

Service Manual

Allison Transmission

HD 4060, 4060P, 4060R, 4060PR

HD 4560, 4560P, 4560R, 4560PR

B 500, B 500P, B 500R, B 500PR

HD 4070, 4070P, 4070R, 4070PR

Revision No. 2 January 1999
August 1995



Allison Transmission

Division of General Motors Corporation
P.O. Box 694 Indianapolis, Indiana 46206-0694

INTRODUCTION

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

Shift Selector or Diagnostic Data Reader/Tool (DDR) 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:

- Pro-Link® is a registered trademark of Micro Processor Systems, Inc.
- VCI #10® is the registered trademark for a vapor phase rust preventive manufactured by Daubert Chemical Company, Chicago, Illinois. VCI #10 is covered by Military Specifications MIL-L-46002 (ORD) and MIL-I-233 10 (WEP) under the designation of Nucle Oil.
- DEXRON® is a registered trademark of General Motors Corp.
- Biobor JF® is the registered trademark for a biological inhibitor manufactured by Hammonds Fuel Additives Company.
- Loctite® is a registered trademark of the Loctite Corporation.
- Teflon® is a registered trademark of the 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.

- **DO NOT check transmission fluid level while the engine is running until the following actions are taken. The transmission must be in N (Neutral), the parking brake and/or emergency brakes must be set and properly engaged, and the wheels must be chocked. Unexpected and possible sudden vehicle movement may occur if these precautions are not taken.**
- **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.**
- **Be sure that lifting equipment and the repair stand can properly support the weight of the transmission being serviced. The dry weight of the HD 4060/4560/B 500PR Series transmissions is 440 kg (968 lb); the dry weight of the HD 4060/4560/B 500P Series transmissions is 406 kg (893 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).**
- **Carefully release spring force. Piston springs are highly compressed. 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.**
- **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).**

TABLE OF CONTENTS

<i>Paragraph</i>	<i>Page</i>	<i>Paragraph</i>	<i>Page</i>
Section 1. GENERAL INFORMATION		1- 10. RESTORING TRANSMISSION TO SERVICE	
1-1. SCOPE OF MANUAL		a. Transmission Exterior	1-7
a. Content and Organization	1-1	b. Sealed Breather and Openings	1-7
b. Illustrations	1-1	c. New Transmissions.	1-7
c. Maintenance Information.	1-1	d. Stored Without Fluid	1-7
1-2. SUPPLEMENTARY INFORMATION	1-1	e. Stored With Fluid	1-7
1-3. ORDERING PARTS		1-11. ELECTROMAGNETIC/RADIO FREQUENCY INTERFERENCE.	1-7
a. Transmission Nameplate	1-1	1-12. OPERATING INSTRUCTIONS	1-8
b. Parts Catalog.	1-1	1-13. SPECIFICATIONS AND DATA	1-8
1-4. GENERAL DESCRIPTION		Section 2. PREVENTIVE MAINTENANCE	
a. Major Modules.	1-4	2-1. SCOPE	2-1
b. Unique Features.	1-4	2-2. PERIODIC INSPECTION AND CARE	
1-5. MAJOR COMPONENTS		a. Exterior Cleaning and Inspection.	2-1
a. Input Module.	1-4	2-3. IMPORTANCE OF PROPER FLUID LEVEL	
b. Torque Converter	1-4	a. Transmission Fluid.	2-1
c. Power Takeoff.	1-4	b. Oil Level Sensor.	2-1
d. Main Housing and Gear Module.	1-4	c. Electronic Controls and Protection Circuits	2-1
e. Range Clutches	1-4	2-4. ELECTRONIC FLUID LEVEL CHECK (PUSHBUTTON OR LEVER SHIFT SELECTORS)	
f. Gearing Ratios	1-4	a. Fluid Level Check Procedure.	2-1
g. Control System	1-5	2-5. MANUAL FLUID LEVEL CHECK PROCEDURE	
h. Transmission Fluid Filters	1-5	a. Preparation.	2-3
i. Transmission Fluid Coolers	1-5	b. Accuracy.	2-3
j. Rear Cover.	1-5	2-6. COLD CHECK	
k. Output Retarder and Output Flange.	1-5	a. Purpose	2-3
1-6. MODEL DESIGNATION CODE	1-5	b. Cold Check Procedure	2-3
1-7. EXPLODED (DISASSEMBLED) VIEWS.	1-5	2-7. HOT CHECK	
1-8. DIAGNOSIS		a. Procedure.	2-3
a. Before Starting	1-5	2-8. KEEPING FLUID CLEAN	
b. DO NOT SHIFT Light.	1-5	a. Foreign Material.	2-4
c. Entering Diagnostic Mode (Pushbutton Shift Selector)	1-6	2-9. FLUID RECOMMENDATIONS	
d. Entering Diagnostic Mode (Lever Shift Selector)	1-6	a. Fluid Type	2-4
e. Diagnostic Codes	1-6	2- 10. FLUID AND FILTER CHANGE INTERVALS	
f. Displaying Diagnostic Codes.	1-6	a. Fluid and Filter Changes	2-5
g. Diagnostic Code Displays	1-6		
h. Exiting Diagnostic Mode.	1-6		
1-9. PRESERVATION AND STORAGE			
a. Storage (New Transmissions, Before Installation).	1-6		
b. Preservation Methods.	1-6		
c. One Year Storage (Without Fluid)	1-6		
d. One Year Storage (With Fluid).	1-7		

