

**Allison
Transmissions**

**3321, 3331 Series
Service Manual**



IMPORTANT SAFETY NOTICE

Proper service and repair is important to the safe, reliable operation of all motor vehicles. The service procedures recommended by Detroit Diesel Allison and described in this service manual are effective methods for performing service operations. Some of these service operations require the use of tools specially designed for the purpose. The special tools should be used when and as recommended.

It is important to note that some warnings against the use of specific service methods that can damage the vehicle or render it unsafe are stated in this service manual. It is also important to understand these warnings are not exhaustive. Detroit Diesel Allison could not possibly know, evaluate and advise the service trade of all conceivable ways in which service might be done or of the possible hazardous consequences of each way. Consequently, Detroit Diesel Allison has not undertaken any such broad evaluation. Accordingly, anyone who uses a service procedure or tool which is not recommended by Detroit Diesel Allison must first satisfy himself thoroughly that neither his safety nor vehicle safety will be jeopardized by the service method he selects.

Service Manual

Allison Transmissions

POWERSHIFT MODELS

CRT 3321-1

CRT 3321-3

CRT 3331-1

CRT 3331-3

1 FEBRUARY 1979



Detroit Diesel Allison

Division of General Motors Corporation

Indianapolis, Indiana 46206

NOTE: This publication is revised periodically to include improvements, new models, special tools, and procedures. Revision is indicated by letter suffix to publication number. Check with your Detroit Diesel Allison service outlet for currently applicable publication. Additional copies of this publication may be purchased from authorized Detroit Diesel Allison service outlets. See your yellow pages under Engines—Diesel or Transmissions—Truck, Tractor, etc.

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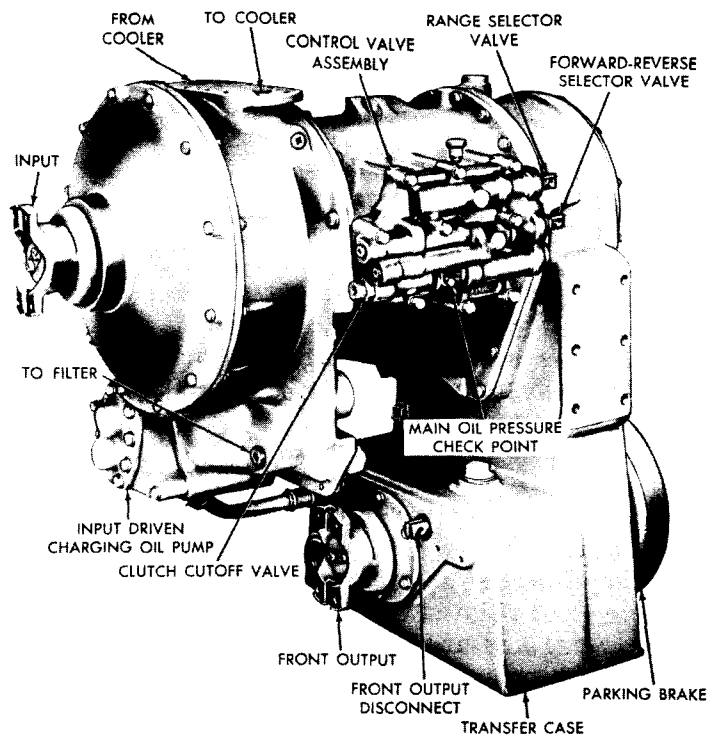
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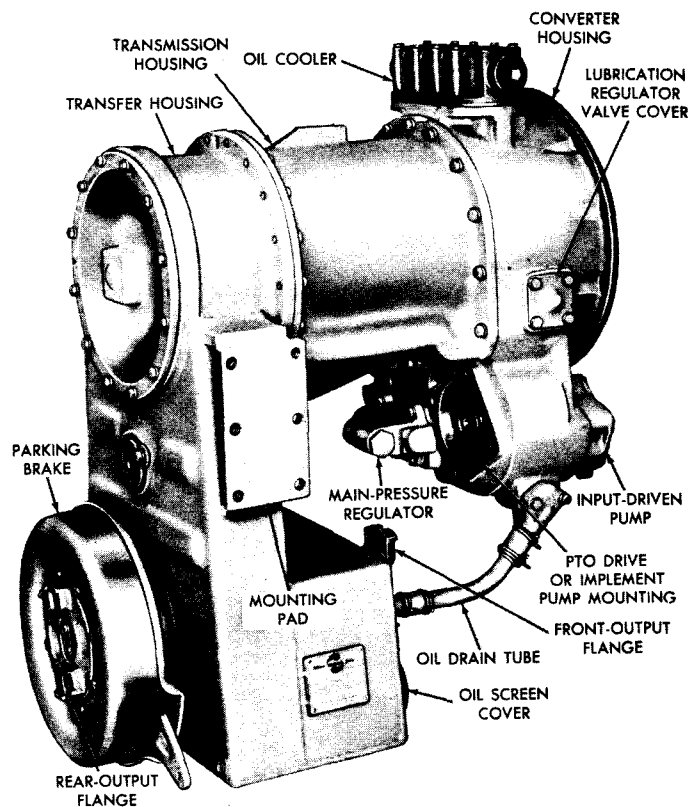
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Fig. I-1. Model CRT 3321-1 or CRT 3331-1 transmission with remote-mount option—left-front view



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Fig. I-2. Model CRT 3321-1 or CRT 3331-1 transmission with direct-mount option—right-rear view

Section I GENERAL INFORMATION

1. SCOPE, ARRANGEMENT OF MANUAL

a. Sections, Paragraphs

(1) This service manual is composed of eight sections indicated by Roman numerals. The page numbers of each section begin with 1, following the section number. Each section is composed of paragraphs which are numbered beginning with 1. Subparagraphs under each paragraph begin with a. Further division of subparagraphs is indicated by (1), (2), etc.

(2) Sect. I contains general information; sect. II describes the transmission and its function; sect. III covers maintenance instructions; sect. IV lists information required for general overhaul of the transmission;

sect. V covers disassembly of the transmission; sect. VI outlines the rebuild of sub-assemblies; sect. VII covers assembly of the transmission; sect. VIII is a tabulation of wear limits and spring information.

b. Illustrations

(1) Illustrations include photographs, line drawings, cross sections, and exploded views. Transmission features and overhaul procedures are illustrated mainly by photographs. Line drawings illustrate special tools and the hydraulic system. Cross sections show transmission construction and illustrate the torque paths through the transmission. Exploded views show in detail the relationship of all parts.

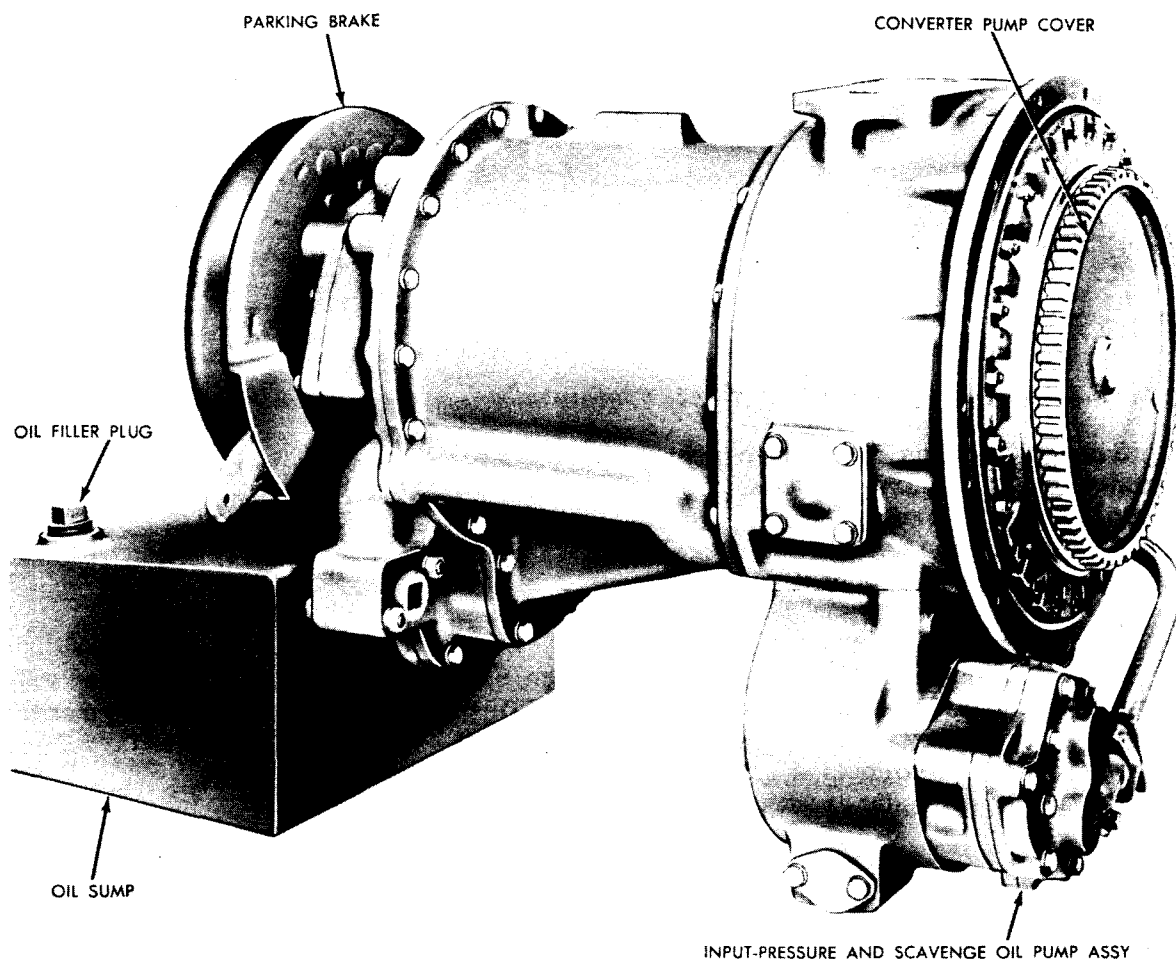


Fig. I-3. Model CRT 3321-3 or CRT 3331-3 transmission with direct-mount option—right front view

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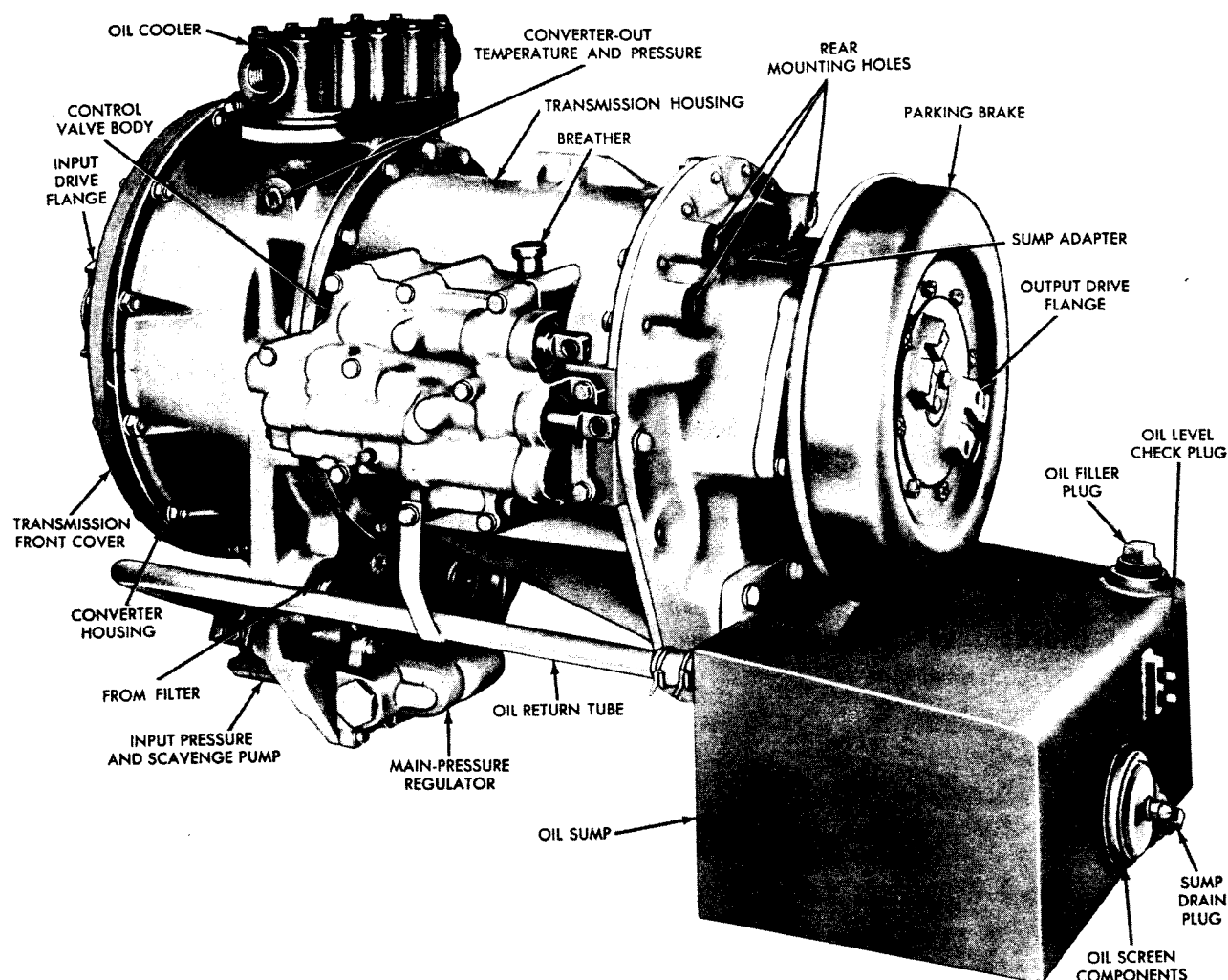


Fig. I-4. Model CRT 3321-3 or CRT 3331-3 transmission with remote-mount option—left-rear view

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(2) Cross sections, hydraulic schematics, and a series of parts exploded views are in foldouts at the back of the manual. These can be opened and used simultaneously for reference with any section of the manual.

c. How Instructions Apply to Specific Models. Because of basic similarities of all models covered, instructions apply generally to all of the models. Where procedures vary between models, notes within the basic instructions identify the procedures with specific models.

2. MODELS COVERED

a. Four Models. Four basic Torqmatic

models are covered in this manual. These are:

CRT 3321-1
 CRT 3321-3
 CRT 3331-1
 CRT 3331-3

Each of these models includes specific assemblies which differ in optional features and equipment. Typical assemblies are illustrated in fig. I-1 through I-4.

b. Model Designation, Identification. The transmission may be identified by the model, assembly number, and serial number stamped on the name plate (fig. I-5) located on the lower-right side of the transfer gear housing of -1 models, or on the top of the adapter

housing at the rear of -3 models. The letters and numerals in the model designation indicate the following:

- C - Torque converter
- R - Reverse available in every basic speed range
- T - Transmission
- First numeral (3) - Converter series 300
- Second numeral (3) - Approximate transmission capacity
- Third numeral (2 or 3) - Basic speed ranges
- Fourth numeral (1) - Major model change
- Suffix (-1) - Transfer case with front and/or rear outputs
- Suffix (-3) - Straight-through transmission with rear output only

c. Model Differences

(1) The major differences between the models covered in this manual are in the type of outputs (transfer case and straight-through) and in the number of basic speeds (two and three). The CRT 3321-1 model has two speeds and a transfer case; the CRT 3331-1 has three speeds and a transfer case; the CRT 3321-3 has two speeds and a straight-through output; the CRT 3331-3 model has three speeds and a straight-through output.

(2) Because the essential difference between two- and three-speed models (with like output arrangements) is the elimination of components from the 3-speed transmission, both models are covered in the same para-

graphs. Exceptions are noted where applicable in the text. Because the differences in outputs are more pronounced, the paragraphs covering the transfer case models are separate from those covering the straight output models.

(3) Foldout 1, at the back of the book, illustrates the CRT 3321-1 and is representative of the CRT 3331-1 except for the omitted range. Foldout 2 illustrates the CRT 3331-3 and is representative of the CRT 3321-3 except for the inclusion of a third gear range.

3. SUPPLEMENTARY INFORMATION

When new models and/or assemblies are introduced, which have features not covered in this service manual, supplementary information will be issued. Contact your dealer or distributor for latest service information. Such inquiries should include model, assembly number (part number) and serial number from the transmission name plate. Check the Yellow Pages for your nearest authorized service outlet. He is listed under Transmission — Truck or Engines — Diesel.

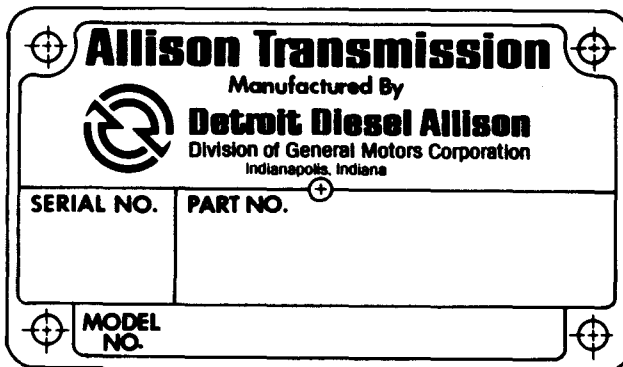
4. ORDERING PARTS

All replacement parts should be ordered from your dealer or distributor. Parts should be ordered from the current parts catalogs for specific models. Do not use item identification numbers in this service manual when ordering. Furnish the model, assembly number and serial number from the transmission nameplate when ordering parts (refer to 2b, above).

5. CONSTRUCTION FEATURES

a. Full-powershift Type

(1) All transmission models covered in this service manual are the full-powershift type, consisting of a torque converter coupled to planetary gearing controlled by hydraulic clutches. The gearing and clutches give forward and reverse operation in every range.



Previous name plates specify type C1 transmission fluid. All transmissions now use type C3.

Fig. 1-5. Torqmatic transmission name plate

(2) Two speed ranges are available in CRT 3321 models; three in CRT 3331 models.

(3) Models with -1 suffix have a transfer case with front and/or rear outputs located 20 inches vertically below the transmission input center line (fig. I-1 and I-2). Those with -3 suffix have only a rear output directly in line with the input (fig. I-3 and I-4).

(4) Speed ranges, and forward and reverse, are manually selected at controls linked to hydraulic valves. The transmission is a single, compact unit which transmits power from the engine to the vehicle drive line. Individual features are discussed in subparagraphs b through g, below.

b. Input Drive, Mounting

(1) Available for all models is a closed torque converter housing and input drive flange for mounting the transmission remote from the engine (fig. I-1). Also, available is provision for mounting the transmission directly on the engine (fig. I-3).

(2) When direct mounted, the torque converter is driven by a closed and sealed concentric gear arrangement in which grease is permanently retained. This grease ring drive reduces noise and gear wear. Models having transfer cases are supported at the rear on 6-hole mounting pads at each side of the transfer case (fig. I-1).

(3) Straight-through models have tapped bosses on the adapter housing for rear support (fig. I-4). Remote-mount models have a trunnion on the front cover, concentric with the input shaft for front support (fig. I-1). Direct-mount transmissions depend upon the engine flywheel housing for front support.

c. Torque Converter

(1) Two types of torque converters have been furnished. They are similar in operation but differ in the stator area. One type has a double freewheeling stator; the other has a single freewheeling stator. Later references will identify the single-stator converter as the 3-element type (foldout 1), while the double-stator converter will be identified as the 4-element type (foldout 2).

(2) The torque converter elements are vaned, aluminum castings. The pump element is driven by the engine. The turbine element drives the planetary gearing. The stator is a reaction member which multiplies torque between the engine and transmission gearing.

d. Planetary Gearing, Clutches. CRT 3331 model transmissions have four planetary gear sets and five clutches (foldout 2). CRT 3321 models have the same arrangement except that the low-range planetary gear set and clutch are omitted (foldout 1). The gear sets provide reverse, forward, high range and low range. Each gear set is controlled by a hydraulic clutch concentric with the gear set. Intermediate range is a direct-drive clutch which acts without a planetary gear set. Foldouts 1 and 2 illustrate the gearing and clutches.

e. Transfer Gearing. Those transmission models which have a -1 suffix (foldout 1) include a drive gear on the transmission main shaft, an idler gear in the transfer case, and a driven gear on the output shaft. This arrangement locates the transmission output 20 inches vertically below the transmission input center line.

f. Outputs, Flanges

(1) A variety of flanges and output arrangements are available among the different models. CRT 3321-3 and CRT 3331-3 models all have an extended main shaft which locates the transmission output at the rear, on a line with the input (foldout 2). Some -3 assemblies include an output flange, while others provide for coupling the splined end of the main shaft directly into the vehicle drive line.

(2) The transfer case models (-1 suffix) may have front or rear outputs, or both (foldout 1). Either of these may include a manual disconnect feature. All types and sizes of output flanges are available. A rear-mounted parking brake is optional for -1 or -3 models.

g. Hydraulic System. A single, integral hydraulic system lubricates, cools and controls the transmission. A pump, which supplies pressure at any time the engine is running, draws oil from the sump. Control valves regulate pressures and direct the oil to vari-

ous components. Oil pressure applies the clutches. Oil is the power-transmitting medium in the torque converter. The oil is continually circulated, filtered and cooled during transmission operation. Foldouts 3 through 6 illustrate the hydraulic system.

6. OPTIONS

a. Service Instructions for Options. In sect. V, VI and VII, the various optional components are covered in procedural instructions along with basic components. Notes are inserted to identify options during disassembly (sect. V) and assembly (sect. VII). In rebuild of subassemblies (sect. VI) no distinction is made between basic and optional components.

b. Integral, Remote Oil Cooler. A flat mounting pad is located atop the converter housing (fig. I-1). There are 12 tapped bolt holes around the pad and two tapped oil passages near its ends. An oil cooler may be mounted on this pad. If a remote-mounted oil cooler is used, the lines which carry oil to and from the cooler are connected to the oil passages on the pad. Whether integral- or remote-mounted, the cooler has inlet and outlet connections for the coolant.

c. Remote-mount Oil Filter. Some units are connected to a remote-mount oil filter. When such a filter is used, an oil transfer tube (fig. VI-20) is installed in the converter housing to direct the oil to the filter. Oil lines to and from the filter connect into tapped openings in the converter housing (fig. I-1 and I-4). No oil transfer tube is used, and tapped openings are plugged, in installations not equipped with a filter.

d. Remote, Direct Mount

(1) Transmissions differ in the components which couple them to the engine. Remote-mount installations have a cover 13 (A, foldout 7) on the front of the converter pump, to which input shaft 12 is bolted. Input flange 4 is splined to the input shaft. Front cover 7, bolted to the converter housing, encloses the input drive. The transmission and engine are connected by a shaft.

(2) Direct-mount installations have a "grease ring" drive, in which concentric gears (internal and external teeth) connect the transmission and engine. The external-tooth gear is integral with converter pump cover 20 (A, foldout 7). The gear teeth are permanently lubricated and sealed. The converter housing is bolted directly to the engine, which supports the front of the transmission.

e. Control Valve Bodies

(1) Several types of control valve bodies have been used in various transmission installations (fig. I-1 and I-4). Earlier models were equipped with one of five different control valves. These were:

(a) "Sense-feel" selector valve with hydraulically actuated (from hydraulic brake system) clutch cutoff valve.

(b) "Sense-feel" valve without a clutch cutoff valve.

(c) "Inching control" selector valve with hydraulic-actuated clutch cutoff valve.

(d) "Inching control" without clutch cutoff control.

(e) "Inching control" with air-actuated (from air brake system) clutch cutoff control.

(2) Recent models use control valve body assemblies which retain the basic characteristics of earlier valve assemblies, but in improved forms. The current valve body assemblies include three types:

(a) Hydraulic-actuated "clutch cutoff" control valve body without the "inching control."

(b) Air-actuated "clutch cutoff" control valve body without "inching control."

(c) "Inching control" valve body without "clutch cutoff."

(3) The description and function of the various valve body assemblies are covered in sect. II, para 12.

f. Accessory Drives

(1) Governor drive. On transfer case (-1) models, a governor drive, located on output drive gear cover 1 (B, foldout 11) is available. This drive is rotated by the turbine output shaft and permits the speed of the engine to be controlled by the output speed of the torque converter.

(2) Speedometer drive. A speedometer drive option is available and can be mounted in the same location in which the governor drive ((1), above) is mounted. However, the governor drive and speedometer drive options are not available together. The speedometer drive rotates at a given ratio to the transmission output regardless of the transmission operating range.

(3) Steer pump drive. On the remote-mount, transfer case (-1) models, an input pump assembly with provisions for mounting and driving a steer pump 7 (A, foldout 8), is available. This option consists of an extended front cover 12 on the input pump, an extended pump drive gear 17, and a splined coupling 6. Space limitations prohibit the use of this option on direct-mount transmissions.

(4) Implement pump or PTO drive. On all models, an implement pump or power take-off drive may be mounted at the lower-right rear of the converter housing (fig. I-2). Rotation is clockwise as viewed from the input end of the transmission. Speed is the same as engine speed and the drive rotates when the engine rotates.

g. Output Disconnects. Outputs and output disconnects vary between installations. On straight-through (-3) models, only a rear output, without the disconnect feature, is available. On transfer case (-1) models, either front or rear outputs, or both, are available. Either of these may include the manual disconnect feature (fig. I-1), in which a splined collar is manually shifted to connect or disconnect the output shaft.

h. Parking Brake. A rear-mounted, internal-expanding, shoe-type parking brake is available for all model transmissions. The brake is mechanical and can be linked to a hand control.

i. Torque Converter Ratios. There are three torque multiplication ratios which are optional. These are:

- 2.48 to 1
- 2.50 to 1
- 3.5 to 1

These ratios are available in both the 3- and 4-element converters. The ratios are determined by the blading in the various elements. Service procedures are identical for all ratios (within the two converter types).

j. Transfer Gear Ratios. Two transfer gear ratios are available for transfer case (-1) models. The two ratios are:

- 0.659 to 1
- 1.62 to 1

The different ratios are obtained from different size transfer drive and driven gears. The transfer idler gear is not changed in size but is located differently for each ratio.

7. TRANSMISSION OPERATING INSTRUCTIONS

a. Related to Vehicle. For information on controls and linkage provided by the vehicle manufacturer, refer to the vehicle service manual.

b. Range Selection

(1) Position the range selector control in neutral position while starting the engine or at any time the vehicle is standing unattended.

(2) When a shift is made from neutral to any driving range, the engine should be at idle speed. Any shift to a higher speed range, in the same direction, can be made at full throttle, under load. Downshift to the next lower speed range may be made at full throttle, under load, providing the vehicle is not exceeding the maximum speed attainable in the lower range.

c. Changing Direction of Travel

(1) Full power directional shifts can

be made under certain operating conditions. Making directional shifts at full throttle when the vehicle is traveling above creeping speed subjects the entire vehicle drive train to abusive loads which may result in unnecessary and premature failure. The forward and reverse clutches should not be used as a substitute for vehicle braking in reducing speed prior to stopping or reversing direction of travel.

(2) Before making a directional shift with the vehicle above creeping speed, service brakes should be used to obtain a reasonable speed and the engine reduced from full throttle. At the moment the vehicle changes direction, the accelerator can be fully depressed without danger to the transmission or other driveline components.

d. Clutch Cutoff Control. On transmissions equipped with clutch cutoff control, the application of the vehicle brakes actuates the clutch cutoff control valve. This valve movement cuts off pressure to the range clutch in earlier models, or to the forward-reverse clutch in recent models. Control pressure for the clutch cutoff valve may be either hydraulic or air, depending upon the type of brake system used on the vehicle. When the vehicle is traveling, in either direction, application of the brakes will interrupt the flow of power in the transmission. Release of the brake restores power.

e. Sense-feel Valve Operation. The purpose of the "sense-feel" valve used in earlier transmissions is to provide a definite retarding force against the engagement of the forward-reverse control valve. This force increases until the point of full clutch-apply is reached, then is automatically relieved. The operator has the sensation of "picking up" the load and can more accurately gage the application of the clutch.

f. Inching Control

(1) Two types of "inching control" have been used. The earlier version is built into the forward-reverse control valve. It involved only the design of the spool-type valve. Two lands on the valve are ground with a gradual taper to increase the linear travel of the valve between cutoff and admission of clutch apply pressure. In addition, the valve detent grooves are shallow and separated by straight lands. This permits more accurate control of the valve between detents.

(2) The more recent type of "inching control" involves the use of an additional spool-type valve to which a manual control, expressly for "inching," is linked. This valve is manipulated to accurately control the application of main pressure to the forward or reverse clutch.

g. Parking Brake. The parking brake is controlled manually. It should be applied while the vehicle is unattended.

h. Output Disconnect. The output disconnect, whether of the front or rear type, is manually controlled. Engagement or disengagement of the output disconnect should not be attempted while the vehicle is in motion.

i. Temperatures, Pressures. If the transmission is equipped with a temperature gage and a pressure gage, these instruments should be observed occasionally to determine if the operation of the transmission is normal. Clutch pressure should be 110 to 135 psi (758.4 to 930.8 kPa), or 135 to 155 psi (930.9 to 1,068.7 kPa), at full throttle stall (depending upon main-pressure regulator calibration). Converter-out temperature should never exceed 250°F (121°C).

8. SPECIFICATIONS AND DATA

The following specifications and data apply generally to CRT 3321 and CRT 3331 models. When information is limited to a particular configuration, this is indicated.

SPECIFICATIONS, DATA – CRT 3321, 3331

<u>Item</u>	<u>Description</u>
Transmission type	Torque converter and planetary gear
Rating:	
max input speed	3000 rpm
max input torque	300 lb ft (406.7 N·m) net
max input	175 gross hp (130.5 kW)
Rotation, viewed from input end:	
input	Clockwise
outputs, forward operation	Clockwise
Mounting, drive:	
rear, -1 models.	Four 5/8-11 tapped holes in side pads, each side
rear, -3 models.	Four 5/8-11 tapped holes in upper rear of adapter housing
front, direct mount	SAE 3 flange on converter housing, bolts to engine flywheel housing; grease ring drive
front, remote mount	Trunnion concentric with input shaft; converter enclosed; input flange for shaft and universal joint coupling
Gear ranges, selector positions:	
forward (3321).	2 speeds
reverse (3321).	2 speeds
forward (3331).	3 speeds
reverse (3331).	3 speeds
range control	Neutral, low (except 3321), intermediate and high
direction control	Forward, neutral, reverse
Size:	
length overall	Variable, determined by model and options
width overall	Variable, determined by model (max 20 in.)
height overall	(508 mm)
-1 models (less cooler)	34.57 in. (878.08 mm)
-3 models (less cooler)	24.40 in. (619.76 mm)
Weight, dry (approx): (varies with options)	
CRT 3321-1	1140 to 1230 lb (517 to 558 kg)
CRT 3331-1	1170 to 1260 lb (530.7 to 571.5 kg)
CRT 3321-3	800 to 925 lb (363.0 to 419.6 kg)
CRT 3331-3	830 to 955 lb (376.5 to 433.2 kg)

(Continued on next page)

SPECIFICATIONS, DATA - Continued

<u>Item</u>	<u>Description</u>
Torque converter:	
type	Single-stage, polyphase, 3- or 4-element, freewheeling stator
elements	Pump, turbine, stator
torque multiplication ratios	TC 320 — 3.50:1 TC 330 — 2.48:1 TC 370 — 2.50:1
Gear data:	
direction and range gears	10-pitch, straight spur, planetary
transfer gears	4-pitch, straight spur
accessory gearing	6-pitch, straight spur
Clutch data:	
type	Multidisk, hydraulic-actuated, spring-released, oil-cooled, automatic compensation for wear
material	Reaction plates — steel Friction plates — sintered bronze on steel
Parking brake:	
size, type	13 3/8 x 2 (339.7 x 50.8 mm) expanding shoe, mechanical
rating	45,000 in. lb at 2100 lb (5084.1 N·m at 9341.3 N) apply force
Flanges:	
input (remote mount)	Mechanics 6C, 7C; Spicer 1500, 1600; Rockwell 5N
front output (-1 models)	Mechanics 6C, 7C, 8C, 9C; Spicer 1600; Rockwell 5N, 6N
rear output	Mechanics 6C, 7C, 8C; Spicer 1500, 1700; Rockwell 5N, 6N
Oil system:	
oil type	C-3
fluid viscosity and grade	Ambient temperatures below which, preheat of the transmission as required
30	32°F (0°C)
15W-40	15°F (-9.4°C)
10W, 10-10W	-10°F (-23.3°C)
5W-20	-30°F (-34.4°C)

(Continued on next page)

SPECIFICATIONS, DATA - Continued

<u>Item</u>	<u>Description</u>
Oil system: (cont'd)	
oil capacity, US gal:	
CRT 3321, 3331-1	Initial fill — 7.5 US gal (28.4 litre); refill — 5.5 US gal (20.8 litre)
CRT 3321, 3331-3	Initial fill — 9 US gal (34 litre); refill — 7 US gal (26.5 litre)
oil filter	Remote mounted, furnished by customer
oil cooler	Integral or remote mounted
Oil temperature (max), converter out	250°F (121°C)
Oil pressure:	
converter outlet (full throttle, stall). . . .	25 psi (172 kPa)
(full throttle, no load)	65 psi (448 kPa)
main (full throttle, stall, approx)	115 to 130 psi (793 to 896 kPa)
lubrication (full throttle)	15 to 30 psi (103 to 206 kPa)
Accessory drives:	
governor drive (-1 models)	At rear on input center line; rotates at converter turbine speed
speedometer drive (-1 models)	At rear on input center line; rotates at 0.659 or 1.62 times output speed
steer pump drive (remote-mount -1 models)	SAE size A, 6-bolt mount on input pump
rating	*15 hp (11.2 kW) continuous
ratio to engine speed	1:1
power takeoff (or implement pump drive)	SAE size C at lower-right rear of converter housing
rating	*50 hp (37.3 kW) continuous; 80 hp (59.7 kW) intermittent (subtract 15 hp (11.2 kW) when steer pump is used)
ratio to engine speed	1:1
Gear ratios:	
forward planetary	2.90:1
reverse planetary	2.81:1
low-range planetary	2.76:1
high-range planetary	0.345:1
output transfer	0.659 or 1.62 optional
oil pump drive	1:1

*When used simultaneously, the total load for steer pump and power takeoff must not exceed 50 horsepower (37.3 kW) for continuous operation or 80 horsepower (59.7 kW) for intermittent operation.

(Continued on next page)

SPECIFICATIONS, DATA - Continued

Overall transmission ratios:

Low-range forward	Gearing only – with output ratio:			With converter – at stall		
	0.659:1	1.62:1	1:1	TC 320	TC 330	TC 370
				(Multiply gearing ratio by:)		
CRT 3321-1	1.91:1	4.70:1		3.50	2.48	2.50
CRT 3331-1	5.27:1	12.96:1		3.50	2.48	2.50
CRT 3321-3			2.90:1	3.50	2.48	2.50
CRT 3331-3			8.00:1	3.50	2.48	2.50
Intermediate-range forward						
CRT 3331-1	1.91:1	4.70:1		3.50	2.48	2.50
CRT 3331-3			2.90:1	3.50	2.48	2.50
High-range forward						
CRT 3321-1	0.659:1	1.62:1		3.50	2.48	2.50
CRT 3331-1	0.659:1	1.62:1		3.50	2.48	2.50
CRT 3321-3			1.00:1	3.50	2.48	2.50
CRT 3331-3			1.00:1	3.50	2.48	2.50
Low-range reverse						
CRT 3321-1	1.85:1	4.55:1		3.50	2.48	2.50
CRT 3331-1	5.11:1	12.56:1		3.50	2.48	2.50
CRT 3321-3			2.81:1	3.50	2.48	2.50
CRT 3331-3			7.75:1	3.50	2.48	2.50
Intermediate-range reverse						
CRT 3331-1	1.85:1	4.55:1		3.50:1	2.48:1	2.50:1
CRT 3331-3			2.81:1	3.50:1	2.48:1	2.50:1
High-range reverse						
CRT 3321-1	0.639:1	1.57:1		3.50:1	2.48:1	2.50:1
CRT 3331-1	0.639:1	1.57:1		3.50:1	2.48:1	2.50:1
CRT 3321-3			0.97:1	3.50:1	2.48:1	2.50:1
CRT 3331-3			0.97:1	3.50:1	2.48:1	2.50:1

Service Information Notes

Section II DESCRIPTION AND OPERATION

1. SCOPE OF SECTION II

This section describes in detail and explains the function of transmission components. Covered in the same manner are the various features – for options or basic equipment, and for specific models, or for earlier or later models. No mention is made of the application of the feature except as is necessary for distinguishing similar features – such as the several valve bodies which have been used.

