Allison Transmission®

Service Manual

1000 and 2000 Product Families

SM3191EN

Service Manual

2009 FEBRUARY

SM4006EN

Allison Transmission

VOCATIONAL MODELS

1000 EVS	2100 EVS	2200 EVS	2300 HS	2500 EVS
1000 HS	2100 HS	2200 HS	2300 RDS	2500 HS
1000 MH	2100 MH	2200 MH	2350 EVS	2500 MH
1000 PTS	2100 PTS	2200 PTS	2350 HS	2500 PTS
1000 RDS	2100 RDS	2200 RDS	2350 MH	2500 RDS
1000 SP	2100 SP	2200 SP	2350 PTS	2500 SP
			2350 RDS	2550 EVS
			2350 SP	2550 HS
				2550 MH
				2550 PTS
			B 210	2550 RDS
			B 220	2550 SP

For vocational models not listed, call the Allison Technical Assistance Center at 1-800-252-5283 or see www.allisontransmission.com

Allison Transmission

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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 become unsafe. It is, however, important to understand that these Warnings and Cautions are not exhaustive. Allison Transmission could not possibly know, evaluate, and advise the service trade of all conceivable ways in which service might be done or of the possible hazardous consequences of each way. Consequently, Allison Transmission has not undertaken any such broad evaluation. Accordingly, ANYONE WHO USES A SERVICE PROCEDURE OR TOOL WHICH IS NOT RECOMMENDED BY ALLISON TRANSMISSION MUST first be thoroughly satisfied that neither personal safety nor equipment safety will be jeopardized by the service methods selected.

Proper service and repair are important to the safe, reliable operation of the equipment. The service procedures recommended by Allison Transmission and described in this Service Manual are effective methods for performing service operations. Some of these service operations require the use of tools specifically 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.

Observe safety precautions during hydraulic pressure check procedures. All personnel must stand clear of the vehicle. Take precautions against movement of the vehicle. Be sure that gauges (vacuum, pressure, tachometer) have extended lines so that they can be read from inside the vehicle.

To help avoid personal injury, such as burns, from hot transmission fluid and/or to help avoid equipment damage, do not stall the torque converter for more than ten seconds maximum and monitor transmission fluid temperature. Immediately return the engine to idle if converter out (to cooler) temperature exceeds 150°C (300°F). Operating the transmission at high engine power at transmission stall or near stall conditions causes a rapid rise in the transmission fluid temperature. The fluid in the transmission torque converter is absorbing all of the engine power and the vehicle cooling system cannot dissipate the excessive heat load. Extended operation under high heat load conditions causes transmission and cooling system damage, and can possibly fail hydraulic lines causing leaking high temperature fluid.

To help avoid personal injury and equipment damage while conducting a transmission stall test, the vehicle must be positively prevented from moving. Apply the parking brake, the service brake, and chock the wheels securely. Warn personnel to keep clear of the vehicle and its travel path.

Use appropriate safety equipment such as safety glasses, safety shoes, and gloves.

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

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.

Avoid contact with the hot fluid or the sump when draining transmission fluid. Direct contact with the hot fluid or the hot sump may result in bodily injury.

Chock wheels to prevent vehicle from moving when driveline is disconnected. This is not necessary if all wheels are off the ground.

Be sure the torque converter is moving rearward with the transmission as it is removed. Do not allow the torque converter to become disengaged from the oil pump or to fall and injure yourself or others.

The torque converter must be held to the torque converter housing by a retaining device such as shipping brackets. Without the retaining device, the torque converter may slide forward, disengaging the oil pump, or may fall completely out of the transmission causing personal injury and/or property damage. NEVER tilt the converter end down unless a torque converter retaining device is installed.

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SECTION 1—GENERAL INFORMATION

1–1. SCOPE OF MANUAL

a. Transmission Product Families And Model Years. The 1000 and 2000 Product Families with Allison 4th Generation Controls, include the following vocational models:

- Emergency Vehicle Series—1000 EVS, 2100 EVS, 2200 EVS, 2350 EVS, 2500 EVS, 2550 EVS
- Highway Series—1000 HS, 2100 HS, 2200 HS, 2300 HS, 2350 HS, 2500 HS, 2550 HS
- Motor Home Series—1000 MHS, 2100 MHS, 2200 MHS, 2350 MHS, 2500 MHS, 2550 MHS
- Pupil Transport/Shuttle Series—1000 PTS, 2100 PTS, 2200 PTS, 2350 PTS, 2500 PTS, 2550 PTS
- Rugged Duty Series—1000 RDS, 2100 RDS, 2200 RDS, 2300 RDS, 2350 RDS, 2500 RDS, 2550 RDS
- Specialty Series—1000 SPS, 2100 SPS, 2200 SPS, 2350 SPS, 2500 SPS, 2550 SPS
- Bus Urban Series—B 210, B 220

b. Vocational Model Nomenclature. The first digit of the nomenclature (1 or 2) indicates the product family—1000, 2000. The second digit (0–4) indicates close ratio or (5) wide ratio. The third digit indicates the number of ranges in the transmission, five (0) or six (5) ranges.

c. Content and Organization. This Service Manual describes overhaul procedures for the 1000 and 2000 Product Families automatic transmissions (Figures 1–1 and 1–2). All 1000 and 2000 Product Families vocational models are included in this manual.

- Major transmission components are described and their functions explained.
- Detailed instructions are provided for disassembly, rebuild, and assembly.
- Part inspection instructions are in Section 3.
- Wear limits and spring data are in Section 7.

d. Illustrations

1. Text is supported with line drawings, exploded, and cross-sectional views. Overhaul procedures are illustrated by line drawings. Cross-sections and exploded views show the relationship of assembled parts and are contained in foldout pages in the back of the manual.
2. Illustrations show correct procedures for all models, including models not illustrated.

e. Maintenance Information. Each task described in this manual has been successfully completed by service organizations and individuals. Not every service organization or individual possesses the required special tooling, training, or experience to perform all described tasks. However, any task may be performed if the following conditions are met:

1. The organization or individual has the required knowledge of the task through:
   - Formal instruction at Allison Transmission or a distributor training facility.
   - On-the-job instruction by an Allison Transmission 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. The required tools and fixtures, listed in Table 3–1 (Section 3 of this manual), are available.
4. Reasonable and prudent maintenance practices are used.

NOTE:

Service organizations and individuals are encouraged to contact their local Allison Transmission distributor for information and guidance on any task outlined in this manual.

1–2. SUPPLEMENTARY INFORMATION

Supplementary information is issued, as required, if any changes occur after publication of this manual. Check with your dealer or distributor to be sure you have the latest information.

1–3. ORDERING PARTS

a. Transmission Nameplate. The nameplate (1) (Figure 1–3) is located on the right side of the transmission. Nameplates are imprinted (Figure 1–4) with the transmission model, serial number, transmission identification number, engineering feature configuration number, and date of manufacture. Use all of these numbers when ordering replacement parts or requesting service information.

b. Parts Catalog. Use Parts Catalog PC3062EN to determine the correct part number and to order replacement parts. Order all replacement parts from your distributor or authorized dealer.

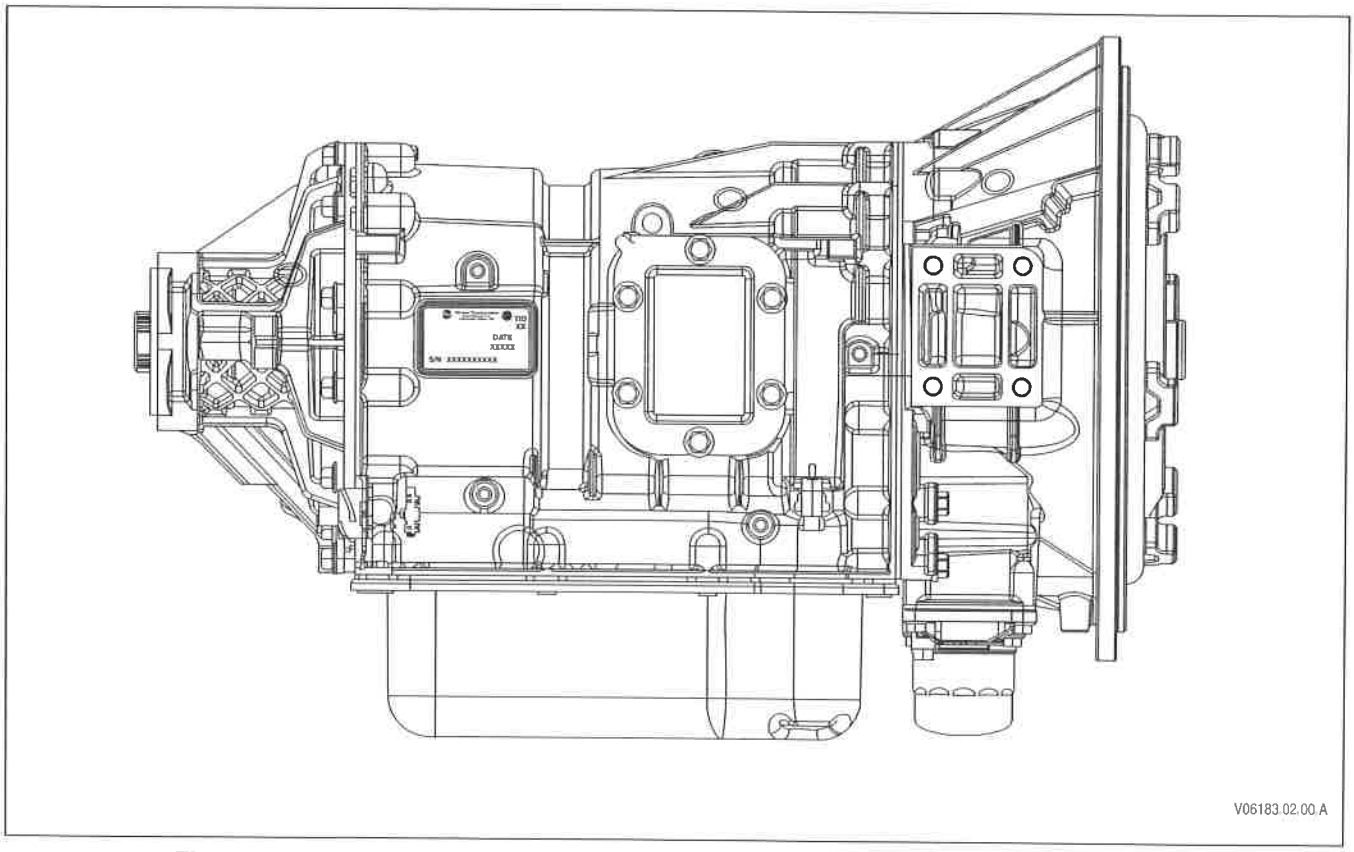

Figure 1–3. 1000 and 2000 Product Families Transmission Nameplate Location

6. *Transmission Fluid Filtration.* Fluid filtration is provided by two filter systems. A suction filter, located in the sump, provides general protection to the entire hydraulic system by filtering large particulates. A spin-on filter provides full-time protection for the control solenoids and multipass protection for the entire system. The spin-on filter is externally located on the converter housing at the lower left front of the transmission.

7. *Allison Transmission 4th Generation Electronic Controls*

   - A microcomputer provides electronically-controlled automatic gear selection and automatic engagement of the TCC. The microcomputer is an independent controller and is referred to as a Transmission Control Module (TCM).
   - The electronic control system uses adaptive logic to provide optimum shift quality. Driving efficiency is improved by shifting at the exact programmed transmission shift point for every engine/transmission/vehicle combination. The electronic controls can be customized for four, five, or six-speed operation to meet vocational requirements.

8. *Remote Oil Cooler.* Ports for remote mount oil cooler lines are located on the bottom surface of the converter housing near the converter housing/main housing splitline. Remote oil-to-water coolers require plumbing for transmission fluid and engine cooling water. Remote oil-to-air coolers may also be used and only transmission fluid lines need to be provided. Heat is transferred from the transmission fluid to either water or air depending upon the cooler type used.

9. *Oil Fill Tube/Dipstick Provisions.* All 1000 and 2000 Product Families models have an oil fill tube/dipstick provision on both sides of the transmission. The fill tube and dipstick are Original Equipment Manufacturer (OEM) installed and adapted as specified by the vehicle manufacturer. A plug is installed in the unused port.

10. *Park Pawl/Parking Brake*

    - All 1000, 2200, 2350 and 2550 model transmissions have a park pawl. The internal park pawl is engaged by selection of the **P** (Park) position on the shift selector. The park pawl is not available on 2100 or 2500 models.
    - Some 1000 and 2000 Product Families models are available with an optional rear cover that accommodates an OEM-installed two-shoe, expanding-type drum brake. All parking brake controls and linkages are OEM-supplied.

11. *Power Takeoff (PTO).* 1000 and 2000 Product Families transmissions, except Highway Series and Pupil Transport/Shuttle Series, have a provision to drive a PTO unit mounted on the left and/or right side of the transmission housing. The optional PTO drive gear is driven by the transmission torque converter turbine, with speed and torque reflecting engine input and the characteristics of the torque converter. PTO units and associated controls are provided by the vehicle manufacturer and/or body builder.

12. *Output Yokes or Flanges.* A variety of output yokes or flanges are available to meet vehicle driveline requirements. Yokes or flanges are OEM-installed and are adapted as specified by the vehicle manufacturer.

WARNING!

Operation with excessive loads can cause transmission damage and unexpected vehicle movement. To help avoid injury, property damage, and/or transmission damage, do not exceed the GVW/GCW for the vocational model or the OEM vehicle rating, whichever is less.

3. When the **CHECK TRANS** light is illuminated, shifts may be restricted by the TCM as follows:

WARNING!

If ignition is turned off and then on while the CHECK TRANS light is displayed, the transmission may remain in neutral until the code is cleared. Leave ignition on until you are in a safe place to stop.

- When the TCM senses abnormal conditions.
- The transmission may be locked in the range it was in when the problem was detected.
- The transmission may continue to operate with inhibited shifting.
- The TCM may not respond to shift selector requests.
- Direction changes and shifts from neutral to range may not occur.
- Whenever the **CHECK TRANS** light is illuminated, the TCM logs a Diagnostic Trouble Code (DTC) in memory. These DTCs can be accessed through the Allison DOC™ for PC–Service Tool.

NOTE:

DTCs can be logged without illuminating the CHECK TRANS light. This occurs when the TCM senses a problem, but determines the problem will not cause immediate transmission damage or dangerous performance.

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c. Range Inhibit Indicator

1. Some conditions detected by the TCM cause the transmission to be locked in one range. When this occurs, the TCC is automatically disengaged. Shifts out of neutral may be inhibited.

2. At the same time these events occur, a required OEM-supplied **RANGE INHIBIT(ED)** light, mounted on the dash or near the shift selector, is illuminated. This notifies the driver that shifting is inhibited and the shift selector may not respond to shifts requested.

d. Allison DOC™ For PC–Service Tool.

Provides tabular, graphical, and chart displays of real-time and recorded TCM data. A Help system is incorporated into the Allison DOC™ software. Allison DOC™ software and interface devices are available through Allison Transmission tool sources.

1. A PC serves as the receiver/transmitter/display medium that allows the service technician to communicate with the TCM. Typical troubleshooting activities performed are installation checkout and DTC retrieval.

2. The Allison DOC™ for PC–Service Tool Help system contains information for performing the following:

   - Display (retrieve) DTCs. Transmission DTCs begin with P0, P1, P2, U0, U1, or U2 followed immediately by three additional numbers. For a complete list of codes and more detailed information, refer to 1000 and 2000 Product Families Troubleshooting Manual TS3977EN.
   - Clear DTCs.
   - Obtain transmission data such as input speed or sump fluid temperature.
   - A solenoid test.
   - Clutch diagnostics (including TCC).

e. Troubleshooting When No Diagnostic Trouble Codes Are Present

- Always start with the basics:
  - — Make sure the shifter is in the appropriate range.
  - — Check the fluid level.
  - — Make sure batteries are properly connected and charged.
  - — Make sure throttle is closed and engine speed is below 900 rpm.
  - — Make sure electrical connections are properly made.
  - — Check support equipment for proper installation and operation.
- If the shifting process is rough, give the shifts time to adapt to converged state before assuming there is a problem.

d. One Year Storage *(With Fluid)*

1. Drain the fluid and replace the oil filter elements.
2. Fill the transmission to operating level with a mixture of one part VCI #10 (or equivalent) to 30 parts TES-295 or TES-389 transmission fluid (refer to Paragraph 2–6 for fluid recommendations). Add 3 ml of Biobor® JF (or equivalent) for every 10 liters (¼ teaspoon per gallon) of fluid 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.

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3. Operate the transmission for approximately five minutes at 1500 rpm with the transmission in neutral.
4. Make sure the transmission shifts through all ranges and the lockup clutch is also activated.
5. Continue operating the transmission in neutral at 1500 rpm until normal operating temperature is reached.

CAUTION:
If the unit does not have a converter-out temperature gauge, do not stall the converter.

6. If normal operating temperature is less than 107°C (225°F), shift the transmission to forward range and stall the converter. Do not exceed 107°C (225°F).
7. As soon as the transmission is cool enough to touch, seal all openings and the breather with moisture-proof tape.
8. Coat all exposed, unpainted surfaces with preservative grease such as petrolatum (MIL-C-11796, Class 2).
9. If additional storage time is required, repeat Steps 2 through 8 yearly, except it is not necessary to drain the transmission each year. Just add VCI #10 and Biobor® JF (or equivalents).

1–7. RESTORING TRANSMISSION TO SERVICE

a. Transmission Exterior. Wash all external grease from the transmission with mineral spirits.

b. Sealed Breather and Openings. Remove all tape from openings and the breather.

c. New Transmissions. If the transmission is new, drain the residual preservative oil. Refill the transmission to the proper level with TES-295 or TES-389 transmission fluid.

d. Stored Without Fluid. If the transmission was prepared for storage without fluid, drain the residual fluid and replace the oil filter elements. Refill the transmission to the proper level with TES-295 or TES-389 transmission fluid.

CAUTION:
When a transmission has been stored, the TCM must be reset to unadapted shifts. Resetting to unadapted shifts erases previous shift adaptations and allows the transmission to begin using Fast Adaptive mode to regain adapted shifts. Use Allison DOC™ For PC–Service Tool to reset to unadapted shifts.

e. Stored With Fluid. If the transmission was prepared for storage with fluid, it is not necessary to drain and refill the transmission with new transmission fluid. Check for proper fluid level. Add or drain transmission fluid, as required, to obtain the proper level.

1–8. OPERATING INSTRUCTIONS

WARNING!
Operation with excessive loads can cause transmission damage and unexpected vehicle movement. To help avoid injury, property damage, and/or transmission damage, do not exceed the GVW/GCW for the vocational model or the OEM vehicle rating, whichever is less.

Detailed transmission operation information is in the 1000 and 2000 Product Families Principles of Operation Manual, PO4009EN, or the latest edition of the relevant vocational model operator's manuals.

Table 1–5. HYDRAULIC SYSTEM

Fluid type	Motor Home Series transmission models require a TES 295 fluid such as TranSynd™; all other models may use TES-295 or TES-389. Refer to Section 2–6, Fluid Recommendations before using TES-295 or TES-389.	
Filters	Internal suction filter in the sump; Control main spin-on multipass filter externally mounted to the converter housing.	
Oil Temperature Limits	Location	Temperature Limit
	Minimum start-up, TES-295	–30°C (–22°F)
	Minimum continuous sump	–30°C (–22°F)
	Typical continuous sump	93°C (199°F)
	Maximum intermittent sump	121°C (250°F)
	Typical continuous converter-out	121°C (250°F)
	Maximum intermittent converter-out	149°C (300°F)
Initial Transmission Fill Quantities (Transmission Only)**	Sump	Fill Quantity
	Standard	14 liters (14.8 qts)
	Shallow	12 liters (12.7 qts)
Refill Transmission Fill Quantities (Transmission Only)*	Sump	Fill Quantity
	Standard	10 liters (10.62 qts)
	Shallow	7 liters (7.4 qts)

Table 1–6. OPERATIONAL EQUIPMENT

Engine Adaptation	**Adaptation**	**1000 Product Family**	**2000 Product Family**
	SAE No. 2	X	X
	SAE No. 3	X	X
Throttle Position Input Signal	Throttle Position Sensor (TPS)		
	Pulse-width-modulated (PWM) signal		
	Throttle position signal from an SAE J1850 or SAE J1939 serial communication link		
Range Shift Controls	Cable, electric, electronic		
Output Yokes and Flanges (customer supplied)	2WD/Fixed yoke		

Table 1–7. REGULATION EQUIPMENT

Tachograph Provision	6 tooth tone wheel
Parking Brake (customer supplied)	9 inch x 3 inch; 10 inch x 3 inch

* All data and specifications are subject to change without notice.

** Engines with full load governed speed greater than 3800 rpm require Shift Energy Management (SEM) and additional calibration development.

*** Includes truck, school buses, one-way rental trucks, and road sweepers.

NOTE: Values with English units shown in parentheses () are for reference purposes only. Conversions between Metric and English units are not necessarily equivalent.

2–1. SCOPE

Proper care and regular maintenance enables the transmission to meet its duty requirements. Perform the maintenance procedures described in this section on a regular basis to prevent premature transmission or support equipment failure. Allison transmissions are manufactured to provide long term, efficient service in their designed applications.

2–2. PERIODIC INSPECTIONS AND CARE

a. Transmission Inspection

CAUTION:

Do not spray steam, water, or cleaning solution directly at the electrical connectors or breather. Spraying steam, water, or cleaning solution at the electrical connectors can cause false codes and crosstalk. Spraying steam, water, or cleaning solution at the breather can force the water or cleaning solution into the transmission and contaminate the transmission fluid.

Clean and inspect the exterior of the transmission at regular intervals. Severity of service and operating conditions determine the frequency of these inspections. Inspect the transmission for:

- Loose bolts—transmission and mounting components.
- Fluid leaks—repair immediately.
- Loose, dirty, or improperly adjusted throttle sensor or shift selector linkage.
- Damaged or loose hoses.
- Worn, frayed, or improperly routed electrical harnesses.
- Worn or frayed electrical connections.
- Worn or out-of-phase driveline U-joints and slip fittings.
- Clogged or dirty breather.

b. Vehicle Inspection.

Check the vehicle cooling system occasionally for evidence of transmission fluid which would indicate a faulty oil cooler.

c. Welding

CAUTION:

When welding on the vehicle:

- **Disconnect all control system wiring harness connectors from the Transmission Control Module (TCM).**
- **Disconnect the TCM battery power and ground leads.**
- **DO NOT WELD on any control components.**
- **DO NOT CONNECT welding cables to any control components.**
- **PROTECT CONTROL COMPONENTS FROM SPARKS AND HEAT DURING WELDING.**

A label describing on-vehicle welding precautions (ST2067EN) is available from your authorized Allison service dealer and should be installed in a conspicuous place. A vehicle used in a vocation that requires frequent modifications or repairs involving welding **must** have an on-vehicle warning label.

2–3. IMPORTANCE OF PROPER TRANSMISSION FLUID LEVEL

Transmission fluid cools, lubricates, and transmits hydraulic power. Always maintain proper fluid level. If fluid level is too low, the torque converter and clutches do not receive an adequate supply of fluid and the transmission overheats. If the level is too high, the fluid aerates, causing the transmission to shift erratically and overheat. Fluid may be expelled through the breather or dipstick tube when the fluid level is too high.

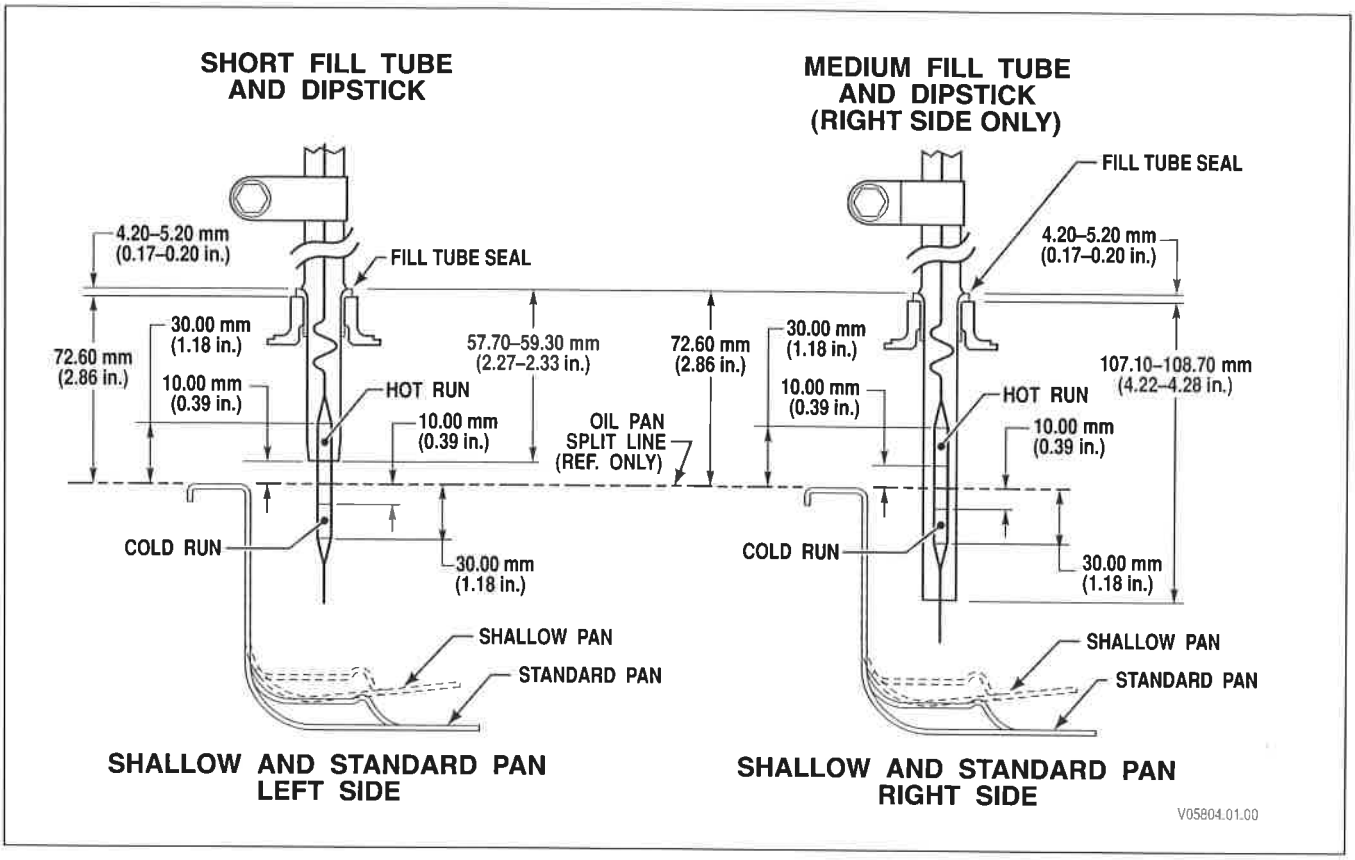


Figure 2–1. Short And Medium Fill Tube And Dipstick Requirements

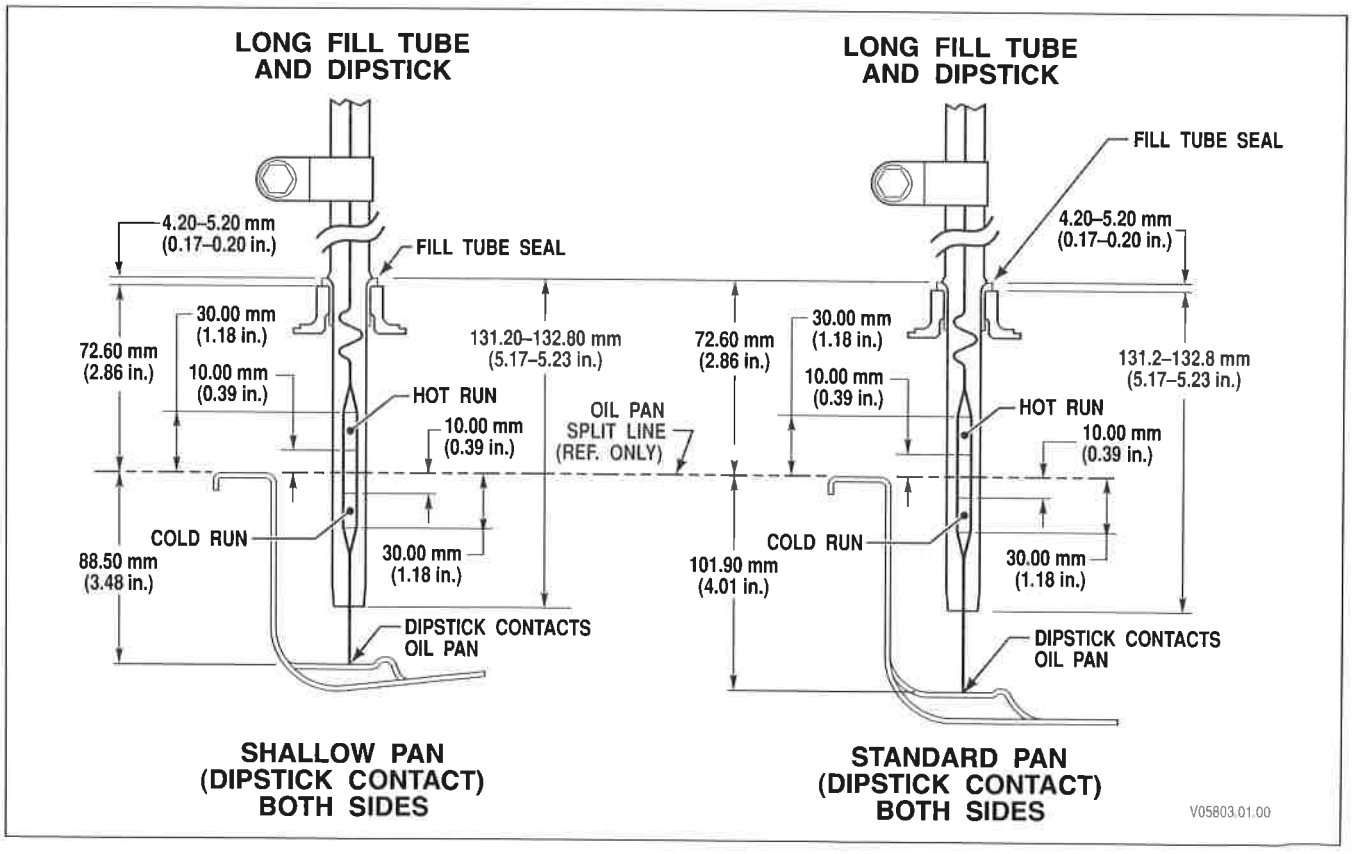


Figure 2–2. Long Fill Tube And Dipstick Requirements

- Park vehicles containing 1000 Product Family transmissions with park pawls as follows:
  - — Use the service brake and bring the vehicle to a complete stop on a level surface.
  - — Make sure the engine is at low idle rpm.
  - — Put the transmission in **P** (Park).
  - — Engage the **P** (Park) range by slowly releasing the service brake.
  - — Apply the emergency brake and/or parking brake, if equipped, and make sure it is properly engaged.
- Park vehicles containing 2000 Product Family transmissions with **PB** (Auto-Apply Parking Brakes) as follows:
  - — Use the service brake and bring the vehicle to a complete stop on a level surface.
  - — Make sure the engine is at low idle rpm.
  - — Put the transmission in **PB** (Auto-Apply Parking Brake). Make sure the parking brake is properly engaged.
  - — Apply the emergency brake, if equipped, and make sure it is properly engaged.
- Park vehicles containing 2000 Product Family transmissions without **PB** (Auto-Apply Parking Brakes) as follows:
  - — Use the service brake and bring the vehicle to a complete stop on a level surface.
  - — Make sure the engine is at low idle rpm.
  - — Put the transmission in **N** (Neutral).
  - — Apply the emergency brake and/or parking brake and make sure they are properly engaged.
- Chock the wheels and take any other steps necessary to keep the vehicle from moving.
- With the engine running, remove the dipstick from the tube and wipe the dipstick clean.
- Insert the dipstick into the tube and remove. Check fluid level reading. Repeat the check procedure to verify the reading.

NOTE:

Safe operating level is within the HOT RUN band on the dipstick. See Figures 2–1 and 2–2. The width of the HOT RUN band represents approximately 1.0 liter (1.06 quart) of fluid at normal operating sump temperature.

- If the fluid level is not within the HOT RUN band, add or drain as necessary to bring the fluid level to within the HOT RUN band.

d. Consistency of Readings. Always check the fluid level at least twice using the procedure described above. Consistency (repeatable readings) is important to maintaining proper fluid level. If inconsistent readings persist, check the transmission breather to be sure it is clean and unclogged. If readings are still inconsistent, contact your nearest Allison Transmission distribution or dealer.

2–5. KEEPING FLUID CLEAN

Prevent foreign material from entering the transmission by using clean containers and fillers. Lay the dipstick in a clean place while filling the transmission.

CAUTION:

Containers or fillers that have been used for antifreeze solution or engine coolant must NEVER be used for transmission fluid. Antifreeze and coolant solutions contain ethylene glycol which, if put into the transmission, can cause the clutch plates to fail.

2–6. FLUID RECOMMENDATIONS

Hydraulic fluids (oils) used in the transmission are important influences on transmission performance, reliability, and durability. Only TranSynd™ or a TES-295 fluid is acceptable for use in the Motor Home Series transmissions. For all other models, only fluids meeting TES-295 (TranSynd™) and TES-389.

To make sure the fluid is qualified for use in Allison transmissions, check for TES-295 or TES-389 fluid license or approval numbers on the container, or consult the lubricant manufacturer. Consult your Allison Transmission dealer or distributor before using other fluid types.

CAUTION:

Disregarding minimum fluid temperature limits can result in transmission malfunction or reduced transmission life.

When choosing the optimum viscosity grade of fluid to use, duty cycle, preheat capabilities, and/or geographical location must be taken into consideration. Table 2–1 lists the minimum fluid temperatures at which the transmission may be safely operated without preheating the fluid. Preheat with auxiliary heating equipment or run the equipment or

1000 and 2000 Product Families Transmissions

Recommended Fluid and Filter Change Intervals

Filter

100 Percent Concentration Allison Approved TES-295 Fluids*

Control Main	Internal	Lube/Auxiliary
Initial 10,000 Miles (16 000 km) 400 Hours		
General or Severe*****	**Overhaul**	**General** or Severe*****
50,000 Miles (80 000 km) 2000 Hours 24 Months		50,000 Miles (80 000 km) 2000 Hours 24 Months

Allison Approved Non-TES-295 Fluids*

Control Main		Internal	Lube/Auxiliary	
Initial 10,000 Miles (16 000 km) 400 Hours				
General**	**Severe*****	**Overhaul**	**General****	**Severe*****
50,000 Miles (80 000 km) 2000 Hours 24 Months	12,000 Miles (20 000 km) 500 Hours 6 Months		50,000 Miles (80 000 km) 2000 Hours 24 Months	12,000 Miles (20 000 km) 500 Hours 6 Months

Fluid

100 Percent Concentration Allison Approved TES 295 Fluids*

General**	Severe***
150,000 Miles (240 000 km) 4000 Hours 48 Months	75,000 Miles (120 000 km) 3000 Hours 36 Months

Allison Approved Non-TES 295 Fluids*

General**	Severe***
50,000 Miles (80 000 km) 2000 Hours 24 Months	12,000 Miles (20 000 km) 500 Hours 6 Months

NOTE: Change fluid/filters at or before recommended mileage, months, or hours have elapsed, whichever occurs first.

NOTE: Local conditions, severity of operation or duty cycle may require more or less frequent fluid change intervals that differ from the published recommended fluid change intervals of Allison Transmission. Allison Transmission recommends that customers use fluid analysis as the primary method for determining fluid change intervals. In the absence of a fluid analysis program the fluid change intervals listed in the charts above should be used.

* Anything other than 100 percent concentration of Allison Approved TES 295 fluid is considered a mixture and should utilize non-TES 295 change intervals.

** General Vocation: All other vocations.

*** Severe Vocation: 2000 MH, On/Off Highway, Refuse, City Transit, and Shuttle Transit.

†† Fluid fill capacity is dependent on vehicle configuration. Final fluid capacity must be determined by dipstick level (see Mechanic's Tips MT3190EN Section 1 or your Operator's Manual under "Care and Maintenance").

Capacities†† (Approximate)

Transmissions Fluid Loss—Filter Change Only:
Control Main (spin-on) = 1 pint (0.47 liters)

Sump	Initial Fill†††		Re fill†††	
	Liters	Quarts	Liters	Quarts
Standard	14	14.8	10	10.6
Shallow	12	12.7	7	7.4

††† Approximate quantities, do not include external lines, cooler, and hoses.

Filters

Control Main	**P/N 29539579**
Shallow Pan Suction (Overhaul Only)	P/N 29537965
Deep Pan Suction (Overhaul Only)	P/N 29537966

c. Engine Coolant

CAUTION:

Engine coolant in the transmission hydraulic system requires immediate action to prevent malfunction and possible serious damage. Completely disassemble, inspect, and clean the transmission. Remove all traces of the coolant, and varnish deposits resulting from engine coolant contamination. Replace the torque converter, all seals, gaskets, bearings, friction clutch plates, solenoids, and all rusted parts.

d. Flush Oil Cooler. Transmission failures can cause the oil cooler to become restricted or plugged. Flush the oil cooler whenever the transmission is removed for repair. Use the J 46550 Transmission Cooler Flush Cart or an approved flushing device that can perform the following:

1. Flow clean transmission fluid through the cooler and hoses in the opposite direction of normal flow. Use a minimum pulsating flow rate of 0.5 liter/sec (8.0 gpm), at 275–345 kPa (40–50 psi). Flush the cooler and hoses thoroughly to remove all contaminated fluid.
2. After thoroughly flushing contaminated fluid, circulate clean transmission fluid through the cooler in a closed loop that includes a 10 micron filter.
3. Circulate clean transmission fluid through the filter for 5 minutes or more, the longer the filtering process the cleaner the fluid.
4. Determine the pressure drop in the external cooler.
5. If the pressure drop is above specification, the cooler has excessive trapped particles and must be repaired or replaced.

2–9. TRANSMISSION FLUID AND FILTER CHANGE PROCEDURE

a. Drain Fluid

- Drain the fluid when the transmission is at normal operating sump temperature—71°C–93°C (160°F–199°F). Hot fluid flows quicker and drains more completely.
- Remove the drain plug from the oil pan and allow the fluid to drain into a suitable container.
- Examine the fluid as described in Section 2–8.

b. Replace Control Main Filter *(Figure 2–3)*

Tools Required:

- J 45023 Control Main Filter Wrench

1. Remove the control main filter by rotating it in the counterclockwise direction. Use a standard strap-type filter wrench or the J 45023.
2. Remove the magnet from the filter attachment tube or from the top of the filter element.
3. Clean any metal debris from the magnet. Report any metal pieces larger than dust to your service management.
4. Reinstall the magnet onto the filter attachment tube.
5. Lubricate the gasket on the control main filter with transmission fluid.
6. Install, by hand, the control main filter until the gasket on the control main filter touches the converter housing or cooler manifold.

CAUTION:

Turning the control main filter more than one full turn after gasket contact damages the filter.

7. Using the J 45023, or by hand, turn the filter **one full turn only** after gasket contact.
8. Reinstall the drain plug and sealing washer. Tighten the drain plug to 30–40 N·m (22–30 lb ft).

c. Refill Transmission. The amount of refill fluid is less than the amount used for the initial fill. Fluid remains in the external circuits and transmission cavities after draining the transmission. After refill, check the fluid level using the procedure described in Section 2–4.

Table 2–3. Transmission Fluid Capacity

	Initial Fill*		Refill*	
Sump	**Liters**	**Qts**	**Liters**	**Qts**
Standard	14	14.8	10	10.6
Shallow	12	12.7	7	7.4

* Approximate quantities, does not include external lines and cooler hose.

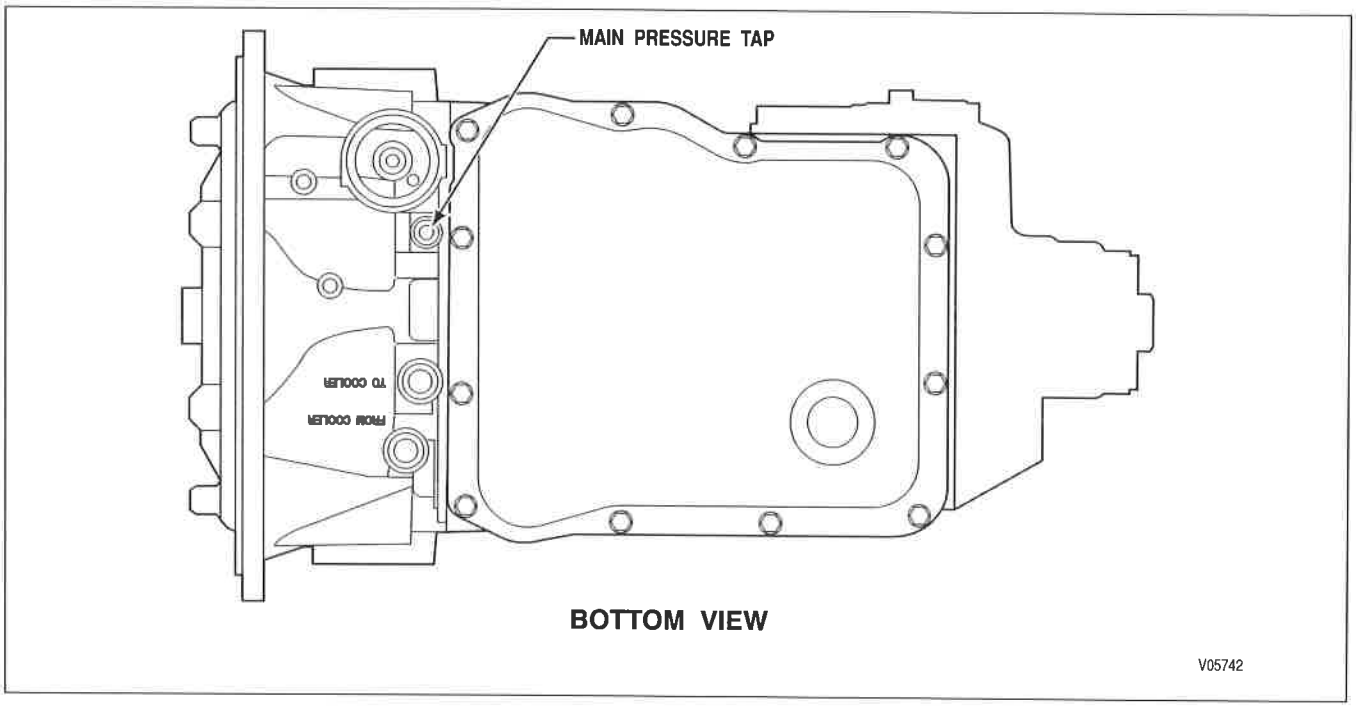


Figure 2–4. Main Pressure Checkpoint

2–11. *MAIN PRESSURE CHECK PROCEDURE*

Checking main pressures helps determine if a transmission performance complaint is due to a mechanical or electrical problem. Properly making these pressure checks requires transmission and vehicle (or test stand) preparation, recording of data, and comparing recorded data against specifications provided.

WARNING!

Observe safety precautions during hydraulic pressure check procedures. All personnel must stand clear of the vehicle. Take precautions against movement of the vehicle. Be sure the vacuum, pressure, and tachometer gauges have extended lines so they can be read from inside the vehicle.

1. Perform all transmission fluid level and pressure checks at normal operating temperatures 71–93°C (160–199°F) sump; 82–104°C (180–219°F) converter out. Check transmission fluid level.
2. Connect a 0–2070 kPa (0–300 psi), 0.4375-20 UNF-2B inch series oil pressure gauge at the main pressure tap (Figure 2–4). Use Allison DOC™ for PC–Service Tool to check engine rpm. See Table 2–5 for main pressure levels.
3. Disconnect the driveshaft.
4. With brakes applied, check main pressure with the engine running at 2100 rpm and 600 rpm.
5. Continue the procedure for all ranges

11. The vehicle's brakes are fully locked.

WARNING!

To avoid personal injury, such as burns, from hot transmission fluid and/or to help avoid equipment damage, do not stall the torque converter for more than 10 seconds maximum and monitor transmission fluid temperature. Immediately return the engine to idle if converter out (to cooler) temperature exceeds 150°C (302°F). Operating the transmission at high engine power at transmission stall or near stall conditions causes a rapid rise in the transmission fluid temperature. The fluid in the transmission torque converter is absorbing all of the engine power and the vehicle cooling system cannot dissipate the excessive heat load. Extended operation under high heat load conditions causes transmission and cooling system damage, and can possibly fail hydraulic lines causing leaking high temperature fluid.

WARNING!

To avoid personal injury and equipment damage while conducting a transmission stall test, the vehicle must be positively prevented from moving. Apply the parking brake, the service brake, and chock the wheels securely. Warn personnel to keep clear of the vehicle and its travel path.

c. Performing a Transmission Stall Test

1. Start the engine. While in neutral let the transmission warm to normal operating temperature:

   — Sump temperature: 71–93°C (160–199°F)
   — Converter out to cooler temperature: 82–104°C (180–219°F)

2. Perform a hot check of the transmission fluid level and adjust as necessary.

3. Turn all engine accessories **off**.

4. Use Allison DOC™ for PC–Service Tool to select fourth range. Using fourth range reduces the torque imposed on the transmission and driveline. Do not perform a transmission stall test in **R** (Reverse).

CAUTION:

To avoid transmission or driveline damage, never perform full throttle transmission stall tests in R (Reverse) (all models) or low ranges (seven-speed models).

5. Notify personnel in the area to keep clear of the vehicle.

6. Slowly increase engine rpm until engine speed stabilizes.

7. Record engine speed.

CAUTION:

The transmission stall test procedure causes a rapid rise in transmission fluid temperature that can damage the transmission. Never maintain a stall condition once engine speed stabilizes or converter out (to cooler) temperature exceeds 150°C (302°F). During a stall condition, converter out temperature rises much faster than internal (sump) temperature. Never use sump fluid temperature to determine the length of the stall condition. If the stall test is repeated, do not let the engine overheat.

