TECHNICAL MANUAL

ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST)

FOR

85' AERIAL LADDER
FIRE FIGHTING TRUCK

NSN 4210-00-965-1254

HEADQUARTERS, DEPARTMENT OF THE ARMY
5 NOVEMBER 1986

COMPLETE MANUAL TABLE OF CONTENTS

COMPLETE MANUAL TABLE OF CONTENTS (Continued)

FOREWORD

Descriptions, instructions and parts listing pertaining to the Model QWT 85 are discussed throughout this manual under general headings. Foldout illustrations and schematics are located at the rear of this volume. The foldout format is provided in order that illustrations and schematics may be referred to while the supporting text is being examined and studied.

A detailed description is given in the Introduction of each Part of the manual to assist the user in finding the information required to operate or maintain the equipment.

- Operator's Manual (TM 5-4210-227-10)

  This manual is designed to provide the information necessary for a fire fighter or mechanic to properly operate the truck, the pump and the ladder.

- Maintenance Manual (TM 5-4210-227-24&P)

  This manual contains the information necessary for an experienced mechanic to maintain and repair all facets of the apparatus. Each volume is individually indexed for ease of reference. This manual contains all the information necessary to obtain assemblies and subassemblies or individual parts, required to repair and maintain the fire truck.

NOTE

The installation manual for Jacobs Engine Brake, Model 71/92 and 71A/92A is presented on the following pages. The second part of this volume consists of a commercial bound manual (HT700F Series Engine Manual).

TABULATED DATA.

(N/A).

MAINTENANCE MANUAL
SECTION I

1. INTRODUCTION/TABULATED DATA

1.1.1. TM 5-4210-227-24&P, Organizational, Direct Support, and General Support Maintenance Manual for 85' Aerial Ladder Fire Fighting Truck is divided into eight volumes. These eight volumes are further subdivided into specific sections consisting of both Government and commercial literature. TM 5-4210-227-10, Operator's Manual for the Aerial Ladder Fire Fighting Truck is one separate manual consisting of five separate sections.

1.1.2. This volume consists of the Jacobs Engine Brake Manual and 8 sections and is arranged as follows:

1. General Information
2. Description and Operation
3. Preventive Maintenance
4. General Overhaul Information
5. Disassembly of Transmission
6. Rebuild of Subassemblies
7. Assembly of Transmission
8. Wear Limits and Spring Data

Installation Manual for

Model 71/92 & 71A/92A

This Engine Brake is designed for use on the following Detroit Diesel Engine Models:

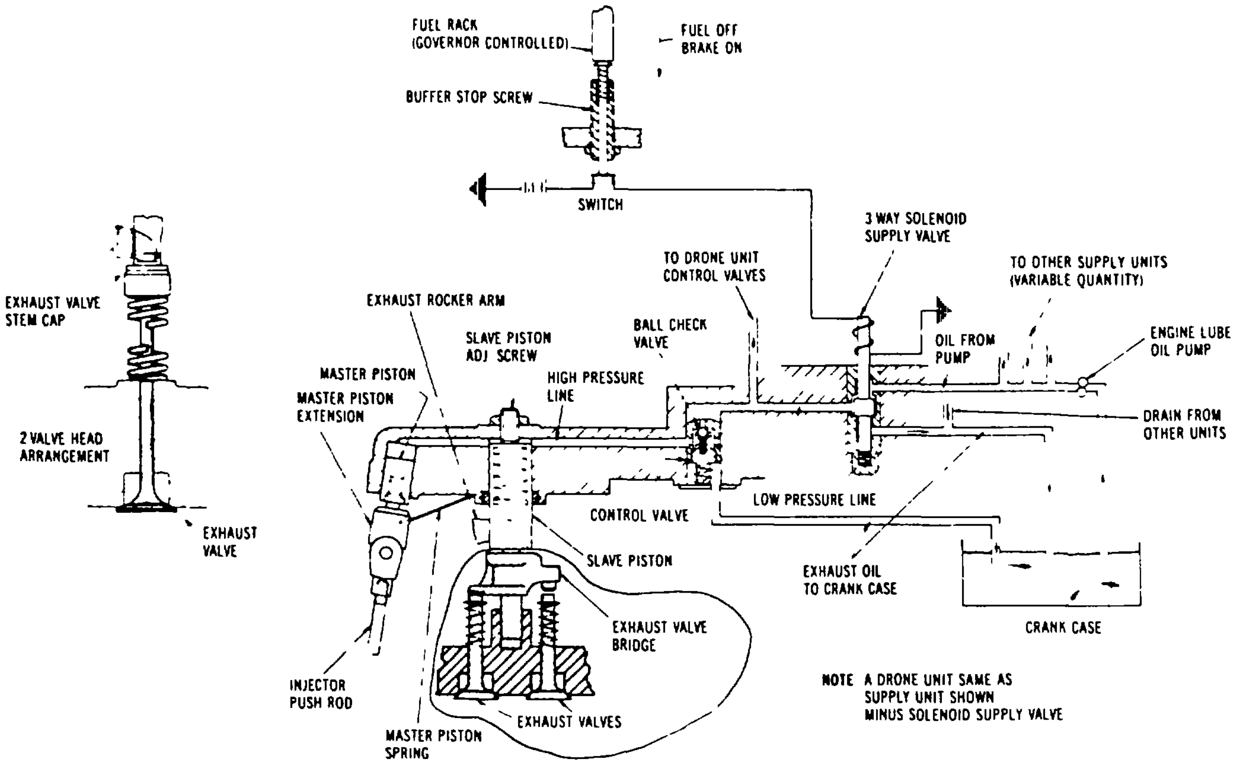
4-71	**8V-71**	**6V-92**
6-71	**12V-71**	**8V-92**
6V-71	**16V-71**	**16V-92**

It will also fit any 71 or 92 series Detroit Diesel Engine that has the same 4-valve or 2-valve cylinder head design and valve spacing as the Engines listed above.

Jacobs®

Vehicle Equipment Division
The Jacobs Manufacturing Company
Bloomfield, Connecticut 06002 U.S.A.

SCHEMATIC DIAGRAM OF ENGINE BRAKE OPERATION



OPERATING DESCRIPTION OF JACOBS ENGINE BRAKE

THEORY OF OPERATION - Simply stated. energizing the Engine Brake effectively converts a power producing diesel engine Into a power absorbing air compressor. This is accomplished when desired by motion transfer through a master-slave piston arrangement which opens the cylinder exhaust valves near the top of the normal compression stroke releasing the compressed cylinder charge to exhaust. The blowdown of compressed air to atmospheric pressure prevents the return of energy to the engine piston on the expansion stroke. the effect being a net energy loss since the work done in compressing the cylinder charge Is not returned during the expansion process.

EXHAUST BLOWDOWN - Referring to the schematic drawing. exhaust blowdown occurs as follows:

1. Energizing the solenoid valve permits engine lube oil to flow under pressure through the control valve to both the master piston and the slave piston.

2. 011 pressure causes the master piston and Its extension to move down, coming to rest on the injector rocker clevis

3. The injector rocker clevis begins upward travel (as in normal injection cycle) forcing the master piston upward and creating a high pressure oil flow to the slave piston The ball check valve in the control valve Imprisons high pressure oil in the master slave piston system.

4. The slave piston under the influence of the high pressure oil flow moves down momentarily opening the exhaust valve while the engine piston is near Its top dead center position releasing compressed cylinder air to the exhaust manifold

5. Compressed air escapes to atmosphere completing a compression braking cycle

METHOD OF DRIVING A VEHICLE EQUIPPED WITH A JACOBS ENGINE BRAKE

The proper method of driving a vehicle equipped with a Jacobs Engine Brake will be simple for an operator to learn. Since the Engine Brake Is most effective at rated engine speeds. gear selection Is very Important. Gearing down the vehicle. within the limits of rated engine speed, makes the Engine Brake a more effective retarder. Obviously. maximum retarding occurs with the selection of the lowest gear that prevents exceeding rated engine speed.

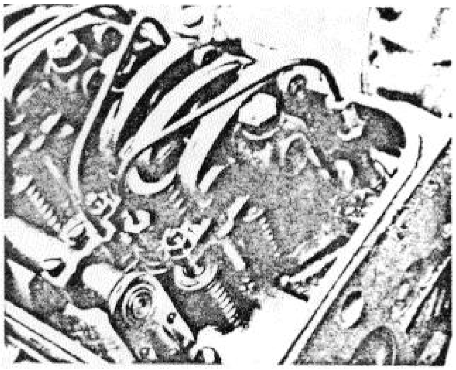
The Engine Brake kit contains a progressive switch that provides two degrees of engine braking This switch provides the operator with greater flexibility of engine retarding

After short practice. drivers will learn the combination of gears that will give the best results over a particular route.

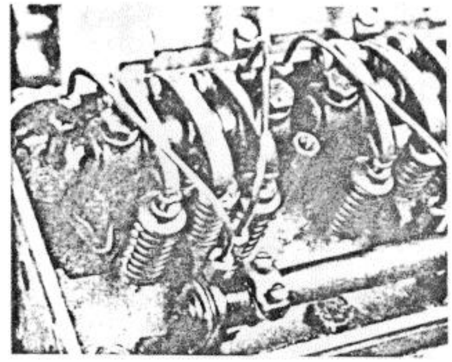
ENGINE BRAKE INSTALLATION

This manual contains instructions for Engine Brake installation on both 2 valve and 4 valve cylinder head designs The 4 valve instructions are labeled 4 valve and the 2 valve instructions are labeled 2 valve If no heading is shown the instructions are applicable to both.

4-Valve Head

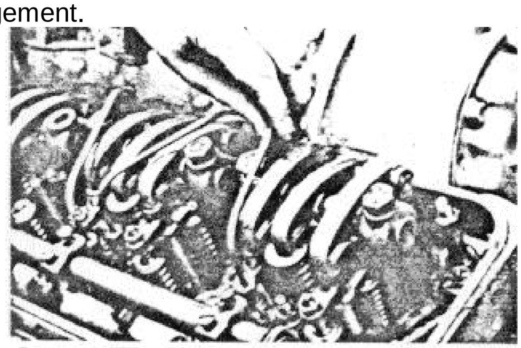


2-Valve Head

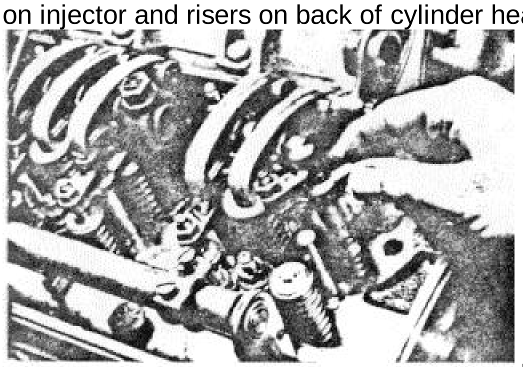


ENGINE PREPARATION

Remove rocker cover and observe cylinder head arrangement.

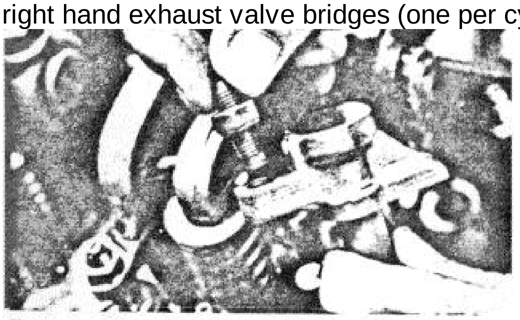


Remove fuel supply and draintubes by loosening nuts on injector and risers on back of cylinder head.



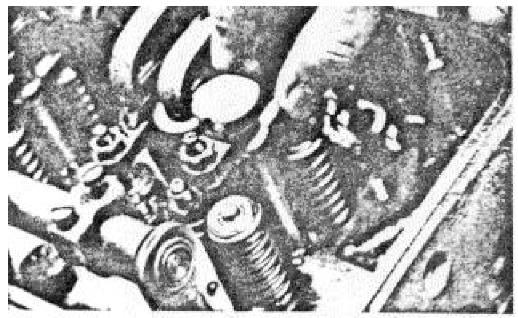
4-Valve

Remove the rocker pedestal hold down bolts and disassemble the rocker pedestals and shafts. Remove right hand exhaust valve bridges (one per cylinder).



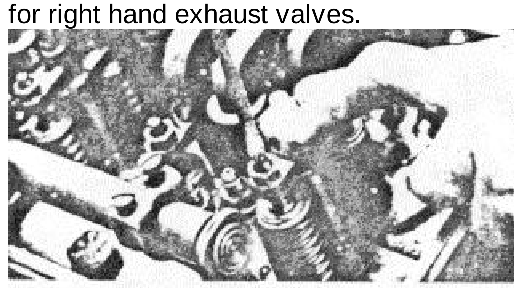
4-Valve

Remove adjusting screws and locknuts from engine bridges and insert them into Jacobs bridges.



4-Valve

Install Jacobs exhaust valve bridges onto bridge guides for right hand exhaust valves.



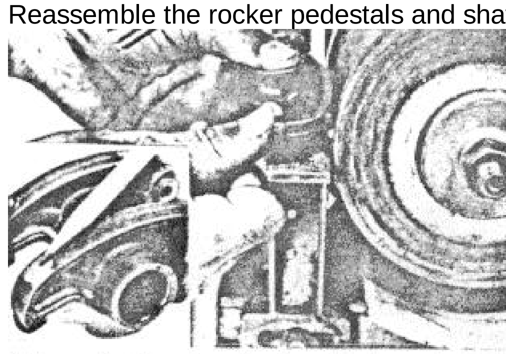
4-Valve

Adjust exhaust valve bridges as instructed in Detroit Diesel Maintenance Manual.

CAUTION

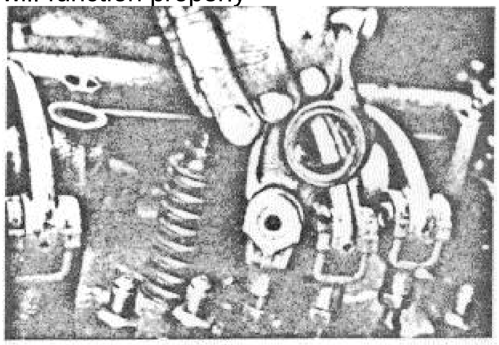
LOCK LOCKNUT WITH BRIDGE IN VISE, NOT ON ENGINE

Tighten locknut to 20-25 lb ft (27-34 N-m) torque Reassemble the rocker pedestals and shafts.



If the engine is equipped with rocker levers having an oil hole drill boss, remove right hand exhaust rocker.

lever and grind off drill boss as shown The drill boss must be removed so that the Jacobs Brake slave piston will function properly



2-Valve

Remove rocker pedestal hold down bolts and disassemble the rocker pedestals and shafts.

CAUTION

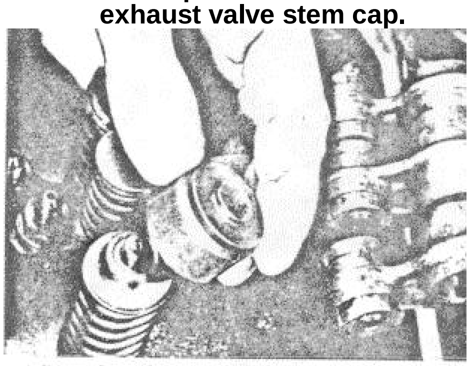
Loosen right-hand exhaust valve push rod locknut as viewed from fuel rack side of cylinder head and rotate rocker lever to provide approximately 1/16" (16 mm) more valve lash This clearance is obtained to accommodate the thickness of the Jacobs valve stem cap when installed.

2-Valve

On engines equipped with high mount injector clamps remove clamp by removing bolt and special washer Replace with Jacobs high mount clamp and the same washer and bolt

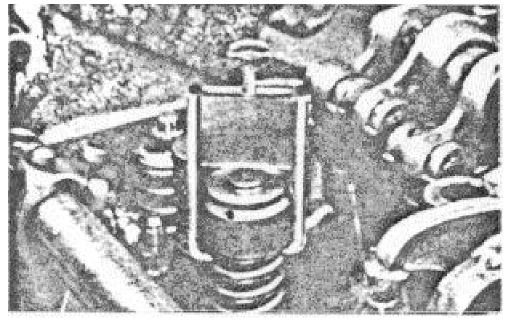
IMPORTANT

Tighten bolt to 20-25 lb ft (27-34 N-m) The Jacobs clamp can be identified by a small milled section on one side This provides clearance for the exhaust valve stem cap.



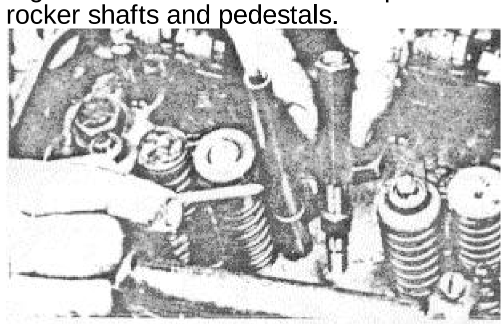
2-Valve

Install Jacobs valve stem caps on right hand exhaust valves (one per cylinder) Press caps firmly over valve springs Hexagon cover studs must be removed if located near this valve.



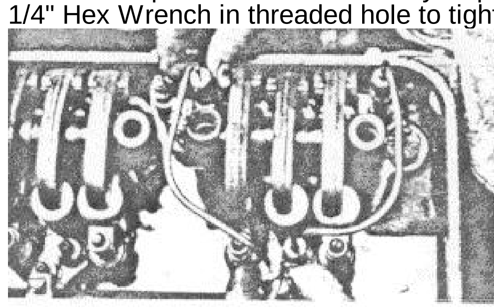
2-Valve

Using the clamping tool from the Jacobs Kit, back off thumb screw Install tool squarely over valve stem cap with Its feet under the exposed coil of valve spring Tighten thumb screw to seat cap Remove Tool Replace rocker shafts and pedestals.

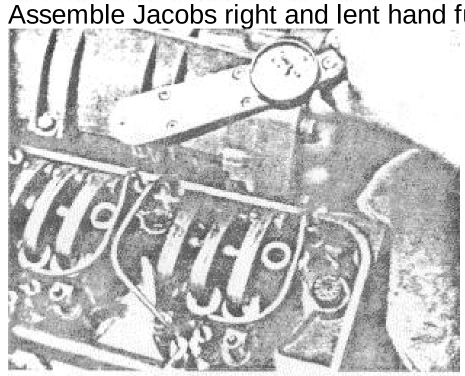


2-Valve

If a hexagon cover stud is located near a right hand exhaust valve. replace It with a round Jacobs cover stud which provides the necessary cap clearance Use 1/4" Hex Wrench in threaded hole to tighten stud.



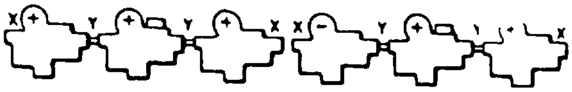
Assemble Jacobs right and lent hand fuel pipes



IMPORTANT

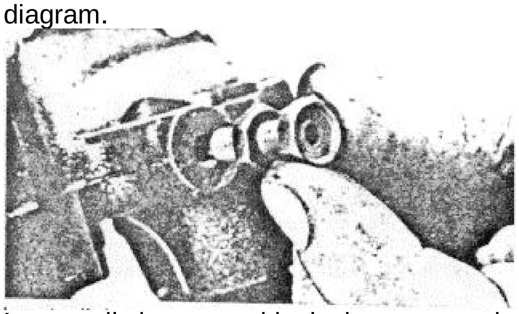
Torque fuel pipe nuts to 12 to 15 lb ft (16-20 N·m) NOTE: This torque specification is very important and should be strictly adhered to. Over tightening or under tightening may cause fuel pipe failure and engine lube oil dilution Serious engine damage may result Be careful not to contact the fuel pipe with the fuel pipe nut wrench as this may cause damage to the flare.

BRAKE ARRANGEMENT FOR 4, V-8 & V 16

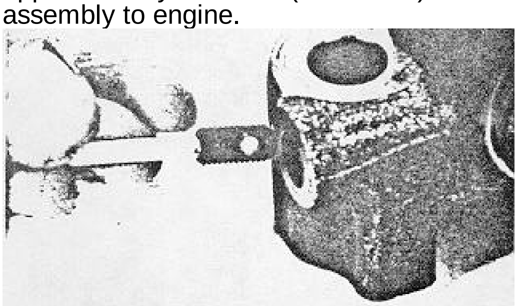


BRAKE ARRANGEMENT FOR 6 & V-12

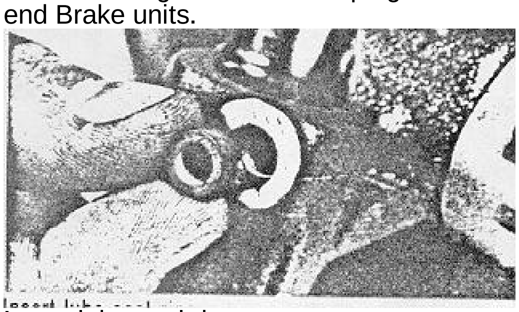
Prior to installing units on engine Brake housings should be laid out on work bench in order shown in diagram to match engine configuration Jumper and seal rings (X) should be Inserted into each unit as indicated in diagram.



Insert oil jumper with lock nut attached Screw In approximately 1/2 inch (12. 7 mm) to avoid damage in assembly to engine.



Insert and tighten 5/16"-24 plugs on outboard side of end Brake units.

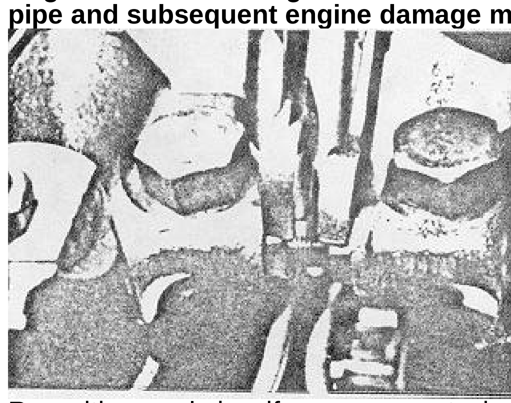


Insert lube seal ring.

Assemble Jacobs hold down cap screws to brake housing Position housing over rocker and pedestal assembly insuring the master piston fork guide assembly is properly located over the injector push rod clevis Torque hold down cap screws to 88 - 92 lb ft (119-125N•m).

CAUTION

Make certain that fuel pipes do not interfere with the Engine Brake Housing A fuel pipe rubbing on the Engine Brake Housing will cause failure of the fuel pipe and subsequent engine damage may result



Reposition seal ring if necessary. to insure proper fit into head of oil jumper Back out oil jumper until metal to metal contact Is made with adjacent housing Back off 1/3 turn from contact point to establish working clearance Hold jumper in this position and lock locknut.

VALVE AND INJECTOR ADJUSTMENT

Adjust valves and time Injectors as instructed In Detroit Diesel Maintenance Manual

ADJUSTMENT OF ENGINE BRAKE UNITS

To prevent engine damage by piston to valve contact the following Instructions must be followed carefully Prior to making slave piston adjustments Insure exhaust valves are closed and injector Is in delivery position

A new Slave Piston setting of.059" has been released to provide for an increase In Engine Brake performance on all 71 and 92 Detroit Diesel series engines.

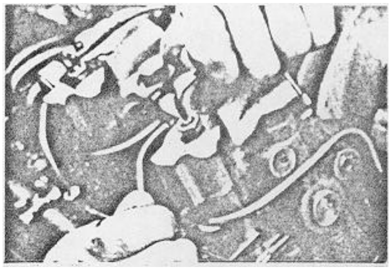
There are two requirements which <u>must</u> be met before the .059" setting can be used

1. The engine rocker brackets must be the latest style with a larger pad area for better engine brake housing support The new bracket was Introduced on all Detroit Diesel series 71 and 92 engine about November, 1977. The part number for this bracket is 5103903
2. The Model 71A/92A engine brake housings (P/N 007077 and 007078) only can be used for the new 059" setting Refer to Jacobs Service Letter 160 for differences in engine brake housings

Do not use the .059" setting with the former Detroit Diesel Rocker brackets or with the earlier Model 71/92 engine brake. Engine or engine brake failures will result. Those applications must continue to use the .064" slave piston setting.

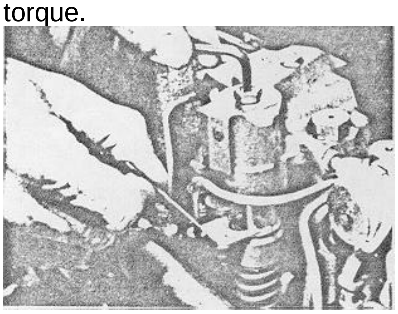
A Jacobs Feeler Gauge (059") has been released The gauge P/N is 007958 and can be obtained from any Jacobs Engine Brake Distributor

With engine stopped and exhaust valves closed, insert the 064 (1.6 mm) or the .059 (1. 49 mm) feeler gauge between slave piston foot and exhaust valve bridge Turn adjusting screw in



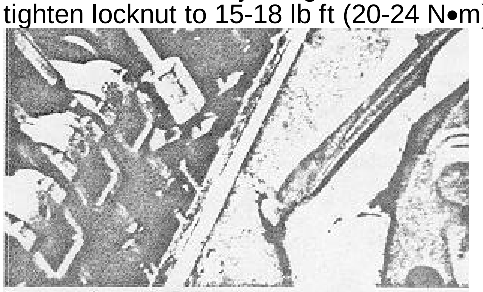
4-Valve

until a slight drag Is felt on feeler gauge. Check both feet of slave piston and establish the setting under foot with minimum clearance. Hold adjusting screw in this position and tighten locknut to 15 -18 lb ft (20 -24 N•m) torque.



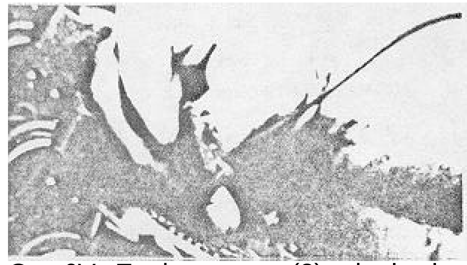
2-Valve

With engine slopped and exhaust valves closed insert the .064 (1. 6 mm) feeler gauge between slave piston feet and valve stem cap Turn adjusting screw in until proper clearance is achieved as indicated by a slight drag on feeler gauge Check both feet of slave piston and establish the setting under foot with minimum clearance Hold adjusting screw in this position and tighten locknut to 15-18 lb ft (20-24 N•m) torque.



Remove plug on back of cylinder head rim in the most convenient location closest to Engine Brake supply units For alternate installation method due to a recent Detroit Diesel blower mounted turbo bracket see Jacobs Service Letter #129.

Connect harness assembly with rubber wire support to fuel tubes closest to Engine Brake supply units as shown.



On 6V Engines two (2) single lead harnesses are necessary Use Harness assembly Part No 005383.

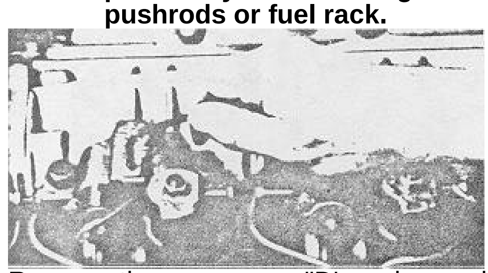
NOTE

Make sure that wire is passed through the small hole in the rubber wire support as shown.

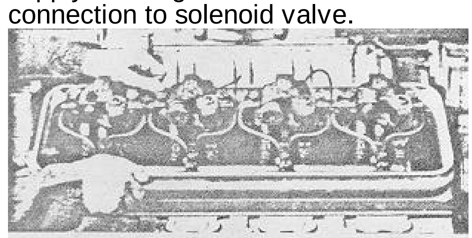
Install seal bushing Part No. 004653 onto harness and thread into cylinder head rim Tighten bushing until It has seated to prevent oil leakage.

NOTE

Make sure that excess wire is pushed through the bushing before tightening so that there is no possibility of entanglement with pushrods or fuel rack.



Remove the capscrew. "D' washer and clamp from the supply housing Attach to wire and reinstall Attach spade connection to solenoid valve.

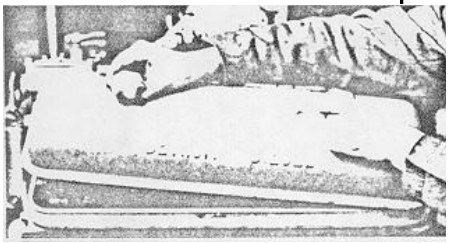


Place Jacobs rocker cover spacer on cylinder head The spacer Is required to provide for the additional height of the Brake units.

Install Jacobs cover hold down bolt extensions to the cover.

NOTE

On two valve Engines where Jacobs round cover studs replace the original hex studs hold down bolt extensions are not required.



Check rocker cover gasket and replace if necessary Position rocker cover over hold down studs and assemble cover to engine.

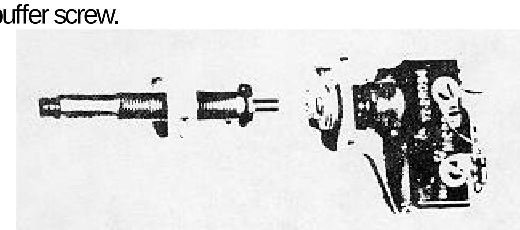
NOTE

Detroit Diesel Allison Division of General Motors has released die cast aluminum valve covers for use on their series 71 and 92 engines. These valve covers and the Jacobs valve cover spacers are not compatible Detroit Diesel has also released deep die cast covers for Jacobs Engine Brake installations. Only the Detroit Diesel stamped valve covers can be used with Jacobs valve cover spacers

CONTROL SYSTEM INSTALLATION

Buffer Switch Installation:

Remove buffer screw from governor housing and remove lock nut from buffer screw.



Separate buffer switch as shown in photo. Do not loosen the switch mounting screws. This switch has been pre-set at the factory to insure that the Engine Brake will not operate while fuel is being supplied to the engine Field replacement of the micro switch or diode, if necessary, requires the use of an adjusting gauge to re-adjust the switch to factory standards. This adjusting gauge (Part No 2859) is capable of adjusting three different style switches, Part Nos. 2732. 2733, and fast idle switch 2808.

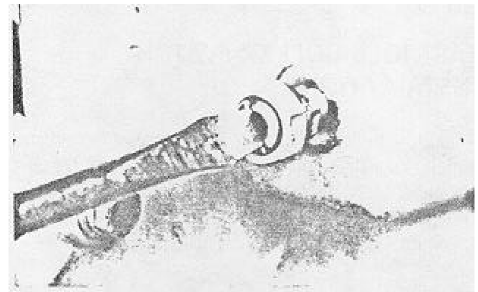
ADJUSTMENT PROCEDURE

1. Insert thread portion of butter screw into open end of the tool until buffer spring is nearly in contact with the plunger.

2. Tighten locknut so that tool is tight on the buffer screw and will not rotate.

3. Push the plunger in so that it rests on but does not compress the buffer spring. Tighten thumb screw to lock plunger in position.

4. Attach switch loosely to mounting bracket. Move switch in until it clicks on then back out until switch clicks off.
5. Hold this position and tighten switch mounting screws.
6. If switch is mounted correctly a .010 (.25 mm) feeler gauge inserted between the switch and switch actuator should activate the switch.



Remove plunger from Jacobs butter screw and install lock nut removed from Engine buffer screw. Insert Jacobs buffer screw into governor housing to approximately the same depth as Engine buffer screw.

Start engine and adjust buffer screw in accordance with the Detroit Diesel Manual as follows.

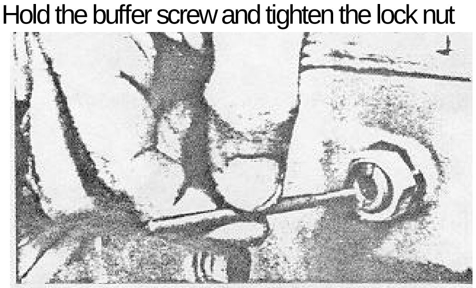
With the Idle speed properly set, adjust the buffer screw as follows:

1. With the engine running at normal operating temperature, turn the buffer screw in so It contacts the differential lever as lightly as possible and still eliminates engine roll.

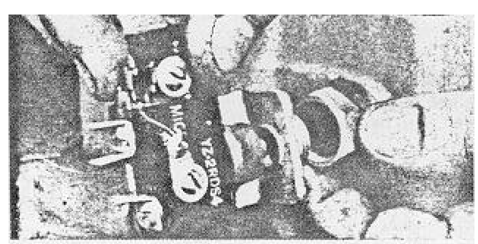
NOTE

Do not increase the engine Idle speed more than 15 rpm with the buffer screw

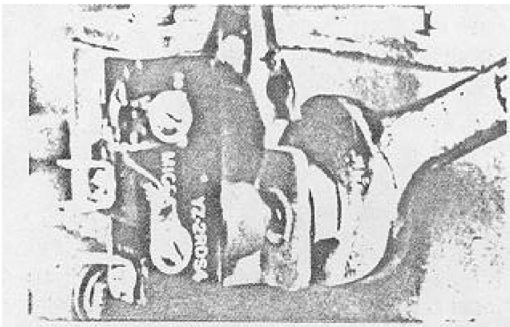
2. Recheck the maximum no-load speed If It has increased more than 25 rpm. back off the buffer screw until the increase is less than 25 rpm.
3. Hold the buffer screw and tighten the lock nut



Shut down engine and insert buffer switch plunger into buffer screw.



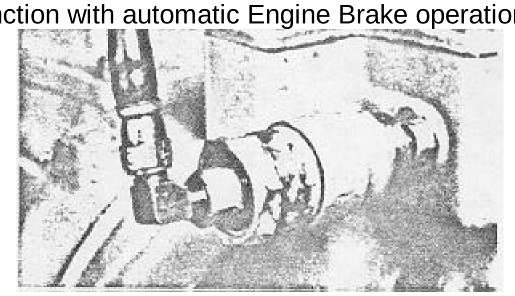
Attach buffer switch to buffer screw and position switch to clear other engine components.



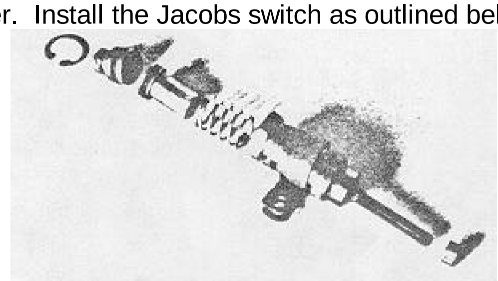
Lock buffer switch lock nut by holding switch in position.

FAST IDLE BUFFER SWITCH INSTALLATION

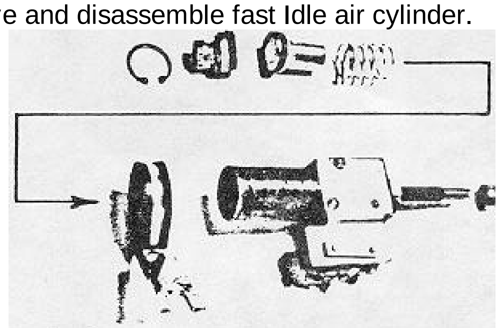
A fast idle buffer switch may be purchased for buffer switch installations on Series 71 and 92 Detroit Diesel Engines containing last Idle air cylinders. This type switch must be installed to retain the fast idle feature in conjunction with automatic Engine Brake operation



If the engine Is equipped with a fast idle air cylinder as shown it must be removed and replaced with Jacobs optional fast idle buffer switch which contains its own air cylinder. Install the Jacobs switch as outlined below.

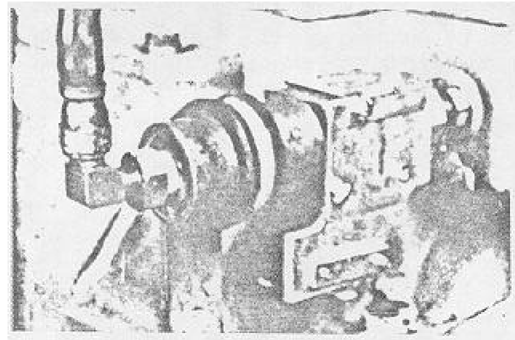


Remove and disassemble fast Idle air cylinder.



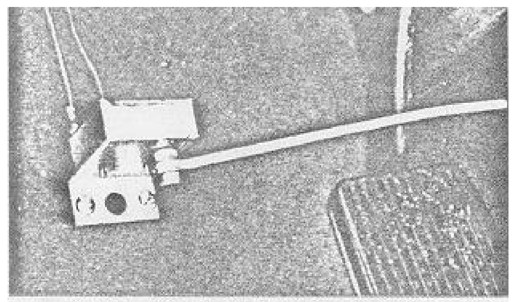
Install cylinder spring, piston, inlet plug, retainer ring and locknut from fast Idle air cylinder Into Jacobs fast Idle buffer switch and clamp assembly. Insert them in the order shown Separate buffer screw portion from fast idle buffer switch and complete the standard buffer switch installation.

Replace and lock fast idle switch to buffer screw.



Adjust switch bracket and clamp to line up with Detroit Diesel Housing to blower bolt as shown. Remove bolt and washer and secure switch by placing mounting bracket between washer and bolt. Tighten bolt and clamp Install air tube elbow into inlet plug and attach air tube between elbow and fast idle limiting air cylinder on top of governor housing. With the fast Idle buffer switch properly installed the Engine Brake will operate only during deceleration and will automatically shut off when fast Idle activation occurs.

CLUTCH SWITCH INSTALLATION

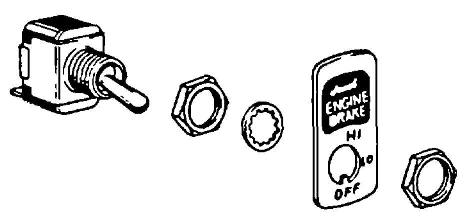


Mount CLUTCH switch so that adjustable rod on switch actuator is in contact with clutch pedal arm.

ADJUSTMENT With Clutch pedal in relaxed position, loosen actuator rod clamp so that switch "clicks" with rod In contact with clutch arm. Tighten clamp in this position This adjustment should allow switch to work during clutch pedal play before actual clutch disengaging takes place.

OFF/ON DASH SWITCH INSTALLATION

(Standard for all In-line 71 and 92 Series Detroit Diesel Engines)



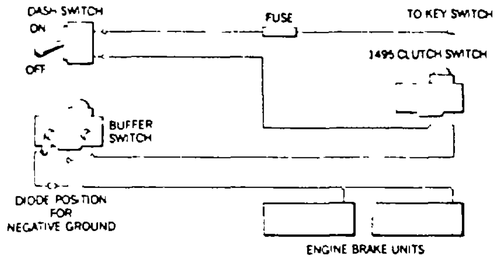
Mount the dash switch In a convenient position for operation by the driver Install the wiring in the vehicle as shown in wiring diagram below.

NOTE

Plastic ties are included in the Engine Brake kits and should be used to secure the wiring for a neat Installation. If necessary, cut the wire to the required length to eliminate bundling up of loose wire.

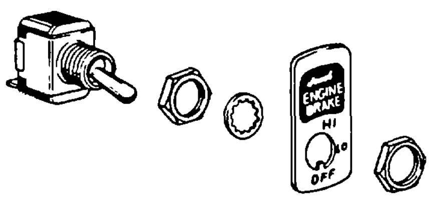
NOTE

The switch contacts are protected against arcing by a small diode connected between the load side switch terminal and ground. The Engine Brake must be connected to the load side terminal. If the vehicle has a positive ground electrical system. reverse the position of the diode.



THREE POSITION DASH SWITCH INSTALLATION

(Standard for all 6V and 8V series 71 or 92 Detroit Diesel Engines)



This new three-position switch provides the operator with two degrees of braking Install the wiring in the vehicle as shown in wiring schematic below.

NOTE

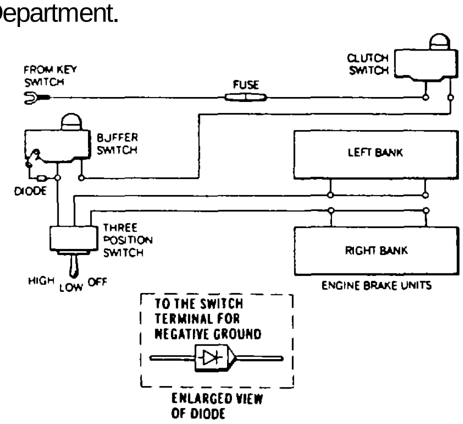
The switch contacts are protected against arc mg by a small diode connected between the load side switch terminal and ground. The Engine Brake must be connected to the load side terminal. If the vehicle has a positive ground electrical system, reverse the position of the diode.

NOTE

If Engine Brake installations are to be completed on vehicles containing the following transmissions:

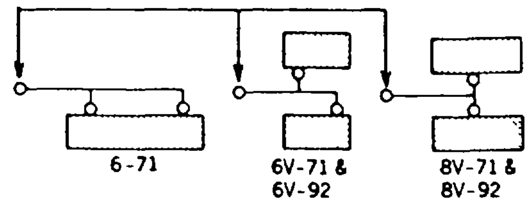
Allison Hydraulic VH	Allison Off Highway
Allison Super V	Dana Spicer 184
Allison Electric VH	

the wiring circuit must be modified For complete information consult your nearest Jacobs distributor or contact the factory Service Department.



Connect to Diode side of Buffer Switch

WIRING DIAGRAM FOR ENGINE BRAKES ON VARIOUS ENGINE MODELS



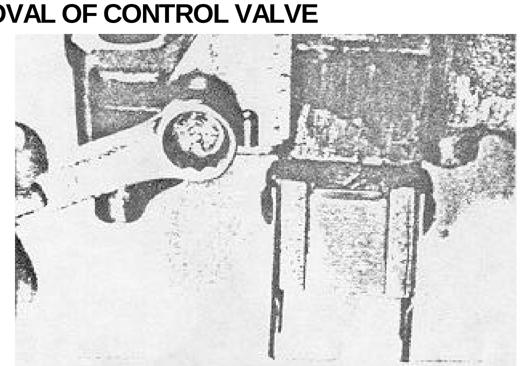
INITIAL STARTING AND TESTING OF ENGINE BRAKE

Do not operate the solenoids manually. Depressing the solenoid armature will energize the Engine Brake when the Engine is being fueled Damage may result during manual operation.

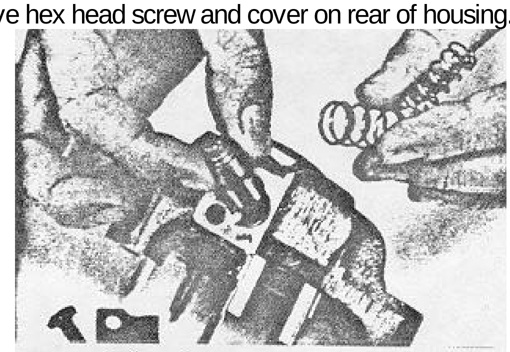
Start engine and check lube oil pressure After engine has warmed up, throw dash switch to "ON" position. Manually open throttle to full fuel position and release instantly to permit throttle and governor to return engine to Idle speed. This action will permit the governor to close the buffer switch and energize the Engine Brake solenoids. Repeat the above process six to eight times to bleed entrapped air from the Engine Brake housings. During the bleeding process, the Engine Brakes will begin to react as evidenced by exhaust noise and rapid engine deceleration. The engine may die during the above procedure, however, after the engine lube oil temperature rises to normal, the Engine Brake will shut off before the engine dies.

TEAR DOWN AND REBUILDING OF BRAKE UNIT

REMOVAL OF CONTROL VALVE

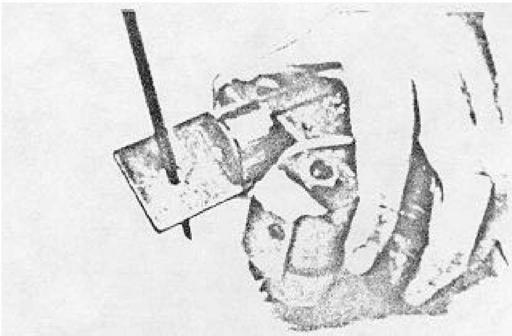


Remove hex head screw and cover on rear of housing.

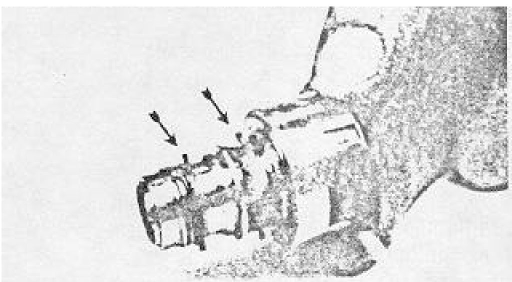


Remove both springs and carefully withdraw control valve from housing assembly To reinstall reverse procedure.

REMOVAL OF SOLENOID VALVE

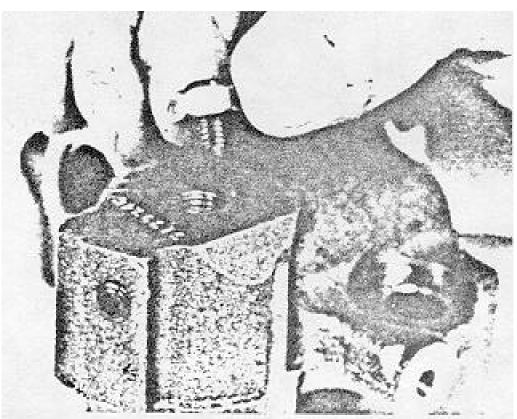


Insert screw driver into Jacobs solenoid wrench and loosen solenoid. Screw out solenoid valve.

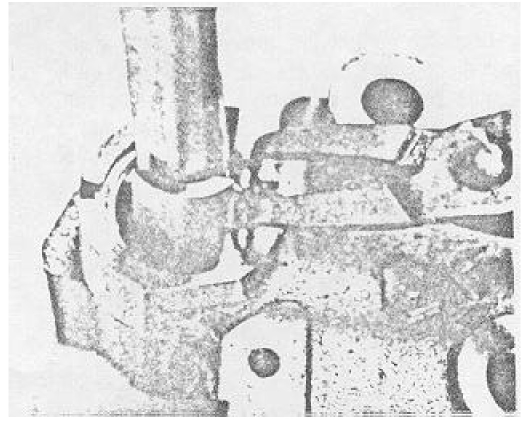


Lubricate seals with Engine lube oil before assembly Insert lower (1083) "0" ring in bottom of solenoid bore in housing Install upper (1081) "0" ring on solenoid valve Install center (1082) "0" ring on solenoid valve Insert solenoid into housing gently without disturbing "0" ring positions.

REMOVAL AND INSTALLATION OF SLAVE PISTON



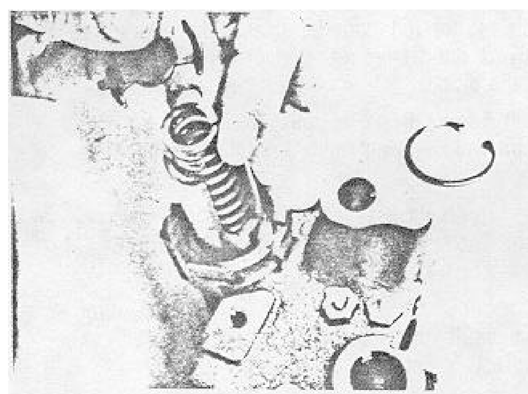
Remove slave piston adjusting screw with Allen wrench.



WARNING

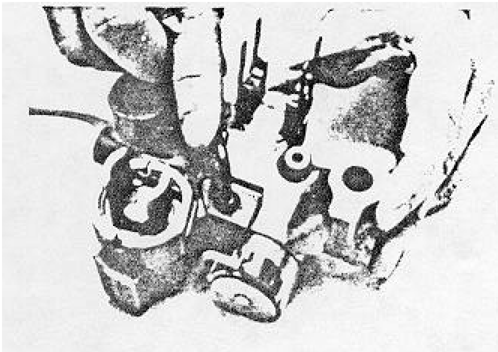
THE SLAVE PISTON IS RETAINED BY A SPRING (OR SPRINGS) THAT IS UNDER HEAVY COMPRESSION IF THE FOLLOWING INSTRUCTIONS ARE NOT FOLLOWED AND PROPER TOOLS NOT USED, THE SPRING COULD BE DISCHARGED WITH ENOUGH FORCE TO CAUSE PERSONAL INJURY

Invert the housing Use an arbor press or "C" clamp to hold the slave piston spring and retainer in place Remove the snap ring with special snap ring pliers (furnished in Jacobs tool kit). Slowly back off on the force applied to the retainer to relax the slave piston spring.

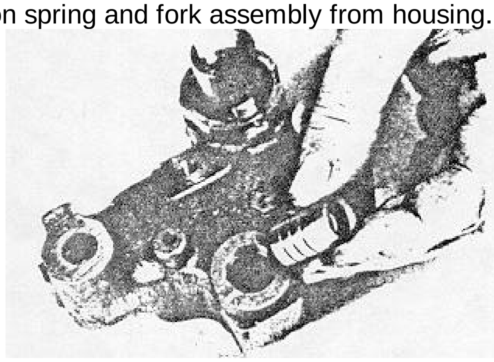


Remove spring retainer, springs and slave piston. Reassemble components using same procedure as when removed. Be sure retainer Is in same position as shown in picture.

REMOVAL AND INSTALLATION OF MASTER PISTON



Remove button head screw, lock plate master piston spring and fork assembly from housing.



Withdraw master piston. Reassemble components using same procedure as when removed.

RECOMMENDED TORQUE VALUES

PART NAME	TORQUE
Exhaust Valve Bridge Adjusting Screw Locknuts	20-25 lb ft (27 34 N•m)
Fuel Tube Nuts	12-15 lb ft (16-20 N•m)
Injector Clamp Bolt	20-25 lb ft (27-34 N•m)
Engine Brake Hold down Bolts	88-92 lb ft (119-125 N•m)
Slave Piston Adjusting Screw Locknuts	15-18 lb f (20-24 N•m)

SPRING DATA

Slave Piston Spring	Load at 1.39 in (35 3 mm) 72 5-80 5 lbs (323-358 N)
Part Number - 1288	Load of 1.27 In(32 3 mm) 82.5-91 5 lbs (367-407 N)
	Free length 2 36 In (60 mm)
	Number of coils - 10 3/4 approx
Control Valve Spring	Load at 81 in (20. 6 mm)2.1-2.5 lbs (9-11 N)
Part Number - 1518	Load at 50 in (12. 7 mm) 5. 6-6.4 lbs (25-28 N)
	Free length 1.01 inches (26 mm)
	Number of cells - 6 1/2 approx
Control Valve Stop Spring	Load at .81 In (20.6 mm)4.0-4.6 lbs (18 20 N)
Part Number - 1519	Load at .50 In (12.7 mm) 8.5-9.5 lbs (38-42 N)
	Free length 1.10 in (28 mm)
	Number of coils - 5 1/2 approx

JACOBS ENGINE BRAKE LIMITED WARRANTY

The Jacobs Engine Brake, a product of The Jacobs Manufacturing Company Vehicle Equipment Division, is sold with the following warranty:

The Jacobs Engine Brake Is warranted to be free of defects In construction and operation under normal use and service for the Warranty Coverage periods set forth below.

THERE ARE NO REPRESENTATIONS OR WARRANTIES WHICH EXTEND BEYOND THE TERMS HEREOF OR THE DESCRIPTION OF THE PRODUCT CONTAINED IN THE CONTRACT FOR SALE.

Warranty Coverage

Engine brake housing assembly and related attaching parts except seals, O-rings and gaskets-one year or 100,000 miles (161,000 kilometers), whichever shall first occur

Attaching parts not of Jacobs manufacture and all control system components, seals, gaskets, O-rings and switches -three months or 24,000 miles (38,600 kilometers), whichever shall first occur

Replacement Parts installed during the original Warranty Coverage period are warranted for the remainder of that period, but not less than 3 months or 24,000 miles (38,600 kilometers), whichever shall first occur. Replacement Parts installed after the expiration of the original Warranty Coverage period on new equipment are warranted for 3 months or 24,000 miles (38,600 kilometers), whichever shall first occur.

Under this warranty our factory is obligated to replace, without charge, any part returned to us which our examination discloses to our satisfaction to have been defective within the Warranty Coverage period measured from the date of delivery of the product In question to the original user.

Jacobs will also pay for all repairs to damaged engine components in which a Jacobs Engine Brake or Jacobs Replacement Parts have been properly installed, provided the damage is shown to be a direct result of a defect of the Jacobs Engine Brake or Jacobs Replacement Parts occurring under normal operation during the Warranty Coverage periods specified above.

This warranty will not apply to any part or parts which have been altered or repaired outside of our factory or authorized Jacobs distributor service centers, nor to parts which have been subjected to misuse, abuse, neglect, or accident, nor to parts which have been improperly applied or installed Improper installation or application. or substitution of parts not manufactured or approved by us, shall void this warranty.

If the product should become defective within the Warranty Coverage period, an authorized Jacobs Engine Brake distributor should be notified There is a world wide network of authorized distributors whose names and addresses can be found in the Sales and Service Directory located In the back of your Jacobs Engine Brake Driver's Manual If any of the listed distributors are unable to correct your problem or if you have any questions regarding this warranty. write to the following address giving full details of your problem including the Model and Serial Numbers of the product involved.

WARRANTY ADMINISTRATOR
THE JACOBS MANUFACTURING COMPANY
VEHICLE EQUIPMENT DIVISION
EAST DUDLEY TOWN ROAD
BLOOMFIELD, CONNECTICUT 06002

JACOBS SOLE LIABILITY ANDYOUR EXCLUSIVE REMEDY IS LIMITEDTOTHEOBLIGATIONSSET FORTH HEREIN. AND JACOBS SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES.

Vehicle Equipment Division
The Jacobs Manufacturing Company
Bloomfield, Connecticut 06002 U.S.A.

Form 3879

Revised 12/80

Printed In U S A 6/81

Allison
Transmissions

HT 700 D 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 possible 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.

WARNING is used when an operating procedure, practice, etc., which, if not correctly followed could result in personal injury or loss of life.

CAUTION 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. Also, spinning a bearing without lubrication can damage the bearing.

When conducting a converter stall test, the vehicle must be prevented from moving. Both the parking and service brake must be applied and, if necessary, the vehicle should be blocked to prevent movement.

Warn personnel to keep clear of the vehicle and its travel path.

The main pressure regulator valve spring is under approximately 85 lbs. (378 N) compression.

Do not install forward-clutch hub 19 (B, foldout 13) and fourth-clutch driving hub 22 into fourth-clutch housing assembly 12 (A, foldout 14). If these two hubs are installed into the fourth-clutch housing assembly by mistake, the transmission will operate in reverse when the driver selects any forward range.

Be sure the forward-clutch hub and the fourth-clutch driving hub are installed into the forward-clutch assembly as shown in figure 6-45. If these two hubs are installed into the third-clutch housing by mistake, the transmission will operate in reverse when the driver selects any forward range.

SA 1270J

Service Manual

Allison Transmissions

AUTOMATIC MODELS

HT 740D, HT 747D
HT 750CRD, HT 754CRD
HT 750DRD
HT 750DRD DB
HT 754CRD

REVISED DECEMBER 1983

Detroit Diesel Allison
Division of General Motors Corporation
Indianapolis, Indiana 46206

Printed in U.S.A.

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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Exploded Views

Section 1. GENERAL INFORMATION

1-1. SCOPE OF MANUAL

a. Coverage. This Service Manual describes the operation, maintenance, and overhaul procedures for the HT 700 Series automatic transmissions figures 1-1 through 1-8. The major components of the transmission are explained. Detailed instructions are provided for disassembly and rebuild. Spring data is shown in Section 8. Troubleshooting and part inspection are shown in Sections 3 and 4.

b. Illustrations

(1) The text is illustrated with photographs, line drawings, and cross-section views. The overhaul procedures are illustrated mainly by photographs. Line drawings are used to supplement detailed assembly procedures; cross-sections show the torque paths and relationship of assembled parts. Cross-sections, color-coded schematics of the hydraulic system, and all exploded views are on foldout pages at the back of the manual.

(2) Certain illustrations will not always show the model being serviced. However, the illustration will show the correct procedure.

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, as required, to cover any improvements which may occur after publication of this manual. Check with your dealer to ensure you have the latest information.

1-3. ORDERING PARTS

a. Transmission Nameplate. The nameplate (fig. 1-9) is located on the right-rear side of the transmission housing. The nameplate displays the transmission serial number, part number (assembly number), and model number. All three of these must be supplied when ordering replacement parts or requesting service information.

b. Parts Catalog. All replacement parts should be ordered from your dealer. These parts are listed in the Parts Catalog SA 1268. Do not order by illustration item numbers used on exploded views in this manual.

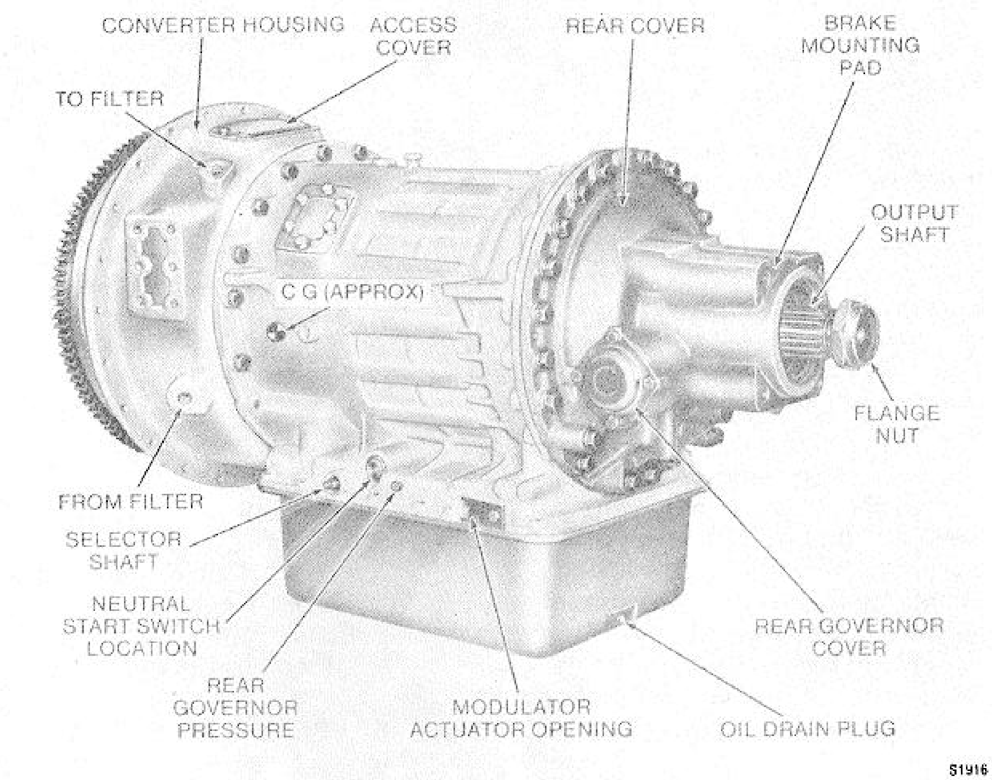

Fig. 1-1. Model HT 740D transmission-left-rear view

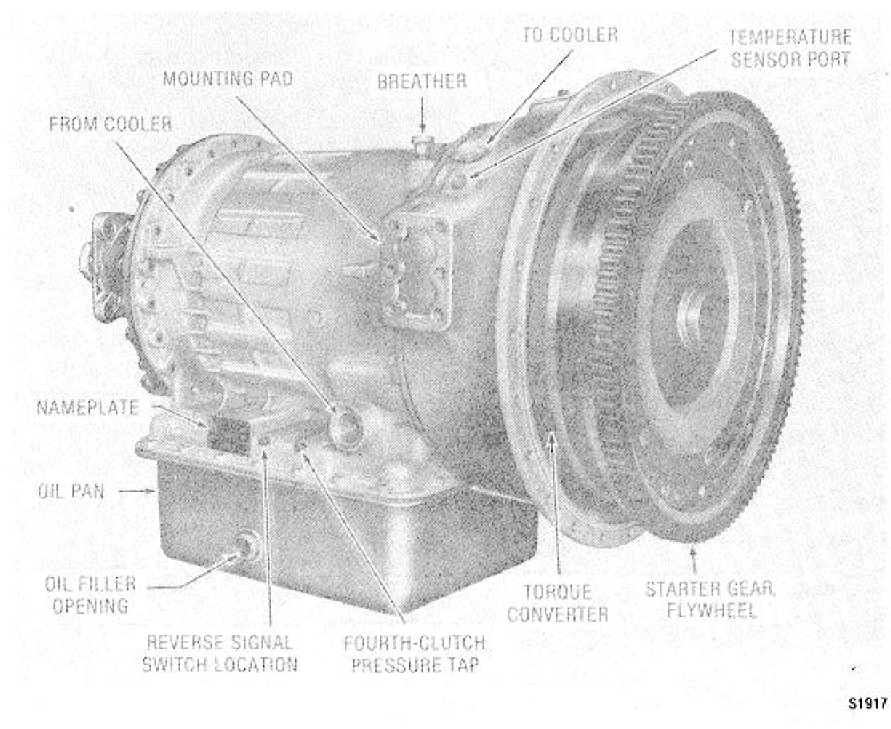

Fig. 1-2. Model HT 740D transmission-right-front view

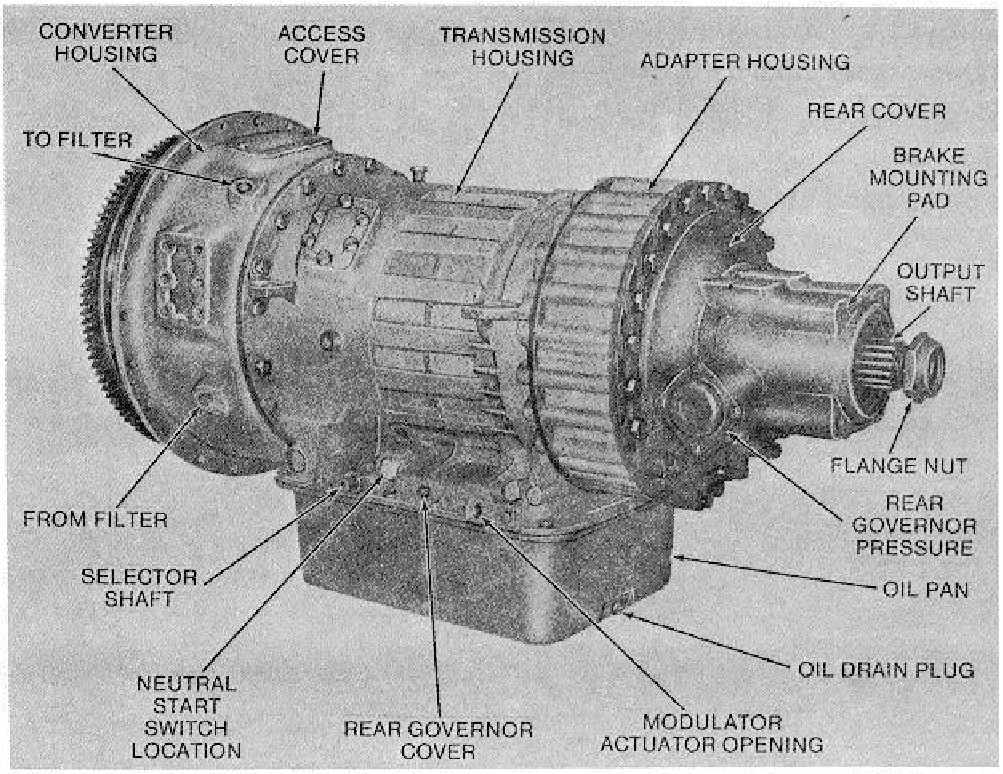

Fig. 1-3. Model HT 750 transmission-left-rear view

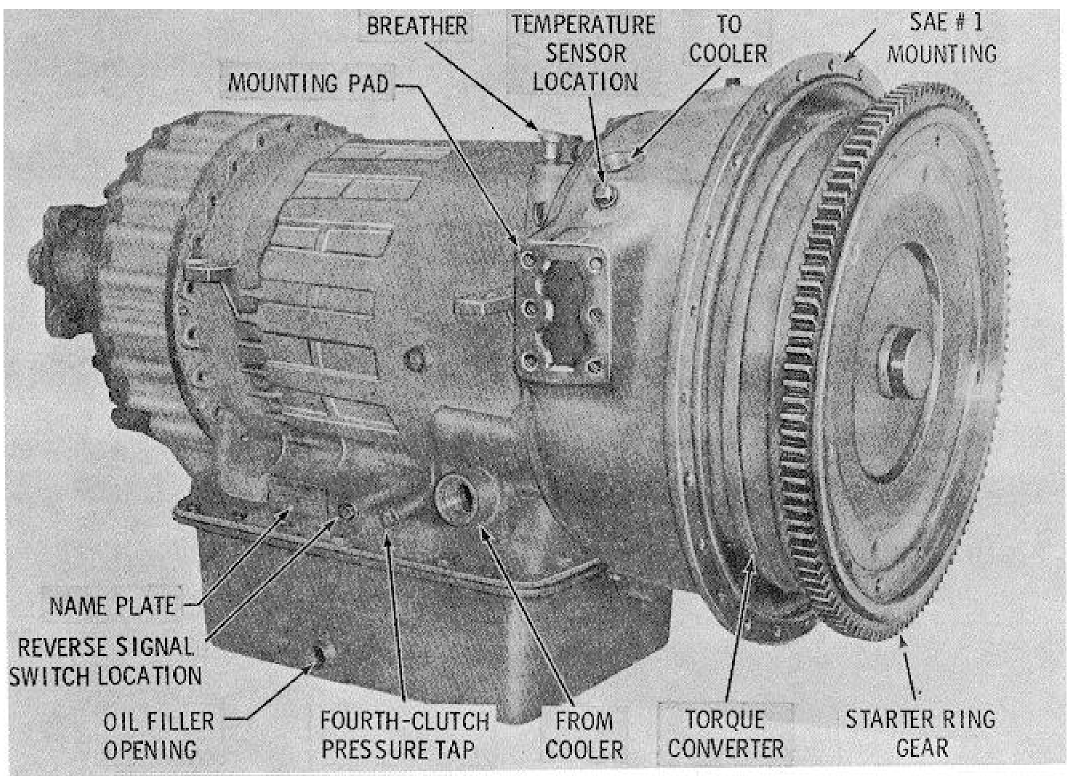

Fig. 1-4. Model HT 750 transmission--right-front view

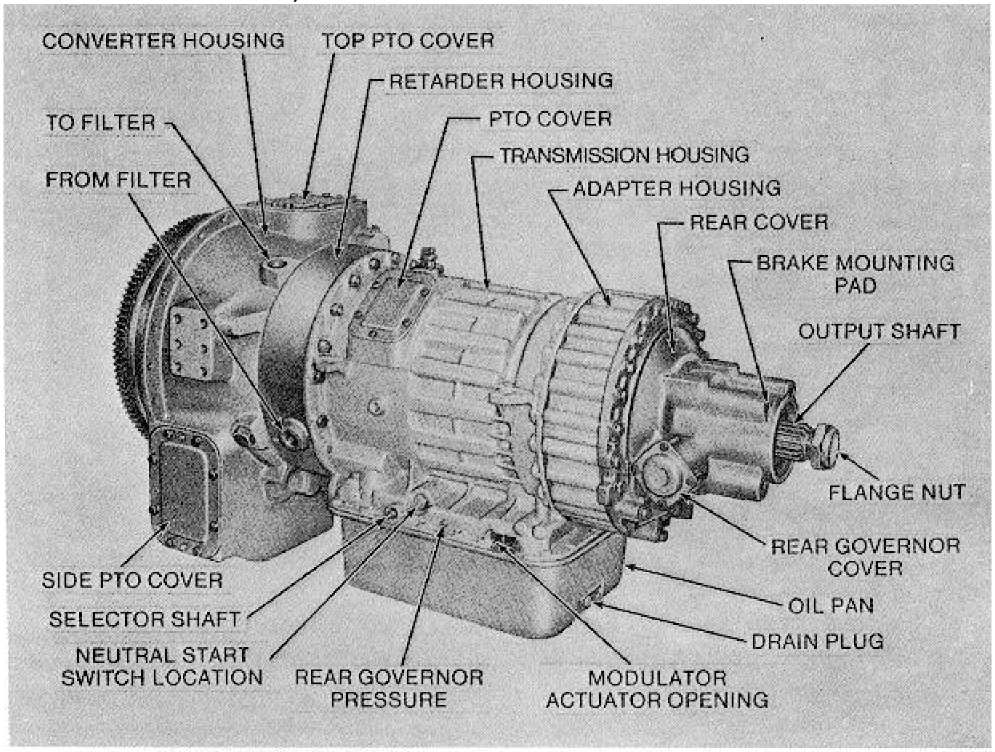

Fig. 1-5. Model HT 750 transmission-left-rear view (with retarder)

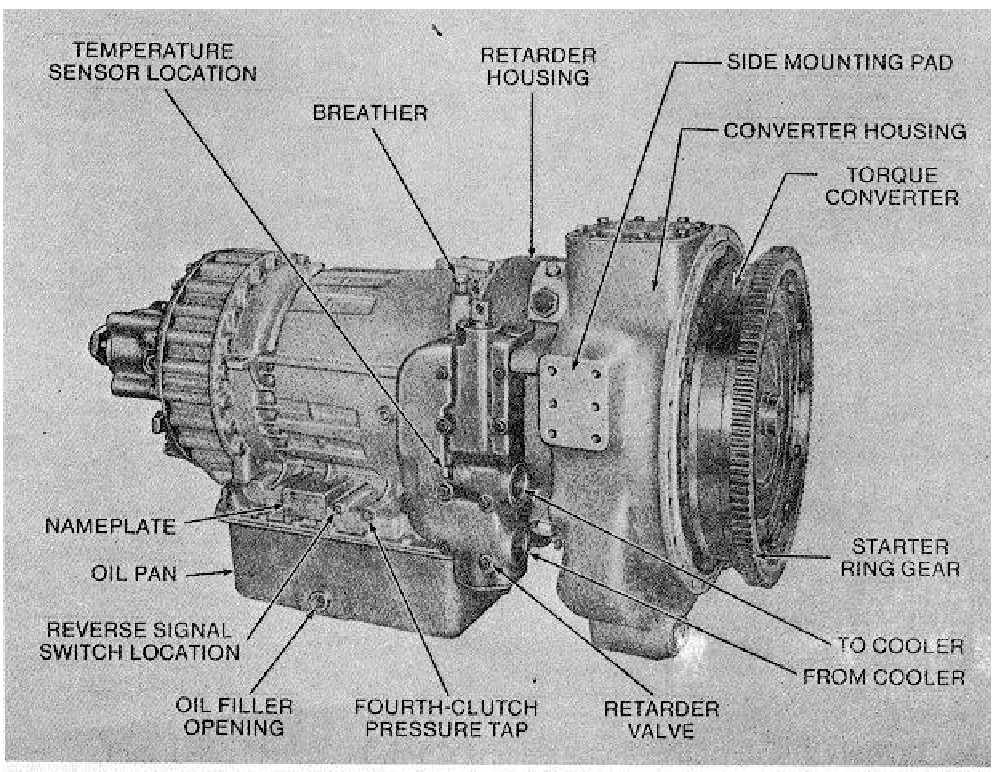

Fig. 1-6. Model HT 750 transmission-right-front view (with retarder)

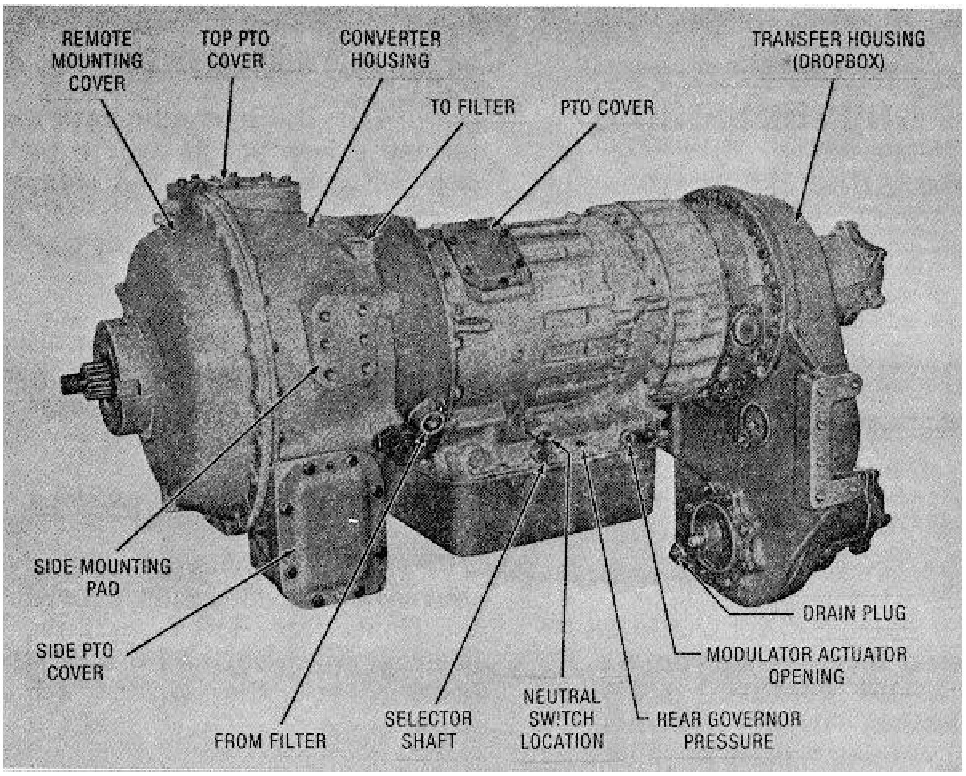

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Fig. 1-7. Model HT 750 transmission-left-front view (with dropbox)

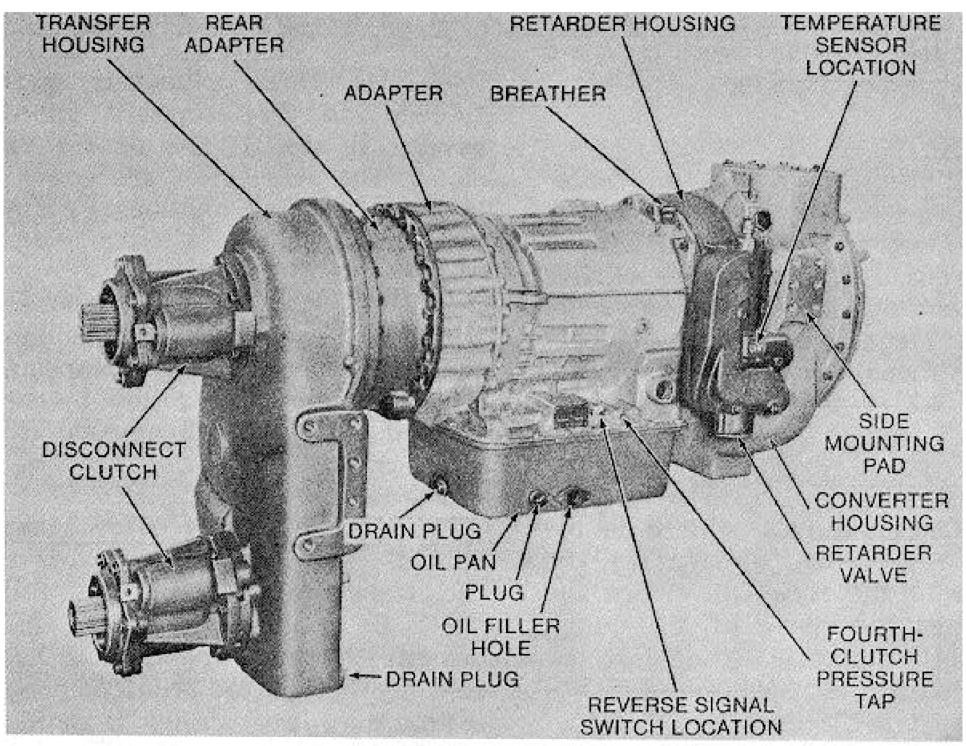

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Fig. 1-8. Model HT 750 transmission-right-rear view (with dropbox)

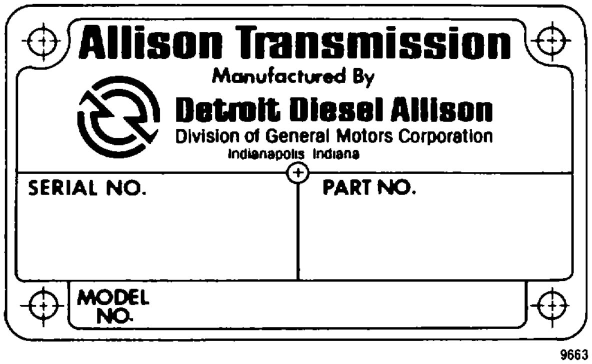

Fig. 1-9. Transmission name plate

1-4. GENERAL DESCRIPTION

a. Automatic Shifting. Automatic shifting is accomplished in all ranges on the HT 740D, HT 747D, HT 750CRD, a n d HT 754CRD transmissions. The HT 750DRD, HT 750DRD DB transmissions must be manually shifted into and out of first range, while the remaining ranges are automatic. Design incorporates four speeds forward and one reverse on the HT 740 models, and five speeds forward and one reverse on the HT 750 models. All transmissions were designed for operation with a diesel engine.

b. Torque Converter. A simple, 3-element torque converter (fig. 1-2) transmits power from the engine to the transmission gearing. The torque converter serves as both a fluid coupling and a torque multiplier. Five combinations of torque converter elements may be used. These give converter stall ratios of 3.04: 1, 2.21: 1, 2.70: 1, 2.56: 1, 2.09: 1 and 1.83:1.

c. Lockup Clutch. This clutch automatically locks the turbine element of the torque converter to the flywheel. When the turbine approaches the speed of the pump, hydraulic pressure automatically applies the lockup clutch. With the lockup clutch applied, engine output is directed to the transmission gearing at a 1: 1 speed ratio. A decrease in speed automatically releases the lockup clutch.

d. Hydraulic Retarder

(1) The hydraulic retarder contains a turbine driven paddle type rotor enclosed by two vaned castings. The retarder plate assembly 2 or 19 (B, foldout 12) is located on the front side of the rotor and the retarder housing 16 on the rear.

(2) A manually controlled valve admits oil to a vaned chamber surrounding the rotor. When charged, the retarder assists in slowing the vehicle.

e. Power Takeoff Provisions

(1) Transmissions are equipped with provisions for mounting a power takeoff on the front, upper-left side of the transmission housing, lower-left side of the converter housing, and the top of the converter housing.

(2) The PTO on the transmission housing is converter driven. The PTO's on the converter housing are engine driven.

f. Planetary Gearing, Clutches

(1) Three planetary gear sets establish the four forward speeds and one reverse in the HT 740 or HT 747 transmissions. The planetaries are controlled by five hydraulic-applied clutches. All gearing is in constant mesh.

(2) Four planetary gear sets establish the five forward speeds and one reverse in the HT 750 or HT 754 transmissions. The planetaries are controlled by six hydraulic applied clutches. All gearing is in constant mesh.

g. Control Valve Body Assembly. The control valve body assembly is the brain of the transmission. It is hydraulically operated. Its oil passages, valves and springs are designed to guide the flow of hydraulic fluid to a pre-designated area. Through variations of pressure and spring tension the components in the valve body are hydraulically moved at the precise time redirecting fluid to its pre-selected point.

h. Output Transfer Housing (dropbox) (fig. 1-7 and 1-8). Transmissions which have the suffix DB in their model designations include a dropbox (transfer gear housing) at the rear instead of having the output shaft in line with the input shaft. The drop box provides an in-line output and a front and/or rear output below the input center line, at a radius of 20 inches (508 mm). It also provides five angular output positions:

1 -- directly below center line
2 -- below and 15 degrees to the left of vertical center
3 -- below and 30 degrees to the left
4 -- below and 45 degrees to the left
5 -- below and 60 degrees to the left

i. Output Disconnects. Output disconnects are available on all dropbox models. Any desired combination of disconnects can be assembled. Rear disconnects are shown in figures 1-7 and 1-8. A front disconnect is shown on (B, foldout 23).

1-5. OPERATING INSTRUCTIONS (Refer to Drivers Handbook SA 1334)

a. Vehicle-Related Controls. For information on controls which are related to the vehicle, refer to the vehicle service manual.

b. Neutral (N). Place the shift selector at the neutral position before starting the engine. A neutral safety switch (on the transmission or in the selector linkage) prevents starting the engine while the selector lever is not at neutral. Apply the vehicle brakes and shift to neutral any time the engine is to be running while the operator is not at the controls.

c. Forward Drive Ranges

(1) Shifting from neutral. The engine should be at idle speed when any shift from neutral to a drive range is made.

(2) Drive (D). This range is the most commonly used forward range. It includes all forward gears on the HT 740D, HT 747D, HT 750CRD, HT 754CRD and the upper four ranges on the HT 750DRD. To drive in this range, simply depress the accelerator. The transmission will start in first (second on HT 750DRD), and automatically upshift at the proper speeds through all gears. Downshifts also will occur automatically, in relation to speed and throttle position.

(3) Drive 4 (4) (HT 750 only). In this range, the transmission will start in first (second on HT 750DRD), and automatically upshift, at the proper speeds, to the fourth gear.

(4) Drive 3 (3). In this range, the transmission will start in first (second on HT 750DRD), automatically upshift, at the proper speeds, to third gear.

(5) Drive 2 (2). In this range, the transmission will start in first (second on HT 750DRD), automatically upshift, at the proper speeds, to second gear. The HT 750DRD will remain in second gear.

(6) Drive 1 (1). In this range, the transmission will start in first gear. No automatic upshift will occur unless governed speed is exceeded.

d. Reverse (R). To move the vehicle backward, idle the engine and shift the selector to the reverse position. Depressing the accelerator will then cause the vehicle to back up.

e. Range Selection

- Drive (D) range should be selected for normal load, grade and traffic conditions with an open highway ahead.
- Drive (4) (HT 754CRD, HT 750DRD) should be selected for moderate grades and over-the-road operation with restricted speeds.
- Drive (3) (HT 740D, HT 747D, HT 750CRD, HT 754CRD) should be selected for moderate grades and over-the-road operation with restricted speeds.

- Drive (3) (HT 750DRD) is appropriate for operating in heavy traffic.

- Drive (2) (HT 740D, HT 747D, HT 750CRD, HT 754CRD) is appropriate for operating in heavy traffic.

- Drive (2) (HT 750DRD) should be selected 'when need for speed control requires a hold condition such as descending steep grades where additional engine braking is required, or for operation on rough terrain.

- Drive (1) (HT 740D, HT 747D, HT 750CRD, HT 754CRD) should be selected when need for speed control requires a hold condition such as descending steep grades where additional engine braking is required, or for operation on rough terrain.

- Drive (1) (HT 750DRD) should permit the driver to operate the vehicle in areas with maximum performance on extremely rough terrain.

f. Hydraulic Retarder. Apply the hydraulic retarder to help reduce speed on curves or downgrades. The throttle should be closed when using the retarder. Retarder effectiveness is increased by downshifting.

g. Towing. All lubricating and clutch apply oil is provided by an engine-driven pump located in the transmission housing. Because the pump location is ahead of the transmission gearing and clutches, the pump cannot be motored by pushing or towing the vehicle. Therefore, anytime that the vehicle must be towed or pushed, the driveline must be disconnected or the driving wheels must be lifted off the ground.

1-6. SPECIFICATIONS AND DATA

The specifications and data in the chart below provide a quick reference to the major characteristics of the transmission.

SPECIFICATIONS AND DATA CHART

Rating:

Input torque (net installed)	1300 lb ft (1762 N•m) (max)
Input speed (full load gov)	1900 rpm (min)--all models 2400 rpm (max)--HT 740D, HT 750DRD, HT 754CRD
Input horsepower (net installed)	425 (317 kW) (max)
Idle speed in range	500 rpm (min)

Mounting:

Engine	SAE 1 automotive flange
Converter housing	Six-hole SAE 2 mounting pad. (earlier models have four-hole SAE 1 mounting pad)
Rear (dropbox)	Two six-bolt threaded pads
Drive	Flex disk
Remote (optional)	Straight-through; converter side pads and rear housing top pad Dropbox; trunion mount at front with dropbox side pads

Rotation: (view from input)

Input	Clockwise
Output (in forward ranges)	Clockwise

Torque converter:

Type .... Single-stage, poly-phase, 3 element

	TC 470	TC 495	TC 496	TC 497	TC 498	TC 499
HT 740D	x	x	x	x	x	x
HT 740FS				x	x	x
HT 747D	x	x				x
HT 750CRD	x	x	x	x	x	x
HT 750DRD	x	x	x	x		x
HT 754CRD	x	x	x		x	x
HT 750DRD DB						x
Torque multiplication ratio (at stall)	3.04:1	2.21:1	1.83:1	2.70:1	2.56:1	2.09:1

Lockup clutch .... Automatic in selected ranges

Gear Data.	Planetary straight-cut spur, constant mesh
Clutches	Oil cooled, hydraulically actuated, spring released, self-compensating for wear
Sump	Integral

SPECIFICATIONS AND DATA CHART (cont)

Oil systems:

Oil pump (input)..Engine driven, positive displacement

Oil pump (scavenge) ....Engine driven, positive displacement, spur gear type

Oil filter..External (customer supplied). Suction screen (in sump)

	Oil Pan Depth		
Oil capacity:	6 or 7 inch	8 1/2 inch	4.5 inch
Initial fill (as received from factory) or refill (transmission only)	8.25 U.S gal (31 liters)	9.5 U.S. gal 36 liters)	8.5 U.S. gal (32.2 liters)

Oil type ....Above -30°F (-34°C) hydraulic transmission fluid type Dexron® * or Dexron® * II. Below -30°F (-34°C), hydraulic transmission fluid type Dexron--auxiliary preheat required to raise temperature in sump and external circuit

Transfer gear housing

Oil capacity...2.6 U.S. qts (2.5 liters)

Oil type...30 weight, C3

Sump..Integral, separate from transmission

	HT 740D	HT 750CRD & HT 754CRD	HT 750DRD & HT 750DRD DB
Oil pressure:			
Main pressure			
--Idle 600 rpm in fwd or rev)	90 psi 621 kPa)-min	90 psi (621 kPa)-min	90 psi (621 kPa)-min
--Stall 1200 RPM in fwd	140-175 psi (965-1206 kPa)	140-175 psi (965-1206 kPa)	235-270 psi (1620-1861 kPa)
--Stall 1200 RPM in rev	235-270 psi (1620-1861 kPa)	235-270 psi (1620-1861 kPa)	235-270 psi (1620-1861 kPa)
--1500-2000 RPM in all fwd ranges	140-175 psi (965-1206 kPa)	140-175 psi (965-1206 kPa)	
--3rd, 4th and 5th ranges....................................			140-175 psi (965-1206 kPa)
--1st converter, 2nd converter and rev			235-270 psi (1620-1861 kPa)
** --1st lockup, 2nd lockup, rev. lockup			140-175 psi** (965-1206 kPa)

Lockup pressure...Must be within 10 psi (69 kPa) of main pressure

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*Dexron® is a registered trademark of General Motors.

**Units incorporating all range lockup

SPECIFICATIONS AND DATA CHART (cont)

Lubrication pressure		
Retarder model	30 psi @ 1900 rpm	
Non-retarder model	25 psi @ 1900 rpm	
Rear governor pressure	Refer to table at end of section 1	
Oil temperature:	Converter-Out (To Cooler)	Sump
Normal operating	160-200°F (71-93°C)	150°F (66°C) min.
Lockup operation	250°F (121°C) max.	250°F (121°C) max.
Converter operation	300°F (149°C) max.	250°F (121°C) max.
Retarder operation	330°F (165°C) max.	250°F (121°C) max.
Transfer gear housing		250°F (121°C) max.

Parking brake provision:

Type	12 x 5 (304.8 x 127.0 mm) (customer supplied)
Weight	50 lb (22.68 kg)

Drive range and sequences:

HT 740D	Reverse, neutral, 1-2-3-4, 1-2-3, 1-2, 1
HT 750CRD	Reverse, neutral, 1-2-3-4-5, 1-2-3-4, 1-2-3, 1-2, 1
HT 754CRD	Reverse, neutral, 1-2-3-4-5, 1-2-3-4, 1-2-3, 1-2, 1
HT 750DRD	Reverse, neutral, 2-3-4-5, 2-3-4, 2-3, 2, 1
HT 750DRD DB	Reverse, neutral, 2-3-4-5, 2-3-4, 2-3, 2, 1

Drive range and shift control	Mechanical (external)
Shifting mechanism	Hydraulic (internal control)
Shift modulation (upshift and downshift)	Mechanically actuated (cable, cam, modulator valve)
Neutral start and reverse signal switches	Supplied by customer

Speedometer drive:

Type	Spiral gear
Drive gear data	6-tooth, rh helix angle
Driven gear	Supplied by customer

SPECIFICATIONS AND DATA CHART (cont)

Dry weight	HT 740D	HT 750CRD	HT 750DRD	HT 750DRD DB
Standard	840 lb	940 lb	940 lb	1375 lb
	(381 kg)	(426 kg)	(426 kg)	(624 kg)
Retarder package	190 lb	190 lb	190 lb	190 lb
(housing, rotor, valve body)	(86 kg)	(86 kg)	(86 kg)	(86 kg)
Power takeoff package	120 lb	120 lb	120 lb	120 lb
(converter hsg, drive and driven gears)	(55 kg)	(55 kg)	(55 kg)	(55 kg)
Transfer gear housing				550 lb (250 kg)

Power takeoff mounting (optional)

Converter-driven PTO
- Location. .... 10 o'clock position, as viewed from rear
- Mounting flange.......... SAE 6-bolt
- Intermittent rating .... 400 lb ft (543 N•m)
- Continuous rating .... 300 lb ft (407 N•m)
- Drive gear data.......... 6-pitch, 20° pressure angle, 78 teeth

Engine-driven PTO
- Top-mounting pad .... 1 o'clock position, as viewed from rear
- Mounting flange.......... SAE 8-bolt
- Intermittent rating .... 260 hp (194 kW)
- Continuous rating .... 200 hp (149 kW)
- Drive gear ratio .... 1.35 hp x engine speed
- Drive gear data.......... 6-pitch, 250 pressure angle, 40 teeth

- Side-mounting pad .... 8 o'clock position, a viewed from rear
- Mounting flange.......... SAE 8-bolt
- Intermittent rating .... 260 hp (194 kW)
- Continuous rating .... 200 hp (149 kW)
- Drive gear ratio .... .844 x engine speed
- Drive gear data.......... 6-pitch, 250 pressure angle, 64 teeth

Manual disconnect clutches (optional at three locations)
- Upper rear (B position).......... In line with input
- Lower rear (D position) .... In line with output
- Lower front (C position).......... In line with output

Hydraulic retarder absorption
- capacity.......... 365 hp (272 kw) at 2100 rpm

Output flange .... Supplied by installer

SPECIFICATIONS AND DATA CHART (cont)

Transmission Ratios (mechanical*)

	Range	Clutches engaged	Ratio Before S/N 14679	S/N 14198-14509 & after S/N 14678	After S/N 28004
HT 740D	Neutral	First			
HT 747D	First	Forward and first	3.69:1	3.69:1	
	Second	Forward and second	2.07:1	2.02:1	
	Third	Forward and third	1.40:1	1.38:1	
	Fourth	Forward and fourth	1.00:1	1.00:1	
	Reverse	Fourth and first	5.73:1	6.04:1	
HT 750CRD	Neutral	Low			
HT 754CRD	First	Forward and low	3.19:1	3.19:1	3.69:1**
	Second	Forward and first	1.89:1	1.89:1	2.00:1**
	Third	Forward and second	1.55:1	1.53:1	1.58:1**
	Fourth	Forward and third	1.24:1	1.23:1	1.25:1**
	Fifth	Forward and fourth	1.00:1	1.00:1	1.00:1**
	Reverse	Fourth and low	7.97:1	8.33:1	9.65:1**
HT 754CRD	Neutral	Low			
Optional	First	Forward and low			3.69:1
Ratios with	Second	Forward and first			2.00:1
2nd gear	Third	Forward and second			1.58:1
start	Fourth	Forward and third			1.25:1
	Fifth	Forward and fourth			1.00:1
	Reverse	Fourth and low			2.96:1
HT 750DRD	Neutral	First			
	First	Forward and low	7.97:1	7.97:1	
	Second	Forward and first	3.19:1	3.19:1	
	Third	Forward and second	2.07:1	2.02:1	
	Fourth	Forward and third	1.40:1	1.38:1	
	Fifth	Forward and fourth	1.00:1	1.00:1	
	Reverse	Fourth and first	4.47:1	4.72:1	
HT 750DRD DB	Neutral	First			
	First	Forward and low			7.97:1
	Second	Forward and first			3.19:1
	Third	Forward and second			2.02:1
	Fourth	Forward and third			1.38:1
	Fifth	Forward and fourth			1.00:1
	Reverse	Fourth and first			4.72:1
	Dropbox only				1.00:1

*Overall torque multiplication ratio of transmission (output stalled) is the product of the converter torque multiplication ratio and the mechanical (rear) ratio.
**Only these ratios are used on HT 754CRD models.

SPECIFICATIONS AND DATA CHART (cont)

HT 700 SERIES GOVERNOR PRESSURE

Governor	Governor Pressure (psi)	*At rpm
6834473	103-112	1650
6834864	83-91	1650
6836769	59-65	1650

*May be read from engine tachometer during lockup in highest gear.

Section 2. DESCRIPTION AND OPERATION

2-1. SCOPE

This section describes the transmission components and explains their functions. It also explains the hydraulic system and the torque paths.

2-2. TRANSMISSION MOUNTING

a. Direct Mount (straight-through models)

(1) Mounting converter housing 16 (B, foldout 10) to the engine bell housing and coupling transmission flywheel 12 (A, foldout 9) to the engine, provides a direct drive from engine to transmission.

(2) This type of mounting requires a minimum of ten bolts, including two at the uppermost bolt holes in the converter housing to properly retain the converter housing to the engine housing.

b. Remote Mount (straight-through models)

(1) A remote type mounting is provided for those transmission that are mounted to the vehicle and separated from the engine.

(2) This type of mounting requires the transmission be supported at both front and rear. A bracket from the frame to the side pads on the converter supports the front. A second bracket supporting the rear may be mounted to the top pads on the transmission rear cover and the vehicle frame.

c. Direct Mount (drop-box models)

(1) Mounting converter housing 16 (B, foldout 10) to the engine bell housing and coupling transmission flywheel 12 (A, foldout 9) to the engine, provides a direct drive from engine to transmission.

(2) Dropbox models utilizing this type of mounting require proper support. It is recommended the transmission be cradle

mounted between the mounting pads on the side of the engine housing and the mounting pads on the side of the drop-box.

d. Remote Mount (drop-box models)

(1) A remote type mounting is provided for those transmissions that are mounted to the vehicle and separated from the engine.

(2) This type of mounting requires the transmission be supported at both front and rear. The front may be supported by attaching a trunnion mount bracket onto the front cover hub and to the vehicle frame. The rear may be supported by attaching a bracket from the drop-box side pads to the vehicle frame.

(3) The flywheel 12 (A, foldout 9) (used on direct type mountings) is removed and replaced by drive cover 7 (B, foldout 9) and front cover 4.

(4) A coupling or flange is installed onto the input shaft (integral part to drive cover 7), providing a remote connection.

2-3. INPUT DRIVE

a. Direct Drive. A steel laminated flex disk-assembly 2 (A, foldout 9) connects the engine crankshaft and transmission flywheel assembly 10. This flywheel serves as the engine flywheel. T h e inner circumference of the flex plate assembly bolts to an adapter which, in turn, bolts to the engine crankshaft. The plate's outer circumference bolts to flywheel 12. The flywheel is bolted to torque converter pump 33 (A, foldout 10). Starter ring gear 11 (A, foldout 9) is shrunk onto the flywheel.

b. Remote Drive. The remote mounted transmission is driven by a shaft from the vehicle engine through universal joints, to the input flange which is splined to the converter input drive housing assembly. This housing assembly is bolted to the torque converter pump. The direct mounted model has flex plate drive from the engine crankshaft to the transmission flywheel.

2-4. TORQUE CONVERTER

a. Description (A, foldout 10). The torque converter consists of three elements-pump assembly 36, stator assembly 13, and turbine assembly 8. These are vaned elements which are cast aluminum. Pump assembly 36 is the input element and is driven by the engine through the flywheel. Turbine assembly 8 is the output element and is splined to forward clutch and turbine shaft assembly 5 (B, foldout 13). Stator assembly 13 (A, foldout 10) is the reaction (torque multiplying) element. The stator is supported on free-wheel roller race 25 which is splined to a stationary ground sleeve. This stator arrangement provides an over-running clutch which permits the stator to rotate freely in one direction but locks in the opposite direction.

b. Operation

(1) The torque converter assembly is continually filled with oil, which flows through the converter to cool and lubricate it. When the converter is driven by the engine, the pump vanes throw oil against the turbine vanes. The impact of the oil against the turbine vanes tends to rotate the turbine.

(2) The turbine, splined to the turbine input shaft, transmits torque to the transmission gearing. At engine idle speed, the impact of oil against the turbine vanes is light. At high engine speed, the impact is much greater than at idle, and high torque is produced by the turbine.

(3) Oil thrown into the turbine flows to the stator vanes. The stator vanes change the direction of the oil flow (when the stator is locked against rotation), and directs the oil to the pump in a direction that assists pump rotation. It is the redirection and velocity of oil to the pump that enables the torque converter to multiply input torque.

(4) Greatest torque multiplication occurs when the turbine is stalled and the pump is rotating at its highest speed. Torque multiplication decreases as the turbine rotates and gains speed.

(5) When turbine speed approaches the speed of the pump, oil flowing to the stator begins striking the backs of the stator vanes. This rotates the stator in the same direction as the turbine and pump. At this point, torque multiplication stops and the converter becomes, in effect, a fluid coupling.

(6) Thus, as explained in (1) through (5), preceding, the torque converter accomplishes three main functions. It acts as a disconnect clutch because little torque is transmitted at engine idle speed. It multiplies torque at low turbine/high pump speed to give greater starting or driving effort when needed. It acts as a fluid coupling to efficiently transmit engine torque to the transmission gearing during drive, other than idle or starting.

2-5. LOCKUP CLUTCH

a. Description (A, foldout 10). The lockup clutch consists mainly of three elements piston 3, clutch plate 4, and back plate 5. These elements are located inside the flywheel. The piston and backplate rotate with the converter pump. The clutch plate is located between the piston and backplate and is splined to the converter turbine.

b. Operation (A, foldout 10). The lockup shift valve directs clutch apply pressure to the lockup clutch piston when sufficient rotational speed is achieved by the forward clutch and turbine shaft assembly. The clutch apply pressure compresses the lockup clutch plate between the piston and backplate, locking all three together. Thus, the

Automatic Shift Sequence and Lockup/Converter Designation

Transmission (Designation)	Automatic Shift Sequence - Lockup/Operation (Full Throttle)	Applicable Engine/Vocation
HT 740D, HT 747D (Coach, Fuel Economy, and Fire Truck)	Standard 1C-2C-2L-3L-4L Second Gear Start 2C-2L-3L-4L	Any Diesel in High Power to Weight Vehicles (Coaches, Fire Trucks, etc). High torque rise diesel having a full load governed speed equal to or less than 2100 RPM and a peak torque below 1300 RPM (trucks)
HT 740D (General)	1C-1L-2C-2L-3C-3L-4C-4L	Conventional Diesels in On/Off Highway Trucks
HT-754CRD (General)	Standard 1C-2C-2L-3L-4L-5L Lockup in 1st. Hold Second Gear Start 2C-2L-3L-4L-5L Lockup in 1st. Hold	Conventional and high torque rise diesels in truck.
HT 750DRD (General)	2C-2L-3C-3L-4C-4L-5C-5L 1st. Hold (1C-1L)	Any Diesel in On/Off Highway Trucks
HT 750DRD (Hi Torque Rise)	2C-2L-3L-4L-5L 1st. Hold (1C-1L)	High torque rise diesel having a full load governed speed equal to or less than 2100 RPM and a peak torque below 1300 RPM (On/Off Highway Trucks)

converter pump and turbine are locked together, and provide a direct drive from the engine. As rotational speed of the forward clutch and shaft assembly decreases, the lockup shift valve will release the lockup clutch.

c. The shift point check table in para 3-10, shows the speed (rpm) required to shift from one gear to another during closed or open throttle on transmissions in the 1950 to 2700 rpm range. It also shows at what rpm the lockup clutch is engaged and disengaged. The table is coded alphabetically to indicate engine application. If your unit is not applicable to the table in para 3-10 or the following shift sequence table, contact Detroit Diesel Allison Service Department.

2-6. TORQUE CONVERTER HOUSING

Converter housing 16 (B, foldout 10) i s machined from cast aluminum. The front of the housing is machined to mate with an SAE 1 engine flywheel housing. The rear of the housing is machined to accept either retarder plate assembly 2 or 19 (B, foldout 12), or front support and valve assembly 1 or 33 (A, foldout 13), and transmission housing assembly 7 (B, foldout 16). The converter housing encloses and supports the torque converter elements and input-driven oil pump assembly 1 (B, foldout 10).

2-7. HYDRAULIC RETARDER

a. The hydraulic retarder (B, foldout 12), located between the converter and the range gearing, consists of three main elements-a rotor and two stators. The rotor assembly 10 is a vaned member splined to the turbine output shaft. The front and rear stators consist of vanes cast into the walls on each side of the retarder rotor.

b. The rotor turns continuously at turbine output shaft speed. However, the retarder functions only when the cavity around the rotor is filled with oil. A manual valve directs oil which fills the cavity when retarder operation is desired. The churning of the oil between the rotor and stators resists the rotation of the rotor. Part of this energy is used to circulate the oil through a cooler to dissipate the heat generated. When the control valve is released, the retarder cavity is evacuated.

c. The retarder is used to slow the vehicle in traffic, on curves, or on downgrades. Maximum retarder effect occurs in the lowest gear range. The throttle should be closed when the retarder is used. Long continuous use will raise the oil temperature. Short periods of full-release, to interrupt continuous application, will prevent overheating.

2-8. OIL PUMP ASSEMBLY

a. Description (B, foldout 10). Oil pump assembly 1 consists mainly of three elements-drive gear 5, driven gears 8 and pump body 3. The oil pump assembly is retained in the converter housing by six bolts. Driven gear (or gears) 7 is supported in the pump body by gear shafts 6.

b. Operation (B, foldout 10). When the converter pump rotates, its rear hub drives pump drive gear 5. Gear 5 is in mesh with driven gear assembl(ies) 7. Thus, as the gears rotate, oil is drawn into the inlet port and is carried between the pump housing and the gear teeth to the outlet side of the pump into the hydraulic system.

2-9. FRONT SUPPORT AND VALVE ASSEMBLY

The front support and valve assembly is connected to the rear of the retarder housing or to the rear of the converter housing if the unit has no retarder. It provides support for the forward clutch and turbine shaft. Contained within the support assembly are three valves-main pressure regulator valve assembly 3 (A, foldout 13), lockup shift valve 8, and converter bypass valve 14.

2-10. DESIGNATION OF CLUTCHES, PLANETARY GEAR SETS

a. Necessary for Clarity of Description

(1) In this section and those following, uniform designations for clutches and planetary gear sets are used for all models in the HT 700D series. In the first edition of the manual, which covered only the HT 740D model transmission, clutches were designated to match the transmissions forward gear selections (first, second, third, fourth and forward). With the introduction of new models with an additional clutch and g e a r set, and the changes in functions of each clutch among models, such designation is no longer practical. Also, a similar situation exists for the planetary gear sets. The first edition of the manual covered only the HT 740D model transmission, which included only three gear sets. These were designated front, center and rear, for their relation to the position of each other, and to transmission front and rear. The five-speed models which have been added, include another gear set. Thus, it was necessary to assign uniform designations to each planetary gear set, applicable to all models.

(2) Accordingly, to avoid confusion in the designation of and reference to clutches and planetary gear sets, the methods outlined in b and c, following, were

b. Clutch Designations

(1) Each clutch in the same physical location, regardless of model or clutch drive function, will have the same name.

(2) These names will parallel the names assigned to clutches in the first edition of the manual, except for the added clutch in five-speed models. Refer to figure 2-1 for uniform clutch designations.

c. Planetary Gear Set Designations

(1) Each gear set in the same physical location, regardless of model or gear drive function, will have the same name.

(2) These names will parallel the names assigned to gear sets in the first edition of the manual, except for the added gear set in five-speed models. Refer to figure 2-1 for uniform gear set designations.

2-11. FORWARD CLUTCH AND TURBINE SHAFT (B, foldout 13)

a. Function Differs Among Models

(1) The forward clutch in the HT 740D, HT 747D has a multiple function. When engaged simultaneously with the first clutch, it produces first gear. When engaged with second clutch, third or fourth clutches, it produces second, third or fourth gears, in that sequence.

(2) In the HT 750CRD, HT 754CRD and HT 750DRD, the forward clutch has multiple functions. When engaged with low clutch, it produces first gear. When engaged

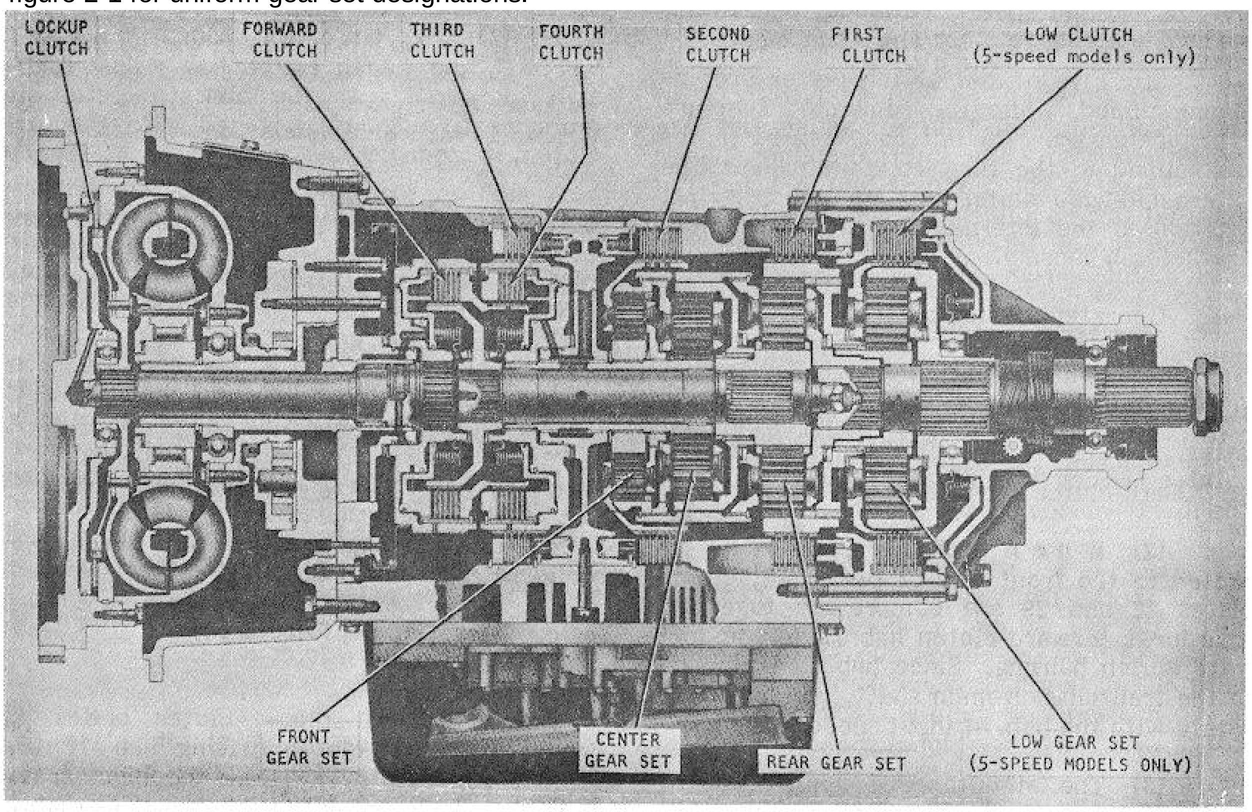

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Fig. 2-1. Uniform clutch and gear designation for HT 700D series transmissions with first, second, third or fourth clutches, it produces second, third, fourth or fifth gears, in that sequence.

b. Description

(1) The forward clutch in models, HT 740D, HT 747D, HT 750CRD, HT 754CRD, HT 750DRD, contain the same basic parts. Each model has a clutch housing with turbine shaft attached, ten clutch plates, a piston, a forward clutch hub and a fourth-clutch driving hub.

(2) The clutch housing contains an oil collector ring attached to its outer diameter and works in conjunction with a pitot tube to produce front governor pressure. If front governor pressure is not required, a rectangular steel block is used in place of the pitot tube. The clutch housing contains the forward clutch piston, positioned inside the housing in its bore, retained by twenty springs, a spring retainer and a snapring.

(3) Five of the clutch plates are internal-splined, while the remaining five are external-tanged. The internal-splined plates are splined to the forward clutch hub. The external-tanged plates are anchored against rotation to the internal grooves of the forward clutch housing.

c. Operation (B, foldout 13)

(1) Clutch housing and shaft assembly 5 rotate when the converter turbine rotates. Fourth-clutch driving hub 22 also rotates causing the internal-splined plates of the fourth-clutch pack to rotate.

(2) When hydraulic pressure is directed to the front side of piston 12, clutch plates 22 and 29 are compressed together. This locks forward-clutch hub 19 to the forward clutch housing. Since hub 19 is splined to the transmission main shaft, the shaft will rotate with the hub, at input speed.

(3) The simultaneous application of two clutches is necessary to produce one forward or o n e reverse gear. The forward clutch is applied only in forward gears (refer to a, (1), (2), above). When the converter turbine rotates, and the forward clutch is applied, it drives the output shaft.

(4) Rotation of the oil (pitot) collector ring directs oil against the front pitot tube any time the converter turbine rotates. Thus, an increase in turbine speed produces a proportional increase in front governor pressure.

2-12. FOURTH CLUTCH (A, foldout 14)

a. Function Differs Among Models

(1) The fourth clutch, in the HT 740D or HT 747D, has a dual function. When engaged simultaneously with the forward clutch, it produces fourth gear. When engaged with the first clutch, it produces reverse gear.

(2) In the HT 750CRD or HT 754CRD, the fourth clutch has a dual function. Engaged with the forward clutch, it produces fifth gear. Engaged with the low clutch, it produces reverse gear.

(3) In the HT 750DRD, the fourth clutch has a dual function. Engaged with the forward clutch, it produces fifth gear. Engaged with the first clutch, it produces reverse gear.

b. Description. The fourth clutch, for all models, contain t e n clutch plates, a clutch piston housing and a piston. Five plates are internally splined and five are externally tanged. The piston is positioned inside the clutch housing in its bore and retained by twenty piston return springs, a spring retainer and a snapring.

c. Operation (A, foldout 14)
(All models)

(1) Internal-splined clutch plates 4, driven by fourth-clutch driving hub 22 (B, foldout 13), rotate any time the input shaft and the forward-clutch housing assembly rotates.

(2) When hydraulic pressure is directed to the back side of fourth-clutch piston 9 (A, foldout 14), the piston compresses clutch plates 4 and 5 together. This locks internal-splined plates 4 to external-tanged plates 5, and, in turn, to clutch housing 14.

(3) Since center sun gear and shaft assembly 23 (A, foldout 15, or B, foldout 15) or (A, foldout 16) is splined to the clutch housing, it will also rotate at input speed.

2-13. SECOND, THIRD CLUTCHES, AND CENTER SUPPORT (B, foldout 14) a. Function Differs Among Models

(1) The second and third clutches, in the HT 740D and HT 747D, perform only one function. When engaged simultaneously with forward clutch, the second clutch produces second gear, while the third clutch produces third gear.

(2) The second and third clutches, in the HT 750CRD, HT 754CRD and HT 750DRD, perform only one function. When engaged w i t h forward clutch, the second clutch produces third gear, while the third clutch produces fourth gear.

b. Description

(1) The second and third clutches, for all three models, are composed of two identical pistons, twenty-one clutch plates (13 in second clutch; 8 in third clutch) and a center support.

(2) Two pistons 9 and 20 are separated by a wall in the center support housing assembly 15. Each piston is retained in its bore by twenty piston return springs 8 or 21, a return spring retainer 7 or 22, four selflocking retainer rings 6 or 23 and snaprings 5 or 24.

(3) Eight clutch plates are required for the third clutch (f o u r internal-splined and four external-tanged plates). The internal-splined plates are splined to the outside diameter of the fourth clutch housing and are free to rotate. The external-tanged plates are anchored against rotation to the transmission housing.

(4) Thirteen clutch plates are required for the second clutch. Six internal-splined plates are splined to the outside diameter of the front carrier assembly, and are free to rotate. The seven external-tanged clutch plates are anchored to the transmission housing and cannot rotate.

(5) The center support assembly is housed in the transmission and located by an anchor bolt. This insures accurate oil passage hole alignment from the valve body to the second and third piston cavities.

c. Operation of Third Clutch (B, foldout 14) (All models)

(1) When hydraulic pressure is directed through the oil passages in the center support to the back side of clutch piston 9, clutch plates 3 and 4 a r e compressed together. This locks the fourth clutch housing to the transmission housing, which prevents the f o u r t h clutch housing and attached components from rotation.

(2) With the application of the forward clutch in conjunction with third clutch, a reaction within the planetary gearing will produce a forward rotation to t h e output shaft.

d. Operation of Second Clutch (B, foldout 14) (All models)

(1) When hydraulic pressure is directed through the oil passages in the center support to the front side of clutch piston 20, the piston and clutch plates 25 and 26 are compressed together. This locks the front planetary carrier to the transmission housing, which prevents the carrier from rotating.

(2) With the application of the forward clutch in conjunction with the second clutch, a reaction within the planetary gearing will produce a forward rotation to the output shaft.

2-14. FIRST CLUTCH (A, foldout 18)

a. Function Differs Among Models

(1) The first clutch, in the HT 740D and HT 747D has a d u a 1 function. When engaged simultaneously with the forward clutch, it produces first gear. When engaged with the fourth clutch, it produces reverse gear.

(2) In the HT 750CRD a n d HT 754CRD, the first clutch has a single function. Engaged with the forward clutch, it produces second gear.

(3) In the HT 750DRD, the first clutch has a dual function. When engaged with the forward clutch, it produces second gear. When engaged with the fourth clutch, it produces reverse.

b. Description. The first clutch in all models contain thirteen clutch plates and a piston. Six are internal-splined clutch plates and seven are external-tanged clutch plates. The external-tanged plates are held stationary by the transmission housing, while the internal-splined plates are free to rotate. The piston for each model is positioned in its respective bore and retained there by return springs and a spring retainer.

c. Operation (A, foldout 18) (HT 740D, HT 747D)

(1) When the first clutch is released, internal-splined plates 2 are free to rotate. Since rear planetary ring gear 4 is splined to the internal plates, it will also rotate freely.

(2) When hydraulic pressure is directed to the back side of the piston (shown in phantom), the piston compresses clutch plates 1 and 2 together. This locks rotating internal-splined plates 2 t o stationary external-tanged plate 1, preventing ring gear 4 from rotating.

(3) With the application of forward or fourth clutch in conjunction with the first clutch (refer to a(1), above), a reaction within the planetary gearing will produce either forward or reverse rotation at the output shaft.

d. Operation (A, foldout 18) (HT 750CRD, HT 754CRD)

(1) Refer to c(1), above.

(2) When hydraulic pressure is directed to the back side of piston 6 (B, foldout 18), the piston compresses clutch plates 1 (A, foldout 18) and 2 together. This locks the rotating internal plates to the stationary external plates preventing ring gear 4 from rotating.

(3) With the application of forward clutch in conjunction with first clutch, a reaction within the planetary gearing will produce a forward rotation at the output shaft.

e. Operation (A, foldout 18) (HT 750DRD)

(1) Refer to c(l), above.

(2) When hydraulic pressure is directed to the back side of piston 6 (A, foldout 19), the piston compresses clutch plates 1 (A, foldout 18) and 2 together. This locks the rotating internal plates to the stationary external plate preventing ring gear 3 from rotating.

(3) With the application of the forward or fourth clutch in conjunction with the first clutch (refer to a(3), above), a reaction within the planetary gearing will produce either forward or reverse rotation at the output shaft.

2-15. LOW CLUTCH (B, foldout 18, A, foldout 19)

a. Function Differs Among Models

(1) Only the five-speed transmissions include the low clutch. Refer to figure 2-1 for its location.

(2) The low clutch in the HT 750CRD and HT 754CRD has a dual function. When engaged with the forward clutch, it produces first gear. When engaged with the fourth clutch, it produces reverse gear.

(3) In the HT 750DRD model, the low clutch has a single function. When engaged with the forward clutch, it produces first gear.

b. Description. The low clutches in both t h e HT 750CRD, HT 754CRD a n d the HT 750DRD models each contain thirteen clutch plates and a piston. Six are internal-splined clutch plates and seven are external-tanged clutch plates. The external-tanged plates are held stationary by the adapter housing, while the internal-splined plates are free to rotate. The piston for each model is positioned in its respective bore and retained there by twenty-eight piston return springs, the return spring retainer, four retainer rings and a snapring.

c. Operation (B, foldout 18)
(HT 750CRD, HT 754CRD)

1) When the low clutch is released, internal-splined clutch plates 15 are free to rotate. Since low planetary ring gear 14 is splined to internal plates 15, it will also rotate freely.

2) When hydraulic pressure is directed to the back side of low piston 6 (B, foldout 18), the piston compresses clutch plates 15 and 16 together. This locks rotating internal-splined plate 15 to stationary external-tanged plate 16, preventing ring gear 14 from rotating.

3) With the application of the forward or fourth clutch in conjunction with the low clutch, a reaction within the planetary gearing will produce either forward or reverse rotation, respectively, at the output shaft.

d. Operation (A, foldout 19)
(HT 750DRD)

(1) When the low clutch is released, internal-splined clutch plates 14 are free to rotate. Since these plates are splined to the outside diameter of low carrier assembly 29, the carrier will also rotate freely.

(2) When hydraulic pressure is directed to the back side of low piston 6 (A, foldout 19), the piston compresses clutch plates 14 and 15 together. This locks rotating internal-splined plate 14 to stationary external-tanged plates 15, preventing low carrier assembly 29 from rotating.

(3) With the application of the forward clutch in conjunction with the low clutch, a reaction within the planetary gearing will produce a forward rotation at the output shaft.

2-16. PLANETARYGEARING (HT 740D, HT 747D)

a. Description (A, foldout 15)

(1) The gear unit and main shaft assembly contain three planetary gear sets. These, because their functions overlap, are identified as front, center and rear planetary carrier assemblies. Their identification was so designated because of their location in relation to the transmission and to each other.

(2) Each of the three gear sets contains a sun gear and a ring gear, which are interconnected by the main transmission shaft and a connecting drum. This interconnection of the planetary input, reaction, and output elements-and connections with the forward and fourth clutches-produces four forward speeds and one reverse speed.

b. Operation (A, foldout 15)

(1) The front planetary assembly 5, used in conjunction with the center planetary assembly 16, produces second gear when the forward and second clutches are applied (fig. 2-4).

(2) The center planetary is active in second, third, fourth and reverse gears, but only in second and reverse gears is the compounding of two planets required.

(3) The rear planetary carrier assembly 39 (A, foldout 15), is active in first and reverse gears. In first gear t h e rear planetary acts alone to transmit torque to the transmission output shaft via main shaft 36, sun gear 37 and four pinions in carrier assembly 39. Reverse gear is activated by compounding the center and rear planetary carriers (fig. 2-7).

NOTE

In fourth gear, because both the forward and fourth clutches are engaged, all three planetaries rotate as a unit. This gives direct drive through the transmission.

2-17. PLANETARY GEARING (HT 750CRD, HT 754CRD)

a. Description (B, foldout 15)

(1) The planetary gearing is composed of a gear unit and main shaft assembly 1 (B, foldout 15), the low planetary carrier assembly 18 (B, foldout 18) and its sun gear and ring gear.

(2) The gear unit and main shaft assembly I (B, foldout 15) contains three planetaries called front, center and rear, so designated because of their location in relation to each other in the gear unit.

(3) Each of the three planetaries has a sun gear and a ring gear, which are interconnected by the main transmission shaft and a connecting drum.

(4) The low planetary gear set is located behind the gear unit and main shaft assembly. Refer to figure 2-9. It contains a sun gear, a carrier assembly, and a ring gear. The sun gear is splined to the main shaft, and the rear carrier is splined to the low ring gear, thereby interconnecting the four planetary systems.

(5) This interconnection of the planetary input, reaction, and output elements and connections with the forward and fourth clutches-produces five forward speeds and one reverse speed.

b. Operation (B, foldout 15)

(1) The front planetary assembly 5, used in conjunction with the center planetary assembly 16, produces third gear when the forward and second clutches are applied (fig. 2-11).

(2) The center planetary is active in third, fourth, fifth and reverse gears.

(3) The rear planetary carrier assembly 38, is active in second, third, fourth and fifth gears. In second gear, with the application of forward and first clutches, it transmits torque, at a reduction, through the low carrier to the output shaft (fig. 2-10). In third, fourth a n d fifth gears its only function is in the transmitting of torque through the low carrier to the output shaft.

(4) The low planetary carrier assembly 18 (B, foldout 18), is active in all gears. With the application of the forward clutch with any one of the other clutches (low, first, second, third, fourth), torque is transmitted, via the main shaft and planetary carrier components (ref. para 2-28), through the low carrier to the output shaft. In reverse gear, torque is transmitted through the fourth clutch housing, sun gear shaft assembly 23 (B, foldout 15), center carrier assembly 16 and main shaft assembly 34 to the low sun gear and carrier.

NOTE

In fifth gear, because both the forward a n d fourth clutches are engaged, all four planetaries rotate as a unit. This gives direct drive through the transmission.

2-18. PLANETARY GEARING (HT 750DRD)

a. Description (A, foldout 16)

(1) The planetary gearing in both the HT 750C , HT 754CRD and HT 750DRD is similar. The description in items (1), (2) and (3) paragraph -17a, is applicable by changing B, foldout 15 to A, foldout 16 and 18 (B, foldout 18) to 29 (A, foldout 19). The above

items describe the gear unit and shaft assembly and its three planetary gear sets.

(2) The low planetary gear set is located behind the gear unit and main shaft assembly. Refer to figure 2-15. It contains a carrier assembly, a sun gear a n d a ring gear. The sun gear is driven by the rear planetary ring gear. The 1 o w ring gear is splined to the output shaft and driven by the low planetary pinions, which in turn drive the carrier and the output shaft.

(3) Planetary reaction of the three unit planetaries (front, center, rear) work independently of the low planetary system in all but first gear. These three planetaries are required to produce second, third, fourth, fifth and reverse gears, transmitting torque directly to the output shaft. Low planetary is required to produce first gear only.

b. Operation (A, foldout 16)

(1) Compounding front a n d center planetary assemblies 5, 16, used in conjunction with the forward and second clutches, produces third gear when the forward and second clutches are applied (fig. 2-18).

(2) The center planetary is active in third, fourth, fifth and reverse gears.

(3) The rear planetary carrier assembly 39 (A, foldout 16), is used in all gears. In first gear it works in combination with the 1 o w planetary to produce a high output torque. In second gear it acts alone to transmit torque at a reduction, to the output shaft. In third, fourth and fifth gears its only function is to transfer torque to the output shaft. In reverse gear it transmits torque, at a reduction to the output shaft.

(4) The low planetary carrier assembly 29 (A, foldout 19) has only one function, first gear. With the application of forward and low clutches, torque is transmitted through the main shaft to the rear planetary sun gear splitting at this point, sends torque through the rear carrier to the output shaft, and through the low sun gear, carrier pinions and ring gear, to the output shaft. This interconnection between the two carriers causes a compounding action, producing a high output torque.

NOTE

In fifth gear, because both the forward and fourth clutches are engaged, a 11 four planetaries rotate as a u n i t. This gives direct drive through the transmission.

2-19. SPEEDOMETER DRIVE (Straight-Through Models)

a. Description (A, foldout 20)

(1) The speedometer drive consists of drive gear 24 and driven gear bushing 15.

(2) Drive gear 24 is a w o r m gear with a right hand helix. The gear is concentric with the output shaft and has no key or drive splines. The drive gear is clamped between rotating parts which, in turn, cause the drive gear to rotate.

b. Operation (A, foldout 20). When the transmission output shaft rotates, drive gear 24 rotates. Bushing 15 supports the driven gear (vehicle furnished) within the rear cover. The driven gear rotates clockwise (as viewed at the cable connection in the rear cover) during forward operation.

2-20. GOVERNOR

a. Description (A, foldout 20). Governor assembly 38 is a centrifugal (flyweight) governor which is driven by a gear that is integral with output shaft 23 or 30. The governor is supported by a bore in rear cover 14 and pin 11, and retained in the rear cover by cover 42.

b. Operation (A, foldout 20). Rotation of the governor causes the governor valve (foldouts 5, 6, 7, 8) to travel within its bore. When the valve moves leftward, governor pressure rises; when the valve moves rightward governor pressure falls. Thus, governor pressure is proportional to transmission output speed. Governor pressure, in combination with modulator pressure (para 2-31h, below), provides the automatic shifting in the transmission. (Refer also to para 2-31g, i, j, k, and l, below, for additional information about automatic shift circuits.)

2-21. CONTROL VALVE ASSEMBLY

a. Description (B, foldout 20). Control valve body assembly 1 includes the various valves, springs and other components which control t h e selection of ranges, and the automatic shifting of gears. The valve body assembly is bolted to the bottom of the transmission housing, which is channeled to direct the flow of oil between the valve body and clutches, and other components.

b. Operation. Refer to paragraph 2-31, below, for operation of the control valve body assembly.

2-22. LOW SHIFT AND TRIMMER VALVES

a. Description (A, foldout 21). Low shift valve body assembly 2 contains a relay valve, a shift valve, springs, pins and an adjusting ring. It is mounted at the back of the control valve assembly, and retained by bolt 1. Mounted directly under the low shift valve body, is low-trimmer valve body assembly 18. This body consists of a valve, trimmer and retainer plugs, a spring, a valve stop and a pin. Six bolts 17 extending through both valve bodies and the control valve assembly into the transmission housing, retain the two bodies.

b. Operation (foldouts 6, 7, and 8). With the selector valve placed in the Drive 1 (D1) position, hydraulic fluid is directed to the 1-2 shift signal valve (foldout 6) or through the 1-2 shift signal valve to the top of the 1-2 relay valve (foldout 7). Hydraulic fluid (foldout 6) holds the 1-2 shift valve down until governor pressure charges the line (refer para 2-31o(3)). Hydraulic fluid (foldout 7) forces the relay valve down against its spring allowing main pressure to apply low clutch (refer para 2-31p(6)).

2-23. LOCKUP CUTOFF VALVES

a. Description (A, foldout 21)

(1) The lockup valve body assembly 28 contains three identical valves 33, 36 and 37. The assembly is bolted to the lower front of the oil transfer plate in the transmission oil pan.

(2) The valves move in their bores in response to various clutch pressures, at the moment the clutches are applied. Some transmission assemblies do not include lockup cutoff valves.

b. Operation HT 740D, HT 747D (foldout 5)

(1) When either the first, second, third or fourth clutch is applied, pressure is sent to the lockup cutoff valves. In first gear, a valve is pushed upward and pressure can then charge the lockup feed line. Lockup will occur in first gear when front governor pressure is sufficiently high. (Lockup will not occur in first gear on models equipped with rear governor option.)

(2) When the transmission shifts to second gear, first clutch pressure is exhausted and the lockup clutch, if engaged, releases. Also, second clutch pressure is exerted upon the opposite end of the same valve from which first clutch pressure was released. However, second clutch pressure must, initially, flow through an orifice to move the valve downward. This delays the movement of the valve to a point where second clutch pressure can again apply the lockup clutch.

(3) Similar actions occur at the other two valves when second clutch pressure is released and third clutch pressure is applied, and when third clutch pressure is released and fourth clutch pressure applied.

(4) The delay in valve movement provides a momentary release of the lockup clutch between upshifts. In downshifts, similar actions occur, but in a reverse sequence.

c. Operation, HT 750DRD (foldouts 7, 8)

(1) Operation of t h e lockup cutoff valves in the HT 750 model is similar to that described for the HT 740. In some models, the f i r s t through fourth clutch pressures provide lockup feed for second through fifth gears respectively. T h e r e is no lockup in first gear (foldout 7).

(2) In HT 750DRD models (foldout 8), low-clutch pressure is brought into the same valve that receives second clutch pressure, through a shuttle b a 1 1 check valve. Thus lockup is effective in all gears.

2-24. SECOND GEAR START (HT 740, HT 747, HT 750CRD, HT 754CRD)

a. Description. The second gear start feature provides vehicles equipped with a 3.19: 1 or 3.69: 1 first gear ratio, an option of automatically bypassing first gear and accelerating the vehicle in second gear from a standing start.

b. Forward Gear Operation (vehicle stationary). Shift the selector lever into DR4 position. F o r w a r d regulated pressure moves the 1-2 modulator valve upward in its bore compressing the valve spring (late models). The tickler spring at the bottom of the 1-2 shift valve forces the 1-2 shift valve upward permitting main pressure to pass through the valve forcing the spring loaded 1-2 relay valve to the bottom of its bore. Priority main pressure is then directed to flow through the relay valve to the second clutch.

c. First Gear Operation. Shift the selector lever into Drive 1 (DR1) position. Hold pressure (DR1) is directed from the selector valve to an area between the 1-2 shift valve and the 1-2 modulator valve. This pressure moves the 1-2 shift valve to the bottom of its bore, blocking main pressure flow to the 1-2 relay valve and maintaining first gear operation until the selector lever is moved or DR1 hold speed is exceeded.

d. Reverse Gear Operation (early models). Shift the selector lever into R (reverse) position. Reverse pressure from the selector valve is directed to three points; the reverse signal valve pin, pushing the valve pin and the 1-2 shift valve downward, blocking main pressure to the top of the 1-2 relay valve. This allows reverse pressure to pass through the bottom of 1-2 relay valve engaging fourth and first clutch. Reverse pressure in the first trimmer trim boost area blocks the trimmer and prevents any trimming action.

e. Reverse Gear Operation (late models). Shift the selector lever into R (reverse) position. With forward regulated pressure absent, the 1-2 shift spring at the top of the 1-2 shift valve will force the 1-2 modulator and 1-2 shift valves to the bottom of their bores. This blocks main pressure flow to the top of the 1-2 relay valve leaving the valve at the top of its bore and permits reverse pressure from the selector valve to pass through the bottom of the 1-2 relay valve to the fourth and first clutches. Reverse pressure is also directed through the trim regulator valve to the trim boost area of the first, second, and third trimmers, blocking all trimming action.

2-25. OIL PAN AND OIL FILTER

a. Description

(1) There are three different oil pans designed f o r the transmission. T w o steel pans and one iron pan. The steel pans (illustrated in foldouts B, 16 and A, 17) are made of pressed steel. The pan illustrated in B, 16 is six inches deep, measured from the splitline to the bottom of the pan. The pan illustrated in A, 17 is seven i n c h e s deep, measured from the transmission splitline to the bottom of the pan.

(2) The third pan is made of cast iron. It is eight and one-half inches deep, measured from the transmission splitline to the bottom of the pan (reference B, foldout 17).

(3) The pan holds the oil that activates the clutches, valves, etc., and is sometimes referred to as the sump. It is retained to the bottom of the transmission housing with twenty-three screw and washer assemblies.

(4) Most oil pans h a v e two holes. One at the side, to attach the oil filler tube. The other hole is at the rear of the pan f o r convenient draining of t h e oil. Earlier oil pans provided one hole for filling and draining the oil.

(5) Oil pans with three holes were designed to accommodate an oil preheating element or the shift assist feed line required on split shaft PTO transmissions.

(6) Oil filters 33 (B, foldout 16), 29 (A, foldout 17) and 29 (B, foldout 17) are boxlike sheet metal frame with a perforated sheet metal reinforcement covered by a fine-mesh screen across the bottom. Sump oil is drawn through the screen by the oil pump and directed into the hydraulic system. The filters are retained to the bottom of the control valve with bolts.

NOTE

The dropbox has its own oil system and requires a different grade of oil.

b. Function (B, foldout 16)

(1) The oil pan holds the oil supply for the transmission and covers the control valve body assemblies and oil filter. It does not hold the oil supply for the dropbox.

(2) The oil filter screens all oil entering the hydraulic system.

2-26. REAR ADAPTER HOUSING

a. Adapter housing 9 (A, foldout 19) is machined to receive first clutch piston 6. Cast slots inside t h e housing receive the tangs of the external-tanged clutch plates of the low clutch.

b. b. The rear adapter housing is mounted between main housing 8 (B, foldout 16) and rear cover 8 (A, foldout 20) in the straight through models.

c. In transfer gear housing models, the rear adapter housing is covered by transfer housing adapter assembly 9 (B, foldout 19) and transfer gear housing 6 (B, foldout 22).

2-27. REAR COVER (A, foldout 20)

Rear cover 14 is made of cast iron and machined to receive governor assembly 38 and first or low clutch piston 4. The rear cover provides support for output shaft assemblies 19 or 26. A parking brake mounting face is also provided on the rear surface. The cover is the rear closure member and is attached to either the transmission housing (HT 740, 747 models) or the adapter housing (HT 750 models) b y twenty-four bolts 17 and 36.

2-28. TRANSFER GEAR HOUSING ADAPTER

Transfer gear housing adapter assembly 9 (B, foldout 19) is made of cast iron and machined to receive governor assembly 26 and low clutch piston 5. An oil seal is installed in the rear of the housing to keep the oil in the front section from mixing with a different grade of oil used in the dropbox.

2-29. TRANSFER GEAR HOUSING (DROPBOX) (B, foldout 22)

The dropbox housing contains a drive gear at the top, an idler gear in the center and an output driven gear at the bottom. Rotation of the drive gear and the output driven gear are in the same direction. The input-output ratio is 1.00:1.

2-30. MANUAL DISCONNECT CLUTCH (A, foldout 23)

A manual disconnect clutch can be mounted at the top rear of the dropbox, at the bottom rear, bottom front or any combination of these output positions.

2-31. HYDRAULIC SYSTEM

NOTE

Unless otherwise specified, all of the hydraulic functions explained in paragraph 2-31 and shown on foldouts 5, 6, 7, and 8, are common to the HT 740D, HT 747D, HT 750CRD, HT 754CRD and the HT 750DRD.

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

b. System Schematics. Color-coded foldout illustrations of the hydraulic system are presented at the back of this manual (foldouts 5, 6, 7, 8). Each illustration represents the system as it would function during neutral operation and with the engine idling.

c. Oil Filter, Pump Circuit (foldouts 5, 6, 7, 8)

(1) Oil (blue) is drawn from the sump (transmission oil pan) through a fine-mesh filter screen by the input-driven pump assembly.

(2) The oil (red) is discharged by the input pump through an external filter (when so equipped) and into the bore of the main pressure regulator valve.

(3) For models equipped with a hydraulic retarder, the oil is discharged from two sections of the input pump. The first section directs oil (red) to the main-pressure regulator valve (item (2), above). The second section directs oil (black and green) to the lubrication circuit, and assists in providing oil to the converter-in circuit.

(4) d. Main-Pressure Circuit (foldouts 5, 6, 7, 8)

(1) Main pressure (red) i s regulated by the main-pressure regulator valve. Oil from the pump flows into the valve bore, through an internal passage in the valve, to the upper end of the valve. Pressure at the upper end of the valve forces the valve downward against the spring until oil (yellow) f 1 o w s into the converter-in circuit. When flow from the pump exceeds the circuit requirement, the converter bypass valve opens and allows the excess to escape into the converter-out circuit (orange).

(2) Although main pressure is controlled primarily by the spring force below the regulator valve, it is also affected by the presence of forward regulator pressure. When this pressure is not present at the regulator valve, main pressure is regulated at a higher value.

(3) Main pressure (red) is directed to several p o i n t s in the hydraulic circuit. These points will vary among models, and depend upon the features such as lockup cutoff, and hydraulic retarder.

e. Converter, Cooler, Lubrication Circuit (foldouts 5, 6, 7, 8)

(1) T h e converter circuit originates at the main-pressure regulator valve. Converter-in oil (yellow) flows to the torque converter. Oil must flow through the converter continuously to keep it filled and to carry off the heat generated within the converter.

(2) Converter-out oil (orange) leaving the torque converter, is directed to an external cooler (supplied by vehicle or engine manufacturer). When the transmission includes a hydraulic retarder, converter-out oil flows through the retarder control valve before going to the cooler. A flow of air or water over or through the cooler removes the heat from the transmission oil.

(3) On models having no hydraulic retarder, lubrication oil (green) is directed through the transmission to components requiring continuous lubrication and cooling. The lubrication oil then drains into the sump. Oil in excess of that required by the lubrication circuit escapes to the sump through the lubrication regulator valve.

(4) Lubrication oil on the retarder equipped models originates in the second section of the input driven pump (para c, above). The oil (black and green) leaving the pump, is directed to the 0.250 orifice and the lubrication regulator valve. The oil (green) passing through the 0.250 orifice is directed to transmission components requiring continuous lubrication and cooling. Oil in excess of that required by the lubrication circuit escapes through the lubrication regulator valve into the converter-in circuits. Excess supply to the converter-in circuit escapes to the sump through the converter bypass valve and secondary converter pressure regulator valve.

f. Selector Valve, Forward Regulator Circuits (foldouts 5, 6, 7, 8)

(1) The selector valve is manually shifted to select the operating range desired. The HT 740D or HT 747D mode 1 can be shifted into six lever positions; (R) reverse, (N) neutral, (D4) drive 4, (D3) drive 3, (D2) drive 2, (D1) drive 1.

(2) The HT 750 model can be shifted into seven lever positions; (R) reverse, (N) neutral, (D5) drive 5, (D4) drive 4, (D3) drive 3, (D2) drive 2, (D1) drive 1. At each of these positions, the selector valve establishes the hydraulic circuit for operation in the condition indicated.

NOTE

The quadrant designations listed above are not necessarily the same as those in the vehicle.

(3) On model HT 740D, HT 747D (foldout 5), drive 1, drive 2, drive 3 and drive 4 are forward ranges. Anytime the vehicle moves forward, regardless of what range was selected, the transmission starts in first gear (except 2nd gear start units). Shifting is automatic in any of the above ranges, varying with vehicle speed and throttle position.

(4) Second gear start units utilize automatic forward motion in second, third and fourth gears (HT 740, 747D), or second, third, fourth and fifth gears (HT 750). First gear must be manually selected, and will not automatically shift to the next higher gear unless maximum governor pressure is exceeded.

(5) On mode 1 HT 750CRD or HT 754CRD (foldout 6), drive 1, drive 2, drive 3, drive 4 and drive 5 are forward ranges. Anytime the vehicle moves forward (except 2nd gear start units), regardless of what range was selected, it starts in first gear. Shifting is automatic in any of the above ranges, varying with vehicle speed and throttle position.

(6) On model HT 750DRD (foldouts 7 and 8), drive 1, drive 2, drive 3, drive 4 and drive 5 are forward ranges. Drive 1 is the only range of the five forward ranges that does not include an automatic shift. The remaining four ranges (2-5) provide automatic shifts, up or down, according to vehicle speed and throttle position, and within the gears embraced by the selected range.

(7) On the HT 740D, HT 747D (foldout 5) and the HT 750CRD, HT 754CRD (foldout 6), forward regulator pressure is directed from the selector valve to the main-pressure regulator valve when the selector valve is in any position except reverse. On late production HT 740, HT 747D 2nd gear start units, forward regulator pressure is also directed to the top of the 1-2 modulator valve. In neutral and all forward drive ranges, this regulator pressure assists the pump pressure acting downward upon the main-pressure regulator valve. In reverse, the forward regulator pressure is absent from the main-pressure regulator valve. This allows the valve spring to exert its full force upward against the regulator valve,

causing an increase in main pressure. This increase in pressure is necessary for higher clutch pressures, to handle the high torque produced in reverse gear.

(8) On the HT 750DRD (foldouts 7 and 8), first gear develops a high torque ratio. Since high torque requires greater main pressure (approximately 250 psi) to apply and retain the low clutch, forward regulator pressure is omitted in this gear. Moving the selector valve to engage third gear will initiate a hydraulic flow of oil from the 2-3 relay valve to the main regulator valve. This oil will force the regulator valve downward, bringing main pressure to its normal state (approximately 150 psi) for the remaining automatic shifting operations.

g. Rear Governor Circuit

(1) Governor feed is merely main pressure directed to the governor valve. A centrifugal-type governor, driven by the transmission output, controls the position of the governor valve. The position of the governor valve determines the pressure in the governor circuit. When the transmission output is not rotating, governor pressure is negligible. When the transmission output rotates, governor pressure varies with the speed of rotation.

