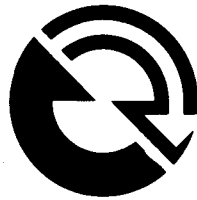


**Allison
Transmissions**

**TT, TTB, TRT 2001
Series Service Manual**



**Detroit Diesel
Allison**

IMPORTANT SAFETY NOTICE

IT IS YOUR RESPONSIBILITY to be completely familiar with the warnings and cautions described in this service manual. These warnings and cautions advise against the use of specific service methods that can result in personal injury, damage to the equipment, or cause the equipment to be unsafe. It is, however, important to understand that these warnings and cautions 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 be thoroughly satisfied that neither personal safety nor equipment safety will be jeopardized by the service methods selected.

Proper service and repair is important to the safe, reliable operation of the equipment. 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.

WARNINGS, CAUTIONS, AND NOTES

Three types of headings are used in this manual to attract your attention.

- | | |
|-----------------------|--|
| <u>WARNING</u> | is used when an operating procedure, practice, etc., which, if not correctly followed, could result in personal injury or loss of life. |
| <u>CAUTION</u> | is used when an operating procedure, practice, etc., which, if not strictly observed, could result in damage to or destruction of equipment. |
| NOTE | is used when an operating procedure, practice, etc., is essential to highlight. |

LIST OF WARNINGS

This manual contains the following warnings. IT IS YOUR RESPONSIBILITY to be familiar with all of them.

Do not burn discarded Teflon seals. Toxic gases are produced by burning.

Never dry bearings by spinning them with compressed air. A spinning bearing can disintegrate, allowing balls or rollers to become lethal flying projectiles.

During disassembly, do not allow second-turbine drive gear and freewheel unit to remain with the converter housing. The second-turbine drive gear could fall unexpectedly and cause damage or injury.

Service Manual

Allison Transmissions

POWERSHIFT MODELS

TT 2221-1, TTB 2221-1

TT 2421-1, TTB 2421-1

TRT 2211-3, TRT 2411-3

TRT 2221-1, TRT 2421-1

TRT 2221-3, TRT 2421-3

NOVEMBER 1984



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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- 17,B. Parking brake

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- 18,B. Control valve assemblies

Section 1. GENERAL INFORMATION

1-1. SCOPE OF MANUAL

a. Coverage. This Service Manual describes the operation, maintenance, and overhaul procedures for the following Powershift transmissions (fig. 1-1 through 1-5):

TT 2221-1	TTB 2221-1
TT 2421-1	TTB 2421-1
TRT 2211-3	TRT 2221-1
TRT 2221-3	TRT 2411-3
TRT 2421-1	TRT 2421-3

The function and operation of the hydraulic systems, torque paths, wear limits, inspection procedures, and torque specifications are included.

b. Illustrations. Transmission features and overhaul procedures are illustrated mainly by photographs. Line drawings are used to illustrate the hydraulic systems and to supplement detailed assembly procedures; cross sections show torque paths and the relationship of assembled parts. Exploded views illustrate the relationship of transmission parts. The cross section and exploded views appear on foldouts at the back of the manual. The foldouts may be opened for reference while studying the text.

c. Maintenance Information. Each task outlined in this Service Manual has been successfully accomplished by service organizations and individuals. It is not expected that every service organization or individual will possess the required special tooling, training, or experience to perform all the tasks outlined. However, any task outlined herein may be performed if the following conditions are met:

(1) The organization or individual has the required knowledge of the task through:

- Formal instruction in a DDA or Distributor training facility.
- "On-the-job" instruction by a DDA or Distributor representative.
- Experience in performing the task.

(2) The work environment is suitable to prevent contamination or damage to transmission parts or assemblies.

(3) Required tools and fixtures are available as outlined in the Service Manual.

(4) Reasonable and prudent maintenance practices are utilized.

NOTE

Service organizations and individuals are encouraged to contact their local DDA Distributor for information and guidance on any of the tasks outlined herein.

1-2. SUPPLEMENTARY INFORMATION

Supplementary information will be issued when significant design changes occur. The supplements will pertain only to specific changes and, therefore, must be used in conjunction with this Service Manual.

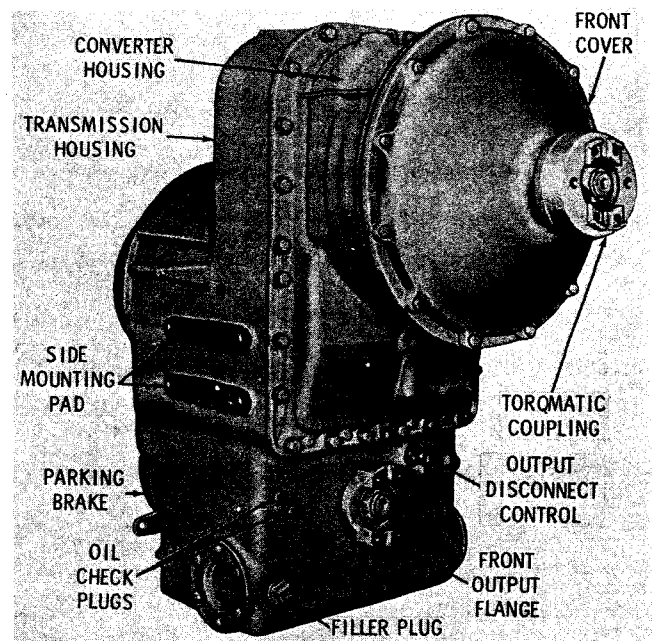
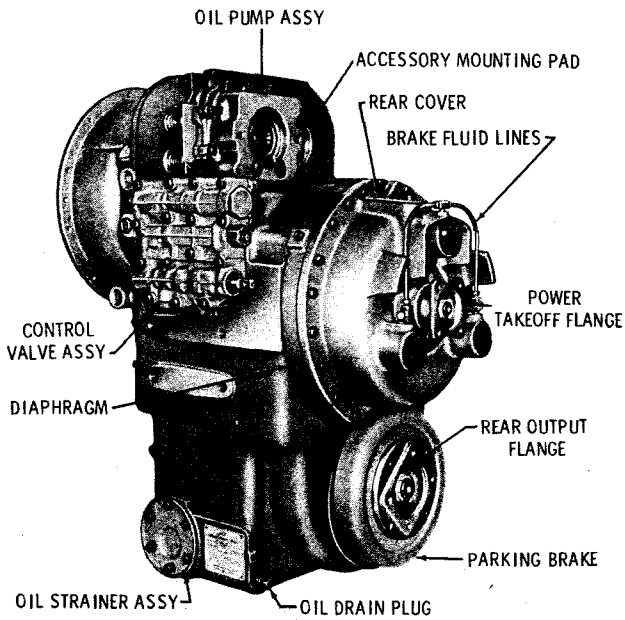


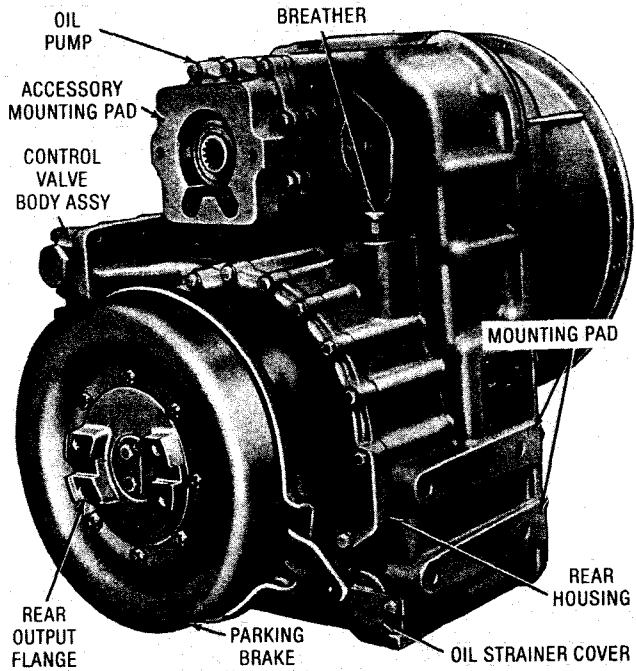
Fig. 1-1. Model TT 2221-1 (or TT 2421-1) transmission--right-front view

TT, TTB, TRT 2001 SERIES TRANSMISSIONS



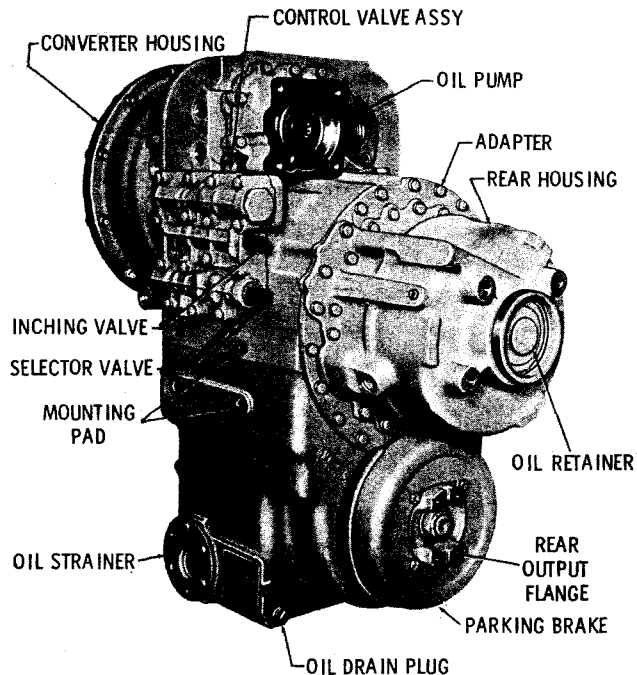
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Fig. 1-2. Model TTB 2221-1 (or TTB 2421-1) transmission--left-rear view



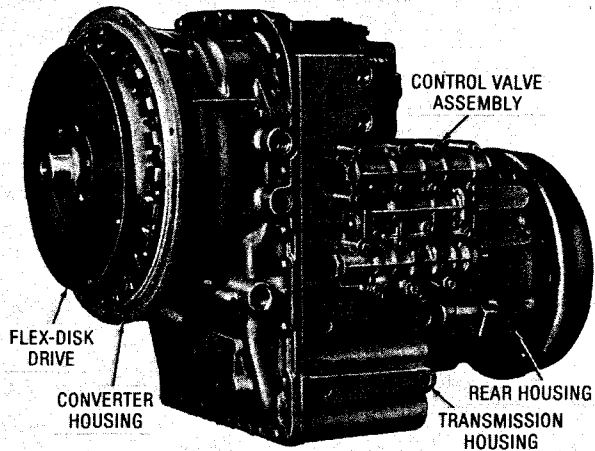
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Fig. 1-4. Model TRT 2211-3 (or 2411-3) transmission--right-rear view



S1375

Fig. 1-3. Model TRT 2221-1 (or 2421-1) transmission--left-rear view



S1372

Fig. 1-5. Model TRT 2221-3 (or 2421-3) transmission--left-front view

1-3. ORDERING PARTS

a. Transmission Nameplate. The nameplate (fig. 1-6), located on the lower left side of the transmission housing, has the serial number, part number (assembly number), and

GENERAL INFORMATION

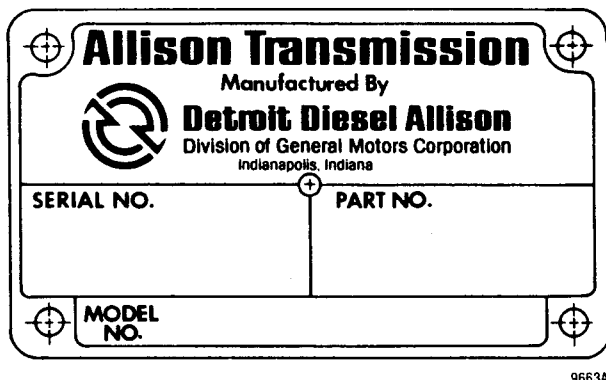


Fig. 1-6. Transmission nameplate

model number all of which must be supplied when ordering parts or requesting service information.

b. Parts Catalog. All replacement parts and service kits should be ordered from your dealer. These parts are listed in the current Parts Catalog SA 1248. Do not order parts by illustration item numbers used in this Service Manual.

1-4. DESIGN FEATURES

a. Model Differences. Refer to foldout 1, 2, 3, 4, or 5 for the model that is to be serviced or rebuilt. The various features described in this section will not all be on any one model. For detailed description of specific models, refer to Section 2. Basic differences are indicated by the model designation:

- TT - Twin turbine with two forward ranges, one reverse range
- TRT - Twin turbine with equal ranges forward and reverse
- B - Internal service brake
- 2 - 2000 Series transmission
- 2 (or 4) - Converter series
- 2 (or 1) - Number of drive ranges
- 1 - Major model change
- 1 - Long drop transfer housing
- 3 - Short drop transfer housing

b. Mounting, Input Drive

(1) The transmission may be direct mounted or remote mounted. A direct-mount transmission is coupled to the engine through

a modified SAE 3 mounting face on the torque converter housing, which is bolted to the engine flywheel housing. A flex disk drive assembly is bolted to the engine flywheel. Another direct-mount configuration consists of a splined converter drive cover which is driven by the engine flywheel (or adapter plate) through a splined drive ring.

(2) The remote-mount transmission is equipped with a front cover. An input shaft, connected to the converter drive cover, extends through the front cover and receives the customer-selected flange. The input flange is driven by the engine through a drive shaft and universal joints.

c. Twin-Turbine Torque Converter

(1) A four-element twin-turbine torque converter transmits power from the engine to the transmission gearing through two sets of turbine gears.

(2) When torque demand is high, the freewheel clutch is engaged and the first turbine, assisted by the second turbine, drives the range gears. When the speed of the vehicle increases and torque demand decreases sufficiently, the second turbine assumes the entire load and the freewheel clutch disengages. The transition from both turbines to second turbine only (high torque to high speed) is automatic, and occurs when the load demand has reduced to a level that can be supplied by the second turbine.

d. Range Gearing, Clutches. The transmissions have two or three planetary gear sets and two, three, or four clutches. Each of the clutches is applied separately. Two forward ranges (F1 and F2) and reverse (R1 and R2) are derived from the range gearing and clutches. All clutches are multiplate, hydraulically applied, and spring released. All gearing is in constant mesh.

e. Transfer Gears. Two transfer spur gears are in constant mesh and in conjunction with the turbine gear, provide either a 19-inch (483 mm) (-1 models) vertical drop or a 7-inch (178 mm) (-3 models) vertical drop from the input shaft to the output shaft. The transfer gears drive the output shaft.

f. Output Shafts

(1) The transmission may be equipped with either a one-piece shaft or a two-piece shaft.

(2) A one-piece shaft may provide for identical operation at the front and rear outputs or may provide for operation at the rear output only. The two-piece shaft and disconnect coupling allow the front output shaft to be disconnected from the driveline while drive at the rear output shaft is maintained.

g. Converter-driven Power Takeoff. Some models include a converter-driven power takeoff (PTO) which consists of a PTO shaft which extends through the rear cover. An output flange is splined to the rear end of the PTO shaft. The forward end of the PTO shaft is splined to the reverse-and-low-range sun gear, which is driven by the torque converter. Thus, regardless of the range selector position, the PTO rotates at the same rpm as the torque converter output.

h. Output-driven Power Takeoff (TT models). Some TT models include an output-driven power takeoff (PTO) which consists of an access to the splines in the rear of the high-range piston housing through the rear cover. With the addition of an OEM furnished hydraulic pump, this PTO-driven pump provides hydraulic pressure for steering in the event of engine failure, as long as the vehicle is still moving.

i. Internal Brake. All TTB models include a multidisk, self-adjusting, hydraulically-applied dynamic brake. This brake is connected to the vehicle driveline through the transfer drive gears and the transmission output shaft(s).

j. Accessory Drive Pad

(1) An SAE size A, two-bolt mounting pad is located at the upper-right rear of the transmission housing to accommodate a steer pump or other accessory (in addition to that mounted at the rear of the oil pump). Rotation at this pad is clockwise (as viewed from the rear). Lubrication is supplied to the splined drive, and a customer-supplied gasket is required at the mounting surface.

(2) If no requirement exists for an accessory drive at this location, the drive gear, shaft assembly, and related parts are omitted, and the opening in the housing is closed with a plug.

k. Oil Pump. A positive displacement, gear-type oil pump furnishes the oil flow and pressure necessary for hydraulic operation, lubrication, and cooling of the transmission components. Rotation of the pump is in a clockwise direction (viewed from rear) and is proportional to the speed of the engine. A mounting pad is provided at the rear of the oil pump to accommodate an implement pump. Lubrication is supplied to the splined output drive and a customer-supplied gasket is required at the mounting surface.

l. Control Valve Body Assembly. The control valve body assembly is located on the left side of the transmission housing (fig. 1-2, 1-3, 1-5). Movement of the valves within the valve body controls the functions of the transmission. All shifts are trimmed for a soft-shift capability. The control valve body assembly contains, in addition to the pressure regulator valve, range selector valve, and related components, either a clutch cut-off valve or an inching control valve.

m. Parking Brake. The transmission may be equipped with an expanding-shoe parking brake. The brake is mechanical and is manually operated.

n. Oil Filter, Cooler. Provision is made for connecting a remote-mount, full-flow oil filter and an oil cooler to the transmission (both customer-furnished). Refer to figure 3-1 for the points at which these items are attached.

1-5. OPERATING INSTRUCTIONS

NOTE

Refer to Operators Manual
SA 1336.

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

GENERAL INFORMATION

b. Range Selection

(1) Position the range selector control in neutral position before starting the engine. A neutral start switch (if used) will prevent the engine from starting if the shift lever is in any other position.

(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. Directional shifts can be made under full-power or full-speed conditions in the working ranges (F1 to R1 and R1 to F1). Shifts from reverse should be made to F1 drive range—not F2. Direct shifts from R1 to F2 will adversely affect clutch service life.

d. Clutch Cutoff Control. When the transmission is equipped with the clutch cutoff control, the driving clutch is completely released whenever the vehicle brakes are applied. Air or hydraulic pressure which applies the brakes also actuates the clutch cutoff. Thus, with the clutch released, full engine power is available for PTO-driven equipment without shifting the range selector control to neutral.

e. Inching Control

CAUTION

Use of inching control in high range will cause premature failure of the high-range clutch because no cooling oil is present at the clutch during inching.

(1) Applying the inching control releases the driving clutch. The inching control may be used during operation in any range except that its use in high range (F2) is not recommended.

(2) Full application will completely release the driving clutch. Lesser application will slip the clutch while it is driving. Very slight and slow movements of the vehicle can be made with this control.

f. Output Disconnect. The transmission front output may be disconnected by moving the control (at the front of the dropbox) which moves the disconnect coupling forward. Rearward movement connects the front and rear output shafts through the splines of the coupling. Two spring-loaded ball detents retain the coupling in either position. The control should never be shifted while the vehicle is moving; however, slight shaft rotation may be required to obtain correct spline alignment for engagement.

g. Towing. All lubrication and clutch apply oil is provided by the engine-driven oil pump. Because of the pump location, ahead of the transmission gearing and clutches, the oil pump cannot be motored by towing or pushing the vehicle. THEREFORE, ANY TIME THE VEHICLE MUST BE TOWED OR PUSHED FOR MORE THAN A HALF MILE (HALF KILOMETER), THE DRIVELINE MUST BE DISCONNECTED.

h. Temperatures, Pressures

(1) When a transmission is equipped with a temperature gage, the bulb or sending unit is mounted in the converter-out oil circuit (fig. 3-1). Temperature should never be permitted to exceed 275°F (135°C). Extended, severe operating conditions may cause the temperature to exceed this maximum. If so, the transmission should be shifted to neutral and the engine should be operated at approximately 1000-1500 rpm for several minutes until the normal temperature of 180-220°F (82-104°C) is restored. If the temperature reaches a maximum of 275°F (135°C) during normal operation of the transmission, stop the engine and locate the trouble. Refer to the Troubleshooting Chart (para 3-13).

(2) When a transmission is equipped with a clutch (main) pressure gage, it is connected to the front of the control valve body

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assembly (fig. 3-1). The pressure shown is that which is effective in the operating range clutch. Shifting or use of the clutch cutoff or inching control will cause a drop in the pressure indicated. If abnormal pressures are evident, refer to the Troubleshooting Chart (para 3-13).

1-6. SPECIFICATIONS, DATA

The following table of specifications and data are applicable to all models within the scope of this Service Manual.

SPECIFICATIONS AND DATA

<u>Item</u>	<u>Description</u>
Transmission type.	torque converter and planetary gear
Rating:	
input speed	3000 rpm (max)
input torque (net*)	310 lb ft (420 N·m) (max)
input horsepower.	175 hp (130 kW) (max)
Rotation, viewed from front:	
input	<u>-1</u> clockwise
output (forward operation).	<u>-3</u> clockwise
(reverse operation).	counterclockwise
Mounting, drive:	
side.	four 5/8-11 tapped holes in side pads, each side
front, direct mounted	modified SAE-3 flange on converter housing bolts to engine flywheel housing, flex plate attaches to engine flywheel (optional splined drive)
front, remote mounted	front unmounted, converter enclosed, input flange for shaft and universal joint coupling

Gear ranges, selector positions:

	TRT 2211-3	TT 2221-1	TRT 2221-1
	TRT 2411-3	TTB 2221-1	TRT 2221-3
		TT 2421-1	TRT 2421-1
		TTB 2421-1	TRT 2421-1
Reverse High	-	-	R2
Reverse Low	R	R	R1
Neutral	N	N	N
Forward Low	F	F1	F1
Forward High	-	F2	F2

* Net as installed: inlet restriction, exhaust restriction, alternator, fan, idle steer pump, idle implement pump, and air compressor should be deducted when applicable.

GENERAL INFORMATION

SPECIFICATIONS AND DATA (cont)

<u>Item</u>	<u>Description</u>	
Weight, dry (approx):		
<u>Basic Model</u>	<u>lb</u>	<u>kg</u>
TT 2001-1	760	345
TTB 2001-1	935	424
TRT 2001-1	910	413
TRT 2001-3	755	342
TRT 2011-3	660	299
<u>Add Weight</u>		
Remote mount	40	18
2401 Model (larger converter)	15	7
Torqmatic® coupling	36	16
Flange	6	3
Parking brake (-1 models)	20	9
Parking brake (-3 models)	35	16

Torque converter two-stage, four-element, twin-turbine

<u>0.826:1 T₂ Converters*</u>	<u>1.211:1 T₂ Converters*</u>
TT 220 -- 5.47:1	TT 252 -- 5.09:1
TT 240 -- 5.44:1	TT 262 -- 3.32:1
TT 260 -- 5.11:1	TT 272 -- 4.81:1
TT 270 -- 6.97:1	TT 426 -- 4.78:1
TT 425 -- 5.19:1	TT 427 -- 3.40:1
TT 444 -- 6.79:1	TT 447 -- 3.34:1
TT 445 -- 4.92:1	
TT 465 -- 4.67:1	

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* To obtain overall transmission torque ratios, multiply the applicable torque converter ratio times the gear ratio.

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SPECIFICATIONS AND DATA (cont)

<u>Item</u>	<u>Description</u>
Range gearing.	constant mesh, straight spur, planetary
Transfer gearing	constant mesh, straight spur, in-line

*Gear ratios:

	<u>0.826:1 T₂ Converters</u>		<u>1.211:1 T₂ Converters</u>	
	<u>Low</u>	<u>High</u>	<u>Low</u>	<u>High</u>
TT(B) 2221-1, 2421-1				
F:	2.663:1	0.699:1	3.902:1	1.024:1
R:	1.964:1	---	2.878:1	---
F:	2.029:1	0.699:1	2.973:1	1.024:1
R:	1.964:1	---	2.878:1	---
F:	2.153:1	0.566:1		
R:	1.588:1	---		
TRT 2211-3, 2411-3				
F:	2.398:1	---		
R:	2.321:1	---		
TRT 2221-1, 2421-1				
F:	2.029:1	0.736:1	2.973:1	1.079:1
R:	1.964:1	0.712:1	2.878:1	1.043:1
TRT 2221-3, 2421-3				
F:	6.612:1	2.398:1	9.689:1	3.514:1
R:	6.398:1	2.321:1	9.375:1	3.401:1
F:	2.398:1	0.826:1		
R:	2.321:1	0.799:1		

Clutch data:

type.	multidisk, hydraulic-actuated, spring released, oil-cooled; automatically compensates for wear
material.	external-tanged reaction plates--polished steel internal-splined friction plates forward, reverse--resin-graphite high range--sintered bronze

Freewheel clutch standard or heavy duty, depending on application

* To obtain overall transmission torque ratios, multiply the applicable torque converter ratio times the gear ratio.

GENERAL INFORMATION

SPECIFICATIONS AND DATA (cont)

<u>Item</u>	<u>Description</u>
Parking brake:	
-1 Models	Type and Size expanding-shoe, mechanically-applied, 10 x 1-1/2 in. (254 x 38 mm) Burnished Rating 30,000 lb in. (3389 N·m) at 1500 lb (6672 N) apply force
-3 Models	Type and Size expanding-shoe, mechanically-applied, 13-3/8 x 2 in. (340 x 51 mm) Burnished Rating 45,000 lb in. (5084 N·m) at 2100 lb (9341 N) apply force
Internal brake (TTB model):	
type.	multidisk, hydraulic-applied, self-adjusting, oil cooled
rating (static capacity).	3000 lb ft (4068 N·m) at transmission output shaft with 1500 psi (10 342 kPa) max. brake-apply pressure
hydraulic brake fluid	SAE J70, type 70R1 or 70R3
Flanges:	
input and output.	Mechanics 4C, 5C, 6C, 7C; Rockwell 5N plain, 6N plain; Spicer 1480
Torqmatic coupling.	Mechanics 5C (TT,TTB,TRT 2221-1) Mechanics 6C (TT,TTB,TRT 2421-1)
Oil system:	
oil pump.	input driven, positive displacement, gear type
oil pump output pressure.	255 psi (1758 kPa) max (with clean filter) (measure at TO FILTER port)
sump.	single, integral
oil	Type C3
<u>Fluid Viscosity and Grade</u>	<u>Ambient Temperature Below Which Preheat is Required</u>
SAE 30.	32°F (0°C)
SAE 15W-40.	32°F (0°C)
SAE 10W-30.	10°F (-12°C)
SAE 10W	10°F (-12°C)
SAE 5W-20	-10°F (-23°C)

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SPECIFICATIONS AND DATA (cont)

<u>Item</u>	<u>Description</u>
Oil system (cont):	
oil capacity:	
-1 model (less external circuits) . . .	initial fill--8-1/2 US gal (32 liters)
-3 model (less external circuits) . . .	initial fill--6-1/2 US gal (25 liters)
oil filter (customer furnished)	
filtration.	remote mounted
pressure drop across filter	44 micron (max)
	clean 35 psi (241 kPa) max; dirty 45 psi (310 kPa) max
converter-out oil temperature	275°F (135°C) max continuous
main pressure, at full throttle,	
in all ranges	*135 to 170 psi (930 to 1171 kPa)-- vehicle weight to 28,000 lb (12 701 kg)
	*160 to 195 psi (1102 to 1343 kPa)-- vehicle weight over 28,000 lb (12 701 kg)
lubrication pressure, at full	
throttle stall.	10 to 30 psi (68 to 206 kPa)
converter-out pressure, at	
full throttle stall	40 psi (275 kPa) (min)
converter-out pressure, at	
full throttle, no-load.	65 psi (447 kPa) (max)
Control valve body assembly:	
clutch cutoff	hydraulic- or pneumatic-actuated
inching control	manual-actuated
Engine-driven power takeoffs:	
implement pump drive (pad at rear of oil pump):	
ratio--standard	0.91 x engine speed
--optional	1.00 x engine speed
maximum rating:	<u>Continuous</u> <u>Intermittent</u>
horsepower, at 2000 to 3000 rpm	90 (67 kW) 110 (82 kW)
torque, up to 2000 rpm	236 lb ft (321 N·m) 288 lb ft (391 N·m)
mounting pad.	SAE size C, two-bolt or four-bolt; SAE size B, two-bolt
spline size	SAE size B, SAE size C, SAE size B-B (1.00:1 PTO Ratio only)

* Main pressure in high range may be as much as 10 psi (33 kPa) lower than in other ranges. These pressures are established for a converter-out temperature range of 140 to 165°F (60 to 73.8°C). As converter-out temperature approaches 250°F (121°C), main pressure can drop as much as 15 psi (103 kPa).

GENERAL INFORMATION

SPECIFICATIONS AND DATA (cont)

<u>Item</u>	<u>Description</u>
Engine-driven power takeoffs (cont):	
accessory drive:	
ratio--standard	0.91 x engine speed
--optional	1.00 x engine speed
*maximum rating:	
horsepower.	30 hp (22 kW) at 2000-3000 rpm
torque.	79 lb ft (107 N·m) up to 2000 rpm
mounting pad.	SAE size A, two-bolt
spline size	SAE size A or SAE size B
Converter-driven power takeoff:	
ratio--standard	1.21 x converter output speed
--optional	0.83 x converter output speed
rating, continuous.	full input (engine) hp (kW)
Output-driven power takeoff (emergency-steer PTO):	
ratio	0.846 x output speed or 0.684 x output speed, depending on transmission gear ratio
maximum rating.	30 hp (22 kW) at 2000-3000 rpm
mounting pad.	SAE size A, two-bolt (gasket required)
Speedometer drive pad (some models):	
type.	SAE 5/32, heavy duty
ratio	0.846 x transmission output speed or 0.684 x transmission output speed depending on transmission gear ratio
Magnetic speed pickup provision (later models).	
	3/4-16 UNF-3B tapped port in main housing

* If both drive pads are used simultaneously, their combined duty requirements should not exceed the duty rating for the implement pump PTO.

Section 2. DESCRIPTION AND OPERATION

2-1. SCOPE

This section describes the functions of the transmission components. The hydraulic systems are explained and schematically illustrated. The transmission torque paths are also explained for each gear range.

2-2. GEARING, CLUTCHES, HYDRAULIC SYSTEMS, TORQUE PATHS

Table 2-1 shows the relationship of clutches, planetaries, and ranges for the various TT, TTB, and TRT 2001 Series Transmissions. It also references the paragraphs which explain the hydraulic systems and torque paths.

2-3. POWER TAKEOFF (TT MODELS)

a. Converter-driven PTO (foldout 1)

(1) The converter-driven power takeoff consists of PTO shaft 49 which is driven at converter output speed by forward-and-reverse sun gear 26. The PTO shaft extends through the rear cover. Output flange 48 is splined to the rear end of the PTO shaft. The converter-driven PTO is designed so that full engine horsepower can be utilized.

(2) Driving, Winching. Although it is permissible to drive and winch at the same time, this mode of operation splits the torque path. Thus, to achieve full power at the converter-driven PTO, shift the range selector to neutral position.

b. Output-driven Power Takeoff

(1) Some TT models include an output-driven PTO which consists of a 2-bolt SAE type-A pad located in the center of the rear cover. A vehicle-furnished pump mounted on this pad will provide hydraulic pressure for emergency steering in the event of engine failure.

(2) As long as the vehicle is moving (without engine running), torque from the vehicle wheels is transmitted back through the driveline to the transfer gears in the drop-box. Rotation of the transfer gears drives the forward clutch piston. Splines in the rear hub of the piston transmit the torque to the PTO pad.

2-4. IMPLEMENT PUMP, ACCESSORY DRIVE PADS

NOTE

Refer to Specifications and Data (para 1-6) for duty ratings.

a. Implement Pump Drive Pad. The implement pump drive pad, located on the rear face of oil pump body 10 (foldout 18,A), may be any one of four configurations—four-bolt, SAE size C; two-bolt, SAE size C; 2- and 4-bolt SAE size C; or a two-bolt, SAE size B. Accessory-driven gear 2 (foldout 7,B) is engine-driven through accessory drive gear 19 (foldout 7,A) at one of two customer-selected ratios—1 to 1 or 0.91 to 1. Regardless of the range selector position, the shaft rotation is clockwise as viewed from the rear. Adapter drive coupling 18 (foldout 18,A) may be used to accommodate a B-size spline to the C-size splines in gear 2 (foldout 7,B).

b. Accessory Drive Pad. A two-bolt, SAE size A pad is located at the upper right rear face of the transmission housing. The drive at the pad is provided by accessory drive gear 1 (foldout 7,B) and drive shaft 8, which rotate at a 1 to 1 or 0.91 to 1 ratio. Shaft 8 provides either a size A or size B internal spline at its rear end. Regardless of the range selector position, the shaft rotation is clockwise as viewed from the rear. If no requirement exists for a PTO at this location, the drive gear, shaft, and related parts are omitted, the opening closed by cup plug 12 (foldout 8,B), and the oil passage closed by cup plug 10.

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TABLE 2-1. Model Differences

TRANSMISSION MODELS	TT 2221-1 TTB 2221-1 TT 2421-1 TTB 2421-1			TRT 2221-1 TRT 2221-3 TRT 2421-1 TRT 2421-3			TRT 2211-3 TRT 2411-3			
CLUTCHES	Reverse Low (forward) High Internal brake (TTB)	FOLD-OUT	Reverse Forward Low High	FOLDOUT			Reverse Forward	FOLD-OUT		
		1		2	3	4		5		
		17		39	36	37		25		
		19		38	33	34		23		
		24		21	20	19				
		60		23	18	21				
PLANETARIES	Reverse Low (forward)	FOLD-OUT	Reverse Forward High (over-drive) Low (under-drive)	FOLDOUT			Reverse Forward	FOLD-OUT		
		1		2	3	4		5		
		18		15	14	15		17		
		21		18	29	32		22		
				28	—	29				
			—	26	—					
RANGES	Reverse Neutral Forward-1 Forward-2	Clutches Applied			Clutches Applied				Clutch Applied	
		H I G H	F O R W A R D	R E V E R S E	H I G H	L O W	F O R W A R D	R E V E R S E	F O R W A R D	R E V E R S E

DESCRIPTION AND OPERATION

2-5. OIL PUMP

Oil pump assembly 2 (foldout 18,A) consists mainly of two spur gears 5 and 7, body assembly 9, and cover 3. The oil pump assembly furnishes the entire oil flow and pressure for all transmission operations (except brake apply pressure on TTB models). The pump is driven by accessory drive gear 19 (foldout 7,A) and rotates any time the engine output shaft rotates. The transmission oil is drawn, through oil strainer 22 (foldout 8,B), into the lower end of suction tube 2 which directs it to the pump assembly. The oil is then directed, under pressure, through passages in the transmission housing to the control valve assembly and other locations for lubrication and cooling.

2-6. INTERNAL BRAKE (TTB MODELS)

a. Brake Components. The brake consists mainly of hub 13 (foldout 15,B), five internal-splined plates 15, six external-tanged plates 14, diaphragm assembly 2, apply plate assembly 20, three pistons 26, and cover assembly 37. The hub of high-range clutch piston housing 22 or 35 (foldout 15,A) is extended to receive brake hub 13 (foldout 15,B). Diaphragm assembly 2 and cover 38 are mounted on the rear of the transmission. These parts house the brake assembly.

b. Brake Operation

(1) When the vehicle hydraulic brake master cylinder is actuated, brake fluid pushes three pistons 26 (foldout 15,B) forward. The pistons push apply plate 23 forward, compressing brake plates 14 and 15 against diaphragm 4.

(2) Internal-splined plates 15 are compressed between external-tanged plates 14. Rotation of plates 14 is prevented by anchor pins 6. Plates 15 are slowed or stopped by friction against stationary plates 14.

(3) Adjusting ring 21 has two functions. It continually adjusts the brake to a predetermined clearance, and it controls the flow of brake coolant. The ring is attached

to apply plate 23 by six spring pins 22. Rings 21 can move lengthwise on the pins when sufficient force is applied. Ring 21 can move a predetermined distance forward and rearward on the inner hub of cover 38. It is restrained from further forward movement by snapping 19.

(4) When the brake is released, springs 11 push apply plate 23 rearward. Plate 23 carries ring 21 rearward until it bottoms on the flat face of the inner hub of cover 38. At this point, the ring and apply plate stop, because springs 11 do not have sufficient force to move pins 22 in ring 21. Also, in this position, ring 21 closes a large opening through which cooling oil (returning from the oil filter) is supplied. A small hole in ring 21 continues to supply sufficient oil for lubrication while the brake is released.

(5) When the brake is applied, plate 23 and ring 21 move forward together. The brake applies when plate 23 compresses the brake plates. Ring 21, in the forward position, uncovers the large oil passage and the brake is flooded with coolant. If there is excess clearance in the brake plate pack (due to wear), ring 21 is stopped by snapping 19 while plate 23 continues to move forward to apply the brake. Pins 22 are pushed forward through the pin holes in ring 21 the distance plate 23 moves in excess of ring 21 movement. This is the automatic adjustment action.

(6) When released, plate 23 and ring 21 move rearward until ring 21 is stopped by the face of the cover inner hub. Thus, brake plate clearance is continually maintained at a dimension equal to the movement permitted the adjusting ring in its travel from the cover inner hub face to snapping 19.

2-7. PARKING BRAKE

An expanding shoe-type brake may be mounted at the lower-rear output location on the transmission housing. Brake backplate 2, 8, or 13 (foldout 17,B) is bolted to the transmission housing, and brake drum 9 or 18 is bolted to a customer-selected output flange. The brake is manually operated.

2-8. CONTROL VALVE BODY ASSEMBLY

a. Control Valve Body (foldout 18,B). The control valve body contains a manually operated range selector valve 29 for reverse, neutral, low-, or high-range operation, plus main-pressure regulator valve 8, and either clutch cutoff valve 20 or inching control valve 42.

b. Main-Pressure Regulator, Selector Valves (foldout 18,B)

(1) Main-pressure regulator valve components and trimmer valve components are contained in the upper bore of the body; clutch cutoff valve (or inching control valve) components in the middle bore; and the selector valve components in the lower bore. The main-pressure regulator valve group includes items 6, 7, 8, 13, and 14. The selector valve group contains items 26 through 35.

(2) Main-pressure regulator valve 8 is spring loaded and regulates the pressure for all hydraulic functions except brake apply pressure for TTB models. The selector valve is a spool-type valve which is manually moved lengthwise to the various range positions. Spring-loaded detent balls 30 position the valve in each range.

c. Clutch Cutoff Valve (foldout 18,B)

(1) Clutch cutoff valve 20 is located between the main-pressure regulator valve and selector valve 29. It is a spool-type valve which is moved rearward by spring 19 force and forward by plug 21 when brake hydraulic pressure acts on the plug.

(2) If the valve is actuated by brake air pressure, a miniature air cylinder is mounted at the rear of the valve body. A stem of the air cylinder moves plug 49 forward within retainer plug 50.

(3) During normal operation, valve 20 is rearward. This allows main pressure to flow to the selector valve and trimmer plug 16. When vehicle brakes (hydraulic or air) are applied, valve 20 moves against spring 19. This interrupts the flow of main pressure to the selector valve and exhausts clutch apply pressure, releasing the applied clutch.

d. Inching Control Valve (foldout 18,B)

CAUTION

Do not use the inching control while operating in high range. No provision is made for lubricating and cooling the high-range clutch during inching operation.

(1) Inching control valve 42 replaces the clutch cutoff valve in the valve body when this feature is used. This is a spool-type valve that is manually controlled by the vehicle operator through mechanical linkage attached to one end of the valve. Pressure from spring 41 and main oil pressure hold the valve in the CLUTCH-ON (non-inching) position. In the CLUTCH-ON position, full main oil pressure is directed to the range selector valve.

(2) When the inching control is moved, main pressure applying the driving clutch is bled off through an oil passage to the driving clutch plate area. This reduces main pressure available to apply the clutch, allowing it to slip. At the same time, the oil being bled off cools and lubricates the slipping clutch. The degree of inching valve movement determines the degree of slippage, from full apply to full release. Inching regulator valve 39 and spring 38 maintain a uniform clutch apply pressure at any given position of the inching valve.

2-9. HYDRAULIC SYSTEM—ALL MODELS

a. System Functions. The hydraulic system generates, directs, and controls the pressure and flow of the hydraulic fluid within the transmission. The hydraulic fluid is the power-transmitting medium in the torque converter. Its flow lubricates and cools the transmission components, its pressure applies the clutches, and its velocity drives the converter turbines.

b. System Schematics (fig. 2-1 through 2-11). Color-coded schematics are presented which illustrate the hydraulic systems of the models covered by this manual.

DESCRIPTION AND OPERATION

2-10. HYDRAULIC SYSTEM--TT, TTB MODELS (fig. 2-1, 2-2, and 2-3)

a. Oil Pump, Filter Circuit

(1) TT models (fig. 2-1, 2-2). Oil is drawn from the transmission sump, through a wire-mesh strainer, into the oil pump. The pump delivers its entire output to a full-flow oil filter which is customer-supplied. The oil filter is mounted external from the transmission. From the filter, the entire oil supply is returned to the transmission and control valve assembly.

(2) TTB models (fig. 2-3). The oil pump and filter circuit is the same as that described for the TT models, except an additional circuit is required for cooling and lubrication of the brake components. This circuit is external and extends from the oil filter return circuit to the tapped boss in the rear cover.

b. Main-Pressure Regulator Valve, Converter-in Circuit

(1) At the control valve assembly, oil from the oil filter (red) enters the valve body, and flows around the main-pressure regulator valve. The oil also flows through a diagonal passage (orifice A) to the left end of the valve. The resultant pressure at the left end of the valve pushes the valve rightward against a spring until the oil pressure is balanced by spring force.

(2) The rightward movement of the valve against the spring exposes the port to the converter-in circuit (yellow). Oil in excess of that required to maintain main pressure is allowed to escape into the converter-in circuit. Under certain conditions, the converter-in circuit can be charged with more oil than can be exhausted by the converter pressure regulator valve. When this is the case, the main-pressure regulator valve moves farther to the right and allows oil to flow directly into the exhaust port (blue) at the left end of the valve. This flow occurs between the two short lands at the left end of the regulator valve.

(3) Oil flowing into the converter-in (yellow) circuit is directed to the torque con-

verter. A pressure regulator valve in the circuit limits converter-in pressure to 80 psi (552 kPa).

c. Torque Converter. The torque converter is continuously filled with oil during transmission operation. Rotation of the converter pump imparts energy to the oil which, in turn, drives the turbines. The oil then flows between the stator vanes which redirect it to the pump.

d. Converter-Out, Cooler, Lubrication Circuit

NOTE

On TTB models, an additional circuit is required to cool and lubricate the brake components. (Refer to para 2-10i.)

(1) Oil flowing out of the torque converter (orange) is directed into the oil cooler. The oil cooler, like the oil filter, is customer supplied and vehicle mounted. The oil cooler is a heat exchanger in which the oil flows through water- or air-cooled passages.

(2) On transmissions equipped with a thermostat, a bypass tube provides adequate lubrication when the thermostat is closed. The bypass tube permits a constant low-volume flow from the converter-out circuit to the lubrication circuit. When the oil is warm, the thermostat opens and permits converter-out oil to flow through the cooler.

(3) From the cooler, oil flows to the lubrication circuit (green) for distribution to the transmission components. All oil in excess of that required to maintain lubrication pressure is exhausted to sump (blue) through the lubrication regulator valve.

e. Clutch Cutoff Valve Circuit (fig. 2-1, 2-3)

(1) Main pressure oil (red), supplied from the left end of the main-pressure regulator valve, flows through orifice B to the clutch cutoff valve bore and then to the manual selector valve. From the selector valve the flow is directed back through the clutch cutoff valve bore to the trimmer. The orifice functions in connection with the trimmer. (Refer to para 2-10h.)

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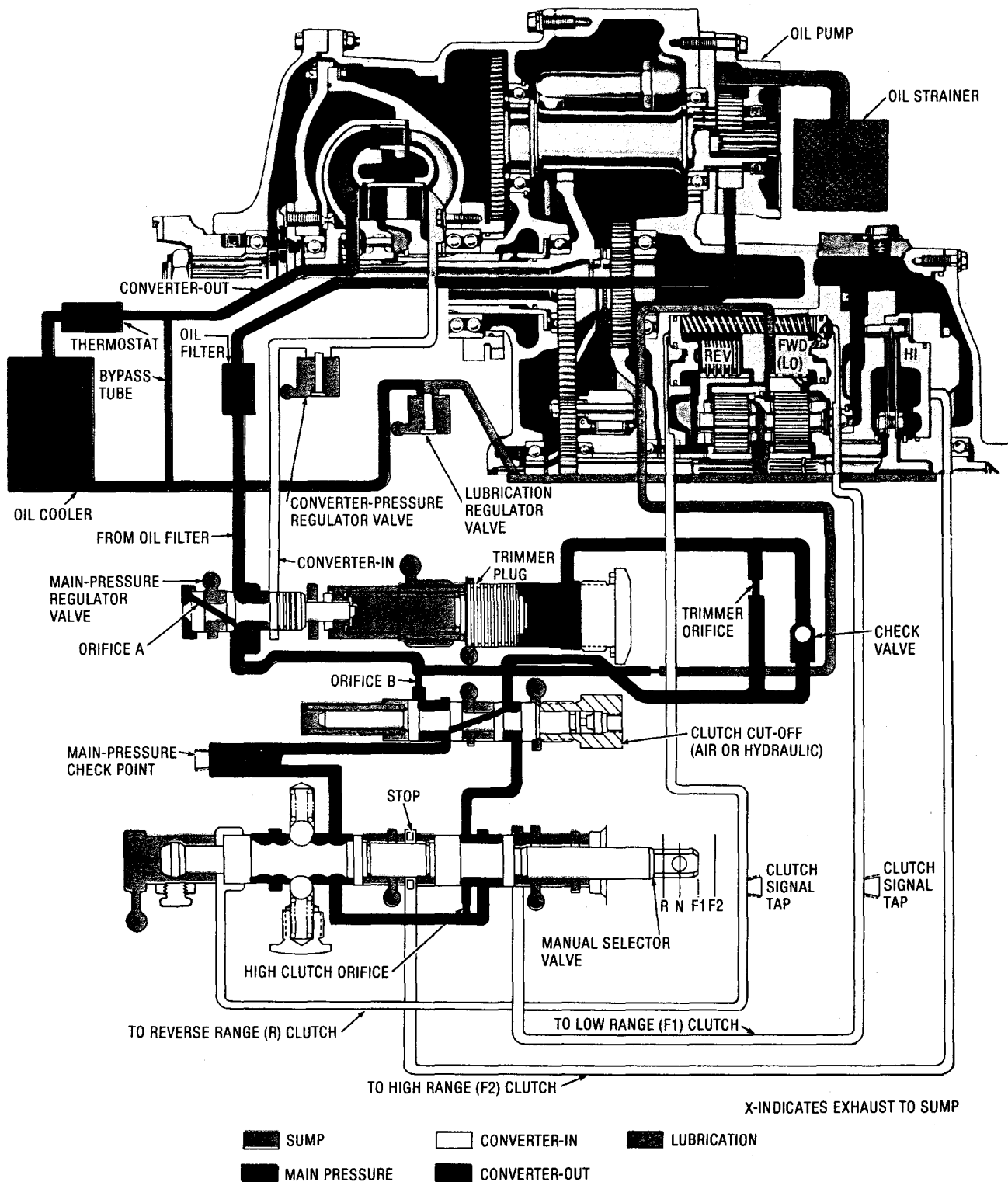


Fig. 2-1. TT 2221-1, TT 2421-1 hydraulic system with clutch cutoff control

(2) The clutch cutoff valve is normally in the position shown and functions only when the vehicle brakes are applied. A

spring holds the valve rightward, allowing main oil pressure to flow through the valve bore to the manual selector valve and trimmer.

DESCRIPTION AND OPERATION

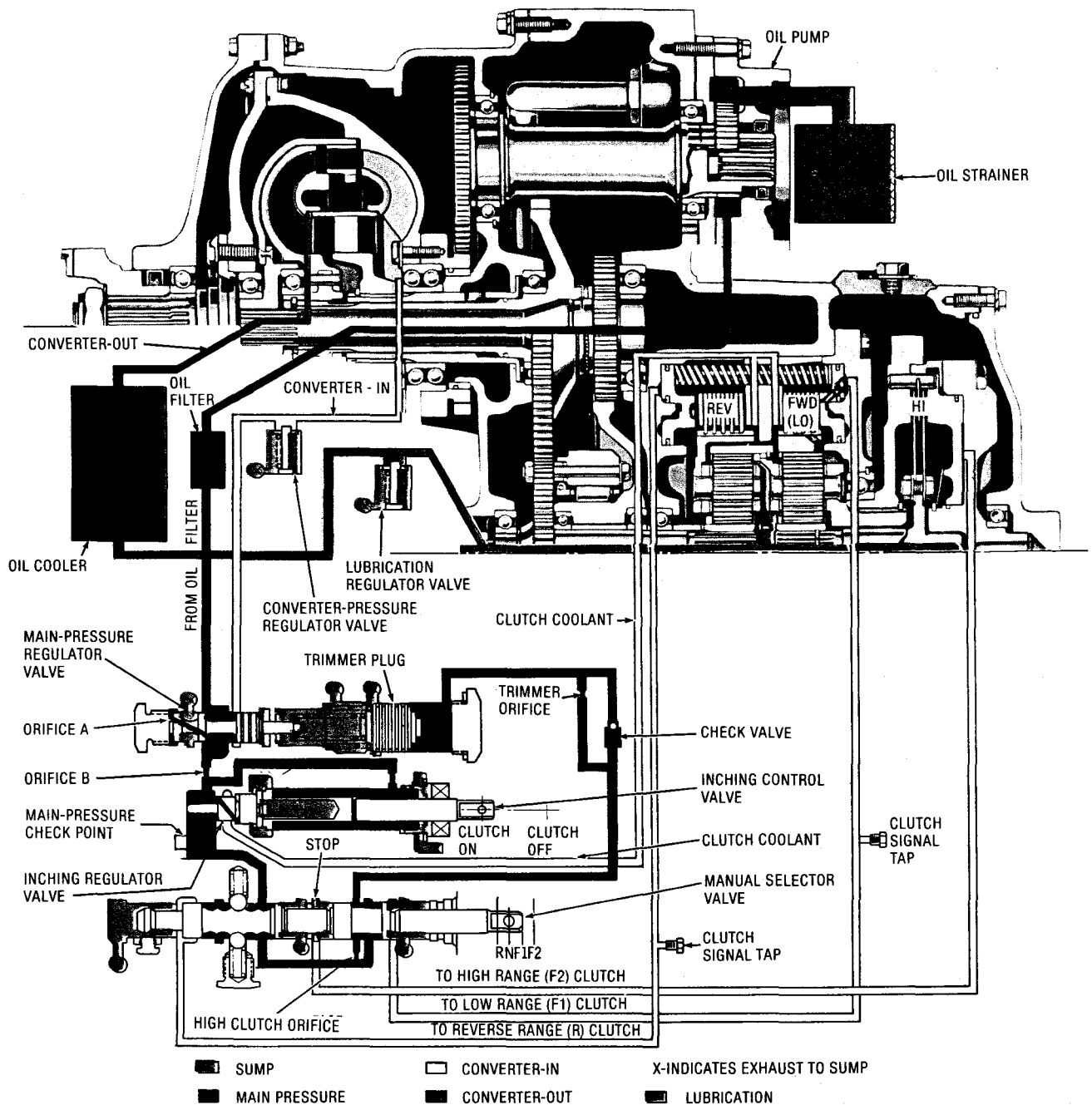


Fig. 2-2. TT 2221-1, TT 2421-1 hydraulic system with inching control

(3) When the vehicle has hydraulic brakes, hydraulic brake pressure acts directly against a plug which moves the clutch cutoff valve leftward during brake application. When the vehicle is equipped with air brakes, air brake pressure actuates a miniature air cylinder. The air cylinder piston rod pushes

the clutch cutoff valve leftward. When leftward against its spring, the clutch cutoff valve interrupts the flow of main pressure oil to the manual selector valve. In this position, the oil in the trimmer circuit is retained, and the charged clutch is allowed to exhaust to sump (blue) through the port

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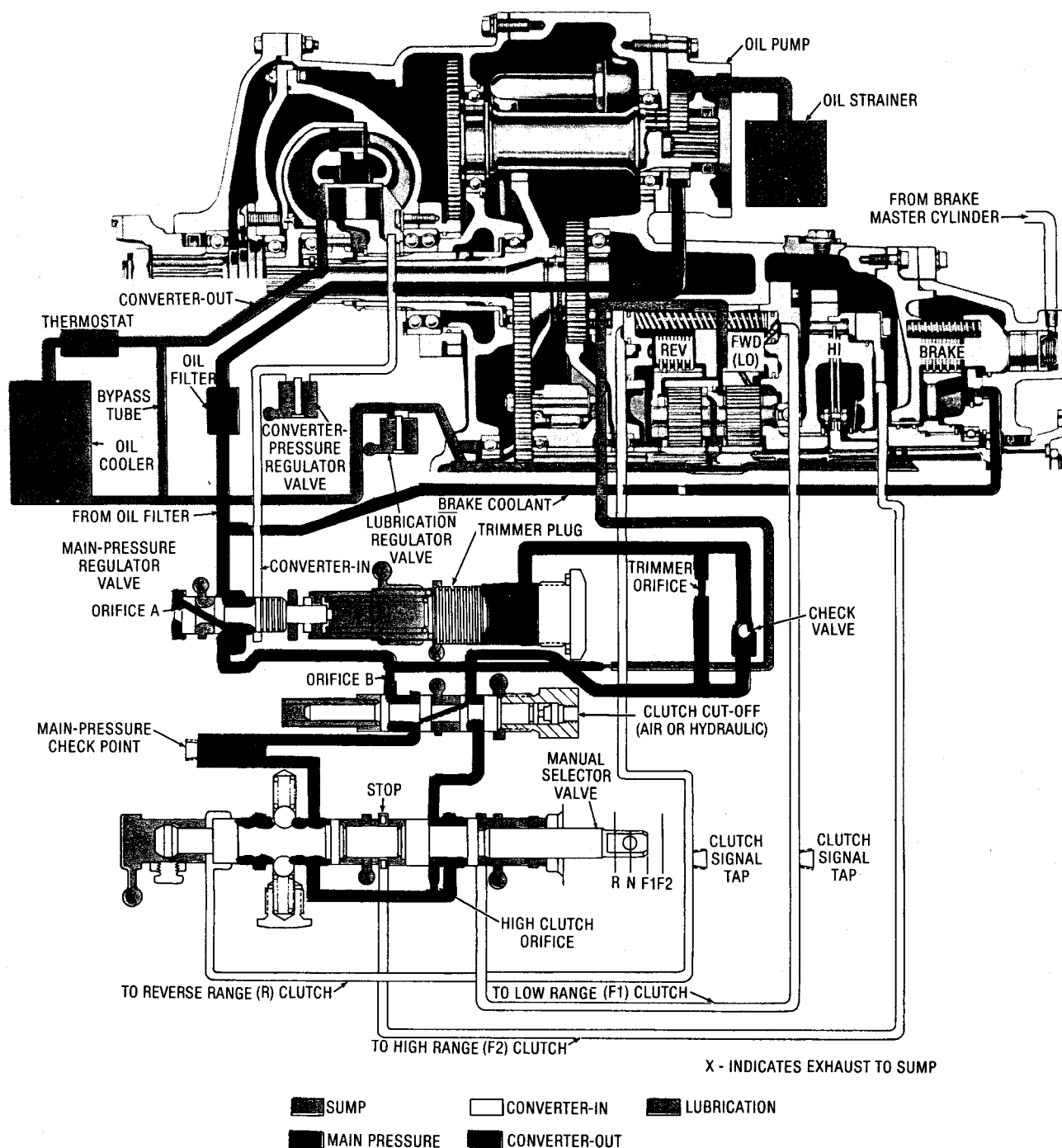


Fig. 2-3. TTB 2221-1, TTB 2421-1 hydraulic system with clutch cutoff control

shown at the top-center of the valve. Thus, when the vehicle brake is applied, the driving clutch is released.

(4) When the brake is released, the clutch cutoff valve returns to its normal position (as shown). This allows the oil re-

DESCRIPTION AND OPERATION

tained at the trimmer to enter the exhausted clutch circuit. This additional volume from the trimmer assists in the quick application of the clutch.

f. Inching Control Valve Circuit (fig. 2-2)

(1) Main pressure (red) from the main-pressure regulator connects to the inching control valve at two points. One is at orifice B directly below the regulator valve. The other is through a line running toward the right end of the inching control valve. Pressure at the left passes on to the manual selector valve. Pressure at the right helps retract the valve against its tendency to move rightward because of main pressure at the inching regulator valve. A spring keeps the valve retracted when the engine is stopped.

(2) Main pressure at the left pushes the inching regulator valve rightward against a spring which seats in the left end of the inching control valve. When the inching control valve is released (retracted), main pressure and spring force at its right end are sufficient to hold it leftward. This exerts sufficient pressure on the regulator spring to hold the inching regulator valve leftward far enough to prevent oil escaping to the clutch coolant passage. Thus, main pressure is retained at the left end of the inching regulator valve.

(3) When the inching control is actuated, the valve is pulled rightward (extended). This reduces the force of the spring acting against the inching regulator valve, permitting the valve to move rightward. This uncovers a port which directs cooling oil to the clutch which slips or releases during inching. The amount of oil which goes to the slipping clutch depends upon the degree of movement of the inching control valve. The escape of oil into the clutch coolant line reduces main pressure, which causes the driving clutch to slip. Orifice B, directly below the main-pressure regulator valve, restricts the flow of oil and causes a lower pressure downstream from the orifice.

(4) Full rightward movement of the inching control valve will completely release the driving clutch. Any degree of clutch en-

gagement is possible by allowing the control to retract.

g. Manual Selector Valve Circuit

(1) Main-pressure oil from the clutch cutoff (or inching control) valve flows into the manual selector valve bore and surrounds the valve in the area of the detent notches. Main oil then flows, regardless of valve position, to another surrounding area toward the right end of the valve. Here it is available for forward ranges and for operation of the trimmer.

(2) Three clutch apply lines leave the bottom of the selector valve bore. From left to right these are reverse range, forward-2, and forward-1. In neutral all three clutch lines are exhausted, and the neutral start switch is actuated. Moving the selector valve one notch rightward will charge the forward (low-range) line and thus apply the clutch. This condition provides low-range operation. A pressure tap, located on the control valve body, provides access to the apply pressure for actuating vehicle signals.

(3) Moving the selector valve a second notch rightward will close off oil to the low-range line and allow it to exhaust. At the same time, oil will charge the forward-2 (high-range) line and thus apply the clutch. This condition provides high-range operation. When the selector valve is in the high-range position, oil to fill the high-range clutch must pass through both orifice B and the high-range clutch orifice. The high-range clutch orifice being smaller than orifice B restricts the volume of oil which can flow through in a given time. As a result, the high-range clutch fills at a slower rate and thus provides smoother engagement.

(4) Moving the selector valve one notch leftward of neutral will charge the reverse line and thus apply the clutch. This condition provides reverse operation.

h. Trimmer Circuit

(1) The trimmer circuit works in conjunction with orifice B and the high-range orifice. The trimmer regulates clutch apply

pressure during initial stages of clutch engagement, and the orifices provide a specific flow at a given pressure. The combination of the trimmer and orifices provide the final pressure and flow pattern to engage the clutches in the desired manner.

(2) Normally, full main pressure (red) holds the trimmer plug leftward against its spring and a shoulder in the valve body bore. This compresses the main-pressure regulator valve spring which causes main pressure to be regulated at maximum psi.

(3) When any shift is made, oil is required to charge the oncoming clutch. This oil must flow through orifice B, directly below the main-pressure regulator valve. The restriction of the oil flow through the orifice causes pressure below the orifice to be reduced. This reduction in pressure allows the trimmer plug to move rightward. Force against the main-pressure regulator valve spring is reduced and main pressure is reduced.

(4) When the clutch being charged is full, flow through the orifice stops and pressure below the orifice rises until it equals main pressure. This increased pressure acts against the right end of the trimmer plug, pushing the trimmer plug leftward. This compresses the main-pressure regulator valve spring and raises main pressure. As main pressure rises, the trimmer plug moves farther leftward until, finally, main pressure is restored to maximum.

(5) The check valve and orifice in parallel branches of the line connecting the selector valve bore to the trimmer plug bore ensure rapid movement of the trimmer plug toward the right (check valve opens) and slower return of the trimmer plug leftward (check valve closes, orifice restricts flow). Main pressure is rapidly reduced but slowly restored.

i. Internal Brake Coolant Lubrication Circuit (fig. 2-3)

(1) Flow in this circuit is controlled by movement of brake adjusting ring 21 (fold-out 15,B). When the brake is applied, the ad-

justing ring moves forward and uncovers the large port, allowing cooling oil to flood the cavity and cool the brake plates.

(2) When the brake is released, the adjusting ring returns to its seat in the rear cover, closing the large port and stopping the flow of cooling oil. However, a small orifice in the adjusting ring allows oil to bleed into the cavity to provide sufficient lubrication of the released brake components.

2-11. HYDRAULIC SYSTEM--TRT 2221 AND TRT 2421 MODELS (fig. 2-4 through 2-9)

a. Oil Pump, Filter Circuit. Refer to paragraph 2-10a (1).

b. Main-Pressure Regulator Valve, Converter-in Circuit. Refer to paragraph 2-10b.

c. Torque Converter. Refer to paragraph 2-10c.

d. Converter-out, Cooler, Lubrication Circuit. Refer to paragraph 2-10d.

e. Clutch Cutoff Valve Circuit (fig. 2-4, 2-6, 2-8). Refer to paragraph 2-10e.

f. Inching Control Valve Circuit (fig. 2-5, 2-7, 2-9). Refer to paragraph 2-10f. Not all -3 underdrive models (fig. 2-6) use the low-range clutch for inching. Some use the forward or reverse clutch as the slipping clutch. When one of these clutches is used, the clutch coolant circuit directs the coolant to the slipping clutch.

g. Manual Selector Valve Circuit

(1) Main-pressure oil from orifice B flows into the manual selector valve bore and surrounds the valve in the area of the detent notches. From this area, main oil flows, regardless of valve position, to another area at the right surrounding the valve. Here it is available for high range and forward clutches and for operation of the trimmer.

(2) Four clutch-apply lines leave the bottom of the selector valve bore. From left

DESCRIPTION AND OPERATION

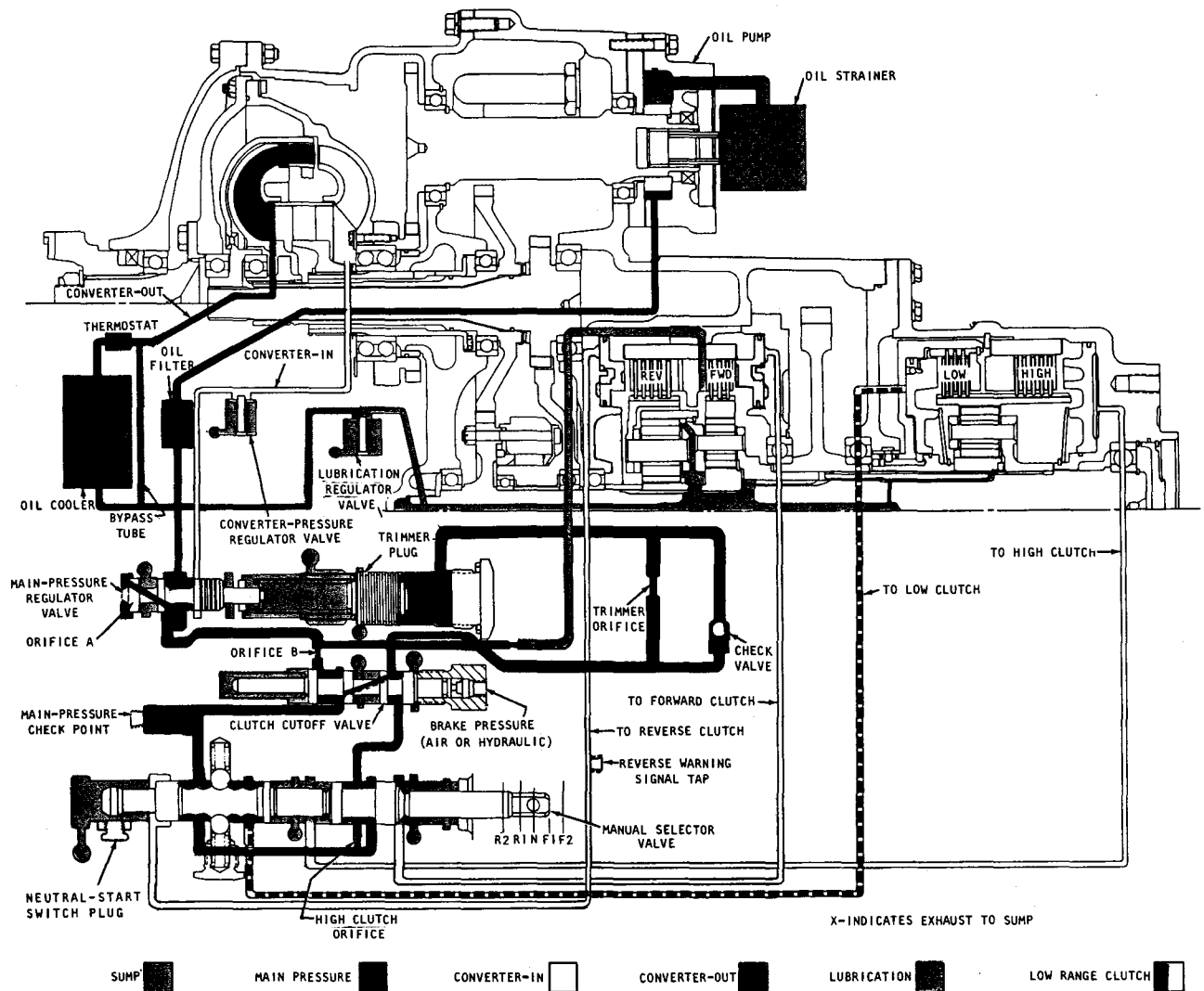


Fig. 2-4. TRT 2221-1, TRT 2421-1 hydraulic system with clutch cutoff control

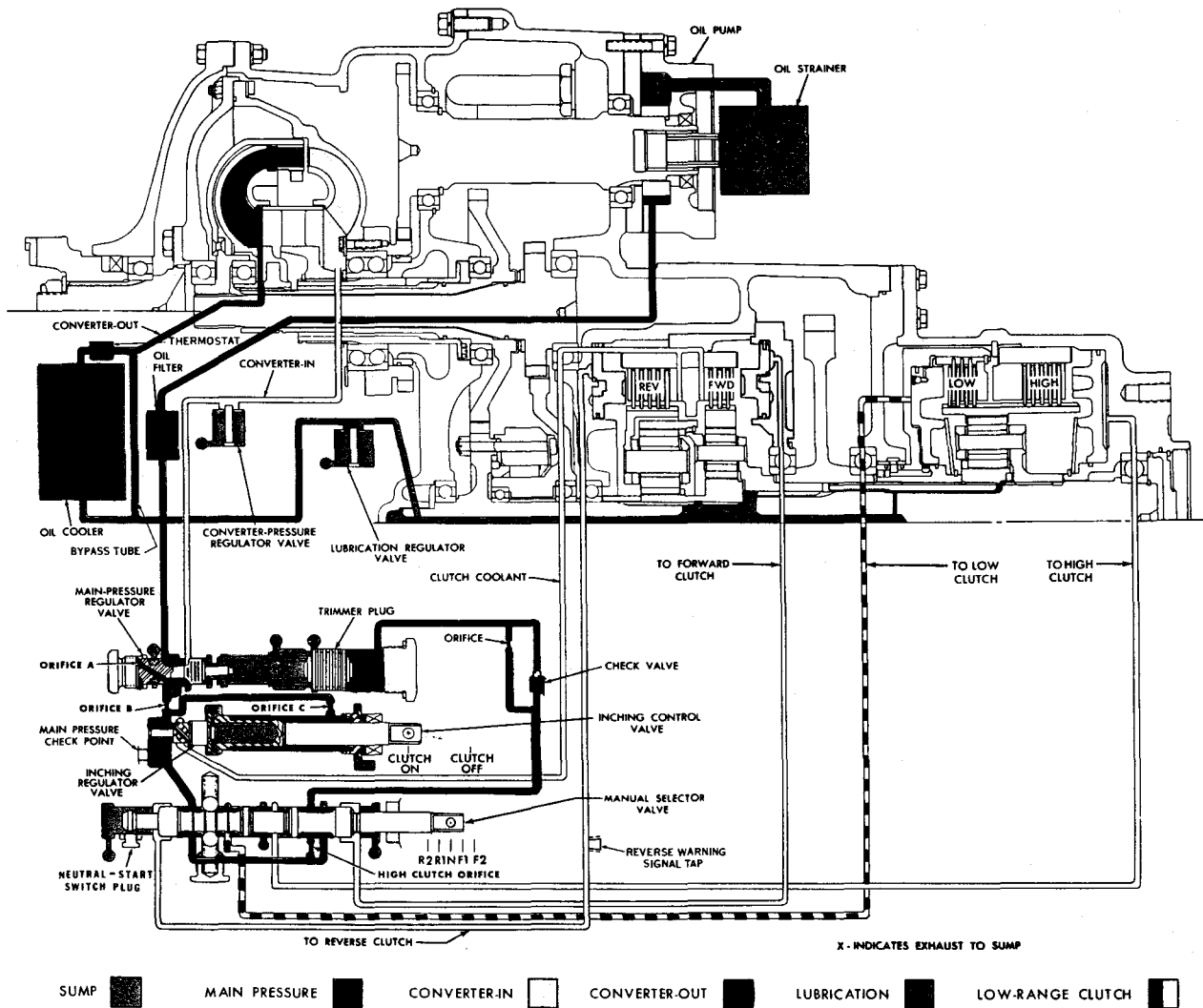
to right these are reverse, low range, high range, and forward. In neutral, the low range clutch is applied, and the remaining three are exhausted. Moving the selector valve one notch rightward will leave the low-range clutch applied and will charge the forward clutch. This is forward-1.

(3) Moving the selector valve a second notch rightward will close off oil to the low-range clutch and allow it to exhaust. The forward clutch will remain applied and the high-range clutch will be charged. This is forward-2.

(4) Moving the selector valve one notch leftward of neutral will charge the reverse clutch while allowing the low-range clutch to remain charged. This is reverse-1. If the vehicle is equipped with a reverse warning signal, clutch apply pressure in the reverse circuit actuates the warning device.

(5) Moving the valve a second notch leftward will close off oil to the low-range clutch and allow it to exhaust. The reverse clutch will remain applied and the high-range clutch will be charged. This is reverse-2.

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Fig. 2-5. TRT 2221-1, TRT 2421-1 hydraulic system with inching control

(6) When the selector valve is moved to the high-range position (either F2 or R2), oil to fill the high-range clutch must pass through both orifice B and the high-range clutch orifice. This is due to the oil passage immediately to the right of the high-range clutch orifice being blocked by the manual selector valve. The high-range clutch orifice is smaller than orifice B and restricts the flow of oil to the high range clutch. As a result, the high-range clutch fills at a slower rate than other clutches and thus provides smoother engagement.

h. Trimmer Circuit. Refer to paragraph 2-10h.

2-12. HYDRAULIC SYSTEM—TRT 2211 AND TRT 2411 MODELS (fig. 2-10, 2-11)

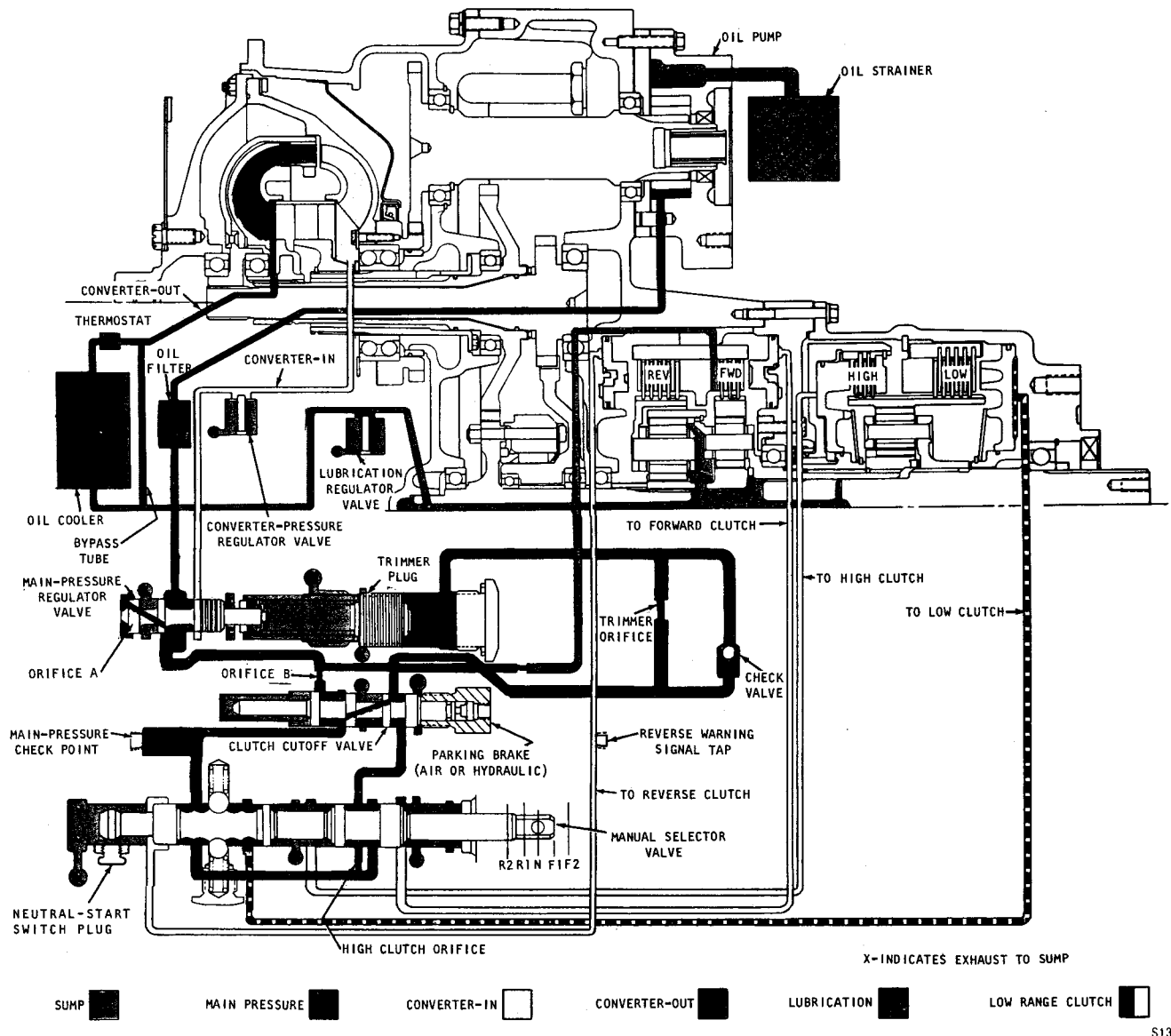
a. Oil Pump, Filter Circuit. Refer to paragraph 2-10a (1).

b. Main-Pressure Regulator Valve, Converter-in Circuit. Refer to paragraph 6-10b.

c. Torque Converter. Refer to paragraph 6-10c.

d. Converter-out, Cooler, Lubrication Circuit. Refer to paragraph 2-10d.

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Fig. 2-6. TRT 2221-3, TRT 2421-3 hydraulic system for underdrive model with clutch cutoff

e. Clutch Cutoff Valve Circuit (fig. 2-10). Refer to paragraph 2-10e.

f. Inching Control Valve Circuit (fig. 2-11). Refer to paragraph 2-10f.

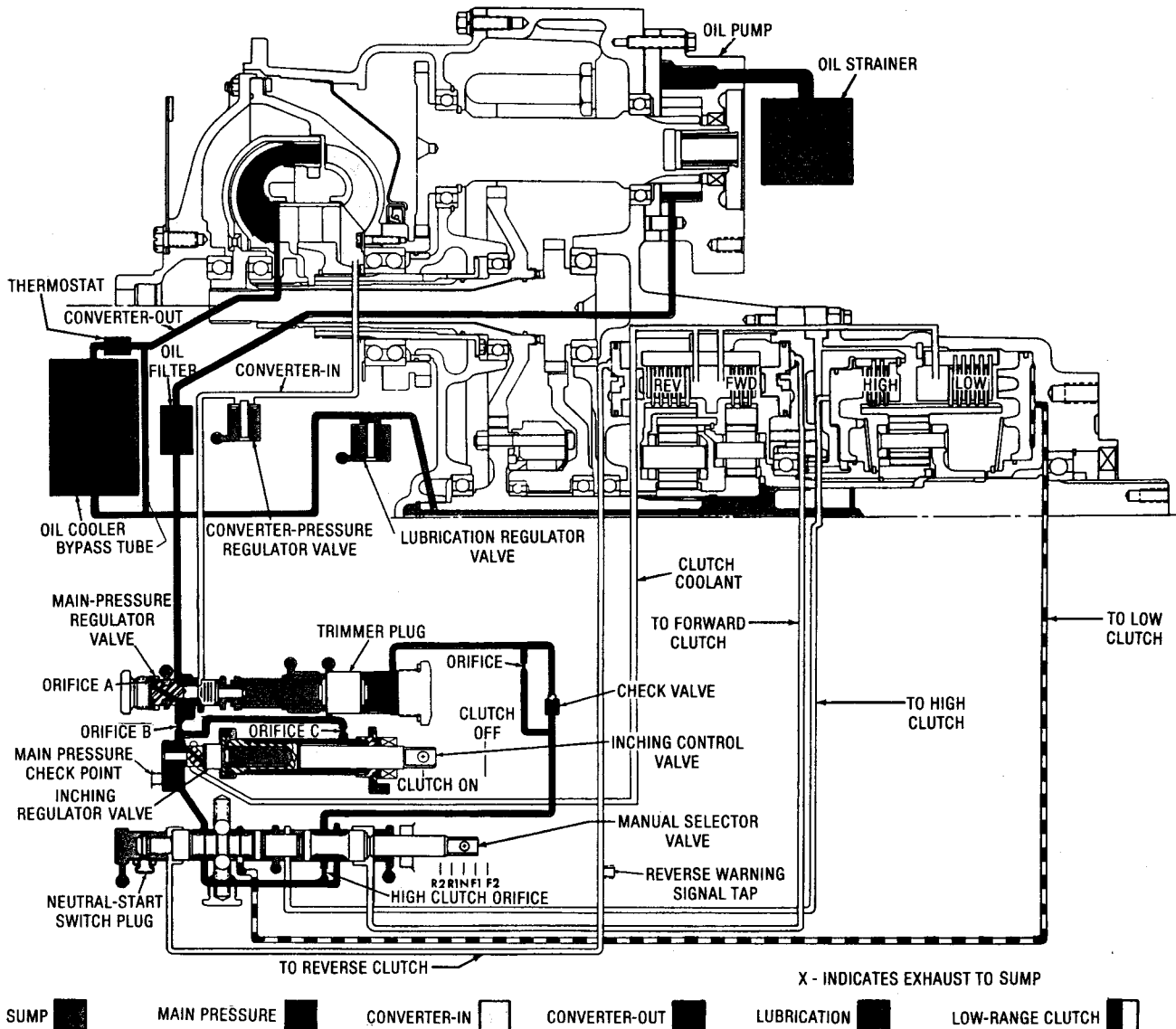
g. Manual Selector Valve Circuit

(1) Refer to paragraph 2-11g for explanation of the manual selector valve circuit, but disregarding those explanations on the F2 or R2 driving mode. The TRT 2211-3 and 2411-3 manual selector valve is restricted to three positions. These are neu-

tral, forward, and reverse. Accordingly, only two clutch-apply lines lead from the bottom of the selector valve bore. The left-side line goes to the reverse clutch. The right-side line goes to the forward clutch. Movement of the selector valve one notch leftward charges the reverse clutch. In neutral, both clutches are exhausted. Movement one notch to the right charges the forward clutch and exhausts reverse. Two valve stops limit the travel of the manual selector valve to these three positions.

h. Trimmer Circuit. Refer to paragraph 2-10h.

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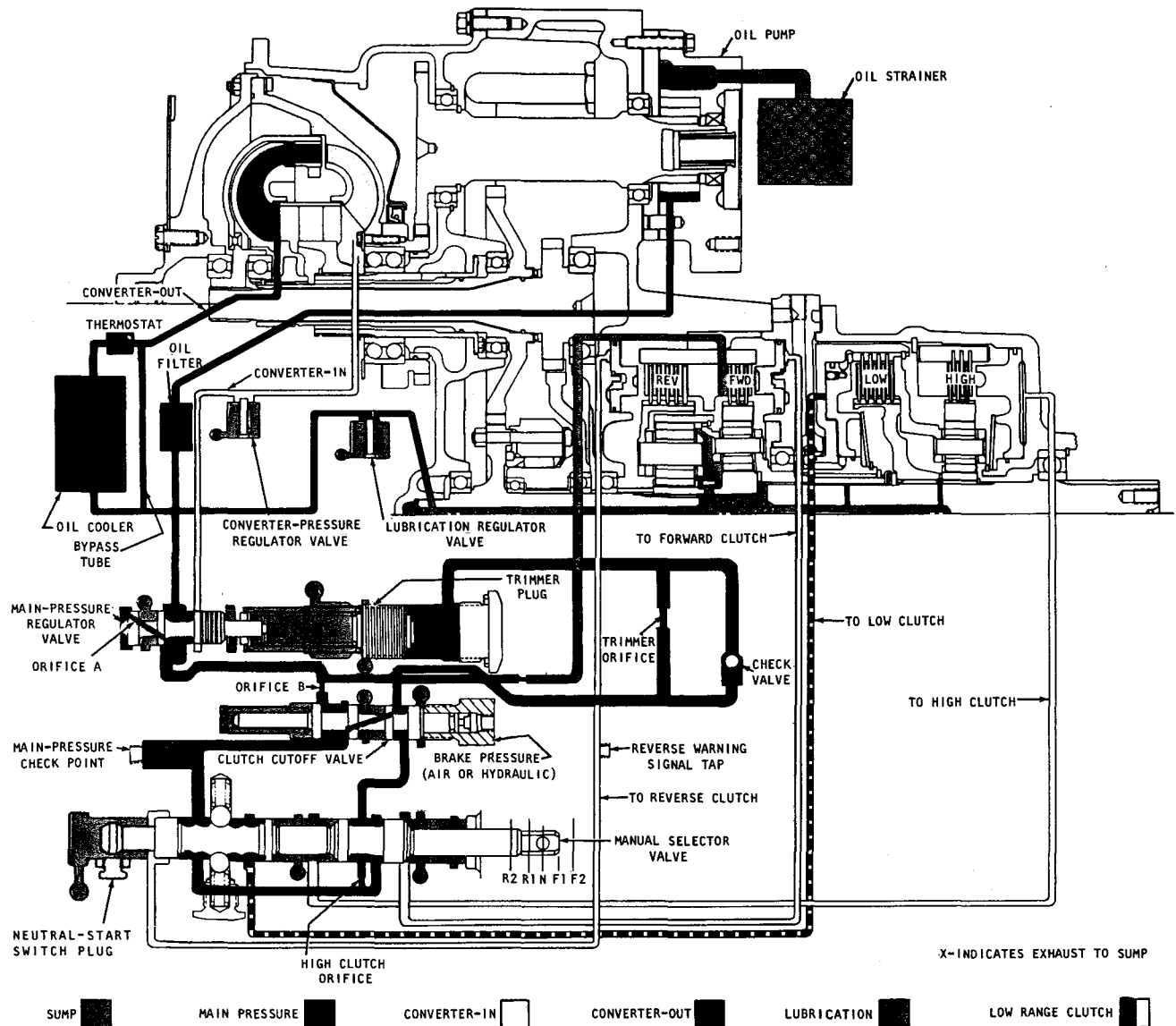
Fig. 2-7. TRT 2221-3, TRT 2421-3 hydraulic system for underdrive model with inching control

2-13. TRANSMISSION TORQUE PATHS

a. Component Functions. The torque converter, driven by the engine, directs torque through the first and/or second turbine to the second-turbine driven gear shaft. The shaft, splined to the forward-and-reverse sun gear, drives the range planetaries and the high-range clutch hub. Hydraulic-actuated clutches, when applied, cause reactions within the involved range components. The interaction within the planetaries or application

of the high-range clutch determines the gear ratio and direction of torque imparted to transfer gears. Thus, the torque path changes for each operating condition. Therefore, a knowledge of how these components direct the power flow through the transmission is necessary for proper diagnosis of transmission trouble. An understanding of the accessory gearing and converter-driven PTO is also helpful when the vehicle includes equipment driven by the transmission PTO components.

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Fig. 2-8. TRT 2221-3, TRT 2421-3 hydraulic system for overdrive model with clutch cutoff

b. Cross-Section Illustrations

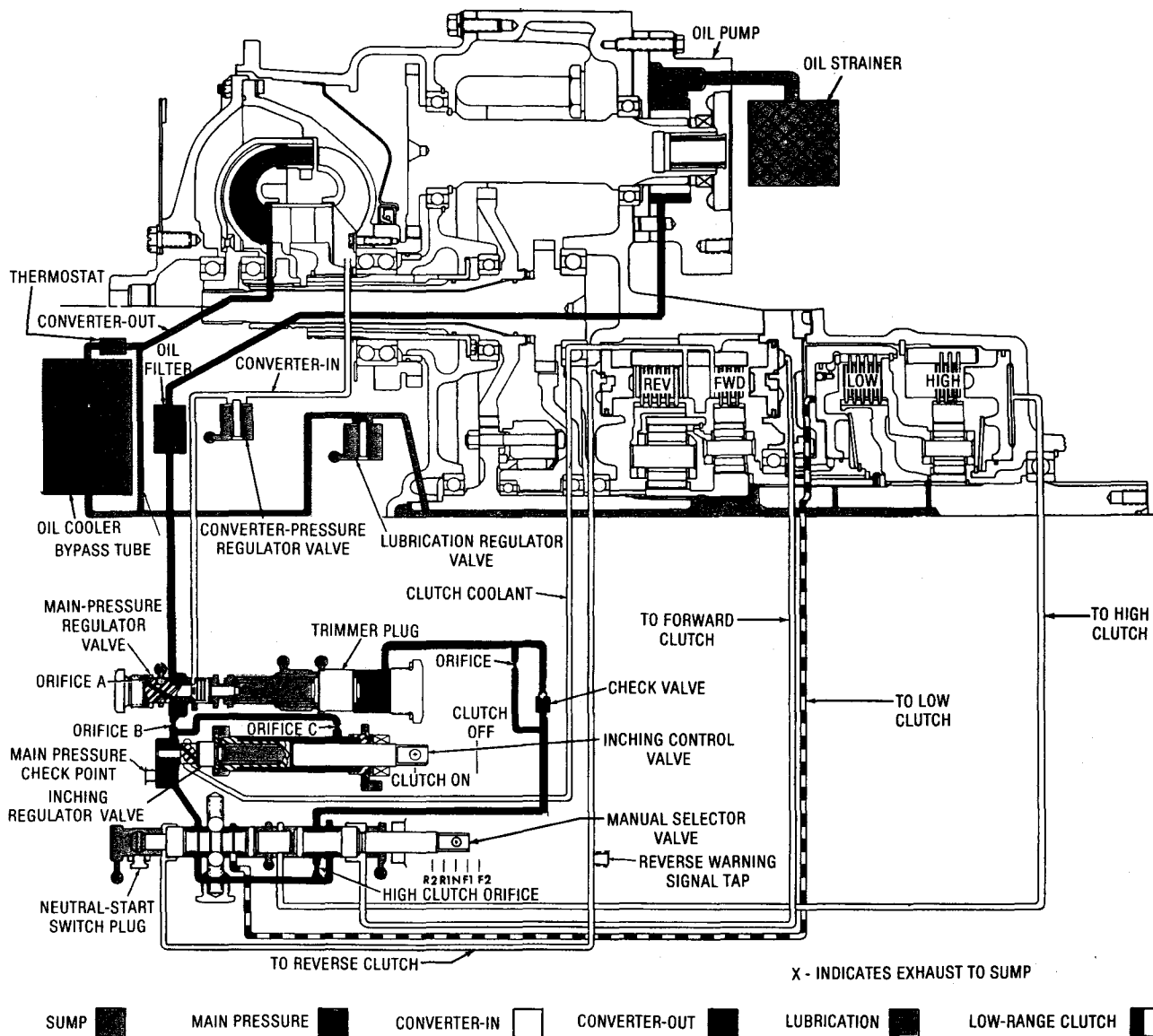
(1) Figure 2-12 is a cross-section view of the twin-turbine torque converter. Figures 2-13 through 2-25 illustrate the paths through which the power flows from the engine to the transmission outputs.

(2) Because the driving turbine is automatically determined by the load and speed requirement imposed by the vehicle, the torque path through the converter is not

necessarily confined to a specific operating range. Thus, both paths are shown—a dotted red line indicates the first-turbine torque path and a broken red line indicates the second-turbine torque path. Engagement of the range clutches is indicated by horizontal red bars across the clutch plates.

(3) All individual conditions for each transmission are not illustrated. However, the red torque paths and explanations for specific models can be applied to other

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Fig. 2-9. TRT 2221-3, TRT 2421-3 hydraulic system for overdrive model with inching control

models. This will be done by referring, in some instances, to text and illustrations for one model when explaining another model.

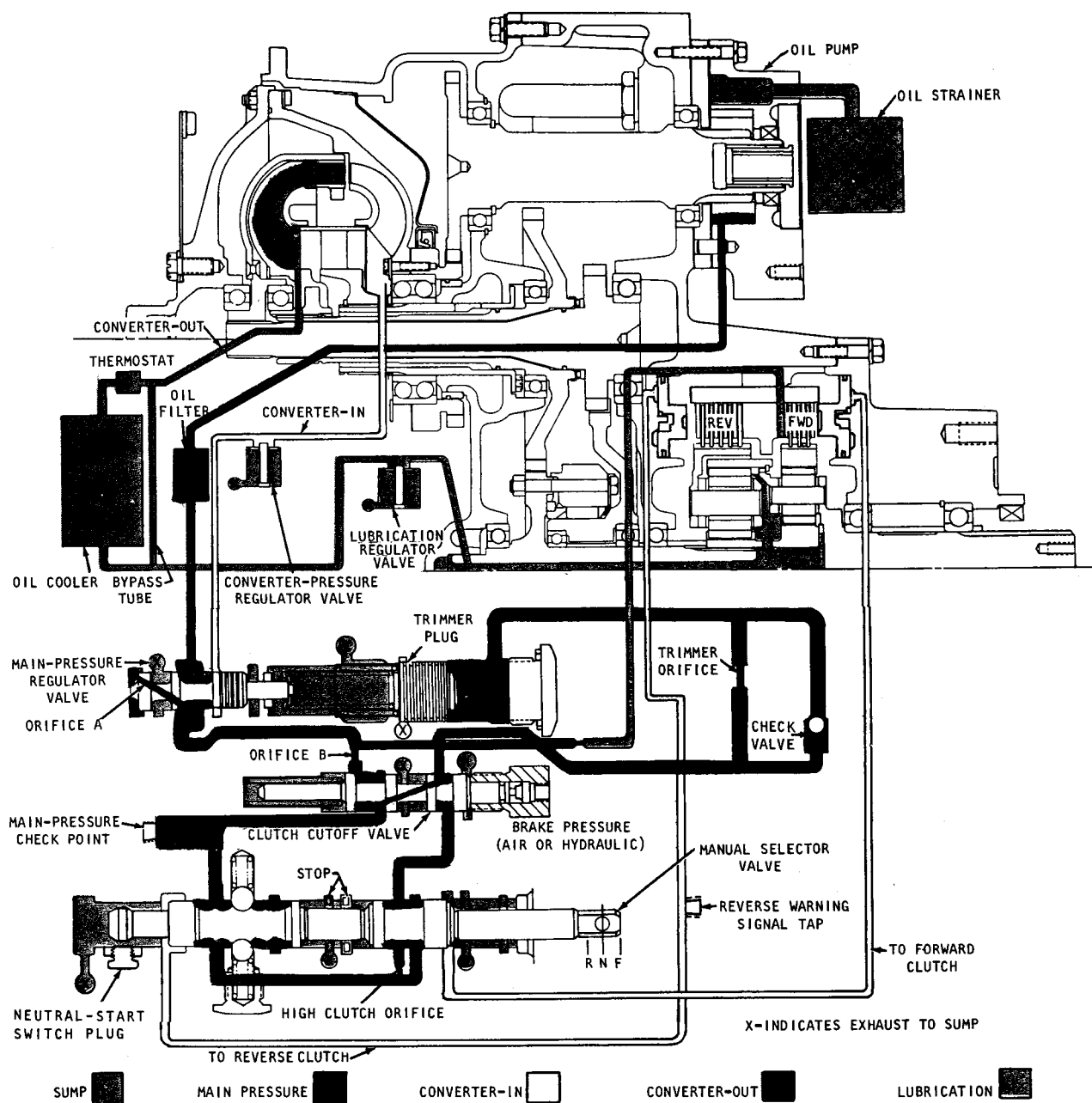
c. Torque Converter, Freewheel Clutch (fig. 2-12)

(1) Power is transmitted from the engine to torque converter pump assembly 6 by either a flex disk drive or an input flange. From the pump, power must be transmitted

hydraulically to either first-turbine assembly 3 or second-turbine assembly 4, or to both under certain operating conditions.

(2) Speed and load determine whether the torque flows through the first- and second-turbine assemblies 3 and 4, or only through second-turbine assembly 4. At high-load demand and low speed, freewheel clutch 12 is engaged and first-turbine assembly 3 acts as the driving member. As speed in-

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Fig. 2-10. TRT 2211-3, TRT 2411-3 hydraulic system with clutch cutoff control

creases and load demand decreases, free-wheel clutch 12 disengages and second-turbine assembly 4 becomes the primary driving member. Thus, first-turbine operation is related to higher torque, and second-turbine operation to higher speed. The transition from the torque phase to the speed phase is entirely automatic, governed by the load and speed of the vehicle.

2-14. CONVERTER GEARING TO FORWARD-AND-REVERSE SUN GEAR—TORQUE PATH

a. First Turbine (fig. 2-12). Torque from converter pump assembly 6 is transmitted hydraulically to first-turbine assembly 3. The first turbine is splined to first-turbine drive gear 10 which meshes with first-tur-

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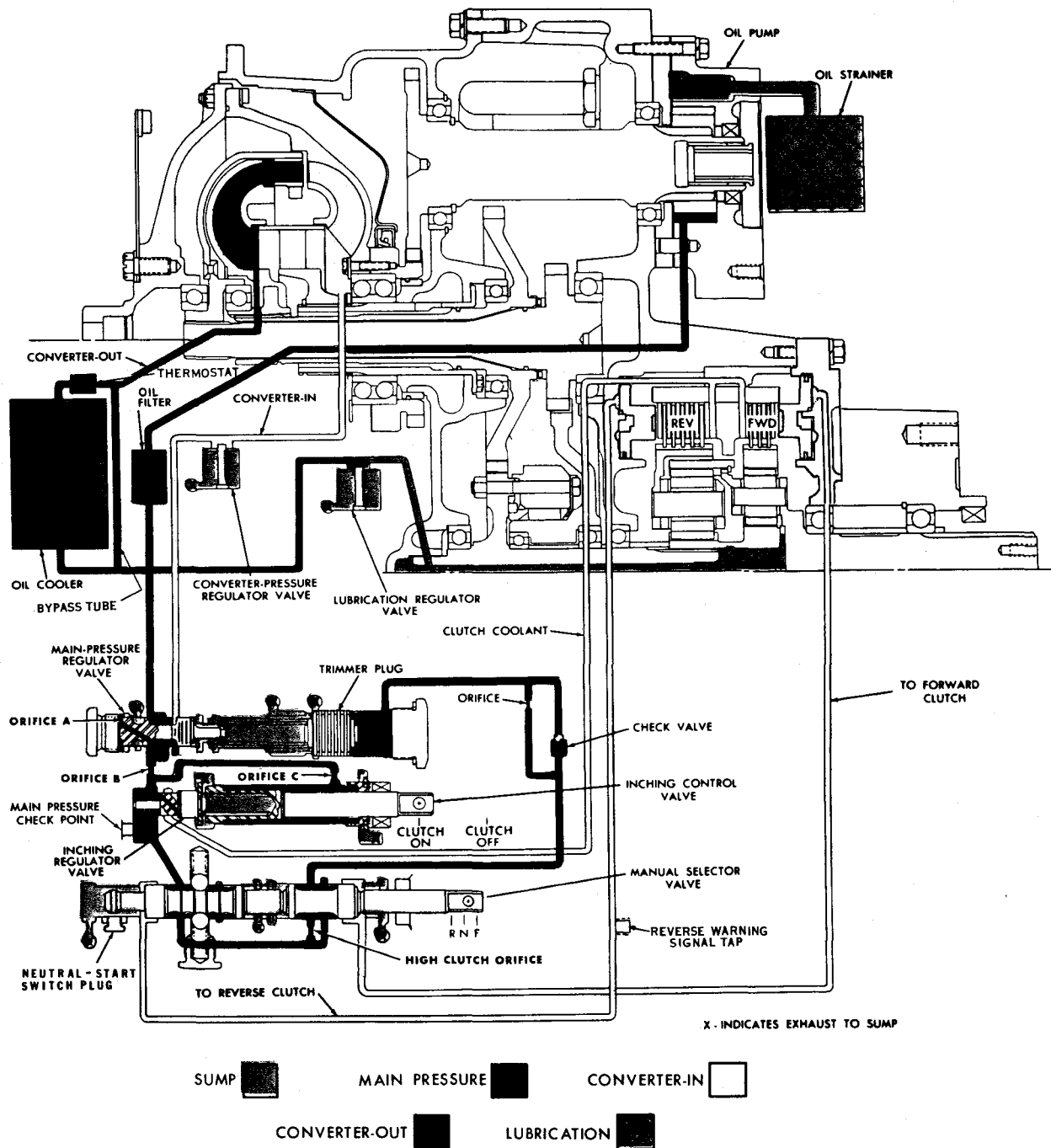


Fig. 2-11. TRT 2211-3, TRT 2411-3 hydraulic system with inching control

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bine driven gear 11. The first-turbine driven gear is connected by freewheel clutch 12 to second-turbine driven gear 14. The second-turbine driven gear is integral with range gear input shaft 13. The forward-and-reverse sun gear is splined onto the shaft end. Thus, all these components rotate when the vehicle is

operating in a high-load, low-speed condition. The hydraulic action in the converter and the interconnection of the turbine-driven gears (first and second) permit the second turbine to assist the first until the freewheel clutch disengages.

