifting force. This can be done in two ways. Increase the power source or relocate the fulcrum. We relocate the fulcrum by moving into position a larger gear (fig. II-2, Part Two). For every two revolutions of A, gear B will make one revolution. If the input twisting effort is 20 pound-feet, the output torque will be 40 pound-feet.

c. Speed, Torque, Load. What effect will the speed of the input and the twisting effort have on raising the load attached to the windlass? Note in Part One of the diagram that the load will move twice as fast as the load will move in Part Two. However, in Part Two, the load may be moved with half the input effort.

d. Mathematical Formula.

(1) There is a direct mathematical relationship between the input speed and output speed versus output torque and input torque. It can be stated as follows:

$$\frac{\text{Input Speed}}{\text{Output Speed}} = \frac{\text{Output Torque}}{\text{Input Torque}}$$

Suppose the input torque at A = 20 pound-feet and the input speed at A = 50 rpm. The gear ratio being 1:1 means the figures would look like this:

$$\frac{50}{50} = \frac{20}{20}$$

Applying this to Part Two in fig. II-2, the formula will look like this if A = 50 rpm:

$$\frac{50}{25} = \frac{40}{20}$$

(2) Another formula important to torque, speed and horsepower is stated in this manner: $t = hp \times \frac{5252}{n}$; t stands for torque (lb.-ft.), hp for horsepower, and n for speed (rpm). For example, if at a governed speed of 1800 rpm (n) an engine develops 100 horsepower the torque (t) will be: $t = \frac{100 \times 5252}{1800} = 291\text{-}7/9$ lb.-ft. of engine output torque. For easy figuring we will call it 292 lb.-ft. Using formula (1), above, let's see what happens when we use a torque multiplier with a ratio of 3.5:1. The output torque is equal to the torque ratio times the input torque.

$$\text{Output Torque} = 3.5 \times 292 = 1022$$

$$\frac{\text{Input Speed}}{\text{Output Speed}} \quad \frac{1800 \text{ rpm}}{X} = \frac{\text{Output Torque}}{\text{Input Torque}} \quad \frac{1022}{292}$$

$$\text{Output Speed} = X = 514.2 \text{ rpm}$$

From this example it can be seen that ratio of input speed to output speed is equal to the torque ratio.

5. FULCRUM, A REACTION MEMBER

At this point it will be well to consider the fulcrum in another light. The fulcrum can be considered a reaction member. Without its being able to react to the forces x and y in fig. II-1, there could be no balance and no multiplication of force. The fulcrum is always "grounded." In the step-gear transmission, the transmission case is the "ground" against which spinning levers (gears) react.

6. MECHANICAL STEP-GEAR TRANSMISSION

a. Fulcrum Points. Fig. II-3 illustrates a conventional step-gear transmission. The fulcrum points are the various gear ratios. The limited number of gear ratios results in a limited number of fulcrum points. In the leverage distance between the load and the power there will be only five fulcrum points where the load and the engine will be in exact balance. These fulcrum points permit the driver to change the torque ratio to meet the variable load demand. Each time the fulcrum point is shifted, the power source must be disengaged from the load by a clutch while the driver shifts gears.

b. Driver Must Adjust Fulcrum. If the driver does not choose the right fulcrum point, the engine and load will be out of balance. The result of a wrong guess will mean a lugged down or stalled engine, or the engine will be running at excessive speeds. In this type of transmission, the operator must choose the

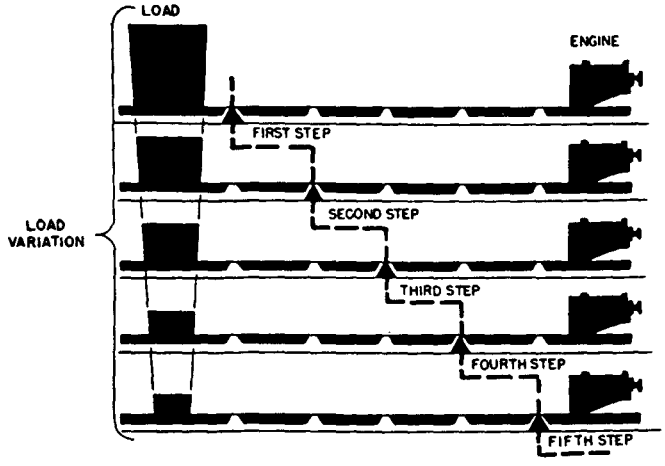


Fig II-3. Limited number of fulcrum points of mechanical step-gear transmission

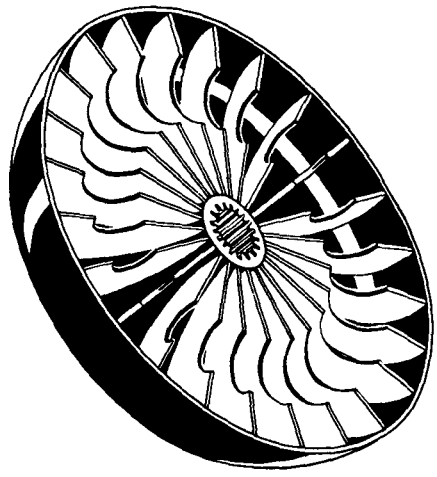


Fig II-4. Blading schematic of hydraulic coupling — pump and turbine

fulcrum points and they are limited to the fixed number of gear ratios in the transmission. The hydraulic torque converter has no such limits — but that's getting ahead of the story. Before the hydraulic torque converter can be discussed, it is necessary to consider the hydraulic coupling.

7. HYDRAULIC COUPLING

a. Simple Transmission. The hydraulic coupling is the simplest means of transmitting torque hydraulically. It can be called a fluid coupling, a fluid flywheel or a fluid clutch. The ratio of input to output torque is always one-to-one or less.

b. Coupling Elements. The hydraulic coupling consists of two elements: a pump and a turbine. Each element has a number of flat, straight, radial blades leading from the hub to the outside edge (fig. II-4).

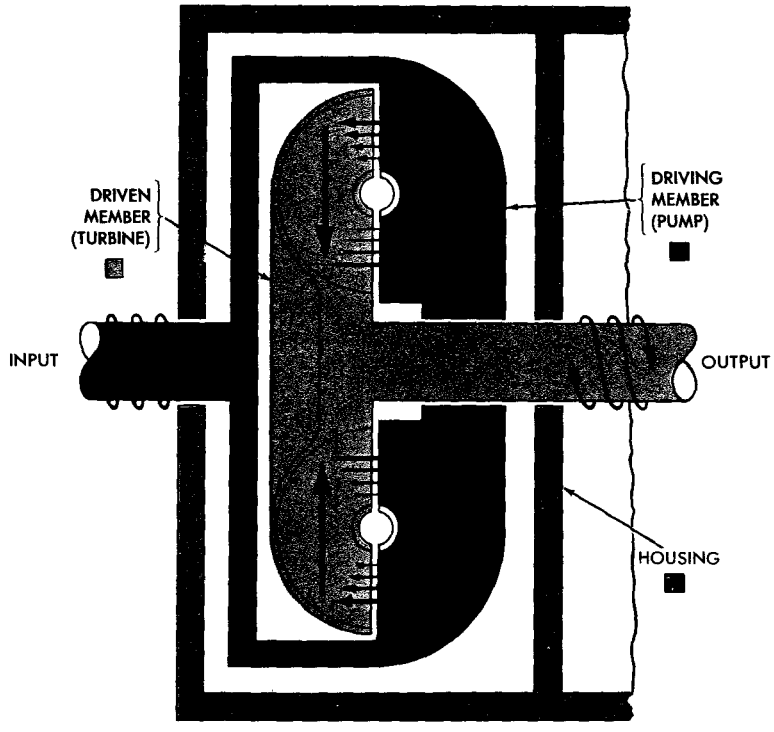


Fig II-5. Fluid coupling — schematic

c. How Hydraulic Coupling Works.

(1) A cover, integral with the pump, completely encloses the turbine (fig. II-5). This enclosure is filled with oil.

(2) When the engine is started, the pump starts turning. If the pump is turning fast, the oil will be thrown toward the outside circumference of the pump — just like marbles on a revolving phonograph turntable. But the design of the pump blading guides the "outward" flow of oil across to the turbine.

(3) When the oil hits the turbine blades with enough force, the turbine turns. This movement slows the oil which then travels inward toward the hub of the turbine, then across to the pump, and the whole sequence repeated. Note that the oil flows "outward" in the pump, and "inward" in the turbine. The ratio of input to output torque will always be one-to-one or less in a fluid coupling. Note also that there is no stationary or reaction member — there is no fulcrum, or "ground" on which to place a fulcrum. Hence the fluid coupling cannot multiply torque.

8. STATORS, LIKE FULCRUM, MAKE TORQUE MULTIPLICATION POSSIBLE

In order to make the hydraulic coupling perform as a torque multiplier, it is necessary only to add a reaction member, or fulcrum. The stator becomes the reaction member. By placing a stator (reaction member) between the load and power source, a fulcrum is provided. This fulcrum is "grounded" to the housing of the converter which is attached to the equipment frame. A hydraulic converter has at least three elements — pump, turbine and stator (par. 12a).

9. HOW A CONVERTER WORKS

Fig. II-6 illustrates a simple converter. A cover, fastened to the pump, completely encloses the turbine.

a. Blade Design. The oil circulates in the same manner as in the hydraulic coupling. But in the hydraulic coupling the blades of the pump and turbine are straight. In the hydraulic torque converter the blading is curved in the pump and turbine elements (fig. II-7).

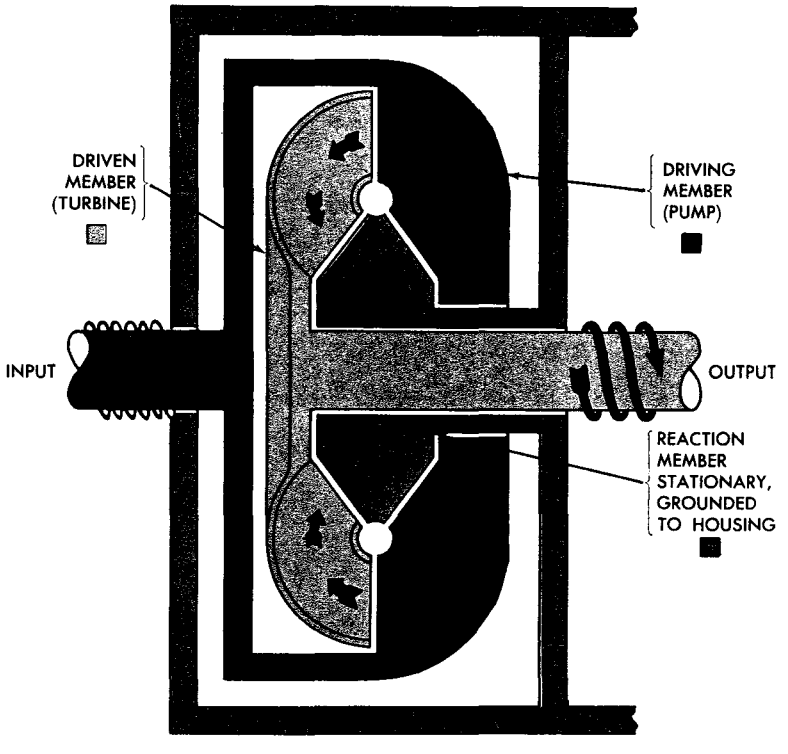


Fig II-6. Torque converter — schematic

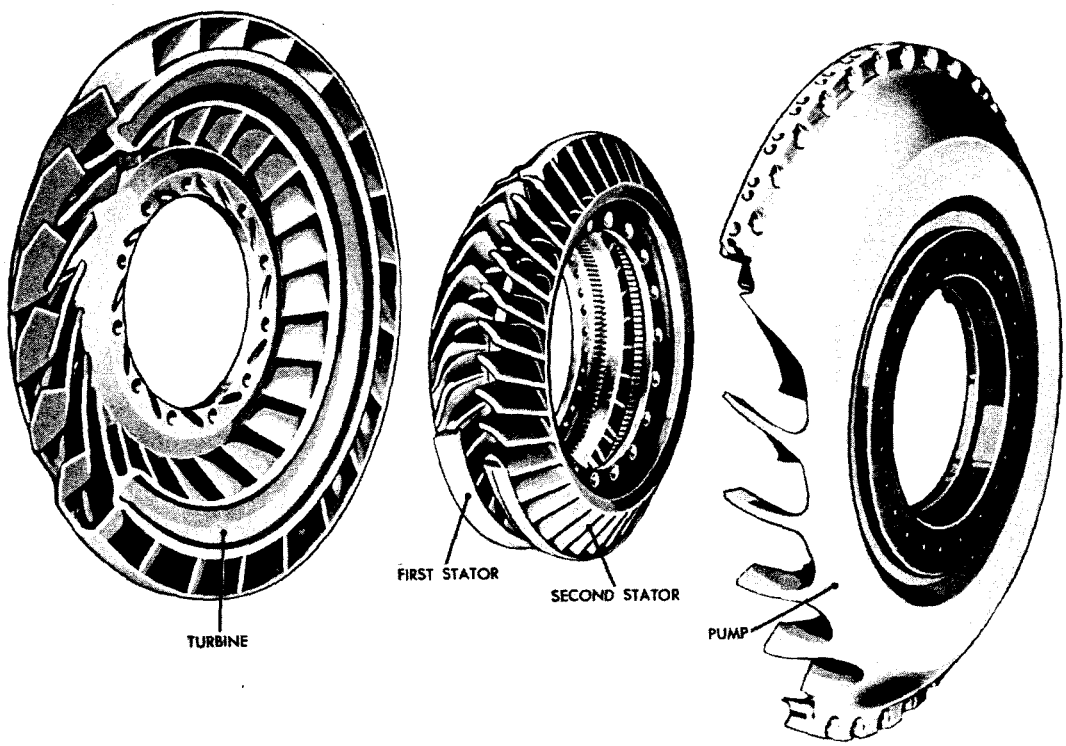


Fig II-7. Torque converter elements, partially cut away to show blade curvature

b. Flow Pattern. The pump pushes the oil outward and in the direction the pump is turning. The oil strikes the turbine, causing the turbine to turn. After striking the blades, the oil is directed inward toward the inner circumference of the turbine. As the oil leaves the turbine, it is moving in a direction opposite pump rotation. The stator, being held stationary, causes the oil to change direction and add its motion to the pump.

c. Some New Terms. To aid in understanding hydraulic torque multiplication, let us consider three new terms as applied to b, above. First, kinetic energy: oil in motion has kinetic energy (imparted to the oil by the pump). A thrown baseball has kinetic energy. Anything in motion has kinetic energy. Second, rotary flow: the flow of oil around the outer circumference in the converter is rotary flow. Third, vortex flow: the flow of oil across the converter is called vortex flow. These will be fully explained in par. 13, below. Let's look first at kinetic energy as it applies to b, above.

d. Kinetic Energy and the Stator.

(1) Considering b, above, note that only part of the kinetic energy was removed from the oil as it struck the turbine. The oil leaving the turbine has some kinetic energy left. The stator deflects the oil in motion with its remaining kinetic energy so that it enters the pump in the same direction the pump is moving — aiding the pump rather than hindering it. The multiplication of input torque results from the velocity (kinetic energy) imparted to the oil by the pump plus the velocity (kinetic energy) entering the pump from the stator. The more the turbine resists turning (heavy load) the greater will be the velocity of the vortex flow of the oil circulating in the converter — and the greater will be the torque multiplication. The less the turbine resists turning (light load) the less will be the velocity of the vortex flow of the oil in the converter, and the less will be the torque multiplication.

(2) Recall how in sec. II, par. 4b, the smaller gear turns faster to multiply the input torque. We relocated the fulcrum by the use of the larger gear. Well, here we have somewhat the same relationship and action between the pump and turbine. The pump turns faster in relation to the turbine. The fulcrum is relocated by the use of an "expanding-contracting

fluid gear." When torque demand is greatest, the "fluid-gear" contracts, resulting in greater torque multiplication. When torque demand diminishes, the "fluid gear" expands, bringing the relationship of output and input torque closer to one-to-one.

10. FLOATING FULCRUM PRINCIPLE

Torqmatic Drive employs what we choose to call the floating-fulcrum principle of multiplying torque. Floating suggests (one) a cushioning of shock, and (two) an infinite number of torque ratios. That's exactly what Torqmatic Drive is. The step-gear transmission will provide generally not more than 10 exact fulcrum points, whereas Torqmatic Drive furnishes an infinite number of fulcrum points — and does so automatically, without guesswork on the part of the driver (fig. II-8). Because the fulcrum is "floating," it absorbs drive line shock, protecting both engine and equipment against harmful engine lugging, and permitting the engine to operate at high efficiency.

11. TORQMATIC DRIVE — HYDRAULIC TORQUE CONVERTER AND FLUID COUPLING

Torqmatic Drive operates both as a hydraulic torque multiplier and as a hydraulic coupling. This is possible because of the "floating fulcrum" principle. Note that in figure II-6 the stator is permanently "grounded." This illustrates a straight torque converter. The Allison Torqmatic converter can "float" so that when no torque multiplication is necessary, the Torqmatic converter becomes a fluid coupling, thus permitting a more economical overall range of operation. The following explains how the Allison Torqmatic converter embodies the floating fulcrum principle of multiplying torque.

12. TORQMATIC CONVERTER

a. Elements. All series Torqmatic converters, except the TC-200 series, contain four elements. These elements are the pump, the turbine, the first stator, and the second stator. Fig. II-9 illustrates a 4-element Torqmatic Converter.

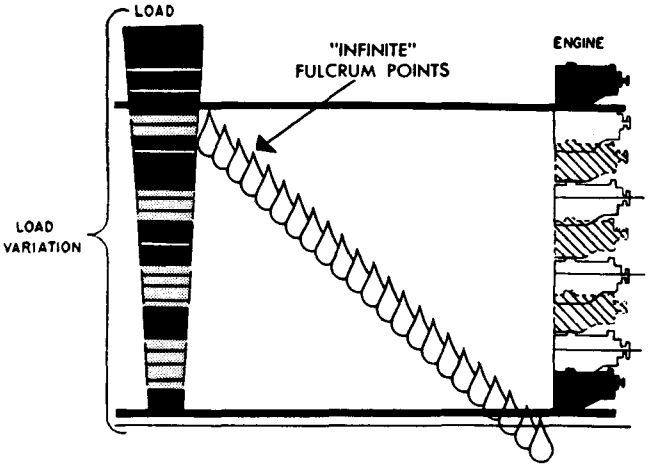


Fig II-8. "Infinite" number of fulcrum points of hydraulic torque converter

b. Rotating Housing. The Torqmatic converter is a rotating housing type of converter. The elements are enclosed in a housing consisting of the converter flywheel and the converter pump. The converter flywheel is driven by the engine crankshaft through a flexible flywheel disk assembly. Greater flexibility is obtained because the converter can operate as a torque multiplier and fluid coupling.

c. Freewheeling Stators. The stators' design is such that they can freewheel, or automatically lock up to provide the necessary reaction for torque multiplication.

d. Converter Charging Oil Pump. Mounted on the converter housing is an oil pump driven through gearing by the hub of the converter pump. The oil pump provides charging pressure and cooling flow to the converter through internal passageways (figs. I-8 and I-9). Whenever the engine runs, the pump is driven. Where the installation has a Torqmatic transmission, the oil pump also provides pressure to the transmission clutches through an external opening in the pump body (fig. III-4). This opening is plugged when the converter is used alone. The lockup clutch in TCL models is engaged by hydraulic pressure. The charging oil pump cover used with these models will include either a valve to control lockup pressure, or a tapped hole to allow the use of external controls (fig. III-4). Oil pressure for the lockup clutch is supplied by the same cavity in the charging pump that supplies oil pressure to the transmission clutches.

e. Pressure Regulating Valves.

(1) The pressure regulating valves, located in the charging oil pump cover, control the oil pressure to the transmission clutches and converter lockup clutch if used, and to the converter circuit (fig. I-8). Oil is pumped by the charging pump gears to the transmission clutches and converter lockup clutch circuit after this circuit is charged, the clutch pressure regulating valve opens, admitting oil to the converter circuit.

(2) This circuit charges the converter and also supplies oil to the transmission lube circuit if a transmission is used in the installation. When the desired pressure is reached in this circuit, the converter pressure regulating valve opens, bypassing any excess oil back to the inlet side of the pump.

f. Oil Flow to, from Converter. Incoming oil from the oil pump flows through internal passageways in the converter housing and through the ground sleeve. It then enters the converter elements between the second stator and the converter pump. The oil leaves the converter elements between the first stator and the turbine, flows inside the ground sleeve along the output shaft and out through a passageway in the converter housing to the oil reservoir (fig. I-9).

13. HOW TORQMATIC CONVERTER WORKS

a. Same Principle for One- or Two-Stator Converter. Whether the 3-element or 4-element converter is discussed, the principle is the same. However, the 4-element converter will be described in order to have the complete story.

b. Vortex, Rotary Flows.