(2) Governor pressure is directed to the shift signal valves in all models, and to the governor accumulator valve on later models. Also, some models utilize rear governor pressure to control lockup.

(3) The governor accumulator valve is a spring-loaded valve In a straight bore. The accumulator valve absorbs pressure surges and provides a more uniform governor pressure.

h. Modulator Pressure Circuit (foldouts 5, 6, 7, 8)

(1) The modulator valve produces a regulated, reduced pressure which is derived from main pressure. The valve is moved rightward by a spring at the left end of the valve when the throttle is closed. The valve is moved leftward by the cam and spring action when the throttle is opened. When the spring force at the left of the valve is in balance with the spring force and modulator pressure at the right end of the valve, modulator pressure is regulated.

(2) When the throttle setting is increased, the movement of the actuator cam forces the modulator valve toward the left. This leftward movement reduces modulator pressure. When the throttle setting is reduced, the downward movement of the actuator cam allows the spring at the left end of valve to return the valve to another regulating position. Thus modulation pressure varies with throttle opening.

(3) At all the shift signal valves, modulator and governor pressures act on calibrated areas to upshift the valves against calibrated springs. Each of the shift valves and springs is calibrated to insure that the valves will shift at the proper time and in proper sequence. At a given governor pressure, an increase in modulator pressure will upshift a signal valve. A decrease in modulator pressure will cause a downshift if governor pressure alone will not hold the valve upward.

(4) At the trimmer regulator valve, modulator pressure assists in regulating the trimmer regulator pressure against the spring at the top of the valve.

(5) At the lockup valve, modulator pressure causes lockup to occur at a lower vehicle speed.

i. Trimmer Regulator Valve

(1) The trimmer regulator valve reduces main pressure to a regulated pressure. The regulated pressure is raised or lowered by changes in modulator pressure (red and green).

(2) Trimmer regulator pressure is directed to the lower side(s) of the trimmer regulator plug(s) to vary the clutch apply pressure pattern of the trimmer valves. A higher modulator pressure (closed throttle)

will reduce trimmer regulator pressure. This results in lower initial clutch pressure. Conversely, a lower modulator pressure (open throttle) results in higher regulator pressure and a higher initial clutch pressure.

j. Trimmer Valves

(1) T h e purpose of t h e trimmer valves is to avoid shift shock. The valves reduce pressure in the clutch apply circuit during initial clutch application, then gradually return the pressure to the operating maximum. This applies the clutch gently to prevent harsh shifts.

(2) Although each trimmer valve is calibrated for the clutch it serves, all trimmers function in the same manner. Each trimmer includes (from top to bottom) an orificed trimmer valve, trimmer valve plug, trimmer spring and stop pin.

(3) When any clutch (except forward) is applied, apply pressure is sent also to the upper end of the trimmer valve. Initially, the valve and plug are forced downward against the trimmer spring until oil escapes to exhaust. This escape of oil, as long as it continues, reduces clutch apply pressure. However, oil flows through an orifice in the trimmer valve to the cavity between the trimmer valve and plug. Pressure in this cavity forces the plug farther downward, to the stop. The plug stops, but flow through the orifice in the trimmer valve continues. The pressure below the trimmer valve, because it is acting upon a greater diameter than at the upper end, pushes the trimmer valve to the top of the valve bore. This throttles, then stops, the escape of oil to exhaust. When escape of oil is stopped, clutch apply pressure is at maximum value. The plug remains downward, against the stop, until the clutch is released.

(4) When the clutch is released, the trimmer spring pushes the trimmer components to the top of the bore. In this position, the trimmer is reset and ready to repeat the trimming action when its clutch is again engaged.

(5) In current models, a trimmer boost accumulator valve is connected to the trimmer regulator pressure circuit. The accumulator will absorb surges in the trimmer regulator pressure and provide a more uniform regulator pressure.

k. Lockup Circuit (Actuated by front governor HT 740D, HT 747D, HT 750)

(1) The front governor circuit originates at the front pitot. Rotation of the vaned pitot collector ring directs oil against, and into, the pitot orifice. This produces a pressure in the front governor circuit which varies with the rotational speed of the collector ring. Pressure increases as speed increases. This pressure is directed to the top of the lockup valve.

(2) When front governor pressure (or front governor pressure assisted by modulator pressure) is sufficient to compress the spring at the bottom of the valve, the lockup valve moves downward. In this position, the valve directs pressure to the lockup clutch piston, which causes the lockup clutch to engage. Main pressure applies the lockup clutch in models not equipped with lockup cutoff valves. When lockup cutoff valves (para 2-23) are included, clutch apply pressure from the drive clutch engaged is used to a p p 1 y the lockup clutch. Early HT 750DRD models do not have first gear lockup.

l. Lockup Circuit (Actuated by rear governor HT 740D, HT 747D)

(1) R e a r governor pressure varies with vehicle or transmission output speed. T h e pressure created by t h e rotational movement of the governor is fed to the top of the lockup valve. During normal operation in first gear this pressure never increases sufficiently to overcome the lockup valve spring. Therefore, lockup in first gear is omitted.

(2) With an increase in output speed, the governor will transmit a higher pressure to the lockup valve.

(3) When the pressure is sufficient, the lockup valve moves downward, compressing its spring. This opens a path for pressure to flow to the lockup clutch piston. Lockup is now engaged. Main pressure applies the lockup clutch in models not equipped with lockup cutoff valves. When lockup cutoff valves (para 2-23) are included, clutch apply pressure from the drive clutch engaged is used to apply the lockup clutch.

m. Priority Valve

(1) The priority valve insures that the control system upstream from the valve will retain sufficient pressure during shifts to perform its automatic functions.

(2) Without the priority valve, the filling of a clutch might require a greater volume of oil (momentarily) than the pump could supply and still maintain the necessary control pressures.

n. Clutch Circuits, Drive Ranges (HT 740D, HT 747D, foldout 5)

(1) There are five clutches in the transmission. These are first clutch; second clutch; third clutch; fourth clutch; and forward clutch. The clutches are applied for various conditions, as follows:

Condition	Clutch(es) applied
Neutral	First
First gear	First and forward
Second gear	Second and forward
Third gear	Third and forward
Fourth gear	Fourth and forward
Reverse	First and fourth

(2) Each of the five clutches has its own circuit. Each clutch except the forward clutch is connected to a relay valve and a trimmer valve. The forward clutch is connected directly to the selector valve and does not connect to a trimmer valve. It does not require connection to a trimmer valve because the vehicle is not moving.

(3) (3) The first clutch circuit connects the clutch to the 1-2 relay valve and to the first trimmer valve. In neutral, the 1-2 relay valve is held upward by spring force, and main pressure (red) is directed to the first clutch circuit. The 1-2 relay valve cannot move downward unless the 1-2 signal line is charged. This will not occur in neutral (vehicle standing) because there is no governor pressure to shift the 1-2 signal valve. Only the first clutch is applied, so the transmission output cannot rotate until two clutches are applied (refer to fig. 2-2).

(4) The first clutch, in addition to being applied during neutral operation, is applied also in f i r s t and reverse gears. Shifting the selector valve from neutral (N) to drive 4 (D4) or to any other forward drive range (3, 2, or 1) charges the forward clutch circuit and applies the forward clutch. The first clutch remains charged. Application of the forward clutch a 1 s o directs main pressure through the priority valve to the 1-2 relay valve. Shifting the selector valve from neutral to reverse (R) charges the fourth clutch, while the first clutch remains applied. In reverse, fourth clutch (reverse signal) pressure is also directed to the bottom of the 1-2 relay valve. The pressure at this point prevents the relay valve from moving downward during reverse operation. On later models, a bypass and check ball are provided between the reverse and first trimmer passages to ensure rapid charging of the first clutch when a shift is made from first to reverse.

(5) When the circuits are charged, as described for the s h i f t to drive 4 (D4), above, any forward shift from first to second, second to third, and third to fourth can occur automatically. These shifts occur as a result of r e a r governor pressure. At less than full throttle, modulator pressure will assist governor pressure.

(6) Movement of the selector valve determines the highest gear which will be normally reached automatically. In drive 4 (D4), automatic 1-2, 2-3, and 3-4 shifts can

occur. In drive 3 (D3), automatic 1-2 and 2-3 shifts can occur. In drive 2 (D2), an automatic 1-2 shift can occur. In drive 1 (D1), no upshift can occur unless overspeed occurs. Automatic downshifts can occur within the selected ranges.

NOTE

Models equipped with a second gear start feature, will always start in second gear and progress to the highest gear. Refer to paragraph 2-24.

(7) The various drive ranges limit the highest gear attainable by introducing a pressure which prevents rear governor pressure from upshifting the signal valves (unless a governor pressure well above that normally attained is reached). This pressure is a regulated, reduced pressure derived from main pressure at the hold regulator valve. Main pressure is directed to the hold regulator valve through the hold feed line when the selector valve is at D3, D2, or D1 position. The pressure produced in the hold regulator valve is directed to the 3-4 shift signal valve when the selector valve is at drive 3. The hold pressure is directed to the 2-3 and 3-4 shift signal valves when the selector valve is at drive 2 position. The pressure is directed to all three shift signal valves (3-4, 2-3 and 1-2) when the selector valve is at drive 1 position.

(8) Hold regulator pressure at each shift signal valve will push the upper valve upward, and raise the pressure at which the lower valve will be pushed upward by rear governor pressure. Thus, when hold regulator pressure is present, an upshift can occur at that shift signal valve, but only at an elevated speed.

o. Clutch Circuit, Drive Ranges (HT 750CRD, HT 754CRD, foldout 6)

p.

(1) There are six clutches in the transmission. These are: low clutch; first clutch; second clutch; third clutch; fourth clutch; and forward clutch. The clutches are applied for various conditions as follows:

(2) Condition	Clutch(es) applied
Neutral	Low
First gear	Low and forward
Second gear	First and forward
Third gear	Second and forward
Fourth gear	Third and forward
Fifth gear	Fourth and forward
Reverse gear	Low and fourth

(2) Each of the six clutches has its own circuit. Each clutch except the forward clutch is connected to a relay valve and a trimmer valve. The forward clutch is connected directly to the selector valve and does not require connection to a trimmer valve because the vehicle is not moving.

(3) The low clutch circuit connects the clutch to the 1-2 relay valve and to the low trimmer valve. In neutral, the 1-2 shift valve feeds main pressure to the top of the 1-2 relay valve. As long as main pressure is at the top of the 1-2 relay valve, the valve cannot move. Until the 1-2 shift valve is charged by governor pressure, main pressure will continue to hold the 1-2 relay valve down. Therefore hydraulic fluid is directed' to only one clutch. Since two clutches are required to move the vehicle and since governor pressure is negligible until the vehicle is moving, neutral is maintained (refer to fig. 2-8).

(4) The low clutch in addition to being applied during neutral operation, is also applied in first and reverse gears. Shifting the selector valve from neutral to drive 5 (D5) position or any other forward drive range (D4, D3, D2, D1) charges the forward clutch circuit and applies the forward clutch. The low clutch remains charged. Hydraulic fluid is directed from the selector valve to the forward clutch. It is also directed through the priority valve to the 2-3 relay valve. The unit is now in first gear. Automatic shifting from first gear, progressively, to higher gears (second, third, fourth, fifth) will occur when vehicle speed increases. The highest gear attainable, in automatic shifts, is determined by the range selected (refer to (7), below).

(5) Shifting the selector valve from neutral to reverse (R) charges t h e fourth clutch, while the low clutch remains applied. In reverse, fourth clutch (reverse signal) pressure is also directed to the bottom of the 2-3 relay valve. The pressure at this point prevents the relay valve from moving downward during reverse operation.

(6) When the circuits are charged, as described for the shift to drive 5 (D5), above, any forward shift from first to second, second to third, third to fourth, and fourth to fifth can occur automatically. These shifts occur as a result of rear governor pressure. At less than full throttle, modulator pressure will assist governor pressure.

(7) Position of the selector valve determines the highest gear which will be normally reached automatically. In drive 5 (D5), automatic 1-2, 2-3, 3-4 and 4-5 shifts can occur. In drive 4 (D4), automatic 1-2, 2-3 and 3-4 shifts can occur. In drive 3 (D3), automatic 1-2 and 2-3 shifts can occur. In drive 1 (Dl), no upshift can occur unless overspeed occurs. Automatic downshifts can occur within the selected ranges.

NOTE

Models equipped with a second gear start feature will always start in second gear and progress to its highest gear when the selector lever is placed in any position e x c e p t drive 1 (D1).

(8) The various drive ranges limit the highest gear attainable by introducing a pressure which prevents rear governor pressure from upshifting the signal valves (unless a governor pressure well above that normally attained is reached). This pressure is a regulated, reduced pressure derived from main pressure at the hold regulator valve. Main pressure is directed to the hold regulator valve through the hold feed line when the selector valve is at drive 4 (D4), drive 3 (D3), or drive 2 (D2) position
.

The pressure produced in the hold regulator valve is directed to the 4-5 shift signal valve when the selector valve is at drive 4 (D4). The hold pressure is directed to the 3-4 and 4-5 shift signal valves when the selector valve is at drive 3 (D3) position. With the selector valve in drive 2 (D2) position, the pressure is directed to the 2-3, 3-4 and 4-5 shift valves.

(9) Hold regulator pressure at each shift signal valve will push the upper valve upward, and raise the pressure at which the lower valve will be pushed upward by rear governor pressure. Thus, when hold regulator pressure is present, no upshift can occur at that shift signal valve, except at an elevated speed.

p. Clutch Circuit Drive Ranges (HT 750DRD, foldouts 7, 8)

(1) There are six clutches in the transmission. These are: low clutch; first clutch; second clutch; third clutch; fourth clutch; and forward clutch. The clutches are applied for various conditions, as follows:

Condition	Clutch(es) applied
Neutral	First
First gear	Low and forward
Second gear	First and forward
Third gear	Second and forward
Fourth gear	Third and forward
Fifth gear	Fourth and forward
Reverse gear	First and fourth

(2) Each of the six clutches has its own circuit. Each clutch except the forward clutch is connected to a relay valve and a trimmer valve. The forward clutch is connected directly to the selector valve and does not require connection to a trimmer valve because the vehicle is not moving.

(3) The first clutch circuit connects the clutch to the 1-2 relay valve. In neutral, the 1-2 r e 1 a y valve is held upward by its spring force, and main pressure (red) is directed to the clutch circuit. The 2-3 relay valve is also held upward by its spring force and cannot move downward unless the 2-3

signal line is changed. This will not occur in neutral (vehicle standing) because there is no governor pressure to shift the 2-3 signal valve. Only the first clutch is applied, so the transmission output will not rotate until two clutches are applied simultaneously (refer to fig. 2-15).

(4) The first clutch, in addition to being applied during neutral operation, is also applied in second and reverse gears. Shifting the selector valve from neutral to drive 5 (D5) position or any other forward drive range (D4, D3, D2) charges the forward clutch circuit and applies the forward clutch. The first clutch remains charged (except in D1). In D1 the first clutch exhausts and the low clutch engages. Hydraulic fluid is directed from the selector valve to the forward clutch. It is also directed through the priority valve to the 2-3 relay valve. The unit is now in second gear (except when the selector is at D1 position). D1 gives first gear only. Automatic shifting from second gear to progressively higher gears (third, fourth, fifth) will occur as vehicle speed increases (refer to (8), below).

(5) Shifting the selector valve from neutral to reverse (R) charges the fourth clutch while the first clutch remains applied. In reverse, fourth clutch (reverse signal) pressure is also directed to the bottom of the 2-3 relay valve. The pressure at this point prevents the relay valve from moving downward during reverse operation.

(6) First gear can be obtained only by manually shifting the selector lever into drive 1 (D1) position. This gear is not automatic. Hydraulic fluid is directed through the bore of the 1-2 shift signal valve to the top of the 1-2 relay valve. Hydraulic pressure forces the 1-2 relay valve (against its spring f o r c e) to the bottom of its bore, thereby directing main pressure to the low trimmer valve and low clutch. When (D1) position was selected, main pressure was directed from the selector valve to the forward clutch. With the application of two clutches, torque can be transmitted to the output shaft.

(7) When t h e circuits are charged for drive 5 (D5), as described above, any forward shift from second to third, third to fourth, and fourth to fifth can occur automatically. These shifts occur as a result of rear governor pressure. At less than full throttle, modulator pressure will assist governor pressure.

(8) Position of the selector valve determines the highest gear which will be normally reached automatically. In drive 5 (D5), automatic 2-3, 3-4, 4-5 shifts can occur. In drive 4 (D4), automatic 2-3, 3-4 shifts can occur. In drive 3 (D3), automatic 2-3 shift can occur. In drive 2 (D2), no upshift will occur (remains in second gear). In drive 1 (D1), no upshift will occur (remains in first gear). Automatic downshifts can occur within any selected range except D1 or D2.

(9) Refer to paragraph o(8), (9), above, for operation of hold regulator valve.

<u>q.</u> Automatic Upshifts

(1) When the transmission is operating in D4 (HT 740, HT 747D) or D5 (HT 750), a combination of rear governor pressure and modulator pressure, or rear governor pressure alone, will upshift the transmission to the next gear. At closed, or part throttle, modulator pressure exists and will assist rear governor pressure. At full throttle, there is no modulator pressure. Thus, upshifts occur at lower road speed when the throttle is closed; and at higher road speed when the throttle is open.

(2) Rear governor pressure is dependent upon the rotational speed of the transmission output. The greater the output (vehicle) speed, the greater is rear governor pressure. When rear governor pressure is sufficient, the first upshift (1-2 HT 740D, HT 747D, HT 750CRD, HT 754CRD or 2-3 HT 750DRD) will occur. A further increase in rear governor pressure (and vehicle speed) will cause a 2-3 (or 3-4) upshift. A still further increase in rear governor pressure will cause a 3-4 (or 4-5) upshift. Note that each of these upshifts will be either delayed or hastened by the decrease or increase, respectively of modulator pressure.

(3) In other drive ranges, the same upshift sequence occurs until the highest gear attainable in that range selection is reached.

(4) In any automatic upshift, the shift signal valve acts first. This directs a shift pressure to the relay valve. The relay valve shifts, exhausting the applied clutch and applying a clutch for a higher gear.

r. Automatic Downshifts

(1) Automatic downshifts, like upshifts, are controlled by rear governor and modulator pressures. Downshifts occur in sequence as rear governor pressure and/or modulator pressures decrease. Low modulator pressure (open throttle) will hasten the downshift; high modulator pressure (closed throttle) will delay downshifts.

(2) In any automatic downshift, the shift signal valve acts first. This exhausts the shift signal holding the relay valve downward. The relay valve then moves upward, exhausting the applied clutch and applying the clutch for the next lower gear.

s. Downshift and Reverse Inhibiting

(1) Inherent in the system, as a result of valve areas and pressure calibrations, is a means for preventing downshifts at a too high vehicle speed or a reverse shift at an excessive forward speed.

(2) Progressive downshifts occur because the regulated hold pressure is calibrated, along with the valve areas, to shift the signal valves downward against rear governor pressure only when the governor pressure decreases to a value corresponding to a safe downshift speed. Thus, if speed is too great, rear governor pressure is sufficient to hold the shift signal valve upward against hold pressure. As rear governor pressure decreases, the shift signal valves move downward in sequence.

2-32. TORQUE PATHS THROUGH TRANSMISSION (HT 740D, HT 747D)

a. Converter Operation. Power is transmitted hydraulically through the torque converter. The engine drives the converter pump. The pump throws oil against the vanes of the turbine, imparting torque to the converter turbine shaft. From the turbine, oil flows between the vanes of the stator, and re-enters the pump where the cycle begins again. When the engine is idling, impact of the oil upon the turbine blades is negligible. When the engine is accelerated, the impact is increased and the torque directed through the turbine shaft can exceed the engine torque (by an amount equal to the torque ratio of the converter). Converter operation is illustrated in first, second (also third-HT 750) and reverse operation.

b. Lockup Operation. Power is transmitted mechanically through the lockup clutch. Application of the lockup clutch occurs automatically as a function of governor pressure. When the lockup clutch Is applied, the converter elements rotate as a unit at engine speed. This provides a direct drive from the engine to the turbine shaft. Lockup operation is illustrated in third(except HT 750), fourth-, and fifth-gear operation.

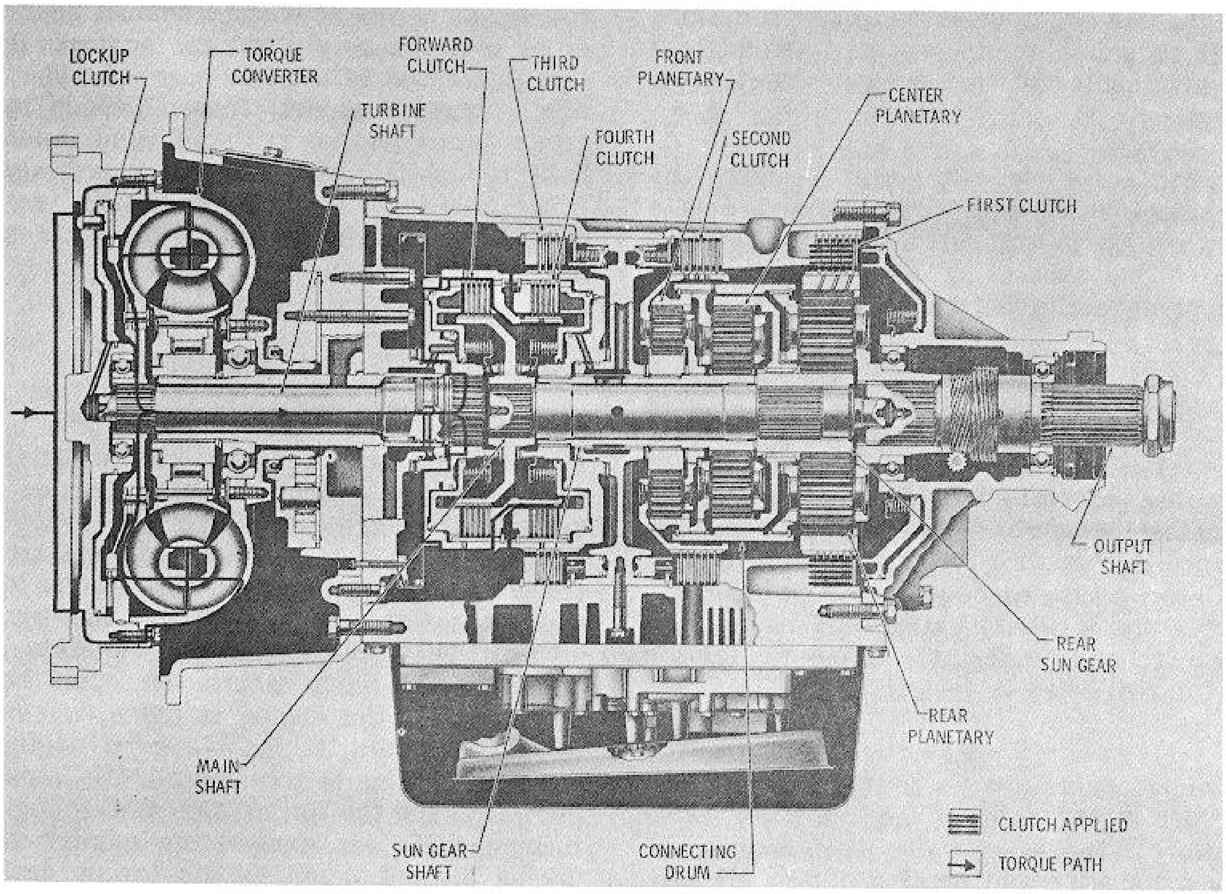

Fig. 2-2. Neutral torque path (HT 740D, HT 747D)

c. Neutral Operation (fig. 2-2). Engine torque is transmitted through the torque converter as described in a, above. The forward c 1 u t c h is not engaged. Thus, the torque is not transmitted beyond the fourth-clutch hub. (Although the first clutch is applied, two clutches must be applied to produce output shaft rotation in either forward or reverse.)

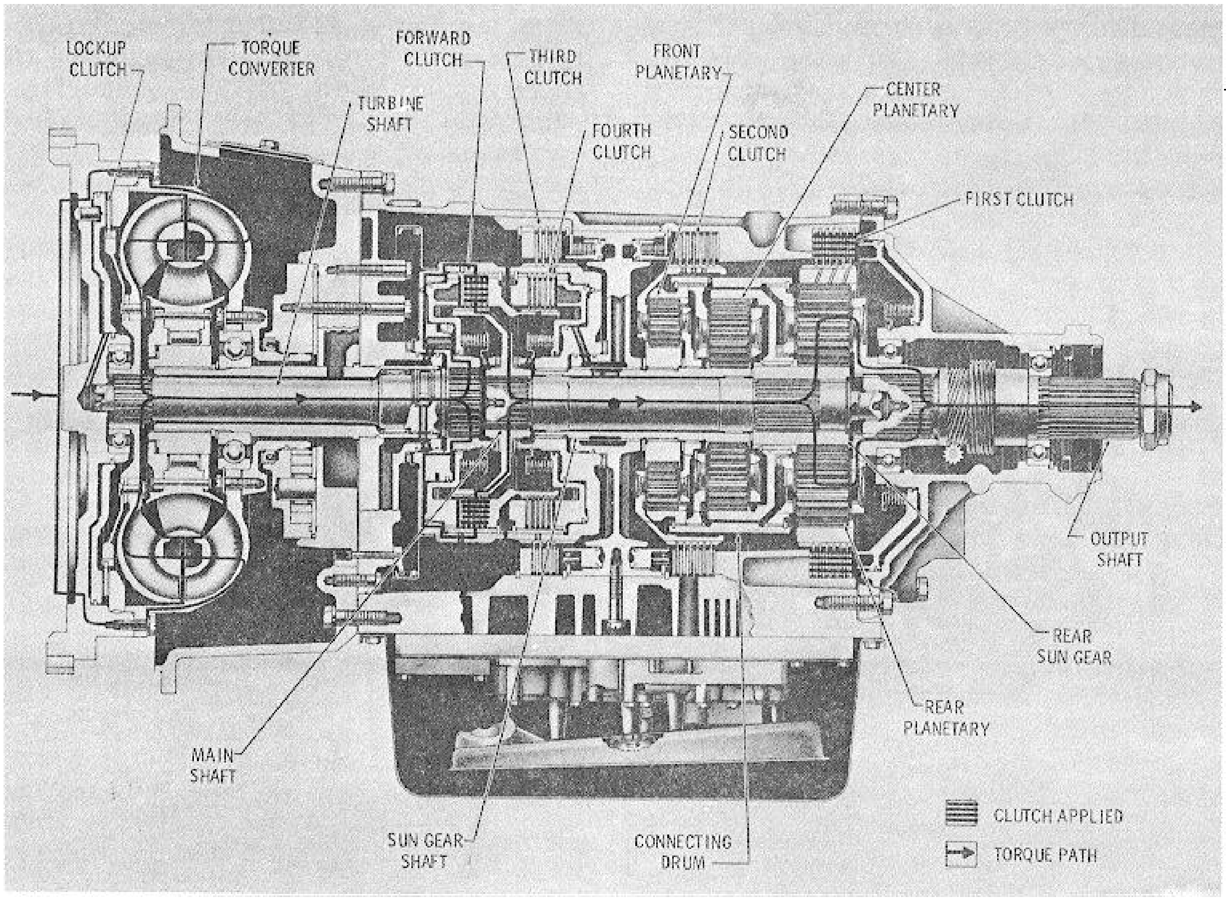

Fig. 2-3. First-gear torque path (HT 740D, HT 747D)

d. First-Gear Operation (fig. 2-3). Engine torque is transmitted through the torque converter as described in a, above. The forward and first clutches are applied. The first clutch application anchors the rear planetary ring gear against rotation. The forward clutch application locks the turbine shaft and transmission main shaft together so that they rotate as a unit. The rear sun gear is splined to the m a i n shaft and rotates with it and, in turn, it rotates the rear planetary pinions. The pinions are part of the carrier assembly which is splined to the transmission output shaft. With the rear ring gear held stationary by the applied first clutch and the rear sun gear rotating the pinions, the rear planetary carrier must rotate within the ring gear and drive the output shaft at a speed reduction of 3.69:1.

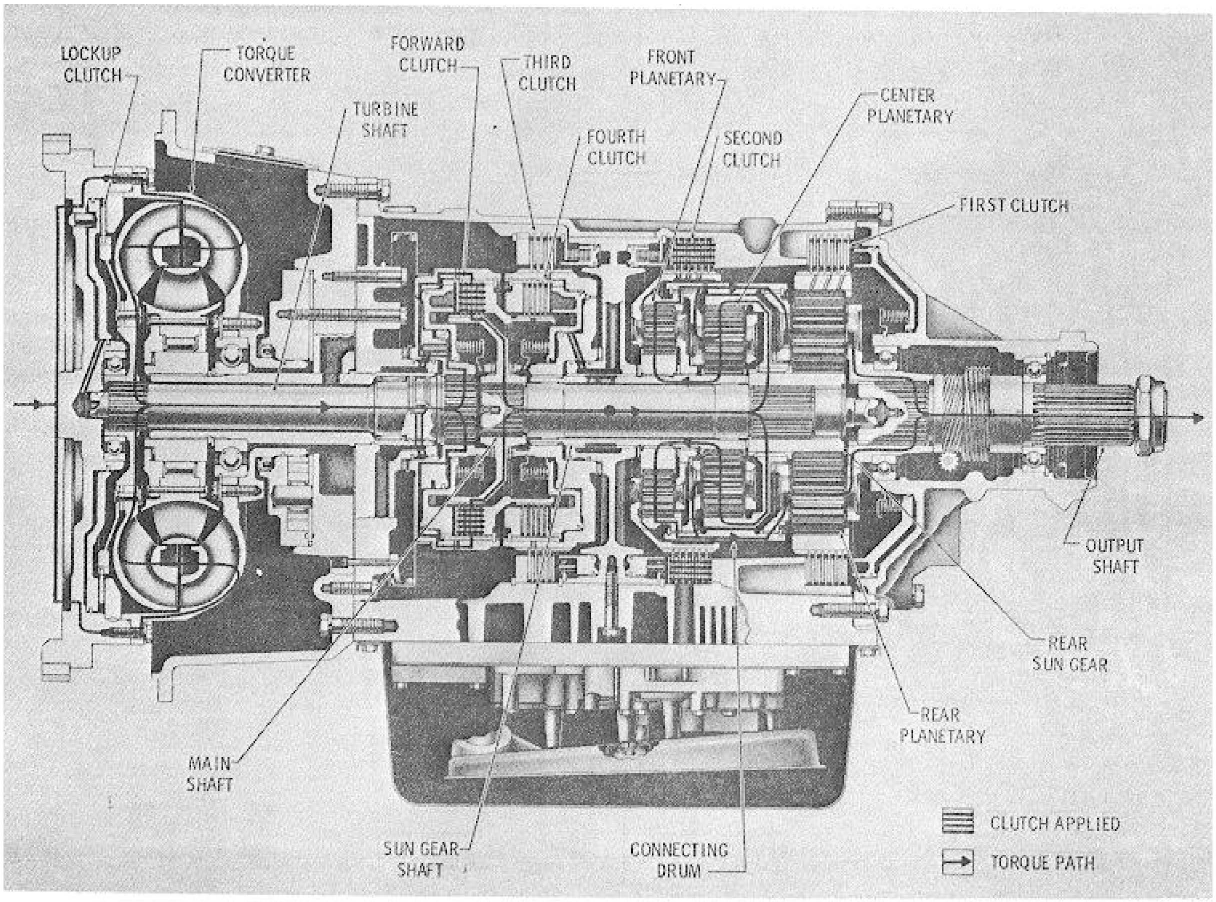

Fig. 2-4. Second-gear torque path (HT 740D, HT 747D)

e. Second-Gear Operation (f i g. 2-4). Engine torque is transmitted through the torque converter as described in a, above. The forward and the second clutches are applied. The second-clutch application anchors the carrier of the front planetary assembly against rotation. The forward clutch application locks the input shaft and main shaft together so that they rotate as a unit. The rear sun gear is splined to both the rotating main shaft and the center ring gear and all three parts rotate at input speed. With the carrier of the front planetary carrier assembly anchored against rotation (by second-clutch application), the rotating centerring gear rotates the center sun gear shaft via the carrier pinions. This sun gear is integral with the sun gear shaft assembly to which the front sun gear is also splined. The rotating front sun gear rotates the front carrier pinons w h o s e carrier is anchored against rotating by the applied second clutch. In turn, the rotating front carrier pinions rotate the front ring gear, which, along with the center carrier, is splined to the rear planetary through the connecting d r u m. Rotation of the connecting drum drives the output shaft through the splines of the rear planetary carrier, at a speed reduction shown in paragraph 1-6.

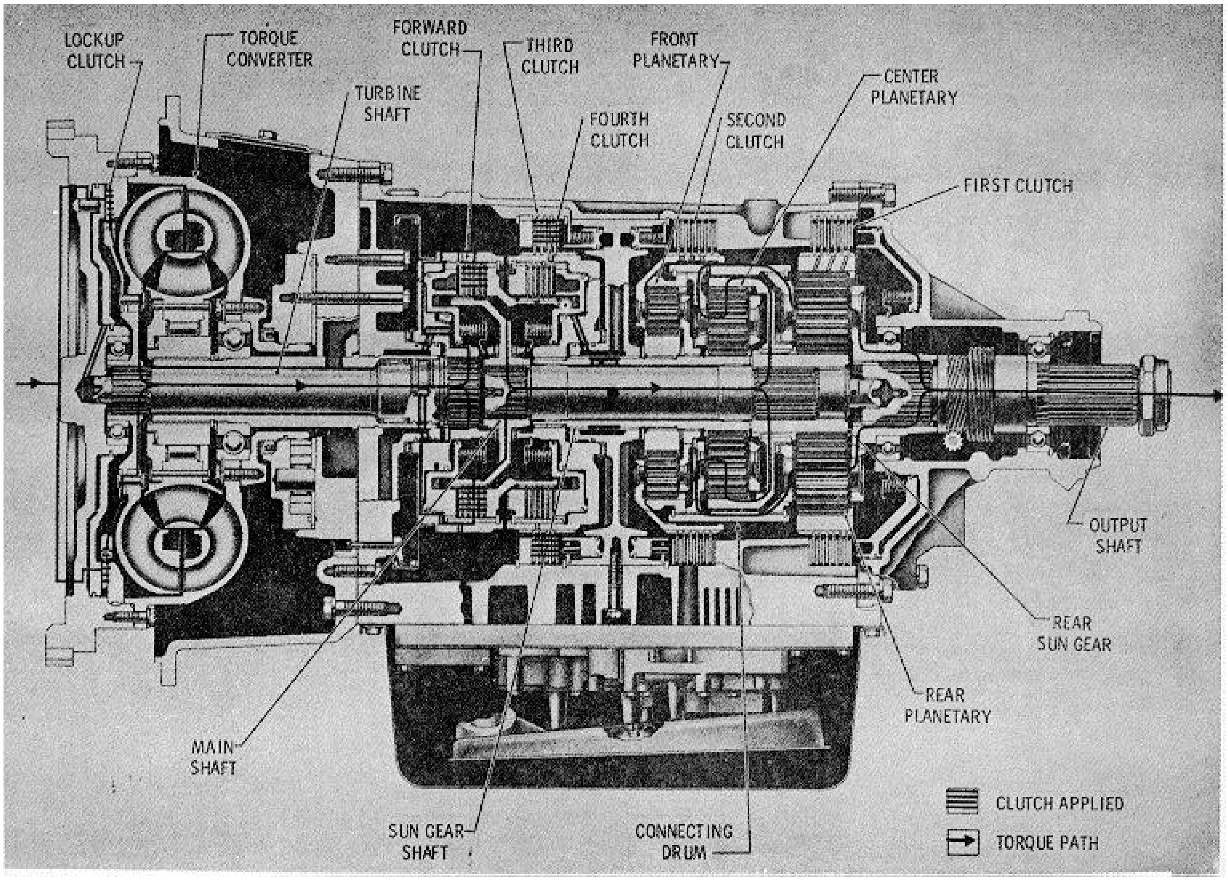

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Fig. 2-5. Third-gear torque path (HT 740D, HT 747D)

f. Third-Gear Operation (fig. 2-5). Engine torque is transmitted through the lockup clutch as described in b, above. The forward and the third clutches are applied. The third-clutch application anchors the sun gear shaft against rotation which prevents the integral center sun gear from rotating. The forward clutch application locks the turbine shaft and main shaft together so they rotate as a unit. The rear sun gear is splined to both the main shaft and the center ring gear and rotates at input speed. With the center sun gear stationary and the center ring gear rotating, the ring gear drives the center planetary carrier pinions. This rotates the center planetary carrier at a speed reduction shown in paragraph 1-6. This carrier and the rear planetary carrier are splined to the planetary connecting drum and rotate with it as a unit. Thus, the output shaft, being splined to the rear carrier, rotates at the same speed as the center planetary carrier.

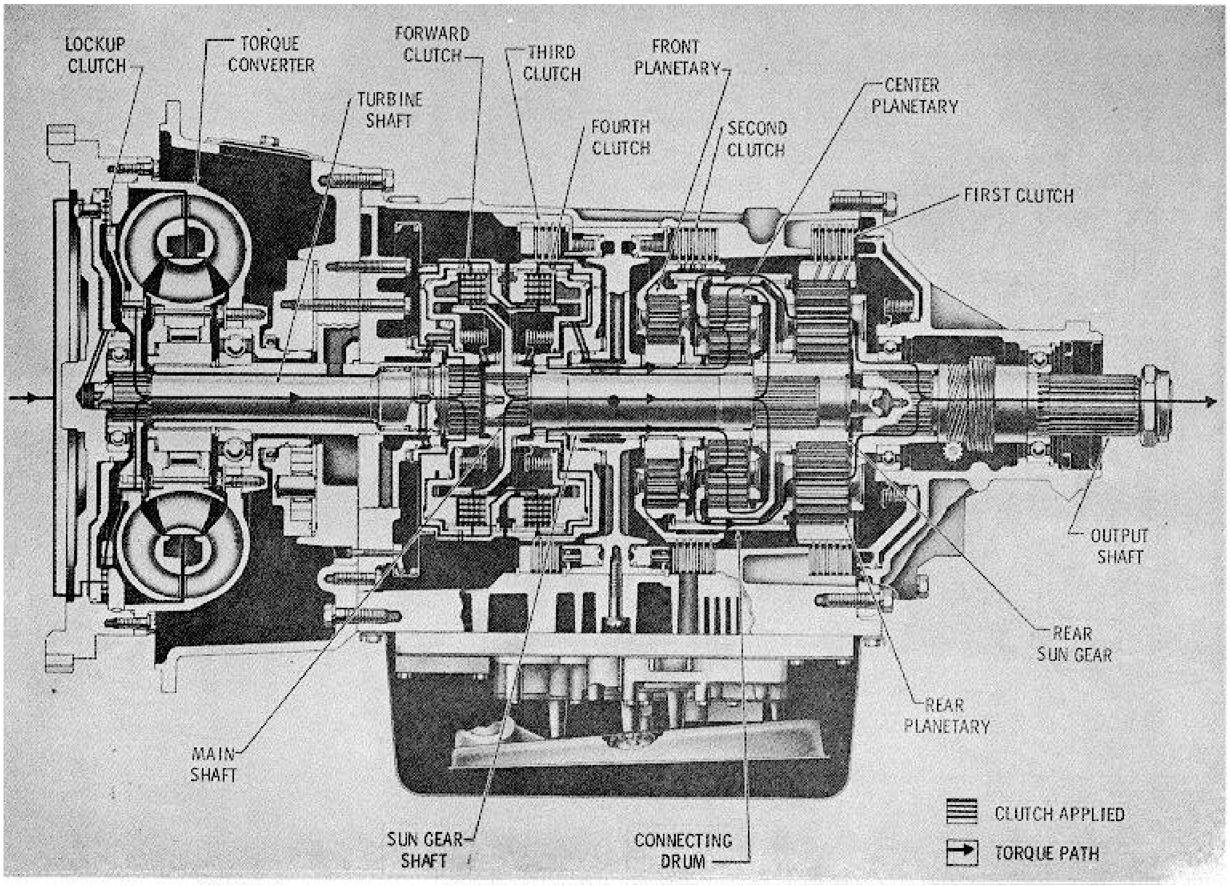

Fig. 2-6. Fourth-gear torque path (HT 740D, HT 747D)

g. Fourth-Gear Operation (fig. 2-6). Engine torque is transmitted through the lockup clutch as described in b, above. The forward and fourth clutches are applied. With the clutches applied, the transmission main shaft and the sun gear shaft are locked together and rotate as a unit at input speed. With the center and rear sun gears rotating at the same speed (locked together), and their carriers splined to the planetary connecting drum, all components rotate at input speed. The transmission output shaft is splined to the rear carrier and thus produces an output ratio of 1.00:1.

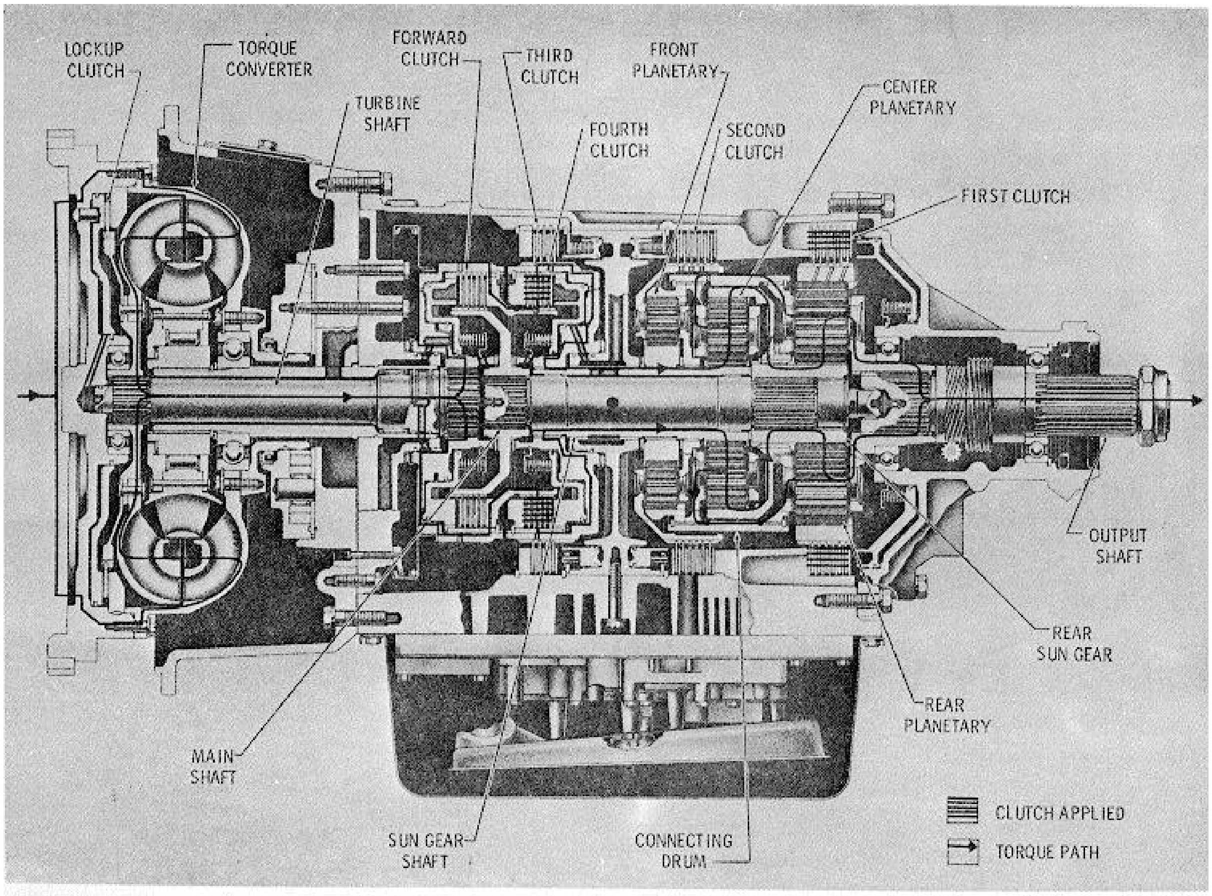

Fig. 2-7. Reverse-gear torque path (HT 740D, HT 747D).

h. Reverse Gear Operation (fig. 2-7). Engine torque is transmitted through the torque converter as described in a, above. Reverse gear is the only gear in which the forward clutch is not engaged. In this gear, the fourth clutch is applied and this rotates the sun gear shaft assembly (with the front sun gear splined to it) at input speed. The first clutch is applied also, and anchors the rear ring gear against rotation. The center sun gear rotates the center carrier pinions, which, in turn, rotate the center ring gear in an opposite direction. The center carrier is splined to the planetary connecting drum, which is splined to the rear carrier. The reverse direction of rotation of the center ring gear rotates the rear sun gear. This causes the rear planetary pinions to drive the rear carrier, in a reverse direction, within the stationary ring gear. Thus, the transmission output shaft, being splined to the rear carrier, rotates in a reverse direction at a speed reduction shown in paragraph 1-6.

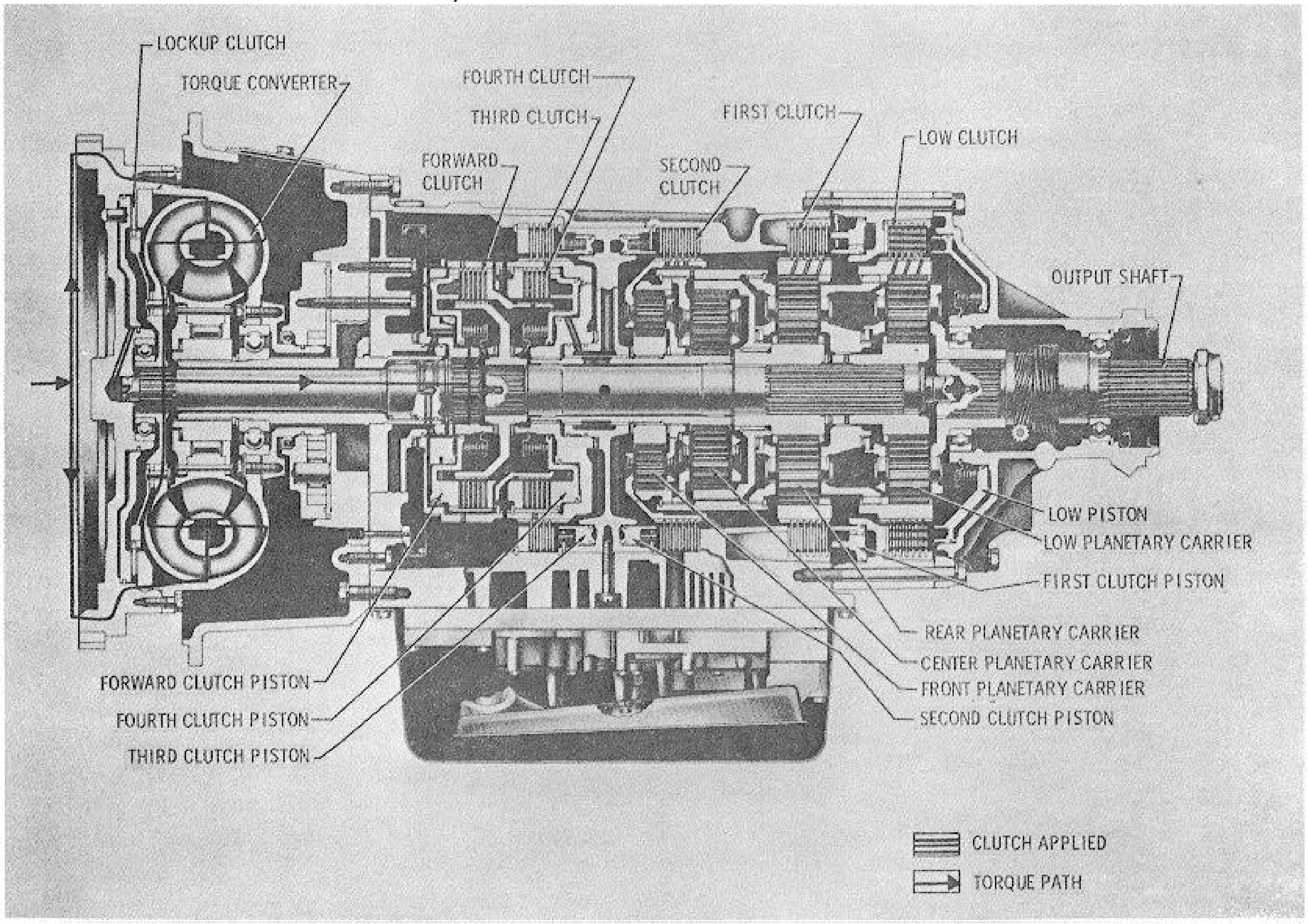

Fig. 2-8. Neutral torque path (HT 750CRD, HT 754CRD).

2-33. TORQUE PATHS THROUGH TRANSMISSION (HT 750CRD, HT 754CRD)

a. Converter Operation. Power is transmitted hydraulically through the torque converter. The e n g i n e drives the converter pump. The p u m p throws oil against the vanes of the turbine, imparting torque to the converter turbine shaft. From the turbine, oil flows between the vanes of the stator, and re-enters the pump where the cycle begins again. When the engine is idling, impact of the oil upon the turbine blades is negligible. When the engine is accelerated, the impact is increased and the torque directed through the turbine shaft can exceed the engine torque (by an amount equal to the torque ratio of the converter). Converter operation is illustrated in first, second, third a n d reverse operation where it is most likely to occur.

b. Lockup Operation. Power is transmitted mechanically through the lockup clutch. Application of the lockup clutch occurs automatically in selected ranges as a function of governor pressure. When the lockup c 1 u t c h is applied, the converter elements rotate as a unit at engine speed. This provides a direct drive from the engine to the turbine shaft. Lockup operation is illustrated in fourth and fifth gear operation.

c. Neutral Operation (fig. 2-8). Engine torque is transmitted through the torque converter as described in a, above. The forward clutch is not engaged. Thus the torque is not transmitted beyond the fourthclutch hub. (Although the low clutch is applied, two clutches must be applied to produce output shaft rotation in either forward or reverse.)

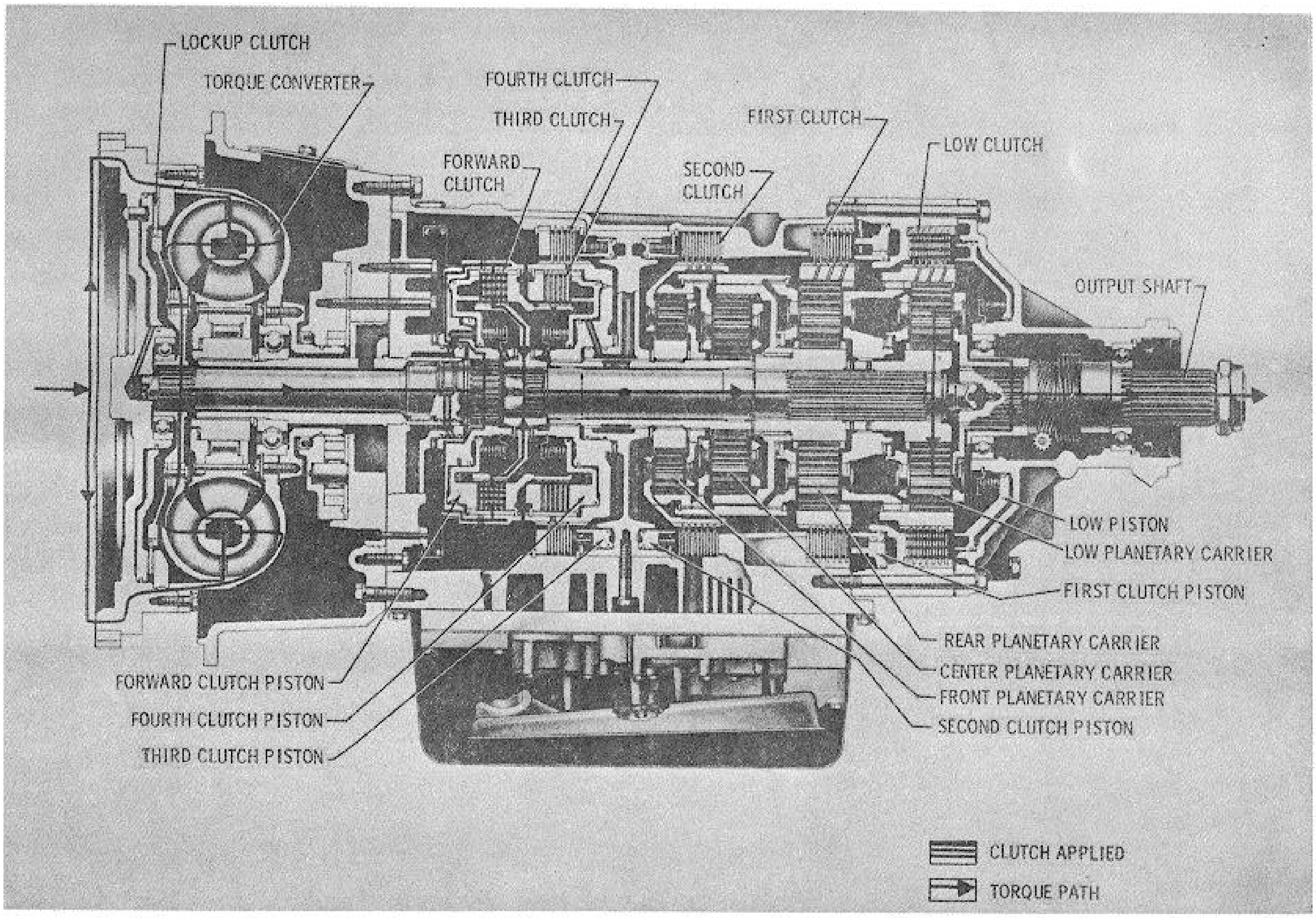

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Fig. 2-9. First-gear torque path (HT 750CRD, HT 754CRD).

d. First-Gear Operation (fig. 2-9). Engine t o r q u e is transmitted through the torque converter as described in a, above. The forward and low clutches are applied. The low clutch application anchors the rear planetary ring gear against rotation. The forward clutch application locks the turbine shaft and transmission main shaft together so that they rotate as a unit. The low sun gear is splined to the m a i n shaft and rotates with it and, in turn, rotates the low planetary pinions. The pinions are p a r t of the low carrier assembly which is splined to the transmission output shaft. With the low ring gear held stationary by the applied low clutch and the low sun gear rotating the pinions, the low planetary carrier must rotate within the ring gear and drive the output shaft at a speed reduction shown in paragraph 1-6.

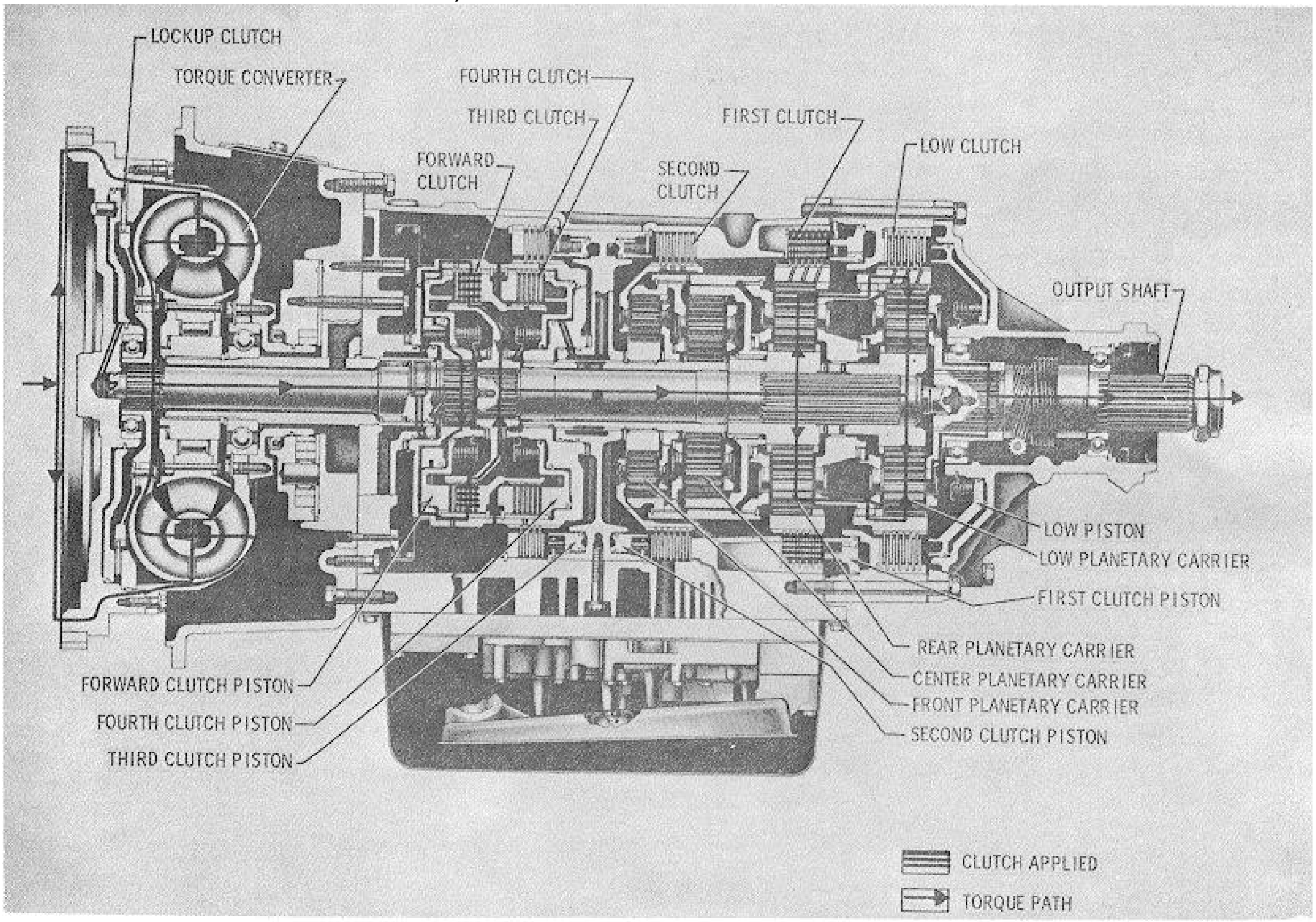

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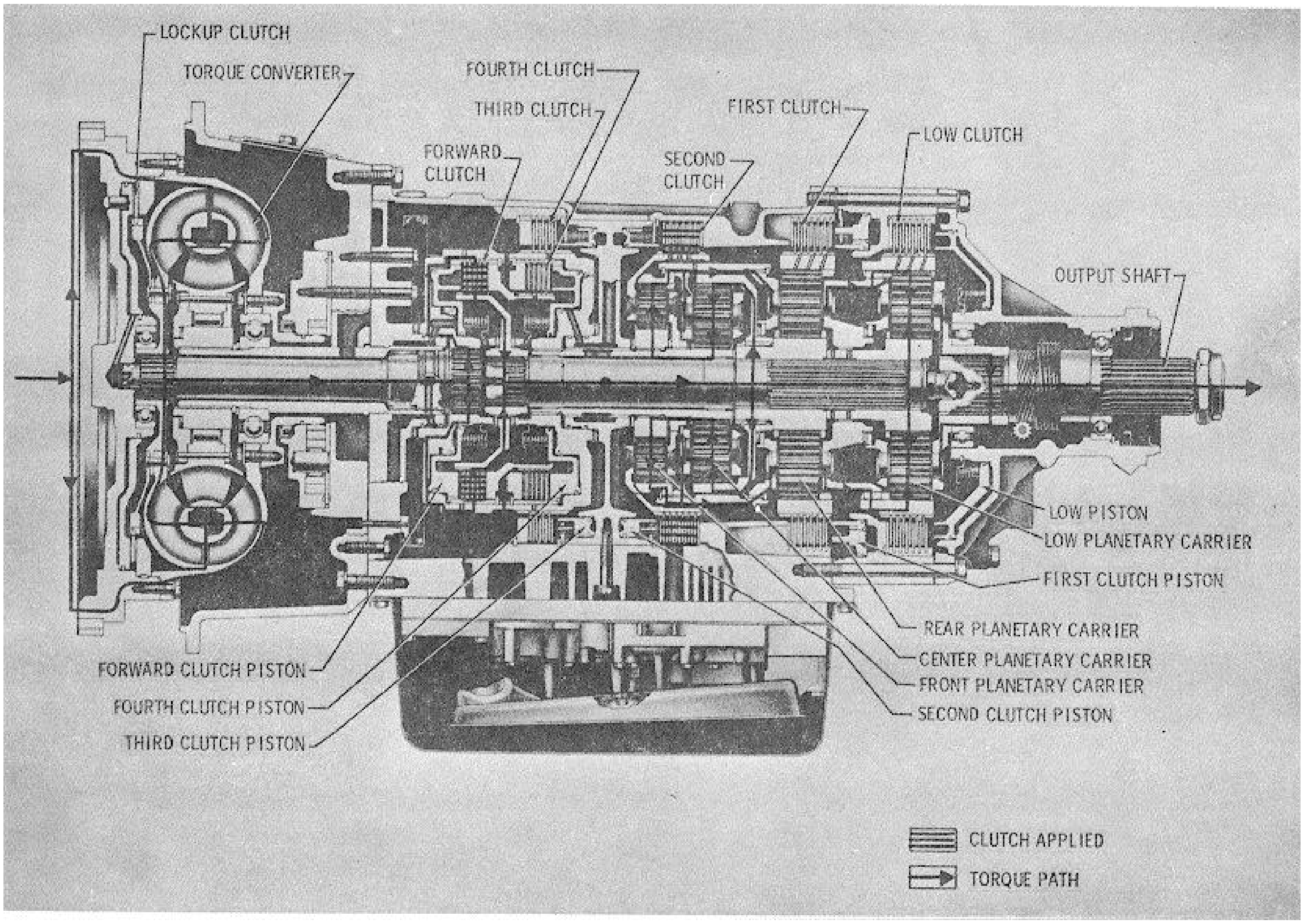
Fig. 2-10. Second-gear torque path (HT 750CRD, HT 754CRD).

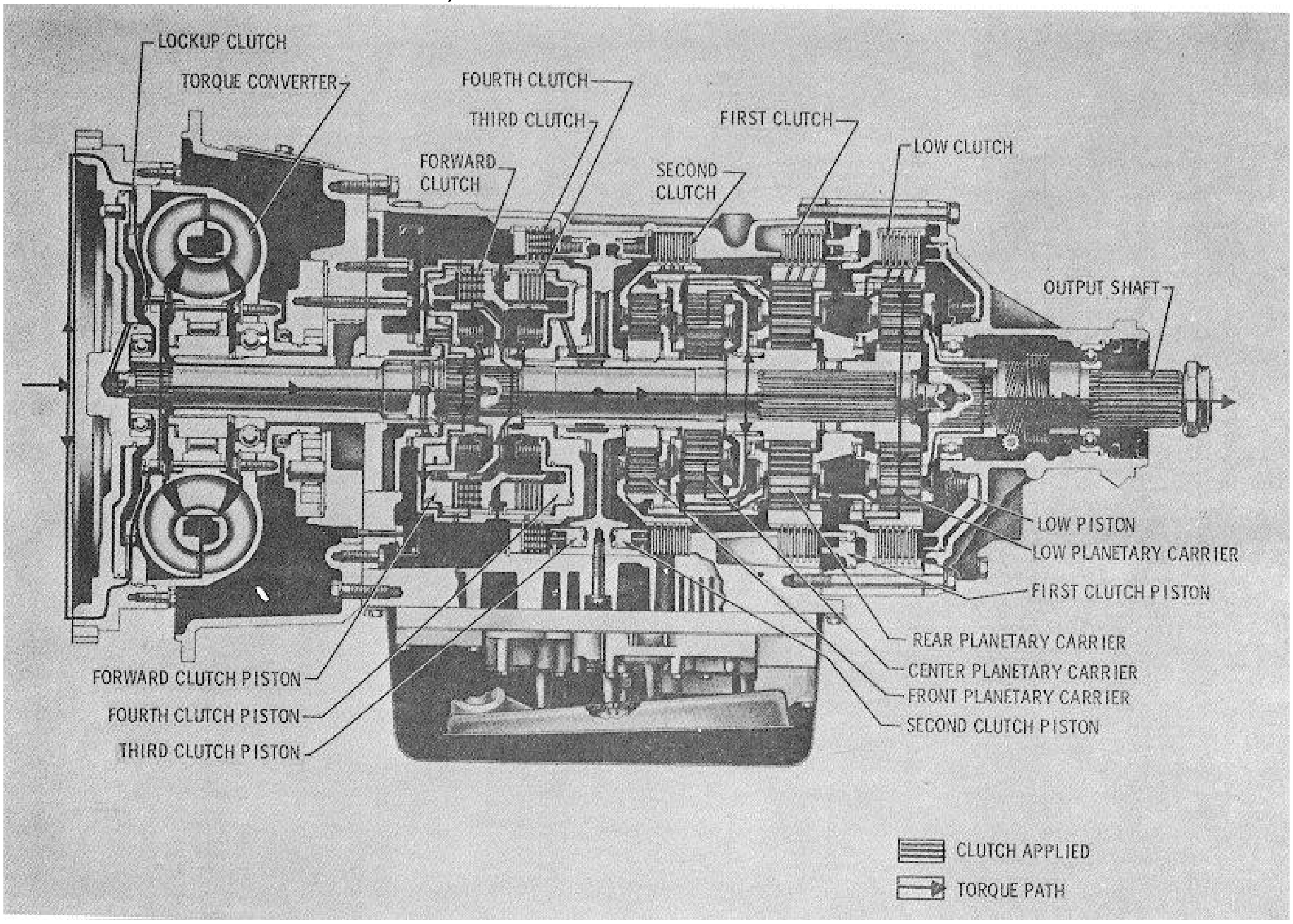
e. Second-Gear Operation (fig. 2-10). Engine torque is transmitted through the torque converter as described in a, above. The forward and first clutches are applied. The first clutch application anchors the rear planetary ring gear against rotation. The forward clutch application locks the turbine shaft and transmission main shaft together so that they rotate as a unit. The rear sun gear and low sun gear are splined to the main shaft and rotate with it and, in turn, they rotate the rear and low planetary pinions respectively. With the rear planetary ring gear held stationary by the applied first clutch, the rear carrier will rotate in a clockwise direction. Since the rear carrier hub is splined to the low carrier ring gear, it will also rotate clockwise. Since two members of the low planetary system are driving members (rotating at differing speeds), the third member (carrier) becomes the output member. This, in turn, drives the output shaft at a speed reduction shown in paragraph 1-6.



S2962

Fig. 2-11. Third-gear torque path (HT 750CRD, HT 754CRD).

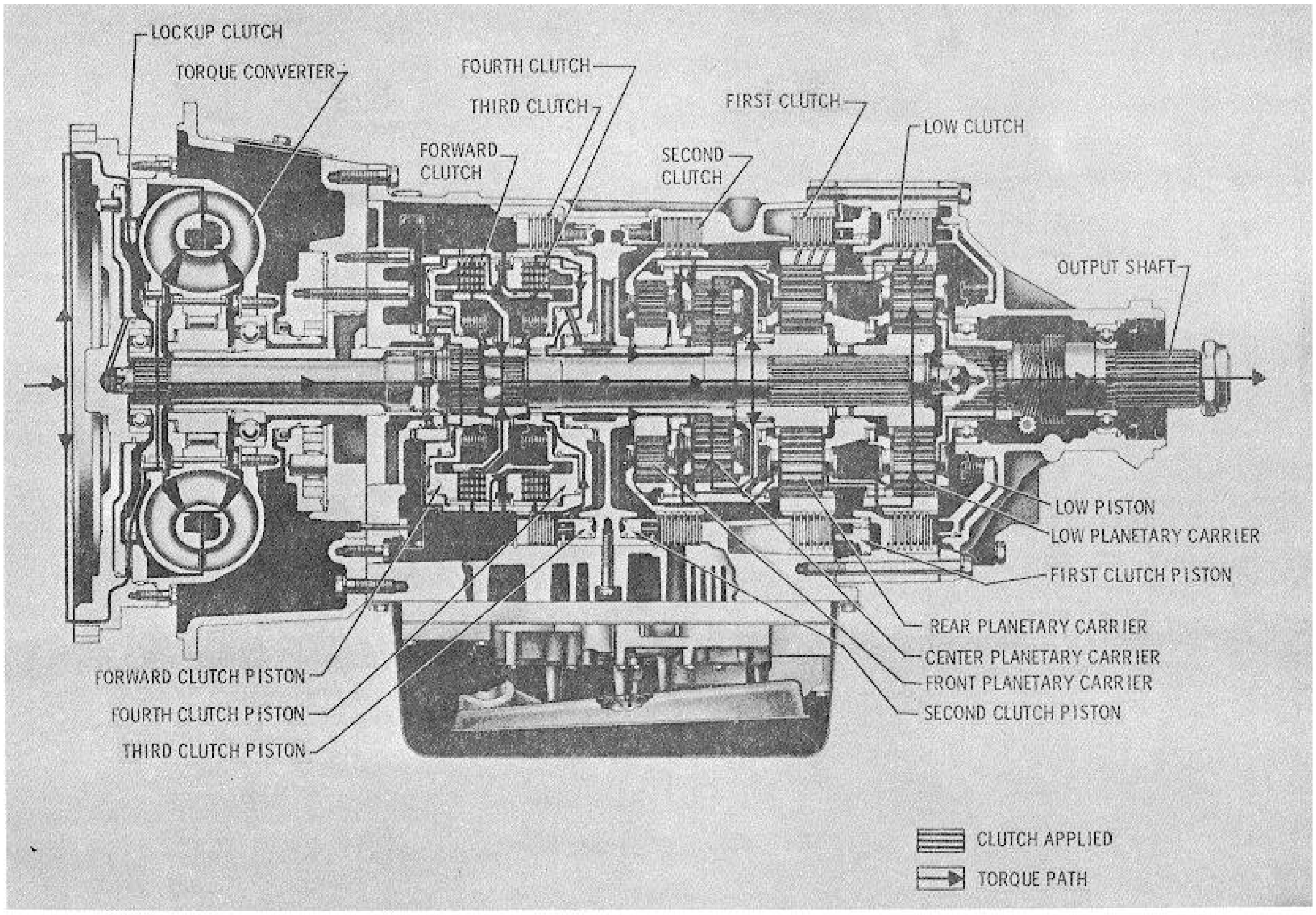
f. Third-Gear Operation (fig. 2-11). Engine t o r q u e is transmitted through the torque converter as described in a, above. The forward and the second clutches are applied. T h e second-clutch application anchors the carrier of the front planetary assembly against rotation. The forward-clutch application locks the turbine driven shaft (input shaft) and the main shaft together so they rotate as a unit. The rear sun gear is splined to both the rotating main shaft and the center ring gear and all three parts rotate at input speed. With the carrier of the front planetary carrier assembly anchored against rotation (by second-clutch application), the rotating center ring gear rotates the center sun gear shaft via the carrier pinions. The center sun gear is integral with the sun g e a r shaft assembly to which the front sun gear is splined. The rotating front sun gear rotates the f r o n t carrier pinions whose carrier is anchored against rotating by the applied second clutch. In turn, the rotating f r o n t carrier pinions rotate the front ring gear, which, along with the center carrier, is splined to the r e a r planetary through the connecting drum. Since the rear carrier hub is splined to the connecting drum on one end and to the low carrier ring gear on the other end, rotation speed of all three components are the same. With the low ring g e a r driving the low planetary pinions and the low sun gear (which is splined to the rotating main shaft) also driving the low pinions, output shaft rotates at a speed reduction as shown in paragraph 1-6.



S2962

Fig. 2-12. Fourth-gear torque path (HT 750CRD, HT 754CRD).

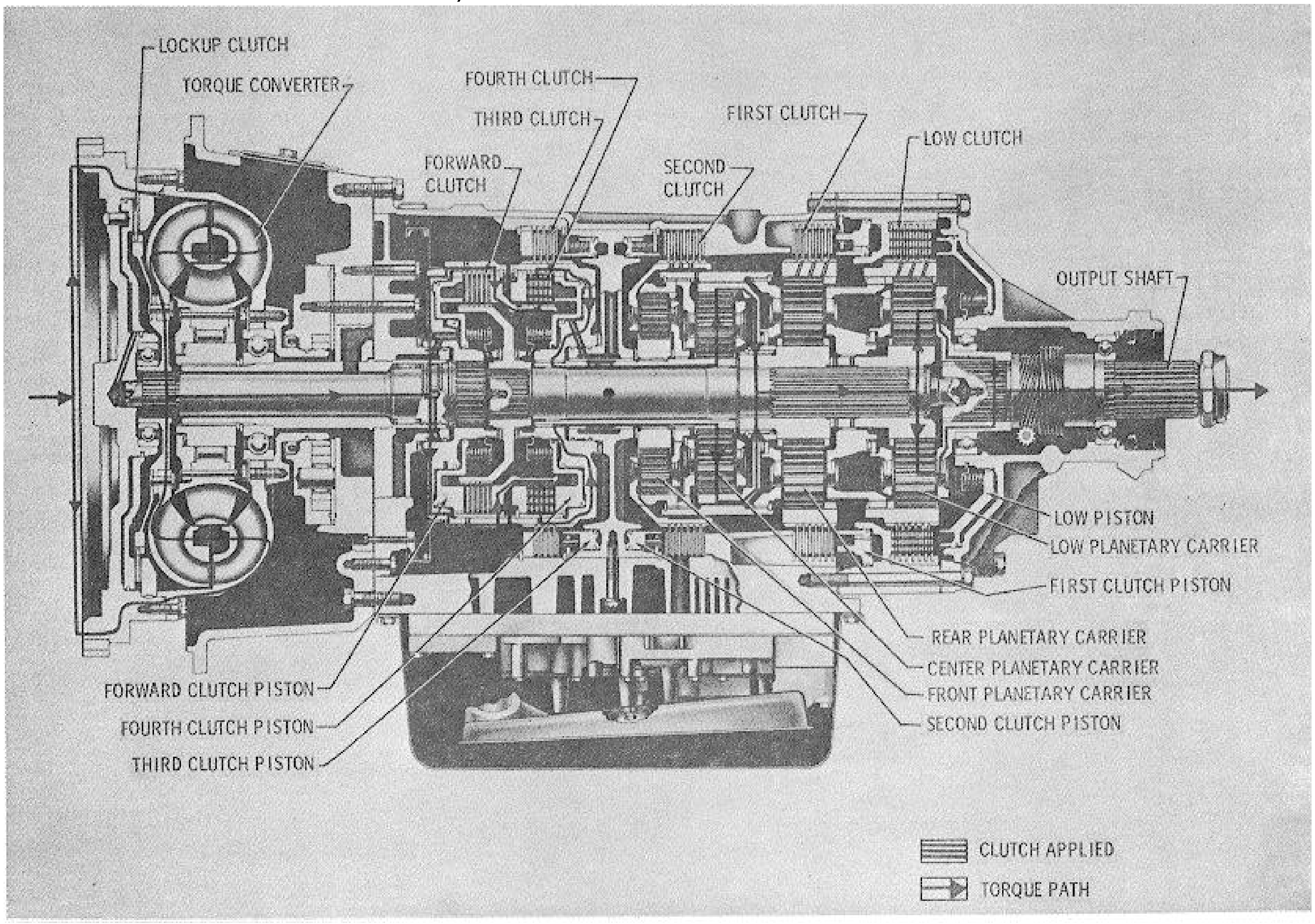
g. Fourth-Gear Operation (fig. 2-12). Engine torque is transmitted through the lockup clutch as described in b, above. The forward and the third clutches are applied. The third-clutch application anchors the sun gear shaft via the fourth clutch housing, against rotation which prevents the integral center sun gear from rotating. The forward clutch application locks the turbine shaft and main shaft together so they rotate as a unit. The rear sun gear is splined to both the main shaft and the center ring gear and rotates at input speed. With the center sun gear stationary and the center ring gear rotating, the ring gear drives the center planetary carrier pinions. This rotates the center planetary carrier at a speed reduction. This carrier and the rear planetary carrier are splined to the planetary connecting drum. The rear carrier hub on the output side is splined to the low ring gear. When the connecting drum rotates, the rear carrier and the low ring gear rotate at the same speed. This rotation causes the low ring gear to drive the low planetary pinions while the low sun gear, which is splined to the rotating main shaft, also drives the low pinions. The result is a further change of ratio (from that produced in the center planetary). Thus, the output shaft, being splined to the rear carrier, rotates at the reduction shown in paragraph 1-6.



S2962

Fig. 2-13. Fifth-gear torque path (HT 750CRD, HT 754CRD).

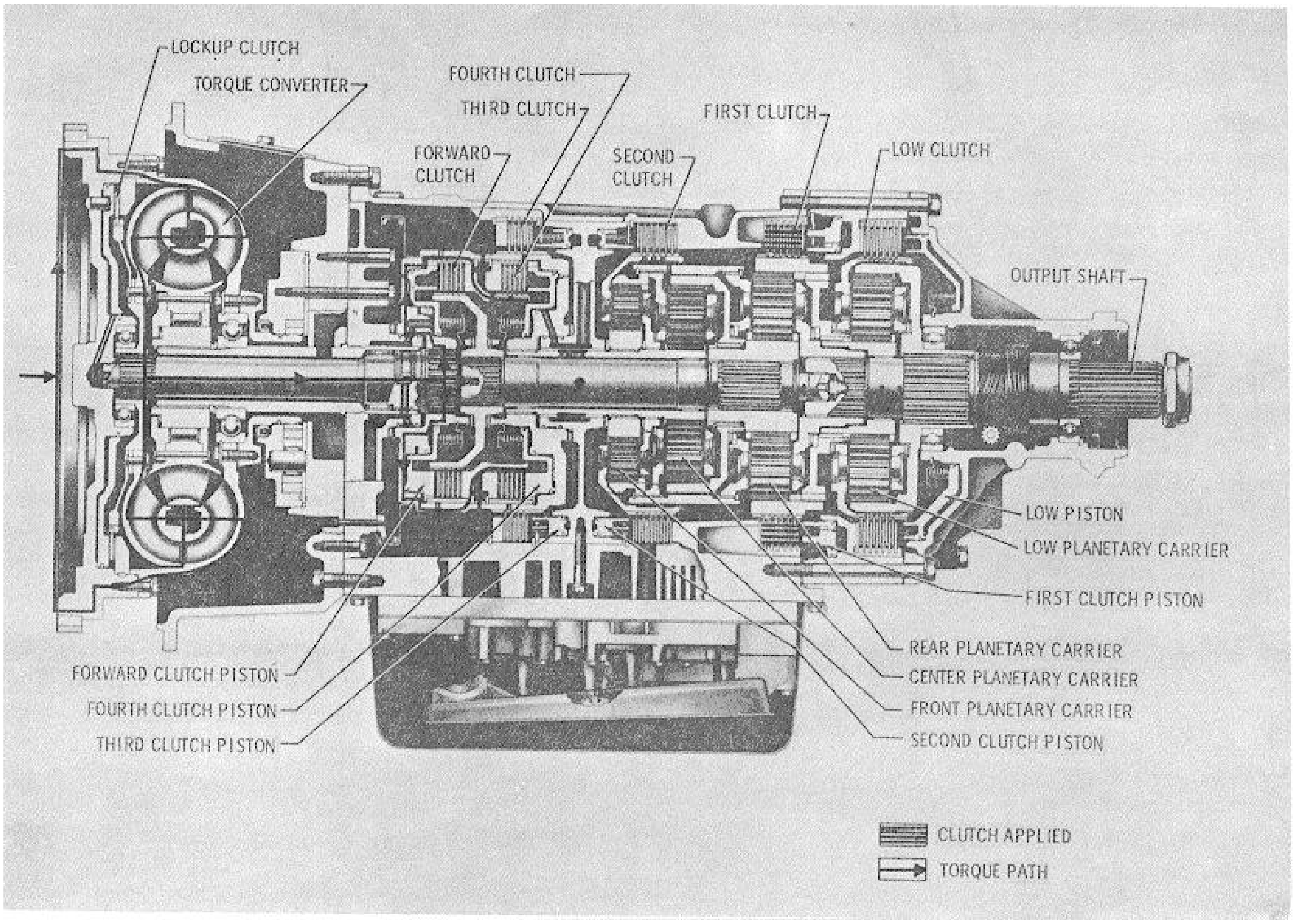
h. Fifth-Gear Operation (fig. 2-13). Engine torque is transmitted through the lockup clutch as described in b, above. The forward and fourth clutches are applied. With the clutches applied, the transmission main shaft and the sun gear shaft are locked together and rotate as a unit at input speed. With the center, rear and low sun gears rotating at the same speed (locked together), and their carriers interconnected to the planetary connecting drum also rotating at the same speed, the transmission output shaft, being splined to the low carrier will produce an output ratio of 1.00:1.



S2962

Fig. 2-14. Reverse-gear torque path (HT 750CRD, HT 754CRD).

i. Reverse-Gear Operation (fig. 2-14). Engine torque is transmitted through the torque converter as described in a, above. Reverse gear is the only gear in which the forward clutch is not engaged. In this gear, the fourth clutch is applied and rotates the sun gear shaft, via the fourth-clutch housing, at input speed. The low clutch is also applied and anchors the low ring gear against rotation. In turn, the low ring gear, rear carrier, center carrier and connecting drum are splined together to form one stationary unit. When the center sun gear rotates, it causes the pinions in the center carrier to rotate in the opposite direction. This rotates the center carrier ring gear in a counterclockwise direction (reverse of input). This reverse rotation is transferred through the main shaft and the low planetary carrier to the output shaft. Thus the transmission output shaft rotates in a reverse direction at a speed reduction shown in paragraph 1-6.



S2963

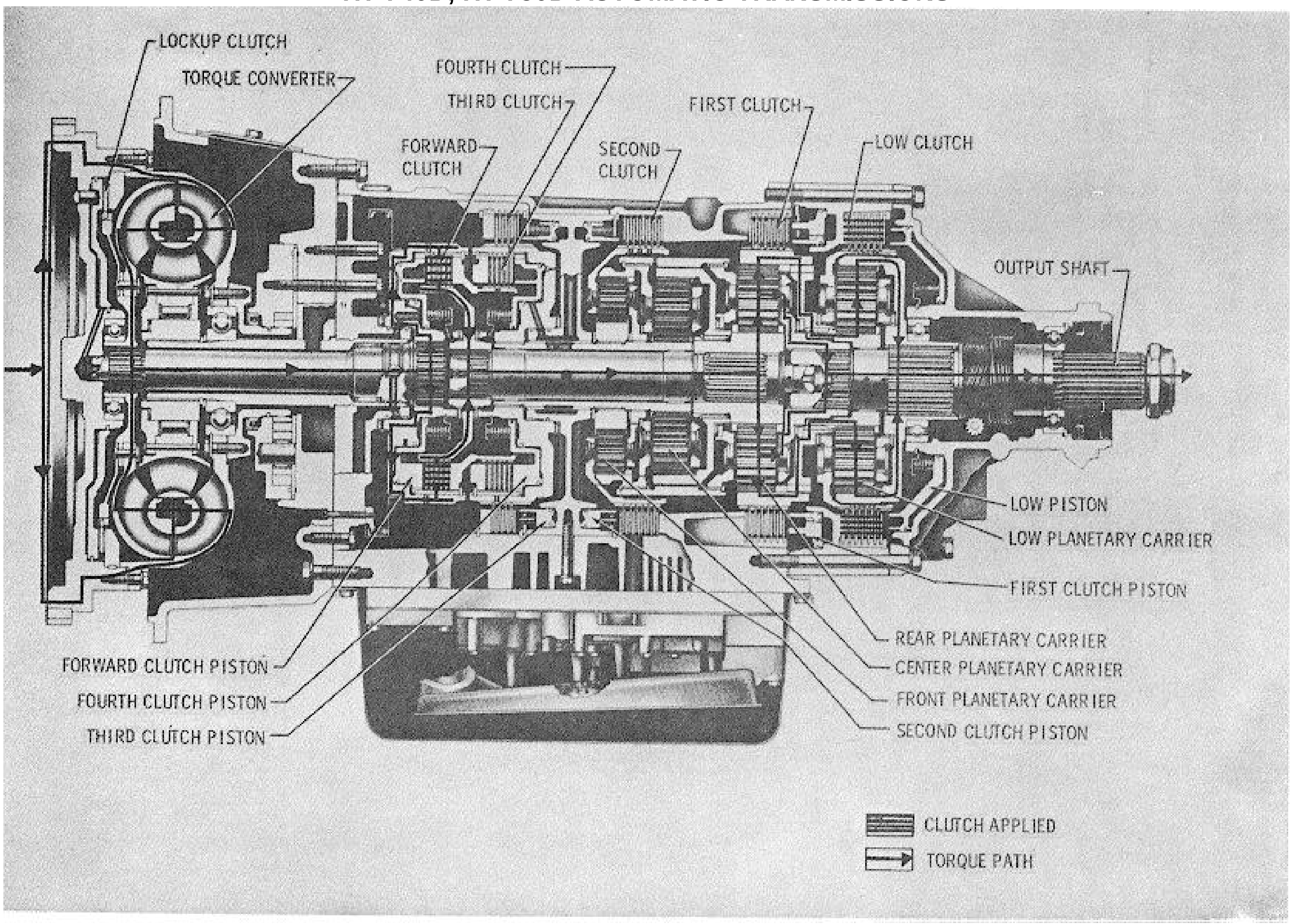
Fig. 2-15. Neutral torque path (HT 750DRD).

2-34. TORQUE PATHS THROUGH TRANSMISSION (HT 750DRD)

a. Converter Operation. Power is transmitted hydraulically through the torque converter. The engine drives the converter pump. The pump throws oil against the vanes of the turbine, imparting torque to the converter turbine shaft. From the turbine, oil flows between the vanes of the stator, and re-enters the pump where the cycle begins again. When the engine is idling, impact of the oil upon the turbine blades is negligible. When the engine is accelerated, the impact is increased and the torque directed through the turbine shaft can exceed the engine torque (by an amount equal to the torque ratio of the converter). Converter operation is illustrated in first, second, third and reverse operation where it is most likely to occur.

b. Lockup Operation. Power is transmitted mechanically through the lockup clutch. Application of the lockup clutch occurs automatically in selected ranges as a function of governor pressure. When the lockup clutch is applied, the converter elements rotate as a unit at engine speed. This provides a direct drive from the engine to the turbine shaft. Lockup operation is illustrated in fourth and fifth gear operation.

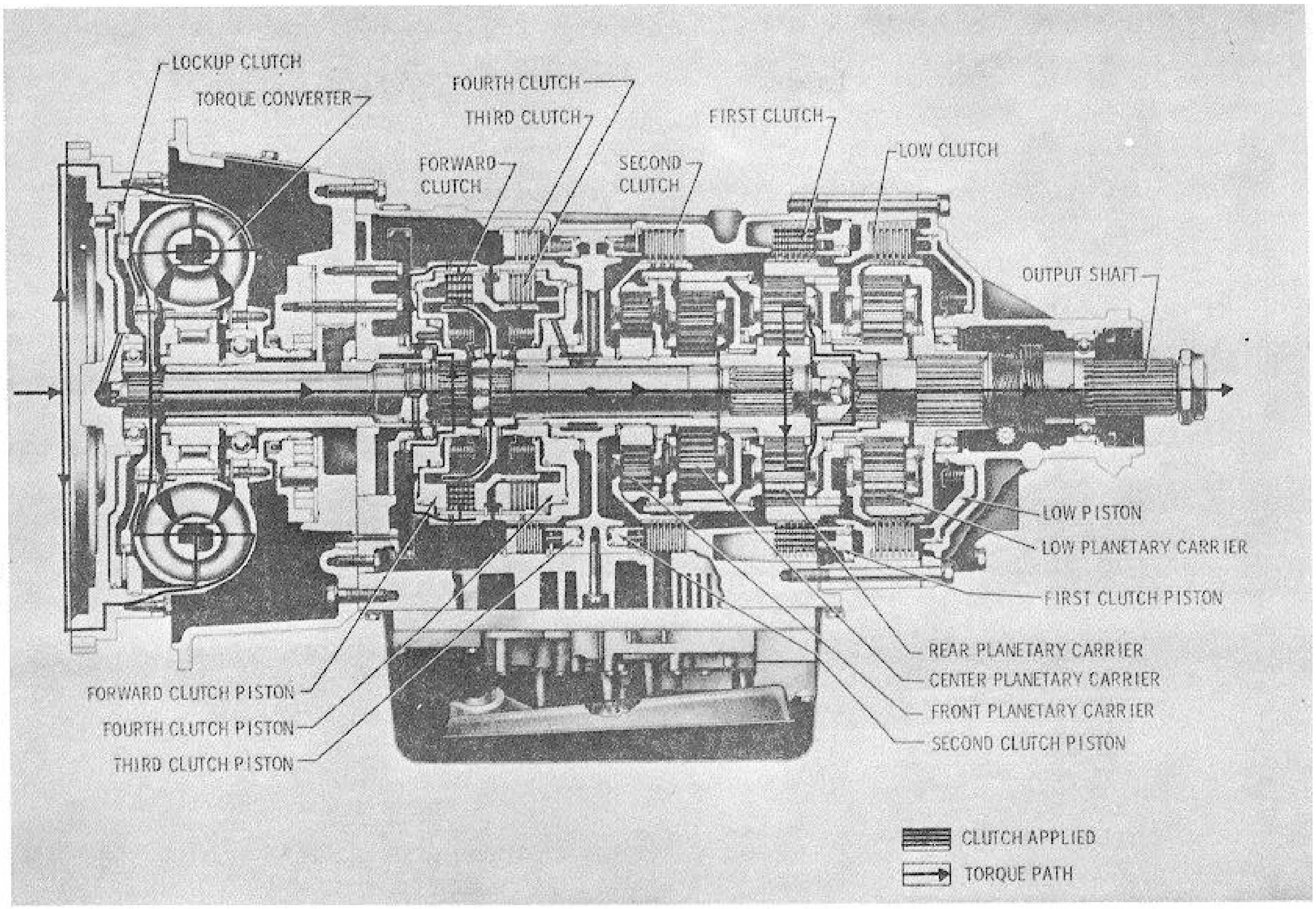
c. Neutral Operation (fig. 2-15). Engine torque is transmitted through the torque converter as described in a, above. The forward clutch is not engaged. Thus, torque is not transmitted beyond the fourth-clutch hub. (Although the first clutch is applied, two clutches must be applied to produce output shaft rotation in either forward or reverse.)



S2963

Fig. 2-16. First-gear torque path (HT 750DRD).

d. First-Gear Torque Path (fig. 2-16). Engine torque is transmitted through t h e torque converter as described in a, above. The forward and the low clutches are applied. The low-clutch anchors the low carrier against rotation. The forward clutch application locks the turbine shaft and main shaft together so they rotate as a unit. The rear planetary carrier sun gear is splined to the rotating main shaft and rotates at input speed. This sun gear rotates the rear planetary carrier assembly pinions which in turn rotates the rear carrier ring gear. Because vehicle inertia tends to restrain the output shaft and the rear carrier from rotation, the rear carrier pinions rotate the rear ring gear. This in turn rotates the low sun gear, which is splined to the rear ring gear. With the low carrier held stationary by the applied low clutch and the low sun gear rotating the low carrier assembly pinions, the low ring gear must rotate. Since the rear carrier and the low ring gear are splined to the output shaft, a combination of rear and low planetary carrier output ratios are simultaneously introduced to the output shaft to form a speed reduction of 7.97: 1.



S2963

Fig. 2-17. Second-gear torque path (HT 750DRD).

e. Second-Gear Operation (f i g. 2-17). The forward and first clutches are applied. Refer to paragraph 2-27d for detailed explanation, differing only in output shaft speed reduction of 3.19:1.

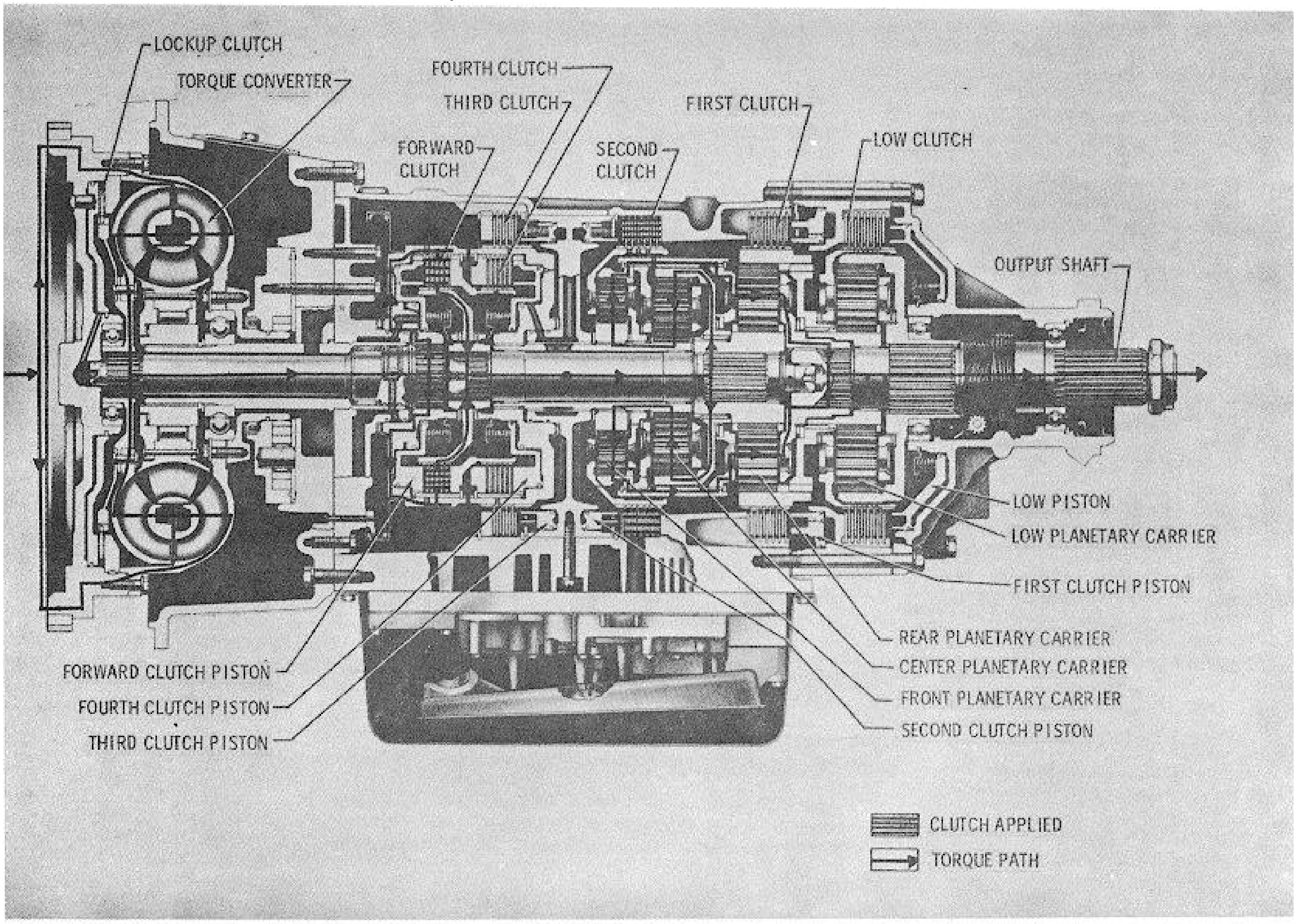


Fig. 2-18. Third-gear torque path (HT 750DRD)

f. Third-Gear Operation (fig. 2-18). The forward and second clutches are applied. Refer to paragraph 2-27e for detailed explanation of the torque path flow. Refer to paragraph 1-6 for third gear ratio.

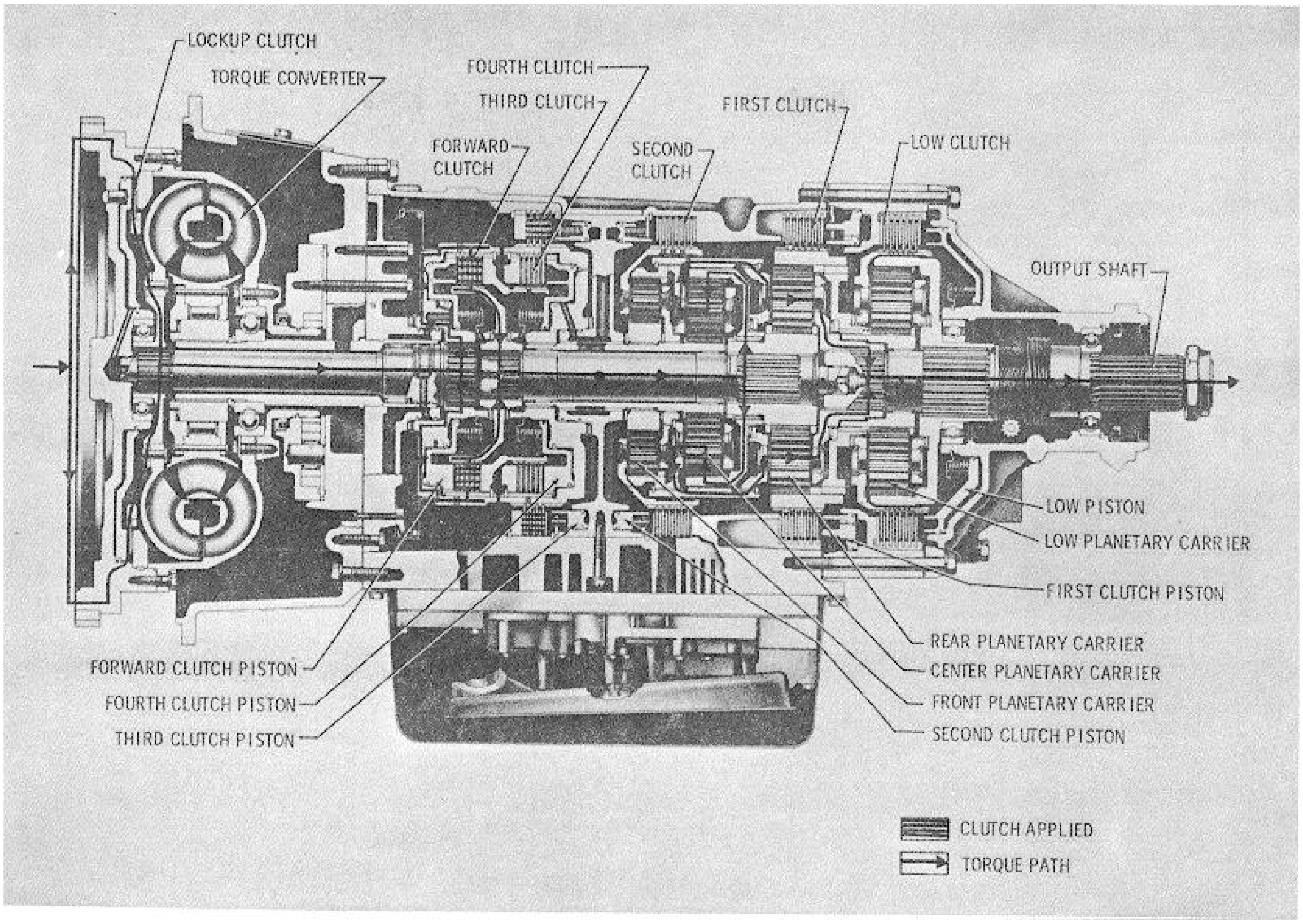


Fig. 2-19. Fourth-gear torque path (HT 750DRD).

g. Fourth-Gear Operation (fig. 2-19). The forward and third clutches are applied. Refer to paragraph 2-27f for detailed explanation of torque path flow. Refer to paragraph 1-6 for fourth gear ratio.

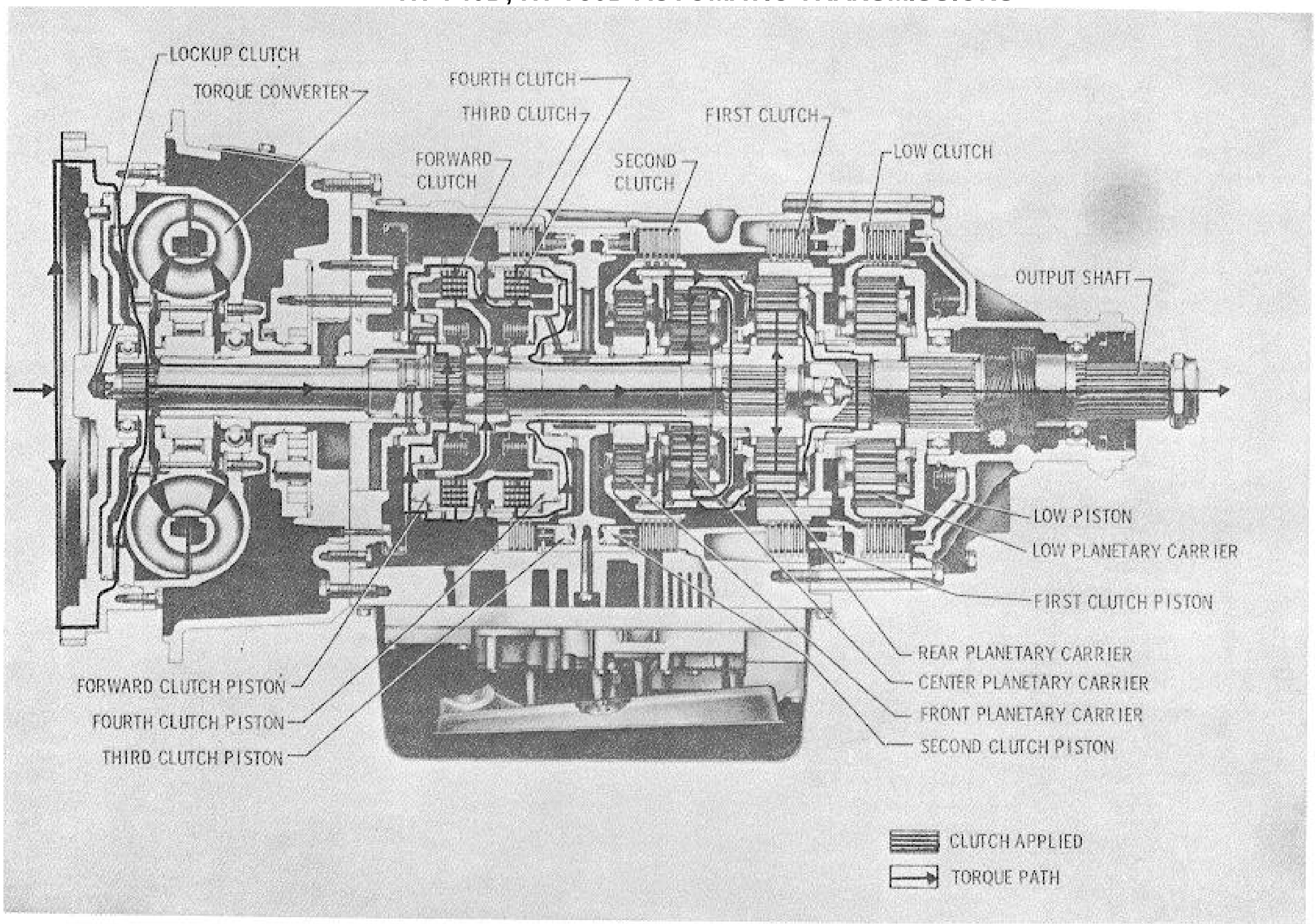
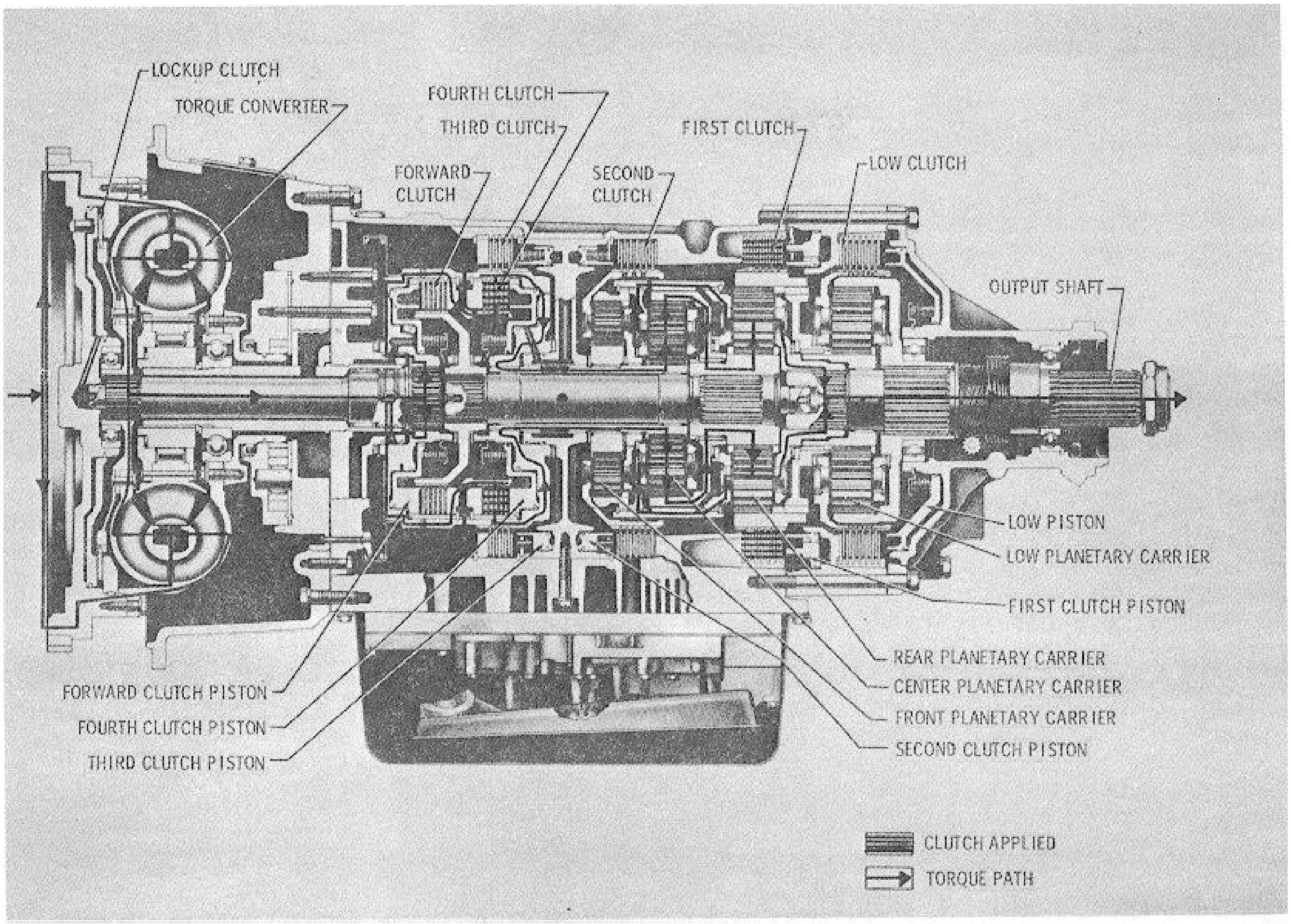


Fig. 2-20. Fifth gear torque path (HT 750DRD).

h. Fifth-Gear Operation (fig. 2-20). The forward and fourth clutches are applied. Refer to paragraph 2-27g for detailed explanation of torque path flow. Refer to paragraph 1-6 for fifth gear ratio.



S2963

Fig. 2-21. Reverse-gear torque path (HT 750DRD).

i. Reverse-Gear Operation (fig. 2-21). The first and fourth clutches are applied. Refer to paragraph 2-27h, which explains the planetary action, differing only in output shaft speed reduction shown in paragraph 1-6.

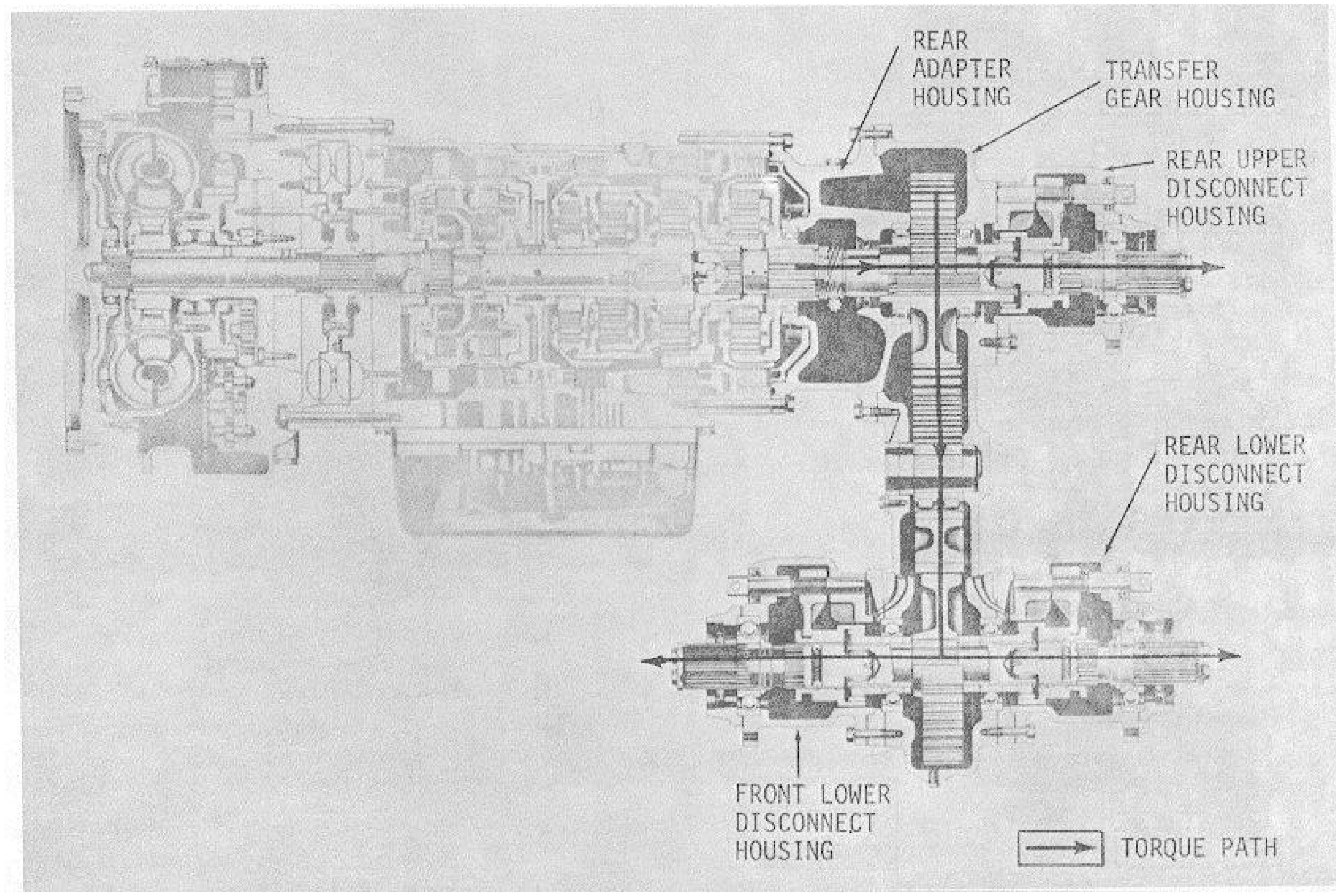


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Fig. 2-22. Transfer gear torque path (HT 750DRD DB).

2-35. TORQUE PATHS THROUGH TRANSMISSION (HT 750DRD DB)

a. Figure 2-22 shows the HT 750DRD with a transfer housing (dropbox) attached. Since the transmission is an HT 750DRD the converter, lockup, neutral and shifting operations are the same as explained in paragraph 2-34.

b. The addition of a transfer gear housing (dropbox) does not change speed reduction ratios. The dropbox has a 1.00: 1 ratio.

3-1. SCOPE

This section covers routine and periodic procedures required to maintain the transmission in good operating condition. Included are instructions for inspection, care of the oil system and breather, linkage adjustment, care of the external lines, oil filter and oil cooler, stall testing, storage, and checking oil pressures. Troubleshooting information is tabulated at the end of this section.

3-2. INSPECTION AND CARE

The transmission should be kept clean to make inspection easier. Check for loose bolts, loose or leaking oil lines, oil leakage, and condition of control linkage and cables. Check the transmission oil level at the intervals specified in the vehicle or transmission operator's manual.

3-3. DIPSTICK CALIBRATION

a. The dipstick must be properly calibrated at initial installation of the transmission, If any doubt exists as to the calibration of the dipsticks, refer to b through e below.

<u>b.</u> <u>Six-inch deep oil pan</u>. The transmission oil dipstick should be calibrated for the 6-inch deep oil pan as shown in fig. 3-1.

<u>c.</u> <u>Seven and eight and one half-inch deep oil pan</u>. The transmission oil dipstick should be calibrated for the 7 or 8 1/2-inch deep oil pan as shown in fig. 3-2.

<u>d.</u> Earlier model dipsticks were calibrated with Full and Add marks. Such dipsticks may be recalibrated as shown in fig. 3-3.

<u>e.</u> <u>Dropbox models.</u> The dropbox fill pipe and oil level indicator should have the Full mark 2 inches (50 mm) below a horizontal line through the center of the output drive

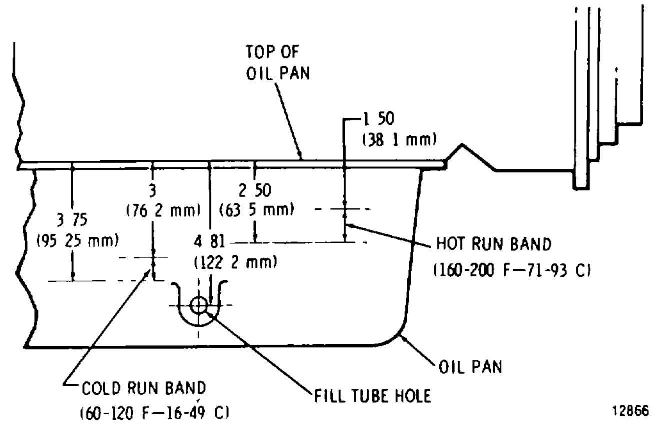

Fig. 3-1. Oil levels (6-inch deep pan)

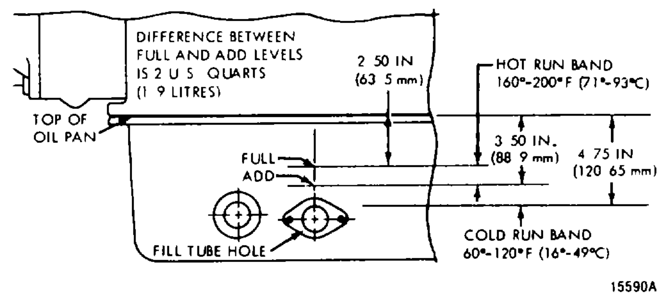

Fig. 3-2. Oil levels (7 and 8 1/2 inch deep pan)

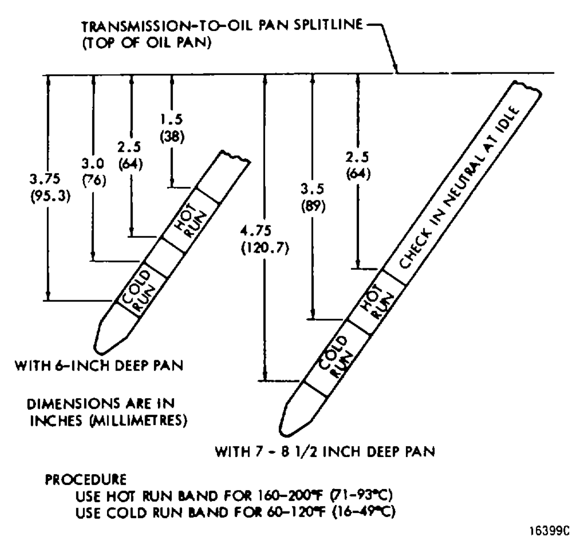

Fig. 3-3. Transmission oil dipstick markings

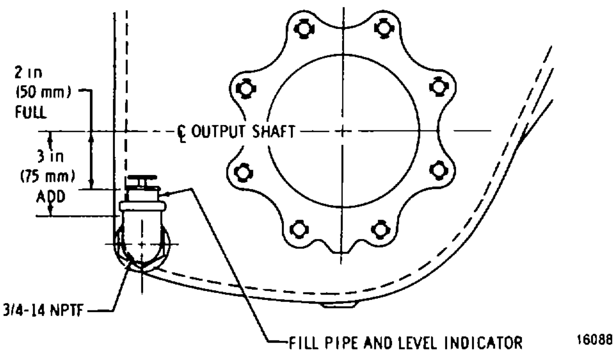

Fig. 3-4. Dropbox oil level (front view)

shaft. The Add mark should be 3 inches (75 mm) below a horizontal line through the center of the output drive shaft (fig. 3-4).

NOTE

The dropbox ADD and FULL marks are these same dimensions below the horizontal centerline of the output shaft for any mounting angle of rotation (0°, 15°, 30°, 45°, or 60°).

3-4. OIL LEVEL CHECKS

a. Importance of Proper Level

(1) Maintaining the proper oil level is very important. If, during check procedure (e. below), inconsistent dipstick readings occur, look for proper venting of the transmission breather (para 3-9), and/or proper venting of the oil filler tube.

(2) Always check the oil level on the dipstick at least twice. Consistency is important in maintaining accuracy.

CAUTION

The oil level rises as the sump temperature increases. Do not add oil to the transmission until a normal operating temperature is reached (e, (4), (5), (6)). Add the required amount of oil to bring the oil level to the Full, Hot Run band or the Cold Run band marks.

(3) Do not overfill the transmission with oil. Excessive oil causes overheating and irregular shift patterns. If the oil level is too low the result can be poor performance (clutches will not receive adequate oil supply).

CAUTION

A dipstick that anchors inside the top end of a non-vented filler tube can draw oil up into the tube during removal and give an inaccurate reading on the dipstick.

b. Foaming and Aerating

(1) Transmission performance will be affected when the oil foams or aerates. Foaming or aeration is normally caused by low oil in the sump, too much oil in the sump, or a defective or missing sealring on the intake pipe.

(2) A low oil level will not completely envelop the oil filter. Therefore oil and air is drawn by the input pump and is directed to the clutches and converter, causing converter cavitational noises and irregular shifting. The aeration also changes the viscosity and color to a thin milky liquid.

(3) The oil levels are established as shown in figure 3-1 and 3-2. Previously, only add and full levels were established. Figure 3-3 illustrates the six, seven and eight and one-half inch dipstick configurations.

(4) A defective sealring 34 (B, foldout 16) on the filter intake pipe will cause the input pump to draw air into the oil system. Air thus entering the oil will result in the conditions described in (2), above.

c. Protect Fill Pipe. When adding oil or checking oil level, dirt or foreign material must not be allowed to enter the fill pipe. Before removing the dipstick, clean around the end of the fill pipe.

d. Oil Level Check Procedure

(1) Check the oil while the vehicle is on level ground and the parking brake applied. Start the engine and shift the trans

mission through all drive ranges to fill the clutch cavities and oil passages; then shift to neutral.

(2) Shift the engine for at least one minute at 1000-1200 rpm to clear the system of air.

CAUTION

Do not overfill the transmission. Overfilling can cause aeration of the oil (milky appearance). If overfilling occurs, drain oil as required to bring it to the proper level.

(3) Cold Oil Check (COLD RUN band). Run the engine for one minute at 1000 rpm to charge the system. Idle the engine until the temperature reaches 60-120°F (1649°C). With the engine idling and the transmission in neutral, remove the dipstick from the oil filler tube and check the oil level. Oil registering in the COLD RUN band indicates a sufficient quantity of oil to safely operate the transmission until the temperature reaches 160-200°F (71-93°C). When the temperature is 160-200°F (71-93°C), a hot oil check must be made.

(4) Hot Oil Check (FULL and ADD). Be sure the temperature has reached 160 to 200°F (71-93°C). With the engine idling and the transmission in neutral, remove the dipstick from the oil filler tube and check the oil level. If the oil level registers between the ADD and FULL marks, the oil level is safe for operating the vehicle. If it registers on or below the ADD mark, add the required amount of oil necessary to bring the oil level mid way between the ADD and FULL marks. Approximately one (1) quart (0.9 liters) of oil is required to move the oil level from ADD to mid way between the ADD and FULL marks on the dipstick.

(5) Hot Oil Check (HOT RUN band). Be sure the temperature has reached 160 to 200°F (71-93°C). With the engine idling and the transmission in neutral, remove the dipstick from the oil filler tube and check the oil level. If the oil level registers in the HOT RUN band (fig. 3-3), the quantity of oil in the transmission is safe for operating the vehicle. If it registers on or below the bottom line of the Hot Run band (fig. 3-3), add the required amount of oil necessary to bring the oil level to the middle of the hot run band. (Approximately one (1) quart (0.9 liters) of oil is required to move the oil level from the bottom line of the HOT RUN band to the middle of the HOT RUN band.)

e. Dropbox Oil Check

(1) Transmissions equipped with a transfer gear housing (dropbox) have two independent oil circuits; the transmission circuit and the dropbox circuit. Each circuit requires a different type and grade of oil and must be checked and serviced independently.

(2) Park the vehicle on level ground, shift to neutral and apply the parking brake.

(3) If the dropbox has a fill tube level indicator (fig. 3-4), remove the fill tube plug and check the oil level. The dropbox is full when the oil level is at the top of the fill tube.

(4) If the dropbox has a dipstick, remove it and wipe it clean. Insert the dipstick and check the oil level. Safe level for the dropbox is any level between the FULL and ADD marks on the dipstick. If the oil level is at or below the ADD mark, add oil to bring the oil level to midway between the ADD and FULL marks.

3-5. HYDRAULIC FLUID RECOMMENDATIONS

a. Recommended Fluids

(1) Hydraulic fluids used in the transmission are important influences on transmission reliability. Dexron, Dexron II, and type C-3 (DDA approved SAE 10W or SAE 30) fluid is the only fluid approved for use in off highway applications. Use type C-3 SAE 30 in all applications where the ambient temperature is consistently above 86°F (30°C).

(2) Some Dexron II fluids are also qualified as type C-3 fluids and may be used in off-highway applications. However, a

Dexron II fluid which is not a qualified type C-3 fluid must never be used in off-highway applications. Consult your local Detroit Diesel Allison dealer or distributor to determine if a Dexron II fluid is also a qualified type C-3 fluid.

(3) Before using type C-3 fluids, consult the vehicle manufacturer to ensure that materials used in tubes, hoses, external filters, seals, etc., are compatible with C-3 fluids.

b. Other Approved Fluids. Ford Motor Company specifies fluids M2C33-F, M2C138-CJ, and M2C166H may be used and may be intermixed with Dexron II fluid.

c. Cold Weather Start-up. Listed below are the minimum fluid temperatures at which transmission may be safely operated in a forward or reverse range. When ambient temperature is below the minimum fluid temperature limit and the transmission is cold, preheat is required. If auxiliary heating equipment is available, preheat the fluid to the minimum temperature limit. If auxiliary heating equipment is not available, run the engine for at least 20 minutes with the transmission in neutral before operating in a forward or reverse range. Failure to observe the minimum fluid temperature limit can result in transmission malfunction or reduced transmission life.

Fluid Type	Minimum Fluid Temperature
Dexron II or Dexron	-30°F (-34°C)
Type C-3 SAE 10W	10°F (-12°C)
Type C-3 SAE 30	32°0F (0°C)

3-6. CHANGING THE OIL AND FILTERS

a. Cleanliness

(1) Oil must be handled in clean containers to prevent foreign material entering the transmission.

CAUTION

Containers or fillers that have been used for antifreeze or engine coolant solution must not be used for transmission oil.

(2) Clean around the oil filler tube before removing the dipstick and lay the dipstick in a clean place while filling the transmission.

(3) Check the current issue of the HT 700 Series Parts Catalog (SA 1268) for proper oil filter. Keep the filters in cartons until ready for installation.

b. Change Interval. The transmission oil and filters should be changed at the intervals recommended in the following Oil and Oil Filter Change Intervals Chart. These intervals may vary under different operating conditions such as extreme heat and dusty conditions. If the oil shows traces of contamination or the effects of high operating temperature, change the oil and filter regardless of miles or hours of operation

c. Oil Capacity. Determine the amount of oil required for an oil change from the following:

Application	U.S. Quarts	Liters
6-inch deep oil pan	33	31
7-inch deep oil pan	33	31
8 1/2-inch deep oil pan	37.0	35
Dropbox	2.6	2.5

CAUTION

Do not overfill the dropbox. Overfilling can cause excessive oil temperatures. If oil level is above the FULL line, drain oil as required to bring it to the proper level.

OIL AND OIL FILTER CHANGE INTERVALS

	Oil change	Suction screen in oil pan	External main pressure oil filter
Coaches	100,000 miles (160 000 km) or 12 months*	At 500,000 miles (804 500 km) or overhaul*	After first 5,000 miles (8 000 km); thereafter, every 25,000 miles (40 000 km) or 6 months*
Trucks (on-highway)	50,000 miles (80 000 km) or 12 months*	At 500,000 miles (804 500 km) or overhaul*	After first 5,000 miles (8 000 km); thereafter, every 50,000 miles or 12 months*
Trucks (off-highway)	1000 hours max** or 12 months*	At 200,000 miles (321 800 km) or overhaul*	After first 600 hours; thereafter, 1200 hours max***

* Whichever occurs first.
** Oil may require change sooner depending on operating conditions. Oil must be changed whenever there is evidence of dirt or high temperature condition indicated by discoloration, strong odor, or oil analysis.
*** Local conditions, severity of operation, or duty cycle may dictate more or less frequent service intervals.

d. Oil and Oil Filter Change Procedure.

(1) The oil should be warm when draining. This will ensure quicker and better drainage.

(2) On earlier models, remove the fill tube from the oil pan and allow the oil to drain. On later models remove the drain plug from the rear of the oil pan and allow the oil to drain. Check the condition of the oil as described in paragraph 3-9.

NOTE

Procedures outlined in (3) through (10) are required only when the suction screen in the oil pan must be replaced (refer to oil and filter change intervals chart).

(3) After draining is completed, remove twenty-three washer-head screws 42 (B, foldout 16) that retain the oil pan to the transmission housing. Discard pan gasket 38 and clean the pan with mineral spirits or paint thinner.

(4) Remove washer-head screw 30 (B, foldout 16) and washer 31. Remove oil filter 33 (and spacer 32 on later models). Inspect the filter. If damage has occurred, replace the filter. If the filter is in satisfactory condition, clean and reuse it. Remove, clean, and reinstall the governor feed line screen in the valve body (fig. 5-13). Refer to paragraph 6-4b (27).

(5) Prior to installing filter 33, install new sealring 34 (B, foldout 16) onto the oil intake pipe (integral with filter). Lubricate the sealring with transmission fluid.

(6) Install the oil filter (aligned so that filter does not require twisting), inserting the oil intake pipe into the hole in the bottom of the transmission. Secure the oil filter with a 5/16-18 x 1 5/8-inch washerhead screw. Tighten the screw to 10-13 lb ft (14-18 N-m).

(7) Place the oil pan gasket onto the oil pan. A sealer or cement may be applied only to the oil pan flange area that is outside the raised bead of the flange. Do not use grease on cork gaskets.

CAUTION

Gasket cements, sealing compounds, vegetable-based cooking compounds, or fibrous nonsoluble greases should never be used inside the transmission. Only oil-soluble grease (petrolatum) should be used for retaining parts (except cork gaskets) temporarily.

(8) Install the oil pan and gasket, carefully guiding them into place. Guard against dirt or foreign material entering the pan. Retain the pan to the housing with four 5/16-18 X 5/8-inch washer-head screws. Install a screw into each corner of the pan.

(9) Install the remaining nineteen washer-head screws, carefully threading each one through the gasket. Bottom all screws before tightening them.

(10) Alternately tighten screws 1800 apart to 5 pound feet (7 N-m). Repeat the process tightening the screws to 10-13 pound feet (14-18 N-m).

(11) On earlier models install the filler tube at the side of the pan. Tighten the filler tube retainer nut to 90-100 lb ft (122-136 N-m). On later models install the oil drain plug at the rear of the oil pan. Tighten the plug to 15-20 lb ft (20-27 N-m).

(12) Remove the dipstick and pour approximately 30 US quarts (28.4 liters) of transmission fluid into the transmission through the filler tube. Then check the oil level using the procedure described in paragraph 3-3.

3-7. 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.

b. 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, the transmission must be disassembled and closely inspected to find the source. Metal contamination will require complete disassembly of the transmission and cleaning of all internal and external circuits, cooler, and all other areas where the particles could lodge.

c. Coolant Leakage.

(1) The presence of ethylene glycol coolant in the transmission oil is detrimental to the reliability and durability of the internal components. Ethylene glycol has a deteriorating effect on non-metallic components (seals, gaskets, etc.) and on highly loaded steel parts, such as bearings and gears, due to reduced lubricity of the oil.

(2) Should the presence of ethylene glycol in the oil be suspected, an immediate verification test should be made. A GlyTek-Testkit is available and is a quick and easy method to determine the presence of glycol. If glycol is found, disassemble the transmission, inspect and remove all traces of coolant and varnish deposits resulting from coolant contamination. Replace seals, gaskets and friction clutch plates.

d. Auxiliary Filter (models without hydraulic retarder). After a transmission failure occurs that introduces debris into the oil system, a complete cleanup of the oil system is required. Repeated cleaning and flushing will not ensure a clean (free from debris) oil system, due to cooler retension. To prevent a repeated transmission failure, installation of an auxiliary oil filter in the line from the oil cooler is recommended. This recommendation applies whether the failed transmission is overhauled or replaced by a new or rebuilt unit. The auxiliary filter must have a 40 micron particle filtering capacity and a maximum pressure drop of 2 psi at 15 gpm. The maximum pressure drop in the cooler circuit must not exceed 30 psi at 15 gpm at operating temperature and at full throttle stall. The following filter assemblies and filter elements are recommended.

Filter Assembly	Filter Element
AC PM 13-7	PF 132W
AC PM 13-15	PF 911

Auxiliary filter elements should be monitored for contamination after 500-1000 hours operation (depending on application), and changed at regular filter change intervals thereafter.

NOTE

Retarder equipped transmissions should have the heat exchanger replaced or disassembled and thoroughly cleaned. Installing a filter in the cooler return line generally is unsatisfactory because of the size required to handle the flow and not increase the external circuit pressure drop above specified maximum limits.

3-8. BREATHER

The breather is located at the top of the transmission housing as shown in figure 1-2. The breather prevents pressure buildup within the transmission. The breather must be kept clean and the passage open. The prevalence of dust and dirt will determine the frequency at which the breather requires cleaning. Always use a wrench of the proper size to remove or replace the breather. Pliers or a pipe wrench will crush or damage the stem and produce metal chips which could enter the transmission.

3-9. LINKAGE

a. General Information. Maintain proper adjustment of all linkage. Periodic inspections should be made for defective parts. Bent or worn parts should be replaced. All moving parts must be kept clean and well lubricated.

CAUTION

Manual selector shafts that are center-drilled at their outer ends require an M10 x 1.5-6G nut (Metric thread). Shafts that are undrilled require a 3/8-16 nut (standard inch series). Use of the wrong nut will damage both the shaft and nut. Torque for either nut is 15-20 lb ft (20-27 N-m). Excessive torque applied to the external selector lever retaining nut may damage the internal selector lever.

b. Selector Lever Installation and Adjustment

(1) To properly install the external lever rotate the manual selector shaft to a position that is two detent notches from either end of its travel. Install the external lever so that the flat sides of the shaft opening are parallel to the flats on the shaft. Install the nut. While holding the lever against rotation, tighten the nut to 15-20 lb ft (20-27 N-m).

(2) Refer to vehicle manual for specific linkage adjustment procedures. The following general procedures are applicable to most vehicles.

(3) The manual selector lever should move easily and give a crisp detent feel in each position. The linkage should be adjusted so that the stops in the shift tower match the detents in the transmission.

c. Retarder Linkage Adjustment. Clean and lubricate all hydraulic retarder valve linkage. The retarder is applied when the valve moves upward (out of the valve body). Therefore, it is important for normal operation with retarder Off, that the linkage be adjusted so the valve returns to the retracted position. If the linkage causes the retarder to be partially applied, loss of lubrication pressure, overheating, or excessive drag will result and fuel consumption will be excessive. If the valve does not have full travel (1.5 in. (38.1 mm)), maximum performance of the retarder cannot be obtained.

d. Fuel Control Actuator Adjustment

(1) It is imperative the mechanical linkage be properly adjusted for efficient performance.

(2) Place the fuel control lever on the engine at full throttle position.

(3) Place the mechanical actuator cable at full throttle position against the mechanical stop.

(4) Adjust the clevis at the fuel control lever so the pin fits freely through the hole in the clevis, making sure the lever is secure.

(5) Total cable control travel should not be less than 1.187 inches (30.14 mm) or more than 1.56 inches (39.62 mm).

e. Disconnect Control Linkage (dropbox models only)

CAUTION

Improper shifter shaft adjustment reduces lube oil flow to the disconnect clutch needle bearing.

NOTE

If the disconnect shaft is not permitted to stroke to the full disconnect position, the driven gear may move far enough to disengage the driving gear, but not enough to allow sufficient oil to reach the needle bearing for adequate lubrication. The bearing will fail.

(1) If a manual or a i r actuator is used, adjust the linkage or the cylinder stroke to give a crisp detent at the engaged and disengaged positions.

(2) Push the shifter shaft inward to the engaged position detent. Rotate the shaft until the outer end of the shaft is 1.29 to 1.33 inches (32.8 to 33.8 mm) from the face of the housing.

3-10. SHIFT SPEED ADJUSTMENTS

NOTE

Transmission shift points cannot be satisfactorily adjusted if the transmission has the wrong governor installed. Check the three-digit code on the head of the governor with the code shown in the current parts catalog SA 1268 for the governor listed for your transmission assembly part number. If the letter "M" follows the three digit code, the governor is a service replacement assembly. If the "M" is not included, the governor was installed at original factory build.

a. Calibrated On Test Stand Or In Vehicle

(1) Proper timing of shift speed points is necessary for maximum transmission performance. Shifts may be adjusted on the test stand when the transmission is rebuilt or overhauled, or during road testing of the vehicle.

PREVENTIVE MAINTENANCE
SHIFT POINT CHECK

Engine Governor Speed (RPM)			1950-2050		2100-2200				2300-2500				2600-2700		2200	1950-2050	2300-2500	2100-2200
Column (Engine)			R	AB	A	B	C	D	E	F	W	AC	G	AG	Y	AH	AL	AN
Throttle Position	Selector Position	Shift	Transmission Output Speed (RPM) at Start of Shift															
Full	Drive 4	1C-1L	--	420 500	420 500	320 420	--	--	370 470	--	440 540	470 570	--	470 570	--	--	--	--
		1-2	400 455	500 560	550 600	510 590	430 480	430 480	620 670	510 580	590 650	590 650	590 650	670 730	470 530	**	**	**
		2C-2L	560 790	--	--	--	560 790	770 940	--	700 835	--	--	900 1220	--	560 790	560 790	700 835	560 790
		2-3	965 1005	930 1000	1000 1070	970 1050	1000 1070	1000 1070	1120 1190	1100 1170	1100 1170	1100 1170	1240 1320	1240 1310	1080 1120	965 1005	1100 1170	1000 1070
Closed	Drive 4	3-4	1390 1435	1400 1490	1500 1590	1440 1540	1500 1580	1500 1580	1660 1760	1650 1740	1650 1740	1650 1740	1860 1950	1860 1950	1610 1660	1390 1435	1650 1740	1500 1580
		4-3	690 525	570 320	750 390	950 550	1000 590	1000 590	1350 890	860 610	760 500	760 500	1120 720	720 290	1060 780	690 525	860 610	1000 590
		3-2	555 455	530 350	630 390	730 510	630 440	630 440	860 620	650 485	600 380	600 380	870 570	580 290	670 480	555 455	650 485	630 440
		2-1	255 70	380 120	410 190	480 280	350 70	350 70	560 370	385 165	470 240	470 240	410 100	400 20	370 140	**	**	**
		Lockup Out	390 190	215 Min	215 Min	1360 1040	390 190	480 280	390 Min	400 200	230 Min	320 Min	620 420	320 Min	390 190	390 190	400 200	390 190
Full	Drive 3	4-3	1910 1430	1870 1320	2040 1430	2040 1430	1910 1430	1910 1430	2100 1570	2100 1570	2100 1570	2100 1570	2300 1790	2320 1990	1960 1700	1910 1430	2100 1570	1910 1430
	Drive 2	3-2	1280 960	1180 890	1330 960	1330 960	1280 960	1280 960	1410 1060	1410 1060	1410 1060	1410 1060	1610 1210	1580 1260	1300 1090	1280 960	1410 1060	1280 960
	Drive 1	2-1	670 510	650 500	710 540	710 540	670 510	670 510	720 590	720 590	720 590	720 590	860 670	810 690	680 540	600 530	730 590	600 530

Column	Engine
A, AB, AC, AG	Conventional Diesel Engine - HT 740D
B, E	High-Torque Rise Engine - HT 740D
C, F, G, R, Y	Conventional Diesel Engine (No 1st Lockup) - HT 740D
W	Conventional Diesel Engine (Special Lockup Points) - HT 740D
D	Conventional Diesel Engine (No 1st Lockup) (For 190 H.P Coach) - HT 740D
AN, AH, AL	Conventional Diesel Engine (No 1st Lockup) (2nd Gear Start) - HT 740D

**Check for manual shift function only

HT 740D, HT 750D AUTOMATIC TRANSMISSIONS
SHIFT POINT CHECK

Engine Governor Speed (RPM)			1950-2050		2100-2200					2300-2500				2600-2700		2800-2900	1950-2050	2600-2700	1950-2050	2100-2200	2600-2700	2300-2500
Column (Engine)			T	AF	J	K	L	S	AE	M	N	O	V	P	U	AJ	AK	AM	AO	AP	AQ	AR
Throttle Position	Selector Position	Shift		Transmission Output Speed (RPM) at Start of Shift																		
Full	Low	LC-LL	—	*	*	*	--	--	--	*	--	*	--	--	*	*	--	--	*	*	*	*
		L1	320 380	**	**	**	430 500	**	300 400	**	450 520	**	**	520 580	**	**	240 320	385 500	**	**	**	**
		1C-1L	825 960	370 460	490 580	430 520	900 1010	--	850 960	430 520	960 1110	590 660	--	1140 1290	680 760	680 760	685 830	1080 1230	490 580	850 960	1080 1230	905 1055
	Drive 4	1-2	1010 1085	605 645	630 690	650 690	1090 1170	550 600	980 1050	690 750	1200 1280	690 750	650 690	1360 1430	790 850	850 910	955 1025	1290 1350	580 645	980 1050	1290 1350	1140 1200
		2-3	1245 1335	965 1005	1000 1070	1040 1080	1340 1430	900 950	1240 1330	1120 1190	1470 1560	1100 1170	1035 1075	1660 1750	1240 1315	1340 1415	1235 1285	1645 1695	920 995	1240 1330	1645 1695	1455 1505
		3-4	1580 1680	1390 1435	1500 1590	1500 1545	1700 1800	1360 1410	1600 1700	1660 1760	1860 1960	1650 1740	1500 1550	2100 2200	1860 1950	2000 2090	1535 1585	2055 2105	1390 1485	1600 1700	2055 2105	1815 1865
Closed	Drive 4	4-3	1070 660	575 395	840 380	670 470	1270 640	560 370	1010 660	980 630	1030 770	820 550	675 470	1490 900	900 620	1055 690	880 670	1270 840	620 395	1010 660	1270 840	850 650
		3-2	790 550	505 365	630 390	545 405	870 570	475 320	790 530	670 460	820 610	660 440	545 405	1150 570	670 390	660 430	730 575	870 705	500 330	790 530	870 705	745 540
		2-1	615 400	420 260	460 310	465 320	680 390	370 160	570 370	560 370	540 350	570 370	465 320	770 530	570 370	595 390	575 425	600 370	420 220	570 370	600 370	480 220
		1-L	380 120	**	**	**	450 120	**	300 200	**	475 250	**	**	740 120	**		240 100	420 275	**	**	**	**
		Lockup Up	400 Min	240 Min	250 Min	320 Min	570 320	--	370 Min	390 Min	400 Min	570 Min	--	350 Min	700 Min	700 Min	290 Min	350 Min	250 Min	370 Min	350 Min	400 Min
Full	Drive 3	4-3	2080 1610	1840 1500	1850 1520	1850 1520	2110 1610	1850 1520	2050 1730	1910 1560	2140 1760	1910 1560	1910 1565	2400 2160	2160 1820	2290 1975	1890 1620	2400 2160	1840 1500	2050 1730	2400 2160	2140 1760
	Drive 2	3-2	1610 1290	1250 970	1280 960	1280 960	1660 1290	1290 1000	1600 1340	1330 1060	1710 1420	1330 1060	1330 1060	1960 1730	1590 1240	1655 1370	1490 1255	1960 1730	1250 970	1600 1340	1960 1730	1710 1420
	Drive 1	2-1	1360 1060	760 650	780 620	780 620	1410 1060	780 620	1360 1110	810 660	1460 1160	810 660	805 660	1690 1320	1010 810	1080 830	1260 1010	1690 1320	760 650	1360 1110	1690 1320	1460 1160
	Low	1-L	850 620	330 120	330 120	330 120	960 620	330 120	770 590	390 150	1000 710	390 150	390 150	1140 830	350 150	380 240	675 560	960 800	330 120	770 590	960 800	700 810

Column	Engine
J, O, U, AJ, AO	Conventional Diesel Engine - HT 750DRD
K, M, AF	High-Torque Rise Engine - HT 750DRD
S, V	Conventional Diesel Engine - HT 750DRD (No Lockup)
L, N, P, T	Conventional Diesel Engine - HT 750CRD
AM, AE, AK	Conventional Diesel Engine - HT 750CRD (3 69 Gear Ratio)
AP, AQ, AR	Conventional Diesel Engine - HT 754CRD (3 69 Gear Ratio) (2nd Gear Start)

*Check that automatic converter to lockup shift occurs.
**Check for manual shift functioon only

(2) The Kent Moore Valve and Governor Test Stand (J-25000) is designed to check five principle transmission functions. It performs a checking procedure on the governor, modulator, hold regulator, shift points (up-down-inhibit), and a trimmer regulator check. If a test stand is not available, satisfactory calibration of shift points may be made after road testing of the vehicle.

b. Location of Adjusting Components

(1) Shift speeds are changed by changing the positions of adjusting rings that determine the retaining force of certain valve springs in the valve body. Refer to items 22, 74, 84, 93, 98 and 104 (B, foldout 19) and 15 (A, foldout 20).