HD 4000/B 500 SERIES AUTOMATIC TRANSMISSIONS

<i>Paragraph</i>	<i>Page</i>	<i>Paragraph</i>	<i>Page</i>
2-11 . FLUID CONTAMINATION		Section 3. GENERAL OVERHAUL	
a. Water	2-5	INFORMATION	
b. Engine Coolant	2-5	3-1. SCOPE	3-1
c. Metal.	2-5	3-2. TOOLS AND EQUIPMENT	
2-12. FLUID AND FILTER CHANGE		a. Improvised Equipment	3-1
PROCEDURE		b. Special Tools	3-1
a. Drain Fluid.	2-5	c. Mechanic's Tools and	
b. Replace Filters	2-5	Shop Equipment.	3-1
c. Refill Transmission.	2-6	3-3. REPLACEMENT PARTS	
2-13. BREATHER		a. Ordering Information	3-2
a. Location and Purpose.	2-6	b. Parts Normally Replaced	
b. Maintenance.	2-6	at Overhaul	3-2
2-14. TRANSMISSION STALL TEST AND		3-4. CAREFUL HANDLING	3-2
NEUTRAL COOL-DOWN CHECK		3-5. CLEANING AND INSPECTION	
a. Purpose	2-6	a. Dirt Causes Malfunction.	3-2
b. Stall Testing Preparation	2-7	b. Cleaning Transmission, Parts.	3-2
c. Stall Test Procedures —		c. Cleaning Bearings	3-5
Without Pro-Link®.	2-7	d. Inspecting Bearings	3-5
d. Stall Test Procedures —		e. Keeping Bearings Clean	3-5
With Pro-Link®.	2-8	f. Inspecting Cast Parts and	
e. Stall Test Procedures —		Machined Surfaces	3-5
Smoke-Controlled Engines.	2-8	g. Inspecting Bushings and	
f. Neutral Cool-Down		Thrust Washers	3-6
Check Procedure	2-8	h. Inspecting Sealrings and Gaskets	3-6
g. Stall Test Results	2-8	i. Inspecting Gears	3-6
2-15. CHECKING CLUTCH PRESSURES		j. Inspecting Splined Parts.	3-6
a. Purpose.	2-9	k. Inspecting Threaded Parts	3-7
b. Transmission and Vehicle		l. Inspecting Snaprings.	3-7
Preparation	2-9	m. Inspecting Springs	3-7
c. Recording Data.	2-9	n. Inspecting Clutch Plates.	3-7
d. Comparing Recorded Data		o. Inspecting Swaged and	
to Specifications	2-10	Interference-Fit Parts	3-7
2-16. FLUID LEAK DIAGNOSIS		p. Inspecting Sealing Surfaces.	3-7
a. Finding Leak	2-11	3-6. ASSEMBLY PROCEDURES	
b. Powder Method	2-11	a. Parts Lubrication.	3-7
c. Black Light and Dye Method	2-11	b. Grease Used for Assembly.	3-7
d. Possible Points of Fluid Leaks and		c. Sealing Compounds and	
Their Causes.	2-11	Nonsoluble Greases	3-7
e. Repairing Leak	2-12	d. Clutches and Pistons	3-8
2-17. OUTPUT FLANGE/YOKE AND		e. Threaded Plugs and Hydraulic Fittings	3-8
OIL SEAL MAINTENANCE		f. Lip-Type Oil Seals.	3-8
a. Disassembly	2-12	g. Butt-Joint Sealrings	3-8
b. Assembly	2-12	h. Bearings	3-8
2-18. ON-VEHICLE MAINTENANCE.	2-12	i. Bushings	3-9
		j. Electrical Components.	3-9

