

Service Manual

2005 OCTOBER

SM4013EN

Allison Transmission ALLISON 4TH GENERATION CONTROLS VOCATIONAL MODELS

3000 EVS	3200 SP	3500 EVS	3700 SP	B 300
3000 HS	3200 TRV	3500 RDS		B 400
3000 MH		3500 SP		T 250
3000 PTS				T 255
3000 RDS				T 260
3000 TRV				T 265
				T 270
				T 280
				T 310
				T 325
				T 350



Allison Transmission, General Motors Corporation
P.O. Box 894 Indianapolis, Indiana 46206-0894
www.allisontransmission.com

3000 PRODUCT FAMILY SERVICE MANUAL

ELECTRONIC CONTROL UNIT DISPLAYS AND BUTTON NAMES

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

The actual message displayed (text and/or letters) is printed within double quotation marks (“O L”, “O K”, etc.).

TRADEMARK USE

The following trademarks are the property of the companies indicated:

- Allison Diagnostic Optimized Connection™ (Allison DOC™) is a trademark of General Motors Corporation.
- Biobor® JF is the registered trademark for a biological inhibitor manufactured by Hammonds Fuel Additives Company.
- DEXRON® is a registered trademark of General Motors Corporation.
- Spiralock® is a registered trademark of Spiralock of Michigan.
- Teflon® is a registered trademark of the DuPont Corporation.
- TranSynd™ is a trademark of Castrol, Ltd.
- Viton™ is a trademark of DuPont Corporation.

NOTE:

This publication is revised periodically to include improvements, new models, special tools, and procedures. A revision is indicated by letter suffix to the publication number. 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.

- To help prevent personal injury or property damage caused by sudden and unexpected vehicle movement, do not check the fluid 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 sump when draining transmission fluid. Direct contact with the hot fluid or the hot sump may result in bodily injury.
- To help avoid personal injury, such as burns, from hot transmission fluid and/or to help avoid equipment damage, do not stall the torque converter for more than ten seconds maximum and monitor transmission fluid temperature. Immediately return the engine to idle if converter out (to cooler) temperature exceeds 150°C (300°F). Operating the transmission at high engine power at transmission stall or near stall conditions causes a rapid rise in the transmission fluid temperature. The fluid in the transmission torque converter is absorbing all of the engine power and the vehicle cooling system cannot dissipate the excessive heat load. Extended operation under high heat load conditions causes transmission and cooling system damage, and can possibly fail hydraulic lines causing leaking high temperature fluid.
- To help avoid personal injury and equipment damage while conducting a transmission stall test, the vehicle must be positively prevented from moving. Apply the parking brake, the service brake, and chock the wheels securely. Warn personnel to keep clear of the vehicle and its travel path.
- Use appropriate safety equipment such as safety glasses, safety shoes, and gloves.
- Do not burn discarded Teflon® seals; toxic gases are produced by burning Teflon®.
- Never dry bearings by spinning them with compressed air. A spinning bearing can disintegrate, allowing balls or rollers to become lethal flying projectiles. Also, spinning a bearing without lubrication can damage the bearing.
- 3000 Product Family transmission dry weights are as follows:

—Base Transmission	243 kg (535 lb)
—With PTO Provision	261 kg (575 lb)
—With Retarder	279 kg (610 lb)
—With PTO and Retarder	297 kg (655 lb)
—With PTO, Retarder, and and Integral Sump Cooler	336.5 kg (740 lb)
—3700 SP	530 kg (1170 lb)

Use proper tools and lifting equipment when installing or removing a transmission from the repair stand.

LIST OF WARNINGS (*cont'd*)

This manual contains the following warnings —

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

- **The transfer case module assembly weighs approximately 270 kg (595 lb).**
- **The control module assembly weighs approximately 25 kg (56 lb). Handle carefully to avoid personnel injury or control module damage. The control module assembly used in a 3700 SP weighs approximately 29 kg (65 lb).**
- **The retarder module assembly weighs approximately 64 kg (141 lb). Use care to prevent injury to personnel while handling the retarder module assembly.**
- **Piston springs are highly compressed. Be extremely careful during disassembly. Personal injury can occur if the spring force is not controlled.**
- **Transmissions installed in overhaul stands must be positioned vertically before installing control module. Failure to do so could result in personal injury.**
- **To help avoid personal injury, securely support the cooler in its installed position before installing the bolts retaining the cooler to the manifold. The cooler weighs 140 kg (64 lb), use care when handling the cooler.**