(2) A special tool J-24314 is used to depress and rotate the adjusting rings to the proper positions. Clockwise rotation increases spring force and will raise the shift point. Counterclockwise rotation will reduce spring force, and lower the shift point.

NOTE

Each notch of adjustment will alter the shift point as follows.

HT 740D, HT 747D	HT 754CRD, HT 750CRD & DRD
Shift 1-2 - 40 rpm	Shift 1-2 - 10 rpm
Shift 2-3 - 40 rpm	Shift 2-3 - 10 rpm
Shift 3-4 - 40 rpm	Shift 3-4 - 25 rpm
	Shift 4-5 - 35 rpm

c. Checks Before Adjusting Shift Points

(1) When calibration is to be made during a road test, or on a test stand that simulates road operation, certain preparations must be made.

(2) Raise the temperature of the transmission fluid in the transmission or test stand to 160 to 200°F (71 to 93°C).

(3) Check the engine no-load governor setting, and adjust if required, to conform to the transmission's engine speed requirements.

(4) Check the engine for satisfactory performance before making shift point adjustments.

(5) Check the throttle linkage that controls the mechanical modulator valve actuator on the transmission for proper travel, routing and operation.

(6) Check the shift selector linkage for proper range selection.

(7) Provide accurate instrumentation required for observing speeds, temperatures, pressures, etc.

d. Calibration by Road Test Method

NOTE

Before road test, determine the vehicle tachometer error with a test tachometer. Make corrections for error, as required, in subsequent tests.

(1) Subtract 100 rpm from the engine no-load governed speed and record the remainder as the desired speed for all automatic upshifts to occur, except the 1-2 shift in HT 750CRD models. The 1-2 shift in the HT 750CRD must occur at 100 rpm below lockup engagement speed.

(2) If doubt exists regarding w h e n 1 o c k u p is occurring in HT 750CRD, HT 754CRD, install a 0-300 psi (0-2068 kPa) gage at the lockup pressure tap. During road operation in 1-hold observe the first movement of the gage and note rpm. This is first gear lockup engagement speed.

(3) While driving the vehicle in 1-4 (HT 740) or 2-5 (HT 750) range, check the w i d e open throttle upshift points. These shifts should occur at 100 rpm below engine no-load governed speed. If upshift speed points do not reach those specified, the shiftpoint speed may be raised by adjusting (increasing) the spring load on the 1-2, 2-3,

3-4 or 4-5 (HT 750 only) shift signal valve. If upshift speeds are above those engine speeds specified, or do not occur at all, the spring load(s) must be reduced. Only the load on springs for the valve (or valves) which do not upshift at the proper speed require adjustment.

NOTE

If more than one shift signal valve spring requires adjustment in the same direction, it may be necessary to adjust the spring force on the modulator valve in the same direction. If not adjusted, the closed throttle downshifts may be abnormally high or low depending on the direction the shift signal adjusting rings were rotated. If all full throttle upshift points are too low by approximately the same amount, check adjustment on the modulator external linkage.

(4) Refer to Sections 5, 6 and 7 for procedures covering removal and replacement of affected components. Spring charts are at the end of Section 8 immediately preceding foldouts.

e. Alternate Method Using Speedometer Readings

(1) When a tachometer is not available for checking shift points, the vehicle speedometer can be used. Proceed as outlined in (2) through (4) below.

(2) Check and record the road speed of the vehicle at which lockup occurs in the HT 750CRD, HT 754CRD during operation in 1-hold (refer to d (3), above). Also check and record the top speeds that can be attained while operating in 1-2, 2-3 and 3-4 ranges (HT 750 only).

(3) For checking t h e shift points, place the selector at 1-4 (HT 740D, 747D), 1-5 (HT 750CRD, 754CRD) or 2-5 (HT 750DRD), so that all automatic shifts can occur. Drive the vehicle at full throttle from a standing start until the 3-4 (HT 740) or 4-5 (HT 750) upshift occurs. Record the road speed at which each upshift occurs.

(4) Compare the upshift speeds with the speeds recorded in (2), above. The 1-2 shift in HT 750CRD, 754CRD should occur at approximately two mph below the speed recorded for lockup engagement. All other upshifts should occur approximately two mph below the top speeds recorded in (2), above.

f. Calibration by Test Stand Method

(1) The shift point check table provides information required for adjusting shift points on transmissions matched to engines having governed speeds from 1950 to 2900 rpm.

(2) The actual adjustment procedures are as outlined in d, above. However, the base for checks and adjustments is output shaft speeds instead of engine governed speed. Individual output shaft speed ranges are given for each shift.

3-11. EXTERNAL LINES AND OIL COOLER

a. External Lines

(1) Inspect for loose or leaking connections, worn or damaged hoses, tubing and loose fastenings.

(2) Examine the radiator coolant for traces of transmission oil. This condition indicates a faulty heat exchanger.

b. Oil Cooler. Transmission operation at abnormally high temperatures can cause clogging of the oil cooler as well as transmission failure. It is suggested the oil cooler system be thoroughly cleaned after each major or minor rebuild (para 3-8d). Failure to do so may cause poor performance, overheating and transmission damage. For recommendations for cleaning or flushing the oil cooler, see the vehicle service manual.

3-12. TRANSMISSION STALL TEST

a. Purpose. A stall test may be conducted when the power package (engine, transmission combined) is not performing satisfactorily. The purpose of the test is to determine whether the transmission or the engine is the malfunctioning component.

WARNING

When conducting a converter stall test, the vehicle must be positively prevented from moving. Both the parking and service brakes must be applied and, if necessary, the vehicle should be blocked to prevent movement forward or in reverse. Warn personnel to keep clear of the vehicle and its travel path in the event of brake failure or inadequate blocking. Do not maintain the stalled condition longer than 30 seconds due to rapid heating of the transmission oil.

CAUTION

With the transmission in neutral, run the engine at 1200 to 1500 rpm for 2 minutes to cool the oil between tests. Do not allow the converter-out temperature to exceed 300°F (149°C). Keep close check to prevent the engine cooling system from overheating.

b. Procedure

CAUTION

Do not attempt to stall test the HT 750, 754CRD transmission in reverse, nor the HT 750DRD in first gear. The extremely high torque produced in either of these gears may damage the transmission and or the vehicle drive line.

(1) Connect a tachometer of known accuracy to the engine. Stall the torque converter by locking the transmission output (putting the transmission in gear) and accelerating the engine to full throttle. Note the maximum rpm the engine will attain. The speed attained is then compared to the speed specified, by the vehicle manufacturer as normal for those conditions. This information (stall speed) may be obtained from your equipment dealer or distributor. An engine speed above or below the specified range may indicate a malfunction in the engine or transmission.

NOTE

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 deviations do not exceed 150 rpm and can be attributed to such causes, the actual speed can be accepted as normal.

(2) After making allowances for items in Note, above, a low engine speed may indicate the engine is not delivering full power. Refer to the engine service manual for engine repair information.

(3) If low engine speed persists after the engine is tuned, refer to the troubleshooting chart in paragraph 3-20.

(4) If high engine speed is noted, refer to the troubleshooting chart in paragraph 3-20.

3-13. PRESERVATION AND STORAGE

a. Storage, New Transmissions (prior to installation).

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 one full year (stored without further treatment inside in conditions of normal climate and with all shipping plugs installed).

b. Preservation Methods.

When the transmission is to be stored or to remain inactive for an extended period (one or more years), specific preservation methods are recommended to prevent damage due to r u s t, corrosion, and organic growth in the oil. Preservation methods are presented for storage with and without transmission fluid.

c. Storage, One Year-Without Oil

(1) Drain the oil.

(2) Seal all openings and breathers 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 VCI #10 (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) into the transmission through the fill tube hole.

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

d. Storage, One Year-With Oil.

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

(2) Fill the transmission to operating level with a mixture of one part VCI #10 (or equivalent) to 30 parts Dexron or Dexron II transmission fluid. Add 1/4 teaspoon of Biobor JF (or equivalent) for each 3 gallons (11 liters) of oil in the system.

NOTE

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

(3) Run the engine for approximately five minutes at 1500 rpm with the transmission in neutral.

(4) Drive the vehicle. Make sure the transmission shifts through all ranges. If it is equipped with a converter lockup clutch, make sure the lockup clutch activates.

(5) Continue running the engine at 1500 rpm with the transmission in neutral until normal operating temperature is reached.

CAUTION

If the unit does not have a converter-out temperature gage, do not stall the converter.

(6) If normal operating temperature is less than 225°F (107°C), shift the transmission to forward range and stall the converter. Do not exceed 225°F (107°C).

(7) As soon as the transmission is cool enough to touch, seal all openings and the breather with moisture-proof tape.

VCI #10 is the registered trademark for a vapor phase rust preventive manufactured by Daubert Chemical Company, Chicago, Illinois. VCI #10 is covered by Military Specifications MIL-L-46002 (ORD) and MIL-I-23310 (WEP) under the designation of Nucle Oil. Biobor JF is the registered trademark for a biological inhibitor manufactured by U.S. Borax and Chemical Corporation.

(8) Coat all expose, unpainted surfaces with preservative grease such as petroleum (MIL-C-11796), Class 2.

(9) If additional storage time is required, repeat steps (2) through (8) at yearly intervals; except, it is not necessary to drain the transmission each year. Just add VCI #10 and Biobor JF (or equivalents).

e. Restoring Transmission to Service.

(1) Remove all tape from openings and the breather.

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

(3) If the transmission is new, drain the residual preservative oil. Refill the transmission to the proper level (para 3-7) with Dexron or Dexron II transmission fluid.

(4) If the transmission was prepared for storage without oil, drain the residual oil and replace the oil filter elements. Refill the transmission to the proper level with Dexron or Dexron II transmission fluid.

(5) If the transmission was prepared for storage with oil, it is not necessary to drain and refill the transmission with new transmission fluid. Check for proper fluid level (para 3-3). Add or drain transmission fluid as required to obtain the proper level.

3-14. RETAINING OUTPUT FLANGE

a. Before removing the retaining nut, check the number of notches that have been cut into the wrenching flats. If there are five notches, remove the nut and throw it away.

b. 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.

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

- 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).

d. Each time the nut is reused, deeply scri6e one of the wrenching flats. This method of marking the nut will indicate how many times the nut has been reused.

e. Before installing the retainer nut, coat the threads of the nut with molybdenum disulfide grease. Install the flange retaining washer and nut.

CAUTION

The use of an impact wrench requires a means to hold the flange. Failure to hold the flange can cause internal damage to the transmission.

f. Tighten the nut 600-800 lb ft. (814-1085 N-m).

3-15. OUTPUT SEAL AND BEARING REPLACEMENT IN VEHICLE

a. Removal (Foldout 2)

(1) Disconnect the vehicle drive shaft and remove the flange (refer to para 3-14). Remove the speedometer driven gear from the rear cover.

(2) Remove the oil seal as described in paragraph 6-26a,(2).

(3) Remove the snapring that retains the output bearing.

(4) Using puller tools J-24420 and J-24534, remove the rear bearing (fig. 3-5).

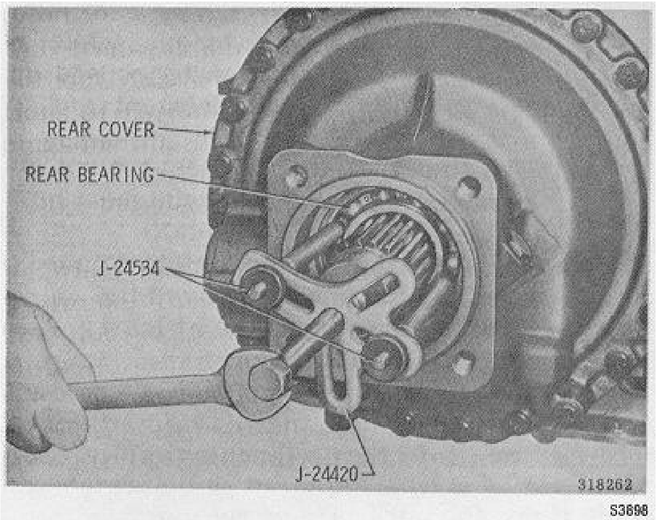

Fig. 3-5. Removing rear bearing

The legs of the bearing remover are designed to lock between the inner and outer races of the bearing. Do not force the feet of the legs into position. Forcing may damage the races.

(5) Remove the spacer and speedometer drive gear from the output shaft.

b. Installation (A, foldout 20)

(1) Install speedometer drive gear 24, spacer 25 and output bearing 35 onto the output shaft. Use installer J-24447 and driver handle J-24202-4 to seat the bearing.

(2) On assemblies prior to S/N 5660, install beveled snapring 34 (bevel toward rear of transmission). On later transmissions, the snapring is not beveled. Be sure the proper snapring is used and that it is fully expanded into the groove.

(3) Pack the rear oil seal with high temperature grease that conforms to MILG-3545A. Place the seal on oil seal installer J-24202-1 sealing lip facing installer. Attach handle J-24202-4. Apply a non-hardening sealer (Perfect Sealer No. 4 or equivalent) onto the outer surface of the rear oil seal. Pre-coated seals do not require sealer on the O.D.

(4) Insert the seal installer and the seal into the rear cover and drive the seal into the bore until its rearward surface is 0.60 to 0.70 inch (15.2 to 17.8 mm) in front of the parking brake mounting surface plane.

(5) Coat the outer circumference of the dust shield with non-hardening sealer. Install the shield, flat side first, into the rear cover. Press the shield flush to 0.04 inch (1.02 mm) below the surface.

(6) Install the output flange and retainer nut per paragraph 3-14. Install the speedometer driven gear into the cover.

3-16. REPLACING MANUAL DISCONNECT OUTPUT SEAL

a. Remove Seal

(1) Disconnect the equipment drive shaft from the output flange.

(2) Remove the two bolts lockstrip and shims that secure the flange retainer to the output shaft. Remove the flange retainer.

(3) Using a puller, remove the output flange.

(4) Using seal remover J-24171-1, 2 and 4, remove the oil seal from the disconnect housing.

b. Install Seal

(1) Before installing the lip-type seal, refer to paragraph 4-6 f for seal preparation. Install oil seal 18 or 50 (A, foldout 23) or 6 (B, foldout 23) spring-loaded lip first. Use installer J-24202-1 and driver handle J-24202-4 to seat the seal against the shoulder in the housing.

(2) Install the output flange onto the shaft.

(3) Install retainer 21 or 53 (A, foldout 23) or 3 (B, foldout 23) and two bolts 23 or 55 (A, foldout 23) or 1 (B, foldout 23).

Tighten the bolts sufficiently to ensure the flange is firmly seated on the shaft; then remove the two bolts and retainer.

(4) Measure the distance from the counterbored surface of the output flange to the end of the output shaft. Select a combination of shims 19 and 20 or 51 and 52 (A, foldout 23) or 4 and 5 (B, foldout 23) that will be 0.008 to 0.012 inch (0.20 to 0.30 mm) less than the measured dimension.

(5) Install the selected shims, retainer, lockstrip 22 or 54 (A, foldout 23) or 2 (B, foldout 23) and two bolts for each flange. Tighten the bolts to 96-115 lb ft (130-156 N-m). Bend a corner of the lockstrip against each bolt head.

(6) Connect the equipment drive shaft to the output flange.

3-17. CHECKING OIL PRESSURES

Oil pressures may be checked during operation of the transmission to assist in the location of malfunctions. Pressure check points are shown in figures 3-6 thru 3-9. Make pressure tests in conjunction with troubleshooting procedures outlined in paragraphs 3-17 thru 3-21. Refer to paragraph 1-6 for pressures.

3-18. TROUBLESHOOTING-BEFORE REMOVAL OR OPERATION

a. Visual Inspection. Do not operate the vehicle prior to completing the procedures described in this paragraph. Inspect for oil leakage. Visually inspect all splitlines, plugs, all hose and tube connections at the transmission and cooler. Oil leakage at splitlines may be caused by loose mounting bolts or defective gaskets. Tighten all bolts, plugs, and connections where leakage is found. Check to ensure that the modulator control cable and linkage are free.

b. System Knowledge. The engine and transmission must be regarded as a single package during troubleshooting. A thorough study of the description and operation of the components and hydraulic system will be helpful in determining the cause of trouble.

3-19. TROUBLESHOOTING-DURING OPERATION

a. Determine Trouble Cause. If inspection (para 3-18a, above) does not reveal the cause of trouble, and the vehicle is operational, further troubleshooting is necessary. Do not remove the transmission from the vehicle until the causes of trouble are checked against the troubleshooting chart (para 3-21, below).

b. Properly Tuned Engine. To make a thorough test of the vehicle-mounted transmission, be sure that the engine is properly tuned and that the oil level in the transmission is correct. (Refer to para 3-3 for checking oil level.)

3-20. TROUBLESHOOTING-AFTER REMOVAL

When the malfunction of a transmission was not detected by tests or inspections before removal from the vehicle, the transmission may be mounted in a test stand and checked (if a test stand is available). Particular attention should be given to proper oil level in every transmission test.

3-21. TROUBLESHOOTING

The troubleshooting information, below, outlines the possible causes of transmission troubles and their remedies. Capital letters indicate the symptom; numerals following the symptom indicate several possible causes; corresponding numerals in the right column indicate remedies for the causes.

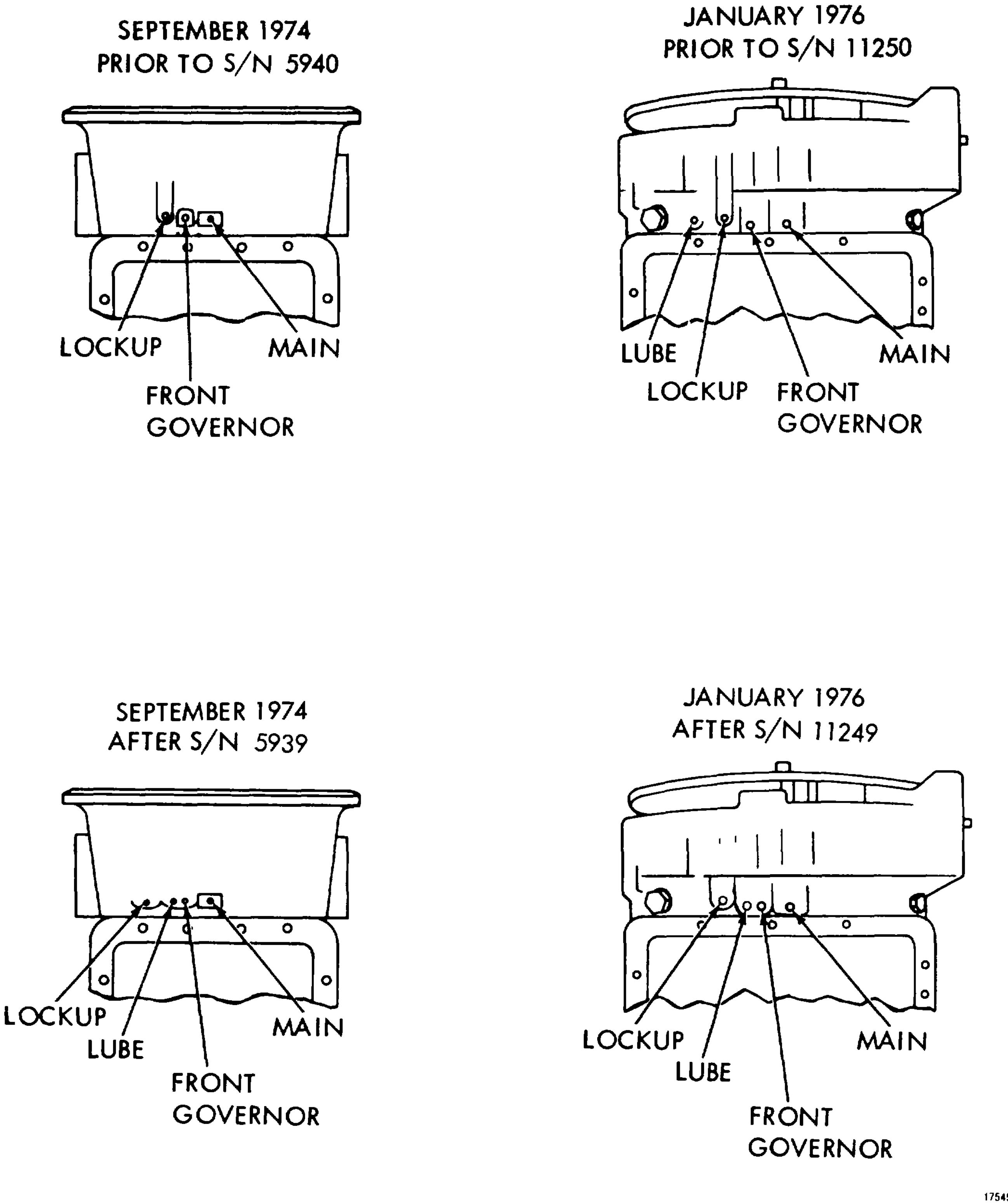

Fig. 3-6. Transmission check points-without retarder

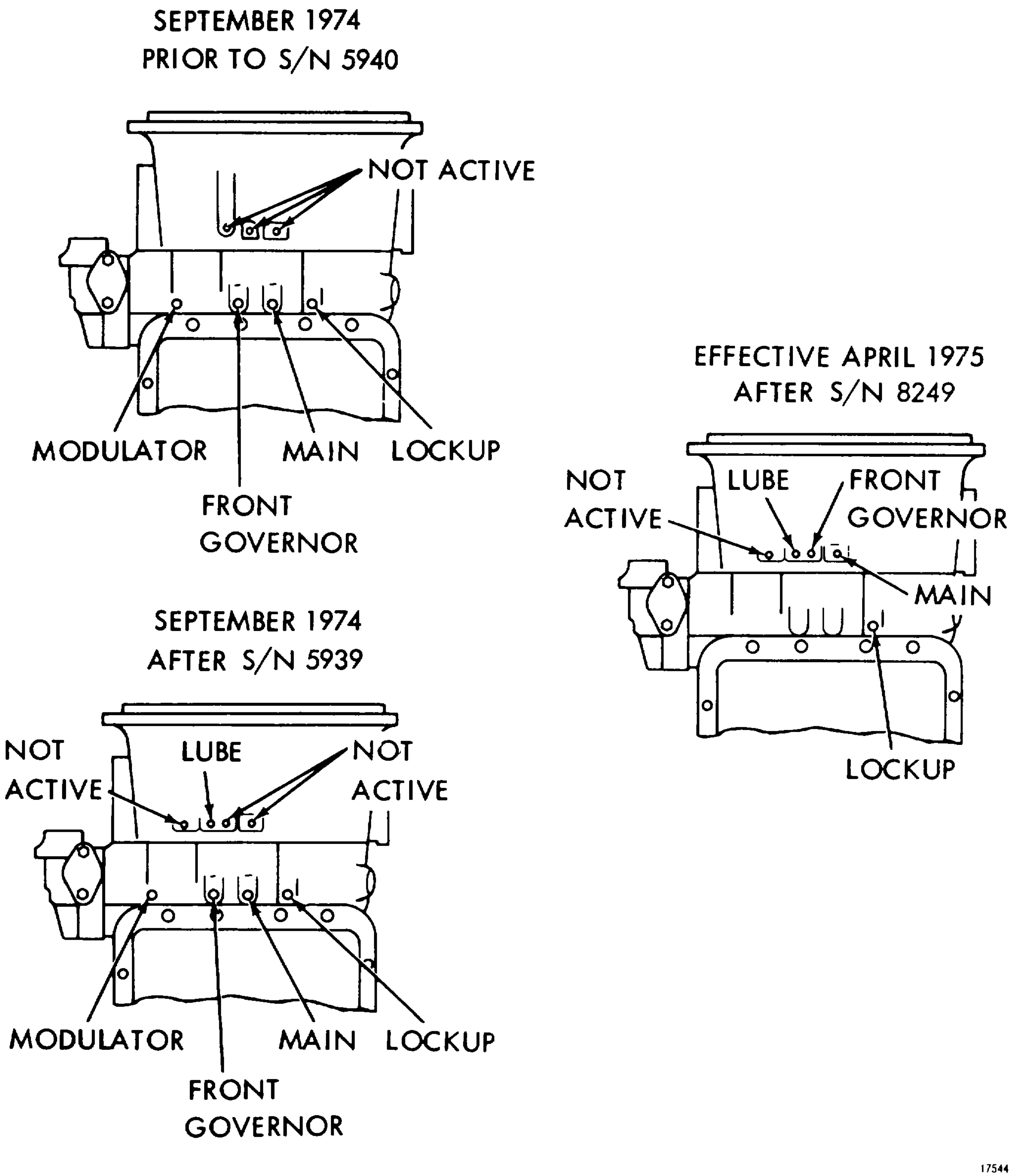

Fig. 3-7. Transmission check points - with retarder

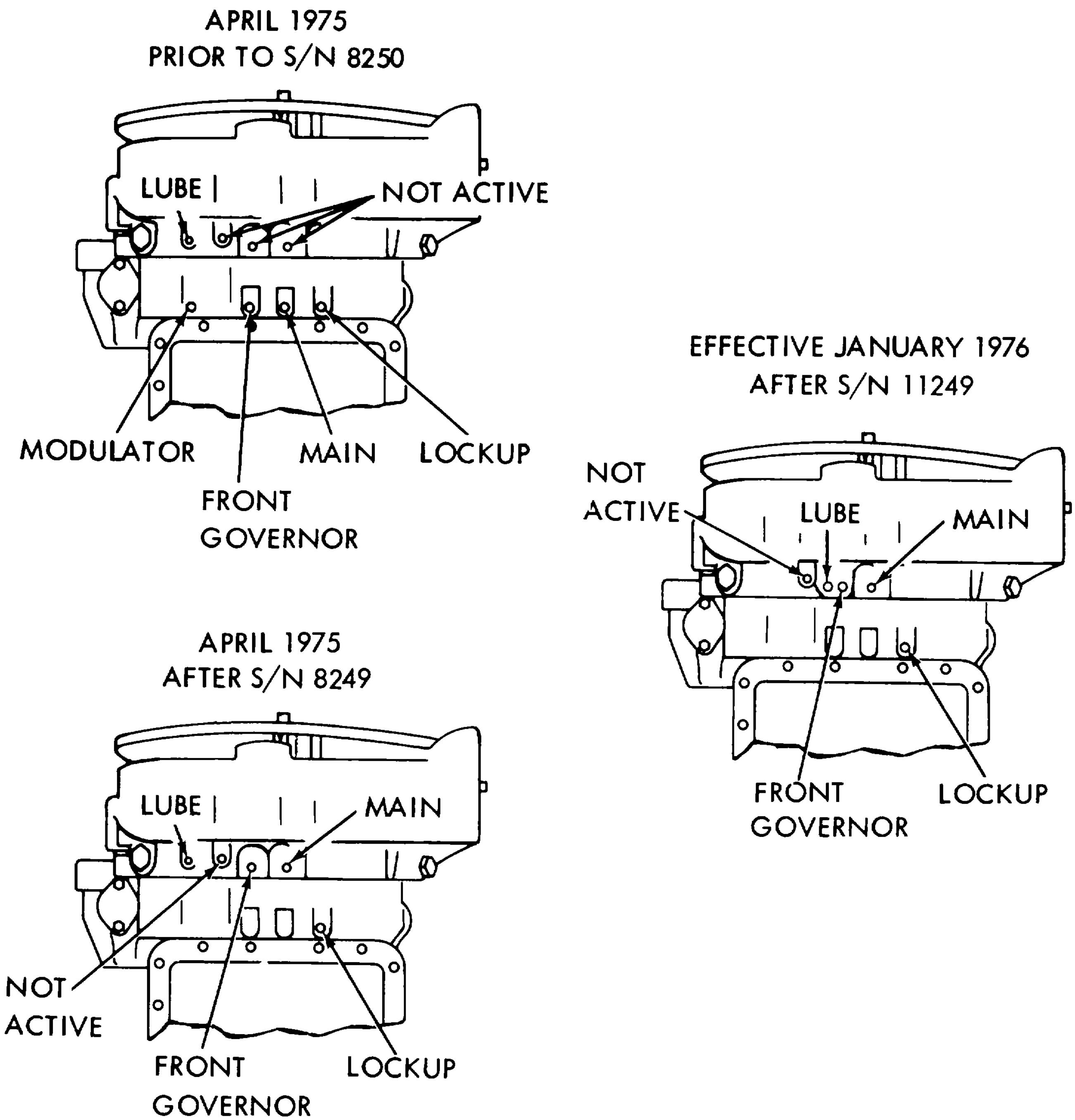

Fig. 3-8. Transmission check points - with retarder and engine-driven PTO

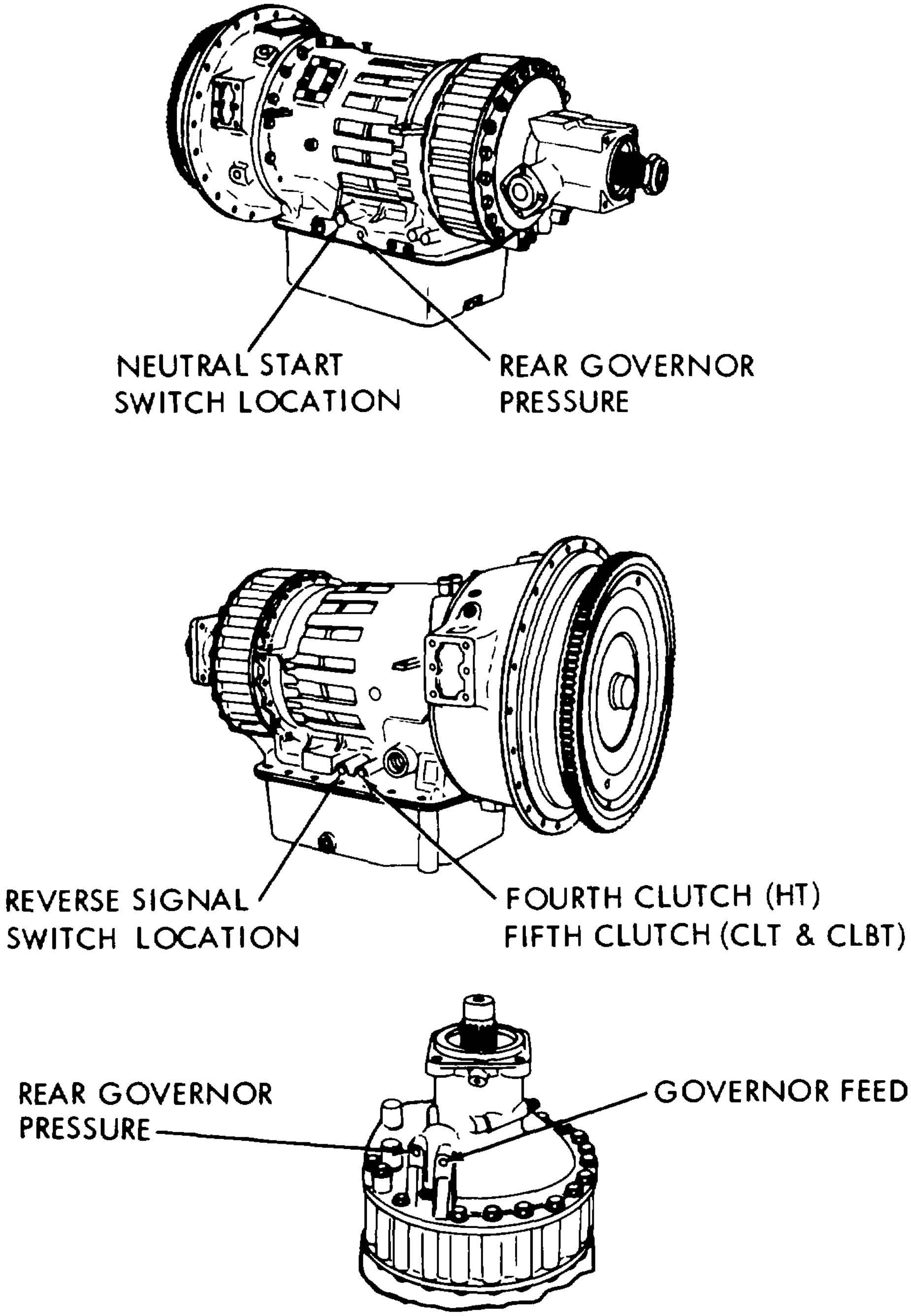

Fig. 3-9. Transmission check points - all models

Table 3-1. TROUBLESHOOTING CHART

Cause	Remedy
A AUTOMATIC SHIFTS OCCUR AT TOO HIGH SPEED	
1. Governor valve stuck	1. Clean or replace governor
2. Shift signal valve spring adjustment too tight	2. Back off spring adjusting ring (para 6-4)
3. Valves sticking	3. Overhaul valve body assembly (para 6-4)
4. Shift points not properly adjusted	4. Refer to paragraph 3-12
B AUTOMATIC SHIFTS OCCUR AT TOO LOW SPEED	
1. Governor valve stuck	1. Clean or replace governor
2. Governor spring weak	2. Replace governor
3. Shift signal valve spring adjustment too loose	3. Tighten spring adjusting ring (para 6-4)
4. Modulator valve stuck	4. Clean or replace modulator valve (para 6-4)
5. Shift points not properly adjusted	5. Refer to paragraph 3-12
C LOW MAIN PRESSURE IN ALL RANGES	
1. Low oil level	1. Add oil to proiper level (para 3-3)
2. Oil filter element clogged	2. Replace filter
3. Sealring at oil intake pipe (filter output) leaking or missing	3. Replace sealring
4. Main-pressure regulator valve spring weak	4. Replace spring
5. Control valve body leakage	5. Replace or rebuild valve body assembly
6. Valves stuck (trimmers, relays, and main-pressure regulator)	6. Overhaul valve body assembly, main-pressure regulator valve
7. Oil pump, worn or damaged	7. Replace or rebuild oil pump
D LOW MAIN PRESSURE IN ONE OPERATING RANGE, NORMAL IN OTHER RANGES	
1. Leakage in clutch apply circuits for specific range	1. Replace or rebuild valve body assembly
2. Excessive leakage at clutch piston seals for specific range	2. Overhaul transmission and replace piston seals
E EXCESSIVE CREEP IN FIRST AND REVERSE GEARS	
1. Idle throttle setting too high vehicle manual)	1. Adjust throttle setting (refer to
F LOW LUBRICATION PRESSURE	
1. Oil level low	1. Add oil to proper level (para 3-3)
2. Excessive internal oil leakage lubrication valve seat and spring; low main pressure (refer to C)	2. Check the valve body mounting bolts;
3. Cooler lines restricted or leaking	3. Reroute or replace as necessary
4. Lubrication valve spring weak	4. Replace valve spring

Table 3-1. TROUBLESHOOTING CHART (cont)

Cause	Remedy
G OIL LEAKING INTO CONVERTER HOUSING	
1. Converter pump hub seal worn	1. Replace seal
2. Converter pump hub worn at seal area	2. Replace pump hub
3. Engine rear seal worn	3. Refer to engine (or vehicle) service manual
H TRANSMISSION OVERHEATING IN ALL RANGES	
1. Oil level low	1. Add oil to proper level (para 3-3)
2. Oil level high	2. Drain oil to proper level (para 3-3)
3. Cooler restricted (oil or coolant side)	3. Remove restrictions
I NO RESPONSE TO SHIFT LEVER MOVEMENT	
1. Range selector linkage disconnected	1. Connect linkage (refer to vehicle service manual)
2. Range selector linkage defective or broken	2. Repair or replace linkage (refer to vehicle service manual)
3. Main pressure low	3. Refer to C, above
4. Range selector not engaged at control valve	4. Install or replace parts involved (inside oil pan)
J ROUGH SHIFTING	
1. Manual selector linkage out of adjustment	1. Adjust linkage
2. Control valves sticking	2. Replace or rebuild control valve assembly (para 6-4)
3. Modulator valve sticking; spring adjustment too tight	3. Repair or replace valves; back off spring adjustment (para 6-4)
4. Modulator actuator cable kinked or out of adjustment	4. Replace or adjust actuator cable (refer to vehicle service manual)
K DIRTY OIL	
1. Failure to change oil at proper interval	1. Change oil, install new filter (para 3-8)
2. Heat excessive	2. Refer to H
3. Clutch failure	3. Overhaul transmission
4. Damaged oil filter	4. Replace filter (para 3-8)
L OIL LEAKING AT OUTPUT SHAFT	
1. Oil seal at output flange worn or damaged	1. Replace seal
2. Flange worn at seal surface	2. Replace flange

Table 3-1. TROUBLESHOOTING CHART (cont)

	Cause		Remedy
M	HIGH STALL SPEED (refer to para 3-13)		
1.	Oil level low	1.	Add oil to proper level (para 3-3)
2.	Clutch pressure low	2.	Refer to D
3.	Forward clutch slipping	3.	Rebuild forward clutch (para 6-17)
4.	First clutch slipping	4.	Rebuild first clutch (para 7-3 or 7-4)
5.	Fourth clutch slipping (reverse)	5.	Rebuild fourth clutch (para 6-18)
6.	Low clutch slipping (5 speed)	6.	Rebuild low clutch (para 7-4)
N	LOW STALL SPEED (refer to para 3-13)		
1.	Engine not performing efficiently (may be due to high altitude)	1.	Refer to engine manufacturer's manual or vehicle service manual
2.	Broken converter parts	2.	Replace converter assembly
O	CLUTCH SLIPPAGE IN ALL FORWARD GEARS		
1.	Oil level low	1.	Add oil to proper level
2.	Clutch (main) pressure low	2.	Refer to C
3.	Forward clutch slipping piston sealrings	3.	Rebuild forward clutch and replace
4.	Sealrings on front support hub worn or broken	4.	Replace sealrings
P	CLUTCH SLIPPAGE IN FIRST-AND-REVERSE ONLY (HT 740D)		
1.	First clutch slipping	1.	Rebuild clutch and replace piston sealrings
Q	CLUTCH SLIPPAGE IN FIRST AND REVERSE GEARS ONLY (HT 750CRD)		
1.	Low clutch slipping	1.	Rebuild clutch and replace piston sealrings
R	CLUTCH SLIPPAGE IN FIFTH AND REVERSE GEARS ONLY (HT 750CRD, DRD)		
1.	Fourth clutch slipping	1.	Rebuild clutch and replace piston sealrings
S	CLUTCH SLIPPAGE IN ALL FORWARD GEARS, BUT NO SLIPPAGE IN REVERSE (all models)		
1.	Forward clutch slipping	1.	Rebuild clutch and replace piston sealrings
T	CLUTCH SLIPPAGE IN FOURTH AND REVERSE GEARS ONLY (HT 740D)		
1.	Fourth clutch slipping	1.	Rebuild clutch and replace piston sealrings
U	CLUTCH SLIPPAGE IN THIRD GEAR ONLY (HT 740D)		
1.	Third clutch slipping	1.	Rebuild clutch and replace piston sealrings

Table 3-1. TROUBLESHOOTING CHART (cont)

Cause	Remedy
V CLUTCH SLIPPAGE IN SECOND GEAR ONLY (HT 740D)	
1. Second clutch slipping	1. Rebuild clutch and replace piston sealrings
W CLUTCH SLIPPAGE IN FOURTH GEAR ONLY (HT 750CRD, DRD)	
1. Third clutch slipping	1. Rebuild clutch and replace piston sealrings
X CLUTCH SLIPPAGE IN THIRD GEAR ONLY (HT 750CRD, DRD)	
1. Second clutch slipping	1. Rebuild clutch and replace piston sealrings
Y CLUTCH SLIPPAGE IN SECOND GEAR ONLY (HT 750CRD)	
1. First clutch slipping	1. Rebuild clutch and replace piston sealrings
Z CLUTCH SLIPPAGE IN SECOND AND REVERSE GEARS ONLY (HT 750DRD)	
1. First clutch slipping	1. Rebuild clutch and replace piston sealrings
AA CLUTCH SLIPPAGE IN FIRST GEAR ONLY (HT 750DRD)	
1. Low clutch slipping	1. Rebuild clutch and replace piston sealrings
AB VEHICLE MOVES IN NEUTRAL	
1. Range selector linkage out of adjustment	1. Adjust linkage properly
2. Forward clutch will not release	2. Rebuild forward clutch
3. Fourth clutch will not release	3. Rebuild fourth clutch
AC OIL THROWN FROM FILLER TUBE	
1. Dipstick loose	1. Tighten cap; replace if necessary
2. Oil level too high	2. Drain oil to proper level (para 3-3)
3. Breather clogged	3. Clean or replace breather
4. Dipstick gasket worn	4. Replace gasket or dipstick
5. Improper dipstick marking (high oil level)	5. Replace dipstick

Section 4. GENERAL OVERHAUL INFORMATION

4-1. SCOPE

This section provides information required before proceeding with overhaul of the transmission. Tools and equipment for overhaul are discussed. Information on replacement parts and service kits is provided. The importance of cleanliness and careful handling is stressed. Helpful information on cleaning and inspection is given. General information on the removal and installation of the transmission is given. Torque specifications for bolts and nuts are tabulated. Information on wear limits and spring specifications is referenced.

4-2. TOOLS AND EQUIPMENT

a. Improvised Tools and Equipment. The following items may be improvised:

- Work table-1500-pound (680 kg) capacity (fig. 4-1)
- Overhaul stand (fig. 5-1)
- Pins to retain low sun gear and hub assembly (fig. 4-6)

An improvised tool similar to that shown in fig. 4-6 is recommended. This tool will prevent the accidental loss of one or, more of the cotter pins in the transmission during disassembly or assembly (fig. 5-53).

b. Special Tools. Special tools are illustrated in figures 4-2, 4-3, 4-4 and 4-5. They are identified in the tables following the illustrations.

c. Mechanic's Tools, Shop Equipment. The following tools, in addition to the common tools ordinarily required, should be available:

- Snapring pliers
- Micrometer
- A 3-leg lifting sling of 1/2-ton (454 kg) capacity with 900 angle attaching plates
- Suitable hoist--1/2-ton (454 kg) capacity
- Container of volatile mineral spirits for cleaning parts

CAUTION

Caustic cleaning compounds will damage some transmission parts. Use only mineral spirits.

- A 100-inch pound (11.3 N-m) torque wrench
- A 100-foot pound (136 N-m) torque wrench
- A 1000-foot pound (1356 N-m) torque wrench
- A hot plate or heating equipment (for heating bearings or other interference-fit parts to aid assembly)
- A press for disassembly and assembly of spring-loaded clutches, valves, and interference-fit parts
- Clean shop cloths (do not use waste)
- Boxes, receptacles for parts
- Supply of wood blocks
- Oil-soluble, non-fibrous grease (petrolatum)
- Nonhardening sealer, Permatex No. 2, or equivalent (for plugs, seals, etc.)

4-3. REPLACEMENT PARTS

a. Ordering Information. Refer to the current issue of Parts Catalog SA 1268 for parts information.

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

- Gaskets
- Lockstrips
- Washers or snaprings damaged by removal
- Oil seals, piston sealrings

WARNING

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

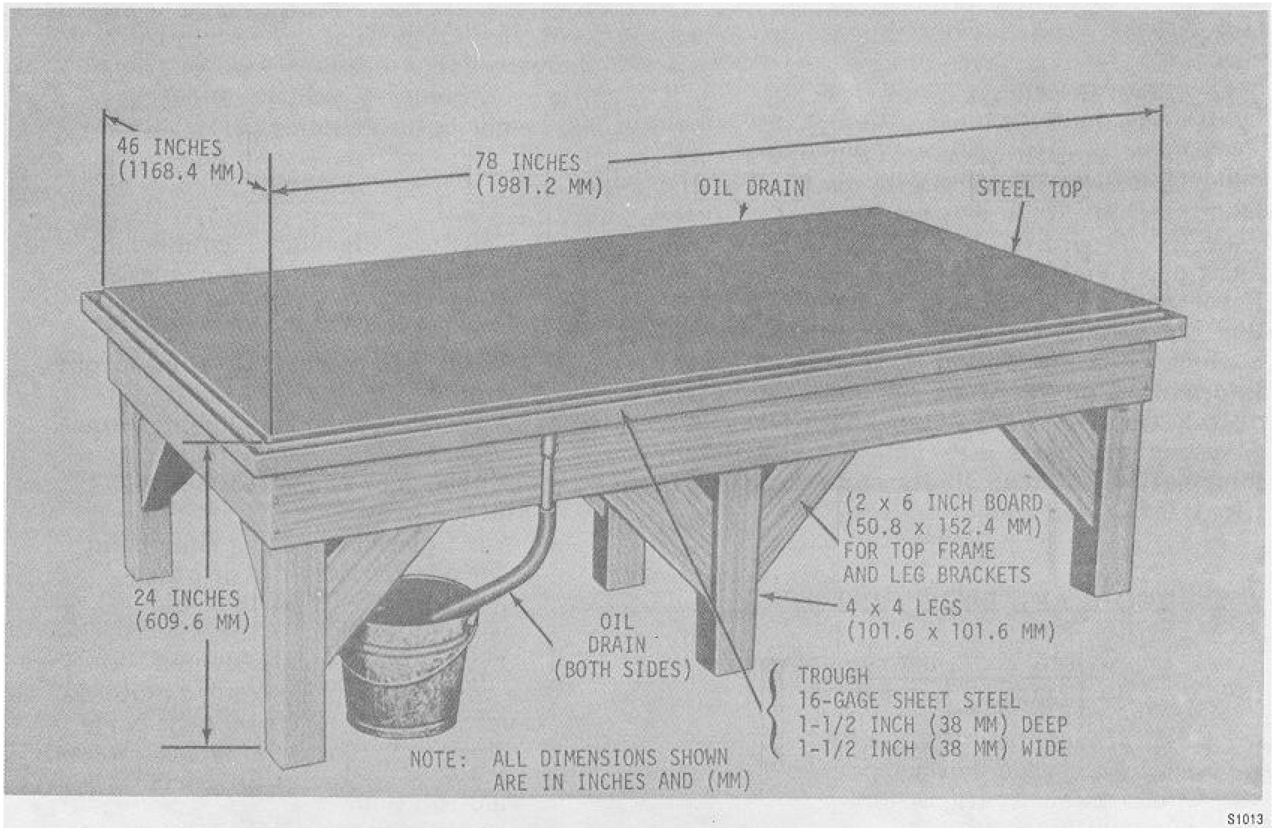

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Fig. 4-1. Work table

4-4. CAREFUL HANDLING

During all rebuild procedures, parts and subassemblies must be handled carefully to prevent nicking, scratching a n d denting. Parts which fit together closely and have proper operating clearance can bind if damaged. Parts which depend upon smooth surfaces for sealing may leak if scratched. This is very important concerning parts of the control valve body assembly (valves, when dry, must move freely by their own weight). Such parts should be carefully handled and protected during removal, cleaning, inspection and installation as well as being kept clean while in containers awaiting installation.

4-5. CLEANING, INSPECTION

a. Dirt Causes Malfunction. All parts must be clean to permit effective inspection. At assembly, it is very important that no dirt or foreign material be allowed to enter the transmission. Even minute particles can cause the malfunction of close-fit parts, such as valves.

b. Cleaning Parts

(1) All the metallic p a r t s of the transmission except bearings and frictionfaced clutch plates should be cleaned thoroughly with volatile mineral spirits or by the steam-cleaning method. Do not use caustic soda solution for steam cleaning. Use only mineral spirits to clean friction-faced clutch plates.

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

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

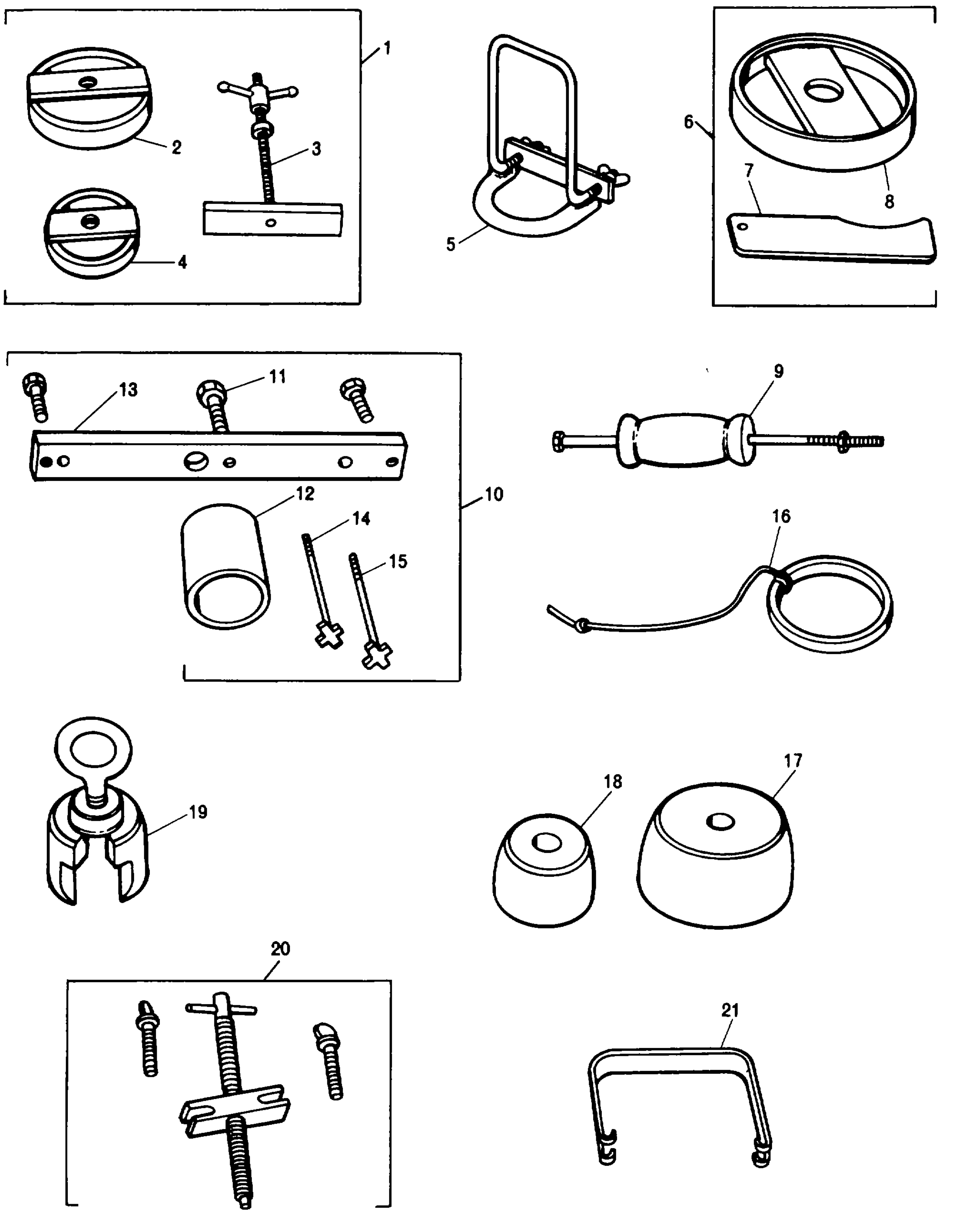


Fig. 4-2. Special tools (1 through 21)

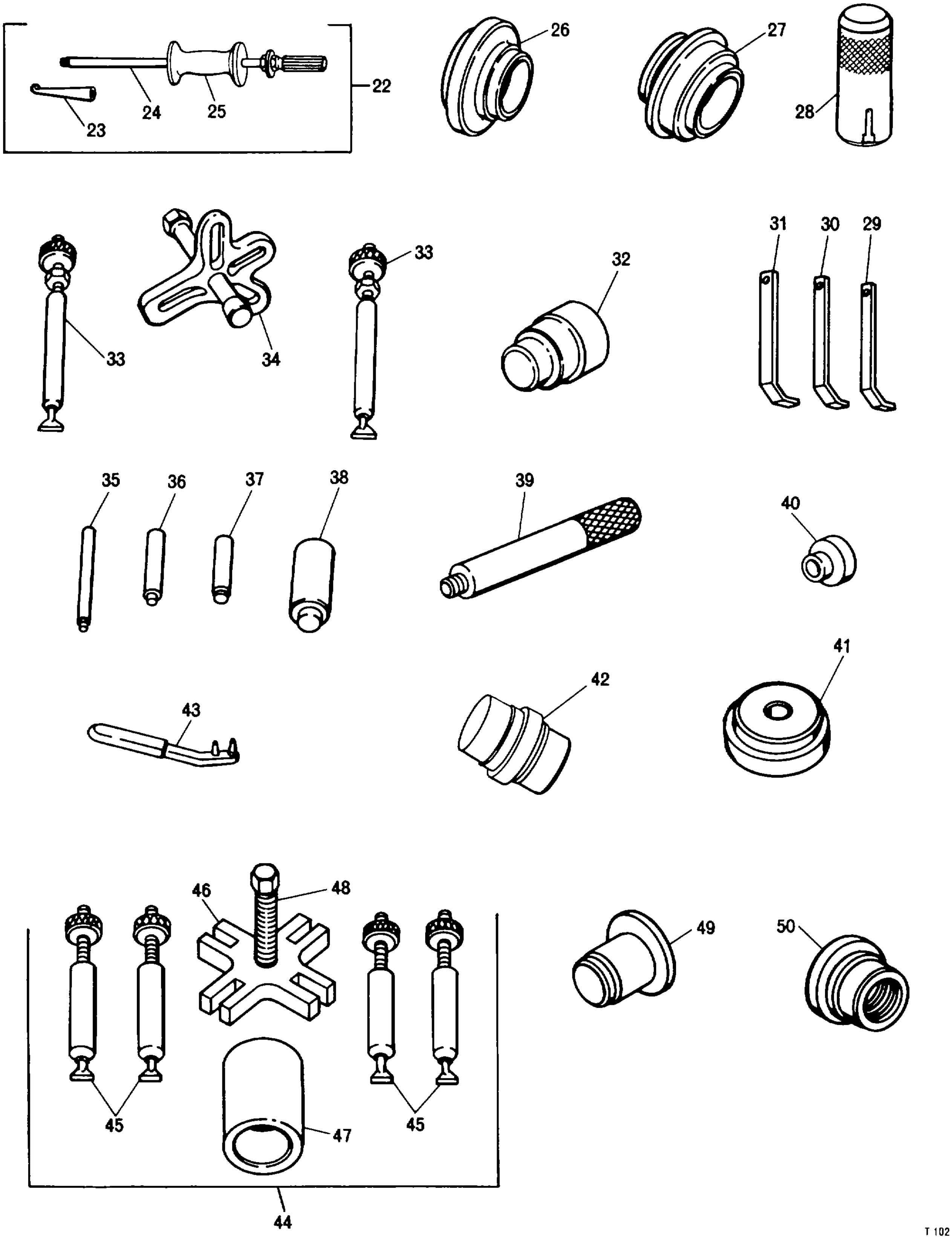


Fig. 4-3. Special tools (22 through 50)

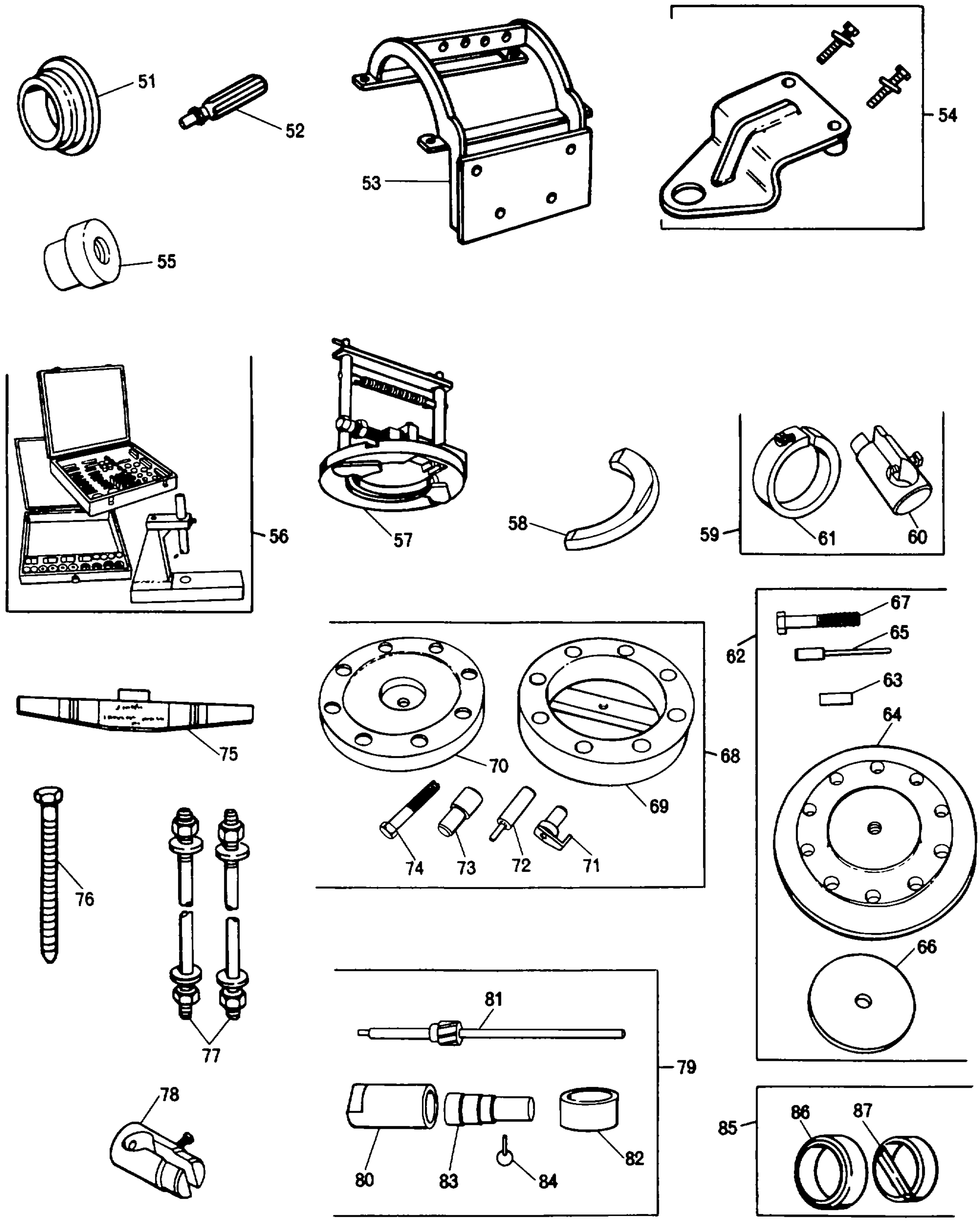


Fig. 4-4. Special tools (51 through 87)

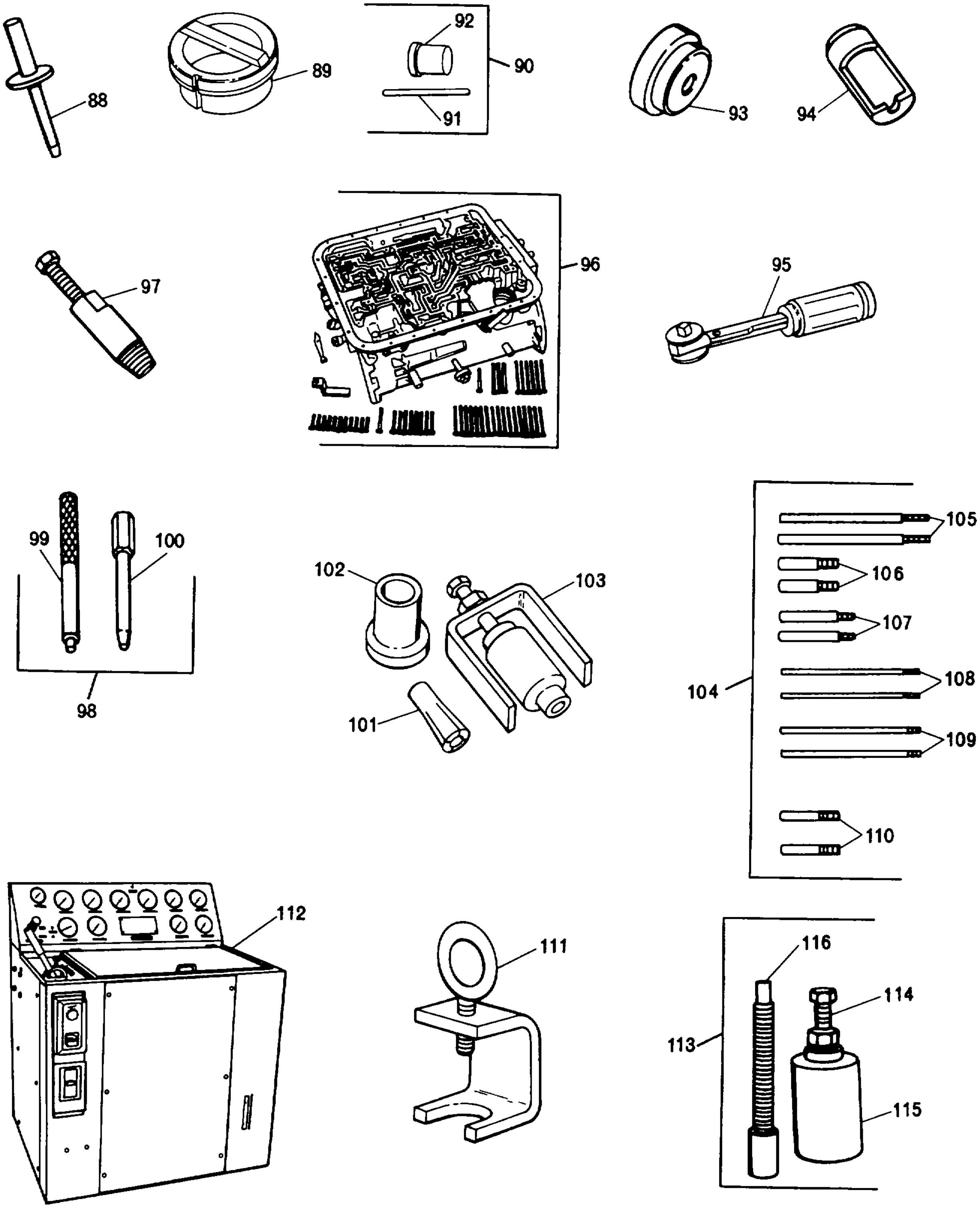


Fig. 4-5. Special tools (88 through 116)

SPECIAL TOOLS

Tool No.	Fig.	Item	Description	Ref. Paragraph
J-1126	4-5	106	Converter housing guide screws 1/2-13 (part of J-24315)	7-12a(4)
J-3387-2	4-5	107	Oil pan guide screw 5/16-18 X 3 (2) (part of J-24315)	5-6a(2), 7-16b(6)
J-6125-1	4-2	19	Slide hammer (used with J-24205-2 and J-24412-2)	6-26a(11)
J-6889-1	4-5	109	Pitot tube guide screw #10-32 X 6 (2) (part of J-24315)	7-12a(5), 7-13a(4)
J-8092	4-3	39	Driver handle (used with J-24371, J-24197, J-24769, J-24368)	6-10b(11), (16)
J-8433-1	4-4	75	Puller body	5-8a(12)
J-8646-2	4-3	48	Puller body screw	5-8a(12)
J-22214-4	4-4	76	Forcing screw	5-8a(12)
J-23544-A	4-5	113	Idler gear spindle puller set	6-28a(5)
J-23544-1	4-5	114	Idler gear spindle puller screw 1/2-20 thread	6-28a(5)
J-23544-2	4-5	115	Idler gear spindle remover	6-28a(5)
J-23544-5	4-5	116	Idler gear spindle puller screw 1 1/4-12 thread	6-28a(5)
J-24171	4-3	22	Seal and dust shield remover	3-16a(4), 6-26a(1), (2)
J-24171-1	4-3	23	Jaw attachment	3-16a(d), 6-26a(1), (2)
J-24171-2	4-3	24	Rod assembly	3-16a(4), 5-8c(2), 6-26a(1),(2)
J-24171-4	4-3	25	Slide hammer	3-16a(4), 5-8c(2), 6-26a(1),(2)
J-24192	4-3	29	Clutch pack clearance gage (forward, fourth)	6-17b(13)
J-24193	4-3	30	Clutch pack clearance gage (third)	7-11 a(4)
J-24194	4-3	31	Clutch pack clearance gage (first, second, low)	7-3a(5), c(5), 7-4a(6),(7), c(6)
J-24195	4-2	5	Center support lifting bracket	5-12a(3), 5-15b(3), 7-3b(3),(5), 7-4b(3), (5),7-6a(7), b(6), 7-8a(1),-b(2), 7-10a (2),-b(2) -
J-24196	4-2	19	Main shaft lifting bracket	5-12-b(1), 5-15b(6), 7-8a3), a(7)
J-24197	4-3	32	Front support needle bearing installer	6-10b(1)
J-24198	4-3	26	Oil pump and dust shield installer (used with J-24202-4)	6-10b(15), 6-26b(14)
J-24200	4-2	6	Collector ring installer and staking set	6-17b(4),(5)
J-24200-1	4-2	7	Staking tool	6-17b(5)
J-24200-2	4-2	8	Collector ring installer	6-17b(4)
J-24201	4-3	42	Sun gear shaft bushing installer	6-20b(3)
J-24202-IA	4-3	27	Output shaft seal installer (used with J-24202-4)	3-15b(3), 3-16b(l), 6-26b(13)
J-24202-4	4-3	28	Driver handle (used with items J-24198, J-24202-1, J-24447)	3-15b(1),(3), 3-16b (1), 6-10b(15), 6-26b(13)

SPECIAL TOOLS

Tool No.	Fig.	Item	Description	Ref. Paragraph
J-24203	4-3	38	Output shaft bushing installer	6-26b(10)
J-24204	4-2	1	Clutch spring compressor set	6-29a(4)
J-24204-1	4-2	2	Low and first clutch spring compressor	6-26a(8), b(8)
J-24204-2	4-2	3	Bar and stud assembly	6-18a(6), b(14) 6-26a(8), b(8)
J-24204-3	4-2	4	Forward & fourth clutch spring compressor	6-17a(11), 6-18a(6), b(14)
J-24205-A	4-5	98	Speedometer driven gear bushing remover and installer set	6-26b(4)
J-24205-1	4-5	99	Speedometer driven gear bushing installer	6-26b(4)
J-24205-2	4-5	100	Speedometer driven gear bushing remover	6-26a(11)
J-24207	4-3	41	Front planetary bushing sleeve installer	6-23c(5)
J-24208-D	4-2	10	Center support compressor set	
J-24208-1	4-2	11	Compressor bolt	7-3b(7), 7-4b(7)
J-24208-2	4-2	12	Compressor sleeve	7-3b(6),(9), 7-4b(6),(9)
J-24208-3	4-2	13	Compressor bar (bar is also used as gear pack support)	5-15a(2), b(10), 7-3b(6),(9), 7-4b(6),(9), 7-6a(5)
J-24208-25	4-2	15	Selective snapring gage assembly	7-3b(7), 7-4b(7)
J-24209	4-2	21	Fourth clutch lifting fixture	5-11a(5), 7-11a (6) Note
J-24210	4-2	17	Low and first clutch piston inner seal protector	6-26b(6), 6-29b(6)
J-24216-01	4-2	18	Forward clutch piston inner seal protector	6-17b(17)
J-24217	4-3	36	Main shaft orifice installer	NR
J-24218-2	4-2	16	Stator cam spring and roller retainer ring	6-4c(3)
J-24219	4-2	20	Lockup valve and main pressure regulator spring compressor	6-10a(6), b(1) Note
J-24221	4-5	89	Fourth clutch alignment fixture	7-11b(2)
J-24310	4-4	53	Transmission holding fixture	5-2a(1)
J-24314	4-3	43	Valve ring adjusting tool	3-10b(2)
J-24315	4-5	104	Guide pin set - consists of two: J-1126, J-3387-2, J-6889-1, J-24315-1, J-24315-2, J-24315-3	
J-24315-1	4-5	108	Oil pump guide screw 3/8-16 x 6 (2)	6-10b(21)
J-24315-2	4-5	110	Flywheel guide screw, 3/8-24 x 2 (2)	5-5a(3) Note 7-18a(2), 7-18b(1), (4)
J-24315-3	4-5	105	Valve body guide screw, 1/4-20 x 5 (2)	5-7b(2), 7-17a(1), (5),-7-16a(1)
J-24365	4-4	54	Flywheel lifting bracket	5-5a(3), 7-18a(3)
J-24368	4-3	49	Rear planetary carrier bushing installer	
J-24369	4-3	35	Orifice plug output shaft installer	6-20c(1), 6-21b(1), 6-26b(1), 6-29b(11)

NR - Not referenced in paragraph

SPECIAL TOOLS

Tool No.	Fig.	Item	Description	Ref. Paragraph
J-24371	4-5	93	Low sun gear bushing installer	6-24
J-24412-2	4-5	94	Valve pin remover (used with J-6125-1)	
J-24420-1	4-3	34	Universal puller body (used with J-24534)	3-15a(4)
J-24447	4-4	51	Rear bearing installer (used with J-24202-4)	3-15b(1)
J-24453	4-4	52	Retaining ring installer	6-19b(2), 6-25b(4)
J-24534	4-3	33	Rear bearing puller legs (2) (used with J-24420)	3-15a(4)
J-24769	4-3	40	Output shaft bushing installer (HT 750DRD, used with J-8092)	6-26b(10)
J-25000-1	4-5	112	Valve body and governor test stand	3-10a(2)
J-25000-227	4-5	96	Valve body test stand adapter	NR
J-25007	4-3	44	Torque converter pump bearing puller	5-8a(8)
J-25007-2	4-3	45	Leg and nut assembly (4)	5-8a(10)
J-25007-3	4-3	46	Puller body	5-8a(11)
J-25007-4	4-3	47	Sleeve	5-8a(9),(12),(15),(17)
J-25562	4-3	50	Output shaft needle bearing installer (used with J-8092)	6-29b(12)
J-25587-01	4-4	56	Planetary rebuilding set	6-23b Note
J-26282	4-3	37	Shift lever seal installer	6-27b(1)
J-26401	4-5	97	Shift lever seal remover	NR
J-26598-A	4-4	57	Converter pump snapring remover & installer	5-8a(3),(7), 7-15a (4)
J-26899	4-4	85	PTO gear removing fixture set	6-17a(11)
J-26899-1	4-4	87	Inner ring driver	6-17a(26)
J-26889-2	4-4	86	Outer ring support	6-17a(26)
J-26901-A	4-4	77	Puller bolts - 3/8-24 thread	5-8a(12)
J-26997-A	4-4	59	Sun gear bushing swaging tool set	6-20b(5)
J-26997-1	4-4	60	Swaging tool	6-20b(5)
J-26997-2	4-4	61	Collar	6-20b(5)
J-28489	4-4	79	Sun gear bushing reamer set	6-20b(6),(7)
J-28489-1	4-4	80	Sun gear shaft pilot	6-20b(6),(7)
J-28489-2	4-4	81	Reamer and shaft assembly	6-20b(6),(7)
J-28489-3	4-4	82	Holding fixture	6-20b(6),(7)
J-28489-4	4-4	83	Bushing pilot body	6-20b(6),(7)
J-28489-6	4-4	84	Self-locking pin	6-20b(6),(7)
J-28525	4-5	90	Center support bushing installer & staking set	6-19b(1)
J-28525-1	4-5	91	Center support bushing staking tool	6-19b(1)
J-28525-2	4-5	92	Center support bushing installer	6-19b(1)
J-28557	4-4	78	Front support rear bearing remover	6-10a(10)
J-28646-A	4-4	55	Charging pump bearing installer	6-10b(16)
J-28684	4-5	88	Governor support pin installer	6-26b(3)
J-29121	4-4	62	Stator rivet or set	6-4b
J-29121-1	4-4	63	Rivet punch staker	6-4b(3)
J-29121-2	4-4	64	Base plate	6-4b(3),(13)
J-29121-3	4-4	65	Rivet remover pin	6-4b(5)
J-29121-4	4-4	66	Top plate	6-4b(3),(13)

NR - Not referenced in paragraph

SPECIAL TOOLS

Tool No.	Fig.	Item	Description	Ref. Paragraph
J-29198-3	4-4	58	Sealring groove gage	6-10a(14), 6-19a(7)
J-29535	4-4	68	Turbine hub rivet or tool set	6-3b
J-29535-1	4-4	69	Base plate	6-3b(4),(17)
J-29535-2	4-4	70	Guide plate	6-3b(5),(8),(18)
J-29535-3	4-4	73	Staking tool	6-3b(21)
J-29535-4	4-4	72	Rivet remover tool	6-3b(10)
J-29535-5	4-4	71	Drill guide	6-3b(8)
J-29612	4-5	95	Valve body torque wrench	NR
J-33079	4-5	111	Forward clutch and shaft assembly lifter	NR
J-33080-4	4-5	101	Collet	NR
J-33080-7	4-5	102	Height gage	NR
J-33080-20	4-5	103	Bridge assembly	NR
J-33127	4-2	14	Selective snapring gage	7-3b(7), 7-4b(7)
	4-4	67	Bolt, 5/8-11 X 3 1/4	6-4b(3),(13)
	4-4	74	Bolt, 1/2-13 X 3 1/2	6-3b(5),(8),(18)

NR - Not referenced in paragraph

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

c. Cleaning Bearings

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

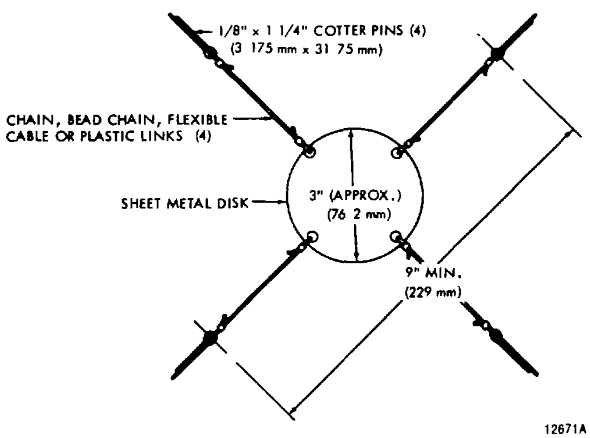


Fig. 4-6. Low sun gear and hub pins

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

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

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 without lubrication can damage the bearing.

d. Keeping Bearings Clean. Since the presence of dirt or grit in ball bearings is usually responsible for bearing failures, it is important to keep bearings clean during removal and installation. 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, lint-free paper.

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

e. Inspecting Cast Parts, Machined Surfaces

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

(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 out with mineral spirits.

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

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

(5) Inspect the ribs inside the main housing for reaction clutch plate wear grooves in the side of the ribs. Replace housings that have wear grooves beyond wear limits. (Refer to wear limits table 8-1.)

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

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

(8) Inspect the oil tracks in the valve body and main housing for porosity, broken lands, cracks, dirt and land surface imperfections. These imperfections will cause severe oil leakage leading to transmission failure. The oil tracks identified in figure 4-7 will assist in locating troubled areas.

f. Inspecting Bearings

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

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

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

(4) When installing a bearing on a shaft, heat the bearing to 2000F (930C) in an oil bath (approximately 30 minutes). Use the proper size installation sleeve and a press to seat the bearing.

(5) When removing a bearing, do not apply pressure across the balls. This can cause brinelling and bearing failure.

(6) If a bearing must be removed or installed without a sleeve, 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 hammer, driving against the supported race.

g. Inspecting Bushings, Thrust Washers

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

CAUTION

When a defective bushing is removed, care should be exercised to prevent damage to the bushing bore.

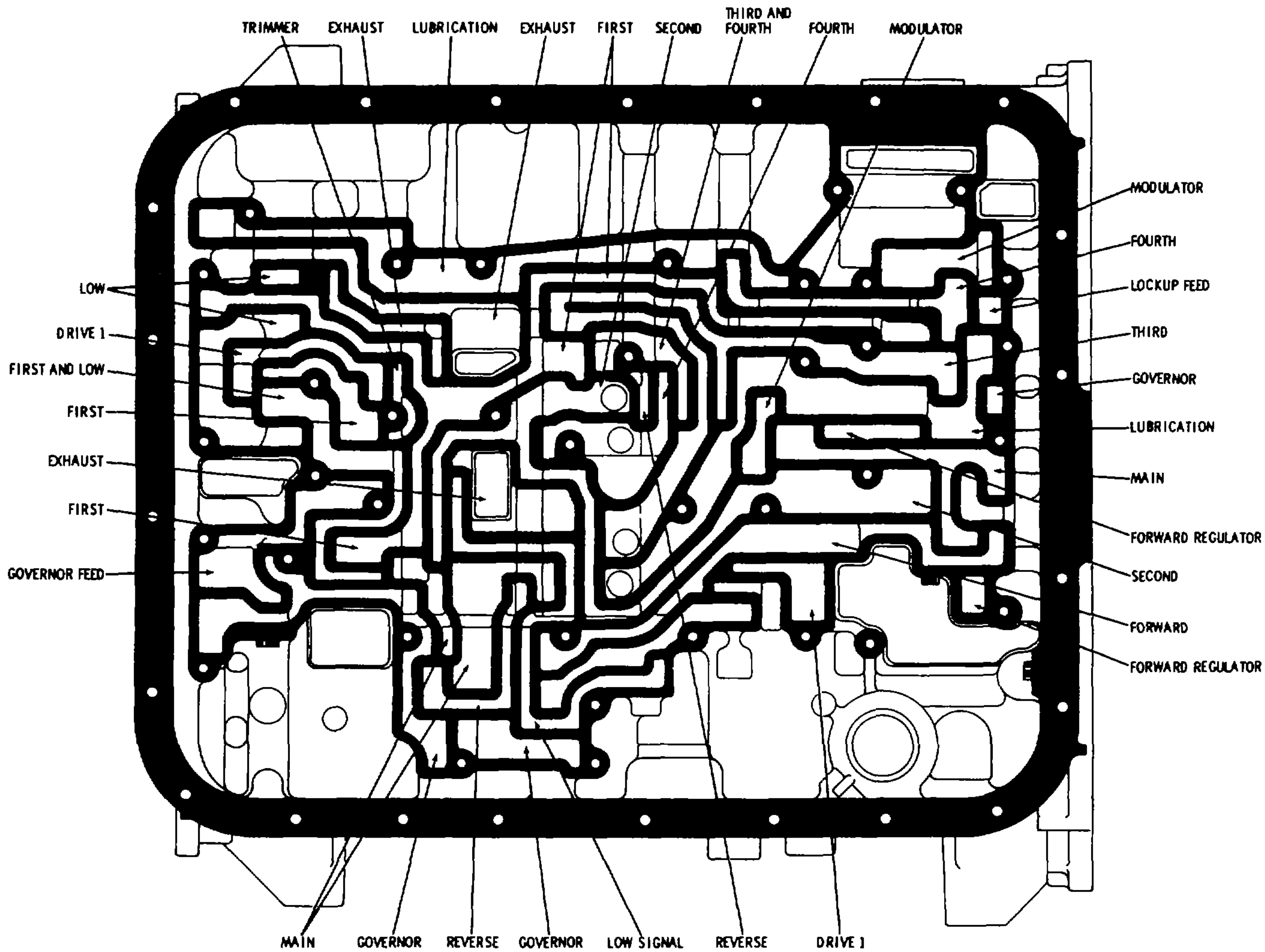


Fig. 4-7. Main housing valve body mounting surface tracks

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

h. Inspecting Sealrings, Gaskets

(1) Inspect piston sealrings and liptype seals for nicks, cuts, tears, splits and pattern damage. Damage on old seal can indicate rough or sharp edges in piston grooves or on mating surface that could also damage new seal.

(2) Replace all composition gaskets.

(3) Inspect 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 diameter, or if there is excessive side wear.

(5) The sides of the sealring must be smooth (0.005-inch (0.13 mm) maximum side wear). The sides of the shaft groove (or the bore) in which the sealring fits should be smooth (50 microinches (1.27 micrometers) equivalent) and square with the axis of rotation within 0.002 inch (0.05 mm). If the sides of the grooves have to be reworked, install a new sealring.

(6) Inspect clutch housing sealring, surfaces for nicks, burrs, dents or displaced, metal that could interfere with mating parts

or damage the piston seal. Remove raised metal, sharp edges, burrs, or nicks with a soft stone and crocus cloth. Thoroughly clean all residue from housing prior to assembly.

(7) Inspect sealring grooves in the piston for nicks, burrs, dents, or displaced metal that could damage the seal. Remove raised metal, sharp edges, burrs, or nicks with a soft stone and crocus cloth. Thoroughly clean all residue from the piston prior to assembly.

i. Inspecting Gears

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

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

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

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

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

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

m. Inspecting Springs. Inspect springs for signs of overheating, permanent set, or wear due to rubbing adjacent parts. Replace the spring if any one of these defects is found. Refer to the spring chart at end of Section 8.

n. Inspecting Clutch Plates

(1) Inspect friction-faced steel plates (internal-splined plates) for burs, embedded metal particles, severely pitted faces, loose facings, 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 (external-tangled plates) for burs, scoring, excessive wear, cone, distortion, imbedded metal, galling, cracks, breaks, and damaged tangs. Remove burs and minor surface irregularities, using a soft-honing stone. Replace plates which have other defects.

(3) The amount of cone in clutch plates is determined by measuring the distance between the inside diameter of the plate and a level surface (fig. 4-8). Discard plates having excessive cone (refer to wear limits, Section 8). When assembling a clutch pack, soak friction-faced clutch plates in transmission fluid for at least 2 minutes and make sure that each plate is installed so that its cone is in the same direction as the cone of the adjacent plates.

o. Inspecting Swaged, Interference-fit Parts. If there is evidence of looseness, the assembly should be replaced.

p. Inspecting Balls in Clutch Housings. Inspect all balls in rotating clutch housings for free movement. Any restriction could prevent the ball from seating during clutch application. Inspect staking that retains the balls.

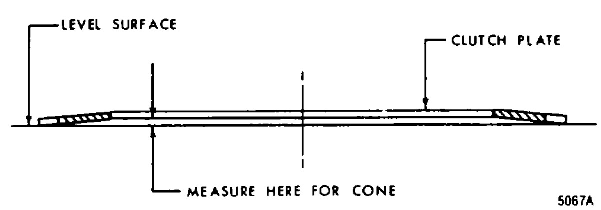


Fig. 4-8. Method of measuring clutch plate cone

g. Inspecting Sealing Surfaces.

(1) At locations contacted by hooktype and step-joint sealrings, inspect the i n s i d e diameter, for step-wear, nicks, scratches, and scoring. Remove only the raised metal portion of these defects with a soft stone or crocus cloth. Polishing the area to remove the defect is not necessary or desirable. If the defects are too severe replace the defective part.

(2) At locations contacted by springloaded, lip-type seals, inspect for n i c k s, scratches, roughness, or other surface irregularities. Also inspect for embedded particles, step-wear, and dirt on flanges or any other components exposed to external contamination. Remove the defects and restore the finish. Replace the part if scores or scratches would permit oil leakage.

4-6. ASSEMBLY PROCEDURES

a. Clutches, Pistons

(1) After clutch pack clearances have been established, soak each friction-face clutch plate (2 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.

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. Threaded 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 sealer, 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 procedure and on the exploded views.

d. Grease Used for Assembly. Use oilsoluble grease with a low melting point (petrolatum) to temporarily retain parts, stepjoint sealrings, scarf-cut sealrings, and hooktype sealrings during assembly with mating parts.

CAUTION

Do not use to retain cork gaskets.

e. S e a 1 i n g 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. However, if adhesives or sealers are required for the oil pan gasket, they may be applied on the pan mounting flange, but only in the area outside of the flange bead.

f. Lip-type Seals

(1) W h e n replacing lip-type 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 (MIL-G-3545A or equivalent) to protect the seal during shaft installation and to provide lubrication during initial operation.

(2) Dry sealing compound. 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) Nonhardening sealing compound. The circumference of some seals is not precoated with a dry sealant. A nonhardening sealant should be applied to the circumference of these seals before installation.

g. Butt-joint Sealrings

(1) Butt-joint sealrings require special handling during assembly. The sealrings contain materials which will absorb moisture from the atmosphere and expand the sealring. The sealrings are sealed in air-tight packages and should not be opened until you are ready to install them into the transmission. Before installing the sealring, the end clearance must be checked to ensure that the sealring has not been expanded.

CAUTION

If humidity is allowed to penetrate and expand the butt-joint sealring, the sealring can be damaged during installation. A damaged sealring will leak oil from the clutch piston cavity and cause clutch slippage. Do not open the sealed package until you are ready to install the sealring.

(2) Remove the sealring from its sealed package. Place it in its operational position inside the bore that it will be sealing.

(3) Using a feeler gage, check the end clearance of the sealring. The end clearance must not be less than 0.010 in. (0.25 mm).

(4) If the end clearance is less than 0.10 in. (0.25 mm), bake the sealring in an oven at 200-3000F (93-1490C) for 24 hours or get a new sealring. Repeat steps (2) and (3) to ensure that the end clearance is correct.

(5) Pack the sealring and its groove with a liberal amount of oil-soluble grease.

(6) Roll up the sealring to about half its free diameter and hold it that way for a b o u t 10 seconds. Being careful not to spread the sealring more than necessary, slide it onto the hub. Place one end of the sealring into the groove and gradually work the seal into the groove.

h. 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 3000F (1490 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.

i. Sleeve-type Bearings. The use of a locking compound is recommended to retain bushings and sleeve-type bearings that have press-fit tolerances. One such compound is Loctite Sleeve Retainer 601. This compound or equivalent should be used.

j. Bearings (Ball or Roller)

(1) When installing a bearing on a shaft, heat the bearing to 2000F (930C) 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.

4-7. REMOVING (OR INSTALLING) TRANSMISSION

a. Drain Oil. Drain the oil from the transmission before removal from the vehicle (para 3-7). For better drainage, the transmission should be warm and allowed to drain over night. Since applications will differ, consult the vehicle service manual for specific instructions for transmission removal and installation.

b. Check Linkages and Lines. Make sure that all linkages, controls, cooler lines, modulator actuator cable, temperature connection, input and output couplings, and mounting bolts are disconnected before transmission removal (also, oil filler tube and other equipment such as attached parking brake handle, etc). Oil lines should be carefully placed out of the way of damage and all openings covered to keep out dirt.

NOTE

Position jack or hoist sling to coincide with the transmission center of gravity, as follows (measured rearward from front mounting of transmission to engine):

HT 740D-13.50 in. (343 mm)
HT 747D-13.50 in. (343 mm)
HT 750CRD-14.50 in. (368 mm)
HT 754CRD-14.50 in. (368 mm)
HT 750DRD-15.75 in. (400 mm)
HT 750DRD DB-23.47 in. (596 mm)

c. Clean Transmission. Clean the exterior of the transmission. Steam cleaning should be followed immediately by disassembly, because condensation allowed to remain in the transmission could cause rust.

d. Reconnect at Installation. At installation, all items should be reconnected. A transmission jack is convenient to raise the transmission into mounting position. The transmission should be filled with oil (para 3-7) and road tested after installation.

4-8. WEAR LIMITS

Refer to Section 8 for general and specific information covering parts fits, clearances and wear limits.

4-9. SPRING SPECIFICATIONS

Refer to the spring data (table 8-2) in Section 8 for spring identification and specifications.

4-10. TORQUE SPECIFICATIONS

Assembly procedures in Sections 6 and 7 specify the torque requirements for all bolts and nuts. Torque values are also presented on the foldout illustrations at the rear of this manual. Torque values specified are for dry assembly, except when otherwise noted. Bolts and washers should be washed and dried before assembly.

5-1. SCOPE

a. This section covers disassembly of HT 740D, HT 747D, HT 750CRD, HT 754CRD, HT 750DRD and HT 750DRD DB transmissions. The disassembly sequence is continuous and includes all models. Where procedures apply to specific models, they will be identified as to model.

b. When a procedure does not apply to the specific model being disassembled, go to the next procedure which is applicable.

c. Certain illustrations will not always illustrate the model being disassembled, but, when the operation is identical, the illustration will correctly illustrate the procedure.

5-2. REMOVING EXTERNAL COMPONENTS

a. Mounting Transmission In Overhaul Stand

(1) Overhaul stands, and mounting of the transmission therein, will vary. Figure 5-1 shows the transmission installed in a typical overhaul stand.

(2) B e f o r e installing the lifting bracket onto the transmission, remove any bolts which cannot be removed due to obstruction by the bracket.

b. Removing External Components

(1) Remove the output flange. Paragraph 3-14 a, explains the removal procedure for flanges retained with a self locking nut.

(2) On models having a two-bolt top cover on the converter housing, remove two bolts 13 (B, foldout 10), two washers (earlier model only), cover 14 and gasket 15.

(3) On models having an eight bolt top cover and an eight bolt side cover on the converter housing, remove eight bolts 24, 41 (A, foldout 11), eight washers 23, 42, covers 22, 43 and gaskets 21, 44.

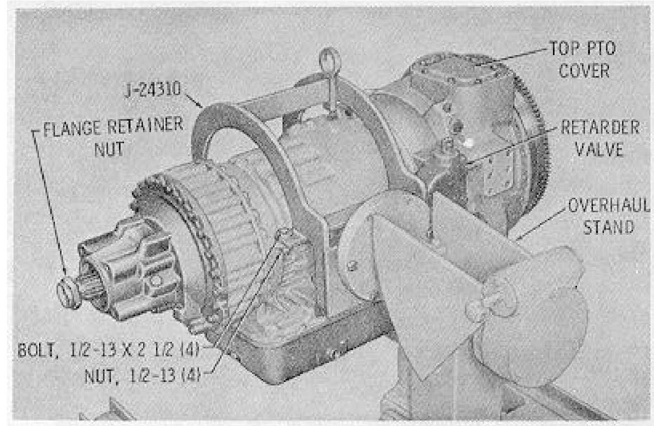


Fig. 5-1. Installing transmission overhaul stand

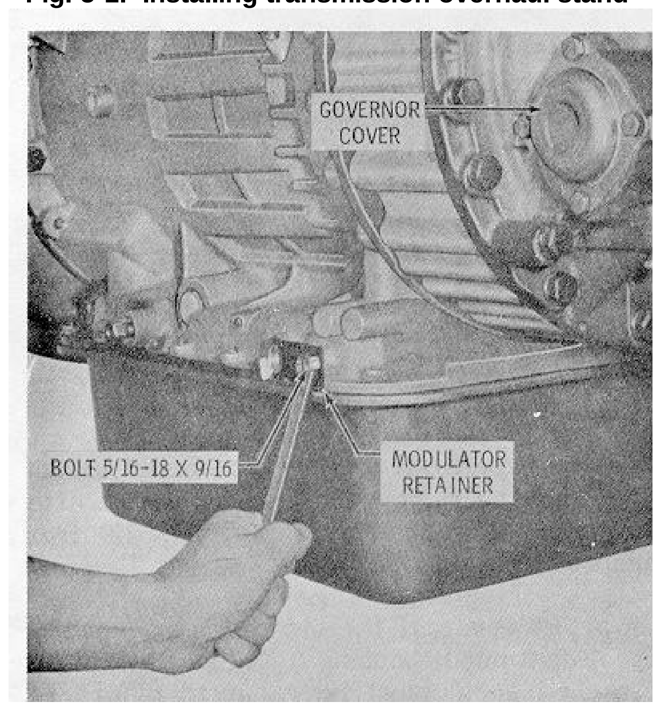


Fig. 5-2. Removing modulator actuator retainer

(4) On models having a converter driven PTO, refer to B, foldout 16. Remove six bolts 61, six washers 60, cover 59, and gasket 58.

(5) Remove the four bolts that retain the governor cover and gasket (fig. 5-2). Remove the cover and gasket.

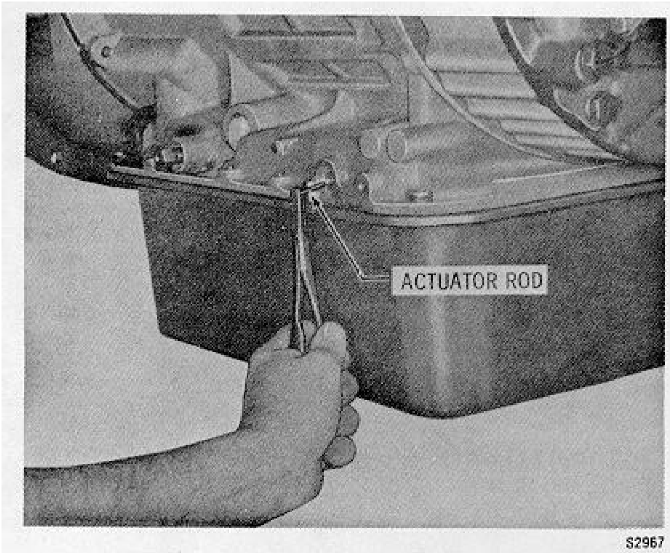


Fig. 5-3. Removing modulator actuator rod

(6) Carefully remove the governor by rotating it clockwise while removing it.

(7) Remove the bolt that retains the modulator retainer (fig. 5-2). Remove the retainer. On earlier models, remove the modulator actuator rod (fig. 5-3).

5-3. REMOVAL OF MANUAL OUTPUT DISCONNECT ASSEMBLIES (DROPBOX MODELS)

a. Lower front or rear disconnect assemblies may be removed either before or after removal of dropbox 6 (B, foldout 22) from adapter 9 (B, foldout 19).

b. However, if the top rear disconnect is used, disconnect housing 6 (A, foldout 23) and attached parts must be removed before removal of the transfer case. Also, snapring 3 and output drive gear 2 must be removed. (Refer to , h, and i below.)

c. To remove the lower front output disconnect assembly, remove four bolts 20 (B, foldout 23), two bolts 22, and lockwashers 23 and 21.

d. Lift off housing 19 (B, foldout 23) and attached parts. Remove gasket 28.

e. To remove the lower rear output disconnect assembly, remove four bolts 41 (A, foldout 23), two bolts 37, and lockwashers 42 and 36.

f. Lift off housing 35 and attached parts. Remove gasket 30.

g. To remove the upper rear output disconnect assembly, remove six bolts 25 and lockwashers 26.

h. Lift off housing 6 and attached parts. Remove gasket 1.

i. Remove snapring 3 and output drive gear 2.

j. Refer to paragraph 6-32 for rebuild of the disconnect assemblies.

5-4. SEPARATING DROPBOX FROM TRANSMISSION

a. Removal of Transfer Gear Housing

NOTE

Governor assembly 26 (B, foldout 19) must be removed from adapter housing 10 before loosening t h e transfer gear housing. Refer to paragraph 5-16 a, for removal.

(1) Position t h e transmission front end downward and attach a hoist to the dropbox housing. Put some lift tension on the sling.

(2) Loosen the twenty-four bolts 18 (B, foldout 19) and 25 approximately three turns. Mark the indexing of the dropbox to the adapter for correct reassembly angle (00, 150, 300, 450 or 600).

CAUTION

The output drive shaft assembly must remain seated at all times during removal of dropbox. Reference figure 5-4.

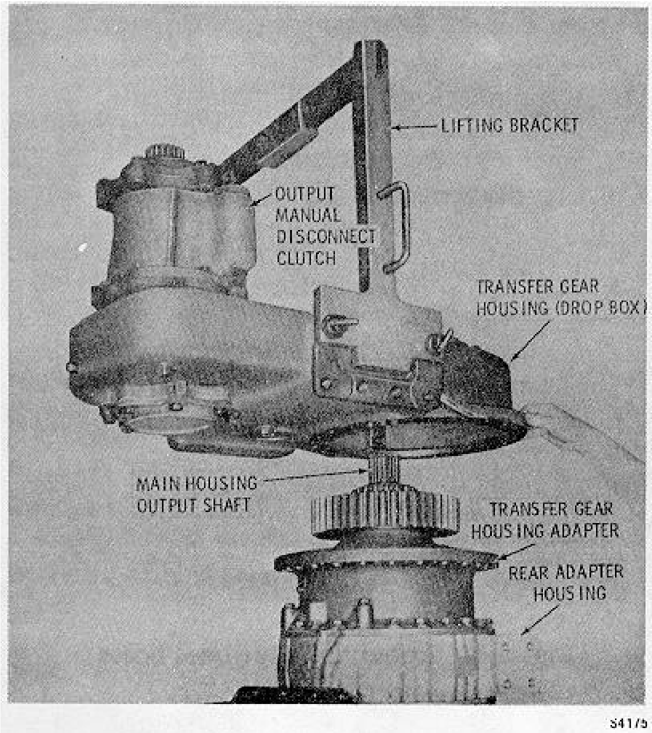


Fig. 5-4. Removing dropbox housing fro m adapter

(3) Gently separate the dropbox from the adapter and at the same time use a soft mallet to keep the output drive shaft assembly from pulling upward with the dropbox (fig. 5-4).

(4) Remove twenty-four bolts 18 and 25 and lockwashers 19 and 24. Lift off the dropbox. Transfer drive gear 2 (A, foldout 22) will remain with the drive shaft.

(5) Refer to paragraph 6-28 for rebuild of transfer gear housing (dropbox) components.

NOTE

Remove transmission output shaft assembly 32 or 38 (B, foldout 19) only if further disassembly of transmission is necessary.

(6) If shaft assembly 38 is used, pry up staked portion of nut 43 (B, foldout 19) and remove the nut.

(7) Carefully remove g e a r 2 (A, foldout 22) and attached bearings 1 and 3 from the shaft.

(8) Remove twenty-two bolts 21 (B, foldout 19) and two bolts 22, and lockwashers 20 and 23.

(9) With a hoist and a three-strand sling, lift off transfer gear housing adapter assembly 9.

CAUTION

Rear adapter housing assembly 9 (A, foldout 19) is h e 1 d in place by the same bolts as the transfer gear housing adapter 9 (B, foldout 19). The adapter housing should be held while removing the transfer g e a r housing adapter.

(10) Remove output shaft assembly 32 (B, foldout 19).

(11) Replace transfer gear housing adapter assembly 9 (B, foldout 19) onto the transmission, and retain it with four bolts 21 (B, foldout 19).

NOTE

Further disassembly procedures a p p 1 y to both dropbox and straight-through models.

5-5. REMOVING REMOTE COVER, FLYWHEEL AND LOCKUP CLUTCH

NOTE

Position the transmission front end upward.

a. Removing Remote Front Cover (B, foldout 9)

(1) Remove nut 1 and spacer 2.

(2) Remove the twenty-two 7/16 inch bolts and lockwashers that retain cover 4 (B, foldout 9) to the converter housing.

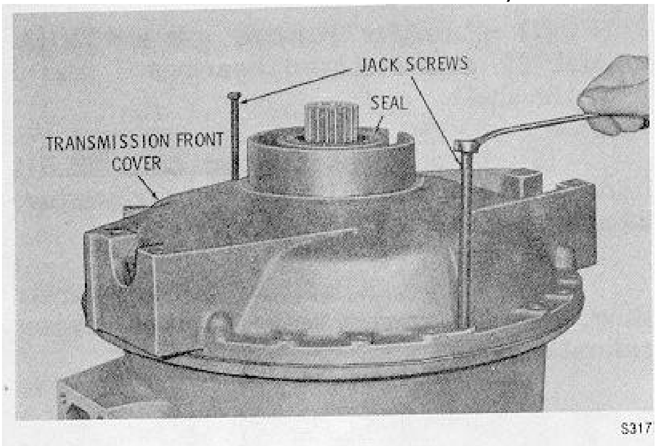


Fig. 5-5. Removing transmission front cover

(3) If necessary, use jack screws to loosen cover (fig. 5-5).

(4) Lift off cover 4 and discard gasket 5.

(5) Remove cover seal 3 for replacement only.

(6) If replacement is necessary, remove ball bearing 6 from the shaft on drive housing 7 (or from the bore in cover 4).

b. Removing Flywheel, Lockup Clutch

NOTE

Position the transmission horizontally.

(1) Place a suitable container beneath the flywheel to catch any excess oil which may drain during removal of the flywheel.

(2) Remove twenty-nine of the thirty bolts and washers that retain the flywheel on the converter pump (fig. 5-6).

(3) Install lifting tool J-24365 onto the flywheel (fig. 5-7).

NOTE

Guide bolts J-24315-2 shown in figures 5-7 and 5-8 are used only for installing the flywheel.

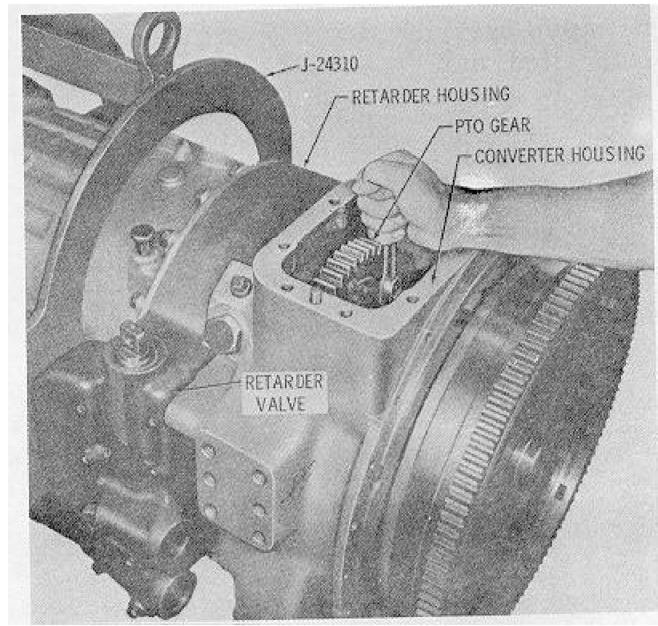


Fig. 5-6. Removing flywheel bolts

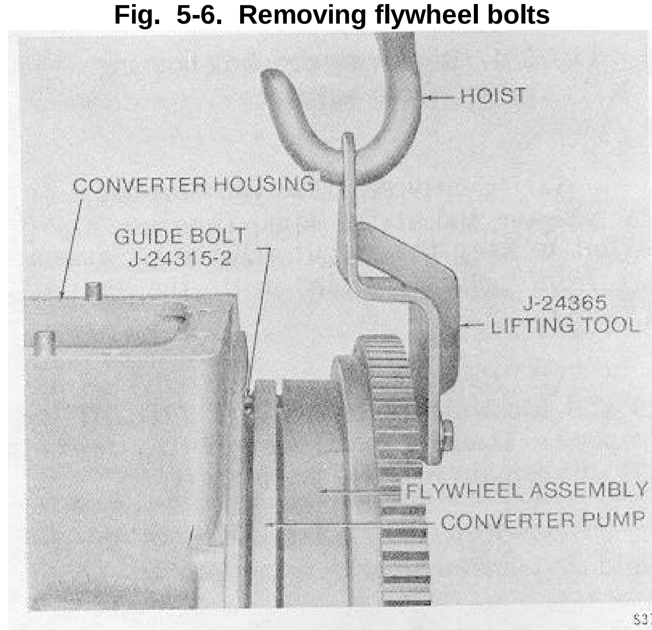


Fig. 5-7. Lifting tool installed on flywheel

(4) Attach a hoist to the lifting tool. Support the weight of the flywheel during removal of the remaining bolt and washer.

(5) Remove the flywheel and attached parts f r o m the converter housing (fig. 5-8).

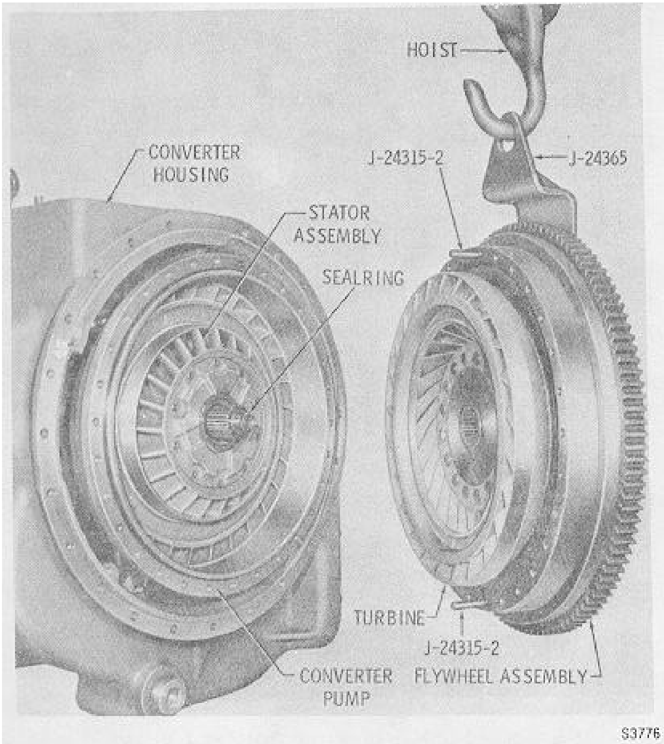


Fig. 5-8. Removing flywheel and turbine

NOTE

Whether the turbine is removed with the flywheel as shown, or remains on the transmission, use care to prevent its falling.

(6) Remove the turbine from the flywheel (or transmission). Refer to paragraph 6-3 for rebuild of the turbine and flywheel assembly.

5-6. REMOVING OIL PAN, FILTER, VALVE BODY (HT 740D, 747D)

a. Oil Pan, Filter

(1) Rotate the transmission to a vertical position, front end (converter housing) upward.

(2) Remove two oil pan screws (fig. 5-9) and install two 5/16-18 g u i d e bolts J-3387-2.

(3) Remove the remaining twenty-one pan screws. Remove the oil pan and gasket. Remove the guide bolts.

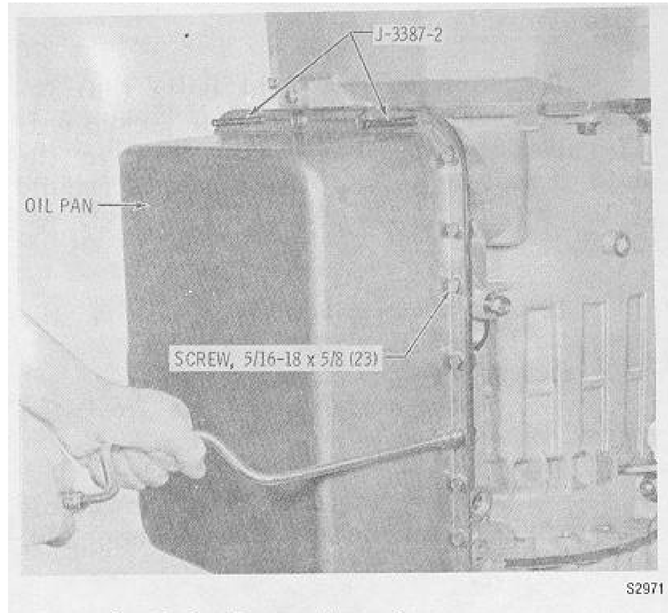


Fig. 5-9. Removing oil pan screws

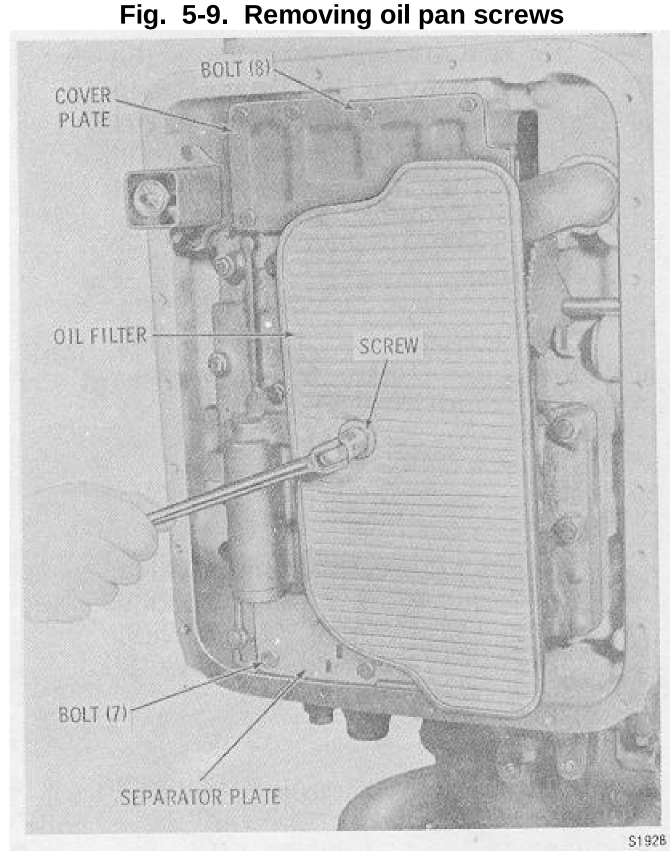


Fig. 5-10. Removing oil filter screw (HT 740D, 747D)

(4) Remove the screw that retains the oil filter (fig. 5-10). Remove the oil filter, sealing and, on later models, oil filter spacer 32 (B, foldout 16).

b. Valve Body

(1) Remove the eight bolts that retain the cover plate (fig. 5-10) or lockup cutoff valve 28 (A, foldout 21). Remove the plate or valve. Refer to para 6-9 for rebuild of the lockup clutch cutoff valve body assembly.

(2) Remove seven bolts from the separator plate (fig. 5-10).

(3) Remove eighteen bolts from the control valve body.

(4) Remove one 2 1/2-inch long bolt that retains the selector detent assembly. Remove selector detent assembly.

NOTE

Do not attempt to remove the valve body at this time. Three bolts located on the underside of the transfer plate (fig. 6-18) hold the modulator body, oil transfer plate, separator plate and control valve b o d y, together.

(5) Install two 1/4-20 guide bolts J-24315-3, one at the top; the other at the bottom of the oil transfer plate.

CAUTION

Do not allow the selector valve to drop out of the valve body when the assembly is removed. Wire it in place, or remove it from the valve body.

(6) Remove the four bolts, two washers and baffle that retain the valve body assembly to the transmission (fig. 5-11). Remove the valve body assembly.

(7) Refer to paragraph 6-6 for rebuild of the control valve body assembly.

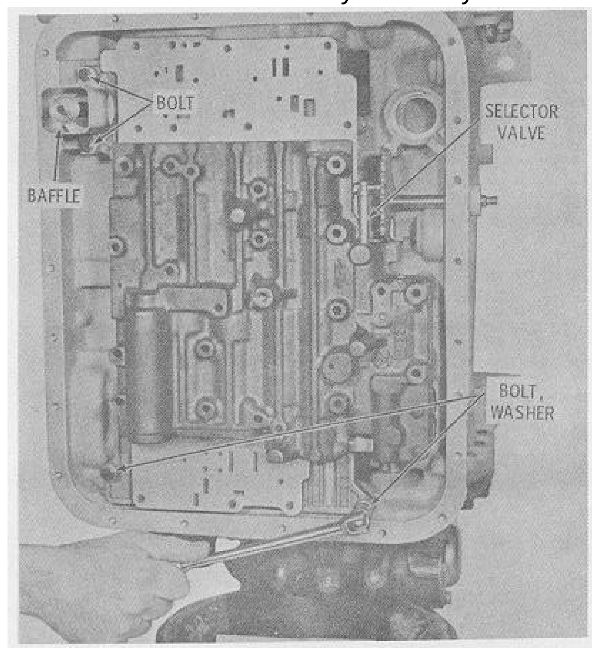


Fig. 5-11. Removing control valve assembly (HT 740D, 747D)

5-7. REMOVING OIL PAN, FILTER, VALVE BODIES (HT 750D, 754D)

a. Oil Pan, Filter

(1) Refer to paragraph 5-6a(l), (2), (3).

(2) Remove the screw that retains the oil filter (fig. 5-12). Remove the oil filter (fig. 5-13), sealring, and the oil filter spacer (late models only). Note the number of spacers removed.

(3) Models with cast iron pan 29 (B, foldout 17) use three bolts 23 to retain the oil filter to the valve body. Remove the three filter retaining bolts and the oil filter. Remove sealring 21 from the neck of the filter tube.

b. Valve Bodies

(1) Remove the lockup clutch feed tube and the 3-4-5 signal tube (fig. 5-14).

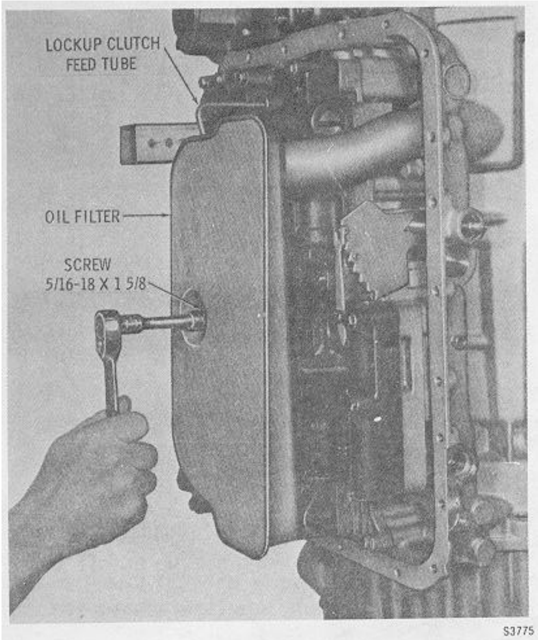


Fig. 5-12. Removing oil filter screw (HT 750D, 754D)

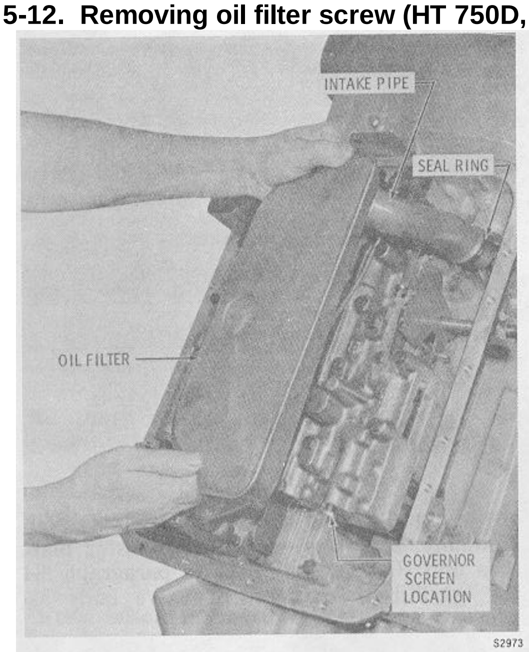


Fig. 5-13. Removing oil filter (HT 750D, 754D)

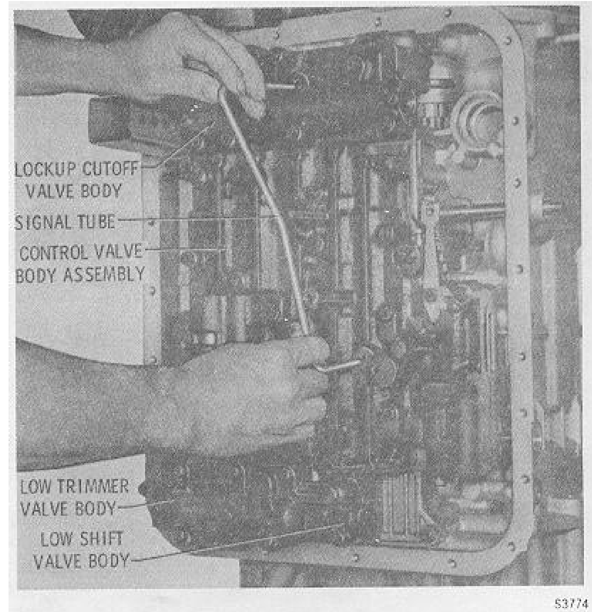


Fig. 5-14. Removing signal tube (HT 750D, 754D)

NOTE

Models not equipped with allrange lockup, will not contain the lockup clutch feed tube.

(2) Remove bolts A and B (fig. 5-15). Install two 1/4-20 guide bolts J-24315-3 into positions A and B.

(3) Remove the five bolts remaining In the low trimmer valve body (fig. 5-16). Remove the low trimmer valve body.

(4) Remove the one remaining bolt In the low shift valve body. Remove the low shift valve body.

(5) Refer to paragraphs 6-7 and 6-8 for rebuild of the low trimmer and shift valve bodies.

(6) Remove the seven remaining bolts that retain the cover plate or lockup cutoff valve (fig. 5-17). Remove the cover plate or lockup cutoff valve. Refer to paragraph 6-7 for lockup cutoff valve body rebuild.

(7) Remove eighteen bolts from the control valve (fig. 5-18). Remove the selector lever detent retainer bolt. Do not

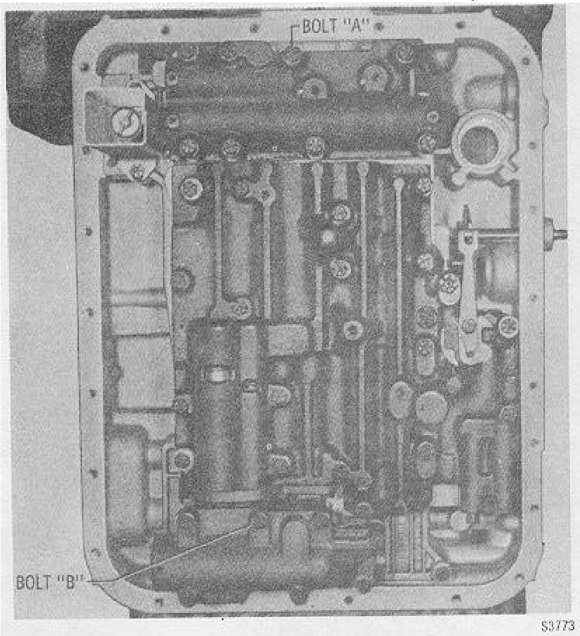


Fig. 5-15. Valve body assembly (HT 750D, 754D)

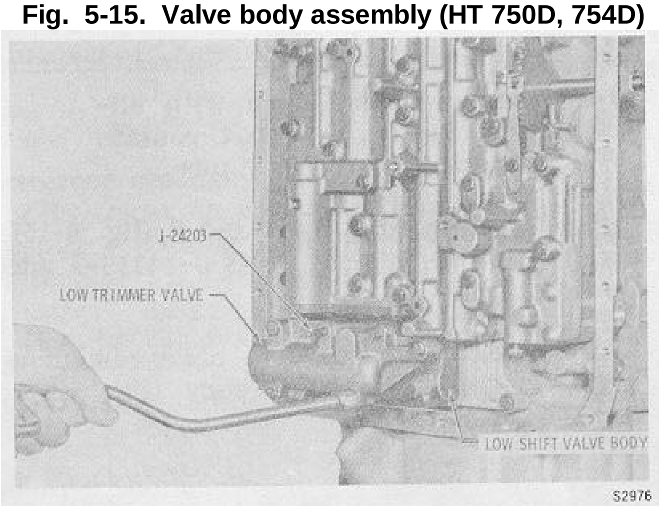


Fig. 5-16. Removing trimmer valve body (HT 750, 754)

remove the bolt (0.725-long) that retains the selector valve. Models built prior to S/N 10300, use this bolt to retain the manual selector valve.

(8) Remove the f o u r bolts, two washers and baffle that retain the oil transfer plate (fig. 5-18).

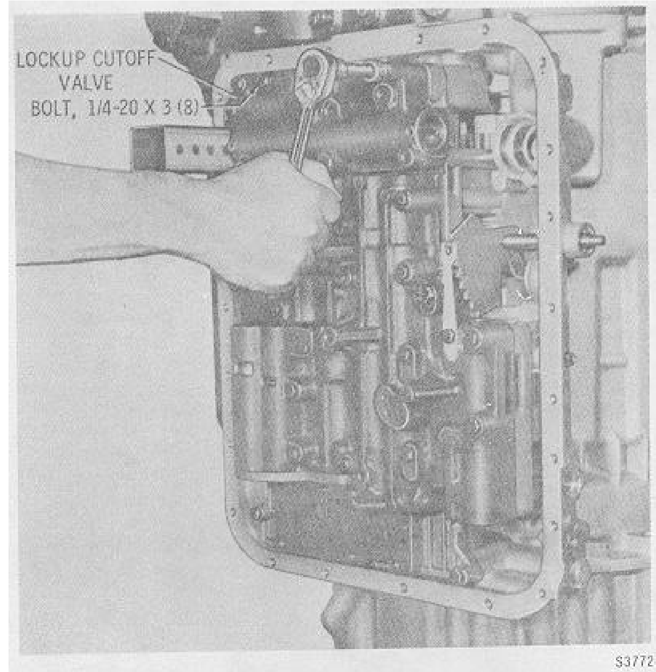


Fig. 5-17. Removing lockup cutoff valve (HT 750, 754)

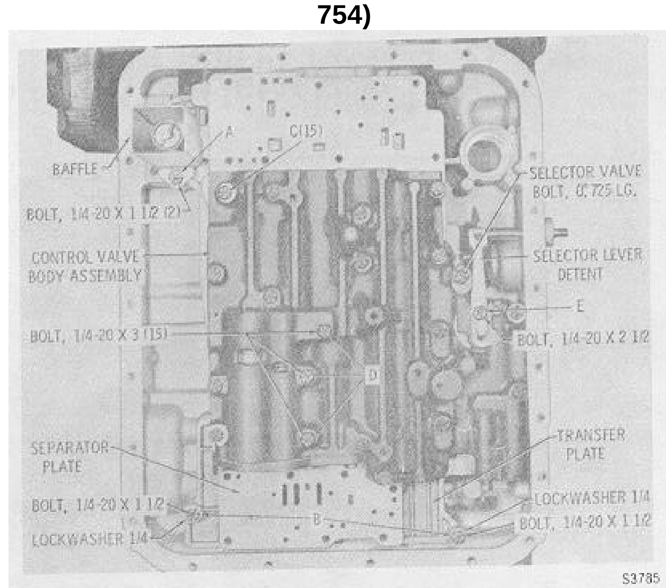


Fig. 5-18. Control valve body bolt locations

(9) Remove the control valve body assembly, separator plate and transfer plate as a unit (fig. 5-19). Refer to paragraph 6-6 for rebuild of the control valve body assembly.

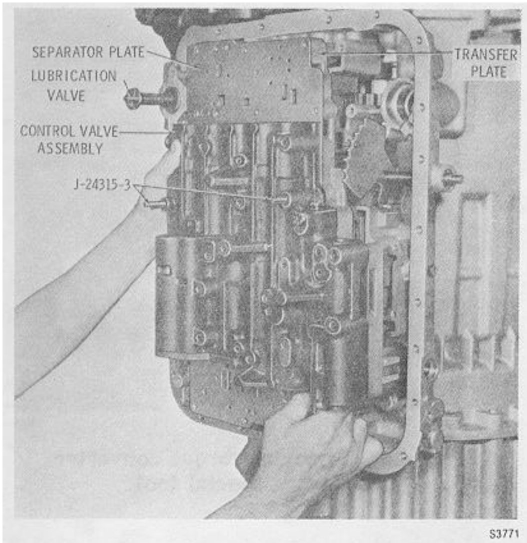


Fig. 5-19. Removing control valve assembly

5-8. REMOVING TORQUE CONVERTER AND PTO COMPONENTS

a. <u>Converter Stator, Pump</u>

(1) Holding the stator assembly, lock the stator and the freewheel roller race together by rotating the stator in a counterclockwise direction. (Refer to figure 5-8.)

(2) Carefully lift the stator assembly from the turbine shaft. Refer to paragraph 6-4 for rebuild of the stator assembly.

(3) Remove snapring 25 (A, foldout 10) using tool J-26598.

(4) Hold the safety guards open, (fig. 5-20) place the tool over the converter ground sleeve and snapring, and position the jaws into the snapring gap.

(5) Close the jaws by rotating the adjusting nut (fig. 5-21).

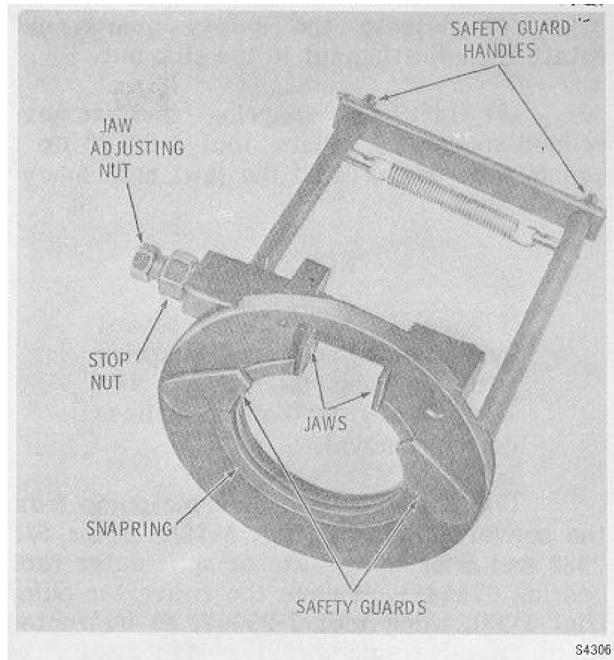


Fig. 5-20. Converter pump snapring tool J-26598

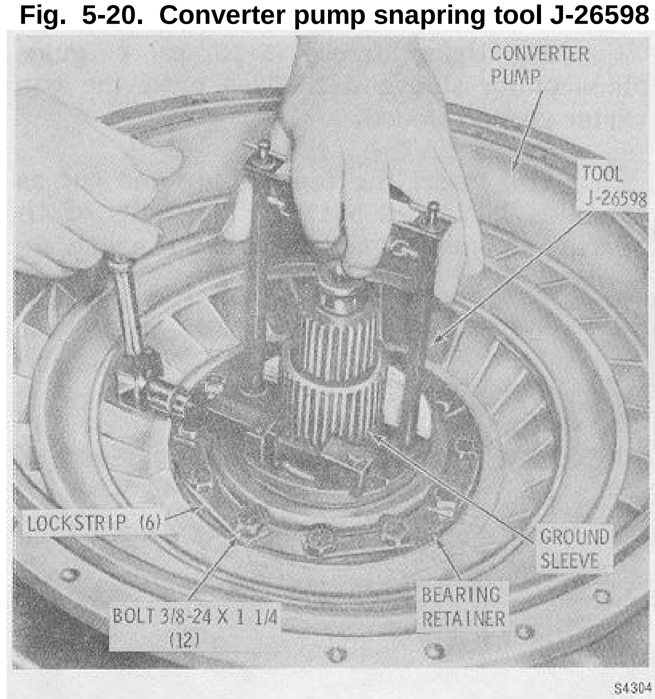


Fig. 5-21. Removing (installing) converter pump snapring

(6) Release the safety guards and rotate the adjusting nut to the stop nut.

(7) Lift off snapring and remove splined spacer 26. Place tool J-26598 on a bench, face down, close the jaws and remove the snapring.

NOTE

If special tool J-26598 is not available, remove the snapring with snapring pliers. Do not scrape the ground sleeve splines during removal.

(8) Remove the converter pump from the converter housing (fig. 5-22). After S/N 2082 and prior to the use of split outer race bearing 6752471, remove the converter pump (fig. 5-23), using tool J-25007, as instructed in items (9) through (12) below. Refer to items (13) through (15) for removing converter pump with split race bearing.

(9) Using figure 5-23 as a guide, place puller sleeve J-25007-4 onto the converter ground sleeve.

(10) Insert the feet of leg and nut assemblies J-25007-2 between the balls of the bearing assembly, spacing them 900 apart.

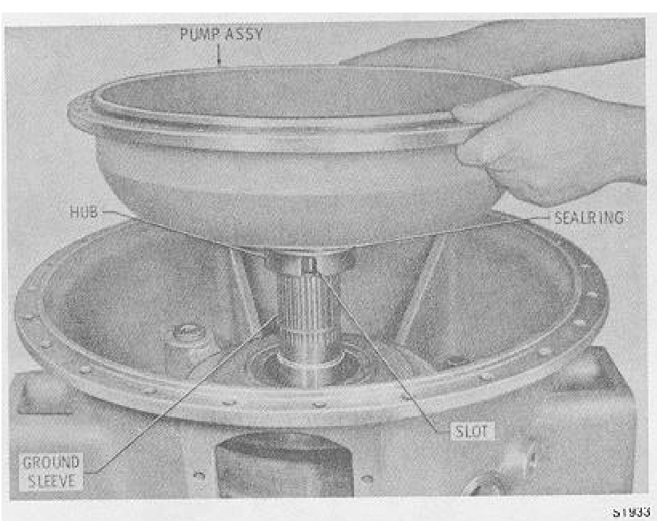


Fig. 5-22. Removing torque converter pump

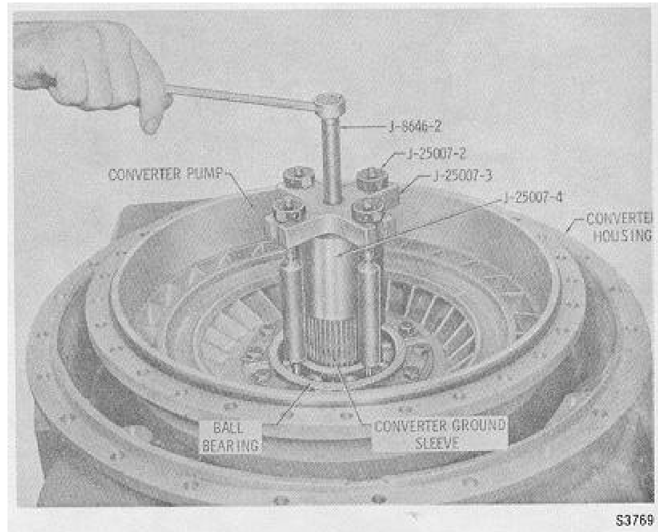


Fig. 5-23. Removing torque converter pump, using special tool

(11) Rotate the legs to make the feet bear against both the inner and outer bearing race grooves. Install puller head tool J-25007-3 onto the legs, tightening the nuts evenly.

(12) Install center screw J-8646-2 and tighten it by hand until it is centered on sleeve J-25007-4. Hold the pump assembly, and tighten the center screw until the pump assembly will lift off the ground sleeve. Refer to paragraph 6-5 for rebuild of the pump assembly.

NOTE

The inner race of the split race bearing is a press fit onto the ground sleeve.

(13) S o m e models after S/N 2081 contained a split outer race converter pump hub bearing 6752471. Remove as follows.

(14) Select two 3/8-24 X 1 1/4 inch bearing retainer bolts, 1800 apart (fig. 5-21). Bend the lockstrips clear of the bolts. Remove the two bolts.

(15) Using figure 5-24 as a guide, install sleeve J-25007-4 over the converter ground sleeve.

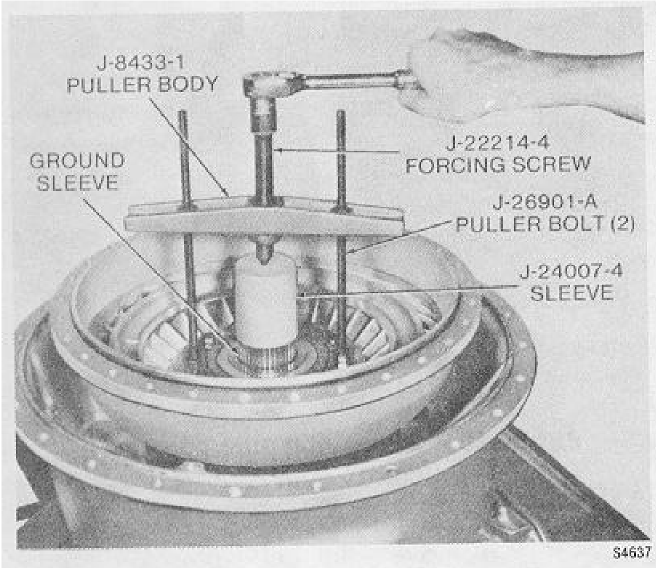


Fig. 5-24. Removing torque converter pump

(16) Install the two 3/8-24 puller body studs into the two bearing retainer bolt holes. Tighten each stud finger tight.

(17) Place puller body J-8433-1 with f o r c i n g screw J-22214-4 onto sleeve J-25007-4. Insert studs J-26901-A through the puller b o d y as shown in figure 5-24. Tighten the forcing screw and two stud nuts finger tight maintaining a parallel position between the puller body and converter pump.

(18) Using a wrench, tighten the forcing screw, until the converter pump and ground sleeve separate. Remove the pump.

b. Scavenge Pump Assembly

(1) Position the transmission horizontally, bottom side downward. Remove bolt 3 (A, foldout 12) from the suction tube retaining clip on the scavenge pump (fig. 5-25).

(2) Remove three bolts and washers that retain the scavenge pump assembly (fig. 5-25). Remove the pump assembly. Refer to paragraph 6-14 for rebuild of the pump assembly.

c. Power Takeoff

(1) Remove the bolt that retains the PTO idler gear spindle (fig. 5-26).

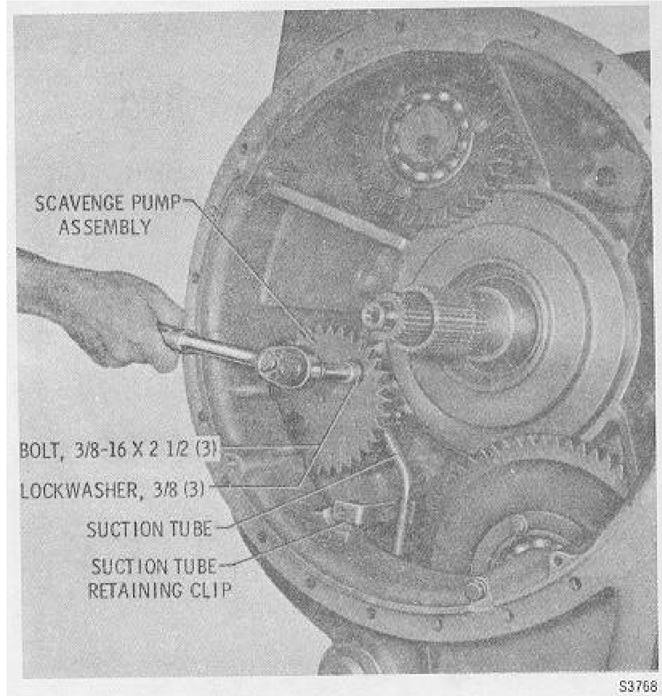


Fig. 5-25. Removing scavenge pump assembly

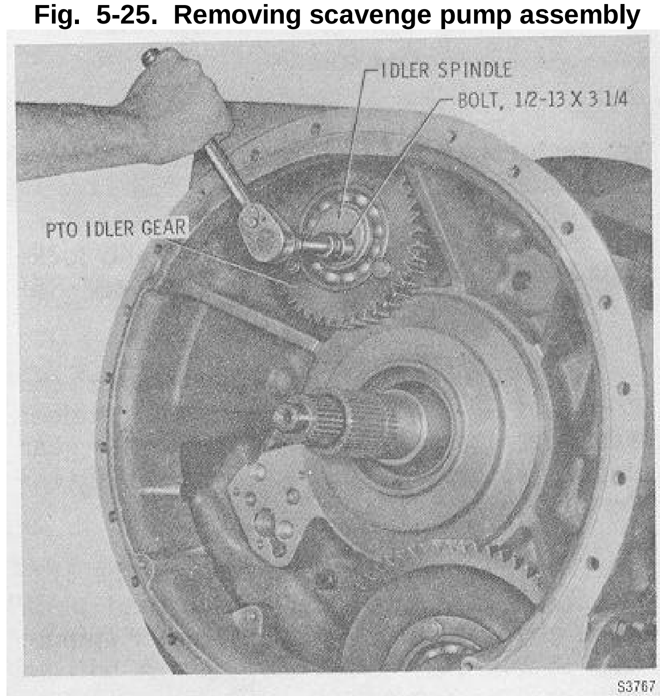


Fig. 5-26. Removing top PTO gear retaining bolt

(2) Use slide hammer and adapter J-24171-2 to remove the spindle and gear assembly (fig. 5-27). Press the spindle from the bearing. If the gear is damaged, replace the gear assembly. Refer to paragraph 6-14.

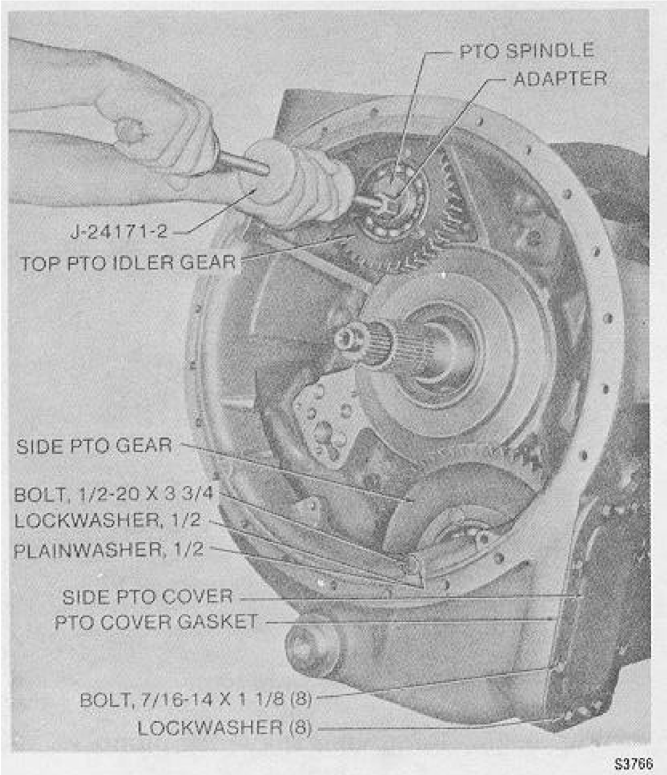


Fig. 5-27. Removing top PTO idler gear spindle

for replacement of other gear assembly components.

(3) Remove the eight bolts and lockwashers that retain the side PTO cover. Remove the cover and gasket (fig. 5-27).

(4) On earlier models, remove the 1/2-20 x 1 1/4 bolt, lockwasher and retainer washer from the front of the side PTO gear spindle. Remove the g e a r assembly as shown in figure 5-28.

(5) On later models, remove the 1/220 x 3-3/4-inch bolt, lockwasher and plain washer that retains the side PTO gear spindle (fig. 5-27). Install a 1/2-20 x 6-inch bolt to replace the 3 3/4-inch bolt, and tighten it finger tight.

(6) Using a mallet, drive the bolt rearward while supporting the PTO gear. When the spindle is free of the housing, remove the bolt, spindle and PTO gear.