TABLE OF CONTENTS

<i>Paragraph</i>	<i>Page</i>	<i>Paragraph</i>	<i>Page</i>
3-7. REMOVING TRANSMISSION FROM VEHICLE		Section 5. MODULE REBUILD	
a. Drain Fluid.	3-9	5-1. SCOPE	
b. Disconnecting Controls	3-10	a. Section	5-1
c. Disconnecting Retarder	3-10	b. Procedures.	5-1
d. Uncoupling Transmission From Vehicle and Engine Driveline	3-10	5-2. GENERAL INFORMATION FOR MODULE REBUILD.	5-1
e. Removing Transmission	3-10	5-3. TORQUE CONVERTER MODULE	
3-8. WEAR LIMITS	3-10	a. Disassembly	5-1
3-9. SPRING SPECIFICATIONS.	3-10	b. Assembly.	5-2
3-10. TORQUE SPECIFICATIONS.	3-10	5-4. TORQUE CONVERTER HOUSING MODULE (Models without PTO)	
		a. Disassembly	5-4
		b. Assembly.	5-4
Section 4. TRANSMISSION DISASSEMBLY		5-5. TORQUE CONVERTER HOUSING MODULE (Models with PTO)	
4-1. SCOPE		a. Disassembly	5-4
a. Section	4-1	b. Disassembly of Bearing Retainer.	5-4
b. Procedures.	4-1	c. Disassembly of PTO Gear Assembly.	5-4
c. Illustrations	4-1	d. Assembly of PTO Gear Assembly	5-4
d. General Information	4-1	e. Assembly of Bearing Retainer Assembly	5-5
e. Foldout	4-1	f. Assembly	5-5
4-2. DISASSEMBLY OF TRANSMISSION		5-6. FRONT SUPPORT AND CHARGING OIL PUMP MODULE	
a. Mounting Transmission on Repair Stand	4-1	a. Disassembly	5-5
b. Removal of Power Takeoff	4-1	b. Assembly of Front Support.	5-6
c. Removal of External Parts	4-1	c. Assembly of Pump Housing	5-8
d. Removal of Control Valve Module	4-2	5-7. ROTATING CLUTCH MODULE	
e. Removal of Torque Converter Module.	4-5	a. Disassembly	5-8
f. Removal of Converter Housing Module.	4-5	b. Assembly.	5-10
g. Removal of Retarder Module.	4-6	5-8. C3/C4 AND MAIN HOUSING MODULE	
h. Removal of Rear Cover Module	4-6	a. Disassembly	5-11
i. Removal of Main Shaft Module.	4-6	b. Assembly.	5-12
j. Removal of P2 Module, C5 Clutch Plates, and P1 Module.	4-7	5-9. MAIN SHAFT MODULE	
k. Removal of Front Support/Charging Pump Module and Rotating Clutch Module.	4-7	a. Disassembly	5-13
l. Removal of C3/C4 Clutch Assembly From Main Housing Module	4-8	b. Assembly.	5-13
		5-10. P1 PLANETARY MODULE	
		a. Disassembly	5-13
		b. Assembly	5-13