(1) Recalling the definitions of vortex and rotary oil flow in par. 9c, above, let's see how they work. The instant the torque converter pump, which is driven by the engine flywheel, starts rotating, the oil spins around with the pump. This movement of oil is rotary flow. The converter turbine, connected to

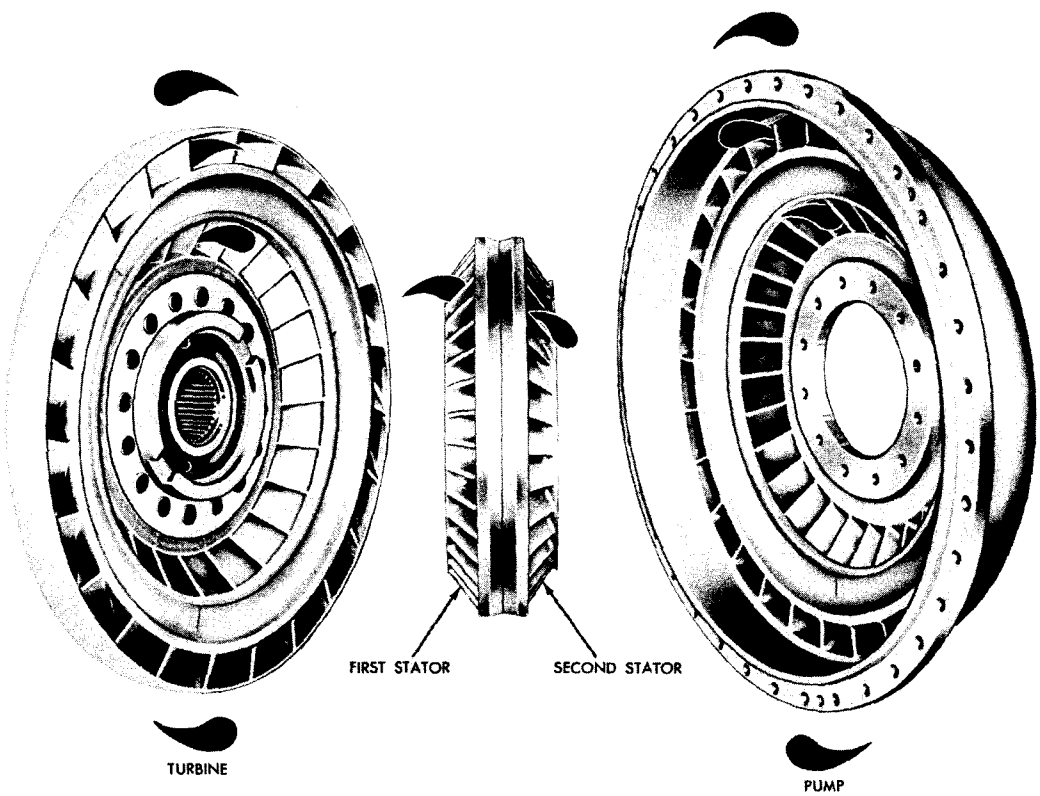
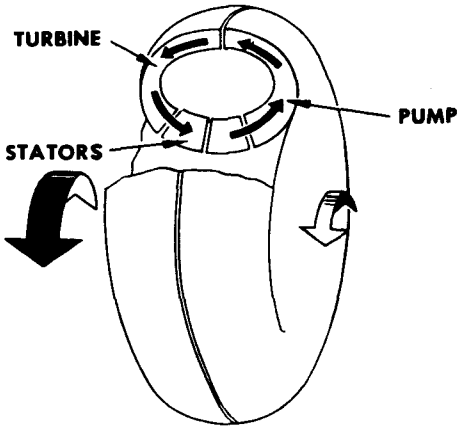


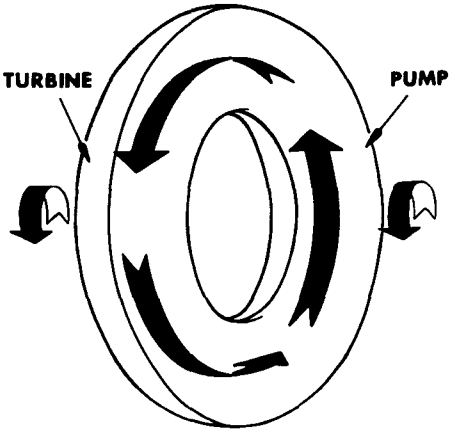
Fig II-9. Four-element Torqmatic converter

the load, resists turning as the oil strikes its blades. Because of the resistance, and because of the shape of the blades within the converter elements, the oil takes a second path of travel — crosswise. This second path is called vortex flow. See fig. II-10.

(2) The greater the load resistance transmitted by the turbine, the greater will be the vortex flow with the engine operating at its governed output. The greater the vortex flow, the greater the torque multiplication. All the action is automatic. The "floating fulcrum" automatically chooses the exact torque ratio required. No guesswork here. At vehicle stall, or when getting the load under

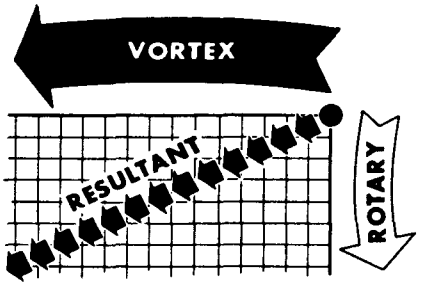


VORTEX FLOW

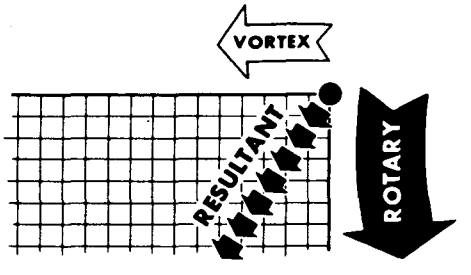


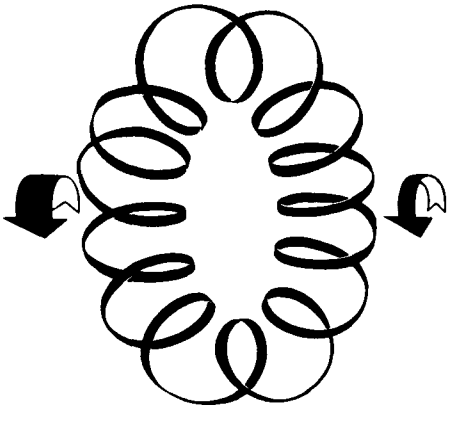
ROTARY FLOW

RESULTANT FLOW WHEN PUMP IS ROTATING MUCH FASTER THAN TURBINE



RESULTANT FLOW WHEN TURBINE SPEED APPROACHES SPEED OF PUMP





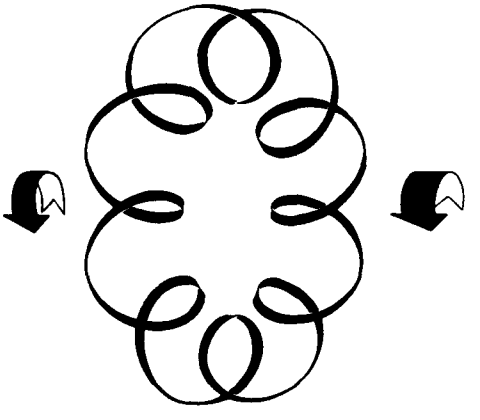


Fig II-10. Rotary and vortex flow — schematic

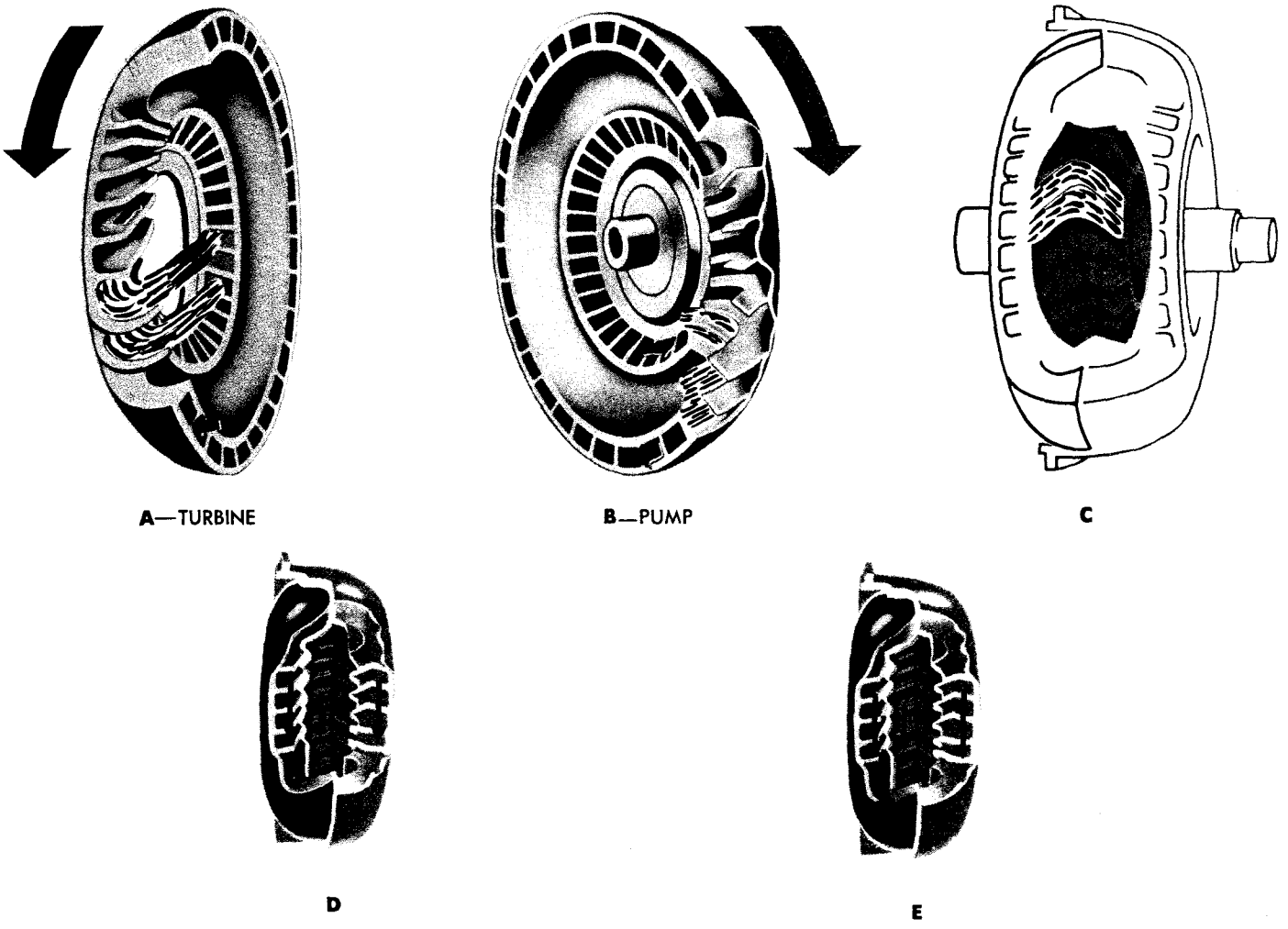


Fig II-11. Torqmatic converter in operation

way, a torque ratio up to 3.5:1 is available from the Torqmatic converter alone, depending upon the model.

c. First-Converter Phase.

(1) In tracing the action of Torqmatic Drive, remember, we are considering the 4-element, single-stage converter. First-converter phase means both stators are being held stationary, and the greatest multiplication between input torque and output torque is being accomplished. Refer to fig. II-11.

(2) In this phase the stators are being held stationary because the oil leaving the turbine strikes the stators so that they try to turn in a direction opposite both the pump and turbine rotation. But the stators are mounted on cams on the ground sleeve. Refer to figs. V-5 and VI-34. These cams with rollers permit the stators to rotate in one direction only (the same direction as the pump and turbine) like a coaster brake on a bicycle, which permits the pedals to rotate forward only. The stators redirect the vortex flow of oil so that it enters the pump in the same direction it is turning. This flow aids the pump and multiplies torque, as explained in par. 9, above.

d. Second-Converter Phase. Second-converter phase means that the first stator is freewheeling (fig. II-11). The first stator starts to freewheel as soon as the load demand for output torque becomes less. This means that the turbine is turning faster in relation to the pump. As the turbine speed increases, the oil leaving the turbine strikes the blades of the

first stator in such a manner that it no longer locks up on the cam, but starts to freewheel in the direction of the turbine. Torque multiplication is decreasing while turbine speed is increasing and vortex flow is becoming less.

e. Fluid Coupling Phase.

(1) The torque converter is in a fluid coupling phase when the second stator starts to freewheel. This means the turbine speed is approaching pump speed; input torque and output torque are approaching a one-to-one ratio. The vortex flow has practically stopped. This stopping of vortex flow permits the second stator to freewheel with the first stator. In this phase the converter is a fluid coupling (fig. II-11).

(2) But just as soon as the turbine slows down, and the demand for output torque increases, the "floating fulcrum" readjusts the torque output. First one stator, then the other, becomes stationary as an aid to torque multiplication.

14. HOW TORQMATIC RETARDER WORKS

a. Simplicity of Action.

(1) Note fig. II-12, which is a cross-section drawing of the Torqmatic retarder. You will see that this dynamic retarder has only one moving part — the rotor, or "paddle wheel."

(2) Recall how a paddle wheel on a river boat can be used as a retarder by reversing its direction of rotation — well, in a somewhat similar fashion, the "paddle wheel" of the retarder attempts to reverse the forward motion of the vehicle.

(3) The same oil in the converter used to drive the vehicle is used to retard it.

b. Torqmatic Retarding in Drive Line.

(1) To brake a vehicle going downhill, the driver opens the control valve to let the oil enter the rotor cavity. Remember that the

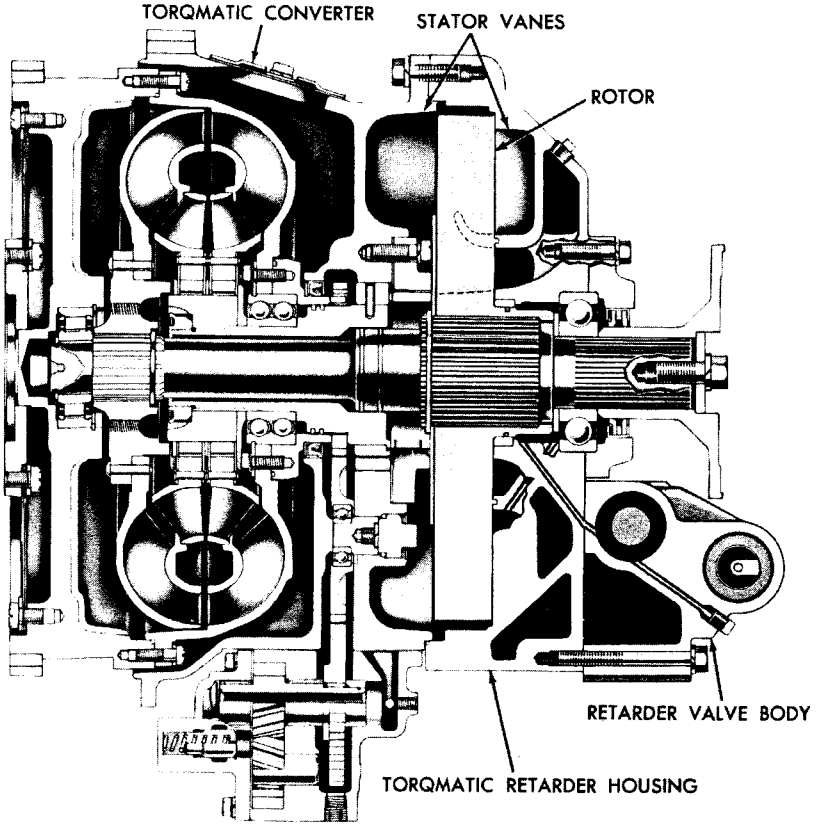


Fig II-12. Torqmatic converter and retarder — cross-section view

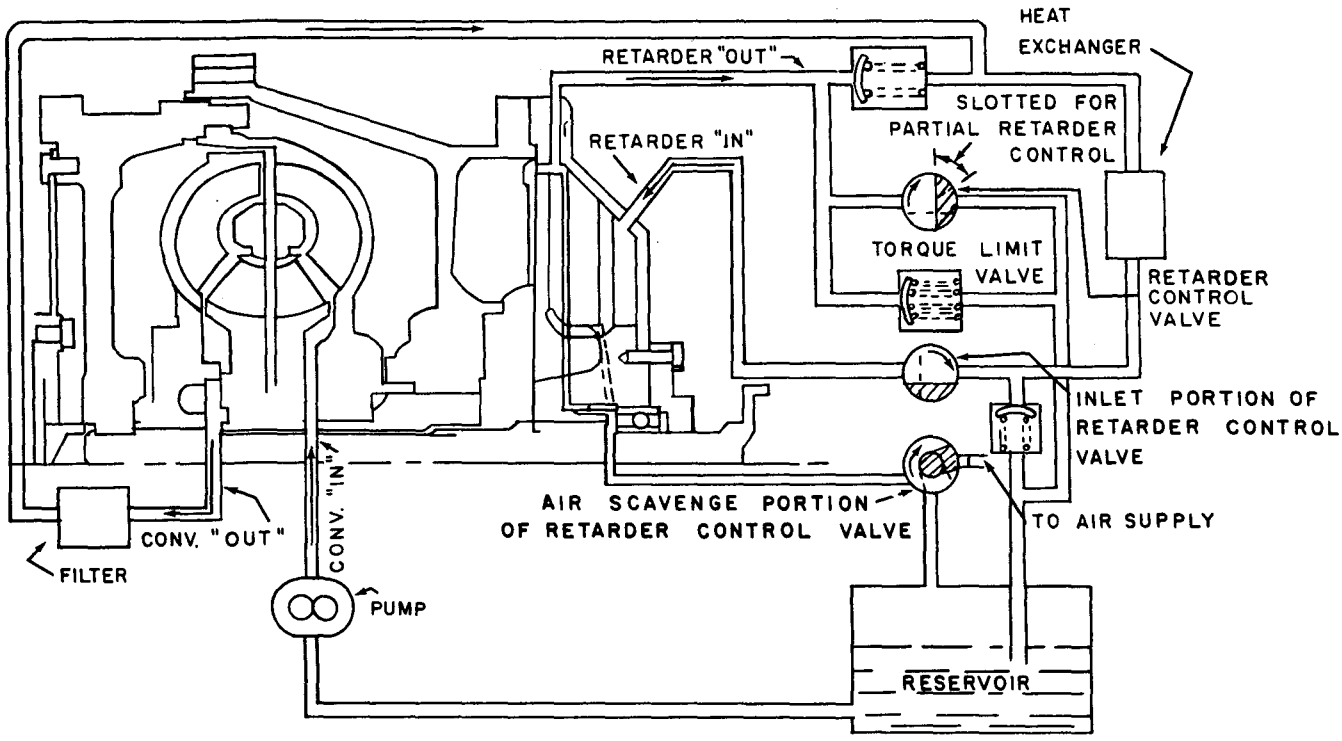


Fig II-13. Torqmatic retarder oil system — schematic

vehicle wheels are turning the rotor through the transmission.

(3) While all this churning of the oil and resistance of the rotor from turning is going on, heat is being created. Most of this heat is being absorbed by the oil. The same churning or pumping action of the rotor circulates the oil to a heat exchanger where the retarding heat is harmlessly dissipated. The cooled oil returns to the rotor cavity to repeat the cycle as long as necessary.

(2) As the cavity fills with oil, the "paddle wheel" sets the oil in motion. But the fixed stator vanes in the housing prevent the churning oil from going anywhere. Consequently, the oil makes it harder for the rotor to turn — and correspondingly makes it harder for the vehicle wheels to turn, thus slowing down the forward motion of the vehicle.

(4) The driver controls the degree of retarding by letting more or less oil into the retarder housing. When the valve is closed the oil is evacuated from the retarder housing.

(5) A torque limit valve, contained in the brake valve body (fig. X-3), functions to prevent excessive torque from being imposed upon the drive line components during retarder operation. However, care must be exercised that the horsepower absorption in the Torqmatic retarder during retarder operation does not exceed 300 hp in low and intermediate range and 400 hp in high range. Recommended maximum vehicle speeds during retarder operation in low, intermediate or high range will depend upon the installation and will be specified by the vehicle manufacturer. Fig. II-13 shows the oil system for the Torqmatic retarder.

Service Information Notes

SECTION III PREVENTIVE MAINTENANCE

1. SIMPLE MAINTENANCE

Because the Torqmatic converter has only four major moving parts, which are running in oil, the maintenance job is relatively simple. However, like all equipment, it will need periodic attention and servicing. Only specified oil, free of dirt and contamination, can be used for the Torqmatic converter.

2. MAINTENANCE INTERVALS, PRECAUTIONS

a. Intervals. The type of service and operating conditions will determine the maintenance intervals. However, it is well to check the oil system oil level daily, or at the end of each shift; also, at the same time, check for oil leaks. Occasionally while the equipment is operating, check the converter operating temperature. If the equipment has been idle overnight or longer, the oil reservoir should be checked.

b. Keeping Oil Clean. Because the hydraulic system (sec. 1, par. 5) is the "heart" of the Torqmatic Drive, the oil that goes into it, and stays in it must be kept clean. The area around which the oil is poured into the system must be kept clean, and oil containers must be kept free from mud, dirt, water, and other harmful matter (par. 4, below).

c. Keeping Breather Clean. The breather, whether located on an external sump or on a transmission used in conjunction with this converter, should be frequently inspected and thoroughly cleaned when necessary. Neglect of the breather will cause undue condensation within the system and cause rapid oxidation and sludging of the oil. The breather should be cleaned at each oil change or more often under extremely dirty operating conditions.

