Service Manual

2004 DECEMBER
Rev. 1 2006 December

SM2148EN

Allison Transmission
VOCATIONAL MODELS

3000 EVS		3500 EVS	
3000 HS		3500 HS	
3000 MH		3500 MH	
3000 PTS		3500 PTS	
3000 RDS		3500 RDS	
3000 SP	3200 SP	3500 SP	3700 SP
3000 TRV	3200 TRV		
MD 3060	MD 3066	MD 3560	MD 3070PT
MD 3060P	MD 3066P	MD 3560P	
MD 3060R	MD 3066R	MD 3560R	
MD 3060PR	MD 3066PR	MD 3560PR	
B 300	B 400		
B 300P	B 400P		
B 300R	B 400R		
B 300PR	B 400PR		
T 250	T 310		
T 255	T 325		
T 260	T 350		
T 265	T 375		
T 270			
T 280			

Allison Transmission®

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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.).

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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.

- **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 sump when draining transmission fluid. Direct contact with the hot fluid or the hot sump may result in bodily injury.**
- **While conducting a stall check, the vehicle must be positively prevented from moving. Apply the parking brake and service brake, and chock the wheels securely. 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.**
- **3000 Product Family transmission dry weights are as follows:**

—basic configuration	**243 kg (535 lb)**
—with PTO provision	**261 kg (575 lb)**
—with retarder	**279 kg (615 lb)**
—with PTO provision and retarder	**297 kg (655 lb)**
—with PTO provision, retarder, and integral sump cooler	**336.5 kg (740 lb)**
3700 SP and MD 3070PT	**530 kg (1170 lb)**

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

- **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 3700SP and MD 3070PT 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 removal and installation. 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.**

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 1–6

1–3. ORDERING PARTS
- a. Transmission Nameplate 1–6
- b. Parts Catalog 1–6

1–4. GENERAL DESCRIPTION
- a. Major Modules 1–6
- b. Unique Features 1–6

1–5. MAJOR MODULES
- a. Input Module 1–7
- b. Torque Converter 1–7
- c. Power Takeoff Provision 1–7
- d. Main Housing and Gear Module 1–7
- e. Range Clutches 1–7
- f. Gearing Ratios 1–7
- g. Control System and Electronic Control Unit (ECU) 1–7
- h. Oil Filters 1–7
- i. Transmission Fluid Coolers 1–7
- j. Output Configuration 1–7

1–6. MODEL DESIGNATION CODE
- a. 3000 Product Family Vocational Model Standard and Optional Features 1–8

1–7. DIAGNOSIS
- a. Before Starting 1–9
- b. DO NOT SHIFT or CHECK TRANS Light 1–9
- c. Entering Diagnostic Mode 1–9
- d. Diagnostic Codes 1–9
- e. Displaying Diagnostic Codes 1–9
- f. Diagnostic Code Displays 1–9
- g. Exiting Diagnostic Mode 1–9

1–8. PRESERVATION AND STORAGE
- a. Storage 1–9
- b. Preservation Methods 1–10
- c. One Year Storage (Without Fluid) 1–10
- d. One Year Storage (With Fluid) 1–10

1–9. RESTORING TRANSMISSION TO SERVICE
- a. Transmission Exterior 1–10
- 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 1–11

1–11. SPECIFICATIONS AND DATA 1–11

1–12. ELECTROMAGNETIC/RADIO FREQUENCY INTERFERENCE 1–12

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
- c. Electronic Controls and Protection Circuits 2–1

2–4. ELECTRONIC FLUID LEVEL CHECK (WHEN AN OPTIONAL OLS IS PRESENT—FULL-FUNCTION PUSHBUTTON OR LEVER SHIFT SELECTORS)
- a. Fluid Level Check Procedure 2–1

2–5. ELECTRONIC FLUID LEVEL CHECK (WHEN AN OPTIONAL OLS IS PRESENT—STRIP TYPE PUSHBUTTON SHIFT SELECTORS)
- a. Fluid Level Check Procedure (WTEC II) 2–3
- b. Fluid Level Check Procedure (WTEC III) 2–3

2–6. MANUAL FLUID LEVEL CHECK PROCEDURE
- a. Preparation 2–4
- b. Consistency of Readings 2–4

2–7. COLD CHECK
- a. Purpose 2–4
- b. Cold Check Procedure 2–4

2–8. HOT CHECK
a. Procedure 2–5
2–9. KEEPING FLUID CLEAN
a. Foreign Material.....2–5
2–10. FLUID RECOMMENDATIONS 2–5
2–11. FLUID AND FILTER CHANGE INTERVAL
a. Fluid and Filter Changes 2–6
b. Fluid Analysis.....2–6
2–12. FLUID CONTAMINATION
a. Water.....2–6
b. Engine Coolant.....2–7
c. Metal.....2–7
2–13. FLUID AND FILTER CHANGE PROCEDURE
a. Drain Fluid 2–7
b. Replace Filters—3000 Product Family . .2–7
c. Replace Filters—3700 SP or MD 3070PT 2–8
d. Refill Transmission.....2–9
2–14. BREATHER
a. Location and Purpose.....2–9
b. Maintenance 2–9
2–15. CHECKING CLUTCH PRESSURES
a. Transmission and Vehicle Preparation.....2–10
b. Recording Data.....2–10
c. Comparing Recorded Data to Specifications 2–11
d. Pressure Specifications for all 3000 Product Family Transmissions 2–12
2–16. TRANSMISSION STALL TEST AND NEUTRAL COOL-DOWN CHECK
a. Purpose..... 2–13
b. Stall Testing Preparation 2–13
c. Performing a Transmission Stall Test . 2–14
d. Driving Transmission Stall Test..... 2–14
e. Driving Transmission Stall Testing Preparation..... 2–15
f. Performing a Driving Transmission Stall Test..... 2–15
g. Neutral Cool-Down Check Procedure..... 2–15
h. Transmission Stall Test Results 2–15
2–17. FLUID LEAK DIAGNOSIS
a. Finding the Leak..... 2–16
b. Powder Method 2–16
c. Black Light and Dye Method..... 2–16
d. Possible Points of Fluid Leaks and Their Causes..... 2–16
e. Repairing the Leak..... 2–17
2–18. OUTPUT FLANGE/YOKE AND OIL SEAL MAINTENANCE (All, Except 3700 SP and MD 3070PT)
a. Disassembly 2–17
b. Assembly 2–17
2–19. YOKE AND OIL SEAL MAINTENANCE (3700 SP and MD 3070PT)
a. Disassembly 2–19
b. Assembly 2–19
2–20. ON-VEHICLE MAINTENANCE..... 2–19

Section 3. GENERAL OVERHAUL INFORMATION

3–1. SCOPE 3–1
3–2. TOOLS AND EQUIPMENT
a. Improvised Tools and Equipment 3–1
b. Special Tools 3–1
c. Mechanic's Tools and Shop Equipment 3–1
3–3. REPLACEMENT PARTS
a. Ordering Information 3–5
b. Parts Normally Replaced at Overhaul .. 3–5
3–4. CAREFUL HANDLING..... 3–5
3–5. CLEANING AND INSPECTION
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

TABLE OF CONTENTS

3–5. CLEANING AND INSPECTION *(cont'd)*

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 3–8
p. Inspecting Retainer and Ball Assembly in Retarder Stator 3–9
q. Inspecting Sealing Surfaces 3–9

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 3–10
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 3–12
d. Removing the Transmission 3–12

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) 4–4
g. Removal of Transfer Case Module— 3700 SP or MD 3070PT 4–4
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) 4–7
l. Removal of Retarder Module (Units Built Beginning 1/98) and Units Starting With S/N 6510262246) 4–7
m. Removal of Transfer Case Adapter Housing Module 4–7
n. Removal of Rear Cover Module 4–7
o. Removal of Main Shaft Module 4–7
p. Removal of P2 Module, C5 Clutch Plates, and P1 Module 4–8
q. Removal of Front Support/Charging Pump Module and Rotating Clutch Module 4–9
r. Removal of C3/C4 Clutch Assembly From Main Housing Module 4–9

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

5–6. FRONT SUPPORT AND CHARGING OIL PUMP MODULE
a. Module Disassembly 5–5
b. Assembly of the Front Support 5–7
c. Assembly of the Pump Housing 5–9

5–7. ROTATING CLUTCH MODULE
a. Disassembly 5–9
b. Assembly 5–11

5–8. C3/C4 AND MAIN HOUSING MODULE
a. Disassembly 5–13
b. Assembly 5–15

5–9. MAIN SHAFT MODULE
a. Disassembly (3000 Product Family Models, Except 3500, MD 3560, 3700 SP, and MD 3070PT) 5–17
b. Assembly (3000 Product Family Models, Except 3500, MD 3560, 3700 SP and MD 3070PT) 5–18
c. Module Disassembly (3500 and MD 3560 Models) 5–18
d. Module Assembly (3500 and MD 3560 Models) 5–18
e. Module Disassembly (3700 SP and MD 3070PT Models) . .5–18
f. Module Assembly (3700 SP and MD 3070PT Models) . .5–18

5–10. P1 PLANETARY MODULE
a. Disassembly 5–19
b. Assembly 5–20

5–11. P2 PLANETARY MODULE
a. Disassembly 5–20
b. Assembly 5–21

5–12. RETARDER MODULE
a. Disassembly of Retarder Valve Body (Units Built Before 1/98) 5–22
b. Removal of Wiring Harness and Temperature Sensor 5–23
c. Disassembly of Retarder Housing 5–23
d. Disassembly of P3 Planetary Carrier Assembly 5–24
e. Disassembly of Retarder Stator Assembly 5–25
f. Assembly of Retarder Stator 5–25
g. Assembly of P3 Planetary Carrier Assembly 5–25
h. Assembly of Retarder Housing Assembly 5–26
i. Installation of Wiring Harness Assembly 5–27
j. Assembly and Installation of Retarder Control Body Assembly 5–28
k. Disassembly of Retarder Valve Body (Units Built Starting 1/98) 5–28
l. Disassembly of Retarder Housing 5–28
m. Disassembly of P3 Planetary Carrier Assembly 5–30
n. Disassembly of Retarder Stator Assembly 5–30
o. Assembly of Retarder Stator 5–30
p. Assembly of P3 Planetary Carrier Assembly 5–31
q. Assembly of Retarder Housing Assembly 5–31
r. Assembly and Installation of Retarder Control Body Assembly 5–32
s. Disassembly of Retarder Valve Body (Units Starting With S/N 6510262246) 5–33
t. Disassembly of Retarder Housing 5–33
u. Disassembly of P3 Planetary Carrier Assembly 5–34
v. Disassembly of Retarder Stator Assembly 5–35
w. Assembly of Retarder Stator 5–35

TABLE OF CONTENTS

5–12. RETARDER MODULE *(cont'd)*
- x. Assembly of P3 Planetary Carrier Assembly 5–35
- y. Assembly of Retarder Housing Assembly 5–36
- z. Assembly and Installation of Retarder Control Body Assembly 5–37

5–13. REAR COVER MODULE
- a. Disassembly 5–37
- b. Disassembly of the P3 Planetary Carrier Assembly 5–38
- c. Disassembly of the Rear Cover Assembly 5–38
- d. Assembly of Rear Cover 5–38
- e. Assembly of the P3 Planetary Carrier Assembly 5–39
- f. Completion of the Rear Cover Module 5–39

5–14. ADAPTER HOUSING AND P3 OVERHAUL
- a. Disassembly 5–40
- b. Assembly 5–41

5–15. SCAVENGE PUMP OVERHAUL
- a. Disassembly 5–42
- b. Assembly 5–44

5–16. TRANSFER CASE MODULE
- a. Disassembly of Transfer Case Module 5–44
- b. Disassembly of C6 Clutch 5–46
- c. Assembly of C6 Clutch 5–46
- d. Disassembly of C7 Clutch 5–47
- e. Assembly of C7 Clutch Housing 5–47
- f. Disassembly of Oil Pump 5–48
- g. Assembly of Oil Pump 5–48
- h. Disassembly of P4 Carrier 5–48
- i. Assembly of P4 Carrier 5–48
- j. Disassembly of Drive, Idler, and Driven Gears 5–49
- k. Assembly of Drive, Idler, and Driven Gears 5–49
- l. Disassembly of the Front Output Housing and Front Output Shaft ... 5–49
- m. Assembly of the Front Output Housing and Front Output Shaft 5–49
- n. Disassembly of the Rear Output Housing 5–50
- o. Assembly of the Rear Output Housing 5–50
- p. Output Housing Bearing Preload Procedures 5–50
- q. Disassembly of C7 Control Valve Body 5–51
- r. Assembly of C7 Control Valve Body Assembly 5–51
- s. Assembly of Transfer Case Module .. 5–51

5–17. CONTROL VALVE MODULE
- a. Removal of Filters 5–55
- b. Removal of Electrical Components and Sensors 5–55
- c. Disassembly of the Rotating Clutch Solenoid Body 5–55
- d. Disassembly of the Stationary Clutch Solenoid Body 5–56
- e. Disassembly of C6 Control Valve Body 5–56
- f. Disassembly of the Main Valve Body 5–56
- g. Disassembly of the Channel Plate 5–57
- h. Assembly of the Channel Plate 5–57
- i. Assembly of the Main Valve Body ... 5–57
- j. Assembly of C6 Control Valve Body .. 5–58
- k. Assembly of the Stationary Clutch Solenoid Body 5–58
- l. Assembly of the Rotating Clutch Solenoid Body 5–58
- m. Installation of the Wiring Harness Assembly and Cover Plate 5–59

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 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

6–2. ASSEMBLY OF TRANSMISSION *(cont'd)*

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
i. Main Shaft Selective Shim Measurement (Wide Ratio Models) . . 6–4
j. Main Shaft Selective Shim Measurement For 3700 SP and MD 3070PT 6–5
k. Installation of Retarder Module (Units Built Before 1/98) 6–6
l. Installation of Retarder Module (3000 Product Family Units Built Starting 1/98). 6–6
m. Installation of Rear Cover Module. 6–7
n. Installation of Transfer Case Adapter Housing. 6–8
o. Installation of Transfer Case Module. . . 6–8
p. Installation of the Converter Housing Module 6–9
q. Installation of the Torque Converter Module 6–9
r. Installation of the Control Module 6–11
s. Installation of Power Takeoff(s). 6–12
t. Installation of Integral Oil Cooler 6–12
u. Installation of Integral Retarder Sump Oil Cooler 6–13
v. Installation of Speed Sensors 6–14
w. Installation of Common Externally-Mounted Parts 6–14
x. Removal of Transmission From Repair Stand 6–15

Section 7. WEAR LIMITS AND SPRING DATA

7–1. WEAR LIMITS DATA
a. Maximum Variations 7–1
b. Cleaning and Inspection 7–1

7–2. SPRING DATA
a. Spring Replacement 7–1
b. Inspection 7–1

Section 8. CUSTOMER SERVICE

8–1. OWNER ASSISTANCE 8–1

8–2. SERVICE LITERATURE 8–2

LIST OF SUPPORTING ILLUSTRATIONS
(Back of Service Manual)

CROSS-SECTION VIEWS

1. 3000 Product Family Transmission
2. MD 3066 Transmission with Retarder (Prior To January 1, 1998)
3. 3000 Product Family (Except 3000 HS and 3700 SP) Transmission with PTO Provision and Retarder (Beginning January 1, 1998)
4. 3000 Product Family Transmission (Except 3000 HS and 3700 SP) with PTO Provision and Retarder (Starting with S/N 6510262246)
5. 3500 and MD 3560 Transmission
6. 3700 SP and MD 3070PT Transmission

EXPLODED VIEWS

7. Torque Converter Module
8,A. Converter Housing Module, Without PTO Provision
8,B. Converter Housing Module, With PTO Provision
9,A. Front Support and Oil Pump Module
9,B. Rotating Clutch Module
10,A. Main Housing Module
10,B. 3000 Product Family Main Shaft Module (Except 3500, 3700 SP, MD 3560, and MD 3070PT)
11,A. Main Shaft Module (3500 and MD 3560)
11,B. Main Shaft Module (3700 SP and MD 3070PT)
12,A. P1 Planetary Module
12,B. P2 Planetary Module
13,A. Retarder and P3 Planetary Module (Prior To 1/98)
13,B. Retarder and P3 Planetary Module (Beginning 1/98)
13,C. Retarder and P3 Planetary Module (Starting with S/N 6510262246)
13,D. Rear Cover and P3 Planetary Module
14,A. Transfer Case, Special Tools
14,B. Transfer Case, Special Disassembly/Assembly Instructions
15. Front Main Transfer Case
16. Rear Main Transfer Case
17,A. Control Valve Module (Prior To S/N 6510032369)
17,B. Control Valve Module (S/N 6510032369 To S/N 6510096670)
17,C. Control Valve Module (Starting With S/N 6510096671)
18,A. Output Flange and Yoke
18,B. Transfer Case Adapter Housing
19,A. Oil Cooler
19,B. Integral Sump Cooler
19,C Scavenge Pump
19,D Support Equipment

HYDRAULIC SCHEMATIC

20. 3000 Product Family—Neutral

NOTES

SECTION 1—GENERAL INFORMATION

1–1. SCOPE OF MANUAL

a. Content and Organization. This Service Manual describes overhaul procedures for 3000 Product Family automatic transmissions (Figures 1–1 through 1–8).

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

The 3000 Product Family consists of the following transmission series and models:

Highway Series

- 3000 HS

Rugged Duty Series

- 3000 RDS
- 3500 RDS

Emergency Vehicle Series

- 3000 EVS
- 3500 EVS

Motorhome Series

- 3000 MH

Truck Recreational Vehicle Series

- 3000 TRV
- 3200 TRV

Pupil Transportation/Shuttle Series

- 3000 PTS

Specialty Series

- 3200 SP
- 3500 SP
- 3700 SP

Bus Urban Series

- B 300
- B 400

T 200 Series

- T 250/ T 255/ T260/ T 265/ T 270/T 280

T 300 Series

- T 310/ T 325/ T 350

MD 3000 Series

- MD 3060/MD 3066/MD 3560 Models
- MD 3070PT Model

Power Takeoff (PTO) and output retarder options may be added to a base transmission model.

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 and exploded views are on fold-out 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 needed are shown in Figure 3–3 and Table 3–1 (Section 3 of this manual).
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.

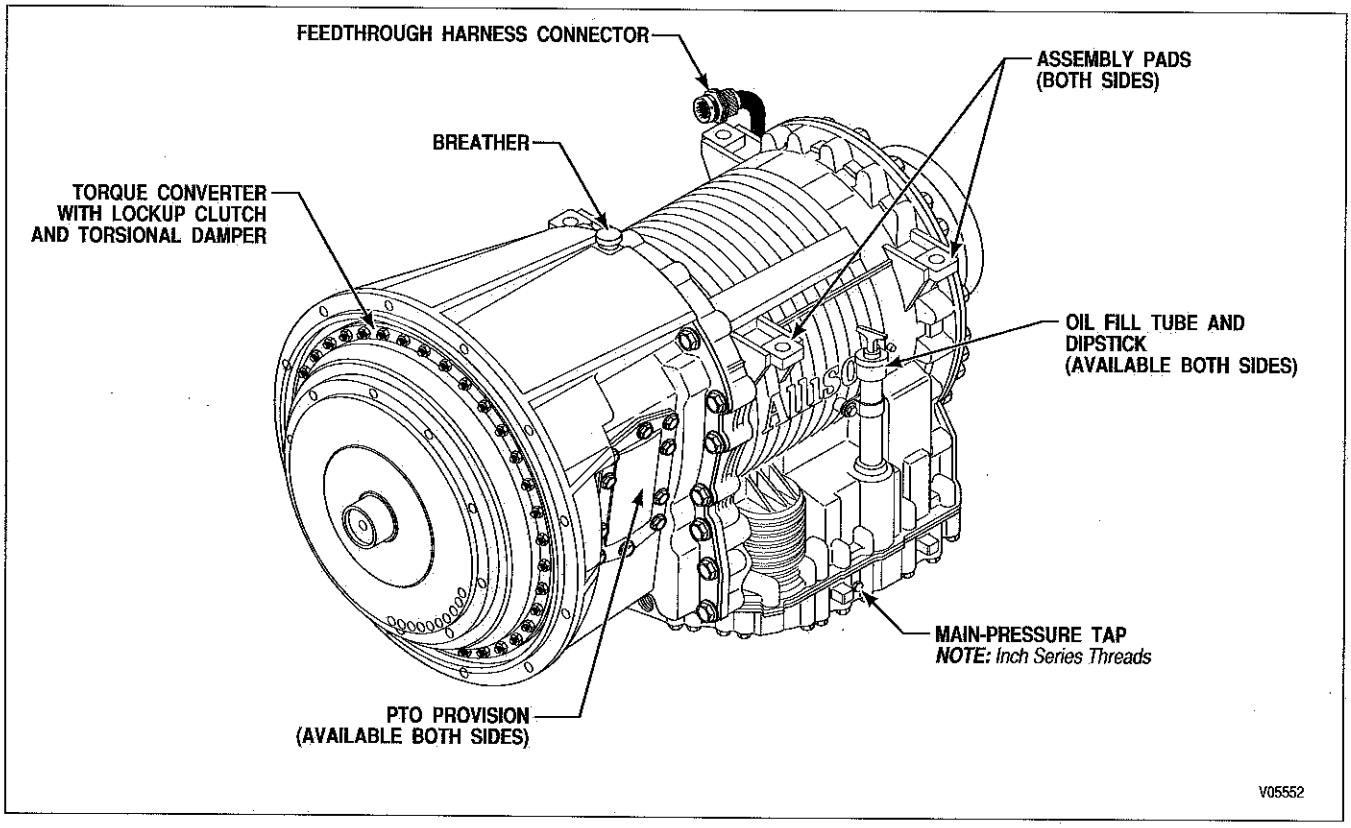

Figure 1–1. 3000 Product Family Transmission with PTO Provision—Left-Front View

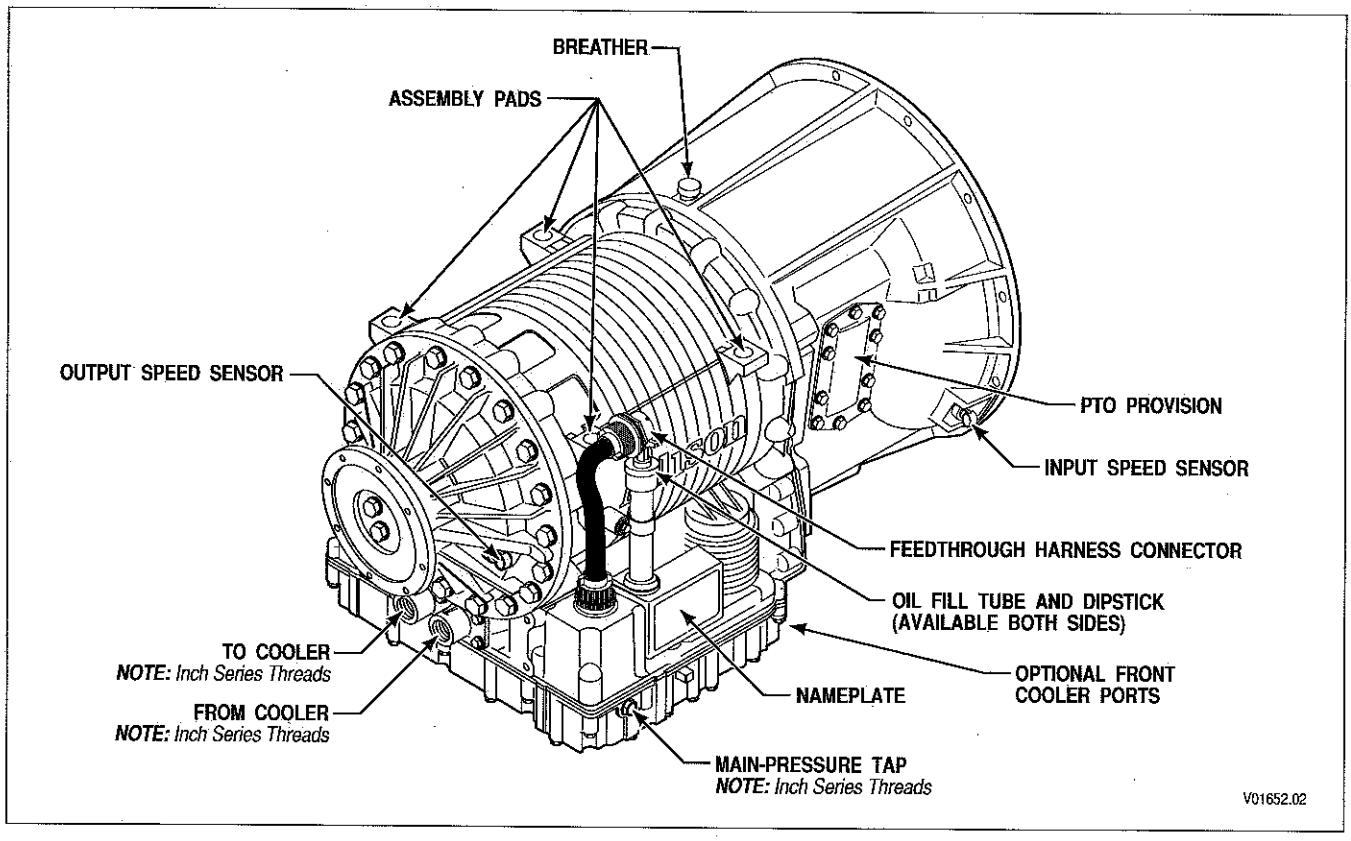

Figure 1–2. 3000 Product Family Transmission with PTO Provision—Right-Rear View

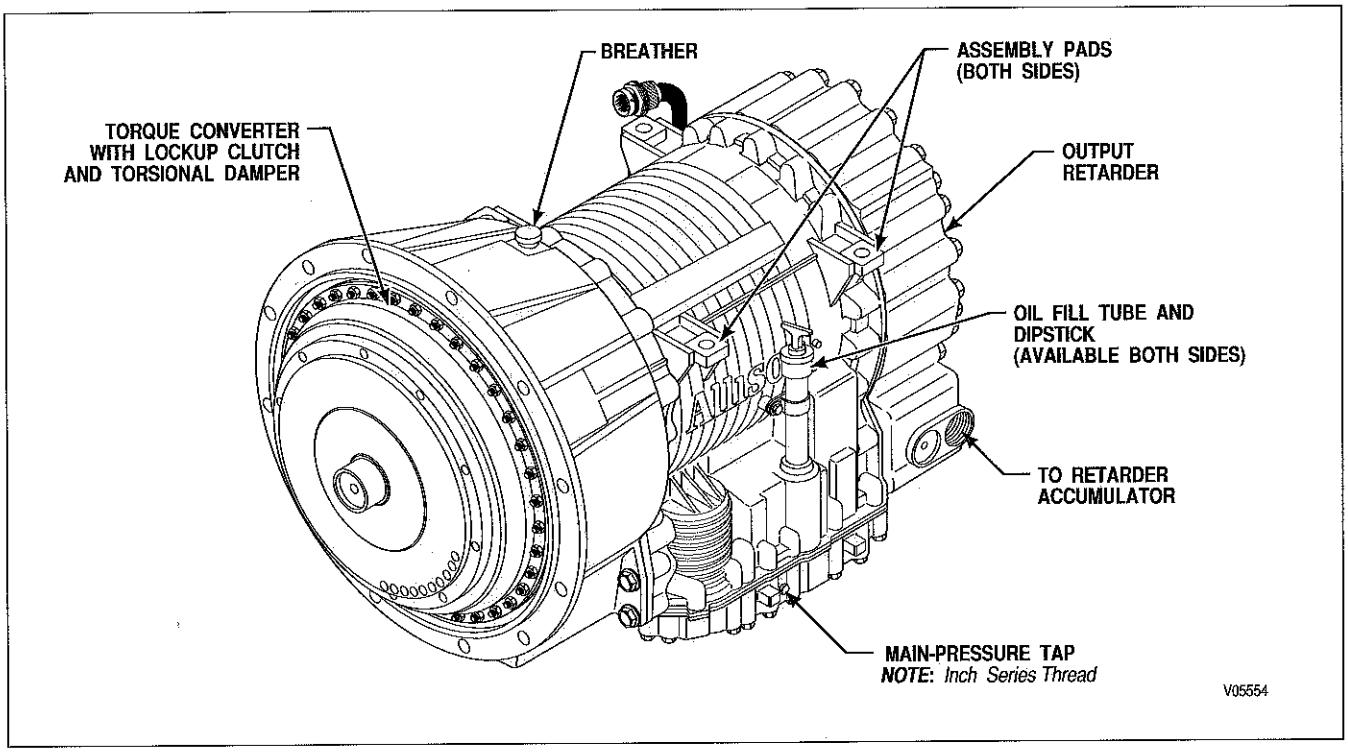

Figure 1–3. 3000 Product Family Transmission with Retarder (Prior To 1/98)—Left-Front View

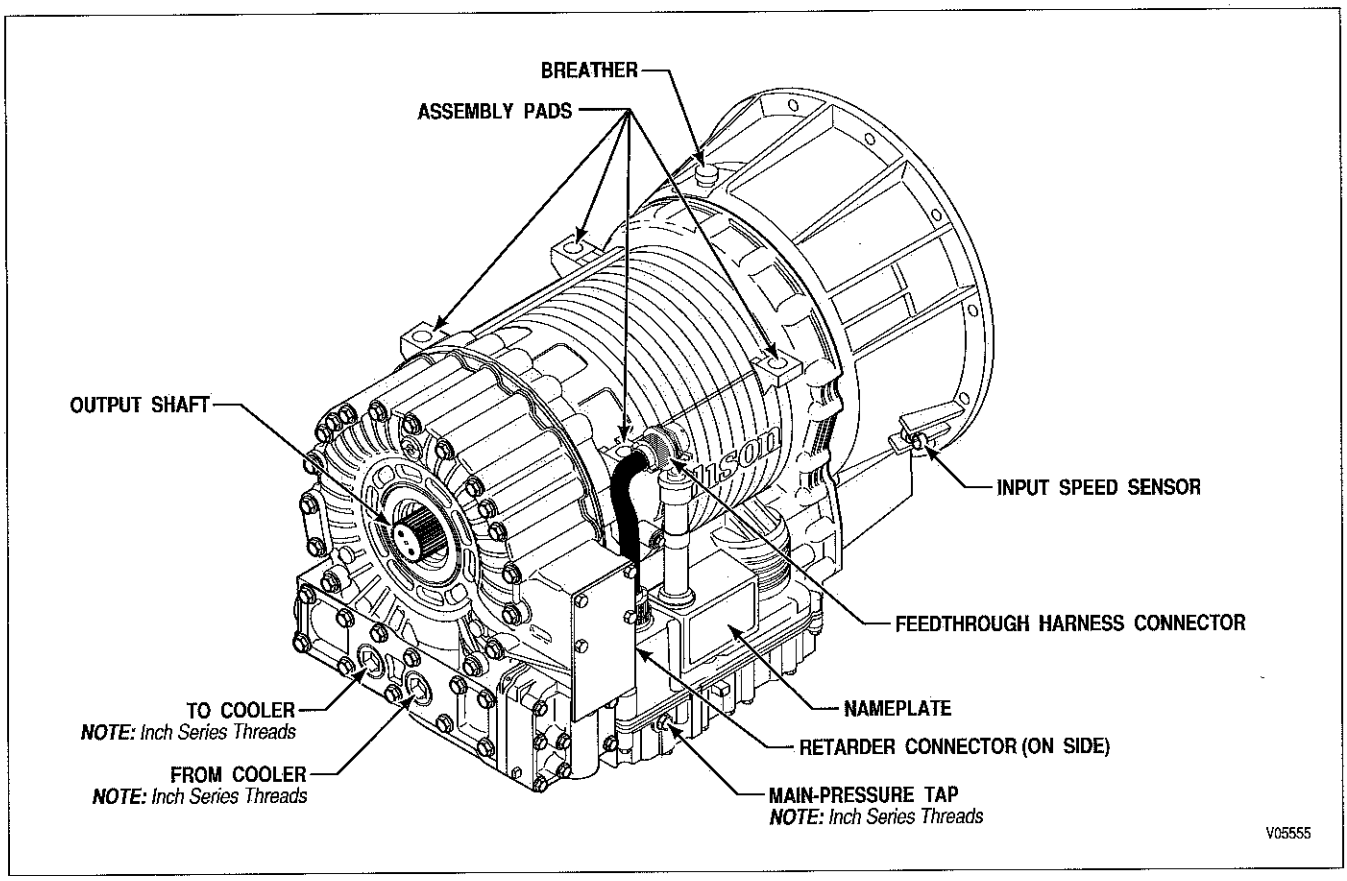

Figure 1–4. 3000 Product Family Transmission with Retarder (Prior To 1/98)—Right-Rear View

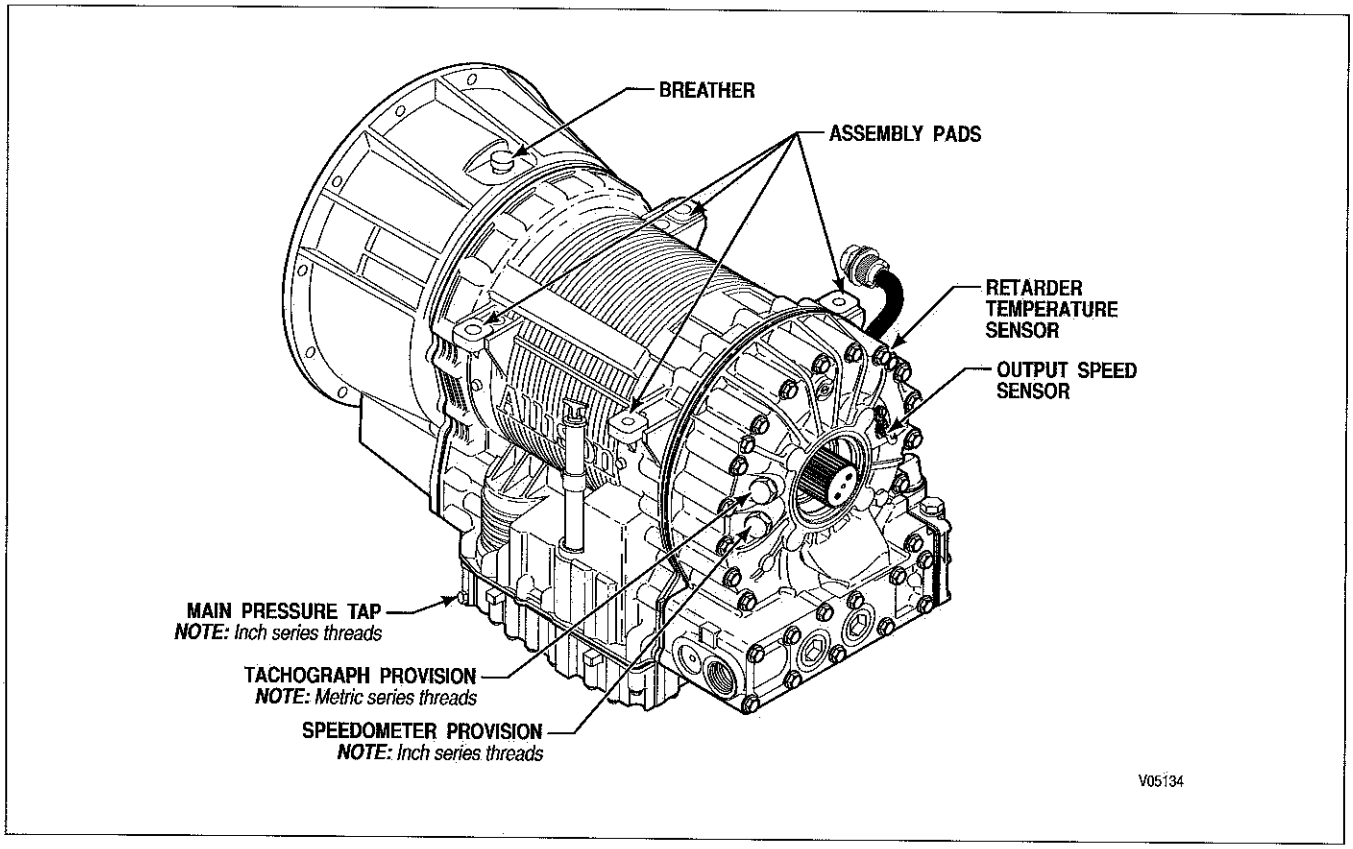

Figure 1–5. 3000 Product Family Transmission with Retarder (Beginning 1/98)—Left-Rear View

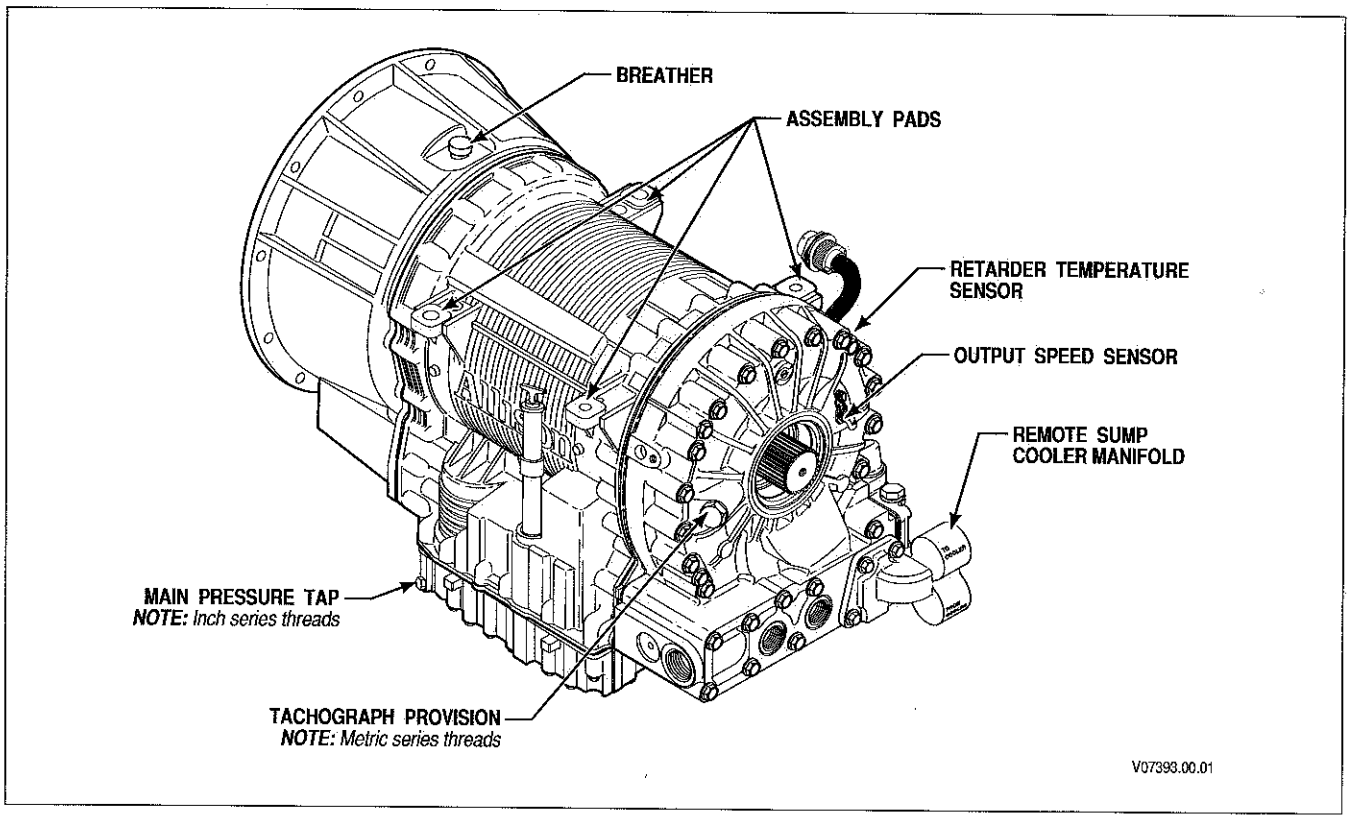

Figure 1–6. 3000 Product Family Transmission with Retarder (Starting with S/N 6510262246)

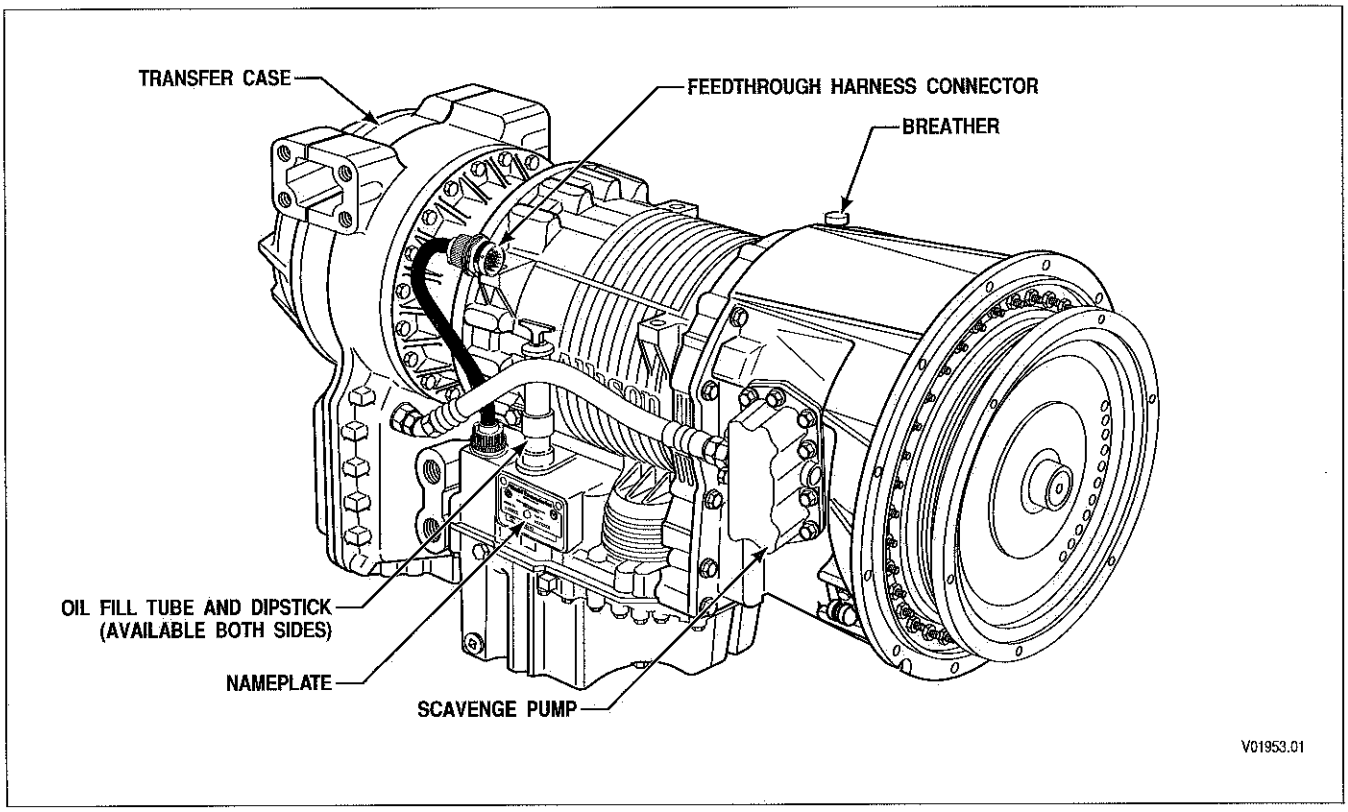

Figure 1–7. 3700 SP and MD 3070PT Transmission—Right Front-View

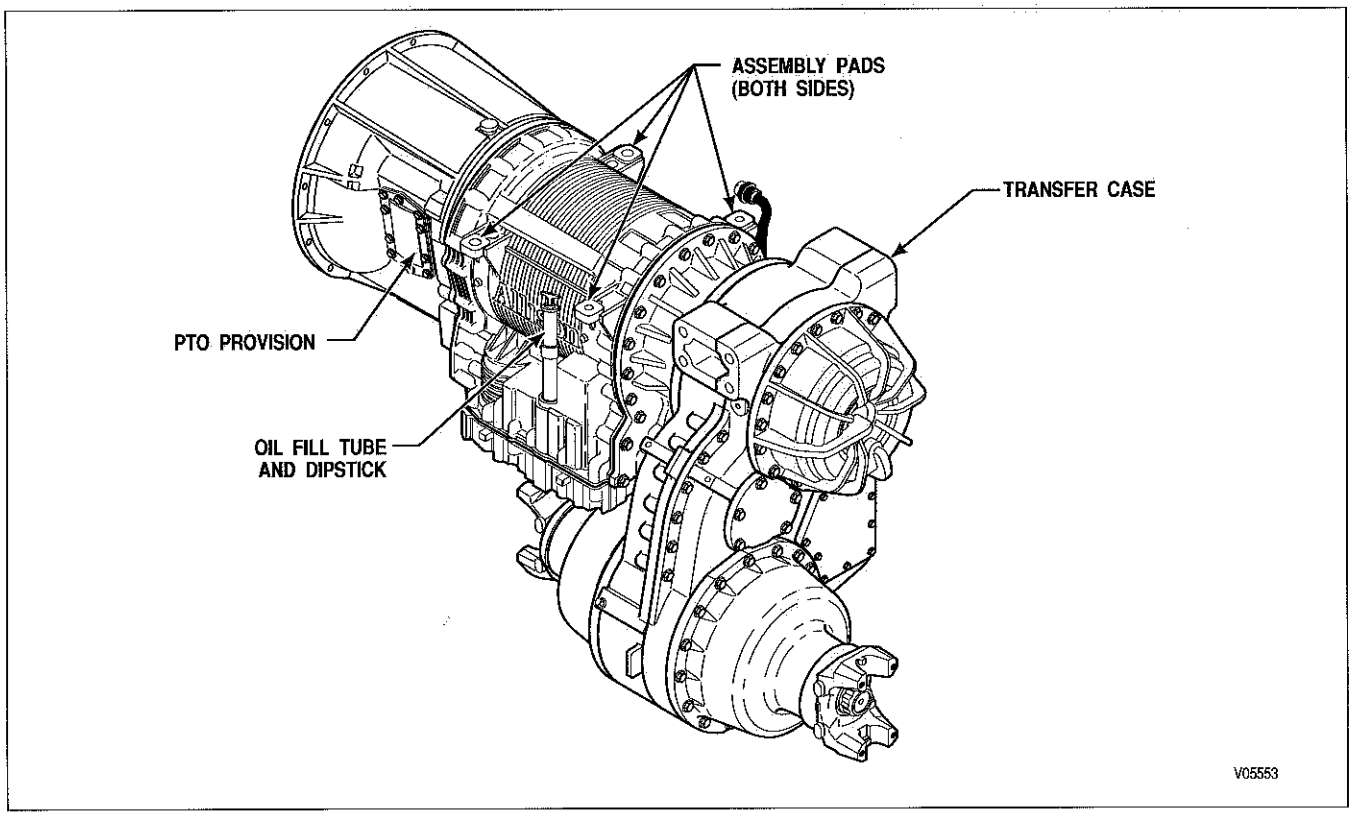

Figure 1–8. 3700 SP and MD 3070PT Transmission—Left-Rear View

1–2. SUPPLEMENTARY INFORMATION

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

1–3. ORDERING PARTS

a. Transmission Nameplate. The nameplate (Figure 1–9) is located on the right side of the transmission. The nameplate used prior to April 14, 1998, is imprinted with the transmission serial number, part number (assembly number), and model number. Use all three numbers when ordering replacement parts or requesting service information. The nameplate used beginning April 14, 1998, is imprinted with the transmission model, serial number, date code, TransID number, and engineering groups. Use all of these numbers when ordering replacement parts or requesting service information.

