Allison Transmission

DRIVING TRANSMISSION TECHNOLOGY™

SERVICE MANUAL

1000/2000 PRODUCT FAMILIES

ALLISON 4th GENERATION CONTROLS

SM4006EN

TECHNICAL PUB

Service Manual

2004 DECEMBER

SM3191EN

Allison Transmission

VOCATIONAL MODELS

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

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.

To help avoid injury or property damage caused by sudden and unexpected vehicle movement, do not start a stationary stall test until you:

- **Put the transmission in P (Park) or N (Neutral)...and**
- **Apply the parking brake and service brake...and**
- **Chock the vehicle wheels and take any other steps necessary to keep the vehicle from moving...and**
- **Warn personnel to keep clear of the vehicle and its 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 vehicle is on a lift or jackstands.

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.

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.**

If the transmission is not secured properly to the adapter plate, it could fall. To help avoid personal injury and/or property damage:

- **Use at least 5 bolts to support the transmission.**
- **Use M10 x 1.5 bolts with 19–25 mm (3/4–1 inch) thread engagement. If the proper bolt is not used, the PTO bolt holes may be damaged.**

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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 include the 1000/2000/2400 Series. The following provides guidance in distinguishing between the various 1000 and 2000 Product Families transmissions and 1000/2000/2400 Series transmissions models and the content of the various model years. Model Year and serial number breaks identify engineering changes.

b. Model Year 04 (MY04) (refer to SIL 13-1K2K-03). MY04, June 2003, introduced modulated main pressure hardware and the associated calibration software. The serial number breaks for MY04 are:

- Indianapolis units:
  - — 6310292155 through 6310292563
    6310296468 through 6310296471
    6310301450 through 6310301451
    6310303122 through 6310303124
    6310307722—start of MY04 production
- Baltimore units:
  - — 6320218358 through 6320218387
    6320247492 through 6320248001
    6320269500—start of MY04 production

c. MY04 Parts Changes. MY04 parts and former parts are not interchangeable. Parts changed by MY04 are:

- Internal Wiring Harness
- Separator Plate
- Modulated Main Body Assembly
- Modulated Main Body
- Shift Valve Body
- Main Valve Body
- Control Main Valve
- Control Main Regulator and Control Main Relief Spring
- Main Pressure Regulator Valve

d. Model Year 04i (MY04i) (refer to SIL 3-1K2K-04). 1000 and 2000 Product Families MY04i serial number breaks are:

- S/N 6310374684 (Indianapolis)
- S/N 6320367833 (Baltimore)

e. MY04i Parts Changes. MY04i parts and former parts are not interchangeable. Parts changed by MY04i are:

- Front Support Assembly and Bearing
- Main Regulator Valve
- Converter Relief Valve
- Lube Regulator Valve
- Lube Regulator Spring
- Lube Regulator Stop
- Lube Regulator O-ring deleted
- C1 Clutch Backfill Valve
- C1 Clutch Backfill Spring
- C1 Clutch Backfill Stop
- Converter Flow Valve
- Retaining Clip replaces a retaining pin
- Converter/Main Housing Separator Plate
- Pump Assembly
- Pump Wear Plate

f. Improved Shift Valve Body Casting. Serial number breaks for 1000 and 2000 Product Families improved Shift Valve Body casting are:

- Indianapolis Units—6310368401
- Baltimore Units—6320354862

g. Vocational Models (refer to WATCH 309). Beginning January 2004, Allison Transmission began shipping new 1000 and 2000 Product Families transmission models for North America. 1000 and 2000 Product Families models are:

- Emergency Vehicle Series—1000 EVS, 2100 EVS, 2200 EVS, 2500 EVS
- Highway Series—1000 HS, 2100 HS, 2200 HS, 2500 HS
- Motorhome Series—1000 MH, 2100 MH, 2200 MH, 2500 MH
- Pupil Transport/Shuttle Series—1000 PTS, 2100 PTS, 2200 PTS, 2500 PTS
- Rugged Duty Series—1000 RDS, 2100 RDS, 2200 RDS, 2500 RDS
- Specialty Series—1000 SP, 2100 SP, 2200 SP, 2500 SP
- Bus Series—B210, B220

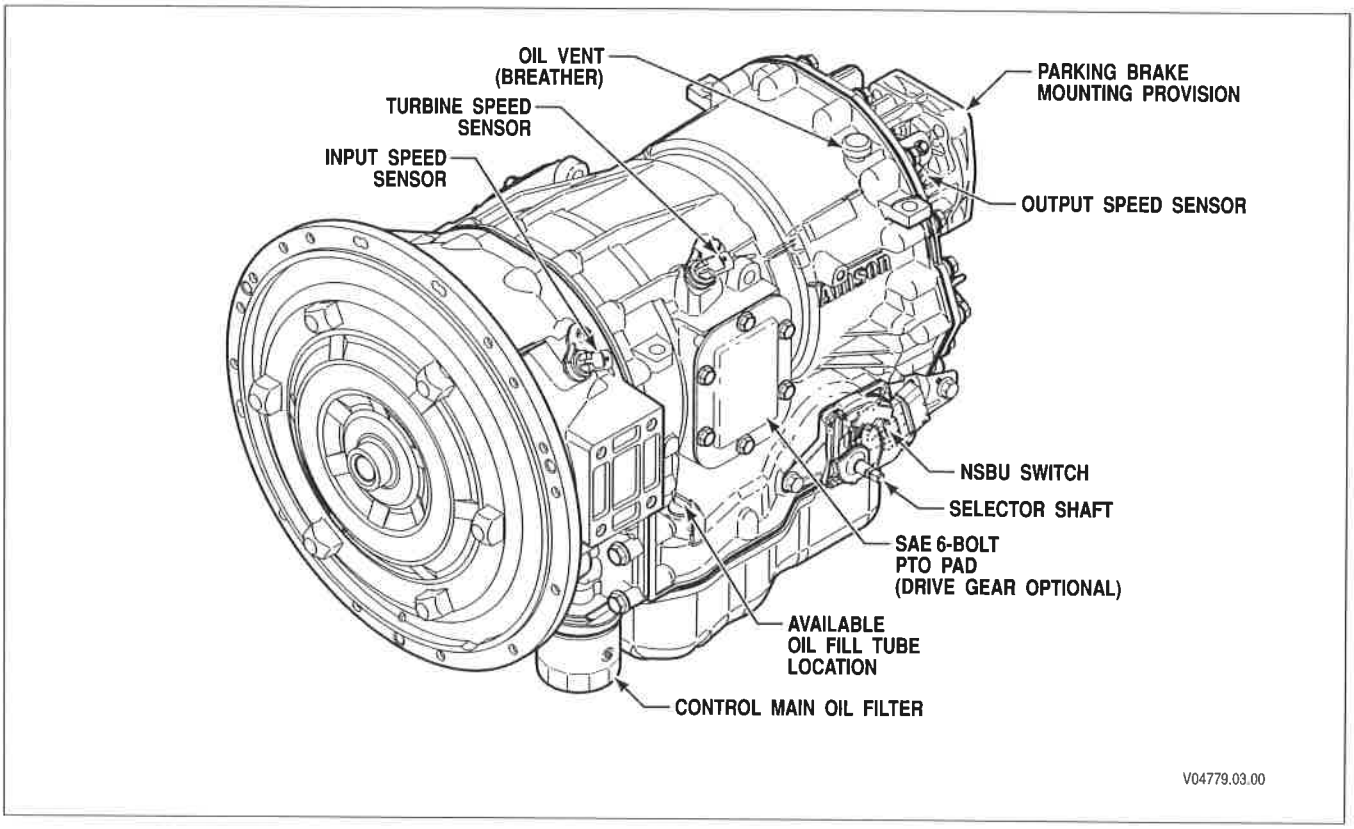


Figure 1–1. 1000 and 2000 Product Families Transmission—Left-Front View

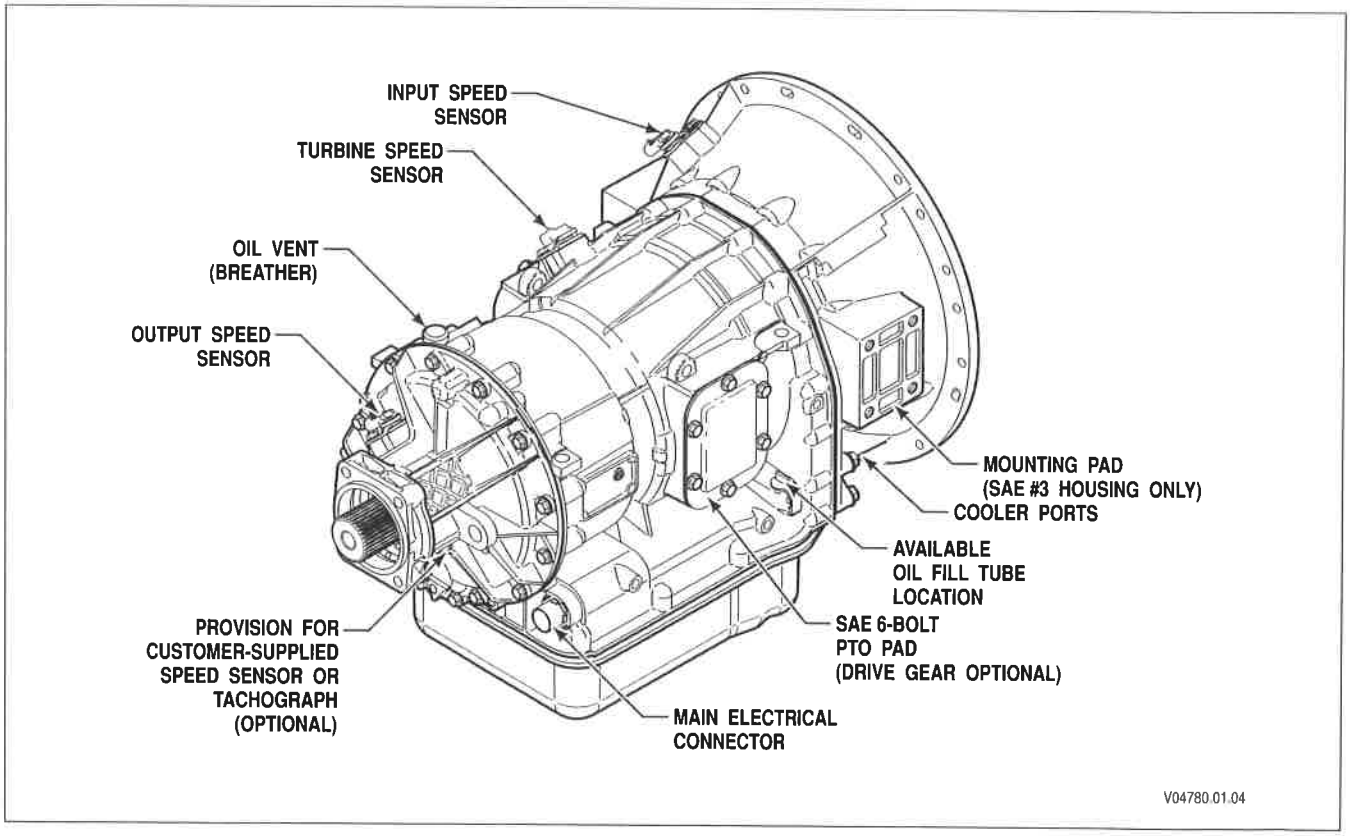
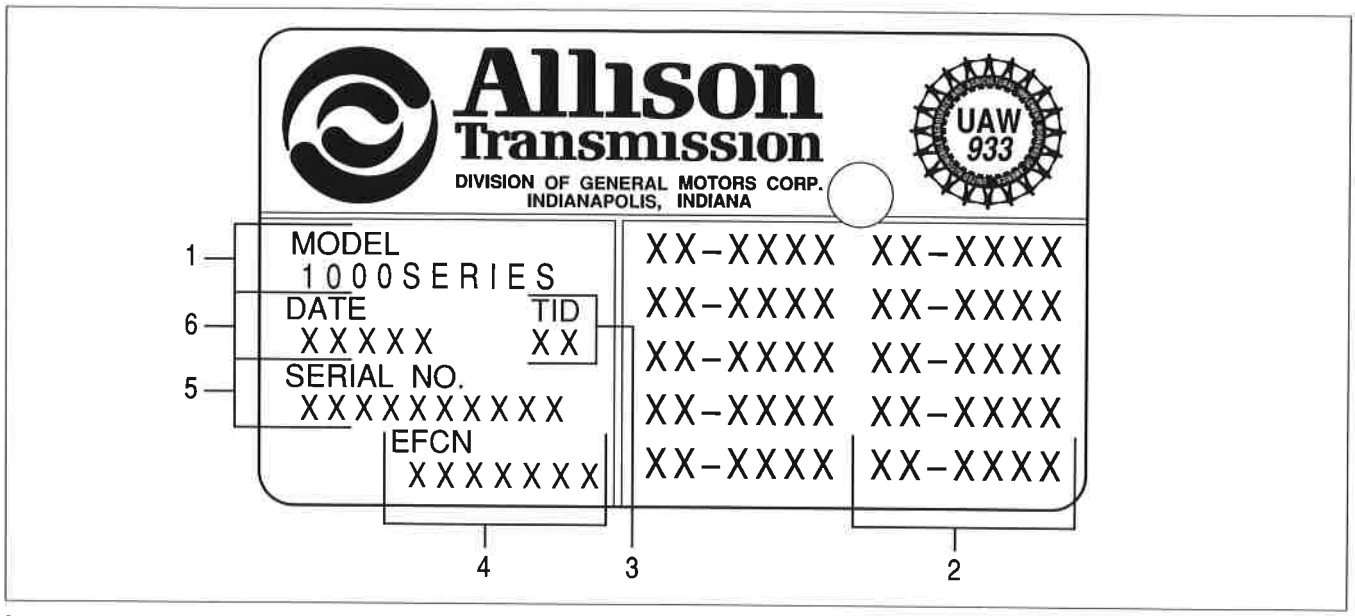


Figure 1–2. 1000 and 2000 Product Families Transmission—Right-Rear View



Legend

(1) Model (Series)
(2) Engineering Group Number
(3) Transmission Identification Number
(4) Engineering Feature Configuration Number
(5) Serial Number
(6) Date of Manufacture

Figure 1–5. 1000 and 2000 Product Families Transmission Nameplate Components (Before March, 2000)

1–4. GENERAL DESCRIPTION

a. Transmission Design Features. Allison 1000 and 2000 Product Families (Figures 1–1 and 1–2) are torque-converter driven, electronically controlled, fully automatic transmission systems. The 1000 and 2000 Product Families transmissions have up to five forward speeds, neutral, and reverse. The fifth range has an overdrive gear ratio. The 1000 and 2000 Product Families incorporate a variety of standard and optional design features.

1. *Transmission-to-Engine Coupling.* The converter housings of 1000 and 2000 Product Families transmissions mate directly to SAE No. 2 or No. 3 flywheel housings or to the engine block in some cases. Flexplate drive is used for engine-to-transmission torque transfer.

2. *Torque Converter.* Several torque converters are available to match the transmissions to a wide variety of diesel and gasoline engines. The torque converter is a single-stage, polyphase, three-element unit, consisting of a pump, stator, and turbine. At lower output speeds, the torque converter multiplies torque and provides a fluid coupling to the engine. At higher speeds, the torque converter clutch (TCC) is automatically engaged to provide direct drive from the engine to the transmission. Hydraulic fluid for converter charging pressure comes from the sump and is supplied by the input pump. The torque converter clutch is applied or released by changing direction of fluid in the torque converter. An integral converter damper minimizes the need for additional engine vibration control.

3. *Planetary Gearing.* The planetary gear train includes three constant-mesh, helical gear planetary sets. By the engagement of clutches in various combinations, the planetary sets act singly or together to provide five forward ranges, neutral, and reverse.

4. *Clutches.* Five clutches (two rotating and three stationary) direct the flow of torque through the transmission. All range clutches are hydraulically-actuated and spring-released, with automatic wear compensation. Clutches are cooled by the transmission fluid. The transmission electronic control module signals solenoid valves to apply and release clutches based on speed and power combinations and the range selected by the operator.

b. General Description. Several transmission configurations are available within the 1000 and 2000 Product Families.

1000*	Heavy-duty automatic transmission with parking pawl Maximum GVW 19,850 lb Maximum GCW 26,000 lb
2000 2100 2500*	Heavy-duty automatic transmission without parking pawl Maximum GVW 30,000 lb Maximum GCW 30,000 lb
2100 MH 2500 MH*	Heavy-duty automatic transmission without parking pawl Limited release in motorhome applications only Maximum GVW 28,000 lb Maximum GCW 28,000 lb
1000 MH 2200 MH*	Heavy-duty automatic transmission with parking pawl Limited release in motorhome applications only Maximum GVW 28,000 lb Maximum GCW 28,000 lb
2200 2400*	Heavy-duty automatic transmission with parking pawl Maximum GVW 26,000 lb Maximum GCW 26,000 lb

* GVW rating, GCW rating, or OEM axle rating, whichever is less.

1–5. DIAGNOSIS

NOTE:

Refer to the TS3192EN, 1000 and 2000 Product Families Troubleshooting Manual, for in-depth troubleshooting procedures.

a. Before Starting. Before attempting to repair the transmission, identify the faulty condition and its probable cause.

b. CHECK TRANS Light

1. The **CHECK TRANS** light is original equipment manufacturer (OEM)-supplied and usually located on the vehicle's instrument panel.
2. The **CHECK TRANS** light is illuminated briefly during vehicle start-up as a bulb check.

NOTE:

The CHECK ENGINE light may serve the CHECK TRANS function for vehicles which are compliant to industry On Board Diagnostics II (OBD-II) requirements.

3. When the **CHECK TRANS** light is "ON", shifts may be restricted by the Transmission Control Module (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 displayed, the TCM logs a diagnostic code in memory. These diagnostic codes can be accessed through the PC-based Allison DOC™ diagnostic systems.

NOTE:

Diagnostic codes can be logged without illuminating the CHECK TRANS light. This occurs when the TCM senses a problem, but determines the problem won't cause immediate transmission damage or dangerous performance.

c. Range Inhibit Indicator

1. Some conditions detected by the TCM cause the transmission to be locked in one range. When this occurs, the torque converter clutch is automatically disengaged. Shifts out of **N** (Neutral) may be inhibited.

3. To help locate intermittents, it sometimes helps to place the appropriate tester on the suspect component or circuit and simulate operating conditions—wiggle, pull, bump, and bend while watching the tester.

1–6. PRESERVATION AND STORAGE

a. Storage ***(New Transmissions, Before Installation).*** New transmissions are filled with transmission fluid and drained before shipment. The residual fluid in the transmission provides adequate protection to safely store the transmission without further treatment for one full year if stored indoors, in conditions of normal climate, and with all shipping plugs installed.

b. Preservation Methods. When the transmission is stored or inactive for an extended period (one or more years), specific preservation methods are required to prevent damage from rust, corrosion, and organic growth in the transmission fluid. Preservation methods described are for storage with or without transmission fluid. The methods are the same whether a transmission is in or out of a vehicle.

c. One Year Storage *(Without Fluid)*

1. Drain the fluid.
2. Remove the vent assembly per Paragraph 5–11**f**.
3. Spray 30 ml (one ounce) of VCI #10 (or equivalent) into the transmission through the vent assembly hole. Also, spray 30 ml (one ounce) through the fill tube hole.
4. Install the vent assembly per Paragraph 5–11**f.**
5. Seal all openings and the vent assembly with moisture-proof tape.
6. Coat all exposed, unpainted surfaces with preservative grease such as petrolatum (MIL-C-11796, Class 2).
7. If additional storage time is required, do the following at yearly intervals.
   - Wash all external grease from the transmission with mineral spirits.
   - Remove all tape from openings and the vent assembly.
   - Repeat Steps (2) through (6).

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 TranSynd™ or DEXRON®-III transmission fluid. 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.

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 that 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 vent assembly 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 at yearly intervals, except, it is not necessary to drain the transmission each year. Just add VCI #10 and Biobor® JF (or equivalents).

Table 1–1. Specifications and Data Chart for 1000 and 2000 Product Families

	Max Net Input Torque Without SEM		Max Net Input Torque With SEM		Max Net Input Power		Max Turbine Torque		Full Load Governed Speed (Min–Max)	Max GVW		Max GCW		Max Output Shaft Speed
	N·m	lb ft	N·m	lb ft	kW	hp	N·m	lb ft	rpm	kg	lbs	kg	lbs	rpm
1000 HS	746	550	766	565	254	340	1152	850	2200–4600	8845	19,000	11 800	26,000	5000
1000 RDS	746	550	766	565	254	340	1152	850	2200–4600	8845	19,000	11 800	26,000	5000
1000 PTS	746	550	766	565	254	340	1152	850	2200–4600	8845	19,000	11 800	26,000	5000
1000 EVS	746	550	766	565	254	340	1152	850	2200–4600	8845	19,000	11 800	26,000	5000
1000 MH	746	550	766	565	254	340	1152	850	2200–4600	10 000	22,000	11 800	26,000	5000
1000 SP	746	550	N/A	N/A	254	340	1152	850	2200–4600	10 000	22,000	11 800	26,000	5000
B 210	746	550	766	565	254	340	1152	850	2200–4600	11 800	26,000	N/A	N/A	5000
2000 MH	N/A	N/A	813	600	224	300	1152	850	2200–4600	12 700	28,000	12 700	28,000	4500
2100 HS	746	550	766	565	254	340	1152	850	2200–4600	11 800	26,000	11 800	26,000	4500
2100 RDS	746	550	766	565	254	340	1152	850	2200–4600	11 800	26,000	11 800	26,000	4500
2100 PTS	746	550	766	565	254	340	1152	850	2200–4600	11 800	26,000	11 800	26,000	4500
2100 EVS	746	550	766	565	254	340	1152	850	2200–4600	11 800	26,000	11 800	26,000	4500
2100 MH	746	550	766	565	254	340	1152	850	2200–4600	11 800	26,000	11 800	26,000	4500
2100 SP	740	545	N/A	N/A	224	300	1150	850	2200–4600	12,000	26,500	13 600	30,000	4500
2200 HS	746	550	766	565	254	340	1152	850	2200–4600	11 800	26,000	11 800	26,000	4500
2200 RDS	746	550	766	565	254	340	1152	850	2200–4600	11 800	26,000	11 800	26,000	4500
2200 PTS	746	550	766	565	254	340	1152	850	2200–4600	11 800	26,000	11 800	26,000	4500

Table 1–1. Specifications And Data Chart*

INPUT/OUTPUT RATINGS (1000 Models):

Input Speed**	**General*****	**Refuse (On-Highway)**	**Motorhome**	**Transit Bus**
Max Full Load Gov. Speed	4600 rpm	4600 rpm	4600 rpm	4600 rpm
Min Full Load Gov. Speed	2200 rpm	2200 rpm	2200 rpm	2200 rpm
Max Idle Speed in Drive	900 rpm	900 rpm	900 rpm	900 rpm
Min Idle Speed in Drive	500 rpm	500 rpm	500 rpm	500 rpm
Input Power				
Maximum Net	254 kW (340 hp)	254 kW (340 hp)	254 kW (340 hp)	134 kW (180 hp)
Input Torque				
Maximum Net	705 N·m (520 lb ft)	705 N·m (520 lb ft)	705 N·m (520 lb ft)	603 N·m (445 lb ft)
Turbine Torque				
Maximum Net	1152 N·m (850 lb ft)	1152 N·m (850 lb ft)	1152 N·m (850 lb ft)	1017 N·m (750 lb ft)
Output Shaft Speed				
Maximum Speed	5000 rpm	5000 rpm	5000 rpm	5000 rpm
Other				
Gross Vehicle Weight (GVW)	9000 kg (19,850 lbs)	7500 kg (16,540 lbs)	9980 kg (22,000 lbs)	7500 kg (16,540 lbs)
Gross Combined Weight (GCW)	11 800 kg (26,000 lbs)	N/A	11 800 kg (26,000 lbs)	N/A
Min Vehicle N/V Ratio				
Output rpm/kmph	24	24	24	24
(Output rpm/mph)	(38)	(38)	(38)	(38)
Max Vehicle N/V Ratio				
Output rpm/kmph	38	38	38	38
(Output rpm/mph)	(62)	(62)	(62)	(62)
Max Angular Rotation of Output Shaft After Static Apply of Park Provision	18.5 Degrees	18.5 Degrees	18.5 Degrees	18.5 Degrees

* 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.

Table 1–1. Specifications And Data Chart* *(cont'd)*

INPUT/OUTPUT RATINGS (2000/2500 Motorhome Series):

Input Speed	**Motorhome**
Max Full Load Gov Speed	2800 rpm
Min Full Load Gov Speed	2200 rpm
Max Idle Speed in Drive	900 rpm
Min Idle Speed in Drive	500 rpm
Input Power	
Maximum Net	205 kW (275 hp)
Input Torque	
Maximum Net	813 N·m*** (600 lb ft)
Turbine Torque	
Maximum Net	1152 N·m (850 lb ft)
Output Shaft Speed	
Maximum Speed	4500 rpm
Other	
Gross Vehicle Weight (GVW)	12 700 kg (28,000 lbs)
Gross Combined Weight (GCW)	12 700 kg (28,000 lbs)
Min Vehicle N/V Ratio**	
Output rpm/kmph (Output rpm/mph)	24 (38)
Max Vehicle N/V Ratio**	
Output rpm/kmph (Output rpm/mph)	38 (62)

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

** Min/Max N/V ratio values for the 2000 Series™ are guidelines only.

*** With Shift Energy Management.

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

Table 1–1. Specifications And Data Chart* *(cont'd)*

MAIN PRESSURE SCHEDULES*:

	Pressure During Normal Operation	
	Main Pressure @ 600 rpm	**Main Pressure @ 2100 rpm**
Forward/Rev Converter w/ G solenoid active	590–720 kPa (85–105 psi)	634–758 kPa (92–110 psi)
Forward Converter w/ G inactive	700–1380 kPa (101–200 psi)	1515–1795 kPa (220–260 psi)
Forward Lockup w/G active†	N/A	510–627 kPa (74–91psi)
Forward Lockup w/G inactive	N/A	1000–1170 kPa (145–170 psi)
Neutral/ Park w/G solenoid active	590–720 kPa (85–105 psi)	N/A
Neutral/Park	800–1655 kPa (130–240 psi)	1515–1795 kPa (220–260 psi)

† Medium duty gasoline engines only.

* Refer to Table 2–5 Main Pressure Test Conditions.

FITTINGS—METRIC AND ENGLISH:

The cooler ports and main pressure tap are the only non-metric fittings on the transmission.

DRY WEIGHTS:	**1000**	**2100, 2500**	**2200**
	150 kg (330 lb)	150 kg (330 lb)	150 kg (330 lb)

DRIVE: ..... Flexplate

DRIVE RANGE AND SHIFT CONTROL: ..... Mechanical (external)

ROTATION (viewed from input):

Input ..... Clockwise

Output ..... Clockwise

CLUTCHES: ..... Oil-cooled, hydraulically-actuated, spring-released, self-compensating for wear

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

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

Table 1–1. Specifications And Data Chart* *(cont'd)*

GEAR DATA:

Type . . . . . Planetary, constant mesh, helical

Range	1000 1000 Series™†	2100, 2500 2000 Series™†	2200, 2400 Series™†
First	3.10:1	3.51:1	3.51:1
Second	1.81:1	1.90:1	1.90:1
Third	1.41:1	1.44:1	1.44:1
Fourth	1.00:1	1.00:1	1.00:1
Fifth	0.71:1	0.74:1	0.74:1
Reverse	–4.49:1	–5.09:1	–5.09:1

† The ratios shown do not include the torque multiplication characteristics of the transmission torque converter.

HYDRAULIC SYSTEM:

Fluid type . . . . . 2000 MH transmission models requires a TES-295 fluid such as TranSynd™; all other models may use TranSynd™ or DEXRON®-III.

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, DEXRON®-III	–27C (–17°F)
Minimum start-up, TranSynd™	–30°C (–22°F)
Minimum continuous sump	40°C (100°F)
Typical continuous sump	93°C (200°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 (15 qts)
Shallow	12 liters (13 qts)

Refill Transmission Fill Quantities (Transmission Only)**

Sump	Fill Quantity
Standard	10 liters (10.5 qts)
Shallow	7 liters (7.5 qts)

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

** Quantities are approximate and do not include external lines and cooler hose.

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

Table 1–1. Specifications And Data Chart* *(cont'd)*

PARK PAWL	
Maximum GVW	11 818 kg (26,000 lb)
Static Capacity	4067 N·m (3000 ft lb)
Disengagement Effort at Static Capacity	<34 N•m (<25 ft lb)
Impact Capability	4 kph (2.5 mph)
Engagement speed	1.6–4.8 kph (1–3 mph) during deceleration
N/V Range**	24–38 output rpm/kmph (38–62 output rpm/mph)
Maximum Vehicle Roll	150 mm (5.91 inches) when engaged on a 10 percent grade

1–10. ELECTROMAGNETIC/RADIO FREQUENCY INTERFERENCE

All electrical and electronic systems generate electromagnetic fields that can interfere with other electronic systems. Allison Transmission electronic transmission controls comply with Federal Communications Commission (FCC) regulations and other guidelines concerning emitted radio frequency interference for transportation electronics. The position of Allison Transmission Inc. is that manufacturers and installers of Electromagnetic Interference (EMI)/Radio Frequency Interference (RFI) emitting equipment are responsible for adhering to FCC regulations and other guidelines concerning emitted radio frequency interference for transportation electronics.

Some radio-telephone or two-way communication radios (land-mobile radio), or the manner in which they are installed, can adversely affect vehicle operation or be affected by other vehicle components. Expenses incurred to protect vehicle-related systems from EMI/RFI emissions by radio-telephone or two-way communications radios (land-mobile radio) or to integrate such devices into vehicles are not the responsibility of Allison Transmission.

Refer to the latest edition of the 1000 and 2000 Product Families Troubleshooting Manual, TS3192EN, for detailed instructions regarding EMI problems.

SECTION 2—PREVENTIVE MAINTENANCE

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:

When cleaning the transmission, do not spray steam, water, or cleaning solution directly at the vent assembly. Spraying steam, water, or cleaning solution at the vent assembly 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
- dented, worn, or out-of-phase driveline U-joints and slip fittings
- clogged or dirty vent assembly

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:

- **DO NOT WELD on the vehicle without disconnecting from the TCM all control system wiring harness connectors.**
- **DO NOT WELD on the vehicle without disconnecting TCM battery power and ground leads.**
- **DO NOT WELD on any control components.**
- **DO NOT CONNECT welding cables to any control components.**

A label describing on-vehicle welding precautions 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 welding label (ST2067EN).

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 vent assembly or dipstick tube when the fluid level is too high.

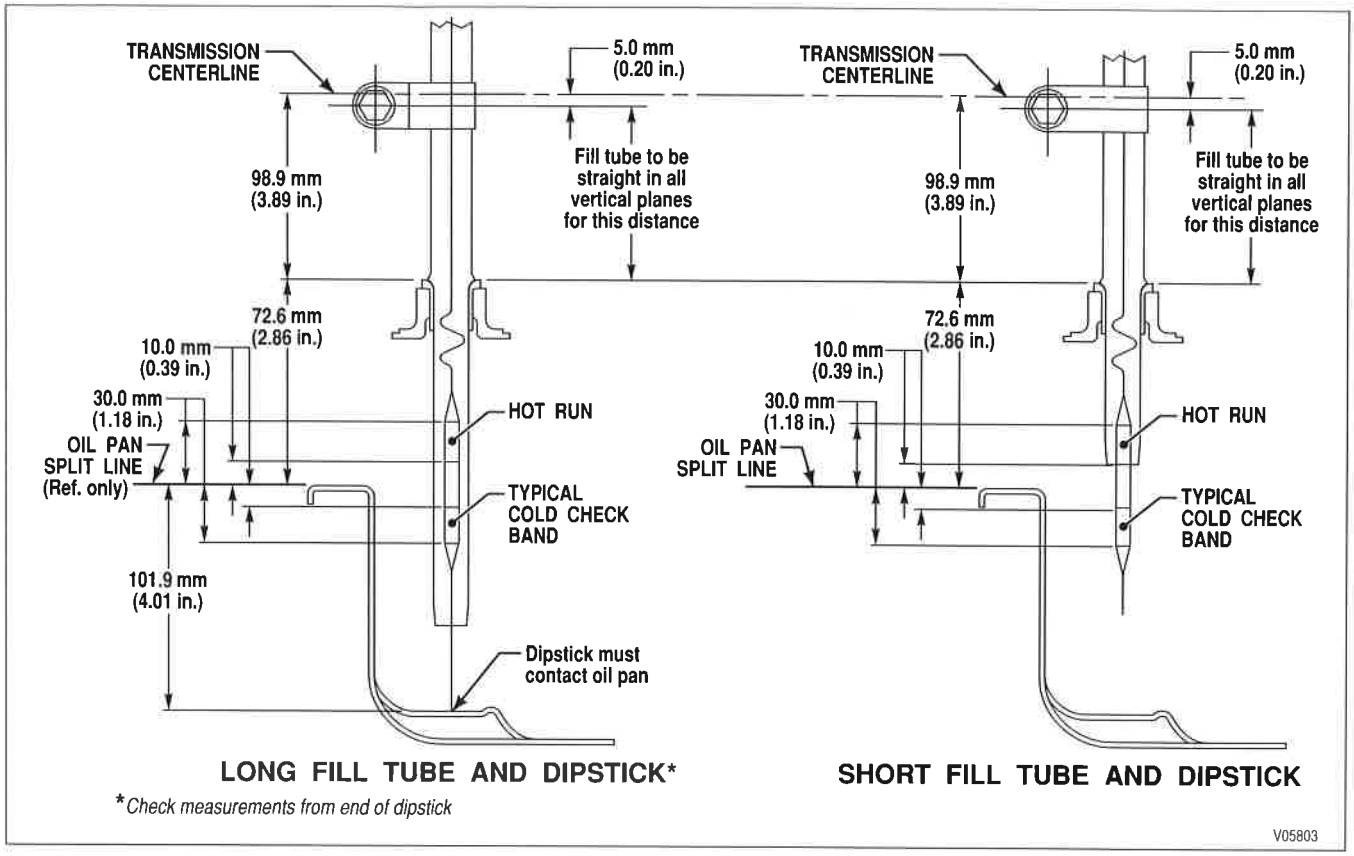


Figure 2–1. Fill Tube And Dipstick Requirements (Standard Oil Pan)

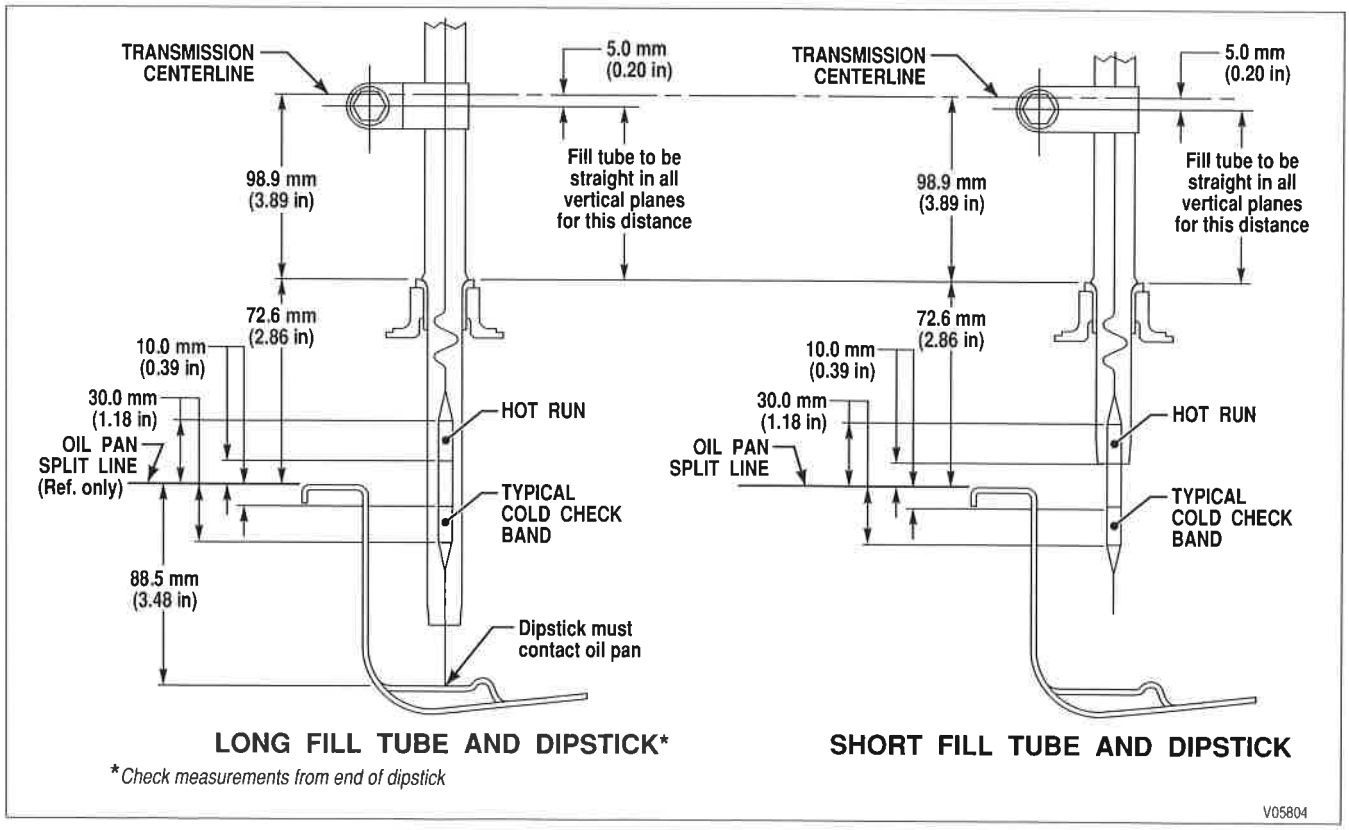


Figure 2–2. Fill Tube And Dipstick Requirements (Shallow Oil Pan)

  - Engage the **P** (Park) range by slowly releasing the service brake.
  - Apply the emergency brake and/or parking brake, if present, and make sure it is properly engaged.

- Park vehicles containing 2000 Product Family transmissions with auto-apply parking brakes as follows:
  - Bring the vehicle to a complete stop on a level surface using the service brake.
  - Make sure the engine is at low idle rpm.
  - Put the transmission in **PB** (Auto-Apply Parking Brake). Make sure that the parking brake is properly engaged.
  - Apply the emergency brake, if present, and make sure it is properly engaged.
- Park vehicles containing 2000 Product Family transmissions without auto-apply parking brakes as follows:
  - Bring the vehicle to a complete stop on a level surface using the service brake.
  - 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 vent assembly to be sure it is clean and unclogged. If readings are still inconsistent, contact your nearest Allison distribution or dealer.

2–5. KEEPING FLUID CLEAN

Prevent foreign material from entering the transmission by using clean containers, fillers, etc. 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 2000 MH transmissions. For all other models, only fluids meeting TES-295 (TranSynd™) or DEXRON®-III specifications are acceptable. TranSynd™ fluids fully meet the DEXRON®-III specifications.

To make sure the fluid is qualified for use in Allison transmissions, check for a TranSynd™ or a DEXRON®-III 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

Table 2–3. Transmission Fluid and Filter Change

1000 and 2000 Product Families

Schedule 1. Recommended Fluid and Filter Change Intervals (Non-TranSynd™/Non-TES 295 Fluid)

SEVERE VOCATION				GENERAL VOCATION			
	Filters				Filters		
Fluid	Control Main	Internal	Lube/Auxiliary	Fluid	Control Main	Internal	Lube/Auxiliary
12,000 Miles (19 000 km) 6 Months 500 Hours	12,000 Miles (19 000 km) 6 Months 500 Hours	Overhaul	12,000 Miles (19 000 km) 6 Months 500 Hours	50,000 Miles (80 000 km) 24 Months	50,000 Miles (80 000 km) 24 Months	Overhaul	50,000 Miles (80 000 km) 24 Months

NOTE: The following recommendations in Schedule 2 are based upon the transmission containing 100 percent of TranSynd™ fluid. For transmissions that contain a mixture of TranSynd™ and non-TranSynd™ fluids, refer to Schedule 3.

Flushing Machines are not recommended due to inconsistencies in removing 100 percent of the used fluid. Recommendations in Schedule 2 are based upon standard Allison fluid change procedures.

Schedule 2. Recommended Fluid and Filter Change Intervals (TranSynd™/TES 295 Fluid)

SEVERE VOCATION				GENERAL VOCATION			
	Filters				Filters		
Fluid	Control Main	Internal	Lube/Auxiliary	Fluid	Control Main	Internal	Lube/Auxiliary
50,000 Miles (80 000 km) 24 Months	50,000 Miles (80 000 km) 24 Months	Overhaul	50,000 Miles (80 000 km) 24 Months	100,000 Miles (160 000 km) 48 Months	50,000 Miles (80 000 km) 24 Months	Overhaul	50,000 Miles (80 000 km) 24 Months

NOTE: Change fluid/filters after recommended mileage, months, or hours have elapsed, whichever occurs first.
Severe Vocation: On/Off Highway, Refuse, City Transit, Shuttle Transit, and 2000 MH/2500 MH models.
General Vocation: All other vocations.

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. Using 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 minuets 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–200°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 Paragraph 2–8.

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

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 maintenance personnel.

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 will damage 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 Paragraph 2–4.

Table 2–4. 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.

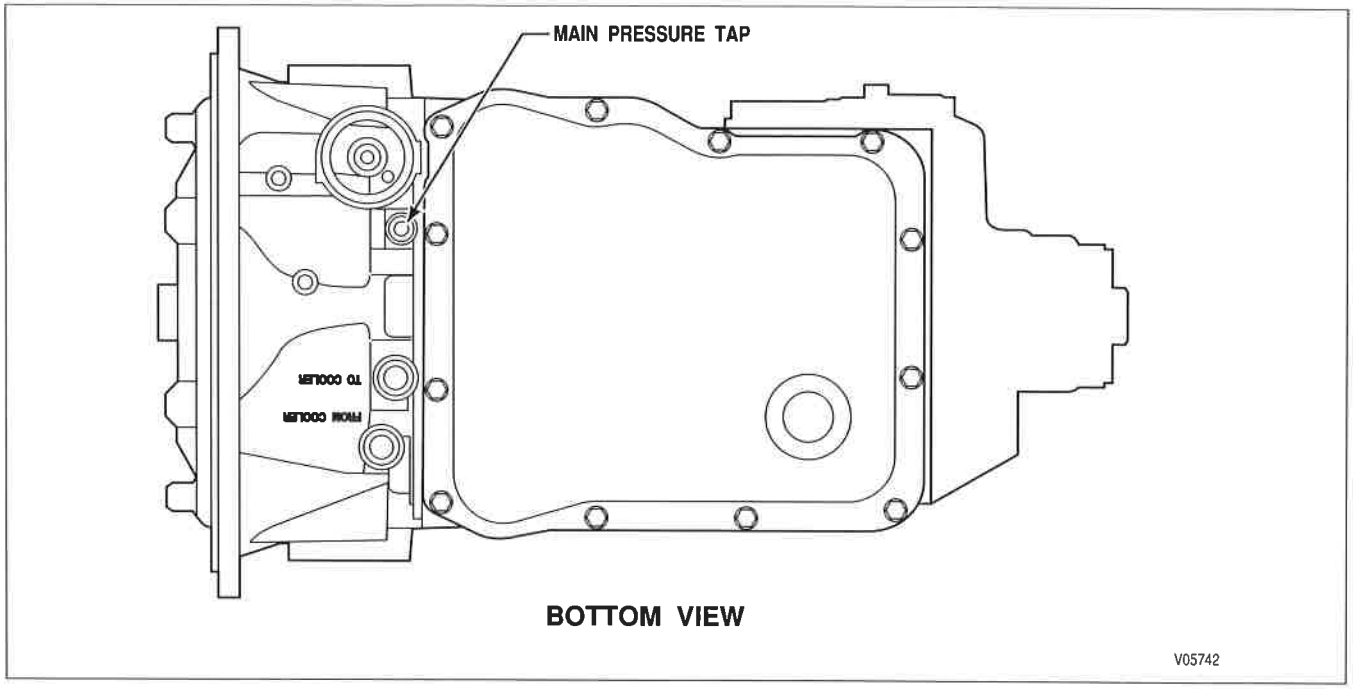


Figure 2–4. Main Pressure Check Point

Table 2–5. Main Pressure Test Conditions

(Used Prior To S/N 6310004116)		
Range	**Main Pressure @ 600 rpm**	**Main Pressure @ 2100 rpm**
Forward (Converter)	800–1380 kPa (115–200 psi)	1515–1795 kPa (220–260 psi)
Forward (Torque Converter Clutch Applied)	—	1000–1170 kPa (145–170 psi)
Reverse	800–1380 kPa (115–200 psi)	1515–1795 kPa (220–260 psi)
Neutral/Park	900–1655 kPa (130–240 psi)	1515–1795 kPa (220–260 psi)

(Used Starting With S/N 6310004116)		
Range	**Main Pressure @ 600 rpm**	**Main Pressure @ 2100 rpm**
Forward (Converter)	700–1280 kPa (101–186 psi)	1515–1795 kPa (220–260 psi)
Forward (Torque Converter Clutch Applied)	—	1000–1170 kPa (145–170 psi)
Reverse	700–1280 kPa (101–186 psi)	1515–1795 kPa (220–260 psi)
Neutral/Park	800–1655 kPa (130–240 psi)	1515–1795 kPa (220–260 psi)

(Transmissions with Modulated Main "G" solenoid)		
	Main Pressure @ 600 rpm	**Main Pressure @ 2100 rpm**
Forward/Rev Converter w/ G solenoid active	590–720 kPa (85–105 psi)	634–758 kPa (92–110 psi)
Forward Converter w/ G inactive	700–1380 kPa (101–200 psi)	1515–1795 kPa (220–260 psi)
*Forward Lock-up w/G active	N/A	510–627 kPa (74–91psi)
Forward Lock-up w/G inactive	N/A	1000–1170 kPa (145–170 psi)
Neutral/ Park w/G solenoid active	590–720 kPa (85–105 psi)	N/A
Neutral/Park	800–1655 kPa (130–240 psi)	1515–1795 kPa (220–260 psi)
* Medium duty gasoline engines only.		

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

3. Turn all engine accessories **OFF**.

4. Use Allison DOC™ diagnostic tool. Use the shift selector to select fourth range. Using fourth range reduces the torque imposed on the transmission and driveline. Do not perform a transmission stall test in Reverse. Select a Drive range.

CAUTION:

To help avoid transmission or driveline damage, full throttle transmission stall tests must never be performed in reverse range (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 (300°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 inhibit engines acceleration the following transmission stall test procedure can be used.

CAUTION:

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

e. Driving Transmission Stall Testing Preparation. If a transmission stall test is to be performed, make sure the following preparations have been made before conducting the transmission stall test.

1. The manufacturer concurs with performing a full-throttle stall test.

2. Engine programmable parameter for 0 rpm output speeds are set higher than value expected for stall speed.

3. The vehicle is in an area in which a transmission stall test can be safely performed.

4. Make sure the fuel control linkage goes to full throttle and does not stick when released.

5. Inspect the engine air induction system and exhaust system for restrictions.

6. Perform a cold check of the transmission fluid level and adjust as necessary.

7. Connect Allison DOC™ to the vehicle diagnostic data connector.

8. Install an accurate tachometer (do not rely on the vehicle tachometer).

9. Install a temperature gauge with the probe in the transmission converter out (to cooler) line. Allison DOC™ displays sump temperature only.

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 vent (breather)
     - — Water or coolant in fluid—fluid will appear milky
     - — Drain-back holes plugged

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

CAUTION:

When cleaning the transmission, do not spray steam, water, or cleaning solution directly into open electrical connectors or the vent assembly. Spraying steam, water, or cleaning solution directly into open electrical connectors can cause false diagnostic codes or crosstalk between pins and terminals. Spraying steam, water, or cleaning solution directly into the vent assembly can contaminate the transmission fluid.