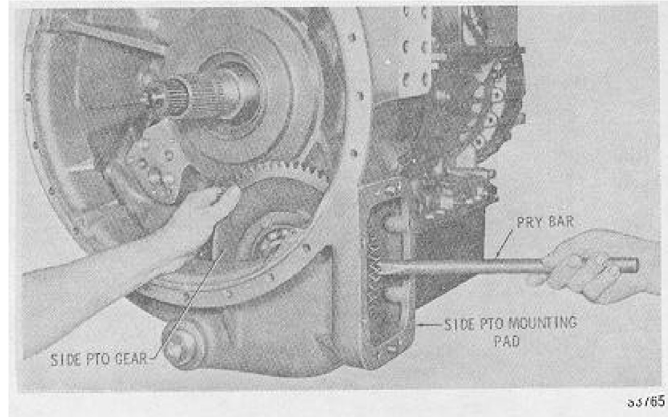


Fig. 5-28. Removing side power takeoff gear

(7) Remove the sealring from the PTO gear spindle. If the gear is damaged, replace the gear assembly. Refer to paragraph 6-14 for replacement of other gear assembly components.

5-9. REMOVING CONVERTER HOUSING

a. Housing with 2-Bolt Top Cover (no retarder)

(1) From inside the converter housing, remove the two screws and washers that retain the pitot tube or steel block (fig. 5-29).

(2) Remove seven bolts and washers from the inside of the converter housing (fig. 5-29).

(3) Remove nine bolts and washers retaining the converter housing to the transmission housing. Two bolts were removed before the installation of the lifting bracket. Refer to figure 5-1.

(4) Remove t h e converter housing from the transmission housing with the lifting sling and place it on the work table (fig. 5-30).

(5) Refer to paragraph 6-10 for rebuild of the converter housing assembly.

(6) Remove the pitot tube or steel block (fig. 5-30) freed in item (1).

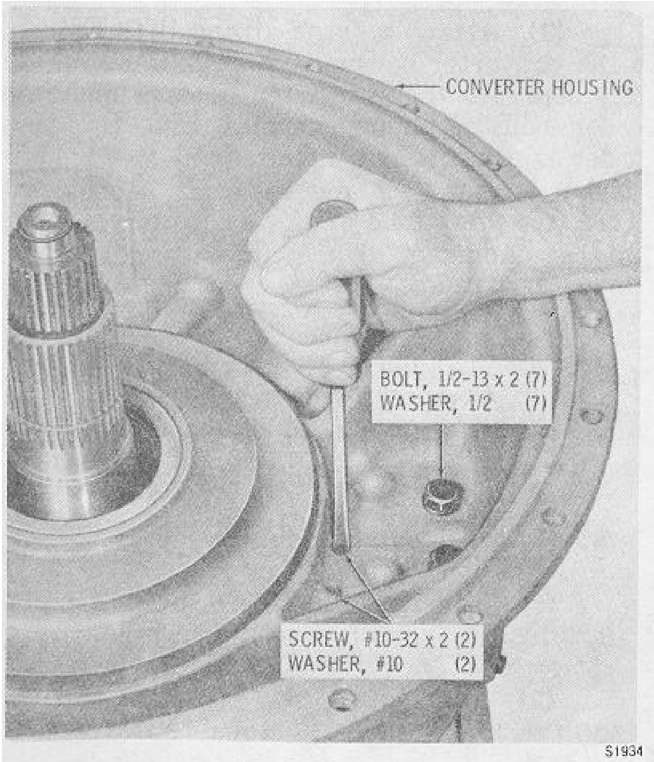


Fig. 5-29. Removing pitot tube or block screws

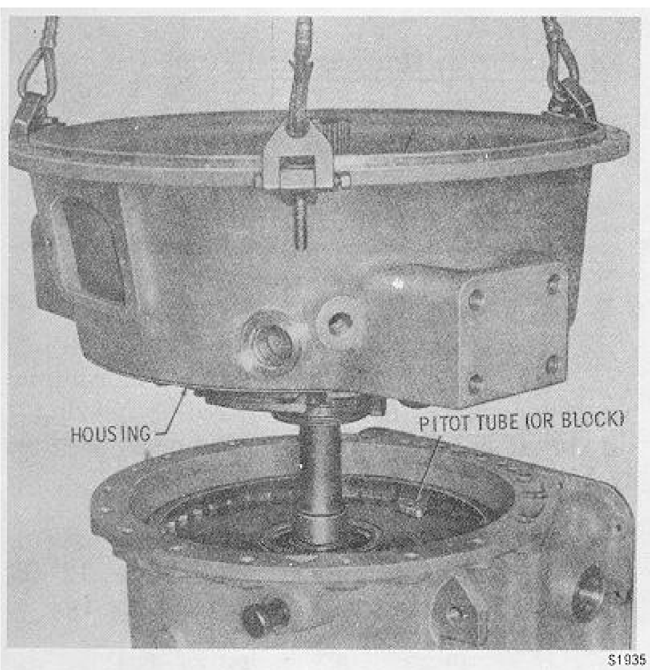


Fig. 5-30. Removing torque converter housing

b. <u>Housing with 2-Bolt Top Cover</u> (with retarder)

(1) From inside the converter housing remove the seven bolts (fig. 5-31).

(2) Remove seven bolts 63 and washers 62 (B, foldout 16) retaining the converter and retarder housings to t h e transmission housing (one bolt removed when holding fixture installed-fig. 5-1). Remove three nuts 56 and three washers 57.

(3) Separate t h e converter housing from the retarder housing, being careful that the retarder housing is not lifted from the transmission housing (fig. 5-32). If the retarder housing is lifted, the pitot tube and/or oil collector ring can be damaged. When free, remove the converter housing. Refer to paragraph 6-11 for rebuild of the housing assembly.

c. <u>Housing with 8-Bolt Top Cover</u> (no retarder)

(1) Remove the two screws and washers retaining the pitot tube or steel block from inside the converter housing (fig. 5-29).

(2) Remove seven bolts and washers from inside the converter housing (fig. 5-29).

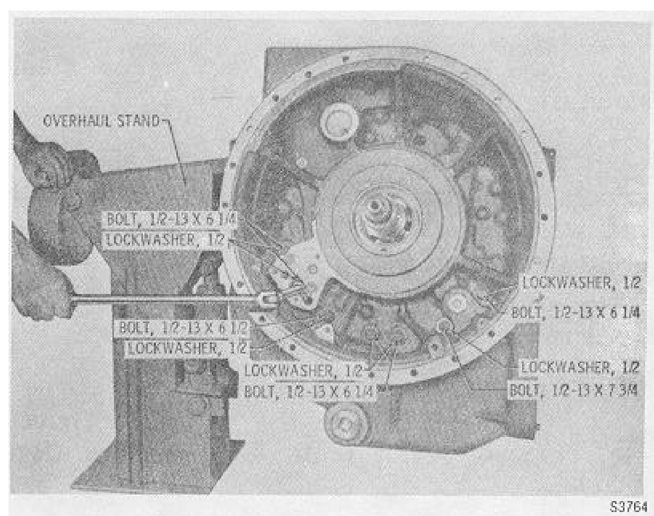


Fig. 5-31. Removing converter housing bolts (retarder models)

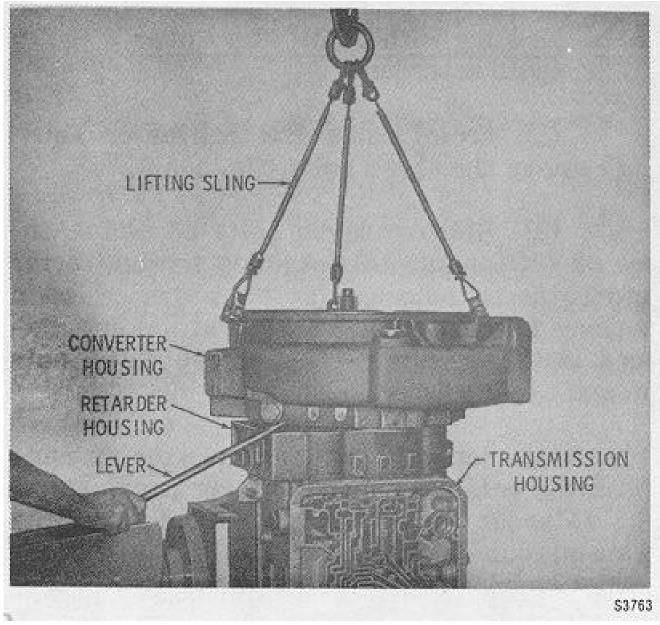


Fig. 5-32. Removing converter housing

(3) Remove nine bolts 3 and washers 2 (B, foldout 16), retaining the converter housing to the transmission housing (two bolts removed when holding fixture was installed fig. 5-1).

(4) Attach a three strand lifting sling (fig. 5-30) and remove the converter housing.

(5) Refer to paragraph 6-13 for rebuild of the converter housing assembly.

(6) Remove the pitot tube or steel block (fig. 5-30) freed in item (1).

(7) On earlier models, if the side PTO spindle must be removed, remove the bolt and washers from the rear of the spindle. Press the spindle rearward.

d. Housing with 8-Bolt Top Cover (with retarder)

(1) From inside the converter housing, remove seven bolts and washers (fig. 5-31).

(2) Remove seven bolts 63 and washers 62 (B, foldout 16), retaining the converter and retarder housings to the transmission housing (one bolt removed when holding fixture was installed-fig. 5-1). Remove three nuts 56 and three washers 57.

(3) Attach a three strand lifting sling to the converter housing (fig. 5-32) and carefully separate the converter housing and retarder housing, being careful that the retarder housing is not lifted from the transmission housing. If the retarder housing is lifted, the pitot tube and/or oil collector ring can be damaged. When free, remove the converter housing. Refer to paragraph 6-12 for rebuild of the housing assembly.

5-10. REMOVING RETARDER VALVE BODY, HOUSING, AND FRONT SUPPORT AND SLEEVE ASSEMBLY

a. Retarder Valve Body Assembly

(1) Remove four 3/8-16 x 2 5/8 bolts 2 (B, foldout 21) and four 3/8 lockwashers 1.

(2) Remove two 3/8-16 x 3 3/4 bolts 4 and two lockwashers 3. Remove two 3/8-16 x 4 3/4 bolts 6 and two 3/8 lockwashers 5.

(3) Remove valve body assembly 9 and gasket 8. Refer to paragraph 6-15 for rebuild of the retarder valve body assembly.

b. Retarder Housing, and Front Support and Sleeve Assembly

NOTE

Item 6, 7, 8 (B, foldout 12) may have adhered to the housing assemblies removed in para 5-9b or d. If so, remove them.

(1) If not previously removed, remove thrust race 6 (B, foldout 12), roller bearing 7 and thrust race 8 from retarder rotor assembly 10.

(2) Remove the retarder rotor assembly (fig. 5-33). Remove thrust race 12 (B, foldout 12), bearing 13, and thrust race 14.

(3) Remove the sealrings from the front and rear of the retarder rotor (fig. 5-33).

(4) Remove two screws 18 and two washers 17 (B, foldout 12), releasing the pitot tube into oil collector ring 6 (B, foldout 13).

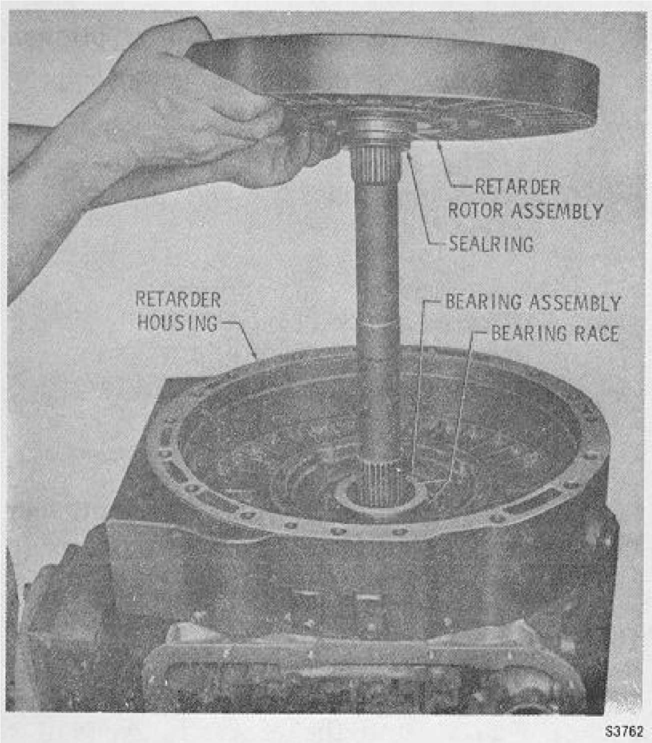


Fig. 5-33. Removing retarder rotor assembly

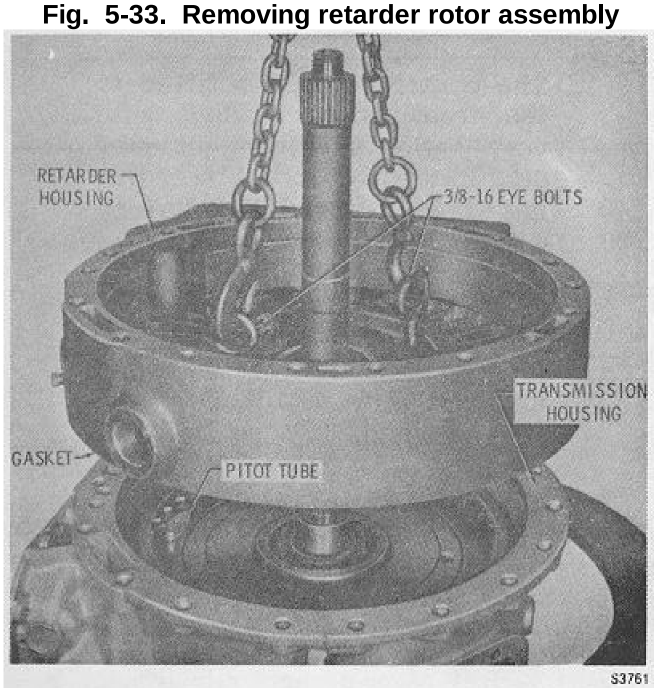


Fig. 5-34. Removing retarder housing assembly

(5) Install two 3/8-16 eyebolts into the front side of the retarder housing (fig. 5-34). Attach a chain or sling to the eyebolts. Remove the retarder housing and front support, and gasket. Refer to para 6-16 for rebuild of the retarder housing and front support assembly.

(6) Remove bearing race 2 (B, foldout 13) or bearing 24 (A, foldout 13) if they adhere to the front support hub.

5-11. REMOVING FORWARD, FOURTH, THIRD CLUTCHES

a. Forward, Fourth Clutches

(1) If the pitot tube or steel block (fig. 5-34) was not removed from the oil collector ring, remove it.

(2) Grasp the turbine shaft (fig. 5-35) and lift out the forward clutch and turbine shaft assembly.

CAUTION

Do not let weight rest on the governor oil collector.

(3) During removal of the forward clutch assembly, do not lose race 16 (B, foldout 13), needle bearing 17 or race 18, if they adhere to the forward clutch hub.

(4) Refer to paragraph 6-17 for rebuild of the forward clutch and turbine shaft assembly.

(5) Place the hooked legs of lifting tool J-24209 under the edges of the fourth clutch spring retainer and remove the fourth clutch (fig. 5-36).

NOTE

Keep both front and rear bearing races with the clutch assembly during rebuild.

(6) Refer to paragraph 6-18 for rebuild of the fourth-clutch assembly.

b. Third Clutch

(1) Remove the snapring (fig. 5-36) that retains the third-clutch backplate. Remove the backplate.

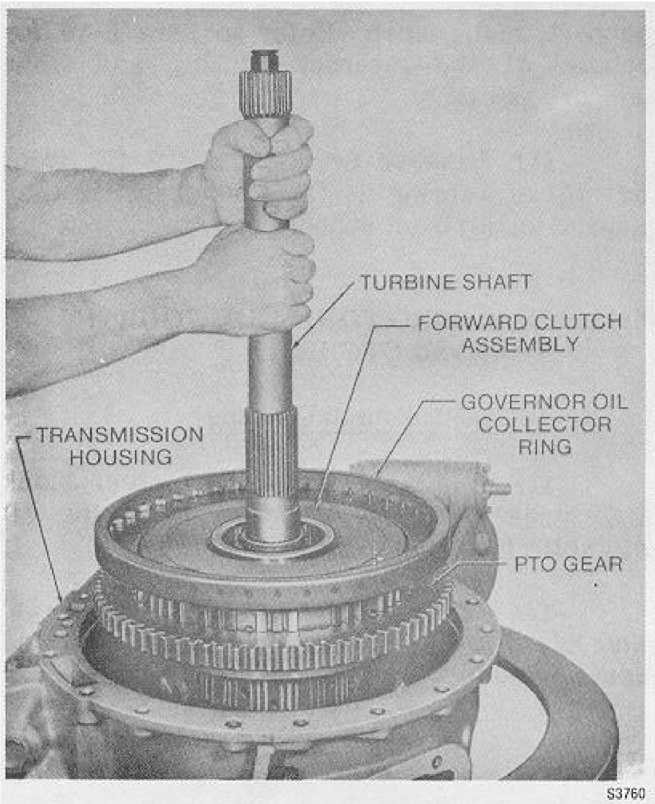


Fig. 5-35. Removing forward clutch assembly

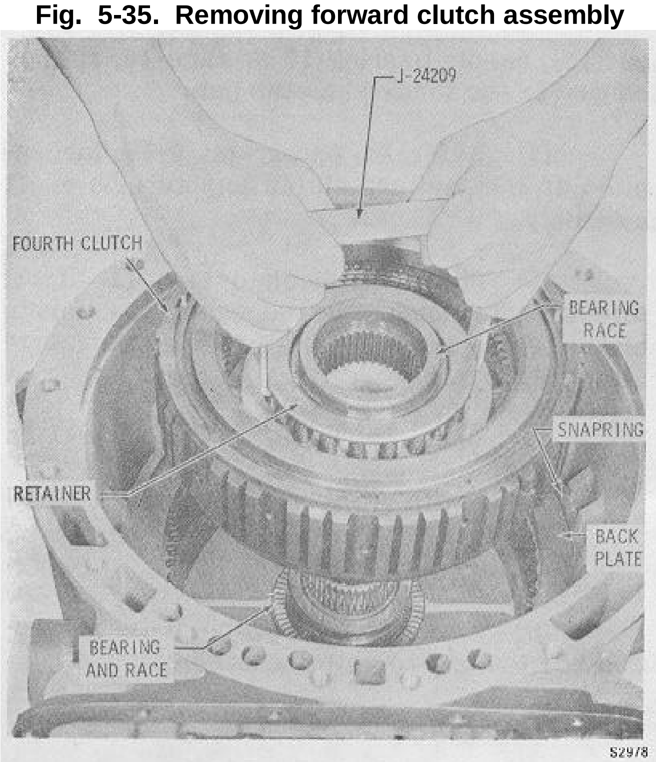


Fig. 5-36. Removing fourth-clutch assembly

(2) Remove eight third-clutch plates.

NOTE

Tie the third-clutch plates together, and identify the pack. Retain for inspection.

5-12. REMOVING CENTER SUPPORT, GEAR UNIT, SECOND CLUTCH (HT 740D, 747D or HT 750DRD)

a. Center Support

(1) Remove the center support anchor bolt and washer (fig. 5-37).

(2) Remove the snapring that retains the center support assembly (fig. 5-38).

(3) Install c e n t e r support lifting bracket J-24195 into the recess between the sealrings on the center support hub (fig. 5-39).

CAUTION

The center support is fitted to the transmission housing with very little clearance. It may bind in the housing if the housing is cold. Heat the housing slightly, if necessary. Do not use a torch to heat the housing. A heat lamp, or a current of warm air, is sufficient. If the support assembly starts upward and then binds, tap it downward and lift again.

(4) Lift carefully, straight upward, on the lifting bracket to remove the center support assembly. If the thrust washer adheres to the rear of the support, remove it.

(5) Refer to paragraph 6-19 for rebuild of the center support assembly.

b. Gear Unit

(1) Attach lifting bracket J-24196 to the main shaft of the gear unit assembly (fig. 5-40).

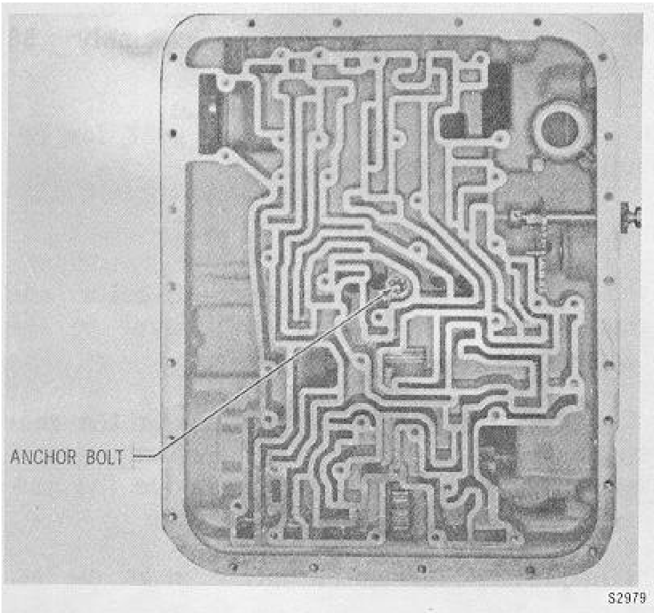


Fig. 5-37. Center support anchor bolt

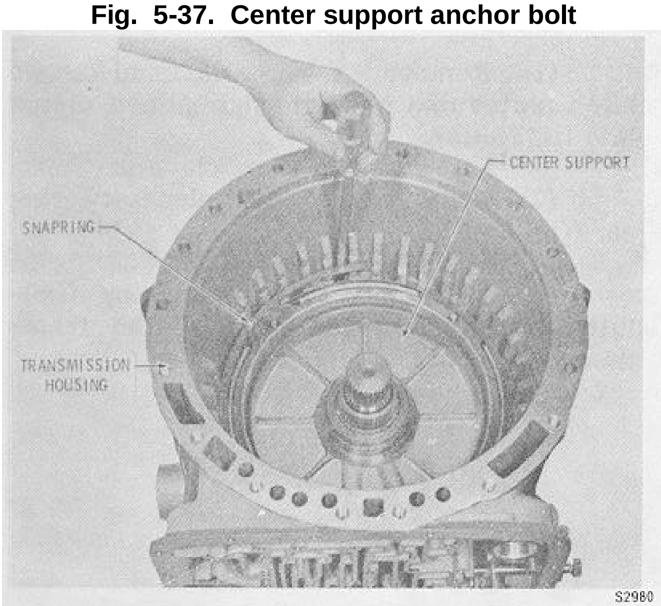


Fig. 5-38. Removing center support snapring

(2) Attach a hoist to the lifting bracket eyebolt and remove the gear unit and shaft assembly from the transmission housing (fig. 5-40).

(3) In HT 750DRD model, remove race 16 (A, foldout 19), needle bearing 17 and race 18 from gear and hub assembly 19 (one or both of these items might adhere to the gear unit when removed).

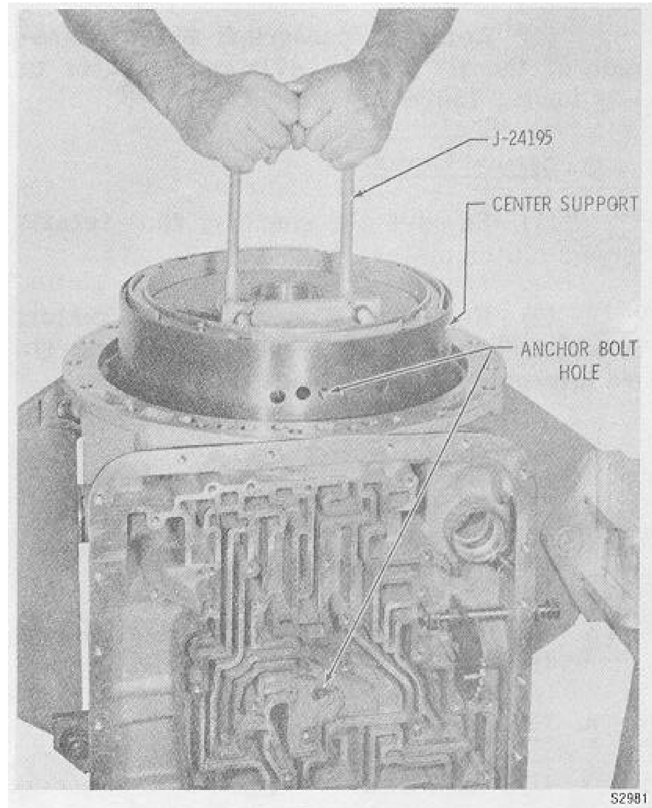


Fig. 5-39. Removing center support

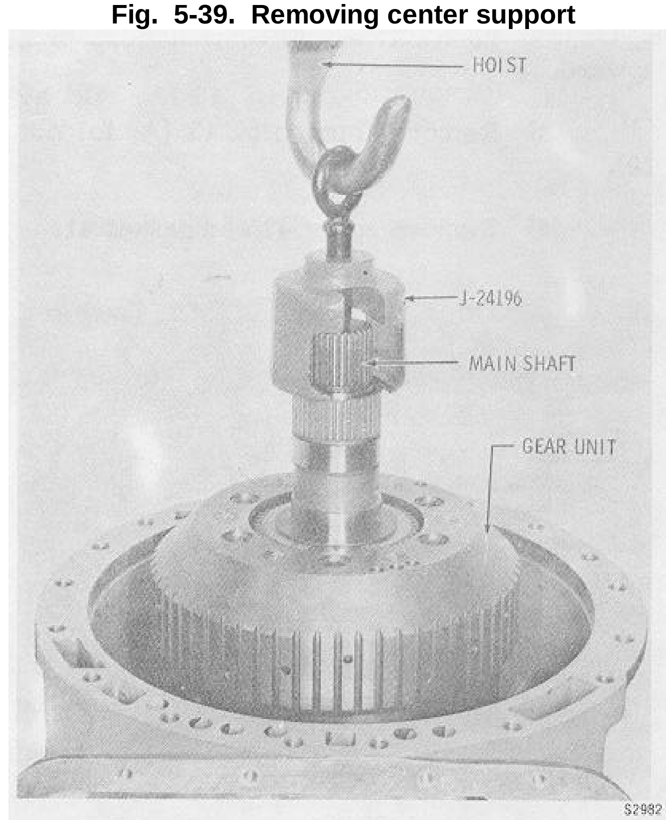


Fig. 5-40. Removing gear unit assembly (HT 740D, 747D or HT 750DRD)

(4) Refer to paragraph 6-20 for rebuild of the HT 740D, 747D gear unit or to 6-21 for HT 750DRD.

c. Second Clutch

(1) Remove the snapring that retains second-clutch plates (fig. 5-41).

(2) Remove 13 second-clutch plates, of which seven are external-tanged and six are internal-splined plates.

NOTE

Tie the second-clutch plates together, and identify the pack. Retain for inspection.

5-13. REMOVING REAR COMPONENTS (HT 740D, 747D) (A, foldout 20)

a. Governor (A, foldout 20)

(1) If the governor was not previously removed, proceed as follows.

(2) Position the transmission rear end upward.

(3) Remove four bolts 43 (A, foldout 20).

(4) Remove cover 42 and gasket 41.'

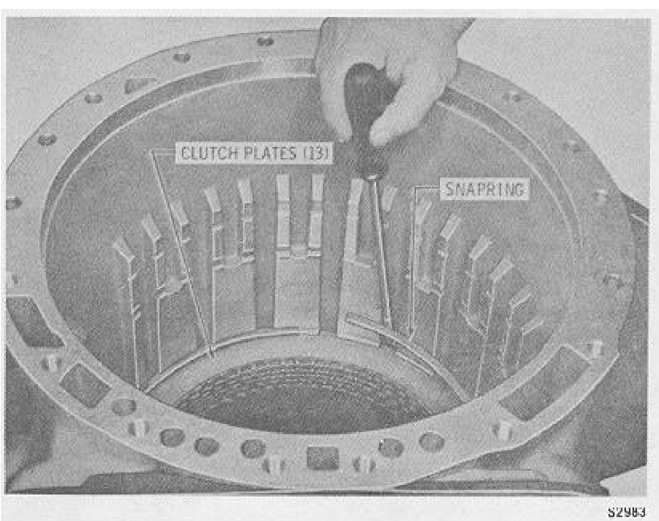


Fig. 5-41. Removing second-clutch snapring

(5) Rotate governor assembly 38 clockwise, then remove it.

(6) Refer to paragraph 6-31 for rebuild of the governor assembly.

b. Rear Cover

(1) Remove twenty-four bolts and washers that retain the rear cover to the transmission housing (fig. 5-42).

(2) Attach a lifting sling to the rear cover and remove the cover from the transmission housing (fig. 5-43). Remove the gasket.

(3) Refer to paragraph 6-26 for rebuild of rear cover assembly.

c. First Clutch

(1) Remove two external-tanged clutch plates and one internal-splined clutch plate (fig. 5-43).

(2) Remove the rear planetary ring gear (fig. 5-43).

(3) Remove the ten remaining first-clutch plates from the rear of the transmission housing.

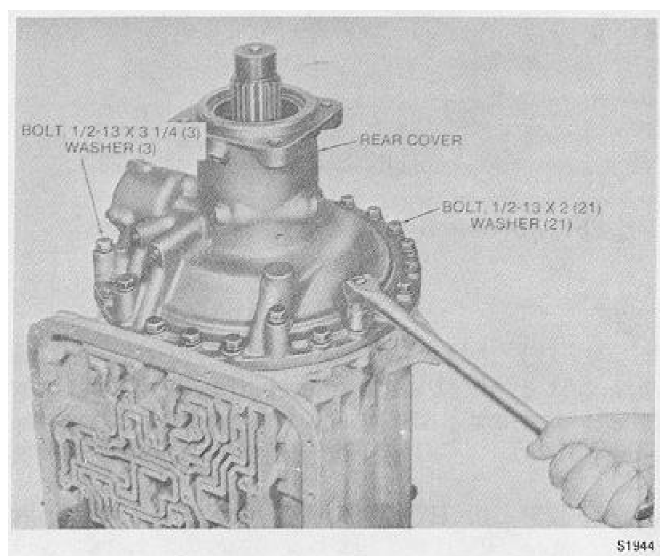


Fig. 5-42. Removing rear cover retaining bolts (HT 740D, 747D)

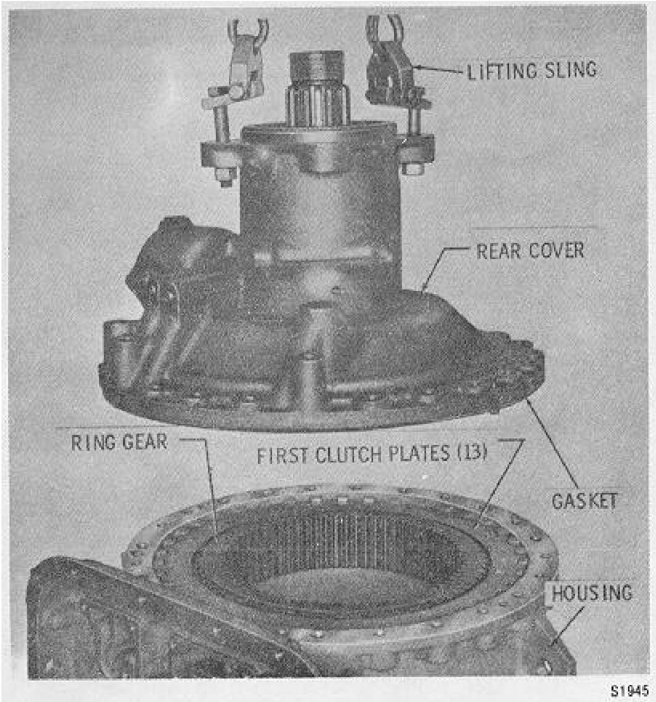


Fig. 5-43. Removing rear cover (HT 740D, 747D)

NOTE

Tie the first-clutch plates together, and identify the pack. Retain for inspection.

(4) Refer to paragraph 6-27 for rebuild of transmission housing.

5-14. REMOVING REAR COMPONENTS (HT 750CRD, HT 754CRD)

a. Governor (A, foldout 20)

(1) If the governor was not previously removed, proceed as follows.

(2) Position the transmission rear end upward.

(3) Remove four bolts 43 (A, foldout 20).

(4) Remove cover 42 and gasket 41.

(5) Rotate governor assembly 38 clockwise, then remove it.

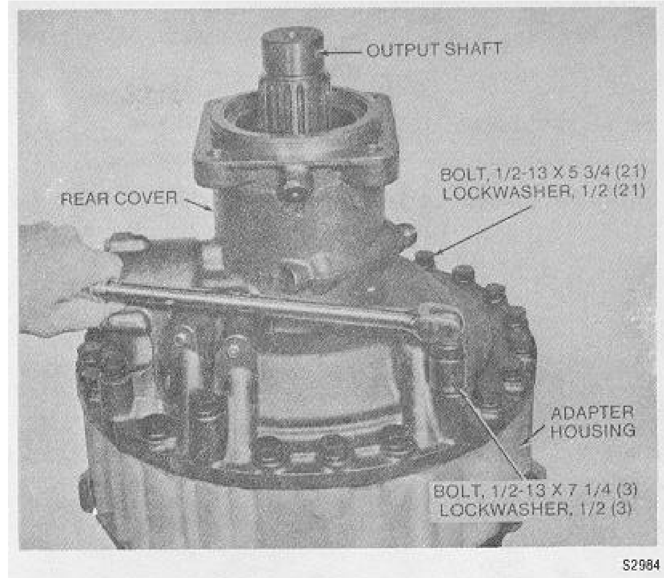


Fig. 5-44. Removing rear cover bolts (HT 750CRD, HT 754CRD)

(6) Refer to paragraph 6-31 for rebuild of the governor assembly.

b. Rear Cover

(1) Remove the twenty-four bolts and washers that retain the rear cover and the adapter housing to the transmission housing (fig. 5-44).

(2) Attach a hoist to the lifting bracket (fastened to output shaft) and carefully separate the rear cover from the adapter housing (fig. 5-45). Remove the rear cover gasket.

(3) Refer to paragraph 6-26 for rebuild of the rear cover assembly.

c. Low Planetary and Clutch

(1) Remove the low planetary carrier assembly (fig. 5-46).

CAUTION

Because the bearing fit on the carrier hub may not be tight, do not attempt to carry the planetary carrier by the bearing.

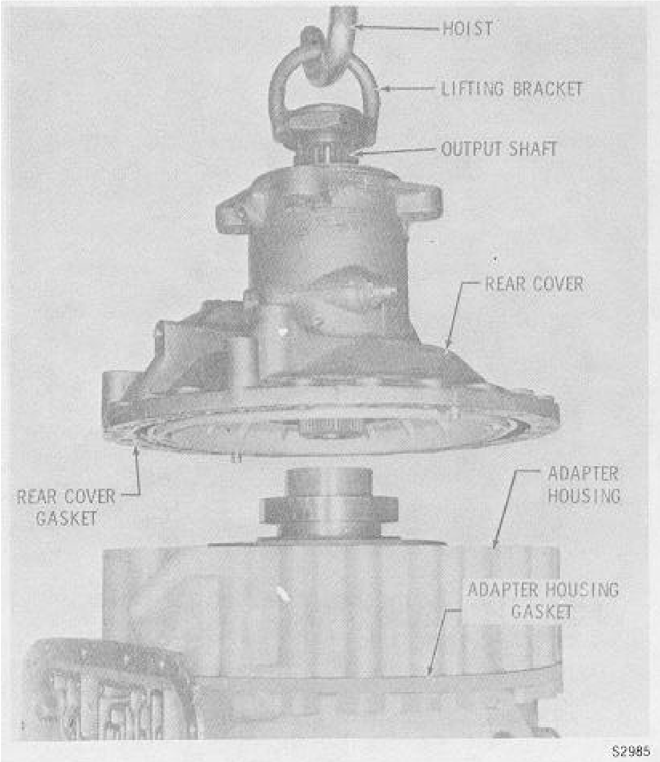


Fig. 5-45. Removing rear cover (HT 750CRD, HT 754CRD)

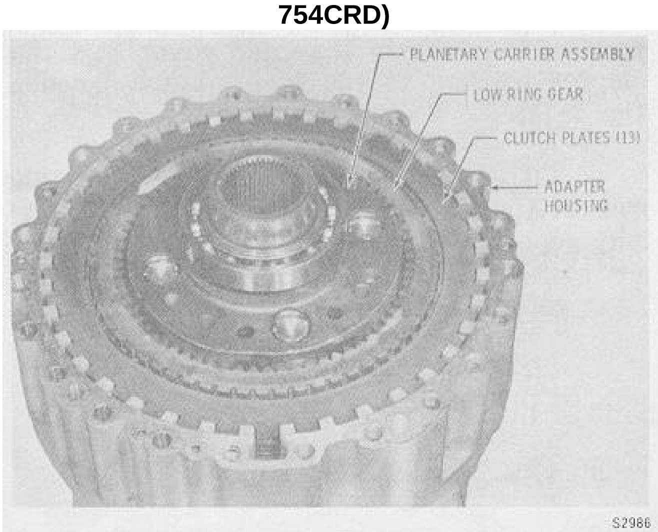


Fig. 5-46. Low planetary carrier, ring gear and clutch (HT 750CRD, HT 754CRD)

(2) Refer to paragraph 6-23 for rebuild of low planetary carrier assembly.

(3) Remove the low ring gear with two clutch plates (fig. 5-47).

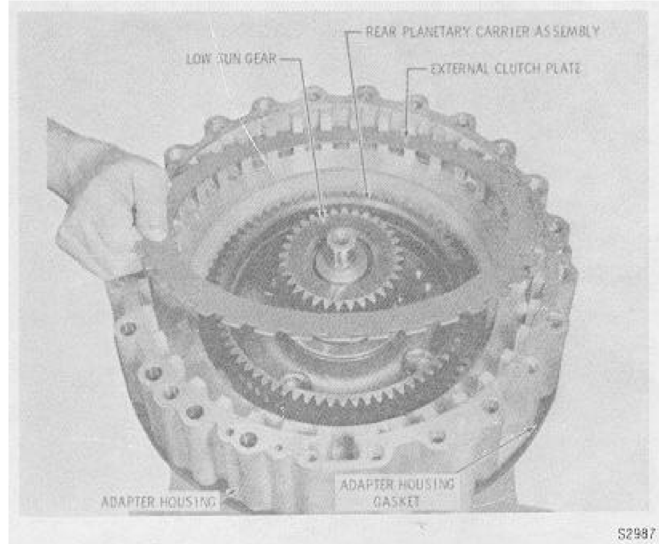


Fig. 5-47. Removing low clutch plates (HT 750CRD, HT 754CRD)

(4) Remove the remaining eleven clutch plates (fig. 5-47).

NOTE

Tie the low-clutch plates together, and identify the pack. Retain for inspection.

(5) Remove the adapter housing and the adapter housing gasket (fig. 5-47).

(6) Refer to paragraph 6-25 for rebuild of the adapter housing assembly.

d. First Clutch and Ring Gear

(1) Remove one internal-splined and one external-tanged clutch plate (fig. 5-48).

(2) Remove the ring gear (fig. 5-48).

(3) Remove the remaining eleven clutch plates (fig. 5-48).

NOTE

Tie the first-clutch plates together, and identify the pack. Retain for inspection.

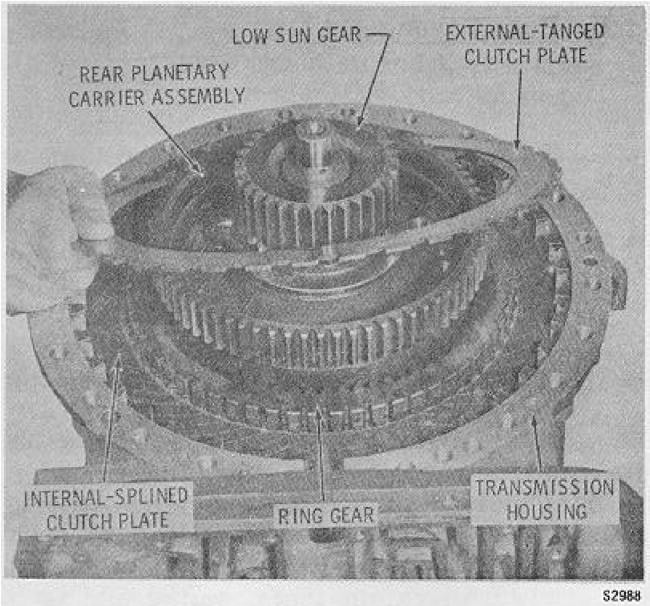


Fig. 5-48. Removing first-clutch plates (HT 750CRD, HT 754CRD)

5-15. REMOVING CENTER SUPPORT, GEAR UNIT, SECOND CLUTCH (HT 750CRD, HT 754CRD)

a. Supporting Gear Unit

(1) With the output end of the transmission upward, install the adapter housing (less piston) and gasket.

(2) Place center support compressor bar J-24208-3 across the rear of the adapter housing so that the center hole in the bar will engage the mainshaft (fig. 5-49).

(3) Install two bolts to retain the tool and the adapter housing to the transmission housing.

b. Removing Components

(1) Invert the transmission housing, converter end upward. Remove the center support anchor bolt and washer (figure 5-37).

(2) Remove the snapring that retains the center support assembly (fig. 5-38).

(3) Install center support lifting bracket J-24195 into the recess between the sealrings on the center support hub (fig. 5-39).

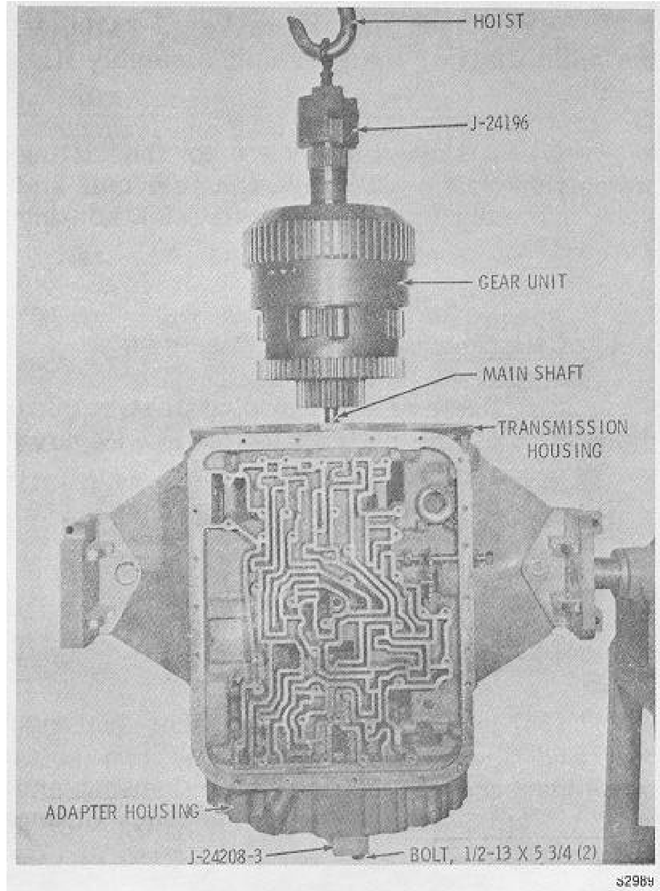


Fig. 5-49. Removing gear unit assembly (HT 750CRD, HT 754CRD)

(4) Lift careful, straight upward, on the lifting bracket to remove the center support assembly.

CAUTION

The center support is fitted to the transmission housing with very little clearance. It may bind in the housing if the housing is cold. Heat the housing slightly, if necessary. Do not use a torch to heat the housing. A heat lamp, or a current of warm air, is sufficient. If the support assembly starts upward and then binds, tap it downward and lift again.

(5) Refer to paragraph 6-19 for rebuild of the center support assembly.

(6) Attach lifting bracket J-24196 to the main shaft of the gear unit assembly (fig. 5-49).

(7) Attach a hoist to the lifting bracket eyebolt and remove the gear unit and shaft assembly from the transmission housing (fig. 5-49).

(8) Refer to paragraph 6-22 for rebuild of the gear unit and shaft assembly.

(9) Remove the snapring that retains the second-clutch plates (fig. 5-41). Remove the 13 second-clutch plates.

NOTE

Tie the second-clutch plates together, and identify the pack. Retain for inspection.

(10) Invert the transmission housing, rear end upward and remove the two bolts retaining bar J-24208-3, adapter housing and gasket (fig. 5-49). Remove the bar, housing and gasket.

(11) Refer to paragraph 6-27 for rebuild of the transmission housing.

5-16. REMOVING REAR COMPONENTS (HT 750DRD)

a. Governor (B, foldout 19)

(1) If the governor assembly was not previously removed, proceed as follows.

(2) Position the rear end upward.

(3) Remove four bolts 31 (B, foldout 19).

(4) Remove cover30 and gasket 28.

(5) Rotate governor assembly 26 clockwise, then remove it.

(6) Refer to paragraph 6-31 for rebuild of the governor assembly.

b. Rear Cover

NOTE

The procedure in (1), below, follows the removal of the second clutch (5-12c). Position the transmission front upward. The improvised tool shown in figure 4-3 may be used, or cotter pins alone (fig. 5-49).

(1) Locate the oil passage holes in the rear planetary ring gear. Insert four 1/8-inch cotter pins, ninety degrees apart, into the oil passage holes in the ring gear until they bottom (fig. 5-50). The pins should be greased to retain them, and should be in holes in the same plane.

(2) Carefully invert the transmission housing, rear cover upward. Remove the twenty-four bolts and washers that retain the rear cover and adapter housing to the transmission housing (fig. 5-44).

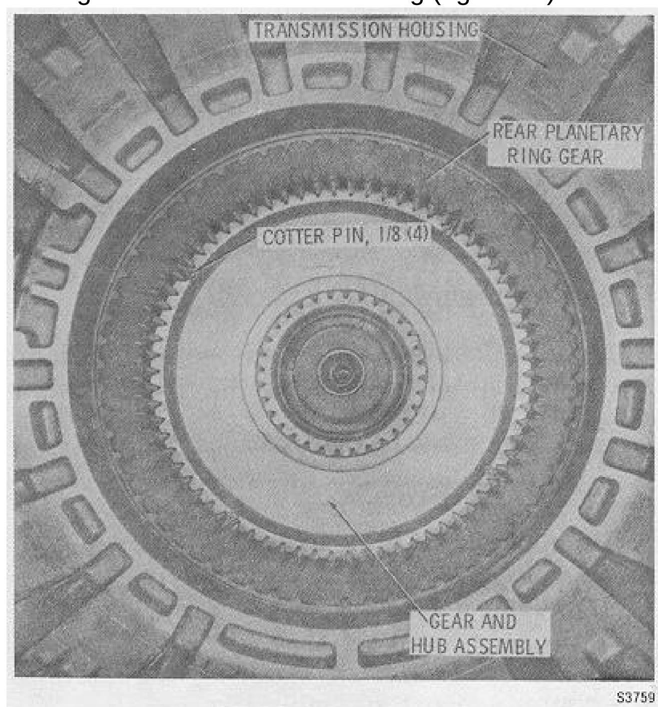


Fig. 5-50. Retaining low sun gear and hub assembly (HT 750DRD)

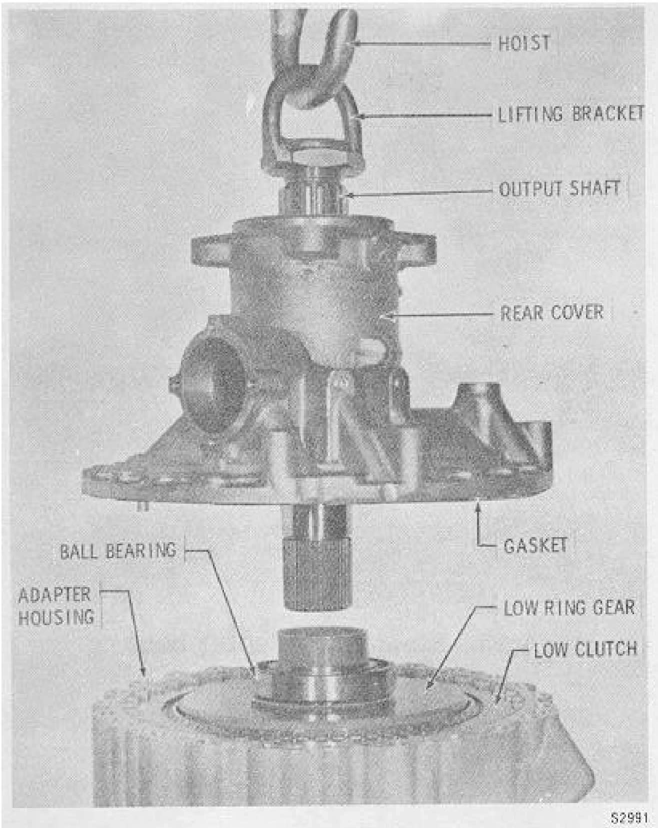


Fig. 5-51. Removing rear cover assembly (HT 750DRD)

(3) Attach a hoist to the lifting bracket (fastened to output shaft) and carefully separate the rear cover from the adapter housing (fig. 5-51). Remove the rear cover gasket.

(4) Refer to paragraph 6-26 for rebuild of the rear cover assembly.

c. <u>Low Planetary and Clutch</u>

(1) Remove the low ring gear and ball bearing assembly (fig. 5-52). Remove the ball bearing assembly from the ring gear if bearing replacement is necessary.

(2) Remove bearing race from ring gear (fig. 5-52).

(3) Remove the bearing race and needle bearing from the low planetary carrier.

(4) Remove the low planetary carrier assembly (fig. 5-53). Remove the bear

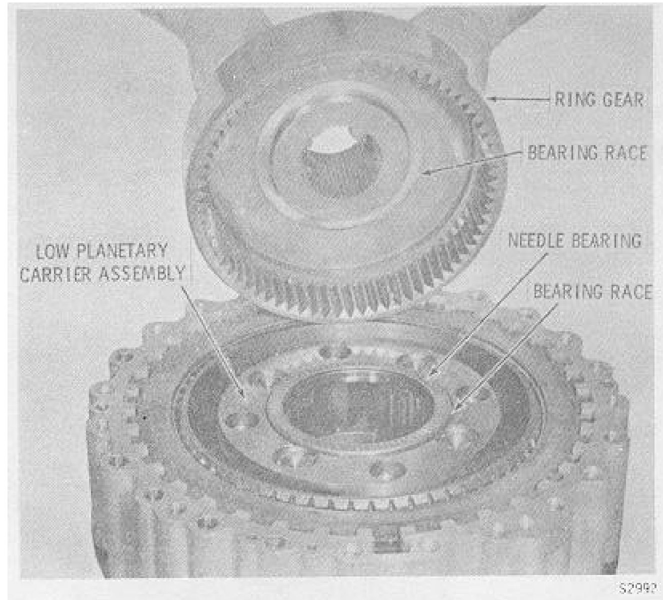


Fig. 5-52. Removing low ring gear (HT 750DRD)

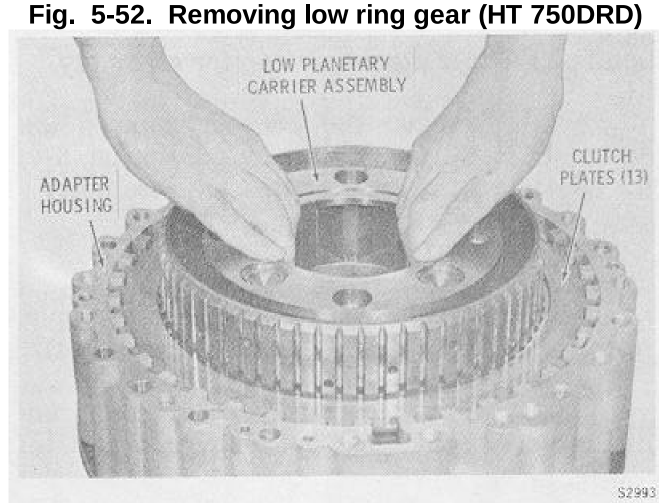


Fig. 5-53. Removing low planetary carrier assembly (HT 750DRD)

ing and bearing races from the low gear hub and gear assembly.

(5) Remove the low sun gear and hub assembly (fig. 5-54). Refer to paragraph 6-24 for rebuild of the low sun gear and hub assembly.

(6) Remove seven external-tanged and six internal-splined low clutch plates from the adapter housing (fig. 5-54).

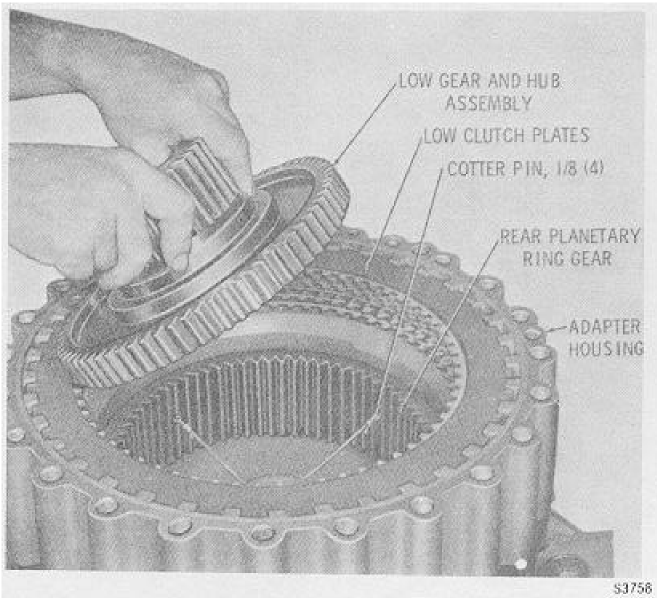


Fig. 5-54. Removing low sun gear and hub assembly (HT 750DRD)

(7) Refer to paragraph 6-23 for rebuild of the low planetary carrier assembly.

(8) Remove the adapter housing and gasket (fig. 5-55). Refer to paragraph 6-25 for rebuild of the adapter housing assembly.

d. First Clutch and Ring Gear

(1) Remove the1/8-inch cotter pins from the rear planetary ring gear (fig. 5-54).

(2) Grasp the ring gear internally and lift upward, removing the ring gear and ten clutch plates from the transmission housing (fig. 5-56).

(3) Remove the three remaining clutch plates.

(4) Refer to paragraph 6-27 for rebuild of transmission housing assembly.

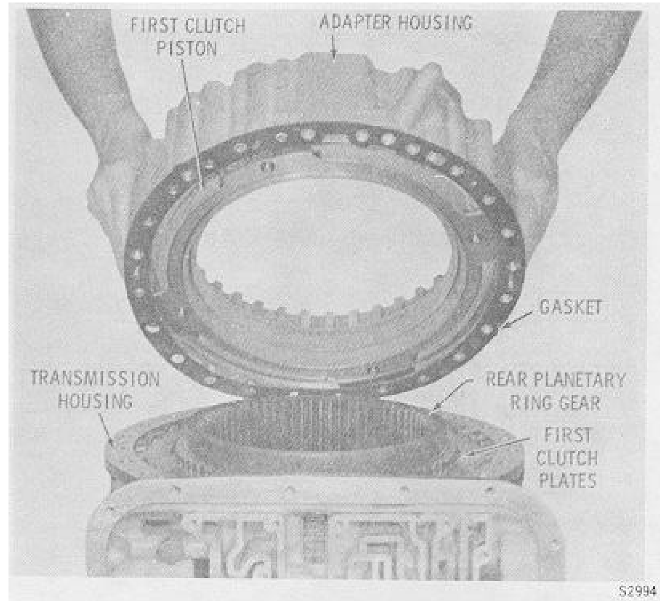


Fig. 5-55. Removing adapter housing (HT 750DRD)

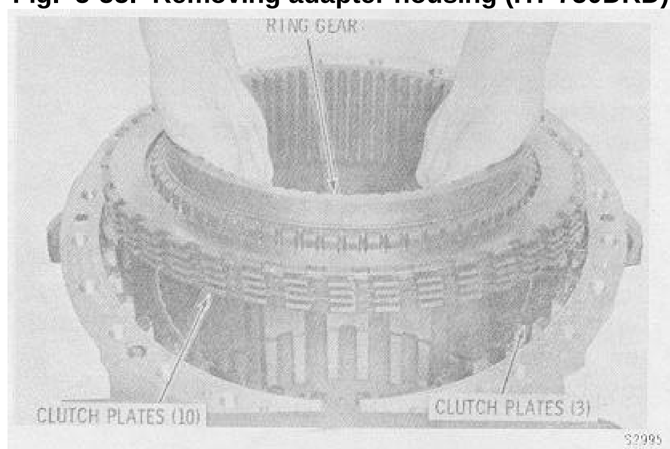


Fig. 5-56. Removing rear planetary ring gear (HT 750DRD)

6-1. SCOPE

This section describes the disassembly and assembly of subassemblies that were removed in Section 5. For rebuild procedures, refer to the exploded views (foldouts 9 through 23) located at the end of this manual. Reference is also made to line drawings and photographs in this section.

6-2. GENERAL INFORMATION FOR SUBASSEMBLY REBUILD

a. Tools, Parts, Methods. Refer to paragraphs 4-2, 4-3 and 4-4.

b. Cleaning, Inspection. Refer to paragraph 4-5 for cleaning and inspection procedures.

c. Torque Specifications. The specific torque value for each threaded fastener is stated at each assembly step. Torque values are also presented on the foldout illustration.

d. Wear Limits, Spring Data. Refer to Section 8 for wear limits and spring data.

e. Plugs and Fittings. Prior to installation, refer to paragraph 4-6c.

f. Clutch Pack Procedure. Clutch clearance must be established prior to assembly. Soak the friction-faced clutch plates in transmission fluid for two minutes after establishing clutch clearance and prior to assembly.

g. Sleeve-Retaining Compound. The use of Loctite Sleeve Retainer 601, or equivalent, is recommended for installing press fit bushings and sleeve-type bearings.

6-3. FLYWHEEL, LOCKUP CLUTCH, CONVERTER TURBINE

a. Disassembly (A, foldout 9)

(1) Position the flywheel assembly, front downward, on the work table (fig. 6-1).

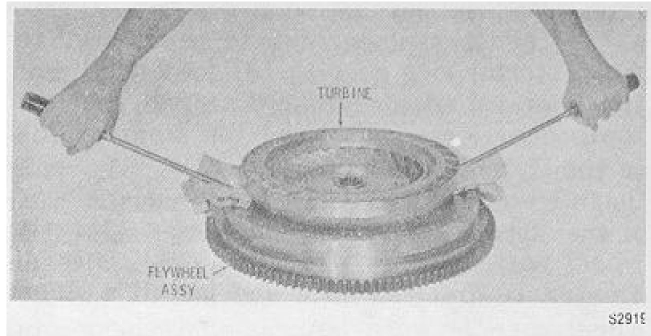


Fig. 6-1. Removing converter turbine from flywheel

Figure 6-2. Removing (or installing) lockup clutch backplate

(2) Using two prybars cushioned to prevent scratching the parts, remove the torque converter turbine from the flywheel (fig. 6-1).

(3) Remove ball bearing 6 (A, foldout 10) from torque converter turbine assembly 8, only if replacement is necessary.

(4) Remove the lockup clutch back plate from the flywheel (fig. 6-2). Remove the key from the flywheel bore.

(5) Remove the lockup clutch plate (fig. 6-2).

(6) Remove the lockup clutch piston (fig. 6-3). Remove the sealring from the piston outer groove.

(7) Remove the sealring from the inner hub of the flywheel (fig. 6-3).

(8) If replacement is necessary, remove starter ring gear 11 (A, foldout 9) from flywheel 12, after noting whether the gear tooth chamfers are toward the front or rear of the flywheel.

(9) If the sealring surface of the flywheel bore is worn beyond 1.007 inches diameter, rework the bore and install a sleeve (P/N 6881519) as shown in figure 6-4.

(10) Cool the sleeve in dry ice for at least thirty minutes before installing. Proper alignment during installation is necessary to prevent damaging the bore and sleeve.

(11) Press the sleeve flush with surface X (fig. 6-4). Be sure the internal chamfer is toward the rear side of the flywheel.

NOTE

Refer to paragraph 6-2, above.

b. Rebuilding Converter Turbine Assembly (A, foldout 10)

NOTE

Do not disassemble the turbine unless the drive gear or turbine hub must be replaced. If the converter turbine is damaged, replace the assembly.

A hydraulic press having a minimum capacity of ten tons, an adjustable press bed with a 25 inch opening and a pressure gauge to assist in determining the rivet staking load. A reworked turbine assembly must be rebalanced.

(1) Remove ball bearing 6 (A, foldout 10) if not previously removed.

(2) Punch mark relationship of lockup clutch hub and turbine.

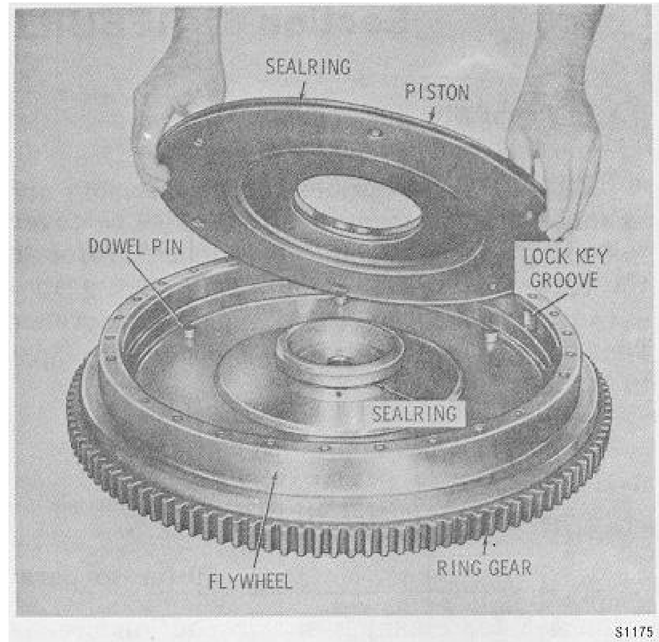


Figure 6-3. Removing (or installing) lockup clutch piston

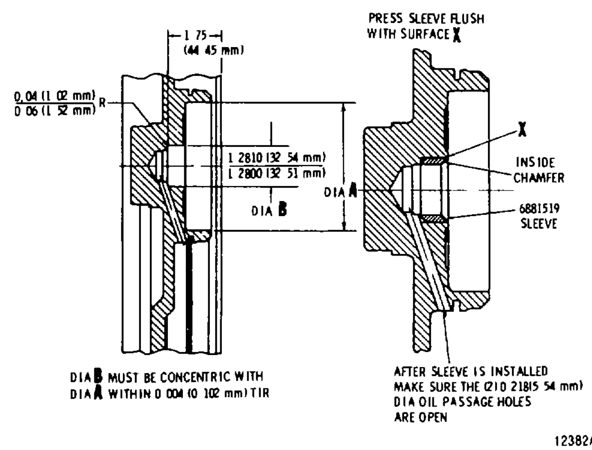


Fig. 6-4. Rework of flywheel-cross section view

(3) Using figure 6-5 as a guide, place base plate J-29535-1 on a work bench, hole side up.

(4) Place converter turbine assembly 8 (A, foldout 10), hub 10 side up, on top of base plate J-29535-1. Align the sixteen rivets to the sixteen holes in the baseplate

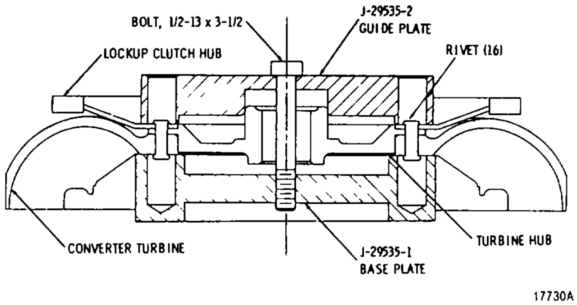


Fig. 6-5. Rivet removing fixture

(5) Place guide plate J-29535-2 on top of converter turbine hub 10. Centrally locate each rivet in the guide plate holes.

(6) Install one clamping bolt 1/2-13 X 3 1/2-inch (fig. 6-5) to retain the guide plate, converter turbine and base plate together. Tighten the bolt 50 lb ft (68 N-m).

(7) Place the turbine assembly and fixture in a drill press.

(8) Place drill guide J-29535-5 into guide plate J-29535-2 (fig. 6-6). Using a 1/4 inch drill, drill approximately 3/16 inch deep.

(9) Place the drill guide in the next hole. Rotate the guide plate and drill the rivet. Continue until all the rivet heads have been removed.

(10) Place the turbine and fixture In a hydraulic press. Install rivet remover tool J-29535-4 into the guide plate (fig. 6-7). Press out each rivet.

CAUTION

Do not use a hammer to remove the rivets.

(11) Remove the guide plate retaining bolt.

(12) Inspect turbine 11 (A, foldout 10) for cracks, distortion and abrasions. If deficiencies are noted, the turbine must be scraped.

(13) Inspect the rivet holes for burrs or swelling. Deburr as necessary.

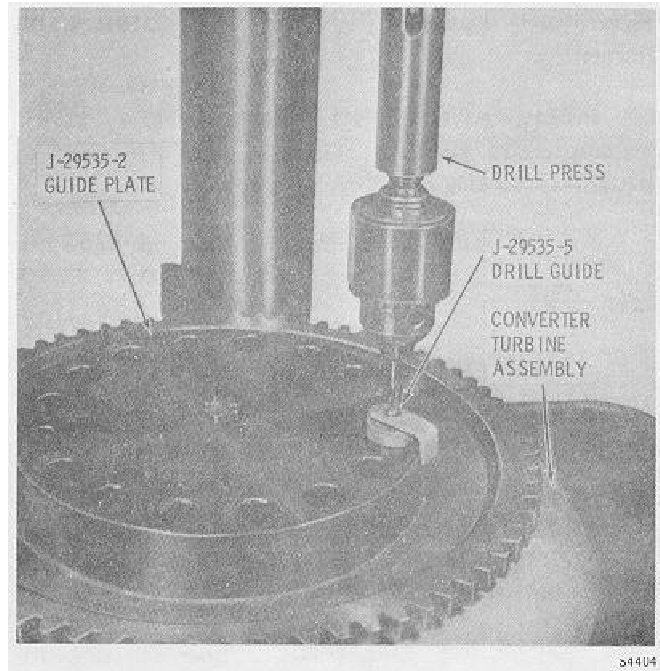


Fig. 6-6. Removing rivet heads from converter turbine

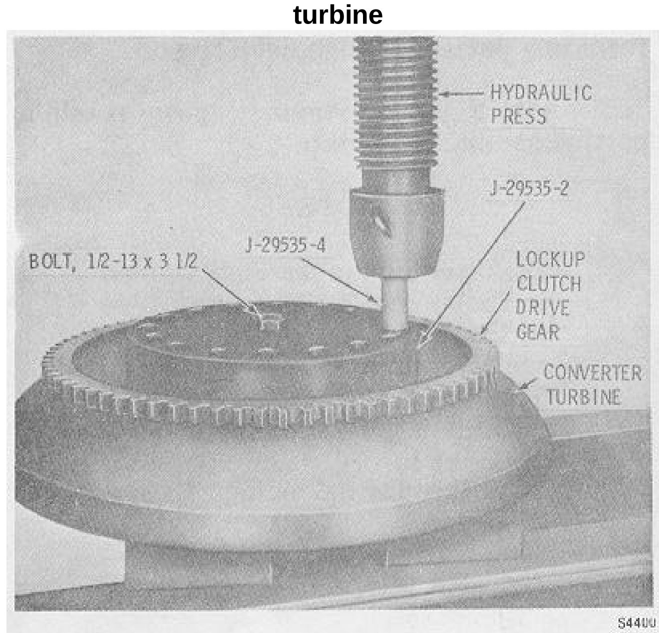


Fig. 6-7. Removing rivets from converter turbine

(14) Inspect detail lockup clutch drive gear for cracks distortion, abrasion, battered or broken teeth.

(14) Reassemble components, being sure to correctly index punch marks of the lockup drive gear, turbine and hub. Use the

new rivets to help index the detail components.

(16) Install sixteen new rivets through the turbine, turbine hub and lockup clutch gear (fig. 6-8).

(17) Assemble base plate J-29535-1, solid side of plate against the rivet heads (fig. 6-8).

(18) Place guide plate J-29535-2 on top of the assembled components. Centrally locate the rivets in the holes of the guide plate.

(19) Retain the turbine assembly and the two plates with bolt 1/2-13 x 3 1/2 (fig. 6-8). Tighten the bolt 50 lb ft (68 N-m).

(20) Place the turbine and fixture in the hydraulic press (fig. 6-9).

(21) Insert staking tool J-29535-5 into the top plate (fig. 6-9). Using an alternating pattern, swage each rivet.

(22) Remove staking tool, retaining bolt, guide and base plate.

NOTE

Each reclaimed assembly must be balanced by rotating type static balance to within 1.0 ounce inch by removing metal from area indicated as required maintaining 0.13 minimum wall. Optional to drill 0.250 diameter holes thru for balancing.

c. Assembly

(1) If the starter ring gear was removed install a new gear, as follows.

(2) Install the starter ring gear after heating it uniformly to 4000F (2040C) maximum temperature. Be sure the chamfers of the teeth are facing the proper direction for starter pinion engagement. The ring gear must seat firmly against the shoulder on the flywheel.

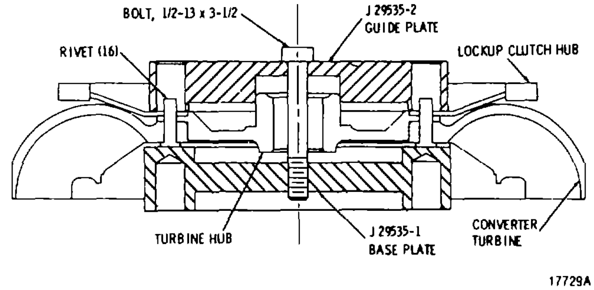


Fig. 6-8. Rivet installation fixture

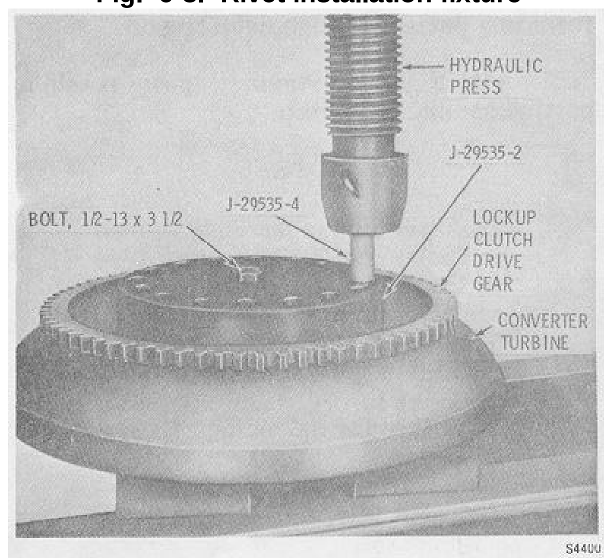


Fig. 6-9. Staking converter turbine rivets

(3) Place flywheel12 (A, foldout 9) on the assembly table, with the cavity side upward.

(4) Install sealring1 (A, foldout 10) onto the flywheel hub (fig. 6-3), and sealring 2 onto the outside diameter of lockup clutch piston 3. Lubricate both sealrings.

(5) Place a pencil mark on the edge of the lockup clutch piston opposite a dowel pin hole. Also place a pencil mark in the flywheel bore, opposite a dowel pin.

(6) Install the lockup clutch piston into the flywheel, aligning the pencil marks, to engage the recesses in the piston with the dowel pins (fig. 6-3). Be certain the dowel pins are engaged.

(7) Install the lock key in the lock key groove of the flywheel (fig. 6-2). Use oil-soluble grease to retain it.

(8) Install the lockup clutch plate (fig. 6-2).

(9) Install the lockup clutch back plate, flat side first, engaging the notch in the plate with the key in the flywheel (fig. 6-2).

(10) If ball bearing 6 (A, foldout 10) was removed, press it onto the hub of turbine 7.

(11) Carefully center t h e lockup clutch plate in the flywheel. Install the torque converter turbine, engaging its hub splines with the internal splines of the lockup clutch plate. Seat the ball bearing in its bore.

6-4. TORQUE CONVERTER STATOR ASSEMBLY

a. Disassembly (A, foldout 10) (1) Rotate stator freewheel roller race 25 in a clockwise direction to free it for removal.

(2) Remove race 25, thrust bearing 24, thrust bearing race 23, ten stator rollers 22 and ten freewheel roller springs 21 from stator assembly 13.

NOTE

Refer to paragraph 6-2, above.

b. Rebuilding Stator Assembly (A, foldout 10)

NOTE

Do not disassemble the stator assembly unless replacement of stator thrust washer 14, rivets 19, or washer 18 is necessary. If stator 16 or cam 17 is cracked or damaged, replace the complete stator assembly. A hydraulic press having a minimum capacity of five tons, an adjustable table, and a pressure gauge to assist in determining the rivet staking load that is required to rebuild the stator assembly.

(1) Place the stator assembly in a drill press, formed rivet side up (fig. 6-10).

(2) Using a 3/8 inch drill, align and drill the rivet, removing the formed head.

(3) Place base plate J-29121-2 under the stator assembly (fig. 6-11). Be sure the holes in the baseplate are under the rivet heads. Place top plate J-29121-4 on top of the stator assembly.

(4) Install the 5/8-11 X 3.25 inch bolt to hold the two plates together. Tighten the bolt to 60 lb ft (81 N-m).

(5) Place fixture stand J-25587-1 on a hydraulic press (fig. 6-11). Install rivet remover pin J-29121-3 into fixture J-25587-1 head. Tighten the tool retainer thumb screw.

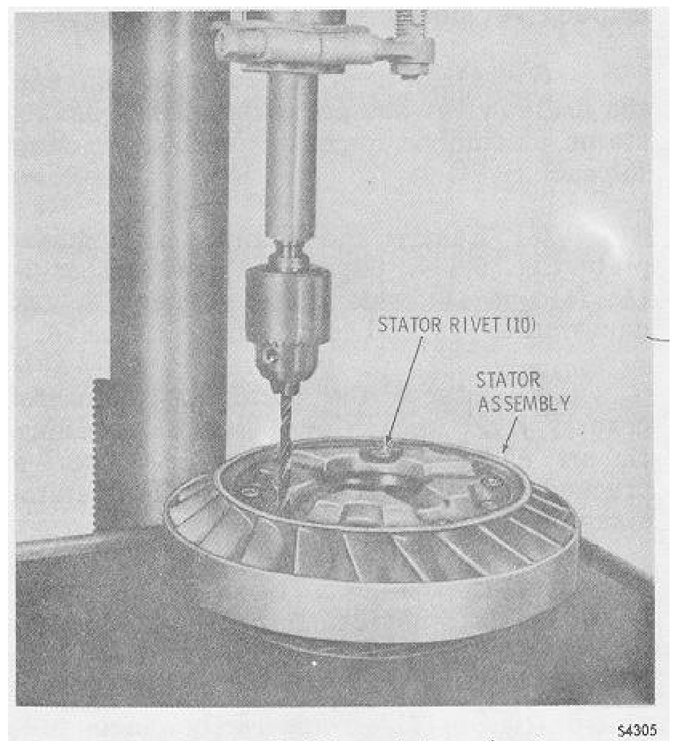


Fig. 6-10. Drilling stator rivets

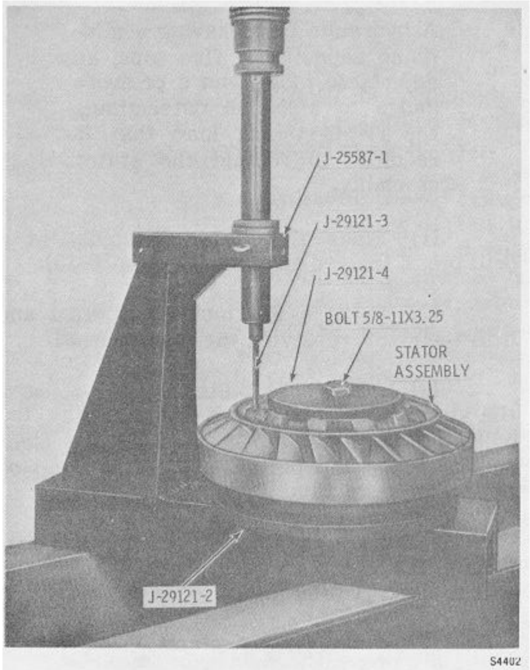


Fig. 6-11. Removing stator rivets

(6) Place the stator assembly, with base and top plates, onto the fixture stands, drilled rivet side up.

(7) Align the rivet remover pin with the drilled rivet and press the rivet from the stator assembly. Repeat the above process for each rivet.

(8) Remove the retaining bolt and top plate (fig. 6-11). Separate thrust washer 14 (A, foldout 10), side plate washer 18, two cam washers 15, and cam 17 from stator 16.

(9) Inspect the stator and cam for cracks, rivet holes for burrs or swelling. Deburr as required. If cam or stator is cracked or distorted, replace the stator assembly.

(10) If the cam becomes separated from the stator, it can be reinstalled in the following manner. Place the stator on a work table so that the thick portion of the vanes is upward (fig. 6-12). Temporarily place two rivets 180° apart with the headless ends up

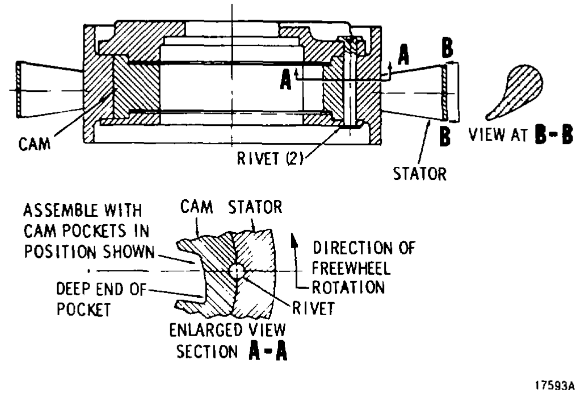


Fig. 6-12. Locating cam pockets

into their grooves in the stator. Using the rivets for alignment, install the cam so that the deep end of each pocket is positioned as shown. Tap the cam into place with a soft drift. Remove the two rivets.

(11) Install cam washers 15, one on each side of the stator. Install freewheel washer 18 and thrust washer 14.

(12) Align the rivet holes and insert ten new 1/4 X 2 5/8-inch rivets into the stator assembly from the side plate washer side and through the stator thrust washer.

(13) Place the stator assembly on base plate J-29121-2 (fig. 6-13). Be sure the rivet heads rest on the base plate, between clearance holes. Install top plate J-29121-4 and the 5/8-11 X 3.25 retaining bolt. Strike the top plate with a rubber mallet to seat components. Tighten retainer bolt to 60 lb ft (81 N-m).

(14) Place the stator assembly on fixture J-25587-1 (fig. 6-13). Install stake tool J-29121-1 into the fixture head of J-25587-1 and tighten the thumb screw finger tight.

NOTE

The amount of force to apply will vary depending on the condition of the swaging tool and the press equipment being used.

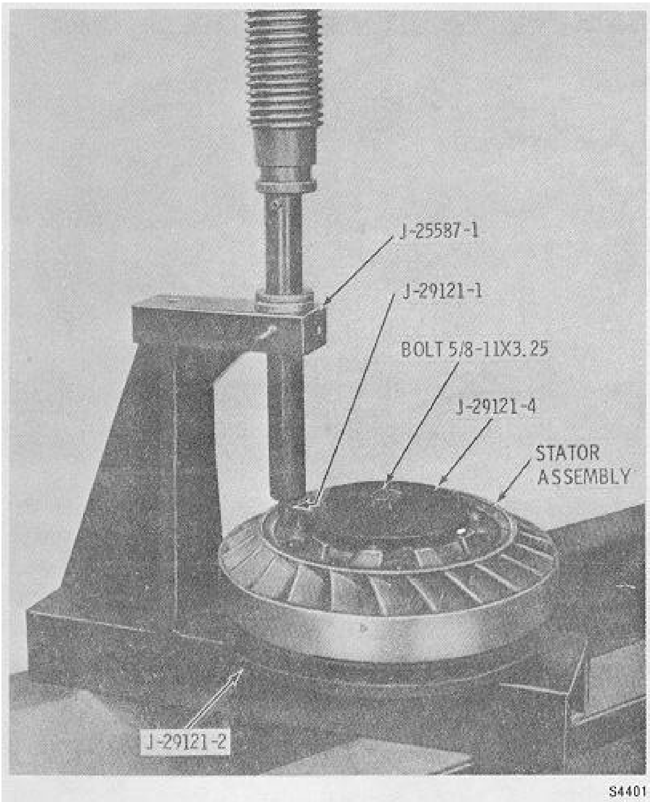


Fig. 6-13. Staking stator rivet

(15) Apply approximately 8000 pound (3629 kg) load to swage each rivet head. Swage the second rivet 180 degrees from the first. Locate the third rivet, 90 degrees from the second, etc., until all rivets are swaged.

(16) Remove the top and bottom plate retaining bolt from stator assembly 13 (A, foldout 10). Remove the two plates.

c. Assembly (A, foldout 10) (1) Place stator assembly 13 on the work table, rear side upward. Install thrust bearing race 22 into the stator.

(2) Coat the pockets of stator assembly 13, stator springs 20 and rollers 21 with oil-soluble grease.

(3) Install stator roller holder J-24218-2 into the stator against the thrust bearing race installed in (1). above (fig. 6-14).

(4) Install ten freewheel roller springs into the stator cam pockets. The springs must be positioned as shown in figure 6-15.

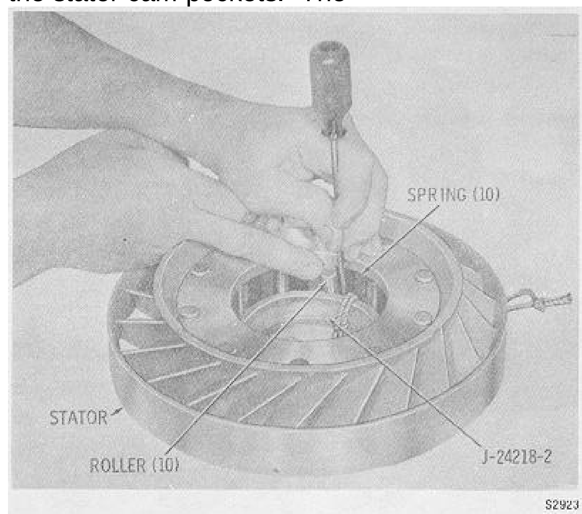


Fig. 6-14. Installing stator free wheel roller

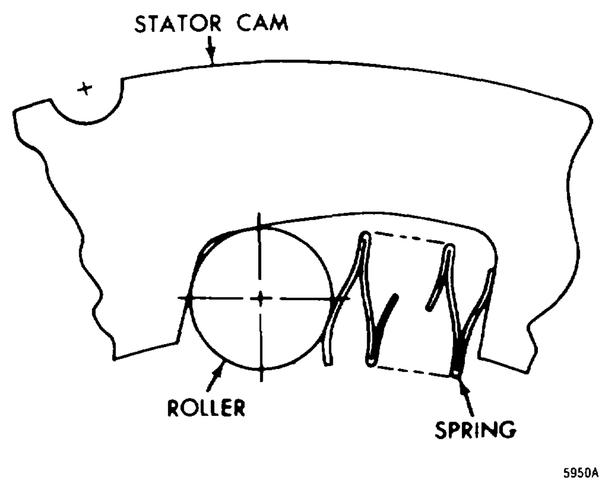


Fig. 6-15. Spring and roller in stator cam

(5) Install ten freewheel rollers (fig. 6-14).

(6) Install the thrust bearing onto the freewheel roller race (fig. 6-16).

(7) Start the freewheel roller race into the stator until the thrust bearing is near the roller holder (fig. 6-16). Rotate the race clockwise to install it.

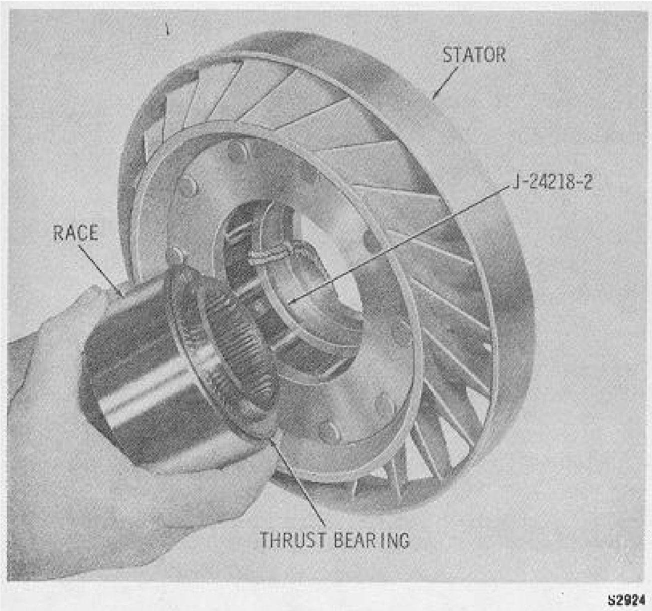


Fig. 6-16. Installing freewheel roller race

(8) Remove the roller holder by pulling on the thong attached to it. Push the roller race inward (rotating it clockwise) until the thrust bearing seats.

(9) Rotate the freewheel roller race counterclockwise to lock in place. Position the stator assembly with its roller race upward until ready for installation. Cover or wrap the assembly to keep out dust and dirt.

6-5. TORQUE CONVERTER PUMP ASSEMBLY

a. Disassembly (A, foldout 10)

(1) Remove sealring 31 from the front of converter pump 33.

(2) Flatten the corners of the lockstrips, and remove twelve bolts from the converter pump (fig. 6-17).

(3) On earlier models, remove bolts 27, lockstrips 28, two piece bearing retainer 29, gasket 41, pump hub 42 and hub sealring 43. Do not remove ball bearing unless part replacement is necessary.

(4) On later models, remove bolts 27, lockstrips 28, one piece retainer 30, split

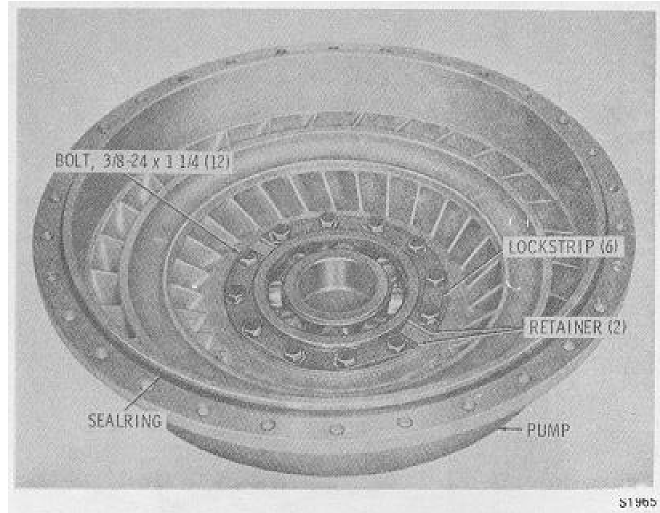


Fig. 6-17. Torque converter pump components

race bearing 36, gasket 40, pump hub 42 and hub sealring 43.

(5) On models containing converter housing PTO gears, remove items 27, 28, 29 and 39. Do not remove bearing 38 unless part replacement is necessary.

(6) The torque converter must be rebalanced if balance weights 34 were added or replaced.

NOTE

Refer to paragraph 6-2, above.

b. Assembly (A, foldout 10)

NOTE

Items 2 through 10 below describe the installation of the split race bearing. Items 12 through 15 describe the installation of the PTO drive gear with a double row ball bearing.

(1) If bearing 36 (split race) was removed from the converter pump, use the following procedure to install a new bearing.

(2) Make sure the outer races have the same serial numbers, and all the bearing balls on the inner race are in place.

(3) Install new bearing 36 (all three parts) into pump hub 42.

(4) Place new gasket 40 onto pump hub 42 and install both the gasket and the hub onto the rear of the converter pump 33.

(5) Install retainer 31 into the front of the converter pump 33. Align the holes in the retainer, converter pump and pump hub. Install one 3/8-24 X 1 1/4-inch bolt 27 and one lockstrip 28 at the 12 o'clock position. Do not tighten the bolt.

(6) Install three more bolts and lockstrips one each at 3, 6 and 9 o'clock positions. Snug the bolts in the 12, 6, 3 and 9 o'clock sequence.

(7) Tighten the four bolts in the same sequential manner 33-40 lb ft (44-54 N•m).

(8) Install the retaining eight bolts and lockstrips. Tighten the bolts 33-40 lb ft (44-54 N•m) and bend the corner of each lockstrip to retain the twelve bolts. Install gasket 40 onto hub 42.

(9) Retain the ground sleeve in a rigid position. Install the assembled converter pump onto the ground sleeve until the bearing is properly seated.

(10) Rock the pump about the bearing, noting outer pump lip travel. Total rock must be at least 0.015 inch or bearing must be replaced.

NOTE

Failing to use t h e sequential torque procedure for installing the twelve retainer bolts and the recommended rocking clearance check, will lead to premature bearing failure.

(11) If bearing 37 was removed, replace it with new split race bearing 36. Discard gasket 41. Refer to paragraph b, (2) through (10).

(12) If bearing 38 was removed, install a new bearing grooved end last, into drive gear 39.

(13) Install drive gear 39 and bearing 38 on to converter pump 33. Retain drive gear 39 and bearing 38 to converter pump 33 with retainers 29, twelve bolts 27 and six lockstrips 28.

(14) Tighten the bolts to 33-40 lb ft (45-54 N•m). Bend the corner of each lockstrip to retain the twelve bolts (fig. 6-17).

(15) Install sealring 31 onto the outside diameter of converter pump assembly 32.

6-6. CONTROL VALVE BODY ASSEMBLY

CAUTION

The valve body assembly contains a number of springs, some of which are similar and can be mistakenly interchanged. Also, springs vary in v a 1 v e bodies u s e d on different models. If the springs are not reinstalled in the s a m e locations from which removed, erratic shift patterns may occur. For these reasons, it is recommended that each spring, at removal, be tagged with its item number in B, foldout 20. This will simplify correct assembly of the valve body components.

a. <u>Disassembly</u> (B, foldout 20)

(1) Place valve assembly 1 (B, foldout 20) on the work table, modulator valve body 28 upward. Reference figure 6-18.

(2) If not previously removed, remove manual selector valve 80 or 81. Stop bolt 70 must be removed before valve 81 can be removed.

(3) Remove three bolts 17 that retain modulator valve body 28. Remove control valve body 30 while holding oil transfer plate 7 and separator plate 29 together.

(4) Invert the oil transfer and separator plates (separator plate on top) while holding them firmly together. Place them on the work table.

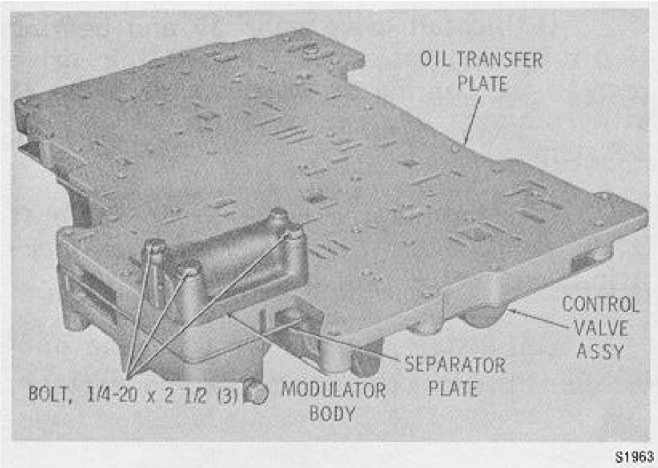


Fig. 6-18. Components of control valve assembly

(5) Lift or slide separator plate 29 off oil transfer plate 7. Note check ball locations in the oil transfer plate (fig. 6-19). Make a sketch or list that will identify the ball sizes and locations (for reassembly). Remove the balls.

NOTE

If balls are accidentally lost, dropped or misplaced, refer to PARTS CATALOG SA 1268 for proper location.

(6) Remove the lubrication pressure regulator valve from the oil transfer plate as follows. Depress cup washer 4 (B, foldout 20) and remove pin 5. Release washer 4 and remove it. Remove spring 3 and valve 2. Remove valve pin 6 from the oil transfer plate.

NOTE

Before removing p i n s 27, 79, 82, 103 and 109, make a note or sketch that shows the position of adjusting rings 26, 78, 88, 97, 102 and 108 in respect to their retaining p i n s. If the valve body is reassembled with t h e same springs, and the adjusting rings are in their original positions, the original calibration of the valve body is maintained.

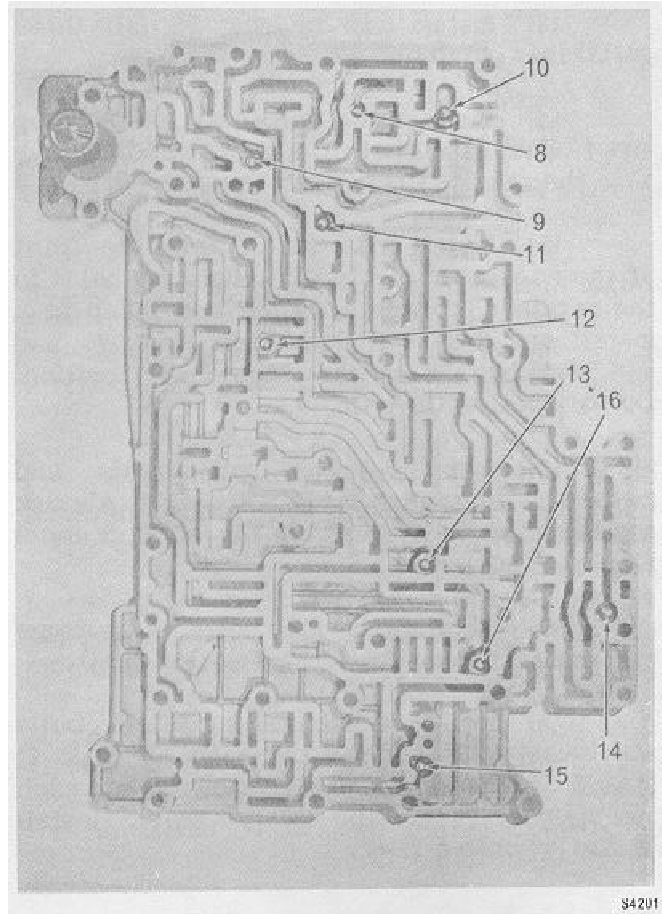


Fig. 6-19. Ball locations in oil transfer plate

(7) Disassemble the modulator valve body, removed in (3), above. Press adjusting ring 22 or 26 inward and remove retainer pin 27. Release the adjusting ring and remove it. Remove valve stop 21, washer 20, spring 19, and valve 18 prior to S/N 2510066690(After S/N 2510066689, remove spring 25, modulator valve 24 and modulator actuator valve 23.

(8) Remove priority valve 73, spring 72, and valve stop 71 from the control valve body 30.

(9) Position valve body 30, flat side upward, on the work table. Remove plug 65 and screen assembly 64.

(10) Remove eight bolts 50 while holding trimmer cover 49 against spring pressure. Relieve pressure and remove cover 49.

(11) Remove springs 33 and 34, valve stop 35, trimmer plug 32, and trimmer valve 31.

(12) Remove springs 38 and 39, stop 40, plug 37, and valve 36.

(13) Remove springs 43 and 44, stop 45, plug 42, and valve 41.

(14) Remove valve 48, spring 47 and stop 46.

(15) Remove springs 53 and 54, stop 55, plug 52 and valve 51.

NOTE

In operations (16) through (24), below, the components in each bore are spring-loaded and must be compressed while removing the retainer pins.

(16) Remove retainer pin 56, valve stop 60, spring 59, and valve 58.

NOTE

In earlier models, valve stop 60 consisted of two separate pieces.

(17) Remove retainer pin 57, spring spacer 63, spring 62, and valve 61.

(18) Remove retainer pin 69, spring 67, stop 68 and valve 66.

NOTE

Before S/N 10300, remove retainer pin 79, plug, s t o p 76, spring 75, and valve 74. After S/N 10299 remove parts in item (19), below.

(19) Remove retainer pin 79, adjusting ring 78, spring washer 77, valve stop 76, spring 75 and valve 74.

NOTE

Step (20) explains the removal of the 1-2 shift valve configuration used in early production 2nd gear start units. Step (21) explains the removal of the 1-2 shift valve configuration used in late production 2nd gear start units. Step (22) explains the removal of the 1-2 shift valve used in all transmissions that do not require 2nd gear start.

(20) Remove retainer pin 82, shift signal plug 92, signal plug 91, shift valve 90, and shift valve spring 89.

(21) Remove retainer pin 82, adjusting ring 88, valve stop 87, spring 86, modulated valve 85, 1-2 shift valve 84 and spring 83.

(22) Remove retainer pin 82, adjusting ring 97, stop 96, spring 95, modulator valve 94, and 1-2 shift valve 93.

(23) Remove retainer pin 103, adjusting ring 102, spring 100, valve stop 101, and valves 98 and 99.

(24) Remove retainer pin 109, adjusting ring 108, spring 106, valve stop 107, and valves 105 and 104.

(25) Remove retainer pin 113, valve stop 112, spring 111, and valve 110.

NOTE

In earlier models, valve stop 112 consisted of two separate pieces.

(26) Remove retainer pin 117, spring 115, valve stop 116, and valve 114.

NOTE

Refer to paragraph 6-2, above.

b. Assembly (B, foldout 20)

NOTE

Check the position of all components, configuration of all valves and plugs, and identification of all springs before installation. P 1 a c e the valve body on a work table, flat side upward. Refer to figure 6-20; B, foldout 20; and spring chart in Section 8. All valves, when dry, should move freely by their own weight, in their bores.

(1) Install relay valve 61 (B, foldout 20), larger diameter first, spring 62 and valve spring spacer 63 into bore 'A', figure 6-20. Depress spacer 63 and install retainer pin 57 into its hole in valve body 30.

NOTE

In earlier models valve stop 60 consisted of t w o separate pieces.

(2) Install relay valve 58, spring 59 and valve stop 60 into bore 'B', figure 6-20. Depress the valve stop and install retainer pin 56 into its hole in valve body 30.

(3) Install fourth clutch trimmer valve 51 (smaller end first), plug 52, secondary spring 53, primary spring 54 and valve stop 55 into bore 'C' (fig. 6-20) of valve body 30.

(4) Install second clutch trimmer valve 41 (smaller end first), plug 42, secondary spring 43, primary spring 44 and valve stop 45 into bore 'D' (fig. 6-20) of valve body 30.

(5) Install third clutch trimmer valve 31 (B, foldout 20), smaller end first, plug 32, secondary spring 33, primary spring 34 and valve stop 35 into bore 'E' (fig. 6-20) of valve body 30.

(6) Install first clutch trimmer valve 36 (smaller end first), plug 37, secondary spring 38, primary spring 39 and valve stop 40 into bore 'F' (fig. 6-20) of valve body 30.

(7) Install trimmer boost accumulator stop 46 (B, foldout 20), spring 47 and trimmer boost accumulator valve 48 into bore 'S' (fig. 6-20) of valve body 30.

(8) Place trimmer valve cover 49 (B, foldout 20) onto valve body 30. Compress the springs and retain the cover with eight 1/4-20 x 5/8-inch bolts 50. Tighten the bolts to 9-11 lb ft (12-15 N•m).

(9) Install trimmer regulator valve 114 (smaller diameter first), spring 115 and valve stop 116 into bore 'G' (fig. 6-20) of valve body 30 (B, foldout 20). Depress the valve stop and insert retainer pin 117 into its hole in the valve body.

NOTE

In earlier models valve stop 112 consisted of two separate pieces.

(10) Install relay valve 110, spring 111 and valve stop 112 into bore 'H' (fig. 6-20) of valve body 30 (B, foldout 20). Depress the valve stop and insert retainer pin 113 into the hole at the front of the valve bore.

(11) Install shift valve 104 (smaller end first), modulator valve 105 (smaller end first), spring 106, valve stop 107 and adjusting ring 108, flat side first, into bore 'I' (fig. 6-20) of valve body 30 (B, foldout 20).

(12) Align the pin hole in valve stop 107 with the pin holes in the valve body. Compress the spring, and install retainer pin 109 into the valve body to retain adjusting ring 108. Be sure the adjusting ring is in the same position as it was before removal.

(13) Install shift valve 98 (smaller diameter first), modulator valve 99 (smaller diameter first), spring 100, valve stop 101 and adjusting ring 102, flat side first, into bore 'J' (fig. 6-20) of valve body 30 (B, foldout 20).

(14) Align the pin hole in valve stop, 101 with the pin holes in the valve body. Compress the spring, and install retainer pin 103 into the valve body to retain adjusting

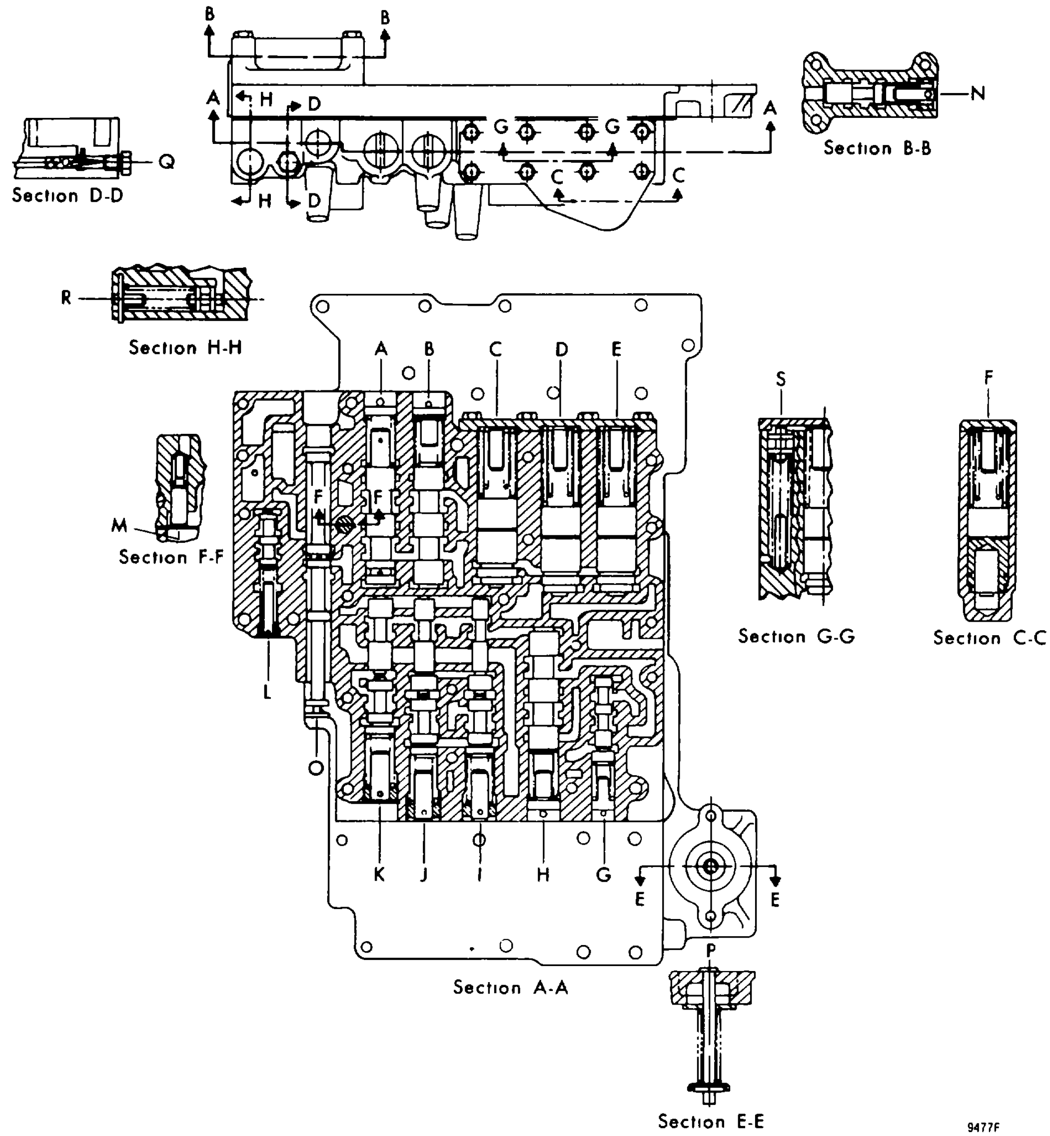


Fig. 6-20. Control valve assembly--with components installed

ring 102. Be sure the adjusting ring is in the same position as it was before removal.

NOTE

A configuration difference between the early and late production 1-2 shift valves was introduced into the transmission. The early production version installed in steps (15) and (16) is 89 t h r u 92. The stalled in steps (17) and (18) is 83 thru 88. Steps (19) and (20) explain the installation of the 1-2 shift valve parts used in models that do not have 2nd gear start.

(15) Install 1-2 shift valve spring 89, 1-2 shift valve 90, signal plug 91, and 1-2

shift signal plug 92 (smaller diameter first), into bore 'K' (fig. 6-20) of valve body 30 (B, foldout 20).

(16) Align the pin hole in signal plug 92 with the pin holes in the valve body. Compress the spring and install pin 82 into the valve body.

(17) Install 1-2 shift valve spring 83, 1-2 shift valve 84, 1-2 modulator valve 85, spring 86, valve stop 87, and adjusting ring 88 into bore 'K' (fig. 6-20) of valve body 30 (B, foldout 20).

(18) Align the pin hole in valve stop 87 with the pin holes in the valve body. Compress the spring and install retainer pin 82 into the valve body to retain adjusting ring 88. Be sure the adjusting ring is in the same position as it was before removal.

(19) Install shift valve 93 (shorter end first), modulator valve 94, spring 95, valve stop 96, and adjusting ring 97, flat side first, into bore 'K' (fig. 6-20) of valve body 30 (B, foldout 20).

(20) Align the pin hole in valve stop 96 with the pin holes in the valve body. Compress the spring and install retainer pin 82 into the valve body to retain adjusting ring 97. Be sure the adjusting ring is in the same position as it was before removal.

NOTE

Before S/N 10300, install hold regulator valve 74, spring 75, valve stop 76 and a holding regulator valve plug into bore 'L' of valve body 30. Depress the valve plug and insert retainer pin 79 into the hole at the front of the valve bore.

(21) After S/N 10299 install hold regulator 74, spring 75, v a 1 v e stop 76, washer 77 and adjusting ring 78, flat side first, into bore 'L' (fig. 6-20) of valve body 30 (B, foldout 20).

(22) Align the pin hole in valve stop 76 with the pin holes in the valve body. Compress the spring, and install retainer pin 79 into the valve body to retain adjusting ring 78. Be sure the adjusting ring is in the same position as it was before removal.

(23) Install priority valve stop 71, spring 72 and priority valve 73 into bore 'M' (fig. 6-20) of valve body 30 (B, foldout 20).

(24) Prior to S/N 2510066690, install modulator valve 18 (longer end first), spring 19, retainer washer 20, valve stop 21 and adjusting ring 22 (flat side first), into bore 'N' (fig. 6-20) of valve body 28 (B, foldout 20). After S/N 2510066689, install modulator actuator valve 23, modulator valve 24, spring 25 and adjusting ring 26 into bore 'N' of valve body 28.

(25) Align the pin hole in valve stop 21 (if stop is used), with the pin holes in the valve body. Compress the spring, and install retainer pin 27 into valve body 28 to retain adjusting ring 22 or 26. Be sure the adjusting ring is in the same position as it was before removal.

(26) Install governor accumulator valve 66, spring 67 and valve stop 68 into bore 'R' (fig. 6-20) of valve body 30 (B, foldout 20). Align stop 68 and valve body for correct retainer pin installation. Compress spring 67 and install retainer pin 69.

(27) Install governor screen assembly 64, open end first, into bore Q. Retain the screen assembly with plug 65. Tighten to 5161-in. lb (5.6-6.8 N-m).

(28) Install check valve pin 6 (smaller end first), through the top side of oil transfer plate 7. Install lubrication valve 2, spring 3 and cup washer 4 onto pin 6, from bottom side of plate 7. Depress cup washer 4 and install retainer pin 5.

(29) Position oil transfer plate 7, channeled side upward, on the work table.

(30) Place each check valve ball into the oil transfer plate in the same position it: was removed during disassembly. Retain the, balls in the plate with oil soluble grease. If: correct ball location is not known, refer to, the transmission assembly number in the control valve section in Parts Catalog SA 1268.

NOTE

Failure to retain the balls with oil-soluble grease may result in balls being accidentally misplaced during subsequent assembly steps.

(31) Place separator plate 29 (B, foldout 20) onto the oil transfer plate so that their bolt holes align. Grasp the two plates together, invert them, and position them on the assembled control valve body so that priority valve 73 is compressed against spring 72 into its bore in valve body 30.

NOTE

Do not separate the oil transfer Plate and the separator plate during handling. A slight separation could dislocate the check valve balls and cause malfunction of the transmission.

(32) Install the assembled modulator valve onto the oil transfer plate as shown in figure 6-18. Install three 1/4-20 x 2 1/2-inch bolts to retain the modulator body, oil transfer plate, separator plate and control valve body assembly as a unit. Do not tighten the bolts at this time.

(33) Align the bolt holes in the control valve assembly with those in the separator plate and oil transfer plate. When all bolt holes are aligned, tighten the bolts installed in (32), above, to 9-11 lb ft (12-15 N-m).

(34) Install manual selector valve 80 (B, foldout 20) into bore 'O' (fig. 6-18), of control valve body 30. Valve 80 may be retained by tape or soft wire temporarily until the valve assembly is installed onto the transmission.

(35) Before S/N 1030, in HT 750 models, valve 81 must be positioned so that its flat side is upward (when assembly is positioned as in fig. 6-21).

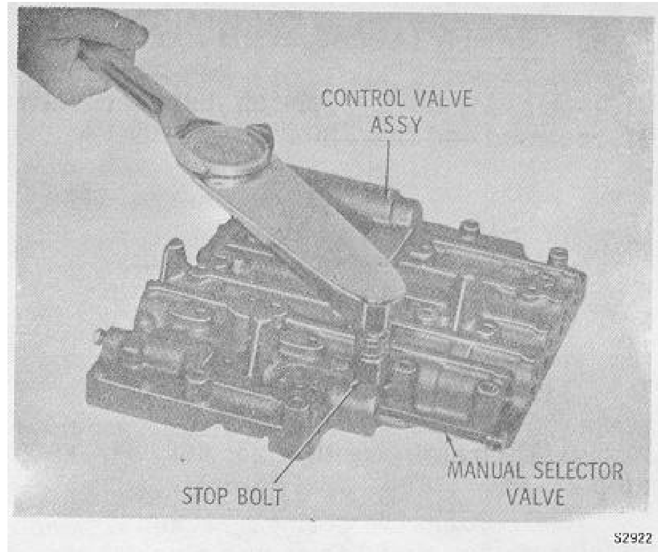


Fig. 6-21. Tightening selector valve stop bolt (HT 750 prior to S/N 10300)

(36) Install stop bolt 70 (when valve 81 is used) into control valve assembly. The flat end of the bolt must align with the flat side of the selector valve (fig. 6-21). Tighten the stop bolt to 36-43 lb ft (49-58 N-m).

NOTE

Refer to paragraph 3-12 for the adjustment of shift speed points.

(37) To prevent dust or dirt from contaminating the valve assembly, place it in a plastic bag until ready for installation into the transmission.

6-7. LOW TRIMMER VALVE BODY ASSEMBLY (HT 750)

a. Disassembly (A, foldout 21)

(1) Press inward on retainer plug 26, and remove retainer pin 20.

(2) Release pressure, and remove plug 26, springs 23 and 24, valve stop 25, plug 22 and valve 21.

NOTE

Refer to paragraph 6-2, above.

b. Assembly (A, foldout 21)

(1) Install low clutch trimmer valve 21, recessed end first, into valve body 19.

NOTE
Valves, when installed dry, should move by their own weight.

(2) Install trimmer plug 22.

(3) Install springs 23 and 24, valve stop 25, and retainer plug 26.

(4) Compress springs 23 and 24, and install retainer pin 20 to secure plug 26.

6-8. LOW SHIFT VALVE BODY ASSEMBLY (HT 750)

a. Disassembly (A, foldout 21)

(1) Depress valve stop 9 against its spring and remove retainer pin 5.

NOTE
In earlier models, valve stop 9 consisted of t w o separate pieces.

(2) Release spring pressure and remove valve stop 9, spring 8 and relay valve 7.

NOTE
Note or sketch position of adjusting ring 15 in relation to retainer pin 6 before removal.

(3) Depress adjusting ring 15 against its spring and remove retainer pin 6.

(4) Remove adjusting ring 15, washer 14, valve stop 13, spring 12, and valve 10 (HT 750DRD) or valve 11 (HT 750CRD, 754CRD).

(5) From HT 750, 754CRD assemblies, remove retainer pin 4 and plug valve 16.

NOTE
Refer to paragraph 6-2, above.

b. Assembly (A, foldout 21)

(1) Install, into HT 750, 754CRD assemblies, plug valve 16, and retainer pin 4.

NOTE
Valves, when installed dry, should move by their own weight.

(2) Install valve 10 (HT 750DRD) or valve 11 (HT 750, 754CRD) into valve body 3.

(3) Install spring 12, valve stop 13, washer 14, and adjusting ring 15. Align the hole in valve stop 13 with the pin hole in valve body 3. Position the adjusting ring in the same position as it was before removal (a,(3), above).

(4) Press inward against adjusting ring 15 until retainer pin 6 can be installed.

(5) Install relay valve 7, spring 8, valve stop 9.

NOTE
In earlier models, valve stop 9 consisted of two separate pieces.

(6) Press inward against valve stop 9, and install retainer pin 5.

6-9. LOCKUP CUTOFF VALVE BODY ASSEMBLY

a. Disassembly (A, foldout 21)

NOTE
When reinstalled, each valve should go into the same bore from which it was removed.

(1) Remove retainer pins 30, 31 and 32 from valve body 29.

(2) Remove valve plugs 34, 35 and 38, and valves 33, 36 and 37 from their respective bores.

NOTE
Refer to paragraph 6-2, above.

b. Assembly (A, foldout 21)

NOTE
All valves, when dry, must move freely of their own weight in their respective bores.

(1) Unless parts replacement is required, the lockup cutoff valves removed in disassembly, should be installed in the same location from which removed.

(2) Install valves 33, 36 and 37 into their respective bores in valve body 29.

(3) Install valve plugs 34, 35 and 38 into their respective bores. Retain the valves with pins 30, 31 and 32.

6-10. CONVERTER HOUSING WITH 2-BOLT TOP COVER, FRONT SUPPORT, OIL PUMP

a. Disassembly

(1) Place the converter housing front downward (fig. 6-22). Remove and discard the two front support hub sealrings, needle bearing and race from the front support hub.

NOTE
A damaged or worn front support hub can be salvaged with guidance from the instructions on the instruction sheet in the sleeve and pin kit. The kit contains one unfinished front support sleeve, one sleeve retainer pin and one machining and installation instruction sheet. Refer to Parts Catalog SA 1268 for the kit part number.

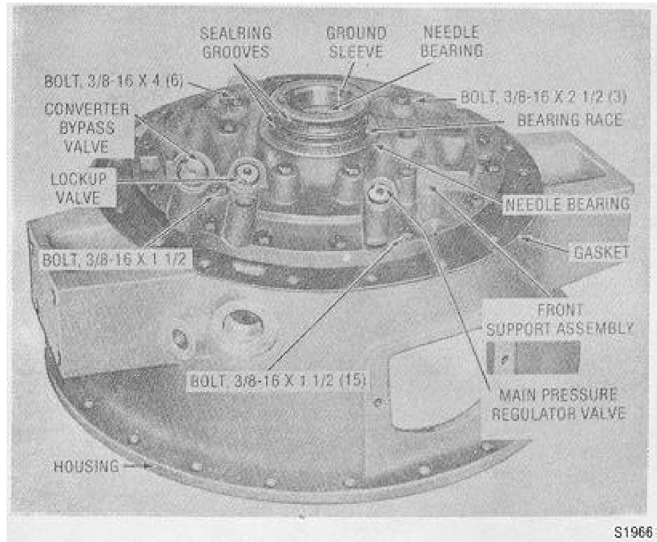


Fig. 6-22. Converter housing components (2-bolt cover, no retarder)

(2) Place a wood 2 x 4 (51 x 102 mm) through the converter housing access opening, about 14 inches (356 mm) into the housing (fig. 6-23). Remove four of the six bolts retaining the oil pump assembly. Loosen the remaining two bolts, leaving about four turns of thread engaged.

(3) Press on the wood 2 x 4 (51 x 102 mm) and tap alternately on the two loose bolts (fig. 6-23). This will dislodge the oil pump. Remove the two remaining bolts, and allow the pump to drop onto the wood support. Remove the pump assembly. Remove the sealring (if present) from the outer circumference of the pump.

(4) Remove the screw that retains the cover to the oil pump body (fig. 6-24). Remove the cover, sealring (if used) and the oil pump body containing the drive gear and driven gear assembly. If any of the 3/4-inch plugs (used in later models) in the oil pump body are damaged, replace them with new plugs.

(5) Remove the roller bearing from the driven gear, and the oil seal from the pump assembly.

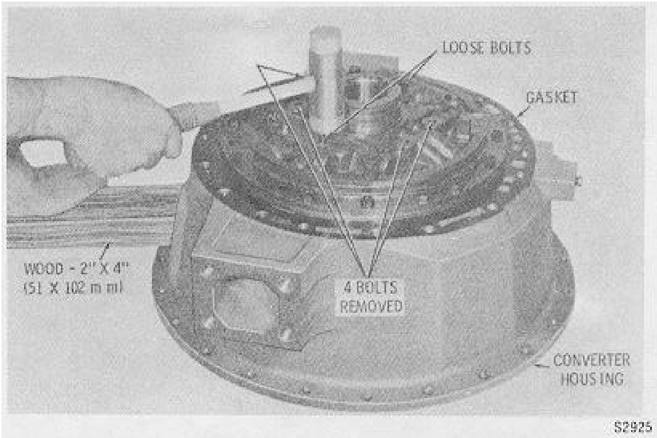


Fig. 6-23. Supporting oil pump during removal

WARNING

The main pressure regulator valve spring is under approximately 85 lbs (378 N) compression.

(6) Using spring compressor J-24219 depress the main pressure regulator valve spring (fig. 6-25). Remove the snapring.

NOTE

The spring compressor may be used whether the front support assembly is attached to or removed from the torque converter housing.

(7) Remove the spring compressor, and remove washer 6 (A, foldout 13), valve stop 5, spring 4, and main pressure regulator valve 3.

(8) Using the spring compressor, remove snapring 12, washer 11, valve stop 10, spring 9, and lockup shift valve 8.

(9) The spring compressor is not required for the remaining valve components. Push inward against valve support assembly 16, and remove snapring 19. Remove support assembly 16, seat 15, converter bypass valve 14, and spring 13.

(10) Remove the nineteen bolts remaining In the front support assembly (fig. 6-22). Lift off the front support assembly and gasket.

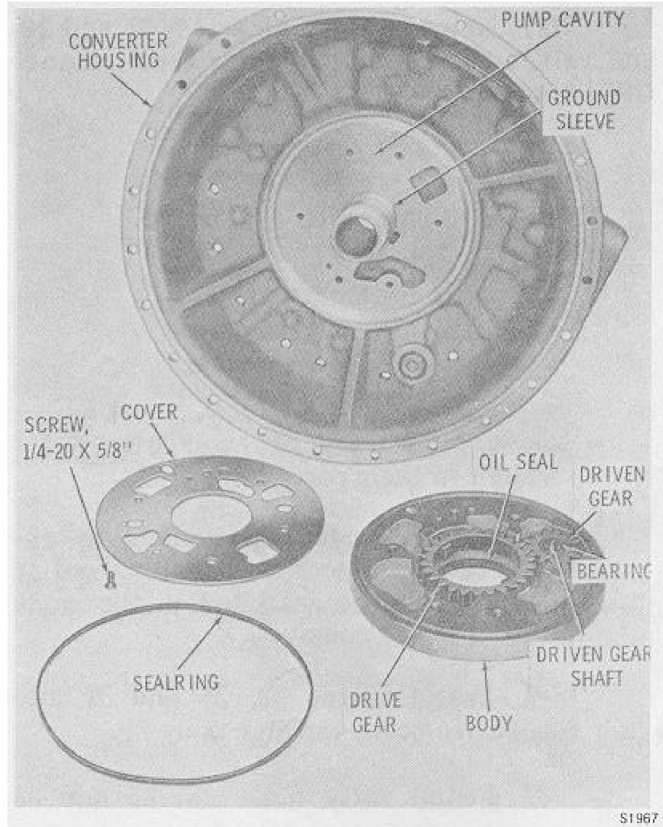


Fig. 6-24. Oil pump and torque converter housing

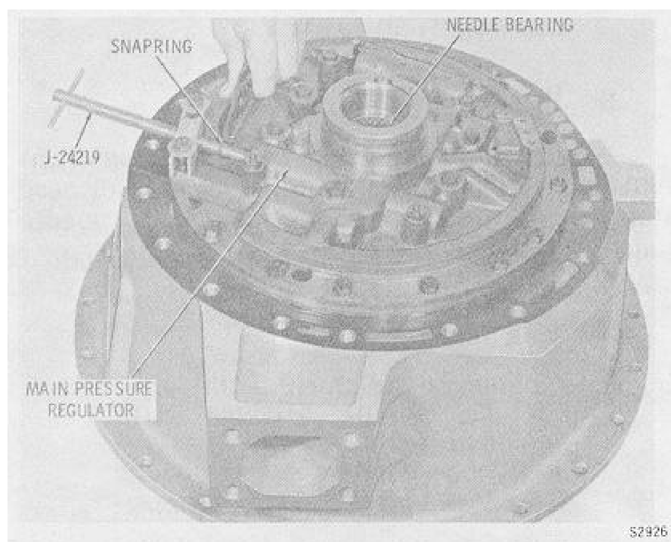


Fig. 6-25. Removing (or installing) main pressure regulator snapring

(11) If replacement is necessary, remove the needle bearing from the bore of the

support hub (fig. 6-25). Special tool J-28557 may be used to remove the needle bearing.

(12) If parts replacement is necessary, remove test plugs 18 (B, foldout 10) from housing 16.

(13) Do not remove the ground sleeve (fig. 6-24) from the front support. If there is evidence of movement, or damage, replace front support and ground sleeve assembly 2 (A, foldout 13).

(14) Determine the serviceability of the sealring grooves on the front support hub. Insert, do not force gage J-29198-3 into a groove on the support hub. Rotate the gage 360 degrees around the hub. If the gage does not rotate freely, the support is damaged and should be replaced.

NOTE
Refer to paragraph 6-2, above.

b. Assembly

NOTE
When bearing installer J-24197 is not available, the depth of installation must be measured. Proper depth, from the rear of the hub to the rear of the bearing is 1.26 to 1.28 inches (32-32.5 mm).

(1) If the needle bearing was removed from the front support (fig. 6-26), install a new bearing. Installer J-24197 may be used with handle J-8092 for driving the bearing, or without the handle when press-installing the bearing. Drive or press on the numbered side of the bearing.

NOTE
Installation of the main-pressure regulator and lockup shift valves, as described in (2) through (5), below, is done with the aid of spring compressor J-24219. The spring compressor is not required for installation of the converter regulator valve, described in (6) and (7), below.

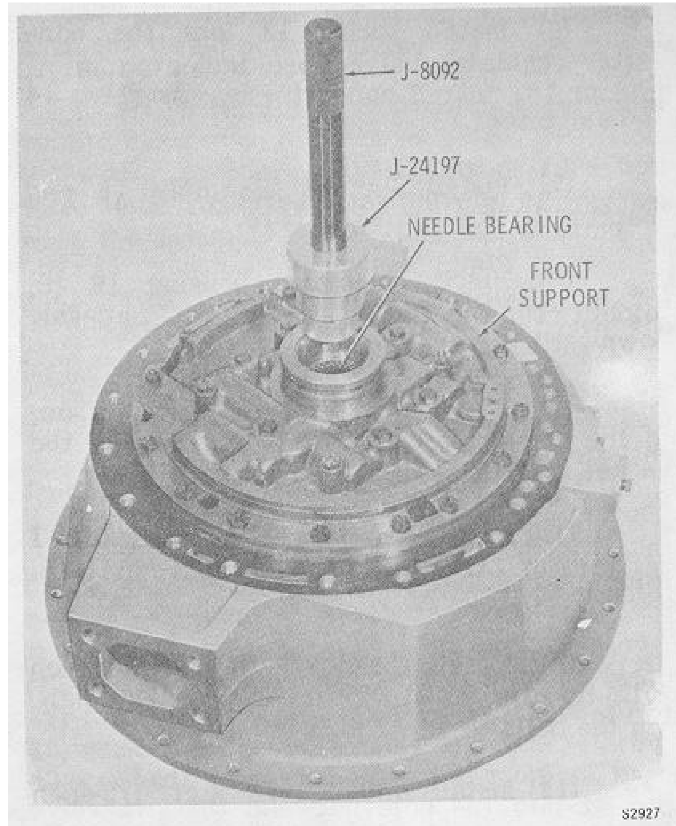


Fig. 6-26. Tool for installing front support needle bearing

(2) Install main-pressure regulator valve 3, small end first, into the bore indicated in A, foldout 13. Be sure the valve will move freely of its own weight in its bore.

(3) Install spring 4 and valve stop 5. Place washer 6 on spring 4 and compress the spring into the valve bore until the snapring groove is clear (fig. 6-25). Install snapring 7.

(4) Install lockup shift valve 8, small end first, into the bore indicated in A, foldout 13. Be sure the valve will
move freely of its own weight in its bore.

(5) Install spring 9 and valve stop 10. Place washer 11 on spring 9 and compress the spring into the valve bore until the snapring groove is clear. Install snapring 12.

(6) Install spring 13 into the converter regulator valve bore indicated in A foldout 13. Install converter bypass valve 1 and valve seat 15.

(7) Install support assembly 16 and snapring 19 into the valve bore.

(8) Place converter housing 16 (B, foldout 10) on the work table, front side downward.

(9) Place front support gasket 17 onto the converter housing. Align holes in the gasket with those in the converter housing.

(10) Install front support assembly 1 (A, foldout 13) onto converter housing 16 (B, foldout 10).

(11) Install three 3/8-16 x 2 1/2-inch bolts into the front support (fig. 6-22). Tighten the bolts to 36-43 lb ft (49-58 N-m).

(12) Install one 3/8-16 x 1 1/2-inch bolt into the hole between the two valve bores that are closer to each other (fig. 6-22). Tighten it to 36-43 lb ft (49-58 N-m).

(13) Install fifteen 3/8-16 x 1 1/2- inch bolts into the outer bolt circle of the front support (fig. 6-22). Tighten the bolts to 36-43 lb ft (49-58 N-m).

(14) Install the bearing race, flat side first, onto the front support hub (fig. 6-22). Install the needle bearing onto the race.

NOTE

Grease both the race and bearing, before installing, with sufficient oil-soluble grease to retain them.

(15) If the oil seal was removed from the oil pump body, install a new seal (fig. 6-27). Coat the oil seal bore in pump body 3 (B, foldout 10) with Perfect Sealer No. 4 or equivalent. Use seal installer J-24198 and driver handle J-24202-4 for driving or pressing the seal. The lip of the seal must face inward (toward rear of transmission). If no installer is available, press the seal lightly until it is flush with the front of the housing.

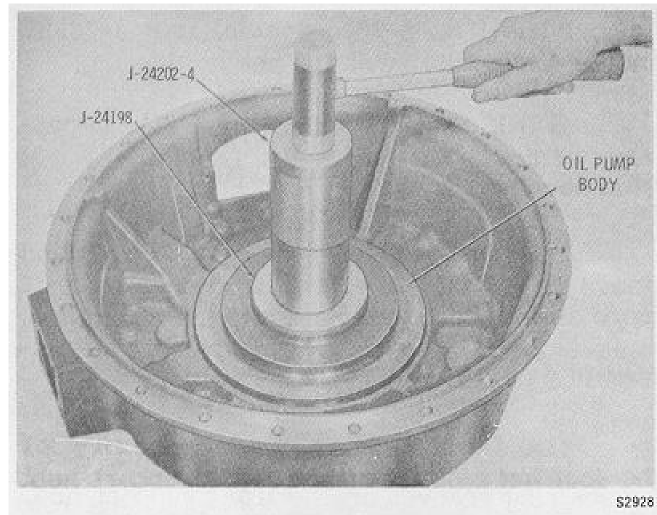


Fig. 6-27. Installing oil pump oil seal

NOTE

Installer J-24198 can be used with the transmission assembled except for the flywheel and torque converter.

(16) If needle bearing 8 (B, foldout 10) was removed, install a new bearing. Place the bearing, numbered end first, onto installer tool J-28646A. Attach handle J-8092. Install the bearing into driven gear 7.

NOTE

If an installer tool is not available, the bearing may be installed w i t h a soft mallet. Drive the bearing on the numbered end into driven gear 7, until the bearing is 0.001-0.005 inch (0.025-0.127 mm) below the surface.

(17) If plug 4 was removed, install new plugs. Press the plug flush to 0.010 inch (0.25 mm) below the surface.

(18) Install the driven gear and the drive gear into the oil pump body (fig. 6-24).

(19) Place a straight edge across the surface of the oil pump and oil pump gears as shown in figures 6-28 and 6-29. Insert a thickness gage between the drive and driven gears and the straight edge. If the gear end clearance exceeds 0.006 inch (0.15 mm), replace the gear.

(20) Install the cover, and retain it with the 1/4-20 x 5/8-inch flat-head screw (fig. 6-24). Tighten screw 9 to 11 lb ft (12 to 15 N-m).

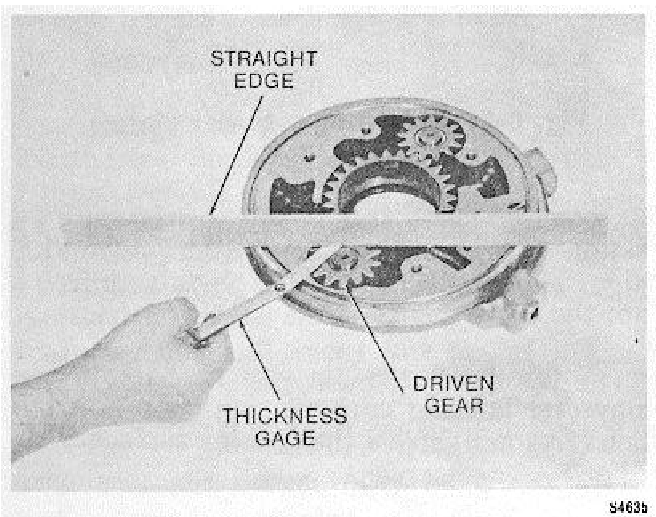


Fig. 6-28. Checking oil pump driven gear end clearance

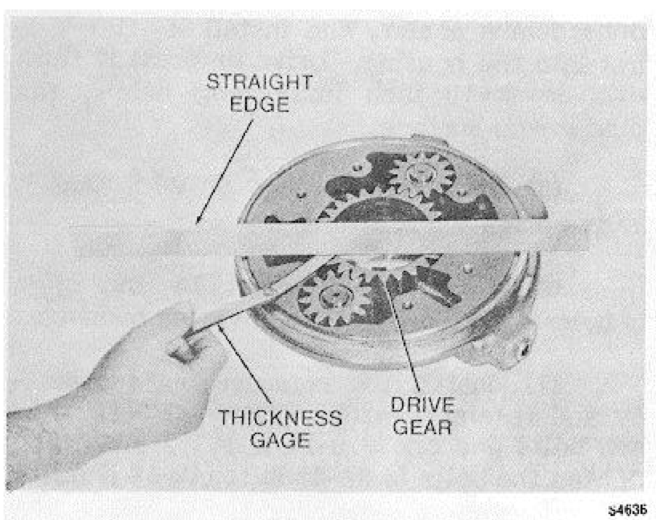


Fig. 6-29. Checking oil pump drive gear end clearance

(21) Install the sealring (if used) around the cover outer circumference (fig. 6-30). Install two 3/8-16 x 6-inch guide screws J-24315-1 into pump at the locations shown.

(22) Lubricate the sealring (if used) and oil pump cavity in the housing (fig. 6-30). Install the pump assembly, guiding the screws through the holes indicated.

(23) While holding the pump assembly in place, install six 3/8-16 x 4-inch bolts to retain it (remove guide screws to install last two bolts). Tighten the bolts to 36-43 lb ft (49-58 N-m).

(24) If removed, install plugs 18 (B, foldout 10). Use nonhardening sealer on the plug threads, and tighten them to 4 to 5 lb ft (5.4-6.8 N-m).

NOTE

Front support sealrings must not be installed onto the support hub until the converter housing and front support are installed onto the transmission housing. Reference para 4-6g and 7-12.

6-11. CONVERTER HOUSING WITH 2-BOLT TOP COVER, RETARDER PLATE, OIL PUMP

a. Disassembly

(1) Refer to para 6-10a(1) through (5) for removal of the oil pump components. Note that the oil pump includes two driven gears.

(2) Remove sealring 1 (B, foldout 12) from the groove in retarder plate 2.

(3) Remove nineteen bolts retaining the retarder plate (fig. 6-31).

(4) Remove the retarder plate and gasket from the converter housing. Do not remove the ground sleeve from the retarder plate.

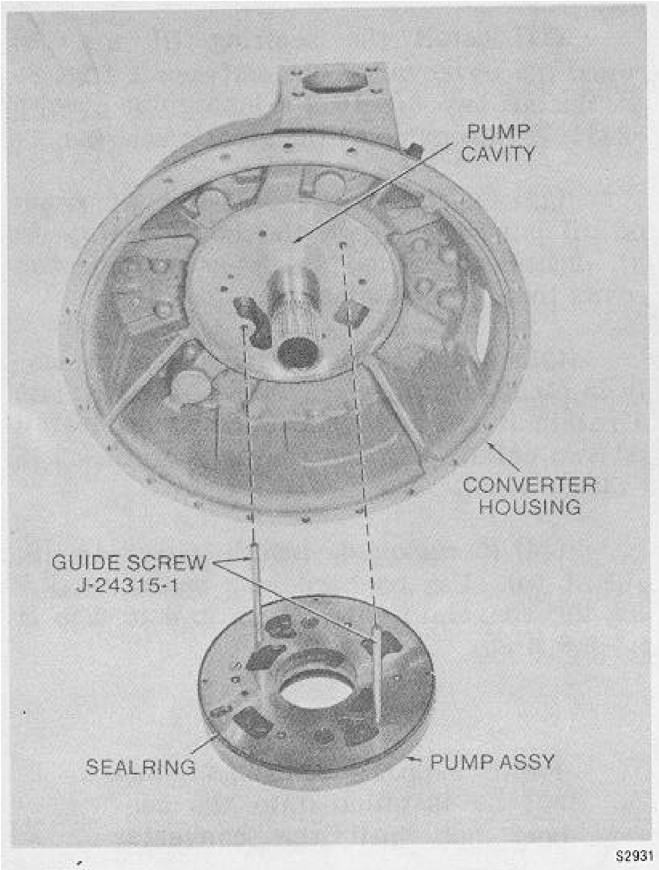


Fig. 6-30. Installation position of oil pump assembly (housing with 2-bolt cover)

(5) Remove plugs 8 (B, foldout 11).

(6) Remove studs 7 only if replacement is necessary.

(7) Remove plug 6 only if replacement is necessary.

(8) Position the housing, rear downward, on a clean flat surface.

(9) Remove lubrication valve pin 13, valve 12 and spring 11 only if parts replacement is necessary.

NOTE
Refer to paragraph 6-2, above.

b. Assembly

(1) If lubrication valve components 11, 12, and 13 (B, foldout 11) were removed, install new components. Install valve 12, larger end first, onto pin 13. Install spring 11 into the valve cavity in the converter housing.

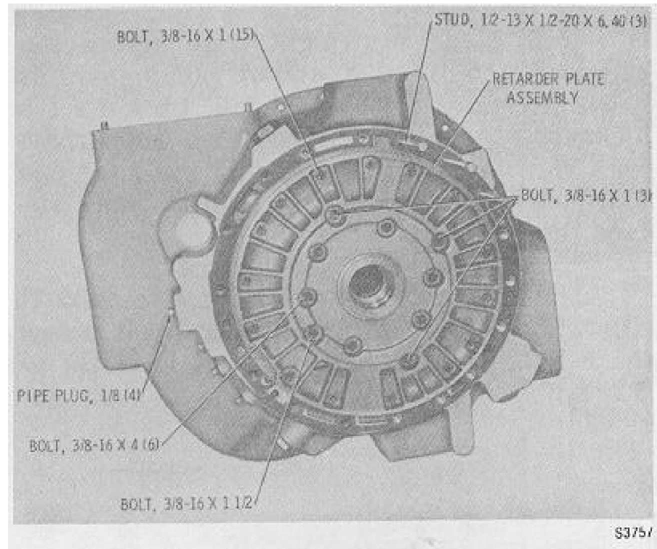


Fig. 6-31. Locating retarder plate assembly bolts

(2) Press the pin into its bore in the converter housing until the pin head is 0.300 inch (7.62 mm) above the housing surface.

(3) Position the housing, front downward, on a clean flat surface.

(4) If plug 6 was removed, install a new plug. Coat its circumference with a nonhardening sealer, and install it, flat side first into the housing. Drive or press it flush with, to 0.010 inch (0.25 mm) below, the housing rear surface.

(5) Install four plugs 8, with sealer. Torque plugs 4-5 lb ft (5.4-6.8 N-m).

(6) Install gasket 14 and align its holes with those in the converter housing.

(7) Install the retarder plate assembly and retain it with eighteen 3/8-16 x 1-inch bolts and one 3/8-16 x 1 1/2-inch bolt. Tighten the bolts to 36-43 lb ft (49-58 N-m).

(8) Assemble and install the oil pump as outlined in paragraph 6-10b(15) through (21). Note that the oil pump includes two driven gears.

(9) While holding the pump in position, install six 3/8-16 x 3-inch bolts (replacing guide bolts with last two). Tighten the bolts to 36-43 lb ft (49-58 N-m).

(10) Lubricate with oil-soluble grease, and install sealring 1 (B, foldout 12) into the groove around retarder plate 2.

(11) If studs 7 (B, foldout 11) were removed, install new studs (oversizes are available, if required).

(12) Select s t u d s which, when installed to project 5.47 to 5.53 inches (138.9 to 140.46 mm), will tighten to 15-65 lb ft (20-88 N-m).

6-12. CONVERTER HOUSING WITH 8-BOLT TOP COVER, RETARDER PLATE, OIL PUMP

a. Disassembly

(1) Refer to para 6-10a(l) through (5) for removal of the oil pump. Note that the oil pump includes two driven gears.

(2) Remove the sealring from the groove in the retarder plate.

(3) Remove nineteen bolts retaining the retarder plate (fig. 6-31).

(4) Remove the retarder plate and gasket from the converter housing (fig. 6-32).

(5) Remove the four test plugs from the converter housing (fig. 6-32).

(6) Remove the three studs from the converter housing if replacement is necessary (fig. 6-31).

(7) On earlier models, if the side PTO spindle must be removed, remove the bolt and washers from the rear of the spindle. Press the spindle rearward.

(8) Position the housing, front upward. Remove eight bolts that retain the ground sleeve (fig. 6-33).

(9) Remove the ground sleeve.

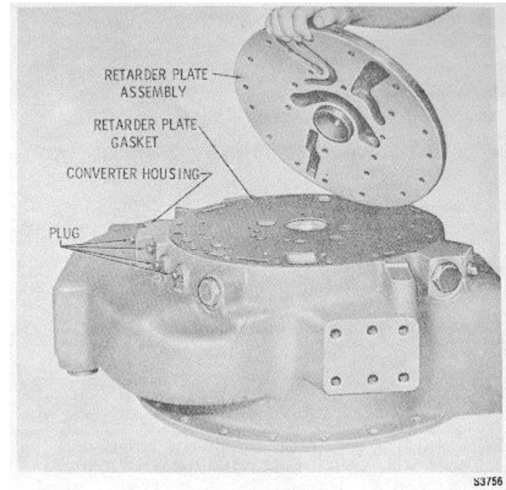


Fig. 6-32. Removing (or installing) retarder plate assembly

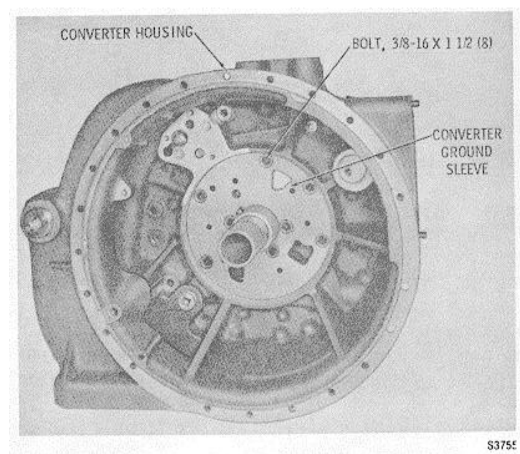


Fig. 6-33. Converter ground sleeve installed (housing with 8-bolt covers)

(10) Remove lubrication valve components (pin, valve and spring) if replacement is necessary (fig. 6-34).