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- 1- Input flange
- 2- First-turbine support bearing
- 3- First-turbine assembly
- 4- Second-turbine assembly
- 5- Stator
- 6- Converter pump assembly
- 7- Converter pump bearing
- 8- Transmission housing
- 9- Oil pump and engine-driven PTO
- 10- First-turbine drive gear
- 11- First-turbine driven gear
- 12- Freewheel clutch
- 13- Range gear input shaft
- 14- Second-turbine driven gear
- 15- Second-turbine drive gear
- 16- Input accessory drive gear
- 17- Torque converter housing
- 18- Converter drive cover
- 19- Transmission front cover
- 20- Second-turbine support bearing
- 21- Converter front support bearing

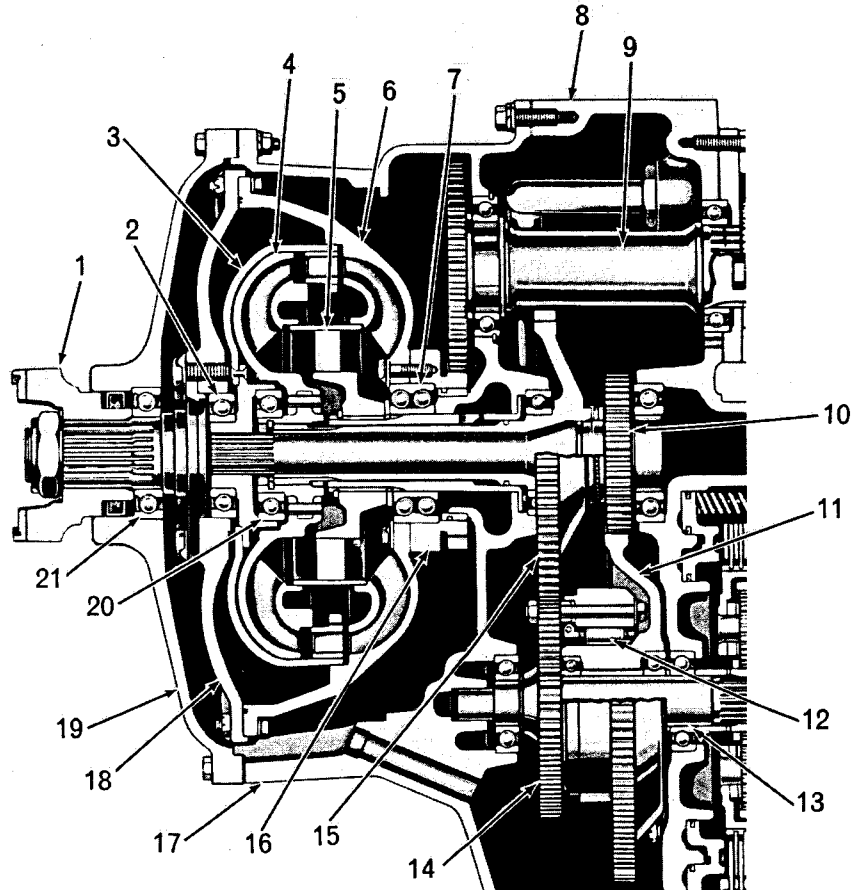


Fig. 2-12. Typical twin-turbine torque converter and converter gearing

b. Second Turbine (fig. 2-12). When the output speed of the converter increases, the load is assumed by second-turbine assembly 4, and when it attains sufficient speed, freewheel clutch 12 will disengage. This allows first-turbine assembly 3 to rotate freely, and no drive is contributed by the first turbine. Second-turbine assembly 4 is splined to the hollow shaft of second-turbine drive gear 15. The drive gear meshes with second-turbine driven gear 14 (integral with range gear input shaft 13) which is splined with the forward-

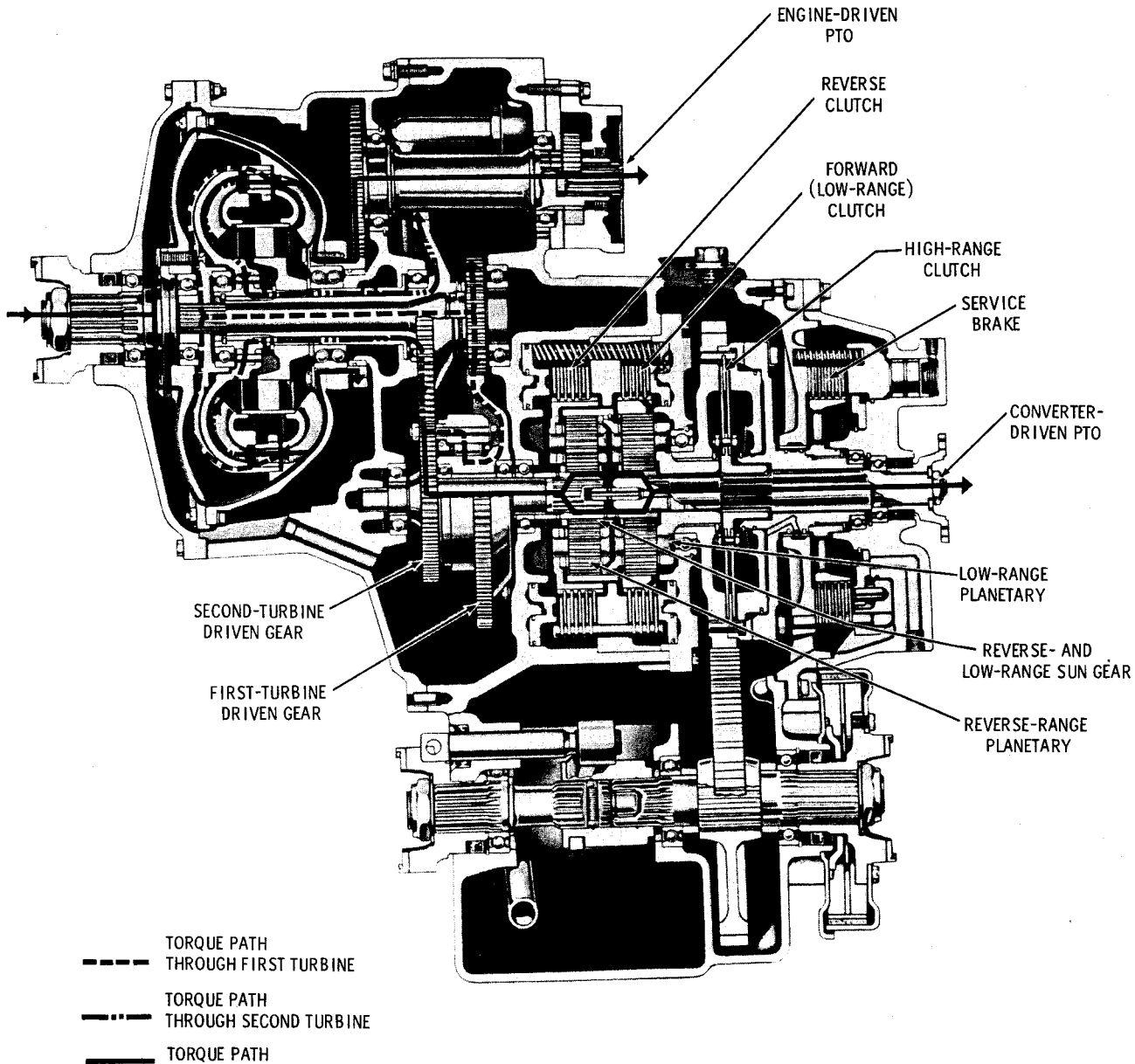
and-reverse sun gear. Thus, all these components rotate when the vehicle is operating in a low-load, high-speed condition.

2-15. TT, TTB 2221-1, 2421-1 TORQUE PATHS

a. Neutral and Power Takeoff (fig. 2-13)

(1) When the range selector is in neutral position, power is transmitted through

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Fig. 2-13. Neutral torque path (TTB 2221-1, TTB 2421-1 with converter-driven PTO)

the torque converter to the forward-and-reverse sun gear as described in paragraph 2-14. No range clutches are engaged. Thus, rotation of the sun gear causes the planetary pinions to rotate freely, and no power flow occurs in the range gearing. However, on models equipped with a converter-driven PTO, rotation of the sun gear drives the PTO shaft any time the turbines are rotating.

(2) Torque from the engine flows through the torque converter pump to the in-

put accessory drive gear. Rotation of the input accessory drive gear drives the engine-driven PTO through the accessory driven gear. If the transmission is equipped with an implement pump drive, rotation of the input accessory drive gear also drives the accessory drive gear and shaft assembly. The gearing for the implement pump drive is located directly behind (relative to illustration) the engine-driven PTO gearing.

DESCRIPTION AND OPERATION

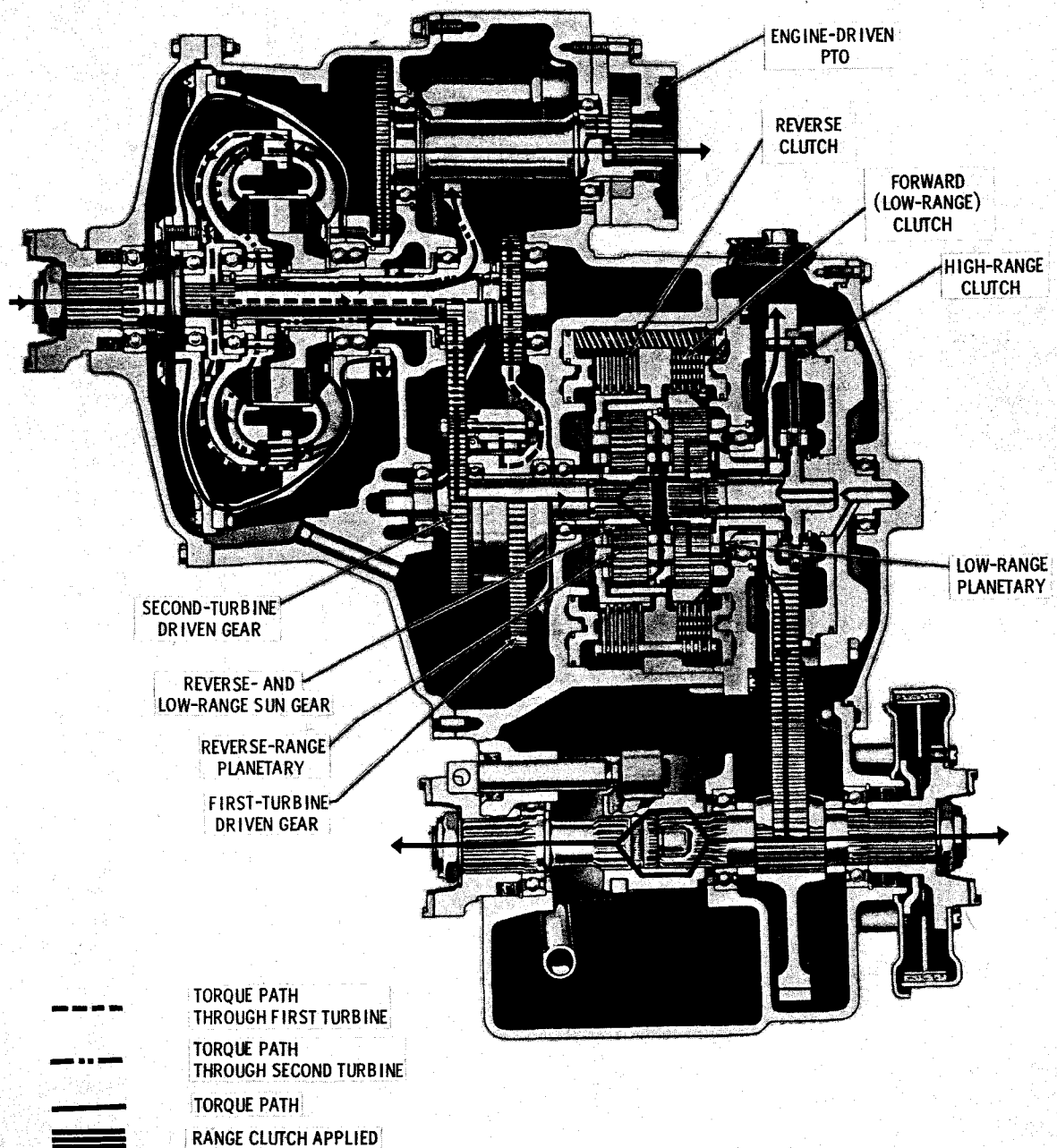


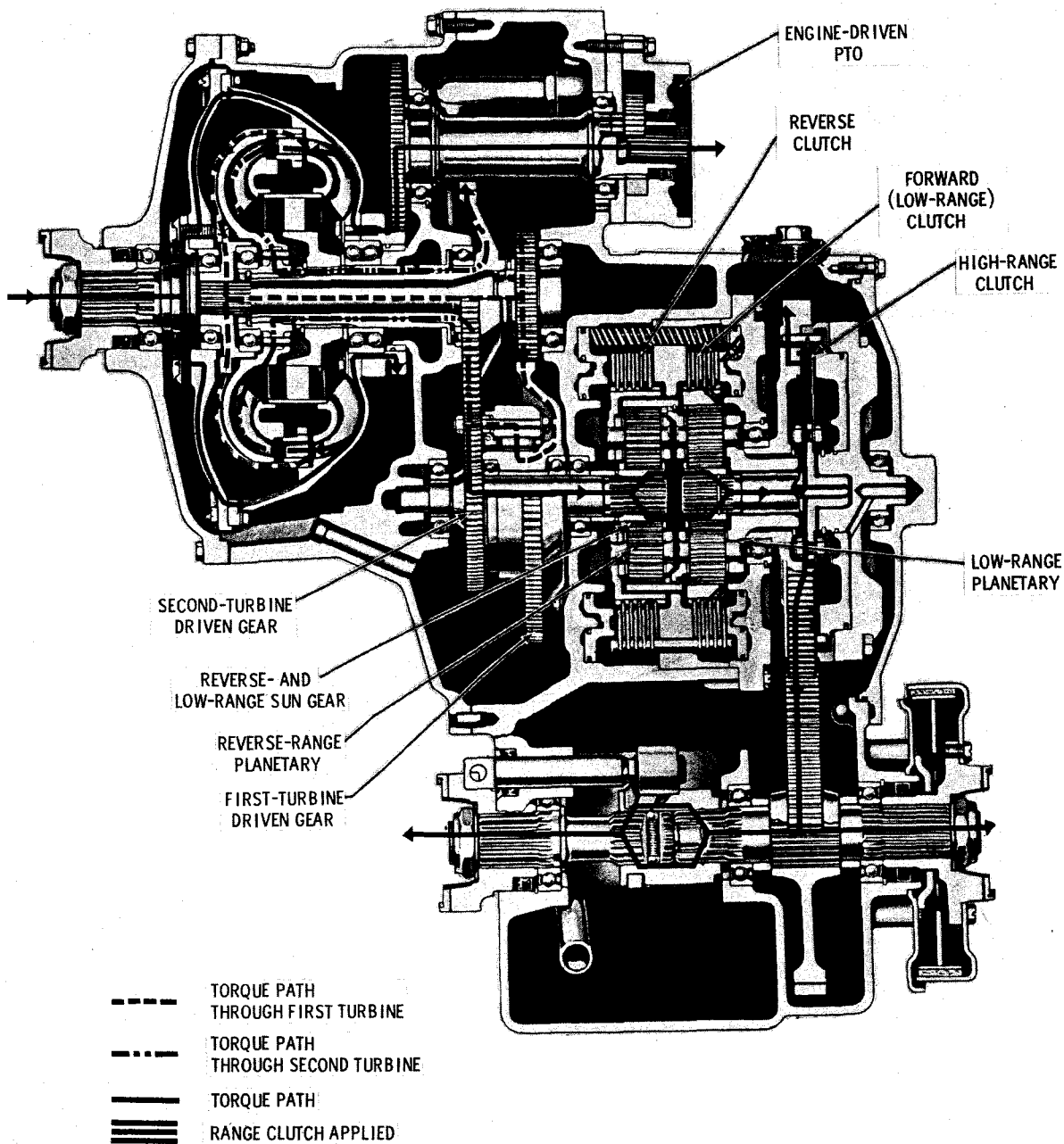
Fig. 2-14. Forward-1 (low-range) torque path (TT 2221-1, TT 2421-1 transmission)

b. Forward-1 (low-range) (fig. 2-14)

(1) In forward-1 (low-range) operation, torque is transmitted through the torque converter to the forward-and-reverse sun gear in the same manner as described in paragraph 2-14. When the range selector is moved from neutral to low range (F1), the forward clutch engages and holds the forward ring gear stationary.

(2) The rotating forward-and-reverse sun gear drives the forward planetary pinions within the stationary ring gear. This causes the forward planetary carrier to rotate. The hub of the carrier is splined to the transfer drive gear. The drive gear meshes with the driven gear which is splined to the output shaft. The manual-operated disconnect coupling, when moved forward, will interrupt the drive to the front output.

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Fig. 2-15. Forward-2 (high-range) torque path (TT 2221-1, TT 2421-1 transmission)

c. Forward-2 (high-range) (fig. 2-15)

(1) In forward-2 (high-range) operation, torque is transmitted through the torque converter to the forward-and-reverse sun gear in the same manner as described in paragraph 2-14. When the range selector is moved from low range (F1) to high range (F2), the forward (low-range) clutch releases and the high-range clutch engages.

(2) The rotating forward-and-reverse sun gear drives the high-range clutch hub which is bolted to the high-range clutch friction plates. Engagement of the high-range clutch locks the transfer drive gear to the rotating high-range clutch hub. The transfer drive gear meshes with the driven gear which is splined to the output shaft. The manual-operated disconnect coupling, when moved forward, will interrupt the drive to the front output.

DESCRIPTION AND OPERATION

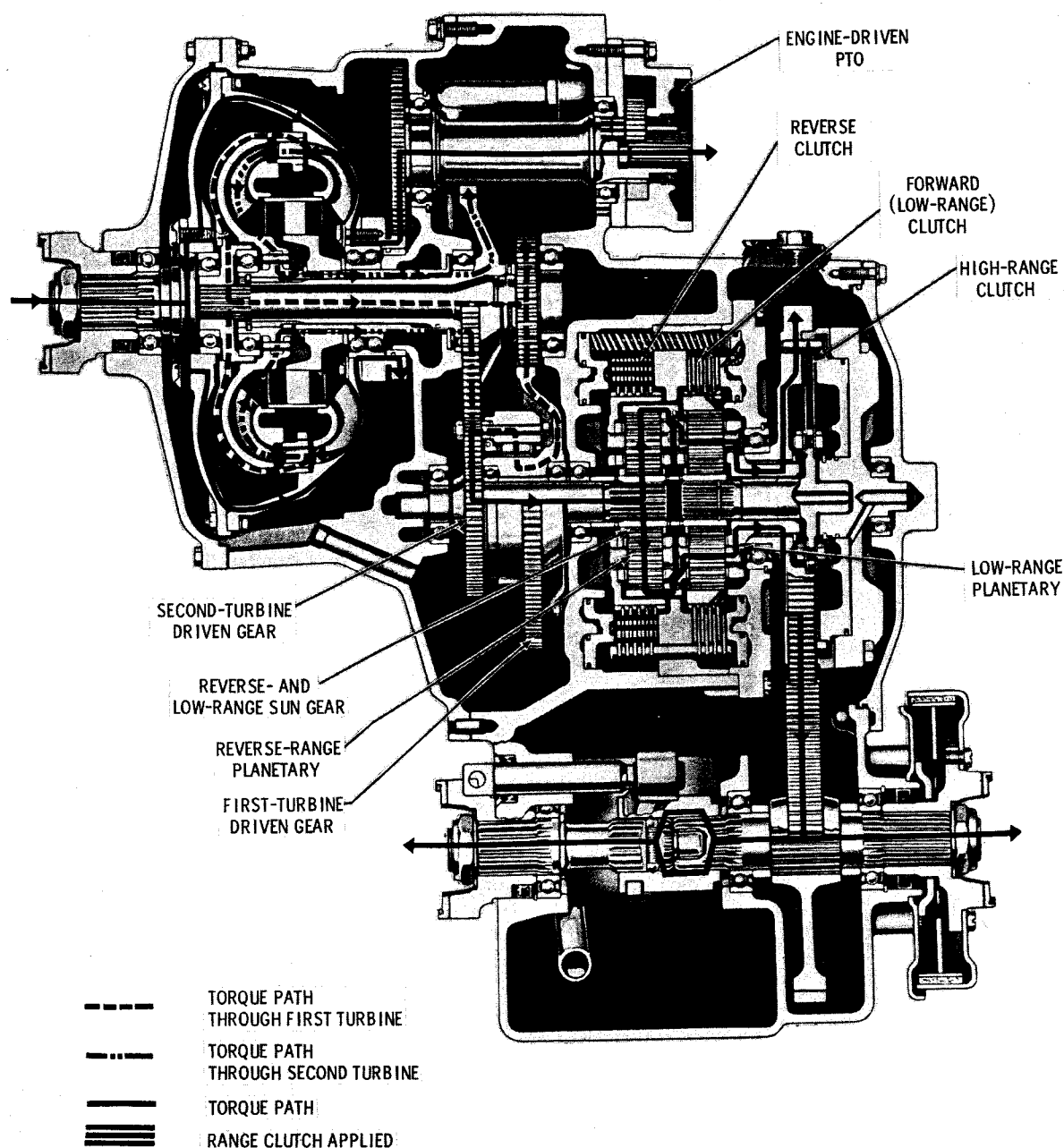


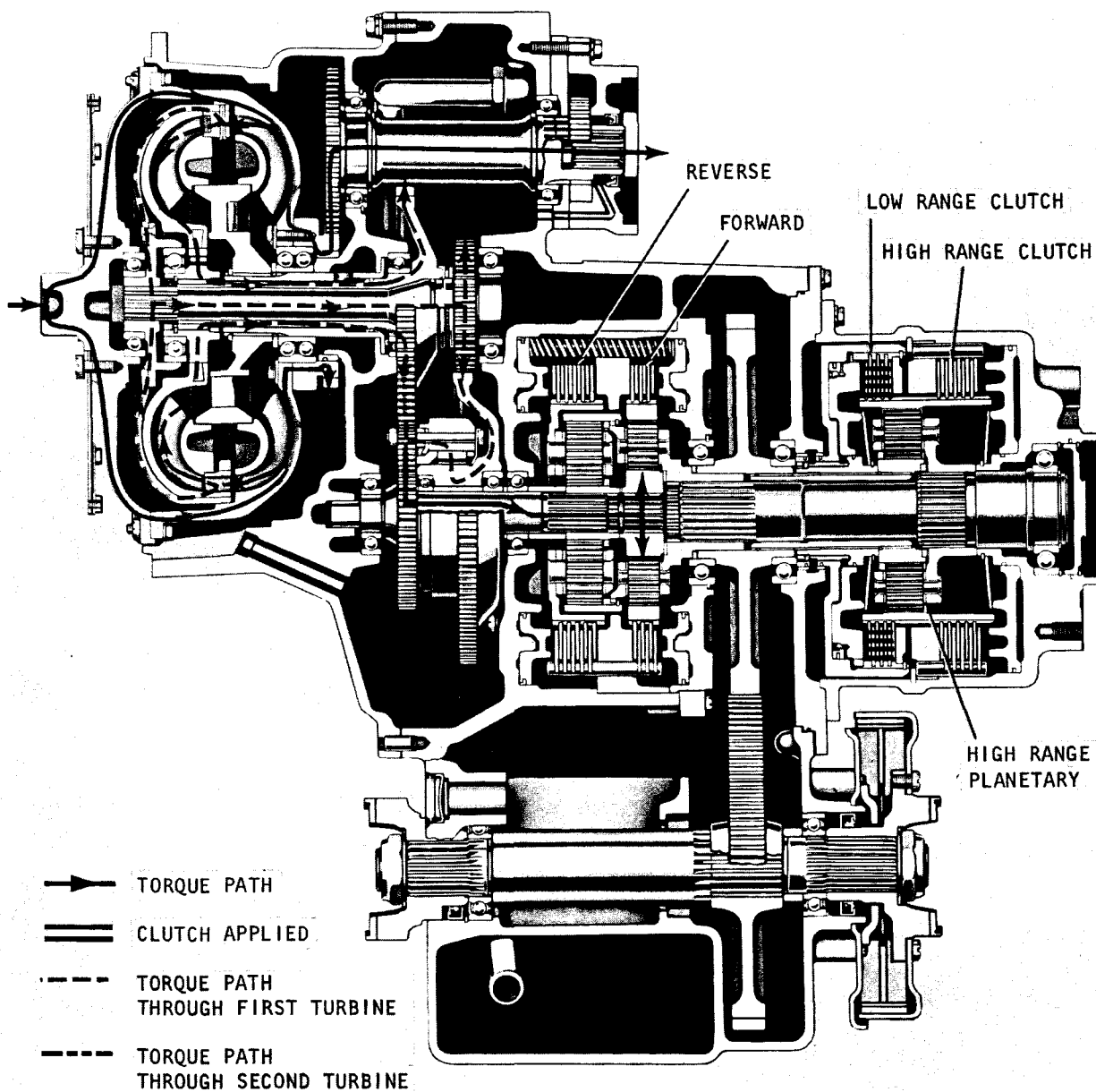
Fig. 2-16. Reverse-range torque path (TT 2221-1, TT 2421 transmission)

d. Reverse Range (fig. 2-16)

(1) In reverse-range operation, torque is transmitted through the torque converter to the forward-and-reverse sun gear in the same manner as described in paragraph 2-14. When the range selector is moved to reverse-range position, the forward-range clutches (F1 and F2) are exhausted and the reverse-range clutch engages and holds the reverse-range planetary hub (and carrier) stationary.

(2) The rotating forward-and-reverse sun gear drives the pinions which also are in mesh with the reverse-range ring gear. This causes the ring gear to rotate in a direction opposite to that of the sun gear. The ring gear is attached to the forward planetary carrier. Thus, the reverse torque is transmitted from the reverse-range ring gear through the forward planetary carrier to the transfer drive gear. The transfer drive gear meshes with the driven gear which in turn

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Fig. 2-17. Neutral torque path (TRT 2221-1, TRT 2421-1 transmission)

drives the transfer drive gear and output shaft in reverse. The manual-operated disconnect coupling, when moved forward, will interrupt the drive to the front output.

2-16. TRT 2221-1, 2421-1 TORQUE PATHS

a. Neutral and Power Takeoff (fig. 2-17)

(1) When the range selector is in Neutral position, power is transmitted through

the torque converter to the forward-and-reverse sun gear as described in paragraph 2-14. The low-range clutch is engaged but no torque is transmitted because neither the forward nor reverse clutch is engaged. The reverse carrier and forward ring gear rotate freely.

(2) Refer to paragraph 2-15a (2).

DESCRIPTION AND OPERATION

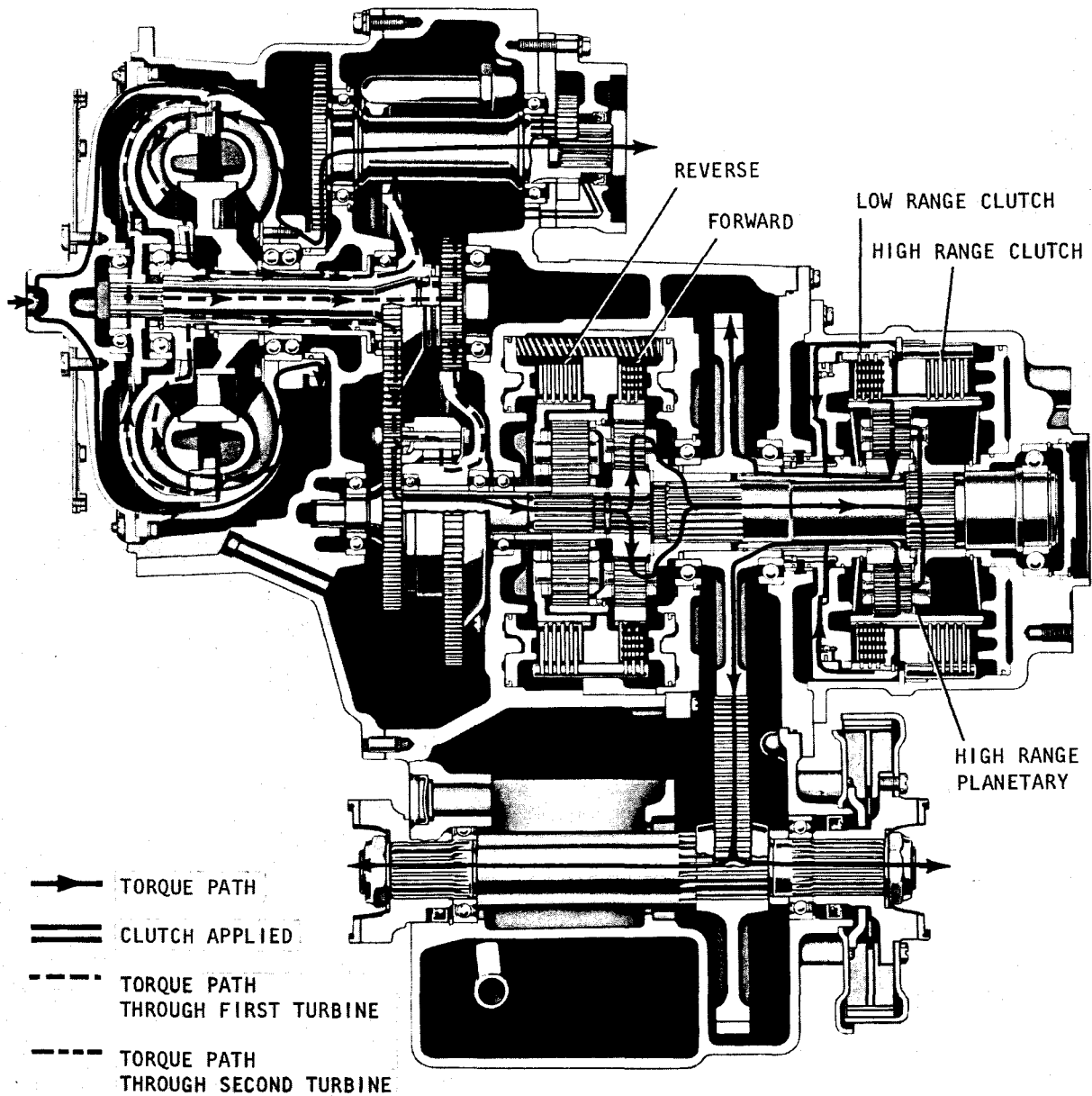


Fig. 2-18. Forward-1 torque path (TRT 2221-1, TRT 2421-1 transmission)

b. Forward-1 (fig. 2-18)

(1) When the range selector is in Forward-1 position, power is transmitted through the torque converter to the forward-and-reverse sun gear as described in paragraph 2-14.

(2) The low-range clutch remains engaged, which holds the forward planetary ring gear stationary.

(3) The forward planetary sun gear rotates the forward planetary pinions within

the stationary ring gear. This causes the forward carrier to rotate in the same direction as the sun gear, but at a reduction in speed. The carrier drives a shaft, the rear end of which is splined to the high-range planetary carrier.

(4) The high-range planetary sun gear is splined to a sleeve, which is splined to both the low-range clutch drum and to the transfer drive gear. The high-range ring gear is splined to the low-range clutch internal-splined plates. The low-range clutch exter-

nal-splined plates engage internal splines in the low-range clutch drum.

(5) Thus, when the forward planetary carrier rotates, the high-range planetary carrier rotates. This causes both the high-range planetary sun gear and ring gear to rotate in the same direction and speed because the low-range clutch is engaged. There is no relative movement of the sun and ring gears.

(6) The low-range clutch drum drives the splined sleeve which, in turn, drives the transfer drive gear. The rotation of the transfer drive gear is opposite that of the converter turbine, and at a reduced speed. This results from the combination of the converter transfer gearing (which may be under-drive or overdrive), and the reduction ratio of the forward planetary.

(7) The transfer drive gear rotates the driven gear and output shaft, and rotation is converted to that of the engine. The output shaft rotates at a speed greater than that of the transfer drive gear. Figure 2-18 illustrates the one-piece output shaft, but some models include a manually operated front output disconnect which interrupts drive to the front output flange.

c. Forward-2

(1) Refer to foldout 2 while studying the explanation of Forward-2 operation. Refer to paragraph 2-14 for explanation of power flow from the engine to the transmission gearing.

(2) When the manual selector valve is shifted from Forward-1 to Forward-2, the low-range clutch releases and the high-range clutch engages. The forward clutch remains engaged, holding the forward planetary ring gear stationary.

(3) The forward planetary sun gear rotates the forward planetary pinions, and drive is transmitted to the high-range planetary carrier, as described in paragraph 2-16b (3).

(4) The engaged high-range clutch holds the high-range planetary ring gear stationary. The rotation of the high-range car-

rier pinions within the stationary ring gear overdrives the high-range sun gear. The sun gear, splined to a sleeve which is splined also to the transfer drive gear, rotates the transfer drive gear.

(5) Refer to paragraph 2-16b (7) for explanation of the remainder of the torque path.

d. Reverse-1

(1) Refer to foldout 2 while studying the explanation of reverse-1 operation. Refer to paragraph 2-14 for explanation of power flow from the engine to the transmission gearing.

(2) When the manual selector is shifted from Neutral to Reverse-1, the low-range clutch remains engaged while the reverse clutch also engages. The reverse clutch, engaged, holds the reverse planetary carrier stationary.

(3) The reverse planetary sun gear rotates the carrier pinions which, in turn, rotate the reverse ring gear in a direction opposite that of the sun gear. The ring gear, being connected by splines to the forward carrier, rotates the forward carrier. The forward carrier drives a shaft, the rear end of which is splined to the high-range planetary carrier.

(4) From this point, to the transmission output flanges, the flow of power is the same as described in paragraph 2-16b (4) through (7) except that all rotations are reversed.

e. Reverse-2 (fig. 2-19)

(1) Refer to paragraph 2-14 for explanation of power flow from the engine to the transmission gearing.

(2) When the manual selector valve is shifted from Reverse-1 to Reverse-2, the low-range clutch releases, the high range clutch engages, and the reverse clutch remains engaged. The engaged high-range clutch holds the high-range planetary ring gear stationary.

DESCRIPTION AND OPERATION

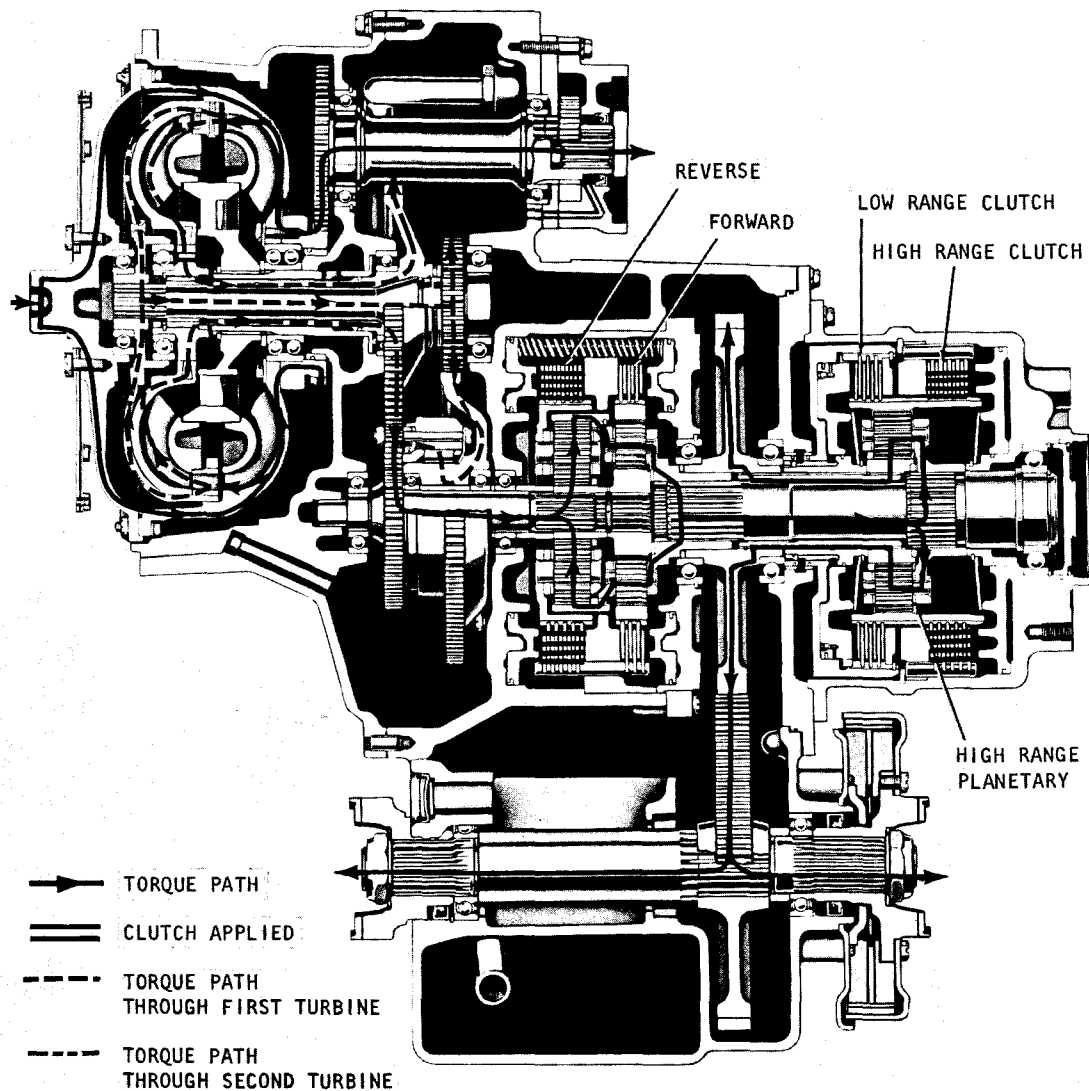


Fig. 2-19. Reverse-2 torque path (TRT 2221-1, TRT 2421-1 transmission)

(3) The reverse planetary sun gear rotates the carrier pinions in the stationary carrier. They, in turn, rotate the reverse ring gear, driving it in a direction opposite that of the sun gear. The ring gear, being connected by splines to the forward carrier assembly, rotates it. The forward carrier drives a shaft, the rear end of which is splined to the high-range planetary carrier.

(4) The engaged high-range clutch holds the high-range ring gear stationary. The rotation of the high-range planetary carrier within the stationary ring gear causes the carrier pinions to overdrive the sun gear. The sun gear, splined to a sleeve which is

splined also to the transfer drive gear, rotates the transfer drive gear.

(5) Refer to paragraph 2-16b (7) for explanation of the remainder of the torque path.

2-17. TRT 2221-3, 2421-3 (underdrive model) TORQUE PATHS

a. Neutral

(1) Refer to foldout 3 while studying the explanation of operation in neutral. Refer to paragraph 2-14 for explanation of power

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flow from the engine to the transmission gearing.

(2) In neutral, power is not transmitted beyond the forward-and-reverse sun gear. The low-range clutch is engaged but no torque is transmitted because neither the forward nor reverse clutch is engaged. The reverse carrier and forward ring gear rotate freely.

(3) Refer to paragraph 2-15a (2) and figure 2-16 for explanation of the power takeoff torque path.

b. Forward-1

(1) Refer to foldout 3 while studying the explanation of operation in forward-1. Refer to paragraph 2-14 for explanation of power flow from the engine to the transmission gearing.

(2) When the manual selector valve is shifted from Neutral to Forward-1, the low-range clutch remains engaged while the for-

ward clutch also engages. The forward clutch, engaged, holds the forward planetary ring gear stationary.

(3) The forward planetary sun gear rotates the forward planetary pinions within the stationary ring gear. This causes the forward carrier to rotate in the same direction as the sun gear, but at a reduction in speed. The carrier has an integral shaft, splined to the low-range planetary sun gear.

(4) The low-range sun gear, rotating with the forward carrier rotates the low-range planetary pinions within the stationary low-range ring gear. This drives the low-range carrier in the same direction as its sun gear but at a reduction in speed.

(5) The low-range carrier is splined to the transmission output shaft. The transmission output is driven in a direction opposite to that of the engine and at a reduction in speed. The speed reduction is the result of the combination of the converter transfer gear, forward planetary, and low-range planetary ratios.

DESCRIPTION AND OPERATION

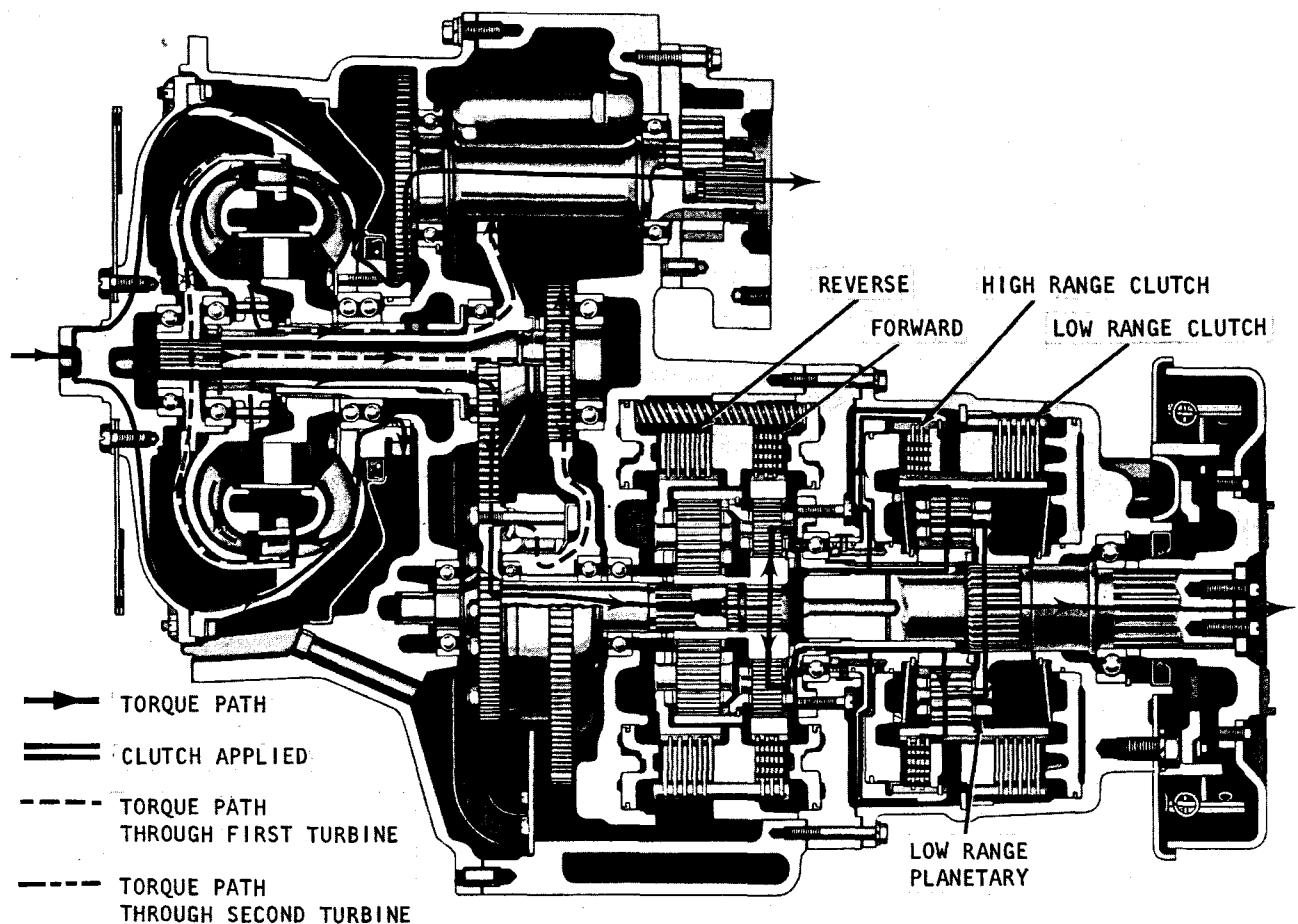


Fig. 2-20. Forward-2 torque path (TRT 2221-3, TRT 2421-3 underdrive transmission)

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c. Forward-2 (fig. 2-20)

(1) Refer to paragraph 2-14 for explanation of power flow from the engine to the transmission gearing.

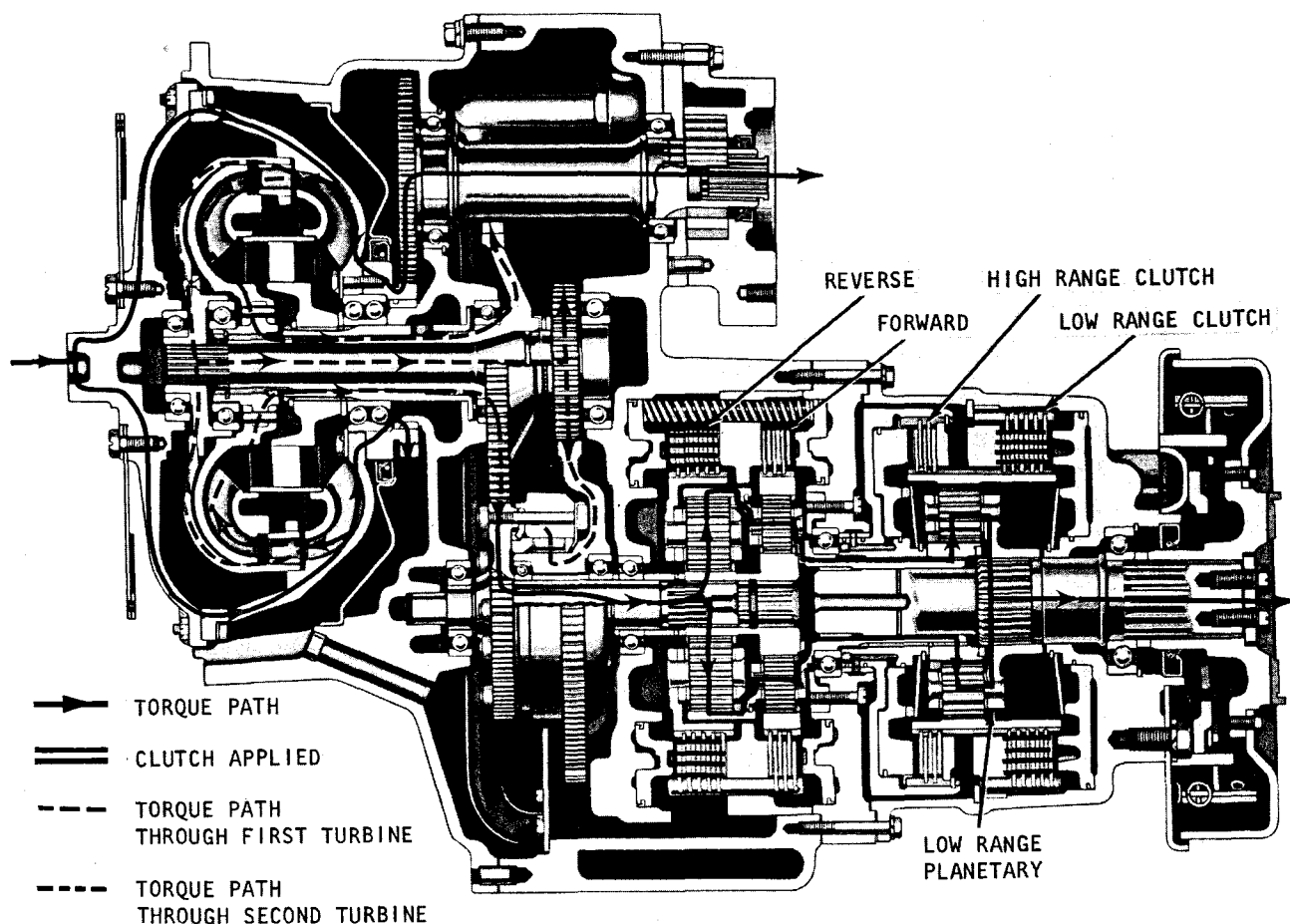
(2) When the manual selector valve is shifted from Forward-1 to Forward-2, the low-range clutch releases and the high-range clutch engages. The forward clutch remains engaged. The high-range clutch, engaged, locks the high-range clutch drum to the low-range ring gear.

(3) The forward planetary sun gear rotates the forward planetary pinions within the stationary ring gear. This causes the forward carrier to rotate in the same direction as the sun gear but at a reduction in speed. The carrier has an integral hollow shaft

which is splined both to the high-range clutch drum and to the low-range planetary sun gear.

(4) The high-range clutch drum and low-range planetary sun gear thus rotate together, at the same speed. The high-range clutch, engaged, drives the low-range planetary ring gear at the same speed as that of the high-range clutch drum and low-range sun gear. The low-range sun and ring gears drive the low-range carrier and transmission output shaft at an equal speed.

(5) Thus, the final transmission ratio in Forward-2 is an underdrive since the combined result of the ratios of the converter transfer gears, the forward planetary and a direct drive in the high-range clutch gives an overall reduction in speed.



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Fig. 2-21. Reverse-1 torque path (TRT 2221-3, TRT 2421-3 underdrive transmission)

d. Reverse-1 (fig. 2-21)

(1) Refer to paragraph 2-14 for explanation of power flow from the engine to the transmission gearing.

(2) When the manual selector valve is shifted from Forward-2 to Reverse-1, the forward and high-range clutches release, and the reverse and low-range clutches engage. Engaged, the reverse clutch holds the reverse-range planetary carrier stationary, and the low-range clutch holds the low-range ring gear stationary.

(3) The reverse sun gear rotates the reverse planetary pinions in the stationary carrier. The pinions drive the reverse planetary ring gear in a direction opposite that of the sun gear. The reverse ring gear, splined to the forward carrier, drives the forward carrier in reverse. The forward carrier shaft,

in turn, drives the low-range planetary sun gear in reverse.

(4) The low-range sun gear rotates the low-range pinions within the stationary low-range ring gear. This causes the low-range planetary carrier and transmission output shaft to rotate. The rotation is in the same direction as that of the engine but at a reduction in speed. The reduction is the result of the combination of the ratios of the converter transfer gears. The reverse planetary (underdrive), and the low-range planetary (underdrive).

e. Reverse-2

(1) Refer to foldout 3 while studying the power flow during operation in Reverse-2. Refer to paragraph 2-14 for explanations of power flow from the engine to the transmission gearing.

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(2) When the manual selector valve is shifted from Reverse-1 to Reverse-2, the low-range clutch releases, the high-range clutch engages, and the reverse clutch remains engaged. The high-range clutch, engaged, locks the high-range clutch drum to the low-range planetary ring gear.

(3) The reverse sun gear rotates the reverse planetary pinions in the stationary carrier. The pinions drive the reverse planetary ring gear in a direction opposite that of the sun gear. The reverse ring gear, splined to the forward planetary carrier, drives the forward carrier in reverse. The forward carrier shaft, in turn, drives the high-range clutch drum (and low-range planetary ring gear) in reverse.

(4) The high-range clutch drum and low-range planetary sun gear thus rotate together, at the same speed. The high-range clutch, engaged, drives the low-range planetary ring gear at the same speed as that of the high-range clutch drum and low-range sun gear. The low-range sun and ring gears drive the low-range carrier and transmission output shaft at an equal speed.

(5) Thus, the final transmission ratio in Reverse-2 is an underdrive, resulting from the combined ratios of the converter transfer gears, the reverse planetary (underdrive), and that of the high-range clutch (direct drive).

2-18. TRT 2221-3, 2421-3 (overdrive model) TORQUE PATHS

a. Neutral

(1) Refer to foldout 4 while studying the power flow during operation in neutral. Refer to paragraph 2-14 for explanation of power flow from the engine to the transmission gearing.

(2) Refer to paragraph 2-17a (2) and (3) for the remainder of the explanation of power flow in neutral.

b. Forward-1 (fig. 2-22)

(1) Refer to paragraph 2-14 for explanation of power flow from the engine to the transmission gearing.

(2) When the manual selector valve is shifted from Neutral to Forward-1, the forward clutch engages and the low-range clutch remains engaged. The forward clutch holds the forward planetary ring gear stationary, and the low-range clutch locks the low-range clutch drum to the low-range clutch hub, which is splined to the transmission output shaft.

(3) The forward planetary sun gear rotates the forward pinions within the stationary forward ring gear. This causes the forward planetary carrier and its integral hollow shaft to rotate in the same direction as that of the sun gear, but at a reduction in speed. The carrier shaft is splined to the low-range clutch drum and rotates it and the high-range planetary carrier to which the drum is splined.

(4) The low-range clutch, engaged, drives the clutch hub. The hub, in turn, drives the transmission output shaft, to which it is splined.

(5) The overall transmission ratio is an underdrive, resulting from the combined ratios of the converter transfer gears, the forward planetary, and the direct drive, low-range clutch.

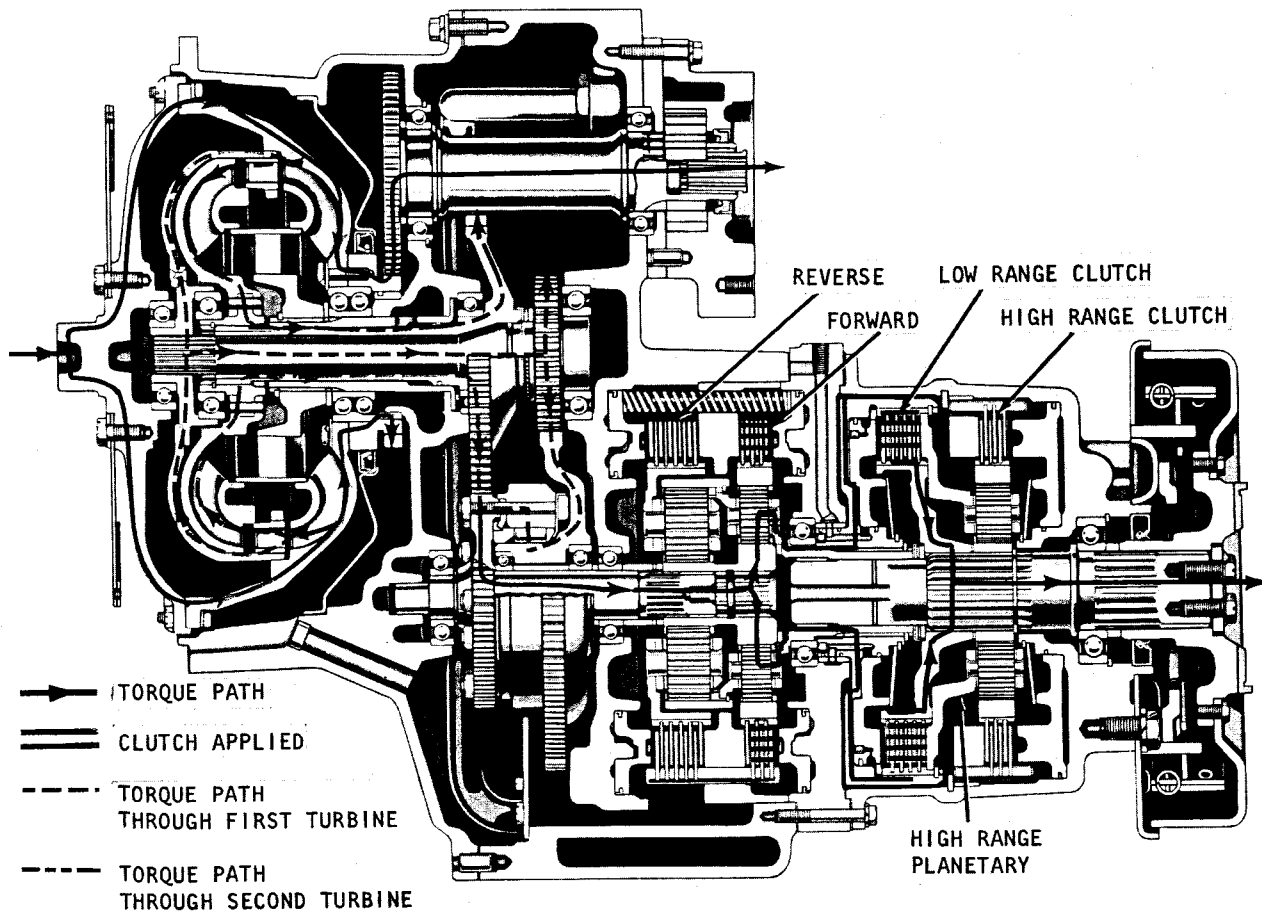
c. Forward-2

(1) Refer to foldout 4 while studying power flow during operation in Forward-2. Refer to paragraph 2-14 for explanation of power flow from the engine to the transmission gearing.

(2) When the manual selector valve is shifted from Forward-1 to Forward-2, the low-range clutch releases and the high-range clutch engages. The forward clutch remains engaged. The high-range clutch, engaged, holds the high-range planetary ring gear stationary.

(3) Refer to paragraph 2-18b (3) for explanation of the function of the forward planetary gearing.

(4) The high-range planetary carrier, splined to the low-range clutch drum rotates within the stationary high-range ring gear.



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Fig. 2-22. Forward-1 torque path (TRT 2221-3, TRT 2421-3 overdrive transmission)

This causes the pinions to rotate and overdrive the high-range planetary sun gear, which is splined to the transmission output shaft.

(5) The overall transmission gear ratio in Forward-2 is an overdrive. This results from the combination of the ratios of the converter transfer gears, the forward planetary and the high-range planetary.

d. Reverse-1

(1) Refer to foldout 4 while studying power flow during operation in Reverse-1. Refer to paragraph 2-14 for explanation of power flow from the engine to the transmission gearing.

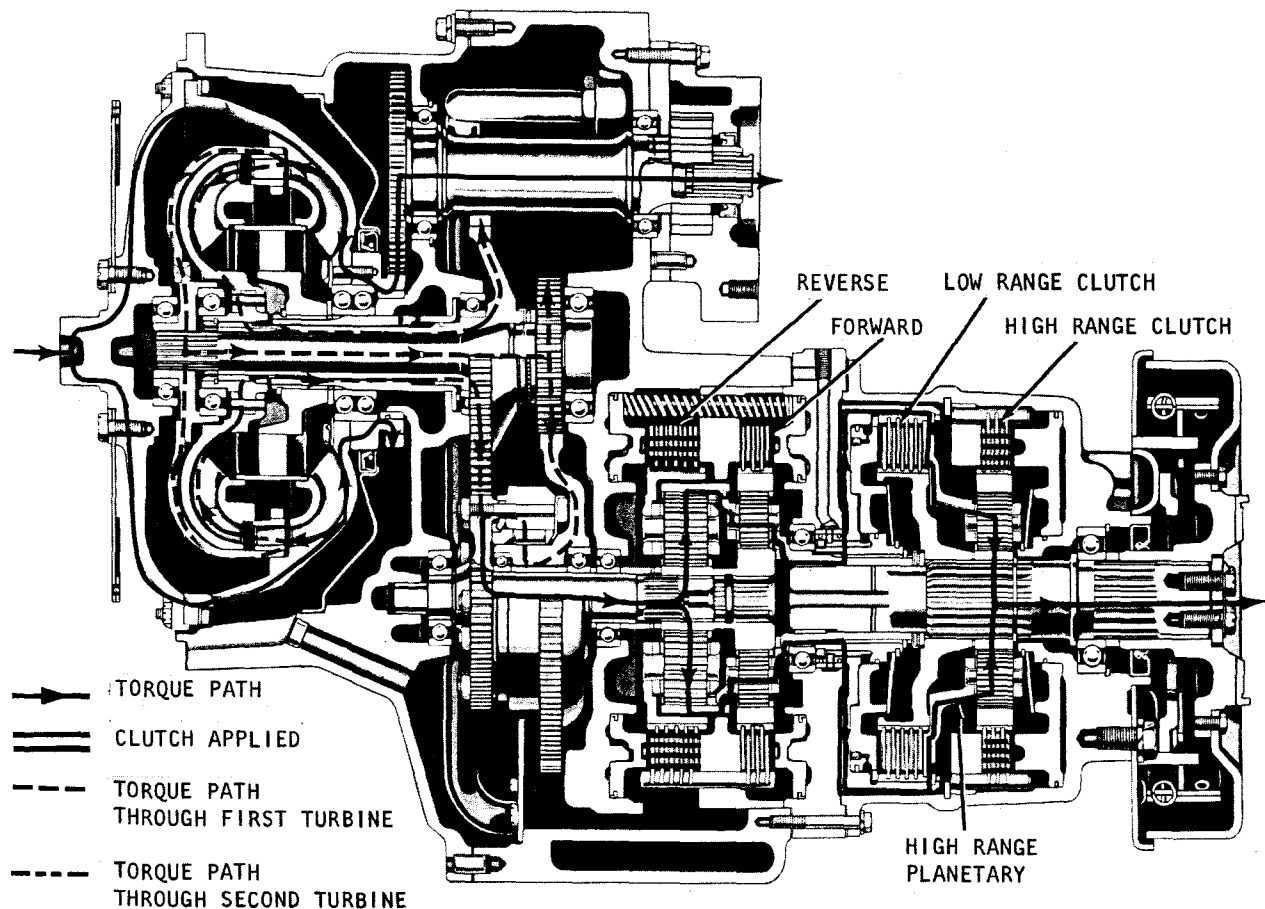
(2) When the manual selector valve is shifted from Neutral to Reverse-1, the reverse clutch engages, and the low-range

clutch remains engaged. The reverse clutch, engaged, holds the reverse planetary carrier stationary. The low-range clutch, engaged, locks the low-range clutch drum to the low-range clutch hub, and to the transmission output shaft which is splined to the hub.

(3) The reverse planetary sun gear rotates the pinions in the stationary reverse carrier. The pinions rotate the reverse ring gear in a direction opposite that of the sun gear. The ring gear, being splined to the forward carrier, causes it to rotate.

(4) The forward carrier has an integral hollow shaft, to which the low-range clutch drum is splined. The low-range clutch drum is splined also to the high-range planetary carrier assembly. The low-range clutch, engaged, locks the clutch drum and low-range clutch hub together. The clutch hub is splined to the transmission output shaft.

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Fig. 2-23. Reverse-2 torque path (TRT 2221-3, TRT 2421-3 overdrive transmission)

Thus, when the reverse planetary ring gear rotates, it drives, in succession, the forward carrier, low-range clutch drum, low-range clutch hub, and the transmission output shaft.

(5) The overall transmission ratio is underdrive, resulting from a combination of the ratios of the converter transfer gears, the reverse planetary ratio, and the direct drive, low-range clutch.

e. Reverse-2 (fig. 2-23)

(1) Refer to paragraph 2-14 for explanation of power flow from the engine to the transmission gearing.

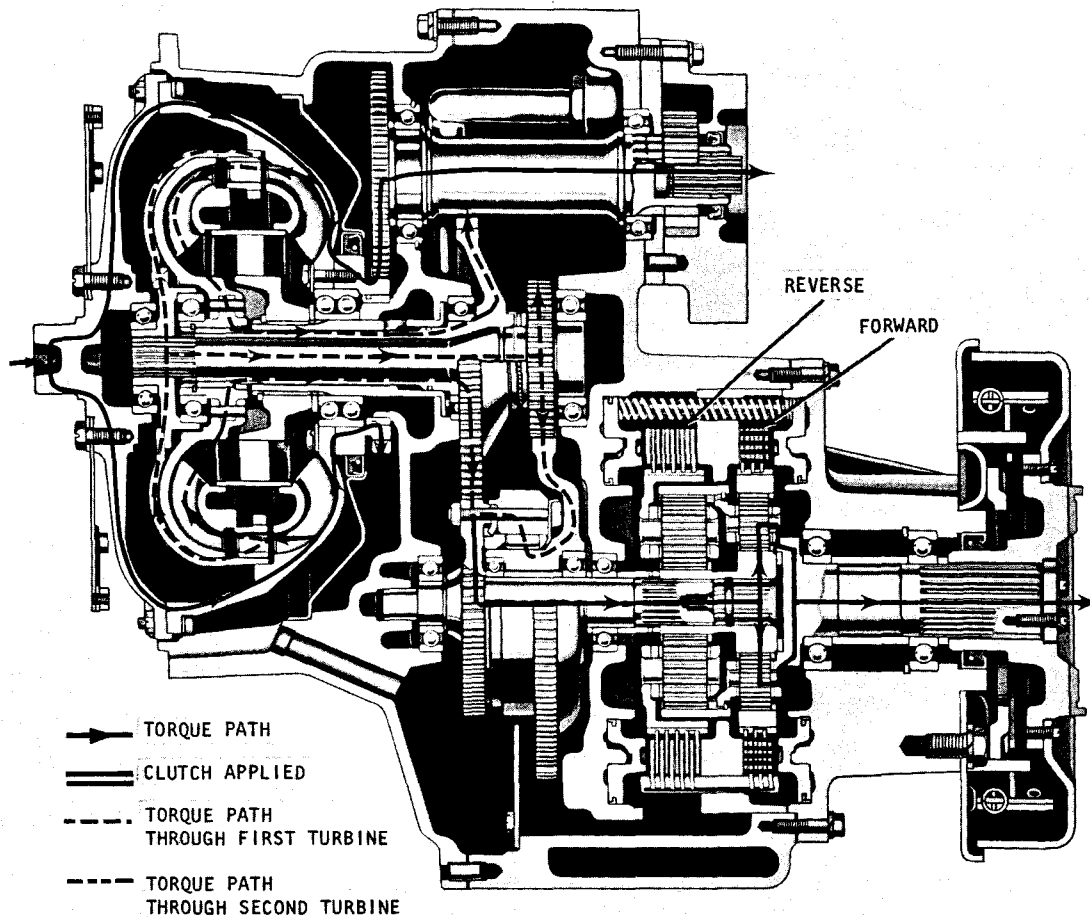
(2) When the manual selector valve is shifted from Reverse-1 to Reverse-2, the low-range clutch releases, the high-range clutch engages, and the reverse remains en-

gaged. The high-range clutch, engaged, holds the high-range planetary ring gear stationary.

(3) Refer to paragraph 2-18d (3) for explanation of the function of the reverse gearing.

(4) The forward carrier has an integral hollow shaft which is splined to the low-range clutch drum. The low-range clutch drum, in turn, is splined to the high-range planetary carrier. The high-range carrier, thus, rotates within the stationary high-range ring gear. Rotation of the high-range planetary pinions causes them to overdrive the high-range planetary sun gear, and the output shaft.

(5) The overall transmission ratio is overdrive, resulting from the combination of the ratios of the converter transfer gears, reverse planetary, and the overdrive high-range planetary.



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Fig. 2-24. Forward torque path (TRT 2211-3, TRT 2411-3 transmission)

2-19. TRT 2211-3, 2411-3 TORQUE PATHS

a. Neutral

(1) Refer to foldout 5 while studying the explanation of power flow in neutral. Refer to paragraph 2-14 for explanation of power flow from the engine to the transmission gearing.

(2) In neutral, no power is transmitted beyond the forward-and-reverse planetary sun gear. Refer to paragraph 2-15 and figure 2-16 for explanation of the power takeoff power flow.

b. Forward (fig. 2-24)

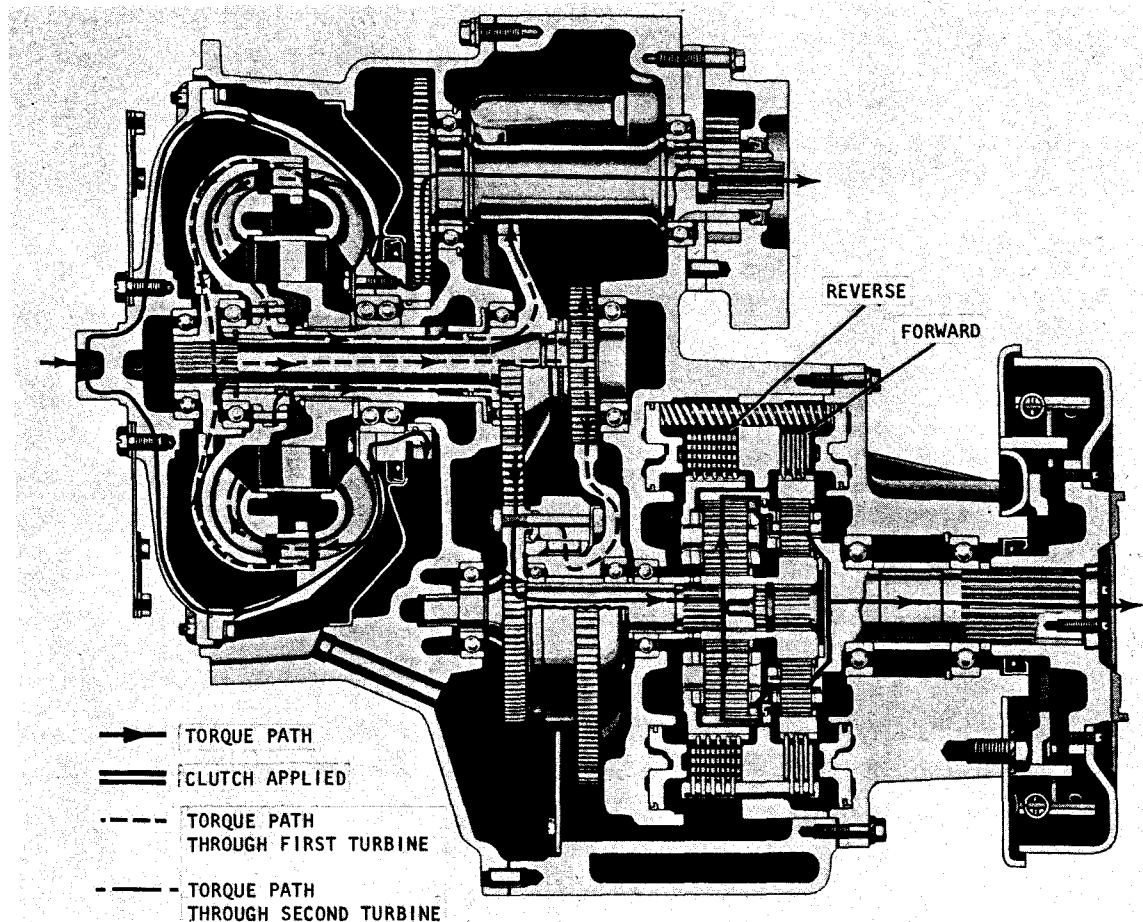
(1) Refer to paragraph 2-14 for explanation of power flow from the engine to the transmission gearing.

(2) When the manual selector valve is shifted to Forward, the forward clutch engages. The forward clutch, engaged, holds the forward planetary ring gear stationary.

(3) The forward planetary sun gear rotates the forward pinions within the stationary ring gear. This causes the forward carrier to rotate in the same direction as that of the sun gear, but at a reduction in speed. The transmission output shaft, to which the output flange is splined, is integral with the forward carrier.

(4) The transmission output thus rotates in a direction opposite to that of the engine, at reduced speed. The reduction in speed is due to the combination of the ratio of the converter transfer gearing (which may be overdrive or underdrive) and that of the forward planetary.

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Fig. 2-25. Reverse torque path (TRT 2211-3, TRT 2411-3 transmission)

c. Reverse (fig. 2-25)

(1) Refer to paragraph 2-14 for explanation of power flow from the engine to the transmission gearing.

(2) When the manual selector valve is shifted from Forward to Reverse, the forward clutch releases and the reverse clutch engages. The reverse clutch, engaged, holds the reverse planetary carrier stationary.

(3) The reverse planetary sun gear rotates the carrier pinions in the stationary carrier. This drives the ring gear in a direction opposite that of the sun gear. The ring gear, being splined to the forward carrier assembly, rotates the forward carrier, its integral output shaft and the output flange.

(4) Rotation is in the same direction as the engine but at a reduction in speed. The reduction in speed is due to the combination of the ratio of the converter transfer gears and that of the reverse planetary.

Section 3. PREVENTIVE MAINTENANCE

3-1. SCOPE

This section outlines the routine and periodic procedures required to maintain the transmission in good operating condition. Included are instructions for care of the oil system, minor adjustments of the transmission and control linkages, tests to determine condition, instructions for extended storage, and troubleshooting information.

3-2. PERIODIC INSPECTIONS, CLEANING

a. Inspecting Exterior

(1) The exterior of the transmission should be cleaned and inspected at regular intervals. The severity of service and operating environment will determine the frequency of such procedures.

(2) The transmission should be inspected for loose or missing bolts, oil leaks, linkage damage, and worn or frayed oil lines. Oil leaks require immediate attention. Refer to paragraph 3-12.

(3) Linkage must be clean, adjusted, and well lubricated.

b. Cleaning Breather. The prevalence of dust and dirt will determine the frequency at which the breather requires cleaning. Clean the area around the breather stem before removing the breather. Wash the breather thoroughly by agitating it in mineral spirits or cleaning solvent. Dry it thoroughly with compressed air after cleaning. 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 could enter the transmission.

3-3. OIL CONTAMINATION

a. Examine at Oil Change. At each oil change examine the oil which is drained for evidence of dirt or water. A normal amount of condensation will emulsify in the oil during

operation of the transmission. However, if there is evidence of water, check the cooler (heat exchanger) for leakage between the water and oil areas. Oil in the water side of the cooler (or vehicle radiator) is another sign of leakage. This, however, may indicate leakage from the engine oil system. Any accumulation of sludge or soft dirt in the sump should be removed with flushing oil.

b. Coolant Leakage. If engine coolant leaks into the transmission oil system, immediate action must be taken to prevent malfunction and possible serious damage. Glycol solution will attack friction-faced clutch plates. The transmission must be completely disassembled, inspected, and cleaned. If glycol solution is present, all friction-faced clutch plates must be replaced. All traces of the coolant and varnish deposits, resulting from coolant contamination, must be removed. The cooler should be thoroughly cleaned or replaced prior to installation of the new or rebuilt transmission.

NOTE

A Gly-Tek test kit to detect glycol in transmission oil can be obtained from Nelco Company, 1047 McKnight Road South, St. Paul, Minnesota 55119. (Some transmission fluids may produce a positive reading due to "additives" that are not actually glycol. When test results are questionable, a test of an unused sample of the oil type or brand should be made to confirm test results.)

c. Metal Particles. Metal particles in the oil (except for the minute particles normally trapped in the oil filter) indicate damage has occurred in the transmission. When these particles are found in the sump or on the magnetic drain plug, the transmission must be disassembled and closely inspected to find the source. Metal contamination will require complete disassembly of the transmission and cleaning or replacement of all internal and external circuits, cooler, filter,

and all other areas where the particles could lodge.

d. Auxiliary Filter

(1) After a transmission failure that introduces debris into the oil system, a complete clean-up of the oil cooler and lines is necessary.

(2) Repeated cleaning and flushing may not remove all debris. To prevent a repeated failure, caused by eventual movement of trapped debris, installation of an auxiliary filter in the cooler-out line (between cooler and transmission) is recommended. This recommendation applies whether the failed transmission is overhauled or replaced by a new or rebuilt unit.

(3) If any doubt exists about the clean-up of the oil cooler, replace the cooler.

(4) When an auxiliary filter is placed in the cooler-out line, converter regulator valve spring P/N 6773551 must be replaced with spring P/N 6880795 on S/N's before 92911.

(5) Refer to paragraph 6-8 for instructions for removal and replacement of the converter regulator valve, spring, and pin.

(6) The auxiliary filter should be an AC DM 13-5 P/N 5575224 or equivalent 40 micron filter. Pressure drop across the new filter can not exceed 5 psi (34 kPa) and the cooler circuit pressure differential can not exceed 40 psi (276 kPa) at full throttle stall.

(7) Auxiliary filter elements should be inspected for contamination after 500 and 1000 hours operation (depending on application), and changed at regular filter change intervals thereafter. Pressure drop across a dirty filter in excess of 15 psi (103 kPa) will cause the filter bypass valve to open and dirty oil will contaminate the system.

3-4. CHECKING OIL LEVEL

a. Cold Check (using oil level check plugs)

(1) Two oil level check plugs are located at the lower-right front on -1 models

(fig. 1-1) and the lower-left rear on -3 models of the transmission housing. Before starting the engine, remove the upper (Full) plug. If oil flows from the plug opening, the hydraulic system has sufficient oil to permit starting the engine. If no oil flow is present, add sufficient oil to cause a flow from the opening, and replace the plug.

(2) Start the engine and operate at 1000 to 1500 rpm with the transmission in neutral. Operate for approximately 2 minutes. Then idle the engine and shift through all range positions slowly to charge the hydraulic system.

(3) While the engine is running, add oil as required to establish the oil level at the lower (Add) plug. Then proceed with the hot check (para 3-4b).

NOTE

An oil check made at a lower engine rpm may result in low oil level at operating speeds. Thermal expansion will raise oil level when the transmission attains operating temperature.

b. Hot Check (using oil level check plugs)

(1) Start the engine and operate the vehicle until the transmission reaches the operating temperature of 180-220°F (82-104°C). Then idle the engine and shift through all range positions slowly. This will ensure that all parts of the system are filled with oil. Shift to neutral and run the engine at approximately 1200-1500 rpm.

(2) Remove the upper (Full) oil level check plug. Oil should be at the level of the plug opening. Add or drain oil to bring it to this level.

NOTE

Foaming or spurting may indicate a false oil level. A true level is indicated by a steady trickle of oil flowing from the check plug hole. The transmission may be operated safely as long as the oil is above the level of the lower (Add) oil check plug.

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c. Cold Check (using dipstick)

(1) If the transmission is equipped with an oil dipstick, check the oil level before starting the engine. It is safe to start the engine if the oil is near or above the HOT (FULL) mark. If the oil level is not within this range, add oil. (One quart equals approximately 1/2-inch (12.7 mm) change in oil level.)

(2) Start the engine and let engine idle (500-750 rpm) with the transmission in neutral. Idle engine for approximately 2 minutes. Then shift through all range positions slowly to fully charge the hydraulic system.

(3) Add oil as required to establish the oil level at the COLD (ADD) mark. (One quart equals approximately 1/2-inch (12.7 mm) change in oil level.)

(4) Then proceed with the hot check (para 3-4d).

d. Hot Check (using dipstick)

(1) Start the engine and operate the vehicle until the transmission reaches an operating temperature of 180-220°F (82-104°C). Idle the engine and shift through all range positions slowly to fully charge the hydraulic system. With the engine at idle speed and transmission in neutral range, the oil level should be within the OPERATING RANGE and not exceed the HOT (FULL) mark.

(2) If oil level is below the COLD (ADD) mark, add oil. (One quart equals approximately 1/2-inch (12.7 mm) change in oil level.)

3-5. MAINTENANCE INTERVALS

a. Frequency. The severity of service and the environment in which the transmission operates will determine the frequency of some maintenance operations. Under very dusty or dirty operating conditions, the transmission oil should be changed more often. Oil should be changed immediately if it has been subjected to overheating. The breather

will require more frequent cleaning when dirt and dust conditions are severe.

b. Oil and Filter Change. Generally the oil and filter should be changed after each 1200 hours of operation. For severe service, refer to paragraph 3-5a. Refer also to paragraph 3-3 before changing oil. Do not operate a transmission which is filled with preservative oil except for minimum necessary time and distance. Refer to paragraph 3-11e.

3-6. CHANGING OIL, FILTER

a. Draining Oil. Transmission should be at an operating temperature of 180-220°F (82-104°C) when the oil is changed. Remove the drain plug at the lower-left rear of the transmission housing (fig. 1-3). Remove the oil filter element from the remote-mount filter. Remove and clean the oil strainer assembly. Let the oil drain for 30 minutes if time permits. Replace the oil strainer, gasket, and oil drain plug. Install a new oil filter element (PF 151 or equivalent).

b. Refilling Oil System. Refer to Tables 3-1 and 3-2 and refill the oil system. Then conduct the hot check as described in paragraph 3-4b or d, adding oil as necessary to establish the correct oil level for operation.

3-7. BLEEDING INTERNAL BRAKE (TTB models)

a. All air must be bled out of the hydraulic brake system before the brake will apply properly. Air in the system will cause the brake apply action to feel soft and springy. Also, air in the system may cause the pedal to completely depress without applying the brake.

b. To bleed the system, use a pressure bleeder inserted into either the master valve or plug. When manually bleeding the system, the reservoir must not be permitted to empty, or more air will be introduced. The bleeder valve, or plug 30 or 36 (foldout 15,B) is located directly opposite the point to which the tube from the master cylinder to the transmission is connected (left to right side).

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Table 3-1. CHOICE OF PROPER C-3 OIL

Fluid viscosity and grade	Ambient temperature below which PREHEAT IS REQUIRED
SAE 30	32°F (0°C)
SAE 15W-40	32°F (0°C)
SAE 10W-30	10°F (-12°C)
SAE 10W	10°F (-12°C)
SAE 5W-20	-10°F (-23°C)

Table 3-2. OIL SYSTEM REFILL AMOUNTS

Initial fill (dry)

Model	Amount*
-3	6-1/2 U.S. gal (25 liters)
-1	8-1/2 U.S. gal (32 liters)

Refill (after drain)

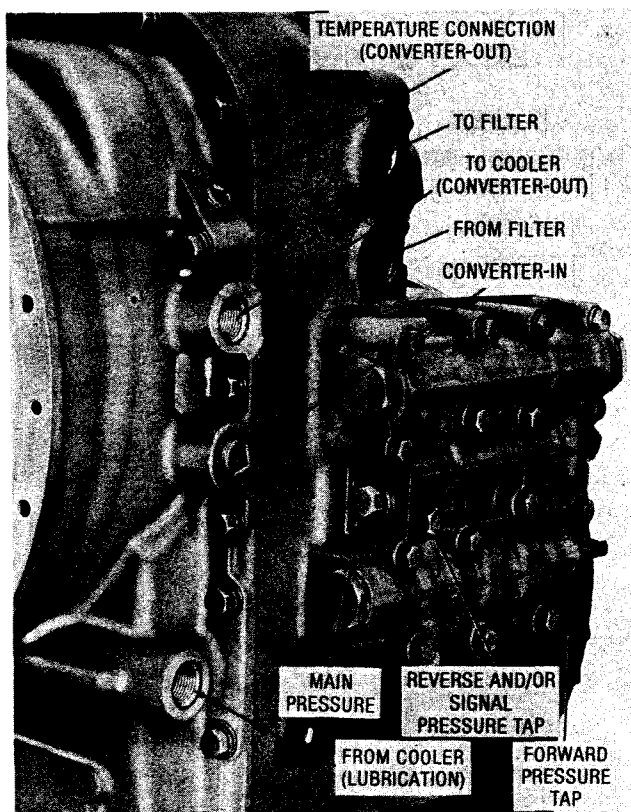
Model	Amount*
-3	4-1/2 U.S. gal (17 liters)
-1	6-1/2 U.S. gal (25 liters)

* less external circuits

c. Flush fluid through the system with a pressure bleeder, or pump the brake pedal slowly through complete strokes, until no more air escapes at the bleeder valve or plug. If difficulty is experienced in obtaining a firm, solid feel when the brake is applied after bleeding, loosen one of the nuts at the upper ends of brake manifold 32 or 34 (fold-out 15,B) and continue to purge air from the system. When the brake is bled manually, always close the bleeder valve or plug before the pedal upstroke.

3-8. PRESSURES, TEMPERATURES

Figure 3-1 illustrates the points where the transmission temperature and pressure may be measured. The vehicle may be equipped with a temperature gage and a pressure gage. If so, the temperature gage registers the con-



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Fig. 3-1. Pressure and temperature check points

verter-out (to cooler) temperature, and the pressure gage registers main (clutch) pressure. Clutch pressure during normal operation in any range or in neutral is approximately equal to main pressure and may be regarded as main pressure. However, while either the clutch-cutoff control or inching control is being used, clutch pressure may fall to practically zero—this does not indicate that main pressure has decreased. Therefore, when checking main pressure, do not actuate either of these controls.

3-9. LINKAGE CHECKS, ADJUSTMENTS

a. See Vehicle Manual Instructions. The specific design of control linkages for range selection, inching control, output disconnect, and parking brake depends upon the installation. Control linkages are provided by the vehicle manufacturer. Therefore, only general instructions for linkage adjustments can be provided in this manual.

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b. Selector, Inching Linkage. The selector linkage must be adjusted so that the operator's control and selector valve are both within desired range at the same time. Make initial adjustment in neutral. Then shift through all range positions to make sure that the selector valve is in the full detent position in each range. Adjust the inching valve control linkage so that the valve has full travel from retracted to extended positions. Linkage must be kept clean, adjusted, and well lubricated. Bent or damaged linkage must be repaired or replaced.

c. Front Output Disconnect

(1) There are two points of adjustment for the front output disconnect. The shifter shaft must be adjusted first, and then adjust the linkage. Push the shifter shaft inward (toward the rear) to its engaged position. A spring-loaded detent will indicate positive engagement. Adjust the shifter shaft by rotating it until the center of the clevis pin hole is approximately 3/8 inch (9 mm) ahead of the linkage support bracket mounting pad faces.

(2) When the shifter shaft is pulled outward (forward) to its disengaged position, the detent ball should seat when the center of the clevis pin hole is approximately 2-1/8 inch (54 mm) ahead of the bracket mounting pad faces. Adjust the linkage so that the engaged and disengaged positions of the operator's control correspond exactly with the detent positions of the shifter shaft.

d. Parking Brake (external, mechanical)

(1) Disconnect the brake linkage before adjustment. Adjust the brake shoes for proper drum clearance by inserting a screwdriver or adjusting tool into one of the openings at the rear of the brake drum and turning the starwheel. The starwheel should be rotated until 0.010 inch (0.254 mm) thickness gages are held snugly between the adjustment end of the shoes and the drum (use two gages simultaneously—one at each shoe).

(2) Hold the brake assembly actuating lever so that all slack is removed (without applying the brakes). Adjust the vehicle linkage by releasing the hand lever fully and

adjusting the connecting rod so that it can be connected to the brake assembly actuating lever.

3-10. TRANSMISSION STALL TEST

NOTE

The engine stall speeds for all Detroit Diesel Allison approved engine/transmission applications may be obtained from the SCAAN Computerized Vehicle Performance program. Access to this program is available at Detroit Diesel Allison distributors and any Detroit Diesel Allison Regional Office.

a. Purpose

(1) A stall test should be conducted when the power package (engine and transmission) is not performing satisfactorily. The purpose of the test is to determine if the transmission is the malfunctioning component.

(2) A stall test is conducted with the transmission in F2 range, the engine running at full throttle, and the transmission outputs stalled. The data obtained from the test must be used in conjunction with engine-converter matched performance curves. These performance curves can be obtained from your equipment dealer or distributor.

b. Procedure

(1) Connect a tachometer of known accuracy to the engine, and bring transmission to the normal operating temperature of 180-220°F (82-104°C).

CAUTION

Stall condition should never be maintained for more than 30 seconds at any one time because of the rapid rise in oil temperature.

(2) Apply the parking brake, block the vehicle securely, and shift the selector control to high range. (The test may also be

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conducted in F1 or reverse, if necessary. However, such tests must be made with extreme caution because of the high torque delivered at the transmission output shaft.)

CAUTION

Do not apply service brakes if the transmission is equipped with a clutch cutoff.

(3) Accelerate the engine to wide-open throttle. After reaching a stabilized converter-out temperature of 225°F (107°C) minimum, record the engine speed while the engine is at open throttle. Do not let the converter-out temperature exceed 250°F (121°C).

NOTE

Allow approximately 2 minutes of neutral operation between stall tests to prevent overheating. During the 2-minute period, engine speed should be maintained (except for the momentary throttle release when shifting to neutral).

c. Results. Under stall test conditions, a comparison of actual engine speed with the established normal speed for such conditions will indicate if the engine or the transmission is malfunctioning.

NOTE

Environmental conditions, such as ambient temperature altitude, engine accessory loss variations, etc., affect the power input to the converter. These conditions may cause the stall speed to vary ± 150 rpm from the established normal value. When deviation can be attri-

buted to such causes, the actual speed can be accepted as normal.

3-11. PRESERVATION, STORAGE

a. Storage, New Transmissions. New transmissions are tested with preservative oil and drained prior to shipment. The residual oil remaining in the transmission provides adequate protection to safely store the transmission for six weeks without further treatment.

b. Preservation Methods. When the transmission is to be stored or to remain inactive for an extended period (up to one year), specific preservation methods are recommended to prevent damage due to rust, corrosion, and growth of biologicals. Preservation methods are presented for storage with and without oil.

c. Storage, One Year — Without Oil

(1) Drain the oil and replace the oil filter element(s) (para 3-6).

(2) Seal all openings with moisture-proof tape.

(3) Coat all exposed, unpainted surfaces with preservative grease, such as petrolatum (MIL-C-11796), Class 2.

(4) If the breather can be easily removed, spray one ounce (30 milliliters) of Motorstor® * (or equivalent) into the transmission through the breather hole. Also, spray one ounce (30 milliliters) through the fill tube hole. If the breather cannot be removed, spray two ounces (60 milliliters) of Motorstor (or equivalent) into the transmission through the fill tube hole.

(5) If additional storage time is required, repeat (3) and (4) at yearly intervals.

* Motorstor® is the registered trademark for a vapor phase rust preventative manufactured by the Daubert Chemical Company, Chicago, Illinois. Motorstor is covered by Military Specifications MIL-L-46002 (ORD) and MIL-I-23310 (WEP) under the designation of "Nucle Oil".

PREVENTIVE MAINTENANCE

d. Storage, One Year — With Oil

(1) Drain the oil and replace the filter element(s) (para 3-6).

(2) Fill the transmission to operating level with a mixture of 30 parts Type C-3 oil to one part Motorstor rust preventative (or equivalent). Add 1/4 tsp of Biobor JF® * (or equivalent) for each 3 gallons (0.1 ml/liter) of oil in the system.

NOTE

When calculating the amount of Biobor JF required, use the total volume of the system including external lines, filters, and cooler; not just the quantity required to fill the transmission.

(3) Shift through all selector positions to thoroughly distribute the oil. Then stop the vehicle and stall the transmission output until an oil temperature of 225°F (107°C) is obtained.

CAUTION

Do not allow the temperature to exceed 225°F (107°C). If the vehicle does not have a temperature gauge, do not stall the transmission for more than 10 seconds.

(4) Stop the engine. As soon as the unit is cool enough to touch, seal all openings and breather with moisture-proof tape.

(5) Coat all exposed, unpainted surfaces with preservation grease, such as petrolatum (MIL-C-11796), Class 2.

(6) If additional storage time is required, just add the prescribed mixture (para 3-11d (2)) of Motorstor and Biobor JF, or equivalent,

and repeat (3) through (5) above, at yearly intervals. It is not necessary to drain the transmission each year.

e. Restoring Units to Service

(1) Remove the tape from openings and breather.

(2) Wash off all the external grease with mineral spirits.

(3) If the transmission is new, drain the residual preservative oil. Refill the transmission to the proper level (para 3-4) with type C-3 oil.

(4) If the transmission was prepared for storage without oil, refill the transmission to the proper level (para 3-6) with type C-3 oil.

(5) If the transmission was prepared for storage with oil, check for proper oil level (para 3-6). Add or drain transmission oil as required to obtain the proper level.

NOTE

It is not necessary to drain and refill the transmission with new oil.

3-12. FLANGE RETAINER

Oil seepage may occur in some -1 models at the output locations. This seepage can result from a worn lip-type seal within the housing, improper torque at the flange retainer nut, or loss of sealing contact between the retainer washer and the flange seat. If inspection reveals that the seepage is due to the loss of contact sealing at the retainer washer, remove and discard the washer. Replace the flat washer with a stepped washer and seal as shown in figure 3-2. The stepped washer and sealing are available from the dealer or distributor.

* Biobor JF® is the registered trademark for a biological inhibitor manufactured by U.S. Borax and Chemical Corporation.

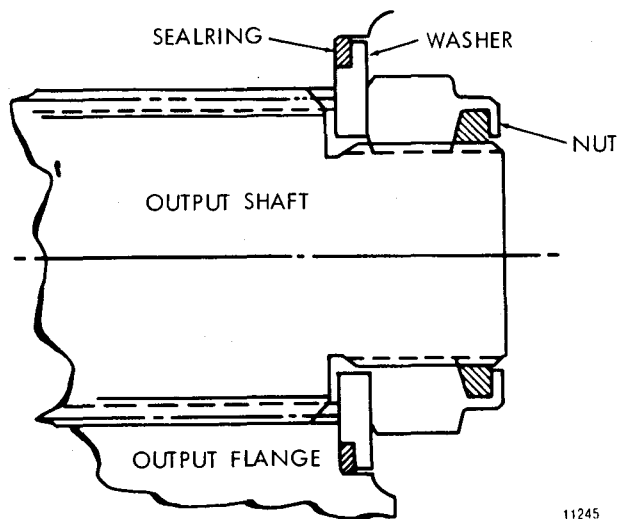


Fig. 3-2. Output shaft retainer washer and seal

3-13. TROUBLESHOOTING

a. Importance of Troubleshooting. Troubleshooting is the systematic search for and location of malfunctions in the engine or transmission that affect transmission performance. A thorough study of the description and operation of components and the hydraulic system (Section 2) will be helpful in troubleshooting. The engine and transmission must be regarded as a single package during troubleshooting.

b. Troubleshooting Table. Table 3-3 outlines the possible causes of and remedies for 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.

Table 3-3. TROUBLESHOOTING

<u>Cause</u>	<u>Remedy</u>
A LOW MAIN PRESSURE	
1. Low oil level	1. Add oil to correct level (para 3-4)
2. Clogged oil strainer	2. Clean strainer (para 3-6a)
3. Clogged oil filter	3. Replace filter element (para 3-6a)
4. Weak or broken main-pressure regulator valve spring	4. Replace spring (para 6-3)
5. Inching control adjustment not fully retracted	5. Check, adjust linkage (para 3-9)
6. Oil pump worn	6. Rebuild oil pump (para 6-26)
7. Air leak at intake side of oil pump	7. Check pump mounting bolts (para 7-13b); check oil pickup tube nut (para 7-10c)
8. Internal oil leakage	8. Disassemble transmission; rebuild subassemblies as required
9. External oil leakage	9. Tighten bolts or replace gaskets
10. Brake hydraulic (or air) pressure applying clutch cutoff valve	10. Check brake residual pressure (brakes released); check brakes for full release
B OVERHEATING	
1. High oil level	1. Restore proper oil level (para 3-4)
2. Clutch failed	2. Rebuild transmission
3. Vehicle overloaded	3. Reduce load
4. Low main pressure	4. Refer to A
5. Engine water overheated	5. Correct engine overheating
6. Cooler oil or water line kinked or clogged	6. Clean or replace line

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Table 3-3. TROUBLESHOOTING (cont)

<u>Cause</u>	<u>Remedy</u>
<u>C</u> LOW CLUTCH-APPLY PRESSURE	
1. Low main pressure	1. Refer to <u>A</u>
2. Clutch piston sealrings failed	2. Overhaul transmission
3. Clutch cutoff control valve sticking	3. Rebuild control valve assembly (para 6-3)
4. Inching control valve sticking	4. Rebuild control valve assembly (para 6-3)
5. Internal oil leakage	5. Overhaul transmission
<u>D</u> AERATED (foaming) OIL	
1. Incorrect type oil used	1. Change oil; use proper type. Refer to Table 3-1
2. High oil level	2. Restore proper oil level (para 3-4)
3. Low oil level	3. Restore proper oil level (para 3-4)
4. Air entering suction side of oil pump	4. Check oil pump bolts and gasket (para 7-13 <u>b</u>); check oil pickup tube and nut (para 7-10 <u>c</u>)
5. Air entering at clutch cutoff valve (air actuated)	5. Check plug seal and sealring of valve (para 6-3)
<u>E</u> VEHICLE WILL NOT TRAVEL	
1. Low main pressure	1. Refer to <u>A</u>
2. Low clutch-apply pressure	2. Refer to <u>C</u>
3. Selector linkage broken or disconnected	3. Repair or connect linkage (para 3-9)
4. Internal mechanical failure	4. Overhaul transmission
<u>F</u> VEHICLE TRAVELS IN NEUTRAL WHEN ENGINE IS ACCELERATED	
1. Selector linkage out of adjustment	1. Adjust linkage (para 3-9)
2. Clutch failed (won't release)	2. Overhaul transmission
<u>G</u> VEHICLE LACKS POWER AND ACCELERATION AT LOW SPEED	
1. Low clutch-apply pressure	1. Refer to <u>C</u>
2. Aerated oil	2. Refer to <u>D</u>
3. High oil viscosity	3. Preheat oil, or change to a lighter viscosity. Refer to Table 3-1.
4. Engine malfunction	4. Check engine; refer to engine service manual
5. Turbine freewheel clutch failed	5. Overhaul transmission
<u>H</u> STALL SPEED TOO HIGH (see para 3-10)	
1. Clutch slipping	1. Overhaul transmission
2. Low main pressure	2. Refer to <u>A</u> and <u>C</u>

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Table 3-3. TROUBLESHOOTING (cont)

<u>Cause</u>	<u>Remedy</u>
<u>I</u> STALL SPEED TOO LOW (see para 3-10)	
1. Engine not producing full power	1. Tune or repair engine; refer to engine service manual
2. Torque converter failed	2. Rebuild converter
3. Loss of engine power through accessories attached to engine	3. Disconnect accessories which are absorbing power
<u>J</u> SERVICE BRAKE MALFUNCTIONS—TTB MODELS	
1. Brake slips when pedal is fully applied	1. Rebuild brake (para 6-16)
2. Spongy brake pedal	2. Bleed hydraulic brake lines (para 3-7)
3. Brake pedal bottoms when brake is applied	3. Check for leaks in hydraulic brake lines and for broken linkage. Bleed brake hydraulic system (para 3-7)
<u>K</u> CLUTCH CUTOFF VALVE INEFFECTIVE	
1. Valve or plug sticking	1. Rebuild control valve body assembly (para 6-3)
2. Brake-apply hydraulic pressure not reaching control valve	2. Check pressure at control valve (min-max limits — 100-2000 psi; 689-13 789 kPa)
3. Brake-apply air pressure not reaching air cylinder	3. Check at air cylinder for brake-apply pressure (35 lb (136 N) force required to stroke valve)
4. Plunger sticking in air cylinder	4. Check operation of air cylinder
5. Air entering at valve (air actuated)	5. Check operation of air cylinder (seals)

Section 4. GENERAL OVERHAUL INFORMATION

4-1. SCOPE

This section contains preliminary information required for the overhaul of the transmission. Cleaning instructions, inspection criteria, and recommended rework procedures are discussed. Good shop practices, coupled with the recommended procedures described herein, will aid in restoring high-quality performance.