8. Record converter out (to cooler) temperature.

9. Reduce engine speed to idle and shift the transmission to **N** (Neutral).

10. Raise engine speed to 1200–1500 rpm for two minutes to cool the transmission fluid.

11. At the end of two minutes, record converter out (to cooler) temperature.

d. Driving Transmission Stall Test

NOTE:

If the vehicle is equipped with a smoke controlled or an emission controlled engine, or engine control programming inhibits the engine's acceleration, the following transmission stall test procedure can be used.

CAUTION:

To avoid personal injury and/or equipment damage, perform a driving transmission stall test by a trained driver and a qualified technician.

h. Transmission Stall Test Results

NOTE:

Environmental conditions, such as ambient temperature, altitude, and engine accessory loss variations, affect engine performance/power. Due to such conditions, stall speed can vary from specification by +/–150 rpm and still be accepted as within published stall speed.

If engine speed with the transmission stalled is more than 150 rpm below the stall speed specified, an engine issue is indicated.

If engine speed with the transmission stalled is more than 150 rpm above specification, a transmission issue is indicated.

Conditions that can exist to cause stall speed to be 150 rpm above specification could be:

— Transmission fluid cavitation or aeration. Verify proper fluid level using the oil level sensor, if equipped, or dipstick.

— Slipping clutch

— Torque converter malfunction

— Sticking/damaged torque converter valve

A low stall speed that is at least 33 percent lower than the published stall speed could indicate an engine issue or a freewheeling stator in the torque converter.

2–13. FLUID LEAK DIAGNOSIS

a. Finding the Leak

1. Identify the fluid. Determine whether it is engine oil, automatic transmission fluid, or hydraulic fluid from a specific vehicle system.

2. Operate the vehicle to reach normal operating temperature and park the vehicle. Inspect the vehicle to identify the source of the leak. Refer to the following list for possible points of fluid leaks and their causes.

   - Transmission mating surfaces:
     — Attaching bolts not correctly tightened
     — Improperly installed or damaged gasket
     — Mounting face damaged
   - Housing leak:
     — Filler pipe or plug seal damaged or missing
     — Filler pipe bracket dislocated
     — Oil cooler connector fittings loose or damaged
     — Output shaft seals worn-out or damaged
     — Pressure port plug loose
     — Porous casting
   - Leak at converter end:
     — Converter seal damaged
     — Seal lip cut (check converter hub for damage)
     — Garter spring missing from seal
     — Converter leak in weld area
     — Porous casting
   - Fluid comes out of fill tube:
     — Overfilled—incorrect dipstick calibration
     — Plugged breather
     — Water or coolant in fluid—fluid appears milky
     — Drain-back holes plugged

3. Visually inspect the suspected area. Inspect all the gasket mating surfaces for leaks.

CAUTION:

Do not spray steam, water, or cleaning solution directly at the electrical connectors or breather. Spraying steam, water, or cleaning solution at the electrical connectors can cause false codes and crosstalk. Spraying steam, water, or cleaning solution at the breather can force the water or cleaning solution into the transmission and contaminate the transmission fluid.

4. If the leak still cannot be identified, clean the suspected area with a degreaser, steam, or spray solvent. Clean and dry the area. Operate the vehicle for several miles at varying speeds. Inspect the vehicle for leaks. If the source of the leak is still not identified, use the powder method, and/or black light and dye method as explained below.

3–1. SCOPE

This section provides general information for transmission overhaul. The information provided includes:

- Tools and equipment required for overhaul
- Replacement parts information
- Cleanliness and careful handling
- Cleaning and inspection
- Assembly procedures
- Transmission removal and installation
- Locating wear data
- Locating spring specifications
- Locating torque specifications for plugs, bolts, and nuts

3–2. TOOLS AND EQUIPMENT

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

- Work Table—500 kg (1000 lbs) capacity (Figure 3–1)
- Overhaul Stand—J 29109 or equivalent (Table 3–1)

b. Special Tools. Special tools are illustrated and identified in Table 3–1.

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

- Common hand tools, metric where required
- Metric wrench set (sockets, box-end wrenches, and Allen wrenches)

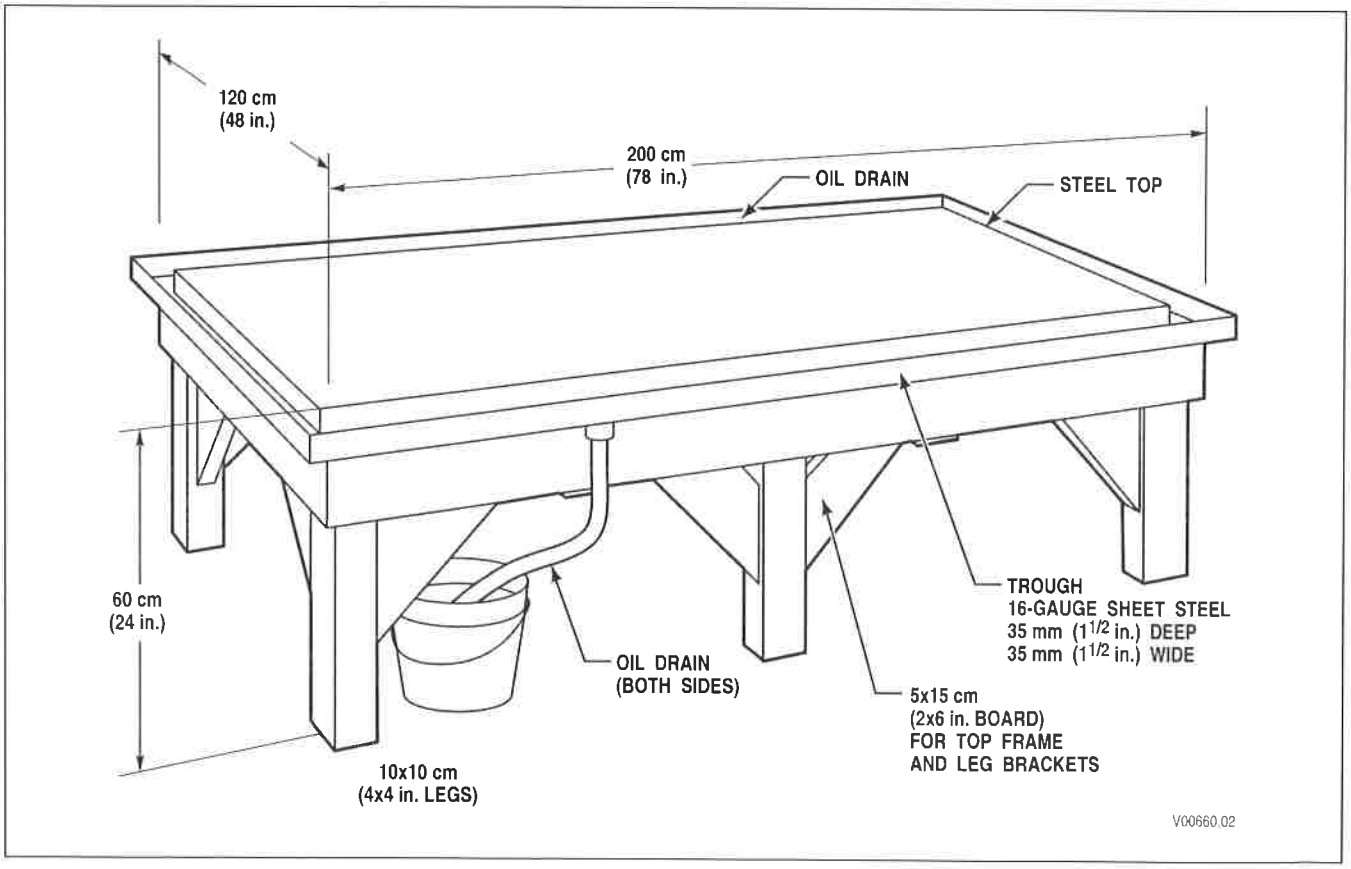


Figure 3–1. Work Table

Table 3–1. Special Tools and Equipment*

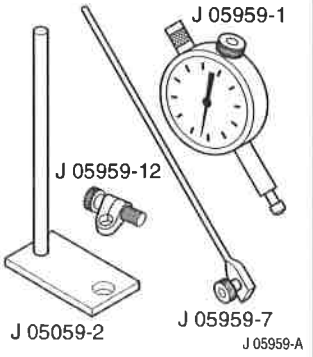
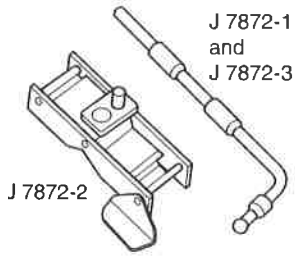
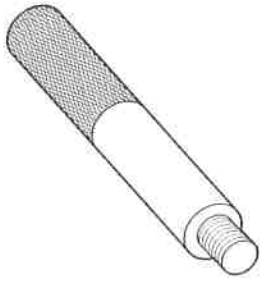
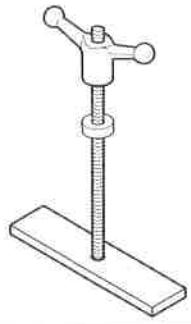
Illustration	Kent-Moore Tool No.**/ Description
	J 05959-A Dial Indicator Set
	J 7872 Dial Indicator Clamp and Adapter
	J 8092 Universal Driver
	J 24204-2 Bar and Stud Assembly

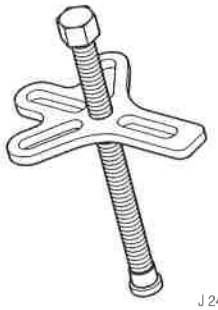
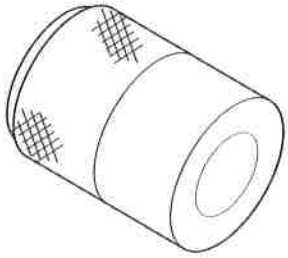
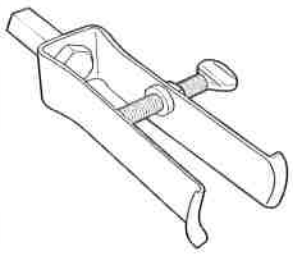
Illustration	Kent-Moore Tool No.**/ Description
	J 24420-B Universal Puller
	J 24446 Rear Bearing Installer
	J 24459-5 Spring Compressor Adapter (Used with J 43770)
	J 26941 Front Support Needle Bearing Remover

Table 3–1. Special Tools and Equipment* *(cont'd)*

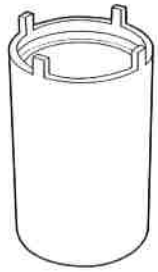
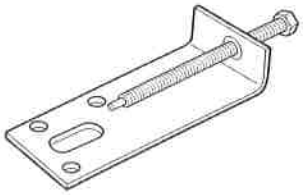
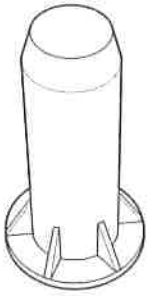
Illustration	Kent-Moore Tool No.**/ Description
 J 43769	J 43769 Spanner Nut Wrench—4WD
 J 43770	J 43770 Main, Lube, Converter Relief Valve Spring Compressor (Requires J 24459-5)
 J 43771	J 43771 Pump Bushing Installer/Remover
 J 43772	J 43772 Oil Pump Seal Installer

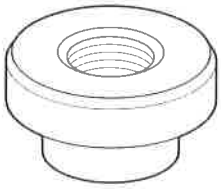
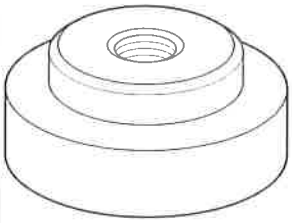
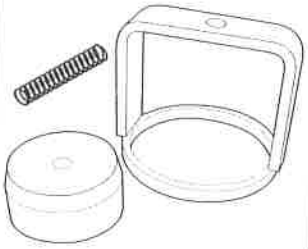
Illustration	Kent-Moore Tool No.**/ Description
 J 43773	J 43773 Valve Spring Compressor
 J 43774	J 43774 Ground Sleeve Bushing Installer
 J 43775	J 43775 Front Support Needle Bearing Installer
 J 47339	J 47339 C1/C2 Piston Return Spring Compressor (silver plated)

Table 3–1. Special Tools and Equipment* *(cont'd)*

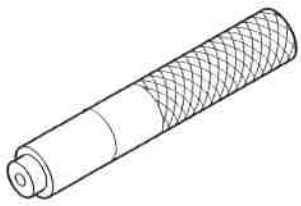
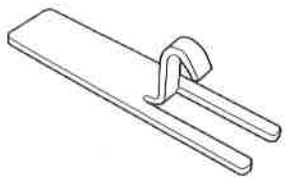
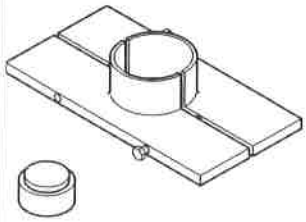
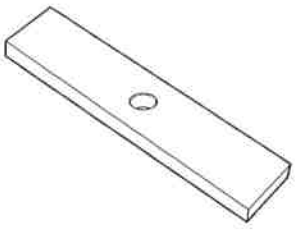
Illustration	Kent-Moore Tool No.**/ Description
 J 43797	J 43797 P3 Carrier Bearing Race Installer
 J 43909	J 43909 Selector Shaft Seal Installer
 J 43910	J 43910 Output Bearing Puller Leg Set
 J 43911	J 43911 Selector Shaft Seal Remover
 J 44247	J 44247 Wiring Harness Connector Installer

Illustration	Kent-Moore Tool No.**/ Description
 V20034.00.0	J 44525-A C1 Clutch Backplate Selector (These components can be obtained by combining the contents of the J 44525 and the J 47158 kits)
 J 44526	J 44526 Output/Turbine Shaft Bushing Remover
 J 44528	J 44528 P3 Carrier Bearing Race Remover
 J 44529	J 44529 Ground Sleeve Bushing Remover
 J 44530	J 44530 C3/C4 Piston Spring Compressor

3–3. REPLACEMENT PARTS

a. Ordering Information. Refer to the latest version of Parts Catalog PC3062EN or http://www.allisontransmission.com Extranet Parts Catalog for parts information. Do not order replacement parts using the reference numbers in this service manual.

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

- Gaskets
- Lockstrips
- Washers or retaining rings damaged by removal or abnormal wear
- Oil seals and piston sealrings
- Suction filters

WARNING!

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

3–4. CAREFUL HANDLING

Handle parts and subassemblies carefully to prevent nicking, scratching, and denting. Parts that fit together closely and have a specific operating clearance can bind if damaged. Parts that depend upon smooth surfaces for sealing may leak if scratched. Control valve body assembly parts are especially susceptible to leaking if scratched. Valves, when dry, must move freely by their own weight. Handle these parts carefully and protect them during removal, cleaning, inspection, and installation. Keep control valve body assembly parts in clean containers until installation.

3–5. CLEANING AND INSPECTION

a. Dirt Causes Malfunction. All parts must be clean to permit effective inspection. Do not allow dirt or foreign material to enter the transmission during assembly. Even minute particles can cause close-fit parts, such as valves, to malfunction.

b. Cleaning Parts

1. Clean all metallic transmission parts, except bearings and friction-faced clutch plates, by steam-cleaning or with volatile mineral spirits. Do not use caustic soda solution for steam-cleaning. Clean friction-faced clutch plates and bearings with mineral spirits only.
2. Dry all parts, except bearing assemblies, with compressed air. To prevent rust, lubricate steam-cleaned parts as soon as they are dry.
3. Clean fluid passages by working a piece of soft wire or a soft wire brush through the passages and flushing them with mineral spirits. Dry the passages with compressed air.
4. Examine parts, especially fluid passages, after cleaning to make certain they are entirely clean. Re-clean parts if necessary.

c. Cleaning Bearings

1. Bearings that have been in service should be thoroughly cleaned in volatile mineral spirits.
2. Soak particularly dirty bearings or ones filled with hardened grease in mineral spirits before trying to clean them.

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.

3. Before inspection, lubricate the bearings with transmission fluid.

d. Keeping Bearings Clean. Ball or roller bearing failures are usually caused by dirt or grit in the bearing. Keep bearings clean during removal and installation. Observe the following rules for maximum bearing life:

- Do not unwrap new bearings until they are to be installed.
- Do not remove the grease in which new bearings are packed until they are to be installed.

h. Inspecting Sealrings and Gaskets

1. Inspect piston sealrings and lip-type seals for nicks, cuts, tears, splits, and pattern damage. A damaged seal can indicate rough or sharp edges in piston grooves or on a mating surface that could damage a 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 old ring shows any wear on its outside diameter, or if there is excessive side wear.
5. Inspect clutch housing sealing 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 the housing before assembly.
6. Inspect piston sealring grooves 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 before assembly.

i. Inspecting Gears

1. Inspect gears for scuffed, nicked, burred, or broken teeth. If a defect cannot be removed with a soft stone, replace the gear.
2. Inspect gear teeth for wear that has changed the original tooth shape. If this condition is found, replace the gear.
3. Inspect the thrust face of gears for scores, scratches, and burrs. Remove such defects with a soft stone. If scratches and scores cannot be removed with a soft stone, replace the gear.
4. Inspect gears for load pattern and signs of distress. Any sign of distress indicates that a gear failure during operation is possible. Reusing distressed gears is an individual customer decision based on experience. Backlash cannot be used to establish critical gear wear. Backlash tolerances are of such nature that a gear usually pits, scuffs, scores, or galls long before gear wear becomes critical.

j. Inspecting Splined Parts

1. Inspect splined parts for stripped, twisted, chipped, or burred splines. Remove burrs with a soft stone. Replace the part if other defects are found. Spline wear is not considered harmful except where it affects the fit of the splined parts.
2. Spline wear is determined by comparing feeler gauge thickness with the thickness of the worn area on the spline. Replace parts having excessive spline wear. (Refer to Wear Limits, Section 7.)
3. Backlash cannot be used to establish critical spline wear. Accurate backlash measurement requires the mating parts to be concentrically located.

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

l. Inspecting Retaining Rings. Inspect all retaining rings for nicks, distortion, or excessive wear. Replace the retaining ring if any defects are found. The retaining ring must snap tightly into its groove to function properly.

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 are found. (Refer to Spring Data, Table 7–2 in Section 7.)

n. Inspecting Clutch Plates *(Figure 3–2)*

NOTE:

Anti-freeze and water have adverse effects on the bonding agent between the friction material and the steel core. Do not reuse the friction plate if it has been exposed to water and/or glycol. A loose face or flaking friction material indicates exposure to water and/or glycol.

Tighten all pipe plugs to the specified torque in the assembly procedure and on the exploded views. Tighten other fittings sufficiently to prevent leakage.

f. Lip-Type Seals

1. When replacing lip-type seals, make sure the spring-loaded lip is toward the fluid to be sealed (toward the inside of the unit). Coat the inside of the seal with petrolatum to protect the seal during shaft installation and to provide lubrication during initial operation.
2. The circumference of some seals is precoated with a dry sealant. The sealant is usually colored for easy identification. Precoated seals do not require any additional sealant before installation.

g. Butt-Joint/Overlap Sealrings

CAUTION:

If humidity is allowed to penetrate and expand a butt-joint sealring, the sealring can be damaged during installation. A damaged sealring will leak fluid from the clutch piston cavity and cause clutch slippage. Do not open the sealed package until you are ready to install the sealring.

1. Butt-joint/overlap sealrings require special handling during assembly. The sealrings contain materials that absorb moisture from the atmosphere causing the sealring to expand. The sealrings are shipped in airtight packages. Do not open the sealed package until the butt-joint sealring is ready to be installed into the transmission. Check sealring end clearance before installation to make sure the sealring has not expanded.
2. Remove the sealring from its package and place it in its operational position inside the bore that it will be sealing.
3. Using a feeler gauge, check the end clearance of the sealring. The end clearance must be greater than 0.38 mm (0.015 inch).
4. If the end clearance is less than minimum specifications, bake the sealring in an oven at 93–149°C (199–300°F) for 24 hours or get a new sealring. Repeat Steps (2) and (3).
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 for about 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. Bearings. If a bearing must be removed or installed without an installation sleeve, drive or press only on the race which is adjacent to the mounting surface. If a press is not available, carefully seat the bearing with a drift and a hammer, driving against the supported race.

i. Electrical Components. For inspection and repair of electrical components, refer to the Allison Transmission 1000 and 2000 Product Families Electronic Controls Troubleshooting Manual, TS3977EN.

3–7. REMOVING (OR INSTALLING) TRANSMISSION

WARNING!

Avoid contact with the hot fluid or the sump when draining transmission fluid. Direct contact with the hot fluid or the hot sump may result in bodily injury.

CAUTION:

Whenever a transmission is overhauled, exchanged, or has undergone repairs, the Transmission Control Module (TCM) must be set to RESET ADAPTIVE SHIFT PARAMETERS. This causes the TCM to erase previous adaptive information. Use Allison DOC™ for PC–Service Tool to reset the TCM to adaptive shift parameters. Refer to the appropriate user guide for Adaptive Shift Parameters instructions.

a. Draining Transmission. Drain the transmission fluid before removing the transmission from the vehicle.

- Remove the drain plug from the oil pan. Examine the drained fluid for evidence of contamination (refer to Section 2–8). Reinstall the drain plug.

e. Transmission Installation

1. Use a transmission jack to raise the transmission into mounting position. Mount the transmission.
2. Make all connections from vehicle to transmission.
3. Verify all mechanical and electrical connections.
4. Fill the transmission with transmission fluid (Sections 2–4 through 2–9) and road test after installation.

3–8. WEAR LIMITS

Refer to Wear Limits Data Table 7–1, for information covering parts fits, clearances, and wear limits.

3–9. SPRING SPECIFICATIONS

Refer to Spring Data Table 7–2 for spring identification and specifications.

3–10. TORQUE SPECIFICATIONS

Assembly procedures in Sections 5 and 6 specify the torque requirements for all plugs, bolts, and nuts. Torque values are also presented with the foldout illustrations in the back of this manual. Torque values specified are for dry assembly, except when otherwise noted. Bolts and washers should be washed and dried before assembly.

4–1. INSTALLATION OF TRANSMISSION INTO REPAIR STAND

Tools Required

- J 44723 Transmission/Stand Adapter Plate
- J 29109 Repair Stand

WARNING!

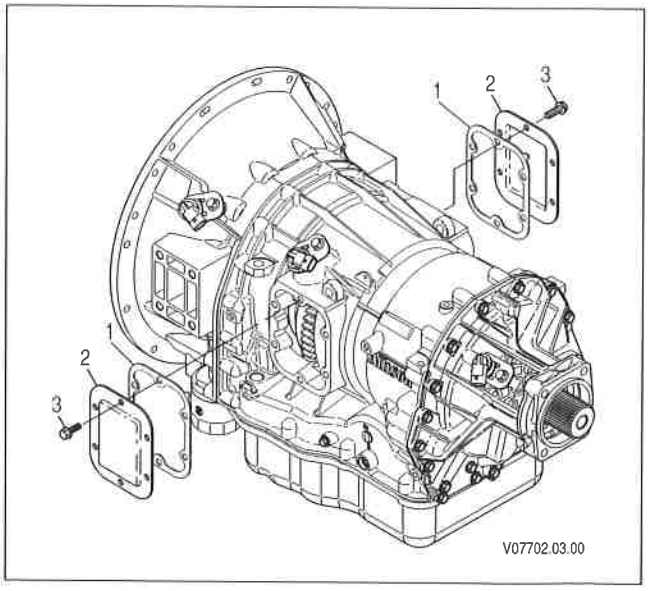
The torque converter must be held to the torque converter housing by a retaining device such as shipping brackets. Without the retaining device, the torque converter may slide forward, disengaging the oil pump, or may fall completely out of the transmission causing personal injury and/or property damage.

WARNING!

The 1000 and 2000 Product Families transmission dry weights are approximately 150 kg (330 lb). To help avoid personal injury and/or property damage:

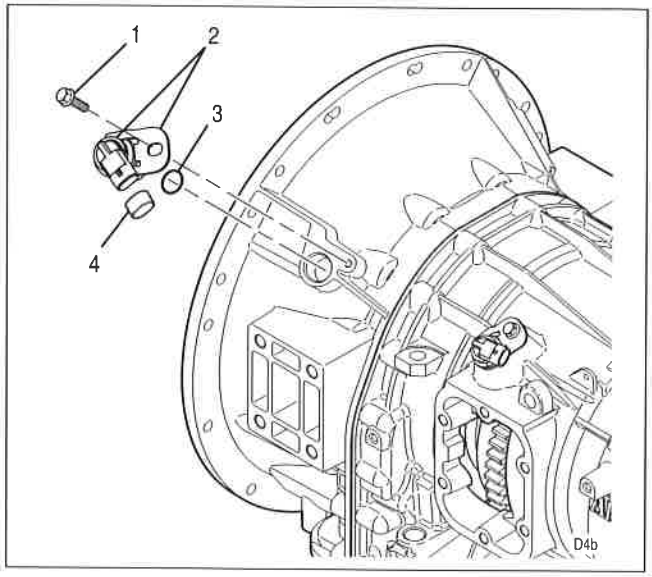
- **Use caution when installing, removing, or moving the transmission.**
- **Get help when lifting the transmission. Assistance from a hoist or another person may be required.**
- **Make sure that the lifting equipment can properly support the transmission.**

1. Position the transmission on the work table so the oil pan is facing down.
2. If not equipped with Power Takeoff (PTO) remove the following:
   - Twelve PTO cover bolts (3).
   - Two PTO covers (2).
   - Two PTO gaskets (1).



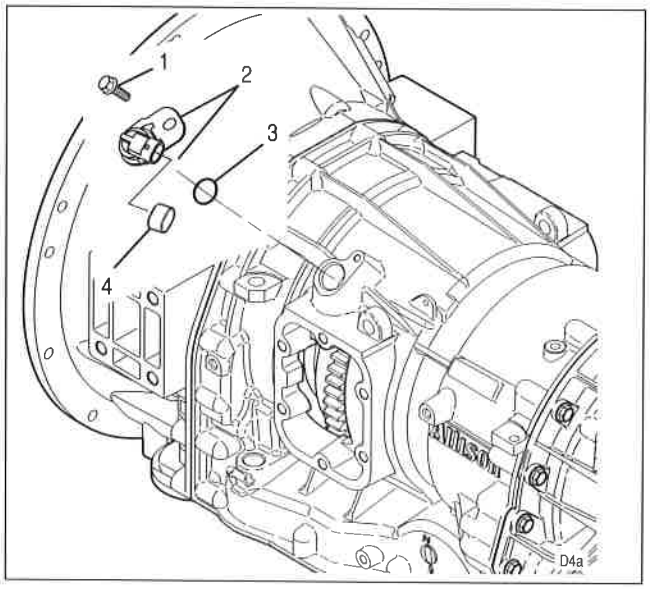
4–2. INPUT SPEED SENSOR REMOVAL

1. Position the main housing so the oil pan is facing down.
2. If equipped, remove sensor shipping cover (4).
3. Remove the bolt (1) securing the speed sensor (2) to the converter housing.
4. Remove the speed sensor (2).
5. Remove O-ring (3) from the speed sensor.



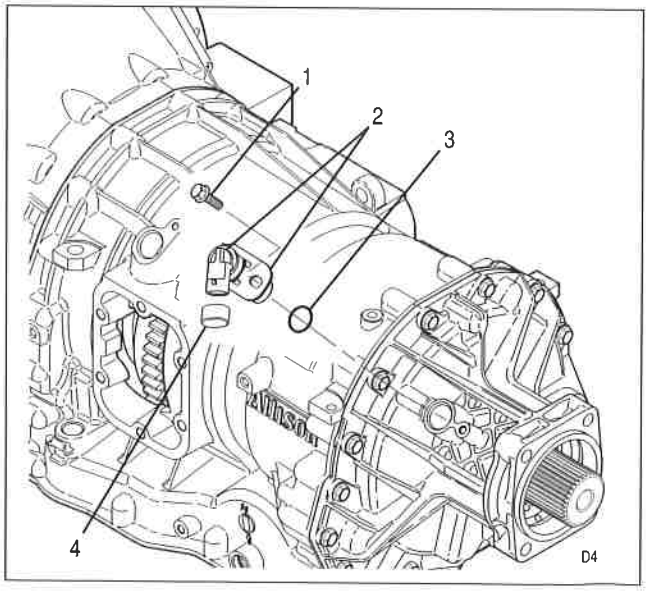
4–3. TURBINE SPEED SENSOR REMOVAL

1. If equipped, remove sensor shipping cover (4).
2. Remove bolt (1) securing the speed sensor (2) to the main housing.
3. Remove speed sensor (2).
4. Remove O-ring (3) from the speed sensor.

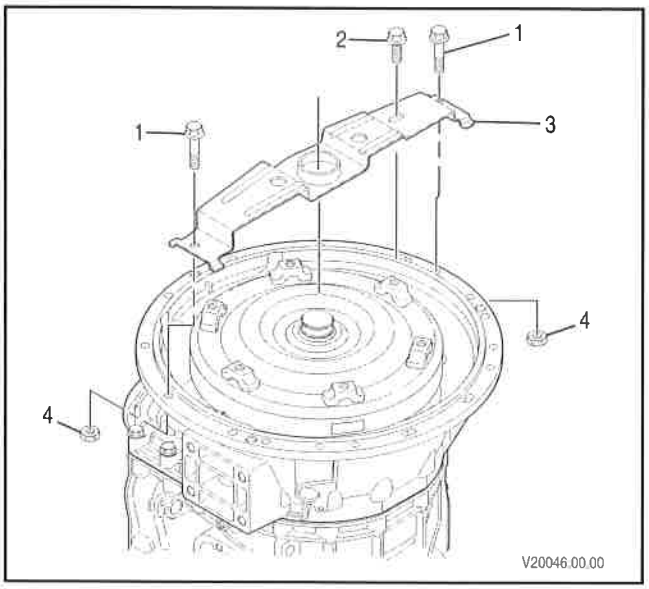


4–4. OUTPUT SPEED SENSOR REMOVAL

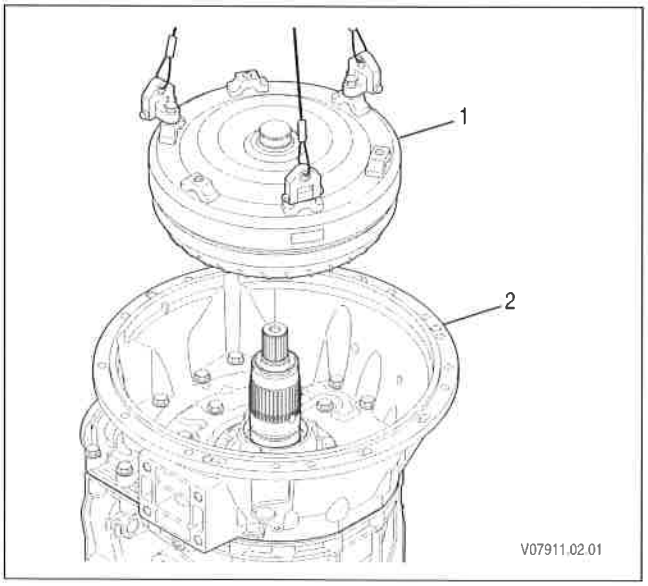
1. If equipped, remove sensor shipping cover (4).
2. Remove the bolt (1) securing the speed sensor (2) to the rear cover.
3. Remove the speed sensor (2).
4. Remove O-ring (3) from the speed sensor



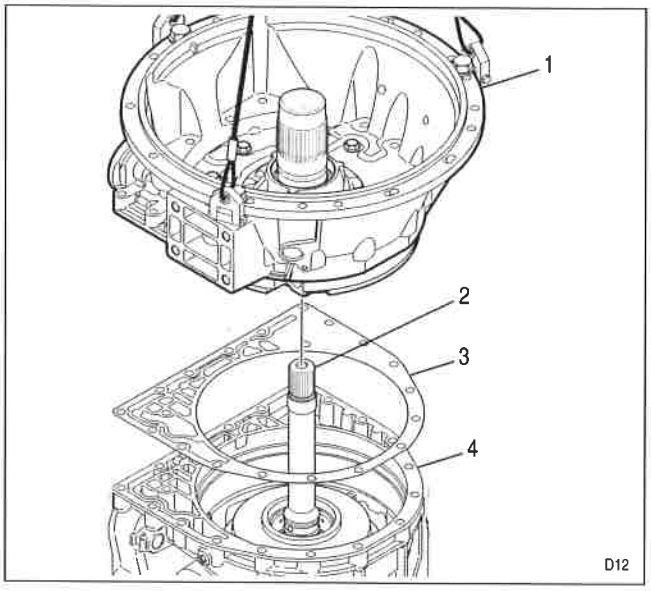
3. If present, remove one bolt (2), two nuts (4), two bolts (1), and shipping bracket (3).



4. Attach a sling to the torque converter (1).
5. Attach a hoist to the sling and raise the torque converter (1) from the converter housing (2).
6. Place the torque converter (1) on the work table. Remove the sling.



2. Attach a sling to the converter housing (1).
3. Attach a hoist to the sling.
4. Remove the converter housing/front support module (1) from the main housing (4) and turbine shaft (2).
5. Place the converter housing/front support module on the work table.
6. Remove the sling.
7. Remove and discard the main housing/separator plate gasket (3).

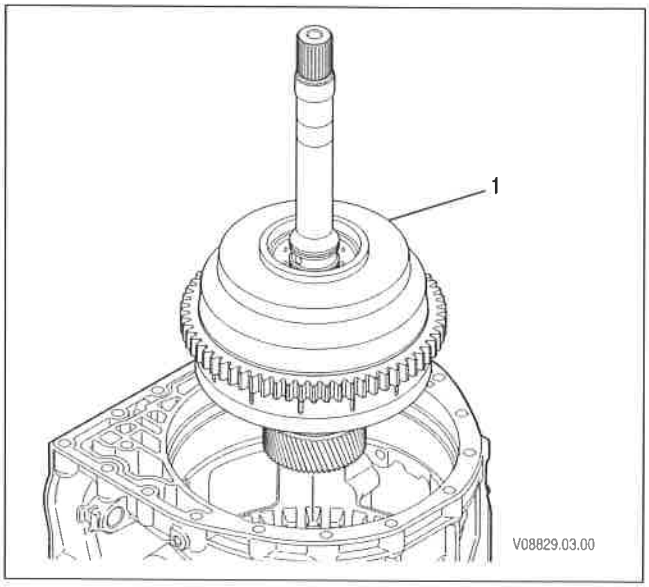


4–8. ROTATING CLUTCH ASSEMBLY REMOVAL

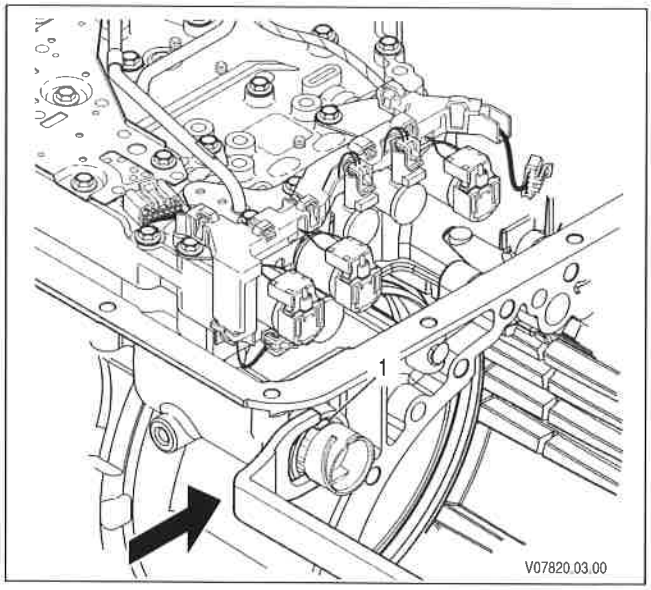
1. Remove the rotating clutch module (1).

NOTE:
The thrust bearing assembly may adhere to the rotating clutch module or the P1 planetary module.

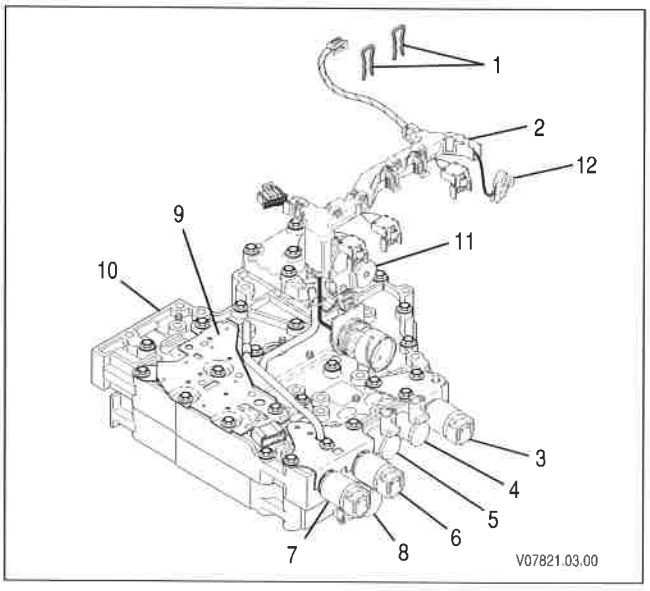
2. Remove the thrust bearing assembly from the rotating clutch assembly or P1 planetary module.



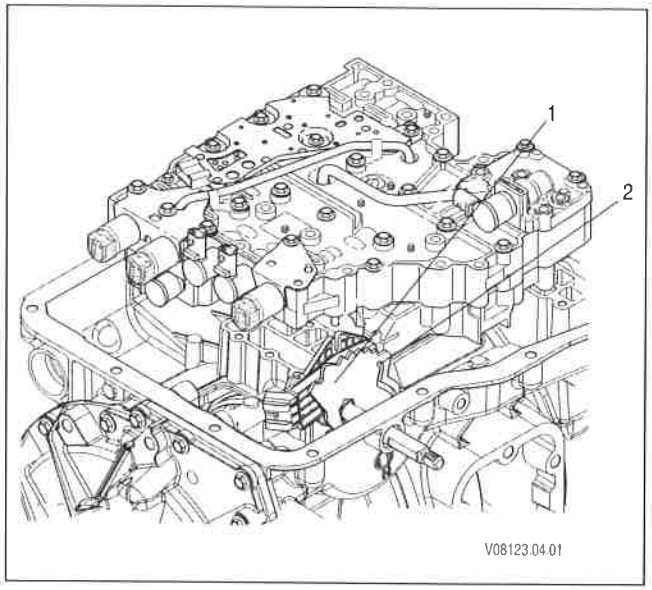
2. Use J 47944 to press the tabs on the internal wiring harness connector (1) and gently pop the connector into and through the main housing.



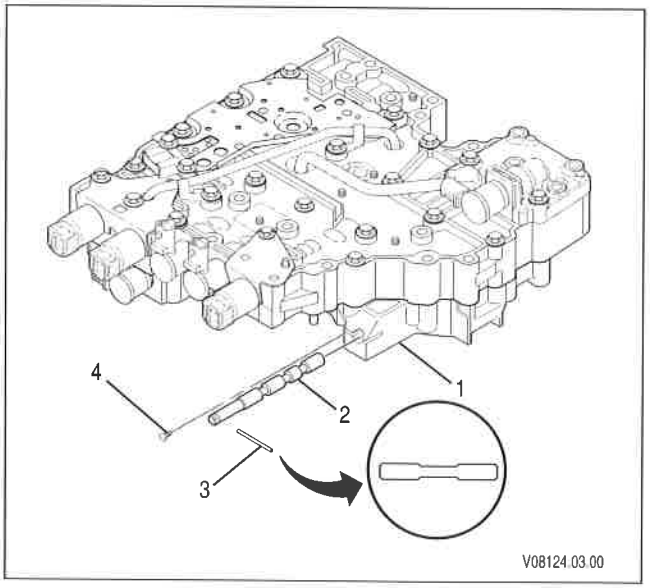
3. Disconnect the following components from the internal wiring harness (2):
   - Pressure Control Solenoid 1 (PCS1) (7)
   - Pressure Control Solenoid 2 (PCS2) (6)
   - Shift Solenoid 3 (SS3) (5)
   - Shift Solenoid 2 (SS2) (4)
   - Torque Converter Clutch (TCC) solenoid (3)
   - Shift Solenoid 1 (SS1) (8)
   - Pressure switch assembly (9)
   - Modulated Main solenoid (11)
   - Internal Mode Switch (IMS) (12)
4. Remove solenoid retainers (1) from SS2 (4) and SS3 (5).
5. Remove internal wiring harness (2) from main valve body (10).
6. Install solenoid retainers (1) onto SS2 and SS3.



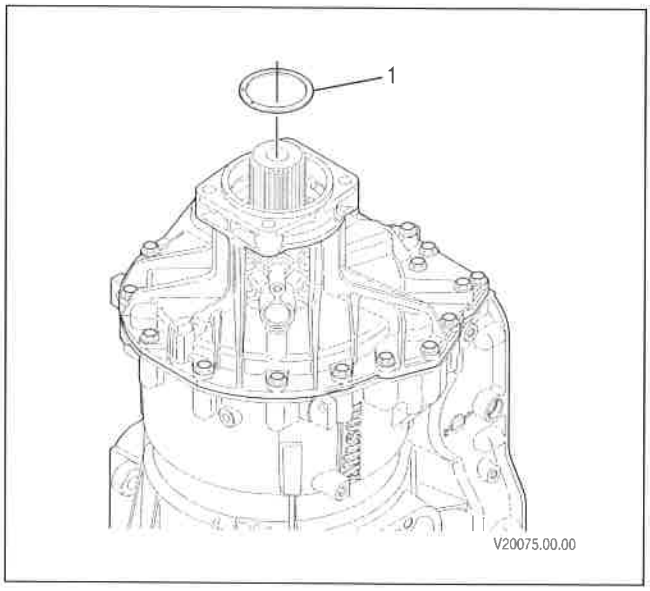
6. Slide the control valve assembly to the side and disengage selector valve pin, at location (2), from detent lever (1).
7. Remove the control valve assembly from the main housing.



8. Remove manual selector valve plug (4).
9. Remove the manual selector valve (2) and selector valve pin (3) as an assembly from the shift valve body (1).
10. Remove the selector valve pin (3) from the manual selector valve (2).



10. Remove selective spacer (1).



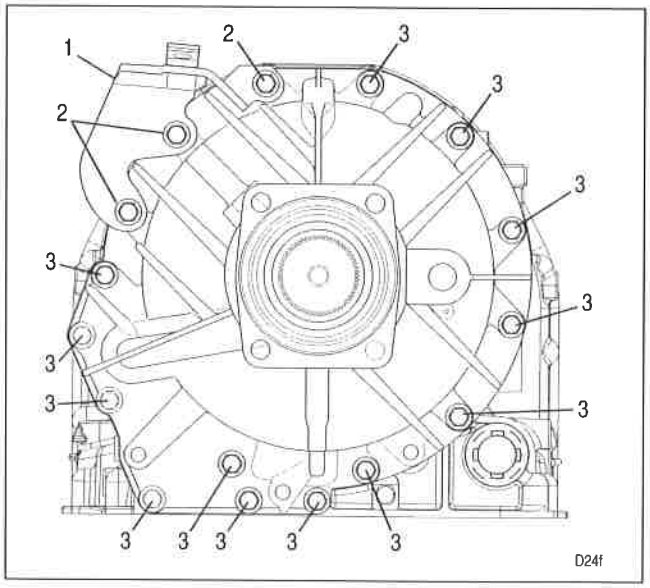
4–13. REAR COMPONENTS REMOVAL

1. If equipped with a park brake cable bracket, remove the following:

CAUTION:

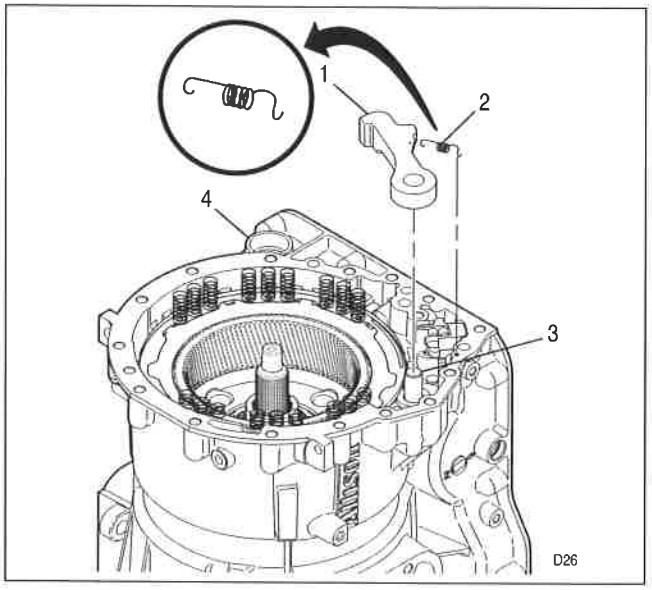
The bolts used to install the torque converter housing and rear cover to the main housing are similar in size and color. The rear cover bolts are shorter than the torque converter housing bolts. Installing torque converter housing bolts into the rear cover may damage the main housing. To avoid torque converter housing bolts from being installed into the rear cover and vice versa, store the bolts separately. These bolts must be installed into their correct locations to avoid main housing damage.

- Three bolts (2)
- Bracket (1) from the rear cover
- Thirteen bolts (3)

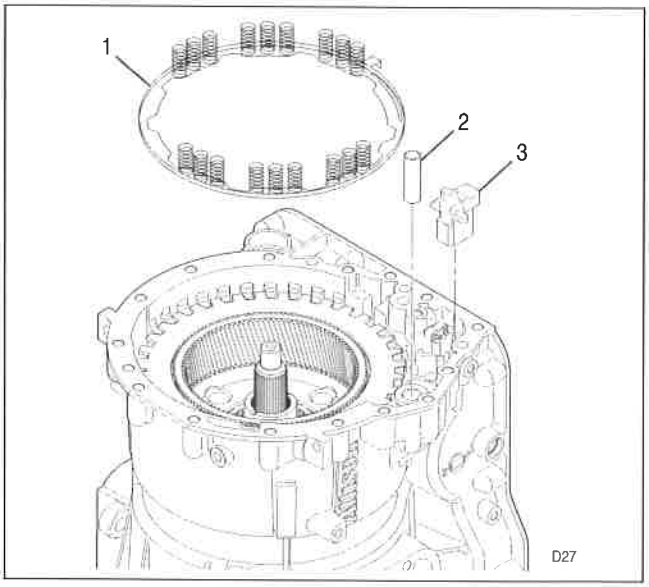


4–14. PARK PAWL REMOVAL

1. For transmissions with park pawls, perform the following.
   - Disengage the pawl return spring (2) from the main housing (4).
   - Remove the park pawl (1) and pawl return spring (2) as an assembly from the pawl support pin (3).
   - Remove the pawl return spring from the park pawl.