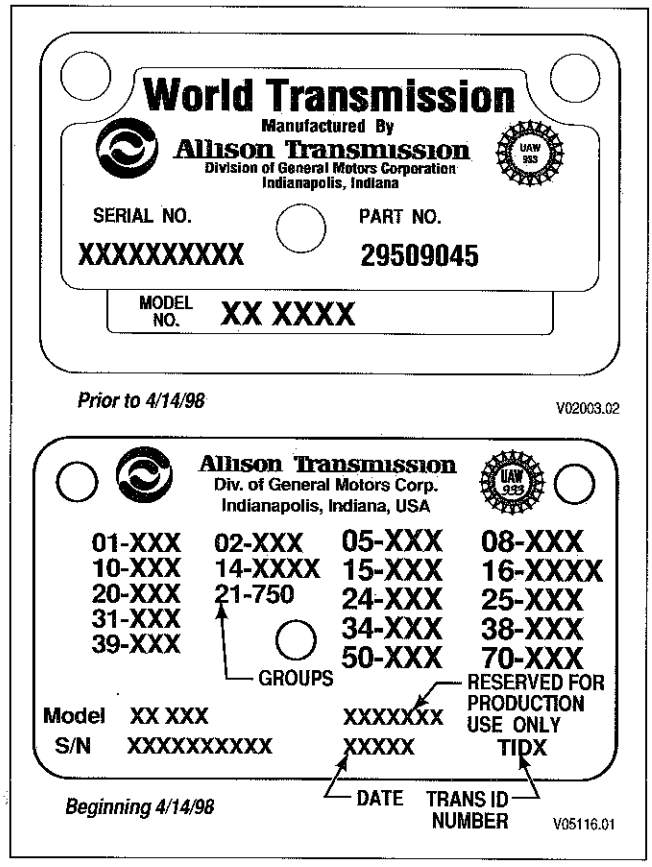

Figure 1–9. Transmission Nameplate

b. Parts Catalog. Replacement parts are listed in Parts Catalog PC2150EN. 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, Tractor, Etc. Service outlets can also be located on the Allison Transmission website at www.allisontransmission.com.

1–4. GENERAL DESCRIPTION

Allison 3000 Product Family transmissions are a complete transmission system that includes all hardware needed for vehicle applications.

a. Major Modules. 3000 Product Family transmissions contain the following major modules:

- Input Module
- Main Housing and Gear Module
- Control Module
- Output Module

b. Unique Features. Features unique to 3000 Product Family transmissions are:

- Four, five, or six forward speed configurations (Mechanically, every 3000 Product Family transmission model is a six speed transmission. Options are available to convert it to a four or five speed model.) The 3700 SP and MD 3070PT have a transfer case and seven forward speeds.
- 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

1–5. MAJOR MODULES

a. Input Module. The Input Module includes:

- Engine adaptation
- Torque converter
- Power takeoff gearing

b. Torque Converter

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

2. The available torque converter models are:

Torque Converter Model
TC 411
TC 413
TC 415
TC 417
TC 418
TC 419
TC 421

c. Power Takeoff Provision. Provision for a direct, engine-driven PTO is available at two positions.

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

- Main Housing
- Oil pump charging system
- Three planetary gear sets
- Two rotating clutches
- Three stationary clutches

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. Gearing Ratios. Gear ratios are listed in Table 1–1 following Paragraph 1–11.

g. Control System and Electronic Control Unit (ECU). 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:

- Electronic Control Unit (ECU)
- Control module
- Shift selector
- Sensors
- Wiring harness (customer-furnished)

The ECU 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.

h. Oil Filters. Two disposable external-access oil 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.

i. Transmission Fluid Coolers. The main housing accepts remote or integral transmission fluid coolers.

j. Output Configuration. The output module includes either an integral retarder and an output flange, or a rear cover that includes pads for mounting a parking brake and a flange or yoke. A yoke is not available with parking brake equipped transmissions. The MD 3070PT has a transfer case and adapter as an output module.

1–6. MODEL DESIGNATION CODE

The following explains the transmission model designation code stamped on the transmission nameplate for vocational models.

Highway Series	3000 HS
Rugged Duty Series	3000 RDS, 3500 RDS
Emergency Vehicle Series	3000 EVS, 3500 EVS
Motorhome Series	3000 MH
Truck Recreational Vehicle Series	3000 TRV, 3200 TRV
Pupil Transportation/ Shuttle Series	3000 PTS
Specialty Series	3200 SP, 3500 SP, 3700 SP
Bus Urban Series	B 300, B 400
T 200 Series	T 250/T 255/T 260/T 265/ T 270/T 280
T 300 Series	T 310/T 325/T 350

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. Seal all openings and the breather with moisture-proof tape.
3. Coat all exposed, unpainted surfaces with preservative grease such as petrolatum (MIL-C-11796, Class 2).
4. Remove the breather and spray 30 ml (one ounce) of VCI #10 (or equivalent) into the transmission through the breather hole. Also, spray 30 ml (one ounce) through the fill tube hole.
5. If additional storage time is required, repeat Steps (3) and (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) per 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 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).

1–9. RESTORING TRANSMISSION TO SERVICE

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

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

c. New Transmissions. If the transmission is new, drain the residual preservative fluid. Refill the transmission to the proper level with an Allison approved transmission fluid.

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

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.

1–10. OPERATING INSTRUCTIONS

Detailed transmission operation information is in the MD/HD/B Series Principles of Operation Manual, PO2454EN or WTEC III Operator's Manual, OM2995EN. Refer to the latest edition.

1–11. SPECIFICATIONS AND DATA

The following specifications and data provide a quick reference to the major characteristics of the transmission. More detailed information may be obtained from Sales Tech Data books.

Table 1–1. Specifications and Data Chart*

Range	3000 Product Family **	3500 MD 3560**	3700 SP MD 3070PT**
First	3.49:1	4.59:1	6.93:1
Second	1.86:1	2.25:1	4.18:1
Third	1.41:1	1.54:1	2.24:1
Fourth	1.00:1	1.00:1	1.69:1
Fifth	0.75:1	0.75:1	1.20:1
Sixth	0.65:1	0.65:1	0.90:1
Seventh	N/A	N/A	0.78:1
Reverse	–5.03:1	–5.00:1	–6.03:1

HYDRAULIC SYSTEM:

Fluid type . . . . . TranSynd™ (TES-295), MIL-L-2104, MIL-L-46167, MIL-PRF-21260, TES-389, C-4 (Refer to Section 2, Paragraph 2–10.)

Filters, main and cooler . . . . . Dual integral, replaceable cartridge type

Cooler . . . . . Remote mounted, optional integral

3000 Product Family SIZES:	Base Transmission	With PTO Provision	With Retarder	With PTO Provision and Retarder	3700 SP MD 3070PT
Length (transmission mounting face to end of output shaft)	715.3 mm† (28.16 in.) 719.4 mm†† (28.32 in.)	825.4 mm† (32.50 in.) 821.9 mm†† (32.36 in.)	718.6 mm (28.29 in.)	821.6 mm (32.35 in.)	1310.3 mm (51.58 in.)
Depth (centerline to lowest point)	327.7 mm (12.90 in.)	327.7 mm (12.90 in.)	327.7 mm (12.90 in.)	327.7 mm (12.90 in.)	555.3 mm (21.87 in.)
Dry Weight	243 kg (535 lb)	261 kg (575 lb)	279 kg (615 lb)	297 kg (655 lb)	530 kg (1170 lb)
Dry Weight with integral retarder sump cooler				336.5 kg (740 lb)	

(Refer to drawings AS66-001 through AS66-005 for more information.)

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

** Gear ratios do not include torque converter multiplication.

† Models prior to 1995

†† 1995 models

1–12. 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 equipments 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). Refer to the latest edition of WTEC II Troubleshooting Manual, TS2470EN, or WTEC III Troubleshooting Manual, TS2973EN, for detailed instructions regarding EMI problems.

SECTION 2—PREVENTIVE MAINTENANCE

2–1. SCOPE

Proper care and regular maintenance ensures the transmission meets 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 (refer to SIL 12-WT-02)
   - Loose, dirty, or improperly adjusted throttle sensor linkage
   - Damaged or loose fluid hoses
   - Worn, frayed, or improperly routed electrical harnesses
   - Dented, 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 check the fluid level from either a full-function pushbutton or a lever shift selector. When a WTEC II version strip type pushbutton selector is used, the OLS fluid level information can be read from the strip type pushbutton selector. There is no fluid level reading capability for a WTEC III strip type pushbutton selector; use the Allison DOC™ 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 check the transmission fluid level with the dipstick, the transmission fluid must be at operating temperature.**

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c. Electronic Controls and Protection Circuits. The 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. Check 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 WTEC II 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. The WTEC III full-function pushbutton and lever selectors display one character at a time.

---

a. Fluid Level Check Procedure

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

2. On the full-function pushbutton shift selector, simultaneously press the **UP** (↑) and **DOWN** (↓) arrow buttons once.

3. On the lever shift selector, press the **DISPLAY MODE** pushbutton once.

NOTE:

The ECU 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.**

The delayed fluid level display signal for a WTEC II selector is a flashing indicator under the SELECT display and a countdown from 8 to 1 under the MONITOR display. For a WTEC III selector, the delayed fluid level display is a countdown from 8 to 1 in the display window.

4. Correct fluid level is reported when "O L" is displayed ("O L" indicates the Oil Level Check Mode), followed by "O K". The "O K" display indicates the fluid level is within the "O K" zone. The sensor display and the transmission dipstick may not agree exactly because the oil level sensor compensates for fluid temperature. *Example (WTEC II selector)*: "O L O K"—indicates correct fluid level. (For a WTEC III selector, the display would be "o,L,o,K.")

5. 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 of quarts of fluid the transmission requires. Confirm a low fluid level condition by making a manual fluid level check. *Example (WTEC II selector)*: "O L, L O, 0 2"—indicates 2 additional quarts of fluid will bring the fluid level within the middle of the "O K" zone. (For a WTEC III selector, the display would be "o,L,L,o,2.")

6. High fluid level is reported when "O L" is displayed, followed by "H I". "H I" indicates high fluid level and the number of quarts the transmission is overfilled. *Example (WTEC II selector)*: "O L, H I 0 1"—indicates 1 quart of fluid past the full level. (For a WTEC III selector, the display would be "o,L,H,I,1.")

CAUTION:

Low or high fluid level can cause overheating and irregular shift patterns. These conditions can damage the transmission if not corrected.

7. An Invalid for Display condition is reported when "O L" is displayed, followed by "– –" and a number display. The displayed number is a fault code, and indicates improper conditions or a system malfunction. *Example (WTEC II selector)*: "O L,– –,70"—indicates an Invalid for Display condition and fault code 70. (For a WTEC III selector, the display would be "o,L,–,7,0.")

8. Invalid for Display is activated when conditions do not allow the fluid level to be checked. 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. (Check the Allison Transmission website www.allisontransmission.com or a telephone directory for the Allison Transmission service outlet nearest you.)

Code	Cause of Code
"O L – – 5 0"	— Engine speed (rpm) too low
"O L – – 5 9"	— Engine speed (rpm) too high
"O L – – 6 5"	— **N** (Neutral) must be selected
"O L – – 7 0"	— Sump fluid temperature too low
"O L – – 7 9"	— Sump fluid temperature too high
"O L – – 8 9"	— Output shaft rotation
"O L – – 9 5"	— Sensor failure

NOTE:

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

9. To exit the oil level display mode (WTEC II selector):
   - Pushbutton shift selector—press the **R** (Reverse), **N** (Neutral), or **D** (Drive) pushbutton.
   - Lever shift selector—press the **DISPLAY MODE** pushbutton two times or move the lever.

10. To exit the oil level display mode (WTEC III selector):

    - Pushbutton shift selector—press the **N** (Neutral) pushbutton or press **UP** (↑) and **DOWN** (↓) arrow pushbuttons simultaneously two times.
    - Lever shift selector—press the **DISPLAY MODE** pushbutton two times or move the lever.

2–5. ELECTRONIC FLUID LEVEL CHECK (WHEN AN OPTIONAL OLS IS PRESENT—STRIP TYPE PUSHBUTTON SHIFT SELECTORS)

NOTE:

The WTEC II strip type pushbutton shift selectors can give fluid level information. The WTEC III strip type pushbutton selector has no display capability. Fluid level must be checked manually or with a diagnostic tool.

a. Fluid Level Check Procedure (WTEC II)

1. Park the vehicle on a level surface and shift to **N** (Neutral). Apply the parking brake.
2. Activate switch provided by the vehicle manufacturer to initiate display of fluid level information.

NOTE:

The ECU 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.**

The delayed fluid level display signal for a WTEC II selector is a flashing indicator under the SELECT display and a countdown from 8 to 1 under the MONITOR display.

3. Correct fluid level is indicated by a flashing red LED on the **N** (Neutral) pushbutton. When this occurs, the fluid level is within the "OK" zone. The selector display and the transmission dipstick may not agree exactly because the oil level sensor compensates for fluid temperature.
4. Low fluid level is indicated by a flashing red LED on the **R** (Reverse) pushbutton and a tone. The number of times the tone sounds is the number of quarts of fluid which need to be added to produce an "OK" level. The **N** (Neutral) pushbutton red LED will remain on during this display.
5. High fluid level is indicated by a flashing red LED on the **D** (Drive) pushbutton and a tone. The number of times the tone sounds is the number of quarts of fluid which need to be drained to produce an "OK" level. The **N** (Neutral) pushbutton red LED will remain on during this display.

CAUTION:

Low or high fluid level can cause overheating and irregular shift patterns. These conditions can damage the transmission if not corrected.

6. An Invalid for Display condition is indicated by flashing red LEDs in a repeated sequence from **R** (Reverse) down through the lowest **D** (Drive) range while the **N** (Neutral) red LED remains constantly illuminated. A constant tone sounds until the fluid level mode is exited. (Reasons for Invalid For Display are the same as those in the chart in Paragraph 2–4**a**(8).)
7. To exit the fluid level display mode, press any pushbutton or deactivate the switch provided by the vehicle manufacturer that was used to enter the fluid level display mode in Step 2.

b. Fluid Level Check Procedure (WTEC III)

1. Connect the Allison DOC™ to the diagnostic connector on the wiring harness and follow the instructions in the Allison DOC™ User's Guide.
2. Read the fluid level.
3. An Invalid for Display condition is indicated by a message on the Allison DOC™. (Reasons

for Invalid For Display are the same as those in the chart in Paragraph 2–4 above under "Cause of Code.")

2–6. 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:

- **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.**

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.

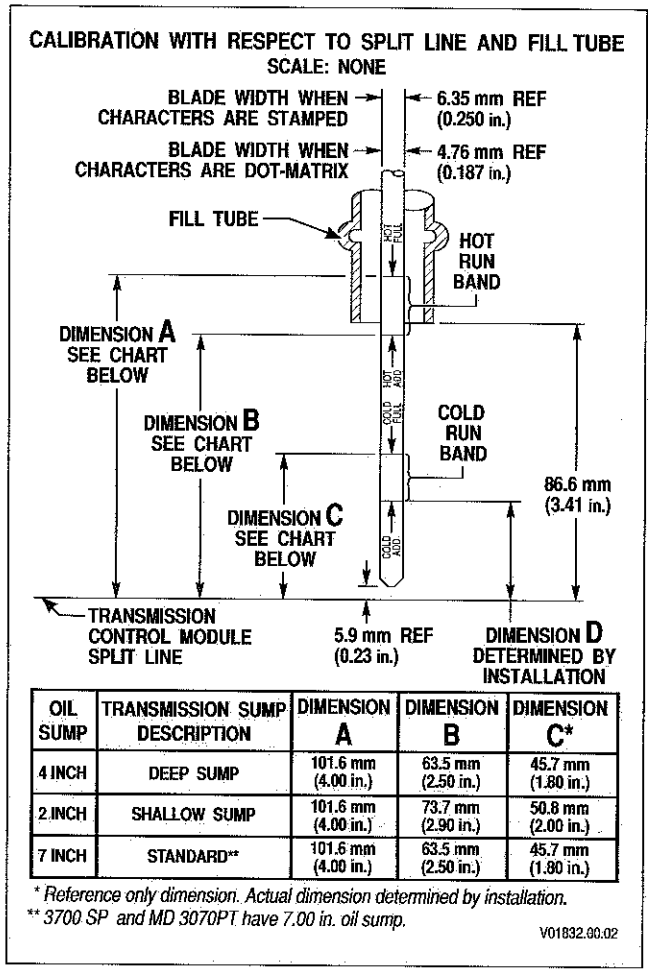
b. Consistency of Readings. Always check the fluid level reading at least twice using the following procedure. Consistency (repeatable readings) is important to maintaining proper fluid level. If inconsistent readings persist, check the transmission breather to be sure it is not clogged. If readings are still inconsistent, contact your nearest Allison distributor or dealer.

2–7. COLD CHECK *(Figure 2–1)*

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.

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.



OIL SUMP	TRANSMISSION SUMP DESCRIPTION	DIMENSION A	DIMENSION B	DIMENSION C*
4 INCH	DEEP SUMP	101.6 mm (4.00 in.)	63.5 mm (2.50 in.)	45.7 mm (1.80 in.)
2 INCH	SHALLOW SUMP	101.6 mm (4.00 in.)	73.7 mm (2.90 in.)	50.8 mm (2.00 in.)
7 INCH	STANDARD**	101.6 mm (4.00 in.)	63.5 mm (2.50 in.)	45.7 mm (1.80 in.)

** Reference only dimension. Actual dimension determined by installation.*
*** 3700 SP and MD 3070PT have 7.00 in. oil sump.*

V01832.00.02

Figure 2–1. Fluid Dipstick Markings

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 about one minute. Shift to **D** (Drive) and then to **R** (Reverse) to clear the hydraulic system of air. Then shift to **N** (Neutral) and allow the engine to remain at 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. Check the fluid level. Repeat the check procedure to verify the reading.
5. If the fluid level is within the "COLD RUN" band, the transmission can be operated until the fluid is hot enough to perform a "HOT RUN" check. If the fluid level is not within the "COLD RUN" band, add or drain as necessary

to bring the fluid level to the middle of the "COLD RUN" band.

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

2–8. 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:

- **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.**

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. 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, check 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 block 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. Check fluid level. Repeat the check procedure to verify the reading.
5. If the fluid level is not within the "HOT RUN" band, add or drain as necessary to bring the fluid level to within the band. Safe operating level is within the "HOT RUN" band on the dipstick (refer to Figure 2–1).

2–9. 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.

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

2–10. FLUID RECOMMENDATIONS

1. The hydraulic fluids (oils) used in Allison transmissions directly affect transmission performance, reliability, and durability. Use a TES-295 fluid such as TranSynd™ or a TES-389 fluid for regular duty, on-highway applications.
2. TranSynd™ and some TES-389 fluids are also qualified as Type C-4 fluids. To make sure your fluid is qualified for use in Allison transmissions, check for a TranSynd™ label or a TES-389 fluid or Type C-4 fluid license, or approval number on the fluid container, or consult the lubricant manufacturer. Consult your Allison Transmission dealer or distributor before using any fluid types except those fluids qualified for use in Allison transmissions.

CAUTION:

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

3. When choosing the optimum viscosity grade of fluid to use, duty cycle, preheat capabilities, and/or geographical location must be taken into consideration. Table 2–1 lists the minimum fluid temperatures at which the transmission may be safely operated. Preheat

with auxiliary heating equipment or by running the equipment or vehicle with the transmission in neutral for a minimum of 20 minutes before attempting range operation.

Table 2–1. Transmission Fluid Operating Temperature Requirements

(Ambient Temperature Below Which Preheat Is Required)

Viscosity Grade	Celsius	Fahrenheit
0W-20 or TranSynd™*	–30	–22
TES-389	–27	–17
SAE 10W	–20	–4
SAE 15W-40	–15	5
SAE 30	0	32
SAE 40	10	50

* "Arctic" as defined by MIL-L-46167B

2–11. FLUID AND FILTER CHANGE INTERVAL

CAUTION:

Transmission fluid and filter change frequency is determined by the severity of transmission service. More frequent changes may be necessary than recommended in the general guidelines when operating conditions create high levels of contamination or overheating.

a. Fluid And Filter Changes. Change the main filter at the first 8 000 km (5,000 miles) or 200 hours, then follow the recommendation in Table 2–2. Table 2–2 is given only as a general guide for fluid and filter change intervals using 100 percent TranSynd™ and Allison Transmission Gold series filters. Refer to SIL 10-TR-99.

Table 2–2. Transmission Fluid and Filter Change

Transmission	Fluid	Main/Lube Filter
General Vocation	240 000 km (150,000 miles) 48 month 4000 hours*	120 000 km (75,000 miles) 36 months 3000 hours*
Severe Vocation	120 000 km (75,000 miles) 36 months 3000 hours*	120 000 km (75,000 miles) 36 months 3000 hours*

* Whichever occurs first.

CAUTION:

Transmission fluid and filters must be changed whenever there is evidence of dirt or a high temperature condition. A high temperature condition is indicated when the transmission fluid is discolored, has a strong odor or has exceeded oil analysis limits shown in Table 2–3.

b. Fluid Analysis. Transmission protection and fluid change intervals can be optimized by monitoring fluid oxidation according to the tests and limits shown in Table 2–3. Consult your local telephone directory for fluid analysis firms. For consistent and accurate fluid analysis, use only one fluid analysis firm. Refer to the Technician's Guide for Automatic Transmission Fluid, GN2055EN, for additional information.

Table 2–3. Fluid Oxidation Measurement Limits

Test	Limit
Viscosity	±25% change from new fluid
Total Acid Number	+3.0* change from new fluid
Water	0.2% by volume maximum

* mg of KOH to neutralize a g of fluid.

2–12. FLUID CONTAMINATION

CAUTION:

Upon discovering transmission fluid contamination, if there is any doubt about the total clean-up of the cooler, replace the cooler. Contamination remaining in the cooler can re-contaminate the transmission fluid.

a. Water

1. At each fluid change, examine the drained fluid for evidence of dirt or water. A normal amount of condensation will appear in the fluid during operation.

2. Obvious water contamination of the transmission fluid requires inspecting and pressure testing the cooler (heat exchanger) for leaks between the water and fluid areas. Transmission fluid in the water side of the cooler (heat exchanger) is another sign of a leak.

NOTE:

Cooler water can also be contaminated by engine oil. Be sure to locate the correct source of cooler water contamination.

b. Engine Coolant. Engine coolant (ethylene glycol) in the transmission hydraulic system requires immediate action to prevent malfunction and possible serious damage. The transmission must be completely disassembled, inspected, and cleaned. Remove all traces of the coolant and varnish deposits resulting from engine coolant contamination. Replace friction clutch plates, seals, gaskets, and bearings contaminated with engine coolant.

c. Metal

CAUTION:

If excessive metal contamination has occurred, replace the oil cooler and visually inspect all bearings in the transmission.

Visible metal particles in the transmission fluid (except for the minute particles normally trapped in the oil filter) may indicate internal transmission damage. When these particles are found in the sump, the transmission must be disassembled and closely inspected to find the source. Metal contamination requires complete transmission disassembly. Clean all internal and external hydraulic circuits, cooler, and all other areas where the particles could lodge.

2–13. FLUID AND FILTER CHANGE PROCEDURE

NOTE:

If only filters are being replaced, do not drain the fluid.

a. Drain Fluid

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.

1. Drain the transmission fluid when the fluid is at operating temperature—71–93°C (160–200°F). Hot fluid flows quicker and drains more completely.
2. For all models except 3700 SP and MD 3070, remove drain plug assembly 11 (Figure 2–2) from the control module and allow the fluid to drain into a suitable container. For a 3700 SP or MD 3070, remove drain plug assemblies 8 and 11 (Figure 2–3) from the control module and transfer case. Allow the fluid to drain into suitable containers.
3. Examine the fluid as described in Paragraph 2–11.

b. Replace Filters—3000 Product Family Transmission *(Figure 2–2)*

CAUTION:

Do not interchange filters for the deep and shallow sump. Installation of the wrong filter can cause damage to the transmission.

1. To replace the oil filters on units prior to S/N 6510069120, remove twelve bolts 5, two filter covers 4, two O-rings 2, two square cut seals 3, and two filters 1 from the bottom of the control module.
2. When reinstalling parts on units prior to S/N 6510069120, lubricate and install an O-ring 2 on each cover 4. Install a square cut seal 3 on each cover 4. Lubricate filter O-ring and install filters 1 onto covers 4.
3. To replace the oil filters on units beginning with S/N 6510069120, remove twelve bolts 5, two filter covers 4, two gaskets 8, two O-rings 7, two O-rings 6 and two filters 1 from the bottom of the control module.
4. When reinstalling parts on units beginning with S/N 6510069120, lubricate and install new O-ring 6 and 7 on each cover 4. Lubricate O-ring inside filter 1 and push filter onto each cover 4. Install new gasket 8 on each cover 4 and align holes in gasket with holes in cover.

CAUTION:

Do not use the bolts to draw filter covers to the sump. This can damage the covers, seals, or sump.

5. Install filter 1 and cover 4 assemblies into the filter compartment. Index each filter/cover assembly to the holes in the channel plate/sump. Push the filter/cover assemblies in by hand to seat the seals.

6. Install six bolts 5 into each cover 4 and tighten them to 51–61 N·m (38–45 lb ft).

c. Replace Filters—3700 SP or MD 3070PT Transmission *(Figure 2–3)*

CAUTION:
Do not interchange filters for the deep and shallow sump. Installation of the wrong filter can cause damage to the transmission.

1. To replace the oil filters on units prior to S/N 6510069120, remove twelve bolts 5, two filter covers 4, two O-rings 2, two square cut seals 3, and two filters 1 from the bottom of the control module.

2. When reinstalling parts on units prior to S/N 6510069120, lubricate and install an O-ring 2 on each cover 4. Install a square cut seal 3 on each cover 4. Lubricate filter O-ring and install filters 1 onto covers 4.

3. To replace the oil filters on units beginning with S/N 6510069120, remove 12 bolts 5, two filter covers 4, two gaskets 14, two O-rings 13, and two O-rings 12.

4. When reinstalling parts on units beginning with S/N 6510069120, lubricate and install new O-rings 12 and 13 on cover 4. Lubricate O-ring inside filter 1 and push filter onto cover 4. Install new gasket and align holes with those in cover 4.

CAUTION:
Do not use the bolts to draw filter covers to the sump. This can damage the covers, seals, or sump.

5. Install filter 1 and cover 4 assemblies into the filter compartment. Index each filter/cover assembly to the holes in the channel plate/sump. Push the filter/cover assemblies in by hand to seat the seals.

6. Install six bolts 5 into each cover 4 and tighten them to 51–61 N·m (38–45 lb ft).

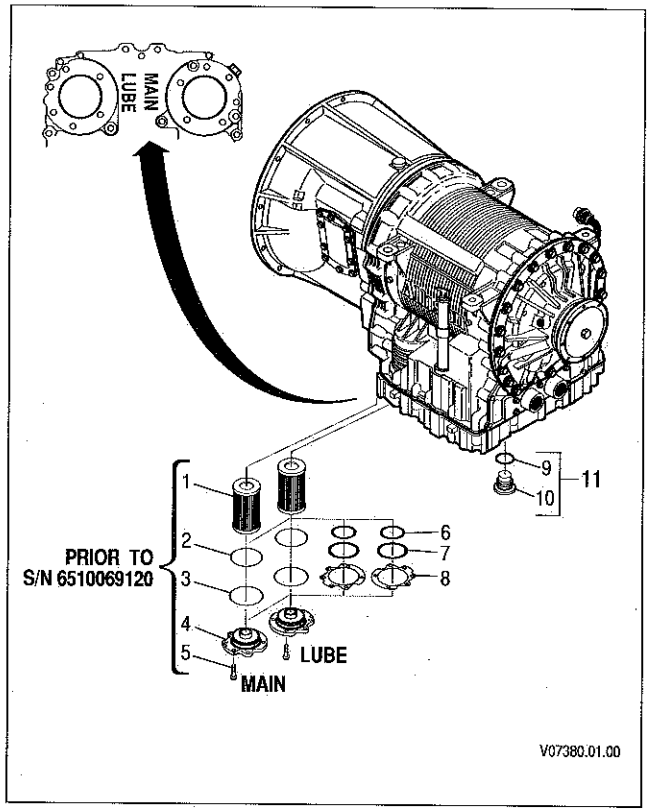


Figure 2–2. Filter Change

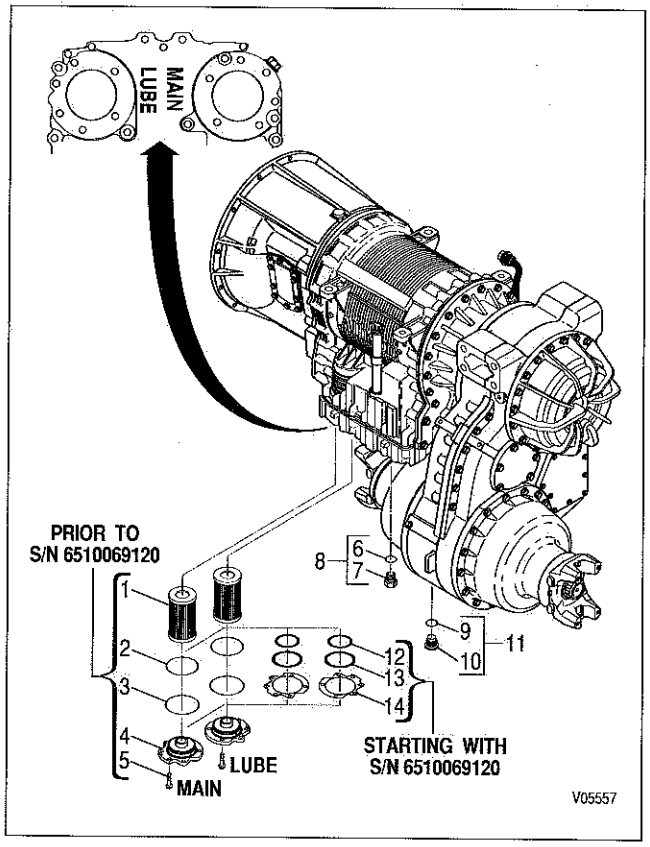


Figure 2–3. 3700 SP and MD 3070PT Filter Change

d. Refill Transmission

1. For all models, except the 3700 SP and MD 3070PT, and if removed, inspect drain plug assembly 11 (Figure 2–2) and replace O-ring 9 or plug 10 as required. For 3700 SP and MD 3070PT models, remove and inspect drain plug assemblies 8 and 11 (Figure 2–3) and replace O-rings or plugs as required.

NOTE:

Whenever metallic particles larger than those normally found in filters are present on plug 10, the transfer case must be disassembled to find and repair the source of the contamination.

2. Tighten drain plugs to 25–32 N·m (18–24 lb ft) after inspection is completed.
3. After refill, check the fluid level (refer to Paragraphs 2–6 and 2–7).

NOTE:

When the transmission is not completely disassembled or when just filters or fluid is changed, some fluid will remain in the transmission so that refill quantity will be less than for a dry unit.

4. Refer to Table 2–4 for typical initial fill (dry unit) and for fluid amounts required to fill coolers and the remote retarder accumulator.

Table 2–4. Fluid Fill Quantities

Item Being Filled		Initial Fill*
3000 Product Family	4.00 inch Sump	27.0 liters 29.0 quarts
3000 Product Family	2.00 inch Sump	25.0 liters 26.0 quarts
3700 SP and MD 3070PT	7.00 inch Sump	37.0 liters 39.0 quarts
Additional Fill For Cooler*		
Direct-mount	Non-retarder	1.0 liters 1.1 quarts
Direct-mount	Retarder	2.5 liters 2.6 quarts

Table 2–4. Fluid Fill Quantities *(cont'd)*

Item Being Filled		Initial Fill*
Additional Fill For Retarder Accumulator*		
Remote	Accumulator	1.2 liters 1.3 quarts

* Does not include hoses or fittings.

2–14. BREATHER

a. Location and Purpose. The breather is located on top of the transmission converter housing. It serves to prevent air pressure buildup within the transmission and must be kept clean and open.

b. Maintenance

1. The amount of dust and dirt encountered will determine the frequency of breather cleaning. Use care when cleaning the transmission exterior. Spraying steam, water, or cleaning solution directly at the breather can force the water or cleaning solution into the transmission.
2. Always use a properly sized wrench to remove or replace the breather. Pliers or a pipe wrench can crush or damage the stem and produce metal chips which could enter the transmission.

2–15. CHECKING CLUTCH PRESSURES

Measuring individual clutch pressures helps to determine if a transmission malfunction is due to a mechanical or an electrical problem. Properly making these pressure measurements requires transmission and vehicle (or test stand) preparation, recording of data, and comparing recorded data against specifications provided. These instructions are for all 3000 Product Family transmissions.

NOTE:

Determine if there are diagnostic codes set which are related to the transmission difficulty you are evaluating. Proceed to make mechanical preparations for measuring clutch pressures after codes have first been evaluated.

a. Transmission and Vehicle Preparation

1. Remove the plugs from the pressure tap locations where measurement is desired (refer to Figure 2–4).

CAUTION:

Be sure that the hydraulic fittings have the same thread as the plugs removed (7/16-20 UNF-2A). Fittings must be straight thread, O-ring style. Failure to do this will result in damage to the control module.

2. Install hydraulic fittings suitable for attaching pressure gauges or transducers.

3. Connect pressure gauges or transducers. Pressure gauge set J 26417-A is available for this purpose. See Table 2–6 for pressure levels expected.

4. Be sure that engine speed can be monitored. (The Allison DOC™ may be used for this purpose.)

5. Be sure that transmission sump fluid temperature can be measured. (The Allison DOC™ may be used for this purpose.)

6. Be sure that the transmission has enough fluid for cold operation until an operating temperature fluid level can be set.

7. Bring the transmission to normal operating temperature of 71–93°C (160–200°F). Inspect for fluid leaks in the added pressure gauge/transducer lines. Repair leaks as needed. Be sure that fluid level is correct.

b. Recording Data

1. Use the Allison DOC™ diagnostic tool, which allows selecting individual ranges so that clutch pressures can be measured with the vehicle stationary. Consult the Allison DOC™ User's Guide for Action Request and select Clutch Test Mode. Follow instructions to select individual ranges. Record pressures in the desired range(s).

NOTE:

Measure lockup clutch pressure by driving the vehicle in a range where lockup can be obtained. Record the pressure values at the engine speed and sump fluid temperature values shown in Table 2–5. The lockup clutch is functioning correctly when engine speed and turbine speed values are equal as recorded from the Allison DOC™.

2. Consult Table 2–5 and locate the transmission model that you are testing.

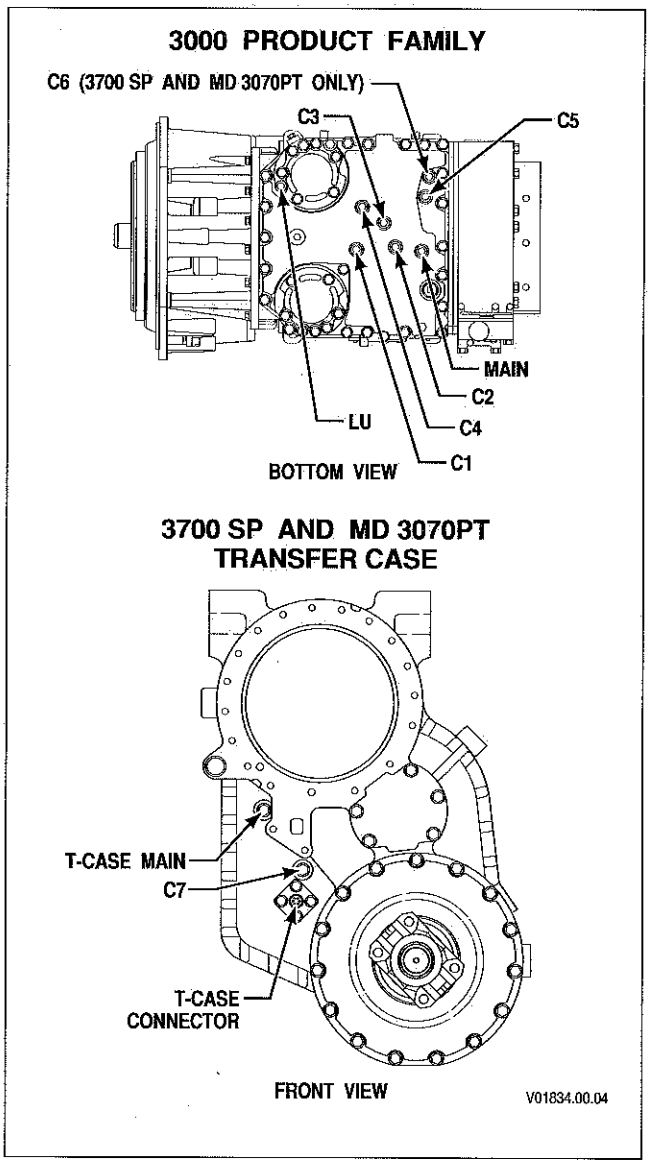


Figure 2–4. Clutch Pressure Check Points

3. Operate the transmission at the conditions shown in Table 2–5 and record engine speed, transmission sump fluid temperature, main hydraulic pressure, and clutch pressures in the ranges where a problem is suspected.

c. Comparing Recorded Data to Specifications

1. Be sure that engine speed and transmission sump fluid temperatures were within the values specified in Table 2–5.

2. Compare the main pressure and clutch-pressure data, recorded in Step **b**, with the specifications in Table 2–6.

3. If clutch pressures are within specifications, return the transmission and vehicle to their original configuration and proceed with electrical troubleshooting.