4. If the leak still cannot be identified, then 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.

b. Powder Method

- Clean the suspected area.
- Apply an aerosol-type white powder.
- Operate the vehicle under normal operating conditions.
- Visually inspect the suspected area and trace the leak path over the white powder surface to the source.

NOTE:

Dye and black light kits are available for finding leaks. Refer to the manufacturer's directions when using the kits. See kit directions for the color of the fluid dye mix.

SECTION 3—GENERAL OVERHAUL INFORMATION

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)

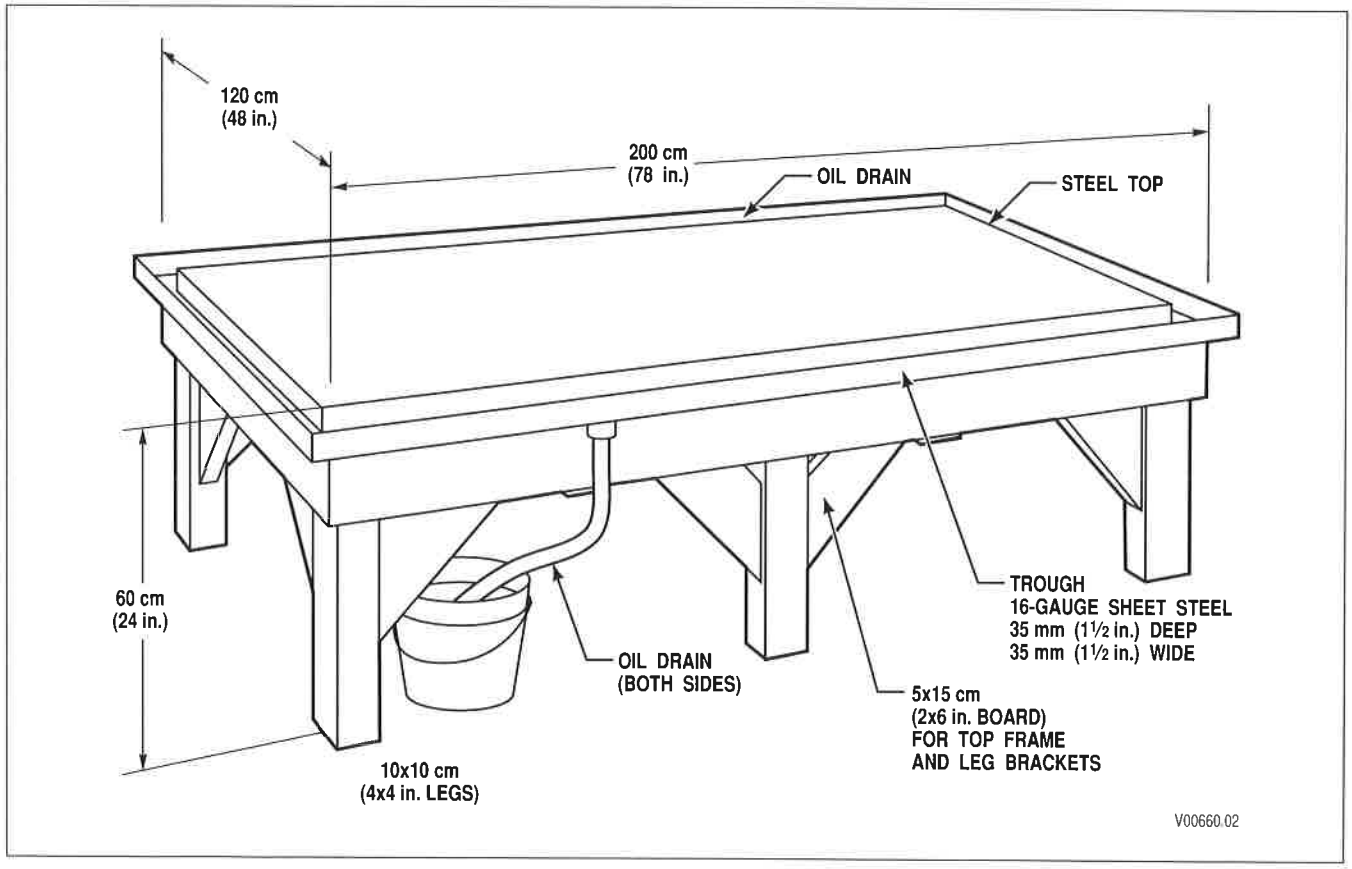


Figure 3–1. Work Table

Table 3–1. Special Tools and Equipment*

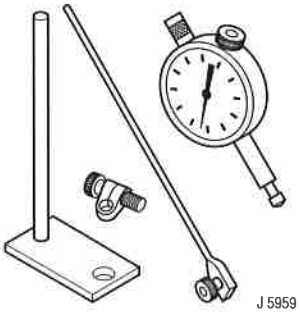
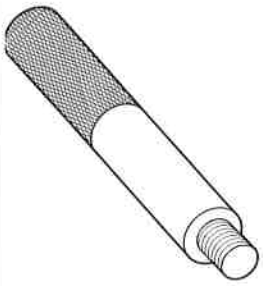
Illustration	Kent-Moore Tool No.**/ Description
 J 5959	J 5959 Dial Indicator Set
	J 7872 Dial Indicator Clamp and Adapter
 J 8092	J 8092 Universal Driver
	J 21369-F Torque Converter Leak Test Fixture

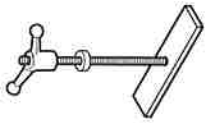
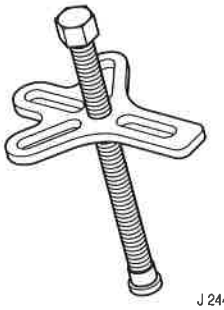
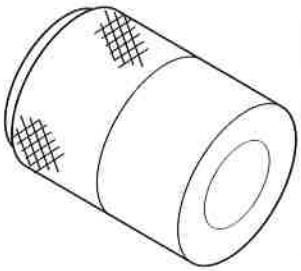
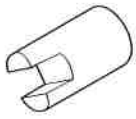
Illustration	Kent-Moore Tool No.**/ Description
	J 24204-2 Bar and Stud Assembly
 J 24420-B	J 24420-B Universal Puller
 J 24446	J 24446 Rear Bearing Installer
 J 24459-5	J 24459-5 Spring Compressor Adapter

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

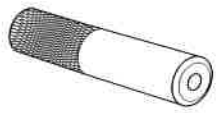
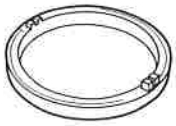
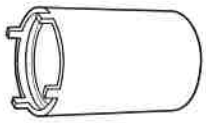
Illustration	Kent-Moore Tool No.**/ Description
	J 43766 Selector Shaft Spring Pin Installer
	J 43767 Tone Wheel Staker
	J 43768 Tone Wheel Driver
	J 43769 Spanner Nut Wrench—4WD

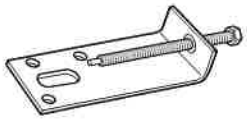
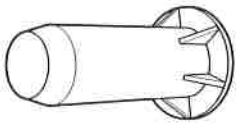
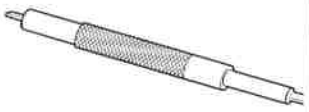
Illustration	Kent-Moore Tool No.**/ Description
	J 43770 Main, Lube, Converter Relief Valve Spring Compressor
	J 43771 Pump Bushing Installer/Remover
	J 43772 Oil Pump Seal Installer
	J 43773 Valve Spring Compressor

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

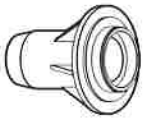
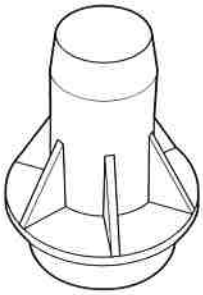
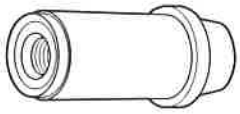
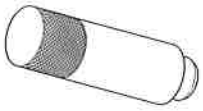
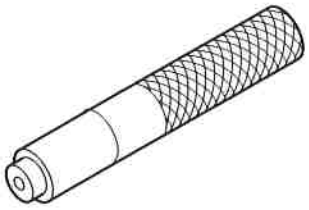
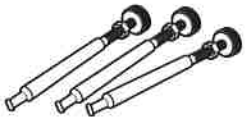
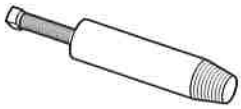
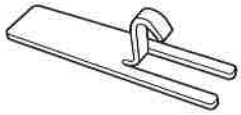
Illustration	Kent-Moore Tool No.**/ Description
	J 43782 Output Shaft Seal Installer
 J 43783	J 43783 Output Shaft Seal Installer
	J 43785 P2 Bushing Remover/ Installer
	J 43791 Output/Turbine Shaft Bushing Installer
	J 43797 P3 Carrier Bearing Race Installer

Illustration	Kent-Moore Tool No.**/ Description
 J 43909	J 43909 Selector Shaft Seal Installer
	J 43910 Output Bearing Puller Leg Set
	J 43911 Selector Shaft Seal Remover
	J 44247 Wiring Harness Connector Installer
	J 44525 C1 Clutch Backplate Selector (Silver colored)

3–3. REPLACEMENT PARTS

a. Ordering Information. Refer to the latest version of Parts Catalog PC3062EN 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 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.
- Do not lay bearings on a dirty bench. Place bearings on clean, lint-free paper.

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. A friction plate must not be re-used if it has been exposed to water and/or glycol. A loose face or flaking of friction material indicates being exposed.

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1. Inspect friction-faced clutch plates (C1 clutch plates are externally tanged; all other clutch plates are internally splined) for burrs, embedded metal particles, severely pitted faces, loose faces, excessive wear, cone, cracks, distortion, shallow oil groove depth, or damaged spline teeth. Remove burrs using a soft honing stone. Replace plates which have any defects.

2. Inspect steel plates (C1 clutch plates are internally splined; all other clutch plates are externally tanged) for burrs, scoring, excessive wear, excessive cone, distortion, imbedded

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 (200–300°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, TS3192EN.

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 "RESET ADAPTIVE SHIFT PARAMETERS." This will cause the TCM to erase previous adaptive information. Use Allison DOC™ 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 Paragraph 2–8). Reinstall the drain plug.
- Remove the transmission fill tube if it interferes with transmission removal. Plug the fill tube hole in the main housing to keep dirt from entering the transmission.

NOTE:

A significant amount of fluid may drain from the hydraulic lines when they are disconnected from the transmission.

e. Transmission Installation

CAUTION:

To avoid damage to the NSBU switch, make sure the transmission jack safety strap or chain does not bear on the NSBU switch.

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 (Paragraphs 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:

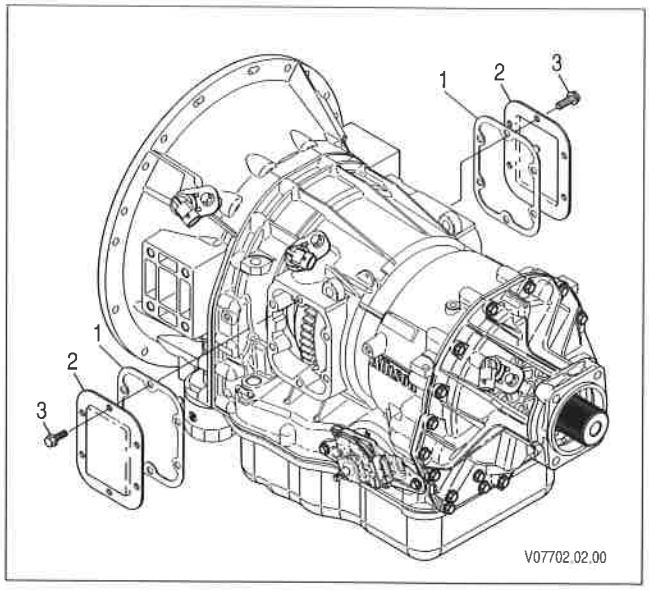
- **Use caution when installing, removing, or moving the transmission.**
- **Get help when lifting the transmission. Assistance from a hoist or another person may be required.**
- **Make sure that the lifting equipment can properly support the transmission.**

1. Position the transmission on the work table so that the oil pan is facing down.
2. If present, remove twelve PTO cover bolts (3).
3. If present, remove two PTO covers (2).

NOTE:

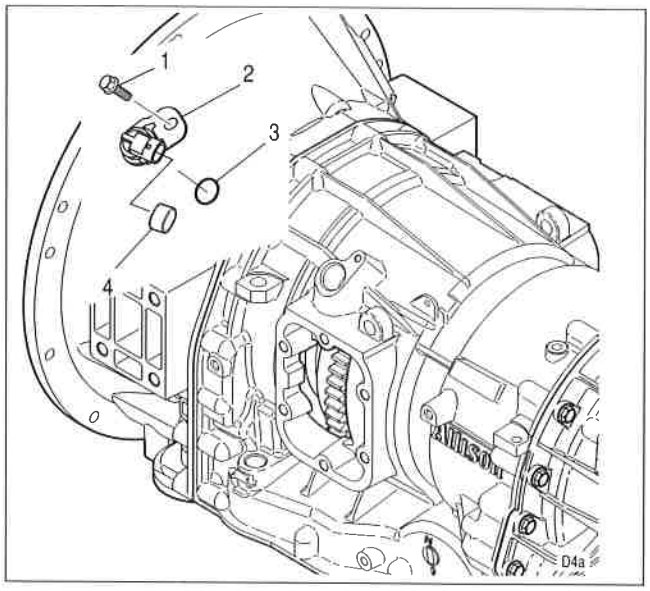
PTO cover gasket (1) has been redesigned. The former and current designs are interchangeable. The former design may be reused unless replacement is necessary or the design is no longer available. DO NOT use a PTO cover gasket to mount a PTO (refer to SIL 24-1K2K-01).

4. If present, remove two PTO gaskets (1).



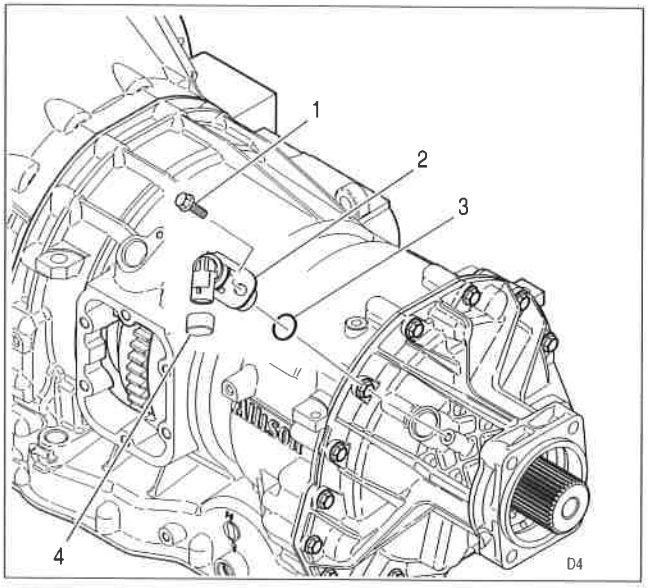
4–3. TURBINE SPEED SENSOR REMOVAL

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



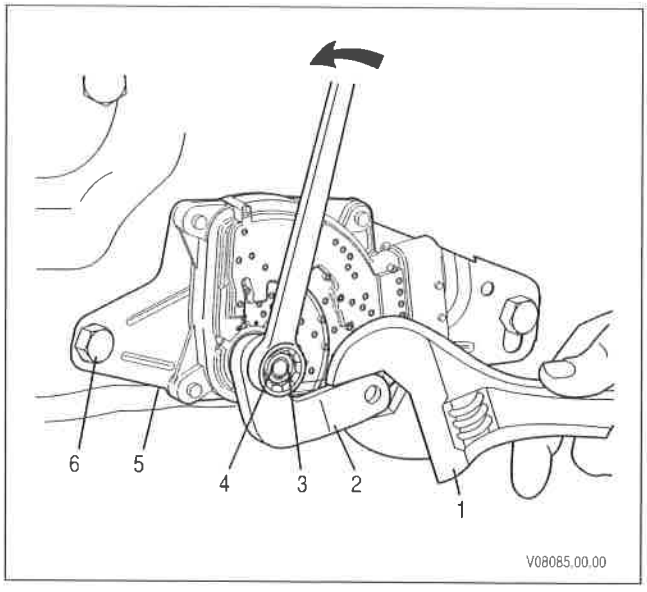
4–4. OUTPUT SPEED SENSOR REMOVAL (2WD TRANSMISSIONS ONLY)

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



4–5. NSBU SWITCH REMOVAL (IF PRESENT)

1. With a wrench keeping selector lever (2) from rotating, turn nut (3) counter-clockwise and remove from the selector shaft (4).
2. Inspect the selector shaft for a shoulder or a burr. Remove any shoulder or burr with a file before removing the NSBU switch.
3. Remove the selector lever from the selector shaft.



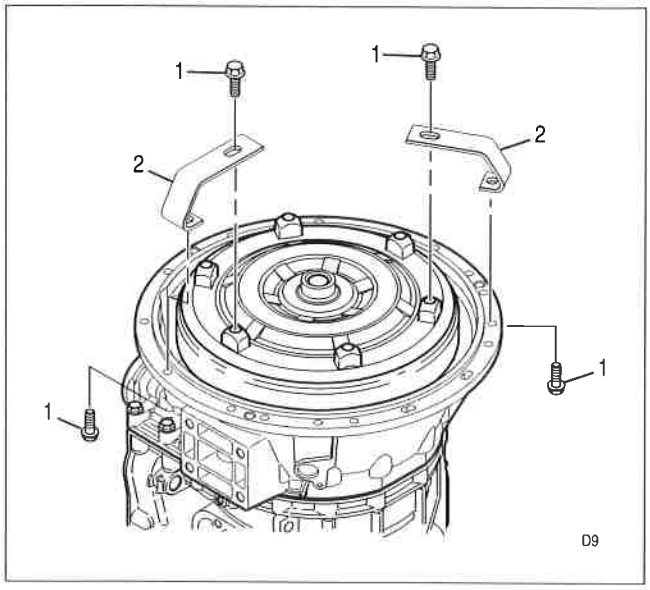
4–7. TORQUE CONVERTER REMOVAL

WARNING!

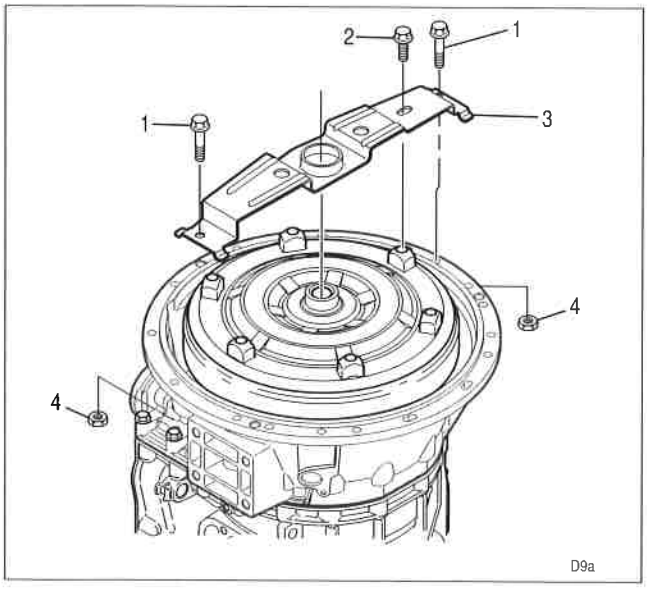
The 1000 and 2000 Product Families torque converter dry weights are approximately 29 kg (63 lb). To help avoid personal injury and/or property damage:

- **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 that the lifting equipment can properly support the torque converter.**

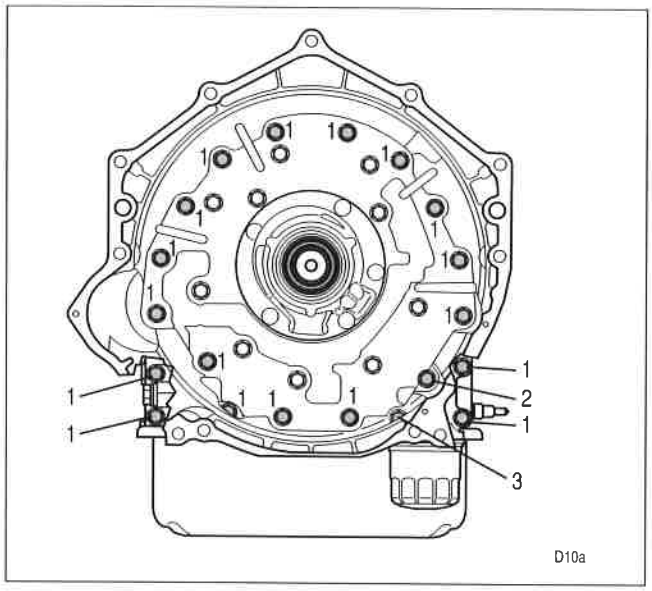
1. Position the transmission so that the front of the converter housing is facing up.
2. If present, remove four bolts (1) and two shipping brackets (2).



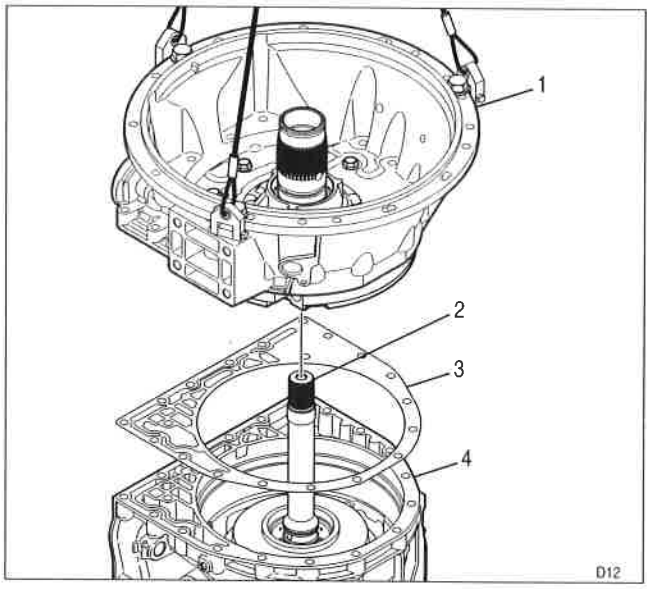
3. If present, remove one bolt (2), two nuts (4), two bolts (1), and shipping bracket (3).



2. For direct mount torque converter housings, remove the following.
   - 18 bolts (1)
   - 1 bolt (2)
   - 1 bolt (3)



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



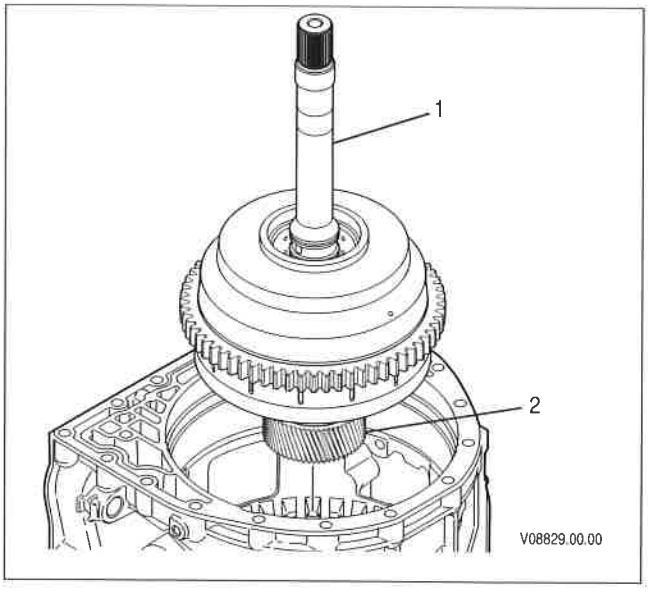
4–9. ROTATING CLUTCH ASSEMBLY REMOVAL

Tools Required

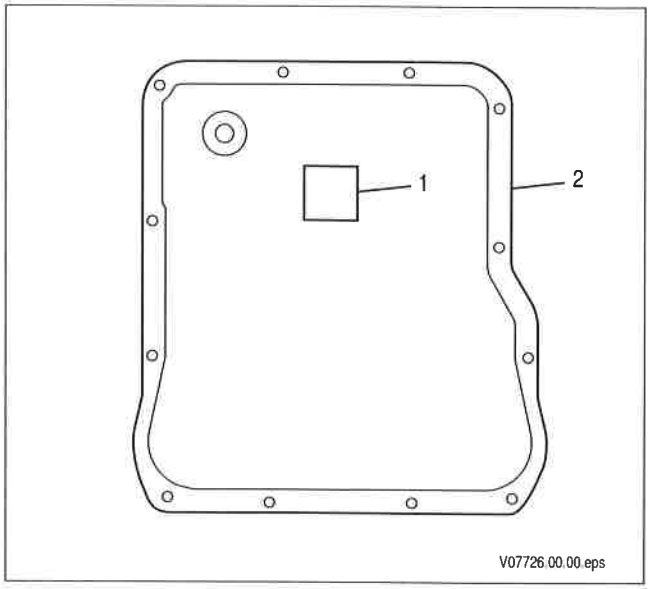
- J 44587 Main Shaft Holder

1. Remove rotating clutch module (1).

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

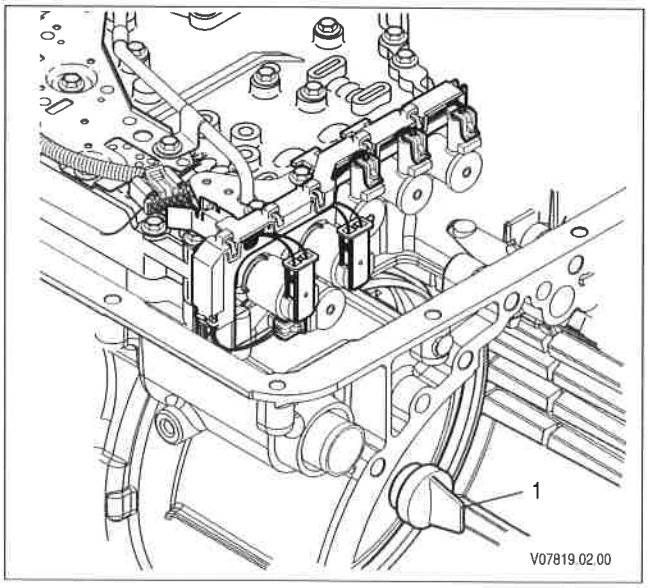


9. Inspect and clean magnet (1) in oil pan (2).

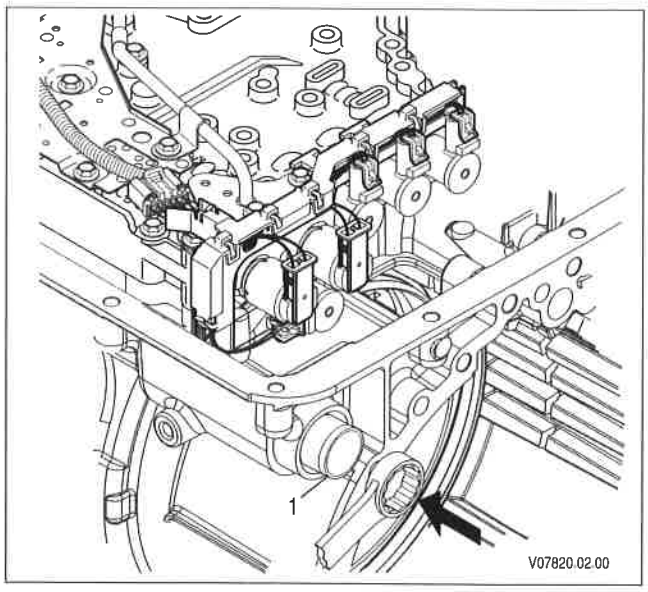


4–11. WIRING HARNESS ASSEMBLY REMOVAL

1. If present, remove connector shipping cover (1).



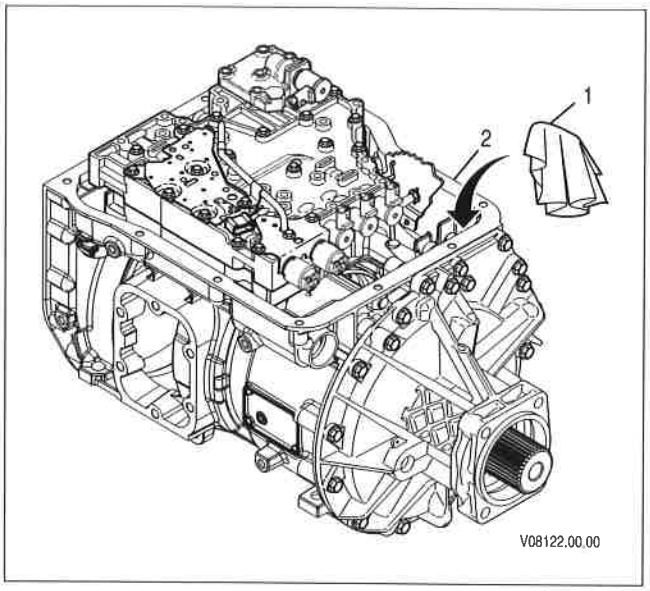
2. Using a 30–32 mm (1 3/16 inch) deepwell socket or box end wrench, depress the four tabs on internal wiring harness connector (1).
3. With the tabs depressed, gently pop the connector into and through main housing with the palm of the hand.



NOTE:

Installing a lint-free cloth into the park pawl apply assembly guide hole prevents the selector valve pin from falling into the transmission.

4. Install a lint-free cloth (1) in the park pawl apply assembly guide hole in main housing (2).



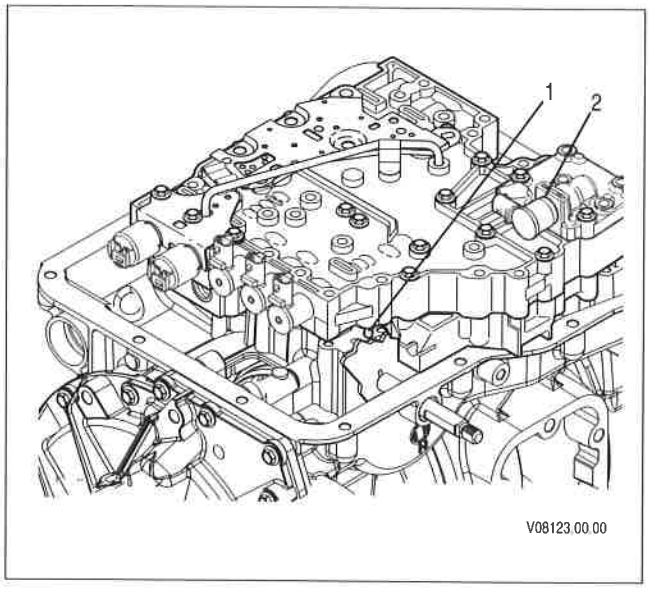
CAUTION:

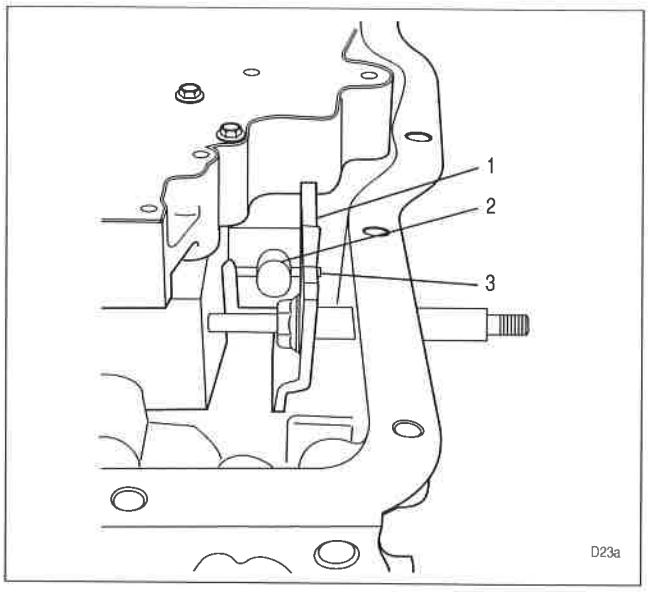
The main selector valve can be easily damaged. Do not drop the main selector valve when removing or installing the control valve assembly onto or from the main housing.

NOTE:

Placing an index finger over the end of the manual selector valve hole during the removal of the control valve module from the main housing is highly recommended.

5. Lift control valve assembly (2) until two dowel pins (1) of the control valve assembly are disengaged from the main housing.
6. Slide the control valve assembly to the side and disengage selector valve pin (3) from detent lever (1).
7. Remove the control valve assembly from the main housing.

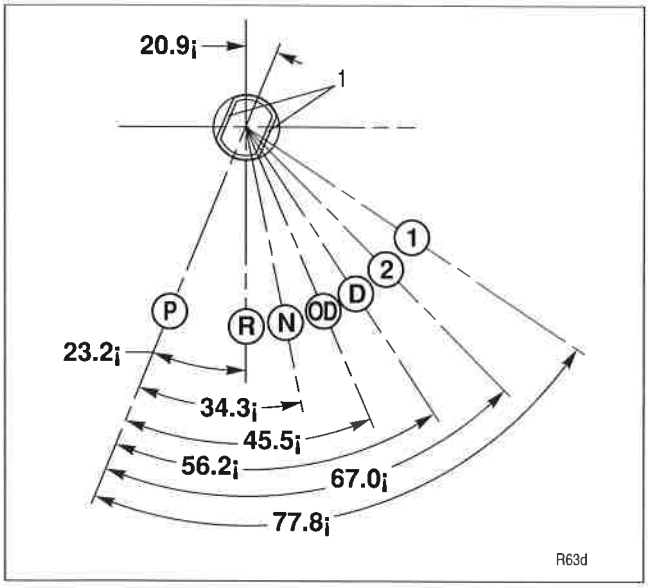




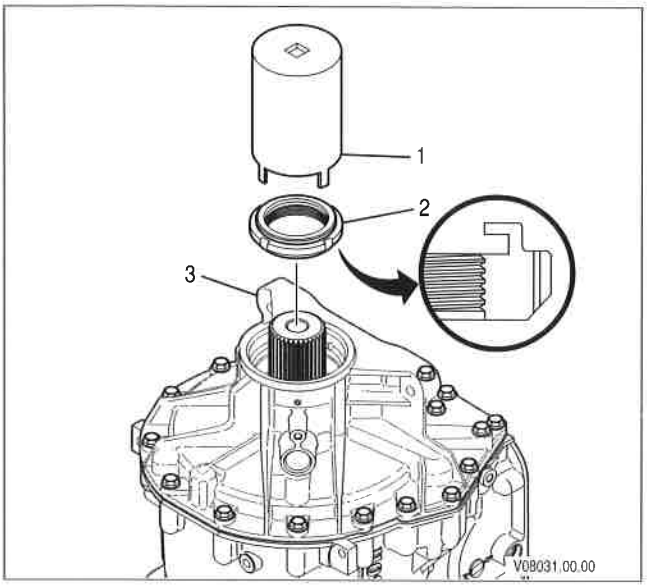
NOTE:

The fullest clockwise position of the selector shaft is P (Park), which engages the park pawl.

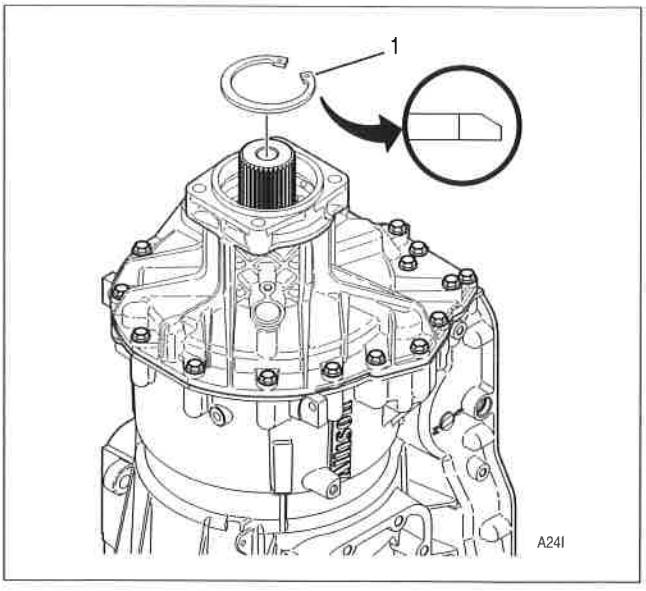
3. For four-wheel drive model transmissions only, use a wrench on selector shaft flats (1) to rotate the selector shaft to its fullest clockwise position.



4. For four-wheel drive model transmissions only, do the following.
   - Install J 43769 (1) onto output nut (2).
   - Remove output nut (2).



5. Remove retaining ring (1).



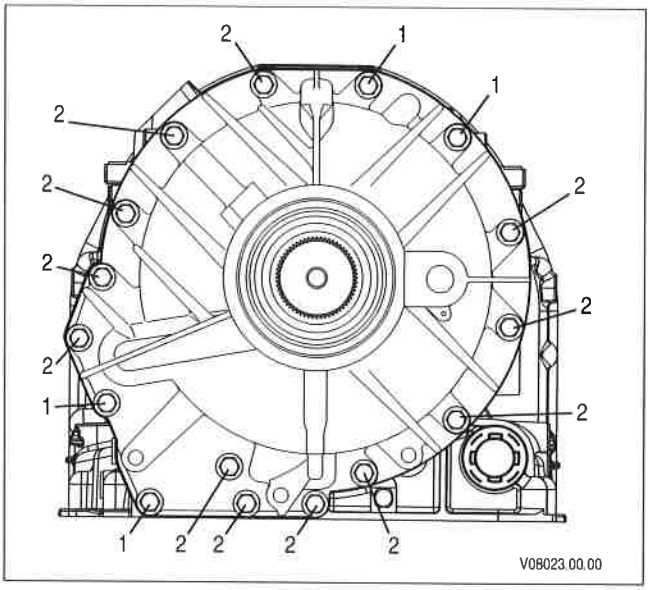
2. If a park brake cable bracket is not present, do the following.

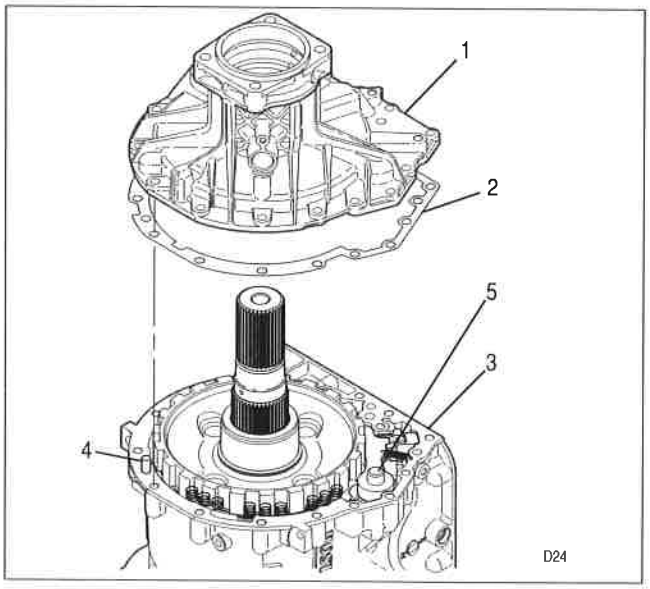
CAUTION:

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, however, shorter than the torque converter housing bolts. Installing torque converter housing bolts into the rear cover may damage the main housing. To help 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 help avoid main housing damage.

- Remove four bolts (1).
- Remove twelve bolts (2).

3. Disengage rear cover assembly (1) from main housing dowel pin (4) and pawl support pin (5).
4. Remove rear cover assembly (1).
5. Remove and discard rear cover gasket (2).





WARNING!

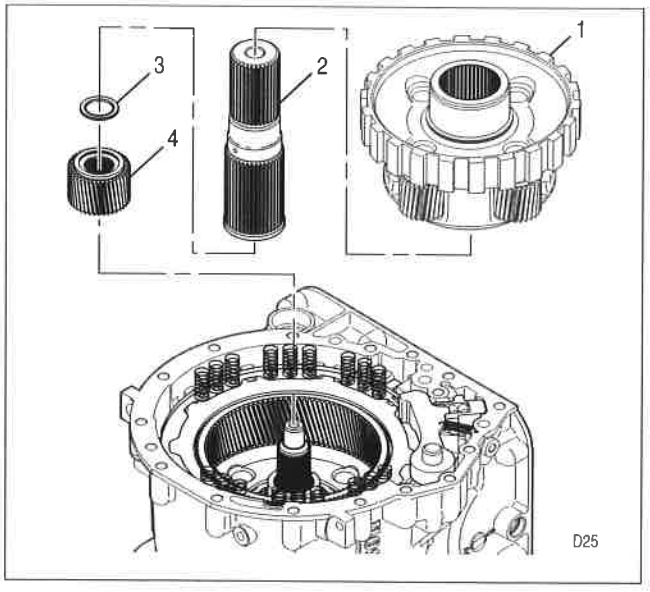
Always remove or install the P3 planetary carrier assembly by holding onto the output shaft. Holding onto the P3 carrier assembly instead of the output shaft may allow the output shaft to fall causing personal injury and/or property damage.

6. Remove, as a unit, output shaft (2) and P3 planetary carrier assembly (1).
7. Remove output shaft (2) from P3 planetary carrier (1).
8. Remove P3 sun gear (4).

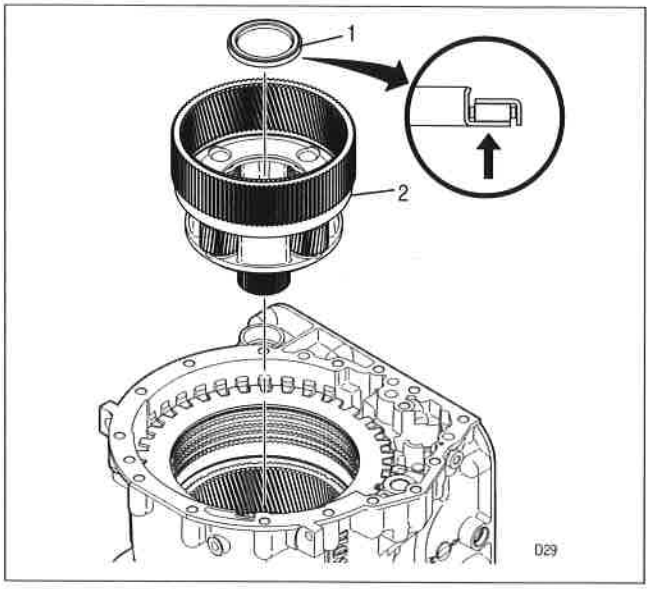
NOTE:

The thrust bearing assembly may adhere to the output shaft or the P3 sun gear.

9. Remove thrust bearing (3) from output shaft (2) or P3 sun gear (4).



3. Remove P2 planetary module (2).



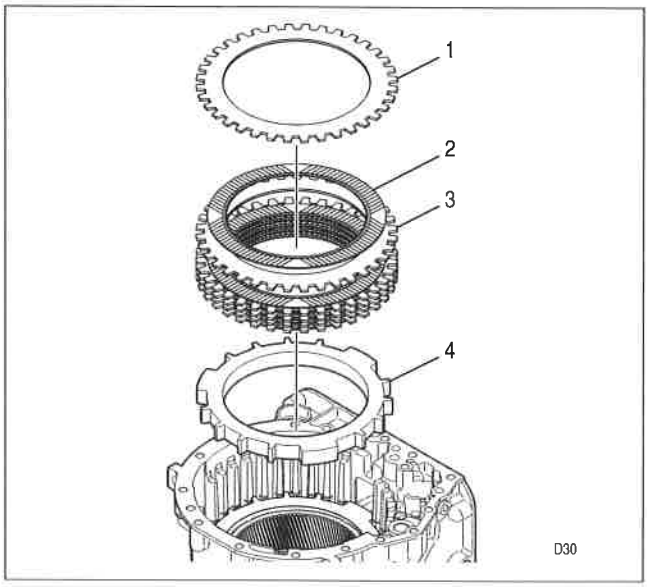
NOTE:

The thrust bearing assembly may adhere to the P2 planetary module or the P2 sun gear.

4. Remove thrust bearing assembly (1) from P2 planetary module (2) or the P2 sun gear.

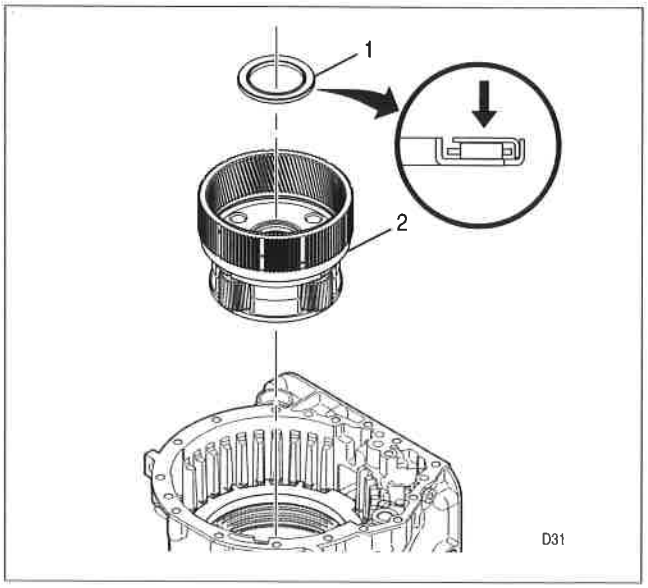
4–17. C5 CLUTCH REMOVAL

1. Remove selective reaction plate (1).
2. Remove six C5 clutch friction plates (2) and five C5 clutch reaction plates (3).
3. Remove C5 clutch backplate (4).



4–18. P1 PLANETARY MODULE

1. Remove P1 planetary module (2).

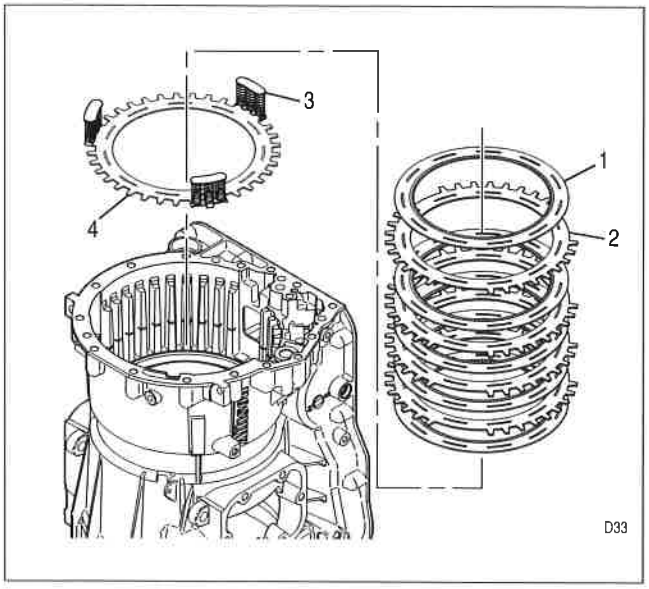


NOTE:

The thrust bearing assembly may adhere to the P1 planetary module or the P2 planetary module.

2. Remove thrust bearing assembly (1) from P1 planetary module (2) or the P2 planetary module.

7. Remove five C4 clutch friction plates (1) and four C4 clutch reaction plates (2).
8. Remove, as a unit, C4 spring plate (4) and three piston return spring assemblies (3).