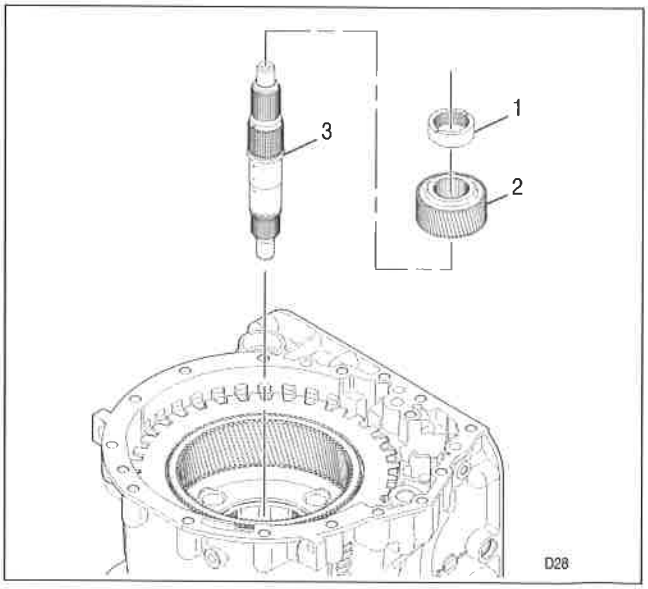


2. Remove pawl support pin (2) from the main housing.
3. If equipped, remove park pawl apply assembly guide (3).
4. Remove C5 piston return spring assembly (1).



4–15. P2 PLANETARY MODULE AND MAIN SHAFT REMOVAL

1. Remove the main shaft (3), P2 sun gear (2), and sun gear spacer (1) as an assembly.
2. Remove the sun gear spacer (1) and the P2 sun gear (2) from the main shaft.



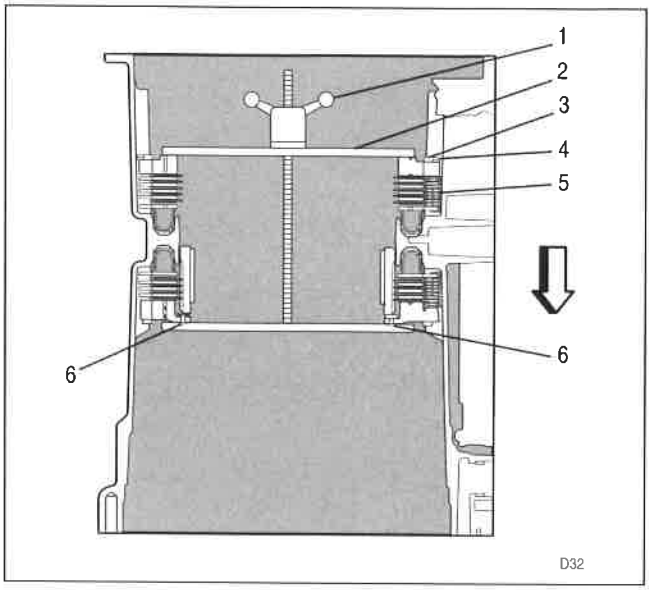
4–18. C4 CLUTCH REMOVAL

Tools Required

- J 24204-2 Bar and Stud Assembly
- J 44530 C3/C4 Piston Spring Compressor

CAUTION:

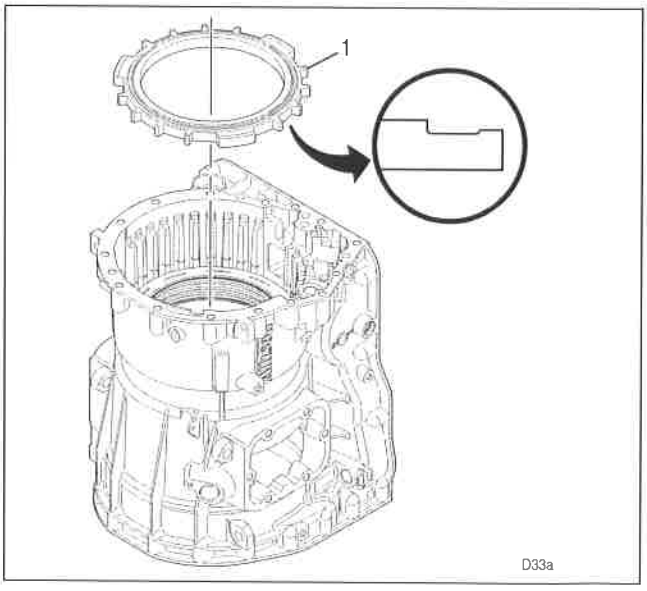
- **Do not install special tools (J tools) onto the gear thrust plate rivets of the C3 clutch backplate assembly. The special tools could damage the gear thrust plate rivets.**
- **Do not damage the P1 planetary carrier bushing when installing J 24204-2 into the main housing. The threaded rod of J 24204-2 must pass through but not touch the bushing.**



1. Install J 24204-2 (1) and J 44530 (2) into the main housing. Make sure the J 24204-2 does not touch gear thrust plate rivets (6) on the C3 clutch backplate assembly.
2. Compress piston return spring assemblies (5) until a gap is visible below the retaining rings (3) and (4).
3. Remove retaining rings (3) and (4).
4. Remove J 24204-2 (1) and J 44530 (2) from the main housing.

NOTE:
The outer C4 retaining ring is thinner and larger in circumference compared to the inner C5 retaining ring.

5. Remove the C4 clutch backplate (1).



4–19. C4 CLUTCH PISTON ASSEMBLY REMOVAL

NOTE:

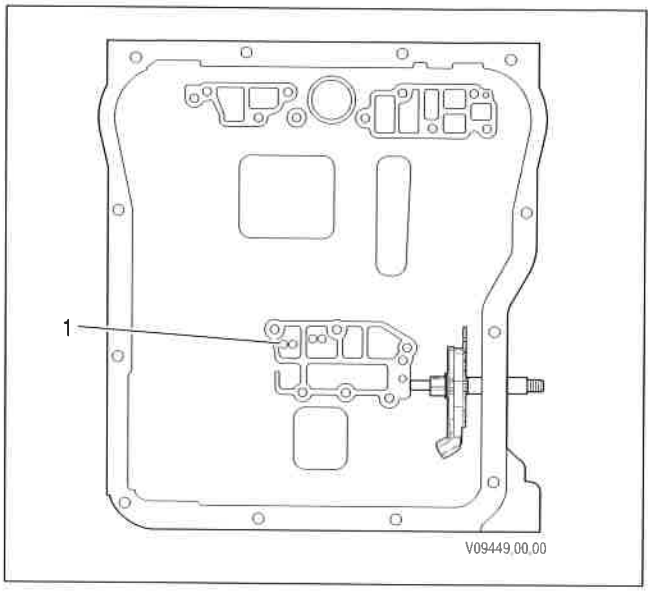
The preferred method of dislodging the C4 clutch piston assembly is with compressed air. If compressed air is not available, remove the C4 clutch piston assembly using pliers. If compressed air is used, note the following.

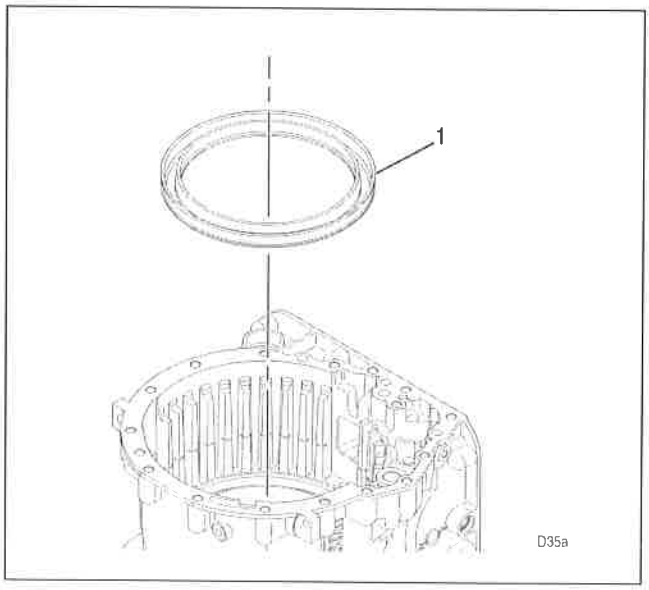
- **Use a 10 mm (0.40 inch) rubber hose on the air connection to reach into the C4 clutch annulus port.**
- **When injecting air into the annulus port, make sure the rubber hose covers both of the C4 clutch annulus port holes.**

1. Position the air connection rubber hose so the hose covers both C4 clutch annulus holes (1).
2. Inject air into the C4 clutch annulus port until the C4 clutch piston assembly (1) is dislodged.
3. Remove the C4 clutch piston assembly (1).

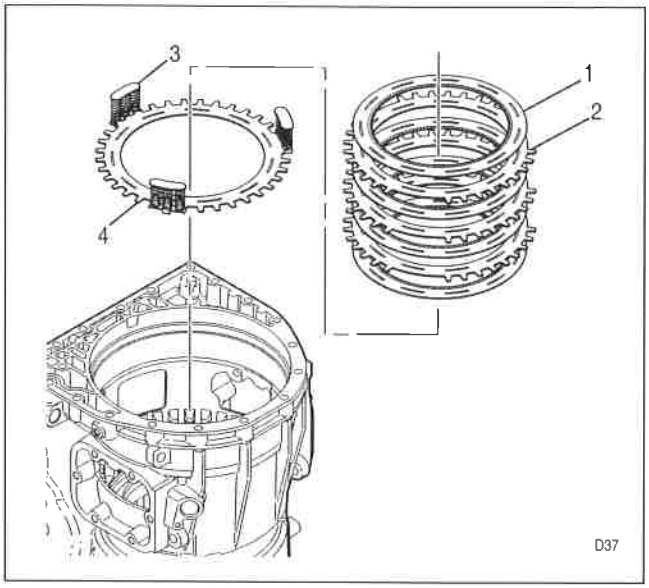
NOTE:

Do not reuse the old C4 clutch piston assembly. Install a new C4 clutch piston assembly.

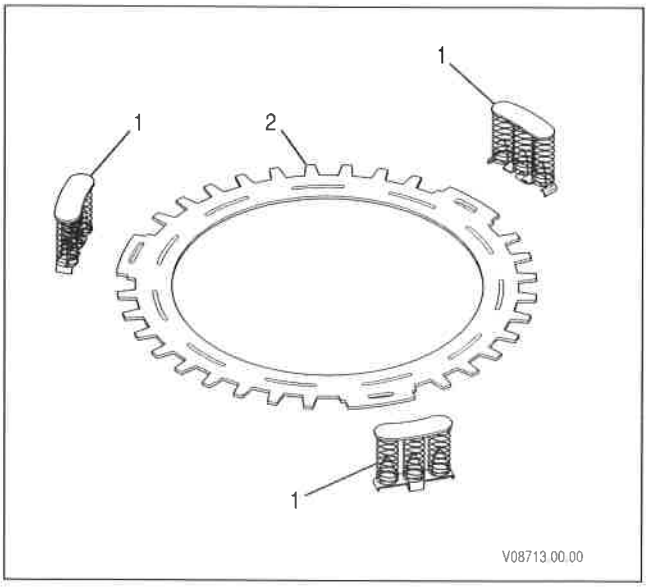




7. Remove the four C3 clutch friction plates (1) and the three C3 clutch reaction plates (2).
8. Remove the C3 spring plate (4) and the three piston return spring assemblies (3) as a unit.



9. Remove the three piston return spring assemblies (1) from the C3 spring plate (2).



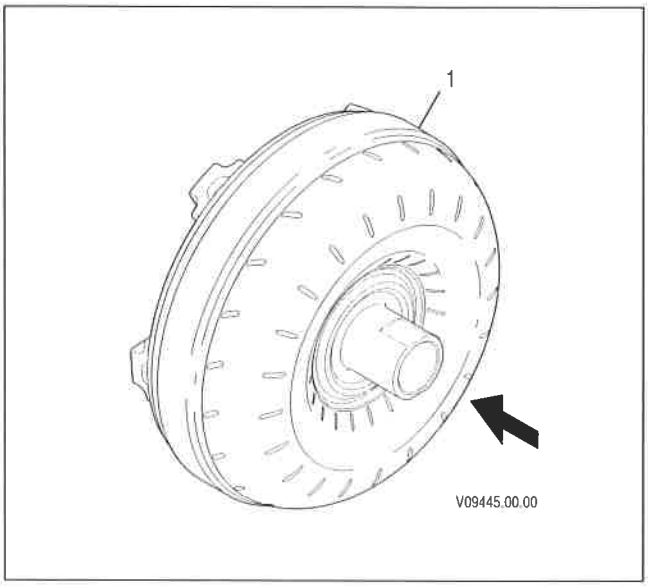
5–1. TORQUE CONVERTER ASSEMBLY

CAUTION:

Allison Transmission recommends using only genuine Allison torque converters with 1000 and 2000 Product Families transmissions. Any transmission damage that may occur as a result of using a converter other than a new Allison converter or a genuine Allison replacement is the responsibility of the owner and will not be covered by Allison warranty.

a. Preliminary Inspection

1. Drain the transmission fluid from the torque converter (1).
2. Inspect the transmission fluid for evidence of foreign matter and/or metal particles.
3. If the torque converter is damaged, replace the torque converter.



b. End Play Check

Tools Required

- J 43764 Torque Converter End Play Gauge
- J 5959-A Dial Indicator Set
  - J 5959-1 Dial Indicator
  - J 5959-3 Rod 1/4 x 10 1/2 inches
  - J 5959-7 Lug Attachment
- J 7872 Dial Indicator Clamp and Adapter
  - J 7872-2 Magnetic Clamp
  - J 7872-3 Swivel Adapter

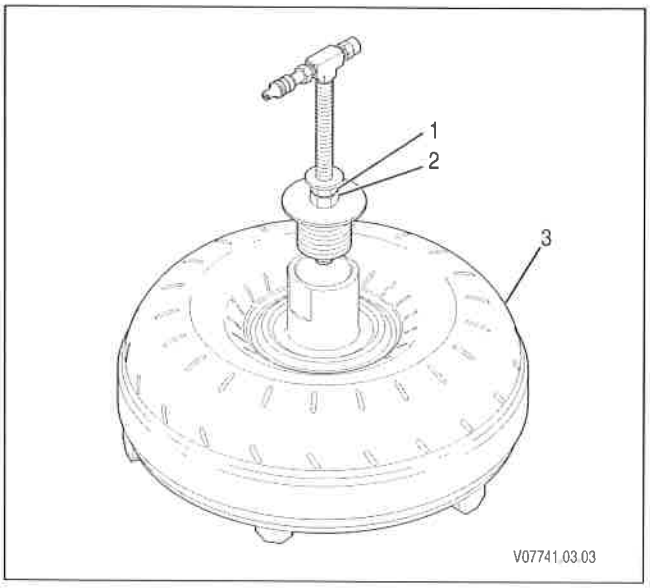
c. Leak Test

Tools Required

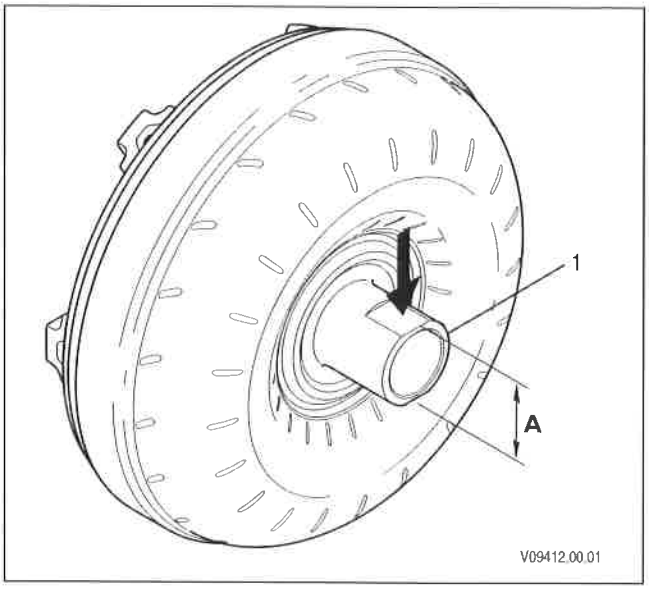
- J 43763 Torque Converter Leak Test Plug

NOTE:
The torque converter leak test requires a large container of water in order to submerge the torque converter.

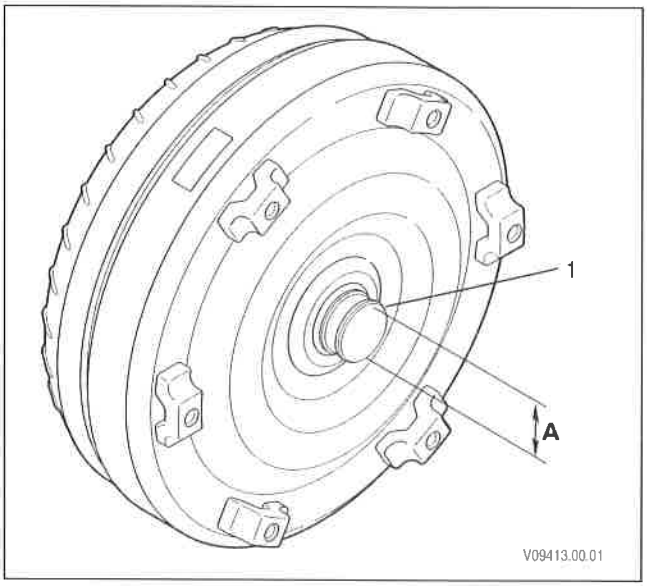
1. Position torque converter (3) on the work table so the pump hub is facing up.
2. Move the nut (1) to approximately 13 mm (0.50 inch) above the nut (2).
3. Install J 43763 into the torque converter hub.



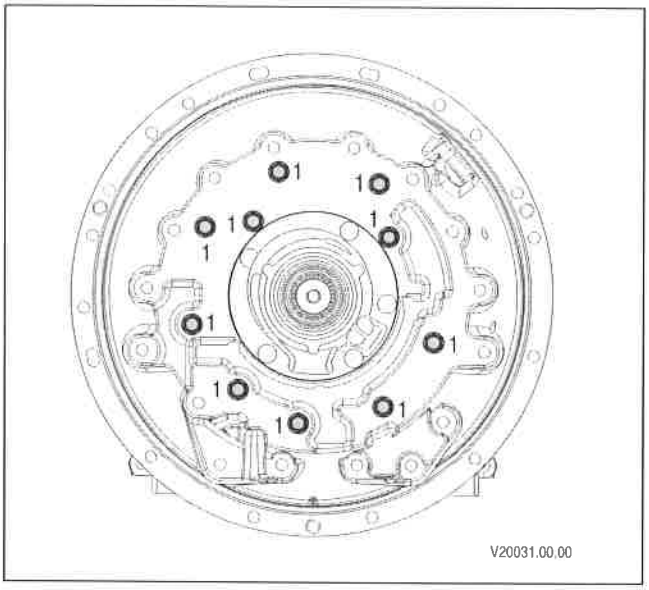
2. Measure the distance between the flats of the torque converter hub (1), Dimension A. Dimension A must be equal to or greater than 51.816 mm (2.040 inch).



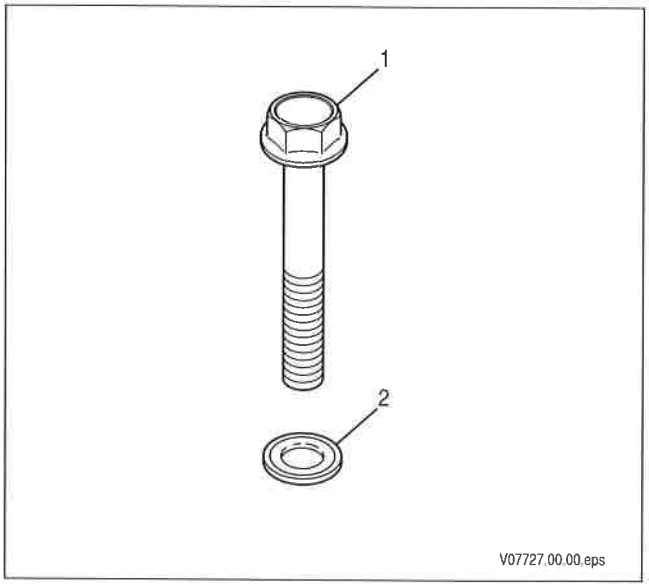
3. Measure the outside diameter of the torque converter cover (1) pilot (Dimension A). Dimension A must be equal to or greater than 43.080 mm (1.696 inch).



3. Remove the ten M10 x 1.5 x 50 flange head bolts (1) securing the front support module to the torque converter housing.



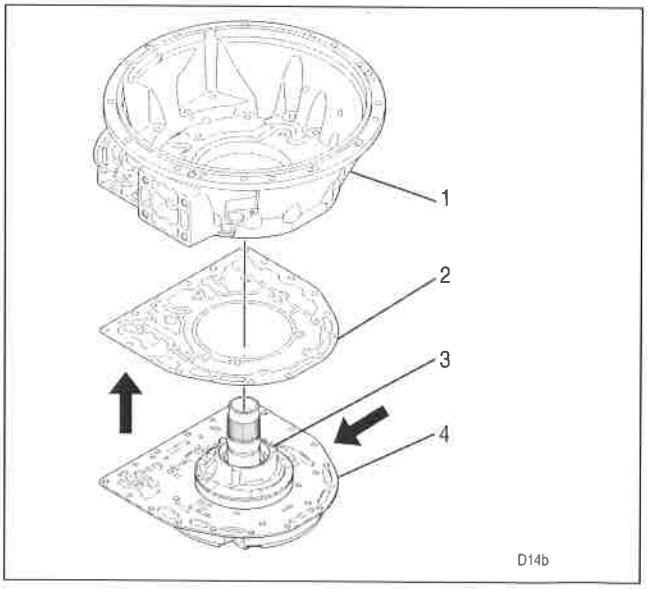
4. Remove and discard the seals (2) from the bolts (1).



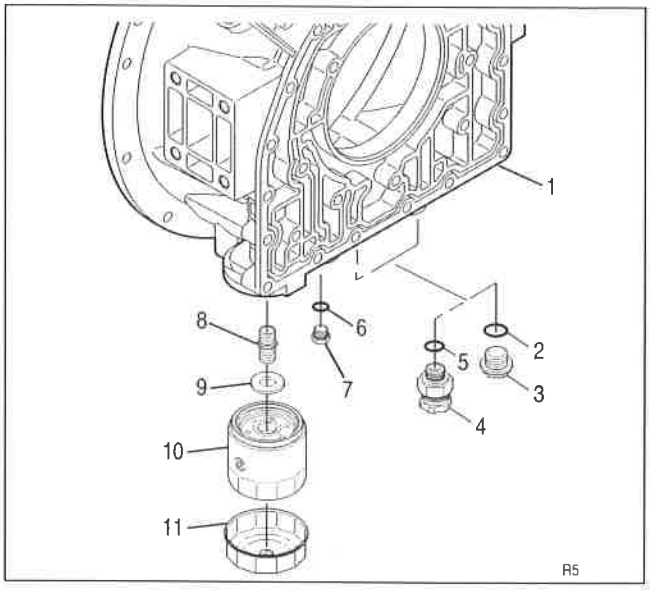
CAUTION:

Do not damage the separator plate when separating the torque converter housing from the front support module.

5. Remove torque converter housing (1) from the front support module (3).
6. Remove torque converter housing/separator plate gasket (2) from the separator plate (4) and discard.



5–4. TORQUE CONVERTER HOUSING (WITHOUT COOLER MANIFOLD)



a. Disassembly

Tools Required

- J 45023 Control Main Filter Wrench

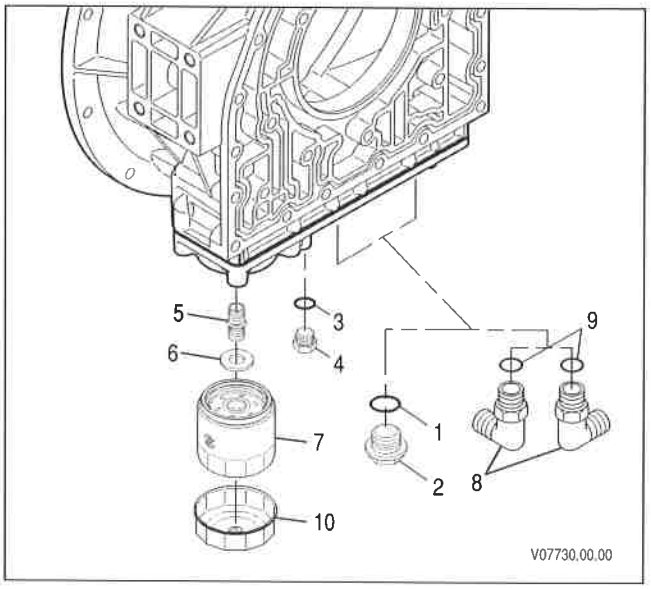
1. Remove pressure tap plug (7) from torque converter housing (1).
2. Remove O-ring (6) from pressure tap plug (7).
3. Using J 45023 (11) or a filter strap wrench, turn the control main filter (10) counterclockwise and remove.
4. Remove magnet (9) from the filter attachment tube (8) or from filter (10).
5. Remove filter attachment tube (8).
6. If equipped, remove the two hydraulic connector assemblies (4). Remove O-rings (5) from the connector assemblies.
7. If equipped, remove two shipping plugs (3). Remove O-rings (2) from the shipping plugs.

5–5. TORQUE CONVERTER HOUSING (WITH COOLER MANIFOLD)

a. Disassembly

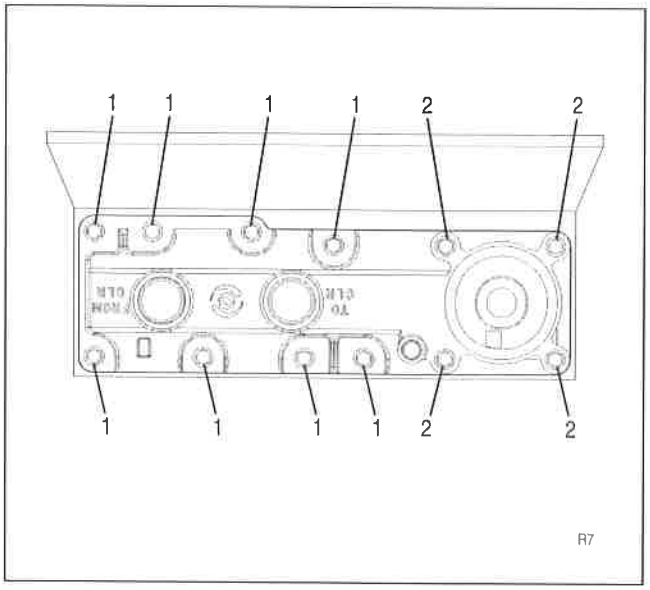
Tools Required

- J 45023 Control Main Filter Wrench



1. Remove the pressure tap plug (4). Remove the O-ring (3) from the pressure tap plug.
2. Using J 45023 (10) or a filter strap wrench, turn the control main filter (7) counterclockwise and remove.
3. Remove the magnet (6) from the filter attachment tube (5) or from filter (7).
4. Remove filter attachment tube (5).
5. If equipped, remove two shipping plugs (2). Remove O-rings (1) from the shipping plugs.
6. If equipped, remove the two 90 degree elbow adapters (8) as follows.
   - Mark the orientation of the elbow adapters on the cooler manifold.
   - Loosen the lock nuts on the elbow adapters.
   - Remove the elbow adapters from the cooler manifold.
   - Remove O-rings (9) from elbow adapters (8).

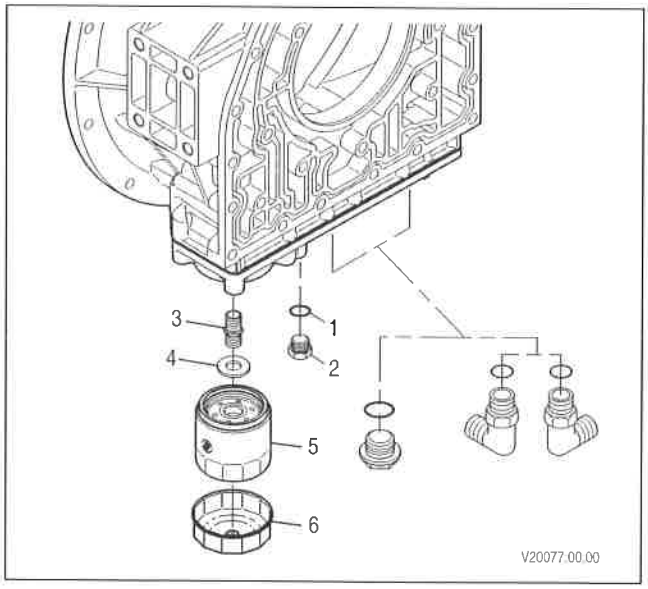
2. Install four manifold bolts (2).
3. Install eight manifold bolts (1). Tighten bolts (1) and (2) to 24–29 N·m (18–21 lb ft).



CAUTION:

Install the short-threaded end of the filter attachment tube into the converter housing. If the long-threaded end of the filter attachment tube is installed, the threads of the converter housing will be damaged.

4. Install filter attachment tube (3) by hand. Tighten the tube to 24–29 N·m (18–21 lb ft).
5. Install magnet (4) onto the filter attachment tube.
6. Lubricate the gasket on the control main filter (5) with transmission fluid.
7. Install the control main filter by hand, turning it clockwise, until the gasket on the control main filter touches the converter housing.



CAUTION:

Turning the control main filter more than one full turn after gasket contact damages the filter.

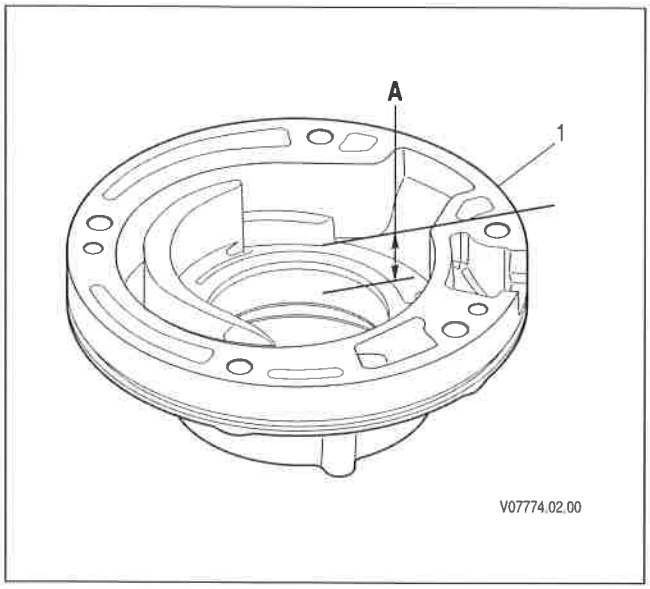
8. Using J 45023 (6) or by hand, turn the filter clockwise one full turn only.
9. Install O-ring (1) onto pressure tap plug (2).
10. Install pressure tap plug (2) and tighten to 10–13 N·m (7–10 lb ft).

b. Main Pump Inspection

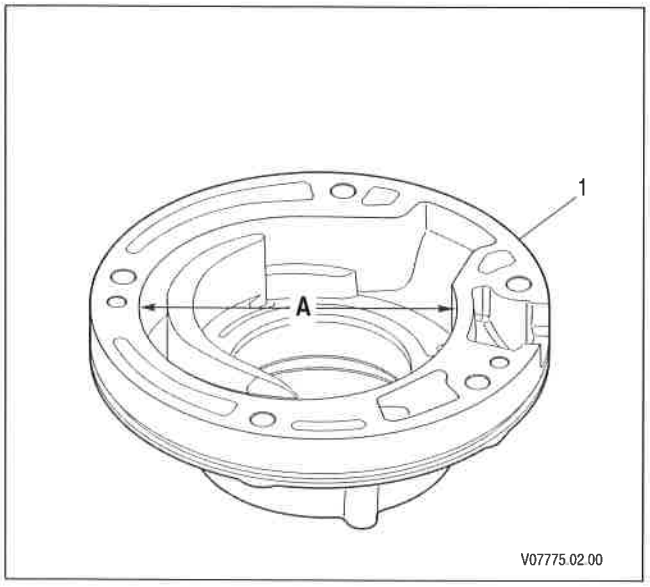
NOTE:

- **Make the measurements described below at several locations.**
- **Replace the main pump body, driven gear, and drive gear if any of the following specifications are not met.**

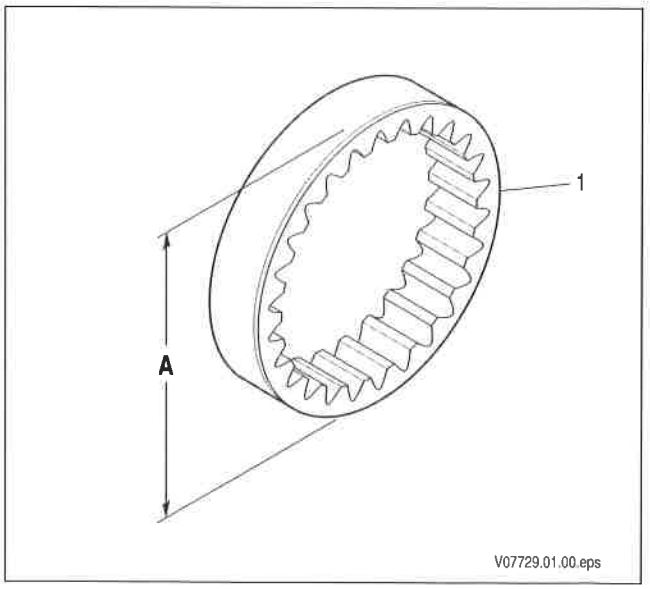
1. Measure the depth of the main pump (1) body gear cavity (Dimension A). The maximum depth of the gear cavity is 22.495 mm (0.8856 inch).



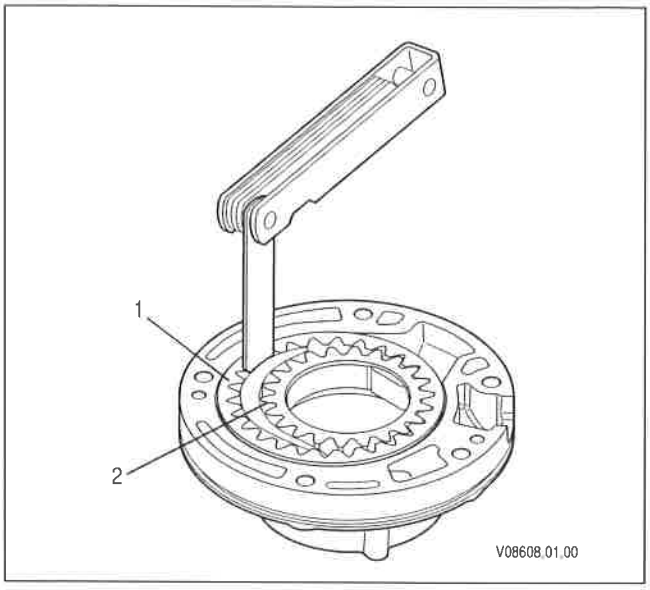
2. Measure the inside diameter of the main pump (1) body gear cavity (Dimension A). The maximum inside diameter of the gear cavity is 110.191 mm (4.3382 inch).



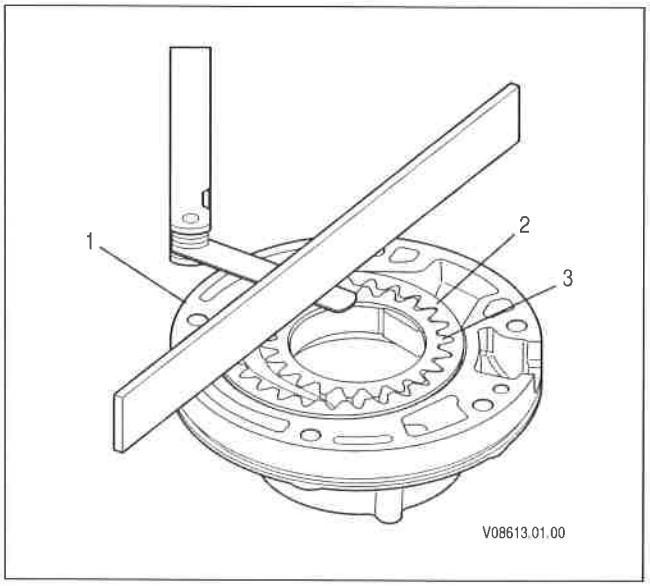
3. Measure the outside diameter of the driven gear (1) (Dimension A). The minimum outside diameter of the driven gear is 109.987 mm (4.3302 inch).



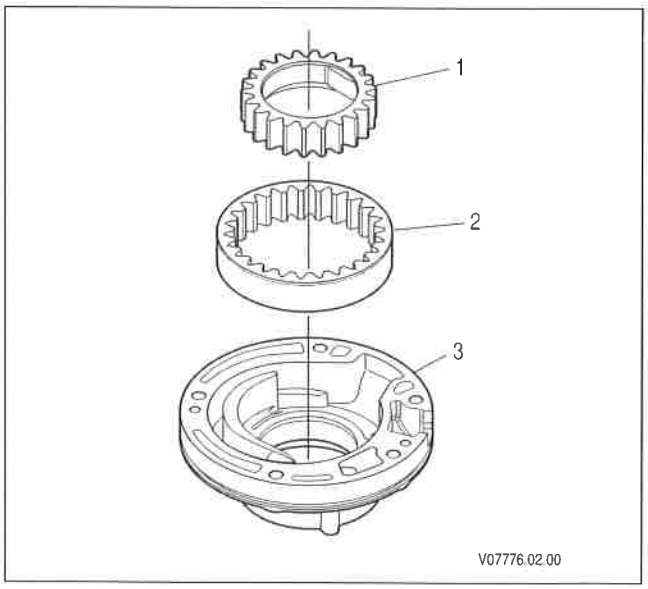
8. Measure the clearance between the driven gear (1) and the main pump body crescent (2). This is referred to as the driven gear/crescent tooth clearance. The maximum clearance is 0.455 mm (0.0179 inch).



9. Hold a straightedge across the main pump body (1) and drive gear (3). Measure the clearance between the drive gear and the straightedge (drive gear side clearance). The maximum clearance is 0.066 mm (0.0026 inch).
10. Hold a straightedge across the main pump body (1) and driven gear (2). Measure the clearance between the driven gear and the straightedge (driven gear side clearance). The maximum clearance is 0.066 mm (0.0026 inch).



11. Remove the drive gear (1) and the driven gear (2) from the main pump body (3).

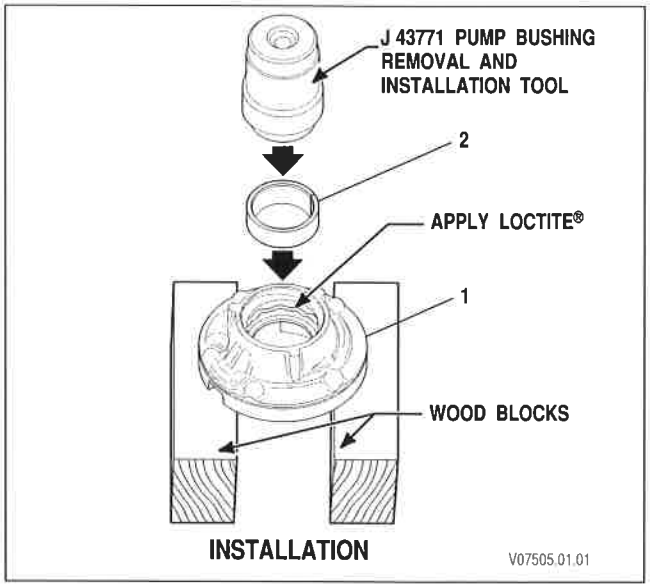


NOTE:
The bushing may be oriented in any position, but the preferred orientation is with the bushing split joint aligned with the casting numbers and the centerline of the boss opposite the numbers. Position the split joint away from the boss.

9. Support the main pump body (1), machined surface down, on two wooden blocks.
10. Install the bushing (2) onto the shorter end of J 43771.
11. Apply Loctite® 620 to the bushing bore.
12. Using J 43771, press or drive the bushing into the pump body until J 43771 seats.

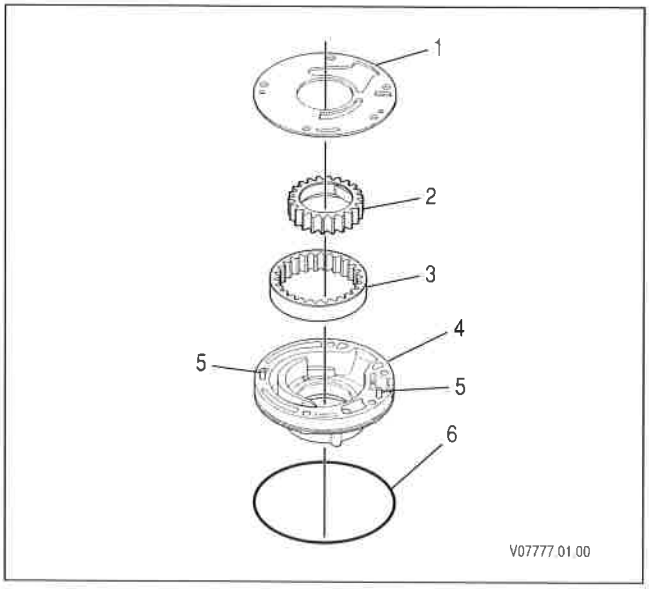
NOTE:
Transmissions beginning with S/N 6310670488 and use redesigned input seal P/N 29545376. Use only the redesigned input seal. The redesigned input seal is compatible with all Allison approved fluids including DEXRON®-VI. Refer to SIL 19-1K2K-06.

13. Install the input seal.



f. Main Pump Assembly

1. Lubricate and install new O-ring (6) onto main pump body (4).
2. Position main pump body (4) on the work table so the pump body hub is facing down.
3. Lubricate drive gear (2) and driven gear (3).



CAUTION:

When the drive gear and driven gear are installed into the main pump, install the gears in their original orientation by having their punch marks in the same position as when they were originally removed. Failure to install the drive and driven gears in their original orientation may damage the transmission.

4. Align the drive gear and driven gear with the main pump so their punch marks are in the same position as when they were removed.
5. Install the gears into the main pump body (4).
6. Align the dowel pin holes in the wear plate (1) with the dowel pins (5) in the main pump body. Make sure the bolt holes in wear plate (1) align with the bolt holes on main pump body (4).
7. Install the wear plate (1) onto the dowel pins (5) and the main pump body (4).

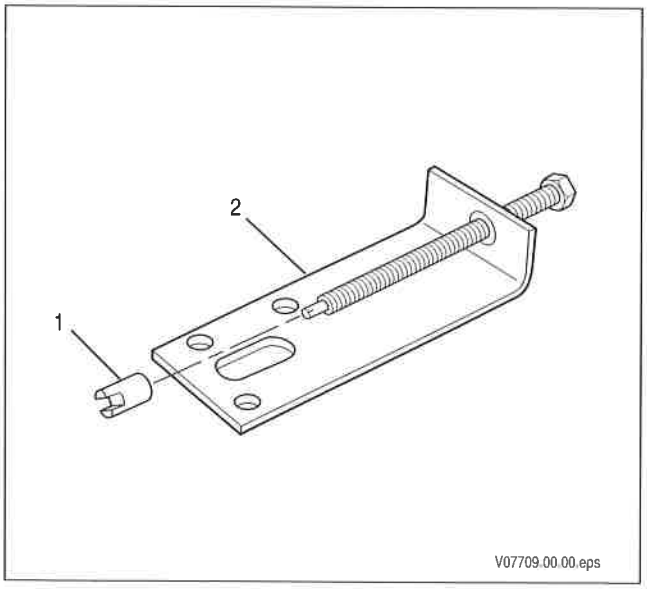
5–7. *FRONT SUPPORT ASSEMBLY*

a. Front Support Disassembly

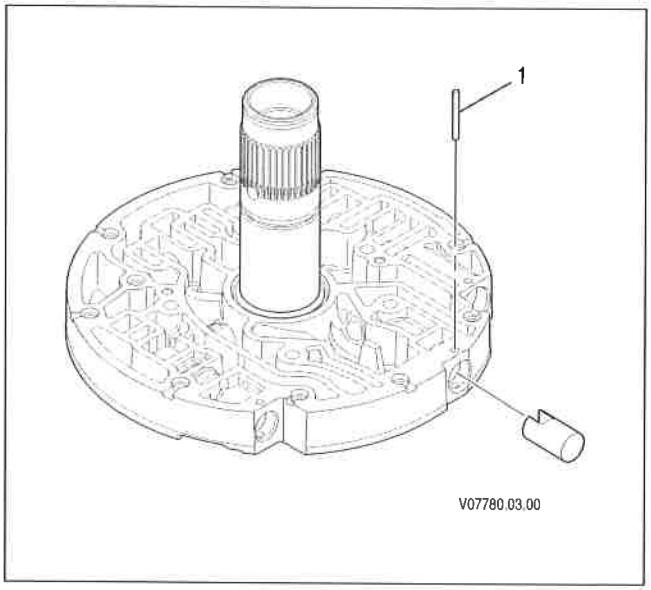
Tools Required

- J 24459-5 Spring Compressor Adapter
- J 43770 Main, Lube, Converter Relief Valve Spring Compressor
- J 43773 Valve Spring Compressor

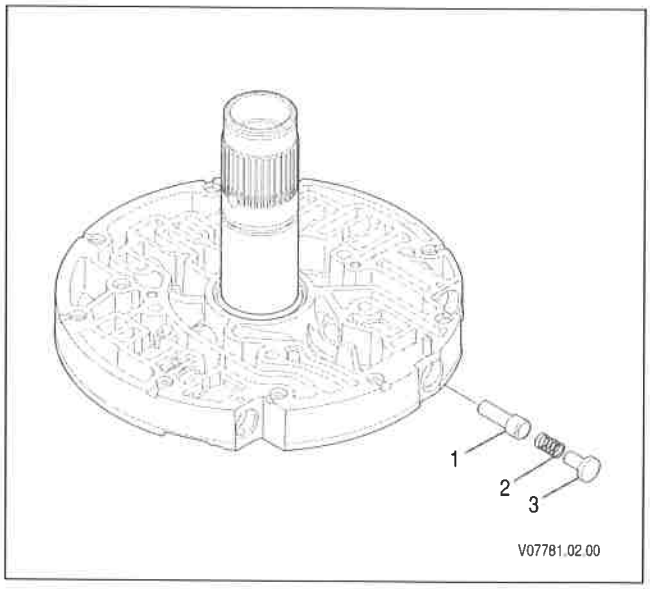
1. Install J 24459-5 (1) onto J 43770 (2).