4. If clutch pressures are not within specification, take corrective action to replace the internal parts of the transmission necessary to correct the problem.

5. Measure pressure values after the transmission has been repaired.

6. Return the transmission to its original configuration. (Remove instrumentation and reinstall any components removed for the pressure testing. Pressure tap plugs should be reinstalled and tightened to 10–13 N·m; 7–10 lb ft.)

Table 2–5. Clutch Pressure Test Conditions

Transmission Model/ Test Type	Engine rpm	Sump Fluid Temp	Range	Clutches Pressurized
All (except 3700 SP and MD 3070PT) — Idle Check	580–620	71–93°C (160–200°F)	Neutral	C5
			Reverse	C3 C5
			1C	C1 C5
			2C (2nd gear start)	C1 C4
3700 SP and MD 3070PT — Idle Check	580–620	71–93 °C (160–200°F)	Neutral	C5
			Reverse	C3 C5
			LowC	C3 C6
			1C	C1 C5
All (except 3700 SP and MD 3070PT) — High Speed	2080–2120		Reverse	C3 C5
			Neutral	C5
			1C	C1 C5
			2C	C1 C4
			2L	C1 C4 LU
			3L	C1 C3 LU
			4L	C1 C2 LU
			5L	C2 C3 LU
			6L	C2 C4 LU
3700 SP and MD 3070 — High Speed	2080–2120		Reverse	C3 C5
			Neutral	C5
			LoC	C3 C6
			1C	C1 C5
			2C	C1 C4
			2L	C1 C4 LU
			3L	C1 C3 LU
			4L	C1 C2 LU
			5L	C2 C3 LU
			6L	C2 C4 LU

d. Pressure Specifications for all 3000 Product Family Transmissions. The following table defines the clutch pressure specifications for 3000 Product Family transmissions. The pressures were obtained under the following conditions (conversions are not exact.):

- C7 clutch specification measurements were taken at 3700 SP or MD 3070P T-case pressure tap.
- To meet a pressure specification, measured clutch pressures must be within 70 kPa (10 psi) of actual measured main pressure and still be within the min./max. values listed, except for the lockup clutch.
- Pressure measurements were recorded at sump temperature of 80–90°C (160–200°F).
- Pressure specifications pressure are based on an external cooler restriction of 150 kPa–200 kPa (20–30 psi) pressure drop at 2100 rpm and a "cooler in" fluid temperature of 76°C +/-5°C (170°F +/-10°F). Measured cooler flow was 60 l/min (16 gal/min).

Table 2–6. 3000 Product Family Transmission Clutch Pressure Specifications

Transmission Model/Test Type	Engine rpm	Range	Range Clutches Applied	Main Press. Spec. kPa / [psi]	Range Clutch Press. Spec. kPa / [psi]	Lube Press. Spec kPa/[psi]	T-Case C7 Press. Spec. kPa / [psi]
All—Idle	580–620	Neutral	C5	1700–2100 [245–300]	1625–2100 235–300]	10–35 [1–5]	
		Reverse	C3, C5	1700–2100 [245–300]	1625–2100 235–300]	10–35 [1–5]	1625–2100 235–300]
3700 SP and MD 3070 Only		Low C	C3, C6	1380–1900 [200–275]	1300–1900 [190–275]	10–35 [1–5]	1300–1900 [190–275]
		1C	C1, C5	1380–1900 [200–275]	1300–1900 [190–275]	10–35 [1–5]	1300–1900 [190–275]
		2C	C1, C4	1380–1900 [200–275]	1300–1900 [190–275]	10–35 [1–5]	1300–1900 [190–275]
All—High Speed	2080–2120	Neutral	C5	1800–2300 [260–335]	1725–2300 [250–335]	100–240 [14-35]	1725–2300 [250–335]
		Reverse	C3, C5	1800–2300 [260–335]	1725–2300 [250–335]	100–240 [14-35]	1725–2300 [250–335]
3700 SP and MD 3070 Only		Low C	C3, C6	1520–2300 [220–335]	1450–2300 [210–335]	100–240 [14-35]	1450–2300 [210–335]
		1C	C1, C5	1520–2300 [220–335]	1450–2300 [210–335]	100–240 [14-35]	1450–2300 [210–335]
		2C	C1, C4	1520–2300 [220–335]	1450–2300 [210–335]	100–240 [14-35]	1450–2300 [210–335]
		2L	C1, C4, LU	1050–1450 [150–210]	980–1450 [140–210]	100–240 [14-35]	980–1450 [140–210]
		3C	C1, C3	1520–2300 [220–335]	1450–2300 [210–335]	100–240 [14-35]	1450–2300 [210–335]
		3L	C1, C3, LU	1050–1450 [150–210]	980–1450 [140–210]	100–240 [14-35]	980–1450 [140–210]
		4C	C1, C2	1520–2300 [220–335]	1520–2300 [220–335]	100–240 [14-35]	1520–2300 [220–335]

Table 2–6. 3000 Product Family Transmission Clutch Pressure Specifications *(cont'd)*

Transmission Model/Test Type	Engine rpm	Range	Range Clutches Applied	Main Press. Spec. kPa / [psi]	Range Clutch Press. Spec. kPa / [psi]	Lube Press. Spec kPa/[psi]	T-Case C7 Press. Spec. kPa / [psi]
3700 SP and MD 3070 Only *(cont'd)*	2080–2120 *(cont'd)*	4L	C1, C2, LU	1050–1450 [150–210]	980–1450 [140–210]	100–240 [14-35]	980–1450 [140–210]
		5C	C2, C3	1150–2100 [165–300]	1080–2100 [155–300]	100–240 [14-35]	1080–2100 [155–300
		5L	C2, C3, LU	1000–1450 [145–210]	930–1450 [135–210]	100–240 [14-35]	930–1450 [135–210]
		6C	C2, C4	1150–2100 [165–300]	1080–2100 [155–300]	100–240 [14-35]	1080–2100 [155–300]
		6L	C2, C4, LU	1000–1450 [145–210]	930–1450 [135–210]	100–240 [14-35]	930–1450 [135–210

2–16. TRANSMISSION STALL TEST AND NEUTRAL COOL-DOWN CHECK

a. Purpose. Stall testing is performed to determine if a vehicle performance complaint is due to an engine or transmission malfunction. Stall testing is a troubleshooting procedure only—never perform a stall test as a general check or during routine maintenance.

Transmission stall speed is the maximum engine rpm attainable when the engine is at full throttle and the torque converter turbine is not moving, or "stalled." After a transmission stall test, compare the actual full throttle engine speed at torque converter turbine stall with specifications established by the vehicle manufacturer.

NOTE:

Engine speed data can be obtained from the vehicle manufacturer, or from the equipment dealer or distributor. Some engine manufacturers provide a programmable parameter to limit engine speed when the transmission output speed is 0 rpm, such as at a stop. This parameter should be set to a higher value than the expected transmission stall speed before performing a stall test.

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b. 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 transmission stall test.
2. The engine programmable parameter for 0 rpm transmission output speed is set higher than the value expected at transmission 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. Make sure the engine air induction system and exhaust system have no 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 or install an accurate tachometer (do not rely on the vehicle tachometer).
8. Install a temperature gauge with the probe in the transmission converter out (to cooler) line. Allison DOC™ displays sump temperature only.
9. Install wheel chocks.
10. A driver is in the driver's position.

11. The vehicle's brakes are fully locked.

WARNING!

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.

WARNING!

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.

c. Performing a Transmission Stall Test

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

   — Sump temperature: 71–93°C (160–200°F)

   — Converter out temperature: 82–104°C (180–220°F)

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

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

4. 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.

f. Performing a Driving Transmission Stall Test

1. Start the engine while in Neutral and let the transmission warm to normal operating temperature

   — Sump: 71–93°C (160–200°F)

   — Converter out: 82–104°C (180–220°F)
2. Perform a hot check of the transmission fluid level and adjust as necessary.
3. Turn all engine accessories **OFF**.
4. While located in isolated area, begin the driving transmission stall test.
5. Select a hold range that will limit road speed (usually 2nd or 3rd range). Never perform a driving stall test in Reverse or Low range (seven speed models).
6. Operate the engine at 100 percent full throttle, maximum governed speed.
7. With the engine at maximum governed speed, begin gradually applying the vehicle service brakes while maintaining 100 percent full throttle.
8. When the vehicle comes to a complete stop, 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.

9. Record converter out (to cooler) temperature.
10. Reduce engine speed to idle and shift the transmission to neutral.
11. Raise engine speed to 1200–1500 rpm for two minutes to cool the transmission fluid. At the end of two minutes, record converter out (to cooler) temperature

g. Neutral Cool-Down Check Procedure

1. At the end of two minutes, converter out (to cooler) fluid temperature should return to within normal operating temperature range.
2. If the transmission fluid does not cool within two minutes, the cause could be a stuck torque converter stator or an issue with the transmission cooler, lines, or fittings.

h. Transmission Stall Test Results

NOTE:

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

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

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

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

— Transmission fluid cavitation or aeration. Verify proper fluid level using the oil level sensor, if equipped, or dipstick.
— Slipping clutch
— Torque converter malfunction
— Sticking/damaged torque converter valve

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

2–17. FLUID LEAK DIAGNOSIS

Most fluid leaks can be located and repaired by visually finding the leak and replacing or repairing the necessary parts. On some occasions, a fluid leak may be difficult to locate or repair. The following procedure may help in locating and repairing most leaks. (refer to SIL 12-WT-02)

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. After a few minutes look for dripping fluid to identify the approximate location of the leak.

3. Inspect around the suspected area. Inspect all gasket mating surfaces for leaks. A mirror is useful for finding leaks in areas that are hard to reach.

4. If the leak still cannot be found, it may be necessary to clean the suspected area with a degreaser, steam, or spray solvent. Completely clean and dry the area. Operate the vehicle for several miles at normal operating temperature and varying speeds. After operating, inspect the suspected leak area. If the leak is not located, use the powder or black light and dye methods.

b. Powder Method

1. Clean the suspected area.

2. Apply an aerosol-type white powder, such as foot powder, to the suspected area.

3. Operate the vehicle under normal operating conditions.

4. Visually inspect the suspected area and trace the leak path over the white powder surface to the source.

c. Black Light and Dye Method

NOTE:

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

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1. Pour the specified amount of dye into the transmission fill tube.

2. Operate the vehicle under normal operating conditions as directed in the kit.

3. Direct the black light toward the suspected area. The dyed fluid will appear as a brightly colored path leading to the source.

d. Possible Points of Fluid Leaks and Their Causes

1. Transmission mating surfaces:

- Attaching bolts not correctly tightened
- Improperly installed or damaged gasket
- Mounting face damaged

2. 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 or damaged
- Pressure port plugs loose
- Porous casting

3. *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
   - Damaged or missing converter O-ring seal
   - Porous casting
4. *Fluid comes out vent or fill tube:*
   - Overfilled—incorrect dipstick
   - Plugged vent
   - Water or coolant in fluid—fluid will appear milky
   - Incorrect electronic fluid level indication
   - Drain-back holes plugged
5. *Gaskets:*
   - Fluid level/pressure is too high
   - Plugged vent or drain-back holes
   - Improperly tightened fasteners or dirty/damaged threads
   - Warped flanges or sealing surface
   - Scratches, burrs, or other damage to a sealing surface
   - Damaged or worn gasket
   - Cracked or porous casting
   - Improper sealant used (where applicable)
6. *Seals:*
   - Fluid level/pressure is too high
   - Plugged vent or drain-back holes
   - Damaged seal bore
   - Damaged or worn seal
   - Improper seal installation
   - Cracks in component
   - Output shaft surface scratched, nicked or damaged
   - Loose or worn bearing causing excess seal wear
   - Improper driveline installation

e. Repairing the Leak. Once the leak has been located and traced back to its source, repair the leaking components. If a gasket is replaced, but the sealing flange is bent, the new gasket will not repair the leak. The bent flange must be repaired also.

2–18. *OUTPUT FLANGE/YOKE AND OIL SEAL MAINTENANCE (All, Except 3700 SP and MD 3070PT)*

a. Disassembly *(Figure 2–5)*

1. If installed, remove eight washers 12 and eight bolts 13 and brake drum 11.
2. Bend down tabs of locktab 6, if present.
3. Remove two bolts 7 and locktab 6 or two bolts 18 and two washers 19 or one bolt 16. Discard locktab 6 and bolts 7.
4. Remove flange 2 or yoke 8. Remove two O-rings 4, retainer plug 5, and O-ring 3 or one O-ring 14 and retainer plug 15.
5. If present, remove four bolts 10 and parking brake assembly 9.
6. Inspect the journal sealing area. Minimum allowable diameter is 89.78 mm (3.535 inch).
7. Remove oil seal 1 using tool J 24171 or equivalent.

b. Assembly *(Figure 2–5)*

1. For all models, except those with parking brake, install the output seal using installer J 39928 and drive sleeve J 35921-1. If equipped with a parking brake, install the rear seal using installer J 35921-4 and drive sleeve J 35921-1. Place the seal on the installer tool so that the seal P/N will face outward after the seal is installed. Drive the seal into its bore until the installer tool bottoms out squarely against its locating surface.
2. Install flange 2 or yoke 8.
3. Install O-ring 3 on retainer plug 5 or 15. Lubricate the O-ring.

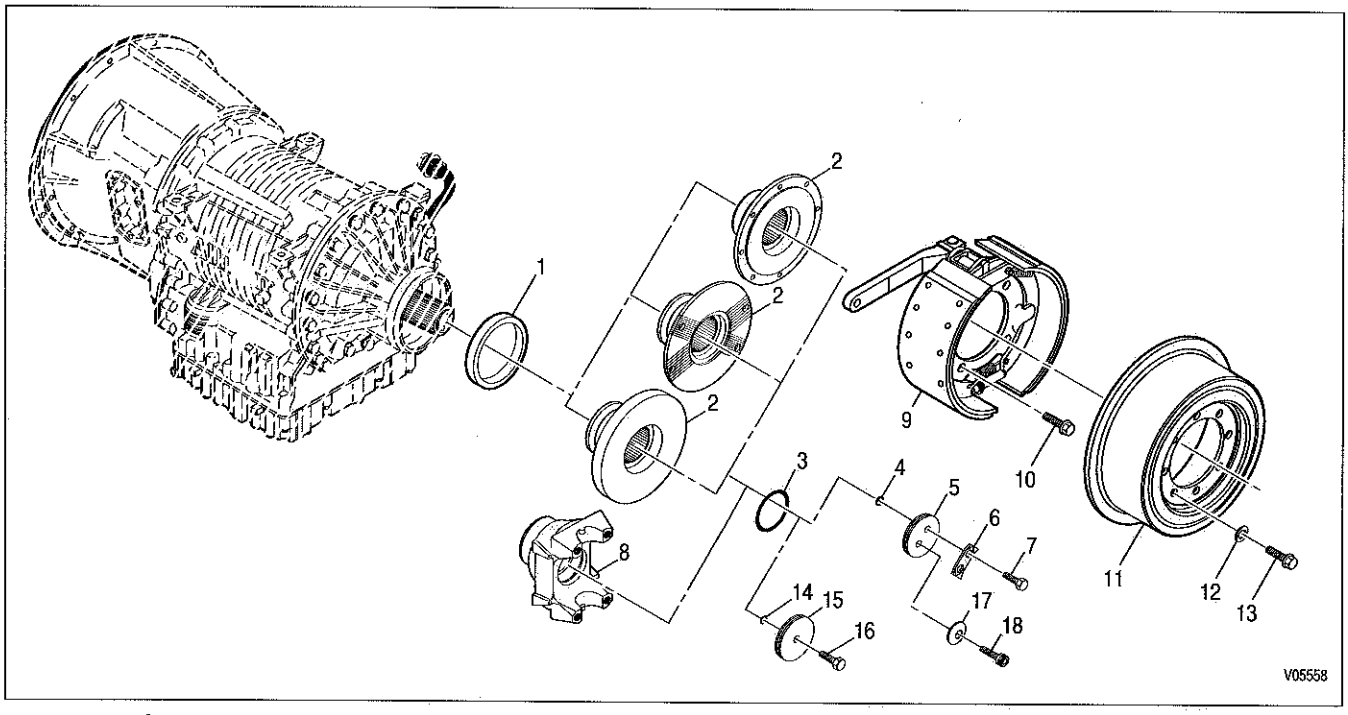

Figure 2–5. Output Flange and Oil Seal—3000 Product Family (Except 3700 SP and MD 3070PT)

NOTE:

Bolts 18 and washers 17 are available in Service Bolt Kit P/N 29535910 as described in SIL 15-WT-98. Coned end of belleville washer 17 MUST contact the head of bolt 18 as shown in Figure 2–6. DO NOT use locktab 6 with washer 17 and bolt 18.

4. Insert two bolts 18 through belleville washers 17 and retainer plug 5 or bolt 16 through retainer plug 15.
5. Install an O-ring 4 over the threaded end of each bolt 18 or O-ring 14 over bolt 16 so that the O-ring seats against the retainer plug.
6. Install retainer plug 5 or 15 into the yoke or flange. Tighten bolts 18 to 30–35 N·m (22–26 lb ft). Tighten bolt 16 to 70–80 N·m (52–59 lb ft).
7. If used, bend one tab of locktab 6 against each bolt.
8. If used, install parking brake 9 and retain with four bolts 10. Tighten bolts to 228–266 N·m (168–196 lb ft). Install brake drum 11 and eight bolts 13 and eight washers 12. Tighten bolts 13 to 56–66 N·m (41–49 lb ft).

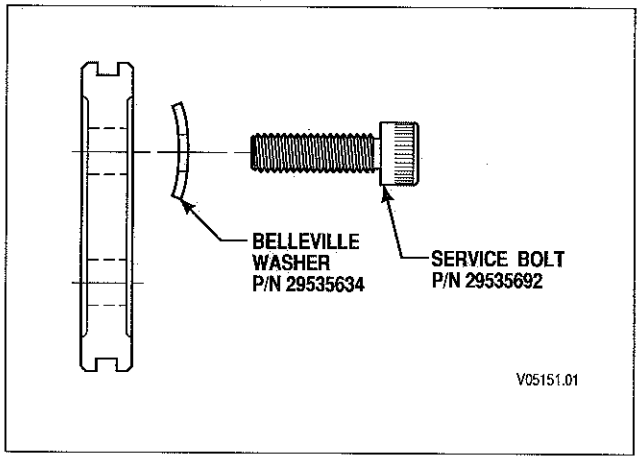

Figure 2–6. Installing Redesigned Two-Bolt Flange Retention Kit

2–19. YOKE AND OIL SEAL MAINTENANCE (3700 SP AND MD 3070PT)

a. Disassembly *(Figure 2–7)*

1. Hold yoke 5 or 3 and remove output nuts 1 and washers 2 to remove rear output yoke 5 and front output yoke 3.
2. Remove yoke 5 and yoke 3 by using a slide hammer or a similar tool.
3. Remove oil seals 4 using tool J 24171-A.
4. Inspect the front and rear output yokes and front and rear oil seals for wear and damage.

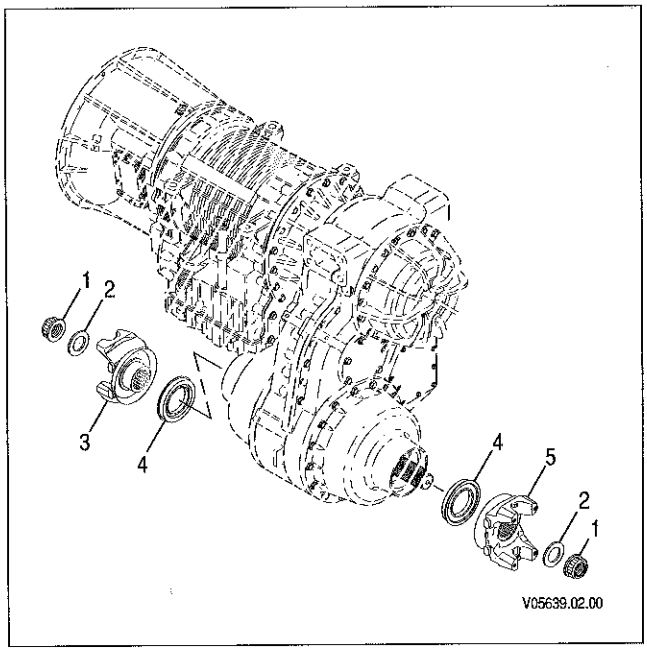

Figure 2–7. Output Flange and Oil Seal—3700 SP and MD 3070PT

b. Assembly *(Figure 2–7)*

1. Inspect front output yoke 3 and rear output yoke 5 for wear on the output seal journal. No scoring is permitted and should be removed by using a soft stone or crocus cloth. Minimum allowable seal journal diameter is 76.20 mm (3.000 inch).
2. Install oil seals 4 using J 38547 and J 35921-1.
3. Install rear output yoke 5 and front output yoke 3 by using a slide hammer or a similar tool.
4. Apply sealant on both sides of flat washers 2. Install flat washers 2.
5. Install output nuts 1; tighten the nuts to 610–815 N·m (450–600 lb ft).

2–20. ON-VEHICLE MAINTENANCE

The following may be serviced or removed with the transmission mounted in the vehicle. Refer to the indicated paragraph for removal instructions.

Item	Paragraph
PTO(s)	4–2**f**
Oil Cooler Manifold	4–2**d**
Input and Output Speed Sensors	4–2**c**
Scavenge Pump	4–2**g**(1)
Control Module	4–2**h**

NOTES

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 lb) capacity (Figure 3–1)
- Overhaul Stand—J 29109 or equivalent (Figure 3–2)

b. Special Tools. Special tools are illustrated in Figure 3–3. They are identified in Table 3–1, following the special tool illustrations.

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)

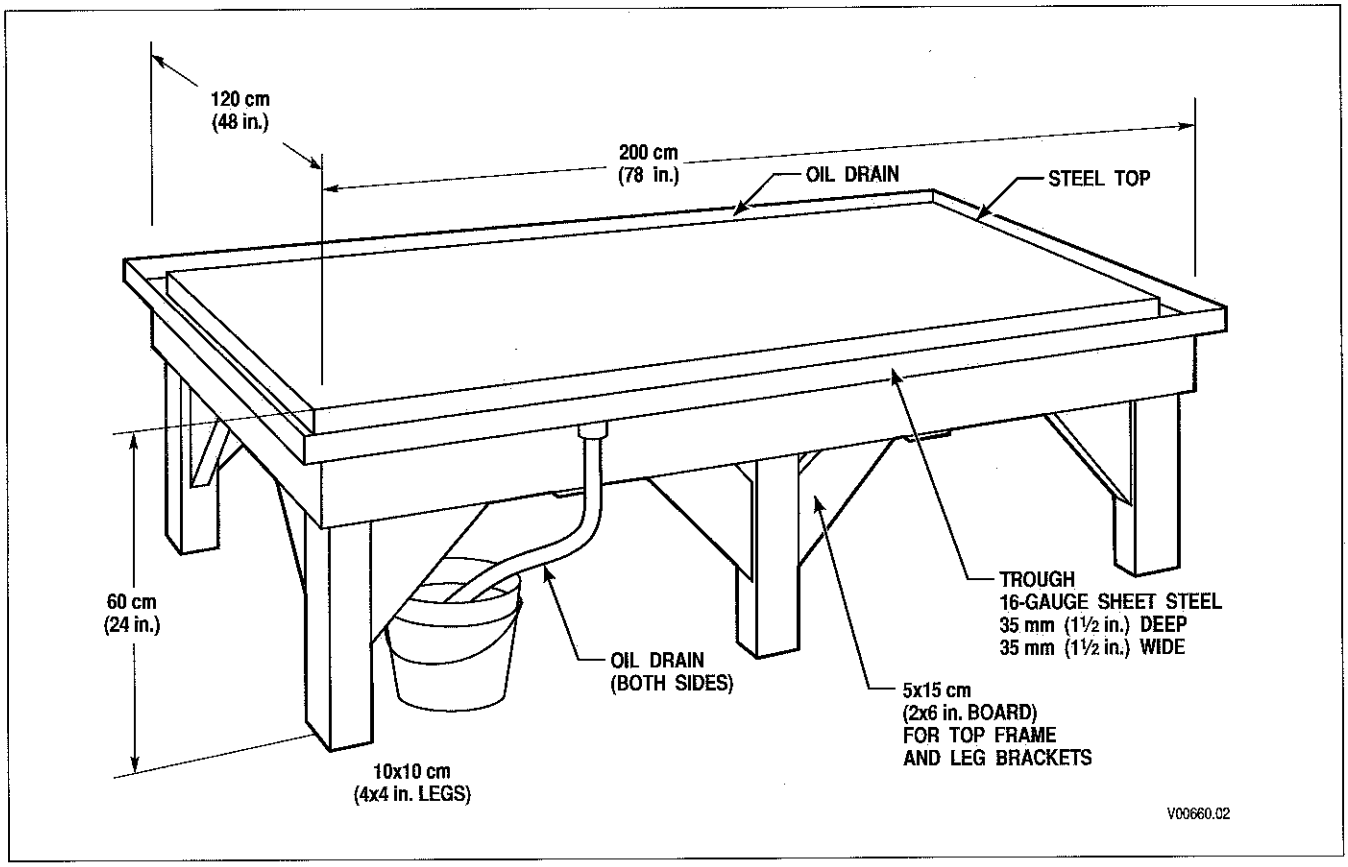

Figure 3–1. Work Table

- Snapring pliers
- Micrometer (metric preferred)
- Depth micrometer (metric preferred)
- Dial indicator set (metric preferred)
- Metric headless guide bolts set
- M10 eye bolt
- M16 eye bolt
- Suitable hoist—500 kg (1000 lb) capacity
- A 12 N·m (100 lb in.) torque wrench
- A 350 N·m (250 lb ft) torque wrench
- A press for disassembly and assembly of spring-loaded clutches and interference-fit parts
- Clean, lint-free shop cloths (do not use waste cloths)
- Containers for parts
- Supply of wood blocks
- Petrolatum
- Container of mineral spirits for cleaning parts

CAUTION:
Caustic cleaning compounds will damage some transmission parts. Use only mineral spirits to clean transmission parts.

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

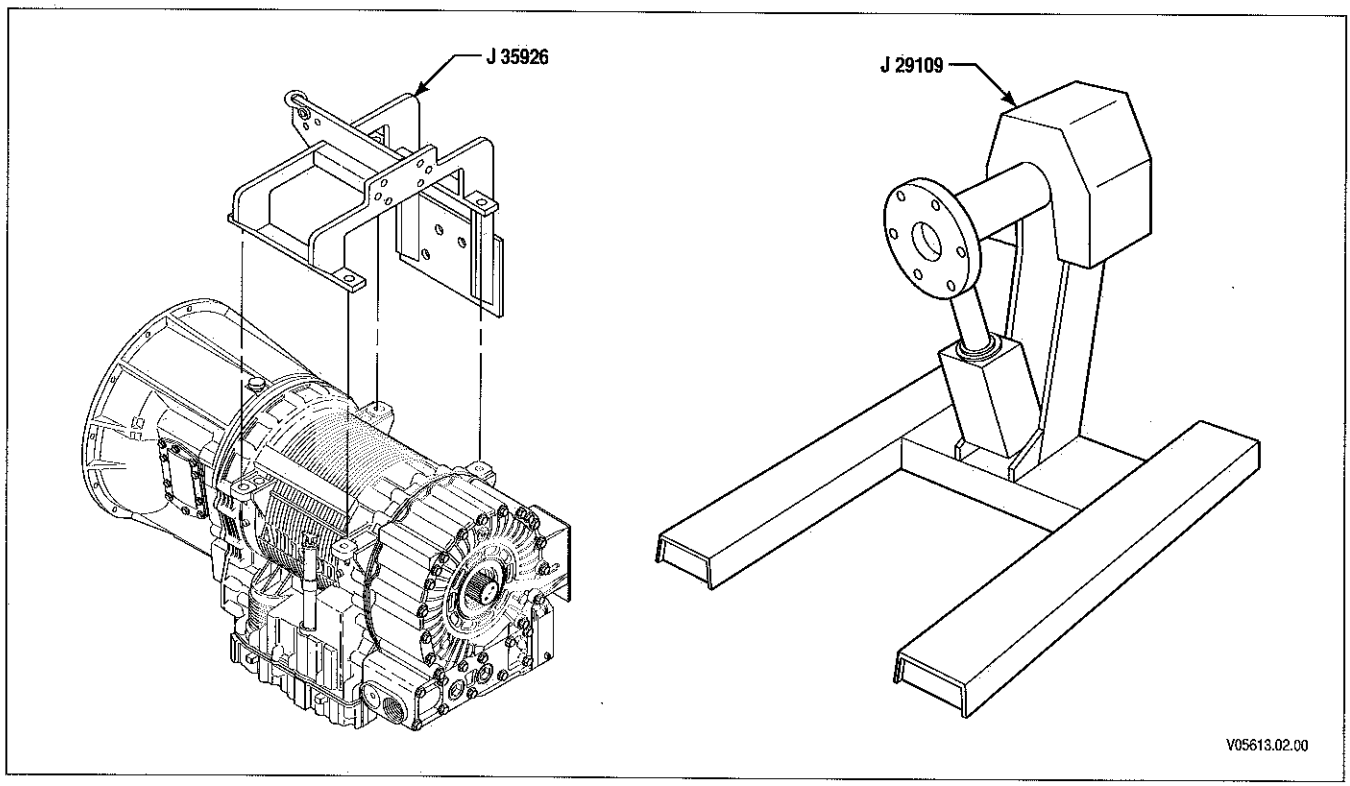

Figure 3–2. Overhaul Stand

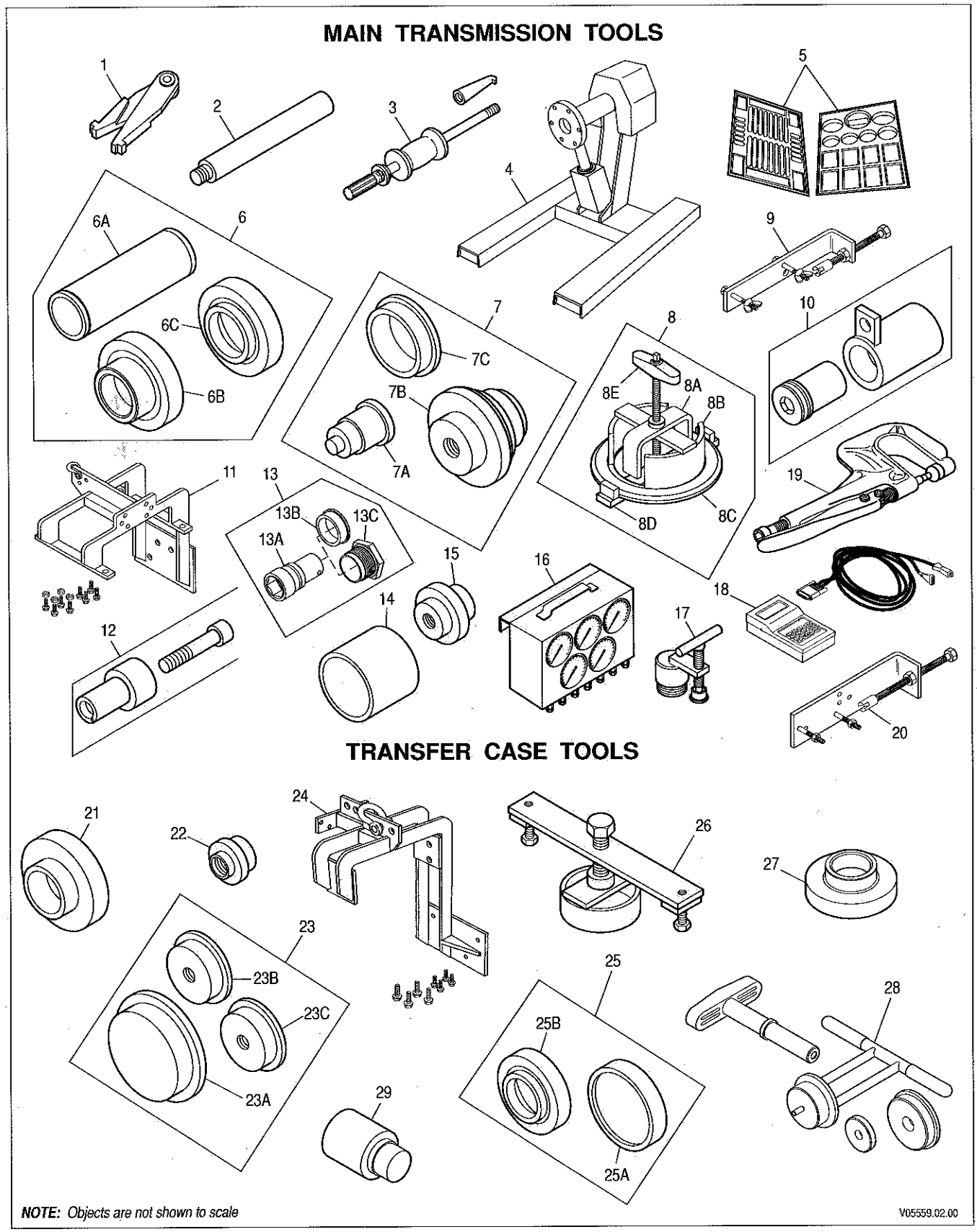

Figure 3–3. Special Tools

Table 3–1. Special Tools*

Kent-Moore Tool No.**	Figure	Item	Description	Reference Paragraph
J 3940	3–3	1	Bearing Race Remover	5–12c, e, l, n, t, v; 5–13a, c; 5–16l, n, o
J 8092	3–3	2	Drive Handle	5–3b; 5–5e; 5–6b, c; 5–7b; 5–11b; 5–12g, p, x; 5–13e; 5–14b; 5–15b; 5–16a, c, e
J 24171-A	3–3	3	Slide Hammer and Jaw Set	2–18a; 2–19a; 5–5b; 5–6a; 5–12c, l, t; 5–13a; 5–16l, n
J 26417-A	3–3	16	Pressure Gauge Set	2–15a
J 28467-34	3–3	8E	Handle	5–7a
J 29109	3–3	4	Repair Stand	6–2a
J 33163	3–3	5	Valve Body Parts Tray Set	5–17a
J 35921	3–3	6	Bearing and Seal Installers	
J 35921-1	3–3	6A	Output Bearing Installer/Drive Sleeve	2–18b; 2–19b; 5–5e; 5–6b, c; 5–12h, q, y; 5–13e, f; 5–16a, m, o
J 35921-3	3–3	6B	Oil Pump (Input) Seal Installer	5–5e; 5–6c
J 35921-4	3–3	6C	Output Seal Installer Adapter (Models With Parking Brake)	2–18b; 5–13f
J 35922	3–3	7	Bearing/Bushing Installers	
J 35922-1	3-3	7A	Turbine Shaft/Output Shaft/P2 Planetary Bushing Installer	5–7b; 5–11b; 5–12g, p, x; 5–13d, e
J 35922-2	3–3	7B	Oil Pump Body Bushing/Ground Sleeve Bearing/ P1 Sun Gear Bushing Installer	5–5e; 5–6b, c; 5–7b
J 35922-3	3–3	7C	Output Bearing Cup Installer	5–12f, o, q, w, y; 5–13f
J 35923	3–3	8	Spring Compressor Set C1, C2, and C5	
J 35923-1	3–3	8A	Piston Spring Compressor (C1)	5–7a, b
J 35923-2	3–3	8B	Piston Spring Compressor (C5)	5–7a, b; 5–12e, f, n, o, v; 5–13c, d; 5–14a, b
J 35923-3	3–3	8C	Piston Spring Compressor (C2), Use With J 35926-2	5–7a, b
J 35923-4	3–3	8D	Compressor Base	5–7a, b; 5–14a, b
J 35924	3–3	9	Main Pressure Spring Remover/Installer	5–17f, i
J 35925	3–3	10	Spanner Nut Torque Tool Set	5–12c, h, l, q, t, y; 5–13a, f
J 35926	3–3	11	Main Case Holding Fixture	4–2a, f; 6–2a
J 38547	3–3	27	Front And Rear Output Seal Installer (MD 3070)	2–19b; 5–16m, o
J 38548	3–3	12	Torque Converter End Play Gauge	5–3b; 6–2q
J 38564A,B,C	3–3	13	Torque Converter Bolt Tool	4–2h; 6–2q
J 38565	3–3	14	PTO Bearing/Sleeve Installer	5–5d; 5–6b
J 38566	3–3	15	Pump Gear, Torque Converter Cover Bushing Installer	5–3b
J 38568	3–3	23	Bearing Cup Installers	
J 38568-1	3–3	23A	Drive/Driven Bearing Cup Installer	5–16a

Table 3–1. Special Tools* *(cont'd)*

Kent-Moore Tool No.**	Figure	Item	Description	Reference Paragraph
J 38568-2	3–3	23B	Idler Bearing Cup Installer	5–16a
J 38568-3	3–3	23C	Fwd/Rear Output Bearing Cup Installer	5–16m
J 38569	3–3	22	P3 Carrier/C6/C7 Housing Bushing Installer	5–14b; 5–16c, e
J 38572	3–3	24	Transfer Case Holding Fixture	4–2a, f; 5–16a; 6–2o
J 38573	3–3	26	C6 Spring Compressor	5–16b, c
J 38579	3–3	25	Bearing Installers	
J 38579-1	3–3	25A	Drive/Driven Bearing Installer	5–16k
J 38579-2	3–3	25B	Fwd/Rear Output and Idler Bearing Installer	5–16k, m, o
J 39354	3–3	19	Rivet Installer	5–8b
J 39623	3–3	28	Bearing End Play Checker	5–16s
J 39928	3–3	21	Output Seal Installer	2–18b; 5–13f; 6–2k, l, m
J 41462	3–3	20	Main Pressure Relief Spring Compressor	5–6a; 5–6c
J 42048	3–3	17	Retarder Flow Valve Spring Compressor	5–12c, h, l, q, t, y
J 47028	3–3	29	Scavenge Pump Bearing Installer	5–15b

* We believe this source and its tools to be reliable. These tools may be available from other manufacturers. Allison Transmission, Inc. does not endorse, indicate any preference for, or assume any responsibility for the products or tools from these firms, or for any such items that may be available from other sources.

** Kent-Moore Tool Division, 29784 Little Mack, Roseville, Michigan 48066

3–3. REPLACEMENT PARTS

a. Ordering Information. Refer to the latest version of Parts Catalog PC2150EN 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
- Spiral retaining ring 4 (Foldout 10,B)
- Suction filter 3 (Foldout 17,A)
- Suction filter 6 (Foldouts 17,B and 17,C)

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 as-

sembly. 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 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 to ensure 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.
- If a bearing is not installed immediately, wrap or cover the lubricated bearing with clean paper or lint-free cloth to keep out dust.

e. Inspecting Bearings

1. Inspect bearings for rough rotation. Replace a bearing if its rotation is still rough after cleaning and lubrication.
2. Inspect bearings for scored, pitted, scratched, cracked, or chipped races, and for excessive roller or ball wear. Replace the bearing if any defects are found.
3. Inspect a defective bearing's bore and mating shaft for grooved, burred, or galled conditions that indicate the bearing has been turning in the bore or on the shaft. If the damage cannot be repaired with crocus cloth, replace the defective part.
4. When removing a bearing, do not apply pressure across the balls. This can cause brinelling and bearing failure.
5. If a bearing must be removed or installed without the proper tool, 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 hammer.

f. Inspecting Cast Parts and Machined Surfaces

1. Inspect bores for wear, scratches, grooves, and dirt. Remove scratches and burrs with crocus cloth. Clean the part. Replace parts that are deeply scratched or grooved.
2. Inspect all fluid passages for obstructions. If an obstruction is found, remove it with compressed air, or by working a soft wire back and forth through the passage and flushing it out with mineral spirits.
3. Inspect mounting faces for nicks, burrs, scratches, and foreign matter. Remove any defects with crocus cloth or a soft stone. Clean the part. If scratches are deep, replace the defective part.

4. Inspect threaded openings for damaged threads. Clean damaged threads with the correct size tap.

CAUTION:

Some parts have Spiralock® threaded holes. A repairable threaded hole can only be repaired using a Spiralock® tap. A standard tap will eliminate the locking feature and require that the part be replaced. Spiralock® taps are available from: Detroit Tool Industries, Madison Tech Center, 25219 DeQuindre, Madison Heights, MI, 48071; Phone: (800) 521-2688.

As of this printing, the following parts have Spiralock threaded holes:

- Torque converter cover—flexplate adapter bolt holes and lockup clutch backplate bolt holes—starting with S/N 6510024410).
- Output shaft with single-bolt flange retention—starting with S/N 6510184819.

5. Inspect the ribs inside the main housing for reaction plate wear grooves in the side of the ribs. Replace housings that have splines worn beyond wear limits. (Refer to Wear Limits, Table 7–1 in Section 7.)