TABLE OF CONTENTS

Section 1. GENERAL INFORMATION

- 1-1. SCOPE OF MANUAL
 - a. Content and Organization 1-1
 - b. Illustrations 1-1
 - c. Maintenance Information 1-1
- 1-2. SUPPLEMENTARY INFORMATION 1-1
- 1-3. ORDERING PARTS
 - a. Transmission Nameplate 1-5
 - b. Parts Catalog 1-5
- 1-4. GENERAL DESCRIPTION
 - a. Major Modules 1-5
 - b. Unique Features 1-5
- 1-5. MAJOR MODULES
 - a. Input Module 1-5
 - b. Torque Converter 1-5
 - c. Power Takeoff Provision 1-6
 - d. Main Housing and Gear Module 1-6
 - e. Range Clutches 1-6
 - f. Gearing Ratios 1-6
 - g. Control System and Electronic Control Unit (TCM) 1-6
 - h. Oil Filters 1-6
 - i. Transmission Fluid Coolers 1-6
 - j. Output Configuration 1-6
- 1-6. MODEL DESIGNATION CODE
 - a. 3000 Product Family Vocational Model Standard and Optional Features 1-6
- 1-7. DIAGNOSIS
 - a. Before Starting 1-8
 - b. CHECK TRANS Light 1-8
 - c. Entering Diagnostic Mode 1-8
 - d. Diagnostic Codes 1-8
 - e. Displaying Diagnostic Codes 1-8
 - f. Diagnostic Code Displays 1-8
 - g. Exiting Diagnostic Mode 1-8
- 1-8. PRESERVATION AND STORAGE
 - a. Preservation Methods 1-9
 - b. Storage 1-9
 - c. One Year Storage (Without Fluid) 1-9
 - d. One Year Storage (With Fluid) 1-9

- 1-9. RESTORING TRANSMISSION TO SERVICE
 - a. Transmission Exterior 1-9
 - b. Sealed Breather and Openings 1-10
 - c. New Transmissions 1-10
 - d. Stored Without Fluid 1-10
 - e. Stored With Fluid 1-10
- 1-10. OPERATING INSTRUCTIONS 1-10
- 1-11. SPECIFICATIONS AND DATA 1-10
- 1-12. ELECTROMAGNETIC/RADIO FREQUENCY INTERFERENCE 1-11

Section 2. PREVENTIVE MAINTENANCE

- 2-1. SCOPE 2-1
- 2-2. PERIODIC INSPECTION AND CARE
 - a. Exterior Cleaning and Inspection 2-1
- 2-3. IMPORTANCE OF PROPER FLUID LEVEL
 - a. Transmission Fluid 2-1
 - b. Oil Level Sensor 2-1
- 2-4. TRANSMISSION FLUID CHECK
 - a. Electronic Check Procedure 2-1
 - b. Fluid Level Display Criteria 2-1
- 2-5. MANUAL FLUID LEVEL CHECK PROCEDURE
 - a. Preparation 2-2
 - b. Consistency of Readings 2-2
- 2-6. COLD CHECK
 - a. Purpose 2-3
 - b. Cold Check Procedure 2-3
- 2-7. HOT CHECK
 - a. Hot Check Procedure 2-3
- 2-8. KEEPING FLUID CLEAN
 - a. Foreign Material 2-4
- 2-9. FLUID RECOMMENDATIONS 2-4
- 2-10. FLUID AND FILTER CHANGE INTERVAL
 - a. Fluid and Filter Changes 2-4
 - b. Fluid Analysis 2-6
- 2-11. FLUID CONTAMINATION
 - a. Water 2-6
 - b. Engine Coolant 2-6
 - c. Metal 2-6