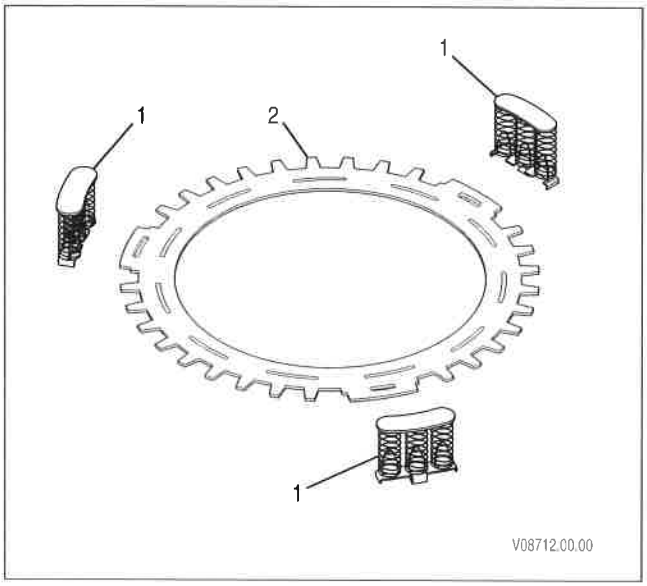


NOTE:

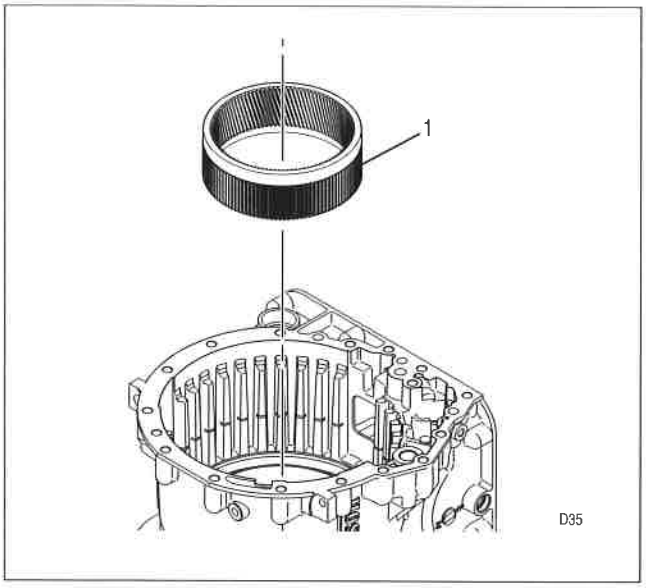
- **Beginning with S/N 6310345600 (Indianapolis) and S/N 6320330196 (Baltimore), the C3/C4 Spring Plate has been redesigned by adding a securing slot.**
- **Beginning with S/N 6310354268 (Indianapolis) and S/N 6320342704 (Baltimore), the C3/C4 Return Spring assembly clamp has been lengthened and tempered.**

Former and current parts are fully interchangeable (refer to SIL 1-1K2K-04).

9. Remove three piston return spring assemblies (1) from C4 spring plate (2).



10. Remove P1 ring gear (1).

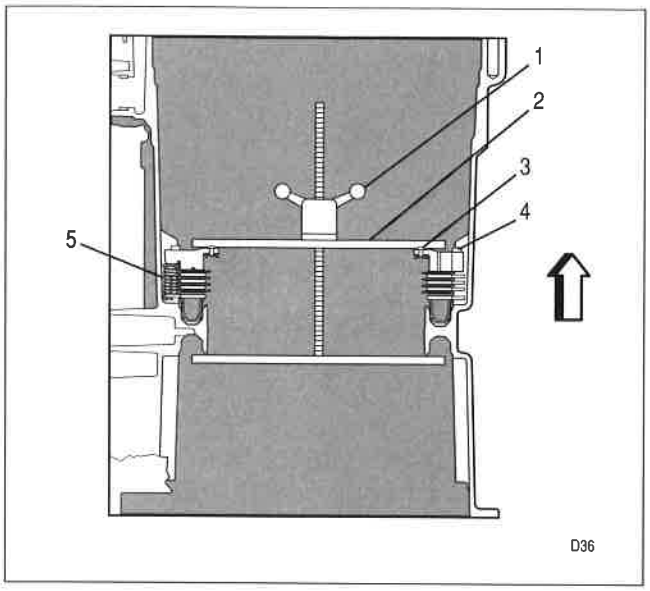


4–21. C3 CLUTCH REMOVAL

Tools Required

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

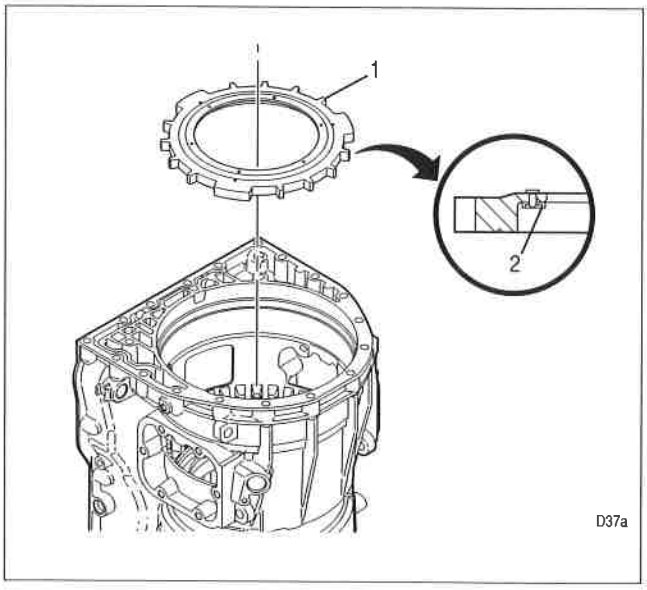
1. Position the main housing so that the front of the main housing is facing up.



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.

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



4–22. C3 CLUTCH PISTON ASSEMBLY REMOVAL

NOTE:

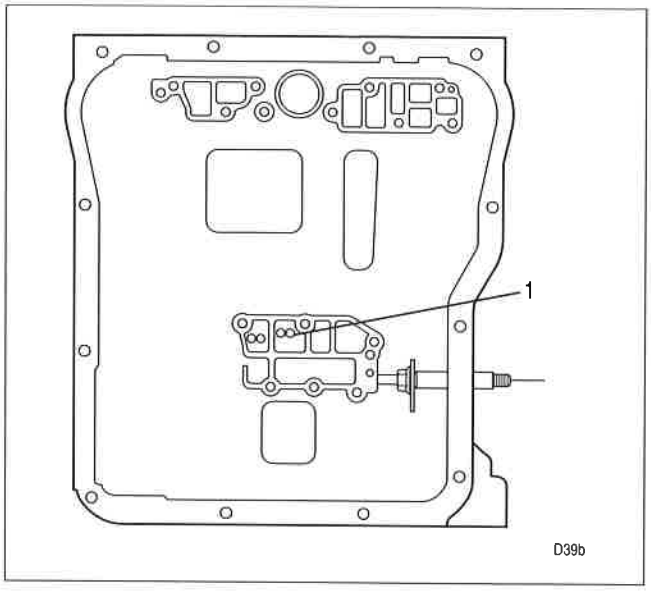
The preferred method of dislodging the C3 clutch piston is with compressed air. If compressed air is not available, remove the C3 clutch piston assembly using pliers. If compressed air is used, note the following.

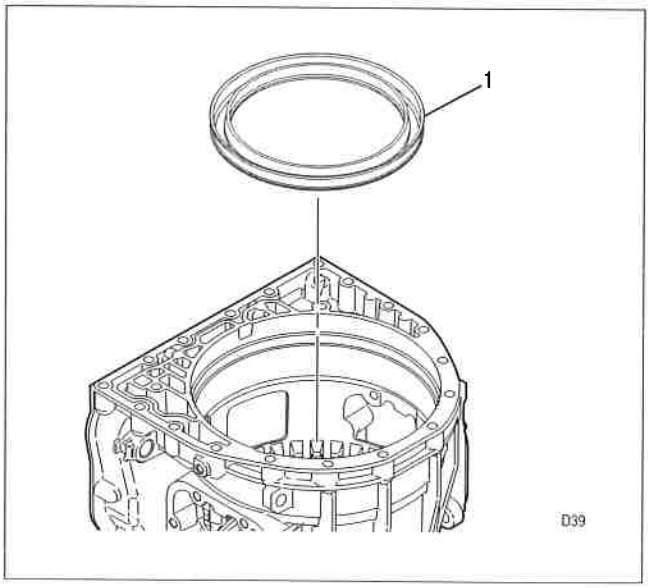
- **Use a 3/8 inch rubber hose on the air connection to reach into the C3 clutch annulus port.**
- **When shooting air into the annulus port, make sure that the rubber hose covers both of the C3 clutch annulus port holes.**

1. Position the air connection rubber hose so that the hose covers both C3 clutch annulus holes (1).

2. Shoot air into the C3 clutch annulus port until C3 clutch piston assembly (1) is dislodged.

3. Remove C3 clutch piston assembly (1).

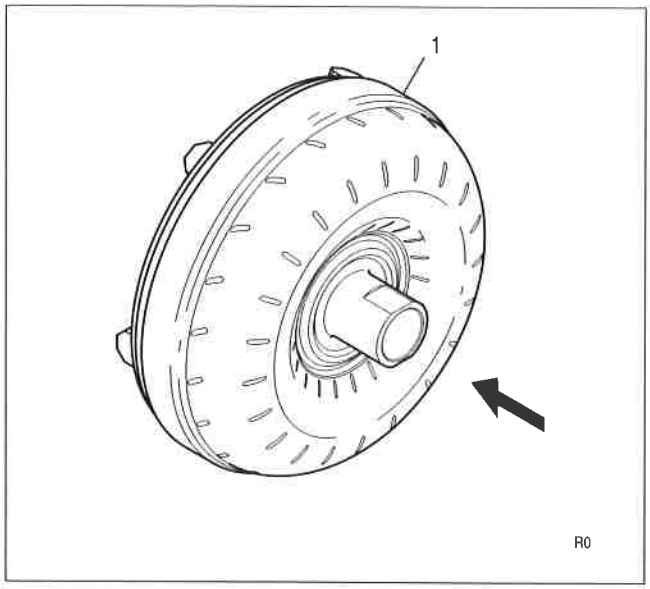




5–1. TORQUE CONVERTER ASSEMBLY

CAUTION:

Allison Transmission recommends using only genuine Allison torque converters with 1000 and 2000 Product Families Allison 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.



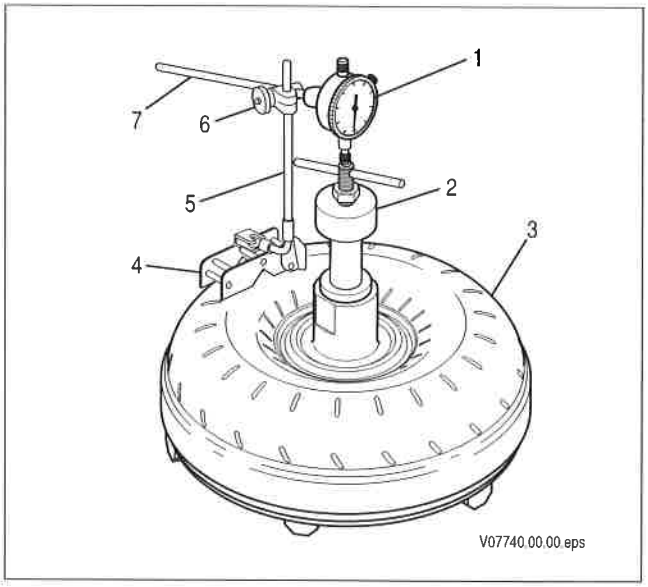
a. Preliminary Inspection

1. Remove the transmission fluid from torque converter (1).
2. Examine the transmission fluid for the following.
   - Evidence of foreign matter
   - Metal particles
3. If the torque converter is damaged, replace the torque converter.

b. End Play Check

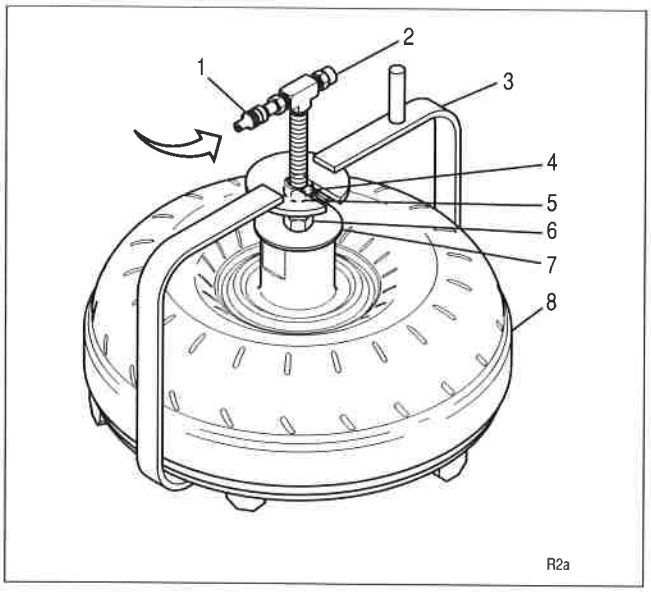
Tools Required

- J 43764 Torque Converter End Play Gauge
- J 5959-1 Dial Indicator
- J 5959-3 Rod ¼ x 10½ inches
- J 5959-7 Lug Attachment
- J 7872-2 Magnetic Clamp
- J 7872-3 Swivel Adapter



1. Position torque converter (3) on the work table so that the pump hub is facing up.
2. Install J 43764 (2) into the torque converter hub.
3. While holding J 43764 (2) in the converter hub, rotate the center screw until J 43764 is locked into the converter hub. Do not over tighten J 43764.

4. Install torque converter (8) with J 43763 (1) into J 21369-F (3).
5. Firmly tighten nut (6) in order to seal J 43763 into the torque converter.
6. Firmly tighten nut (5) in order to securely attach the torque converter to J 21369-F (3).
7. Connect an air hose to air fitting (1) of J 43763.
8. Pressurize the converter to 517 kPa (75 psi) maximum. Disconnect the air hose.
9. Submerge the torque converter in water.
10. Closely observe the torque converter for bubbles that indicate leakage. If the torque converter leaks, replace the torque converter.



WARNING!

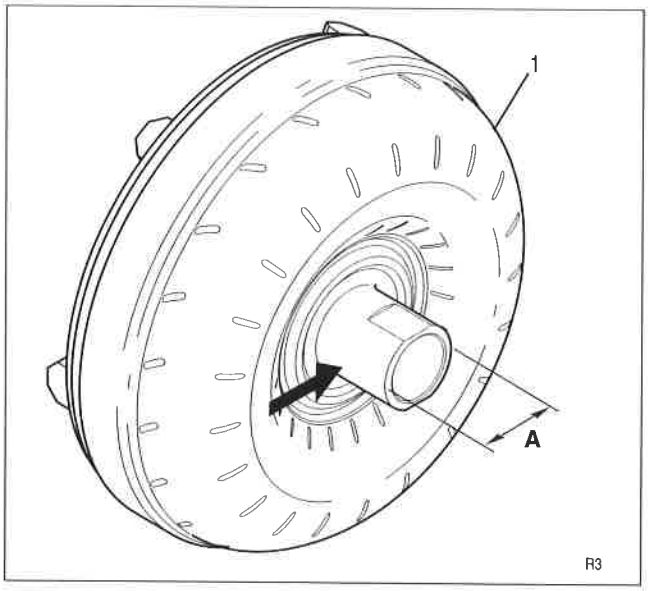
Exhaust all pressure from the torque converter before loosening the test fixture nut. Failure to relieve the pressure could cause personal injury and/or property damage.

11. Push on pressure relief valve (2) of J 43763 and release the air from the torque converter.
12. Remove the J tools from the torque converter.

d. Inspection of Torque Converter

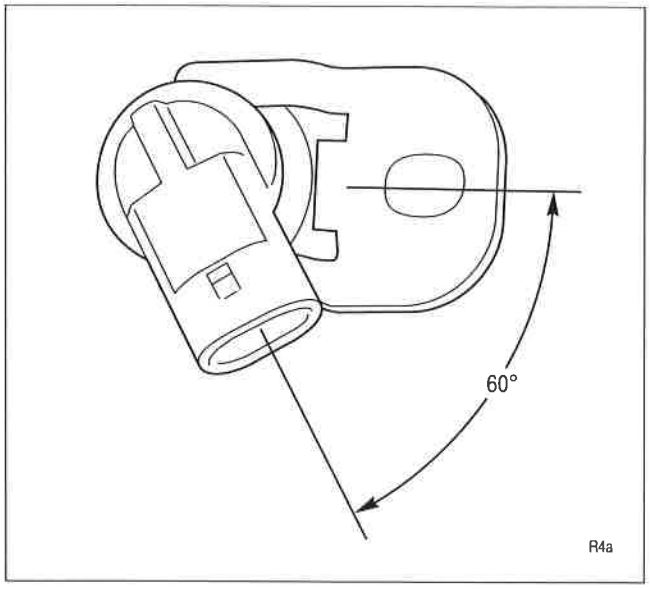
NOTE:
Replace the torque converter if it does not meet specifications.

1. Measure the OD of torque converter hub (1) in the bushing wear area (Dimension A). Dimension A must equal or exceed 58.250 mm (2.2933 inch).



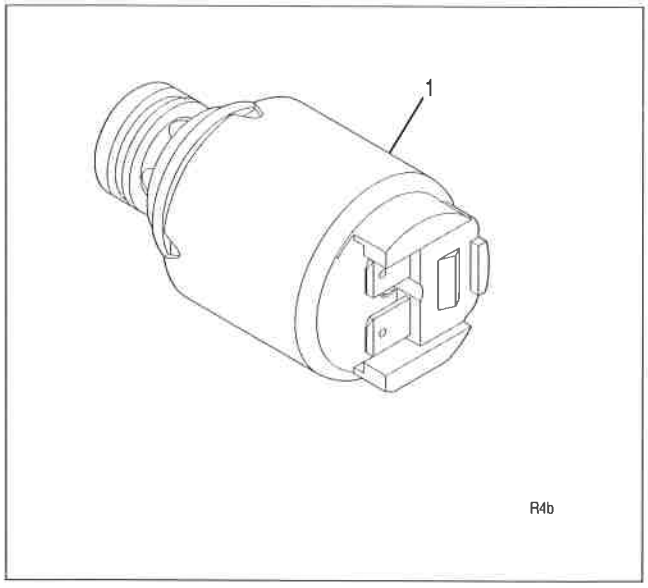
5–2. ELECTRONIC COMPONENT INSPECTION

1. Perform the following steps for the input, turbine, and output speed sensors.
   - Replace speed sensor if the speed sensor shows signs of cracking and/or oil leakage.
   - Replace the speed sensor if the attachment bracket is bent or damaged or the speed sensor is loose in its bore.
   - Make sure the speed sensor connection is oriented as shown.
   - Measure the resistance of the speed sensor. If the resistance does not meet the following specifications, replace the speed sensor.



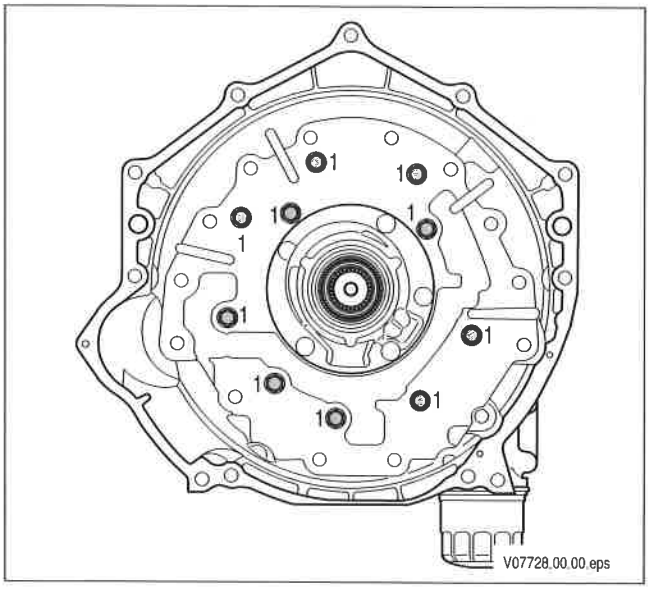
Ambient Temperature		Resistance
(°C)	(°F)	(Ohms)
0	32	2157–2637
25	77	2340–2860
50	122	2614–3195

2. Measure the resistance of A trim and B trim solenoids (1). If the resistance does not meet the following specifications, replace the solenoid.

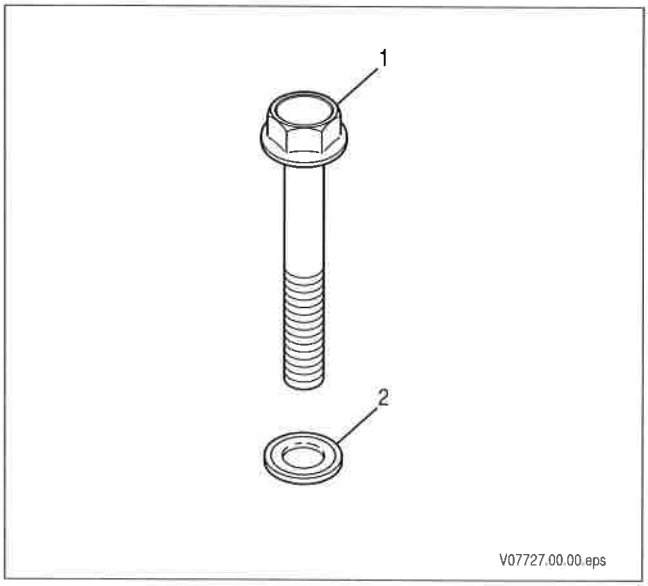


Sump Temperature		Resistance
(°C)	(°F)	(Ohms)
0	32	4.5
20	68	5.5
40	104	6.5

3. Remove 10 bolts (1).



4. Remove seals (2) from bolts (1).



CAUTION:

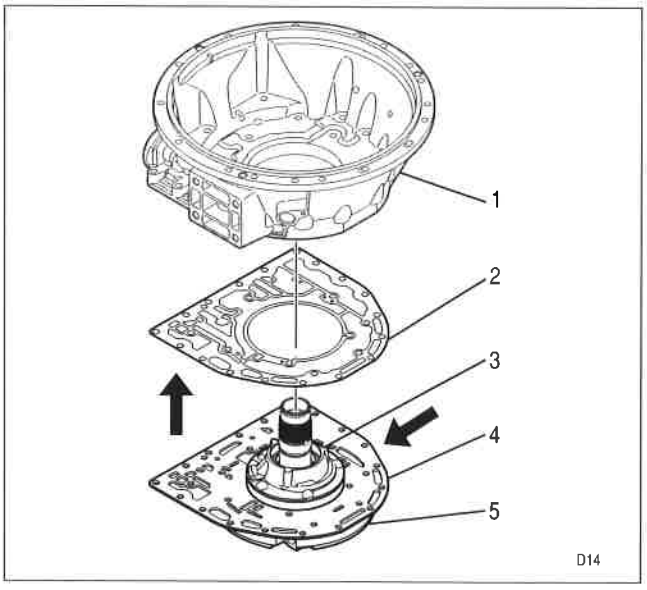
Do not damage the separator plate when separating the torque converter housing from the front support module.

5. Remove converter housing (1) from front support module (3).

NOTE:

Separator Plate Gasket (2) has been redesigned. The former and current designs are interchangeable. The former design may be reused unless replacement is necessary (refer to SIL 21-1K2K-01, Rev. A).

6. Remove converter housing/separator plate gasket (2) from separator plate (4).



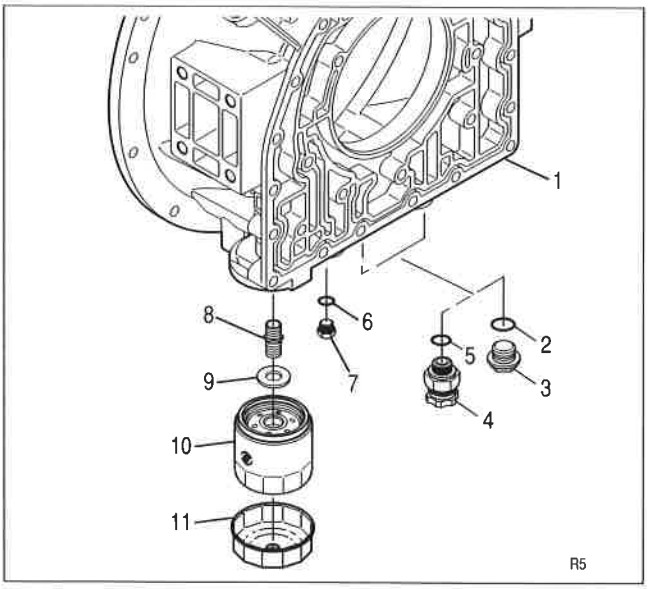
5–4. TORQUE CONVERTER HOUSING (WITHOUT COOLER MANIFOLD)

a. Disassembly

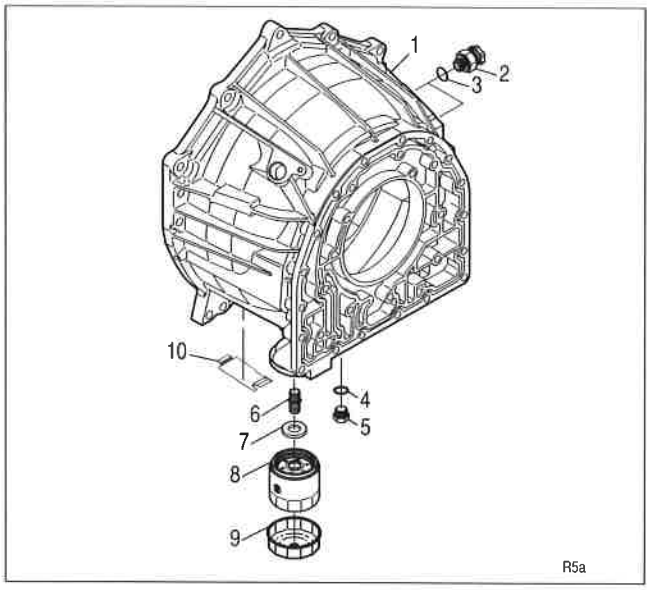
Tools Required

- J 45023 Control Main Filter Wrench

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



5–5. TORQUE CONVERTER HOUSING (DIRECT MOUNT; WITHOUT COOLER MANIFOLD)



a. Disassembly

Tools Required

- J 45023 Control Main Filter Wrench

1. Remove pressure tap plug (5). Remove O-ring (4) from the pressure tap plug.
2. Using J 45023 (9) or a filter strap wrench, remove control main filter (8).
3. Remove magnet (7) from filter attachment tube (6) or from filter (8).
4. Remove filter attachment tube (6).
5. Remove bolt access cover (10).
6. If present, remove two hydraulic connector assemblies (2). Remove O-rings (3) from the connector assemblies.

b. Assembly

Tools Required

- J 45023 Control Main Filter Wrench

CAUTION:

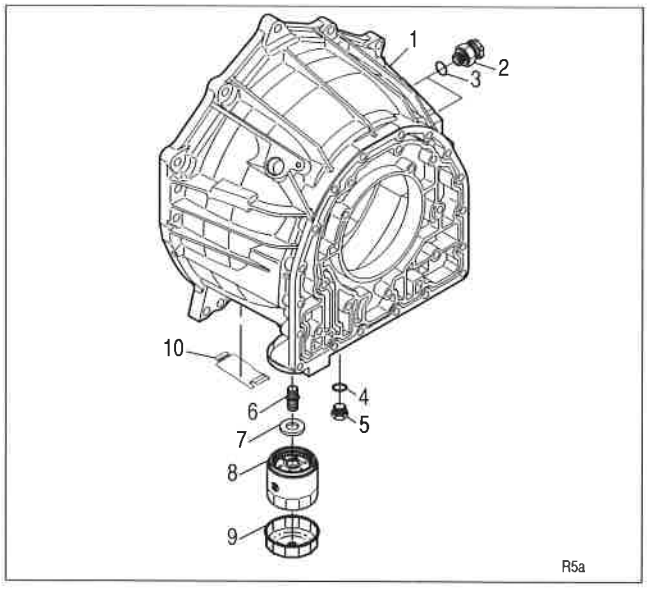
Install the short-threaded end of the filter attachment tube into the converter housing. If the long-threaded end of the filter attachment tube is installed, the threads of the converter housing will be damaged.

1. Install filter attachment tube (6) by hand. Tighten the tube to 25–35 N·m (18–26 lb ft).
2. Install magnet (7) onto the filter attachment tube.
3. Lubricate the gasket on control main filter (8) with transmission fluid.
4. Install the control main filter by hand until the gasket on the control main filter touches the converter housing.

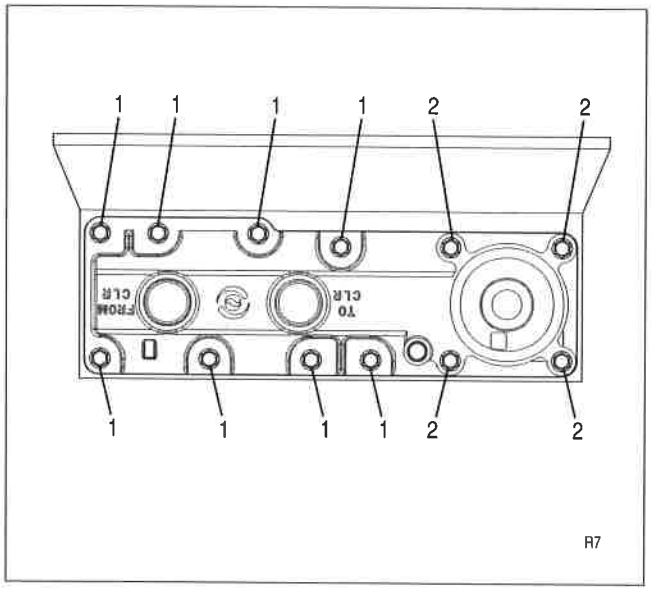
CAUTION:

Turning the control main filter more than ONE FULL TURN after gasket contact will damage the filter.

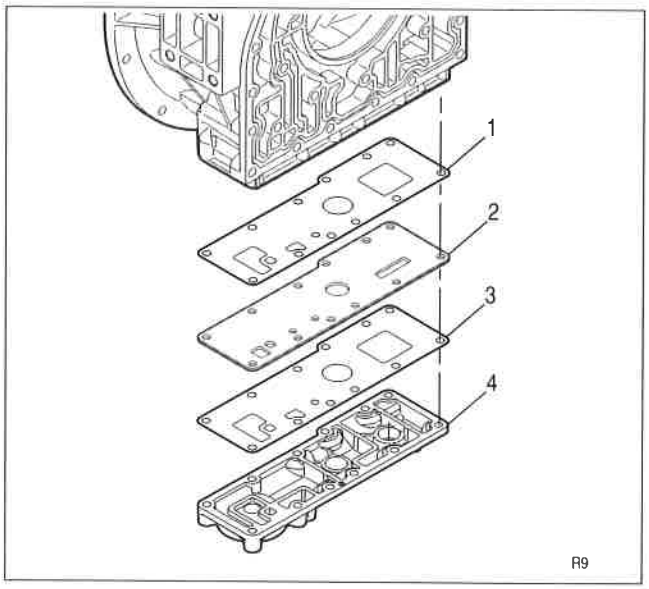
5. Using J 45023 (9) or by hand, turn the filter ONE FULL TURN ONLY.



7. Remove four manifold bolts (2).
8. Remove eight manifold bolts (1).



9. Remove cooler manifold (4), gasket (3), channel plate (2), and gasket (1).

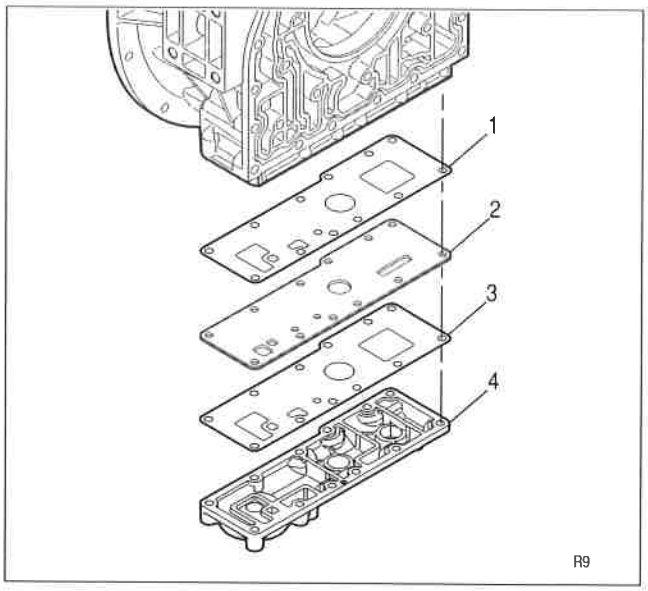


b. Assembly

Tools Required

- J 45023 Control Main Filter Wrench

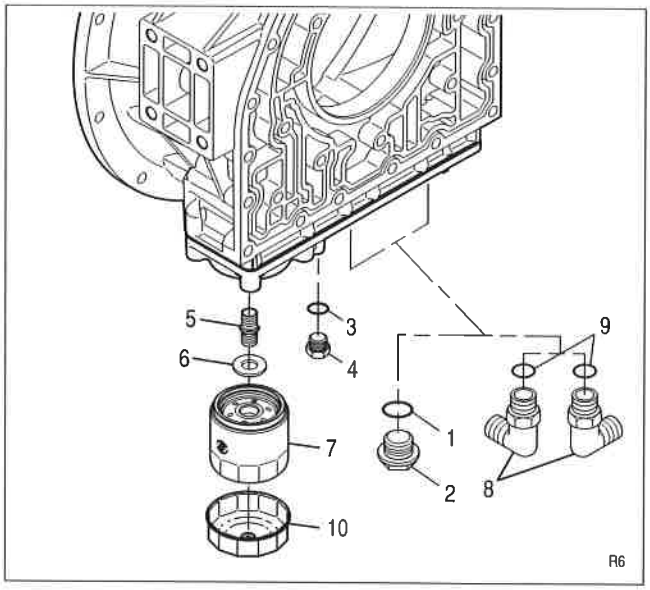
1. Install gasket (1), channel plate (2), gasket (3), and cooler manifold (4).



11. If present, install O-rings (1) onto two shipping plugs (2). Install the shipping plugs. Tighten the plugs to 2.5–3.5 N·m (2–3 lb ft).

12. If present, install two elbow adapters (90 degree) (8) as follows.

    - Install O-rings (9) onto elbow adapters (8).
    - Install the elbow adapters so that they align with the orientation marks made on the manifold.
    - Tighten the elbow adapters to 20–30 N·m (15–22 lb ft).

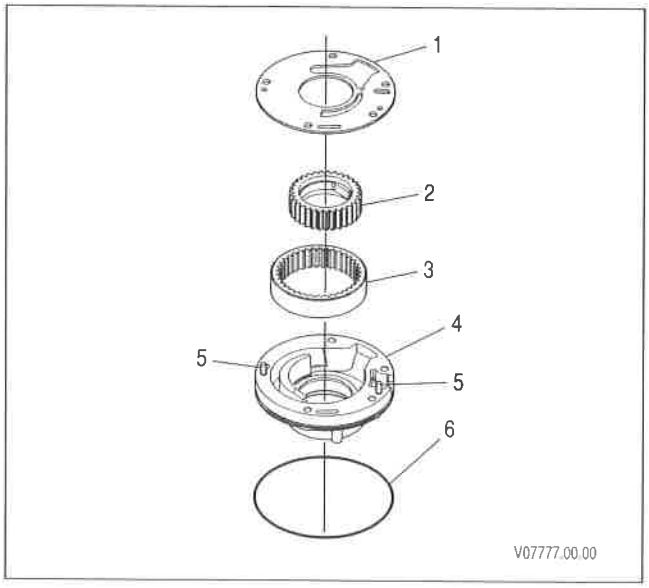


5–7. *MAIN PUMP ASSEMBLY*

a. Main Pump Disassembly

NOTE:
Staring with S/N 6310374684 (Indianapolis) and S/N 6320367833 (Baltimore), the Main Pump Body and Wear Plate have been redesigned. The former and current designs are not interchangeable (refer to SIL 3-1K2K-04).

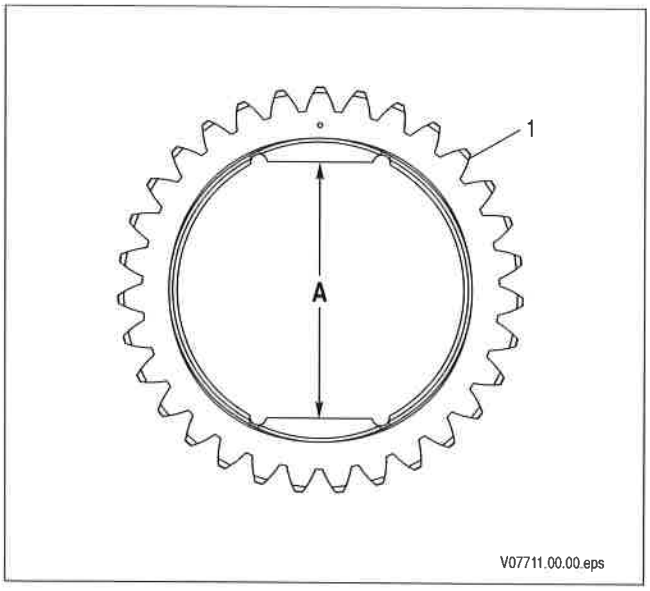
1. Remove wear plate (1).



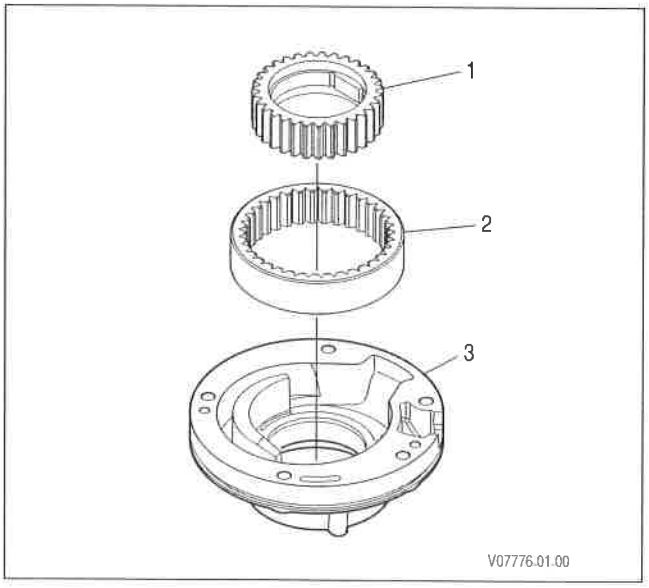
NOTE:
The main pump drive gear and driven gear have a punch mark on one side. Before the gears are removed from the main pump, the presence or absence of the punch marks on the gears must be noted so that the gears can be reinstalled in their original orientation.

2. Note the presence or absence of punch marks on the drive gear and driven gear. If punch marks are absent, move the drive and driven gears for re-alignment.
3. Remove drive gear (2) and driven gear (3) from main pump body (4).
4. Remove O-ring (6).

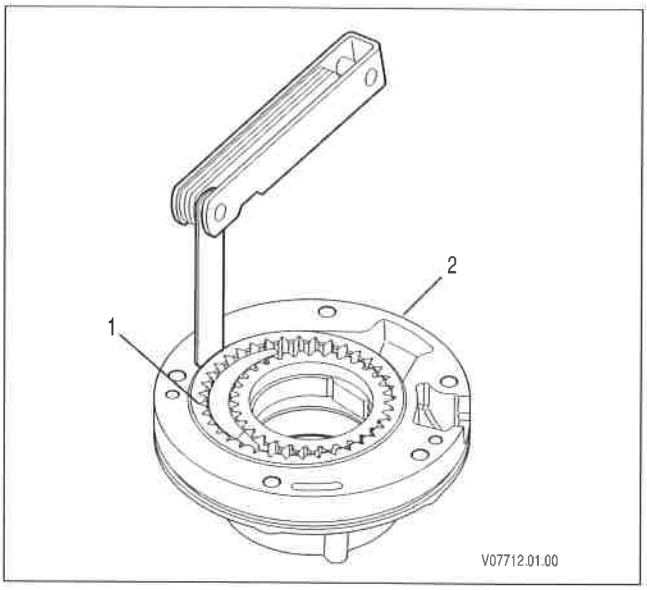
4. Measure the distance between the flats of the drive gear (Dimension A). The maximum distance between the flats is 52.165 mm (2.0537 inch).



5. Align the drive gear and driven gear with the main pump so that their punch marks are in the same position as when they were originally removed.
6. Install the gears into main pump body (3).



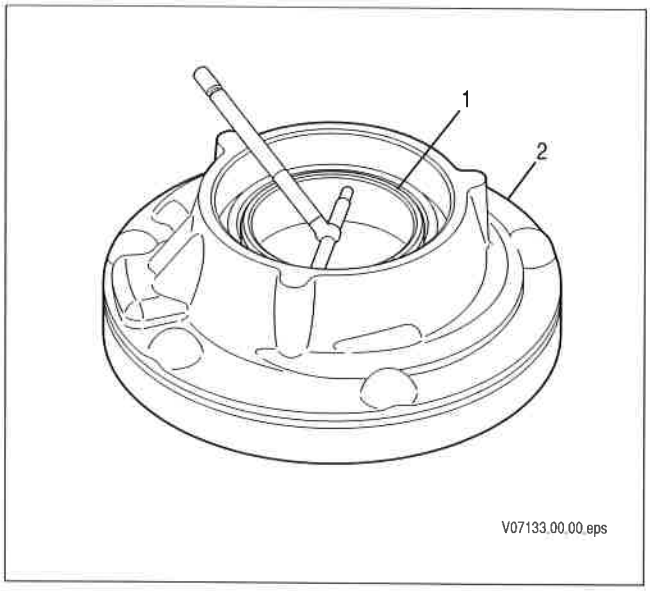
7. Measure the clearance between driven gear (1) and main pump body (2) (Driven Gear Diametral Clearance). The maximum Driven Gear Diametral Clearance is 0.204 mm (0.0080 inch).



c. Main Pump Bushing Replacement

Tools Required

- J 43771 Pump Bushing Removal and Installation Tool
- J 8092 Universal Driver



NOTE:

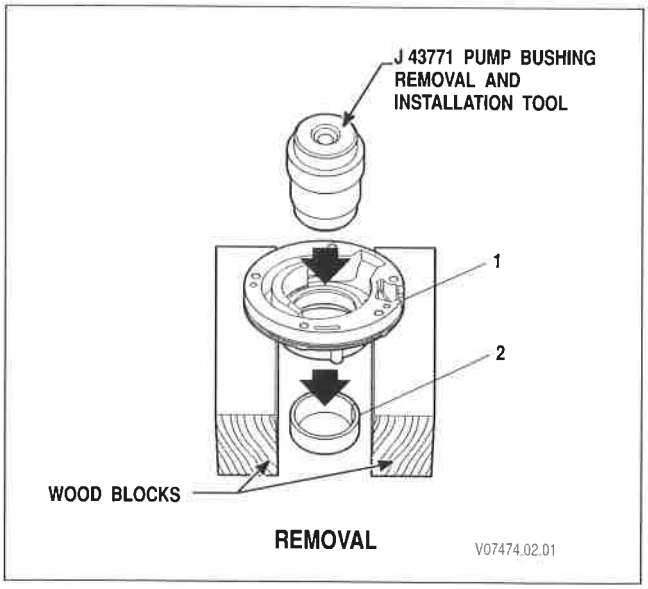
The current pump assembly, P/N 29541145, and the current converter/main case separator plate, P/N 29541148, are interchangeable prior to S/N 6310374684 Indianapolis and S/N 6320367833 Baltimore. After S/N 6310374684 Indianapolis and S/N 6320367833 Baltimore, the current pump assembly, P/N 29541145, wear plate P/N 29541149, and the converter/main case separator plate, P/N 29541148, must be used together with front support assembly P/N 29541134 (refer to SIL 3-1K2K-04).

1. Inspect the bushing for damage and wear. The bushing must not be damaged or worn.
2. Measure the ID of the bushing. The ID of the pump bushing must not exceed 58.458 mm (2.3015 inch). The pump bushing must have a complete burnt-orange Teflon® coating. If any portion of the Teflon® coating is worn and bronze material is visible, replace the bushing.
3. Remove all gears from pump body (1).
4. Remove the front seal from pump body (1).

NOTE:

The preferred method for removing or installing the bushing is to use tool J 43771 and a press. If a press is not available, use J 43771 and universal driver J 8092.