6. Replace housings or other cast parts that are cracked.

7. Inspect all machined surfaces for damage that could cause fluid leakage or other malfunction. Rework or replace defective parts.

8. Inspect the oil tracks of the control module and main housing for porosity, broken lands, cracks, dirt, and land surface imperfections. These imperfections will cause severe fluid leakage leading to transmission failure.

g. Inspecting Bushings and Thrust Washers

1. Inspect bushings for scores, burrs, sharp edges, and evidence of overheating. Remove scores with crocus cloth. Remove burrs and sharp edges with a scraper or knife blade. Before reinstalling, carefully inspect bushings for signs of distress.

CAUTION:

When removing a defective bushing do not damage the bushing bore.

2. Replace bushings that are out-of-round, deeply scored, or excessively worn. Inspect parts mated to bushings to ensure they are not damaged or worn beyond use.

3. Inspect thrust washers for distortion, scores, burrs, and wear. Replace a thrust washer if defective or worn.

h. Inspecting Sealrings and Gaskets

1. Inspect piston sealrings and lip-type seals for nicks, cuts, tears, splits, and pattern damage. A damaged seal can indicate rough or sharp edges in piston grooves or on a mating surface that could damage a new seal.

2. Replace all composition gaskets.

3. Inspect hook-type sealrings for wear, broken hooks, and distortion.

4. Install a new hook-type sealring if the old ring shows any wear on its outside diameter, or if there is excessive side wear.

5. Measure sealring end gap by inserting the sealring into its respective sealing bore. Use a feeler gauge to measure end gap. Discard sealrings having excessive end gap. (Refer to Wear Limits, Section 7.)

6. 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.

7. 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 3–4)*

1. Inspect friction-faced clutch plates (internal-splined plates) 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 (external-tanged plates) for burrs, scoring, excessive wear, excessive cone, distortion, imbedded metal, galling, cracks, breaks, or damaged tangs. Remove burrs and minor surface irregularities using a soft stone. Replace plates which have any defects.

3. The amount of clutch plate cone is determined by measuring the distance between the inside diameter of the plate and a level surface (Figure 3–4). Discard plates having excessive cone. (Refer to Wear Limits, Section 7).

4. Determine oil groove depth with a depth micrometer or by measuring the smooth surface (total) thickness of the plate, measuring the thickness of the steel part of the plate at the oil groove, and subtracting this measurement from the total thickness. Replace plates not having the minimum oil groove depth. (Refer to Wear Limits, Section 7).

o. Inspecting Swaged and Interference-Fit Parts. If there is evidence of looseness, the assembly should be replaced.

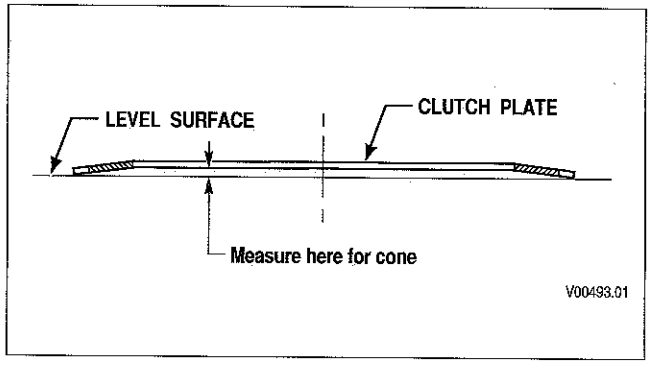

Figure 3–4. Method of Measuring Clutch Plate Cone

p. Inspecting Retainer and Ball Assembly in Retarder Stator. Inspect balls in the retarder stator for free movement. Inspect the staking that retains the balls. Any restriction could prevent the ball from seating during retarder application.

q. Inspecting Sealing Surfaces

1. Inspect surfaces in contact with hook-type, scarf-cut, and butt-joint sealrings for step-wear, nicks, scratches, and scoring. Use a soft stone or crocus cloth to remove only the raised metal portion of these defects. Polishing the area to remove a defect is neither necessary nor desirable. If the defects are too severe to correct, replace the defective part.

2. Inspect surfaces in contact with spring-loaded, lip-type seals for nicks, scratches, roughness, or other surface irregularities. Inspect for embedded particles, step-wear, and dirt on flanges or other components exposed to external contamination. Remove the defects and restore the finish. Replace the part if scores or scratches permit fluid leakage.

3–6. ASSEMBLY PROCEDURES

a. Parts Lubrication. During final assembly, lubricate all moving parts with transmission fluid. The fluid will help protect friction surfaces and ferrous metals until the unit is in service.

b. Grease Used for Assembly. During assembly use oil-soluble grease with a low melting point (petrolatum) to temporarily retain parts, butt-joint sealrings, scarf-cut sealrings, and hook-type sealrings.

c. Sealing Compounds and Nonsoluble Greases. Do not use gasket-type sealing compounds, fibrous greases, or nonsoluble vegetable-base cooking compounds inside the transmission or where they could be flushed into the transmission hydraulic system.

d. Clutches and Pistons

1. Soak each friction-faced clutch plate (two-minute minimum) in transmission fluid before final assembly.

2. Apply a generous amount of transmission fluid to the piston cavity before final assembly.

3. Assemble clutch plates so that the cone of each plate faces the same direction.

e. Threaded Plugs and Hydraulic Fittings

CAUTION:

- **Do not use Teflon® tape on threaded parts. Slivers can cause the transmission to malfunction.**
- **Improperly installed plugs or fittings can cause leakage and cracked housings.**

Threaded plugs in 3000 Product Family transmissions are straight-thread O-ring type plugs. Be sure that the O-ring is in like-new condition and tighten all plugs to the torque values specified in the assembly procedure or in exploded views. Tighten other fittings sufficiently to prevent leakage.

f. Coated Threaded Fasteners. 3000 Product Family control module bolts and certain 3700 SP adapter housing bolts are being manufactured with a band of thread sealant on the threads. The following table identifies the transmissions that contain the improved bolts.

Transmission Model	Serial Number	Bolt Size
3000 Family	6510385205	M10 x 1.5 x 100 mm
	6510385458	M10 x 1.5 x 55 mm
3700 SP	6510362094	M10 x 1.5 x 70 mm M10 x 1.5 x 100 mm M12 x 1.5 x 60 mm

g. Lip-Type Seals

1. When replacing lip-type seals, make sure the spring-loaded lip is toward the fluid to be sealed (toward the inside of the unit). Coat the inside of the seal with high temperature grease (MIL-G-3545A or equivalent) to protect the seal during shaft installation and to provide lubrication during initial operation.

2. The circumference of some seals is precoated with a dry sealant. The sealant is usually colored for easy identification. Precoated seals do not require any additional sealant before installation.

h. Butt-Joint 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 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.

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, measure the end clearance of the sealring. The end clearance must not be less than specifications allow.

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.

i. 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.

j. Electrical Components. For inspection and repair of electrical components, refer to the Allison Transmission Electronic Troubleshooting Manual TS2470EN (WTEC II Controls) or TS2973EN (WTEC III Controls).

3–7. REMOVING (OR INSTALLING) TRANSMISSION (Figures 3–5, 3–6, 3–7, 3–8)

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 Electronic Control Unit (ECU) must be "RESET TO UNADAPTED SHIFTS". This will cause the ECU to erase previous adaptive information and begin to adapt in Fast Adaptive Mode from the base calibration. Use the Allison DOC™ (refer to the Allison DOC™ User's Guide for instructions) to "RESET TO UNADAPTED SHIFTS".

a. Drain Fluid. Drain the transmission fluid before removing the transmission from the vehicle. The transmission should be warm and the fluid allowed to drain overnight.

1. Remove the drain plug from the control module. Examine the drained fluid and magnetic drain plug for evidence of contamination (refer to Paragraph 2–11). Reinstall the drain plug when fluid draining is completed.

2. Remove the transmission fill tube if it interferes with transmission removal.

NOTE:
A significant amount of fluid may drain from a hydraulic hose when it is disconnected from the transmission.

---

3. Disconnect all hydraulic hoses from the transmission. Remove the hoses from the vehicle if they interfere with the transmission removal.

Plug all openings to keep dirt from entering the hydraulic system.

4. If an integral cooler is used, drain coolant from the cooler and disconnect coolant hoses. Remove the hoses from the vehicle if they interfere with transmission removal. Plug all openings to keep dirt from entering the cooling system.

b. Disconnecting Controls. Disconnect or completely remove controls. If controls are not removed from the transmission, position them so that they do not interfere with transmission removal.

1. For non-retarder models, disconnect the transmission external harness from the feedthrough harness connector, the input speed sensor, the output speed sensor, and the PTO connector, if present (see Figure 3–5). Disconnect the tachograph drive, if used.

2. For retarder models prior to 1/98, disconnect the transmission external harness from the feedthrough harness connector, the input speed sensor, the retarder connector, and the PTO connector, if present (see Figure 3–5). Cover the harness connectors to keep out dirt.

3. For current retarder models, disconnect the transmission external harness from the transmission feedthrough harness, the input speed sensor, the output speed sensor, the retarder temperature sensor, the retarder valve body connector, and the PTO connector, if present (see Figure 3–6 and 3–7). If used, disconnect the tachograph drive. Cover the harness connectors to keep out dirt.

4. For transfer case models, disconnect the transmission external harness from the feedthrough harness connector, the input speed sensor, the transfer case connector, and the PTO connector, if present (see Figure 3–8). Cover the harness connectors to keep out dirt.

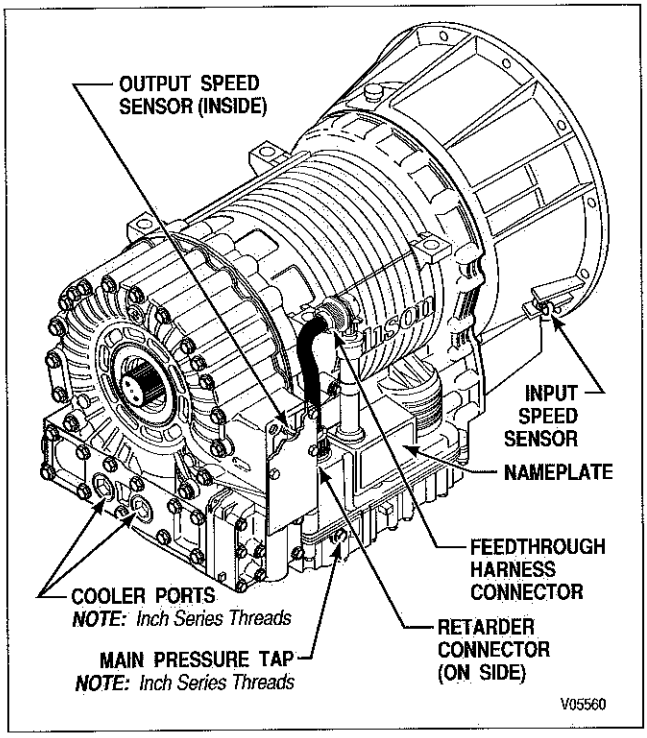

Figure 3–5. Disconnect Locations (Retarder Models Before 1/98)

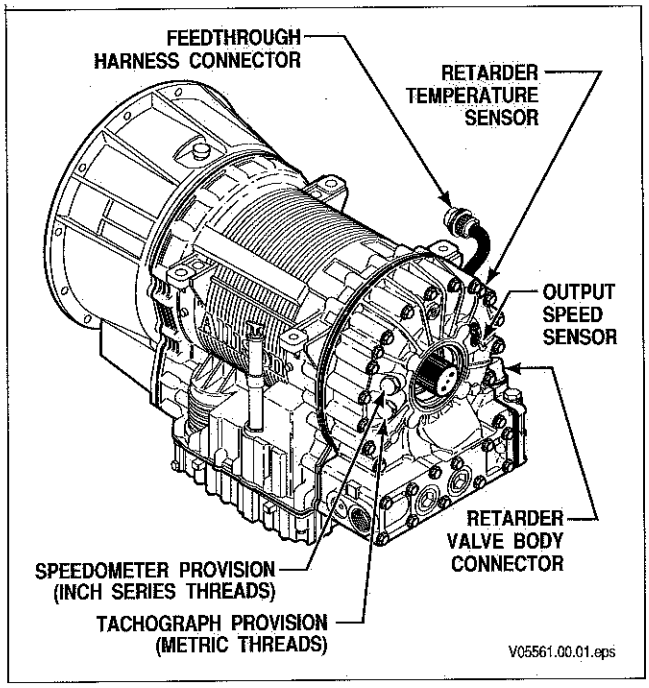

Figure 3–6. Disconnect Locations (Retarder Models Beginning 1/98)

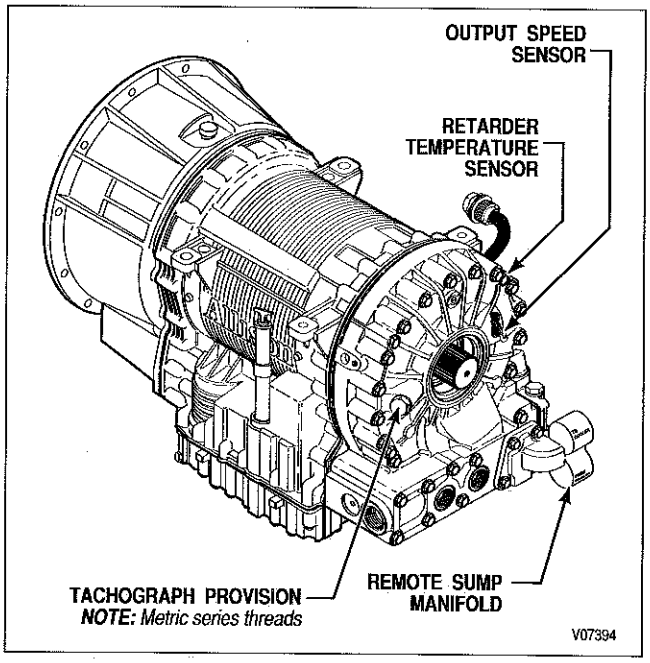

Figure 3–7. Disconnect Locations (Retarder Equipped Models Starting with S/N 6510262246)

c. Uncoupling From Driveline, Vehicle, And Engine

1. Disconnect the vehicle drive shaft from the transmission output flange or yoke. Position the disconnected shaft to avoid interference with removing the transmission.
2. PTOs, if present, must either have the output driveline disconnected or be removed from the transmission.
3. Securely support the transmission with a hoist, jack, or other suitable removal equipment.
4. Remove all bolts, nuts, washers, spacers, and supports that attach the transmission to the vehicle and to the engine.

d. Removing the Transmission

1. Move the transmission away from the engine approximately 110 mm (4.33 inch) until it is completely clear of the engine. Remove the adapter ring (if used).
2. Raise or lower the transmission as necessary to remove it from the vehicle.

3–8. WEAR LIMITS

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

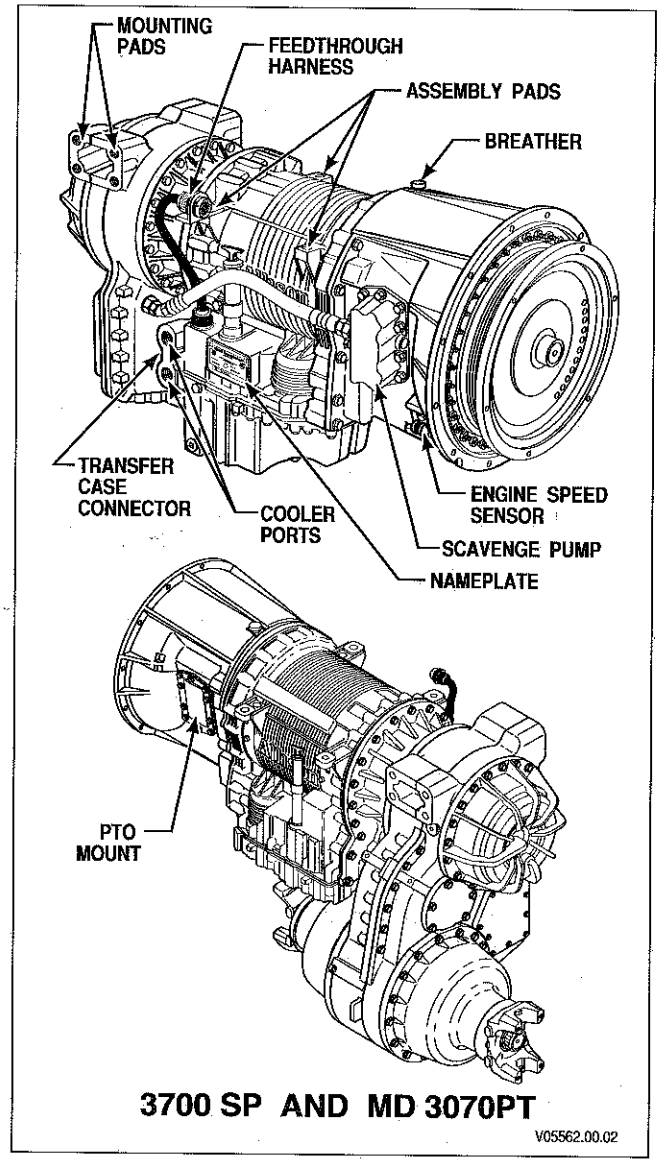

Figure 3–8. Disconnect Locations (3700 SP and MD 3070PT)

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.

SECTION 4—TRANSMISSION DISASSEMBLY

4–1. SCOPE

a. Section. This section covers disassembly of 3000 Product Family transmissions. Disassembly procedures include PTO provisions and retarders. The disassembly sequence is continuous and includes all models.

b. Procedures. When a procedure does not apply to your specific model, go to the next applicable procedure.

c. Illustrations. Illustrations will not always show your model, but when an operation is identical for all models, the correct procedure is shown.

d. General Information. Refer to Sections 3 and 7 for general information as follows:

Paragraph	Title
3–2	Tools and Equipment
3–3	Replacement Parts
3–4	Careful Handling
3–5	Cleaning and Inspection
3–7	Removing Transmission
7–1	Wear Limits Data
7–2	Spring Data

e. Foldouts. Refer to Foldouts 7 through 19 for exploded views.

4–2. DISASSEMBLY OF TRANSMISSION

a. Mounting Transmission on Repair Stand

WARNING!

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 and MD 3070PT 530 kg (1170 lb)**

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

1. Mount holding fixture J 35926 onto the main housing module.
2. Attach a hoist, making sure lifting attachments are placed so transmission is properly balanced, and raise the transmission to the mounting face of the repair stand.
3. Secure the transmission holding fixture to repair stand J 29109.
4. For a 3700 SP or MD 3070PT transmission model, follow Step (1). In addition, install fixture J 38572 on the transfer case. Connect fixtures J 35926 and J 38572 by installing four bolts 1 (Figure 4–1). Secure the transmission holding fixtures to the repair stand.

b. Removal of Common Externally-Mounted Parts *(Figure 4–2)*

1. Inspect transmission breather 1 for damage or obstruction. Remove if necessary for replacement or cleaning.
2. Remove screw 22 retaining fill tube bracket 23 to the main housing module. Remove bracket 23, fill tube 21, seal 20, and dipstick 24.
3. Remove expander plug 2 from the other fill tube location on the opposite side of the main housing module. For transmissions after S/N 6510107518, pry under the head of plug 3 and remove plug 3 and seal 4.
4. Remove six bolts 16 retaining remote cooler manifold 18, or cover 17, to the main housing module. Remove cooler manifold 18, or cover 17, and gasket 19.

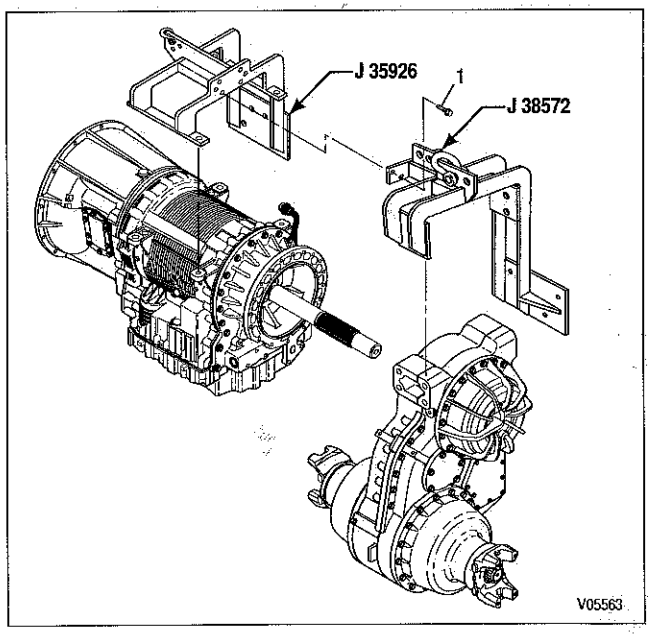

Figure 4–1. 3700 SP or MD 3070PT Repair Stand Brackets

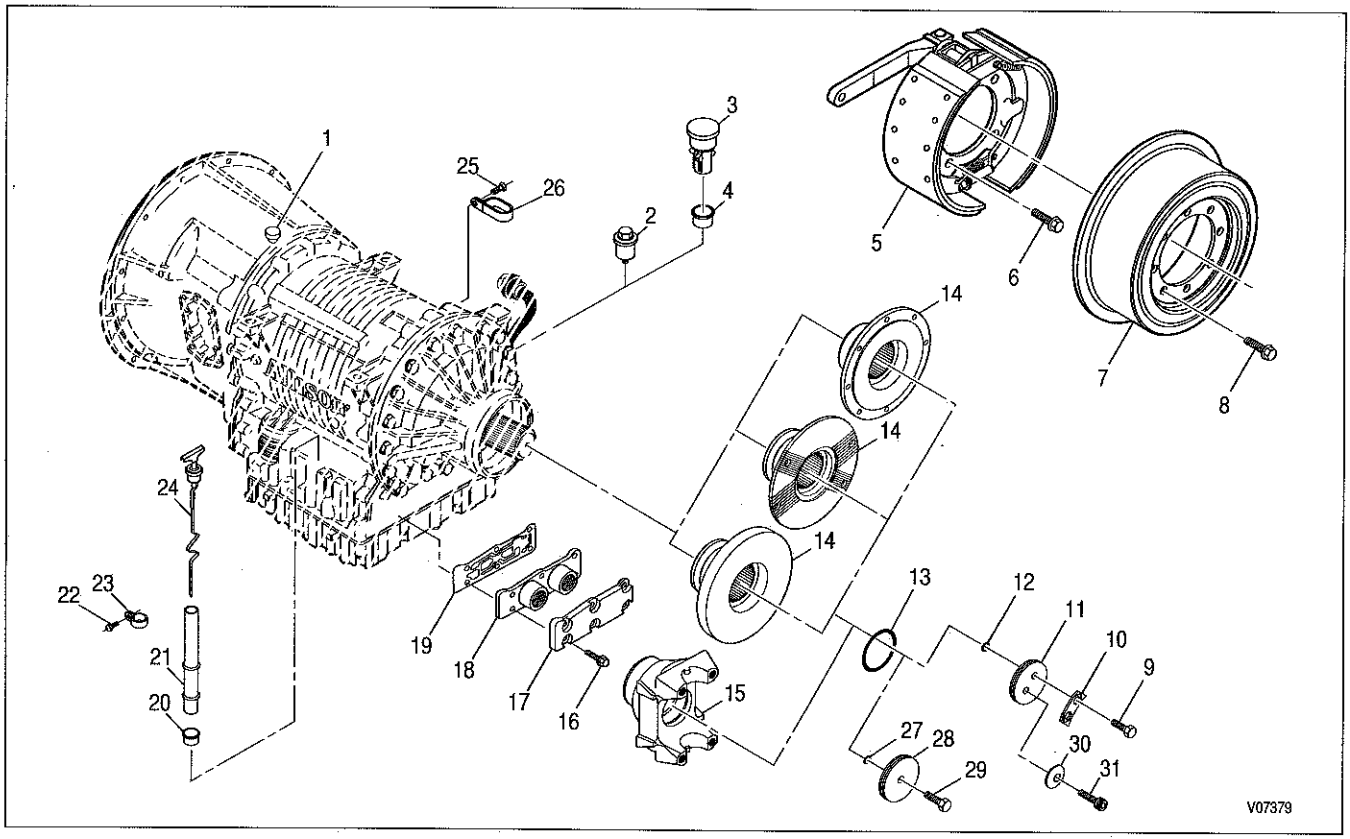

Figure 4–2. Common Externally-Mounted Parts Removal

5. If present, remove bolts 8 and brake drum 7.

NOTE:

For 3700 SP or MD 3070PT transmission models, do not remove yokes now. Removal is covered in Section 5–16 as part of transfer case disassembly.

6. Bend down edges of locktab 10, if present. Remove two bolts 9 and locktab 10 or two bolts 31 and two washers 30, retainer plug 11, O-ring 13, and two O-rings 12 or one bolt 29, retainer plug 28, and O-ring 27. Discard locktab 10 and bolts 9.

7. Remove flange 14 or yoke 15.

8. Inspect the journal sealing area. Minimum diameter allowable is 89.78 mm (3.535 inch).

9. If present, remove four bolts 6 and parking brake assembly 5.

10. If present, remove bolt 25 and harness bracket 26.

c. Removal of Speed Sensors

NOTE:

- **For models without PTO, go to Step (1).**
- **For models with PTO, skip Step (1) and go to Step (2).**

NOTE:

Beginning January 2006, all speed sensors have been redesigned. The current speed sensor coil resistance is 315–365 Ohms at 20°C (68°F). Refer to SIL 5-WT-06 Rev A. Table 1 for serial number breaks.

1. Remove bolt 6 (Foldout 8,A), retainer 5, input speed sensor assembly 3, and O-ring 4 from the converter housing module. Skip to next **NOTE**.

2. Remove bolt 22 (Foldout 8,B), retainer 21, input speed sensor assembly 19, and O-ring 20 from the converter housing module.

NOTE:

- **For models without retarder, go to Step (3).**
- **For models with retarder (built before 1/98), skip Step (3) and go to Step (4).**
- **For models with retarder (built starting 1/98), skip Steps (3) and (4) and go to Step (5).**
- **For 3700 SP or MD 3070PT, go to Paragraph *f*.**

3. Remove bolt 32 (Foldout 13,D), retainer 31, output speed sensor assembly 29, and O-ring 30 from the rear cover module.
4. Remove four bolts 7 (Figure 4–3) and cover 6. Remove bolt 5, retainer 2, output speed sensor assembly 3, and O-ring 4.
5. Remove bolt 43 (Foldout 13,B), retainer 42, output speed sensor assembly 40, and O-ring 41 from the retarder housing.

d. Removal of Integral Oil Cooler
(Foldout 19,A)

NOTE:

- **For models without retarder, go to Step (1).**
- **For models with retarder, skip Steps (1)–(3) and go to Step (4).**

1. Remove two bolts 24 and seventeen bolts 25. Remove cover 23, gasket 22, and two O-rings 26.
2. Remove plate assembly 27 and four O-rings 28.
3. Remove nine bolts 15 and nine washers 16. Remove cooler housing 7 and gasket 5.
4. Remove plate assembly 27 and four O-rings 28.
5. Remove three bolts 13, three washers 14, bolt 12, washer 11, six bolts 15 and six washers 16. Remove cooler housing 7 and gasket 6.

e. Removing Integral Retarder Sump Oil Cooler
(Foldout 19,B)

1. If used and not already removed, remove the retarder accumulator hose from the fitting on cooler manifold 16.
2. If not already removed, remove inlet and outlet water hoses from the cooler manifold.
3. Remove six bolts 5.

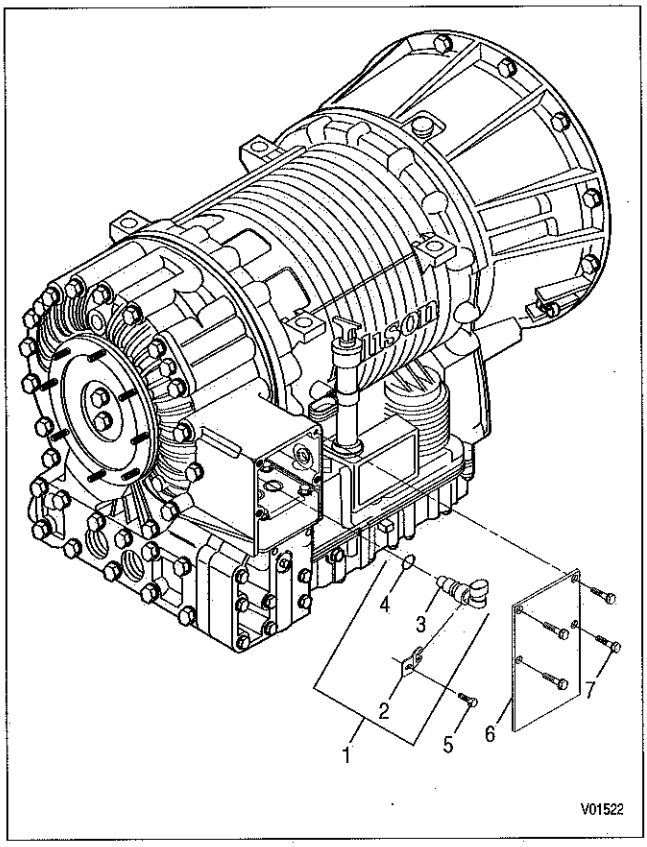

Figure 4–3. Output Speed Sensor (Retarder Models Before 1/98

WARNING:
To help avoid personal injury, securely support the cooler before removing the bolts retaining the cooler to the manifold. The cooler weighs 140 kg (64 lb); use care when handling the cooler.

4. Support cooler 7 to prevent it from falling from manifold 16.
5. Remove sixteen M10 x 1.5 x 60 bolts 1.
6. Remove inlet and outlet water hose adapters from cooler manifold 16. Remove two gaskets 3.
7. Remove cooler assembly 7.
8. Remove two gaskets 8 from the cooler.
9. Rotate the transmission so that the retarder is facing up.
10. Remove eight M10 x 1.5 x 210 bolts 9.
11. Remove three M12 x 1.75 x 218 bolts 8.
12. Remove cooler manifold 16.
13. Remove gasket 4.

f. Removal of Power Takeoff(s) *(Foldout 19,D)*

NOTE:

Each PTO has eight mounting bolts, two studs, and a gasket. Removal instructions are for a transmission with a single right-side mounted PTO. If your transmission has more than one PTO or the PTO is mounted in a different location, use the same procedure to remove the PTO(s).

1. Remove eight PTO mounting bolts 7 or 11. Carefully remove PTO assembly 8 or 12 and gasket 6 or 10.
2. Inspect two PTO studs 5 or 9 for damage and remove them if necessary.

g. Removal of Transfer Case Module—3700 SP or MD 3070PT *(Figures 4–4 and 4–5)*

1. Remove hose 1 (Figure 4–4), fittings 2 and 3, O-rings 4 and 5, and screen 6. Remove scavenge pump 7 by removing nine bolts 8. Remove gasket 9.
2. Separate fixture J 35926 and the transfer case lifting fixture J 38572 by removing four bolts 6.

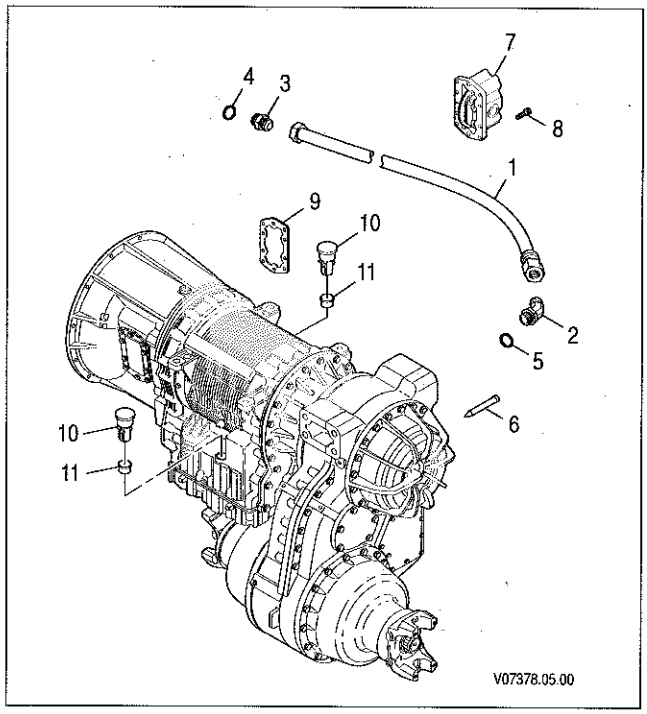

Figure 4–4. 3700 SP and MD 3070PT Scavenge Pump Removal

WARNING:

The transfer case module assembly weighs approximately 270 kg (595 lb).

3. Attach a hoist, making sure that lifting attachments are placed so that the transfer case is properly balanced. Remove nineteen bolts 2 and one bolt 7 to disconnect the transfer case from the main transmission.
4. Raise the transfer case to the mounting face of the repair stand.
5. Secure the transfer case holding fixture to the repair stand.
6. Remove gasket 4 and selective shim 1. The selective shim is located inside shaft adapter 5.

h. Removal of Control Module *(Figure 4–6)*

NOTE:

The control module or filters may contain residual transmission fluid.

WARNING!

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 and a MD 3070PT weighs approximately 29 kg (65 lb).

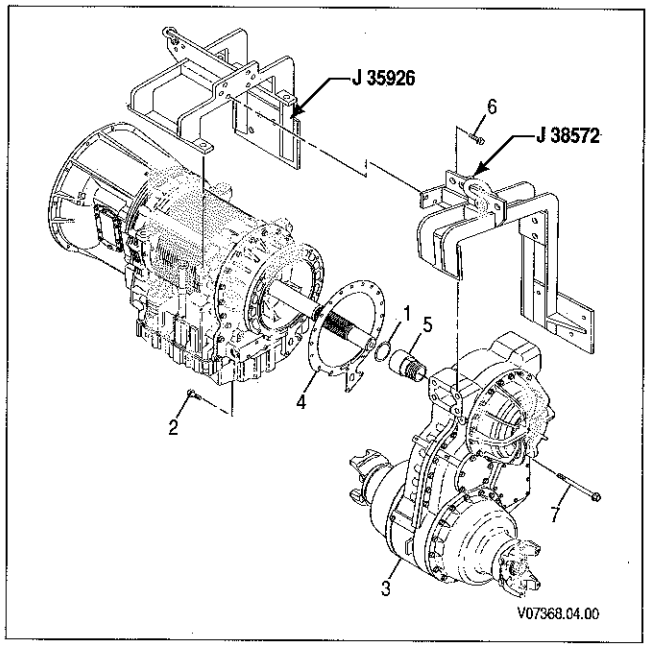

Figure 4–5. Transfer Case Module Removal

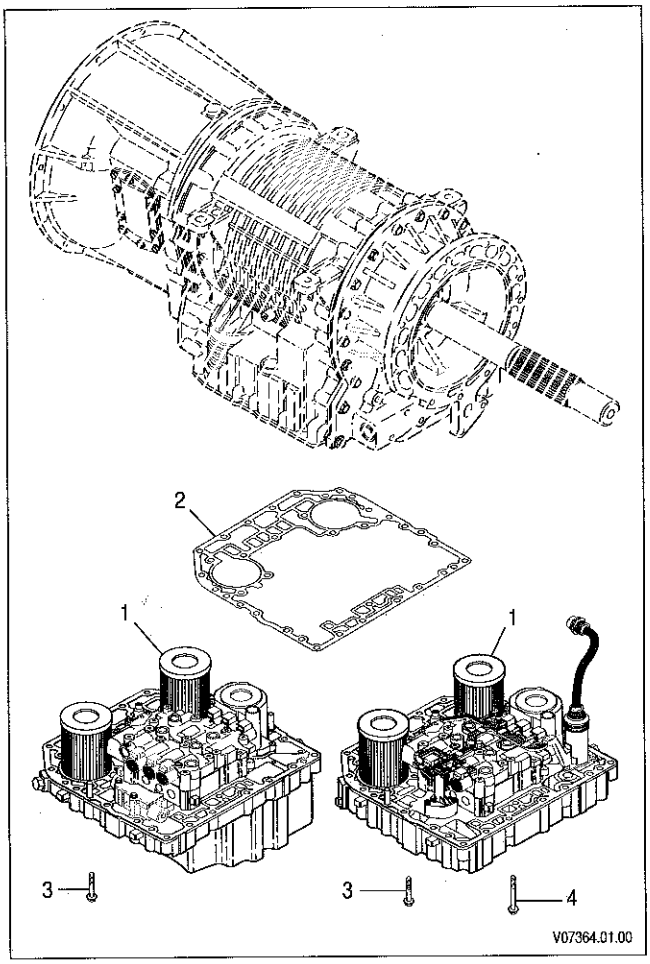

Figure 4–6. Control Module Removal

1. For a two-inch or seven-inch sump, remove thirty-two bolts 3 retaining control module 1 to the main housing module, including the bolts retaining the filter covers.
2. For a four-inch sump, remove seven bolts 3 and twenty-five bolts 4 retaining control module 1 to the main housing module, including the bolts retaining the filter covers.
3. Loosen control module 1 by applying pressure at the reinforced tabs or use jack bolts. Insert jack bolts into the control module bolt holes that bottom against the main housing module.
4. Remove control module assembly 1 and gasket 2.

i. Removal of Torque Converter Module *(Figure 4–7)*

1. Remove any brackets installed to prevent torque converter movement.

NOTE:

- **For units before S/N 6510165560, go to Step (2).**
- **For units beginning with S/N 6510165560, skip Steps (2) and (3) and go to Step (4).**

2. Remove retaining ring 1 using snapring pliers (Figure 4–7, View A).
3. Thread an M6 bolt into converter end plug 2 and remove plug 2 and O-ring 3. Skip Steps (4) and (5) and go to Step (6).
4. Keep the torque converter cover from turning by using a heel bar, two bolts and a screwdriver (Figure 4–7, View C).
5. Remove threaded plug 7 and O-ring 8 using a ¾ inch Allen wrench.
6. Hold the turbine and turbine shaft stationary by using one of the methods listed below:
   - Insert a screwdriver into the vanes on the rotating clutch module (Figure 4–7, View B).
   - If the control module is in place, remove the plug(s), if present, from the fill tube hole or from cooler ports before applying lockup air pressure. Apply air pressure through the lockup pressure tap (Figure 4–7, View D) and use a heel bar, screwdriver, and bolts. Insert the heel bar into a torque converter housing bolt hole. Insert two bolts into the flexplate adapter bolt holes. Then place a screwdriver at an angle to prevent converter rotation (Figure 4–7, View C).
7. Remove bolt 4 using converter bolt tool J 38564.
8. Remove shim 5 located under bolt 4 (Figure 4–7, View A).
9. Attach a sling to the flexplate adapter by positioning the adapter connections an equal distance from each other. Using a chain hoist, carefully lift torque converter module 6 out of the converter housing (Figure 4–7, View A).
10. Place two wooden blocks on the workbench, spaced to support the torque converter module and high enough for the converter hub to clear the workbench. Lower the converter module, converter hub down, onto the blocks.

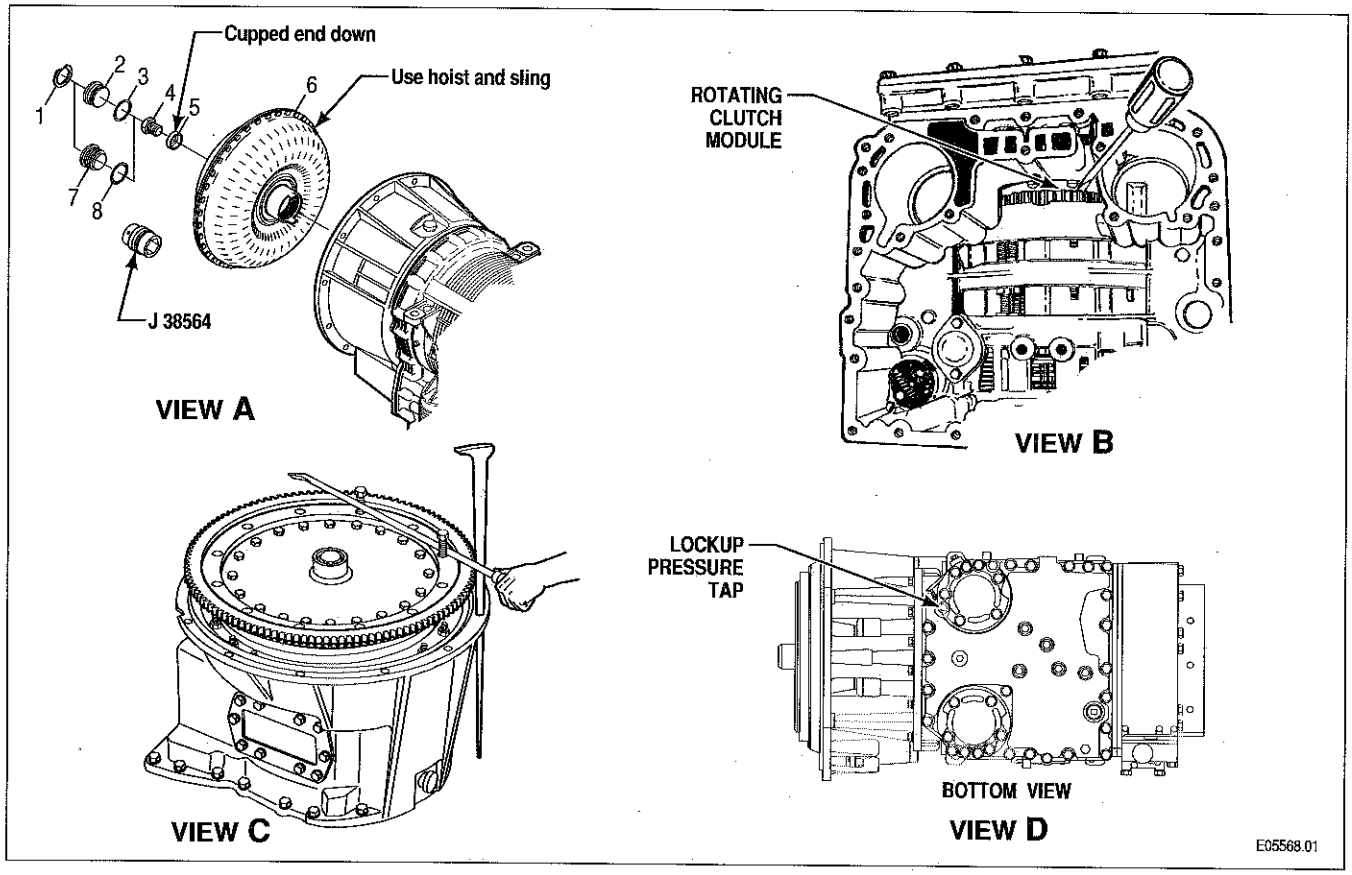

Figure 4–7. Torque Converter Module Removal

j. Removal of Converter Housing Module *(Figure 4–8)*

NOTE:

Three converter housing retaining bolts 3 are removed from inside converter housing 1. After loosening the bolts, use mechanical fingers or a similar tool to remove these bolts.

