Service Manual

2005 OCTOBER

SM4014EN

Allison Transmission

ALLISON 4TH GENERATION CONTROLS VOCATIONAL MODELS

4000 EVS	4500 EVS	4700 EVS	4800 EVS	B 500
4000 HS	4500 HS	4700 RDS	4800 SP	T 425
4000 MH	4500 RDS	4700 SP		T 450
4000 RDS	4500 SP			T 525
4000 SP				
4000 TRV				

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Printed in USA

ELECTRONIC CONTROL UNIT AND DIAGNOSTIC DATA READER/TOOL DISPLAYS AND BUTTON NAMES

Shift Selector, Allison DOC™ button, and display names are printed in bold capital letters—↑ (Up), ↓ (Down), **MODE**, **MONITOR, SELECT,** etc.

Transmission range shifts are indicated by the letter or number on the shift selector, in bold text, followed by the name of the range in parentheses—**D** (Drive), **N** (Neutral), etc.

References to diagnostic messages displayed are printed within double quotation marks (“OL,” “OK,” etc.).

TRADEMARK USAGE

The following trademarks are the property of the companies indicated:

- Allison DOC™ (Allison Diagnostic Optimized Connection Tool) is a trademark of General Motors Corp.
- DEXRON® is a registered trademark of General Motors Corp.
- Biobor® JF is the registered trademark for a biological inhibitor manufactured by U.S. Borax and Chemical Corporation.
- Loctite® is a registered trademark of the Loctite Corporation.
- Teflon® is a registered trademark of the DuPont Corporation.
- TranSynd™ is a trademark of Castrol, Ltd.
- Vespel® is a registered trademark of DuPont Corporation.

NOTE:

This publication is revised periodically to include improvements, new models, special tools, and procedures. A revision is indicated by the date on the title page. Check with your Allison Transmission service outlet for the currently applicable publication. Additional copies of this publication may be purchased from authorized Allison Transmission service outlets. Look in your telephone directory under the heading of Transmissions—Truck, Tractor, etc.

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.

If you leave the vehicle and the engine is running, the vehicle can move suddenly and you or others could be injured. If you must leave the engine running, do not leave the vehicle until you:

- **Put the transmission in N (Neutral)…and**
- **Apply the parking brake and emergency brakes and make sure they are properly engaged…and**
- **Chock the wheels and take any other steps necessary to keep the vehicle from moving.**

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

DO NOT conduct a converter stall test until the following actions are taken. The parking brake and/or emergency brakes must be set and properly engaged and the wheels must be chocked. Warn personnel to keep clear of the vehicle and its travel path. Failure to do so can cause serious injury.

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.

DO NOT disconnect the hydraulic fluid line between the accumulator and the retarder until air and hydraulic pressure have been bled from the retarder.

PREVENT PERSONAL INJURY: Use proper tools and lifting equipment when installing or removing a transmission from the repair stand. Transmission dry weights are as follows:

- **4000 and 4500 Models**

Base transmission	**—377 kg (831 lbs)**
With PTO provision	**—405 kg (893 lbs)**
With retarder	**—411 kg (906 lbs)**
With retarder and PTO provision	**—439 kg (968 lbs)**

- **4700 and 4800 Models**

Base transmission	**—493 kg (1087 lbs)**
With PTO provision	**—521 kg (1149 lbs)**
With retarder	**—529 kg (1162 lbs)**
With retarder and PTO provision	**—555 kg (1224 lbs)**
With retarder, PTO, and integral retarder sump cooler	**—496 kg (1032 lbs)**

LIST OF WARNINGS

This manual contains the following Warnings —

IT IS YOUR RESPONSIBILITY TO BE FAMILIAR WITH ALL OF THEM.

Get help when lifting the control module. Assistance from a hoist or another person may be required. The control module weighs approximately 25 kg (55 lb).

Get help when lifting the retarder module. Assistance from a hoist or another person may be required. The retarder module weighs approximately 34 kg (75 lb).

Get help when lifting the C6 adapter housing module. Assistance from a hoist or another person may be required. The C6 adapter housing module weighs approximately 68 kg (150 lb).

Carefully release spring force. Piston springs are highly compressed. Personal injury can occur if the spring force is not controlled.

Piston springs are highly compressed. Be extremely careful during removal and installation. Personal injury can occur if the spring force is not controlled.

Place the P3 planetary assembly on its side to avoid possible injury while disassembling the planetary.

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SECTION 1—GENERAL INFORMATION

1–1. SCOPE OF MANUAL

a. Content and Organization. This Service Manual describes overhaul procedures for 4000 Product Family transmissions with Allison 4th Generation Controls. Power takeoff (PTO) and output retarder options may be added to a base transmission model.

- Detailed instructions are provided for disassembly in Section 4, rebuild in Section 5, and reassembly in Section 6.
- Part inspection instructions are in Section 3.
- Wear limits and spring data are in Section 7.
- Major transmission components and their functions are explained in 3000 and 4000 Product Families Principles of Operation PO4016EN.

The 4000 Product Family consists of the following transmission series and models (Figures 1–1 through 1–6):

Highway Series:
- 4000 HS
- 4500 HS

Rugged Duty Series:
- 4000 RDS
- 4700 RDS

Emergency Vehicle Series:
- 4000 EVS
- 4500 EVS
- 4700 EVS
- 4800 EVS

Motorhome Series:
- 4000 MH

Truck Recreational Vehicle Series:
- 4000 TRV
- 4500 TRV

Specialty Series:
- 4000 SP
- 4500 SP
- 4700 SP
- 4800 SP

Bus Series:
- B 500

T 400 Series:
- T 425
- T 450
- T 525

b. Illustrations

1. The text is supported with line drawings and cross-sectional views. Overhaul procedures are illustrated by line drawings. Cross-sections show the relationship of assembled parts. Cross-sections, exploded views, and a hydraulic schematic (transmission in Neutral) are on foldout pages in the back of the manual.
2. Illustrations show correct procedures for all models—including models not illustrated.

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

1. The organization or individual has the required knowledge of the task through:
   - Formal instruction at Allison Transmission or a Distributor training facility.
   - On-the-job instruction by an Allison Transmission or Distributor representative.
   - Experience in performing the task.
2. The work environment is suitable to prevent contamination or damage to transmission parts or assemblies.
3. Required tools and fixtures are available as shown in Section 3 of this manual. Refer to Figures 3–2 and 3–3 and Tables 3–1 and 3–2.
4. Reasonable and prudent maintenance practices are used.