4-2. MODEL CHANGES

The release of new assemblies may require new or different overhaul procedures. Major changes in the transmission will be described in supplementary issues to this manual. Contact your dealer or distributor for the latest information. When requesting service information, be sure to give the model, assembly part number, and serial number as stamped on the transmission nameplate (refer to para 1-3a).

4-3. TOOLS, EQUIPMENT

a. Special Tools. Table 4-1, and figures 4-1 and 4-2 show special tools required for overhaul procedures.

b. Mechanic's Tools, S h o p Equipment. The following tools, in addition to common tools, should be available:

CAUTION

Caustic cleaning compounds will damage some transmission parts. Use only mineral spirits such as PD 680-2 (or equivalent).

- Container of mineral spirits (for cleaning parts)
- Hoist (1/2-ton (450 kg) capacity, min)
- Press (for removal and installation of press-fit parts)
- Supply of wood blocks

Table 4-1. SPECIAL TOOLS

<u>Tool No.*</u>	<u>Fig.</u>	<u>Item</u>	<u>Name</u>	<u>Ref. Para.</u>
J-23547	4-1	1	Converter pump assembly puller	5-6a (4)
J-23723-6	4-1	2	Converter pump hub bearing driver	6-7b(2)
J-33080-1	4-1	3	Bridge	6-26
J-33080-2	4-1	4	Retriever	6-26
J-33080-3	4-1	5	Collet	6-26
J-33080-5	4-1	3	Collar	6-26
J-33080-8	4-1	6	Height gage	6-26
J-33080-13	4-1	3	Washer (two required)	6-26
**	4-1	7	Flange puller	4-9a
**	4-1	8	Cam bolt holding fixture	6-9b(6)
**	4-1	9	Suction tube nut wrench	5-7c, 7-7b(4)

* These tools are manufactured by Kent-Moore Tool Division, 29784 Little Mack, Roseville, Michigan 48066, and may be obtained through your local Detroit Diesel Allison dealer or distributor.

** Must be fabricated—not available from Kent-Moore.

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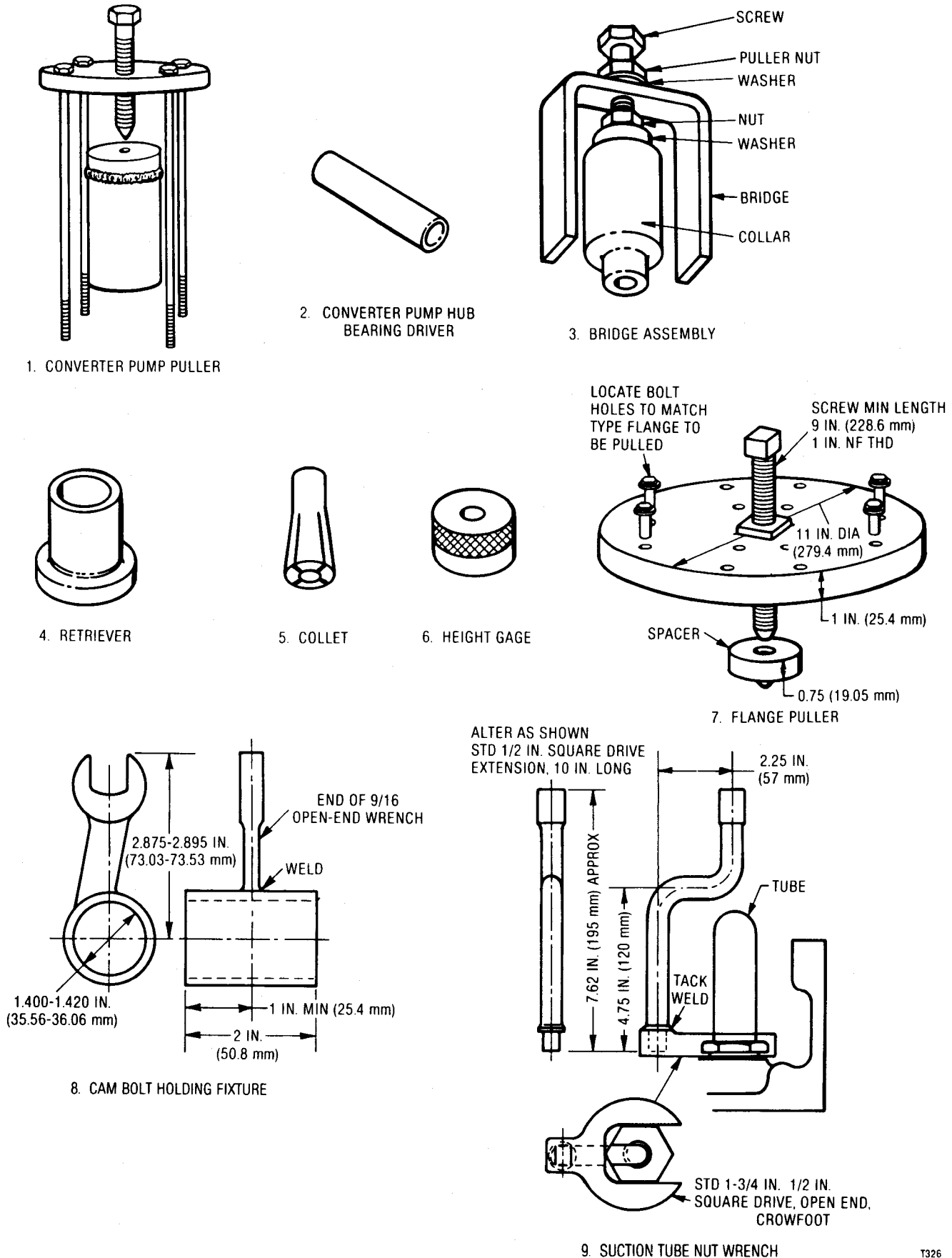
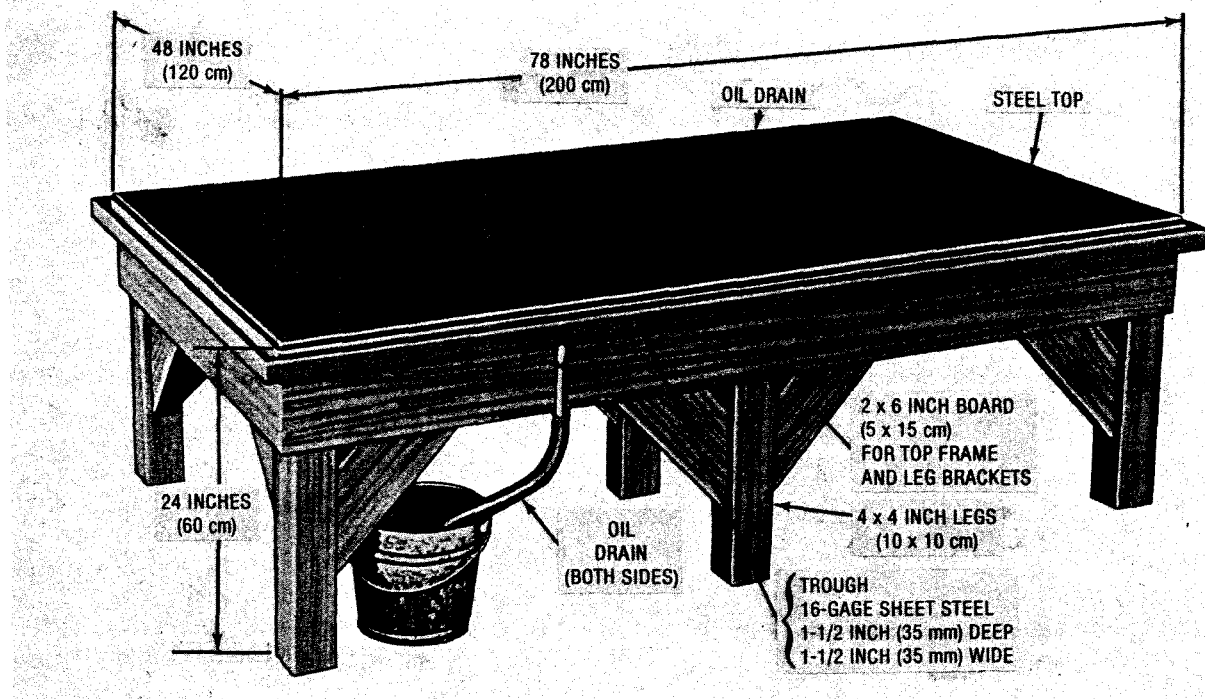


Fig. 4-1. Special tools

GENERAL OVERHAUL INFORMATION



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Fig. 4-2. Work table

- Clean lint-free shop cloths (do not use linty waste)
- Parts receptacles
- Cleaning equipment (brushes, solvents, etc.)
- Oil-soluble grease (petrolatum)
- Dry ice (for cooling interference-fit parts)
- Heating equipment or hot plate to provide oil at 300°F (150°C) (for heating interference-fit parts)
- Snapping pliers
- 3-leg lifting sling—1/2 ton (1200 kg) capacity—90 degree angle attaching plates
- Micrometer
- 100 inch-pound (11 N·m) torque wrench
- 100 foot-pound (136 N·m) torque wrench
- 1000 foot-pound (1356 N·m) torque wrench
- Nonhardening sealer, Permatex® * No. 2 or equivalent (for seals that are not precoated)
- Loctite® ** Pipe Sealant with Teflon or equivalent (for plugs that are not precoated)
- Loctite Sleeve Retainer 601 or equivalent (for sleeve-type bearings)
- High temperature grease, MIL-G-81322, Mobil Grease No. 28 (Mobil Oil Co.), Aeroshell Grease No. 22 (Shell Oil Co.) or equivalent (for lip-type oil seals—do not use inside transmission)
- High-quality molybdenum disulfide grease, Allison P/N 6769877 or equivalent (antiseize compound for input and output shaft threads—do not use inside transmission)

CAUTION

Use an antiseize compound that will not attack the Buna or Polyacrylate seal material. Mobile-Grease Special with molybdenum disulfide, or equivalent, is recommended.

* Permatex® is a registered trademark of Permatex Co. Inc., West Palm Beach, FL.

** Loctite® is a registered trademark of Loctite Corporation, 705 N. Mountain Rd., Newington, CT 06111.

4-4. REPLACEMENT PARTS

a. Ordering Information. Refer to paragraph 1-3 for information on ordering parts and service kits.

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

WARNING

Do not burn discarded Teflon seals. Toxic gases are produced by burning.

- Sealrings
- Oil seals (if removed)
- Gaskets
- Lockstrips
- Washers or snaprings damaged by removal

4-5. CAREFUL HANDLING

Parts which have close operating tolerances must be handled carefully to prevent nicking, scratching, or denting. The slightest damage to these parts can result in erratic operation and possible malfunction of the transmission. These parts should be carefully handled and protected during removal, cleaning, inspection, and installation.

4-6. CLEANING, INSPECTION

a. Dirt-free Assembly. All parts must be clean to permit effective inspection. During 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.

b. Cleaning Parts

CAUTION

Use only mineral spirits for cleaning. Solvents such as trichloroethylene, Benzol, Acetone, and all aromatics are harmful to oil seals using polyacrylate rubber.

(1) Use only mineral spirits on friction-faced clutch plates and bearings. All other metallic parts of the transmission should be cleaned thoroughly with mineral spirits, or by steam-cleaning. Do not use a caustic soda solution for steam cleaning.

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

(3) Clean oil passages by working a piece of soft wire back and forth through the passages and flushing with spirits. Dry the passages with compressed air.

(4) After cleaning, examine the parts and especially the oil passages to make certain they are entirely clean. Reclean them, if necessary.

(5) Removal of minor defects with such items as crocus cloth, soft honing stones, and scrapers produces debris and residue. Cover adjacent parts, ports, and cavities before removing defects. Thoroughly reclean the affected areas after rework.

c. Cleaning Bearings

WARNING

Never dry bearings by spinning them with compressed air. A spinning bearing can disintegrate, allowing balls or rollers to become lethal flying projectiles. Also, spinning a bearing while it is not lubricated can damage the bearing.

(1) Bearings that have been in service should be thoroughly washed in mineral spirits.

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

(3) Before inspection, oil the bearings with type C-3 transmission oil.

GENERAL OVERHAUL INFORMATION

d. Inspecting Bearings

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

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

(3) Inspect the defective bearing's housing and shaft for grooved, burred, or galled conditions that indicate 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.

CAUTION

Any bearing that has been subjected to metal contamination (para 3-3) must be closely inspected for metal particles. Metal particles will cause failure of the bearing.

e. Keeping Bearings Clean. The presence of dirt or grit in ball bearings is usually responsible for bearing failures. Keep bearings clean during installation and removal. Observance of the following rules will do much to ensure 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.

f. Inspecting Cast Parts, Machined Surfaces

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

burrs 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 a soft wire back and forth through the passage and flushing it with mineral spirits.

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

(4) Inspect threaded openings for damaged threads. Chase damaged threads with the correct size used tap (a new tap can cut oversize).

(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 defective parts.

(7) Inspect piston bores in clutch housings for nicks, burrs, and displaced metal that could interfere with mating parts or damage piston sealrings. Remove these defects with crocus cloth or soft honing stone.

(8) Inspect sealring grooves in clutch pistons for nicks, burrs, dents, or displaced metal that could damage sealrings. Remove these defects with crocus cloth or soft honing stone.

g. Inspecting Bushings, Thrust Washers

(1) Inspect bushings for scores, roundness, burrs, sharp edges, and evidence of overheating. Remove scores with crocus cloth. Remove burrs 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 tool. Whenever it is necessary to cut out a defective bushing, do not damage the bore into which the bushing fits.

(2) Inspect thrust washers for distortion, scores, burrs, and wear. Replace the thrust washer if it is defective or worn.

h. Inspecting Oil Seals, Gaskets

(1) Inspect piston sealrings for nicks, cuts, tears, splits, and pattern damage. This type damage on old sealrings can indicate defects in the piston grooves or in the piston housing bores. Locate and remove the defects. Refer to paragraphs 4-6 f, (7) and (8).

(2) Inspect metal-encased seals for cuts and hardness. Replace the seal if defects are found or if the seal is damaged by removal. Replace all sealrings (except hook-type) and composition gaskets.

(3) Inspect the hook-type sealrings for wear, broken hooks, and distortion.

(4) Install a new hook-type sealring if the ring shows any wear on the outside circumference or if there is excessive side wear. The sides of the sealring should be smooth (0.005 inch (0.127 mm) maximum side wear). The sides of the shaft groove (or the bore) in which the sealring fits should be smooth to (50 micro-inches (1.27 μ m)) and square with the axis of rotation within 0.002 inch (0.05 mm). If the sides of ring grooves have to be reworked (0.020 inch (0.51 mm) maximum side wear), install a new sealring.

i. Inspecting Gears

(1) Inspect gears for scuffed, nicked, burred, or broken teeth. If the defect cannot be removed with a soft honing 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 burrs. Remove such defects with a soft honing stone.

j. Inspecting Splined Parts. Inspect parts for stripped, twisted, chipped, or burred splines. Remove burrs with a soft honing stone. Replace the part if other defects are

found. Spline wear is not considered detrimental except where it affects tightness or fit of the splined parts.

k. Inspecting Clutch Plates

(1) Inspect the friction-faced plates for burrs, imbedded metal particles, severely pitted faces, excessive wear, cone, cracks, distortion, and damaged spline teeth. Remove burrs, using a soft honing stone. Replace plates which have other defects.

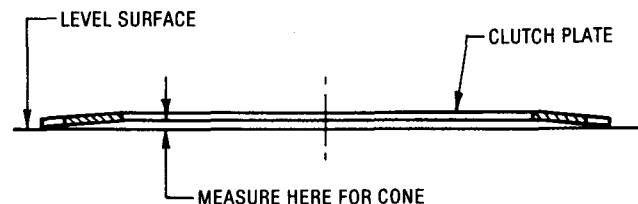
(2) Inspect steel plates for burrs, scoring, excessive wear, cone, distortions, imbedded metal, galling, cracks, breaks, and damaged tangs. Remove burrs and minor surface irregularities using a soft honing stone. Replace plates which have other defects.

(3) The amount of cone is determined by measuring the distance between the inside diameter of the plate and a level surface (fig. 4-3). Discard plates having excessive cone (refer to wear limits, Section 8).

l. Inspecting Threaded Parts. Inspect parts for burred or damaged threads. Remove burrs with a soft honing stone or fine file. Replace damaged parts.

m. Inspecting Snaprings. Inspect all snaprings for nicks, distortion, and excessive wear. Replace the part if any one of these defects is found. The snapring must snap tight in its groove for proper functioning.

n. Inspecting Springs. Inspect all the springs for signs of overheating, permanent set, or wear due to rubbing adjacent parts.



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Fig. 4-3. Method for determining cone of clutch plate

GENERAL OVERHAUL INFORMATION

Replace the spring if any one of these defects is found. Replace springs which do not meet the load-height specifications in the spring chart in Section 8.

o. Inspecting Seal Contact Surfaces. Inspect the surfaces that contact the sealing area or lip of any seal. Roughness, scoring, pitting, or wear that will permit oil leakage or cause damage to the seal must be corrected. The affected part must be replaced if defects cannot be corrected.

p. Inspecting Swaged, Interference-fit Parts. If there is evidence of looseness due to relative motion, the assembly should be replaced.

q. Inspecting Balls in Clutch Pistons. Inspect all balls in clutch pistons for free movement. Any restriction could prevent the ball from seating during clutch application.

r. Inspecting Pump Gears. Inspect pump gears for evidence of wear such as scoring or shiny areas due to rubbing of adjacent parts. Replace gears with any signs of wear.

4-7. ASSEMBLY PROCEDURES

a. Clutches, Pistons

(1) Soak each friction face clutch plate (two-minute minimum) in transmission fluid prior to final assembly.

(2) Apply a generous amount of transmission fluid to the piston cavity prior to final assembly.

(3) Assemble clutch plates so that the cone of each plate faces the same direction as the cone of the adjacent plates (fig. 4-3).

b. Parts Lubrication. During final assembly, lubricate all moving parts with transmission fluid. The lubricant will help protect the friction surfaces and ferrous metals until the unit is in service.

c. External Pipe Plugs, Hydraulic Fittings.

(1) New Precoated Plugs. New plugs that are precoated with Teflon need no preparation for assembly.

(2) Reused or Uncoated Plugs, Hydraulic Fittings. Prepare the threads with a small amount of nonhardening sealant, such as Loctite Pipe Sealant with Teflon, or equivalent. Do not use Teflon tape.

CAUTION

Inaccurate torque can cause leakage and cracked housings. Tighten all pipe plugs to the torque specified in the assembly step and on the exploded views.

d. Oil-soluble Grease. Use only oil-soluble grease with a low melting point, such as MIL-VV-P-236 or Amojell petrolatum (Amoco Oil Co.) or equivalent to temporarily retain parts, step-joint sealrings, scarf-cut sealrings, and hook-type sealrings during assembly with mating parts.

CAUTION

Do not use petrolatum to retain cork gaskets.

e. Sealing Compounds, Nonsoluble Greases. Do not use gasket-type sealing compounds, fibrous greases, or nonsoluble, vegetable-base cooking compounds any place inside the transmission. Do not use them any place where they could be flushed into the transmission hydraulic system.

f. Metal-Encased Oil Seals

(1) When replacing metal-encased oil seals, make sure the spring-loaded lip side is toward the oil to be sealed in (toward the inside of the unit). Coat the inside of the seal with high temperature grease, such as MIL-G-81322, Mobil Grease No. 28 (Mobil Oil Co.) or Aeroshell Grease No. 22 (Shell Oil Co.) or

equivalent to protect the seal during shaft installation and to provide lubrication during initial operation. Do not use high temperature grease on other internal transmission parts.

(2) Precoated Seals. The circumference of some seals is precoated with a dry sealant. The sealant is usually colored for easy identification. The precoated seals do not require any additional sealant before installation.

(3) Uncoated Seals. Prepare the circumference of uncoated seals with a nonhardening sealant such as Permatex No. 2 or equivalent before installation.

g. Interference-fit Parts. Assembly of interference-fit parts may be accomplished by heating and chilling the respective parts. The female part can be heated in an oven or oil bath to 300°F (149°C), and the male part can be chilled in dry ice. Either one or both parts may require a thermal process. However, if the chill process is used for a ferrous alloy part, coat the components with transmission fluid to inhibit rust due to frost and moisture.

h. Sleeve-type Bearings. Loctite Sleeve Retainer 601, or equivalent, should be used to retain bushings and sleeve-type bearings that have press-fit tolerance.

i. Bearings (Ball or Roller)

(1) When installing a bearing on a shaft, heat the bearing to 200°F (93°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 a press to seat the bearing.

NOTE

Bearings must be heated long enough for sufficient expansion. Heating time is determined by the size of the bearing. Forty-five minutes is sufficient for the largest bearing in these transmissions.

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

4-8. REMOVING, INSTALLING TRANSMISSION

a. Drain Oil. Drain the oil from the transmission. For better drainage, the transmission should be warm and allowed to drain overnight. Replace the drain plug.

b. Check Linkages, Lines. Make sure that all linkages, controls, cooler and filter lines, pressure and temperature lines, drive-line couplings, and mounting bolts are disconnected before transmission removal. Carefully place oil lines clear of the removal path and cover all openings to keep out dirt.

c. Remove, Clean Transmission. Consult the vehicle service manual for specific instructions for removal and installation, as applications will differ. Clean the exterior of the transmission. If steam cleaning is used, the transmission should be disassembled and dried immediately as condensation of the steam will rust the ferrous parts in the transmission.

d. Lifting. Two 3/4-10 tapped openings are provided at the top of the transmission housing. Bolts or eyebolts may be installed into the openings for lifting the transmission assembly.

e. Reconnect at Installation

(1) At installation, reconnect all linkage and lines which were previously removed. Refer to the vehicle service manual and to paragraph 3-9 for proper adjustments of control linkage.

(2) Use Loctite Pipe Sealant with Teflon, or equivalent, for thread sealing on hydraulic, air, and other threaded fittings. Do not use Teflon tape. Loose slivers of tape can plug orifices, cause valves to stick, or may interfere with check ball operation.

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(3) On the direct-mount transmissions equipped with torque converter drive cover 12 (foldout 6,B), make sure the counterbore in drive ring 8 is packed with high-quality molybdenum disulfide grease. (Refer to para 7-12b.)

4-9. TIGHT-FIT FLANGES

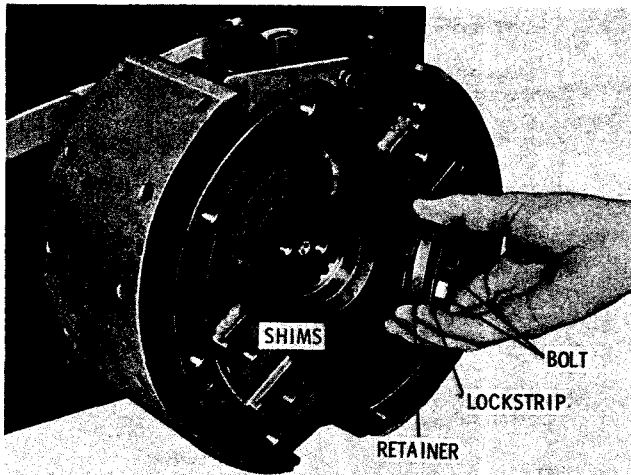
a. Removal of Flanges

(1) If present, flatten the corners of the lockstrip and remove two bolts, lockstrip, retainer washer, and shims (fig. 4-4).

(2) Some flanges are retained by a self-locking nut. Before removing the nut, check to see how many notches have been cut into the wrenching flats. If there are five notches, remove the nut and throw it away.

(3) If there are less than five notches, or none at all, remove all dirt and any burrs from the exposed shaft threads. Then, only loosen the nut until there is approximately 1/16-inch (1.59 mm) gap between the nut and flange.

(4) Check the running torque while removing the nut. The nut can be reused only if it meets the following requirements.



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Fig. 4-4. Removing or installing output flange retaining parts

- The first time (no notches) the nut is removed, the running torque must be at least 400 lb in. (45 N·m).
- Each additional time (one to four notches) the nut is removed, the running torque must be at least 300 lb in. (34 N·m).

(5) Each time the nut is reused, deeply scribe a line onto one of the wrenching flats. This method of marking the nut will indicate how many times the nut has been reused. The nut must not be reused more than five times.

CAUTION

A puller placed on the outside diameter of the flange may deform the pilot diameter and mounting face.

(6) Install a suitable heavy-duty puller to the face of the flange. A typical puller is illustrated in figure 4-1. A Torqmatic coupling requires a puller that will engage the internal groove machined in the coupling hub.

(7) In order to protect the tapped holes in the end of the shaft, install a soft metal spacer between the puller jackscrew point and the end of the shaft.

(8) Provide a means for preventing flange rotation.

CAUTION

Do not use a pry bar or hammer to force the flange at disassembly.

(9) Remove the flange by tightening the puller screw against the spacer and shaft.

b. Installation of Flanges

(1) Coat the shaft splines and the lip of the oil seal with a thin layer of bearing grease.

(2) Heat the flange to approximately 300°F (149°C) prior to assembly. Either heat in a controlled temperature furnace for at least 45 minutes or submerge the flange in a container of oil and heat the oil. (If acetylene torch is used, heat the container of oil for 15 minutes.)

CAUTION

Do not let the flange cool prior to installation. If the flange cools and seizes to the shaft prior to its final assembly, it will be necessary to remove the flange and repeat the assembly procedure. Do not attempt to force the flange with a hammer.

(3) Immediately after heating, install the flange on the shaft, making sure that the flange is tight against its locating shoulder. The flange should slide freely to its assembled position.

(4) If an output nut is used, coat the threads of the nut with molybdenum disulfide grease and install the flange retaining washer and nut. (Do not reuse nut with five notches; refer to paragraph 4-9a.) Tighten the nut to 450-700 lb ft (611-949 N·m) (fig. 4-5).

(5) If washer and bolts are used, install washer and free running bolts to draw

the flange down into final position. (Do not use lock bolts that will be used at final assembly.) Remove the bolts and install the lock-strip (and shim(s), if required—see fig. 4-6). Shims are available in thicknesses of 0.005 inch (0.13 mm) and 0.025 inch (0.63 mm). Use shims to allow 0.005-0.009 inch (0.12-0.22 mm) between surface A (fig. 4-6) and the surface of the shim pack. Install the lock bolts and tighten them to 41-49 lb ft (56-66 N·m).

(6) After the assembly has cooled, it is good practice to check the nuts or bolts for tightness and, if necessary, retighten them.

4-10. WEAR LIMITS, SPRING DATA

a. Wear Limits Inspection. When parts are being inspected, those listed in Section 8 should be measured for wear. Those parts

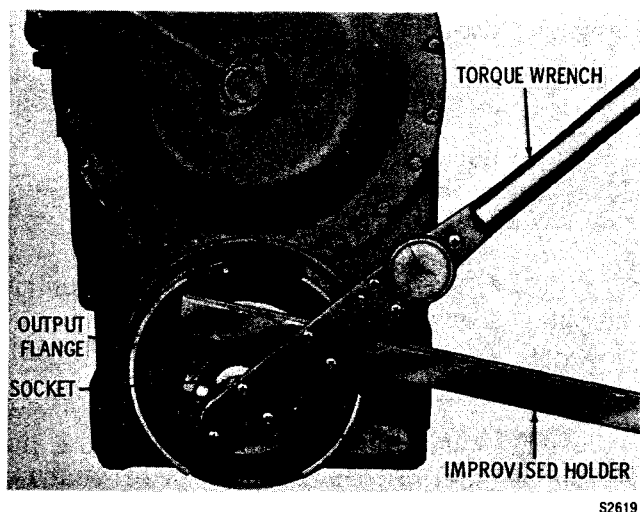


Fig. 4-5. Tightening rear output flange nut

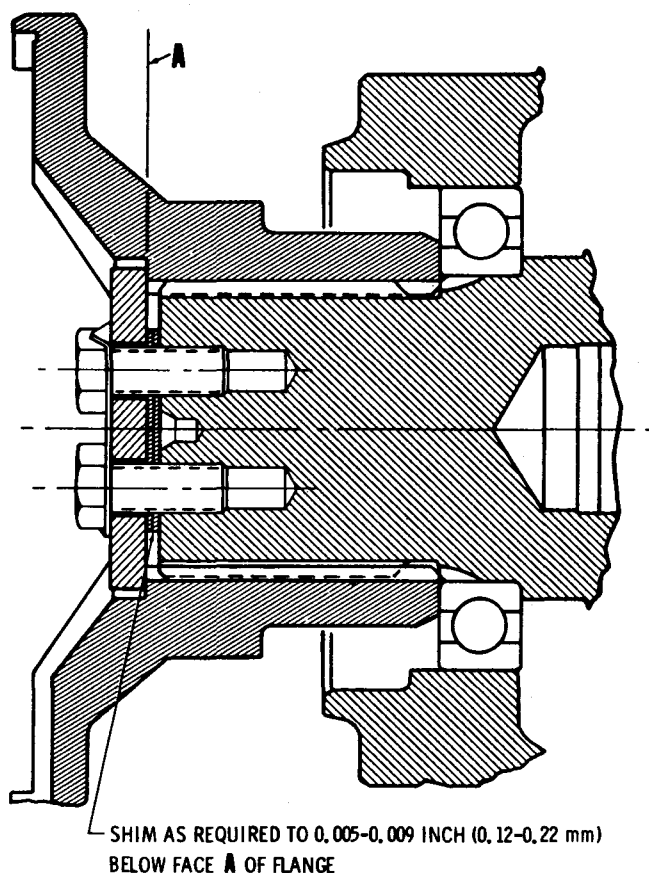


Fig. 4-6. Measurement to determine flange shim thickness

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which have reached or exceeded the specified wear limit should be discarded and replaced. All wear limits data are tabulated in Section 8. The item numbers are keyed to the parts shown in the exploded views at the back of the book.

b. Spring Inspection. The data presented in the Spring Chart in Section 8 will aid in

identification and inspection of the springs within the transmission.

4-11. TORQUE SPECIFICATIONS

Torque specifications are given with each assembly procedure. Also, the exploded view foldouts state torque specifications for all threaded parts.

Section 5. DISASSEMBLY OF TRANSMISSION

5-1. SCOPE

The procedures of this section describe the disassembly of the TT, TTB, TRT 2001 Series transmissions into subassemblies. Disassembly of the subassemblies is described in Section 6. Refer to the cross sections (fold-outs 1 through 5) for the functional location of parts. Refer to the exploded views (fold-outs 6 through 18) for parts identification.

5-2. PREPARATION FOR DISASSEMBLY

a. General Information. Refer to Sections 4 and 8 for general disassembly information as follows:

<u>Paragraph</u>	<u>Title</u>
4-3	Tools, Equipment
4-4	Replacement Parts
4-5	Careful Handling
4-6	Cleaning, Inspection
4-9	Tight-fit Flanges
8-1	Wear Limits Data
8-2	Spring Data

b. Lifting, Handling. All Allison Twin-Turbine transmissions have two 3/4-10 tapped holes in the top of the transmission housing. Eye bolts may be installed into these holes to provide a means of supporting or positioning the transmission housing during disassembly (fig. 5-1).

5-3. SERVICING OF VEHICLE-MOUNTED TRANSMISSION

a. Some Servicing Without Removal. The TT, TTB, and TRT Series transmissions are designed so many service operations may be accomplished without removing the transmission from the vehicle. The disassembly procedures in the manual, however, relate to operations with the transmission removed.

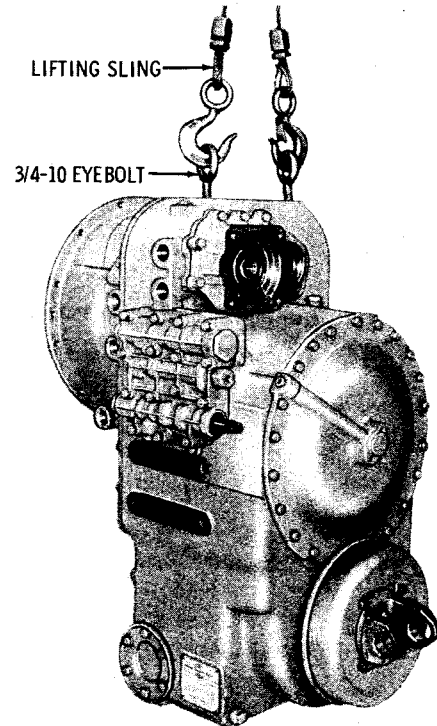


Fig. 5-1. Lifting transmission

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b. Accessibility. Accessibility of the transmission in the vehicle, the nature of the service required, and other factors will determine the advisability of performing major operations without removing the transmission. Procedures for disassembly are essentially the same, but the position of the transmission may cause some inconvenience at times. In general, if the construction of the vehicle provides room, all external subassemblies and all components which can be removed from the rear of the transmission may be serviced.

5-4. REMOVAL OF EXTERIOR COMPONENTS (all models)

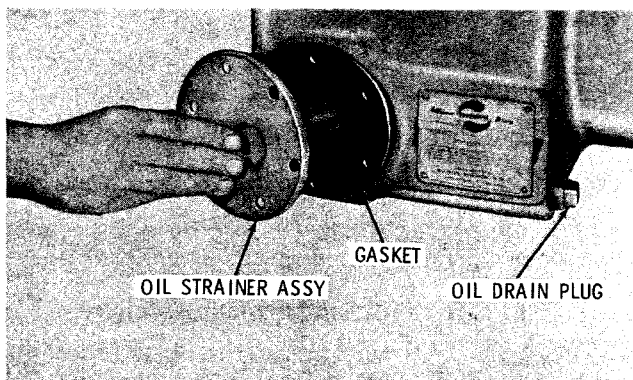
a. External Thermostat. If present, remove external thermostat assembly 31 (fold-out 7, B). If rebuild is necessary, follow the instructions with the new external thermostat kit.

b. Oil Pump Drive Coupling. If the transmission is equipped with adapter drive coupling 18 (foldout 18,A), remove the coupling.

c. Oil Strainer Assembly.

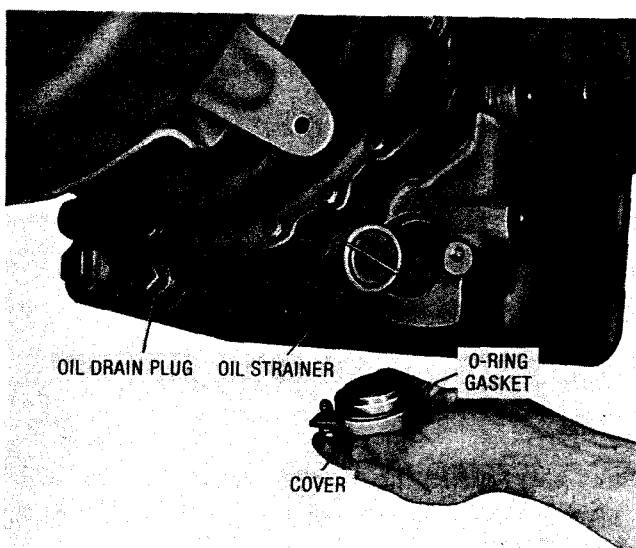
(1) -1 Models. Remove the oil drain plug. Remove the six bolts and lockwashers that retain the oil strainer assembly (fig. 5-2). Remove the oil strainer and gasket.

(2) -3 Models. Remove the oil drain plug. Remove two bolts and lockwashers which retain the strainer cover. Remove the cover and sealing (fig. 5-3). Remove the strainer.



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Fig. 5-2. Removing oil strainer and gasket (-1 models)



S1395

Fig. 5-3. Removing oil strainer and gasket (-3 models)

d. Output Flanges, Parking Brake

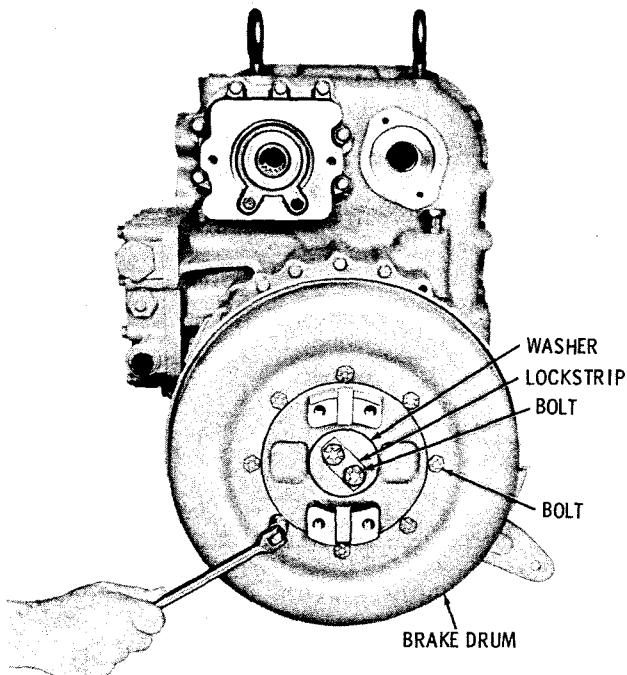
(1) Depending on the model, the rear output flange may be in a position behind or in front of the parking brake. If the flange is behind the brake, remove the attaching hardware and flange.

(2) Remove the four (fig. 5-4) or eight (fig. 5-5) self-locking bolts that retain the parking brake drum. Remove the drum.



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Fig. 5-4. Removing parking brake drum bolts (-1 models)



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Fig. 5-5. Removing parking brake drum bolts (-3 models)

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(3) If the output flange has not yet been removed, remove the attaching hardware and flange (fig. 5-6).

(4) If the model is equipped with a front output flange, remove the attaching hardware and flange.

(5) If present, remove sealrings 3 and 37 (foldout 17,A).

(6) Remove brake shoe return springs 5 or 16 (foldout 17,B) and brake shoes and linings 4 or 15, roller 3 or 14, and cam lever 6 or 17. Remove four self-locking bolts 7 or three bolts 20 and lockwashers 21 and remove brake backplate 2, 8, or 13. Refer to figure 5-7. Remove spacer 33 (foldout 17,A), if present, from the output shaft.

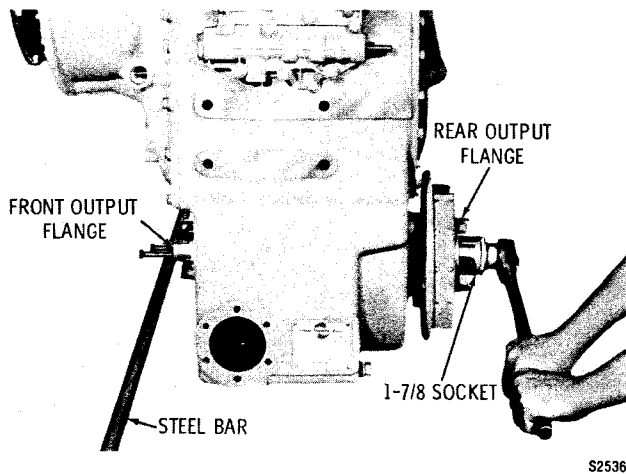


Fig. 5-6. Removing rear output flange nut

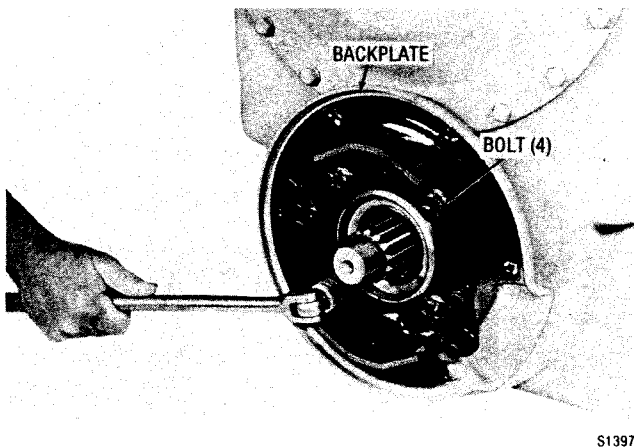


Fig. 5-7. Removing parking brake backplate bolts (-1 models)

e. Control Valve Assembly

(1) Remove fifteen 2-1/2 inch bolts and lockwashers and one hidden 1-inch bolt and lockwasher that attach the control valve body to the transmission housing (fig. 5-8).

(2) If present, remove bracket 28 (foldout 18,B).

(3) Remove the control valve body and gasket (fig. 5-9). Refer to paragraph 6-3 for the control valve assembly rebuild instructions.

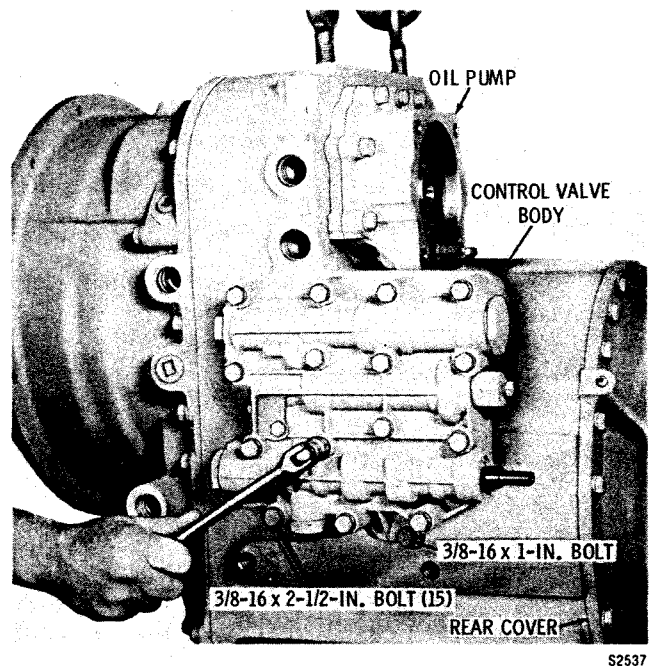


Fig. 5-8. Removing valve body bolts

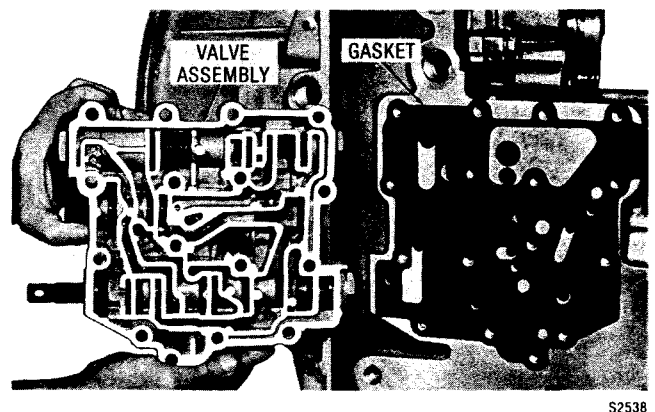


Fig. 5-9. Removing valve body and gasket

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5-5. REMOVAL OF INPUT COMPONENTS

NOTE

Position the transmission on its rear surface. Do not allow the transmission to rest on the speedometer drive assembly, if present, or the output shaft.

For direct-mount models with flex disk, proceed to paragraph 5-5a. For direct-mount models with drive ring, proceed to paragraph 5-5b. For remote-mount models, proceed to paragraph 5-5c.

a. Direct Mount (flex disk)

(1) Remove the six self-locking bolts and plate that retain the flex disk assembly (fig. 5-10).

(2) Remove the flex disk plate and flex disk assembly consisting of three flex disks and a disk and washer assembly (fig. 5-10). If present, remove plates 2 and 4 (foldout 6,B).

(3) Remove the twenty-four self-locking nuts that retain the torque converter drive cover (fig. 5-11).

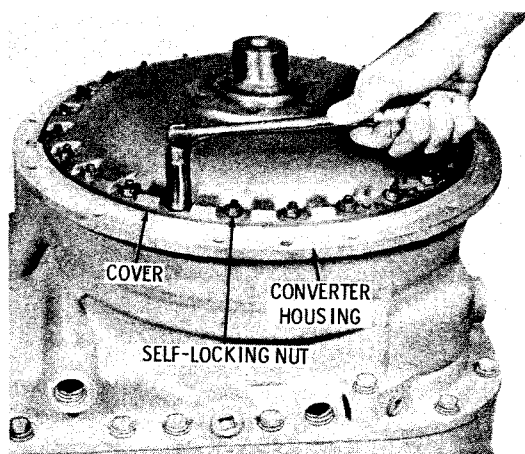
(4) Attach a sling and remove torque converter drive cover (fig. 5-12). Ball bearing

1 (foldout 7,A) may remain in the torque converter drive cover; if so, remove the bearing.

(5) Proceed to paragraph 5-6.

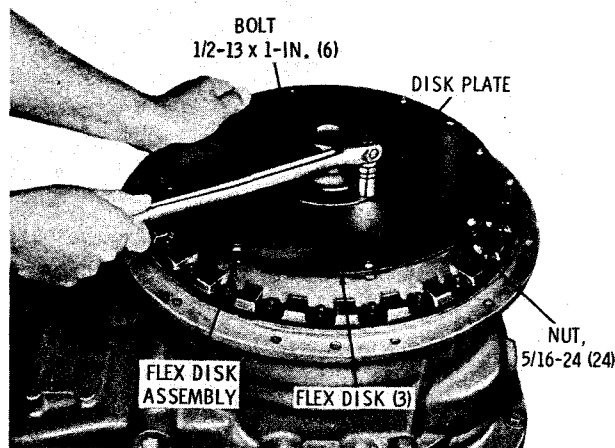
b. Direct Mount (drive ring)

(1) Remove sealring 10 (foldout 6,B) and twenty-four self-locking nuts 11 from torque converter drive cover 12. Remove the torque converter drive cover. Ball bearing 1 (foldout 7,A) may remain in the cover; if so, remove the bearing.



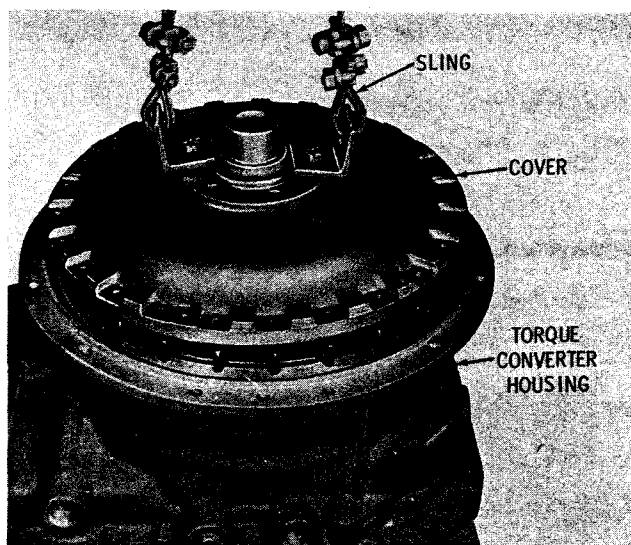
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Fig. 5-11. Removing torque converter drive cover nuts



S2615

Fig. 5-10. Removing flex disk bolts



S2541

Fig. 5-12. Removing torque converter drive cover

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(2) Converter drive ring 8 (foldout 6,B) and eight twelve-point bolts 9 will remain with the engine. Remove the bolts and drive ring only if necessary.

(3) Proceed to paragraph 5-6.

c. Remote Mount

(1) Remove the attaching hardware and input flange. If present, remove sealring 3 (foldout 6,A) from the shaft.

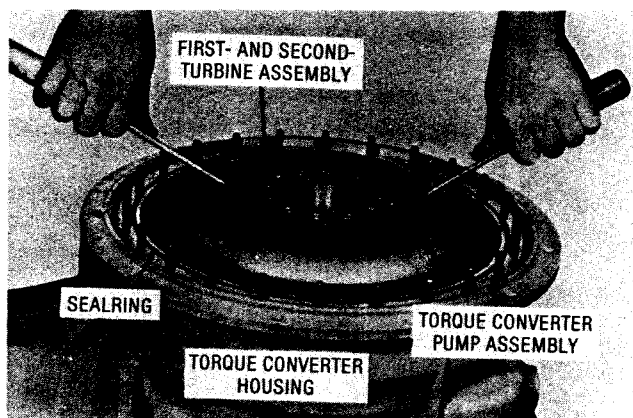
(2) Remove twelve bolts 12 (foldout 6,A), nuts 22, and lockwashers 21, and remove transmission front cover 13 and gasket 14. Refer to paragraph 6-4 for the front cover rebuild instructions.

(3) Remove the twenty-four self-locking nuts 19 (foldout 6,A) that retain torque converter drive cover 20 or 24. Remove the torque converter drive cover and attached input shaft 18 or 23 and bearing 15, as an assembly. Refer to paragraph 6-5 for the torque converter drive cover rebuild instructions.

5-6. REMOVAL OF TORQUE CONVERTER COMPONENTS AND HOUSING

a. Torque Converter Components

(1) Using two screwdrivers, and lifting straight upward, remove the first- and second-turbine assembly (fig. 5-13). Do not disassemble this unit unless necessary. If



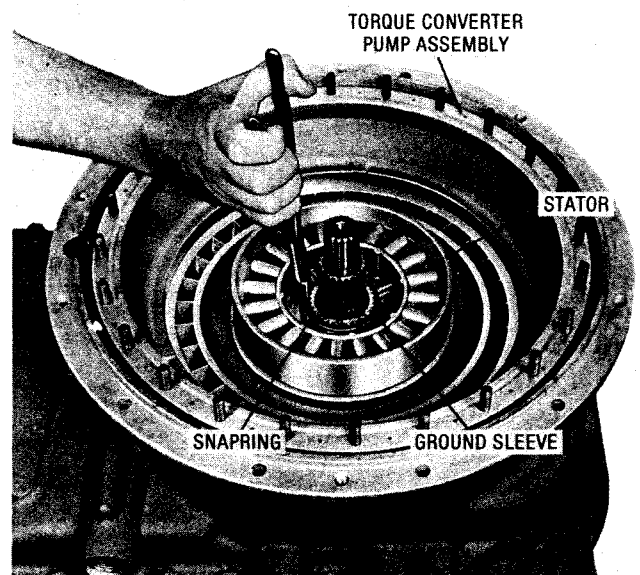
S2542

Fig. 5-13. Removing first- and second-turbine assembly

necessary, refer to paragraph 6-6 for turbine assembly rebuild instructions. Remove the sealring, if present, from the torque converter pump assembly.

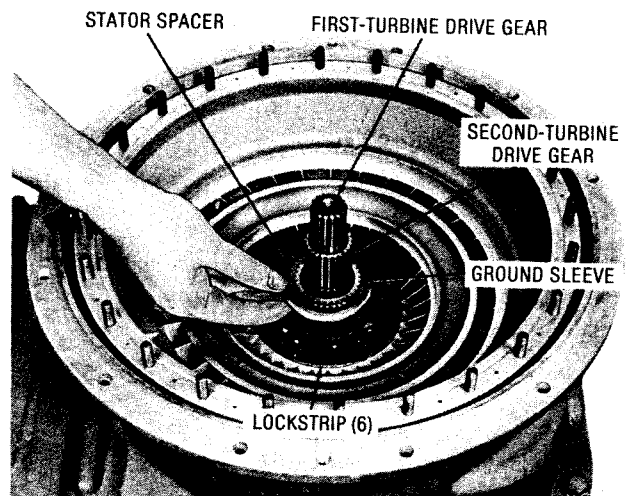
(2) Remove the snapping that retains the converter stator and remove the stator from the converter ground sleeve (fig. 5-14).

(3) Remove the stator spacer from the converter ground sleeve (fig. 5-15).



S2543

Fig. 5-14. Removing stator snapping



S1403

Fig. 5-15. Removing stator spacer

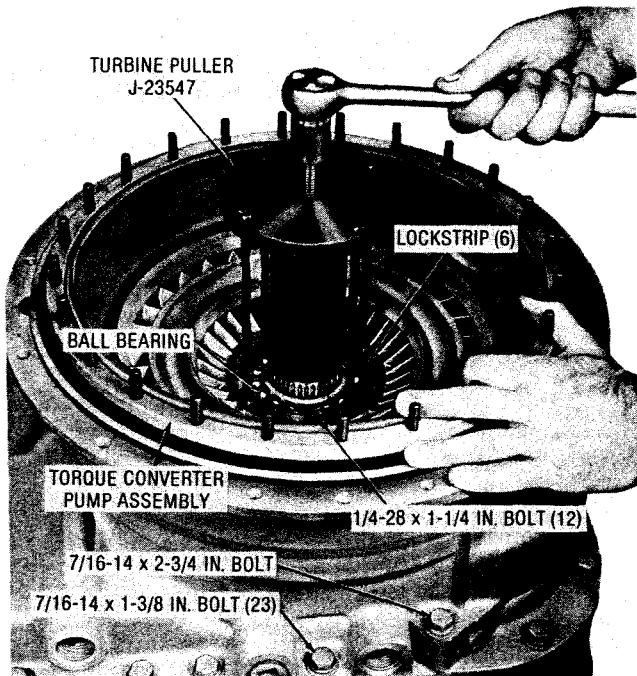


Fig. 5-16. Removing torque converter pump assembly

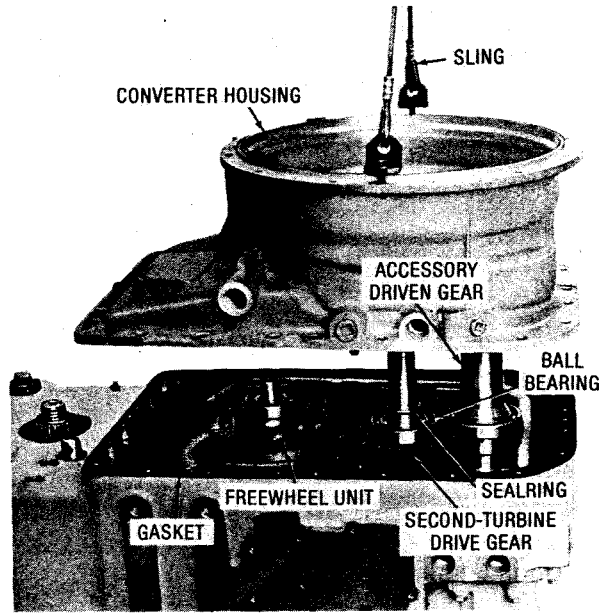
(4) Straighten the tabs of the lockstrips at four places equidistant around the pump hub and remove four of the twelve bolts (fig. 5-16). Install puller J-23547, making sure the puller sleeve rests on the converter ground sleeve and extends above the end of the first-turbine drive gear shaft. Tighten the puller screw.

(5) When the converter pump bearing has been drawn from its seat on the ground sleeve, remove the puller.

(6) Remove the torque converter pump and reinstall the four bolts removed in step (4). If further disassembly is planned, refer to paragraph 6-7 for converter pump rebuild instructions. If disassembly is not necessary, tighten the four 1/4-28 x 1-1/4-inch bolts to 10-12 lb ft (14-16 N·m), and bend the lockstrip tabs against the replaced bolts.

b. Torque Converter Housing

(1) Remove the twenty-four bolts, lockwashers, and plain washers that attach



S1405

Fig. 5-17. Removing torque converter housing assembly

the converter housing to the transmission main housing (fig. 5-16).

(2) Attach a sling to the converter housing flange (fig. 5-17). Apply slight tension on the sling and using a soft hammer, bump the torque converter housing away from the transmission main housing.

WARNING

Do not allow second-turbine drive gear and freewheel unit to remain with the converter housing. The second-turbine drive gear could fall unexpectedly and cause damage or injury.

CAUTION

When converter housing has cleared the transmission housing approximately 1-1/2 inches (35 mm), check to ensure that the second-turbine drive gear and freewheel unit remain with the transmission housing. If the freewheel unit is raised with

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the torque converter housing, the oil suction tube could be damaged. If necessary, use two long screwdrivers to pry the free-wheel front bearing from the converter housing. On units equipped with an internal thermostat, do not pry against bypass tube 30 (foldout 7,B).

(3) Remove the torque converter housing and attached parts (fig. 5-17). Remove the gasket. Refer to paragraph 6-8 for converter housing rebuild instructions.

5-7. REMOVAL OF TORQUE CONVERTER TURBINE GEARING AND OIL SUCTION TUBE

a. Turbine Gears and Freewheel Clutch

(1) Remove the second-turbine drive gear and attached parts (fig. 5-17). Remove the step-joint sealring from the drive gear shaft. Thrust race 25 (foldout 7,B) may remain on the hub of the second-turbine drive gear. If so, remove the race.

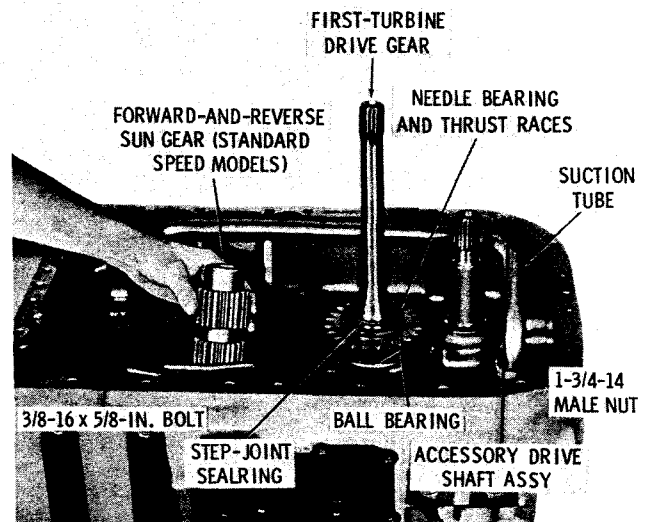
(2) Remove the ball bearing from the second-turbine drive gear only if replacement is necessary (fig. 5-17).

NOTE

On some models, it may be necessary to remove the oil suction tube prior to removal of the freewheel unit. Refer to paragraph 5-7c.

(3) Remove the first-turbine driven gear and the second-turbine driven gear and freewheel unit as an assembly (fig. 5-17). Refer to paragraph 6-9 for freewheel unit rebuild instructions.

(4) If the transmission is equipped to provide a standard speed low-gear ratio, remove the forward-and-reverse sun gear as shown in figure 5-18. If the transmission is equipped with a high speed low-gear ratio, forward-and-reverse sun gear 16 (foldout 9,B) cannot be removed as shown (fig. 5-18) but



S2545

Fig. 5-18. Removing forward-and-reverse sun gear (models with standard speed ratio)

must be removed from the rear of the transmission; however, spacer 8 (foldout 9,B) is accessible and should be removed from the sun gear cavity.

(5) Remove the needle roller bearing, two thrust races, and step-joint sealring from the first-turbine drive gear (fig. 5-18). Remove the first-turbine drive gear and ball bearing as an assembly. Do not remove the bearing unless replacement is necessary. If necessary, refer to paragraph 6-10 for rebuild instructions.

b. Accessory Drive Shaft. Remove the accessory drive shaft (fig. 5-18). Remove bearing 9 (foldout 7,B) from accessory drive shaft 8 only if replacement is necessary.

c. Oil Suction Tube. If present, remove three self-locking bolts 30 and bolt 31 (foldout 9,A) which retain oil baffle plate 29. Remove the baffle plate. Using a fabricated wrench, remove the male nut that retains the oil suction tube at the top of the housing (fig. 5-18). If present, remove self-locking bolt 1 (foldout 8,B) at the suction tube support. Remove the suction tube, and remove the male nut and compression sealring.

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NOTE

Disassembly paragraphs are as follows:

<u>Model</u>	<u>Para</u>
TT 2221-1, 2421-1	5-8, 5-10, 5-12, 5-13, 5-14
TTB 2221-1, 2421-1	5-9, 5-10, 5-12, 5-13, 5-14
TRT -1	5-11, 5-12, 5-13, 5-14
TRT -3	5-11, 5-12, 5-13

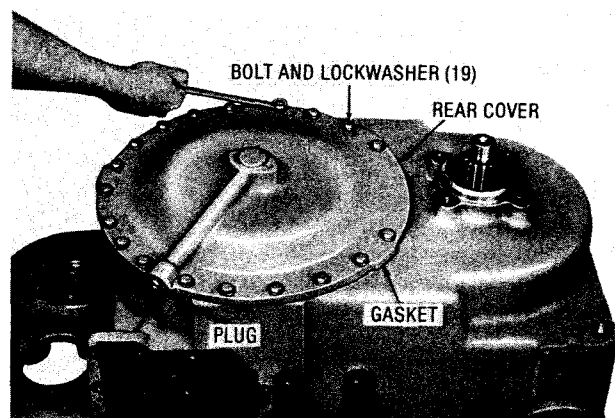
5-8. REMOVAL OF REAR COVER AND HIGH-RANGE CLUTCH PISTON HOUSING (TT 2221-1, 2421-1)

NOTE

Models without converter-driven PTO, proceed to paragraph 5-8a. Models with converter-driven PTO, proceed to paragraph 5-8c.

a. Rear Cover Assembly (TT 2221-1, 2421-1 without converter-driven PTO)

(1) Position the transmission on wood blocks, front splitline downward. Remove the nineteen bolts and lockwashers that attach the rear cover to the transmission housing (fig. 5-19). Remove the rear cover



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Fig. 5-19. Removing transmission rear cover (TT 2221-1, 2421-1 without converter-driven PTO)

and gasket. Remove searing 2 (foldout 16,D) from the rear cover. Remove pipe plug 3 or 33 only if replacement is necessary.

(2) If the transmission is equipped with a speedometer drive assembly, remove two bolts 15 and lockwashers 14. Remove speedometer drive sleeve assembly 10, gasket 9, speedometer drive adapter 8, and gasket 7 from rear cover 4. Remove lip-type oil seal 11 and washer 12 from drive sleeve 13 only if replacement is necessary.

b. High-Range Clutch Piston Housing (TT 2221-1, 2421-1 without converter-driven PTO)

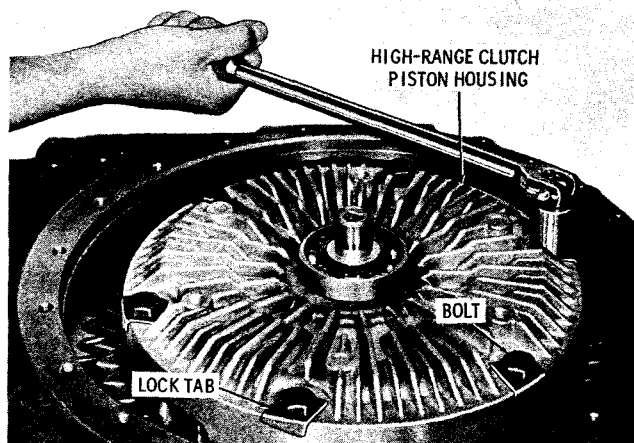
(1) Straighten the locktabs, and remove the six bolts that attach the high-range clutch piston housing to the transfer drive gear (fig. 5-20). Remove the bolts and locktabs.

(2) Using two screwdrivers, pry the high-range clutch piston housing and attached parts from the transfer drive gear (fig. 5-21). Refer to paragraph 6-11 for the high-range clutch piston housing rebuild instructions.

(3) Proceed to paragraph 5-10.

c. Rear Cover Assembly (TT 2221-1, 2421-1 with converter-driven PTO)

(1) Using a 1-1/4-inch socket wrench, loosen but do not remove self-locking nut 29



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Fig. 5-20. Removing high-range clutch piston housing bolts (TT 2221, 2421-1 without converter-driven PTO)

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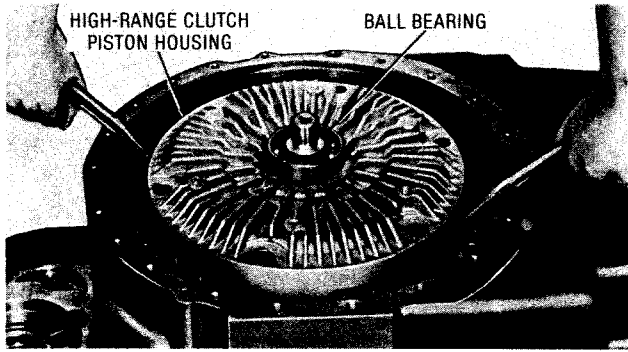


Fig. 5-21. Removing high-range clutch piston housing (TT 2221-1, 2421-1 without converter-driven PTO)

(foldout 16,D). Remove nineteen bolts 30 and lockwashers 31. Attach a hoist to PTO output flange 27. Remove rear PTO cover assembly 22, PTO shaft 17, and attached parts as a unit. Remove gasket 1 and sealring 2.

(2) Remove self-locking nut 29, flange retaining washer 28, and PTO output flange 27. Refer to paragraph 6-20 for rear PTO cover assembly rebuild instructions.

d. High-Range Clutch Piston Housing (TT 2221-1, 2421-1 with converter-driven PTO)

(1) Remove two step-joint sealrings 38 (foldout 11,B) from high-range piston housing 37. Straighten six locktabs 31, and remove six bolts 30 and the locktabs.

(2) Pry high-range clutch piston housing 37 (and attached parts) from transfer drive gear assembly 2. Refer to paragraph 6-11 for clutch piston housing rebuild instructions.

(3) Proceed to paragraph 5-10.

5-9. REMOVAL OF REAR COVER, INTERNAL BRAKE, AND HIGH-RANGE CLUTCH PISTON HOUSING (TTB 2221-1, 2421-1 models)

NOTE

Models with converter-driven PTO, proceed to paragraph 5-9a.

Models without converter-driven PTO, proceed to paragraph 5-9b.

a. Rear Cover Assembly (TTB 2221-1, 2421-1, with converter-driven PTO)

(1) Using a 1-1/4-inch socket wrench, loosen but do not remove the PTO flange retaining nut (fig. 5-22). Remove the eighteen bolts and lockwashers that retain the rear cover assembly. Spring force will push the rear cover upward.

(2) Attach a sling to the PTO flange (fig. 5-23). Remove the rear cover assembly, PTO shaft, and attached parts as a unit. Refer to paragraph 6-21 for rear cover assembly rebuild instructions.

(3) Proceed to paragraph 5-9c.

b. Rear Cover Assembly (TTB 2221-1, 2421-1, without converter-driven PTO)

(1) Remove the eighteen bolts and lockwashers that retain the rear cover assembly (refer to fig. 5-22). Spring force will push the rear cover upward.

(2) Attach a sling to the bolt flange of the rear cover, and remove the rear cover and attached parts. Refer to paragraph 6-21 for rear cover assembly rebuild instructions.

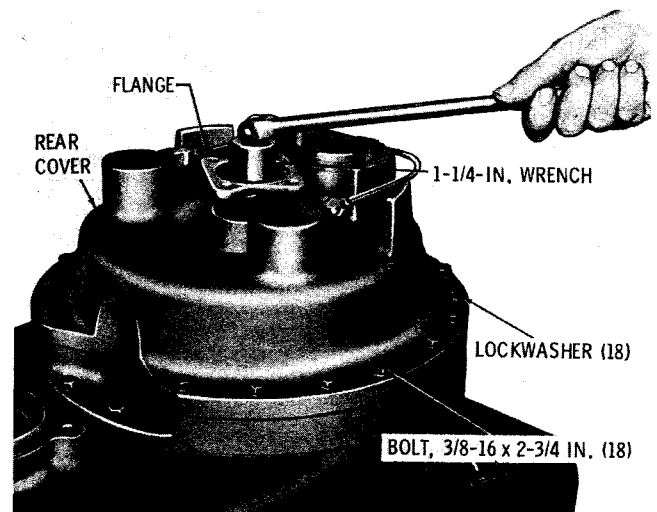


Fig. 5-22. Removing power takeoff flange nut (TTB 2221-1, 2421-1 with converter-driven PTO)

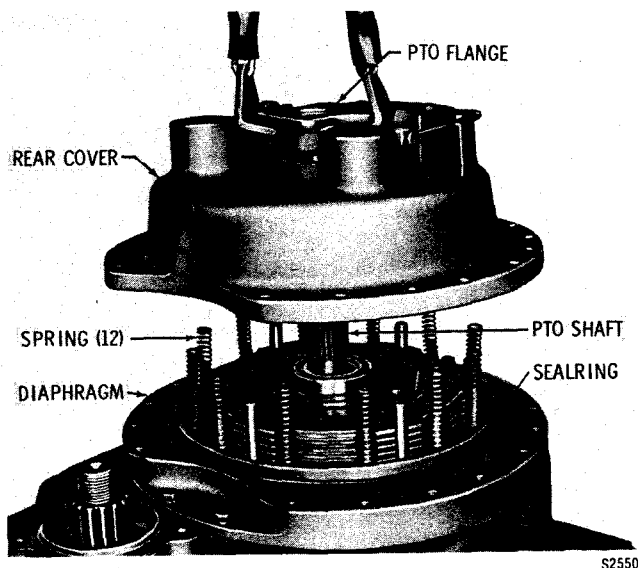


Fig. 5-23. Removing rear cover assembly (TTB 2221-1, 2421-1 with converter-driven PTO)

c. Internal Brake Components
(TTB 2221-1, 2421-1)

(1) Remove twelve brake return springs and twelve guide pins from the recesses in the diaphragm (fig. 5-24). Remove the eleven brake plates from the brake hub. Remove the ball bearing from the hub of the high-range clutch piston housing.

(2) Remove the step-joint sealring from the brake hub (fig. 5-24). Remove the snapring that retains the brake hub, and remove the brake hub. Remove the sealring from the diaphragm.

(3) Remove the three bolts and lockwashers that retain the diaphragm on the transmission housing (fig. 5-24). Remove the diaphragm assembly and gasket. Refer to paragraph 6-16 for diaphragm assembly rebuild instructions.

d. High-Range Clutch Piston Housing
(TTB 2221-1, 2421-1)

(1) Straighten the six locktabs and remove the six bolts and locktabs that attach the high-range clutch piston housing to the transfer drive gear (fig. 5-25). Remove the

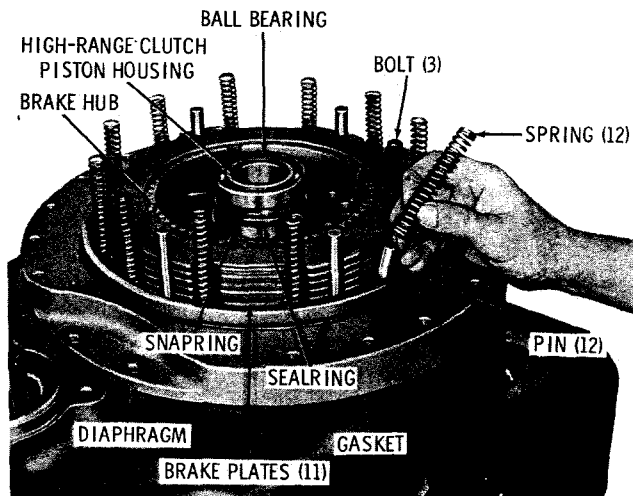


Fig. 5-24. Removing brake return springs and guide pins (TTB 2221-1, 2421-1)

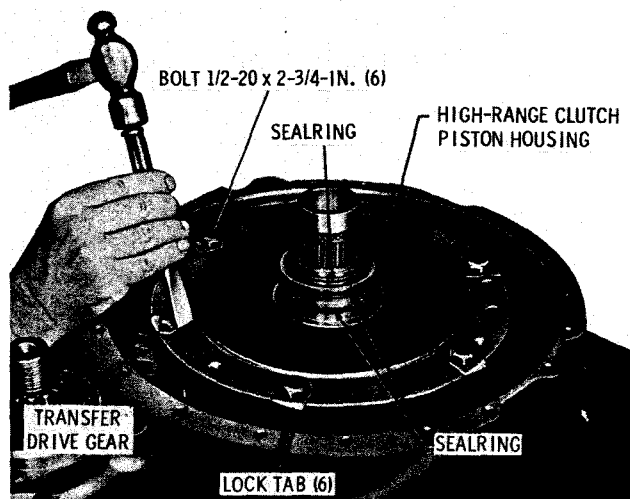


Fig. 5-25. Flattening piston housing bolt tabs (TTB 2221-1, 2421-1)

two step-joint sealrings and the O-ring seal from the hub of the high-range clutch piston housing.

(2) Pry the high-range clutch piston housing from the transfer drive gear, and remove it as an assembly. Refer to paragraph 6-11 for clutch piston housing rebuild instructions.

DISASSEMBLY OF TRANSMISSION

5-10. REMOVAL OF HIGH-RANGE AND FORWARD CLUTCH, GEARING (TT, TTB 2221-1, 2421-1)

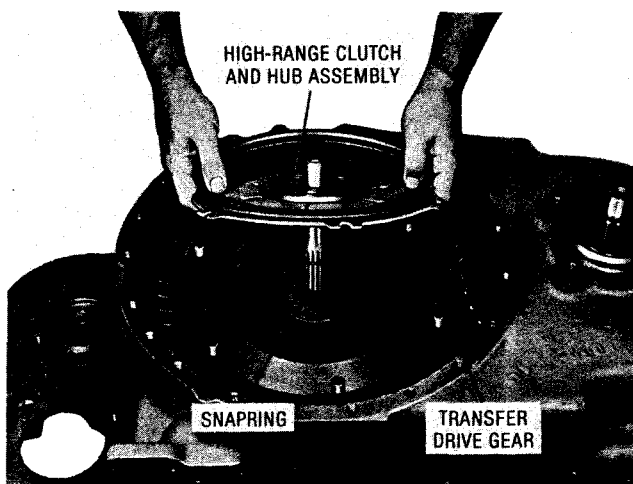
a. High-Range Clutch Assembly and Transfer Drive Gear

(1) For models without a converter-driven PTO, remove the high-range clutch and hub assembly from the transfer drive gear (fig. 5-26). For models with a converter-driven PTO, remove, as an assembly, the high-range clutch and hub 10 (foldout 11,B or 15,A) from the transfer drive gear. Refer to paragraph 6-13 for high-range clutch and hub assembly rebuild instructions.

(2) Remove the snapping from the forward planetary carrier, and remove the transfer drive gear assembly (fig. 5-26). Refer to paragraph 6-17 for the transfer drive gear rebuild instructions.

b. Forward Clutch and Planetary

(1) Replace two of the ten self-locking bolts that retain the forward clutch piston housing with two 3/8-16 x 2-1/2-inch bolts removed from the control valve assembly in 5-3e (fig. 5-27). Install the bolts at opposite sides of the piston housing to restrain the spring force.

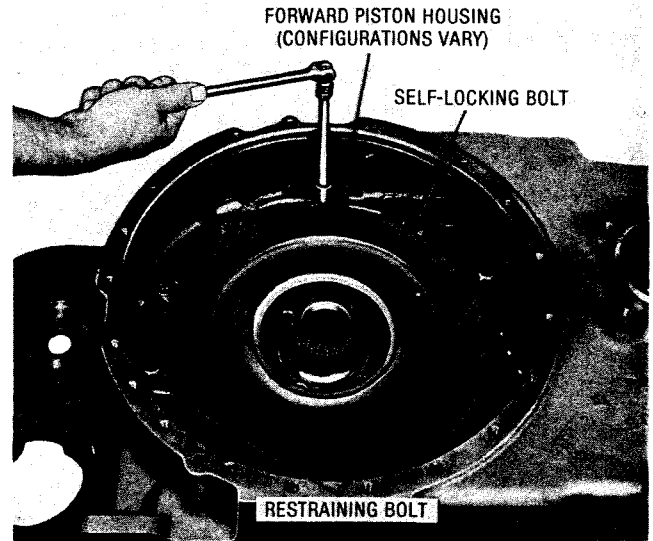


S2553

Fig. 5-26. Removing high-range clutch and hub assembly (TT, TTB 2221-1, 2421-1 without converter-driven PTO)

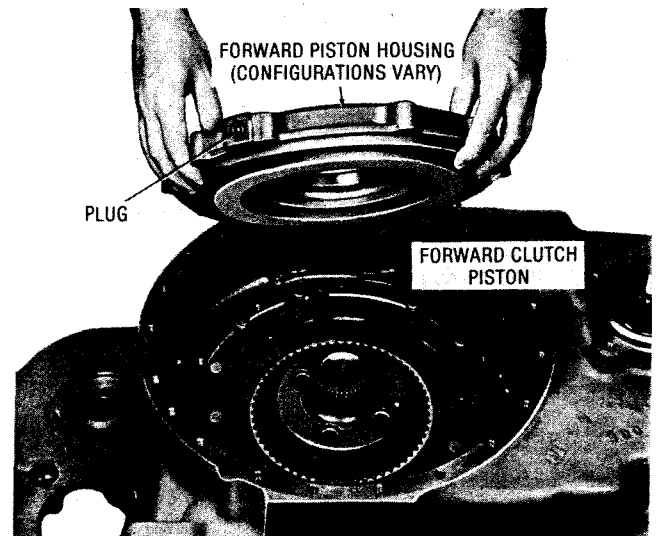
(2) Remove the remaining eight self-locking bolts and plain washers (if present) which retain the forward clutch piston housing (fig. 5-27). Then loosen the two restraining bolts evenly and remove them.

(3) Remove the forward clutch piston housing and piston as an assembly (fig. 5-28). Remove the forward clutch piston



S2554

Fig. 5-27. Removing forward clutch piston housing bolts (TT, TTB 2221-1, 2421-1)



S2555

Fig. 5-28. Removing forward clutch piston housing and piston (TT, TTB 2221-1, 2421-1)

from the piston housing. Refer to paragraph 6-12 for clutch piston assembly rebuild instructions.

(4) Do not remove the socket-head plug from the forward clutch piston housing unless necessary for replacement, or cleaning of the oil passage (fig. 5-28).

(5) Remove the forward planetary carrier assembly, ring gear, four clutch plates, and the attached reverse ring gear as a unit (fig. 5-29). Remove thrust washer 2 (foldout 10,A) from the carrier, if present.

(6) Separate the clutch plates and forward ring gear from the planetary carrier assembly. Remove the twelve piston return springs and guide pins, and remove the remaining four forward clutch plates from the clutch anchor assembly (fig. 5-29).

(7) Remove the snapping that retains the reverse ring gear on the forward planetary carrier assembly (fig. 5-30). Refer to paragraph 6-25 for the planetary carrier assembly rebuild instructions.

5-11. REMOVAL OF REAR HOUSING, HIGH- AND LOW-RANGE CLUTCHES, PLANETARY, AND ADAPTER (TRT -1, TRT -3)

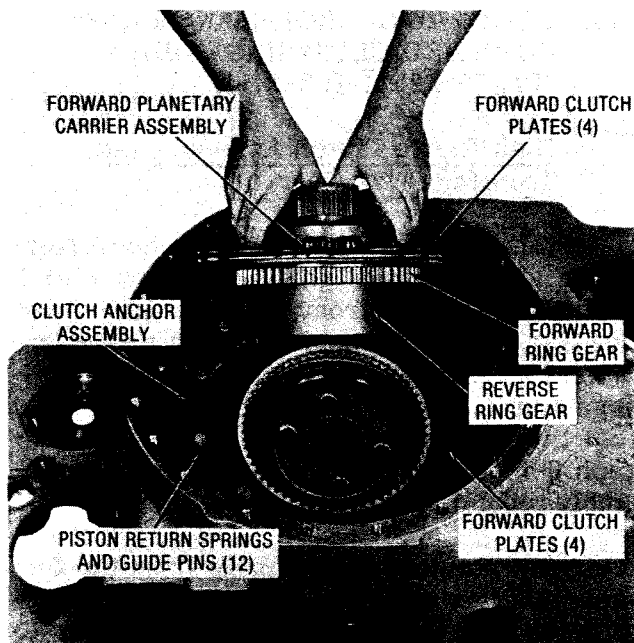
NOTE

Disassembly subparagraphs are as follows:

<u>Model</u>	<u>Para</u>
TRT 2221-1, 2421-1	5-11a
TRT 2221-3, 2421-3 with underdrive	5-11b
TRT 2221-3, 2421-3 with overdrive	5-11c
TRT 2211-3, 2411-3	5-11d

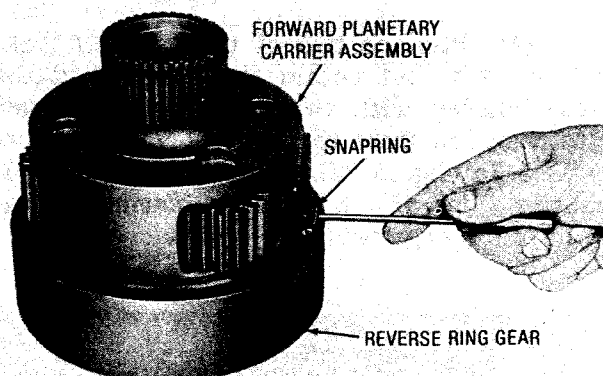
a. TRT 2221-1, 2421-1

(1) Position the transmission, front downward, and remove seventeen short bolts, three long bolts, and lockwashers (fig. 5-31).



S2556

Fig. 5-29. Removing forward planetary carrier assembly (TT, TTB 2221-1, 2421-1)



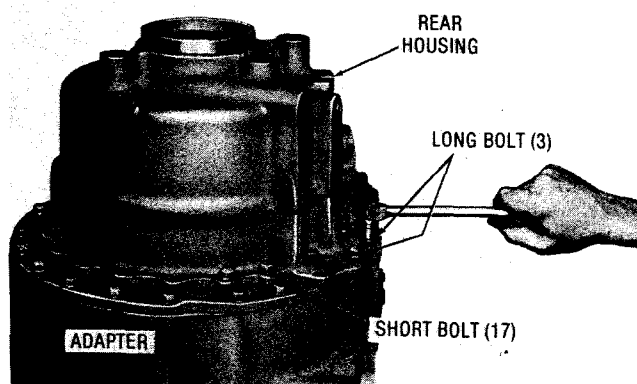
S2557

Fig. 5-30. Removing snapping from reverse ring gear (TT, TTB 2221-1, 2421-1)

(2) Remove the rear housing and internal parts in the rear housing, as a unit (fig. 5-32). Remove the gasket.

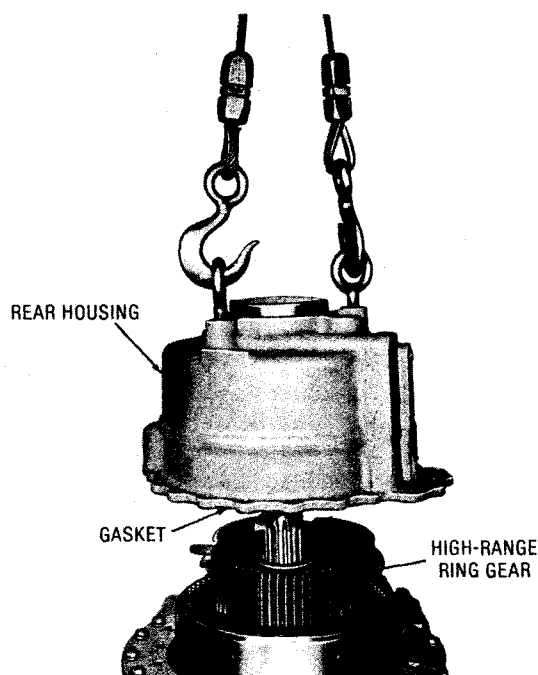
(3) Position rear housing 2 (foldout 16,A) on blocks. Remove snapping 11 which holds oil retainer 10 in the rear housing. Remove the oil retainer, sealing 9, and internal snapping 8 which retains rear bearing 6 in the housing.

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S1408

Fig. 5-31. Removing rear housing bolts (TRT 2221-1, 2421-1)



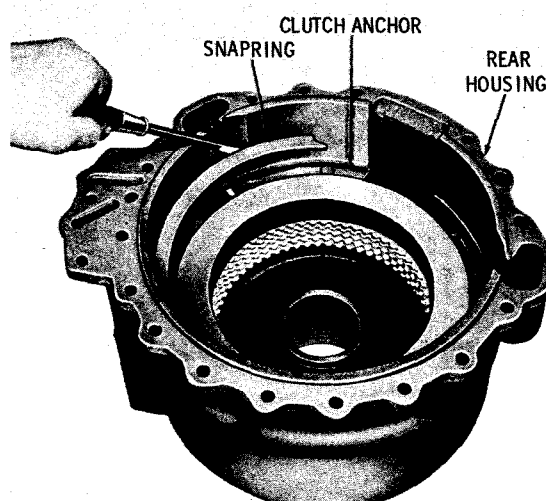
S1409

Fig. 5-32. Removing transmission rear housing assembly (TRT 2221-1, 2421-1)

(4) Using a soft hammer, tap shaft 5 (foldout 16,A) rearward to remove the shaft from the housing. Remove snapping 7 and rear bearing 6 from the shaft, if replacement is necessary.

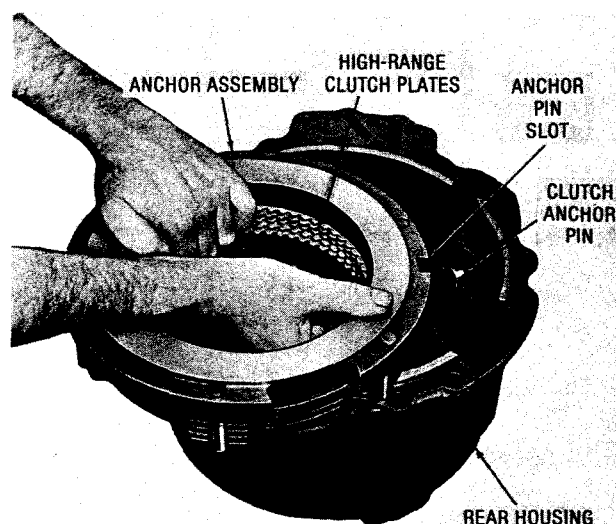
(5) Remove the internal snapping which retains the high-range clutch anchor assembly (fig. 5-33).

(6) Grasp the high-range clutch pack and anchor assembly together and remove



S1410

Fig. 5-33. Removing clutch anchor snapping (TRT 2221-1, 2421-1)



S1411

Fig. 5-34. Removing high-range clutch anchor and plates (TRT 2221-1, 2421-1)

the assembly from the rear housing (fig. 5-34). Separate the parts. Refer to paragraph 6-14 for rebuild of the clutch anchor assembly. Remove the clutch anchor pin (fig. 5-35). Refer to paragraph 6-11 for rebuild of the housing assembly.

(7) Lift the high-range planetary carrier assembly out of the ring gear (fig. 5-36). Refer to paragraph 6-25 for rebuild of the planetary carrier assembly. Remove the sun gear and thrust washer assembly. Remove

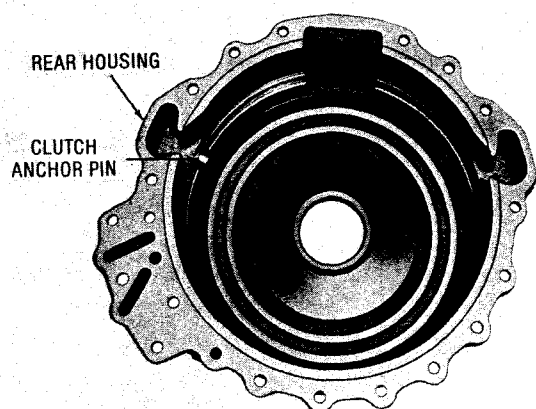


Fig. 5-35. Rear housing and piston assembly (TRT 2221-1, 2421-1)

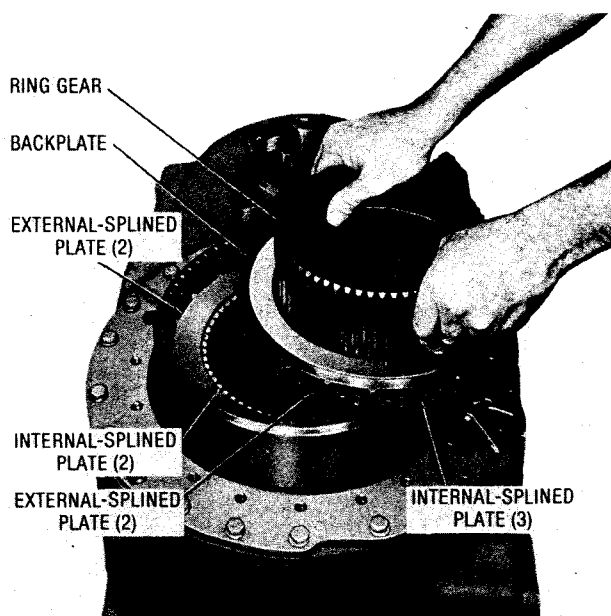


Fig. 5-37. Removing high-range ring gear and low-range clutch plates (TRT 2221-1, 2421-1)

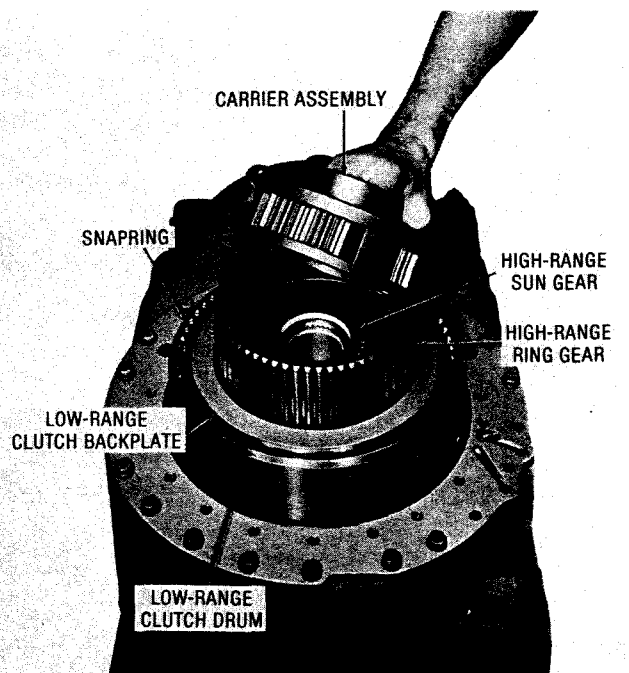


Fig. 5-36. Removing high-range planetary carrier assembly (TRT 2221-1, 2421-1)

the thrust washer only if it is worn or damaged.

(8) Remove the internal snapring which retains low-range clutch backplate (fig. 5-36).

(9) Lift out the ring gear, bringing with it the backplate, three internal-splined

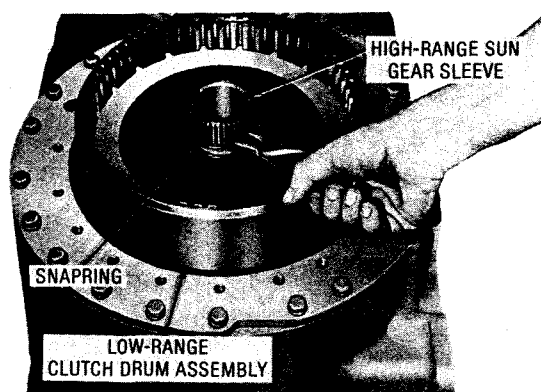


Fig. 5-38. Removing high-range sun gear sleeve snapring (TRT 2221-1, 2421-1)

plates, and two external-tanged plates (fig. 5-37). Remove the two remaining clutch plates.

(10) Remove the snapring from the splined sleeve (fig. 5-38).

(11) Lift the low-range piston housing assembly out of the adapter assembly (fig. 5-39). Remove the two step-joint Teflon seal-rings from the hub of the housing. Refer to

DISASSEMBLY OF TRANSMISSION

paragraph 6-11 for rebuild of the piston housing assembly.

(12) Remove sixteen bolts 10 (foldout 12,A) and lockwashers 11 which retain the rear housing adapter assembly 7.

(13) Remove the rear housing adapter assembly. Remove sealing 6 and gasket 5 from the adapter. Refer to paragraph 6-15 for rebuild of the rear housing adapter assembly.

(14) Remove the transfer drive gear and sun gear sleeve assembly (fig. 5-40). Remove the sleeve from the gear and the snapping from the sleeve. Refer to paragraph 6-19 for rebuild of the sleeve assembly, and to paragraph 6-18 for rebuild of the output transfer drive gear.

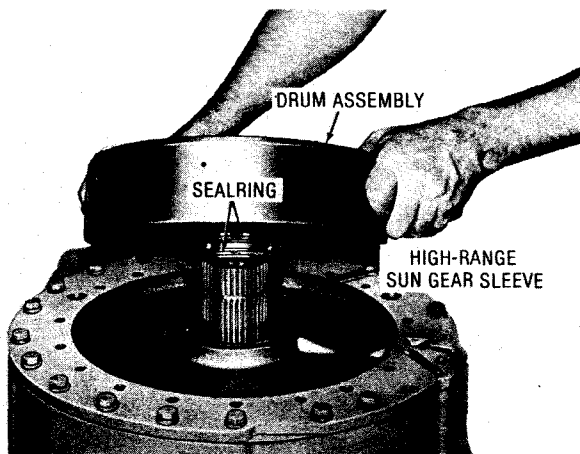


Fig. 5-39. Removing low-range clutch drum assembly (TRT 2221-1, 2421-1)



Fig. 5-40. Removing transfer drive gear and sun gear sleeve

(15) The forward carrier thrust washer may remain either with the transfer drive gear or with the forward planetary carrier. Remove the thrust washer.

(16) Proceed to paragraph 5-12.

b. TRT 2221-3, 2421-3, Models With Underdrive

(1) Position the transmission, front downward, and remove fifteen bolts and lockwashers which retain the rear housing to the adapter (fig. 5-41).

(2) Lift the output shaft, rear housing, and attached parts from the adapter (fig. 5-42). Remove the gasket.

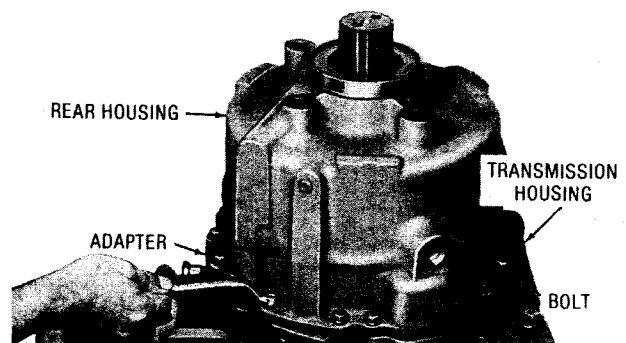


Fig. 5-41. Removing rear housing bolts (TRT 2221-3, 2421-3 with underdrive)

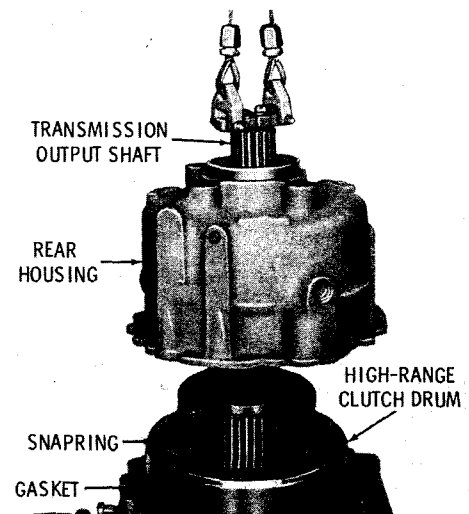
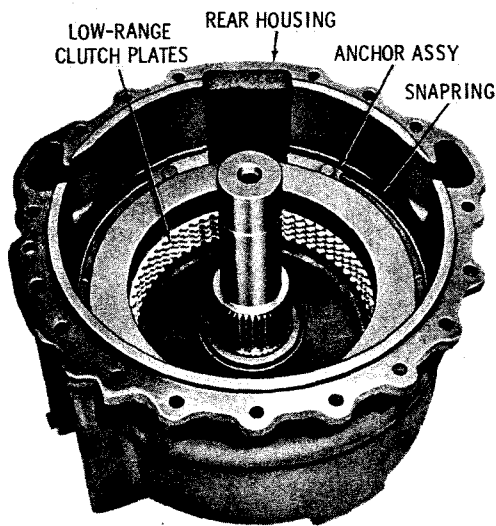


Fig. 5-42. Removing rear housing (TRT 2221-3, 2421-3 with underdrive)

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S1425

Fig. 5-43. Rear housing and low-range clutch (TRT 2221-3, 2421-3 with underdrive)

(3) Position the rear housing, rear downward, and remove the large snapring that retains the clutch anchor assembly (fig. 5-43).

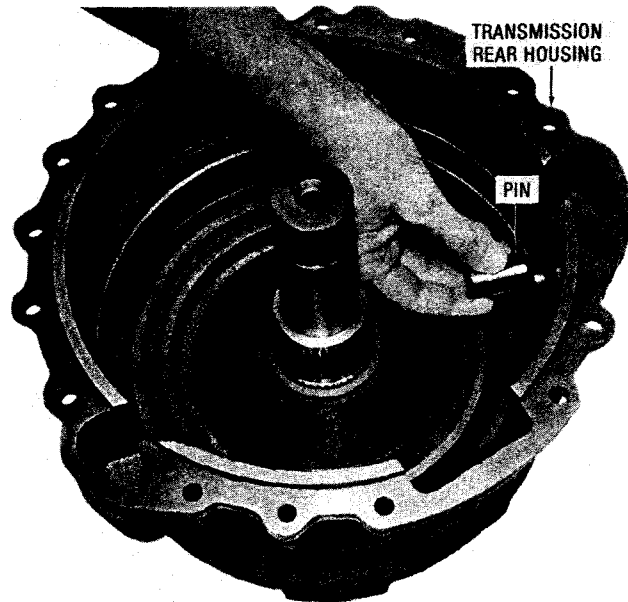
(4) Remove the clutch anchor assembly, five external-tanged clutch plates, and five internal-splined clutch plates as an assembly (fig. 5-43). Separate the plates from the anchor assembly. Refer to paragraph 6-14 for rebuild of the clutch anchor assembly.