1. Remove twenty bolts 3 that retain converter housing 1 to main housing module 4.

2. Lift straight up on converter housing module 1, or remove it using the same sling used for removing the converter module.

3. Remove main housing gasket 2 from converter housing 1, or from main housing module 4.

NOTE:

- **Go to Paragraph *j* for units with retarder built before 1/98.**
- **Go to Paragraph *k* for units with retarder built starting 1/98.**

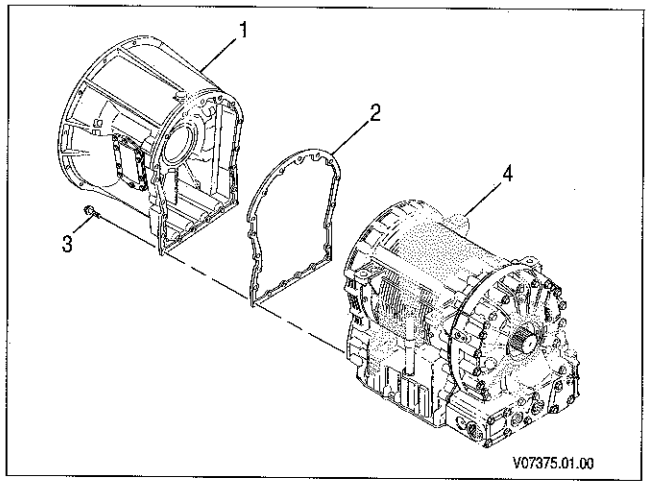

Figure 4–8. Converter Housing Module Removal

k. Removal of Retarder Module (Units Built Before 1/98) *(Foldout 13,A and Figure 4–9)*

NOTE:

Do not remove bolt 56 or two bolts 57 which fasten the retarder housing to the retarder stator.

1. Remove twelve bolts 2 (Foldout 13,A), six bolts 3, and seven bolts 4, that secure retarder module 2 (Figure 4–9) to main housing 3. If used, remove rear support bracket.

WARNING!

The retarder module assembly weighs approximately 64 kg (141 lb). Use care to prevent injury to personnel while handling the retarder module assembly.

2. Thread an M10 eye bolt into the retarder output shaft and lift the retarder module 2 from main housing 3.

3. Remove retarder gasket 1 from main housing 3 or retarder module 2.

l. Removal of Retarder Module (Units Built Beginning 1/98; *Foldout 13,B and Figure 4–9* **and Units Starting With S/N 6510262246;** *Foldout 13,C*)

1. Remove fourteen bolts 2 (Foldout 13,B), two bolts 34, four bolts 3, seven bolts 4, and one bolt 59 that secure retarder module 2 (Figure 4–9) to main housing 3.

WARNING!

The retarder module assembly weighs approximately 64 kg (141 lb). Use care to prevent injury to personnel while handling the retarder module assembly.

2. Thread an M10 eye bolt into the retarder output shaft and lift the retarder module 2 from main housing 3.

3. Remove retarder gasket 1 from main housing 3 or retarder module 2.

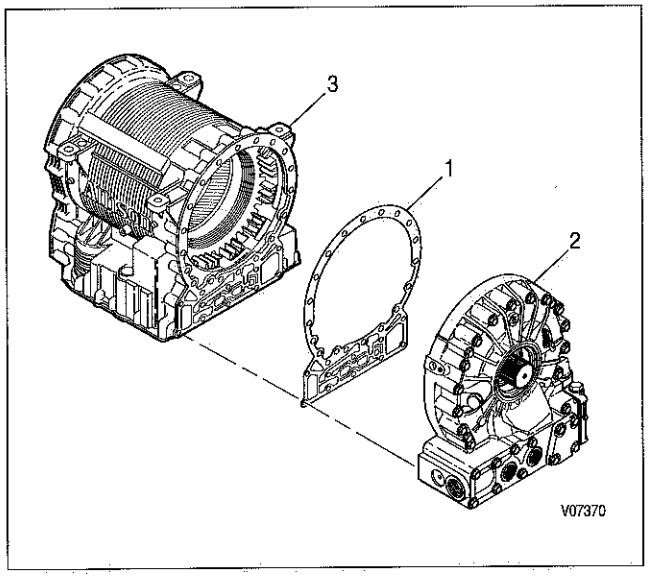

Figure 4–9. Retarder Module Removal

m. Removal of Transfer Case Adapter Housing Module *(Figure 4–10)*

1. Remove adapter housing 3 by removing fifteen bolts 8, three bolts 6, three bolts 5, four bolts 4, and two bolts 7.

2. Remove gasket 2.

3. Remove P3 carrier assembly 1 (Foldout 18,B) by sliding it up over the main shaft.

n. Removal of Rear Cover Module *(Figure 4–11)*

1. Remove nineteen bolts 3.

2. If used, remove the rear support bracket.

3. Attach a suitable sling and lift upward, removing rear cover module 2.

4. Remove rear cover gasket 1 from main housing 4 or rear cover module 2.

o. Removal of Main Shaft Module *(Figure 4–12)*

1. Remove shim 2 and thrust bearing 3 from the main shaft module.

2. Lift main shaft module 1 out of the transmission.

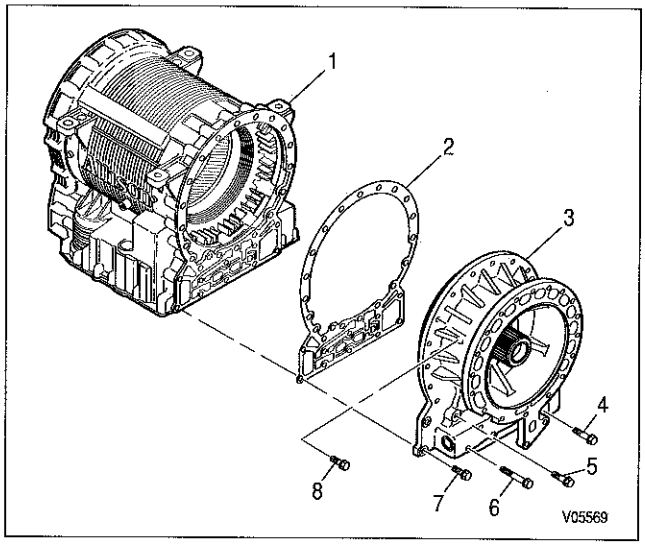

Figure 4–10. Transfer Case Adapter Housing Removal

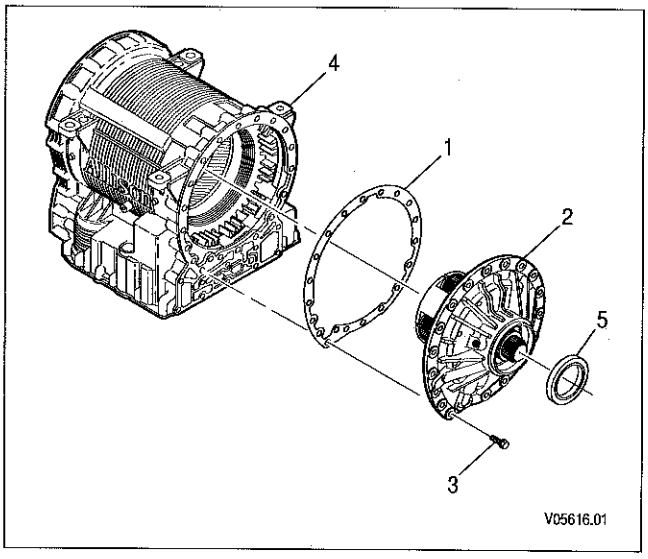

Figure 4–11. Rear Cover Module Removal

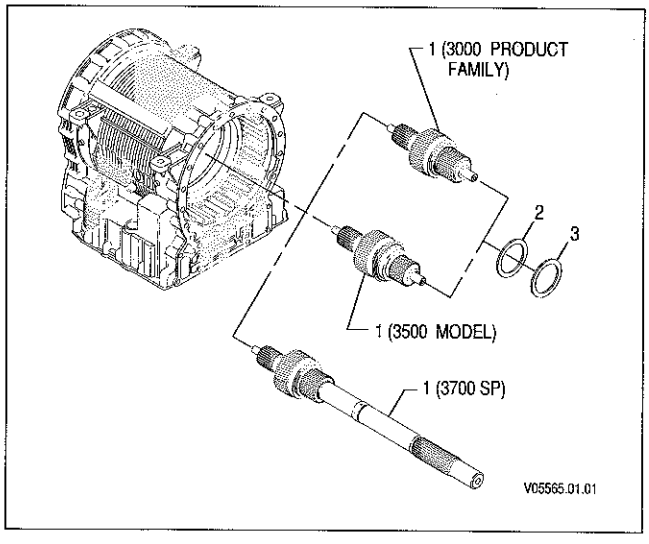

Figure 4–12. Main Shaft Module Removal

p. Removal of P2 Module, C5 Clutch Plates, and P1 Module *(Figures 4–13, 4–14)*

1. Lift P2 planetary module 1 (Figure 4–13) from the main housing module.
2. Lift C5 clutch pack from the main housing module—seven friction plates 3 and eight steel reaction plates 2.
3. Measure the thickness of each friction plate 3. Minimum thickness is 2.90 mm (0.114 inch). Measure the oil groove depth of each friction plate. Minimum groove depth is 0.20 mm (0.008 inch).
4. Measure thickness of each steel reaction plate 2. Minimum thickness is 2.36 mm (0.093 inch).
5. Measure the cone of each plate. Maximum cone is 0.41 mm (0.016 inch).
6. Lift P1 planetary module 1 (Figure 4–14) from the main housing module.

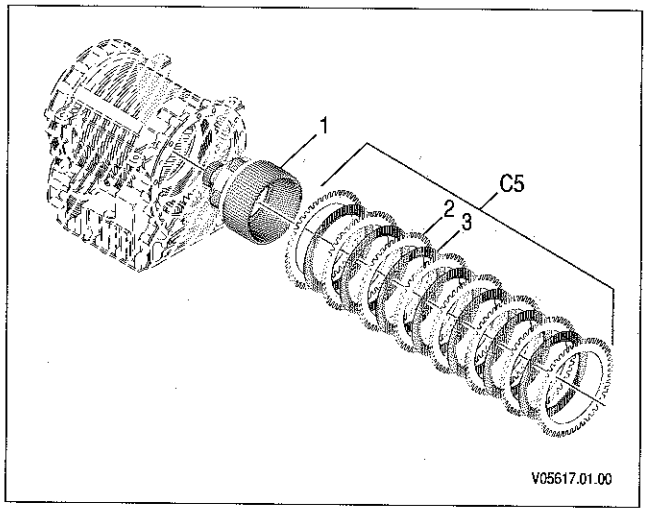

Figure 4–13. P2 Module and C5 Clutch Pack Removal

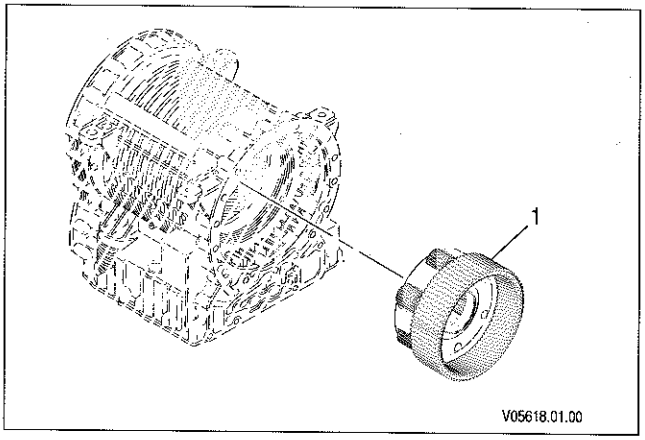

Figure 4–14. P1 Module Removal

q. Removal of Front Support/Charging Pump Module and Rotating Clutch Module *(Figures 4–15, 4–16)*

1. Remove six bolts 1 and five bolts 2 (Figure 4–15) that retain front support and charging pump module 3 to the main housing.
2. Lift front support and charging pump module 3 away from the turbine shaft.

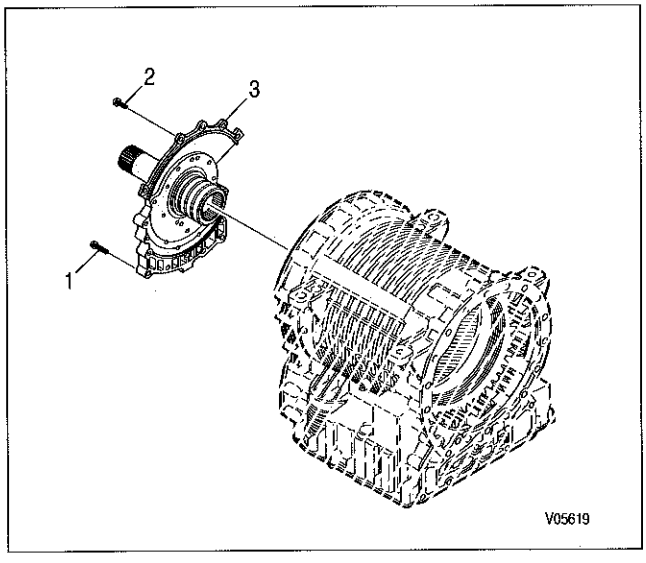

Figure 4–15. Front Support/Oil Pump Module Removal

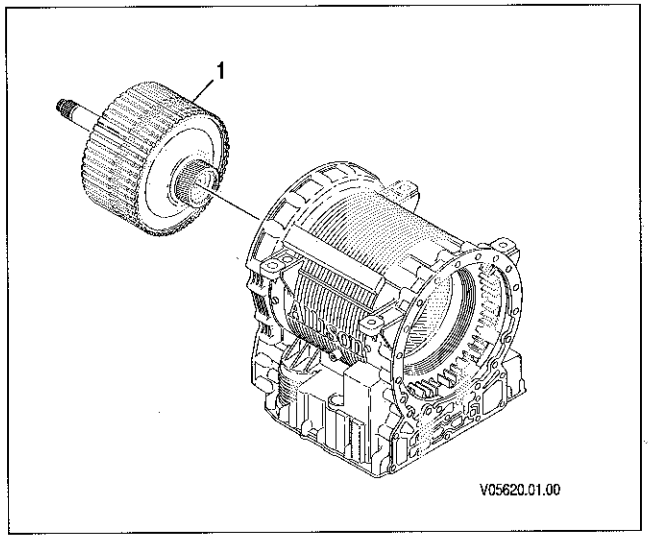

Figure 4–16. Rotating Clutch Module Removal

CAUTION:

Carefully place rotating clutch module 1 (Figure 4–16) on the workbench and prevent it from rolling off the bench.

3. Using a hoist and an M16 eye bolt, lift turbine shaft and rotating clutch module 1 (Figure 4–16) from the main housing module.

r. Removal of C3/C4 Clutch Assembly From Main Housing Module *(Figure 4–17)*

CAUTION:

Make sure that the main housing assembly is horizontal when removing the C3/C4 clutch assembly.

1. Remove twelve bolts 3 retaining C3/C4 clutch assembly 1 in main housing module 2.
2. Remove C3/C4 clutch assembly 1 by sliding it out of the input end of main housing module 2.
3. Remove the main housing from the repair stand for cleaning.
4. Inspect the main housing clutch plate splines. Maximum wear allowed is 1.15 mm (0.045 inch).

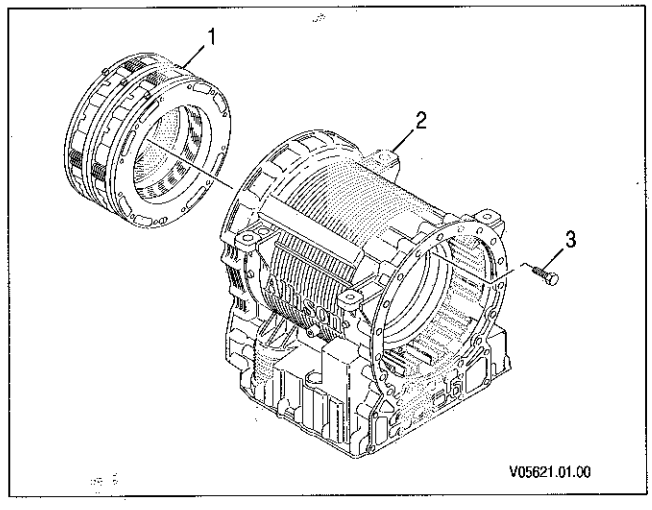

Figure 4–17. C3/C4 Clutch Module Removal

NOTES

SECTION 5—MODULE REBUILD

5–1. SCOPE

a. Section. This section describes the disassembly and assembly of the modules removed in Section 4.

b. Procedures. During rebuild procedures, refer to the exploded views (Foldouts 7 through 19) in the back of this manual.

5–2. GENERAL INFORMATION FOR MODULE REBUILD

Refer to Sections 3 and 7 for general overhaul information as follows:

Paragraph	Description
3–2	Tools, Equipment
3–3	Replacement Parts
3–4	Careful Handling
3–5	Cleaning, Inspection
3–6	Assembly Procedures
7–1	Wear Limits Data
7–2	Spring Data

5–3. TORQUE CONVERTER MODULE

a. Disassembly *(Foldout 7)*

1. Before disassembling the torque converter, note balance marks or mark a line across the converter cover to the pump assembly with a scribe. Aligning these marks will make sure the torque converter is correctly assembled and reduce balance problems.

2. Place torque converter module 4 on a flat surface with the oil pump drive tangs downward. Support the converter assembly on wooden blocks that keep the oil pump drive tangs from contacting the workbench.

3. Remove thirty-six nuts 5 from the OD of torque converter cover assembly 6.

4. Carefully separate cover assembly 6 from pump assembly 32, avoiding damage to their sealing surfaces.

5. Remove large seal 31 used between the cover assembly and pump assembly.

6. Remove turbine assembly 18. Remove sealring 16 from the hub of the turbine assembly. Measure the OD of the turbine hub. Minimum diameter allowed is 61.34 mm (2.415 inch). Place sealring 16 into the bore of cover 8 where it is located during operation. Measure the sealring ID. Replace the sealring when the maximum allowable ID of 56.75 mm (2.234 inch) is exceeded.

7. Remove thrust bearing assembly 19, if replacement is necessary, and star washer 20.

8. Remove stator assembly 21.

9. Remove pump thrust bearing 30 and selective shim 29 from the back of the stator.

10. Remove retaining ring 22.

11. Remove thrust plate 23 and measure its thickness adjacent to the stator race. Minimum thickness allowed is 11.68 mm (0.460 inch).

12. Remove thrust washer 24.

13. Remove and inspect stator race 25, thirteen springs 26, and rollers 27.

14. From converter cover assembly 7, remove twenty (or thirty) bolts 15 retaining lockup clutch backplate 14 to converter cover 8.

15. Remove lockup clutch backplate 14. Measure the thickness of the backplate wear surface. Minimum thickness allowed is 8.58 mm (0.338 inch). Measure the cone of the backplate. Maximum allowable cone is 0.15 mm (0.006 inch).

16. Remove lockup clutch/damper 13 from converter cover 8. Measure the thickness of each lockup clutch friction surface. Minimum thickness allowed is per side is 0.625 mm (0.025 inch). Measure the cone of the lockup clutch friction surfaces. Maximum cone allowed is 0.51 mm (0.020 inch). Check spline wear between the turbine and the lockup clutch damper. Maximum movement allowed is 0.38 mm (0.015 inch).

NOTE:

When the lockup clutch and damper assembly must be replaced, be sure to obtain the correct part for your S/N transmission. All transmissions starting with S/N 6510141464 contain new damper hardware and lockup clutch friction material. This lockup clutch and damper assembly is not interchangeable with parts in units before S/N 6510141464.

17. Remove lockup clutch piston 11 by using air pressure or by lightly striking the converter cover against a flat surface. Remove OD sealring 12 from the lockup clutch piston. Measure the thickness of the lockup clutch piston. Minimum thickness allowed is 5.71 mm (0.225 inch).
18. Remove thrust bearing 17.
19. Inspect the ID of converter cover bushing 9. Maximum allowable bushing ID is 61.51 mm (2.422 inch). If replacement is necessary, remove the bushing using a hammer and a chisel.
20. Remove inner sealring 10 from the converter cover.
21. If replacement is necessary, remove thrust washer 33 from the pump.
22. If bolt replacement is necessary, remove damaged bolt(s) 35 from the OD of torque converter pump 34.
23. Examine torque converter pump assembly 32 for cracks, missing vanes, or a loose torus ring.

b. Assembly *(Foldout 7)*

1. Install stator race 25 into stator and cam assembly 28.
2. Install thirteen springs 26 and rollers 27 into stator and cam assembly 28. Be sure springs and rollers are installed in the cam pockets as shown in Figure 5–1. Lube the rollers.
3. Install thrust washer 24 (Foldout 7) and thrust plate 23 onto stator 28.
4. Install retaining ring 22.
5. Lube star washer 20, and install it on the stator.

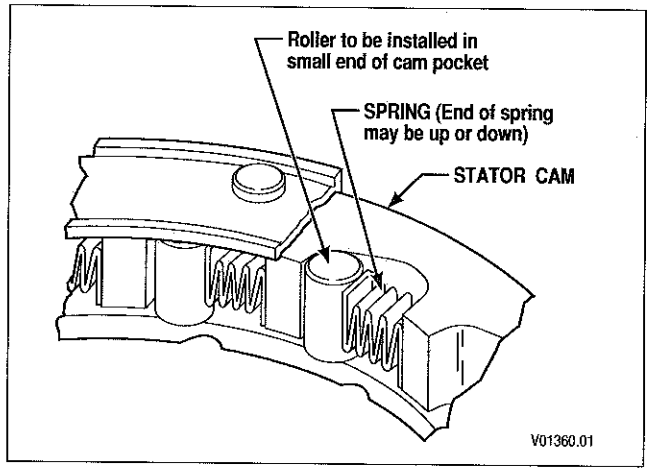

Figure 5–1. Stator Roller/Spring Installation

6. If removed, press a new bushing 9 into the bore of cover 8 using J 38566 bushing installer and J 8092 drive handle. Insert turbine assembly 18 into the new bushing and check for freedom of rotation. After the trial fit, remove the turbine from the front cover.
7. Install thrust bearing 17 in converter cover assembly 7.
8. Install lockup piston seal ring 10 on the hub of converter cover 8 and seal 12 on the OD of lockup clutch piston assembly 11. Install the lockup clutch piston.
9. Install lockup clutch/damper 13 into cover 8.
10. Install lockup clutch backplate 14.
11. Install twenty (or thirty) bolts 15. Tighten bolts to 30–35 N·m (22–26 lb ft).
12. Install thrust bearing 19 onto turbine 18, if it was removed.
13. Install sealring 16 onto turbine 18 and install turbine 18 into converter cover assembly 6.
14. Install stator assembly 21 onto turbine 18.
15. Install selective shim 29, removed in Paragraph 5–3**a**(9), and thrust bearing 30 onto the stator.
16. Be sure all thirty-six bolts 35 are installed into converter pump 34 flange. If removed, install thrust washer 33 into converter pump assembly 32. Stake thrust washer 33 into the converter. Stake at six equally-spaced locations.

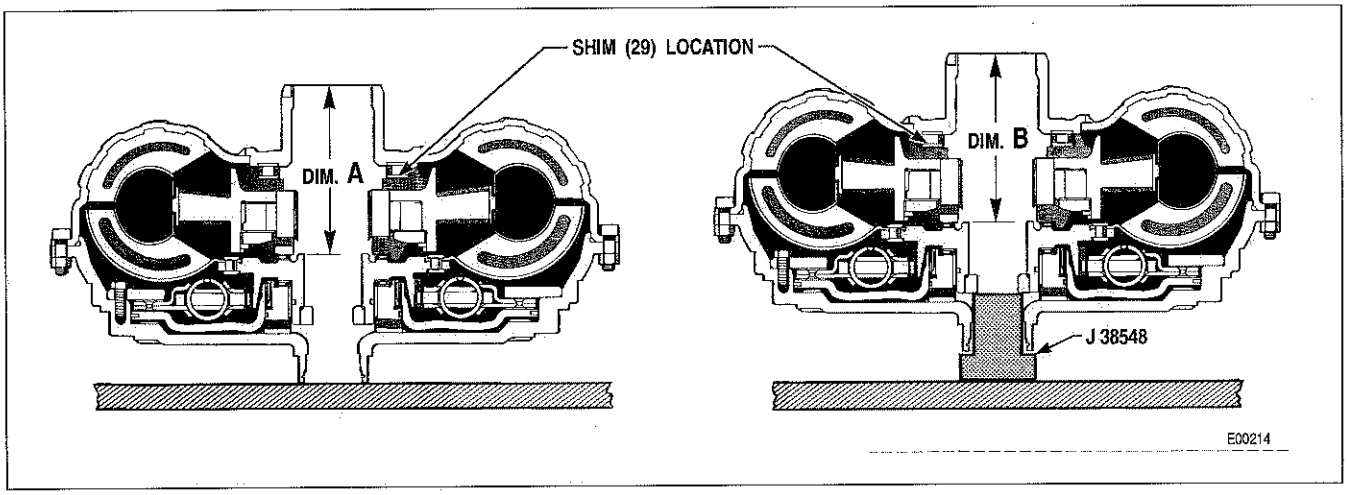

Figure 5–2. Torque Converter Selective Shim Procedure

Table 5–1. Torque Converter Selective Shims

Dimension C	Use P/N	Shim Thickness
0.08–0.35 mm (0.003–0.014 inch)	—	0.000 mm NO STEP
0.36–0.60 mm (0.014–0.024 inch)	29502277	0.23–0.28 mm (0.009–0.011 inch)
0.61–0.83 mm (0.024–0.033 inch)	29502276	0.46–0.51 mm (0.018–0.020 inch)
0.84–1.06 mm (0.033–0.042 inch)	29502275	0.69–0.74 mm (0.027–0.029 inch)

17. Install sealring 31 onto converter cover 8. With balance marks or scribe mark aligned, place converter pump assembly 32 over the top of converter cover assembly 6.
18. Install four nuts 5, evenly spaced, onto four bolts 35. Tighten the nuts to 30–35 N·m (22–26 lb ft).
19. Using a depth micrometer, measure from the top of the converter hub to the thrust surface of turbine assembly 18. This is dimension **A** (Figure 5–2).
20. Insert tool J 38548 into the converter cover and place on a flat surface. Repeat the same measurement as in Step (19). This is dimension **B**.
21. Subtract dimension **B** from dimension **A** to get dimension **C**.
22. Refer to Table 5–1 for correct shim selection.
23. If dimension **C** does not equal the "NO STEP" dimension of 0.08–0.35 mm (0.003–0.014 inch), go back to Paragraph 5–3a and disassemble the converter and install the correct shim at Step **b**(15). Repeat Steps **b**(16)–**b**(23). If dimension **C** equals the "NO STEP" dimension, clearance is correct, go on to Step (24).
24. Install the remaining thirty-two nuts 5 onto converter pump bolts 34. Tighten all the nuts to 30–35 N·m (22–26 lb ft).

5–4. TORQUE CONVERTER HOUSING MODULE (Models Without PTO Provision)

a. Disassembly *(Foldout 8,A)*

NOTE:

Beginning January 2006, all speed sensors have been redesigned. The current speed sensor coil resistance is 315–365 Ohms at 20°C (68°F). Refer to SIL 5-WT-06 Rev A. Table 1 for serial number breaks.

1. If not previously removed, remove input speed sensor retaining bolt 6, sensor retaining bracket 5, input speed sensor assembly 3, and O-ring 4. The input speed sensor should have a resistance of 315–365 Ohms at 20°C (68°F).

CAUTION:
Use the correct wrench size to avoid crushing the breather.

2. Remove breather assembly 9.

b. Assembly *(Foldout 8,A)*

1. Be sure O-ring 4 is in place and install input speed sensor assembly 3. Hold bracket 5 in place and install retaining bolt 6. Tighten the bolt to 24–29 N·m (18–21 lb ft).

CAUTION:
Use the correct wrench size to avoid crushing the breather.

2. Install breather 9. Tighten the breather to 12–16 N·m (9–12 lb ft).

5–5. *TORQUE CONVERTER HOUSING MODULE (Models With PTO Provision)*

a. Module Disassembly *(Foldout 8,B)*

1. If not previously removed, remove input speed sensor retaining bolt 22, sensor retaining bracket 21, input speed sensor assembly 19, and O-ring 20. The input speed sensor should have a resistance of 300 ± 30 Ohms.

CAUTION:
Use the correct wrench size to avoid crushing the breather.

2. Remove breather assembly 29 or breather adapter 30.

3. If present, remove PTO cover(s) 26 by removing ten bolts 27 for each cover. Remove PTO cover(s) 26 and gasket(s) 25.

4. Remove ten bolts 2 holding bearing retainer assembly 3 and PTO gear assembly 9 into converter housing 23.

5. Remove bearing retainer assembly 3 and PTO gear assembly 9. If necessary, use jack bolts to loosen the bearing retainer assembly.

6. Inspect the bearing bore of converter housing 23 for damage. Measure the bearing bore—maximum ID permitted is 140.03 mm (5.513 inch).

b. Disassembly of the Bearing Retainer

1. Remove sealring 8 from bearing retainer 7. Remove oil seal 4 using tool J 24171-A.

2. Inspect bushing 6 for damage or wear and remove if replacement is necessary. Maximum bushing ID permitted is 75.23 mm (2.962 inch).

3. Inspect the bearing bore of bearing retainer 7 for damage. Measure the bearing bore—maximum ID permitted is 140.06 mm (5.514 inch).

c. Disassembly of the PTO Gear Assembly

1. Remove retaining ring 16. Remove oil pump drive hub 14 from PTO gear 13. If present, remove retaining ring 12 only if replacement is required.

2. Inspect oil pump drive hub for excessive wear on drive tangs. Maximum allowable tang wear is 0.38 mm (0.015 inch).

3. Remove sealrings 10 and 17. If replacement is required, remove bearings 11 and 15 from PTO gear 13.

d. Assembly of the PTO Gear Assembly

1. If removed, press bearings 11 and 15 onto PTO gear 13, using tool J 38565.

CAUTION:
On transmissions before S/N 6510005902, be sure to assemble oil pump drive hub 14 with the longer unsplined side toward the oil pump (see Figure 5–3). A drive hub assembled backwards will cause transmission damage.

2. If removed, install retaining ring 12 and then install oil pump drive hub 14 into PTO gear 13. Install retaining ring 16 onto hub 14.

3. Refer to Paragraph 3–6**h**. Insert two butt-joint sealrings 10 and 17 into the sealing bore of converter housing 23 and measure the end gap with feeler gauges. Maximum allowable sealring end gap is 0.57 mm (0.022 inch).

4. Remove the two sealrings 10 and 17 from the converter housing and install them onto PTO gear 13.

e. Assembly of the Bearing Retainer Assembly

1. If removed, install bushing 6 using a press and tools J 35922-2 and J 8092.

2. Install sealring 8. Install oil seal 4 using a press and tools J 35921-3 and J 35921-1.

f. Module Assembly

1. With a mallet, lightly tap PTO gear assembly 9 into converter housing 23 until the gear assembly is seated.

2. Use guide bolts to install bearing retainer assembly 3, rocking the retainer while installing.

3. Install ten bolts 2 holding bearing retainer assembly 3 and PTO gear assembly 9 to housing 23. Tighten the bolts to 51–61 N·m (38–45 lb ft).

4. If used, install PTO cover(s) 26 and gasket(s) 25 using ten bolts 27 in each cover. Tighten the bolts to 51–61 N·m (38–45 lb ft).

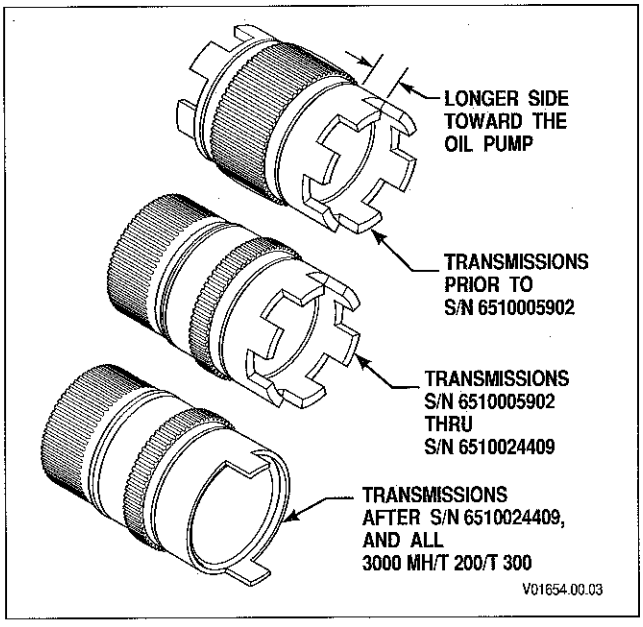

Figure 5–3. Oil Pump Drive Hubs

5. Be sure O-ring 20 is in place and install input speed sensor assembly 19. Hold bracket 21 in place and install retaining bolt 22. Tighten the bolt to 24–29 N·m (18–21 lb ft).

CAUTION:

Use the correct wrench size to avoid crushing the breather.

6. Install breather 29 or breather adapter 30. Tighten the breather or breather adapter to 12–16 N·m (9–12 lb ft).

5–6. FRONT SUPPORT AND CHARGING OIL PUMP MODULE

a. Module Disassembly *(Foldout 9,A)*

1. Remove three seals 23 from the front support hub.

2. Remove thrust bearing 24.

3. Remove eight bolts 6 that retain pump housing assembly 7 to front support assembly 15.

4. Compress pressure relief spring 26 using tool J 41462. Remove pin 25. Slowly release pressure on the spring and remove spring 26 and ball 27.

NOTE:

Beginning with S/N 6510481001 and S/N 6520030485, gear set 10 has been replaced with a new design. The current and former gears set designs are not interchangeable. In the current design, gear set bushing 11 has an orange lining. Refer to SIL 13-WT-04.

5. Remove pump housing assembly 7 and gear set 10.

6. On models without PTO, remove O-ring 4. Remove oil seal 5 using tool J 24171-A.

7. Measure gear-cavity depth in the pump housing (Figure 5–4a). Maximum allowable depth is 17.93 mm (0.706 inch).

8. Measure gear-cavity diameter in the pump housing (Figure 5–4b). Maximum ID permitted is 127.30 mm (5.012 inch).

9. On non-PTO models only, inspect bushing 8 inside pump housing 9 (Foldout 9,A) for wear or damage. Measure the ID of the pump bushing. Maximum allowable ID is 75.23 mm (2.962 inch). If worn or damaged, remove bushing 8 from pump housing 9.

10. If pump housing 9 is worn or damaged, replace the pump housing.

11. Measure the OD of the driven (outer) pump gear. Minimum allowable OD is 126.95 mm (4.998 inch).

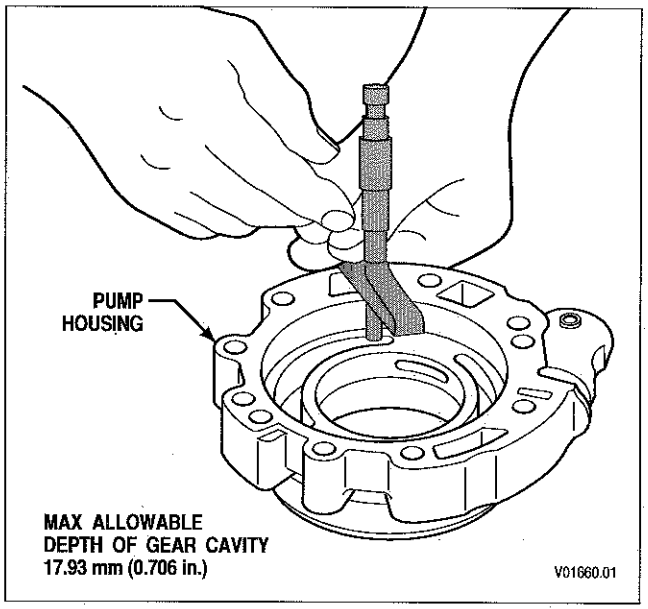

Figure 5–4a. Measuring Gear-Cavity Depth In The Pump Housing

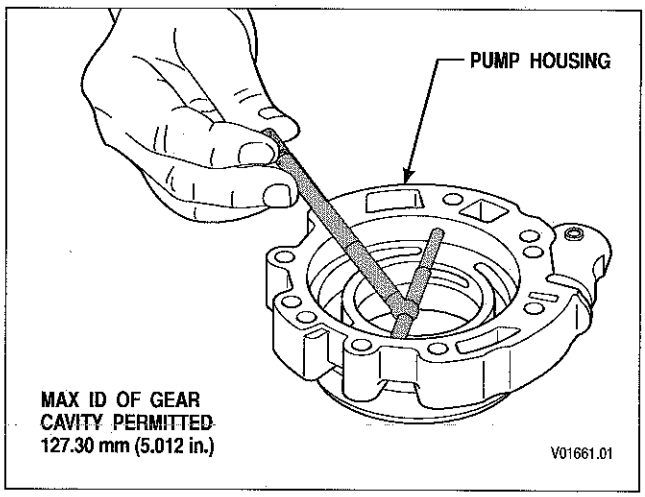

Figure 5–4b. Measuring Gear-Cavity Diameter In The Pump Housing

12. Measure the width of the driven pump gear. Minimum width permitted is 17.81 mm (0.701 inch).

13. Inspect the bushing inside the drive (inner) gear for wear or damage. Measure the ID of the drive gear bushing. Maximum ID allowed is 57.30 mm (2.256 inch). If worn or damaged, remove the bushing from the drive gear.

NOTE:

For 3000 Product Family transmissions starting with S/N 6510024410, a NEW staked bushing is used with a NEW gear set. You must use a NEW bushing with the NEW gear set. The later bushing cannot be used with the earlier gear set. Refer to Figure 5–5.

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14. Measure the width of the drive and driven pump gears. Minimum width allowed is 17.81 mm (0.701 inch).

15. For models with PTO, examine the tang slots in the drive pump gear. Replace the gear if the slots have been battered.

16. Install gear set 10 into pump housing 9. Measure pump gear side clearance (Figure 5–5). Maximum clearance permitted is 0.13 mm (0.005 inch).

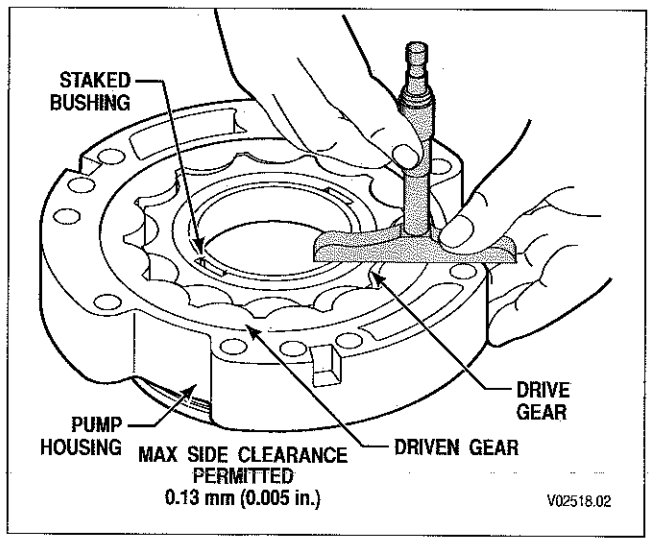

Figure 5–5. Measuring Gear Side Clearance In The Pump Housing

17. Measure gear tooth tip clearance (Figure 5–6). Maximum allowable clearance is 0.20 mm (0.008 inch).

18. Measure driven gear-to-pump housing (diametral) clearance (Figure 5–7). Maximum clearance permitted is 0.36 mm (0.014 inch).

19. If any measurement is out of specification, replace the pump housing and/or gear set 10 and repeat Steps (11) through (18).