3. CHECKING OIL LEVEL

a. Different models of vehicles may vary in the manner in which the oil level check is made – either with a dipstick type of gage, a level plug or a petcock. Oil level should be maintained at full. If needed, add oil according to specifications (end, sec. I). Fig. III-3, III-4 and III-6 illustrate representative oil system schematics for Torqmatic converter installations. The oil should be at operating temperature with the engine idling when the oil level is checked.

b. If the Torqmatic converter is operating in combination with the Torqmatic transmission, the oil level check will be made at the transmission (refer to your Torqmatic Transmission Shop Manual).

4. OIL CAPACITY; WHEN TO CHANGE

a. Oil Capacity. The capacity of the hydraulic system will vary according to the external piping and the type of installation. The Torqmatic converter capacity and the type of oil to use are given in the Specifications and Data chart at the end of sec. I.

b. When to Change Oil. Oil should be changed every 1000 hours of operation, or oftener, depending upon the type of service or the condition of the oil. The oil in the system must be changed whenever the oil shows traces of dirt or the effects of high operating temperature, evidenced by discoloration or strong odor. If the oil shows metal contamination, the system must be thoroughly drained and cleaned. See par. 5, below.

c. When to Change Filters. The strainer (in the Torqmatic transmission) and the hydraulic system filters should be replaced or cleaned with every oil change. Under severe operating conditions, and if it is practical, the external filter should be replaced or cleaned.

d. Metal Contamination of Oil. If the oil in the hydraulic system becomes contaminated with metal particles, all the components of the hydraulic system – transmission, torque converter, oil lines, reservoir, filters, strainer, cooler, valves and oil pumps must be thoroughly cleaned. This usually means disassembly of the components (see secs. IV through IX). Metal particles in the oil are evidence of failure of some part, either in the converter or in the transmission.

5. CHANGING OIL
(TORQMATIC CONVERTER ONLY)

a. Hydraulic System. The oil should be warm when draining it from the hydraulic system. All filters, screens and strainers should be examined for metallic contamination and evidence of high temperature. If metallic contamination is found, the converter will have to be disassembled and all parts thoroughly cleaned.

b. Draining Converter. Remove the drain plug from the reservoir. Drain the three or four gallons of oil remaining in the converter elements by removing the converter "IN" line. Start the engine and run the converter at 1000 rpm for 20 to 30 seconds. Due to lack of lubrication, do not run the converter over 30 seconds.

c. Filling Hydraulic System.

(1) See that drain plugs, oil filters, and oil lines have been installed or replaced.

(2) Pour nine gallons of specified oil through the oil filler hole in the reservoir.

(3) Start the engine and let it run at idling speed to "charge" the hydraulic system.

(4) After the engine has been running at idling speed for two minutes, add enough oil to bring the oil up to the designated level (par. 3, above).

6. CHANGING OIL
(TORQMATIC DRIVE COMBINATION)

a. Hydraulic System. The oil should be warm when draining the hydraulic system. All filters, screens and strainers should be replaced or cleaned. Oil should be examined for metallic contamination and evidence of high temperature operation (par. 4, above).

b. Draining Torqmatic Transmission.

(1) Remove the drain plug from the left-rear corner of the transmission adapter.

(2) Remove the drain plug from the bottom of the transmission housing. Do not install the plugs until all drain points have been opened and the system drained.

(3) Remove the oil strainer from the transmission adapter. Clean the strainer with mineral spirits, using a soft bristle brush.

c. Draining Torqmatic Converter. Part of the oil in the converter will drain back to the transmission sump when the engine is stopped. Drain the three or four gallons remaining in the converter elements by removing the converter "IN" line. Start the engine and run the converter at 1000 rpm for 20 to 30 seconds. Due to lack of lubrication, do not run the converter over 30 seconds.

d. Filling Hydraulic System.

(1) See that drain plugs, oil filters, transmission oil strainer, and oil lines have been installed or replaced. Check the transmission breather cap to be sure it is not clogged. Clean it if necessary.

(2) Pour seven or eight gallons of specified oil through the transmission oil filler hole.

(3) Start the engine and let it run at idling speed with the transmission in neutral range to "charge" the hydraulic system.

(4) After the engine has been running at idling speed for two minutes, add enough of the specified oil to bring the oil up to the designated level (par. 3, above).

7. MANUAL, SPRING-LOADED, INPUT-DISCONNECT CLUTCH

a. Lubrication. The clutch release bearing and the ball bearing should be lubricated with a good heat resistant grease about every 60 hours of operation. Operating conditions may vary this time interval. Two grease fittings are provided on the clutch housing (fig. III-1). Two "shots" of grease from a grease gun should be enough.

Caution: Over lubrication will cause grease to be thrown on the clutch facing, causing the clutch to slip.

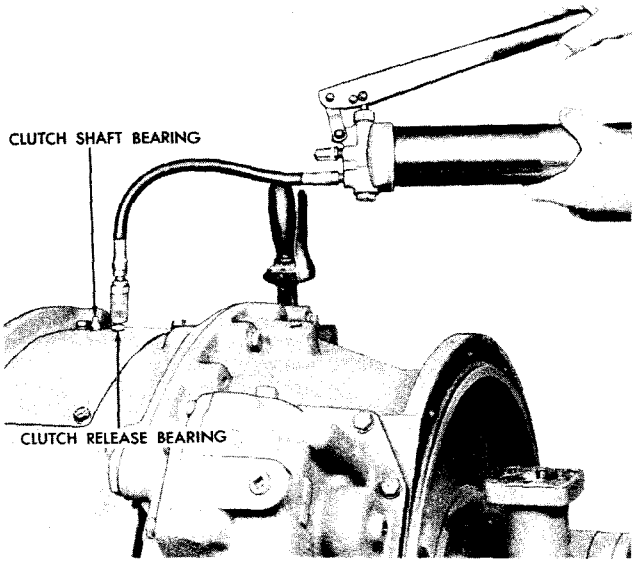


Fig III-1. Lubricating input-disconnect clutch bearings

b. Adjustment. To compensate for normal wear, adjustment of the input-disconnect clutch may be necessary. Should the clutch slip, remove one shim from each bolt that fastens the clutch cover plate to the engine flywheel (fig. III-2). If the clutch still slips after removing one shim, remove the remaining shim from each bolt. If, after removing both shims, the clutch still slips, replacement of the clutch driven disk assembly and shims will be necessary. See sec. VIII.

8. MANUAL, OVERCENTER INPUT-DISCONNECT CLUTCH

a. Lubrication. Refer to par. 7a, above, for lubrication instructions.

b. Adjustment. The clutch requires adjustment if the force required to operate the

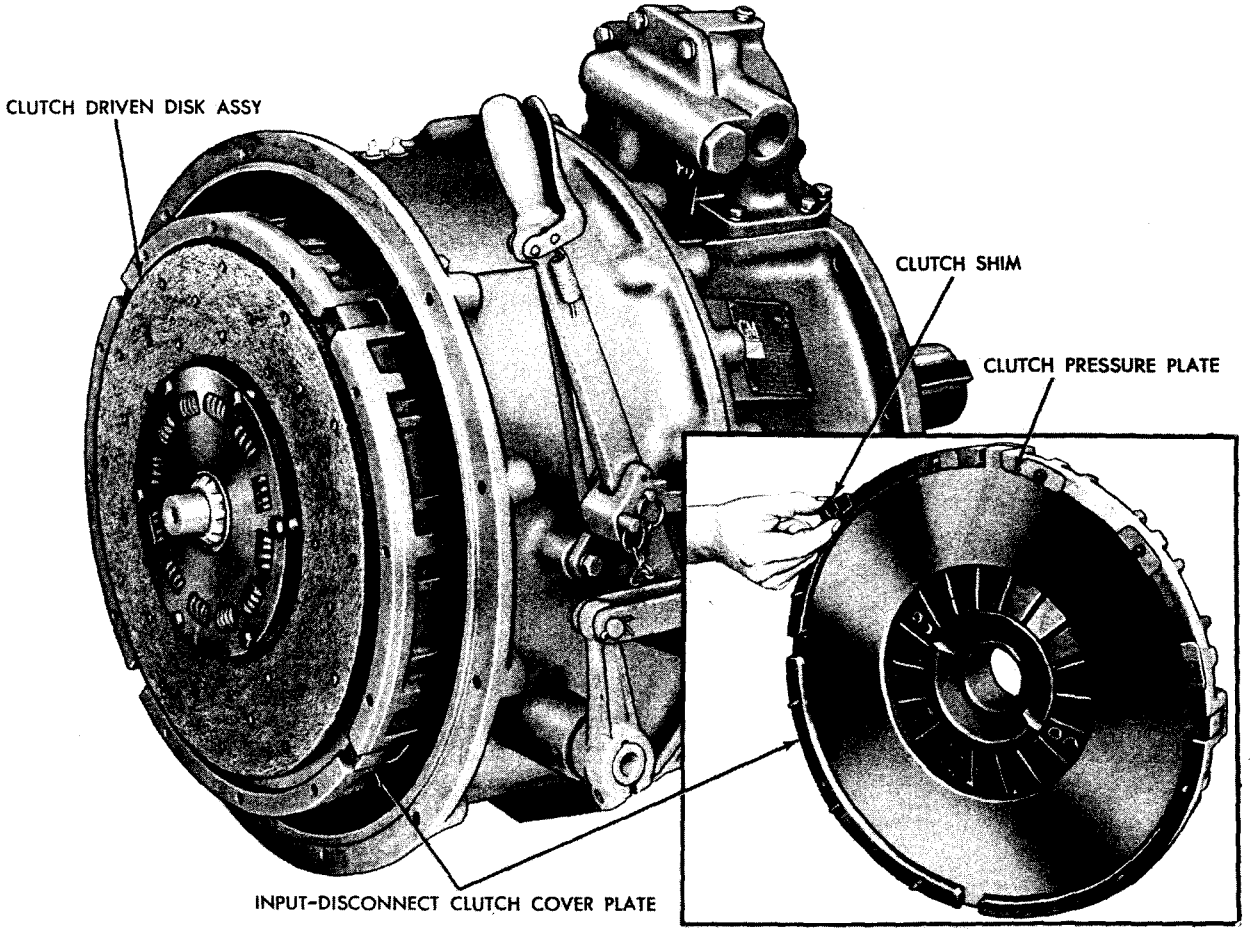


Fig III-2. Adjusting clutch by shim removal

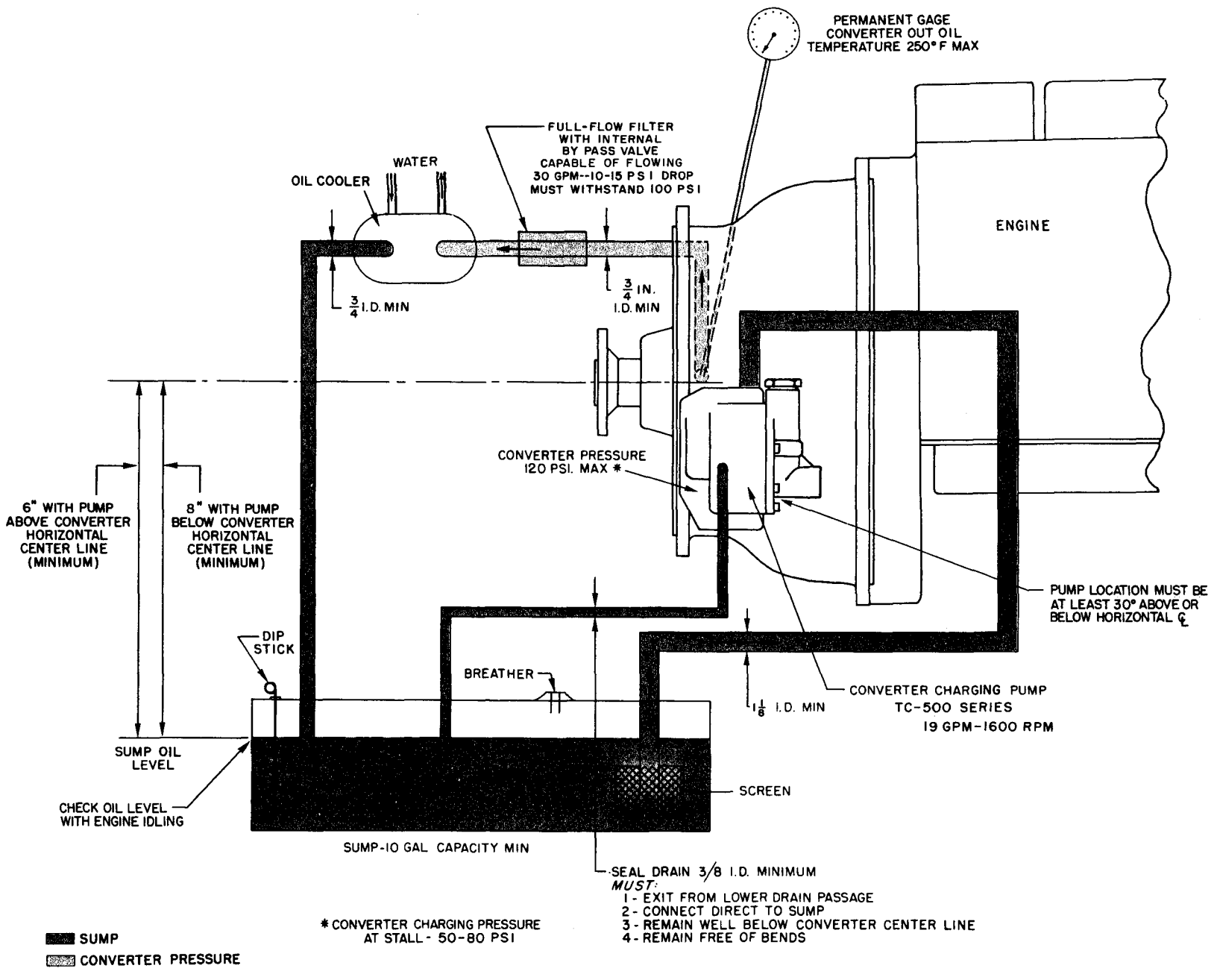


Fig III-3. Oil schematic for Torqmatic converter installation, TC-500 series

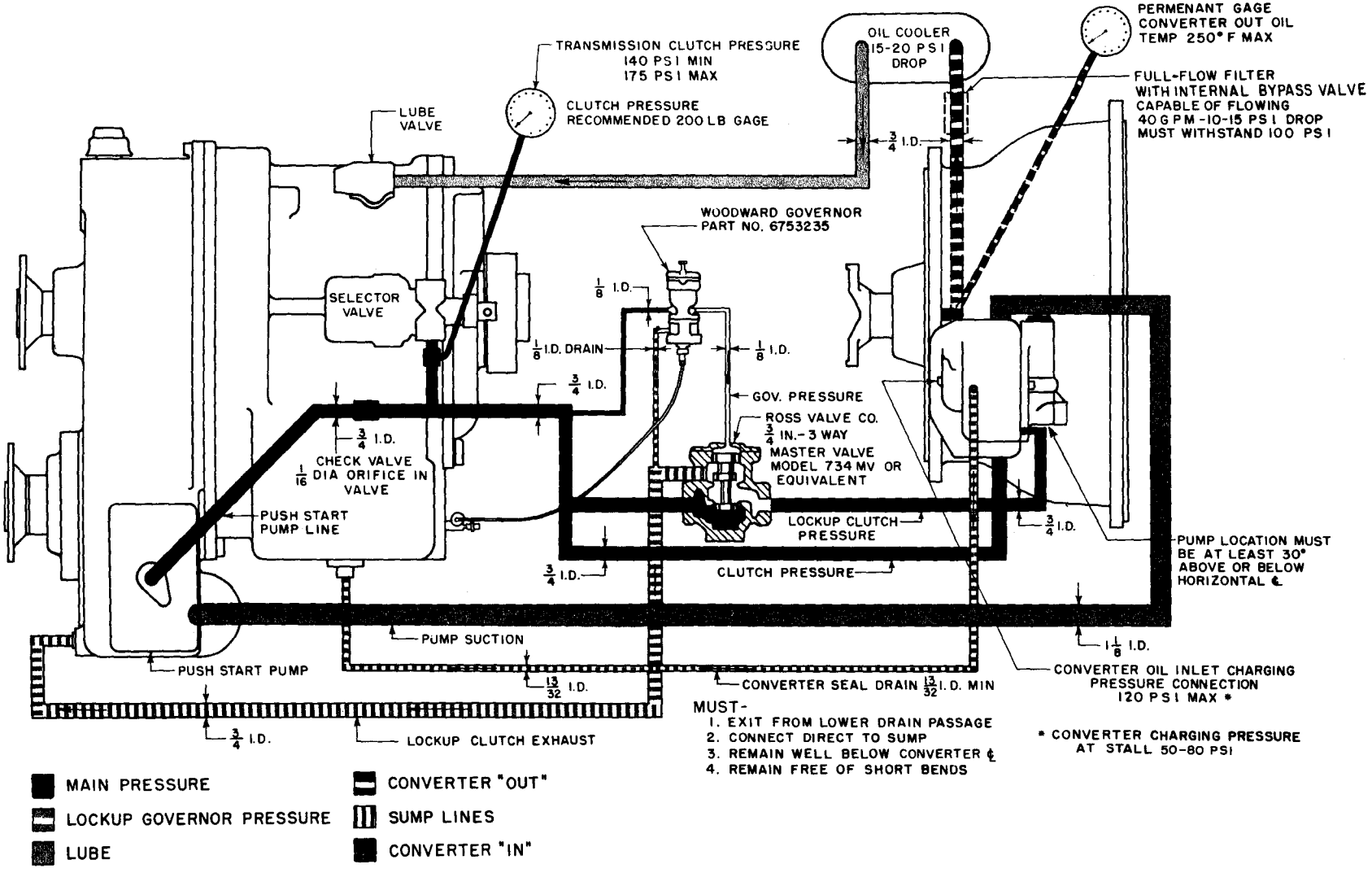


Fig III-4. Oil schematic for Torqmatic converter and lockup installation

clutch through the "overcenter" position is not within the following limits:

Max. Net Engine Torque to be Transmitted	Torque Req'd at Cross Shaft	Force Req'd at 21 in. on Apply Lever
400-600 lb-ft	1150/1580 in.-lb	55-75 lb
600-850 lb-ft	1580/2420 in.-lb	75-115 lb

The clutch adjustment should be checked periodically to avoid excessive slippage. This check should be made every 500 hours of operation or more frequently, depending on the frequency of clutch application and operating conditions.

The procedure for tightening or taking up the clutch is as follows:

(1) Remove the inspection cover from the clutch housing.

(2) With the clutch disengaged, rotate the carrier until the adjustment collar lock is accessible.

(3) Press the adjustment collar lock with the thumb, and rotate the toggle assembly clockwise to tighten until the engagement force shown in the above chart is obtained.

Caution: Always be sure that the adjustment collar lock is engaged in one of the 24 slots and that the spring is in a position to hold the lock in place, or the clutch will lose adjustment.

Note: If an air or hydraulic cylinder is used to operate the engagement lever, caution should be exercised to be sure the stroke is correct to eliminate loading the apply mechanism when in the full apply position. This loading does not increase the clutch holding ability, but will result in excessive stress and wear in the toggle mechanism.

9. OPTIONS NOT REQUIRING PREVENTIVE MAINTENANCE

Since the accessory drive, Torqmatic retarder, and hydraulic lockup clutch are lubricated by the oil from the converter, no other lubrication is required. No adjustment is necessary due to the design of these options.

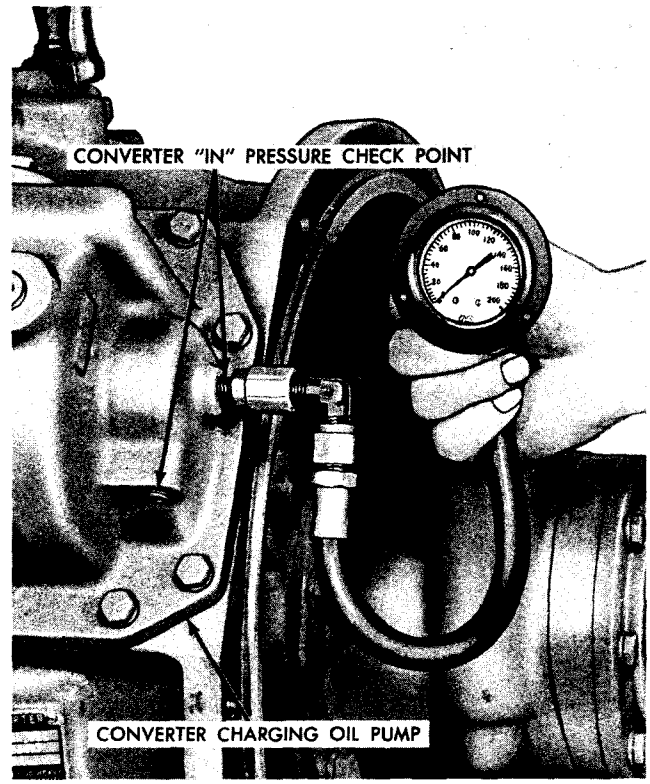


Fig III-5. Checking converter "IN" pressure

10. TROUBLESHOOTING

In this section you will find a Troubleshooting Chart, which will help you locate the source of converter trouble. This chart is organized to cover troubles that may occur first – due to improper maintenance. Remember that the Torqmatic converter is part of the power package, and, therefore, the whole package must be considered when running down the source of trouble.