(11) Remove plugs 13, 14, 15 and 16 (A, foldout 11) if cleaning or replacement is necessary.

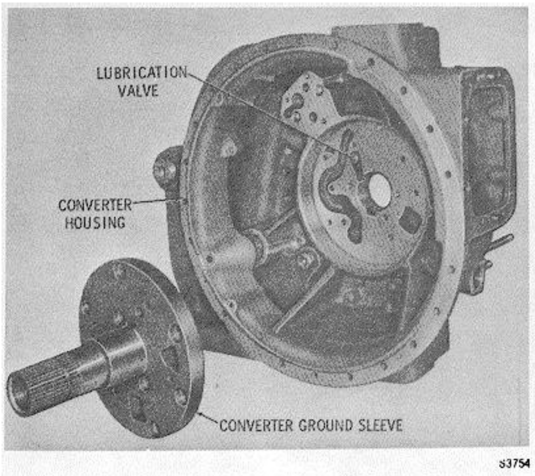


Fig. 6-34. Converter housing with ground sleeve removed (housing with 8-bolt covers)

(12) Remove dowel pins 11 and 12 if replacement is necessary.

NOTE
Refer to paragraph 6-2, above.

b. Assembly

(1) If dowel pins 11 or 12 (A, foldout 11) were removed, install new pins. Press them into the housing until 0.440 inch (11.17 mm) is projecting.

(2) If plugs 14, 13 or 16 were removed, install them with sealant. Tighten plug 14 to 70-90 lb ft (95-122 N-m); plug 13 to 110-130 lb ft (149-176 N•m); plug 16 to 16-20 lb ft (22-27 N•m).

(3) If plug 15 was removed, coat the circumference of a new plug with nonhardening sealer and install it, flat side first. Press or drive it 0.020 to 0.060 inch (0.5 to 1.5 mm) below the surface surrounding the bore.

(4) If spindle 17 (A, foldout 11) was removed, install a new spindle. The assembly procedure for spindle 35 (A, foldout 11) is explained in paragraph 7-12b(10). Spindle 17 is symmetrical and may be installed either end first. The hole in the front of the spindle must be toward the housing's center bore (240 30' from a vertical line). Press the spindle forward until its rear end face is flush with the front of the housing's counter-bore. Install flat washer 18, lockwasher 19 and bolt 20. Tighten the bolt to 83-100 lb ft (113-135 N•m).

(5) If lubrication valve pin 61 (A, foldout 11), valve 60 and spring 59 were removed, install new parts. Install valve 60, larger end first, onto pin 59. Install spring 59 into its cavity in the housing. Press the pin until its head is 0.30 inch (7.62 mm) above the housing surface adjacent to the valve.

(6) Install four 1/8 inch plugs 36 (A, foldout 11) at the bottom of the housing (fig. 6-32). Use sealant on the threads. Tighten the plugs 4-5 lb ft (5.4 to 6.7 N•m).

(7) Install the ground sleeve and retain it with eight 3/8-16 x 1 1/2-inch bolts (fig. 6-33). Tighten the bolts to 36-43 lb ft (49-58 N•m).

(8) Position the housing, front downward (fig. 6-32). Install the retarder plate gasket, aligning its holes with those in the converter housing.

(9) Install the retarder plate (fig. 632). Retain the retarder plate with eighteen 3/8-16 x 1-inch bolts and one 3/8-16 x 1 1/2inch bolt. Tighten the bolts to 36-43 lb ft (49-58 N•m).

(10) Assemble a n d install the oil pump as outlined in paragraph 6-10b(15) through (21). Note that the oil pump includes two driven gears.

(11) While holding the oil pump in position, install six 3/8-16 x 4-inch bolts (replacing guide bolts with last two). Refer to figure 6-31 for location of bolts. Tighten the bolts to 36-43 lb ft (49-58 N•m).

(12) Lubricate sealring 1 (B, foldout 12) with oil-soluble grease. Install the sealring into the groove around the retarder plate.

(13) If the three studs at the rear of the converter housing (fig. 6-31) were removed, install new studs (oversizes are available, if required).

(14) Select studs which, when installed to project 5.47 to 5.53 inches (138.94 to 140.46 mm), will tighten to 15-65 lb ft (20-88 N•m).

6-13. CONVERTER HOUSING WITH 8-BOLT TOP COVER, FRONT SUPPORT, OIL PUMP

a. Disassembly

(1) Refer to para 6-10a(1) through (5) for removal of the oil pump.

(2) Refer to para 6-10a(6) through (11) for removal and disassembly of the front support assembly.

(3) Refer to paragraph 6-12a(5), (7), (8), (10) and (11) for the remaining disassembly steps.

NOTE

Refer to paragraph 6-2, above.

b. Assembly

(1) Refer to para 6-10b(1) through (7) for assembly of the front support components.

(2) Refer to para 6-12b(1), (2), (3), (4), (6) and (7) for initial assembly of the converter housing components.

(3) Position the housing, front downward. Install the front support gasket, and align its holes with those of the converter housing.

(4) Install the front support assembly and retain it with sixteen 3/8-16 x 1 1/2inch bolts and three 3/8-16 x 2 1/2-inch bolts. Tighten the bolts to 36-43 lb ft (49-58 N•m).

(5) Refer to para 6-10b(15) through (21) for assembly and installation of the oil pump components.

(6) While holding the oil pump in position, install six 3/8-16 x 5-inch bolts (replacing guide bolts with last two). Tighten the bolts to 36-43 lb ft (49-58 N•m).

(7) Install the bearing race, flat side first, onto the front support hub (fig. 6-22). Install the needle thrust bearing.

NOTE

Grease both race and bearing with oil soluble grease to retain them.

6-14. SCAVENGE OIL PUMP, PTO IDLER GEAR

a. Disassembly (A, foldout 12)

(1) Place scavenge oil pump assembly 4 on the assembly table with external drive gear 5 down and remove snaprings 15.

(2) Remove oil scavenge pump body plate 13.

(3) Remove snapring 12 from the shaft of drive gear 5.

(4) Remove driven gear assembly 16 from spindle 10.

(5) Remove drive gear 11 from the shaft of drive gear 5. Remove lock roller 6 from the shaft of gear 5.

(6) Remove gear 5 from pump body 9.

(7) If replacement is necessary, press needle bearing 7 out of body 9. Press needle bearing 14 out of plate 13.

(8) If replacement is necessary, press spindles 10 toward the inside of body 9.

(9) Remove snapring 22 from both sides of gear 25.

(10) Remove bearing 23 or 34 from PTO idler gear 25 or 32 if replacement is necessary.

NOTE
Refer to paragraph 6-2, above.

b. Machining Driven Gear Bushing

NOTE
Do not remove bushing 17 from gear 18 if proper machining procedure cannot be used at installation of new bushing.

(1) Remove damaged bushing 17 from scavenge pump driven gear 18.

(2) Press a new bushing into gear 18 to 0.030 inch (0.76 mm) below the surface of the gear.

(3) Check the ID of the bushing for runout. Runout must not exceed 0.001 inch (0.03 mm). Surface finish of the bushing should be 30 microinch (0.762 micrometer).

c. Assembly (A, foldout 12)

(1) If bearing 23 or 34 was removed, apply Loctite Retaining Compound 601 (or equivalent) onto bearing circumference, and install bearing into bore of gear 25 or 32. Allow parts to dry for 2 hours (min).

(2) Retain the bearing by placing washers 24 or 31 at each end of rivets 26 or 33. Peen the rivets onto the washers so that the peened end extends no higher than 0.150 inch (3.8 mm) above the gear face.

(3) On later models bearing 23 is retained in gear 25 by two snaprings 22. Install the snaprings.

(4) If spindles 10 were removed, install the spindles, plain ends first, into the inside of body 9. Press the spindles to 1.0 inch (25.4 mm) above the inside surface of the body.

(5) If needle bearing 7 was removed, press a new bearing to 0.04 inch (1 mm) below the outside surface of body 9.

CAUTION
Press only on numbered end of bearing when installing needle bearings.

(6) If bearing 14 was removed, press a new bearing flush with, to 0.010 inch (0.25 mm) below the outside surface of plate 13.

(7) Install p u m p drive gear 5 into body 9 and install lock roller 6 into its groove in the shaft of gear 5. Install internal drive gear 11 onto the shaft of gear 5, aligning the lock roller with the groove in the gear. Secure the gear with snapring 12.

(8) Install plate 13 onto body 9. Install snaprings 15 onto spindles 10.

6-15. RETARDER VALVE BODY ASSEMBLY

a. Disassembly (B, foldout 21)

(1) Remove two bolts and washers 22 and 21 from bottom of valve body 13.

(2) Remove cover 20 and gasket 19.

(3) Slide valve 14 out through bottom of valve body 13.

(4) Remove snapring 18, washers 15 and 17, and spring 16 from valve 14.

(5) For replacement, remove wiper 10, seal 11 and snapring 12.

NOTE
Refer to paragraph 6-2, above.

b. Assembly (B, foldout 21)

(1) If removed for replacement, install snapring 12, new seal 11, with lip toward inside of valve body, and wiper 10 with scraper edge outside valve body 13.

(2) Install washer 15 on bottom end of valve 14.

(3) Install spring 16 a n d washer 17 on valve 14 and secure with snapring 18.

(4) Install gasket 19 a n d cover 20 with two bolts 22 and two lockwashers 21.

Tighten bolts to 2-32 lb ft (35-43 N-m).

(5) Check the stroke of the retarder valve. It should be 1 1/2 inches (38.1 mm).

6-16. RETARDER HOUSING, FRONT SUPPORT

a. Disassembly (B, foldout 12) (A, foldout 13)

(1) Position the retarder housing, front support assembly upward (fig. 6-35).

(2) Remove and discard two stepjoint sealrings from the hub of the front support (fig. 6-35). Remove the needle roller bearing assembly (if not previously removed) and bearing race.

NOTE

Check the bolt size and location of the nine bolts removed from t h e inner circle of the front support. Some models use six b o 1 t s of one length and three bolts of another length.

(3) Remove the nine bolts from the inner circle and sixteen bolts from the outer circle (fig. 6-35). Carefully separate the front support and valve assembly from the retarder housing (fig. 6-36). Remove retarder housing gasket.

(4) Position front support and valve assembly (fig. 6-36), front (mounting) side downward.

(5) Refer to paragraph 6-10a(6), (7), (8), (9) and (11) for disassembly of the support assembly.

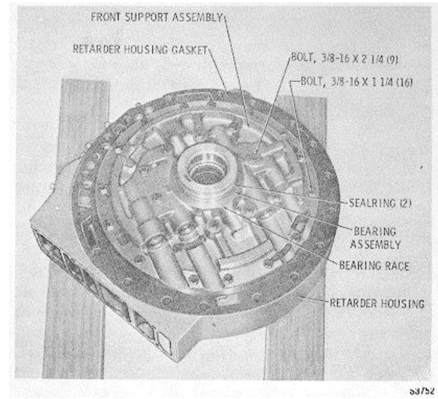


Fig. 6-35. Retarder housing and front support assembly

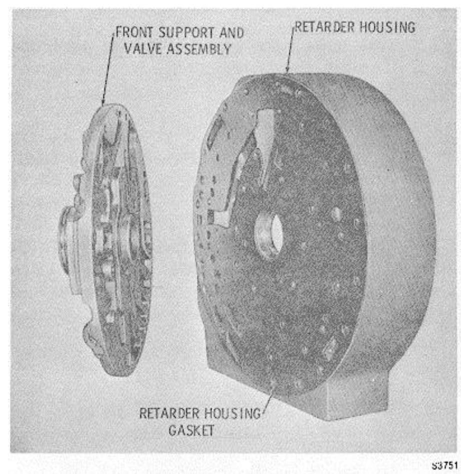


Fig. 6-36. Removing (or installing) front support and valve assembly from retarder housing

(6) Remove plugs 20 (B, foldout 12) from the bottom of the retarder housing.

NOTE
Refer to paragraph 6-2, above.

b. Assembly (B, foldout 12) (A, foldout 13)

(1) Position the retarder housing front downward, on blocks as shown in figure 6-35.

(2) Install the gasket onto the retarder housing as shown in figure 6-36.
Align the holes in the gasket with those in the housing.

(3) Refer to paragraph 6-10b(l) through (7) for assembling the front support and valve assembly.

(4) Install the front support and valve assembly onto the retarder housing and gasket (fig. 6-35).

(5) Install the bolts as shown in figure 6-35. Tighten the bolts evenly to 36-43 lb ft (49-58 N•m).

(6) Using oil-soluble grease to retain them, install the bearing race, flat side first, and the needle roller bearing onto the support hub (fig. 6-36).

(7) If removed, install plugs 20 (B, foldout 12) into the retarder housing. Use nonhardening sealer on the plug threads, and tighten them 4-5 lb ft (5.4-6.8 N•m).

6-17. FORWARD CLUTCH AND TURBINE SHAFT

a. Disassembly (B, foldout 13)

(1) Remove hook-type sealring 1 from the front of the turbine shaft.

(2) Remove bearing race 2 from the hub of forward clutch housing assembly 5.

(3) Remove two hook-type sealrings 4 from the turbine shaft.

(4) Position forward clutch assembly 3 on a work table, turbine shaft down.

(5) Remove bearing race 24 and bearing 25 from forward clutch hub 19.

(6) Remove snapring 23 and fourth clutch driving hub 22.

(7) Remove five each of clutch plates 20 and 21.

(8) Remove forward clutch hub 19.

(9) Remove bearing race 18 and needle bearing 17 from the inner hub of the forward clutch hub (fig. 6-37).

(10) Remove bearing race 16 from the inner hub of the forward clutch housing (fig. 6-37).

(11) Using spring compressor J-24204-3, compress the spring retainer. Remove the snapring (fig. 6-38).

(12) Carefully remove pressure from the spring retainer. Remove the spring retainer.

(13) Remove twenty piston return springs 13 (B, foldout 13).

(14) Remove forward clutch piston 12 and sealrings 10 and 11. If a sealring is used in the clutch housing, remove and discard it.

(15) If the piston is replaced, be sure the identification letter (A, B or C) for the new piston is identical to that of the piston replaced.

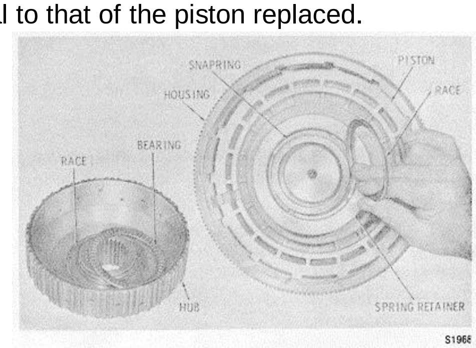


Fig. 6-37. Forward clutch components

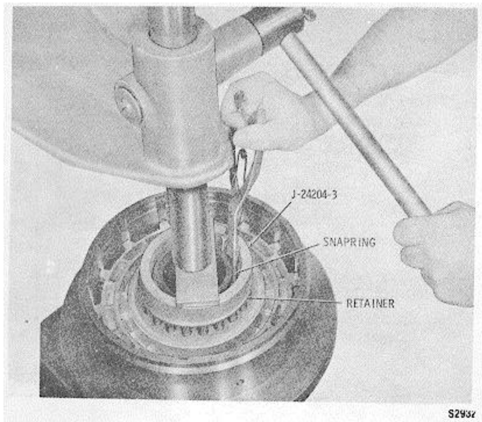


Fig. 6-38. Removing (or installing) forward clutch spring retainer snapring

(16) Do not remove the PTO gear unless replacement is necessary.

(17) To remove the earlier type PTO gear (slip fit on housing), refer to (18) to (21), below. To remove the later type PTO gear (press fit on housing), refer to (22) to (26), below.

(18) Remove collector ring 6 only if damage has occurred. Support the inner circumference of the ring and press the forward housing and input shaft assembly free.

(19) Remove the PTO gear by compressing the snapring into the clutch housing and sliding the gear from the housing.

(20) To compress the snapring, insert 10 pieces of steel shim stock (3/32 x 0.020 x 3) between the snapring and the PTO gear (fig. 6-39). To accomplish this, locate the snapring gap, and at the cut out nearest the gap, press the snapring into the groove in the housing. Slip a piece of shim stock between the snapring and the inner ends of the splines of the PTO gear. Repeat the operation at the other side of the snapring gap. Working at each opening (missing spline) to compress the snapring, insert the remaining pieces of shim stock at approximately 3-inch increments.

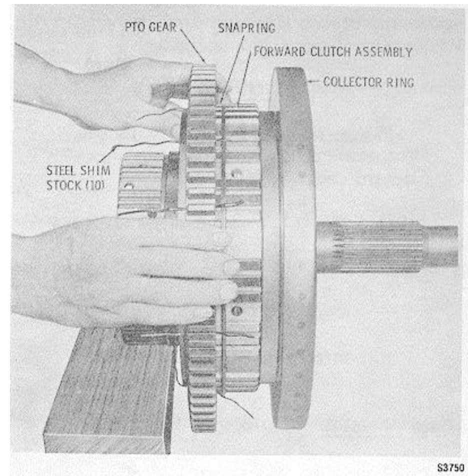


Fig. 6-39. Removing PTO gear from forward clutch

(21) Slide the gear free of the clutch housing. Remove the snapring.

CAUTION

Do not damage oil collector ring during PTO gear removal.

(22) On later models the PTO gear is press-fitted on the clutch housing.

(23) Remove oil collector ring 6 (B, foldout 13) from clutch housing 5 by supporting the inner circumference of the ring and pressing the forward clutch housing and input shaft assembly free.

(24) Place PTO gear fixture J-26899-2 on a press, flat side downward.

Repeat items 19) and (20), above.

(25) Position the clutch housing, turbine shaft downward, so the PTO gear is resting on the cylindrical fixture. Center the fixture directly under the PTO gear.

(26) Center fixture tool J-26899-1 inside the forward clutch housing and apply

sufficient pressure to the tool to remove the PTO gear. Remove the snapring.

CAUTION

Pressure applied directly to the turbine shaft will cause permanent damage.

(27) Do not remove balls 7 from the forward clutch housing unless replacement is necessary.

NOTE

Refer to paragraph 6-2, above.

b. Assembly (B, foldout 13)

NOTE

Early and late models differ in P T O installation. On current models, use procedures (1) through (5), below. On earlier models use procedures (6) through (8).

(1) This procedure, and (2) through (5) following, apply to current models. Place forward clutch housing 5 on a work table, shaft end downward. Install snapring 8 into the groove on the outside diameter of the housing.

(2) Heat PTO gear 9 in an oven or an oil bath to 3500 to 3750F (1770 to 1910C).

(3) Carefully install the PTO gear onto the forward clutch housing (chamfer end first), u n t i 1 the snapring expands into the PTO gear groove. Make sure the snapring is expanded and free in the internal groove of the gear before the gear cools. Failure to obtain this condition can result in difficulty during subsequent removal.

(4) Position the forward clutch housing, turbine shaft upward. Apply Loctite 40 Retaining Compound (or equivalent) onto the collar of the collector ring. Install the collector ring (fig. 6-41). Use installer

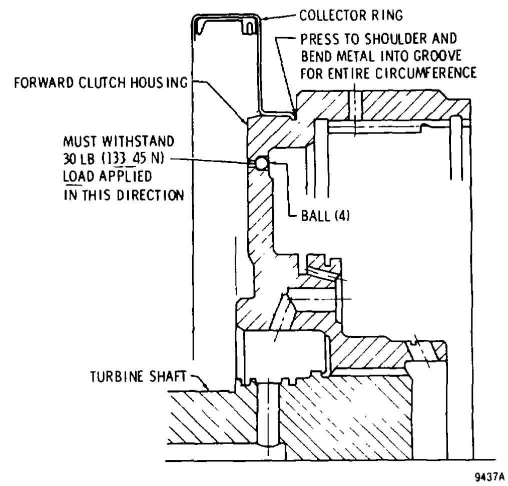


Fig. 6-40. Forward clutch housing-partial cross-section view

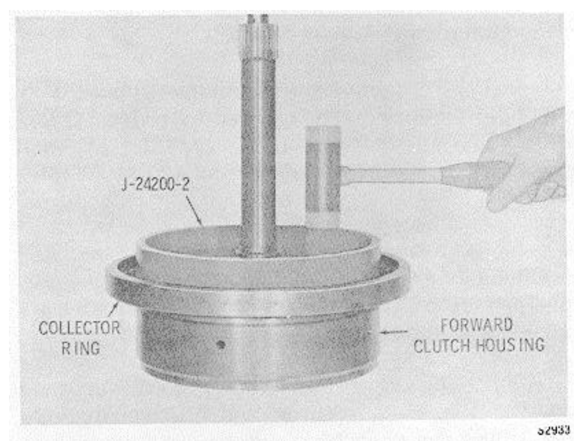


Fig. 6-41. Installing pitot collector ring

J-24200-2 to drive the collector ring onto the clutch housing (fig. 6-41). Use light hammer blows, and work around the entire installer circumference.

(5) Using staking tool J-24200-1, bend the edge of the ring into the groove in the clutch housing (fig. 6-42). Check the four steel balls in the housing (fig. 6-40). Make sure they are securely staked in the housing and are free to move without restriction.

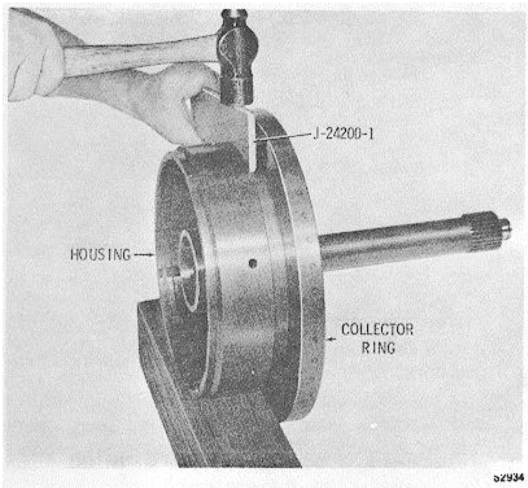


Fig. 6-42. Staking pitot collector ring to forward clutch housing

(6) This procedure, and (7) and (8) following, apply to earlier models. If collector ring 6 was removed, replace it with a new ring. Refer to items (4) and (5), above.

(7) Install PTO gear snapring 8 (B, foldout 13) into its groove on the outside diameter of the forward clutch housing.

(8) Install PTO gear 9, chamfered ends of the internal splines first, onto the forward clutch housing. The chamfered ends of the splines should slide over the snapring until the snapring engages and expands into the groove in the PTO gear.

(9) Before completing the assembly, the clutch clearance must be established. One method is direct measurement as outlined in (10) through (13) below. An alternate method is by stack dimension computation outlined in paragraph 6-33. If the stack method is used disregard (10) through (15) below.

NOTE

If the forward clutch housing is replaced, selection of a proper piston (A, B or C) is imperative before sealring installation. If the forward clutch housing is not replaced and a new piston is required, make sure the identification letter stamped on the new piston is identical to that on the old piston.

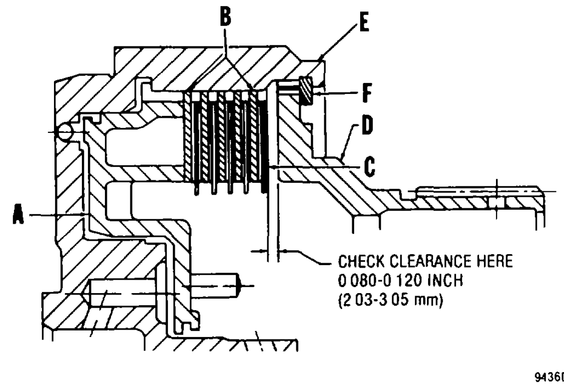


Fig. 6-43. Forward clutch assembly-cross section

(10) Using figure 6-43 as a guide, install forward piston 'A' into clutch housing 'E'.

(11) Beginning with an external tanged plate, alternately install five external-tanged plates 'B' and five internal splined plates 'C' into forward-clutch housing 'E'.

(12) Install the fourth-clutch driving hub 'D' into housing 'E' and retain it with snapring 'F'.

(13) While holding hub D firmly against snapring F, measure the clutch clearance with gage J-24192 at the location shown in figure 6-43. When clearance is satisfactory, the thinner step of the gage will enter between the driving hub and clutch plates; the thicker step will not (fig. 6-45). The prescribed clearance is 0.080 to 0.120 inch (2.03 to 3.05 mm). Any clearance measurement within this range is satisfactory, but the nearer to 0.080 inch that can be attained, the longer the clutch will maintain satisfactory clearance.

(14) If the clutch clearance is not within the specified limits, remove snapring

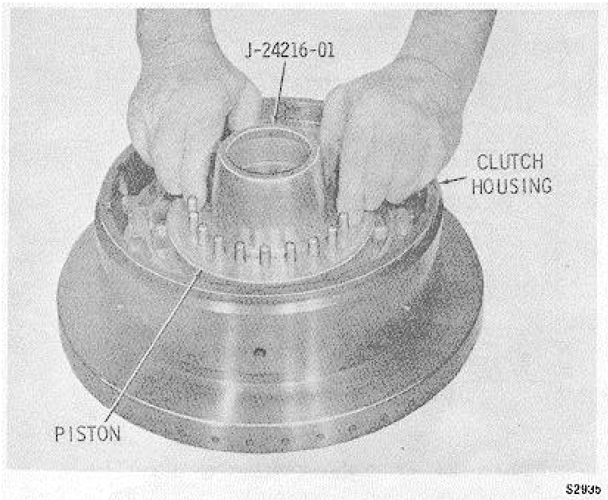


Fig. 6-44. Installing forward clutch piston

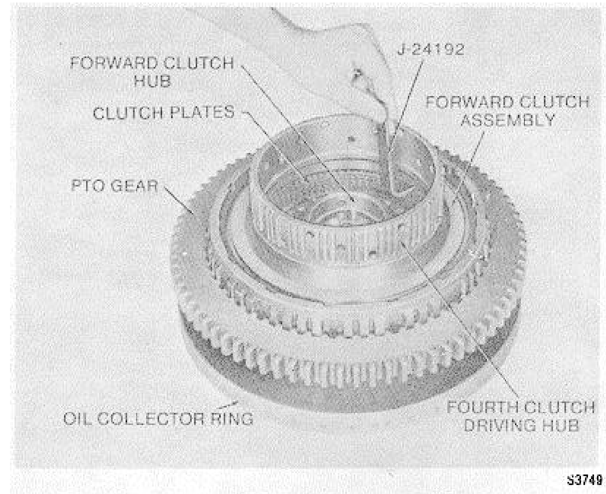


Fig. 6-45. Checking forward clutch plate running clearance

F, fourth-clutch driving hub D and clutch plates B and C. Replace clutch plates, as required, to obtain the desired clearance. Refer to wear limits in Section 8 to determine the plate thicknesses.

(15) Repeat items (12) and (13), above. When the clutch clearance is within the specified limits of 0.080 to 0.120 (2.03 to 3.05 mm), remove snapring F and hub D, clutch plates B and C, and piston A.

(16) Place piston A on a work table with the return spring bosses up. Grease and install two new lip type teflon sealrings into the inner and outer sealring grooves in the piston.

(17) Install sealring protector J-24216-01 onto the clutch housing hub (fig. 6-44).

(18) Lubricate the piston sealrings with transmission fluid and centrally locate the piston in the housing bore. Place the piston and piston housing under an arbor press and apply pressure evenly until the piston is properly seated.

(19) If a press is not available, seat the piston in the housing bore by tapping the piston lightly with a mallet in a continuous circular pattern until the piston is properly seated.

(20) Install twenty piston return springs 13 (B, foldout 13) onto the spring guide bosses of piston 12. Place spring retainer 14 on top of the twenty springs, recessed side (outer lip) of the retainer facing down.

(21) Compress spring retainer 14 (B, foldout 13) until the snapring groove on the clutch housing hub is exposed (fig. 6-38). Install the snapring into the groove.

(22) Install the clutch plate pack removed in (15) above. Beginning with an external-tanged plate, alternately install five external-tanged plates 20 (B, foldout 13) and five internal-splined plates 21, into the forward-clutch housing.

(23) Grease (with oil-soluble grease) and install the thrust bearing race onto the inner hub of forward clutch housing (fig. 6-37).

(24) Grease (with oil-soluble grease) and install the bearing race and needle bearing onto the inner hub of the forward clutch hub (fig. 6-37).

(25) Install the forward clutch hub, outer splines first, into the forward clutch housing (fig. 6-37).

(26) Install fourth-clutch driving hub 22 (B, foldout 13) and retain it with snapring 23.

(27) Grease and install two hook-type sealrings 4 (B, foldout 13). Install hook-type seal-ring 1 on the front of the turbine shaft. Install thrust bearing race 2, cupped side first, onto the front of the forward clutch housing.

(28) Grease (with oil-soluble grease) and install bearing race 24, flat side first and needle bearing 25 onto the rear of forward clutch hub 19.

6-18. FOURTH CLUTCH ASSEMBLY

a. Disassembly (A, foldout 14)

(1) Remove the bearing race from the front hub of the fourth-clutch housing (fig. 6-46).

(2) Remove the bearing race from the rear hub of the fourth-clutch housing (fig. 6-47).

(3) Place the fourth-clutch assembly, snapring up, on the work table.

(4) Remove the large snapring and the backplate (fig. 6-48).

(5) Remove f i v e external-tanged clutch plates and five internal-splined clutch plates.

(6) Using J-24204-2 and J-24204-3 compress the spring retainer until it is clear of the snapring (fig. 6-49). Remove the snapring.

(7) Carefully release t h e pressure from the spring retainer. Remove the retainer and twenty piston return springs.

(8) Remove the piston f r o m the clutch housing (fig. 6-49).

(9) Remove sealrings 10 and 11 (A, foldout 14).

(10) Check the eight steel b a 11 s in fourth-clutch housing 14. Make sure they are securely staked in the housing and are free to move without restriction.

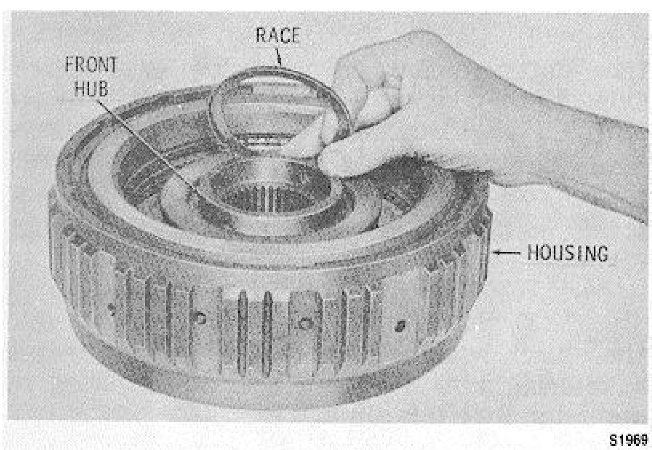


Fig. 6-46. Removing (or installing) fourth clutch front bearing race

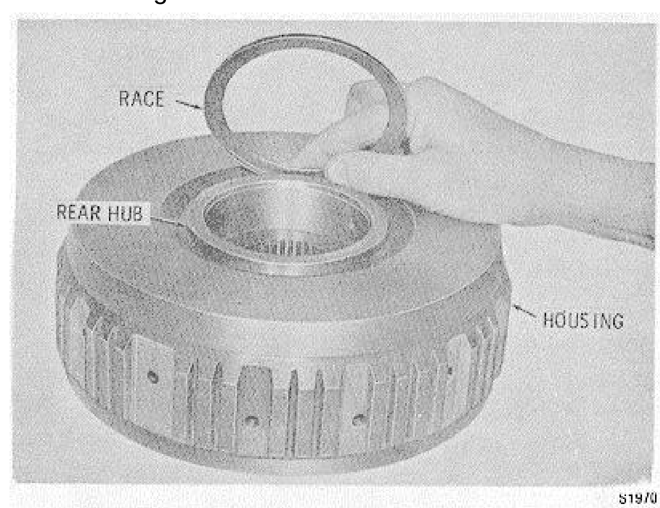


Fig. 6-47. Removing (or installing) fourth clutch rear bearing race

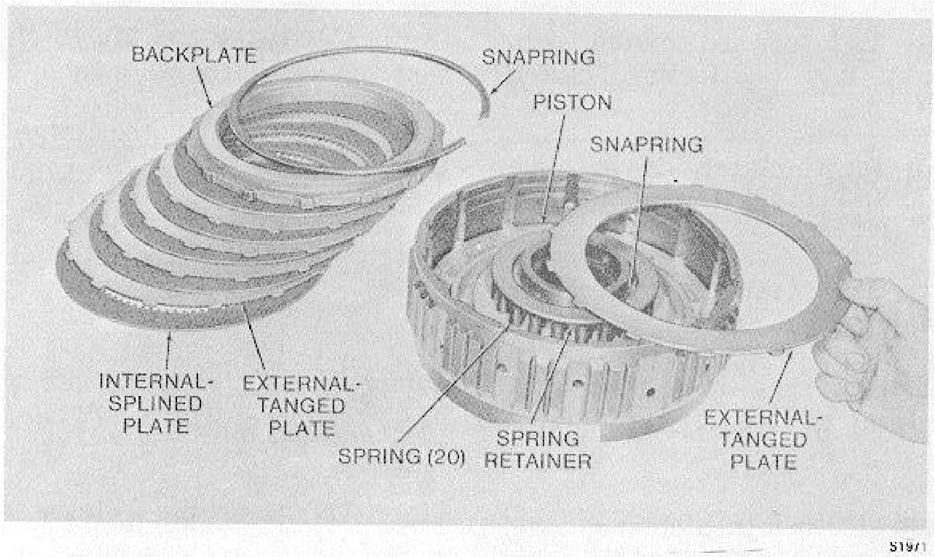


Fig. 6-48. Removing (or installing) fourth clutch plates

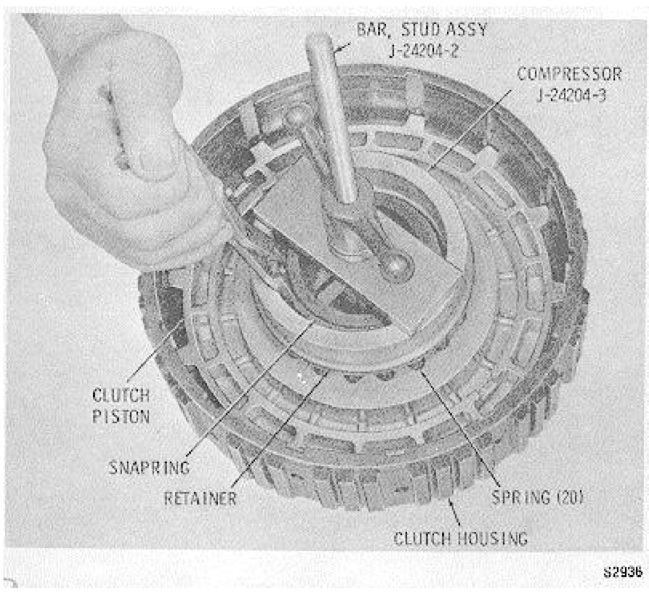


Fig. 6-49. Removing (or installing) fourth clutch spring retainer snapring

NOTE

Refer to paragraph 6-2, above.

b. Assembly (A, foldout 14)

NOTE

If the fourth-clutch housing is replaced, selection of a proper piston (M, S or T) is imperative before seal-ring installation or clutch plate clearance check is d o n e. If the fourth-clutch housing is not replaced and a new piston is required, make sure the identification letter stamped on the new piston is identical to that on the old piston.

(1) Place fourth-clutch housing assembly 12 (A, foldout 14) on the work table, flat (rear) side downward.

(2) Before continuing the assembly, the clutch clearance must be established. One method is by direct measurement as outlined in (3) through (6) below. An alternate method is by stack dimension computation, outlined in paragraph 6-33. If the stack method is used, disregard (3) through (6) below.

(3) Install fourth-clutch piston 9 into the clutch housing (fig. 6-5Q). Do not install a seal-ring into the fourth-clutch housing or on piston 9 at this time.

(4) Beginning with an external-tanged plate, alternately install five external-tanged plates and five internal-splined plates into the fourth-clutch housing (fig. 6-48).

(5) Install the backplate and snapring (fig. 6-52).

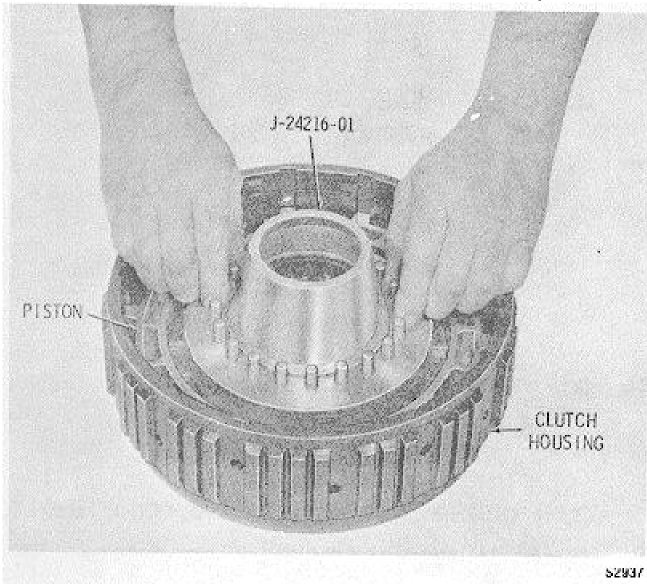


Fig. 6-50. Installing fourth clutch piston

(6) Hold the backplate firmly against the snapring. Insert gage J-24192 and check the clearance at the location shown in figure 6-51. When clearance is satisfactory, the thinner step of the gage will enter between the backplate and clutch plates; the thicker s t e p will not (fig. 6-52). The prescribed clearance is 0.080-0.120 inch (2.03-3.05 mm). Any clearance measurement within this range is satisfactory, but the nearer to 0.080 inch, the longer the clutch will maintain satisfactory clearance.

(7) Remove the snapring, backplate, clutch plates and piston f r o m the clutch housing. Keep the clutch plates in a pack.

(8) Grease (oil-soluble grease) and install a new teflon seal-ring 11 i n t o the clutch housing. Be sure the lip of the seal-ring is facing the bottom of the piston cavity.

(9) Place fourth-clutch piston 9 on the work table, spring bosses side up. Grease and install new teflon seal-ring 10, lip downward, into the groove on the outside circumference of the piston. A seal-ring for the inside groove in piston 9 is not required.

(10) Lubricate the two sealrings with transmission fluid. Centrally locate the piston in the housing bore. Place the piston and housing in an arbor press and apply pressure evenly until the piston is properly seated.

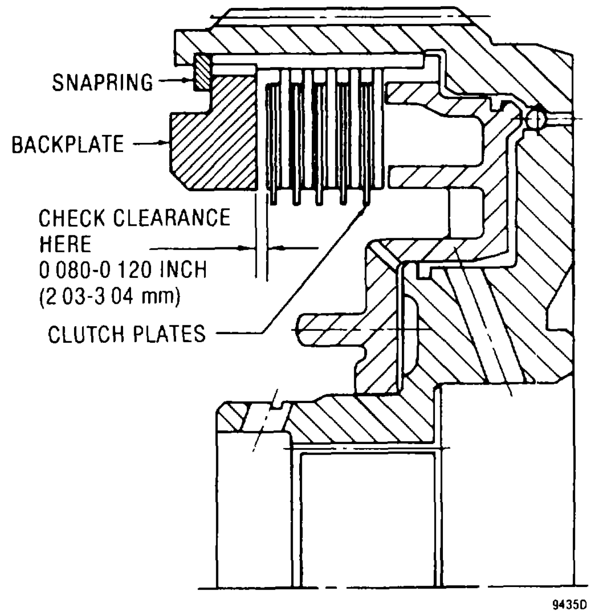


Fig. 6-51. Fourth clutch assembly-cross-section view

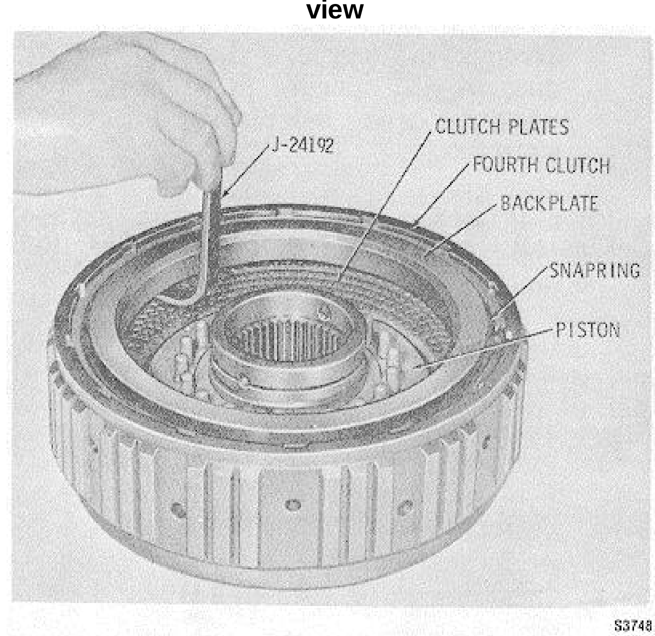


Fig. 6-52. Checking fourth clutch clearance

(11) If a press is not available, the piston may be installed with a mallet. Tap the piston lightly in a continuous circular pattern until the piston is properly seated.

(12) Install twenty piston release springs, one each on the twenty cast bosses on the fourth-clutch piston (fig. 6-48).

(13) Install the spring retainer, recessed side (outer lip) down, on the twenty piston return springs (fig. 6-48).

(14) Compress t h e spring retainer, using J-24204-2 and J-24204-3 tools until the snapring groove on t h e clutch hub is clear (fig. 6-49). Install the snapring.

WARNING

Do not install forward-clutch h u b 19 (B, foldout 13) a n d fourth-clutch driving hub 22 into the fourth-clutch housing assembly 12 (A, foldout 14). If these two hubs are installed into the fourth-clutch housing assembly by mistake, the transmission will operate in reverse when the driver selects any forward range.

(15) Grease (with oil-soluble grease) and install the bearing race onto the rear hub of the fourth-clutch housing (fig. 6-47).

(16) Grease (with oil-soluble grease) and install the bearing race onto the front hub of the fourth-clutch housing assembly (fig. 6-46).

6-19. CENTER SUPPORT ASSEMBLY

a. Disassembly (B, foldout 14)

(1) Place center support housing assembly 15 (B, foldout 14), vertically (upright), on the work table.

(2) Remove pistons 9 and 20 with attached parts.

(3) Remove inner seal-ring 10 and 19, and outer seal-ring 11 and 18 from piston 9 and 20.

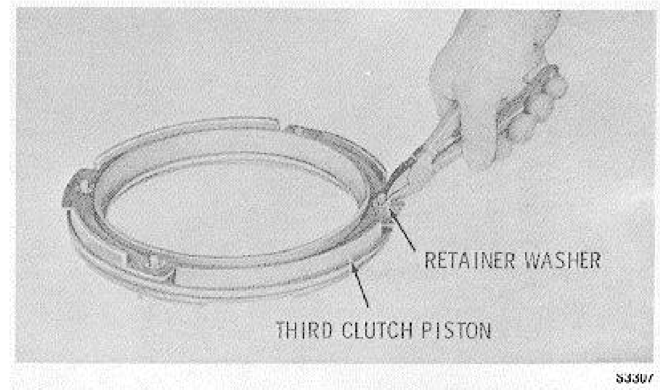


Fig. 6-53. Removing self-locking retainer washers

(4) If replacement is necessary, disassemble the two piston assemblies. Cut retainer rings 6 and 23 to prevent damaging the piston projections (fig. 6-53).

(5) Remove the retainer rings, retainers 7 and 22, and springs 8 and 21 from pistons 9 and 20.

(6) Remove sealrings 12 and discard. Remove thrust bearing race 14 and needle bearing 13 from the hub of center support housing 17.

(7) Determine the serviceability of the seal-ring grooves on the center support hub. Insert, do not force gage J-29198-3 into a groove on the support hub. Rotate the gage 360 degrees around the hub. If the gage does not rotate freely, the support is damaged and should be replaced.

NOTE

A damaged or worn center support hub can be salvaged with guidance from the instructions on the instruction sheet in the Sleeve a n d Pin Kit. The Kit contains one unfinished center support sleeve, one sleeve retainer pin and one machining and installation instruction sheet. Refer to Parts Catalog SA 1268 for the Kit part number.

(8) If bushing replacement is necessary, collapse bushing 16 at its seam using a small half-round chisel. Be careful not to damage the support bore.

NOTE

Refer to paragraph 6-2, above.

b. Assembly (B, foldout 14)

(1) Place center support 17 on a press, hub side up. Using bushing installer tool J-28525-2, install a prebored bushing as shown in figure 6-54. Be sure the oil hole in bushing 16 is in proper alignment with the oil hole in center support 17. Swage bushing using swaging tool J-28525-1 and figure 6-55 as a guide.

(2) Temporarily place piston 9 in the front piston cavity of center support housing 17. Install twenty springs 8 into the pockets of the piston. Align spring retainer 7 on the four ejector pin bosses of the piston. Compress the springs by forcing the retainer into the recess at the outer edge of the center support when the retainer rings are installed (fig. 6-56). Install a new self-locking retainer ring 6 on the ejector pins of each piston, using installer J-24453. Remove the piston from the center support.

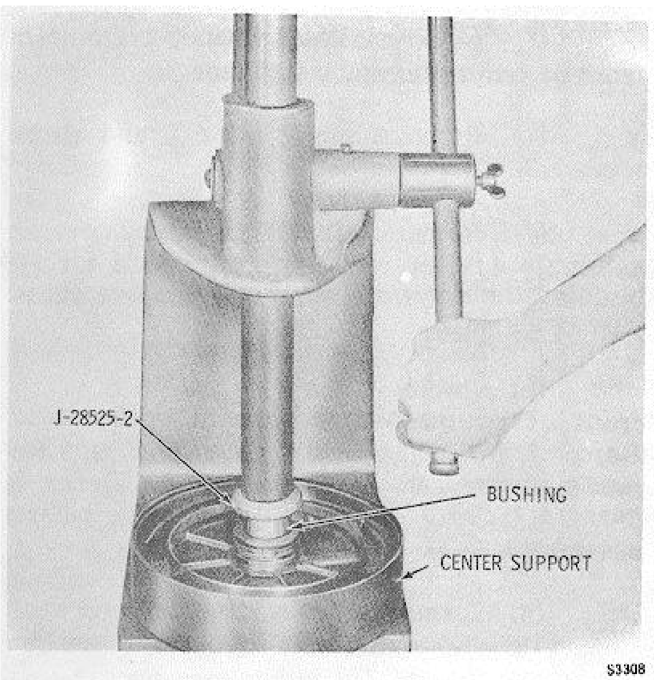


Fig. 6-54. Installing center support bushing

(3) Repeat the procedures in (2), above, to assemble items 20 through 23 (B, foldout 14) into the rear cavity to support housing 17.

NOTE

Force the pistons to the bottom of their cavities during installation of the self-locking retainer rings 6 and 23. This will ensure proper clutch clearance.

(4) Grease (with oil-soluble grease) and install inner seal-ring 10 and 19, and outer sealrings 11 and 18 onto pistons 9 and 20. The lips of all sealrings must be toward the piston cavities of the center support.

(5) Inspect the piston cavities in center support housing 17 for any obstruction or foreign material. Install piston 20 into the rear of the center support. Be sure the lips of both the inner and outer sealrings face the bottom of the piston cavity. Leave the assembled third clutch piston (9) out of the center support until final installation of the center support assembly in Section 7.

(6) Lubricate needle roller bearing 13 and bearing race 14 with oil-soluble grease. Install the race, flat side first, onto the front hub of the center support. To facilitate assembly, keep the race square with the support housing hub during installation. Forcing may damage the race. Install the needle roller bearing onto the race.

NOTE

Do not install butt-joint sealrings onto the support hub until the center support and fourth-clutch assemblies are installed into the transmission in Section 7. Reference paragraphs 4-6g, 7-10b and 7-11a.

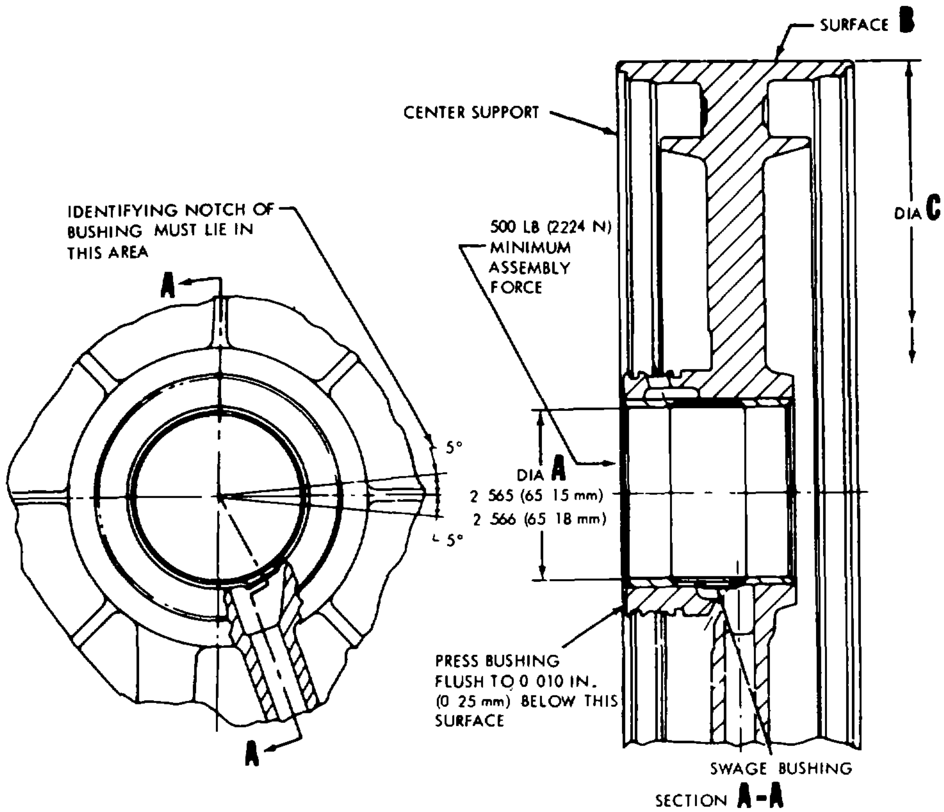


Fig. 6-55. Center support assembly

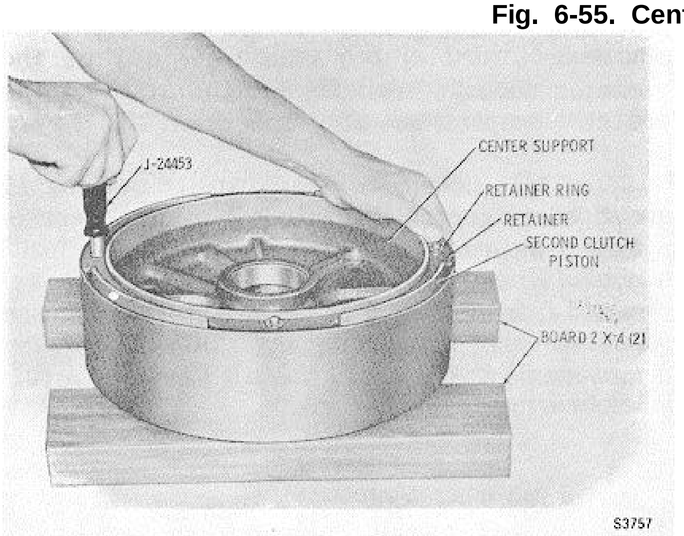


Fig. 6-56. Installing retainer rings onto third clutch piston

6-20. GEAR UNIT AND MAIN SHAFT ASSEMBLY (HT 740D, 747D)

a. Disassembly (A, foldout 15)

(1) Using figure 6-57 as a guide, proceed as follows.

(2) Remove thrust washer 1 from the front of front planetary sun gear 2.

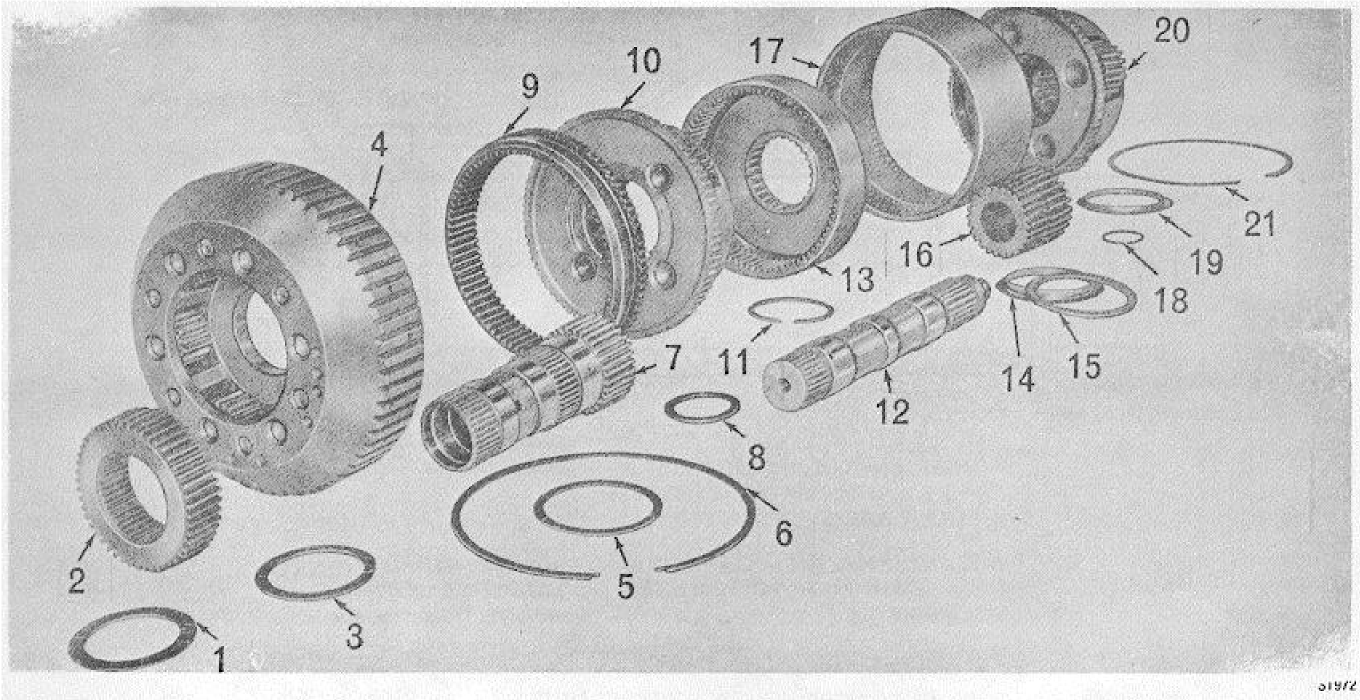
(3) Remove sun g e a r 2 and thrust washer 3.

(4) Remove front planetary carrier assembly 4. Refer to paragraph 6-23 for rebuild of the carrier assembly. Remove thrust washer 5.

(5) Remove snapring 6 f r o m the front of the planetary connecting drum 17. Remove front planetary ring gear 9. Remove center carrier assembly 10. Refer to paragraph 6-23 for rebuild of the carrier assembly.

(6) Remove center sun gear and shaft assembly 7, and thrust washer 8. If bushing 24 or 26 (A, foldout 15) in the sun gear shaft assembly is worn, remove them.

(7) Lift main shaft assembly 12 (fig. 6-57) from the gear unit. Center planetary ring gear 13, and rear planetary sun gear 16, are attached.



1 - Thrust washer
2 - Front planetary sun gear
3 - Thrust washer
4 - Front planetary carrier assembly
5 - Thrust washer
6 - Internal snapring
7 - Sun gear and shaft assembly
8 - Thrust washer
9 - Front planetary ring gear
10 - Center planetary carrier assembly
11 - External snapring
12 - Main shaft assembly
13 - Center planetary ring gear
14 - Roller bearing race
15 - Needle roller bearing assembly
16 - Rear planetary sun gear
17 - Planetary connecting drum
18 - External snapring
19 - Roller bearing race
20 - Rear planetary carrier assembly
21 - Internal snapring

Fig. 6-57. Components of gear unit and main shaft assembly (HT 740D)

(8) Remove snapring 18, and remove main shaft assembly 12 from rear planetary sun gear 17. If orifice plug 35 (A, foldout 15) requires replacement, remove it.

(9) Remove snapring 11 (fig. 6-57) and separate ring gear 13 and sun gear 16.

(10) Remove thrust race 14, needle bearing 15 and thrust race 19.

(11) Remove snapring 21. Remove rear planetary carrier assembly 20 from planetary connecting drum 17. If rear planetary carrier assembly requires rebuild, or if bearing replacement is necessary, remove ball bearing 47 (A, foldout 15). Refer to paragraph 6-23 for rebuild of the rear planetary carrier assembly.

NOTE

Refer to paragraph 6-2, above.

b. Replacing Sun Gear Shaft Bushings (A, foldout 15)

(1) If bushings 24 and 26 were removed, install new bushings as follows.

(2) Apply Loctite Sleeve Retainer 601 (or equivalent) and position bushing 24 at bore of shaft 25. Aline interlock split so that it is more than 45 degrees from the swaging hole in the shaft.

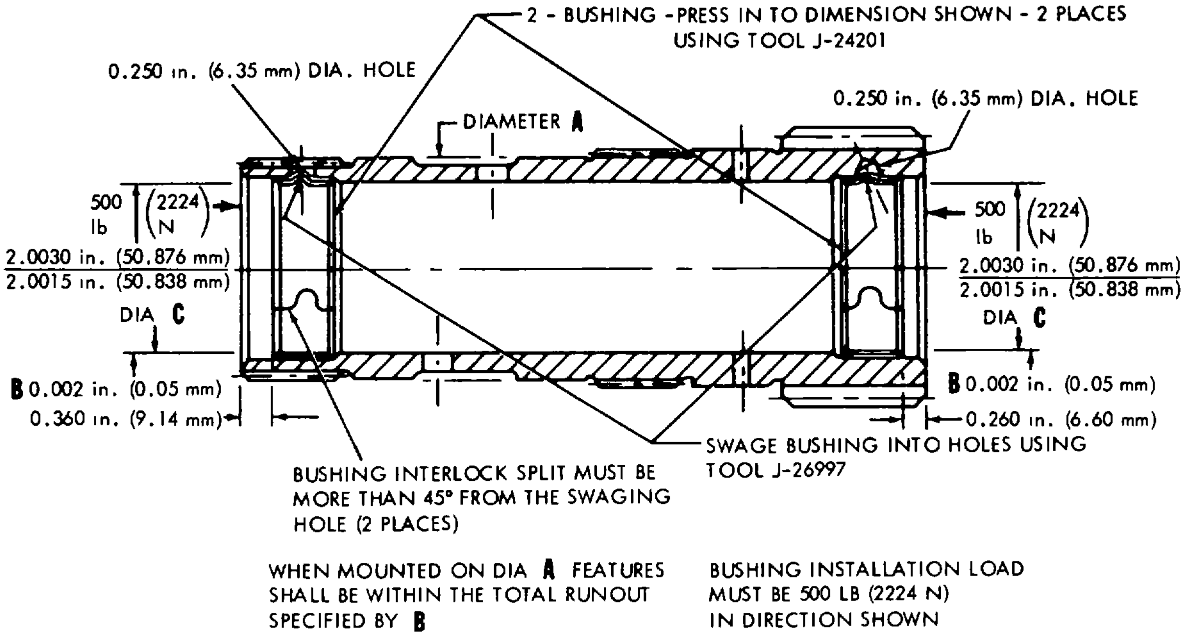


Fig. 6-58. Sun gear shaft bushings installation requirements

(3) Using bushing installer tool J-24201 long end, press new bushing 24 to 0.360 inch (9.14 mm) below end surface into the small OD end of shaft 25.

NOTE

Use a minimum of 500 pounds (2224 Newtons) assembly force on bushing installer.

(4) Install bushing 26 in the same manner as bushing 24 except, use short end of tool J-24201. Press new bushing 26 to 0.260 inch (6.60 mm) below end surface into the large OD end of shaft 25.

(5) Using swaging tool J-26997, swage both bushings into holes in sun gear shaft (fig. 6-59).

(6) If tool J-28489 is not available, place shaft in lathe having a four-jaw chuck. Adjust the chuck to obtain a zero run-out of diameter A (fig. 6-58). Using a 1-inch (25.4 mm) boring bar with a tool having a 1/32-in. (0.78 mm) radius machine the bushings as shown in figure 6-58. Chuck speed should be 300 to 400 rpm and feed should be approximately 0.006 in. (0.15 mm).

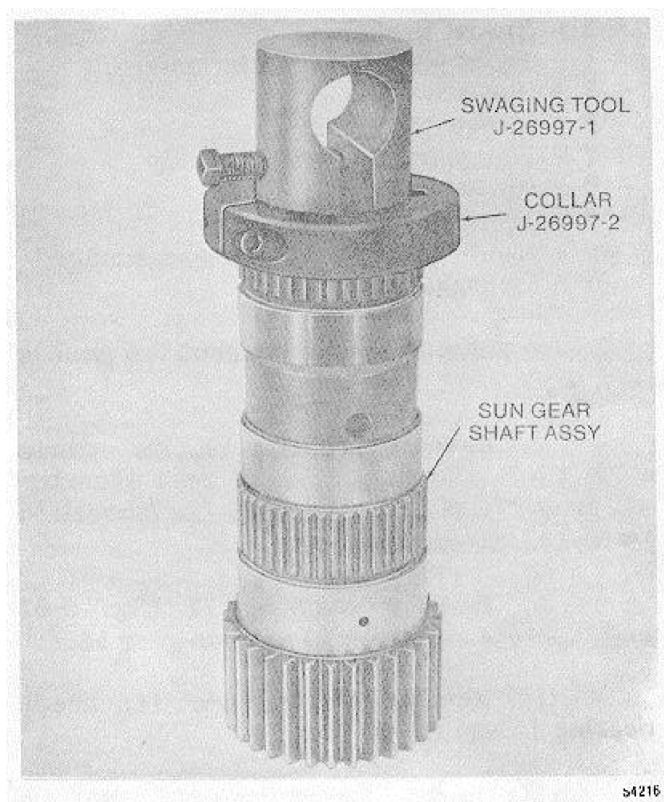


Fig. 6-59. Sun gear shaft and swaging tool

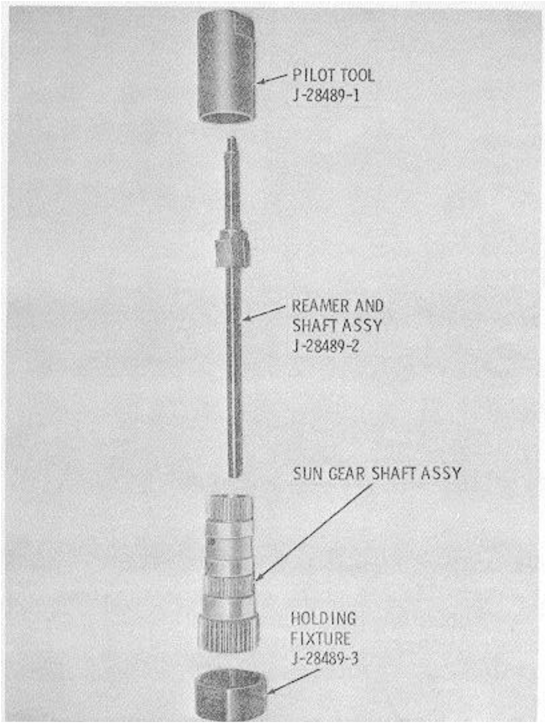


Fig. 6-60. Sun gear shaft assembly and tools for reaming rear bushing

NOTE

If sun gear bushing reamer set J-28489 is not available, perform step (6). If tool J-28489 is available, proceed with step (7).

(7) If tool J-28489 is available, assemble the parts shown in figure 6-60 in the following manner. Clamp the holding fixture in a vise (fig. 6-61). Place the sun gear shaft assembly in the holding fixture, and put the reamer and pilot tool in place. Using a 1.2inch (30.5 mm) electric drill, machine the bushing (approx. 75 to 150 rpm) while adding cutting lubricant through the hole(s) in the pilot tool.

CAUTION

Keep reamer at full drill speed when pulling it back through the bushing. If reamer is not

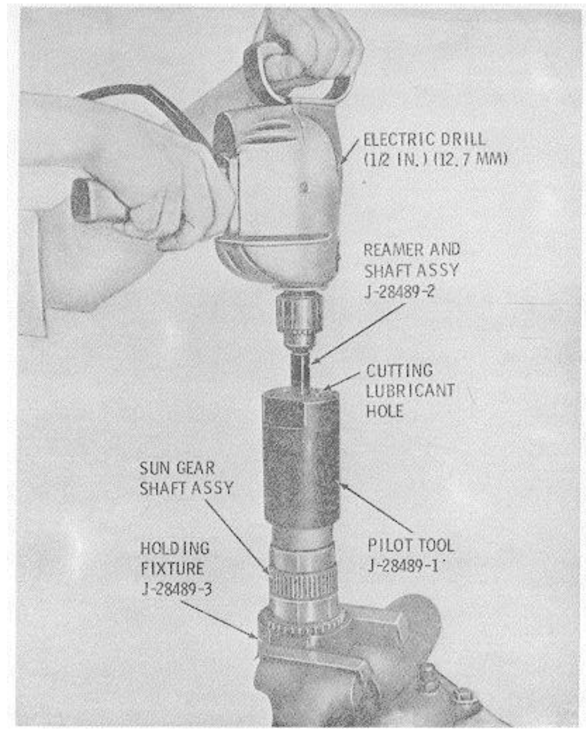


Fig. 6-61. Machining rear bushing in sun gear assembly shaft.

rotating during retrieval, it could damage the bushing.

(8) Assemble the parts as shown in figure 6-62 in the following manner. Clamp the pilot tool in a vise (fig. 6-63). Insert the bushing pilot tool into the sun gear shaft (end with newly machined bushing) and fasten them together with the locking pin. Using the same electric drill, engage the shaft of the reamer in the pilot tool, and machine the bushing. Add cutting lubricant during machining operation. Refer to the preceding caution when retrieving the reamer from the bushing.

(9) Check ID of bushings for runout. Runout must not exceed 0.002 in. (0.05 mm) total indicator reading. Surface finish should be 30 microinch (0.762 micrometer).

(10) Thoroughly clean shaft of chips and debris.

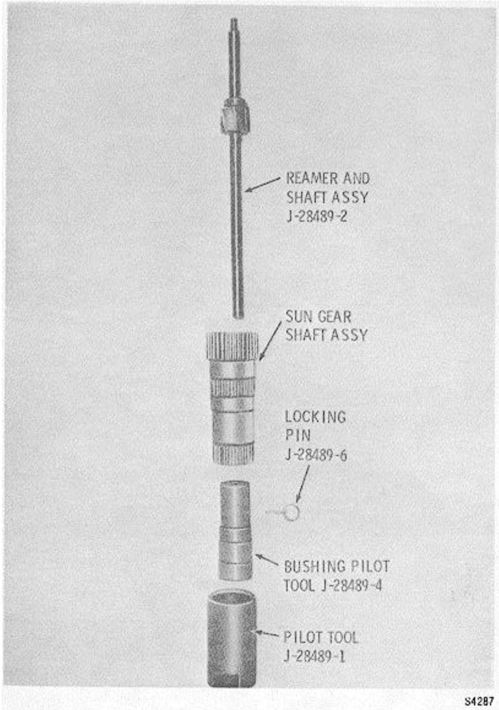


Fig. 6-62. Sun gear shaft assembly and tools for front bushing.

c. Assembly (A, foldout 15)

(1) If orifice plug 35 (A, foldout 15) was removed from main shaft 36, install a new plug. Be sure the plug is pressed deep enough into the bore to clear the chamfer of the shaft. Use installer J-24369 to position the orifice plug properly (fig. 6-64).

(2) Install rear planetary sun gear 16 (fig. 6-57), into the rear of center planetary ring gear 13. Retain it with snapring 11.

(3) Install the sun gear and ring gear, assembled in (5), above, onto the rear of main shaft assembly 12. The counterbore in gear 16 must be toward the rear of shaft assembly 12. Retain the sun gear with snapring 18 (recessed in the gear counterbore).

(4) If ball bearing 47 (A, foldout 15), was removed, press a new bearing onto the Fig. 6-63. Machining front bushing in sun gear shaft assembly.

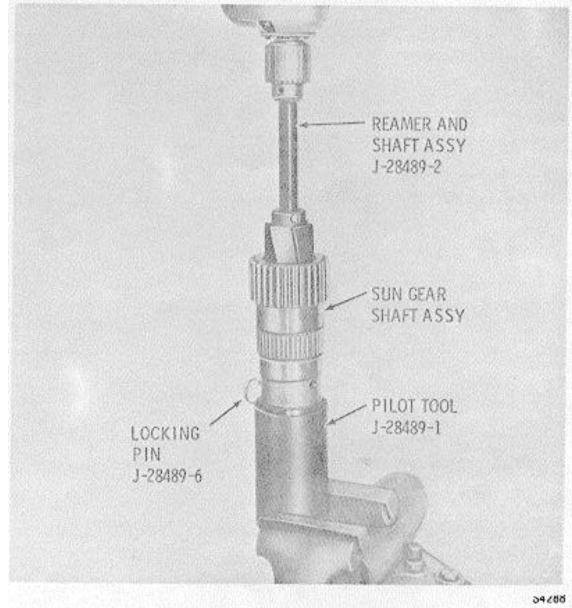


Fig. 6-63. Machining front bushing in sun gear shaft assembly

rear planetary carrier assembly. Seat it firmly against the hub shoulder.

(5) Apply oil-soluble grease to both thrust bearing races 14 and 19 (fig. 6-57), and needle bearing 15. Install race 19, inner lip first, into the front bore of rear planetary carrier assembly 20. Install race 14, flat side first, onto the rear of center planetary ring gear 13. Install needle bearing 15 onto race 14. Install main shaft 12, and attached parts, into the front of rear planetary carrier assembly 20.

(6) Install thrust washer 8 onto the main shaft assembly.

(7) Install sun gear and shaft assembly 7 onto the main shaft, larger end first.

(8) Install center planetary carrier assembly 10, small diameter first, into center planetary ring gear 13 and planetary connecting drum 17.

(9) Install front planetary ring gear 9, splined outer end first, into connecting drum 17 and secure it with snapring 6.

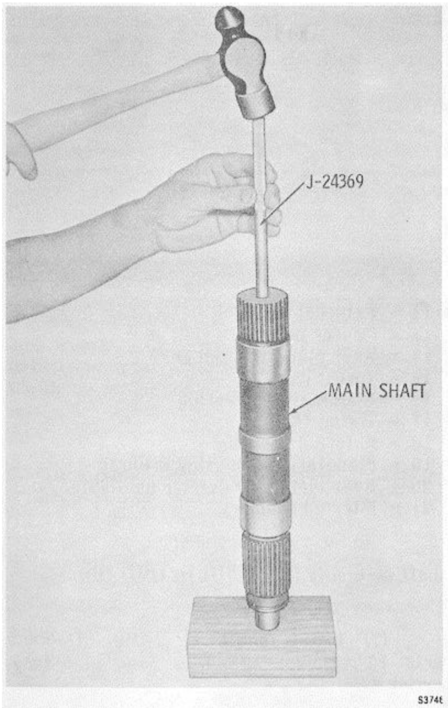


Fig. 6-64. Installing orifice plug into main shaft

(10) Grease thrust washer 5 (fig. 6-57), and place it on the rear hub of front carrier assembly 4. Install the front carrier assembly.

(11) Install thrust washer 3, front planetary sun gear 2 and thrust washer 1.

6-21. GEAR UNIT AND MAINSHAFT ASSEMBLY (HT 750DRD, HT 750DRD-DB

a. <u>Disassembly (A, foldout 16)</u>

(1) Using figure 6-65 as a guide, proceed as follows.

(2) Remove thrust washer 1 from the front of sun gear 2.

(3) Remove sun g e a r 2 and thrust washer 3.

(4) Remove front planetary carrier assembly 4. Refer to paragraph 6-23 for rebuild of the carrier assembly. Remove thrust washer 5 (fig. 6-65).

(5) Remove center sun gear and shaft assembly 8. If the bushings in shaft 8 are worn, remove them.

(6) Remove snapring 6 from the front of planetary connecting drum 19. Remove front planetary ring gear 7. Remove center planetary carrier assembly 10. Refer to paragraph 6-23 for rebuild of the center carrier assembly.

(7) Remove thrust washer 9. Lift main shaft 11 and its attached parts (12 through 18) from planetary connecting drum 19.

(8) Remove snapring 18 from the rear of main shaft 11. Remove m a i n shaft 11 from sun gear 14. If replacement is required, remove orifice plug 35 (A, foldout 16) from shaft 36.

(9) Remove snapring 12 (fig. 6-65) from sun gear 14. Remove sun gear 14 from center planetary ring gear 13.

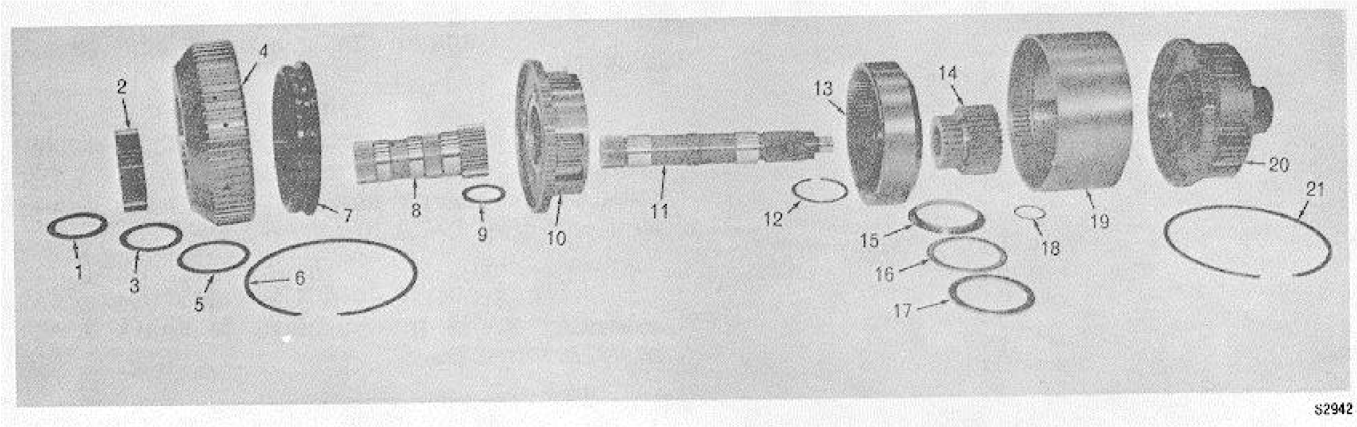
(10) Remove bearing race 17, needle roller bearing 16, and bearing race 15.

(11) Remove snapring 21 f r o m the rear of planetary connecting drum 19. Remove rear planetary carrier assembly 20 from the drum. Refer to paragraph 6-23 for rebuild of the carrier assembly.

NOTE
Refer to paragraph 6-2, above.

b. Assembly (A, foldout 16)

(1) If orifice plug 35 (A, foldout 16) was removed from shaft 36, install a new one. The orificed end of the plug enters the bore first. Use installer J-24369 to properly position the plug (fig. 6-64).



1 - Thrust washer
2 - Front planetary sun gear
3 - Thrust washer
4 - Front planetary carrier assembly
5 - Thrust washer
6 - Internal snapring
7 - Front planetary ring gear
8 - Center sun gear and shaft assembly
9 - Thrust washer
10 - Center planetary carrier assembly
11 - Main shaft assembly
12 - External snapring
13 - Center planetary ring gear
14 - Rear planetary sun gear
15 - Thrust race
16 - Needle roller bearing
17 - Thrust race
18 - External snapring
19 - Planetary connecting drum
20 - Rear planetary carrier assembly
21 - Internal snapring

Fig. 6-65. Components of gear unit and main shaft assembly (HT 750DRD, DRD DB)

(2) If bushings 24 and 26 (A, foldout 16) were damaged or removed from sun gear and shaft 25, refer to paragraph 6-20, b.

(3) Install bearing race 15 (fig. 6-65), flat side first, onto the rear of center planetary ring gear 13. Retain it with oil-soluble grease. Install needle roller bearing 16 onto race 15. Retain the bearing with oil-soluble grease. Install thick, flat bearing race 17 onto bearing 16. Retain it with oil-soluble grease.

(4) Install rear planetary sun gear 14 (fig. 6-65) into the rear of center planetary ring gear 13. Retain it with snapring 12.

(5) Install m a i n shaft 11 into the front of sun gear 14. Retain it with snapring 18.

(6) Install rear planetary carrier assembly 20 into the rear of planetary connecting drum 19. Retain it with snapring 21.

(7) Install shaft 11 (with attached parts 12 through 18), into rear planetary carrier assembly 20.

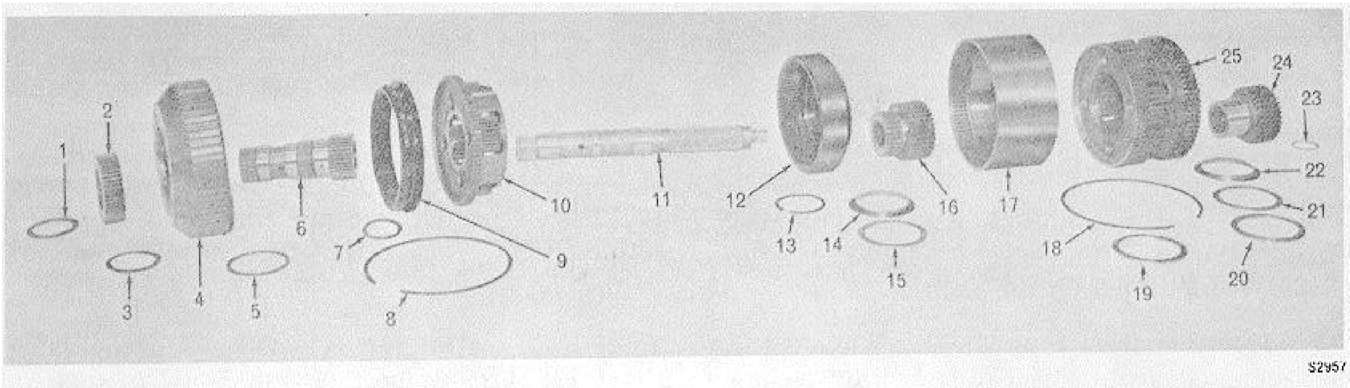
(8) Install center planetary carrier assembly 10 into planetary connecting drum 19. Install thrust washer 9, and sun gear and shaft assembly 8 into center planetary carrier assembly 10.

(9) Install front planetary ring gear 7, outer splines first, into the front of planetary connecting drum 19. Retain gear 7 with snapring 6.

(10) Install thrust washer 5 onto the rear hub of front planetary carrier assembly 4. Retain it with oil-soluble grease.

(11) Install front planetary carrier assembly 4 onto sun gear and shaft assembly 8.

(12) Install thrust washer 3, sun gear 2, and thrust washer 1 onto sun gear and shaft assembly 8.



1 - Thrust washer
2 - Front planetary sun gear
3 - Thrust washer
4 - Front planetary carrier assembly
5 - Thrust washer
6 - Sun gear and shaft assembly
7 - Thrust washer
8 - Internal snapring
9 - Front planetary ring gear
10 - Center planetary carrier assembly
11 - Main shaft
12 - Center planetary ring gear
13 - External snapring
14 - Thrust race
15 - Needle roller bearing
16 - Rear planetary sun gear
17 - Planetary connecting drum
18 - Internal snapring
19 - Thrust race
20 - Thrust race
21 - Needle roller bearing
22 - Thrust race
23 - Snapring
24 - Low planetary sun gear
25 - Rear planetary carrier assembly

Fig. 6-66. Components of gear unit and main shaft assembly (HT 750CRD)

6-22. GEAR UNIT AND MAIN SHAFT ASSEMBLY (HT 750CRD, HT 754CRD)

a. Disassembly (B, foldout 15)

(1) Remove bronze thrust washer 1 (fig. 6-66) from sun gear 2. Remove sun gear 2 and bronze thrust washer 3.

(2) Remove front planetary carrier assembly 4, and thrust washer 5. Refer to paragraph 6-23 for rebuild of the carrier assembly.

(3) Remove sun gear and shaft assembly 6, and thrust washer 7. If the bushings in gear and shaft assembly 6 are worn or damaged, remove them.

(4) Remove snapring 8 and ring gear 9 from the front of planetary connecting drum 17.

(5) Lift out center planetary carrier assembly 10. Refer to paragraph 6-23 for rebuild of the carrier assembly.

(6) Remove snapring 23. Remove low sun gear 24.

(7) Remove bearing race 20, bearing 21, and bearing race 22.

(8) Remove main shaft 11. Remove center planetary ring gear 12 and its attached parts (items 13, 14, 15, 16, 19).

(9) Remove snapring 13. Lift ring gear 12 from sun gear 16. Remove race 14, bearing 15, and race 19.

(10) Remove snapring 18, and lift rear planetary carrier assembly 25 from drum 17. Refer to paragraph 6-23 for rebuild of carrier assembly.

NOTE
Refer to paragraph 6-2, above.

b. Assembly (B, foldout 15)

(1) If the bushings w e r e removed from sun gear and shaft assembly 6 (fig. 6-66), refer to paragraph 6-20b.

(2) If orifice plug 35 (B, foldout 15), was removed from shaft 36, install a new plug. Refer to paragraph 6-20c(l), above, for replacement.

(3) Position planetary connecting drum 17 (fig. 6-66), front (longer internal splines) downward. Install rear planetary carrier assembly 25, larger carrier bore first, into drum 17. Retain the carrier with snapring 18.

(4) Install bearing race 14, flat side first, onto the rear of center planetary ring gear 12. Retain it with oil-soluble grease. Install needle roller bearing 15 onto race 14. Retain it with oil-soluble grease.

(5) Install thick, flat bearing race 19 onto bearing 15. Retain it with oil-soluble grease.

(6) Install rear planetary sun gear 16 into the rear of center planetary ring gear 12. Retain it with snapring 13.

(7) Install main shaft 11, smaller end first, through the parts (12, 13, 14, 15, 16, 19) assembled above. Install shaft 11 and its assembled parts into drum 17 until bearing race 19 seats in the front counterbore of rear planetary carrier assembly 25.

(8) Install bearing race 22, flat side first, onto the rear hub of rear planetary carrier assembly 25. Retain it with oil-soluble grease. Install bearing 21, and thick, flat race 20 onto bearing 21, retaining each with oil-soluble grease.

(9) At the rear of carrier assembly 25, install low sun g e a r 24, extended hub first, over the rear end of shaft 11. Retain it with snapring 23.

(10) Position the assembly, front upward, and support the rear of carrier assembly 25.

(11) Install center planetary carrier assembly 10, outer splines upward, into drum 17. Install front planetary ring gear 9, outer splines first, into drum 17. Retain gear 9 with snapring 8.

(12) Install thrust washer 7 onto main shaft 11. Install sun gear and shaft assembly 6, larger diameter first, onto shaft 11.

(13) Install thrust washer 5 onto the rear hub of front planetary carrier assembly 4. Install carrier assembly 4 so that thrust washer 5 seats on the front of center planetary carrier assembly 10.

(14) Install bronze thrust washer 3, sun gear 2, and bronze thrust washer 1 into the front of front planetary carrier assembly 4.

6-23. PLANETARY CARRIER ASSEMBLIES

NOTE
The disassembly and assembly procedures for all planetary carrier assemblies differ only in the proper tool selection for the specific application. The chart at the end of paragraph 6-23 shows the tool number required for a specific application and identifies the carrier involved (front, center, rear, low). If the tool is common to all of the planetary carrier assemblies, its number will be listed in the text. If the tool is not common, the text will refer to the chart. For planetary carrier detailed information, refer to the exploded views at the back of this manual.

a. Assembly Inspection

(1) Visually inspect planetary carrier assembly for evidence of excessive wear,, overheat indication, damage or heavy metal contamination.

(2) Check end play of planetary carrier pinions. With washer held flat, insert feeler gage between carrier and thrust washer. End play must be within 0.008 to 0.031 inch (0.203 to 0.787 mm).

NOTE

Do not disassemble carrier assembly unless parts replacement is necessary. Failure of one pinion requires replacement of the entire pinion gear set because they are selectively matched.

b. Removal, Installation of Pinion Components

NOTE

The hydraulic press, used with J-25587-01 Planetary Rebuilding Set, should have a ten-ton capacity, an adjustable press bed of 25-inch minimum opening and a pressure gage to assist in determining proper installation and staking of the pinion pins.

(1) Using a drill that is slightly smaller than the pinion pin diameter, drill into the swaged ends of the pins (only one end required). Do not drill into the carrier. The rear ends of all pinion pins except those in the center carrier assembly will be drilled. Drill the front ends of the center assembly pins.

(2) Place press fixture J-25587-1 in a hydraulic press. Select the proper spacer and adapter, if required, from the tool chart below. Position these parts (if used) to support the carrier assembly (drilled ends of pinion pins upward) solidly on the press fixture.

(3) Install the proper pin remover (see chart) into the ram of the press fixture. Press the pinion pins from the carrier assembly.

(4) Remove the pinion groups, consisting of pinions, bearings, and thrust washers. If bushing in the carrier assembly must be replaced, refer to c. below.

(5) Assemble all of the pinion groups for the carrier assembly. Each group is assembled by inserting the proper loading pin into the bore of the pinion, installing the needle roller bearings around the loading pin, installing a steel thrust washer at each end of the pinion, and installing a bronze thrust washer onto each steel thrust washer.

NOTE

Lubricate the needle rollers and the thrust washers before assembling the pinion groups.

(6) Position the carrier assembly rear end upward except the center carrier. Install all pinion groups into the planetary carrier, aligning the loading pins (see chart) with the pin bores in the carrier.

(7) Install the proper pinion guide pins (see chart), larger diameters first, into the pinion pin bores. Push the guide pins through the carrier until the loading pins drop out.

(8) Position the carrier assembly on the press fixture, using the proper pin remover and installed adapter (if required).

(9) Select the proper pin installer, and install it into the press fixture ram.

NOTE

Pin installers are shaped to avoid interference with boses on the carrier assemblies. They must be Installed in the ram so that the cutaway portion of the installer will clear the bosses when the pinion pin is pressed in.

(10) Place a pinion pin onto the pilot end of the pin guide located below the press fixture ram. Press the pinion pin into the carrier until the installer contacts the carrier.

NOTE

All tools have a basic number (J-25587) and a suffix. Only the suffix is shown below. The figures In parentheses are quantities required.

Planetary Carrier Assembly	Press Fixture	Support Blocks	Pin Remover	Pin Remover Installer Adapter	Pin Remover Installer Spacer	Swaging Loading Pins	Guide Pin	Pin Installer	Swaging Tool	Tool Holder
HT 700 (All) Front	-1	-4	-16			-20 (6)	-49 (6)	-9	-25 (2)	-17
HT 700 (All) Center	-1	-3	-29			-67 (4)	-47 (4)	-30	-21 (2)	-17
HT 740 D, 747D Rear	-1	-3	-29	-2	-6		-46 (4)	-15	-19 (2)	-17
HT 750DRD Rear	-l	-5	-29	-2	-6	-7 (4)	-47 (4)	-31	-21 (2)	-17
HT 754CRD HT 750CRD Rear	-1	-5	-29	-2	-6	-7 (4)	-47 (4)	-66	-21 (2)	-17
HT 750DRD Low	-1	-4	-29			-7 (4)	-47 (4)	-36	-21 (2)	-17
HT 754CRD HT 750CRD Low	-1	-5	-29			-7 (4)	-47 (4)	-32	-21 (2)	-17

Tools In the chart above are components of planetary rebuilding Kit J-25587-01.

CAUTION

Do not put pressure on the carrier. Distortion of the carrier will damage it.

(11) Install the remaining pinion pins as instructed in the preceding paragraph.

(12) Remove t h e carrier assembly from the press fixture. Install swaging tool holder J-25587-17 into the opening of the press fixture bed. Install a swaging tool into the holder. Install another swaging tool into the press fixture ram. Lubricate both ends of the pinion pins with oil-soluble grease.

(13) Position the carrier assembly, rear end upward except the center carrier, on the press fixture. Use the proper support block to level the carrier while the lower swaging tool is supporting the lower end of one pinion pin.

(14) Apply sufficient pressure to the press fixture ram to firmly swage the ends of the pinion pins against the metal of the carrier. Figure 6-67 illustrates a typical swage pattern.

NOTE

Swaging pressure is approximately three t o n s for each p i n i o n pin.

While applying pressure, rotate pinions a n d feel for reduction of end play. The pinions must rotate freely and have 0.008 inch <u>minimum</u> end play after swaging the pins.

(15) Swage the remaining pinion pin ends as instructed in (14), above.

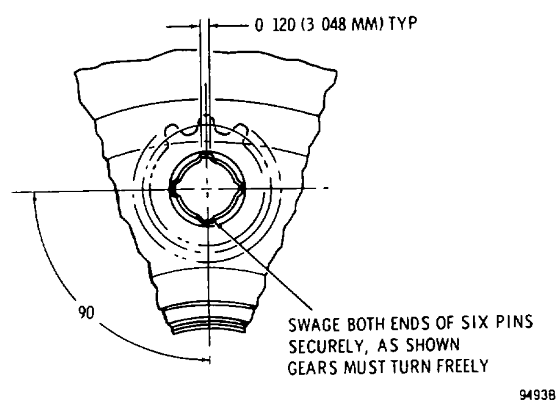


Fig. 6-67. Front planetary carrier assembly swaging location

c. Replacing Bushing in Front Planetary Carrier Assemblies

NOTE

Depending upon the amount of labor (machining bushing), time, parts replacement, and extent of rework, complete replacement of t h e assembly may be warranted.

(1) Fabricate six dummy pins to dimensions shown in figure 6-68.

(2) Place the front carrier on a work table, rear downward.

(3) Press the bushing from the carrier. Do not scratch or score the bushing bore. (Refer to para 4-5e, (1)).

(4) Place the carrier in a press, rear downward.

(5) Apply Loctite Sleeve Retainer No. 601 (or equivalent) to th3 outer diameter of a new bushing. Install the bushing using tool J-24207. Press the bushing flush with, to 0.010 inch below, its adjacent surface (fig. 6-68).

(6) Using alathe with a four jaw chuck, mount the carrier with surface (A) facing the chuck. Insert the six fabricated dummy pins (fig. 6-68) into the pinion pin holes. Adjust the chuck, centering the carrier based on surface (B) and the runout of the dummy pins.

(7) Total runout of bushing after boring must not exceed 0.002 inch. Use figure 6-68 as a guide.

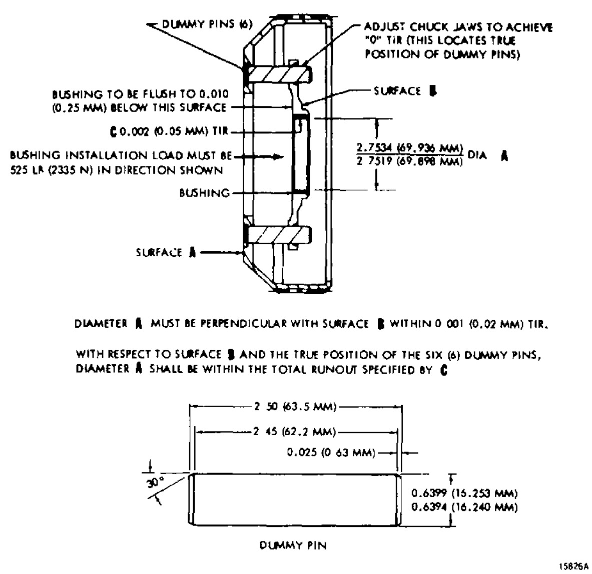


Fig. 6-68. Front carrier assembly bushing installation

6-24. LOW SUN GEAR AND HUB (HT 750DRD, HT 750DRD-DB)

Check the gear and hub assembly. If the assembly is worn or damaged, or has loose components, replace the assembly. If bushing replacement is necessary, proceed as follows.

a. If the bushing is worn, replace it with a new bushing.

b. Remove the worn bushing. Do not damage the bushing bore during removal.

c. Attach handle J-8092 to bushing installer J-24371. Place the new bushing on the installer and install the bushing into its bore in the sun gear.

d. If an installer tool is not available, press the bushing into its bore 0.100 below the face of the gear.

6-25. ADAPTER HOUSING ASSEMBLY (HT 750)

a. Disassembly (B, foldout 18)

(1) Position adapter housing and piston assembly 2, piston assembly upward. Lift out the piston assembly (includes items 3 through 8).

(2) Remove the inner and outer sealrings from the piston (fig. 6-69).

(3) Turn the piston assembly over, and cut the four retainer rings while depressing the retainer (fig. 6-70).

NOTE

Any method of removal except cutting may damage the risers on the piston. Damage will lessen the holding power of retainer rings installed thereafter.

(4) Remove the spring retainer and twenty-eight springs from the piston (fig. 6-70).

(5) If replacement is necessary, remove dowel pins 11 and 12, and orifice plug 13 (B, foldout 18) from adapter housing 10.

NOTE

Refer to paragraph 6-2, above.

b. Assembly (B, foldout 18)

(1) If removed, install new dowel pins 11 and 12 into housing 10. They must project 0.360 to 0.400 (9.14 to 10.16 mm) above the front face of the adapter housing. Install orifice plug 13 (if removed) flush with, or to 0.060 inch below the front face of the housing.

(2) Place piston 6 in the piston cavity of housing 10. Be sure it is firmly bottomed in the cavity.

(3) Install twenty-eight springs 5 into their recesses in the piston. Install retainer 4, so the offset tangs are upward, onto

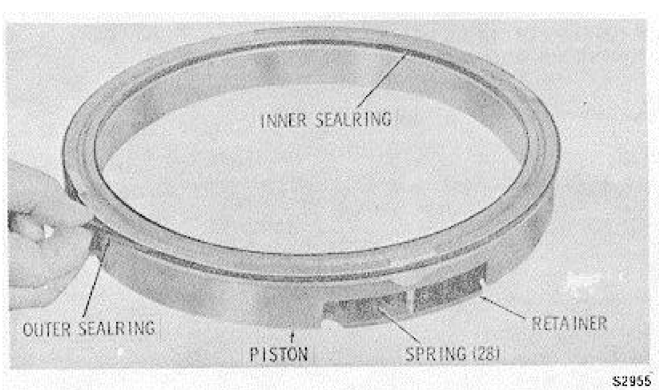


Fig. 6-69. Removing (or installing) first clutch piston seal rings (HT 750)

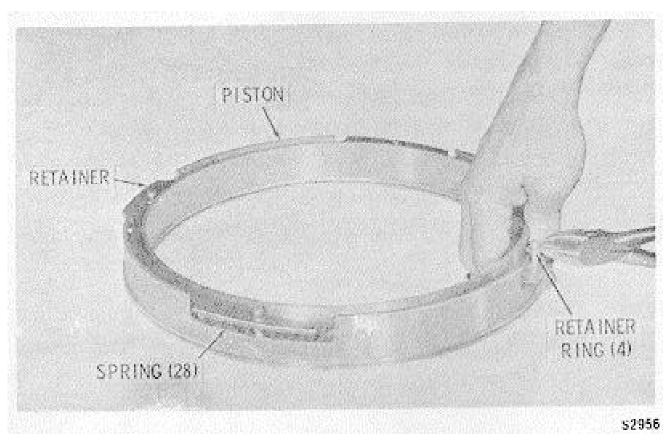


Fig. 6-70. Removing retainer rings from first clutch piston (HT 750)

the piston and springs. Align the holes in the tangs with the bosses on the piston.

(4) Using installerJ-24453 (fig. 6-56), install four retainer rings 3 (B, foldout 18). Press each ring into place until the adjacent retainer t a n g bottoms in the counterbore of the adapter housing.

CAUTION

Failure to install the retainer rings properly can result in transmission damage or malfunction. If installed too far onto the risers, proper clutch clearance cannot be obtained. If not installed far enough, the retainers may fall off.

(5) When all four retainer rings are properly installed, remove the piston assembly from the adapter housing.

(6) Lubricate sealrings 7 and 8 with transmission fluid. Install the sealrings, with the lip of each sealring facing rearward, away from the spring side of the piston (fig. 6-69).

(7) Install the piston assembly into the adapter housing, being very careful to avoid folding the seal lips back upon themselves. If any difficulty is encountered, remove the piston, and check the seals and housing bore before again attempting installation.

6-26. REAR COVER ASSEMBLY

a. Disassembly (A, foldout 20)

(1) Using remover tools J-24171-1, 2, 4, remove the dust shield from the rear cover (fig. 6-71).

(2) Using remover tools J-24171-1, 2, 4, remove the output shaft oil seal from the rear cover (fig. 6-72).

(3) Remove the speedometer drive components from the rear cover (fig. 6-72).

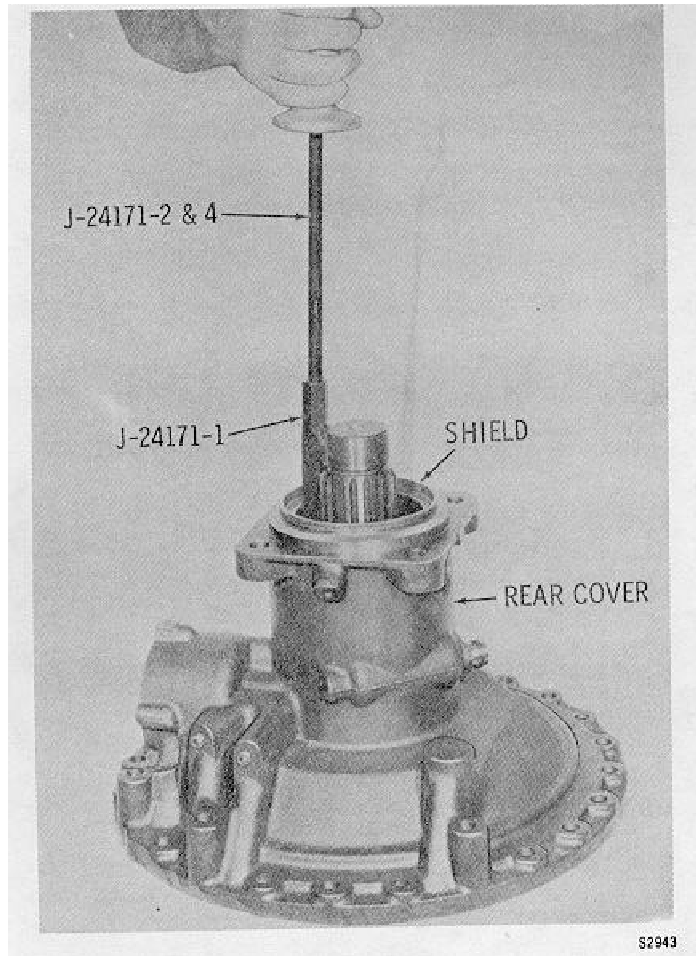


Fig. 6-71. Removing dust shield from rear cover

(4) Remove the snapring that retains the rear output shaft bearing (fig. 6-73).

(5) Remove the rear output shaft, and its attached parts, from the rear cover (fig. 6-74).

(6) Support the front of the speedometer drive gear, and press the output shaft from the gear, spacer sleeve and bearing (fig. 6-74).

(7) If orifice plug 20 (A, foldout 20) or bushing 22 requires replacement in HT 740D, 747D or 750DRD, remove either or both as required. In the HT 750CRD, or HT 754CRD, the corresponding items are orifice plug 27 and bushing 29. Treat them in the same manner as items 20 and 22.

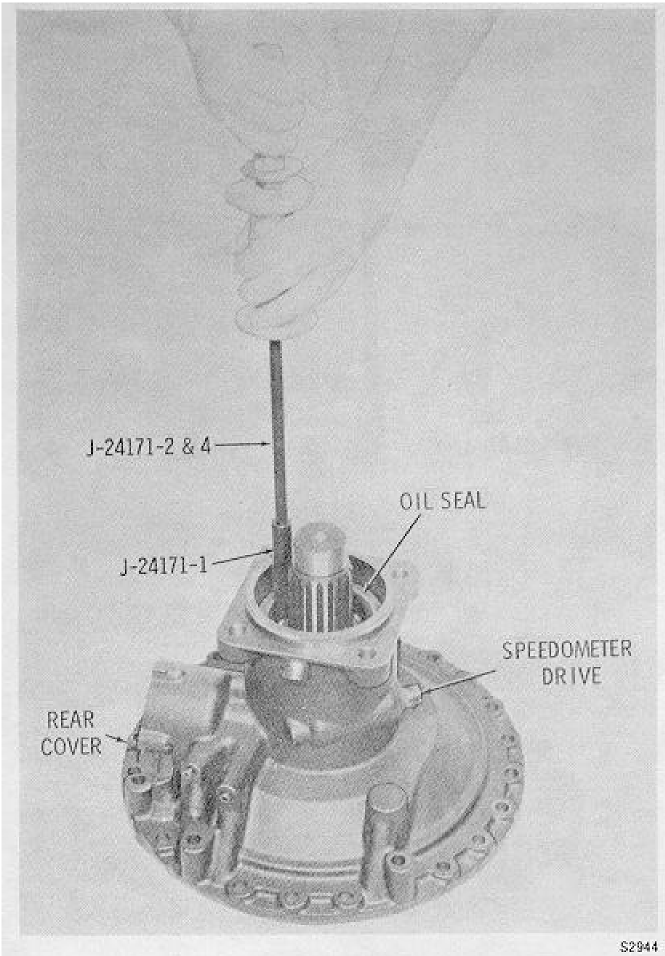


Fig. 6-72. Removing output shaft rear oil seal

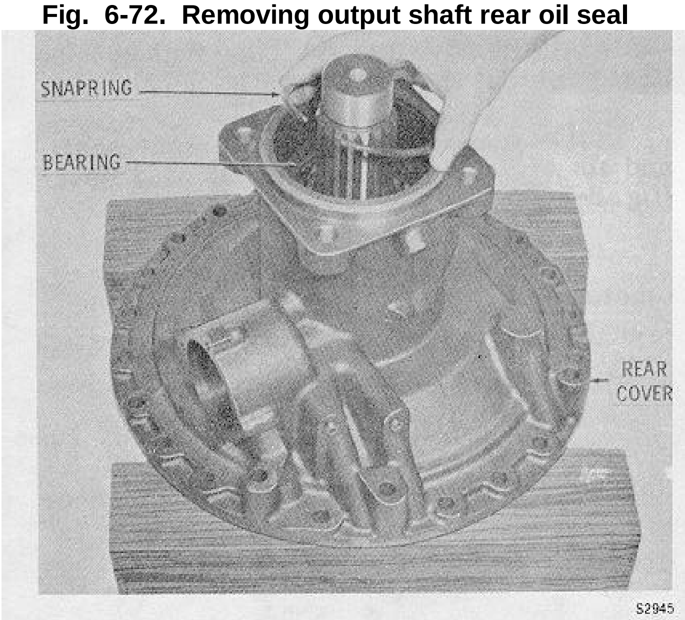


Fig. 6-73. Removing (or installing) output shaft bearing snapring

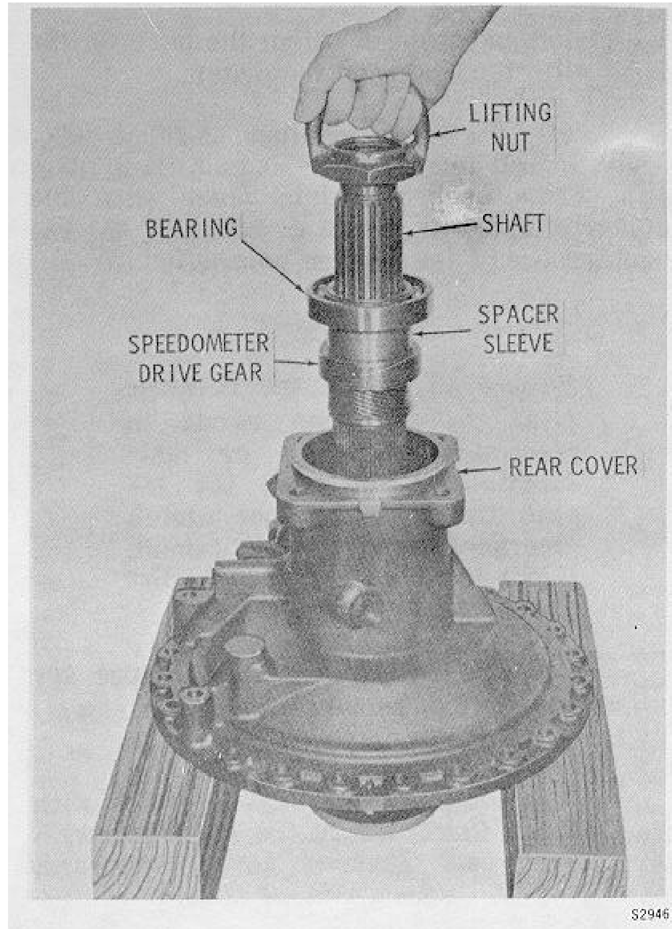


Fig. 6-74. Removing (or installing) output shaft

(8) Using compressor components J-24204-1 and J-24204-2, compress the spring retainer and springs (fig. 6-75). Remove the snapring, and remove the compressor.

(9) Remove the spring retainer and 30 springs (fig. 6-75).

(10) Remove the clutch piston (fig. 6-75). Remove the inner and outer sealrings from the piston.

(11) If the speedometer driven gear bushing requires replacement, remove it. Thread remover J-24205-2 into the bushing (fig. 6-76). Attach slide hammer J-6125-1 to remover J-24205-2 and remove the bushing.

(12) Remove any remaining parts (dowel pins, snapring, governor support pin,

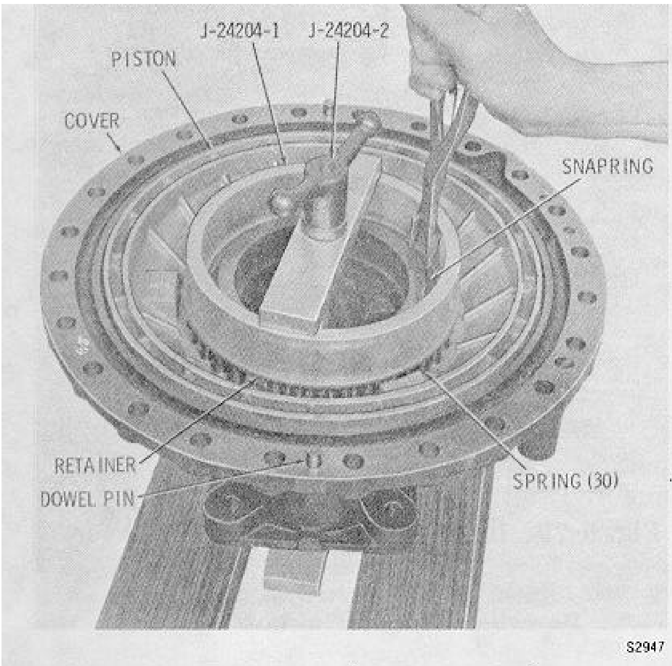


Fig. 6-75. Removing (or installing) snapring that retains piston in rear cover

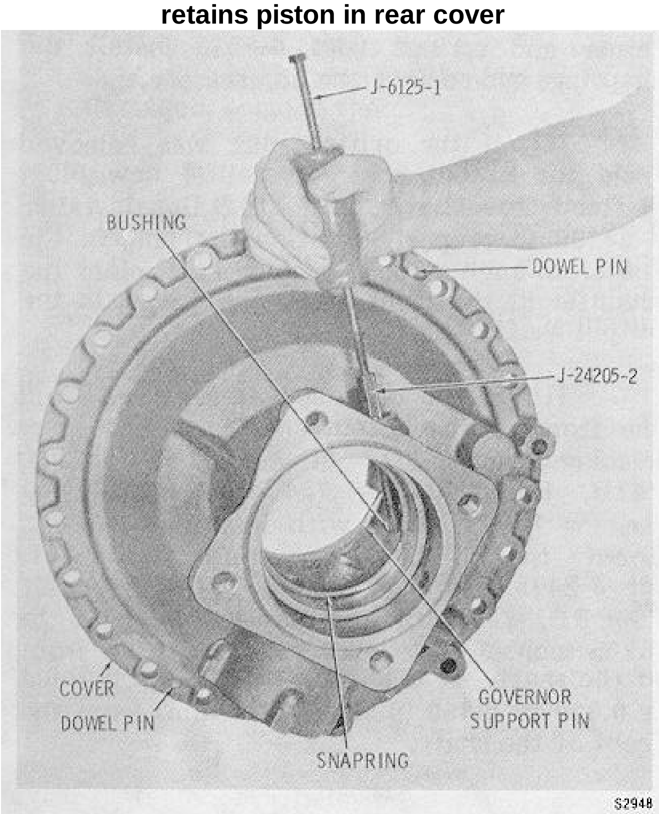


Fig. 6-76. Removing speedometer driven gear bushing

plugs) that require replacement, from the rear cover (fig. 6-76).

NOTE

Refer to paragraph 6-2, above.

b. Assembly (A, foldout 20)

(1) If removed, replace t h e dowel pins in the mounting face of the rear cover (fig. 6-75). The dowel pins project 0.360 to 0.400 inch (9.15 to 10.16 mm) above the face of the cover.

NOTE

Snapring 18 (A, foldout 20) is required on earlier models.

(2) If removed, install the bearing front snapring into the rear cover (fig. 6-77). Install plugs, if removed, into the rear cover (fig. 6-78).

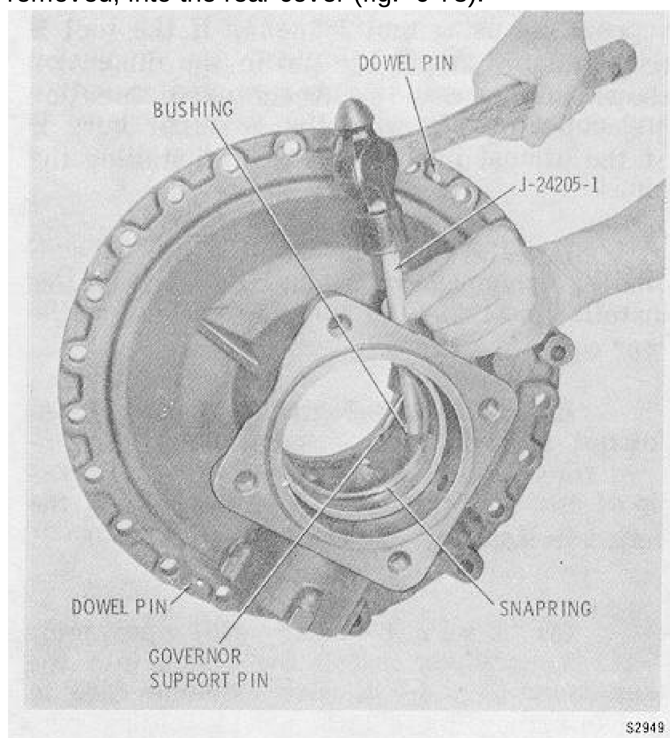


Fig. 6-77. Installing speedometer driven gear bushing

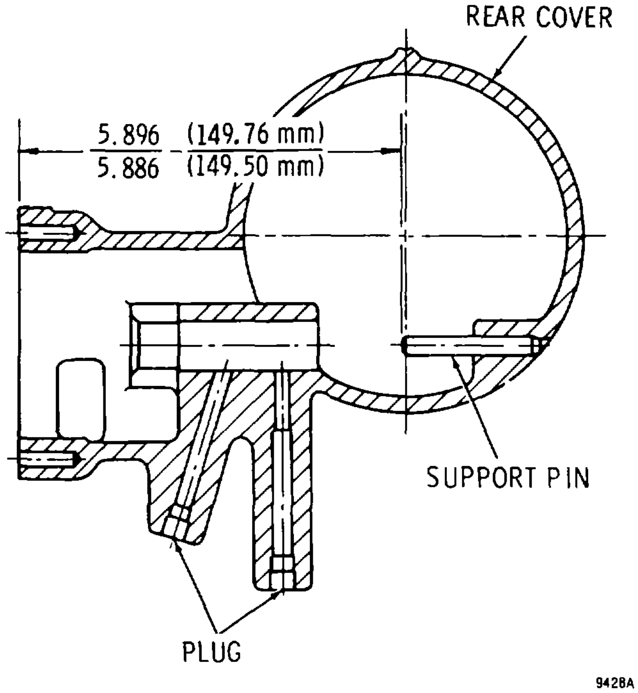


Fig. 6-78. Governor support pin location

(3) If removed, install the governor support pin using tool J-28684. If the tool is not available install the pin to the dimension shown in figure 6-78. Accuracy of location and concentricity with the governor bore is of the utmost importance when installing the pin.

(4) If removed, install a new speedometer driven gear bushing (fig. 6-77). Use installer J-24205-1 to seat the bushing in the rear cover.

(5) Lubricate sealrings 5 and 6 (A, foldout 20) with transmission fluid, and install them into the grooves of piston 4. The lip of each sealring must face the rear of the piston (toward piston cavity in rear cover).

(6) Using inner seal protector J-24210, carefully install the piston into the rear cover (fig. 6-79). Use extreme care to prevent the lip of either seal folding back over itself. If installation is difficult, remove the piston and check the seal and cover bore before again attempting installation.

(7) Remove the seal protector. Install thirty springs (fig. 6-75). Install the

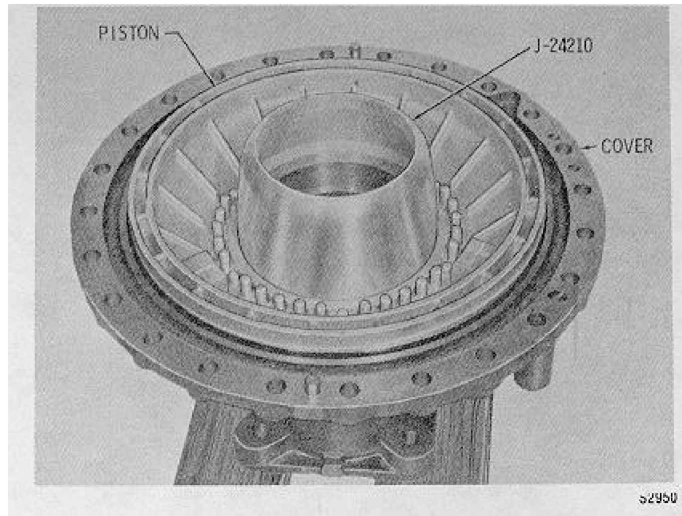


Fig. 6-79. Installing piston into rear cover

spring retainer, cupped side first, onto the springs.

(8) Using compressor components J-24204-1 and J-24204-2, compress the retainer and springs (fig. 6-75). Install the snapring, and remove the compressor.

(9) If the orifice plug was removed from the output shaft, install a new plug, orificed side first (fig. 6-80). Use installer J-24369 to properly position the plug in the shaft. In each model, the plug must clear the chamfer at the front of the plug bore in the output shaft.

(10) If the bushing was removed from the front of the output shaft, install a new bushing (fig. 6-81). In models HT 740D, 747D, HT 750CRD, 754CRD, locate the bushing in the shaft with installer J-24203. Locate the HT 750DRD bushing with installer J-24769. In the HT 740D, 747D or HT 750CRD, 754CRD, the bushing is 0.145 to 0.165 inch (3.68 to 4.19 mm) from the front of the shaft. In the HT 750DRD, the bushing is 0.330 to 0.350 (8.38 to 8.89 mm) from the front of the shaft.

(11) Press the speedometer drive gear, spacer sleeve, and bearing onto the rear output shaft (fig. 6-74). Install the assembled shaft.

(12) On assemblies before S/N 5660, install the bevelled snapring (bevel toward

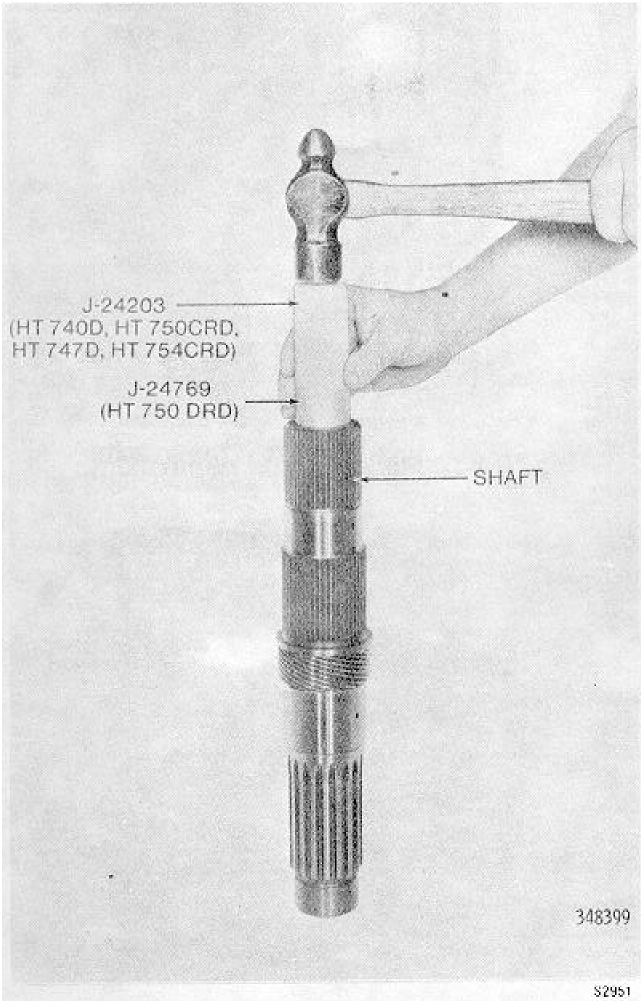


Fig. 6-80. Installing output shaft orifice plug

rear of transmission) as shown in figure 6-73. On later transmissions, the snapring is not bevelled. Be certain that the proper snapring is used to match the groove In the housing. Be sure the snapring is expanded fully into the groove.

(13) Before installing the lip-type oil seal, refer to paragraph 4-6f for seal preparation. Install the oil seal, spring-loaded lip first. Use Installer J-24202-1 and driver handle J-24202-4 to locate the rear of the seal 0.60 to 0.70 inch (15.2 to 17.8 mm) in front of the parking brake mounting surface plane (fig. 6-82).

(14) Coat the outer circumference of dust shield 32 (A, foldout 20), 16 or 35 (B, foldout 22), with nonhardening sealer. Install the shield, flat side first, into the rear cover.

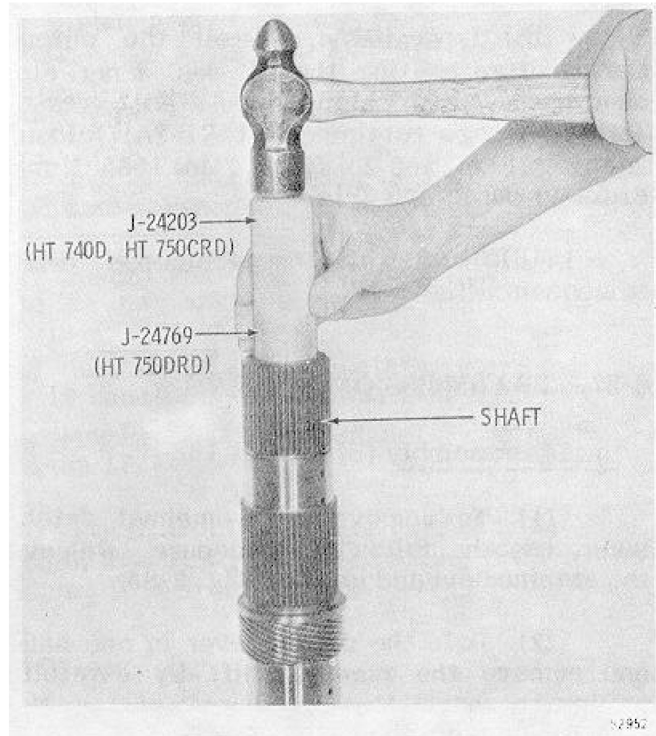


Fig. 6-81. Installing output shaft bushing

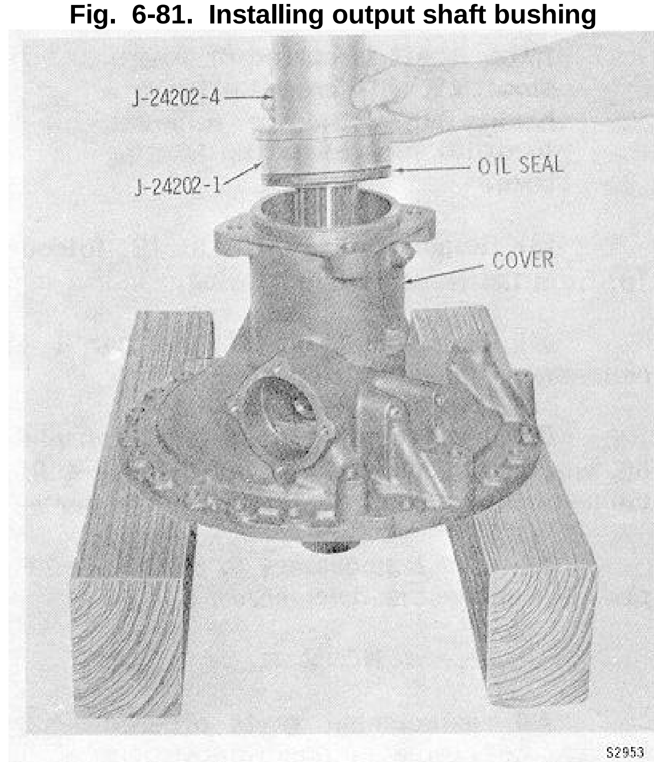


Fig. 6-82. Installing output shaft oil seal

The rear edge of the shield must be flush with, to 0.040 inch (1.0 mm) below, the rear surface of the cover.

(15) If available, install the output flange after coating the oil seal inner circumference with high-temperature grease. Tighten flange retaining nut 31 (A, foldout 20) to 600 to 800 lb ft (814 to 1085 N•m). Refer to paragraph 3-14.

(16) Install the speedometer drive components (fig. 6-72).

6-27. TRANSMISSION HOUSING

a. Disassembly (B, foldout 16)

(1) To remove the manual detent lever, use the following procedure. Remove the retainer pin and locknut (fig. 6-83).

(2) Hold the detent lever in one hand and remove the manual shift by carefully pulling the shaft through the oil seal in the housing. Remove the detent lever.

CAUTION

If the shaft is burred or rough, smooth it with crocus cloth or a honing stone, before removal, to avoid scratching the housing bore.

(3) Remove oil seal 51 (B, foldout 16) from the transmission housing.

(4) If replacement of breather 1 is necessary, remove it from the housing.

(5) Inspect neutral safety switch plug 50, washer 49, and reverse signal plug 4 for damage. If damaged, replace with new parts.

(6) If it is necessary to replace name-plate 6, remove one drive screw 5.

NOTE

All replacement parts ordered refer to the information on the nameplate. Therefore it is imperative that the new nameplate be stamped with identical information.

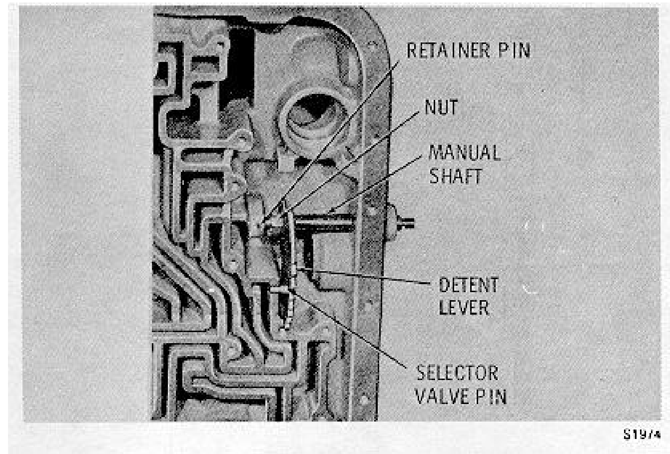


Fig. 6-83. Manual shaft components

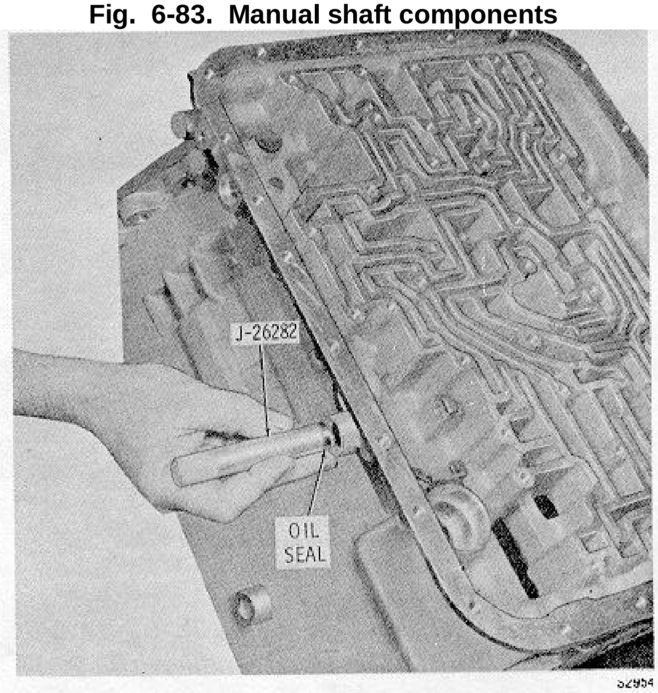


Fig. 6-84. Installing manual shaft oil seal

NOTE

Refer to paragraph 6-2, above.

b. Assembly (B, foldout 16)

(1) Coat the inside diameter of oil seal 51 (B, foldout 16) with a seal lubricant, and the outside diameter with a nonhardening sealant. Install the oil seal, lip first, into the transmission housing (fig. 6-84). Use installer J-26282 to properly locate the seal

in the housing. The seal must clear the chamfer in the housing bore.

(2) Hold detent lever 43 (B, foldout 16) so that the selector valve pin extends toward the inside of the housing (fig. 6-83). Slide the manual shaft through the opening in the housing, oil seal, and slot in the detent lever. Install locknut 44 and retainer pin 48. Tighten the locknut to 15-20 lb ft (20-27 N•m). Refer to paragraph 3-9a, **CAUTION**.

(3) If breather 1 (B, foldout 16) was removed, install the breather.

(4) If removed, install nameplate 6 and drive screw 5 (refer to a(6), and Note, above).

6-28. TRANSFER GEAR HOUSING AND GEARS

NOTE

If any output disconnect is used, and it has not been removed, refer to paragraph 5-3.

a. Disassembly.

(1) If the drive gear and bearings where not removed in section 5, remove them (fig. 6-85).

(2) On front output disconnect models, remove the snapring and drive coupling from the front of the rear output shaft. Remove six bolts, lockwashers, adapter and gasket (fig. 6-86).

(3) On models which do not have a front output, the bearing bore is closed. When a speedometer drive is included, remove bolts 28 (B, foldout 22), washer 27, sleeve 26, oil seal 24, washers 25 and 21, shaft 20 and gasket 22. Remove bolts 19, washers 18, cover 17 and gasket 4. When a plain cover is used, remove bolts 1, washers 2, cover 3 and gasket 4.

(4) On models which have a front-mounted parking brake, remove eight bearing

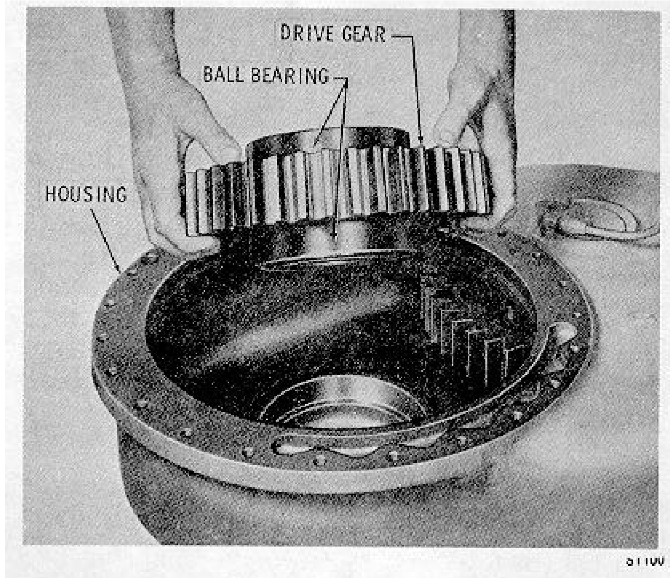


Fig. 6-85. Removing transfer drive gear.

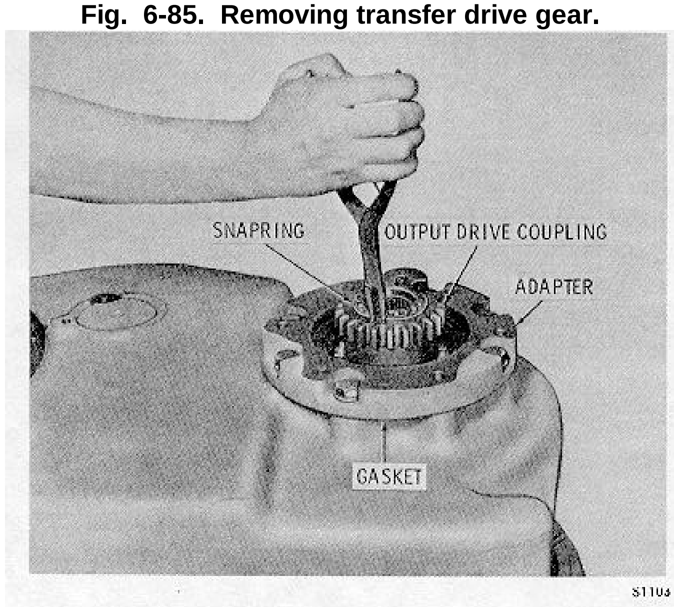


Fig. 6-86. Removing drive coupling snapring.

retainer bolts 30 (B, foldout 22), washers 29, retainer assembly 31 and gasket 4. If disassembly of the bearing retainer assembly is required, refer to item (9), below.

(5) Remove spindle retaining bolt 4 (A, foldout 22) and washers 5 and 6. On spindles with a .500-20 UNF-1B thread use puller tool J-23544 for removal. Spindles with a 1.00-12 UNF-1B thread, must be

drilled and tapped to 1.250-12 UNF-1B. Use puller tool J-23544-A for removal. Reference figure 6-87.

(6) Remove idler gear 10 (A, foldout 22), bearings 8 and 12, snapring 9 and spacer 11.

(7) On models with a rear parking brake, remove eight 1/2-13 bolts 11 (B, foldout 22) and lockwashers 10 and remove bearing retainer assembly 12, gasket 8 and spacer (fig. 6-88).

(8) On models with a rear output disconnect assembly (A, foldout 23), remove six bolts 29, washers, 28, adapter 27 and gasket 8 (B, foldout 22). Remove snapring 32 (A, foldout 23) and drive coupling 31.

(9) If parts replacement is necessary, remove oil drain tube 14 or 32 (B, foldout 22), baffle 16 or 35 and oil seal 15 or 34 from bearing retainer assembly 12 or 31.

(10) Position a wood 2 x 2 in. (50.8 x 50.8 mm) board to hold the output driven gear in place (fig. 6-89). Using a soft drift, drive the output shaft out through the rear opening. The rear bearing and a spacer will come out with the shaft.

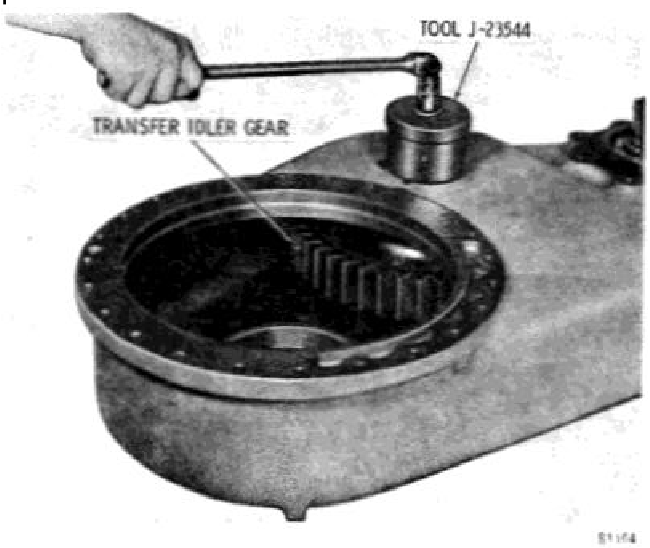


Fig. 6-87. Removing transfer idler gear spindle.

(11) Lift out the front bearing, and spacer between the bearing and the gear (fig. 6-90).

(12) Remove the wood 2 x 2 in. (50.8 x 50.8 mm) board and the driven gear (fig. 6-91).

NOTE
Refer to paragraph 6-2.

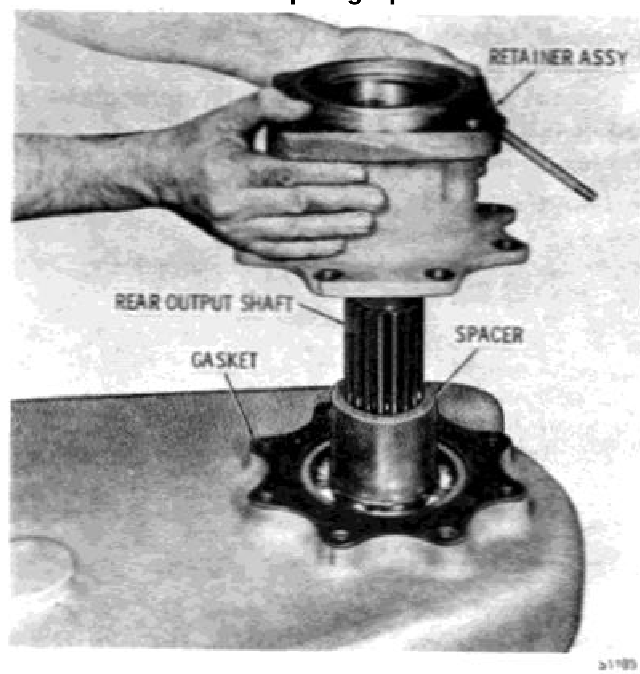


Fig. 6-88. Removing rear bearing retainer assembly.

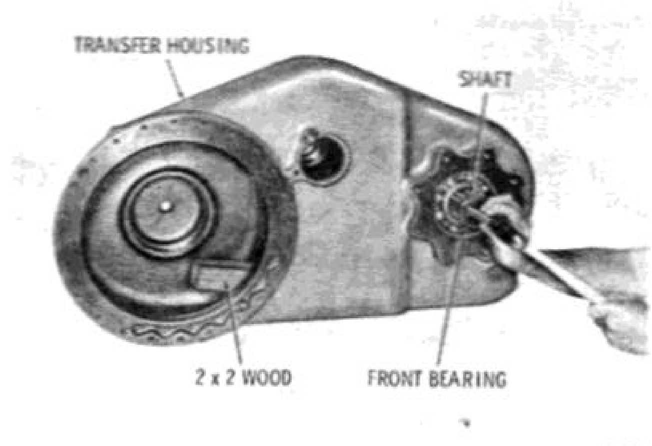


Fig. 6-89. Removing rear output shaft

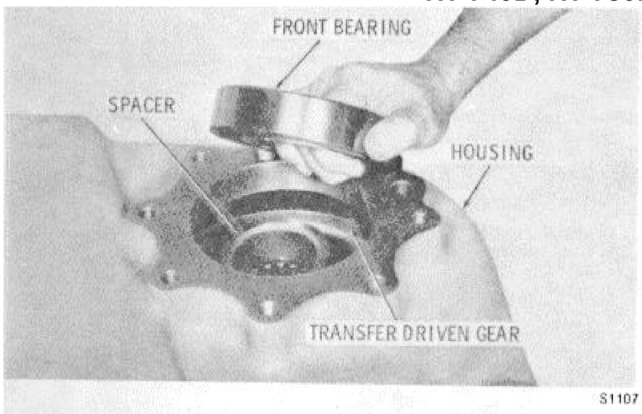


Fig. 6-90. Removing front bearing from transfer housing

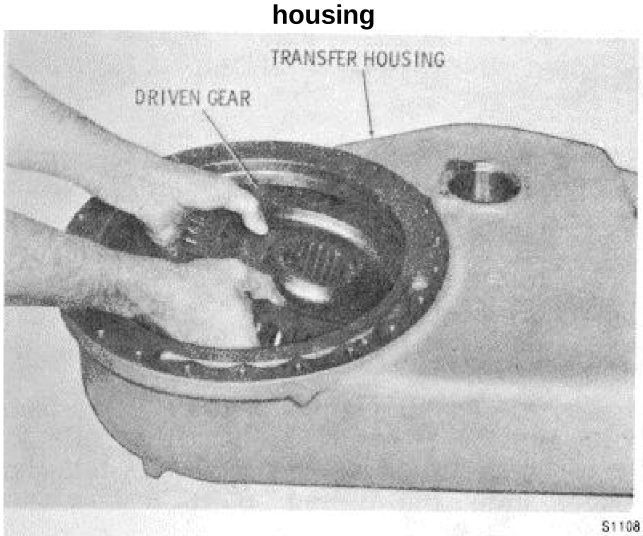


Fig. 6-91. Removing transfer driven gear

b. Assembly

NOTE

Chill spindle 7 (A, foldout 22) in dry ice for one hour before installing it into the transfer gear housing.

(1) Place the housing rear side down and install the transfer driven gear, with its long hub end toward the rear of the housing (fig. 6-92).

NOTE

When only a rear output is used, the longer hub of the drive gear must be toward the front of the transfer housing.

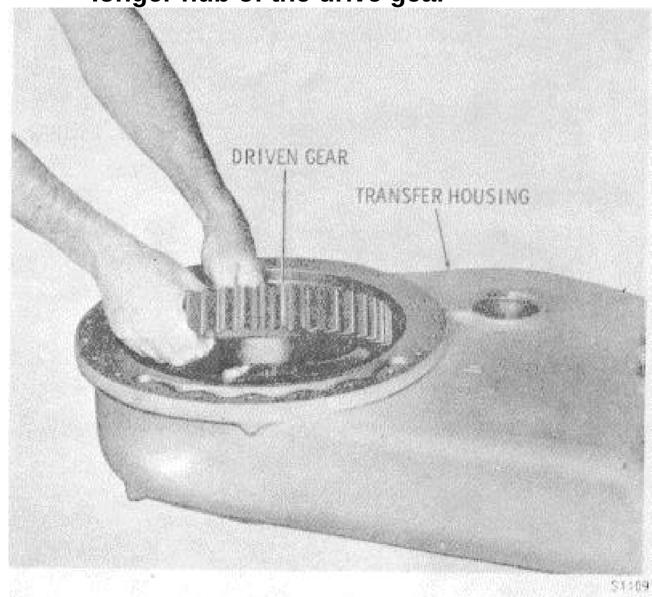


Fig. 6-92. Installing transfer driven gear

(2) Carefully turn the housing front side down (loose gear inside). Align the gear with the bearing bores in he bottom of the housing and install the output shaft spacer toward the gear (fig. 6-93).

NOTE

If a rear output disconnect assembly is used, disregard (3) and (4) below. Continue with (5), below. If there is no front output, continue with (9), below.

(3) If the baffle, oil seal and oil drain tube were removed, install them into the retainer (fig. 6-94). Before Installing the liptype seal, refer to paragraph 4-6f for seal preparation. The oil drain tube must align with the bottom of the chamfer in the hole into which it fits. The oil seal is installed, lip first, and pressed lightly against the shoulder in the retainer. The baffle is installed, flat side first, as shown, flush with the rear of the retainer. Install the retainer gasket and retainer assembly.