12. Using J 24459-5, compress the C1 clutch backfill valve spring until the retainer pin (1) is loose. Remove the retainer pin.

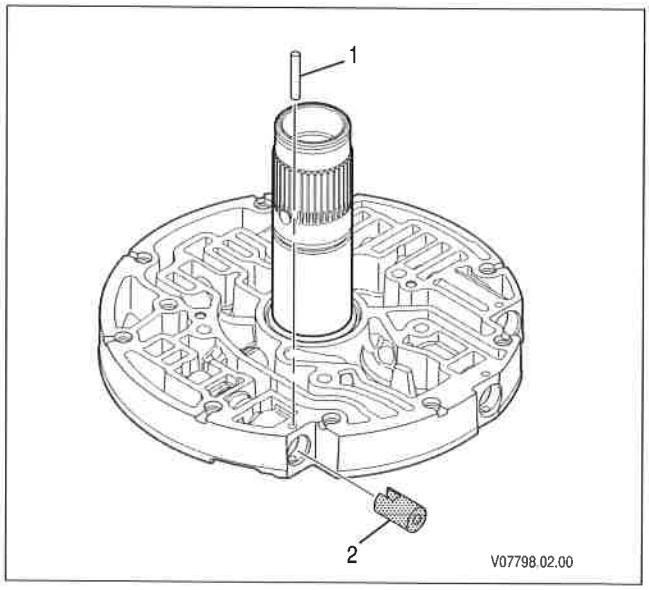


13. Remove the stop (3), spring (2), and C1 clutch backfill valve (1).

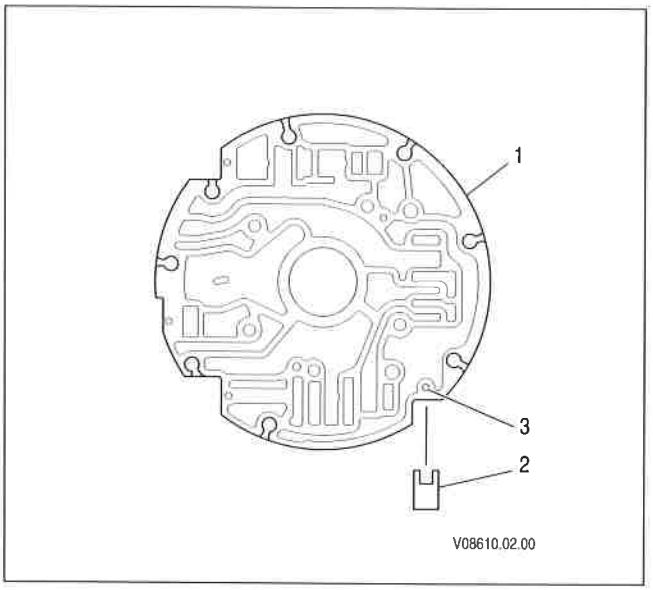


14. Align the slot of J 24459-5 (2) with retainer pin (1).

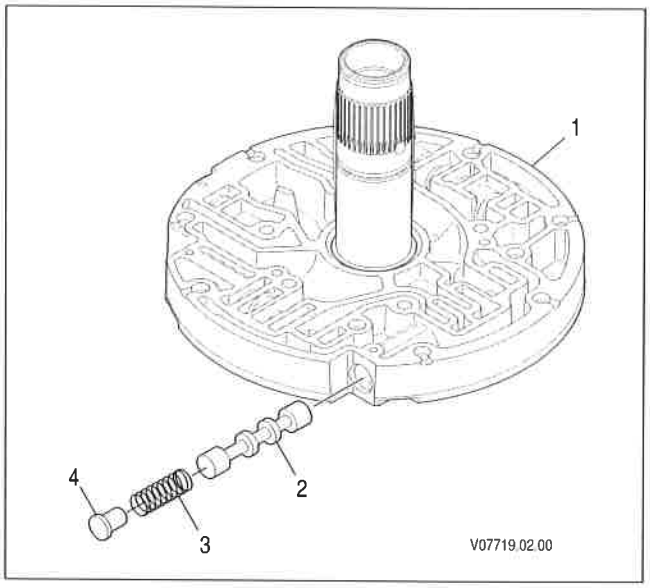
15. Using J 24459-5 (2), compress the lube regulator valve spring until the retainer pin (1) is loose. Remove the retainer pin.



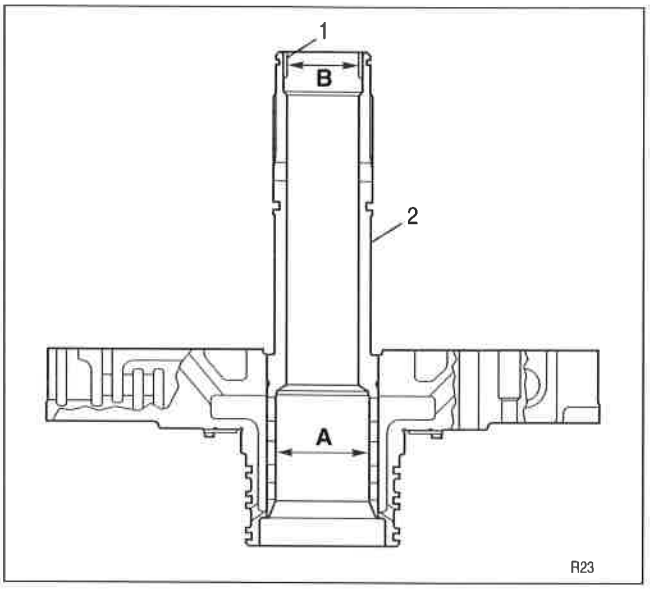
19. Align the slot in J 24459-5 (2) with the retainer pin (3).
20. Using J 24459-5, compress the converter flow valve spring until the retainer pin (3) is loose.
21. Turn the front support so the retainer pin (3) is accessible. Using a pick, push the pin through the front support (1).
22. Turn the front support (1) so the rear is facing down.
23. Relieve converter flow valve spring pressure and remove the J tools.



24. Remove the stop (4), spring (3), and converter flow valve (2) from the front support (1).



2. Measure the inside diameter of ground sleeve (2) at the turbine shaft sealring bore (Dimension A). Maximum inside diameter is 45.450 mm (1.7894 inch).
3. Measure the inside diameter of ground sleeve bushing (1) (Dimension B). Maximum inside diameter is 33.820 mm (1.3315 inch).

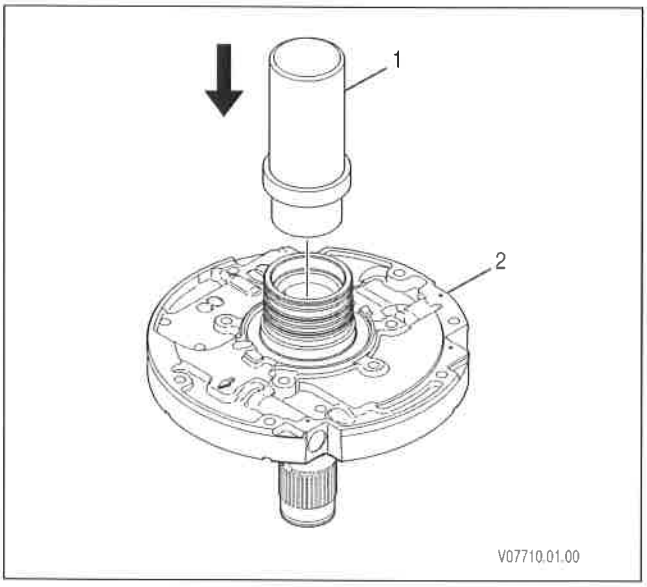


c. Ground Sleeve Replacement

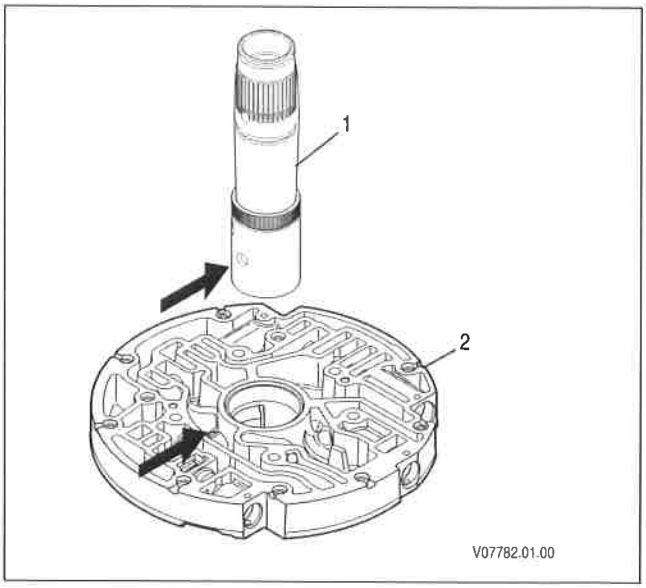
Tools Required

- J 43765 Ground Sleeve Installer/Remover

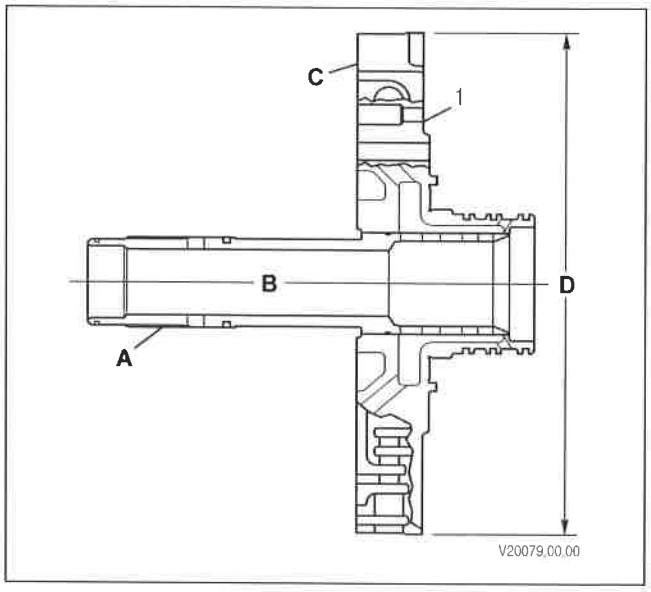
1. Remove the bearing per Paragraph 5–8**d**.
2. Position the front support (2) on a press bed so that it is supported by wooden blocks and the ground sleeve is facing down.
3. Install the short end of J 43765-2 (1) into the rear of the front support.
4. Press the ground sleeve from the front support (2).



5. Position the front support (2) on the work table so the rear hub is facing down.
6. Align the ground sleeve with the front support so the sleeve is centered over the front support (2) and the rear of the sleeve is facing down.
7. Rotate ground sleeve (1) until the lowest (and smallest) hole in the ground sleeve is aligned with fluid passage.



15. Check the Total Indicated Reading (TIR) of the ground sleeve as follows.
    - Install the outside diameter (D) of the front support (1) in a lathe.
    - Using a dial indicator, make sure the front support (1) surface (C) is square with the outside diameter (D) of the front support.
    - Check the TIR along ground sleeve axis (B) at the ground sleeve pitch diameter (A). The TIR must not exceed 0.20 mm (0.008 inch).
16. If the bearing does not need replacing, install the bearing per Paragraph 5–8**d**.



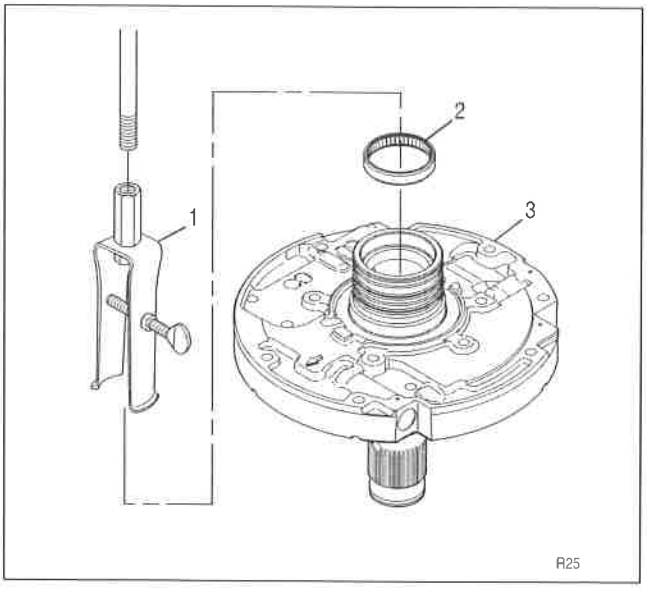
d. Ground Sleeve Needle Bearing Replacement

Tools Required

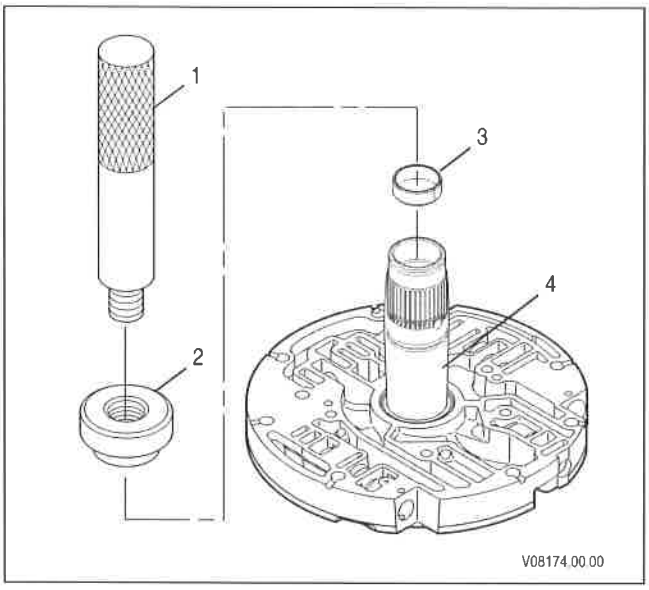
- J 8092 Universal Driver
- J 26941 Front Support Needle Bearing Remover
- J 43775 Front Support Needle Bearing Installer

NOTE:
If the needle bearing has been removed, go to Step 6.

1. Position the front support (3) so that it is supported by wooden blocks and the ground sleeve is facing down.
2. Install J 26941 (1) into the needle bearing (2) so the lips of the tool engage the bottom lip of the needle bearing race.
3. Tighten the screw of J 26941 finger tight.
4. Install a slide hammer onto the end of J 26941.
5. Remove the needle bearing (2).



9. Remove the J tools from the ground sleeve.
10. Remove the ground sleeve bushing from the J tools.



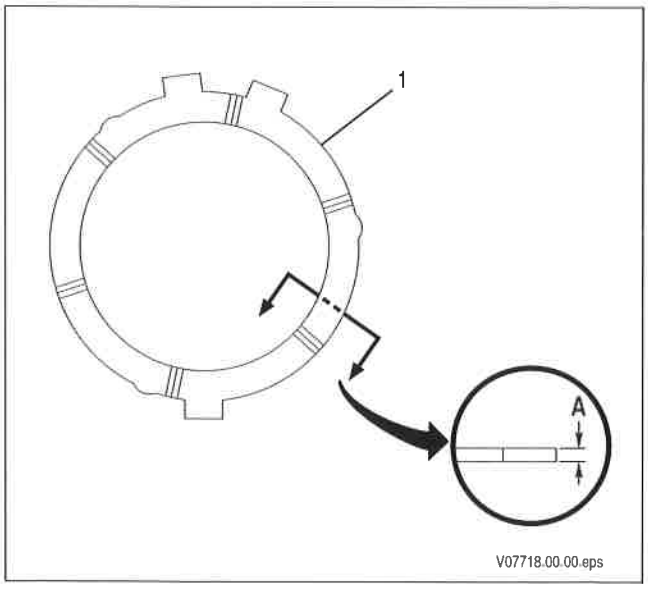
NOTE:
The preferred method for installing the ground sleeve bushing is to use J 43774 and a press. If a press is not available, use J 43774 and J 8092.

11. If the bushing is to be installed by hand, install the large end of J 43774 (2) onto J 8092 (1).
12. Install new ground sleeve bushing (3) onto J 43774.
13. Drive the ground sleeve bushing into ground sleeve (4) until the bushing is seated.
14. Make sure the ground sleeve bushing is installed flush to 0.25 mm (0.010 inch) below the ground sleeve surface.

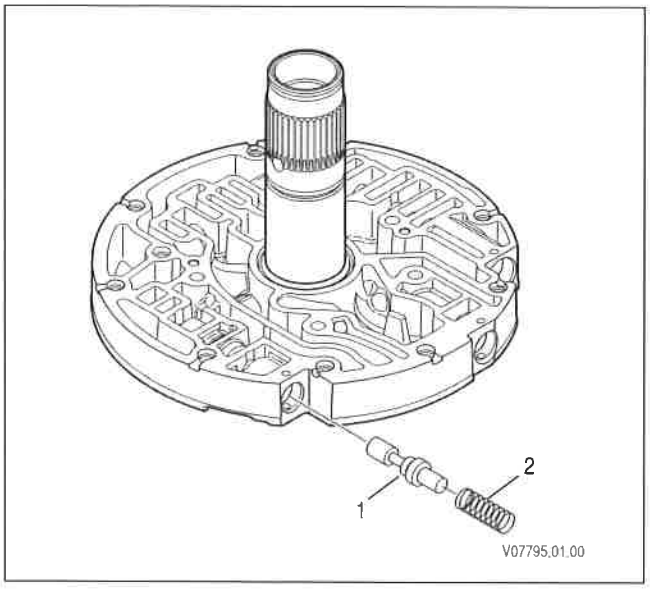
f. Front Support Thrust Washer Inspection

NOTE:
Replace the thrust washer if any of the following specifications are not met.

1. Measure the thickness of the thrust washer (1) (Dimension A).
2. Minimum thrust washer thickness is 1.49 mm (0.059 inches).

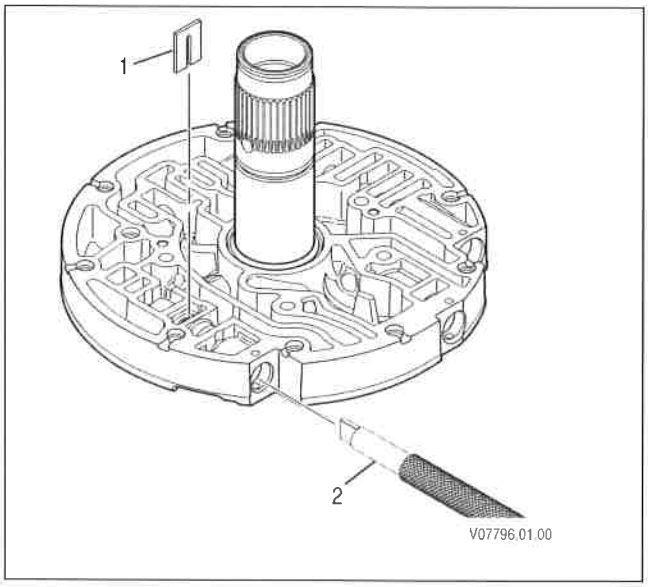


8. Install converter relief valve (1) and converter relief valve spring (2).

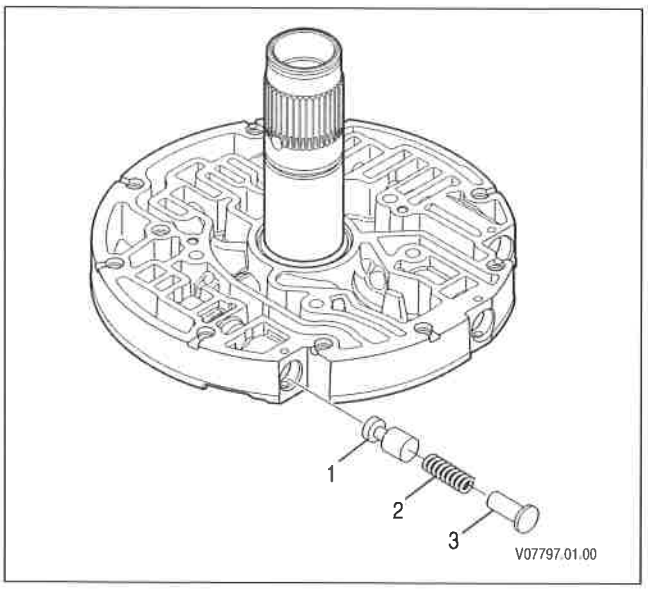


9. Using J 43773 (2), compress the spring.

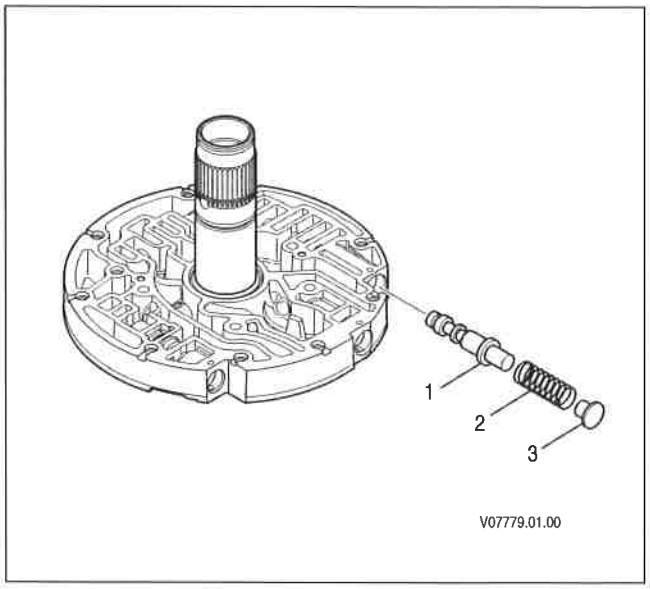
10. Install the retaining clip (1). Make sure the retaining clip is below the front support surface.



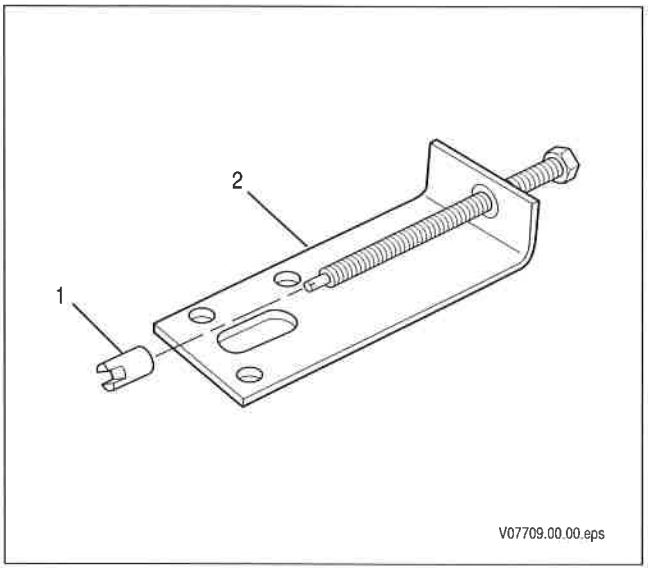
11. Install lube regulator valve (1), spring (2) and stop (3).



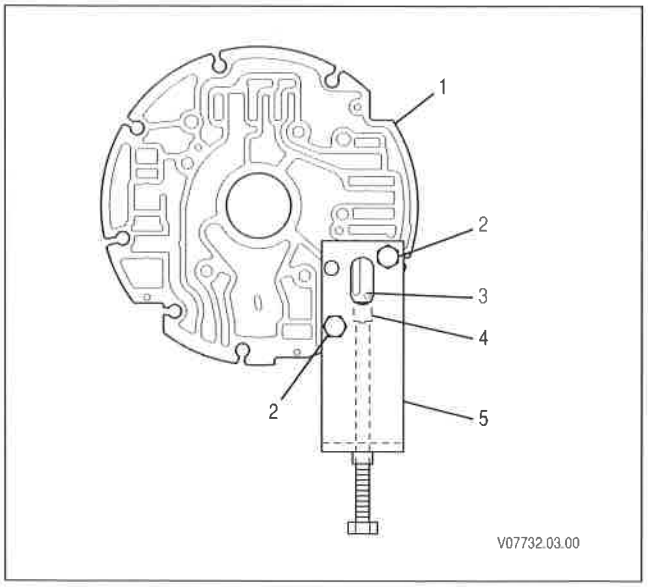
19. Install the main regulator valve spring (2) and stop (3).



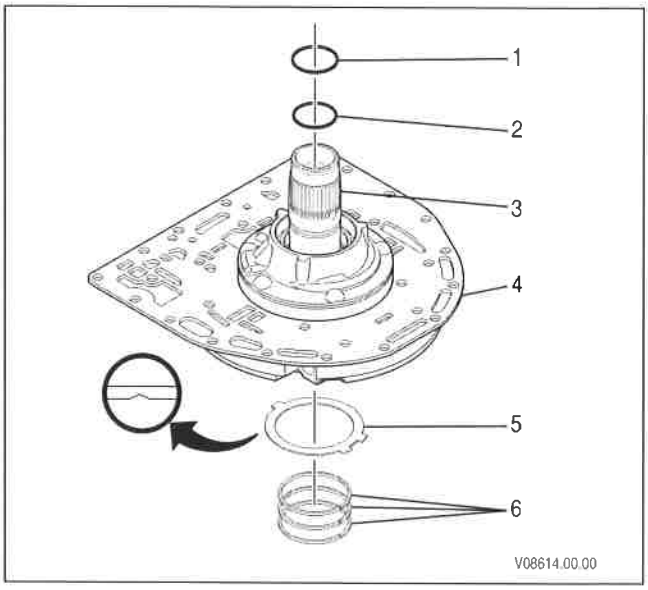
20. Install J 24459-5 (1) onto J 43770 (2).



21. Align J 43770 (5) and J 24459-5 (4) with the main regulator valve (1) bore so:
    - The J 43770 threaded rod faces down.
    - The two J 43770 bolt holes align with the two bolt holes in the front support.
22. Install J 43770 (5) onto the front support assembly.
23. Install the two front support flange head bolts (2).
24. Align J 24459-5 (4) slot with retainer pin (3).
25. Using J 24459-5 (4) and J 43770 (5), compress the spring until the stop is past the retainer pin hole.



8. Align the tangs of thrust washer (5) with the slots at the base of the front support assembly rear hub (4).
9. Install the thrust washer (5) onto the front support assembly. The thrust washer should snap into place.
10. Install three new double lap joint sealrings (6) onto the front support assembly rear hub.



CAUTION:

Interchanging the ground sleeve butt joint sealrings on the ground sleeve may result in transmission damage. Install the correct sealring at the correct ground sleeve location.

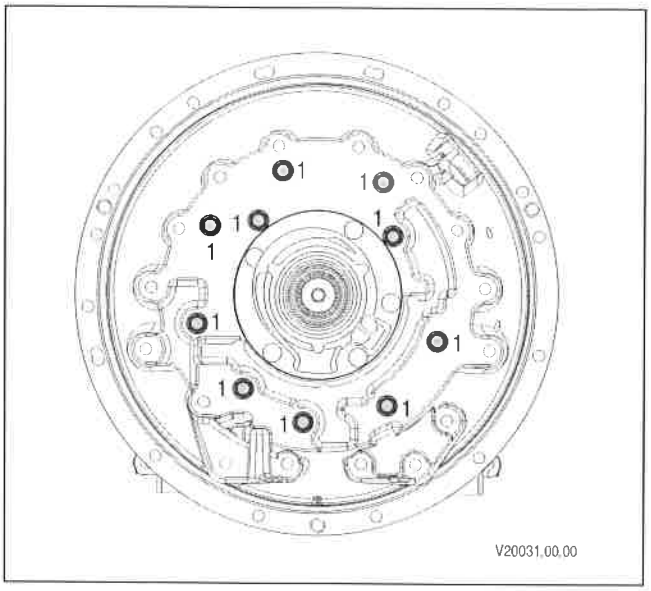
- **P/N 29538158 (1) is installed on the front end of the ground sleeve.**
- **P/N 29531038 (2) is installed on the middle of the ground sleeve.**

NOTE:

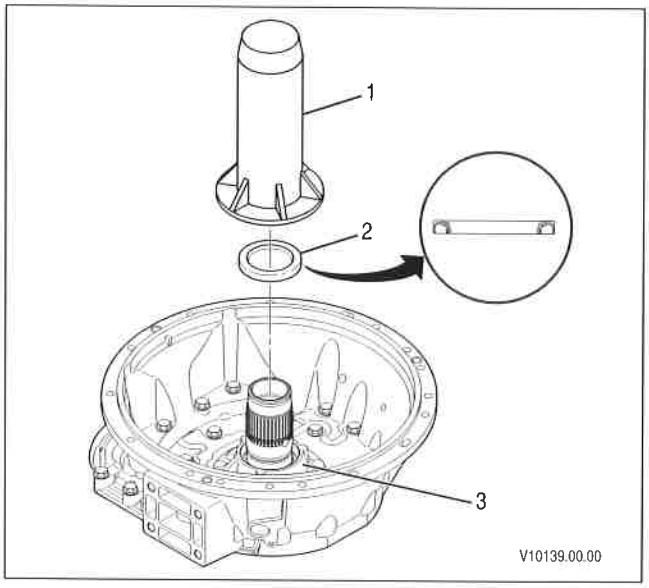
Transmissions with serial numbers 6310656923 to 6310664409 may contain double lap joint sealrings (1) and (2) or a combination of double lap joint and butt joint sealrings. Refer to SIL 18-1K2K-06.

11. Install a new butt joint sealring (2) onto the middle of ground sleeve (3).
12. Install a new butt joint sealring (1) onto the front of ground sleeve (3).

23. Install the ten bolts (1) into the torque converter housing to secure the front support module. In a criss-cross pattern, tighten the bolts to 51–61 N·m (38–45 lb ft).



24. Align a new oil seal assembly (2) with the main pump body (3) so the double edges face the pump body hub.
25. Using J 43772 (1), install the oil seal assembly into the pump body hub.
26. Make sure the seal is installed flush to 0.25 mm (0.010 inch) below the main pump body surface.



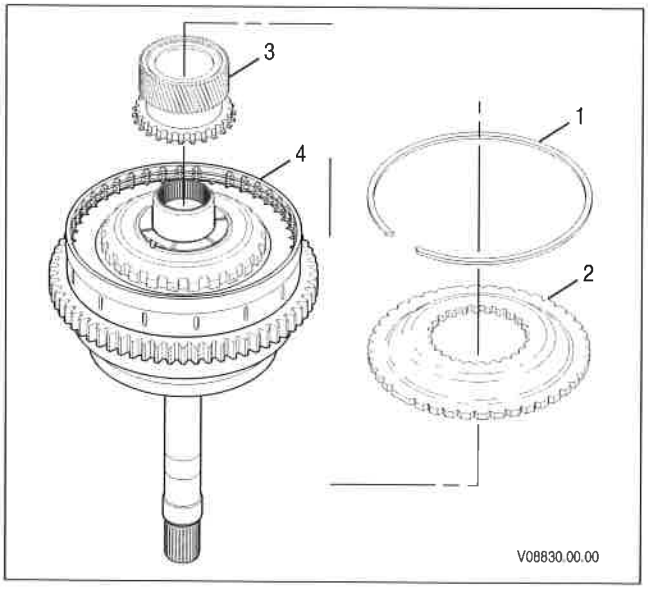
5–9. ROTATING CLUTCH MODULE

a. Disassembly of Rotating Clutch Module

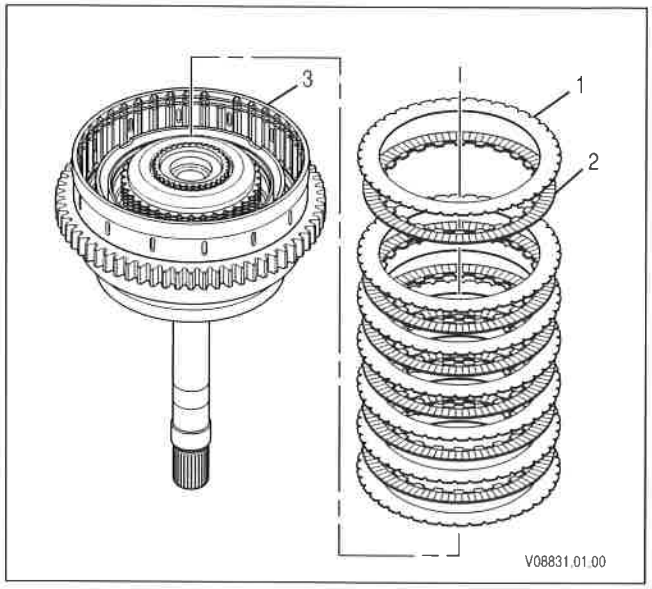
Tools Required

- J 24204-2 Bar and Stud Assembly
- J 43772 Oil Pump Seal Installer
- J 47339 C1/C2 Piston Return Spring Compressor

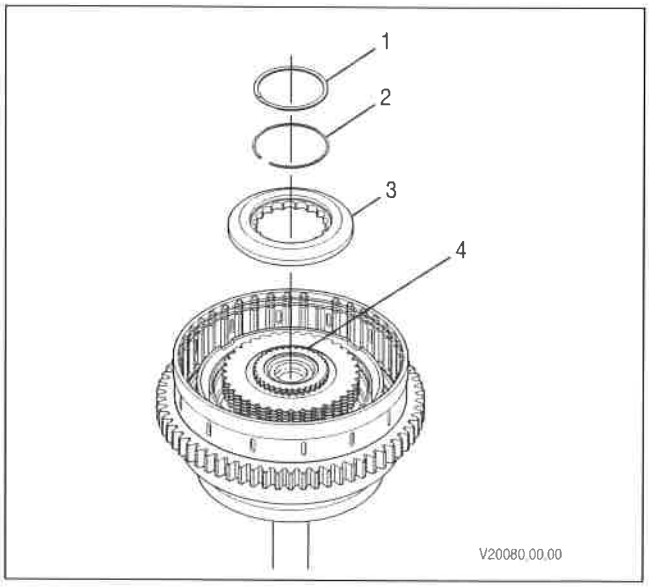
1. Position the rotating clutch assembly (4) on the work table so the rear of the assembly is facing up.
2. Remove the retaining ring (1) from the rotating clutch assembly.



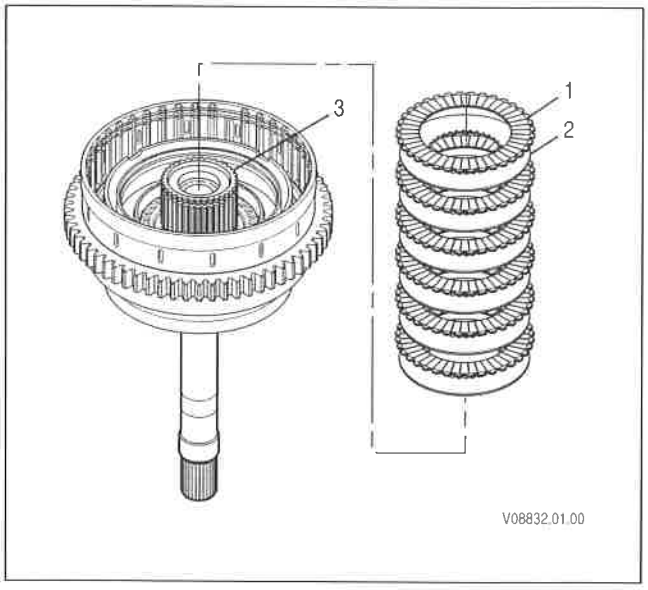
9. Remove the seven C2 clutch reaction plates (1) and the six C2 clutch friction plates (2) from the rotating clutch housing (3).



10. Remove the internal spiral retaining ring (1) from the C1 clutch backplate (3).
11. Remove the retaining ring (2) from the turbine shaft (4).
12. Remove the C1 clutch backplate (3) from the turbine shaft (4).



13. Remove the six C1 clutch friction plates (1) and the six C1 reaction clutch plates (2) from the turbine shaft (3).



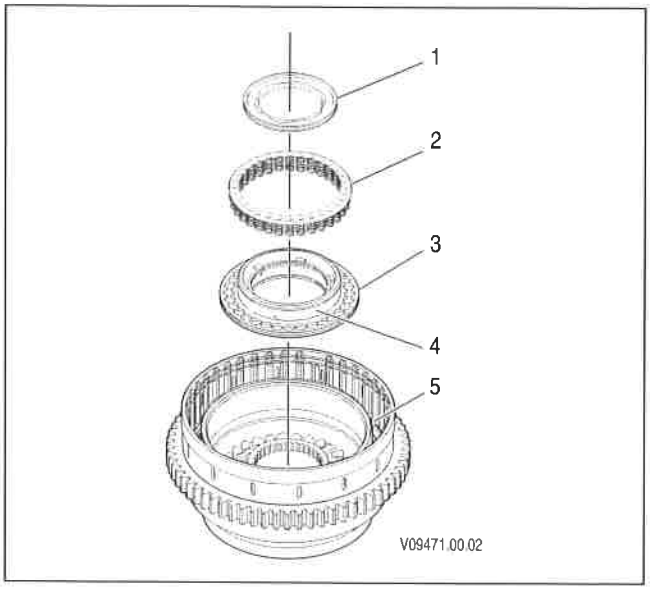
25. Remove C1 balance piston (1) from C1 clutch housing.

26. Remove C1 piston return spring assembly (2) from C1 clutch housing (5).

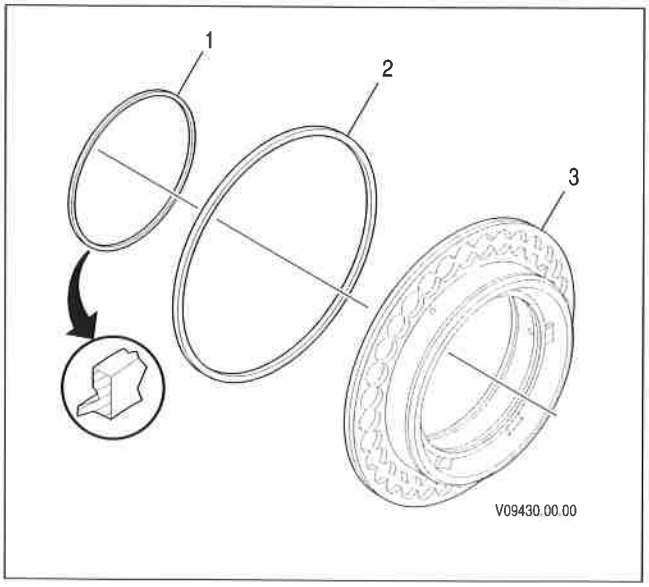
CAUTION:

Do not damage the C1 clutch piston sealing surface (4) when removing the piston.

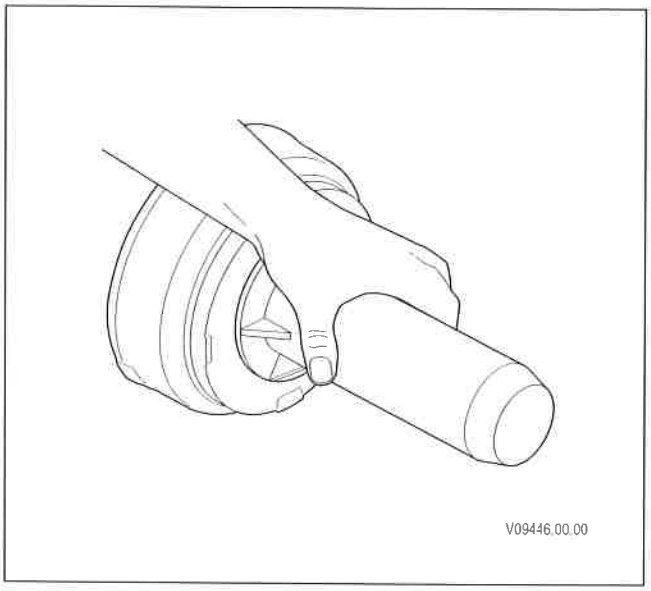
27. Remove C1 clutch piston (3) from C1 clutch housing (5).



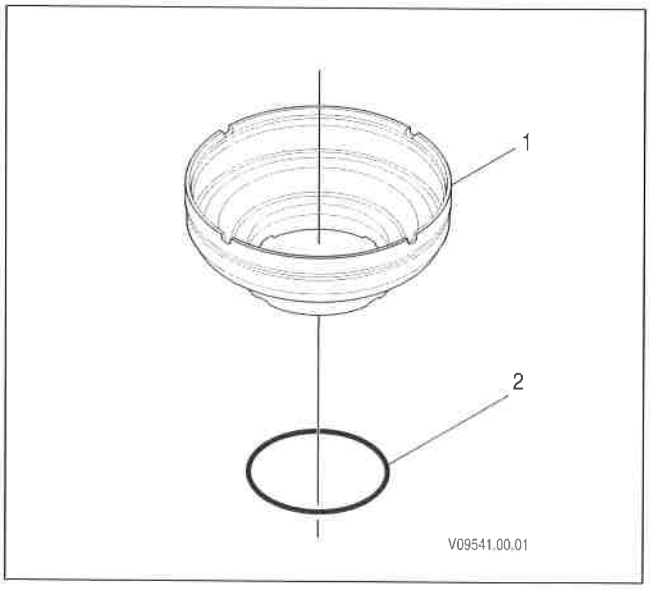
28. Remove sealrings (1) and (2) from C1 clutch piston (3).



41. Place C2 piston/C1 housing on its side.
42. While holding the C2 piston/C1 housing, place J 43772 against the C1 housing.
43. Using a rubber mallet, gently tap on J 43772 until C1 housing is free of the C2 piston.
44. Remove C1 clutch housing.
45. Remove C2 piston return spring assembly from the C2 piston.

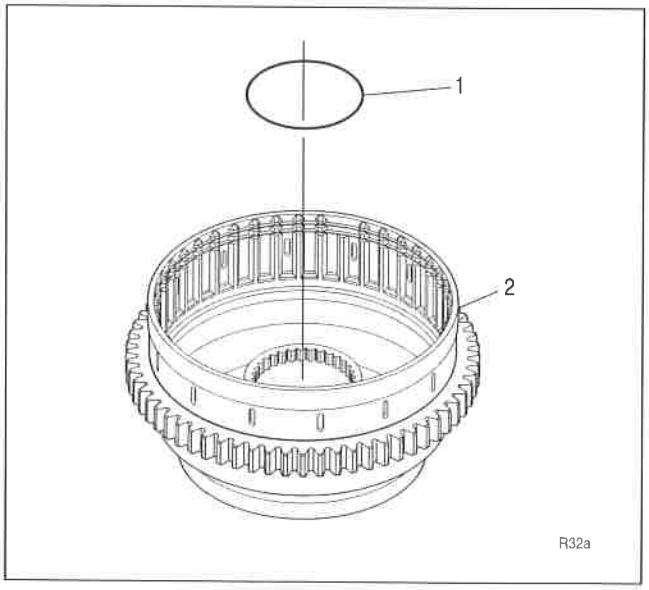


46. Remove sealring (2) from C1 housing (1).



NOTE:
Transmissions beginning with S/N 6310670488 use a redesigned O-ring (1) P/N 29545376. Use only the redesigned O-ring. The redesigned O-ring is compatible with all Allison approved fluids including DEXRON®-VI. Refer to SIL 19-1K2K-06.

47. Remove and discard O-ring (1) from the inner hub of rotating clutch housing (2).



c. Turbine Shaft Bushing Replacement

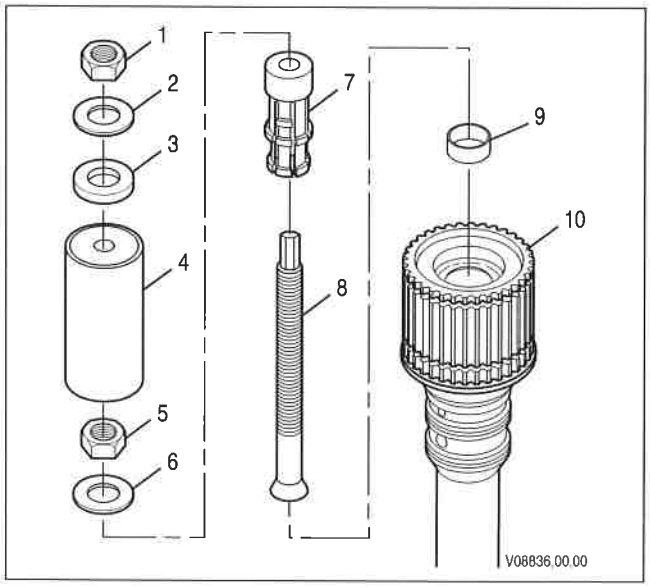
Tools Required

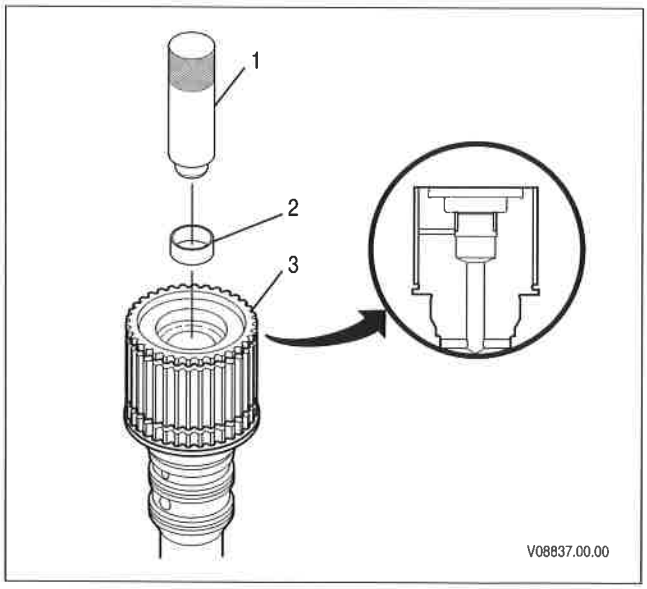
- J 44526 Output/Turbine Shaft Bushing Remover
- J 43791 Output/Turbine Shaft Bushing Installer

CAUTION:

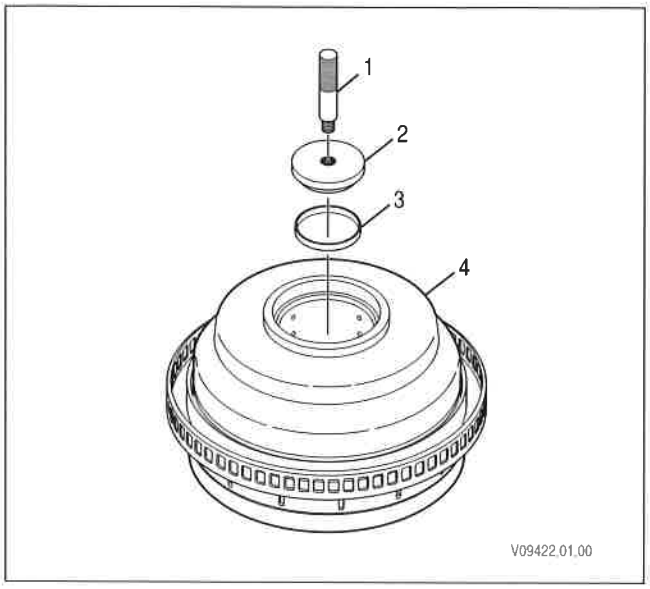
Always use J 44526 when removing the turbine shaft bushing to prevent damage to the turbine shaft.