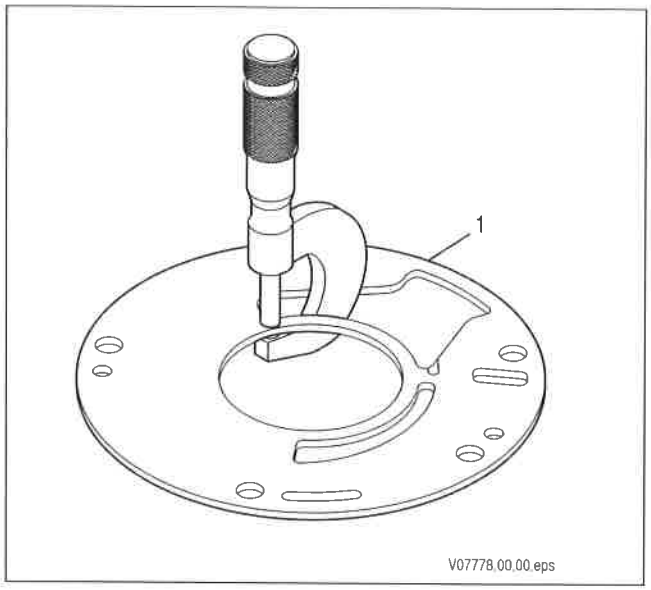
5. Support pump body (1), machined surface up, on two wooden blocks so that bushing (2) can be removed from the back.
6. Install the longer end of J 43771 into the bushing.
7. Press, or drive, bushing (2) from pump body (1).
8. Clean the bushing bore of all residues. Parts must be dry before installing the bushing.



e. Wear Plate Inspection

NOTE:

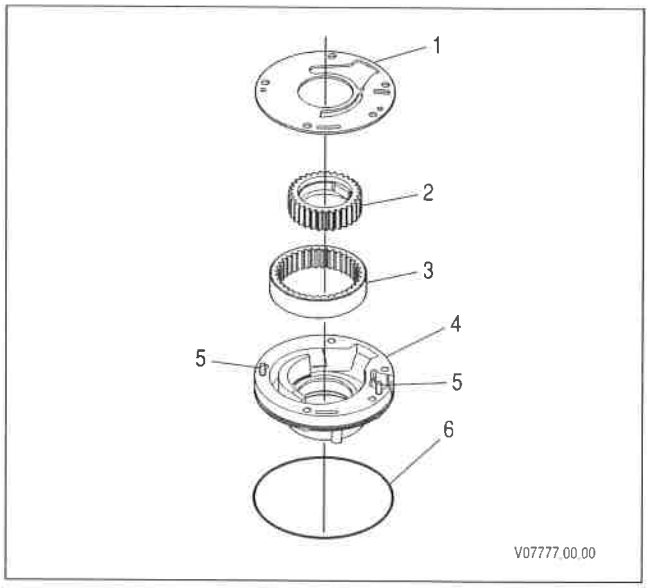
- **Starting with S/N 6310374684 (Indianapolis) and S/N 6320367833 (Baltimore), the Wear Plate has been redesigned. The former and current designs are not interchangeable (refer to SIL 3-1K2K-04).**
- **If any of the following specifications are not met, replace the main pump wear plate.**



1. Inspect wear plate (1) for damage. The wear plate must not be scored, nicked, or grooved.
2. Measure the thickness of the wear plate in the gear wear area. The thickness of the wear plate must not be less than 2.950 mm (0.1161 inch).

f. Main Pump Assembly

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

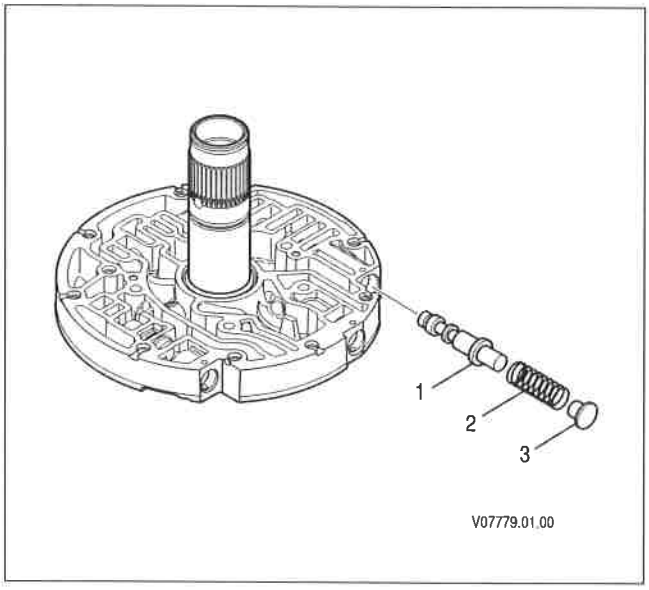


CAUTION:

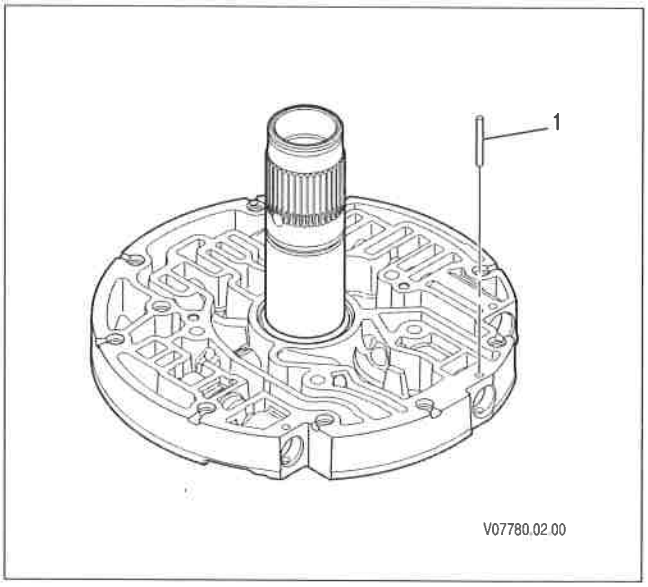
When the drive gear and driven gear are installed into the main pump, the gears must be installed in their original orientation by having their punch marks in the same position as when they were originally removed. Failure to install the drive and driven gears in their original orientation may damage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

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

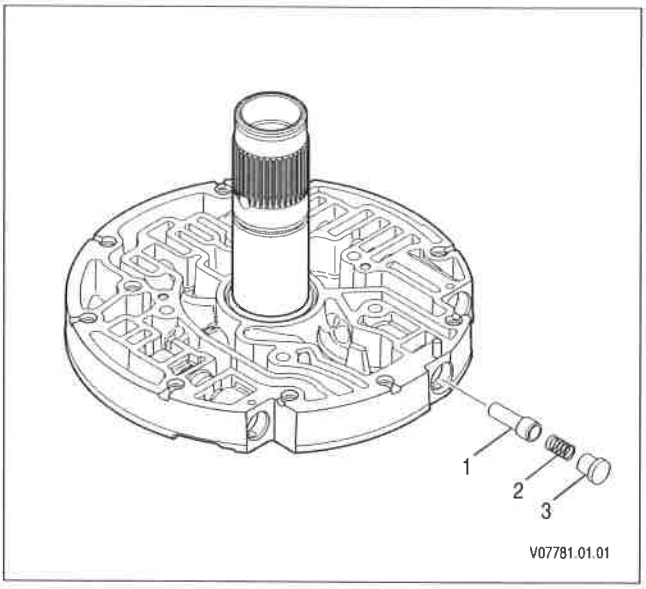
11. Remove stop (3), spring (2), and main regulator valve (1).



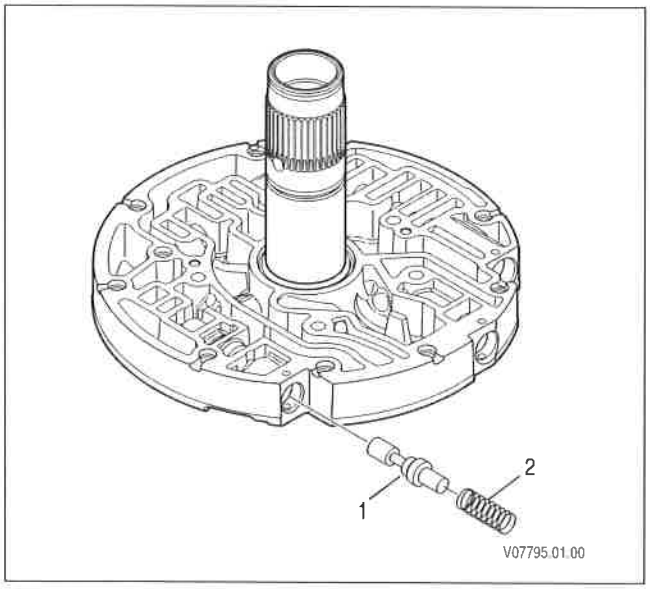
12. For MY04i, use J 24459-5 (2) and adapter to compress the C1 clutch backfill valve spring until retaining pin (1) is loose. Remove the pin.



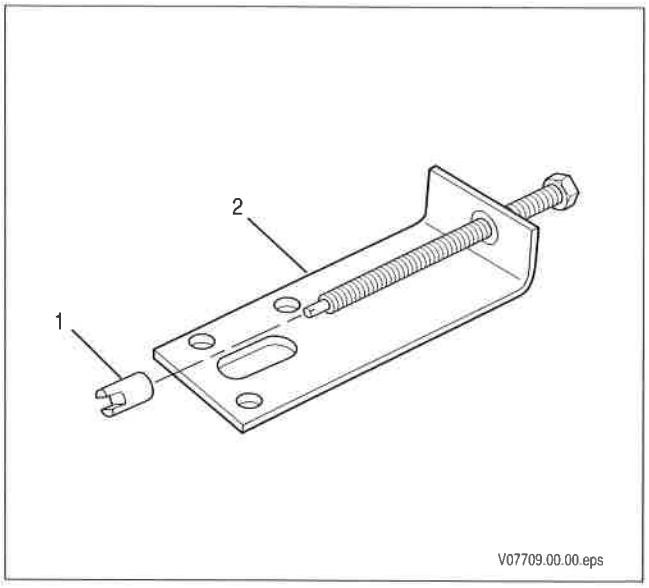
13. Remove spring (2) and C1 clutch backfill valve (1).



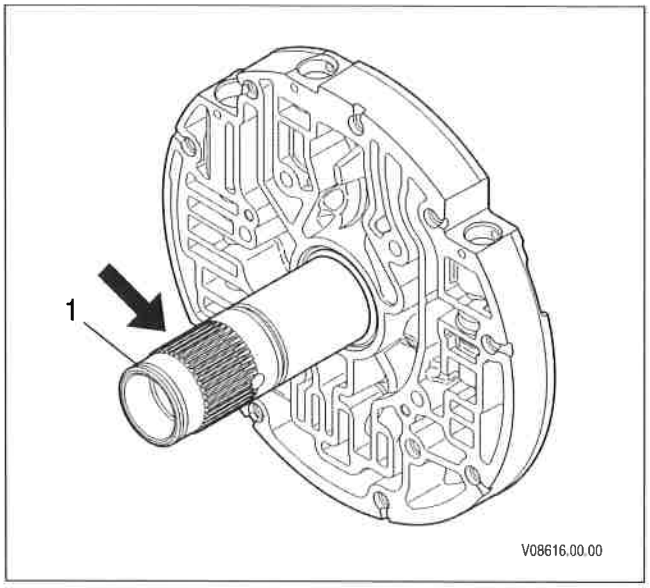
18. Remove spring (2) and converter relief valve (1).



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



b. Ground Sleeve Inspection



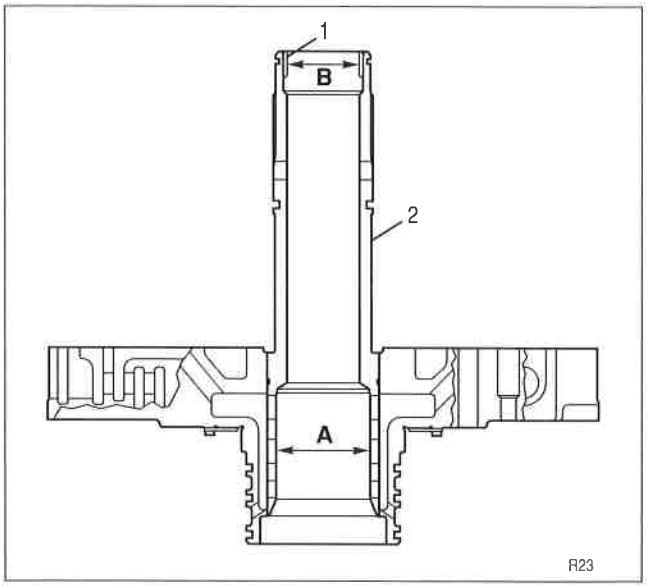
NOTE:

- **The ground sleeve bushing and bearing are replaced with the ground sleeve installed in the front support.**
  - **Replace the needle bearing if the bearing is damaged.**
  - **Replace the bushing if the bushing is damaged or the ID specification is not met.**
- **The only time the ground sleeve is pressed from the front support is to replace the ground sleeve.**
  - **The new ground sleeve comes with a pre-installed bushing.**
  - **Replace the ground sleeve if the ground sleeve splines or sealring bore specification is not met.**
- **The bearing must be removed to replace the ground sleeve. If the ground sleeve and the bearing both need replacing, replace the ground sleeve first.**
- **Replace the ground sleeve if it does not meet specifications.**

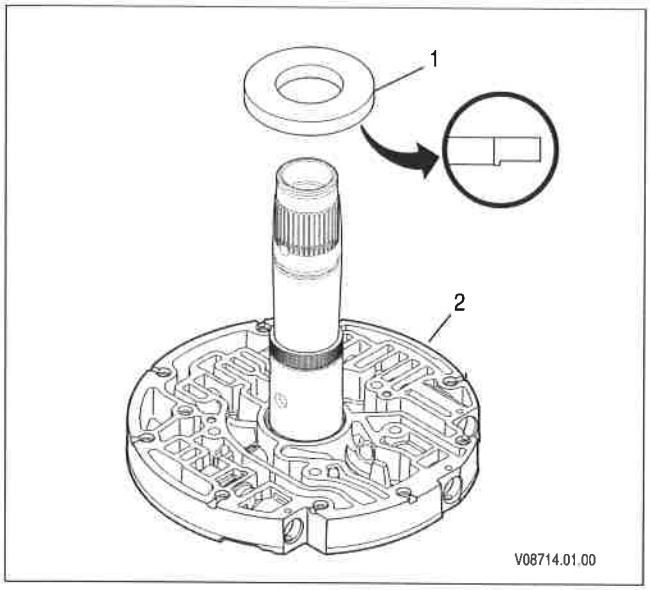
1. Inspect the splines of ground sleeve (1) for damage and wear. No visible wear is allowed.

2. Measure the ID of ground sleeve (2) at the turbine shaft sealring bore (Dimension A). Maximum ID is 45.450 mm (1.7894 inch).

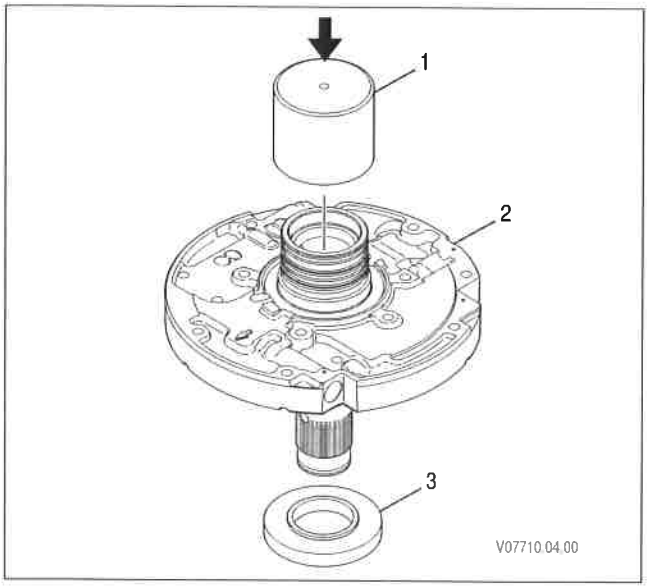
3. Measure the ID of ground sleeve bushing (1) (Dimension B). Maximum ID is 33.820 mm (1.3315 inch).



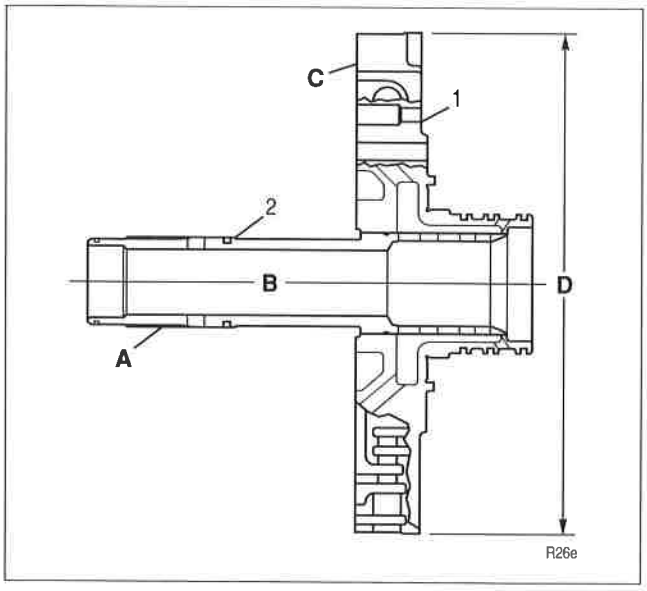
9. Align J 43765-1 (1) so that the lip of the tool is down.
10. Install J 43765-1 (1) onto the ground sleeve.



11. While holding J 43765-1 (3) in place, turn over the front support/ground sleeve and place J 43765-1 on a press.
12. Install J 43765-3 (1) into the rear hub of front support (2).
13. Press on J 43765-3 until the ground sleeve seats.



14. Check the Total Indicated Runout (TIR) of the ground sleeve as follows.
    - Install the OD (D) of front support (1) in a lathe.
    - Using a dial indicator, make sure front support (1) surface (C) is square with the OD (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).
15. If the bearing does not need replacing, install the bearing per Paragraph 5–8**d**.



e. Ground Sleeve Bushing Replacement

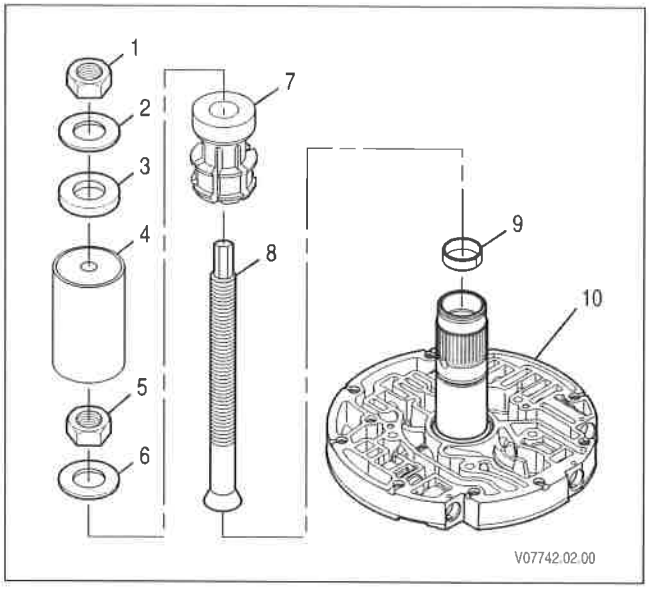
Tools Required

- J 44529 Ground Sleeve Bushing Remover
- J 8092 Universal Driver
- J 43774 Ground Sleeve Bushing Installer

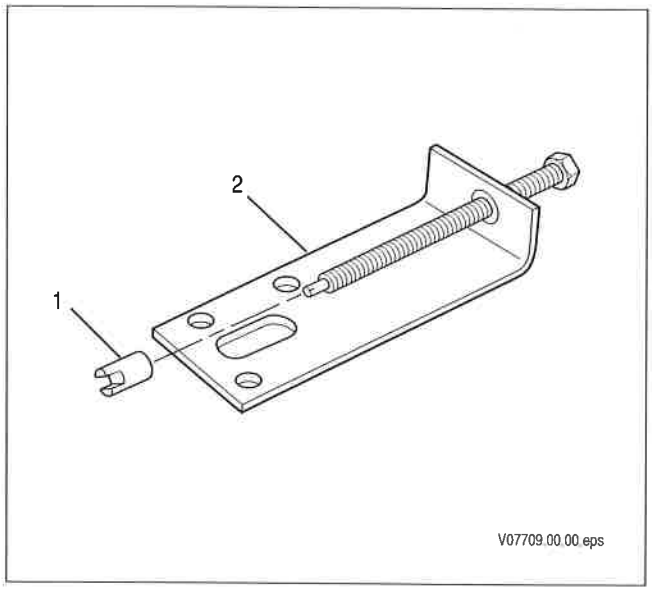
CAUTION:

Always use J 44529 when removing the ground sleeve bushing to help avoid damage to the ground sleeve sealing surface.

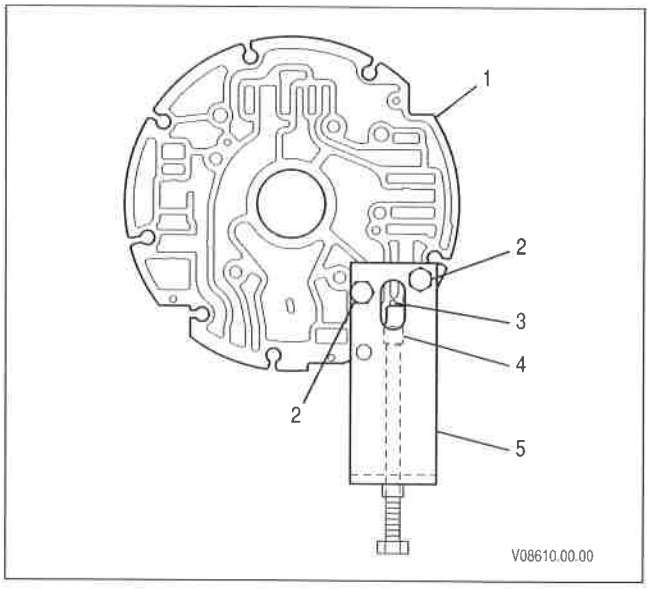
1. Position front support (10) so that it is supported by wooden blocks and the ground sleeve is facing up.
2. Install J 44529-2 (8) into J 44529-1 (7).
3. Install J 44529-2 (8) and J 44529-1 (7) into bushing (9).
4. Install washer (6) and nut (5) onto J 44529-2 (8).
5. While holding the top of J 44529-2 (8) with a wrench, tighten nut (5) until J 44529-1 (7) engages bushing (9).
6. Install J 44529-3 (4) onto J 44529-2 (8).
7. Install bearing (3), washer (2), and nut (1) onto J 44529-2 (8).
8. While holding the top of J 44529-2 (8) with a wrench, tighten nut (1) until the bushing is dislodged.
9. Remove the J tools from the ground sleeve.
10. Remove the bushing from the J tools.



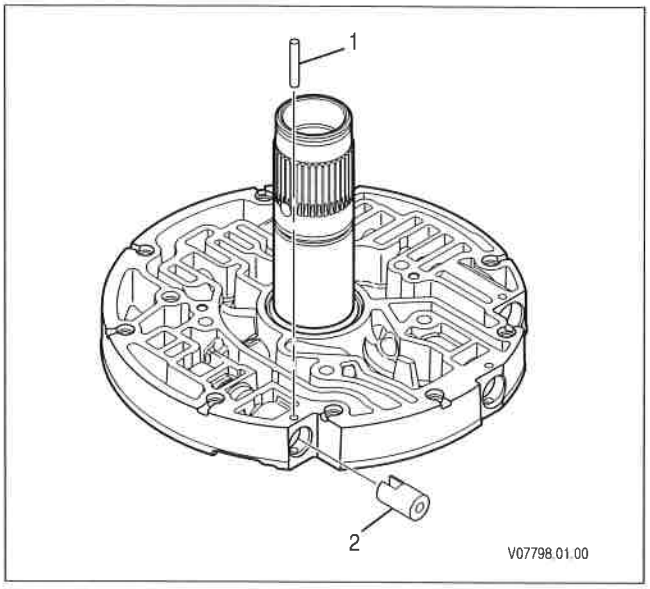
4. Install J 24459-5 (1) onto J 43770 (2).



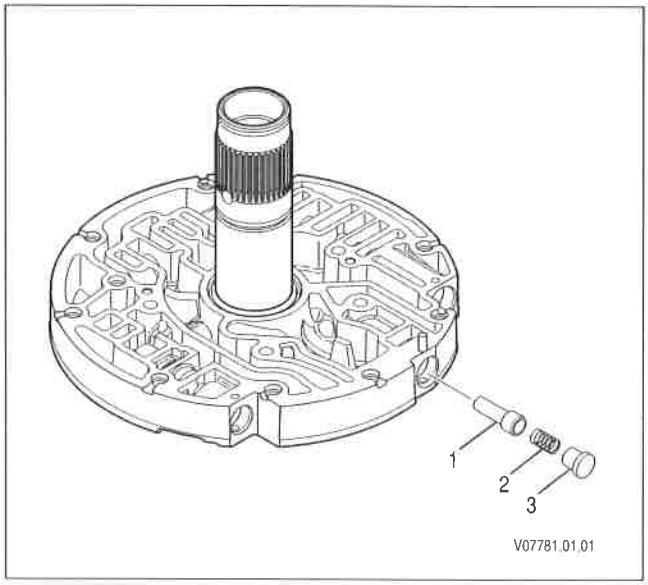
5. Align J 43770 (5) and J 24459-5 (4) with the front support so that:
   - The threaded rod of J 43770 is facing down.
   - Two J 43770 bolt holes align with two bolt holes of the front support.
6. Install J 43770 (5) onto the front support assembly.
7. Install two bolts (2).
8. Align J 24459-5 (4) slot with the pin (3).
9. Using J 24459-5 (4) and J 43770 (5), compress the spring until the stop is past the pin hole.
10. Install retainer pin (3). Make sure the pin is below the front support surface.
11. Remove the J tools.



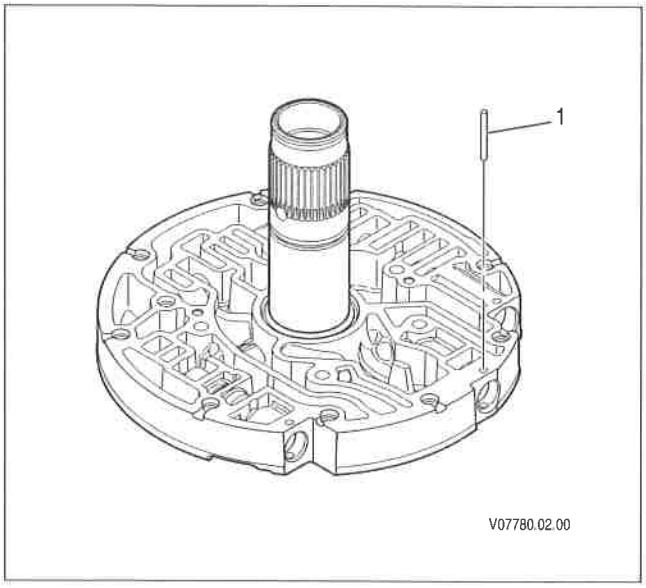
19. Align J 24459-5 (2) slot with retainer pin (1).
20. Using J 24459-5 (2), compress the spring until the stop is past the pin hole.
21. Install retainer pin (1). Make sure the pin is below the surface of the front support.



22. Install C1 clutch backfill valve (1).
23. Install C1 clutch backfill valve spring (2).
24. Install C1 clutch backfill valve stop (3).
25. Align the slot in stop (3) with the retaining pin hole.



26. Using J 24459-5 and adapter, compress the valve spring.
27. Install retaining pin (1). Make sure the retaining pin is below the surface of the front support

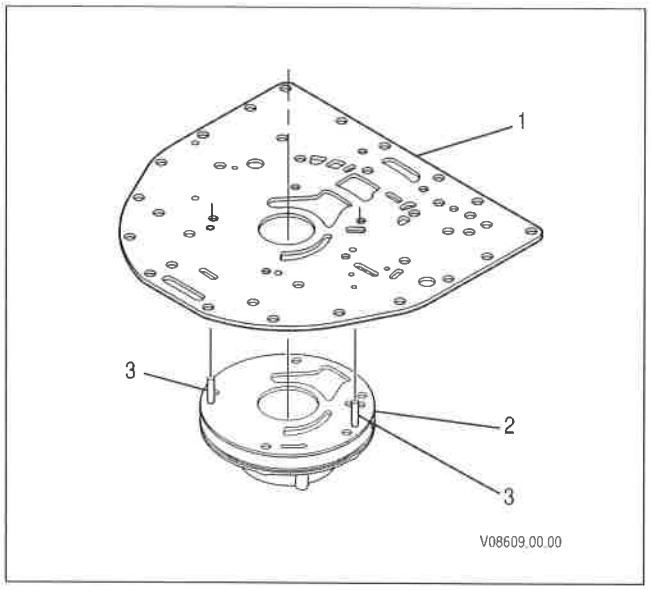


5–9. CONVERTER HOUSING/FRONT SUPPORT MODULE ASSEMBLY

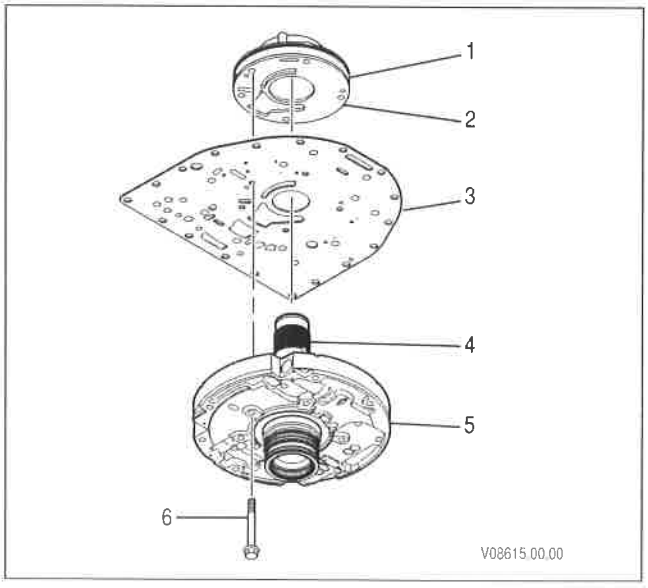
Tools Required

- J 43772 Oil Pump Seal Installer

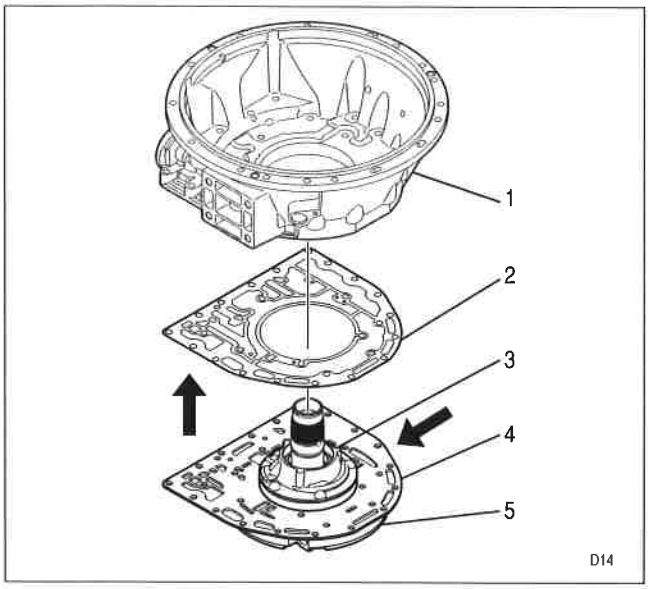
1. Position main pump assembly (2) on the work table so that the rear of the pump is facing up.
2. Align the dowel pin holes in separator plate (1) with dowel pins (3) in the pump body. Align the bolt holes in separator plate (1) with the bolt holes in main pump body (2).
3. Install separator plate (1) onto main pump assembly (2).



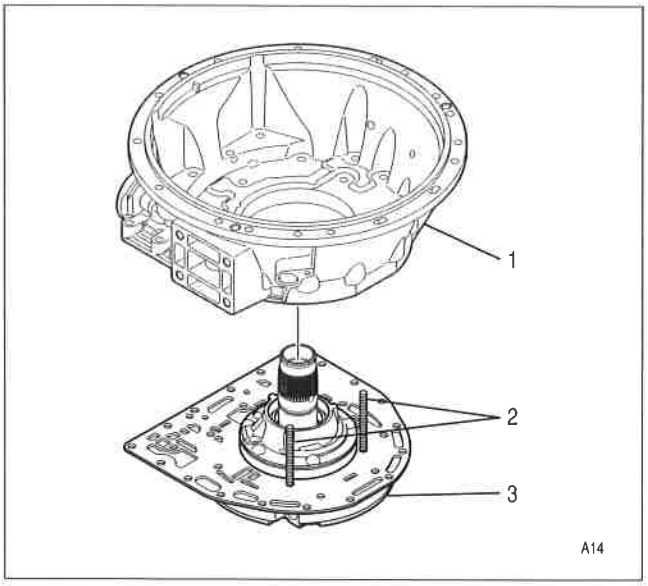
4. Position front support assembly (5) on the work table so that ground sleeve (4) is facing up.
5. Align, as a unit, main pump assembly (1) and separator plate (3) so that:
   - Align main pump dowel pins (2) with their holes in the front support assembly.
   - Align the main pump assembly bolt holes with the bolt holes of the front support assembly.
6. Install, as a unit, main pump assembly (1) and separator plate (3) onto front support assembly (5).
7. Install five bolts (6). Tighten the bolts to 24–29 N·m (18–21 lb ft).



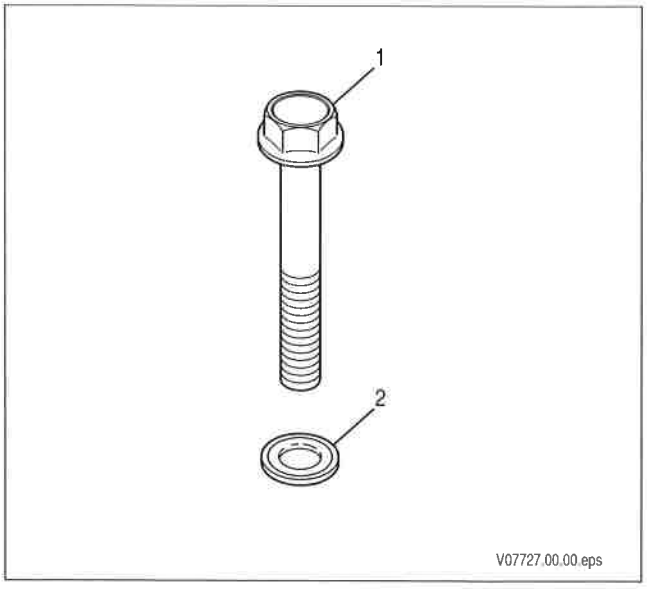
13. Position front support module (5) on the work table so that the ground sleeve is facing up.
14. Align the bolt holes of converter housing/ separator plate gasket (2) with the bolt holes in separator plate (4).
15. To assist in retaining gasket, apply petrolatum in spots to the gasket face nearest the separator plate.
16. Install the gasket onto the separator plate.
17. Apply petrolatum onto the OD of main pump assembly (3).



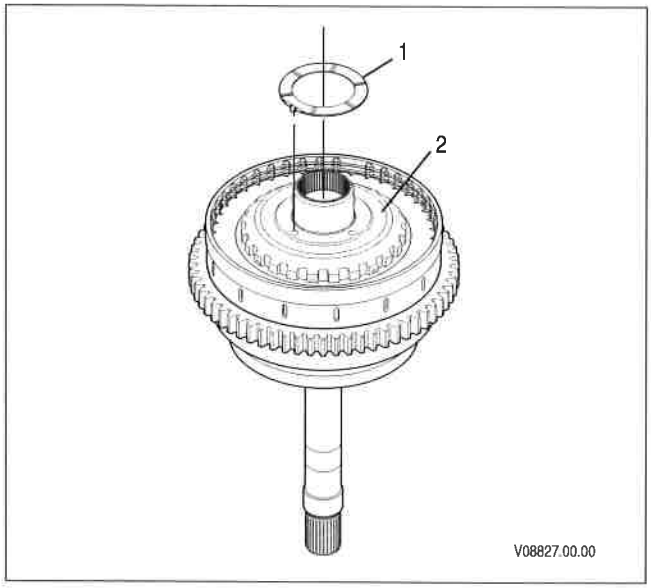
18. Install two M10 x 1.5 guide bolts (2) into front support module (3).
19. Align the converter housing bolt holes with the bolt holes in the front support module.
20. Install the converter housing onto the guide bolts and onto the front support module.
21. Remove the guide bolts from the front support module.



22. Install seals (2) onto ten bolts (1).



4. Remove bronze thrust washer (1) from C2 drive hub (2).

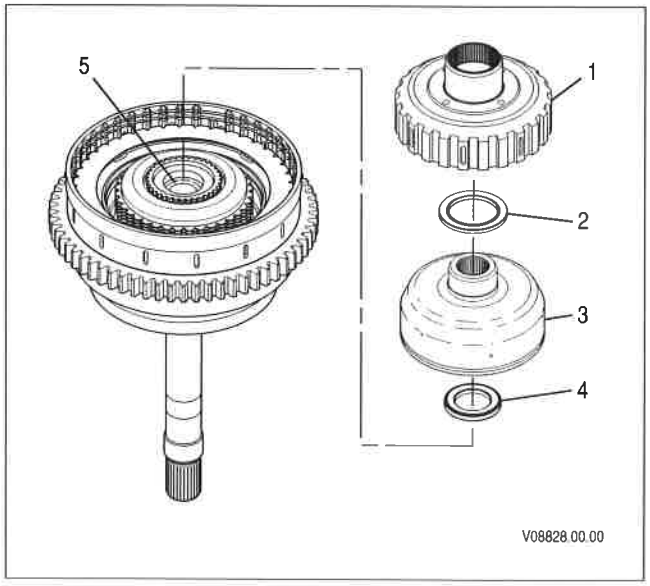


5. Remove C2 drive hub (1).

NOTE:
The thrust bearing assembly may adhere to the C1 drive hub or the C2 drive hub.

6. Remove thrust bearing assembly (2) from the rear of C1 drive hub (3) or the front of C2 drive hub (1).
7. Remove C1 drive hub (3).

NOTE:
The thrust bearing assembly may adhere to the rear of the turbine shaft or the front of the C1 drive hub.

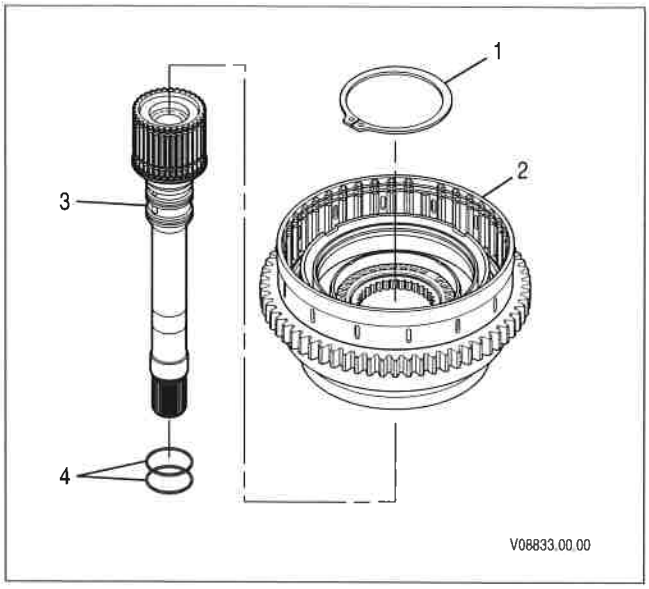


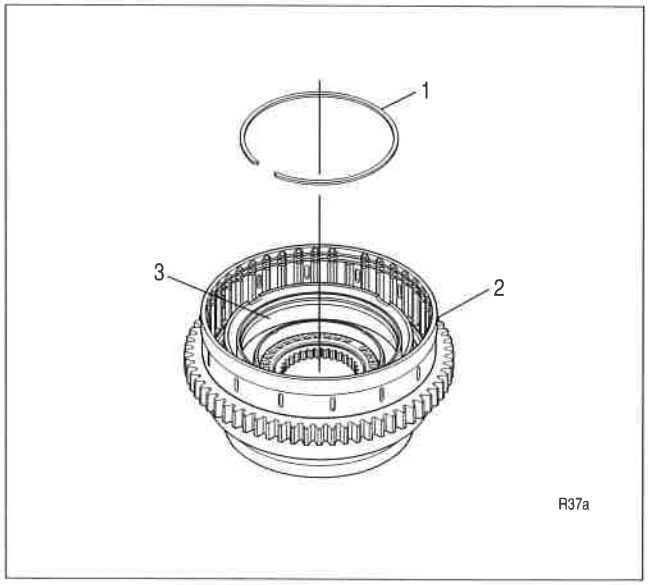
8. Remove thrust bearing assembly (4) from the rear of turbine shaft (5) or the front of the C1 drive hub.

WARNING!

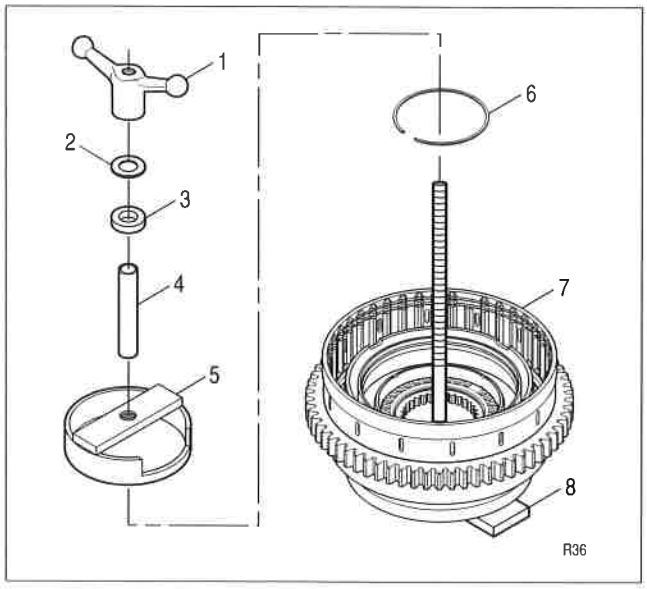
The rotating clutch housing and turbine shaft are held together by a retaining ring. Removing the retaining ring allows the turbine shaft and the rotating clutch housing to move freely. Make sure the rotating clutch housing and the turbine shaft are restrained from moving when removing the retaining ring. Personal injury and/or property damage may result from the movement of the rotating clutch housing or the turbine shaft.

14. Remove retaining ring (1) from turbine shaft (3).
15. Remove rotating clutch housing (2) from the rear of the turbine shaft.
16. Remove two butt joint sealrings (4) from the turbine shaft.
17. Position rotating clutch housing (2) on the work table so that the rear of the housing is facing up.
18. Remove retaining ring (1) from C1 piston housing (3).

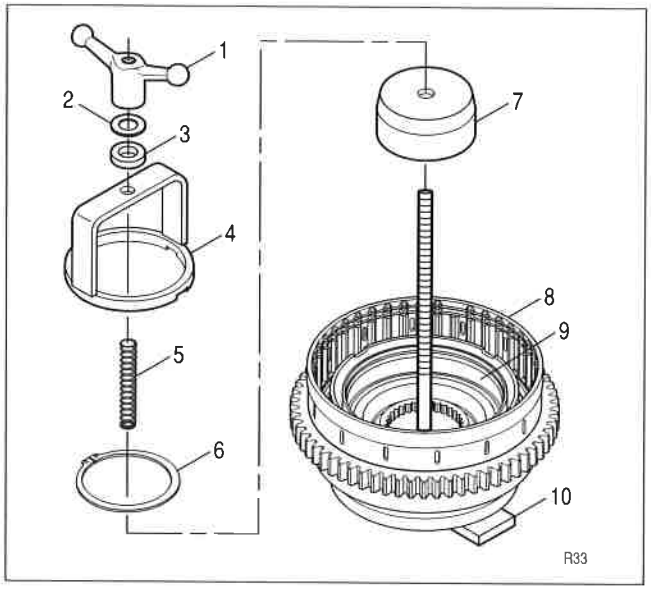




19. Position rotating clutch housing (7) on the base of J 24204-2 (8) so that the rear of the housing is facing up.
20. Install J 43777 (5) onto the C1 piston return spring assembly.
21. Align J 43777 (5) notch with the gap in retaining ring (6).
22. Install J 43777 (4) extension onto the shaft of J 24204-2 (8).
23. Install the J 24204-2 ball bearing (3) and washer (2) onto the shaft of J 24204-2.
24. Install the J 24204-2 wing nut (1) onto the shaft of J 24204-2.



33. Position rotating clutch housing (8) on the base of J 24204-2 (10) so that the rear of the housing is facing up.
34. Align J 43776-2 (7) so that the bowl is facing down.
35. Install J 43776-1 (7) onto the shaft of J 24204-2 and onto the C2 piston return spring assembly. Make sure the rim of the J 43776-2 almost touches the retaining ring.
36. Install J 43776 spring (5) onto the shaft of J 24204-2.



NOTE:

J 43776-1 has two notches. Either notch can fit over the ball of the C1 piston housing, but only one notch also leaves the holes in the retaining ring easily accessible.

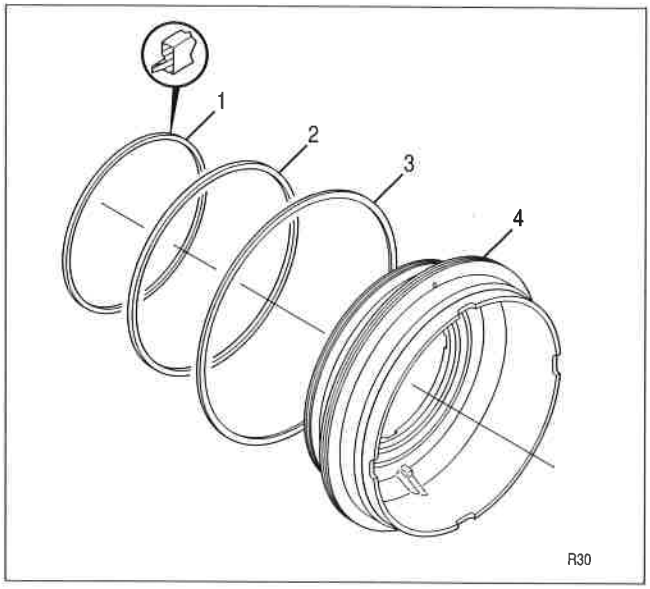
37. Align J 43776-2 (4) so that:
    - One notch fits over the ball of C1 piston housing (9).
    - The holes in retaining ring (6) are easily accessible.
38. Install J 43776-1 (4) onto the shaft of J 24202-2.
39. Install J 24204-2 ball bearing (3) and washer (2) onto the shaft of J 24204-2.
40. Install J 24204-2 wing nut (1) onto the shaft of J 24204-2.

NOTE:

Make sure the J 43776-1 notch remains over the ball of the C1 piston housing while the return spring assembly is being compressed.

41. Compress the return spring assembly until retaining ring (6) can be removed.
42. Remove retaining ring (6) from its groove in the rotating clutch housing inner hub and move the retaining ring over the top of J 43776-2 (7).
43. Remove all J tools from the rotating clutch housing.
44. Remove retaining ring (6) from the rotating clutch housing.

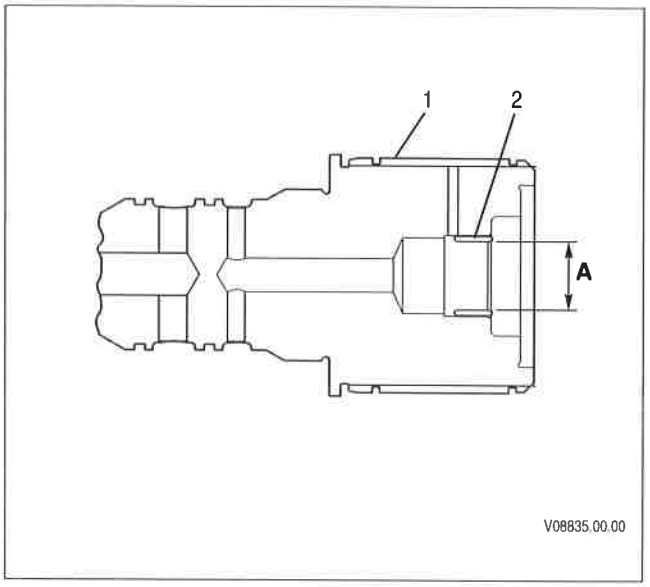
51. Remove three piston sealrings (1), (2), and (3) from C2 clutch piston (4).



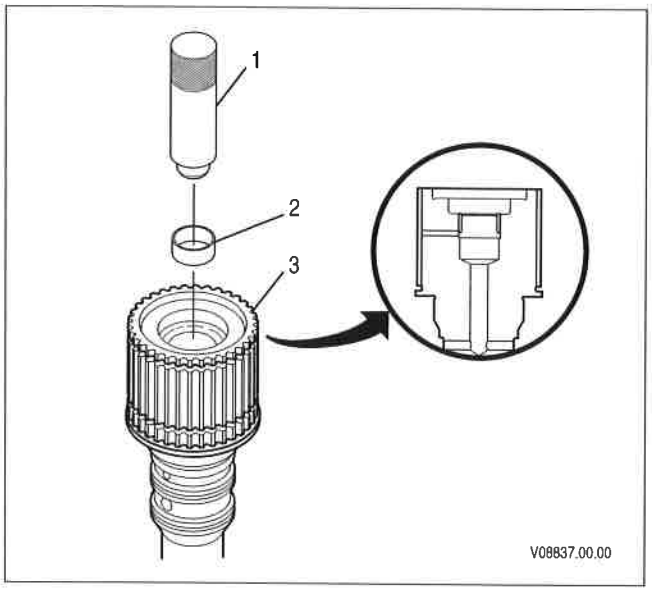
b. Turbine Shaft Inspection

NOTE:
Replace the turbine shaft bushing if any of the following specifications are not met.

1. Inspect bushing (2) inside the end of turbine shaft (1) for damage.
2. Measure the ID of the turbine shaft bushing (Dimension A). Maximum ID is 20.117 mm (0.7920 inch).