NOTE:

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

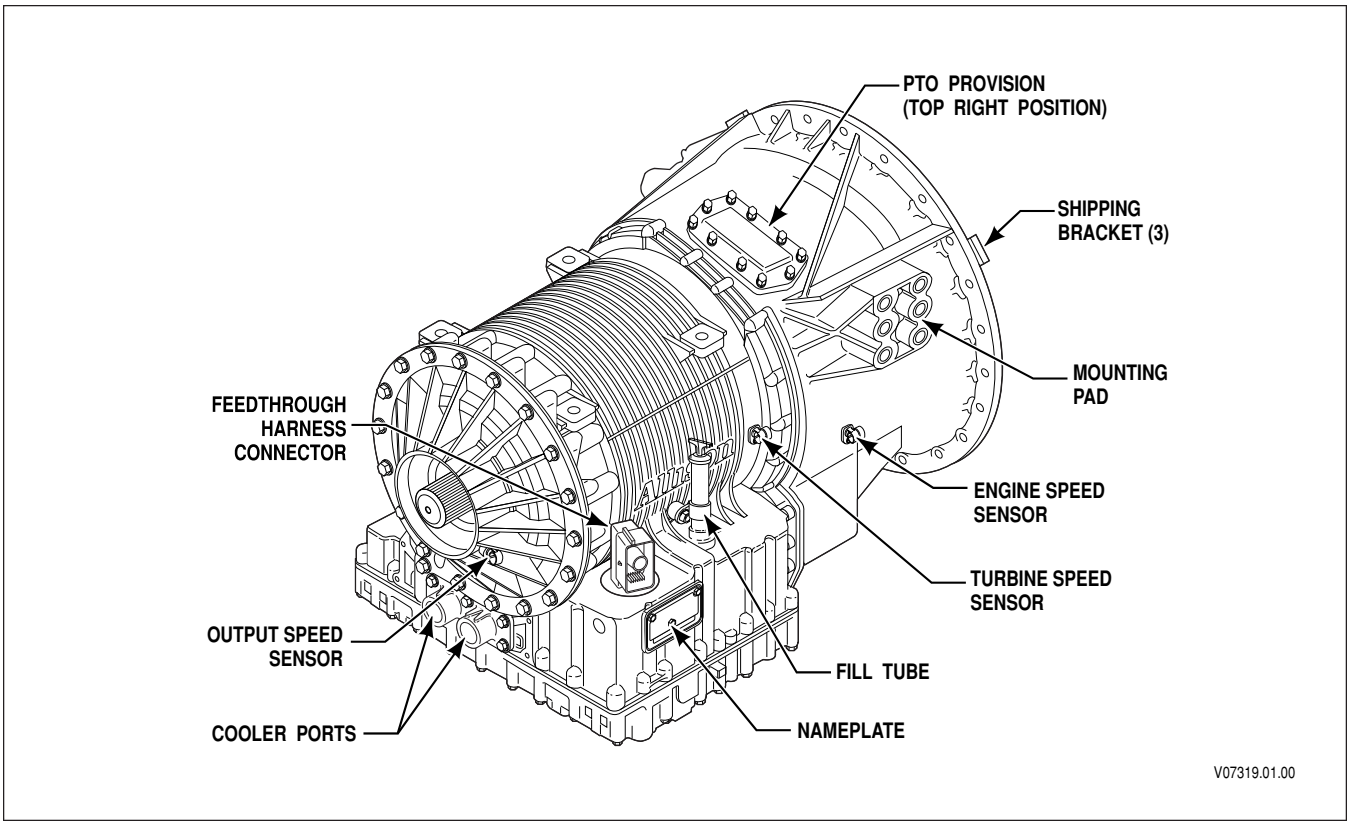

Figure 1–1. 4000 Product Family Transmission With PTO Provision (Except 4700 and 4800 Models)—Right-Rear View

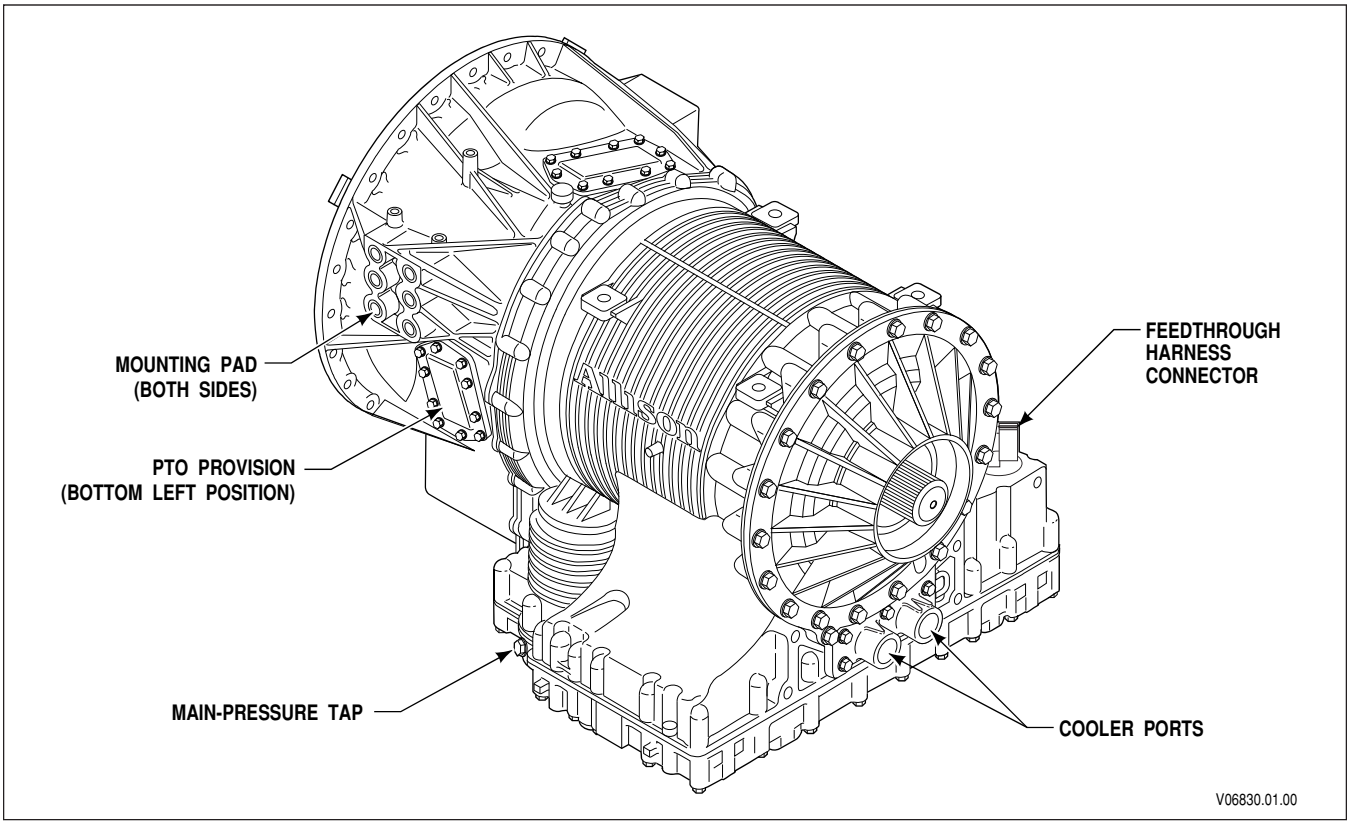

Figure 1–2. 4000 Product Family Transmission With PTO Provision (Except 4700 and 4800 Models)—Left-Rear View