1. Install J 44526-2 (8) into J 44526-1 (7).
2. Install J 44526-2 (8) and J 44526-1 (7) into bushing (9).
3. Install washer (6) and nut (5) onto J 44526-2 (8).
4. While holding the top of J 44526-2 (8) with a wrench, tighten nut (5) until J 44526-1 (7) engages bushing (9).
5. Install J 44526-3 (4) onto J 44526-2 (8).
6. Install bearing (3), washer (2), and nut (1) onto J 44526-2 (8).
7. While holding the top of J 44526-2 (8) with a wrench, tighten nut (1) until the bushing is dislodged.
8. Remove the J tools from the turbine shaft (10).
9. Install a new bushing (2) onto J 43791 (1).
10. Drive the bushing into turbine shaft (3) until the bushing is seated.
11. Make sure the bushing is installed flush to 0.25 mm (0.010 inch) below the inner turbine shaft surface.





2. Remove the bushing (2) from the rotating clutch housing (1).
3. Remove any nicks or burrs with a crocus cloth.
4. Position the rotating clutch housing (4) on a press so the front of the housing is facing up.



NOTE:
The preferred method for installing the rotating clutch housing bushing is to use J 43778 and a press. If a press is not available, use J 43778 and J 8092.

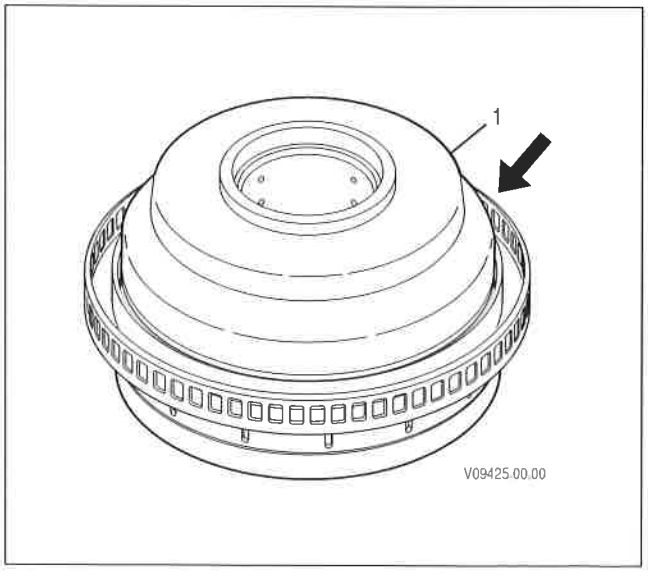
5. If the bushing is to be installed by hand, install the large end of J 43778 (2) onto J 8092 (1).
6. Install a new bushing (3) onto J 43778 (2).
7. Using J 43778, press the new bushing into the clutch housing.
8. Make sure the bushing is installed flush to 0.25 mm (0.010 inch) below the rotating clutch housing surface.

f. Rotating Clutch Housing Tone Wheel Replacement

Tools Required

- J 43767 Tone Wheel Staker
- J 43768 Tone Wheel Driver

1. Grind the stakes from the rotating clutch housing (1).



13. Install J 43768 (1) onto J 43767 (2).

CAUTION:

Stake the tone wheel to 9 tons. The accuracy of the pressure gauges on presses varies. Start at a lower pressure and increase to 9 tons. Too much pressure distorts the tone wheel. Too little pressure results in stakes that will not hold.

14. Using J 43767 (2) and J 43768 (1), stake the tone wheel to the rotating clutch housing.

NOTE:

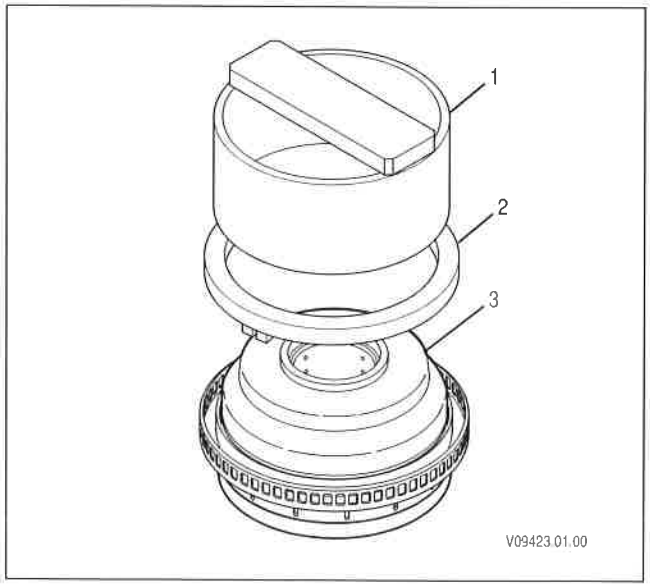
Tapping J 43768 and J 43767 may be required to remove J 43768 and J 43767 from the rotating clutch housing.

15. Remove J 43768 (1) and J 43767 (2).

16. Align J 43767 (2) so the staking prongs are down at the other two staking locations.

17. Install J 43767 (2) onto the tone wheel.

18. Install J 43768 (1) onto J 43767 (2).



CAUTION:

Stake the rotating clutch housing to 9 tons. The accuracy of the pressure gauges on presses varies. Start at a lower pressure and increase to 9 tons. Too much pressure distorts the tone wheel. Too little pressure results in stakes that will not hold.

19. Using J 43767 (2) and J 43768 (1), stake the turbine tone wheel to the rotating clutch housing.

NOTE:

Tapping J 43768 and J 43767 may be required to remove J 43768 and J 43767 from the rotating clutch housing.

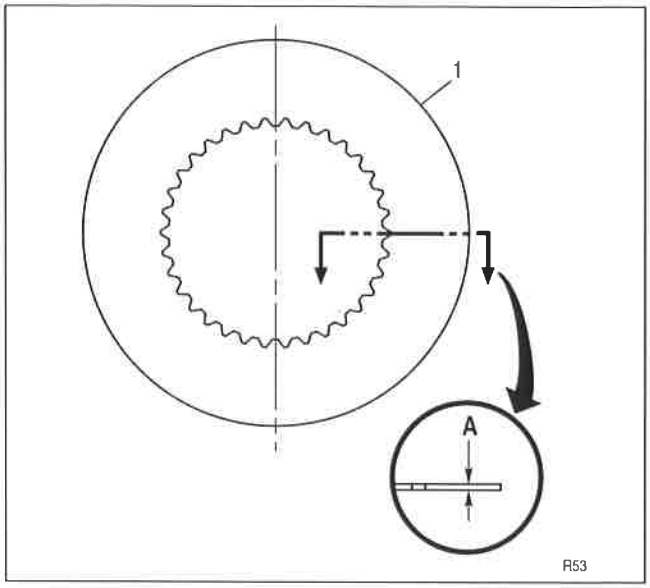
20. Remove J 43768 (1) and J 43767 (2).

h. C1 Clutch Reaction Plate Inspection

NOTE:

- **Measure at three or more locations as described below.**
- **Replace any C1 clutch reaction plate that does not meet specifications.**

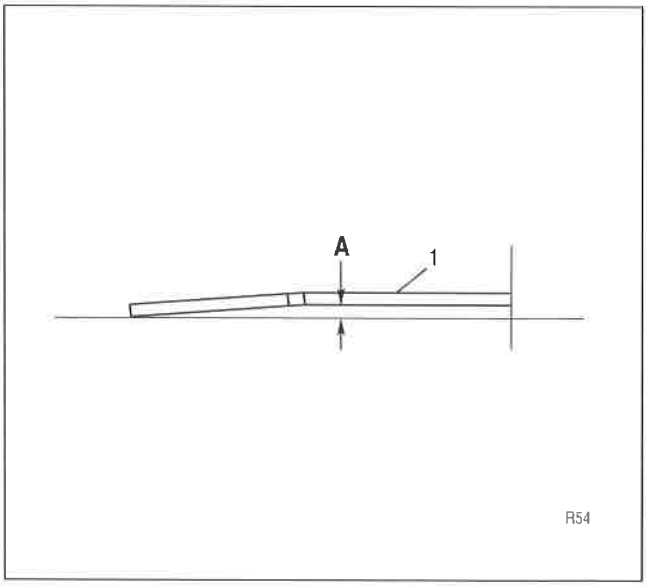
1. Measure the thickness of each C1 clutch reaction plate (1) (Dimension A). Minimum thickness is 2.136 mm (0.0841 inch).



NOTE:

Check the plates for coning on a level surface.

2. Measure the cone of each plate (1) (Dimension A). Maximum cone is 0.200 mm (0.0079 inch).

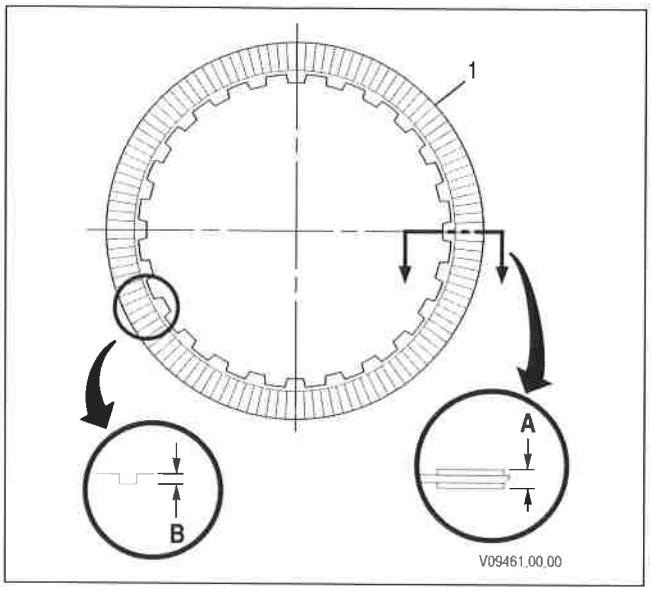


j. C2 Clutch Friction Plate Inspection

NOTE:
Anti-freeze and water have adverse effects on the bonding agent between the friction material and the steel core. Do not reuse the friction plate if it has been exposed to water and/or glycol. A loose face or flaking of friction material indicates deterioration of the friction plate.

NOTE:

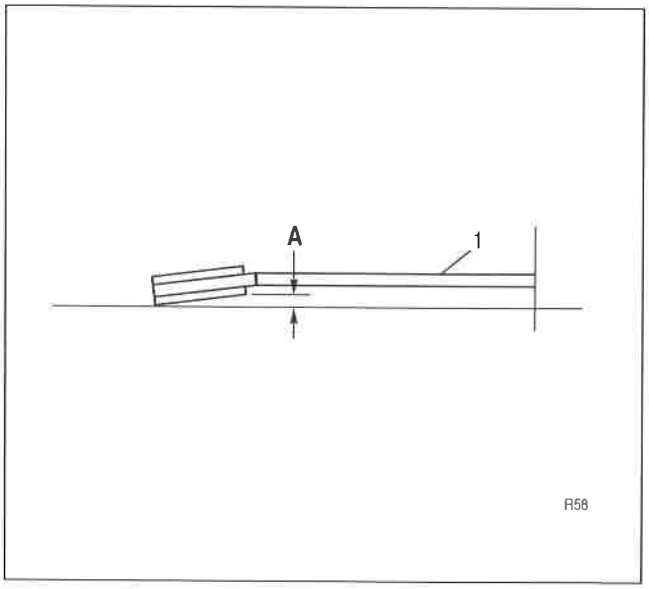
- **Measure at three or more locations as described below.**
- **Replace any C2 clutch friction plate that does not meet specifications.**



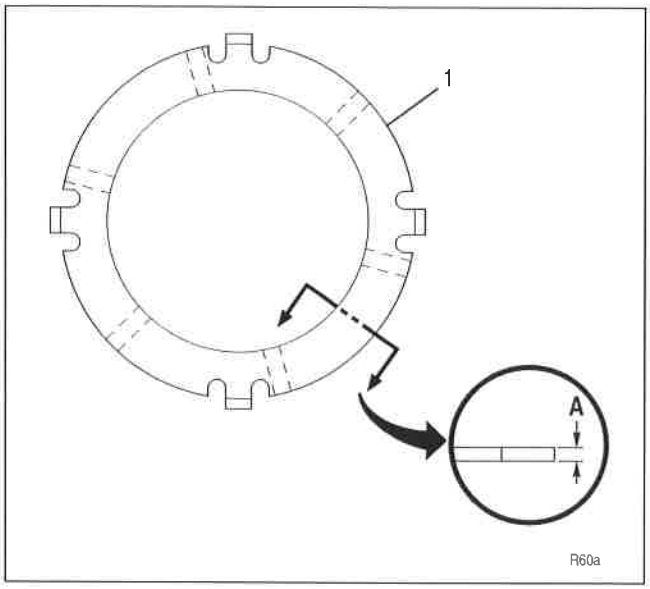
1. Measure the thickness of each C2 clutch friction plate (1) (Dimension A). Minimum thickness is 2.375 mm (0.0935 inch).
2. Measure the oil groove depth of each plate (Dimension B). Minimum groove depth is 0.200 mm (0.0079 inch).

NOTE:
Check the plates for coning on a level surface.

3. Measure the cone of each plate (1) (Dimension A). Maximum cone is 0.225 mm (0.0089 inch).



m. Rotating Clutch Thrust Washer Inspection



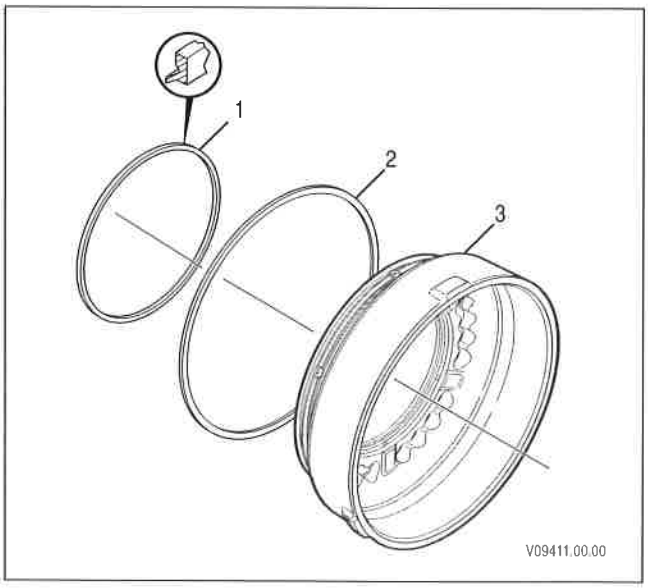
NOTE:
Replace the thrust washer if any of the following specifications are not met.

1. Measure the thickness of thrust washer (1) (Dimension A). The minimum thickness is 2.59 mm (0.102 inches).

n. Assembly of Rotating Clutch Module

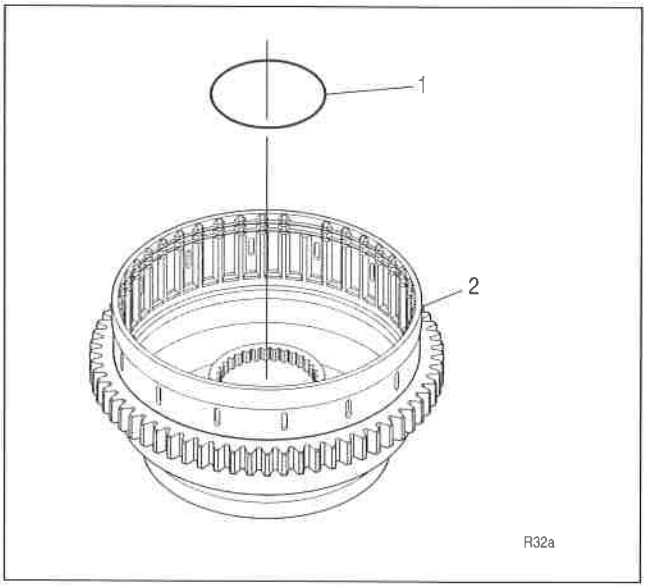
Tools Required

- J 24204-2 Bar and Stud Assembly
- J 47339 C1/C2 Piston Return Spring Compressor
- J 44525 C1 Clutch Backplate Selector



1. Install sealrings (1) and (2) onto C2 clutch piston (3).
2. Lubricate the inside and outside diameter of the C2 piston and sealrings (1) and (2) with petrolatum.

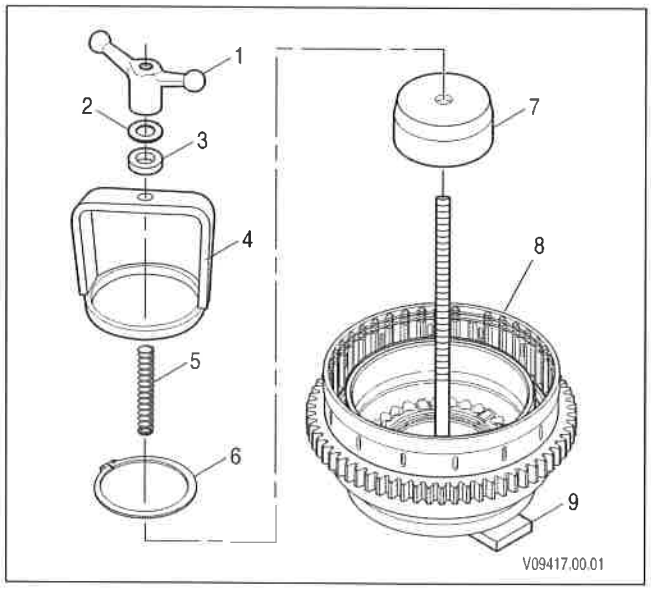
3. Position rotating clutch housing (2) on the work table so the rear of the housing is facing up.

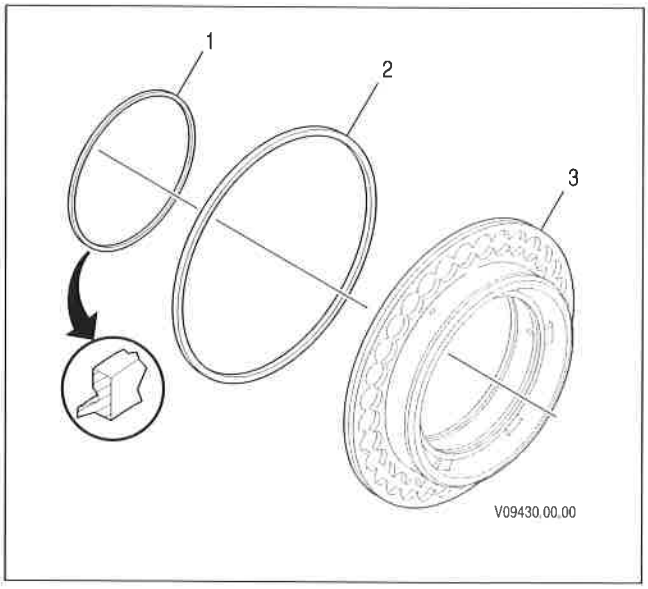


NOTE:
Transmissions beginning with S/N 6310670488 use redesigned O-ring (1) P/N 29545376. Use only the redesigned O-ring. The redesigned O-ring is compatible with all Allison approved fluids including DEXRON®-VI. Refer to SIL 19-1K2K-06.

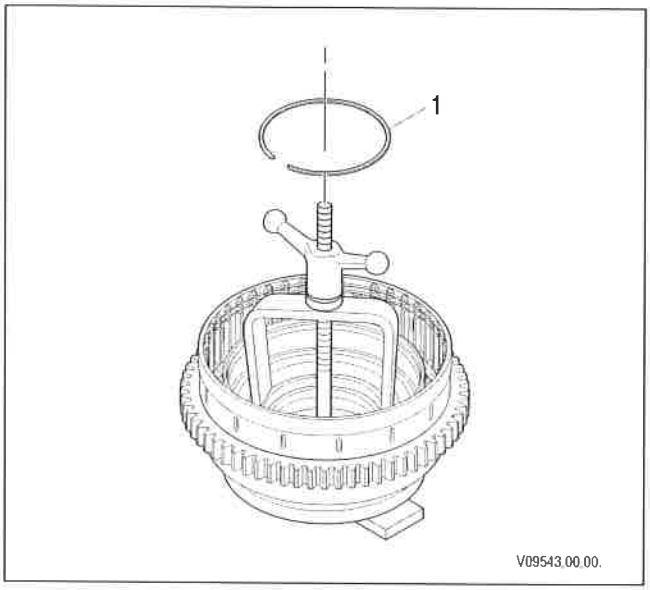
4. Install new O-ring (1) into the bottom groove on the inner hub of rotating clutch housing (2).

13. Position the rotating clutch housing (8) on the base of J 24204-2 (9) so the rear of the housing is facing up.
14. Install J 47339-2 (7) onto the shaft of J 24204-2 with the bowl down.
15. Install retaining ring (6) onto the surface of J 47339-2 (7).
16. Install J 47339 spring (5) onto the shaft of J 24204-2.
17. Install J 47339-1 (4) onto the shaft of J 24204-2.
18. Install J 24204-2 ball bearing (3) and washer (2) onto the J 24204-2 shaft.
19. Install J 24204-2 wing nut (1) onto the shaft of J 24204-2.
20. Compress the C2 piston return spring assembly until the retaining ring groove on the inner hub of the rotating clutch housing is visible.
21. Install retaining ring (6) onto the rotating clutch housing inner hub. Make sure the retaining ring is seated all around the clutch housing.
22. Remove all J tools.
23. Install sealring (1) and C1 sealring (2) onto C1 clutch piston (3). Lubricate the sealrings with petrolatum.

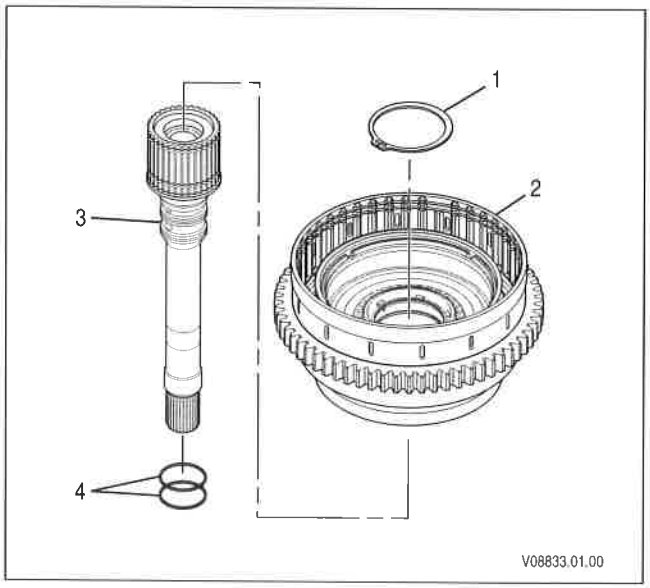




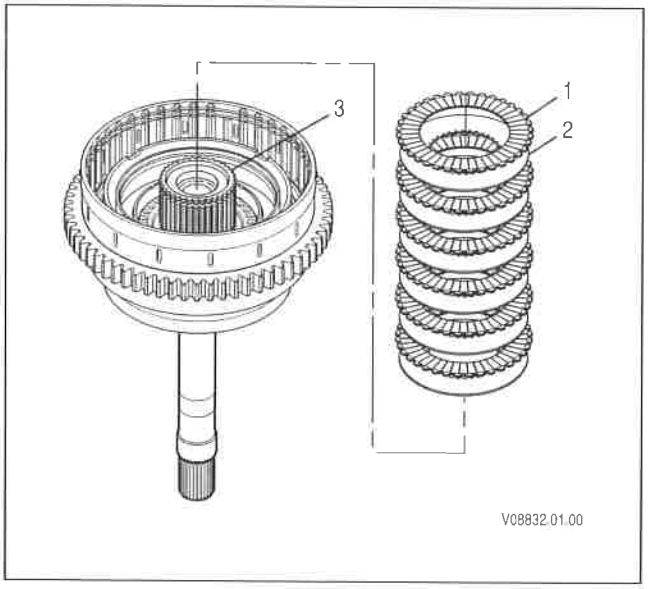
36. Compress the C1 piston return spring assembly until the retaining ring groove on the clutch housing is visible.
37. Install the retaining ring (1) into the clutch housing outer groove.
38. Remove all J tools.



39. Install two butt joint sealrings (4) onto turbine shaft (3).
40. Position turbine shaft (3) on the work table so the rear of the shaft is facing up.
41. Align the rotating clutch housing (2) with the rear of turbine shaft (3) so the rear of the clutch housing is facing up.
42. Install the rotating clutch housing (2) onto the larger splined diameter of the turbine shaft (3).
43. Install the retaining ring (1) onto the turbine shaft. Make sure the retaining ring is seated completely around the turbine shaft.

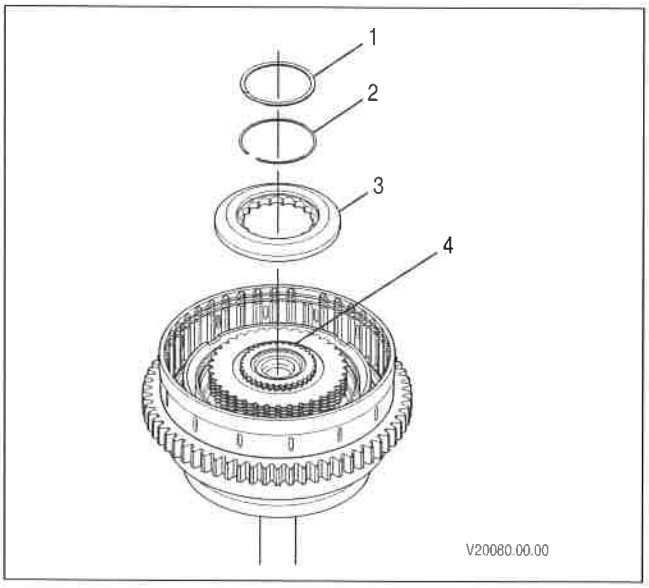


44. Starting with a C1 clutch reaction plate, alternately install six C1 clutch reaction plates (2) and six C1 clutch friction plates (1) onto the turbine shaft (3).



C1 Clutch Backplate	
Identification Number	**Part Number**
2420	29542420
8521	29538521
8522	29538522
8523	29538523
8524	29538524

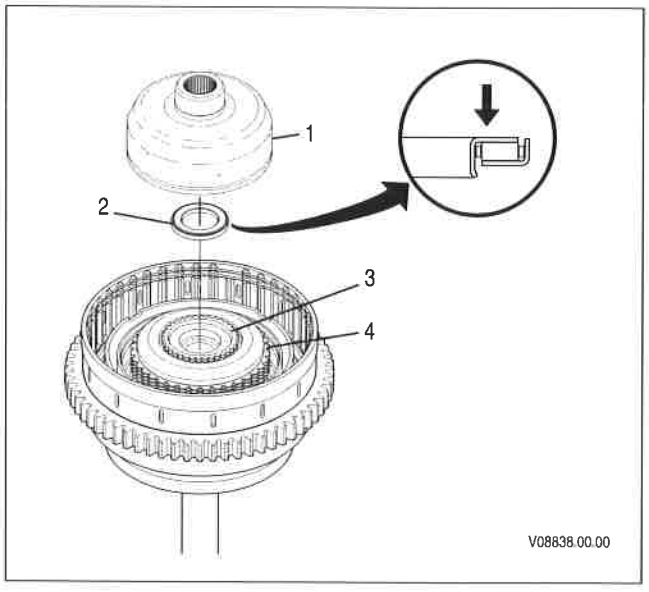
54. Remove all J tools from the turbine shaft.
55. Align the C1 clutch backplate (3) so the beveled edge of the backplate is facing up.
56. Install the C1 clutch backplate onto the turbine shaft (4).
57. Install the retaining ring (2) onto the turbine shaft (4).
58. Lift the C1 clutch backplate (3) and install spiral retaining ring (1) into the C1 clutch backplate (3).



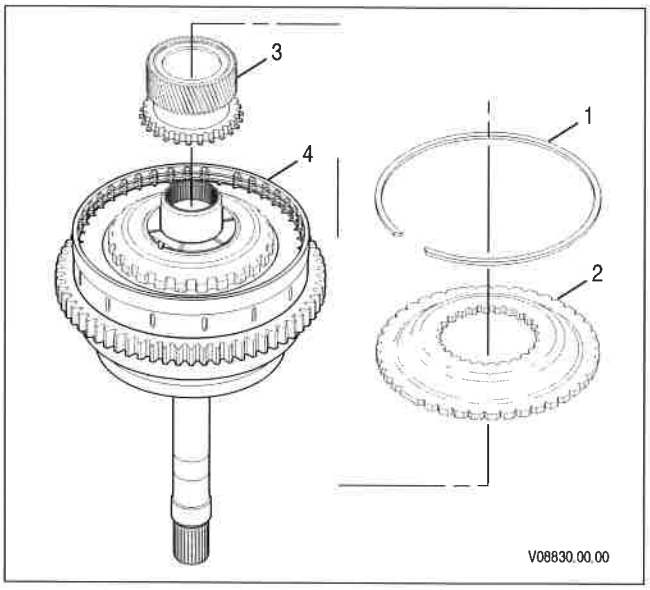
CAUTION:

Installing the T1 thrust bearing assembly into the rear of the turbine shaft in the wrong direction—blue H pattern not showing—could result in destruction of the transmission.

59. Align the T1 thrust bearing assembly (2) so the blue H pattern on the thrust bearing assembly is facing away from turbine shaft (3).
60. Install the T1 thrust bearing assembly (2) into the turbine shaft (3). Make sure the blue H pattern on the thrust bearing assembly is visible.
61. Center the C1 clutch plates (4).
62. Install the C1 drive hub (1) over the C1 clutch plates (4). Make sure the C1 drive hub (1) has seated on the thrust bearing assembly (2).



70. Align the P1 sun gear (3) so the gear teeth of the sun gear face the rotating clutch housing (4).
71. Install the P1 sun gear (3) into the P1 drive flange (2). Make sure the splines are engaged.
72. While holding the sun gear, align the double wide splines of the P1 drive flange (2) with the double wide spaces on the rotating clutch housing (4).
73. Install the P1 sun gear (3) with the P1 drive flange (2) into the rotating clutch housing (4).
74. Install the retaining ring (1) into the rotating clutch housing (4). Make sure the retaining ring is seated all the way around the rotating clutch housing.



5–10. MAIN HOUSING ASSEMBLY

a. Disassembly of Selector Shaft and Detent Lever

Tools Required

- J 43911 Selector Shaft Seal Remover

NOTE:

Do not remove the selector shaft unless replacing one or more of the following:

- **Selector shaft**
- **Internal Mode Switch (IMS)/detent lever assembly**
- **Park pawl apply assembly**

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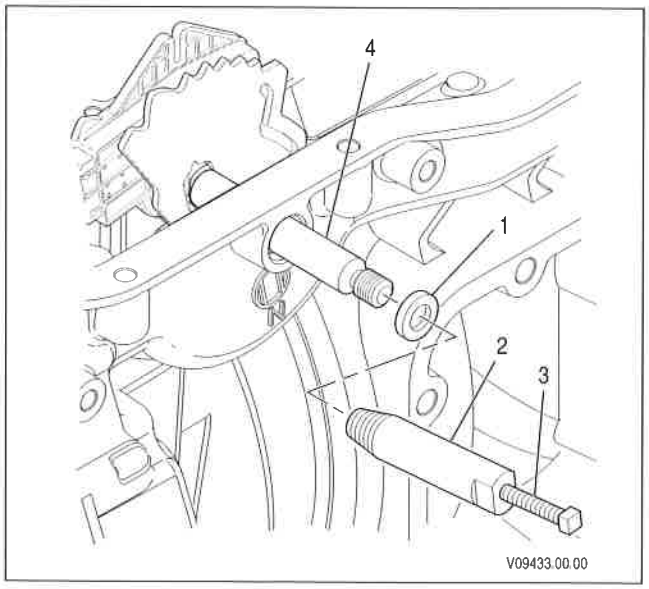
1. Position the transmission so the valve body face of the main housing is facing up.
2. Remove the screw (3) from the body of J 43911-1 (2).
3. Screw the body of J 43911-1 into the selector shaft seal (1).
4. Install the screw (3) into the body of J 43911-1.
5. Tighten the screw (3) against the shaft (4) until the selector shaft seal (1) dislodges.
6. Remove the selector shaft seal (1) from J 43911-1 (2).

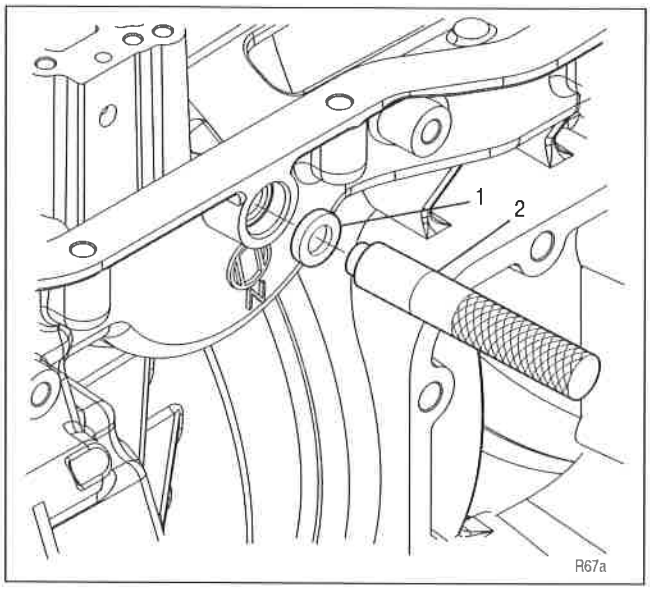


b. Assembly of Selector Shaft and Detent Lever

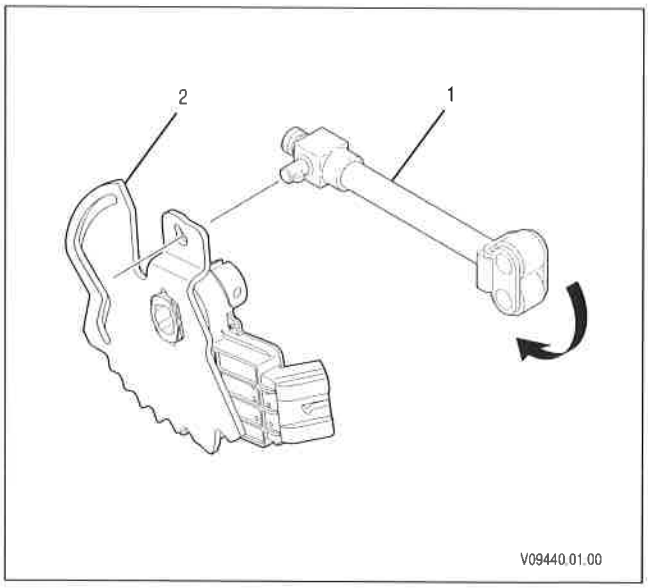
Tools Required

- J 43909 Selector Shaft Seal Installer

1. Install a new selector shaft seal (1) onto J 43909 (2).
2. Using J 43909, drive selector shaft seal (1) into the main housing.
3. Make sure the selector shaft seal is seated in the bottom of the bore.



4. If the transmission is equipped with a park pawl apply assembly (1), do the following.
   - Install the nib of the park pawl apply assembly (1) through the keyhole in the detent lever (2).
   - Rotate the park pawl apply assembly 180 degrees.



c. Nameplate Replacement

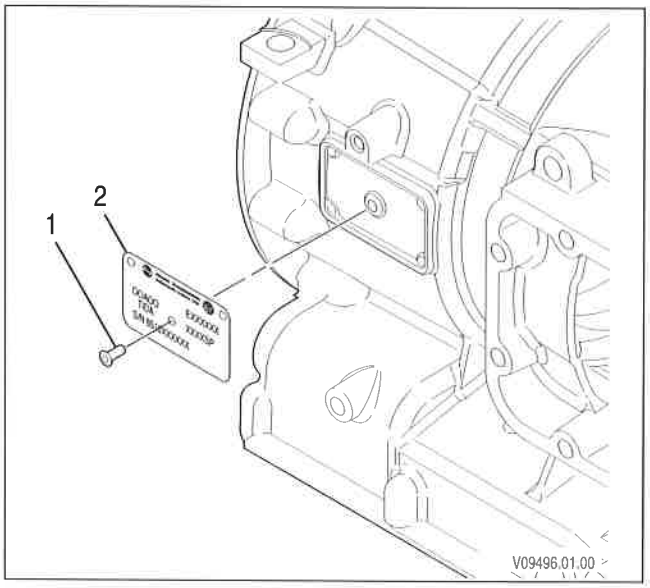
NOTE:

When replacing a nameplate, keep the original nameplate. Stamp the information from the original nameplate onto the replacement nameplate.

CAUTION:

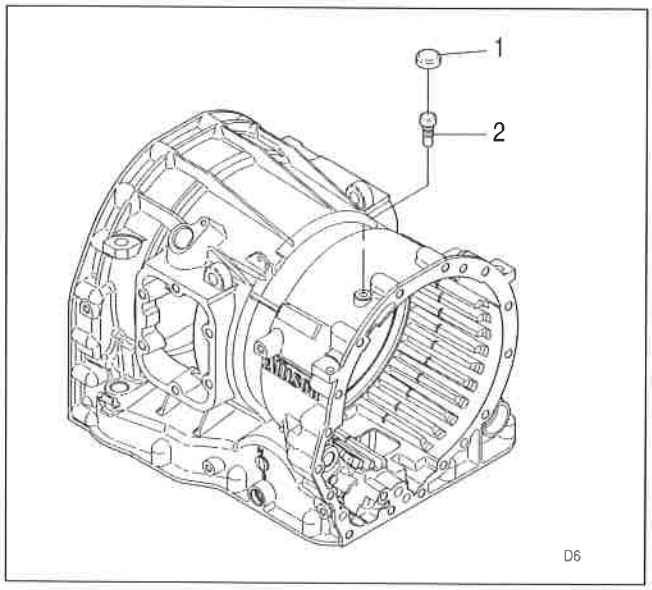
Do not drill through the main housing when drilling out the nameplate rivets.

1. Using a 3/16 inch drill bit, drill through the rivet (1). Remove the rivet (1) and nameplate (2).
2. Place a new nameplate (2) and a new rivet (1) onto the main housing.
3. Using a pop rivet gun, install the rivet into the main housing.



f. Replacement of Breather Assembly

1. If not removed, pry off breather cap (1).
2. If breather (2) remains, gently pry the breather from the main housing.
3. Gently tap a new breather assembly into the main housing until the breather is seated.



5–11. RING GEAR AND CLUTCH COMPONENT INSPECTIONS

a. C3 Clutch Component Inspection

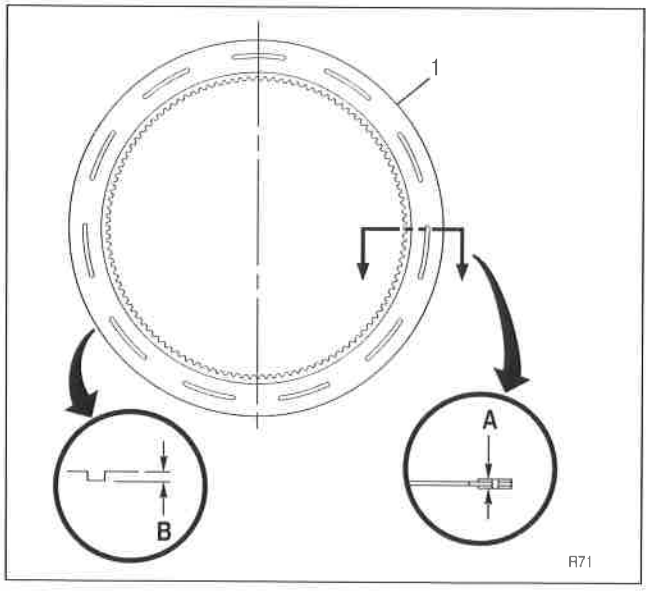
NOTE:

Anti-freeze and water have adverse effects on the bonding agent between the friction material and the steel core. Do not reuse the friction plate if it has been exposed to water and/or glycol. A loose face or flaking of friction material indicates deterioration of the friction plate.

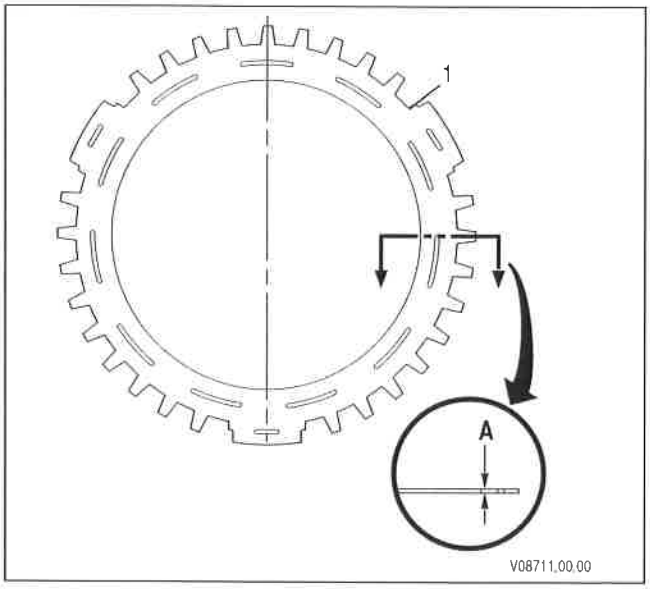
NOTE:

- **Make the measurements described below at three or more locations.**
- **Replace any parts not meeting specifications.**

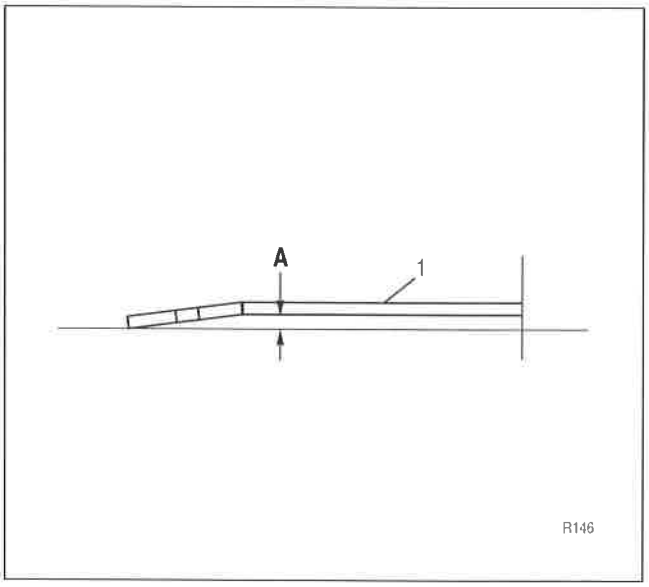
1. Measure the thickness of each C3 clutch friction plate (1) (Dimension A). Minimum thickness is 2.375 mm (0.0935 inch).
2. Measure the oil groove depth of each C3 clutch friction plate (Dimension B). Minimum groove depth is 0.200 mm (0.0079 inch).



6. Measure the thickness of the C3 spring plate (1) (Dimension A). Minimum thickness is 3.110 mm (0.1224 inch).



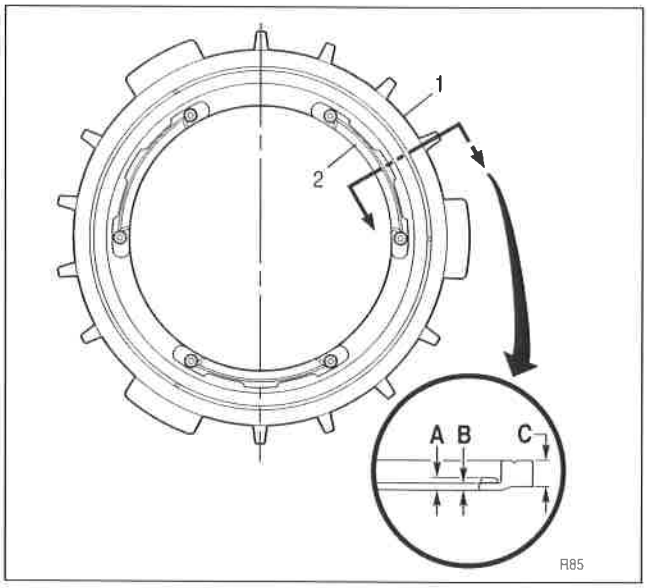
7. Measure the cone of the C3 spring plate (1) (Dimension A). Maximum cone is 0.400 mm (0.0157 inch).



8. Measure the thickness of the C3 clutch backplate (1) (Dimension C). Minimum thickness is 15.325 mm (0.6033 inch).

9. Measure the distance from the top of thrust plate (2) to the bottom of the C3 clutch plate inner rim (Dimension A). Measure the thickness of the C3 clutch plate inner rim (Dimension B).