TABLE OF CONTENTS

<p>2-12. FLUID AND FILTER CHANGE PROCEDURE</p> <ul style="list-style-type: none"> a. Drain Fluid 2-7 b. Replace Filters—3000 Product Family . . 2-7 c. Replace Filters—3700 SP 2-7 d. Refill Transmission 2-8 <p>2-13. BREATHER</p> <ul style="list-style-type: none"> a. Location and Purpose 2-8 b. Maintenance 2-9 <p>2-14. CHECKING CLUTCH PRESSURES</p> <ul style="list-style-type: none"> a. Transmission and Vehicle Preparation 2-9 b. Recording Data 2-10 c. Comparing Recorded Data to Specifications 2-10 <p>2-15. TRANSMISSION STALL TEST AND NEUTRAL COOL-DOWN CHECK</p> <ul style="list-style-type: none"> a. Purpose 2-15 b. Stall Testing Preparation 2-15 c. Performing a Transmission Stall Test . . 2-15 d. Driving Transmission Stall Test 2-16 e. Driving Transmission Stall Testing Preparation 2-16 f. Performing a Driving Transmission Stall Test 2-16 g. Neutral Cool-Down Check Procedure 2-17 h. Transmission Stall Test Results 2-17 <p>2-16. FLUID LEAK DIAGNOSIS</p> <ul style="list-style-type: none"> a. Finding the Leak 2-17 b. Powder Method 2-18 c. Black Light and Dye Method 2-18 d. Possible Points of Fluid Leaks and Their Causes 2-18 e. Repairing the Leak 2-19 <p>2-17. OUTPUT FLANGE/YOKE AND OIL SEAL MAINTENANCE (All, Except 3700 SP)</p> <ul style="list-style-type: none"> a. Disassembly 2-19 b. Assembly 2-20 	<p>2-18. YOKE AND OIL SEAL MAINTENANCE (3700 SP)</p> <ul style="list-style-type: none"> a. Disassembly 2-20 b. Assembly 2-20 <p>2-19. ON-VEHICLE MAINTENANCE 2-20</p> <p>Section 3. GENERAL OVERHAUL INFORMATION</p> <p>3-1. SCOPE 3-1</p> <p>3-2. TOOLS AND EQUIPMENT</p> <ul style="list-style-type: none"> a. Improvised Tools and Equipment 3-1 b. Special Tools 3-1 c. Mechanic's Tools and Shop Equipment 3-1 <p>3-3. REPLACEMENT PARTS</p> <ul style="list-style-type: none"> a. Ordering Information 3-5 b. Parts Normally Replaced at Overhaul . . 3-5 <p>3-4. CAREFUL HANDLING 3-5</p> <p>3-5. CLEANING AND INSPECTION</p> <ul style="list-style-type: none"> a. Dirt Causes Malfunction 3-5 b. Cleaning Parts 3-6 c. Cleaning Bearings 3-6 d. Keeping Bearings Clean 3-6 e. Inspecting Bearings 3-6 f. Inspecting Cast Parts and Machined Surfaces 3-6 g. Inspecting Bushings and Thrust Washers 3-7 h. Inspecting Sealrings and Gaskets 3-7 i. Inspecting Gears 3-8 j. Inspecting Splined Parts 3-8 k. Inspecting Threaded Parts 3-8 l. Inspecting Retaining Rings 3-8 m. Inspecting Springs 3-8 n. Inspecting Clutch Plates 3-8 o. Inspecting Swaged and Interference-Fit Parts 3-9 p. Inspecting Retainer and Ball Assembly in Retarder Stator 3-9 q. Inspecting Sealing Surfaces 3-9
--	--