2. MOUNTING AND INPUT DRIVE

a. Remote Mounting

(1) Remote-mounted transmissions include a converter pump cover 13 (A, foldout 7), input shaft 12 and transmission front cover 7. The drive cover is bolted to the torque converter pump. It encloses the torque converter at its forward end and retains the converter oil. The input shaft is bolted to the drive cover and is splined to receive a drive flange. The input shaft extends through the transmission front cover and is supported on ball bearing assembly 9 in the cover hub. The ball bearing is lubricated by oil which escapes from an orifice in input shaft 12. An oil seal 5 in the hub prevents the entrance of dirt or loss of oil.

(2) Transmission front cover 7 is bolted to the converter housing. The hub of the cover is machined and extends forward to form a trunnion on which the front of the transmission is supported. A variety of input drive flanges 4 have been used. They differ only in the area to which the drive line from the engine is coupled.

b. Direct Mounting

(1) Direct-mounted transmissions include converter pump cover 20 (A, foldout 7), drive ring 15 and seal ring 18. The drive cover is bolted to the front of the converter pump and retains oil in the converter. An external-tooth gear is formed on the front of

the cover. An internal-tooth gear meshes with the gear on the cover. The internal-tooth gear is bolted to either an engine flywheel or driving disk.

(2) A large diameter seal ring 18 seats in a groove behind the external teeth on the drive cover, and in a counterbore at the rear of the internal-tooth drive gear. This seal retains grease which completely covers the meshed teeth of the two gears. A vent hole is drilled, toward the center of the flywheel or drive disk, to prevent pressure building up within the sealed cavity. The converter housing is bolted directly to the rear of the engine flywheel housing, and supports the front of the transmission.

c. Wet, Dry Converter Housing. On direct-mounted transmissions, when it is desired that the inside of the converter housing be free of oil, a diaphragm 2 (B, foldout 8), oil seal 1, and seal ring 21 (A, foldout 7) is installed. The diaphragm and oil seal restrict oil to the area around the oil pump drive gears. Seal ring 21 prevents loss of oil from the converter assembly. This is called a "dry" housing. Transmissions not equipped with these parts have a "wet" housing. Remote-mounted transmissions can have only the "wet" housing because of the oil which must drain continuously from lubrication of the input shaft bearing.

3. TORQUE CONVERTER

a. Two Types Converters

(1) Two types of torque converters are used. Earlier models of the CRT 3321 and CRT 3331 transmissions used a 4-element converter. Later installations are being built with 3-element converters.

(2) Converters within both types differ as to torque multiplying capacity. Difference in blade design provides 2.48:1, 2.50:1, and 3.50:1 ratios within each type. This difference in blading does not affect service procedures in any way. Because of possible ratio

differences, converter elements of two transmissions should not be exchanged.

b. Four-element Converter

(1) The 4-element converter consists mainly of pump 21 (B, foldout 7), turbine 36, first stator assembly 35, second stator assembly 31, rollers 29 and 33, springs 30 and 34, and roller race 28. The pump, turbine, and stators are vaned aluminum castings. The pump is the input element — driven by the engine. The turbine is the output element — driving the gearing. The stators are reaction elements and are mounted on rollers 29 and 33 and freewheel race 28 on a stationary ground sleeve.

(2) The elements operate in oil which circulates for cooling. When the engine rotates, oil is thrown by the blades of pump assembly 21 into the blades of turbine assembly 36, causing it to rotate. Oil returns, between the stator blades, to the pump. The stator blades direct the oil so that its unexpended energy assists the rotation of the pump. When the speed of the turbine approaches that of the pump, stator assemblies 31 and 35 freewheel on rollers 29 and 33. When turbine speed is significantly less than pump speed, the stators lock up on freewheel race 28. Torque is multiplied only when the stators are locked up.

c. Three-element Converter. The 3-element converter includes pump assembly 14 (B, foldout 7), turbine 2, stator assembly 3, rollers 5, springs 6 and freewheel roller race 7. The 3-element converter functions in the same manner as does the 4-element converter described in b, above. However, construction is simpler and involves fewer components. Torque multiplying capacities of 3- and 4-element converters are identical (where they have the same designation).

4. FORWARD, REVERSE GEARING, CLUTCHES

a. Planetary Gears. Two planetary gear sets make up the forward and reverse gearing system. The reverse planetary set includes carrier 10 (A, foldout 9), four 19-tooth pinions 13, four spindles 15, needle rollers 14, thrust

washers 12 and 16, 59-tooth ring gear 45, and the 21-tooth (smaller) diameter portion of sun gear 19. The forward planetary set includes carrier 38, six 14-tooth pinions 40, six spindles 43, needle rollers 41, thrust washers 39 and 42, 59-tooth ring gear 35 and the 31-tooth (larger) diameter of sun gear 19. The gears in both planetaries are 10-pitch and have straight teeth.

b. Clutches. The reverse clutch includes piston 3, five polished steel plates 7, five bronze-faced steel plates 8 and 20, and various minor parts. The forward clutch includes piston 30, three polished steel plates 33 and 47, three bronze-faced steel plates 34 and 48, and related minor parts. Springs 18, pins 17 and anchor assembly 21 serve the reverse and forward clutches jointly.

c. Operation of Clutches, Planetaries

(1) During reverse operation, piston 3 is hydraulically moved toward clutch plates 7 and 8. This compresses them against anchor assembly 21. Plates 7 are engaged with pins in the stationary anchor. Plates 8 and 20 are engaged with hub 11. Thus, when the clutch is applied, the reverse carrier is held stationary. The smaller diameter of sun gear 19 is the driving member. Pinions 13 rotate on spindles 15 in the stationary carrier 10. This imparts reverse rotation to ring gear 45. Ring gear 45 is splined to forward carrier assembly 37 which transmits rotation to the range gears. Reverse ratio is 2.81 to 1.

(2) When the forward clutch is engaged, ring gear 35 is held stationary. The larger diameter of sun gear 19 is the driving member. When sun gear 19 rotates, pinions 40 are forced to rotate within the stationary ring gear 35. This causes carrier 38 to rotate and drive the range gearing. Forward ratio is 2.9 to 1.

5. RANGE GEARING, CLUTCHES

a. Range Gearing. There are two planetary range gear sets (except in CRT 3321 models — refer to d, below). These are for low range (reduction) and high range (over-drive). The low-range gear set includes car-

rier 71 (A, foldout 10), six 14-tooth pinions 73, six spindles 78, spacers 75, needle rollers 74 and 76, thrust washers 72 and 77, 65-tooth ring gear 61, and 37-tooth sun gear 41. The high-range gear set includes carrier 34, six 14-tooth pinions 36, six spindles 38, 59-tooth ring gear 51 and 31-tooth sun gear 28. The gears in both planetaries are 10-pitch and have straight teeth.

b. Range Clutches

(1) There are three range clutches (except in CRT 3321 models – refer to d, below). Two of these – low and high-range – control the planetaries. The third clutch – intermediate range – is direct drive from the forward carrier to the transmission main shaft.

(2) The low-range clutch includes piston 68 (A, foldout 10), five polished steel plates 59 and 63, five bronze-faced steel plates 58 and 64, and minor related parts. The high-range clutch includes piston 46, three polished steel plates 49 and 52, three bronze-faced steel plates 50 and 53, and minor related parts. Anchor assembly 54, pins 60 and springs 57 jointly serve the low- and high-range clutches. The intermediate-range clutch includes drum assembly 2, four bronze-faced plates 31, three polished steel plates 32, hub 27, and minor related parts. The front face of high-range planetary carrier 34 serves as the reaction plate.

c. Operation of Range Planetaries, Clutches

(1) When the low-range clutch is applied, piston 68 (A, foldout 10) compresses plates 58, 59, 63 and 64 against anchor assembly 54. This locks ring gear 61 stationary. Sun gear 41 drives pinions 73, causing them to rotate within stationary ring gear 61. Pinions 73, in their rotation within the ring gear, cause carrier 71 to rotate at reduced speed.

(2) When the high-range clutch is applied, piston 46 compresses plates 49, 50, 52 and 53 against anchor assembly 54. This holds ring gear 51 stationary. Carrier 34 is the driving member. When the carrier is rotated, pinions 36 are rotated at increased

speed. This rotation is imparted to sun gear 28 which drives the transmission main shaft.

(3) When the intermediate-range clutch is engaged, piston 8 compresses plates 31 and 32 against carrier 34. This locks the entire clutch and causes it to rotate as a unit. Rotation is transmitted directly from the forward planetary carrier to the transmission main shaft.

d. One Gear Range Omitted, CRT 3321 Models

(1) The CRT 3321 model transmissions have only two speeds forward or reverse. These transmissions are identical to CRT 3331 models with the exception of the omission of the range planetary gear set and clutch parts normally serving low range. Minor changes are incorporated to compensate for the removal of these parts. Spacer 69 (A, foldout 10) is added to serve as a seat for pins 60, in the absence of piston 68. An oil collector 40 is added to the high-range planetary carrier. Main shaft 16, with ball bearing 17 is used. These are the only differences.

(2) Intermediate range in CRT 3331 transmissions becomes low range in CRT 3321 assemblies. However, in procedural instructions, this difference in terminology will be disregarded.

6. OUTPUT TRANSFER GEARING, SHAFTS

a. Gears

(1) Transmissions having a transfer case (-1 models) include three 4-pitch transfer gears. Drive gear 26 or 32 (B, foldout 11) is splined to the transmission main shaft and supported by ball bearings 25 and 27. Idler gear 36 is supported on a self-aligning roller bearing 35 and spindle 19 (B, foldout 10). The driven gear is splined to the output shaft (refer to b, below).

(2) The drive and driven gears are available in two ratio sizes – 0.659:1 and 1.62:1. The idler gear is the same for either ratio, but is positioned differently. The drive gear for 0.659:1 ratio has 41 teeth; the driven gear

has 27 teeth. The drive gear for 1.62:1 ratio has 26 teeth; the driven gear has 42 teeth. The idler gear for either ratio has 46 teeth.

b. Output Shafts, Disconnects. Several arrangements of the output shafts on transfer case (-1) transmissions are available (refer to foldout 11). The assembly may include front and rear output shafts, rear output shaft only, standard or heavy-duty front output shaft, front disconnect, rear disconnect or capped front or rear output. Some CRT 3331-1 assemblies have been equipped with an additional rear output directly in line with the transmission input (refer to A, foldout 12). This output includes a disconnect feature. Shafts at the lower-front and rear of the transfer case are supported on ball bearings (refer to foldout 11). Output disconnect arrangements consist of a sliding, internal-splined sleeve, a shifter fork, a shifter shaft, a detent spring, and detent balls. The disconnect is manually shifted. A one-piece output shaft is available for transmissions not requiring a front output disconnect.

c. Output, Input Flanges. Popular, standard flanges are available for input (remote-mounted) and output drives. Some assemblies are supplied without flanges (flanges are installed by the customer). Some -3 assemblies are supplied without the rear bearing, retainer, oil seal and spacers (items 1 through 10, B, foldout 12). Such transmissions are adapted to the vehicle drive line by the vehicle manufacturer. Two types of fits have been employed at the splines by which flanges are attached. Instructions are provided for servicing both types.

7. PARKING BRAKE

An internal, expanding, shoe-type parking brake is available for any model. The two brake shoes and their operating mechanism are mounted on a backplate 31 (A, foldout 12). The back plate is bolted to rear-bearing retainer 45. Brake drum 36 is bolted to the output flange. The parking brake is operated by a hand lever mounted on the vehicle.

8. OIL PUMPS

a. CRT 3321, 3331-1 Pressure Pumps. Two types of pressure pumps are available on

transfer case models. The basic pump is a conventional two-gear, positive displacement pump 29 (A, foldout 8). An optional pump 7, which can be used only on remote-mount transmissions, is the same except that it has an extended cover 12 on which a vehicle steer pump can be mounted. A splined extension of pump drive gear 17 and a splined coupling assembly 4 drives the steer pump. The transmission oil pump supplies pressure for the hydraulic system.

b. CRT 3321, 3331-3 Pressure and Scavenge Pump. All straight-through type (-3) transmissions require a 2-section oil pump 47 (A, foldout 8). One section, which includes gears 59 and 60, is the pressure pump. The other section, which includes gears 54, is the scavenge pump. The pressure section supplies oil to the hydraulic system. The scavenge section returns oil which accumulates in the converter housing, to the sump. A scavenge pump is not required on transfer case models because oil returns by gravity to the sump.

9. ACCESSORY PUMP MOUNTINGS

a. Implement Pump Mounting. At the lower-right rear of converter housing 11 (B, foldout 8), a 4-hole, SAE size C mounting is provided. A pump with size C splined shaft can be mounted here, or an adapter will permit pumps with size B splines to be used. Some installations provide an oil seal 44 and seal ring 45 to prevent the loss of oil. Others do not have these seals, and the oil can flow past bearing 47 and lubricate the accessory mounted on the pad. Earlier models used a sealed bearing assembly 48 to prevent loss of oil.

b. Steer Pump Mounting. The mounting pad on the oil pump (refer to 8a, above) is an SAE, size A, 6-bolt mounting for installation of a vehicle steer pump. This mounting can be used on only CRT 3321, 3331-1 remote-mount installations.

10. OIL STRAINER, FILTER

a. Strainer. All assemblies include a wire mesh-type strainer screen 8 (B, foldout

10). This strainer is mounted in the oil sump and retained by six bolts or a cover and nut, depending upon model. All oil which enters the system must pass through this strainer. Foreign matter, if present, will remain outside the strainer.

b. Filter. An oil filter may be mounted remote from the transmission. The filter must be of the full-flow type and equipped with a bypass valve which opens at a differential pressure of 15 psi (103.4 kPa). When a filter is installed, oil director tube 52 (B, foldout 8) must be installed in the converter housing. When no filter is used, tube 52 must not be installed.

11. OIL COOLER

All installations use an oil cooler 5 through 10 (B, foldout 8). It may be of the type illustrated or it may be remote mounted. Oil leaving the torque converter flows through the cooler and returns to the lubrication system. All oil not required for lubrication returns to the sump. Heat from the oil is transferred to water which flows continuously through one circuit of the cooler.

12. VALVE BODY ASSEMBLIES

a. Main-pressure Regulator

(1) Four main-pressure regulator valve bodies have been supplied. These are of two general types. Earlier models have a simple assembly which includes only one valve bore. Later models include an additional valve bore into which is installed a bypass valve assembly.

(2) There are two versions of the older type which differ in pressure calibration. There are also two versions of the newer type which differ in pressure calibration. A, foldout 13 illustrates the two types of valves. The pressure regulator valve is 8 or 21. The pressure adjusting shim is 9 or 22. The pressure regulator spring is 10 or 23. The bypass valve and spring in the newer valve are 26 and 27.

(3) Complete valve body assemblies are interchangeable between transmissions. It is recommended, however, that older valves not

be used on newer transmissions. The main-pressure regulator valve maintains a uniform pressure in the hydraulic system. The bypass valve prevents excessive converter-in pressure during cold-start operation.

b. Control Valve Body

(1) Eight control valve body assemblies have been supplied on the various transmission models, as described in sect. I, para 6e. Subparagraphs (2) through (9), below, outline the primary functions of each assembly and note specific features which aid in identifying each.

(2) Valve body assembly 1 (B, foldout 13) is the earlier style inching control valve without the clutch cutoff feature. This assembly includes two spool-type valves, the stems of which project at the rear of the assembly. Upper valve 9 is the range selector; the lower 4 is the forward and reverse control. When disassembled, this type of valve can be identified by the single, long sleeve 28 surrounding forward and reverse control valve 4, and by the absence of clutch cutoff valve components 49 through 58.

(3) Valve body assembly 33 (B, foldout 13) is the earlier style inching control valve with a hydraulic-actuated clutch cutoff control. This assembly is the same as the assembly described in (2), above, except that it includes items 51 through 58 which comprise the clutch cutoff feature. A 1/8-inch pipe thread in the rear bore of item 51 identifies this as a hydraulic controlled cutoff valve.

(4) Valve body assembly 33 (with items 49 and 50 replacing items 51, 52 and 54) is the earlier style inching control valve with an air-actuated clutch cutoff control. It very closely resembles the assembly described in (3), above, but can be identified by a 5/8-18 thread in the rear bore of item 50.

(5) Control valve body assembly 1 (A, foldout 14) is the sense-feel type without the clutch cutoff feature. When disassembled, this type of valve can be identified by the two short sleeves 3 and 10, and piston 5 on the forward and reverse control valve. It does not include items 52 through 59.

(6) Control valve body assembly 36 (A, foldout 14) is the sense-feel type valve with a hydraulic-actuated clutch cutoff control. It is the same as the assembly described in (5), above, except that it also includes items 52 through 59. The threads in the rear bore of item 59 are 1/8 NPTF.

(7) Control valve body assembly 1 (B, foldout 14) is the later, 3-valve type inching control valve. It can be identified by the three valve stems projecting from the rear of the valve body. Valve 26 is linked to a control on the vehicle which is specifically for inching control. Thus, this assembly provides separate controls for range selection, forward and reverse operation, and inching control.

(8) Control valve body assembly 36 (B, foldout 14) is the later valve body assembly which includes the hydraulic-actuated clutch cutoff control. It has only two valve stems projecting from the rear of the valve body and includes items 57 through 62 at the lower front. It is identified as having the hydraulic-actuated clutch cutoff feature by the 1/8 pipe threads in the front bore of item 62.

(9) Control valve body assembly 36 (B, foldout 14) (with items 37 and 38 replacing items 58, 60 and 62) is the later valve body assembly which includes the air-actuated clutch cutoff control. This assembly closely resembles the assembly described in (8), above, but is identified by the 5/8-18 threads in the front bore of item 37.

Note: The earlier style valve body assemblies (see (3) and (4), above) include the clutch cutoff control in addition to the inching control. Later style valve body assemblies (see (7), (8) and (9), above) have either an inching control valve or clutch cutoff valve but cannot have both.

c. Lubrication Regulator Valve. The lubrication pressure is controlled by a spring-loaded, umbrella-type valve 14 (B, foldout 8), located in the right side of the converter housing. Oil returning from the oil cooler works against this valve, and spring 15. Oil in excess of that required to maintain lubrication pressure opens the valve, passes by it, and returns to the transmission sump.

13. HOUSINGS, COVERS

a. Converter Housing. The converter housing (B, foldout 8) is cast iron and is the main front member of the transmission. It encloses the converter components, houses the oil pump drive gear train, and provides a mounting for the oil pump, oil cooler, and main pressure regulator. The front flange is a modified SAE 3 size. The rear of the housing is machined to receive the reverse clutch piston, converter ground sleeve, and transmission housing.

b. Transmission Housing. Transmission housing 5 (B, foldout 9) is cast iron and is the main center member of the transmission. It houses the reverse, forward and range gears and clutches. The inside is machined to receive the clutch anchor assemblies. The front is machined to mate with the converter housing. The rear is machined to mate with the transfer case (-1 model) or adapter housing (-3 model). The left side is machined to receive the control valve body assembly.

c. Transfer Housing. Transfer housing 40 (B, foldout 10) is cast iron on earlier models and is fabricated steel 16 on later models. It is the main rear member of the -1 model transmission. It houses the output transfer gears and the front and rear output shafts, bearings and disconnect mechanism. The rear is machined to receive the transmission rear cover and rear bearing retainer. Transfer housings differ between various transmission assemblies because of output ratio differences and design changes.

d. Sump Adapter. Sump adapter 29 (B, foldout 12) is cast iron and is the main rear member of -3 transmissions. It supports the transmission main shaft and provides a mounting for the oil sump. The front is machined to receive the low-range clutch piston and to mate with the transmission housing. The rear is machined to receive the rear-bearing retainer and oil sump.

e. Transmission Front Cover. The transmission front cover 7 (A, foldout 7) is cast iron and is the front closure on remote-mount transmissions. It is bolted to the front flange of the converter housing. The center is bored

to receive the input shaft ball bearing and oil seal. A machined hub is formed on the front, concentric with the center bore, for fitting a trunnion-type mounting.

f. Transmission Rear Cover. The transmission rear cover 29 (B, foldout 11) is a circular iron casting. It closes the rear of the transfer housing on -1 models. It is machined in the center to receive the rear bearing on the transfer drive gear. On transmissions which include either a governor or speedometer drive, the center is machined to receive the drive assembly. On transmissions which include an upper-rear disconnect, the cover 25 (A, foldout 12) is machined for its mounting.

14. HYDRAULIC ACTION – GENERAL

Note: The explanations of the various hydraulic actions (para 15 through 21, below) are primarily applicable to CRT 3331 model transmissions. The hydraulic systems for CRT 3321 model transmissions are identical except that the planetary gears and clutch for low range in the CRT 3331 models are eliminated in the CRT 3321 models. Thus, only two range clutches remain in the CRT 3321 models. Accordingly, the clutch designated "intermediate range" in the explanations becomes the "low-range" clutch for CRT 3321 model transmissions. The operator's range selector on vehicles using the CRT 3321 model transmissions is arranged to block the selection of the position which applies the low-range clutch on CRT 3331 models.

Para 15 through 21, below, explain the functions of the hydraulic system under various conditions. These explanations are aided by four schematic diagrams (foldouts 3 through 6, in the back of the manual) which illustrate the different hydraulic system arrangements which result from the use of the various hydraulic components which have been provided. The schematic diagrams represent the transmission in operation in neutral condition. The basic hydraulic circuits are shown in color. After the explanation of neutral action, the hydraulic action of the transmission in forward and reverse, and in various gear ranges, is explained. Where applicable, subsequent explanations will refer to previous explanations rather than repeat them.

15. NEUTRAL – HYDRAULIC ACTION (foldouts 3 through 6)

a. Oil is drawn from the sump, through the oil strainer, by the input-driven pressure pump and sent to the hydraulic system through the oil filter (foldout 3). From the filter, oil is directed to the main-pressure regulator valve, to the forward and reverse selector valve, and to the range selector valve. In its passage to the range selector valve, the oil (in earlier model systems) must pass through the clutch cutoff valve, if the system includes one. The clutch cutoff valve may be either hydraulic- or air-operated. Broken lines indicate the valve's connection into the system.

b. The main-pressure regulator valve may or may not include a bypass circuit. Both types are shown in foldout 3. The type without a bypass is shown as part of the circuit. The bypass type is connected to the circuit by broken lines. A passage directly from the pressure pump to the regulator valve is necessary for the valve which has no bypass. This passage is omitted in the bypass-type valve. Either type of valve may have either a 110 to 135 psi (758.4 to 930.8 kPa) pressure range, or a 135 to 155 psi (930.9 to 1,068.7 kPa) pressure range.

c. In either type of regulator valve, pump pressure exerts a leftward force on the valve, moving it against its spring. The leftward movement of the valve uncovers a port which allows main pressure (red) to escape to the passage which directs converter-in oil (yellow) to the torque converter. In the regulator which has no bypass, there is no provision for relieving excessive converter-in pressure. There is, however, a provision for relieving excessive main pressure. Excessive main pressure is relieved through ports in the tubular body of the regulator valve when the valve moves far enough to the left to align these ports with the passage which brings oil directly from the pressure pump. Oil then flows into the hollow center of the valve and to the sump (blue).

d. The main-pressure regulator valve which includes a bypass valve provides for relief of excessive converter-in pressure (yellow). When converter-in pressure exceeds 80 psi (551.9 kPa) nominal, the bypass valve opens against its spring and returns converter charging oil to the sump. This escape of oil also relieves excessive main pressure.

e. Converter-in oil (yellow) flows into the torque converter. Converter-out oil (orange) flows through the transmission oil cooler and into the lubrication system (green). Excess oil, over that required to maintain lubrication pressure, returns to the sump (blue). Lubrication (green) flows through various passages to points where pressure lubrication is required, and returns eventually to the sump.

f. Main pressure (red) is connected to the forward and reverse selector valve. This valve may be any of three different types. Foldout 3 illustrates an earlier type, in which the inching control feature was included in the forward-reverse control valve. Foldout 4 illustrates another earlier type of valve which included the "sense-feel" feature. Foldouts 5 and 6 illustrate the later type of forward-reverse control valve. The later type valve does not have any function other than forward and reverse clutch control, and the metering of lubrication to the forward and reverse clutches when a separate inching control valve is used.

g. In the early type forward-reverse control valve with the inching control feature, illustrated in foldout 3, main pressure (red) enters the valve bore at two places. When the valve is at neutral position, main pressure is blocked. When the valve is moved rightward, oil is admitted to the cavity surrounding the rightward, smaller diameter of the valve. Two passages lead away from the area of this cavity. One leads to the forward clutch apply piston; the other leads to the lubrication line for the forward clutch. Thus, when the valve first admits oil to the cavity, it flows into both passages. As the valve is moved rightward, the center land of the valve covers the forward lubrication passage. This forces all of the oil to the clutch, applying the clutch.

h. When the valve is moved leftward, oil

is admitted to the cavity surrounding the detent notches in the valve. Two passages lead away from this area — to the reverse clutch apply piston and to the reverse-clutch lubrication line. Further leftward movement closes off the reverse-clutch lubrication and forces all the oil to the reverse clutch. When the valve is returned to neutral (or shifted to the opposite travel position) oil from the released clutch exhausts through the lubrication line for that clutch. Note that the detent notches in the valve are shallow and have straight lands between them. This permits an initial, small, linear movement of the valve to dislodge the detent from its notch. Then there is a period of valve movement which is not hampered by the detent. This permits the operator to control the valve accurately for "inching."

i. In the early type forward-reverse valve with the "sense-feel" feature (foldout 4), main pressure (red) enters the valve bore as described in g, above. The operation of this valve differs from that of the valve described in f, g, and h, above, only in that clutch pressures work against a piston fitted to the center land of the valve. This piston is exposed to the same pressures which apply and lubricate the forward and reverse clutches. As the valve moves toward either the forward or reverse position, the valve piston closes the lube passage which directed oil to the clutch as it was partially applied. When the flow of lube oil is reduced, clutch apply pressure increases, resulting in a stronger force acting against the valve piston. This gives the operator the sensation that he is "picking up the load" as with a manually applied clutch.

j. The currently used forward-reverse valve (foldout 5) has main pressure (red) entering the valve bore at two places. However, at the rightward passage, oil merely flows around the valve, out of the bore, and re-enters at the left. Here, it surrounds a small diameter of the valve. When the valve is moved rightward, oil is admitted to a passage which leads to the forward clutch, applying the clutch. When the valve is moved leftward, oil is admitted to a passage leading to the reverse clutch, applying the clutch. When the valve is returned to neutral position (or to the opposite travel position), the clutch being released exhausts into the lubrication line for that clutch.

Note that, in foldout 5, there is a lubrication feed line leading into the valve bore. Such a line is necessary when an inching control valve is used. Refer to k, below, for an explanation of the function of this passage.

k. When the inching control valve is used (foldout 5), main pressure extends into the valve bore at two places. At the right, main pressure retracts the inching valve when it is released. At the left, it pushes rightward on the inching regulator valve. When the inching control valve is manually moved rightward (against main pressure) the inching regulator valve spring is extended, allowing the regulator valve to move rightward. This allows main pressure to escape into the lubrication feed line which carries it, through the forward-reverse valve bore, to the plates of the acting clutch. This escape of oil, which can be replenished only by flow through an orifice in the line which supplies main pressure to the forward or reverse clutch, lowers the pressure of oil downstream from the orifice. The inching control valve can be positioned to give partial or full release of the acting (forward or reverse) clutch.

l. On early valve body assemblies which include no clutch cutoff valve (foldout 3), main pressure flows directly to the range selector valve. When the assembly includes either the fluid- or air-actuated clutch cutoff valve (shown connected to the system by broken lines, in foldout 3), the main pressure (red) line leading to the range selector valve must pass through the clutch cutoff valve. When air or hydraulic pressure from the vehicle brake system moves the cutoff valve leftward, main pressure to the range selector valve is interrupted and the acting range clutch is exhausted, causing the release of the range clutch.

m. On currently used valve body assemblies which include either the air- or hydraulic-actuated clutch cutoff valve (foldout 6), the clutch cutoff valve is in the circuit which feeds the forward and reverse control valve and clutches. Toward the right end of the forward-reverse valve, main pressure (red) flows into the valve bore, around the valve, leaves the bore and flows to the clutch cutoff valve. Main pressure flows into the clutch cutoff valve

bore, leaves the bore and re-enters the forward-reverse valve bore. Here, it is available for either the forward or reverse clutch.

n. If the forward-reverse control valve is shifted rightward, main pressure is directed to the forward clutch. If it is shifted leftward, pressure is directed to the reverse clutch. When the valve is returned to neutral (or shifted to the opposite travel position), the released clutch is exhausted through the lubrication line for that clutch. Note that, when a clutch cutoff valve is used, there is no lubrication feed such as that shown in foldout 5. This is not required except with the inching control valve.

o. When the vehicle brakes (air or hydraulic) are applied on vehicles which use the current valve body with clutch cutoff control (foldout 6), the clutch cutoff valve moves rightward. This blocks the flow of main pressure to the forward-reverse control valve and exhausts the applied (forward or reverse) clutch. Thus, applying the brakes disconnects power from the vehicle drive line.

16. FORWARD, LOW RANGE - HYDRAULIC ACTION

(See note at beginning of para 14)

a. In low range, the range selector valve is moved one detent notch from neutral. This applies the low-range clutch. The forward-reverse control valve is then moved one detent notch (to forward on the operator's control). This applies the forward clutch. Refer to foldouts 3 through 6 to determine the hydraulic flow paths established when the valves are positioned as described above.

b. When the range selector valve is returned to neutral position, the released range clutch will exhaust into the left end of the valve bore and then to the sump (foldouts 3 through 6). When the range selector valve is shifted from low range to a higher range, the low-range clutch will exhaust into the area of the valve bore surrounding the detent notches of the valve, and then to the sump. When the forward-reverse control valve is returned to neutral from either the forward or reverse

position, the released clutch exhausts through the lubrication line for that clutch.

19. REVERSE, LOW RANGE – HYDRAULIC ACTION

(See note at beginning of para 14)

a. In low range, the range selector valve is positioned one notch from neutral. This directs oil to the low-range clutch. The forward-reverse control valve is then moved one detent notch from neutral (to reverse on the operator's control). This directs oil to the reverse clutch. Refer to foldouts 3 through 6 to determine the hydraulic flow paths established when the valves are positioned as described above.

b. When the range selector valve is returned to neutral, the low-range clutch exhausts into the valve bore at the left end of the valve, and then to the sump (foldouts 3 through 6). When it is upshifted from low-range position, the low-range clutch exhausts into the area surrounding the detent notches on the valve, and then to the sump. When the forward-reverse control valve is returned to neutral (or shifted to forward position from reverse position), the reverse clutch exhausts through the reverse lubrication line.

20. REVERSE, INTERMEDIATE RANGE – HYDRAULIC ACTION

(See note at the beginning of para 14)

a. Refer to para 17, above, for explanation of the filling and exhausting of the intermediate-range clutch.

b. Refer to para 19, above, for explanation of the filling and exhausting of the reverse clutch.

21. REVERSE, HIGH RANGE – HYDRAULIC ACTION

a. Refer to para 18, above, for explanation of the filling and exhausting of the high-range clutch.

b. Refer to para 19, above, for explanation of the filling and exhausting of the reverse-range clutch.

17. FORWARD, INTERMEDIATE RANGE – HYDRAULIC ACTION

(See note at beginning of para 14)

a. In intermediate range, the range selector valve is positioned two notches from neutral. This directs oil to the intermediate-range clutch. The forward-reverse control valve is positioned in the forward position as described in para 16a, above. Refer to foldouts 3 through 6 to determine the hydraulic flow paths established when the valves are positioned as described above.

b. When the range selector valve is downshifted or returned to neutral, the intermediate-range clutch will exhaust into the left end of the valve bore, and then to the sump (foldouts 3 through 6). When the valve is shifted from intermediate to high range, the intermediate-range clutch will exhaust into the valve bore surrounding the detent notches in the valve, and then to the sump. Refer to para 16b, above, for explanation of forward clutch exhaust.

18. FORWARD, HIGH RANGE – HYDRAULIC ACTION

a. In high range, the range selector valve is positioned three detent notches from neutral. This directs oil to the high-range clutch. The forward-reverse control valve is positioned in the forward position as described in para 16a, above. Refer to foldouts 3 through 6 to determine the hydraulic flow paths established when the valves are positioned as described above.

b. When the range selector valve is downshifted or returned to neutral, the high range clutch will exhaust into the left end of the valve bore, and then to the sump (foldouts 3 through 6). Refer to para 16b, above, for explanation of the forward clutch exhaust.

22. TORQUE PATHS THROUGH
TRANSMISSION - GENERAL

a. Fig. II-1 through II-7 illustrate the flow of power through the transmission during operation in the various drive ranges. Para 23 through 29, below, explain the flow of power. In the illustrations, the power path is represented by a continuous red line from the transmission input to the output or outputs. Applied clutches are indicated by parallel, horizontal red lines on the clutch plates.

b. Illustrations include both CRT 3331-1 and CRT 3331-3 models. The CRT 3321 models are not illustrated, but the explanations cover them. In each situation, torque is transmitted hydraulically from the engine to the transmission gearing by the torque converter (refer to para 3, above). Also, in each situation torque is transmitted from the range gearing to the output by transfer gears (para 6, above) in -1 models, or directly by the transmission main shaft in -3 models. Accordingly, all explanations will cover only the power flow in the forward, reverse, and range gearing.

(Torque path illustrations begin on next page)

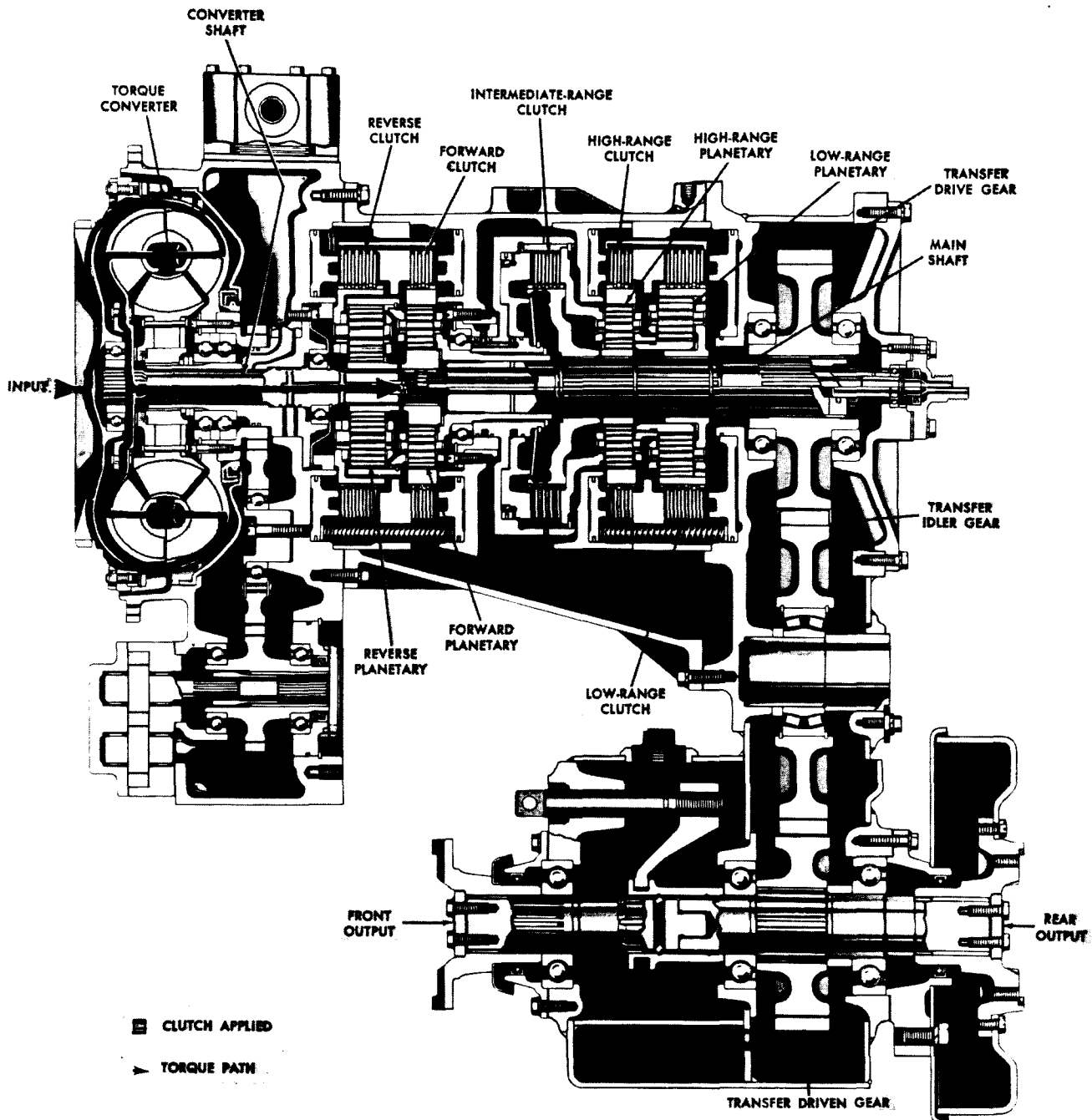


Fig. II-1. Neutral—torque path (CRT 3331-1)

S2667

23. NEUTRAL – TORQUE PATH (fig. II-1)

In neutral, no clutches are applied. As a result, no torque is transmitted beyond the forward and reverse sun gear.