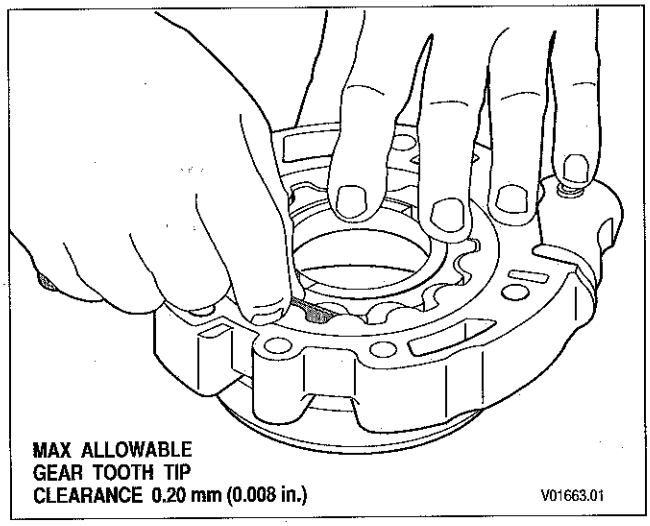

Figure 5–6. Measuring Gear Tooth Tip Clearance In The Pump Housing

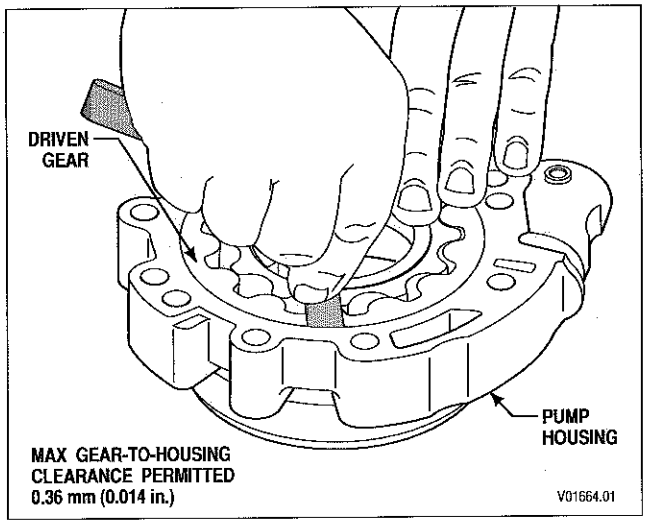

Figure 5–7. Measuring Driven Gear Clearance In The Pump Housing

20. Remove ten bolts 12 (Foldout 9,A) retaining stiffening plate 13, if present, and wear plate 14 to front support assembly 15. Remove stiffening plate 13, if present, and wear plate 14. Inspect wear plate 14 for scoring, nicks, or grooving. Measure the thickness of the wear plate. Minimum wear plate thickness allowed is 4.70 mm (0.185 inch).

21. If damaged, remove bearing 22 from front support assembly 15 using tool J 24171-A.

22. Measure the OD of front support sleeve 20. Minimum allowable OD is 98.83 mm (3.891 inch). If worn or damaged, remove front support sleeve 20 from front support 21.

23. If damaged, remove dowel pin(s) 19 from front support 21.

24. Measure the OD of ground sleeve 16 or 17 at the journal for the oil pump gear set bushing. The minimum allowable OD is 57.04 mm (2.246 inch).

25. If worn or damaged, remove ground sleeve 16 or 17 by pressing ground sleeve from front support 21.

b. Assembly of the Front Support

NOTE:

Before S/N 6510024410, if turbine shaft 6 or 9 (Foldout 9,B) is being replaced, ground sleeve 16 or 17 must be replaced also. All units built after S/N 6510142342 have a redesigned turbine shaft. The current turbine and former turbine shafts are interchangeable. 3000, 3200 TRV, and 3200 SP models with serial numbers greater than S/N 6510142220 must use the current turbine shaft (refer to SIL 8-WT-98 Rev B).

1. If removed, install ground sleeve 16 or 17 (Foldout 9,A and Figure 5–8). Place front

support 21 on press bed. The machined flat at the base of the ground sleeve must align with the cast arrow on the front support (Figure 5–8, View C). Press ground sleeve 16 or 17 into front support 21 to the shoulder. After installation, total runout may not exceed 0.30 mm (0.012 inch).

2. If removed, install dowel pin(s) 19. Press the pin(s) to a height of 14.5 mm (0.57 inch) from the surface (Figure 5–8, View A).

3. Install front support sleeve 20 using a press, and tools J 38565 and J 35921-1.

CAUTION:

Be sure to use the correct length bolts when installing the front support or transmission damage will occur. The ten bolts 12 used when the stiffening plate is present are 5 mm (0.197 inch) longer than the bolts used when the stiffening plate is not present.

4. Install stiffening plate 13, if present, and wear plate 14 (Foldout 9,A). Secure with ten bolts 12. Tighten the bolts to 51–61 N·m (38–45 lb ft).

5. Install bearing 22 using a press and tools J 35922-2 and J 8092. Press bearing 22 flush to 0.25 mm (0.010 inch) below the surface.

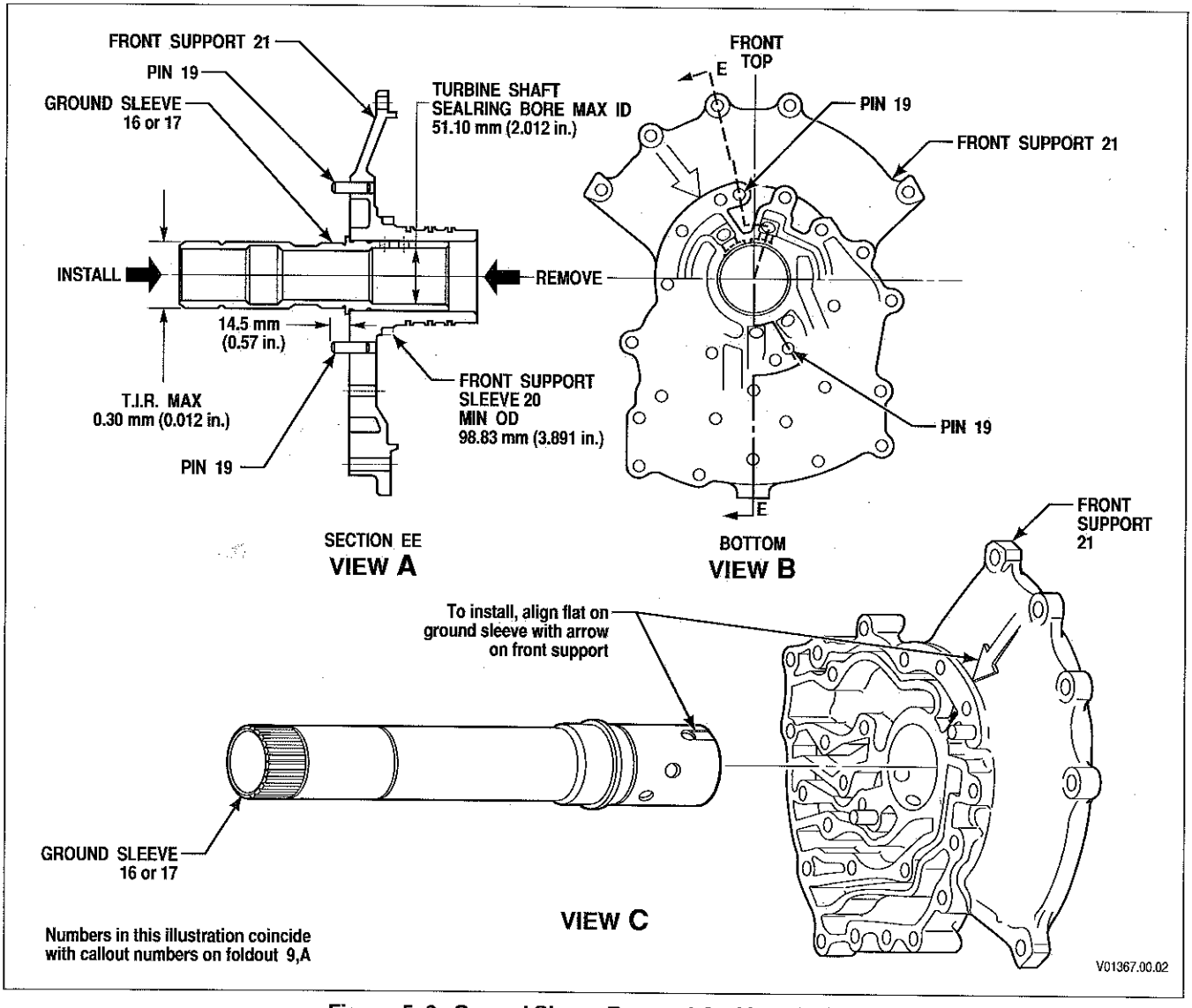

Figure 5–8. Ground Sleeve Removal And Installation

c. Assembly of the Pump Housing *(Foldout 9,A)*

NOTE:

- **For models without PTO, proceed with Step (1).**
- **For models with PTO, skip Steps (1), (2), and (3) and proceed to Step (4).**

1. If old bushing was removed, install new bushing 8 (Foldout 9,A) into pump housing 9 using a press and tools J 35922-2 and J 8092.

NOTE:

For 3000 Product Family transmissions starting with S/N 6510024410, a NEW staked bushing is used with a NEW gear set. You must use a NEW bushing with the NEW gear set. The later bushing cannot be used with the earlier gear set. Refer to Figure 5–5.

2. Install oil seal 5 using a press and tools J 35921-3 and J 35921-1.
3. Install O-ring 4.
4. Install pressure relief ball 27 and pressure relief spring 26 into pump housing. Using tool J 41462, compress spring 26. Install pin 25 to retain spring and ball.

NOTE:

Beginning with S/N 6510481001 and S/N 6520030485, gear set 10 and bushing 11 have been replaced with a new design. The current and former designs are not interchangeable. Current design gear set bushing 12 has an orange lining. The current gear set 10 and bushing 11 designs must be used together. If replacing gear set 10 or bushing 11, replace both parts with the current design. Refer to SIL 13-WT-04.

5. Lubricate pump gear set 10 to prevent damage and install the gear set in pump housing 9.
6. Retain the pump housing to the front support with eight bolts 6. Tighten the bolts to 51–61 N·m (38–45 lb ft).
7. Install thrust bearing 24 onto front support 21.
8. Refer to Paragraph 3–6**h**. Insert three butt-joint sealrings 23 into the sealing bore of the rotating clutch hub and measure the end gap with feeler gauges. Maximum sealring end gap allowed is 0.57 mm (0.022 inch).
9. Remove three sealrings 23 from the rotating clutch hub and install them onto the hub of front support 21.

5–7. ROTATING CLUTCH MODULE

a. Disassembly *(Foldout 9,B)*

1. Remove retaining ring 45.
2. Remove P1 sun gear assembly 42.
3. Inspect and measure the ID of sun gear bushing 44. Maximum ID permitted is 68.22 mm (2.685 inch). Remove the bushing if replacement is necessary.
4. Remove C2 retaining ring 41.
5. Remove C2 backplate 40.
6. Measure the wear surface thickness of C2 backplate 40. Minimum thickness allowed is 6.25 mm (0.246 inch). Check flatness of the backplate. Maximum allowable distortion is 0.45 mm (0.018 inch).
7. Remove C2 clutch pack—six friction plates 39 and six steel reaction plates 38.
8. Measure the thickness of each friction plate 39. Minimum thickness permitted is 2.21 mm (0.087 inch). Measure the oil groove depth and cone of each friction plate. Minimum groove depth permitted is 0.20 mm (0.008 inch). Maximum cone allowed is 0.40 mm (0.016 inch).
9. Measure the thickness and cone of each steel reaction plate 38. Minimum allowable thickness is 2.36 mm (0.093 inch). Maximum cone permitted is 0.40 mm (0.016 inch).
10. Remove C2 drive hub 37, including two thrust bearings 36. Inspect the splines of the C2 drive hub. Maximum spline wear permitted is 0.38 mm (0.015 inch).
11. Remove C1 drive hub 35. Inspect the splines of the C1 drive hub. Maximum allowable spline wear is 0.38 mm (0.015 inch).

NOTE:

3000 Product Family and all MD 3066 and B 400 models starting with S/N 6510142342 have C1 and C2 drive hubs with changed material for increased torque capacity. The improved part MUST be used when replacing either of the hubs in 3000 Product Family units and all MD 3066 or B 400 units with the S/N shown and above. All other 3000 Product Family transmissions before the S/N shown may be serviced with the standard hubs.

12. Remove C1 retaining ring 34 and C1 clutch pack—backplate 29 and apply plate 32 or 33, six friction plates 30, and five steel reaction plates 31.
13. Measure the thickness of each friction plate 30. Minimum thickness allowed is 2.21 mm (0.087 inch). Measure the oil groove depth and cone of each friction plate. Minimum allowable groove depth is 0.20 mm (0.008 inch). Maximum cone permitted is 0.40 mm (0.016 inch).
14. Measure the thickness and cone of each steel reaction plate 31. Minimum thickness allowed is 2.36 mm (0.093 inch). Maximum allowable cone is 0.40 mm (0.016 inch).

NOTE:

For transmission before S/N 6610032320 refer to Section 7 for apply plate and backplate wear limits.

15. Measure the wear surface thickness of the C1 apply 29 and backplates 32 or 33. Minimum thickness permitted is 6.20 mm (0.244 inch). Check flatness of the backplates. Maximum distortion allowed is 0.15 mm (0.006 inch).
16. Remove thrust bearing 15 from hub assembly 12.
17. Remove retaining ring 16 and turbine shaft assembly 5 or 8.
18. Inspect bushing 7 inside the end of turbine shaft 5 or 8. Measure the ID of the turbine shaft bushing. Maximum ID allowed is 20.19 mm (0.795 inch).
19. Remove three rotating sealrings 10.
20. Remove O-ring 4 from turbine shaft assembly 5 or 8.

WARNING!

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

21. Place rotating clutch on tool base J 35923-4 so rotating drum is supported by tool tangs (Figure 5–9, View C). Install J 35923-1 (Figure 5–9, View A), bearing, washer, and handle J 28467-34. Tighten tool, compressing C1 balance piston 26 (Foldout 9,B) and C1 return spring 25. Remove retaining ring 28. Remove tool J 35923-1.
22. Remove balance piston 26, sealring 27, and C1 spring assembly 25.
23. Install tools J 35923-3 and J 35923-2 (Figure 5–9, View B), bearing, washer, and handle J 28467-34. Tighten tool and remove retaining ring 22 (Foldout 9,B). Remove tools J 35923-2 and J 35923-3.
24. Remove C2 spring assembly 21.
25. Lift rotating drum 11 free of hub assembly 12 and C1/C2 pistons 20 and 24. Inspect the clutch splines of the rotating drum. Maximum allowable spline wear is 0.38 mm (0.015 inch).
26. Remove C1 and C2 pistons 20 and 24 from hub assembly 12—rocking the pistons from side-to-side.
27. Inspect the ID of rotating clutch hub bushing 13. Maximum allowable bushing ID is 99.25 mm (3.907 inch). Remove the bushing from hub assembly 12 if replacement is necessary. Avoid damaging the bushing bore.
28. Remove piston seals 17 and 18 from hub assembly 12.

NOTE:

Beginning with MD 3060/3560 models S/N 6510184386 and MD 3066/B 300/B 400 models S/N 6510130438, clutch hub assembly 12 was changed from a single weld design to a double weld design. All T 200 and T 300 models contain the double weld design. Carefully inspect units before this S/N for cracks in the weld area and replace defective parts with the new design. Use magnetic particle inspection or place solvent in the C2 piston bore to confirm that a crack is present.

29. Separate C1 piston 24 and sealring 23 from C2 piston 20 and sealring 19 by tapping lightly on the C1 piston. Remove sealrings 23 and 19 from the pistons.

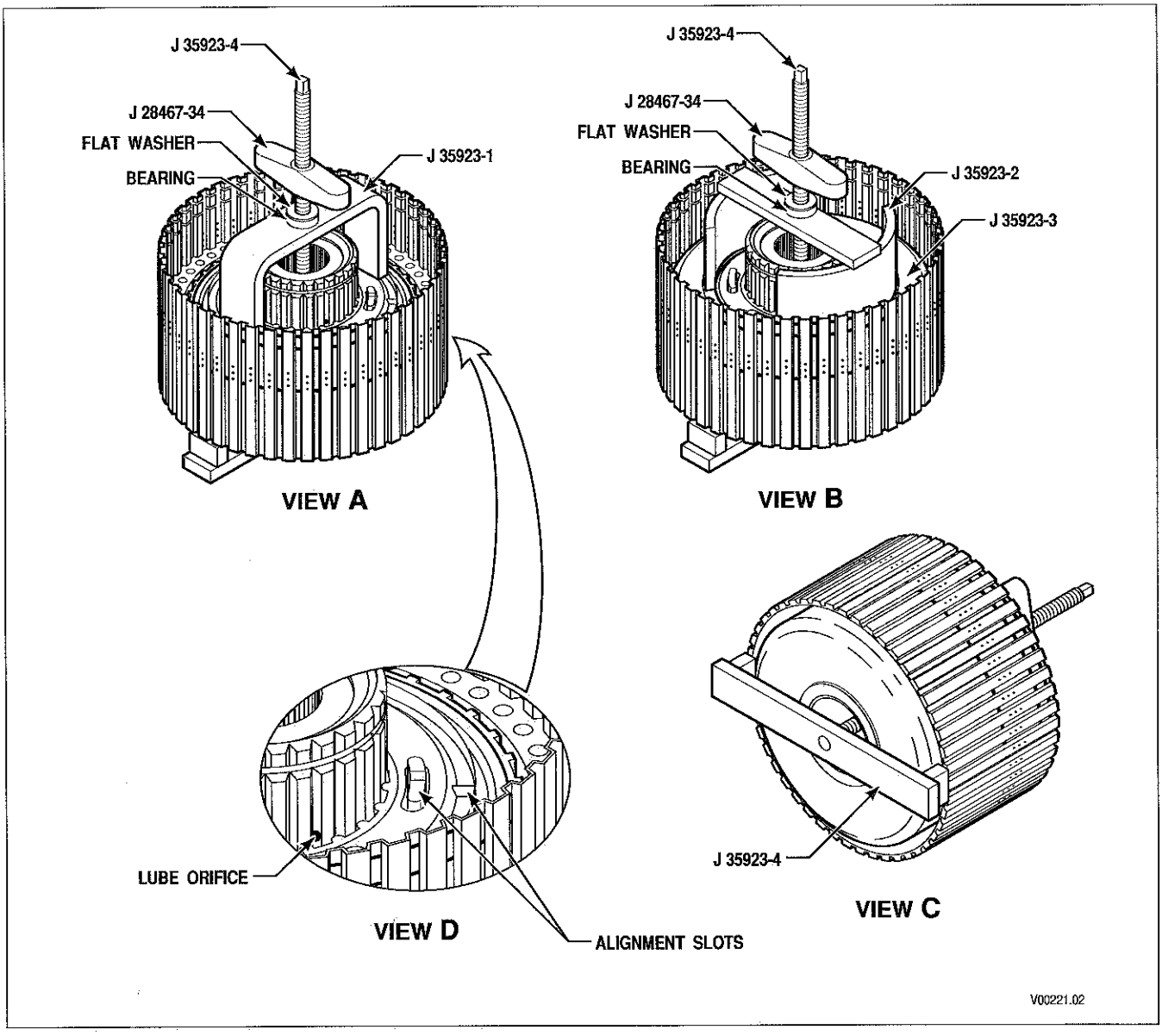

Figure 5–9. Rotating Clutch Assembly/Disassembly

b. Assembly *(Foldout 9,B)*

CAUTION:

Beginning with S/N 661032320, C1 clutch piston 24 and balance piston 26 are a new design. In units before the S/N, if either part must be replaced, BOTH the C1 clutch piston 24 and the balance piston 26 must be replaced with the new design parts. Intermixing new and old design parts causes misalignment leading to damage to C1 return spring assembly 25 and potential failure of C1 clutch piston 24 or C1 balance piston 26.

1. If removed during disassembly, install bushing 13 into rotating clutch hub 14 using tools J 35922-2 and J 8092.

2. Install piston seals 17 and 18 into rotating clutch hub assembly 12. Lube sealrings.

3. Install a new OD sealring 19 in C2 piston 20. Lubricate C2 clutch piston inside bore and OD of the sealring. Install C2 piston 20 into the rotating clutch hub assembly. Lightly tap until it is fully seated.

4. Install a new OD sealring 23 into C1 piston 24. Lube the inside bore and OD sealring on the C1 piston. Aligning slot in C1 clutch piston with any lube orifice on the rotating clutch hub, install C1 clutch piston into the center of C2 piston 20. With a soft mallet, lightly tap C1 piston until it is fully seated.
5. Place the assembly on tool base J 35923-4. Install C1 spring assembly 25.
6. Install a new sealring 27 on balance piston 26. Lube the sealring.
7. Place balance piston 26 on the assembly, aligning the notch on the C1 piston with the cast bump in the balance piston.
8. Install tool J 35923-1 over the assembly along with bearing, washer, and handle. Thread the handle down and compress C1 spring assembly 25.
9. Install retaining ring 28 into the hub of the rotating clutch assembly.
10. Carefully release the C1 spring and remove all tools from the assembly.
11. Install C1/C2 assembly into rotating clutch drum 11.
12. Install C2 clutch spring assembly 21 with the stepped end down. Make sure the spring assembly properly aligns with the drum and hub splines.
13. Place the assembly on tool base J 35923-4 so that the rotating drum is supported by tool tangs (Figure 5–9, View C). Install tools J 35923-3 and J 35923-2 (Figure 5–9, View B), bearing, washer, and handle. Compress C2 spring assembly 21 and install retaining ring 22 (Foldout 9,B). Remove tools J 35923-3 and J 35923-2.

NOTE:

For units built before S/N 6510024410, when turbine shaft 6 or 9 (Foldout 9,B) must be replaced, ground sleeve 16 or 17 (Foldout 9,A) must also be replaced.

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14. If removed, install bushing 7 into turbine shaft 6 or 9 using tools J 35922-1 and J 8092.
15. Install O-ring 4 onto the forward end of the turbine shaft.
16. Refer to Paragraph 3–6h for method and procedure. Insert three butt-joint sealrings 10 into the sealing bore of ground sleeve 16 or 17 (Foldout 9,A) and measure the end gap with feeler gauges. Maximum sealring gap allowed is 0.94 mm (0.037 inch). Remove sealrings from the ground sleeve bore and install them on turbine shaft assembly 5 or 8 (Foldout 9,B).
17. Install turbine shaft assembly 5 or 8. Retain the turbine shaft with retaining ring 16.
18. Install thrust bearing 15 onto the end of rotating clutch hub assembly 12. Position the assembly with the turbine shaft downward.

NOTE:

In 3000 Product Family units starting with S/N 6510164169, the two identical C1 pressure plates have been replaced by two different plate designs. The pressure plate 29 which goes next to the C1 piston is 2 mm (0.157 inch) thinner. The pressure plate 29 at the opposite end of the C1 clutch pack is 2 mm (0.157 inch) thicker and is reshaped. See Figure 5–10 for pictorial information.

CAUTION:

The new design C1 pressure plates must be used together and cannot be intermixed with the older identical plates or C1 clutch will fail.

19. Install C1 clutch pack—one apply plate 29 and one backplate 32 or 33, with apply plate 29 closest to the C1 piston and backplate 32 or 33 farthest away from the C1 piston. Install six friction plates 30, and five steel reaction plates 31. Install clutch plates alternately, starting with a friction plate 30. Install C1 retaining ring 34.
20. Install C1 drive hub 35.
21. Install a thrust bearing 36 on each side of C2 drive hub 37, and install this assembly over C1 drive hub 35.

CAUTION:

B 400 models beginning with S/N 6510043834 were called "enhanced" B 400 models and have C2 clutch plates with a different friction coefficient. Also, most early B 400 units were updated to this configuration. Be sure to replace C2 clutch friction plates with the correct plates. "Enhanced" plates are identified with an orange mark (5–20 mm wide) on the OD of the plate.

22. Install C2 clutch plates—six friction plates 39 and six steel reaction plates 38. Install clutch plates alternately, starting with a steel reaction plate 38.
23. Install C2 backplate 40. Install C2 retaining ring 41.
24. If removed, install bushing 44 using tools J 35922-2 and J 8092.
25. Install P1 sun-gear drive hub assembly 42. Install retaining ring 45.

5–8. *C3/C4 AND MAIN HOUSING MODULE*

a. Disassembly *(Foldout 10,A)*

NOTE:

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

1. If nameplate 28 is damaged, remove nameplate retaining screw 29 and nameplate 28.
2. If present, remove two bolts 30 and feed-through connector assembly 32.
3. Inspect the clutch splines in the interior of main housing 27. Maximum spline wear allowed is 1.15 mm (0.045 inch).
4. Remove twelve bolts 2 retaining C3 clutch components to C4 clutch housing 24. Remove C3 backplate assembly 3. Measure the step wear of C3 backplate 4. Maximum step wear allowed is 0.13 mm (0.005 inch).

NOTE:

Beginning with S/N 6510496989 and S/N 6520033015, 3000 Product Family transmissions contain redesigned wear plates in the C3 clutch housing and on the C3 backplate. Current and former wear plates are not interchangeable. The wear plates do not affect use of the C3 clutch housing or C3 backplate as assemblies. Refer to SIL 17-WT-04.

5. For transmissions after S/N 6510496989 and S/N 6520033015, inspect three wear plates 5 on clutch backplate 4. Measure the wear plates at the contact surface. Minimum thickness allowed is 2.81 mm (0.111 inch). Check flatness of backplate 4 and the wear plates. Maximum allowable distortion is 0.15 mm (0.006 inch). If replacement is necessary, remove the wear plates by gently prying the wear plate from the backplate.

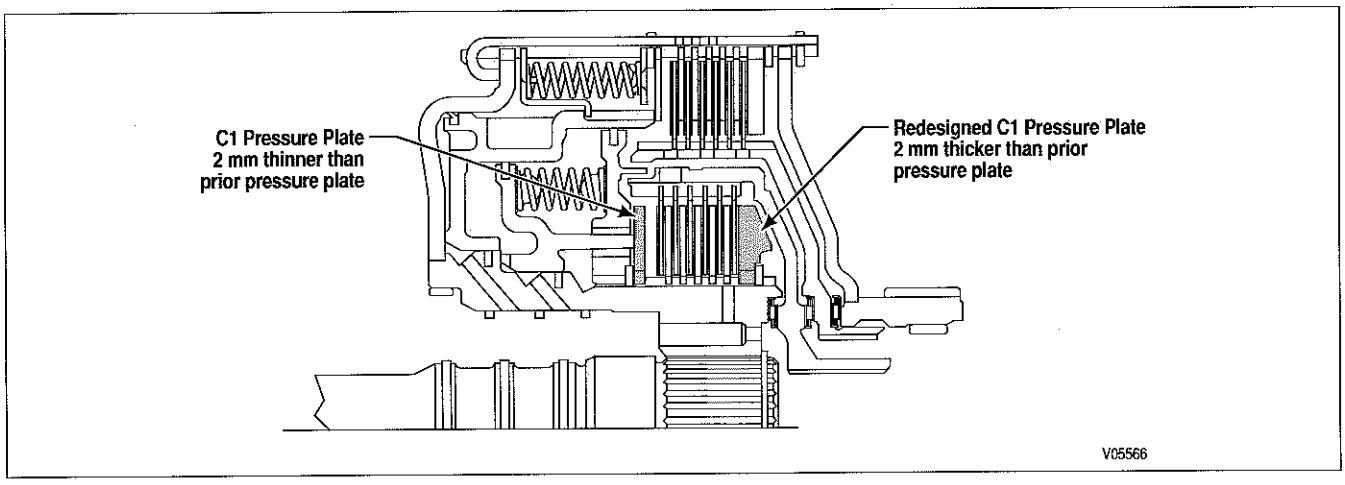

Figure 5–10. Redesigned C Pressure Plates

6. For transmissions before S/N 6510496989 and S/N 6520033015, inspect three wear plates 5 and six rivets 6 on clutch backplate 4. Measure the wear plates at the contact surface. Minimum thickness allowed is 2.81 mm (0.111 inch). Check flatness of backplate 4 and the wear plates. Maximum allowable distortion is 0.15 mm (0.006 inch). If replacement is necessary, remove the wear plates by drilling out the rivets.

NOTE:

Beginning with 3000 Product Family transmissions S/N 6510459168 and 6520035344 (start of production October 2004) the P1 ring gear is not ground on the its end faces. Current and former ring gears are not interchangeable. The current ring gear for S/N 6510459168 has an approximately 8.0 mm (0.305 inch) identification step machined into the OD of the ring gear. The former P1 ring gear and P1 ring gears for S/N 6520035344 transmissions are identified by a 3.20 mm (0.126 inch) groove machined into the OD of the ring gear and a part number etched into the end of the splines. The current P1 ring gear, with unground faces, must be used with PEEK thrust plates (P/N 29522720 or P/N 29538343). The former P1 ring gear may be used with the former steel-backed aluminum thrust plates or the current PEEK thrust plates. Refer to SIL 18-WT-04, Rev. A.

7. Remove P1 ring gear 7. Inspect the clutch splines of the P1 ring gear. Maximum spline wear permitted is 0.38 mm (0.015 inch).
8. Remove C3 clutch pack—five friction plates 8 and four steel reaction plates 9.
9. Measure the thickness of each friction plate 8. Minimum thickness allowed is 2.21 mm (0.087 inch). Measure the oil groove depth of each friction plate. Minimum allowable groove depth is 0.20 mm (0.008 inch). Maximum cone permitted is 0.40 mm (0.016 inch). Measure the friction material erosion at each slot. Maximum friction material erosion allowed is 4.00 mm (0.157 inch).

NOTE:

For 3000 Product Family transmissions starting with S/N 6510076858, C3 and C4 clutch friction plates have hardened internal splines. The improved plates are identified by either a missing spline tooth or by a blue stripe on the OD.

CAUTION:

B 400 models beginning with S/N 6510043834 were called "enhanced" B 400 models and have C3 and C4 clutch plates with a different friction coefficient. Also, most early B 400 units were updated to this configuration. Be sure to replace C3 or C4 clutch friction plates with the correct plates. B 400, 3200 and MD 3066 models use different plates than B 300 and other 3000 Product Family models.

10. Measure the thickness of each steel reaction plate 9. Minimum thickness allowed is 2.36 mm (0.093 inch). Maximum cone allowable is 0.40 mm (0.016 inch).
11. Remove piston return plate 11 with four return spring assemblies 10 attached. Measure the thickness of return plate 11. Minimum thickness permitted is 3.41 mm (0.135 inch). Maximum cone allowed is 0.40 mm (0.016 inch).
12. Only if damaged and replacement is necessary, remove the return spring assemblies. Remove spring retainer assembly 12 and piston 13.
13. Remove C3 housing assembly 14.

NOTE:

For transmissions with S/N 6510496989 and S/N 6520033015 and later, 3000 Product Family transmissions contain redesigned wear plates in the C3 clutch housing and on the C3 backplate. Current and former wear plates are not interchangeable. The wear plates do not affect use of the C3 clutch housing or C3 backplate as assemblies. Refer to SIL 17-WT-04 (Figure 5–10).

14. For transmissions after S/N 6510496989 and S/N 6520033015, inspect three wear plates 16 in clutch housing 17. Measure the wear plates at the contact surface. Minimum thickness allowed is 2.81 mm (0.111 inch). Check flatness of backplate 4 and the wear plates. Maximum allowable distortion is 0.15 mm (0.006 inch). If replacement is necessary remove the wear plates by gently prying the wear plate from the backplate.
15. For transmissions before S/N 6510496989 and S/N 6520033015, inspect three wear plates 16

and six rivets 15 in clutch housing 17. Measure the wear plates at the contact surface. Minimum thickness allowed is 2.81 mm (0.111 inch). Check flatness of backplate 4 and the wear plates. Maximum allowable distortion is 0.15 mm (0.006 inch). If replacement is necessary remove the wear plates by drilling out the rivets.

16. Remove C4 clutch pack—five friction plates 19 and five steel reaction plates 18.

17. Measure the thickness of each friction plate 19. Minimum thickness allowed is 2.21 mm (0.087 inch). Measure the oil groove depth of each friction plate. Minimum groove depth allowable is 0.20 mm (0.008 inch). Maximum cone permitted is 0.40 mm (0.016 inch). Measure the friction material erosion at each slot. Maximum friction material erosion allowed is 4.00 mm (0.157 inch).

NOTE:

3000 Product Family transmissions starting with S/N 6510076858, C3 and C4 clutch friction plates have hardened internal splines. The improved plates are identified by either a missing spline tooth or by a blue stripe on the OD.

CAUTION:

B 400 models beginning with S/N 6510043834 were called "enhanced" B 400 models and have C3 and C4 clutch plates with a different friction coefficient. Also, most early B 400 units were updated to this configuration. Be sure to replace C3 or C4 clutch friction plates with the correct plates. B 400, 3200, and MD 3066 models use different plates than B 300 and other 3000 Product Family models.

18. Measure the thickness of each steel reaction plate 18. Minimum thickness allowed is 2.36 mm (0.093 inch). Maximum allowable cone is 0.40 mm (0.016 inch).

19. Remove piston return plate 21 with four return spring assemblies 20 attached. Measure the thickness of return plate 21. Minimum thickness permitted is 3.41 mm (0.135 inch). Maximum allowable cone is 0.40 mm (0.016 inch).

20. Remove spring retainer assembly 22 and piston 23 from the C4 housing 24.

21. Inspect C4 clutch housing 24 for damage.

b. Assembly *(Foldout 10,A)*

1. Install piston 23 into C4 housing 24. Install spring retainer assembly 22.

2. If removed, install spring assemblies 20 and attach them securely.

3. Install piston return plate 21 with four return spring assemblies 20.

4. Install C4 clutch pack. Starting with a friction plate, alternately install five friction plates 19 and five steel reaction plates 18.

NOTE

For transmissions with S/N 6510496989 and S/N 6520033015 and later, 3000 Product Family transmissions contain redesigned wear plates in the C3 clutch housing. Current and former wear plates are not interchangeable. The wear plates do not affect use of the C3 clutch housing as an assembly.

5. For transmissions with S/N 6510496989 and S/N 6520033015 and later, go to Step (6). For transmission before S/N 6510496989 and S/N 6520033015, go to Step (10).

6. To install new C3 housing wear plates, position the C3 housing on the bed of an arbor press with the wear plate mounting surface facing up (Figure 5–11).

7. Align the post on the back of a wear plate with one of three chamfered wear plate mounting holes in the C3 housing.

8. Lightly press the wear plate until it is flush or a 0.070 mm (0.0027 inch) gap exists between the back of the wear plate and the C3 housing.

9. Repeat Steps (6) through (8), for each of the two remaining wear plates.

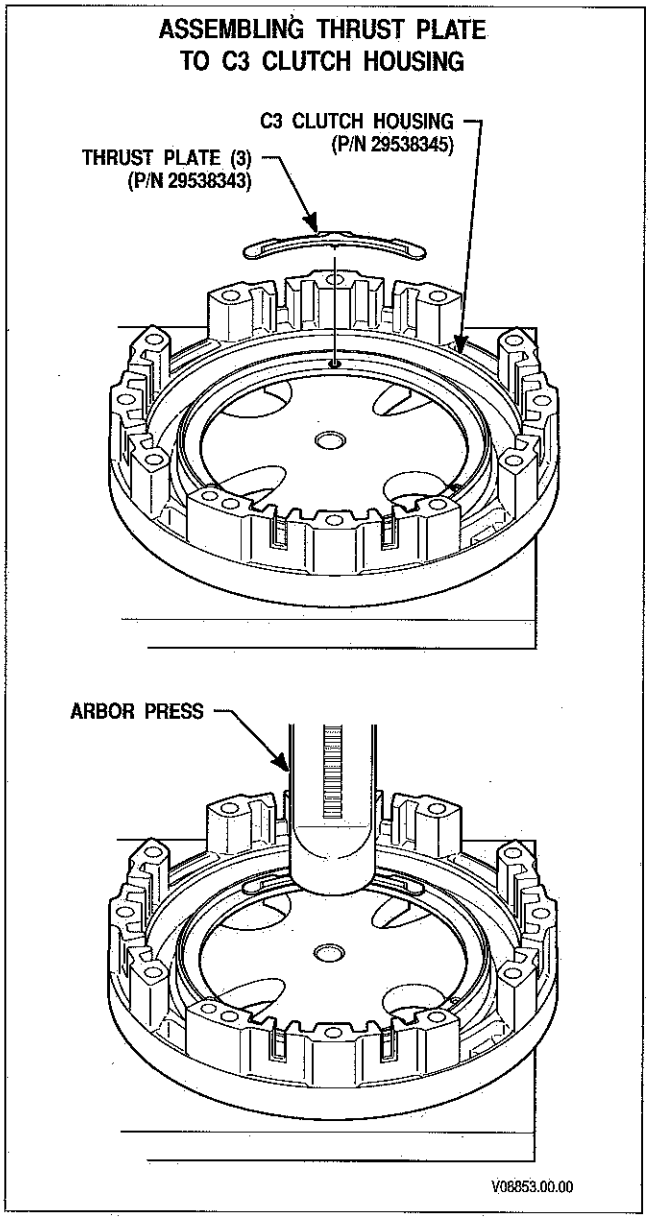

Figure 5–11. Installing Wear Plates

10. To assemble the C3 housing, when wear plates must be replaced, use six rivets 15 to fasten three wear plates 16 to the C3 housing 17. Use tool J 39354 to cold-form the rivets. Insert the rivet so the pre-formed head is below the active surface of the wear plate. Use the cold-forming tool to upset each rivet at the rear of the clutch housing to complete the attachment process. A correctly formed rivet upset will be 4.00 mm (0.157 inch) in diameter and no more than 1.00 mm (0.039 inch) above the surface of the clutch housing. The wear plate must be tightly attached to the housing. No movement of the wear plate is allowed.

11. Lube seal surfaces of C3 clutch piston 13, and install the C3 clutch piston into C3 clutch housing 14.

12. Install C3 clutch housing assembly 14 with clutch piston 13 on top of the assembled C4 clutch housing (items 18–24). Make sure the index tangs on the clutch housings are aligned. Install spring retainer assembly 12.

13. Install piston return plate 11 and four return spring assemblies 10. If removed, install spring assemblies and attach them securely.

NOTE:

Beginning with 3000 Product Family transmissions S/N 6510459168 and 6520035344 (start of production October 2004) the P1 ring gear is not ground on the its end faces. Current and former ring gears are not interchangeable. The current ring gear for S/N 6510459168 has an approximately 8.0 mm (0.305 inch) identification step machined into the OD of the ring gear. The former P1 ring gear and P1 ring gears for S/N 6520035344 transmissions are identified by a 3.20 mm (0.126 inch) groove machined into the OD of the ring gear and a part number etched into the end of the splines. The current P1 ring gear, with unground faces, must be used with PEEK thrust plates (P/N 29522720 or P/N 29538343). The former P1 ring gear may be used with the former steel-backed aluminum thrust plates or the current PEEK thrust plates. Refer to SIL 18-WT-04, Rev. A.

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14. Install P1 ring gear 7.

15. Install C3 clutch pack. Starting with a friction plate, alternately install five friction plates 8, and four steel plates 9.

NOTE:

For transmissions with S/N 6510496989 and S/N 6520033015 and later, 3000 Product Family transmissions contain redesigned wear plates on the C3 backplate (Figure 5–12). Current and former wear plates are not interchangeable. The wear plates do not affect use of the C3 backplate as an assembly.

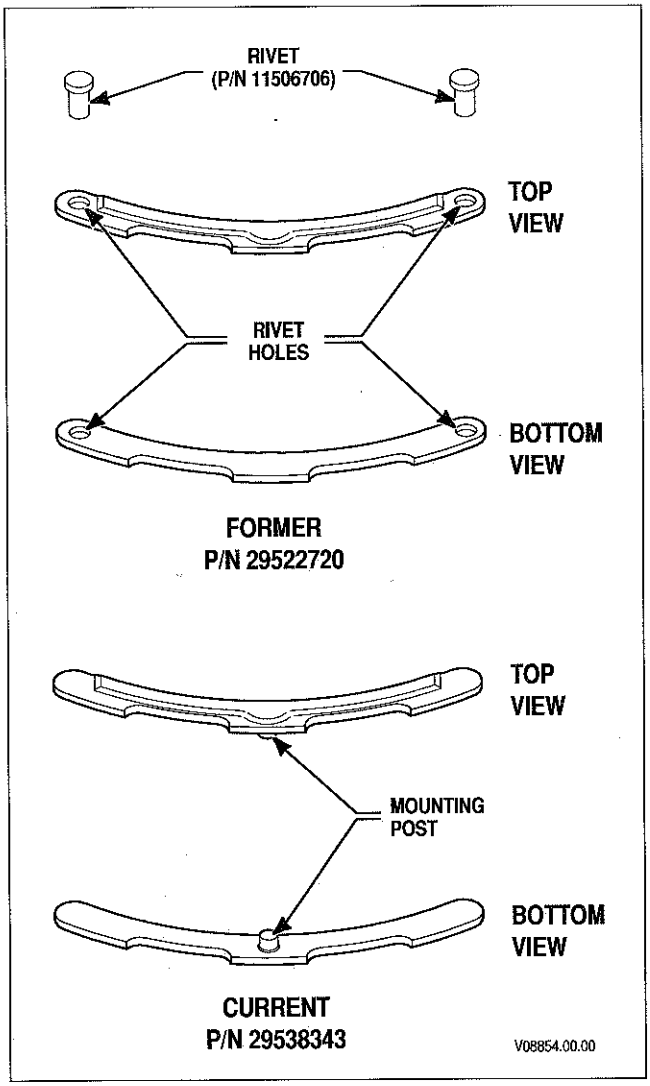

Figure 5–12. Former and Current Wear Plates

16. For transmissions with S/N 6510496989 and S/N 6520033015 and later, go to Step (17). For transmission before S/N 6510496989 and S/N 6520033015, go to Step (21).

17. To install new C3 backplate wear plates, position the C3 backplate on the bed of an arbor press with the wear plate mounting surface facing up.

18. Align the post on the back of a wear plate with one of three chamfered wear plate mounting holes in the C3 backplate.

19. Lightly press the wear plate until it is flush or a 0.070 mm (0.0027 inch) gap exists between the back of the wear plate and the C3 backplate.

20. Repeat Steps (12) through (14), for each of the two remaining wear plates.

21. To assemble the C3 backplate, when wear plates must be replaced, use six rivets 6 to fasten three wear plates 5 to C3 backplate 4. Use tool J 39354 to cold-form the rivets. Insert the rivet so the pre-formed head is below the active surface of the thrust plate. Use the cold-forming tool to upset each rivet at the rear of the backplate to complete the attachment process. A correctly formed rivet upset will be 4.00 mm (0.157 inch) in diameter and no more than 1.00 mm (0.039 inch) above the surface of the backplate. The wear plate must be tightly attached to the backplate. No movement of the wear plate is allowed.

22. Install C3 backplate assembly 3. Backplate 3 must be indexed with C3 and C4 housings in order to insert the assembly into main housing 27 correctly.