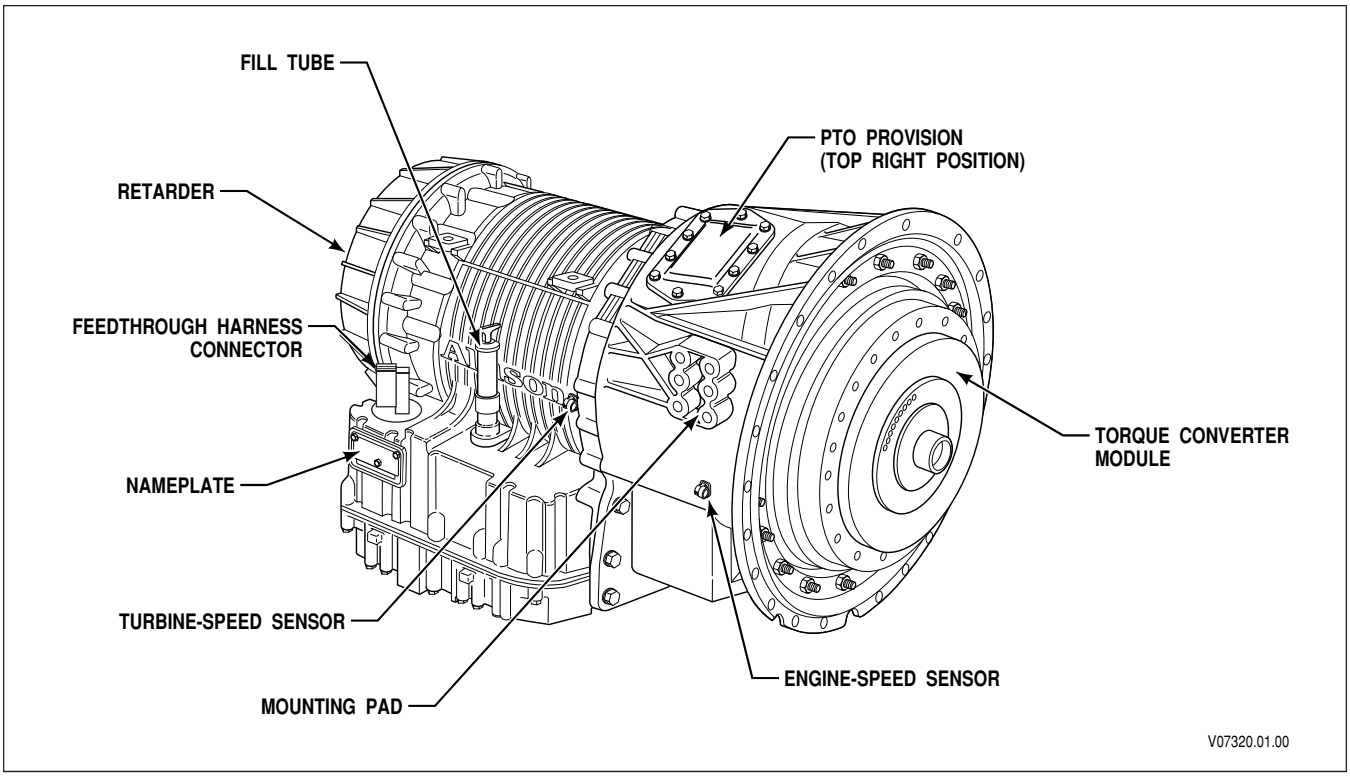

Figure 1–3. 4000 Product Family With PTO Provision and Retarder (Except 4700 and 4800 Models)—Right-Front View

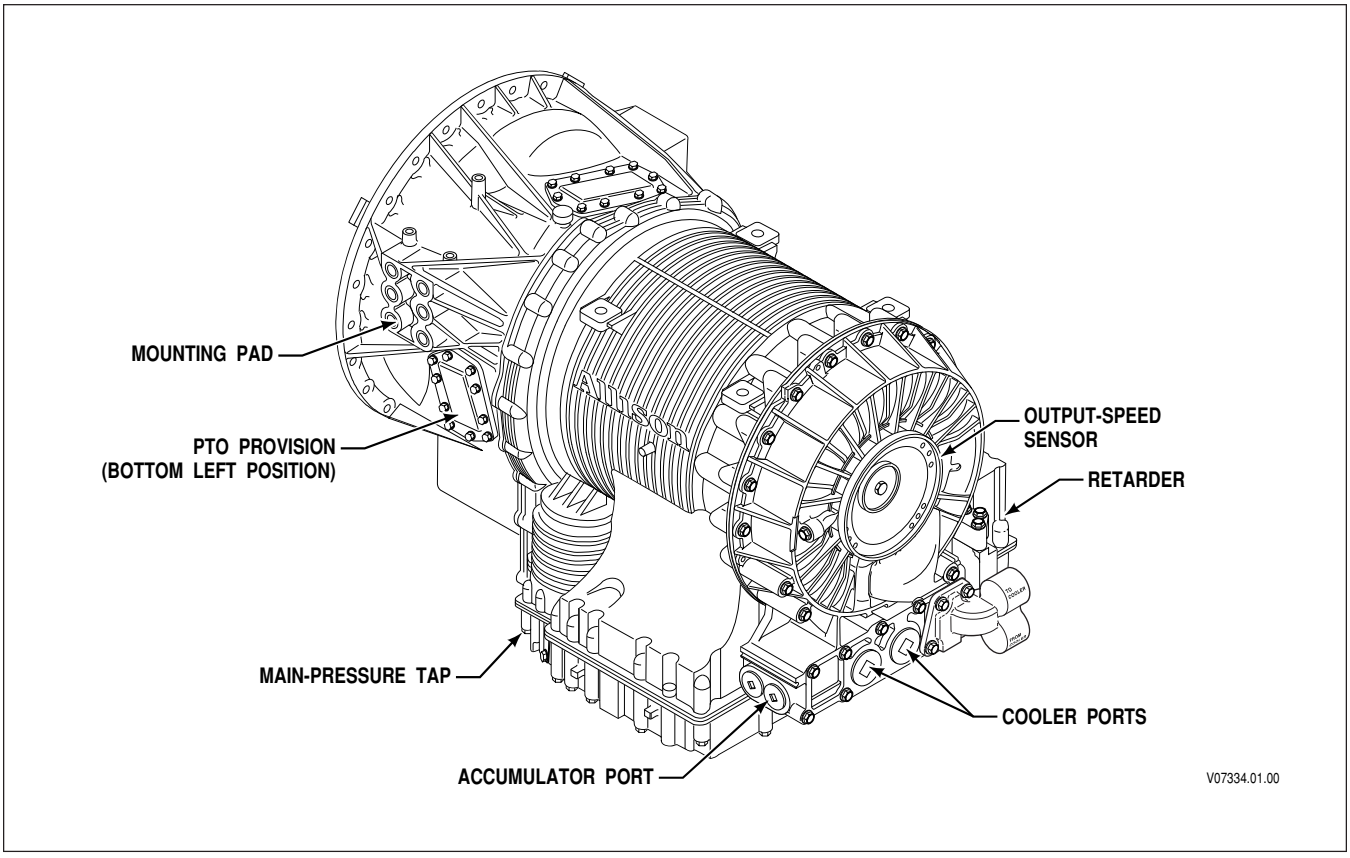

Figure 1–4. 4000 Product Family With PTO Provision and Retarder (Except 4700 and 4800 Models)—Left-Rear View