24. FORWARD, LOW RANGE – TORQUE PATH (fig. II-2)

a. The forward clutch is engaged, holding the forward ring gear stationary. The

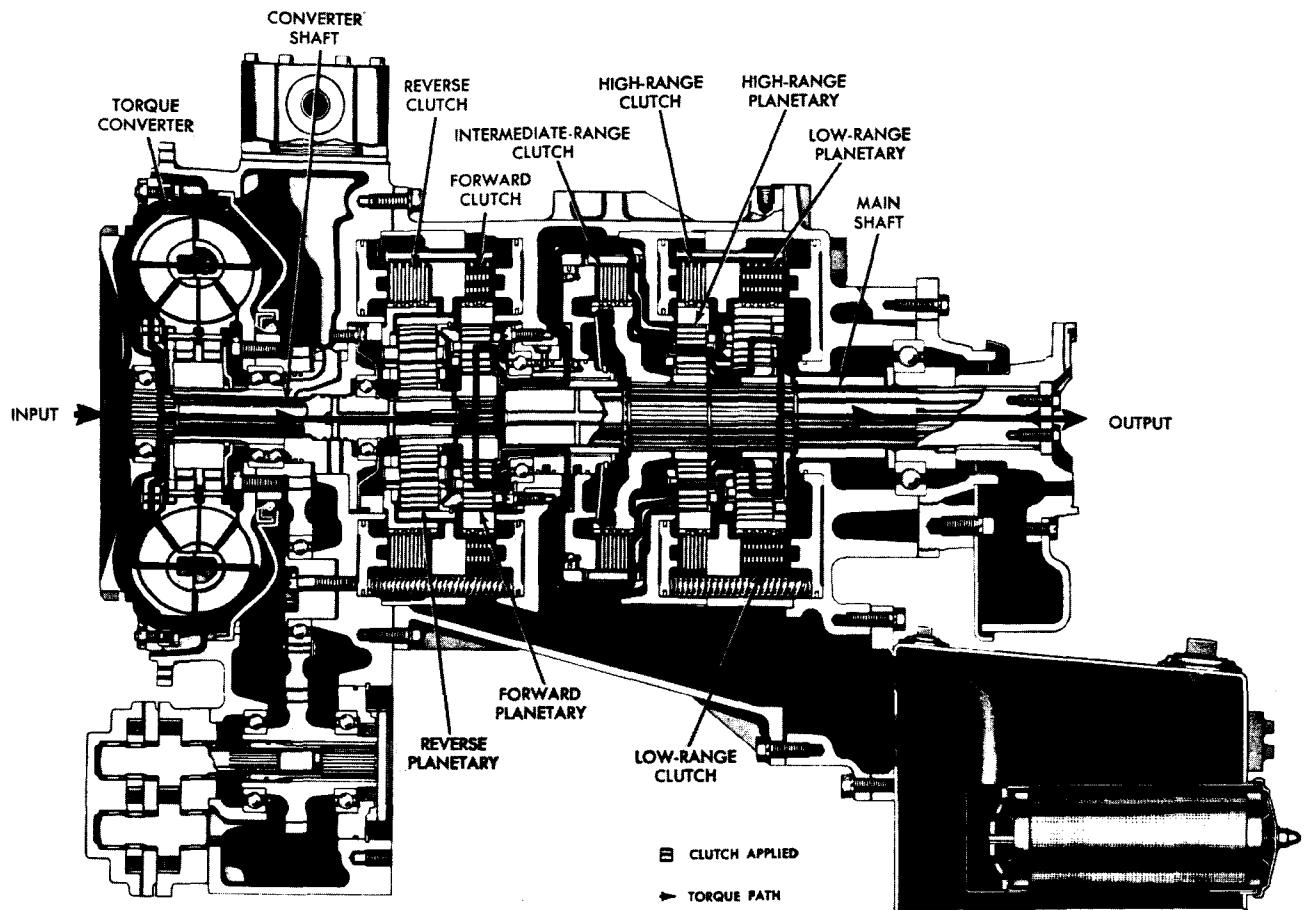


Fig. II-2. Forward, low-range—torque path (CRT 3331-3)

S2668

forward sun gear drives the pinions in the forward carrier, causing them to rotate within the ring gear. As the pinions rotate they cause the carrier to rotate at a speed reduction of 2.90 to 1. The carrier is splined to the intermediate-range clutch drum; the clutch drum is splined to the high-range planetary carrier; and the high-range planetary carrier is splined to the low-range sun gear. Thus, the torque from the forward planetary gear set is transmitted to one element of each range group.

b. In low range, the low-range clutch is engaged and holds the low-range ring gear

stationary. The rotating sun gear causes the low-range carrier pinions to rotate within the stationary ring gear. This drives the low-range planetary carrier which is splined to the transmission output shaft. The speed reduction in the low-range planetary gears is 2.76 to 1. Thus, reduction in the forward gear set, combined with reduction in the low-range gear set is 8 to 1.

c. The low-range gear set as described in b, above, is not included in CRT 3321 models. For an explanation of the power flow for forward, low range as applicable to CRT 3321 models, refer to para 25, below.

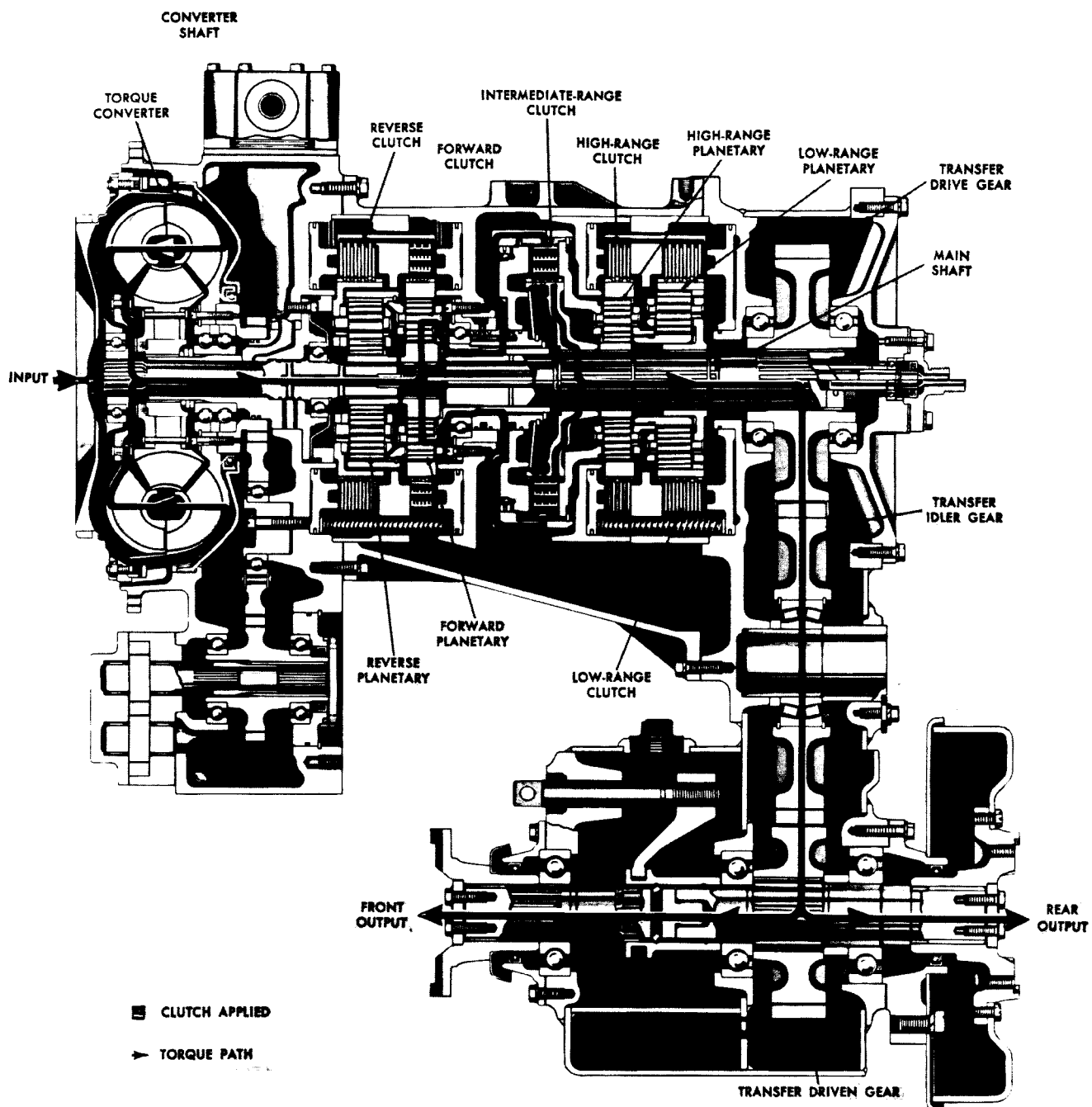


Fig. II-3. Forward, intermediate-range—torque path (CRT 3331-1)

S2669

25. FORWARD, INTERMEDIATE RANGE – TORQUE PATH (fig. II-3)

a. Refer to para 24a, above, for the power flow through the forward planetary gear set.

b. In intermediate range, torque from the forward range planetary is transmitted (from the intermediate-range clutch drum to the clutch hub and transmission main shaft) by the applied intermediate-range clutch. This is direct drive and involves no range planetary

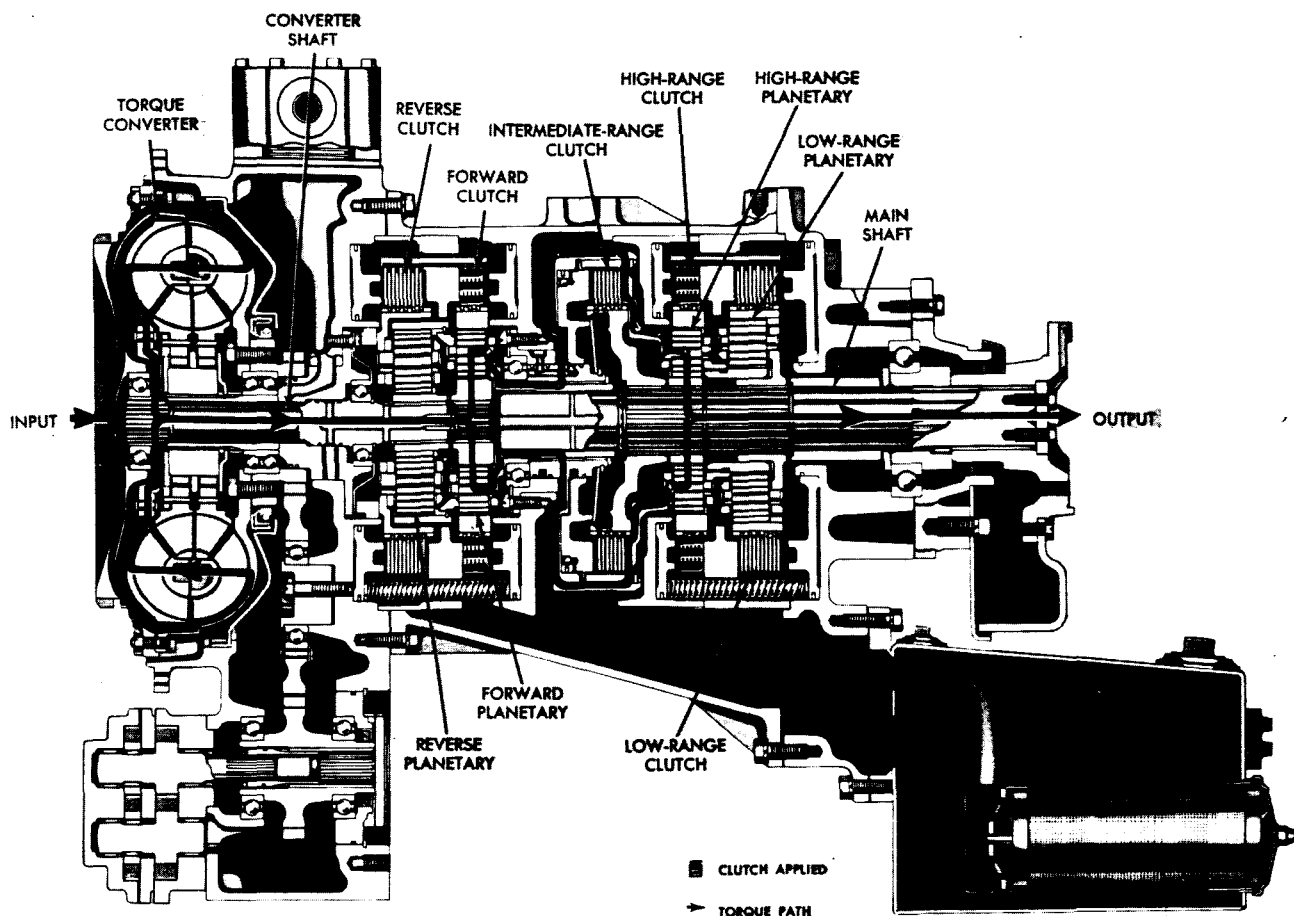


Fig. II-4. Forward, high-range—torque path (CRT 3331-3)

52670

gear set. Thus, the total speed reduction is only that of the forward planetary — 2.9 to 1.

c. The clutch which serves intermediate range in CRT 3331 models serves low range in CRT 3321 models. Thus, the power flow for forward, low range in CRT 3321 models is identical to that for forward, intermediate range in CRT 3331 models.

26. FORWARD, HIGH RANGE — TORQUE PATH (fig. II-4)

a. Refer to para 24a, above, for the

power flow through the forward planetary gear set.

b. In high range, the high-range clutch is engaged, holding the high-range ring gear stationary. Torque from the forward planetary gear set rotates the high-range planetary carrier. The carrier pinions, meshed with the teeth of the stationary ring gear, rotate and overdrive the high-range sun gear. The speed increase is 0.345 to 1. This increase, coupled with the 2.90 to 1 speed reduction of the forward-range planetary, gives a total ratio of 1 to 1.

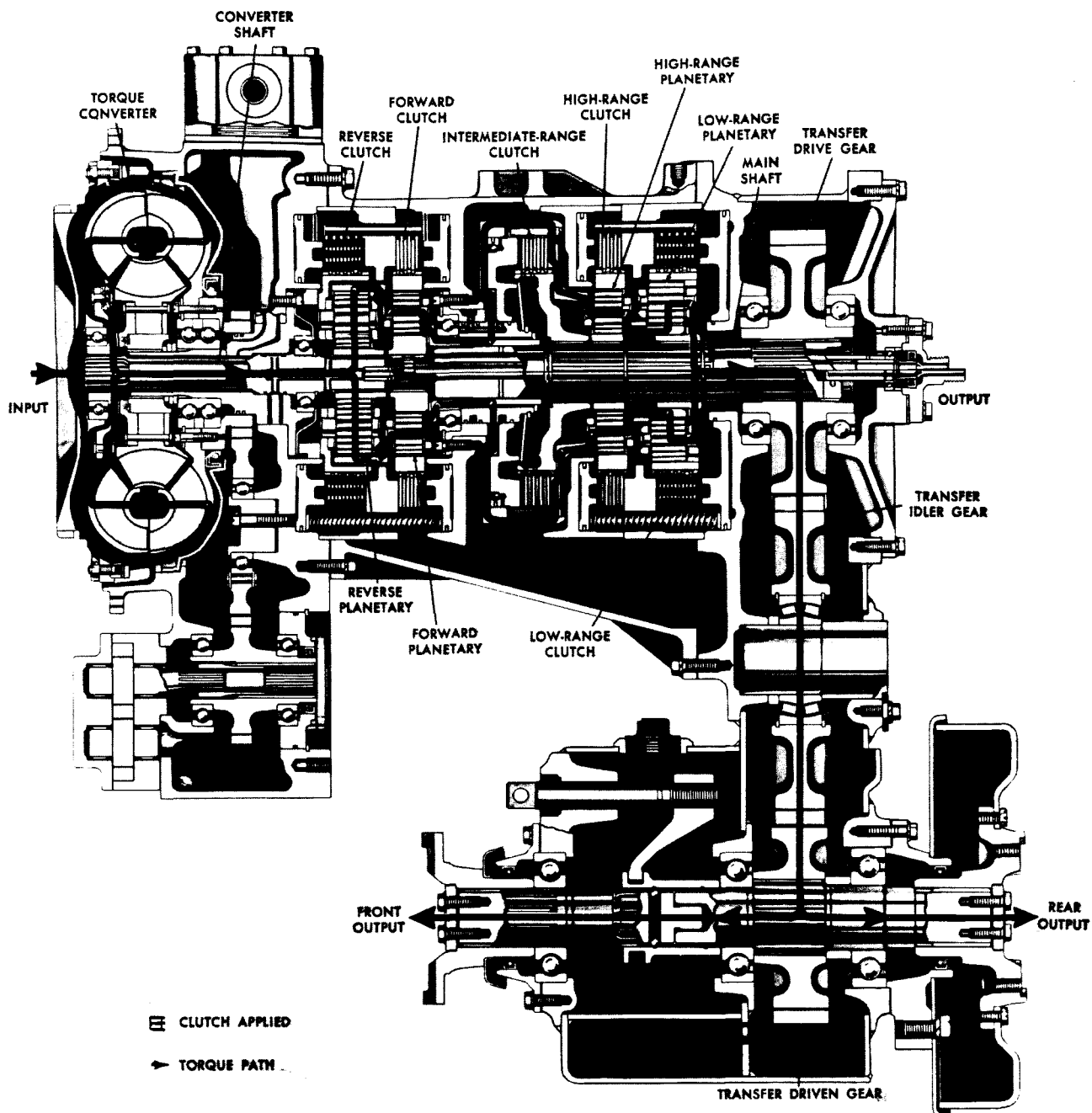


Fig. II-5. Reverse, low-range—torque path (CRT 3331-1)

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27. REVERSE, LOW RANGE — TORQUE PATH (fig. II-5)

a. The reverse clutch is engaged, holding the reverse planetary carrier stationary. The reverse sun gear rotates and drives the carrier pinions. The pinions, in turn, drive

the reverse ring gear in the reverse direction. The rotation of the reverse ring gear is transmitted to the forward planetary carrier, to which it is splined. Thus, the rotation of the reverse ring gear is transmitted to one element of each range group as it is in forward operation (refer to para 24a, above).

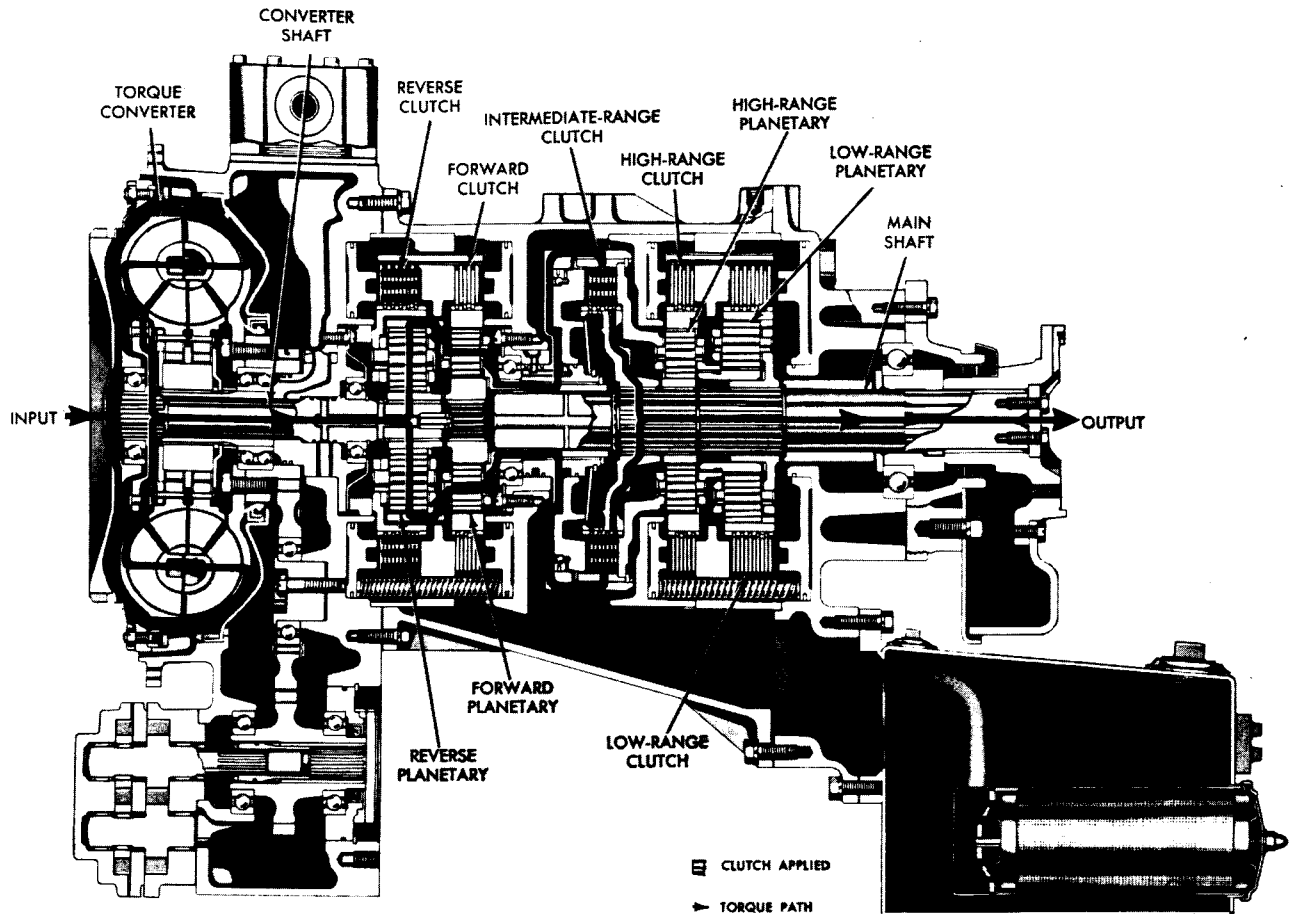


Fig. II-6. Reverse, intermediate-range—torque path (CRT 3331-3)

S2672

b. Refer to para 24b, above, for explanation of the power flow through the low-range components. The reverse planetary reduction of 2.81 to 1, coupled with the low-range planetary reduction of 2.76 to 1, gives a total reduction of 7.75 to 1.

c. The low-range planetary gear set, as described in b, above, is not included in CRT 3321 models. For an explanation of the power flow for reverse, low range as applicable to CRT 3321 models, refer to para 28, below.

28. REVERSE, INTERMEDIATE RANGE — TORQUE PATH (fig. II-6)

a. Refer to para 27a, above, for explanation

of the power flow through the reverse planetary gear set.

b. Refer to para 25b, above, for explanation of the power flow through the intermediate-range clutch components. The 1 to 1 ratio of the intermediate-range clutch, coupled with the reverse planetary reduction of 2.81 to 1, gives a total reduction ratio of 2.81 to 1.

c. The clutch which serves intermediate range in CRT 3331 models serves low range in CRT 3321 models. Thus, the power flow for reverse, low range in CRT 3321 models is identical to that for reverse, intermediate range in CRT 3331 models.

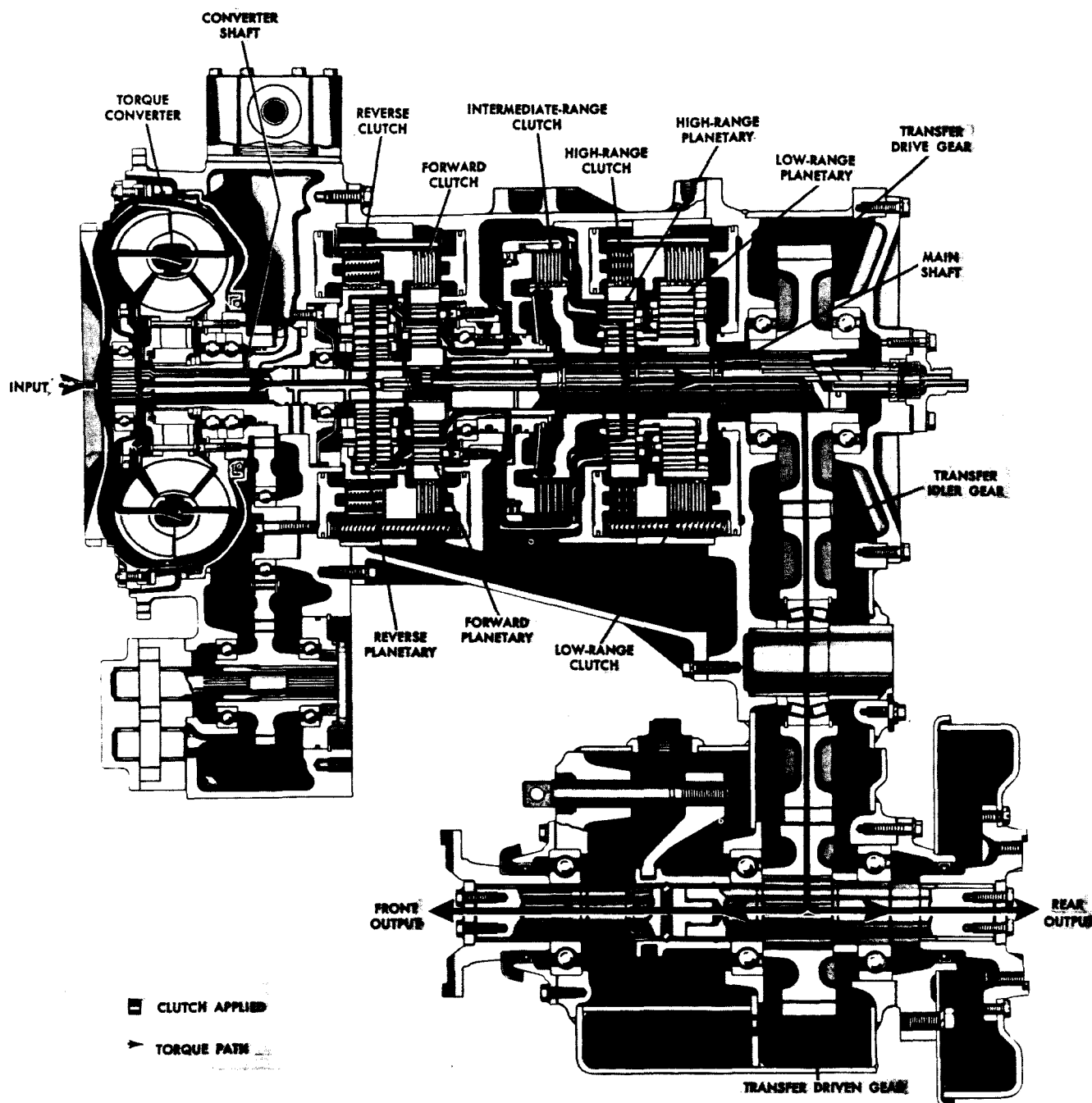


Fig. II-7. Reverse, high-range—torque path (CRT 3331-1)

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29. REVERSE, HIGH RANGE — TORQUE PATH (fig. II-7)

a. Refer to para 27a, above, for explanation of the power flow through the reverse planetary gear set.

b. Refer to para 26b, above, for explanation of the power flow through the high-range planetary gear set. The 2.81 to 1 speed reduction ratio of the reverse-range planetary gear set, coupled with the 0.345 to 1 overdrive ratio of the high-range planetary gear set, gives a total overdrive ratio of 0.97 to 1.

Section III PREVENTIVE MAINTENANCE

1. PERIODIC INSPECTIONS, CLEANING

a. Transmission Exterior. The exterior of the transmission should be cleaned and inspected at regular intervals. The severity of service and the operating environment will determine the frequency of such procedures. The transmission should be inspected for loose bolts, oil leaks, linkage troubles, and bent or damaged oil lines. Oil leaks require immediate attention. Linkage must be kept clean and well lubricated.

b. Cleaning Breather. The prevalence of dirt and dust will determine the frequency at which the breather (fig. III-1) requires cleaning. Clean the area around the breather before removing the breather. Wash the breather thoroughly by agitating it in mineral spirits. After cleaning, dry it thoroughly with compressed air. Always use a wrench of the proper size to remove or replace the breather — pliers, or a pipe wrench, will crush or damage it, and produce metal chips which may enter the transmission.

c. Cleaning Oil Screen. All CRT 3321 and CRT 3331 transmissions have a cylindrical

oil screen located in the oil sump. The location in the sump and the method of fastening varies among assemblies. Two methods of fastening are used. The screen assembly may be retained by a cover with a single bolt or nut and washer (fig. III-1), or with six bolts and washers 29 and 30 (B, foldout 10). A new gasket should be used when replacing either type. The flat washer used with the single central fastening should be replaced if it will not seal against oil leakage. Clean the screen assembly thoroughly. Examine it carefully for leakage after the transmission is refilled with oil. Use special care in tightening the bolt or nut on assemblies which have a single, central fastener. The recommended tightness is 7 to 10 pound feet (9.5 to 13.5 N·m). Excessive torque can pull the center stud loose from the sump.

2. CHECKING OIL LEVEL

a. Cold Check. The cold oil check (engine not running) is made only to determine if there is sufficient oil to prevent transmission damage during warmup. Where two oil check plugs (fig. III-1) are provided on the oil sump, remove the top plug; where only one plug is provided, remove it. The oil level must be at or above the plug level before the engine is started.

b. Hot Check

(1) The hot oil check is made to determine if there is sufficient oil for working operation of the transmission. Before making a hot check, make sure the oil is at operating temperature (180 to 200°F) (82.2 to 93.3°C).

(2) If the vehicle has been operating, let the engine idle at 1000 rpm, with the transmission in Neutral, for 2 minutes before making check.

(3) On CRT 3321-1 and CRT 3331-1 transmissions, the oil level plug (or plugs) may be located either at the lower-left front of the transfer case (fig. III-2) or at the lower-

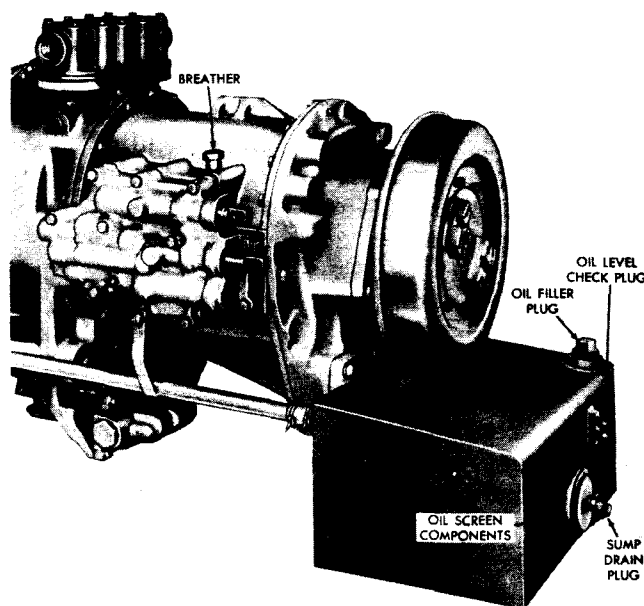
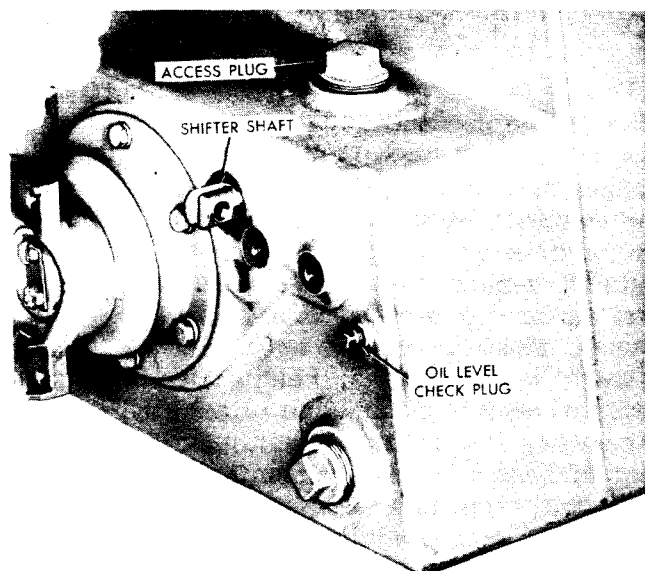
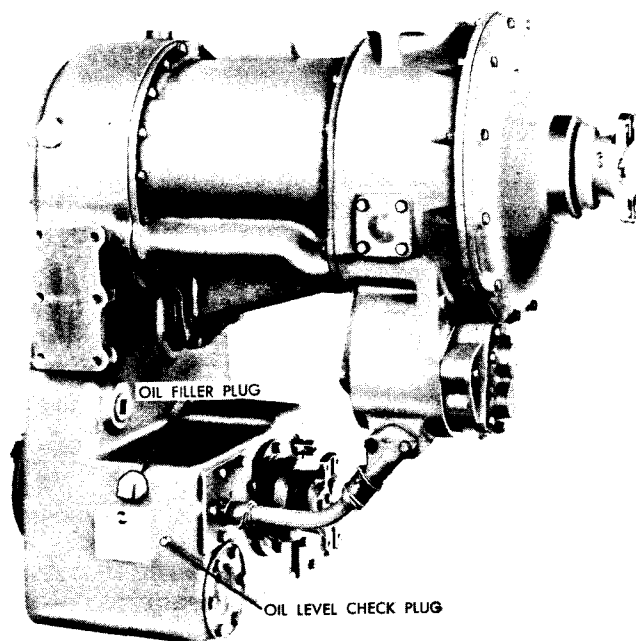


Fig. III-1. CRT 3331-3 transmission—partial left-rear view



S2350

Fig. III-2. CRT 3331-1—left-front view closeup, showing the front-disconnect shaft and oil level check plug



S3053

Fig. III-3. CRT 3331-1—view of oil level check plug right side (fig. III-3). Remove only the upper plug for checking oil.

Note: Where two oil level plugs are provided on CRT 3321-1 and CRT 3331-1 transmissions, it is recommended that the lower plug be tightened and then the head be sawed off.

(4) On CRT 3321-3 and CRT 3331-3 transmissions, two oil level plugs are located at the rear of the sump (fig. III-1). Remove only the upper plug when checking oil level.