(5) Remove the clutch anchor pin (fig. 5-44). Do not remove the weld plug from the anchor pin hole in the housing.

(6) Refer to paragraph 6-11 for rebuild of the housing assembly.

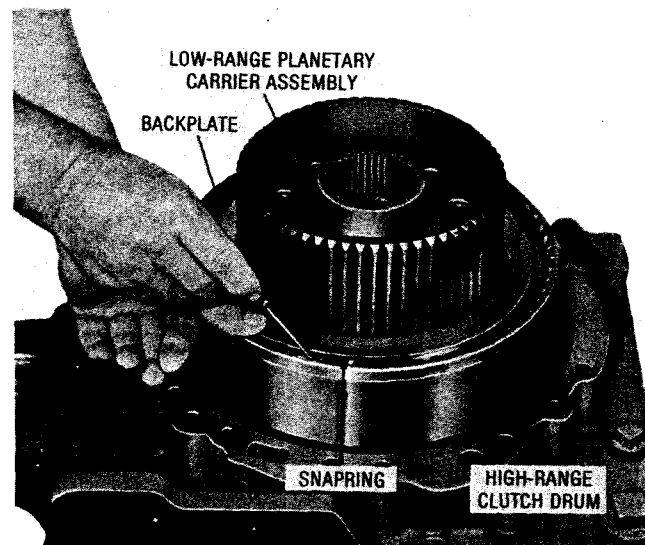
(7) Remove the internal snapring which retains the high-range clutch backplate (fig. 5-45).

(8) Remove the low-range ring gear, backplate, two internal-splined clutch plates, and one external-tanged clutch plate as a unit (fig. 5-46). Remove the low-range planetary carrier assembly. Refer to paragraph 6-25 for rebuild of the planetary carrier assembly. Remove the two remaining clutch plates.



S1426

Fig. 5-44. Removing clutch anchor pin (TRT 2221-3, 2421-3 with underdrive)



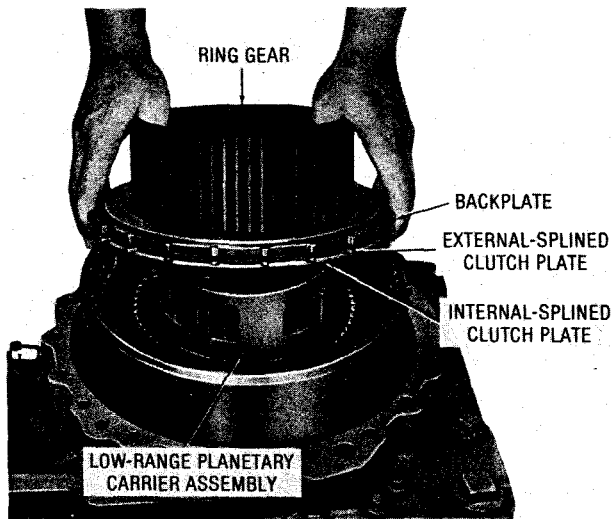
S1427

Fig. 5-45. Removing high-range clutch backplate snapring (TRT 2221-3, 2421-3 with underdrive)

(9) Remove the low-range planetary sun gear (fig. 5-47). Remove the snapring from the hub of the forward planetary carrier.

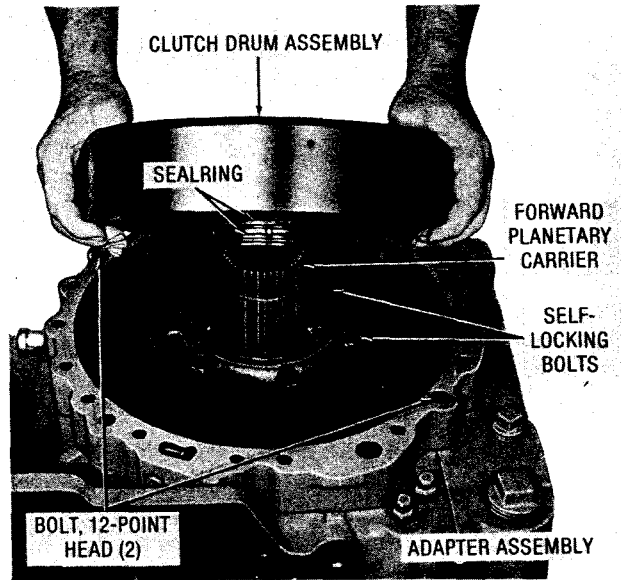
(10) Remove the high-range piston housing assembly (fig. 5-48). Remove the

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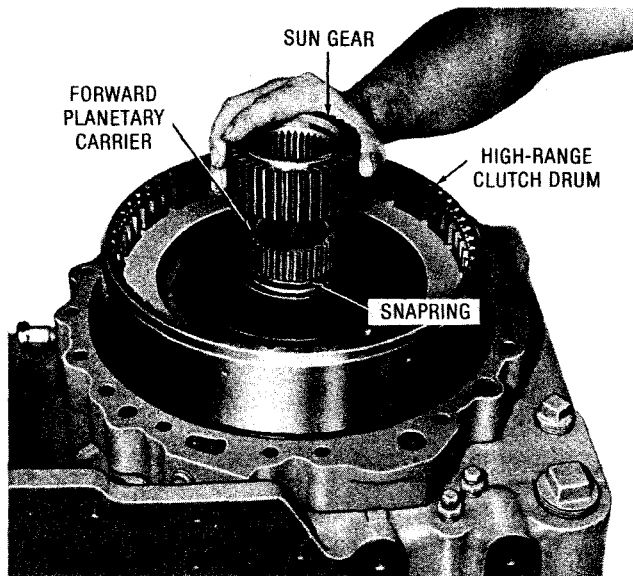
S1428

Fig. 5-46. Removing low-range planetary ring gear (TRT 2221-3, 2421-3 with underdrive)



S1430

Fig. 5-48. Removing high-range clutch drum assembly (TRT 2221-3, 2421-3 with underdrive)

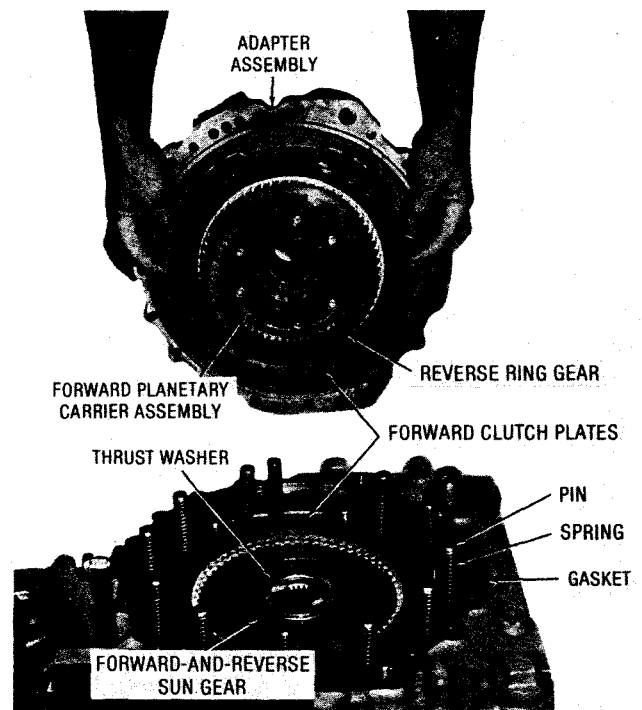


S1429

Fig. 5-47. Removing low-range planetary sun gear (TRT 2221-3, 2421-3 with underdrive)

two step-joint Teflon sealrings from the hub of the drum. Refer to paragraph 6-11 for rebuild of the housing assembly.

(11) The adapter assembly (fig. 5-48) compresses the piston return springs. Loosen the two recessed bolts (12-point heads) evenly while holding the adapter against spring force.



S1431

Fig. 5-49. Removing adapter assembly and attached parts (TRT 2221-3, 2421-3 with underdrive)

(12) Remove the adapter assembly, forward planetary carrier assembly, and other attached parts as a unit (fig. 5-49).

(13) Remove six self-locking bolts 28 (foldout 10,B). Remove adapter assembly 24. Refer to paragraph 6-15 for rebuild of the rear housing adapter assembly.

(14) Remove forward clutch piston 17 with sealrings 18, 19, and 20. Refer to paragraph 6-12 for rebuild of the clutch piston assembly.

(15) Remove bearing 22 by using a puller bolted to retainer 21.

(16) Remove ring gear 14 and two clutch plates 15 and 16. Remove snapping 11 and separate ring gear 1 from carrier assembly 3. Refer to paragraph 6-25 for rebuild of the planetary carrier assembly.

(17) Remove the piston return springs and pins, four clutch plates, the forward-and-reverse sun gear and thrust washer, and the adapter gasket (fig. 5-49).

(18) Proceed to paragraph 5-12.

c. TRT 2221-3, 2421-3, Models With Overdrive

(1) Remove fifteen bolts and lockwashers which retain the rear housing (fig. 5-50).

(2) Attach a lifting sling to the output shaft and remove the rear housing, high-range clutch, and output shaft as a unit (fig. 5-51).

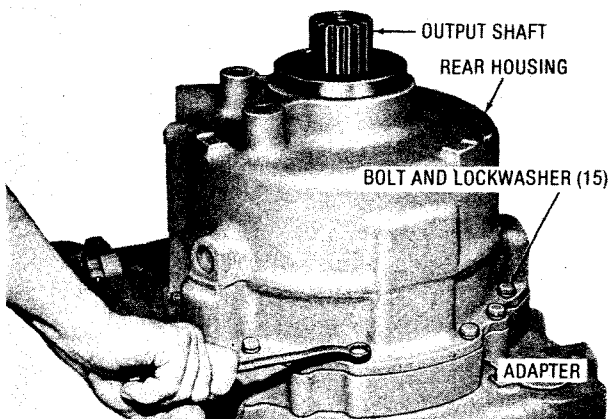


Fig. 5-50. Removing rear housing bolts (TRT 2221-3, 2421-3 with overdrive)

(3) Remove the rear housing gasket. Remove the lifting sling.

(4) Position the rear housing, rear downward, and remove internal snapping 2 (foldout 14,B) which retains the high-range clutch anchor assembly. Remove anchor assembly 3. Refer to paragraph 6-14 for rebuild of the clutch anchor assembly.

(5) Remove the high-range planetary ring gear and the three clutch plates which come with it (fig. 5-52). Remove the three clutch plates remaining in the housing.

(6) Remove clutch anchor pin 12 (foldout 16,B). Do not remove the welch plug in the anchor pin hole at the outside of the housing.

(7) Refer to paragraph 6-11 for rebuild of the housing.

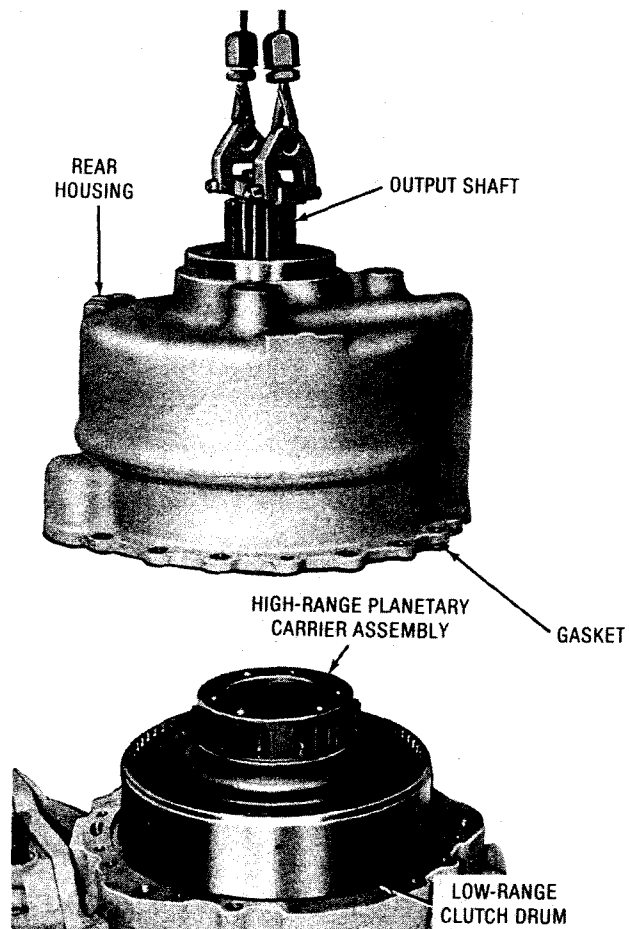
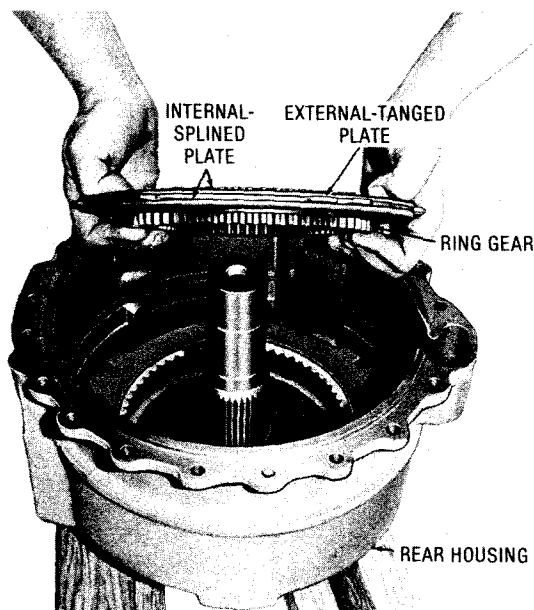


Fig. 5-51. Removing rear housing and attached parts (TRT 2221-3, 2421-3 with overdrive)

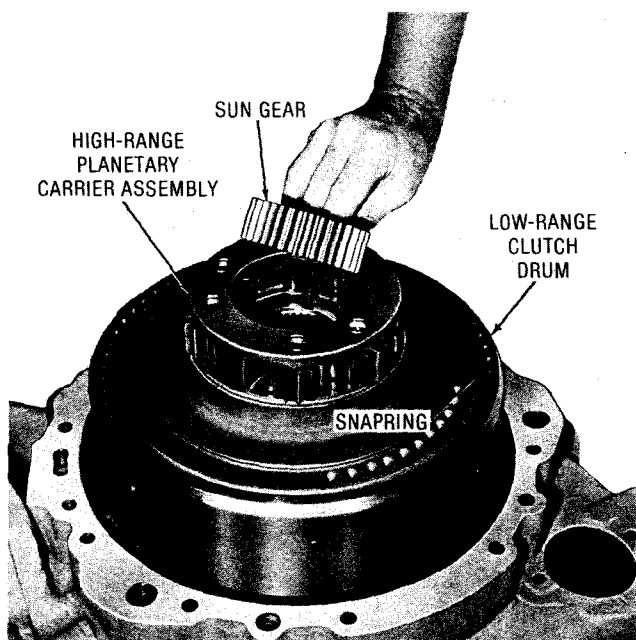
DISASSEMBLY OF TRANSMISSION

(8) Remove the high-range planetary sun gear (fig. 5-53). Remove the internal snapping which retains the high-range planetary carrier assembly.



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Fig. 5-52. Removing high-range planetary ring gear and three clutch plates (TRT 2221-3, 2421-3 with overdrive)



S1435

Fig. 5-53. Removing high-range planetary sun gear (TRT 2221-3, 2421-3 with overdrive)

(9) Remove the high-range planetary carrier assembly (fig. 5-53). Refer to paragraph 6-25 for rebuild of the planetary carrier assembly.

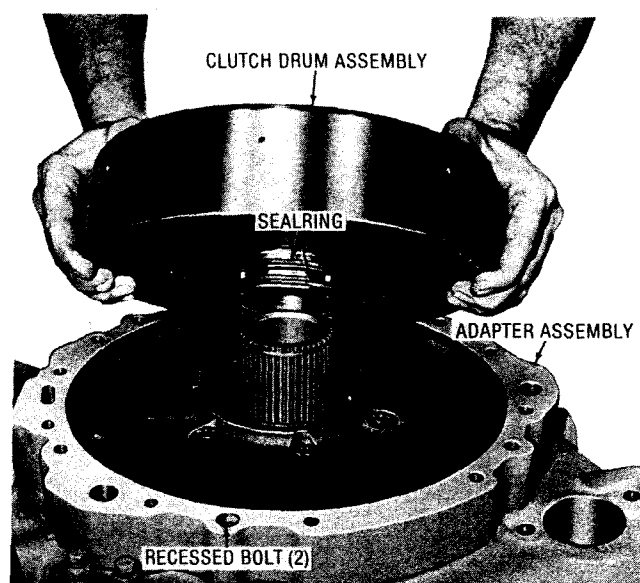
(10) Remove low-range clutch hub 15 (foldout 14,A). Remove the roller bearing assembly consisting of two races and a bearing assembly (items 12, 13, and 14).

(11) Remove five internal-splined clutch plates 16 and four external-splined clutch plates 17. Remove the snapping which retains the low-range piston housing.

(12) Remove the low-range piston housing and its attached parts (fig. 5-54). Remove two step-joint Teflon sealrings from the hub of the clutch drum. Refer to paragraph 6-11 for rebuild of the piston housing assembly.

(13) The adapter assembly (fig. 5-54) compresses the piston return springs. Loosen the two recessed bolts (12-point heads) evenly while holding the adapter against spring force.

(14) Remove the adapter assembly and its attached parts (fig. 5-55). Remove the adapter gasket and sun gear thrust



S1436

Fig. 5-54. Removing low-range clutch drum (TRT 2221-3, 2421-3 with overdrive)

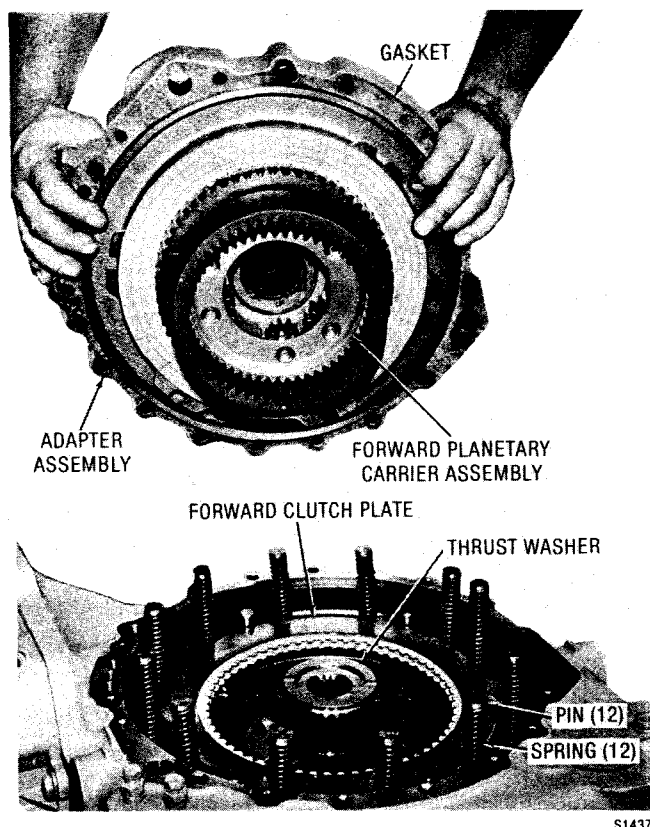


Fig. 5-55. Removing adapter assembly and attached parts (TRT 2221-3, 2421-3 with overdrive)

washer (if it remained in the forward planetary carrier).

(15) Remove the forward-and-reverse planetary sun gear and thrust washer (fig. 5-55). Remove twelve piston return springs and pins.

(16) Remove four forward clutch plates remaining in the transmission (fig. 5-55).

(17) Remove six self-locking bolts 28 (foldout 10,B). Remove adapter assembly 24. Refer to paragraph 6-15 for rebuild of the rear housing adapter assembly.

(18) Remove forward clutch piston 17 (foldout 10,B) with sealrings 18, 19, and 20. Refer to paragraph 6-12 for rebuild of the clutch piston.

(19) Remove bearing 22 (foldout 10,B) by using a puller bolted to retainer 21.

(20) Remove ring gear 14 and two clutch plates 15 and 16. Remove snapping 11 and separate ring gear 1 from carrier assembly 31. Refer to paragraph 6-25 for rebuild of the planetary carrier assembly.

(21) Proceed to paragraph 5-12.

d. TRT 2211-3, 2411-3

(1) Position the transmission, front downward, and remove eighteen bolts 4 (foldout 16,C) and lockwashers 3 that retain rear housing 9 to the transmission housing.

(2) Remove rear housing assembly 5, tapping the output shaft with a soft hammer, if necessary, to keep it from coming out with the housing.

(3) Remove gasket 1 (foldout 16,C).

(4) Remove the forward clutch piston with sealrings, items 18 through 21 (foldout 11,A), from the housing. Remove spacers 12 and 24 from the housing. Refer to paragraph 6-24 for rebuild of the rear housing assembly.

(5) Remove twelve piston return springs 22 (foldout 9,B) and pins 23.

(6) Remove forward planetary ring gear 15 (foldout 11,A) and clutch plates 16 and 17, as a unit. Separate the plates from the ring gear. Remove the remaining two internal-splined clutch plates 13 and two external-tanged clutch plates 14.

(7) Remove forward planetary carrier assembly 3 and reverse planetary ring gear 1 as a unit. Remove snapping 10 and separate the ring gear from the carrier. Refer to paragraph 6-25 for rebuild of the planetary carrier assembly.

(8) Remove thrust washer 2 (foldout 11,A) from the bore of forward planetary carrier assembly 3 or from sun gear 16 (foldout 9,B).

(9) Remove forward-and-reverse sun gear 16.

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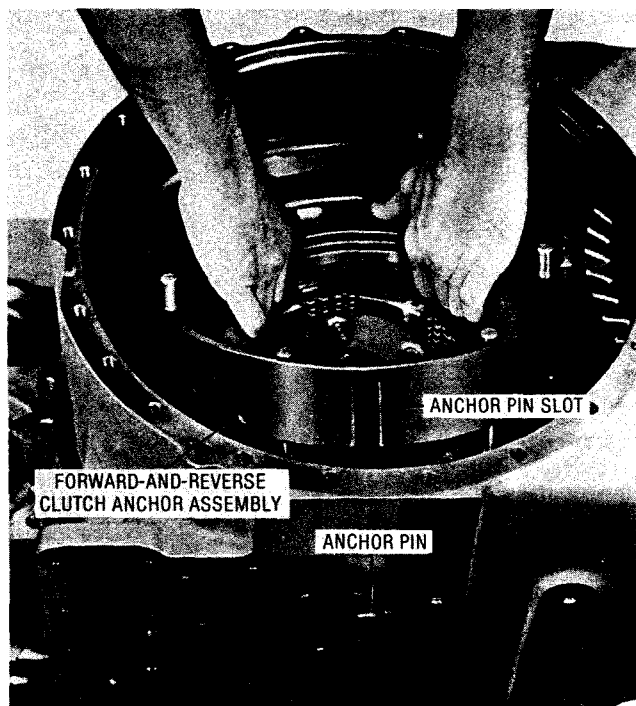


Fig. 5-56. Removing forward-and-reverse clutch anchor assembly

5-12. REMOVAL OF REVERSE CLUTCH AND PLANETARY (All Models)

a. Remove the forward-and-reverse clutch anchor assembly (fig. 5-56). Do not remove six clutch anchor pins 21 (foldout 9,B) from anchor 20. Remove the anchor pin from the valve body mounting pad (fig. 5-56).

b. Remove the reverse planetary carrier assembly and one internal-splined clutch plate as a unit (fig. 5-57). Separate the clutch plate from the carrier assembly. Refer to paragraph 6-25 for the reverse planetary carrier assembly rebuild instructions. Remove the remaining nine reverse clutch plates from the transmission housing.

c. Remove the reverse clutch piston from its bore in the transmission housing (fig. 5-58). Refer to paragraph 6-12 for clutch piston rebuild instructions.

5-13. REMOVAL OF OIL PUMP

a. Remove the bolts and lockwashers that attach the oil pump to the transmission housing (fig. 5-59).

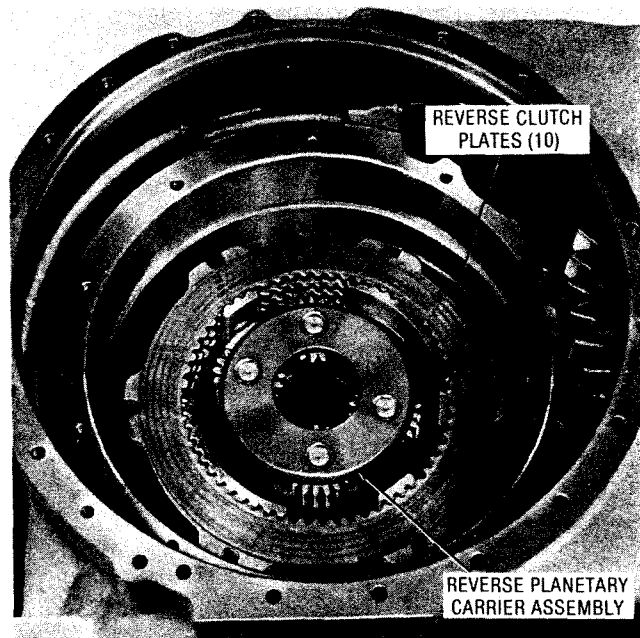


Fig. 5-57. Reverse planetary carrier assembly and clutch plates

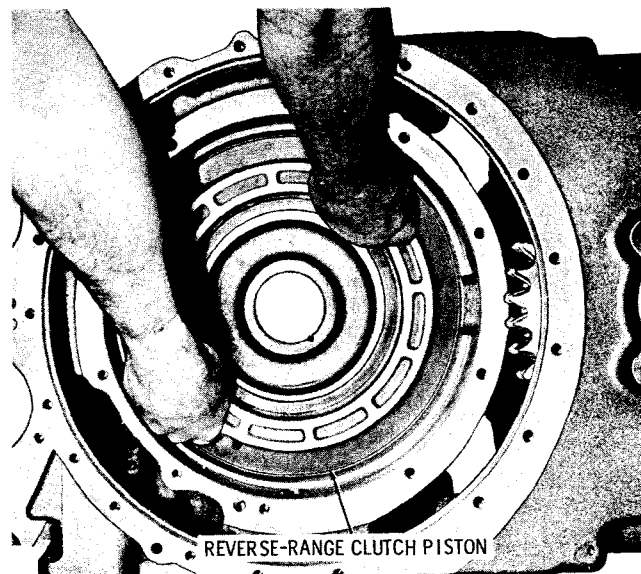


Fig. 5-58. Removing reverse clutch piston

b. Remove the oil pump and gasket, pump cover, and cover gasket as an assembly. Do not separate the oil pump components unless inspection or parts replacement is necessary. Refer to paragraph 6-26 for oil pump rebuild instructions.

NOTE

This concludes the disassembly of -3 models into subassem-

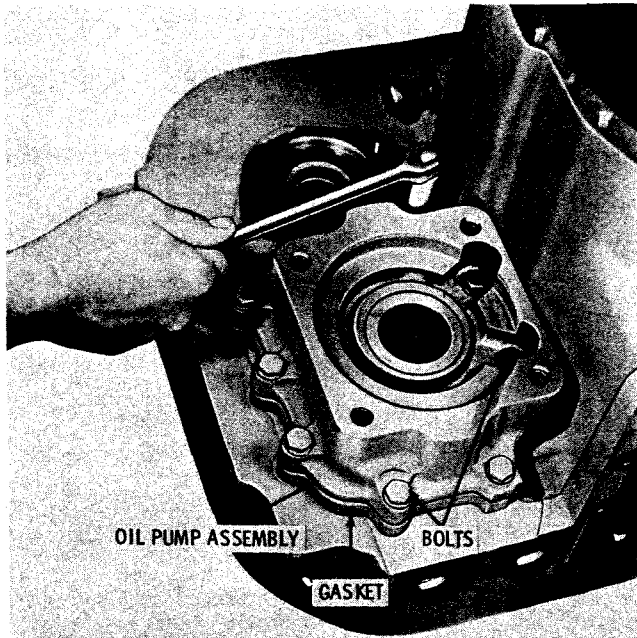


Fig. 5-59. Removing oil pump assembly

blies. For rebuild of the -3 transmission housing, refer to paragraph 6-28. For -1 models, proceed with paragraph 5-14.

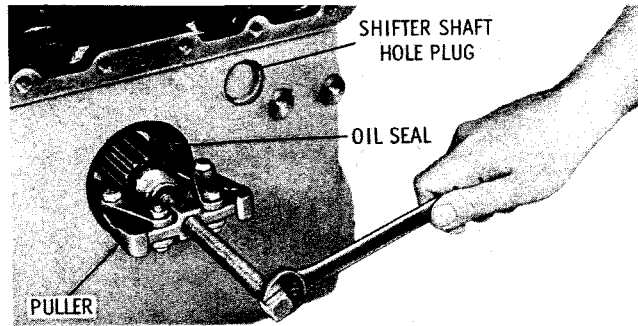
5-14. REMOVAL OF OUTPUT COMPONENTS AND TRANSFER DRIVEN GEAR (TT, TTB, TRT 2221-1, 2421-1)

NOTE

Models with front and rear outputs without output disconnect, proceed to paragraph 5-14a. Models with front and rear outputs with output disconnect, proceed to paragraph 5-14b. Models with rear output only, proceed to paragraph 5-14c.

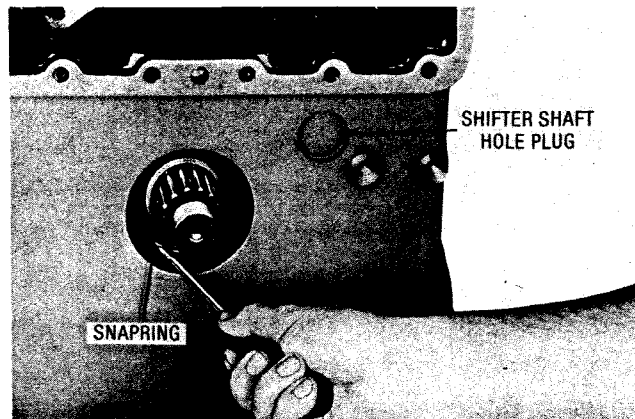
a. One-piece Output Shaft (outputs at front and rear)

(1) Using a puller, remove the oil seal from the front of the transmission housing (fig. 5-60).



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Fig. 5-60. Removing output shaft front oil seal (-1 models with one-piece output shaft)



S1453

Fig. 5-61. Removing output shaft front bearing snapping (-1 models with one-piece output shaft)

(2) Remove the snapping that retains the front output shaft bearing in the housing bore (fig. 5-61). Do not remove the shifter shaft hole plug unless replacement is necessary.

(3) Using a soft hammer, drive the output shaft forward until the front bearing is free from the housing bore (fig. 5-62).

(4) Remove the output shaft and front bearing as an assembly (fig. 5-63). Remove the front bearing from the output shaft.

(5) Removal of the output shaft will free transfer driven gear 23 and spacer 27 (foldout 17,A). Remove the transfer driven gear (fig. 5-64) and remove the spacer from

DISASSEMBLY OF TRANSMISSION

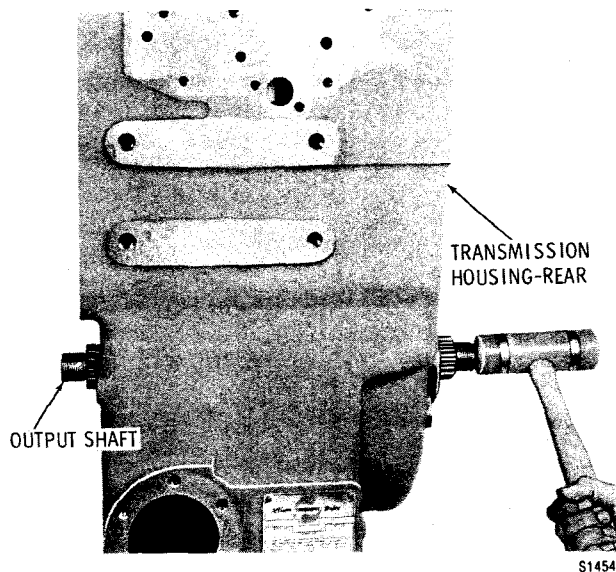


Fig. 5-62. Loosening output shaft front bearing (-1 models with one-piece output shaft)

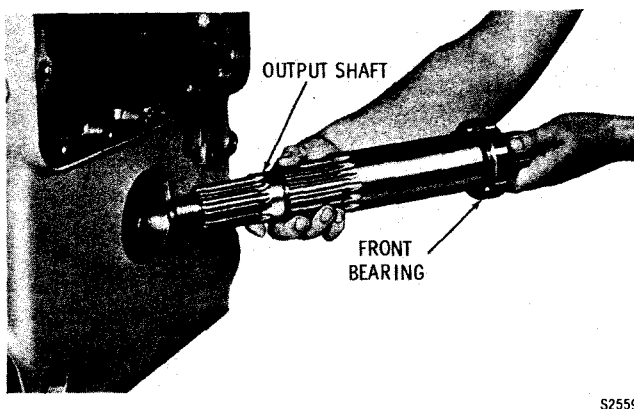


Fig. 5-63. Removing output shaft (-1 models with one-piece output shaft)

the sump area. Remove lip-type oil seal 30 (foldout 17,A) from the rear of the housing. Remove the output shaft rear bearing from its bore (fig. 5-64).

(6) Remove remaining parts from the transmission housing only if part replacement or additional servicing is required. Refer to paragraph 6-27 for the transmission housing rebuild instructions.

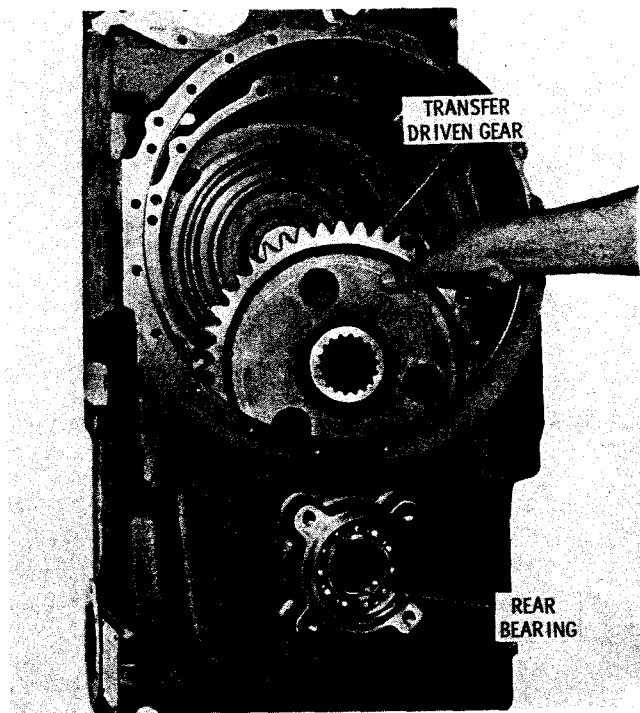


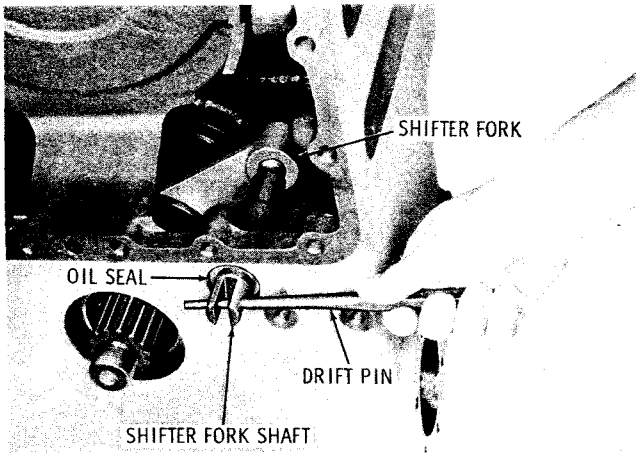
Fig. 5-64. Removing transfer driven gear (-1 models with one-piece output shaft)

b. Two-piece Output Shaft (with output disconnect)

CAUTION

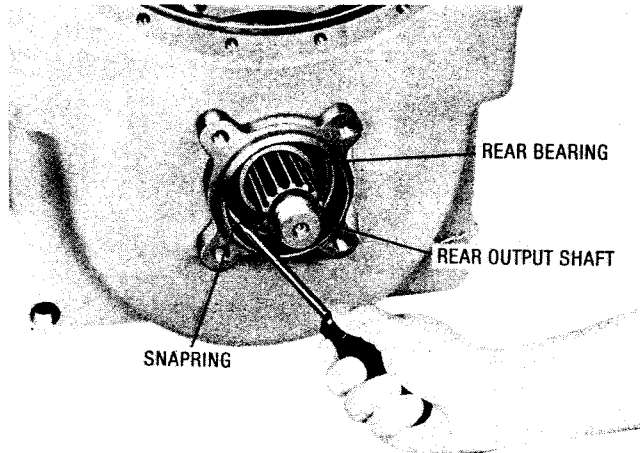
If only the output shaft seal needs to be replaced, do not remove the output disconnect shifter shaft. Removal of the output disconnect shifter shaft allows the shifter fork to drop into the sump area, and partial disassembly of the transmission is required to reinstall the output disconnect shifter components. Remove and discard the failed output shaft seal. Install a new seal. Press it lightly against the shoulder in the bore.

(1) Rotate shifter fork shaft counter-clockwise to remove it from the front of the transmission housing (fig. 5-65). Removal of the shifter fork shaft will allow the shifter fork to fall into the sump area. Remove the shifter fork. Remove the shifter shaft oil seal.



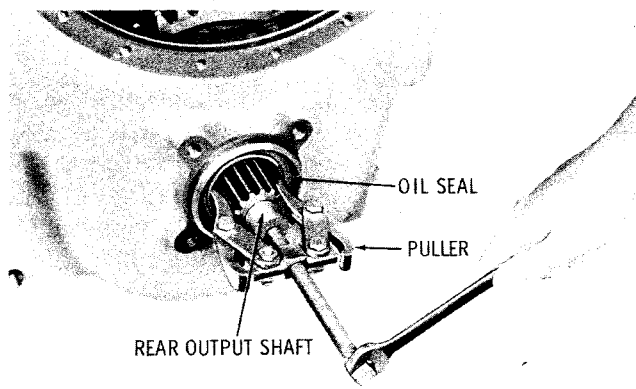
S1456

Fig. 5-65. Removing disconnect shifter shaft (-1 models with output disconnect)



S2562

Fig. 5-67. Removing rear output shaft bearing snapping (-1 models with output disconnect or with no front output)



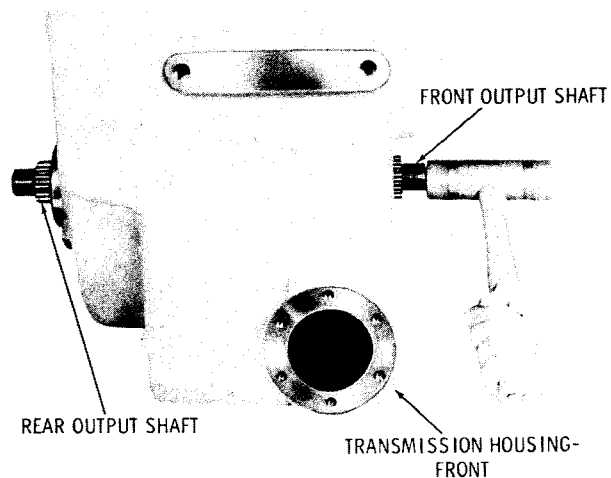
S2561

Fig. 5-66. Removing rear output shaft oil seal (-1 models with output disconnect or with no front output)

(2) Using a puller, remove the oil seal from the rear of the transmission housing (fig. 5-66).

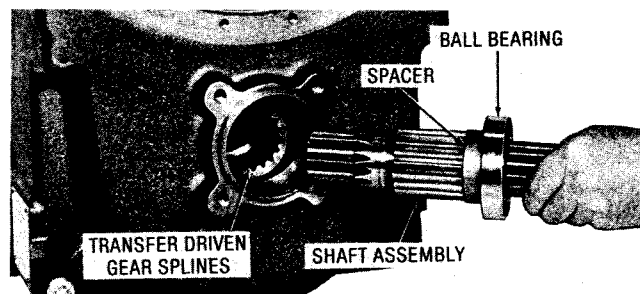
(3) Remove the snapping that retains the rear bearing in the housing bore (fig. 5-67).

(4) Using a soft hammer, drive the front output shaft rearward until the bearing on the rear output shaft is free from the housing bore (fig. 5-68). Remove the rear output shaft and the attached bearing and spacer as an assembly (fig. 5-69). Remove the bearing only if replacement of the bearing or spacer is necessary. Do not remove bushing 22 (foldout 17,A) from rear output shaft 23 unless replacement is necessary.



S1457

Fig. 5-68. Driving output shaft rearward (-1 models with output disconnect)

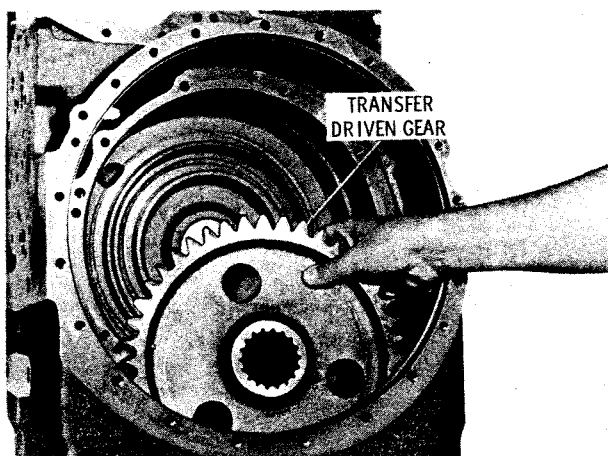


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Fig. 5-69. Removing rear output shaft assembly (-1 models with output disconnect)

(5) Removal of the rear output shaft from the transmission housing will free transfer driven gear 23 and allow spacer 22 to fall

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Fig. 5-70. Removing transfer driven gear (-1 models with output disconnect or with no front output)

into the sump area. Remove the transfer driven gear (fig. 5-70), and remove the fallen spacer from the sump.

(6) Remove the center bearing from its bore in the housing web (fig. 5-71).

(7) Remove the front output shaft and disconnect coupling as an assembly (fig. 5-72).

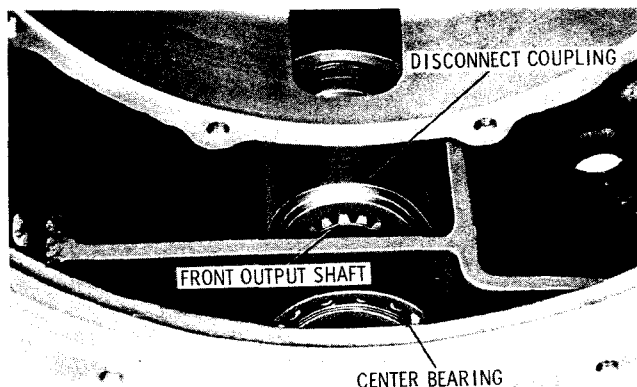
NOTE

A spring and two detent balls will be released when the disconnect coupling is removed from the front output shaft. Drape a shop towel over the assembly to prevent possible loss of the balls.

(8) Remove the disconnect coupling from the front output shaft, and place the two detent balls and spring in a parts receptacle.

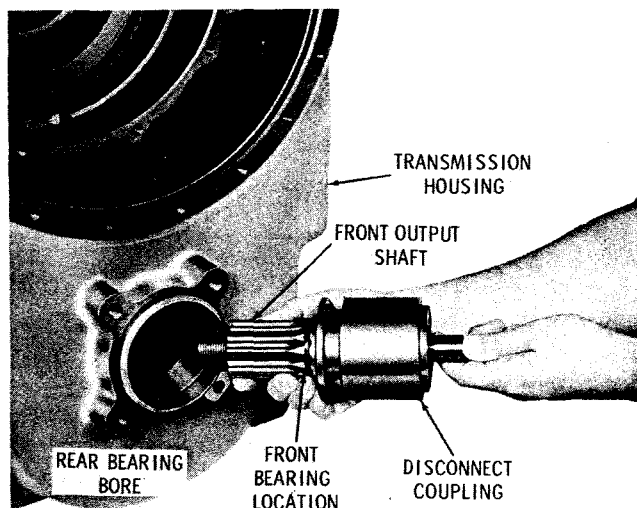
(9) Using a puller, remove the oil seal from the front of the transmission housing.

(10) Remove the snpring and output shaft bearing (refer to fig. 5-61) only if replacement is necessary. If necessary, remove the snpring and, using a puller which will ap-



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Fig. 5-71. Disconnect coupling, front output shaft, and center bearing (-1 models with output disconnect)



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Fig. 5-72. Removing front output shaft and disconnect coupling (-1 models with output disconnect)

ply its force to the rear surface of the outer race, draw the bearing from its bore. If such a puller is not available, use a drift and tap evenly around the outer race to drive the bearing forward.

(11) Remove remaining parts from the transmission housing only if part replacement or additional servicing is required. Refer to paragraph 6-27 for the transmission housing rebuild instructions.

c. Rear Output Shaft (no front output)

(1) Using a puller, remove the oil seal from the rear of the transmission housing (fig. 5-66).

(2) Remove the snapping that retains the rear bearing in the housing bore (fig. 5-67).

(3) Remove plug 8 (foldout 17,A) from the front output shaft orifice in the housing. If necessary, remove plug 16 from the front of the housing. Using a drift, drive rear output shaft 26 rearward until bearing 28 is free in its bore. Remove rear output shaft 26, spacer 27, and bearing 28 as an assembly. Remove the bearing only if re-

placement of the bearing or spacer is necessary.

(4) Removal of the rear output shaft from the transmission housing will free transfer driven gear 23 and allow spacer 22 to fall into the sump area. Remove the transfer driven gear (fig. 5-70), and remove the fallen spacer from the sump.

(5) Remove bearing 21 (foldout 17,A) from its bore in the housing web.

(6) Remove the remaining parts from the transmission housing only if part replacement or additional servicing is required. Refer to paragraph 6-27 for the transmission housing rebuild instructions.

Section 6. REBUILD OF SUBASSEMBLIES

6-1. SCOPE

This section contains the rebuild procedures for the subassemblies which were removed in Section 5. The rebuild procedures refer to photographs and to exploded-view foldouts in the back of this manual.

6-2. GENERAL INFORMATION FOR SUBASSEMBLY REBUILD

Refer to Sections 4 and 8 for general overhaul information as follows:

<u>Paragraph</u>	<u>Title</u>
4-3	Tools, Equipment
4-4	Replacement Parts
4-5	Careful Handling
4-6	Cleaning, Inspection
4-7	Assembly Procedures
4-11	Torque Specifications
8-1	Wear Limits Data
8-2	Spring Data

6-3. CONTROL VALVE BODY ASSEMBLY

a. Disassembly (foldout 18,B)

(1) Remove plug 6 and gasket 7 that retain main-pressure regulator valve 8 and remove the valve.

(2) Remove plug 18 and gasket 17 that retain trimmer plug 16. Remove trimmer plug 16, main-pressure regulator spring 14, spring retainer 13, and trimmer spring 15.

(3) Remove main-pressure check plug 36. Remove clutch signal pressure plug 54. Remove gasket 53 from plug 54. Remove selector valve plug 35 and gasket 34.

NOTE

For models with air-actuated clutch cutoff, proceed to step (4). For models with hydraulic-actuated clutch cutoff, proceed to step (5). For models with

inching control, proceed to steps (6) through (12).

(4) Models with air-actuated clutch cutoff. Remove retainer plug 50 and gasket 23. Remove cutoff valve plug 49 from retainer plug 50. Remove sealring 22 from cutoff plug 49. Remove clutch cutoff valve 20 and valve spring 19 from control valve body 9. Proceed to step (13).

(5) Models with hydraulic-actuated clutch cutoff. Remove retainer plug 25 and gasket 23. Remove cutoff valve plug 21 from retainer plug 25. Remove sealring 22 and cup 24 from cutoff valve plug 21. Remove clutch cutoff valve 20 and valve spring 19 from control valve body 9. Proceed to step (13).

(6) Models with inching control. Remove valve stop 37. Clean the paint and dirt away from the valve body in the area of oil seal 46.

(7) If present, remove snapping 47 or retainer ring 48.

(8) Clean the outer stem of valve 42 to permit seal 46 and plug 45 to be easily removed. Insert a bolt through the linkage pin hole in inching control valve 42, and pull the valve from its bore in valve body 9. If seal 46 prevents removal of inching valve 42, break the sealant bond between the seal OD and the valve bore by driving a wood drift against the seal case.

(9) Remove seal 46, plug 45, sealring 44, and spring 43.

(10) Remove spring 41 from control valve body 9.

(11) Insert a small screwdriver from the inner (mounting) side of the valve body assembly and push inching regulator valve 39 forward to release valve stop 40. Remove valve stop 40.

(12) Remove inching regulator valve 39 and spring 38.

TT, TTB, TRT 2001 SERIES TRANSMISSIONS

(13) All models. Remove plug 31 and gasket 32, and remove one spring 33 and ball 30.

NOTE

Before removing stop(s) 12, take note of the location of the stop(s). This will assist reassembly. Refer to figure 6-1.

(14) At the inner (mounting) side of control valve body 9, remove valve stop(s) 12 from range selector valve 29 or 52.

(15) If present, remove snapping 27.

(16) Insert a bolt through the linkage pin hole in selector valve 29 or 52. Being careful not to loose detent balls 30, pull the selector valve and seal 26 from the bore and remove them from control valve body 9. If seal 26 prevents removal of selector valve 29 or 52, break the sealant bond between seal OD and the valve bore by driving a wood drift against the seal case. Remove the seal from the selector valve. Remove the remaining detent ball 30 and spring 33, which were freed during removal of the selector valve.

(17) Do not remove retainer plug 11 and ball 10 from control valve body 9 unless parts replacement is necessary.

(18) Remove plugs 51 and 55 if necessary.

b. Assembly (foldout 18,B)

NOTE

Before beginning assembly, refer to step (9) for possible rework of valve body 9.

NOTE

At assembly, all spool valves, when dry, must move freely, by their own weight, within their bores.

(1) If the retainer plug and ball were removed from the control valve body, install a new ball and retainer (fig. 6-1). Place the retainer plug, open end upward, over the ball. Press the retainer plug to a depth of 0.000-0.010 inch (0.25 mm) below the surface of the three supporting bosses.

(2) Install one spring 33 (foldout 18,B) and detent ball 30 into control valve body 9. Depress the ball against the spring, and install selector valve 29 or 52, linkage end last, through the seal bore of the control valve body.

(3) Install the remaining detent ball 30 and spring 33; install gasket 32 and plug 31 to retain the ball and spring. Tighten the plug to 60-70 lb ft (82-94 N·m).

(4) Position the selector valve in the middle detent position (neutral). Refer to figure 6-1 and install the selector valve stop(s) as follows:

<u>Models</u>	<u>No. of Stops</u>	<u>Location</u>
TT, TTB	1	A
TRT 2211, 2411	2	B
TRT 2221, 2421	1	C

(5) For models without a groove in valve body 9 for snapping 27, apply Loctite Retaining Compound No. 75 (or equivalent) onto the outer circumference of the new selector valve oil seal. Install the seal, manu-

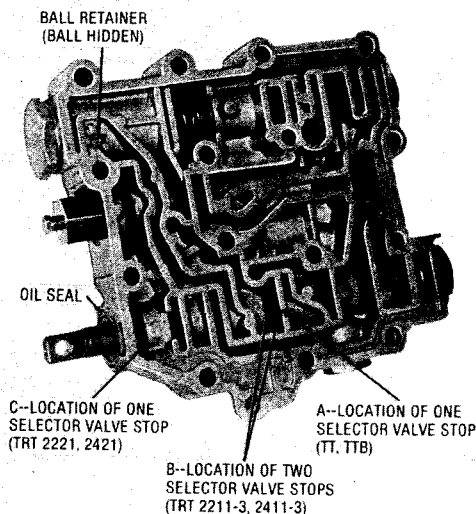


Fig. 6-1. Control valve body assembly--mounting side

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manufacturer's identification numbers outward, over the linkage end of the selector valve into its bore (fig. 6-1). Press the seal into the bore to a location ± 0.010 inch (0.25 mm) from the bottom of the chamfer.

(6) For models with a groove in valve body 9 for snapping 27, apply a light coat of Loctite Retaining Compound No. 75 (or equivalent) onto the outer circumference of new selector valve oil seal 26. Being careful not to load up the snapping groove with retaining compound, install seal 26, with the manufacturer's identification numbers outward, to a depth that clears the snapping groove. Clean out the snapping groove and install snapping 27.

(7) Install main-pressure regulator valve 8 (foldout 18,B), and install gasket 7 and plug 6. Tighten plug 6 to 80-90 lb ft (109-122 N·m). Install gasket 53 and plug 54. Tighten plug 54 to 30-40 lb ft (41-54 N·m).

(8) Install plugs 36, 51, and 55. Tighten the plugs to 10-12 lb ft (14-16 N·m). Install gasket 34 onto plug 35 and install the plug. Tighten plug 35 to 80-90 lb ft (109-122 N·m).

(9) Refer to figure 6-2. If main pressure regulator valve 8 (foldout 18,B) is of the earlier design, spring retainer 13 must be used. If valve 8 is of the later design, no spring retainer is used. If a later design replacement valve is to be used in an earlier valve body, rework is required (fig. 6-2).

(10) If required, install spring retainer 13, concave side first, onto the stem end of main-pressure regulator valve 8. Install main-pressure regulator spring 14, trimmer spring 15, and trimmer plug 16 into the valve bore. Install gasket 17 and plug 18. Tighten plug 18 to 90-100 lb ft (123-135 N·m).

NOTE

For models with inching control, proceed to steps (11) through (16). For models with hydraulic-actuated clutch cut-off control, proceed to step (17). For models with air-actuated clutch cutoff, proceed to step (18).

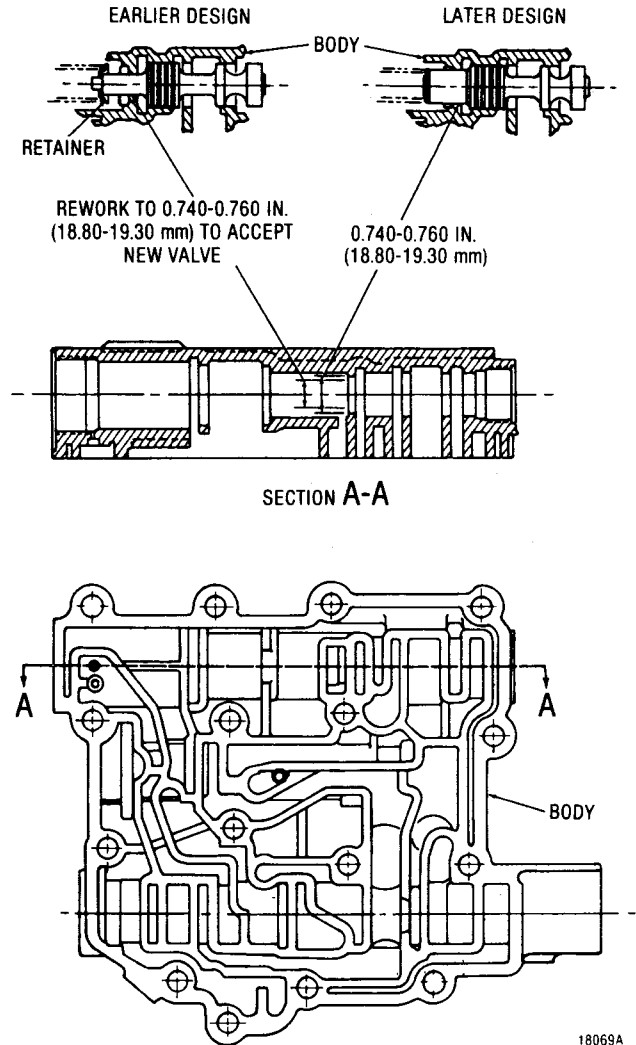


Fig. 6-2. Control valve body rework area (earlier models with new valve)

(11) Models with inching control. Install spring 38 and valve 39. Using a small screwdriver, push valve 39 forward and install valve stop 40 to retain valve 39 against spring 38.

(12) Install spring 41, valve 42, and spring 43.

(13) Install searing 44 onto plug 45.

(14) Install plug 45, larger bore first, over the stem of valve 42. Push plug 45 in until it seats, hold it against spring 43, and install stop 37 to retain plug 45.

(15) For models without a groove in valve body 9 for snapping 47, apply Loctite

Retaining Compound No. 75 (or equivalent) onto the outer circumference of new oil seal 46. Install the new seal, manufacturer's identification numbers outward, over the stem of valve 42. Press the seal to a location ± 0.010 inch (0.25 mm) from the bottom of the chamfer. Install push-on retaining ring 48.

(16) For models with a groove in valve body 9 for snapping 47, apply a light coat of Loctite Retaining Compound No. 75 (or equivalent) onto the outer circumference of new oil seal 46. Being careful not to load up the snapping groove with retaining compound, install seal 46, manufacturer's identification numbers outward, to a depth that clears the snapping groove. Install snapping 47.

(17) Models with hydraulic-actuated clutch cutoff. Assemble valve spring 19 onto clutch cutoff valve 20 and install the assembly, spring first, into valve body 9. Install sealring 22 onto cutoff valve plug 21. Install cup 24, small diameter first, onto the stemmed end of the cutoff valve plug. Lubricate and install the assembled cutoff valve plug, cup first, into the smooth bore end of retainer plug 25. Install retainer plug 25 and gasket 23. Tighten plug 25 to 60-70 lb ft (82-94 N·m). Cover the exposed orifice in the retainer plug until the hydraulic brake line is to be attached.

(18) Models with air-actuated clutch cutoff. Assemble valve spring 19 onto clutch cutoff valve 20 and install them, spring first, into valve body 9. Install sealring 22 onto cutoff valve plug 49. Lubricate and install the assembled cutoff valve plug, sealring first, into the smooth bore end of retainer plug 50. Install retainer plug 50 and gasket 23. Tighten plug 50 to 60-70 lb ft (82-94 N·m). Cover the exposed orifice in the retainer plug until the air-actuated cylinder assembly is to be connected.

6-4. TRANSMISSION FRONT COVER

a. Disassembly (foldout 6,A). If replacement of oil seal 11 is necessary, drive the seal out of the front of front cover 13.

b. Assembly (foldout 6,A)

(1) Install seal 11, spring-loaded lip first, straight into the bore in front cover 13.

(2) If the transmission is equipped with input shaft 18, press oil seal 11 into cover 13 until it bottoms lightly against the bore shoulder. If the transmission is equipped with input shaft 23, press oil seal 11 into cover 13 to a depth of 0.230-0.290 inch (5.9-7.3 mm) below the lead chamfer in the bore.

6-5. TORQUE CONVERTER DRIVE COVER

a. Disassembly (foldout 6,A)

(1) Using a puller, remove bearing 15 from input shaft 18 or 23.

(2) Straighten the ears of lockstrips 17, and remove six bolts 16. Remove input shaft 18 from torque converter drive cover 20, or input shaft 23 from torque converter drive cover 24.

b. Assembly (foldout 6,A)

(1) Install input shaft 23 onto torque converter drive cover 24, or input shaft 18 onto torque converter drive cover 20. Install three new lockstrips 17 and six 1/2-13 x 1-1/8-inch bolts 16. Tighten the bolts to 67-80 lb ft (91-108 N·m). Bend corners of lockstrips 17 against the heads of bolts 16.

(2) Install shielded bearing 15, shield side upward, onto input shaft 18 or install plain bearing 15, manufacturer's identification upward, onto input shaft 23. Press the bearing firmly to a seat against the shoulder of the input shaft.

6-6. FIRST- AND SECOND-TURBINE ASSEMBLY

a. Disassembly (foldout 7,A)

(1) Locate the index marks (V-groove) in the outer rims of the first-turbine support and the first turbine (fig. 6-3). Make sure these marks are well de-

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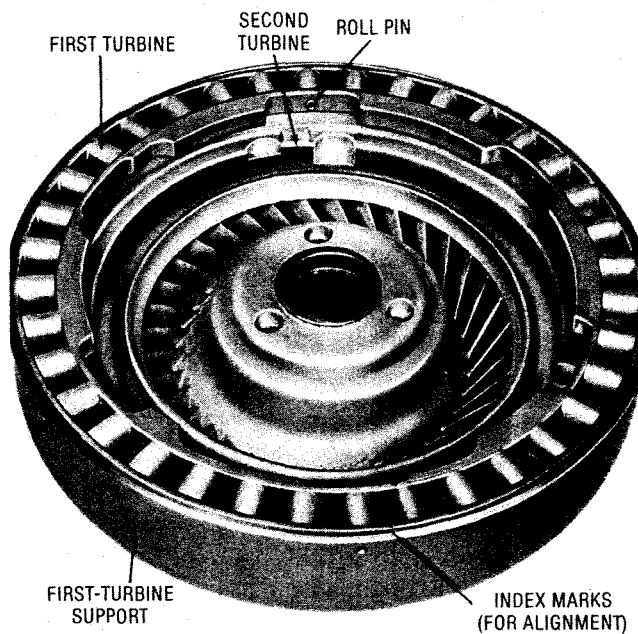


Fig. 6-3. First- and second-turbine assembly

finished in both parts. If the marks are not prominent, deepen them to 0.040 inch (1 mm) (maximum) before continuing with disassembly.

(2) Drive (but do not remove) the six (or nine) roll pins inward toward the hub until they clear the holes in the first-turbine support (fig. 6-3). Remove the roll pins only if replacement is necessary.

(3) Remove the first turbine from its support (fig. 6-4). Remove the second turbine and its bearing from the first-turbine support.

(4) If replacement is necessary, remove bearing 8 (foldout 7,A) from second turbine 6 by pressing lengths of drill rod through the three removal holes in the hub of second turbine 6. Remove snapping 7 from second turbine 6 only if replacement is necessary.

(5) If replacement is necessary, remove bearing 1 from first-turbine support 3 by pressing lengths of drill rod through the removal holes in the hub of first-turbine support 3.

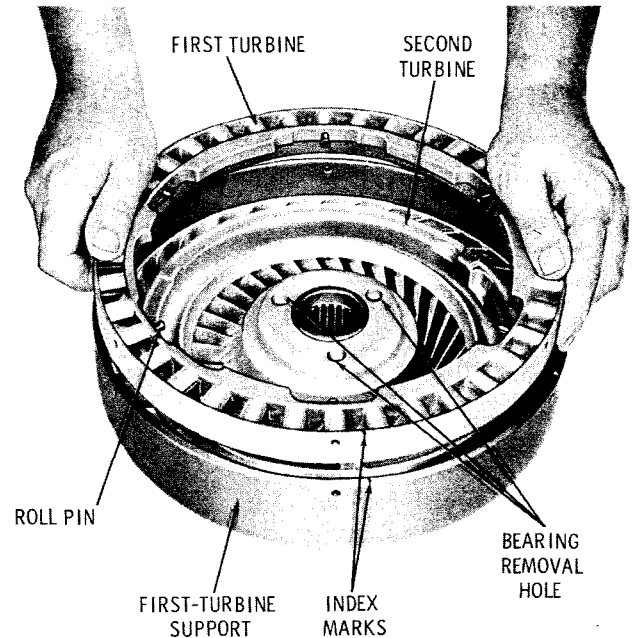


Fig. 6-4. Removing (or installing) first turbine

b. Assembly (foldout 7,A)

(1) If removed, install bearing 1. Position the bearing, manufacturer's identification outward, and press it firmly to a seat against the hub of support 3.

(2) If removed, install bearing 8. Position the bearing, manufacturer's identification outward, and press the bearing firmly to a seat against the hub of second turbine 6. If snapping 7 was removed, install its replacement.

(3) Install the second-turbine (and bearing) into the first-turbine support (fig. 6-4).

(4) Install the first turbine into the first-turbine support and align the V-groove index marks (fig. 6-4).

(5) Drive the six (or nine) roll pins outward to a depth of 0.000-0.030 inch (0.76 mm) below the outer surface of the first-turbine support (fig. 6-3).

6-7. TORQUE CONVERTER PUMP

a. Disassembly (fig. 6-5)

(1) Straighten the ears of the six lockstrips. Remove the twelve bolts that attach the pump retainer and input accessory drive gear to the torque converter pump. Remove the six lockstrips, pump retainer, input accessory drive gear, and bearing. Remove gasket 17 (foldout 7,A) or O-ring 21, if present.

(2) Inspect the twenty-four special bolts around the circumference of the pump. Remove any defective bolts by pressing them from the pump flange.

b. Assembly (fig. 6-5)

(1) If any of the special bolts were removed from the pump, install their replacements. Align the flat side of the bolt head next to the pump and press the new bolt into place.

(2) Using drive tool J-23723-6, install double-row ball bearing 18 (foldout 7,A), loading notch upward, into accessory drive gear 19.

(3) Place gasket 17 or sealring 21 on to input accessory drive gear 19. Install con-

verter pump 15 onto drive gear 19, bearing 18, and gasket 17 or O-ring 21, aligning the bolt holes in the pump with those in the gear and gasket, if used.

(4) Install pump retainer 14, and install six lockstrips 13 and twelve 1/4-28 x 1-1/4-inch bolts 12. Tighten the bolts to 10-12 lb ft (14-16 N·m). Bend the lockstrip ears against the bolt heads (fig. 6-5).

6-8. TORQUE CONVERTER HOUSING

a. Disassembly (foldout 7,B)

NOTE

If the transmission does not include the diaphragm shown in figure 6-6, begin disassembly at step (5).

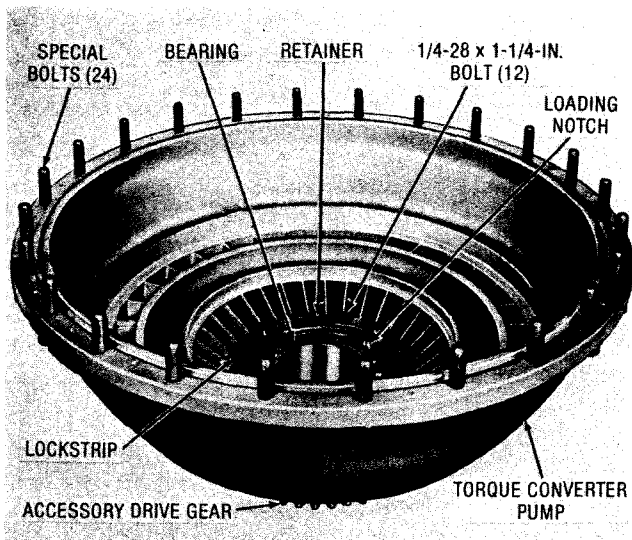
(1) "Dry" converter housings. If the transmission has a "dry" converter housing, it will have a pressed steel diaphragm and oil seal (fig. 6-6). These must be removed before the accessory gearing can be removed. Removal of the diaphragm destroys the diaphragm and seal.

(2) To remove the diaphragm, cut a slit through the diaphragm, as shown in figure 6-6. Insert a hooked tool into the slit and pry the metal above the slit outward. This will push the metal below the slit inward. Deforming the diaphragm in this manner will reduce its outside diameter and allow the diaphragm to be lifted from the converter housing.

(3) Clean the bore from which the diaphragm was removed. A smooth, clean bore will prevent leakage after the new diaphragm has been installed.

(4) Remove the cup plug from the converter housing only if replacement is necessary (fig. 6-6). If necessary, drive the plug from its bore, and clean the bore from which the plug was removed.

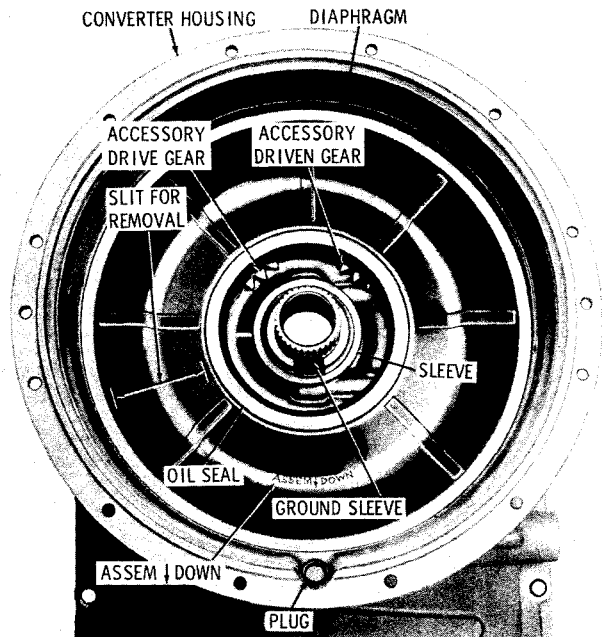
(5) All models. Remove step-joint sealring 50 (foldout 7,B) from converter housing sleeve 40. If replacement is necessary,



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Fig. 6-5. Torque converter pump assembly

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Fig. 6-6. Torque converter housing—front view (models with "dry" converter housing)

remove sleeve 40 from the front of converter housing 38.

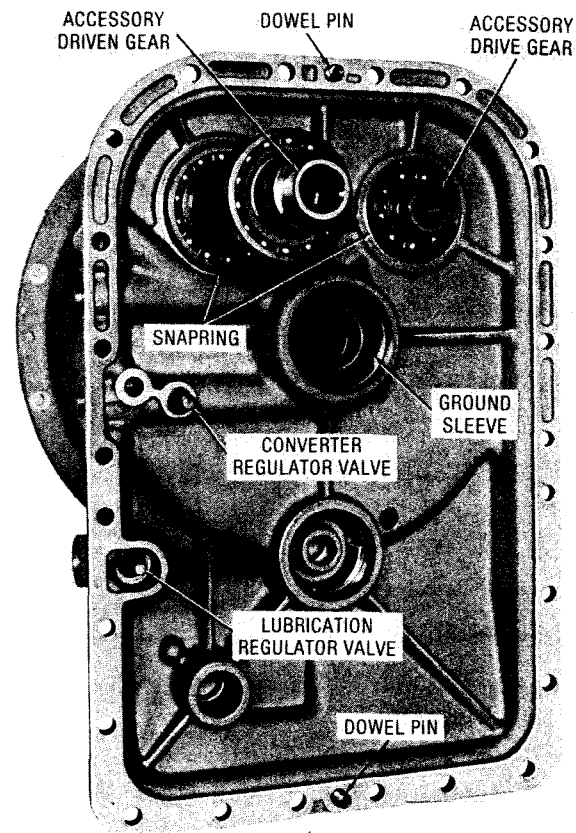
(6) At the rear of the converter housing, remove the snapping that retains the outer race of the accessory-driven gear bearing (fig. 6-7). Tap the accessory-driven gear forward and remove it and the attached parts from the housing.

(7) Remove the outer race and rollers of bearing 12 (foldout 7,B). Press the inner race of bearing 12 from accessory-driven gear 2. Remove snapping 11 and bearing 10 or separable bearing 45.

(8) On transmissions equipped with an accessory drive gear, remove the snapping from the accessory gear bearing (fig. 6-7). Tap the accessory drive gear forward and remove it and the attached parts from the housing.

(9) Remove snapping 7 (foldout 7,B) and bearing 6 from accessory drive gear 1.

(10) Use care during this operation to prevent damage to the protruding converter pressure regulator valve 23 or lubrication by-



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Fig. 6-7. Torque converter housing—rear view

pass tube 30, if present. If replacement of the ground sleeve is necessary, remove the four attaching bolts and press the sleeve from the converter housing (fig. 6-7).

(11) If converter pressure regulator valve spring 22 (foldout 7,B) is not colored light blue or if other replacement is necessary, drive pin 21 rearward with a pin drift and remove spring 22 and valve 23.

(12) If the lubrication regulator valve components 18, 19, and 20 require replacement, remove them by twisting pin 18 from the converter housing.

(13) If the transmission is equipped with an internal thermostat, remove lubrication bypass tube 30 and thermostat assembly 31. Remove searing 33 from thermostat assembly 32.

(14) Do not remove plugs 37 or 39 unless necessary for cleaning or replacement. Do not remove dowel pins 41 unless necessary for replacement.

b. Assembly (foldout 7,B)

(1) If plug 37 was removed, replace it. Tighten it to 33-37 lb ft (45-50 N·m). If plug 39 was removed, replace it. Tighten it to 23-27 lb ft (32-36 N·m). If dowel pins 41 were removed, install new dowel pins. Press the pins to a height of 0.430-0.450 inch (10.92-11.43 mm) above the housing splitline.

(2) If the transmission is equipped with an internal thermostat assembly, install lubrication bypass tube 30 into the rear face of converter housing 38. Install sealring 33 onto the thermostat and install thermostat assembly 32 into the converter housing, as shown in figure 6-8.

(3) If lubrication regulator valve 20 (foldout 7,B) was removed, install spring 19 and valve 20 onto guide pin 18. Install the assembled parts, pressing pin 18 into housing 38 to a depth of 0.000-0.010 inch (0.25 mm) below the housing splitline. Refer to the Note below step (4).

(4) If converter pressure regulator valve 23 was removed, install spring 22 (spring 22 must be light blue) and valve 23 onto guide pin 21. Install the assembled parts, pressing pin 21 to a height of 1.16-1.18 inches (29.4-29.9 mm) above the top of the valve.

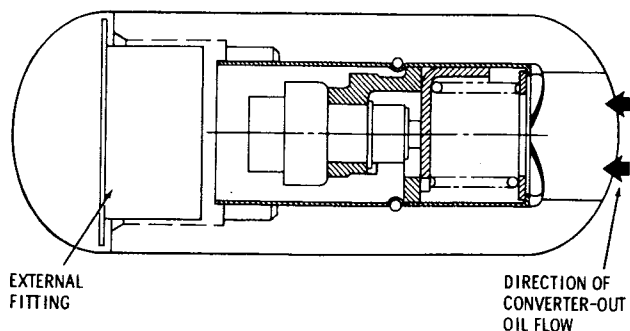


Fig. 6-8. Installation of thermostat assembly

NOTE

If the press fit of pins 18 or 21 is not satisfactory, clean the bore and pin of all oil residue and apply Loctite Grade B (Loctite Corp., Newington, Conn.) or equivalent to the bore and mating surface of the pin. Install the pin as described. Allow the sealant to cure for two hours at room temperature.

(5) If ground sleeve 13 was removed, chill the replacement sleeve in dry ice for at least 1 hour. Align the bolt holes in ground sleeve 13 with those in housing 38, and press the sleeve to a firm seat against the rear of the housing. Install four 5/16-18 x 3/4-inch, self-locking bolts 14, and tighten them to 17-20 lb ft (24-27 N·m).

(6) If the transmission is equipped with accessory drive gear 1, install bearing 6, with snapping groove away from the gear. Install snapping 7 to retain bearing 6.

(7) Install accessory drive gear 1 and bearing (outer race snapping removed) into the front of housing 38. Install the snapping onto the outer race of the bearing.

(8) Install bearing 10 or the outer race and rollers of bearing 45, with its snapping groove away from the gear, onto accessory-driven gear 2. If bearing 45 is used, install the bearing inner race, flanged side away from the gear. Install snapping 11 to retain the bearing. Press bearing 12 inner race, flange first, against the rearward seat on accessory-driven gear 2. Install the outer race and rollers of bearing 12.

(9) Install accessory-driven gear 2 and assembled bearings (outer race snapping removed) into the front of housing 38. Install the snapping onto the outer race of bearing 10 or 45.

(10) If converter housing sleeve 40 was removed from housing 38, install a new sleeve. Heat the sleeve for ease of replacement. Press converter housing sleeve 40,

REBUILD OF SUBASSEMBLIES

sealing groove last, onto the hub of housing 38. Seat the sleeve firmly against the shoulder on the hub. Install stepjoint sealing 50 into the groove in the converter housing sleeve. Retain the sealing with oil-soluble grease.

NOTE

This completes procedures for "wet" torque converter housings. For "dry" torque converter housings, proceed to step (11).

(11) "Dry" converter housings. Coat the outer diameter of a new diaphragm and seal assembly with nonhardening sealer and start it, convex side first and arrow pointing toward bottom of transmission, into the front of the converter housing (fig. 6-6). Using two soft hammers (one driving against the other or a block of wood contoured to the circumference of the diaphragm), drive the diaphragm assembly onto its seat in the housing bore. Move the driver evenly around the circumference, driving only slightly at each position.

(12) If plug 49 (foldout 7,B) was removed, coat the outer diameter of the new plug with nonhardening sealer. Drive plug 49, flat side first, into the converter housing, and seat it against the shoulder in the bore.

6-9. TURBINE-DRIVEN GEARS AND FREEWHEEL CLUTCH

a. Disassembly (foldout 8,A)

(1) Press the second-turbine driven gear out of the assembled unit (fig. 6-9). This will free spacers 29 and 31 (foldout 8,A) and bearing 32 which may be removed. Remove fifteen rollers 9 or 23, also freed.

(2) Remove bearing 30 from gear 28. Remove twelve nuts 2 or 16 from bolts 14 or 27.

(3) Using a screwdriver, pry cam assembly 10 or 24 away from gear 3 or 17. Remove spring plate 5 or 19 and roller cage 8 or

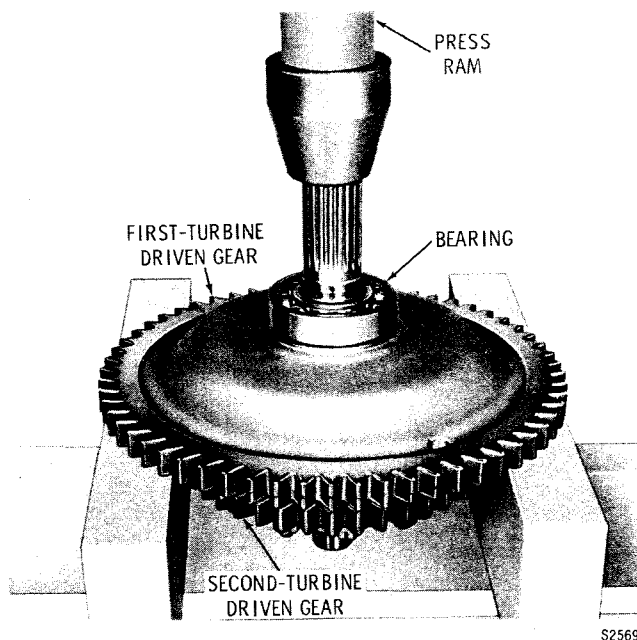


Fig. 6-9. Pressing second-turbine driven gear assembly from freewheel clutch assembly

22. Remove three spring pins 6 or 20 and springs 7 or 21 from the roller cage. Remove bolts 14 or 27 and retainer plate 13 (if present). Remove roll pin 11 or 25 from cam 12 or 26 if replacement is necessary.

(4) If replacement is necessary, remove bearings 1 or 15 and 4 or 18 from gear 3 or 17.

b. Assembly (foldout 8,A)

(1) If bearings 1 or 15 and 4 or 18 were removed from gear 3 or 17, install the bearings by pressing them against the shoulders on the gear.

(2) Install the roll pin into the cam and press it to the bottom of the bore (fig. 6-10).

(3) Insert the roller cage into the freewheel cam, and align the index marks on the cam and cage as shown in figure 6-10. Install the spring retainer plate onto the cam, indexing the small hole with the roll pin.

(4) Install the three springs and spring pins into the bored ears of the roller cage (fig. 6-11).

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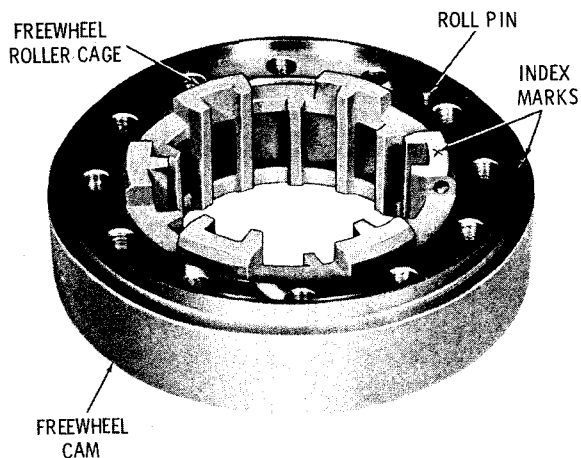
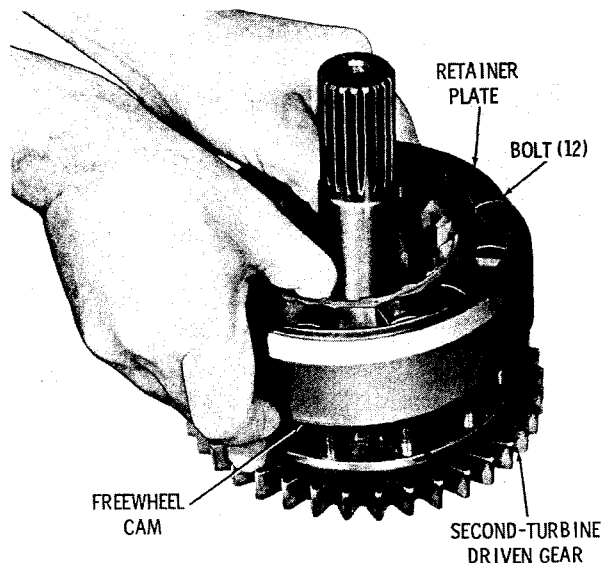


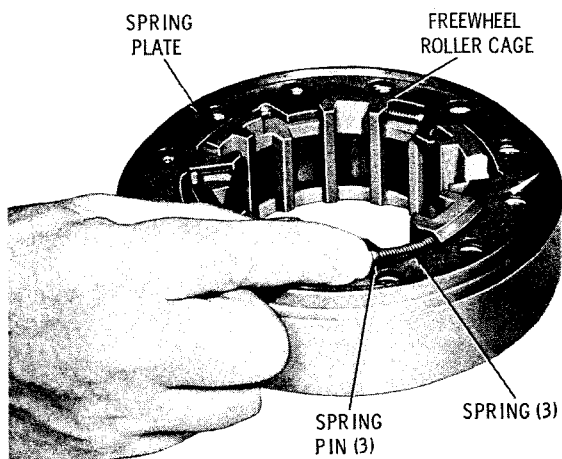
Fig. 6-10. Freewheel roller cage installed in freewheel cam

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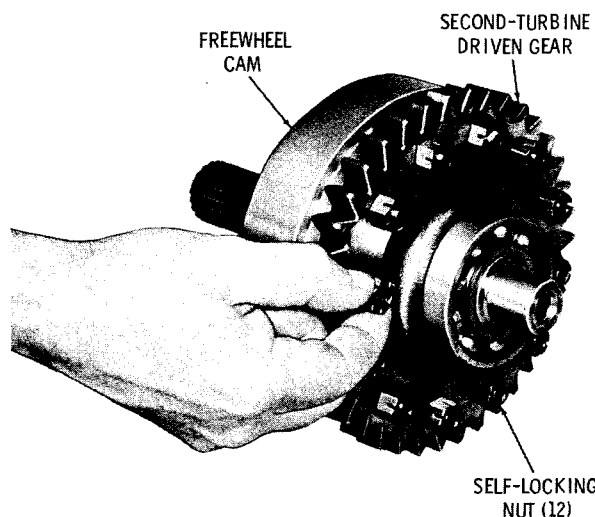
S2572

Fig. 6-12. Installing assembled cam onto assembled second-turbine driven gear



S2571

Fig. 6-11. Installing spring and spring pin into roller cage



S2573

Fig. 6-13. Installing self-locking nut onto freewheel cam bolt

(5) If applicable to the model, place retainer plate 13 (foldout 8,A), flat side first, against the rear face of the assembled cam and cage. Insert twelve bolts 14 or 27. Install the assembled cam onto the assembled second-turbine driven gear (fig. 6-12).

(6) Secure the assembled parts with twelve self-locking nuts (fig. 6-13). To prevent rotation of the bolt heads, use a fabricated wrench or an open-end wrench, and tighten the nuts to 41-49 lb ft (56-66 N·m).

(7) Install fifteen rollers into the cam pockets; use oil-soluble grease to retain the rollers in the cage (fig. 6-14).

(8) Install the first-turbine driven gear by placing the lead chamfer on the gear hub against rollers, and while pressing downward, rotate the first-turbine driven gear in a counterclockwise direction (fig. 6-15).

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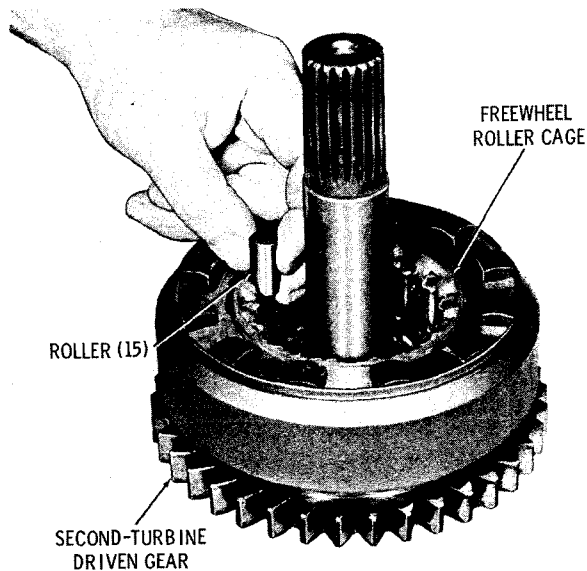


Fig. 6-14. Installing roller into roller cage

S2574

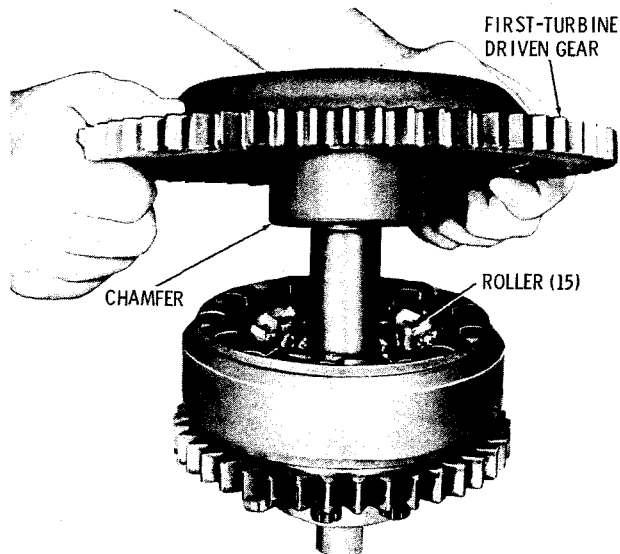
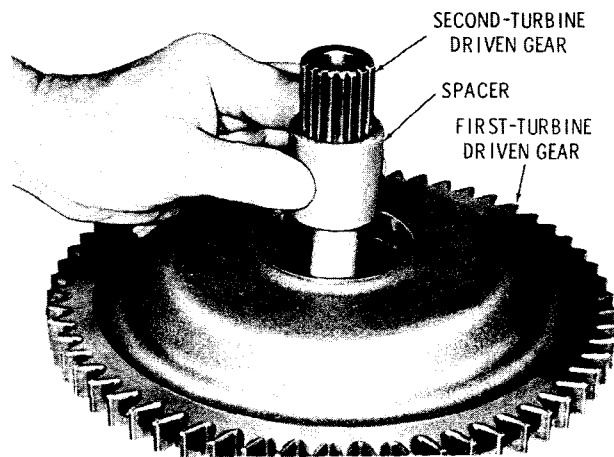


Fig. 6-15. Installing first-turbine driven gear

S2575

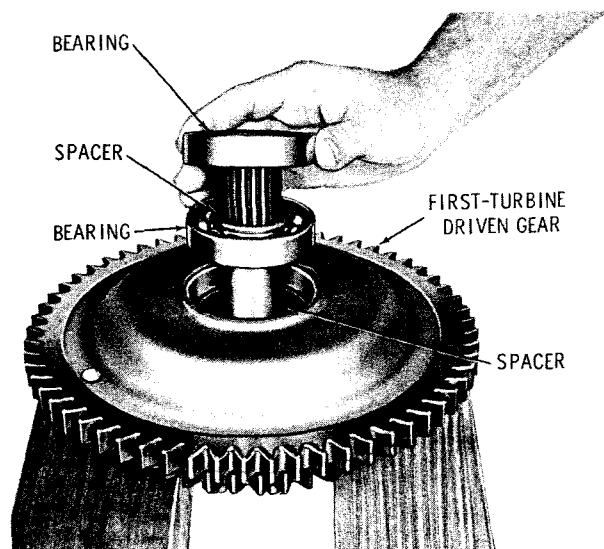
(9) Install the bearing spacer onto the shaft of the second-turbine driven gear (fig. 6-16).

(10) Install the remaining bearings and spacer, as shown in figure 6-17, onto the shaft of the second-turbine driven gear. Accurately center the spacer to prevent it from getting caught on the shaft shoulder. Press



S2576

Fig. 6-16. Installing bearing spacer onto second-turbine driven gear



S1448

Fig. 6-17. Installing bearings and spacer onto second-turbine driven gear

the bearings and spacer firmly into place while supporting the second-turbine driven gear.

6-10. FIRST-TURBINE DRIVE GEAR AND BEARING ASSEMBLY

a. Disassembly (foldout 7,B)

(1) If bearing 29 can be easily pressed from first-turbine drive gear 28, remove the

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bearing. If unusual resistance is encountered, heat the inner race of bearing 29 to 450°F (232°C) and press first-turbine drive gear 28 from the bearing.

(2) Press bearing 29 firmly against its seat on first-turbine drive gear 28. Allow assembled parts to cure for two hours at room temperature.

(2) If the bearing did not easily press from the drive gear, discard bearing 29 and clean the journal of gear 28.

6-11. CLUTCH PISTON HOUSING

NOTE

These procedures will rebuild any of the assemblies listed in Table 6-1.

b. Assembly (foldout 7,B)

(1) Apply Loctite Retaining Compound, or equivalent, to the ID of new bearing 29 and its journal on first-turbine drive gear 28.

Table 6-1. PISTON HOUSING ASSEMBLIES

	F O L D O U T	H O U S I N G	P I S T O N	S E A L I N G (E X P A N D E R)	H O S E - T R Y P E G	S P R I N G	S N A P R I N G
High-Range Clutch Piston Housing							
TT	11,B	24, 34, 36, 37	19	20 (21), 39	18	17	16
TTB	15,A	22, 35	19	20 (21), 38	18	17	16
TRT -1	12,B; 16,A	2	23	21 (20)	22	19	18
TRT -3 w/underdrive	13,A	4	8	6 (5)	7	9	10
TRT -3 w/overdrive	14,B; 16,B	2	17	15 (14)	16	13	12
Low-Range Clutch Piston Housing							
TRT -1	12,A	15	19	17 (16)	18	20	21
TRT -3 w/underdrive	13,B; 16,B	2	23	21 (20)	22	19	18
TRT -3 w/overdrive	14,A	4	8	6 (5)	7	9	10

REBUILD OF SUBASSEMBLIES

a. Disassembly

NOTE

For high-range clutch piston housing, if the transmission is equipped with a speedometer drive assembly, proceed to step (1). Otherwise, proceed to step (2).

(1) Speedometer drive models, high-range. Remove sealrings 27 and 29 (foldout 11,B), and drive pin 25 from the hub of high-range clutch piston housing 24. Remove speedometer drive shaft 26 and bearing 28 from the high-range clutch piston housing.

(2) If present, remove the bearing from the housing.

(3) Position the piston and housing, piston side up, in a press. Use care to prevent damage to the assembly. Depress the belleville spring and remove the snapping (fig. 6-18).

(4) Remove the piston and sealring (and expander, if present) from the piston housing. Refer to paragraph 6-12 for clutch piston rebuild instructions.

(5) Remove the hook-type sealring from the inner hub of the housing.

(6) Remove the bushing and sleeve from the piston housing only if replacement is necessary.

b. Assembly

(1) If a bushing was removed from the housing, install a new bushing. Press the new bushing to a depth of 0.040-0.080 inch (1.01-2.03 mm) below the face of the hub. If a sleeve was removed, install a new sleeve. Press the new sleeve against the shaft shoulder.

(2) Install the hook-type sealring onto the inner hub of the housing. Install the piston, with sealring (and expander) in place (as assembled in para 6-12), into the housing.

(3) Install the belleville spring, convex side up, onto the piston. Place the as-

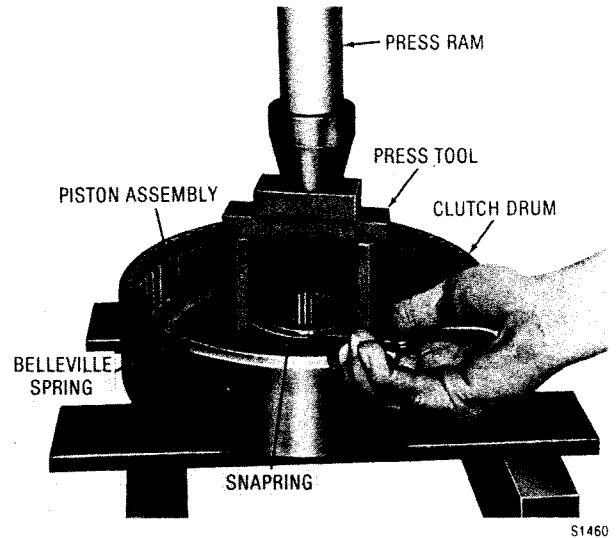


Fig. 6-18. Removing (or installing) piston return spring (typical configuration)

sembled parts, piston side upward, in a press. Depress the spring and install the snapping (fig. 6-18).

(4) If a bearing was removed from the rear hub of the housing, install the bearing.

(5) If the transmission is equipped with a speedometer drive assembly, install sealrings 27 and 29 (foldout 11,B) onto the hub of high-range piston housing 24. Install speedometer drive shaft 26 into the rear hub of piston housing 24. Install pin 25 through the hub of the piston housing and drive shaft. Press the pin to a depth of 0.020-0.040 inch (0.51-1.01 mm) below the surface of the piston housing hub.

(6) For TRT 2221-1, 2421-1 models, refer to paragraph 6-22 for rebuild of the rear housing; for TRT 2221-3, 2421-3, paragraph 6-23.

6-12. CLUTCH PISTON ASSEMBLIES

NOTE

Warming Teflon sealrings in oil at 150°F (65°C) will make them easier to remove and install.

a. Disassembly

(1) Do not use sharp-edged or pointed tools to remove Teflon sealrings. Rather,

slip a very thin, flat blade into piston groove between the sealring and side of the groove and work the seal out of the groove until it can be grasped with the fingers. Remove and discard the sealring.

(2) Remove the expander, if present, from the groove in the piston.

(3) Check for the presence of three holes in the piston. One hole should be clear. The other two holes have ball check valves. The ball should be clean and seat properly.

(4) If the balls need to be replaced, pry the retainer plugs from the piston and remove the balls. Discard the retainer plugs and balls.

b. Assembly

(1) If the retainer plugs and balls were removed, replace them in accordance with the instructions contained in the parts kit. (See Parts Catalog SA 1248.)

(2) For pistons that use an expander with the sealring, install the expander into the groove in the piston. Make sure the free ends of the expander turn away from the sealring (fig. 6-19). The ends of some expanders may require additional bending to ensure they turn toward the bottom of the groove.

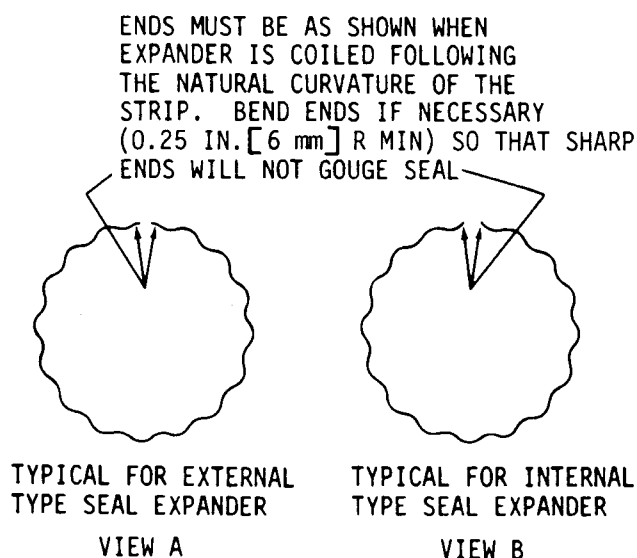


Fig. 6-19. Typical expanders for teflon sealrings

(3) Oil the installed expander and sealring. Start the sealring into the piston groove at a point directly opposite the gap in the expander.

(4) Carefully work the sealring into the groove, compressing the expander while moving both directions from the starting point to the expander gap location. Do not stretch or distort the sealring more than absolutely necessary.

(5) For sealrings that do not require expanders, install the lip-type sealring into the groove of the piston. Make sure that the lip of the sealring is toward the oil-pressure side of the piston. Refer to the exploded-view foldout for illustrations of lip directions.

CAUTION

Clutch application or leakage will occur if sealrings are improperly installed (lip in wrong direction).

(6) After installation, adjust the sealring in the groove to center it radially in the piston.

6-13. HIGH-RANGE CLUTCH AND HUB (TT, TTB)

a. Disassembly (foldout 11,B for TT; or foldout 15,A for TTB)

(1) Position the assembly so that nuts 6 and lockstrips 7 are upward. If the transmission is not equipped with a power takeoff, remove snapping 11 from hub 12.

(2) Flatten the corners of six lockstrips 7 and remove twelve nuts 6. Remove twelve bolts 15 and washers 14.

(3) Separate hub 10 or 12 from clutch plates 8, 9, and 13.

b. Assembly (foldout 11,B for TT; or foldout 15,A for TTB)

(1) Assemble twelve flat washers 14 onto twelve 5/16-24 x 7/8-inch, self-locking bolts 15. Install bolts 15 into clutch plate 13.