11. CHECKING CONVERTER CHARGING OIL PRESSURE

The charging oil pump pressure should be 50 psi minimum and 80 psi maximum at full-throttle stall condition. Refer to par. 14, below. The maximum permissible pressure at full throttle, no load, is 120 psi. It is most important that the values not exceed the limits given. This pressure can be checked at either

of the two converter "IN" pressure check points (fig. III-5), on the charging oil pump. If the pressure is not normal, refer to the Troubleshooting Chart, item A.

12. CHECKING OIL TEMPERATURE

The maximum converter "OUT" oil temperature is 250° F. If there is no converter temperature gage on the control panel a temperature reading can be taken at the converter oil "OUT" temperature connection (figs. III-3, III-4, and III-6).

13. CHECKING FOR LOCKED STATORS

If it should become necessary to check for locked stators by observing temperature drop rate, increase converter "OUT" temperature to 230° F by stalling the converter output shaft at full throttle. Release the converter output shaft and immediately check the rate of temperature drop with no load on the converter and maximum input rpm. Temperature should start to drop after 15 seconds. A slow temperature drop rate probably indicates that one or both stators are locked. A rapid temperature drop rate indicates normal stator operation.

14. CONVERTER STALL CHECK

a. Purpose. The stall check is for the purpose of determining whether or not the engine and the Torqmatic converter are functioning satisfactorily as a unit. It will be necessary to refer to the engine-converter matched performance curve to determine the recommended engine speed at stall. This curve is available from your engine manufacturer or from Allison Division, Transmission Service Department.

b. Vehicle Installations.

(1) Start the engine and let it warm up. Run the engine at idling speed.

(2) Check the air brake pressure to see that it is normal and apply the air brakes.

(3) Shift the transmission into high range and increase the engine speed to full throttle. Do not stall the converter for longer than 30 seconds. Do not permit the converter "OUT" temperature to exceed 250° F.

(4) Record the engine speed, converter "IN" pressure and "LUBE" pressure. The converter "IN" pressure should be at least 50 psi, and the "LUBE" pressure at least 8 psi. This completes the check. Compare the recorded engine speed at stall with the recommended engine speed at stall shown in the engine-converter matched performance curve. This stall speed is for normal conditions and some variation should be expected.

c. Stationary Installations. The only difference in procedure for a converter stall check in a stationary installation is that a different method from b(2), above, will be necessary to hold the Torqmatic converter output shaft.

15. CHECKING TORQMATIC DRIVE LINE ROTATION

a. Purpose. With a Torqmatic converter and a Torqmatic transmission in the drive line, a check for freeness of rotation can be made. If there is a malfunction and it does not exist in other members of the drive line, this check will show whether it is in the converter or the transmission.

b. Procedure.

(1) If the drive line between the converter and transmission does not turn freely by hand, disconnect this drive line and also the power take-off drive line.

(2) Rotate the transmission input flange. If it does not rotate freely by hand, a range clutch failure is indicated. If it rotates freely, the difficulty may lie either with the converter or an accessory unit.

(3) Refer to the vehicle service manual for further information concerning an accessory unit.

(4) Refer to the Torqmatic Transmission Shop Manual concerning the transmission.

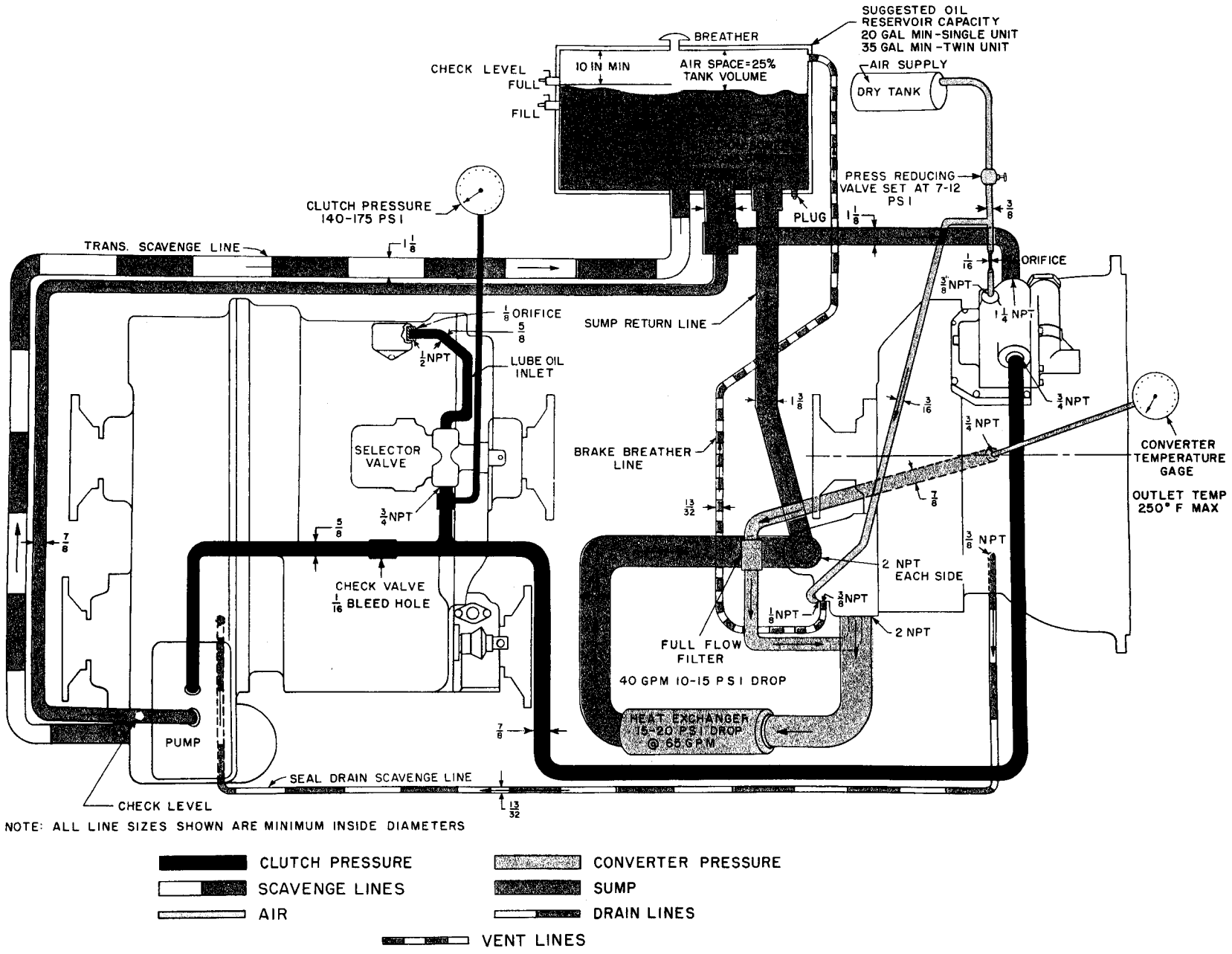


Fig III-6. Oil schematic for Torqmatic converter and Torqmatic retarder installation, TCB-500 series

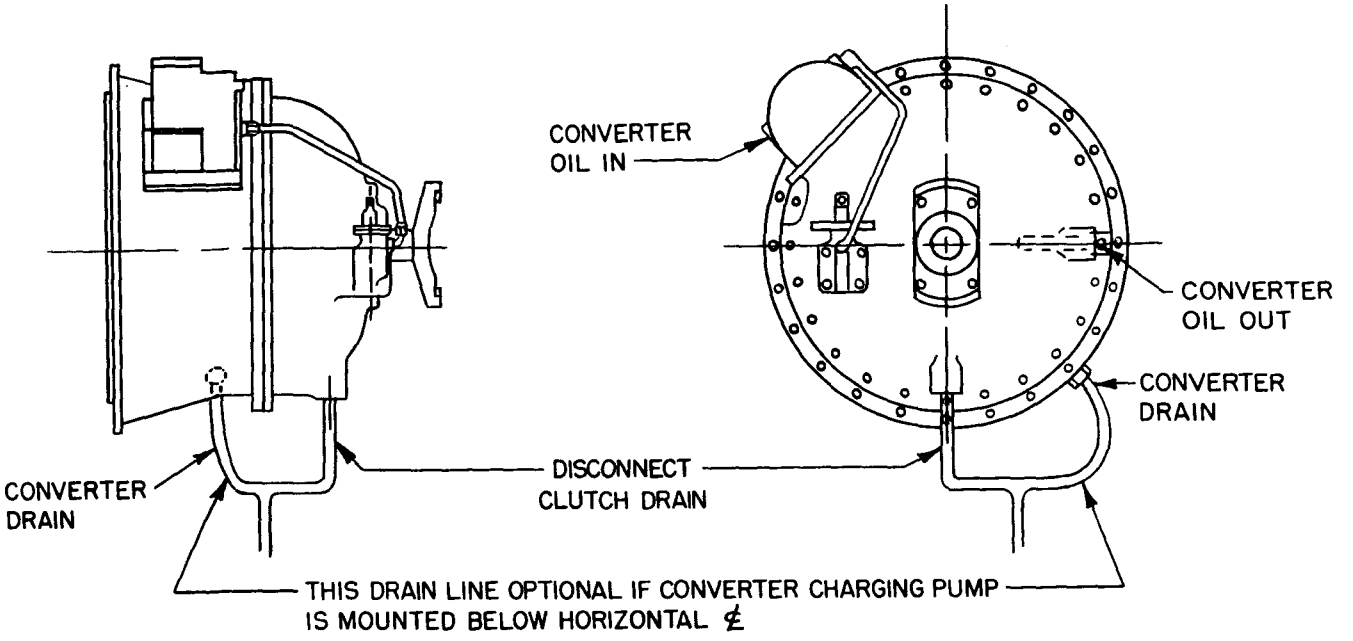


Fig III-7. Drain line requirements for TCRD models

16. CHECKING ENGINE CONVERTER ALINEMENT

a. If the engine has been overhauled or if the converter pilot bearing was defective at converter overhaul, check the converter installation as outlined below.

b. Check the runout of the engine crankshaft with the engine bell housing face. This should not exceed .013 of an inch. If the runout does exceed .013, contact the Engine Service Representative before assembling.

c. Check the runout of the engine flywheel housing pilot diameter with the engine crankshaft. This should not exceed .013 of an inch. If the runout does exceed .013, contact the Engine Service Representative before assembling.

d. Check to see whether the seal ring (see 11, fig. VI-41), is preventing the cover from adequately squeezing the bearing outer race. The seal chamfer must be large enough to prevent the seal from overlapping the chamfer and holding the cover away from the flywheel.

e. If misalinement between the engine and converter is found to be excessive, do not install the converter until it is corrected. Misalinement puts abnormal loads on the pilot bearing and could contribute to a premature bearing failure.

17. SEAL DRAIN LINE ROUTING, BENDS, CARBON BUILD-UP

a. Seal Drain Line Routing, Bends. The correct seal drain line routing from the converter to the oil sump is critical and must be adhered to. The drain line must be at least 3/8-inch inside diameter and must be installed 3 1/2 inches or more below the center line of the converter at every point in the line. There should never be any kinks or tight bends in the line (figs. III-3, III-4, III-6 and III-7). Improper installation will result in excess leakage past the converter pump hub seal or the output shaft dual oil seal.

b. Seal Drain Line Carbon Build-up. Excessively high converter operating temperatures will sometimes result in oxidation of the oil, causing carbon deposits to occur in the hydraulic system. The seal drain line will become restricted sufficiently to cause a pressure build-up at the pump hub seal. Leakage or complete failure of the pump hub seal will result. Remove the seal drain line from

the converter housing periodically and check for carbon build-up. If any carbon is evident, remove the deposit and reinstall the fitting and seal drain line. Watch the engine flywheel housing drain hole for indications of leakage at the pump hub seal, which could cause complete failure of the seal. If the problem of carbon build-up persists, correct the conditions causing high operating temperatures.

18. STORAGE

a. Length of Storage. If the Torqmatic converter is to be stored or remain inactive for a period of 30 days or more, it should be treated as outlined below. If severe corrosive conditions are present and the inactive period will exceed one week, the Torqmatic converter should be treated as outlined below. These procedures will provide maximum control of rust and corrosion for 12 months. If the storage period is extended, the process should be repeated every 12 months.

b. Materials. To provide maximum protection, the oil and grease must meet specifications as follows: preservative oil, Government Specification USA 2-126 Grade 1; grease, Government Specification ANC 124a. Moistureproof tape should also be available.

c. Procedure for Preserving.

(1) Start the engine and let it run at idling speed (neutral range if Torqmatic transmission is used) until the hydraulic system reaches a temperature of 150° F.

(2) Drain the hydraulic system (pars. 5 and 6, this section).

(3) Fill the hydraulic system with the recommended preservative (pars. 5c and 6d).

(4) Start the engine and operate the Torqmatic converter for at least five minutes at a maximum of 1000 rpm. The hydraulic system should reach a temperature of 225° F during this period. It may be necessary to stall the converter output (par. 13, above). If no temperature gage is available, do not operate the converter at stall for more than 30 seconds.

(5) Stop the engine and permit the Torqmatic converter to cool to a temperature suitable to touch.

(6) Seal all the exposed openings and breathers with moistureproof tape.

(7) Coat all exposed, unpainted surfaces with preservative grease. All controls should be positioned so as to present a minimum of exposed surface. All shafts or flanges with oil seals should receive special attention.

d. Procedure for Restoration to Service.

(1) Remove the tape and other covering.

(2) Remove all preservative grease with solvent.

(3) Start the engine and let it run at idling speed (with the transmission in neutral range) until the hydraulic system reaches a temperature of 150° F.

(4) Drain the hydraulic system (pars. 5 and 6, this section).

Caution: Only limited, part load running of Torqmatic Drive with preservative oil is permitted.

(5) Fill the hydraulic system with oil (pars. 5c and 6d).

19. TOWING VEHICLE (vehicle installations)

While this converter is not equipped with an output-driven oil pump to provide lubrication during towing, the unit may be coupled to a Torqmatic transmission which is so equipped. In such installations, the transmission pump can be relied upon for lubrication while towing the vehicle for limited distances and at low speeds. However, if such means of lubrication is not present, or if the vehicle is to be towed long distances or at higher speeds, the drive line must be disconnected.

TROUBLESHOOTING CHART

A. LOW CONVERTER CHARGING PRESSURE

Cause	Remedy
1. Low oil supply.	1. Add oil (sec. III, par. 3).
2. Oil line leakage.	2. Check for air leaks in suction lines and oil leaks in pressure lines.
3. Excessive oil flow to transmission.	3. Check operation of selector valve, check valve, bypass valve and transmission driven pump.
4. Plugged inlet line or screen.	4. Check inlet line and screen. Clean if necessary.
5. Defective oil pump.	5. Check for wear in oil pump.
6. Suction screen uncovered.	6. Low oil level or improper installation of screen.
7. Oil foaming.	7. Oil return line not below oil level in sump.

B. HIGH OIL TEMPERATURE

1. Low oil level (low flow rate).	1. Add oil (sec. III, par. 3).
2. High oil level.	2. Drain oil to full mark.
3. Low water level in cooling system.	3. Add water. Check for leaks.
4. Low converter charging pressure.	4. Refer to A, above.
5. Clogged or dirty heat exchanger or filter.	5. Clean or replace as necessary.
6. Operating too long in an inefficient converter range.	6. Readjust work cycle to allow converter operation in an efficient converter range.
7. One or both stators locked.	7. (a) Check for low top speed of vehicle or other equipment. (b) Refer to sec. III, par. 13.
8. Stators interchanged (low stall speed).	8. (a) Check for lack of power at converter stall (sec. III, par. 14). (b) Disassemble converter and check stators (sec. VI, pars. 2c and 3d).
9. Stator(s) installed without rollers or springs (low stall speed).	9. Disassemble converter and install rollers or springs.

C. HIGH ENGINE SPEED AT CONVERTER STALL

(Refer to sec. III, par. 14 for further information on converter stall)

1. Low oil supply.	1. Add oil (sec. III, par. 3).
2. Low converter charging pressure.	2. Refer to A, above.
3. High oil temperature.	3. Refer to B, above.

(Continued on next page)

TROUBLESHOOTING CHART - Continued

D. LOW ENGINE SPEED AT CONVERTER STALL
(Refer to sec. III, par. 14 for further information on converter stall)

Cause	Remedy
1. Low engine output torque.	1. Tune engine and check output.
2. Converter element interference.	2. Check for noise at stall. Overhaul converter if necessary.
3. Stators interchanged.	3. (a) Check for lack of power at converter stall (sec. III, par. 14). (b) Disassemble converter and check stators (sec. VI, pars. 2c and 3d).
4. Stators installed without rollers.	4. Disassemble converter and install rollers (sec. VI, pars. 2c and 3d).

E. LOSS OF POWER

1. Stators interchanged.	1. (a) Check for lack of power at stall (sec. III, par. 14). (b) Disassemble converter and check stators (sec. VI, pars. 2c and 3d).
2. Stators installed without rollers (low stall speed).	2. Disassemble converter and install rollers (sec. VI, pars. 2c and 3d).
3. Low converter charging pressure.	3. Refer to A, above.
4. Low engine speed, at converter stall.	4. Refer to D, above.

F. LOCKUP CLUTCH SLIPPAGE

1. Faulty lockup clutch valve linkage adjustment.	1. Adjust linkage.
2. Lockup clutch selector valve not working properly.	2. Remove charging oil pump cover and check clutch selector valve (sec. VI, pars. 2a and 16b).
3. Failed or worn seal rings.	3. Disassemble converter. Replace failed or worn seal rings.
4. Stoppage in passage from oil pump to lockup piston.	4. Disassemble converter and clean passage (sec. IV, par. 5). Inspect converter for dirt).

G. MANUAL INPUT-DISCONNECT CLUTCH SLIPPAGE

1. Clutch facing wear.	1. Adjust clutch (sec. III, pars. 7 and 8).
2. Grease on faces	2. Clean parts (sec. III, pars. 7a and 8a).

SECTION IV GENERAL OVERHAUL INFORMATION

1. SCOPE

The overhaul procedures are divided into eight sections. Section IV contains general information, special tools listing, cleaning and inspection procedures, and wear limits. Section V contains information on removal of TC-500 series converters from, and installation into, the drive line. Section VI gives disassembly, assembly and rebuild procedures for each of the various models. Sections VII through X give instructions for the rebuild of the original optional equipment available with TC-500 series converters. Note that it may not be necessary to completely tear down the Torqmatic converter to make certain repairs.

2. PROCEDURES SUBJECT TO CHANGE

Because of the release of new models and changes in models already in the field, the instructions given in this manual are subject to change. Therefore, always check the latest Service Information Letters issued by the Allison Division Transmission Service Department. These letters usually can be found in the back pages of the current TC-500 Parts Catalogs. When requesting service information, be sure to include the part number of your Torqmatic converter. The number may be found on the name plate.

3. TOOLS, EQUIPMENT

a. Equipment Needed. Proper equipment should be available before overhaul is started — a suitable hoist, proper hand tools, receptacles for small parts, an arbor press, and a converter teardown stand — although convenient, the latter two are not necessary.

b. Special Tools. This section includes a chart listing special tools and their part numbers, their use, and other references to their use contained in this manual. Special tools for the Allison Torqmatic Converter are available through Kent-Moore Organization, Inc., Detroit, Michigan. Refer to fig. IV-1 for these tools. Refer to figs. IV-2 and IV-3 for drawings of special tools that can be fabricated locally.

c. Careful Handling. Handle the converter parts with care. Nicks, scratches, or dents caused by careless handling of parts can cause subsequent converter failure.

4. ORDERING PARTS

a. How to Order. Because of the many models, each Torqmatic converter has a part number besides its serial number. When ordering parts, always include this converter part number, or A/N number, (see converter name plate, fig. I-7) with the part numbers of the required parts. **REFER TO SERIES TC-500 PARTS CATALOG WHEN ORDERING PARTS.** Do not use exploded view reference numbers to order parts.

b. New Parts Needed. Replace all gaskets, worn seal rings, and cotter pins. If the converter has been subjected to excessive heat, replace all springs and rubber seals. Handle rubber and metal seal rings with care to prevent damage.

c. Service Kits Save Time. For your convenience in ordering parts, use Allison Torqmatic Converter Service Kits. Service Kits parts lists are supplied with the Torqmatic Converter Series 500 Parts Catalog, or are available at your dealer. Order one part number and you will receive a complete kit, including seals, gaskets, and other frequently needed items.