10. Calculate the thickness of the thrust plate (Dimension D) by subtracting Dimension B from Dimension A (Dimension D = Dimension A – Dimension B). Minimum thrust plate thickness is 3.000 mm (0.1181 inch).



c. C4 Clutch Component Inspection

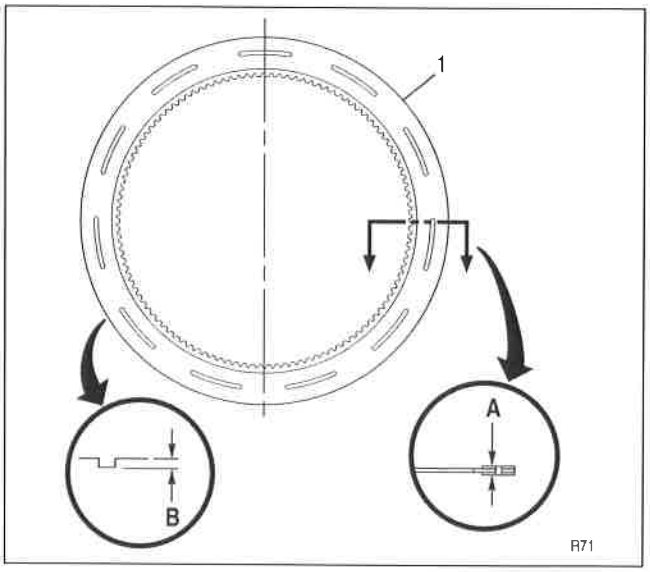
NOTE:

Anti-freeze and water have adverse effects on the bonding agent between the friction material and the steel core. Do not reuse the friction plate if it has been exposed to water and/or glycol. A loose face or flaking of friction material indicates deterioration of the friction plate.

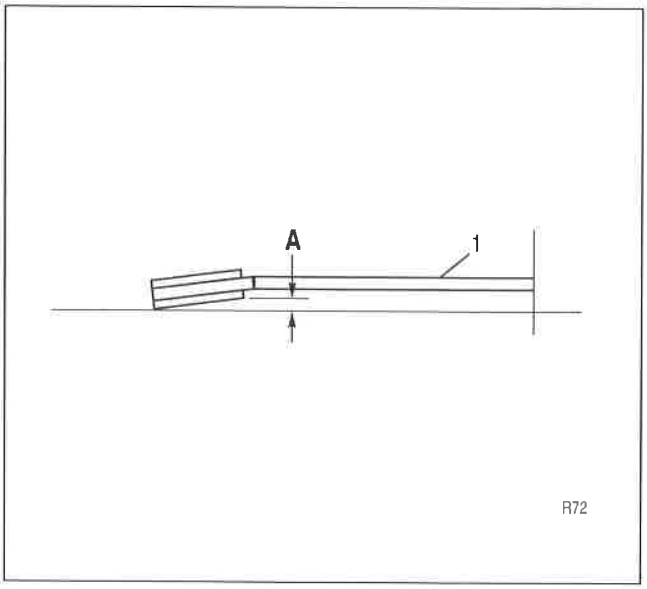
NOTE:

- **Measure at three or more locations as described below.**
- **Check the plates for coning on a level surface.**
- **Replace any parts not meeting specifications.**

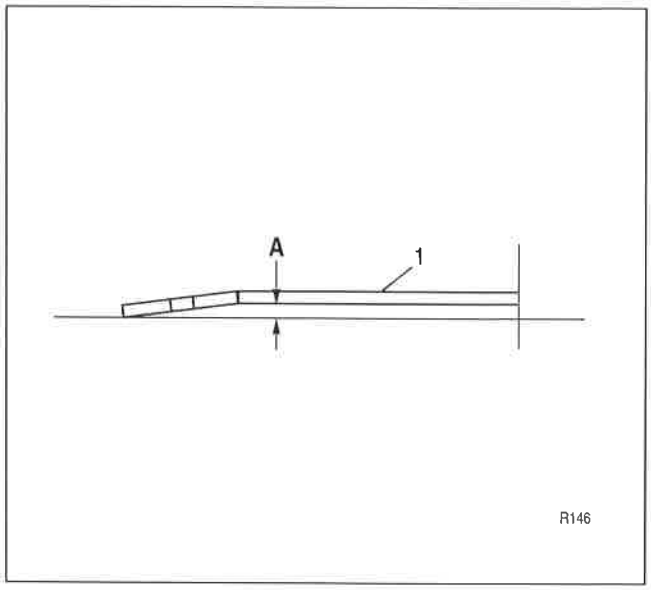
1. Measure the thickness of each C4 clutch friction plate (1) (Dimension A). Minimum thickness is 2.375 mm (0.0935 inch).
2. Measure the oil groove depth of each C4 clutch friction plate (1) (Dimension B). Minimum groove depth is 0.200 mm (0.0079 inch).



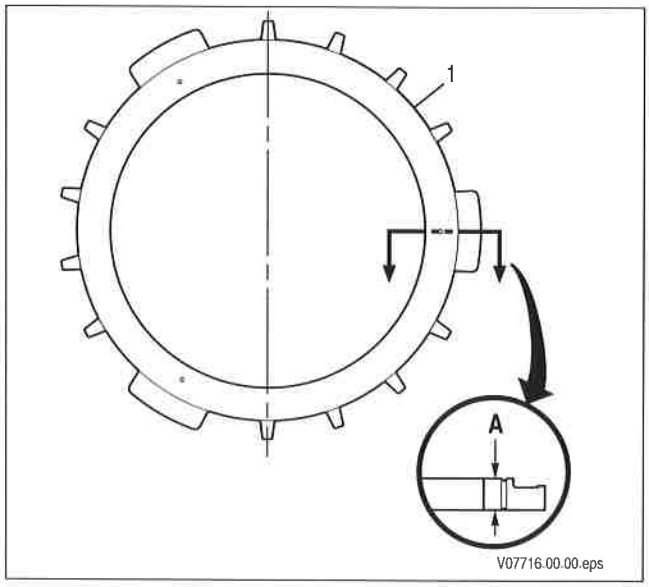
3. Measure the cone of each C4 clutch friction plate (1) (Dimension A). Maximum cone is 0.225 mm (0.0089 inch).



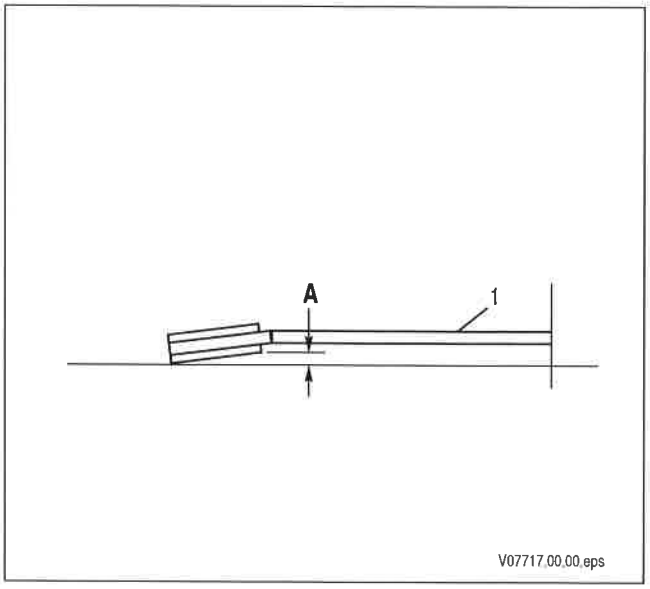
7. Measure the cone of the C4 spring plate (1) (Dimension A). Maximum cone is 0.400 mm (0.0157 inch).



8. Measure the thickness of the C4 clutch backplate (Dimension A). Minimum thickness is 15.400 mm (0.6063 inch).
9. Measure the cone of the C4 clutch backplate. Replace backplate (1) if any cone is present.

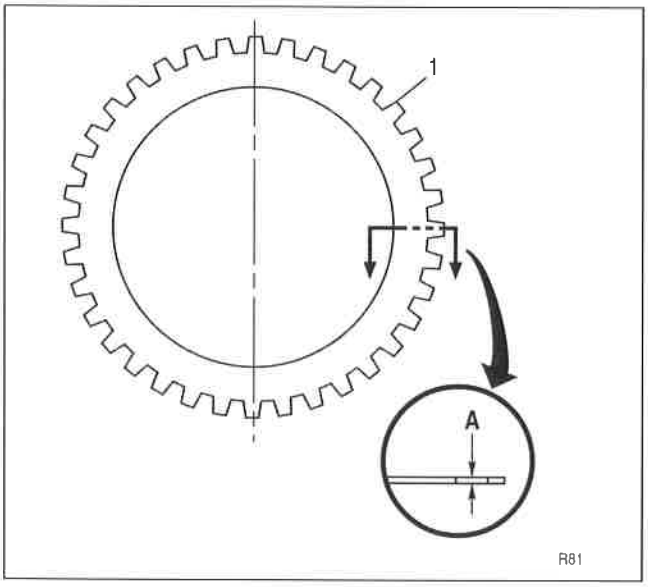


3. Measure the cone of each C5 clutch friction plate (1) (Dimension A). Maximum cone is 0.225 mm (0.0089 inch).

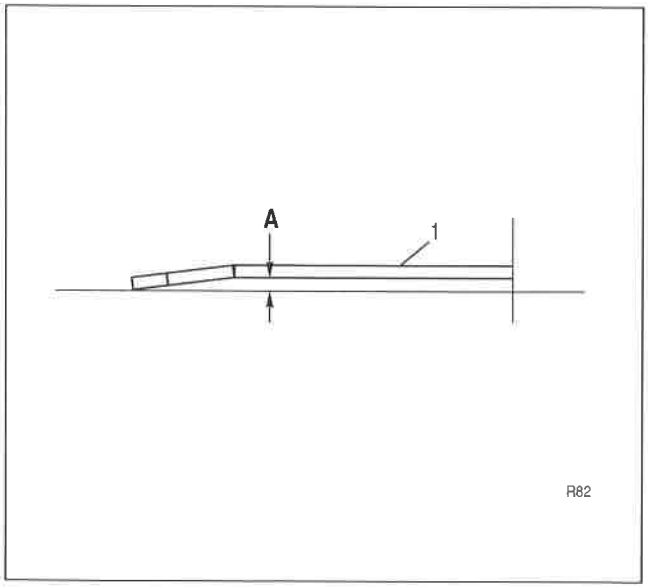


4. Measure the thickness of each C5 clutch reaction plate (1). Minimum thickness is given in the following table. The clutch pack contains five identification number 2 plates and an identification number 1, 2, or 3 selective plate. A clutch may contain six identification number 2 plates if build measurements require an identification number 2 plate as the selective plate.

Part Number	Minimum Thickness	Identification Number
29536481	1.935 mm (0.0762 inch)	1
29536482	2.435 mm (0.0959 inch)	2
29536483	2.935 mm (0.1156 inch)	3



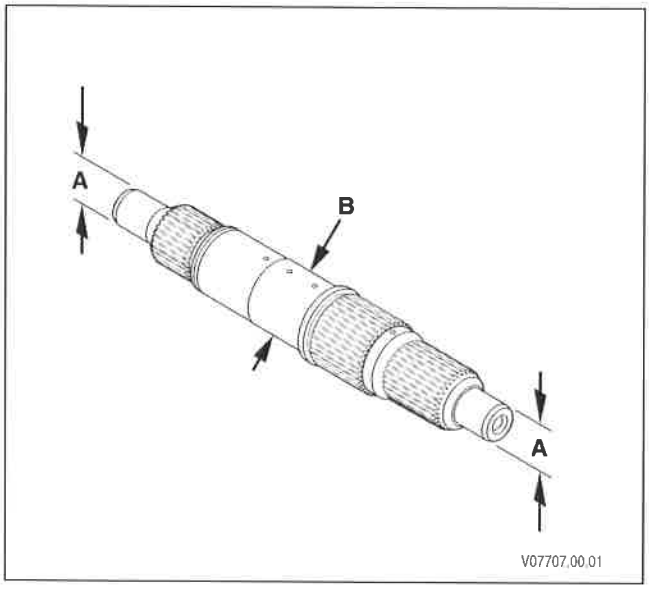
5. Measure the cone of each C5 clutch reaction plate (1) (Dimension A). Maximum cone is 0.295 mm (0.0116 inch).



5–12. MAIN SHAFT INSPECTION

NOTE:
Replace the main shaft if it does not meet specifications.

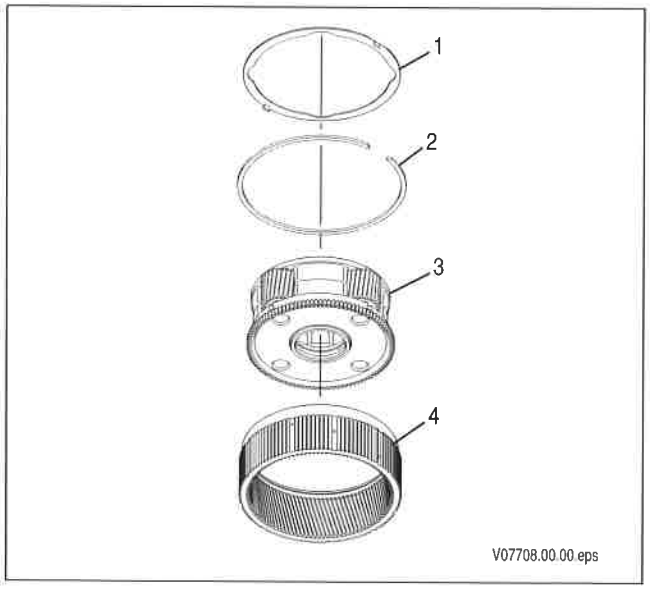
1. Inspect the main shaft pilots for damage.
2. Measure the main shaft pilots (Dimension A). Minimum pilot outside diameter is 19.987 mm (0.7869 inch).
3. Inspect the main shaft journal contact area for damage.
4. Measure the main shaft journal contact area for the P2 planetary bushing (Dimension B). Minimum main shaft journal diameter is 36.405 mm (1.4333 inch).
5. Replace the main shaft if Dimension A or B specifications are not met, or the pilot or journal contact areas are damaged.
6. Inspect the main shaft lube holes and center bore for debris.



5–13. P1 PLANETARY MODULE

a. P1 Planetary Module Disassembly

1. Remove the thrust washer (1) from the P2 ring gear (4).
2. Remove the retaining ring (2) from the P2 ring gear (4).
3. Separate the P1 planetary carrier assembly (3) from the P2 ring gear (4).



d. P1 Planetary Carrier Bushing Replacement

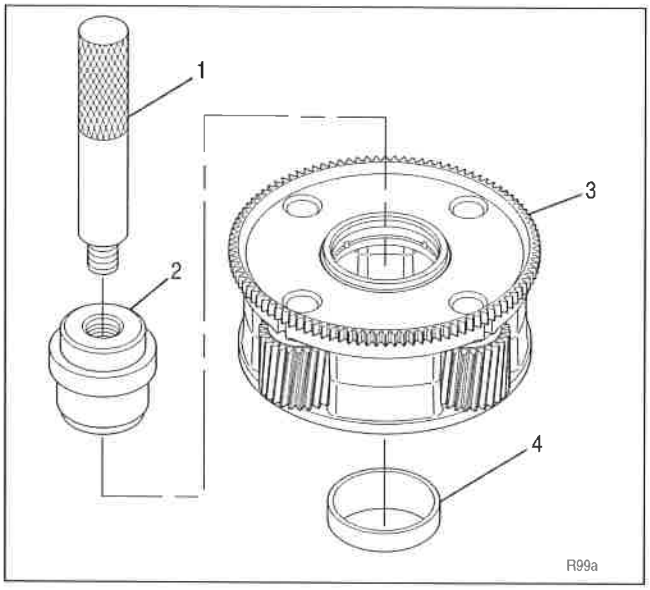
Tools Required

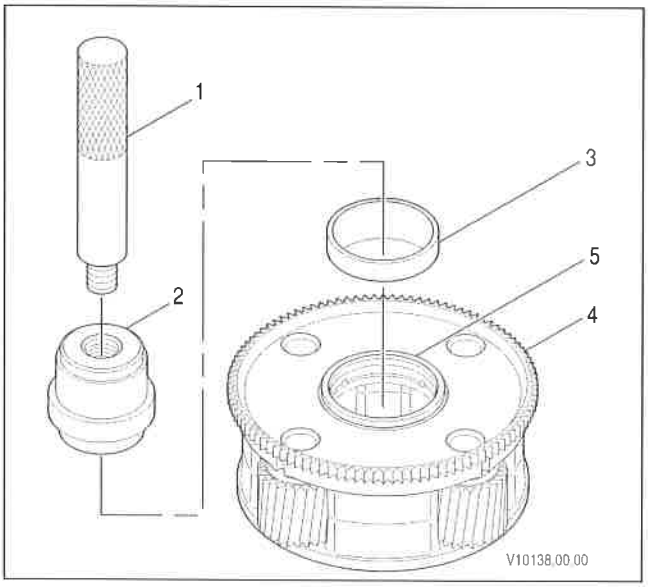
- J 43781 P1 Bushing Remover/Installer
- J 8092 Universal Driver

NOTE:

The preferred method for removing and installing the P1 carrier bushing is to use J 43781 and a press. If a press is not available, use J 43781 and J 8092.

1. Position P1 planetary carrier (3) on the press with the external splines facing up.
2. If the bushing is removed by hand, install the short end of J 43781 (2) onto J 8092 (1).
3. Using the longer end of J 43781, press bushing (4) out of the carrier.
4. If the bushing is installed by hand, install the long end of J 43781 (2) onto J 8092 (1).
5. Install a new bushing (3) onto the short end of J 43781 (2).
6. Using J 43781, press or drive the bushing into the carrier until J 43781 (2) seats. Install the new bushing 1.875–2.125 mm (0.074–0.084 inch) below the surface (5).

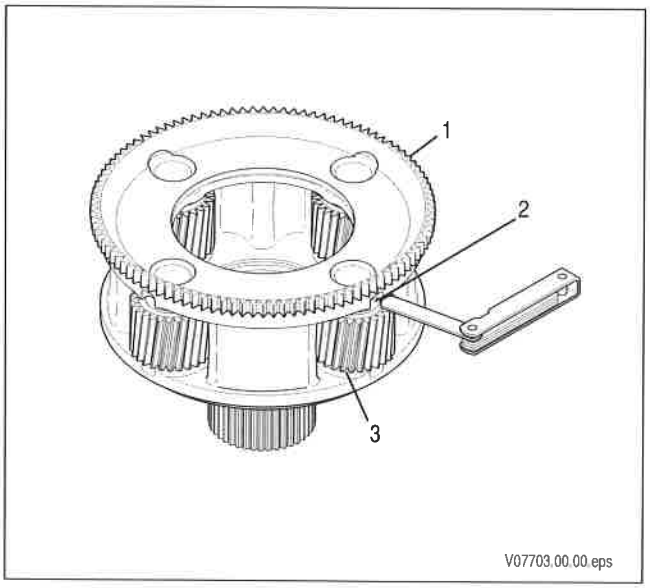




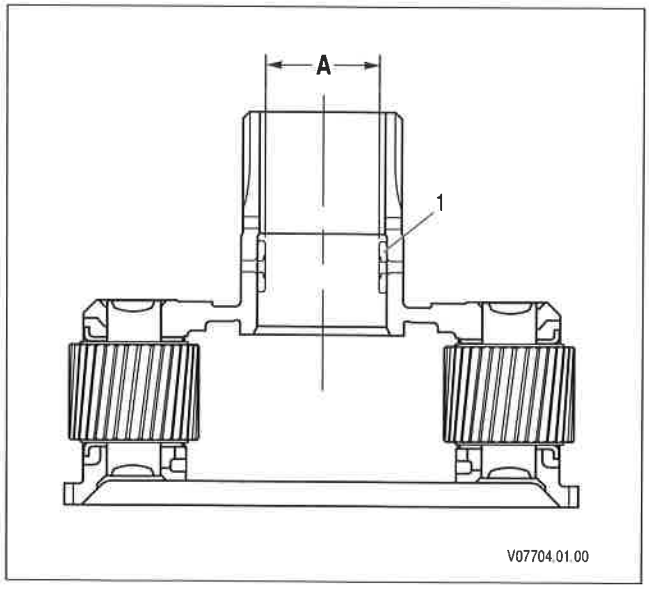
b. P2 Planetary Carrier Assembly Inspection

NOTE:
The T5 thrust bearing capacity has been increased starting with transmission S/N 6310696028. To accommodate the larger capacity T5 bearing, the P2 carrier assembly and P2 sun gear were redesigned. Do not mix former and current parts. Transmission serial numbers before 6310467635 may need the P2 sun gear spacer replaced with a revised (thicker) sun gear spacer, P/N 29541728, in order to establish the proper internal stack dimensions. Refer to SIL 28-1K2K-06.

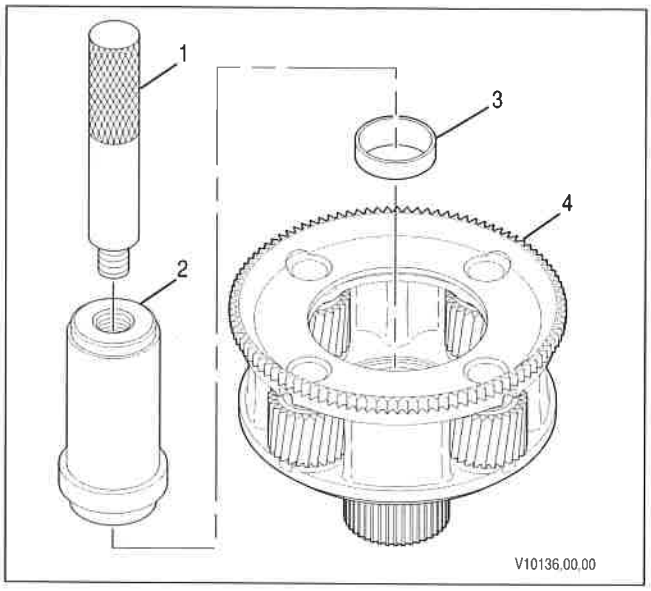
1. Check the end play between P2 planetary carrier (1) and thrust washer (2) at each pinion gear (3).
2. If the end play is greater than 1.010 mm (0.0400 inch), replace the P2 planetary carrier assembly.



3. Inspect the bushing (1) for wear and damage.
4. Measure the inside diameter of the bushing (Dimension A). If the bushing inside diameter is greater than 36.575 mm (1.4400 inch), replace the bushing.

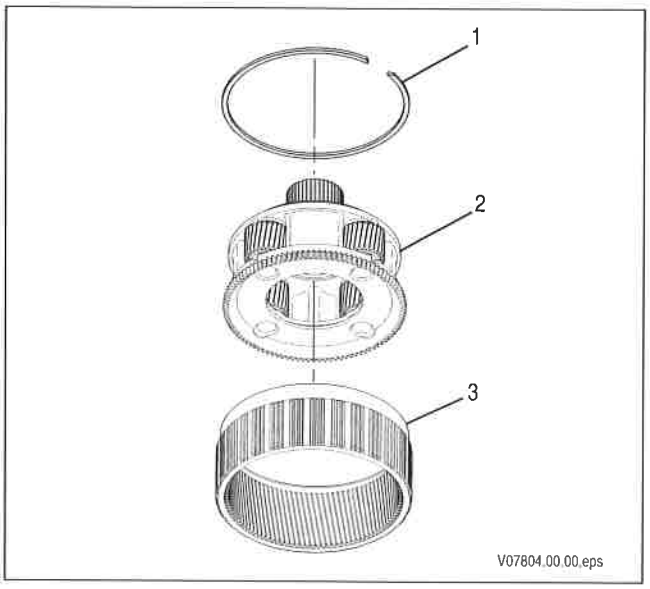


5. If the bushing is installed by hand, install the long end of J 43785 (2) into J 8092 (1).
6. Install a new bushing (3) onto the shorter end of J 43785 (2).
7. Using J 43785 (2), press or drive the bushing into the carrier until J 43785 (2) seats.



e. P2 Planetary Module Assembly

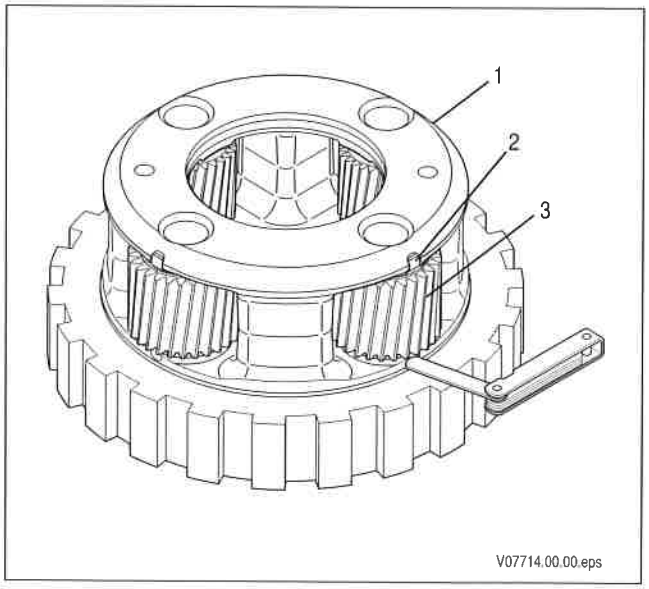
1. Position the P3 planetary ring gear (3) on the work table so the outer splines are facing down.
2. Install P2 planetary carrier assembly (2) into P3 planetary ring gear. Make sure the splines are engaged.
3. Install the retaining ring (1) into the P3 ring gear so the P2 planetary carrier assembly is retained.



5–15. P3 PLANETARY CARRIER ASSEMBLY

a. P3 Planetary Carrier Assembly Inspection

1. Check the end play between P3 planetary carrier (1) and thrust washer (2) at each pinion gear (3).
2. If the end play is greater than 1.010 mm (0.0400 inch), replace the P3 planetary carrier assembly.

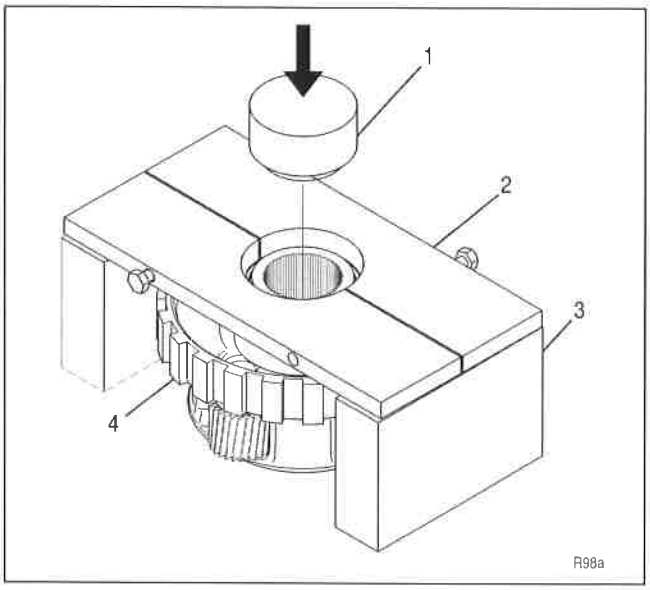


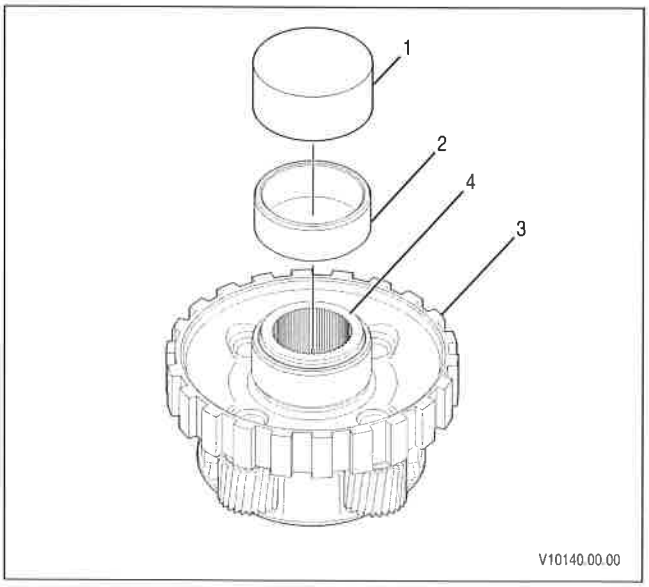
4. Place two wooden blocks (3) on the press.
5. Position the P3 planetary carrier (4) so that J 44528-1 (2) spans the wooden blocks and the front of the carrier is facing down.
6. Install J 44528-2 (1) into the carrier.

WARNING!

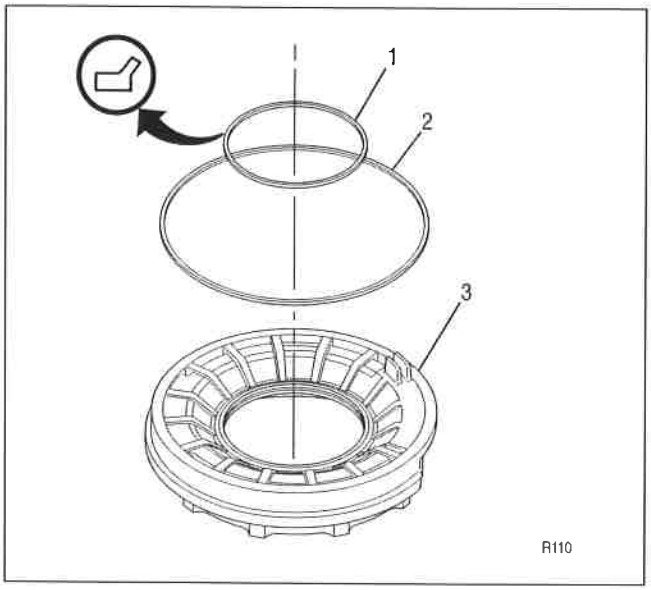
Pressing the P3 planetary carrier from the bearing race causes the P3 carrier to fall from the bearing race. Make sure the P3 carrier is safely caught when freed from the bearing race. An uncontrolled fall of the P3 carrier could cause personal injury and/or property damage.

7. Using J 44528-2 (1), press the P3 planetary carrier (4) from J 44528-1 (2).
8. Remove the bearing race from J 44528-1.
9. Remove J 44528-2 (1) from the carrier.
10. Position the P3 planetary carrier (3) on the press so the rear of the carrier is facing up.
11. Install a new bearing race into J 43797 (1).
12. Using J 43797 (1), press bearing race (2) onto the P3 planetary carrier (3) until J 43797 seats. Install a new bearing race (2) 5.175–5.425 mm (0.204–0.214 inch) below the surface (4).

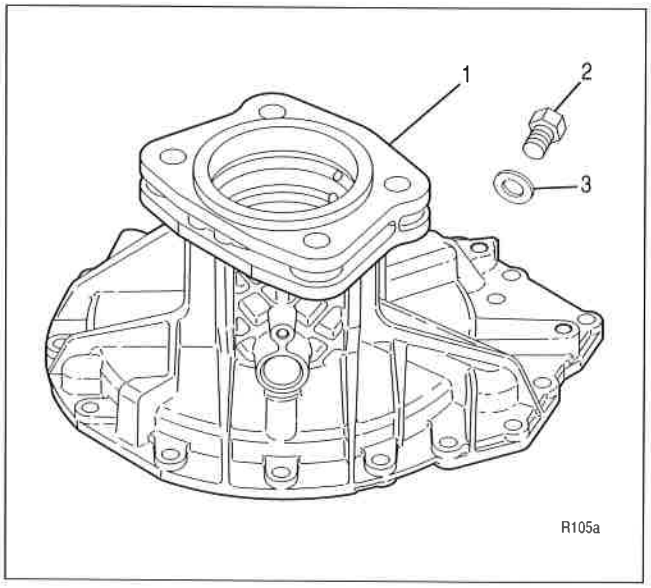




6. Remove sealrings (1) and (2) from the C5 clutch piston (3).



7. If equipped with a tachograph plug (2):
   - Position the rear cover (1) on the work table so the rear of the cover is facing up.
   - Remove the tachograph plug (2).
   - Remove the washer (3).



d. Output Shaft Bushing Replacement

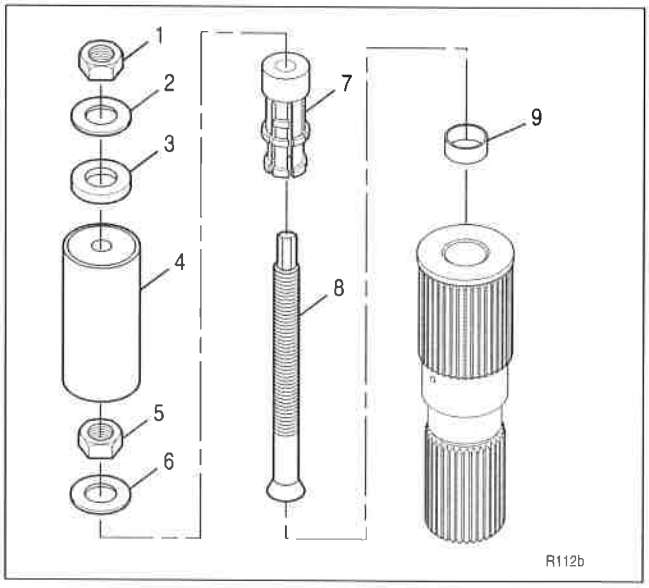
Tools Required

- J 43791 Output/Turbine Shaft Bushing Installer
- J 44526 Output/Turbine Shaft Bushing Remover

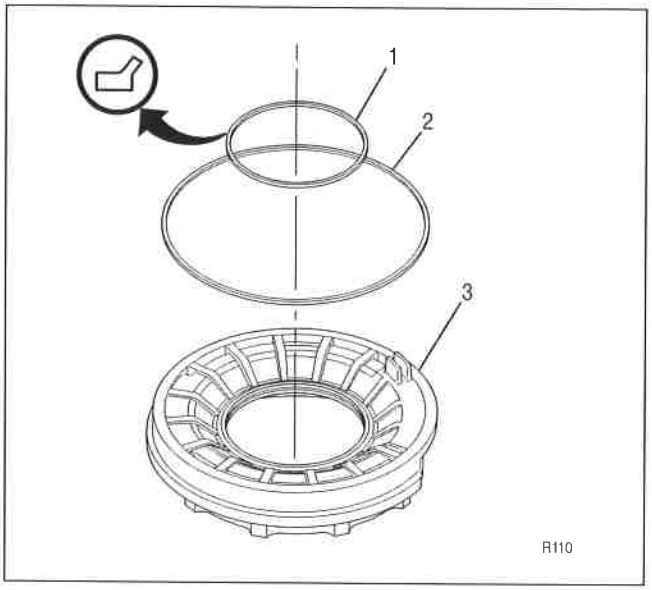
CAUTION:

To help avoid damage to the output shaft, always use J 44526 to remove the output shaft bushing.

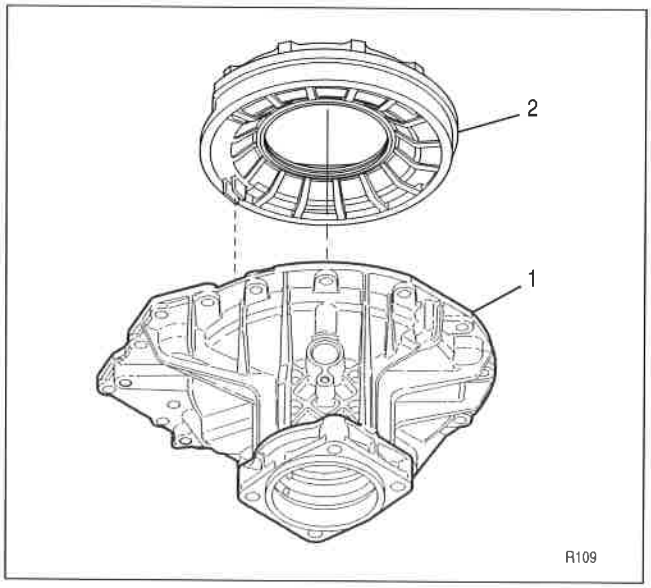
1. Install J 44526-2 (8) into J 44526-1 (7).
2. Install J 44526-2 (8) and J 44526-1 (7) into bushing (9).
3. Install the washer (6) and nut (5) onto J 44526-2 (8).
4. While holding the top of J 44526-2 (8) with a wrench, tighten the nut (5) until J 44526-1 (7) engages the bushing (9).
5. Install J 44526-3 (4) onto J 44526-2 (8).
6. Install the bearing (3), washer (2), and nut (1) onto J 44526-2 (8).
7. While holding the top of J 44526-2 (8) with a wrench, tighten nut (1) until the bushing is dislodged.
8. Remove the J tools.
9. Remove the bushing from the J tools.



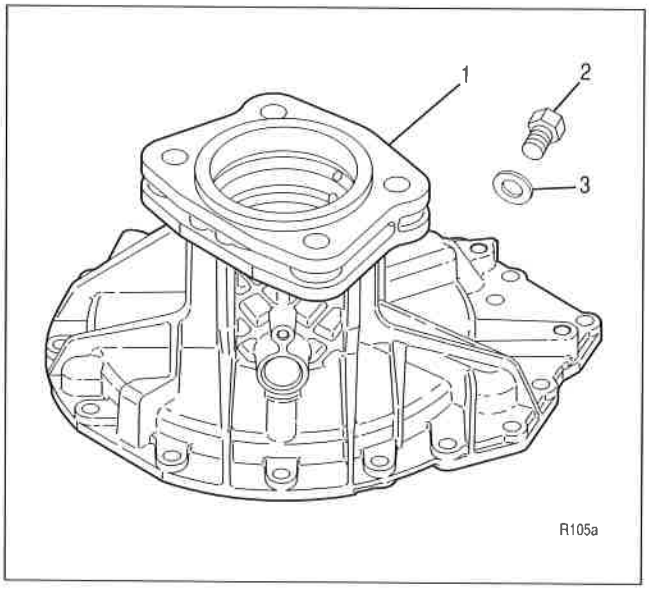
5. Install sealrings (1) and (2) onto C5 clutch piston (3). Lubricate the sealrings with petrolatum.



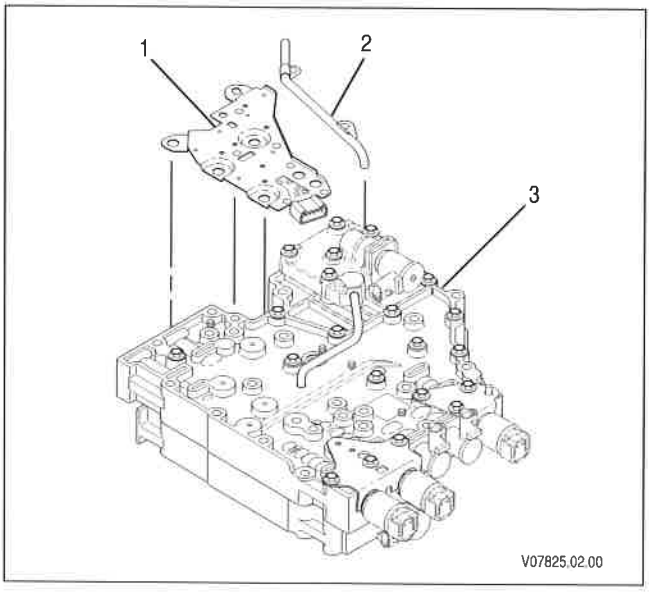
6. Position the rear cover so the rear of the cover is facing down.
7. Align the tang on the C5 clutch piston (2) with the tang hole in rear cover (1).
8. Install the C5 clutch piston (2) into the rear cover (1).



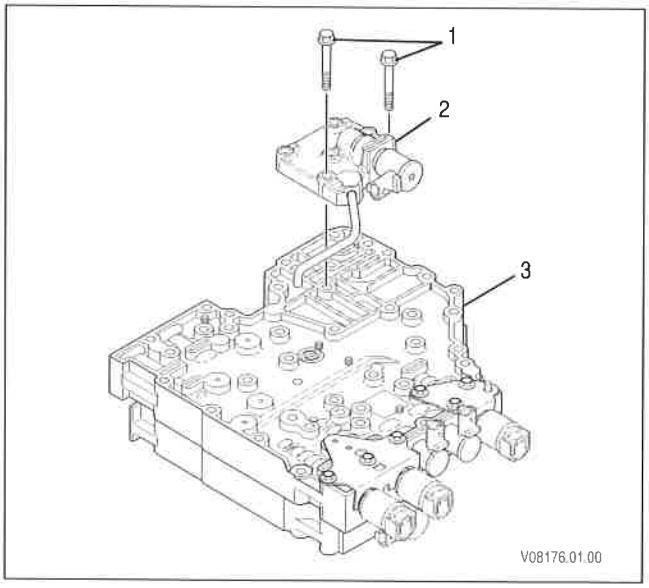
9. If equipped with a tachograph plug (2):
   - Position the rear cover (1) on the work table so that the rear of the cover is facing up.
   - Install the washer (3) onto the tachograph plug (2).
   - Install the tachograph plug (2) and washer (3) into rear cover (1).
   - Tighten the tachograph plug to 60–67 N·m (44–49 lb ft).



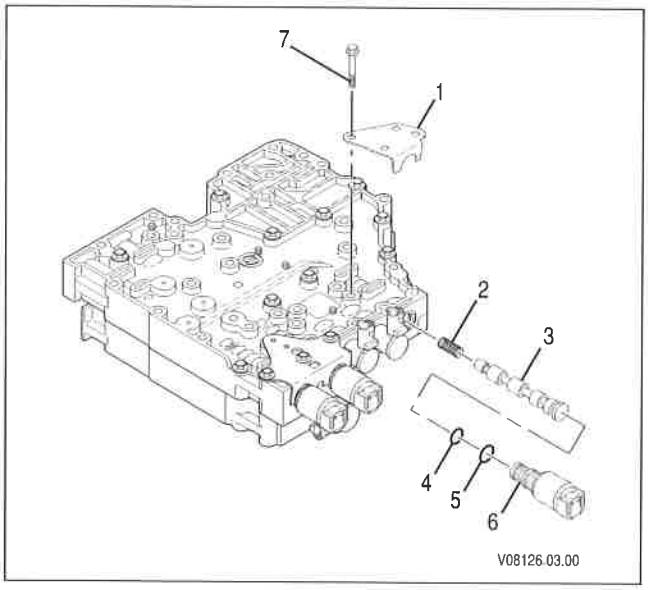
3. Remove the pressure switch assembly (1) from the main valve body (3).
4. Remove the reverse signal tube (2) from the main valve body (3).



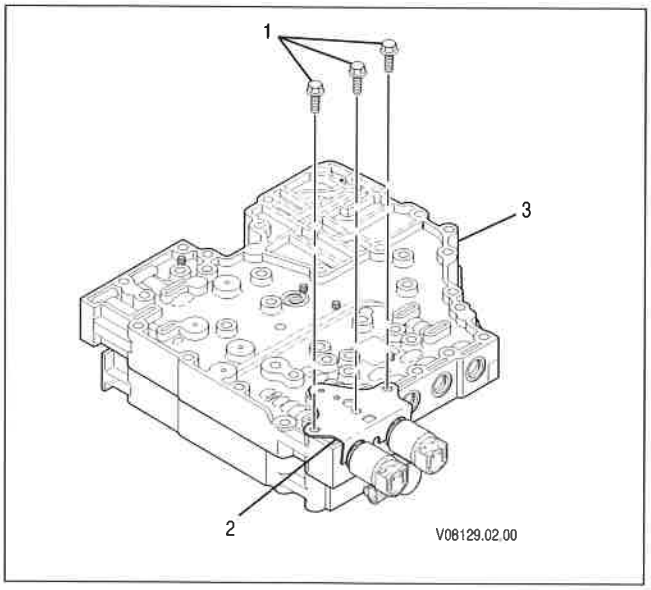
5. Remove the two bolts (1) securing the modulated main valve body (2) to the valve body (3).
6. Remove the modulated main valve body (2) and the six speed tube.
7. Remove the six speed tube from the modulated main valve body.



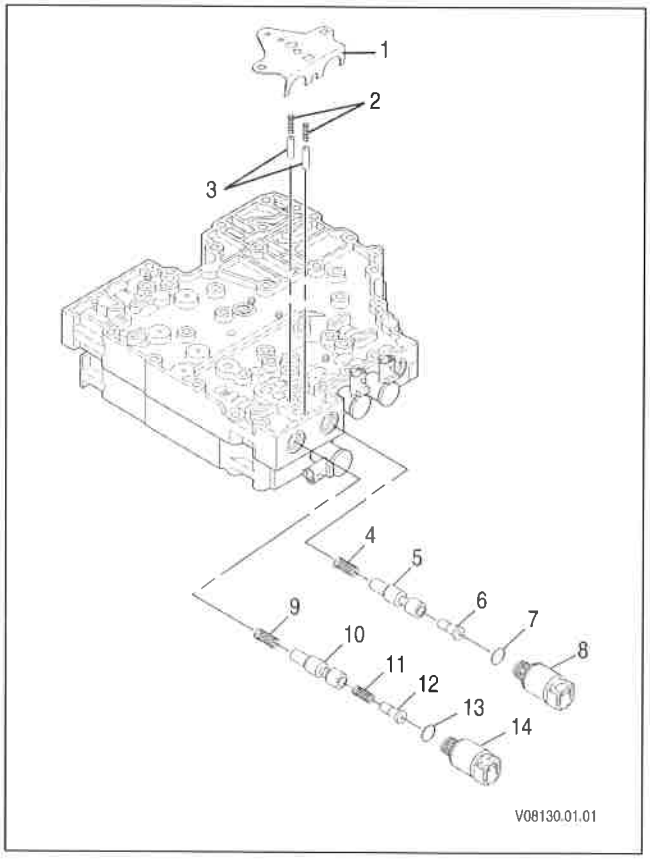
8. Remove the bolt (7) securing the Torque Converter Clutch (TCC) solenoid bracket (1) to the main valve body (3).
9. Remove the TCC solenoid bracket (1).
10. Remove the TCC solenoid (6), valve (3), and spring (2).
11. Remove the O-rings (4) and (5) from the TCC solenoid (6) and discard.



20. Remove the three bolts (1) securing Pressure Control Solenoid 1/Pressure Control Solenoid 2 (PCS1/PCS2) bracket (2) to the main valve body (3).



21. Remove the PCS1/PCS2 bracket (1), two accumulator springs (2), and two accumulator plugs (3).
22. Remove the PCS1 (14), valve (12), spring (11), valve (10), and spring (9).
23. Remove the PCS2 (8), valve (6), valve (5), and spring (4).
24. Remove the O-ring (13) from PCS1 (14) and discard.
25. Remove the O-ring (7) from PCS2 (8) and discard.