REBUILD OF SUBASSEMBLIES

(2) Install clutch hub 10 or 12 onto the bolt and clutch plate assembly. Note that the long end of hub 10 or the unsplined end of hub 12 should be at the same side of clutch plate 13 as washers 14.

(3) Install external-tanged plate 9 onto the front side of clutch plate 13. Install clutch plate 8 onto the front side of external-tanged plate 9, engaging bolts 15.

(4) Install six lockstrips 7 and twelve 5/16-24 nuts 6. Tighten the nuts to 14-18 lb ft (19-24 N·m), and bend the lockstrip corners against the bolt heads.

(5) On models using hub 12, install snapping 11 into its groove on the splined shaft.

6-14. CLUTCH ANCHOR (TRT 2221-1, 2421-1, 2221-3, 2421-3)

NOTE

These procedures are for anchor assembly 12 (foldout 12,B), anchor assembly 12 (foldout 13,B), or anchor assembly 3 (foldout 14,B). Callouts are for foldout 12,B unless otherwise noted.

a. Disassembly

(1) Disassemble anchor assembly 12 only if parts replacement is necessary.

(2) Position the assembly, pins downward, in a press. Press pins 14 and 15 out of anchor 13.

b. Assembly

NOTE

Chill pins 14 and 15 in dry ice for at least 1 hour before installing them into anchor 13.

CAUTION

For anchor 13 (foldout 12,B or 13,B), the flat side of the

anchor faces the rear of the transmission. For anchor 4 (foldout 14,B), the flat side of the anchor faces the front of the transmission.

(1) Position the anchor front side downward, in a press. Install two (longer) pins 15 at each side of the large cutout in the outer perimeter of anchor 13. Press the pins to a height of 1.55-1.57 inches (39.4-39.8 mm) above the rear face of the anchor.

NOTE

Longer pins 15 project slightly at the front side of anchor 13. They prevent snapping 11 from rotating.

(2) Press four (shorter) pins 14 into the remaining holes to a height of 1.55-1.57 inches (39.4-39.8 mm) above the rear face of anchor 13.

6-15. ADAPTER ASSEMBLY (TRT)

a. Disassembly

(1) Remove sleeve 27 (foldout 10,B) from adapter 26 or sleeve 9 (foldout 12,A) from adapter 8 only if replacement is necessary.

(2) -3 models. Remove two plugs 25 (foldout 10,B) from adapter 26.

b. Assembly

(1) If removed, position sleeve 27 (foldout 10,B) or sleeve 9 (foldout 12,A), internal chamfer first, into the front (ball bearing bore side) of the adapter.

(2) Press the sleeve (rearward) until its forward (unchamfered) end is to a depth of 0.000-0.010 inch (0.25 mm) below the shoulder against which the ball bearing assembly seats.

(3) -3 models. Install two plugs 25 (foldout 10,B) into adapter 26. Tighten the plugs to 8-10 lb ft (11-13 N·m).

6-16. INTERNAL BRAKE DIAPHRAGM (TTB)

a. Disassembly (foldout 15,B)

(1) Remove plug 3 from diaphragm 4.

(2) Position diaphragm assembly 2, pins upward, in a press. Support the area of the hub surrounding sleeve 5 and press the sleeve from the hub of the diaphragm. Do not remove pins 6.

b. Assembly (foldout 15,B)

(1) Position diaphragm 4, rear side downward, in a press. (Rear side of diaphragm has the recess for two bolts.) Support the hub area around the center bore on a sleeve having a slightly larger inside diameter than the bore of the diaphragm.

(2) Install sleeve 5, chamfered inside diameter end last, into the hub bore of diaphragm 4. Press the sleeve until the chamfered inside diameter end is to a depth of 0.075-0.085 inch (1.90-2.15 mm) below the front mounting surface (outer bolt circle) of the diaphragm.

(3) Install plug 3 into diaphragm assembly 2. Tighten the plug 14-16 lb ft (19-21 N·m).

6-17. TRANSFER DRIVE GEAR (TT, TTB)

a. Disassembly (foldout 11,B for TT; foldout 15,A for TTB)

(1) If bearing replacement is necessary, pull bearing 1 from transfer drive gear assembly 2.

(2) If the drive pins require replacement, press pins 4 from transfer drive gear 3.

b. Assembly (foldout 11,B for TT; foldout 15,A for TTB)

(1) If pins 4 were removed, place transfer drive gear 3, hub downward, in a press and install new pins. Press the pins to a height of 0.74-0.76 inch (18.8-19.3 mm).

(2) If bearing 1 was removed from transfer drive gear assembly 2, install a new bearing, outer snapping first, onto the gear hub. Seat the bearing firmly against the shoulder on the gear hub.

6-18. TRANSFER DRIVE GEAR (TRT -1)

a. Disassembly (foldout 12,A)

(1) Remove the bearings from gear 3 only if parts replacement is necessary.

(2) Remove the snapping from bearing assembly 1. Using a bearing puller, remove bearings 1 and 4 from gear 3.

b. Assembly (foldout 12,A)

(1) Press bearing 4, manufacturer's number outward, onto the splined hub of gear 3. Seat it firmly against the hub shoulder.

(2) Press bearing 1, outer snapping groove toward gear, onto the smooth-bore hub of gear 3. Seat it firmly against the hub shoulder.

(3) Install the external snapping into the groove in the outer race of bearing assembly 1.

6-19. TRANSFER DRIVE GEAR SLEEVE ASSEMBLY (TRT -1)

a. Disassembly (foldout 12,A). If necessary for replacement, remove bushing 23 from sleeve 24. If the bushing must be cut out, do not damage the sleeve bore.

b. Assembly (foldout 12,A). Install bushing 23 into the larger bore of sleeve 24. Press it in until the front (outer) end of the bushing is at a depth of 0.29-0.31 inch (7.4-7.8 mm) below the end (front) of sleeve 24. (The bushing is prebored to give the proper inside diameter when installed.)

6-20. REAR PTO COVER ASSEMBLY (TT)

a. Disassembly (foldout 16,D)

(1) Tap PTO shaft assembly 17 forward from rear PTO cover assembly 22. Re-

move snapping 16 from the shaft assembly. Do not remove pin 18 from shaft 19 unless replacement is necessary.

(2) Remove snapping 20 from rear PTO cover 24 and remove bearing 21. Remove sleeve 23 only if replacement is necessary.

(3) Remove dust shield 26 and lip-type searing 25 from rear of cover 24, and remove plug 32.

b. Assembly (foldout 16,D)

(1) Install the PTO oil seal and dust shield as shown in figure 6-20. Install plug 32 (foldout 16,D). If the plug is 1/8-in. NPTF, tighten the plug to 10-12 lb ft (14-16 N·m). If the plug is 3/8-in. NPTF, tighten the plug to 18-22 lb ft (25-29 N·m).

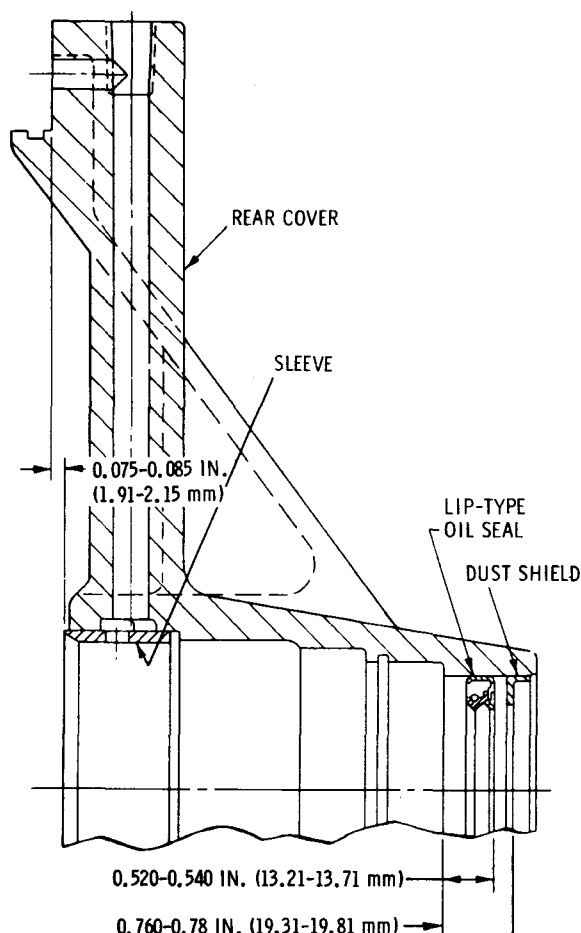


Fig. 6-20. Oil and dust shield installation (TT with converter-driven PTO)

(2) If sleeve 23 was removed, install a new sleeve, beveled OD first, into PTO cover 24. Press the sleeve to the dimension shown in figure 6-20. Install bearing 21 (fold-out 16,D) and snapping 20 into PTO cover 24.

(3) If pin 18 was removed from shaft 19, install a new pin, straight outer diameter first, into the shaft. Press the pin to a height of 0.810-0.830 inch (20.58-21.08 mm) from the front end surface of the shaft.

(4) Install snapping 16 onto shaft assembly 17 and install the shaft, threaded end first, through bearing 21 and into PTO cover assembly 22. Seat the shoulder of the shaft against the bearing.

6-21. REAR COVER ASSEMBLY (TTB)

a. Disassembly (foldout 15,B)

NOTE

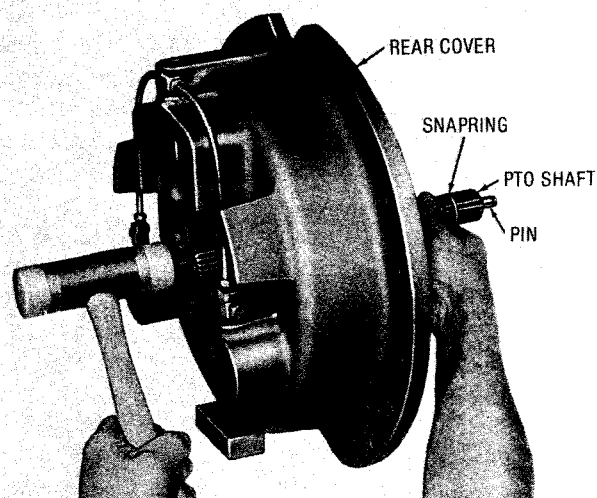
For models with converter-driven PTO, proceed to step (1). For models without converter-driven PTO, proceed to step (3).

(1) Position the rear cover assembly on its side on a bench and remove flange retaining self-locking nut 43, flange retaining washer 42, and output flange 41.

(2) Tap the PTO shaft forward and remove it from the rear cover assembly (fig. 6-21). Remove the snapping from the shaft. Remove the pin only if replacement is necessary.

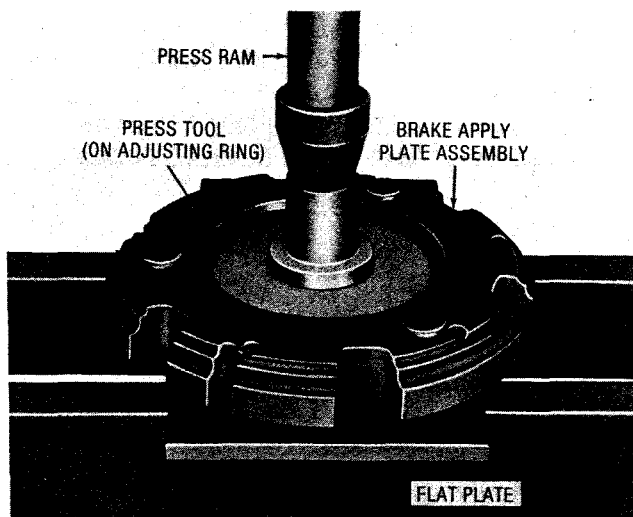
(3) Position the rear cover so that the mounting flange is upward and remove the snapping that retains the brake-apply plate assembly (fig. 6-22). Remove the brake-apply plate assembly. Do not disassemble the apply plate assembly unless it does not meet the minimum press force of 400 pounds (1780 N) during the readjustment procedure described in step (4).

(4) The brake apply plate assembly (fig. 6-23) must be readjusted to the setting established when the transmission was new, so that the automatic adjustment for brake



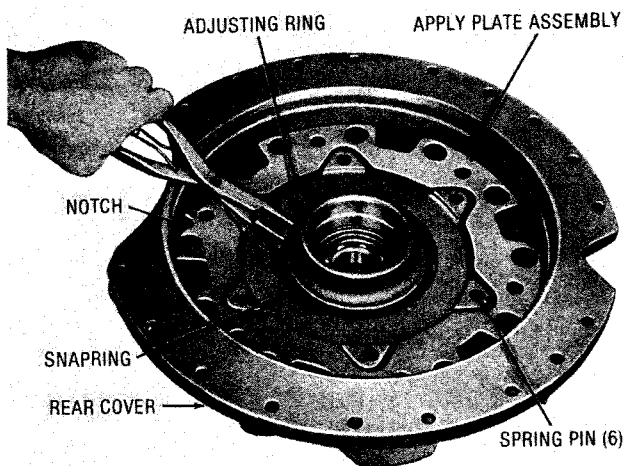
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Fig. 6-21. Removing PTO shaft from rear cover (TTB)



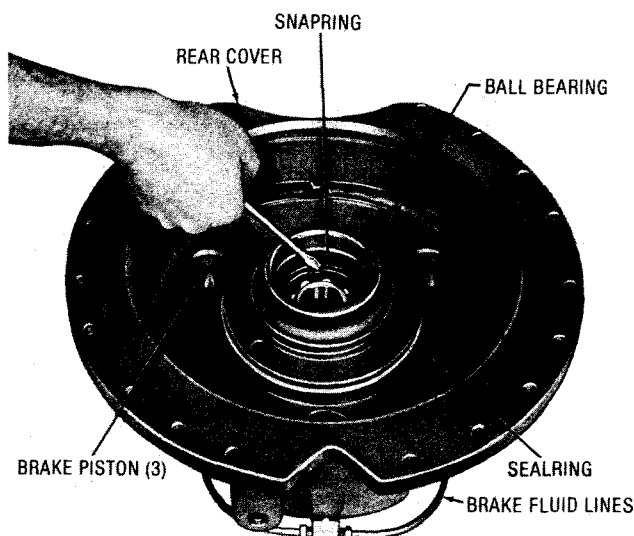
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Fig. 6-23. Pressing brake adjusting ring flush with apply-plate surface (TTB)



S2578

Fig. 6-22. Removing (or installing) brake-apply plate snapring (TTB)



S2580

Fig. 6-24. Removing snapring from rear bearing bore (TTB)

wear and proper release clearance are provided. This adjustment is made by positioning the apply plate assembly, front downward, in a press on a smooth, flat plate (fig. 6-23).

(5) Press brake adjusting ring 21 (fold-out 15,B) downward until its front surface is flush with the front surface of brake-apply plate 23. If the adjusting ring moves with the application of less than 400 pounds (1780 N) force of the press, heat breakdown of spring pins 22 is indicated, and the pins must be replaced.

(6) If replacement of spring pins 22 is necessary, press adjusting ring 21 from brake-apply plate 23. Remove six spring pins 22 from adjusting ring 21.

(7) If present, remove the snapring that retains the ball bearing and remove the bearing from the rear cover (fig. 6-24). Remove the Teflon sealring from the inner hub. Note the location of the three brake pistons.

REBUILD OF SUBASSEMBLIES

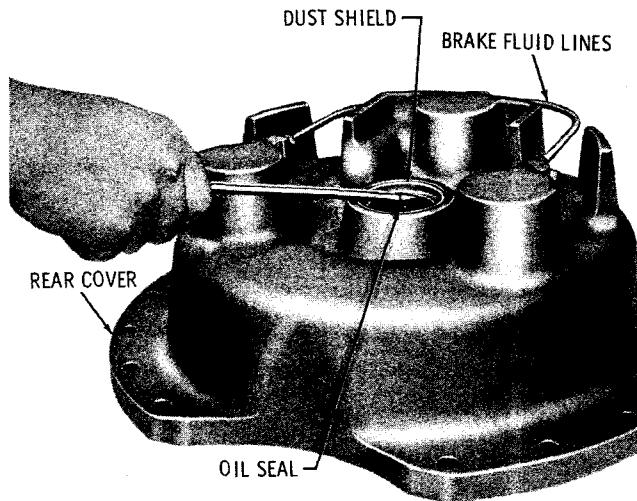


Fig. 6-25. Removing dust shield from rear cover (TTB)

(8) Position the rear cover so that it rests on the mounting flange and remove the dust shield and oil seal (fig. 6-25). Or remove plug 44 (foldout 15,B), if necessary. Remove the brake fluid lines and fittings.

(9) Using forced air at each brake fluid port, remove the brake pistons and related parts from their bores (fig. 6-26). Each piston bore contains a piston 26 (foldout 15,B), sealing 25, piston cup 27, and expander assembly 28. Remove sealrings 25 from pistons 26.

b. Assembly (foldout 15,B)

(1) Pack the inside diameter groove of oil seal 39 with high temperature grease, MIL-G-3545A or equivalent. Install oil seal 39 and dust shield 40 into rear cover 38 in the positions shown in figure 6-27. Or, apply a nonhardening sealer and install plug 44 (foldout 15,B).

(2) Lubricate the brake piston components with hydraulic brake fluid prior to installation into their bores. Install the three expander assemblies, brake piston cups (flat side upward), and brake pistons (flat side first), with sealrings assembled, into the three bores in the rear cover (fig. 6-28).

(3) Install a new Teflon sealring, outer lip upward, into the groove in the inner hub of the rear cover (fig. 6-28). Install the bearing and snapping into the rear cover.

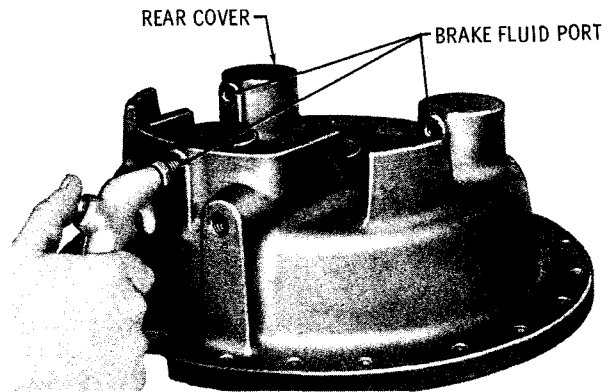


Fig. 6-26. Removing brake pistons from rear cover (TTB)

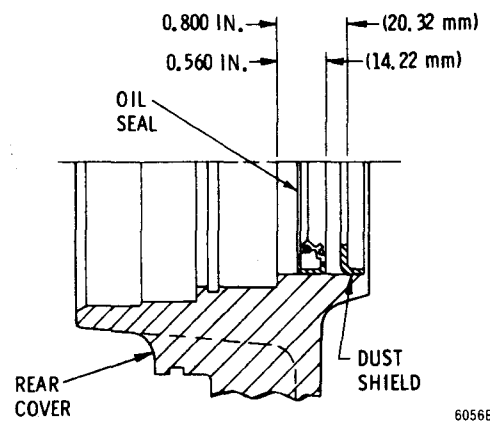


Fig. 6-27. Oil and dust shield installation (TTB with converter-driven PTO)

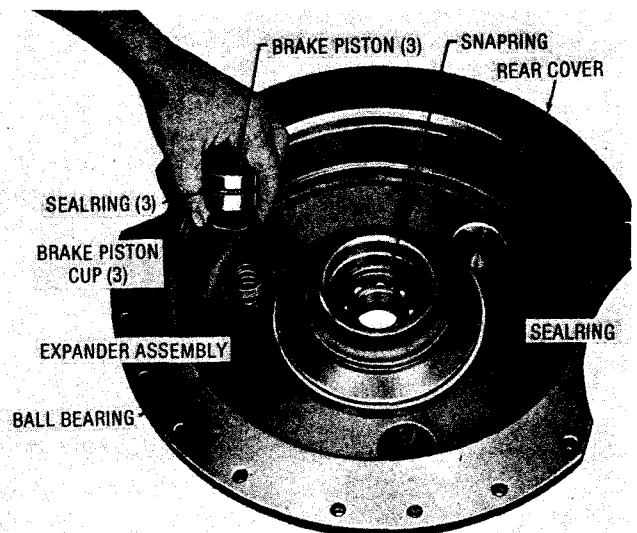


Fig. 6-28. Installing brake piston components in rear cover (TTB)

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(4) If removal of six spring pins 22 (foldout 15,B) was not necessary, proceed to step (6).

CAUTION

It is essential that ring 21 be parallel to plate 23 and that pins 22 not be distorted or damaged during installation.

(5) If removal of six spring pins 22 (foldout 15,B) was necessary, install six new pins into apply plate 23. Press the pins to a seat against the bottom of their bores. Press adjusting ring 21 onto pins 22 until the front surface of ring 21 is at a height of 0.000-0.010 inch (0.25 mm) above the front surface of apply plate 23.

(6) Install brake-apply plate assembly 20 into rear cover 38. Align the small notch in the plate with the cast lug located at the bottom of the cover bore (fig. 6-22). Install the snapping to retain the brake-apply plate in the rear cover.

(7) Install the brake fluid lines and fittings (fig. 6-25). Tighten the fittings to 275-325 lb ft (373-440 N·m).

NOTE

This completes procedures for repair of this subassembly for models without converter-driven PTO. For models with converter-driven PTO, proceed with step (8).

(8) If pin 29 (foldout 15,A) was removed from PTO shaft 30, install a new pin, straight outer diameter first, to a height of 0.810-0.830 inch (20.57-21.08 mm) from the front end surface of the shaft. Install snapping 27 onto PTO shaft assembly 28.

(9) Install PTO shaft assembly 28, threaded end first, into the assembled rear cover and seat the shaft in bearing 32 within the assembled rear cover.

(10) Install output flange 41 (foldout 15,B) and flange retaining washer 42 onto output shaft assembly 28 (foldout 15,A). Ap-

ply molybdenum disulfide grease (Molykote Type G or equivalent) onto the threads of flange retaining nut 43 (foldout 15,B) and install the nut. Do not tighten the nut at this time.

6-22. TRANSMISSION REAR HOUSING ASSEMBLY (TRT 2221-1, 2421-1)

a. Disassembly (foldout 16,A). If replacement is necessary, remove welch plug 13 and pipe plug 14. To remove plug 13, insert a punch from the inside of housing 2, through the clutch anchor pin hole, and drive out plug 13. Clean the bore from which it was removed.

b. Assembly (foldout 16,A)

(1) If welch plug 13 was removed, coat the new plug with nonhardening sealer. Press or drive the plug, closed end first, into housing 2 until its outer end is even with the inner end of the chamfer in the bore.

(2) If plug 14 was removed, install it into the threaded opening in the housing. Tighten plug 14 to 8-10 lb ft (11-13 N·m).

6-23. TRANSMISSION REAR HOUSING ASSEMBLY (TRT 2221-3, 2421-3)

a. Disassembly (foldout 16,B)

(1) Remove oil seal 11 and internal snapping 9.

(2) Using a soft hammer, drive output shaft 5 or 7 rearward and out of housing 2.

(3) If present, remove snapping 6.

(4) Remove bearing 8 from shaft 5 or 7, if replacement is necessary.

(5) If replacement is necessary, remove plug 13 by inserting a punch through the clutch anchor pin bore inside housing 2 and driving the plug out.

(6) Remove pipe plug 14, and plug 15 (if used).

REBUILD OF SUBASSEMBLIES

b. Assembly (foldout 16,B)

(1) Install 1/4-inch pipe plug 14. Tighten plug 14 to 8-10 lb ft (11-13 N·m). If used, install 3/8-inch plug 15. Tighten plug 15 to 12-16 lb ft (17-21 N·m).

(2) If plug 13 was removed, coat the new plug with nonhardening sealer. Install it, closed end first, into the clutch anchor pin bore in housing 2. Press or drive the plug in until its outer end is even with the inner end of the chamfer in the bore.

(3) Install bearing 8 onto shaft 5 or 7 and seat it firmly against the shaft shoulder.

(4) If removed, install snapping 6 onto shaft 7.

(5) Install the assembled output shaft and bearing, unsplined end first, into the rear of housing 2. Tap on the outer race of bearing 8 to seat it against the housing shoulder. Install snapping 9.

(6) Install oil seal 11, spring-loaded lip first, into the rear bore of housing 2. Seat it lightly against the shoulder in the housing bore.

6-24. TRANSMISSION REAR HOUSING ASSEMBLY (TRT 2211-3, 2411-3)

a. Disassembly (foldout 16,C)

(1) If present, remove baffle 6.

(2) Remove oil seal 7.

(3) If present, remove tube 8 only if replacement is necessary.

(4) Remove snapping 22 (foldout 11,A) and bearing 23.

(5) Remove plug 2 (foldout 16,C).

b. Assembly (foldout 16,C)

(1) Install plug 2 into housing 9. Tighten plug 2 to 4-5 lb ft (5.5-6.7 N·m).

(2) Install bearing 23 (foldout 11,A) and snapping 22 into the housing.

(3) If tube 8 (foldout 16,C) was removed, coat the larger end of the tube with nonhardening sealer and install it, smaller end first, through the rear bore of housing 9. Press the tube into its bore until the upper end of the tube is even with the lower edge of the countersink in the bore (tube not used in some models).

(4) Press a new seal 7, spring-loaded lip first, into the rear of housing 9. Seat it lightly against the shoulder in the housing bore.

(5) Coat baffle 6 (not used in some models) with nonhardening sealer. Install the baffle, convex side first, into the housing. Press it into the housing bore to a depth of 0.060-0.090 inch (1.52-2.28 mm) below the rear surface of housing 9.

6-25. PLANETARY CARRIER ASSEMBLY

NOTE

Planetary pinions are a matched set. If one pinion requires replacement, the remaining pinions must also be replaced. Also, new needle bearings, thrust washers, and spindles should be installed any time a planetary carrier assembly is being rebuilt.

a. Disassembly (Table 6-2)

(1) Use Table 6-2 to determine the data for the specific planetary assembly which is to be disassembled.

CAUTION

Do not drill into the carrier. The diameter of spindles is slightly more than the diameter of the drill (Table 6-2, K). Centering the drill accurately will prevent drilling into the carrier.

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Table 6-2. PLANETARY ASSEMBLIES

A	B	C	D	E	F G	H	I	J	K		L		M	N
Planetary	Models	Fold- out	Car- rier	Spindles	Thrust Washers	Pinions (Matched Set)	Pinion Bearing Rollers	Bush- ing	Drill Size to Remove Pinions		Spindle Dimension Before Swaging ± 0.010 in. (0.25 mm)		Figure 6-29 Showing Spindle Dimension Before Swaging	Figure 6-30 Swaging Tools 1 and 2
									1/2 in. (12.7 mm)	3/4 in. (19 mm)	Height	Depth		
Reverse	All	9,B	15	14 (4)	10 (4) 13 (4)	11 (4)	12 (88) (22 ea)	—		X	0.140 in. (3.56 mm)	—	1	1
Forward (Low)	TT, TTB, TRT -1	10,A	9	4 (4)	5 (4) 8 (4)	7 (4)	6 (88) (22 ea)	—		X	—	0.180 in. (4.57 mm)	2	1
Forward	TRT -1	10,A	16	11 (6)	12 (6) 15 (6)	14 (6)	13 (120) (20 ea)	—	X		0.092 in. (2.33 mm)	—	3	2
Forward (Low)	TT, TTB	10,A	23	18 (6)	19 (6) 22 (6)	21 (6)	20 (120) (20 ea)	—	X		0.092 in. (2.33 mm)	—	3	2
Forward	TRT 2221-3, 2421-3 w/underdrive	10,B	5	6 (6)	7 (6) 10 (6)	9 (6)	8 (120) (20 ea)	4	X		0.092 in. (2.33 mm)	—	4	2
Forward	TRT 2221-3, 2421-3 w/overdrive	10,B	32	33 (6)	34 (6) 37 (6)	36 (6)	35 (120) (20 ea)	31	X		0.092 in. (2.33 mm)	—	4	2
Forward	TRT 2211-3, 2411-3	11,A	4	5 (6)	6 (6) 9 (6)	8 (6)	7 (120) (20 ea)	—	X		0.092 in. (2.33 mm)	—	3	2
High	TRT -1	12,B	5	9 (6)	6 (6) 10 (6)	7 (6)	8 (96) (16 ea)	—	X		0.095 in. (2.41 mm)	—	5	2
Low	TRT 2221-3, 2421-3 w/underdrive	13,B	5	9 (6)	6 (6) 10 (6)	7 (6)	8 (96) (16 ea)	—	X		0.095 in. (2.41 mm)	—	5	2
High	TRT 2221-3, 2421-3 w/overdrive	14,A	19	20 (6)	21 (6) 24 (6)	23 (6)	22 (120) (20 ea)	—	X		0.092 in. (2.33 mm)	—	6	2

(2) Use the size drill indicated in Table 6-2, K. Drill into the ends of the pinion spindles (Table 6-2, E), to weaken the swage.

(3) Refer to figure 6-29. Place the carrier assembly (Table 6-2, D) in a press and press out a spindle.

(4) Remove two thrust washers (Table 6-2, F and G), the pinion (Table 6-2, H), and the pinion rollers (Table 6-2, I).

(5) Repeat steps (3) and (4), for removal of the remaining pinion assemblies.

(6) If present, and replacement is necessary, remove the bushing (Table 6-2, J).

b. Assembly (Table 6-2)

(1) If removed, install the bushing (Table 6-2, J) to the depth shown in figure 6-29, View 4.

(2) Chill the new spindles (Table 6-2, E) in dry ice for one hour, or heat the carrier (Table 6-2, D) in an oil bath or oven to 300-350°F (150-176°C).

NOTE

An aligning tool can be made by grinding a used spindle to 0.005-inch (0.13 mm) under-size.

(3) Install a thrust washer (Table 6-2, F) on a spindle aligning tool.

(4) Coat the bore of the pinion (Table 6-2, H) with oil-soluble grease and install the pinion onto the aligning tool.

(5) Install the pinion rollers (Table 6-2, I) into the space between the aligning tool and the pinion bore. Install the second thrust washer (Table 6-2, G) onto the pinion.

REBUILD OF SUBASSEMBLIES

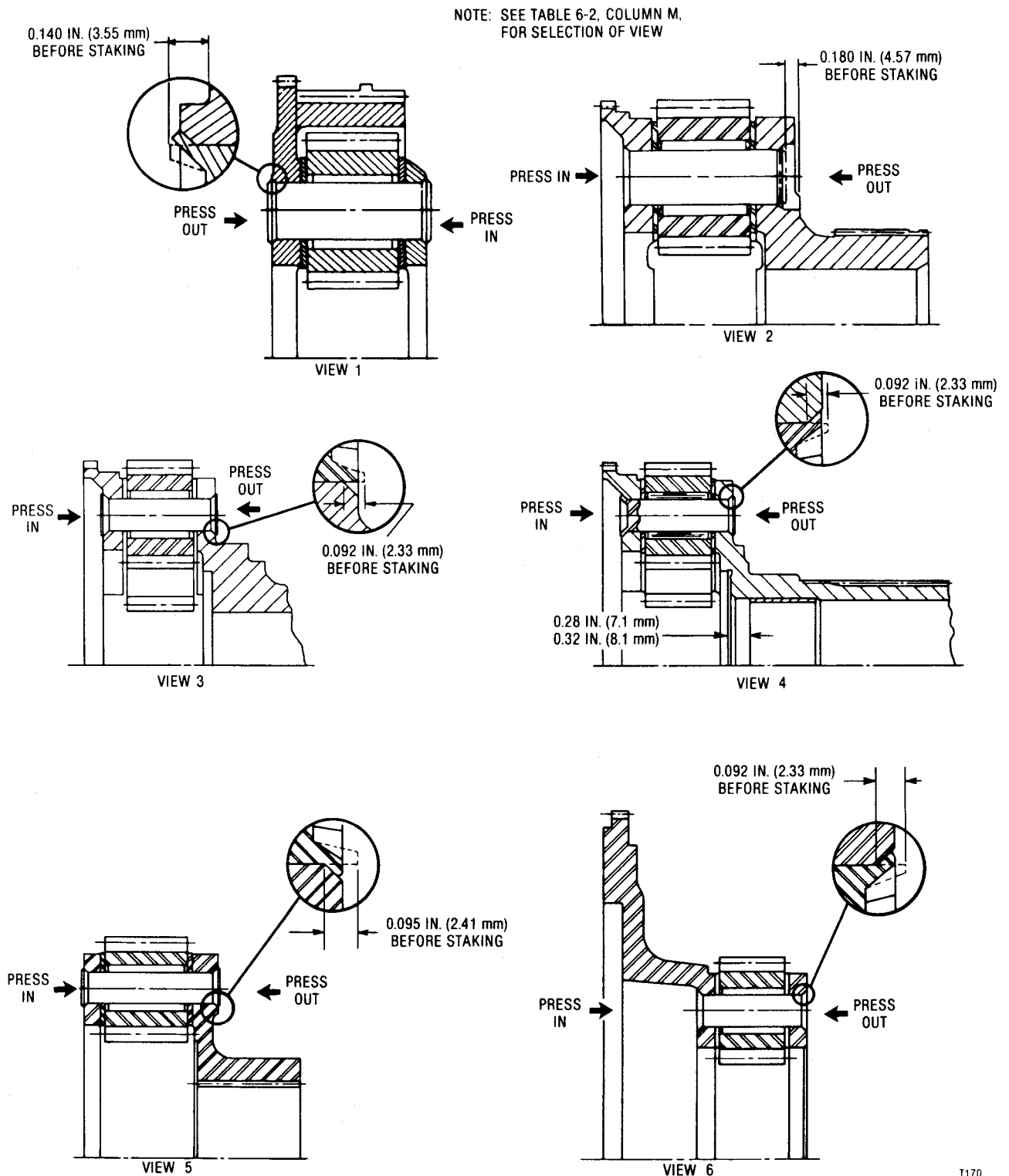


Fig. 6-29. Planetary assembly spindle installation

(6) Remove the aligning tool and install the assembled pinion parts into the planetary carrier (Table 6-2, D). Insert the aligning tool to center the assembled pinion parts with the bore in the carrier.

(7) Refer to figure 6-29. Place the carrier assembly into a press, remove the aligning tool, and start a spindle (Table 6-2, E) into the pinion bore.

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NOTE: SEE TABLE 6-2, COLUMN N,
FOR SELECTION OF VIEW

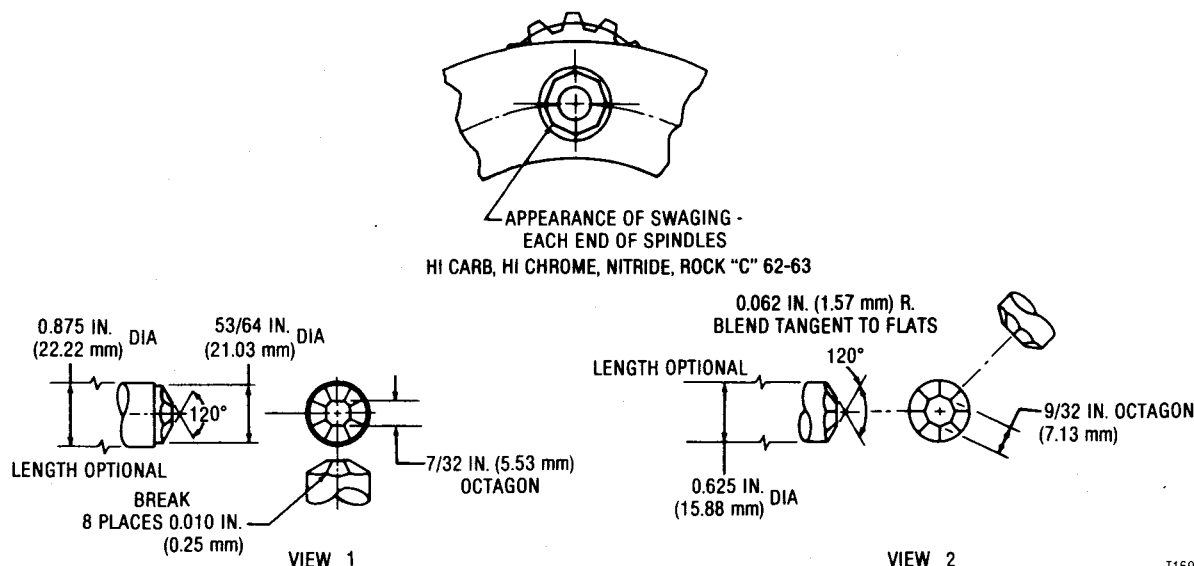


Fig. 6-30. Swaging tools

(8) Press the spindle into the bore to the indicated dimension. Refer to Table 6-2, L and M, and to figure 6-29.

(9) Refer to Table 6-2, N and to figure 6-30. Support the spindle and swage it securely at both ends with an octagon punch. The pinion must rotate freely after assembly.

(10) Install the remaining pinion assemblies in the same manner as described in steps (3) through (9).

(11) If chilled spindles were installed, apply a coating of oil around the spindles to inhibit rust.

6-26. OIL PUMP

a. Disassembly

(1) Remove the pump cover and gasket (fig. 6-31).

(2) Remove the drive gear and driven gear assembly.

(3) If necessary, remove the needle bearings from the driven gear.

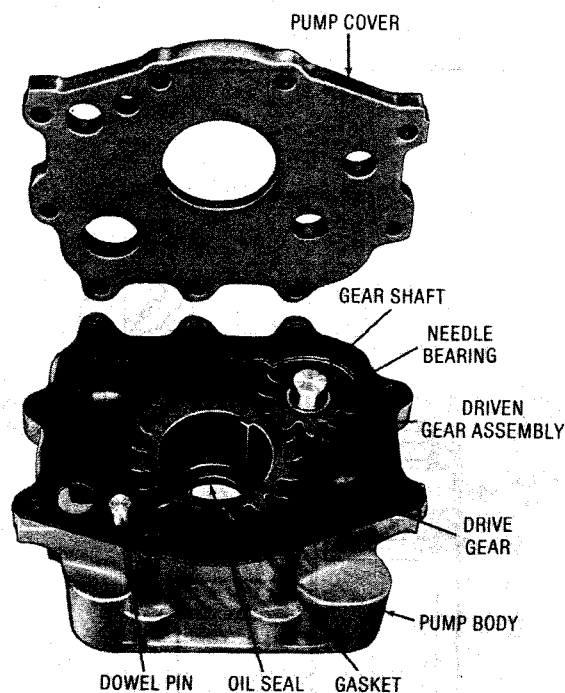


Fig. 6-31. Oil pump assembly

(4) If necessary for replacement, remove the dowel pin by clamping it in a vise and twisting the pump body.

REBUILD OF SUBASSEMBLIES

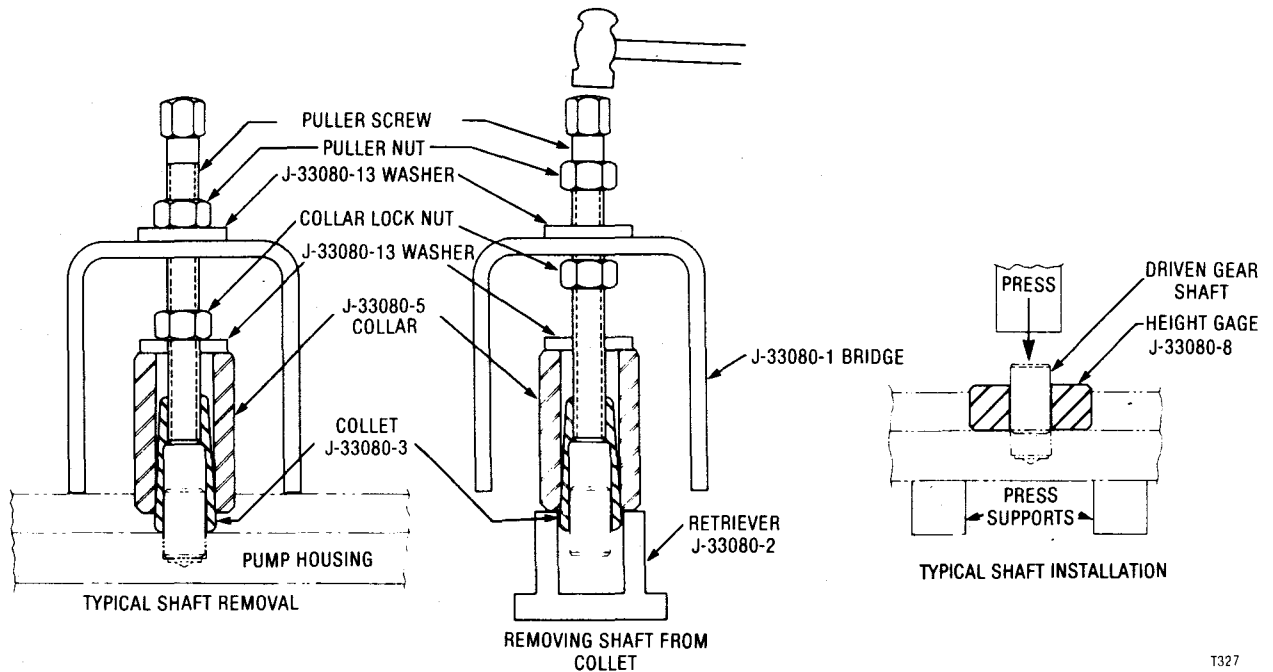


Fig. 6-32. Removal and installation of pump driven gear shaft

(5) If present, remove the oil seal by driving or pressing it toward the rear (accessory mounting face) of the pump.

(6) If replacement of the driven gear shaft is necessary, remover assembly J-33080 may be used.

(7) Assemble the puller over the shaft as shown in figure 6-32 with collet J-33080-3.

(8) Tighten the collar locknut until the collar is secured against the collet and onto the shaft that is to be removed (fig. 6-33).

(9) Retain the puller screw (fig. 6-32) with a wrench while tightening the puller nut to remove the shaft. If the collet does not pull the shaft, repeat steps (8) and (9) and apply additional torque to the collet locknut.

(10) To remove the shaft from the collet, back off the collar locknut and puller nut, position the collar over retriever J-33080-2 (fig. 6-34), and tap the top of the puller screw with a hammer (fig. 6-32).

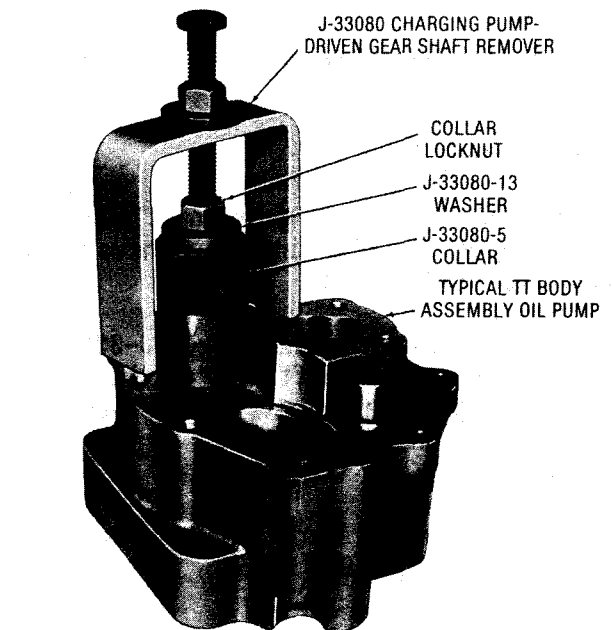


Fig. 6-33. J-33080 shaft remover in place

(11) If the pump body, drive gear, or driven gear requires replacement, a new pump assembly must be used.

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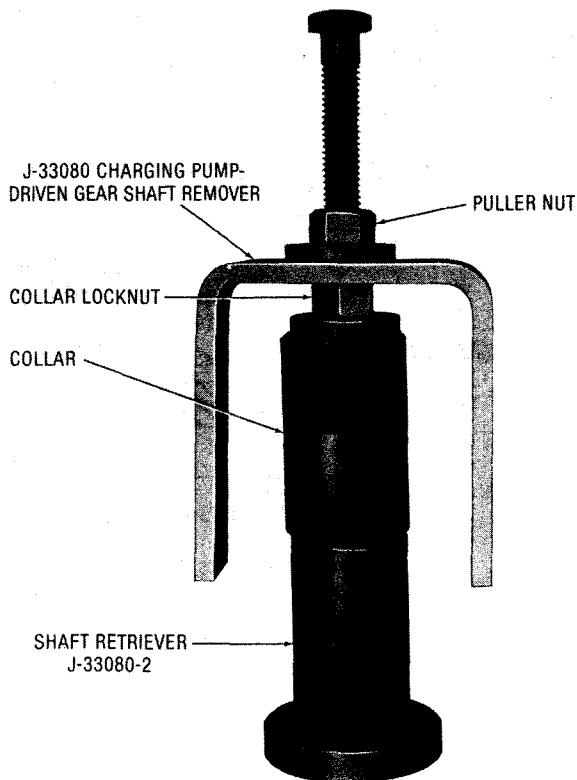


Fig. 6-34. Removing shaft from collet

b. Assembly

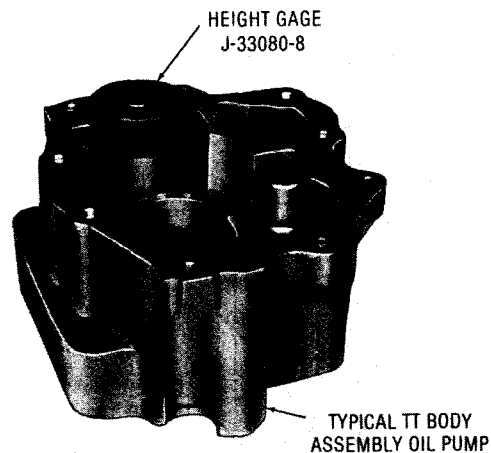
(1) If the driven gear shaft was removed, support the charging pump housing in a press (fig. 6-32).

(2) Position height gage J-33080-8 over the driven gear shaft bore in the pump housing and place the new shaft into the gage; chamfer on the shaft will engage into the housing bore.

(3) Press the shaft until it is flush with the height gage (fig. 6-35).

(4) Install a new seal, spring-loaded lip first, into the rear of the pump body. Press the seal until it seats lightly on the shoulder in the body bore (fig. 6-31).

(5) If the dowel pin was removed, press a new pin to a height of 0.41-0.43 inch (1.04-1.09 mm) above the front surface of the pump body.



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Fig. 6-35. Height gage J-33080-8 in place

(6) If the needle bearings were removed from the driven gear, install new bearings so that the replacer tool rests against the part number end of the bearing race. Press each bearing to a depth of 0.000-0.020 inch (0.50 mm) below the end surface of the driven gear.

(7) Install the driven gear assembly over the gear shaft and into the pump body. Install the drive gear into the pump body. When properly installed, the end faces of both gears will project 0.002-0.003 inch (0.05-0.07 mm) above the front surface of the pump body (measured before gasket is installed). If the end faces of the gears are below the flush line of the pump body, the pump will not perform satisfactorily and should be replaced.

(8) Apply a liberal amount of oil onto the pump gears and install the cover gasket and cover. Position the pump assembly front upward, until ready for installation onto the transmission housing.

6-27. TRANSMISSION HOUSING (TT, TTB, TRT -1)

a. Disassembly (foldout 8,B)

(1) Remove six bolts 13 and lockwashers 14, and remove core hole cover 15 and gasket 16.

REBUILD OF SUBASSEMBLIES

(2) Remove plug 7, but do not remove filter plug 6 unless replacement is necessary. If necessary, measure and record the depth of installed plug 6 prior to removal of the plug.

(3) Remove breather 9.

(4) If the transmission is equipped with an accessory drive gear, remove lip-type oil seal 11. If the transmission is not equipped with an accessory drive gear, remove cup plugs 10 and 12 only if replacement is necessary.

(5) If present, remove plugs 17 and 25, and plug 30 and washer 29.

(6) Remove oil level plugs 26 and 27 from the front face of housing 8.

(7) If present, remove cup plug 28.

(8) Do not remove nameplate 18 and drive screws 19 unless a new nameplate with the correct data stamped on it is available for replacement.

b. Assembly (foldout 8,B)

(1) If nameplate 18 was removed, install the new nameplate (with the correct information stamped on it). Secure the nameplate with four No. 4 x 1/4-inch drive screws 19.

(2) If oil level plugs 26 and 27 were removed, replace them. Tighten the plugs to 14-16 lb ft (19-21 N·m).

(3) If cup plugs 10, 12, or 28 were removed, install new plugs, closed end first, into housing 8. Press each plug against the shoulder in its bore. If lip-type oil seal 11 was removed, install a new seal, spring-loaded lip first, into the rear face of housing 8. Press the seal to a depth of 0.2575-0.2825 inch (6.541-7.175 mm) below the surface adjacent to the bore.

(4) Install breather 9 and tighten it sufficiently to prevent leakage.

(5) Install washer 29 and plug 30. Install drain plug 17. Tighten both plugs 17

and 30 to 33-37 lb ft (45-50 N·m). Install oil filler plug 25. Tighten plug 25 sufficiently to prevent leakage.

(6) If plug 6 was removed, apply non-hardening sealant onto the outside diameter of the new plug. Install the new plug, closed end first, into the passage. Press the plug to the exact depth recorded prior to removal in paragraph 6-27a(2). Install plug 7 and tighten it to 33-37 lb ft (45-50 N·m).

(7) Install core hole cover gasket 16 and cover 15. Retain them with six 3/8-16 x 7/8-inch bolts 13 and lockwashers 14. Tighten the bolts to 26-32 lb ft (36-43 N·m).

6-28. TRANSMISSION HOUSING (TRT -3)

a. Disassembly (foldout 9,A)

(1) Remove plug 7. If plug 6 must be removed, accurately measure and record the depth at which it is installed. Remove plug 6 only if replacement is necessary.

(2) Remove breather 8.

(3) If the transmission is equipped with an accessory drive gear, remove oil seal 13. If the transmission is not equipped with an accessory drive gear, remove cup plugs 9 and 12 if replacement is necessary.

(4) Remove oil check plugs 19 and 20, and oil level tubes 21 and 22.

(5) Remove plugs 23 and 24. If plugs 28 are used, remove them only if necessary.

(6) Do not remove nameplate 10 and drive screws 11 unless a new nameplate with the correct data stamped on it is available for replacement.

b. Assembly (foldout 9,A)

(1) If nameplate 10 was removed, install the new nameplate (with the correct information stamped on it). Secure the nameplate with four No. 4 x 1/4-inch drive screws 11.

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(2) Install two plugs 28, plug 23, and plug 24 into the transmission housing. Tighten the plugs sufficiently to prevent leakage.

(3) Install oil level tubes 21 and 22.

(4) Install oil check plugs 19 and 20 into the transmission housing. Tighten the plugs sufficiently to prevent leakage.

(5) Install a new oil seal 13, spring-loaded lip first, into the rear of housing 26. Press the seal to a depth of 0.255-0.285 inch (6.48-7.23 mm) below the surface adjacent to the bore.

(6) If the transmission is not equipped with an accessory drive gear, install new cup plugs 9 and 12.

(7) Install breather 8 and tighten it sufficiently to prevent leakage.

(8) If plug 6 was removed, coat the outer diameter of a new plug with nonhardening sealer and install, closed end first, into the top of housing 26. Press the plug to the exact depth recorded when it was removed in paragraph 6-28a (1). Install plug 7 and tighten it to 33-37 lb ft (45-50 N·m).

Section 7. ASSEMBLY OF TRANSMISSION

7-1. SCOPE

a. The assembly procedures in this section describe the assembly of the transmission from subassemblies. Refer to the cross-sections of the transmissions (foldouts 1 through 5) for functional location of parts. Refer to parts exploded views (foldouts 6 through 18) for parts identification.

b. Illustrations may not, in some areas, show the specific model being serviced. However, the procedure represented will be correct.

c. Assembly techniques for vehicle-mounted transmissions are presented in paragraph 7-14.

NOTE

Assembly paragraphs are as follows:

<u>Model</u>	<u>Paragraphs</u>
TT 2221-1, 2421-1	7-2, 7-3, 7-4, 7-5, 7-7, 7-10 through 7-14
TTB 2221-1, 2421-1	7-2, 7-3, 7-4, 7-5, 7-6, 7-10 through 7-14
TRT 2221-1, 2421-1	7-2, 7-3, 7-4, 7-8, 7-10 through 7-14
TRT-3	7-2, 7-9, 7-10 through 7-14

7-2. GENERAL INFORMATION FOR ASSEMBLY OF TRANSMISSION

Refer to Section 4 for general assembly information as follows:

<u>Paragraph</u>	<u>Title</u>
4-3	Tools, Equipment
4-4	Replacement Parts
4-5	Careful Handling
4-7	Assembly Procedures
4-9	Tight-fit Flanges
4-11	Torque Specifications
8-1	Wear Limits Data
8-2	Spring Data

7-3. INSTALLATION OF OUTPUT COMPONENTS, TRANSFER-DRIVEN GEAR (-1 models)

NOTE

For -1 models with front and rear outputs without output disconnect, proceed to paragraph 7-3a. For -1 models with front and rear output with output disconnect, proceed to paragraph 7-3b. For -1 models with rear output only, proceed to paragraph 7-3c.

a. One-Piece Output Shaft

(1) Install the transfer-driven gear into the rear of the housing (fig. 7-1).

(2) If shifter shaft hole plug was removed, install a new plug (fig. 7-2). Apply nonhardening sealant onto the outside diameter of the new plug. Install the plug, closed

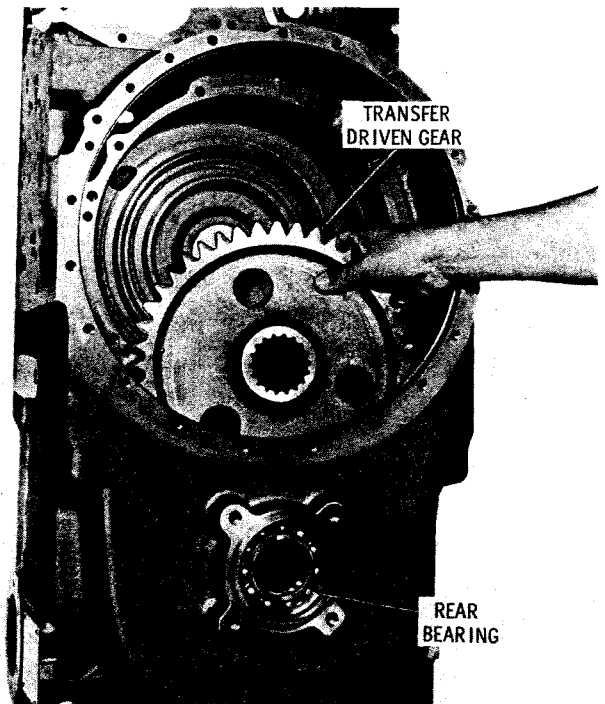
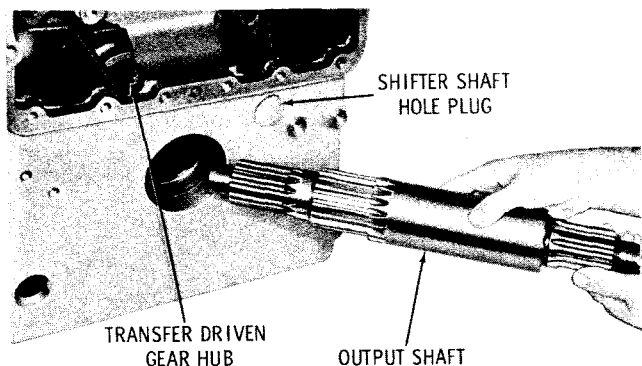


Fig. 7-1. Installing transfer-driven gear (-1 models)



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Fig. 7-2. Installing output shaft (-1 models with one-piece shaft, with outputs at front and rear)

end first, and seal it against the shoulder in the housing bore.

(3) Install the output shaft, double-splined end first, through the front of the housing and the splined hub of the transfer-driven gear (fig. 7-2).

(4) Start bearing 11 (foldout 17,A), the shield side last, into the front bore of the housing.

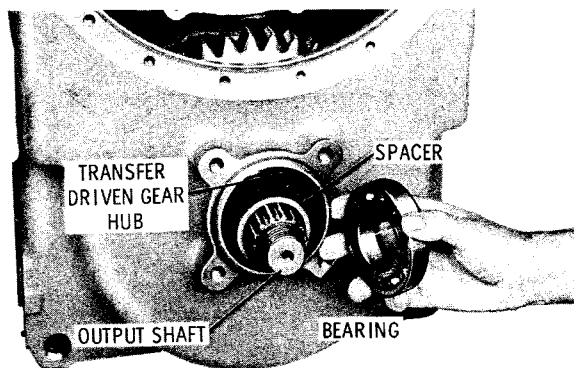
(5) Install the spacer onto the rear end of the output shaft (fig. 7-3). Start the rear bearing, loading groove first, into its bore in the housing, pushing the spacer toward the transfer gear hub.

(6) Supporting the shaft at the front end surface, drive the rear bearing and spacer forward until they are firmly seated against the transfer gear hub.

(7) At the front of the transmission housing, drive the bearing rearward and seat it firmly against the shoulder in the bore. Install the snapping to retain the bearing (fig. 7-4).

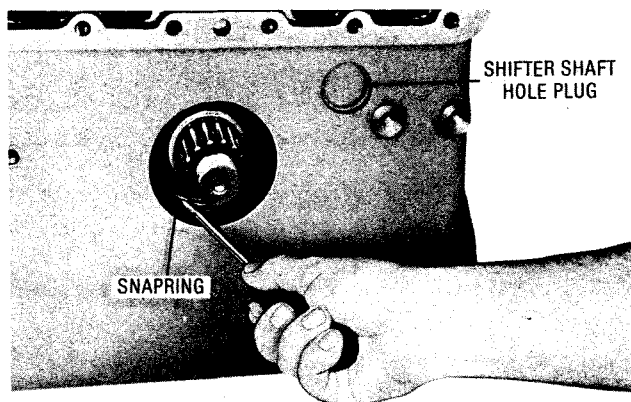
(8) Reseat the rear bearing, if necessary.

(9) Install lip-type oil seal 9 (foldout 17,A), spring-loaded lip first, into the front output bore. Press or drive the seal squarely and lightly against the counterbore in the housing.



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Fig. 7-3. Installing output shaft rear bearing and spacer (-1 models)



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Fig. 7-4. Installing output shaft front bearing snapping (-1 models)

(10) Install lip-type oil seal 30, spring-loaded lip first, into the rear output bore. Press or drive the seal squarely and lightly against the counterbore in the housing.

(11) Proceed to paragraph 7-4.

b. Two-piece Output Shaft

(1) If the front output shaft bearing was removed, replace the bearing, shield side last, into the housing bore (fig. 7-5). Seat the front bearing firmly against the shoulder in the bore, and install the snapping against the bearing outer race.

(2) Install a new output shaft oil seal, spring-loaded lip first, and press it squarely into the bore until it is lightly seated against the counterbore shoulder (fig. 7-5).

ASSEMBLY OF TRANSMISSION

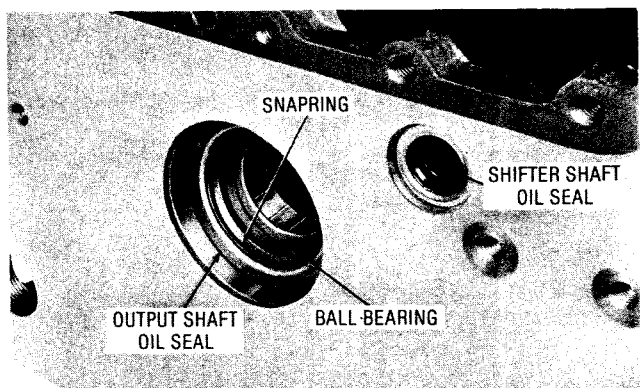


Fig. 7-5. Output shaft front bearing and sealring (-1 models)

(3) Install a new shifter shaft oil seal, spring-loaded lip first, and press it squarely into the bore at the front of the housing, until it is lightly seated against the counterbore shoulder.

(4) Install one ball 14 (foldout 17,A), spring 15, and another ball 14 into front output shaft 13. While holding these balls against the spring pressure, slide disconnect coupling 20, grooved end first, onto shaft 13 until the rear end of the coupling is flush with the shaft rear splines (disengaged position) (fig. 7-6).

(5) Install the front output shaft and assembled disconnect coupling, threaded end first, into the rear output shaft bearing bore (fig. 7-6). Support the inner race of the front output bearing (fig. 7-5), and seat the shoulder of the front output shaft against the bearing.

(6) Install the output shaft center bearing, shield side first, into the web of the transmission housing (fig. 7-7). Press or tap on the bearing outer race to seat it against the shoulder in the housing web bore.

(7) Install the transfer-driven gear (fig. 7-8).

(8) If bushing 25 (foldout 17,A) was removed from rear output shaft 26, install a new bushing. Press the bushing into the front bore of the shaft to a depth of 0.160-0.200 inch (4.06-5.08 mm) below the shaft end surface.

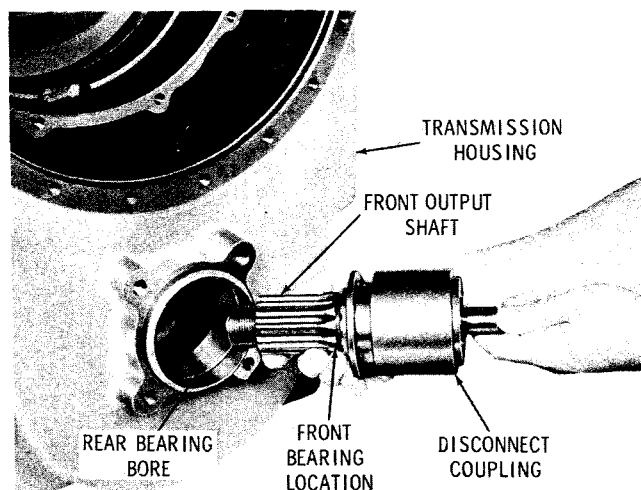


Fig. 7-6. Installing front output shaft and disconnect coupling (-1 models with two-piece output shaft)

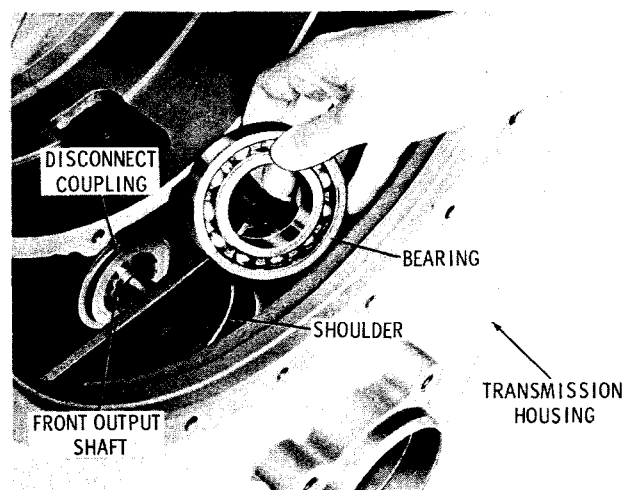
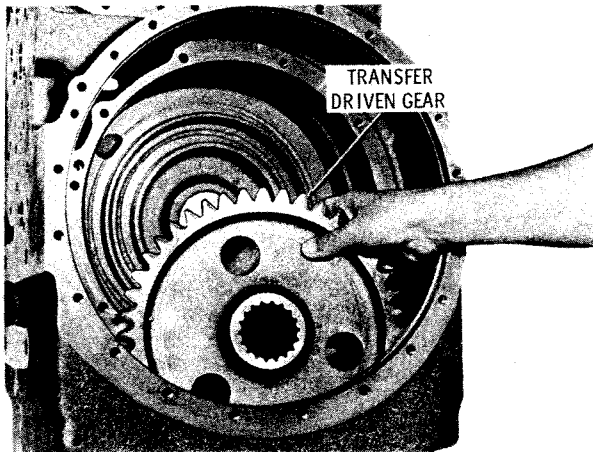


Fig. 7-7. Installing output shaft center bearing (-1 models with two-piece output shaft)

(9) If bearing 28 or spacer 27 were removed from rear output shaft assembly 24, replace them. Install spacer 27 and bearing 28, shield side last, onto the shaft. Seat the bearing firmly against the spacer.

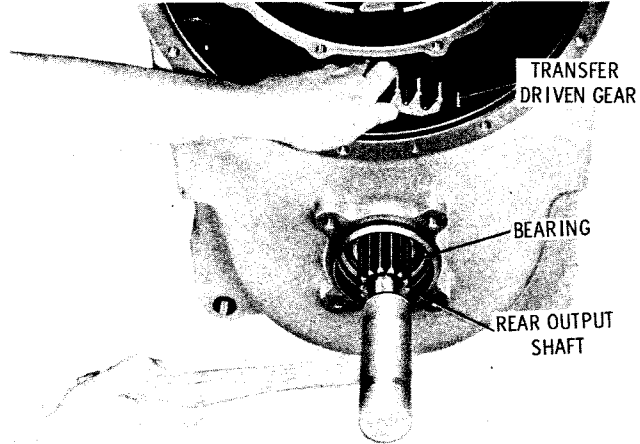
(10) Place the spacer at the front side of the transfer-driven gear hub (fig. 7-9). Install the assembled rear output shaft, splined end first, through the splined hub of

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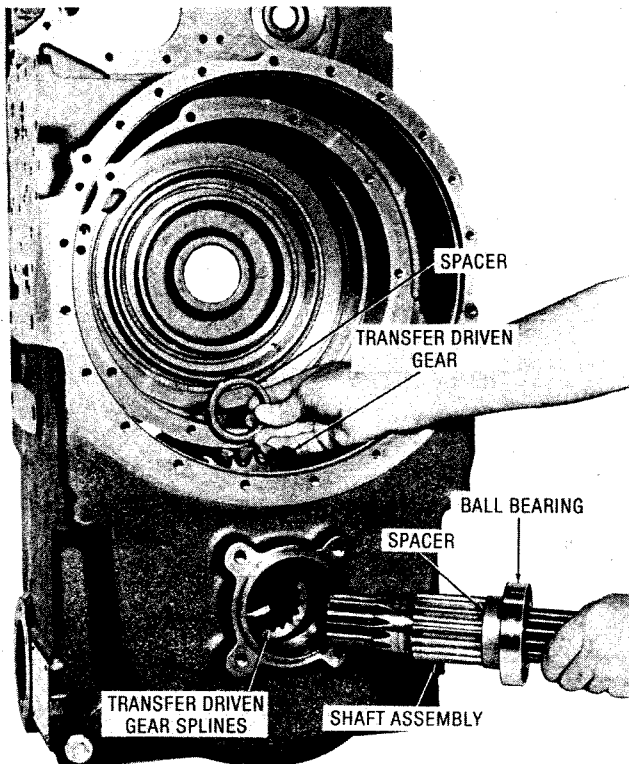
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Fig. 7-8. Installing transfer-driven gear (-1 models)



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Fig. 7-10. Seating rear output shaft in housing (-1 models with two-piece or rear output shaft)

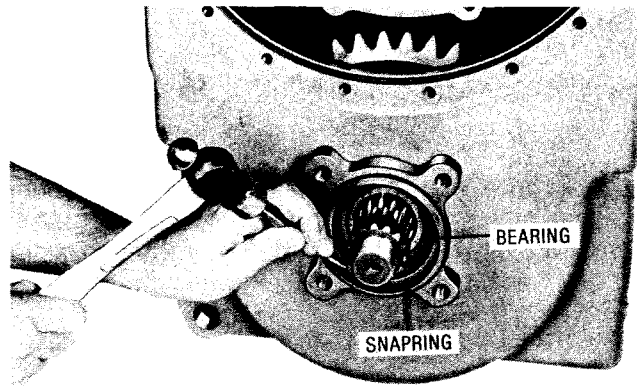


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Fig. 7-9. Installing rear output shaft assembly (-1 models with two-piece or rear output shaft)

the gear, the spacer, and the center support bearing.

(11) Support the transfer-driven gear and drive the rear output shaft assembly and



S2591

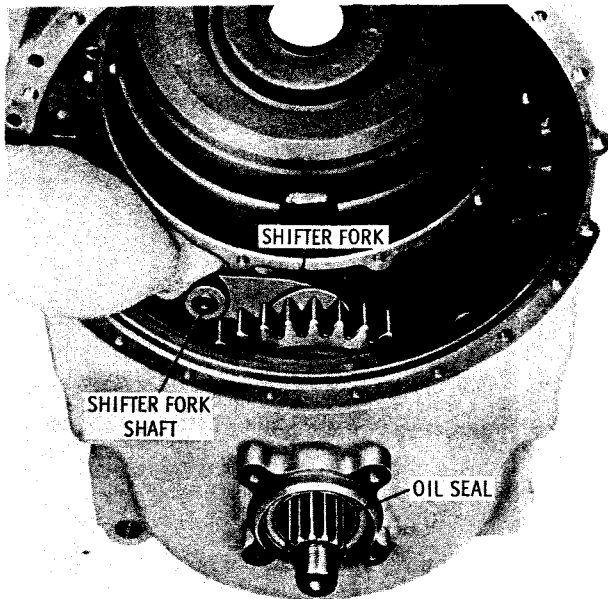
Fig. 7-11. Installing rear output shaft snapping (-1 models with two-piece or rear output shaft)

bearing forward (fig. 7-10). If necessary, reseat the rear bearing by driving on its inner race until the outer race clears the snapping groove in the bore.

(12) Install the snapping and tap progressively around its circumference until it snaps into place against the bearing (fig. 7-11).

(13) Install the new rear output lip-type oil seal, spring-loaded lip first, and press it squarely into the bore until it is lightly seated against the counterbore shoulder (fig. 7-12).

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Fig. 7-12. Installing disconnect shifter fork and shaft (-1 models with two-piece output shaft)

(14) Position the disconnect shifter fork in the groove of the disconnect coupling (fig. 7-12). While holding the fork in position, install the shifter fork shaft, threaded end first, through the oil seal in the front of the housing and fully engage the threads in the shifter fork. Refer to paragraph 3-9c for final adjustment of the shifter fork shaft.

(15) Proceed to paragraph 7-4.

c. Rear Output Shaft (no front output)

(1) Install bearing 21 (foldout 17,A), shield side first, into the web of the transmission housing (refer to fig. 7-7). Press or tap on the bearing outer race to seat it against shoulder in the housing web bore.

(2) Install the transfer-driven gear (fig. 7-8).

(3) If bearing 28 (foldout 17,A) or spacer 27 were removed from rear output shaft 26, replace them. Install spacer 27 and bearing 28, shield side last, onto the shaft. Seat the bearing firmly against the spacer.

(4) Place the spacer at the front side of the transfer-driven gear hub (fig. 7-9). In-

stall the assembled rear output shaft, splined end first, through the splined hub of the gear, the spacer, and the bearing installed in the housing web.

(5) Support the transfer-driven gear, and drive the assembled rear output shaft forward (fig. 7-10). If necessary, reseal the rear bearing by driving on its inner race until the outer race clears the snapping groove in the bore.

(6) Install the snapping and tap progressively around its circumference until it snaps into place against the bearing (fig. 7-11).

(7) Install the new rear output lip-type oil seal, spring-loaded lip first, and press it squarely into the bore until it is lightly seated against counterbore shoulder (refer to fig. 7-12).

(8) Apply nonhardening sealant onto the smaller outside diameter of plug 8 (foldout 17,A) and install the plug into the front output orifice. Press the plug into the bore until its flange is firmly seated against the front surface of the housing.

(9) If shifter shaft hole plug 16 was removed, apply nonhardening sealant onto the outside diameter of the plug. Install the plug, closed end first, and seat it against the shoulder in the housing bore.

7-4. INSTALLATION OF REVERSE AND FORWARD CLUTCHES, GEARING (All -1 Models)

a. Reverse Clutch, Planetary

(1) Position the transmission housing on blocks on its front splitline (fig. 7-13). Install the reverse clutch piston with sealrings (as assembled in para 6-12) into the transmission housing.

NOTE

For vehicle-mounted transmissions, refer to paragraph 7-14.

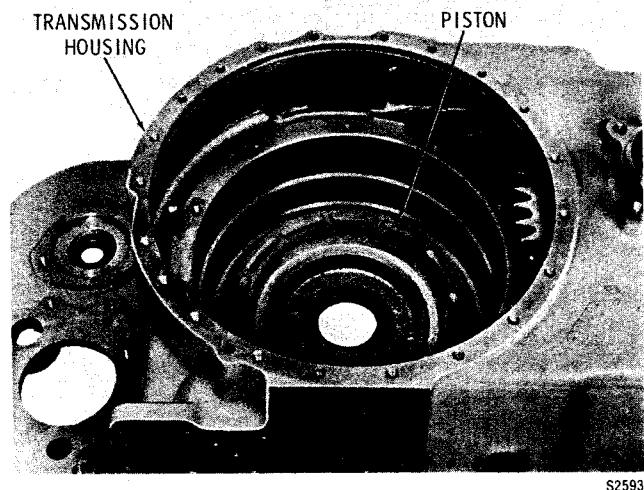


Fig. 7-13. Reverse clutch piston installed

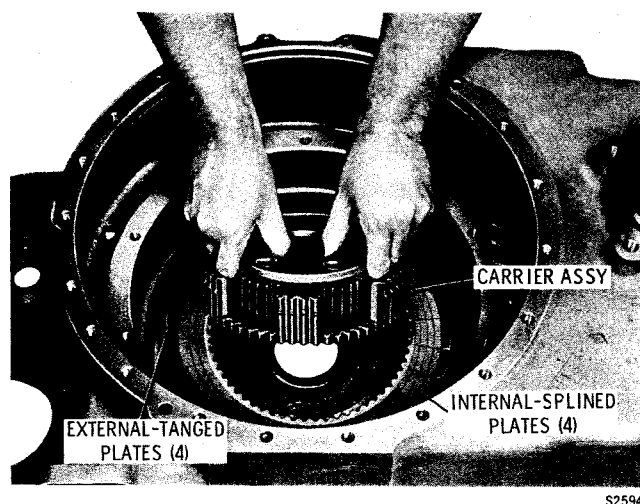


Fig. 7-14. Installing reverse planetary carrier assembly

(2) Beginning with an external-tanged clutch plate, alternately install four external-tanged clutch plates and four internal-splined clutch plates onto the reverse piston (fig. 7-14). Install the reverse planetary carrier assembly, long splines first, into the reverse plates.

(3) Install one external-tanged plate and one internal-splined plate onto the reverse planetary carrier assembly (fig. 7-15).

(4) If transmission is equipped with a high-speed, forward ratio, install sun gear 16 (foldout 9,B), small end first, into the reverse planetary carrier assembly.

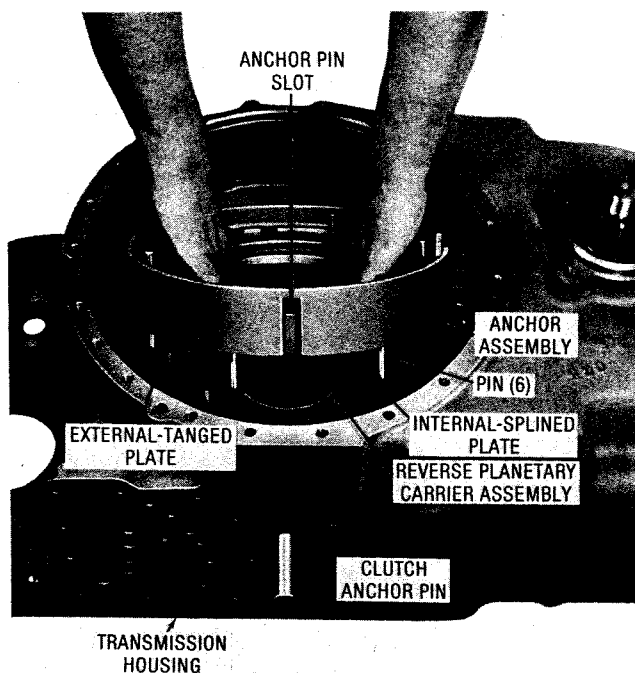


Fig. 7-15. Installing forward-and-reverse clutch anchor assembly

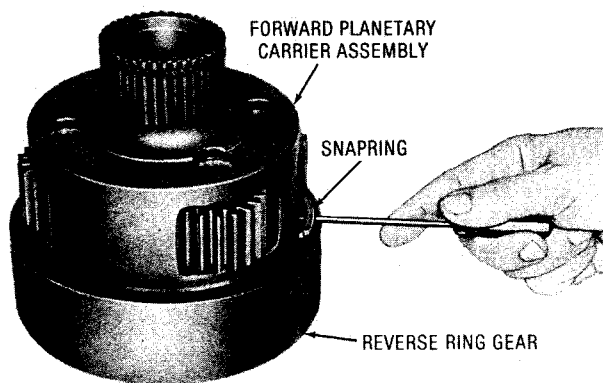
(5) Align the slots of the five reverse, external-tanged clutch plates to receive the pins in the clutch anchor assembly (fig. 7-15). Install the clutch anchor pin into the control valve mounting pad on the left side of the transmission housing. Aligning the anchor pin slot with the clutch anchor pin hole within the transmission housing, install the forward-and-reverse clutch anchor assembly, longer ends of pins downward, and engage the slots of the five external-tanged clutch plates. Be sure that the six notches of the five external-tanged plates are engaged by the six anchor pins in the anchor assembly. (Listen for a sound of the assembly seating when the plates are aligned.)

(6) Push the clutch anchor pin into the slot in the forward-and-reverse clutch anchor assembly (fig. 7-15). Temporarily install a 3/8-16 x 1-inch bolt and a flat washer to retain the anchor pin during subsequent assembly operations. (Refer to fig. 7-17.)

b. Forward Clutch and Planetary

(1) Assemble the forward planetary carrier assembly onto the reverse ring gear (fig. 7-16).

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Fig. 7-16. Installing snapping into reverse ring gear

(2) If the transmission is equipped with a high-speed, forward ratio, install thrust washer 2 (foldout 10,A) into the inner hub of six-pin, forward carrier 3. Apply oil-soluble grease to retain the washer during installation of the carrier.

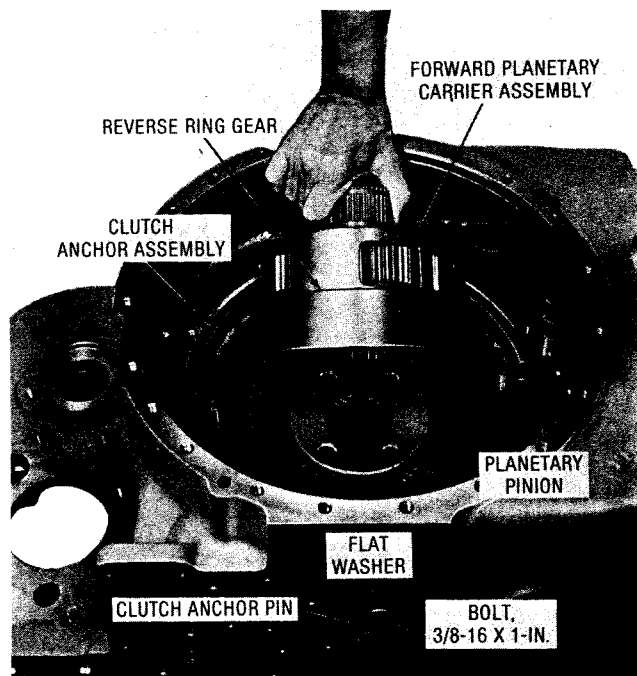
(3) Install the assembled reverse ring gear and forward planetary carrier, engaging the reverse ring gear teeth with the planetary pinion teeth (fig. 7-17).

(4) Place an external-tanged plate between two internal-splined plates and install them as a unit onto the flat side of the forward ring gear (fig. 7-18). Install the assembled clutch plates and ring gear, flat side first, onto the forward planetary carrier assembly, and engage the slots of the external-tanged plate onto the six clutch anchor pins.

(5) Starting with an external-tanged clutch plate, alternately install three external-tanged clutch plates and two internal-splined clutch plates onto the forward ring gear (fig. 7-19).

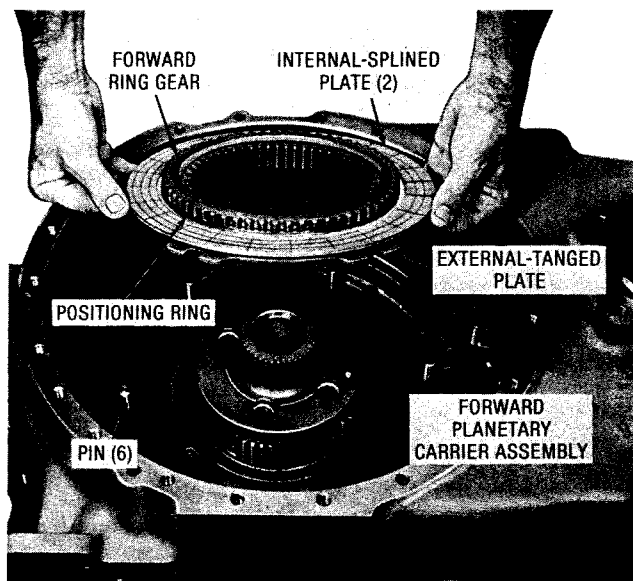
(6) Install the twelve piston return springs and spring guide pins into the holes in the clutch anchor assembly (fig. 7-19).

(7) If plug 39 (foldout 10,A) was removed from forward clutch piston housing 37, replace it. Apply nonhardening sealant onto the plug threads and install the plug into the



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Fig. 7-17. Installing forward planetary carrier assembly and reverse ring gear



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Fig. 7-18. Installing forward ring gear and three clutch plates

housing. Tighten the plug to 14-16 lb ft (19-21 N·m).

(8) Install the forward clutch piston with sealrings (as assembled in para 6-12),

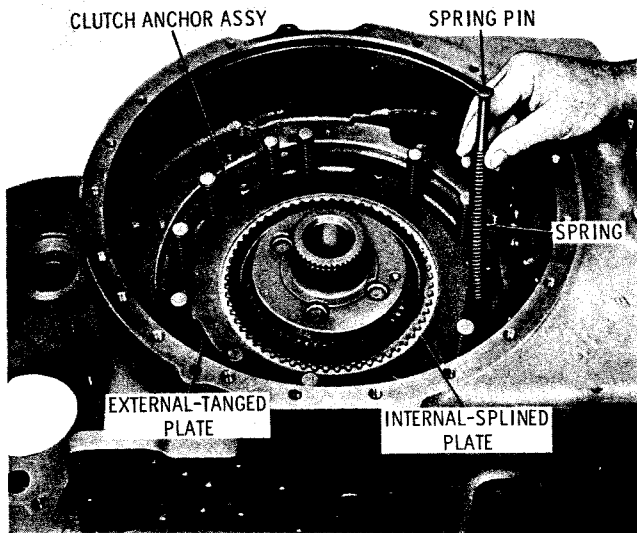


Fig. 7-19. Installing piston return springs and guide pins

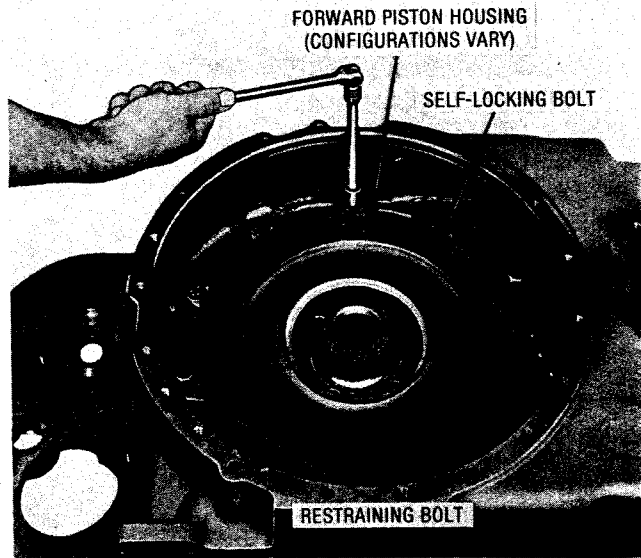


Fig. 7-21. Installing forward clutch piston housing bolts

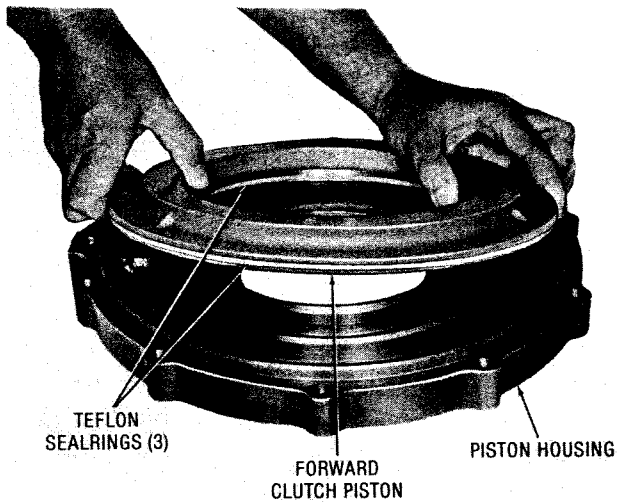


Fig. 7-20. Installing forward clutch piston into piston housing

flat side first, into the forward clutch piston housing (fig. 7-20).

(9) Install the forward clutch piston housing and piston assembly. For earlier models, install flat washers and eight of ten 3/8-16 x 1-1/2-inch self-locking bolts (fig. 7-21). For later models, install eight of ten 3/8-16 x 1-3/4-inch self-locking bolts. Use two of the longer valve body mounting bolts

(3/8-16 x 2-1/2-inch) to draw the piston housing down sufficiently to engage the piston housing bolts. Remove the two draw bolts and install the two remaining flat washers (earlier models) and self-locking bolts. Tighten the bolts to 36-43 lb ft (49-58 N·m).

(10) For TRT-1 models, proceed to paragraph 7-8.

7-5. INSTALLATION OF TRANSFER DRIVE GEAR, HIGH-RANGE CLUTCH (TT, TTB)

a. Transfer Drive Gear

(1) Install the transfer drive gear (as assembled in para 6-17), bearing first, onto the splined hub of the forward planetary carrier (fig. 7-22).

(2) Using a suitable hook-type tool, raise the forward planetary carrier sufficiently to expose the snapping groove in the splined hub, and install the snapping (fig. 7-23).

b. High-Range Clutch and Hub Assembly

(1) If the model is equipped with a power takeoff, install the high-range clutch

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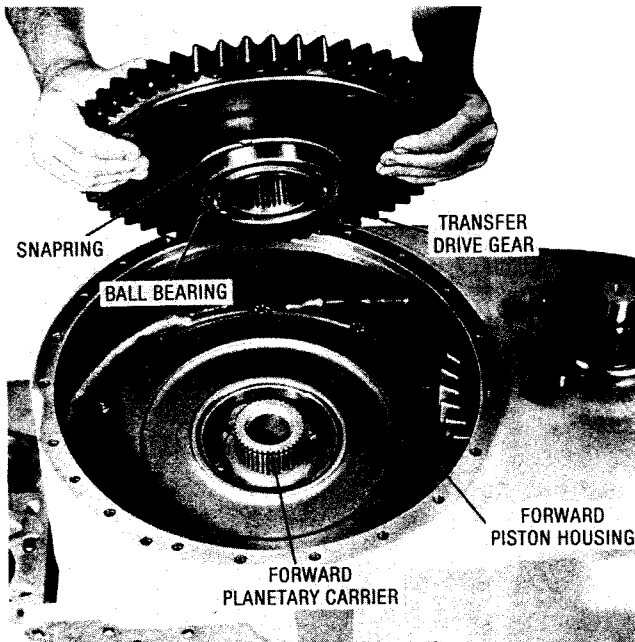


Fig. 7-22. Installing transfer drive gear assembly (TT, TTB)

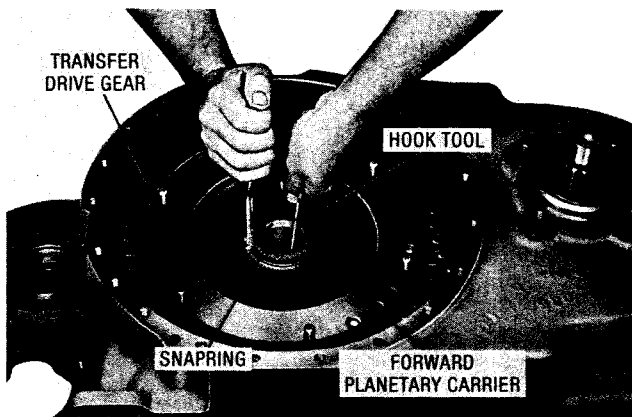


Fig. 7-23. Installing transfer drive gear snapping (TT, TTB)

hub assembly (as assembled in para 6-13) onto the transfer drive gear (fig. 7-24).

(2) If the model is not equipped with a power takeoff, install the high-range clutch and hub assembly (as assembled in para 6-13), splined end of shaft first, into the hub of the transfer drive gear (fig. 7-25).

(3) For TT models, proceed to paragraph 7-7.

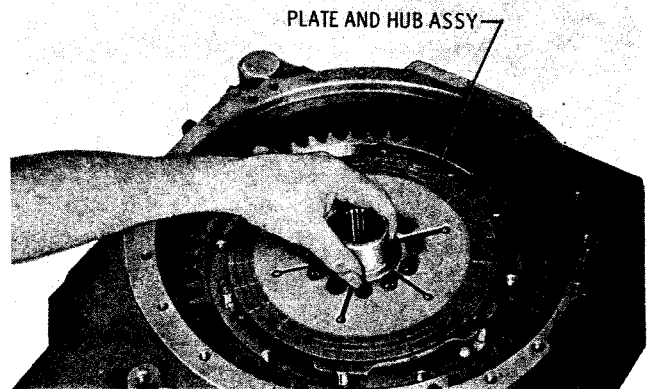


Fig. 7-24. Installing high-range clutch plate and hub assembly (TT, TTB models with power takeoff)



Fig. 7-25. Installing high-range clutch and hub assembly (TT, TTB models without power takeoff)

7-6. INSTALLATION OF HIGH-RANGE CLUTCH PISTON HOUSING, INTERNAL BRAKE, REAR COVER — TTB

a. High-range Clutch Piston Housing

(1) Align the bolt holes in piston housing 22 or 35 (foldout 15,A) with those in transfer drive gear 3, and install the high-range clutch piston housing (as assembled in para 6-11) onto the transfer drive gear. Using a soft hammer, seat the piston housing in the counterbore of the gear.

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(2) Install six 1/2-20 x 2-3/4-inch bolts 24 or 37 and locktabs 23 or 36 to retain piston housing 22 or 35. Tighten the bolts to 83-100 lb ft (113-135 N·m). Bend the locktabs against the bolt heads. Install the step-joint sealrings 25 and one O-ring 26 onto the hub of the piston housing.

b. Internal Brake Components

(1) Install the gasket onto the diaphragm (as assembled in para 6-16) and install the diaphragm onto the transmission housing (fig. 7-26). Install two 3/8-16 x 1-1/8-inch bolts, one 3/8-16 x 2-inch bolt, and three lockwashers to retain the diaphragm. Tighten the bolts to 26-32 lb ft (35-43 N·m).

(2) Install the sealring onto the diaphragm (fig. 7-27). Install the brake hub onto the splined hub of the high-range clutch piston housing. Retain the brake hub with a snapring.

(3) Beginning with an external-tanged brake plate, alternately install six external-tanged plates and five internal-splined plates onto the diaphragm and brake hub (fig. 7-28). Be sure that the slots of the external-tanged

plates engage the six anchor pins in the diaphragm.

(4) Install the ball bearing onto the hub of the high-range clutch piston housing (fig. 7-29).

(5) Install the twelve brake return springs, flared end first, into the recesses in the diaphragm. Twist the springs counter-clockwise to seat them in the recesses and drop the twelve guide pins into the springs.

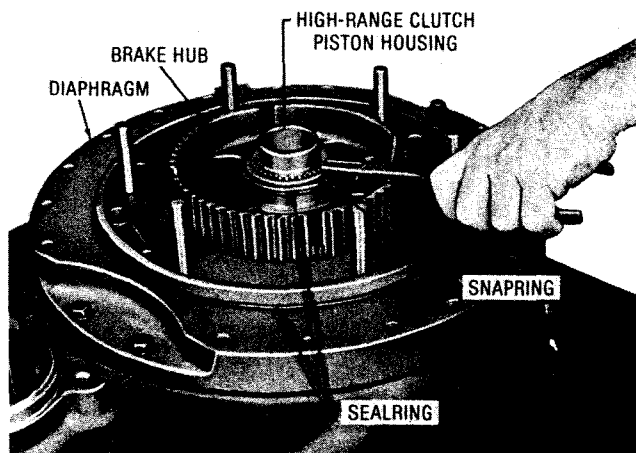


Fig. 7-27. Installing brake hub snapring (TTB)

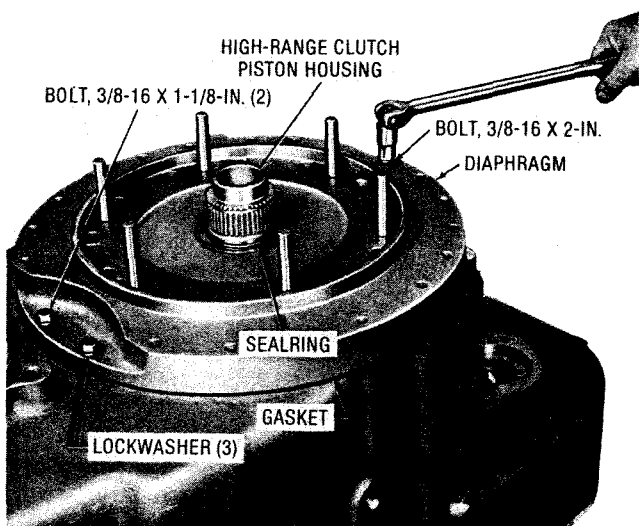


Fig. 7-26. Installing diaphragm bolts (TTB)

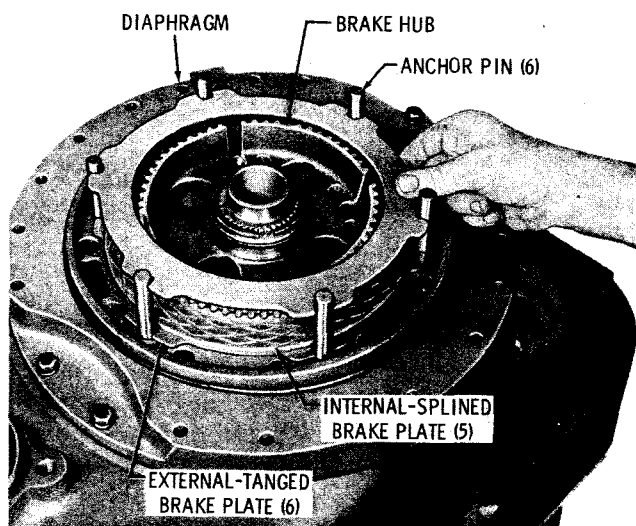


Fig. 7-28. Installing brake plates (TTB)

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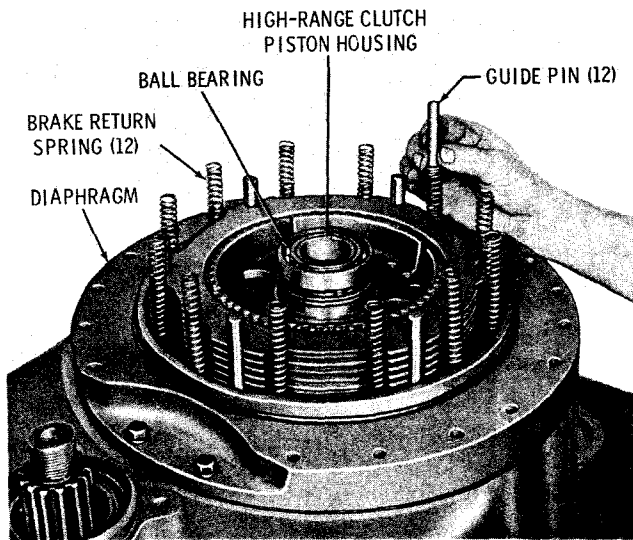


Fig. 7-29. Installing brake return spring guide pins (TTB)

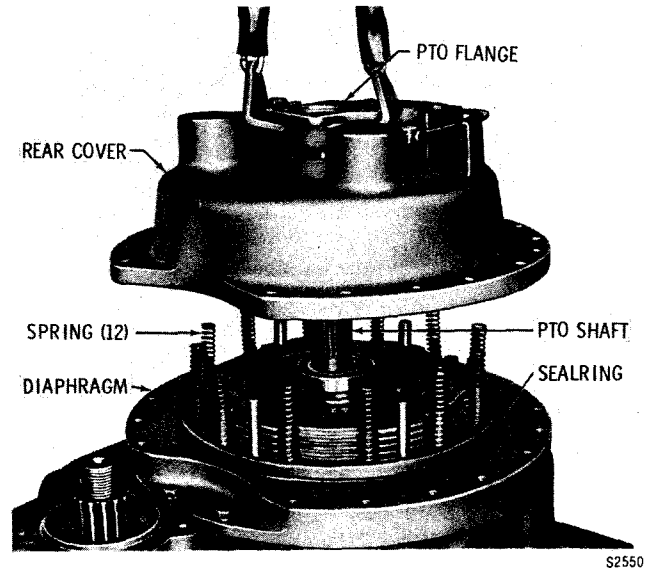


Fig. 7-30. Installing rear cover assembly (TTB)

c. Rear Cover (TTB without converter-driven PTO)

NOTE

For TTB models with converter-driven PTO, proceed to paragraph 7-6d.

(1) Attach a sling to the bolt circle flange of the rear cover assembly (as assembled in para 6-21). Hoist the assembly into position over the transmission in a manner similar to that shown in figure 7-30.

(2) Check to ensure that all of the brake return springs are straight and aligned, and that the sealing is in place on the diaphragm (fig. 7-30).