HD 4000/B 500 SERIES AUTOMATIC TRANSMISSIONS

<i>Paragraph</i>	<i>Page</i>	<i>Paragraph</i>	<i>Page</i>
5-11. P2 PLANETARY MODULE		i. Assembly of Rotating Clutch Solenoid Body	5-25
a. Disassembly	5-14	j. Assembly of Control Valve Module	5-25
b. Assembly	5-14		
5-12. RETARDER MODULE			
a. Disassembly of Retarder Valve Body	5-15		
b. Disassembly of Temperature Sensor	5-15		
c. Disassembly of Retarder Housing	5-16		
d. Disassembly of P3 Planetary Carrier Assembly	5-16		
e. Disassembly of Retarder Stator Assembly	5-17		
f. Assembly of Retarder Stator	5-17		
g. Assembly of P3 Planetary Carrier Assembly	5-17		
h. Assembly of Retarder Housing Assembly	5-18		
i. Assembly of Retarder Valve Body	5-19		
5-13. REAR COVER MODULE			
a. Disassembly	5-19		
b. Disassembly of P3 Planetary Carrier Assembly	5-19		
c. Completion of Rear Cover Disassembly	5-20		
d. Beginning Rear Cover Assembly.	5-20		
e. Assembly of P3 Planetary Carrier Assembly	5-21		
f. Completion of Rear Cover Assembly	5-21		
5-14. CONTROL VALVE MODULE			
a. Disassembly of Control Valve Module	5-22		
b. Disassembly of Rotating Clutch Solenoid Body	5-22		
c. Disassembly of Stationary Clutch Solenoid Body	5-23		
d. Disassembly of Main Valve Body	5-23		
e. Disassembly of Channel Plate	5-24		
f. Assembly of Channel Plate	5-24		
g. Assembly of Main Valve Body	5-24		
h. Assembly of Stationary Clutch Solenoid Body	5-24		
		Section 6. TRANSMISSION ASSEMBLY	
		6-1. SCOPE	
		a. Section	6-1
		b. Procedures.	6-1
		c. Illustrations.	6-1
		d. General Information.	6-1
		e. Foldouts	6-1
		6-2. ASSEMBLY OF TRANSMISSION	
		a. Assembly of Main Housing Module	6-1
		b. Installation of Rotating Clutch Module	6-1
		c. Installation of Front Support/Charging Pump Module	6-2
		d. Installation of P1 Planetary Module	6-2
		e. Installation of P2 Planetary Module	6-2
		f. Installation of C5 Clutch Pack	6-2
		g. Installation of Main Shaft.	6-2
		h. Main Shaft Selective Shim Measurement (Models Equipped with Retarder).	6-3
		i. Main Shaft Selective Shim Measurement (Models Equipped With Rear Cover)	6-4
		j. Installation of Retarder Module	6-5
		k. Installation of Rear Cover Module.	6-5
		l. Installation of Converter Housing Module	6-6
		m. Installation of Torque Converter Module	6-6
		n. Installation of Control Module	6-8
		o. Installation of Externally Mounted Parts.	6-9
		p. Installation of Power Takeoff.	6-10
		q. Removal of Transmission From Repair Stand	6-10

TABLE OF CONTENTS

<i>Paragraph</i>	<i>Page</i>	<i>Paragraph</i>	<i>Page</i>
<i>Section 7. WEAR LIMITS AND SPRING DATA</i>		<i>Section 8. CUSTOMER SERVICE</i>	
7-1. WEAR LIMITS DATA		8-1. OWNER ASSISTANCE	8-1
a. Maximum Variations	7-1	8-2. SERVICE LITERATURE	8-2
b. Cleaning and Inspection	7-1		
7-2. SPRING DATA			
a. Spring Replacement	7-1		
b. Inspection	7-1		

HD 4000/B 500 SERIES AUTOMATIC TRANSMISSIONS

LIST OF FOLDOUT ILLUSTRATIONS (Back of Service Manual)

CROSS-SECTION VIEWS

Foldout

- 1 Model HD 4060 (Close Ratio) Transmission — Cross Section
- 2 Model HD 4560P (Wide Ratio) Transmission — Cross Section
- 3 Model HD 4060R/B 500R (Close Ratio) Transmission — Cross Section
- 3,A Model HD 4070 Transmission — Cross Section
- 3,B Model HD 4070R Transmission — Cross Section
- 3,C Model HD 4070PR Transmission — Cross Section

EXPLODED VIEWS

Foldout

- 4,A Flex Disc and Adapter
- 4,B Torque Converter Module
- 5,A Torque Converter Housing Module, Non-PTO Equipped
- 5,B Torque Converter Housing Module PTO Equipped
- 6,A Front Support and Charging Oil Pump Module
- 6,B Rotating Clutch Module
- 7 Main Housing Module
- 8 Main Shaft Module
- 9,A P1 Planetary Module
- 9,B P2 Planetary Module
- 9,C P3 Planetary Module and C6 Adapter Housing Module (HD 4070 Models Only)
- 10,A Retarder and P3 Planetary, Retarder Valve Body Module
- 10,B Rear Cover and P3 Planetary Module
- 10,C Retarder and Output Shaft Module (HD 4070 Models Only)
- 10,D Rear Cover and Output Shaft Module (HD 4070 Models Only)
- 11,A Control Module
- 11,B Control Module
- 11,C C6 Clutch Body Assembly (HD 4070 Models Only)
- 12,A Output Flange and Yoke
- 12,B Support Equipment
- 13 HD 4000/B 500 Hydraulic Schematic — Neutral
- 13,A HD 4070 Hydraulic Schematic — First Range