5. CLEANING, INSPECTION

a. Dirt, Abrasives Harmful. Whenever the converter contains dirt or other abrasive matter, unnecessary wear will result. Inspect all parts for abrasive material any time the converter is disassembled. Metallic contamination of oil is evidence of the failure of some part in either the converter (or the transmission). When metal particles are found, the converter (and transmission) must

SPECIAL TOOLS CHART

Name	Number	References Figure	References Sec.-Par.	Use
Charging oil pump needle bearing replacer	J 4850	IV-1	VI-16a(9) VI-16d(1) VI-16d(2)	To remove needle bearing from pump body; to install needle bearing in pump driven gear; to install sleeve into pump body.
Charging oil pump driving shaft needle bearing replacer	J 4523-A	IV-1	VI-16d(3)	To install drive shaft needle bearing in pump body.
Snap ring pliers	KMO 410	IV-1	VI-2c(1) VI-2c(3) VI-3d(17) & (20)	To remove and install all snap rings.
Charging oil pump rear bearing sleeve puller	J 4852	IV-1	VI-16a(10)	To remove rear oil pump bearing sleeve from charging oil pump.
Charging oil pump idler gear shaft remover (slide hammer puller)	J 3187	IV-1	VI-8a(2)	Used with adapter J 4857 to remove charging oil pump idler gear shaft.
Charging oil pump idler gear shaft remover (adapter)	J 4857	IV-1	VI-8a(2)	Used with puller J 3187 to remove charging oil pump idler gear shaft.
Converter pump hub seal replacer	J 7475	IV-1	VI-8c(2)	To press pump hub oil seal into converter housing.
Spanner wrench	J 6534	IV-1	VI-2c(9) VI-3d(9)	To remove and install stator roller race retainer nut.
Torqmatic converter overhaul stand	TSD 20183	IV-2		To support converter during overhaul.
Overcenter disconnect clutch lock nut spanner wrench	TSD 20231	IV-3	VIII-3a(4) VIII-3g(4)	To remove and install overcenter disconnect clutch lock nut.

be thoroughly cleaned. Refer to sec. III, par. 4d. All oil lines and cooler passages should be cleaned.

b. Cleaning Parts.

(1) All metallic parts except bearings should be cleaned thoroughly with dry-cleaning solvent, volatile mineral spirits, paint thinner, or by the steam-cleaning method.

(2) Parts should be dried with compressed air. Steam cleaned parts should be oiled immediately after drying.

(3) Clean oil passages by working a

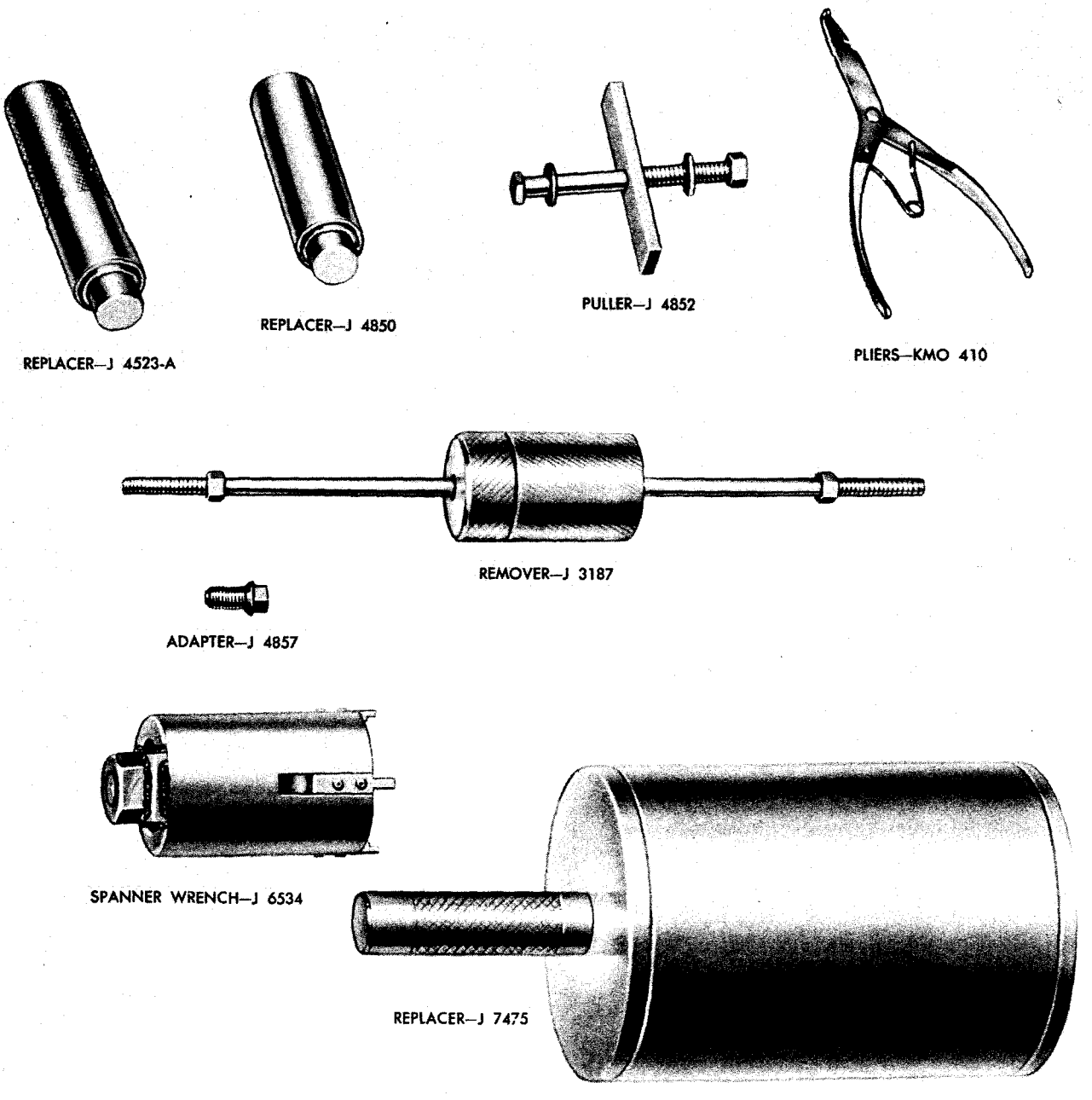


Fig IV-1. Special tools for Torqmatic converter overhaul

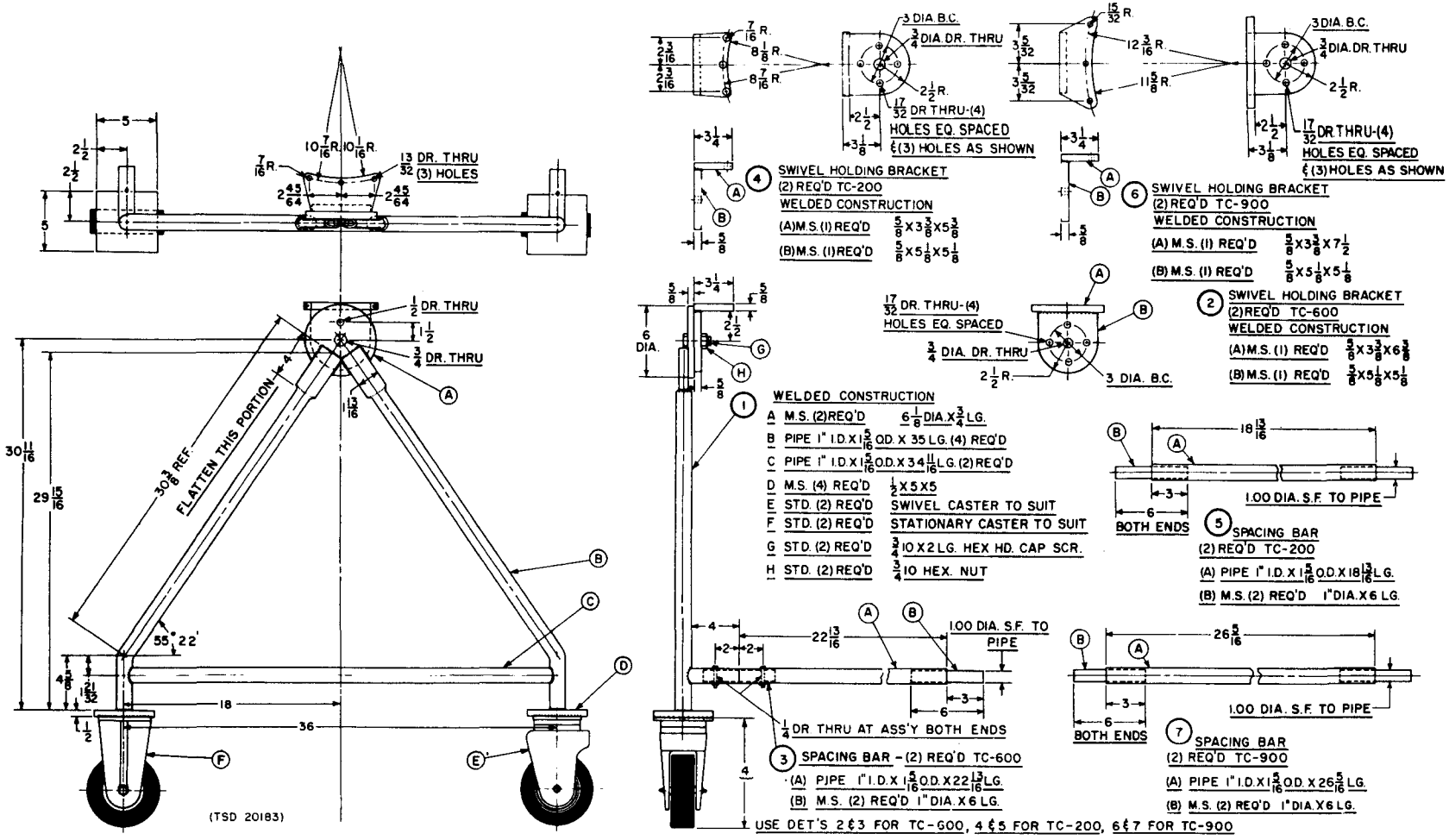


Fig IV-2. Special tool — converter overhaul stand

piece of wire back and forth through the passages and flushing them with cleaning solvent or paint thinner. Dry the passages with compressed air.

(4) Examine parts, especially oil passages, after cleaning to make certain they are entirely clean. Reclean them if necessary.

c. Cleaning Bearings.

(1) Thoroughly wash bearings that have been in service in dry-cleaning solvent, volatile mineral spirits, or paint thinner.

(2) If the bearings are particularly dirty or filled with hardened grease, soak them in solvent before trying to clean them.

(3) Before inspection, oil bearings with the same type of oil that will be used in the transmission.

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

d. Keeping Bearings Clean. Since dirt or grit in ball bearings is usually responsible for bearing failures, it is important to keep bearings clean during installation and removal. Observance of the following rules will do much to insure maximum bearing life.

(1) Do not remove the wrapper from new bearings until ready to install them.

(2) Do not remove the grease in which new bearings are packed.

(3) Do not lay bearings on a dirty bench; place them on clean paper.

(4) If assembly is not to be completed at once, wrap or cover the exposed bearings with clean paper or cloth to keep out dust.

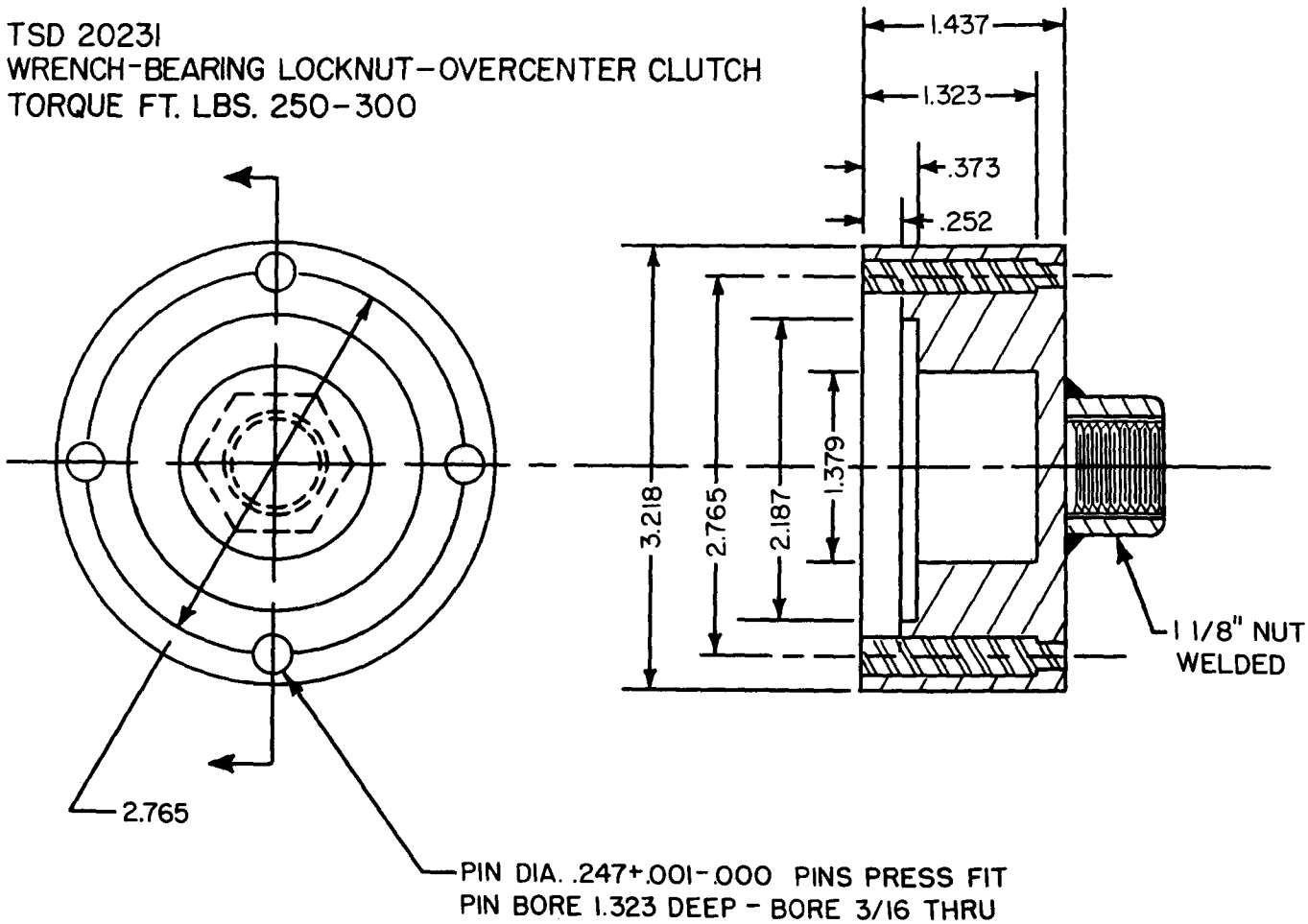


Fig IV-3. Special tool — spanner wrench for manual overcenter input-disconnect clutch lock nut

e. Inspecting Cast Parts, Machined Surfaces.

(1) Inspect bores for wear, grooves, scratches, and dirt. Remove all burs and scratches with crocus cloth. Remove foreign matter. Replace parts that are deeply grooved or scratched.

(2) Inspect all oil passages for obstructions. If an obstruction is found, remove it with compressed air or by working wire back and forth through the passage and flushing it out with cleaning solvent.

(3) Inspect mounting faces for burs, scratches, nicks, and foreign matter. Remove such defects with crocus cloth or a soft stone. If scratches are deep, replace the defective part.

(4) Inspect threaded openings for damaged threads. Chase damaged threads with the correct size tap.

(5) Replace housings or other cast parts that are cracked.

(6) Inspect all machined surfaces for damage that could cause oil leakage or other malfunction of the part. Rework or replace the defective parts.

f. Inspecting Bearings.

(1) Inspect bearings for roughness of rotation. Replace a bearing if its rotation is still rough after cleaning and oiling.

(2) Inspect bearings for scored, pitted, scratched, cracked, or chipped races, and for indication of excessive wear of rollers or balls. If one of these defects is found, replace the bearing.

(3) Inspect a defective bearing's housing and shaft for grooved, burred or galled conditions that would indicate that the bearing has been turning in its housing or on its shaft. If the damage cannot be repaired with crocus cloth, replace the defective part.

(4) When installing a bearing on a shaft, heat the bearing to 300° F on an electric hot plate or in an oil bath. Coat the mating surfaces with white lead and use the proper size installation sleeve and an arbor press to seat the bearing.

(5) If a bearing must be removed or installed without a sleeve, be careful to press only on the race which is adjacent to the mounting surface. If an arbor press is not available, seat the bearing with a drift and a hammer, driving against the supported race.

g. Inspecting Bushings, Thrust Washers.

(1) Inspect bushings for roundness, scores, burs, sharp edges, and evidence of overheating. Remove scores with crocus cloth. Remove burs and sharp edges with a scraper or knife blade. If the bushing is out of round, deeply scored, or excessively worn, replace it using the proper size replacer.

Note: Sometimes it is necessary to cut out a defective bushing. Be careful not to damage the bore into which the bushing fits.

(2) Inspect thrust washers for distortion, scores, burs, and wear. Replace the thrust washer if it is defective or worn. It is much less expensive to replace such parts than to replace converter elements, which can fail due to defective bearings, bushings, or thrust washers.

h. Inspecting Oil Seals, Gaskets.

(1) Inspect seal rings for cuts and hardness. Replace the seal rings if these defects are found.

(2) When replacing lip-type seal rings, make sure the spring-loaded side is toward the oil to be sealed in (toward the inside of the unit). Use a nonhardening sealing compound on the outside diameter of the seal to help prevent oil leaks.

(3) Replace all composition gaskets.

(4) Inspect hook-type seal rings for wear, broken hooks, and distortion.

(5) Install a new hook-type seal ring if it is worn so much that there is no gap be-

tween the hooks of the seal ring when it is installed.

(6) The sides of the seal ring should be smooth (.005-inch maximum side wear). The sides of the shaft groove (or the bore) in which the seal ring fits should be smooth (50 micro inches equivalent) and square with the axis of rotation within .002 of an inch. If the sides of the ring grooves have to be reworked (.020-inch maximum side wear), install a new seal ring.

i. Inspecting Gears.

(1) Inspect gears for scuffed, nicked, burred or broken teeth. If the defect cannot be removed with a soft stone, replace the gear.

(2) Inspect gear teeth for wear that may have destroyed the original tooth shape. If this condition is found, replace the gear.

(3) Inspect the thrust faces of gears for scores, scratches, and burs. Remove such defects with a soft stone. If scratches and scores cannot be removed with a soft stone, replace the gear.

j. Inspecting Splined Parts. Inspect splined parts for stripped, twisted, chipped, or burred splines. Remove burs with a soft stone. Replace the part if other defects are found. Spline wear is not considered detrimental except where it affects tightness of fit of the splined parts.

k. Inspecting Threaded Parts. Inspect parts for burred or damaged threads. Remove burs with a soft stone or fine file. Replace damaged parts.

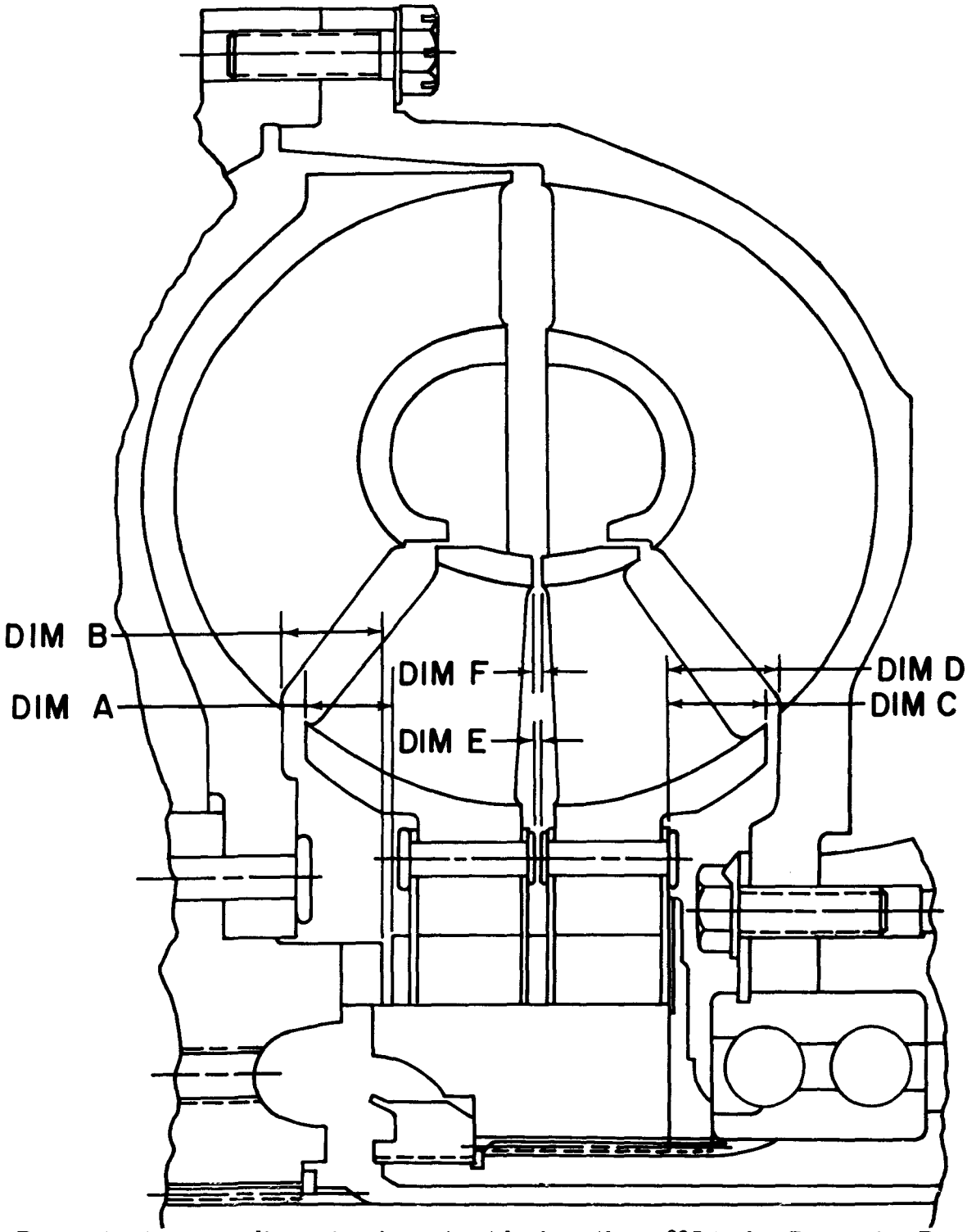
l. Inspecting Snap Rings. Inspect all snap rings for nicks, distortion, and excessive wear. Replace the part if one of these defects is found. The snap ring must snap tight in its groove for proper functioning.

m. Inspecting Springs. Inspect all springs for signs of overheating, permanent set or wear due to rubbing adjacent parts. Replace the spring if any one of these defects is found.