(3) Lower the assembly to within approximately 1-1/4 inches (32 mm) of the diaphragm and check "by feel" to ensure that each brake return spring will enter its recess in the brake-apply plate.

(4) Continue lowering the assembly until it stops its downward travel and its weight is supported by the brake return springs. Remove the sling. Using two 3/8-16 x 3-inch bolts, draw the rear cover assembly down sufficiently to allow the engagement of the proper bolts. Install sixteen 3/8-16 x

2-3/4-inch bolts 45 (foldout 15,B) and lockwashers 46. Remove the two draw bolts, and install the remaining two 3/8-16 x 2-3/4-inch bolts 45 and lockwashers 46. Tighten the eighteen bolts to 26-32 lb ft (35-43 N·m).

(5) Proceed to paragraph 7-7.

d. Rear Cover (TTB with converter-driven PTO)

(1) Attach a sling to the PTO flange of the rear cover assembly (as assembled in para 6-21). Hoist the assembly into position over the transmission, as shown in figure 7-30.

(2) Check to ensure that all of the brake return springs are straight and aligned, and that the sealing is in place on the diaphragm (fig. 7-30).

(3) As the rear cover assembly is lowered, rotate the PTO flange, so that the shaft splines will engage the high-range clutch hub and the forward-and-reverse sun gear.

(4) Lower the assembly to within approximately 1-1/4 inches (32 mm) of the diaphragm and check "by feel" to ensure that each brake return spring will enter its recess in the brake-apply plate. Attach the rear

cover assembly as described in paragraph 7-6c(4).

(5) Proceed to paragraph 7-10.

7-7. INSTALLATION OF HIGH-RANGE CLUTCH PISTON HOUSING, REAR COVER — TT

a. High-range Clutch Piston Housing (TT with converter-driven PTO)

NOTE

For TT models without converter-driven PTO, proceed to paragraph 7-7c.

(1) Install high-range clutch piston housing 37 (foldout 11,B) and attached parts (as assembled in para 6-11) onto transfer drive gear assembly 2. Align the drive pin holes in the piston with the drive pins in the transfer drive gear. Using a soft hammer, seat the piston housing in the counterbore of the transfer drive gear.

(2) Attach the piston housing to the transfer drive gear with six 1/2-20 x 2-3/4-inch bolts 30 and locktabs 31. Tighten the bolts to 83-100 lb ft (113-135 N·m). Bend the locktabs against the bolt heads.

(3) Install two step-joint sealrings 38 into the grooves in the hub of piston housing 37.

b. Rear Cover Assembly (TT with converter-driven PTO)

(1) Lubricate sealring 2 (foldout 16,D) and install it into its groove in rear PTO cover assembly 22 (and attached parts as assembled in para 6-20). Apply oil-soluble grease onto gasket 1 and install the gasket onto the mounting flange of the rear PTO cover assembly.

(2) Install PTO output flange 27 and flange retaining washer 28 onto the threaded end of PTO shaft assembly 17. Apply molybdenum disulfide grease (Molykote Type G or equivalent) onto the threads of 7/8-14 self-locking nut 29 and install the nut onto PTO

shaft assembly 17. Do not bring the nut to full torque at this time.

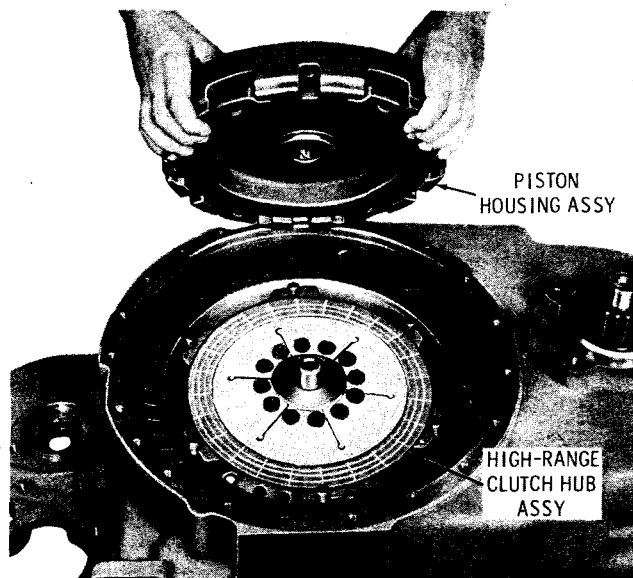
(3) Attach a sling to PTO output flange 27 and hoist the rear PTO cover assembly and attached parts into position over the transmission. While lowering the cover assembly into the transmission, rotate the PTO output flange so that the PTO shaft splines will engage the high-range clutch hub and forward-and-reverse sun gear.

(5) Retain the rear PTO cover assembly with nineteen 3/8-16 x 1-1/8-inch bolts 30 and lockwashers 31. Tighten the bolts to 26-32 lb ft (35-43 N·m). Proceed to paragraph 7-7.

c. High-range Clutch Piston Housing (TT without converter-driven PTO)

(1) Install the high-range clutch piston housing and attached parts (as assembled in para 6-11) onto the transfer drive gear (fig. 7-31). During installation, align and engage the recesses in the piston with the drive pins in the transfer drive gear.

(2) Using a soft hammer, seat the piston housing in the counterbore of the drive gear, and install the six locktabs and six 1/2-



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Fig. 7-31. Installing high-range clutch piston housing assembly (TT)

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(2) Install six 1/2-20 x 2-3/4-inch bolts 24 or 37 and locktabs 23 or 36 to retain piston housing 22 or 35. Tighten the bolts to 83-100 lb ft (113-135 N·m). Bend the locktabs against the bolt heads. Install the step-joint sealrings 25 and one O-ring 26 onto the hub of the piston housing.

b. Internal Brake Components

(1) Install the gasket onto the diaphragm (as assembled in para 6-16) and install the diaphragm onto the transmission housing (fig. 7-26). Install two 3/8-16 x 1-1/8-inch bolts, one 3/8-16 x 2-inch bolt, and three lockwashers to retain the diaphragm. Tighten the bolts to 26-32 lb ft (35-43 N·m).

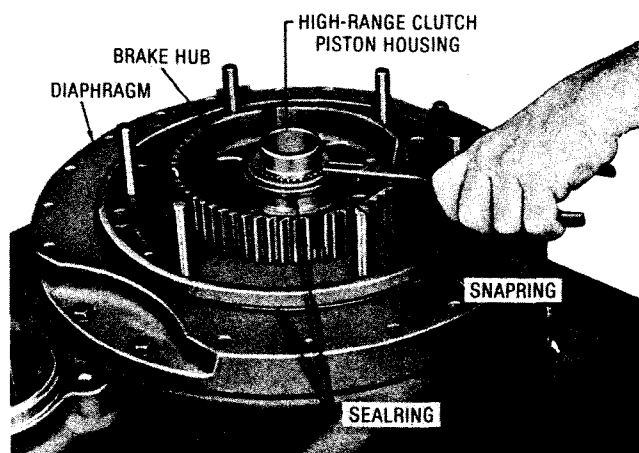
(2) Install the sealring onto the diaphragm (fig. 7-27). Install the brake hub onto the splined hub of the high-range clutch piston housing. Retain the brake hub with a snapring.

(3) Beginning with an external-tanged brake plate, alternately install six external-tanged plates and five internal-splined plates onto the diaphragm and brake hub (fig. 7-28). Be sure that the slots of the external-tanged

plates engage the six anchor pins in the diaphragm.

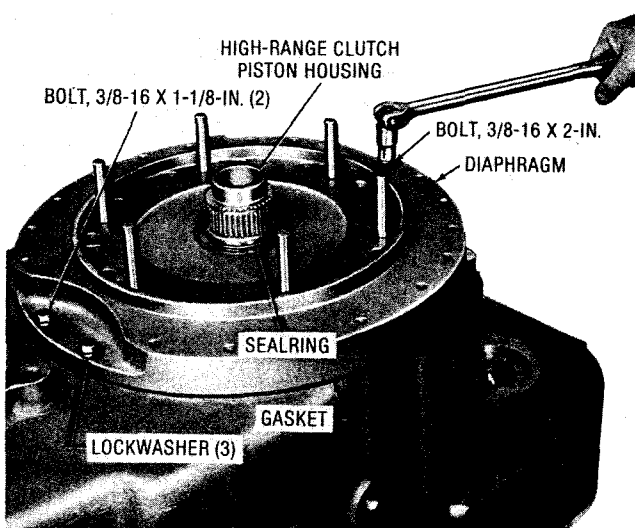
(4) Install the ball bearing onto the hub of the high-range clutch piston housing (fig. 7-29).

(5) Install the twelve brake return springs, flared end first, into the recesses in the diaphragm. Twist the springs counter-clockwise to seat them in the recesses and drop the twelve guide pins into the springs.



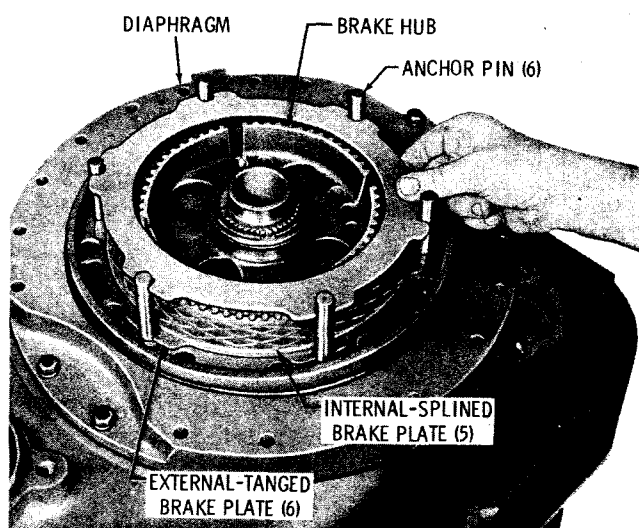
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Fig. 7-27. Installing brake hub snapring (TTB)



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Fig. 7-26. Installing diaphragm bolts (TTB)



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Fig. 7-28. Installing brake plates (TTB)

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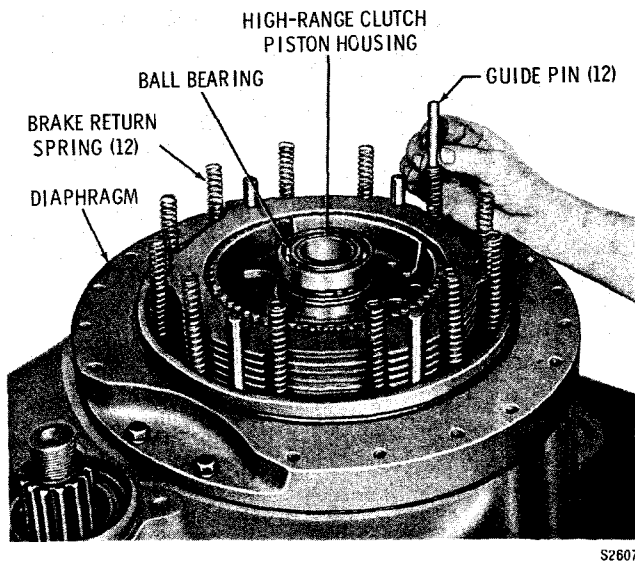


Fig. 7-29. Installing brake return spring guide pins (TTB)

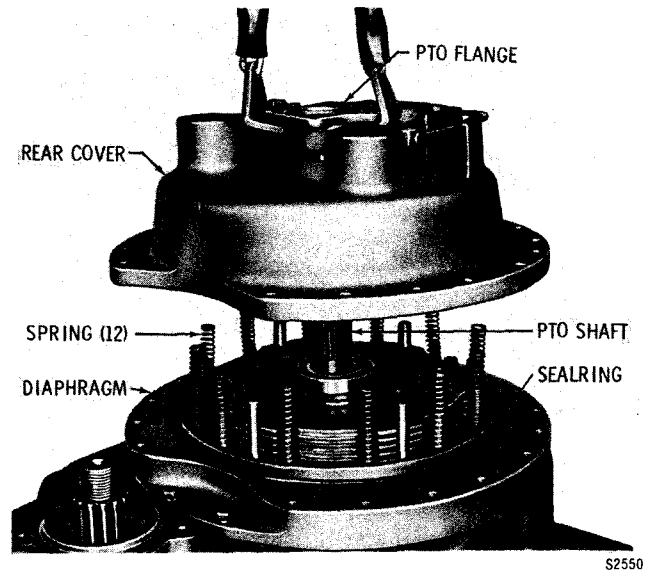


Fig. 7-30. Installing rear cover assembly (TTB)

c. Rear Cover (TTB without converter-driven PTO)

NOTE

For TTB models with converter-driven PTO, proceed to paragraph 7-6d.

(1) Attach a sling to the bolt circle flange of the rear cover assembly (as assembled in para 6-21). Hoist the assembly into position over the transmission in a manner similar to that shown in figure 7-30.

(2) Check to ensure that all of the brake return springs are straight and aligned, and that the sealring is in place on the diaphragm (fig. 7-30).

(3) Lower the assembly to within approximately 1-1/4 inches (32 mm) of the diaphragm and check "by feel" to ensure that each brake return spring will enter its recess in the brake-apply plate.

(4) Continue lowering the assembly until it stops its downward travel and its weight is supported by the brake return springs. Remove the sling. Using two 3/8-16 x 3-inch bolts, draw the rear cover assembly down sufficiently to allow the engagement of the proper bolts. Install sixteen 3/8-16 x

2-3/4-inch bolts 45 (foldout 15,B) and lockwashers 46. Remove the two draw bolts, and install the remaining two 3/8-16 x 2-3/4-inch bolts 45 and lockwashers 46. Tighten the eighteen bolts to 26-32 lb ft (35-43 N·m).

(5) Proceed to paragraph 7-7.

d. Rear Cover (TTB with converter-driven PTO)

(1) Attach a sling to the PTO flange of the rear cover assembly (as assembled in para 6-21). Hoist the assembly into position over the transmission, as shown in figure 7-30.

(2) Check to ensure that all of the brake return springs are straight and aligned, and that the sealring is in place on the diaphragm (fig. 7-30).

(3) As the rear cover assembly is lowered, rotate the PTO flange, so that the shaft splines will engage the high-range clutch hub and the forward-and-reverse sun gear.

(4) Lower the assembly to within approximately 1-1/4 inches (32 mm) of the diaphragm and check "by feel" to ensure that each brake return spring will enter its recess in the brake-apply plate. Attach the rear

cover assembly as described in paragraph 7-6c(4).

(5) Proceed to paragraph 7-10.

7-7. INSTALLATION OF HIGH-RANGE CLUTCH PISTON HOUSING, REAR COVER — TT

a. High-range Clutch Piston Housing (TT with converter-driven PTO)

NOTE

For TT models without converter-driven PTO, proceed to paragraph 7-7c.

(1) Install high-range clutch piston housing 37 (foldout 11,B) and attached parts (as assembled in para 6-11) onto transfer drive gear assembly 2. Align the drive pin holes in the piston with the drive pins in the transfer drive gear. Using a soft hammer, seat the piston housing in the counterbore of the transfer drive gear.

(2) Attach the piston housing to the transfer drive gear with six 1/2-20 x 2-3/4-inch bolts 30 and locktabs 31. Tighten the bolts to 83-100 lb ft (113-135 N·m). Bend the locktabs against the bolt heads.

(3) Install two step-joint sealrings 38 into the grooves in the hub of piston housing 37.

b. Rear Cover Assembly (TT with converter-driven PTO)

(1) Lubricate sealring 2 (foldout 16,D) and install it into its groove in rear PTO cover assembly 22 (and attached parts as assembled in para 6-20). Apply oil-soluble grease onto gasket 1 and install the gasket onto the mounting flange of the rear PTO cover assembly.

(2) Install PTO output flange 27 and flange retaining washer 28 onto the threaded end of PTO shaft assembly 17. Apply molybdenum disulfide grease (Molykote Type G or equivalent) onto the threads of 7/8-14 self-locking nut 29 and install the nut onto PTO

shaft assembly 17. Do not bring the nut to full torque at this time.

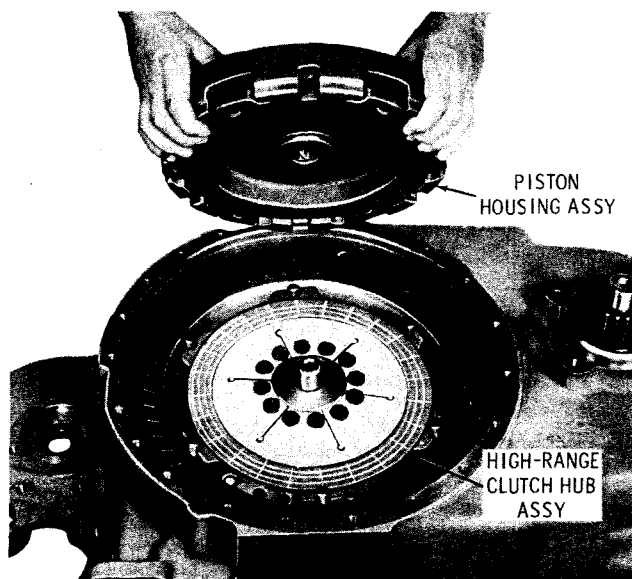
(3) Attach a sling to PTO output flange 27 and hoist the rear PTO cover assembly and attached parts into position over the transmission. While lowering the cover assembly into the transmission, rotate the PTO output flange so that the PTO shaft splines will engage the high-range clutch hub and forward-and-reverse sun gear.

(5) Retain the rear PTO cover assembly with nineteen 3/8-16 x 1-1/8-inch bolts 30 and lockwashers 31. Tighten the bolts to 26-32 lb ft (35-43 N·m). Proceed to paragraph 7-7.

c. High-range Clutch Piston Housing (TT without converter-driven PTO)

(1) Install the high-range clutch piston housing and attached parts (as assembled in para 6-11) onto the transfer drive gear (fig. 7-31). During installation, align and engage the recesses in the piston with the drive pins in the transfer drive gear.

(2) Using a soft hammer, seat the piston housing in the counterbore of the drive gear, and install the six locktabs and six 1/2-



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Fig. 7-31. Installing high-range clutch piston housing assembly (TT)

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20 x 2-3/4-inch bolts (fig. 7-32). Tighten the bolts to 83-100 lb ft (113-135 N·m). Bend the locktabs against the bolts heads.

d. Rear Cover (TT without converter-driven PTO)

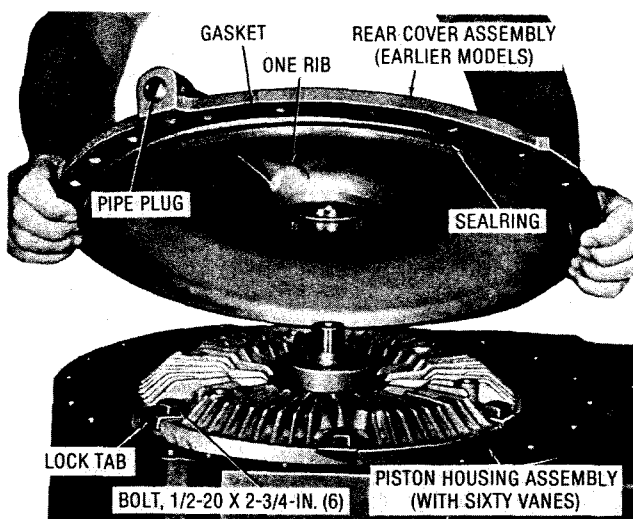
(1) If the transmission is equipped with a speedometer drive assembly, install washer 12 (foldout 16,D) into drive sleeve 13. Install lip-type oil seal 11, metal side first, into drive sleeve 13. Press the seal to a depth of 0.035-0.065 inch (0.88-1.65 mm) below the front surface of the drive sleeve.

(2) Install gasket 7, speedometer drive adapter 8, gasket 9, and sleeve assembly 10 onto rear cover 4. Retain the speedometer components with two 5/16-18 x 2-1/4-inch bolts 15 and lockwashers 14. Tighten the bolts to 13-16 lb ft (18-21 N·m).

(3) If the pipe plug was removed from the rear cover, install the plug (fig. 7-32). If the plug is 1/8-in. NPTF, tighten the plug to 10-12 lb ft (14-16 N·m). If the plug is 3/8-in. NPTF, tighten the plug to 18-22 lb ft (25-29 N·m).

CAUTION

Rear covers having two ribs on the inside of the cover (used



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Fig. 7-32. Installing transmission rear cover (TT)

with later models) must not be used with piston housings having sixty vanes (used with earlier models) (fig. 7-32).

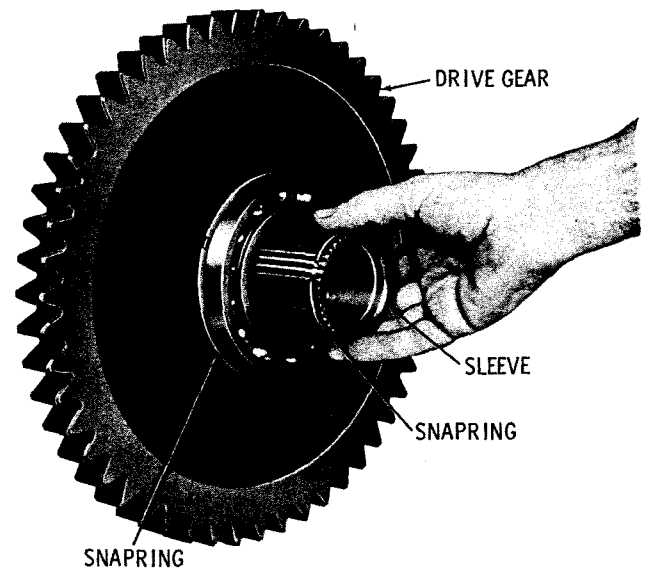
(4) Lubricate the sealring and install it into the groove in the rear cover pilot diameter (fig. 7-32). Apply oil-soluble grease onto the gasket and install the gasket onto the rear cover pilot diameter. Install the rear cover onto the transmission housing and retain it with nineteen 3/8-16 x 1-1/8-inch bolts and lockwashers. Tighten the bolts to 26-32 lb ft (35-43 N·m).

(5) Proceed to paragraph 7-10.

7-8. INSTALLATION OF TRANSFER DRIVE GEAR, HOUSING ADAPTER, LOW-RANGE CLUTCH, HIGH-RANGE CLUTCH (TRT-1)

a. Transfer Drive Gear, Housing Adapter

(1) Install the snapping into the groove nearer the end of the high-range sun gear splined sleeve. Install the sleeve into the transfer drive gear assembly at the side which has a smooth bore in the hub (fig. 7-33).



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Fig. 7-33. Installing high-range sun gear sleeve into transfer drive gear (TRT-1)

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(2) Install the transfer drive gear and splined sleeve, bearing with snapping first, onto the forward planetary carrier (fig. 7-34).

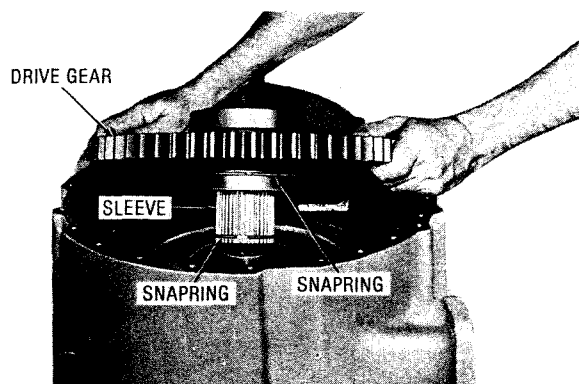
(3) Install the gasket and sealring onto the rear housing adapter assembly. Install the adapter assembly (fig. 7-35).

(4) Install the sixteen 3/8-16 x 1-1/8-inch bolts, with lockwashers, to retain the adapter (fig. 7-36). Tighten the bolts to 26-32 lb ft (36-43 N·m).

b. Low-Range Clutch, High-Range Planetary

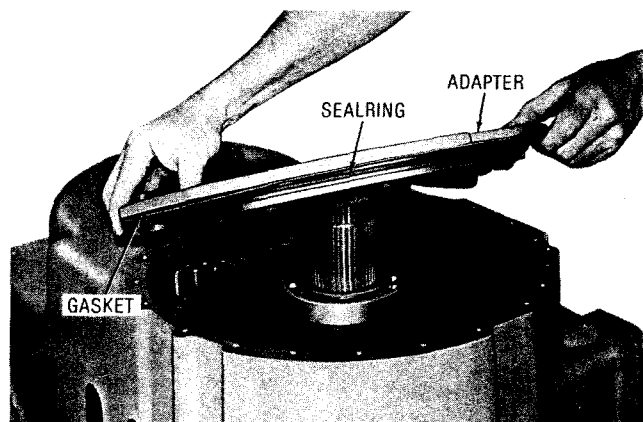
NOTE

New Teflon sealrings may require forming by hand to help



S1467

Fig. 7-34. Installing transfer drive gear assembly (TRT-1)



S1468

Fig. 7-35. Installing rear housing adapter (TRT-1)

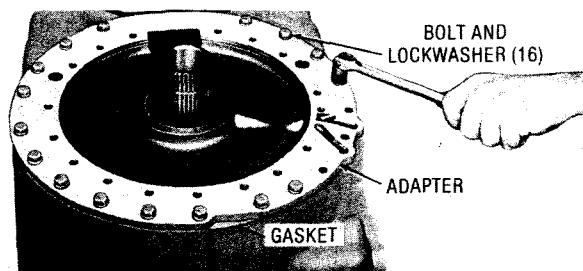
retain their proper circular shape. Wrap them in a circle around an object about two-thirds the diameter of the groove they fit.

(1) Install two Teflon step-joint sealrings 12 (foldout 12,A) into the grooves in the front hub of low-range clutch drum 15. Use oil-soluble grease to retain them.

(2) Install low-range clutch drum assembly 13 onto the high-range sun gear sleeve (fig. 7-37).

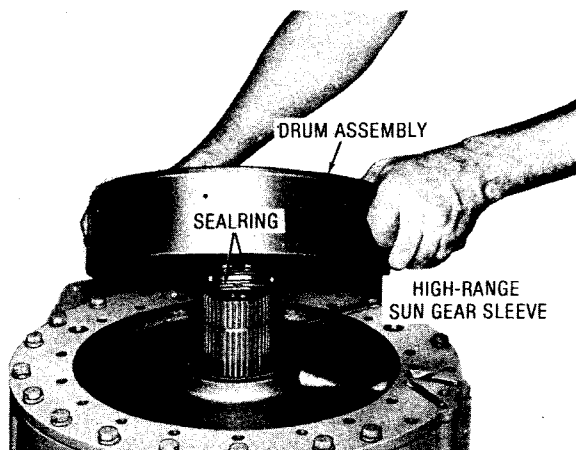
(3) Install snapping 25 (foldout 12,A) into the groove in the high-range sun gear sleeve.

(4) Install one low-range, internal-splined clutch plate into the low-range clutch drum (fig. 7-38). Install the high-range ring



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Fig. 7-36. Installing rear housing adapter bolts (TRT-1)



S1416

Fig. 7-37. Installing low-range clutch drum assembly (TRT-1)

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gear, positioning ring first, into the clutch plate splines.

(5) Beginning with an external-splined plate, alternately install three external- and three internal-splined, low-range clutch plates (fig. 7-39).

(6) Install the low-range clutch backplate, flat side first, into the low-range clutch drum (fig. 7-39).

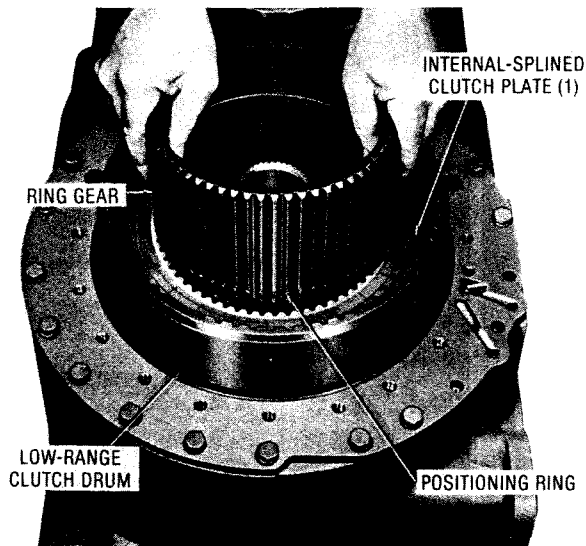
(7) Install the internal snapping which retains the clutch backplate (fig. 7-40).

(8) Install the high-range planetary sun gear, thrust washer upward, onto the splines of the sun gear sleeve (fig. 7-40).

(9) Install high-range planetary carrier assembly into high-range ring gear (fig. 7-41).

c. High-Range Clutch, Rear Housing

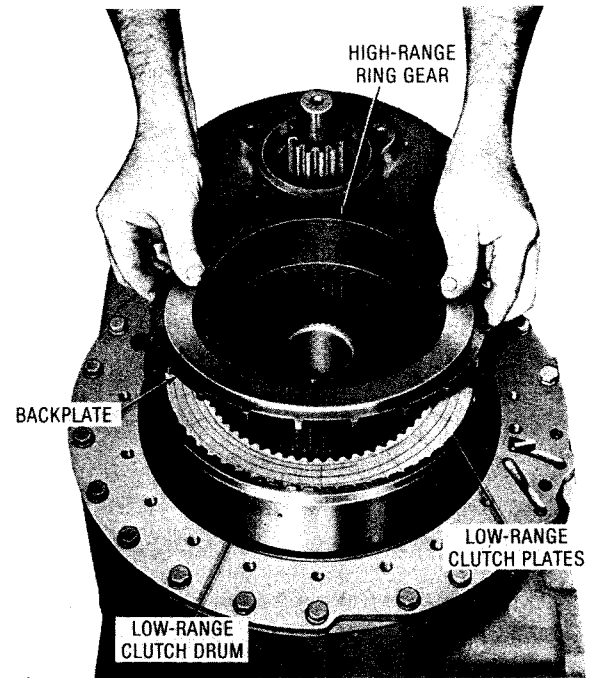
(1) Install the clutch anchor pin into the rear housing (as rebuilt in paragraph 6-11). Leave the flat-milled end of the pin extending at the inside of the housing (fig. 7-42).



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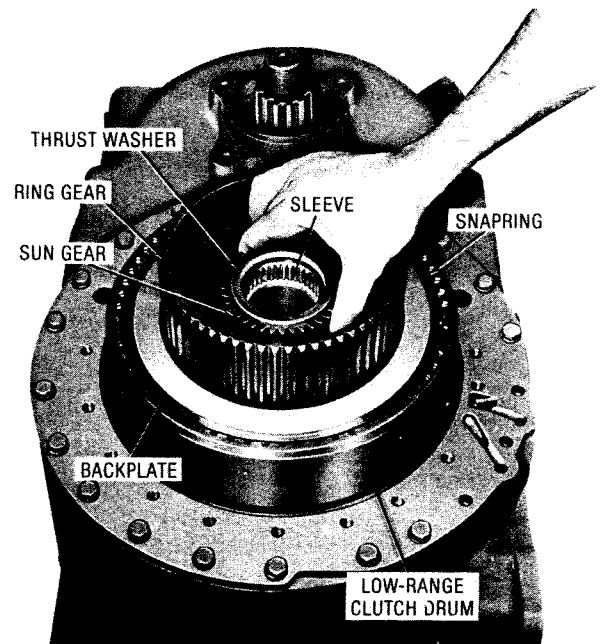
Fig. 7-38. Installing high-range ring gear (TRT-1)

(2) Position the high-range clutch anchor assembly 12 (foldout 12,B), pins up-



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Fig. 7-39. Installing low-range clutch backplate (TRT-1)



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Fig. 7-40. Installing high-range sun gear (TRT-1)

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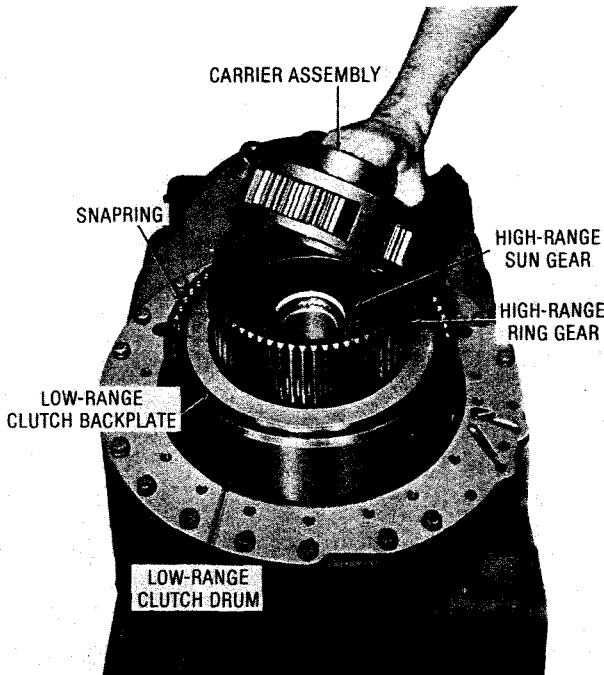


Fig. 7-41. Installing high-range planetary carrier assembly (TRT-1)

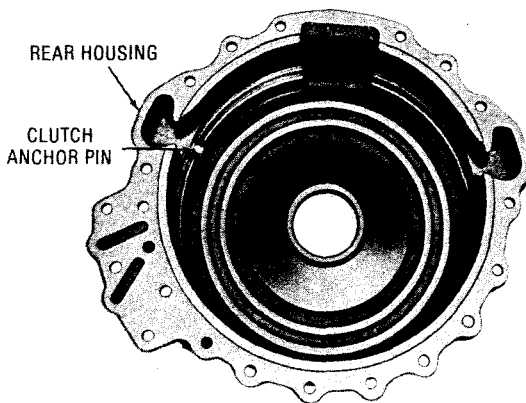


Fig. 7-42. Rear housing and piston assembly (TRT-1)

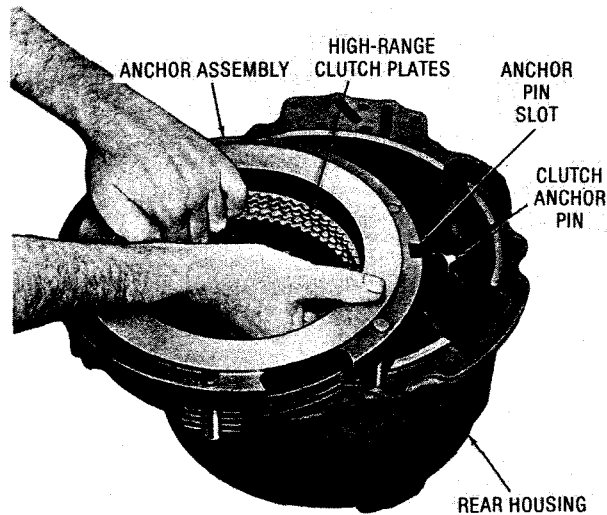


Fig. 7-43. Installing high-range clutch anchor and plates (TRT-1)

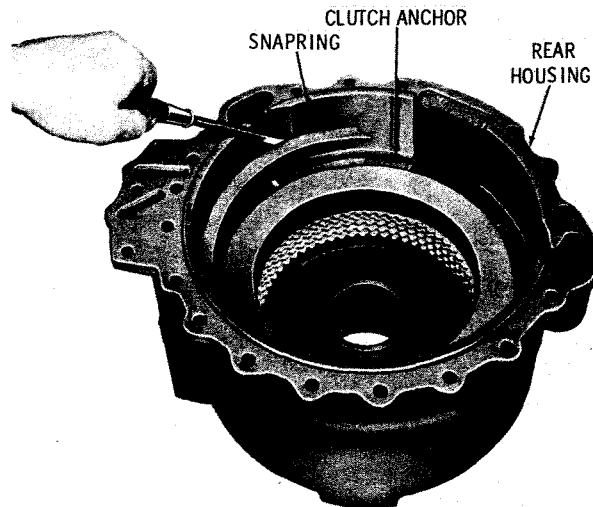


Fig. 7-44. Installing clutch anchor snapping (TRT-1)

ward on a flat surface. Beginning with an internal-splined clutch plate, alternately install five internal-splined and five external-tanged, high-range clutch plates. Engage the external tangs with the clutch anchor pins.

(3) Grasp the entire anchor and plate assembly to hold the parts together. Install

the anchor and plates into the rear housing, aligning the anchor pin slot with the clutch anchor pin (fig. 7-43).

(4) Install the heavy internal snapping which retains the clutch anchor (fig. 7-44). Note the position of the ends of the snapping in relation to the two slightly extended pins in the anchor.

(5) If bearing 6 (foldout 16,A) was removed from shaft 5, install the bearing and

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snapping 7. Press the assembled shaft and bearing, splined end first, into the rear of housing 2. Seat the bearing against the shoulder in the housing.

(6) Install the internal snapping which retains the shaft rear bearing (fig. 7-45).

(7) Install the sealing into the groove in the rear bore of the rear housing (fig. 7-45). Install the retainer, chamfered side first.

(8) Install the snapping which holds the oil retainer in the rear of the rear housing (fig. 7-46).

(9) Install the rear housing gasket onto the rear housing, using oil-soluble grease to retain it. Install the rear housing onto the transmission (fig. 7-47).

NOTE

Rotate the transmission output shaft slowly to engage the splines of the high-range clutch plates with the splines of the high-range ring gear.

(10) Install three 3/8-16 x 1-1/2-inch bolts and lockwashers, and seventeen 3/8-16 x 1-1/8-inch bolts and lockwashers to retain

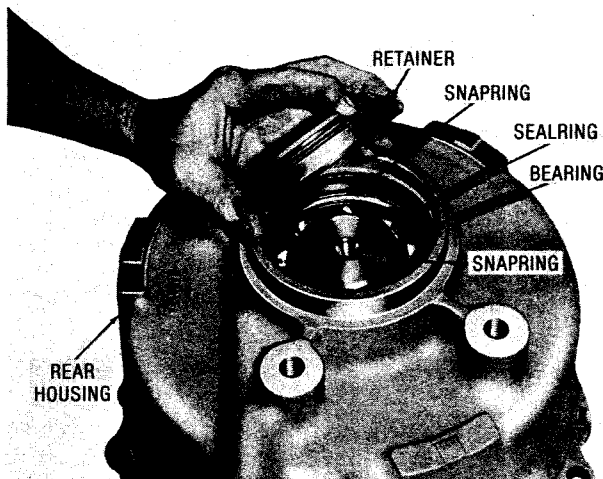


Fig. 7-45. Installing oil retainer (TRT-1)

the rear housing on the adapter (fig. 7-48). Tighten the bolts to 26-32 lb ft (35-43 N·m).

(11) Proceed to paragraph 7-10.

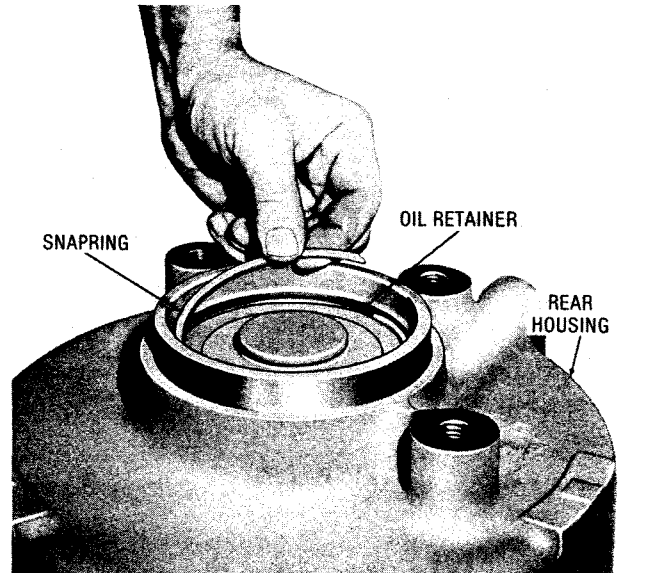


Fig. 7-46. Installing oil retainer snapping (TRT-1)

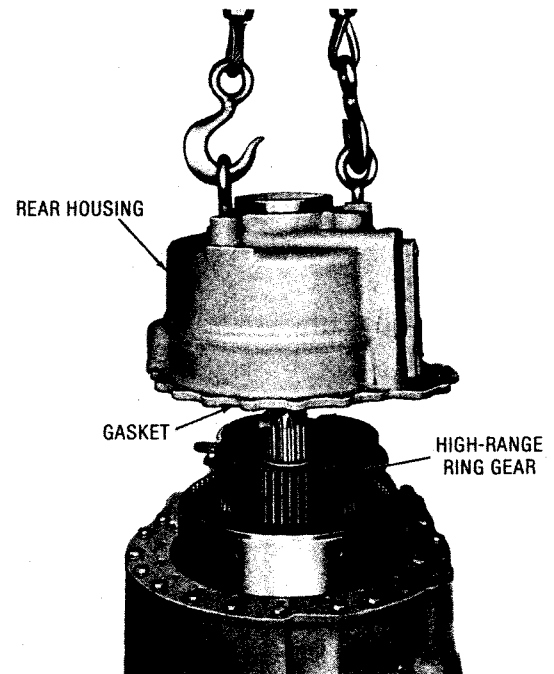


Fig. 7-47. Installing transmission rear housing assembly (TRT-1)

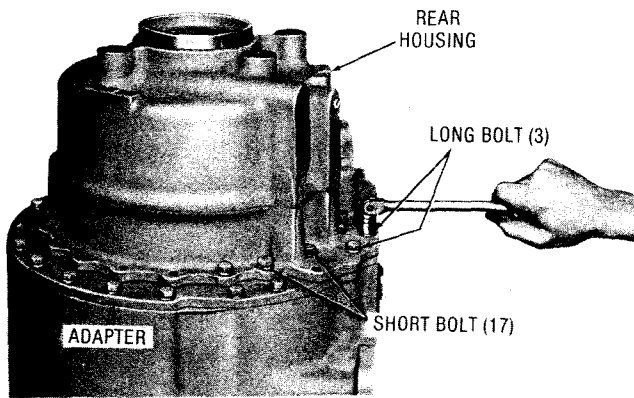


Fig. 7-48. Installing rear housing bolts (TRT-1)

7-9. ASSEMBLY OF TRT-3 MODELS

a. Reverse Clutch and Planetary (TRT-3 models)

(1) Position the transmission housing on blocks on its front splitline (refer to fig. 7-13). Install the reverse clutch piston with sealrings (as assembled in para 6-12) into the transmission housing.

NOTE

For vehicle-mounted transmissions, refer to paragraph 7-14.

(2) Beginning with an external-tanged clutch plate, alternately install four external-tanged clutch plates and four internal-splined clutch plates onto the reverse piston (refer to fig. 7-14). Install the reverse planetary carrier assembly, long splines first, into the reverse plates.

(3) Install one external-tanged plate and one internal-splined plate onto the reverse planetary carrier assembly (refer to fig. 7-15).

(4) Align the slots of the five reverse, external-tanged clutch plates to receive the pins in the clutch anchor assembly (fig. 7-49). Install the clutch anchor pin into the control valve mounting pad on the left side of the transmission housing. Aligning the anchor pin slot with the clutch anchor pin hole within the transmission housing, install the forward-

and-reverse clutch anchor assembly, longer ends of the pins downward, and engage the slots of the five external-tanged clutch plates. Be sure that the six notches of the five external-tanged plates are engaged by the six anchor pins in the anchor assembly. (Listen for a sound of the assembly seating when the plates are aligned.)

(5) Push the clutch anchor pin into the slot in the forward-and-reverse clutch anchor assembly (fig. 7-49). Temporarily install a 3/8-16 x 1-inch bolt and a flat washer to retain the anchor pin during subsequent assembly operations (refer to fig. 7-17).

(6) For TRT 2221-3, 2421-3 with overdrive, proceed to paragraph 7-9b. For TRT 2221-3, 2421-3 with underdrive, proceed to paragraph 7-9e. For TRT 2211-3, 2411-3 models, proceed to paragraph 7-9h.

b. Forward Clutch, Planetary and Adapter Assembly (TRT 2221-3, 2421-3 overdrive models)

(1) Beginning with an internal-splined clutch plate, alternately install two internal-

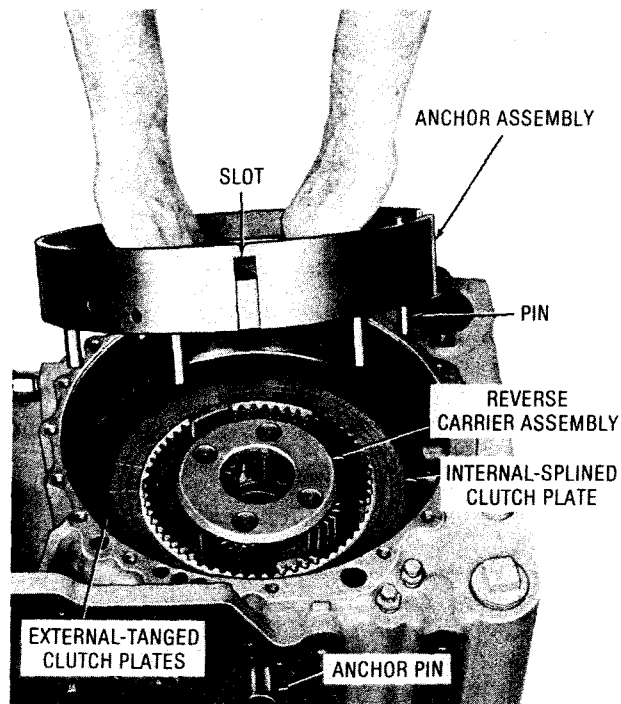


Fig. 7-49. Installing forward-and-reverse clutch anchor assembly (TRT-3)

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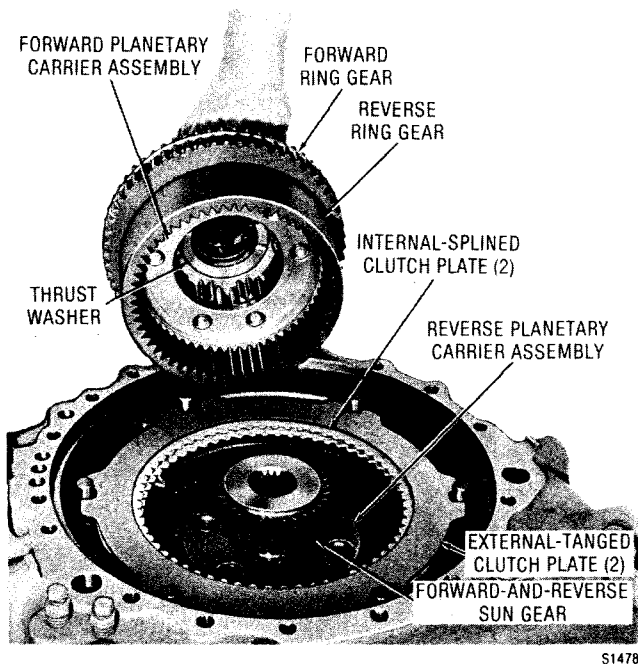


Fig. 7-50. Installing forward planetary carrier assembly and attached parts (TRT-3)

splined plates and two external-tanged plates (fig. 7-50).

(2) Install the forward-and-reverse sun gear into the reverse planetary carrier assembly (fig. 7-50).

(3) Install ring gear 1 (foldout 10,B) onto carrier assembly 30. Retain it with snapping 11. Install ring gear 14, longer ends of external splines first, onto carrier assembly 30.

(4) Install retainer 21, flat side first, onto the rear of carrier assembly 30. Install bearing assembly 22 against the shoulder at rear of carrier assembly 30.

(5) Install the thrust washer into the forward carrier assembly, using oil-soluble grease to retain it (fig. 7-50).

(6) Install the forward carrier assembly, as assembled in steps (3), (4), and (5), meshing its teeth with those of the reverse carrier pinions and the forward sun gear (fig. 7-50). Also, mesh the external splines of the forward ring gear with the installed internal-splined clutch plates.

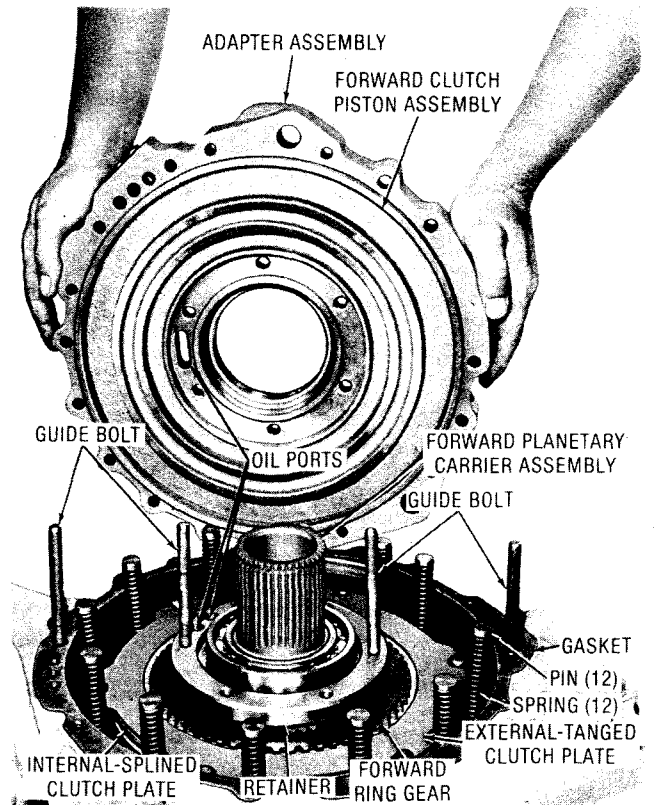


Fig. 7-51. Installing rear housing adapter assembly (TRT-3 overdrive)

(7) Install another internal-splined clutch plate and another external-tanged plate above the positioning ring on the forward ring gear (fig. 7-51).

(8) Install twelve clutch piston return springs and twelve pins (fig. 7-51).

(9) Install the adapter gasket onto the transmission housing (fig. 7-51). Install headless guide bolts at the four positions shown in figure 7-51.

(10) Install forward clutch piston, with sealrings, flat side first, into the rear housing adapter assembly (fig. 7-51).

(11) Install the adapter assembly, aligning oil ports in the adapter and retainer (fig. 7-51).

(12) Install two 3/8-16 x 2-3/4-inch bolts temporarily to pull the adapter assembly down against the piston return springs (fig. 7-52).

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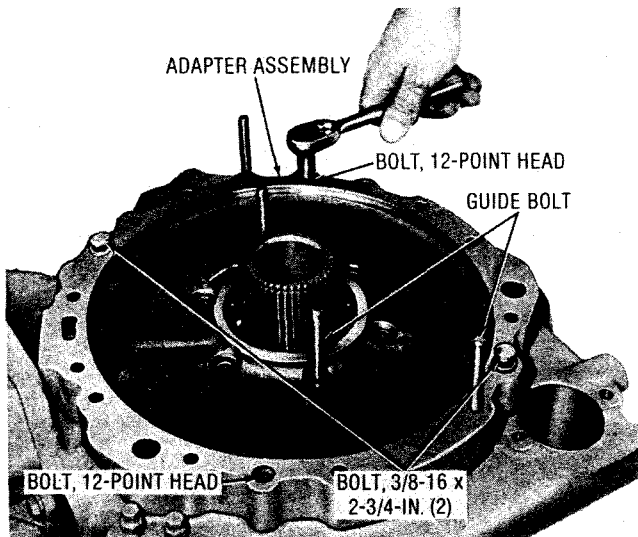


Fig. 7-52. Installing adapter assembly bolts (TRT-3 overdrive)

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(13) Install two 3/8-16 x 1-3/4-inch, 12-point-head bolts into the recessed holes at each edge of the adapter assembly (fig. 7-52). Remove the two outer guide bolts and the temporary pull-down bolts. Tighten the 12-point-head bolts to 36-43 lb ft (49-58 N·m).

(14) Install six 3/8-24 x 1-1/4-inch, self-locking bolts into the inner circle of bolt holes. Remove the two inner guide bolts to install the last two bolts. Tighten the bolts to 41-49 lb ft (56-66 N·m).

c. Installation of Low-Range Clutch, High-Range Planetary (TRT 2221-3, 2421-3 overdrive models)

NOTE

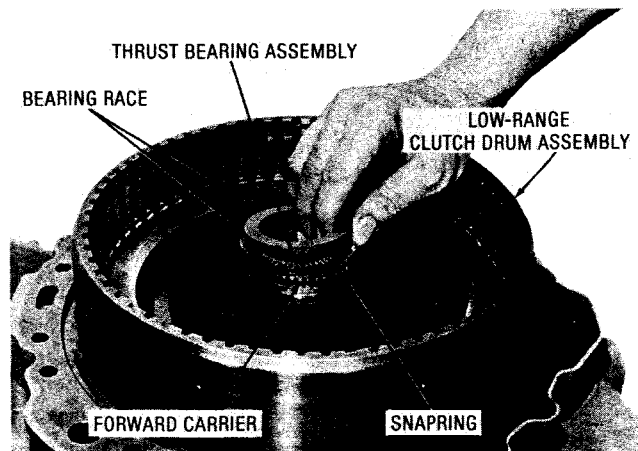
New Teflon sealings may require forming by hand to help retain their proper circular shape. Wrap them in a circle around an object about two-thirds the diameter of the groove they fit.

(1) Install two step-joint sealings 1 (foldout 14,A) into the grooves in the hub of low-range clutch drum assembly 2. Use oil-soluble grease to retain them.

(2) Install the low-range clutch drum assembly.

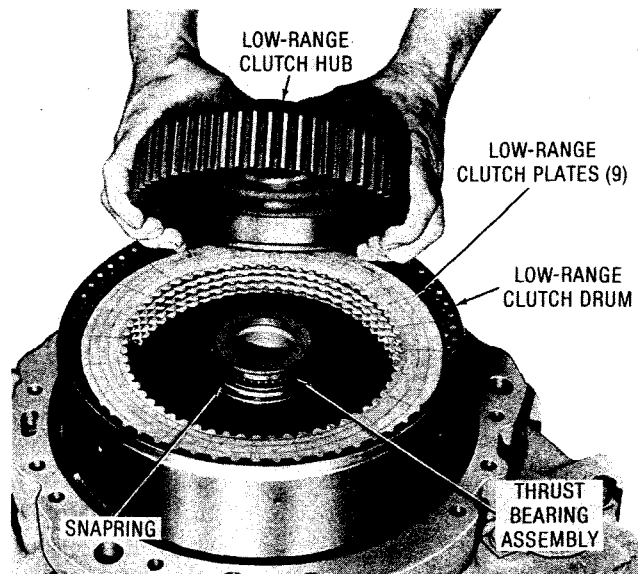
(3) Install the snapping which retains the clutch drum assembly on the forward carrier (fig. 7-53). Install two bearing races and bearing assembly (fig. 7-53). The thinner, lipped race is installed, flat side first, against the forward carrier hub.

(4) Beginning with an internal-splined clutch plate, alternately install five internal-splined and four external-splined clutch plates (fig. 7-54).



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Fig. 7-53. Installing needle roller thrust bearing assembly (TRT-3 overdrive)



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Fig. 7-54. Installing low-range clutch hub (TRT-3 overdrive)

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(5) Install the low-range clutch hub, engaging its splines with those of the internal-splined clutch plates (fig. 7-54). Rotate the hub until it is engaged with all five internal-splined plates.

(6) Install the high-range planetary carrier assembly and retain it with an internal snapping (fig. 7-55).

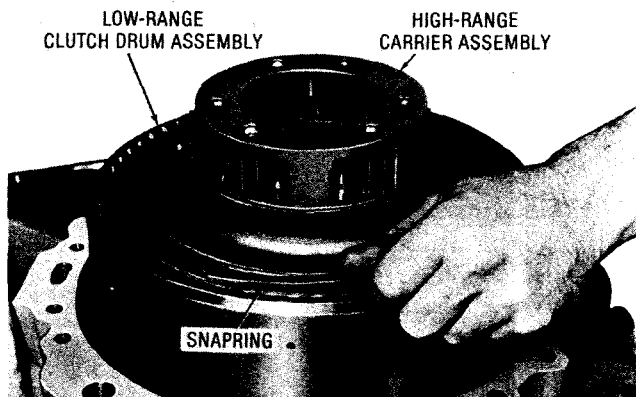
(7) Install high-range planetary sun gear 1 (foldout 14,B), meshing its teeth with the high-range planetary pinions.

d. High-Range Clutch, Rear Housing (TRT 2221-3, 2421-3 overdrive models)

(1) Install the clutch anchor pin into the rear housing (as rebuilt in paragraph 6-11). Leave the flat-milled end of the pin extending at the inside of the housing (fig. 7-56).

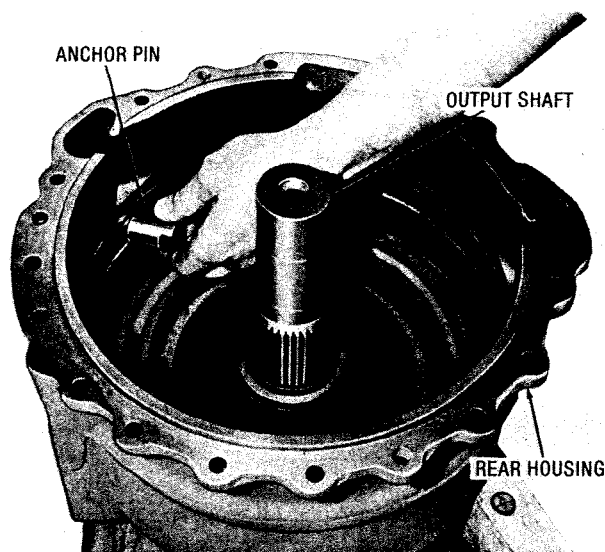
(2) Position the high-range clutch anchor assembly, pins upward, on a level surface. Beginning with an internal-splined clutch plate, install alternately two internal-splined and two external-tanged plates (fig. 7-57).

(3) Install the high-range planetary ring gear, longer ends of external splines first, into the internal-splined clutch plates (fig. 7-57).



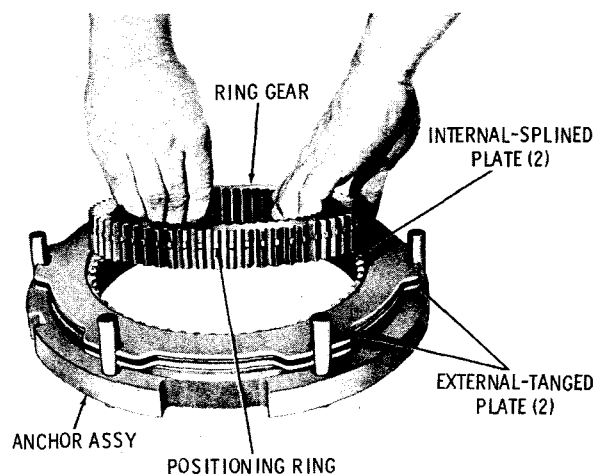
S1483

Fig. 7-55 Installing snapping retaining high-range planetary carrier assembly (TRT-3 overdrive)



S1484

Fig. 7-56. Installing clutch anchor pin (TRT-3 overdrive)



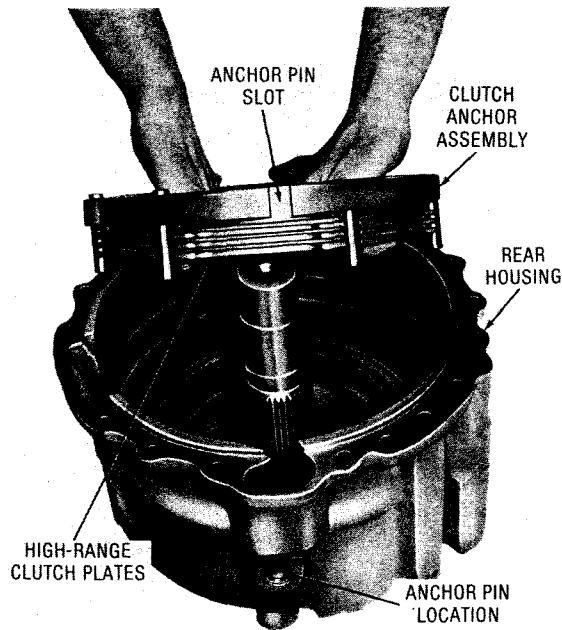
S1485

Fig. 7-57. Assembling high-range clutch and anchor (TRT-3 overdrive)

(4) Install another internal-splined and another external-tanged clutch plate onto the assembly made in steps (2) and (3).

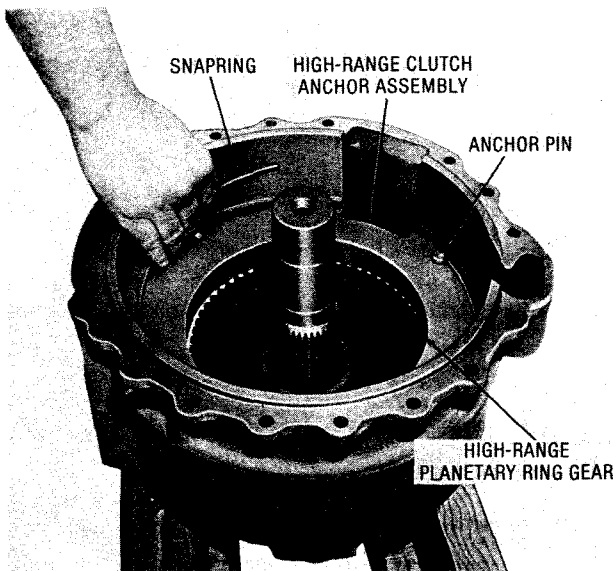
(5) Grasp the entire clutch assembly, invert it, and install it into the rear housing (fig. 7-58). Engage the slot in the anchor with the anchor pin in the housing.

(6) Install the heavy internal snapping to retain the high-range clutch anchor assembly (fig. 7-59). Note the relation of the ends



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Fig. 7-58. Installing assembled high-range clutch (TRT-3 overdrive)

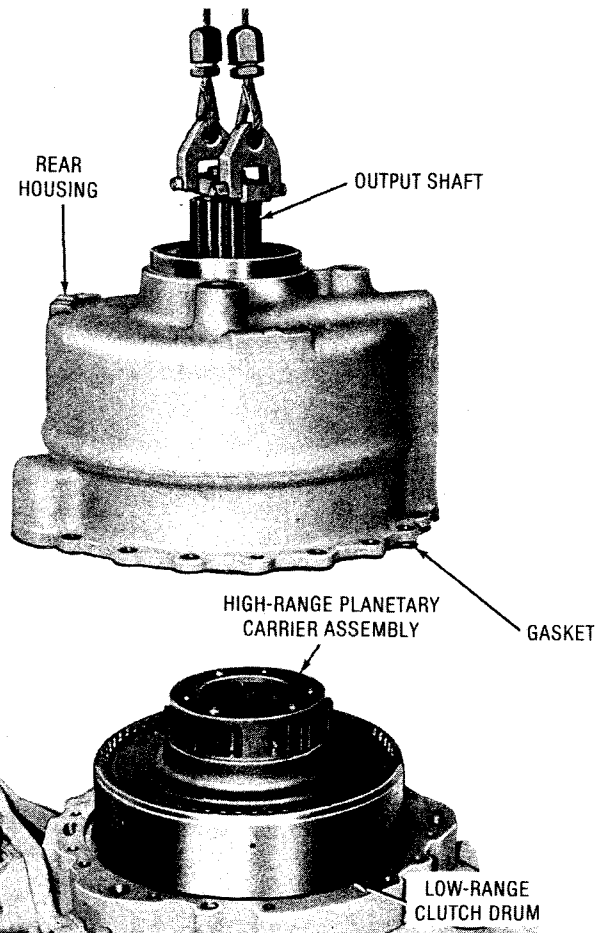


S1487

Fig. 7-59. Installing clutch anchor snapping (TRT-3 overdrive)

of the snapping to the two long pins extending through the anchor.

(7) Suspend the assembled rear housing on a hoist. Install the gasket, using oil-soluble grease to retain it (fig. 7-60).



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Fig. 7-60. Installing rear housing and attached parts (TRT-3)

(8) Install the rear housing assembly, rotating the output shaft to align the splines and gear teeth. Install fifteen 3/8-16 x 2-3/4-inch bolts 4 (foldout 16,B) with lockwashers 3 to retain the housing and adapter. Tighten the bolts to 26-32 lb ft (36-43 N·m).

(9) Proceed to paragraph 7-10.

e. Forward Clutch, Planetary, and Adapter Assembly (TRT 2221-3, 2421-3 underdrive models)

(1) Beginning with an internal-splined clutch plate, alternately install two internal-splined plates and two external-tanged plates (fig. 7-61).

(2) Install the forward-and-reverse sun gear into the reverse planetary carrier assembly (fig. 7-61).

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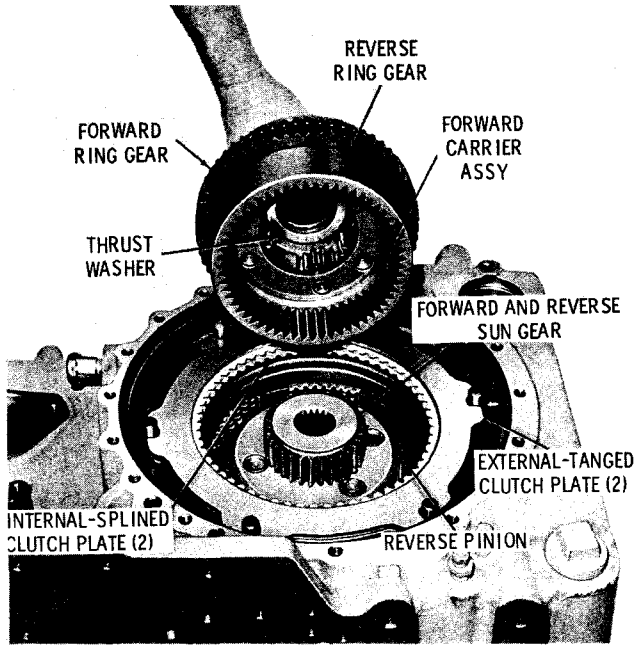


Fig. 7-61. Installing forward planetary carrier assembly and attached parts (TRT-3 overdrive)

(3) Install ring gear 1 (foldout 10,B) onto carrier assembly 3. Retain it with snap-ring 11. Install ring gear 14, longer ends of external splines first, onto carrier assembly 3.

(4) Install retainer 21, flat side first, onto the rear of carrier assembly 3. Install bearing assembly 22 against the shoulder at the rear of carrier assembly 3.

(5) Install the thrust washer into the forward planetary carrier assembly, using oil-soluble grease to retain it (fig. 7-61).

(6) Install the forward carrier assembly and attached parts (fig. 7-61). Rotate the carrier and ring gears until all gear teeth and clutch plate splines are engaged.

(7) Install another internal-splined, and another external-tanged clutch plate onto the forward ring gear, above the positioning ring (fig. 7-62).

(8) Install twelve clutch piston return springs and pins (fig. 7-62). Install the adapter gasket.

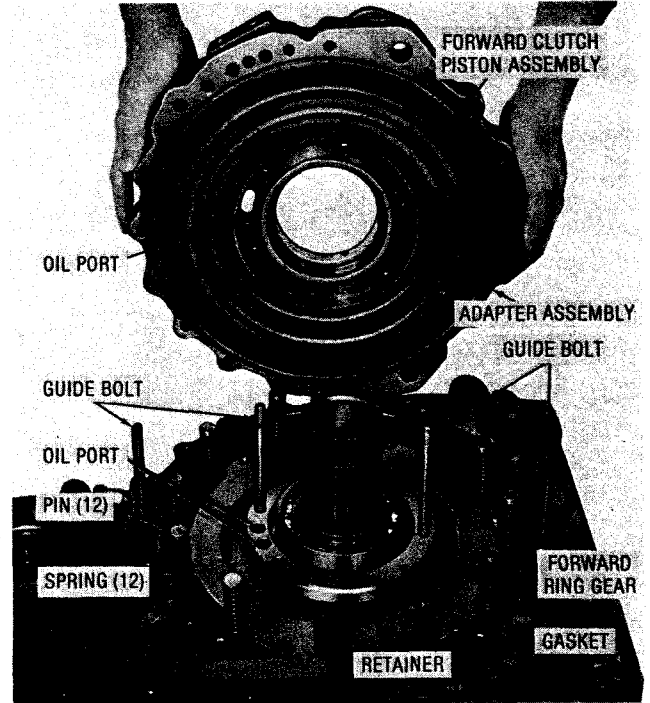


Fig. 7-62. Installing rear housing adapter assembly (TRT-3 underdrive)

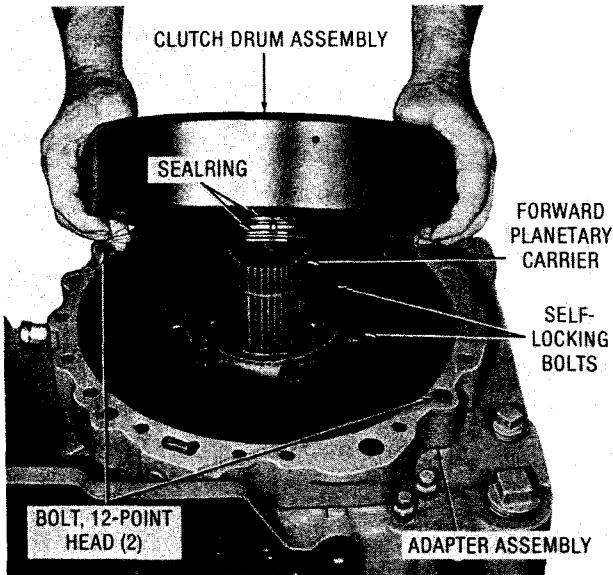
(9) Install headless guide bolts into the retainer and transmission housing as shown in figure 7-62.

(10) Install the forward clutch piston, with sealrings, flat side first, into the adapter assembly (fig. 7-62).

(11) Install the adapter assembly, aligning the oil ports in the retainer and adapter (fig. 7-62).

(12) Install two 3/8-16 x 2-3/4-inch bolts at opposite sides of the adapter assembly to pull the adapter down against the clutch piston return springs. Install the two 3/8-16 x 1-3/4-inch, 12-point-head bolts (fig. 7-63). Tighten the bolts to 36-43 lb ft (49-58 N·m).

(13) Remove the two outer guide bolts and 3/8-16 x 2-3/4-inch pulldown bolts which were temporarily installed in step (12). Install the six 3/8-24 x 1-1/4-inch, self-locking bolts 28 (foldout 10,B) into the inner bolt circle. (Remove the inner guide bolts to install the last two self-locking bolts.) Tighten the bolts to 41-49 lb ft (56-66 N·m).



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Fig. 7-63. Installing high-range clutch drum assembly (TRT-3 underdrive)

f. High-Range Clutch, Low-Range Planetary (TRT 2221-3, 2421-3 underdrive models)

NOTE

New Teflon sealrings may require forming by hand to help retain their proper circular shape. Wrap them in a circle around an object about two-thirds the diameter of the groove they fit.

(1) Install two step-joint sealrings 1 (foldout 13,A) into the grooves in the hub of the high-range clutch drum assembly (fig. 7-63). Use oil-soluble grease to retain the sealrings.

(2) Install the high-range clutch drum assembly onto the forward planetary carrier (fig. 7-63).

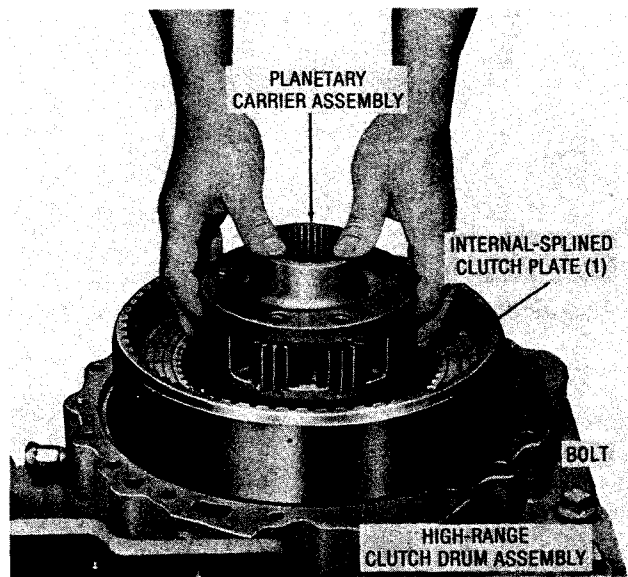
(3) Install the snapping which retains the high-range clutch drum on the forward planetary carrier.

(4) Install low-range planetary sun gear assembly 1 (foldout 13,B), thrust washer 3 upward, onto the forward planetary carrier.

(5) Install one internal-splined clutch plate (fig. 7-64). Install the low-range planetary carrier assembly.

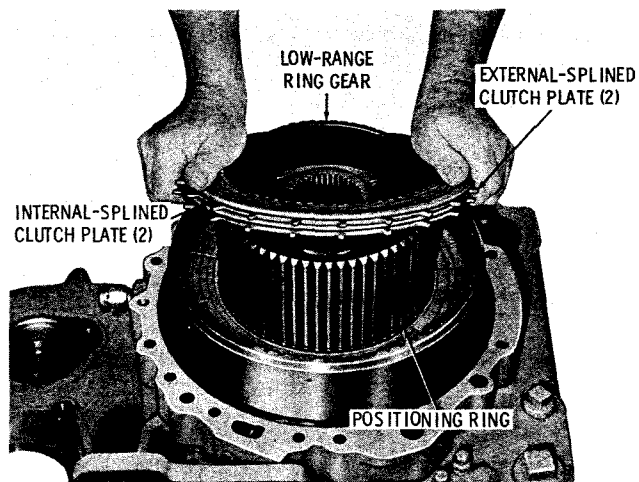
(6) Install the low-range ring gear, positioning ring first, into the clutch plate installed in step (5) (fig. 7-65).

(7) Install two external-splined and two internal-splined, low-range clutch plates, stacked alternately as shown in figure 7-65.



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Fig. 7-64. Installing low-range planetary carrier assembly (TRT-3 underdrive)



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Fig. 7-65. Installing high-range clutch plates (TRT-3 underdrive)

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(8) Install high-range clutch back-plate 17 (foldout 13,A), flat side first. Retain it with large internal snapping 18.

g. Low-Range Clutch, Rear Housing Assembly (TRT 2221-3, 2421-3 underdrive models)

(1) Install the clutch anchor pin into the rear housing (as rebuilt in paragraph 6-11). Leave the flat-milled end of the pin extending at the inside of the housing (fig. 7-66).

(2) Beginning with an external-tanged clutch plate, alternately stack five external-tanged and five internal-splined plates on the face of the low-range clutch piston in the housing (fig. 7-66).

(3) Install the low-range clutch anchor assembly, engaging the anchor pins with the slots in the external-tanged clutch plates, and the slot in the anchor with the anchor pin in the rear housing (fig. 7-66).

(4) Install the heavy internal snapping which retains the low-range clutch anchor assembly. Note the relation of the ends of the snapping to the two anchor pins which extend

slightly above the anchor surface (refer to fig. 7-59).

(5) Suspend the assembled housing on a hoist and install the rear housing gasket. Use oil-soluble grease to retain the gasket (fig. 7-67).

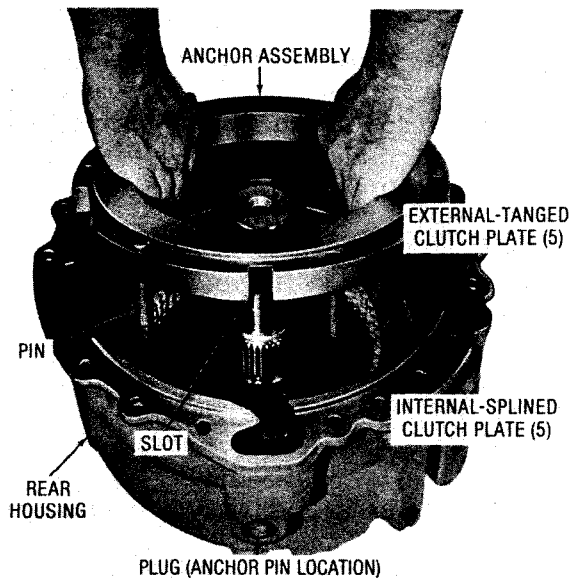
(6) Install the rear housing assembly onto the adapter assembly (fig. 7-67). To align gear teeth and clutch plate splines, rotate the output shaft while lowering the assembly.

(7) Install fifteen 3/8-16 x 2-3/4-inch bolts 4 (foldout 16,B) and lockwashers 3 to retain the rear housing and adapter. Tighten the bolts to 26-32 lb ft (36-43 N·m).

(8) Proceed to paragraph 7-10.

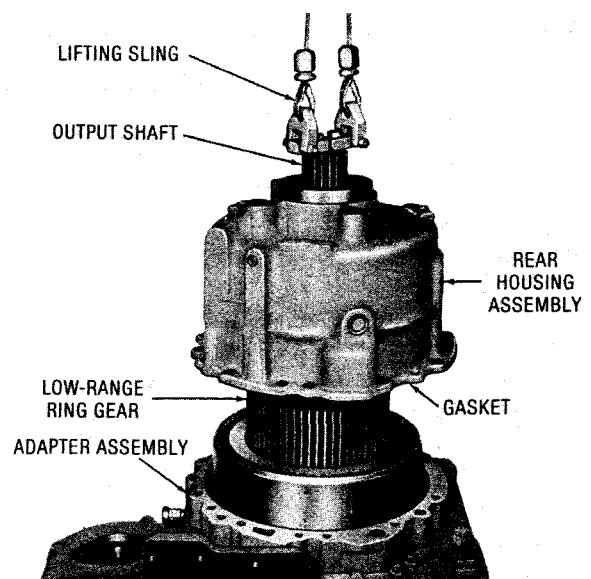
h. Forward Planetary, Clutch, Rear Housing (TRT 2211-3, 2411-3)

(1) Beginning with an internal-splined forward clutch plate, alternately install two internal-splined plates and two external-tanged plates onto the forward-and-reverse clutch anchor assembly (fig. 7-68).



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Fig. 7-66. Installing low-range clutch anchor assembly (TRT-3 underdrive)



S1493

Fig. 7-67. Installing rear housing assembly (TRT-3 underdrive)

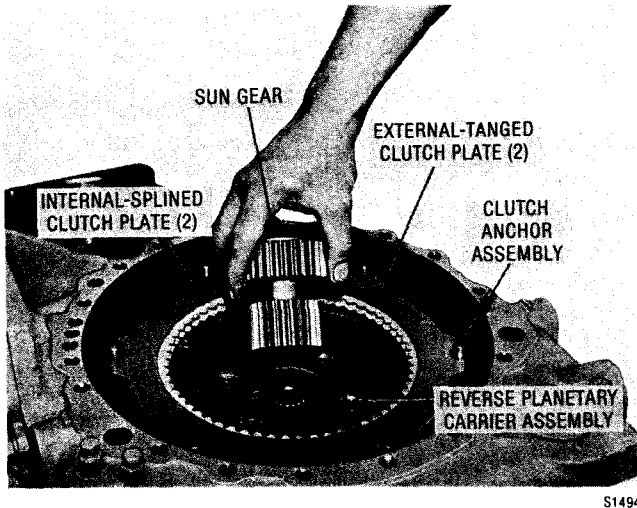


Fig. 7-68. Installing forward-and-reverse sun gear (TRT 2211-3, 2411-3)

(2) Install the forward-and-reverse sun gear into the reverse planetary carrier assembly (fig. 7-68).

(3) Install reverse ring gear 1 (foldout 11,A) onto carrier assembly 3. Retain it with snapping 10.

(4) Install bearing 11 onto the rear of carrier assembly 3, pressing it to seat on the shoulder of the carrier.

(5) Install bearing spacer 12 against bearing 11.

(6) Install thrust washer 2 into the front of carrier assembly 3, retaining it with oil-soluble grease. Install forward ring gear 15, longer splines first, onto the carrier assembly.

(7) Install the carrier assembly, as assembled in steps (3) through (6) into the transmission. Rotate the carrier shaft and forward ring gear to mesh gears and clutch plate splines.

(8) Install one internal-splined clutch plate 16 and then one external-tanged clutch plate 17 onto those previously installed.

(9) Install twelve piston return springs 22 (foldout 9,B) and twelve pins 23 into the circle of holes in the forward-and-reverse clutch anchor assembly.

(10) Install forward clutch piston 18 (foldout 11,A), with sealrings 19, 20, and 21, into housing 9 (foldout 16,C).

(11) Install gasket 1 onto the front flange of housing 9.

(12) Install housing assembly 5 onto the transmission and retain it with eighteen 3/8-16 x 1-3/4-inch bolts 4 and lockwashers 3. Tighten the bolts to 26-32 lb ft (36-43 N·m).

7-10. INSTALLATION OF TURBINE GEARING, OIL SUCTION TUBE, AND STRAINER

a. Accessory Drive Shaft Assembly

(1) If removed, install bearing 9 (foldout 7,B) onto drive shaft 8 and seat the bearing firmly against the shaft shoulder. Apply Molykote Type G or equivalent into the drive splines of the shaft.

(2) Install the accessory drive shaft and bearing into the transmission housing (fig. 7-69).

b. Turbine Gears, Freewheel Clutch

(1) If the transmission is equipped with a standard-speed, low-gear ratio, proceed to step (2). If the transmission is equipped with a high-speed, forward-gear ratio, proceed to step (3).

(2) Install the forward-and-reverse sun gear, as shown in figure 7-69. Proceed to step (5).

(3) Install the spacer into the sun gear cavity in the housing wall, as shown in figure 7-70.

(4) After installation, the end of the spacer (fig. 7-70) should be flush with the bearing bore seat (shoulder) in the transmission housing. If the spacer is above the shoulder, this indicates the forward-and-reverse sun gear thrust washer is not seated properly. To reseat the thrust washer, remove the spacer and use a suitable probe through the forward-and-reverse sun gear to relocate

ASSEMBLY OF TRANSMISSION

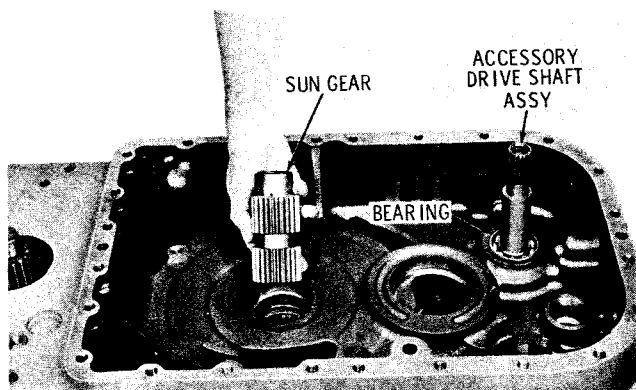


Fig. 7-69. Installing forward-and-reverse sun gear (-1 models)

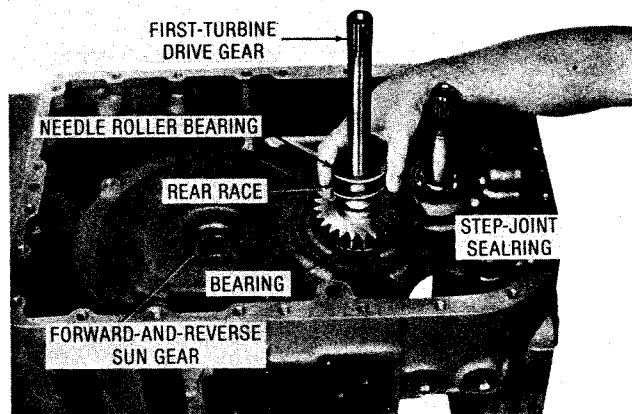


Fig. 7-71. Installing first-turbine drive gear components

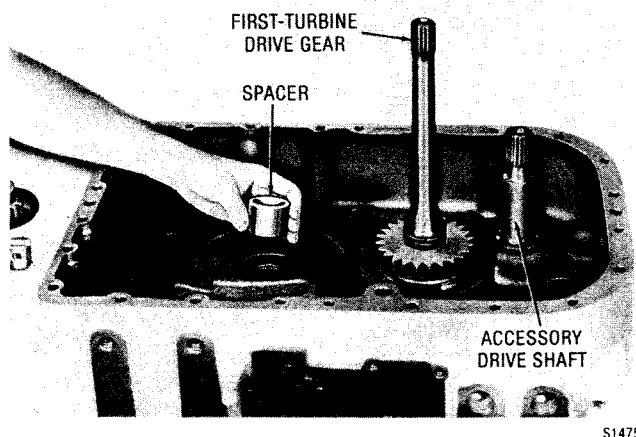


Fig. 7-70. Installing forward-and-reverse sun gear spacer (-1 models)

(center) the thrust washer. Reinstall the spacer.

(5) Install the first-turbine drive gear and bearing (as assembled in para 6-10) (fig. 7-71). Install the step-joint sealing into the groove in the drive gear hub. Use oil-soluble grease to retain the sealing in its groove. Install the rear thrust bearing race (flat) and the needle roller bearing onto the drive gear.

(6) Install the turbine-driven gears and freewheel clutch assembly (as assembled in para 6-9) (fig. 7-72). Rotate the assembly to engage the second-turbine driven gear splines with those of the forward-and-reverse sun gear (fig. 7-71).

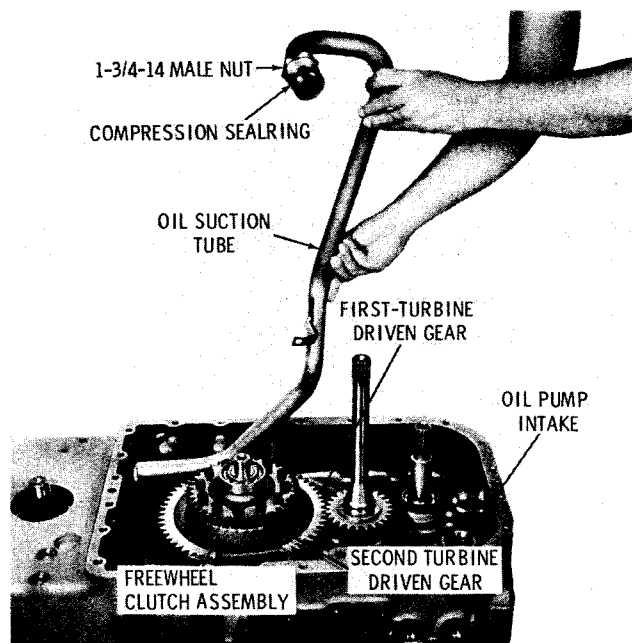


Fig. 7-72. Installing oil suction tube

c. Oil Suction Tube, Oil Strainer

(1) Generously lubricate the oil suction tube compression sealing with transmission fluid (fig. 7-72). Using the fabricated wrench, install the 1-3/4-14 male nut and compression sealing onto the pump end of the oil suction tube. Insert the suction end of the tube into the sump area, and the pump end into the threaded hole at the pump in-

take. Make sure the sealing is squarely seated in the intake boss. Install the nut into the boss but do not tighten at this time.

NOTE

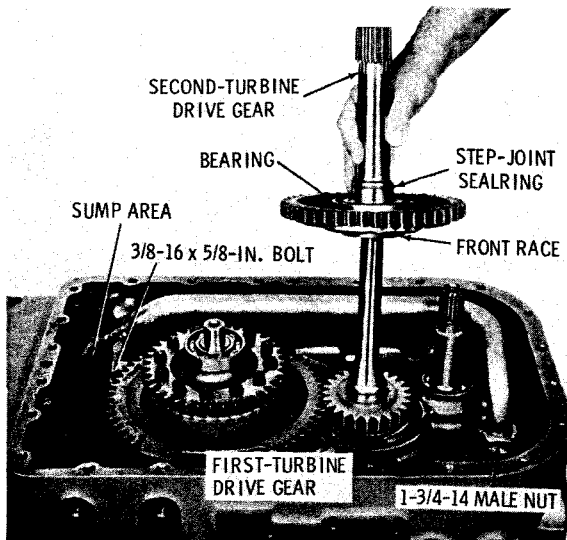
For -1 models, proceed to step (2). For -3 models, proceed to step (3).

(2) -1 Models. Install one 3/8-16 x 5/8-inch self-locking bolt to secure the suction tube to the housing but do not tighten at this time (fig. 7-73). Install the oil strainer and gasket (fig. 7-74). Secure the oil strainer with six 3/8-16 x 7/8-inch bolts 20 (foldout

8,B) and lockwashers 21. Tighten the bolts to 26-32 lb ft (36-43 N·m). Install the oil drain plug (fig. 7-74) and tighten it to 33-37 lb ft (45-50 N·m). Then, while holding the suction tube flush with the oil pump mounting surface and using a fabricated wrench, tighten the male nut to 120-150 lb ft (163-204 N·m). Tighten the self-locking bolt, which holds the oil suction tube, to 36-43 lb ft (49-58 N·m). Proceed to step (4).

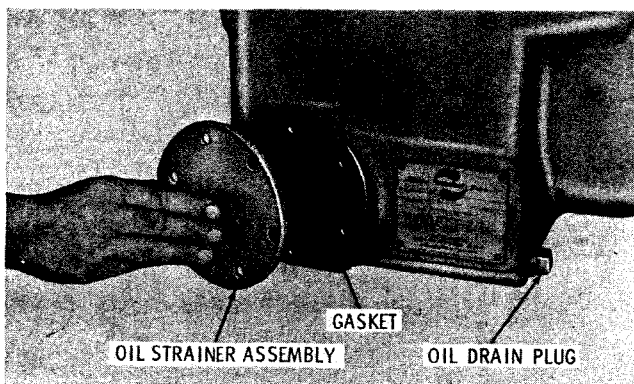
(3) -3 Models. Install one 5/16-18 x 5/8-inch self-locking bolt to secure the suction tube to the housing but do not tighten at this time (refer to fig. 7-73). Install the oil strainer (fig. 7-75). Install the O-ring gasket onto the strainer cover and install the cover. Secure the cover with two 3/8-16 x 3/4-inch bolts and lockwashers. Tighten the bolts to 26-32 lb ft (36-43 N·m). Install the oil drain plug and tighten it to 33-37 lb ft (45-50 N·m). Then, while holding the suction tube flush with the oil pump mounting surface and using a fabricated wrench, tighten the male nut to 120-150 lb ft (163-204 N·m). Tighten the self-locking bolt, which holds the oil suction tube, to 17-20 lb ft (23-27 N·m). Install baffle plate 29 (foldout 9,A) and retain it with three 5/16-18 x 5/8-inch, self-locking bolts 30. Leave bolt hole for the suction tube bracket. Tighten bolts 30 to 17-20 lb ft (23-27 N·m).

(4) If the ball bearing was removed from the second-turbine drive gear, install a



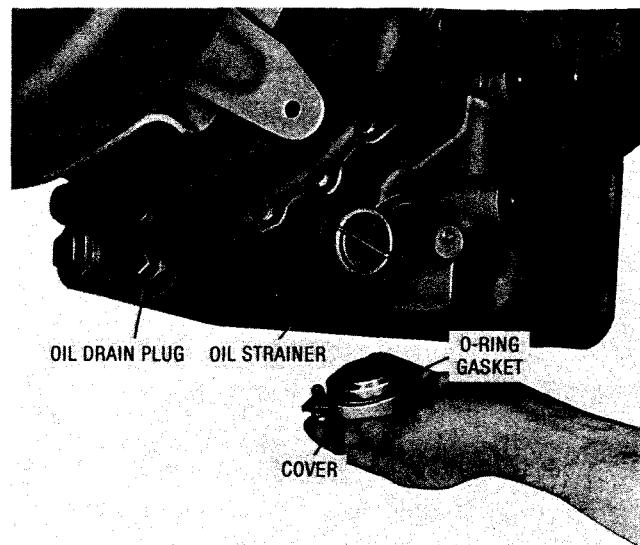
S2613

Fig. 7-73. Installing second-turbine drive gear



S2534

Fig. 7-74. Installing oil strainer and gasket (-1 models)



S1395

Fig. 7-75. Installing oil strainer and O-ring gasket (-3 models)

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new bearing (fig. 7-73). Install the step-joint sealing into its groove near the bearing. Install the front race of the thrust bearing, flange first, onto the bottom (rear) of the drive gear. Use oil-soluble grease to retain the bearing race on the drive gear. Install the second-turbine drive gear and assembled parts onto the first-turbine drive gear (fig. 7-73).

7-11. INSTALLATION OF CONVERTER HOUSING, CONVERTER COMPONENTS

a. Converter Housing

(1) If roller bearing 45 (foldout 7,B) is used with the accessory-driven gear, install the outer race, lip toward the rear, into the main housing bore. It may be necessary to temporarily install the charging pump to maintain bearing race alignment. Install the gasket onto the converter housing splitline (fig. 7-76). Use oil-soluble grease to retain the gasket during installation of the housing. Attach a sling to the converter housing front flange and, while lowering the converter housing (as assembled in para 6-8) onto the transmission housing, guide the accessory-driven gear past the second-turbine drive gear. Seat the converter housing and remove the sling.

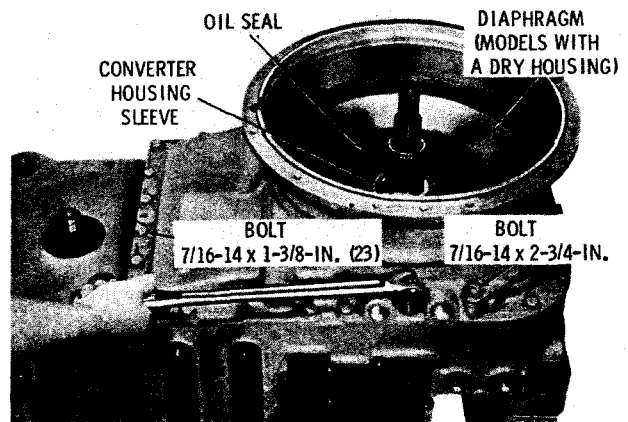
(2) To attach the converter housing, install one 7/16-14 x 2-3/4-inch bolt, twenty-

three 7/16-14 x 1-3/8-inch bolts, twenty-four 7/16-inch flat washers, and twenty-four 7/16-inch lockwashers (fig. 7-77). Tighten the bolts to 42-50 lb ft (57-67 N·m).

b. Converter Components

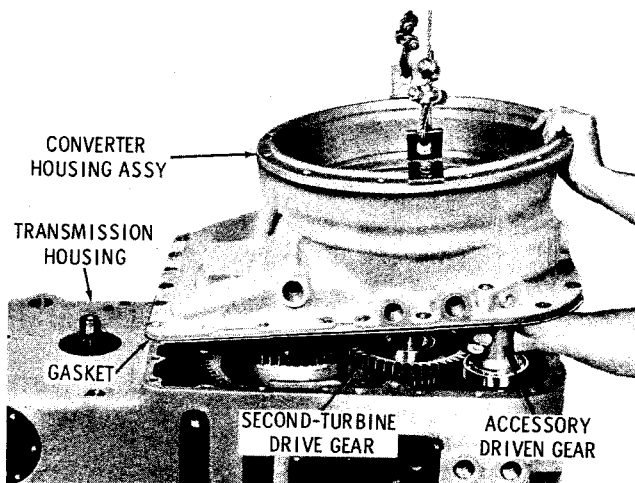
(1) Check to ensure that the step-joint sealing (installed in para 6-8) is firmly seated in the converter housing sleeve (fig. 7-77). For models with a dry converter housing, check to be sure the diaphragm oil seal is packed with high-temperature grease.

(2) Install the torque converter pump (as assembled in para 6-7) onto the converter ground sleeve (fig. 7-78). Install the splined



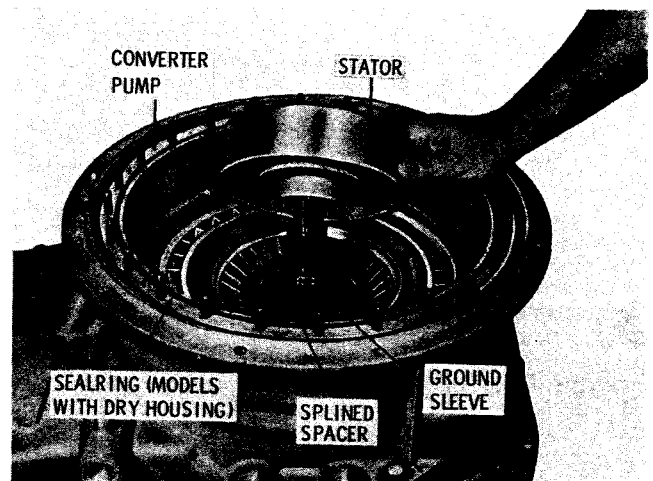
S2614

Fig. 7-77. Installing torque converter housing bolts



S1497

Fig. 7-76. Installing torque converter housing assembly



S1498

Fig. 7-78. Installing torque converter stator

spacer. Install the stator, hub projection first, onto the ground sleeve.

(3) For models with a dry converter housing, install the sealring into the groove in the converter pump splitline. The sealring used on models with a dry housing has a rectangular cross-section—0.113–0.123 x 0.133–0.143 in. (2.88–3.12 x 3.38–3.63 mm), and will fit into the groove in the converter pump either way. The sealring must be installed with the 0.133–0.143 inch (3.38–3.63 mm) dimension in the clamp direction (fig. 7-79) in order to provide adequate seal. (The O.D. of the sealring may be marked with white paint.) Fill in the remaining sealring groove area with petrolatum.

(4) Install the snapring onto the converter ground sleeve to retain the stator (fig. 7-80). Install the first- and second-turbine assembly (as assembled in para 6-6) onto the turbine drive-gear shafts.

7-12. INSTALLATION OF INPUT COMPONENTS

NOTE

Direct-mount models with flex disks, proceed to paragraph 7-12a. Direct-mount models with a drive ring, proceed to paragraph 7-12b. Remote-mount models, proceed to paragraph 7-12c.

a. Direct Mount (flex disk)

(1) Install the torque converter drive cover (fig. 7-81).