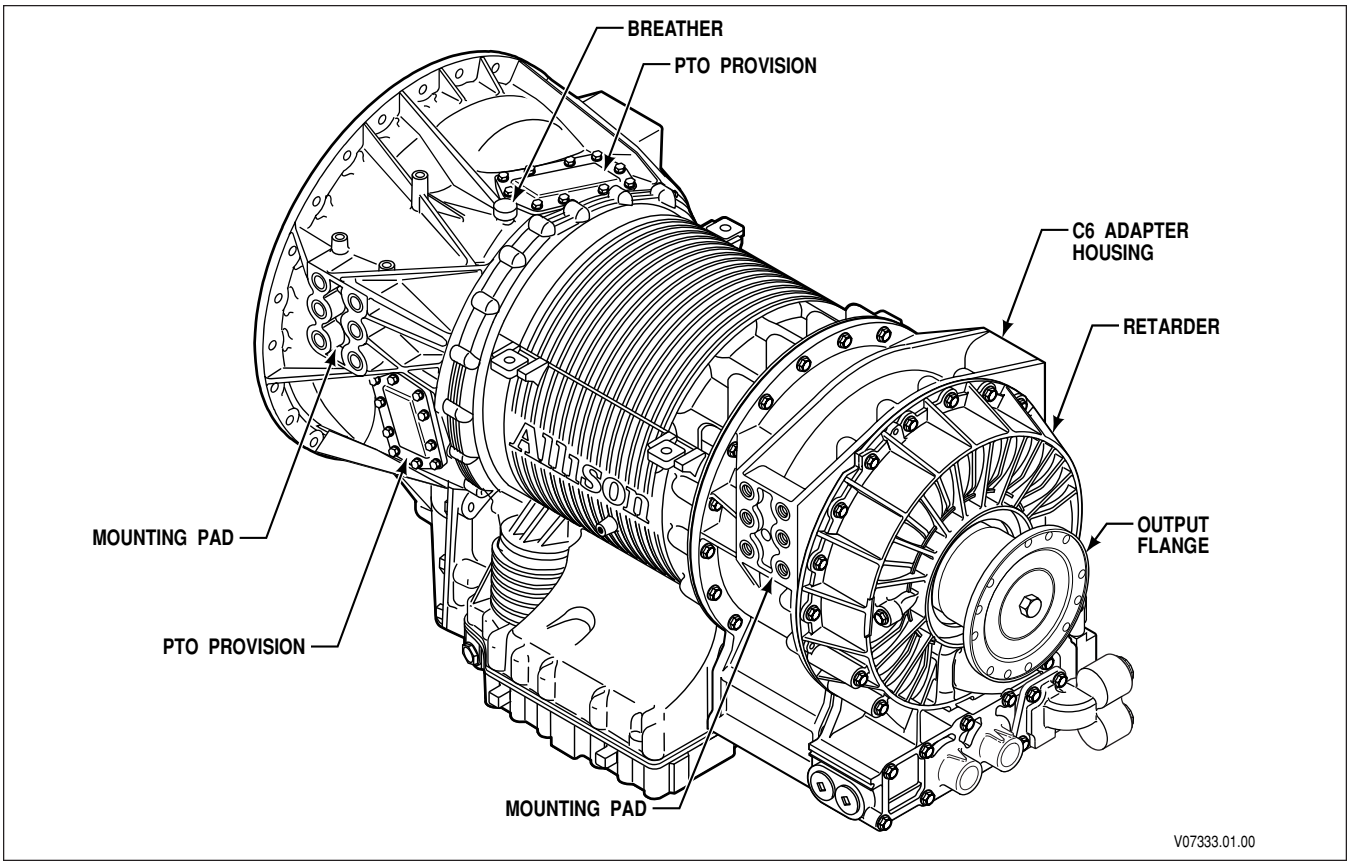

Figure 1–5. 4000 Product Family With PTO Provision and Retarder (4700 and 4800 Models)—Left-Rear View

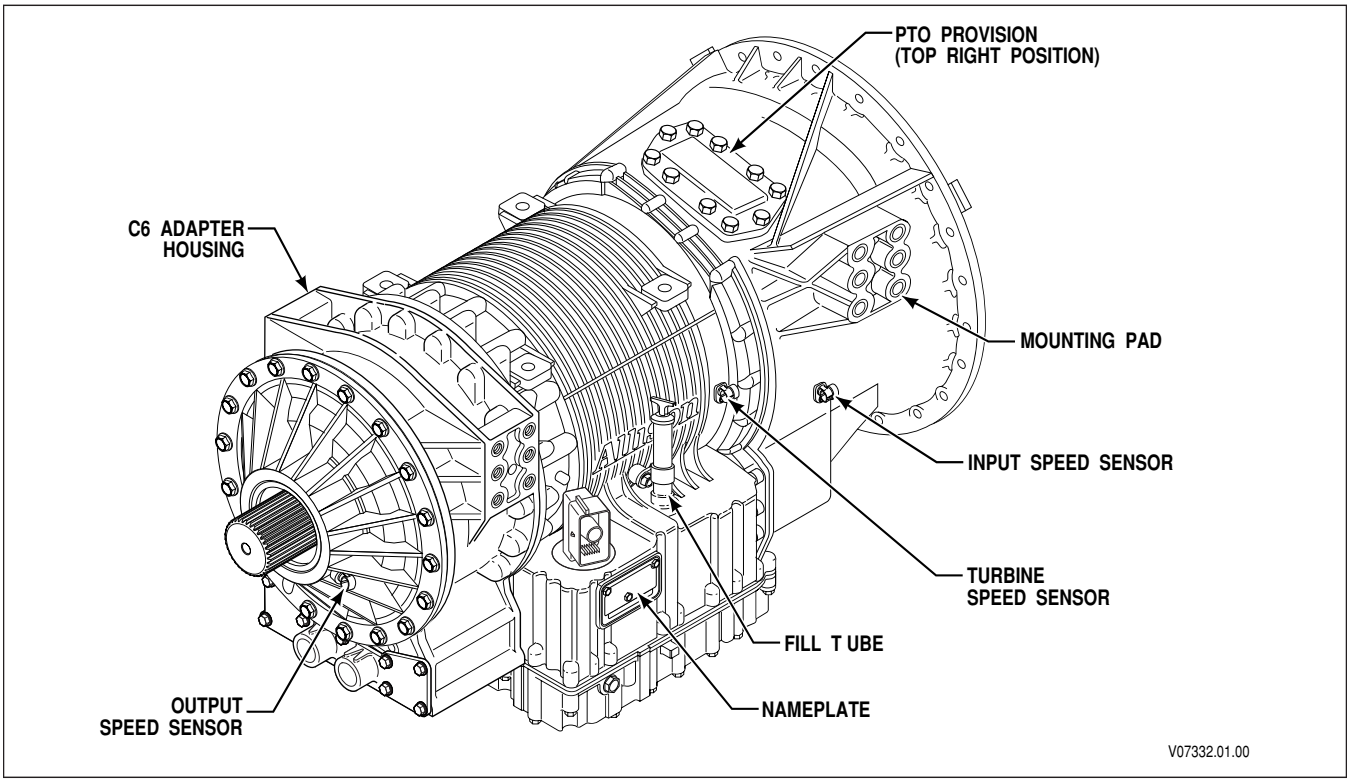

Figure 1–6. 4000 Product Family With PTO Provision (4700 and 4800 Models)—Right-Rear View