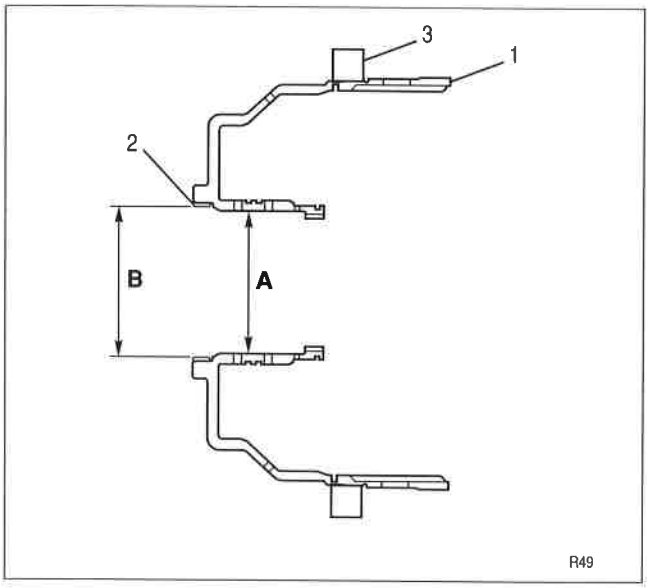


9. Install a new bushing (2) onto J 43791 (1).
10. Drive the bushing into turbine shaft (3) until the bushing is seated.
11. Make sure the bushing is installed flush to 0.25 mm (0.010 inch) below the inner turbine shaft surface.



d. Rotating Clutch Housing Inspection

NOTE:
PTO gears are permanently staked to the rotating clutch housing and are not serviceable. Turbine tone wheels are serviceable.



1. Inspect the turbine tone wheel or PTO Gear (3) for damage. Make sure a tone wheel is not dented or out-of-round.
2. If the PTO gear is damaged, replace the rotating clutch housing. If the tone wheel is damaged, replace the tone wheel.
3. Measure the ID of the rotating seal bore of rotating clutch housing (1) (Dimension A). If the ID exceeds 74.050 mm (2.9154 inch), replace the rotating clutch housing.

NOTE:
Replace the rotating clutch housing bushing if any of the following specifications are not met.

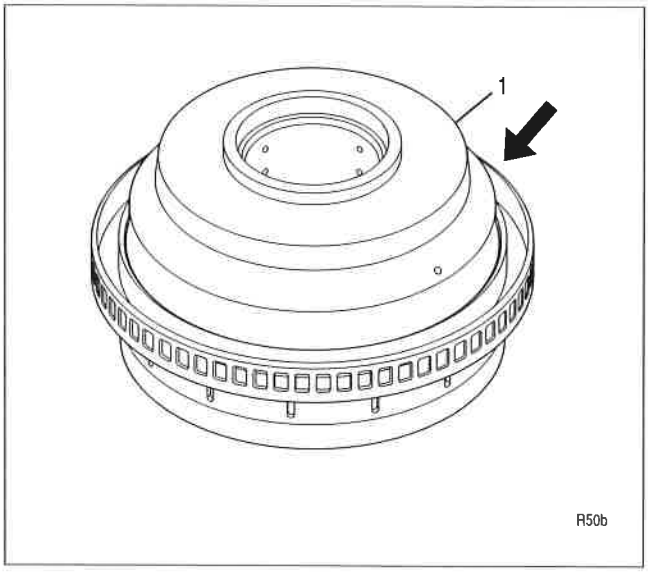
4. Inspect bushing (2) inside the front of rotating clutch housing (1) for damage.
5. Measure the ID of the bushing (Dimension B). The maximum ID is 78.170 mm (3.0776 inch).

f. Rotating Clutch Housing Tone Wheel Replacement

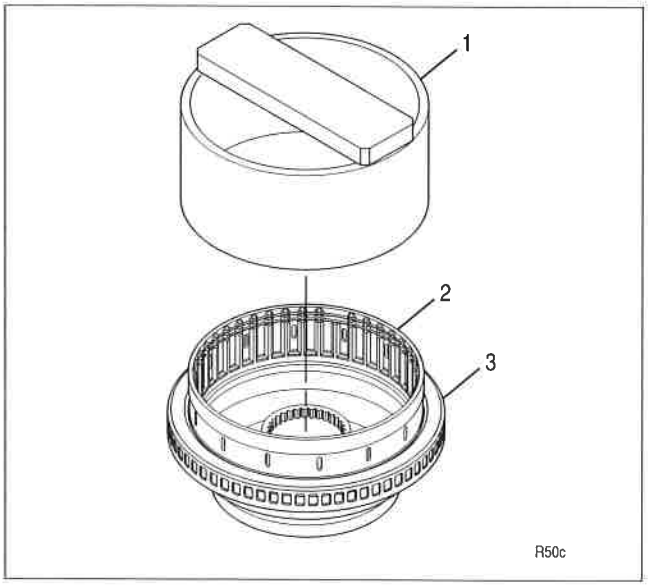
Tools Required

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

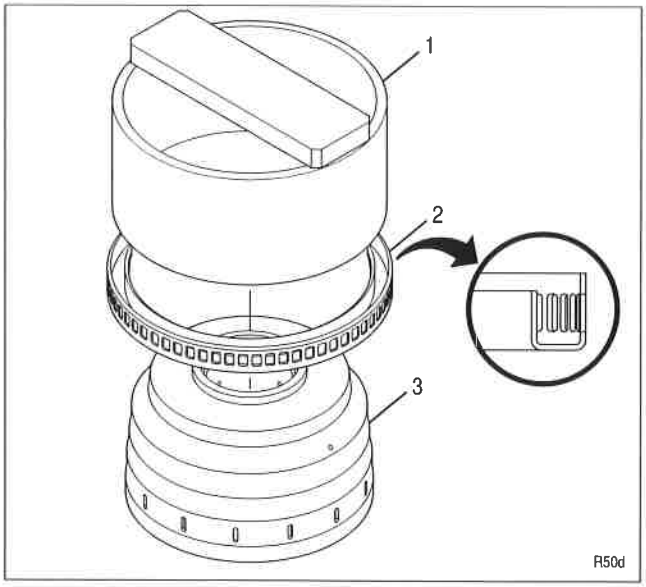
1. Grind the stakes from rotating clutch housing (1).



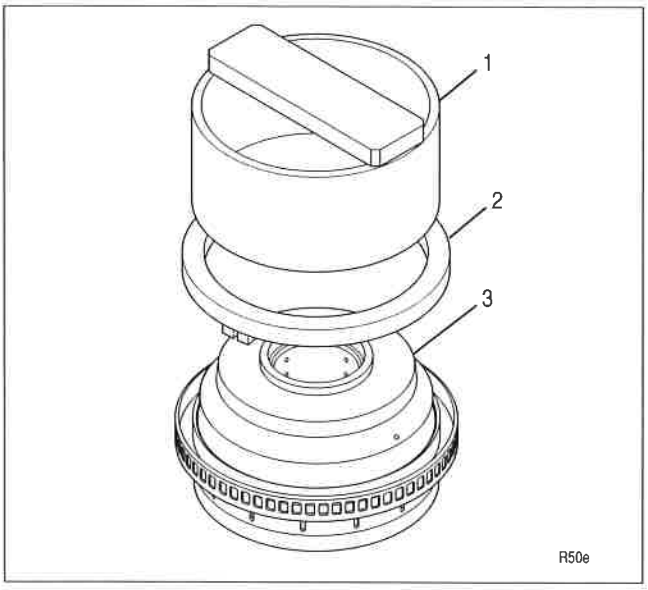
2. Position rotating clutch housing (2) on a press so that the front of the housing is down.
3. Install J 43768 (1) onto tone wheel (3).
4. Using J 43768 (1), press tone wheel (3) from rotating clutch housing (2).



5. Position rotating clutch housing (3) on a press so that the front of the housing is facing up.
6. Align tone wheel (2) so that the outside edge is facing up.
7. Install tone wheel (2) onto the rotating clutch housing.
8. Install J 43768 (1) onto the tone wheel.
9. Using J 43768 (1), press the tone wheel onto the rotating clutch housing.



16. Align J 43767 (2) so that the staking prongs are down at the other two 2 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 great a pressure will distort the tone wheel. Too little pressure will result 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).

g. C1 Clutch Friction Plate Inspection

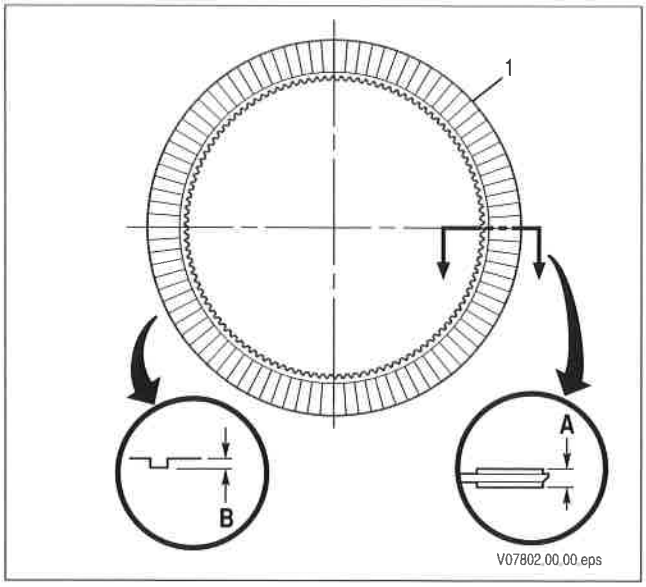
NOTE:

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

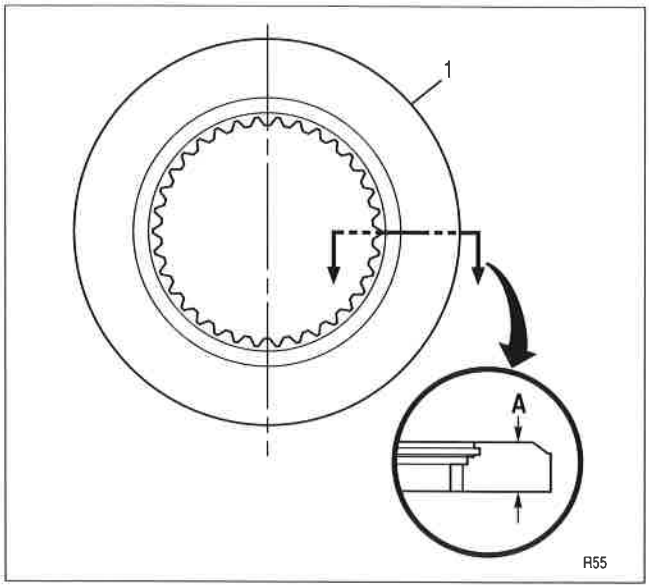
NOTE:

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

1. Measure the thickness of each C1 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).



i. C1 Clutch Backplate Inspection



NOTE:

- **Measure as described below at three or more locations.**
- **Replace the C1 clutch backplate if it does not meet specifications.**

Transmissions before S/N 6310415454 (Indianapolis) and S/N 6320442099 (Baltimore) use a different backplate design (refer to SIL 23-1K2K-04).

1. Measure the wear surface thickness of C1 clutch backplate (1) (Dimension A). Minimum thickness is shown in the table.

ID	Minimum Thickness (Beginning S/N 6310415454 (Indianapolis) and S/N 6320442099 (Baltimore))
2420	11.400 mm (0.4488 inch)
8521	11.840 mm (0.4661 inch)
8522	12.280 mm (0.4835 inch)
8523	12.730 mm (0.5012 inch)
8524	13.180 mm (0.5189 inch)
8525	13.630 mm (0.5366 inch)

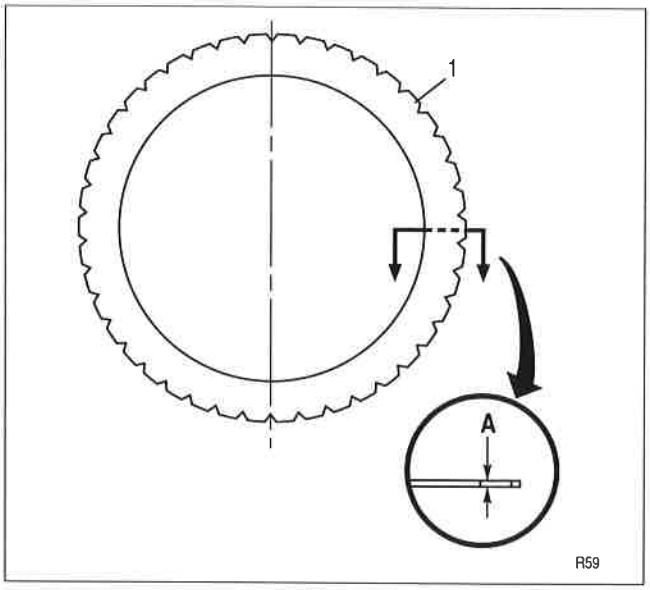
ID	Minimum Thickness (Before S/N 6310415454 (Indianapolis) and S/N 6320442099 (Baltimore))
6221	11.840 mm (0.4661 inch)
6222	12.280 mm (0.4835 inch)
6223	12.730 mm (0.5012 inch)
6224	13.180 mm (0.5189 inch)
6225	13.630 mm (0.5366 inch)

k. C2 Clutch Reaction Plate Inspection

NOTE:

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

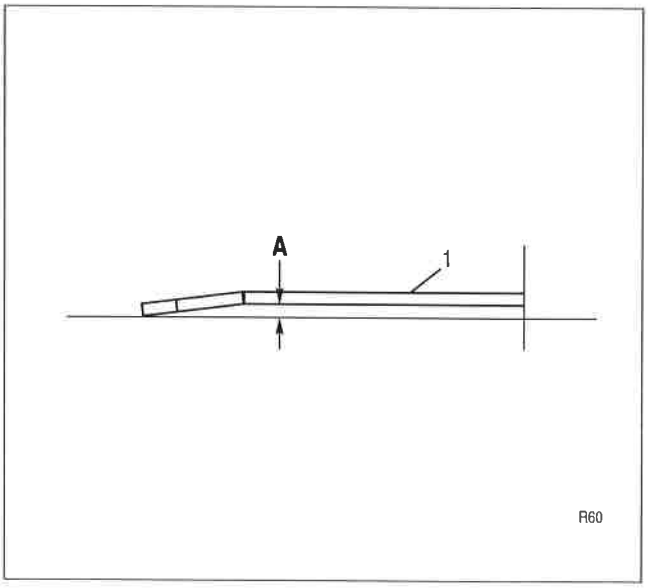
1. Measure the thickness of each C2 clutch reaction plate (1) (Dimension A). Minimum thickness is 2.135 mm (0.0841 inch).



NOTE:

Check the plates for coning on a level surface.

2. Measure the cone of plate (1) (Dimension A). Maximum cone is 0.240 mm (0.0094 inch).

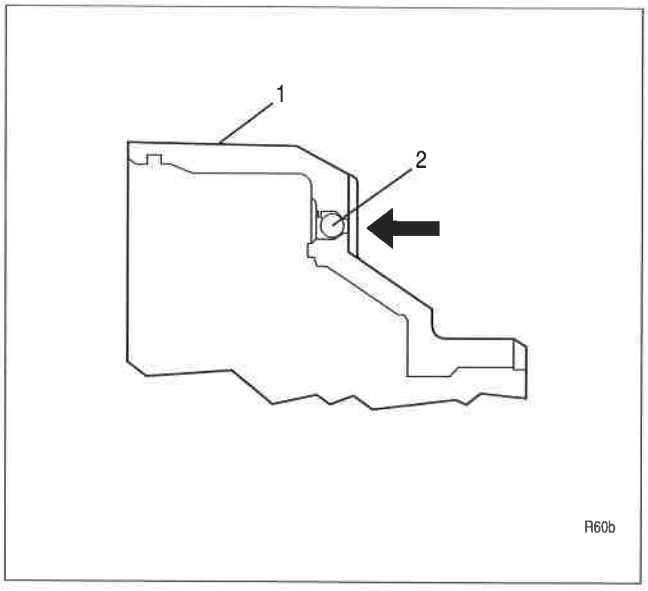


l. C1 Piston Housing Inspection

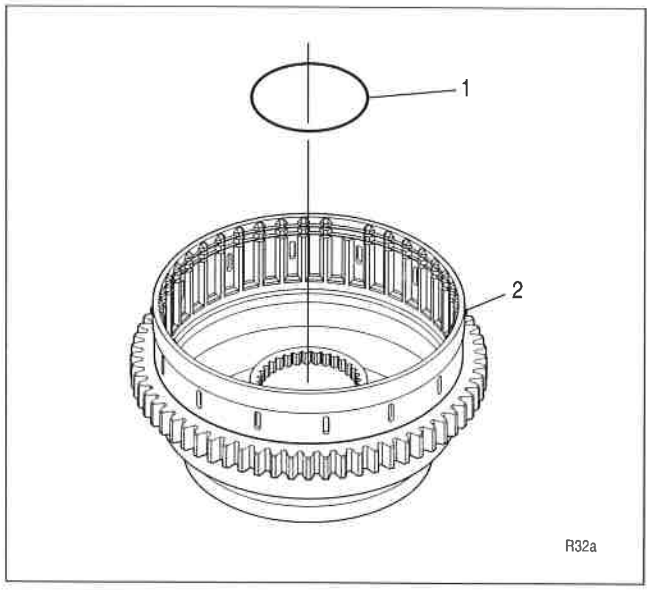
NOTE:

- **Measure as described below at three or more locations.**
- **Replace the C1 piston housing if it does not meet specifications.**

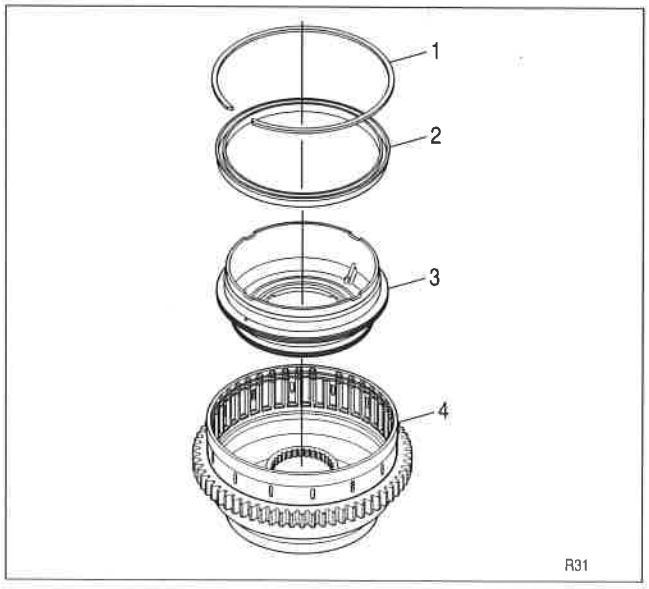
1. Inspect C1 piston housing (1) for damage.
2. Make sure ball (2) moves freely and has a minimum of 1.0 mm (0.04 inch) travel parallel to the centerline of the C1 piston housing.



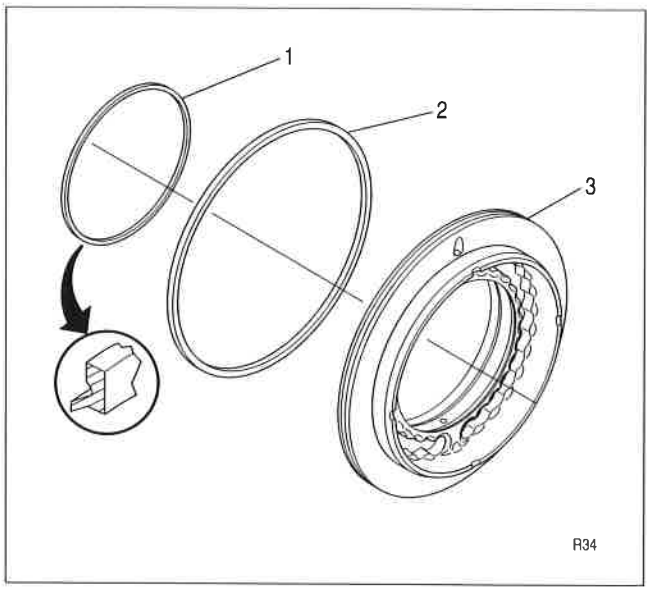
3. Position rotating clutch housing (2) on the work table so that the rear of the housing is facing up.
4. Install O-ring (1) into the bottom groove on the inner hub of rotating clutch housing (2).



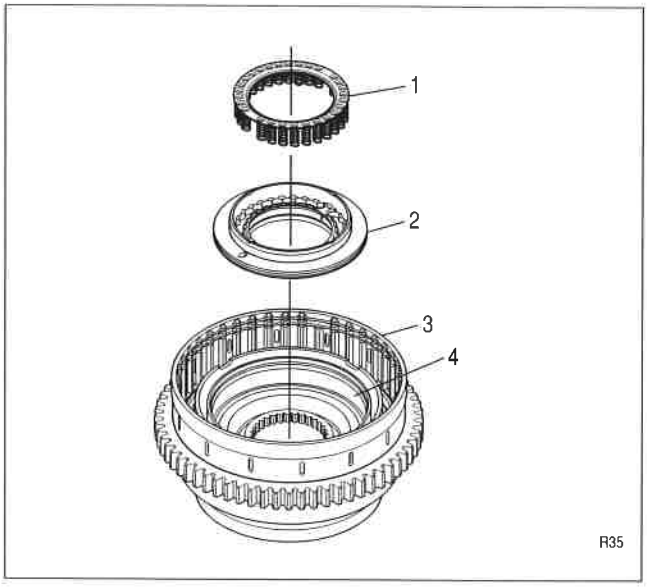
5. Position C2 clutch piston (3) on the work table so that the rear of the piston is facing up.
6. Align C2 balance piston (2) so that the rubber seal is facing down.
7. Install C2 balance piston (2) onto C2 clutch piston (3).
8. Lubricate the rubber seals on C2 balance piston (2) with petrolatum.
9. Install C2 clutch piston (3) with C2 balance piston (2) attached into rotating clutch housing (4). Make sure the C2 clutch piston is seated on the rotating clutch housing.
10. Push C2 balance piston (2) below the retaining ring groove on rotating clutch housing (4).
11. Install retaining ring (1) into rotating clutch housing (4). Make sure the retaining ring is seated completely around the rotating clutch housing.



27. Install C1 piston ID sealring (1) and C1 piston OD sealring (2) onto C1 clutch piston (3). Lubricate the sealrings with petrolatum.



28. Position rotating clutch housing (3) on the work table so that the rear of the housing is facing up.
29. Align C1 clutch piston (2) so that the spring indents are facing up.
30. Install C1 clutch piston (2) into C1 piston housing (4). Make sure the C1 clutch piston is seated in the C1 piston housing.
31. Align C1 piston return spring assembly (1) so that the springs are facing and aligned with the spring pockets of C1 clutch piston (2).
32. Install C1 piston return spring assembly (1) into C1 clutch piston (2).



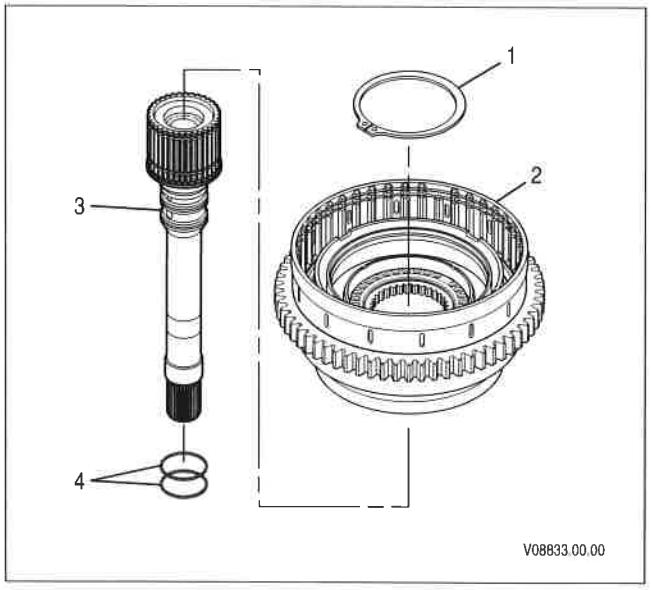
49. Install two butt joint sealrings (4) onto turbine shaft (3).

50. Position turbine shaft (3) on the work table so that the rear of the shaft is facing up.

51. Align rotating clutch housing (2) with the rear of turbine shaft (3) so that the rear of the clutch housing is facing up.

52. Install rotating clutch housing (2) onto the larger splined diameter of turbine shaft (3).

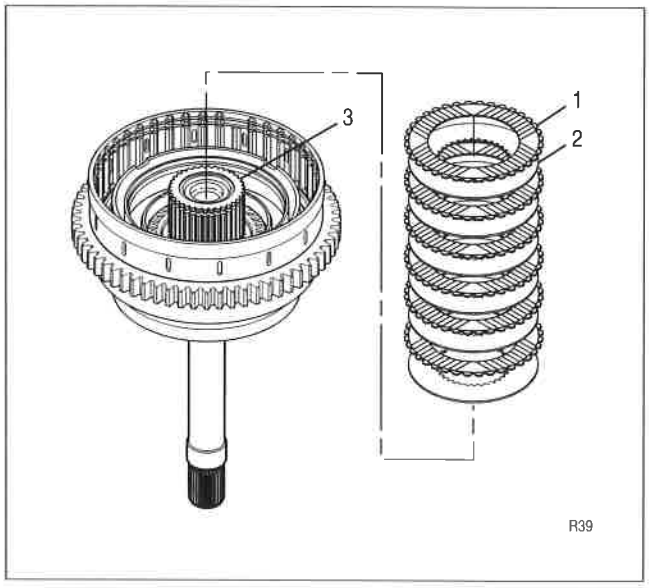
53. Install retaining ring (1) onto the turbine shaft. Make sure the retaining ring is seated completely around the turbine shaft.



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

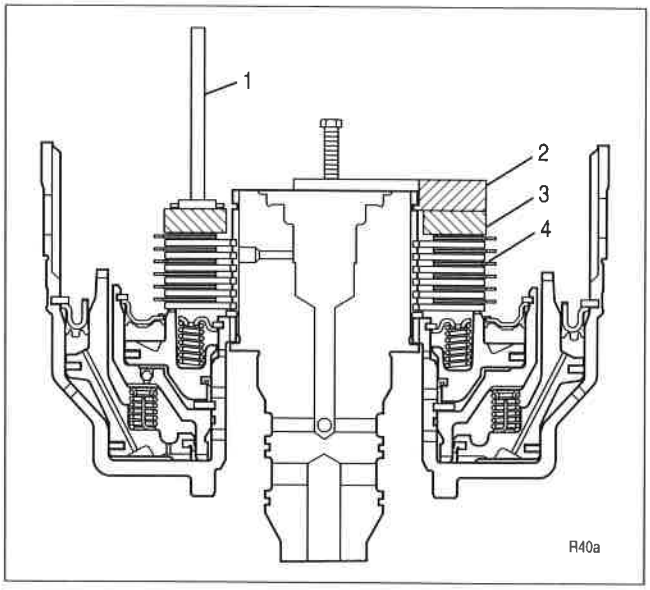
NOTE:

Units beginning with S/N 6310415454 (Indianapolis) and S/N 6320442099 (Baltimore) use a larger diameter T1 thrust bearing, a redesigned turbine shaft, and a redesigned C1 clutch backplate. Current and former parts are not interchangeable (refer to SIL 23-1K2K-04).



62. Do the following for each tab of J 44525-3 (black) or J 44525-4 (silver) (1).

    - Place the flat surface (tabbed end) of J 44525-3 or J 44525-4 (1) onto the top surface of J 44525-2 or J 44525-5 (3).
    - Try to slide a tab of J 44525-3 or J 44525-4 (1) into the retaining ring groove on the turbine shaft.



NOTE:

At most, two of the tabs will fit into the retaining ring groove.

    - If a tab fits into the retaining ring groove, record the tab's four digit ID number, located on the stem of J 44525-3 or J 44525-4.

63. Select a C1 clutch backplate so that:

    - If no tab of J 44525-3 or J 44525-4 fits into the retaining ring groove, select the C1 clutch backplate with ID No. 6221 or 8521.
    - If one or more tabs of J 45525-3 or J 44525-4 fit into the retaining ring groove, select the C1 clutch backplate with an ID No. corresponding to the highest number recorded in the previous step.

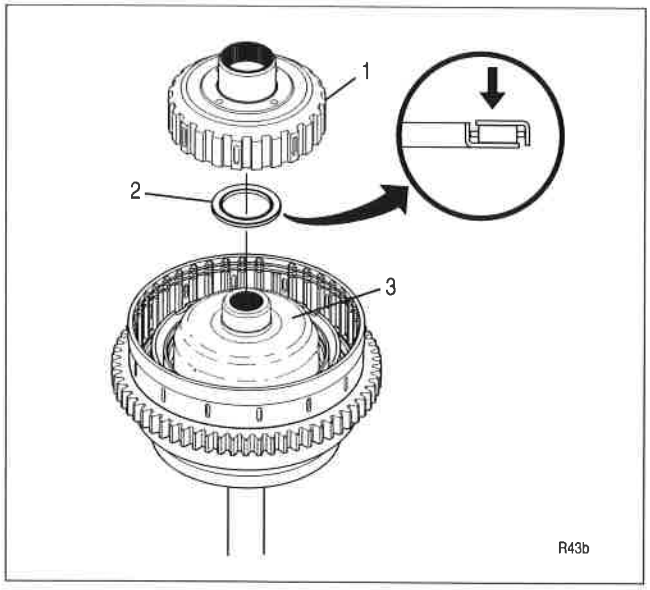
C1 Clutch Backplate	
ID No.	**Part Number**
2420	29542420*
8521	29538521
8522	29538522
8523	29538523
8524	29538524
8525	29538525
* Not used with former C1 backplate design.	

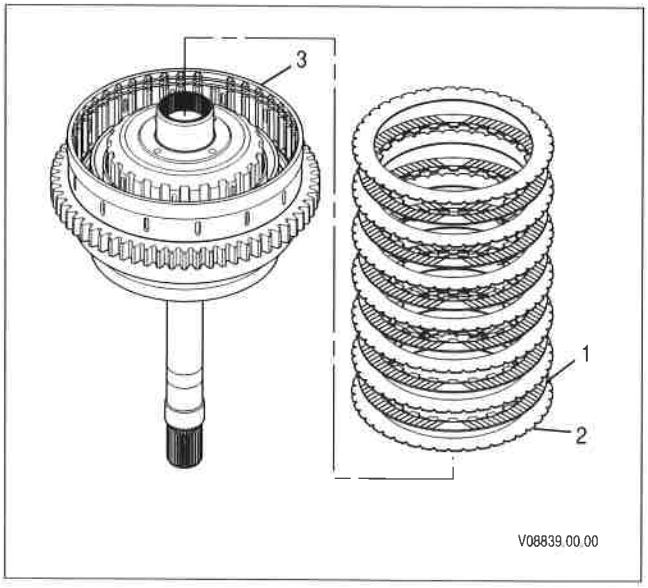
64. Remove all J tools from the turbine shaft.

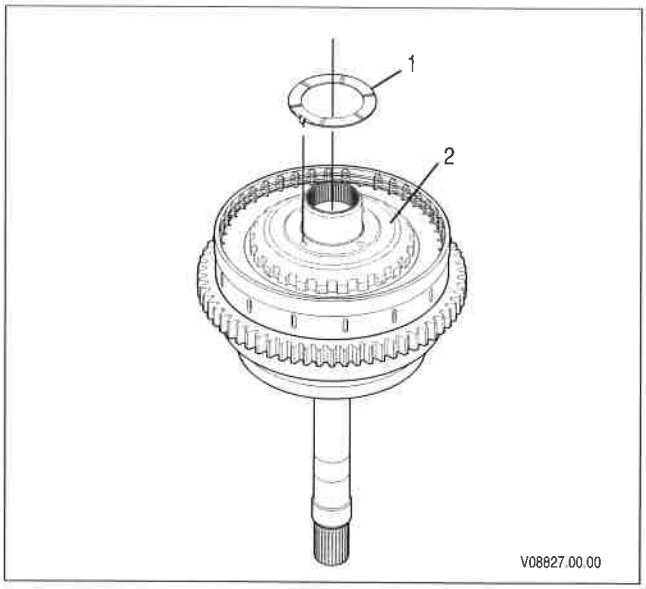
CAUTION:

Installing the thrust bearing assembly onto the rear of the C1 drive hub in the wrong direction—blue stripe not showing—could result in destruction of the transmission.

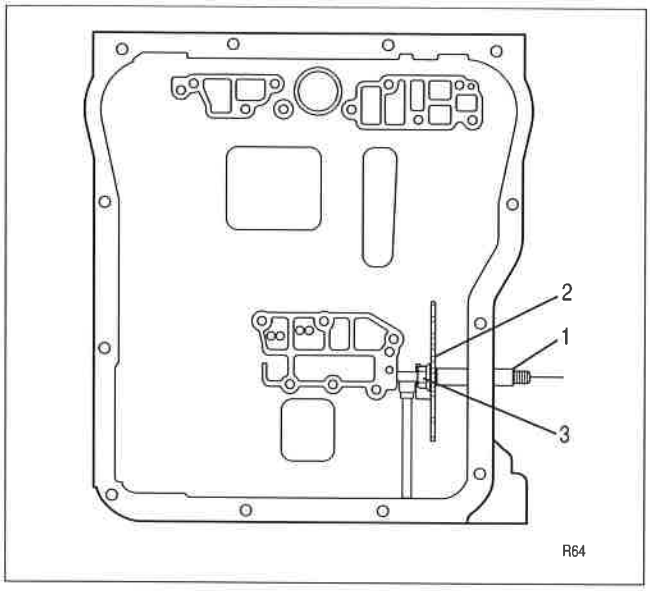
73. Align thrust bearing assembly (2) so that the blue stripe on the thrust bearing assembly is facing away from C1 drive hub (3).
74. Install thrust bearing assembly (2) onto rear of C1 drive hub (3). Make sure the blue stripe on the thrust bearing assembly is visible.
75. Align C2 drive hub (1) so that the small end is facing up.
76. Install C2 drive hub (1).
77. Starting with a C2 clutch reaction plate, alternately install seven C2 clutch reaction plates (2) and six C2 clutch friction plates (1) into the rotating clutch housing.
78. Align the tangs of bronze thrust washer (1) with the holes in C2 drive hub (2).
79. Install bronze thrust washer (1) onto C2 drive hub (2).





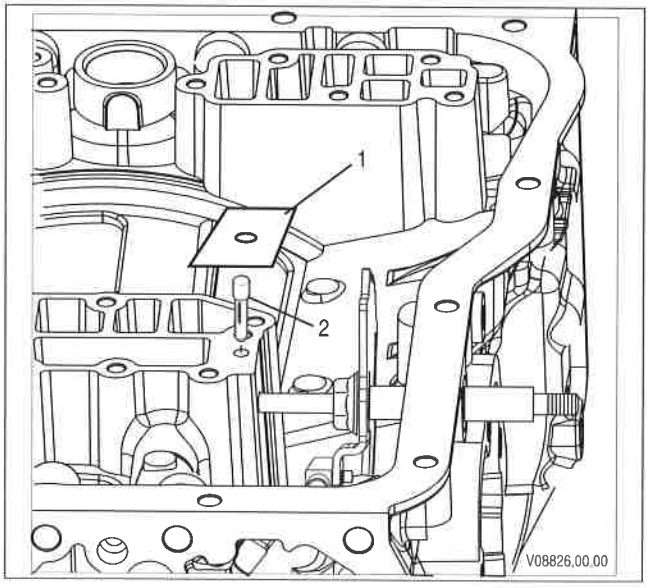


7. While holding the flats of selector shaft (1), loosen selector shaft nut (2) so that the nut slides freely on the selector shaft.
8. Remove detent lever (2) from the flats of the selector shaft.



NOTE:

Beginning the second quarter of 2004, 1000 and 2000 Product Families transmissions contain a solid, spherical-tip, selector shaft retention pin with a cylindrical head rather than a rolled spring pin. The solid pin and spring pin are totally interchangeable (refer to SIL 21-1K2K-04).



CAUTION:

DO NOT mar the main housing surface around the selector shaft retention pin. An unmarred surface is required to maintain the seal between the control valve assembly and the main housing.

9. For a solid selector shaft retention pin, place a protective plate (1) on the main housing surface around retention pin (2).

CAUTION:

DO NOT twist the solid pin during removal. A twisting action can cause damage to the pin bore in the main housing.

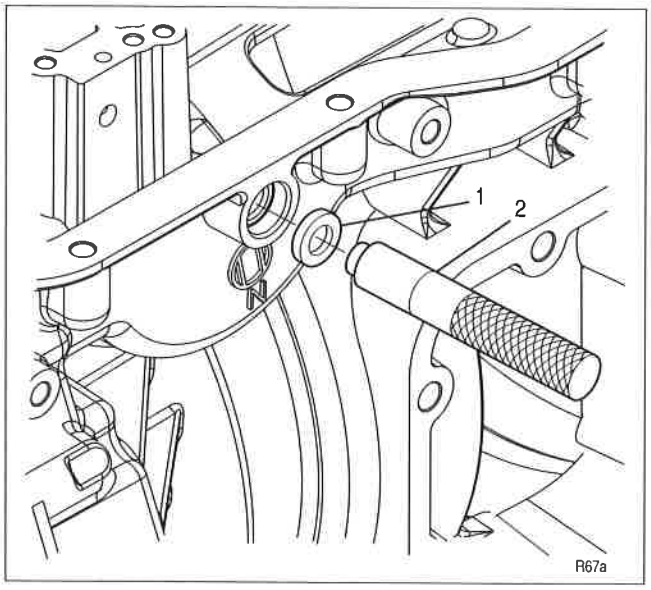
10. Remove pin (2) from the main housing.

b. Assembly of Selector Shaft and Detent Lever

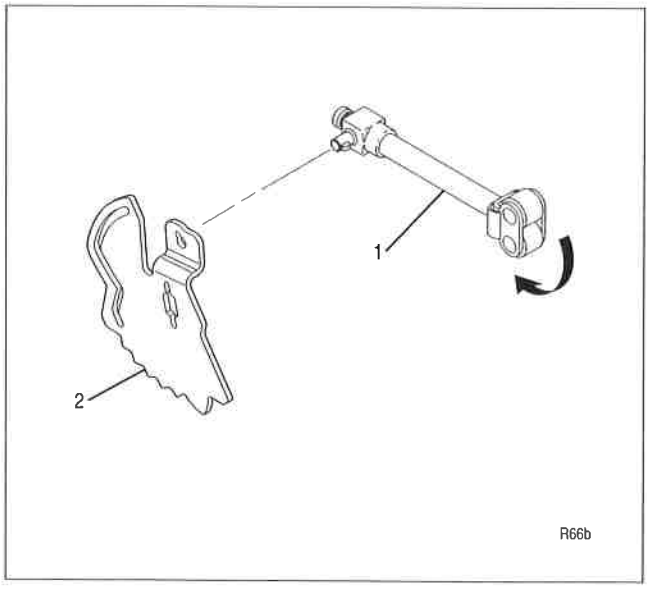
Tools Required

- J 43909 Selector Shaft Seal Installer
- J 43766 Selector Shaft Spring Pin 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.



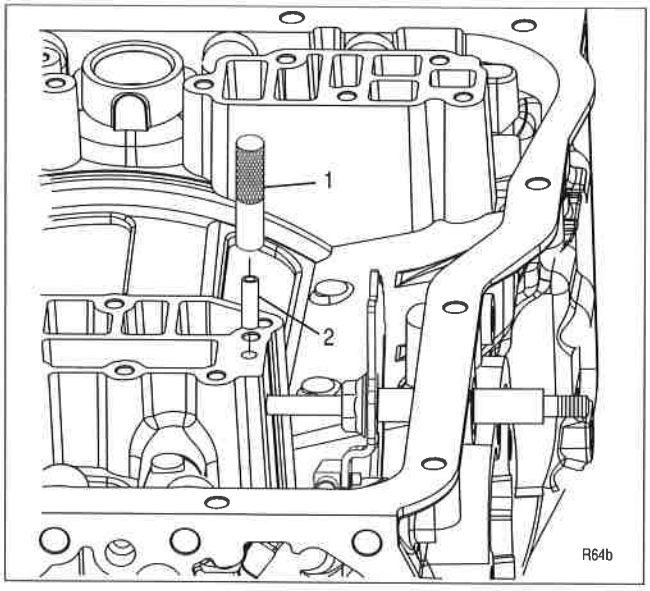
4. If the transmission has park pawl apply assembly (1), do the following.
   - Install the nib of park pawl apply assembly (1) through the keyhole in detent lever (2).
   - Rotate the park pawl apply assembly 180 degrees.



CAUTION:

DO NOT mar the main housing surface when installing the retention pin. Use only gentle tapping on the J 43766 selector shaft spring pin installer tool or the head of the solid pin. Heavy or continued hammering will damage the main housing surface.

15. For a rolled selector shaft retention pin, install spring pin (2) into J 43766.
16. Using J 43766, drive spring pin (2) into the main housing.
17. Make sure the spring pin is installed to a height of 8.50–9.00 mm (0.335–0.354 inch).



c. Nameplate Replacement

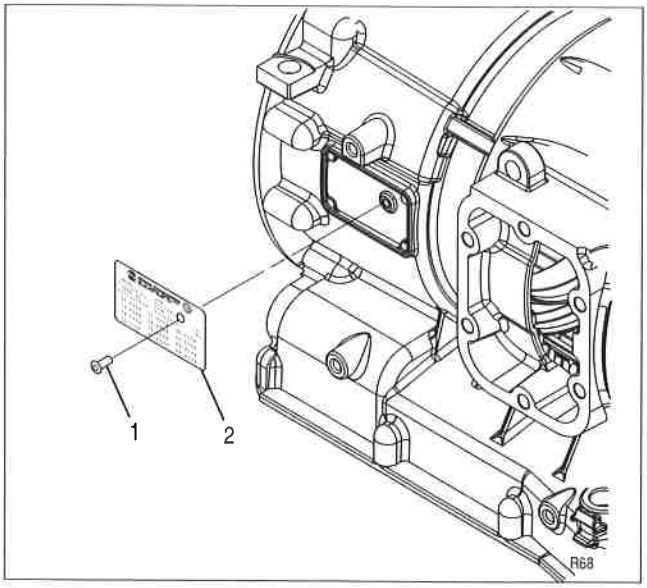
NOTE:

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

CAUTION:

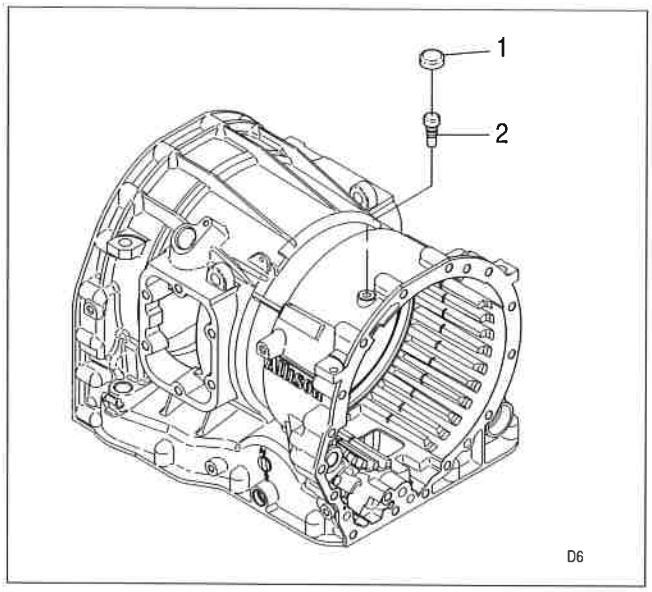
DO NOT drill through the main housing when drilling out the nameplate rivets.

1. Using a 3/16 inch drill bit, drill through rivet (1). Remove 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 Vent Assembly

1. Pry off vent cap (1).
2. If vent (2) remains, gently pry the vent from the main housing.
3. Gently tap a new vent assembly into the main housing until the vent is seated.



5–12. RING GEAR AND CLUTCH COMPONENT INSPECTIONS

a. C3 Clutch Component Inspection

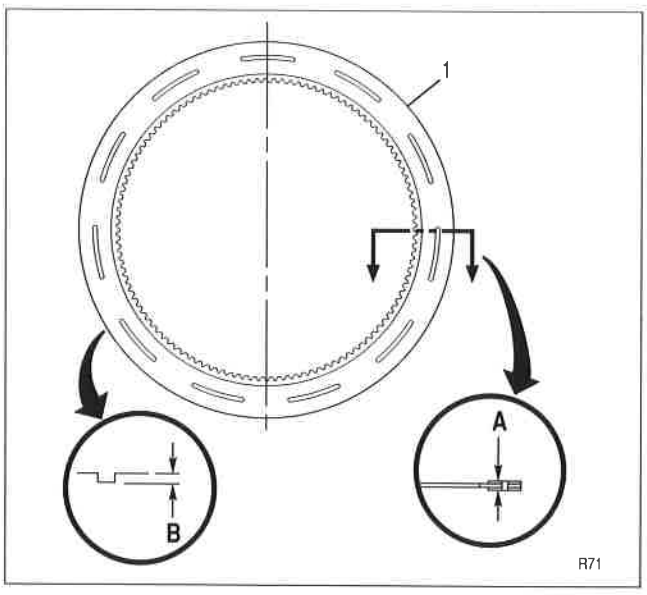
NOTE:

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

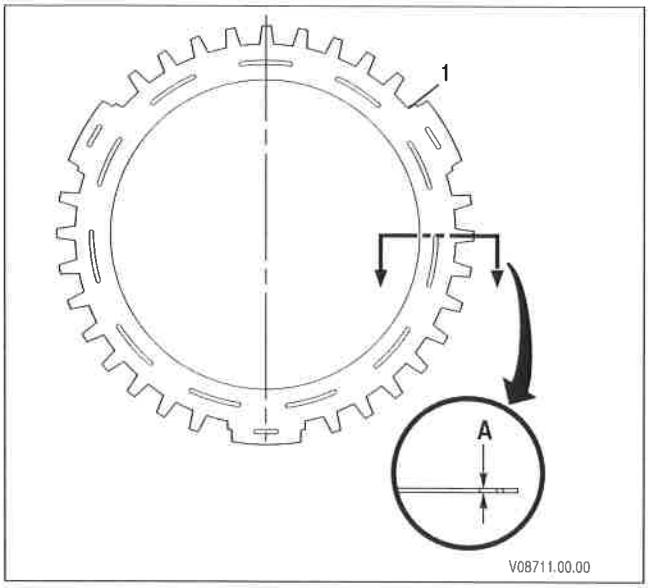
NOTE:

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

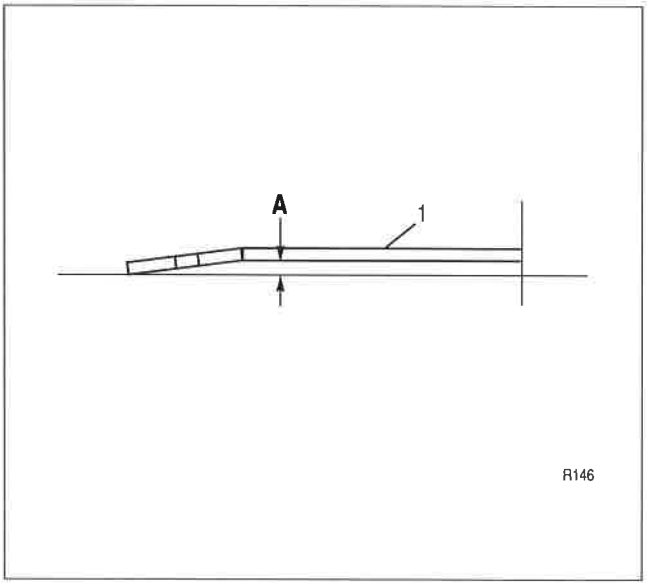
1. Measure the thickness of each C3 clutch friction plate (1) (Dimension A). Minimum thickness is 2.375 mm (0.0935 inch).
2. Measure the oil groove depth of each C3 clutch friction plate (Dimension B). Minimum groove depth is 0.200 mm (0.0079 inch).



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



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



b. C3 Clutch Backplate Assembly Thrust Plate Replacement

Tools Required

- J 39354 Rivet Installer

CAUTION:

Use care when drilling through the backplate rivets. Once the rivet has been drilled through, the drill bit may catch on the backplate causing damage to the drill bit and/or the backplate.