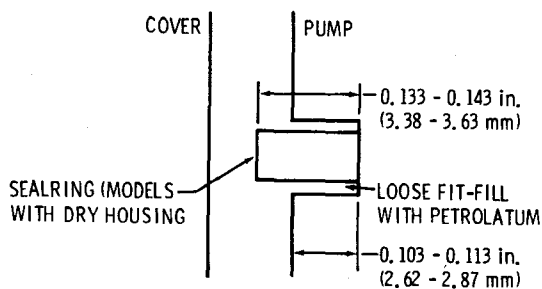
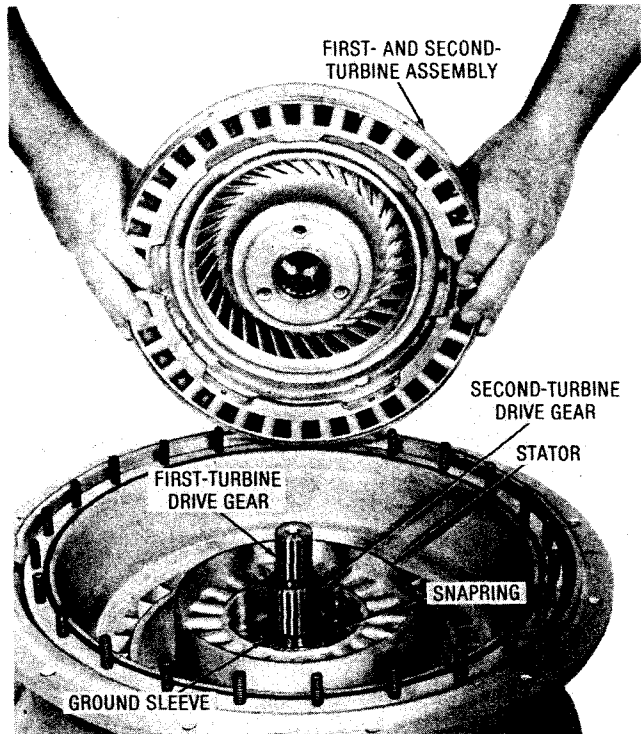


Fig. 7-79. Assembly of converter pump sealring

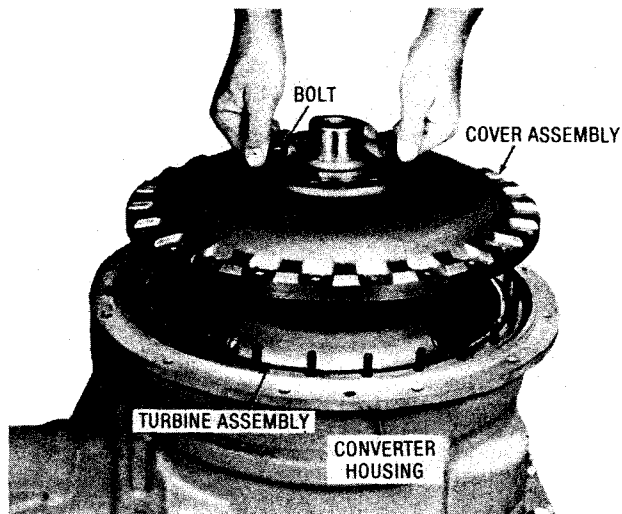
(2) Install twenty-four 5/16-24, self-locking nuts to retain the cover (fig. 7-82). Tighten the nuts to 14-18 lb ft (19-24 N·m).

(3) Install the flex disk and washer assembly, washer side first, into the hub of



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Fig. 7-80. Installing first-and-second turbine assembly



S1500

Fig. 7-81. Installing torque converter drive cover—direct mount

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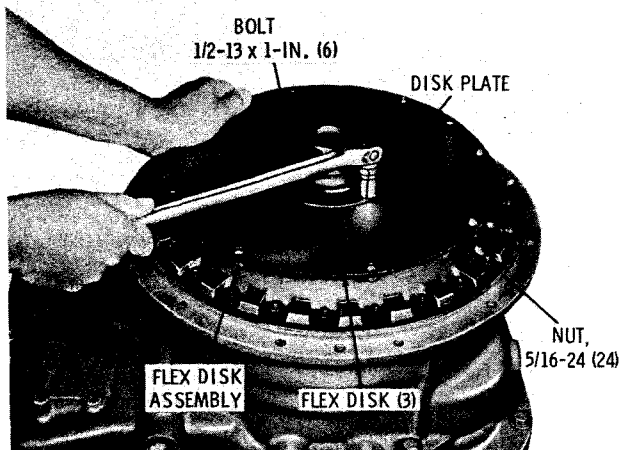


Fig. 7-82. Installing flex disk assembly (direct mount)

the converter cover (fig. 7-82). Install flex disk plate 4 (foldout 6,B), if applicable. Assemble the three flex disks so the cone of each will be parallel to the flex disk and washer assembly and install the three disks as an assembly (fig. 7-82). Install the disk plate and align all the disk holes with the tapped holes in the converter drive cover. Install six 1/2-13 x 7/8-inch, self-locking bolts and tighten them to 81-97 lb ft (110-131 N·m).

(4) If the transmission is equipped with a wet converter housing, gasket 13 (foldout 6,B) must be used when the transmission is attached to the engine housing. Proceed to paragraph 7-13.

b. Direct Mount (drive ring)

(1) Install torque converter drive cover 12 (foldout 6,B). Install twenty-four 5/16-24, self-locking nuts 11 to retain torque converter cover 12. Tighten the nuts to 14-18 lb ft (19-24 N·m).

(2) Lubricate sealring 10 with a high quality molybdenum disulfide grease, and install it into the groove behind the splines on converter drive cover 12.

(3) Apply sealer (Permatex No. 3 or equivalent) to drive ring 8 and to the drive ring mounting face on the engine flywheel or drive disk (also to gasket 13, if used). Install converter drive ring 8 and attach it with

eight 3/8-16 x 1-1/4-inch, 12-point bolts 9. Tighten the bolts to 36-43 lb ft (49-58 N·m). Pack the spaces between the internal teeth of drive ring 8 with molybdenum disulfide grease. Fill the spaces between the teeth completely, but do not use an excessive amount of grease. Proceed to paragraph 7-13.

c. Remote Mount (foldout 6,A)

(1) Install torque converter drive cover 20 or 24 and attached parts (as assembled in para 6-5) onto the converter pump. Install twenty-four 5/16-24 self-locking nuts 19 to retain the cover. Tighten the nuts to 14-18 lb ft (19-24 N·m).

(2) Install gasket 14 onto the converter housing front splitline. Install transmission front cover 13 with oil seal 11 (as assembled in para 6-4) and secure it with twelve 3/8-24 x 2-inch bolts 12, lockwashers 21, and 3/8-24 nuts 22. Tighten the nuts to 33-40 lb ft (45-54 N·m).

(3) Install spacer 3, if required. Install coupling assembly 8 or input flange 9 or 10 onto input shaft 18 or 23. Refer to paragraph 4-9b for instructions for installation, shim pack selection, and torque requirements.

7-13. INSTALLATION OF EXTERIOR COMPONENTS

a. External Thermostat. If required, install external thermostat kit 33 (foldout 7,B).

b. Oil Pump

(1) Install the gasket and oil pump assembly onto the pump mounting pad (fig. 7-83).

(2) Retain the pump with two 3/8-16 x 3-inch bolts, seven 3/8-16 x 2-inch bolts, and nine lockwashers (fig. 7-84). Tighten the bolts to 26-32 lb ft (36-43 N·m).

NOTE

If the pump assembly has a two-bolt, SAE C mounting pad, install six 3/8-16 x 2-inch bolts, three 3/8-16 x 3-inch bolts, and

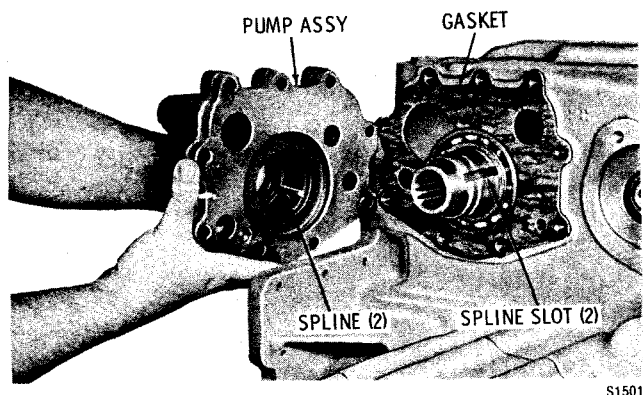


Fig. 7-83. Installing oil pump assembly

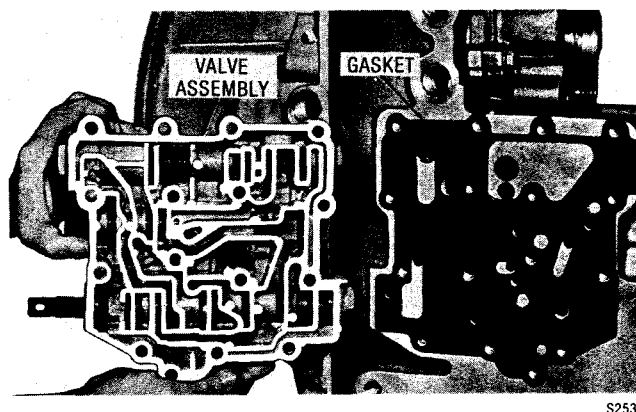


Fig. 7-85. Installing control valve body assembly

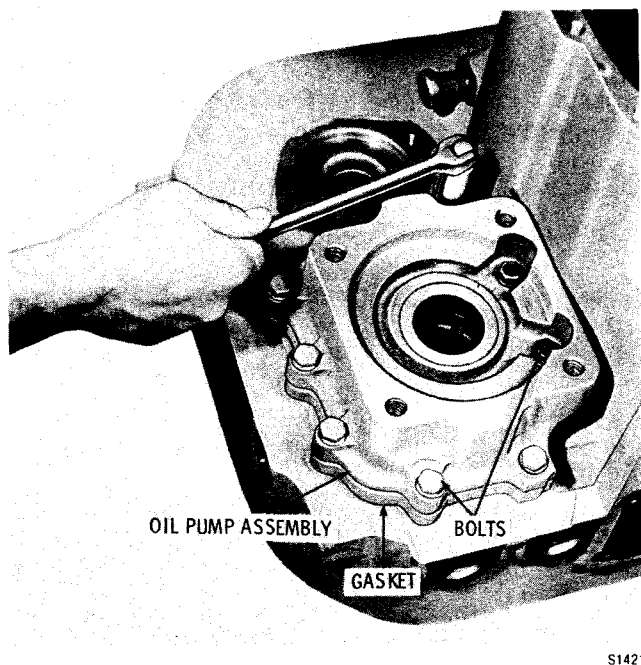


Fig. 7-84. Installing oil pump assembly

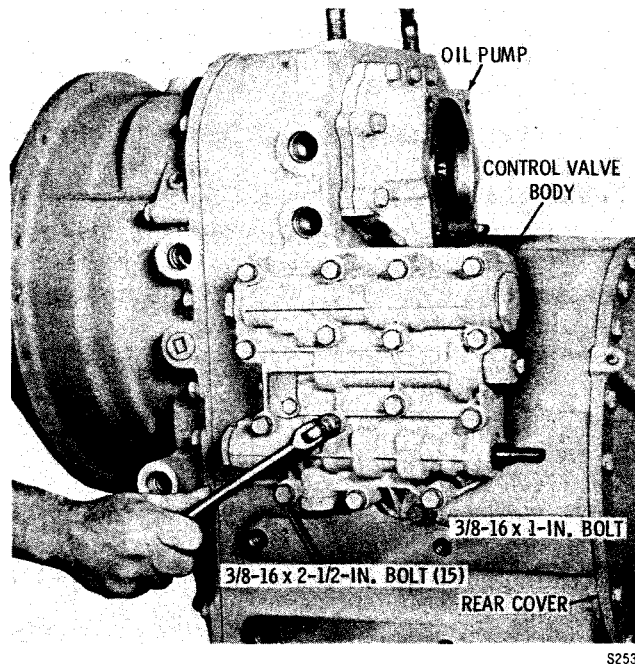


Fig. 7-86. Installing valve body bolts

nine lockwashers. Tighten these bolts to 26-32 lb ft (36-43 N·m).

c. Oil Pump Drive Coupling. If the transmission is equipped with adapter drive coupling 18 (foldout 18,A), replace the coupling. Apply molybdenum disulfide grease (Molykote Type G or equivalent) onto the coupling splines and the mating splines of the pump. Install the drive coupling into the pump and retain it temporarily with a strip of tape.

d. Control Valve Body

(1) Remove the temporarily installed bolt and washer from the valve body mounting pad (refer to fig. 7-17). Install the valve body gasket and retain it with oil-soluble grease (fig. 7-85). Install the control valve body assembly.

(2) Install fifteen 3/8-16 x 2-1/2-inch bolts with lockwashers and one hidden 3/8-16 x 1-inch bolt and lockwasher (fig. 7-86). Progressing from the center of the valve body

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outward, tighten the bolts evenly to 26-32 lb ft (36-43 N·m).

e. Parking Brake, Output Flanges

(1) Install the brake backplate onto its mounting pad (fig. 7-87). Install and tighten the bolts. Refer to foldout 17,B.

Model	Back-plate	Bolts	Torque lb ft (N·m)
TT, TRT-1	2	7 (4)	81-97 (110-131)
TTB	8	7 (4)	81-97 (110-131)
TRT-3	13	20 (3) with lock- washers	117-140 (159-189)

(2) Install the spacer roller onto the backplate lever, and install the cam lever (fig. 7-88).

(3) Install two brake shoes (fig. 7-89). Install the two springs into the brake shoe holes away from the backplate. Install spacer 33 (foldout 17,A), if used, onto the output shaft. If flange 31, 32, or 34 is used, install the rear output flange. Install shaft sealing 37, making sure that it is well seated in the cavity between the shaft and flange. (Seal-ring not used in some models.) Refer to paragraph 4-9b for instructions for flange installation and torque requirements.

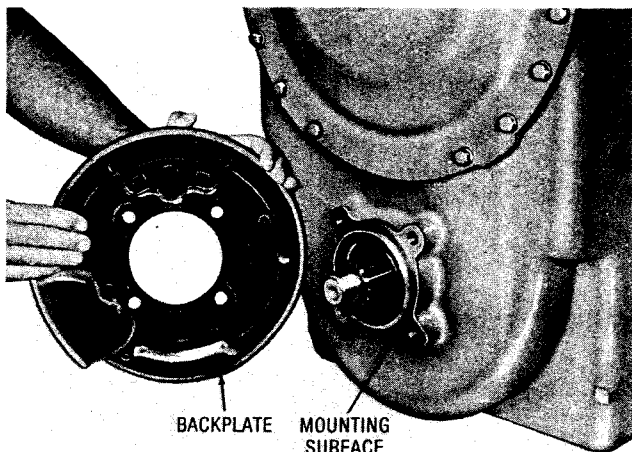
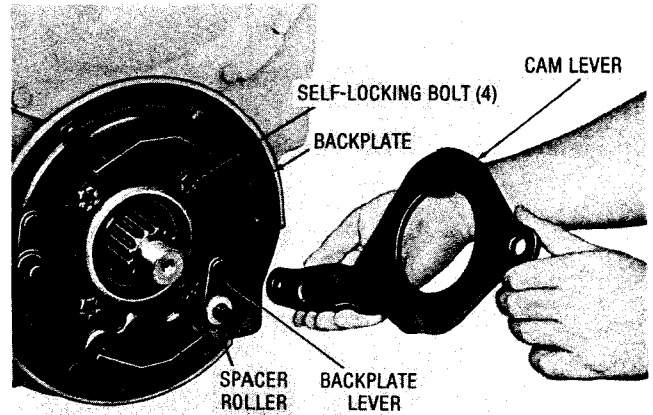


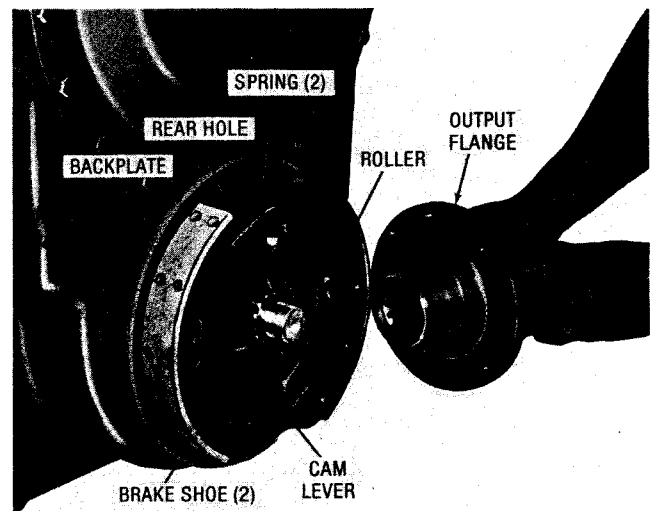
Fig. 7-87. Installing parking brake backplate

S2616



S2617

Fig. 7-88. Installing brake apply arm

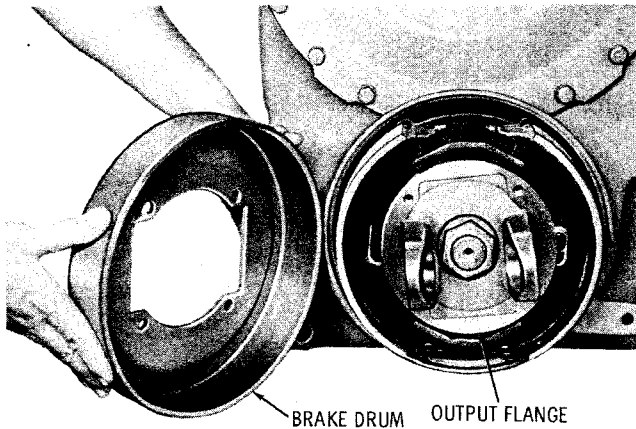


S2618

Fig. 7-89. Installing rear output flange

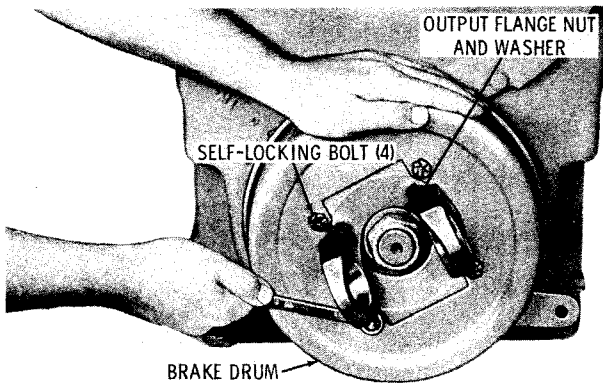
(4) For transmission equipped with output flanges 35 or 36 (foldout 17,A), install the flange into brake drum 9 or 18 (foldout 17,B) and retain it with 3/8-24 self-locking bolts. Tighten the bolts to 41-49 lb ft (56-66 N·m) and install the assembly onto the output shaft. Refer to paragraph 4-9b for instructions for installation and torque requirements.

(5) If flange 31 or 32 (foldout 17,A) is used, install the brake drum onto the output flange (fig. 7-90); then rotate the drum 90°. For -1 models, attach the brake drum with four 3/8-24 x 5/8-inch, self-locking bolts (fig.



S2620

Fig. 7-90. Installing parking brake drum



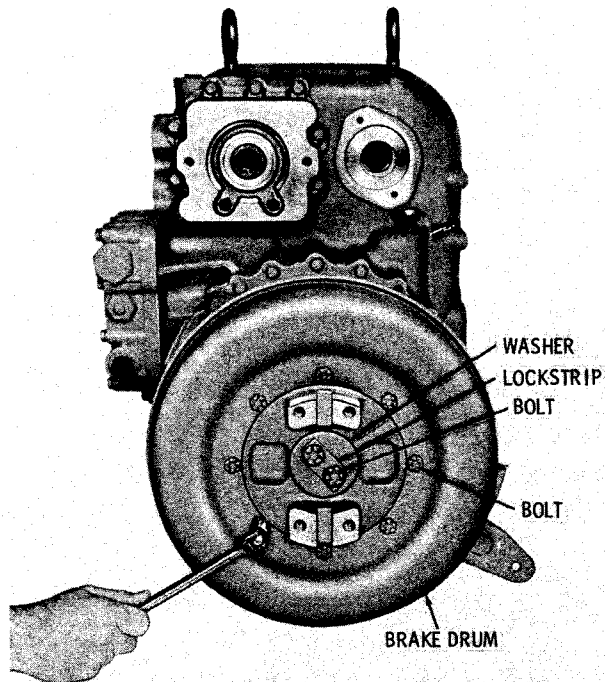
S2535

Fig. 7-91. Installing parking brake drum (some -1 models)

7-91). For -3 models, install eight 3/8-24 x 3/4-inch self-locking bolts (fig. 7-92). Tighten the bolts to 41-49 lb ft (56-66 N·m).

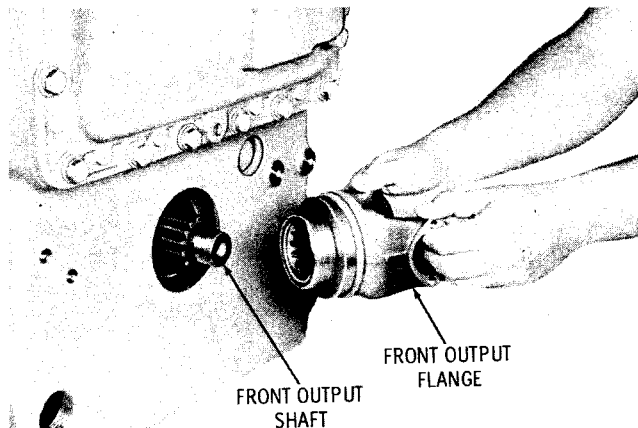
(6) For -1 models, install spacer 5 (foldout 17,A), if used, onto the output shaft and install the front output flange (fig. 7-93). Install shaft sealring 3 (foldout 17,A), making sure that it is well seated in the cavity between the shaft and flange. (Sealring is not used in some models.) Refer to paragraph 4-9b for instructions for flange installation and torque requirements.

(7) Tighten PTO flange retaining nut 29 (foldout 16,D) to 275-325 lb ft (373-440 N·m).



S1398

Fig. 7-92. Installing parking brake drum (-3 models)



S2621

Fig. 7-93. Installing front output flange

7-14. ASSEMBLY TECHNIQUES FOR VEHICLE-MOUNTED TRANSMISSIONS

a. Similar Procedures. Components are installed into the transmission in the vehicle by methods similar to those used when the transmission is removed. The methods and

ASSEMBLY OF TRANSMISSION

sequence outlined in the manual are a general guide but may require some variation because of positioning and space limitations.

b. Clutch Installation

(1) Special care is required to install clutch assemblies into a transmission mounted in the vehicle. Make sure that all clutch plates are properly engaged with their mating components and that all clutch springs are properly positioned.

(2) The reverse clutch requires that the clutch components be installed as an assembled unit. The assembly of the reverse clutch components results in a clutch and planetary unit similar to that shown in figure 7-94.

(3) Using two wires or cords, tie the clutch plates to the clutch anchor assembly by passing the wires or cords over the opposite tangs of the clutch plates, around the inner side of the anchor pins, and through the adjacent holes in the anchor (fig. 7-94). Secure the wire or cord ends at the under (rear) side of the clutch anchor.

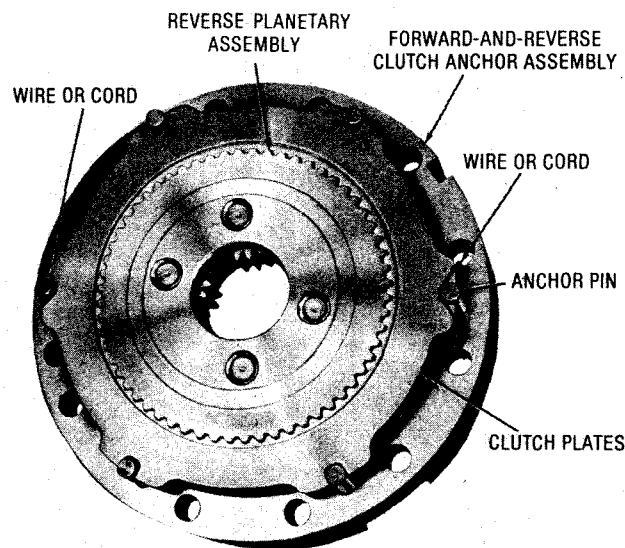


Fig. 7-94. Reverse clutch plates and planetary wired in position on forward-and-reverse clutch anchor

(4) Install the entire assembly, clutch plates first, into the rear of the transmission, engaging the anchor pin slot with the anchor in the transmission housing. Remove the wires or cords and continue with the assembly procedures as applicable.

Section 8. WEAR LIMITS AND SPRING DATA

8-1. WEAR LIMITS DATA

a. Maximum Variations. The wear limits information in this section shows the maximum wear at which components are expected to function satisfactorily. Table 8-1 lists the wear limits data and is referenced to the exploded view (foldouts 6 through 18) in the back of the manual.

b. Cleaning, Inspection. Parts must be clean to permit effective inspection for wear or damage. Refer to paragraph 4-6.

c. Bearings, Bearing Journals, B o r e s. The application of bearings to any product is based on the recommendations of the bearing manufacturer and, therefore, no diametral dimensional deviation should be permitted in the bearing or mated parts. Bearings should be carefully checked for signs of distress before reinstalling.

d. Gears. Gears should be inspected for load pattern and signs of distress. Any distress indicates a possible future failure, and the reuse of such gears should be the decision of the individual customer, based on experience. Backlash cannot be used to establish critical wear of a gear. A gear usually pits, scuffs, scores, or galls long before the gear wear becomes critical.

e. Splines. Unless severe, spline wear is not considered detrimental except where it affects tightness of an assembly s u c h as driveline flanges. Backlash cannot be used to establish critical wear because both mating

parts must be concentrically located to obtain accurate measurement of backlash.

f. Hook-type Sealrings. Sides of the sealring should be smooth—maximum wear 0.005 inch (0.12 mm). The sides of the groove into which the sealrings fit should be smooth—50 microinch (1.25 micrometers) equivalent, and square with the axis of rotation within 0.002 inch (0.05 mm). A new sealring should be installed if the groove is reworked or if there is wear on the sealring outside the diameter.

8-2. SPRING DATA

a. Springs must be clean to permit effective inspection. Springs should be replaced if there are signs of overheating, wear due to rubbing adjacent parts, or permanent set. Discard springs which do not meet the load-height specifications in Spring Data Table 8-2.

b. Inspection criteria (load versus height) a n d identification characteristics of the springs a r e presented in Table 8-2. The spring data are keyed to the exploded views (foldouts 6 through 18) in the b a c k of the manual.

NOTE

When more than one spring part member is listed for the same location, refer to parts catalog SA 1248 to determine which spring is used for your specific assembly number.

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Table 8-1. WEAR LIMITS

Illustration	Description	Wear Limit	
		in.	(mm)
Foldout 7,B	TORQUE CONVERTER HOUSING AND TURBINE DRIVE GEARS		
25	Thrust bearing front race, min thickness	0.028	0.71
27	Thrust bearing rear race, min thickness	0.120	3.04
Foldout 8,A	TURBINE DRIVEN GEARS AND FREEWHEEL CLUTCH		
9, 23	* Freewheel roller, min diameter	0.4980	12.65
12, 26	* Freewheel cam, max surface wear	0.003	0.07
28	* First-turbine driven gear hub, min OD	3.0327	77.02
Foldout 9,B	REVERSE CLUTCH AND PLANETARY		
5, 17	Clutch plate: min thickness	0.097	2.46
	max cone	0.030	0.76
6, 18	Clutch plate: min thickness	0.130	3.30
	max cone	0.012	0.30
	** Clutch pack, min thickness	1.185	30.09
11	Pinion, max end play in carrier 15	0.055	1.39
20	Clutch anchor, max face wear reverse face	0.020	0.50
	forward face	0.020	0.50
Foldout 10,A	FORWARD CLUTCH AND PLANETARY (-1 MODELS)		
2	Thrust washer, min thickness	0.125	3.17
7, 14, 21	Pinion, max end play in carrier	0.055	1.39
24	Thrust washer, min thickness	0.089	2.26
26	Clutch plate: min thickness	0.130	3.30
	max cone	0.012	0.30
27	Clutch plate: min thickness	0.097	2.46
	max cone	0.030	0.76
	** Clutch pack, min thickness		
	6-plate pack	0.681	17.29
	8-plate pack	0.908	23.06

* Total wear of freewheel parts (2 x roller wear + sum of cam surface wear at two opposing points + gear hub wear) must not exceed 0.010 inch (0.25 mm). (Determine cam surface wear by measuring depth of groove caused by roller contact in the cam pocket.)

** Total of individual plate thicknesses. Replace plates having the most wear with new plates to increase pack thickness.

WEAR LIMITS AND SPRING DATA

Table 8-1. WEAR LIMITS (cont)

<u>Illustration</u>	<u>Description</u>	<u>Wear Limit</u>	
		<u>in.</u>	<u>(mm)</u>
Foldout 10,B	FORWARD CLUTCH AND PLANETARY (TRT 2221-3, 2421-3)		
2	Thrust washer, min thickness	0.087	2.20
4, 31	Bushing, min ID	1.885	47.87
9, 36	Pinion, max end play in carrier	0.055	1.39
12, 15	Clutch plate:		
	min thickness	0.130	3.30
	max cone	0.012	0.30
13, 16	Clutch plate:		
	min thickness	0.097	2.46
	max cone	0.030	0.76
27	Adapter sleeve	no scoring permissible	
	* Clutch pack, min thickness	0.691	17.55
Foldout 11,A	FORWARD CLUTCH AND PLANETARY (TRT 2211-3, 2411-3)		
2	Thrust washer, min thickness	0.125	3.17
8	Pinion, max end play in carrier 4	0.055	1.39
13, 16	Clutch plate:		
	min thickness	0.130	3.30
	max cone	0.012	0.30
14, 17	Clutch plate:		
	min thickness	0.097	2.46
	max cone	0.030	0.76
	* Clutch pack, min thickness	0.691	17.55
Foldout 11,B	HIGH-RANGE CLUTCH AND PISTON HOUSING (TT MODELS)		
3	Transfer drive gear, max face wear	0.020	0.50
8, 13	Clutch plate:		
	min thickness	0.130	3.30
	max cone	0.012	0.30
9	Clutch plate:		
	min thickness	0.097	2.46
	max cone	0.030	0.76
	* Clutch pack, min thickness	0.357	9.06
	Max diametral clearance between:		
10, 12	high-range clutch hub and		
23, 33	bushing in piston housing		
	24, 34, 36, or 37	0.005	0.12
18	Sealring, min thickness	0.0880	2.23
19	Piston, max face wear	0.020	0.50
27, 29	Sealring, min thickness	0.0875	2.22

* Total of individual plate thicknesses. Replace plates having the most wear with new plates to increase pack thickness.

TT, TTB, TRT 2001 SERIES TRANSMISSIONS

Table 8-1. WEAR LIMITS (cont)

Illustration	Description	Wear Limit	
		in.	(mm)
Foldout 12,A	LOW-RANGE CLUTCH AND TRANSFER DRIVE GEAR (TRT-1 MODELS)		
9	Adapter sleeve	no scoring permissible	
19	Clutch piston, max face wear	0.010	0.25
23	Sleeve bushing, max ID	2.008	51.00
26, 29	Clutch plate:		
	min thickness	0.130	3.30
	max cone	0.012	0.30
27, 30	Clutch plate:		
	min thickness	0.097	2.46
	max cone	0.030	0.76
31	Backplate, max face wear	0.010	0.25
	* Clutch pack, min thickness	0.841	21.36
Foldout 12,B	HIGH-RANGE CLUTCH AND PLANETARY (TRT-1 MODELS)		
1	High-range sun gear assembly, min thickness	1.718	43.63
7	Pinion, max end play in carrier 5	0.055	1.39
13	Anchor, max face wear (rear)	0.020	0.50
16	Clutch plate:		
	min thickness	0.130	3.30
	max cone	0.012	0.30
17	Clutch plate:		
	min thickness	0.097	2.46
	max cone	0.030	0.76
	* Clutch pack, min thickness	1.135	28.82
Foldout 13,A	HIGH-RANGE CLUTCH, LOW-RANGE RING GEAR (TRT 2211-3, 2421-3 UNDERDRIVE)		
8	Clutch piston, max face wear	0.010	0.25
12, 15	Clutch plate:		
	min thickness	0.130	3.30
	max cone	0.012	0.30
13, 16	Clutch plate:		
	min thickness	0.097	2.46
	max cone	0.030	0.76
17	Backplate, max face wear	0.010	0.25
	* Clutch pack, min thickness	0.595	15.11
Foldout 13,B	LOW-RANGE CLUTCH AND PLANETARY (TRT 2221-3, 2421-3 UNDERDRIVE)		
1	Low-range sun gear assembly, min thickness	1.718	43.63

* Total of individual plate thicknesses. Replace plates having the most wear with new plates to increase pack thickness.

WEAR LIMITS AND SPRING DATA

Table 8-1. WEAR LIMITS (cont)

<u>Illustration</u>	<u>Description</u>	<u>Wear Limit</u>	
		<u>in.</u>	<u>(mm)</u>
Foldout 13,B (cont)	LOW-RANGE CLUTCH AND PLANETARY (TRT 2221-3, 2421-3 UNDERDRIVE) (cont)		
7	Pinion, max end play in carrier 5	0.055	1.39
13	Clutch anchor, max face wear (rear)	0.020	0.50
16	Clutch plate:		
	min thickness	0.130	3.30
	max cone	0.012	0.30
17	Clutch plate:		
	min thickness	0.097	2.46
	max cone	0.030	0.76
	* Clutch pack, min thickness	1.185	29.09
Foldout 14,A	LOW-RANGE CLUTCH, HIGH-RANGE PLANETARY		
8	Clutch piston, max face wear	0.010	0.25
12	Thrust bearing race, min thickness	0.028	0.71
14	Thrust bearing race, min thickness	0.182	4.62
16	Clutch plate:		
	min thickness	0.130	3.30
	max cone	0.012	0.30
17	Clutch plate:		
	min thickness	0.097	2.46
	max cone	0.030	0.76
19	Carrier, max face wear (front)	0.010	0.25
23	Pinion, max end play in carrier 19	0.055	1.39
	* Clutch pack, min thickness	1.108	28.14
Foldout 14,B	HIGH-RANGE CLUTCH, PLANETARY SUN AND RING GEARS		
4	Clutch anchor, max face wear (rear)	0.020	0.50
7, 10	Clutch plate:		
	min thickness	0.130	3.30
	max cone	0.012	0.30
8, 11	Clutch plate:		
	min thickness	0.097	2.46
	max cone	0.030	0.76
	* Clutch pack, min thickness	0.721	18.31
Foldout 15,A	HIGH-RANGE CLUTCH AND PISTON HOUSING (TTB MODELS)		
3	Transfer drive gear, max face wear	0.020	0.50
8, 13	Clutch plate:		
	min thickness	0.130	3.30
	max cone	0.012	0.30

* Total of individual plate thicknesses. Replace plates having the most wear with new plates to increase pack thickness.

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Table 8-1. WEAR LIMITS (cont)

Illustration	Description	Wear Limit	
		in.	(mm)
Foldout 15,A (cont)	HIGH-RANGE CLUTCH AND PISTON HOUSING (TTB MODELS) (cont)		
9	Clutch plate:		
	min thickness	0.097	2.46
	max cone	0.030	0.76
	* Clutch pack, min thickness	0.357	9.06
18	Sealring, min thickness	0.880	2.23
19	Piston, max face wear	0.020	0.50
	Max diametral clearance between:		
12	high-range clutch hub and		
34	bushing in piston housing 35	0.005	0.12
Foldout 15,B	INTERNAL BRAKE AND REAR COVER (TTB MODELS)		
14	Brake plate:		
	min thickness	0.097	2.46
	max cone	0.030	0.76
15	Brake plate:		
	min thickness	0.130	3.30
	max cone	0.012	0.30
	* Brake pack, min thickness	1.232	31.29
38	Rear cover, brake cylinder bores, max ID	1.6290	41.37
Foldout 17,A	OUTPUT SHAFTS AND DISCONNECT ASSEMBLY		
	Max diametral clearance between:		
13	front output shaft and		
25	bushing in output shaft 26	0.010	0.25
Foldout 18,A	OIL PUMP ASSEMBLIES		
3	Cover	no scoring permissible	
12	Driven gear shaft, min OD	0.749	19.02
Foldout 18,B	CONTROL VALVE ASSEMBLIES		
8	Valve, max clearance in body 9	0.004	0.10
16	Plug, max clearance in body 9	0.0035	0.09
20	Valve, max clearance in body 9	0.004	0.10
21	Valve plug, max clearance in plug 25	0.004	0.10
29, 39, 42	Valve, max clearance in body 9	0.003	0.07
45	Valve plug, max clearance in body 9	0.004	0.10
49	Valve plug, max clearance in plug 50	0.004	0.10
52	Valve, max clearance in body 9	0.003	0.07

* Total of individual plate thicknesses. Replace plates having the most wear with new plates to increase pack thickness.

Table 8-2. SPRING DATA

Fold-out	Ref.	Spring	Part No.	Color Code	No. Coils	Wire dia in. (mm)	Spring OD in. (mm)	Free Length in. (mm)	Length Under Load in. (mm)	lb. (N)
7,B	19	Lubrication pressure regulator valve	6773689	No color	13.5	0.048 (1.22)	0.403 (10.24)	1.44 (36.6)	1.00 (25.4)	5.6-6.8 (25-30)
7,B	22	Converter pressure regulator valve	6773551	Solid red, white stripe	10	0.080 (2.03)	0.468 (11.89)	1.21 (30.7)	1.00 (25.4)	23.4-28.6 (105-127)
			6880795	Solid light blue	12	0.067 (1.70)	0.434 (11.02)	1.55 (39.4)	1.02 (25.9)	31.4-34.6 (140-153)
8,A	7,21	Freewheel clutch	6774681	No color	19	0.041 (1.04)	0.251 (6.38)	1.22 (31.0)	1.00 (25.4)	5.3-6.3 (24-28)
			6833973	No color	26	0.033 (0.84)	0.175 (4.44)	1.41 (35.8)	1.14 (29.0)	6.1-7.2 (28-32)
			6835343	No color	27	0.033 (0.84)	0.185 (4.70)	1.50 (38.1)	1.14 (29.0)	6.1-7.2 (28-32)
9,B	22	Reverse, low-range clutch piston return	6772068	No color	37	0.105 (2.67)	0.625 (15.88)	5.51 (140.0)	4.18 (106.2)	44.8-49.6 (200-220)
			6775437	Green stripe	37.5	0.105 (2.67)	0.625 (15.88)	6.13 (155.7)	4.80 (121.9)	45.1-49.9 (201-222)
11,B	17	High-range clutch piston return	6756134	No color	Belleville spring		5.14 (130.6)	0.28 (7.1)	-	-
12,A	20	Low-range clutch piston return	6759491	No color	Belleville spring		6.70 (170.2)	0.27 (6.9)	-	-
12,B	19	High-range clutch piston return	6759491	No color	Belleville spring		6.70 (170.2)	0.27 (6.9)	-	-
13,A	9	High-range clutch piston return	6759491	No color	Belleville spring		6.70 (170.2)	0.27 (6.9)	-	-
13,B	19	Low-range clutch piston return	6759491	No color	Belleville spring		6.70 (170.2)	0.27 (6.9)	-	-
14,A	9	Low-range clutch piston return	6777032	No color	Belleville spring		6.70 (170.2)	0.27 (6.9)	-	-
14,B	13	High-range clutch piston return	6777032	No color	Belleville spring		6.70 (170.2)	0.27 (6.9)	-	-
15,A	17	High-range clutch piston return	6756134	No color	Belleville spring		5.14 (130.6)	0.28 (7.1)	-	-

WEAR LIMITS AND SPRING DATA

Table 8-2. SPRING DATA (cont)

<u>Fold-out</u>	<u>Ref.</u>	<u>Spring</u>	<u>Part No.</u>	<u>Color Code</u>	<u>No. Coils</u>	<u>Wire dia in. (mm)</u>	<u>Spring OD in. (mm)</u>	<u>Free Length in. (mm)</u>	<u>Length Under Load</u>	
									<u>in. (mm)</u>	<u>lb. (N)</u>
15,B	11	Hydraulic brake return (TTB models)	6758503	No color	20	0.092 (2.34)	0.625 (15.88)	3.20 (81.3)	2.38 (60.5)	27.9-34.1 (125-151)
			6765710	No color	18.5	0.080 (2.03)	0.625 (15.88)	3.04 (77.2)	2.08 (52.8)	18.9-23.1 (85-102)
			6831441	No color	20	0.080 (2.03)	0.622 (15.80)	3.86 (98.0)	2.94 (74.7)	16.7-20.3 (75-90)
17,A	15	Disconnect detent	6773464	No color	14	0.062 (1.57)	0.353 (8.97)	1.32 (33.5)	1.15 (29.2)	11.9-14.5 (53-64)
17,B	5	Parking brake shoe-to-shoe*	9027076	Solid black	12	0.072 (1.83)	0.500 (12.70)	-	2.62 (66.5)	20.0* (89)
17,B	16	Parking brake shoe-to-shoe*	6758260	Solid black	18	0.142 (3.61)	0.812 (20.62)	4.00 (101.6)	4.62 (117.3)	60.0-75.0* (267-333)
18,B	14	Main-pressure regulator valve: 135-170 psi (931-1172 kPa)	6833211	Green stripe	18.5	0.127 (3.23)	0.772 (19.61)	3.62 (91.9)	2.50 (63.5)	90.0-102.0 (401-453)
			6834941	No color	17	0.125 (3.18)	0.768 (19.51)	3.62 (91.9)	2.50 (63.5)	90.0-102.0 (401-453)
			6835377	Blue stripe	17	0.118 (3.00)	0.754 (19.15)	3.61 (91.7)	2.50 (63.5)	80.0-90.0 (356-400)
			6835705	No color	16	0.125 (3.18)	0.765 (19.43)	3.64 (92.5)	2.50 (63.5)	100.0-110.0 (445-489)
			6885165	Solid white	17.6	0.128 (3.25)	0.777 (19.74)	3.66 (93.0)	2.50 (63.5)	100.0-110.0 (445-489)
18,B	15	Trimmer	6773593	No color	10	0.131 (3.33)	1.120 (28.45)	2.90 (73.7)	2.38 (60.5)	25.6-31.2 (114-138)
			6830365	No color	8	0.128 (3.25)	1.110 (28.19)	2.58 (65.5)	1.43 (36.3)	72.2-82.2 (322-365)

*Tension spring

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Table 8-2. SPRING DATA (cont)

<u>Fold-out</u>	<u>Ref.</u>	<u>Spring</u>	<u>Part No.</u>	<u>Color Code</u>	<u>No. Coils</u>	<u>Wire dia in. (mm)</u>	<u>Spring OD in. (mm)</u>	<u>Free Length in. (mm)</u>	<u>Length Under Load in. (mm)</u>	<u>lb. (N)</u>
18,B	19	Clutch cutoff valve: 130 psi (896 kPa)	6765710	No color	18.5	0.080 (2.03)	0.625 (15.88)	3.04 (77.2)	2.08 (52.8)	18.9-23.1 (85-102)
			6831441	No color	20	0.080 (2.03)	0.622 (15.80)	3.86 (98.0)	2.94 (74.7)	16.7-20.3 (75-90)
		250 psi (1724 kPa)	6758503	No color	20	0.092 (2.34)	0.625 (15.88)	3.20 (81.3)	2.38 (60.5)	27.9-34.1 (125-151)
			23017350	Solid yellow, green end	20	0.092 (2.34)	0.625 (15.88)	3.20 (81.3)	2.03 (51.6)	39.6-48.4 (177-215)
		400 psi (2758 kPa)	6830366	Solid white	16.5	0.112 (2.84)	0.625 (15.88)	2.72 (69.1)	2.04 (51.8)	71.0-86.6 (316-385)
18,B	33	Selector valve detent	6769251	No color	10	0.062 (1.57)	0.480 (12.19)	1.14 (29.0)	0.78 (19.8)	13.6-14.0 (61-62)
			6770253	White stripe	11	0.054 (1.37)	0.480 (12.19)	1.24 (31.5)	0.78 (19.8)	7.6-8.4 (34-37)
			6833934	Solid white, orange stripe	10	0.054 (1.37)	0.490 (12.45)	1.47 (37.3)	0.080 (20.3)	11.9-13.1 (53-58)
18,B	38	Inching regulator front	6770298	No color	14.6	0.041 (1.04)	0.384 (9.75)	1.28 (32.5)	0.78 (19.8)	3.93-4.07 (17.5-18.1)
			6772046	No color	15.5	0.085 (2.16)	0.810 (20.57)	3.75 (95.2)	1.95 (49.5)	25.2-27.8 (113-123)
18,B	41	Inching regulator rear	6774595	No color	21.5	0.072 (1.83)	0.585 (14.86)	3.80 (96.5)	2.00 (50.8)	25.2-27.8 (113-123)
			6838473	No color	26.4	0.090 (2.29)	0.620 (15.75)	4.29 (109.0)	2.50 (63.5)	41.9-51.1 (187-227)
18,B	43	Inching valve return	6774594	No color	17	0.120 (3.05)	1.105 (28.07)	5.75 (146.0)	4.04 (102.6)	28.5-31.5 (127-140)

WEAR LIMITS AND SPRING DATA

Section 9. OWNER ASSISTANCE AND SERVICE LITERATURE

9-1. OWNER ASSISTANCE

The satisfaction and goodwill of the owners of Allison transmissions are of primary concern to Detroit Diesel Allison, its distributors, and their dealers.

As an owner of an Allison transmission, you have service locations throughout the U.S. and Canada, plus many outlets worldwide that are prepared and eager to meet your parts and service needs with:

- Expert service by trained personnel
- Emergency service 24 hours a day in many areas
- Complete parts support
- Sales teams to help determine your power requirements
- Product information and literature

We recognize, however, that despite the best intentions of everyone concerned, misunderstandings may occur. Normally, any such situation that arises in connection with the sale, operation, or service of your transmission will be handled by the distributor or dealer in your area (check the Yellow Pages for the Detroit Diesel Allison service outlet nearest you).

To further assure your complete satisfaction, we have developed the following three-step procedure to be followed in the event you have a problem that has not been handled satisfactorily.

Step One—Discuss your problem with a member of management from the distributorship or dealership. Frequently, complaints are the result of a breakdown in communication and can quickly be resolved by a member of management. If you have already discussed the problem with the Sales or Service Manager, contact the General Manager. If your problems originate with a dealer, explain the matter to a management

member of the distributorship with whom the dealer has his service agreement.

Step Two—When it appears that your problem cannot readily be resolved at the distributor level without additional assistance, contact the Detroit Diesel Allison Regional Office nearest you listed below:

EASTERN REGION

9 Sylvan Way
P.O. Box 3001
Parsippany, New Jersey 07054 USA
Phone: (201) 993-4047
TWX: 710-998-0563

SOUTHEASTERN REGION

5730 Glenridge Drive, NE
Atlanta, Georgia 30328 USA
Phone: (404) 257-3640
TWX: 810-751-8141

GREAT LAKES REGION

Suite 365
New Center One Building
3031 W. Grand Blvd.
P.O. Box 33122 (N65)
Detroit, Michigan 48232 USA
Phone: (313) 556-5400
TWX: 810-221-6283

MIDWESTERN REGION

475 Alexis R. Shuman Blvd.
Naperville, Illinois 60566 USA
Phone: (312) 961-6750
TWX: 910-651-3032

SOUTHWESTERN REGION

General Motors Building
130 E. Carpenter Freeway
Irving, Texas 75062 USA
Phone: (214) 659-5070
TWX: 910-860-5063

WESTERN REGION

Suite 2700
39465 Paseo Padre Parkway
Fremont, California 94538 USA
Phone: (415) 498-5200
TWX: 910-381-6105

TT, TTB, TRT 2001 SERIES TRANSMISSIONS

CANADA

Diesel Division - GM of Canada Ltd.
P. O. Box 5990
600 Clarke Road
London, Ontario N6A 4L6, Canada
Phone: (519) 452-5000
Telex: 064-5850
TWX: 610-352-0269

LATIN AMERICAN REGION

Detroit Diesel Allison
Gables Center, suite 321
95 Merrick Way
Coral Gables, Florida 33144 USA
Phone: (305) 446-4900
Telex: 810-848-7061

EUROPEAN REGION

Detroit Diesel Allison - Europe
Div. of GM Continental, S.A. Nederland
Parmentierplein 1, 3088 GN Rotterdam
Mail: P. O. Box 5061
3008 AB Rotterdam, Netherlands
Phone: 010-290-000
Telex: 28355 GMCNL

ASIA REGION

Detroit Diesel Allison
Div. of GM Oversea Corp.
15 Benoi Sector
Jurong Town, Singapore 2262
Phone: (65) 265-4697 or (65) 261-0801
Telex: RS 21608 A/B GM SING

MIDDLE EAST/AFRICA REGION

Detroit Diesel Allison
Athens Towers, "A" Bldg., 6th Floor
Messoghion 2/4
Athens 610, Greece
Phone: (30) 1-770-6669
(30) 1-778-5344
(30) 1-778-7281
Telex: 215759 DDA

PACIFIC REGION

Detroit Diesel Allison - Australia
Div. of GM Overseas Corp.
Princes Highway, P. O. Box 163
Dandenong, Victoria 3175
Australia
Phone: (61) 3-797-7911
Telex: AA30792

Step Three—If you are still not satisfied, present the entire matter in writing or by phone to the product headquarters:

Allison Transmission Operations: Manager Off-Highway Transmissions Service, Detroit Diesel Allison, P. O. Box 894, Indianapolis, Indiana 46206. Phone: (317) 242-3549.

The inclusion of all pertinent information will assist the Home Office in expediting the matter. If an additional review by the Home Office of all the facts involved indicates that some further action can be taken, the Regional Office will be so instructed.

If at this point your problem is still not resolved to your satisfaction, call or write: Manager Transmission Service, Indianapolis Operations (317) 242-3547 or Director Transmission Sales, Indianapolis Operations, (317) 242-3584.

When contacting the Regional or Home Office, please keep in mind that ultimately your problem will likely be resolved at the distributorship or dealership utilizing their facilities, equipment, and personnel. Therefore, it is suggested that you follow the above steps in sequence when experiencing a problem.

Your purchase of a Detroit Diesel Allison product is greatly appreciated, and it is our sincere desire to assure complete satisfaction.

9-2. SERVICE LITERATURE

Additional service literature is available for the owner who takes pride in his equipment. These books provide fully illustrated instructions for the maintenance, service, overhaul, and parts support of your transmission. To ensure that you get maximum performance and service life from your unit, see your dealer or distributor for the following publications. Check the Yellow Pages under Transmissions — Truck or Engines — Diesel for your nearest authorized service outlet.

OWNER ASSISTANCE AND SERVICE LITERATURE

TT, TTB, TRT 2001
Transmission Publications

For Allison Transmission information, the
number is:

1200, 1400, 2000 Series
Parts Catalog SA 1248

(317) 242-INFO

TT, TTB, TRT 2001, 3000, 4000
Operators Manual SA 1278

For off hours and times when all "INFO" lines
are busy, telephone answering equipment will
provide the opportunity for the caller to leave
a name and phone number for a prompt re-
turn call or call back on the next business day.

9-3. FACTORY SERVICE "INFO"

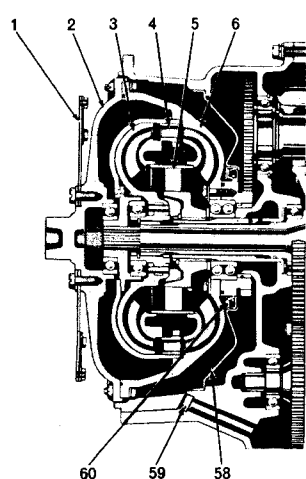
Detroit Diesel Allison maintains factory serv-
ice "INFO" telephone lines to respond to cus-
tomer needs on a timely basis when the nor-
mal channels of communications a r e not
available. "INFO" lines, created as part of
Detroit Diesel Allison's customer response
effort, are open between 8:00 a.m. and 4:30
p.m. (local time).

As a reminder, the service "INFO" lines are
not intended to bypass the normal channels of
communication, but rather to provide direct
factory assistance when normal contacts are
not available. Therefore, you are urged to
use the three-step procedure outlined under
"Owner Assistance" prior to using the service
"INFO" telephone line(s).

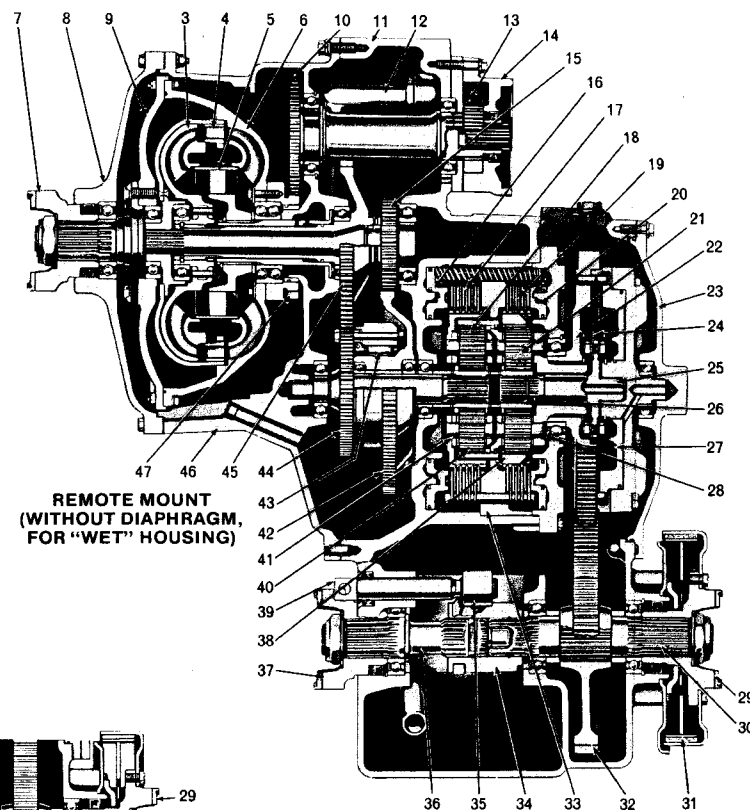
- 1 - Flex disk drive assembly
- 2 - Torque converter cover
- 3 - Second turbine
- 4 - First turbine
- 5 - Torque converter stator
- 6 - Torque converter pump
- 7 - Input flange
- 8 - Transmission front cover
- 9 - Torque converter drive cover
- 10 - Accessory-driven gear
- 11 - Transmission housing
- 12 - Oil suction tube
- 13 - Oil pump
- 14 - Accessory pump mounting pad
- 15 - First-turbine drive gear
- 16 - Reverse clutch piston
- 17 - Reverse clutch
- 18 - Reverse planetary pinion
- 19 - Forward (low-range) clutch
- 20 - Forward (low-range) piston
- 21 - Forward (low-range) planetary pinion
- 22 - Transfer drive gear
- 23 - Transmission rear cover
- 24 - High-range clutch
- 25 - High-range clutch hub
- 26 - Forward-and-reverse sun gear
- 27 - High-range piston
- 28 - Forward (low-range) planetary carrier assembly
- 29 - Rear output flange
- 30 - Rear output shaft

- 31 - Parking brake
- 32 - Transfer-driven gear
- 33 - Forward-and-reverse clutch anchor
- 34 - Disconnect coupling
- 35 - Disconnect shifter fork
- 36 - Front output shaft
- 37 - Front output flange
- 38 - Forward (low-range) ring gear
- 39 - Disconnect shifter shaft
- 40 - Reverse ring gear
- 41 - Reverse planetary carrier assembly
- 42 - First-turbine driven gear
- 43 - Freewheel clutch
- 44 - Second-turbine driven gear
- 45 - Second-turbine drive gear
- 46 - Torque converter housing
- 47 - Accessory drive gear
- 48 - Converter-driven PTO output flange
- 49 - Converter-driven PTO shaft
- 50 - Internal brake
- 51 - Brake-apply plate
- 52 - Brake piston
- 53 - Rear cover plug
- 54 - Diaphragm
- 55 - Output-driven PTO output shaft
- 56 - One-piece output shaft
- 57 - Shifter shaft hole plug
- 58 - Converter diaphragm
- 59 - Plug
- 60 - Oil seal

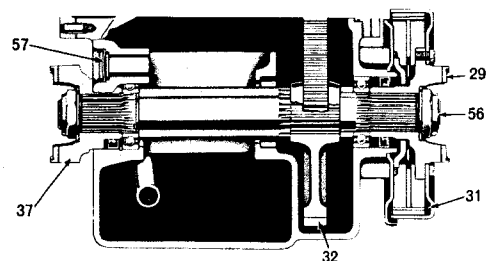
TT, TTB, TRT 2001 SERIES TRANSMISSIONS



**DIRECT MOUNT
(WITH DIAPHRAGM,
FOR "DRY" HOUSING)**

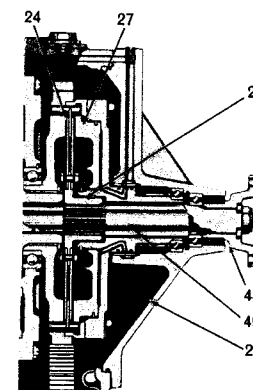


**REMOTE MOUNT
(WITHOUT DIAPHRAGM,
FOR "WET" HOUSING)**

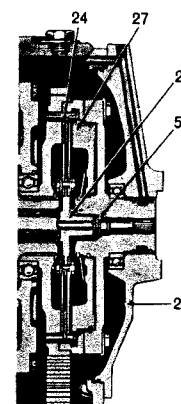


ONE-PIECE OUTPUT SHAFT

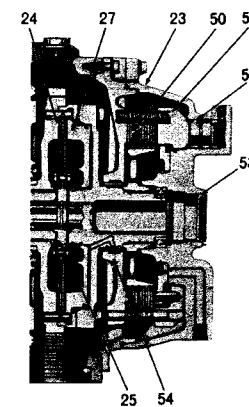
TWO-PIECE OUTPUT SHAFT



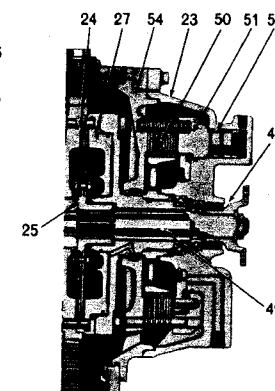
**TT WITH CONVERTER
DRIVEN PTO**



**TT WITH OUTPUT
DRIVEN PTO**



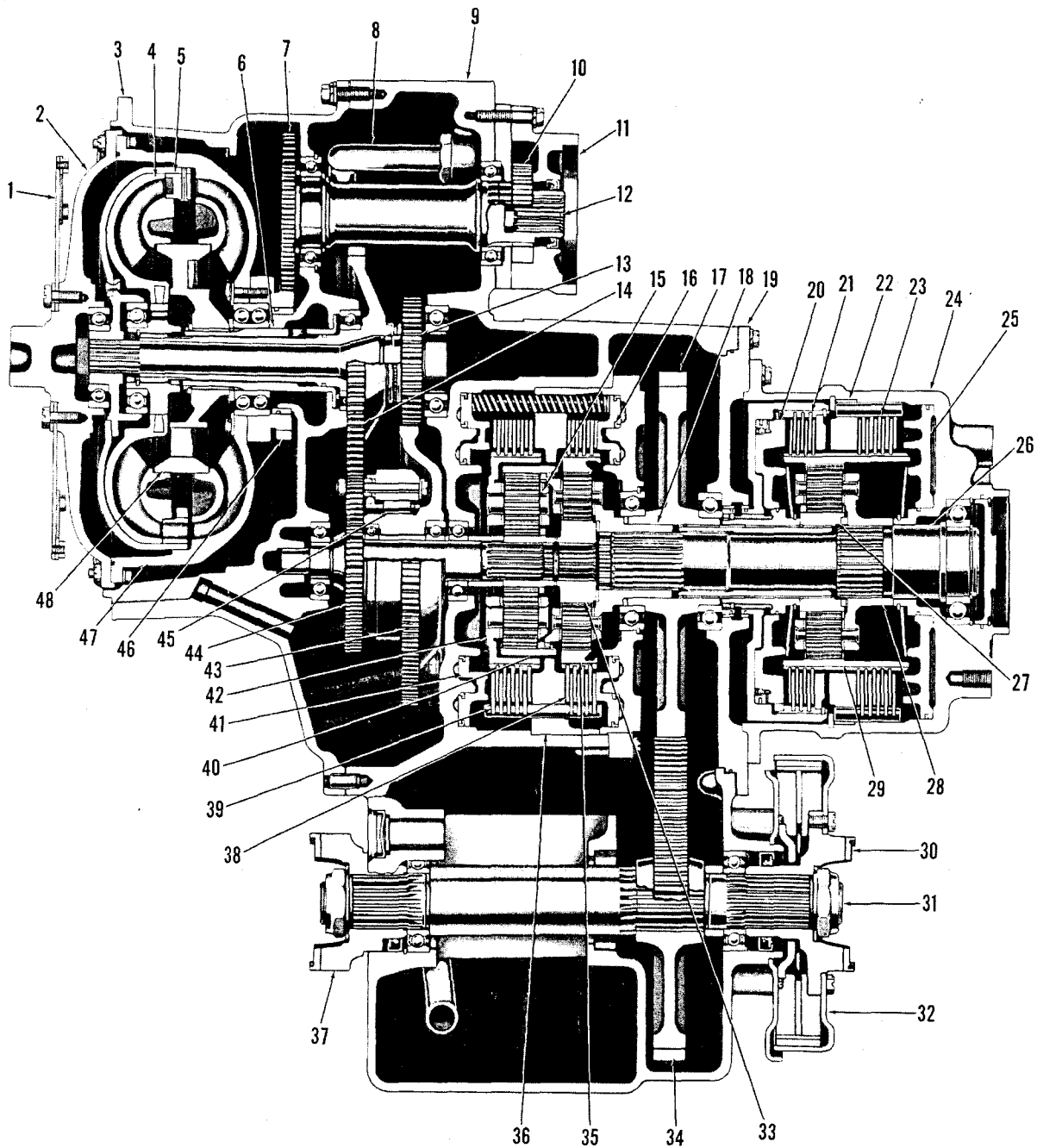
TTB WITHOUT PTO



**TTB WITH CONVERTER
DRIVEN PTO**

- | | |
|--------------------------------|--|
| 1 - Flex disk drive | 25 - High-range clutch piston |
| 2 - Torque converter cover | 26 - Output shaft |
| 3 - Torque converter housing | 27 - High-range sun gear |
| 4 - Second turbine | 28 - High-range planetary carrier |
| 5 - First turbine | 29 - High-range ring gear |
| 6 - Converter ground sleeve | 30 - Rear output flange |
| 7 - Accessory driven gear | 31 - Transmission output shaft |
| 8 - Oil suction tube | 32 - Parking brake |
| 9 - Transmission housing | 33 - Forward-and-reverse sun gear |
| 10 - Oil pump drive gear | 34 - Transfer driven gear |
| 11 - Accessory mounting pad | 35 - Forward ring gear |
| 12 - Accessory drive splines | 36 - Forward-and-reverse clutch anchor |
| 13 - First-turbine drive gear | 37 - Front output flange |
| 14 - Second-turbine drive gear | 38 - Forward clutch |
| 15 - Reverse planetary carrier | 39 - Reverse clutch |
| 16 - Forward clutch piston | 40 - Reverse ring gear |
| 17 - Transfer drive gear | 41 - Reverse clutch piston |
| 18 - Forward planetary carrier | 42 - Reverse clutch hub |
| 19 - Adapter | 43 - First-turbine driven gear |
| 20 - Low-range clutch piston | 44 - Second-turbine driven gear |
| 21 - Low-range clutch | 45 - Freewheel clutch |
| 22 - High-range clutch anchor | 46 - Accessory drive gear |
| 23 - High-range clutch | 47 - Converter pump |
| 24 - Rear housing | 48 - Converter stator |

TT, TTB, TRT 2001 SERIES TRANSMISSIONS

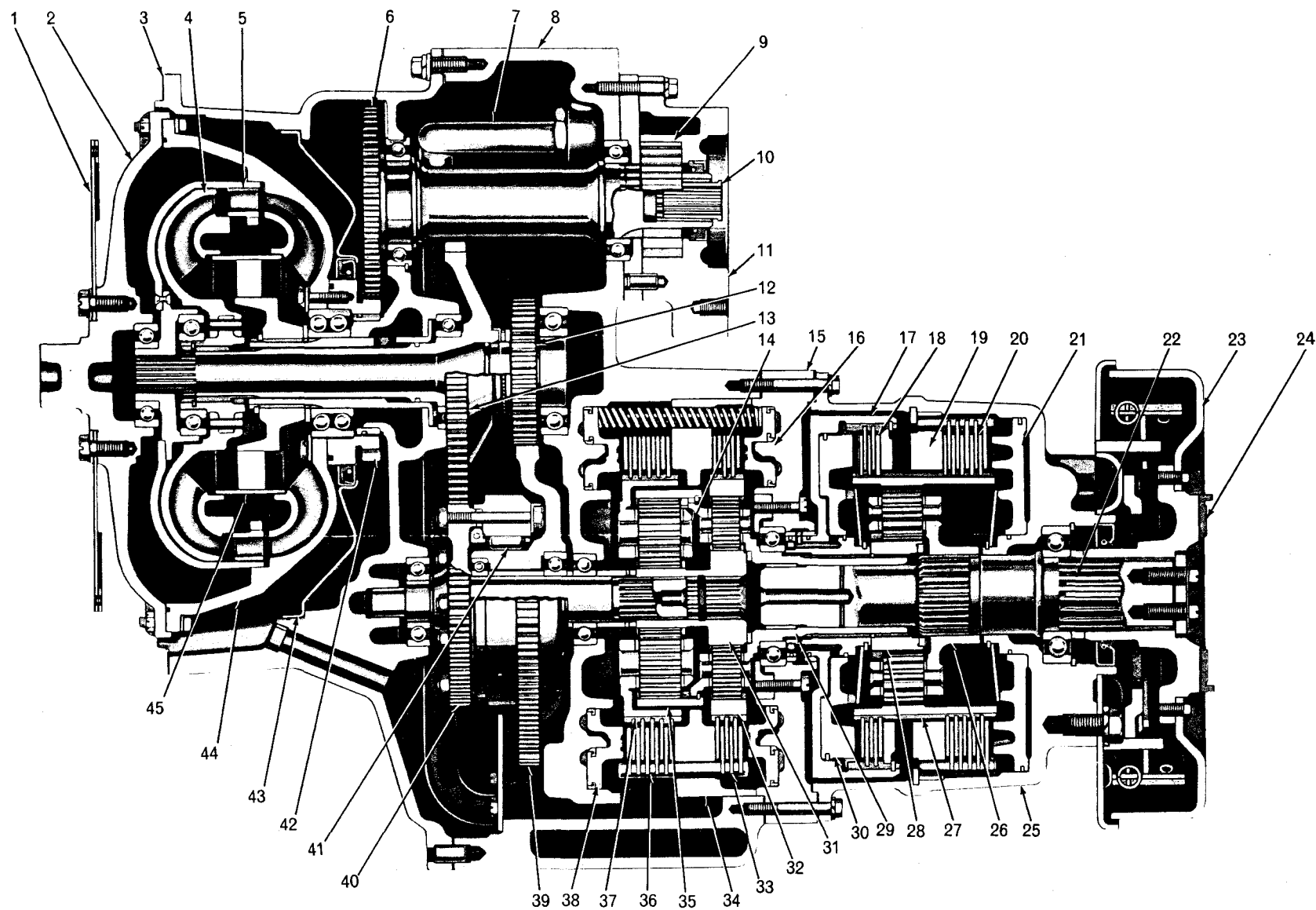


S1505

Foldout 2. TRT 2421-1 Transmission

- 1 - Flex disk drive
- 2 - Torque converter cover
- 3 - Torque converter housing
- 4 - Second turbine
- 5 - First turbine
- 6 - Accessory driven gear
- 7 - Oil suction tube
- 8 - Transmission housing
- 9 - Oil pump drive gear
- 10 - Accessory drive coupling
- 11 - Accessory mounting pad
- 12 - First-turbine drive gear
- 13 - Second-turbine drive gear
- 14 - Reverse planetary carrier
- 15 - Rear output housing adapter
- 16 - Forward clutch piston
- 17 - High-range clutch drum
- 18 - High-range clutch
- 19 - Low-range clutch anchor
- 20 - Low-range clutch
- 21 - Low-range clutch piston
- 22 - Transmission output shaft
- 23 - Parking brake

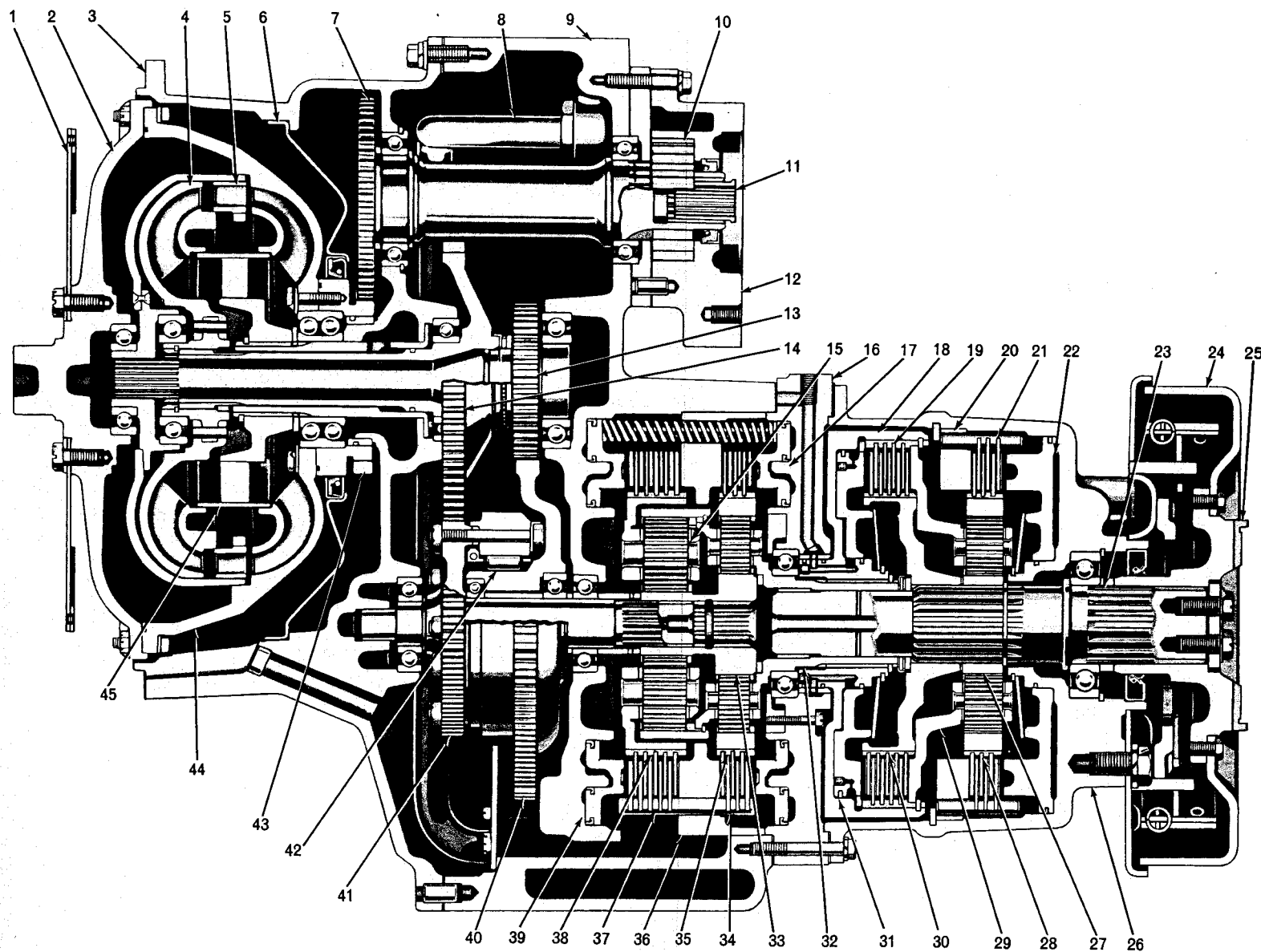
- 24 - Output flange
- 25 - Rear housing
- 26 - Low-range planetary carrier
- 27 - Low-range ring gear
- 28 - Low-range sun gear
- 29 - Forward planetary carrier
- 30 - High-range clutch piston
- 31 - Forward-and-reverse sun gear
- 32 - Forward ring gear
- 33 - Forward clutch
- 34 - Forward-and-reverse clutch anchor
- 35 - Reverse ring gear
- 36 - Reverse clutch
- 37 - Reverse clutch hub
- 38 - Reverse clutch piston
- 39 - First-turbine driven gear
- 40 - Second-turbine driven gear
- 41 - Freewheel clutch
- 42 - Accessory drive gear
- 43 - Diaphragm
- 44 - Torque converter pump
- 45 - Torque converter stator



Foldout 3. TRT 2221-3 Transmission (with underdrive)

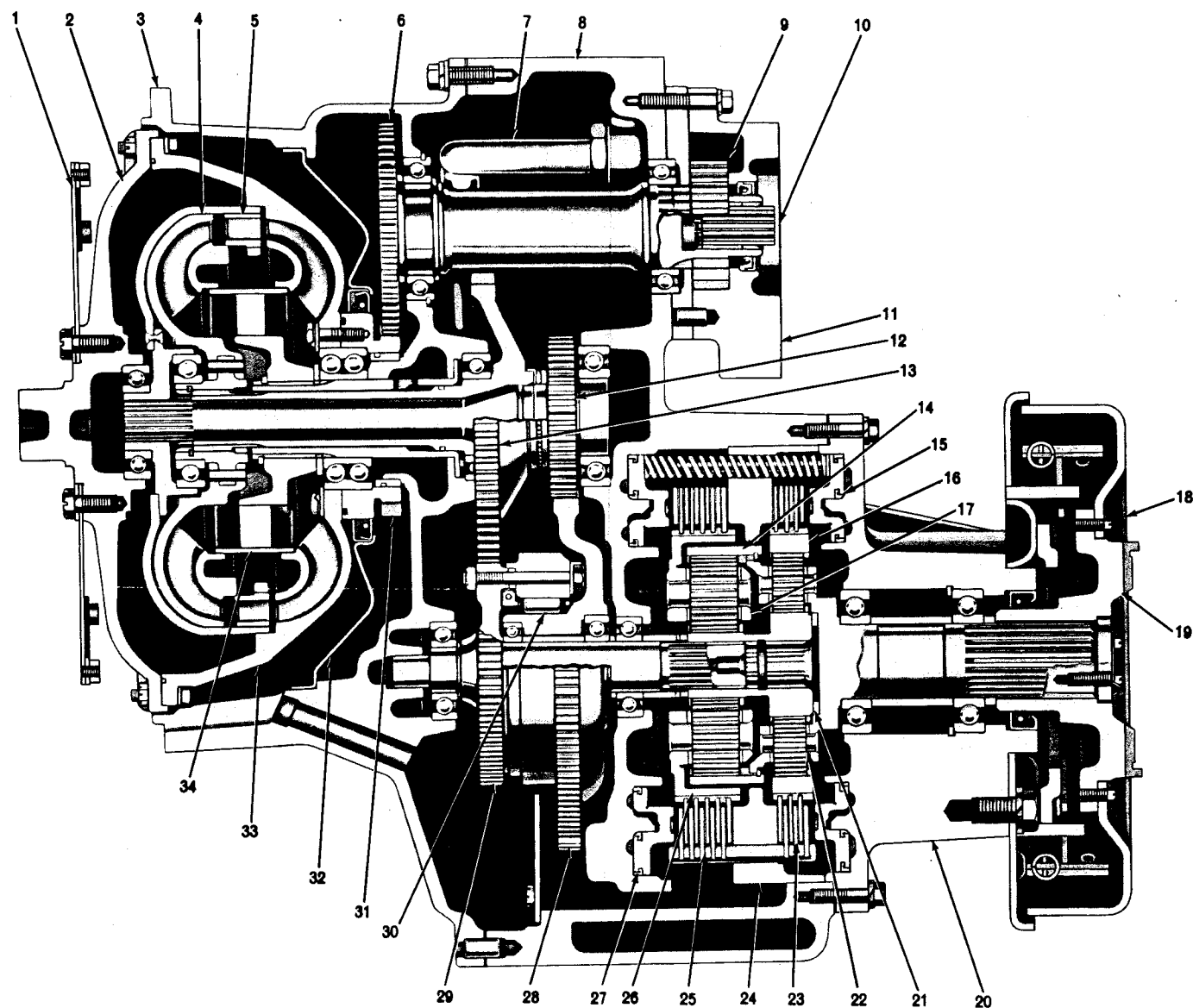
- 1 - Flex disk drive
- 2 - Torque converter cover
- 3 - Torque converter housing
- 4 - Second turbine
- 5 - First turbine
- 6 - Diaphragm
- 7 - Accessory driven gear
- 8 - Oil suction tube
- 9 - Transmission housing
- 10 - Oil pump drive gear
- 11 - Adapter coupling
- 12 - Accessory mounting pad
- 13 - First-turbine drive gear
- 14 - Second-turbine drive gear
- 15 - Reverse planetary carrier
- 16 - Adapter
- 17 - Forward clutch piston
- 18 - Low-range clutch drum
- 19 - Low-range clutch
- 20 - High-range clutch anchor
- 21 - High-range clutch
- 22 - High-range clutch piston
- 23 - Output shaft

- 24 - Parking brake
- 25 - Output flange
- 26 - Rear housing
- 27 - High-range sun gear
- 28 - High-range ring gear
- 29 - High-range planetary carrier
- 30 - Low-range clutch hub
- 31 - Low-range clutch piston
- 32 - Forward planetary carrier
- 33 - Forward-and-reverse sun gear
- 34 - Forward clutch
- 35 - Forward ring gear
- 36 - Forward-and-reverse clutch anchor
- 37 - Reverse clutch
- 38 - Reverse clutch hub
- 39 - Reverse clutch piston
- 40 - First-turbine driven gear
- 41 - Second-turbine driven gear
- 42 - Freewheel clutch
- 43 - Accessory drive gear
- 44 - Torque converter pump
- 45 - Torque converter stator



- 1 - Flex disk drive
- 2 - Torque converter cover
- 3 - Torque converter housing
- 4 - Second turbine
- 5 - First turbine
- 6 - Accessory driven gear
- 7 - Oil suction tube
- 8 - Transmission housing
- 9 - Oil pump drive gear
- 10 - Accessory drive coupling
- 11 - Accessory mounting pad
- 12 - First-turbine drive gear
- 13 - Second-turbine drive gear
- 14 - Reverse ring gear
- 15 - Forward clutch piston
- 16 - Forward ring gear
- 17 - Reverse planetary carrier

- 18 - Parking brake
- 19 - Output flange
- 20 - Rear housing
- 21 - Forward-and-reverse sun gear
- 22 - Forward planetary carrier
- 23 - Forward clutch
- 24 - Forward-and-reverse clutch anchor
- 25 - Reverse clutch
- 26 - Reverse clutch hub
- 27 - Reverse clutch piston
- 28 - First-turbine driven gear
- 29 - Second-turbine driven gear
- 30 - Freewheel clutch
- 31 - Accessory drive gear
- 32 - Diaphragm
- 33 - Torque converter pump
- 34 - Torque converter stator



A

- 1 - Flange retaining nut, 1-1/4-12
(nylon insert) A
- 2 - Flange washer
- 3 - Flange spacer
- 4 - Self-locking bolt,
3/8-24 x 1-1/8 in. (2) B
- 5 - Lockstrip
- 6 - Flange retaining washer
- 7 - Shim (as required)
0.025-in. (0.63-mm) thick
0.005-in. (0.13-mm) thick
- 8 - Torqmatic coupling assembly
- 9 - Flange (Mechanics 5C)
- 10 - Flange (Mechanics 6C)
- 11 - Oil seal
- 12 - Bolt, 3/8-24 x 2 in. (12)
- 13 - Transmission front cover
- 14 - Front cover gasket

- 15 - Ball bearing
- 16 - Bolt, 1/2-13 x 1-1/8 in. (6) C
- 17 - Lockstrip (3)
- 18 - Input shaft
- 19 - Self-locking nut, 5/16-24 (24) D
- 20 - Torque converter drive cover
- 21 - Lockwasher, 3/8 in. (12)
- 22 - Nut, 3/8-24 (12) E
- 23 - Input shaft
- 24 - Torque converter drive cover

<u>Torque</u>	<u>lb ft</u>	<u>N·m</u>
<u>A</u>	450-700	611-949
<u>B</u>	41-49	56-66
<u>C</u>	67-80	91-108
<u>D</u>	14-18	19-24
<u>E</u>	33-40	45-54

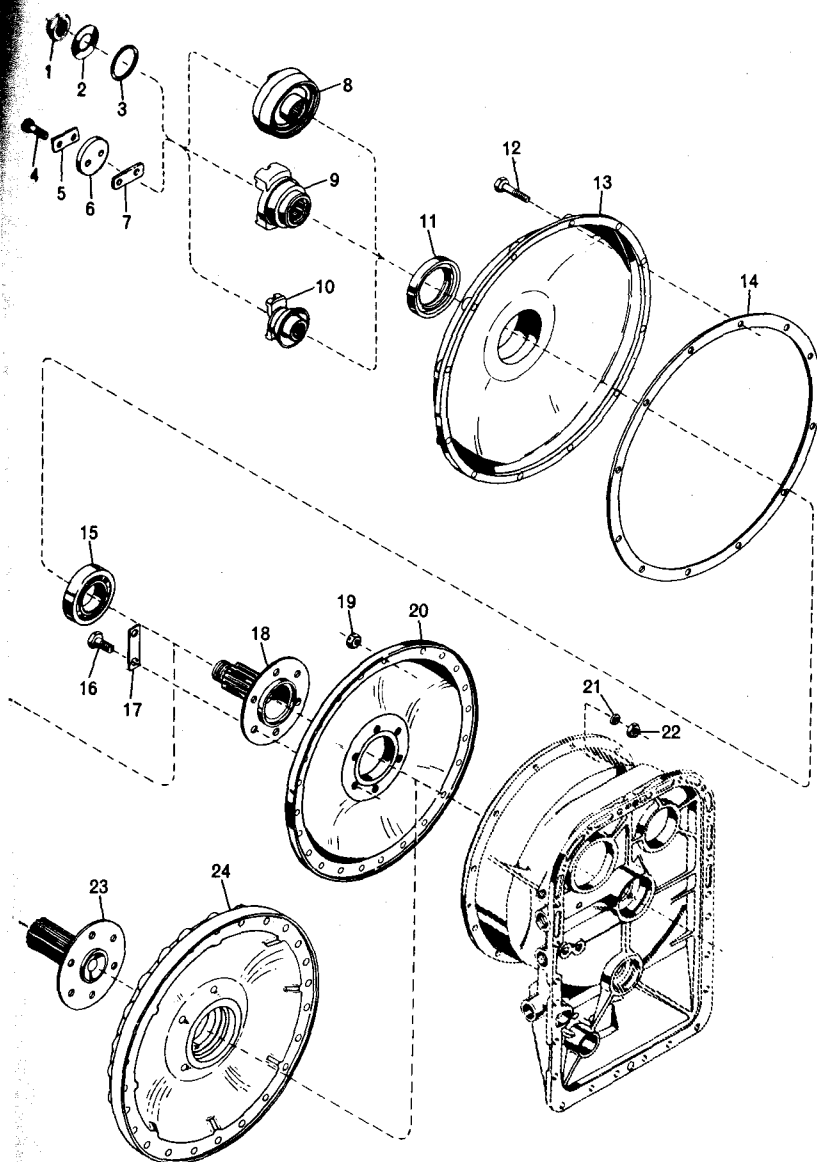
B

- 1 - Self-locking bolt,
1/2-13 x 7/8 in. (6) A
- 2 - Flex disk plate
- 3 - Flex disk (3)
- 4 - Flex disk plate
- 5 - Flex disk and washer assembly
- 6 - Self-locking nut, 5/16-24 (24) B
- 7 - Torque converter drive cover
- 8 - Converter drive ring
- 9 - Twelve-point bolt, 3/8 x
1-1/4 in. (8) C

- 10 - Sealring
- 11 - Self-locking nut, 5/16-24 (24) B
- 12 - Torque converter drive cover
- 13 - Gasket

<u>Torque</u>	<u>lb ft</u>	<u>N·m</u>
<u>A</u>	81-97	110-131
<u>B</u>	14-18	19-24
<u>C</u>	36-43	49-58

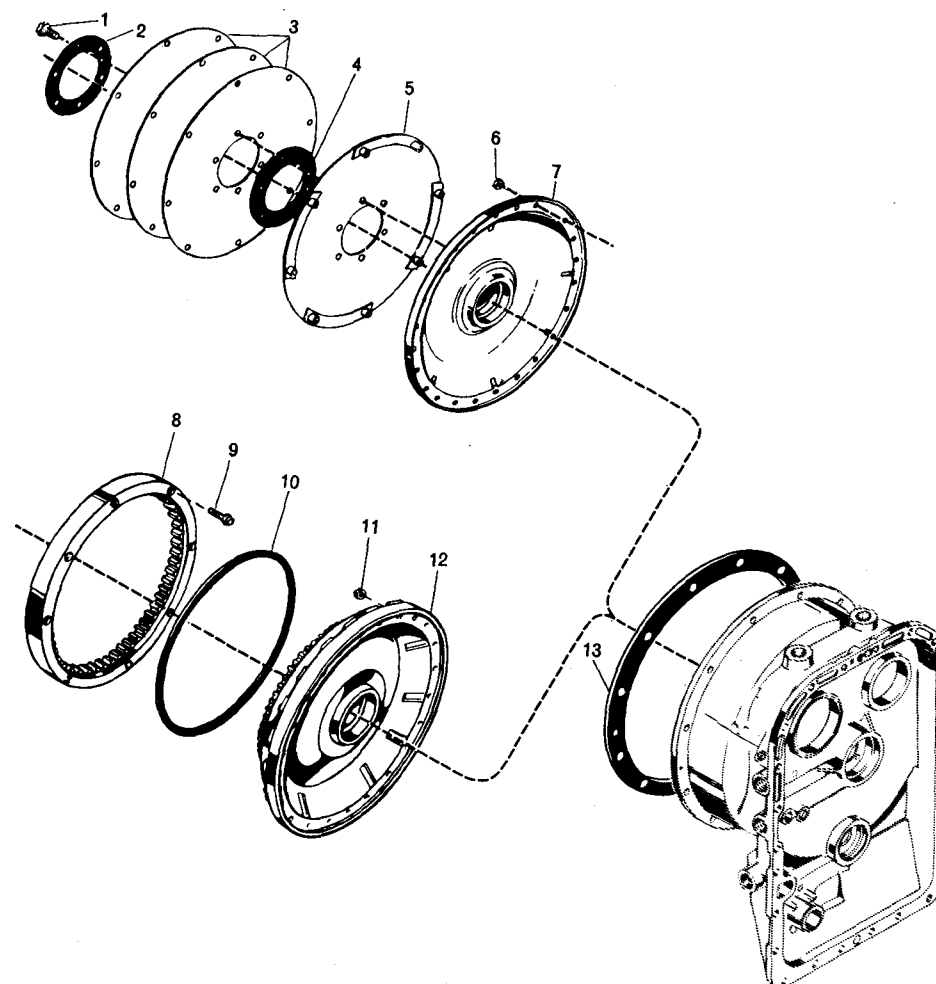
A



9812A

Foldout 6,A. Transmission front cover and remote-mount input drive

B



19056

Foldout 6,B. Transmission direct-mount input drive

A

- 1 - Ball bearing
- 2 - First turbine and support assembly
- 3 - First-turbine support
- 4 - First turbine
- 5 - First-turbine roll pin
TT, TTB, TRT 2211, 2221 (6)
TT, TTB, TRT 2411, 2421 (9)
- 6 - Second turbine
- 7 - Internal snapping
- 8 - Ball bearing
- 9 - External snapping
- 10 - Torque converter stator
- 11 - Spacer
- 12 - Bolt, 1/4-28 x 1-1/4 in. (12) A
- 13 - Lockstrip (6)

- 14 - Torque converter pump retainer
- 15 - Torque converter pump assembly
- 16 - Special bolt, 5/16-24 x 1.30 in. (24)
- 17 - Torque converter pump gasket
- 18 - Double-row ball bearing
- 19 - Input accessory drive gear
- 20 - Sealring*
- 21 - Sealring

*Not used with "wet" housings

<u>Torque</u>	<u>lb ft</u>	<u>N·m</u>
<u>A</u>	10-12	14-16

B

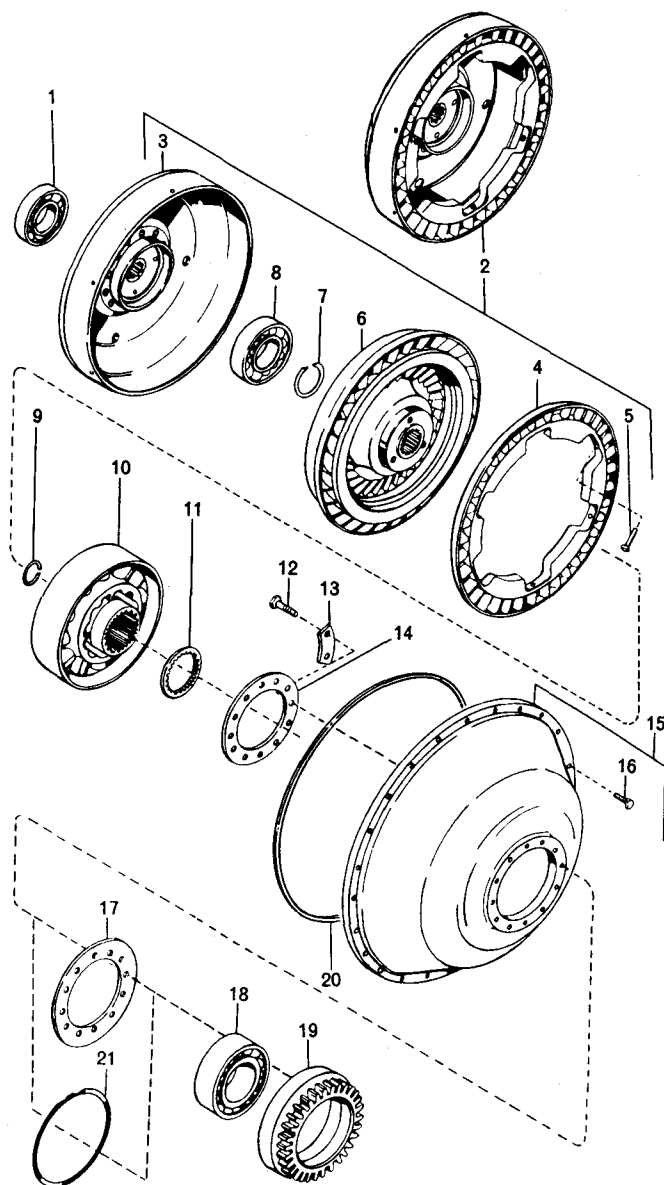
- 1 - Accessory drive gear
- 2 - Accessory-driven gear
- 3 - Bolt, 7/16-14 x 1-3/8 in. (23) A
- 4 - Lockwasher (23)
- 5 - Flat washer (23)
- 6 - Ball bearing
- 7 - External snapping
- 8 - Accessory drive shaft
- 9 - Ball bearing
- 10 - Ball bearing (standard duty)
- 11 - External snapping
- 12 - Ball bearing
- 13 - Converter ground sleeve
- 14 - Self-locking bolt,
5/16-18 x 3/4 in. (4) B
- 15 - Step-joint sealring
- 16 - Ball bearing
- 17 - Second-turbine drive gear
- 18 - Lubrication regulator valve guide pin
- 19 - Lubrication regulator valve spring
- 20 - Lubrication regulator valve
- 21 - Converter pressure regulator valve
guide pin
- 22 - Converter pressure regulator valve
spring
- 23 - Converter pressure regulator valve
- 24 - Step-joint sealring
- 25 - Thrust race
- 26 - Thrust roller bearing
- 27 - Thrust race
- 28 - First-turbine drive gear
- 29 - Ball bearing

- 30 - Lubrication bypass tube
- 31 - External thermostat kit
- 32 - Thermostat assembly
- 33 - Sealring
- 34 - Connector
- 35 - Adapter
- 36 - Converter housing assembly
- 37 - Pipe plug, 3/4 in. NPTF C
- 38 - Converter housing
- 39 - Plug, 1/2-14 PTF D
- 40 - Converter housing sleeve
- 41 - Dowel pin (2)
- 42 - Flat washer, 7/16 in.
- 43 - Lockwasher, 7/16 in.
- 44 - Bolt, 7/16-14 x 2-3/4 in. A
- 45 - Roller bearing (heavy duty)
- 46 - Diaphragm assembly*
- 47 - Oil seal*
- 48 - Diaphragm*
- 49 - Cup plug*
- 50 - Step-joint sealring

*Used with "dry" housings

<u>Torque</u>	<u>lb ft</u>	<u>N·m</u>
<u>A</u>	42-50	57-67
<u>B</u>	17-20	24-27
<u>C</u>	33-37	45-50
<u>D</u>	23-27	32-36

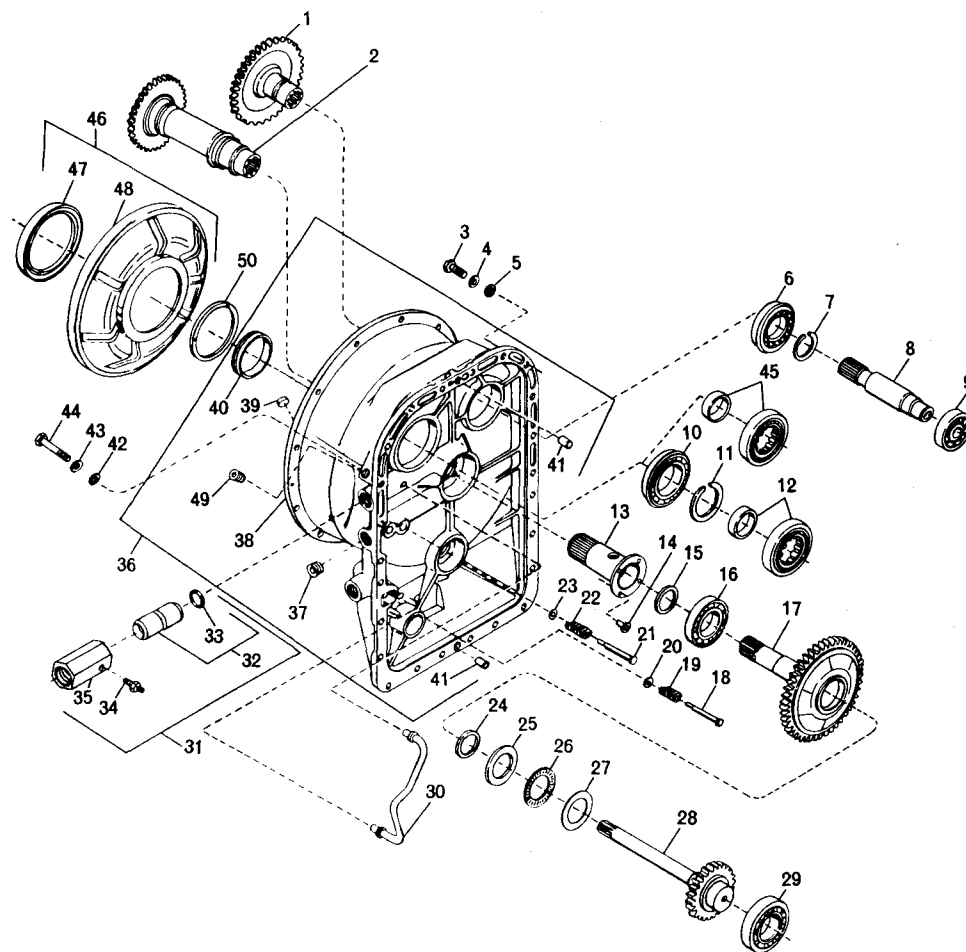
A



Foldout 7.A. Torque converter

63778

B



Foldout 7.B. Torque converter housing and turbine drive gears

63780

A

- 1 - Ball bearing
- 2 - Self-locking nut, 3/8-24 (12) A
- 3 - Second-turbine driven gear
- 4 - Ball bearing
- 5 - Spring retainer plate
- 6 - Spring pin (3)
- 7 - Spring (3)
- 8 - Freewheel roller cage
- 9 - Freewheel roller (15)
- 10 - Freewheel cam assembly
- 11 - Roll pin
- 12 - Freewheel cam
- 13 - Retainer plate
- 14 - Square-head bolt (12)
- 15 - Ball bearing
- 16 - Self-locking nut, 3/8-24 (12) A
- 17 - Second-turbine driven gear
- 18 - Ball bearing

- 19 - Spring retainer plate
- 20 - Spring pin (3)
- 21 - Spring (3)
- 22 - Freewheel roller cage
- 23 - Freewheel roller (15)
- 24 - Freewheel cam assembly
- 25 - Roll pin
- 26 - Freewheel cam
- 27 - Square-head bolt (12)
- 28 - First-turbine driven gear
- 29 - Bearing spacer
- 30 - Ball bearing
- 31 - Bearing spacer
- 32 - Ball bearing

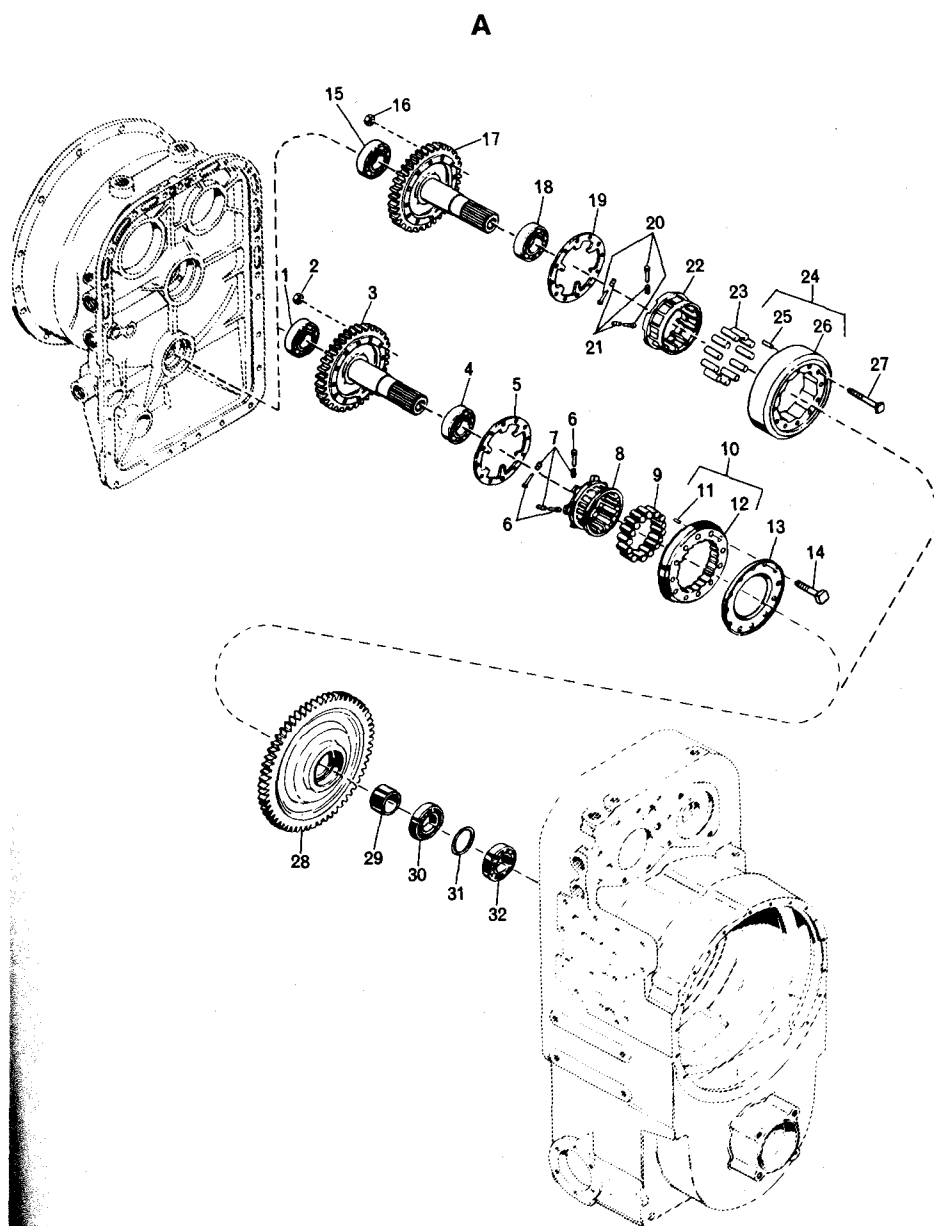
<u>Torque</u>	<u>lb ft</u>	<u>N·m</u>
<u>A</u>	41-49	56-66

B

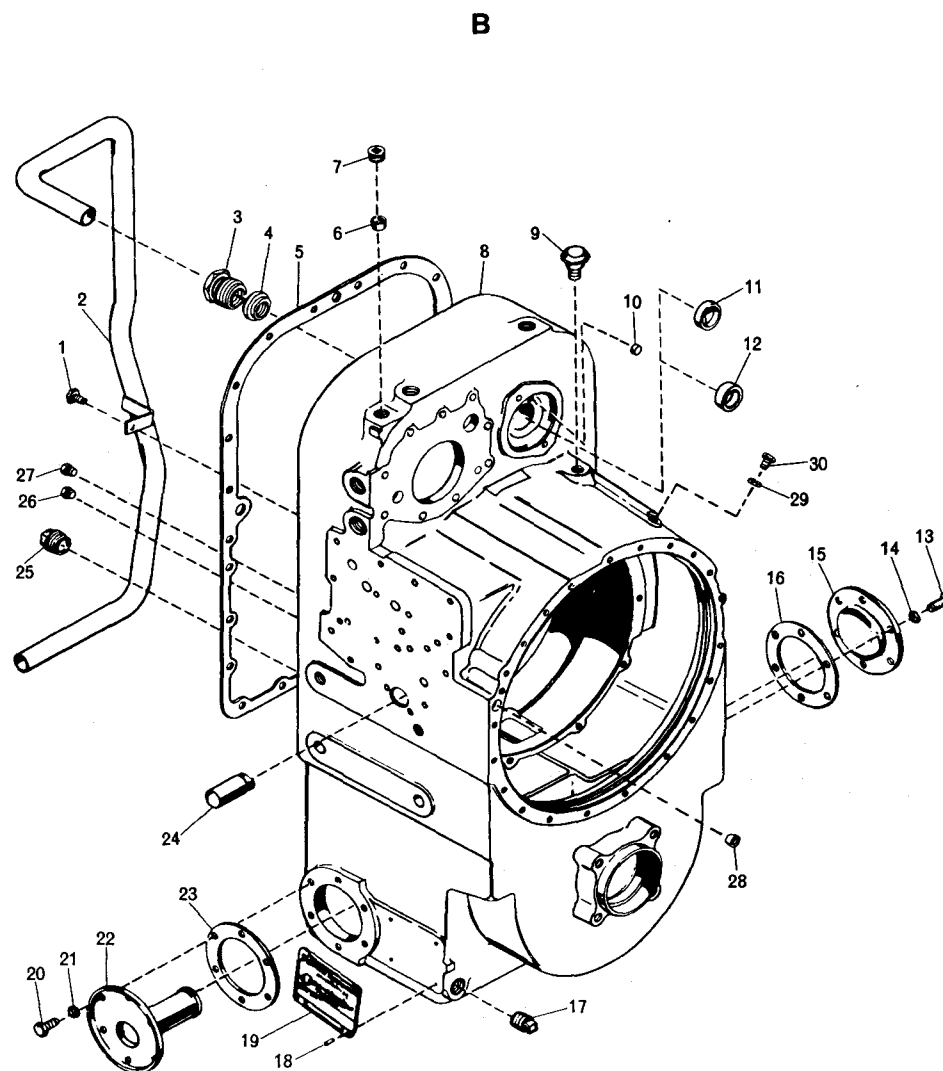
- 1 - Self-locking bolt, 3/8-16 x 5/8 in. A
- 2 - Suction tube
- 3 - Male nut, 1 3/4-14 B
- 4 - Suction tube compression sealring
- 5 - Transmission housing gasket
- 6 - Remote filter plug
- 7 - Plug, 3/4-14 NPTF C
- 8 - Transmission housing
- 9 - Breather
- 10 - Cup plug
- 11 - Oil seal
- 12 - Accessory drive cup plug
- 13 - Bolt, 3/8-16 x 7/8 in. (6) D
- 14 - Lockwasher, 3/8 in. (6)
- 15 - Core hole cover
- 16 - Gasket
- 17 - Drain plug, 3/4-14 NPTF C
- 18 - Nameplate
- 19 - Drive screw, no. 4 x 1/4 in. (4)

- 20 - Bolt, 3/8-16 x 7/8 in. (6) D
- 21 - Lockwasher, 3/8 in. (6)
- 22 - Oil strainer assembly
- 23 - Gasket
- 24 - Anchor pin
- 25 - Oil filler plug
- 26 - Add-level oil plug, 1/4-18 NPTF E
- 27 - Full-level oil plug, 1/4-18 NPTF E
- 28 - Cup plug
- 29 - Flat washer
- 30 - Plug C

<u>Torque</u>	<u>lb ft</u>	<u>N·m</u>
<u>A</u>	36-43	49-58
<u>B</u>	120-150	163-204
<u>C</u>	33-37	45-50
<u>D</u>	26-32	36-43
<u>E</u>	14-16	19-21



Foldout 8,A. Turbine driven gears and freewheel clutch



Foldout 8,B. Transmission housing (-1 models)

Copyright 1984 General Motors Corp.