6. WEAR LIMITS

The Wear Limits Chart in this section lists the maximum variations from the original dimensions at which the converter can be expected to function satisfactorily. It is possible that in individual cases parts may give satisfactory service beyond the limits specified. The chart is based on field service experience and is intended only as a guide to parts replacement. Use this chart in conjunction with par. 5, this section, on Cleaning and Inspection. Wear limits are illustrated in the exploded views throughout this manual and may be located by referring to the figure numbers and reference letters in the chart.

(WEAR LIMITS CHART follows on next page)



Dimension B minus dimension A must not be less than .025 inch. Dimension D minus dimension C must not be less than .025 inch. Dimension E (distance between rivet heads) must not be less than .005 and can be measured by inserting a .005 shim between the rivet heads. A check can be made easily by rotating the first stator and noting if there is any rivet head interference. Dimension F (distance between 1st and 2nd stator outer shrouds) must not be less than .005.

Fig IV-4. TC-500 Torqmatic converter cross section, showing wear limit points of measurement

WEAR LIMITS CHART

ILLUSTRATED	DESCRIPTION	LIMIT
Fig. VI-27	CONVERTER HOUSING ASSEMBLY	
A	6751502 Oil pump drive gear — 4.162 in. bore	4.172
	Oil pump drive gear thickness (Gear may be reversed to equalize wear)	0.006 per face
Fig. VI-34	TORQUE CONVERTER STATOR ASSEMBLY	
A	6758485 bronze thrust washer — .127 in. thickness Wear must be even across face and have no metallic pickup (see fig. IV-4)	0.117
B	All stator assemblies — 4.764 in. bore	4.767
C	All stator freewheel side washers — 0.058 in. thickness (see fig. IV-4)	0.048 min
D	6756319 stator race — 4.749 in. O.D.	4.739
E	6759855 stator back plate — 0.298 in. thickness	0.288
F	6769469 stator freewheel roller spring — 1.17 lb ± .11 lb at 0.94 in. operating height	
Fig. VI-36	TORQUE CONVERTER TURBINE ASSEMBLY	
A	6757083 turbine hub — 0.570 in. dim.	0.010 max wear
A	6756374 turbine hub — 0.570 in. dim.	0.010 max wear
Fig. VI-40	CONVERTER OUTPUT SHAFT	
A	6758135 converter output-shaft seal ring bore	1.0025 in. dia
Fig. VI-41	FLYWHEEL ASSEMBLY	
A	Converter flywheel — 2.435 in. pilot dia	2.425
A	Converter flywheel (lockup) — 1.751 in. dia bore	1.754
Fig. VI-44	CHARGING OIL PUMP	
A	6752719 clutch pressure regulating spring — 82 lb ± 5% load at 2.22 in. operating height	
B	6752882 clutch pressure regulating valve — clearance with oil pump cover	0.006
C	6756527 converter pressure regulating valve — clearance with oil pump cover	0.006
D	6756484 converter pressure regulating spring — 88.6 lb ± 5% load at 3.52 in. operating height	
E	5171417 detent spring — 20 lb ± 10% load at 1.5 in. operating height	
F	6770417 clutch pressure regulating spring — 26 lb ± 2% load at 1.75 in. operating height	

(Continued on next page)

WEAR LIMITS CHART - Continued

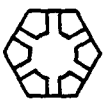
ILLUSTRATED	DESCRIPTION	LIMIT
Fig. VI-51	ACCESSORY DRIVE	
A	6752614 governor drive shaft bushing – 0.624-0.626 bushing bore	0.630
B	6752615 governor drive shaft – 0.620-0.621 shaft O.D.	0.618
Fig. VII-5	HYDRAULIC INPUT-LOCKUP CLUTCH	
A	6768273 piston — face wear	0.015
B	6750270 friction plate — thickness	0.153
C	6704228 piston return spring - 880 lb ± 10% load at 0.22 in. operating height	
D	6770022 reaction plate — face wear	0.010
Fig. VIII-3	MANUAL INPUT-DISCONNECT CLUTCH	
A	5174923 clutch release lever spring — 14 to 16 lb load at 2.38 in. operating height	
Fig. IX-3	HYDRAULIC REAR-DISCONNECT CLUTCH ASSEMBLY	
A	6752529 piston — face wear	0.015
B	6752587 piston return spring — 95 lb ± 10% load at 2 in. operating height	
C	6750269 bronze friction plate — thickness	0.153 0.020 max cone
D	6752922 steel reaction plate — thickness	0.109 0.038 max cone
E	6750092 reaction plate — face wear	0.010
F	6752710 disconnect valve — clearance with 6752715 valve body	0.006
G	6752715 valve body — clearance with 6752710 disconnect valve	0.006
H	6756907 valve body detent spring — 20 lb ± 10% load at .76 in. operating height	
Fig. X-3	TORQMATIC RETARDER	
A	6757646 torque limit valve spring — 18.4 lb ± 5% load at 2 in. operating height	
B	6757388 torque limit valve spring — 7.9 lb ± 5% load at 2 in. operating height	
C	6754125 brake oil valve spring — 2 lb ± 10% load at 2.14 in. operating height	
D	6757420 brake valve — clearance with 6757390 valve body	0.010
E	6757390 valve body — clearance with 6757420 brake valve	0.010
F	6757393 converter "out" bypass valve spring — 24.4 lb ± 10% load at 2.14 in. operating height	

7. TORQUE SPECIFICATIONS

The following general torque specifications are recommended for use in all cases where specific requirements are not set forth:

GENERAL TORQUE SPECIFICATIONS - BOLTS AND SCREWS

(All torque values are given in pound feet)

Size	Threads per inch	Standard heat-treated bolts and screws	Special heat-treated bolts, screws, Allen-head screws, and self-locking capscrews
			
1/4	20	6-8	9-11
	28	8-10	10-12
5/16	18	15-18	17-20
	24	17-20	19-23
3/8	16	26-32	36-43
	24	33-40	41-49
7/16	14	42-50	54-65
	20	50-60	64-77
1/2	13	67-80	81-97
	20	83-100	96-115
9/16	12	85-100	103-123
	18	100-120	122-146
5/8	11	117-140	164-192
	18	134-160	193-225
3/4	10	180-210	284-325
	16	215-250	337-385
7/8	9	315-360	490-550
	14	372-425	575-650
1	8	445-500	685-770
	14	535-600	830-925

Service Information Notes

SECTION V TORQMATIC CONVERTER IN DRIVE LINE

1. SCOPE

This section contains information for the removal and installation of the different model TC-500 Torqmatic converter installations (fig. V-1). For additional information on the installation and removal of the converter, consult your Equipment Service Manual.

2. REMOVING TORQMATIC CONVERTERS FROM DRIVE LINE (MODELS TC, TCL AND TCB)

a. Preparation for Removal. Drain the hydraulic system. Refer to sec. III, pars. 5 and 6 for this procedure.

b. Removal Procedure.

(1) Install an eyebolt in the converter output-drive shaft to support the rear of the converter. Install an eyebolt in the tapped hole in the top of the converter housing. Attach the hoist and a suitable lifting sling and take up the slack in the chain. Use a rope sling if eyebolts are not available.

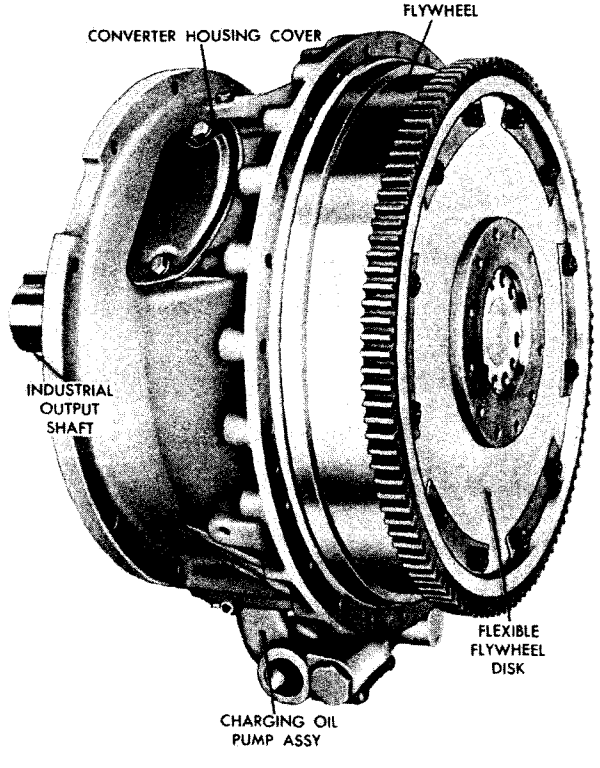


Fig V-1. Torqmatic converter with industrial shaft, right-front view

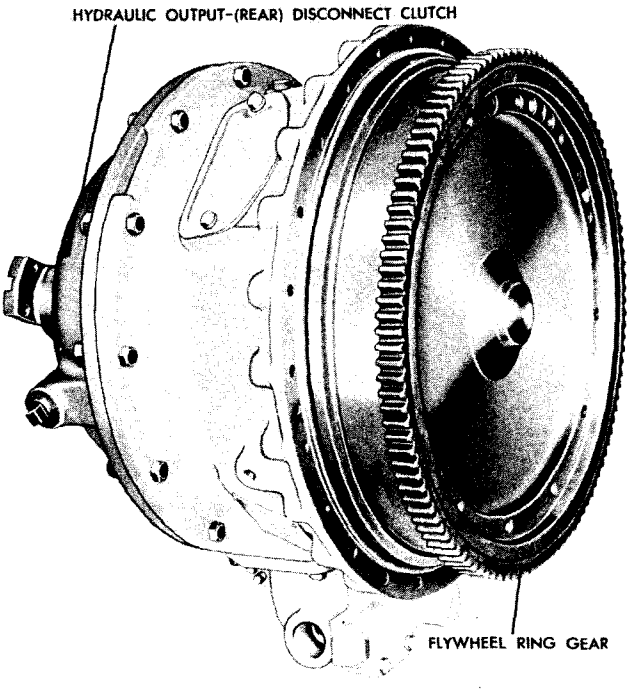


Fig V-2. Torqmatic converter with hydraulic output- (rear) disconnect clutch

(2) Working through an opening in the front of the engine flywheel housing, remove the 12 bolts that secure the flexible flywheel disk to the converter flywheel (fig. VI-2).

(3) Remove the 12 bolts that secure the converter housing to the engine flywheel housing.

(4) Pull the converter rearward until the converter flywheel is out of the engine flywheel housing. The flexible flywheel disk assembly remains attached to the engine crankshaft and the assembly need not be removed unless replacement is necessary.

c. Removing Rear-Disconnect Clutch only from Drive Line. If only the rear-disconnect clutch assembly (fig. V-2) is to be removed from the drive line, use the same procedure for separating the rear-disconnect clutch assembly from the converter outlined in par. 2, sec. IX.

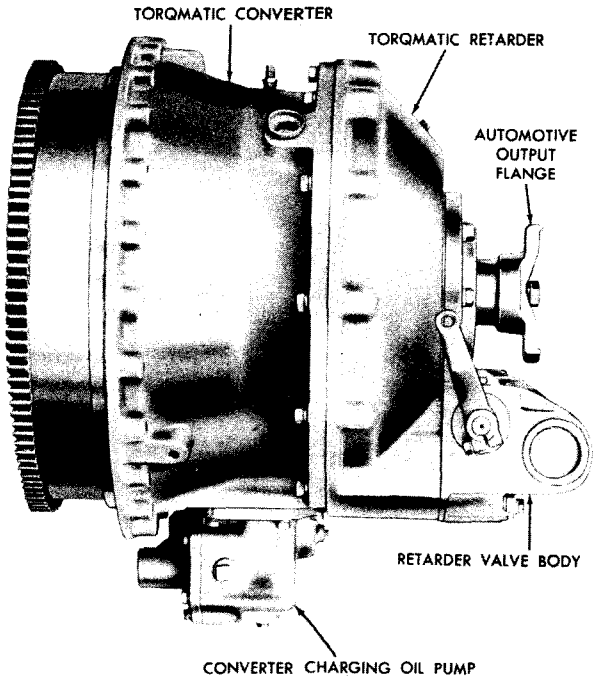


Fig V-3. Torqmatic converter with Torqmatic retarder, left-side view

d. Removing Torqmatic Retarder only from Drive Line. If only the retarder is to be removed from the drive line, use the same procedure for separating the brake (fig. V-3) from the converter outlined in par. 2, sec. X.

3. INSTALLING TORQMATIC CONVERTER IN DRIVE LINE (MODELS TC, TCL AND TCB)

a. Installation Procedure.

(1) Install the flexible flywheel disk assembly on the engine crankshaft.

Note: If the hub of the disk assembly has an "O" index mark stamped on it, aline this mark with matching mark stamped on the crankshaft.

(2) Install an eyebolt in the converter output shaft and an eyebolt in the tapped hole in the top of the converter housing. Attach a suitable lifting sling to the eyebolts and hoist the converter.

Note: Before installing a converter which includes a lockup clutch (TCL) onto the engine, check the engine crankshaft end play to see if it is within the manufacturer's specifications. After installing the converter, again check the crankshaft end play. The two readings should be the same.

(3) Position the converter at the rear of the engine bell housing. Move the converter forward until the flywheel enters the engine bell housing.

(4) Aline the bolt holes and install the 12 bolts that secure the converter housing to the engine bell housing.

(5) On all converters with a lockup clutch, the bolts that secure the flexible flywheel disk assembly to the crankshaft must be indexed with the countersunk holes on the flywheel to prevent interference between the crankshaft and flywheel. After the converter is bolted to the engine, if no end play can be obtained, rotate the crankshaft or flywheel until the bolts drop into place. See note above.

Note: The flywheel has a dowel locating pin; position the clearance hole in the flex disk over this pin.

(6) Working through an opening in the front of the engine bell housing, install 12 self-locking bolts that secure the flywheel disk assembly to the converter flywheel.

Caution: Be especially careful to prevent dropping a bolt into the bell housing. A bolt dropped into the bell housing may prevent rotation of the flywheel. A suitable trough can be constructed to catch bolts dropped accidentally.

(7) Remove the eyebolts. If the output shaft has an automotive flange, install the bolt, lock washer, and output-flange washer into the converter output shaft.

(8) Install any engine accessories that have been removed from the engine and install all external lines.

(9) Refill the converter system with oil in accordance with the specifications given in sec. I, par. 6. Also see sec. III, pars. 3 and 4.

b. Installing Rear-Disconnect Clutch Only in Drive Line. If only the rear-disconnect clutch was removed from the drive line,

use the same procedure for assembling the rear-disconnect clutch to the converter outlined in sec. IX, par. 4.

c. Installing Torqmatic Retarder Only in Drive Line. If only the Torqmatic retarder was removed from the drive line, use the same procedure for assembling the Torqmatic retarder to the converter outlined in sec. X, par. 4.

4. REMOVING TCD MODELS FROM DRIVE LINE (MANUAL, SPRING-LOADED, INPUT-DISCONNECT CLUTCH)

a. Removing Converter. The recommended procedure for removing TCD models (fig. V-4) is to remove the converter first and then to remove the manual input-disconnect clutch. To remove the converter, use the procedure below.

(1) Drain the converter oil. Refer to sec. III, pars. 5 and 6 for this procedure.

(2) Install an eyebolt in the converter output-drive shaft to support the rear of the converter. Install an eyebolt in the tapped hole in the top of the converter housing. Attach the hoist and a suitable lifting sling and take up the slack in the chain. Use a rope sling if eyebolts are not available.

(3) Set the disconnect clutch lever in the engaged position.

(4) Remove the four bolts and the lock washers from the disconnect clutch housing cover. It is not necessary to remove the lube tubes at this time.

(5) Working through the disconnect clutch housing cover opening, remove the 12 bolts that secure the flexible disk assembly to the converter flywheel.

(6) Remove the 11 bolts and lockwashers that secure the converter housing to the disconnect clutch housing.

(7) Pull the converter rearward until the flywheel is free from the disconnect clutch housing.

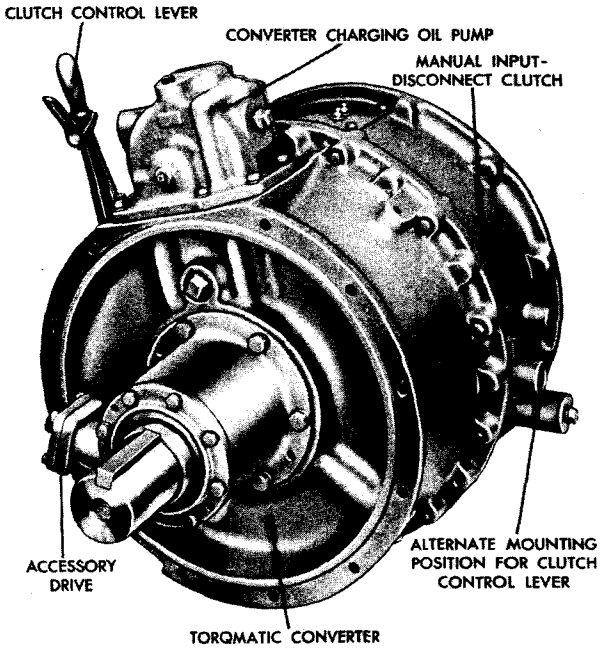


Fig V-4. Torqmatic converter with manual input-disconnect clutch and accessory drive

Note: If the flexible flywheel disks and disconnect clutch shaft assembly should come out of the disconnect clutch, the clutch plate will be supported by clutch spring pressure only. To avoid the possibility of the clutch plate dropping out of position, replace the flexible flywheel disk and disconnect clutch shaft immediately.

b. Removing Manual Input-Disconnect Clutch.

(1) It may not be necessary to overhaul the manual input-disconnect clutch and it can be left in the drive line. To remove the manual input-disconnect clutch, remove the flexible flywheel disk and disconnect clutch shaft assembly.

(2) Remove the top coupling of one of the clutch release bearing lube tubes. Remove the other coupling from its fitting in the same manner. Remove the disconnect clutch housing cover.

(3) Disconnect the hand lever links from the clutch shifter shaft lever by removing the cotter pin and clevis pin.

(4) Remove the 12 bolts and lockwashers that secure the disconnect clutch housing to the engine and remove the housing.

(5) Remove the 12 bolts that fasten the clutch assembly to the flywheel and remove the assembly and shims. There will be two shims at each bolt if they have not been previously removed for clutch adjustment.

5. INSTALLING TCD MODELS IN DRIVE LINE (MANUAL, SPRING-LOADED, INPUT-DISCONNECT CLUTCH (fig. I-4)).

a. Installing Manual, Spring-Loaded, Input-Disconnect Clutch:

(1) Lay the clutch cover plate, spring and hub assembly, and clutch pressure plate on the table with the pressure plate up.

(2) Lay the clutch driven disk assembly, with long hub side down, on the clutch pressure plate.

(3) Grease the pilot bearing in the center of the engine flywheel with high temperature grease.

(4) Install 12 bolts and lock washers into the clutch cover plate.

(5) Install two shims on the end of each bolt that sticks out of the cover plate.

(6) Install the clutch assembly onto the engine flywheel and secure it with the 12 bolts.

(7) Apply a small amount of high-temperature grease to the inside of the fork on the clutch shifter yoke.

(8) Attach a suitable sling and suspend the disconnect clutch housing from the hoist.

(9) Position the input-disconnect clutch housing at the rear of the engine flywheel housing. Move the unit forward, and, working through the input-disconnect housing cover opening, engage the clutch shifter yoke with the two bushings extending on each side of the clutch release bearing sleeve.

(10) Install the 12 bolts and lockwashers that secure the disconnect clutch housing to the engine bell housing.

(11) Guide the converter disconnect clutch shaft and flexible flywheel disk assembly into the clutch release bearing sleeve guide, and engage the splines on the shaft with the splines in the clutch driven disk assembly.

Note: It may be necessary to rotate the converter disconnect clutch shaft and to release the spring pressure on the clutch driven disk assembly to aline the disk assembly. To release the spring pressure, install the clevis pin and cotter pin into the clutch shifter shaft lever. The clutch shifter shaft lever can then be moved to the release position.

b. Installing Torqmatic Converter.