NOTE:

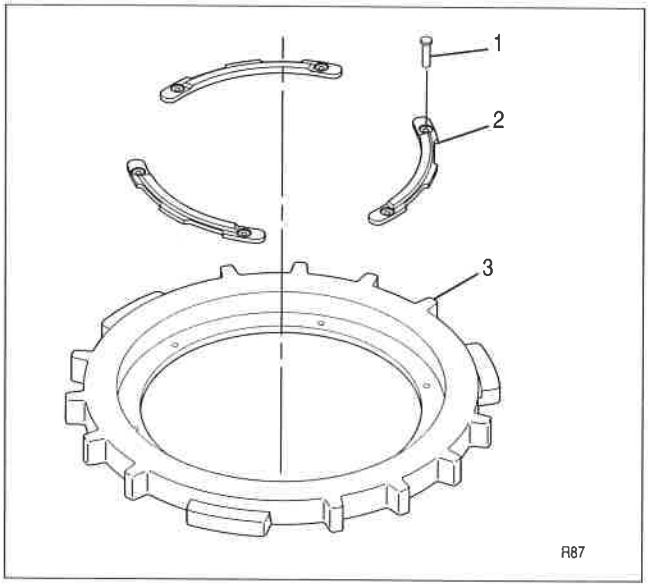
Replace all three thrust plates if one thrust plate needs replacing.

1. Using a 9/64 inch drill bit, drill through the heads of six rivets (1).
2. Remove the rivets and three gear thrust plates (2).

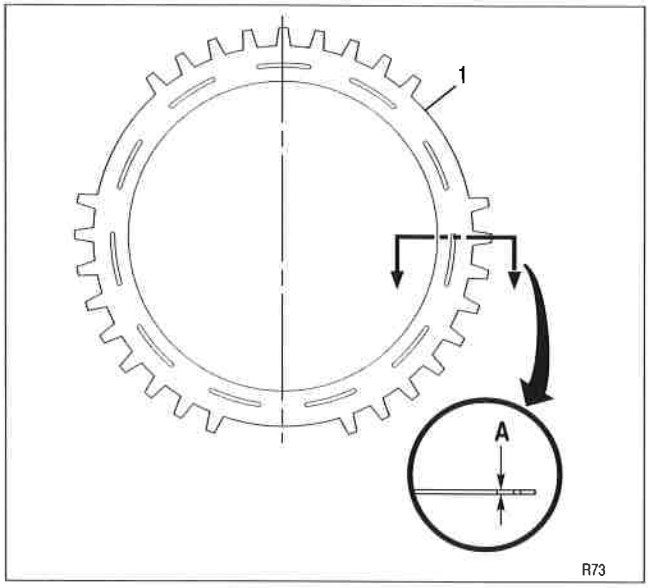
NOTE:

Set the gap of the rivet installer to 4.45 mm (0.175 inch). If the rivet connection is too loose, use a smaller gap.

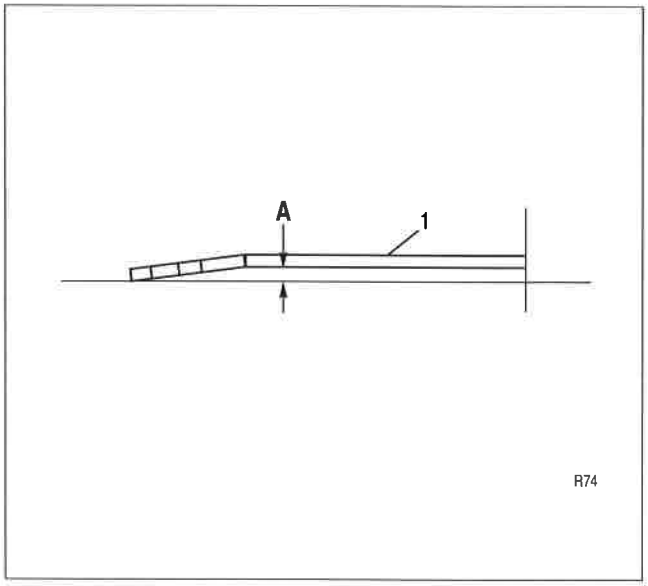
3. Using J 39354, install three new gear thrust plates (2) and six rivets (1) so that the rivets are flush or below the surface of the thrust plates.
4. Make sure rivets (1) and thrust plates (2) are not loose.



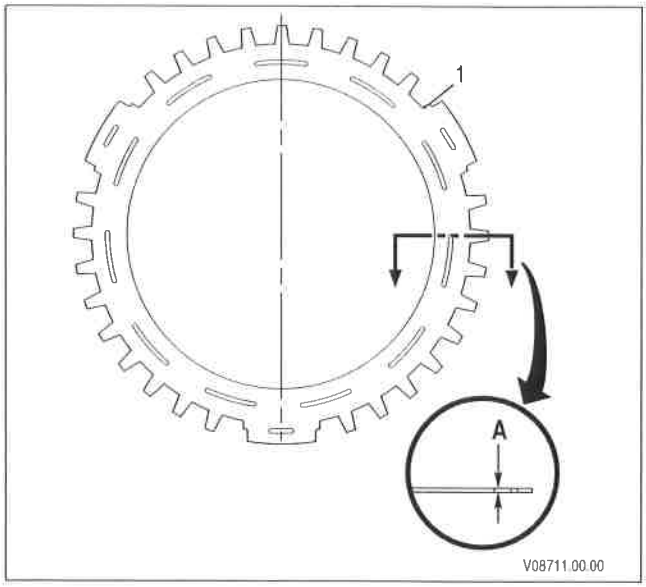
4. Measure the thickness of each C4 clutch reaction plate (1) (Dimensions A). Minimum thickness is 2.440 mm (0.0961 inch).



5. Measure the cone of each C4 clutch reaction plate (1) (Dimension A). Maximum cone is 0.400 mm (0.0157 inch).



6. Measure the thickness of C4 spring plate (1) (Dimension A). Minimum thickness is 3.110 mm (0.1224 inch).



d. C5 Clutch Component Inspection

NOTE:

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

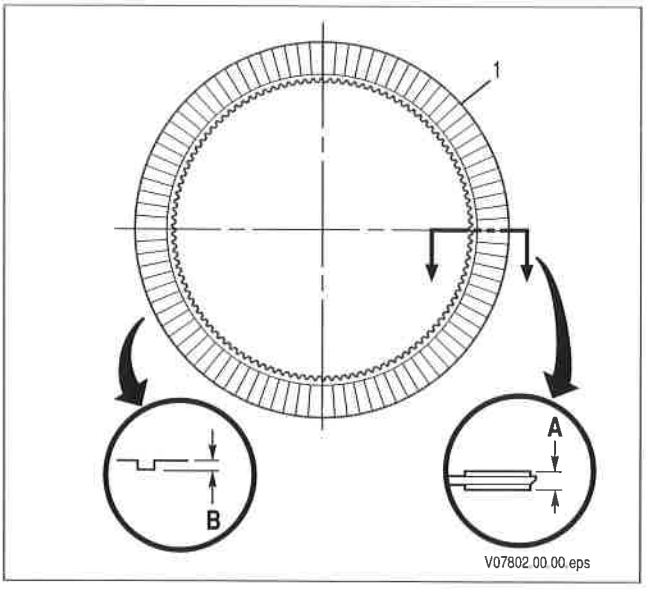
NOTE:

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

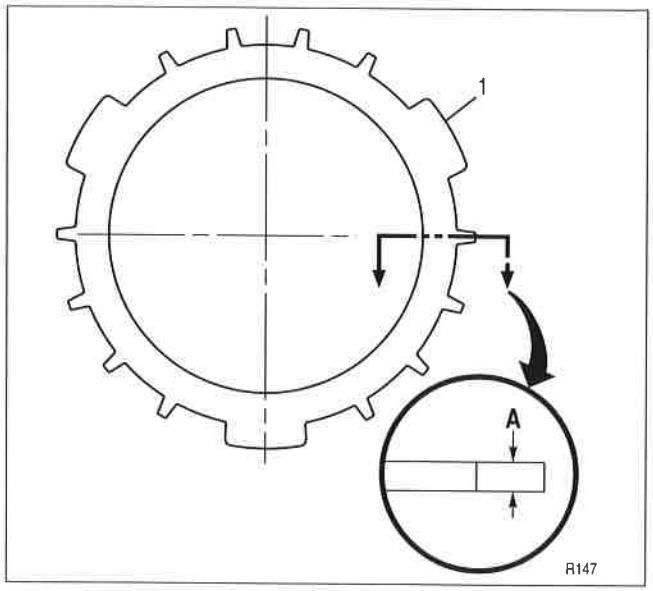
NOTE:

Starting with S/N 6310013648 (Indianapolis) and S/N 6320002001 (Baltimore), C5 Clutch Friction Plates and the P3 Ring Gear have been redesigned. The former and current designs are interchangeable only if the current C5 Friction Plates are used with the current P3 Ring Gear. Do not mix current and former designs. The former design may be reused unless replacement is indicated by wear measurements or the design is no longer available (refer to SIL 31-1K2K-01).

1. Measure the thickness of each C5 clutch friction plate (1). Minimum thickness is 2.375 mm (0.0935 inch).
2. Measure the oil groove depth of each C5 clutch friction plate (1). Minimum groove depth is 0.200 mm (0.0079 inch).



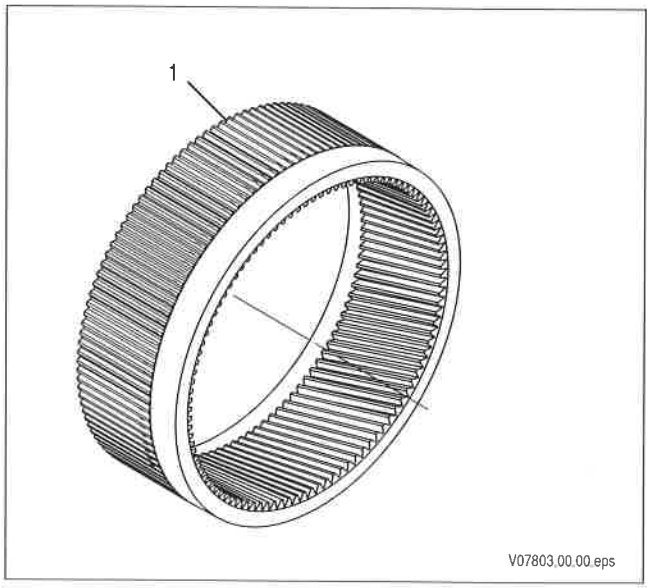
6. Measure the thickness of C5 clutch backplate (1) (Dimension A). Minimum thickness is 17.900 mm (0.7047 inch).
7. Measure the cone of C5 clutch backplate (1) (Dimension A). Replace backplate (1) if any cone is present.



e. P1 Ring Gear Inspection

NOTE:
Clutch plate movement can cause notching on the external splines of P1 ring gear.

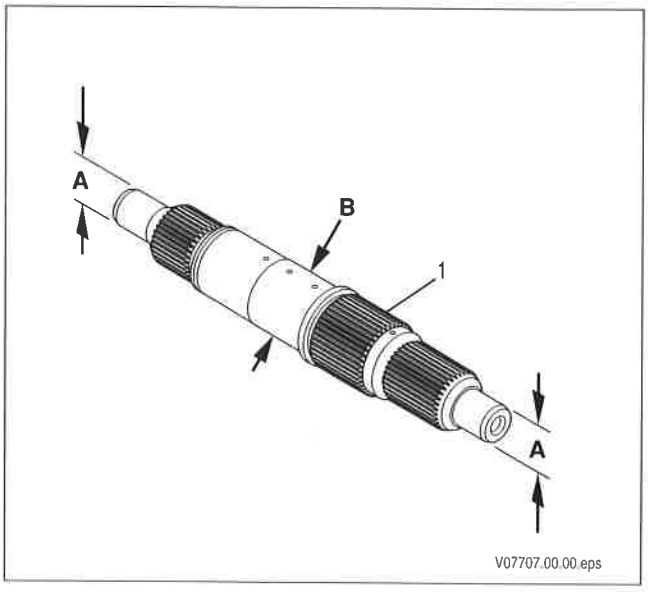
1. Inspect the external splines of P1 planetary ring gear (1) for notching. Replace the ring gear if detectable notching has occurred.



5–13. MAIN SHAFT INSPECTION

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

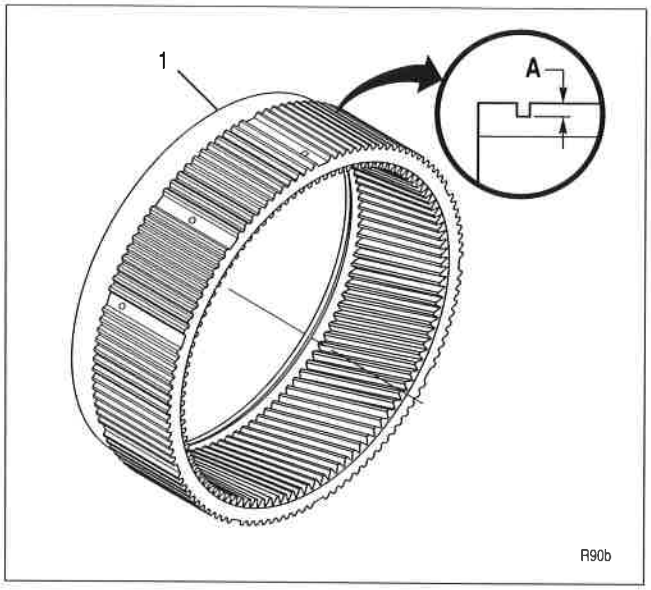
1. Inspect the main shaft pilots for damage.
2. Measure the main shaft pilots (Dimension A). Minimum pilot OD is 19.987 mm (0.7869 inch).
3. Inspect the main shaft journal contact area for damage.
4. Measure the main shaft journal contact area for the P2 planetary bushing (Dimension B). Minimum main-shaft journal diameter is 36.405 mm (1.4333 inch).



c. P2 Planetary Ring Gear Inspection

NOTE:
Clutch plate movement can cause notching on the external splines of P2 ring gear.

1. Inspect the external splines of P2 planetary ring gear (1) for notching. Replace the ring gear if detectable notching has occurred.



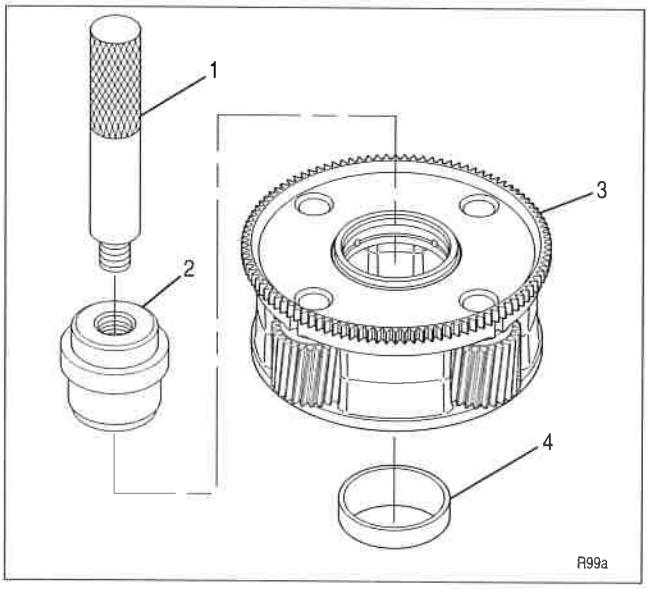
d. P1 Planetary Carrier Bushing Replacement

Tools Required

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

NOTE:
The preferred method for removing/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 universal driver.

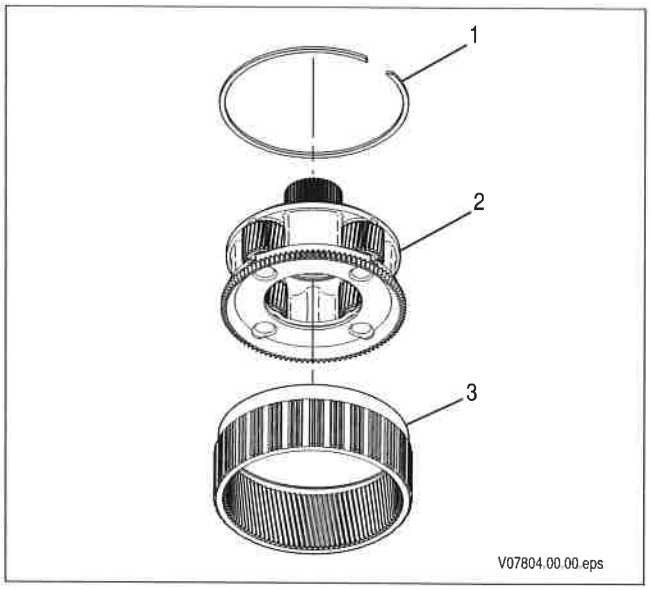
1. Position P1 planetary carrier (3) on the press with the external splines facing up.
2. If the bushing will be removed by hand, install the short end of J 43781 (2) onto J 8092 (1).
3. Using J 43781, press bushing (4) out of the carrier.



5–15. P2 PLANETARY MODULE

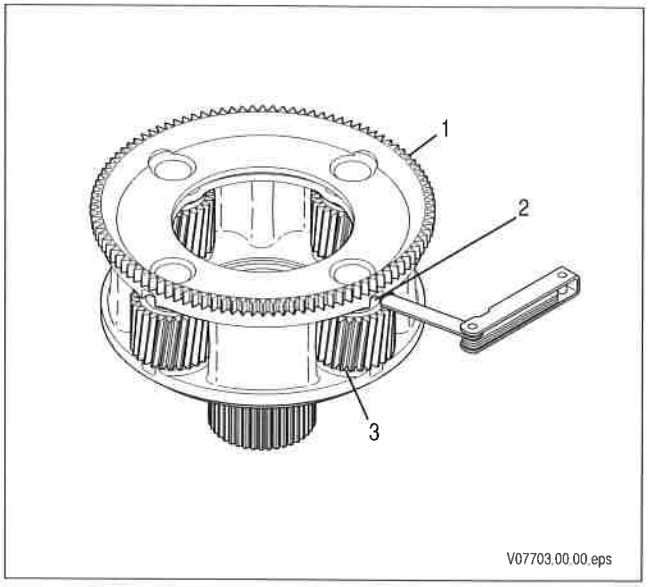
a. P2 Planetary Module Disassembly

1. Remove retaining ring (1) from P3 ring gear (3).
2. Separate P2 planetary carrier assembly (2) from P3 ring gear (3).

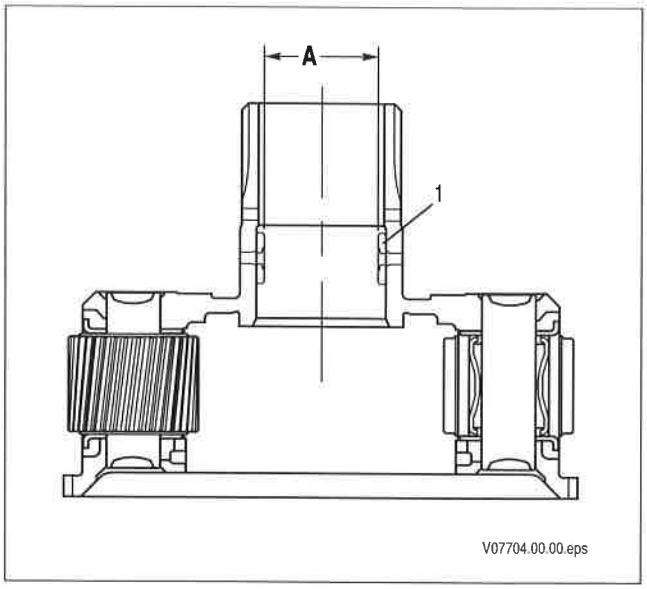


b. P2 Planetary Carrier Assembly Inspection

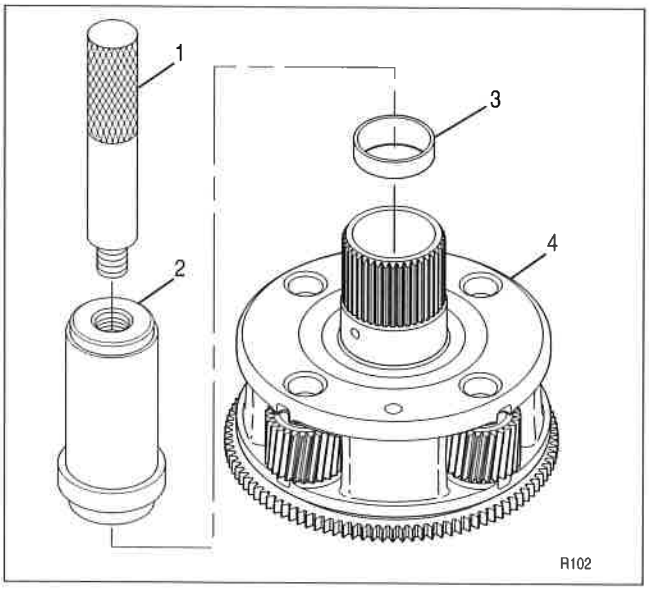
1. Check the end play between P2 planetary carrier (1) and thrust washer (2) at each pinion gear (3).
2. If the end play exceeds 1.010 mm (0.0400 inch), replace the P2 planetary carrier assembly.



3. Inspect bushing (1) for wear and damage.
4. Measure the ID of the bushing (Dimension A). If the bushing ID exceeds 36.575 mm (1.4400 inch), replace the bushing.

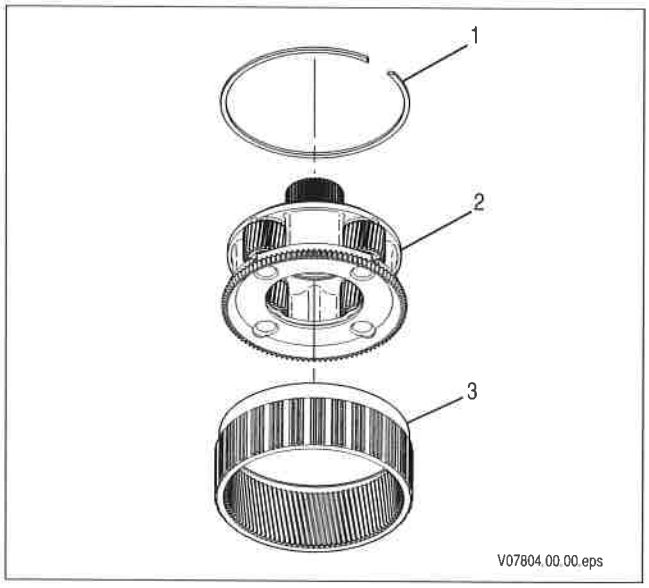


5. If the bushing will be installed by hand, install the long end of J 43785 (2) into J 8092 (1).
6. Install a new bushing (3) onto J 43785 (2).
7. Using J 43785 (2), press or drive the bushing into the carrier until J 43785 (2) seats.



e. P2 Planetary Module Assembly

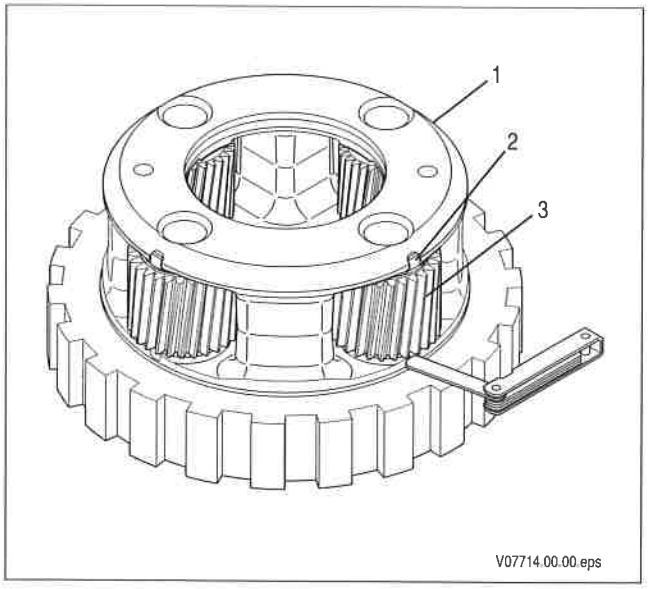
1. Position P3 ring gear (3) on the work table so that the outer splines are facing down.
2. Install P2 planetary carrier assembly (2) into P3 ring gear. Make sure the splines are engaged.
3. Install retaining ring (1) into the P3 ring gear so that the P2 planetary carrier assembly is retained.



5–16. 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 exceeds 1.010 mm (0.0400 inch), replace the P3 planetary carrier assembly.

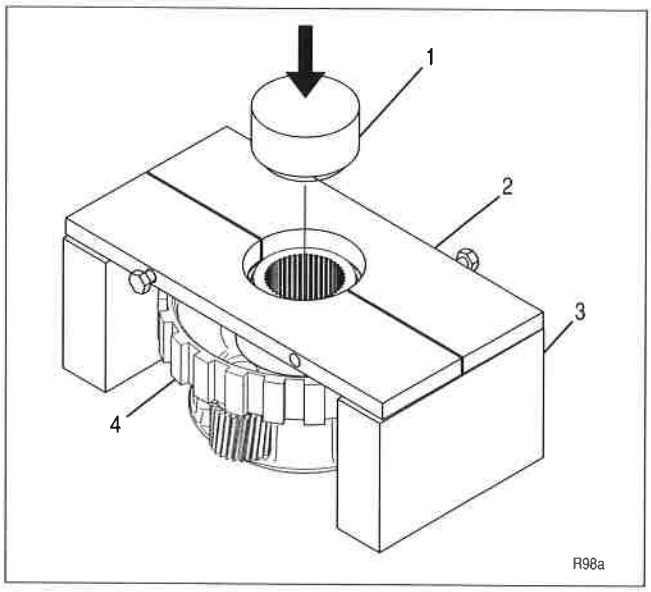


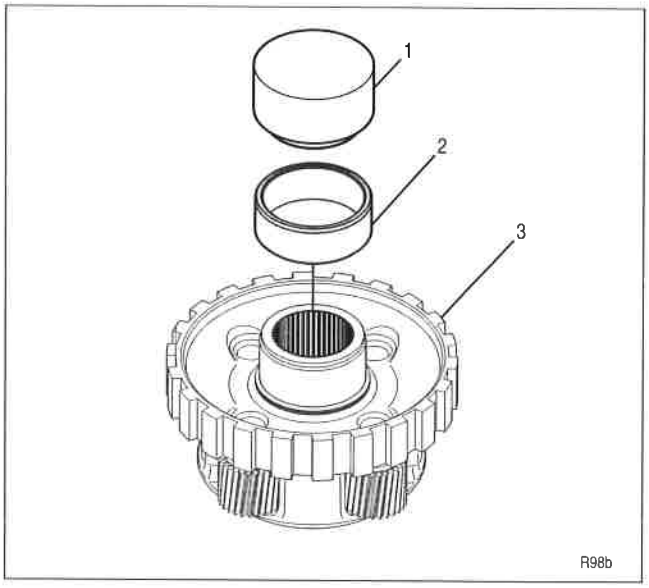
4. Place two wooden blocks (3) on the press.
5. Position carrier (4) so that J 44528-1 (2) spans the wooden blocks and the front of the carrier is facing down.
6. Install J 44528-2 (1) into the carrier.

WARNING!

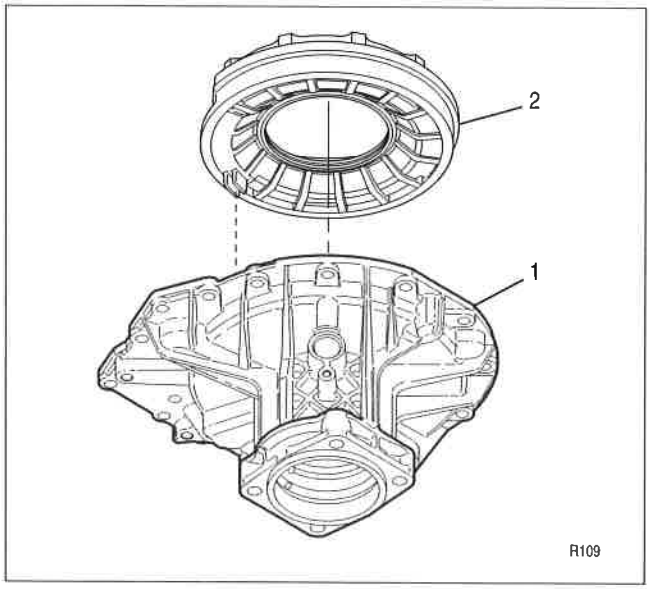
Pressing the P3 planetary carrier from the bearing race causes the P3 carrier to fall from the bearing race. Make sure the P3 carrier is safely caught when freed from the bearing race. An uncontrolled fall of the P3 carrier could cause personal injury and/or property damage.

7. Using J 44528-2 (1), press 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 P3 planetary carrier (3) on the press so that 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 P3 planetary carrier (3) until J 43797 seats.

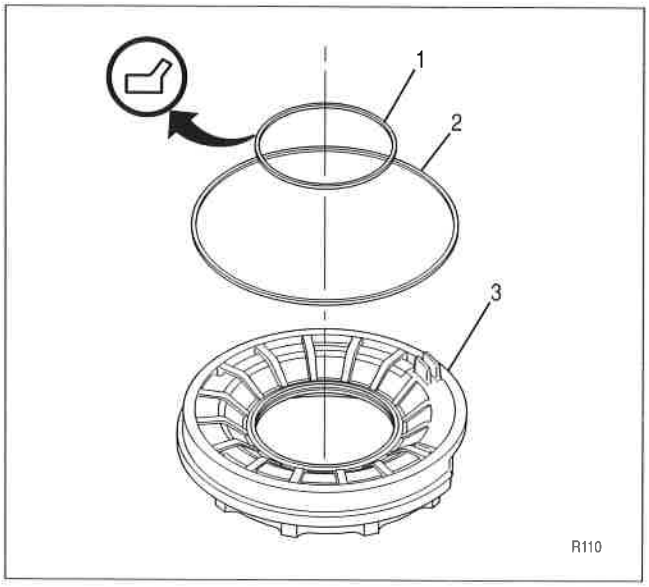




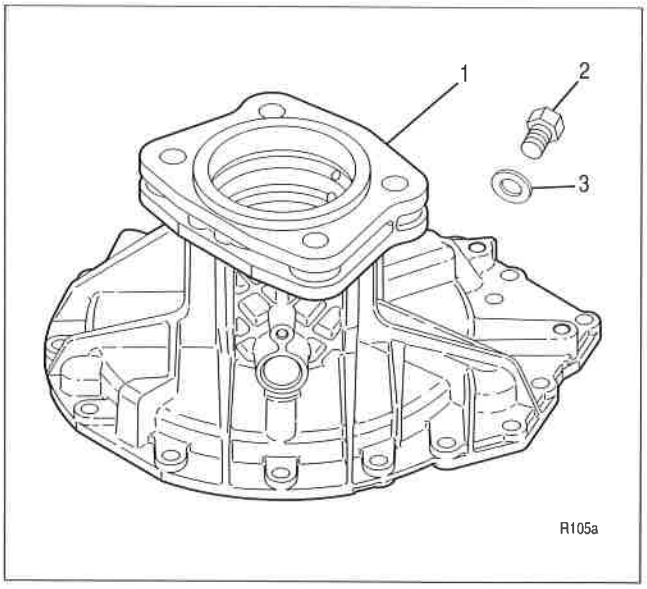
5. Position rear cover (1) on the work table so that the rear of the cover is facing down.
6. Gently pry C5 clutch piston (2) from rear cover (1).



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



8. If tachograph plug (2) is present do the following.
   - Position the rear cover on the work table so that the rear of the cover is facing up.
   - Remove tachograph plug (2).
   - Remove washer (3).



e. Output Shaft Bushing Replacement

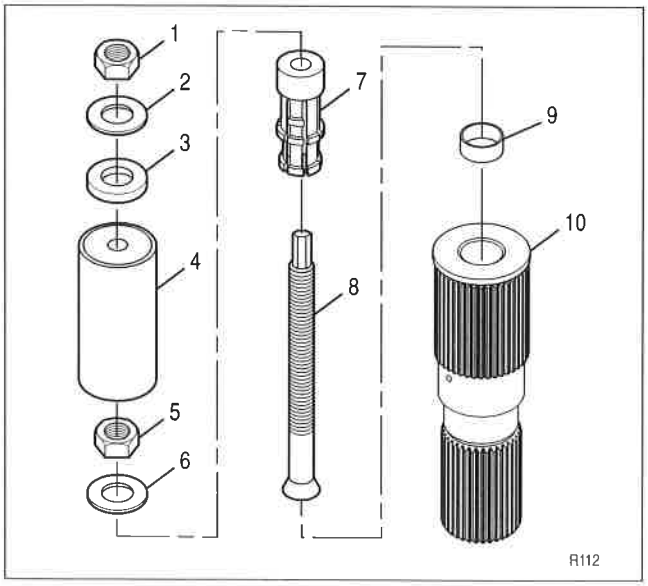
Tools Required

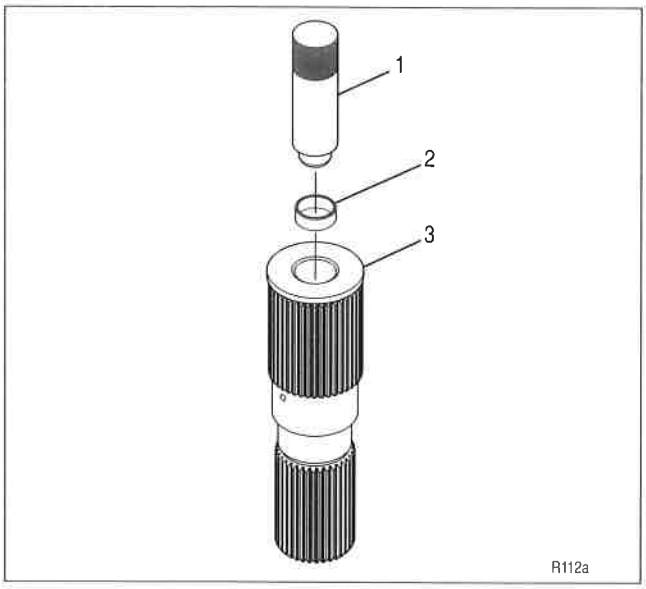
- J 44526 Output/Turbine Shaft Bushing Remover
- J 43791 Output/Turbine Shaft Bushing Installer

CAUTION:

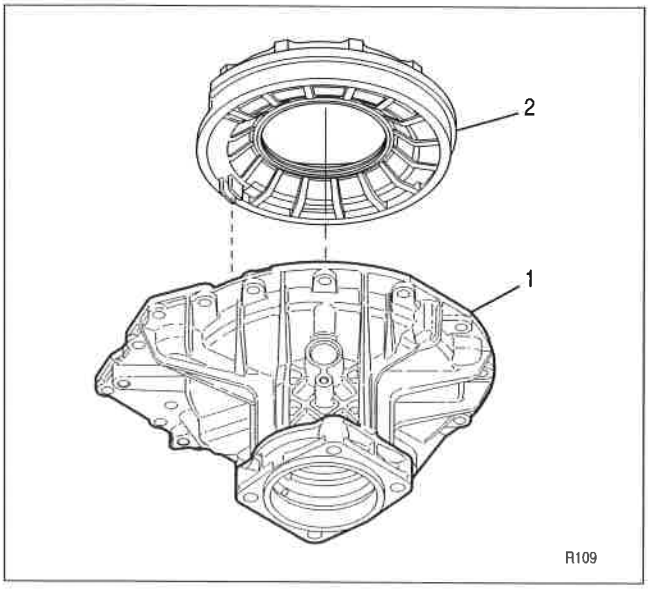
Always use J 44526 when removing the output shaft bushing to help avoid damage to the output shaft.

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.
9. Remove the bushing from the J tools.
10. Install a new bushing (2) onto J 43791 (1).
11. Using J 43791, drive the bushing into output shaft (3) until J 43791 (1) is seated.
12. Make sure the bushing is pressed flush to 0.25 mm (0.010 inch) below the output shaft surface.

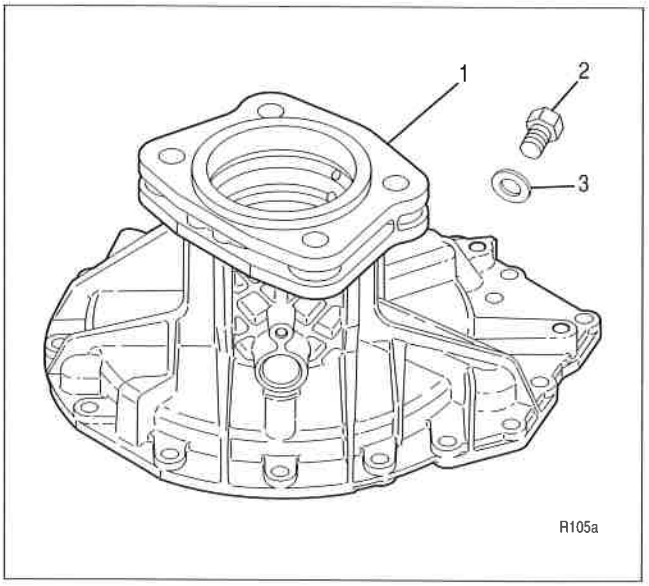




6. Position the rear cover so that the rear of the cover is facing down.
7. Align the tang on C5 clutch piston (2) with the tang hole in rear cover (1).
8. Install C5 clutch piston (2) into rear cover (1).



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

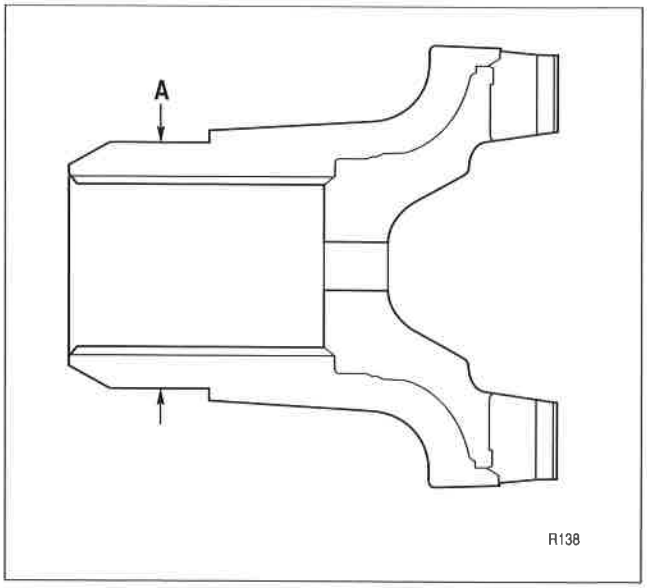


5–18. OUTPUT YOKE INSPECTION

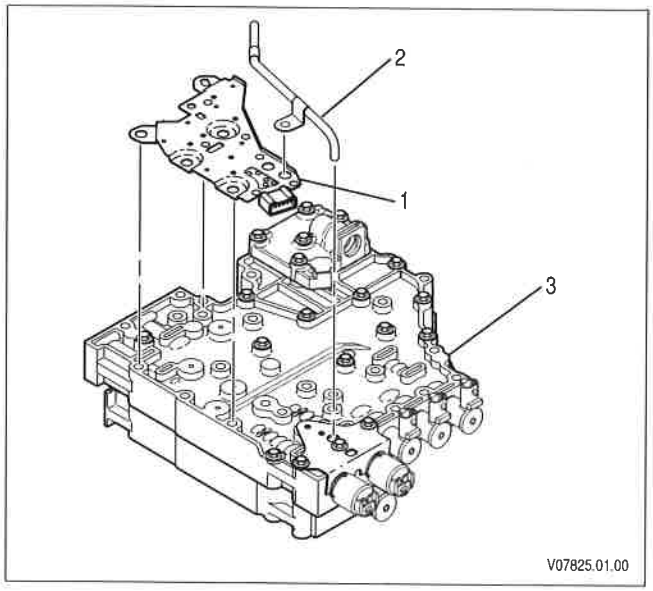
NOTE:

- **Measure as described below at three or more locations.**
- **Replace the output yoke if it does not meet specifications.**

1. Inspect output yoke for damage.
2. Measure the OD of the output yoke oil seal surface. Minimum surface OD is 65.080 mm (2.5622 inch).



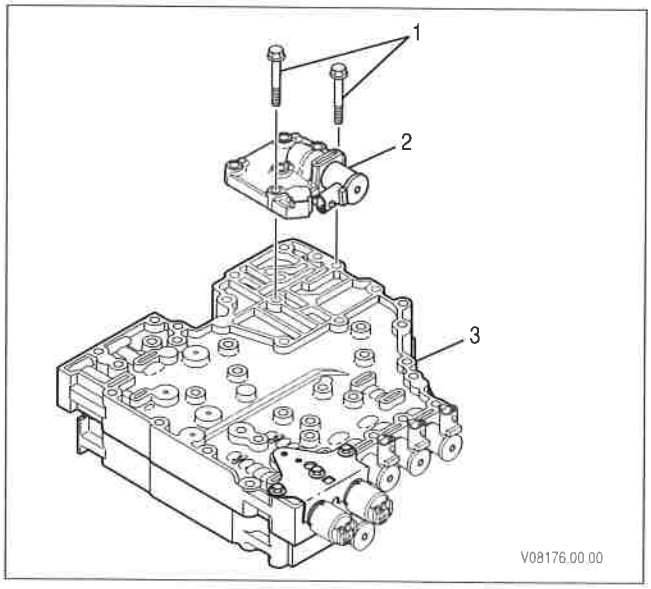
3. Remove reverse signal tube (2) from main valve body (3).
4. Remove pressure switch assembly (1) from main valve body (3).



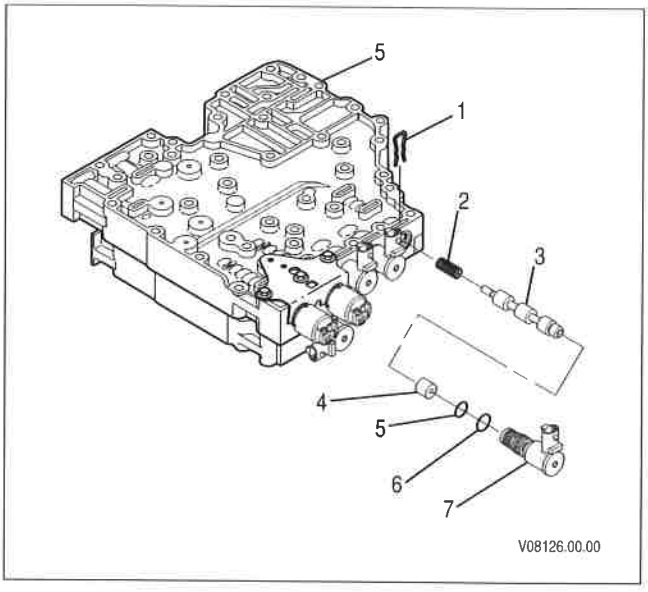
NOTE:

Beginning March 2004, a redesigned pressure switch manifold is used. The current pressure switch manifold has blue insulation material and two pressure switches have been deleted. The current and former pressure switch manifolds are completely interchangeable (refer to SIL 16-1K2K-04).

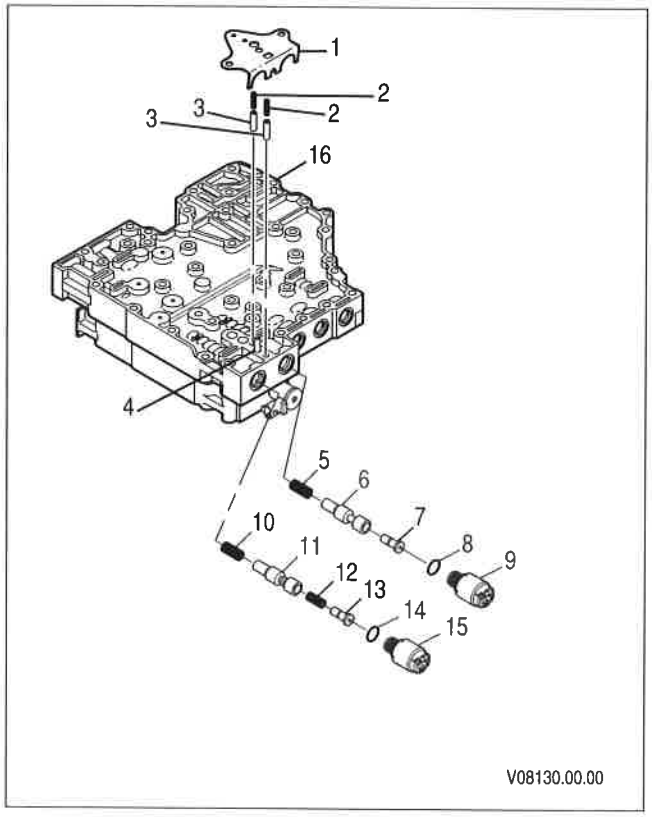
5. Remove two bolts (1) retaining modulated main valve body (2) to valve body (3).
6. Remove modulated main valve body (2).



7. Remove F trim solenoid retainer (1).
8. Remove F trim solenoid (7), sleeve (4), valve (3), and spring (2).
9. Remove O-rings (5) and (6) from F trim solenoid (7).



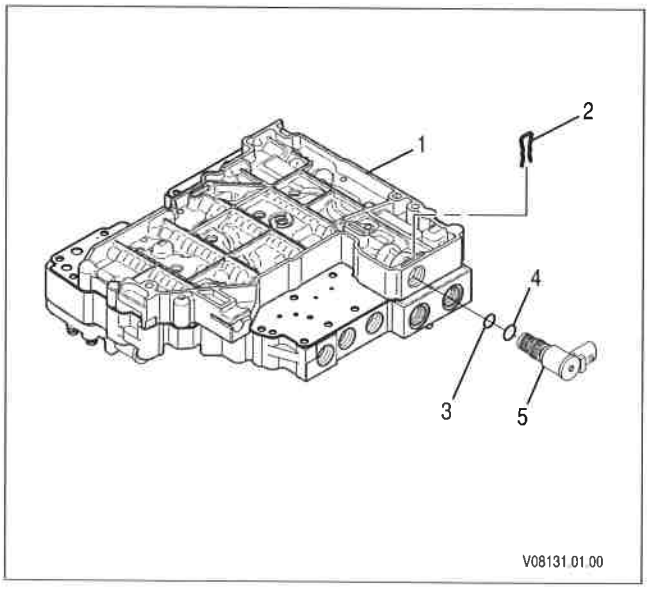
17. Remove A/B solenoid bracket (1), two accumulator springs (2), and two accumulator plugs (3).
18. Remove A trim solenoid (15), valve (13), spring (12) if present, valve (11), and spring (10).
19. Remove B trim solenoid (9), valve (7), valve (6), and spring (5).
20. Remove O-ring (14) from A trim solenoid (15).
21. Remove O-ring (8) from B trim solenoid (9).



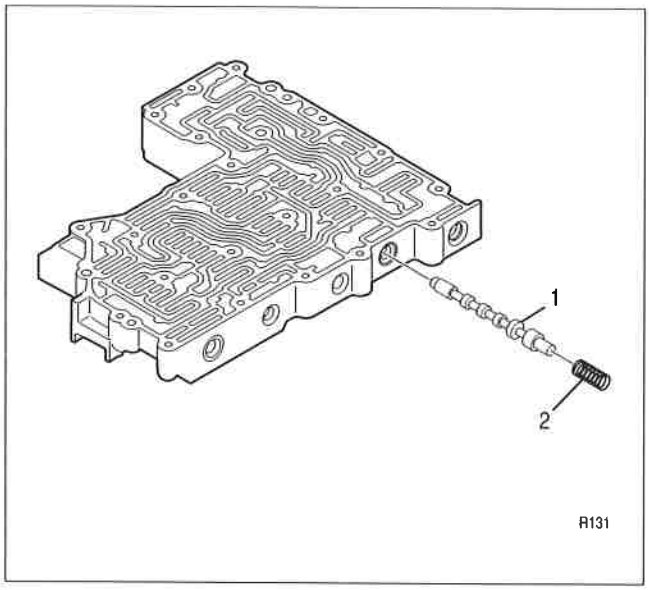
CAUTION:

Do not damage the solenoid(s) when turning over the control valve assembly.