(5) With the engine running at 1000 rpm and with the transmission in Neutral, remove the check plug. If the oil is level with the check plug, no additional oil is necessary.

(6) If the oil level is below the check plug, add oil, with the engine running, until the level is just even with the plug. Replace the plug. Let the engine run for 2 minutes, then recheck.

3. CHANGING OIL, FILTER ELEMENTS

a. **Oil Capacity.** CRT 3321-1 and CRT 3331-1 transmissions require 7 1/2 US gallons (28.4 litres) for initial fill (dry). The same models require only 5 1/2 US gallons (20.8 litres) for refill (approximately 2 US gallons (7.5 litres) remain after draining.) CRT 3321-3 and CRT 3331-3 models require 9 gallons (34 litres) initially, and 7 US gallons (26.5 litres) at refill. These capacities do not include the additional oil required to fill the external system (cooler, filter, external oil lines). The requirement for the external system will vary among installations.

b. **Intervals Between Changes.** The interval between oil changes will vary with operating environment and conditions. The oil and filter elements should be changed when the oil becomes contaminated or has been overheated. Oil that has been overheated is discolored and has a strong odor. The presence of dirt, water or foreign matter in the oil may damage the transmission or cause malfunction. Under favorable operating conditions, the oil and filter elements should be changed after 2000 hours or six months of operation (whichever occurs first).

c. **Draining Oil.** The transmission should be warm when the oil is drained. Remove the drain plug (fig. III-1), oil screen assembly and oil filter elements. Allow the system to drain thoroughly before replacing the drain plug. Clean the screen assembly (para 1c, above), and replace it. Install new oil filter elements (e, below).

d. **Contamination of Oil.** When the oil is drained, it should be examined for evidence of contamination. If water is present, check the oil cooler (heat exchanger) for leakage between

the oil and water sides. Oil in the water side (radiator) is another sign of leakage — this, however, may indicate leakage from the engine oil system. Any accumulation of dirt or sludge in the sump should be removed with "flushing oil." Metal particles (except the usual minute particles normally removed by the oil filter) in the oil indicate damage or excessive wear of transmission parts. When this condition is found, the transmission should be disassembled, inspected, and rebuilt. The oil lines, cooler, filter and all areas where particles might lodge must be cleaned.

e. Replacing Filter Elements. Filter elements should be replaced at every oil change. The filter shells should be thoroughly cleaned. New gaskets (or seal rings) should be used when new filter elements are installed. After installation, inspect the filter components for oil leakage while the vehicle engine is running.

f. Filling the Oil System

(1) Oil should be stored or handled in clean containers. Dust, dirt, water, or other foreign matter must not enter the transmission oil system. After draining, cleaning and replacement of components removed during draining, fill the system with hydraulic transmission fluid, type C-3. The oil filler arrangement varies among installations. Refer to a, above, for oil capacities of the various models.

(2) When filling the system, pour 4 to 5 US gallons (15 to 19 litres) of oil into the transmission, start the engine, and let it run at 1000 rpm for 2 or 3 minutes. If the main oil pressure fluctuates and will not stabilize during this period, add sufficient oil to stabilize main oil pressure. After enough oil is added to stabilize the pressure, check the oil as outlined in para 2b, above. Add oil as required, while the engine is running.

4. PRESSURES, TEMPERATURES

a. Pressure Gage

(1) A pressure gage may be installed on the vehicle instrument panel, to indicate main oil pressure. The gage is connected to the control valve body (fig. III-4). Some earlier gages have a red band covering the 50 to 90 psi (344.8 to 620.5 kPa) segment of the face, and a green band covering the 90 to 150 psi (620.8 to 1,034.2 kPa) segment; later gages

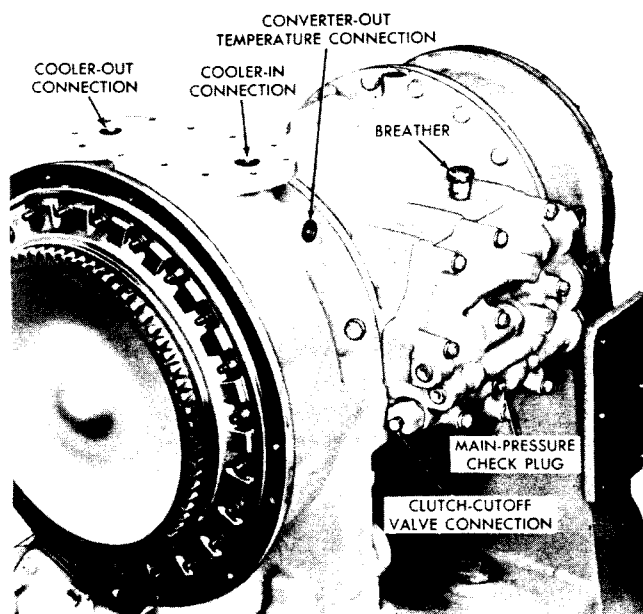


Fig. III-4. CRT 3331-1 transmission—partial left-front view

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have a red band covering the 0 to 110 psi (0 to 758.4 kPa) segment, and a green band on the 110 to 150 psi (758.4 to 1,034.2 kPa) segment. Both gages have a red band in the 150 to 200 psi (1,034 to 1,379 kPa) segment. Pressure may occasionally go slightly into the red (150 to 200 psi) (1,034 to 1,379 kPa) segment but this is not abnormal. Earlier gages were used when main-pressure regulator valves were calibrated to lower pressures (below S/N 13660).

Note: Main-pressure regulator valves on transmissions having serial numbers below 13660 may be recalibrated to 110 to 135 psi (758.4 to 930.8 kPa) (at full-throttle stall) by adding shims (P/N 6770423) at the valve end of the main-pressure regulator valve spring. Each shim will raise pressure approximately 10 psi (68.9 kPa).

(2) Transmission main pressure can be read directly from the pressure gage for all CRT 3321 and CRT 3331 transmissions. Except for the earlier models (below S/N 13660) the pressure should be either in the 110 to 135 psi (758.4 to 930.8 kPa) range or in the 135 to 155 psi (930.8 to 1,068.7 kPa) range at full-throttle stall, depending upon the main-

pressure regulator valve body used. Refer to Parts Catalog SA 1244 for the correct control valve body assembly for your transmission.

Note: Main-pressure regulators which have 110 to 135 psi (758.4 to 930.8 kPa) pressure range have a spring with two red coils (earlier models — without bypass), or two blue coils (later models — with bypass valve); all regulators in the 135 to 155 psi (930.8 to 1,068.7 kPa) pressure range have a spring with two yellow coils.

(3) The several control valve body assemblies provided affect the readings which the pressure gage will give. When one of the five earlier model control valve body assemblies is used (refer to sect. II, para 15f, g, h, i, l), the gage will read main pressure at all times — and clutch apply pressure is equal to main pressure at all times. When one of the later model control valve bodies is used (refer to sect. II, para 15f, j, k, m, n), the gage will read main pressure at all times except while the clutch cutoff valve or inching control is in use. When the clutch cutoff valve is acting (vehicle brakes applied), the gage will show no pressure (50 psi (344.7 kPa) on gage). When the inching control valve is acting, the gage will show the clutch apply pressure — this may range from 50 psi (344.7 kPa) (lowest reading on the gage) to full-main pressure (110 to 155 psi) (758.4 to 1,068.7 kPa).

(4) The main pressure check plug is located on the outer side of the control valve body on all transmissions (fig. III-4). The location of the checkpoint in the various systems is shown on each of the foldout hydraulic schematics in the back of the manual.

b. Temperature Gage. An oil temperature gage may be installed on the vehicle instrument panel to indicate converter-out (to cooler oil temperature. The gage sending-unit is installed in a tapped hole at the upper-left side of the torque converter housing (fig. III-4). The gage is marked with a range of 100 to 320°F (37.8 to 160.0°C). The 100 to 250°F (37.8 to 121.1°C) segment has a green band; the 250 to 320°F (121.1 to 160.0°C) seg-

ment is red. The safe operating range is green. The red indicates overheating. The normal operating temperature of the transmission is 180 to 200°F (82.2 to 93.2°C).

c. Checking Main, Converter-out and Lubrication Pressures

(1) Main pressure check. Main pressure can be checked by the gage on the instrument panel (if so equipped) or by connecting a gage (0 to 250 psi (0 to 1,723.7 kPa) range) to the 1/8-inch NPTF tapped opening on the outer side of the control valve body (fig. III-4). Main pressure at full-throttle stall should be approximately 110 to 135 psi (758.4 to 930.8 kPa) on those transmissions equipped with main-pressure regulator valve bodies 6759543 or 6772431. On transmissions equipped with main-pressure regulator valve bodies 6771309 or 6772433, main pressure should be 135 to 155 psi (930.8 to 1,068.7 kPa).

Note: If transmission is equipped with a later model valve body (P/N 6773644) the inching control valve must be released (retracted). If equipped with later model valve body (6773645 or 6773646), the vehicle brakes must be released.

(2) Converter-out pressure check. Converter-out pressure may be checked at the point provided for attaching the temperature gage sending unit (1/2 NPTF tapped opening on the upper-left side of the converter housing) (fig. III-4). Maximum converter-out pressure at full-throttle top speed is 65 psi (448.2 kPa), with transmission at normal (180-200°F) (82.2-93.3°C) operating temperature.

(3) Lubrication pressure check. On those transmissions equipped with a remote-mounted oil cooler, the lubrication pressure may be checked by connecting a pressure gage into the oil return line which enters the torque converter housing at the right top (fig. III-4). The lubrication oil pressure should be 20 to 25 psi (137.9 to 172.4 kPa) when the transmission is in low range, forward, with the output stalled and the transmission at normal (180-200°F) (82.2-93.3°C) operating temperature and engine running at 1000 rpm.

5. CHECKING, ADJUSTING LINKAGE

a. Frequent Inspections. All linkage between the operator's controls and the trans-

mission should be inspected frequently for cleanliness, proper lubrication, adjustment, wear, damage and freedom of operation. Because linkage differs widely among installations, no specific adjustment procedures are given. However, general rules, which apply to all installations, are outlined in b through e, below.

b. Range Selector Linkage. The linkage must be adjusted so that the operator's control is positioned to correspond exactly to the detent positions of the range selector valve. With the linkage disconnected, place both the selector valve and the operator's control in neutral position. Adjust the linkage so that it can be freely connected without moving the valve or control. Then try the control in each range position. Make minor readjustments, if necessary, to insure that the selector valve detent seats at every range position of the operator's control.

Note: The operator's control on vehicles equipped with CRT 3321 transmissions must have provision for avoiding a shift into the position which is low range on CRT 3331 models. The selector valve must pass through this position while being shifted from neutral to low range (corresponding to intermediate range on CRT 3331 models), but must not be allowed to remain.

c. Forward, Reverse Linkage. The forward and reverse control linkage must be adjusted so that the neutral, forward, and reverse detent positions of the valve correspond exactly with those of the operator's control. This adjustment is made in a manner similar to the adjustment of the range selector linkage in b, above.

d. Inching Control Linkage. On vehicles equipped with the later valve bodies, which have a separate valve for inching, the linkage must be adjusted to insure full application and full release. The inching control valve has a total linear movement of 2.02 inches (51.4 mm) from full retract (released) to full extension (applied).

e. Output Disconnect Linkage. There are two points of adjustment for the front-output

disconnect on CRT 3321-1 and CRT 3331-1 transmissions (fig. III-2). The shifter shaft must be adjusted first, and then the linkage. Push the shifter shaft in (rearward) until the "engaged" detent seats. Adjust the shifter shaft by rotating it until the center of the linkage-connection hole is 0.610 to 0.650 inch (15.5 to 16.5 mm) (approximately 5/8 inch) (16 mm) from the front surface of the transfer case. When the shifter shaft is pulled outward (forward) the "disconnect" detent should seat when the center of the shaft hole is approximately 2 3/8 inches (60 mm) from the transfer case front surface. Adjust the linkage so that the "engaged" and "disconnect" positions of the operator's control correspond exactly with the detent positions of the shaft.

6. CONVERTER STALL TEST

a. Definition, Purpose. The converter stall test is a test of the engine and transmission as a unit, wherein the transmission output is stalled while the engine is operated at full throttle. This test will indicate, by the speed which the engine reaches, whether the engine and transmission are performing satisfactorily under full load. A lower or higher speed than that established as normal for the specific engine-transmission combination are indications of either engine or transmission malfunction.

Note: To conduct a stall test, it will be necessary to know the established normal stall speed of the specific engine and transmission combination. This information may be obtained from your equipment dealer or distributor.

b. Procedures. The test is usually made while the engine and transmission are installed in the vehicle. The vehicle wheels must be blocked securely to prevent vehicle movement. The brakes should be applied except on those installations which include a clutch cutoff valve. Conduct the test as outlined below.

(1) Start the engine and allow the transmission to warm up to normal (180-200° F) (82.2-93.3°C) operating temperature.

(2) Shift the transmission controls to high range and forward.

(3) Increase the engine speed to full throttle. Converter-out pressure should be 25 psi minimum.

Note: Do not allow converter-out temperature to exceed 250°F (121°C). Do not maintain full-stall condition longer than 30 seconds.

(4) Record the engine speed attained at full-throttle operation.

c. Results. The only reading derived from the stall test is engine speed. The difference between established normal (see a, above) speed and the actual speed recorded is significant only if it exceeds 150 rpm. Refer to the troubleshooting chart in para 8, below, for malfunctions which may be indicated by excessively high or low speed readings derived in a stall test.

Note: The tachometer used must be accurate.

7. PRESERVATION, STORAGE

a. Preservative Selection. When transmissions are to be stored or remain inactive for extended periods of time, specific preservative methods are recommended to prevent rust and corrosion damage. The length of storage will usually determine the preservative method to be used. Various methods are described below.

b. Storage, New Units. New units contain preservative oil when shipped from Allison and can be safely stored for 6 weeks without further treatment.

c. Storage, Month to 6 Weeks

(1) The following procedures will prepare a transmission for a month to 6 weeks storage, depending on the environment.

(2) Drain the oil as described in paragraph 3c, above. Remove the transmission oil filter element(s).

(3) Install the drain plugs and new filter element(s).

(4) Fill the unit to operating level with any commercial preservative oil which meets US Military specifications MIL-L-21260, Grade 1, to latest specifications.

(5) Operate the unit for at least 5 minutes at a minimum of 1000 rpm. Shift the transmission slowly through all selector positions to thoroughly distribute the oil, then stall the converter to raise the oil temperature to 225°F (107°C).

Caution: Do not allow temperature to exceed 225°F (107°C). If the unit does not have a temperature gage, do not stall for more than 30 seconds.

(6) As soon as the unit is cool enough to touch, seal all openings and breathers with moisture-proof tape.

(7) Coat all exposed, unpainted surfaces with a good grade of preservative grease, such as Petrolatum (MIL-C-11796) Class 2.

(8) Repeat above procedures ((5) through (7)) at monthly intervals for indefinite storage.

d. Storage, 1 Year — Without Oil

(1) Drain oil as described in paragraph 3c, above.

(2) Seal openings and breathers with moisture-proof tape.

(3) Coat all exposed, unpainted surfaces with a good grade of preservative grease.

(4) Atomize or spray 2 ounces (59 ml) of Motorstor*, or equivalent, into the transmission through the oil pan drain plug.

*Motorstor is a preservative additive manufactured by the Daubert Chemical Company, Chicago, Illinois. Motorstor (under the designation of "Nucle Oil") is covered by US Military Specifications MIL-L-46002 (ORD) and MIL-I-23310 (WEP).

(5) If additional storage time is required, (3) and (4), above, should be repeated at yearly intervals.

e. Storage, 1 Year — With Oil

(1) Drain the oil as described in paragraph 3c, above. Remove the transmission oil filter element(s).

(2) Install the drain plugs and new filter element(s).

(3) Fill the transmission to operating level with a mixture of hydraulic transmission fluid, type C3 and a 3 percent (30 parts C3 oil to 1 part Motorstor) preservative or equivalent.

(4) Operate the unit for approximately 5 minutes at a minimum of 1000 rpm. Shift the transmission slowly through all selector positions to thoroughly distribute the oil, then stall the converter to raise the oil temperature to 225°F (107°C).

Caution: Do not allow temperature to exceed 225°F (107°C). If the unit does not have a temperature gage, do not stall for more than 30 seconds.

(5) As soon as the unit is cool enough to touch, seal all openings and breathers with moisture-proof tape.

(6) Coat all exposed, unpainted surfaces with a good grade of preservative grease.

(7) If additional storage time is required, (3) through (6), above, should be repeated at yearly intervals, except it is not necessary to drain the transmission each year — just add the Motorstor, or equivalent.

f. Restoring Units to Service

(1) If Motorstor, or equivalent, was used in preparing the transmission for storage, use the following procedures to restore the unit to service.

(2) Remove the tape from openings and breather.

(3) Wash off all the external grease with solvent.

(4) Add hydraulic transmission fluid, type C3 to proper level.

Note: It is not necessary to drain C3 oil and Motorstor mixture from the transmission.

(5) If Motorstor, or equivalent, was not used in preparing the transmission for storage, use the following procedures to restore the unit to service.

(6) Remove the tape from openings and breathers.

(7) Wash off all the external grease with solvent.

(8) Drain oil as described in paragraph 3c, above.

(9) Install a new oil filter element(s).

(10) Refill transmission with hydraulic transmission fluid, type C3 to proper level.

8. TROUBLESHOOTING

a. Systematic Check. Troubleshooting is the systematic search for, and location of, malfunctions in the engine or transmission, which affect transmission performance. A thorough study of the description and operation of components and the hydraulic system in sect. II will be helpful in troubleshooting. The engine and transmission must be regarded as a single package during troubleshooting.

b. Preliminary Checks. The engine must be correctly adjusted and performing satisfactorily when troubleshooting is started. The various control linkages must be properly adjusted and functioning properly. The oil level in the transmission must be at the proper level. Refer to the engine service information for

procedures pertaining to the engine. Refer to para 2 through 5, above, for procedures pertaining to the transmission.

c. Troubleshooting Chart. The following chart outlines the causes and remedies for

possible transmission troubles. Capital letters indicate the symptom; numerals following the symptom indicate several possible causes; numerals in the right column indicate remedies for the correspondingly numbered causes in the left column.

TROUBLESHOOTING CHART

<u>Cause</u>	<u>Remedy</u>
A. LOW MAIN PRESSURE	
1. Low oil level	1. Add oil to proper level (sect. III, para 3)
2. Clogged strainer screen	2. Clean screen (sect. III, para 1)
3. Weak or broken main-pressure regulator spring	3. Replace spring (sect. VI, para 9 or 10)
4. Main-pressure regulator valve sticking open	4. Rebuild main-pressure regulator valve body assembly (sect. VI, para 9 or 10)
5. Clutch cutoff valve sticking open	5. Rebuild control valve body assembly (sect. VI, para 1 thru 8)
6. Inching control valve linkage out of adjustment (later model valve body)	6. Adjust linkage (sect. III, para 5d)
7. Oil aerated, foaming	7. (a) High oil level – drain to proper level (sect. III, para 2) (b) Improper oil – drain, refill with recommended oil (sect. III, para 2, 3) (c) Dirty strainer screen – clean screen (sect. III, para 1) (d) Ruptured control valve body gasket – replace gasket (sect. V, para 2a or 3c; sect. VII, para 2t or 3r) (e) Internal leakage – overhaul transmission (sect. IV through VII)
8. Input oil pump worn or damaged	8. Rebuild pump (sect. VI, para 11, 12 or 13)
9. Lubrication pressure regulator valve dirty, open	9. Clean valve (sect. VI, para 17)
10. Oil aerated, foaming (CRT 3321 models only)	10. (a) Refer to A. 7(a) through (e), above (b) Range control valve allowed to remain in first detent next to neutral (refer to note following para 5b in sect. III)

(Continued on next page)

TROUBLESHOOTING CHART - Continued

<u>Cause</u>	<u>Remedy</u>
B. LOW CONVERTER-OUT PRESSURE	
1. See causes and remedies under A, above	
2. Converter-in bypass valve leaking	2. Rebuild main-pressure regulator valve (sect. VI, para 9 or 10)
C. LOW LUBRICATION OIL PRESSURE	
1. Lubrication pressure regulator valve dirty, open	1. Clean valve (sect. VI, para 17)
2. Lubrication pressure regulator valve seal washer damaged	2. Replace washer (sect. VI, para 17)
3. Lubrication pressure regulator valve spring weak or broken	3. Replace spring (sect. VI, para 17)
4. Low main pressure	4. Refer to A, above
D. HIGH OIL TEMPERATURE	
1. Low oil level (low flow rate)	1. Add oil to proper level (sect. III, para 3)
2. High oil level	2. Drain oil to proper level (sect. III, para 3)
3. Low water level in cooling system	3. Add water — check for leaks
4. Low converter-out pressure	4. Refer to B, above
5. Clogged or dirty oil cooler, cooler lines	5. Clean cooler and lines, or replace if necessary
6. Oil aerated, foaming	6. Refer to A7 and A10, above
7. Overheated water system	7. Check and correct water system troubles
8. Operating too long in an inefficient converter range	8. Adjust work cycle to allow operation in an efficient range
9. Stator (or stators) locked	9. Check for low top speed of vehicle; check converter components (sect. V, para 2d, e, f or g; and sect. VII, para 2i, j, k or l)
10. Stators interchanged (4-element type converter)	10. Check stall speed (sect. III, para 6); if low, check converter assembly (sect. V, para 2)

(Continued on next page)

TROUBLESHOOTING CHART - Continued

<u>Cause</u>	<u>Remedy</u>
E. LOSS OF POWER	
1. Low engine output	1. Check and tune engine
2. Converter element interference	2. Check for noise at stall; overhaul converter (sect. V, VI and VII)
3. Clutch slipping	3. (a) Check clutch pressure (sect. III, para 4) (b) Check for worn piston seals Overhaul transmission if necessary (sect. IV through VII)
4. Converter not properly functioning	4. Refer to D9 and 10, above
5. Control valves not properly positioned	5. Check linkage adjustments (sect. III, para 5)
6. Low main pressure	6. Refer to A, above
7. Overheating	7. Refer to D, above
F. NO POWER TRANSMITTED IN ANY RANGE	
1. Low main pressure	1. Refer to A, above
2. Control valves not properly positioned	2. Check, adjust control valve linkage (sect. III, para 5)
3. Clutch slipping	3. Refer to E3, above
4. Mechanical failure	4. Disassemble and rebuild transmission (sect. IV through VII)
G. NO POWER TRANSMITTED IN ONE RANGE	
1. Clutch slipping	1. Refer to E3, above
2. Control valves not properly positioned	2. Check, adjust control valve linkage (sect. III, para 5)
3. Mechanical failure	3. Disassemble and rebuild transmission (sect. IV through VII)

(Continued on next page)

TROUBLESHOOTING CHART - Continued

<u>Cause</u>	<u>Remedy</u>
H. SLOW CLUTCH ENGAGEMENT	
1. Low main pressure	1. Refer to A, above
2. Worn piston seals.	2. Overhaul transmission (sect. IV through VII)
3. Slow clutch cutoff valve return	3. (a) Check brake system pressure release (b) Check cutoff valve movement in valve body (sect. VI, para 2, 3, 5, 7 or 8) (c) Check cutoff valve spring (sect. VI, para 2, 3, 5, 7 or 8)
I. HIGH CONVERTER-OUT PRESSURE	
1. Restricted oil cooler or cooler lines	1. Clean cooler, clean or replace cooler lines
2. Lubrication pressure regulator valve sticking closed	2. Inspect, and correct sticking condition (sect. VI, para 17)
Note: In all conditions described in J through N, below, the vehicle will operate when the control valve for the failed clutch (forward-reverse or range clutch) is shifted to neutral. This is true because the failed clutch is locked and will not release.	
J. VEHICLE OPERATES IN ALL FORWARD GEARS, BUT STALLS IN ALL REVERSE GEARS	
1. Forward clutch failed (will not release)	1. Overhaul transmission (sect. IV through VII)
K. VEHICLE OPERATES IN ALL REVERSE GEARS, BUT STALLS IN ALL FORWARD GEARS	
1. Reverse clutch failed (will not release)	1. Overhaul transmission (sect. IV through VII)
L. VEHICLE OPERATES FORWARD AND REVERSE IN LOW RANGE, BUT STALLS IN INTERMEDIATE AND HIGH RANGES	
1. Low-range clutch failed (will not release)	1. Overhaul transmission (sect. IV through VII)

(Continued on next page)

TROUBLESHOOTING CHART - Continued

<u>Cause</u>	<u>Remedy</u>
M. VEHICLE OPERATES FORWARD AND REVERSE IN INTERMEDIATE RANGE, BUT STALLS IN LOW AND HIGH RANGES	
1. Intermediate-range clutch failed (will not release)	1. Overhaul transmission (sect. IV through VII)
N. VEHICLE OPERATES FORWARD OR REVERSE IN HIGH RANGE, BUT STALLS IN LOW AND INTERMEDIATE RANGES	
1. High-range clutch failed (will not release)	1. Overhaul transmission (sect. IV through VII)

Section IV GENERAL OVERHAUL

1. CHANGES IN MODELS, PROCEDURES

The release of new assemblies and/or product improvements may require new or different service procedures. Major changes will be covered in supplementary information for this manual. Consult your dealer or distributor for the latest information. Give the model, assembly part number, and serial number stamped on the transmission name plate (refer to sect. I, para 2b).

2. TOOLS, EQUIPMENT NEEDED

a. Equipment. In addition to mechanic's ordinary hand tools, the following items should be available:

(1) Chain hoist (at least 1-ton capacity).

(2) Suitable disassembly and assembly table (fig. IV-1).

(3) Press (for removal, installation of press-fit parts).

(4) Supply of wood blocks.

(5) Clean wiping cloths (do not use linty waste).

(6) Parts receptacles.

(7) Cleaning equipment (brushes, solvent, etc.)

(8) Torque wrenches.

(9) Oil-soluble grease.

(10) White lead.

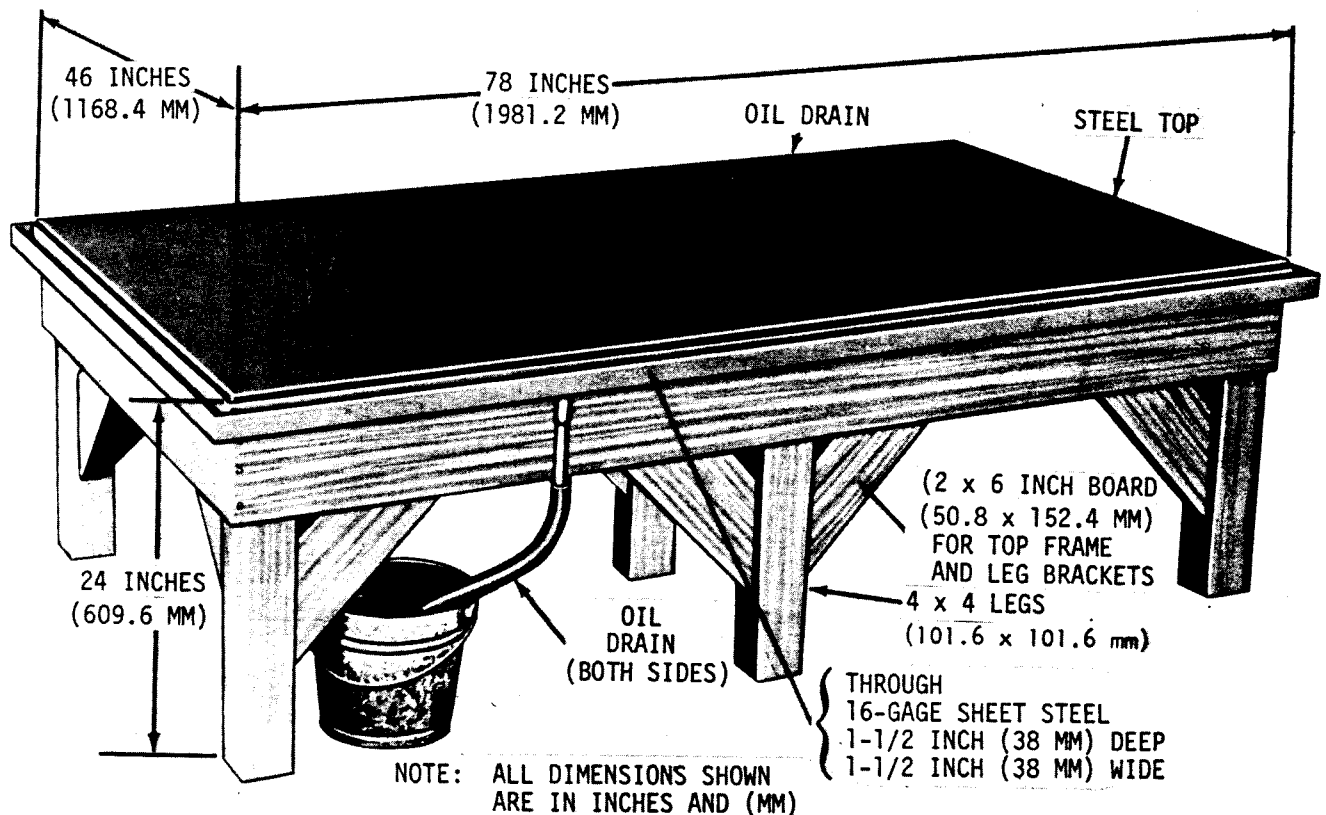


Fig. IV-1. Disassembly and assembly table

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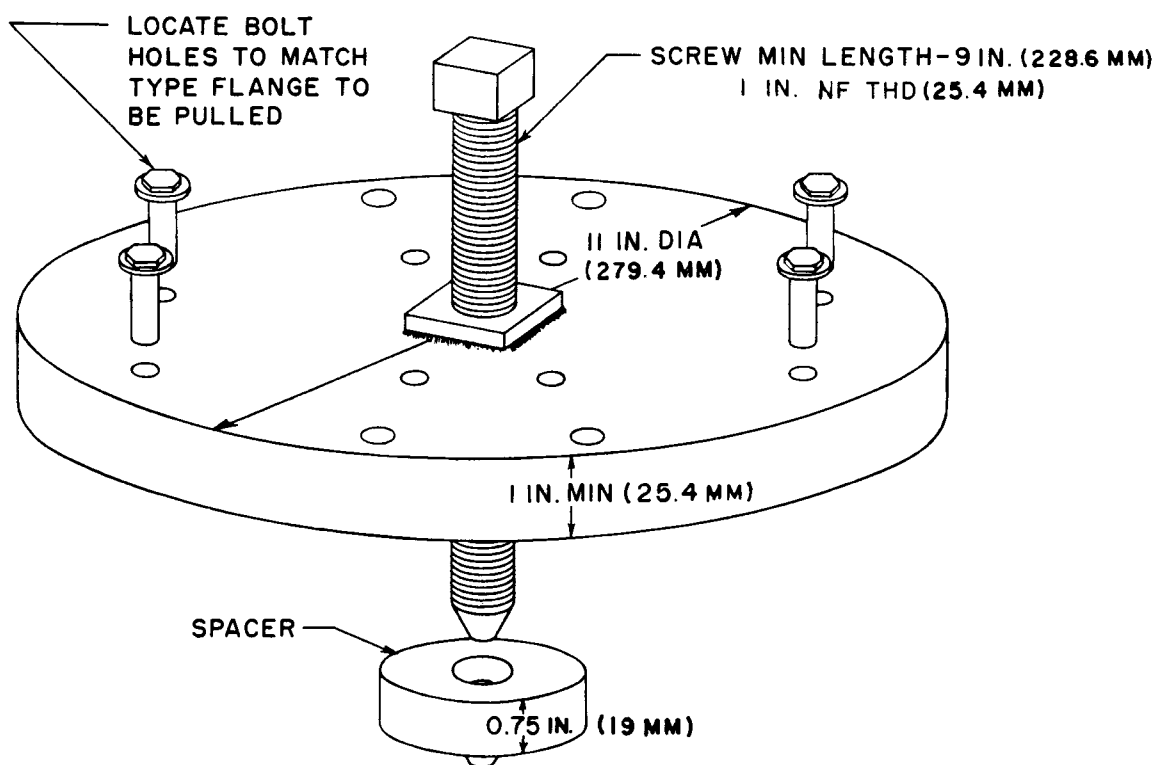


Fig. IV-2. Special tool for removing input or output flange

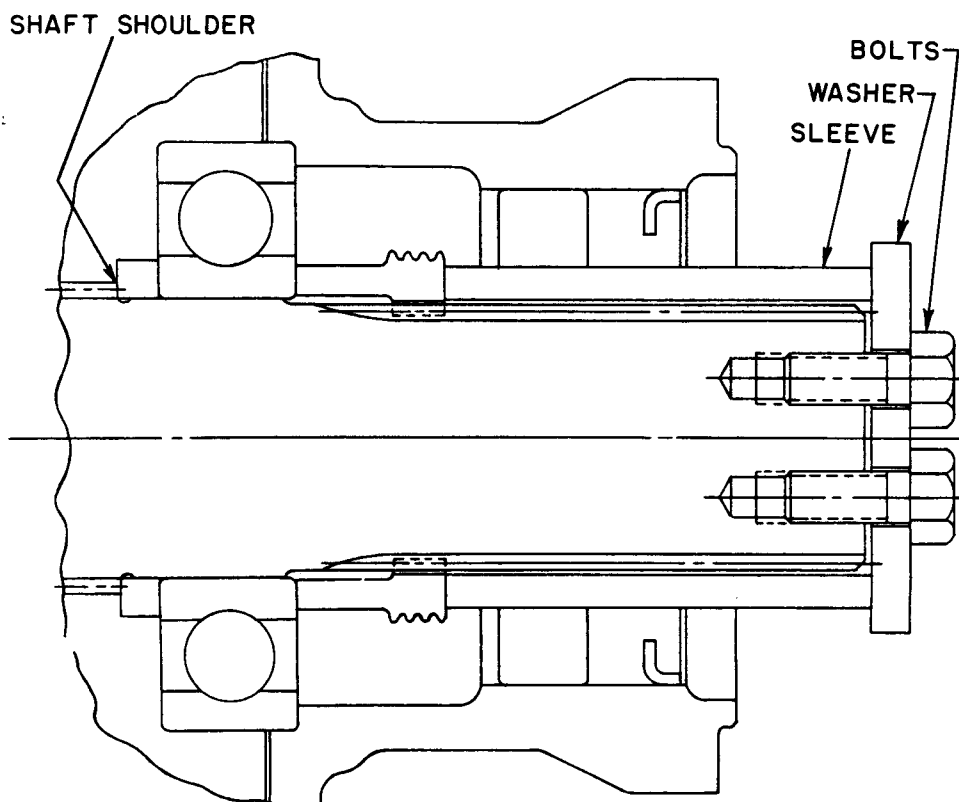
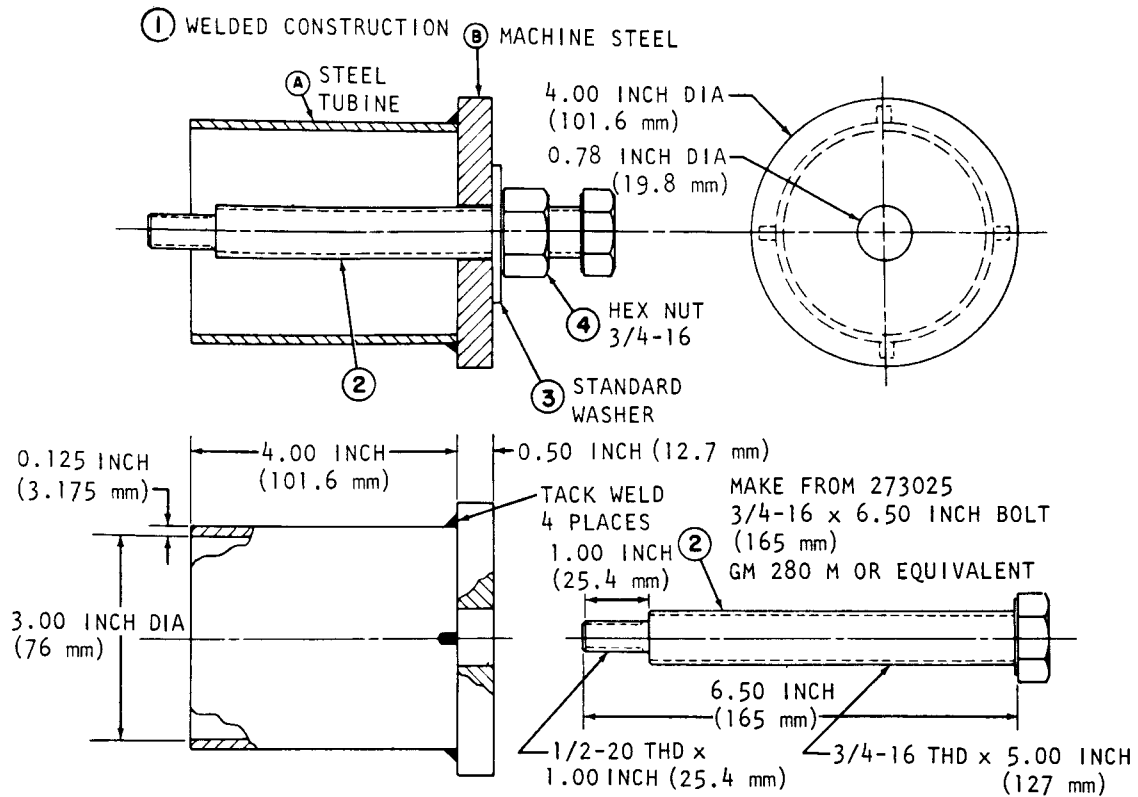


Fig. IV-3. Special tool for positioning parts prior to installing flange



TOOL NO. TSD-20221

Fig. IV-4. Special tool for removing transfer idler gear spindle in CRT 3321-1 and CRT 3331-1

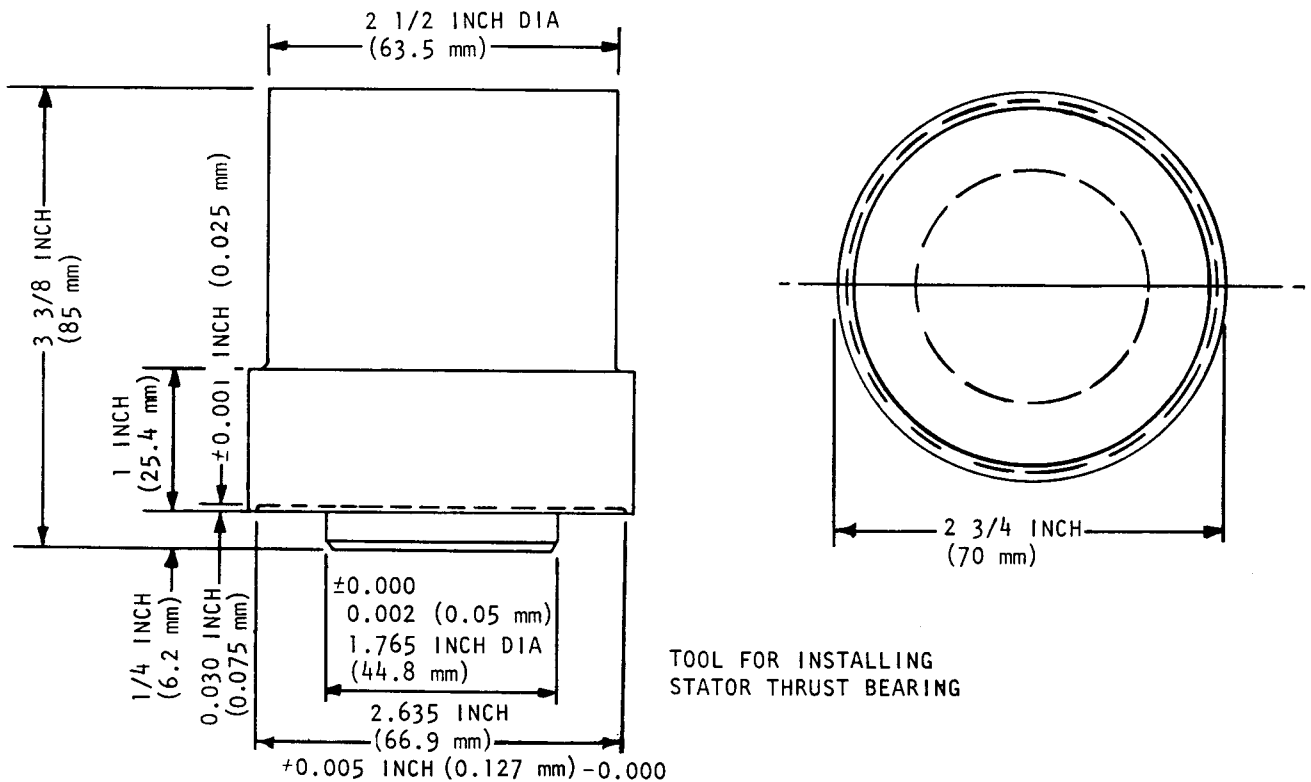


Fig. IV-5. Special tool for installing stator thrust bearing assembly

(11) Dry ice (for cooling press-fit spindles, etc.)