TABLE OF CONTENTS

3-6. ASSEMBLY PROCEDURES	
a. Parts Lubrication	3-9
b. Grease Used for Assembly	3-9
c. Sealing Compounds and Nonsoluble Greases	3-9
d. Clutches and Pistons	3-9
e. Threaded Plugs and Hydraulic Fittings	3-9
f. Coated Threaded Fasteners	3-9
g. Lip-Type Seals	3-9
h. Butt-Joint Sealrings	3-9
i. Bearings	3-10
j. Electrical Components	3-10
3-7. REMOVING (OR INSTALLING) TRANSMISSION	
a. Drain Fluid	3-10
b. Disconnecting Controls	3-11
c. Uncoupling From Driveline, Vehicle, and Engine	3-11
d. Removing the Transmission	3-11
3-8. WEAR LIMITS	3-12
3-9. SPRING SPECIFICATIONS	3-12
3-10. TORQUE SPECIFICATIONS	3-12
Section 4. TRANSMISSION DISASSEMBLY	
4-1. SCOPE	
a. Section	4-1
b. Procedures	4-1
c. Illustrations	4-1
d. General Information	4-1
e. Foldouts	4-1
4-2. DISASSEMBLY OF TRANSMISSION	
a. Mounting Transmission on Repair Stand	4-1
b. Removal of Common Externally- Mounted Parts	4-1
c. Removal of Speed Sensors	4-2
d. Removal of Integral Oil Cooler	4-3
e. Removing Integral Retarder Sump Oil Cooler	4-3
f. Removal of Power Takeoff(s)	4-3
g. Removal of Transfer Case Module—3700 SP	4-3
h. Removal of Control Module	4-4
i. Removal of Torque Converter Module	4-5
j. Removal of Converter Housing Module	4-6
k. Removal of Retarder Module (Units Built Before 1/98)	4-6
l. Removal of Transfer Case Adapter Housing Module	4-6
m. Removal of Rear Cover Module	4-7
n. Removal of Main Shaft Module	4-7
o. Removal of P2 Module, C5 Clutch Plates, and P1 Module	4-7
p. Removal of Front Support/Charging Pump Module and Rotating Clutch Module	4-8
q. Removal of C3/C4 Clutch Assembly From Main Housing Module	4-8
Section 5. MODULE REBUILD	
5-1. SCOPE	
a. Section	5-1
b. Procedures	5-1
5-2. GENERAL INFORMATION FOR MODULE REBUILD	5-1
5-3. TORQUE CONVERTER MODULE	
a. Disassembly	5-1
b. Assembly	5-2
5-4. TORQUE CONVERTER HOUSING MODULE (Models Without PTO Provision)	
a. Disassembly	5-3
b. Assembly	5-4
5-5. TORQUE CONVERTER HOUSING MODULE (Models With PTO Provision)	
a. Module Disassembly	5-4
b. Disassembly of the Bearing Retainer	5-4
c. Disassembly of the PTO Gear Assembly	5-4
d. Assembly of the PTO Gear Assembly	5-4
e. Assembly of the Bearing Retainer Assembly	5-5
f. Module Assembly	5-5

TABLE OF CONTENTS

<p>5-6. FRONT SUPPORT AND CHARGING OIL PUMP MODULE</p> <p>a. Module Disassembly 5-5</p> <p>b. Assembly of the Front Support 5-7</p> <p>c. Assembly of the Pump Housing 5-7</p> <p>5-7. ROTATING CLUTCH MODULE</p> <p>a. Disassembly 5-8</p> <p>b. Assembly 5-10</p> <p>5-8. C3/C4 AND MAIN HOUSING MODULE</p> <p>a. Disassembly 5-11</p> <p>b. Assembly 5-12</p> <p>5-9. MAIN SHAFT MODULE</p> <p>a. Disassembly (3000 Product Family Models, Except 3500 and 3700 SP) 5-13</p> <p>b. Assembly (3000 Product Family Models, Except 3500 and 3700 SP) 5-13</p> <p>c. Module Disassembly (3500 Transmission Models) 5-14</p> <p>d. Module Assembly (3500 Transmission Models) 5-14</p> <p>e. Module Disassembly (3700 SP Transmission Models) 5-14</p> <p>f. Module Assembly (3700 SP Transmission Models) 5-14</p> <p>5-10. P1 PLANETARY MODULE</p> <p>a. Disassembly 5-14</p> <p>b. Assembly 5-15</p> <p>5-11. P2 PLANETARY MODULE</p> <p>a. Disassembly 5-15</p> <p>b. Assembly 5-15</p> <p>5-12. RETARDER MODULE</p> <p>a. Disassembly of Retarder Valve Body . . . 5-16</p> <p>b. Disassembly of Retarder Housing 5-17</p> <p>c. Disassembly of P3 Planetary Carrier Assembly 5-18</p> <p>d. Disassembly of Retarder Stator Assembly 5-19</p> <p>e. Assembly of Retarder Stator 5-19</p> <p>f. Assembly of P3 Planetary Carrier Assembly 5-19</p> <p>g. Assembly of Retarder Housing Assembly 5-20</p> <p>h. Assembly and Installation of Retarder Control Body Assembly 5-21</p>	<p>5-13. REAR COVER MODULE</p> <p>a. Disassembly 5-21</p> <p>b. Disassembly of the P3 Planetary Carrier Assembly 5-21</p> <p>c. Disassembly of the Rear Cover Assembly 5-22</p> <p>d. Assembly of Rear Cover 5-22</p> <p>e. Assembly of the P3 Planetary Carrier Assembly 5-22</p> <p>f. Completion of the Rear Cover Module 5-23</p> <p>5-14. ADAPTER HOUSING AND P3 OVERHAUL</p> <p>a. Disassembly 5-23</p> <p>b. Assembly 5-24</p> <p>5-15. SCAVENGE PUMP OVERHAUL</p> <p>a. Disassembly 5-25</p> <p>b. Assembly 5-27</p> <p>5-16. TRANSFER CASE MODULE</p> <p>a. Disassembly of Transfer Case Module . . . 5-27</p> <p>b. Disassembly of C6 Clutch 5-29</p> <p>c. Assembly of C6 Clutch 5-29</p> <p>d. Disassembly of C7 Clutch 5-30</p> <p>e. Assembly of C7 Clutch Housing 5-30</p> <p>f. Disassembly of Oil Pump 5-31</p> <p>g. Assembly of Oil Pump 5-31</p> <p>h. Disassembly of P4 Carrier 5-31</p> <p>i. Assembly of P4 Carrier 5-31</p> <p>j. Disassembly of Drive, Idler, and Driven Gears 5-32</p> <p>k. Assembly of Drive, Idler, and Driven Gears 5-32</p> <p>l. Disassembly of the Front Output Housing and Front Output Shaft . . . 5-32</p> <p>m. Assembly of the Front Output Housing and Front Output Shaft . . . 5-32</p> <p>n. Disassembly of the Rear Output Housing 5-33</p> <p>o. Assembly of the Rear Output Housing . . 5-33</p> <p>p. Output Housing Bearing Preload Procedures 5-33</p> <p>q. Disassembly of C7 Control Valve Body 5-34</p> <p>r. Assembly of C7 Control Valve Body Assembly 5-34</p> <p>s. Assembly of Transfer Case Module . . . 5-34</p>
--	---