A

- 1 - Oil suction tube
- 2 - Sealring
- 3 - Male nut, 1-3/4-14 A
- 4 - Sealring
- 5 - Transmission housing gasket
- 6 - Remote filter plug
- 7 - Plug, 3/4-14 NPTF B
- 8 - Breather
- 9 - Cup plug
- 10 - Nameplate
- 11 - Drive screw, No. 4 x 1/4 in. (4)
- 12 - Accessory drive cup plug
- 13 - Oil seal
- 14 - Oil strainer
- 15 - Sealring
- 16 - Oil strainer cover
- 17 - Lockwasher, 3/8 in. (2)
- 18 - Bolt, 3/8-16 x 3/4 in. (2) C
- 19 - Oil level ADD plug D
- 20 - Oil level FULL plug D

- 21 - Oil level tube
- 22 - Oil level tube
- 23 - Oil drain plug, 3/4 in. NPTF B
- 24 - Oil filler plug D
- 25 - Anchor pin
- 26 - Transmission housing assembly
- 27 - Transmission housing
- 28 - Plug (2) D
- 29 - Baffle plate
- 30 - Self-locking bolt, 5/16-18 x 5/8 in. (3) E
- 31 - Self-locking bolt, 5/16-18 x 5/8 in. E

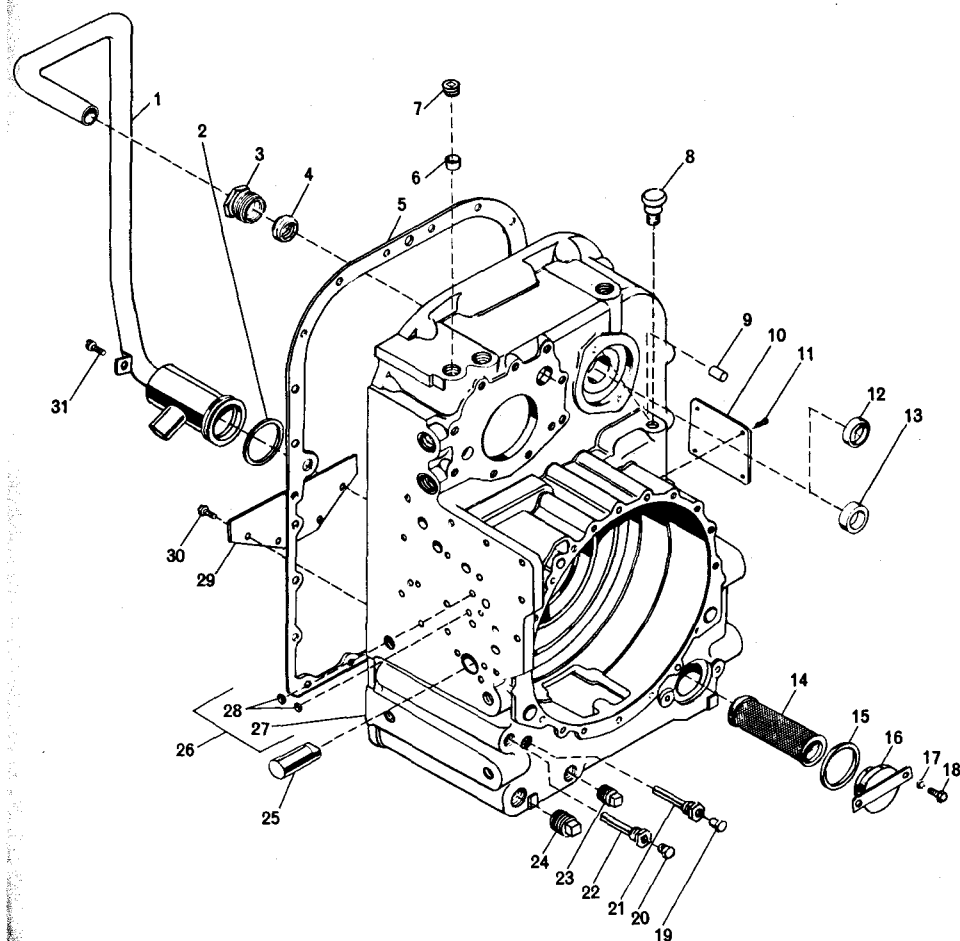
<u>Torque</u>	<u>lb ft</u>	<u>N·m</u>
<u>A</u>	120-150	163-204
<u>B</u>	33-37	45-50
<u>C</u>	26-32	36-43
<u>D</u>	Tighten sufficiently to prevent leakage	
<u>E</u>	17-20	23-27

B

- 1 - Piston sealring
- 2 - Piston sealring
- 3 - Piston sealring
- 4 - Reverse clutch piston
- 5 - External-tanged, reverse clutch plate (4)
- 6 - Internal-splined, reverse clutch plate (4)
- 7 - Forward-and-reverse sun gear (standard-speed low gear)
- 8 - Spacer
- 9 - Reverse planetary carrier assembly
- 10 - Thrust washer (4)
- 11 - Planetary pinion (matched set of 4)
- 12 - Pinion roller (88)
- 13 - Thrust washer (4)
- 14 - Spindle (4)
- 15 - Reverse planetary carrier

- 16 - Forward-and-reverse sun gear (high speed, low gear)
- 17 - External-tanged reverse clutch plate
- 18 - Internal-splined reverse clutch plate
- 19 - Forward-and-reverse clutch anchor assembly
- 20 - Forward-and-reverse clutch anchor
- 21 - Anchor pin (6)
- 22 - Piston return spring (12)
- 23 - Return spring guide pin (12)
- 24 - Check ball, white (2)
- 25 - Retainer (2)

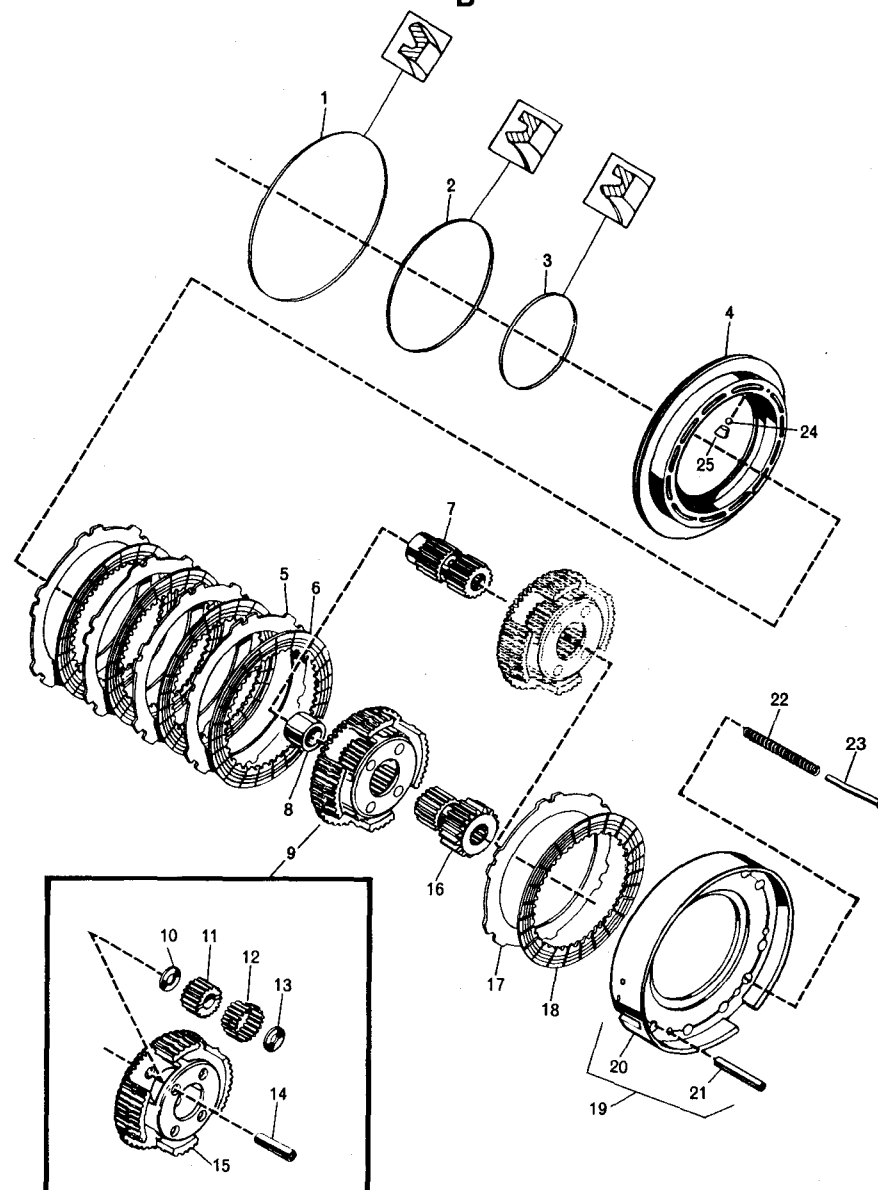
A



Foldout 9,A. Transmission housing (-3 models)

8187A

B



Foldout 9,B. Reverse clutch and planetary

9/98A

A

- 1 - Reverse ring gear
- 2 - Thrust washer
- 3 - Forward planetary carrier assembly
- 4 - Spindle (4)
- 5 - Thrust washer (4)
- 6 - Pinion roller (88)
- 7 - Pinion (matched set of 4)
- 8 - Thrust washer (4)
- 9 - Forward planetary carrier
- 10 - Forward planetary carrier assembly
- 11 - Spindle (6)
- 12 - Thrust washer (6)
- 13 - Pinion roller (120)
- 14 - Pinion (matched set of 6)
- 15 - Thrust washer (6)
- 16 - Forward planetary carrier
- 17 - Forward planetary carrier assembly

- 18 - Spindle (6)
- 19 - Thrust washer (6)
- 20 - Pinion roller (120)
- 21 - Pinion (matched set of 6)
- 22 - Thrust washer (6)
- 23 - Forward planetary carrier
- 24 - Thrust washer
- 25 - Internal snapping
- 26 - Internal-splined low-range clutch plate (4)
- 27 - External-tanged low-range clutch plate (4)
- 28 - Forward ring gear
- 29 - Forward clutch piston assembly
- 30 - Check ball and retainer kit
- 31 - Check ball, white (2)
- 32 - Retainer (2)

- 33 - Forward clutch piston
- 34 - Piston sealring
- 35 - Piston sealring
- 36 - Piston sealring
- 37 - Forward clutch piston housing
- 38 - Self-locking bolt (10) A
3/8-16 x 1-1/2-in. (earlier models)*
3/8-16 x 1-3/4-in. (later models)
- 39 - Plug, 1/4-18 PTF B

*Used with flat washers

<u>Torque</u>	<u>lb ft</u>	<u>N·m</u>
<u>A</u>	36-43	49-58
<u>B</u>	14-16	19-21

B

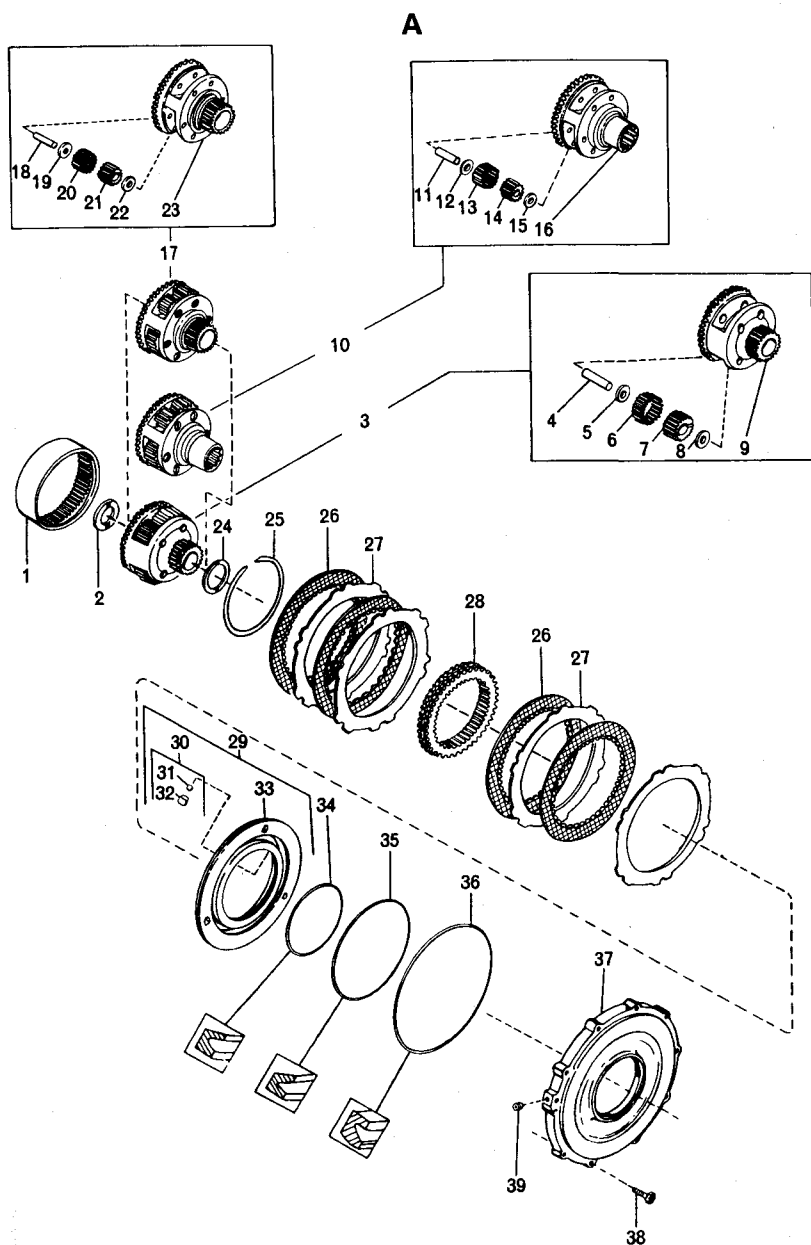
- 1 - Reverse planetary ring gear
- 2 - Thrust washer
- 3 - Forward planetary carrier assembly
- 4 - Bushing
- 5 - Forward planetary carrier
- 6 - Spindle (6)
- 7 - Thrust washer (6)
- 8 - Roller (120)
- 9 - Pinion (matched set of 6)
- 10 - Thrust washer (6)
- 11 - Internal snapping
- 12 - Internal-splined clutch plate (2)
- 13 - External-tanged clutch plate (2)
- 14 - Forward planetary ring gear
- 15 - Internal-splined clutch plate
- 16 - External-tanged clutch plate

- 17 - Forward clutch piston
- 18 - Piston sealring
- 19 - Piston sealring
- 20 - Piston sealring
- 21 - Bearing retainer
- 22 - Ball bearing
- 23 - Adapter gasket
- 24 - Adapter assembly
- 25 - Plug, 1/4 in. (2) A
- 26 - Adapter
- 27 - Sleeve
- 28 - Self-locking bolt,
3/8-24 x 1-1/4 in. (6) B
- 29 - Twelve-point bolt,
3/8-16 x 1-3/4 in. (2) C

- 30 - Forward planetary carrier assembly
- 31 - Bushing
- 32 - Forward planetary carrier
- 33 - Spindle (6)
- 34 - Thrust washer (6)
- 35 - Roller (120)
- 36 - Pinion (matched set of 6)
- 37 - Thrust washer (6)

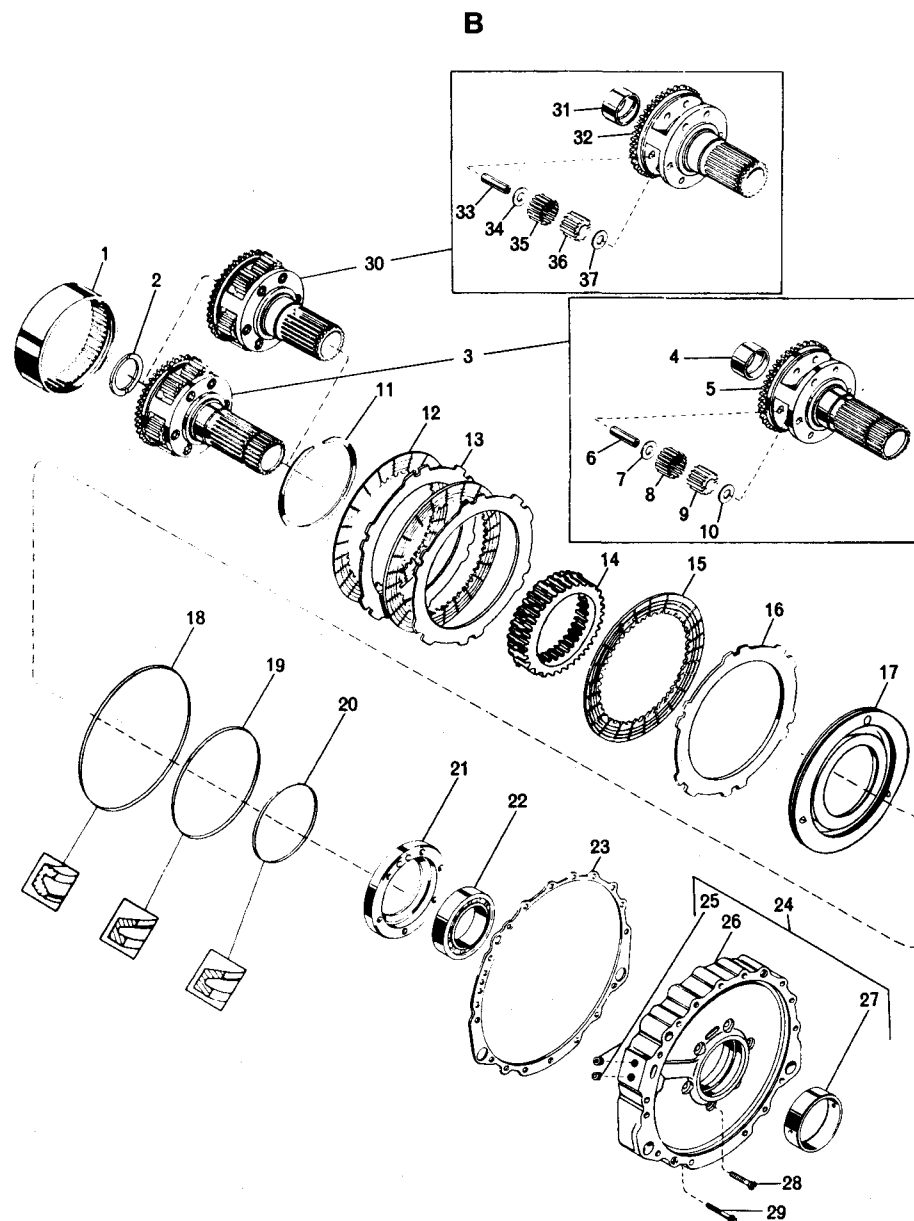
<u>Torque</u>	<u>lb ft</u>	<u>N·m</u>
<u>A</u>	8-10	11-13
<u>B</u>	41-49	56-66
<u>C</u>	36-43	49-58

TT, TTB, TRT 2001 SERIES TRANSMISSIONS



Foldout 10,A. Forward clutch and planetary (-1 models)

1354



Foldout 10,B. Forward clutch and planetary (TRT 2221-3, 2421-3)

9850

A

- 1 - Reverse planetary ring gear
- 2 - Thrust washer
- 3 - Forward planetary carrier assembly
- 4 - Forward planetary carrier
- 5 - Spindle (6)
- 6 - Thrust washer (6)
- 7 - Roller (120)
- 8 - Pinion (matched set of 6)
- 9 - Thrust washer (6)
- 10 - Internal snapping
- 11 - Ball bearing
- 12 - Spacer

- 13 - Internal-splined clutch plate (2)
- 14 - External-tanged clutch plate (2)
- 15 - Forward planetary ring gear
- 16 - Internal-splined clutch plate
- 17 - External-tanged clutch plate
- 18 - Forward clutch piston
- 19 - Piston sealring
- 20 - Piston sealring
- 21 - Piston sealring
- 22 - Internal snapping
- 23 - Ball bearing
- 24 - Spacer

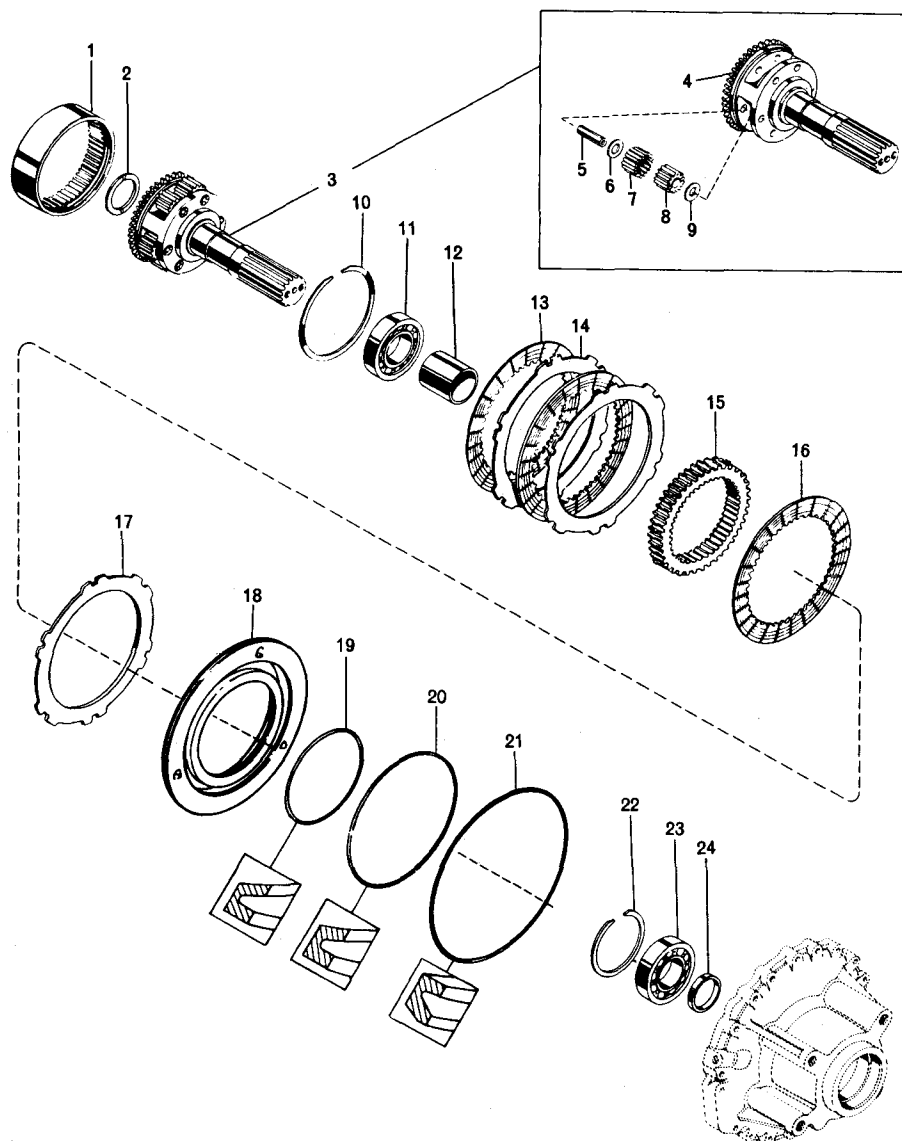
B

- 1 - Ball bearing
- 2 - Transfer drive gear assembly
- 3 - Transfer drive gear
- 4 - Pin (6)
- 5 - External snapping
- 6 - Nut, 5/16-24 (12) A
- 7 - Lockstrip (6)
- 8 - High-range clutch plate
- 9 - High-range, external-tanged clutch plate
- 10 - High-range clutch hub (PTO)
- 11 - External snapping
- 12 - High-range clutch hub
- 13 - High-range clutch plate
- 14 - Flat washer (12)
- 15 - Self-locking bolt, 5/16-24 x 7/8 in. (12)
- 16 - External snapping
- 17 - High-range clutch piston return spring
- 18 - Hook-type sealring
- 19 - High-range clutch piston
- 20 - Sealring
- 21 - Sealring expander
- 22 - High-range clutch piston housing assembly (speedometer drive)

- 23 - Bushing
- 24 - High-range clutch piston housing
- 25 - Pin
- 26 - Speedometer drive shaft
- 27 - Hook-type sealring
- 28 - Ball bearing
- 29 - Hook-type sealring
- 30 - Bolt, 1/2-20 x 2-3/4 in. (6) B
- 31 - Lock tab (6)
- 32 - High-range clutch piston housing assembly (earlier models)
- 33 - Bushing
- 34 - High-range clutch piston housing
- 35 - Sleeve
- 36 - High-range clutch piston housing assembly (later models)
- 37 - High-range clutch piston housing (PTO without brake)
- 38 - Step-joint sealring (2)
- 39 - Sealring

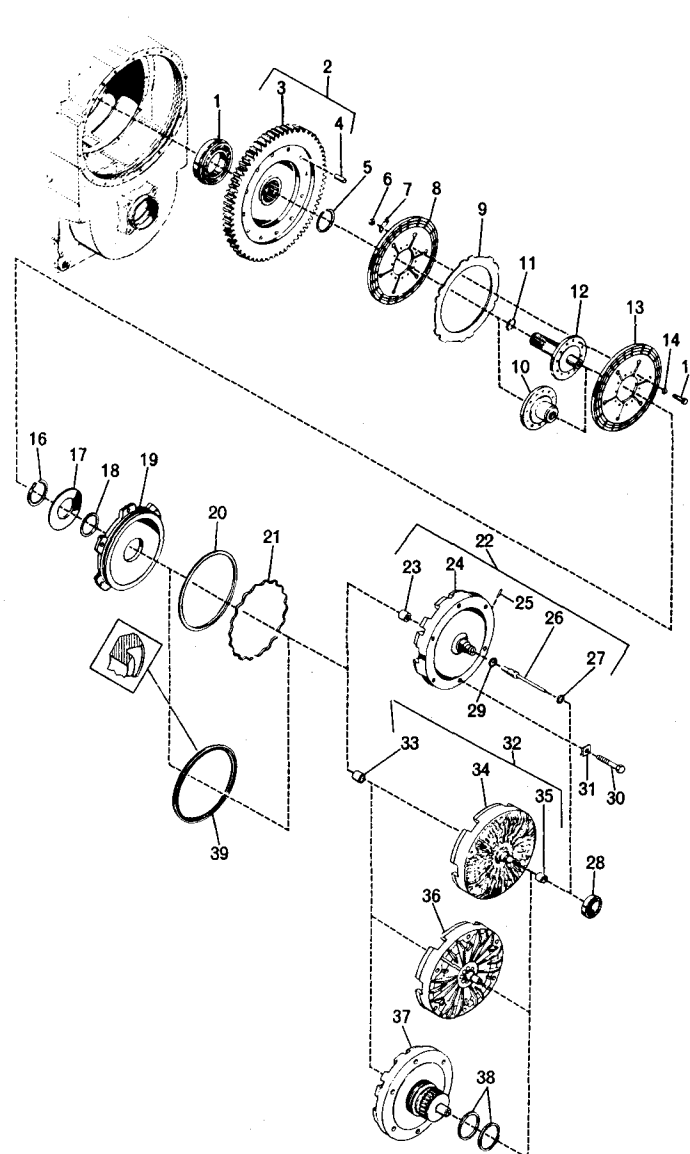
<u>Torque</u>	<u>lb ft</u>	<u>N·m</u>
<u>A</u>	14-18	19-24
<u>B</u>	83-100	113-135

A



Foldout 11,A. Forward clutch and planetary (TRT 2211-3, 2411-3)

B



Foldout 11,B. High-range clutch and piston housing (TT models)

A

- 1 - Ball bearing
- 2 - External snapping
- 3 - Transfer drive gear
- 4 - Ball bearing
- 5 - Adapter gasket
- 6 - Adapter sealring
- 7 - Adapter assembly
- 8 - Adapter
- 9 - Sleeve
- 10 - Bolt, 3/8-16 x 1-1/8 in. (16) A
- 11 - Lockwasher, 3/8 in. (16)
- 12 - Sealring (2)
- 13 - Low-range clutch drum assembly
- 14 - Pin (4)
- 15 - Clutch drum
- 16 - Sealring expander
- 17 - Clutch piston outer sealring
- 18 - Clutch piston inner sealring

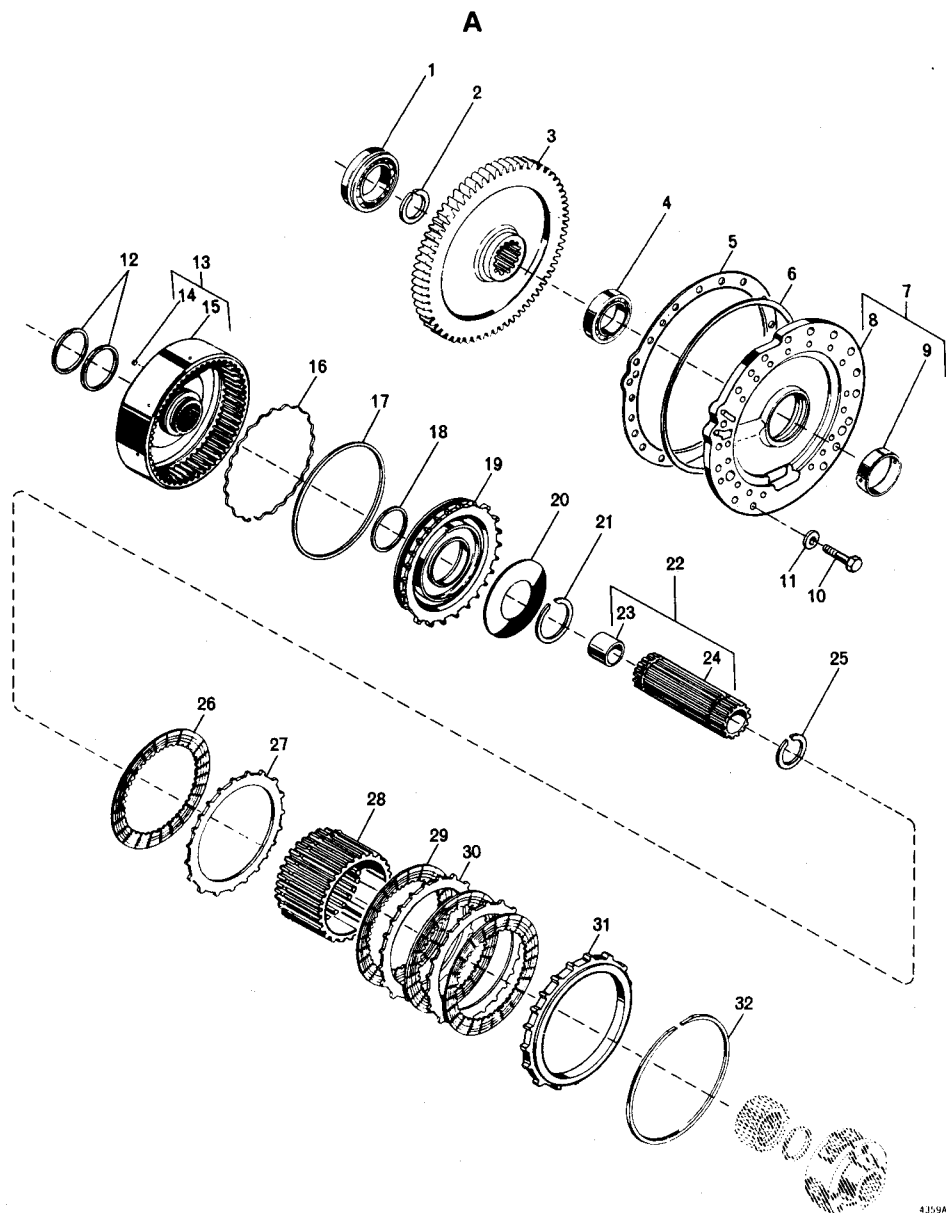
- 19 - Low-range clutch piston
- 20 - Clutch piston return spring
- 21 - External snapping
- 22 - Sleeve assembly
- 23 - Bushing
- 24 - Sleeve
- 25 - External snapping
- 26 - Internal-splined clutch plate
- 27 - External-splined clutch plate
- 28 - High-range ring gear
- 29 - Internal-splined clutch plate (3)
- 30 - External-splined clutch plate (2)
- 31 - Low-range clutch backplate
- 32 - Internal snapping

<u>Torque</u>	<u>lb ft</u>	<u>N•m</u>
<u>A</u>	26-32	36-43

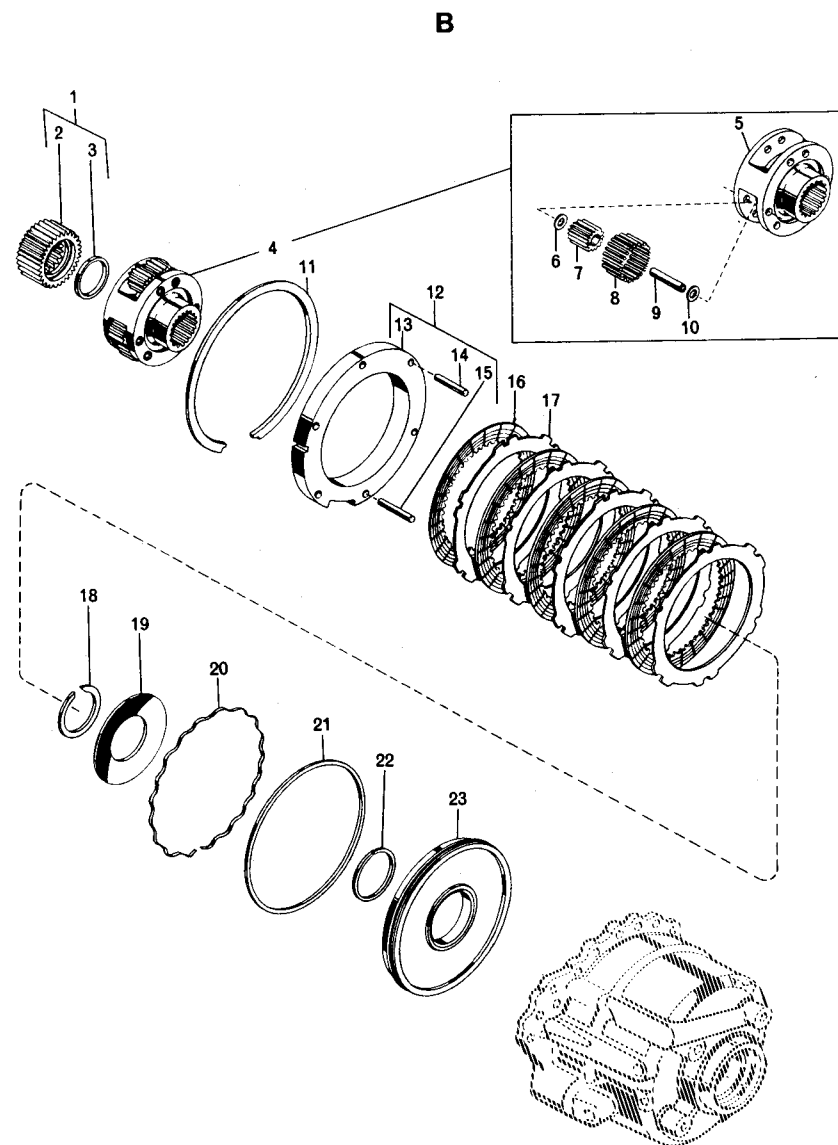
B

- 1 - High-range planetary sun gear assembly
- 2 - Sun gear
- 3 - Thrust washer
- 4 - High-range planetary carrier assembly
- 5 - High-range planetary carrier
- 6 - Thrust washer (6)
- 7 - Pinion (matched set of 6)
- 8 - Roller (96)
- 9 - Spindle (6)
- 10 - Thrust washer (6)
- 11 - Internal snapping
- 12 - High-range clutch anchor assembly

- 13 - Anchor
- 14 - Pin (short) (4)
- 15 - Pin (long) (2)
- 16 - Internal-splined clutch plate (5)
- 17 - External-tanged clutch plate (5)
- 18 - External snapping
- 19 - Clutch piston return spring
- 20 - Sealring expander
- 21 - Clutch piston outer sealring
- 22 - Clutch piston inner sealring
- 23 - High-range clutch piston



Foldout 12,A. Low-range clutch and transfer drive gear (TRT-1 models)



Foldout 12,B. High-range clutch and planetary (TRT-1 models)

A

- 1 - Sealring (2)
- 2 - High-range clutch drum assembly
- 3 - Pin (4)
- 4 - Clutch drum
- 5 - Sealring expander
- 6 - Clutch piston outer sealring
- 7 - Clutch piston inner sealring
- 8 - High-range clutch piston
- 9 - Clutch piston return spring

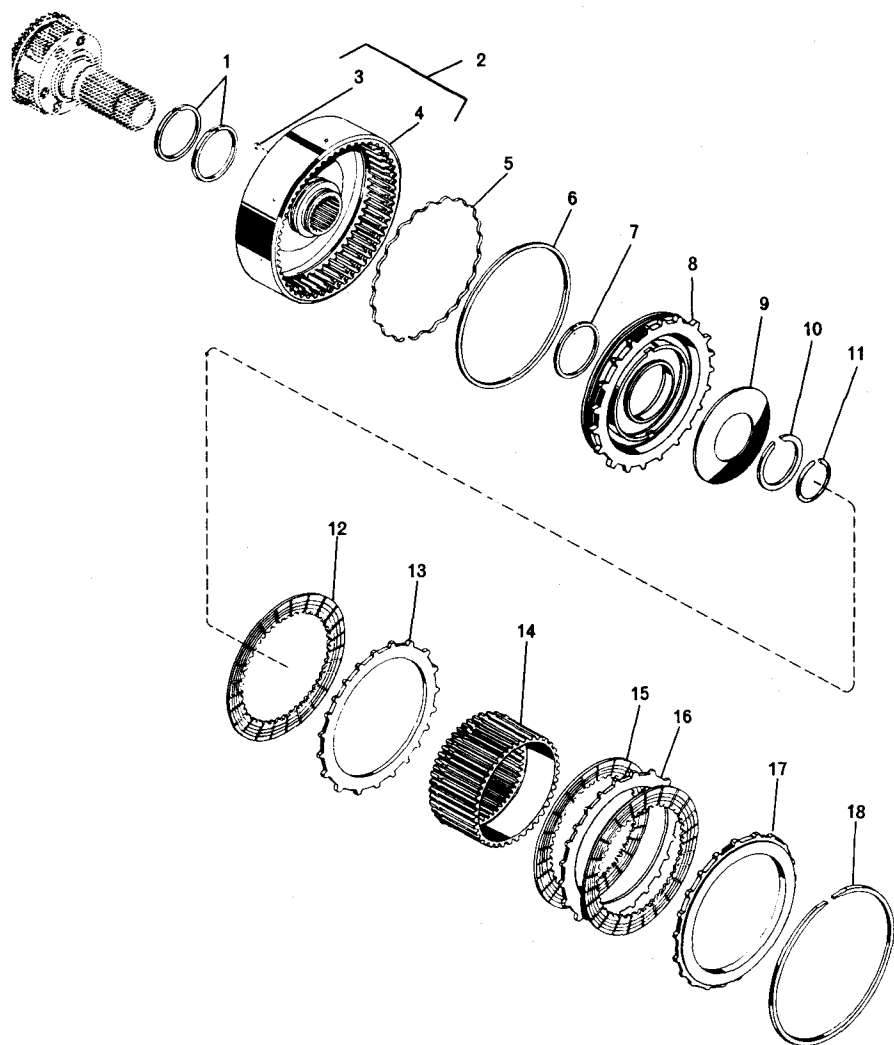
- 10 - External snapping
- 11 - External snapping
- 12 - Internal-splined clutch plate
- 13 - External-splined clutch plate
- 14 - Low-range ring gear
- 15 - Internal-splined clutch plate (2)
- 16 - External-splined clutch plate
- 17 - High-range clutch backplate
- 18 - Internal snapping

B

- 1 - Low-range planetary sun gear assembly
- 2 - Sun gear
- 3 - Thrust washer
- 4 - Low-range planetary carrier assembly
- 5 - Low-range planetary carrier
- 6 - Thrust washer (6)
- 7 - Pinion (matched set of 6)
- 8 - Roller (96)
- 9 - Spindle (6)
- 10 - Thrust washer (6)
- 11 - Internal snapping
- 12 - Low-range clutch anchor assembly

- 13 - Anchor
- 14 - Pin (long) (2)
- 15 - Pin (short) (4)
- 16 - Internal-splined clutch plate (5)
- 17 - External-tanged clutch plate (5)
- 18 - External snapping
- 19 - Clutch piston return spring
- 20 - Sealring expander
- 21 - Clutch piston outer sealring
- 22 - Clutch piston inner sealring
- 23 - Low-range clutch piston

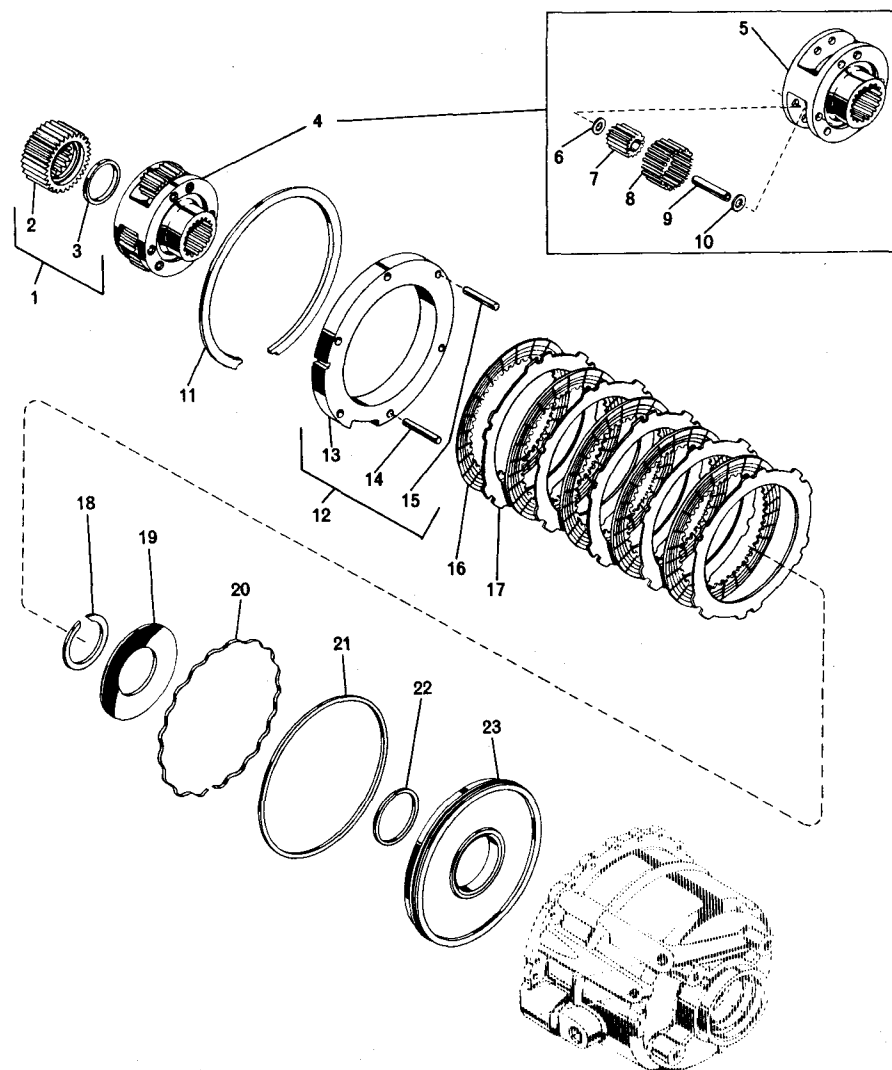
A



4295A

Foldout 13.A. High-range clutch, low-range ring gear (TRT 2221-3, 2421-3 with underdrive)

B



4358A

Foldout 13.B. Low-range clutch and planetary (~3 models with underdrive)

A

- 1 - Sealring (2)
- 2 - Low-range clutch drum assembly
- 3 - Pin (4)
- 4 - Clutch drum
- 5 - Sealring expander
- 6 - Clutch piston outer sealring
- 7 - Clutch piston inner sealring
- 8 - Low-range clutch piston
- 9 - Clutch piston return spring
- 10 - External snapping
- 11 - External snapping
- 12 - Bearing race
- 13 - Roller bearing

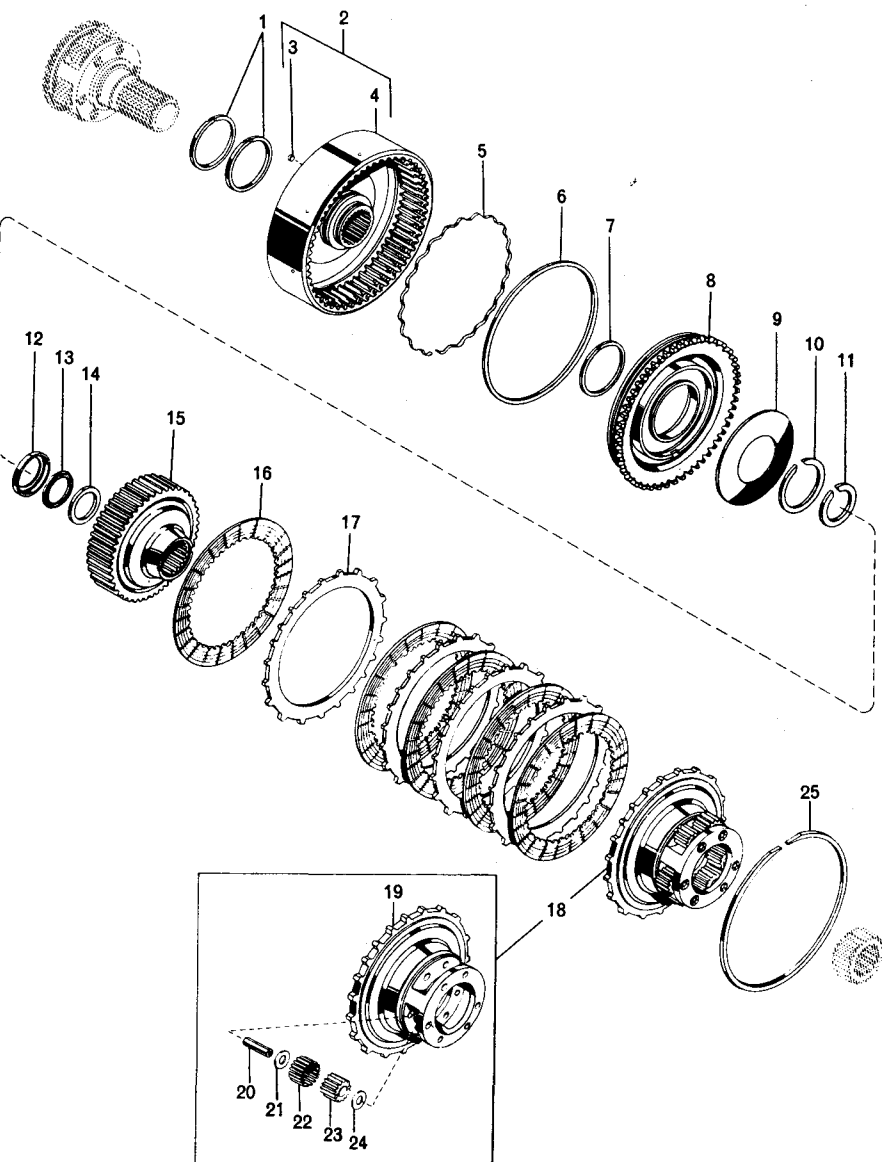
- 14 - Bearing race
- 15 - Low-range clutch hub
- 16 - Internal-splined clutch plate (5)
- 17 - External-splined clutch plate (4)
- 18 - High-range planetary carrier assembly
- 19 - High-range planetary carrier
- 20 - Spindle (6)
- 21 - Thrust washer (6)
- 22 - Roller (120)
- 23 - Pinion (matched set of 6)
- 24 - Thrust washer (6)
- 25 - Internal snapping

B

- 1 - High-range planetary sun gear
- 2 - Internal snapping
- 3 - High-range clutch anchor assembly
- 4 - Anchor
- 5 - Pin (long) (2)
- 6 - Pin (short) (4)
- 7 - Internal-splined clutch plate (2)
- 8 - External-tanged clutch plate (2)
- 9 - High-range ring gear

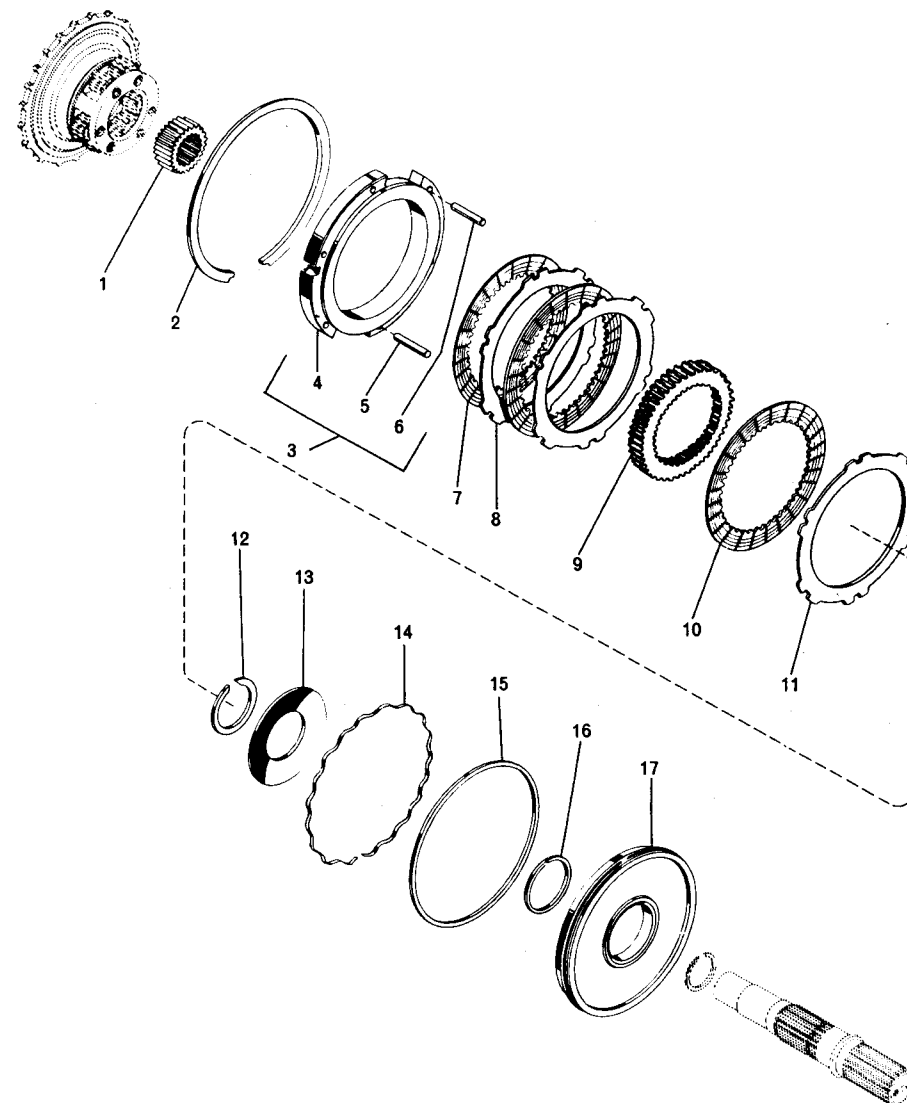
- 10 - Internal-splined clutch plate
- 11 - External-tanged clutch plate
- 12 - External snapping
- 13 - Clutch piston return spring
- 14 - Sealring expander
- 15 - Clutch piston outer sealring
- 16 - Clutch piston inner sealring
- 17 - High-range clutch piston

A



4297

B



4296A

Foldout 14,A. Low-range clutch, high-range planetary (~3 models with overdrive)

Foldout 14,B. High-range clutch, planetary sun and ring gears (~3 models with overdrive)

A

- 1 - Ball bearing
- 2 - Transfer drive gear assembly
- 3 - Transfer drive gear
- 4 - Pin (6)
- 5 - External snapping
- 6 - Nut, 5/16-24 (12) A
- 7 - Lockstrip (6)
- 8 - High-range clutch plate
- 9 - High-range, external-tanged clutch plate
- 10 - High-range clutch hub (models with converter-driven PTO)
- 11 - External snapping
- 12 - High-range clutch hub
- 13 - High-range clutch plate
- 14 - Flat washer (12)
- 15 - Self-locking bolt, 5/16-24 x 7/8 in. (12)
- 16 - External snapping
- 17 - Piston return spring
- 18 - Hook-type sealring
- 19 - High-range clutch piston
- 20 - Sealring
- 21 - Sealring expander

- 22 - High-range clutch piston housing (PTO)
- 23 - Lock tab (6)
- 24 - Bolt, 1/2-20 x 2-3/4 in. (6) B
- 25 - Step-joint sealring (2)
- 26 - O-ring seal
- 27 - External snapping
- 28 - PTO shaft assembly
- 29 - Pin
- 30 - PTO shaft
- 31 - Internal snapping
- 32 - Ball bearing
- 33 - High-range clutch piston housing assembly
- 34 - Bushing
- 35 - High-range clutch piston housing
- 36 - Lock tab (6)
- 37 - Bolt, 1/2-20 x 2-3/4 in. (6) B
- 38 - Sealring

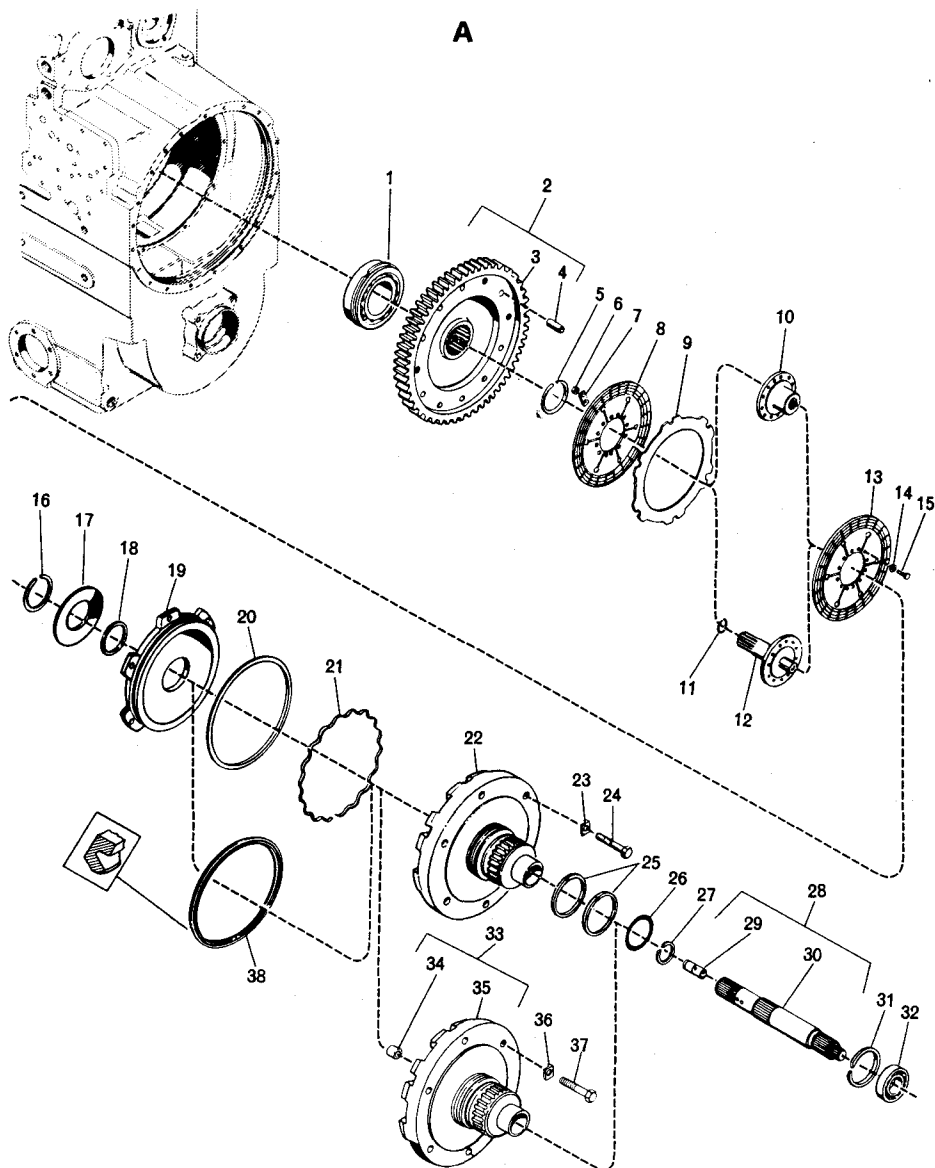
<u>Torque</u>	<u>lb ft</u>	<u>N·m</u>
<u>A</u>	14-18	19-24
<u>B</u>	83-100	113-135

B

- 1 - Gasket
- 2 - Diaphragm assembly
- 3 - Pipe plug, 1/4 in. NPTF A
- 4 - Diaphragm
- 5 - Sleeve
- 6 - Pin (6)
- 7 - Lockwasher, 3/8 in.
- 8 - Bolt, 3/8-16 x 2 in. B
- 9 - Lockwasher, 3/8 in. (2)
- 10 - Bolt, 3/8-16 x 1-1/8 in. (2) B
- 11 - Brake return spring (12)
- 12 - Spring guide pin (12)
- 13 - Brake hub
- 14 - External-tanged brake plate (6)
- 15 - Internal-splined brake plate (5)
- 16 - Step-joint sealring
- 17 - External snapping
- 18 - Ball bearing
- 19 - External snapping
- 20 - Brake-apply plate assembly
- 21 - Brake adjusting ring
- 22 - Spring pin (6)
- 23 - Brake-apply plate
- 24 - Sealring
- 25 - Sealring (3)
- 26 - Brake piston (3)

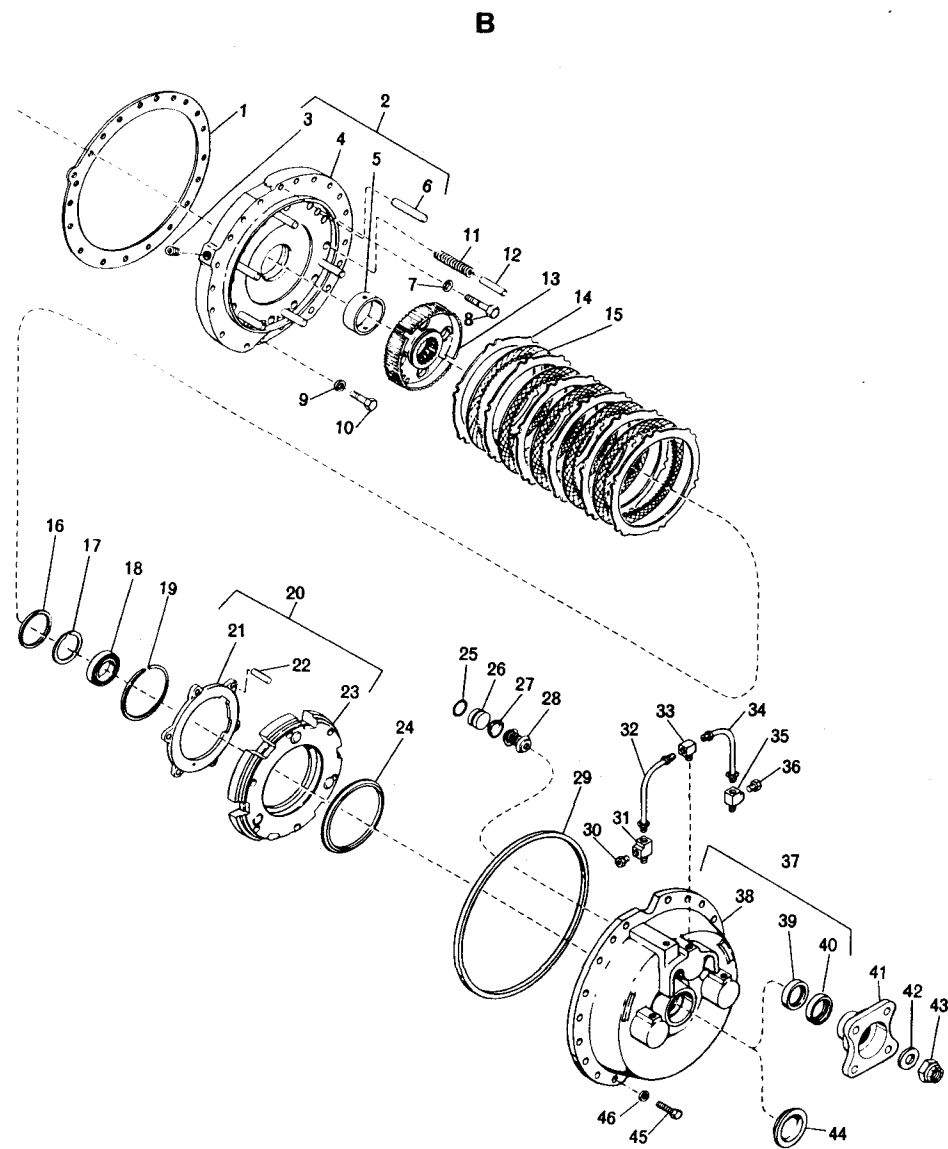
- 27 - Brake piston cup (3)
- 28 - Expander assembly (3)
- 29 - Sealring
- 30 - Plug, 7/16-20 C
- 31 - Brake manifold fitting C
- 32 - Brake manifold
- 33 - Brake manifold fitting C
- 34 - Brake manifold
- 35 - Brake manifold fitting C
- 36 - Plug, 7/16-20 C
- 37 - Rear cover assembly (PTO)
- 38 - Rear cover
- 39 - Lip-type oil seal
- 40 - Dust shield
- 41 - PTO output flange
- 42 - Flange retaining washer
- 43 - Self-locking nut, 7/8-14 C
- 44 - Plug
- 45 - Bolt, 3/8-16 x 2-3/4 in. (18) B
- 46 - Lockwasher, 3/8 in. (18)

<u>Torque</u>	<u>lb ft</u>	<u>N·m</u>
<u>A</u>	14-16	19-21
<u>B</u>	26-32	35-43
<u>C</u>	275-325	373-440



Foldout 15,A. High-range clutch and piston housing (TTB models)

19055



Foldout 15,B. Internal brake and rear cover (TTB models)

6394

A

- 1 - Rear housing gasket
- 2 - Rear housing
- 3 - Lockwasher, 3/8 in. (17)
- 4 - Bolt, 3/8-16 x 1-1/8 in. (17) A
- 5 - High- and low-range input shaft
- 6 - Rear bearing
- 7 - External snapping
- 8 - Internal snapping
- 9 - Sealring
- 10 - Oil retainer
- 11 - Internal snapping

- 12 - Clutch anchor pin
- 13 - Welch plug
- 14 - Plug, 1/4 in. B
- 15 - Bolt, 3/8-16 x 1-1/2 in. (3) A
- 16 - Lockwasher, 3/8 in. (3)

<u>Torque</u>	<u>lb ft</u>	<u>N·m</u>
<u>A</u>	26-32	36-43
<u>B</u>	8-10	11-13

B

- 1 - Rear housing gasket
- 2 - Rear housing
- 3 - Lockwasher, 3/8 in. (15)
- 4 - Bolt, 3/8-16 x 2-3/4 in. (15) A
- 5 - Output shaft (underdrive models)
- 6 - External snapping
- 7 - Output shaft (overdrive models)
- 8 - Rear bearing
- 9 - Internal snapping
- 10 - Spacer
- 11 - Oil seal

- 12 - Clutch anchor pin
- 13 - Welch plug
- 14 - Plug, 1/4 in. B
- 15 - Plug, 3/8 in. C

<u>Torque</u>	<u>lb ft</u>	<u>N·m</u>
<u>A</u>	26-32	36-43
<u>B</u>	8-10	11-13
<u>C</u>	12-16	17-21

C

- 1 - Rear housing gasket
- 2 - Plug, 1/8 in. A
- 3 - Lockwasher, 3/8 in. (18)
- 4 - Bolt, 3/8-16 x 1-3/4 in. (18) B
- 5 - Rear housing assembly
- 6 - Baffle
- 7 - Oil seal

- 8 - Oil drain tube
- 9 - Rear housing

<u>Torque</u>	<u>lb ft</u>	<u>N·m</u>
<u>A</u>	4-5	5.5-6.7
<u>B</u>	26-32	36-43

D

- 1 - Gasket
- 2 - Sealring
- 3 - Pipe plug A
- 4 - Rear cover (with speedometer drive)
- 5 - Lockwasher, 3/8 in. (19)
- 6 - Bolt, 3/8-16 x 1-1/8 in. (19) B
- 7 - Gasket
- 8 - Speedometer drive adapter
- 9 - Gasket
- 10 - Speedometer drive sleeve assembly
- 11 - Lip-type oil seal
- 12 - Washer (cork)
- 13 - Speedometer drive sleeve
- 14 - Lockwasher, 5/16 in. (2)
- 15 - Bolt, 5/16-18 x 2-1/4 in. (2) C
- 16 - External snapping

- 17 - PTO shaft assembly
- 18 - Pin
- 19 - PTO shaft
- 20 - Internal snapping
- 21 - Ball bearing
- 22 - Rear PTO cover assembly
- 23 - Sleeve
- 24 - Rear cover
- 25 - Lip-type oil seal
- 26 - Dust shield
- 27 - PTO output flange
- 28 - Flange retaining washer
- 29 - Self-locking nut, 7/8-14 D
- 30 - Bolt, 3/8-16 x 1-1/8 in. (19) B
- 31 - Lockwasher, 3/8 in. (19)
- 32 - Pipe plug A

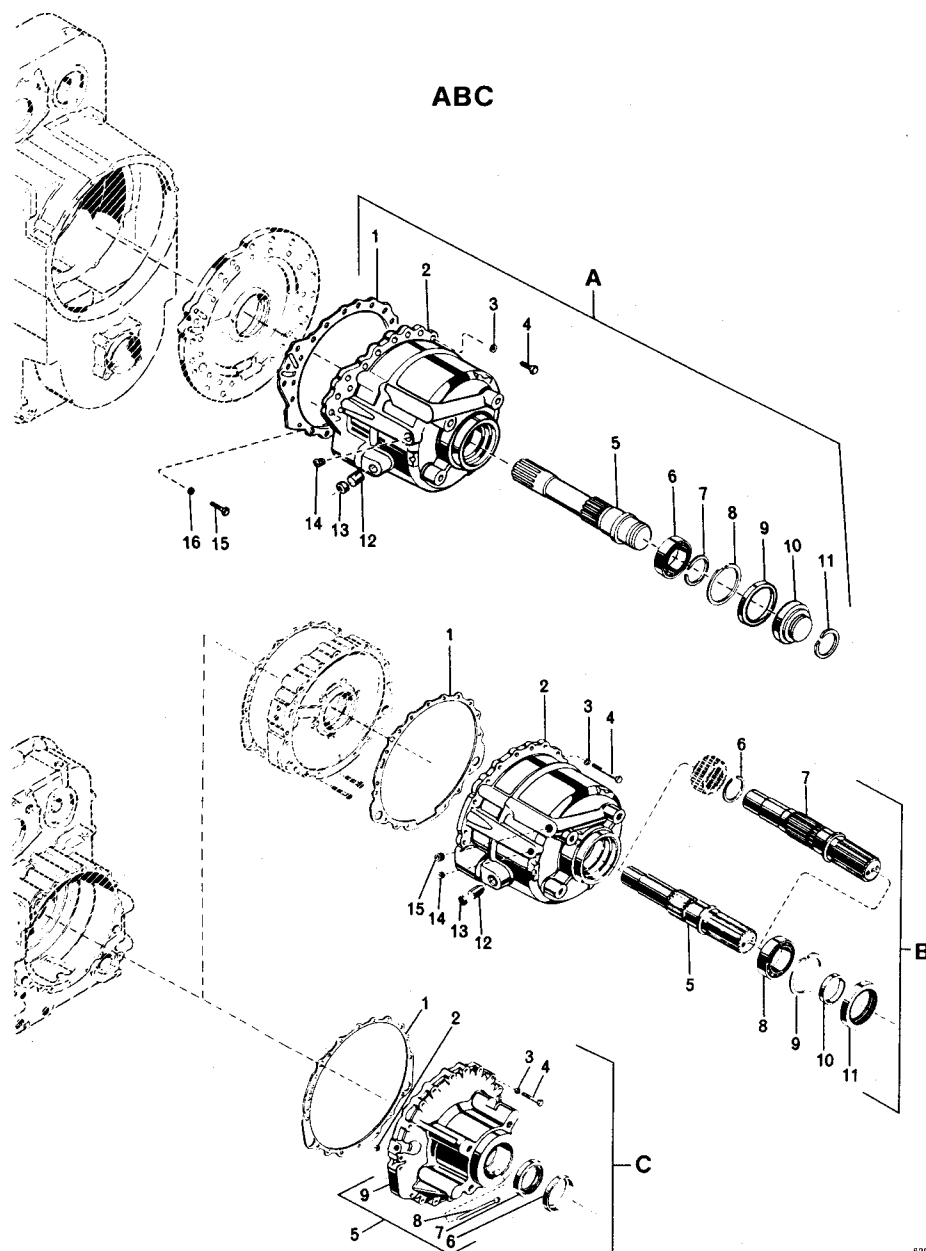
- 33 - Pipe plug A
- 34 - Rear cover
- 35 - Lockwasher, 3/8 in. (19)
- 36 - Bolt, 3/8-16 x 1-1/8 in. (19) B

<u>Torque</u>	<u>lb ft</u>	<u>N·m</u>
<u>A</u>	10-12*	14-16*
	18-22**	25-29**
<u>B</u>	26-32	35-43
<u>C</u>	13-16	18-21
<u>D</u>	275-325	373-440

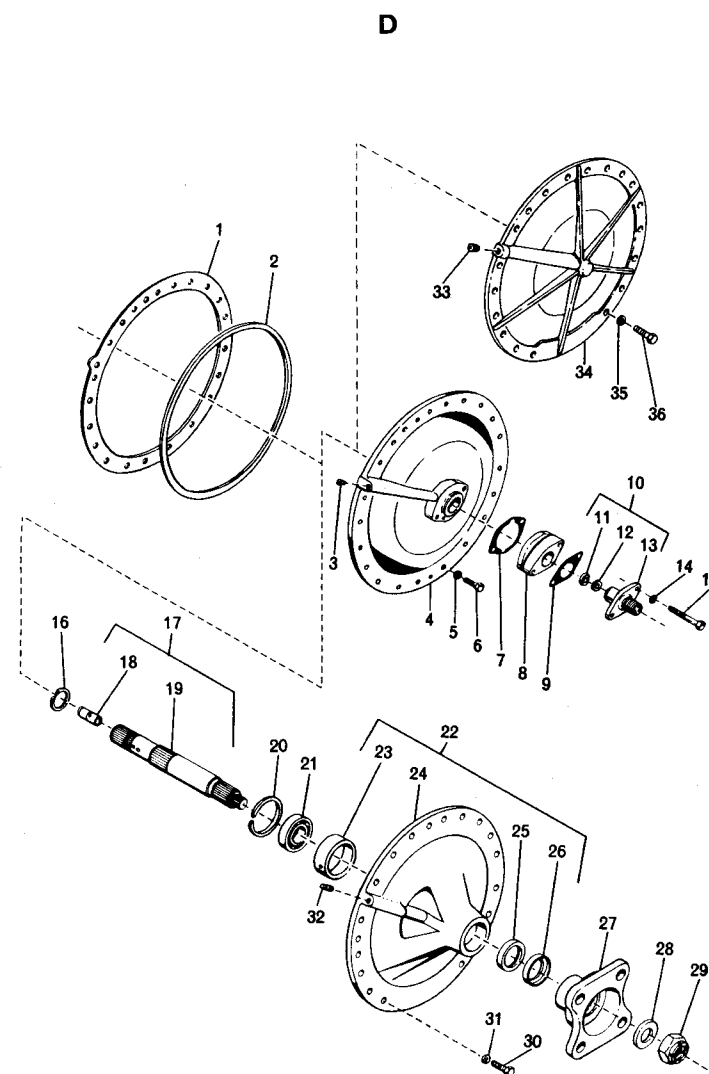
* For 1/8 in. NPTF plugs

** For 3/8 in. NPTF plugs

TT, TTB, TRT 2001 SERIES TRANSMISSIONS



Foldout 16,A,B,C. Rear housings and output shafts (TRT models)



Foldout 16,D. Rear covers and PTO shaft (TT models)

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8207

16439

A

- 1 - Flange retaining nut, 1-1/4-12 A
(nylon insert)
- 2 - Flange washer
- 3 - Sealring (use after S/N 23290)
- 4 - Flange (Mechanics 5C)
- 5 - Flange spacer
- 6 - Flange (Type 5N)
- 7 - Flange (S1480)
- 8 - Front output shaft orifice plug
- 9 - Lip-type oil seal
- 10 - Internal snapping
- 11 - Ball bearing
- 12 - Output shaft
- 13 - Front output shaft
- 14 - Detent ball (2)
- 15 - Detent spring
- 16 - Shifter fork shaft orifice plug
- 17 - Lip-type oil seal
- 18 - Shifter fork shaft
- 19 - Shifter fork
- 20 - Disconnect coupling
- 21 - Ball bearing
- 22 - Spacer

- 23 - Transfer-driven gear
- 24 - Rear output shaft assembly
- 25 - Bushing
- 26 - Rear output shaft
- 27 - Spacer
- 28 - Ball bearing
- 29 - Internal snapping
- 30 - Lip-type oil seal
- 31 - Flange (Type 5N)
- 32 - Flange (Mechanics 5C)
- 33 - Spacer
- 34 - Flange (Mechanics 5C)
- 35 - Flange (S1480)
- 36 - Flange (Mechanics 5C)
- 37 - Sealring (use after S/N 23290)
- 38 - Flange washer
- 39 - Flange retaining nut, 1-1/4-12 A
(nylon insert)

<u>Torque</u>	<u>lb ft</u>	<u>N·m</u>
<u>A</u>	450-700	611-949

B

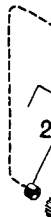
- 1 - Parking brake assembly*
- 2 - Brake backplate*
- 3 - Roller*
- 4 - Brake shoe and lining (2)*
- 5 - Brake shoe return spring (2)*
- 6 - Cam lever*
- 7 - Self-locking bolt,
1/2-13 x 7/8 in. (4) A*
- 8 - Brake backplate (TTB)
- 9 - Brake drum*
- 0 - Self-locking bolt, 3/8-24 x 5/8 in. (4) B*
- 1 - Self-locking bolt, 3/8-24 x 5/8 in. (4) B*
- 2 - Parking brake assembly**
- 3 - Brake backplate**
- 4 - Roller**
- 5 - Brake shoe and lining (2)**

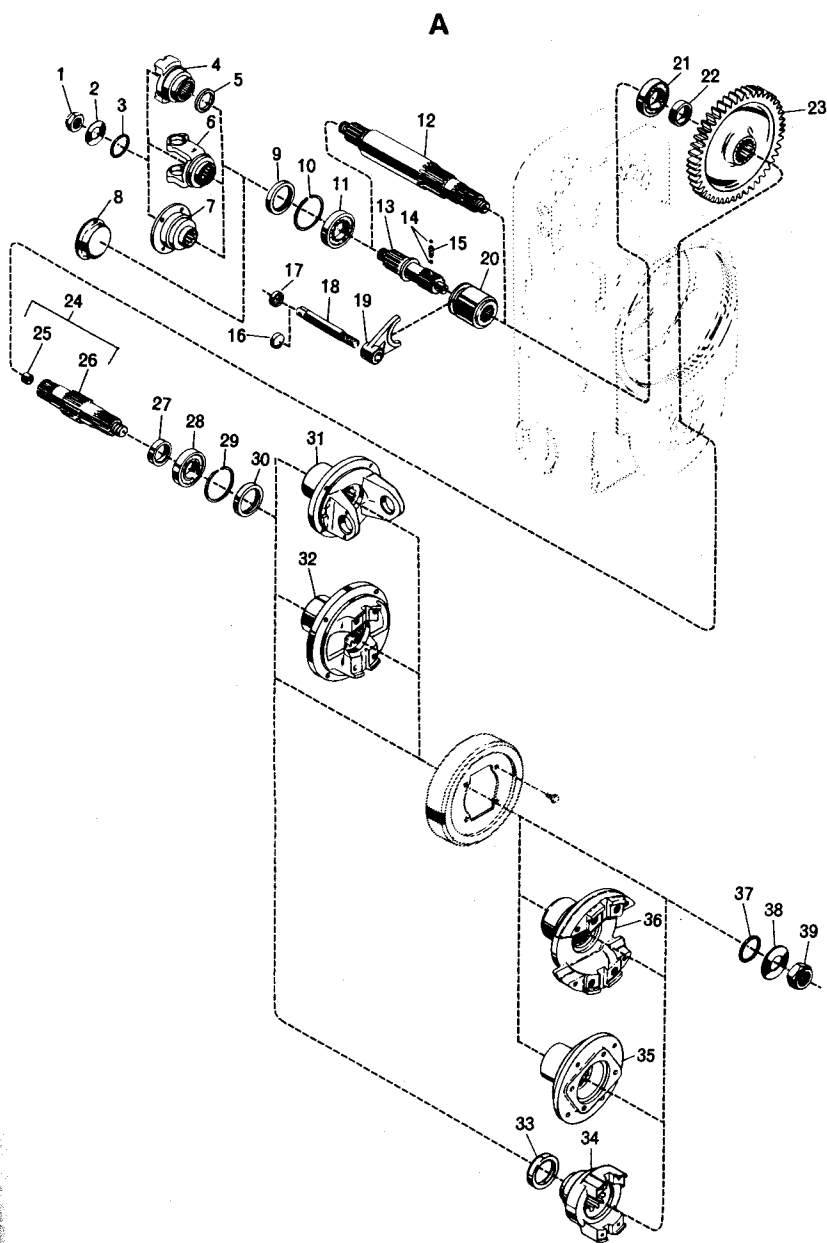
- 16 - Brake shoe return spring (2)**
- 17 - Cam lever**
- 18 - Brake drum**
- 19 - Self-locking bolt, 3/8-24 x 3/4 in. (8) B**
- 20 - Bolt, 5/8-11 x 1-1/4 in. (3) C**
- 21 - Lockwasher, 5/8 in. (3)**

<u>Torque</u>	<u>lb ft</u>	<u>N·m</u>
<u>A</u>	81-97	110-131
<u>B</u>	41-49	56-66
<u>C</u>	117-140	159-189

* -1 models

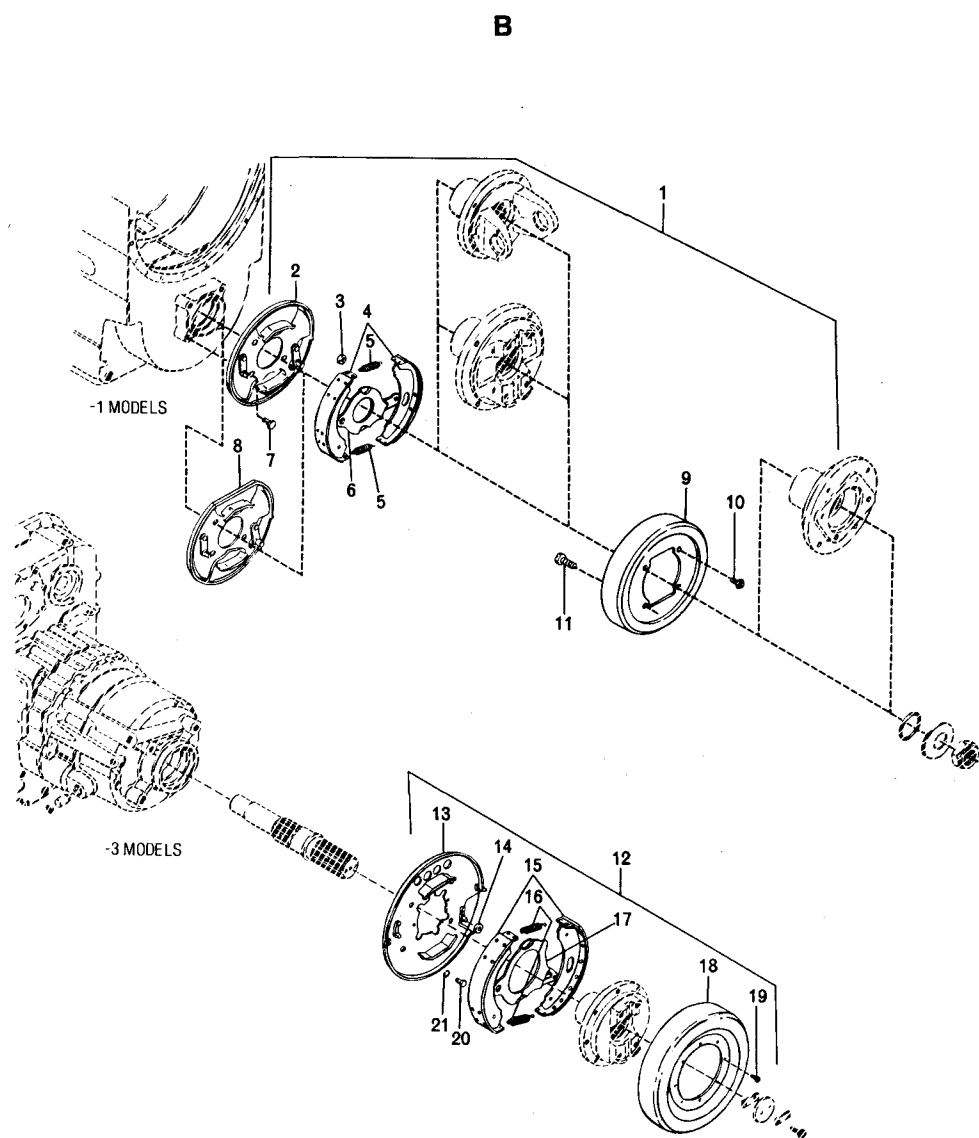
** -3 models





Foldout 17,A. Output shafts and disconnect assembly (-1 models)

6477B



Foldout 17,B. Parking brake

6476B

A

- 1 - Gasket
- 2 - Oil pump assembly
- 3 - Oil pump cover
- 4 - Oil pump cover gasket
- 5 - Drive gear
- 6 - Driven gear assembly
- 7 - Driven gear
- 8 - Needle bearing (2)
- 9 - Oil pump body assembly
- 10 - Oil pump body
- 11 - Dowel pin
- 12 - Driven gear shaft
- 13 - Lip-type oil seal
- 14 - Lockwasher, 3/8 (7)

- 15 - Bolt, 3/8-16 x 2 in. A
4-bolt C pad (7)
2-bolt B pad (7)
2-bolt C pad (6)
- 16 - Lockwasher, 3/8 in. (2)
- 17 - Bolt, 3/8-16 x 3 in. (2) A
- 18 - Adapter drive coupling
- 19 - Bolt, 3/8-16 x 3 in. A
- 20 - Lockwasher, 3/8 in.

<u>Torque</u>	<u>lb ft</u>	<u>N•m</u>
<u>A</u>	26-32	36-43

B

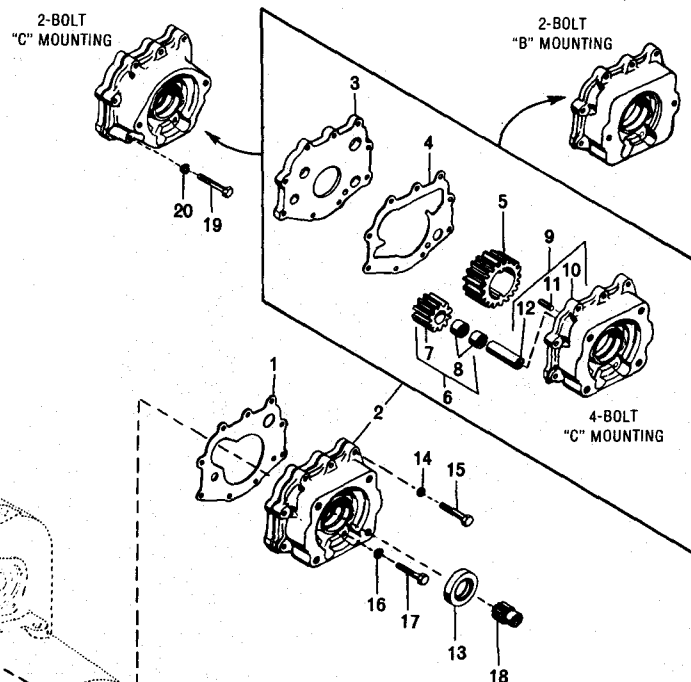
- 1 - Control valve body gasket
- 2 - Lockwasher, 3/8 (16)
- 3 - Bolt, 3/8-16 x 1 in. A
- 4 - Bolt, 3/8-16 x 2-1/2 in. (15) A
- 5 - Control valve body assembly
- 6 - Plug B
- 7 - Gasket
- 8 - Main-pressure regulator valve
- 9 - Control valve body
- 10 - Ball
- 11 - Ball retainer plug
- 12 - Valve stop
TRT 2211-3 (1)
TRT 2411-3 (2)
- 13 - Spring retainer (earlier models)
- 14 - Main-pressure regulator spring
- 15 - Trimmer spring
- 16 - Trimmer plug
- 17 - Gasket
- 18 - Plug C
- 19 - Clutch cutoff valve spring
- 20 - Clutch cutoff valve
- 21 - Cutoff valve plug (hydraulic actuated)
- 22 - Sealring
- 23 - Gasket
- 24 - Cup (hydraulic actuated)
- 25 - Retainer plug (hydraulic actuated) D
- 26 - Oil seal
- 27 - Internal snapping
- 28 - Bracket
- 29 - Manual range selector valve (models without neutral start switch)
- 30 - Detent ball (2)
- 31 - Plug D

- 32 - Gasket
- 33 - Detent spring (2)
- 34 - Gasket
- 35 - Plug B
- 36 - Plug, 1/8 in. E
- 37 - Inching valve stop
- 38 - Spring
- 39 - Inching regulator valve
- 40 - Regulator valve stop
- 41 - Inching regulator valve spring
- 42 - Inching control valve
- 43 - Valve return spring
- 44 - Sealring
- 45 - Plug
- 46 - Oil seal
- 47 - Internal snapping
- 48 - Push-on retaining ring
- 49 - Cutoff valve plug (air actuated)
- 50 - Retainer plug (air actuated) D
- 51 - Plug E
- 52 - Manual range selector valve (models with neutral start switch)
- 53 - Gasket
- 54 - Plug (neutral switch hole) F
- 55 - Plug, 1/8 in. E

<u>Torque</u>	<u>lb ft</u>	<u>N•m</u>
<u>A</u>	26-32	36-43
<u>B</u>	80-90	109-122
<u>C</u>	90-100	123-135
<u>D</u>	60-70	82-94
<u>E</u>	10-12	14-16
<u>F</u>	30-40	41-54

TT, TTB, TRT 2001 SERIES TRANSMISSIONS

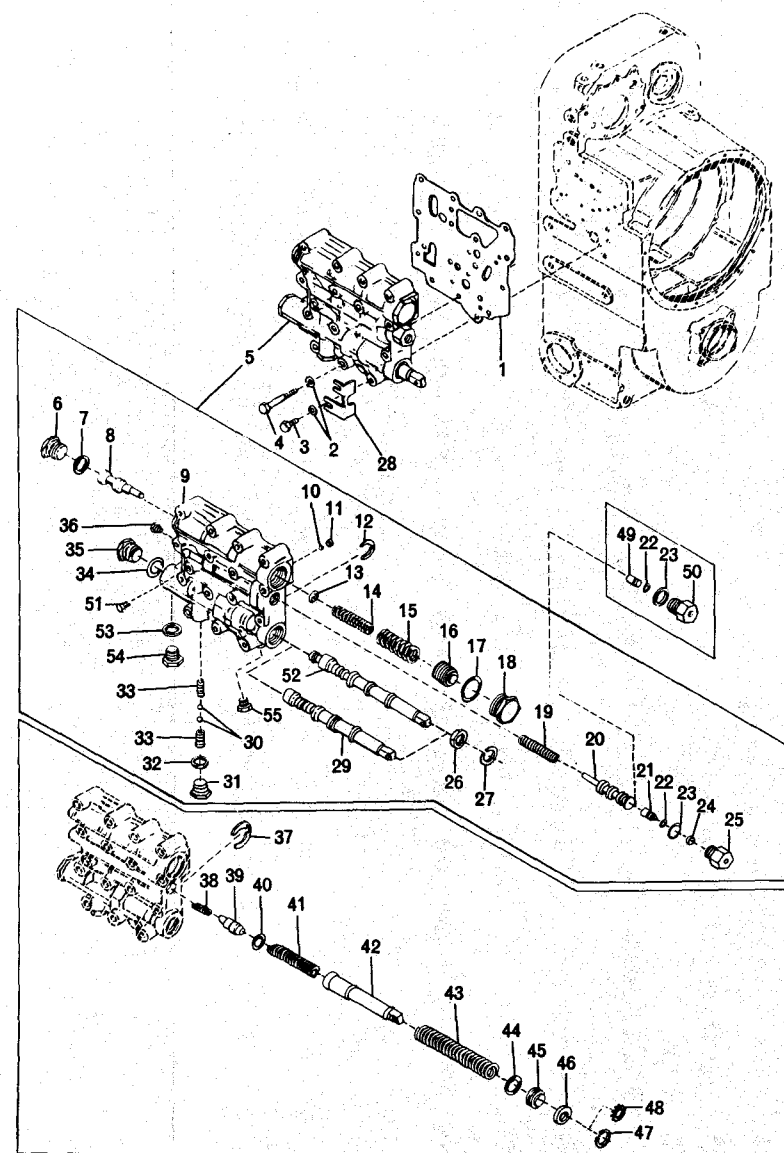
A



Foldout 18,A. Oil pump assemblies

6374A

B



Foldout 18,B. Control valve assemblies

112448