23. Install twelve retaining bolts 2 through the C3 backplate assembly 3 and into the C4 clutch housing 24. Tighten the bolts to 51–61 N·m (38–45 lb ft).

24. If removed, install nameplate 28 and screw 29.

25. If present and removed, install feedthrough connector assembly 32 and two bolts 30. Tighten the bolts to 5–8 N·m (4–5 lb ft).

5–9. MAIN SHAFT MODULE

NOTE:

- **For 3000 Product Family models, except 3500, MD 3560, 3700 SP, and MD 3070PT models, proceed to Paragraph *a*.**
- **For 3500 and MD 3560 models, skip Paragraphs *a* and *b* and proceed to Paragraph *c*.**
- **For 3700 SP and MD 3070PT model, skip Paragraphs *a–d* and proceed to Paragraph *e*.**

a. Disassembly (3000 Product Family Models, Except 3500, MD 3560, 3700 SP, and MD 3070PT Models) *(Foldout 10,B)*

1. Remove spiral retaining ring 4.
2. Remove P2 sun gear 6.
3. Remove thrust bearing 5.
4. Remove bearing spacer 7.

5. Remove selective shim 1, if not previously removed.
6. Remove thrust bearing 2, if not previously removed.
7. Remove P3 sun gear 8 from main shaft 9.
8. Inspect and measure main shaft pilots. Minimum pilot OD allowed is 19.98 mm (0.787 inch). Inspect and measure main shaft journal OD for the P2 planetary bushing. Minimum permissible main shaft journal OD is 42.97 mm (1.692 inch). Inspect the main shaft splines for damage and measure spline wear. Maximum spline wear allowed is 0.38 mm (0.015 inch).

b. Assembly (3000 Product Family Models, Except 3500, MD 3560, 3700 SP, and MD 3070PT Models) *(Foldout 10,B)*

NOTE:
Do not install thrust bearing 2 or selective shim 1 until final transmission assembly. Measurement for selective shim 1 is performed during final buildup.

1. Install P3 sun gear 8 onto main shaft 9.
2. Install bearing spacer 7.
3. Install thrust bearing 5.
4. Install P2 sun gear 6.
5. Install spiral retaining ring 4. Compress the spiral retaining ring to lock it into place.
6. Proceed to Paragraph 5–10.

c. Module Disassembly (3500 and MD 3560 Transmission Models) *(Foldout 11,A)*

1. Remove spiral retaining ring 4.
2. Remove P2 sun gear 5 and thrust bearing 6.
3. Remove spacer 7.
4. Inspect and measure main shaft pilots. Minimum pilot OD permitted is 19.98 mm (0.787 inch). Inspect and measure main shaft journal OD for P2 planetary bushing. Minimum allowable main shaft journal OD is 42.97 mm (1.692 inch).

d. Module Assembly (3500 and MD 3560 Transmission Models) *(Foldout 11,A)*

NOTE:
Do not install thrust bearing 2 or selective shim 1 until final transmission assembly. Measurement for selective shim 1 is performed during final buildup.

1. Install spacer 7 and thrust bearing 6.
2. Install P2 sun gear 5 and spiral retaining ring 4. Compress the spiral retaining ring to lock it into place.
3. Proceed to Paragraph 5–10.

e. Module Disassembly (3700 SP and MD 3070PT Transmission Models) *(Foldout 11,B)*

1. Remove spiral retaining ring 3.
2. Remove P2 sun gear 5 and thrust bearing 4.
3. Remove spacer 6.
4. Remove P3 sun gear 7.
5. Remove thrust bearing 1.
6. Inspect C6 bushing journal OD on main shaft 8. Minimum allowable OD is 35.92 mm (1.414 inch). Inspect P3 bushing journal OD. Minimum OD allowed is 52.98 mm (2.086 inch).
7. Measure the front main shaft pilot. Minimum pilot OD permitted is 19.98 mm (0.787 inch). Inspect and measure main shaft journal OD for P2 planetary bushing. Minimum journal OD allowed is 42.97 mm (1.692 inch). Inspect and measure main shaft 9 spline wear. Maximum output shaft spline wear is 0.38 mm (0.015 inch).

f. Module Assembly (3700 SP and MD 3070PT Transmission Models) *(Foldout 11,B)*

1. Install thrust bearing 1.
2. Install P3 sun gear 7.
3. Install spacer 6.
4. Install P2 sun gear 5 and thrust bearing 4.
5. Install spiral retaining ring 3. Compress the spiral retaining ring to lock it into place.

5–10. P1 PLANETARY MODULE

a. Disassembly *(Foldout 12,A)*

1. Remove retaining ring 2 from P2 ring gear 14.
2. Remove P2 ring gear 14.
3. Measure P1 planetary pinion end play in P1 carrier assembly 4. Pinion end play should not exceed 0.94 mm (0.037 inch). Measure all six pinion gears.
4. Remove retaining ring 5 and indexing ring 6. Inspect indexing ring 6 for abnormal wear where the spindles 7 contact (Figure 5–13). If abnormal wear is present, the planetary spindle 7 probably has a sharp edge instead of a radius edge (Figure 5–14).

NOTE:

Planetary spindles on transmission S/Ns between 6510063169–6510114718 have sharp edges (Figure 5–14). If index ring 6 is worn and the spindles have a sharp edge and fall within the S/N range above, replace the spindles.

5. Remove six spindles 7 from P1 carrier 8.
6. Slide pinion gear 10, thrust washers 9 and 12, and two bearing sets 11 from the side of P1 planetary carrier 8. Repeat the procedure with the five remaining pinion gears.
7. Measure the thickness of all thrust washers 9 and 12. Minimum thrust washer thickness permitted is 1.39 mm (0.054 inch). Measure thrust washers 9 step wear. Maximum step wear allowed is 0.12 mm (0.005 inch).
8. Remove thrust bearings 3 and 13 from each side of P1 planetary carrier 8.
9. Check spline wear of P1 planetary carrier 8 and P2 planetary ring gear 14. Maximum spline wear allowed is 0.38 mm (0.015 inch).

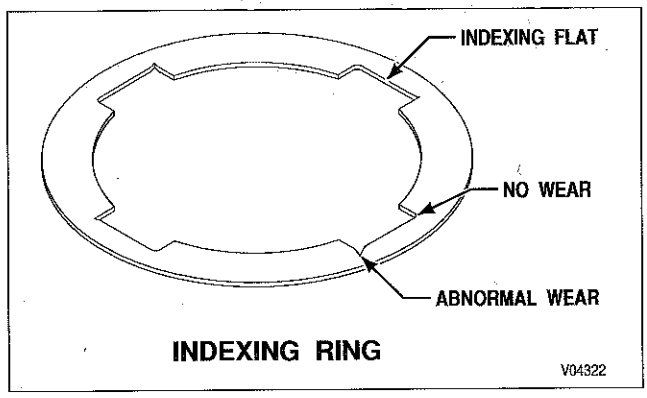

Figure 5–13. Carrier Indexing Ring Wear

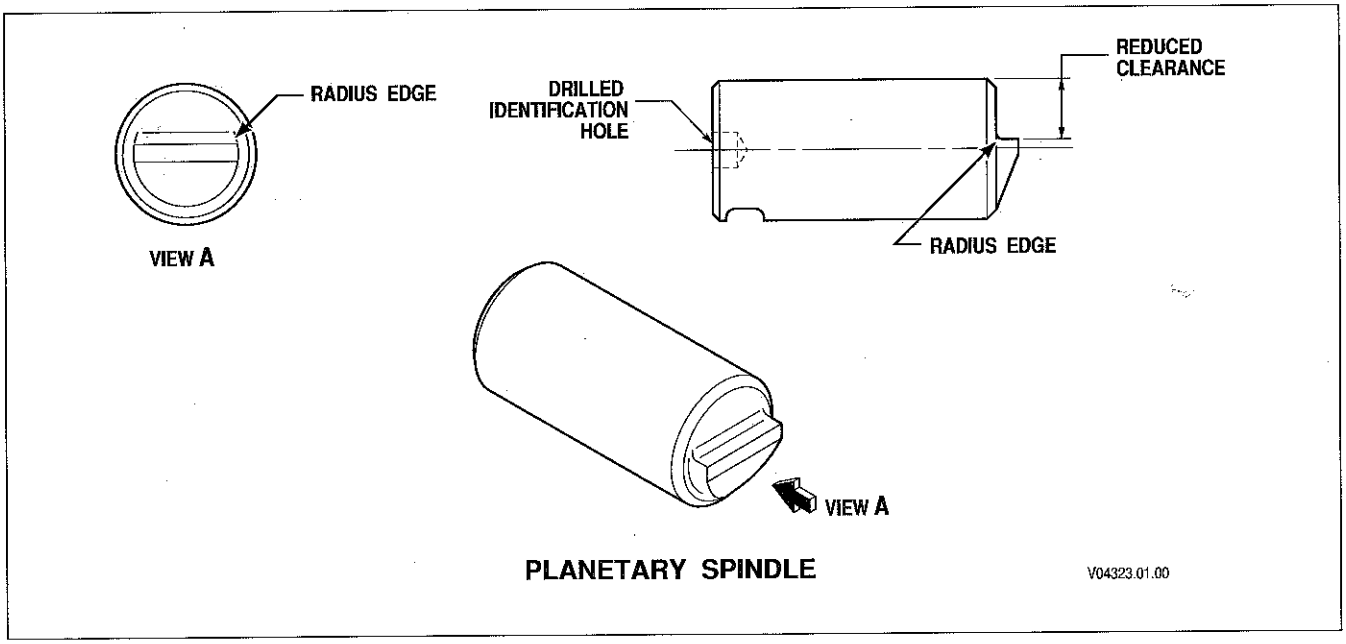

Figure 5–14. Sharp Edge vs. Radius Edge On Planetary Spindles

b. Assembly *(Foldout 12,A)*

NOTE:

3000 Product Family transmissions starting with S/N 6510142342 include an oil groove in the ID bore of the P1 carrier. This carrier is not interchangeable with former carriers. The new carrier must be used with the new P2 carrier which has eliminated two sealring grooves and sealrings. The former carriers are still available for service.

CAUTION:

When replacing a P1 carrier in a transmission before S/N 6510142342, be sure to obtain the correct replacement part. If installing a new style carrier with the inner oil groove, also install a new P2 carrier which eliminates two sealring grooves and sealrings.

1. Install two bearing sets 11 into the center of pinion gear 10. Install thrust washers 9 and 12 inside P1 planetary carrier 8. Align thrust washer tangs with the slots in the carrier and retain them with oil-soluble grease. Slide the pinion gear and bearing sets into the side of the P1 planetary carrier, between the thrust washers. Repeat the procedure with the five remaining pinion gears.

NOTE:

Transmissions built beginning September 13, 2000 contain improved planetary spindles (Figure 5–14, View A) designed to reduce wear on the spindles and the spindle retaining ring. The new design reduces the clearance between the spindle and the spindle retaining ring. The improved spindles can be identified by a shallow drilled hole in the end of the spindle. Former (Figure 5–14, View A, S/N 6510063169–6510114718) and current spindles (Figure 5–14, View A) are interchangeable. Refer to SIL 15-WT-01.

2. Install six spindles 7 so the lower step is positioned for proper installation of indexing ring 6.

CAUTION:

Be sure that the planetary spindles cannot rotate after the indexing ring has been installed or lube flow to the pinion bearings may be blocked. When the indexing ring slots are worn on one corner (Figure 5–13), flip the plate over to obtain a new unworn contact surface. If both contact areas are worn, replace the indexing ring.

3. Install indexing ring 6 and retaining ring 5.

4. If components were replaced, check pinion end play. Pinion end play should not exceed 0.94 mm (0.037 inch). Check all six pinion gears.

5. Install P1 planetary carrier assembly 4 into P2 ring gear 14.

6. Install retaining ring 2 into P2 ring gear 14, retaining P1 planetary carrier assembly 4 in the P2 planetary ring gear.

7. Install two thrust bearings 3 and 13 one on each side of P1 planetary carrier assembly 4.

5–11. P2 PLANETARY MODULE

a. Disassembly *(Foldout 12,B)*

NOTE:

In 3000 Product Family transmissions starting with S/N 6510142342, the two sealrings 2 on P2 carrier assembly 4 have been eliminated. The new carrier is not interchangeable with former carriers. The new carrier must be used with the new P1 carrier which has an oil groove in the ID bore. The former carriers are still available for service.

CAUTION:

When replacing a P2 carrier in a transmission before S/N 6510142342, be sure to obtain the correct replacement part. If installing a new style carrier with the two eliminated sealring grooves and sealrings, also install a new P1 carrier which has an oil groove in the ID bore.

1. Remove two sealrings 2, if present, from P2 carrier.
2. Remove retaining ring 3.
3. Remove P3 ring gear 15.
4. Check P2 planetary pinion end play. Pinion end play should not exceed 0.94 mm (0.037 inch). Check all four pinion gears.
5. Remove retaining ring 14. Remove indexing ring 13. Remove four pinion spindles 12 from P2 carrier 6. Inspect indexing ring 13 for abnormal wear where the spindles 12 contact (Figure 5–13). If abnormal wear is present, the planetary spindle 12 probably has a sharp edge instead of a radius edge (Figure 5–14).

NOTE:

Planetary spindles on transmission S/Ns from 6510063169–6510114718 have sharp edges (Figure 5–14). If the index ring is worn and the spindles have a sharp edge and fall within the S/N range above, replace the spindles.

6. Slide a pinion gear 10, thrust washers 8 and 11, and two bearing sets 9 from the side of P2 planetary carrier 6. Repeat the procedure with the three remaining pinion gears.
7. Measure the thickness of all thrust washers 8 and 11. Minimum thickness allowed is 1.39 mm (0.054 inch). Measure thrust washers 8 step wear. Maximum step wear allowed is 0.12 mm (0.005 inch).
8. Inspect bushing 7 inside P2 planetary carrier 6 for wear or damage. Maximum allowable bushing ID is 43.20 mm (1.701 inch).
9. Check spline wear between P2 planetary carrier 6 and P3 planetary ring gear 15. Maximum movement permitted is 0.38 mm (0.015 inch).

b. Assembly *(Foldout 12,B)*

1. If replacement is necessary, press a new bushing 7 into P2 carrier 6 using a press, installer J 35922-1, and driver J 8092.
2. Install two bearing sets 9 into the center of pinion gear 10. Install thrust washers 8 and 11 in P2 planetary carrier 6, align thrust washer tangs with slots in the carrier 6, and retain them with oil-soluble grease. Slide the pinion gear and two bearing sets into the side of the P2 planetary carrier between the thrust washers. Repeat the procedure with the three remaining pinion gears.
3. Install four spindles 12 so the lower step is positioned for proper installation of indexing ring 13.

CAUTION:

Be sure that the planetary spindles cannot rotate after the indexing ring has been installed or lube flow to the pinion bearings may be blocked. When the indexing ring slots are worn on one corner (Figure 5–13), flip the plate over to obtain a new unworn contact surface. If both contact areas are worn, replace the indexing ring.

4. Install indexing ring 13 and retaining ring 14.
5. If components were replaced, check pinion end play. Pinion end play should not exceed 0.94 mm (0.037 inch). Check all four pinion gears.
6. Install P2 carrier 4 into P3 ring gear 15.
7. Install retaining ring 3 into P3 ring gear 15, retaining P2 planetary carrier assembly 4.
8. Insert two sealrings 2 into the P1 planetary carrier bore and measure their end gap with a feeler gauge. Maximum sealring end gap allowed is 0.59 mm (0.023 inch). Refer to Section 3 if the sealring end gap is incorrect.
9. Install two sealrings 2 on P2 carrier assembly 4.

NOTE:

- **For models without retarder and without transfer case, skip Paragraph 5–12 and proceed to Paragraph 5–13, Rear Cover Module.**
- **For models with transfer case, skip Paragraphs 5–12 and 5–13 and proceed to Paragraph 5–14, Adapter Housing and P3 Overhaul.**

5–12. RETARDER MODULE

NOTE:

- **For transmissions with retarder built before January, 1998, proceed to Paragraph *a*.**
- **For transmissions with retarder built in January, 1998 or later, skip Paragraphs *a–j* and proceed to Paragraph *k*.**
- **For transmissions starting with S/N 6510262246, proceed to Paragraph *s*.**

a. Disassembly of Retarder Valve Body (Units Built before 1/98) *(Foldout 13,A)*

1. If not done previously, remove four bolts 71 retaining wiring harness cover 70 to retarder housing assembly 35 and remove the cover.
2. Remove nine bolts 77 that retain retarder control body assembly 78 to retarder housing assembly 35 and remove control body assembly 78.
3. Remove separator plate gasket 72, solenoid separator plate 73, separator plate gasket 74, channel plate 75, and channel plate gasket 76.
4. Remove four bolts 79, solenoid cover 81, and gasket 95.
5. Remove fluted retaining pin 93 from the retarder control body 88. Remove solenoid 82 and O-rings 83 and 84.
6. Check the resistance of retarder solenoid 82. Resistance must be within the range shown on Figure 5–15.
7. Remove solenoid 82 from harness 80.
8. If repair or replacement of solenoid wiring harness 80 is necessary, remove the external nut retaining the harness connector to solenoid cover 81.
9. Remove pressure tap plug 86 and O-ring 87 from retarder control body 88.
10. Remove retaining ring 90, O-ring 91, valve plug 89, and spring 92 from retarder control body 88.
11. Remove retarder control valve 94 from retarder control body 88.

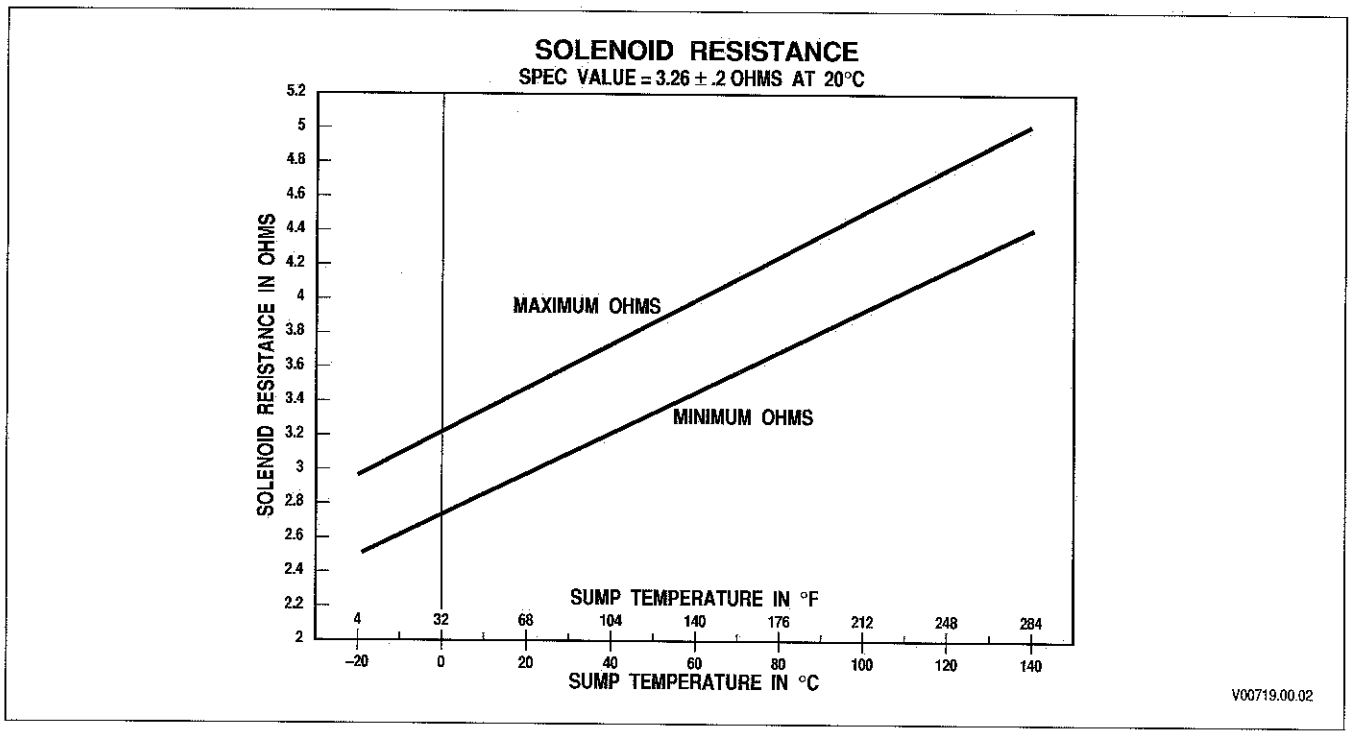

Figure 5–15. Solenoid Resistance vs. Temperature

b. Removal of Wiring Harness and Temperature Sensor *(Foldout 13,A)*

1. Remove temperature sensor retainer bolt 59 and temperature sensor retainer 58. Carefully remove temperature sensor assembly 68 from retarder housing assembly 35.

2. Check temperature sensor with an ohmmeter. See Figure 5–16 for proper sensor readings.

3. If repair or replacement of temperature sensor 68 and wiring harness assembly 60 is necessary, remove the external nut that retains harness connector 61 to retarder housing assembly 35.

c. Disassembly of Retarder Housing *(Foldout 13,A)*

1. If not already removed, remove output speed sensor bolt 39, bracket 38, output speed sensor assembly 36, and O-ring 37 from retarder housing 51. Output speed sensor resistance should be 300 ± 30 Ohms.

2. For transmissions before S/N 6510021203, remove signal valve retaining ring 40, plug 41, signal valve 42, and O-ring 43. For transmissions between S/N 6510021203 and 6510064183, remove retaining ring 40 and plug 41.

NOTE:

- **For units before S/N 6510064183, do Step (3), skip Step (4), and go to Step (5).**
- **For units beginning with S/N 6510064183, skip Step (3) and go to Step (4).**

3. Remove retaining ring 49, plug 48, O-ring 47, spring 46, retarder valve 45, and pin 44.

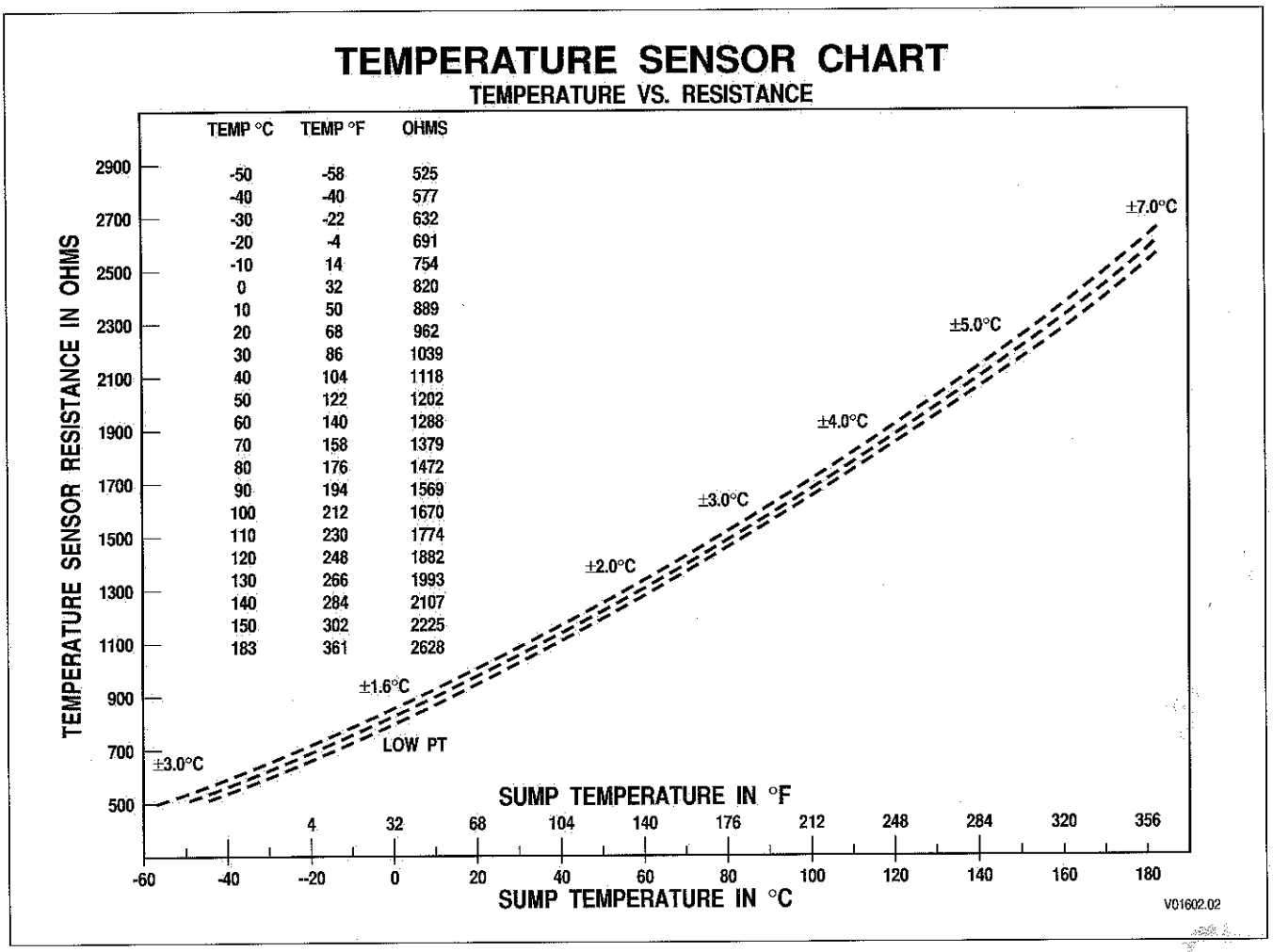

Figure 5–16. Temperature Sensor Chart (Units Built Before 1/98)

4. Thread the J 42048 spring compressor tool into the accumulator port as far as it will go and still allow the handle to be aligned with plug 48. Compress plug 48 to relieve the spring load on retaining ring 49. Remove retaining ring 49. Carefully release the spring load by turning the tool handle counterclockwise. Remove the J 42048 tool, retaining ring 49, plug 48, O-ring 47, spring 46, retarder valve 45, and pin 44.

5. If not previously removed, remove oil seal 55, using seal removal tool J 24171-A.

6. Flatten the tang of locknut retainer 53 to allow rotation and removal of bearing retainer nut 54. Remove bearing retainer (spanner) nut 54 using special tool J 35925. Remove locknut retainer 53.

7. Support retarder housing 51 so that P3 planetary carrier assembly 6 can be removed from the retarder housing. Place special tool J 35925-1 against the threaded shoulder of the P3 planetary carrier. Drive on J 35925-1 with a hydraulic press or a mallet until the P3 planetary carrier is separated from the retarder housing.

NOTE:

Perform Steps (8) and (11) only if roller bearing 52 and cup 50 need to be replaced.

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8. Remove roller bearing 52 from the retarder housing.

9. Remove two bolts 57 and bolt 56 to allow removal of retarder stator assembly 21 from retarder housing 51. Remove gasket 32 which seals between stator 28 and the retarder housing.

10. Remove rotor 33 and sealrings 31 and 34. Insert hook-type sealrings 31 and 34 into their mating bores and measure the ID of each sealring. Replace the sealrings if the ID exceeds 95.67 mm (3.767 inch).

11. Remove bearing cup 50 using bearing tool J 3940.

d. Disassembly of P3 Planetary Carrier Assembly *(Foldout 13,B)*

1. Remove retaining ring 15 and spacer 14. Remove output shaft assembly 7. Inspect bushing 8 inside the end of output shaft 9 for wear or damage. Measure the ID of the output shaft bushing. Maximum ID allowed is 20.19 mm (0.795 inch). Inspect and measure output shaft 9 spline wear. Maximum output shaft spline wear is 0.38 mm (0.015 inch).

2. If replacement is necessary, remove bearing assembly 13.

3. Check pinion end play. Pinion end play should not exceed 0.94 mm (0.037 inch). Repeat the check on the three remaining pinion gears.

NOTE:

The spindles and pinions do not need to be removed before removing output shaft assembly 7.

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4. Remove retaining ring 10. Remove indexing ring 11. Remove four pinion spindles 16. Inspect indexing ring 11 for abnormal wear where the spindles 16 contact (Figure 5–13). If abnormal wear is present, the planetary spindle 16 probably has a sharp edge instead of a radius edge (Figure 5–14).

NOTE:

Planetary spindles on transmission S/Ns from 6510063169–6510114718 have sharp edges (Figure 5–14). If index ring 11 is worn and the spindles have a sharp edge and fall within the S/N range above, replace the spindles.

CAUTION:

Be sure that the planetary spindles cannot rotate after the indexing ring has been installed or lube flow to the pinion bearings may be blocked. When the indexing ring slots are worn on one corner (Figure 5–13), flip the plate over to obtain a new unworn contact surface. If both contact areas are worn, replace the indexing ring.

5. Slide pinion gear 18, thrust washers 17 and 20, and two bearings 19 from the side of P3

planetary carrier 12. Repeat the procedure with three remaining pinion gears.

6. Measure the thickness of eight thrust washers 17 and 20. Minimum thickness permitted is 1.39 mm (0.054 inch). Measure thrust washer step wear. Maximum step wear allowed is 0.12 mm (0.005 inch).

e. Disassembly of Retarder Stator Assembly *(Foldout 13,B)*

1. Remove O-ring 30 from stator assembly 21.

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

2. Compress retainer and spring assembly 23 using piston spring compressor J 35923-2. Remove retaining ring 22 and slowly release the spring tension. Remove spring assembly 23 and C5 clutch piston 24 from retarder stator 28.
3. Remove outer sealring 25 from C5 clutch piston 24.
4. Remove inner sealring 26 from C5 clutch piston 24.

NOTE:
Perform Step (5) only if roller bearing 13 and cup 27 need to be replaced.

5. Remove bearing cup 27 using bearing tool J 3940.

CAUTION:
Use care not to damage the stator housing when removing the check ball and retainer assembly.

6. Inspect each check ball and retainer assembly 29 for proper movement. The balls should move a minimum of 0.50 mm (0.020 inch) in their respective retainer seats. If ball movement is less than the specified amount, use a ¼-20 UNF tap to remove the check ball and retainer assembly.

f. Assembly of Retarder Stator *(Foldout 13,A)*

1. If removed, install check ball and retainer assemblies 29.
2. If removed, install bearing cup 27 using bearing tool J 35922-3.
3. Install inner sealring 26 onto C5 clutch piston 24.
4. Install outer sealring 25 onto C5 clutch piston 24. Lube sealrings on the piston and seal bore areas in the retarder stator.

NOTE:
Align the tang on the back of the C5 clutch piston with the notch for the piston tang in the retarder stator before installing C5 clutch piston 24 into retarder stator 28.

5. Install C5 clutch piston 24 into retarder stator 28.

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

CAUTION:
Use care when compressing spring assembly not to allow the assembly to catch in and damage the retaining ring groove.

6. Align the tab on spring retainer 23 with the notch in stator housing 28. Compress retainer and spring assembly 23 using piston spring compressor J 35923-2. Install retaining ring 22 so that the ends clear the tab in the spring retainer and slowly release the spring force. Remove the compressor tool.
7. Install O-ring seal 30 on retarder stator 28.

g. Assembly of P3 Planetary Carrier Assembly *(Foldout 13,B)*

1. If removed, install bearing assembly 13.
2. If removed, install bushing 8 inside the end of output shaft 9 using installer J 35922-1, drive handle J 8092, and a press.
3. If removed, install output shaft assembly 7 into P3 planetary carrier 12.
4. Install spacer 14 and retaining ring 15.

5. Install two bearings 19 into the center of pinion gear 18. Install thrust washers 17 and 20 in P3 planetary carrier 12. Align thrust washer tangs with the slots in the carrier and retain them with oil-soluble grease. Slide the pinion gear and bearing sets into the side of the P3 planetary carrier between the thrust washers. Repeat the procedure with the three remaining pinion gears.

6. Install four pinion spindles 16 so the lower step is positioned for proper installation of indexing ring 11.

7. Install indexing ring 11. Install retaining ring 10.

8. If components were replaced, check pinion end play. Pinion end play should not exceed 0.94 mm (0.037 inch). Check all four pinion gears.

h. Assembly of Retarder Housing Assembly *(Foldout 13,B)*

1. Place P3 carrier assembly 6 on the work table (output shaft up) and place stator assembly 21 over the output shaft.

2. Install sealrings 31 and 34 onto rotor 33. Install the rotor assembly over the output shaft.

3. Install gasket 32 between stator assembly 21 and retarder housing 51. Place the retarder housing over the output shaft and align the holes of the housing with the holes of the stator assembly. Install two bolts 57. Tighten the bolts to 51–61 N·m (38–45 lb ft).

4. Install roller bearing 52 using installer J 35921-1 and press into retarder housing 51 while rotating the retarder housing.

5. Install locknut retainer 53.

CAUTION:

Over-tightening bearing retainer nut 54 will damage bearing rollers and cone 13 and 52. If the torque wrench and breaker bar positions in Figure 5–17 are reversed, the output spanner nut will be overtorqued. Be sure wrenches are positioned ONLY as shown in Figure 5–17.

6. Install and tighten bearing retainer nut 54 using special tools J 35925-1 and J 35925-2. Place the torque wrench and a breaker bar as shown in Figure 5–17. Rotate the torque wrench in the counterclockwise direction and tighten the nut to 145–155 N·m (107–114 lb ft). If the retarder module is installed on a transmission, see Section 6 assembly instructions for correct torque specifications.

NOTE:

- **For units before S/N 6510064183, do Step (7), skip Steps (8)–(11), and go to Step (12).**
- **For units beginning with S/N 6510064183, skip Step (7) and go to Step (8).**

7. Support retarder housing 51 so that turning torque of P3 carrier assembly 6 can be checked after installation of bearing retainer nut 54 (Figure 5–18). Maximum allowable drag is 3 N·m (26 lb inch).

NOTE:

Delay bending the retainer tangs on the retainer nut and the installing of output oil seal 55 until final assembly of the transmission.

NOTE:

Effective S/N 6510021203, a different valve plug is used which does not require a signal valve. The later valve plug is not interchangeable with the earlier housing. Refer to SIL 31-WT-94.

8. For 3000 Product Family transmissions before S/N 6510021203, install O-ring 43, signal valve 42, plug 41, and retaining ring 40. For transmissions after S/N 6510021203, install valve plug 41 and retaining ring 40.

9. Install pin 44 into retarder valve 45 and insert into the valve bore. Install spring 46, O-ring 47, plug 48, and retaining ring 49.

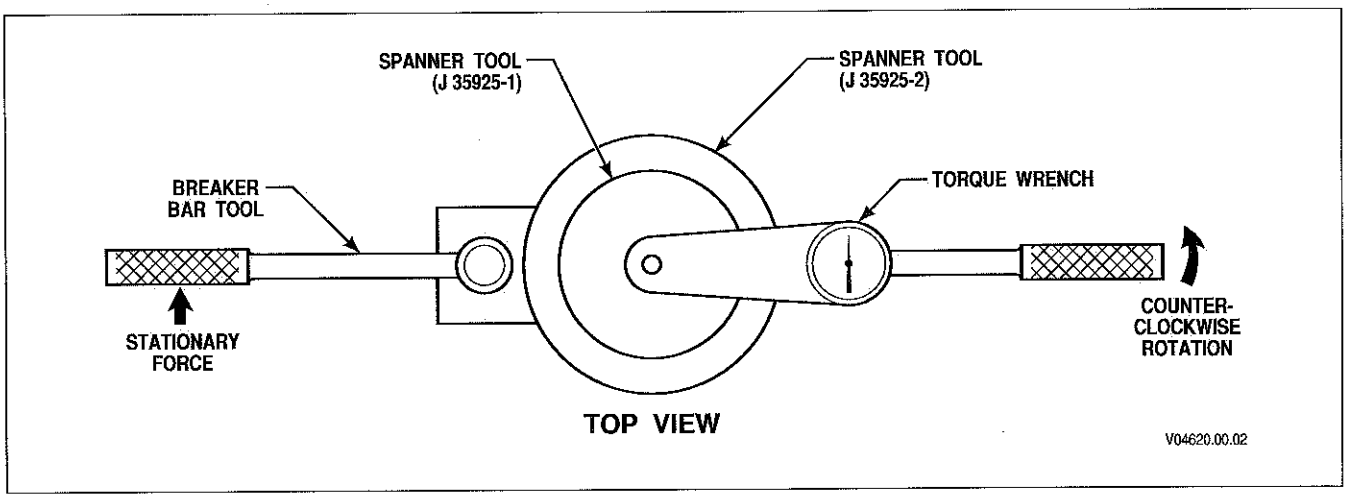

Figure 5–17. Tightening Output Spanner Nut

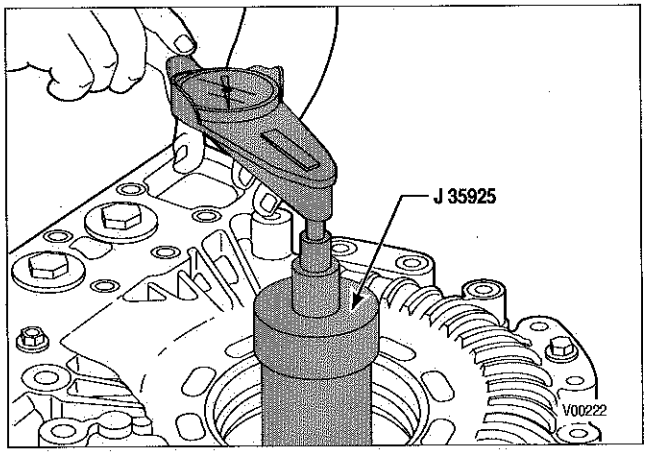

Figure 5–18. P3 Carrier Turning Torque Check—Retarder Equipped Models

NOTE:

Effective S/N 6510044372, a different retarder valve spring, separator plate, retarder housing, stator, and rotor are used. The later parts are not interchangeable with the earlier parts. If the parts are interchanged, retarder capacity will be affected. Refer to SIL 28-WT-94, Rev. A.

10. Thread the J 42048 spring compressor tool into the accumulator port as far as it will go and still allow the handle to be aligned with the retarder valve bore. Rotate the tool counterclockwise to provide clear access to the retarder valve bore.

11. Install pin 44 into retarder valve 45 and insert into the valve bore. Install spring 46, O-ring 47, and plug 48. Spring 46 must remain uncompressed until tool J 42048 is used to safely compress it.

12. Align tool J 42048 with the retarder valve bore and rotate the tool handle clockwise to contact the center of plug 48. Continue turning the tool handle clockwise to compress spring 46 until plug 48 is below the groove for retaining ring 49. Install retaining ring 49.

13. Turn the tool handle counterclockwise to allow plug 48 to contact retaining ring 49 and to allow removal of the tool. Remove the J 42048 compressor tool from the accumulator bore by rotating it counterclockwise.

14. Be sure O-ring 37 is in place and install output speed sensor assembly 36. Hold bracket 38 in place and install retaining bolt 39. Tighten the bolt to 24–29 N·m (18–21 lb ft).

i. Installation of Wiring Harness Assembly

(Foldout 13,B)

1. If temperature sensor 68 and/or wiring harness assembly 60 were repaired or replaced, carefully install the temperature sensor assembly into the retarder housing. Install a new O-ring 69 on the temperature sensor. Install the nut retaining the harness connector to the retarder housing. Tighten the nut to 10–13 N·m (7–10 lb ft).

2. Install temperature sensor retainer 58 and retainer bolt 59. Tighten bolt to 24–29 N·m (18–21 lb ft).

j. Assembly and Installation of Retarder Control Body Assembly *(Foldout 13,A)*

1. Install retarder control valve 94, spring 92, valve plug 89, O-ring 91, and retaining ring 90 into retarder control body 88.
2. Install O-ring 87 and pressure tap plug 86. Tighten plug to 10–13 N·m (7–10 lb ft).
3. If solenoid wiring harness 80 was repaired or replaced, install the nut retaining the harness connector to solenoid cover 81. Tighten the nut to 2.8–3.4 N·m (25–30 lb inch).
4. If replaced, connect solenoid 82 to harness 80.
5. Lube O-rings and install gasket 95 and solenoid 82 into solenoid mounting bore of the retarder control body 88.

CAUTION:

When inserting solenoid retaining pin 93, be certain it is installed into the off-center hole in the solenoid bore. Installing the pin in the bore centerline hole will destroy the solenoid.

6. Install, smooth end first, solenoid retaining pin 93 into retarder control body 88.
7. Install solenoid cover 81 and four bolts 79. Tighten bolts to 24–29 N·m (18–21 lb ft).
8. Install two guide pins into the retarder control body mounting flange bolt holes on retarder housing assembly 35.
9. Install gasket 76, channel plate 75, gasket 74, solenoid separator plate 73, and gasket 72.
10. Install wiring harness cover 70 and four bolts 71. Tighten bolts to 24–29 N·m (18–21 lb ft).
11. Install retarder control body assembly 78 and nine bolts 77 that retain it to retarder housing assembly 35. Tighten bolts to 24–29 N·m (18–21 lb ft).

NOTE:

Proceed to Paragraph 5–17, Control Valve Module to continue module rebuild.

k. Disassembly of Retarder Valve Body (Units Built Starting 1/98) *(Foldout 13,B)*

1. Remove three bolts 91 and six bolts 92 that retain retarder control body assembly 67 to retarder housing assembly 35 and remove control body assembly 67.
2. Remove separator plate gasket 64, solenoid separator plate 65, and separator plate gasket 66.
3. Remove plug 82, O-ring 83, valve 84, and spring 85.
4. Remove plug 80, O-ring 79, spring 78, and valve 77.
5. Remove spring clip 90. Move connector 69 partially out of the bore to allow space for solenoid removal.
6. Remove retaining pin 81 from retarder control body 86. Carefully rotate and wiggle solenoid 74 while exerting force toward connector 69. Remove solenoid 74 and O-rings 75 and 76.
7. Disconnect connector assembly 71 from solenoid 74. Remove wiring harness 68 from control body 86. For repair or replacement of terminals 73 or connector 72, see TS2973EN, WTEC III Troubleshooting Manual.
8. Check the resistance of retarder solenoid 74. Resistance must be within the range shown on Figure 5–15.
9. Remove pressure tap plug 89 and O-ring 88 from retarder control body 86.

l. Disassembly of Retarder Housing *(Foldout 13,B)*

1. If not already removed, remove output speed sensor bolt 43, bracket 42, output speed sensor assembly 40, and O-ring 41 from the retarder housing. Output speed sensor resistance should be 300 ± 30 Ohms.
2. If not already removed, remove temperature sensor bolt 39, bracket 38, temperature sensor assembly 36, and O-ring 37 from the retarder housing. Check the resistance of the temperature sensor and replace the sensor if it is defective (Figure 5–19).