(1) Install an eyebolt in the converter output shaft and an eyebolt in the tapped hole in the top of the converter housing. Attach a suitable lifting sling and hoist and suspend the converter from the hoist.

(2) Position the converter at the rear of the disconnect clutch housing. Move the converter forward until the flywheel enters the disconnect clutch housing.

(3) Install the 11 bolts and lockwashers that secure the converter housing to the disconnect clutch housing.

(4) Working through the disconnect clutch housing cover opening, install 12 bolts that secure the flexible flywheel disks to the converter flywheel.

(5) Insert one of the grease fittings through one of the holes in the center of the disconnect clutch housing cover. Thread the coupling on one of the lube tubes into the grease fitting and tighten. Repeat this procedure on the other fitting and lube tube. Use a high temperature grease to lubricate the bearings after the lube tubes are in place.

(6) Secure the disconnect clutch housing cover with four bolts and lock washers.

(7) For completion of the installation, follow the procedure given in par. 3, above, steps (7) through (9).

6. REMOVING TCD MODELS FROM DRIVE LINE (MANUAL OVERCENTER, INPUT-DISCONNECT CLUTCH (fig. I-5))

a. Removing from Drive Line. The recommended procedure for removing TCD models with overcenter, input-disconnect clutch from the drive line is to remove the converter and disconnect clutch as one package unit. To remove them, use the procedure which follows:

(1) Drain the converter oil. Refer to sec. III, pars. 5 and 6 for this procedure.

(2) Using eyebolts and a suitable lifting sling (use a rope sling if eyebolts are not available), attach a hoist and take up the slack in the sling.

(3) Remove any driven equipment, including output flange, governor drive cable, or linkage.

(4) Remove the 11 bolts and lockwashers that secure the disconnect clutch housing to the engine bell housing.

(5) Pull the converter and clutch package rearward until the unit is clear.

b. Removing Manual Overcenter, Input-Disconnect Clutch from Converter.

(1) Position the converter-disconnect clutch package on blocks on a work bench with the disconnect clutch down.

(2) Remove the two bolts and lockwashers which secure the converter housing inspection cover and gasket.

(3) Working through the converter housing opening, remove the 36 self-locking bolts which secure the converter drive housing to the converter pump element.

(4) Remove the 11 bolts and lockwashers which secure the torque converter housing to the overcenter disconnect clutch housing.

(5) Lift the converter off the disconnect clutch.

7. INSTALLING TCD MODELS IN DRIVE LINE (MANUAL OVERCENTER, INPUT-DISCONNECT CLUTCH)

a. Installing Manual Overcenter, Input-Disconnect Clutch on Converter.

(1) Place the input-disconnect clutch, with the rear end up, on blocks on a work bench. Install a headless guide bolt in the converter drive housing.

(2) Install an eyebolt in the converter output shaft. Using a suitable lifting sling and hoist, lower the converter onto the disconnect clutch housing, indexing the converter pump with the converter drive housing. Remove the headless indexing bolt from the converter drive housing.

(3) Install the 36 self-locking bolts that retain the converter drive housing on the converter pump element.

(4) Install the 11 bolts and lockwashers that secure the converter housing to the disconnect clutch housing.

(5) Secure the converter housing inspection cover and gasket with two bolts and lock washers.

b. Installing Manual Overcenter, Input-Disconnect Clutch and Converter in Drive Line.

(1) Attach a suitable lifting sling and suspend the disconnect clutch-converter package from a hoist.

(2) Position the package at the rear of the engine. Move the package forward, working the bearing into the flywheel, the clutch assembly into the clutch drive gear, and the clutch housing into the engine flywheel housing.

(3) Secure the overcenter, input-disconnect clutch housing to the engine with 11 bolts.

(4) For completion of the installation, follow the procedure given in par. 3, above, steps (7) through (9).

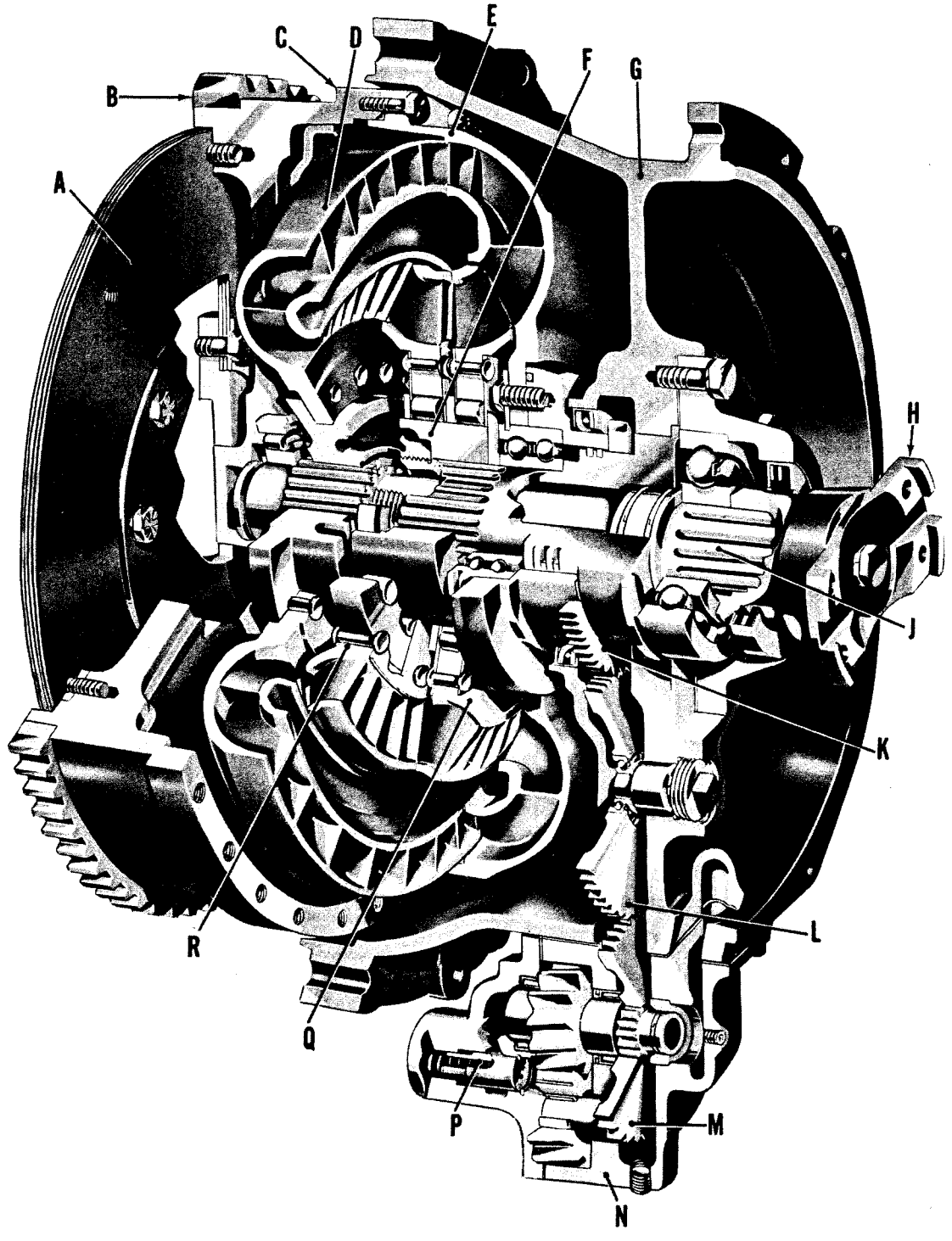


Fig V-5. Torqmatic converter (automotive shaft) — cutaway view

SECTION VI OVERHAUL PROCEDURES TORQMATIC CONVERTER

1. SCOPE

The disassembly and assembly procedures outlined in pars. 2 and 3, below, apply to one of the basic models. Other models are covered in the paragraphs following par. 3. (See par. IV, par. 2). If a converter assembly stand is used, the procedure may vary. However, the sequence of disassembly and assembly will remain practically the same. Refer to the Torqmatic converter cutaway views and exploded parts views for parts identification and relationship. Output-shaft options are covered in this section. Rebuild of the hydraulic input-lockup clutch, manual input-disconnect clutch, hydraulic rear-disconnect clutch, and Torqmatic retarder, as furnished by Allison, are covered in secs. VII, VIII, IX, and X. Refer to sec. IV, par. 6 for wear limits.

2. DISASSEMBLY OF TC MODELS (INDUSTRIAL SHAFT)

a. Removing Charging Oil Pump Assembly.

(1) Place the converter on the flywheel end (fig. VI-1).

(2) Remove the six bolts and lockwashers from the charging oil pump assembly and remove the assembly and gasket from the converter housing (fig. VI-1).

A - Flexible flywheel disk assembly
B - Flywheel ring gear
C - Flywheel
D - Converter turbine assembly
E - Converter pump assembly
F - Stator freewheel roller race
G - Converter housing assembly
H - Output flange (automotive)
J - Converter output shaft (automotive)
K - Oil pump drive gear
L - Oil pump idler gear assembly
M - Oil pump driving gear
N - Charging oil pump assembly
P - Clutch pressure regulating valve
Q - Second-stator assembly
R - First-stator assembly

Fig V-5. Torqmatic converter (automotive shaft) — cutaway view, legend

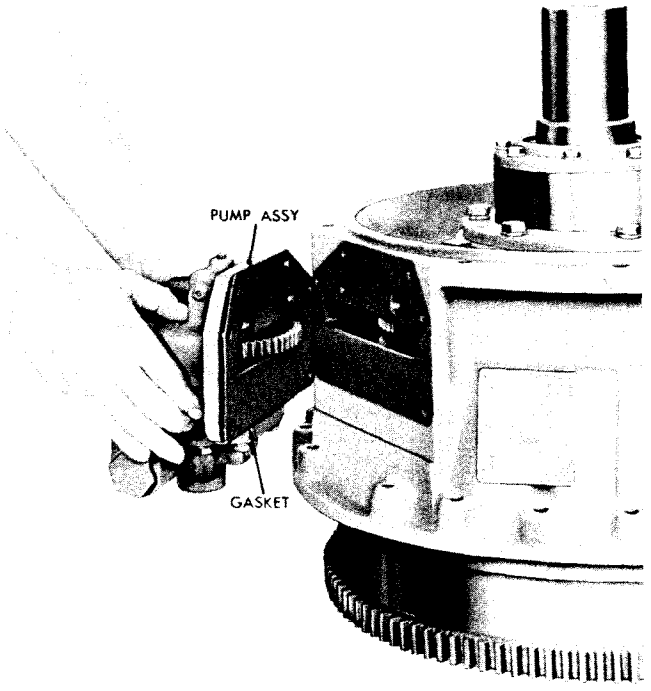


Fig VI-1. Removing (or installing) charging oil pump assembly

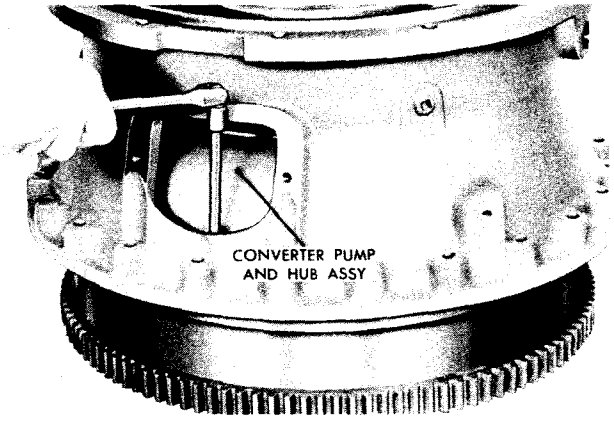


Fig VI-2. Removing (or installing) converter pump-to-flywheel bolts

b. Removing Flywheel Assembly.

(1) Remove the two bolts and the lock washers that secure the converter housing cover and remove the housing cover and gasket (fig. I-1).

(2) Using a 9/16-inch socket, and work-

ing through the converter housing cover opening, remove the 36 bolts that secure the converter pump to the flywheel (fig. VI-2).

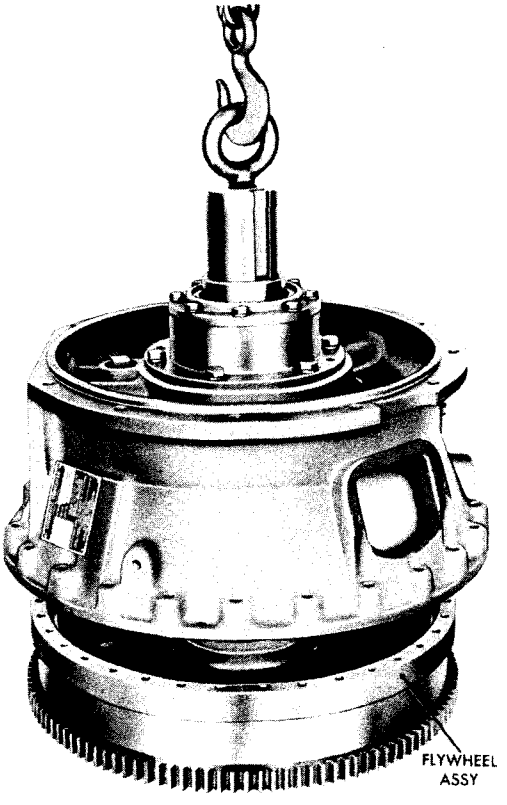


Fig VI-3. Removing (or installing) flywheel assembly

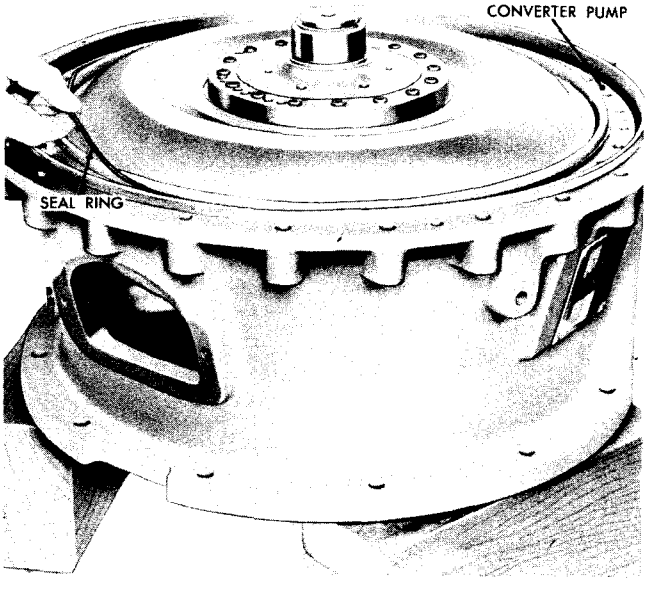


Fig VI-4. Removing (or installing) seal ring from converter pump flange

(3) Using an eyebolt in the output shaft or a sling attached to the housing, lift the converter up, leaving the flywheel on the table (fig. VI-3).

(4) Turn the converter over and place on blocks (fig. VI-4).

(5) Remove the large seal ring from the converter pump flange (fig. VI-4).

c. Removing Torqmatic Converter Elements.

(1) Remove the snap ring from the converter output shaft (fig. VI-5).

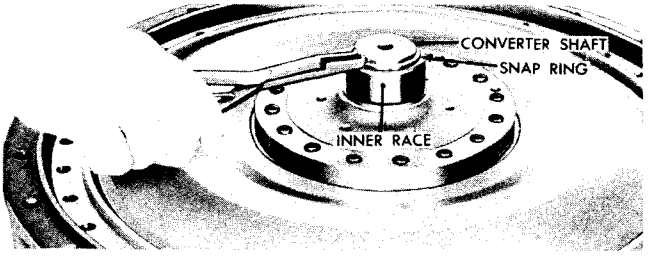


Fig VI-5. Removing (or installing) snap ring from converter shaft

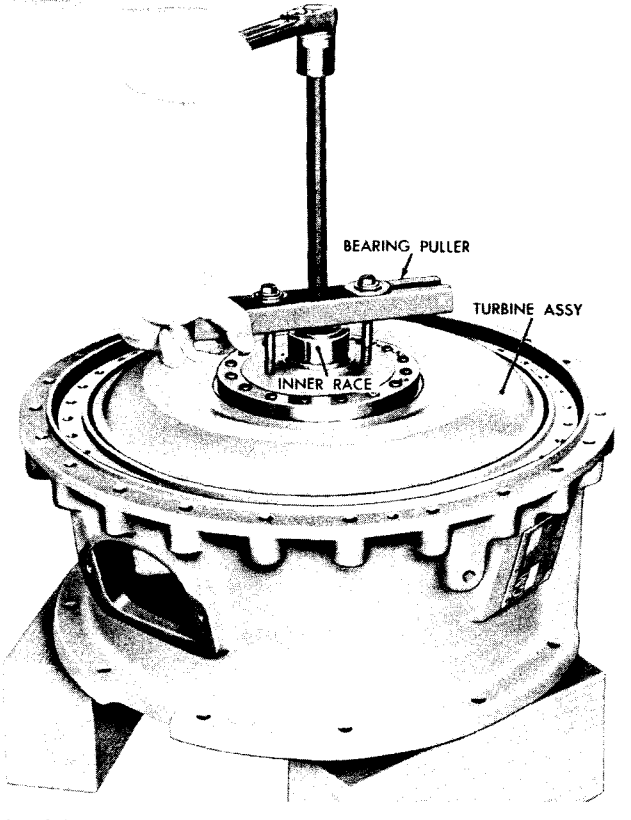


Fig VI-6. Removing pilot bearing inner race and turbine assembly, using bar-type bearing puller

(2) Install the bolts of any suitable bar-type bearing puller into the tapped holes provided in the turbine hub. Remove the bearing inner race and the turbine assembly (fig. VI-6).

(3) Remove the snap ring that locates the turbine (fig. VI-7).

(4) Remove the thrust washer between the turbine and the first stator (fig. VI-7).

(5) Remove the first-stator assembly (fig. VI-8).

(6) Remove the thrust washer between the first and second stators (fig. VI-9).

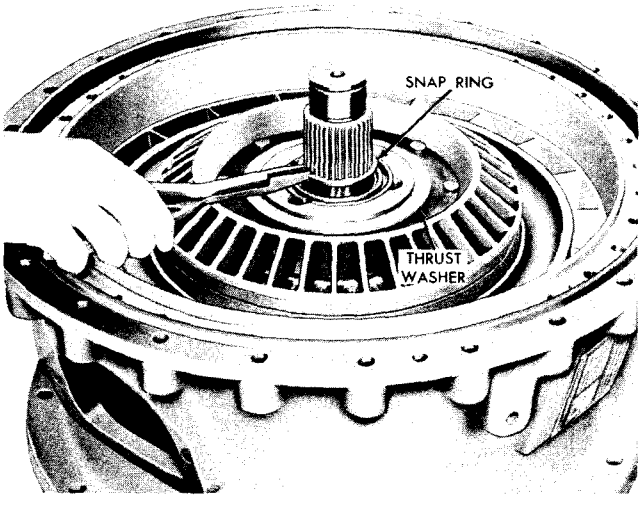


Fig VI-7. Removing (or installing) snap ring that locates turbine

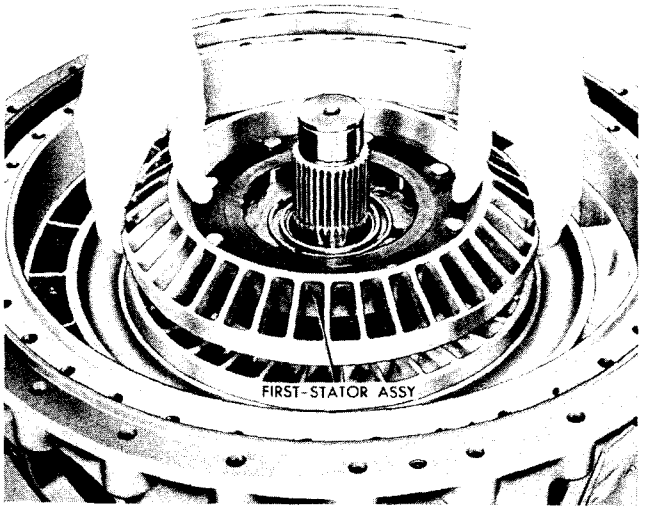


Fig VI-8. Removing first-stator assembly

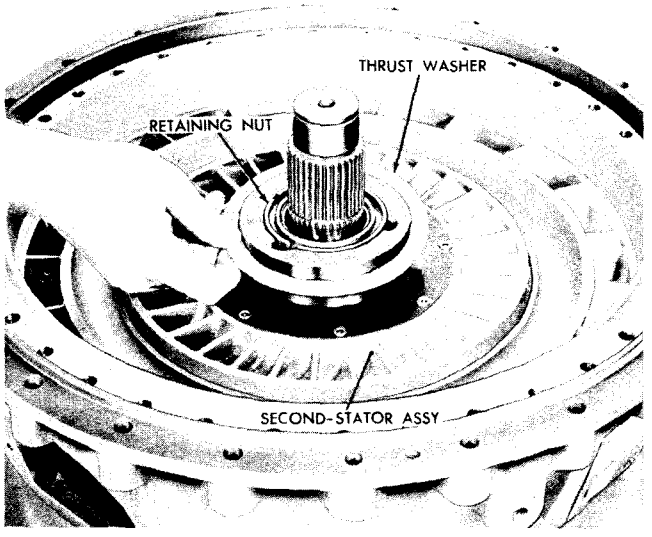


Fig VI-9. Removing (or installing) thrust washer between first-stator assembly and second-stator assembly

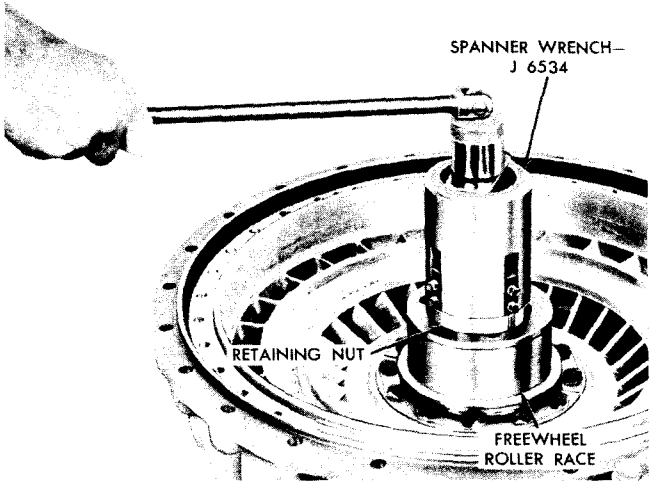


Fig VI-10. Removing (or installing) freewheel roller race retaining nut

(7) Remove the second stator assembly (fig. VI-9).