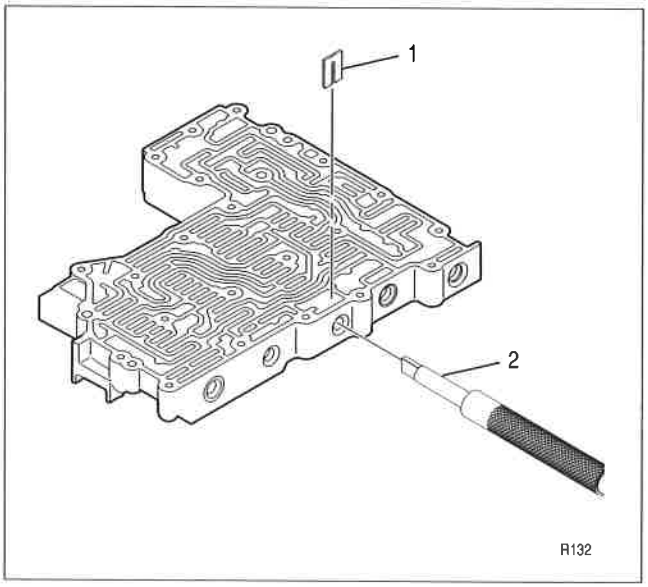
22. Position the control valve assembly on the work table so that shift valve body (1) is facing up.
23. Remove C ON/OFF shift solenoid retainer (2).
24. Remove C ON/OFF shift solenoid (5).
25. Remove O-rings (3) and (4) from C ON/OFF shift solenoid (5).



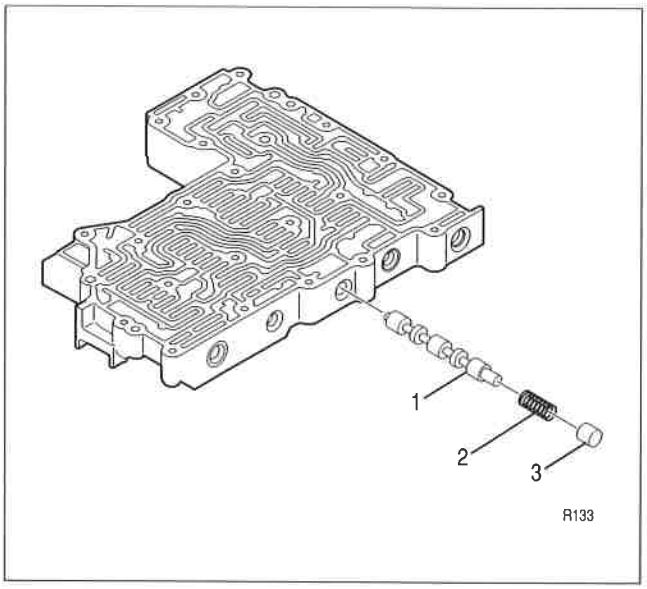
2. Remove spring (2) and C shift valve (1).



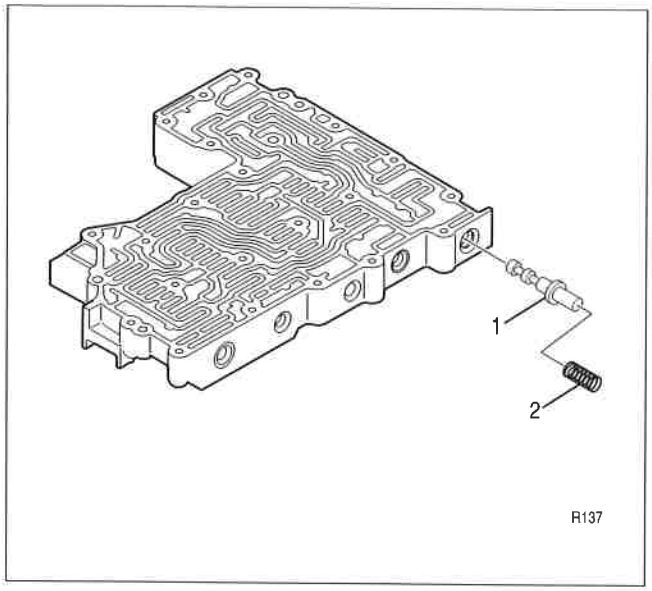
3. Using J 43773 (2), compress the E shift spring until retaining clip (1) is loose. Remove the clip.



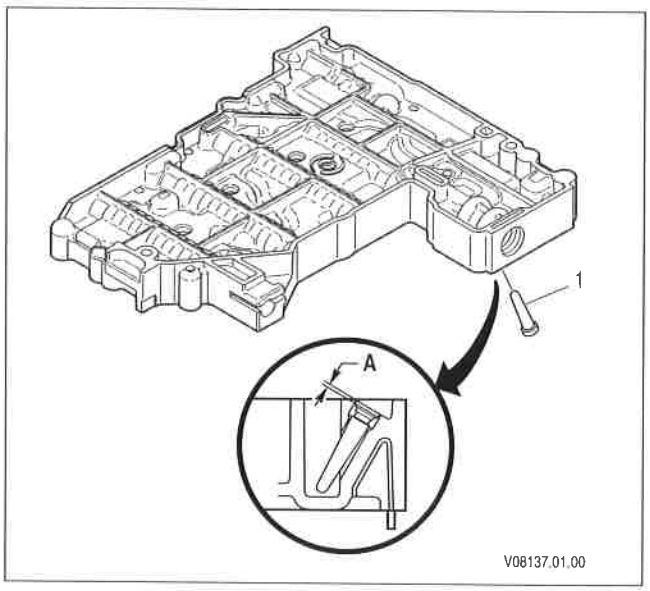
4. Remove plug (3), spring (2), and E shift valve (1).



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

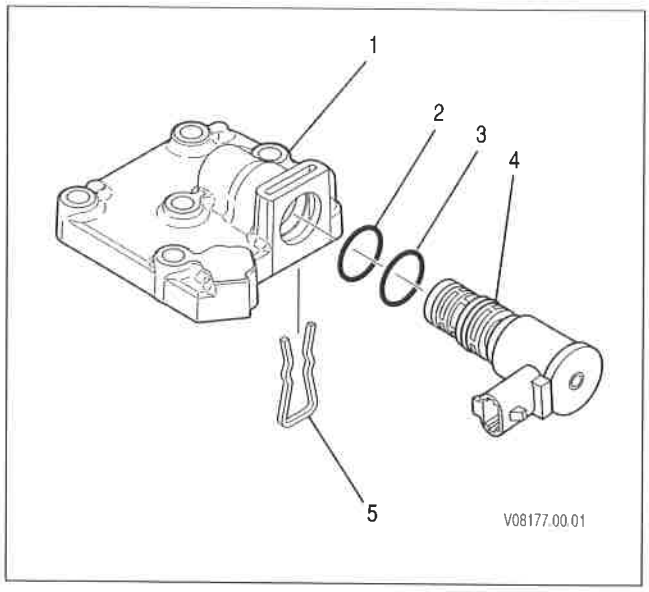


9. Remove solenoid screen (1).

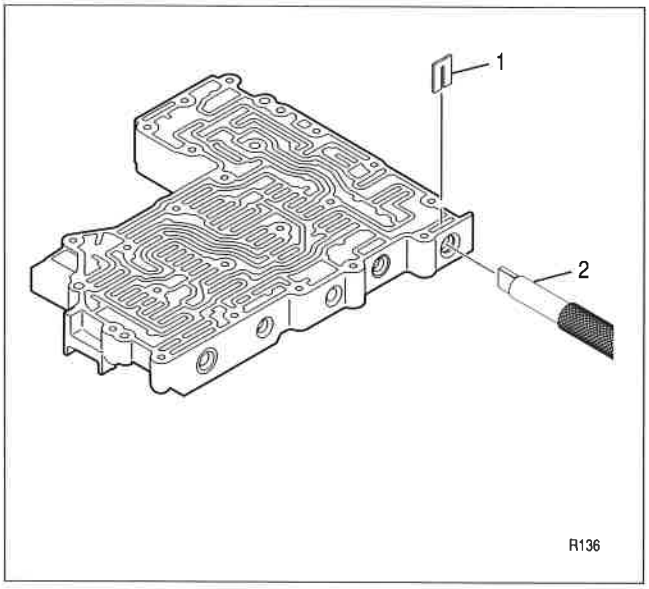


c. Disassembly of Modulated Main Valve Body

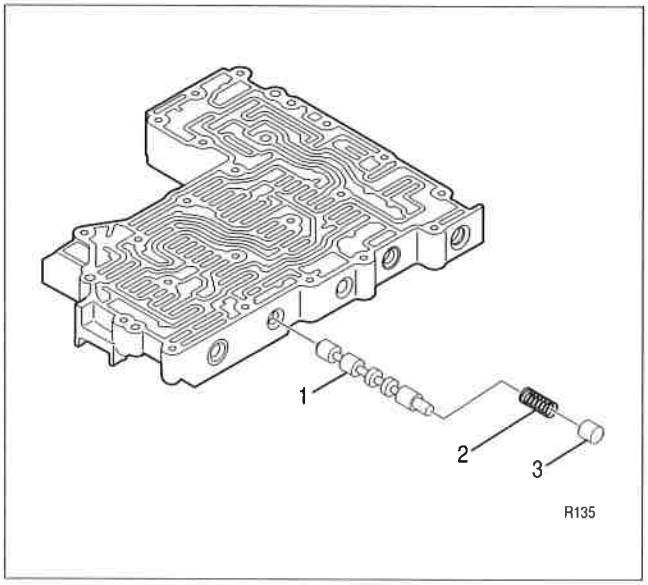
1. Remove G ON/OFF solenoid (4) retainer.
2. Remove G ON/OFF solenoid (3) from modulated main valve body (1).
3. Remove two O-rings (2) and (3) from the G ON/OFF solenoid.



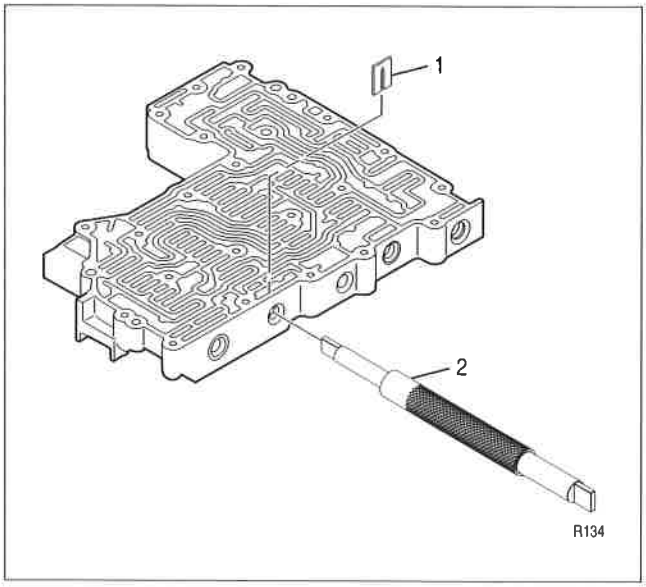
4. Compress the spring with J 43773 (2).
5. Install retaining clip (1). Make sure the retaining clip is below the valve body surface.



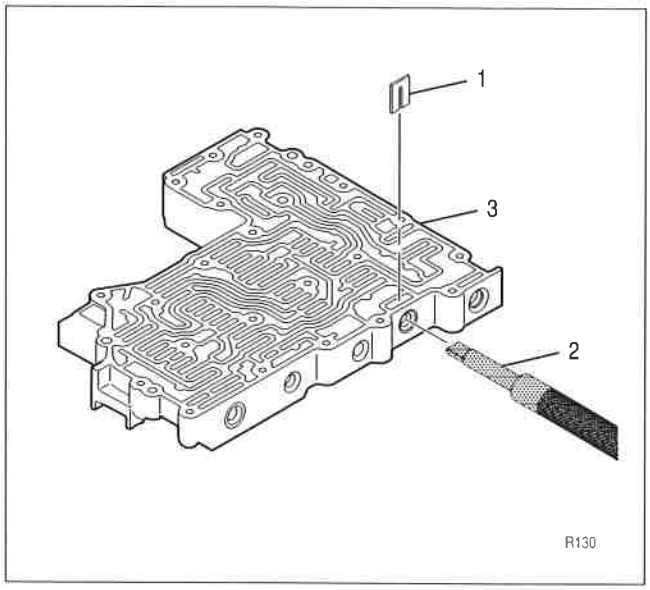
6. Install D shift valve (1), spring (2), and plug (3).



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



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

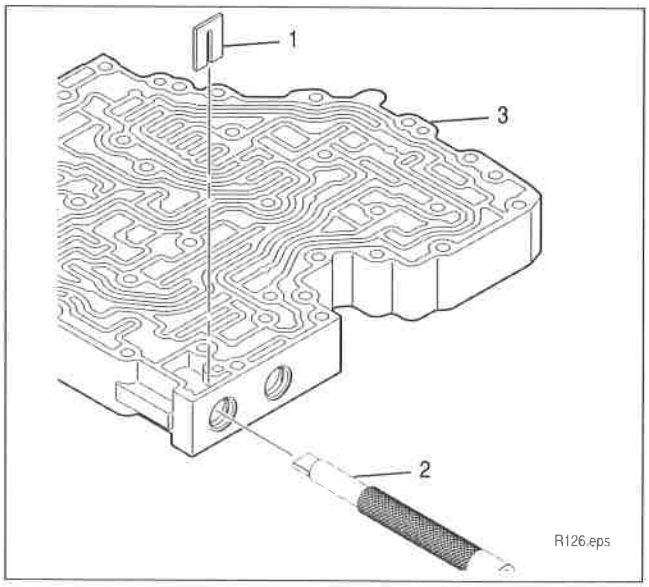


f. Disassembly of the Main Valve Body

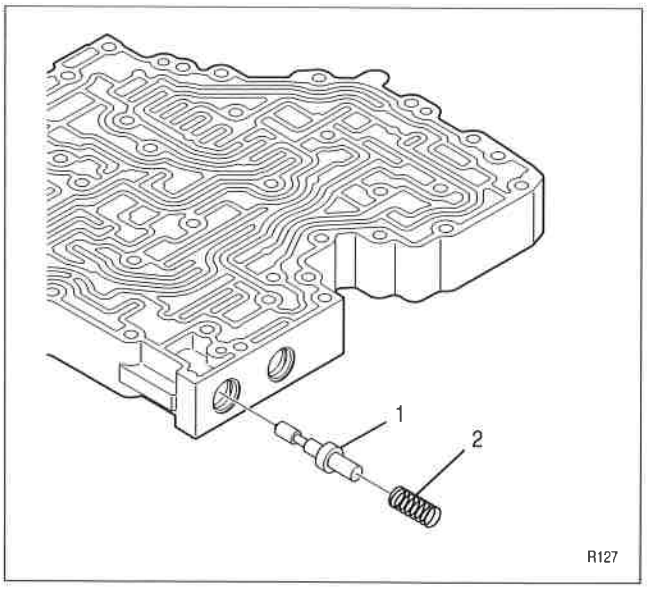
Tools Required

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

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



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



g. Dowel Pin Replacement

Tools Required

- J 43779 Dowel Pin Installer

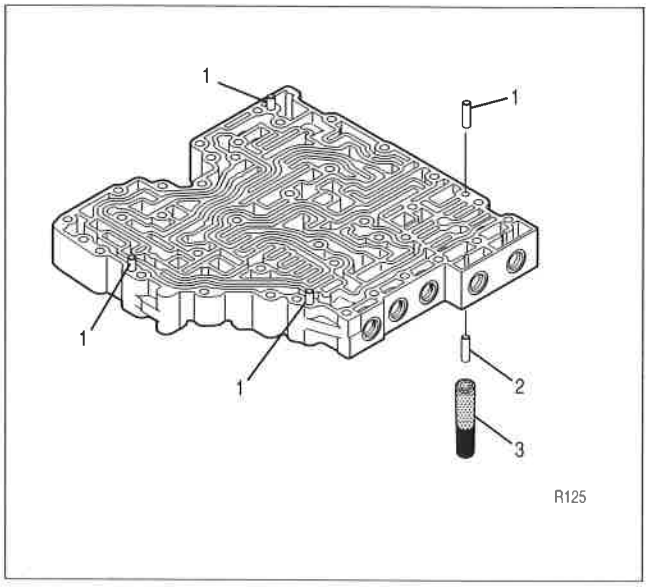
CAUTION:

DO NOT mar the main valve body surface when installing the dowel pin(s). Use only gentle tapping on dowel pin installer tool J 43779. Heavy or continued hammering on J 43779 will damage the main housing surface.

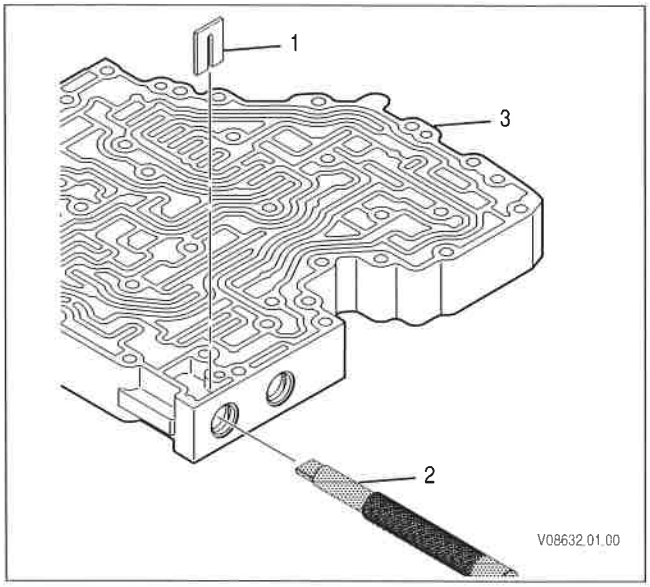
NOTE:

The main valve body has five dowel pins that can be replaced. Do not replace a dowel pin unless the dowel pin is damaged. Use the following procedure to replace a dowel pin.

1. Remove the dowel pin from the main valve body.
2. Place a new dowel pin into J 43779 (3).
3. Install J 43779 with the dowel pin into the dowel pin hole.
4. Gently tap J 43779 until J 43779 touches the main valve body surface.
5. Make sure the dowel pin is installed to a height of 10.7–11.3 mm (0.42–0.44 inch) above the main valve body surface.



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

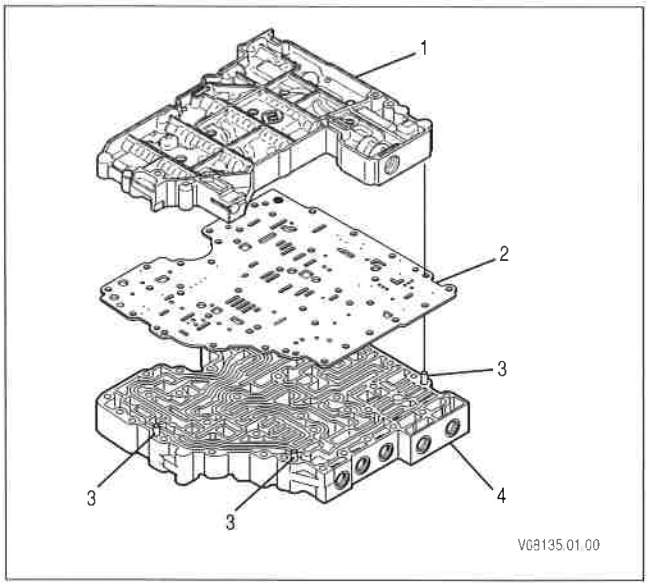


i. Assembly of Control Valve Assembly

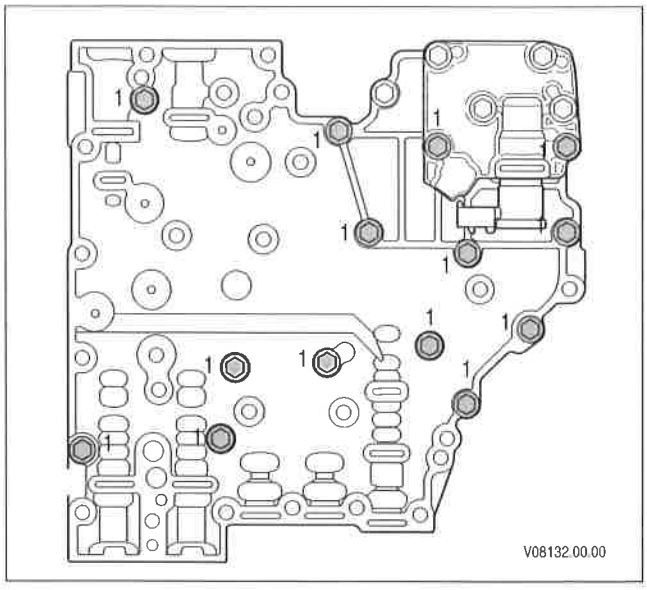
Tools Required

- J 33163 Valve Tray Set

1. Position main valve body assembly (4) on the work table so that the worm-track side is facing up.
2. Align separator plate (2) with main valve body dowel pins (3).
3. Install the separator plate.
4. Align shift valve body assembly (1) with main valve body dowel pins (3).
5. Install the shift valve body assembly onto the separator plate.



6. Position the control valve assembly on the work table so that the main valve body is facing up.
7. Install fourteen bolts (1) retaining the valve bodies together. Tighten the bolts to 10–13 N·m (84–120 lb in.).



CAUTION:

Do not damage the solenoid(s) when turning over the control valve assembly.

14. Position the control valve assembly on the work table so that main valve body (16) is facing up.

NOTE:

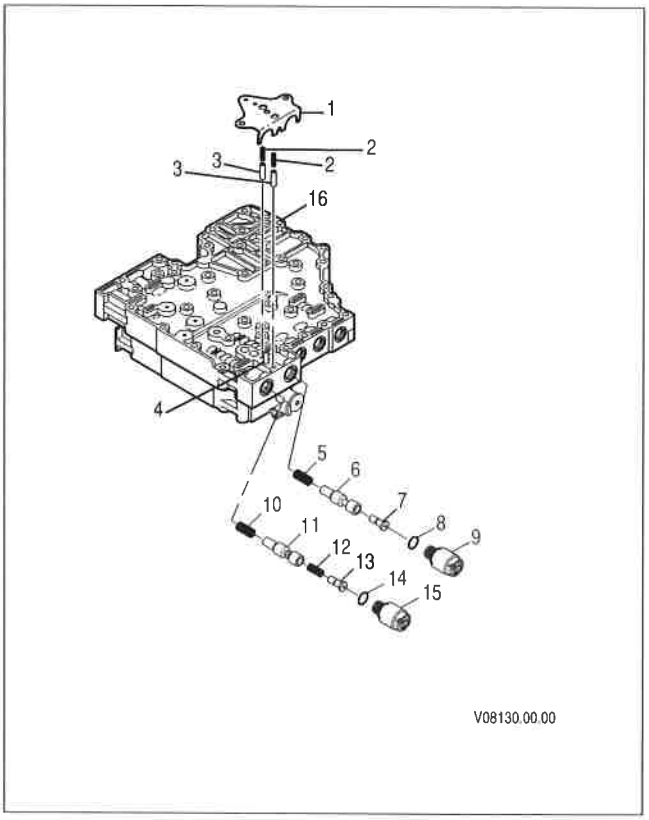
A trim solenoid (15) has P/N 29533074 printed on the solenoid.

15. Install solenoid O-ring (14) onto A trim solenoid (15).

NOTE:

The B trim solenoid (9) has P/N 29533075 printed on the solenoid.

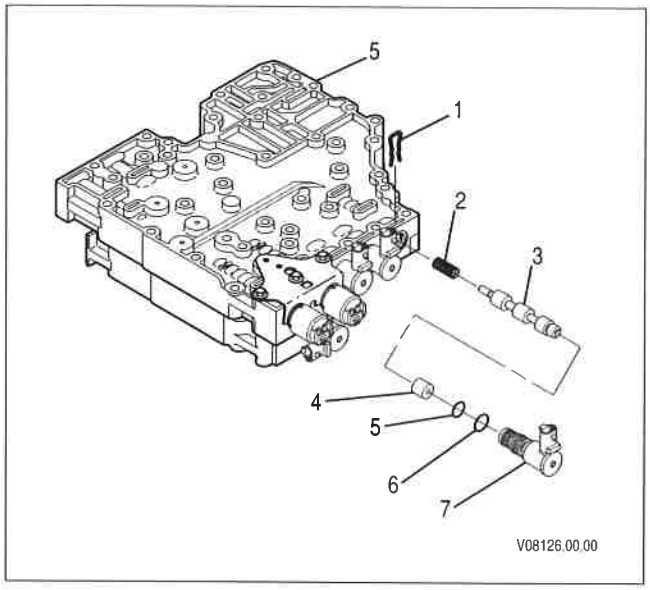
16. Install solenoid O-ring (8) onto B trim solenoid (9).
17. Install spring (10), A trim valve (11), spring (12) if present, and trim gain valve (13).
18. Install spring (5), B trim valve (6), and trim gain valve (7).
19. Install A trim solenoid (15) so that the electrical connector faces up.
20. Install B trim solenoid (9) so that the electrical connector faces up.
21. Align two accumulator plugs (3) so that their spring bores are facing up.
22. Install two accumulator plugs (3) and two accumulator springs (2).
23. Push the A and B trim solenoids into their bores until the solenoids seat.
24. Align A/B solenoid bracket (1) with main valve body dowel pin (4).
25. Install A/B solenoid bracket (1) so that the A and B trim solenoids and the accumulator plugs and springs are retained in the valve body.



NOTE:

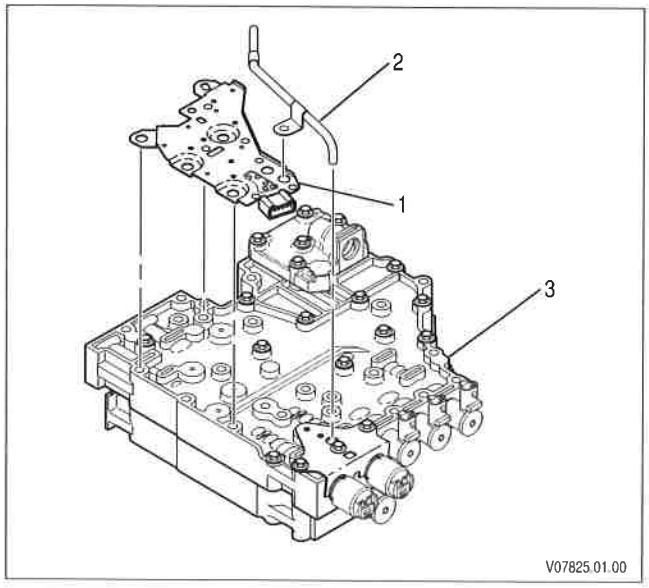
The solenoid O-rings are brown in color. O-ring (6) is slightly larger than O-ring (5).

35. Install solenoid O-ring (6) onto F trim solenoid (7).
36. Install solenoid O-ring (5) onto F trim solenoid (7).
37. Install F trim spring (2).
38. Install F trim valve (3).
39. Install F trim sleeve (4).
40. Align F trim solenoid (7) so that the electrical connector faces up.
41. Push the solenoid into the valve body until the solenoid seats.
42. Install solenoid retainer (1).
43. Align the bolt holes and alignment tab of pressure switch assembly (1) with the pressure switch assembly holes in main valve body (3).
44. Install pressure switch assembly (1) onto main valve body (3).
45. Install reverse signal tube (2) into the main valve body.



NOTE:

Beginning March 2004, a redesigned pressure switch manifold is used. The current pressure switch manifold has blue insulation material and two pressure switches have been deleted. The current and former pressure switch manifolds are completely interchangeable (refer to SIL 16-1K2K-04).

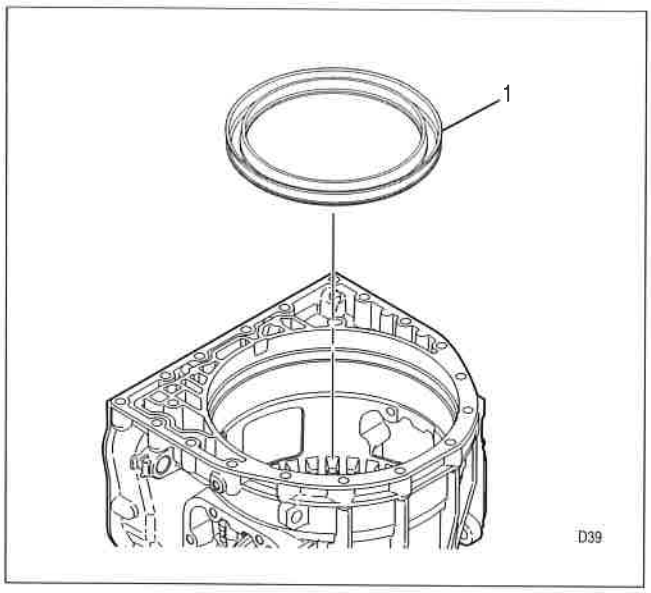


6–1. C3 CLUTCH INSTALLATION

Tools Required

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

1. Position the main housing so that 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.

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2. Apply petrolatum to the ID and OD of new C3 clutch piston assembly (1).
3. Align new C3 clutch piston assembly (1) with the main housing so that the seal is facing down and the 1.016 mm (0.040 inch) lubrication/cooling orifice positioned at the top of the main housing.
4. Install the C3 clutch piston assembly. Gently tap the piston until the piston seats.

NOTE:

- **Beginning with S/N 6310345600 (Indianapolis) and S/N 6320330196 (Baltimore), the C3/C4 Return Spring Plate had been redesigned by adding a securing slot.**
- **Beginning with S/N 6310354268 (Indianapolis) and S/N 6320342704 (Baltimore), the C3/C4 Return Spring assembly clamp has been lengthened and tempered.**
- **The spring assemblies can be reused. If necessary, squeeze the spring assembly tabs with pliers to make sure the spring assemblies are retained to the spring plate.**
- **The piston return spring assemblies should snap into place.**
- **Former and current parts are fully interchangeable (refer to SIL 1-1K2K-04).**

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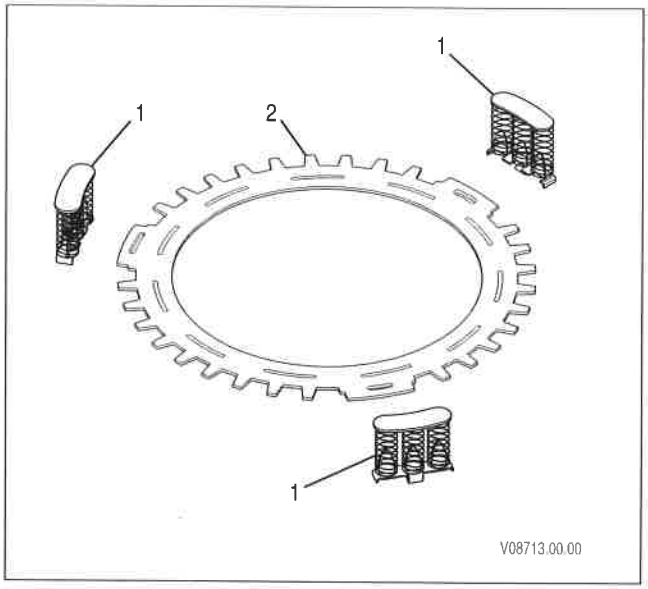
5. Install three piston return spring assemblies (1) onto spring plate (2) so that the spring assemblies are securely engaged in the retaining slot in the spring plate.

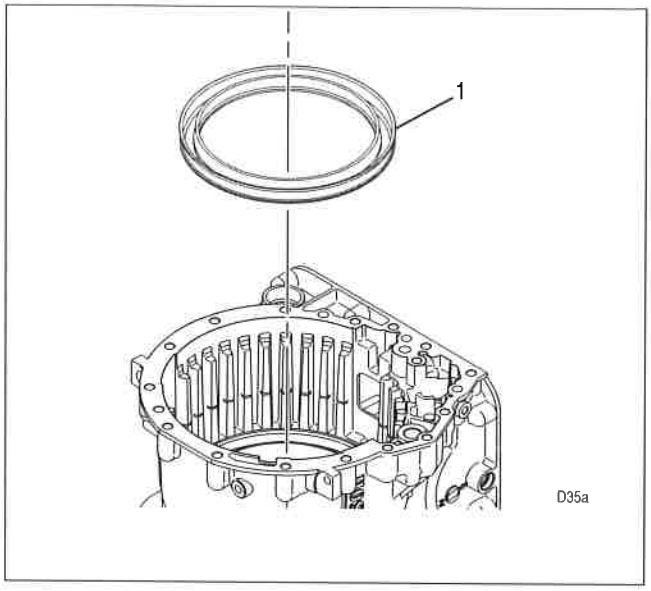


6–2. P1 PLANETARY MODULE AND C4 CLUTCH INSTALLATION

Tools Required

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

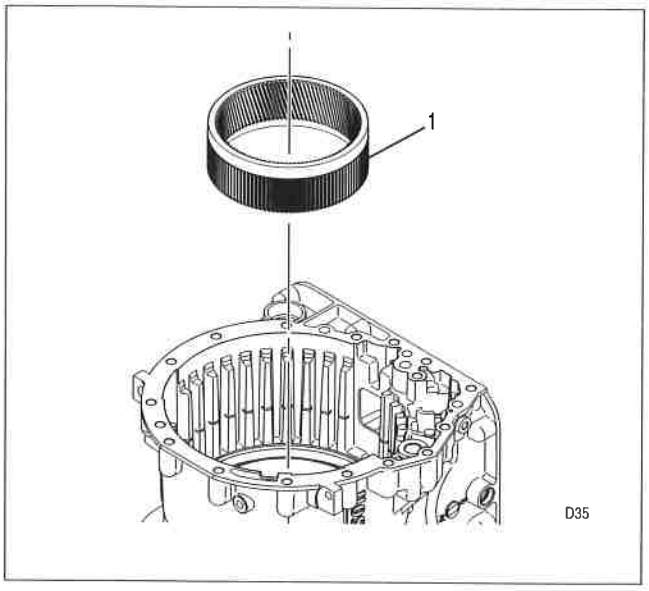
1. Position the main housing so that the rear of the main housing is facing up.



NOTE:

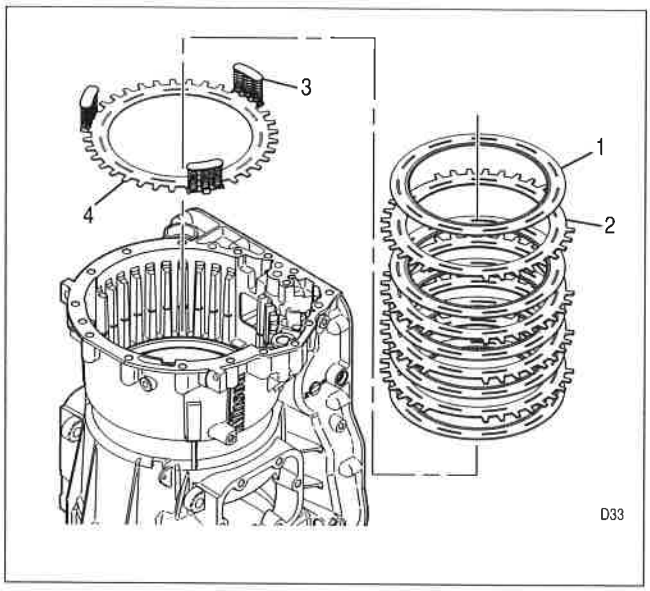
Do not reuse the old C4 clutch piston assembly. Install a new C4 clutch piston assembly.

2. Apply petrolatum to the ID and OD of new C4 clutch piston assembly (1).
3. Align C4 clutch piston assembly (1) so that the seal is facing down and the 1.016 mm (0.040 inch) lubrication/cooling orifice positioned at the top of the main housing.
4. Install C4 clutch piston assembly (1). Gently tap the piston until the piston seats.

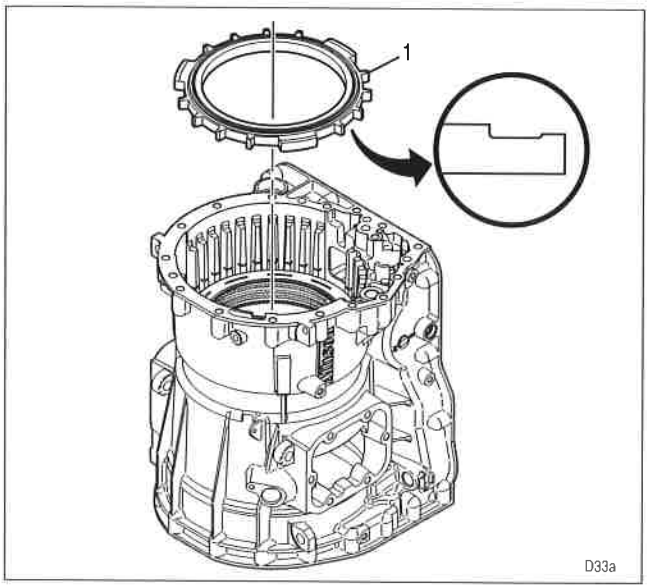


5. Align P1 ring gear (1) so that the outside splines are facing down.
6. Install P1 ring gear (1). Rotate the ring gear until the C3 friction plates are engaged.
7. Make sure P1 ring gear (1) is seated against the thrust plates of the C3 clutch backplate assembly.

12. Align spring plate (4) and piston return spring assemblies (3) with the spring assemblies up.
13. Install spring plate (4) into the main housing.
14. Starting with a C4 clutch friction plate, alternately install five C4 clutch friction plates (1) and four C4 clutch reaction plates (2).



15. Install C4 clutch backplate (1).



6–3. C5 CLUTCH REACTION PLATE SELECTION

Tools Required

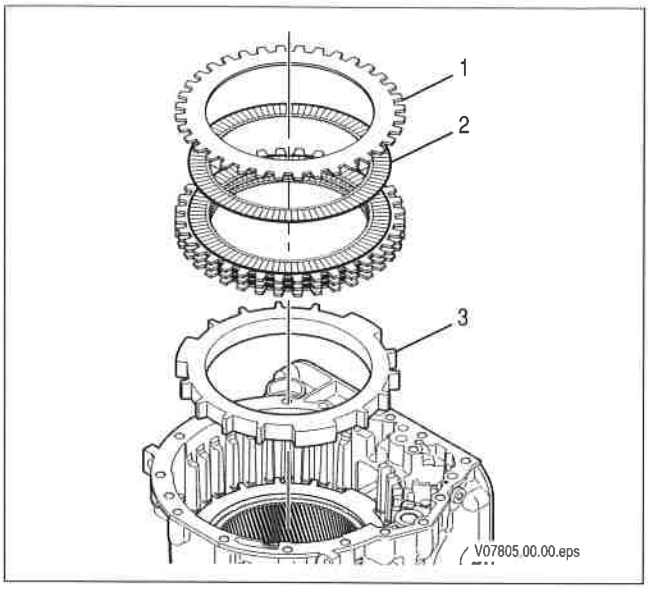
- J 24204-2 Bar and Stud Assembly
- J 44530 C3/C4 Piston Spring Compressor

NOTE:
The C5 clutch backplate installs in either direction. The plate may have no grooves, one side grooved, or both sides grooved.

1. Install C5 clutch backplate (3).

NOTE:
The C5 clutch pack uses a single selective reaction plate. The C5 clutch pack is stacked out of order to allow determining the required reaction plate part number. When properly stacked, the top plate is a reaction plate and the next two plates are friction plates. The selective reaction plate is not stacked. Reaction plates have an ID number stamped on a tang. The ID number that does not match the other ID numbers is the selective reaction plate.

2. Starting with a C5 clutch friction plate, alternately install the remaining five C5 clutch friction plates (2) and four C5 clutch reaction plates (1).
3. Install a C5 clutch friction plate (2).
4. Install a C5 clutch reaction plate (1).



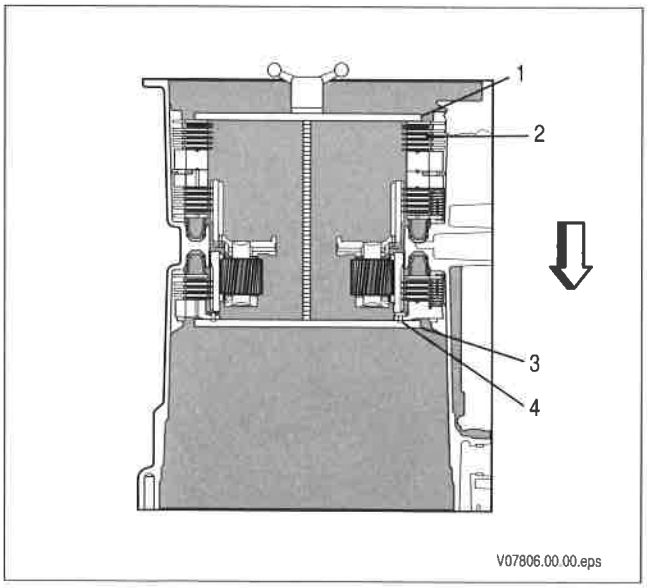
CAUTION:

- **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 the J 24204-2 must pass through but not touch the bushing.**

5. Install J 24204-2 (3) and J 44530 (1) into the main housing. Make sure J 24204-2 does not touch gear thrust plate rivets (4) on the C3 clutch backplate assembly.

NOTE:
The C5 clutch plates need to be compressed enough to remove the coning from the plates. Hand tightening the wing nut of J 24204-2 should be sufficient to remove the coning.

6. Using the J 24204-2 wing nut, compress the C5 clutch plates until hand tight.

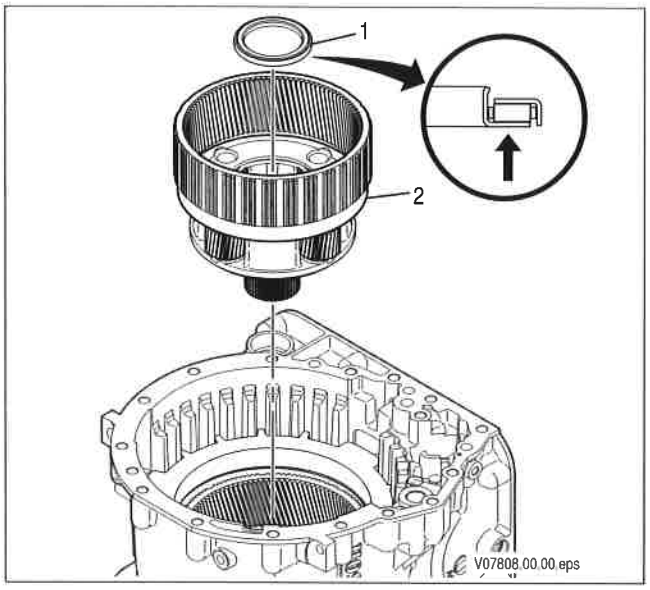


6–4. P2 PLANETARY MODULE AND MAIN SHAFT INSTALLATION

Tools Required

- J 44587 Main Shaft Holder

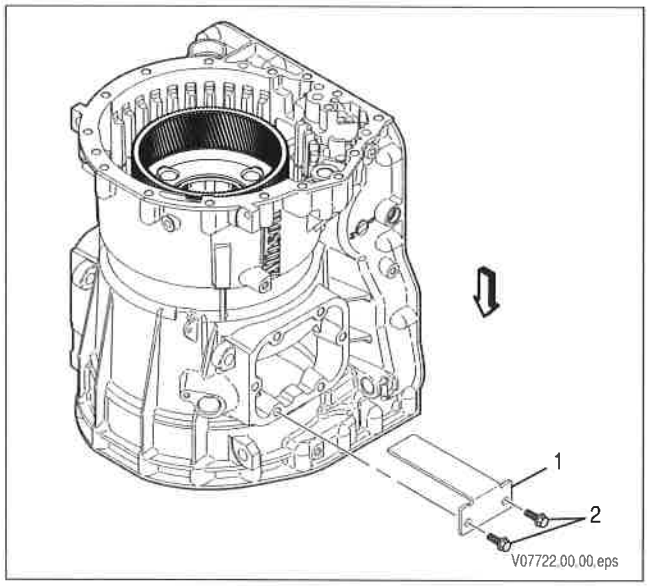
1. Install P2 planetary module (2). Rotate the module until the module drops into place.



CAUTION:

Installing the thrust bearing incorrectly could destroy the transmission.

2. Align thrust bearing assembly (1) so that the blue stripe on the thrust bearing assembly is facing towards P2 planetary module (2).
3. Install thrust bearing assembly (1) onto P2 planetary module (2).
4. If not already installed, align J 44587 (1) with the PTO access as follows.
   - The tongue of J 44587 is facing toward the PTO access.
   - The bolts holes of J 45587 are aligned with the two front bolt holes of the PTO access.



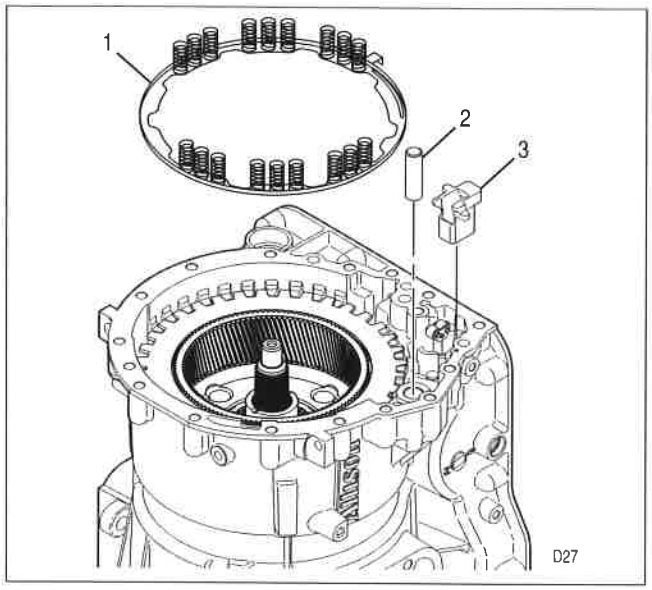
CAUTION:

Transmission damage may occur if special tool J 44587 is not left in place until after the transmission is rotated with the front of transmission facing upward.

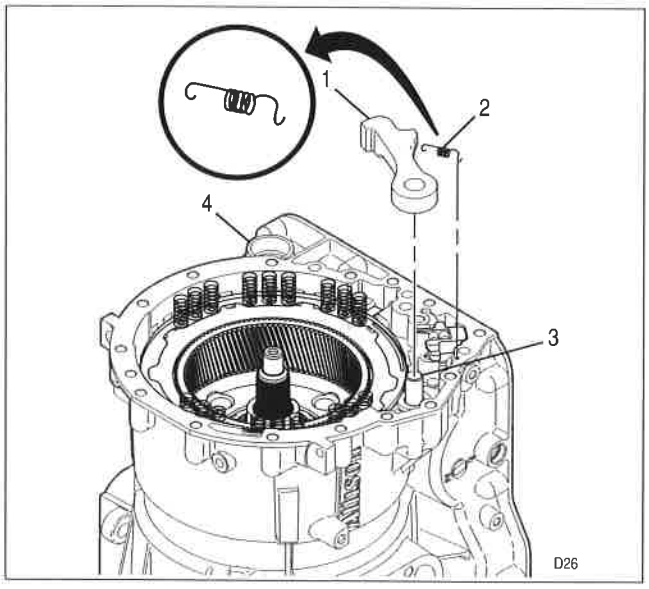
5. Install J 44587 (1) onto the PTO access.
6. Install two bolts (2) into J 45587 (1) and tighten the bolts.