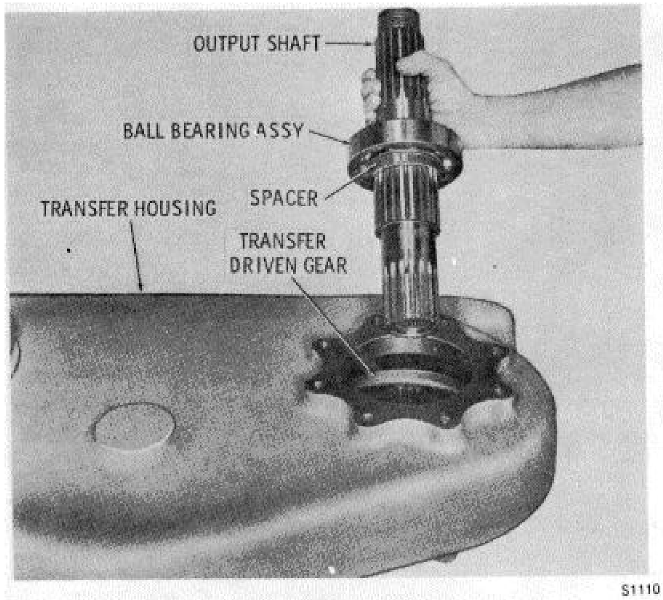


Fig. 6-93. Installing rear output shaft bearing and spacer

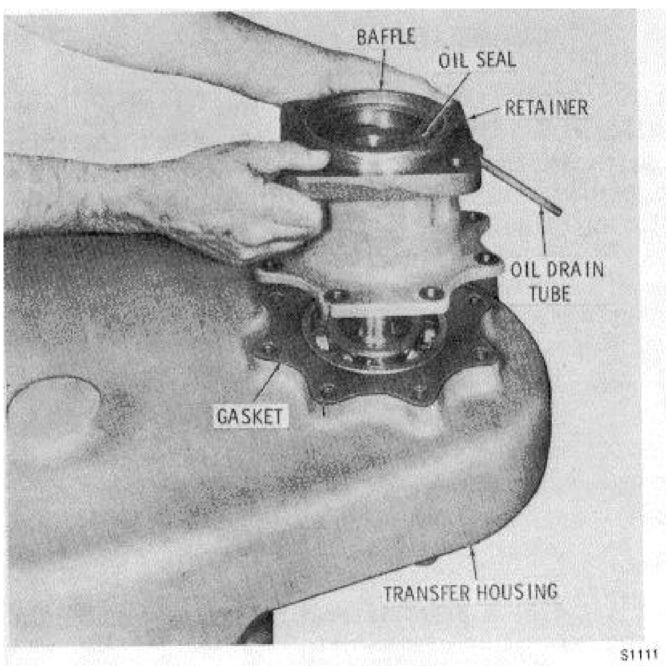


Fig. 6-94. Installing rear bearing retainer assembly

NOTE

The angle at which the retainer is installed depends upon the angle at which the transfer

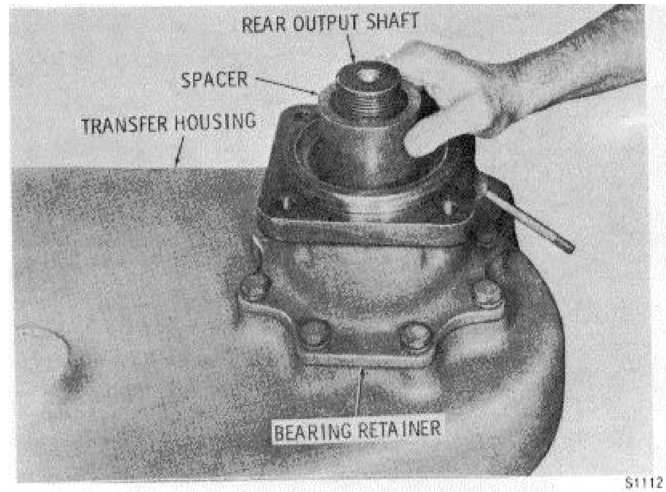


Fig. 6-95. Installing rear output flange spacer

case is installed on the transmission housing. In any installation, the oil drain tube should be aligned as closely as possible to a downward vertical line (transmission in installed position).

(4) Install eight 1/2-13 x 1 1/4-inch bolts and lockwashers. Tighten the bolts to 67 to 80 lb ft (91 to 108 N•m). Install the spacer onto the output shaft (fig. 6-95). Loosely install the nut on the end of the output shaft.

(5) If a rear output disconnect assembly is used, install gasket 8 (B, foldout 22), adapter 27 (A, foldout 23), washer 28 and six 1/2-13 x 1 1/4-inch bolts 29. Tighten the bolts to 67 to 80 lb ft (91 to 108 N•m). Install drive coupling 31 and snapring 32.

(6) Turn the housing over (front up) and install the spacer and front bearing assembly on the rear output shaft (fig. 6-96).

(7) On models having a front output disconnect, install the drive coupling and snapring onto the output shaft (fig. 6-97), Install the gasket and adapter. Install six 1/2-13 x 1 1/4-inch bolts, and lockwashers to retain the adapter. Tighten the bolts to 67 to 80 lb ft (91 to 108 N•m), to seat the bearing.

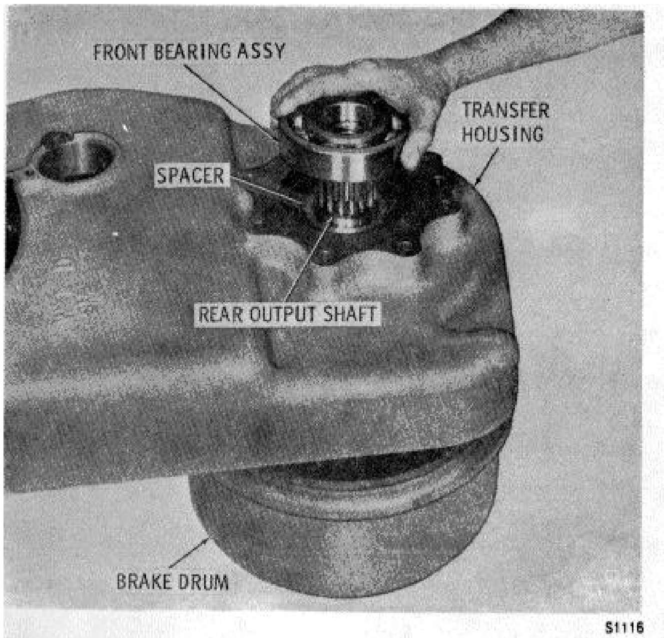


Fig. 6-96. Installing output shaft front bearing.

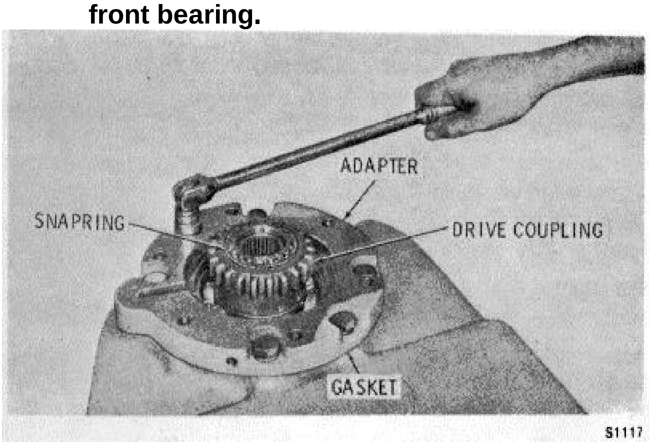


Fig. 6-97. Installing adapter retaining bolt

(8) On models with a front-mounted parking brake, follow the instructions in (3) and (4), above. Then install spacer 28 (A, foldout 22).

(9) On models which have no front output, install gasket 4 (B, foldout 22) and either cover 3, retained with washers 2 and eight 1/2-13 x 1 1/4-inch bolts 1, or cover 17, retained by washers 18 and eight 1/2-13 x 1 1/4-inch bolts 19. Tighten the bolts to 67 to 80 lb ft (91 to 108 N•m). When a speedometer drive is included, assemble and install items 20 through 28. Tighten the two 5/16-18 x 7/8-inch bolts 28 to 10 to 13 lb ft (13.6 to 17.6 N-m).

CAUTION

Incorrect installation of idler gear bearings 8 and 12 (A, foldout 22) will cause the bearings to fail.

(10) Install snapring 9 (A, foldout 22) into its bore in idler gear 10.

NOTE

On earlier models, the outer race of the idler gear bearing is removable. On later models, the inner race is removable.

(11) On early models, install the outer race, chamfered end last, into the idler gear bearing bore. Snug the race to the snapring. Install the inner race and roller bearing into the outer race.

(12) On later models, install the outer race and roller bearing into the idler gear bearing bore. Snug the bearing to the snapring. Install the inner race, chamfered end first.

(13) Install the transfer idler gear assembly over the spacer (if used) and align it and the spacer with the spindle bore in the transfer housing (fig. 6-98).

(14) Install the chilled idler gear spindle, aligning the circular milled slot in the spindle with the lock bolt hole in the transfer housing. Seat the spindle in the housing (fig. 6-98).

(15) Install the idler spindle retaining washer 6 (A, foldout 22), lockwasher 5 and 7/15-14 x 1-inch bolt 4. Tighten the bolt to 42 to 50 lb ft (57 to 68 N•m).

(16) Install the transfer drive gear with bearings attached. Tap it into the bearing bore with a soft hammer (fig. 6-99).

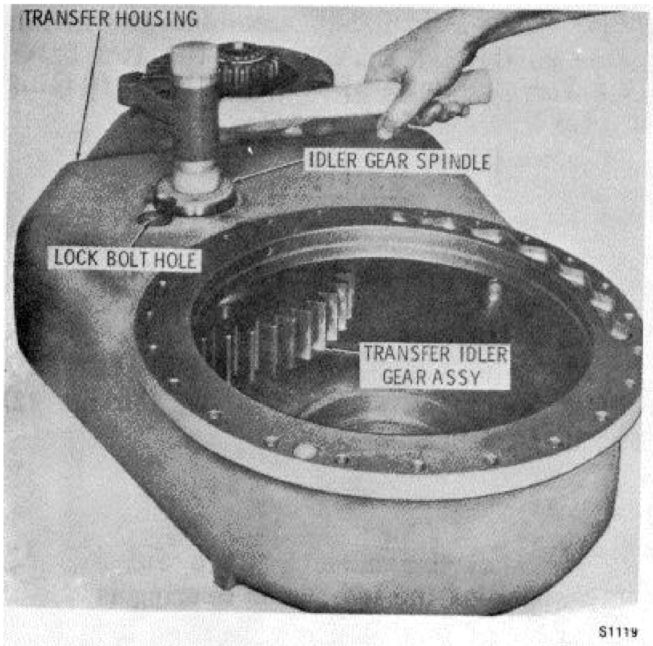


Fig. 6-98. Installing transfer idler gear spindle

(17) If plugs 5 or 7 (B, foldout 22) were removed, re-install the plugs. If cup plug 9 was used and was removed, press a new cup to the bottom of its bore.

(18) Cover the opening to keep out dirt until the transfer housing is installed onto the transmission.

6-29. TRANSFER GEAR HOUSING ADAPTER, OUTPUT SHAFTS

a. Disassembly (B, foldout 19)

(1) If replacement is necessary, remove needle bearing and bushing 34 or 42 from output shaft 35 or 41.

(2) Remove oil seal 11 (B, foldout 19) from transfer housing adapter assembly 9.

NOTE

This seal keeps the hydraulic fluid in the front section of the transmission separated from the oil in the dropbox.

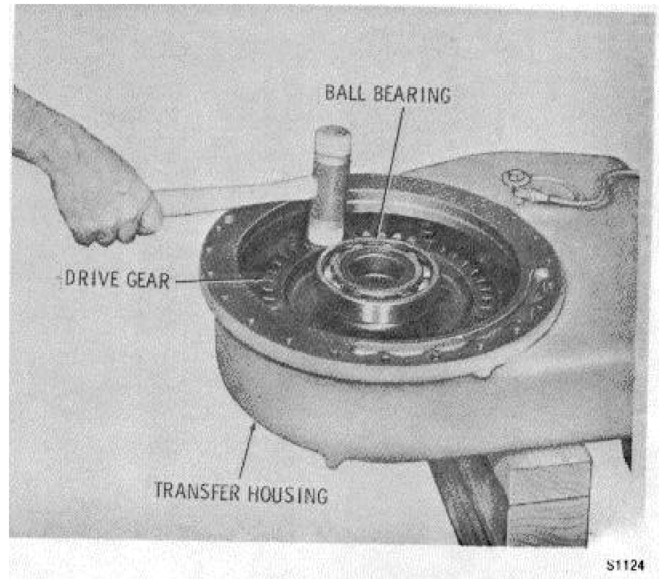


Fig. 6-99. Installing transfer drive gear

(3) Place adapter assembly 9, piston side up, on the work table.

(4) Using compressor J-24204, compress spring retainer 3 and remove snapring 2.

(5) Carefully release spring pressure and remove retainer 3.

(6) Remove t h i r t y piston return springs 4.

(7) Remove low clutch piston 5 and sealrings 6 and 7.

(8) If parts replacement is necessary, remove the following parts from the transfer housing adapter assembly; governor support pin 13, dowel pins 14 and 15, and pipe plugs 12.

NOTE

Refer to paragraph 6-2.

b. Assembly (B, foldout 19)

(1) If dowel pins 14 and 15 (B, foldout 19) were removed from adapter 10, install new pins. The pins must extend 0.38 inch (9.65 mm) above face of the adapter.

CAUTION

The alignment of the governor support pin with the governor bore in the adapter assembly is critical. The governor must rotate freely and without interference with either the adapter bore or the pin. Any interference will result in damage to the governor body, the bore in the adapter or the governor driven gear.

(2) If governor support pin 13 was removed, press In a new pin to the dimension shown in figure 6-73.

(3) If removed, install plugs 12 (B, foldout 19). Tighten the plugs to 10 to 12 lb ft (13.6 to 16.3 N-m).

(4) Grease and install inner sealring 7 and outer sealring 6 into the sealring grooves of piston 5. Lips of the sealrings must be toward the rear of the transmission.

(5) Place adapter assembly 9, piston cavity upward, on the work table.

(6) Using inner seal protector J-24210, carefully install low clutch piston 5 (B, foldout 19), spring guide bosses upward, into the piston cavity. Make sure that the lips of the sealrings face the bottom of the piston cavity.

(7) Install thirty piston return springs 4 onto the guide bosses of the piston. Install spring retainer 3, outer lips toward the piston, onto the springs.

(8) Compress the spring retainer until it is clear of the snapring groove in the adapter hub. Install snapring 2.

(9) Invert the adapter assembly so it is resting, piston downward, on blocks.

(10) Coat the outer diameter of oil seal 11 (B, foldout 19) w i t h nonhardening sealer and the inside diameter with a high temperature grease. Reference paragraph 4-6f. Install oil seal, lip first, into the bore of adapter assembly 9. Press or drive the seal inward until its rear surface is 1.165 to 1.175 inch (29.591 to 29.845 mm) below the bottom outer machined bore.

(11) If orifice plug 36 or 39, located in the front end of output shaft 35 or 41 was removed, use tool J-24369 and install a new plug. Press the plug to a depth that will clear the front edge of the bore.

(12) If needle bearing 37 (B, foldout 19) was removed, use tool J-25562 and install a new needle bearing to 0.150 inch (3.81 mm) below the end of the shaft.

(13) If bushing 34 or 42 (B, foldout 19) was removed from shaft 35 or 41, install a new bearing and press it to 0.340 inch (8.636 mm) below the end of the shaft.

6-30. FLEX DISK ASSEMBLY

a. Disassembly (A, foldout 9)

(1) If flex disk assembly 2 has not been removed from the engine crankshaft, remove it.

(2) Remove twelve self-locking bolts 9 and separate plate 8, flex disks 6 and 7, and hub assembly 3.

NOTE

Refer to paragraph 6-2, above.

b. Assembly (A, foldout 9)

(1) Install flex disk 6 onto hub assembly 3, aligning the dowel pin hole in the disk with pin 5. Washers attached to disk 6 must face toward hub assembly 3.

(2) Install flex disks 7 in the same manner.

(3) Install plate 8, aligning the plate with dowel pin 5.

(4) Install twelve self-locking, ½-20 x 3/4-inch bolts 9 through plate 8, disks 6 and 7, and into hub assembly 3. Tighten the bolts to 96 to 115 lb ft (130 to 156 N•m).

(5) Install flex disk assembly 2 onto the engine crankshaft. Refer to the vehicle service manual for bolt torque value.

6-31. GOVERNOR

a. Disassembly

(1) The governor may be disassembled for cleaning and inspection. Do not disassemble the governor unless the kit consisting of two governor weight pins and the cover gasket is available.

(2) Follow t h e directions furnished with the kit to disassemble the governor.

NOTE

Refer to paragraph 6-2, above.

b. Assembly

(1) Assemble the governor as outlined in the directions furnished with the governor service kit.

(2) Check the governor port openings as outlined in the kit instructions. Refer to figure 6-100.

6-32. OUTPUT MANUAL DISCONNECT ASSEMBLIES

NOTE

Upper rear, lower rear or front disconnect clutch assemblies are identical. The following instructions (for rebuild of the upper rear assembly) apply to all locations of the disconnect clutch.

a. Disassembly (A, foldout 23)

(1) Remove the bolts and lockwashers which hold the bearing retainer (fig. 6-101). Remove the retainer and gasket but do not remove the oil seal unless replacement is necessary.

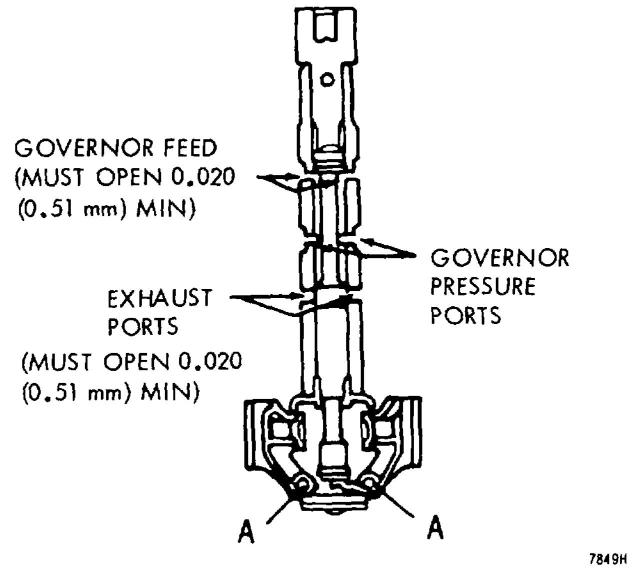


Fig. 6-100. Governor assembly-showing port openings

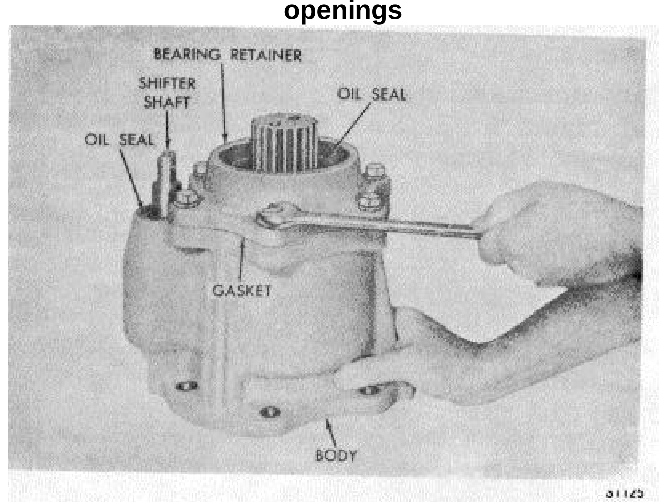


Fig. 6-101. Removing or installing bearing retainer bolts

(2) Remove the disconnect output shaft and bearing (fig. 6-102). Remove the two detent balls and their spring, which will be freed when the shaft Is removed.

(3) Remove the shifter shaft by rotating it counterclockwise (fig. 6-102).

(4) Do not remove the ball bearing assembly or the needle bearing race from the disconnect output shaft unless replacement is necessary.

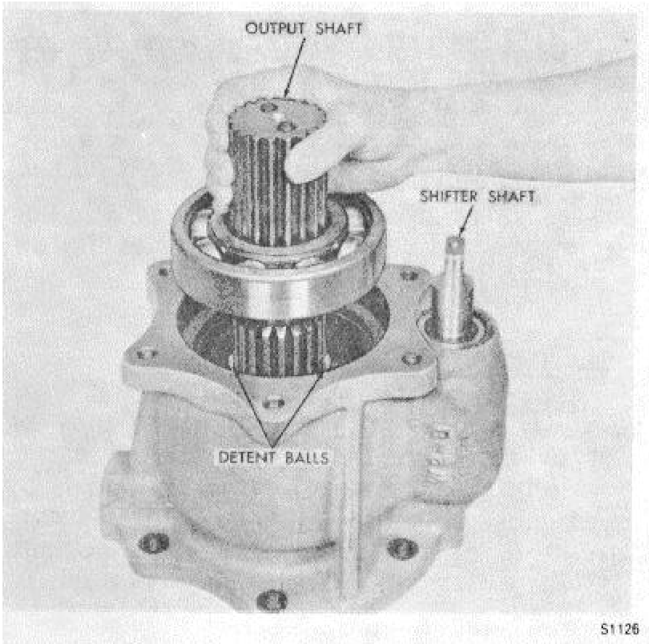


Fig. 6-102. Removing output disconnect shaft

(5) Remove the output driven coupling (fig. 6-103). Remove the shifter fork.

(6) Do not remove the shifter shaft oil seal from the housing unless replacement is necessary (fig. 6-103).

NOTE

Refer to paragraph 6-2.

b. Assembly (A, foldout 23)

(1) If the shifter shaft oil seal was removed from the body (fig. 6-103), install a new oil seal. Press the seal, spring loaded lip first, into the body until it seats lightly against the shoulder in the body bore.

(2) Install the shifter fork, long side of threaded boss away from the oil seal, into the body (fig. 6-104).

(3) Install the output-driven coupling into the body and engage the shifter fork with the external-groove in the coupling (fig. 6-103).

(4) If the ball bearing assembly was removed from the disconnect output shaft,

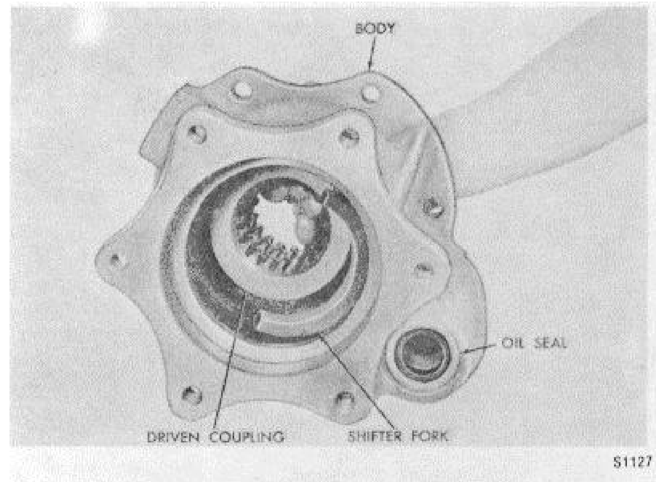


Fig. 6-103. Removing (or installing) disconnect driven coupling

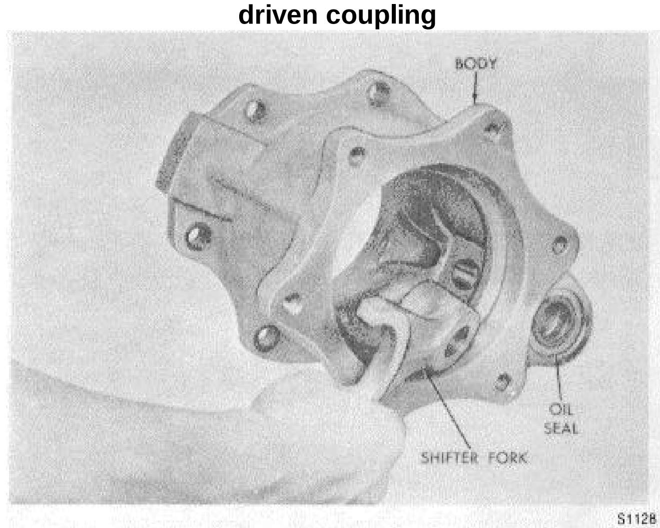


Fig. 6-104. Installing shifter fork

install a new bearing. Press on the inner race of the bearing and seat it against the shaft shoulder (fig. 6-105).

(5) If the needle bearing race was removed from the shaft, install a new race and retain it with the snapring (fig. 6-105).

(6) Install the detent spring and two detent balls (fig. 6-105).

(7) Install the shifter shaft by threading it clockwise into the shifter fork (fig. 6-106). Install the assembled shaft into the output-driven coupling while holding the detent balls until they engage the inner diameter of the coupling. Tap the outer race of

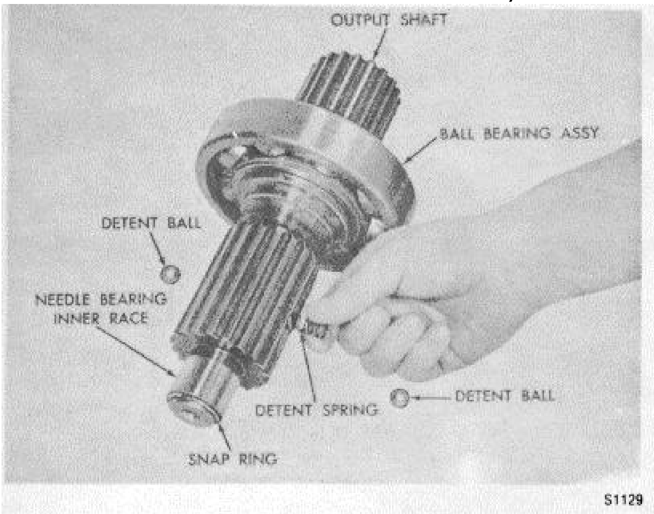


Fig. 6-105. Installing driven coupling detent spring

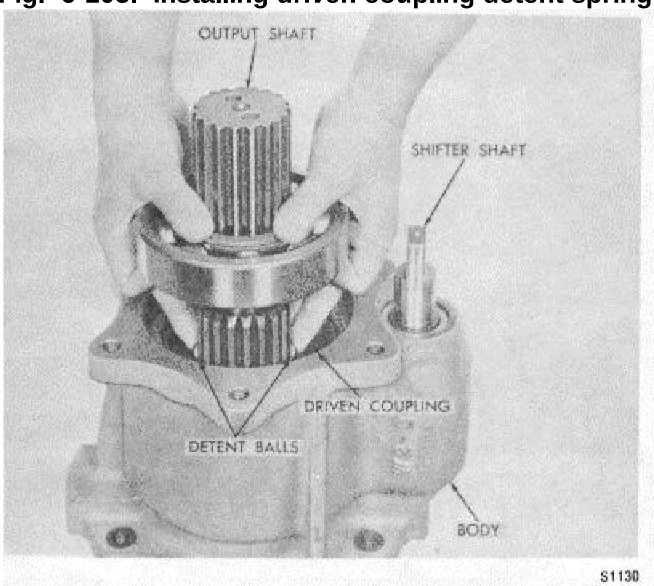


Fig. 6-106. Installing output disconnect shaft

the ball bearing assembly until it seats on the shoulder in the body.

(8) If oil seal 19 (A, foldout 23) was removed from the retainer, install a new oil seal. Press the seal, spring-loaded lip first, into the retainer until it seats lightly on the shoulder in the retainer.

(9) Install the gasket, retainer, six lockwashers and six 1/2-13 x 1-1/2 inch bolts (fig. 6-101). Tighten the bolts to 67 to 80 pound feet (91 to 108 N-m).

(10) Push the shifter inward (to engaged position detent) and adjust it by rotating the shaft until the outer end of the shaft is 1.29 to 1.33 inches (32.8 to 33.8 mm) from the outer steel face of the shaft oil seal (fig. 6-101).

6-33. ESTABLISHING CLUTCH CLEARANCES

a. Two Methods

(1) Either of t w o methods may be used to establish the proper clutch clearances (clutches released). One method is by direct measurement. This method is incorporated in each clutch assembly procedure relating either to subassembly rebuild or transmission assembly (see para 6-17, 6-18, 7-3a, b, 7-4a, b and 7-11). The second method is by stack dimension computation, which may be more convenient when quantity or assembly-line overhaul practices are used.

(2) Subparagraphs b through f, below, outline the stack dimension computation method for each clutch.

NOTE

The stack methods outlined require t h a t clutch plates be new. T h e specified load must be evenly distributed over the entire clutch pack.

b. Forward Clutch

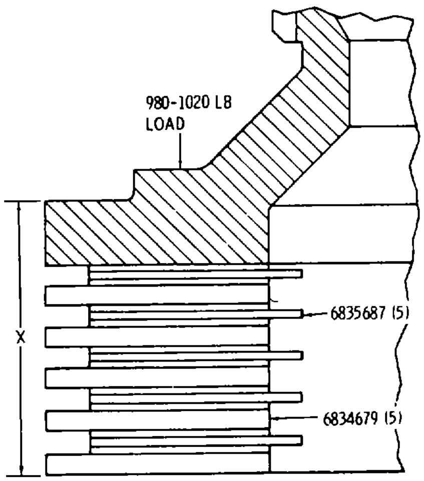
(1) Stack the forward clutch plates and fourth clutch hub as shown in figure 6-107.

(2) Apply the specified load, and measure dimension X.

(3) From the table in figure 6-107, select the forward clutch piston. Use the parts measured, and the selected piston, ins the forward clutch assembly.

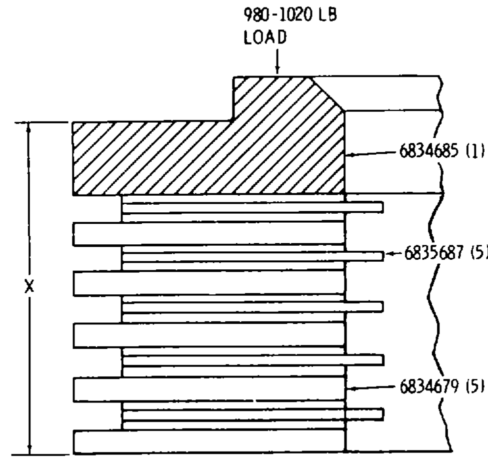
c. Fourth Clutch

(1) Stack the fourth clutch plates and backplate as shown in figure 6-108.



	DIMX	USE PISTON	MARKED
BEFORE SIN 16801	1 3615-1 3878	6836718	C
	1.3882-1 4148	6836715	B
	1 4152-1 4415	6836714	A
AFTER SIN 16800	1.3615-1.3878	6885128	C
	1 3882-1 4148	6885130	B
	1 4152-1.4415	6885129	A

Fig. 6-107. Forward clutch stack dimension



	DIMX	USE PISTON	MARKED
BEFORE SIN 16801	1 3615-1.3878	6880204	F
	1.3882-1.4148	6880205	E
	1 4152-1.4415	6880206	D
AFTER SIN 16800	1.3615-1.3878	6885131	T
	1.3882-1 4148	6885132	S
	1.4152-1 4415	6885133	M

Fig. 6-108. Fourth clutch stack dimension

(2) Apply the specified load, and measure dimension X.

(3) From the table in figure 6-108, select the fourth clutch piston. Use the parts measured, and the selected piston, in the fourth clutch assembly.

d. First Clutch (HT 740), Low Clutch (HT 750)

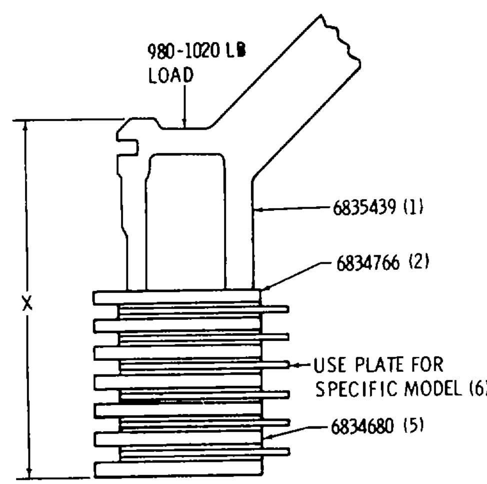
(1) Stack the first clutch plates and piston as shown in figure 6-109. Be sure the specific internal clutch plates designed for the unit are being used in this stacking procedure. (Refer to Parts Catalog.)

(2) Apply the specified load, and measure dimension X.

(3) From the table in figure 6-109, select the recommended clutch plates to satisfy the required clutch plate clearance.

e. First Clutch (HT 750)

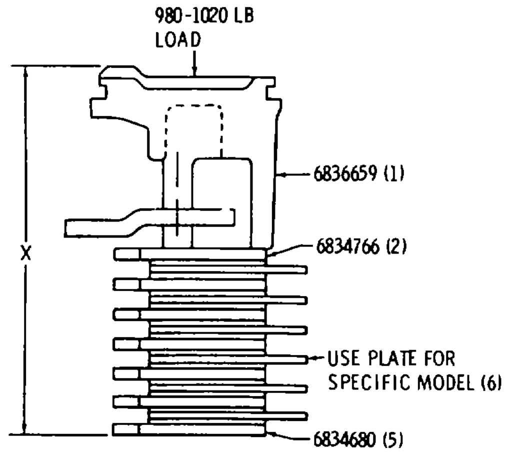
(1) Stack the first clutch plates as shown in figure 6-110. Be sure the specific internal clutch plates designed for the unit are being used in this stacking procedure. (Refer to Parts Catalog.)



DIM X		PLATE	PLATE
FROM	TO	6834680	6834766
2 5800	2 5667	ADD 2	REMOVE 2
2.5667	2 5534	ADD 1	REMOVE 1
2.5534	2 5214	---	---
2 5214	2.5081	REMOVE 1	ADD 1
2.5081	2.4948	REMOVE 2	ADD2

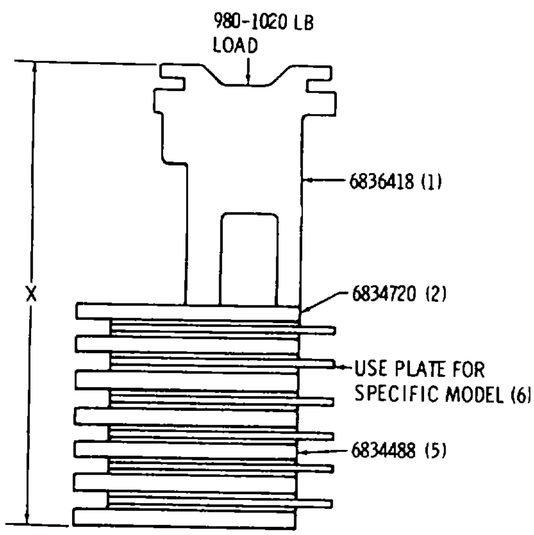
Fig. 6-109. Stack dimension for first clutch (HT 740) or low clutch (HT 750)

(2) Apply the specified load, and measure dimension X.



DIM X		PLATE	PLATE
FROM	TO	6834680	6834766
3.0900	3.0767	ADD 2	REMOVE2
3 0767	3.0634	ADD 1	REMOVE 1
3 0634	3.0314	---	---
3.0314	3 0181	REMOVE 1	ADD 1
3 0181	3 0048	REMOVE 2	ADD 2

Fig. 6-110. First clutch stack dimension (HT 750)



DIM X		PLATE	PLATE
FROM	TO	6834488	6834720
3.1950	3.1817	ADD 2	REMOVE 2
3.1817	3.1684	ADD 1	REMOVE 1
3.1614	3.1364	---	---
3.1364	3.1231	REMOVE 1	ADD 1
3 1231	3.1098	REMOVE 2	ADD 2

Fig. 6-111. Second clutch stack dimension

(3) From the table in figure 6-110, select the recommended clutch plates to satisfy the required clutch plate clearance.

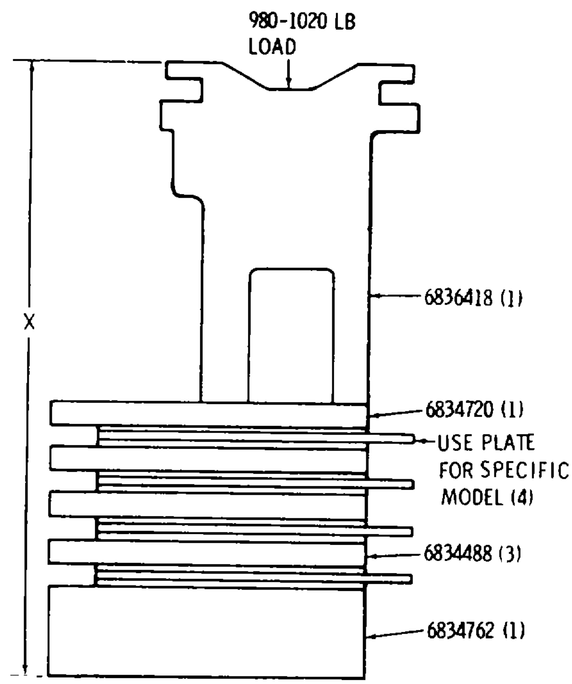
f. Second and Third Clutches

(1) Stack the second clutch plates as shown in figure 6-111. Be sure the specific internal clutch plates designed for the unit are being used in this stacking procedure. (Refer to Parts Catalog.)

(2) Apply the specified load, and measure dimension X.

(3) From the table in figure 6-111, select the recommended clutch plates to satisfy the required clutch plate clearance.

(4) Repeat the proceduresin (1), (2) and (3) above, stacking the third clutch plates and piston using table in figure 6-112.



DIM X		PLATE	PLATE
FROM	TO	6834488	6834720
3.0551	3.0418	ADD 1	REMOVE 1
3.0418	3.0098	---	---
3.0098	2.9965	REMOVE 1	ADD 1
2.9965	2.9878	REMOVE 2	ADD 2

Fig. 6-112. Third clutch stack dimension

7-1. SCOPE

a. This section covers the assembly of the HT 740D, HT 747D, HT 750CRD, HT 754CRD, HT 750DRD and HT 750DRD DB transmissions. The assembly sequence is continuous and includes all models. Where procedures apply to specific models, they will be so identified.

b. When a procedure does not apply to the specific model being assembled, go to the next procedure which is applicable.

c. Certain illustrations will not always illustrate the model being assembled, but, when the operation is identical, the illustration will correctly illustrate the procedure.

NOTE

The clearances for low, first, second and third clutches are established by direct measurement in this section (para 7-3, 7-4 and 7-11). Refer to paragraph 6-33 for stack dimension computation of clutch clearances.

7-2. CLUTCH CLEARANCES

a. Preparation Procedure Preparations are required to establish the proper clearance for each clutch pack. Follow the procedures in b, below.

b. Determine Plate Thickness

(1) Determine the original thickness of each external-tanged plate with a micrometer. Because the tangs of the clutch plate are not subject to face wear, the micrometer reading at a tang will be the original thickness. Note that each clutch pack must contain one thick plate next to the piston, and a basic number of thick and thin plates. The combination of thick and thin plates are selected to meet the prescribed clearance with the clutch released. Install all thick plates toward the piston end of the pack.

(2) Determine the wear on both internal and external plates (refer to wear limits in Section 8). Replace worn plates. Note that the thicknesses of external-tanged plates in the low, first, second, and third clutches in earlier models may be different from the thicknesses of corresponding plates in later models. Wear limits stated in Section 8 are for plates presently supplied.

(3) If it is necessary to replace an external-tanged plate, be sure the plate thickness is identical to the original equipment. Refer to b (1) and (2), above. Keep the clutch packs separated; do not mix the plates of one clutch with the plates of another.

(4) Clearance for all clutch plates is established during assembly procedure. Clearances for the forward and fourth clutches are established during rebuild of those subassemblies in Section 6.

7-3. ESTABLISHING CLUTCH CLEARANCES, SELECTING CENTER SUPPORT SNAPRING (HT 740D, HT 747D)

a. First Clutch Clearance

(1) Before assembly, the clutch clearance must be established. One method is by direct measurement as outlined in (5) below. An alternate method is by stack dimension computation outlined in paragraph 6-33. If the stack method is used disregard (2) through (5) below.

(2) Place the transmission housing in a vertical position, rear end upward (fig. 7-1).

(3) Beginning with an external-tanged clutch plate, alternately install seven external-tanged, and six internal-splined first clutch plates (fig. 7-1).

(4) Install the rear cover assembly (as assembled in para 6-26) and gasket onto the rear of the transmission housing and secure it with six 1/2-13 bolts and flatwashers, evenly spaced. Refer to figure 7-9. Tighten the bolts to approximately 30 lb ft (41 N·m).

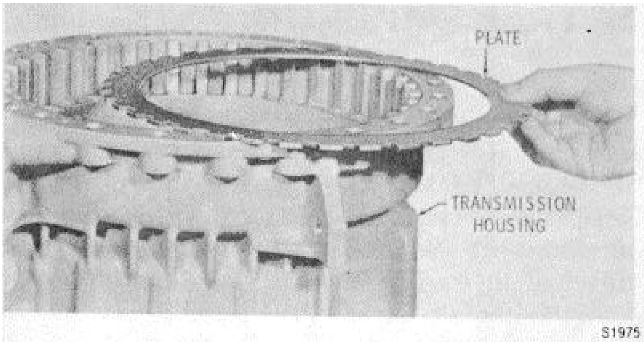


Fig. 7-1. Installing first-clutch external-tanged plate

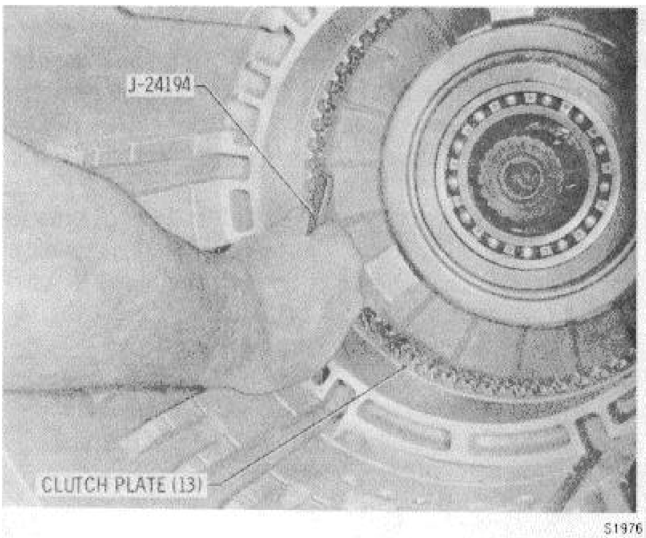


Fig. 7-2. Checking first-clutch clearance (HT 740D, 747D)

(5) Invert the transmission housing, front upward. Using clearance gage J-24194, check the clearance between the clutch plates (fig. 7-2). The prescribed clearance is 0.095 to 0.145 Inch (2.41 to 3.68 mm). Any dimension within 0.095 to 0.145 inch is satisfactory. However, the closer the clearance is to 0.095 Inch, the longer the interval between clutch plate replacements will be. Replace worn plates with new plates to establish the desired clearance. Recheck the clearance as described above.

b. Selecting Center Support Snapring

NOTE

If the stack method of selecting the second clutch components is used, disregard (1), below.

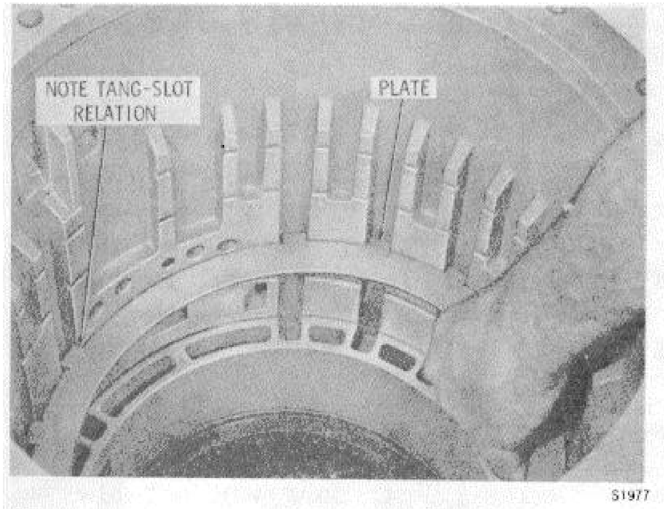


Fig. 7-3. Installing second-clutch, external-tanged plate

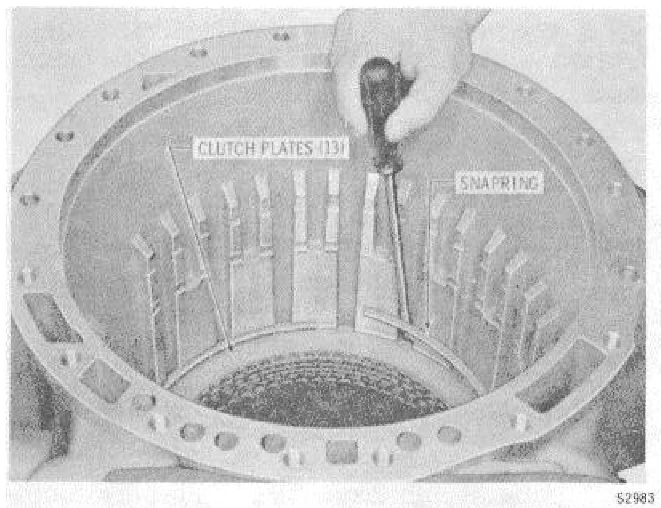


Fig. 7-4. Installing second-clutch snapring

(1) Beginning with an external-tanged plate, alternately Install seven second clutch external-tanged and six internal-splined clutch plates (fig. 7-3).

(2) Retain the plates with selective snapring (.155-.157) (fig. 7-4). The snapring must be color coded white.

(3) Remove the third-clutch piston from the center support assembly (If not previously removed). Install lifting bracket

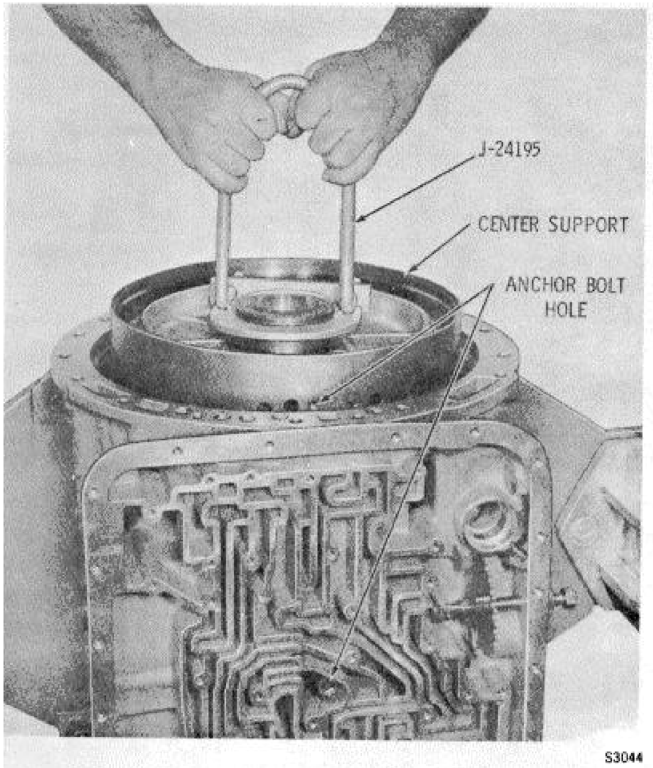


Fig. 7-5. Installing center support assembly

J-24195 into the recess between the sealrings grooves on the center support hub (fig. 7-5).

(4) Install the center support into the transmission housing (fig. 7-5). Be sure the tapped hole in the support is aligned with the anchor bolt hole in the bottom of the housing.

(5) Remove lifting bracket J-24195 from the center support. Install the special 3/8-16 x 2 1/4-inch anchor bolt into the support through the anchor bolt hole in the bottom of the housing (fig. 7-5). Tighten the bolt finger tight.

(6) Place the compressor sleeve J-24208-2 on the hub of the center support (fig. 7-6). Place compressor J-24208-3 across the transmission housing. Retain the compressor bar with two bolts.

(7) Compress the center support by applying a torque of 5 lb ft (6.78 N-m) to the center screw J-24208-1. Determine the width of the snapring opening using gage J-24208-13 or 15 (fig. 7-6). Select one of the snaprings listed below (gage lugs are color-coded to match the snapring colors). Select the thickest snapring that can be put into the groove.

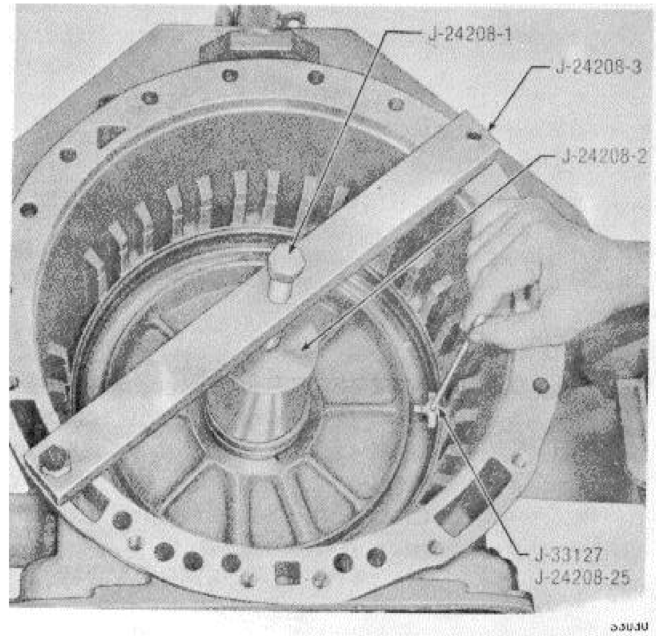


Fig. 7-6. Checking selective snapring clearance

Color code	Thickness
Blue	0.148-0.150 in. (3.76-3.81 mm)
Yellow	0.152-0.154 in. (3.86-3.91 mm)
White	0.155-0.157 in. (3.94-3.99 mm)
Red	0.158-0.160 in. (4.01-4.06 mm)

(8) Install the selected snapring to retain the center support. Be sure the gap of the snapring is at the top of the housing, regardless of its position when removed.

(9) Remove compressor J-24208-3 and sleeve J-24208-2.

c. Second Clutch Clearance

NOTE
If the stack method was used to select the first clutch components, disregard (2), (3) and (4), below.

(1) Before completing the assembly, the clutch clearance must be established. One method is by direct measurement as outlined in c, (4) below. An alternate method is by stack dimension computation outlined in paragraph 6-33. If the stack method was used to select the second clutch components, disregard (5), below.

(2) Invert the transmission housing, rear upward.

(3) Remove the six bolts and washers that temporarily retained the rear cover to the transmission housing. Remove the rear cover and gasket.

(4) Remove the thirteen first clutch plates from the transmission housing. Since these plates have been preset for clearance, they should be retained in a pack to prevent intermixing with other plates.

(5) Using gage J-24194, check the second clutch plate clearance (fig. 7-7). The prescribed clearance is 0.095 to 0.145 inch (2.41 to 3.68 mm). Any dimension within 0.095 to 0.145 inch is satisfactory. However, the closer the clearance is to 0.095 inch, the longer the interval between clutch plate replacements will be. Replace worn plates with new plates to establish the desired clearance. Recheck the clearance as described above.

NOTE
Leave the second clutch and the center support in the transmission housing until the housing is again positioned front upward. Continue assembly of Model HT 740D, HT 747D at paragraph 7-5.

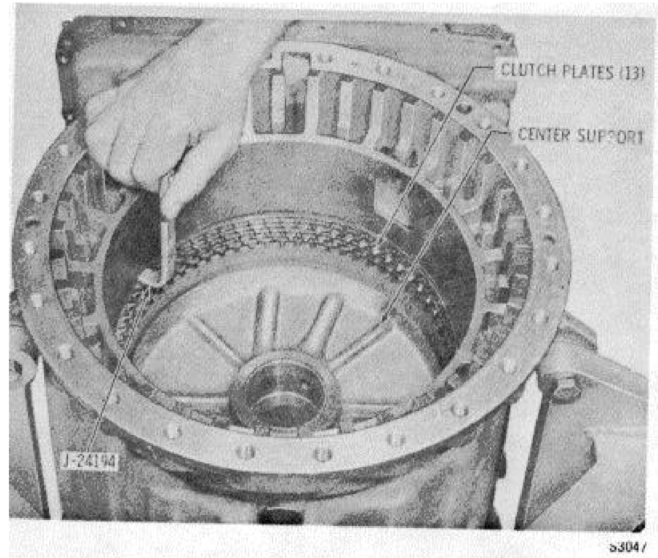


Fig. 7-7. Checking second-clutch plate clearance

7-4. ESTABLISHING CLUTCH CLEARANCES, SELECTING CENTER SUPPORT SNAPRING (HT 750CRD, HT 754CRD, HT 750DRD, HT 750DRD DB)

a. Low and First Clutch Clearances

NOTE
Two methods of checking clutch plate clearance have been established. One method is by direct measurement as outlined in items (6) and (7) below. The alternate method is by stack dimension computation outlined in paragraph 6-33. If the stack method is used, disregard (1) through (7), below.

(1) Place the transmission housing in a vertical position, rear upward (fig. 7-8).

(2) Beginning with an external-tanged clutch plate, alternately install seven external-tanged, and six internal-splined first clutch plates (fig. 7-8).

(3) Install two guide bolts (180° apart) into the transmission housing. Align and install the adapter housing assembly (as assembled in para 6-25) and gasket.

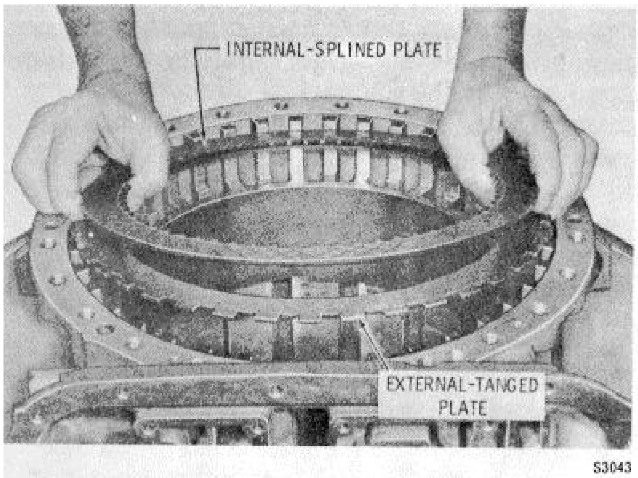


Fig. 7-8. Installing first-clutch plates

(4) Beginning with an external-tanged clutch plate, alternately install seven external-tanged and six internal-splined low clutch plates (refer to fig. 7-18).

(5) Install the rear cover assembly (as assembled in para 6-26) and gasket onto the rear of the transmission housing and secure it with six 1/2-13 bolts and lockwashers, evenly spaced (fig. 7-9). Tighten the bolts to approximately 30 lb ft (41 N·m).

(6) Invert the transmission, front upward. Using gage J-24194, check the clearance between the low clutch plates (fig. 7-10). It is recommended the gage be placed between the adapter housing wall and the first steel plate. The prescribed clearance is 0.095 to 0.145 inch (2.41 to 3.68 mm). Any dimension within 0.095 to 0.145 inch is satisfactory. However, the closer the clearance is to 0.095 Inch, the longer the interval between clutch plate replacements will be. Replace worn clutch plates with new plates to establish the desired clearance. Recheck the clearance as described above.

(7) Using gage J-24194, check the clearance between the first clutch plates (fig. 7-11). It is recommended the gage be placed between the transmission housing and the first steel plate. The prescribed clearance is 0.095 to 0.145 inch (2.41 to 3.68 mm). Any dimension within 0.095 to 0.145 Inch is satisfactory. However, the closer the clearance is to 0.095 inch, the longer the interval between clutch plate replacements will be. Replace worn clutch plates with new plates to establish the desired clearance. Recheck the clearance as described above.

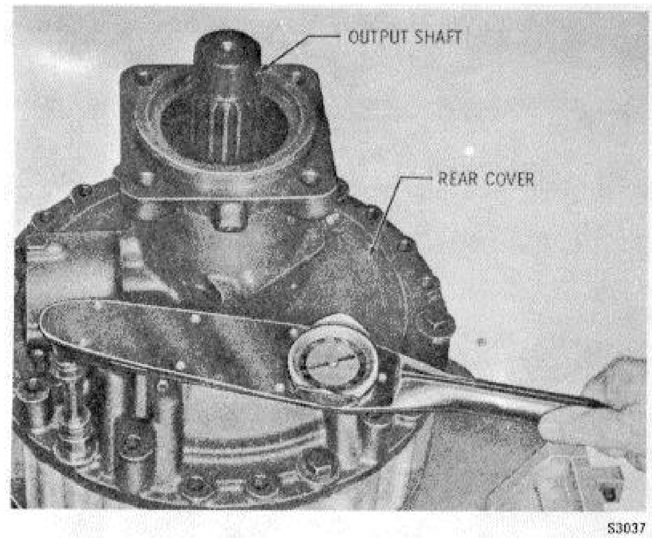


Fig. 7-9. Installing rear cover assembly (HT 750CRD, HT 754CRD, HT 750DRD)

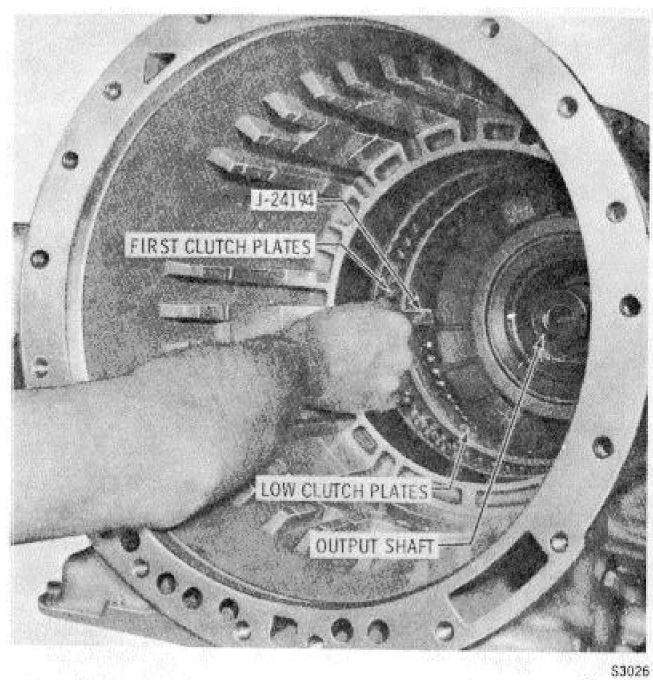


Fig. 7-10. Checking low-clutch clearance (HT 750CRD, DRD)

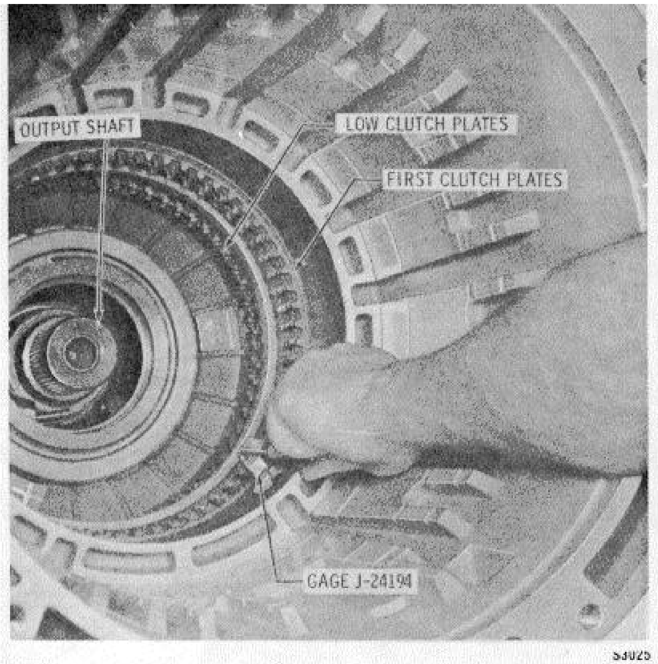


Fig. 7-11. Checking first-clutch clearance (HT 750CRD, DRD, HT 754CRD)

b. Selecting Center Support Snapring

NOTE
If the stack method is used to select second clutch components, disregard (1), following.

(1) Install thirteen second clutch plates, beginning with an external-tanged plate. Alternately install seven external-tanged plates and six internal-splined plates (fig. 7-3).

(2) Retain the plates with selective snapring (.155-.157) (fig. 7-4). The snapring must be color coded white. Be sure the snapring gap is at the top of the transmission housing, regardless of its position when removed.

(3) Remove the third-clutch piston from the center support assembly (if not previously removed). Install bracket J-24195 into the recess between the sealrings on the center support hub (fig. 7-5).

(4) Install the center support into the transmission housing (fig. 7-5). Be sure the tapped hole in the support is aligned with the anchor bolt hole in the bottom of the housing.

(5) Remove lifting bracket J-24195 from the center support. Install a used 3/8-16 x 2 1/4-inch anchor bolt into the support through the anchor bolt hole in the bottom of the housing (fig. 7-5). Tighten the bolt finger tight.

(6) Place the compressor sleeve J-24208-2 on the hub of the center support. Place compressor J-24208-3 across the transmission housing. Retain the compressor bar with two bolts (fig. 7-6).

(7) Compress the center support by applying a torque of 5 lb ft (6.78 N·m) to the center screw J-24208-1. Determine the width of the snapring opening, using gage J-24208-13 or 15 (fig. 7-6). The lugs of the gage are color-coded to match the snapring colors. Select one of the snaprings listed below. Select the thickest snapring that can be put into the groove.

Color code	Thickness
Blue	0.148-0.150 in. (3.76-3.81 mm)
Yellow	0.152-0.154 in. (3.86-3.91 mm)
White	0.155-0.157 in. (3.94-3.99 mm)
Red	0.158-0.160 in. (4.01-4.06 mm)

(8) Install the selected snapring to retain the center support. Be sure the snapring gap is at the top of the transmission housing, regardless of its position when removed.

(9) Remove compressor J-24208-3 and sleeve J-24208-2.

c. Second Clutch Clearance

NOTE

Two methods of checking clutch plate clearance have been established. One method is by direct measurement as outlined in items c, (6) below. The alternate method is by stack dimension computation outlined in paragraph 6-33. If the stack method is used to select second clutch components, disregard (1) through (6), below.

(1) Invert the transmission housing, rear cover upward.

(2) Remove the six bolts and washers that temporarily retained the rear cover to the transmission housing. Remove the rear cover and gasket. (Refer to figure 7-9.)

(3) Remove the thirteen low clutch plates from the adapter housing. (Refer to figure 7-18.) Since these plates are preset for the low clutch clearance, they should be maintained in a package form so they cannot be intermixed with other plates.

(4) Remove the adapter housing and gasket from the transmission housing. (Refer to figure 7-27.)

(5) Remove the thirteen first clutch plates from the transmission housing. These plates were preset for proper clearance and should be maintained as a package for final installation.

(6) Using gage J-24194, check the second clutch plate clearance (fig. 7-7). It is recommended the gage be placed between the transmission housing and the first steel plate. The prescribed clearance is 0.095 to 0.145 inch (2.41 to 3.68 mm). Any dimension within 0.095 to 0.145 inch is satisfactory. However, the closer the clearance is to 0.095 inch, the longer the interval between clutch plate replacements will be. Replace worn plates with new plates to establish the desired clearance. Recheck the clearance as described above.

NOTE

Leave the second clutch and the center support in the transmission housing until the housing is again positioned front end upward. Begin assembly of Model HT 750CRD, HT 754CRD at paragraph 7-6. Begin assembly of Model HT 750DRD at paragraph 7-9.

7-5. INSTALLING REAR COMPONENTS (HT 740D, 747D)

a. First Clutch

(1) Place the transmission housing in a vertical position, rear upward.

(2) Install the first clutch pack removed in 7-3c(3), or first clutch components selected by stack method.

(3) Beginning with an external-tanged clutch plate, install five external-tanged, and five internal-splined clutch plates (fig. 7-12).

(4) Install the rear planetary ring gear, longer splines first (fig. 7-12).

(5) Install the three remaining clutch plates as shown in figure 7-12. Be sure a thick plate is placed next to the piston (refer to para 7-2(1), above).

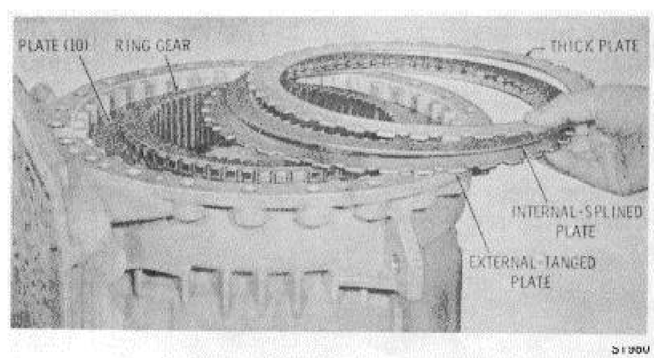


Fig. 7-12. Installing first-clutch plates

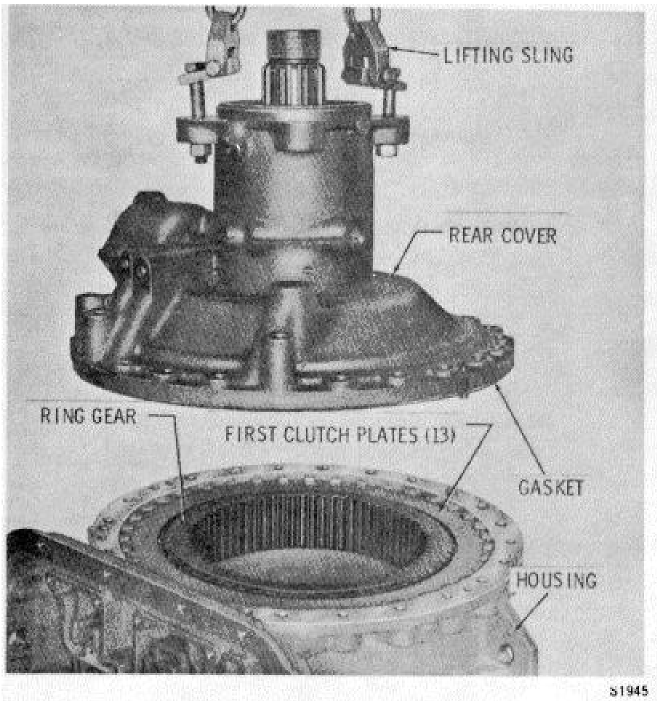


Fig. 7-13. Installing rear cover assembly (HT 740D, 747D)

b. Rear Cover Assembly

(1) Place the rear cover gasket onto the rear cover. Retain the gasket with oil soluble grease (fig. 7-13). Be sure the holes in the gasket are aligned with those in the main housing.

(2) Attach a lifting sling to the rear cover (fig. 7-13). Carefully install the rear cover assembly (as assembled in para 6-26), guiding the two dowel pins into place. (Dowel pins are different sizes.)

(3) Install twenty-one 1/2-13 x 2-inch bolts and three 1/2-13 x 3 1/4-inch bolts, and lockwashers, to retain the rear cover. Tighten the bolts to 67-80 lb ft (90-108 N.m).

(4) Install the governor assembly into the rear cover by rotating it counterclockwise (fig. 7-22).

(5) Install the governor cover and gasket. Retain them with four 5/16-18 x 9/16-inch bolts. Tighten the bolts 10-13 lb ft (14-17 N•m) (fig. 1-1).

(6) Invert the transmission, front upward.

NOTE
Continue assembly of Model HT 740D, HT 747D at paragraph 7-8.

7-6. INSTALLING FIRST CLUTCH, GEAR UNIT, SECOND CLUTCH, CENTER SUPPORT (HT 750CRD, HT 754CRD)

a. First Clutch, Rear Planetary Ring Gear

(1) Place the rear planetary ring gear, short splines (rear) downward, on a bench. Install ten of the plates from the clutch pack removed in 7-4c(5), above, or from the first clutch components selected by the stack method, as follows. Lay aside the first three plates from the piston end of the pack (refer to para 7-2b). Starting with the fourth plate in the pack (internal-splined), alternately install five internal-splined and five external-tanged plates onto the ring gear.

(2) Align the external tangs of the plate pack. Carefully invert the ring gear and plate pack, and install the assembled parts into the rear of the transmission housing.

(3) Install the three remaining plates of the pack (external-tanged, internal-splined, external-tanged sequence).

NOTE
Last plate installed must be a thick plate.

(4) Place the adapter housing with piston (front) downward onto the transmission housing.

(5) Install compressor bar J-24208-3 onto the adapter housing (fig. 7-14). Retain it with two 1/2-13 x 5 3/4-inch bolts.

(6) Position the transmission with the front upward.

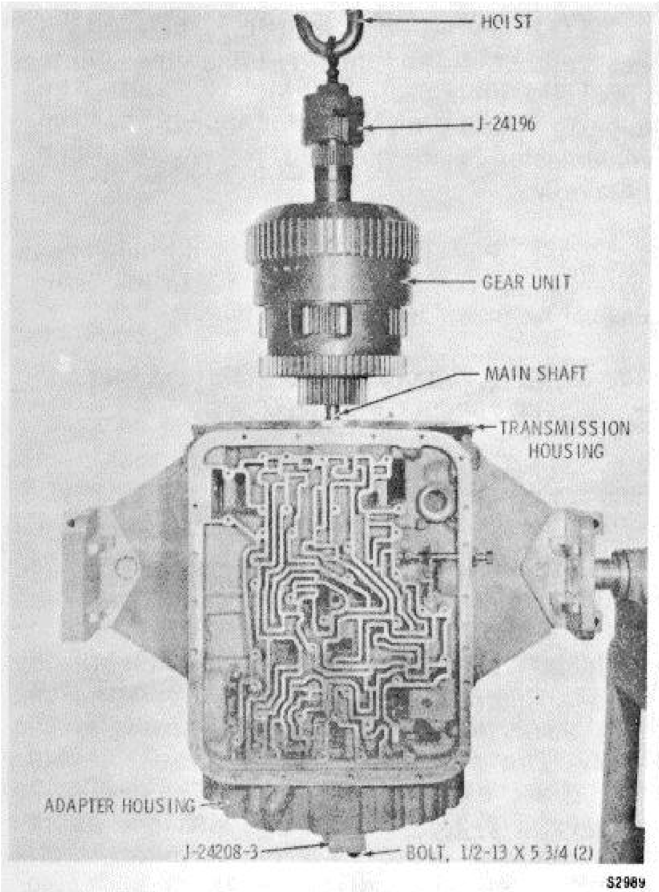


Fig. 7-14. Installing gear unit assembly (HT 750CRD, HT 754CRD)

(7) Remove the center support snapring and anchor bolt. Attach bracket J-24195 to the center support, and remove the support assembly (fig. 7-5).

(8) Remove the snapring (fig. 7-4). Remove the second clutch plates (except when p 1 a t e s were selected by stack method). These plates are now preset for proper clearance and should be retained as a pack for final installation.

b. Gear Unit, Second Clutch, Center Support

(1) Attach lifting bracket J-24196 to the assembled gear unit (fig. 7-14). Lower the gear unit carefully, aligning the pinions of the rear planetary to mesh with the rear planetary ring gear. Remove the lifting bracket.

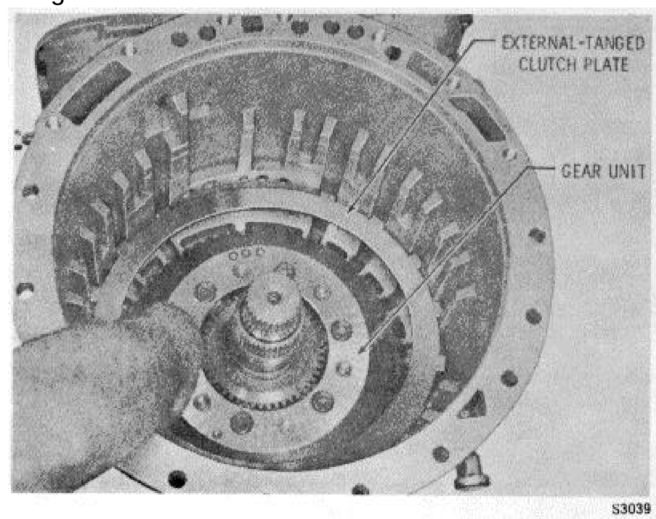


Fig. 7-15. Installing second-clutch plate

(2) Install the second clutch plate pack removed in a(8) above (or plate pack selected by the stack method). The thinner external-tanged plates should be installed toward the rear of the transmission housing (refer to para 7-2b). Begin with an external-tanged plate (fig. 7-15) and alternately install seven external-tanged and six internal-splined plates.

(3) Install the white color coded snapring that retains the second clutch pack (fig. 7-16).

(4) Install the third clutch piston assembly into the center support. The lips of the sealring must be toward the cavity in the center support.

CAUTION

Improper installation of the butt-joint sealrings may cause transmission failure. Refer to paragraph 4-6E for proper installation procedure.

(5) Install the butt-joint sealrings onto the center support hub. Attach lifting bracket J-24195 and install the center support assembly. Align the tapped hole in the support to the hole in the transmission housing (fig. 7-17).

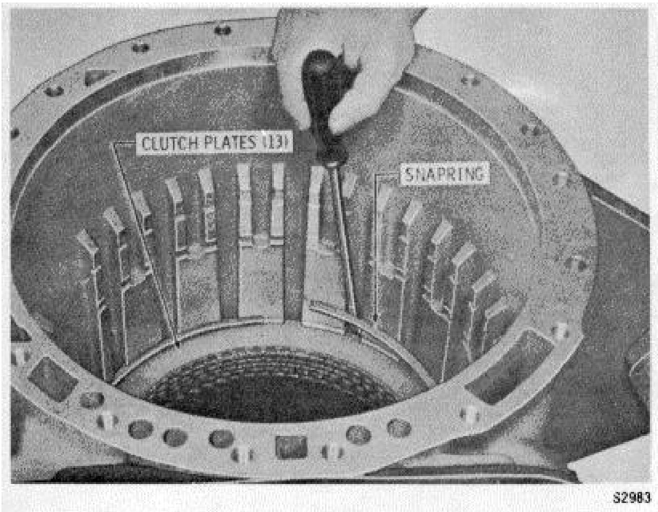


Fig. 7-16. Installing second-clutch snapring

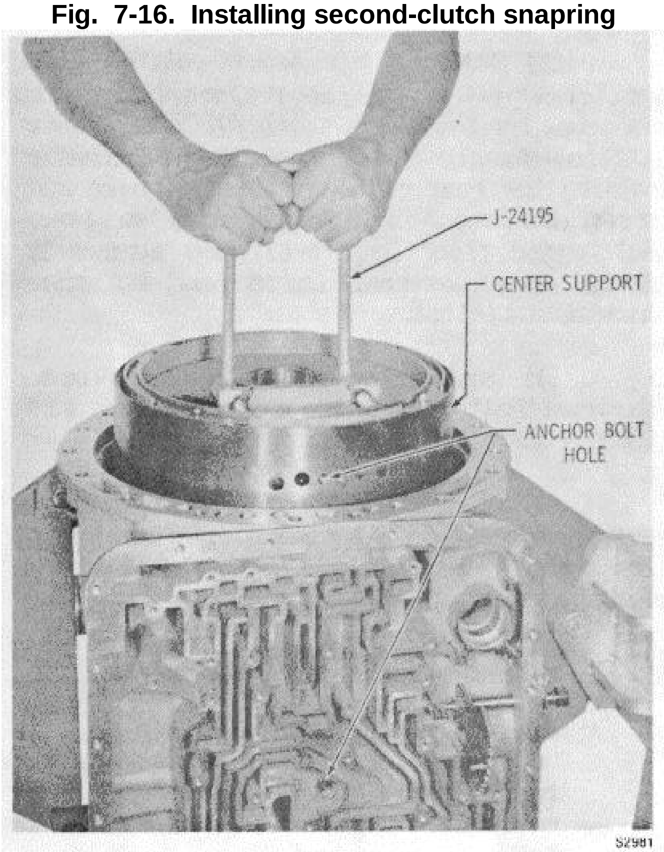


Fig. 7-17. Installing center support

(6) Install the special 3/8-16 x 3-inch (2 1/4-inch in earlier models) anchor bolt and plain washer, finger-tight. Remove the lifting bracket.

(7) Install the snapring, selected in paragraph 7-4b(7), that retains the center support assembly (fig. 7-25). The gap of the snapring should be toward the top of the transmission, regardless of its position when removed.

(8) Position the transmission rear upward, and remove the two bolts and compressor bar from the adapter housing.

7-7. INSTALLING REAR COMPONENTS (HT 750CRD, HT 754CRD)

a. Adapter Housing, Low Clutch, Low Ring Gear

(1) Place the low ring gear, flat side (rear) downward on a bench. Install ten plates of the low clutch pack removed in paragraph 7-4c(3) (or clutch pack selected by the stack method), as follows. Lay aside the first three plates from the piston end of the pack. The plates laid aside should include two thick external tanged plates (refer to paragraph 7-2b). Beginning with the fourth plate in the pack (internal-splined), alternately install five internal-splined and five external-tanged plates onto the ring gear.

(2) Remove the adapter housing from the transmission housing. Do not drop the first clutch piston.

(3) Place the adapter housing, with piston upward, over the assembled low ring gear and clutch plates.

(4) Install the adapter housing gasket onto the adapter housing, aligning the holes in the gasket with those in the housing. Retain the gasket with oil-soluble grease.

(5) Grasp the assembled adapter housing, ring gear and clutch plates, invert the assembly and install it onto the rear of the transmission housing as follows.

(6) Align the adapter housing dowel pins with proper holes in the transmission housing. Lower the adapter housing until the

internal teeth of the low ring gear begin to mesh with splines on the rear planetary carrier hub. Support the adapter housing while meshing the low ring gear by tapping with a soft mallet. When mesh is complete, seat the adapter housing.

(7) Install the three remaining low clutch plates (laid aside in (1), above). Install the plates in external-tang, internal-spline, external-tang sequence (fig. 7-18).

b. Low Planetary, Rear Cover ,Assembly

(1) Install the low planetary carrier by carefully aligning the teeth of the four pinions with those of the low ring gear (fig. 7-19).

CAUTION

Do not lift the low carrier by the ball bearing. The bearing may be loose, permitting the assembly to drop.

(2) Place the rear cover gasket onto the rear cover. Retain the gasket with oil soluble grease (fig. 7-20). Be sure the holes in the gasket are aligned with those in the adapter housing.

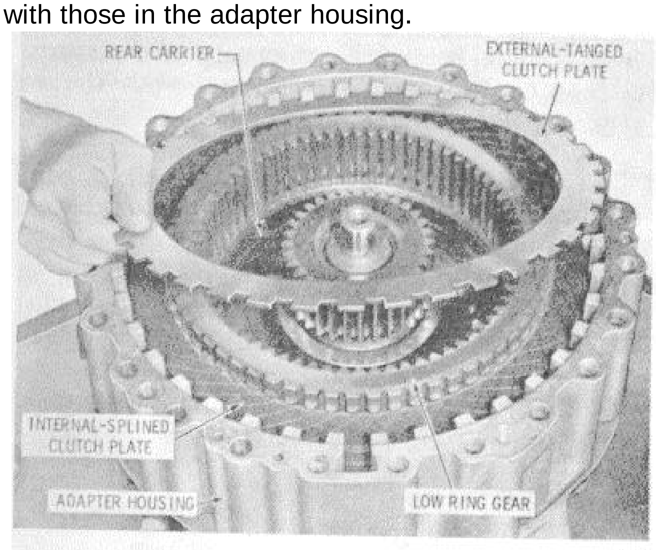


Fig. 7-18. Installing low-clutch plates and ring gear (HT 750CRD, HT 754CRD)

(3) Attach a lifting bracket to the output shaft (fig. 7-20). Using a hoist, guide the cover onto the adapter housing. Since the two dowel pins in the cover are of different size, cover to adapter installation is simplified.

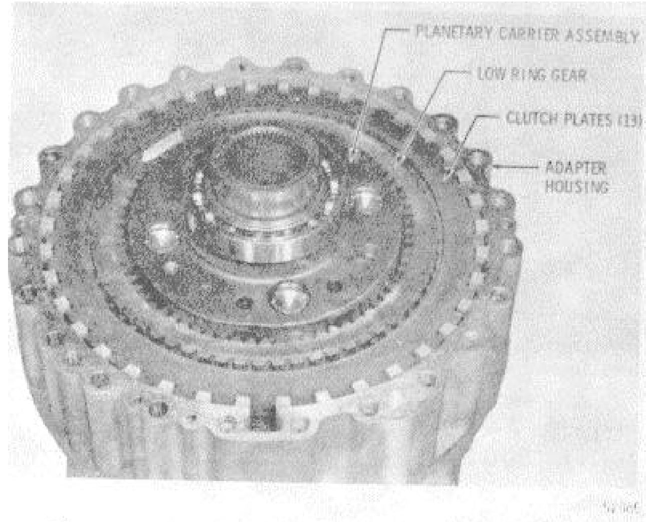


Fig. 7-19. Low planetary carrier, ring gear and clutch (HT 750CRD, HT 754CRD)

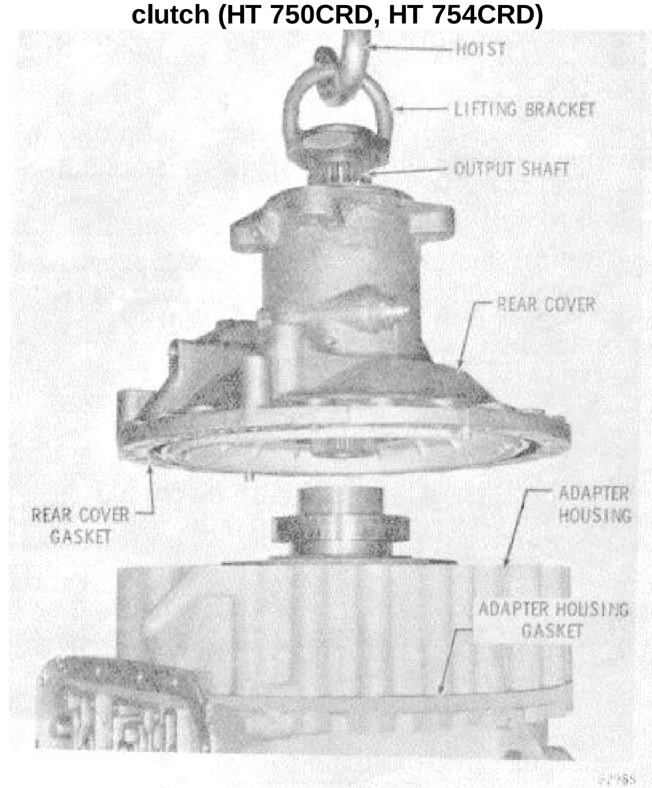


Fig. 7-20. Installing rear housing (HT 750CRD, HT 754(CRD)

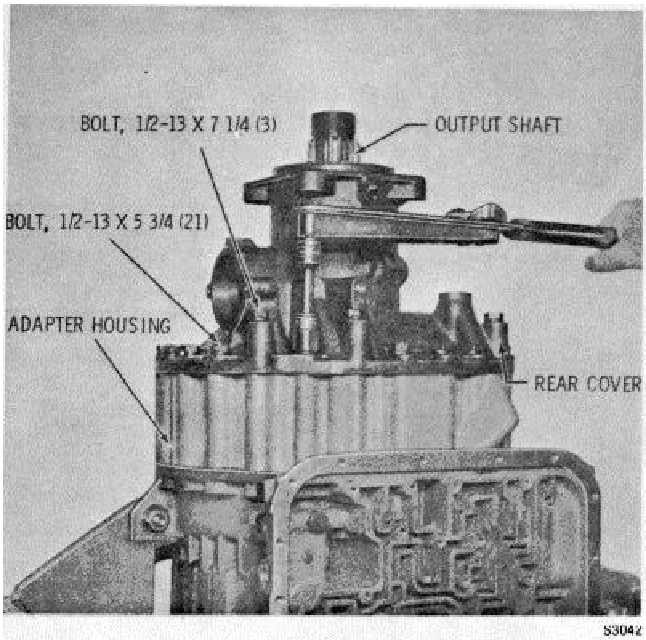


Fig. 7-21. Installing rear cover bolts (HT 750CRD, HT 754CRD, HT 750DRD)

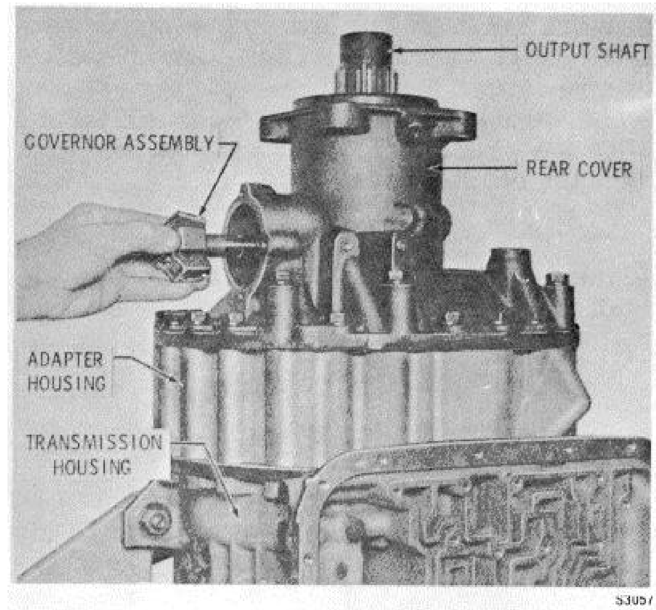


Fig. 7-22. Installing governor assembly (HT 750CRD, HT 754CRD, HT 750DRD)

(4) Install twenty-one 1/2-13 x 5 3/4-inch bolts and three 1/2-13 x 7 1/4-inch bolts, and washers, to retain the rear cover (fig. 7-21). Tighten the bolts to 67-80 lb ft (90-108 N•m).

(5) Install the governor assembly into the rear cover by rotating it counter-clockwise (fig. 7-22).

(6) Install the governor cover gasket and cover, and retain them with four 5/16-18 x 9/16-inch bolts. Tighten the bolts to 10-13 lb ft (14-17 N•m).

NOTE

Continue assembly of Model HT 750CRD, HT 754CRD at paragraph 7-11.

7-8. INSTALLING GEAR UNIT, SECOND CLUTCH, CENTER SUPPORT (HT 740D)

a. Gear Unit, Second Clutch

(1) Remove the center support anchor bolt. (Refer to fig. 7-39.) Remove the special selective snapring that retains the center support. Using lifting bracket J-24195, remove the center support (fig. 7-5).

(2) Remove the white color coded snapring. Remove the second-clutch plates. Retain the plates in a pack.

(3) Attach lifting bracket J-24196 to the main shaft of the gear unit assembly (fig. 7-23). Attach a hoist to the eyebolt on bracket J-24196. Lower the gear unit assembly (as assembled in para 6-20) into the transmission housing, engaging the internal splines to the rear carrier hub with the external splines of the output shaft.

(4) Install 13 (pre-selected) second-clutch plates beginning with an external-tanged plate, and alternately installing seven external-tanged and six internal-splined plates (fig. 7-15). Be sure a thick steel plate is next to the piston. (Refer to para 7-2b(1).)

(5) Install the white color coded snapring that retains the second-clutch plates (fig. 7-16).

b. Center Support

(1) Install the third clutch piston assembly into the center support. The lips of the sealring must be toward the cavity in the center support.

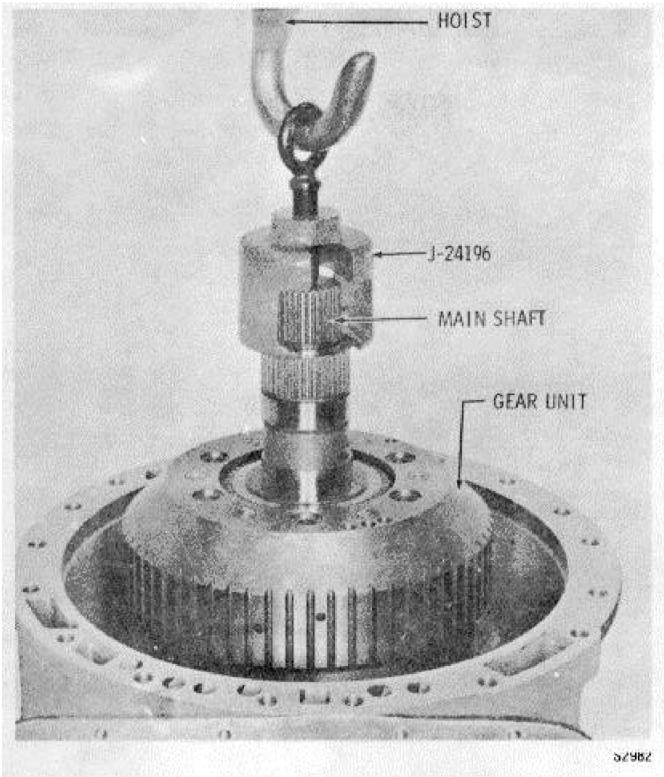


Fig. 7-23. Installing gear unit assembly (HT 740D, HT 747D, HT 750DRD)

CAUTION

Improper installation of butt-joint sealrings may cause transmission failure. Refer to paragraph 4-6g for proper installation procedure.

(2) Install the butt-joint sealrings onto the center support hub. Attach lifting bracket J-24195 and install the center support assembly. Align the tapped hole in the support to the hole in the transmission housing (fig. 7-24).

CAUTION

The center support is fitted to the transmission housing with very little clearance. It may bind during installation if the housing is cold. Heat the housing slightly, if necessary. Do not use a torch to heat the

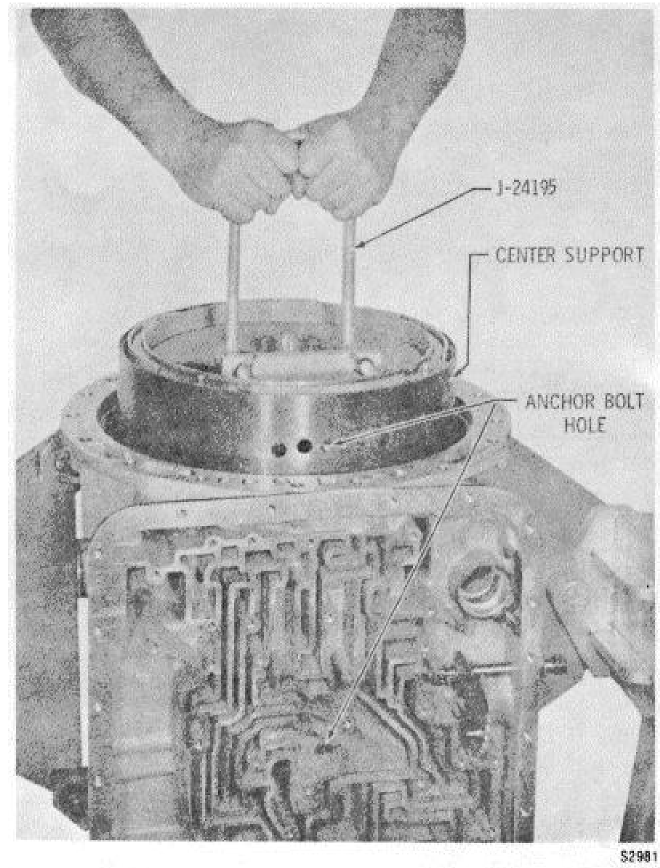


Fig. 7-24. Installing center support

housing. A sun lamp, or a current of warm air is sufficient.

(3) Install the special 3/8-16 x 3-inch (2 1/4-inch on earlier models) anchor bolt and plain washer, finger tight. Remove the lifting bracket.

(3) Install the snapring, selected in paragraph 7-3b(7), that retains the center support assembly (fig. 7-25). The gap of the snapring should be toward the top of the transmission, regardless of its position when re moved.

NOTE

It may be necessary to compress the center support to install the selective snapring. Continue assembly of Model HT 740D, HT 747D at paragraph 7-11.

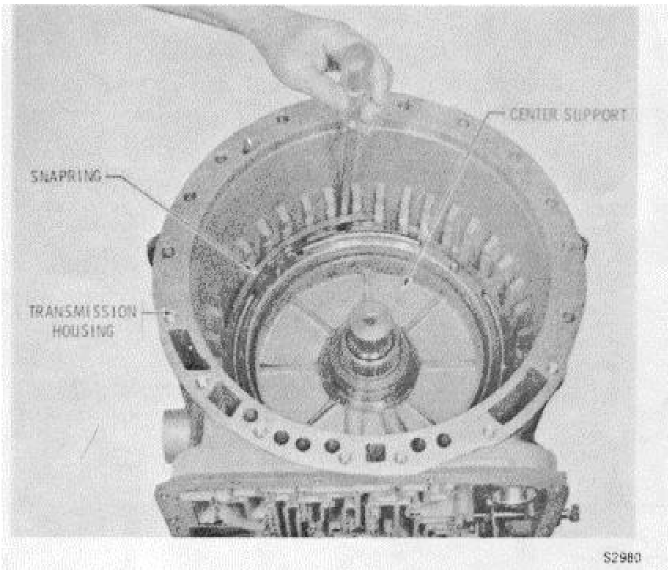


Fig. 7-25. Installing center support snapring

7-9. INSTALLING REAR COMPONENTS (HT 750DRD, DRD DB)

a. First Clutch and Ring Gear

(1) Install one external-tanged and one internal-splined first clutch plate Into tile rear of the transmission (fig. 7-8). These plates should come from the front of the clutch pack removed in 7-4c(5) (or first clutch plates selected by the stack method), and the external-tanged plate should be a thin plate (if pack includes thin plates-refer to para 7-2b).

(2) Install the rear planetary ring gear, stepped diameter upward (fig. 7-26).

(3) Install the remainder of the first clutch pack removed in 7-4c(5) (or selected by the stack method). Begin with an external-tanged plate, and alternately install six external-tanged and five internal-splined plates (fig. 7-26). The last plate must be a thick external-tanged plate (refer to para 7-2b).

b. Adapter Housing, Low Clutch and Planetary Carrier

(1) Place the adapter housing gasket on the adapter housing (fig. 7-27). Retain the gasket on the housing with oil-soluble grease. Be sure all holes in the gasket are aligned with those in the housing.

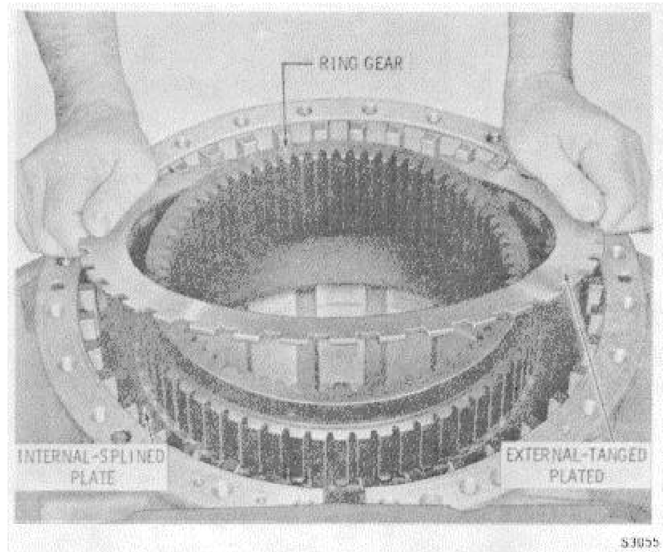


Fig. 7-26. Installing first-clutch plate (HT 750DRD)

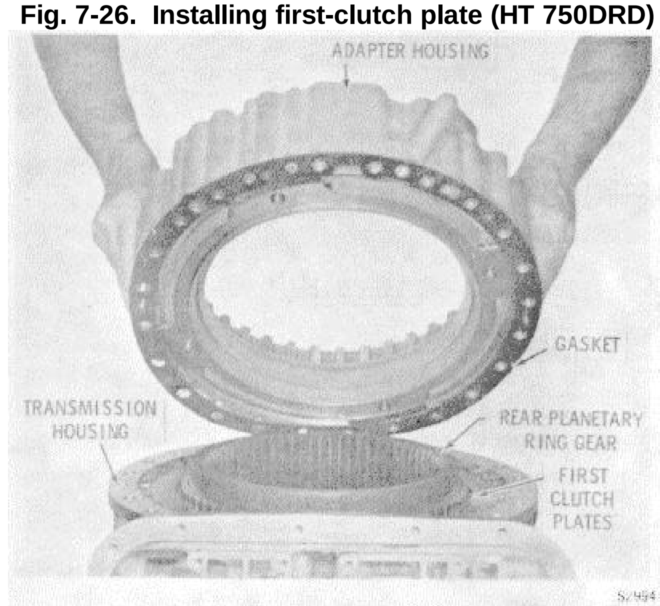


Fig. 7-27. Installing adapter housing (HT 750DRD)

(2) Carefully place the adapter housing assembly (as assembled in para 6-25) onto the transmission housing. Since the dowel pins are different in size, installation is simplified.

(3) Install four 1/8-inch cotter pins (1 1/2-inch max length) into the four oil holes

nearest the rear of the rear planetary ring gear. Refer to figure 5-51.

NOTE

Figure 4-6 illustrates a handy tool that may be easily improvised. Such a tool will ensure that the cotter pins will be removed before assembly is completed.

(4) Install gear and hub assembly 19 (A, foldout 19), larger end first, into the rear planetary ring gear. The hub will stop when it reaches the four cotter pins.

(5) Install bearing race 21 (A, foldout 18), flat side first, onto the rear of gear and hub assembly 19. Coat needle roller bearing 22 and r a c e 23 with oil-soluble grease, and install it onto race 21.

(6) Install the low planetary carrier assembly (as assembled in para 6-23) into the adapter housing (fig. 7-28).

(7) Beginning with an external-tanged plate, alternately install seven external-tanged and six internal-splined low clutch plates (fig. 7-28).

(8) Install the ball bearing 28 (A, foldout 19) onto rear hub 27 of the low ring gear.

(9) Install a bearing race, lip first, and a needle bearing onto the rear inner diameter of the low carrier assembly (fig. 7-29). Install the rear race on the front hub of the low ring gear (fig. 7-29). Retain the bearing and two races with oil-soluble grease.

(10) Install the low ring gear by carefully engaging the teeth of the gear with those of the four planetary pinions (fig. 7-29).

c. Rear Cover Assembly

(1) Install a lifting bracket onto the threaded end of the output shaft (fig. 7-30).

(2) Install the rear cover gasket onto the rear cover (fig. 7-30). Be sure the holes In the gasket align with those in the adapter housing. Retain the gasket on the rear cover with oil-soluble grease.

(3) Attach a hoist to the lifting bracket. Install the rear cover (as assembled in para 6-26) onto the adapter housing (fig. 7-30). Since the two dowel pins in the cover are of different size, installation is simplified.

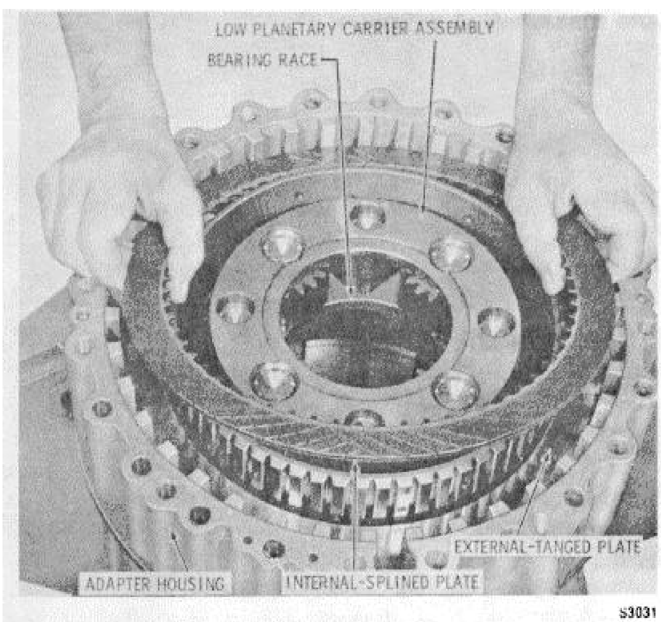


Fig. 7-28. Installing low-clutch plate (HT 750DRD)

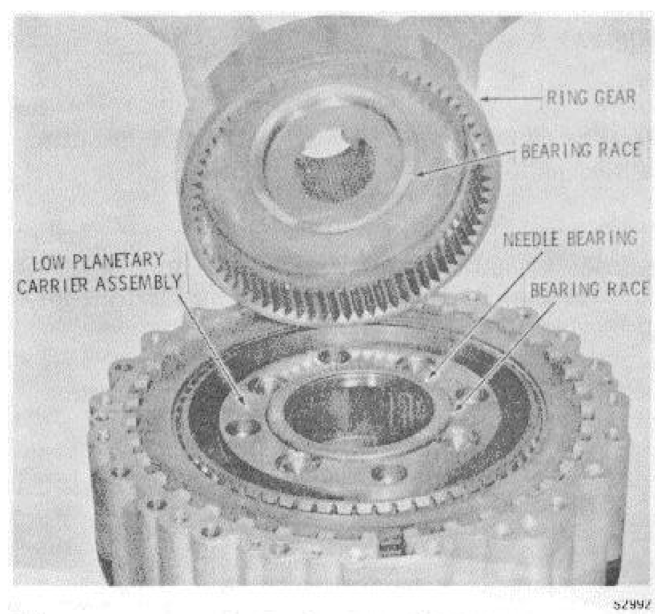


Fig. 7-29. Installing low-ring gear (HT 750DRD)

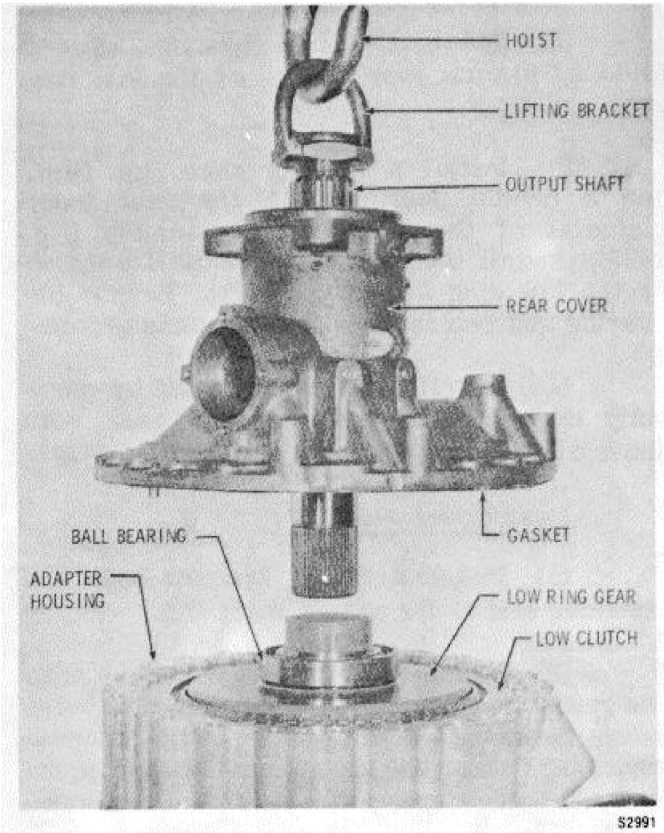


Fig. 7-30. Installing rear cover assembly (HT 750DRD)

(4) Install twenty-one 1/2-13 x 5 3/4-inch bolts and three 1/2-13 x 7 1/4-inch bolts, and washers, to retain the rear cover (fig. 7-21). Tighten the bolts to 67-80 lb ft (90-108 N•m).

(5) Install the governor assembly into the rear cover by rotating it counter-clockwise (fig. 7-22).

(6) Install the governor cover gasket and cover, and retain them with four 5/16-18 x 9/16-inch bolts. Tighten the bolts to 10-13 lb ft (14-17 N•m).

d. Temporary Installation of Transfer Gear Housing Adapter Assembly (B, foldout 19)

NOTE

For ease of handling, the drop box should not be installed until the main transmission is completely assembled.

(1) Attach a 3-strand sling to rear of adapter 10 and install the adapter.

(2) Install two 1/2-13 x 7 3/4-inch bolts 22 and lockwashers 23 into opposite holes in the bolt circle (180° apart).

(3) Tighten bolts sufficiently to retain the adapter.

(4) Invert the transmission, front upward.

7-10. INSTALLING GEAR UNIT, SECOND CLUTCH, CENTER SUPPORT (HT 750DRD, DRD DB)

a. Gear Unit, Second Clutch

(1) Remove the selective snapring that retains the center support (fig. 7-25). Remove the anchor bolt that retains the center support to the transmission housing.

(2) Install lifting bracket J-24195 onto center support and remove the support (fig. 7-24).

(3) Remove the second-clutch snap-ring. Remove the second-clutch plates. Identify the pack and keep it intact.

(4) Remove the four 1/8-inch cotter pins installed in 7-9b(3).

CAUTION

Be sure all four cotter pins have been removed from the rear planetary ring gear. (Refer to note, para 7-9b(3).)

(5) Install bearing race 18 (A, foldout 19) into the recess in the front of the sun gear and hub assembly. Retain it with oil-soluble grease.

(6) Install bearing race 16 and needle bearing 17 onto the hub of the rear carrier assembly. Retain them with oil-soluble grease.

(7) Attach lifting bracket J-24196 to the main shaft of the gear unit assembly (fig. 7-23). Attach a hoist to the eyebolt on the

lifting bracket. Lower the gear unit assembly (as assembled in para 6-21) into the transmission housing, engaging the teeth of the four carrier pinions and the internal splines in the carrier hub with the internal teeth of the rear ring gear and external splines of the output shaft respectively.

(8) Install 13 pre-selected second-clutch plates beginning with an external-tanged plate, and alternately installing seven external-tanged and six internal-splined plates (fig. 7-15).

(9) Install the white color coded snapring that retains the second-clutch plates. Be sure the snapring gap is located at the top of the transmission housing (fig. 7-31) regardless of its position when removed.

b. Center Support

CAUTION

The center support is fitted to the transmission housing with very little clearance. It may bind during installation if the housing is cold. Heat the housing slightly, if necessary. Do not use a torch to heat the housing. A sun lamp, or a current of warm air is sufficient.

(1) Install the third clutch piston assembly into the center support. The lips of the sealrings must be toward the cavity in the center support.

CAUTION

Improper installation of butt-joint sealrings may cause transmission failure. Refer to paragraph 4-6g for proper installation procedure.

(2) Install the butt-joint sealrings onto the center support hub. Attach lifting bracket J-24195 and install the center support assembly. Align the tapped hole in the support to the hole in the transmission housing (fig. 7-24).

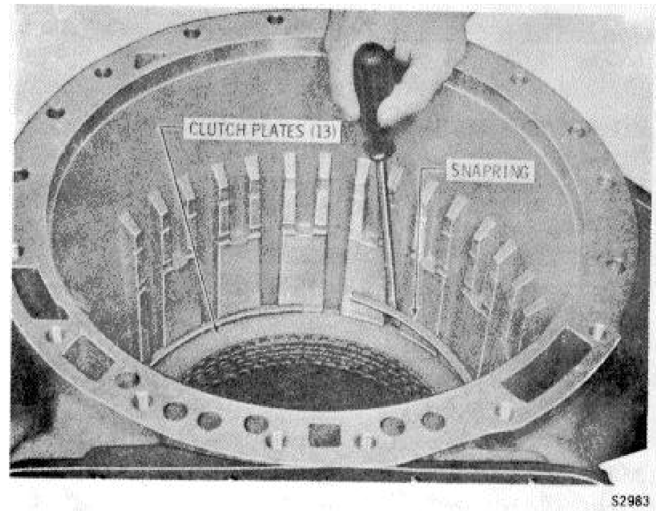


Fig. 7-31. Installing second-clutch snapring

(3) Install the special 3/8-16 x 3-inch (2 1/4-inch in earlier models) bolt and plain washer, finger-tight. Remove the lifting bracket.

NOTE

It may be necessary to compress the center support to install the selective snapring.

(4) Install the selective snapring (para 7-3b(7), above) that retains the center support (fig. 7-25). Be sure the gap of the snapring is at the top of the transmission housing, regardless of its position when removed.

7-11. INSTALLING THIRD, FOURTH, FORWARD CLUTCHES

NOTE

Two methods of checking clutch plate clearance have been established. One method is by direct measurement as outlined in items (4) and (5) below. The alternate method is by stack dimension computation outlined in paragraph 6-33. If the stack method is used, disregard items (4) and (5).

a. Third Clutch, Fourth Clutch

(1) When installing the third clutch plates (fig. 7-32), the external-tanged clutch plates must have a definite tang-to-slot relation. The tangs must be installed into the shorter, narrower slots (the wider slots are longer and extend to the second clutch plates). Figure 7-32 illustrates the proper tang-slot relationship (note the wider space between two of the tangs and its location).

(2) Install ten third-clutch plates (fig. 7-32), beginning with a thick external-tanged plate and alternately installing five external-tanged plates and five internal-splined plates. Refer to paragraph 7-2b, (1).

CAUTION

Be sure the clutch plate next to the piston is a thick plate.

(3) Install backplate 2 (B, foldout 14) and white color coded snapring 1. Be sure the gap of the snapring is at the top of the transmission housing, regardless of its position when removed.

(4) Check the third clutch clearance by inserting gage J-24193 between the snapring and the backplate of the third clutch (fig. 7-33). The clearance should be 0.060-0.120 inch (1.52-3.05 mm). Any dimension between 0.060-0.120 inch is satisfactory. However, the closer the clearance is to 0.060 inch, the longer the interval between clutch plate replacements will be. Replace worn plates with new plates to establish the desired clearance. If the assembly is satisfactory, continue assembly with b below.

(5) If the clearance is not satisfactory, replae the plates in the third clutch as required to obtain a satisfactory clearance. Refer to paragraph 7-2b, and wear limits in Section 8.

(6) Prior to the installation of the fourth-clutch assembly, be sure the bearing races at both the front and back are in place (fig. 6-46 and 6-47). Check also that the sealrings, bearing and race are in place on the center support.

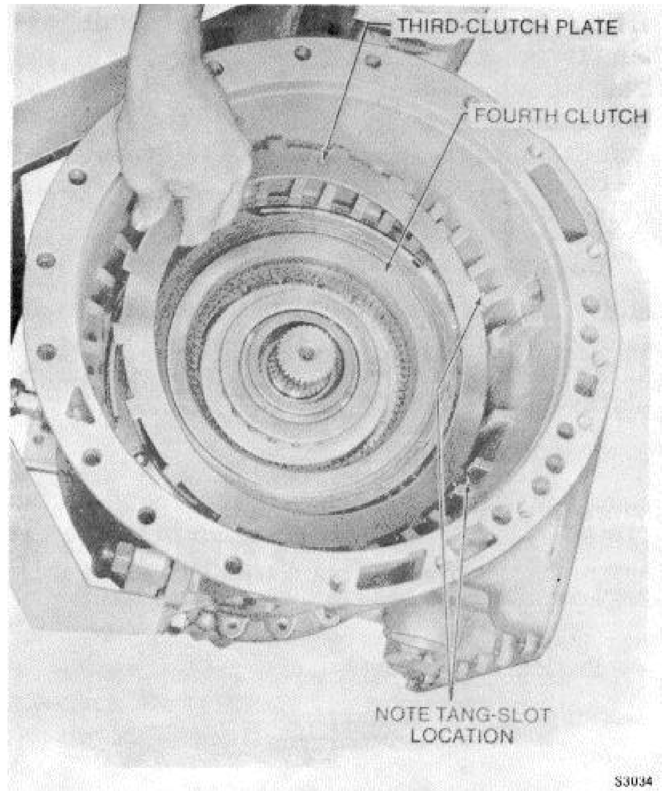


Fig. 7-32. Installing third-clutch plates

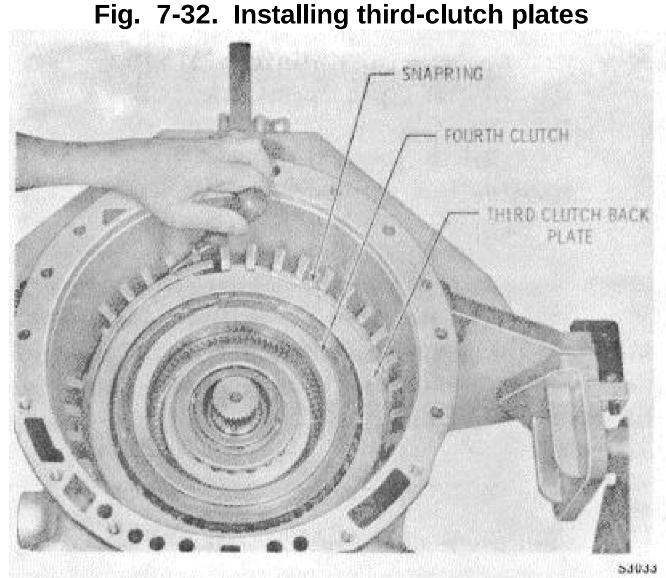


Fig. 7-33. Installing third-clutch snapring

NOTE

Do not remove the support ring from the fourth-clutch housing.

(7) Place lifting bracket J-24209 under the spring retainer of the fourth-clutch

assembly (refer to fig. 5-35). Align the internal-splines of the third-clutch plates and the sun gear shaft to the fourth-clutch housing. Install the housing.

(8) Be sure the bearing race at the top (front) of the clutch is in place. If not, lubricate it with oil-soluble grease and install.

b. Forward Clutch

WARNING

Be sure the forward-clutch hub and the fourth-clutch driving hub are installed into the forward-clutch assembly as shown in figure 6-45. If these two hubs are installed into the third-clutch housing by mistake, the transmission will operate in reverse when the driver selects any forward range.

(1) Prior to installation of the forward clutch assembly, make sure the thrust bearing race and thrust bearing have been installed at the rear of the clutch assembly. Install thrust race 2 (B, foldout 13), cup side first, onto the forward clutch hub. Install needle bearing 24 (A, foldout 13) onto the race. Refer to foldout 1. Retain the bearing and race with oil soluble grease.

(2) Install alignment fixture J-24221. Engage the fourth-clutch plates by applying air pressure to the fourth-clutch piston (fig. 7-34). If all plates do not engage tool J-24221, the fixture will rise slightly when air pressure is applied.

(3) Hold air pressure in the clutch and remove the fixture. Continue holding air pressure, and install the forward clutch assembly (with race and bearing) (fig. 7-35).

(4) Release the air pressure when the forward clutch is fully seated (forward clutch will fall slightly when air is released if the clutch is not fully seated).

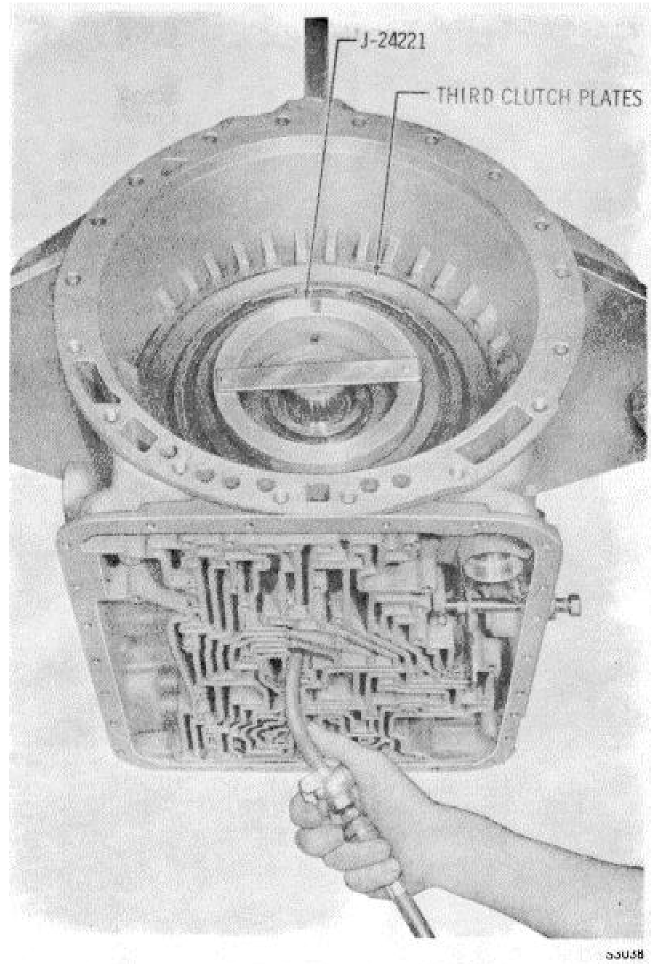


Fig. 7-34. Applying air pressure to fourth-clutch piston

(5) Make sure the thrust bearing race on the front of the forward clutch assembly is installed (fig. 7-36). If not, apply oil-soluble grease to the race and install it.

(6) Be sure to install a new center support bolt. Tighten the bolt to 39-46 lb ft (53-62 N·m), figure 7-37.

7-12. INSTALLING TORQUE CONVERTER HOUSING (models without retarder)

a. Housing With 2-Bolt Top Cover

(1) Place the converter housing assembly (as assembled in para 6-10) on the work table so that both the front and rear are accessible.

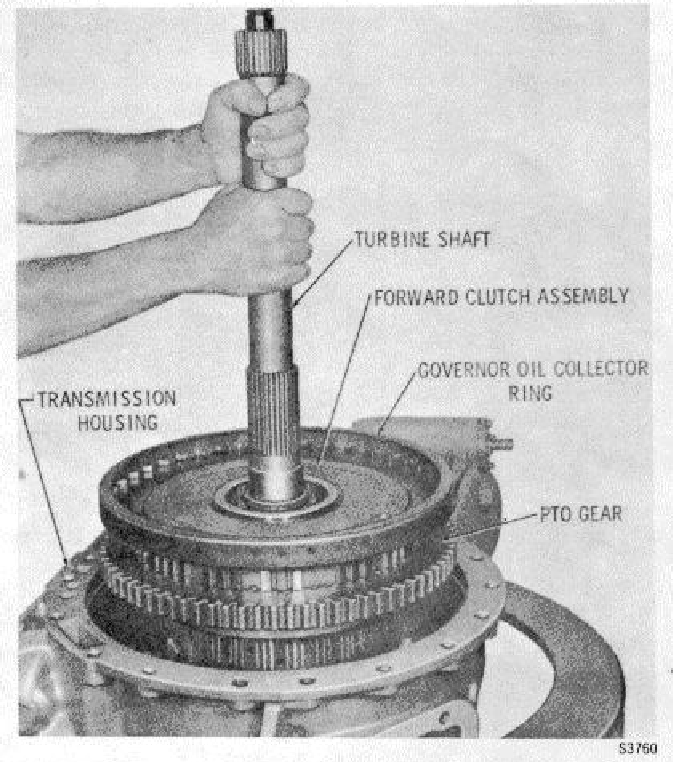


Fig. 7-35. Installing forward-clutch assembly

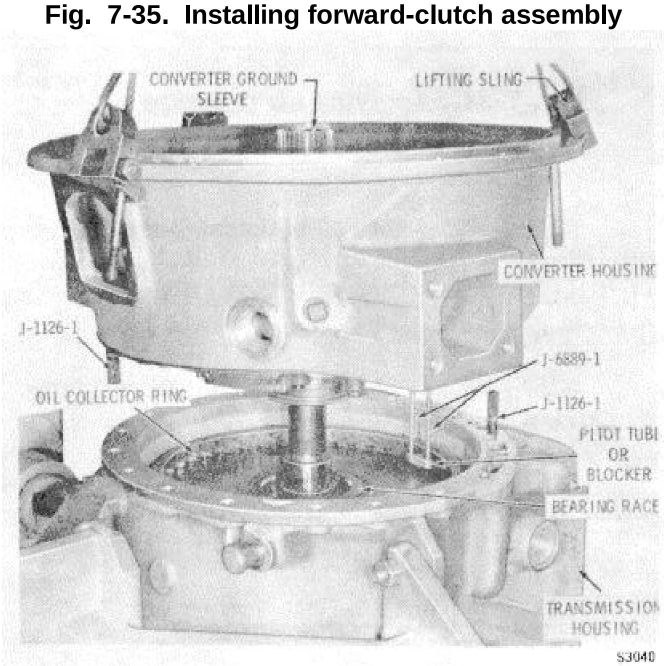


Fig. 7-36. Installing converter housing assembly

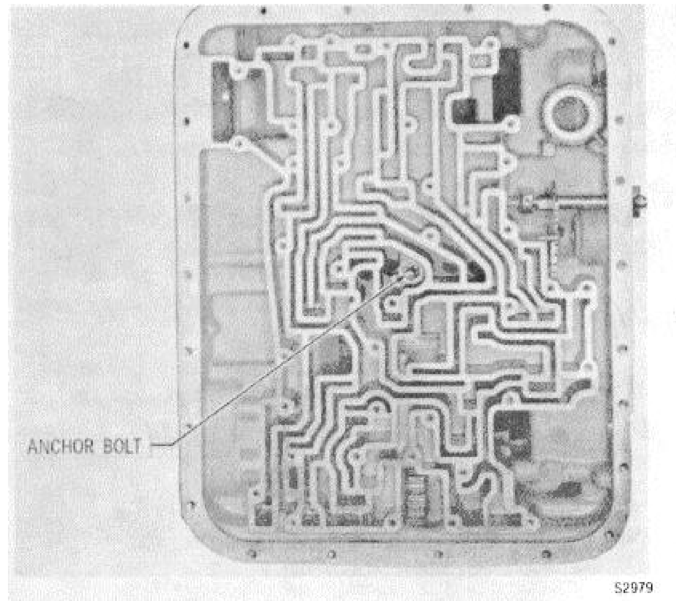


Fig. 7-37. Center support anchor bolt

(2) Make sure the thrust race and the needle bearing have been installed at the rear of the converter housing. Refer to figure 6-22.

NOTE

If assembly includes front pitot blocker 27 (A, foldout 13), it may be installed now. Tighten the screws to 30-48 in. lb (3.4-5.4 N·m). (fig. 7-39). If installed, disregard items (5) and (8) below.

CAUTION

Improper installation of the two butt-joint sealrings onto the front support hub may cause transmission failure. Refer to paragraph .4-6g for proper installation procedure.

(3) Install the butt-joint sealrings onto the front support hub. Attach a lifting sling to the converter housing (fig. 7-36). Raise the converter housing assembly above the transmission.

(4) Install two 1/2-13 x 2 3/8-inch guide screws J-1126-1, one in the converter housing and one in the transmission housing (fig. 7-36).

(5) Install two #10-32 x 6-inch guide screws J-6889-1 into the pitot tube. Exit port of pitot tube must face toward guide bolts (fig. 7-36). Install the pitot tube and guide bolts so that the guide bolts enter the screw holes in the converter housing, and entrance port of pitot tube faces outward (toward pitot collector ring) (fig. 7-36).

(6) Install the converter housing onto the transmission housing, using care to avoid damage to the pitot tube and the collector ring (fig. 7-36).

(7) Install seven 1/2-13 x 2-inch bolts and washers at the inside of the converter housing (fig. 7-38). Tighten the bolts 67-80 lb ft (90-108 N•m).

(8) Install the pitot tube screws and washers as each guide bolt is removed (fig. 7-39). Tighten the screws to 30-48 in. lb (3.4-5.4 N•m).

(9) Install nine 1/2-13 x 2-inch bolts with washers through the transmission housing into the converter housing (fig. 7-37). The two remaining bolts and washers cannot be installed until the mounting bracket is removed. Tighten the bolts to 67-80 lb ft (90-108 N•m).

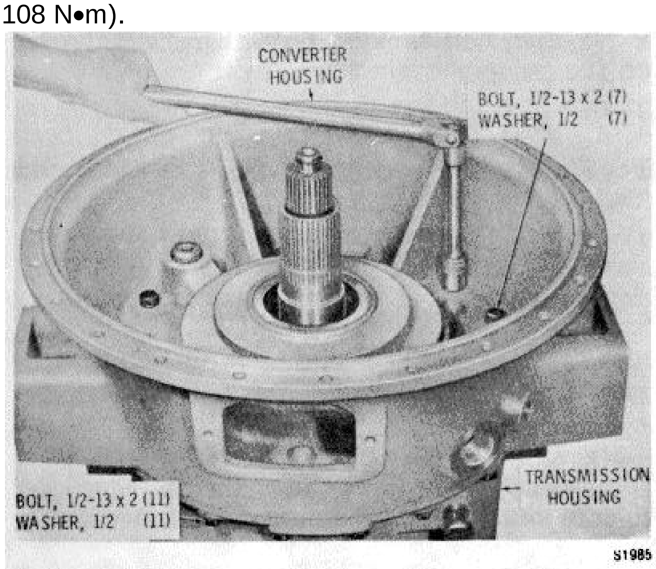


Figure 7-38. Installing converter housing bolts

(10) Tighten the center support anchor bolt to 39-46 lb ft (53-62 N•m) (fig. 7-39).

b. Housing With 8-Bolt Top Cover

(1) Refer to a(1) through (6), above, for initial installation procedures, except reference rebuild para 6-13.

(2) Install two 1/2-13 x 2 1/4-inch self-locking bolts, with flat washers, into the recessed holes in the mounting pad (at the 8 o'clock position, viewed from front of transmission, figure 7-40).

(3) Into the next bolt hole, counter-clockwise, install a 1/2-13 x 2 1/2-inch bolt, with a lockwasher.

(4) Install a 1/2-13 x 3 3/4-inch bolt, with lockwasher, at the five o'clock position (older models use a 2 1/8-inch bolt). Install

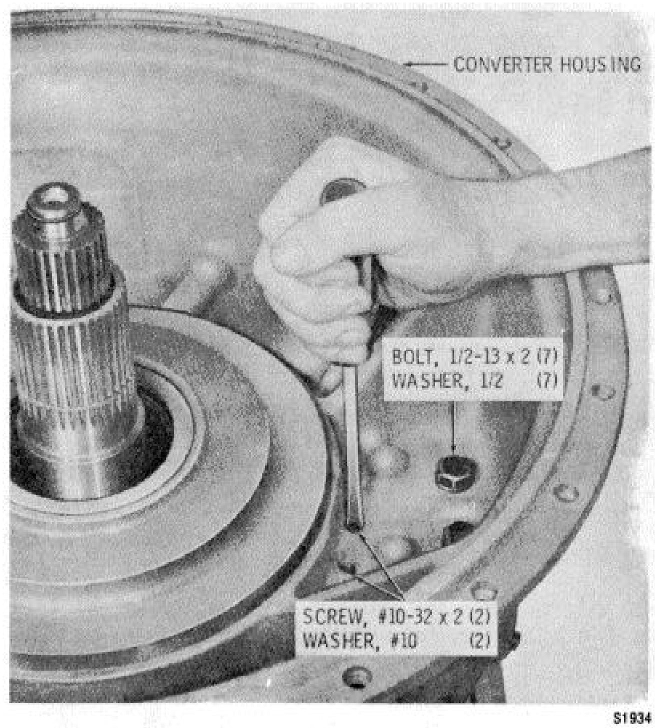


Fig. 7-39. Installing pilot tube screw

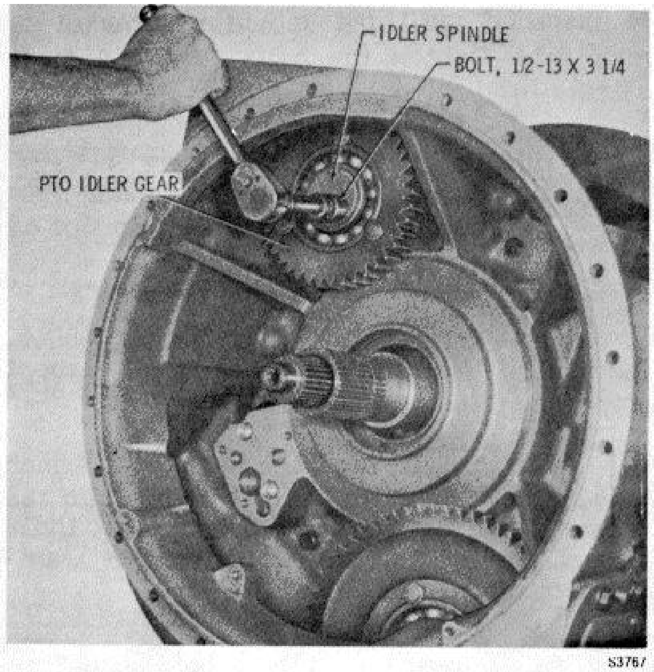


Fig. 7-40. Installing top PTO gear retaining bolt

three 1/2-13 x 2 1/8-inch bolts, with lockwashers, into the remaining holes.

(5) Tighten the two bolts installed in (2), above, to 81-97 lb ft (110-131 N•m). Tighten the remaining five bolts to 67-80 lb ft (90-108 N•m).

(6) Install the pitot tube screws and washers as each guide bolt is removed (fig. 7-39). Tighten the screws to 3-4 lb ft (4-5 N•m).

(7) Install eleven 1/213 x 2-inch bolts, with lockwashers through the front flange of the transmission housing, into the rear of the converter housing (some bolt holes may be blocked by mounting fixture-install bolts when removed from fixture). Tighten the bolts to 67-80 lb ft (90-108 N•m).

(8) For transmissions equipped with a power takeoff at the top and/or side of the converter housing, continue assembly as applicable in the following steps.

(9) On earlier models, install the PTO idler gear assembly 30 (A, foldout 12) onto the spindle near the bottom of the converter housing. Install retainer 29, lockwasher 28, and bolt 27 to retain the gear assembly. Tighten the bolt to 83-100 lb ft (113-135 N•m). On later models, install gear assembly 30 (A, foldout 12) into the converter housing. Install sealring 34 (A, foldout 11) onto spindle 35. Coat the spindle with oil-soluble grease. Align the gear with the spindle bore in the housing. Install spindle 35 by driving it forward with a soft mallet until its larger diameter seats against the inner race of the bearing in the gear. Install lockwasher 45, and the 1/2-20 x 3-3/4-inch bolt 46 to retain the spindle. Tighten the bolt to 83-100 lb ft (113-136 N•m).

(10) Install the PTO idler gear and spindle (fig. 7-40). Install the gear and spindle into the bore near the top of the converter housing, aligning the bolt hole in the spindle with the tapped hole in the housing.

(11) Retain the gear and spindle with a 1/2-13 x 3 1/4-inch self-locking bolt. Tighten the bolt to 81-97 lb ft (110-131 N•m) (fig. 7-40).

(12) Install the scavenge pump assembly onto the mounting pad (fig. 7-41). Through holes in the pump drive gear, install three 3/8-16 x 2 1/2-inch bolts, with lockwashers, to retain the pump. Install a 3/8-16 x 7/8-inch self-locking bolt to retain the lug on the pump suction tube.

(13) Tighten the pump mounting bolts to 26-32 lb ft (35-43 N•m) (fig. 7-41). Tighten the tube lug bolt to 36-43 lb ft (49-58 N•m).

7-13. INSTALLING HYDRAULIC RETARDER COMPONENTS

a. Housing, Front Support

(1) Make sure the thrust race and needle bearing have been installed at the rear of the retarder housing assembly. Also check that the needle bearing rear race is in place at the front of the forward clutch (fig. 7-42).

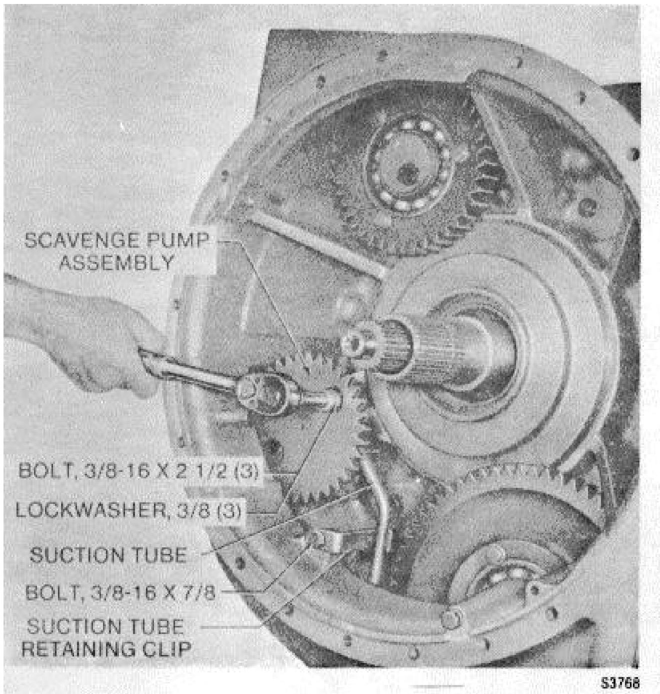


Fig. 7-41. Installing scavenge pump assembly

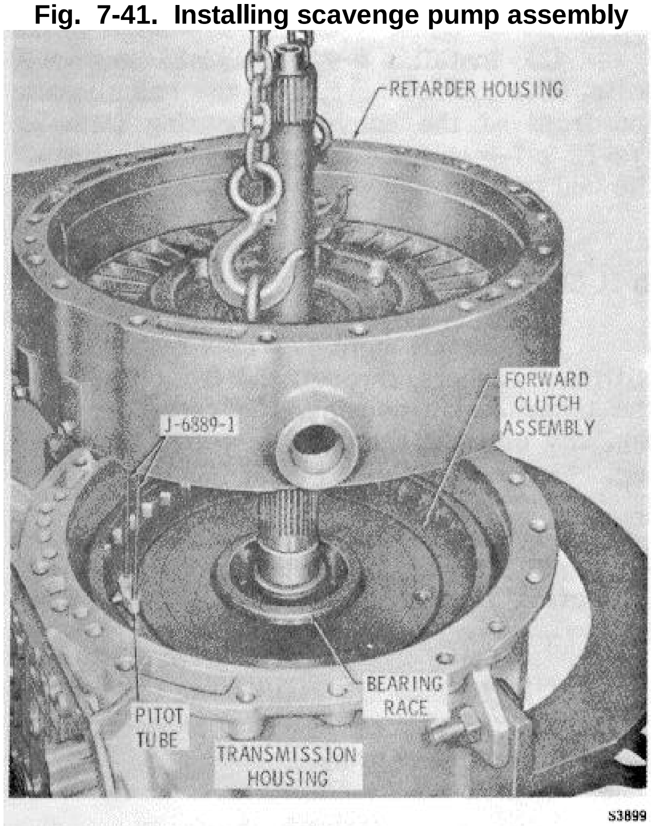


Fig. 7-42. Installing retarder housing

CAUTION

Improper installation of the two butt-joint sealrings onto the front support hub may cause transmission failure. Refer to paragraph 4-6g for proper installation procedures.

(2) Install the butt-joint sealrings onto the front support hub. Install a 1/2-13 x 7-inch headless guide bolt into a tapped hole in the front of the transmission housing.

(3) If pitot blocker 27 (A, foldout 13) is used, install it onto the rear of the front support (at rear of retarder housing. Retain the block with two screws 18 (B, foldout 12), and washers 17. Tighten the screws to 3-4 lb ft (4-5 N•m). If installed, disregard steps (3) and (6), below.

(4) Install two #10-32 x 6-inch guide screws J-6889-1 into the pitot tube. The exit port (between tapped holes) of the pitot tube must face toward the guide screws (fig. 7-42). Position the guide screws and pitot tube in the pitot collector ring so that the entrance port of the tube faces outward (toward lip of collector ring (fig. 7-42).

(5) Position the retarder housing assembly (fig. 7-42) so that the flat outer side is toward the right side of the transmission.

(6) Lower the retarder housing, engaging the guide bolt with the proper bolt hole in the housing. Then continue to lower the housing until the pitot tube guide screws enter the pitot tube screw holes. Seat the retarder housing on the transmission housing. Drop a 1/2 x 6-inch bolt into a hole opposite the 7-inch guide bolt, and align the housing until the 6-inch bolt drops freely through the hole in the transmission housing front flange.

(7) Install screws 18 (B, foldout 12) and washers 17 as each guide screw is re- moved. Tighten the screws to 3-4 lb ft (4-5 N•m).

(8) Remove the 6-inch bolt, leaving the 7-inch headless bolt in place.

b. Rotor Components

(1) Coat thrust bearing races 8 and 12 (B, foldout 12) with oil-soluble grease, and install them, flat sides first, onto the front and rear, respectively, of the hub of the retarder rotor assembly.

(2) Coat bearing assemblies 7 and 13 with oil-soluble grease, and install them onto races 8 and 12.

(3) Install race 6 (coated with oil-soluble grease) onto the front support (at rear of the converter housing assembly).

(4) Install race 14 (coated with oil-soluble grease) onto the front hub of the retarder housing (installed on transmission).

(5) Coat sealrings 9 and 11 with oil-soluble grease, and install them onto the front and rear, respectively, of the hub of the rotor assembly.

(6) Install the rotor assembly, (fig. 7-43) bolt heads upward (toward front of transmission), onto the turbine shaft splines. Seat the rotor on the thrust bearing race at the rear. When the rotor is seated, the rotor front vanes should be approximately one inch below the front surface of the retarder housing.

7-14. INSTALLING TORQUE CONVERTER HOUSING (models with retarder)

a. Housing With 2-Bolt Top Cover

(1) Make sure that bearing race 6 (B, foldout 12), and sealring 1 are in place at the rear of the converter housing assembly (as rebuilt in paragraph 6-11).

(2) Using a hoist, lower the converter housing onto the retarder housing, engaging the 1/2 x 7-inch headless guide bolt projecting from the retarder housing. The three studs engage holes in the retarder housing.

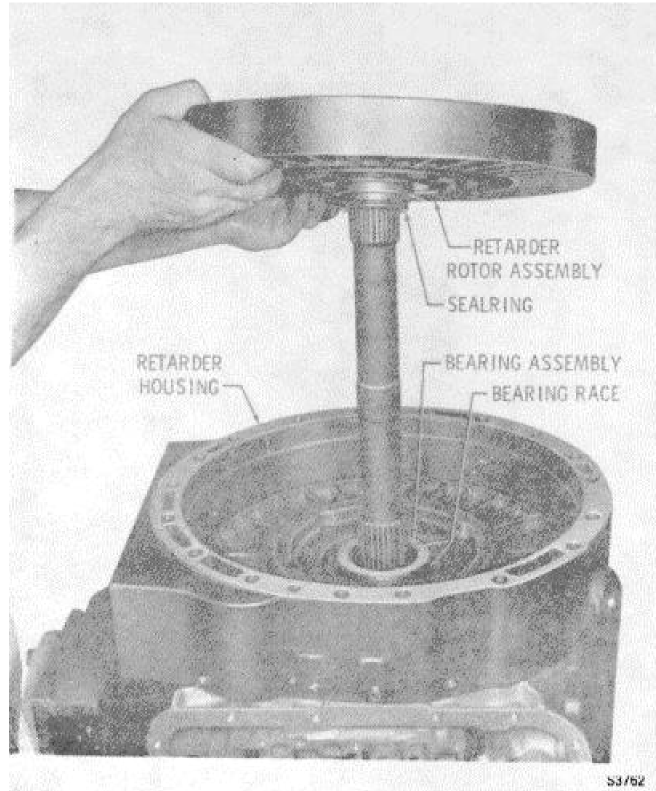


Fig. 7-43. Installing retarder rotor assembly

(3) Install seven 1/2-13 x 6-inch bolts, with lockwashers, into the holes inside the front of the converter housing (remove 1/2-13 x 7-inch headless guide bolt to install the last bolt).

(4) Tighten the seven bolts to 67-80 lb ft (90-108 N•m).

(5) Install eight 1/2-13 x 6-inch bolts, with lockwashers, through the front flange of the transmission housing, the retarder housing, and into the rear of the converter housing.

(6) Install three 1/2-inch lockwashers, and three 1/2-20 nuts onto the studs projecting through the transmission housing front flange.

(7) Tighten the eight bolts to 67-80 lb ft (90-108 N•m). Tighten the three nuts to 67-80 lb ft (91-109 N•m).

b. Housing With 8-Bolt Top Cover

(1) Make sure that bearing race 6 (B, foldout 12), and sealring 1 are in place at the

rear of the converter housing assembly (as rebuilt in paragraph 6-12).

(2) Using a hoist, lower the converter housing onto the retarder housing, engaging the 1/2 x 7-inch headless guide bolt projecting from the retarder housing (fig. 7-44). The three studs engage holes in the retarder housing.

(3) Install two 1/2-13 x 6 1/2-inch bolts, with flat washers, into the recessed holes in the scavenge pump mounting pad (fig. 7-45).

(4) Into the next bolt hole, counterclockwise, install a 1/2-13 x 6 1/4-inch (early models) or 6 1/2-inch (later models) bolt, with a lockwasher (fig. 7-45).

(5) Install a 1/2-13 x 6 1/4-inch (early models) or 7 3/4-inch (later models) b o 1 t, with a lockwasher, into the hole nearest the side PTO gear spindle (fig. 7-45). Install three 1/2-13 x 6 1/4-inch bolts, with lockwashers, into the three remaining holes.