1–2. SUPPLEMENTARY INFORMATION

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

1–3. ORDERING PARTS

a. Transmission Nameplate. The nameplate (Figure 1–7) is located on the right side of the transmission. The nameplate is imprinted with the following:

- Model number
- Serial number
- Data code
- TransID number
- Engineering Feature Configuration Number (for Specialty Series vocation models)

Use all of these numbers when ordering replacement parts or requesting service information.

b. Parts Catalog. Replacement parts are listed in the current 4000 Product Family Parts Catalog PC2456EN. Do not order by the item numbers used on exploded views in this manual. Use the Parts Catalog to determine the correct part number. Order all replacement parts from your distributor. Check the Yellow Pages for your nearest authorized service outlet. Listings are under Transmission—Truck or Engines—Diesel.

1–4. GENERAL DESCRIPTION

Allison 4000 Product Family transmissions are a complete transmission system that includes all hardware needed for vehicle application.

a. Major Modules. 4000 Product Family transmissions contain the following major modules:

- Input Module
- Main Housing and Gear Module
- Control Module
- Output Module
- C6 Adapter Module (4700 and 4800 models)

b. Unique Features. Features unique to 4000 Product Family transmissions are:

- Three, four, five, six, or seven forward speed configurations
- Lockup clutch with torsional damper
- Integral retarder (optional)
- Integral oil filters, serviceable without complete loss of transmission fluid
- Adaptive electronic closed-loop controls with self-diagnostic capabilities

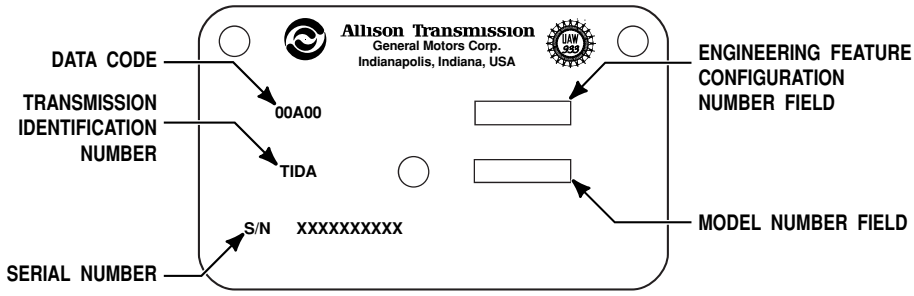

Figure 1–7. Transmission Nameplate

1–5. MAJOR COMPONENTS

a. Input Module. The Input Module includes:

- Engine adaptation
- Torque converter
- Power takeoff gearing (optional)

b. Torque Converter

1. The torque converter includes a lockup clutch and torsional damper for direct and smooth transfer of engine power.

2. Torque converter models available are:

Torque Converter Model
TC 521
TC 531
TC 541
TC 551
TC 561

c. Power Takeoff. Direct, engine-driven PTO gearing is available at two positions, except in the 4000 HS.

d. Main Housing and Gear Module. The Main Housing and Gear Module include:

- Main Housing
- Oil pump charging system
- Three planetary gear sets (four for 4700 and 4800 models)
- Two rotating clutches
- Three stationary clutches (four for 4700 and 4800 models)

e. Range Clutches. Range clutches are multiple-disc, wet-type clutches. Exhaust backfill pressure is used to reduce fill time for quick response and smooth shifts.

f. Control System. The control system is capable of recognizing hydraulic and electronic conditions that are not within the operating limits of the programmed calibration. Some out-of-limit conditions can be corrected by the control system. All out-of-limit condition diagnostic codes are stored for later retrieval by a technician.

The Electronic Control System includes:

- Transmission Control Module (TCM)
- Control module
- Shift selector
- Sensors
- Wiring harness (customer-furnished)

The TCM is a high-speed digital computer that receives information from the sensors and shift selector. This information is processed and shift commands are sent to the control module for range selection.

g. Transmission Fluid Filters. Two disposable external-access filters are part of the control module. Each filter is in a separate cavity which permits removal and replacement without complete loss of transmission fluid.

h. Transmission Fluid Coolers. The 4000 Product Family has provision for remote or integral transmission fluid coolers.

i. C6 Adapter Housing Module. The C6 adapter housing module is unique to the 4700 and 4800 models. It provides a seventh range and is located between the main housing and rear cover/retarder.

j. Rear Cover. A rear cover is standard equipment on the 4000 Product Family. The output shaft can be provided with a variety of companion flanges or yokes.

k. Output Retarder and Output Flange. The optional output retarder module replaces the standard rear cover. An output flange or yoke is available for use with the retarder.

1–6. 4000 PRODUCT FAMILY MODEL DESIGNATION CODE

BUS	–	Bus Series
EVS	–	Emergency Vehicle Service
HS	–	Highway Series
MH	–	Motorhome Series
RDS	–	Rugged Duty Series
SP	–	Specialty Series
TRV	–	Truck Recreational Vehicle Series
7 or 8	–	Widest Ratio Coverage (WRC)
5	–	Wide Ratio (WR)
0	–	Close Ratio (CR)

The following table lists the standard (STD) and optional (OPT) features of each 4000 Product Family model code designations:

Vocational Model	CR/WR	Maximum Forward Ranges	PTO	Retarder	Deep Sump	Shallow Sump	OLS
4000 EVS	CR	6	STD	OPT	STD	OPT	STD
4000 HS	CR	6	N/A	OPT	STD	N/A	STD
4000 MH	CR	6	OPT	OPT	STD	OPT	STD
4000 RDS	CR	6	STD	OPT	STD	N/A	STD
4000 SP	CR	6	STD	OPT	STD	OPT	STD
4000 TRV	CR	6	OPT	OPT	STD	N/A	STD
4500 EVS	WR	6	STD	OPT	STD	OPT	STD
4500 HS	WR	6	N/A	OPT	STD	N/A	STD
4500 RDS	WR	6	STD	OPT	STD	N/A	STD
4500 SP	WR	6	STD	OPT	STD	OPT	STD
4700 EVS	WR	7	STD	OPT	STD	OPT	STD [1]
4700 RDS	WRC	7	STD	OPT	STD	N/A	STD [1]
4700 SP	WRC	7	STD	OPT	STD	N/A	STD
4800 EVS	WRC	7	STD	OPT	STD	OPT	STD [1]
4800 SP	WRC	7	STD	OPT	STD	N/A	STD
B 500	CR	6	OPT	OPT	STD	OPT	STD
T 425	CR	5	OPT	OPT	STD	OPT	STD
T 450	CR	5	OPT	OPT	STD	OPT	STD
T 525	CR	5	OPT	OPT	STD	OPT	STD

[1]—OLS not available on 7-speed models with retarders.