(12) Hot plate or heating equipment to heat oil to 300° F (for heating bearings before installation).

b. Special Tools. A minimum number of special tools is required in the overhaul of these transmissions. Such tools may be fabricated if suitable similar items are not available. Special tools are listed and identified as to use, in (1) through (3), below.

(1) Input or output flange puller (fig. IV-2).

(2) Sleeve - for positioning parts prior to installing input or output flange (fig. IV-3).

(3) Puller assembly - for removal of output idler gear spindle in CRT 3321-1 and CRT 3331-1 (fig. IV-4).

(4) Special tool for installing stator thrust bearing assembly (fig. IV-5).

3. REPLACEMENT PARTS

a. Ordering Information. Refer to sect. I, para 4 for parts ordering information.

b. Parts Normally Replaced. The following parts are normally replaced at transmission overhaul:

(1) Gaskets.

(2) Cotter pins.

(3) Lock strips.

(4) Washers or snap rings damaged during removal.

(5) Oil seals (when removed).

Caution: Do not burn discarded Teflon seals. Toxic gasses are produced when Teflon is burned.

(6) All parts which are revealed by inspection to be damaged, or worn beyond acceptable wear limits.

c. Service Kits. Repair and overhaul kits are available for certain transmissions and subassemblies. Check with your dealer or distributor for such kits.

4. CAREFUL HANDLING

During all rebuild procedures, parts and subassemblies must be handled carefully to prevent nicking, scratching and denting. Parts which fit closely but with operating clearance will stick if damaged only slightly. Parts which depend upon smooth surfaces for sealing may leak if scratched. Such parts must be carefully handled and protected during removal, cleaning, inspection and installation.

5. CLEANING, INSPECTION

a. Dirt Can Cause Malfunctions. All parts must be clean to permit effective inspection. At assembly, it is very important that no dirt or foreign matter enters the transmission. Even minute particles can cause the malfunction of close-fitting parts such as valves.

b. Cleaning Parts

(1) All metallic parts of the transmission except bearings should be cleaned thoroughly with volatile mineral spirits, or by the steam-cleaning method. Do not use caustic soda solution for steam cleaning.

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

(3) Clean oil passages by working a piece of wire back and forth through the passages and flushing them with spirits. 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) Bearings that have been in service should be thoroughly washed in volatile mineral spirits.

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

(3) Before inspection, oil the 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 the presence of 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.

e. Inspecting Cast Parts, Machined Surfaces

(1) Inspect bores for wear, grooves, scratches, and dirt. Remove scratches and burs 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

Caution: Any bearing subjected to metal contamination (para 3-3d) must be closely inspected.

(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 200°F (93.3°C) 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 or transmission gearing, 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 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 between the hooks of the seal ring when it is installed.

(6) The sides of the seal ring should be smooth (0.005-inch (0.127 mm) maximum side wear). The sides of the shaft groove (or the bore) in which the seal ring fits should be smooth (50 microinches (1.25 μ m) equivalent) and square with the axis of rotation within 0.002 inch (0.05 mm). If the sides of the ring grooves have to be reworked (0.020-inch (0.5 mm) 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 defects with a soft stone. If scores and scratches 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 the 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. Refer to the spring chart at the end of sect. VIII.

6. REMOVING, INSTALLING TRANSMISSION

a. Draining Oil. Drain the oil from the transmission by removing the drain plug and sump screen (fig. I-4). If possible, the oil should be allowed to drain overnight and be drained while the transmission is warm. Replace the drain plug. Consult the vehicle service manual for specific instructions for removal and installation of the transmission, since applications will differ.

b. Disconnect at all Points. Be sure all linkages, controls, cooler and filter lines, temperature and pressure connections, input and output couplings, and mounting bolts are disconnected before attempting to remove the

transmission. Be sure all of these items are reconnected after the transmission is installed.

c. Converter Drive Ring

(1) If the transmission is directly mounted to the engine bell housing, converter drive ring 15 (A, foldout 7), eight 12-point bolts 17, and washers 16 will remain with the engine. Remove the drive ring and attaching bolts and washers only if necessary.

(2) After the transmission has been assembled as described in Section VII, lubricate seal ring 18 with a grease meeting the requirements specified in the note below. Install the seal into the groove behind the drive teeth on pump cover 20.

(3) If drive ring 15 was removed, apply sealer (Permatex No. 3 or equivalent) to the drive ring and to the mating face on the engine flywheel or drive disk (also to gasket, if used). Attach the drive ring to the engine flywheel or disk with eight bolts 17 and washers 16. Tighten the bolts to 36 to 43 pound feet (48.8 to 58.3 N·m) torque.

(4) Pack the spaces between the internal teeth of the drive ring with high quality molybdenum disulfide grease (Allison P/N 6769877 or equivalent). Fill the spaces between the teeth completely, but do not use an excessive amount of grease.

Note: The grease must not attack Buna or Polyacrylate seal material. Mobil Special with molybdenum disulfide, or equivalent, is recommended.

d. Lifting Transmission. Two 1/2-13 tapped holes are provided (in converter housing and transmission housing) at the top of the transmission for lifting. Bolts or eyebolts may be installed into these openings.

e. Clean Exterior. Clean the exterior of the transmission after it is removed. Steam cleaning should be followed immediately by disassembly to prevent rust which can result from moisture entering the transmission.

7. REMOVING, INSTALLING
DRIVE FLANGES

a. Removing Flanges. When interference-fit drive flanges are used, they should be removed as the first step in disassembly. A heavy-duty puller kit or one similar to that illustrated in fig. IV-2 is required. A heavy steel plate may be bolted to the ears of the flange to prevent bending them and to provide a grip for the puller jaws of a standard puller. A steel bar may be used to prevent rotation of the flange while the puller is being tightened.

b. Installing Flanges. Be sure that spacer or other parts are in place on the shaft which receives the flange, using a sleeve similar to that shown in fig. IV-3 to seat them. Inspect the shaft and flange splines for dirt, paint, rust, burs and rough spots. Remove any of these. Coat the shaft splines with light bearing grease. Grease the internal lip of the oil seal. Heat the flange to approximately 300 degrees F (148.8°C), in heated oil (for 15 minutes) or in an oven (for 30 minutes). Install the flange immediately after removing it from heat. It should slide freely into place. (If it does not slide easily into position, remove it and repeat the process.) Install the retaining parts and tighten the retaining bolts before the flange cools.

Note: Some flanges require shims under their retaining washer. Refer to sect. VII, para 2a (31) and 21 (8).

Recheck the tightness of the retaining bolts after the flange cools.

8. WEAR LIMITS, SPRING CHARTS

a. Definition, Wear Limits. A wear limit is the point to which a part may wear before it must be replaced. Normally, this does not include an additional life factor beyond this point. Accordingly, any part which has reached the wear limit should be replaced if satisfactory operation of the transmission is to be expected.

b. Inspection, Wear Limits. When parts are inspected (refer to para 5, above), those listed in sect. VIII should be measured for

wear. Discard and replace with new parts those that have reached or exceed the specified wear limits.

c. Wear Limits Data in Sect. VIII. All available wear limits data is tabulated in sect. VIII. The item numbers are keyed to the parts exploded views at the back of the manual.

d. Spring Charts in Sect. VIII. Data which will describe and aid in inspection of

all springs in the transmission may be found in sect. VIII, para 4.

9. TORQUE SPECIFICATIONS

The torque specifications listed on the chart are for dry assembly, unless otherwise specified in the text. All nuts and bolts should be washed and dry before assembly. Use fig. IV-6 for convenient reference to the torque required for the threaded fasteners shown in the cross-sectional view.

GENERAL TORQUE SPECIFICATIONS – BOLTS AND SCREWS

(All torque values are given in pound feet and Newton metres)

Size	Threads per inch	Standard heat-treated bolts and screws		Special heat-treated bolts, screws, Allen-head screws, and self-locking capscrews	
					
		lb ft	(N·m)	lb ft	(N·m)
1/4	20	6-8	(8-11)	9-11	(12-15)
	28	8-10	(11-14)	10-12	(14-16)
5/16	18	15-18	(20-24)	17-20	(23-27)
	24	17-20	(23-27)	19-23	(26-31)
3/8	16	26-32	(35-43)	36-43	(49-58)
	24	33-40	(45-54)	41-49	(56-66)
7/16	14	42-50	(57-68)	54-65	(73-88)
	20	50-60	(68-81)	64-77	(87-104)
1/2	13	67-80	(91-108)	81-97	(110-131)
	20	83-100	(113-136)	96-115	(130-156)
9/16	12	85-100	(115-136)	103-123	(140-167)
	18	100-120	(136-163)	122-146	(165-198)
5/8	11	117-140	(159-189)	164-192	(222-260)
	18	134-160	(182-217)	193-225	(262-305)
3/4	10	180-210	(244-285)	284-325	(385-441)
	16	215-250	(292-339)	337-385	(457-522)
7/8	9	315-360	(427-488)	490-550	(664-746)
	14	372-425	(504-576)	575-650	(780-881)
1	8	445-500	(603-678)	685-770	(929-1044)
	14	535-600	(725-813)	830-925	(1125-1254)

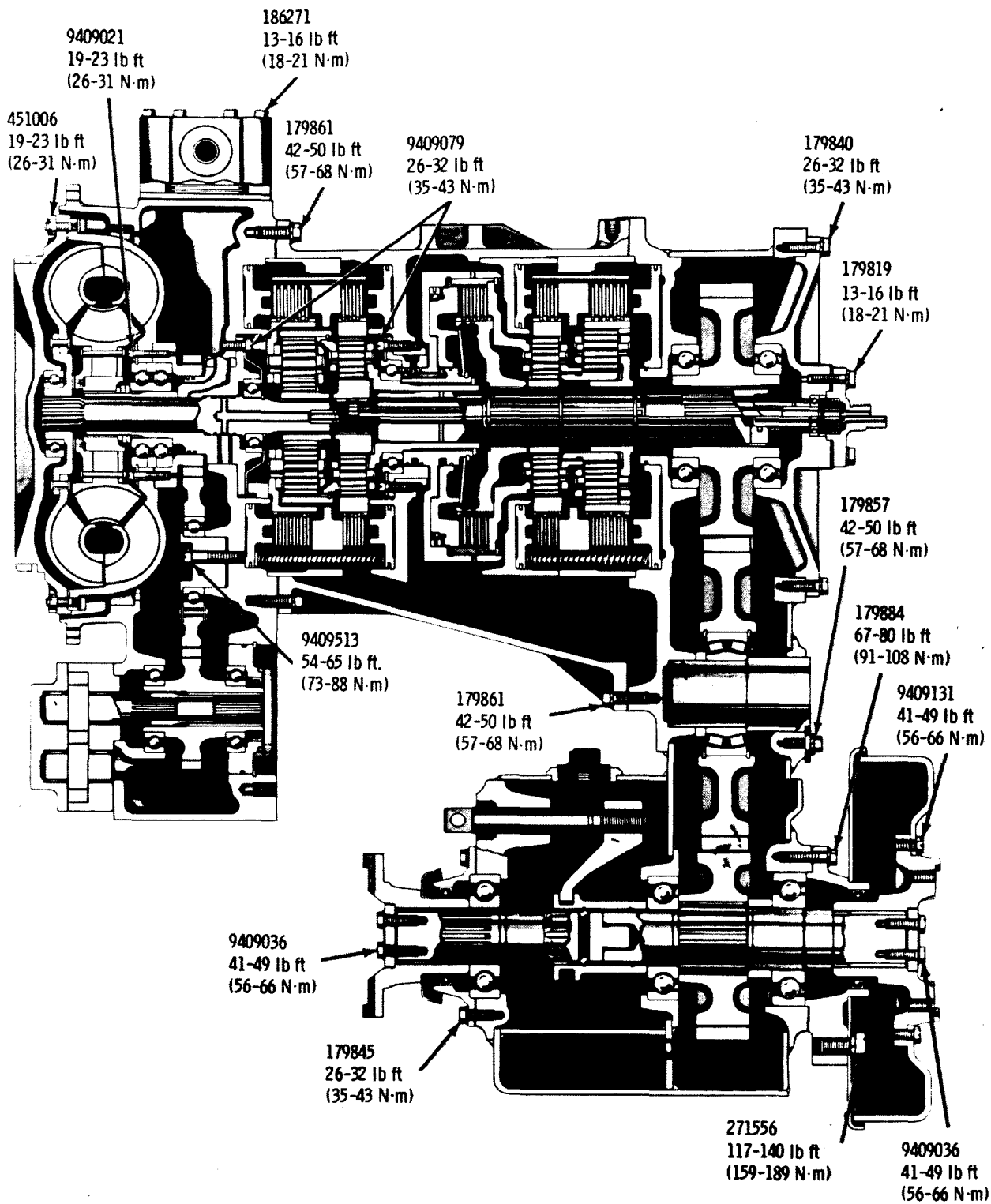


Fig. IV-6. Model 3331-1 transmission—cross section, showing torque tightness of bolts

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Service Information Notes

Section V DISASSEMBLY OF TRANSMISSION INTO SUBASSEMBLIES

1. PREPARATION FOR DISASSEMBLY

a. Major-Minor Subassemblies

(1) This section covers the disassembly of the transmission by removal of subassemblies. Major subassemblies will be rebuilt as outlined in sect. VI. Detail parts and minor subassemblies, which require no further disassembly, should be cleaned and inspected as outlined in sect. IV, para 5.

(2) The procedures for disassembly, outlined below, are arranged so that any model, with any optional equipment, may be disassembled in logical sequence by following the instructions in the order given. Simply disregard the paragraphs which do not apply to the transmission being disassembled, and go on to the next paragraph which does apply.

b. Preliminary Cleaning. The transmission should be cleaned externally and as much oil as possible should be drained from the assembly. Overhaul should be done on a suitable table (fig. IV-1). If necessary to perform some operations on the shop floor, the floor should be clean and smooth.

c. Lifting Major Subassemblies. Lifting slings should be securely attached to prevent dropping and damaging the transmission or

major parts of the transmission. Heavy items should be securely blocked or otherwise supported when there is danger they will slip or fall when disconnected from other parts. Tapped puller or lifter holes are provided in parts which cannot be easily removed by another method.

2. DISASSEMBLY OF CRT 3321-1 OR CRT 3331-1 TRANSMISSION

a. External Subassemblies - Removal

(1) Flatten the lock strip, remove two bolts and the flange retainer washer from each drive flange (fig. V-1). Remove the flanges. Refer to sect. IV, para 7a for removal instructions for interference-fit flanges.

Note: Shims 5 (A, foldout 11) and 22 (A, foldout 7) are used under some flange retainer washers. Tie these to the washer and identify its location.

(2) Remove the 12 bolts which retain the oil cooler assembly. Remove the cooler and cooler gasket. Remove the core from the cooler and remove the core gasket. Refer to fig. V-2.

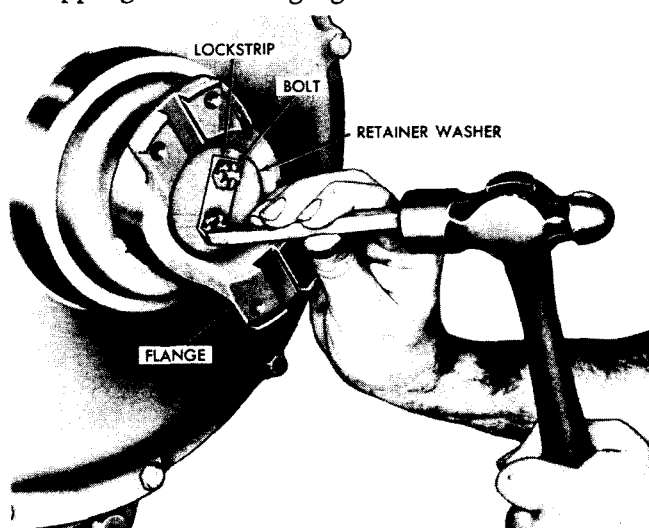


Fig. V-1. Flattening lock strip on drive flange



Fig. V-2. Removing (or installing) oil cooler assembly

(3) Remove 11 bolts and lock washers which secure the control valve body assembly. Remove the valve body assembly and gasket (fig. V-3). Refer to sect. VI, para 1 through 8 for rebuild of control valve body assembly. The paragraph head will indicate the applicable rebuild paragraph.

(4) Remove five bolts and lock washers which retain the main-pressure regulator valve body assembly. Remove the valve body assembly and gasket (fig. V-4). Refer to sect. VI, para 9 and 10 for rebuild of regulator valve body assembly. The paragraph head will indicate the applicable rebuild paragraph.

(5) Remove two bolts and lock washers which retain the converter housing drain tube flange. Remove the rear hose clamp. Remove the flange, hoses, drain tube and remaining clamps as a unit. Remove the flange gasket. Refer to fig. V-5.

b. Parking Brake - Removal

(1) Remove brake drum, if required, from the output drive flange removed in 2a(1), above.

(2) Remove the brake return springs and brake shoe assemblies from the brake back plate (fig. V-6).

(3) Remove the roller from the brake link and remove the cam lever (fig. V-7). Remove three bolts and lock washers which retain the brake back plate. Remove the back plate.

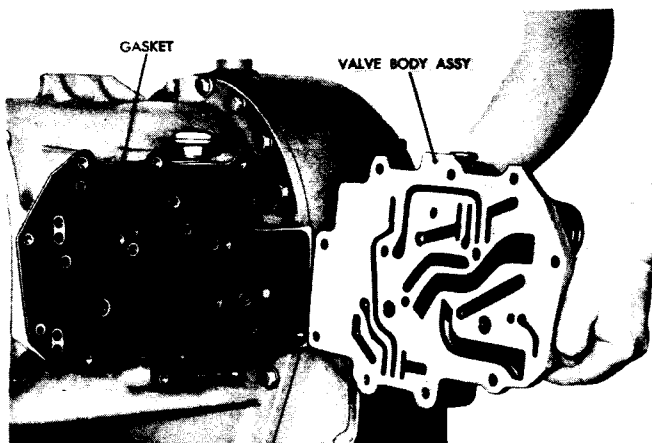


Fig. V-3. Removing (or installing) control valve body assembly

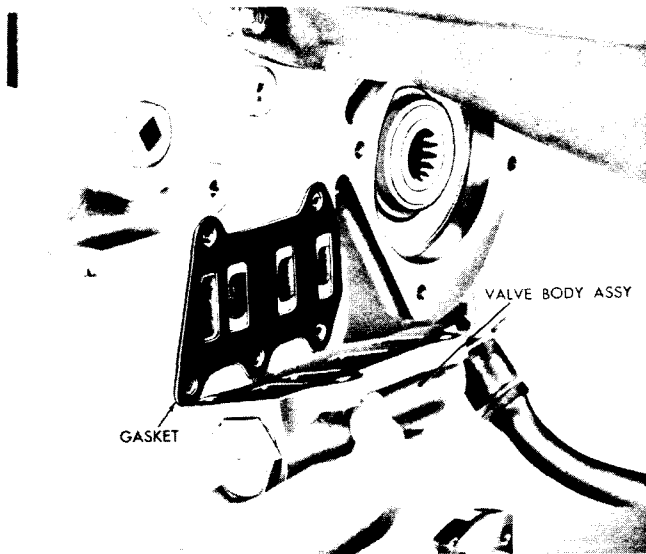


Fig. V-4. Removing (or installing) main-pressure regulator valve body assembly

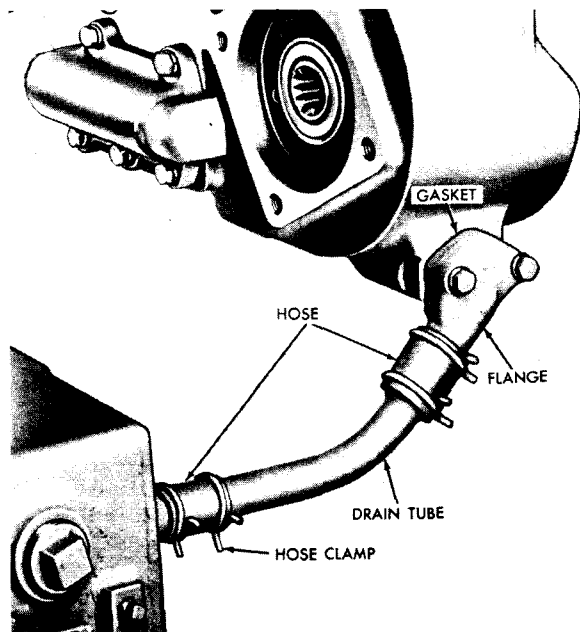


Fig. V-5. Converter housing drain components

c. Input Pressure Pump Assembly - Removal

Remove six bolts and lock washers from the outer perimeter of the input pump assembly (fig. V-8). (Do not remove the four cover bolts closer to the center.) Remove the pump assembly, pump coupling and gasket. If one is used, remove the seal ring from the coupling. Refer to sect. VI, para 11, 12 and 13 for rebuild of the pump assembly. The paragraph head will indicate the applicable rebuild paragraph.

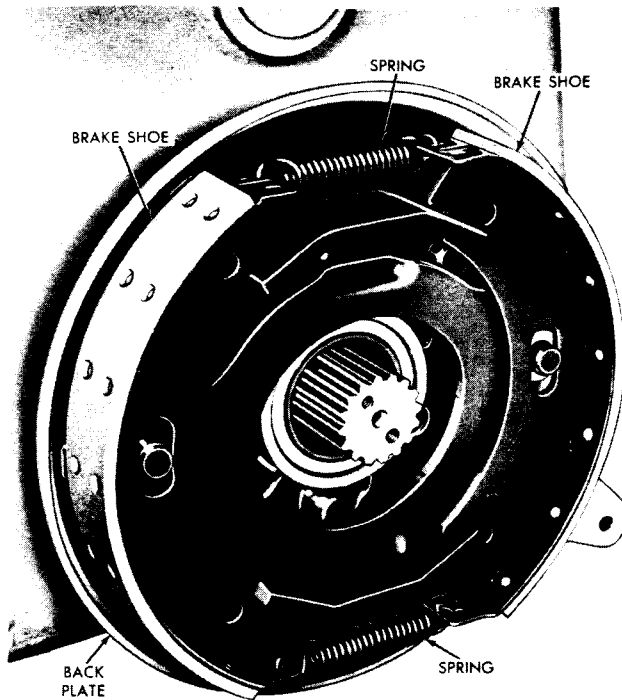


Fig. V-6. Parking brake components

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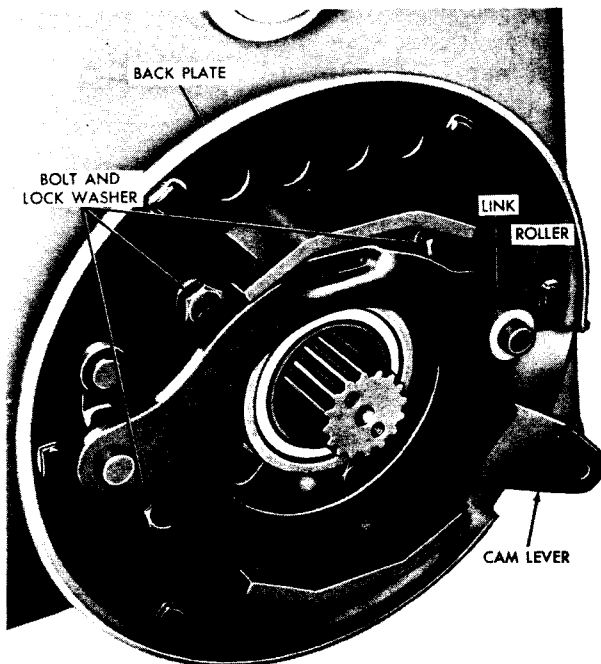


Fig. V-7. Brake cam lever and back plate

S2365

d. Input Drive Components (remote-mount models) – Removal

Note: If the transmission is equipped with an upper- and/or lower-rear output disconnect, refer to instruc-

tions for removal in o(3) and (4), below.

(1) Position the transmission on its rear surface and block it as shown in fig. V-9.

(2) Remove the 12 bolts, nuts and lock washers which retain the transmission front cover (fig. V-9).

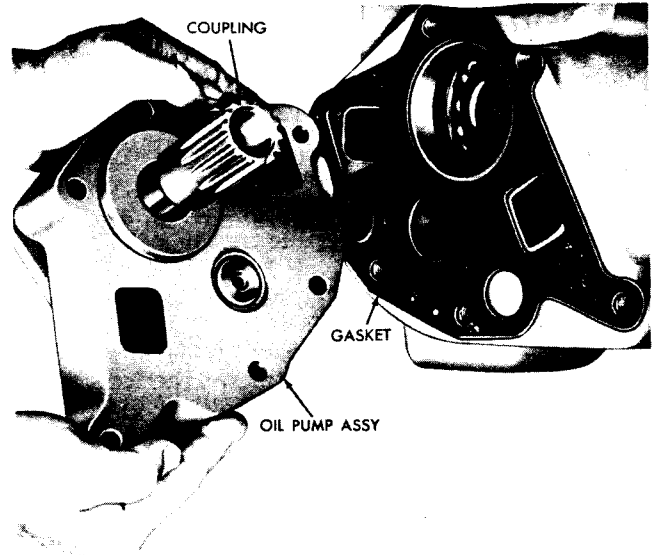


Fig. V-8. Removing (or installing) input pump assembly

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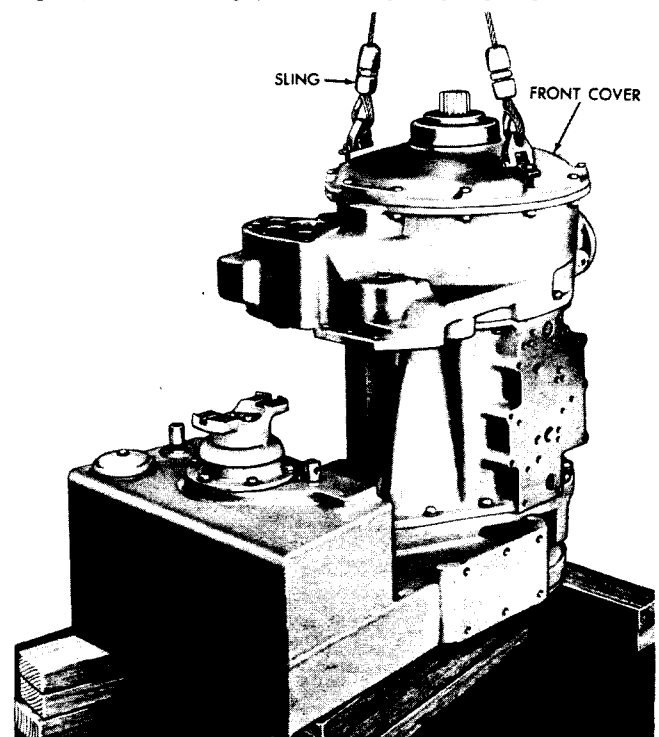


Fig. V-9. Positioning transmission on blocks

S2366

(3) Loosen the cover, using the tapped jackscrew holes in the converter housing.

(4) Remove the front cover and cover gasket. Do not remove the oil seal from the cover unless replacement is necessary.

(5) Install a bolt into one of the holes in the converter housing. Use a wrench, braced against this bolt, to prevent the converter rotating (fig. V-10). Remove 24 self-locking nuts which retain the converter pump cover.

(6) Remove the converter pump cover, using jackscrews in the tapped holes provided.

(7) If parts replacement is required, remove the ball bearing from the input shaft (fig. V-10).

(8) If looseness is evident, or if parts replacement is required, flatten the lock strips and remove six bolts and the input shaft from the converter pump cover (fig. V-10).

e. Input Drive Components (direct-mount models) - Removal

(1) Position the transmission on its rear surface and block it as shown in fig. V-9.

(2) Install a bolt into one of the holes in the converter housing flange. Use a wrench, braced against this bolt, to prevent the con-

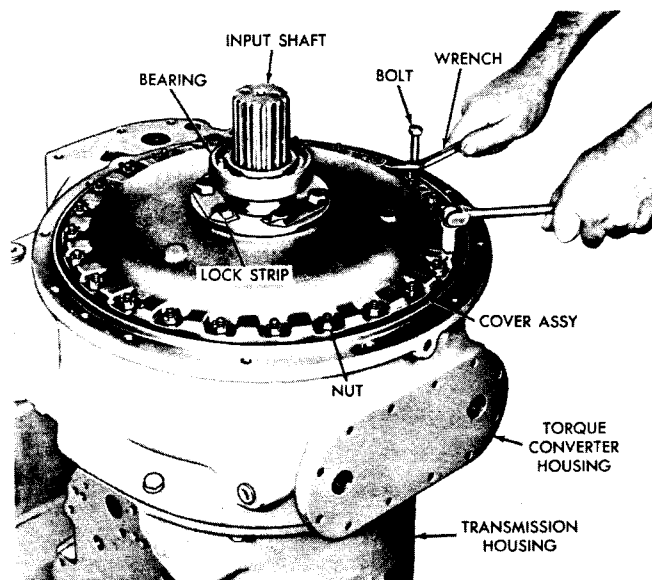


Fig. V-10. Removing converter pump cover bolts

verter rotating. Remove the 24 self-locking nuts which retain the converter pump cover. Refer to fig. V-10.

(3) Remove the converter pump cover, using jackscrews in the tapped holes provided.

(4) Remove the seal ring 18 (A, foldout 7) which is behind the drive teeth of the cover.

(5) If the transmission has a "dry housing" (sect. II, para 2c), an oil seal ring 21 is installed in a groove immediately inside the converter pump bolt circle. Remove the seal ring.

f. Torque Converter Components (3-element converter) - Removal

(1) Lift the torque converter turbine assembly off the converter shaft. Refer to figure V-14. Remove the ball bearing only if replacement is necessary.

(2) Remove the torque converter stator assembly and freewheel roller race (fig. V-11). Refer to sect. VI, para 14 for rebuild of the stator assembly.

Caution: There are 10 freewheel rollers and 10 springs in this assembly which may fall out when the stator as-

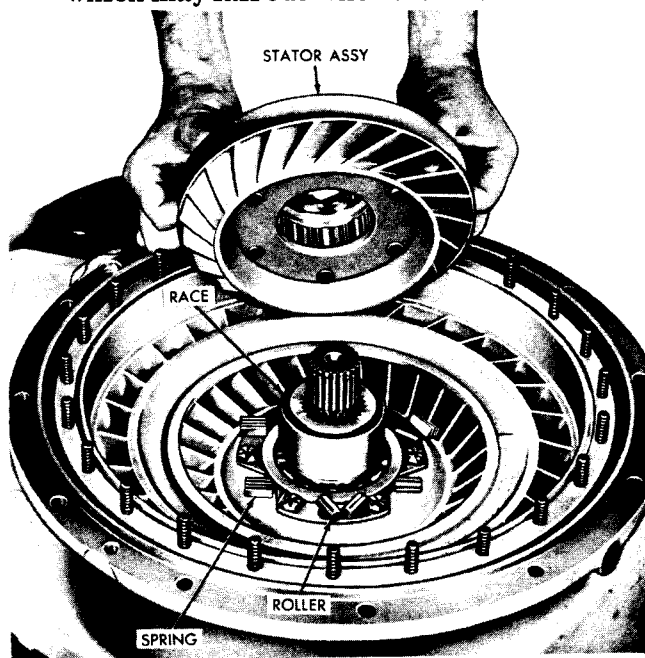


Fig. V-11. Removing torque converter stator assembly

sembly is removed. Be certain that all of these parts are removed from the torque converter pump.