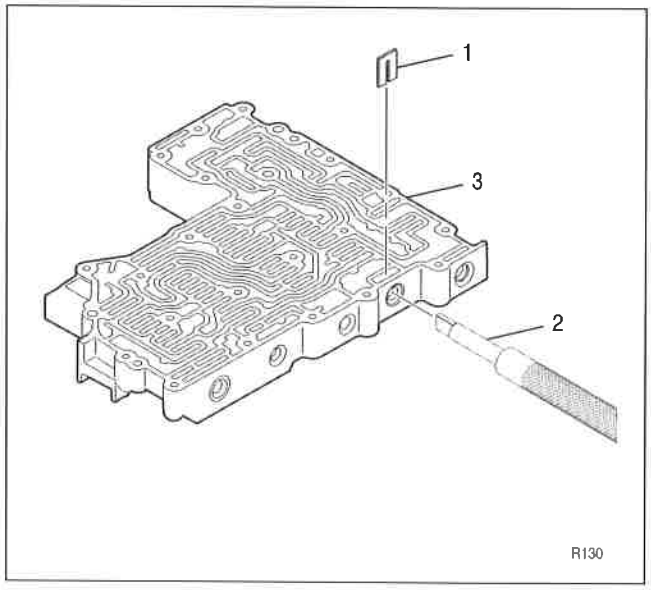


b. Disassembly of Shift Valve Body

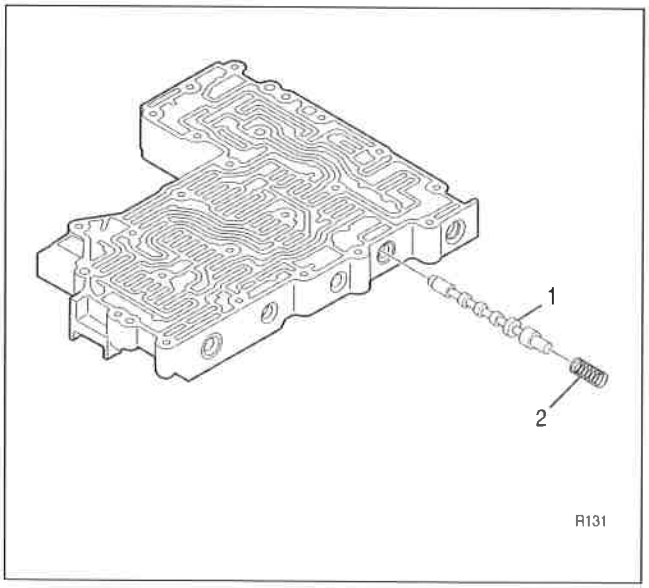
Tools Required

- J 33163 Valve Tray Set
- J 43773 Valve Spring Compressor

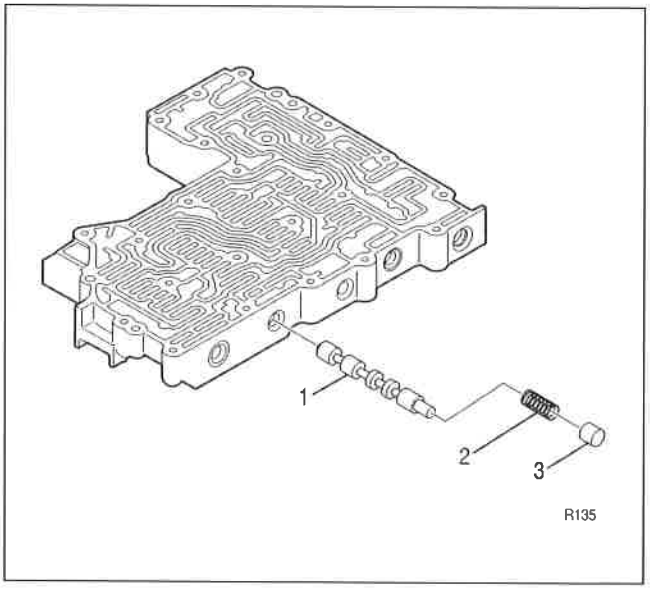
1. Using J 43773 (2), compress the Shift Valve 1 (SV1) spring until the retaining clip (1) is loose. Remove the retaining clip from the shift valve body (3).



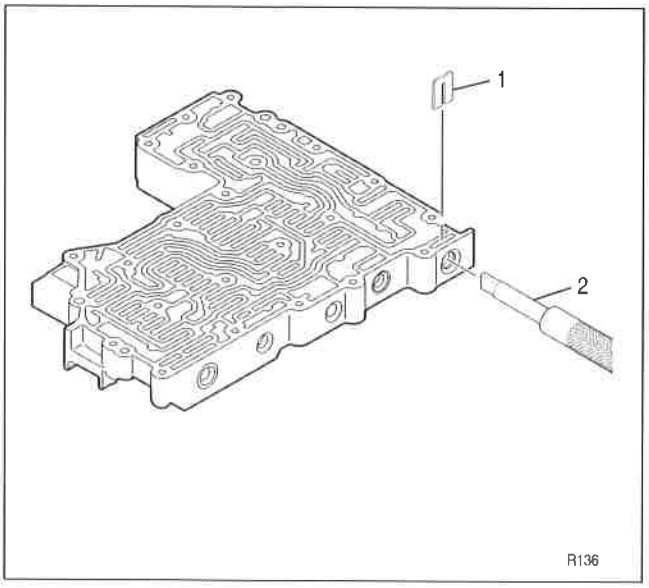
2. Remove the spring (2) and SV1 (1).



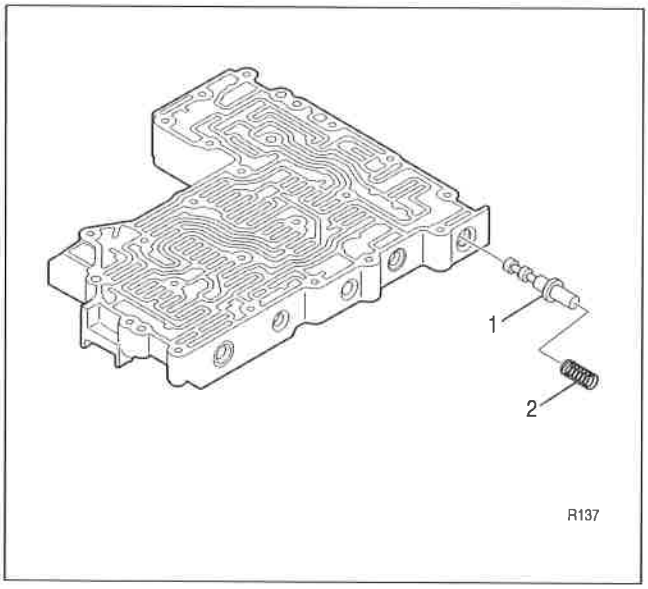
6. Remove the plug (3), spring (2), and SV2 (1).



7. Using J 43773 (2), compress the control main valve spring until the retaining clip (1) is loose. Remove the retaining clip.



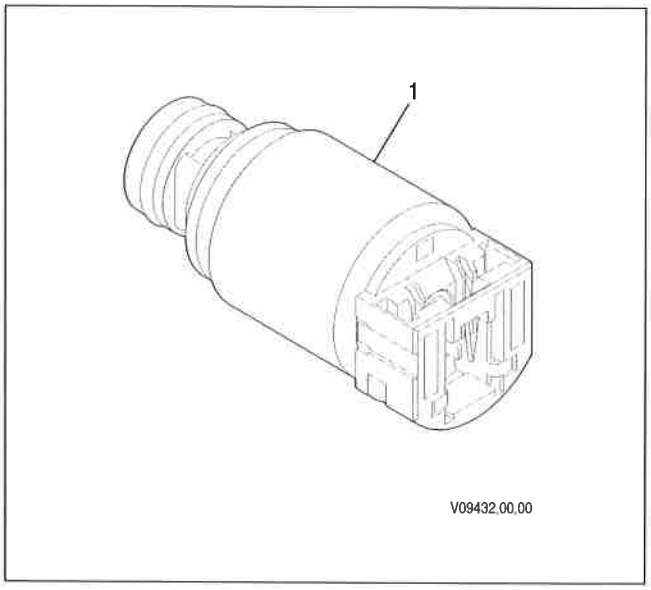
8. Remove the spring (2) and control main valve (1).



3. Measure the resistance of PCS1, PCS2, and TCC solenoids (1). If the resistance does not meet the following specifications, replace the solenoid.

Sump Temperature		Resistance
(°C)	(°F)	(Ohms)
0	32	4.47–4.84
20	68	4.85–5.25
40	104	5.23–5.66

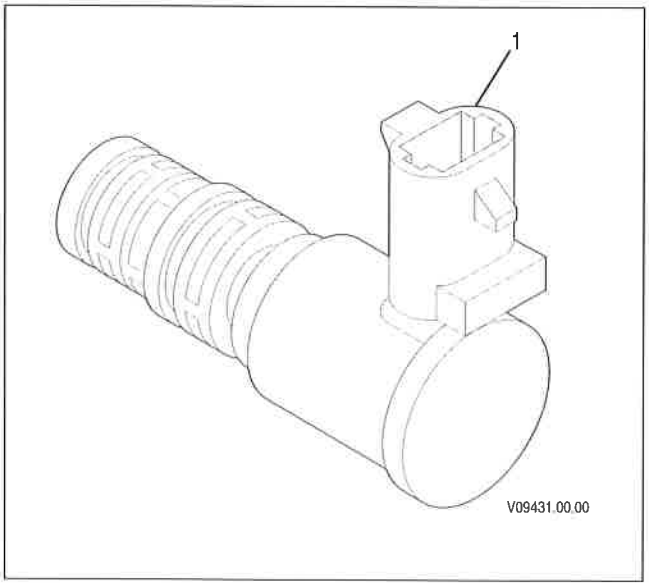
4. Test for a short between the solenoid coil and the solenoid case. The multimeter should indicate an open circuit or infinite resistance.



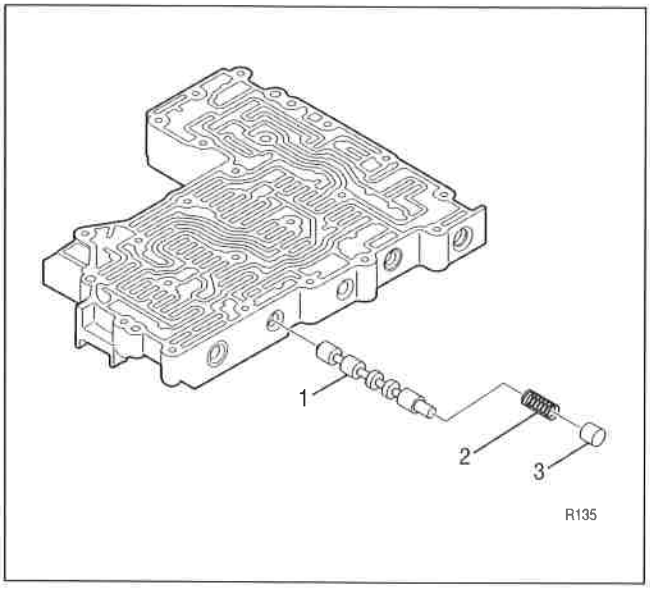
5. Measure the resistance of SS1, SS2, SS3, and the modulated main solenoid (1). If the resistance does not meet the following specifications, replace the solenoid.

Sump Temperature		Resistance
(°C)	(°F)	(Ohms)
0	32	19.35–21.19
20	68	21.00–23.00
40	104	22.65–24.81

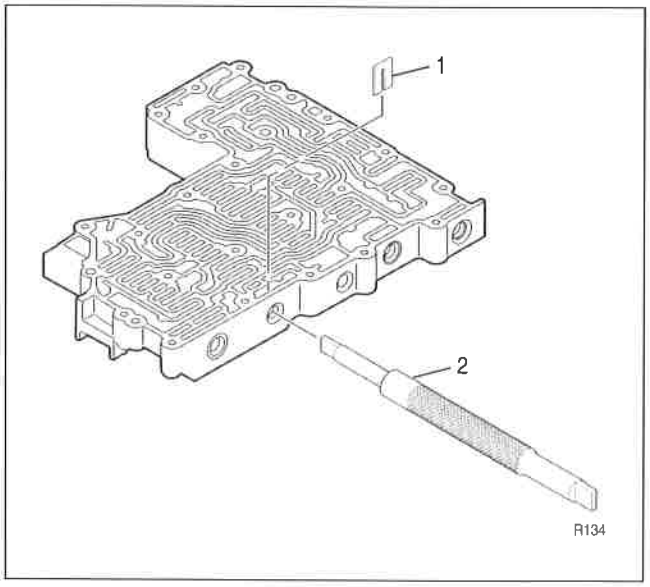
6. Test for a short between the solenoid coil and the solenoid case. The multimeter should indicate an open circuit or infinite resistance.



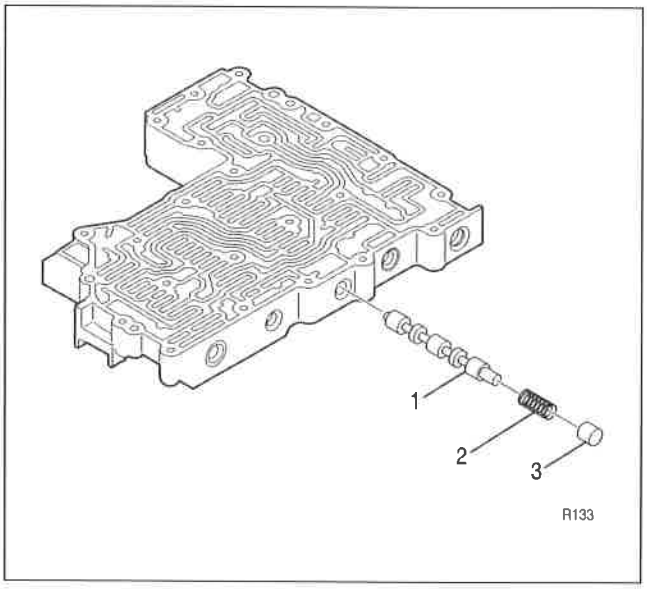
6. Install SV2 (1), spring (2), and plug (3).



7. Compress the spring with J 43773 (2).
8. Install the retaining clip (1). Make sure the retaining clip is below the valve body surface.



9. Install SV3 (1), spring (2), and plug (3).

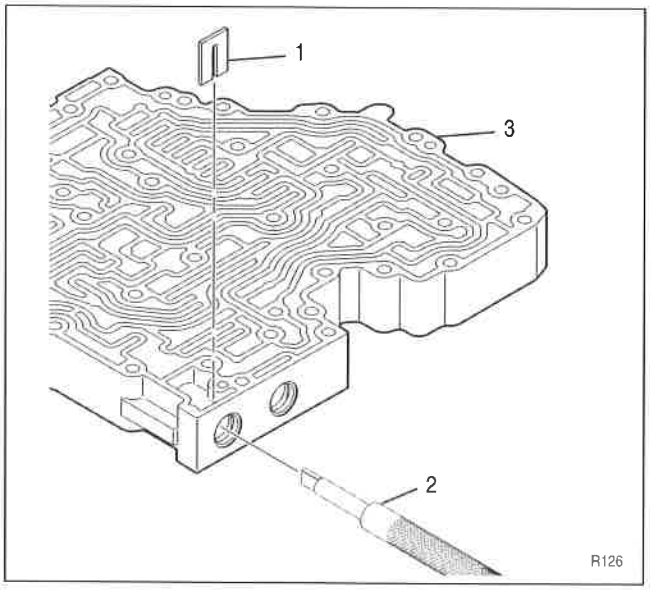


f. Disassembly of the Main Valve Body

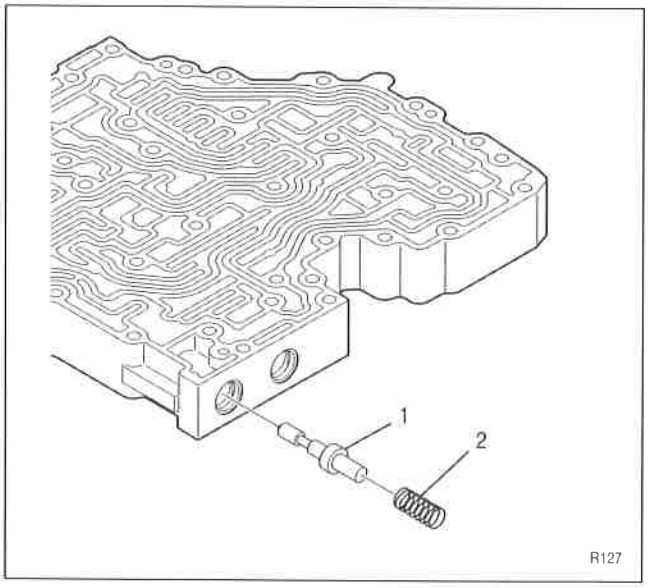
Tools Required

- J 33163 Valve Tray Set
- J 43773 Valve Spring Compressor

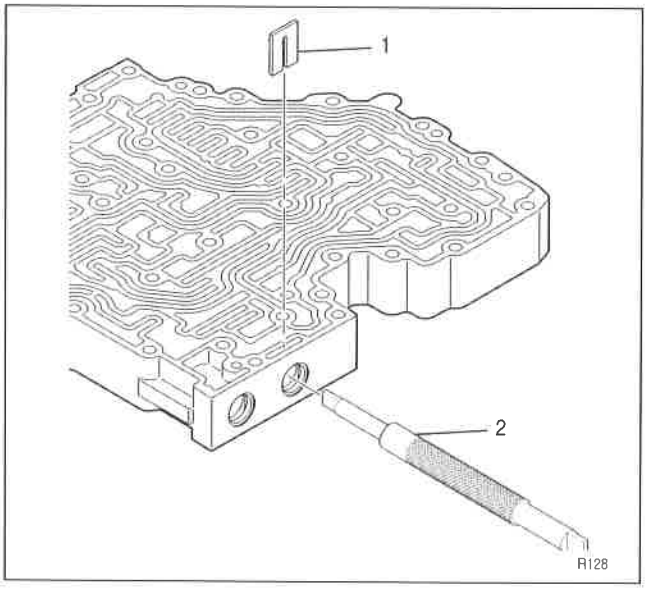
1. Using J 43773 (2), compress the control main relief spring until the retaining clip (1) is loose. Remove the retaining clip from valve body (3).



2. Remove the spring (2) and the control main relief valve (1).



3. Using J 43773 (2), compress the exhaust backfill spring until the retaining clip (1) is loose. Remove the clip.

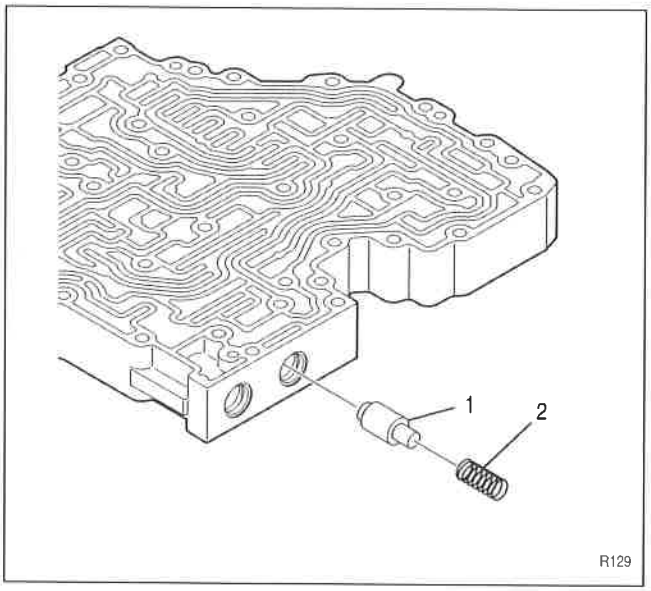


h. Assembly of the Main Valve Body

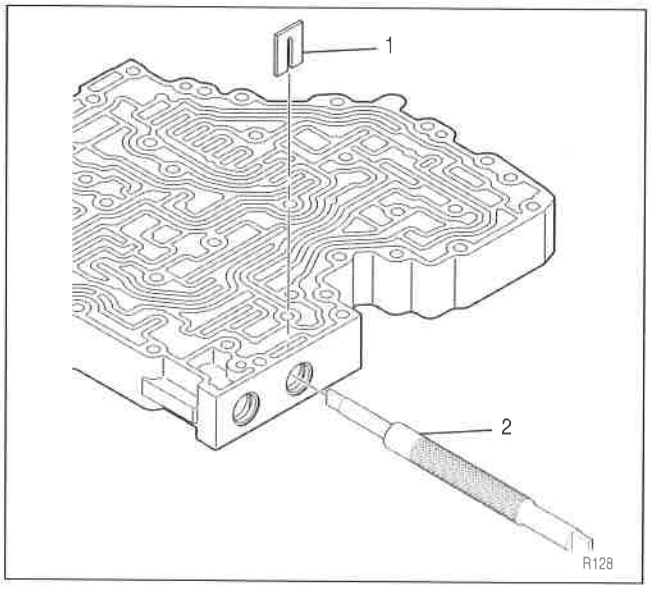
Tools Required

- J 33163 Valve Tray Set
- J 43773 Valve Spring Compressor

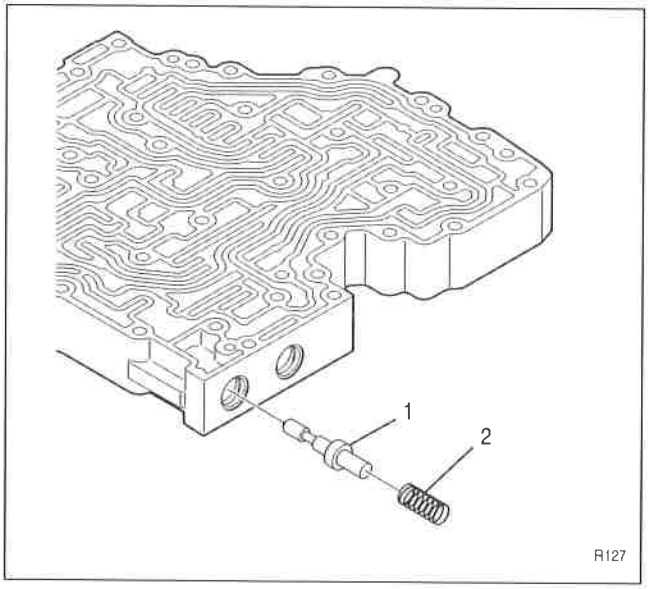
1. Install the exhaust backfill valve (1) and spring (2).



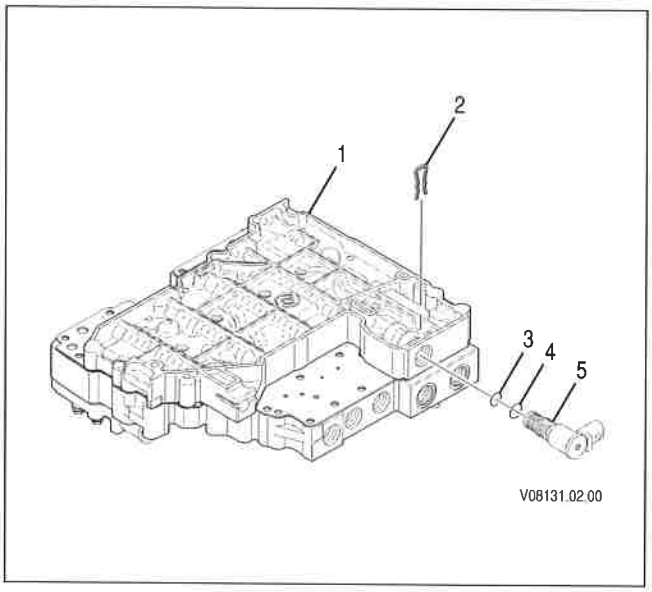
2. Compress the spring with J 43773 (2).
3. Install the retaining clip (1). Make sure the retaining clip is below the valve body surface.



4. Install the control main relief valve (1) and spring (2).



8. Position the control valve assembly on the work table so the shift valve body (1) is facing up.

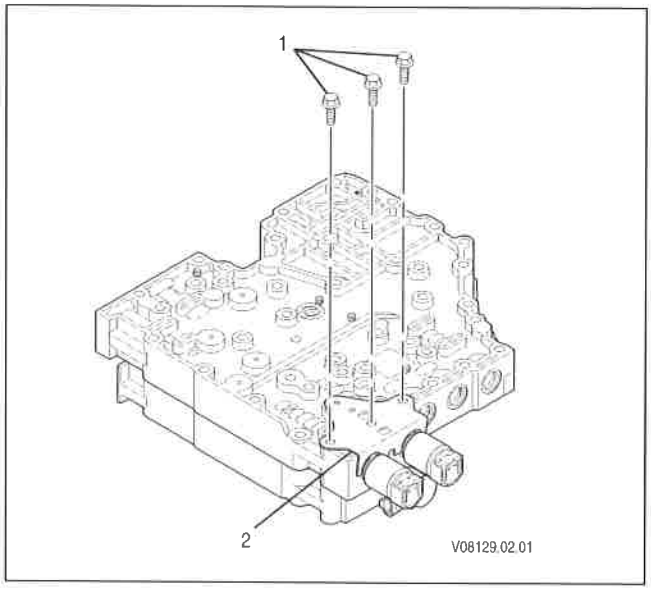


NOTE:

- **O-ring (4) is slightly larger than O-ring (3).**
- **SS1 (5) has P/N 29536833 printed on the solenoid.**

9. Install solenoid O-ring (4) onto SS1 (5).
10. Install solenoid O-ring (3) onto SS1 (5).
11. Align SS1 (5) so the electrical connector points away from the selector valve and is parallel to the separator plate.
12. Push the solenoid into the shift valve body (1) until the solenoid seats.
13. Install solenoid retaining clip (2).

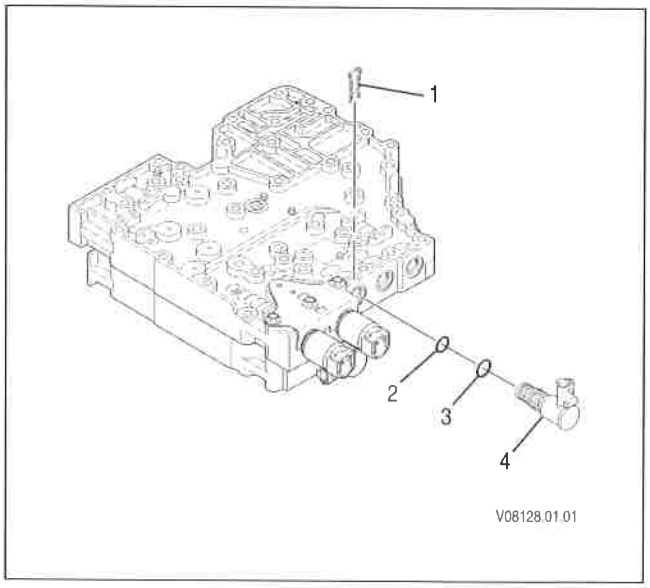
26. Install the three bolts (1) through PCS1/PCS2 bracket (2). Tighten the bolts to 10–13 N·m (88–115 lb inch).



NOTE:

- **Original solenoid O-rings are blue, replacement O-rings are brown. O-ring (3) is slightly larger than O-ring (2).**
- **SS3 (4) has P/N 29536833 printed on the solenoid.**

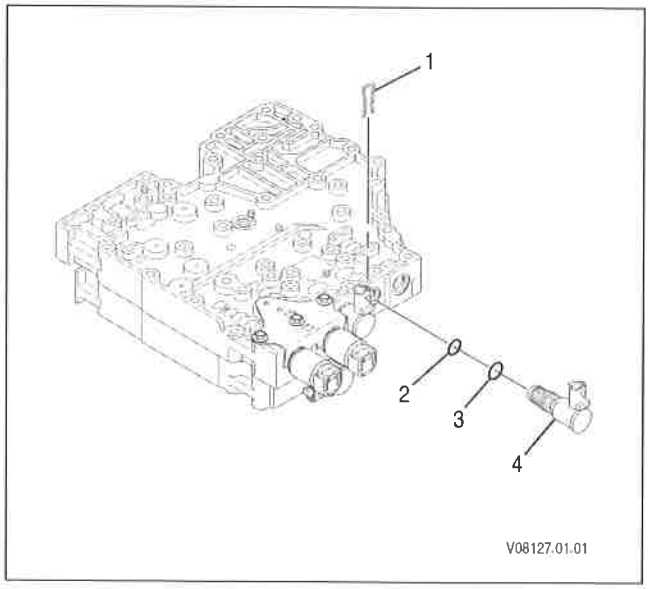
27. Install the solenoid O-ring (3) onto SS3 (4). Lubricate O-ring with clean transmission fluid.
28. Install the solenoid O-ring (2) onto SS3 (4). Lubricate O-ring with clean transmission fluid.
29. Install SS3 (4) so the solenoid electrical connector faces up.
30. Install the solenoid retaining clip (1).



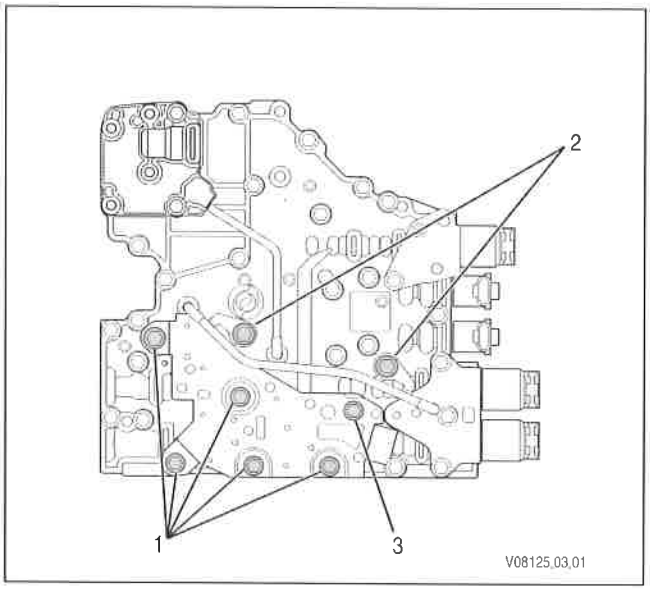
NOTE:

- **The solenoid O-rings are brown. O-ring (3) is slightly larger than O-ring (2).**
- **SS2 (4) has P/N 29536833 printed on the solenoid.**

31. Install the solenoid O-ring (3) onto SS2 (4). Lubricate O-ring with clean transmission fluid.
32. Install the solenoid O-ring (2) onto SS2 (4). Lubricate O-ring with clean transmission fluid.
33. Install SS2 (4) so the solenoid electrical connector faces up.
34. Install the solenoid retaining clip (1).

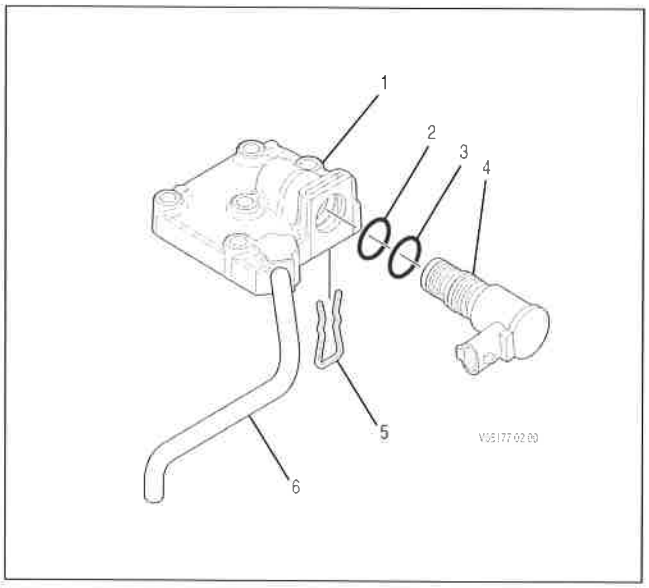


46. Install the five bolts (1) and one silver bolt (3) securing the pressure switch assembly to the main valve body.
47. Install the two bolts (2) securing the reverse signal tube to the main valve body.
48. Tighten bolts (1), (2), and (3) to 10–13 N·m (88–115 lb inch).



j. Assembly of Modulated Main Valve Body

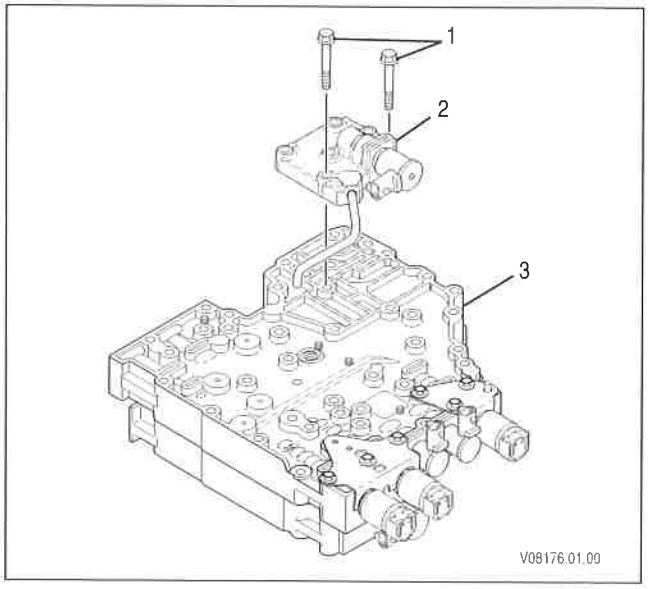
1. Install the O-ring (3) onto the modulated main solenoid (4). Lubricate O-ring with clean transmission fluid.
2. Install the O-ring (2) onto the modulated main solenoid (4). Lubricate O-ring with clean transmission fluid.
3. Install the modulated main solenoid (4) into its bore in the modulated main valve body (1) with the electrical connector pointing to the sixth range tube hole.
4. Install the solenoid retaining clip (5) into the valve body.
5. Install the sixth range tube (6) into the modulated main valve body.
6. Align the modulated main valve body (2) with its bolt holes in the main valve body (3).
7. Install the sixth range tube into its hole in the main valve body.



NOTE:

The modulated main valve body retaining bolts, M6 x 1.0 x 65, are slightly longer.

8. Install the two bolts (1) securing the modulated main valve body (2) to the main valve body (3).
9. Tighten the bolts to 10–13 N·m (88–115 lb inch).

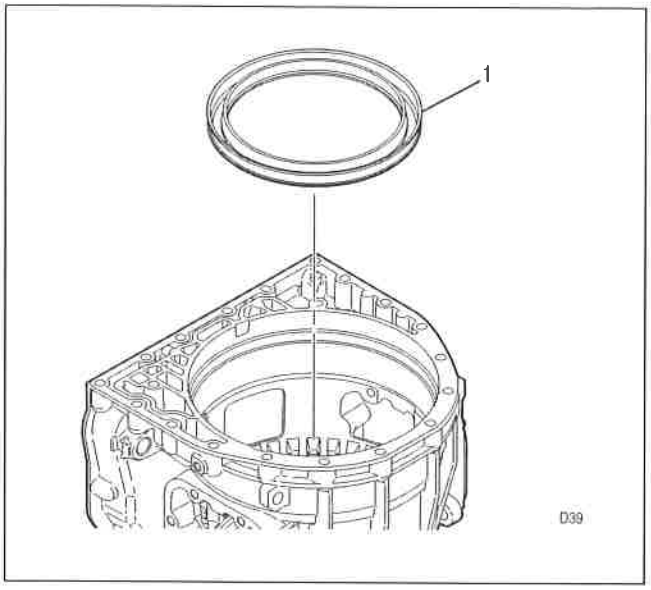


6–1. C3 CLUTCH INSTALLATION

Tools Required

- J 24204-2 Bar and Stud Assembly
- J 44530 C3/C4 Piston Spring Compressor

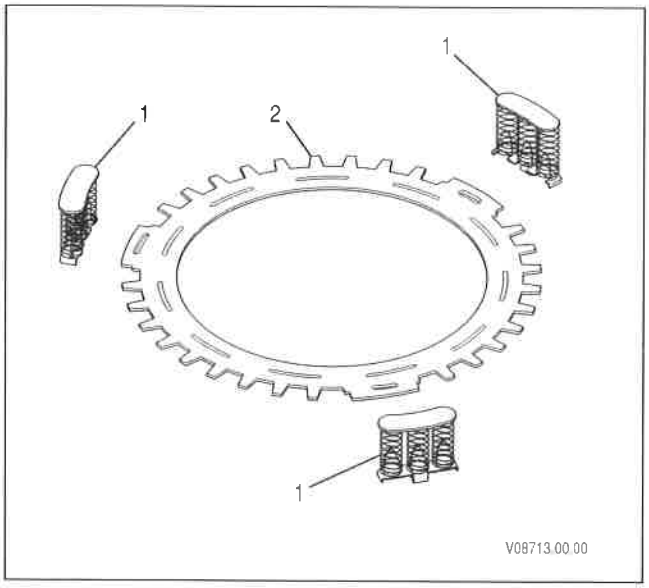
1. Position the main housing so the front of the main housing is facing up.



NOTE:

Do not reuse the old C3 clutch piston assembly. Install a new C3 clutch piston assembly.

2. Apply petrolatum to the inside and outside diameter of a new C3 clutch piston assembly (1).
3. Align the new C3 clutch piston assembly (1) with the main housing so the seal is facing down and the 1.016 mm (0.040 inch) lubrication/cooling orifice is positioned at the top of the main housing.
4. Install the C3 clutch piston assembly. Gently tap the piston until it seats.
5. Install three piston return spring assemblies (1) onto the C3 spring plate (2) so the spring assemblies are securely engaged in the retaining slot in the spring plate.

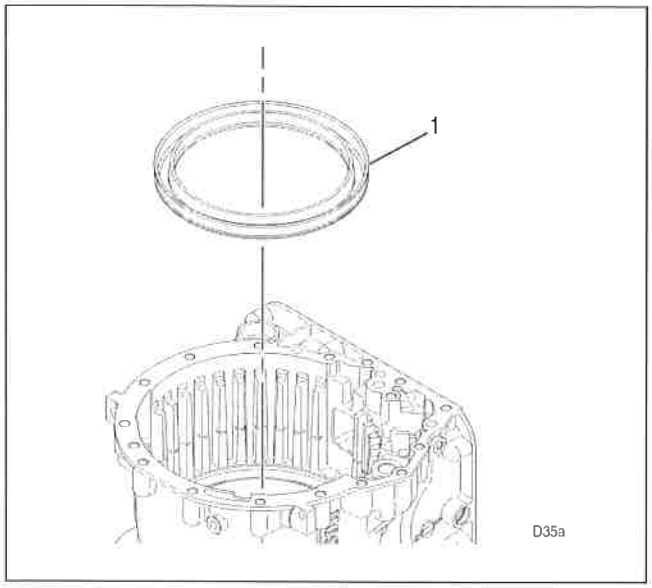


6–2. P1 PLANETARY MODULE AND C4 CLUTCH INSTALLATION

Tools Required

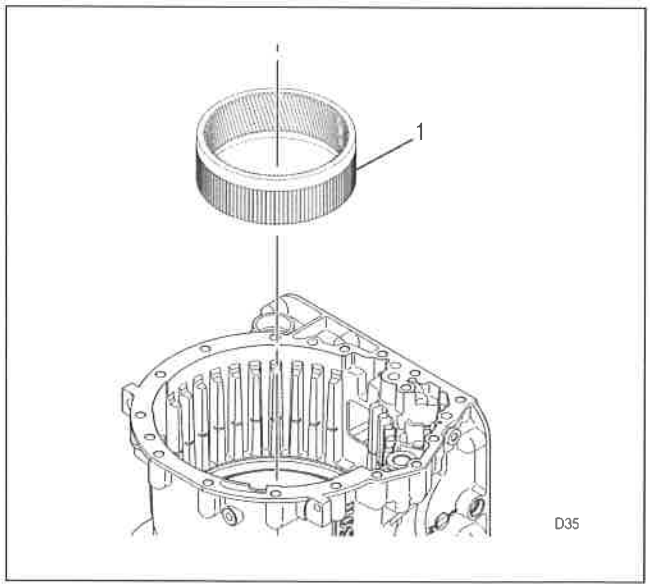
- J 24204-2 Bar and Stud Assembly
- J 44530 C3/C4 Piston Spring Compressor

1. Position the main housing so the rear of the main housing is facing up.

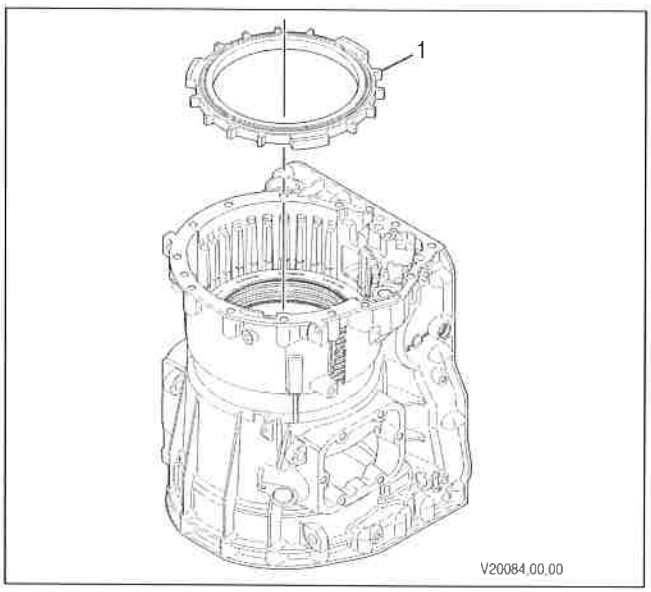


NOTE:
Do not reuse the old C4 clutch piston assembly. Install a new C4 clutch piston assembly.

2. Apply petrolatum to the inside and outside of the new C4 clutch piston assembly (1).
3. Align the C4 clutch piston assembly (1) so the seal is facing down and the 1.016 mm (0.040 inch) lubrication/cooling orifice is positioned at the top of the main housing.
4. Install the C4 clutch piston assembly (1). Gently tap the piston until it seats.
5. Align the P1 ring gear (1) so the outside splines are facing down.
6. Install the P1 ring gear (1). Rotate the ring gear until the C3 friction plates are engaged.
7. Make sure the P1 ring gear (1) is seated against the thrust plates of the C3 clutch backplate assembly.



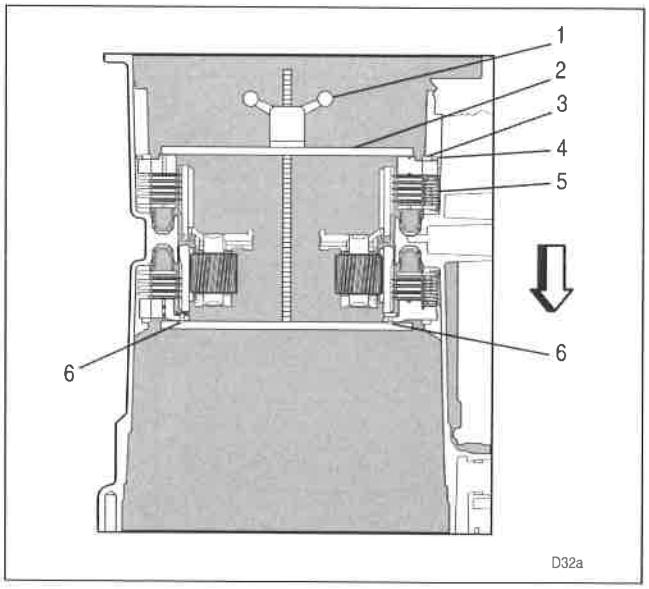
15. Install the C4 clutch backplate (1) as illustrated.



CAUTION:

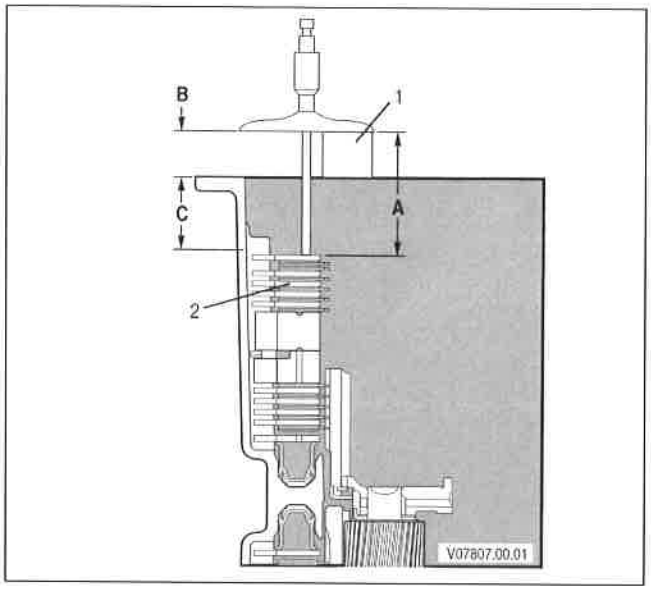
- **Do not install special tools (J tools) onto the gear thrust plate rivets of the C3 clutch backplate assembly. The special tools could damage the gear thrust plate rivets.**
- **Do not damage the P1 planetary carrier bushing when installing J 24204-2 into the main housing. The threaded rod of J 24204-2 must pass through but not touch the bushing.**

16. Install J 24204-2 (1) and J 44530 (2) into the main housing. Make sure J 24204-2 does not touch the gear thrust plate rivets (6) on the C3 clutch backplate assembly.
17. Compress the piston return spring assemblies (5) until the C4 backplate is below the retaining ring groove.
18. Install narrow retaining ring (4) so the gap is located at the 9 o'clock position when viewed from the back of the main housing.
19. Install retaining ring (3) so the gap is located at the 3 o'clock position when viewed from the back of the main housing. Refer to SIL 2-1K2K-05.
20. Remove J 24204-2 and J 44530 from the main housing.



6. Using the J 24204-2 wing nut, compress the C5 clutch plates until hand tight.
7. At the location near J 44530 spring compressor, place a 25 mm (1 inch) gauge bar (1) on the rear surface of the main housing.
8. Measure the distance from the top of the gauge bar to the top of C5 clutch stack (2) (Dimension A).
9. To obtain Dimension C, subtract Dimension B, the width of the gauge bar, from Dimension A.
10. Using Dimension C and the following table, select a C5 clutch reaction plate.