1–7. EXPLODED (DISASSEMBLED) VIEWS

Exploded views illustrate 4000 Product Family transmission parts in relation to each other. The parts numbering system in the exploded views is used in all procedures described in the text.

1–8. DIAGNOSIS

NOTE:

Refer to Allison 4th Generation Controls Troubleshooting Manual (TS3989EN) for in-depth troubleshooting procedures.

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

b. CHECK TRANS Light. Continued illumination of the **CHECK TRANS** light during vehicle operation indicates the TCM has signaled a diagnostic code. At start-up, the **CHECK TRANS** light will briefly illuminate to indicate that the light is functioning properly.

NOTE:

The Strip Pushbutton Shift Selector has no display or diagnostic capabilities. Use the Allison DOC™ For PC–Service Tool to display diagnostic trouble codes.

c. Entering Diagnostic Mode

1. Pushbutton Shift Selector

— When Oil Level Sensor (OLS) is present: Press the ↑ (Up) and ↓ (Down) arrow keys twice simultaneously. Diagnostics will be displayed immediately. The display will list the diagnostic codes logged by position (d1, d2, d3, etc.).

— When OLS is not present: Press the ↑ (Up) and ↓ (Down) arrow keys simultaneously. The display will list the diagnostic codes logged by position (d1, d2, d3, etc.).

2. Lever Shift Selector

— When OLS is not present—Press the **DISPLAY MODE** button. Diagnostics will be displayed immediately.

— When OLS is present—Press the **DISPLAY MODE** button twice to enter Diagnostic Mode. The display will list the diagnostic codes logged by position (d1, d2, d3, etc.).

d. Diagnostic Codes. Diagnostic codes can be displayed on the display portion of the shift selector or by using the Allison DOC™ For PC–Service Tool. A diagnostic code is either active or historical. An active code is any code that is current in the TCM decision-making process. Historical codes are codes that are retained in the TCM memory and will not necessarily affect the TCM decision-making process. Active codes are indicated on the shift selector by the **MODE ON** indicator.

e. Displaying Diagnostic Codes. Press and release the **MODE** button to sequentially display the logged diagnostic codes.

f. Diagnostic Code Displays. The code list position (d1, d2, d3, d4, and d5) is the first item displayed, followed by the diagnostic trouble code (DTC). The following example shows how DTC P0722 is displayed on pushbutton and lever shift selectors:

SELECT	MONITOR
d	1
	P
0	7
2	2

The display cycles continuously until the next code list position is accessed by pressing the **MODE** button. When all codes have been displayed by pressing the **MODE** button, the first code will be redisplayed. Any log position not containing a diagnostic code will display "– –" at the DTC position. No codes are logged after a "– –" display.

g. Exiting Diagnostic Mode

1. Press the same buttons used to enter the diagnostic mode.
2. Select any range. The transmission will enter the selected range if the range is not inhibited.
3. Turn off the ignition switch.
4. The TCM diagnostic mode is exited automatically after approximately two minutes have elapsed without an operator input.

1–9. 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 and in or out of a vehicle.

c. One Year Storage *(Without Fluid)*

1. Drain the transmission fluid.
2. Remove the breather and spray 30 ml (one ounce) of VCI #10 (or equivalent) into the transmission through the breather hole. Re-install the breather. Also, spray 30 ml (one ounce) through the fill tube hole.
3. Seal all openings and the breather with moisture-proof tape.

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

5. If additional storage time is required, repeat Steps (2) through (4) at yearly intervals.

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 transmission fluid. Add 3 ml of Biobor® JF (or equivalent) for each 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 in **N** (Neutral) for approximately five minutes at 1500 rpm.

4. Make sure the transmission shifts through all ranges and the lockup clutch activates.

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 (225ºF), shift the transmission to forward range and stall the converter. Do not exceed 107°C (225ºF).

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

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

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

1–10. RESTORING TRANSMISSION TO SERVICE

CAUTION:

Whenever a transmission is overhauled or exchanged, the Transmission Control Module (TCM) must be "RESET TO UNADAPTED SHIFTS". This causes the TCM to erase previous adaptive information and begin to adapt in Fast Adaptive Mode from the base calibration. Use the Allison DOC™ For PC–Service Tool and select "RESET UNADAPTED SHIFTS". Follow the instructions in the Allison DOC™ For PC–Service Tool User Guide GN3433EN to accomplish the reset.

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

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

c. New Transmissions. If the transmission is new, drain the residual preservative oil. Refill the transmission to the proper level with an Allison-approved transmission fluid. Refer to Paragraph 2–10.

d. Stored Without Fluid. If the transmission was prepared for storage without fluid, drain the residual fluid and replace the oil filter elements. Refill the transmission to the proper level with an Allison-approved transmission fluid. Refer to Paragraph 2–10.

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

1–11. ELECTROMAGNETIC/RADIO FREQUENCY INTERFERENCE

All electrical and electronic systems generate electromagnetic fields that can interfere with other electronic systems. Allison Transmission's electronic transmission controls comply with Federal Communications Commission (FCC) regulations and other guidelines concerning emitted radio frequency interference for transportation electronics. Some radio-telephone or two-way communications radios (land-mobile radio), or the manner in which they are installed, can be affected by other vehicle components or adversely affect vehicle operation. Manufacturers and installers of EMI/RFI emitting equipment are responsible for adhering to FCC regulations and other guidelines concerning emitted radio frequency interference for transportation electronics. Radio or other two-way communication antenna, power, or ground leads near the transmission wiring harness, control devices, or power leads may create or be subject to electromagnetic interference (EMI) from the transmission control system. Refer to the Allison 4th Generation Controls Troubleshooting Manual (TS3989EN) for detailed instructions regarding EMI problems.

1–12. OPERATING INSTRUCTIONS

Detailed transmission operation information is in the 3000 and 4000 Product Families Principles of Operation PO4016EN manual or in vocational model Operator's Manual. Refer to the latest revision.

1–13. SPECIFICATIONS AND DATA

The following specifications and data provide a quick reference to the major characteristics of the transmission.

Table 1–1. Specifications and Data Chart*

GEAR DATA:

Type	Planetary helical, constant mesh

Range	**Close-Ratio†**	**Wide-Ratio†**	**Widest-Ratio Coverage†**
First	3.51:1	4.70:1	7.63
Second	1.91:1	2.21:1	3.51
Third	1.43:1	1.53:1	1.91
Fourth	1.00:1	1.00:1	1.43
Fifth	0.74:1	0.76:1	1.00
Sixth	0.64:1	0.67:1	0.74
Seventh	—	—	0.64
Reverse	–4.80:1	–5.55:1	–4.80:1

ENGINE-DRIVEN POWER TAKEOFF PROVISION:

Positions . . . . . 8 o'clock and 1 o'clock (viewed from rear)

PTO Unit Ratings at the Transmission:

PTO Drive Gear . . . . . Maximum torque through one pad: 930 N·m (685 lb ft)
Maximum torque through both pads simultaneously: 1595 N·m (1175 lb ft)

NOTE: *No more than 930 N·m (685 lb ft) allowed through any single pad.*

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

† Gear ratios do not include torque converter multiplication.