(3) Remove a snap ring, and two splined spacers from the torque converter ground sleeve (fig. V-12).

(4) Flatten the corners of the three lock strips. Remove six self-locking bolts and the lock strips (fig. V-12). Do not remove the bearing retainers.

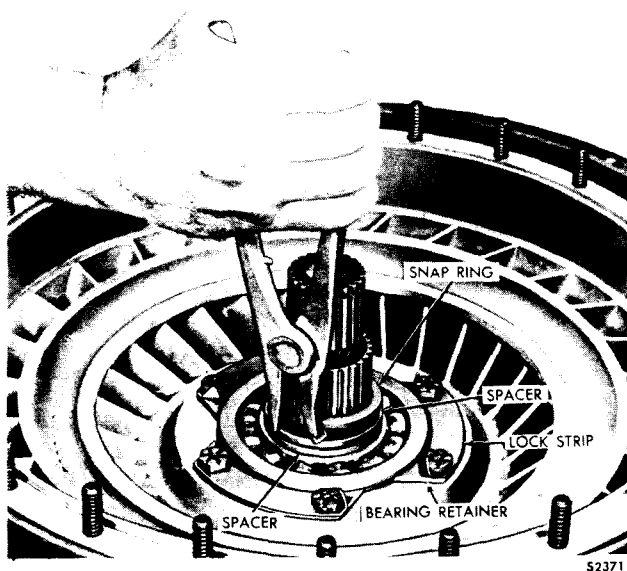


Fig. V-12. Removing snap ring from ground sleeve

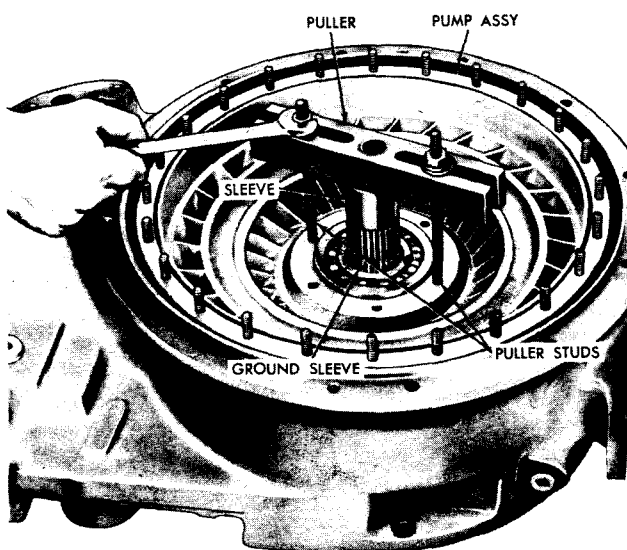


Fig. V-13. Removing converter pump assembly from ground sleeve

(5) Install a steel sleeve over the turbine shaft and against the front of the converter ground sleeve. Install a puller onto the steel sleeve. Then, using two studs, nuts, and flat washers, pull the converter pump assembly from the ground sleeve by tightening the nuts evenly (fig. V-13).

Note: The steel sleeve must have a minimum length of 1 3/4 inches (44.5 mm), a minimum inside diameter of 1 5/16 inches (33.4 mm) and a maximum outside diameter of 1 3/4 inches (44.5 mm). The studs must be 5/16 inch (8 mm) in diameter and have a minimum thread length of 1/2 inch (13 mm) at one end. The overall length must be sufficient to install as shown in fig. V-13. The threads at the upper ends of the studs must be of sufficient length to allow a minimum nut travel of 1 1/4 inch (31.7 mm) when the nuts are tightened. Threads are 5/16-24.

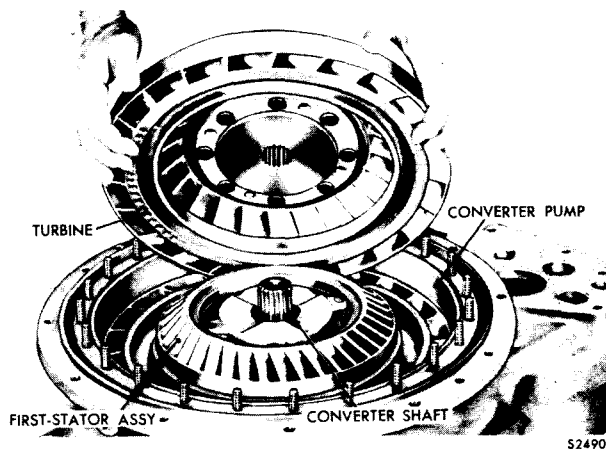


Fig. V-14. Removing torque converter turbine assembly

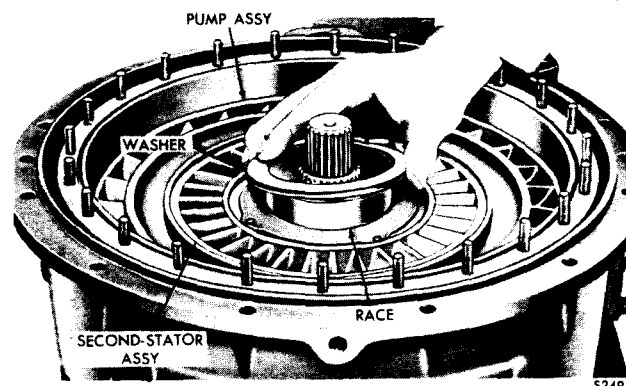


Fig. V-15. Removing (or installing) bronze spacing washer

(6) Disassemble the converter pump assembly 14 (B, foldout 7) by removing the bearing retainers and tapping the accessory drive gear 17 and bearing 13 out of the converter pump. Remove the converter pump gasket. Tap the bearing out of the accessory drive gear. Refer to sect. VI, para 15 for rebuild of the converter pump assembly.

g. Torque Converter Components
(4-element converter) - Removal

(1) Lift the torque converter turbine assembly off the converter shaft (fig. V-14). Remove the ball bearing only if replacement is necessary.

(2) Remove the first-stator assembly (fig. VII-31).

Caution: There are eight freewheel rollers and eight springs in each stator assembly. These rollers and springs may fall out when the stators are removed. Be certain that all of these parts are removed from the torque converter pump.

(3) Remove the bronze spacing washer (fig. V-15).

(4) Remove the second-stator assembly. Refer to sect. VI, para 16 for rebuild of the stator assemblies.

(5) Remove the freewheel roller race (fig. VII-30).

(6) Remove the snap ring and the stator thrust washer (fig. VII-30).

(7) Remove the spacer from the ground sleeve (fig. V-16).

(8) Flatten the three lock strips and remove six bolts (fig. V-16).

(9) Using a sleeve, puller, two studs, nuts and flat washers, pull the torque converter pump assembly from the ground sleeve.

Note: The pump assembly may be removed by the method described in f (5), above, and illustrated in fig.

V-13. The same sleeve and puller may be used, but the studs must have 1/2-20 threads at their lower ends.

(10) Tap the pump bearing 19 (B, foldout 7) and accessory drive gear 18 out of the converter pump. Remove the converter pump gasket. Tap the bearing out of the accessory drive gear. Refer to sect. VI, para 15 for rebuild of the converter pump assembly.

h. Torque Converter Housing
Assembly - Removal

(1) Remove the 13 bolts and lock washers which secure the torque converter housing to the transmission housing (fig. V-10).

(2) Remove the torque converter housing assembly and gasket (fig. VII-27).

Caution: Support the reverse-range clutch piston in the rear of the housing to prevent its falling out. Also, should the aluminum spacer which positions the reverse-range planetary carrier come out with the converter housing, remove it. Refer to sect. VI, para 17 for rebuild of the converter housing assembly.

i. Forward and Reverse Components - Removal

(1) If not previously removed (see h(2), above), remove the aluminum spacer 6 (A, foldout 9) which positions the reverse-range planetary carrier assembly.

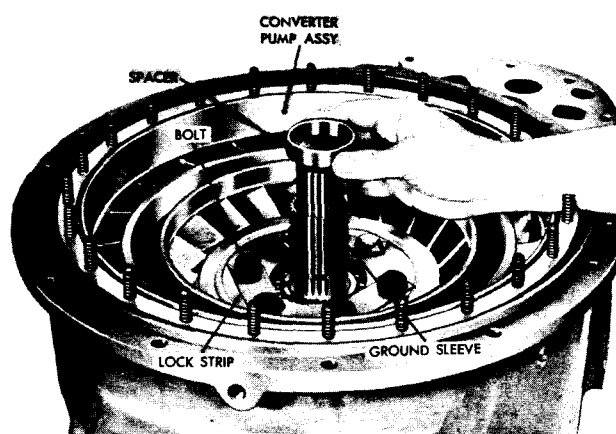


Fig. V-16. Removing (or installing) pump spacer

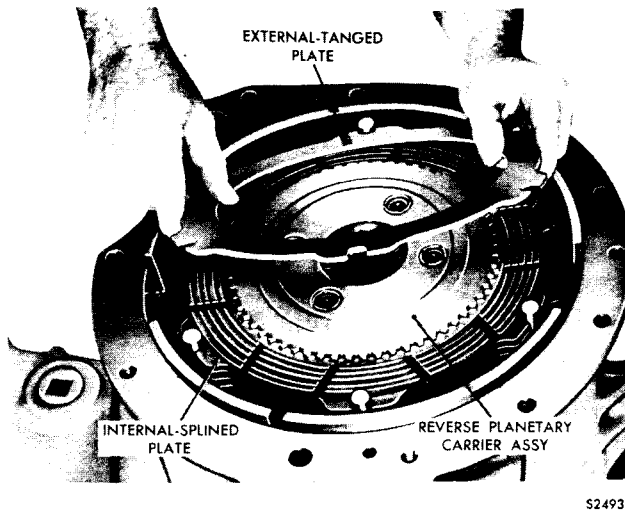


Fig. V-17. Removing (or installing) reverse-range clutch plates

(2) Remove 12 forward-reverse clutch piston return springs and pins (fig. VII-27).

(3) Remove five external-tanged and four internal-splined reverse-range clutch plates (fig. V-17).

(4) Remove the reverse-range planetary carrier assembly and the remaining internal-splined clutch plate (fig. V-17). Refer to sect. VI, para 18 for rebuild of the reverse-range planetary carrier assembly.

(5) Remove the forward and reverse sun gear (fig. VII-26) and the bronze thrust washer beneath it.

(6) Remove the forward and reverse clutch anchor pin (fig. VII-25).

(7) Remove the forward and reverse clutch anchor assembly (fig. VII-25). Refer to sect. VI, para 19 for rebuild of the anchor assembly.

(8) Remove two external-tanged and two internal-splined forward clutch plates (fig. VII-24).

Note: The forward carrier, ring gear, and two remaining forward clutch plates cannot be removed until the range gears and clutches are removed from the rear of the transmission housing. Refer to n, below, for removal instructions.

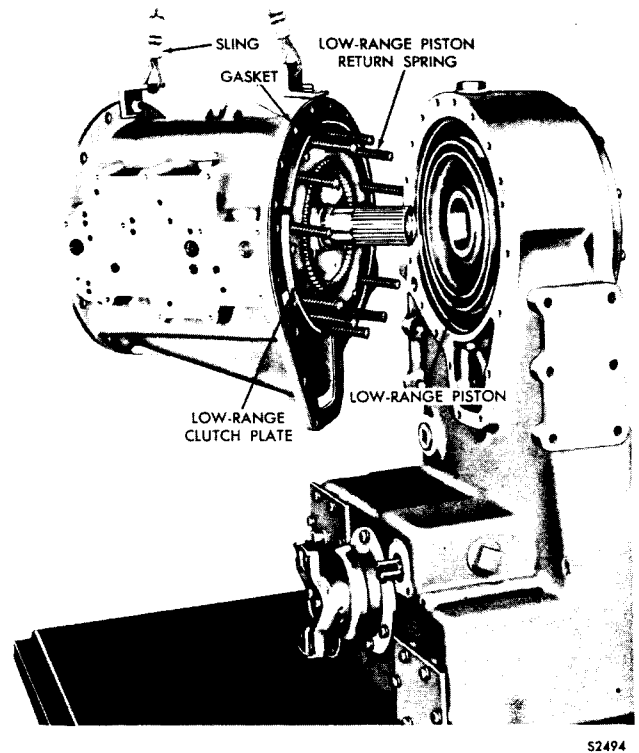


Fig. V-18. Removing transmission housing assembly

j. Transmission Housing – Removal

(1) Position the transmission upright. Attach a sling to the transmission housing (fig. V-18).

Note: If the transmission is equipped with a governor drive (items 2 through 13, B, foldout 11), it should be removed before proceeding with operation (2), below. Remove four bolts 12, lock washers 13, adapter 11, spacer 8, and gasket 10. Then withdraw shaft assembly 2 from the rear of the transmission. If the transmission is equipped with a speedometer drive (items 14 through 24), it may be removed in a similar manner.

(2) While supporting the housing with a hoist, remove the 18 bolts and lock washers which retain the housing to the transfer case.

Note: Leave four equally spaced bolts while removing the others. Then loosen these four bolts evenly to relieve the compression of the clutch piston return springs.

(3) Carefully separate the transmission housing section from the transfer housing section to avoid dropping clutch piston return springs and pins, and the low-range clutch plates (fig. V-18).

(4) While the transmission housing assembly is suspended, remove the 12 clutch piston return springs and pins. Remove also two external-tanged and one internal-splined, low-range clutch plates (fig. V-18).

Note: CRT 3321-1 transmissions do not include the rear planetary assembly and clutch which serve for low range in CRT 3331-1 transmissions. Therefore, when disassembling CRT 3321-1 models, disregard the instructions for removal of clutch plates in (4), above. Also, remove from the transfer housing, spacer 69 (A, foldout 10), which replaces the low-range clutch piston assembly.

(5) Position the transmission housing, front downward, on blocks. Refer to fig. V-20. Leave sufficient room to remove the forward-range planetary carrier assembly from the transmission housing. This will require a minimum of 4 inches of blocking.

k. Low-range Components - Removal

Note: The following instructions apply to the CRT 3331-1. When dis-

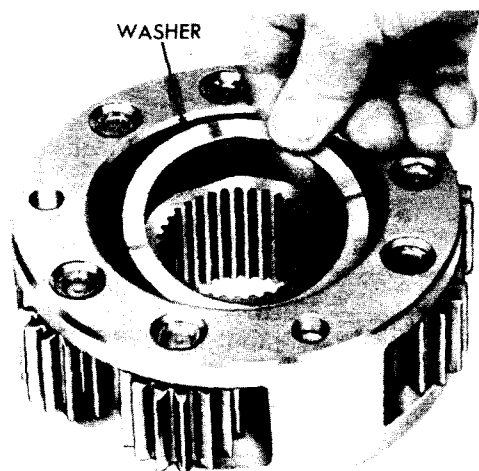


Fig. V-19. Removing (or installing) low-range planetary carrier thrust washer

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assembling CRT 3321-1 transmissions, disregard all operations in this subparagraph except (4) and (6), below.

(1) Remove the low-range ring gear (fig. VII-19).

(2) Remove the remaining four internal-splined and three external-tanged low-range clutch plates (fig. VII-19).

(3) Remove the snap ring which retains the low-range planetary carrier assembly to the transmission main shaft (fig. VII-18).

(4) Remove the high- and low-range clutch anchor pin (fig. VII-18).

(5) Remove the low-range planetary carrier assembly. Remove the thrust washer from the front side of the carrier (fig. V-19). Refer to sect. VI, para 20 for rebuild of the carrier assembly.

Note: This thrust washer may remain on the low-range sun gear, in the transmission housing. If so, remove it.

(6) Remove the high- and low-range clutch anchor assembly (fig. VII-17). Refer

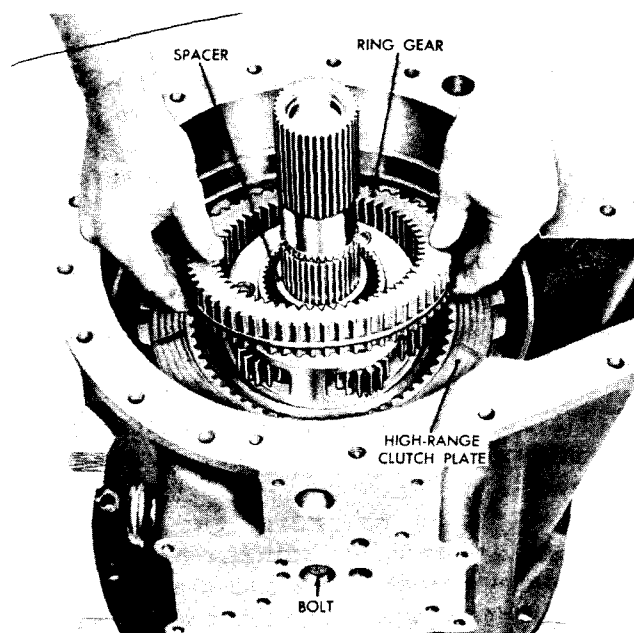


Fig. V-20. Removing (or installing) high-range planetary ring gear

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to sect. VI, para 19 for rebuild of the anchor assembly.

(7) In earlier models, remove the low-range sun gear (fig. VII-17). In later models, the sun gear will remain with high-range planetary carrier assembly 33 (A, foldout 10).

1. High-range Components – Removal

(1) Remove two internal-splined and two external-tanged high-range clutch plates (fig. VII-17).

(2) Remove the high-range planetary ring gear (fig. V-20). Remove the remaining internal-splined plate and external-tanged plate. Remove the bolt and lockwasher which anchors the high-range clutch piston housing. These parts are located in a recess in the valve body mounting pad.

(3) Remove the high-range clutch piston housing and piston (fig. VII-16). Refer to sect. VI, para 21 for rebuild of the piston and housing assembly.

(4) Remove the snap ring which retains the high-range planetary carrier assembly in intermediate-range clutch drum (fig. V-21).

(5) Remove the high-range planetary carrier assembly (fig. V-21). Refer to sect.

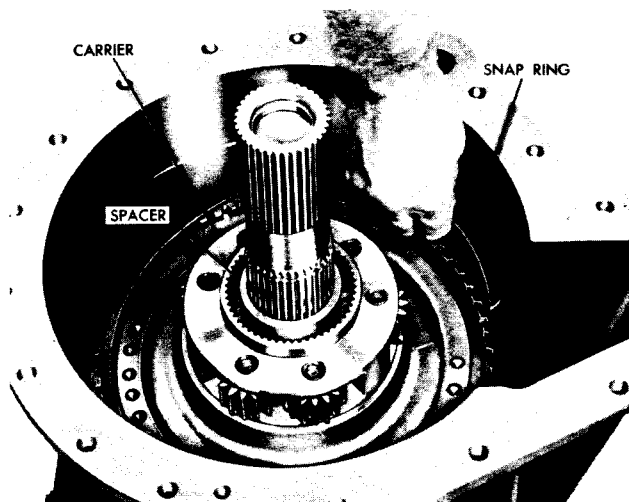


Fig. V-21. Removing (or installing) high-range planetary carrier assembly snap ring

VI, para 22 for rebuild of the high-range planetary carrier assembly.

(6) Remove the high-range sun gear spacer (or snap ring – see note, below) from the transmission main shaft (fig. V-21).

Note: Transmissions prior to serial number 24029 include the spacer illustrated in fig. V-21. Effective with serial number 24029, a snap ring, retaining the high-range planetary sun gear to the transmission main shaft, is used.

(7) Remove the high-range planetary sun gear (fig. VII-15).

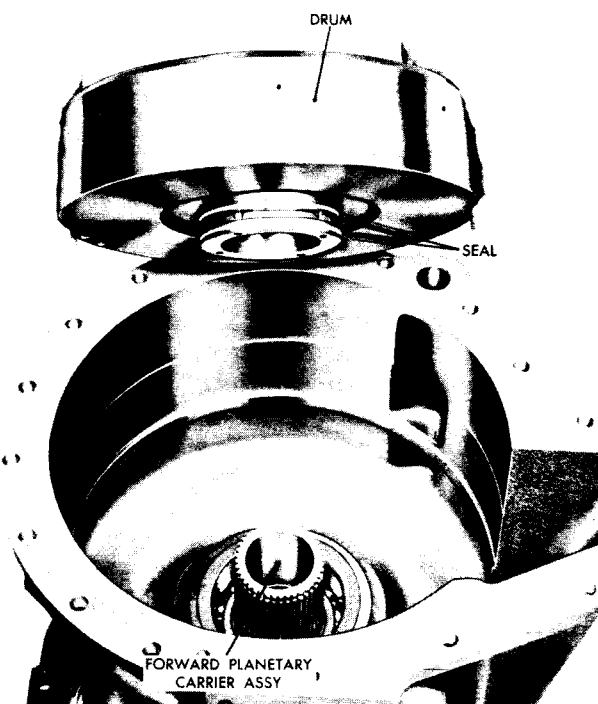


Fig. V-22. Removing (or installing) intermediate-range clutch drum assembly

m. Intermediate-range Components – Removal

(1) Remove the intermediate - range clutch hub from the transmission main shaft (fig. VII-15).

(2) Remove the transmission main shaft assembly (fig. VII-14). Refer to sect. VI, para 23 for rebuild of the main shaft assembly.

(3) Remove four internal-splined and three external-tanged intermediate-range clutch plates (fig. VII-14).

Note: Before proceeding with procedure (4), below, place wood blocks or a thick cloth pad beneath the transmission housing. This will protect the forward planetary carrier assembly against damage should it fall when the snap ring is removed in (4), below, or when it is driven out as outlined in n(1), below.

(4) Remove the smaller snap ring, which retains the intermediate-range clutch drum to the hub of the forward planetary carrier assembly (fig. VII-14).

(5) Remove the intermediate-range clutch drum assembly (fig. V-22). Refer to sect. VI, para 24 for rebuild of the clutch drum assembly.

n. Forward Planetary Carrier and Related Components - Removal

(1) Place a block of soft metal or hard wood on the hub of the forward planetary. Using a heavy drift and hammer, drive the forward planetary carrier out of the ball bearing (fig. V-23).

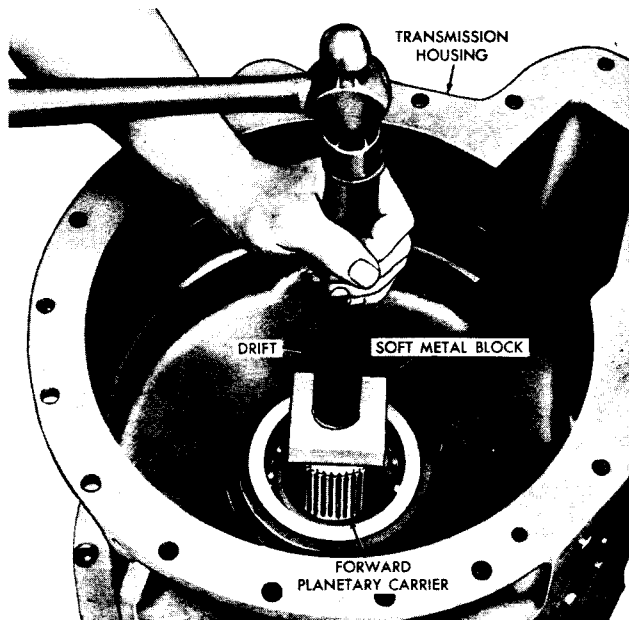


Fig. V-23. Removing forward planetary carrier assembly

(2) Lift the transmission housing off the forward planetary carrier and other components removed in (1), above, and in fig. V-24.

Caution: Because of the necessarily tight fit of the hub of the forward planetary carrier to the bore of the ball bearing, the bearing retainers usually bend when the carrier is driven from the bearing. Thus, it is important that the retainers and bearing be removed and inspected before transmission is reassembled. Refer to sect. VI, para 26.

(3) Remove two clutch plates and the forward planetary ring gear from the carrier assembly (fig. V-24).

(4) Remove the snap ring 36 (A, fold-out 9) and reverse planetary ring gear 45 from the forward planetary carrier assembly 37. Refer to sect. VI, para 25 for rebuild of the carrier assembly.

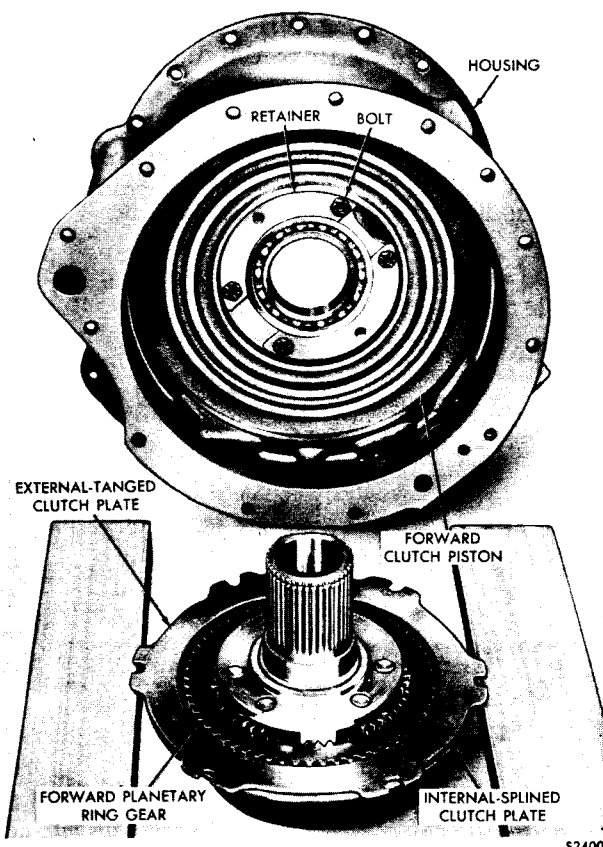


Fig. V-24. Forward planetary carrier assembly and related components

(5) Remove the forward clutch piston assembly from the transmission housing (fig. V-24). Refer to sect. VI, para 21 for rebuild of the piston assembly, and to para 26 for rebuild of the transmission housing assembly.

o. Transfer Housing Assembly Components - Removal

(1) Remove the low-range clutch piston assembly and hook-type seal ring from the front of the transfer housing (fig. VII-10). This procedure applies only to CRT 3331-1 models. Refer to sect. VI, para 21 for rebuild of the piston assembly.

(2) Position the transfer housing assembly upright.

Note: Transfer housings differ as to construction. Earlier housings were cast as a unit and were fitted with some components not found on later housings. Six bolts retain the oil strainer in earlier models. Later housings are weld-fabricated. The oil strainer in later housings is retained by a single central stud or bolt. In addition, the transfer housing assembly may include any of several output shaft or output disconnect options. All of these differences are covered in the procedures outlined in (3) through 25, below.

(3) If the transmission is equipped with an upper-rear output disconnect, remove six bolts 1 (A, foldout 12) and lock washers 2. Remove the output assembly, gasket 4, and coupling 9. Refer to sect. VI, para 27 for rebuild of the output disconnect assembly.

(4) If the transmission is equipped with a lower-rear output disconnect, remove six bolts 3 (A, foldout 12) and lock washers 2. Remove the output assembly, gasket 4, and adapter 27, gasket 26, and coupling 9. Refer to sect. VI, para 27, for rebuild of the output disconnect assembly.

(5) If not previously removed, remove the front-output flange (refer to fig. V-25 and to para a(1), above).

(6) On cast housings, remove the 12 bolts and lock washers which retain the in-

spection covers at the front of the transfer housing. Remove the covers and gaskets (fig. V-25).

(7) On cast housings, remove the six bolts and lock washers which retain the oil strainer assembly. Remove the strainer assembly and gasket (fig. V-25).

(8) On cast or welded housings, remove the six bolts and lock washers which secure the front bearing retainer. Remove the retainer and gasket (fig. V-25). Do not remove the oil seal unless replacement is necessary.

(9) On cast or welded housing which include a front-output disconnect, remove the disconnect shaft by unscrewing it (counterclockwise) (fig. V-25).

Note: On cast or welded housings which include a one-piece output shaft, refer to paragraph 4, below.

(10) Remove the front output shaft, bearing, and disconnect coupling assembly (fig. VII-7). Remove the bearing spacer which is present when a heavy-duty output shaft is used.

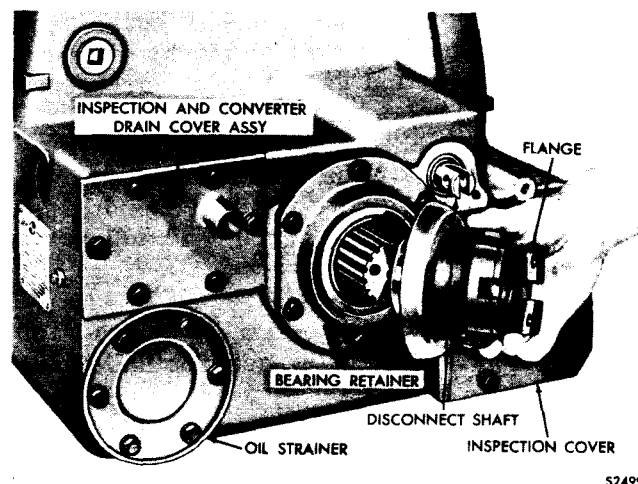
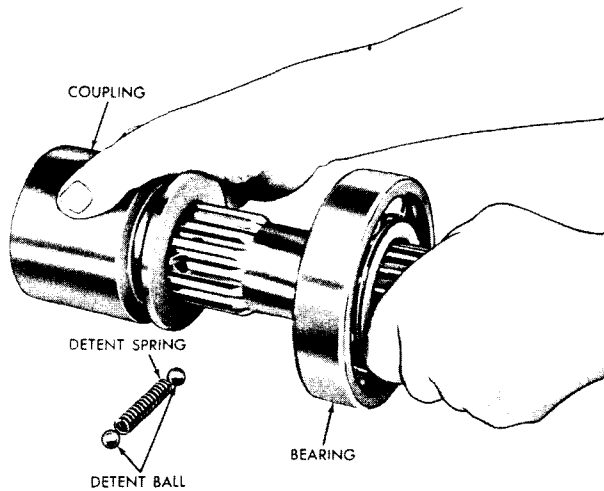


Fig. V-25. Removing (or installing) front output flange

(11) Remove the disconnect coupling, two detent balls, and detent spring from the output shaft. Remove the bearing only if necessary (fig. V-26).

Note: Do not remove the internal-snap ring 18 (A, foldout 11) from coupling 17 on models which do not include disconnect controls.



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Fig. V-26. Removing (or installing) front output flange disconnect coupling

(12) Remove the shifter fork from the transfer housing on those transmissions equipped with disconnect controls.

(13) On welded transfer housings, remove the center bolt which retains the oil strainer components. Remove the oil strainer assembly (fig. VII-5).

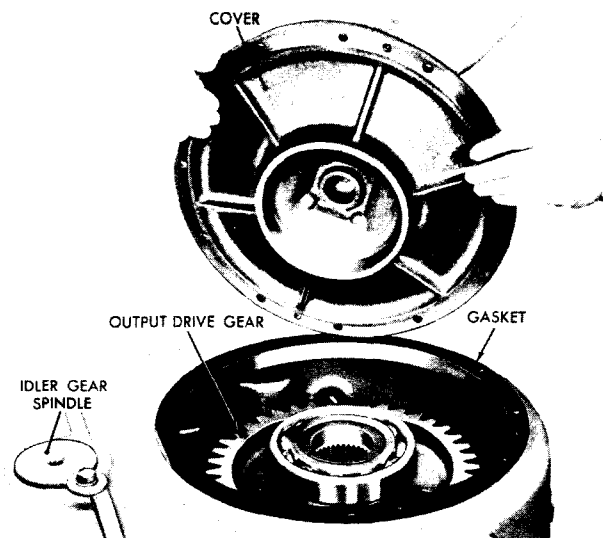
(14) Position the transfer housing assembly, front downward, on blocks. Remove the rear cover and gasket. Use jackscrews in the tapped holes provided (fig. V-27).

(15) Remove the output drive gear (fig. V-27). Do not remove the ball bearing assemblies from the hub of the gear unless replacement is necessary.

(16) Remove the bolt and washers which retain the transfer idler gear spindle (fig. V-27).

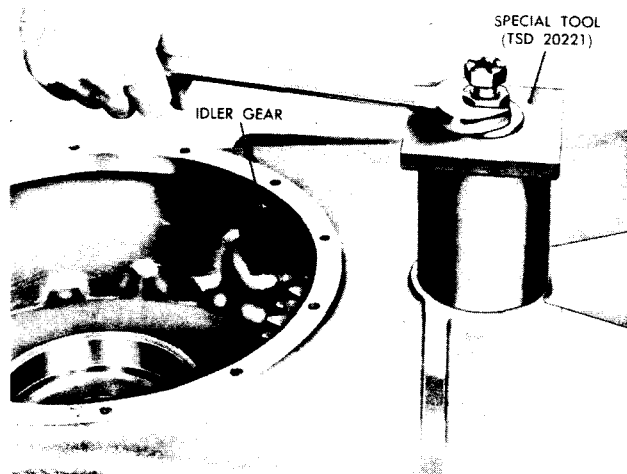
(17) Using a special tool (sect. IV, para 2b(3)), remove the transfer idler gear spindle (fig. V-28).

(18) Remove the transfer idler gear and bearing assembly, and idler gear spacer (fig. VII-3). Do not remove the bearing assembly from the idler gear unless replacement is necessary. The bearing may be removed by removing either of the internal-snap rings which retain it and pressing the bearing out.



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Fig. V-27. Removing (or installing) transfer housing rear cover



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Fig. V-28. Removing transfer idler gear spindle

(19) Remove the bolts and lock washers which retain the rear-output shaft bearing retainer 42 (B, foldout 10).

Note: Earlier transfer housings have eight bolts in the bearing retainer. Later assemblies have six bolts.

(20) Remove the bearing retainer and gasket. Do not remove the oil seal from the retainer unless replacement is necessary.

Note: Assemblies which include a lower-rear output disconnect (removed in (4), above), do not have an oil seal in the retainer. In assemblies which have a covered rear-out-

put shaft, do not remove the cap from the bearing retainer unless replacement is necessary.

(21) Position the transfer housing upright and, using a soft drift, drive the rear-output shaft, bearing and spacer far enough toward the rear to free it from the output transfer driven gear and the bearing remaining in the transfer housing. Remove the shaft, bearing and spacer (fig. V-29). Refer to sect. VI, para 28 for rebuild of the rear-output shaft assembly.

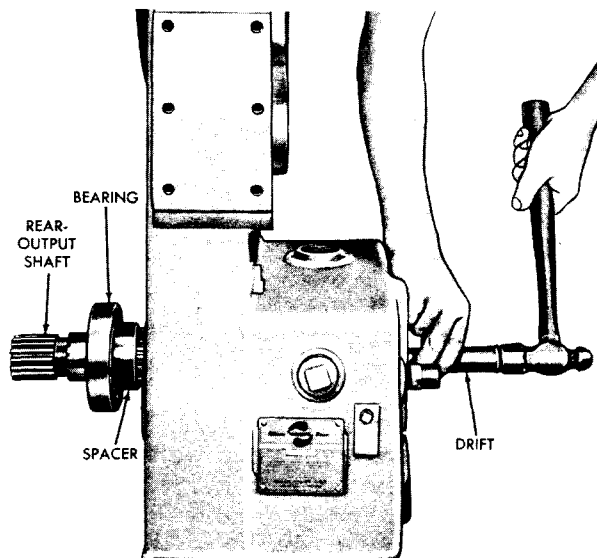


Fig. V-29. Removing rear output shaft, bearing and spacer

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Note: Use a drift with a diameter of 1 1/4 inches (31.7 mm) or larger. Leave the drift in place after removing the shaft, to support the transfer driven gear until the housing is repositioned (see (22), below).

(22) Position the transfer housing, front downward, and remove the drift and the transfer driven gear (fig. VII-1).