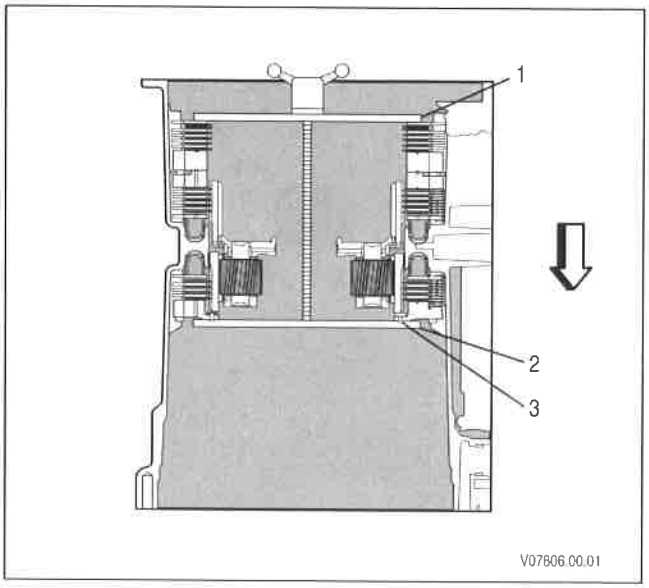
Dimension C	Part Number	ID Number
35.37–35.86 mm (1.393–1.412 in.)	29536481	1
35.87–36.36 mm (1.412–1.431 in.)	29536482	2
36.37–37.27 mm (1.432–1.467 in.)	29536483	3



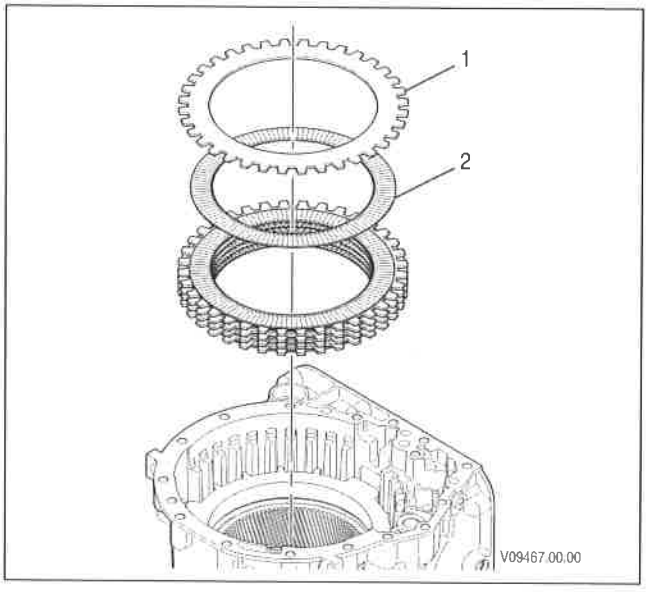
CAUTION:

Do not damage the P1 planetary carrier bushing when removing J 24204-2 from the main housing. The threaded rod of J 24204-2 must pass through but not touch the bushing.

11. Remove J 24204-2 (2) and J 44530 (1).

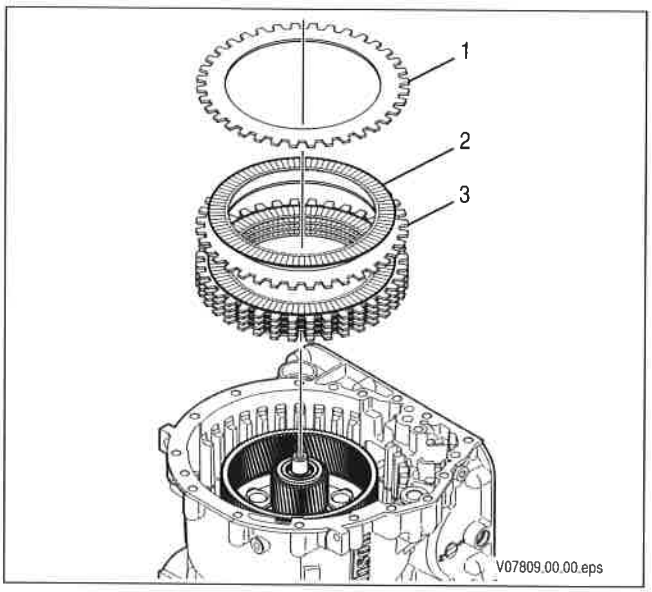


12. Remove six C5 clutch friction plates (2) and five C5 clutch reaction plates (1).



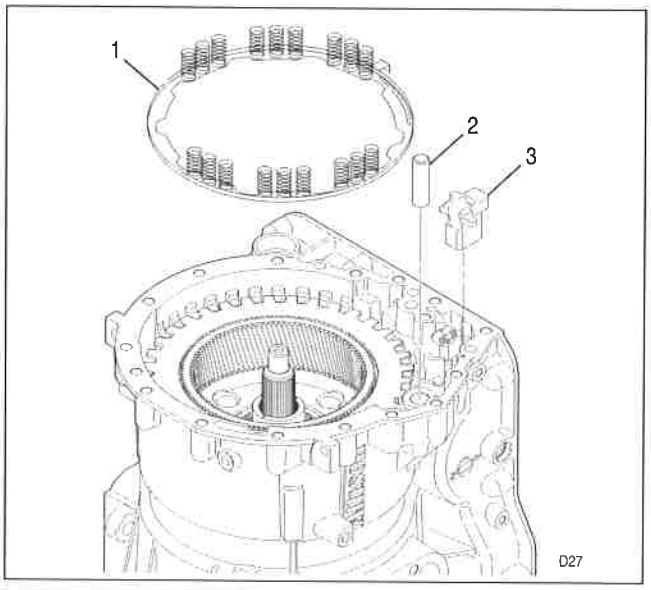
6–5. C5 CLUTCH INSTALLATION

1. Starting with a C5 clutch friction plate, alternately install six C5 clutch friction plates (2) and five C5 clutch reaction plates (3).
2. Install selected C5 clutch reaction plate (1).

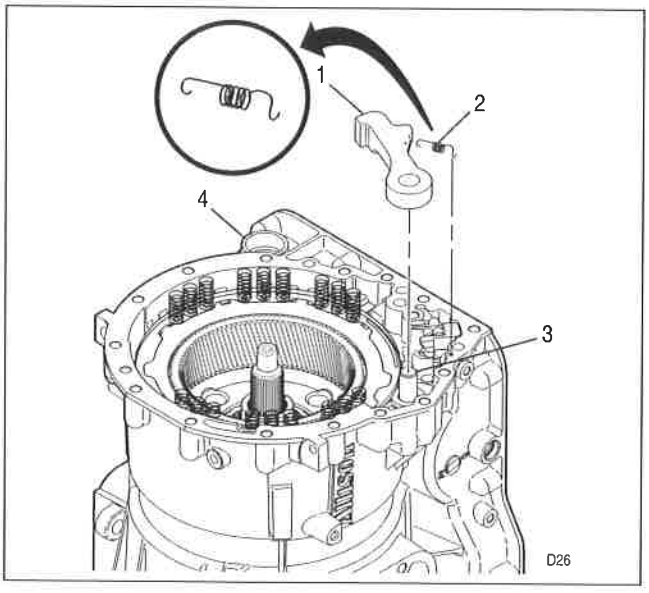


6–6. PARK PAWL INSTALLATION

1. If the transmission is equipped with a park pawl, install the park pawl apply assembly guide (3).
2. Align the tang in C5 piston return spring assembly (1) with the notch in the main housing.
3. Install the C5 piston return spring assembly (1).
4. Install the pawl support pin (2) into the main housing.



5. For transmissions equipped with park pawls, do the following.
   - Install the pawl return spring (2) onto the park pawl (1).
   - Align the park pawl and the pawl return spring toward the rear, with support pin (3).
   - Install the park pawl (1) onto the pawl support pin (3).
   - Connect the pawl return spring (2) to the main housing (4).



4. If equipped with a park brake cable bracket, do the following.

CAUTION:

The bolts used to install the torque converter housing and rear cover to the main housing are similar in size and color. The rear cover bolts are shorter than the torque converter housing bolts. Installing torque converter housing bolts into the rear cover may damage the main housing. To avoid installing torque converter housing bolts into the rear cover and vice versa, store the bolts separately. These bolts must be installed into their correct locations to avoid main housing damage.

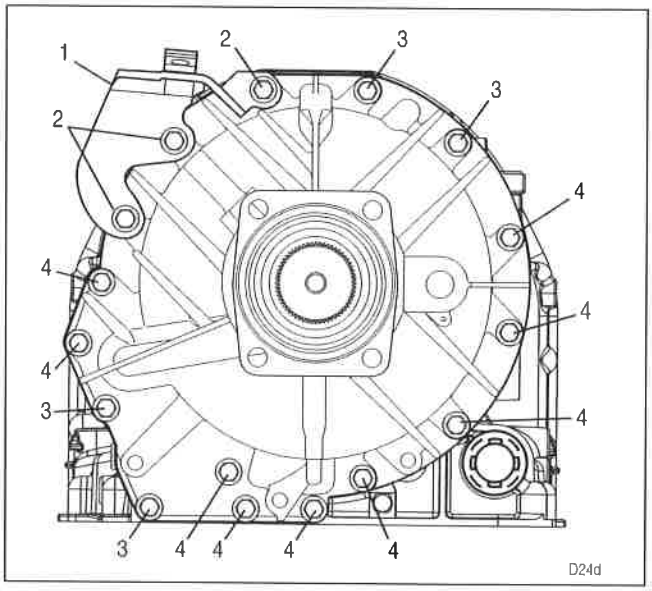
CAUTION:

Some transmissions have park brake cable brackets installed on their rear covers.

- **Use bolts 40 mm (1.6 inch) long to install a bracket 5 mm (0.197 inch) or less thick.**
- **Use bolts 45 mm (1.800 inch) long to install a bracket thicker than 5 mm (0.200 inch).**

Never install a 45 mm (1.800 inch) bolt into the rear cover without at least a 5 mm (0.200 inch) thick park brake cable bracket. Damage to the transmission may result.

- Hand install four rear cover bolts (3).
- Evenly tighten rear cover bolts (3) until the rear cover seats on the main housing.
- Install the bracket (1) onto the rear cover.
- Install the three bolts (2).
- Install the nine bolts (4).
- Tighten the rear cover bolts (2), (3), and (4) to 51–61 N·m (38–45 lb ft).



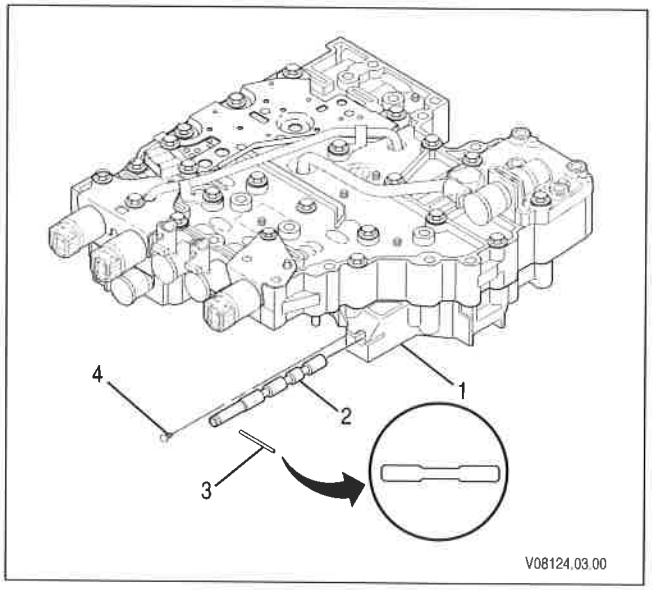
6–9. CONTROL VALVE ASSEMBLY INSTALLATION

1. Position the main housing so the valve body face of the main housing is facing up.
2. Align the selector valve pin (3) with the manual selector valve (2).
3. Rotate the selector valve pin until the pin seats into the manual selector valve.

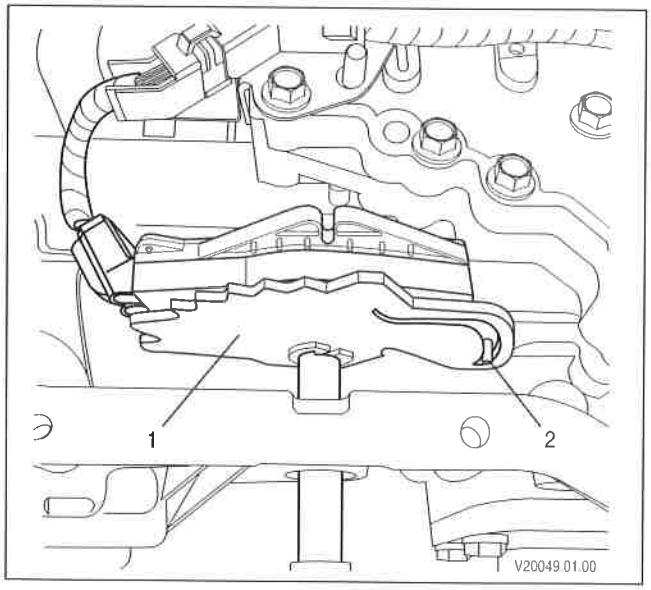
CAUTION:

Do not drop the main selector valve when removing or installing the control valve assembly. The main selector valve is easily damaged.

4. Install the manual selector valve into shift valve body (1).
5. Install the manual selector valve plug (4).



6. Rotate the detent lever and the Internal Mode Switch (IMS) fully counterclockwise.
7. Align the control valve assembly with the main housing while installing selector valve pin (2) into detent lever (1).

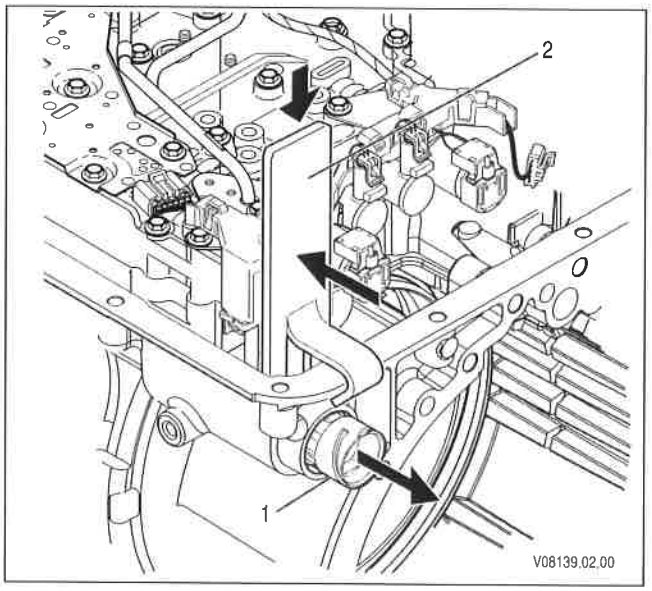


6–10. WIRING HARNESS ASSEMBLY INSTALLATION

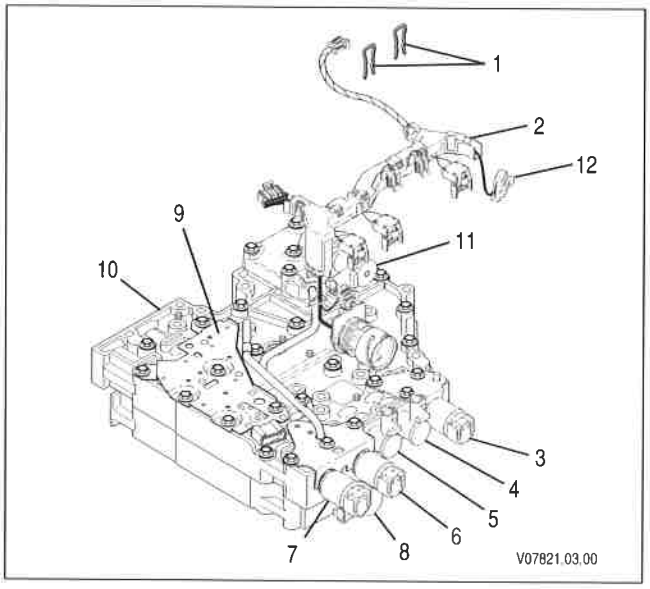
Tools Required

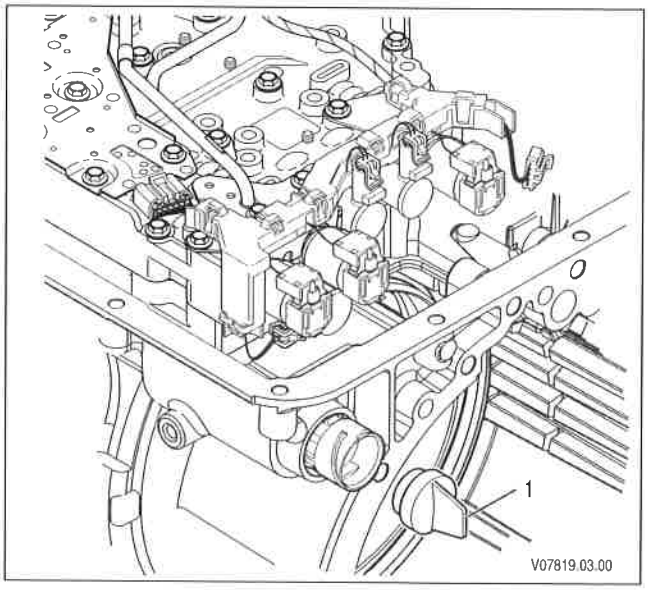
- J 44247 Wiring Harness Connector Installer

1. Install the internal wiring harness connector by hand into the main housing.
2. Using J 44247 (2), install the connector of internal wiring harness (1) into the main housing. The two tabs on the wiring harness connector snap into place.
3. Make sure the wiring harness connector is securely in place.



4. Remove the shift solenoid retainers (1).
5. Install internal wiring harness (2) onto main valve body (10).
6. Install the shift solenoid retainers (1) over the wiring harness tabs.
7. Connect the internal wiring harness (2) to the following components as shown.
   - Pressure Switch Assembly (9)
   - Shift Solenoid 1 (SS1) (8)
   - Torque Converter Clutch (TCC) solenoid (3)
   - Shift Solenoid 2 (SS2) (4)
   - Shift Solenoid 3 (SS3) (5)
   - Pressure Control Solenoid 2 (PCS2) (6)
   - Pressure Control Solenoid 1 (PCS1) (7)
   - Modulated Main solenoid (11)
   - Internal Mode Switch (IMS) (12)
8. If equipped, install the connector shipping cover (1) into the wiring harness connector.





6–12. ROTATING CLUTCH ASSEMBLY INSTALLATION

Tools Required

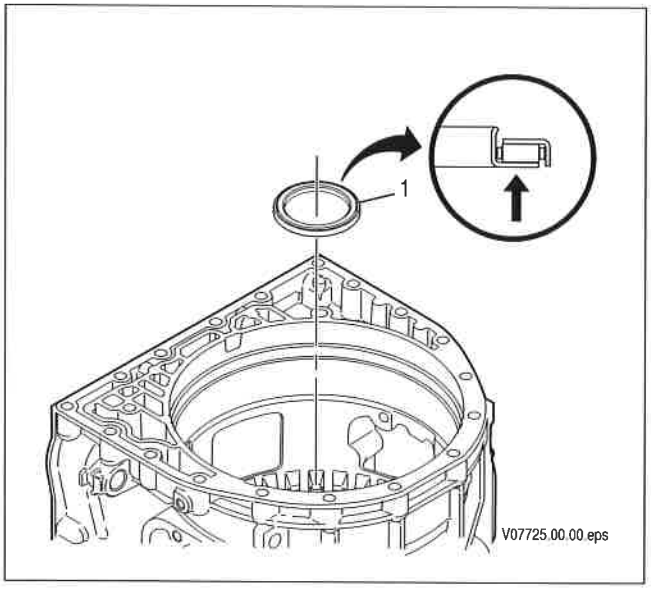
- J 44587 Main Shaft Holder

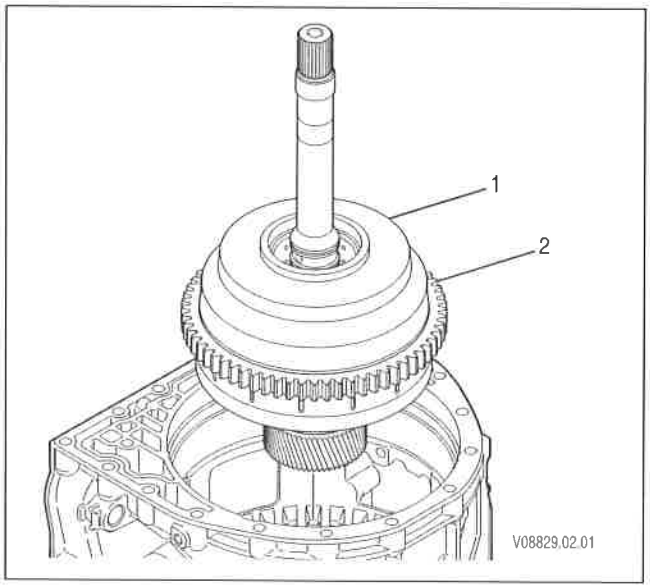
1. Position the main housing so the front of the main housing is facing up.
2. Apply petroleum to the T3 thrust bearing (1).

CAUTION:

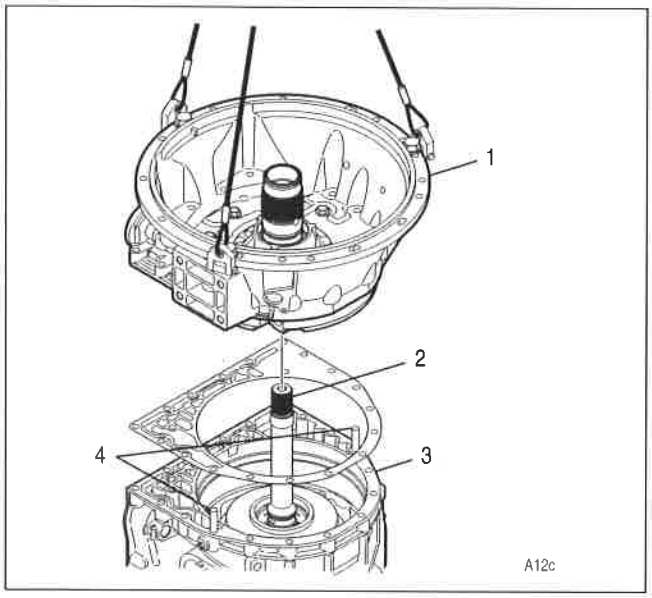
Installing the thrust bearing incorrectly could destroy the transmission.

3. Align the T3 thrust bearing (1) so the blue H pattern on the T3 thrust bearing is facing towards the P1 planetary carrier assembly.
4. Install the T3 thrust bearing (1) into the P1 planetary carrier assembly.
5. Install the rotating clutch assembly (1). Rotate the clutch assembly until the module seats.
6. Make sure one of the following is visible through the turbine speed sensor hole in the main housing:
   - The teeth of the Power Takeoff (PTO) gear (2)
   - The teeth of the turbine tone wheel





6. Lower the converter housing/front support module (1) over the turbine shaft (2) and onto the main housing (3).



CAUTION:

Transmission damage may occur if the torque converter housing is forced into position. If tapping does not cause the torque converter housing to drop into position, the P3 sun gear and/or P3 sun gear spacer or a sealring may be misaligned.

7. Tap the converter housing until the converter housing seats on the main housing. Remove the sling.

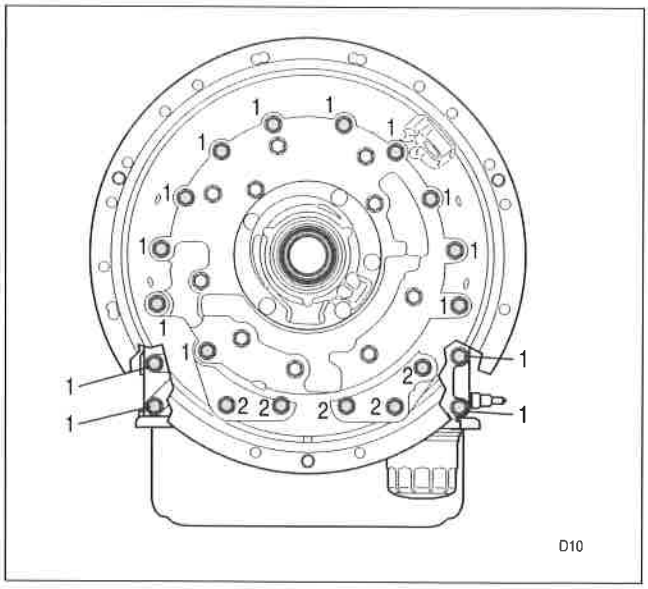
CAUTION:

The bolts used to install the torque converter housing and rear cover to the main housing are similar in size and color. The rear cover bolts are shorter than the torque converter housing bolts. Installing torque converter housing bolts into the rear cover may damage the main housing. To avoid installing torque converter housing bolts into the rear cover and vice versa, store the bolts separately. These bolts must be installed into their correct locations to avoid main housing damage.

8. Remove the two guide bolts (4) from the main housing.

9. For SAE No. 2 or No. 3 torque converter housings:

   - Install the fifteen bolts (1).
   - Install the five bolts (2).
   - Tighten the 20 bolts to 51–61 N·m (38–45 lb ft).

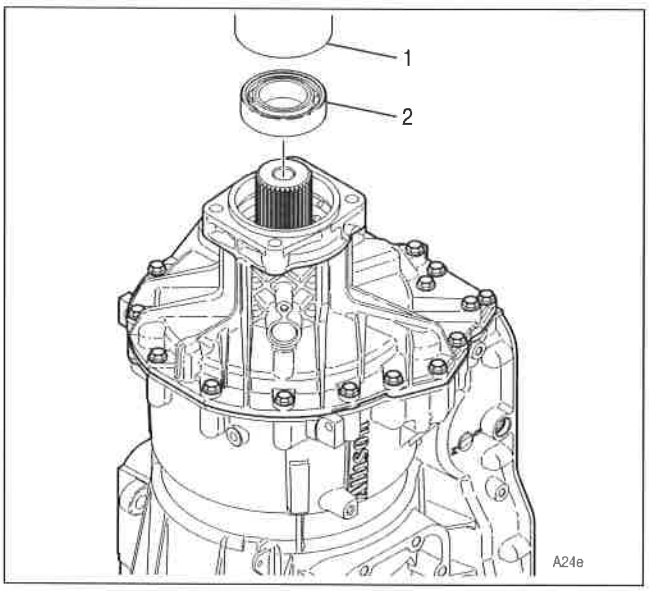


6–15. TRANSMISSION END PLAY CHECK

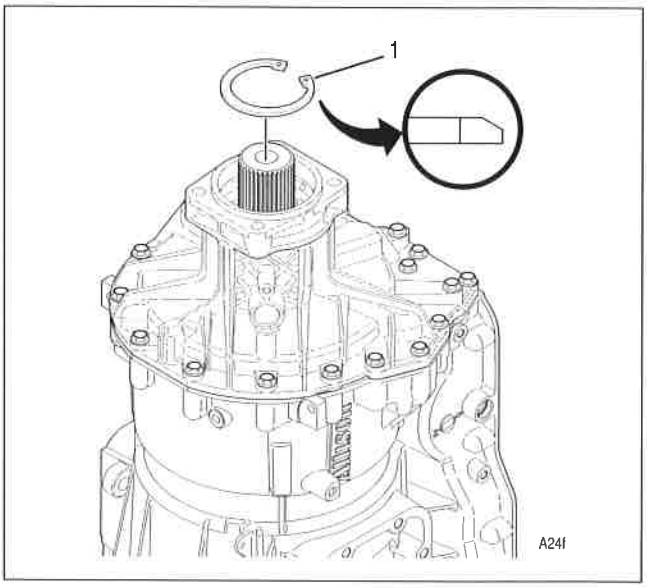
Tools Required

- J 24446 Rear Bearing Installer
- J 5959 Dial Indicator Set

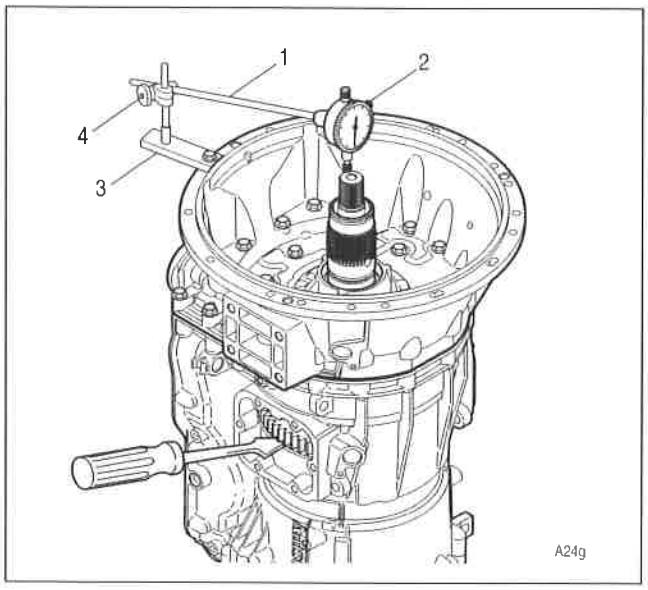
1. Using J 24446 (1), install the ball bearing (2) until the bearing seats.



2. Align the retaining ring (1) so the beveled edge is facing up.
3. Install the retaining ring (1).



4. Position the main housing so the front is facing up. Assemble the following tools and install them onto the torque converter housing as shown.
   - J 5959-1 (2) Dial Indicator
   - J 5959-2 (3) Mounting Bracket
   - J 5959-3 (1) Extension Arm
   - J 5959-7 (4) Clamp
5. Zero the dial indicator (2).



CAUTION:
To avoid equipment damage, Do not pry on a tone wheel. If a tone wheel is present use the slots in the rotating clutch housing as a lifting point.

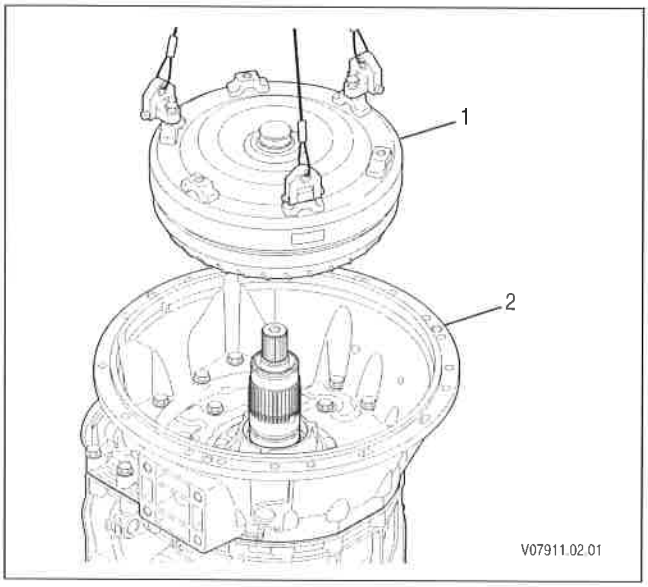
6–16. TORQUE CONVERTER INSTALLATION

WARNING!

The 1000 and 2000 Product Families torque converter dry weights are approximately 29 kg (64 lb). To avoid personal injury and/or property damage:

- **Use caution when installing, removing, or moving the torque converter.**
- **Get help when lifting the torque converter. Assistance from a hoist or another person may be required.**
- **Make sure lifting equipment can properly support the torque converter.**

1. Position the transmission so the torque converter housing (2) is facing up.
2. Attach a sling to the torque converter (1). Attach a hoist to the sling.
3. Lower the torque converter (1) over the turbine shaft and the ground sleeve and into the main pump assembly. Make sure the torque converter is seated in the main pump assembly.
4. Remove the sling.



WARNING!

The torque converter must be secured to the torque converter housing by a retaining device such as shipping brackets. Without the retaining device, the torque converter may slide forward, disengaging the oil pump, or may fall completely out of the transmission causing personal injury and/or property damage. Never tilt the converter end down unless a torque converter retaining device is installed.

NOTE:

The torque converter may not be properly seated if the shipping brackets cannot be installed.

A correctly installed torque converter lifts when the shipping bracket bolts are tightened.

6–17. REAR SEAL INSTALLATION (2WD TRANSMISSIONS ONLY)

Tools Required

- J 43782 Output Shaft Seal Installer
- J 43783 Output Shaft Seal Installer (Parking Brake Provision)

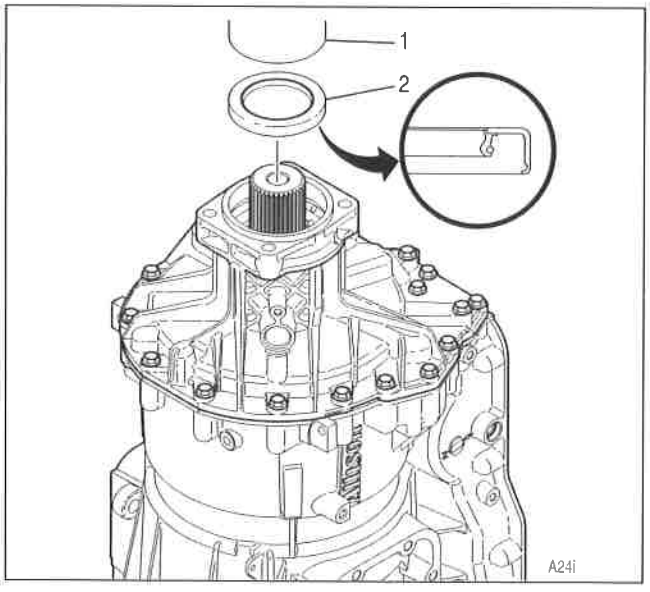
NOTE:

- **For transmissions without a parking brake provision, install the oil seal using J 43782.**
- **For transmissions with a parking brake provision, install the oil seal using J 43783.**

WARNING!

The torque converter must be secured to the torque converter housing by a retaining device such as shipping brackets. Without the retaining device, the torque converter may slide forward, disengaging the oil pump, or may fall completely out of the transmission causing personal injury and/or property damage. Never tilt the torque converter end down unless a torque converter retaining device is installed.

1. Position the transmission with the rear cover facing up.
2. Using J 43782 or J 43783 (1), install the oil seal (2) as illustrated.
3. Check the installation of the oil seal as follows.
   - For transmissions without a parking brake provision, make sure the rear output seal is installed to 4.55–5.35 mm (0.179–0.211 inch) below the rear face of the rear cover.
   - For transmissions with a parking brake provision, make sure the rear output seal is installed to 31.10–31.90 mm (1.224–1.256 inch) below the rear face of the rear cover.

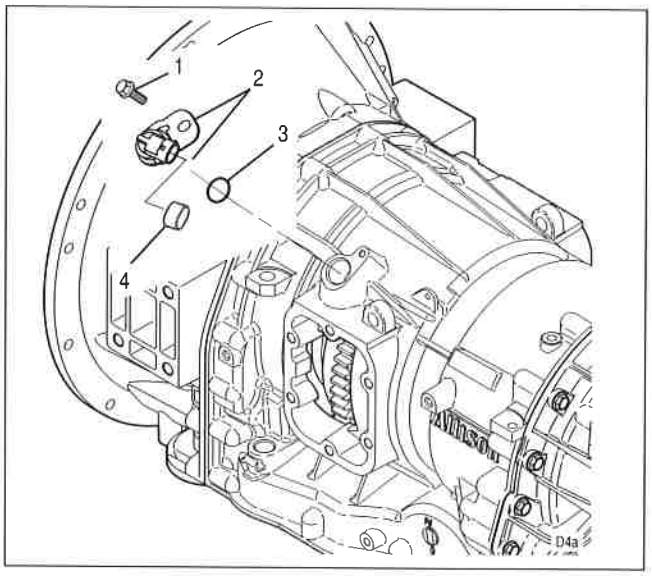


6–20. TURBINE SPEED SENSOR INSTALLATION

CAUTION:

Sensor damage may occur if the sensor is not properly seated before installing retaining bolt.

1. Install the sensor O-ring (3) onto the turbine speed sensor (2).
2. Apply petroleum to O-ring (3).
3. Install the turbine speed sensor (2) into the main housing.
4. Install the turbine speed sensor bolt (1) into the main housing. Tighten the bolt to 10–13 N·m (88–115 lb inch). The turbine speed sensor bolt could be M6 x 1.0 x 13 or, with newer main cases, M8 x 1.25 x 20.
5. If present, install sensor shipping cover (4) onto the speed sensor.

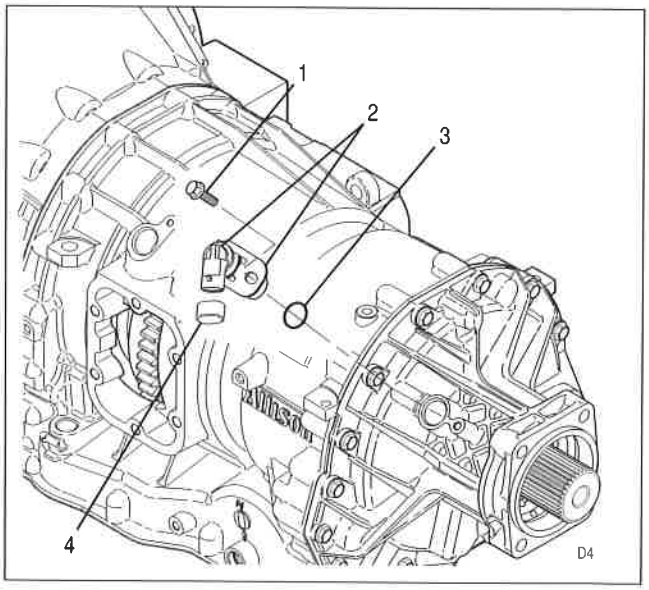


6–21. OUTPUT SPEED SENSOR INSTALLATION

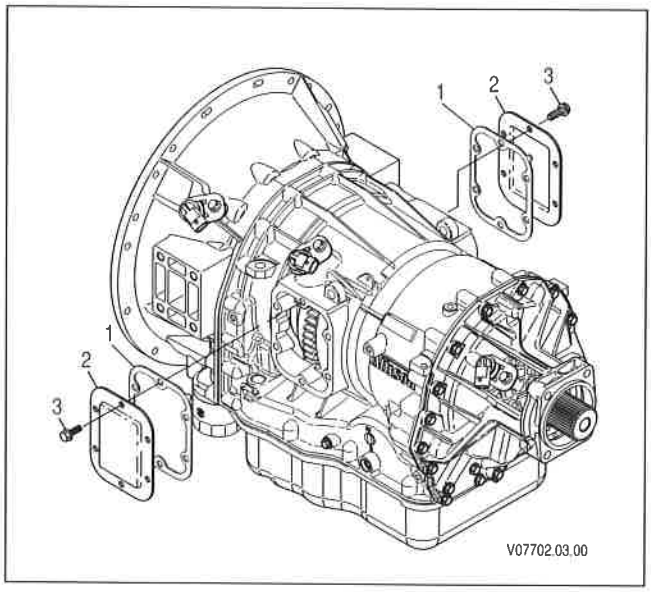
CAUTION:

Sensor damage may occur if the sensor is not properly seated before installing retaining bolt.

1. Install the sensor O-ring (3) onto the output speed sensor (2).
2. Apply petrolatum to O-ring (3).
3. Install the output speed sensor (2) into the rear cover.
4. Install the output speed sensor bolt (1) into the rear cover. Tighten the bolt to 10–13 N·m (88–115 lb inch).
5. If present, install sensor shipping cover (4) onto the speed sensor.



5. If equipped, install the two PTO cover gaskets (1).
6. If equipped, install the two PTO covers (2).
7. If equipped, install the twelve PTO cover bolts (3). Tighten the bolts to 40–45 N·m (29–33 lb ft).
8. If equipped, install the PTO(s) according to the manufacturer's instructions.



7–1. WEAR LIMITS DATA

a. **Maximum Variations.** Wear limits information in this Section are the maximum wear at which components are expected to function satisfactorily. Table 7–1 lists the Wear Limits Data.

b. **Cleaning and Inspection.** Parts must be clean to permit effective inspection for wear or damage. Refer to Section 3.

7–2. SPRING DATA

a. **Spring Replacement.** Replace springs 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 according to Table 7–2, Spring Data.

b. **Inspection.** Inspection criteria (load vs. height) and identification characteristics of the springs are presented in Table 7–2. The Spring Data are keyed to the exploded views (Foldouts 5 through 20) in the back of this manual.

NOTE:

When more than one spring part number is listed for the same location, refer to the latest edition of Parts Catalog PC3062EN to determine which spring is used in your specific assembly number.

Table 7–1. Wear Limits Data

Description		Wear Limit	
		mm	inch
TORQUE CONVERTER MODULE			
Maximum Torque Converter End Play—Used		1.015	0.0400
Maximum Torque Converter End Play—New		0.762	0.0300
Converter Pump Hub	Minimum OD	58.250	2.2933
	Minimum Distance Between Flats	51.816	2.0400
Cover Pilot, Minimum OD		43.080	1.6960
FRONT SUPPORT AND OIL PUMP MODULE			
Charging Pump	Bushing, Maximum ID The pump bushing must have a complete burnt-orange color Teflon® coating. If any portion of the Teflon® coating is worn and bronze material is visible, replace the pump.	58.458	2.3015
	Gear Cavity, Maximum Depth	22.245	0.876
	Gear Cavity, Maximum ID	110.191	4.338
	Driven Gear, Max. Diametric Clearance w/ Pump Body	0.204	0.0080
	Driven Gear, Maximum Tooth Clearance w/ Crescent	0.455	0.0179
	Driven Gear, Minimum OD	109.987	4.330
	Wear Plate, Minimum Thickness	2.950	0.1161
	Gear-to-Wear Plate, Maximum Side Clearance	0.064	0.0025
	Drive Gear, Maximum Distance Between Flats	52.165	2.0537
	Drive Gear, Side Clearance	0.066	0.0026

Table 7–1. Wear Limits Data *(cont'd)*

Description			Wear Limit	
			mm	inch
MAIN HOUSING MODULE (cont'd)				
C3 Backplate	Maximum Cone		0.000	0.0000
	Minimum Thickness		15.325	0.6033
	Thrust Plate Inner Rim, Minimum Thickness		3.000	0.1181
C4 Backplate	Maximum Cone		0.000	0.0000
	Minimum Thickness		15.400	0.6063
C5 Friction Plate	Maximum Cone		0.225	0.0089
	Minimum Thickness		2.375	0.0935
	Minimum Oil Groove Depth		0.200	0.0079
C5 Steel Reaction Plate	Maximum Cone		0.295	0.0116
	Minimum Thickness (Selective)	Part Number 29536481	1.935	0.0762
		Part Number 29536482	2.435	0.0959
		Part Number 29536483	2.935	0.1156
C5 Backplate	Maximum Cone		0.000	0.0000
	Minimum Thickness		17.900	0.7047
P1 Ring Gear, Maximum Spline Wear (Notching)			Detectable	
Main Housing Clutch Plate, Spline Wear (Notching)			1.150	0.0453
PLANETARY GEAR MODULE				
P1 Carrier Assembly	Pinion Gear, Maximum End Play		1.010	0.0400
	Bushing, Maximum ID		50.690	1.9957
	Thrust Washer, Minimum Thickness		1.490	0.0590
P2 Ring Gear, Maximum Spline Wear (Notching)			Detectable	
P2 Carrier Assembly	Pinion Gear, Maximum End Play		1.060	0.0417
	Bushing, Maximum ID		36.575	1.4400
P3 Ring Gear, Maximum Spline Wear (Notching)			Detectable	
Main Shaft	Pilot, Minimum OD (Turbine Shaft and Output Shaft)		19.987	0.7869
	Journal, Minimum OD (P2 Carrier Bushing)		36.405	1.4333
REAR COVER MODULE				
Output Shaft Bushing, Maximum ID			20.070	0.7902
Output Shaft, Minimum Bearing Surface OD			44.978	1.7708
P3 Carrier Assembly	Pinion Gear, Maximum End Play		1.010	0.0400
	Parking Pawl Gear Wear		0.000	0.0000
OUTPUT YOKE				
Output Seal Surface, Minimum OD			65.080	2.5622

SECTION 8—CUSTOMER SERVICE

8–1. OWNER ASSISTANCE

The satisfaction of the owners of Allison transmissions are of primary concern to Allison Transmission, its distributors, and their dealers.

As an owner of an Allison transmission, you have service locations throughout the world that are 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 transmission requirements
- Product information and literature

Normally, any situation that arises in connection with the sale, operation, or service of your transmission is be handled by the distributor or dealer in your area. Check the telephone directory for the Allison Transmission service outlet nearest you or use Allison Transmission's Sales and Service Locator tool on the Allison Transmission web site at www.allisontransmission.com. You may also refer to Allison Transmission's Worldwide Sales and Service Directory (SA2229EN).

We recognize, however, that despite the best intentions of everyone concerned, misunderstandings may occur. To further assure your complete satisfaction, we have developed the following three-step procedure to be followed in the event a problem 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 be resolved quickly by a member of management. If you have already discussed the problem with the Sales or Service Manager, contact the General Manager. All Allison Transmission dealers are associated with an Allison Transmission distributor. If the problem originates with a dealer, explain the matter to a management member of the distributorship with whom the dealer has his service agreement. The dealer will provide his Allison Transmission distributor's name, address, and telephone number on request.

Step Two—When it appears the problem cannot be readily resolved at the distributor level without additional assistance, contact the Allison Technical Assistance Center at 800-252-5283. They will place you in contact with the Regional Customer Support Manager for your area.

For prompt assistance, please have the following information available:

- Name and location of authorized distributor or dealer
- Type and make of vehicle/equipment
- Transmission model number, serial number, and assembly number (if equipped with electronic controls, also provide the ECU assembly number)
- Transmission delivery date and accumulated miles and/or hours of operation
- Nature of problem
- Chronological summary of your transmission's history

Step Three—If you are still not satisfied after contacting the Regional Customer Support Manager, present the entire matter to the Home Office by writing to the following address:

Allison Transmission

Manager, Warranty Administration

P.O. Box 894, Mail Code 462-470-PF9

Indianapolis, IN 46206-0894

The inclusion of all pertinent information will assist the Home Office in expediting the matter.

When contacting the Home Office, please keep in mind that ultimately the problem will likely be resolved at the distributorship or dealership using their facilities, equipment, and personnel. Therefore, it is suggested that Step 1 be followed when experiencing a problem.

Your purchase of an Allison Transmission product is greatly appreciated, and it is our sincere desire to assure complete satisfaction.