(8) Straighten the staked section of the freewheel roller race retaining nut.

(9) Using spanner wrench J 6534 (fig. IV-1), remove the retaining nut (fig. VI-10).

Note: An improved version of tool J 6534 is shown in fig. IV-1.

(10) Remove the freewheel roller race (fig. VI-11).

(11) Remove the spacer (fig. VI-11).

(12) Straighten the bent part of the locking strips and remove 12 bolts (fig. VI-11).

(13) Remove the two halves of the retaining plate (fig. VI-12).

(14) Remove the converter pump (fig. VI-12).

(15) The converter pump hub, seal ring and bearing may come off with the converter pump. If not, remove the converter pump hub, seal ring and bearing from the ground sleeve (fig. VI-13).

(16) Remove the two seal rings from the ground sleeve (fig. VI-14).

d. Removing Converter Output Shaft (Industrial Type).

(1) Position the converter housing with the output shaft up.

(2) Remove the eight bolts and lock washers from the bearing retainer (fig. VI-15).

(3) Remove the retainer and the shims from the bearing housing (fig. VI-15). If necessary, use jackscrews.

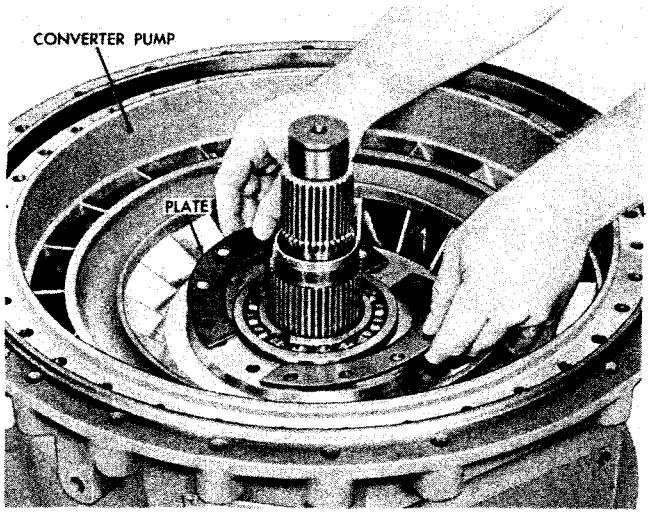


Fig VI-12. Removing (or installing) split retainer plate

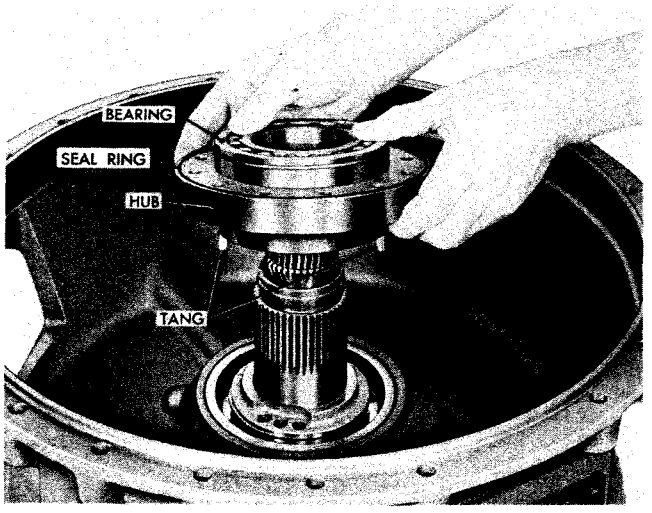


Fig VI-13. Removing (or installing) converter pump hub and bearing

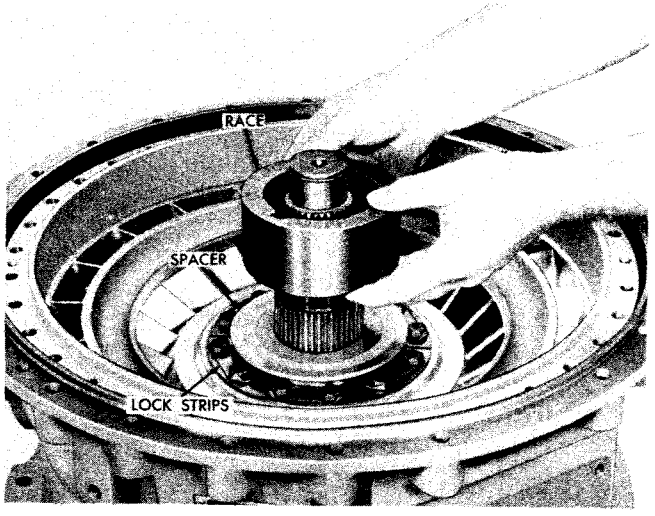


Fig VI-11. Removing (or installing) freewheel roller race

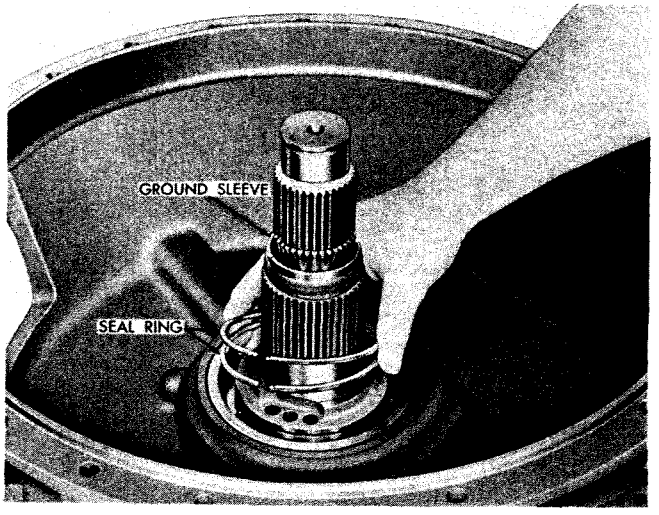


Fig VI-14. Removing (or installing) seal ring from ground sleeve

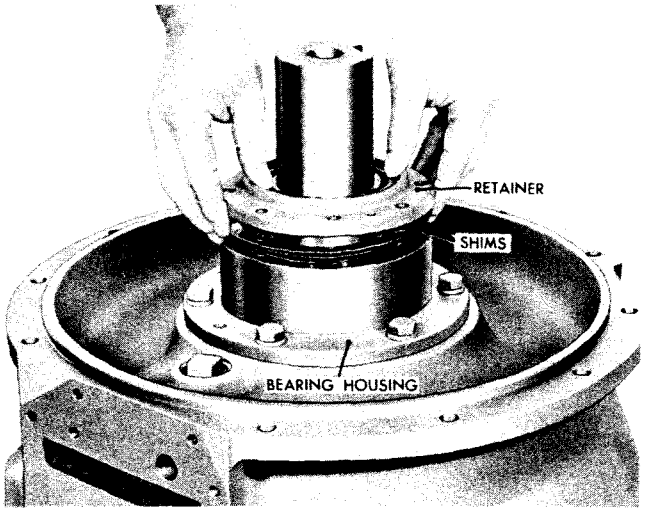


Fig VI-15. Removing (or installing) bearing retainer and shims

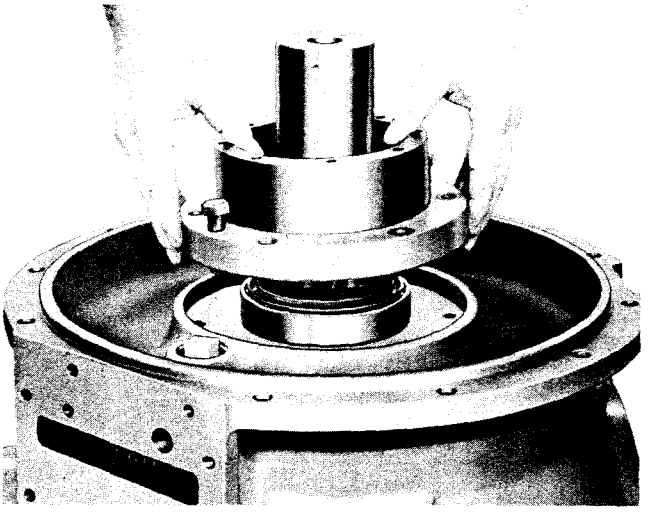


Fig VI-16. Removing bearing housing

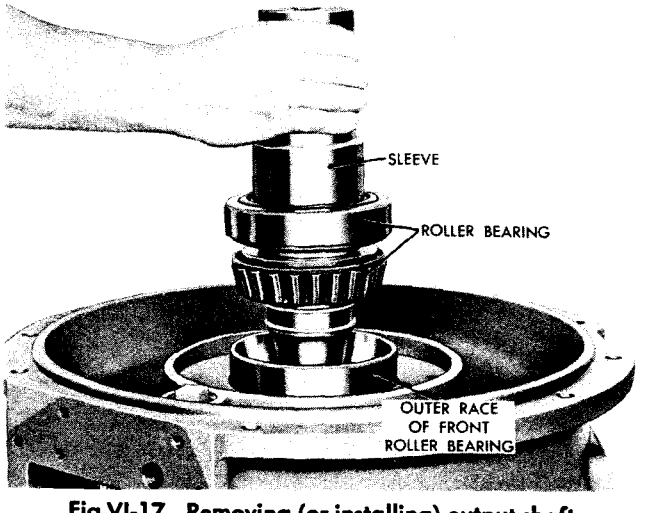


Fig VI-17. Removing (or installing) output shaft

(4) Remove the six bolts and lock washers from the bearing housing (fig. VI-15).

(5) Using jackscrews, remove the bearing housing and gasket from the converter housing (fig. VI-16). The outer race of the rear roller bearing assembly will come off with the bearing housing.

(6) The output shaft may come off with the bearing housing. Remove the bearing housing from the shaft. If the output shaft doesn't come off when the bearing housing is removed, remove the output shaft (fig. VI-17). A sleeve and two roller bearings will come off with the shaft. Refer to par. 13, below, for rebuild of the output shaft.

3. ASSEMBLY OF TC MODELS (INDUSTRIAL SHAFT)

a. Installing Torqmatic Converter Output Shaft (Industrial Type).

(1) Position the converter housing assembly, rear end up, on the disassembly table.

(2) Place the outer race of the front roller bearing, with thick end down, so that it rests against the end of the ground sleeve (fig. VI-17).

(3) Install the output shaft in the ground sleeve so that the front roller bearing engages with its outer race.

(4) Install the bearing housing gasket on the rear of the converter housing.

(5) Install the bearing housing on the rear of the converter housing making sure that any oil drain holes in the bearing housing aline with the holes in the converter housing. Refer to fig. VI-16 showing removal.

(6) Secure the bearing housing to the converter housing with six lock washers and six bolts.

(7) If the outer race of the rear roller bearing was removed, install it, thin edge down, in the bearing housing.

b. Installing Bearing Retainer.

(1) Install the bearing retainer on the output shaft and seat it against the rear bearing by tapping it lightly with a soft hammer. Refer to fig. VI-15.

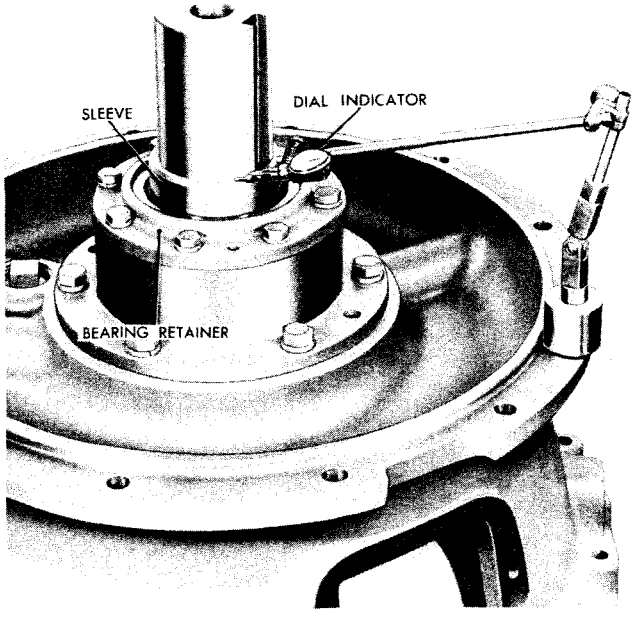


Fig VI-18. Checking end play — weight resting on housing

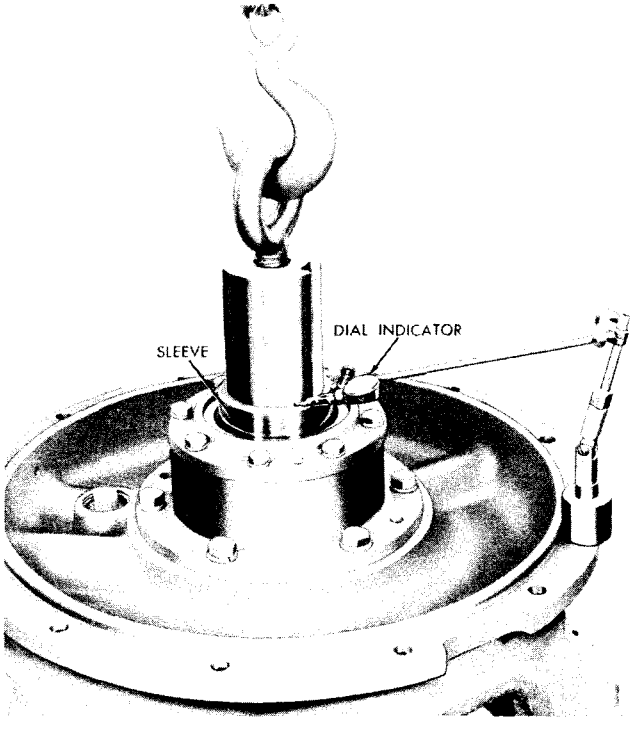


Fig VI-19. Checking end play — weight suspended by output shaft

(2) Using a feeler gage inserted between the bearing retainer and the bearing housing, measure the space between those two parts.

(3) Add .006-inch to the measurement obtained in step (1). This is the calculated shim. Make up a shim pack equal to the calculated shim and install it between the retainer and the bearing (fig. VI-15).

(4) Secure the retainer to the bearing housing with eight lock washers and eight bolts.

c. Checking End Play of Output Shaft.

(1) To check the end play in the output shaft, position the converter, rear end up, on the disassembly table. Support the converter by the converter housing only. Make sure that the shaft does not touch the table.

(2) Attach a dial indicator to the converter housing so that the indicator touches the rear end of the oil seal sleeve on the output shaft (fig. VI-18). Set indicator on zero.

(3) Install an eyebolt in the rear end of the output shaft. Using a hoist, raise the converter high enough to be sure that all of the weight of the converter is on the output shaft (fig. VI-19).

(4) The indicator reading is the end play of the output shaft (fig. VI-19). The end play must be at least .004-inch but not over .006-inch.

(5) If the end play is less than .004-inch, remove the bearing retainer and add a sufficient amount of shims to the shim pack to bring the end play within the required limits. If the end play exceeds .006-inch, remove a sufficient amount of shims from shim pack to bring the end play within required limits.

d. Installing Torqmatic Converter Elements.

(1) Support the converter, front end up.

(2) Install the hook-type seal rings on the ground sleeve (fig. VI-14).

(3) Install the converter pump hub and

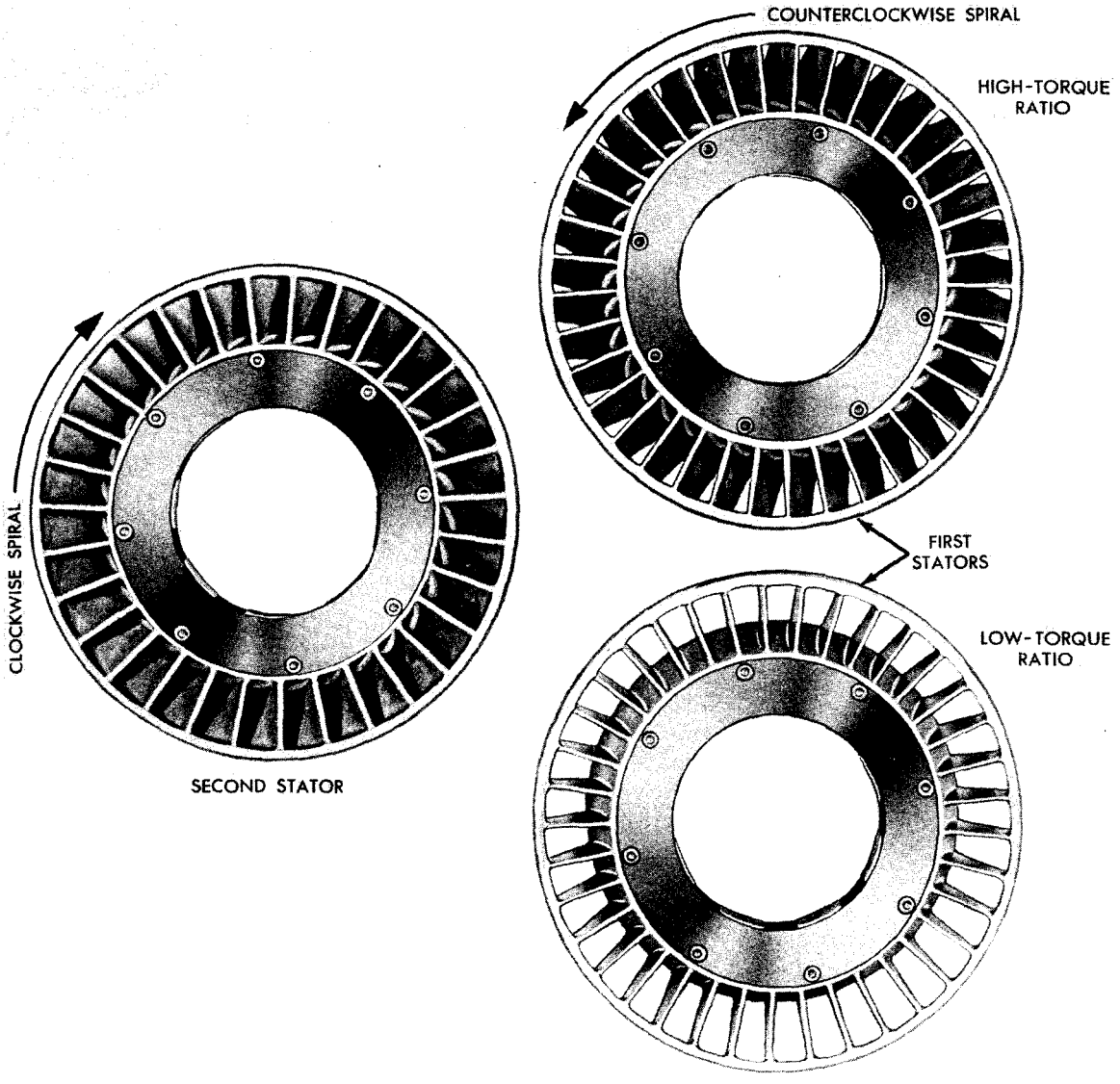


Fig VI-20. Identifying first and second stators

bearing on the ground sleeve, making sure that the tangs on the pump hub are engaged with the slots in the pump drive gear (fig. VI-13).

(4) Install a new neoprene seal ring in the groove of the converter pump hub (fig. VI-13).

(5) Install the converter pump.

(6) Install the two halves of the retaining plate (fig. VI-12).

(7) Install six lock strips and 12 bolts. Bend one corner of the lock strip against the bolt head (fig. VI-11).

(8) Install the spacer (fig. VI-11).

(9) Install the freewheel roller race (fig. VI-11).

(10) Install the freewheel roller race retaining nut using spanner wrench J-6534 (fig. VI-10). Torque tighten the nut to 275 to 325 pound-feet.

(11) Stake the retaining nut (fig. VI-9).

(12) Lay the stator assembly, flat side up, on the table. An examination will show the second stator to have blades that spiral clockwise. The first stator will have either straight blades or blades that spiral counterclockwise (fig. VI-20).