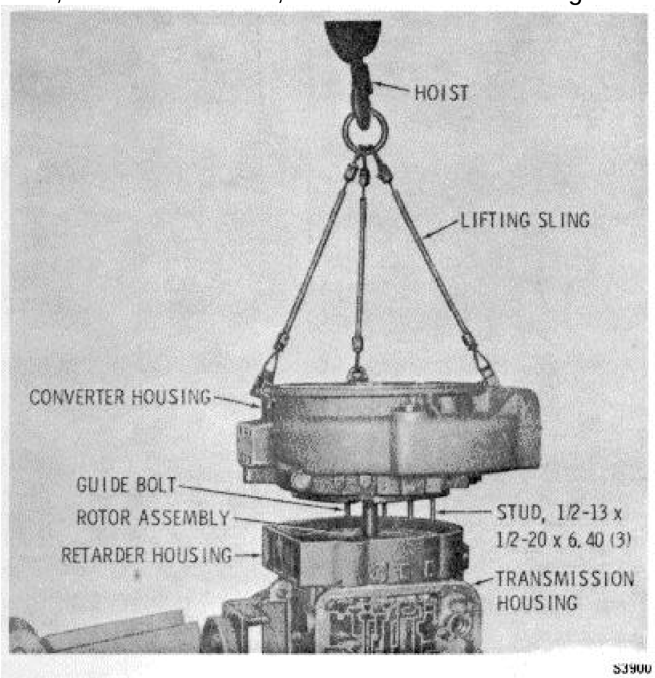


Fig. 7-44. Installing the converter housing bolts

(6) Tighten the seven bolts installed in items (3), (4) and (5) to 67-80 lb ft (90-108 N•m).

(7) Install eight 1/2-13 x 6-inch bolts, with lockwashers, through the front flange of the transmission housing, the retarder housing, and into the rear of the converter housing.

(8) Install three 1/2-inch lockwashers, and three 1/2-20 nuts onto the studs projecting through the transmission housing front flange.

(9) Tighten the eight bolts and the three nuts to 67-80 lb ft (90-108 N•m).

(10) For transmissions equipped with a power takeoff at the top and/or side of the converter housing, complete the installation as outlined in paragraph 7-12b(9) through (13).

7-15. INSTALLING TORQUE CONVERTER PUMP, STATOR ASSEMBLIES

a. Pump Assembly

(1) Install the torque converter pump assembly, as rebuilt in paragraph 6-5, onto

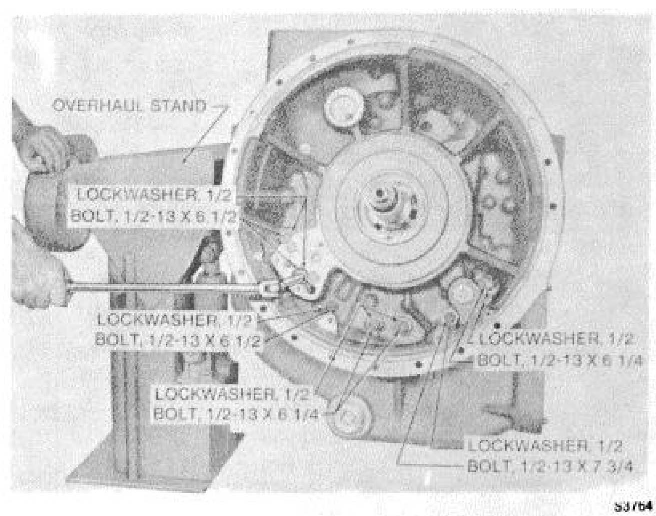


Fig. 7-45. Installing converter housing bolts (retarder models)

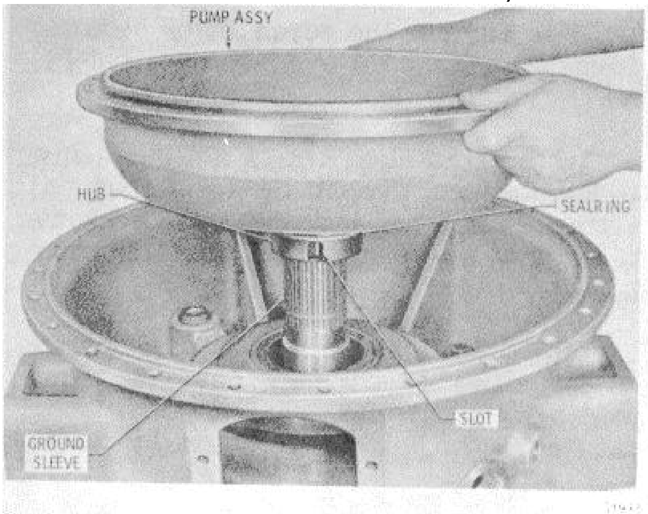


Fig. 7-46. Installing torque converter pump assembly

the ground sleeve (fig. 7-46). Check the sealring on the hub.

NOTE

After transmission S/N 2081, the pump bearing is a press fit on the ground sleeve. It may be necessary to heat the hub and bearing area of the pump assembly to 300°F (149°C) with oil before installation.

(2) Align the slots in the pump hub with tangs in the oil pump drive gear as the pump is being installed (fig. 7-46).

(3) Install spacer 27 (A, foldout 10) onto the converter ground sleeve.

(4) Place snapring 26 into tool J-26598 as follows. Close the jaws of the tool by rotating the adjusting nut (fig. 7-47). Place the snapring in the tool, under the safety guards. Position the jaws of the tool in the snapring gap. Open the jaws of the tool by rotating the adjusting nut to the stop nut.

(5) Place the fixture, with snapring 26 over the ground sleeve. Open the safety guards to position the snapring (fig. 7-48).

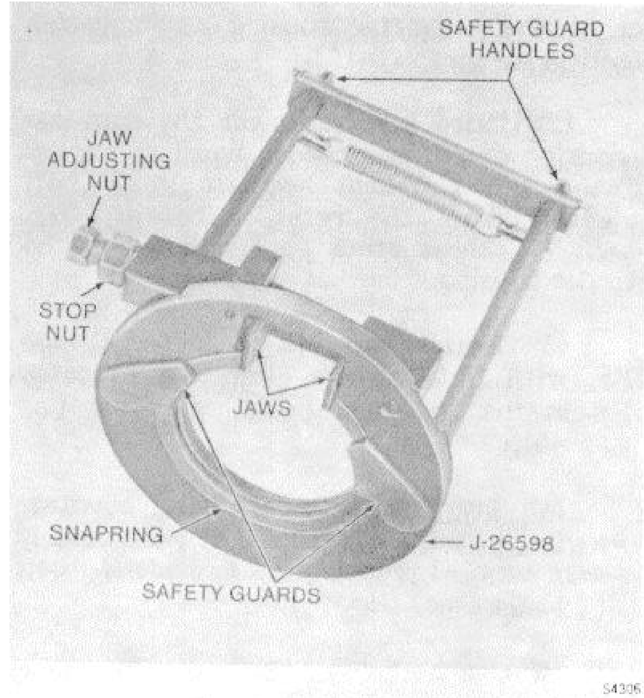


Fig. 7-47. Converter pump snapring tool

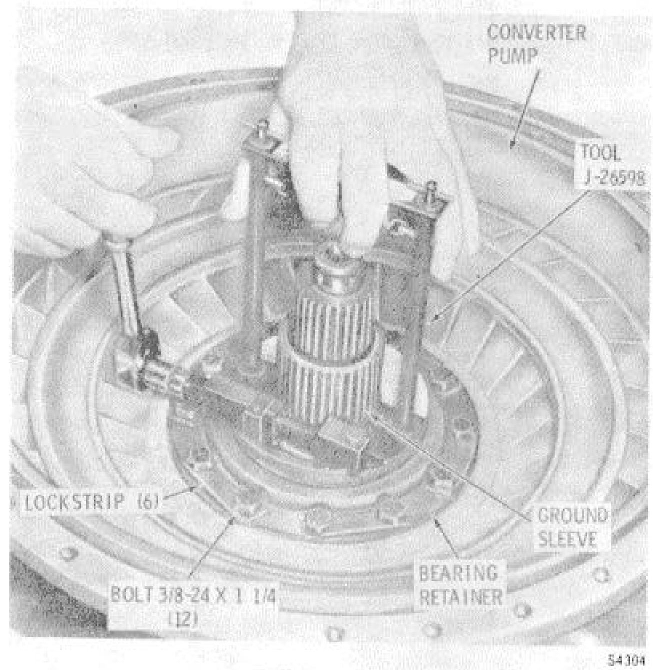


Fig. 7-48. Removing (installing) converter pump snapring

(6) Close the jaws and set the snapring in its bore In the ground sleeve. Remove the tool.

NOTE

If special tool J-26598 is not available, install the snapring with snapring pliers. Do not scrape the ground sleeve splines during installation.

(7) On models that do not include an engine-driven power takeoff, install sealring 32 (A, foldout 10) near the outer bolt holes of the pump (fig. 7-48).

b. Stator Assembly

(1) Install the freewheel roller race and stator assembly, as rebuilt in paragraph 6-4.

(2) Rotate the stator clockwise to check for freedom of rotation. The stator should lock if counterclockwise rotation is attempted.

7-16. INSTALLING VALVE BODY, OIL FILTER, OIL PAN (HT 740D, HT 747D)

a. Valve Body

(1) Install two 1/4-20 x 5-inch guide screws J-24315-3 into opposite holes in the bottom of the transmission housing (fig. 7-49).

CAUTION

Do not allow the selector valve to fall out during handling of the assembly.

(2) Install the control valve assembly (as assembled in para 6-6), onto the transmission, using the guide screws as support. The groove in the selector valve must engage the pin on the detent lever.

(3) Install the lubrication check valve baffle and retain it with two 1/4-20 x 1 1/2inch bolts marked A (fig. 7-50).

(4) Install two 1/4-20 x 1 1/2-inch bolts B and two 1/4-inch washers through the oil transfer plate and into the transmission

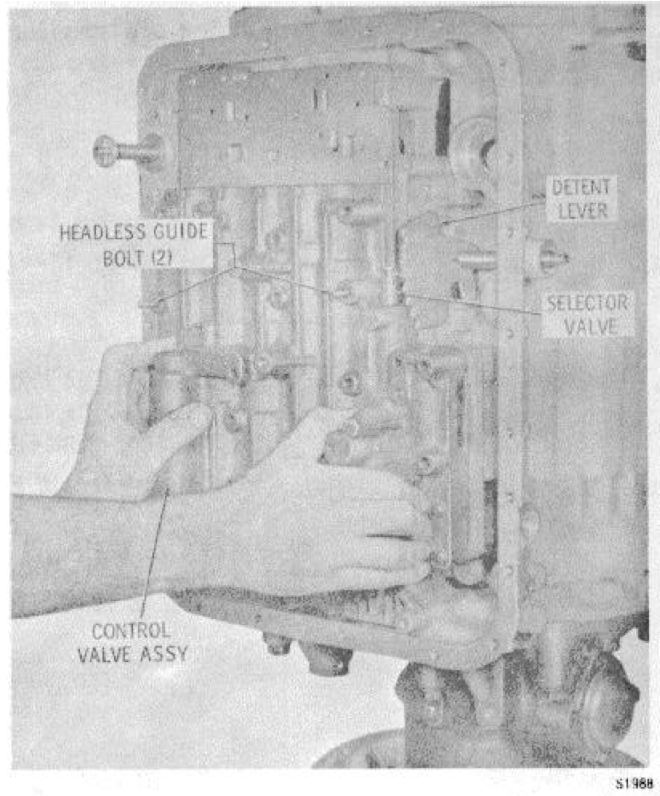


Fig. 7-49. Installing control valve assembly

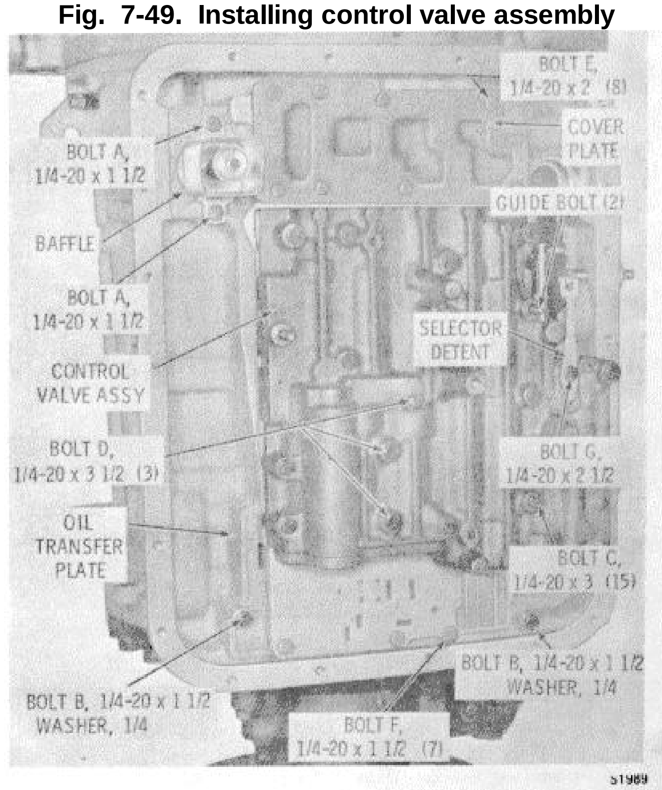


Fig. 7-50. Valve body bolt locations

housing. Bolts A and B retain the oil transfer plate, separator plate and control valve assembly to the transmission housing (fig. 7-50).

(5) Install thirteen of fifteen 1/4-20 x 3-inch bolts C (earlier models use two additional bolts-replaced in later models by two bolts D, at the lower positions in fig. 7-50) through the control valve body assembly, into the housing. Remove the two guide screws and install the two remaining C bolts. Install three (earlier models use only one bolt, at the top hole) 1/4-20 x 3 1/2-inch bolts D into the center of the valve body (fig. 7-50). Install the selector detent and retain it with one 1/4-20 x 2 1/2-inch bolt G.

(6) Install the cover plate and retain it with eight 1/4-20 x 2-inch bolts marked E (fig. 7-50).

NOTE

Some transmissions use lockup cutoff valve assembly 28 (A, foldout 21). If used, install this valve assembly instead of the cover plate in (6), above. Retain it with eight 1/4-20 x 3inch bolts.

(7) Install seven 1/4-20 x 1 1/2-inch bolts marked F through the separator plate, transfer plate, and into the transmission housing.

(8) Hold the detent in alignment over the detent lever while the 2 1/2-inch bolt is tightened to 9-11 lb ft (12-15 N-m). Tighten all (38) of the bolts to 9-11 lb ft (12-15 N-m).

(9) On models that include a lockup cutoff valve (see note following (6), above), install the signal tube as shown in figure 7-58.

<u>CAUTION</u>

The front end of the tube must be installed into the hole nearer the center of the valve body. The hole near the end of the valve body must remain open.

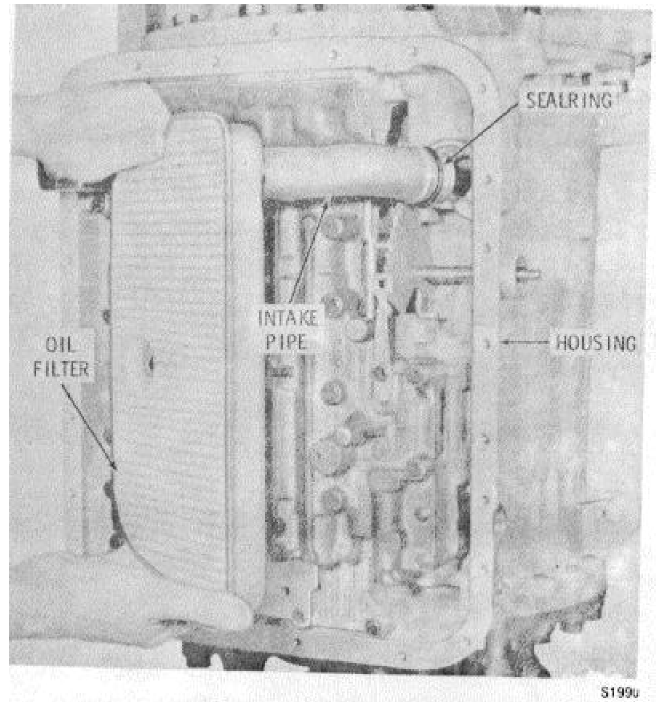


Fig. 7-51. Installing oil filter

<u>b</u>. <u>Oil Filter, Oil Pan</u>

(1) Install the sealring onto the oil intake pipe (fig. 7-51). Lubricate the sealring with oil-soluble grease.

(2) Install the oil filter making sure the intake pipe fits snugly into the housing (fig. 7-51). Do not twist the oil filter during installation-push straight inward.

NOTE

Six, seven and eight and one-half inch deep oil pans are available for the transmission. Each pan requires a different oil filter, and each filter is retained to the transmission differently. Refer to item (3) for installation of the filter with a six-inch deep oil pan; item (4) for a seven-inch deep pan; and item (5) for an eight and one-half-inch deep pan.

(3) Retain oil filter 33 (B, foldout 16) with one 5/16-18 x 1 5/8-inch bolt and one

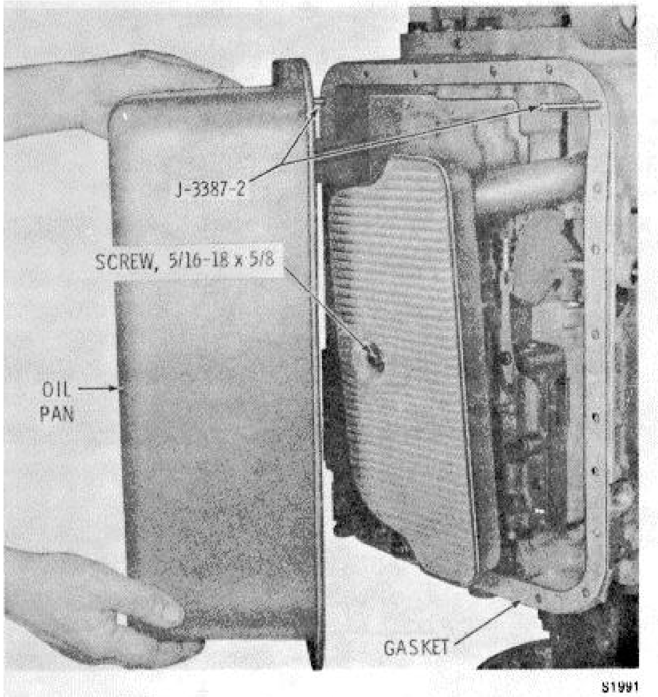


Fig. 7-52. Installing oil pan

5/16 plain washer (fig. 7-52). Later models use one 5/16-18 x 1 5/8 inch bolt and one spacer 32 located on the bolt between the oil filter and the valve body. Tighten the screw to 17-20 lb ft (23-27 N•m).

(4) Retain oil filter 24 (A, foldout 17) with one 5/16-18 x 2 3/4-inch bolt, one 5/16 plain washer and two spacers 27. Tighten the screw to 17-20 lb ft (23-27 N•m).

(5) Retain oil filter 22 (B,foldout 17) with three 5/16-18 x 3 1/4-inch bolts. Tighten the bolts to 17-20 lb ft (23-27 N•m).

(6) Install two 5/16-18 x 3-inch guide screws J-3387-2 into the transmission housing (fig. 7-52).

(7) Install a new oil pan gasket over the guide screws. Align all holes in the gasket with those in the housing (fig. 7-52).

CAUTION

Do not apply grease to a cork gasket. A cement or sealer may be applied only in the area outside the raised bead on the oil pan flange.

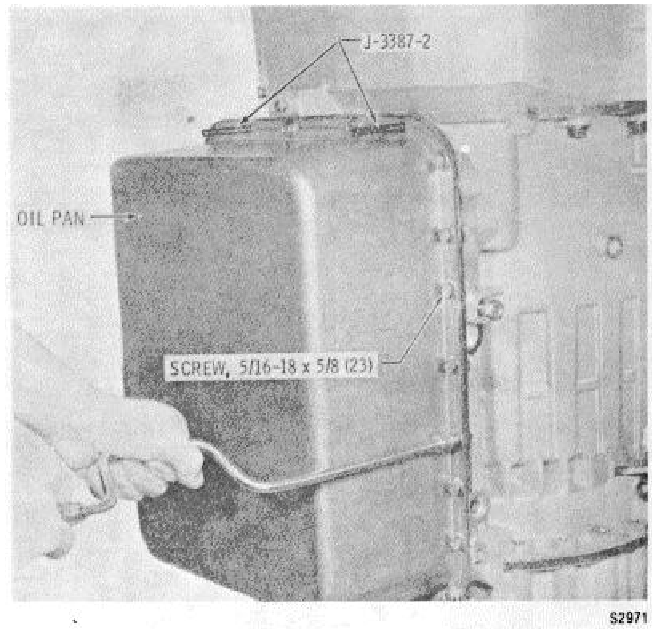


Fig. 7-53. Installing oil pan screws

(8) Install the oil pan (fig. 7-53). Install twenty-three 5/16-18 x 5/8-inch washer-head screws to retain oil pans 41 (B, foldout 16) and 29 (A, foldout 17). Install twenty-three 5/16-18 x 4 3/4-inch bolts to retain oil pan 29 (B, foldout 17). Tighten the screws evenly to 17-20 lb ft (23-27 N•m).

NOTE

To prevent leakage, pan screws must retain a 5 lb ft (7 N•m) minimum torque after gasket set.

7-17. INSTALLING VALVE BODIES, FILTER, OIL PAN (HT 750CRD, HT 754CRD, HT 750DRD, DRD DB)

a. Valve Bodies

(1) Install two guide screws J-24315-3 into opposite holes in the transmission housing (fig. 7-54).

(2) Install the control valve assembly (as assembled in para 6-6), using the guide screws as support, onto the transmission. The groove in the selector valve must engage the pin on the detent lever.

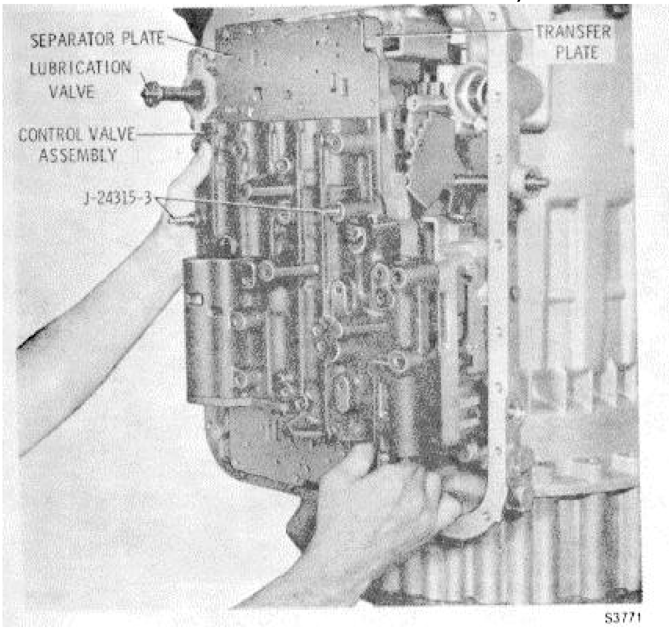


Fig. 7-54. Installing control valve body

(3) Install the lubrication check valve baffle and retain it with two 1/4-20 x 1 1/2inch bolts marked A (fig. 7-55).

(4) Install two 1/4-20 x 1 1/2-inch bolts B and two 1/4-inch washers through the oil transfer plate and into the transmission housing (fig. 7-55). Bolts A and B retain the oil transfer plate, separator plate and control valve assembly to the transmission housing (fig. 7-57).

(5) Install thirteen 1/4-20 x 3-inch bolts "C" through the valve body assembly and into the housing (fig. 7-55). Remove two guide screws (J-24315-3) and install the two remaining 1/4-20 x 3-in. bolts. Earlier models use seventeen 3-inch bolts, two of which were replaced by two 3 l/2-inch bolts at the lower "D" positions in later models. Install three 1/4-20 x 3 1/2-inch bolts "D" (earlier models use only one at the top "1D" position). Install tile selector detent and retain it with a 1/4-20 x 2 1/2-inch bolt "E".

(6) Install the lockup cutoff valve body assembly (fig. 7-56). Retain it with eight 1/4-20 x 3-inch bolts. Tighten all of the bolts to 8-12 lb ft (11-16 N•m).

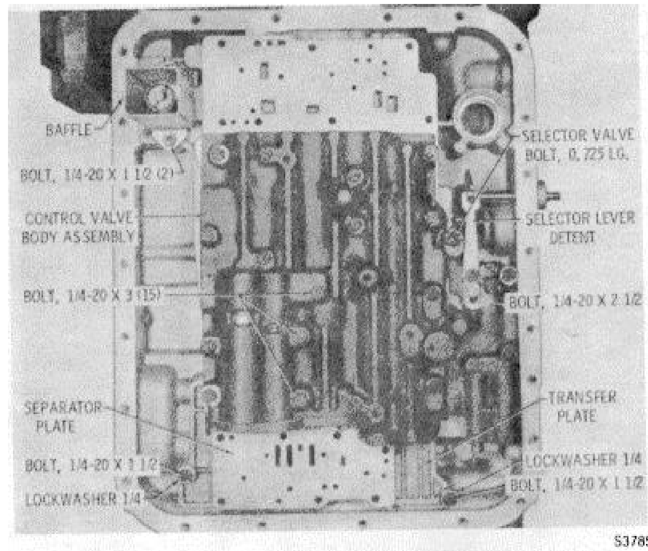


Fig. 7-55. Control valve body bolt locations

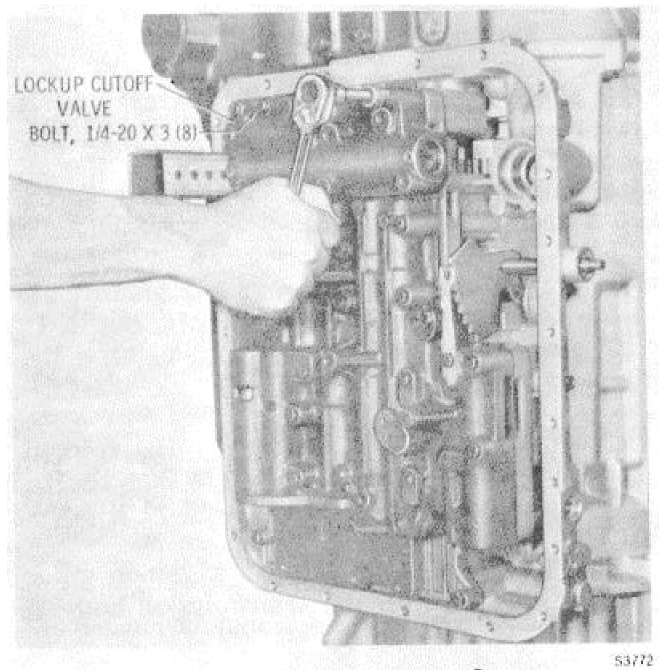


Fig. 7-56. Installing lockup cutoff valve (HT 750)

NOTE

Some transmissions use cover plate 23 (B, foldout 16), retained by eight 14-20 x 2-inch bolts 24, instead of the lockup shift valve body assembly.

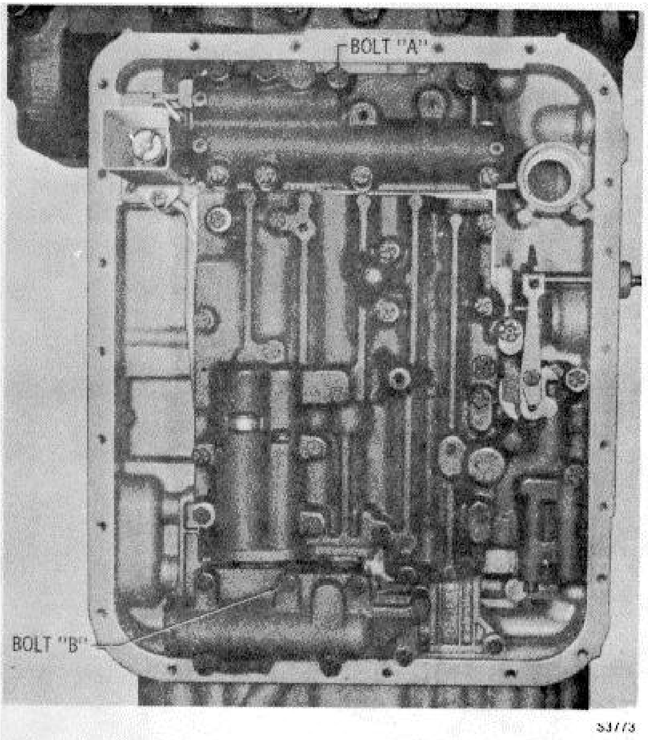


Fig. 7-57. Valve body assemblies (HT 750)

(7) Install the low shift valve body onto the lower guide screw (fig. 7-58). Retain the body with one 1/4-20 x 2 3/4-inch bolt.

(8) Install the low trimmer valve (fig. 7-58). Install six 1/4-20 x 4-inch bolts to retain the trimmer valve.

(9) Hold the detent in alignment over the detent lever while the 2 1/2-inch bolt is tightened to 9-11 lb ft (12-15 N•m). Tighten all (38) of the bolts to 9-11 lb ft (12-15 N•m).

(10) Install the signal tube (fig. 7-58).

CAUTION

On models that include a lockup cutoff valve body assembly (see note following (6), above), the signal tube must be installed into the hole nearer the center of the valve body. The hole near the end of the valve body must remain open.

b. Oil Filter, Oil Pan Refer to paragraph 7-16b, for installation procedure for the oil filter and the oil pan.

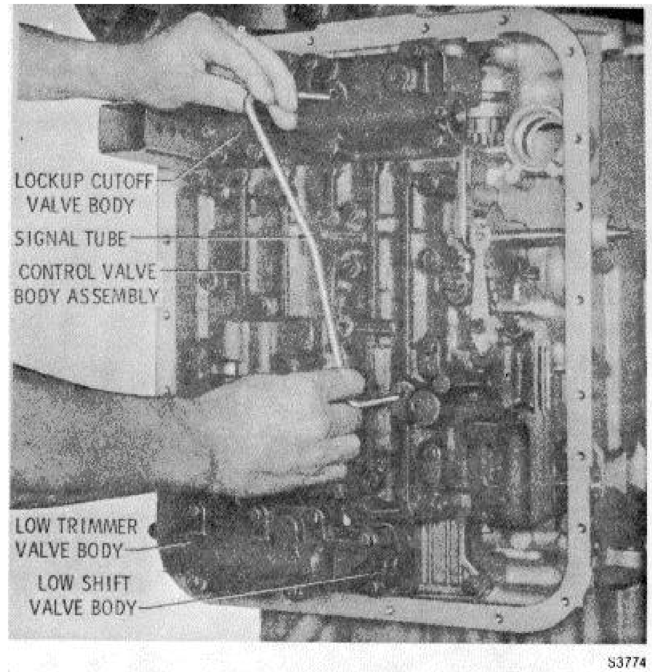


Fig. 7-58. Installing signal tube (HT 750)

7-18. INSTALLING FLYWHEEL, LOCKUP CLUTCH, TORQUE CONVERTER TURBINE

a. Align Flywheel for Installation

(1) Position the transmission horizontally (fig. 7-59).

(2) Place the flywheel assembly (as assembled in para 6-3) on a work table, ring gear side down. Install two 3/8-24 x 2-inch guide screws J-24315-2 into the flywheel mounting holes (fig. 7-59). Be sure the sealring on the end of the input shaft is in place (fig. 7-59).

(3) Carefully lift the flywheel to a vertical position and attach a lifting bracket J-24365 opposite the guide screw. Retain the bracket with 1/2-20 bolts.

(4) Attach a hoist to the lifting bracket. Align the flywheel assembly with the transmission (fig. 7-59).

b. Installation

(1) Push flywheel assembly straight onto the transmission, aligning guide screw J-24315-2 with one bolt hole in the converter

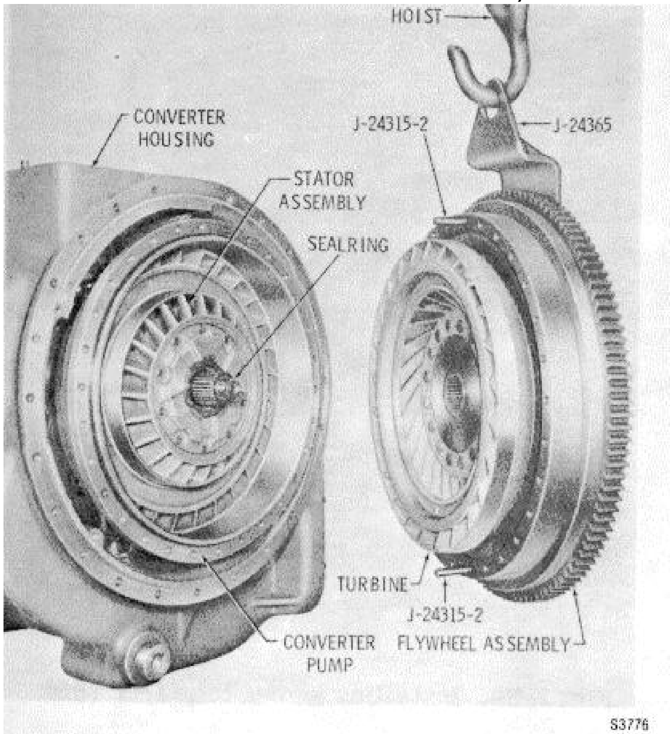


Fig. 7-59. Installing flywheel and turbine

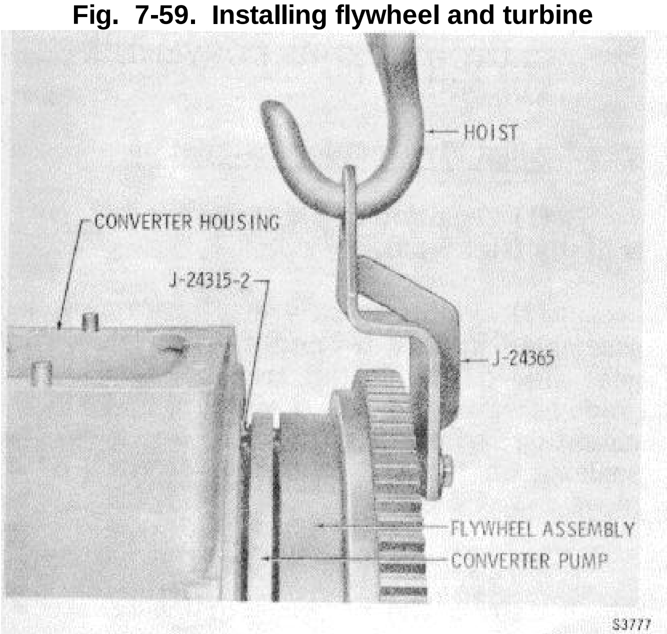


Fig. 7-60. Installing flywheel onto the converter pump

pump. Engage turbine splines with the forward clutch shaft splines (fig. 7-60).

(2) Using the access hole at the top of the converter housing install one 3/8-24 x 1 1/4-inch b o l t and one 3/8 flat washer through the converter housing into the flywheel assembly (fig. 7-61).

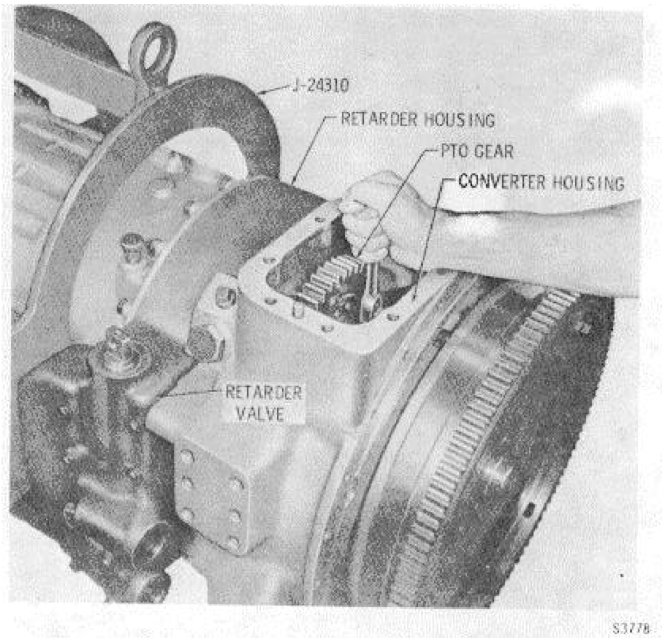


Fig. 7-61. Installing flywheel retaining bolts

(3) Release the hoist and remove the lifting bracket.

(4) Install the remaining 29 bolts and flat washers (fig. 7-61). Prior to Installing the last bolt and washer, remove guide screw J-24315-2.

(5) Tighten the bolts to 41-49 lb ft (56-66 N•m).

c. Transmission Front Cover (B, foldout 9) (Remote Mounting)

NOTE

Bearing 6 (B, foldout 9) with only one side shielded should be replaced with a sealed bearing. Refer to current Parts Catalog SA 1268. If the bearing with only one side shielded is not replaced, fill the cavity in the front cover between the outside seal and bearing 6 half full of high temperature grease.

(1) If bearing 6 (B, foldout 9) was removed from converter drive housing 7, install a new sealed bearing. Seat the bearing against the hub shoulder.

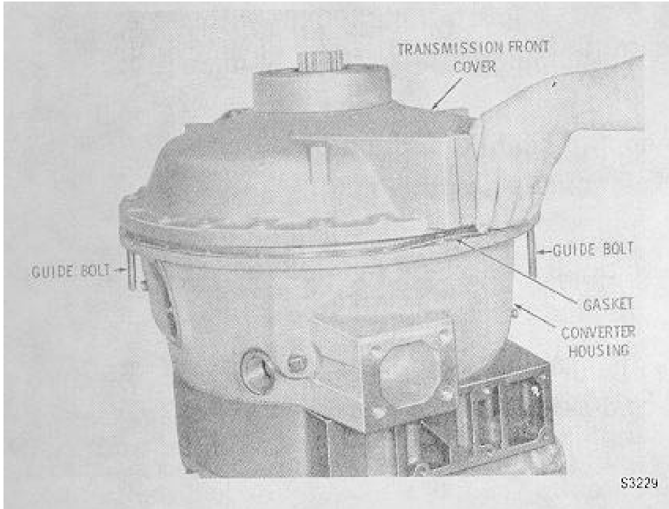


Fig. 7-62. Installing transmission front cover.

(2) Install two 7/16-inch headless guide bolts into the front cover, 1800 apart (fig. 7-62).

(3) Install cover gasket (fig. 7-62).

(4) Install the front cover gasket onto the converter housing (fig. 7-62).

(5) Install twenty of twenty-two 7/16-14 x 1 1/2-inch bolts and lockwashers through the converter housing into the input drive cover. Remove the guide bolts and install the remaining two bolts and lockwashers. Tighten bolts to 42 to 50 pound feet (57 to 68 N-m).

7-19. INSTALLING EXTERNAL COMPONENTS.

a. External Components

(1) Install the modulator pressure valve actuator rod (fig. 7-63). Retain the rod with a plastic cup plug.

(2) Install the modulator valve retainer and secure it with one 5/16-18 x 9/16inch bolt (fig. 7-64). Do not tighten the bolt at this time (modulator actuator will be installed when the transmission goes into the vehicle).

(3) On transmissions equipped with a 2-bolt top cover, install items 1 through 3 (B, foldout 11). Tighten the bolts to 26-32 lb ft (35-43 N•m).

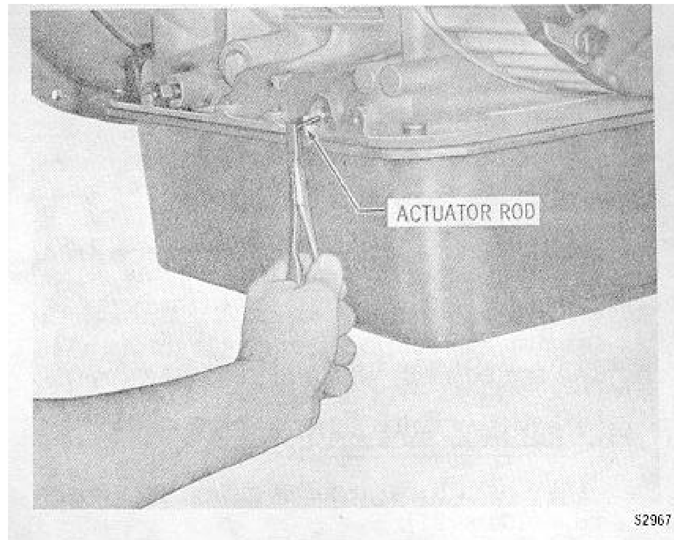


Fig. 7-63. Installing modulator actuator rod.

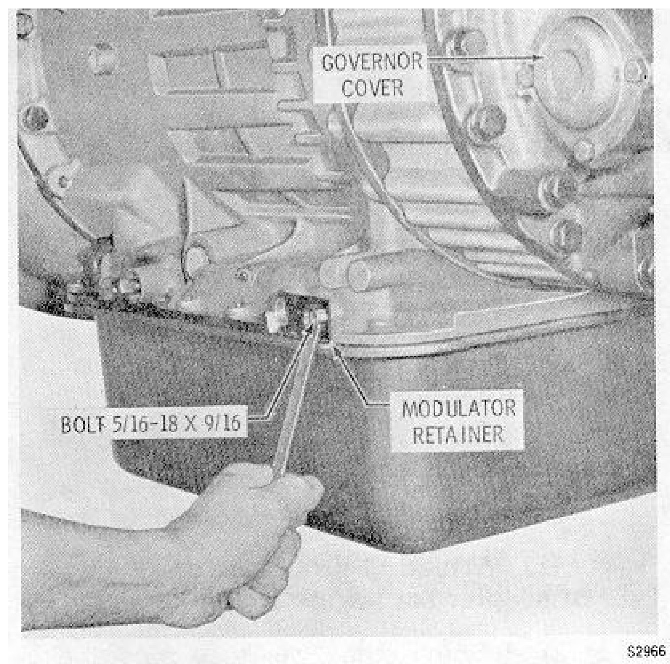


Fig. 7-64. Installing modulator actuator retainer.

(4) On transmissions equipped with a six-bolt cover on the transmission housing, install items 58, 59, 60, and 61 (B, foldout 16). Tighten the bolts to 15-20 lb ft (20-27 N.m).

NOTE

To prevent leakage, pan screws must retain a 5 lb ft (7 N•m) minimum torque after gasket set.

(5) On transmissions equipped with an eight-bolt top and/or side cover on the converter housing, install items 21 through 24 (A, foldout 11) and/or items 41 through 44. Tighten the bolts to 42-50 lb ft (57-68 N.m).

b. Retarder Valve Body

(1) Install retarder valve body gasket 8 (B, foldout 21).

(2) Install retarder control valve body assembly 9 onto the retarder housing.

(3) Retain the valve body with four 3/8-16 x 2 5/8-inch bolts, two 3/8-16 x 3 3/4-inch bolts, and two 3/8-16 x 4 3/4-inch bolts (all with lockwashers). Tighten the eight bolts evenly to 26-32 lb ft (35-43 N.m).

7-20. INSTALLATION OF TRANSFER GEAR HOUSING ADAPTER ASSEMBLY, TRANSFER GEAR HOUSING, DISCONNECT CLUTCHES, OUTPUT, INPUT FLANGES

a. Transfer Gear Housing Adapter Assembly (B, foldout 19)

(1) Attach 3-strand lifting sling to rear of adapter housing assembly 9.

(2) Remove the two bolts and lockwashers installed temporarily in paragraph 7-9d.

(3) Lift off assembled adapter assembly 10.

(4) Install output shaft assembly 32 or 38 onto end of transmission main shaft.

CAUTION

Do not bump governor support pin 13.

(5) Install gasket 8 with holes and cutouts aligned with those in main housing.

(6) Lubricate sealing lip of seal 11 and the sealing surface of output shaft with oil-soluble grease.

(7) Carefully lift housing adapter assembly 9 into place over the shaft and guide the shaft through seal 11.

(8) Lower housing adapter carefully and engage dowel pins 14 and 15.

(9) Install twenty-two 1/2-13 x 5-3/4 inch bolts, two 1/2-13 x 7-3/4 inch bolts and twenty-four 1/2 inch lockwashers. Tighten the twenty-four bolts to 67 to 80 lb ft (91 to 108 N-m). Remove the hoist.

(10) Carefully install transfer drive gear 2 (A, foldout 22) with bearings 1 and 3 in place. Install gear 2 long hub end first onto output shaft.

CAUTION

Avoid any side movement of the shaft that can damage seal or governor support pin.

(11) If a threaded-end shaft is used, install the special 2-16 nut 43 (B, foldout 19) on end of shaft assembly.

(12) Tighten the nut to 15 to 20 lb ft (20 to 27 N-m) and stake the lip of the nut into the rear of the gear at one of the six slots in gear hub.

CAUTION

Front section of transmission must not be moved before installing the dropbox. Rearward movement could allow the output drive shaft to damage the governor support pin and rear seal.

b. Transfer Gear Housing (dropbox)

(1) Attach hoist and lifting bracket or 3-strand sling to the rear of the assembled transfer gear housing and hit the housing into position over the transmission front section.

(2) Check the angular position of the dropbox as marked at disassembly in paragraph 5-4. Install rear gasket 44 (B, foldout 19), aligning holes with those in adapter housing.

(3) Carefully lower the dropbox into place and seat bearing 3 (A, foldout 22) into the bearing bore in the dropbox.

(4) Install twenty-one 1/2-13 x 1-3/4 inch bolts 18 (B, foldout 19), with lockwashers 19, through the thicker bosses.

(5) Install three 1/2-13 x 1 3/8 inch bolts 25, with lockwasher 24, into the remaining three holes having thinner bosses. Tighten the 24 bolts to 67 to 80 lb ft (91 to 108 N-m).

(6) If cup plug 9 (B, foldout 22) used with shaft assembly 32 (B, foldout 19) was removed, coat the OD of the plug lightly with nonhardening sealer, and with cup side out, press the plug to the bottom of the bore.

c. Output Manual Disconnect Clutches

NOTE

The assembly parts and procedure for installing the upper rear, lower rear and lower front disconnect clutch housings to the transfer gear housing is similar. The installation procedure listed below is for only one disconnect clutch housing, but is applicable for all three disconnect housing installations. All peculiar parts will be noted.

(1) Install manual disconnect output clutch gasket 30 (A, foldout 23).

(2) Position and install disconnect housing 35, and associated parts as assembled in paragraph 6-32.

(3) Install two 1/2-13 x 2 1/2 inch bolts 37 and lockwasher 36. Install four 1/2-13 x 1 1/2 inch bolts 41 and lockwasher 42. Tighten all six bolts to 67 to 80 lb ft (91 to 108 N-m).

NOTE

Note the size of the bolts used to retain the disconnect housing to the transfer gear housing for each of the disconnect assemblies.

d. Installing Output, Input Flanges

(1) Install output flanges as required. The nuts that retain the flanges and the threads on the output shaft should be lubricated before installing the nut. Tighten the nut to 600 to 800 lb ft (813 to 1085 N•m). Refer to paragraph 3-14.

(2) Install flanges onto the manual disconnect output shafts. Install retainer 3 (B, foldout 23) or retainer 22 or 55 (A, foldout 23). Install the retainer bolts and tighten them sufficiently to ensure that the flange is firmly seated. Reference paragraph 3-16b, (2) thru (5).

(3) Remove the bolts and retainer. Select a combination of shims 4 and 5 (B, foldout 23) or 20 and 21 or 53 and 54 (A, foldout 23) that will be 0.008 to 0.012 inch (0.20 to 0.30 mm) less than the space between the flange retainer (against the counterbore in flange) and the end of the output shaft.

(4) Install the shims, retainer, lockstrip and two bolts. Tighten the bolts to 96 to 115 lb ft (130 to 156 N•m). Bend a corner of the lockstrip against each bolt head.

e. Bearing Retainer & Cover

(1) If cover 3 (B, foldout 22) was used on the lower front position of the dropbox, install gasket 4 and cover 3. Retain the cover with eight 1/2-13 x 1 1/4-inch bolts and eight lockwashers. Tighten the bolt to 67 to 80 lb ft (91 to 108 N•m).

(2) If bearing retainer 12 (B, foldout 22) was used on the lower rear position of the dropbox, install retainer gasket 8 and retainer assembly 12. Fasten the retainer onto the dropbox with eight 1/2-13 x 1 1/4-inch bolts 11 and lockwashers 10. Tighten the bolts to 67 to 80 lb ft (91 to 108 N•m).

7-21. REMOVING TRANSMISSION FROM OVER-HAUL STAND.

a. Attach a hoist to the holding fixture that is secured to the transmission.

b. Remove all fasteners that retain the holding fixture and the transmission to the overhaul stand. Remove the transmission and fixture from the overhaul stand.

c. Remove the four bolts and nuts that retain the holding fixture to the transmission. Remove the fixture.

d. Install any nuts, bolts or washers that may have been blocked by the transmission holding fixture (fig. 7-65). Tighten the nuts to 83-100 lb ft (113-115 N•m); tighten the bolts to 67-80 lb ft (90-108 N•m).

7-22. CHECKING SHIFT POINTS.

Refer to paragraph 3-10 for procedures covering checking and adjusting shift point speeds.

7-23. POWER TAKEOFF COMPONENTS.

a. Existing Installation

(1) Space limitations will determine whether the PTO should be installed before or after the transmission is installed.

(2) The prescribed backlash between the drive gear (in transmission) and the driven gear (in PTO) is 0.005 to 0.025 inch (0.127 to 0.635 mm) for engine-driven PTO-in converter housing.

(3) The prescribed backlash for converter driven PTO units is 0.018 to 0.024 inch.

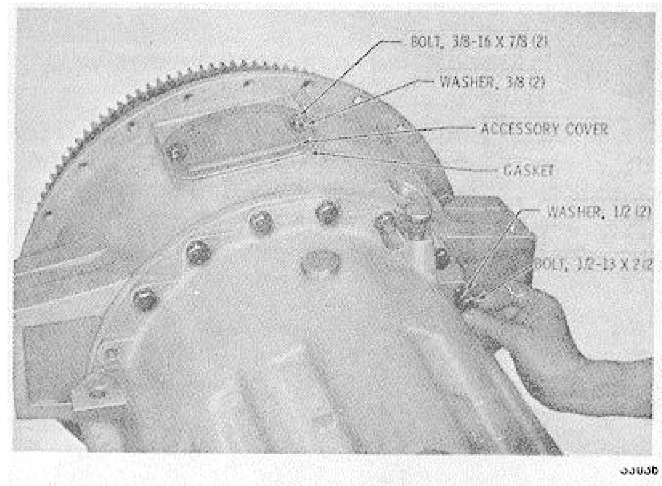


Fig. 7-65. Installing converter housing retainer bolt.

(0.457 to 0.610 mm) prior to S/N 32403 and 0.006 to 0.012 inch (0.15 to 0.30 mm) after S/N 32403.

CAUTION

Cork or other soft gasket material cannot be used to mount the PTO. Use only the shims or gaskets recommended by the PTO manufacturer.

(4) Install two headless guide bolts, one into the top and one into the bottom of the PTO mounting pad. Place the required shims or gasket on the guide bolts.

CAUTION

The transmission and PTO can be damaged if the PTO is installed with its driven gear to the front of the PTO drive gear.

(5) If the PTO has a manual disconnect, be sure that the disconnect lever is in the disconnect position. When the PTO is installed on the mounting pad, the PTO driven gear must be to the rear of the PTO drive gear in the transmission.

(6) Install the PTO on the mounting pad.

(7) Connect the lubrication line (if used).

b. New Installation

(1) Contact Detroit Diesel Allison Division for approval of planned installation, or for recommendations.

(2) Speeds, type of duty, power requirements, and other factors must be considered when adding a PTO to a transmission. If the job requirements of the PTO cannot be fully met by the transmission, the installation will not be satisfactory. Also, the transmission could be damaged.

(3) Follow all of the recommendations in a, above.

(4) If a lubrication source is required, the return line from cooler-to-transmission may be tapped. Provide a 0.060-0.110 inch (1.52-2.79 mm) restriction in the lubrication circuit for engine-driven PTO, or, 0.032-inch (0.81 mm) restriction for converter-driven PTO. This restriction is usually provided in the PTO.

Section 8. WEAR LIMITS AND SPRING DATA

8-1. SCOPE

This section tabulates wear limits and spring data.

8-2. WEAR LIMITS DATA

a. Maximum Variations 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 views (foldouts 9 through 23) in the back of this manual.

b. Cleaning, Inspection. Parts must be clean to permit effective inspection for wear or damage. Refer to Section 4.

c. Bearings, Bearing Journals, Bores 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 in the transmission.

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 w e a r of a gear. The backlash tolerances are of such nature that 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 such 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 w i t h maximum wear of 0.005 inch (0.13 mm). The sides of the groove into which the sealrings fit should be smooth within 50 microinch (1.27 micrometers) and square with the axis of rotation within 0.002 inch (0.05 mm). A new sealring should be installed if grooves are reworked or if there is wear on the sealring outside diameter.

g. Oil Seals. Seals should be replaced if they s h o w signs of excessive hardening, scoring, cracking or o t h e r indications of deterioration. (See Section 4.)

8-3. 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 the spring chart.

b. Inspection criteria (load vs. height) and identification characteristics of the springs are presented in Table 8-2. The spring data are keyed to the exploded views (foldouts 9 through 23) in the back of this manual.

NOTE

When more than one spring part number is listed for the same location, refer to the HT 700 Series Parts Catalog SA 1268 to determine which spring is used in your specific assembly number.

Table 8-1. WEAR LIMITS

Illustration	Part Number	Description	Wear Limit in.	(mm)
A, foldout 10		TORQUE CONVERTER AND LOCKUP CLUTCH		
3	23011093	Piston - face wear	0.010	0.25
*4	6833972	Plate - thickness	0.190	4.83
*4	23010437	Plate - thickness	0.190	4.83
5	23010300	Backplate - face wear	0.010	0.25
5	23016957	Backplate - face wear	0.010	0.25
13	6772462	Stator assembly (TC 470):		
13	6837167	Stator assembly (TC 495):		
13	23011393	Stator assembly (TC 497):		
13	6881898	Stator assembly (TC 498):		
13	6838360	Stator assembly (TC 499):		
		roller thrust washer - thickness	0.022	0.56
		front thrust washer - inside diameter	4.016	102.01
		front thrust washer - thickness	0.460	11.68
		rear thrust washer - inside diameter	4.018	102.06
22	9417722	Thrust bearing race - thickness	0.029	0.74
24	6772293	Roller race -outside diameter	3.998	101.55
B, foldout 10		OIL PUMP ASSEMBLY		
3, 5, 10	6839665 or 6834738 6880834 6771084 6834739 or 6838844	Body, gear, and cover:		
		Gear 5 end clearance between body 3 and cover 10	0.006	0.15
3, 7, 10	6839665 or 6834738 6880834 6834979 6834739 or 6838844	Body, gear and cover:		
		Gear 7 end clearance between body 3 and cover 10	0.006	0.15
A, foldout 12		SCAVENGE OIL PUMP		
9, 11, 13 6771072	6773625	Body, gear, and plate		

*Minimum depth of oil grooves - 0.008 inch (0.20 mm).

Table 8-1. WEAR LIMITS (cont)

Illustration	Part Number	Description	Wear Limit in.	(mm)
A, foldout 12		SCAVENGE OIL PUMP (cont)		
	6773624			
		Gear 11 end clearance between body 9, plate 13	0.007	0.18
9, 18, 13	6773625	Body, gear, and plate		
	6771151			
	6773624			
		Gear 18 end clearance between body 9, plate 13	0.007	0.18
B, foldout 13		FORWARD CLUTCH		
20	6834679	External-tanged clutch plate:		
		Thickness	0.0993	2.522
		Cone	0.010	0.25
*21	6835687	Internal-splined clutch plate - thickness	0.090	2.29
22	6835605	Fourth-clutch driving hub:		
		Friction face thickness	0.390	9.91
		Forward clutch running clearance (refer to para 6-17)		
A, foldout 14		FOURTH-CLUTCH ASSEMBLY		
3	23011235	Clutch backplate - thickness	0.390	9.91
*4	6835687	Internal-splined clutch plate - thickness	0.090	2.29
5	6834679	External-tanged clutch plate:		
		Thickness	0.0993	2.522
		Cone	0.010	0.25
		Fourth-clutch running clearance (refer to para 6-18)		
B, foldout 14		THIRD CLUTCH, CENTER SUPPORT, SECOND CLUTCH		
2	6834319	Third-clutch backplate - thickness	0.490	12.45
*3, 25	6835748	Internal-splined clutch plate - thickness	0.1347	3.421
*3, 25	6834487	Internal-splined clutch plate - thickness	0.1347	3.421
*3, 25	6880727	Internal-splined clutch plate - thickness	0.1347	3.421
4, 26	6834488	External-tanged clutch plate:		
		Thickness	0.0993	2.522
		Cone	0.013	0.33
	6834720	External-tanged clutch plate:		
		Thickness	0.1161	2.949
		Cone	0.013	0.33
16	6883005	Center support bushing - clearance on sun gear shaft 25 (B, foldout 15) or 25 (A, foldout 16)	0.0065	0.165

*Minimum depth of oil grooves - 0.008 inch (0.20 mm).

Table 8-1. WEAR LIMITS (cont)

Illustration	Part Number	Description	Wear Limit in.	(mm)
B, foldout 14		THIRD CLUTCH, CENTER SUPPORT, SECOND CLUTCH (cont)		
		Third-clutch running clearance (refer to para 7-11)		
A, foldout 15		GEAR UNIT AND MAIN SHAFT ASSEMBLY		
2	6881352	Thrust washer - thickness	0.091	2.31
4	6881638	Thrust washer - thickness	0.091	2.31
7	6835322	Front carrier bushing - clearance on sun gear shaft 23	0.0072	0.183
13	6835321	Thrust washer - thickness	0.091	2.31
24, 26	6835323	Sun gear shaft bushing - clearance on main shaft 36 (A, foldout 15)	0.0064	0.163
25	6883702	Sun gear shaft - clearance in support bushing 16 (B, foldout 14)	0.0065	0.165
	6835322	Sun gear shaft - clearance in carrier bushing 7 (A, foldout 15)	0.0072	0.183
27	6883492	Thrust washer - thickness	0.091	2.31
B, foldout 15		GEAR UNIT AND MAIN SHAFT ASSEMBLY		
and				
A, foldout 16				
2	6881352	Thrust washer - thickness	0.091	2.31
4	6881638	Thrust washer - thickness	0.091	2.31
7	6835322	Front carrier bushing - clearance on sun gear shaft 23	0.0072	0.183
13	6835321	Thrust washer - thickness	0.091	2.31
24, 26	6835323	Sun gear shaft bushing - clearance on main shaft 36 (B, foldout 15)	0.0064	0.163
25	6883702	Sun gear shaft - clearance in support bushing 16 (B, foldout 14)	0.0065	0.165
	6835322	Sun gear shaft - clearance in carrier bushing 7 (A, foldout 16)	0.0072	0.183
27	6883492	Thrust washer - thickness	0.091	2.31
B, foldout 16		TRANSMISSION MAIN HOUSING		
8	6881746	Main housing - reaction clutch plate tang groove depth	0.090	2.29
A, foldout 18		FIRST CLUTCH		
1	6834680	External-tanged clutch plate:		
		Thickness	0.0993	2.522
		Cone	0.013	0.33
	6834766	External-tanged clutch plate:		
		Thickness	0.1161	2.948
		Cone	0.013	0.33

Table 8-1. WEAR LIMITS (cont)

Illustration	Part Number	Description	Wear Limit in.	(mm)
A, foldout 18		FIRST CLUTCH (cont)		
*2	6835748	Internal-splined clutch plate - thickness	0.1347	3.421
*2	6834487	Internal-splined clutch plate - thickness	0.1347	3.421
*2	6880727	Internal-splined clutch plate - thickness	0.1347	3.421
B, foldout 18		ADAPTER HOUSING, LOW CLUTCH PLATES		
10	6837467	Adapter housing - reaction clutch plate tang groove depth	0.090	2.29
*15	6835748	Internal-splined clutch plate - thickness	0.1347	3.421
*15	6834487	Internal-splined clutch plate - thickness	0.1347	3.421
*15	6880727	Internal-splined clutch plate - thickness	0.1347	3.421
16	6834680	External-tanged clutch plate:		
		Thickness	0.0993	2.522
		Cone	0.013	0.33
16	6834766	External-tanged clutch plate:		
		Thickness	0.1161	2.949
		Cone	0.013	0.33
		Low clutch clearance (refer to para 7-4)		
A, foldout 19		ADAPTER HOUSING, LOW CLUTCH PLATES		
10	6837467	Adapter housing, reaction clutch plate tang groove depth	0.090	2.29
*14	6835748	Internal-splined clutch plate - thickness	0.1347	3.421
*14	6834487	Internal-splined clutch plate - thickness	0.1347	3.421
*14	6880727	Internal-splined clutch plate - thickness	0.1347	3.421
15	6834680	External-tanged clutch:		
		Thickness	0.993	2.522
		Cone	0.013	0.33
15	6834766	External-tanged clutch:		
		Thickness	0.1161	2.949
		Cone	0.013	0.33
20	6883007	Low sun gear and hub bushing - clearance on output shaft 35 (B, foldout 19)	0.0068	0.173
B, foldout 19		ADAPTER HOUSING, LOW CLUTCH PLATES		
10	6880232	Adapter housing - reaction clutch plate tang groove depth	0.090	2.29
A, foldout 20		REAR COVER, OUTPUT SHAFT AND GOVERNOR		
14	23016853 6885572	Rear cover - clearance of governor bore to governor	0.004	0.10
22, 29	6836272	Output shaft bushing - clearance on main shaft 34 (A, foldout 15), 34 (B, fold-out 15), 34 (A, foldout 16)	0.004	0.10

*Minimum depth of oil grooves - 0.008 inch (0.20 mm).

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)	Length Under Load lb. (N)
10, A	10	Stator freewheel	6775852	No Color Code				0.81 (20.6)	0.38 (9.7)	0.36 to 0.66 (1.6 to 2.9)
11, A	56	Lubrication valve	6837882	No Color Code	8.5	0.054 (1.37)	0.733 (18.6)	1.74 (44.2)	0.81 (20.6)	5.02 to 6.14 (24.3 to 27.3)
11, B	11	Lubrication valve	6837882	No Color Code	8.5	0.054 (1.37)	0.733 (18.6)	1.74 (44.2)	0.81 (20.6)	5.02 to 6.14 (24.3 to 27.3)
13, A	4	Main regulator valve	6839209	No Color Code	19	0.1285 (3.26)	0.830 (21.1)	3.94 (100.1)	2.64 (67.1)	82.4 to 86.6 (366.5 to 385.2)
13, A	9	Lockup shift valve	6830166	Solid green	17	0.081 (2.04)	0.743 (18.9)	3.51 (89.1)	1.80 (45.7)	39.6 to 42.6 (176.1 to 189.5)
			6838089	Green stripe	17	0.092 (2.34)	0.743 (18.9)	3.04 (77.2)	1.80 (45.7)	29.00 to 31.00 (129.0 to 137.9)
			6838090	Solid white	16	0.081 (2.04)	0.720 (18.3)	2.66 (67.6)	1.80 (45.7)	13.44 to 14.36 (59.8 to 63.9)
			6838520	Solid blue	16	0.081 (2.04)	0.720 (18.3)	2.93 (74.4)	1.80 (45.7)	17.60 to 18.80 (78.3 to 83.6)
			6839268	Blue stripe	16	0.081 (2.04)	0.720 (18.3)	3.33 (84.6)	1.80 (45.7)	23.80 to 25.40 (105.9 to 113.0)
			6839419	Solid orange	16	0.081 (2.04)	0.720 (18.3)	3.22 (81.8)	1.80 (45.7)	22.10 to 23.50 (98.3 to 104.5)
13, A	13	Converter bypass valve	6769252	Solid green	14	0.081 (2.04)	0.690 (17.5)	2.65 (67.3)	1.62 (41.2)	21.1 to 23.3 (93.9 to 103.6)
13, B	14	Forward clutch piston release	6836138	Solid orange	10.2	0.062 (1.57)	0.439 (11.2)	1.25 (31.8)	0.88 (22.4)	17.9 to 18.9 (79.6 to 84.1)
14, A	8	Fourth clutch piston release	6836138	Solid orange	10.2	0.062 (1.57)	0.439 (11.2)	1.25 (31.8)	0.88 (22.4)	17.9 to 18.9 (79.6 to 84.1)
14, B	8	Third clutch piston release	6831656	Solid green	11.5	0.041 (1.04)	0.385 (9.8)	1.29 (32.8)	0.82 (20.8)	4.30 to 5.70 (19.1 to 25.4)
14, B	21	Second clutch piston release	6831656	Solid green	11.5	0.041 (1.04)	0.385 (9.8)	1.29 (32.8)	0.82 (20.8)	4.30 to 5.70 (19.1 to 25.4)
18, B	5	First clutch piston release	6831656	Solid green	11.5	0.041 (1.04)	0.385 (9.8)	1.29 (32.8)	0.82 (20.8)	4.30 to 5.70 (19.1 to 25.4)

*Mean dimension shown

Table 8-2. SPRING DATA (cont)

Fold-out	Ref.	Spring	Part No.	Color Code	No. Coils	Wire dia* 1n. (mm)	Spring OD 1n. (mm)	Free Length 1n. (mm)	Length Under Load 1n. (mm)	Length Under Load lb. (N)
19, A	5	First clutch piston release	6831656	Solid green	11.5	0.041 (1.04)	0.385 (9.8)	1.29 (32.8)	0.82 (20.8)	4.30 to 5.70 (19.1 to 25.4)
19, B	4	Low clutch piston release	6831656	Solid green	11.5	0.041 (1.04)	0.385 (9.8)	1.29 (32.8)	0.82 (20.8)	4.30 to 5.70 (19.1 to 25.4)
			6880418	Solid blue	9.5	0.073 (1.85)	0.500 (12.7)	1.31 (33.3)	0.90 (22.9)	26.05 to 27.85 (115.9 to 123.9)
			6886138	Solid orange	9.5	0.063 (1.60)	0.439 (11.2)	1.25 (31.8)	0.88 (22.4)	17.90 to 18.90 (79.6 to 84.1)
20, A	3	Low clutch piston release	6831656	Solid green	11.5	0.041 (1.04)	0.385 (9.8)	1.29 (32.8)	0.82 (20.8)	4.30 to 5.70 (19.1 to 25.4)
			6880418	Solid blue	9.5	0.073 (1.85)	0.500 (12.7)	1.31 (33.3)	0.90 (22.9)	26.05 to 27.85 (115.9 to 123.9)
20, B	3	Lubrication check valve	6836693	Solid green	19	0.092 (2.33)	0.535 (13.6)	2.48 (63.0)	1.97 (50.0)	32.25 to 37.05 (143.5 to 164.8)
			6839127	Solid blue	17	0.107 (2.69)	0.611 (15.5)	2.45 (62.2)	1.97 (50.0)	39.41 to 48.21 (175.3 to 214.4)
			6880652	Solid blue, white stripe	18.5	0.092 (2.33)	0.535 (13.6)	2.38 (60.5)	1.97 (50.0)	27.9 to 29.9 (124.0 to 133.0)
20, B	19	Modulator valve	6833934	Solid white, orange stripe	10	0.054 (1.37)	0.490 (12.5)	1.47 (37.3)	0.80 (20.3)	11.9 to 13.1 (52.9 to 58.3)
			6838077	Solid yellow	10	0.054 (1.37)	0.490 (12.5)	1.15 (29.2)	0.80 (20.3)	6.01 to 7.15 (26.7 to 31.8)
			6838519	Blue stripe	10	0.054 (1.37)	0.490 (12.5)	1.27 (32.3)	0.80 (20.3)	8.39 to 9.03 (37.3 to 40.2)
			6880980	Solid blue, red stripe	10	0.054 (1.37)	0.490 (12.5)	1.36 (34.5)	0.80 (20.3)	9.88 to 10.92 (44.0 to 48.6)
			23012948	Solid white, orange stripe	10	0.054 (1.37)	0.490 (12.5)	1.47 (37.3)	0.80 (20.3)	11.9 to 13.1 (52.9 to 58.3)
20, B	29	Third clutch trimmer valve (secondary)	6880118	Solid blue, white stripe	8.5	0.092 (2.34)	0.690 (17.5)	1.45 (36.8)	1.10 (27.9)	20.70 to 25.30 (92.52 to 112.5)
			6880274	Solid yellow, blue stripe	9.6	0.092 (2.33)	0.690 (17.5)	1.69 (42.9)	1.10 (27.9)	32.6 to 39.8 (145.0 to 177.0)

*Mean dimension shown

Table 8-2. SPRING DATA (cont)

Fold-out	Ref.	Spring	Part No.	Color Code	No. Coils	Wire dia* 1n. (mm)	Spring OD 1n. (mm)	Free Length 1n. (mm)	Length Under Load 1n. (mm)	Length Under Load lb. (N)
20, B	29	Third clutch trim-mar valve (secondary)	6885166	Solid orange, white stripe	9.6	0.091 (2.31)	0.690 (17.5)	1.69 (42.9)	1.10 (27.9)	32.6 to 39.8 (145.0 to 177.0)
20, B	30	Third clutch trimmer - valve (primary)	6833938	Solid yellow	12.5	0.080 (2.03)	0.940 (23.9)	2.96 (75.2)	1.10 (27.9)	15.95 to 17.65 (70.9 to 78.5)
			6833945	Solid blue	7.4	0.092 (2.33)	0.930 (23.6)	2.27 (58.4)	1.94 (49.3)	9.40 to 11.40 (41.8 to 50.7)
			6839271	Solid white, yellow stripe	10	0.103 (2.61)	0.940 (23.9)	2.56 (65.0)	1.94 (49.3)	20 to 22 (89.0 to 97.9)
			6880045	Solid orange	10	0.099 (2.50)	0.940 (23.9)	2.18 (55.4)	1.94 (49.3)	6.2 to 7.4 (27.6 to 32.9)
			6880118	Solid blue, white stripe	8.5	0.092 (2.32)	0.690 (17.5)	1.45 (36.8)	1.10 (27.9)	21.70 to 25.30 (96.5 to 112.5)
			23012937	Solid white	9	0.098 (2.49)	0.949 (24.1)	2.27 (57.7)	1.94 (49.3)	9.4 to 11.4 (41.8 to 50.7)
20, B	34	First clutch trimmer - valve (secondary)	6839102	Solid red	8.5	0.092 (2.33)	0.780 (19.8)	1.68 (42.7)	1.10 (27.9)	32.6 to 39.8 (145.0 to 177.0)
			6880274	Solid yellow, blue stripe	9.6	0.092 (2.33)	0.690 (17.5)	1.69 (42.9)	1.10 (27.9)	32.6 to 39.8 (145.0 to 177.0)
			6884701	Solid orange	9.6	0.092 (2.33)	0.690 (17.5)	1.69 (42.7)	1.10 (27.9)	32.6 to 39.8 (145.0 to 177.0)
			6885166	Sold orange, white stripe	9.6	0.092 (2.33)	0.690 (17.5)	1.69 (42.9)	1.10 (27.9)	32.6 to 39.8 (145.0 to 177.0)
20, B	35	First clutch trimmer valve (primary)	6833938	Solid yellow	12.5	0.080 (2.03)	0.940 (23.9)	2.96 (75.2)	1.10 (27.9)	8.30 to 10.30 (36.9 to 45.8)
			6833945	Solid blue	7.4	0.092 (2.33)	0.930 (23.6)	2.27 (57.7)	1.65 (41.9)	17.5 to 20.5 (77.8 to 91.2)
			6835730	Solid orange, blue stripe	8.5	0.114 (2.89)	0.940 (23.9)	2.16 (54.9)	1.94 (49.3)	12.2 to 14.8 (54.3 to 65.8)
			6837693	Solid green	8.5	0.113 (2.87)	0.940 (23.9)	1.97 (50.0)	1.10 (27.9)	50.4 to 55.6 (224.2 to 247.3)

*Mean dimension shown

Table 8-2. SPRING DATA (cont)

Fold-out	Ref.	Spring	Part No.	Color Code	No. Coils	Wire dia* 1n. (mm)	Spring OD 1n. (mm)	Free Length 1n. (mm)	Length Under Load 1n. (mm)	lb. (N)
20, B	35	First clutch trimmer valve (primary)	6839026	Solid blue. yellow stripe	7	0.092 (2.33)	0.930 (23.6)	1.85 (47.0)	1.10 (27.9)	23.5 to 27.5 (104.5 to 122.3)
			6839271	Solid white, yellow stripe	10	0.103 (2.60)	0.940 (23.9)	2.56 (65.0)	1.94 (49.3)	20 to 22 (89.0 to 97.9)
			6880045	Solid orange	8	0.099 (2.51)	0.940 (23.9)	2.18 (55.4)	1.94 (49.3)	6.2 to 7.4 (27.6 to 32.9)
			6880118	Solid blue, white stripe	8.5	0.092 (2.32)	0.690 (17.5)	1.45 (36.8)	1.10 (27.9)	21.70 to 25.30 (96.5 to 112.5)
			23013754	Solid red	8.5	0.113 (2.87)	0.940 (23.9)	2.16 (54.9)	1.94 (49.3)	12.2 to 14.8 (16.5 to 20.1)
20, B	39	Second clutch trimmer - valve (secondary)	6833940	Solid blue, orange stripe	8.7	0.121 (3.07)	0.940 (23.9)	2.16 (54.9)	1.65 (41.9)	37.8 to 45.8 (168.1 to 203.7)
			6838532	Solid white	8.5	0.121 (3.07)	0.950 (24.0)	2.10 (53.3)	1.10 (27.9)	78.3 to 85.7 (348.3 to 381.2)
			6839102	Solid red	8.5	0.092 (2.33)	0.780 (19.8)	1.68 (42.7)	1.10 (27.9)	32.6 to 39.8 (145.0 to 177.0)
			6880118	Solid blue, white stripe	8.5	0.091 (2.31)	0.690 (17.5)	1.45 (36.8)	1.10 (27.9)	21.7 to 25.3 (96.6 to 112.6)
			6883300	Solid green, white stripe	10	0.084 (2.13)	0.690 (17.5)	1.95 (49.5)	1.10 (27.9)	29.0 to 35.4 (128.9 to 157.5)
			6884701	Solid orange	9.6	0.092 (2.33)	0.690 (17.5)	1.69 (42.9)	1.10 (27.9)	32.6 to 39.8 (145.0 to 177.0)
			6885166	Solid orange, white stripe	9.6	0.092 (2.33)	0.690 (17.5)	1.69 (42.9)	1.10 (27.9)	32.6 to 39.8 (145.0 to 177.0)
			23012937	Solid white	9	0.098 (2.49)	0.949 (24.1)	2.27 (57.7)	1.94 (49.3)	9.4 to 11.4 (41.8 to 50.7)
20, B	40	Second clutch trimmer valve (primary)	6833940	Solid orange, yellow stripe	8.5	0.121 (3.07)	0.950 (24.1)	2.38 (60.5)	1.94 (49.3)	29 to 35 (39 to 47)
			6833945	Solid blue	7.4	0.092 (2.33)	0.930 (23.6)	2.27 (57.7)	1.94 (49.3)	9.40 to 11.40 (41.8 to 50.7)
			6839271	Solid white, yellow stripe	10	0.103 (2.61)	0.940 (23.9)	2.56 (65.0)	1.94 (49.3)	20 to 22 (89.0 to 97.9)

*Mean dimension shown

Table 8-2. SPRING DATA (cont)

Fold-out	Ref.	Spring	Part No.	Color Code	No. Coils	Wire dia* 1n. (mm)	Spring OD 1n. (mm)	Free Length 1n. (mm)	Length Under Load 1n. (mm)	Length Under Load lb. (N)
20, B	40	Second clutch trimmer valve (primary)	6880045	Solid orange	10	0.099 (2.51)	0.940 (23.9)	2.18 (55.4)	1.94 (49.3)	6.2 to 7.4 (27.6 to 32.9)
			6880118	Solid blue, white stripe	8.5	0.092 (2.32)	0.690 (17.5)	1.45 (36.8)	1.10 (27.9)	21.70 to 25.30 (96.5 to 112.5)
			23012937	Solid white	9	0.098 (2.49)	0.949 (24.1)	2.27 (57.7)	1.94 (49.3)	9.4 to 11.4 (41.8 to 50.7)
20, B	43	Trim boost accumulator	6838989	Solid blue, orange stripe	20	0.062 (1.57)	0.564 (14.3)	2.77 (70.4)	1.49 (37.9)	11.6 to 12.8 (51.6 to 56.9)
20, B	49	Fourth clutch trimmer valve (secondary)	6880118	Solid blue, white stripe	8.5	0.092 (2.33)	0.690 (17.5)	1.45 (36.8)	1.10 (27.9)	21.7 to 25.3 (96.6 to 112.6)
			6880274	Solid yellow, blue stripe	9.6	0.092 (2.33)	0.690 (17.5)	1.69 (42.9)	1.10 (27.9)	32.6 to 39.8 (145.0 to 177.0)
			6885166	Solid orange, white stripe	9.6	0.092 (2.33)	0.690 (17.5)	1.69 (42.9)	1.10 (27.9)	32.6 to 39.8 (145.0 to 177.0)
20, B	50	Fourth clutch trimmer valve (primary)	6833940	Solid orange, yellow stripe	8.7	0.121 (3.07)	0.950 (24.1)	2.38 (60.5)	1.94 (49.3)	29.0 to 35.0 (129.0 to 155.7)
			6833945	Solid blue	7.4	0.092 (2.33)	0.930 (23.6)	2.27 (57.7)	1.94 (49.3)	9.4 to 11.4 (41.8 to 50.7)
			6839271	Solid white, yellow stripe	10	0.103 (2.61)	0.940 (23.9)	2.56 (65.0)	1.94 (49.3)	20 to 22 (89.0 to 97.9)
			6880045	Solid orange	10	0.099 (2.51)	0.940 (23.9)	2.18 (55.4)	1.94 (49.3)	6.2 to 7.4 (27.6 to 32.9)
			23012937	Solid white	9	0.098 (2.49)	0.949 (24.1)	2.27 (57.7)	1.94 (49.3)	9.4 to 11.4 (41.8 to 50.7)
20, B	55	2-3 relay valve	6832462	Solid red	11	0.073 (1.85)	0.690 (17.5)	2.18 (55.4)	1.20 (30.5)	16.2 to 19.8 (72.1 to 88.1)
			6834528	Solid blue yellow stripe	11	0.073 (1.85)	0.680 (17.3)	1.52 (38.6)	1.10 (28.0)	7.2 to 8.8 (32.0 to 39.1)

*Mean dimension shown

Table 8-2. SPRING DATA (cont)

Fold-out	Ref.	Spring	Part No.	Color Code	No. Coils	Wire dia* 1n. (mm)	Spring OD 1n. (mm)	Free Length 1n. (mm)	Length Under Load 1n. (mm)	Length Under Load lb. (N)
20, B	58	1-2 relay valve	6834528	Solid blue yellow stripe	11	0.073 (1.85)	0.680 (17.3)	1.52 (38.6)	1.10 (28.0)	7.2 to 8.8 (32.0 to 39.1)
20, B	63	Governor accumulator valve	6836784	Solid yellow	13	0.041 (1.04)	0.400 (10.2)	1.90 (48.3)	1.15 (29.2)	5.93 to 6.17 (26.4 to 27.4)
			6838988	Solid orange, blue stripe	10	0.051 (1.30)	0.564 (14.3)	1.84 (46.7)	0.70 (17.8)	9.6 to 10.6 (42.7 to 47.2)
20, B	68	Priority valve	6835729	Solid white, yellow stripe	11	0.054 (1.37)	0.384 (9.8)	1.17 (29.7)	0.94 (23.9)	8.15 to 9.25 (36.3 to 41.2)
20, B	71	Hold regulator valve	6835733	Solid white, orange stripe	11	0.041 (1.04)	0.400 (10.2)	1.77 (45.0)	1.15 (29.3)	5.85 to 6.45 (26.0 to 28.7)
			6836783	Solid orange, blue stripe	11	0.041 (1.04)	0.400 (10.2)	1.70 (43.2)	1.15 (29.2)	5.29 to 5.51 (23.5 to 24.5)
			6836784	Solid yellow	13	0.041 (1.04)	0.400 1(T8.)	1.90 (48.3)	1.15 (29.2)	5.93 to 6.17 (26.4 to 27.5)
			6836785	Solid white	14	0.041 (1.04)	0.400 (10.2)	2.01 (51.1)	1.15 (29.2)	6.22 to 6.48 (27.7 to 28.8)
			6836867	Solid yellow, orange stripe	11	0.041 (1.04)	0.400) (10.2)	1.62 (41.2)	1.15 (29.2)	4.55 to 4.75 (20.2 to 21.2)
			6836917	Black stripe	11	0.041 (1.04)	0.400 (10.2)	1.59 (40.4)	1.15 (29.2)	4.26 to 4.44 (19.0 to 19.8)
			6836976	Solid white, yellow stripe	14	0.044 (1.12)	0.400 (10.2)	1.85 (47.0)	1.15 (29.2)	6.91 to 7.19 (30.7 to 32.0)
			6836977	Solid orange	16	0.047 (1.19)	0.400 (10.2)	1.85 (47.0)	1.15 (29.2)	7.79 to 8.11 (34.7 to 36.0)
			6837539	Solid blue, white stripe	11	0.041 (1.04)	0.400 (10.2)	1.72 (43.7)	1.15 (29.2)	5.44 to 5.66 (24.2 to 26.2)
			6837540	Solid red	11	0.041 (1.04)	0.400 (10.2)	1.75 (44.35)	1.15 (29.2)	5.73 to 5.97, (25.5 to 26.6)
			6837541	Solid yellow, blue stripe	14	0.044 (1.12)	0.400 (10.2)	1.82 (46.4)	1.15 (29.2)	6.61 to 6.89 (29.4 to 30.7)
			6837952	Solid green	14	0.044 (1.12)	0.400 (10.2)	1.87 (47.6)	1.15 (29.2)	7.10 to 7.40 (31.6 to 32.9)

*Mean dimension shown

Table 8-2. SPRING DATA (cont)

Fold-out	Ref.	Spring	Part No.	Color Code	No. Coils	Wire dia* 1n. (mm)	Spring OD 1n. (mm)	Free Length 1n. (mm)	Length Under Load 1n. (mm)	Length Under Load lb. (N)
20, B	71	Hold regulator valve	6837953	Solid blue	14	0.044 (1.12)	0.400 (10.2)	1.91 (48.5)	1.15 (29.2)	7.46 to 7.76 (33.2 to 34.5)
			6838088	Solid blue, yellow stripe	17.7	0.048 (1.22)	0.409 (10.4)	1.68 (42.7)	1.15 (29.2)	5.14 to 5.36 (22.9 to 23.8)
			6838367	Solid blue orange stripe	15	0.049 (I.24)	0.409 (10.4)	1.79 (45.5)	1.15 (29.2)	8.55 to 9.05 (38.0 to 40.3)
			6838368	Solid yellow, red stripe	15	0.049 (1.24)	0.409 (10.4)	1.92 (48.8)	1.15 (29.2)	10.25 to 10.75 (45.6 to 47.8)
			6880319	Solid orange, white stripe	15	0.049 (1.24)	0.409 (10.4)	1.88 (47.8)	1.15 (29.2)	9.75 to 10.25 (43.4 to 45.6)
			6880320	Solid green, white stripe	17	0.049 (1.24)	0.409 (10.4)	1.93 (49.0)	1.15 (29.2)	9.00 to 9.60 (40.0 to 42.7)
20, B	79	1-2 shift valve	6834536	No Color Code	15	0.020 (0.050)	0.330 (8.38)	1.25 (31.8)	0.94 (23.9)	0.166 to 0.206 (0.74 to 0.92)
20, 8	82	1-2 shift valve	6885065	Solid blue	12	0.054 (1.37)	0.640 (16.3)	1.82 (46.2)	1.15 (29.2)	3.75 to 4.25 (16.7 to 18.9)
20, B	85	1-2 shift valve	6834536	No Color Code	15	0.020 (0.050)	0.330 (8.38)	1.25 (31.8)	0.94 (23.9)	0.166 to 0.206) (0.74 to 0.92)
20, B	91	1-2 shift valve	6833935	Solid blue	9	0.054 (1.37)	0.640 (16.3)	2.17 (55.1)	1.15 (29.2)	8.6 to 9.1 (38.3 to 40.5)
			6833941	Sold blue, white stripe	13.5	0.062 (1.57)	0.640 (16.3)	2.15 (54.6)	1.15 (29.2)	9.35 to 9.85 (41.6 to 43.8)
			6833942	Solid white	12	0.054 (1.37)	0.640 (16.3)	2.50 (63.5)	1.15 (29.2)	7.85 to 8.35 (34.9 to 37.1)
			6834576	Solid orange, yellow stripe	12	0.054 (1.37)	0.640 (16.3)	2.39 (60.7)	1.15 (29.2)	7.18 to 7.68 (31.9 to 34.2)
			6834903	Solid white, yellow stripe	12	0.054 (1.37)	0.640 (16.3)	2.22 (56.4)	1.15 (29.2)	6.1 to 6.7 (27.1 to 29.8)
			6834943	No Color Code	18	056 (1.42)	0.410 (10.4)	1.63 (41.4)	1.19 (30.2)	8.35 to 9.35 (37.1 to 41.6)
			6835309	Solid yellow, blue stripe	12	0.054 (1.37)	0.640 (16.3)	2.32 (58.9)	1.15 (29.2)	6.75 to 7.25 (30.0 to 32.3)

*Mean dimension shown

Table 8-2. SPRING DATA (cont)

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)	Length Under Load lb. (N)
20, B	91	1-2 shift valve	6835310	Solid green	13	0.059 (1.50)	0.640 (16.3)	2.51 (63.8)	1.15 (29.2)	10.75 to 11.25 (47.8 to 50.0)
			6837454	Solid yellow	10.8	0.056 (1.42)	0.672 (17.0)	1.99 (50.4)	1.15 (29.2)	8.22 to 8.72 (36.6 to 38.8)
			6837540	Solid red	11	0.041 (1.04)	0.400 (10.2)	1.74 (44.3)	1.15 (29.2)	5.97 to 6.15 (26.6 to 27.4)
			6838356	Solid blue, yellow stripe	14	0.062 (1.57)	0.640 (16.3)	2.43 (61.7)	1.15 (29.2)	11.45 to 11.95 (50.9 to 53.2)
			6838357	Solid red	14	0.062 (1.57)	0.640 (16.3)	2.53 (64.3)	1.15 (29.2)	12.25 to 12.75 (54.5 to 56.7)
			6838358	Solid orange, white stripe	14	0.062 (1.57)	0.640 (16.3)	2.57 (65.3)	1.15 (29.2)	12.74 to 13.26 (56.7 to 59.0)
			6838366	Solid yellow, red stripe	14	0.062 (1.57)	0.640 (16.3)	2.67 (67.8)	1.15 (29.2)	13.45 to 14.05 (59.8 to 62.5)
			6880991	Solid blue, red stripe	12	0.054 (1.37)	0.640 (16.3)	2.75 (69.9)	1.15 (29.2)	9.25 to 9.95 (41.1 to 44.3)
			6880992	Solid white, red stripe	12	0.054 (1.37)	0.640 (16.3)	2.85 (72.4)	1.15 (29.2)	9.85 to 10.55 (43.8 to 46.9)
			6880993	Solid green, white stripe	12	0.054 (1.37)	0.640 (16.3)	2.98 (75.7)	1.15 (29.2)	10.60 to 11.40 (47.2 to 50.7)
			6881060	Solid yellow, orange stripe	12	0.054 (1.37)	0.640 (16.3)	2.62 (66.6)	1.15 (29.2)	8.50 to 9.10 (37.8 to 40.5)
			6881061	Solid blue, orange stripe	12	0.054 (1.37)	0.640 (16.3)	2.55 (64.8)	1.15 (29.2)	8.10 to 8.70 (36.0 to 38.7)
			6883665	Solid white, green stripe	12	0.054 (1.37)	0.640 (16.3)	2.82 (71.6)	1.15 (29.2)	9.65 to 10.35 (42.9 to 46.0)
			6884934	Yellow stripe	12	0.054 (1.37)	0.640 (16.3)	2.23 (56.6)	1.15 (29.2)	6.20 to 6.80 (27.6 to 30.3)
			6884936	Solid orange, white stripe	12	0.054 (1.37)	0.640 (16.3)	2.36 (59.9)	1.15 (29.2)	6.95 to 7.55 (30.9 to 33.6)

*Mean dimension shown

Table 8-2. SPRING DATA (cont)

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)	Length Under Load lb. (N)
20, B	91	1-2 shift valve	6884938	Solid white, red stripe	12	0.054 (1.37)	0.640 (16.3)	2.44 (61.9)	1.15 (29.2)	7.45 to 8.05 (33.14 to 35.81)
			6884940	Solid yellow, orange stripe	12	0.054 (1.37)	0.640 (16.3)	2.53 (64.3)	1.15 (29.2)	7.95 to 8.55 (35.4 to 38.0)
			6884941	Red stripe	12	0.054 (1.37)	0.640 (16.3)	2.57 (65.3)	1.15 (29.2)	8.20 to 8.80 (36.5 to 39.1)
			6884943	Solid white, orange stripe	12	0.052 (1.32)	0.640 (16.3)	2.65 (67.3)	1.15 (29.2)	8.65 to 9.35 (38.47 to 41.59)
			6884944	Solid blue, red stripe	12	0.052 (1.32)	0.640 (16.3)	2.69 (68.3)	1.15 (29.2)	8.90 to 9.60 (39.59 to 42.70)
			6884946	Solid yellow, white stripe	12	0.054 (1.37)	0.640 (16.3)	2.78 (70.6)	1.15 (29.2)	9.4 to 10.1 (41.8 to 44.9)
			6884947	Solid white, green stripe	12	0.054 (1.37)	0.640 (16.3)	2.86 (72.6)	1.15 (29.2)	9.90 to 10.60 (44.0 to 47.2)
			6884949	Blue stripe	12	0.054 (1.37)	0.640 (16.3)	2.94 (74.7)	1.15 (29.2)	10.4 to 11.2 (46.0 to 49.6)
			6884950	Solid green, white stripe	14	0.062 (1.57)	0.640 (16.3)	2.37 (60.2)	1.15 (29.2)	11.0 to 11.5 (48.9 to 51.2)
			6884951	Orange stripe	14	0.062 (1.57)	0.640 (16.3)	2.40 (60.9)	1.15 (29.2)	11.3 to 11.8 (50.0 to 52.3)
			6884953	Green stripe	14	0.062 (1.57)	0.640 (16.3)	2.45 (62.2)	1.15 (29.2)	11.8 to 12.3 (52.3 to 54.5)
			6884954	Solid yellow, white stripe	14	0.062 (1.57)	0.640 (16.3)	2.48 (62.9)	1.15 (29.2)	12.0 to 12.5 (53.4 to 55.6)
			6884955	Solid blue, orange stripe	14	0.062 (1.57)	0.640 (16.3)	2.54 (64.5)	1.15 (29.2)	12.5 to 13.0 (55.6 to 57.8)
			6885065	Solid blue	12	0.054 (1.37)	0.640 (16.3)	1.82 (46.2)	1.15 (29.2)	3.75 to 4.25 (16.7 to 18.9)
			23012949	Solid blue, green stripe	12	0.054 (1.37)	0.640 (16.3)	2.94 (60.9)	1.15 (29.2)	10.35 to 11.15 (14.0 to 15.1)
			23012937	Solid white	9	0.098 (2.49)	0.949 (24.1)	2.27 (57.7)	1.94 (49.3)	9.4 to 11.4 (41.8 to 50.7)

*Mean dimension shown

Table 8-2. SPRING DATA (cont)

Fold-out	Ref.	Spring	Part No.	Color Code	No. Coils	Wire dia* 1n. (mm)	Spring OD 1n. (mm)	Free Length 1n. (mm)	Length Under Load 1n. (mm)	lb. (N)
20, B	91	1-2 shift valve	23012951	Solid orange, green stripe	12	0.054 (1.37)	0.640 (16.3)	2.98 (75.7)	1.15 (29.2)	10.6 to 11.4 (14.4 to 15.5)
			23012954	Solid yellow, green stripe	13	0.059 (1.50)	0.640 (16.3)	2.51 (63.8)	1.15 (29.2)	10.75 to 11.25 (14.6 to 15.3)
			23013269	Solid orange	12	0.054 (1.37)	0.640 (16.3)	2.69 (68.3)	1.15 (29.2)	8.9 to 9.6 (39.6 to 42.7)
			23013267	Solid yellow	12	0.054 (1.37)	0.640 (16.3)	2.57 (65.3)	1.15 (29.2)	8.2 to 8.8 (11.1 to 11.9)
			23013273	Solid orange, yellow stripe	12	0.054 (1.37)	0.640 (16.3)	2.65 (67.3)	1.15 (29.2)	8.65 to 9.35 (11.7 to 12.7)
20, B	96	2-3 shift valve	6833935	Solid blue	9	0.054 (1.37)	0.640 (16.3)	2.i7 (55.1)	1.15 (29.2)	8.6 to 9.1 (38.3 to 40.5)
			6833939	No Color Code	8.5	02106 (2.69)	0.930 (23.6)	2.18 (55.4)	1.65 (41.9)	23.8 to 28.2 (105.9 to 125.4)
			6833941	Solid blue, white stripe	13.5	0.062 (1.57)	0.640 (16.3)	2.15 (54.6)	1.15 (29.2)	9.35 to 9.85 (41.6 to 43.8)
			6833942	Solid white	12	0.054 (1.37)	0.640 (16.3)	2.50 (63.5)	1.15 (29.2)	7.85 to 8.35 (34.9 to 37.1)
			6834902	Solid orange	13	0.059 (1.50)	0.640 (16.3)	2.41 (61.1)	1.15 (29.2)	9.95 to 10.45 (44.3 to 46.5)
			6835310	Solid green	13	0.059 (1.50)	0.640 (16.3)	2.51 (63.8)	1.15 (29.2)	10.75 to 11.25 (47.8 to 50.0)
			6837454	Solid yellow	9	0.056 (1.42)	0.640 (16.3)	1.98 (50.4)	1.15 (29.2)	8.22 to 8.72 (36.6 to 38.8)
			6838356	Solid blue, yellow stripe	14	0.062 (1.57)	0.640 (16.2)	2.43 (61.7)	1.15 (29.2)	11.45 to 11.9' (50.9 to 53.2)
			6838357	Solid red	14	0.062 (1.57)	0.640 (16.2)	2.52 (64.0)	1.15 (29.2)	12.25 to 12.75 (54.5 to 56.7)
			6838358	Solid orange, white stripe	14	0.062 (1.57	0.640 (16.3)	2.57 (65.3)	1.15 (29.2)	12.74 to 13.26 (56.7 to 59.0)

*Mean dimension shown

Table 8-2. SPRING DATA (cont)

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)	Length Under Load lb. (N)
20, B	96	2-3 shift valve	6838366	Solid yellow, red stripe	14	0.062 (1.57)	0.640 (16.3)	2.67 (67.8)	1.15 (29.2)	13.45 to 14.05 (59.8 to 62.5)
			6880991	Solid blue, red stripe	12	0.054 (1.37)	0.640 (16.3)	2.75 (69.9)	1.15 (29.2)	9.25 to 9.95 (41.1 to 44.3)
			6880992	Solid white, red stripe	12	0.054 (1.37)	0.640 (16.3)	2.85 (72.4)	1.15 (29.2)	9.85 to 10.55 (43.8 to 46.9)
			6880993	Solid green, white stripe	12	0.054 (1.37)	0.640 (16.3)	2.98 (75.7)	1.15 (29.2)	10.60 to 11.40 (47.2 to 50.7)
			6881060	Solid yellow, orange stripe	12	0.054 (1.37)	0.640 (16.3)	2.62 (66.6)	1.15 (29.2)	8.50 to 9.10 (37.8 to 40.5)
			6882078	Solid yellow, white stripe	12	0.054 (1.37)	0.640 (16.3)	2.93 (74.4)	1.15 (29.2)	10.50 to 10.95 (45.6 to 48.7)
			6883665	Solid white, green stripe	12	0.054 (1.37)	0.640 (16.3)	2.82 (71.6)	1.15 (29.2)	9.65 to 10.35 (42.9 to 46.0)
			6884941	Red stripe	12	0.054 (1.37)	0.640 (16.3)	2.57 (65.3)	1.15 (29.2)	8.2 to 8.8 (36.5 to 39.1)
			6884944	Solid blue, red stripe	12	0.054 (1.37)	0.640 (16.3)	2.69 (68.3)	1.15 (29.2)	8.9 to 9.6 (39.6 to 42.7)
			6884945	Solid green, white stripe	12	0.054 (1.37)	0.640 (16.3)	2.73 (69.3)	1.15 (29.2)	9.2 to 9.9 (40.7 to 43.8)
			6884946	Solid yellow, white stripe	12	0.054 (1.37)	0.640 (16.3)	2.78 (70.6)	1.15 (29.2)	9.4 to 10.1 (41.8 to 44.9)
			6884947	Solid white, green stripe	12	0.054 (1.37)	0.640 (16.3)	2.86 (72.6)	1.15 (29.2)	9.9 to 10.6 (44.0 to 47.2)
			6884948	Yellow stripe	12	0.054 (1.37)	0.640 (16.3)	2.90 (73.7)	1.15 (29.2)	10.2 to 10.9 (45.4 to 48.3)
			6884949	Blue stripe	12	0.054 (1.37)	0.640 (16.3)	2.94 (74.7)	1.15 (29.2)	10.35 to 11.15 (46.0 to 49.6)
			6884951	Orange stripe	14	0.062 (1.57)	0.640 (16.3)	2.40 (60.9)	1.15 (29.2)	11.3 to 11.8 (50.0 to 52.3)
			6884950	Solid green, white stripe	14	0.062 (1.57)	0.640 (16.3)	2.37 (60.2)	1.15 (29.2)	11.0 to 11.5 (48.9 to 51.2)

*Mean dimension shown

Table 8-2. SPRING DATA (cont)

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)	Length Under Load lb. (N)
20, B	96	2-3 shift valve	6884953	Green stripe	14	0.062 (1.57)	0.640 (16.3)	2.45 (62.2)	1.15 (29.2)	11.8 to 12.3 (52.3 to 54.5)
			6884956	Solid white, green stripe	14	0.062 (1.57)	0.640 (16.3)	2.59 (65.8)	1.15 (29.2)	12.95 to 13.55 (57.60 to 60.27)
			23012949	Solid blue, green stripe	12	0 054 (1.37)	0.640 (16.3)	2.94 (60.9)	1.15 (29.2)	10.35 to 11.15 (14.0 to 15.1)
			23012951	Solid orange, green stripe	12	0.054 (1.37)	0.640 (16.3)	2.98 (75.7)	1.15 (29.2)	10.6 to 11.4 (14.4 to 15.5)
			23012954	Solid yellow, green stripe	13	0.059 (1.50)	0.640 (16.3)	2.51 (63.8)	1.15 (29.2)	10.75 to 11.25 (14.6 to 15.3)
			23013271	Solid blue, yellow stripe	12	0.054 (1.37)	0.640 (16.3)	2.73 (69.3)	1.15 (29.2)	9.15 to 9.85 (12.4 to 13.4)
20, B	102	3-4 shift valve	6832462	Solid red	11	0.072 (1.83)	0.690 (17.5)	2.18 (55.4)	1.20 (30.5)	16.20 to 19.80 (72.0 to 88.0)
			6833935	Solid blue	9	0.054 (1.37)	0.640 (16.3)	2.17 (55.1)	1.15 (29.2)	8.6 to 9.1 (38.3 to 40.5)
			6833941	Solid blue, white stripe	13.5	0.062 (1.57)	0.640 (16.3)	2.15 (54.6)	1.15 (29.2)	9.35 to 9.85 (41.6 to 43.8)
			6833942	Solid white	12	0.054 (1.37)	0.640 (16.3)	2.50 (63.5)	1.15 (29.2)	7.85 to 8.35 (34.9 to 37.1)
			6834576	Solid orange, yellow stripe	12	0.054 (1.37)	0.640 (16.3)	2.39 (60.7)	1.15 (29.2)	7.18 to 7.68 (31.9 to 34.2)
			6834528	Solid blue, yellow stripe	11	0.073 (1.85)	0.680 (17.3)	1.52 (38.6)	1.10 (27.9)	7.20 to 8.80 (32.0 to 39.1)
			6834902	Solid orange	13	0.059 (1.50)	0.640 (16.3)	2.41 (61.2)	1.15 (29.2)	10.0 to 10.5 (44.3 to 46.5)
			6884940	Solid yellow, orange stripe	12	0.054 (1.37)	0.640 (16.3)	2.53 (64.3)	1.15 (29.2)	7.9 to 8.6 (35.4 to 38.0)
			6884943	Solid white, orange stripe	18	0.056 (1.42)	0.640 (16.3)	2.65 (67.3)	1.15 (29.2)	8.65 to 9.35 (38.5 to 41.6)
			6884944	Solid blue, red stripe	12	0.054 (1.37)	0.640 (16.3)	2.69 (68.3)	1.15 L29.2)	8.9 to 9.6 (39.6 to 42.7)

*Mean dimension shown

Table 8-2. SPRING DATA (cont)

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)	Length Under Load lb. (N)
20, B	102	3-4 shift valve	6835310	Solid green	13	0.059 (1.50)	0.640 (16.3)	2.51 (63.8)	1.15 (29.2)	10.75 to 11.25 (47.8 to 50.0)
			6837454	Solid yellow	10.8	0.056 (1.42)	0.672 (17.0)	1.99 (50.6)	1.15 (29.2)	8.22 to 8.72 (36.6 to 38.8)
			6838356	Solid blue yellow stripe	14	0.062 (1.57)	0.640 (16.3)	2.43 (61.7)	1.15 (29.2)	11.45 to 11.95 (50.9 to 53.2)
			6838357	Solid red	14	0.063 (1.60)	0.640 (16.3)	2.53 (64.3)	1.15 (29.2)	12.25 to 12.75 (54.5 to 56.7)
			6880991	Solid blue, red stripe	12	0.054 (1.37)	0.640 (16.3)	2.75 (69.9)	1.15 (29.2)	9.25 to 9.95 (41.1 to 44.3)
			6880992	Solid white, red stripe	12	0.054 (1.37)	0.640 (16.3)	2.85 (72.4)	1.15 (29.2)	9.85 to 10.55 (43.8 to 46.9)
			6880993	Solid green, white stripe	12	0.054 (1.37)	0.640 (16.3)	2.98 (75.7)	1.15 (29.2)	10.60 to 11.40 (47.2 to 50.7)
			6881060	Solid yellow, orange stripe	12	0.054 (1.37)	0.640 (16.3)	2.62 (66.6)	1.15 (29.2)	8.50 to 9.10 (37.8 to 40.5)
			6881061	Solid blue, orange stripe	12	0.054 (1.37)	0.640 (16.3)	2.55 (64.8)	1.15 (29.2)	8.10 to 8.70 (36.0 to 38.7)
			6883665	Solid white, green stripe	12	0.054 (1.37)	0.640 (16.3)	2.82 (71.6)	1.15 (29.2)	9.65 to 10.35 (42.9 to 46.0)
			6884938	Solid white, red stripe	12	0.054 (1.37)	0.640 (16.3)	2.44 (61.9)	1.15 (29.2)	7.45 to 8,05 (9.9 to 10.9)
			6884941	Red stripe	12	0.054 (1.37)	0.640 (16.3)	2.57 (65.3)	1.15 (29.2)	8.2 to 8.8 (36.5 to 39.1)
			6884943	Solid white, orange stripe	12	0.054 (1.37)	0.640 (16.3)	2.65 (67.3)	1.15 (29.2)	8.65 to 9.35 (11.7 to 12.7)
			6884945	Solid green, white stripe	12	0.054 (1.37)	0.640 (16.3)	2.73 (69.3)	1.15 (29.2)	9.15 to 9.85 (40.7 to 43.8)
			6884946	Solid yellow, white stripe	12	0.054 (1.37)	0.640 (16.3)	2.78 (70.6)	1.15 (29.2)	9.4 to 10.1 (41.8 to 44.9)
			6884947	Solid white, green stripe	12	0.054 (1.37)	0.640 (16.3)	2.86 (72.6)	1.15 (29.2)	9.9 to 10.6 (44.0 to 47.2)

*Mean dimension shown

Table 8-2. SPRING DATA (cont)

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)	Length Under Load lb. (N)
20, B	102	3-4 shift valve	6884948	Yellow stripe	12	0.054 (1.37)	0.640 (16.3)	2.90 (73.7)	1.15 (29.2)	10.2 to 10.9 (45.2 to 48.3)
			6884949	Blue stripe	12	0.054 (1.37)	0.640 (16.3)	2.94 (74.7)	1.15 (29.2)	10.4 to 11.2 (46.0 to 49.6)
			6884950	Solid green, white stripe	14	0.062 (1.57)	0.640 (16.3)	2.37 (60.2)	1.15 (29.2)	11.0 to 11.5 (48.9 to 51.2)
			6884953	Green stripe	14	0.062 (1.57)	0.640 (16.3)	2.45 (62.2)	1.15 (29.2)	11.75 to 12.25 (52.27 to 54.49)
			6884954	Solid yellow, white stripe	14	0.062 (1.57)	0.640 (16.3)	2.48 (62.9)	1.15 (29.2)	12.0 to 12.5 (53.3 to 55.6)
			23012950	Solid white, blue stripe	12	0.054 (1.37)	0.640 (16.3)	2.90 (73.7)	1.15 (29.2)	10.15 to 10.85 (45.2 to 48.3)
			23012951	Solid orange, green stripe	12	0.054 (1.37)	0.640 (16.3)	2.98 (75.7)	1.15 (29.2)	10.6 to 11.4 (14.4 to 15.5)
			23012954	Solid yellow, green stripe	13	0.059 (1.50)	0.640 (16.3)	2.51 (63.8)	1.15 (29.2)	10.75 to 11.25 (14.6 to 15.3)
			23013267	Solid yellow	12	0.054 (1.37)	0.640 (16.3)	2.57 (65.3)	1.15 (29.2)	8.2 to 8.8 (11.1 to 11.9)
			23013269	Solid orange	12	0.054 (1.37)	0.640 (16.3)	2.69 (68.3)	1.15 (29.2)	8.9 to 9.6 (12.1 to 13.0)
			23013271	Solid blue, yellow stripe	12	0.054 (1.37)	0.640 (16.3)	2.73 (69.3)	1.15 (29.2)	9.15 to 9.85 (12.4 to 13.4)
			23013274	Solid orange, blue stripe	12	0.054 (1.37)	0.640 (16.3)	2.53 (64.3)	1.15 (29.2)	7.95 to 8.55 (10.8 to 11.6)
20, B	107	3-4 relay valve	6832462	Solid red	11	0.073 (1.85)	0.690 (17.5)	2.18 (55.4)	1.20 (30.4)	16.2 to 19.8 (72.1 to 88.1)
			6834528	Solid blue, yellow stripe	11	0.073 (1.85)	0.680 (17.3)	1.52 (38.6)	1.10 (27.9)	7.2 to 8.8 (32.0 to 39.1)
20, B	111	Trimmer regulator valve	6770763	Solid orange	14	0.041 (1.04)	0.480 (12.2)	1.78 (45.2)	0.78 (17.8)	3.80 to 4.20 (16.9 to 18.7)
			6834527	Solid blue, red stripe	14	0.047 (1.19)	0.500 (12.7)	1.87 (47.5)	1.14 (29.0)	4.25 to 4.75 (18.9 to 21.1)

*Mean dimension shown

Table 8-2. SPRING DATA (cont)

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)	Length Under Load lb. (N)
20, B	111	Trimmer regulator valve	6880186	Solid yellow, blue stripe	12	0.041 (1.04)	0.464 (11.8)	1.37 (34.8)	0.89 (22.6)	2.43 to 2.69 (10.8 to 11.9)
			6880246	Solid blue	13	0.041 (1.04)	0.464 (11.8)	1.81 (46.0)	0.89 (22.6)	4.25 to 4.75 (18.9 to 21.1)
21, A	8	Low shift relay valve	6768544	Solid yellow, orange stripe	14.0	0.054 (1.37)	0.560 (14.2)	1.99 (50.6)	0.84 (21.3)	8.10 to 9.90 (36.0 to 44.0)
21, A	12	Low shift signal valve	6778156	No color code	11.5	0.041 (1.04)	0.440 (11.2)	1.45 (36.8)	0.80 (20.3)	4.30 to 4.50 (19.1 to 20.0)
			6838285	Solid yellow, orange stripe	8.0	0.041 (1.04)	0.501 (12.7)	1.10 (27.9)	0.69 (17.5)	2.57 to 3.13 (11.4 to 13.9)
			6838340	Solid orange	12.0	0.038 (0.97)	0.450 (11.4)	2.08 (52.8)	1.09 (27.7)	4.00 to 4.50 (17.8 to 20.0)
			6838341	No color code	11.0	0.041 (1.04)	0.450 (11.4)	1.95 (49.5)	1.09 (27.7)	4.90 to 5.40 (21.8 to 24.0)
			6880154	Solid white,	11.0	0.041	0.450	1.88	1.90	4.55 to 4.95
			6838342	Solid yellow,	12.0	0.038	0.450	1.98	1.09	3.60 to 4.10
				white stripe		(0.97)	(11.4)	(50.3)	(27.7)	(16.0 to 18.2)
				yellow stripe		(1.04)	(11.4)	(47.8)	(27.7)	(20.2 to 22.0)
			6880155	Orange stripe	12.0	0.038 (0.97)	0.450 (11.4)	1.80 (45.8)	1.09 (27.7)	2.90 to 3.20 (12.9 to 14.2)
			6880186	Solid yellow, blue stripe	12	0.041 (1.04)	0.464 (11.8)	1.37 (34.8)	0.89 (22.6)	2.43 to 2.69 (10.8 to 12.0)
			6881036	Solid yellow, white stripe	9.0	0.044 (1.12)	0.501 (12.7)	1.16 (29.5)	0.69 (17.5)	3.37 to 4.13 (15.0 to 18.4)
			23012820	Solid yellow	14	0.038 (0.97)	0.450 (11.43)	1.51 (38.4)	1.09 (27.7)	1.42 to 1.58 (6.3 to 7.0)
21, A	24	Low shift trimmer valve (primary)	6833938	Solid green	12.5	0.080 (2.03)	0.940 (23.9)	2.96 (75.2)	1.10 (27.9)	8.30 to 10.30 (36.9 to 45.8)
			6833940	Solid blue, orange stripe	8.5	0.121 (3.07)	0.950 (24.1)	2.38 (60.5)	1.94 (49.3)	29.00 to 35.00 (129.0 to 155.7)
			6833945	Solid blue	7.4	0.092 (2.34)	0.930 (23.6)	2.27 (58.4)	1.94 (49.3)	9.40 to 11.40 (41.8 to 50.7)

*Mean dimension shown

Table 8-2. SPRING DATA (cont)

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)
21, A	23	Low shift trimmer valve (secondary)	6839102	Solid white	8.5	0.091 (2.31)	0.720 (18.3)	1.68 (42.7)	1.10 (27.9)	21.60 to 39.80 (145.0 to 177.0)
			6880274	Solid blue, red stripe	9.6	0.091 (2.31)	0.690 (17.5)	1.69 (42.9)	1.10 (27.9)	32.60 to 39.80 (145.0 to 177.0)
			6885166	Solid orange, white stripe	9.6	0.092 (2.34)	0.690 (17.5)	1.69 (42.9)	1.10 (27.9)	32.6 to 39.8 (145.0 to 177.0)
21, B	16	Retarder control valve	6838531	No color code	8.1	0.105 (2.67)	1.600 (40.6)	3.98 (101.1)	1.45 (36.8)	19.51 to 23.85 (86.8 to 106.1)
21, A	11	Disconnect detent	5171417	No color code	12	0.059 (1.50)	0.438 (11.1)	2.13 (53.9)	1.50 (38.1)	18.0 to 22.0 (80.1 to 97.9)
21, A	43	Disconnect detent	5171417	No color code	12	0.059 (1.50)	0.438 (11.1)	2.13 (53.9)	1.50 (38.1)	18.0 to 22.0 (80.1 to 97.9)
21, B	13	Disconnect detent	5171417	No color code	12	0.059 (1.50)	0.438 (11.1)	2.13 (53.9)	1.50 (38.1)	18.0 to 22.0 (80.1 to 97.9)

*Mean dimension shown

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
Suite 202
10 Parsonage Road
Edison, New Jersey 08837 USA
Phone: (201) 246-5070
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
Room 104
Garrison Place
19855 West Outer Drive
Dearborn, Michigan 48124-2098 USA
Phone: (313) 565-0411
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

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 700 Series Transmissions Service,
Detroit Diesel Allison, P. O. Box 894,
Indianapolis, Indiana 46206. Phone: (317) 242-3531.

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 Sales Manager, 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

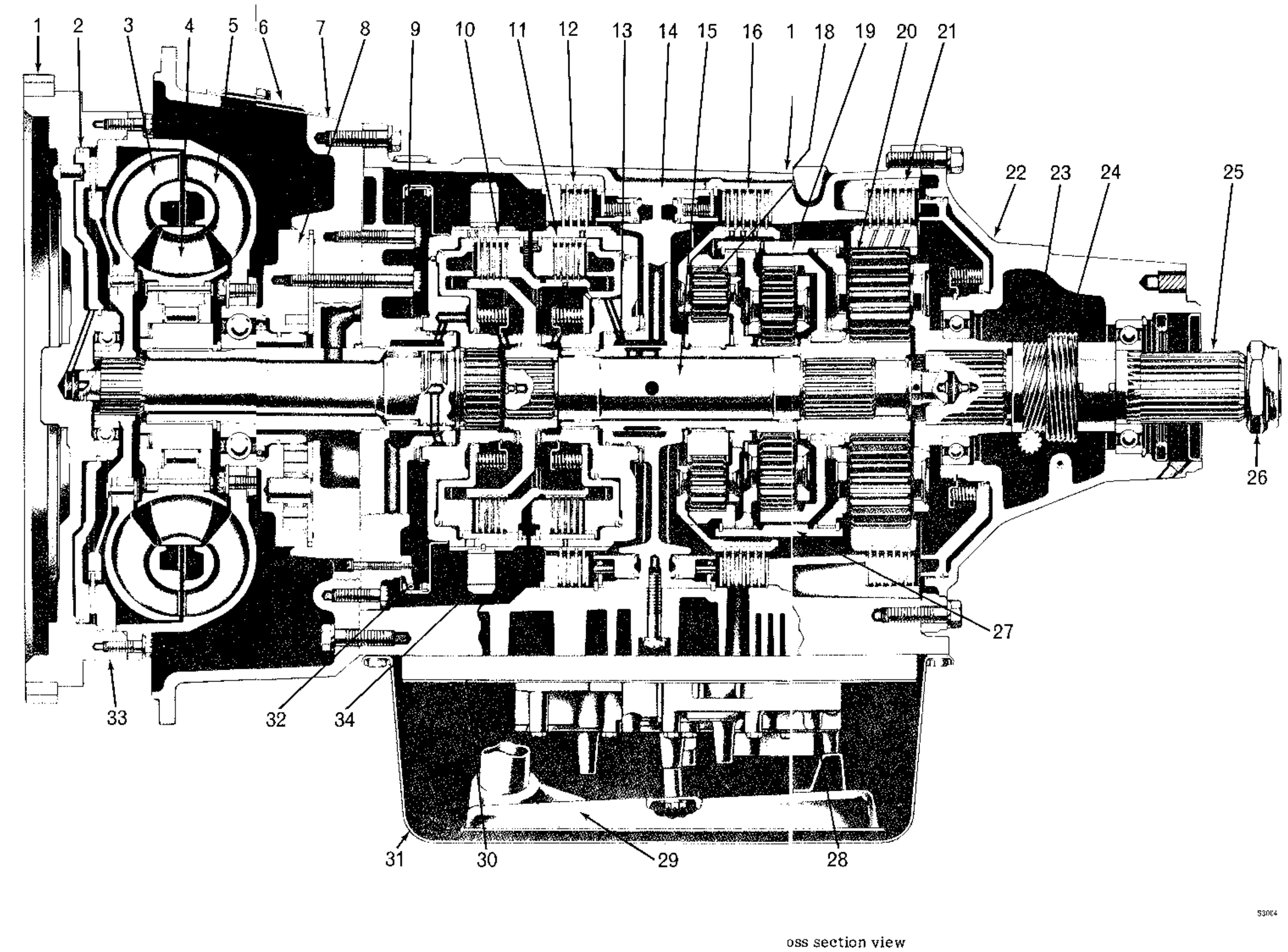
Additional service literature is available for the owner who takes pride in his equipment. These books provide fully illustrated instructions for the maintenance, service, overhaul, and parts support of your transmission. To ensure that you get maximum performance and service life from your unit, see 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

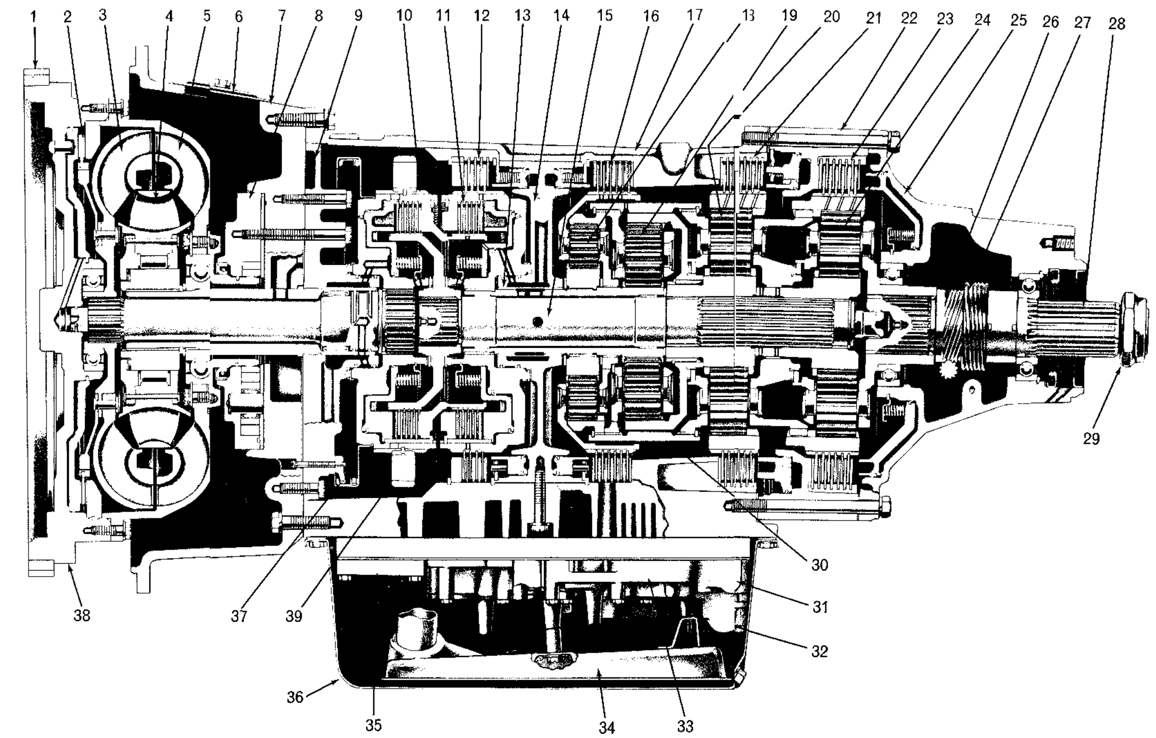
HT 700D Transmission Publications

HT 700 Drivers Handbook	SA 1334	HT 700 Series Parts Catalog	SA 1268
HT 700 Mechanics Tips	SA 1366	HT 700 Preventive Maintenance	SA 1772

1 - Starter ring gear
2 - Lockup clutch
3 - Torque converter turbine
4 - Torque converter stator
5 - Torque converter pump
6 - Accessory cover
7 - Torque converter housing
8 - Transmission input pump
9 - Forward support and valve assembly
10 - Forward clutch assembly
11 - Fourth clutch assembly
12 - Third clutch
13 - Sun gear and shaft assembly
14 - Center support housing assembly
15 - Main shaft assembly
16 - Second clutch
17 - Transmission housing
18 - Front planetary carrier assembly
19 - Center planetary carrier assembly
20 - Rear planetary carrier assembly
21 - First clutch
22 - Rear cover assembly
23 - Governor drive gear
24 - Speedometer drive gear
25 - Output shaft assembly
26 - Output flange retainer nut
27 - Gear unit connecting drum
28 - Control valve body assembly
29 - Oil filter
30 - Oil transfer plate
31 - Oil pan
32 - Pitot tube
33 - Flywheel
34 - PTO drive gear



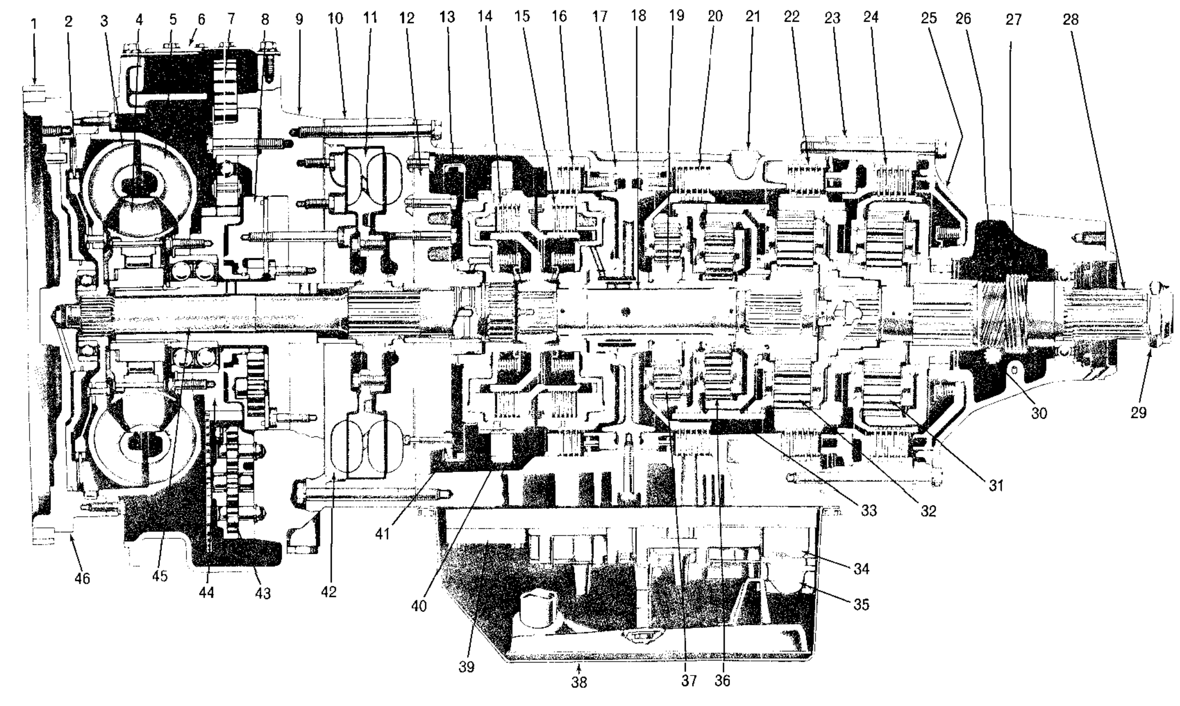
Foldout 1. Model HT 740D, HT 747D transmission - cross section view



1 - Starter ring gear
2 - Lockup clutch
3 - Torque converter turbine
4 - Torque converter stator
5 - Torque converter pump
6 - Accessory cover
7 - Torque converter housing
8 - Transmission input pump
9 - Forward support and valve assembly
10 - Forward clutch assembly
11 - Fourth clutch assembly
12 - Third clutch
13 - Sun gear and shaft assembly
14 - Center support housing assembly
15 - Main shaft assembly
16 - Second clutch
17 - Transmission housing
18 - Front planetary carrier assembly
19 - Center planetary carrier assembly
20 - Rear planetary carrier assembly
21 - First clutch
22 - Adapter housing assembly
23 - Low clutch
24 - Low carrier assembly
25 - Rear cover assembly
26 - Governor drive gear
27 - Speedometer drive gear
28 - Output shaft
29 - Output flange retaining nut
30 - Gear unit connecting drum
31 - Low shift valve assembly
32 - Low trimmer valve assembly
33 - Control valve assembly
34 - Oil filter
35 - Cover plate
36 - Oil pan
37 - Pitot tube
38 - Flywheel
39 - PTO drive gear

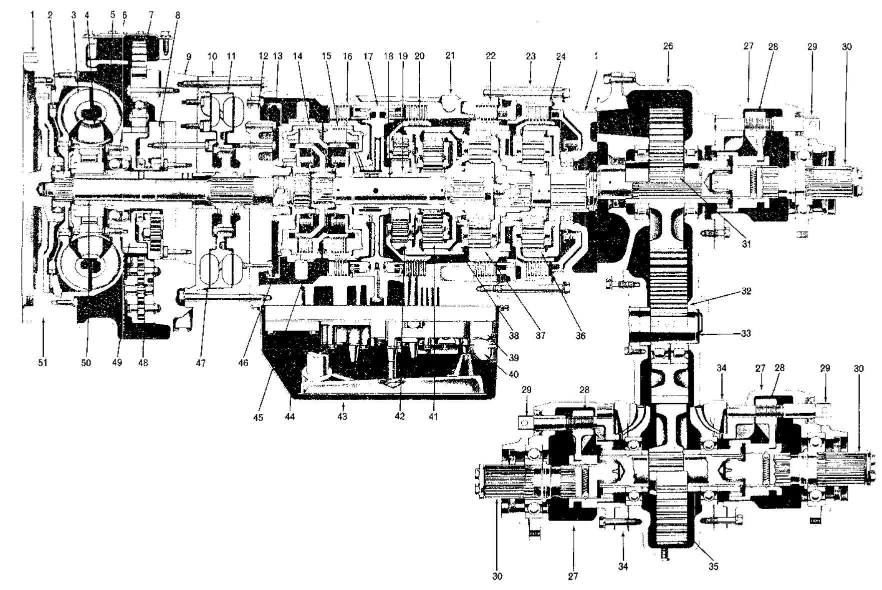
Foldout 2. Model HT 750CRD, HT 747CRD transmission - cross section view

1 - Starter ring gear
2 - Lockup clutch
3 - Torque converter turbine
4 - Torque converter stator
5 - Torque converter pump
6 - PTO accessory cover
7 - PTO idler gear
8 - Transmission input pump
9 - Torque converter housing
10 - Retarder housing
11 - Retarder rotor
12 - Forward support and valve assembly
13 - Pitot collector ring
14 - Forward clutch assembly
15 - Fourth clutch assembly
16 - Third clutch assembly
17 - Center support housing assembly
18 - Main shaft assembly
19 - Sun gear and shaft assembly
20 - Second clutch
21 - Transmission housing
22 - First clutch
23 - Adapter housing assembly
24 - Low clutch
25 - Rear cover assembly
26 - Governor drive gear
27 - Speedometer drive gear
28 - Output shaft
29 - Output flange retainer nut
30 - Governor assembly
31 - Low planetary carrier assembly
32 - Rear planetary carrier assembly
33 - Gear unit connecting drum
34 - Low shift valve assembly
35 - Low trimmer valve assembly
36 - Center planetary carrier assembly
37 - Front planetary carrier assembly
38 - Oil pan
39 - Cover plate
40 - PTO drive gear
41 - Pitot tube
42 - Retarder plate assembly
43 - Scavenge pump assembly
44 - PTO and scavenge pump drive gear
45 - Input shaft
46 - Flywheel

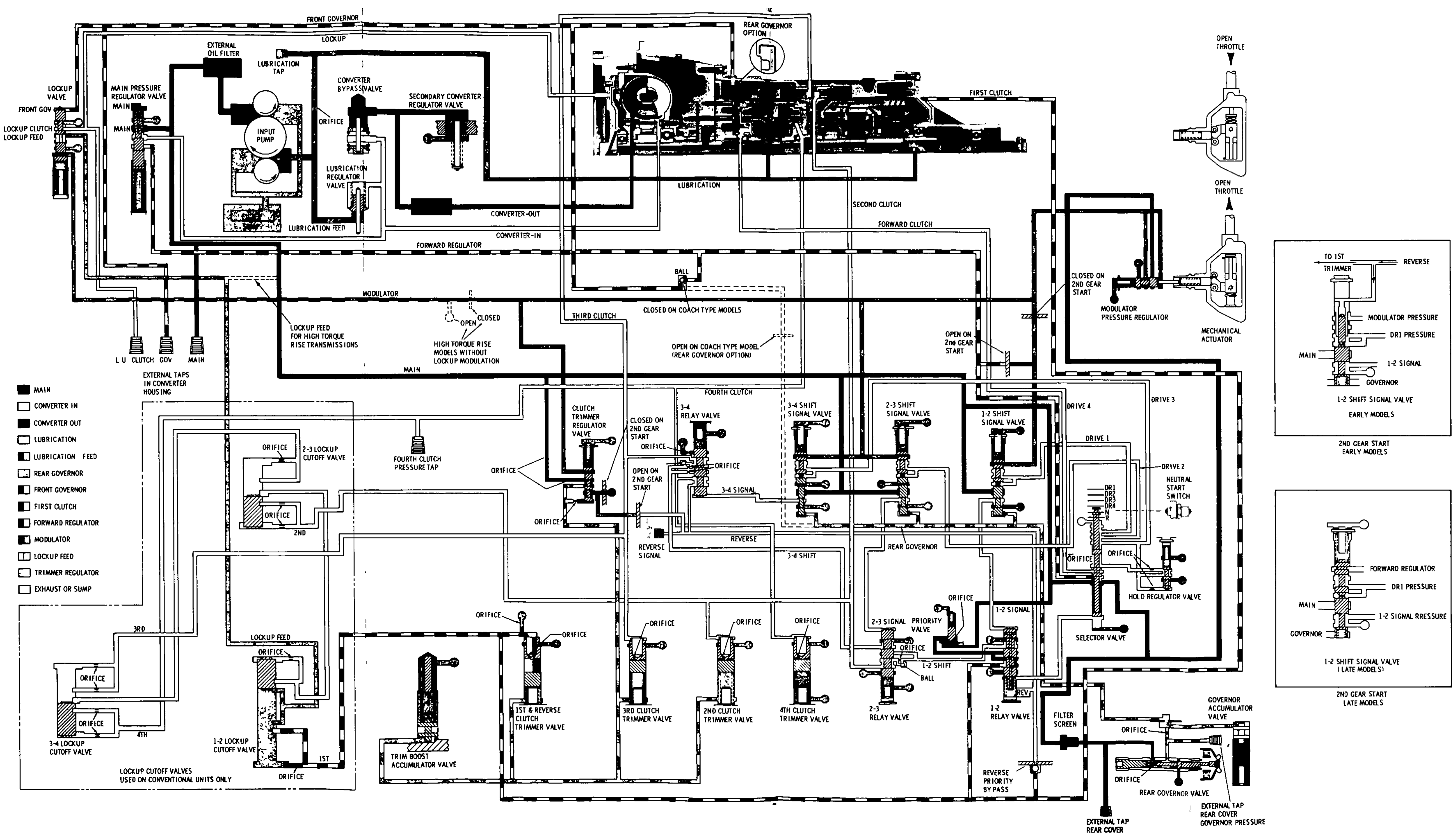


Foldout 3. Model HT 750DRD transmission - cross section view

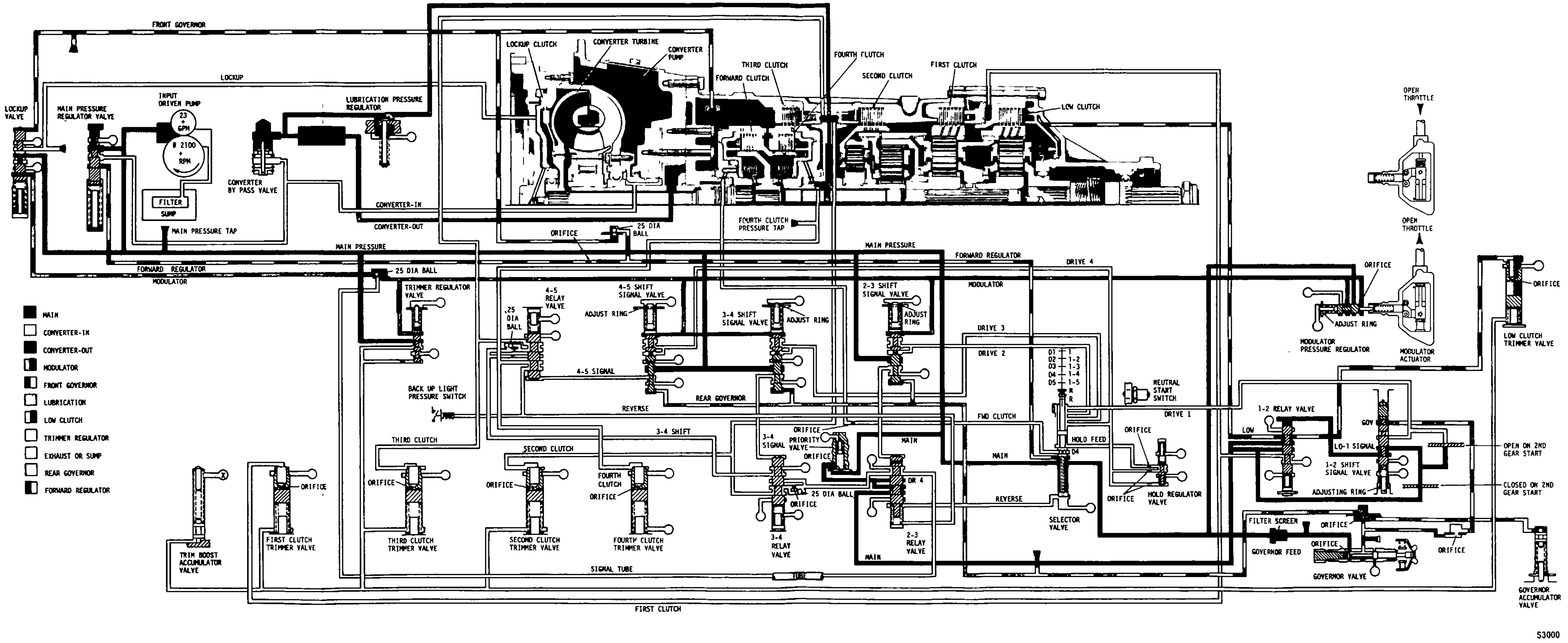
1 - Starter ring gear
2 - Lockup clutch
3 - Torque converter turbine
4 - Torque converter stator
5 - Torque converter pump
6 - PTO accessory cover
7 - PTO idler gear
8 - Transmission input pump
9 - Torque converter housing
10 - Retarder housing
11 - Retarder rotor
12 - Forward support and valve assembly
13 - Pitot collector ring
14 - Forward clutch assembly
15 - Fourth clutch assembly
16 - Third clutch assembly
17 - Center support housing assembly
18 - Main shaft assembly
19 - Sun gear and shaft assembly
20 - Second clutch
21 - Transmission housing
22 - First clutch
23 - Adapter housing assembly
24 - Low clutch
25 - Transfer gear housing (dropbox) adapter
26 - Transfer gear housing (dropbox)
27 - Manual disconnect clutch housing
28 - Disconnect clutch shift fork
29 - Disconnect clutch shift shaft
30 - Disconnect clutch output shaft
31 - Transfer drive gear
32 - Transfer idler gear
33 - Transfer idler gear spindle
34 - Disconnect clutch housing adapter
35 - Transfer driven gear
36 - Low planetary carrier assembly
37 - Rear planetary carrier assembly
38 - Gear unit connecting drum
39 - Low shift valve assembly
40 - Low trimmer valve assembly
41 - Center planetary carrier assembly
42 - Front planetary carrier assembly
43 - Oil pan
44 - Cover plate
45 - PTO drive gear
46 - Pitot tube
47 - Retarder plate assembly
48 - Scavenge pump assembly
49 - PTO and scavenge pump drive gear
50 - Input shaft
51 - Flywheel



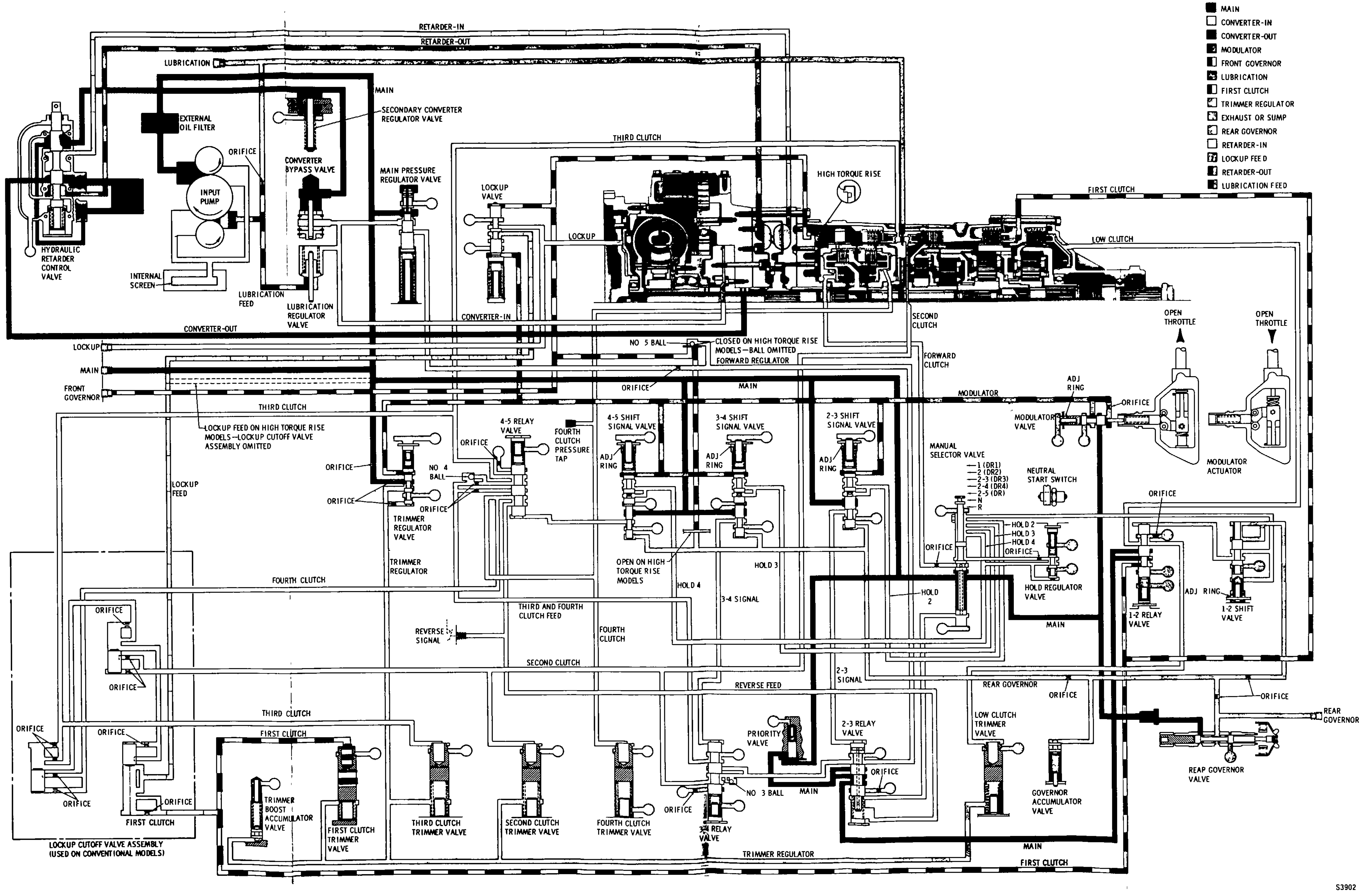
Foldout 4. Model HT 750 DRD DB transmission - cross section view



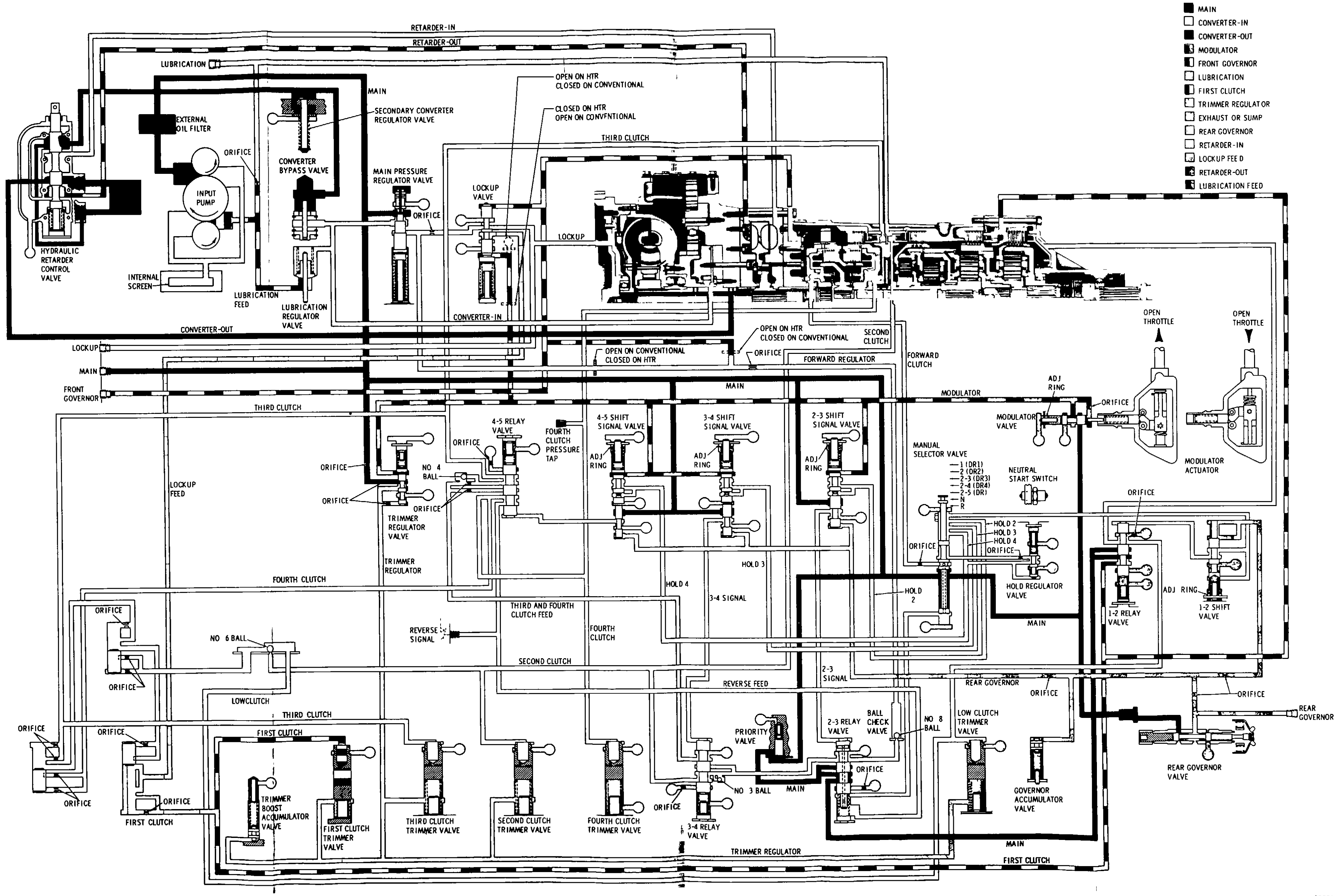
Foldout 5. Model HT 740D, HT 747D transmission hydraulic system- schematic view



Foldout 6. Model HT 750CRD, HT 754CRD transmission hydraulic system- schematic view



Foldout 7. Model HT 750DRD, transmission hydraulic system (no lockup in first gear)- schematic view.