(23) Remove the bearing remaining in the transfer housing (fig. VII-1).

Note: Assemblies which include a heavy-duty rear-output shaft will include a spacer under the bearing which must be removed after the bearing is removed.

(24) Remove remaining plugs in the transfer housing, if necessary for cleaning or repair.

(25) Do not remove the front-output disconnect shaft oil seal 27 (A, foldout 11) unless replacement is necessary.

Note: In assemblies which do not include a front-output disconnect, a plug is fitted to the opening in the housing. Do not remove this plug unless replacement is necessary.

3. DISASSEMBLY OF CRT 3321-3 OR CRT 3331-3 TRANSMISSION

a. Basic Similarities of -1 and -3 Models

(1) Because the 3321-1 and 3331-1 models have major features which are identical to 3321-3 and 3331-3 models, most of the disassembly instructions in para 2, above, apply also to the -3 models. The transmissions are identical forward of their mounting to the output section, except for the input pressure pump and method of draining the torque converter housing.

(2) In -1 models, oil from the torque converter housing drains into the sump through an oil return tube. In -3 models, a section of the oil pump scavenges the oil from the housing and directs to the sump through an oil return tube.

b. Differences in Output Sections

(1) Because of the differences in construction between the -1 (transfer case) models and the -3 models, additional instructions for disassembly of output section for -3 models are provided, below. Therefore, instructions in para 1 and in para 2, through n, above, will apply generally to -3 models. Where they do not apply, proper instructions appear in c through q, below.

(2) To disassemble a -3 model transmission (fig. I-3), follow the steps outlined. Although references to many disassembly pro-

cedures will refer to transfer case models, and illustrations will show such models, the referenced procedures will be identical. Referenced instructions for CRT 3321-1 will apply to CRT 3321-3; referenced instructions for CRT 3331-1 will apply to CRT 3331-3.

c. External Subassemblies - Removal

(1) Follow instructions 2a(1) through (4), above.

(2) Remove four bolts and lock washers which retain the return tube 48 (B, fold-out 12) to the input pressure pump.

(3) Remove the rear hose clamp 45 from the connecting hose at the rear of the return tube 48. Remove the drain tube, hose, and remaining clamp as a unit. Remove the return tube flange gasket.

d. Parking Brake - Removal. Follow instructions in para 2b(1) through (3), above.

e. Input Pressure Pump Assembly - Removal. Follow instructions in para 2c, above.

f. Input Drive Components (remote-mount models) - Removal. Follow instructions in para 2d, above.

g. Input Drive Components (direct-mount models) - Removal. Follow instructions in para 2e, above.

h. Torque Converter Components (3-element converter) - Removal. Follow instructions in para 2f, above.

i. Torque Converter Components (4-element converter) - Removal. Follow instructions in para 2g, above.

j. Torque Converter Housing Assembly - Removal. Follow instructions in para 2h, above.

k. Forward and Reverse Components - Removal. Follow instructions in para 2i, above.

l. Transmission Housing - Removal. Follow instructions in para 2j, above.

Note: Block the lower front of the output section (forward of sump) securely to prevent the output section from tipping over when the housing assembly is removed. Also, remove a spacer from the transmission main shaft immediately after the housing is separated from the output section.

m. Low-range Components - Removal. Follow instructions in para 2k, above.

n. High-range Components - Removal. Follow instructions in para 2l, above.

o. Intermediate-range Components - Removal. Follow instructions in para 2m, above.

p. Forward Planetary Carrier and Related Components - Removal. Follow instructions in para 2n, above.

q. Components from Transmission Sump Adapter - Removal.

Note: Some CRT 3321-3 and CRT 3331-3 transmissions were manufactured without a rear bearing, bearing retainer, and other components at the rear output location. Also, some were manufactured without an oil sump. Such components, or components which replace these items, were supplied by the user of the transmission. The removal and installation of such components will be covered in service instructions for the vehicle or equipment in which the transmission is installed. For transmissions which were fully equipped, follow the instructions below.

(1) Remove the low-range clutch piston (3331-3 only) from sump adapter 29 (B, fold-out 12) and position the sump adapter, front downward. Remove eight bolts 9 and lock washers 8 which retain rear-bearing retainer 7. Refer to sect. VI, para 21 for rebuild of the clutch piston assembly.

(2) Remove the bearing retainer and gasket. Do not remove seal 10 from the retainer unless replacement is necessary.

Note: Pin 5 (B, foldout 12) may have fallen out of sleeve 4 while the sump adapter was being moved. Locate it and remove it.

(3) Remove sleeve 4, bearing 3, and washer 2 from sump adapter 29.

(4) Remove crown nut 44 and washer 43 which retain oil strainer cover 42. Remove cover 42, gasket 41, retainer 40, and oil strainer 39.

(5) Remove the two nuts 58 (B, foldout 12) and lock washers 57 from bolts 35 retaining the oil suction tube seal plate 34.

(6) Remove three bolts 31 and lock washers 30 at the rear of sump adapter 29.

(7) Remove four bolts 54 and lock washers 55 at the front of the sump adapter.

(8) Remove the oil sump and gasket from the sump adapter.

(9) Remove suction tube oil seal 33, seal plate 34 and bolts 35 from the sump.

(10) Remove plugs from the sump if necessary for cleaning.

4. REMOVING ONE-PIECE OUTPUT SHAFT

a. For transfer housings equipped with a one-piece shaft (fig. VII-33), remove the output drive gear and idler gear as described in (14) through (20), above.

b. Position the transfer housing in an upright position. Support the transfer driven gear, and drive the output shaft toward the front of the housing until it is free of the rear bearing.

c. Remove the shaft and front bearing from the front of the housing. Remove the flange spacer (if used), rear bearing, and transfer driven gear from the rear of the housing.

d. Remove the remaining plugs in the housing, if necessary for cleaning or replacement.

Service Information Notes

Section VI REBUILD OF SUBASSEMBLIES

1. CONTROL VALVE BODY ASSEMBLY (Earlier style inching control without clutch cutoff feature) – REBUILD

a. Disassembly (item 1, B, foldout 13)

(1) Remove plug 22, gasket 23, spring 25, pin 24 and detent ball 26.

(2) Remove plug 5 from valve body 11.

(3) Clean the stem of the forward and reverse control valve 4 to remove rust, paint, dirt and rough spots.

(4) Remove valve 4 by pushing it forward (toward the end of the valve body from which plug 5 was removed).

(5) Remove remaining detent ball 26 and spring 27, which were freed by removal of valve 4.

(6) Position the valve body, flat side upward, on the work bench. Remove spring pin 18.

Note: The spring pin may be removed by using an extractor such as an "Easy-out," or by threading the inside of pin 18 with a 1/4-20 tap and installing a bolt to pull the pin out.

(7) Using a soft metal drift or hardwood dowel, drive sleeve 28 and seal assembly 20 out of valve body 11. Drive against the sleeve, which will force the seal out.

(8) Remove plug 15 (B, foldout 13), gasket 14, spring 12, pin 13 and detent ball 16.

(9) Pull range selector valve 9 out of the valve body. Use a knife blade or other small tool to spread the inner lip of seal 19 when shoulders on the valve tend to hang on the seal.

(10) Remove remaining detent ball 16 and spring 17 from valve body 11.

(11) Remove oil seal 19 from valve body

11. Do not remove plug 6 unless replacement is necessary. If plug 6 must be removed use a hardwood dowel, inserted through the valve bore, to drive it out.

(12) Remove plug 21 from valve body 11.

(13) Bushings 3 and 10 may be removed from valves 4 and 9 if replacement is necessary.

b. Cleaning, Inspection, Wear Limits. Refer to sect. IV, para 5 for cleaning and inspection procedures. Refer to sect. IV, para 8 and to sect. VIII for wear limits information.

c. Assembly (item 1, B, foldout 13)

(1) If bushings 3 or 10 were removed from valves 4 or 9, install new bushings. Press the bushings into the valve stems until they are flush with, or below, the surface of the stems.

(2) Install plug 21 into valve body 11.

(3) Install spring 17 and detent ball 16 into valve body 11.

(4) Depress the ball and spring, and install the range selector valve, notched-end first, into the rear of the valve body bore. Push the valve into the bore until it catches detent ball 16. Remove the tool with which the detent ball was depressed, and push the valve to a detent position.

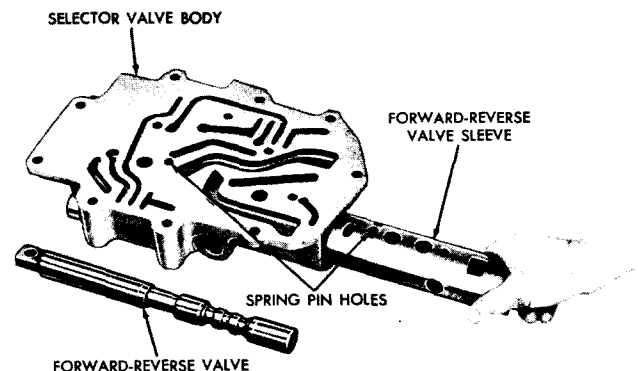


Fig. VI-1. Installing forward-reverse valve sleeve

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(5) Install remaining detent ball 16, spring 12, pin 13, gasket 14 and plug 15.

(6) Install the forward-reverse valve sleeve into the valve body as shown in fig. VI-1. Note the relative positions of the valve body and sleeve, and the openings in the sleeve. The spring pin holes in the body and sleeve must be aligned.

(7) Install spring pin 18 (B, foldout 13). Drive it into the valve body until it seats in the valve sleeve.

(8) Install spring 27 and detent ball 26 into the valve body.

(9) Depress the ball and spring, and install the forward-reverse control valve assembly 2, notched end first, into the rear of the valve body. Push the valve into the bore until it catches detent ball 26. Remove the tool with which the detent ball was depressed, and push the valve to a detent position.

(10) Install remaining detent ball 26, spring 25, pin 24, gasket 23, and plug 22.

(11) Install seal 19 (B, foldout 13), spring-loaded side inward, onto the range selector valve stem.

Note: Optional types of seals are furnished. One type is entirely metal at its outside diameter. The other type has rubber extending to its outside diameter. The depths to which the two types are installed differ. Press the metal OD seal into the valve body until it bottoms. Press the rubber OD seal into the valve body until its outer (rubber) edge is even with the inner end of the valve body chamfer or lacks up to 0.060 inch (1.5 mm) reaching the inner end of the chamfer.

(12) Install seal 20, spring-loaded side inward, onto the forward-reverse control valve. Press the seal into the valve body until it is 0.400 to 0.460 inch (10.2 to 11.6 mm) below the end surface of the valve body.

(13) Press plug 6, closed end first, into the front of the valve body until it bottoms.

(14) Press plug 5 into the front of the valve body until it seats.

2. CONTROL VALVE BODY ASSEMBLY (Early model inching control valve with hydraulic-operated clutch cutoff valve) – REBUILD

a. Disassembly (item 33, B, foldout 13)

(1) Follow instructions in 1a(1) through (13), above.

(2) Remove plug 51 (B, foldout 13) and gasket 55. Plug 54 will be inside plug 51 and removed with it.

(3) Insert a small drift or pin punch into the internal-threaded end of plug 51. Push out plug 54 and remove cup 52 and seal ring 53 from it.

(4) Remove valve 56, spring 58, and pin 57 from the valve body.

b. Cleaning, Inspection, Wear Limits. Refer to sect. IV, para 5 for cleaning and inspection procedures. Refer to sect. IV, para 8 and to sect. VIII for wear limits information.

c. Assembly (item 33, B, foldout 13)

(1) Install pin 57 into spring 58. Install the spring and pin into the recessed end of valve 56.

(2) Install the assembled valve, spring and pin, spring first, into the valve body (fig. VI-2).

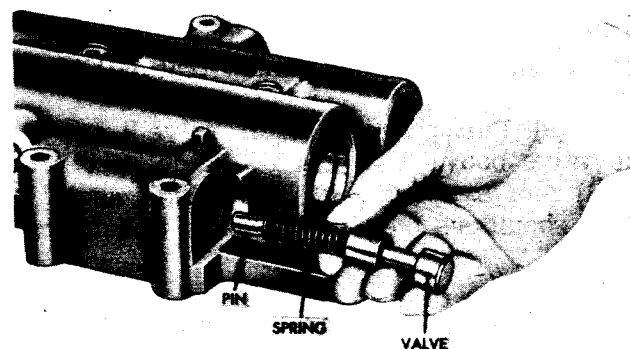


Fig. VI-2. Installing clutch cutoff valve, spring and pin

S2414

(3) Install seal ring 53 (B, foldout 13) and cup 52 onto plug 54. Install plug 54, cup-end first, into retainer plug 51.

(4) Install gasket 55 onto retainer plug 51. Install retainer plug 51 into the valve body.

(5) Complete the assembly by following instructions in 1c (1) through (14), above.

3. CONTROL VALVE BODY ASSEMBLY (Early model inching control valve with air-operated clutch cutoff valve) – REBUILD

a. Disassembly (item 33, B, foldout 13)

(1) Follow instructions in 1a (1) through (13), above.

(2) Remove retainer plug 50 and gasket 55 from the valve body. Plug 49 will be inside retainer plug 50 and removed with it.

(3) Insert a small drift or pin punch into the internal-threaded end of retainer plug 50. Push out plug 49 and remove seal ring 53 from it.

(4) Remove valve 56, pin 57 and spring 58 from the valve body.

b. Cleaning, Inspection, Wear Limits. Refer to sect. IV, para 5 for cleaning and inspection procedures. Refer to sect. IV, para 8 and to sect. VIII for wear limits information.

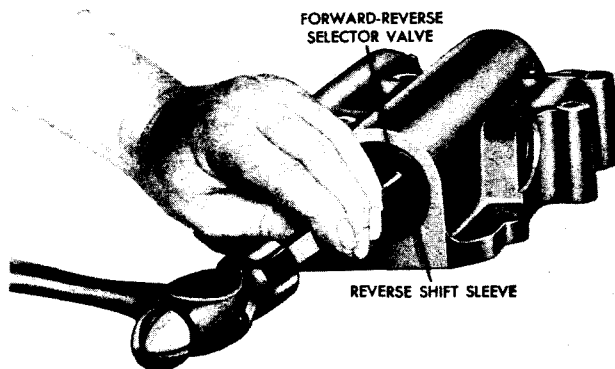


Fig. VI-3. Removing forward-reverse control valve, piston, forward shift sleeve, and oil seal from valve body

c. Assembly (item 33, B, foldout 13)

(1) Install 57 into spring 58. Install the spring and pin into the recessed end of valve 56.

(2) Install the assembled valve, spring and pin, spring first, into the valve body (fig. VI-2).

(3) Install seal ring 53 (B, foldout 13) onto plug 49. Install plug 49, seal ring end first, into retainer plug 50.

(4) Install gasket 55 onto retainer plug 50. Install retainer plug 50 into the valve body.

(5) Complete the assembly by following instructions in 1c (1) through (14), above.

4. CONTROL VALVE BODY (sense-feel type without clutch cutoff feature) – REBUILD

a. Disassembly (item 1, A, foldout 14)

(1) Remove plug 31, gasket 30, spring 29, and detent ball 28 from valve body 16.

(2) Remove plug 2 from valve body 16.

(3) Position the valve body, flat side upward, on the work bench. Remove two spring pins 23.

Note: The spring pins may be removed by using an extractor such as an "Easy-Out," or by threading the insides of the pins with a 1/4-20 tap and installing a bolt to pull the pins out.

(4) Using a hammer and soft metal drift, drive the forward and reverse control valve toward the rear of the valve body (fig. VI-3). This will remove the oil seal 25 (A, foldout 14), shift sleeve 10, piston 5, and valve assembly 7.

(5) Remove remaining detent ball 28 and spring 27 from valve body 16.

(6) Clean the stem of valve 8 thoroughly.

S2502

Then remove oil seal 25, sleeve 10, two snap rings 4 and 6, and piston 5 from valve 8.

(7) Remove reverse shift sleeve 3 by driving in toward the front of valve body 16.

(8) Complete the disassembly by following instructions in 1a (8) through (13), above.

b. Cleaning, Inspection, Wear Limits.
Refer to sect. IV, para 5 for cleaning and inspection procedures. Refer to sect. IV, para 8 and to sect. VIII for wear limits information.

c. Assembly (item 1, A, foldout 14)

(1) Follow instructions in 1c (1) through (5), above.

(2) Install the reverse shift sleeve into the front of the valve body (fig. VI-4). Note the relative positions of the sleeve and valve body, and the openings in the sleeve. The spring pin holes in the body and sleeve must be aligned.

(3) Install one spring pin 23 (A, foldout 14). Drive the spring pin into valve body 16 until it seats in shift sleeve 3.

(4) Install snap ring 6 onto valve 8. Install piston 5 and remaining snap ring 4 onto valve 8.

(5) Install forward shift sleeve 10 onto the rear stem of valve 8. Refer to fig. VI-5 for proper position of the sleeve on the valve.

(6) Install spring 27 (A, foldout 14) and one detent ball 28 into valve body 16.

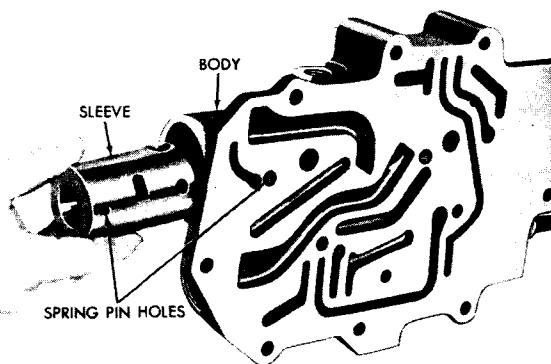


Fig. VI-4. Installing reverse shift sleeve into valve body

S2503

(7) Depress the ball and spring and install the assembled valve, piston and sleeve (fig. VI-5). Note the relative positions of the sleeve, valve and valve body, and the openings in the sleeve. The spring pin holes in the sleeve and valve body must be aligned.

(8) Push the sleeve and valve into the valve body until the valve catches detent ball 28 (A, foldout 14). Then remove the tool with which the detent ball was depressed. Slide the valve to a detent position and align the spring pin holes in the valve body and sleeve 10.

(9) Install remaining spring pin 23, driving it into valve body 16 until it seats in shift sleeve 10.

(10) Install remaining detent ball 28, spring 29, gasket 30 and plug 31 into valve body 16.

(11) Complete the assembly by following instructions in 1c (11) through (14), above.

5. CONTROL VALVE BODY ASSEMBLY (sense-feel type with hydraulic-operated clutch cutoff valve) — REBUILD

a. Disassembly (item 36, A, foldout 14)

(1) Follow instructions in 4a (1) through (8), above.

(2) Follow instructions in 2a (2) through (4), above.

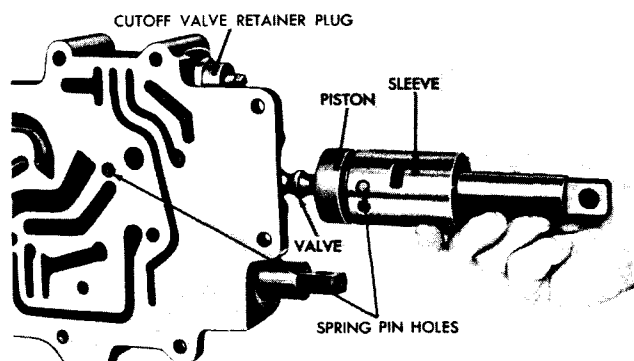
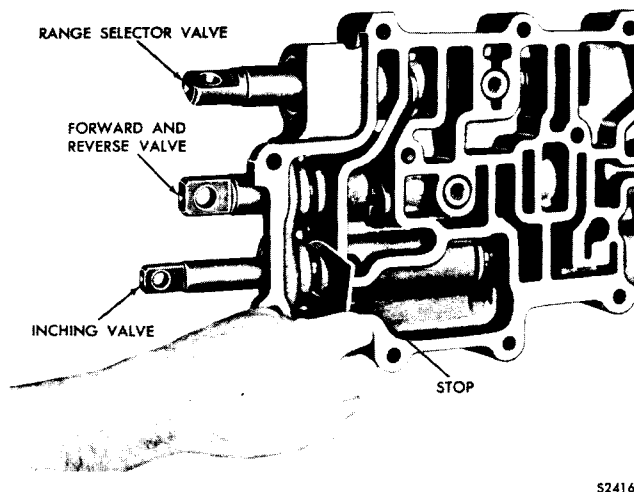


Fig. VI-5. Installing forward-reverse control valve, piston, and forward shift sleeve into valve body

S2504



S2416

Fig. VI-6. Removing (or installing) inching valve stop

b. Cleaning, Inspection, Wear Limits. Refer to sect. IV, para 5 for cleaning and inspection procedures. Refer to sect. IV, para 8 and to sect. VIII for wear limits information.

c. Assembly (item 36, A, foldout 14)

(1) Follow instructions in 2c (1) through (4), above.

(2) Follow instructions in 4c (1) through (11), above.

6. CONTROL VALVE BODY ASSEMBLY
(later style with inching control) –
REBUILD

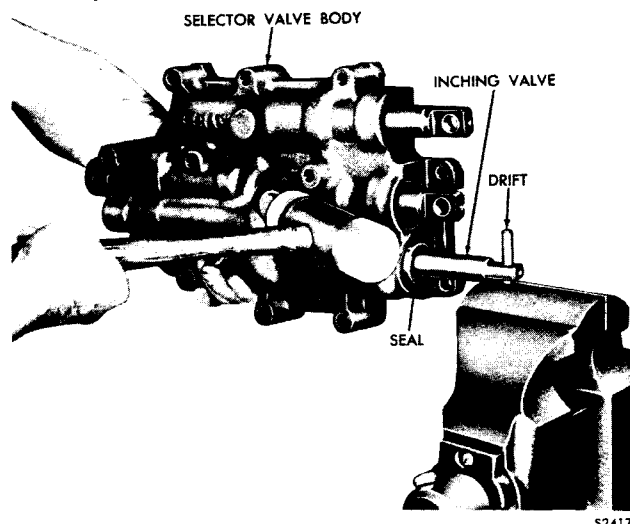
a. Disassembly (item 1, B, foldout 14)

(1) Remove the inching valve stop from the valve body (fig. VI-6).

(2) Anchor the inching valve to a drift or bolt held in a vise (fig. VI-7). Support the valve body horizontally and, with a mallet or soft hammer, drive the valve body off the valve. This will remove seal 29 (B, foldout 14), plug 27 with seal ring 28, valve 26 and spring 25. Separate these parts.

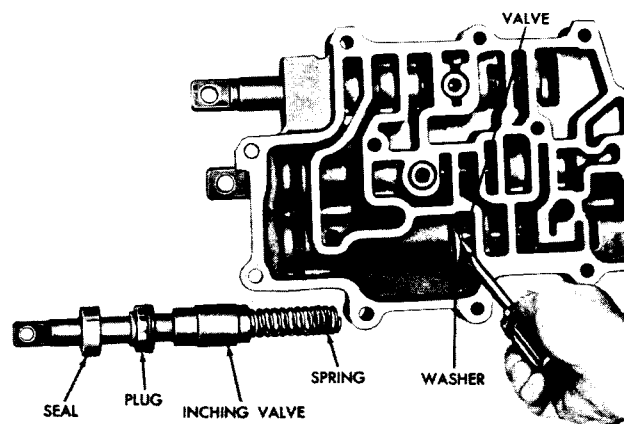
Note: Clean the stem of the valve to permit easy removal of the seal and plug.

(3) Using a small screwdriver, push the



S2417

Fig. VI-7. Removing inching control valve



S2418

Fig. VI-8. Removing (or installing) inching valve washer

inching regulator valve forward in the valve body and remove the washer retaining it (fig. VI-8).

(4) Remove the inching regulator valve and spring (fig. VI-9).

(5) Remove two spring retainers from the valve body (fig. VI-9). Remove the two springs and detent balls which are under the retainers.

(6) Remove two valve stops (fig. VI-9).

(7) Remove the range selector valve and the forward-reverse control valve (fig. VI-9).

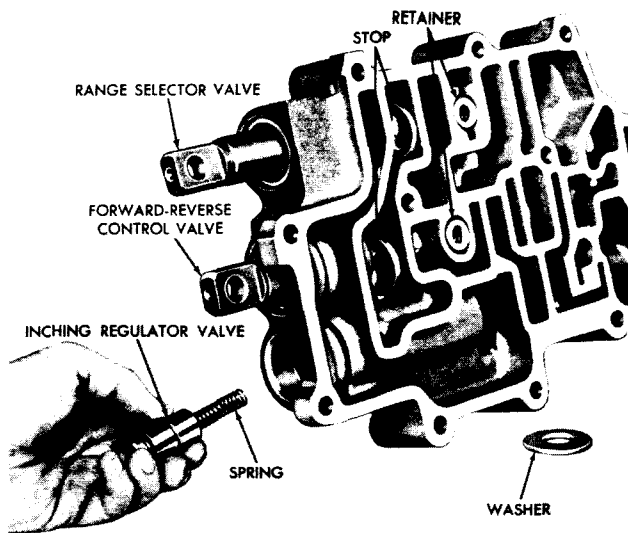


Fig. VI-9. Removing (or installing) inching regulator valve and spring

The valves may be removed by inserting a pin or rod through the linkage pin hole in the stem of each valve. Pull the valves out of their bores, using a small screwdriver or other tool to spread the inner lips of the oil seals when the valve shoulders tend to hang on them.

(8) Remove the remaining detent ball and spring from each valve bore.

(9) Remove the valve stem oil seals (fig. VI-9).

(10) Remove two plugs 3 (B, foldout 14) and plug 2.

(11) Remove bushings 17 and 19 from valves 16 and 20 if parts replacements are necessary.

b. Cleaning, Inspection, Wear Limits. Refer to sect. IV, para 5 for cleaning and inspection procedures. Refer to sect. IV, para 8 and to sect. VIII for wear limits information.

c. Assembly (item 1, B, foldout 14)

(1) If bushings 17 and 19 were removed from valves 16 and 20, install new bushings. Press the bushings into the valve stems until they are flush with, or below, the surface of the stems.

(2) Install plugs 2 and 3 into control valve body 10.

(3) Position the valve body, mounting side upward, and install spring 5 and detent ball 6. The hole into which these parts install intersects the range selector valve bore.

(4) Insert a small punch or pin to depress the ball and spring. Install range selector valve assembly 14, removing the holding tool when the end of the valve catches the detent ball. Push the valve to a detent position.

(5) Install remaining detent ball 6 and spring 7. Install retainer 8, pressing it to flush with, or 0.020 inch (0.5 mm) below the mounting surface of the valve body.

(6) Install spring 9, detent ball 4, forward-reverse control valve assembly 18, remaining spring 9, remaining detent ball 4, and remaining retainer 8. Use the same procedures outlined in (3) through (5), above.

(7) Install the valve stops on the range selector and forward-reverse control valves (fig. VI-9).

(8) Install seal 13 (B, foldout 14), with spring-loaded side inward, onto the range selector valve stem.

Note: Optional types of seals are furnished. One type is entirely metal at its outside diameter. The other type has rubber extending to its outside diameter. The depths to which the two types are installed differ. Press the metal OD seal into the valve body until it is flush with, or to 0.030 inch (0.8 mm) below the end surface of the valve body. The rubber OD seal may be installed to flush or 0.060 inch (1.5 mm) above the surface.

(9) Install seal 21 onto the stem of the forward-reverse control valve and press it into the valve body as outlined in (8), above. Seal 21 is identical to seal 13 and installation is identical.

(10) Install the inching regulator valve spring and valve (fig. VI-9).

(11) Push the inching regulator valve forward against the spring and install the washer which retains it (fig. VI-8).

(12) Install seal ring 28 (B, foldout 14) onto plug 27. Install the plug, flat side first, onto the stem of the inching control valve.

(13) Install spring 25 into the recessed end of the valve.

(14) Install the inching control valve, spring and plug into the valve body. Push plug 27 into its bore in the valve body (fig. VI-8) and install valve stop 12 (B, foldout 14).

(15) Install oil seal 29, spring-loaded side inward and press it flush to 0.030 inch (0.8 mm) below the end-surface of the valve body.

7. CONTROL VALVE BODY ASSEMBLY (later style with hydraulic-operated clutch cutoff valve) – REBUILD

a. Disassembly (item 36, B, foldout 14)

(1) Remove the cutoff valve retainer plug, gasket, and cutoff valve (fig. VI-10).

(2) Remove the clutch cutoff valve plug from the retainer plug. Remove the cup and seal from the valve plug (fig. VI-11).

(3) Complete the disassembly by following instructions in 6a (5) through (11), above.

b. Cleaning, Inspection, Wear Limits. Refer to sect. IV, para 5 for cleaning and inspection procedures. Refer to sect. IV, para 8 and to sect. VIII for wear limits information.

c. Assembly (item 36, B, foldout 14)

(1) Follow instructions in 6c (1) through (9), above.

(2) Install seal ring 59 (B, foldout 14) into the groove on plug 58. Install cup 60 onto the projection on plug 58. Install the valve plug, with cup and seal, into retainer plug 62. Fig. VI-11 shows the proper relation of parts.

(3) Install the clutch cutoff valve, small

diameter first, into the valve body. Install the assembled valve plug, seal, cup retainer plug, and gasket into the valve body (fig. VI-10).

8. CONTROL VALVE BODY ASSEMBLY (later style with air-operated clutch cutoff valve) – REBUILD

The rebuild of this assembly (item 36, B, foldout 14) is identical to that outlined in para 7, above, except that no cup is used with the clutch cutoff valve plug. There are minor differences in the clutch cutoff valve plug and retainer plug used in this assembly. Use items 37 and 38 instead of items 58 and 62. Cup 60 is not used in this assembly.

9. MAIN-PRESSURE REGULATOR VALVE BODY ASSEMBLY (without bypass valve) – REBUILD

Note: Although there are some minor differences between valve body as-

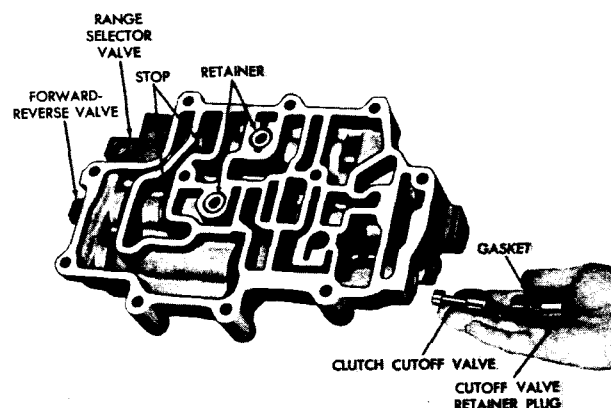


Fig. VI-10. Removing (or installing) clutch cutoff valve assembly S2420

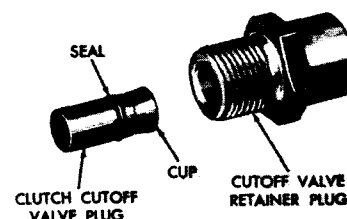


Fig. VI-11. Clutch cutoff valve plug and retainer plug S2421

semblies having different pressure ranges, the rebuild procedures are identical.

a. Disassembly (item 1, A, foldout 13)

(1) Remove plug 3 and gasket 2 from valve body 11.

(2) Remove valve assembly 4 and spring 10. Remove the spring from the valve assembly and remove shims 9 from the recess from which the spring came.

Note: Shims are used in the quantity required to adjust main pressure.

(3) Do not disassemble regulator valve assembly 4. If damaged or worn, replace the assembly.

b. Cleaning, Inspection, Wear Limits. Refer to sect. IV, para 5 for cleaning and inspection procedures. Refer to sect. IV, para 8 and to sect. VIII for wear limits information.

c. Assembly (item 1, A, foldout 13)

(1) Install shims 9 into the recessed end of valve assembly 4.

Note: The number of shims required to properly adjust main pressure cannot be determined until final assembly and test of the transmission. However, for initial operation, install the shims (if any) which were removed during disassembly. Refer to sect. III, para 4a (1) and (2).

(2) Install spring 10 (A, foldout 13) into the recessed end of valve assembly 4.

(3) Install the assembled valve, shims and spring, spring first, into the valve body.

Note: Refer to the note following para 4a (2) in sect. III which identifies springs for various regulator valves.

(4) Install gasket 2 (A, foldout 13) and plug 3 into valve body 11. Torque plug 90 to 100 pound feet (122 to 135.5 N·m).

10. MAIN-PRESSURE REGULATOR VALVE BODY ASSEMBLY (with bypass valve) – REBUILD

Note: Although there are some minor differences between valve body assemblies having different pressure ranges, the rebuild procedures are identical.

a. Disassembly (item 18, A, foldout 13)

(1) Remove plug 30 and gasket 29 from valve body 24.

(2) Remove spring 27, tube 28 and valve 26 from valve body 24.

(3) Remove pin 25, which is a slip fit in body 24.

(4) Complete the disassembly by following instructions in 9a (1) through (3), above.

b. Cleaning, Inspection, Wear Limits. Refer to sect. IV, para 5 for cleaning and inspection procedures. Refer to sect. IV, para 8 and to sect. VIII for wear limits information.

c. Assembly (item 18, A, foldout 13)

(1) Follow instructions in 9c (1) through (4), above.

(2) Install pin 25 (A, foldout 13) into valve body 24.

(3) Install valve 26, convex side first, onto pin 25.

(4) Install tube 28 and spring 27 onto pin 25.

(5) Install gasket 29 and plug 30 into valve body 24. Torque plug 90 to 100 pound feet (122 to 135.5 N·m).

11. INPUT PRESSURE PUMP ASSEMBLY (3321-1 and 3331-1, without steer pump adapter) – REBUILD

a. Disassembly (item 29, A, foldout 8)

(1) Remove four bolts 30 and lock washers 31 which retain cover assembly 32.

(2) Tap, with a soft hammer or mallet, on the pump drive splines to loosen cover assembly 32.

(3) Remove cover assembly 32 and gasket 36.

(4) Remove gears 37 and 38.

(5) Do not remove the needle bearing assemblies from cover assembly 32 or body assembly 39 unless replacement is necessary. If bearing removal is necessary, bearings 40 may be pressed out of body assembly 39. Bearings 35, in cover assembly 32, must be destroyed and their outer shells collapsed before removal.

(6) Do not remove dowel pins 34 from cover assembly 32 unless replacement is necessary. To remove each pin, grasp the pin in a vise and rotate the cover while pulling it from the pin.

b. Cleaning, Inspection, Wear Limits.
Refer to sect. IV, para 5 for cleaning and inspection procedures. Refer to sect. IV, para 8 and to sect. VIII for wear limits information.

c. Assembly (item 29, A, foldout 8)

(1) If dowel pins 34 were removed from cover 33, press new pins into the cover until they project 0.190 inch (0.483 mm) above the cover flat surface.

(2) If bearings 35 were removed from cover 33, press in new bearings. Press on the end of the bearing which has the part number. Press the bearings to 0.090 inch (2.286 mm) below the cover flat surface.

(3) If bearings 40 were removed from body 41, press in new bearings. Press on the end of the bearing which has the part number. Press the bearings to 0.090 inch (2.286 mm) below the body inner flat surface.

(4) Install drive gear 37, splined shaft first, into body assembly 39.

Note: Drive gear 37 must be installed at the thicker end of pump body 41.

(5) Install driven gear 38 into body assembly 39. Lubricate the pump gears thoroughly with transmission fluid.

(6) Install gasket 36 onto cover assembly 32. Install the cover assembly onto the gears and pump body assembly. Tap the cover until it seats evenly.

(7) Install four bolts 30 and lock washers 31 to retain the cover assembly.

Note: The pump must rotate without excessive binding after assembly. If it can be rotated by twisting the splined drive gear by hand, it is satisfactory.

12. INPUT PRESSURE PUMP ASSEMBLY (3321-1 and 3331-1, with steer pump adapter) - REBUILD

a. Disassembly (item 7, A, foldout 8)

(1) Remove four bolts 9 and lock washers 10 which retain cover assembly 11.

(2) Remove cover assembly 11 and gasket 15.

(3) Remove gears 16 and 17 from body assembly 18.