6–6. PARK PAWL INSTALLATION

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



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



4. If a park brake cable bracket is present, 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 help 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.

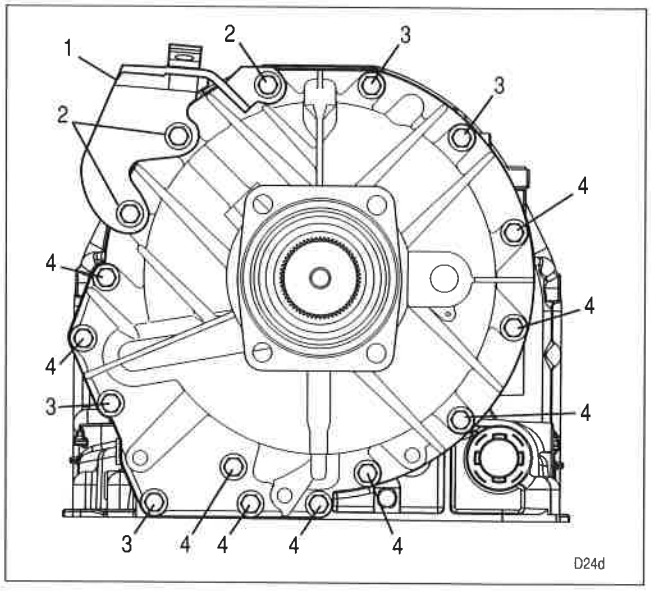
CAUTION:

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. inch) or less thick.**
- **Use bolts 45 mm (1.8 inch) long to install a bracket thicker than 5 mm (0.2 inch).**

Never install a 45 mm (1.8 inch) bolt into the rear cover without at least a 5 mm (0.2 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 bracket (1) onto the rear cover.
- Install three bolts (2).
- Install nine bolts (4).
- Tighten the rear cover bolts (2), (3), and (4) to 51–61 N·m (38–45 lb ft).

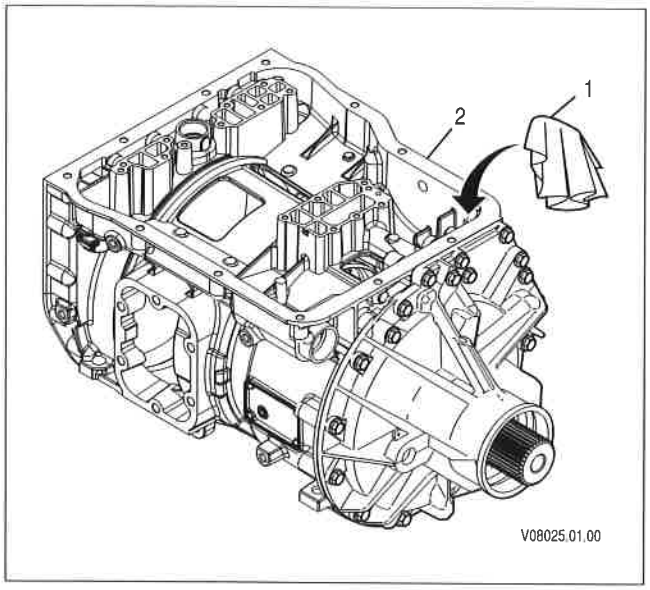


6–9. CONTROL VALVE ASSEMBLY INSTALLATION

1. Position the main housing so that the valve body face of the main housing is facing up.

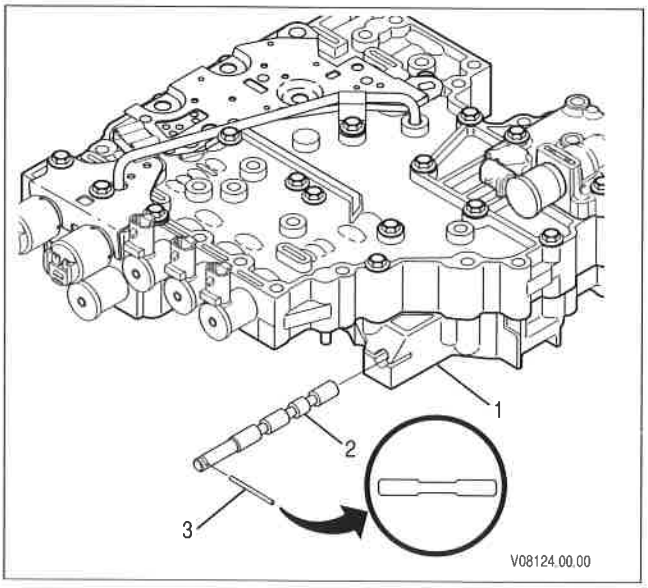
NOTE:

Install a lint-free cloth into the park pawl apply assembly guide hole to prevent the selector valve pin from falling into the transmission.



2. Install a lint-free cloth (1) in the park pawl apply assembly guide hole in main housing (2).

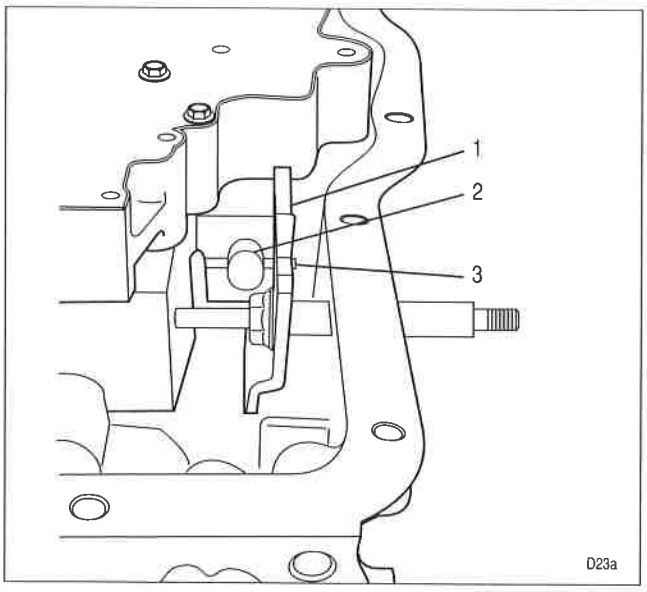
3. Align selector valve pin (3) with manual selector valve (2).
4. Rotate the selector valve pin until the pin can be installed into the manual selector valve.
5. Install selector valve pin (3) into manual selector valve (2).
6. Install the manual selector valve into shift valve body (1).



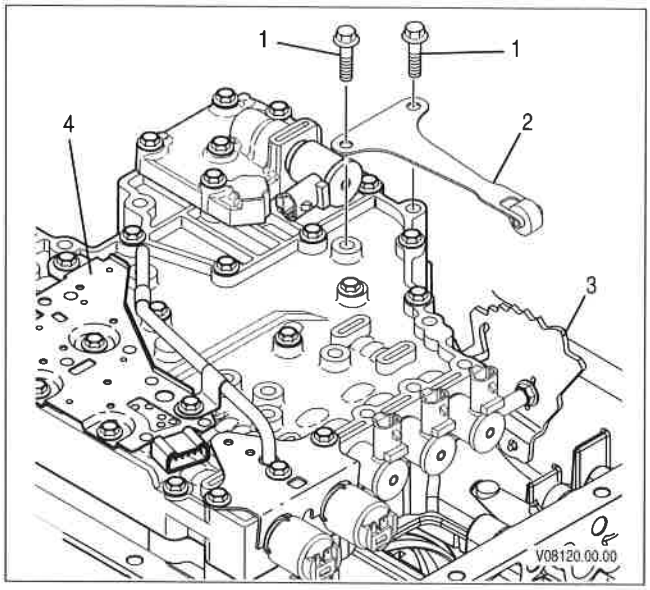
CAUTION:

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

7. Align the control valve assembly with the main housing while installing selector valve pin (3) into detent lever (1).



12. Install detent spring assembly (2) onto main valve body (4). Make sure detent spring assembly (2) roller rests on detent lever (3).
13. Install 2 detent spring assembly bolts (1). Tighten the bolts to 10–13 N·m (84–120 lb in.).

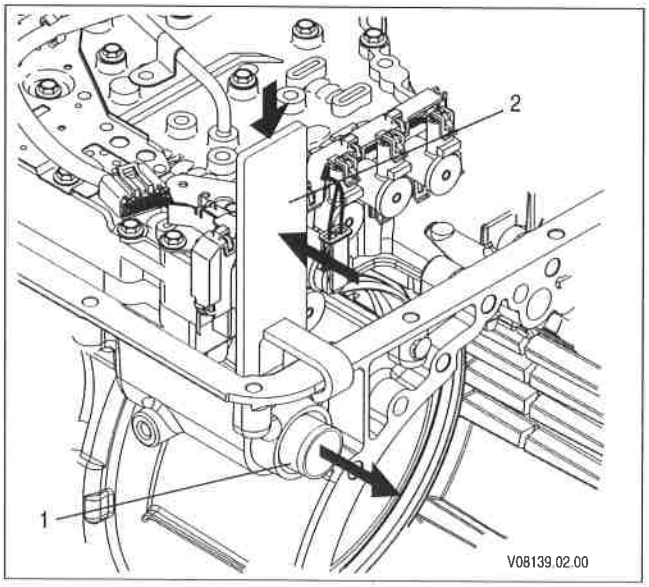


6–10. WIRING HARNESS ASSEMBLY INSTALLATION

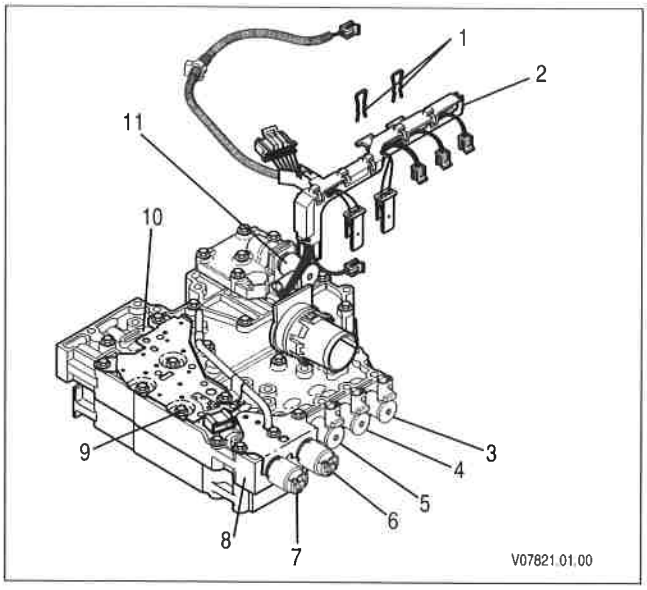
Tools Required

- 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 four tabs on the wiring harness connector snap into place.
3. Make sure the wiring harness connector is securely in place.



4. Remove ON/OFF shift solenoid retainers (1).
5. Install internal wiring harness (2) onto main valve body (10).
6. Install ON/OFF shift solenoid retainers (1) over the wiring harness tabs.
7. Connect internal wiring harness (2) to the following components as shown.
   - Pressure switch assembly (9)
   - C ON/OFF shift solenoid (7)
   - F trim solenoid (3)
   - D ON/OFF shift solenoid (4)
   - E ON/OFF shift solenoid (5)
   - B trim solenoid (6)
   - A trim solenoid (8)
   - G ON/OFF modulated main solenoid (11)

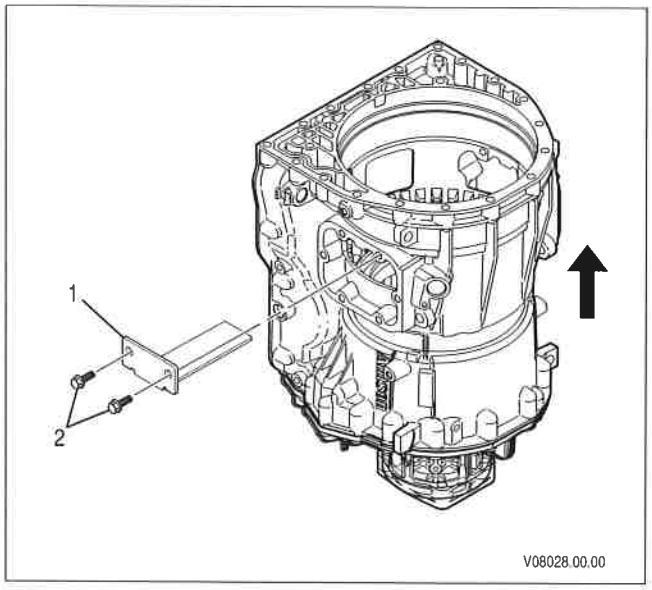


6–12. ROTATING CLUTCH ASSEMBLY INSTALLATION

Tools Required

- J 44587 Main Shaft Holder

1. Position the main housing so that the front of the main housing is facing up.
2. Remove two bolts (2) from J 44587 (1).
3. Remove J 44587 from the PTO access.

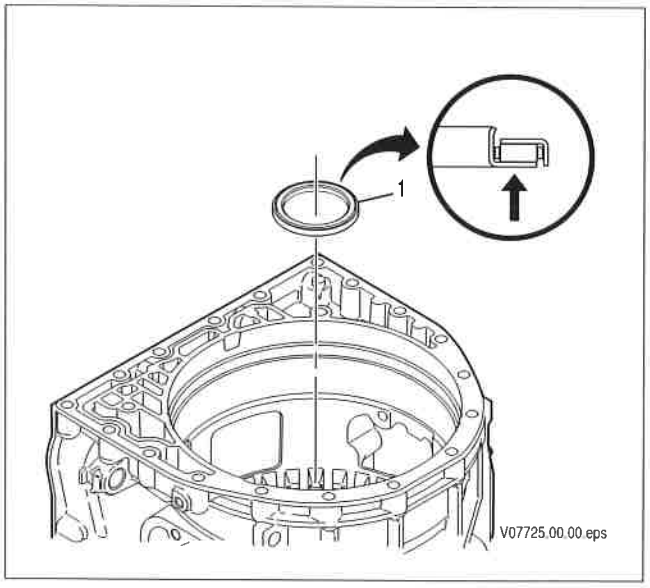


4. Apply petrolatum to thrust bearing (1).

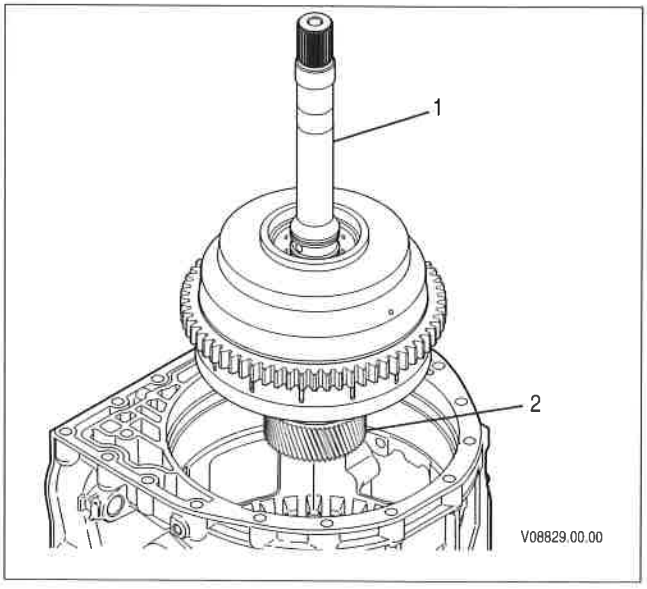
CAUTION:

Installing the thrust bearing incorrectly could destroy the transmission.

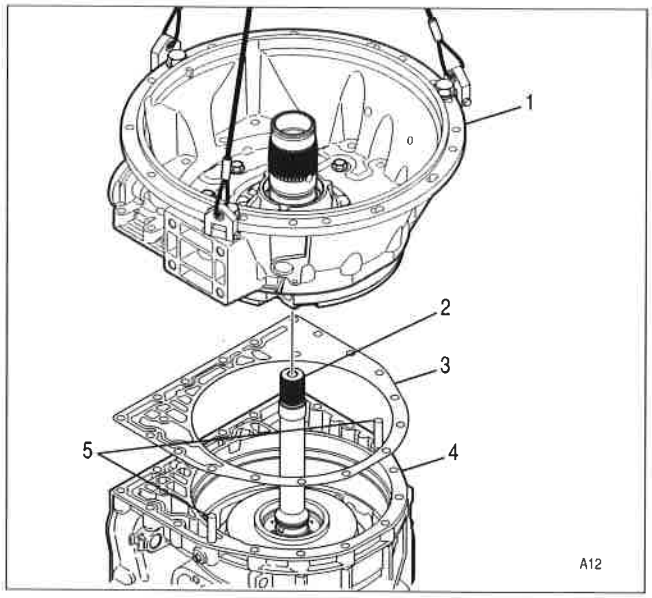
5. Align thrust bearing (1) so that the blue stripe on the thrust bearing is facing towards the P1 planetary carrier assembly.
6. Install thrust bearing (1) into the P1 planetary carrier assembly.



7. Install rotating clutch assembly (1). Rotate the clutch assembly until the module seats.
8. Make sure one of the following is visible through the turbine speed sensor hole in the main housing:
   - The teeth of the PTO gear
   - The teeth of the turbine tone wheel



6. Lower converter housing/front support module (1) over turbine shaft (2) and onto main housing (4).



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.

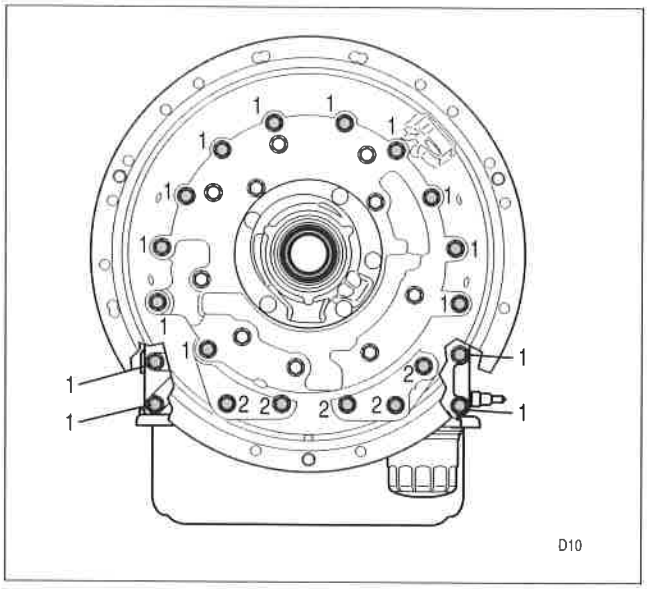
CAUTION:

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 help 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.

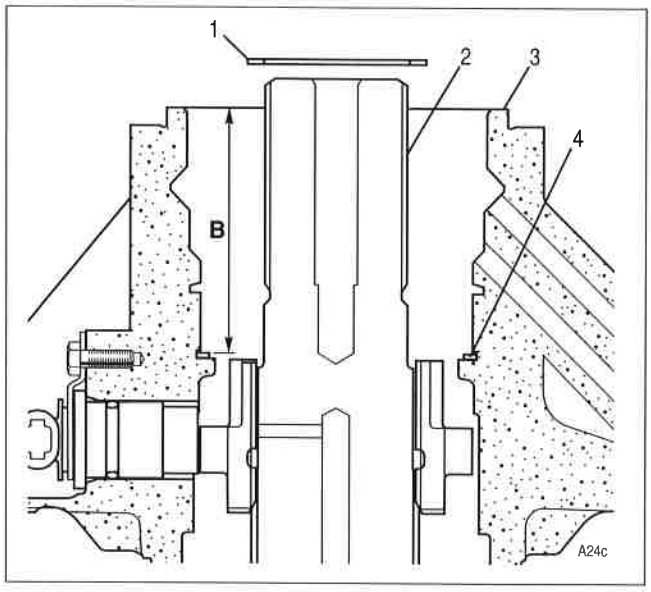
8. Remove two guide bolts (5) from the main housing.

9. For SAE No. 2 or No. 3 converter housings, do the following.

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



3. Measure the distance from the rear face of rear cover module (3) to the rear face of retaining ring (4) (Dimension B).
4. Calculate Dimension C by subtracting Dimension B from Dimension A (Dimension C = Dimension A – Dimension B).
5. Select the appropriate selective spacer (1) from the following table based on Dimension C.

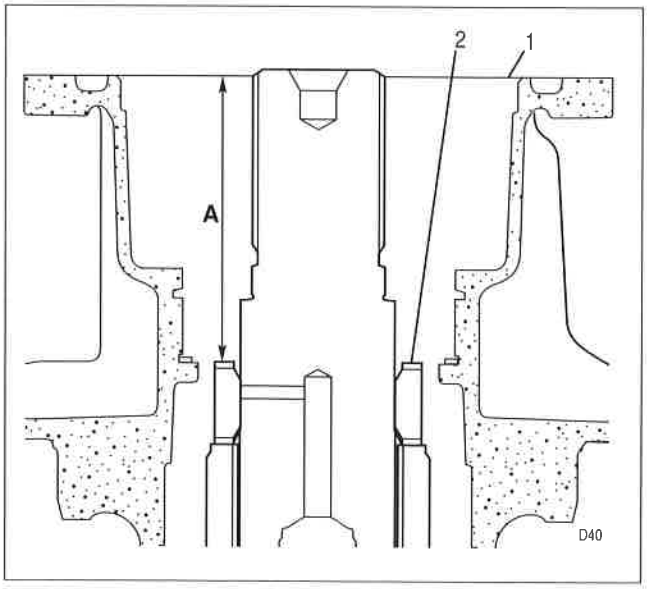


Dimension C	Part Number	Thickness	# of Holes
1.0081–1.184 mm (0.0397-0.0466 in.)	29536850	0.245-0.295 mm (0.0096-0.0116 in.)	0
1.185-1.414 mm (0.0467-0.0557 in.)	29536851	0.475-0.525 mm (0.0187-0.0207 in.)	1
1.415-1.644 mm (0.0557-0.0647 in.)	29536852	0.705-0.755 mm (0.0278-0.0297 in.)	2
1.645-1.874 mm (0.0648-0.0738 in.)	29536853	0.935-0.985 mm) (0.0368-0.0388 in.)	3
1.875-2.104 mm (0.0738-0.0828 in.)	29536854	1.165-1.215 mm (0.0459-0.0478 in.)	4
2.105-2.334 mm (0.0829-0.0919 in.)	29536855	1.395-1.445 mm (0.0549-0.0569 in.)	5
2.335-2.5015 mm (0.0919-0.0988 in.)	29536856	1.625-1.675 mm (0.0640-0.0659 in.)	6

6. Install selective spacer (1) onto output shaft (2).

6–15. REAR COVER SELECTIVE SPACER INSTALLATION (4WD TRANSMISSIONS ONLY)

1. Position the main housing so that the rear of the main housing is facing up.
2. Measure the distance from the rear face of rear cover (1) to the rear face of bearing spacer (2) (Dimension A).

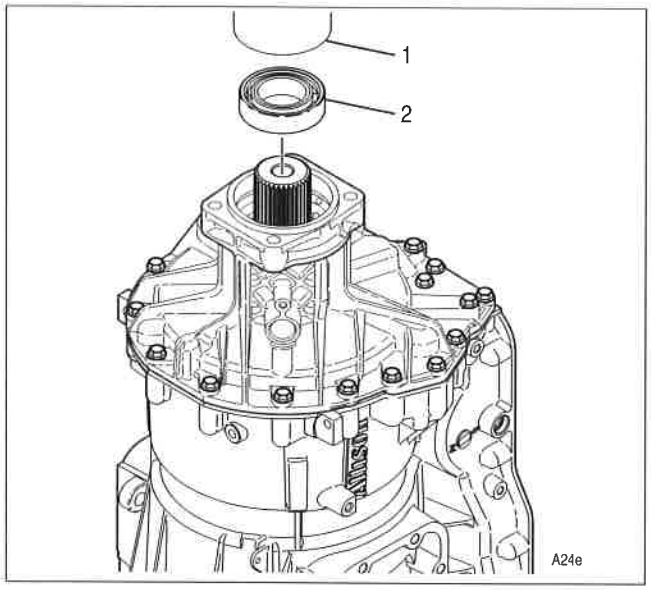


6–16. TRANSMISSION END PLAY CHECK

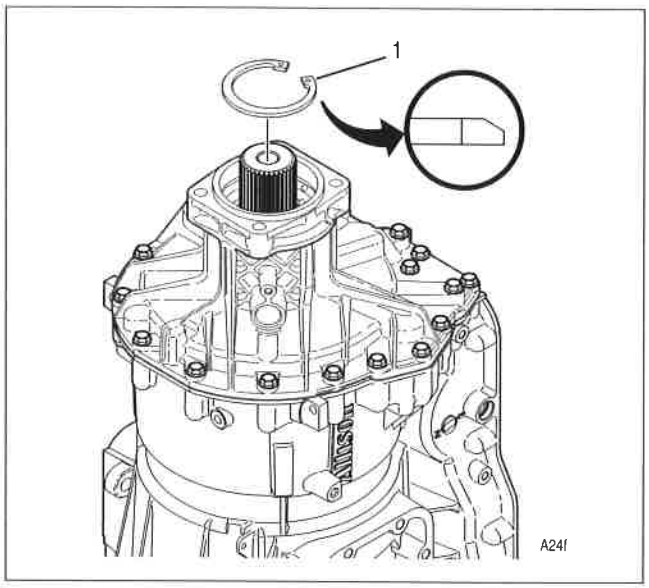
Tools Required

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

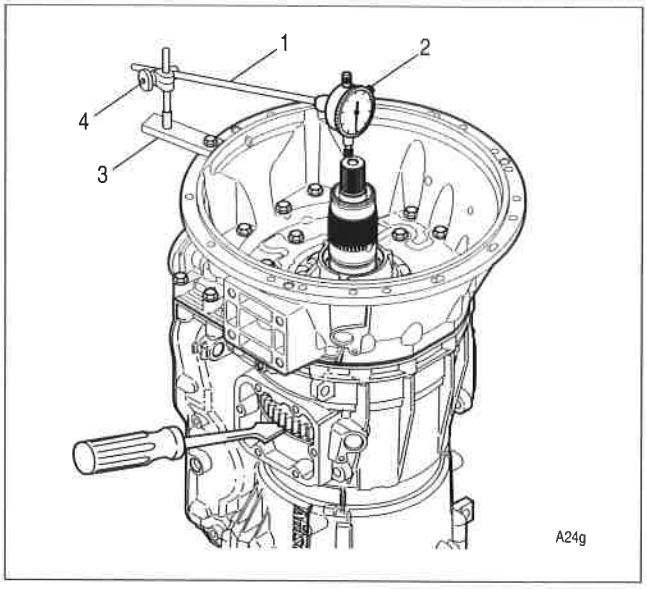
1. Using J 24446 (1), install ball bearing (2) until the bearing seats.



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



4. Position the main housing so that the front is facing up. Assemble the following tools and install them onto the torque converter housing as shown.
   - J 5959-1 (2)
   - J 5959-2 (3)
   - J 5959-3 (1)
   - J 5959-7 (4)
5. Zero dial indicator (2).
6. Lift the rear of the rotating clutch housing with a screwdriver through the PTO hole in the main housing. Note the dial indicator reading (end play). The end play must be 0.279–1.549 mm (0.0110–0.0610 inch).



WARNING!

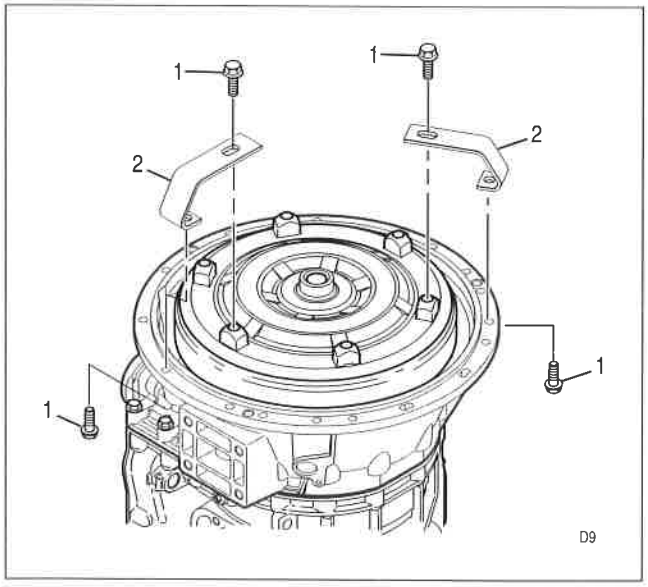
The torque converter must be held to the torque converter housing by a retaining device such as shipping brackets. Without the retaining device, the torque converter may slide forward, disengaging the oil pump, or may fall completely out of the transmission causing personal injury and/or property damage.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

NOTE:

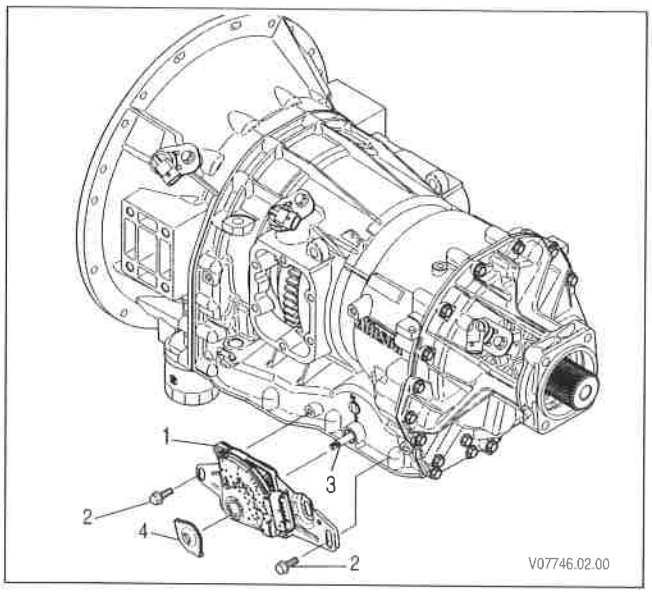
The torque converter may not be seated if the shipping brackets cannot be installed.

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

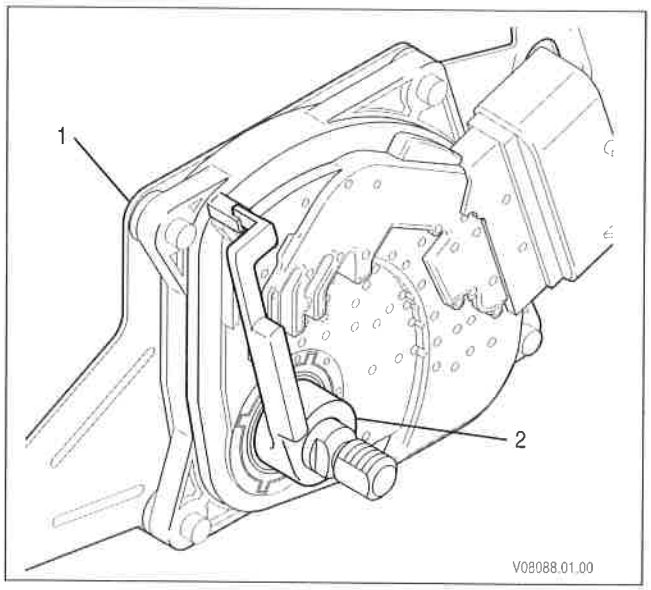
5. If used, install two shipping brackets (2) and four bolts (1).



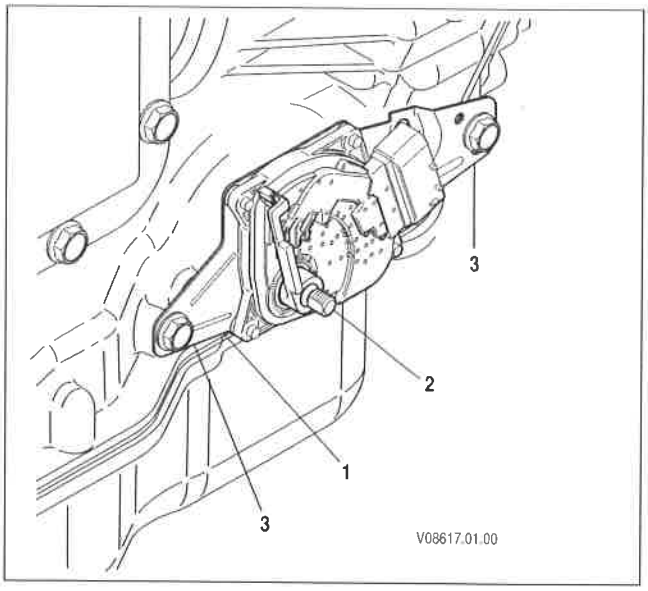
2. If a new NSBU switch is being installed, do the following.
   - Align the flats on the hub of NSBU switch (1) with the flats of selector shaft (3).
   - While maintaining the correct NSBU switch-to-selector-shaft alignment, install the NSBU switch onto the selector shaft and onto the main case.
   - Install front splash shield (4) over the selector shaft so that the larger diameter seals against the NSBU switch body.
   - Install two bolts (2). Tighten the bolts to 24–29 N·m (18–21 lb ft).



3. If the NSBU switch is being reused, do the following.
   - Align the flats on the hub of NSBU switch (1) with the flats of the selector shaft.
   - Install the NSBU switch onto the selector shaft.
   - Position special tool J 41364-A (2) over the selector shaft so that the two tabs on the tool engage two slots on the NSBU switch near the selector shaft.
   - Rotate the NSBU switch (1) and J 41364-A until the tab at the other end of tool (2) engages the slot at the top of the NSBU switch.



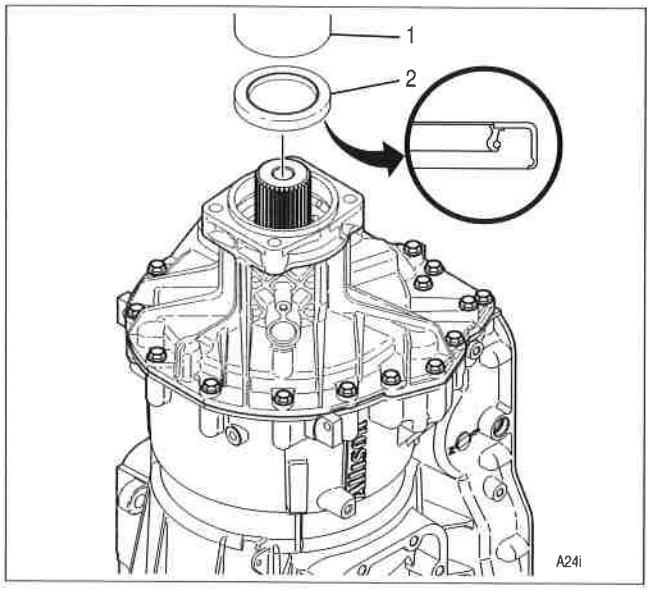
   - While holding J 41364-A to NSBU switch (1), tighten the bolts (3) to 24–29 N·m (18–21 lb ft).
   - Remove J 41364-A from the NSBU switch.



6–19. REAR SEAL INSTALLATION (2WD TRANSMISSIONS ONLY)

Tools Required

- J 43782 Output Shaft Seal Installer
- J 43783 Output Shaft Seal Installer



NOTE:

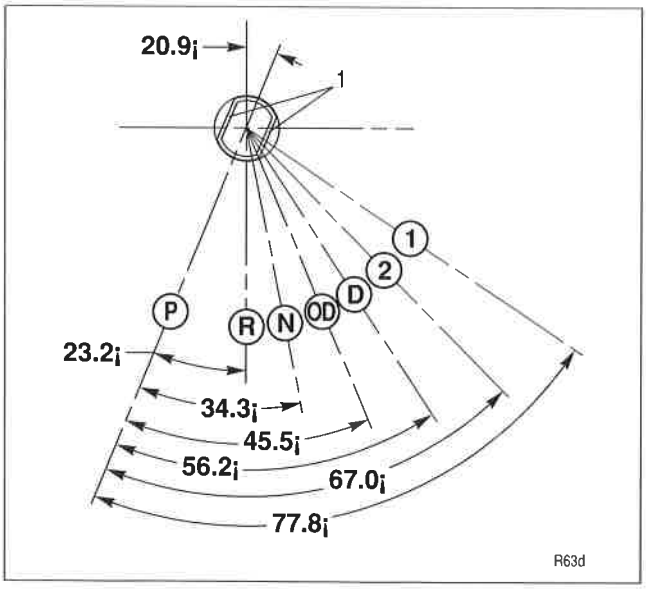
- **For transmissions without a parking brake provision, install the oil seal using J 43782.**
- **For transmissions with a parking brake provision, install the oil seal using J 43783.**

1. Using J 43782 or J 43783 (1), install the oil seal (2).
2. 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. OUTPUT NUT INSTALLATION (4WD TRANSMISSIONS ONLY)

Tools Required

- J 43769 Spanner Nut Wrench—4WD



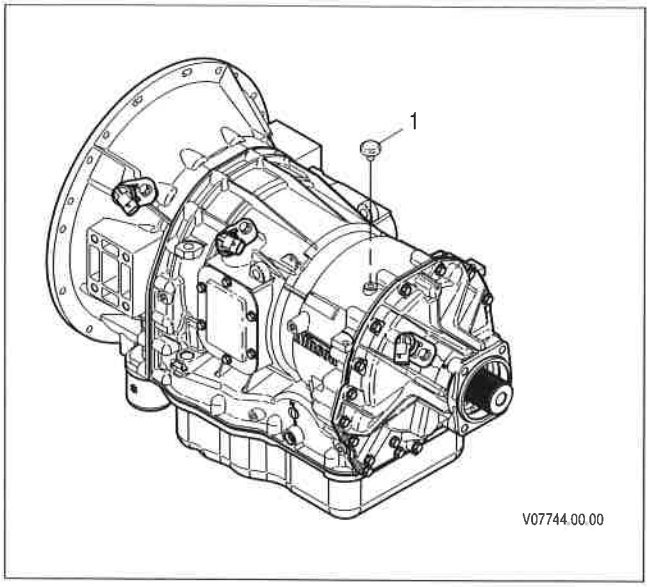
NOTE:

The fullest clockwise position of the selector shaft is P (Park), which engages the park pawl.

1. Using a wrench on selector shaft flats (1), rotate the shaft to its fullest clockwise position.

6–21. VENT INSTALLATION

1. Install vent (1) by hand.
2. Gently tap on vent (1) until seated.

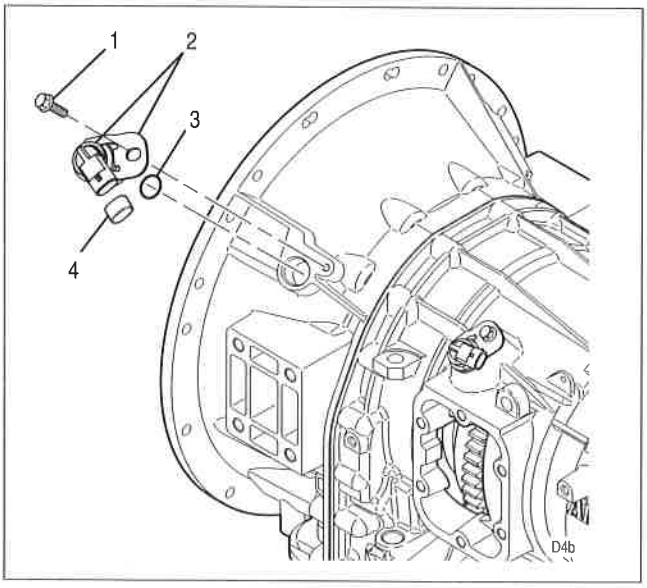


6–22. INPUT SPEED SENSOR INSTALLATION

CAUTION:

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

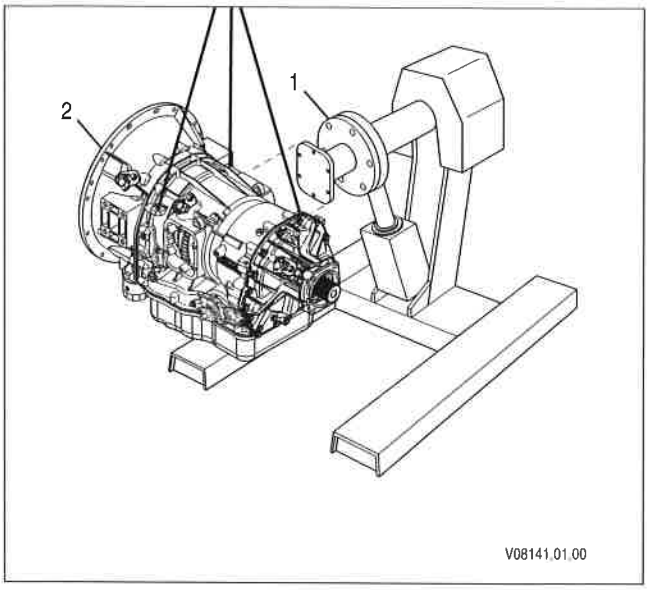
1. Install sensor O-ring (3) onto speed sensor (2).
2. Apply petrolatum to O-ring (3).
3. Install speed sensor (2) into the converter housing.
4. Install speed sensor bolt (1) into the converter housing. Tighten the bolt to 10–13 N·m (7–10 lb ft).
5. If present, install sensor shipping cover (4) onto the speed sensor.



6–25. REMOVAL OF TRANSMISSION FROM REPAIR STAND

Tools Required

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



WARNING!

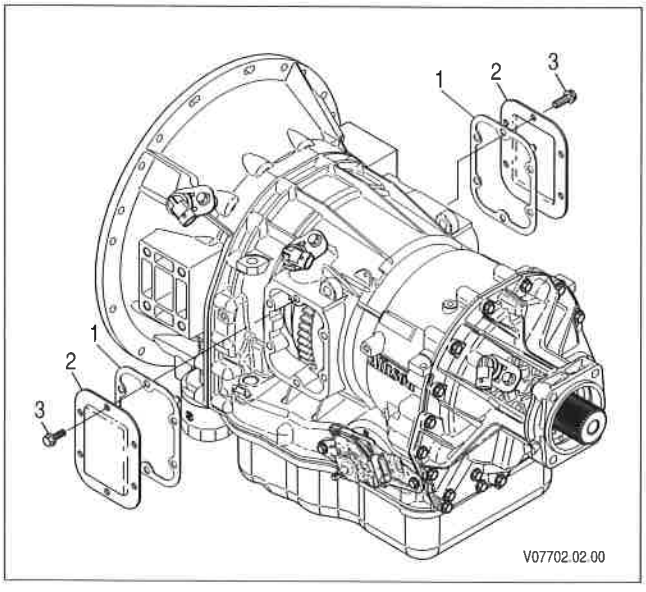
The 1000 and 2000 Product Families transmission dry weights are approximately 150 kg (330 lb). To help avoid personal injury and/or property damage:

- **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 lifting equipment can properly support the transmission.**

1. Attach a sling to the transmission.
2. Attach a hoist to the sling. Put moderate lift tension on the hoist.
3. Disconnect and remove transmission (2) from adapter plate J 44723 (1).
4. Place the transmission on the work table with the oil pan facing down.

NOTE:

PTO cover gasket (1) has been redesigned. The former and current designs are interchangeable. The former design may be reused unless replacement is necessary or the design is no longer available. DO NOT use a PTO cover gasket to mount a PTO (refer to SIL 24-1K2K-01).



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

SECTION 7—WEAR LIMITS AND SPRING DATA

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	Wear Limit (inches)
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	24.940	0.9819
Gear Cavity, Maximum ID	109.191	4.2989
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	108.987	4.2908
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	Wear Limit (inches)
MAIN HOUSING MODULE		
C3/C4 Friction Plate:		
Maximum Cone	0.225	0.0089
Minimum Thickness	2.375	0.0935
Minimum Oil Groove Depth	0.200	0.0079
C3/C4 Steel Reaction Plate:		
Maximum Cone	0.400	0.0157
Minimum Thickness	2.440	0.0961
C3/C4 Spring Plate:		
Maximum Cone	0.400	0.0157
Minimum Thickness	3.110	0.1224
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 # 29536481	1.935	0.0762
Part # 29536482	2.435	0.0959
Part # 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	0.0450

Table 7–2. Spring Data

Foldout	Ref.	Spring	Part No.	Color Code	No. Coils	Wire Dia. mm (in.)	Spring OD mm (in.)	Approx. Free Length mm (in.)	Length Under Load	
									mm (in.)	N (lb) min.
6, 13	12, 4	C3/C4 Return Spring Assembly	29531046	No code	8.78*	1.588* (0.0625)	12.00* (0.472)	31.89** (1.256)	24.81** (0.977)	162.00–187.60** (36.42–42.17)
9	22	Main Pressure Regulator	29531017	No Code	11.87	2.77 (0.109)	22.61 (0.890)	73.74 (2.903)	41.50 (1.634)	231.56–255.94 (52.06–57.54)
9	11	Converter Relief	29541296	No Code	12.18	1.42 (0.056)	13.46 (0.529)	44.85 (1.766)	22.84 (0.899)	45.10–55.44 (10.14–12.46)
9	14	Converter Flow	29540523	Light Blue	6.79	1.60 (0.063)	16.10 (0.634)	31.43 (1.237)	17.05 (0.671)	54.23–73.89 (12.19–16.61)
9	7	Lube Regulator	29541228	No Code	12.38	1.47 (0.058)	11.70 (0.464)	39.22 (1.544)	24.05 (0.946)	55.99–72.00 (12.59–16.19)
9	19	C1 Clutch Backfill	29542713	No Code	7.24	0.81 (0.032)	11.25 (0.443)	27.25 (1.073)	11.05 (0.435)	10.41–13.09 (2.34–2.94)
10	16	C2 Return Spring Assembly	29536104	No Code	5.77*	1.143* (0.0450)	10.05* (0.396)	19.60** (0.772)	15.90** (0.626)	652.5–770.9** (146.7–173.3)
10	25	C1 Return Spring Assembly	29536198	No Code	7.99*	1.295* (0.0510)	9.17* (0.361)	19.49** (0.767)	15.62** (0.615)	941.2–1126.4** (211.6–253.2)
19B, 19C	14, 6	Control Main/Control Relief	29541153	No Code	11.85	1.50 (0.059)	14.00 (0.551)	40.62 (1.599)	22.11 (0.870)	45.86–50.68 (10.31–11.39)
19C	3	Exhaust Backfill	29531161	Orange Stripe	11.35	0.90 (0.035)	12.60 (0.496)	22.54 (0.887)	16.16 (0.636)	2.537–3.003 (0.570–0.675)
19C	11, 17, 28	A, B, and F Trim	29536313	No Code	7.44	0.76 (0.030)	9.80 (0.386)	20.15 (0.793)	9.44 (0.372)	8.14– 9.70 (1.83–2.18)
19C	13	A Trim	29537230	No Code	7.21	1.30 (0.051)	15.20 (0.598)	23.25 (0.915)	13.37 (0.526)	18.69–21.35 (4.20–4.80)
19B	4, 8, 11	C, D, and E Shift	29531176	No Code	11.55	1.00 (0.039)	11.00 (0.433)	29.29 (1.153)	14.26 (0.561)	14.61–16.59 (3.28–3.73)
16A	5	C5 Return Spring Assembly	29531134	No Code	7.8*	1.702* (0.0670)	13.5* (0.531)	31.40** (1.236)	21.60** (0.850)	1454.6–1620.2** (327.0–364.2)
16A	4	Park Pawl Return	29531147	No Code	6	0.75 (0.030)	8.70 (0.343)	29.55 (1.161)	41.75 (1.644)	11.3–14.9 (2.5–3.3)

* Individual Springs
** For the complete Spring Assembly

SECTION 8—CUSTOMER SERVICE

8–1. OWNER ASSISTANCE

The satisfaction and goodwill 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 will be handled by the distributor or dealer in your area. Check the telephone directory for the Allison Transmission service outlet nearest you or utilize 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 quickly be resolved by a member of management. If you have already discussed the problem with the Sales or Service Manager, contact the General Manager. 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 utilizing 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.