TABLE OF CONTENTS

<p>5-17. CONTROL VALVE MODULE</p> <ul style="list-style-type: none"> a. Removal of Filters 5-38 b. Removal of Electrical Components and Sensors 5-38 c. Disassembly of the Solenoid Valve Body 5-38 d. Disassembly of C6 Control Valve Body 5-39 e. Disassembly of the Main Valve Body 5-39 f. Disassembly of the Channel Plate 5-40 g. Assembly of the Channel Plate 5-40 h. Assembly of the Main Valve Body 5-40 i. Assembly of C6 Control Valve Body 5-41 j. Assembly of the Stationary Clutch Solenoid Body 5-41 k. Installation of Electrical Components and Sensors 5-41 l. Installation of Filters 5-41 	<ul style="list-style-type: none"> i. Main Shaft Selective Shim Measurement (Wide Ratio Models) 6-4 j. Main Shaft Selective Shim Measurement For 3700 SP 6-5 k. Installation of Retarder Module 6-6 l. Installation of Rear Cover Module 6-6 m. Installation of Transfer Case Adapter Housing 6-7 n. Installation of Transfer Case Module 6-7 o. Installation of the Converter Housing Module 6-7 p. Installation of the Torque Converter Module 6-8 q. Installation of the Control Module 6-10 r. Installation of Power Takeoff(s) 6-10 s. Installation of Integral Oil Cooler 6-10 t. Installation of Integral Retarder Sump Oil Cooler 6-12 u. Installation of Speed Sensors 6-12 v. Installation of Common Externally-Mounted Parts 6-13 w. Removal of Transmission From Repair Stand 6-14
Section 6. TRANSMISSION ASSEMBLY	
<p>6-1. SCOPE</p> <ul style="list-style-type: none"> a. Section 6-1 b. Procedures 6-1 c. Illustrations 6-1 d. General Information 6-1 e. Foldouts 6-1 <p>6-2. ASSEMBLY OF TRANSMISSION</p> <ul style="list-style-type: none"> a. Assembly of C3/C4 Clutch 6-1 b. Installation of the Rotating Clutch Module 6-1 c. Installation of the Front Support/Charging Pump Module 6-1 d. Installation of the P1 Planetary Module 6-2 e. Installation of the P2 Planetary Module 6-2 f. Installation of the C5 Clutch Pack 6-2 g. Installation of the Main Shaft 6-2 h. Main Shaft Selective Shim Measurement For Close Ratio Models 6-3 	<p>Section 7. WEAR LIMITS AND SPRING DATA</p> <p>7-1. WEAR LIMITS DATA</p> <ul style="list-style-type: none"> a. Maximum Variations 7-1 b. Cleaning and Inspection 7-1 <p>7-2. SPRING DATA</p> <ul style="list-style-type: none"> a. Spring Replacement 7-1 b. Inspection 7-1
Section 8. CUSTOMER SERVICE	
<ul style="list-style-type: none"> 8-1. OWNER ASSISTANCE 8-1 8-2. SERVICE LITERATURE 8-2 	