(4) Do not remove components from cover assembly 11 unless parts replacement is necessary. If dowel pins 13 must be removed, grasp each pin in a vise and rotate the cover while pulling it off the dowel pin.

(5) If oil seal 8 must be removed, punch it out, toward the front of the cover assembly.

(6) If upper bearing 14 must be removed, it can be pressed out of the cover assembly, toward the rear of the cover. If lower bearing 14 must be removed, remove its rollers and collapse the outer shell.

(7) Do not remove bearings 19 from body assembly 18 unless replacement is necessary. They may be removed by pressing them out the front of the body.

b. Cleaning, Inspection, Wear Limits.
Refer to sect. IV, para 5 for cleaning and inspection procedures. Refer to sect. IV, para 8 and to sect. VIII for wear limits information.

c. Assembly (item 7, A, foldout 8)

(1) If bearings 19 were removed from body 20, install new bearings. Press on the end of the bearing which has the part number. Press the bearings into the body, to 0.090 inch (2.286 mm) below the body inner surface.

(2) If dowel pins 13 were removed from cover 12, press new pins into the cover until they project 0.190 inch above the cover flat surface.

(3) If bearings 14 were removed from cover 12, install new bearings. Press on the ends of the bearings which have the part number. Press the bearings to 0.090 inch (2.286 mm) below the cover flat surface.

(4) If oil seal 8 was removed from cover 12, install a new seal. Install the seal, spring-loaded side first, and press it until it bottoms lightly on the shoulder in the cover bore.

(5) Install drive gear 17, larger splined end first into body assembly 18.

Note: Drive gear 17 must be installed at the thicker end of pump body 20.

(6) Install driven gear 16 into pump body 20.

(7) Lubricate the pump gears thoroughly with transmission fluid.

(8) Install gasket 15 onto cover assembly 11.

(9) Install cover assembly 11 onto body assembly 18. Tap the cover assembly lightly until it seats evenly on the body assembly.

(10) Install four bolts 9 and lock washers 10 to retain the cover assembly.

Note: The pump must rotate without excessive binding after assembly. If it can be rotated by twisting the splined drive gear by hand, it is satisfactory.

13. INPUT PRESSURE AND SCAVENGE PUMP ASSEMBLY (3321-3 and 3331-3) - REBUILD

a. Disassembly (item 47, A, foldout 8)

(1) Remove four bolts 48 and lock washers 49.

(2) Remove body assembly 51 and gasket 50.

(3) Remove upper gear 54 and roller 58. Remove lower gear 54.

(4) Remove separator plate assembly 55 and gasket 61.

(5) Remove drive gear 59 and driven gear 60 from pressure pump body assembly 62.

(6) Do not remove bearings 53 from body assembly 51 unless replacement is necessary. If bearings must be removed, remove the rollers and collapse the bearing outer shells.

(7) Do not remove dowel pins 57 from plate assembly 55 unless replacement is necessary. If the pins must be removed, press them out of the plate.

(8) Do not remove bearings 63 from body assembly 62 unless replacement is necessary. If the bearings must be removed, they may be pressed out of the front (inner side) of the body.

b. Cleaning, Inspection, Wear Limits.
Refer to sect. IV, para 5 for cleaning and inspection procedures. Refer to sect. IV, para 8 and to sect. VIII for wear limits information.

c. Assembly (item 47, A, foldout 8)

(1) If bearings 63 were removed from body 64, install new bearings. Press on the ends of the bearings which have part numbers. Press the bearings to 0.090 inch (2.286 mm) below the flat inner surface of the pump body.

(2) If dowel pins 57 were removed from plate 56, install new dowel pins. Press them into the plate until each pin projects 0.190 inch (4.8 mm) from either side of the plate.

(3) If bearings 53 were removed from body 52, install new bearings. Press on the ends of the bearings which have part numbers. Press each bearing to 0.090 inch (2.286 mm) below the inner flat surface of the body.

(4) Install drive gear 59, splined end first, into the thicker end of pressure pump body 64.

(5) Install driven gear 60, shorter shaft-end first, into pressure pump body 64. Lubricate the gears with transmission fluid.

(6) Install gaskets 50 and 61 onto separator plate assembly 55.

(7) Install plate assembly 55 onto pump body 64. Tap the plate until it seats evenly on the body.

(8) Install roller 58 into the groove in the shaft of drive gear 59. Use oil-soluble grease to retain it.

(9) Install upper gear 54 onto the shaft of the drive gear, engaging its internal groove with roller 58.

(10) Install lower gear 54 onto the shaft of driven gear 60. Lubricate the gears with transmission fluid.

(11) Install body assembly 51 onto gasket 50 and separating plate 56. Tap the body assembly until it seats evenly on the gasket and plate.

(12) Install four bolts 48 and lock washers 49 to retain the body assembly.

Note: The pump must rotate without excessive binding after assembly. If it can be rotated by twisting the splined drive gear by hand, it is satisfactory.

14. TORQUE CONVERTER STATOR ASSEMBLY (single-stator for 3-element converter) - REBUILD

a. Disassembly (item 3, B, foldout 7)

(1) Remove any springs 6 and rollers 5 from the stator assembly, which remained after removal from the transmission.

(2) Do not remove thrust bearing assembly 4 unless replacement is necessary.

Note: After thorough cleaning, and lubrication with transmission fluid, freewheel roller race 7 can be installed to check for roughness of bearing 4. Install roller race 7, shouldered side first, and rotate it while pressing it against bearing assembly 4. If roughness is felt, the bearing should be replaced.

(3) If the bearing must be replaced, remove it carefully to avoid nicking the aluminum bore which holds it.

(4) Do not disassemble stator assembly further. If inspection reveals damage or excessive wear, replace the entire assembly.

b. Cleaning, Inspection, Wear Limits. Refer to sect. IV, para 5 for cleaning and inspection procedures. Refer to sect. IV, para 8 and to sect. VIII for wear limits information.

c. Assembly (item 3, B, foldout 7)

(1) If bearing assembly 4 was removed, install a new bearing assembly. The bearing assembly must be installed as shown in fig. VI-12. A special tool (sect. IV, para 2b(4)) should be used to insure proper assembly.

(2) Coat the cam pockets in the stator cam with oil-soluble grease. Install 10 rollers into the shallow ends of the cam pockets. Install the 10 springs into the deep ends of the pockets. Fig. VI-13 shows the proper positions of the rollers and springs in stator cam.

(3) Install the freewheel roller race 7 (B, foldout 7) into the stator assembly. Rotate the race clockwise while installing it. This will roll the rollers toward the deep ends of the cam pockets, allowing the race to enter the bore of the stator assembly.

(4) When the race is seated against the thrust bearing, twist it firmly to the left (counterclockwise) to lock it in place. Lay the assembled stator aside, roller race upward, until ready for installation into the transmission.

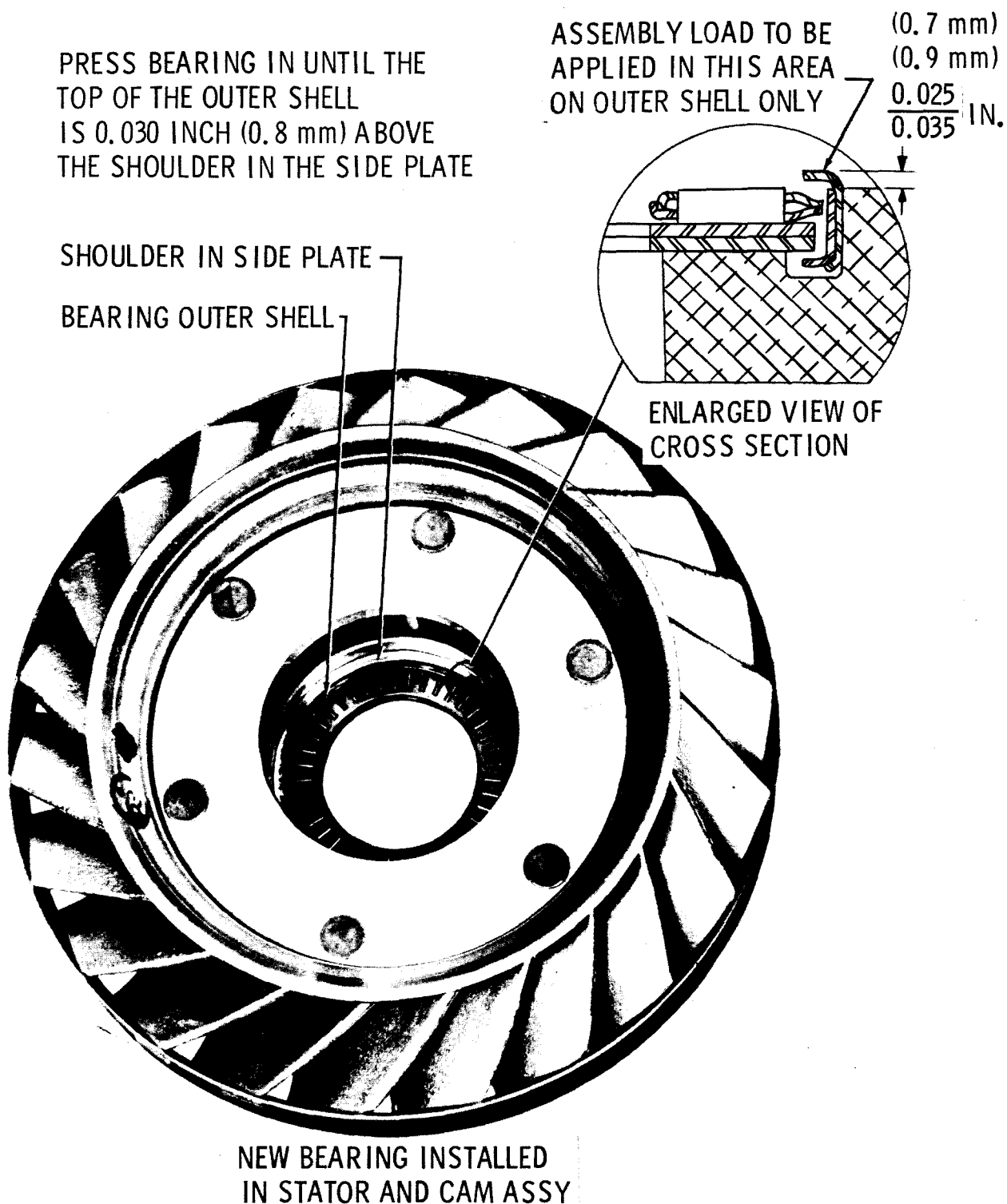


Fig. VI-12. Installation of thrust bearing assembly in stator assembly

S1800

15. TORQUE CONVERTER PUMP ASSEMBLY (3- or 4-element converter) - REBUILD

a. Disassembly (item 14 or 21, B, foldout 7)

(1) Do not disassemble the pump assembly unless parts replacement is necessary.

(2) If bolts 15 or 22 must be replaced, press the old bolts out.

Caution: Balance weights must remain in their original locations. If weights are lost or must be replaced, the new weights must be the same weight and be installed in the same locations.

b. Cleaning, Inspection, Wear Limits. Refer to sect. IV, para 5 for cleaning and inspection procedures. Refer to sect. IV, para 8 and to sect. VIII for wear limits information.

c. Assembly (item 14 or 21, B, foldout 7)

(1) Install any balance weights removed. Refer to caution following a(2), above.

(2) Install new bolts by pressing them into the rear of the pump outer flange. Seat the heads of the bolts against the flange (or balance weights).

16. TORQUE CONVERTER STATOR ASSEMBLIES (double-stator, 4-element converter) - REBUILD

Note: Both the first- and second-stator assemblies are serviced in the same manner and instructions below apply to both.

a. Disassembly (items 31 and 35, B, foldout 7)

(1) Remove any rollers 29 and 33 and springs 30 and 34 not previously removed.

(2) Do not disassemble the stator assemblies further. If inspection reveals damage or excessive wear, replace the entire stator assembly (or assemblies).

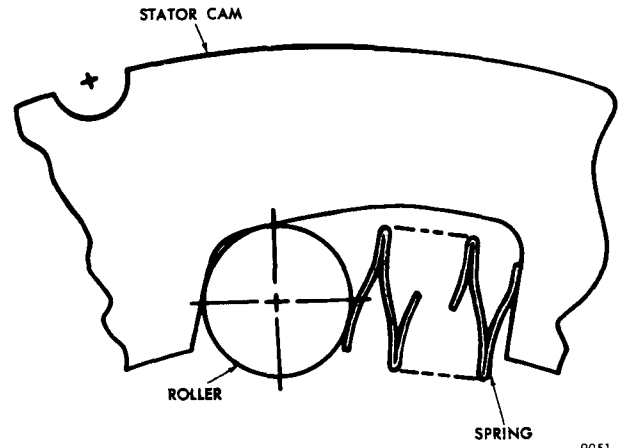


Fig. VI-13. Spring and roller installed in stator cam

b. Cleaning, Inspection, Wear Limits. Refer to sect. IV, para 5 for cleaning and inspection procedures. Refer to sect. IV, para 8 and to sect. VIII for wear limits information.

c. Assembly (items 31 and 35, B, foldout 7)

(1) Position the first-stator (front) assembly, flat side upward, on the work bench. Position the second-stator (rear) assembly flat side downward, on the work bench.

(2) Coat the cam pockets of each stator assembly with oil-soluble grease.

(3) Install eight rollers 29 or 33 into the shallow ends of the cam pockets of each stator assembly.

(4) Install eight springs 30 or 34 into the deep ends of the cam pockets of each stator assembly. Refer to fig. VI-13 for the proper positions of the rollers and springs in the stator cams.

17. TORQUE CONVERTER HOUSING ASSEMBLY - REBUILD

a. Disassembly (item 11, B, foldout 8)

(1) Remove six self-locking bolts 39 and flat washers 38 from bearing retainer 37. Remove the retainer (fig. VI-25). Tap the converter shaft assembly (rearward) out of the converter housing assembly. Remove two hook-type seal rings from the shaft. Do not

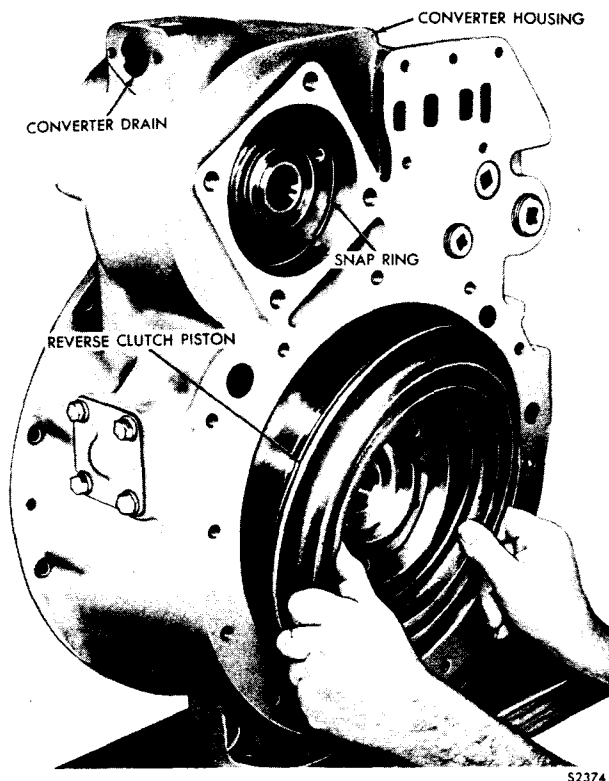


Fig. VI-14. Removing (or installing) reverse clutch piston

remove snap rings and bearing unless replacement is necessary.

Note: Later models have only one seal ring and one snap ring.

(2) Position the torque converter housing assembly on the oil cooler mounting surface (fig. VI-14).

Note: On CRT 3321-3 and CRT 3331-3 models, remove two bolts, lock washers, cover, and gasket from the converter drain opening (fig. VI-14).

(3) Remove the reverse clutch piston assembly (fig. VI-14).

Note: Refer to para 21, below, for rebuild of the piston assembly.

(4) Remove the snap ring which retains implement pump bearing retainer (fig. VI-14).

(5) Using a slide hammer, remove the implement pump bearing retainer, bearings, and pump drive gear (fig. VI-15).

(6) Remove the retainer from the implement pump drive gear bearing. Do not remove the bearings from the gear unless replacement is necessary.

Note: Three types of retainers have been used. Prior to Serial No. 5747, a plain retainer 42 (B, foldout 8) with only an internal groove for a snap ring 40 was used. A sealed bearing 48 was used with this retainer. Effective with Serial No. 5747 and through No. 7595, bearing retainer 42 had added internal and external grooves for seal rings 45 and 41. Effective with Serial No. 7596, a retainer 46, with a bore for installation of a lip-type oil seal 44 and an external groove for a seal ring 45, was used. A plain ball bearing 47 was used with this retainer. Some earlier model retainers were modified to, or replaced by later components.

(7) Remove components, as necessary, from the bearing retainer. Do not remove lip-type oil seal 44 unless replacement is necessary.

Note: Some transmissions are not equipped with an oil seal at this location.

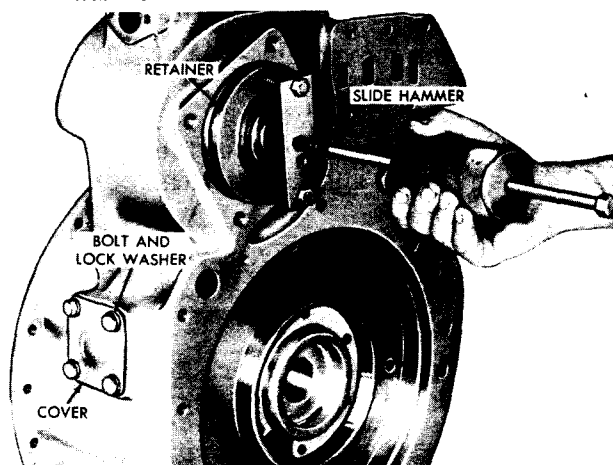
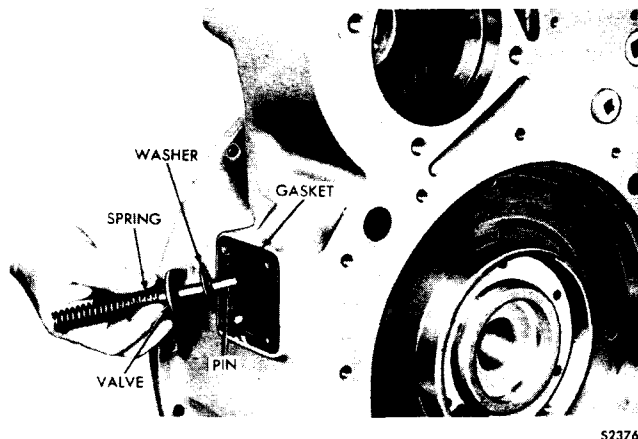


Fig. VI-15. Removing implement pump bearing retainer



S2376

Fig. VI-16. Removing (or installing) lubrication regulator valve components

(8) Remove four bolts, lock washers and cover from the lubrication regulator valve (fig. VI-15).

(9) Remove the lubrication valve spring, valve, washer, pin, and cover gasket (fig. VI-16).

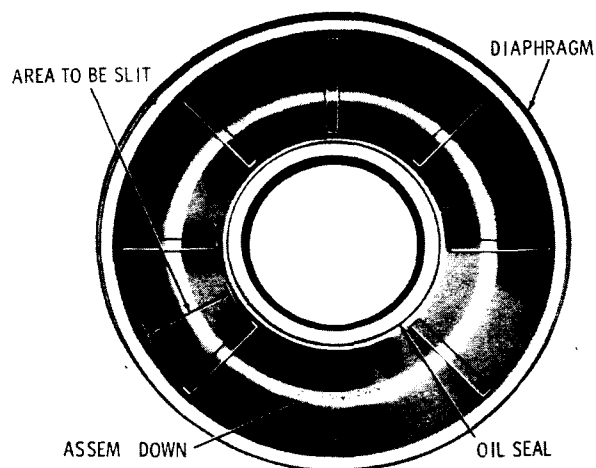
(10) If the transmission has a "dry housing" (sect. II, para 2c), the pressed steel diaphragm must be removed before further disassembly is possible.

(11) With a sharp chisel, slit the diaphragm (fig. VI-17). Insert a hooked tool or heeled bar into the slit and bend the diaphragm. This will push the sheet metal in at one side of the slit and pull it out at the other side. Distortion of the sheet metal will reduce the outside diameter of the diaphragm and it can easily be lifted out.

(12) Remove the self-locking bolt which retains the pump idler gear spindle. Install an adapter into the tapped bore of the spindle. Install the stem of a slide hammer into the adapter and remove the spindle (fig. VI-18).

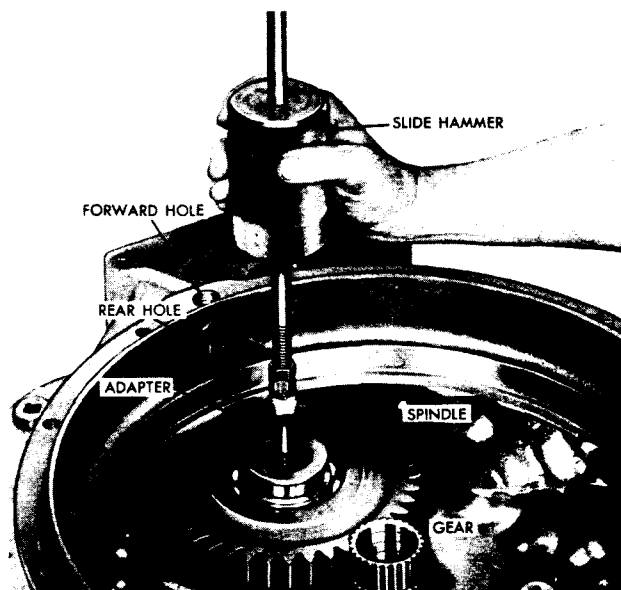
(13) Remove the idler gear assembly (fig. VI-18).

Note: Prior to transmission Serial No. 18408, the bearing was retained in the idler gear either by two snap rings, or by staking with a sharp tool.



S2422

Fig. VI-17. Removing diaphragm from "dry" type converter housing



S2379

Fig. VI-18. Removing pump idler gear spindle

Later, bearings were retained by staking with a blunt tool or by rivets. When the bearing is retained by sharp staking, the bearing and gear must be replaced as a unit; others can be removed by removing a snap ring, removing the displaced metal of the gear, or by removing the rivets.

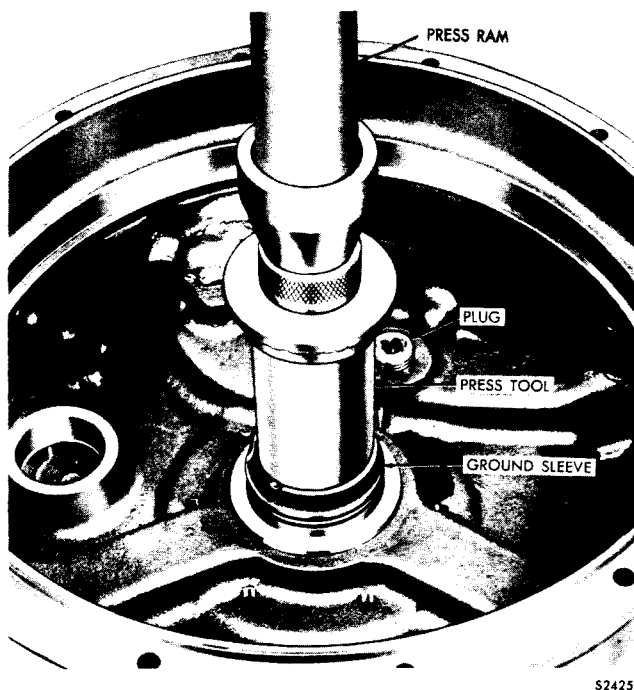


Fig. VI-19. Removing converter ground sleeve

(14) Check the pressed steel plug near the engine mounting flange (fig. VI-18). When a diaphragm is used, the plug must be in rear hole. Both holes must be plugged if vehicle is designed for water operation. The plug must be oil tight.

(15) Remove two hook-type seal rings from the converter ground sleeve. Press the ground sleeve out of the converter housing (fig. VI-19).

(16) Remove the plug from the converter housing (fig. VI-19). Another plug (not shown) should be removed from the front of the housing if not previously removed.

(17) Turn the converter housing over and remove three plugs from the rear of the converter housing (fig. VI-20). When the transmission is equipped for connection to a remote-mounted oil filter, an oil director tube is installed in the converter housing. Remove it, if necessary, for cleaning.

(18) If not previously removed, remove the plug, or oil temperature bulb adapter, from the upper left side of the converter housing (fig. III-4).

b. Cleaning, Inspection, Wear Limits. Refer to sect. IV, para 5 for cleaning and in-

spection procedures. Refer to sect. IV, para 8 and to sect. VIII for wear limits information.

c. Assembly (item 11, B, foldout 8)

(1) If used, install the plug or oil temperature bulb adapter into the upper left side of the torque converter housing (fig. III-4).

(2) If a remote-mounted oil filter is used with the transmission, install the oil director tube into the converter housing (fig. VI-20).

Note: If the thread in the hole into which the tube is installed is 3/4 NPT, the fitting for the line which carries oil to the filter may be installed in this hole or in the 3/4 NPT hole in the front of the converter housing. However, if the hole for the tube is 1 NPT, the filter line fitting must be installed only in the front hole. In this case, plug the tube hole. The line from the filter connects to the hole at the left-rear of the housing. Plug the remaining hole.

(3) If no filter is used, no oil director tube is used and the opening at the front of the housing, and three openings at the rear, are plugged.

(4) If the ground sleeve has been removed from the housing, install two 3/8-16 headless guide bolts into opposite holes at the center bore of the housing. Chill the ground sleeve in "dry ice" for one hour. Install the ground sleeve, aligning the cutout in its flange with the opening in the housing. Press or drive the ground sleeve solidly against the housing. Remove the guide bolts.

(5) Install the plug near the ground sleeve, at the front of the converter housing (fig. VI-19).

(6) Install the two (one on later models) hook-type seal rings on the ground sleeve.

(7) Refer to the note following a(13), above. If the idler gear bearing was removed, apply Loctite Retaining Compound (or equivalent) onto the bearing outer diameter. Allow the parts to dry for 2 hours (min).

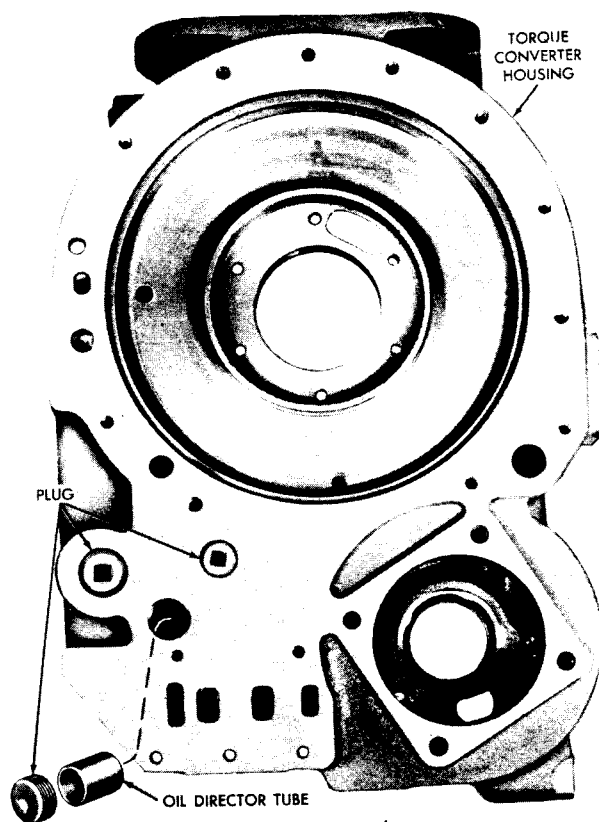


Fig. VI-20. Components at rear of converter housing

Secure the bearing according to the method applicable. When the bearing is retained by blunt staking, use a blunt chisel and restake the gear metal over the bearing at three points 120° apart. Do not restake at the same points previously used. Do not deform the gear metal enough to cramp the bearing, causing it to bind when the inner race is rotated. When the bearing is retained by three rivets, a flat washer is installed at each end of the rivets and the rivets are peened at the recessed side of the gear. After peening, the rivets should not be higher than 0.150 inch (3.8 mm) above the bearing.

(8) Install a 7/16-14 headless guide bolt in the converter housing (fig. VI-21). Press the idler gear spindle into the bearing, at the side of the gear which has the gear teeth offset above the hub of the gear. Install the assembly onto the guide bolt, align the spindle with its bore, and drive it until it seats.

(9) Remove the guide bolt and install the self-locking bolt which retains the spindle.

Note: Check the gear for free rotation to determine proper installation (gear offset away from housing).

(10) If the transmission has a "dry" converter housing (sec II, para 2c), install the diaphragm and seal assembly. See figure VI-17. Start diaphragm into housing bore evenly. Position the diaphragm so that arrow in ASSEM DOWN instruction points toward forward hole in housing. See figure VI-17. Seat the diaphragm in bore by using a soft hammer against diaphragm, while driving with another hammer (fig. VI-22). Drive the diaphragm evenly until it seats in bore.

(11) Refer to a(14), above.

(12) Refer to the note following a(6), above. Assemble the components of the pump

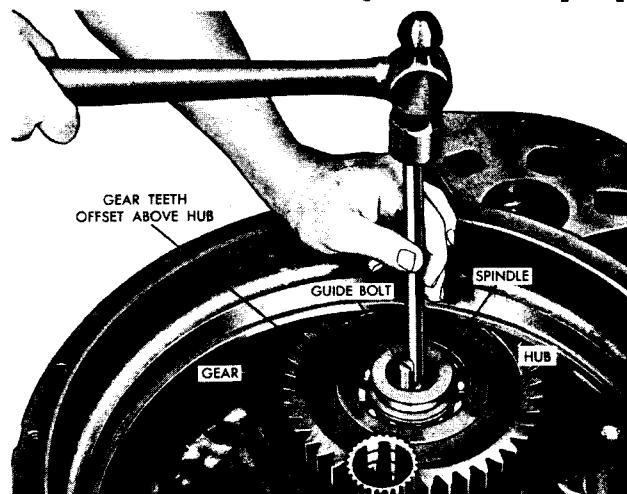


Fig. VI-21. Installing idler gear spindle

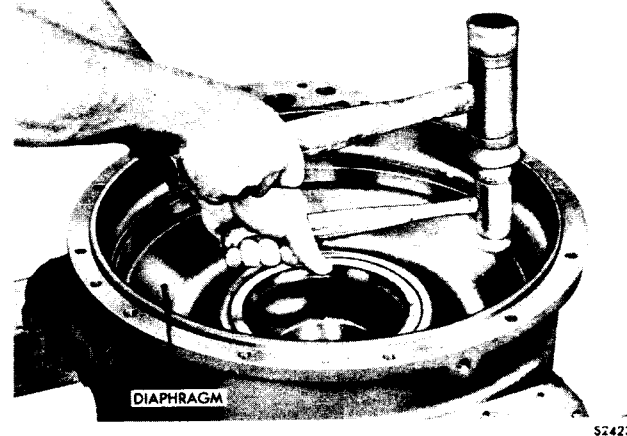


Fig. VI-22. Installing diaphragm into converter housing

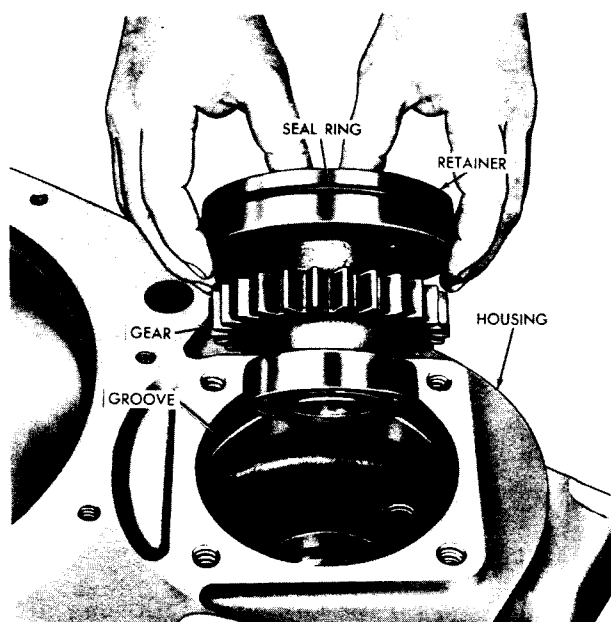


Fig. VI-23. Installing pump drive gear assembly S2467

drive gear assembly according to the arrangement applicable.

(13) Fill the snap ring groove in the converter housing with hard grease (such as No. 4 cup grease) and grease the bore to prevent damaging the outer seal ring on the bearing retainer (fig. VI-23).

(14) Install the gear assembly and tap it into the housing until it seats (fig. VI-23). Grease the internal splines of the pump drive gear with molybdenum disulfide (such as Molykote Type G, or equivalent).

(15) Remove the grease from the snap ring groove and install snap ring (fig. VI-24).

(16) Install the lubrication regulator valve pin, washer, valve and spring. Install the gasket and cover. Retain the cover with four bolts and lock washers (fig. VI-24).

(17) Install the reverse clutch piston assembly, flat side first, into the rear of the converter housing (fig. VI-14).

(18) On CRT 3321-3 and CRT 3331-3 model transmissions, install gasket 26 (B, foldout 8), cover 20, two bolts 23 and lock washers 22 to cover the converter drain (fig. VI-14).

(19) If ball bearing 34 (B, foldout 8) was removed from converter shaft 32, install it.

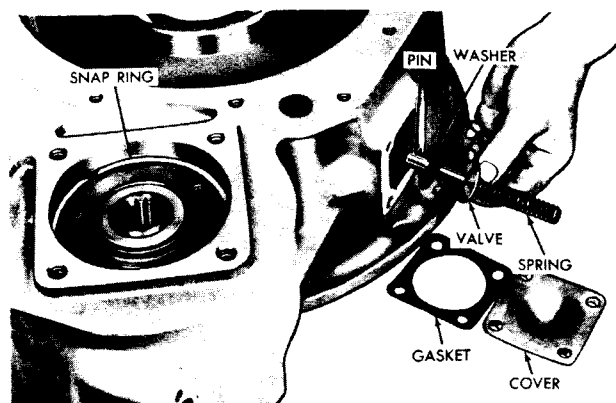


Fig. VI-24. Installing lubrication pressure regulator S2468 components

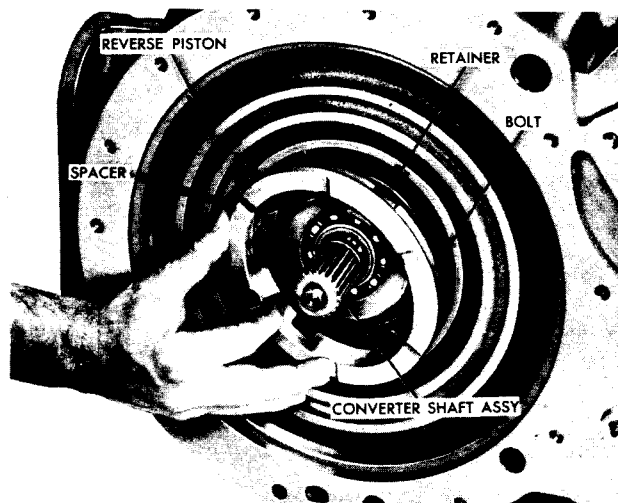


Fig. VI-25. Installing (or removing) thrust spacer S2518

Press the bearing against the shoulder on the shaft and install snap ring 35 to retain it.

(20) If snap ring 36 was removed from the shaft, install it. Install two hook-type seal rings 30.

Note: Some models do not use snap ring 36, and use only one seal ring 30.

(21) Install the converter shaft assembly into the rear of the converter housing assembly (fig. VI-25). Seat the bearing in its bore.

(22) Install bearing retainer 37 (B, foldout 8) and retain it with six self-locking bolts 39 and flat washers 38.

(23) Using a generous quantity of oil-soluble grease to retain it, install the thrust