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

HYDRAULIC SYSTEM:

Fluid type	TranSynd™, MIL-PRF-2104, MIL-PRF-46167, MIL-PRF-21260, DEXRON®-III, C-4 (refer to Paragraph 2–10.)
Filters, main and lube	Dual integral, replaceable cartridge type

4000 PRODUCT FAMILY SIZES:

	With PTO drive	**Without PTO drive**
Length (transmission mounting face to rear of output shaft)		
without retarder	854.0 mm (33.62 inch)	781.1 mm (30.75 inch)
with retarder	845.6 mm (33.29 inch)	772.6 mm (30.42 inch)
Length (transmission mounting flange to output flange mounting face on P3 carrier)	798.7 mm (31.45 inch)	725.7 mm (28.57 inch)
Depth (standard sump, centerline to lowest point)	374.7 mm (14.75 inch)	374.7 mm (14.75 inch)
Dry weight—add 16.0 kg (35.0 lb) if integral cooler is used		
with retarder	439 kg (968 lb)	411 kg (906 lb)
without retarder	405 kg (893 lb)	377 kg (831 lb)
with retarder and integral retarder sump cooler	469 kg (1032 lb)	441 kg (970 lb)

	4700/4800 Models With PTO drive	**4700/4800 Models Without PTO drive**
Length (transmission mounting face to rear of output shaft)		
with retarder or rear cover	1104.1 mm (43.47 inch)	966.3 mm (38.04 inch)
Depth (standard sump, centerline to lowest point)	378.2 mm (14.89 inch)	378.2 mm (14.89 inch)
Dry weight—add 16.0 kg (35.0 lb) if integral cooler is used		
with retarder	554 kg (1324 lb)	527 kg (1162 lb)
without retarder	521 kg (1149 lb)	493 kg (1087 lb)

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

NOTES

SECTION 2—PREVENTIVE MAINTENANCE

2–1. SCOPE

Proper care and regular maintenance is necessary for 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 INSPECTION AND CARE

a. Exterior Cleaning and Inspection

CAUTION:

DO NOT pressure-wash the transmission electrical connectors. Water and detergent cause the electrical contacts to corrode and become faulty.

1. Clean and inspect the exterior of the transmission at regular intervals. Severity of service and operating conditions determine the frequency of inspections.
2. Inspect the transmission for:
   - Loose bolts—transmission and mounting components.
   - Fluid leaks—repair immediately.
   - Loose, dirty, or improperly adjusted throttle sensor linkage.
   - Damaged or loose fluid hoses.
   - Worn, frayed, or improperly routed electrical harnesses.
   - Bent, worn or out-of-phase driveline U-joints and slip fittings.

2–3. IMPORTANCE OF PROPER FLUID LEVEL

a. Transmission Fluid. Transmission fluid cools, lubricates, and transmits hydraulic power. Always maintain the correct fluid level. If the level is too low, the torque converter and clutches do not receive enough fluid and the transmission overheats. If the level is too high, the fluid aerates causing the transmission to shift erratically and overheat.

b. Oil Level Sensor. The optional oil level sensor (OLS) allows the operator to determine the fluid level from either a full-function pushbutton or a lever shift selector. There is no fluid level reading capability for an Allison 4th Generation Controls strip-type pushbutton selector; use the Allison DOC™ For PC–Service Tool to obtain fluid level data from the OLS.

NOTE:

- **The oil level sensor compensates for transmission fluid temperatures from 60–104°C (140–220°F). Any temperature below 60°C (140°F) or above 104°C (220°F) will result in an "Invalid for Display" condition.**
- **To accurately determine the transmission fluid level with the dipstick, the transmission fluid must be at normal operating temperature (71–93°C; 160–200°F).**

c. Electronic Controls and Protection Circuits. 4000 Product Family transmission electronic controls and protection circuits alert the operator to a transmission malfunction or the need for service. The electronic controls and protection circuits do not replace regular, manual, fluid level checks. Confirm the fluid level at the intervals specified in vehicle service instructions.

2–4. ELECTRONIC FLUID LEVEL CHECK (WHEN AN OPTIONAL OLS IS PRESENT—FULL-FUNCTION PUSHBUTTON OR LEVER SHIFT SELECTORS)

NOTE:

The Allison 4th Generation Controls full-function pushbutton and lever shift selectors can display two characters at one time. One character is displayed under the SELECT label and one under the MONITOR label.

a. Fluid Level Check Procedure

1. Park the vehicle on a level surface and shift to **N** (Neutral). Apply the parking brake.

2. To enter oil level display mode:

   - Pushbutton shift selector—simultaneously press the ↑ (Up) and ↓ (Down) arrow buttons once.
   - Lever shift selector—press the **DISPLAY MODE** pushbutton once.

NOTE:

The TCM may delay the fluid level check until the following conditions are met:

- **The fluid temperature is above 60°C (140°F) or below 104°C (220°F).**
- **The transmission is in neutral.**
- **The vehicle has been stationary for approximately two minutes to allow the fluid to settle.**
- **The engine is at idle.**

Indication of a delayed fluid level check for Allison 4th Generation Controls is a flashing display under SELECT label and a digit countdown from 8 to 1 under MONITOR label.

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3. Correct fluid level is reported when "o L" is displayed (o L" indicates the Oil Level Check Mode), followed by "o K o K". The "o K" display indicates the fluid level is within the correct fluid level zone. The sensor display and the transmission dipstick may not agree exactly because the oil level sensor compensates for fluid temperature. *Example:* "o L o K o K" indicates correct fluid level.

4. Low fluid level is reported when "o L" is displayed followed by "L o" and a number. "L o" indicates a low fluid level and the number indicates the number of quarts of fluid the transmission requires. Confirm a low fluid level condition by making a manual fluid level check. *Example:* "o L L o 0 2" indicates two additional quarts of fluid will bring the fluid level within the middle of the "O K" zone.

5. High fluid level (o L H I 0 #) is reported when "o L" is displayed, followed by "H I" and a number. "H I" indicates high fluid level and the number indicates the number of quarts the transmission is overfilled. *Example:* "O L H I 0 1" indicates one quart of fluid above the full level.

CAUTION:

A low or high fluid level causes overheating and irregular shift patterns and if not corrected, can damage the transmission.

6. Invalid for Display condition is reported when "o L" is displayed, followed by "– –" and a number. The displayed number is a fault code, and indicates improper conditions or a system malfunction. *Example:* "o L – – 70" indicates an Invalid for Display condition and fault code 70.