Foldout 8. Model HT 750DRD transmission hydraulic system all-range lockup)--schematic view

HT 740, HT750D AUTOMATIC TRANSMISSIONS

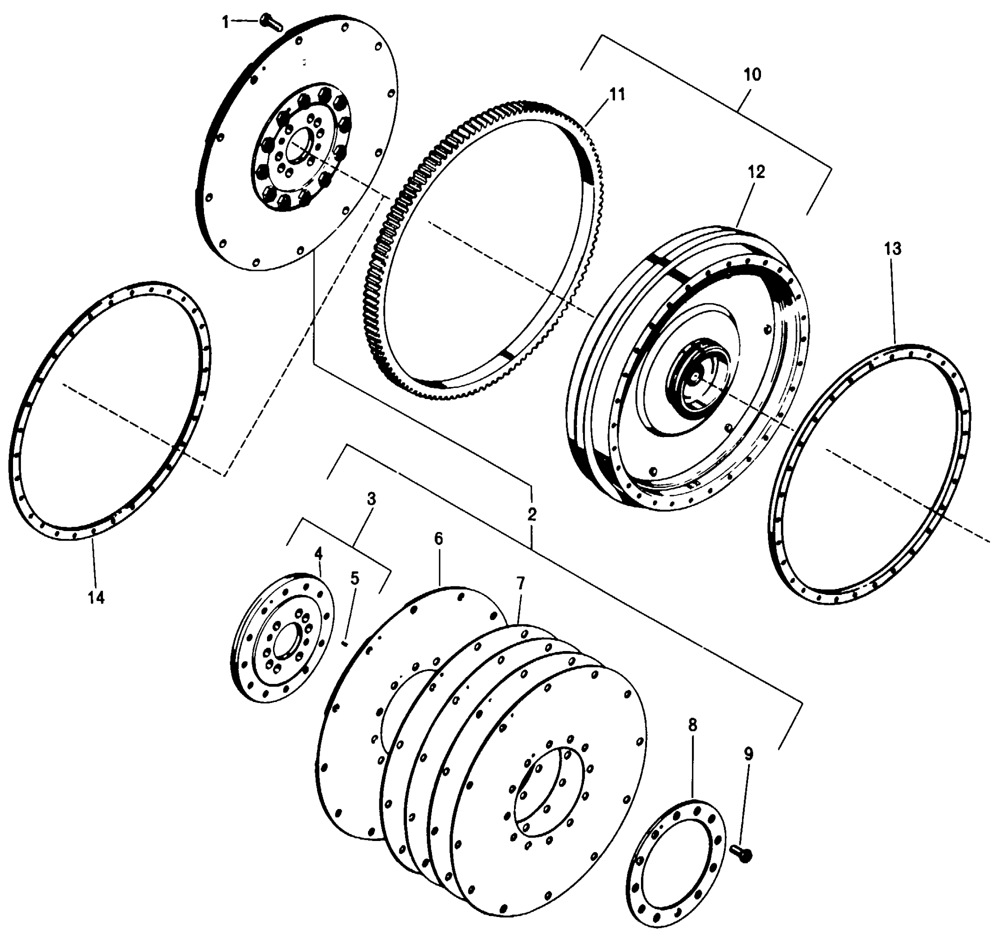
A

1- Self-locking bolt, 1/2-20 x 1 (12) AI
2- Flex disk assembly
3- Flex disk hub assembly
4- Hub
5- Dowel pin
6- Flex disk
7- Flex disk (I)
8- Flex disk plate
9- Self-locking bolt, 1/2-20 x 3/4 (12) A
10- Flywheel assembly
11- Starter ring gear
12- Flywheel
13- Converter housing adapter (HT 750 models)
14- Flywheel housing gasket

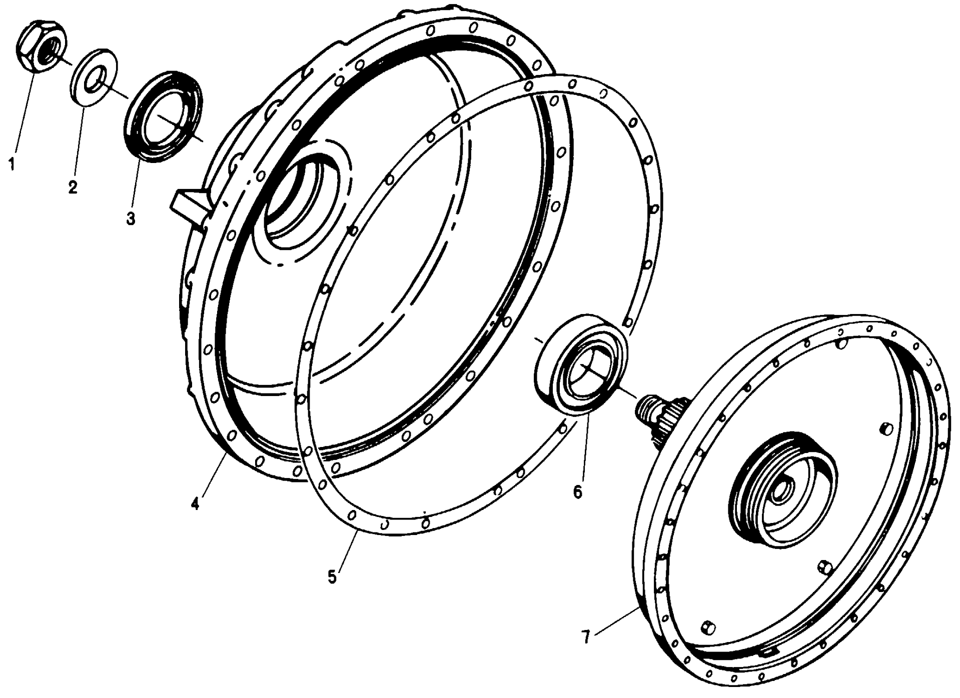
Torque	lb ft	Nm
A	96-115	130-156

B

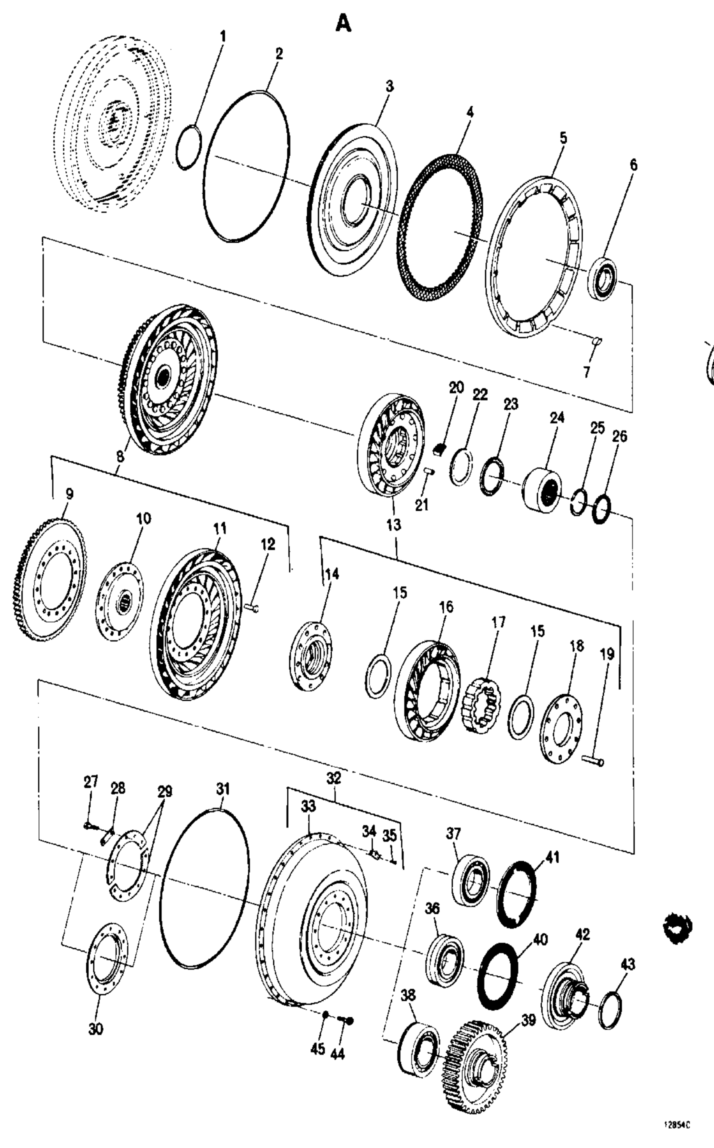
1- Nut
2- Washer
3- Oil seal
4- Front cover
5- Gasket
6- Bearing
7- Converter drive cover



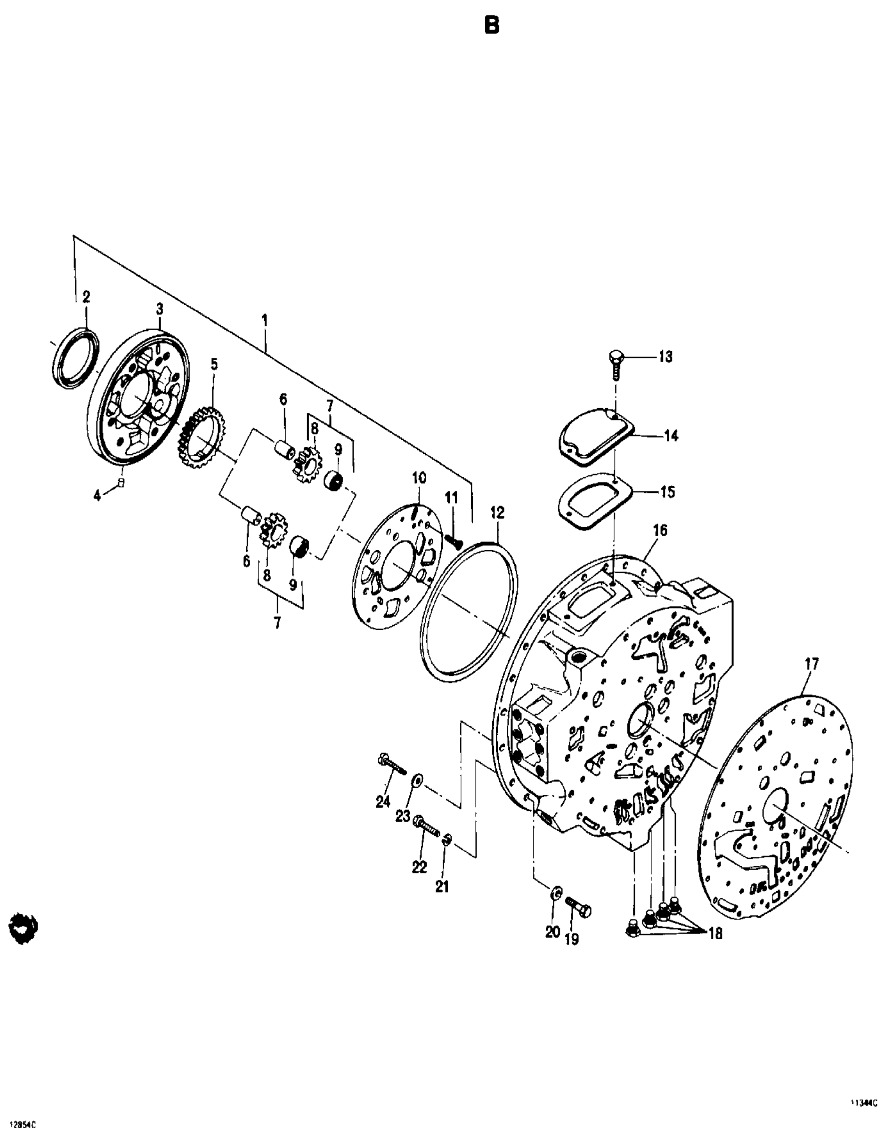
A, Foldout 9. Flex disc and flywheel assemblies - exploded view



B, Foldout 9. Transmission front cover, remote mount - exploded view.



A, Foldout 10. Lockup clutch and torque converter - exploded view



B, Foldout 10. Oil pump and converter housing (for models without retarder or PTO) - exploded view

A

1 -Sealring
2- Sealring
3 - Lockup clutch piston
4 - Lockup clutch plate
5 - Lockup clutch back plate
6 - Ball bearing
7 - Key
8 - Torque converter turbine assembly
9 - Lockup clutch hub
10 - Turbine hub
11 - Turbine
12 - Rivet (16)
13 - Torque converter stator assembly
14 - Stator thrust washer
15 - Stator cam washer (2)
16 - Stator
17 - Stator cam
18 - Freewheel side washer
19 - Rivet, 1/4 x 2-5/8 (10)
20 - Stator freewheel roller spring (10)
21 - Stator Freewheel roller (10)
22 - Thrust bearing race
23 - Thrust bearing
24 - Stator freewheel roller race
25 - External snapping
26 - Converter pump spacer
27.- Bolt, 3/8-24 x 1-1/4 (12) A
Bolt, 3/8-24 x 1-3/8 (split bearing) A
28 - Lockstrip (6)
29 - Bearing retainer (2) (earlier models)
30 - Bearing retainer (later models)
31 - Sealring
32 - Torque converter pump assembly
33 - Torque converter pump
34 - Balance weight (AR)
35 - Balance weight screw (AR)
36 - Ball bearing (later models) (split race)
37 - Ball bearing (earlier models)
38 - Double roll ball bearing (with PTO)
39 - Power-takeoff drive gear (with PTO)
40 - Converter pump hub gasket (later models)
41 - Converter pump hub gasket (earlier models)
42 - Converter pump hub
43 - Hook-type sealring
44 - Self-locking bolt, 3/8-24 x 1-1/4 (30) B
45 - Washer (30)

Torque	lb ft	N m
A	33-40	45-54
B	41-49	56-66

B

1 - Oil pump assembly
2 - Oil seal
3 - Oil pump body
4 - Plug - 3/4 (3) (Non-retarder-Automotive hag)
5 - Oil pump drive gear
6 - Driven gear shaft
7 - Driven gear assembly
8 - Driven gear
9 - Roller bearing
10 - Pump cover
11 - Flat-Head machine screw, 1/4-20 x 5/8 A
12 - Sealring
13 - Bolt, 3/8-16 x 3/4 (2) }3
14 - Converter access cover
15 - Converter access cover gasket
16 - Converter housing
17 - Converter housing gasket
18 - Pipe plug, 1/8 (4) C
19 - Bolt, 7/16-14 x 1-1/2 (22) D
20 - Lockwasher, 7/16 (22)
21 - Lockwasher, 1/2 (7)
22 - Bolt, 1/2-13 x 2 (7) E
23 - Flat washer (2)
24 - Fillister-ead machine screw (2) F

Torque	lb ft	N.m
A	9-11	12-15
B	26-32	35-43
C	4-5	5-7
D	42-50	57-68
E	67-80	91-108
F	10-32	3-5

- Assemblies not equipped with hydraulic retarder require only one of each; those with retarder require two.

FOLDOUT 11

A

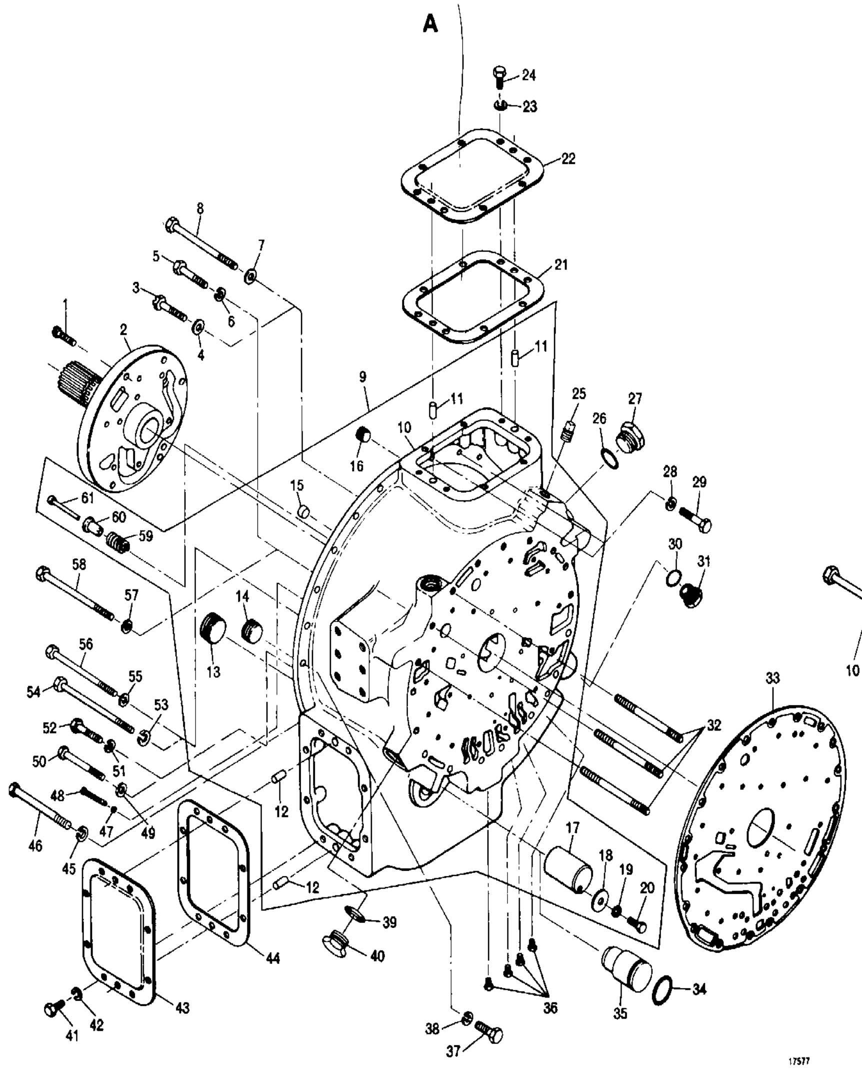
1 - Bolt, 3/8-16x 1-1/2(g) A
2 - Converter ground sleeve
3 -Bolt, 1/2-13 x 2-1/4 (2) (Nonretarder models) B
4 - Plain washer, 1/2 (2) (Non-retarder models)
5 - Bolt, 1/2-13 x 2-1/2 (Non-retarder models) B
6 - Lockwasher, 1/2 (1) (Non-retarder models)
7 - Plain washer, 1/2 (2) (with retarder)
8 - Bolt, 1/2-13 x 6-1/4 (2) (with retarder) E
9 - Converter housing assembly
10 - Converter housing
11 - Dowel pin (2)
12 - Dowel pin (2)
13 - Pipe plug, 1-1 /2 J
14 - Pipe plug, 1 H
15 - Cup plug, 3/4
16 - Pipe plug, 1/2 K
17 - PTO gear spin-e
18 - Plain washer, 1/2
19 -Lockwasher, 1/2
20 - Bolt, 1/2-20 x 1 L
21 - PTO cover gasket
22 - PTO cover
23 - Lockwasher, 7/16 (8)
24 - Bolt, 7/16-14 x 1-1/8 (8) C
25 - Pipe plug, 1/2 K
26- Seal
27 - Plug, 1-5/16
28 - Lockwasher, 7/16 (2)
29 - Bolt, 7/16-14 x 2 (2) C
30 - Seal
31 - Plug, 3/4 M
32 - Stud, 1/2-T3 x 1/2-20 x 6.40 (3) D
(with retarder)
- Stud, .003 oversize (AR) (with retarder)
- Stud, .006 oversize (AR) (with retarder)
- Stud, .009 oversize (AR) (with retarder)
- Stud, .012 oversize (AR) (with
retarder)
33 - Converter housing gasket
34- Sealring
35 - PTO drive gear spindle
36 - Pipe plug, 1/8 (4) E
37 - Bolt, 7/16-14 x 1-1/2 (19) C
38 - Lockwasher, 7/16 (19)
39- Seal
40 - Plug, 1-5/16
41 - Bolt, 7/16-14 x 1-1/8 (8) C
42 - Lockwasher, 7/16 (8)
43 - PTO cover
44 - PTO cover gasket
45 - Lockwasher, 1/2
46 - Bolt, 1/2-20 x 3-3/4 G
47-Flat washer (2)
48 - Fillister-head machine screw 2) F
49 - Lockwasher, 1/2 (3) (Non-retarded;)
50 - Bolt, 1/2-13 x 2-1/8 (3) (Non-retarder) B
51 - Lockwasher, 1/2 (Non-retarder)
52 - Bolt, 1/2-13 x 3-3/4 (Non-retarder) B
53 - Plain washer, 1/2 (with retarder)
54 - Bolt, 1/2-13 x 7-3/4 (with retarder) B
55 - Lockwasher, 1/2 (3) (with retarder)
56 - Bolt, 1/2-13 x 6-1/4 (3) (with retarder) B
57 - Lock washer, 1/2 (with retarder)
58 - Bolt, 1/2-13 x 6-1/2 (with retarder) B
59 - Lubrication valve spring (with retarder)
60 - Lubrication valve (with retarder)
61 - Lubrication valve pin (with retarder)

Torque	lb ft	N•m
A	36-43	49-58
B	67-80	91-108
C	42-50	57-68
D	15-5	20-88
E	4-5	5-7
F	3-4	4 -
G	88-100	119-136
H	70-90	95-122
	110-130	149-176
K	16-20	22-27
L	83-100	113-135
M	21-28	28-38

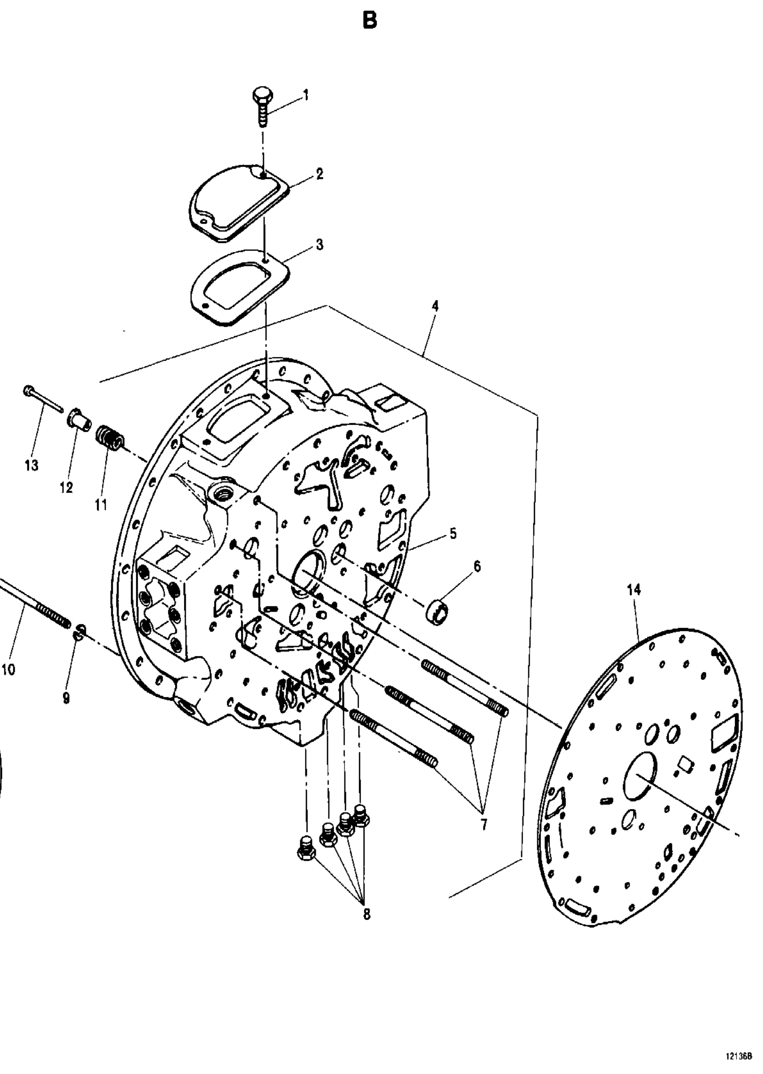
B

1 - Bolt, 3/8-16 x 3/4 (2) A
2 - Converter housing access cover
3 - Converter housing access cover gasket
4 - Converter housing assembly
5 - Converter housing
6 - Plug
7 - Stud, 1/2-13x 1/2-20 x6.40 (3)B
- Stud, 0-003 oversize (AR)
- Stud, 0.006 oversize (AR)
- Stud, 0.009 oversize (AR)
- Stud, 0.012 oversize (AR)
8 - Pipe plug, 1/8 (4) C
9 - Lockwasher, 112 (
10 - Bolt, 1/2-13 x 6 (7) D
11 - Lubrication valve spring
12 - Lubrication valve
13 - Lubrication valve pin
14 - Converter housing gasket

Torque	lb ft	N•m
A	26-32	35-43
B	15-65	20-88
C	4-5	5-7
D	67-80	91-108



A, Foldout 11. Converter housing and ground sleeve--exploded view



B, Foldout 11. Converter housing (models with retarder, no PTO)--exploded view

A

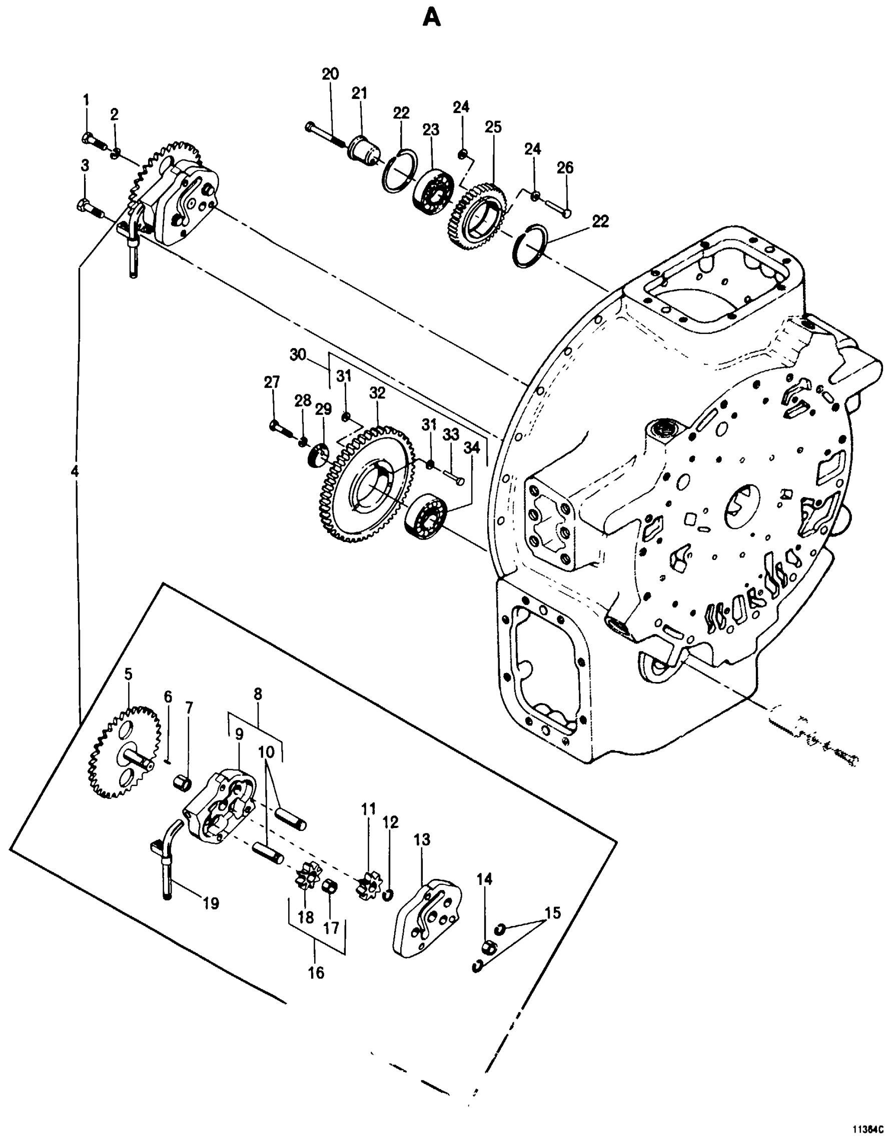
1 - Bolt, 3/8-16 x 2-1/2 (3) A
2 - Lockwasher, 318 (3)
3 - Bolt, 318-16 x 7/8 A
4 - Scavenge oil pump assembly
5 - Drive gear
6 - Roller
7 - Needle bearing
8 - Body assembly
9 - Body
10 - Spindle (2)
11 - Drive gear
12 - External snapring
13 - Scavenge pump plate
14 - Needle bearing
15 - External snapring (2)
16 - Driven gear assembly
17 - Bushing
18 - Driven gear
19 - Scavenge pump tube
20 - Bolt, 112-13 x 3-114 B
21 - Idler gear spindle
22 - Snapring (2)
23 -' Single row ball bearing
24 - Bearing retainer washer (6)
25 - PTO idler gear
26 - Rivet (3)
27 - Bolt, 1/2-20 x 1-1/4 (early models) C
- Bolt, 1/2-20 x 3-3/4 (late models) C
28 - Lockwasher, 112
29 - PTO gear retainer
30 - PTO gear assembly
31 - Bearing retainer washer (6)
32 - PTO gear
33 - Rivet (3)
34 - Single row ball bearing

Torque	lb ft	N•m
A	26-32	35-43
B	81-97	110-131
C	B3-100	113-136

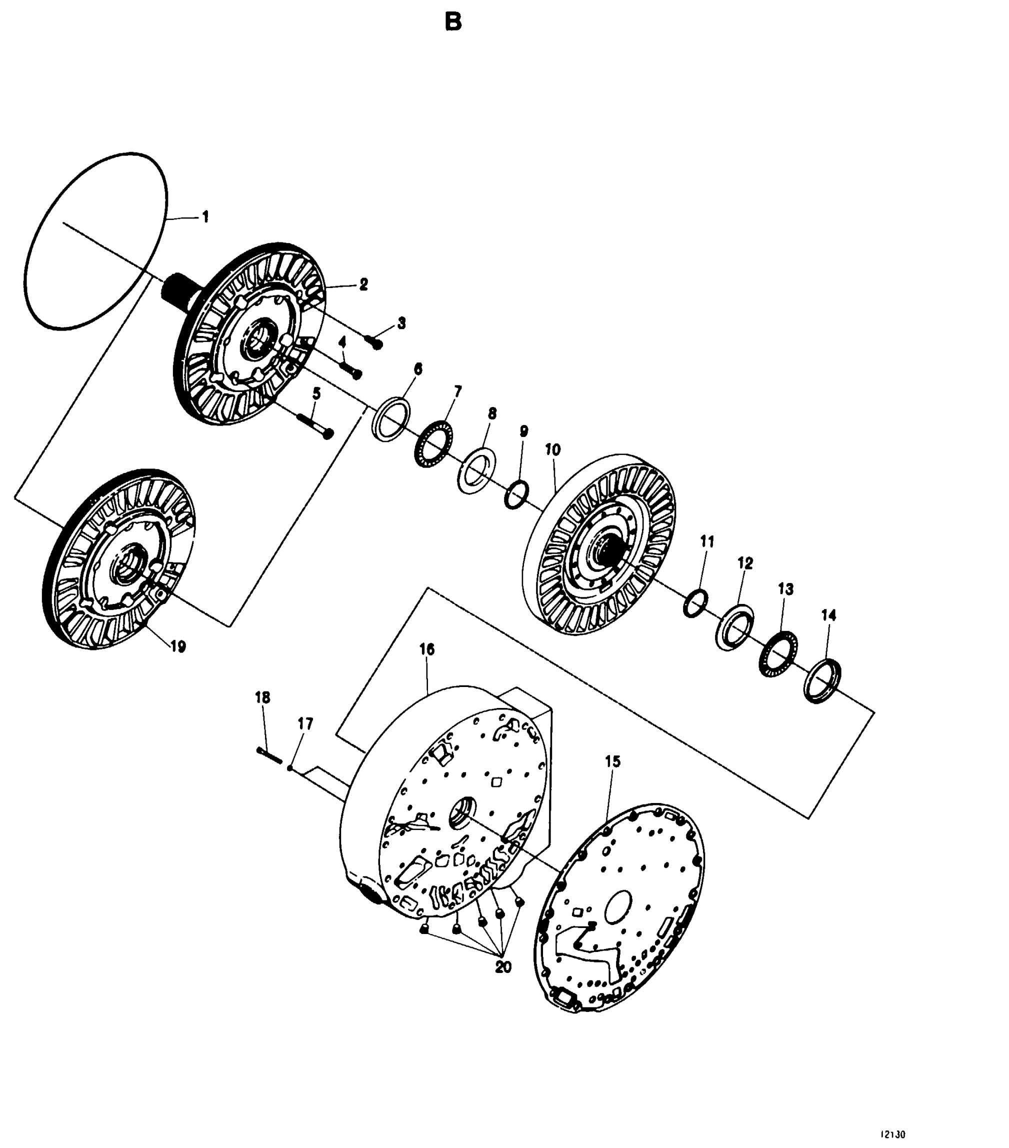
B

1 - Sealring
2 - Retarder plate assembly
3 - Bolt, 318-16 x 1-112 A
4 - Bolt, 318-16 x 1 (18) A
5 - Bolt, 3/8-16 x 3 (6) Aged with item #2 A
- Bolt, 3/8-16 x 4 (6) Used with item #19 A
6 - Thrust bearing race
7 - Roller bearing assembly
8 - Thrust bearing race
9 - Sealring
10 - Retarder rotor and hub balancing assembly
11 - Sealring
12 - Thrust bearing race
13 - Roller bearing assembly
14 - Thrust bearing race
15 - Retarder housing gasket
16 - Retarder housing assembly
17 - Flat washer (2)
18 - Fillister-head machine screw (2) B
19 - Retarder plate assembly
20 - Pipe plug, 1/8 (5) some models C
- Pipe plug, 1/8 (4) some models C
- Pipe plug, 1/8 (1) later models

Torque	lb ft	N•m
A	36-43	49-58
B	3-4	4-5
C	4-5	5-7



A, Foldout 12. Scavenge oil pump and power-takeoff driven gear--exploded view



B, Foldout 12. Retarder housing--exploded view

1 - Front support and valve assembly .
2 - Front support and ground sleeve - assembly
3 - Main pressure regulator valve
4 - Main regulator valve spring
5 - Valve stop
6 - Retainer washer
7 - Internal snapping
8 - Lockup shift valve
9 - Valve spring
10 - Valve stop
11 - Retainer washer
12 - Internal snapping
13 - Valve spring
14 - Converter bypass valve
15 - Valve seat
16 - Valve support assembly
17 - Valve guide
18 - Valve support
19- Snapring
20 - Roller bearing assembly
21 - Bolt, 3/8-16 x 2-1/2 (3) A
22 - Bolt, 3/8-16 x 4 (6) A
23 - Thrust bearing race
24 - Roller bearing assembly
25 - Butt-joint sealring (2)
26 - Iocknut, #10-32 t2)
27 - Front pilot blocker
28 - Front pilot tube
29 - Bolt, 3/8-16 x 1-1/2 (16) A
30 - Sleeve assembly
31 - Pin (Rework only)
32 - Sleeve (Rework only)
33 - Front support and sleeve assembly - (with retarder)
34 - Bolt, 3/8-16 x 5 (6) A
35 Bolt, 3/8-16 x 1-1/2716) A

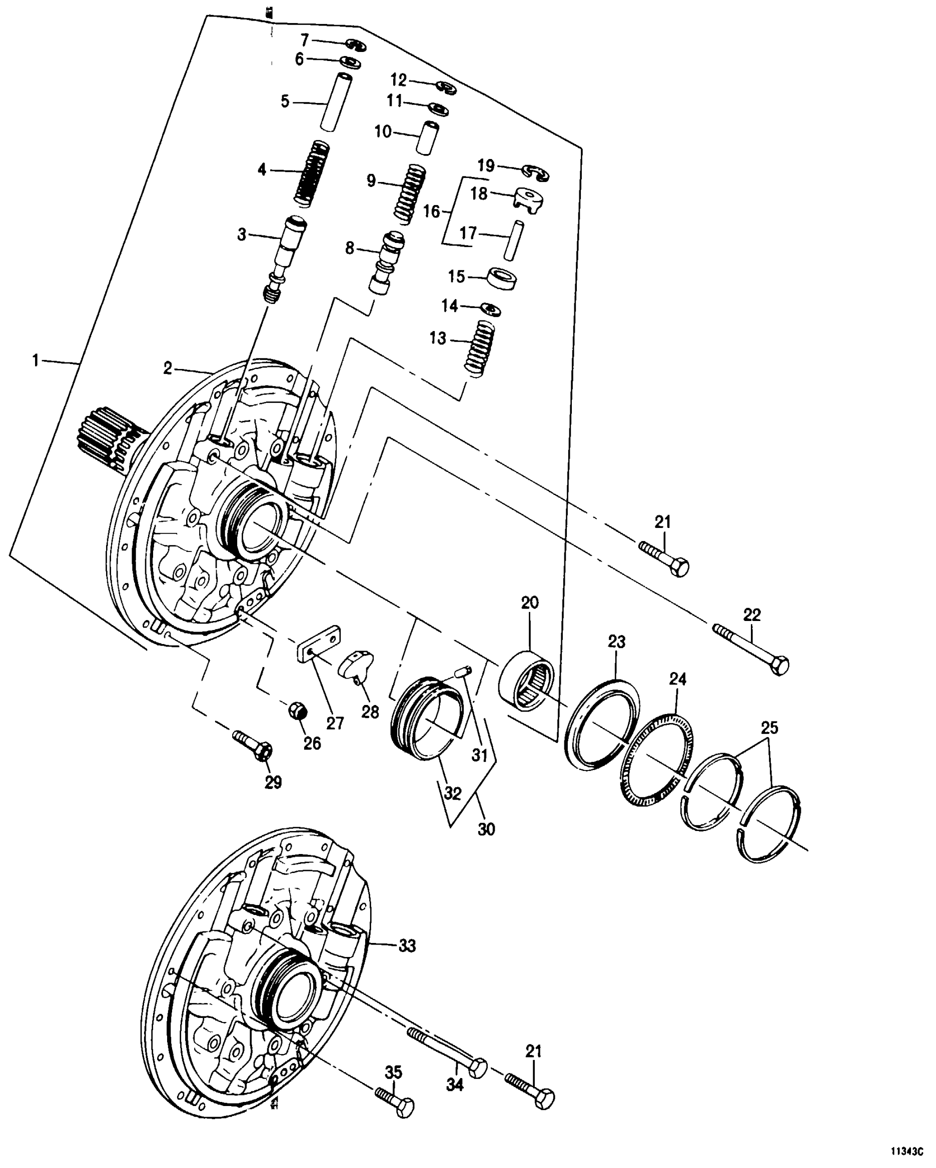
Torque	lb ft	N•m
A	36-3	49-58

B

1 - Sealring
2 - Thrust bearing race
3 - Forward clutch assembly
4 - Hook-type sealring (2)
5 - Forward clutch housing and input shaft assembly
6 - Pitot collector ring
7 - Ball, 3/16 (4)
8 - -Internal snapping
9 - PTO gear
10 - Piston inner sealring
11 - Piston outer sealring
12 - Forward clutch piston (marked):
A 1.110-1.120 THK.
B 1.137-1.147 THK.
C 1.164-1.174 THE.

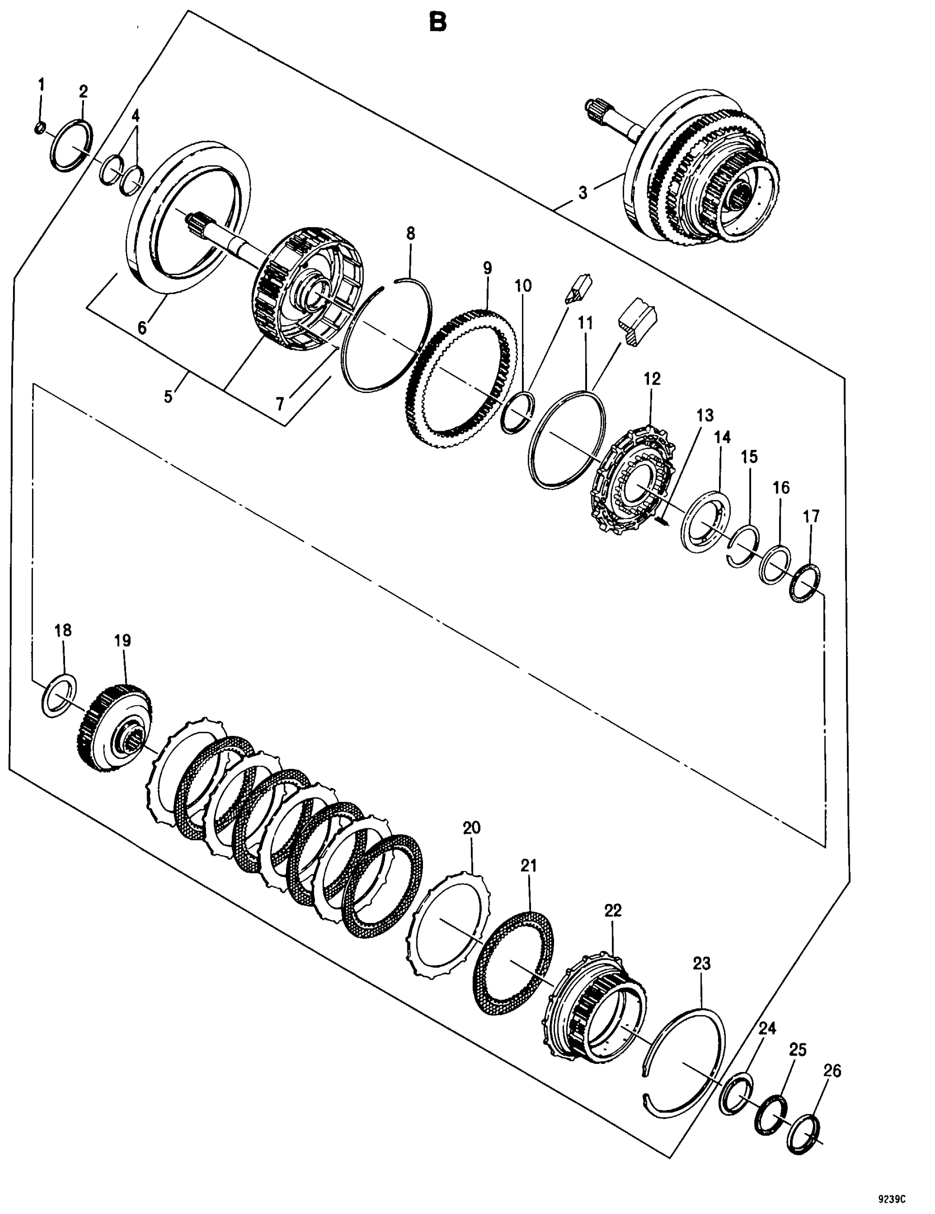
13 - Forward clutch release spring (20)
14 - Spring retainer
15 - External snapping
16 - Thrust bearing race
17 - Roller bearing assembly
18 - Thrust bearing race
19 - Forward clutch hub
20 - External-tanged clutch plate (5)
21 - Internal-splined clutch plate (5)
22 - Fourth-clutch driving hub
23 - Internal snapping
24 - Thrust bearing race
25 - Roller bearing assembly
26 - Thrust bearing race

A



A, Foldout 13. Front support and valve assembly--exploded view

B



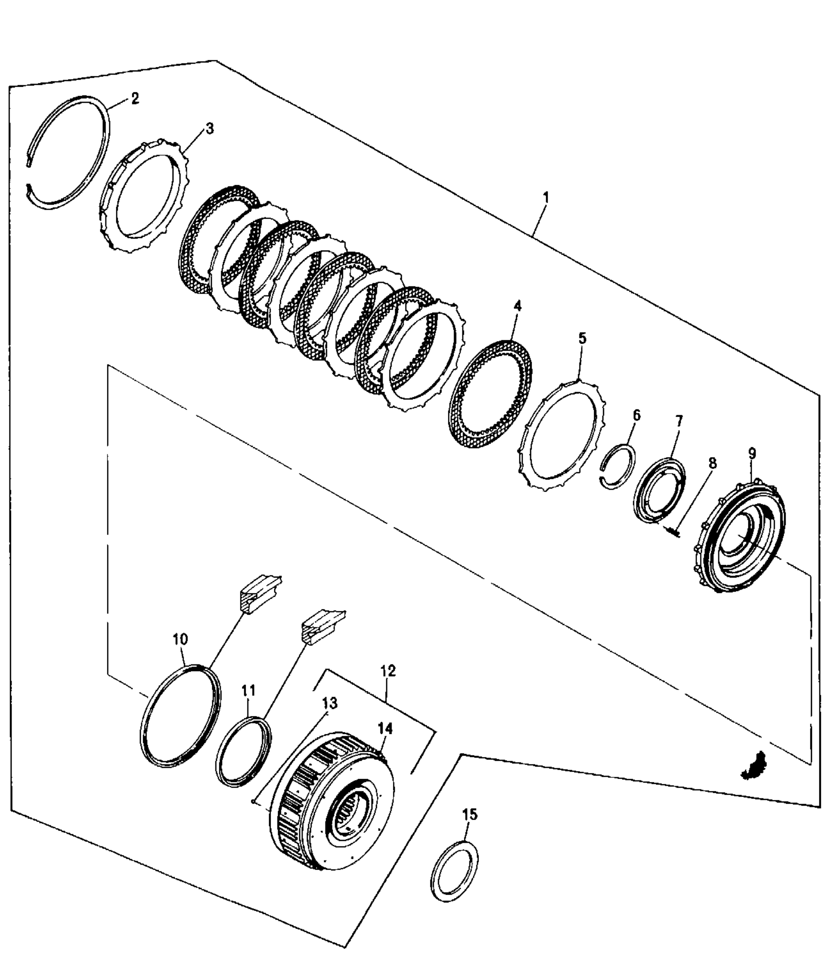
B, Foldout 13. Forward clutch assembly--exploded view

A

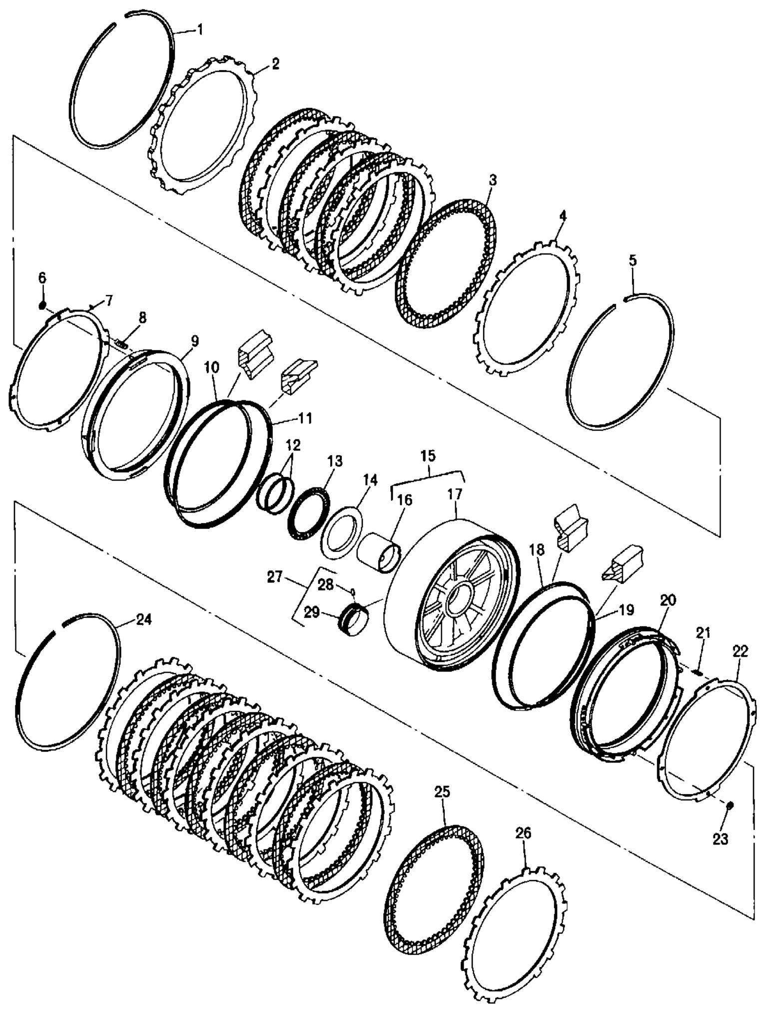
1 - Fourth-clutch assembly
2 - Snapring
3 - Clutch backplate
4 - Internal-splined clutch plate (5)
5 - External-tanged clutch plate (5)
6 - Snapring
7 - Spring retainer
8 - Clutch release spring (20)
9 - Fourth-clutch piston (marked):
   M 1.110-1.120 THK
   S 1.137-1.147 THK
   T 1.164-1.174 THK
10 - Piston outer sealring
11 - Clutch housing sealring
12 - Fourth-clutch housing assembly
13 - Ball, 3/16 (8)
14 - Fourth-lutch housing
15 - Thrust bearing race

B

1 - Snapring
2 - Third-clutch backplate
3 - Internal splined clutch plate (4)
4 - External-tanged clutch plate (4):
   0.0993-0.1063 THK (Red) (AR)
   0.1161-0.1231 THK (Green) (AR)
5 - Snapring (1):
   0.148 (3.76 mm)- 0.150 (3.81 mm)
   0.152 (3.86 mm) - 0.154 (3.91 mm)
   0.155 (3.94 mm)- 0.157 (3.99 mm)
   0.158 (4.01 mm) - 0.160 (4.06 mm)
6 - Self-locking retainer ring (4)
7 - Spring retainer
8 - Piston release spring (20)
9 - Third-clutch piston
10 - Piston inner sealring
11 - Piston outer sealring
12 - Butt-joint sealring (2)
13 - Needle roller bearing
14 - Thrust bearing race
15 - Center support housing assembly
16 - Bushing
17 - Center support housing
18 - Piston outer sealring
19 - Piston inner sealring
20 - Second-clutch piston
21 - Piston release spring t20)
22 - Spring retainer
23 - Self-locking retainer ring (4)
24- Snapring
25 - Internal-splined clutch plate (6)
26 - External-tanged clutch plate (7)
   0.0993-0.1063 THK (Red) (AR)
   0.1161-0.1231 THK (Green) (A'
27 - Sleeve assembly
28 - Pin
29- Sleeve



A, Foldout 14. Fourth clutch assembly--exploded view



B, Foldout 14. Third-clutch, center support, and second clutch--exploded view

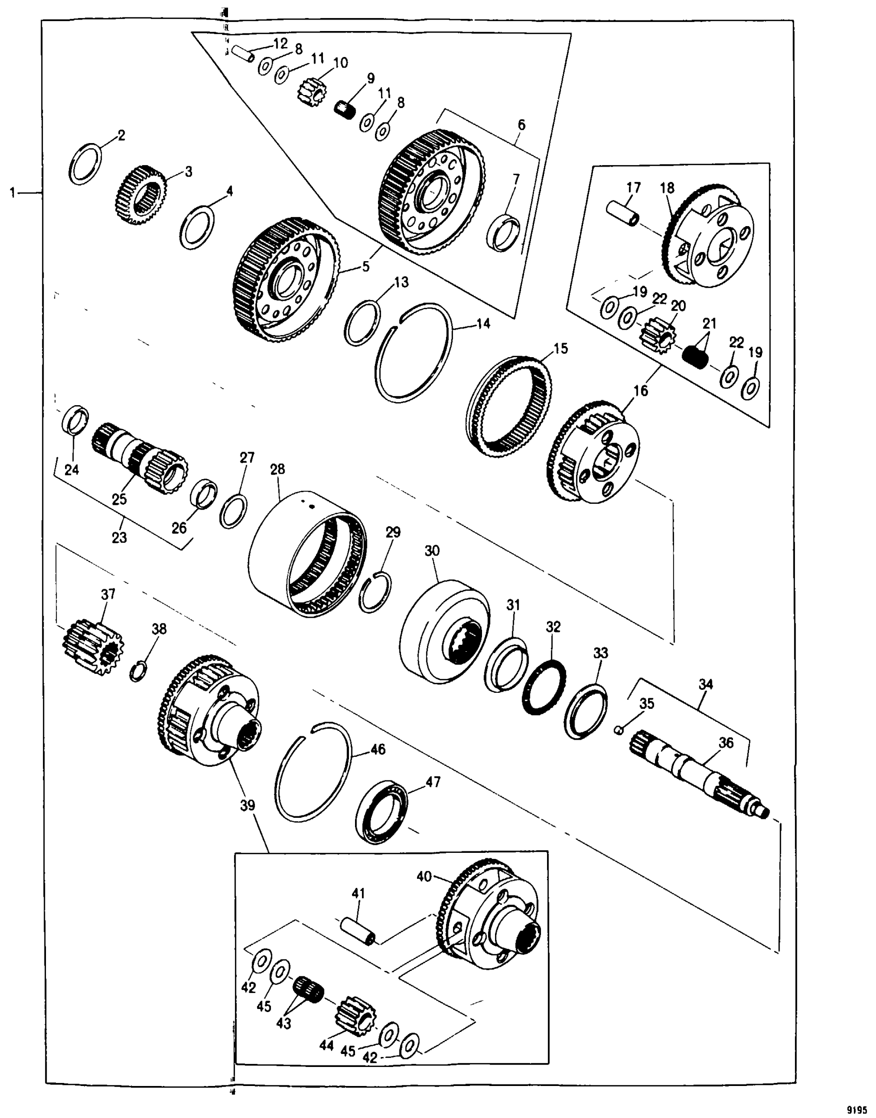
A

1 - Gear unit and main shaft assembly
2 - Thrust washer
3 - Front planetary sun gear
4 - Crust washer
5 - Front planetary carrier assembly
6 - Flange and carrier assembly
7 - Sleeve bushing
8 - Bronze thrust washer (12)
9 - Needle roller bearing (6)
10 - Pinion (6)
11 - Steel thrust washer (12)
12 - Pinion pin (6)
13 - Thrust washer
14 - Snapring
15 - Front planetary ring gear
16 - Center planetary carrier assembly
17 - Pinion pin (4)
18 - Center planetary carrier
19 - Bronze thrust washer (8)
20 - Pinion (4)
21 - Needle roller bearing (8)
22 - Steel thrust washer (8)
23 - Center sun gear and shaft assembly
24. - Split sleeve bushing
25 - Center sun gear shaft
26 - Split sleeve bushing
27 - Thrust washer
28 - Planetary connecting drum
29 - External snapping
30 - Center planetary ring gear
31 - Thrust race
32 - Needle roller bearing
33 - Thrust race
34 - Main shaft assembly
35 - Orifice plug
36 - Main shaft
37 - Rear planetary sun gear
38 - External snapping
39 - Rear planetary carrier assembly
40 - Rear planetary carrier
41 - Pinion pin (4)
42 - Bronze thrust washer (8)
43 - Needle roller bearing (8)
44 - Pinion (4)
45 - Steel thrust washer (8)
46 - Internal snapping
47 -Ball bearing

B

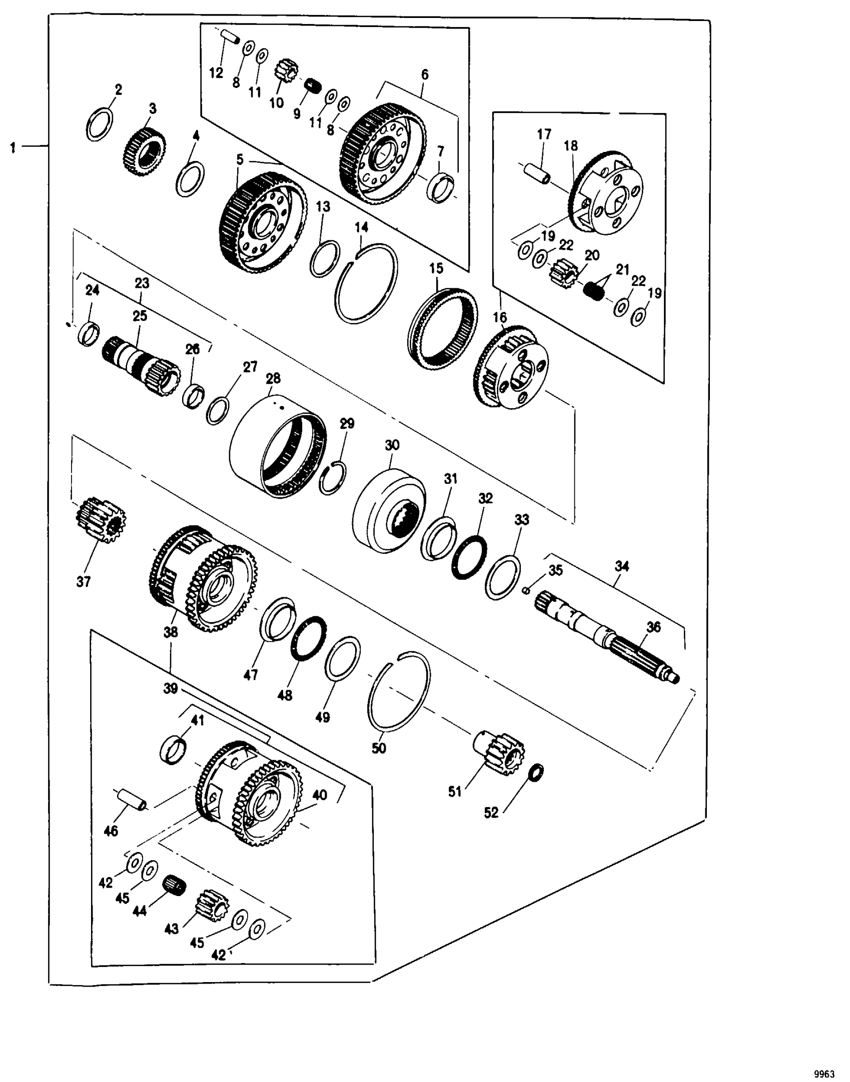
1 - Gear unit and main shaft assembly
2 - Thrust washer
3 - Front planetary sun gear
4 - Thrust washer
5 - Front planetary carrier assembly
6 - Flange and carrier assembly
7 - Sleeve bushing
8 - Bronze thrust washer (12)
9 - Needle roller bearing (6)
10 - Pinion (6)
11 - Steel thrust washer (12)
12 - Pinion pin (6)
13 - Thrust washer
14 - Internal snapping
15 - Front planetary ring gear
16 - Center planetary carrier assembly
17 - Pinion pin (4)
18 - Center planetary carrier
19 - Bronze thrust washer (8)
20 - Pinion (4)
21 - Needle roller bearing (8)
22 - Steel thrust washer (8)
23 - Center sun gear and shaft assembly
24 - Split sleeve bushing
25 - Center sun gear shaft
26 - Split sleeve bushing
27 - Thrust washer
28 - Planetary connecting drum
29 - External snapping
30 - Center planetary ring gear
31 - Thrust race
32 - Needle roller bearing
33 - Thrust race
34 - Main shaft assembly
35 - Orifice plug
36 - Main shaft
37 - Rear planetary sun gear
38 - Rear planetary carrier assembly
39 - Rear carrier and bushing assembly
40 - Rear carrier
41 - Sleeve bushing
42 - Bronze thrust washer (8)
43 - Pinion (4)
44 - Needle roller bearing (4)
45 - Steel thrust washer (8)
46 - Pinion pin (4)
47 - Thrust race
48 - Needle roller bearing
49 - Thrust race
50 - Internal snapping
51 - Low planetary sun gear
52 - Snapring

A



A, Foldout 15. Gear unit and main shaft assembly (HT 740D, HT 747D)--exploded view

B



B, Foldout 15. Gear unit and main shaft assembly (HT 750CRD, HT 754CRD)--exploded view

1 - Gear unit and main shaft assembly
2 - Thrust washer
3 - Front planetary sun gear
4 - Thrust washer
5 - Front planetary carrier assembly
6 - Flange and carrier assembly
7 - Sleeve bushing
8 - Bronze thrust washer (12)
9 - Needle roller bearing (6)
10 - Pinion (6)
11 - Steel thrust washer (12)
12 - Pinion pin (6)
13 - Thrust washer
14 - Internal snapping
15 - Front planetary ring gear
16 - Center planetary carrier assembly

A

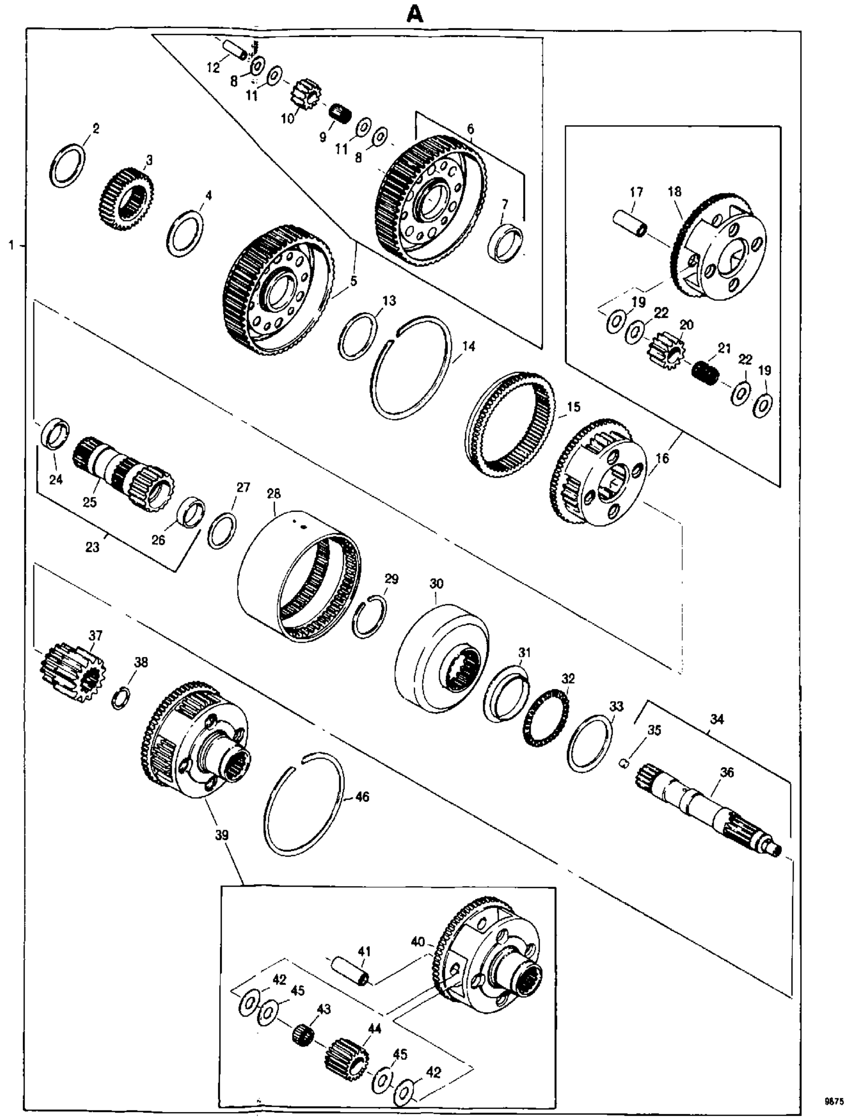
17 - Pinion pin (4)
18 - Center planetary carrier
19 - Bronze thrust washer (8)
20 - Pinion (4)
21 - Needle roller bearing (8)
22 - Steel thrust washer (8)
23 - Sun gear and shaft assembly
24 - Split sleeve bushing
25 - Center sun gear shaft
26 - Split sleeve bushing
27 - Thrust washer
28 - Planetary connecting drum
29 - External snapping
30 - Center planetary ring gear
31 - Thrust race
32 - Needle roller bearing
33 - Thrust race
34 - Main shaft assembly
35 - Orifice plug
36 - Main shaft
37 - Rear planetary sun gear
38 - External snapping
39 - Rear planetary carrier assembly
40 - Rear planetary carrier
41 - Pinion pin
42 - Bronze thrust washer (8)
43 - Needle roller bearing (4)
44 - Pinion (4)
45 - Steel thrust washer (8)
46 Internal snapping

B

1 - Transmission breather
1A - Transmission breather reducer
2 - Lockwasher, 1/2 (11) (Non-retarder)
3 - Bolt, 1/2-13 x 2 (11) (Non-retarder) A
4 - Pipe plug, 1/8 B
5 - Drive screw
6 - Nameplate
7 - Transmission housing assembly
8 - Transmission housing
9 - Pipe plug, 1/4 B
10 - Plain washer, 3/8
11 - Bolt, 3/8-16 x 3 C
12 - Oil baffle
13 - Bolt, 1/4-20 x 1-1/2 (2) D
14 - Plain washer, 1/8
15 - Bolt, 1/4-20 x 1-1/2 D
16 - Bolt, 1/4-20 x 1-1/2 (7) D
17 - Plain washer, 1/4
18 - Bolt, 1/4-20 x 1-1/2 D
19 - Bolt, 1/4-20 x 3-1/2 0) D
20 - Bolt, 1/4-20 x 3 (15) D
21 - Bolt, 1/4-20 x 2-1/2 D
22 - Detent roller and spring assembly
23 - Cover plate
24 - Bolt, 1/4-20 x 2 (8) D
25 - Signal tube, 3, 4, 5 FIT 750)
26 - Low signal tube
27 - 3-4 shift assist tube clip
28 - 3-4 shift assist tube
29 - Signal tube
30 - Bolt, 5/16-18 x 1-5/8 E
31 - Plain washer, 5/16
32 - Oil filter spacer (2)
33 - Oil filter
34- Sealring
35 - Plug
36 - Washer
37 - Plug
38 - Oil pan gasket
39 - Drain plug C
40 - Drain plug washer
41 - Oil pan
42 - Washer-head screw, 5/16-18 x 5/8 (23) F
43 - Inside detent lever assembly
44 - Locknut, 3/8 F
45 - Modulator valve actuator pin
46 - Bolt, 5/16-18 x 9/16 P
47 - Modulator-to-housing retainer
48 - Shaft retainer pin
49 - Washer
50 - Pipe plug, 3/4 B
51 - Shaft seal
52 - Pipe plug, 1/8 B
53 - Manual selector shaft assembly
54 - Manual selector shaft
55 - Manual selector shaft nut C
56 - Nut, 1/2-20 (3)(retarder models) A
57 - Lockwasher, 1/2 (3)
58 - PTO cover gasket
59 - PTO cover
60 - Washer (6)
61 - Bolt, 3/8-16 x 3/4 (6) C
62 - Lockwasher, 1/2 (8) (retarder models)
63 - Bolt, 1/2-13 x 6 (8) (retarder models) A

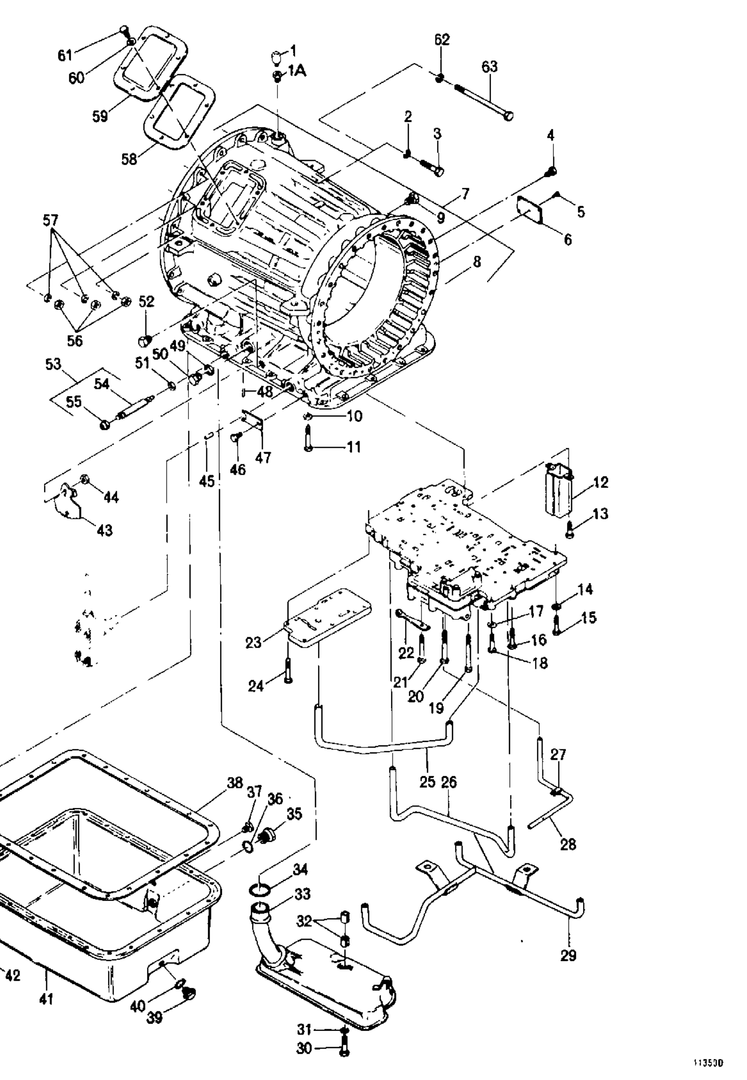
Torque	lb ft	N m
A	67-80	91 -108
B	4-5	5-7
C	15-20	20-27
D	9-11	12-15
E	13-16	18-22
F10-1314-18		

A



A, Foldout 16. Gear unit and main shaft assembly (HT 750DRD)--exploded view

B



B, Foldout 16. Transmission housing, oil filter and six inch deep oil pan --exploded view

HT 740D, HT 750D AUTOMATIC TRANSMISSIONS

A

1 - Breather
2 - Lockwasher, 1/2 (11) (non-retarder models)
3 - Bolt, 1 /2-13 x 2 (11) (non-retarder models) A
4 - Plug, 1/8 B
5 - Drive screw
6 - Name plate
7 - Transmission housing assembly
8 - Transmission housing
9 -Plug, 4th clutch check
10 - Plain washer, 3/8
11 - Bolt, 3/8-16 x 3 C
12 - Oil baffle
13 - Bolt, 1/4-20 x 1-1/2 (2) D
14 - Plain washer, 1/4
15 - Bolt, 1 /4-20 x 1 -1 /2 D
16 - Bolt, 1/4-20 x 1-1/2 0) D
17 - Plain washer
18 - Bolt, 1/4-20 x 1-1/2 D
19 - Bolt, 1/4-20 x 3-1/2 0) D
20 - Bolt, 1/4-20 x 3 (15) D
21 - Bolt, 1/4-20 x 2-1/2 D
22 - Detent roller and spring assembly
23 - Filter tube sealring
24 - Oil filter
25 - Bolt, 5/6-18 x 2-3/4 E
26- Washer
27 - Spacer (2)
28 - Oil pan gasket
29 - Oil pan, (7 inches deep)
30 - Drain plug washer
31 - Drain plug C
32 - Heater plug, 1 inch
33 - Plug, 1/8 inch
34 - Hex washer head screw, 5/16-18 x 5/8 (23) F
35 - Inside detent lever assembly
36 - Locknut, 3/8 F
37 - Valve spacer-
38 - Bolt, 5/16-18 x 3/4 F
39 - Modulator retainer
40 - Shaft retainer pin
41 - Plug washer
42 - Plug, 3/4-16 B
43 - Shaft seal assembly
44 - Manual selector shaft and nut assembly C
45 - Manual selector shaft
46 - Manual selector nut
47 - Plug, 1/8
48 - Hex nut, 1 /2-20 (3) A
49 - Lockwasher, 1/2 (3)
50 - PTO cover gasket
51 - PTO cover
52 - Washer, 3/8 (6)
53 - Bolt, 3/8-16 x 3/4 (6) C
54 - Lockwasher, 1/2 (8) (retarder models)
55 - Bolt, 1/2-13 x 6 (8) (retarder models) A

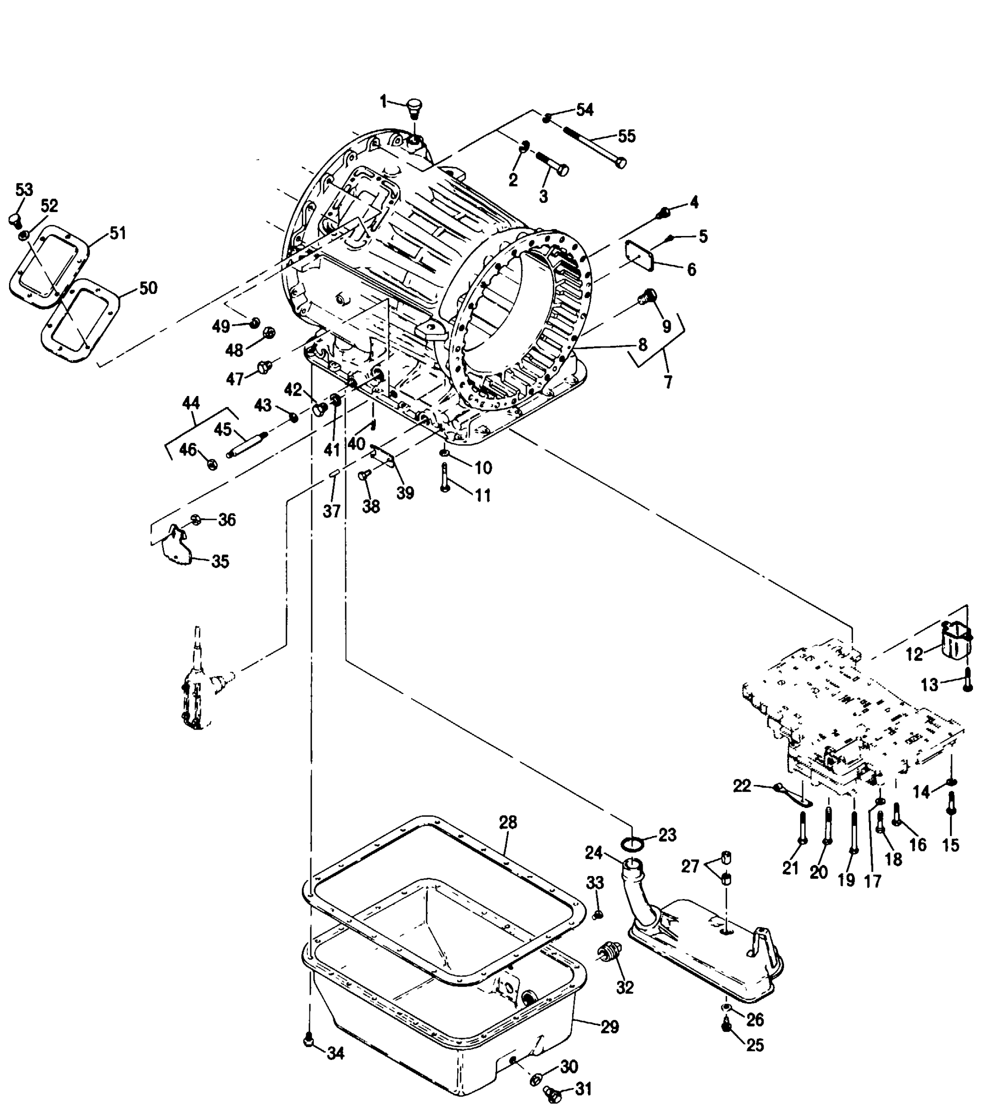
Torque	lb ft	N•m
A	67-80	91-108
B	4-5	5-7
C	15-20	20-27
D	9-11	I2--5
E	17-20	23-27
F	10-13	14-18

B

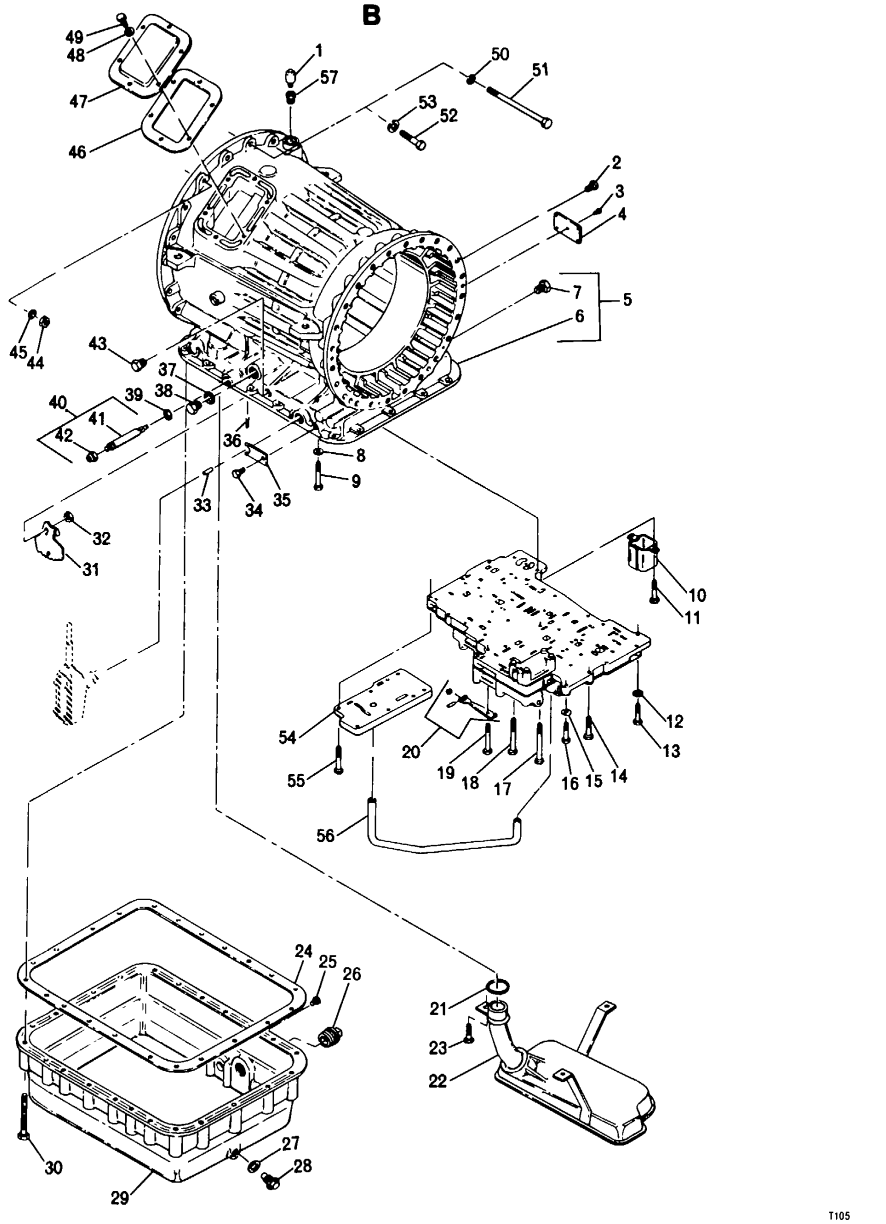
1 - Breather
2 - Plug, 1/8 B
3 - Drew, Drive
4 - Name plate
5 - Transmission housing assembly
6 - Transmission housing
7 - Fourth clutch check plug
8 - Plain washer
9 - Bolt, 3/8-16 x 3 (Center support) C
10 - Oil baffle
11 - Bolt, 1/4-20 x 1-1/2 (2) D
12 - Plain washer
13 - Bolt, 1/4-20 x 1-1/2 D
14 - Bolt, 1/4-20 x 1-1/2 O D
15 - Plain washer
16 - Bolt, 1/4-20 x 1-1/2 D
17 - Bolt, 1/4-20 x 3-1/2 0) D
18 - Bolt, 1/4-20 x 3 (15) D
19 - Bolt, 1 /4-20 x 2-1 /2 D
20 -. Detent roller and sprang assembly
21 - ;-Sealring
22 - Oil filter
23 - Bolt, 5/16-18 x 3-1/4 (3) F
24 - Oil pan gasket
25 - Pipe plug, 1/8 B
26 - Heater orifice plug, 1 inch
27 - Oil pan drain washer
28 - Oil pan drain plug
29 - Oil pan, 8 1/2 inch depth
30 - Bolt, 5/16-18 x 4-3/4 (23) -
31 - Inside detent lever assembly
32 -Lock nut, 3/8
33 - Valve spacer
34 - Bolt, 5/16-18 x 3/4 F
35 - Modulator retainer
36 - Shaft retainer pin
37 -Washer
38 - Plug, 3/4-16 C
39 - Manual selector oil seal
40 - Manual selector shaft {c nut assembly
41 - Manual selector shaft
42 - Manual selector shaft nut (metrie3
43 - Plug, 1/8 inch
44 - Nut, 1/2-20 (32 C)
45 - Lockwasher (3)-
46 - :PTO cover gasket
47 - PTO cover
48 - Washer (6)
49 - Bolt, 3/8-16 x 3/4 (6) C
50 - Lockwasher, 1/2 (8)
51 - Bolt, 1/2-13 x 6 (8) A
52 - Bolt, 1 /2-13 x 2 (11)G
53 - Lockwasher (11)
54 - Cover plate
55 - Bolt, 1/4-20 x 2-1/4 (8) D
56 - Signal tube
57 - Reducer

Torque	lb ft	N•m
A	67-80	91-108
B	4-5	5-7
C	15-20	20-27
D	9-11	12-15
E	13-16	18-22
F	17-20	23-27

A



B



A, Foldout 17. Transmission housing, oil filter and seven-inch oil pan-exploded view

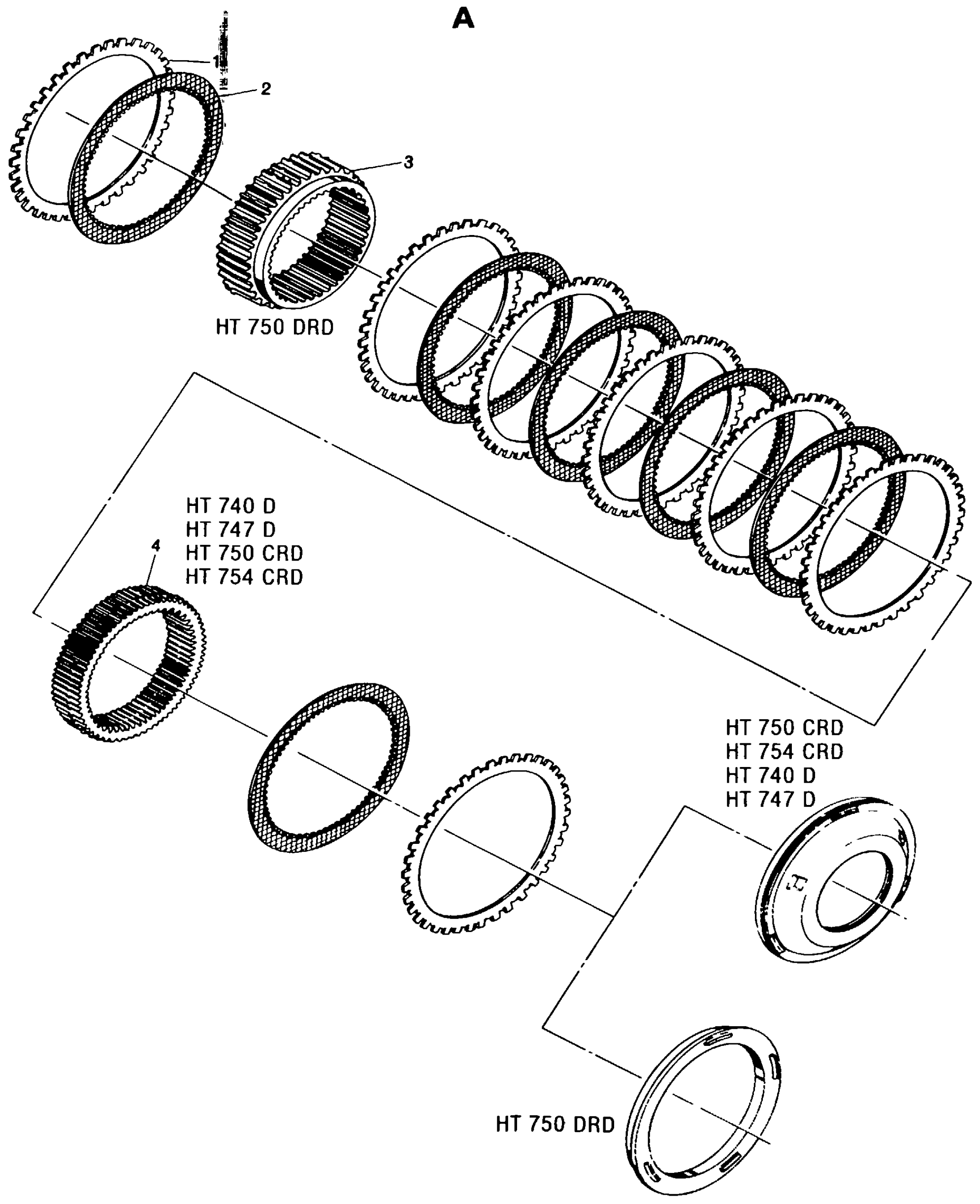
B, Foldout 17. Transmission housing, oil filter and eight and one-half-inch oil pan-exploded view

A

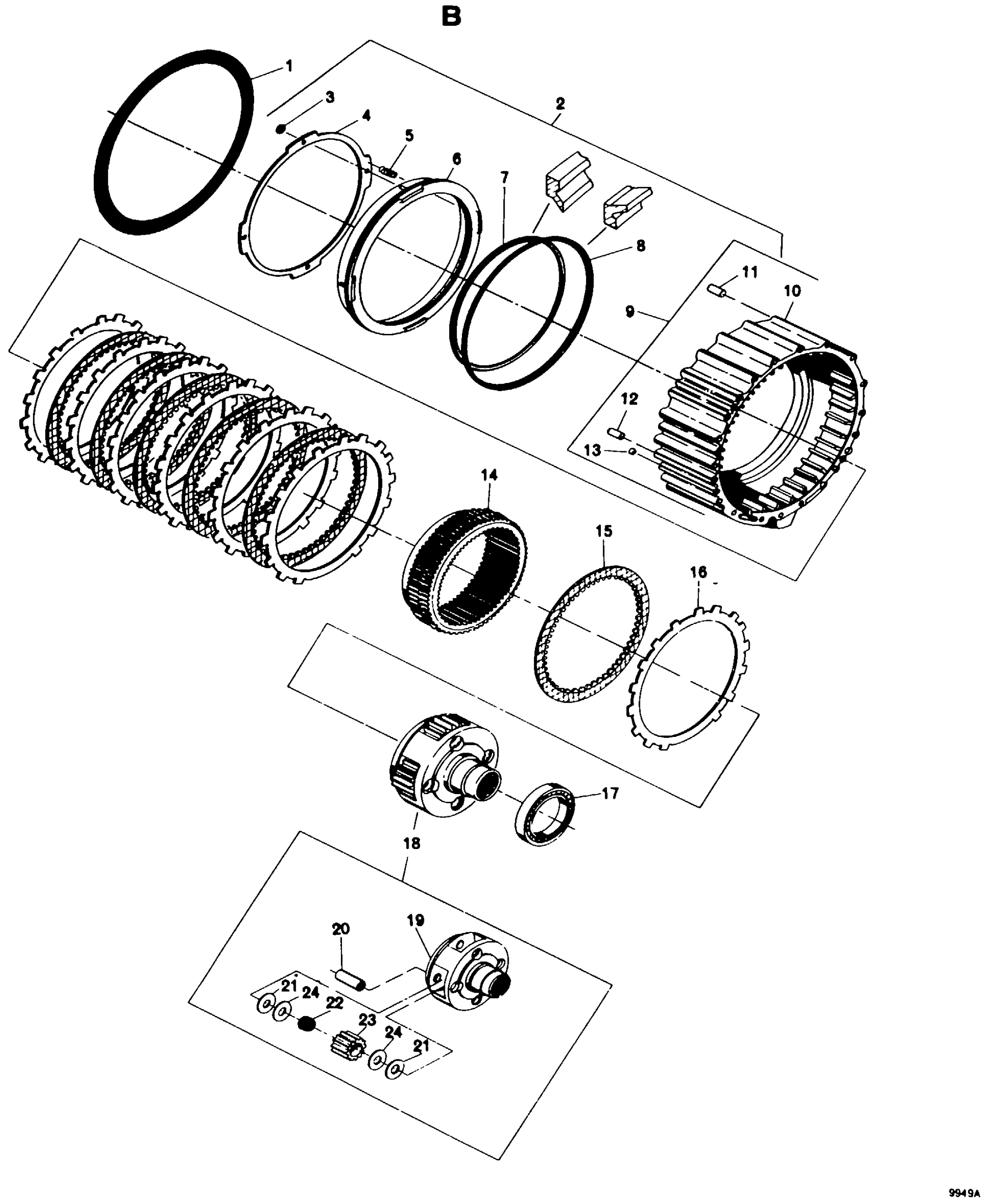
1 - External-tanged clutch plate (7):
0.0955 (2.43 mm-0.1025 (-.60 mm) thk (AR)
0.1161 (2.95 mmp0.1231 (3.13 mm) thk (AR)
2 - Internal-splined clutch plate (6)
3 - Rear planetary ring gear (HT 750DRD)
4 - Rear planetary ring gear (HT 740D & HT 750CRD)

B

1 - Adapter housing gasket
2 - Adapter housing and piston assembly
3 - Self-locking retainer ring (4)
4 - Spring retainer
5 - Piston release spring (28)
6 - First clutch piston
7 - Piston inner sealring
8 - Piston outer sealring
9 - Adapter housing assembly
10 - Adapter housing
11 - Dowel pin, 3/8 x 3/4
12 - Dowel pin, 7/16 x 3/4
13 - Orifice plug
14 - Low-clutch ring gear
15 - Internal-splined clutch plate (6)
16 - External-tanged clutch plate (7)
17 - Ball bearing
18 - Low planetary carrier assembly
19 - Low carrier
20 - Pinion pin
21 - Bronze thrust washer (8)
22 - Needle roller bearing (4)
23 - Pinion (4)
24 - Steel thrust washer (8)



A, Foldout 18. First clutch-exploded view



B, Foldout 18. Adapter housing, low-clutch plates and low carrier
(HT 750CRD, HT 754CRD-exploded view

HT 740D, HT 750D AUTOMATIC TRANSMISSIONS

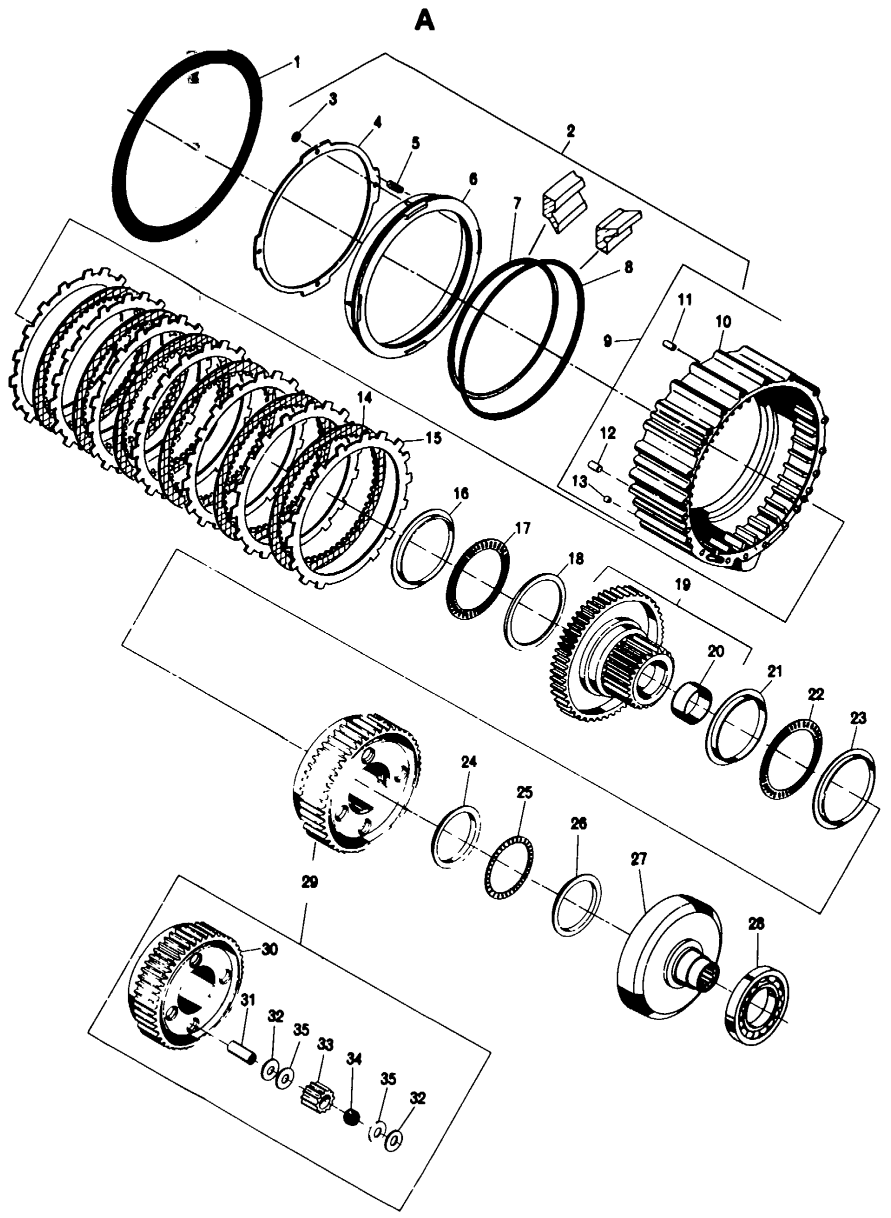
A

1 - Adapter housing gasket
2 - Adapter housing and piston assembly
3 - Self-locking retainer ring (4)
4 - Spring retainer
5 - Piston release spring (28)
6 - First clutch piston
7 - Piston inner sealring
8 - Piston outer sealring
9 - Adapter housing assembly
10 - Adapter housing
11 - Dowel pin, 3/8 x 3/4
12 - Dowel pin, 7/16 x 3/4
13 - Orifice plug
14 - Internal-splined clutch plate (6)
15 - External-tanged clutch plate (7)
16 - Thrust race
17 - Needle roller bearing
18 - Thrust race
19 - Gear and hub assembly
20- Bushing
21 - Thrust race
22 - Needle roller bearing
23 - Thrust race
24 - Thrust race
25 - Needle roller bearing
26 - Thrust race
27 - Low planetary ring gear
28 - Ball bearing
29 - Low planetary carrier assembly
30 - Low planetary carrier
31 - Pinion pin (4)
32 - Bronze thrust washer (8)
33 - Pinion (4)
34 - Needle roller bearing (4)
35 - Steel thrust washer (8)

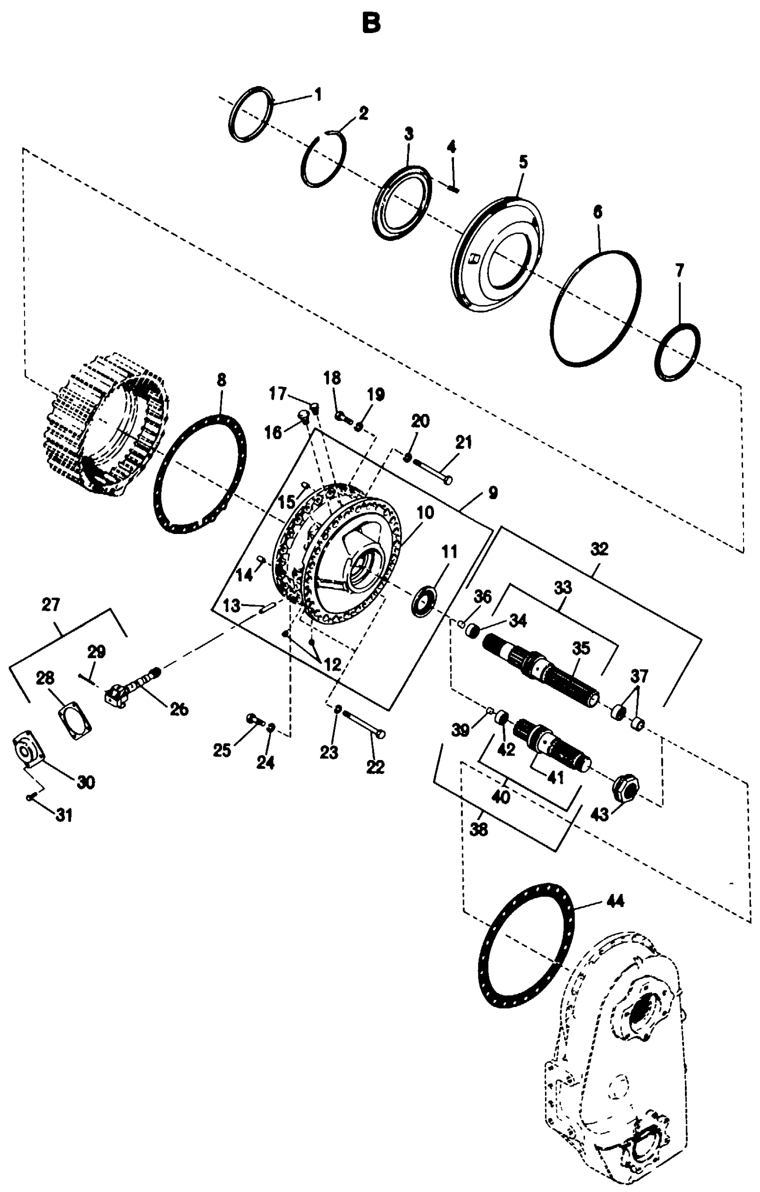
B

1 - Bearing spacer
2 - Internal snapring
3 - Spring retainer
4 - Piston release spring (30)
5 - Low piston
6 - External sealring
7 - Internal sealring
8 - Adapter housing gasket
9 - Transfer housing adapter assy
10 - Transfer housing adapter
11 - Oil seal
12 - Pipe plug, 1/8 (2) B
13 - Governor support pin
14 - Dowel pin
15 - Dowel pin
6 - Breather
17 - Seal plug
18 - Bolt, 1/2-13 x 1-3/4 (21) A
19 - Lockwasher, 112 (21)
20 - Lockwasher, 1/2 (22)
21 - Bolt, 1/2-13 x 5-3/4 (22) A
22 - Bolt, 1/2-13 x 7-3/4 (2) A
23 - Lockwasher, 1/2 (2)
24 - Lockwasher, 1/2 (3)
25 - Bolt, 1/2-13 x 1-3/8 (3) A
26 - Governor assy, I.D. #462
27 - Governor pin and gasket assy
28 - Governor gasket
29 - Governor pin
30 - Governor cover
31 - Bolt, 5/16-18 x 9/16 (4) C
32 - Output shaft assy
33 - Output shaft and bushing assy
34 - Bushing
35 - Output shaft
36 - Cup plug
37 - Needle bearing assy
38 - Output shaft assy
39 - Cup plug
40 - Output shaft and bushing assy
41 - Output shaft
42 - Bushing
43 - Nut, 2-16 D
44 - Transfer housing gasket

Torque	lb ft	N•m
A	67-80	91-108
B	10-12	14-16
C	10-13	14-17
D	600-800	813-1085



A, Foldout 19. Adapter housing, low-clutch plates and low carrier (HT 750DRD) - exploded view



B, Foldout 19. Low-clutch piston, rear adapter housing and governor - exploded view

A

1 - External snapping
2 - Spring retainer
3 - Piston release Spring (30)
4 - Low-clutch piston (HT 750, 754)
  - First-clutch piston (HT 740, 747)
5 - Piston outer sealring
6 - Piston inner sealring
7 - Rear cover gasket
8 - Rear cover assembly
9 - Plug, 1/8 NPTF A
10 - Plug, 1/8 NPTF - A
11 - Governor support pin
12 - Dowel pin, 3/8 x 3/4
13 - Dowel pin, 7/16 x 3/4
14 - Rear cover
15 - Speedometer driven gear bushing
16 - Lockwasher, 1/2 (21)
17 - Bolt, 1/2-13 x 5-3/4 (21) (HT 750) B
  - Bolt, 1/2-13 x 2 (21) (HT 740) B
18 - Internal snapping (use before SN 5660)
19 - Output shaft assembly (HT 740D, HT 750CRD)
20 - Orifice plug
21 - Output shaft and bushing assembly
22 - Bushing
23 - Output shaft
24 - Speedometer drive gear
25 - Spacer sleeve
26 - Output shaft assembly (HT 750DRD)
27 - Orifice plug
28 - Output shaft and bushing assembly
29 - Bushing
30 - Output shaft
31 - Self-locking nut 2-16 C
32 - Dust shield
33 - Lip type oil seal
34 - Internal snapping
35 - Ball bearing
36 - Bolt, 1/2-13 x 7-1/4 (3) (HT 750) B
  - Bolt, 1/2-13 x 3-1/4 (3) (HT 740) B
37 - Lockwasher, 1/2 (3)
38 - Governor assembly
39 - Governor pin and gasket assembly
40 - Governor pin (2)
41 - Gasket
42 - Governor cover
43 - Bolt, 5/16-18 x 9/16 (4) D

Torque	lb ft	N•m
A	4-5	5-7
B	67-80	91 -108
C	600-800	813-1085
D	10-13	14-18

B

1 - Control valve assembly
2 - Lubrication valve
3 - Check valve spring
4 - Spring cup washer
5 - Spring pin
6 - Check valve pin
7 - Oil transfer plate
8 - Ball, 1/4 die
9 - Ball, 5/16 die
10 - Ball, 1/4 die
11 - Ball, 1/4 die
12 - Ball, 1/4 die
13 - Ball, 1/4 die
14 - Ball, 1/4 die
15 - Ball, 1/4 die
16 - Ball, 1/4 die
17 - Bolt, 1/4-20 x 2-1/2 (3) A
18 - Modulator valve
19 - Modulator valve spring
20 - Retainer washer
21 - Valve stop
22 - Spring adjusting ring
23 - Modulator actuator valve
24 - Modulator valve
25 - Spring
26 - Adjusting ring
27 - Retainer pin
28 - Modulator pressure valve body
29 - Separator plate
30 - Control valve body
31 - Third clutch trimmer valve
32 - Trimmer plug
33 - Trimmer valve secondary spring
34 - Trimmer valve primary spring
35 - Third clutch trimmer valve stop
36 - First and reverse clutch trimmer valve
37 - Trimmer plug
38 - Trimmer valve secondary spring
39 - Trimmer valve primary spring
40 - First clutch trimmer valve stop
41 - Second clutch trimmer valve
42 - Trimmer plug
43 - Trimmer valve secondary spring
44 - Trimmer valve primary spring
45 - Second clutch trimmer valve stop
46 - Trimmer boost accumulator stop
47 - Trimmer boost accumulator valve spring
48 - Trimmer boost accumulator valve
49 - Trimmer valve cover
50 - Bolt, 1/4-20 x 5/8 (8) A
51 - Fourth clutch trimmer valve
52 - Trimmer plug
53 - Trimmer valve secondary spring
54 - Trimmer valve primary spring
55 - Fourth clutch trimmer valve stop
56 - Retainer pin
57 - Retainer pin
*58 - 2-3 (3-4) relay valve
*fig - 2-3 (3-4) relay valve spring
*60 - 2-3 (3-4) relay valve stop
*61 - 1-2 (2-3) relay valve
*62 - 1-2 (2-3) relay valve
63 - Valve spring spacer
64 - Governor screen assembly
65 - Pipe plug, 1/8 B
66 - Governor accumulator valve
67 - Governor accumulator valve spring
68 - Governor accumulator valve stop
69 - Retainer pin
70 - Special bolt assembly (HT 750) C
71 - Priority valve stop
72 - Priority valve spring
73 - Priority valve
74 - Hold regulator valve
75 - Hold regulator valve spring
76 - Hold regulator valve stop
77 - Washer
78 - Spring adjusting ring
79 - :Retainer pin
80 - Manual selector valve
81 - Manual selector valve (Before SN 10300 (HT 750)
82 - Retainer pin
83 - 1-2 shift valve assist spring (HT 740, 2nd gear start, late production units)
84 - 1-2 shift valve (HT 740, 2nd gear start, late production units)
85 - 1-2 modulator valve (HT 740, 2nd gear start, late production units)
86 - 1-2 shift valve spring (HT 740, 2nd gear start, late production units)
87 - 1-2 shift valve stop (HT 740, 2nd gear start, late production units)
88 - Spring adjusting ring (HT 740, 2nd gear start, late production units)
88 - 1-2 shift valve spring (HT 740, 2nd gear start, early production units)
90 - 1-2 shift valve (HT 740, 2nd gear start, early production units)
91 - Signal plug (HT 740, 2nd gear start, early production units)
92 - 1-2 shift signal plug (HT 740, 2nd gear start, early production units)
*93 - 1-2 (2-3) shift valve
*94 - 1-2 (2-3) modulator valve
* 95 - 1-2 (2-3) shift valve spring
* 96 - 1-2 (2-3) shift valve stop
97 - Spring adjusting ring
* 98 - 2-3 (3-4) shift valve
* 99 - 2-3 (3-4) modulator valve
*100 - 2-3 (3-4) shift valve spring
*101 - 2-3 (3-4) shift valve stop
102 - Spring adjusting ring 103 - Retainer pin
*104 - 3-4 (4-5) shift valve
*105 - 3-4 (4-5) modulator valve
*106 - 3-4 (4-5) shift valve spring
*107 - 3-4 (4-5) shift valve stop
108 - Spring adjusting ring 109 - Retainer pin
*110 - 3-4 (4-5) relay valve 111 - Relay valve spring
* 112 - 3-4 (4-5)relay valve stop
113 - Retainer pin
114 - Trimmer regulator valve
115 - Trimmer regulator valve spring
116 - Trimmer regulator valve stop
117 - Retainer pin
118 - Stop
119 - Plug

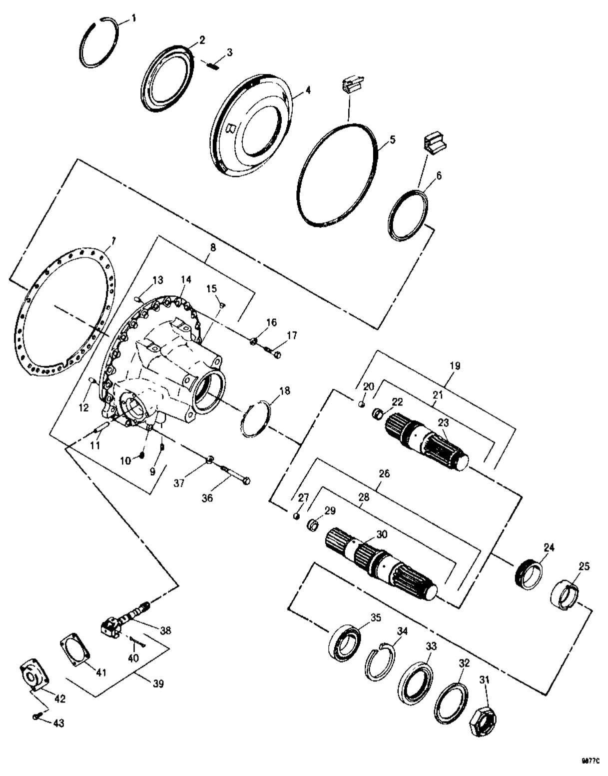
Torque	lb ft	N•m
A	9-11	12-15
B	4-5	5-7
C	36-43	49-58

*Gear range designations in parentheses are for HT 750; others are for HT 740.

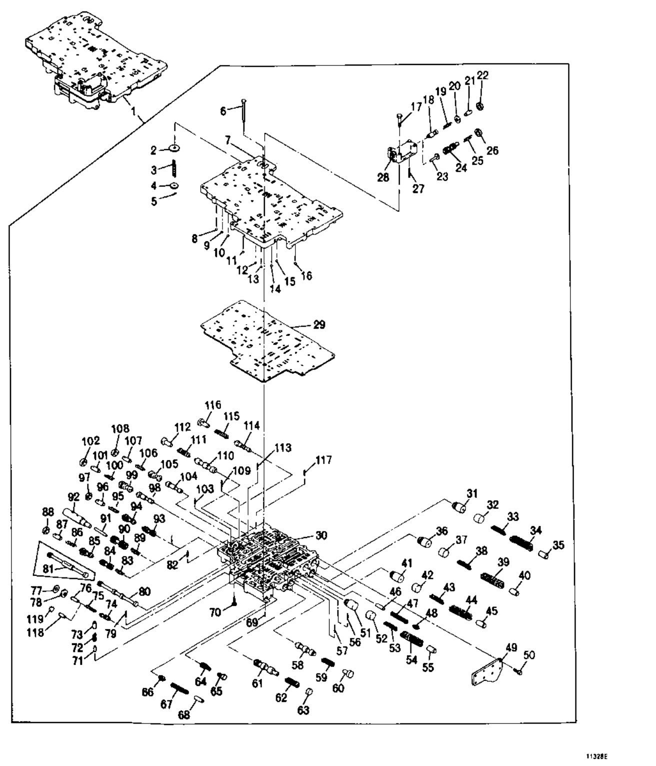
FOLDOUT 20

HT 740D, HT 750D AUTOMATIC TRANSMISSIONS

A



B



A, Foldout 20. First and low piston , rear cover, output shaft and governor-exploded view

B, Foldout 20. Control valve assembly - exploded view

A

1 - Bolt, 1/4-20 x 2-3/4 A
2 - Low shift valve body assembly
3 - Low shift valve body
4 - Retainer pin (HT 750CRD only)
5 - Retainer pin 6 - Retainer pin
7 - Relay valve
8 - Relay valve spring
9 - Relay valve stop
10 - Low shift signal valve (HT 750DRD only)
11 - Low shift signal valve (HT 750CRD only)
12 - Low shift signal valve spring
13 - Low shift signal valve stop
14 - Washer
15 - Spring adjusting ring
16 - Plug valve (HT 750CRD only)
17 - Bolt, 1/4-20 x 4 (6) A
18 - Low trimmer valve body assembly
19 - Low trimmer valve body
20 - Retainer pin
21 - Low trimmer valve
22 - Low trimmer plug
23 - Low trimmer spring, secondary
24 - Low trimmer spring, primary
25 - Low trimmer valve stop
26 - Low trimmer valve plug
27 - Bolt, 1/4-20 x 3 (8) A
28 - Lockup cutoff valve body assembly
29 - Lockup cutoff valve body
30 - Retainer pin
31 - Retainer pin
32 - Retainer pin
33 - Third and fourth clutch lockup cutoff valve
34 - Valve plug
35 - Valve plug
36 - First and second clutch lockup cutoff valve
37 - Second and third clutch lockup cutoff valve
38 - Valve plug

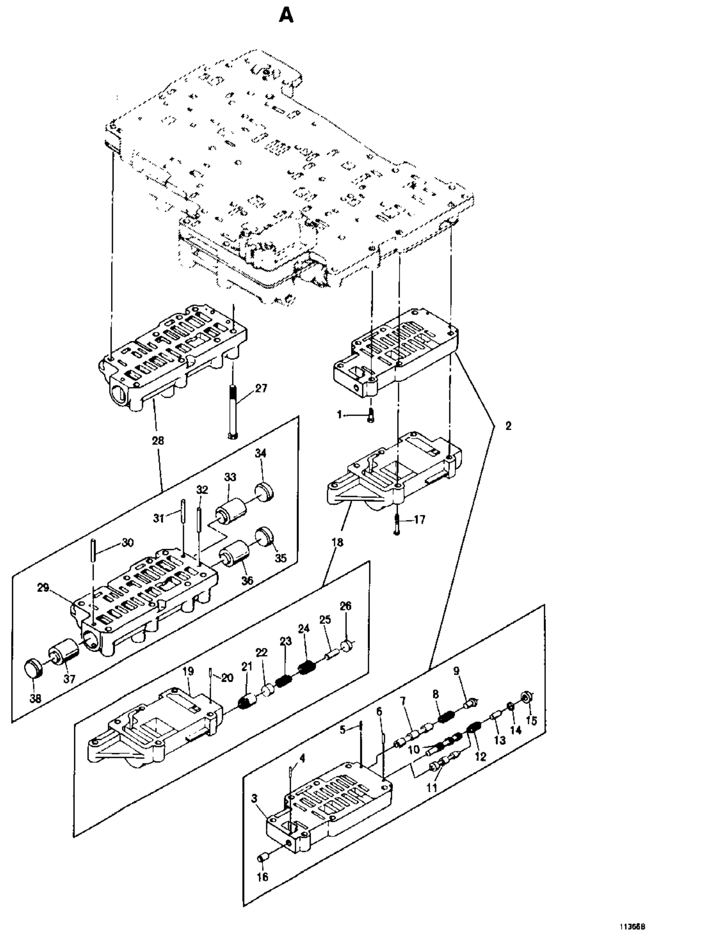
Torque	lb ft	N•m
A	26-32	12-15

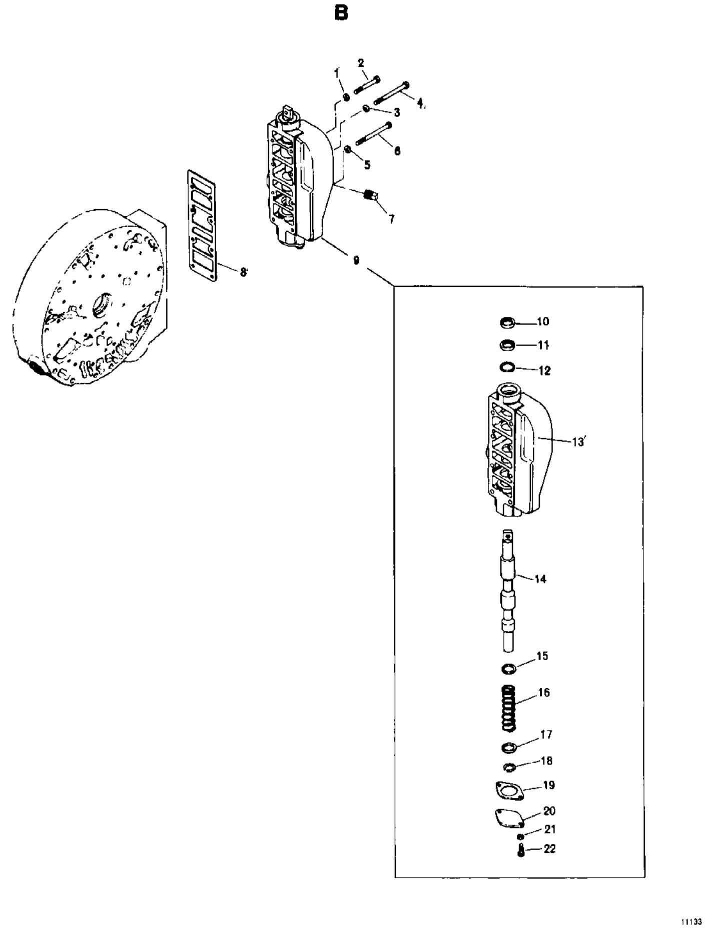
B

1 - Lockwasher, 3/8 (4)
2 - Bolt, 3/8-16 x 2-5/8 (4) A
3 - Lockwasher, 3/8 (2)
4 - Bolt, 3/8-16 x 3-3/4 (2) A
5 - Lockwasher, 3/8 (2)
6 - Bolt, 3/8-16 x 4-3/4 (2) A
7 - Plug
8 - Retarder control valve body gasket
9 - Retarder control valve body assembly
10 - Oil seal
11 - Oil seal
12 - Internal snapring
13 - Retarder control valve body
14 - Retarder control valve
15 - Washer
16 - Retarder control valve spring
17 - Washer
18 - External snapping
19 - Retarder control valve cover gasket
20 - Retarder control valve cover
21 - Lockwasher, 3/8 (2)
22 - Bolt, 3/--16 x 7/8 (2) A

Torque	lb ft	N•m
A	26-32	35-43

HT 740D, HT 750D AUTOMATIC TRANSMISSIONS





A, Foldout 21. Lockup cutoff, low shift and low trimmer valve body assemblies - exploded view

B, Foldout 21. Retarder valve body assembly - exploded view

A

1 - Roller bearing
2 - Transfer drive gear
3 - Roller bearing
4 - Bolt, 7/16-14 x 1 A
5 - Lockwasher, 7/16
6 - Spindle retainer washer
7 - Idler gear spindle
8 - Roller bearing assembly
9 - Internal snapping
10 - Transfer idler gear
11 - Spacer
12 - Roller bearing assembly
13 - Self-locking nut, 2-16 B
14 - Single row ball bearing
15 - Spacer
16- Spacer
17 - Transfer driven shaft assembly
18 - Output shaft
19 - Bearing and race assembly
20 - Transfer driven shaft assembly
21 - Output shaft
22 - Needle bearing assembly
23 - Transfer driven shaft
24 - Transfer driven gear
25 - Spacer
26- Spacer
27 - Single row ball bearing
28- Spacer
29 - Self-locking nut, 2-16 B

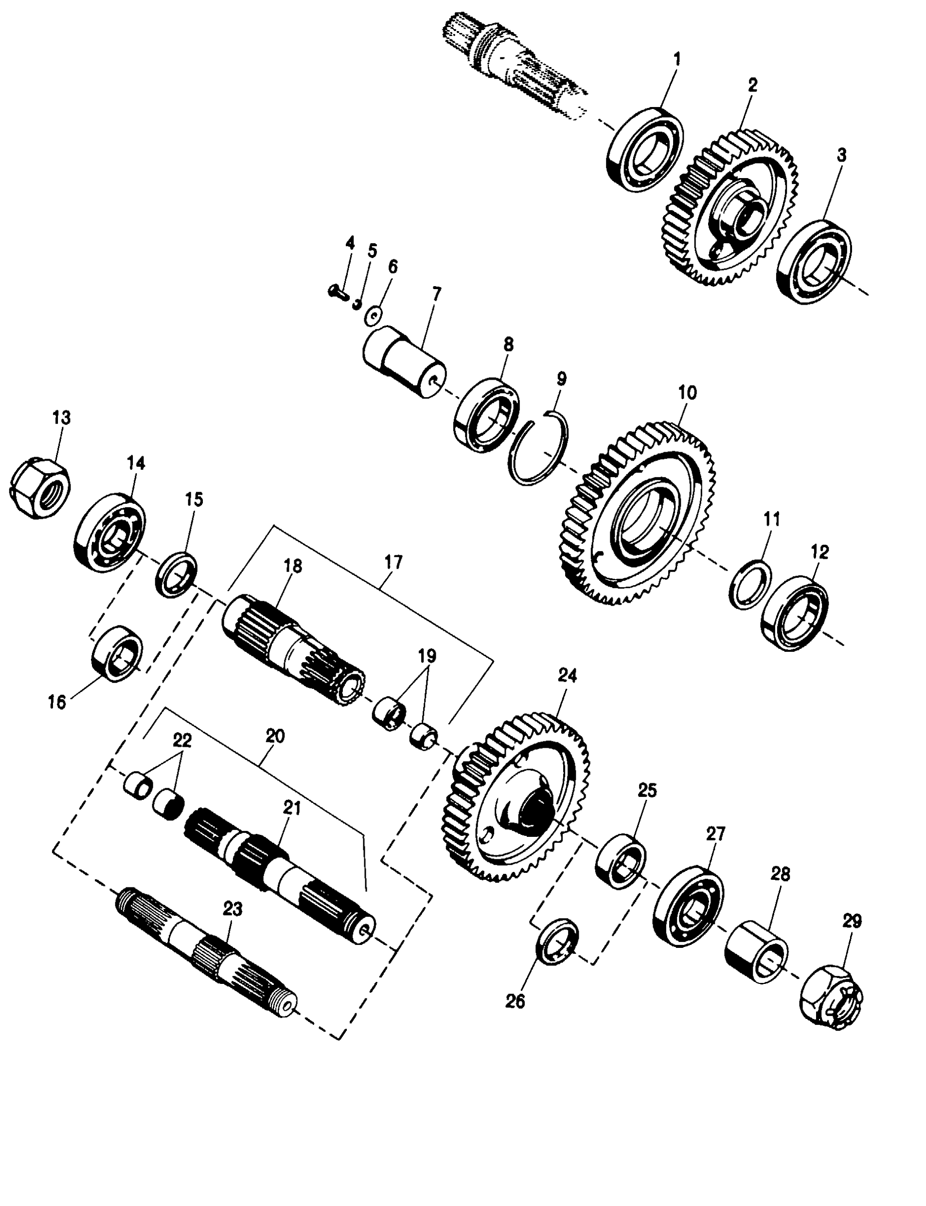
Torque	lb ft	N•m
A	42-50	57-68
B	600-800	813-1085

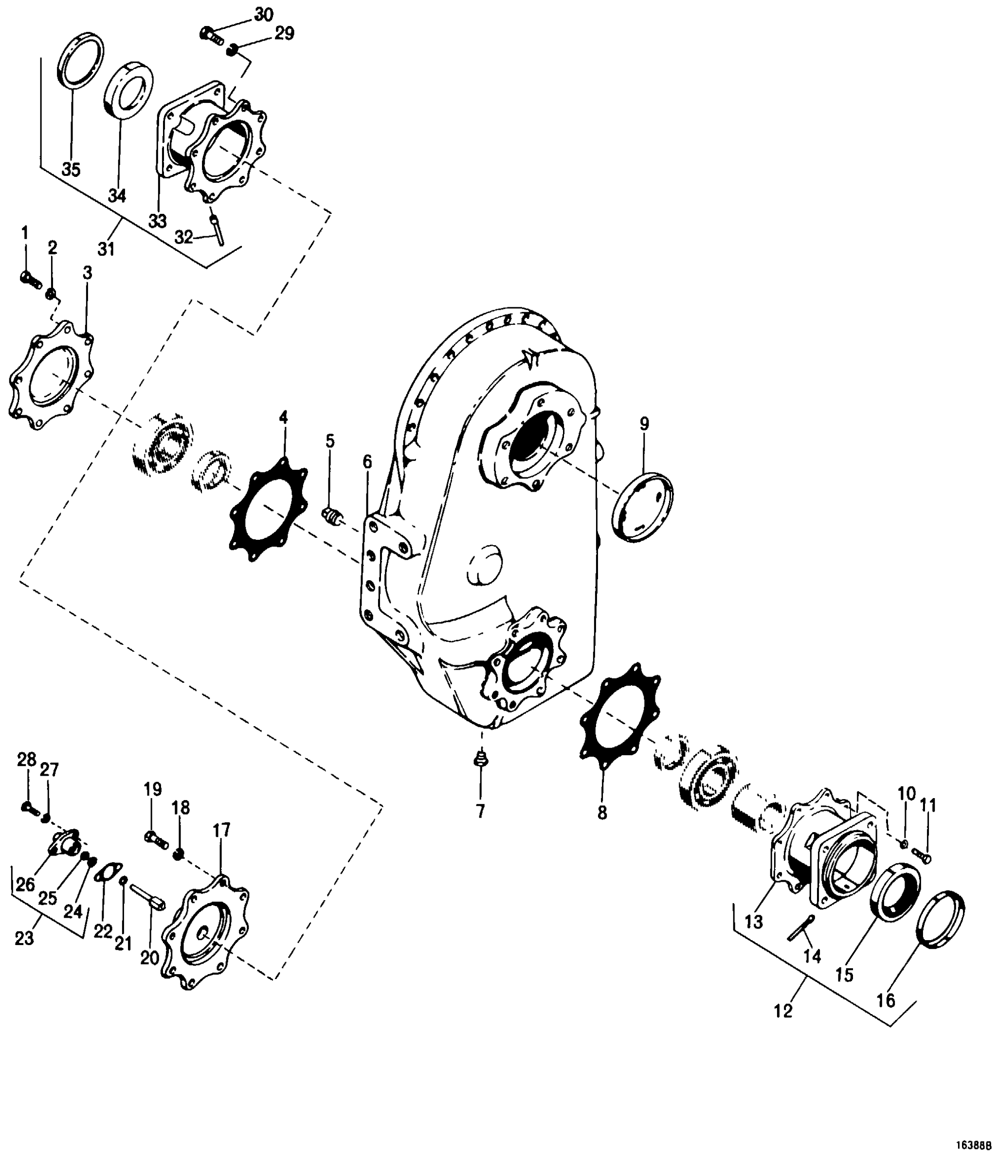
B

1 - Bolt, 1/2-13 x 1-1/4 (8) A
2 - Lockwasher, 1/2 (8)
3- Cover
4 - Adapter housing gasket
5 - Plug, 3/4 NPTF
6 - Transfer gear housing
7 - Plug, 1/4 NPTF
8 - Adapter housing gasket
9 - Cup plug 1
10 - Lockwasher, 1/2 (8)
11 - Bolt, 1/2-13 x 1-1/4 (8) A
12 - Bearing retainer assembly
13 - Bearing retainer
14 - Drain tube
15 - Oil seal
16 - Baffle
17 - Bearing retainer
18 - Lockwasher, 1/2 (8)
19 - Bolt, 1/2-13 x 1-1/4 (8) A
20 - Speedo drive shaft
21 - Washer
22 - Gasket
23 - Drive sleeve assembly
24 - Oil seal
25 - Washer
26 - Sleeve
27 - Lockwasher, 5/16 (2)
28 - Bolt, 5/16-18 x 7/8 (2) B
29 - Lockwasher, 1/2 (8)
30 - Bolt, 1/2-13 x 1-1/4 (8) A
31 - Bearing retainer assembly
32 - Drain tube
33 - Bearing retainer
34 - Oil seal 35 - Baffle

Torque	lb ft	N•m
A	67-80	91-108
B	10-13	14-18

HT 740D, HT 750D AUTOMATIC TRANSMISSIONS





A, Foldout 22. Transfer gears and transfer gear driven shaft - exploded view

B, Foldout 22. Transfer gear housing - exploded view

A

1 - Disconnect clutch housing gasket
2 - Output drive gear
3 - External snapring
4 - Output driven gear
5 - Shifter fork
6 - Disconnect clutch housing
7 - Oil seal
8 - Rod wiper seal
9 - Shifter fork shaft
10 - External snapring
11 - Output shaft
12 - Detent spring
13 - Detent ball (2)
14 - Bearing retainer gasket
15 - Single row ball bearing
16 - Bearing retainer
17 - Lockwasher, 1/2 (6)
18 - Bolt, 1/2-13 x 1-1/2 (6) A
19 - Oil seal
20 - Shim 0.025
21 - Shim 0.005 (4)
22 - Retainer
23 - Locking strip
24 - Bolt, 1/2-20 x 1-1/4 (2) B
25 - Bolt, 1/2-13 x 1-1/2 (6) A
26 - Lockwasher, 1/2 (6)
27 - Disconnect clutch housing adapter
28 - Lockwasher, 1/2 (6)
29 - Bolt, 1/2-13 x 1-1/4 (6) A
30 - Disconnect clutch housing gasket
31 - Output drive gear
32 - External snapring
33 - Output drive gear
34 - Shifter fork
35 - Disconnect clutch housing
36 - Lockwasher, 1/2 (2)
37 - Bolt, 1/2-13 x 2-1/2 (2) A
38 - Oil seal
39 - Rod wiper seal
40 - Shifter fork shaft
41 - Bolt, 1/2-13 x 1-1/2 (4) A
42 - Lockwasher, 1/2 (4)
43 - External snapring
44 - Output shaft
45 - Detent spring
46 - Detent ball (2)
47 - Bearing retainer gasket
48 - Single row ball bearing
49 - Bearing retainer
50 - Lockwasher, 1/2 (6)
51 - Bolt, 1/2-13 x 1-1/2 (6) A
52 - Oil seal
53 - Shim, 0.025
54 - Shim, 0.005 (4)
55 - Retainer
56 - Locking strip
57 - Bolt, 1/2-20 x 1-1/4 (2) B

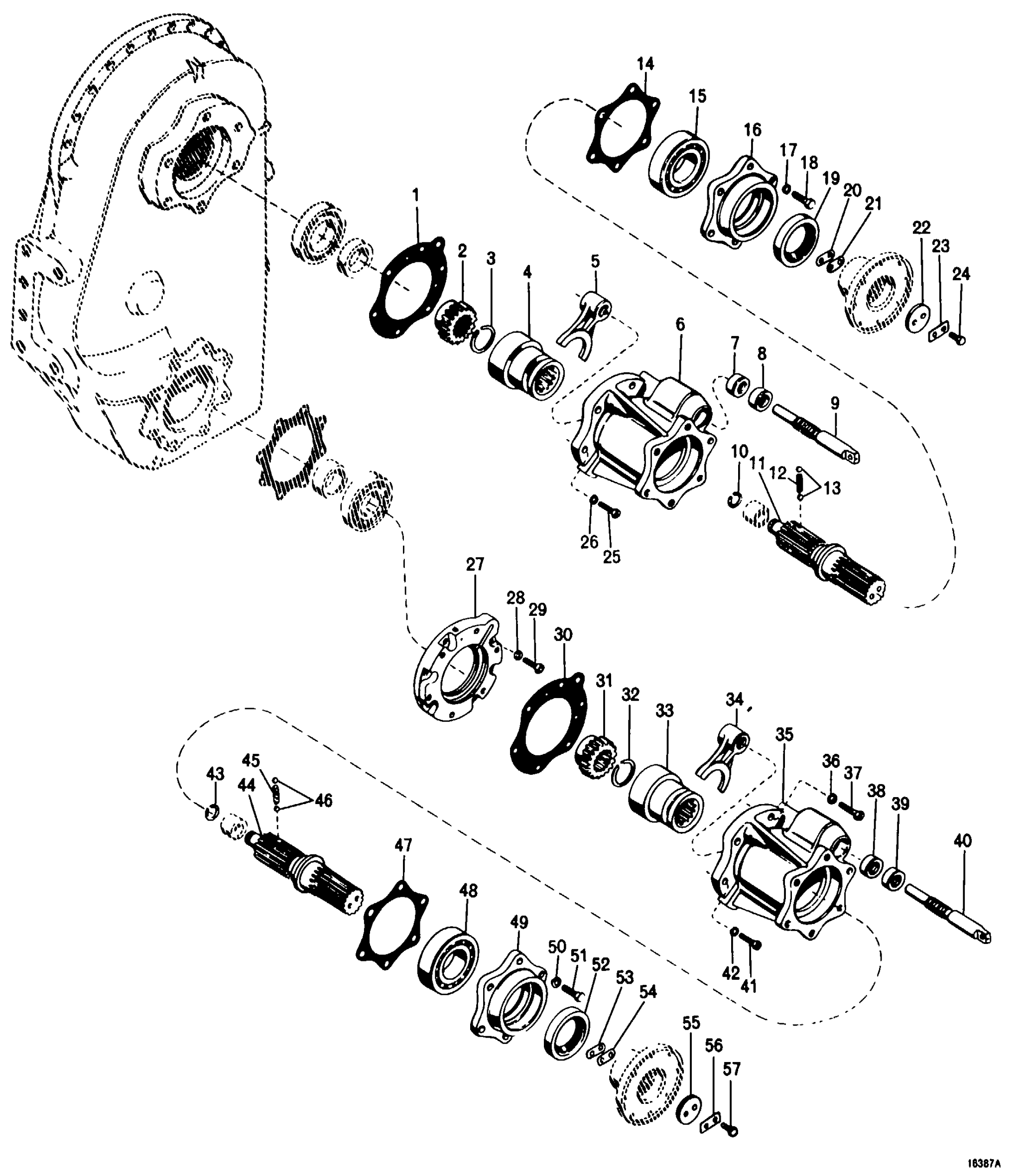
Torque	lb ft	N·m
A	67-80	91-108
B	15-20	20-27

B

1 - Bolt, 1/2-20 x 1-1/4 (2) A
2 - Lock strip
3 - Retainer
4 - Shim, 0.025
5 - Shim, 0.005 (4)
6 - Oil seal
7 - Bolt, 1/2-13 x 1-1/2 (6) B
8 - Lockwasher, 1/2 (6)
9 - Bearing retainer
10 - Single row ball bearing
11 - Bearing retainer gasket
12 - Output shaft
13 - Detent spring
14 - Detent ball (2)
15 - External snapring
16 - Shifter fork shaft
17 - Rod wiper seal
18 - Oil seal
19 - Disconnect clutch housing
20 - Bolt, 1/2-13 x 1-1/2 (4) B
21 - Lockwasher, 1/2 (4)
22 - Bolt, 1/2-13 x 2-1/2 (2) B
23 - Lockwasher, 1/2 (2)
24 - Shifter fork
25 - Output drive gear
26 - External snapring
27 - Output drive gear
28 - Disconnect clutch housing gasket
29 - Disconnect clutch housing adapter
30 - Bolt, 1/2-13 x 1-1/4 (6) B
31 - Lockwasher, 1/2 (6)

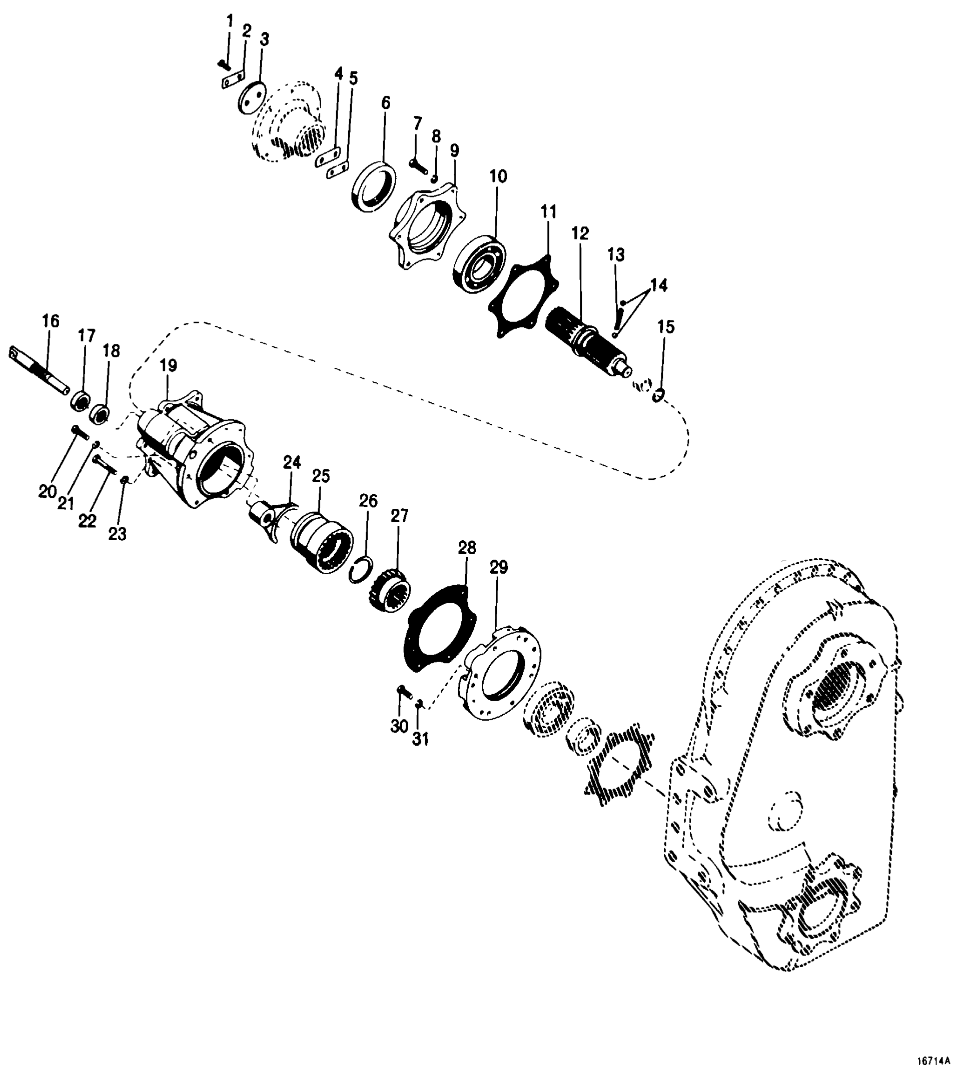
Torque	lb ft	N·m
A	15-20	20-27
B	67-80	91-108

A



A, Foldout 23. Rear output disconnect clutch-exploded view

B



B, Foldout 23. Front output disconnect clutch -exploded view

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Chief of Staff

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PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	IN THIS SPACE, TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT.

PRINTED NAME, GRADE OR TITLE AND TELEPHONE NUMBER	SIGN HERE

TEAR ALONG PERFORATED LINE

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inches
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. ft.
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. Inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*
inches	centimeters	2.540
feet	meters	.305
yards	meters	.914
miles	kilometers	1.609
square inches	square centimeters	6.451
square feet	square meters	.093
square yards	square meters	.836
square miles	square kilometers	2.590
acres	square hectometers	.405
cubic feet	cubic meters	.028
cubic yards	cubic meters	.765
fluid ounces	milliliters	29.573
pints	liters	.473
quarts	liters	.946
gallons	liters	3.785
ounces	grams	28.349
pounds	kilograms	.454
short tons	metric tons	.907
pounds-feet	newton-meters	1.356
pound-inches	newton-meters	.11296

To change	*To*	*Multiply by*
ounce-inches	newton-meters	.007062
centimeters	inches	.394
meters	feet	3.280
meters	yards	1.094
kilometers	miles	.621
square centimeters	square inches	.155
square meters	square feet	10.764
square meters	square yards	1.196
square kilometers	square miles	.386
square hectometers	acres	2.471
cubic meters	cubic feet	35.315
cubic meters	cubic yards	1.308
milliliters	fluid ounces	.034
liters	pints	2.113
liters	quarts	1.057
liters	gallons	.264
grams	ounces	.035
kilograms	pounds	2.205
metric tons	short tons	1.102

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

PIN: **060754-000**