7. Invalid for Display is activated when conditions do not allow the fluid level to be determined. Review the following codes and conditions, and correct as necessary. If these conditions cannot be corrected, contact the nearest distributor or dealer in your area (look in the telephone directory for the Allison Transmission service outlet nearest you.)

Code		Cause of Code
"OL – – 0X"	—	Settling time too short
"OL – – 50"	—	Engine speed (rpm) too low
"OL – – 59"	—	Engine speed (rpm) too high
"OL – – 65"	—	**N** (Neutral) must be selected
"OL – – 70"	—	Sump oil temperature too low
"OL – – 79"	—	Sump oil temperature too high
"OL – – 89"	—	Output shaft rotation
"OL – – 95"	—	Sensor failure

NOTE:

Report sensor failure to a distributor or dealer in your area. Refer to the Allison Transmission website www.allisontransmission.com or a telephone directory for the Allison Transmission distributor or dealer nearest you.

8. To exit the oil level display mode:
   - Pushbutton shift selector—press any pushbutton on the shift selector.
   - Lever shift selector—press the **DISPLAY MODE** button twice.

2–5. MANUAL FLUID LEVEL CHECK PROCEDURE

WARNING!

If you leave the vehicle and the engine is running, the vehicle can move suddenly and you or others could be injured. If you must leave the engine running, do not leave the vehicle until you have completed all of the following procedures:

- **Put the transmission in N (Neutral).**
- **Be sure the engine is at low idle (500–800 rpm).**
- **Apply the parking brake and emergency brakes and make sure they are properly engaged.**
- **Chock the wheels and take any other steps necessary to keep the vehicle from moving.**

a. Preparation. Clean all dirt from around the end of the fluid fill tube before removing the dipstick. Do not allow dirt or foreign matter to enter the transmission. Dirt or foreign matter in the hydraulic system may clog passages and cause undue transmission part wear or sticking valves.

b. Consistency of Readings. Always test the fluid level reading at least twice using the Hot Check and Cold Check procedures in Paragraphs 2–6 and 2–7. Consistency (repeatable readings) is important to maintaining proper fluid level. If inconsistent readings persist, inspect the transmission breather to be sure it is not clogged. If readings are still inconsistent, contact your nearest Allison distributor or dealer.

2–6. COLD CHECK (Figure 2–1)

CAUTION:

DO NOT start the engine until the presence of sufficient transmission fluid has been confirmed. Remove the transmission fluid dipstick and be sure the static fluid level is near the HOT FULL mark.

a. Purpose. The purpose of the Cold Check is to determine if the transmission has enough fluid to be operated safely until a Hot Check can be made.

b. Cold Check Procedure

1. Park the vehicle on a level surface, chock the wheels, and apply the parking brake.

2. Run the engine at idle (500–800 rpm) for at least one minute with the transmission in **N** (Neutral). Shift to **D** (Drive), then shift to **R** (Reverse) to clear the hydraulic system of air. Then, shift to **N** (Neutral) and allow the engine to idle.

3. With the engine running, remove the dipstick from the tube and wipe clean.

4. Insert the dipstick into the tube and remove. Read the fluid level. Repeat the procedure to verify the reading.

5. If the fluid level is within the "COLD CHECK" band, the transmission can be operated until the fluid is hot enough to perform a Hot Check. If the fluid level is not within the "COLD CHECK" band, add or drain as necessary to bring the fluid level to the middle of the "COLD CHECK" band.

6. Perform a Hot Check at the first opportunity after normal operating temperature is reached—71–93°C (160–200°F).

2–7. *HOT CHECK (Figure 2–1)*

WARNING!

If you leave the vehicle and the engine is running, the vehicle can move suddenly and you or others could be injured. If you must leave the engine running, do not leave the vehicle until you have completed all of the following procedures:

- **Put the transmission in N (Neutral).**
- **Be sure the engine is at low idle (500–800 rpm).**
- **Apply the parking brake and emergency brakes and make sure they are properly engaged.**
- **Chock the wheels and take any other steps necessary to keep the vehicle from moving.**

CAUTION:

An accurate fluid level check cannot be made unless the engine is idling (500–800 rpm) in N (Neutral), the transmission fluid is at the proper temperature, and the vehicle is on a level surface.

a. Purpose. The purpose of the Hot Check is to determine if the transmission has enough fluid to be operated safely.

b. Procedure

1. Operate the transmission in **D** (Drive) range until normal operating temperature is reached:
   - Sump temperature—71–93°C (160–200°F)
   - Converter-out temperature—82–104°C (180–220°F)

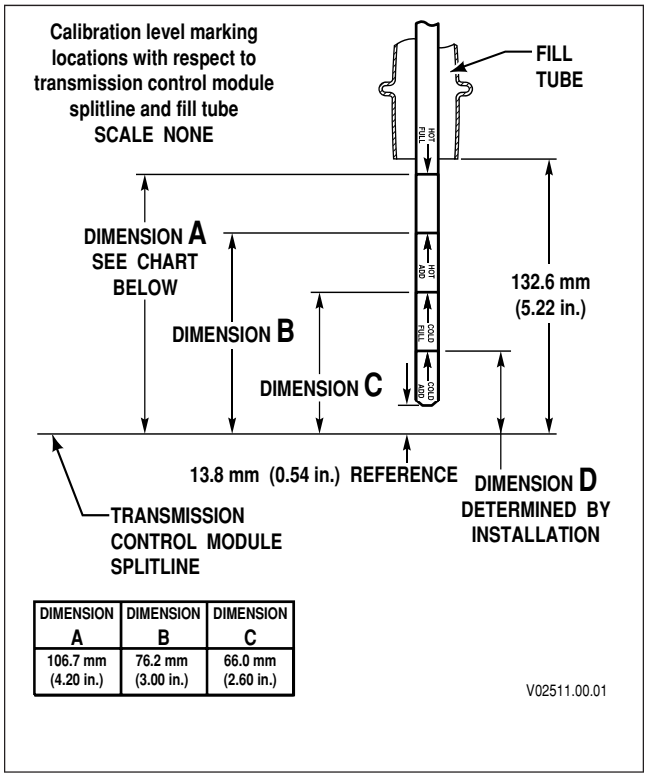
   If a transmission temperature gauge is not present, determine fluid level when the engine water temperature gauge has stabilized and the transmission has been operated under load for at least one hour.
2. Park the vehicle on a level surface and shift to **N** (Neutral). Apply the parking brake and chock the wheels. Allow the engine to idle (500–800 rpm).
3. With the engine running, remove the dipstick from the tube and wipe clean.
4. Insert the dipstick into the tube and remove. Read the fluid level. Repeat the procedure to verify the reading.
5. If the fluid level is not within the "HOT CHECK" band, add or drain as necessary to bring the fluid level within the band. Safe operating level is within the "HOT CHECK" band on the dipstick (refer to Figure 2–1).

2–8. *KEEPING FLUID CLEAN*

CAUTION:

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

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



DIMENSION A	DIMENSION B	DIMENSION C
106.7 mm (4.20 in.)	76.2 mm (3.00 in.)	66.0 mm (2.60 in.)

Figure 2–1. Fluid Dipstick Markings