3. Remove plug 48, O-ring 49, plug 50, and washer 51 from retarder housing 52.

4. Remove retaining ring 44 and flow valve plug 45.

5. Thread the J 42048 spring compressor tool into the accumulator port as far as it will go and still allow the handle to be aligned with plug 57. Compress plug 57 to relieve the spring load on retaining ring 58. Remove retaining ring 57. Carefully release the spring load by turning the tool handle counterclockwise. Remove the J 42048 tool, retaining ring 58, plug 57, O-ring 56, spring 55, retarder valve 54, and pin 53.

6. If not previously removed, remove output seal 63, using seal removal tool J 24171-A.

7. Flatten the tang(s) of locknut retainer 61 (Fold-out 13,B) to allow rotation and removal of bearing retainer nut 62. Remove bearing retainer (spanner) nut 62 using special tool J 35925. Remove locknut retainer 61.

8. Support retarder housing 52 so that P3 planetary carrier assembly 6 can be removed from the retarder housing. Place special tool J 35925-1 against the threaded shoulder of the P3 planetary carrier. Drive on J 35925-1 with a hydraulic press or a mallet until the P3 planetary carrier is separated from the retarder housing.

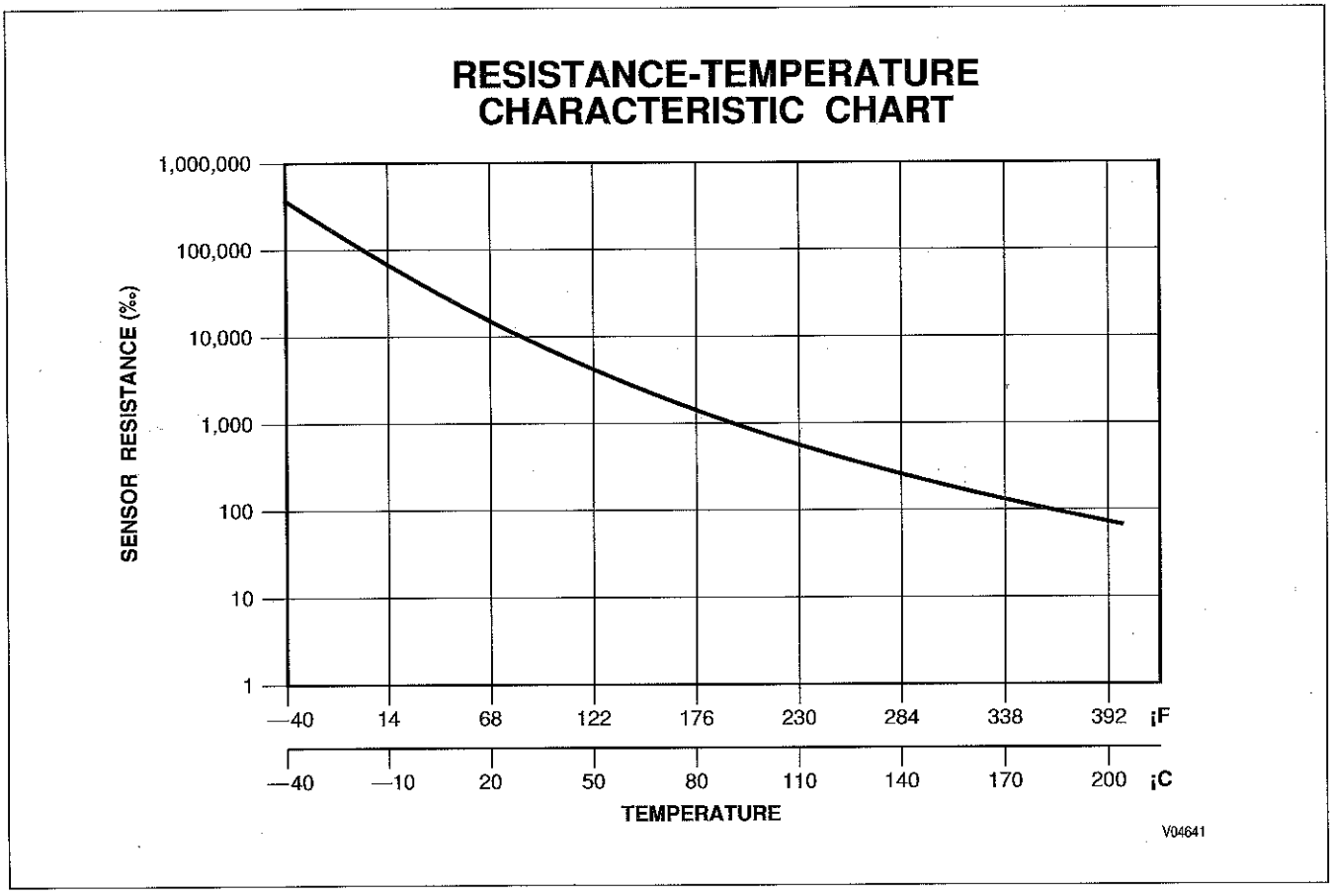

Figure 5–19. Retarder Temperature Sensor Resistance vs. Temperature (Units Built Starting 1/98)

NOTE:

Perform Steps (10) and (13) only if roller bearing 60 and cup 46 need to be replaced.

9. Remove roller bearing 60 from the retarder housing.
10. Remove two bolts 34 and bolt 59 to allow removal of retarder stator assembly 21 from retarder housing 52. Remove gasket 31 which seals between stator 28 and the retarder housing.
11. Remove rotor 32 and sealrings 30 and 33. Insert hook-type sealrings 30 and 33 into their mating bores and measure the ID of each sealring. Replace the sealrings if the ID exceeds 95.67 mm (3.767 inch).
12. Remove bearing cup 46 using bearing tool J 3940.

m. Disassembly of P3 Planetary Carrier Assembly *(Foldout 13,B)*

1. Remove retaining ring 15 and spacer 14. Remove output shaft assembly 7. Inspect bushing 8 inside the end of output shaft 9 for wear or damage. Measure the ID of the output shaft bushing. Maximum ID allowed is 20.19 mm (0.795 inch). Inspect and measure output shaft 9 spline wear. Maximum output shaft spline wear is 0.38 mm (0.015 inch).
2. If replacement is necessary, remove bearing assembly 13.
3. Check pinion end play. Pinion end play should not exceed 0.94 mm (0.037 inch). Repeat the check on the three remaining pinion gears.

NOTE:

The spindles and pinions do not need to be removed before removing output shaft assembly 7.

4. Remove retaining ring 10. Remove indexing ring 11. Remove four pinion spindles 16.
5. Slide pinion gear 18, thrust washers 17 and 20, and two bearings 19 from the side of P3 planetary carrier 12. Repeat the procedure with three remaining pinion gears.
6. Measure the thickness of all thrust washers 17 and 20. Minimum thickness permitted is 1.39 mm (0.054 inch). Measure thrust washer step wear. Maximum step wear allowed is 0.12 mm (0.005 inch).

n. Disassembly of Retarder Stator Assembly

1. Remove O-ring 29 from stator assembly 21.

WARNING!

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

2. Compress retainer and spring assembly 23 using piston spring compressor J 35923-2. Remove retaining ring 22 and slowly release the spring tension. Remove spring assembly 23 and C5 clutch piston 24 from retarder stator 28.
3. Remove outer sealring 25 from C5 clutch piston 24.
4. Remove inner sealring 26 from C5 clutch piston 24.

NOTE:

Perform Step (5) only if roller bearing 13 and cup 27 need to be replaced.

5. Remove bearing cup 27 using bearing tool J 3940.

o. Assembly of Retarder Stator *(Foldout 13,B)*

1. If removed, install bearing cup 27 using bearing tool J 35922-3.
2. Install inner sealring 26 onto C5 clutch piston 24.
3. Install outer sealring 25 onto C5 clutch piston 24. Lube sealrings on the piston and seal bore areas in the retarder stator.

NOTE:

Align the tang on the back of the C5 clutch piston with the notch for the piston tang in the retarder stator before installing C5 clutch piston 24 into retarder stator 28.

4. Install C5 clutch piston 24 into retarder stator 28.

WARNING!

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

CAUTION:

Use care when compressing spring assembly not to allow the assembly to catch in the retaining ring groove.

5. Align the tab on spring retainer 23 with the notch in stator housing 28. Compress retainer and spring assembly 23 using piston spring compressor J 35923-2. Install retaining ring 22 so that the ends clear the tab in the spring retainer and slowly release the spring force. Remove the compressor tool.

6. Install O-ring seal 29 on retarder stator 28.

p. Assembly of P3 Planetary Carrier Assembly *(Foldout 13,B)*

1. If removed, install bearing assembly 13.

2. If removed, install bushing 8 inside the end of output shaft 9 using installer J 35922-1, drive handle J 8092, and a press.

3. If removed, install output shaft assembly 7 into P3 planetary carrier 12.

4. Install spacer 14 and retaining ring 15.

5. Install two bearings 19 into the center of pinion gear 18. Install thrust washers 17 and 20 in P3 planetary carrier 12. Align thrust washer tangs with the slots in the carrier, and retain with them oil-soluble grease. Slide the pinion gear and bearing sets into the side of the P3 planetary carrier between the thrust washers. Repeat the procedure with the three remaining pinion gears.

6. Install four pinion spindles 16 so the lower step is positioned for proper installation of indexing ring 11.

7. Install indexing ring 11. Install retaining ring 10.

8. If components were replaced, check pinion end play. Pinion end play should not exceed 0.94 mm (0.037 inch). Check all four pinion gears.

q. Assembly of Retarder Housing Assembly *(Foldout 13,B)*

1. If removed, install bearing cup 46 using bearing tool J 35922-3.

2. Place P3 carrier assembly 6 on the work table (output shaft up) and place stator assembly 21 over the output shaft.

3. Install sealrings 30 and 33 onto rotor 32. Install the rotor assembly over the output shaft.

4. Install gasket 31 between stator assembly 21 and retarder housing 52. Place the retarder housing over the output shaft and align the holes of the housing with the holes of the stator assembly. Install two bolts 34 and bolt 59. Tighten the bolts to 51–61 N·m (38–45 lb ft).

5. Install roller bearing 60 using installer J 35921-1 and press into retarder housing 52 while rotating the retarder housing.

6. Install locknut retainer 61.

CAUTION:

Over-tightening bearing retainer nut 62 will damage bearing rollers and cone 13 and 60. If the torque wrench and breaker bar positions in Figure 5–17 are reversed, the output spanner nut will be overtorqued. Be sure wrenches are positioned ONLY as shown in Figure 5–17.

7. Install and tighten bearing retainer nut 62 using special tools J 35925-1 and J 35925-2. Place the torque wrench and a breaker bar as shown in Figure 5–17. Rotate the torque wrench in the counterclockwise direction and tighten the nut to 145–155 N·m (107–114 lb ft). If the retarder module is installed on a transmission, see Section 6 assembly instructions for correct torque specifications.

8. Support retarder housing 52 so that turning torque of P3 carrier assembly 6 can be checked after installation of bearing retainer nut 62 (Figure 5–18). Maximum allowable drag is 3 N·m (26 lb inch).

NOTE:

Delay bending the retainer tangs on the retainer nut and the installing of output oil seal 63 until final assembly of the transmission.

9. Install flow valve plug 45 and retaining ring 44.
10. Thread the J 42048 spring compressor tool into the accumulator port as far as it will go and still allow the handle to be aligned with the retarder valve bore. Rotate the tool counterclockwise to provide clear access to the retarder valve bore.
11. Install pin 53 into retarder valve 54 and insert into the valve bore. Install spring 55, O-ring 56, and plug 57. Spring 55 must remain uncompressed until tool J 42048 is used to safely compress it.
12. Align tool J 42048 with the retarder valve bore and rotate the tool handle clockwise to contact the center of plug 57. Continue turning the tool handle clockwise to compress spring 55 until plug 57 is below the groove for retaining ring 58. Install retaining ring 58.
13. Turn the tool handle counterclockwise to allow plug 57 to contact retaining ring 58 and to allow removal of the tool. Remove the J 42048 compressor tool from the accumulator bore by rotating it counterclockwise.
14. Be sure O-ring 41 is in place and install output speed sensor assembly 40. Hold retainer 42 in place and install retaining bolt 39. Tighten the bolt to 24–29 N·m (18–21 lb ft).
15. If temperature sensor assembly 36 was replaced, install a new O-ring 37 on the temperature sensor and install the temperature sensor assembly into the retarder housing.
16. Install temperature sensor bracket 38 and retainer bolt 39. Tighten bolt to 24–29 N·m (18–21 lb ft).
17. Install plug 48, O-ring 49, plug 50, and washer 51. Tighten plug 48 to 60–67 N·m (44–49 lb ft). Tighten plug 50 to 60–67 N·m (44–49 lb ft).
18. For units starting with S/N 6510262246, install gasket 51, cover 52, and nine bolts 53 (Foldout 13,C). Tighten bolts to 24–29 N·m (18–21 lb ft).
19. For units starting with S/N 6510262246, install jumper manifold gasket 94 and jumper manifold 95 or remote manifold 97 and four bolts 96 (Foldout 13,C). Tighten bolts to 51–61 N·m (38–45 lb ft).

r. Assembly and Installation of Retarder Control Body Assembly *(Foldout 13,C)*

1. Install and lube O-ring 70 on connector 69. Thread connector assembly 71, attached to connector 69, through the bore at the top of valve body 86 and partially insert connector 69, leaving room to install solenoid 74.
2. Install and lube O-rings 75 and 76 on solenoid 74. Connect connector assembly 72 to solenoid 74. Place solenoid 74 into position in the valve bore just below connector 69. Rotate and wiggle the solenoid while pushing down to seat the O-rings in their bores and to align the solenoid groove with the hole for retaining pin 81.

CAUTION:

When inserting solenoid retaining pin 81, be certain it is installed into the off-center hole in the solenoid bore. Installing the pin in the bore centerline hole will destroy the solenoid.

3. Install retaining pin 81. Rotate the solenoid to be below the valve body mounting face. Be sure the wires connecting to the solenoid are also below the valve body mounting face to prevent damage during installation of the body.
4. Push connector 69 completely into the bore and install spring clip 90.
5. Install O-ring seal 88 and pressure tap plug 89. Tighten plug to 10–13 N·m (7–10 lb ft).
6. Install valve 77, spring 78, lubed O-ring 79, and plug 80. Tighten plug to 24–29 N·m (18–21 lb ft).
7. Install spring 85, valve 84, lubed O-ring 83, and plug 82. Tighten plug to 24–29 N·m (18–21 lb ft).

8. Install two guide pins into the retarder control body mounting flange bolt holes on retarder housing assembly 35.
9. Install gasket 64, solenoid separator plate 65, and gasket 66.
10. Install retarder control body assembly 67, three bolts 91 and six bolts 92 that retain it to retarder housing assembly 35. Tighten bolts to 24–29 N·m (18–21 lb ft).

s. Disassembly of Retarder Valve Body (Units Starting with S/N 6510262246) *(Foldout 13,C)*

NOTE:

Units before S/N 6510262246 contained two separator plate gaskets 64 and 66.

CAUTION:

Separator plate 65 and, if present, gaskets 64 and 66 are not retained after removing bolts 91 and 92. Avoid damaging the separator plate and gaskets.

1. Remove three bolts 91 and six bolts 92 that retain retarder control body assembly 67 to retarder housing 50 and remove control body assembly 67.
2. Remove separator plate 65 and, if present, separator plate gaskets 64 and 66.
3. Remove plug 82, O-ring 83, valve 84, and spring 85.
4. Remove plug 80, O-ring 79, spring 78, and valve 77.
5. Remove spring clip 90. Move connector 69 partially out of the bore to allow space for solenoid removal.
6. Remove retaining pin 81 from retarder control body 86. Carefully rotate and wiggle solenoid 74 while exerting force toward connector 69. Remove solenoid 74 and O-rings 75 and 76.
7. Disconnect connector assembly 71 from solenoid 74. Remove wiring harness 68 from control body 86. For repair or replacement of terminals 73 or connector 72, see TS2973EN, WTEC III Troubleshooting Manual.
8. Check the resistance of retarder solenoid 74. Resistance must be within the range shown on Figure 5–15.
9. Remove pressure tap plug 89 and O-ring 88 from retarder control body 86.

t. Disassembly of Retarder Housing *(Foldout 13,C)*

1. Remove fours bolts 96 retaining either jumper manifold 95 or remote manifold 97 to retarder housing 50.
2. Remove either jumper manifold 95 or remote manifold 97 and gasket 94.
3. If not already removed, remove output speed sensor bolt 43, bracket 42, output speed sensor assembly 40, and O-ring 41 from the retarder housing. Output speed sensor resistance should be 300 ± 30 Ohms.
4. If not already removed, remove temperature sensor bolt 39, bracket 38, temperature sensor assembly 36, and O-ring 37 from the retarder housing. Check the resistance of the temperature sensor and replace the sensor if it is defective (Figure 5–20).
5. Remove nine bolts 53, cover 52, and gasket 51 from the bottom of retarder housing 50.
6. Remove plug 48, O-ring 49 from retarder housing 50.
7. Remove retaining ring 44 and flow valve plug 45.
8. Thread the J 42048 spring compressor tool into the accumulator port as far as it will go and still allow the handle to be aligned with plug 58. Compress plug 58 to relieve the spring load on retaining ring 59. Remove retaining ring 59. Carefully release the spring load by turning the tool handle counterclockwise. Remove the J 42048 tool, plug 58, O-ring 57, spring 56, retarder valve 55, and pin 54.
9. If not previously removed, remove output seal 63, using seal removal tool J 24171-A.
10. Flatten the tang(s) of locknut retainer 61 to allow rotation and removal of bearing retainer nut 62. Remove bearing retainer (spanner) nut 62 using special tool J 35925. Remove locknut retainer 61.

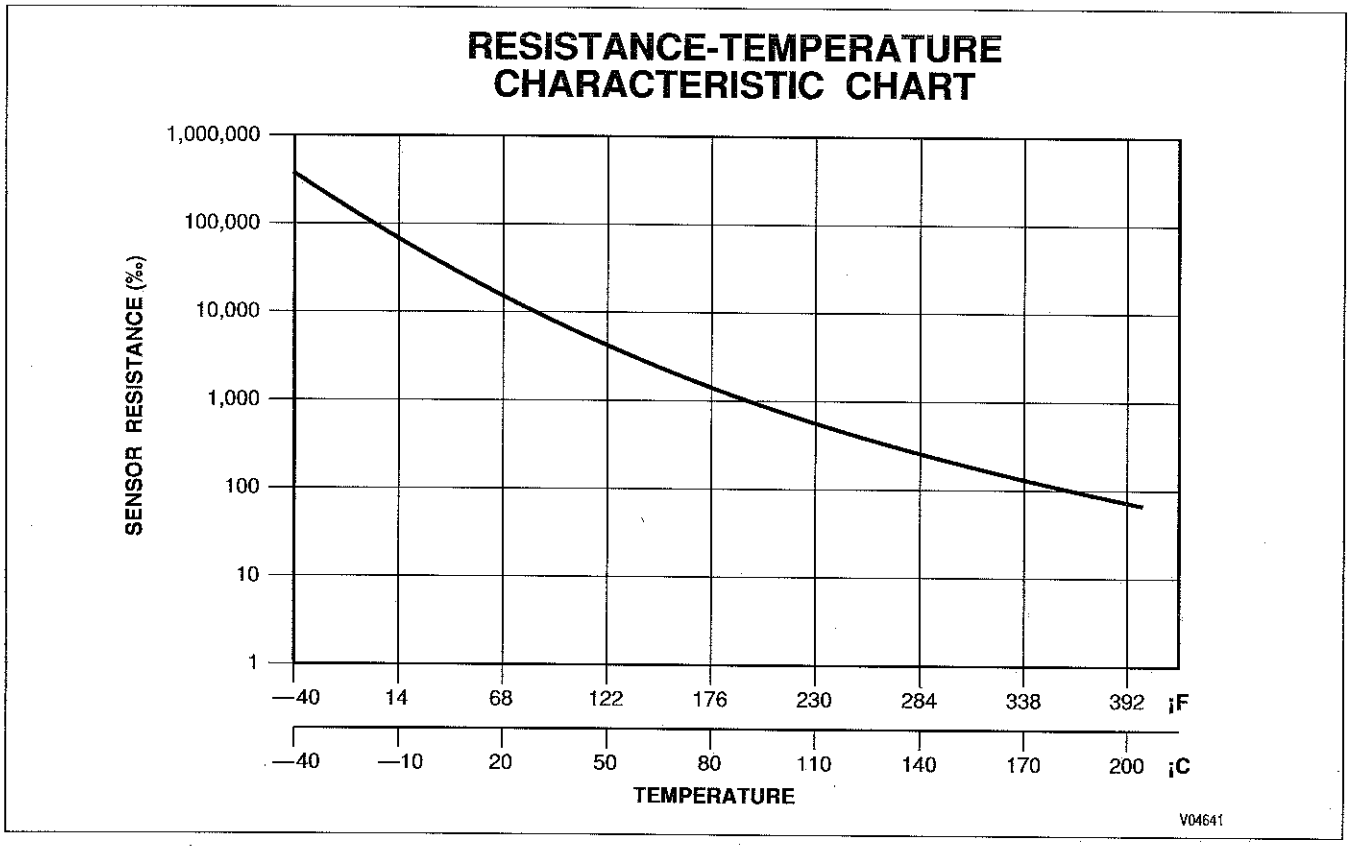

Figure 5–20. Retarder Temperature Sensor Resistance vs. Temperature

11. Support retarder housing 50 so that P3 planetary carrier assembly 6 can be removed from the retarder housing. Place special tool J 35925-1 against the threaded shoulder of the P3 planetary carrier. Drive on J 35925-1 with a hydraulic press or a mallet until the P3 planetary carrier is separated from the retarder housing.

NOTE:

Perform Steps (12) and (15) only if roller bearing 60 and cup 46 need to be replaced.

12. Remove roller bearing 60 from the retarder housing.
13. Remove three bolts 34 to allow removal of retarder stator assembly 21 from retarder housing 52. Remove gasket 31 which seals between stator 28 and the retarder housing.
14. Remove rotor 32 and sealrings 30 and 33. Insert hook-type sealrings 30 and 33 into their mating bores and measure the ID of each sealring. Replace the sealrings if the ID exceeds 95.67 mm (3.767 inch).
15. Remove bearing cup 46 using bearing tool J 3940.

u. Disassembly of P3 Planetary Carrier Assembly *(Foldout 13,C)*

1. Remove retaining ring 15 and spacer 14. Remove output shaft assembly 7. Inspect bushing 8 inside the end of output shaft 9 for wear or damage. Measure the ID of the output shaft bushing. Maximum ID allowed is 20.19 mm (0.795 inch). Inspect and measure output shaft 9 spline wear. Maximum output shaft spline wear is 0.38 mm (0.015 inch).
2. If replacement is necessary, remove bearing assembly 13.
3. Check pinion end play. Pinion end play should not exceed 0.94 mm (0.037 inch). Repeat the check on the three remaining pinion gears.

NOTE:

The spindles and pinions do not need to be removed before removing output shaft assembly 7.

16. Install temperature sensor bracket 38 and retainer bolt 39. Tighten bolt to 24–29 N·m (18–21 lb ft).

17. Install plug 48, O-ring 49. Tighten plug 48 to 60–67 N·m (44–49 lb ft).

18. Install gasket 51, cover 52, and nine bolts 53. Tighten bolts to 24–29 N·m (18–21 lb ft).

19. Install jumper manifold gasket 94 and jumper manifold 95 or remote manifold 97 and four bolts 96. Tighten bolts to 51–61 N·m (38–45 lb ft).

z. Assembly and Installation of Retarder Control Body Assembly *(Foldout 13,C)*

1. Install and lube O-ring 70 on connector 69. Thread connector assembly 71, attached to connector 69, through the bore at the top of valve body 86 and partially insert connector 69, leaving room to install solenoid 74.

2. Install and lube O-rings 75 and 76 on solenoid 74. Connect connector assembly 71 to solenoid 74. Place solenoid 74 into position in the valve bore just below connector 69. Rotate and wiggle the solenoid while pushing down to seat the O-rings in their bores and to align the solenoid groove with the hole for retaining pin 81.

CAUTION:

When inserting solenoid retaining pin 81, be certain it is installed into the off-center hole in the solenoid bore. Installing the pin in the bore centerline hole will destroy the solenoid.

3. Install retaining pin 81. Rotate the solenoid to be below the valve body mounting face. Be sure the wires connecting to the solenoid are also below the valve body mounting face to prevent damage during installation of the body.

4. Push connector 69 completely into the bore and install spring clip 90.

5. Install O-ring seal 88 and pressure tap plug 89. Tighten plug to 10–13 N·m (7–10 lb ft).

6. Install valve 77, spring 78, lubed O-ring 79, and plug 80. Tighten plug to 24–29 N·m (18–21 lb ft).

7. Install spring 85, valve 84, lubed O-ring 83, and plug 82. Tighten plug to 24–29 N·m (18–21 lb ft).

8. Install gasket 64, solenoid separator plate 65, and gasket 66 on retarder control body 86.

9. Install retarder control body assembly 67, three bolts 91 and six bolts 92 that retain it to retarder housing assembly 35. Tighten bolts to 24–29 N·m (18–21 lb ft).

5–13. REAR COVER MODULE

a. Disassembly *(Foldout 13,D)*

1. If not previously removed, remove retaining bolt 32, retainer 31, output speed sensor assembly 29, and O-ring 30. The output speed sensor should have a resistance of 300 ± 30 Ohms.

2. If not previously removed, remove output seal 38 using seal removal tool J 24171-A. If present, remove plug 39 and washer 40.

3. Flatten the tang of locknut retainer 36 to allow rotation and removal of bearing retainer nut 37.

4. Remove bearing retainer (spanner) nut 37 using special tool J 35925.

5. Remove locknut retainer 36.

6. Place blocks under rear cover 28 or 41 so that the P3 carrier assembly is above the work surface far enough to allow disassembly from the rear cover. Place special tool J 35925-1 against the threaded shoulder of the P3 carrier assembly. Drive on special tool J 35925-1 with a press or a mallet until the P3 carrier assembly is separated from the rear cover.

7. Remove roller bearing 35 and output speed signal wheel 33 from rear cover 28 or 41.

NOTE:

Perform Step (8) only if replacing roller bearing 35 and cup 34.

8. Remove bearing cup 34 using bearing tool J 3940.

b. Disassembly of the P3 Planetary Carrier Assembly *(Foldout 13,D)*

1. If damaged, or if removing bearing assembly 13, or if replacing output speed signal wheel 33, remove pin 11.
2. If replacement is necessary, remove bearing assembly 13.
3. Check pinion end play. Pinion end play should not exceed 0.94 mm (0.037 inch). Check all pinion gears.

NOTE:

Spindles and pinions do not need to be removed to remove output shaft assembly 6.

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4. Remove retaining ring 9. Remove indexing ring 10. Remove four pinion spindles 16. Inspect indexing ring 10 for abnormal wear where the spindles 16 contact (Figure 5–13). If abnormal wear is present, the planetary spindle 16 probably has a sharp edge instead of a radius edge (Figure 5–14).

NOTE:

Planetary spindles on transmission S/N 6510063169 to S/N 6510114718 have sharp edges (Figure 5–14). If index ring 10 is worn and the spindles have a sharp edge and fall within the S/N range above, replace the spindles.

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5. Slide pinion gear 18, thrust washers 17 and 20, and two bearings 19, from the side of P3 planetary carrier 12. Repeat the procedure with three remaining pinion gears.
6. Measure the thickness of thrust washers 17 and 20. Minimum thickness allowed is 1.39 mm (0.054 inch). Measure thrust washer step wear. Maximum step wear allowed is 0.12 mm (0.005 inch).
7. Remove retaining ring 15 and spacer 14.
8. If not done previously, remove output shaft assembly 6.
9. Inspect bushing 7 inside the end of output shaft 8 for replacement. Measure the ID of the output shaft bushing. Maximum allowable ID is 20.19 mm (0.795 inch). Inspect and measure output shaft 8 spline wear. Maximum output shaft spline wear is 0.38 mm (0.015 inch).

c. Disassembly of the Rear Cover Assembly *(Foldout 13,D)*

WARNING!

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

1. Remove C5 clutch piston 24 from rear cover 28 or 41 by compressing retainer and spring assembly 23 using piston spring compressor J 35923-2. Remove retaining ring 22 with snapring pliers and slowly release the spring force.
2. Remove outer sealring 25 from C5 clutch piston 24.
3. Remove inner sealring 26 from C5 clutch piston 24.

NOTE:

Perform Step (4) only if replacing roller bearing 13 and cup 27.

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4. Remove bearing cup 27 using bearing tool J 3940.

d. Assembly of Rear Cover *(Foldout 13,D)*

1. Install bearing cup 27 using bearing tool J 35922-1.
2. Install inner sealring 26 onto C5 clutch piston 24. Install outer sealring 25 onto C5 clutch piston 24.

NOTE:

Before installing C5 clutch piston 24 into rear cover 28 or 41, align the tab on the back of the C5 clutch piston with the notch for the piston tab in the rear cover.

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3. Install C5 clutch piston 24 into rear cover 28 or 41.

WARNING!

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

CAUTION:
Use care when compressing spring assembly not to allow the assembly to catch in and damage the retaining ring groove.

4. Align the tab on the spring retainer with the notch in the rear cover. Compress retainer and spring assembly 23 using piston spring compressor J 35923-2. Install retaining ring 22 so that the ends clear the tab in the spring retainer and slowly release the spring force.

e. Assembly of the P3 Planetary Carrier Assembly *(Foldout 13,D)*

1. If removed, install bearing assembly 13.

NOTE:

- **If later model output speed signal wheel P/N 29510781 is to be installed, proceed with Step (2). This P/N is located on the side of the wheel in recessed characters.**
- **If earlier model output speed signal wheel P/N 29506608 is to be installed, skip Step (2) and go to Step (3). This P/N wheel does not have a P/N located on the part.**

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2. Install 12 mm (0.47 inch) roll pin 11 (P/N 11512350) to a height of 2.35–2.95 mm (0.093–0.116 inch) above the carrier shaft. Skip Step (3) and proceed to Step (4).

3. Install 10 mm (0.39 inch) roll pin 11 (P/N 11512348) to a height of 2.20–2.80 mm (0.087–0.110 inch) above the carrier shaft.

4. If removed, press bushing 7 inside the end of output shaft 8 using installer J 35922-1 and drive handle J 8092.

5. If removed, install output shaft assembly 6 into P3 planetary carrier 12.

6. Install spacer 14 and retaining ring 15.

7. Install two bearings 19 into the center of pinion gear 18. Install thrust washers 17 and 20 in P3 planetary carrier 12. Align the thrust washer tangs with the slot in the carrier and retain them with oil-soluble grease. Slide the pinion gear and bearing sets into the side of the P3 planetary carrier between the thrust washers. Repeat the procedure with the three remaining pinion gears.

8. Install four pinion spindles 16 so the lower step is positioned for proper installation of indexing ring 10.

CAUTION:
Be sure that the planetary spindles cannot rotate after the indexing ring has been installed or lube flow to the pinion bearings may be blocked. When the indexing ring slots are worn on one corner (Figure 5–13), flip the plate over to obtain a new unworn contact surface. If both contact areas are worn, replace the indexing ring.

9. Install indexing ring 10. Install retaining ring 9.

10. If components were replaced, check pinion end play. Pinion end play should not exceed 0.94 mm (0.037 inch). Check all four pinion gears.

11. Align the slot in output speed signal wheel 33 with spring pin 11. Using installer J 35921-1 and not exceeding 10 230 N (2300 lbs) of force, press output speed signal wheel 33 to full depth on P3 carrier assembly 5.

f. Completion of the Rear Cover Module *(Foldout 13,D)*

1. If removed, install bearing cup 34 using bearing tool J 35922-3.

2. Place P3 carrier assembly 5 on the work table (with the output shaft up) and place rear cover 28 or 41 over the output shaft.

3. Using installer J 35921-1 and not exceeding 10 230 N (2300 lbs) of force, press roller bearing 35 into rear cover 28 or 41, while rotating the cover assembly.

4. Install locknut retainer 36.

CAUTION:

Over-tightening bearing retainer nut 37 will damage bearing rollers and cone 13 and 35. If the torque wrench and breaker bar positions in Figure 5–17 are reversed, the output spanner nut will be overtorqued. Be sure wrenches are positioned ONLY as shown in Figure 5–17.

NOTE:

- **If later model output speed signal wheel P/N 29510781 was installed in Paragraph 5–13e(11), proceed with Step (5). Part number will be shown on side of wheel in recessed numbers.**
- **If earlier model output speed signal wheel P/N 29506608 was installed in Paragraph 5–13e(11), skip Step (5) and go to Step (6). Part number is not shown on this part but there is a 3.0 mm x 0.8 mm raised identification feature on one end near the gear teeth.**

5. Install and tighten bearing retainer nut 37 using special tools J 35925-1 and J 35925-2. Place the torque wrench and a breaker bar as shown in Figure 5–17. Rotate the torque wrench in the counterclockwise direction and tighten the nut to 74–88 N·m (55–65 lb ft). Skip Step (6) and proceed to Step (7).

6. Install and tighten bearing retainer nut 37 using special tools J 35925-1 and J 35925-2. Place the torque wrench and a breaker bar as shown in Figure 5–17. Rotate the torque wrench in the counterclockwise direction and tighten the nut to 290–340 N·m (214–251 lb ft).

7. Support rear cover 28 or 41 so that turning torque of P3 carrier assembly 5 can be checked after installation of bearing retainer nut 37 (Figure 5–21). Maximum allowable drag is 3 N·m (26 lb inch). Recheck the torque on bearing retainer nut 37 (Step 5 or 6 above). If torque is correct, recheck drag torque. If both torque values meet specification, proceed to Step (8).

8. Bend up two or more tangs of locknut retainer 36 to prevent bearing retainer nut 37 from backing off. If only one tang is aligned with a spanner nut slot, continue to torque the spanner nut (but do not exceed the tightening torque or drag torque limits) until two or more tangs can be bent up into slots on the spanner nut.

NOTE:

DO NOT reuse a tang once it has been bent. Replace locknut retainer 36, if necessary.

9. Install output shaft oil seal 38 using J 39928 (models with non-drum parking brake) or J 35921-4 (models with drum parking brake).

10. Be sure O-ring 30 is in place and install output speed sensor assembly 29. Hold bracket 31 in place and install retaining bolt 32. Tighten the bolt to 24–29 N·m (18–21 lb ft).

11. When rear cover 41 is used, be sure to install plug 39 and washer 40. Torque plug 39 to 60–67 N·m (44–50 lb ft).

5–14. ADAPTER HOUSING AND P3 OVERHAUL

a. Disassembly *(Foldout 18,B)*

1. Place the adapter housing assembly on tool base J 35923-4 with output end down.

2. Install tool J 35923-2 along with its washer, bearing, and handle.

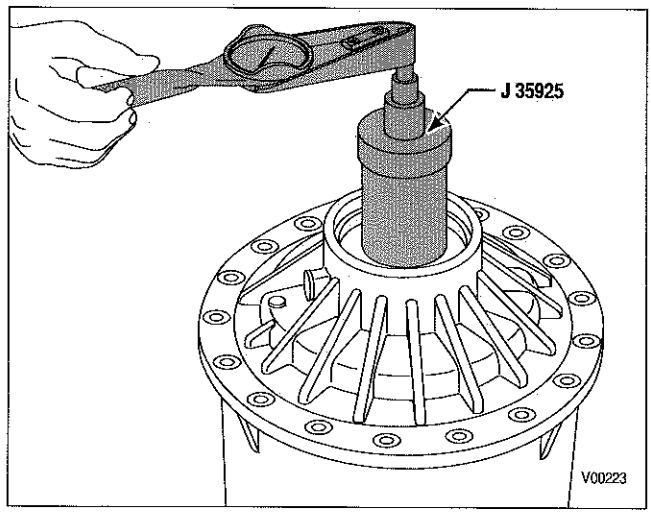

Figure 5–21. P3 Carrier Turning Torque Check—Models Without Retarder

3. Thread the handle down to compress spring retainer assembly 16.
4. Remove retaining ring 15.
5. Remove tool J 35923-2, followed by C5 spring retainer assembly 16.

CAUTION:
Make sure that the spring retainer does not catch in the retaining ring groove.

6. Using a soft face mallet, loosen C5 clutch piston 17. Remove C5 piston from adapter housing 20.
7. Remove square cut outer sealring 18 and inside lip-type sealring 19 from the piston.
8. Inspect seal bore areas in the housing for nicks and wear.
9. Remove plug 22 from the lower left side of the housing.
10. Remove O-ring 23 from the plug.
11. Remove filter screen 24 from housing 20. This screen filters main sump fluid before it enters the transfer case lube pump.

NOTE:
P3 carrier disassembly is covered in Steps (12) through (16).

12. Check pinion end play. Pinion end play should not exceed 0.94 mm (0.037 inch). Check all pinion gears.
13. Remove retaining ring 2. Remove indexing ring 3. Remove four pinion spindles 7. Inspect indexing ring 3 for abnormal wear where the spindles 7 contact (Figure 5–13). If abnormal wear is present, the planetary spindle 7 probably has a sharp edge instead of a radius edge (Figure 5–14).

NOTE:
Planetary spindles on transmission S/Ns from 6510063169–6510114718 have sharp edges (Figure 5–14). If index ring 3 is worn and the spindles have a sharp edge and fall within the S/N range above, replace the spindles.

14. Slide pinion gear 9, thrust washers 8 and 11, and two bearings 10, from the side of P3 planetary carrier 5. Repeat the procedure with three remaining pinion gears.
15. Measure the thickness of thrust washers 8 and 11. Minimum thickness allowed is 1.39 mm (0.054 inch). Measure thrust washer step wear. Maximum step wear allowed is 0.12 mm (0.005 inch).
16. Inspect bushing 6 inside the end of carrier 5 for replacement. Measure the ID of bushing 6. Maximum allowable ID is 53.22 mm (2.095 inch). Remove bushing 6 if replacement is needed. Be careful not to damage the carrier bore during bushing removal.

b. Assembly *(Foldout 18,B)*

1. If removed, press bushing 6 inside carrier 5, using installer J 38569 and drive handle J 8092.
2. Install two bearings 10 into the center of pinion gear 9. Install thrust washers 8 and 11 in P3 planetary carrier 5. Align the thrust washer tangs with the slot in the carrier and retain them with oil-soluble grease. Slide the pinion gear and bearing sets into the side of the P3 planetary carrier between the thrust washers. Repeat the procedure with the three remaining pinion gears.
3. Install four pinion spindles 7 so the lower step is positioned for proper installation of indexing ring 3.

CAUTION:
Be sure that the planetary spindles cannot rotate after the indexing ring has been installed or lube flow to the pinion bearings may be blocked. When the indexing ring slots are worn on one corner (Figure 5–13), flip the plate over to obtain a new unworn contact surface. If both contact areas are worn, replace the indexing ring.

4. Install indexing ring 3. Install retaining ring 2.
5. If components were replaced, check pinion end play. Pinion end play should not exceed 0.94 mm (0.037 inch). Check all four pinion gears.

6. Install a new filter screen 24. Make sure the round metal boss properly indexes in the housing.
7. Install a new O-ring 23 on plug 22, and then install the plug in the housing. Tighten the plug to 34–47 N·m (25–35 lb ft).
8. Install new inner lip-type sealring 19 and outside square-cut sealring 18 on the piston. Lube the sealrings.
9. Lube adapter housing seal bores.
10. Install C5 piston17, aligning the cast tab on the piston with the notch in the housing. Lightly seat the piston using a soft face mallet.
11. Install C5 spring retainer 16, aligning the notch in the housing with the tab on the retainer.
12. Place adapter housing 20 on the base of tool J 35923-4 with input side up.
13. Install J 35923-2 along with its washer, bearing, and handle. Tighten the handle to compress spring retainer assembly 16. Make sure that spring retainer tab indexes with the notch in the housing.
14. Install retaining ring 15.
15. Release spring force and remove tools J 35923-2 and J 35923-4.

5–15. SCAVENGER PUMP OVERHAUL

a. Disassembly *(Foldout 19,C)*

1. Remove retaining pin 2 from pump housing 3.
2. Remove shaft 4.
3. Remove O-rings 5 and 6 from shaft 4.
4. Remove three bolts 7 from pump housing 3.
5. Remove driven gear assembly 8 and pump assembly 13 from pump housing 3.
6. Remove thrust washer 12 from pump housing 3.
7. Measure the thickness of thrust washer 12. Minimum thickness allowed is 2.47 mm (0.097 inch).
8. If thrust washer 12 is worn, damaged, or does not meet specifications, replace thrust washer 12.
9. Remove gasket 18 from pump housing 3.
10. Inspect for damaged bearings 9 and 10 in driven gear 11. Remove damaged bearings using tool J 24171-A.
11. Remove four bolts 19 from pump assembly.
12. Remove pump cover 14, gear set 15, and thrust washer 16 from pump body 17.
13. Measure the thickness of thrust washer 16. Minimum allowed thickness is 2.47 mm (0.097 inch).
14. If thrust washer 16 is worn, damaged, or does not meet specifications, replace thrust washer 16.
15. Measure the thickness of pump cover 14. Minimum allowed thickness is 6.75 mm (0.265 inch).
16. If pump cover 14 is worn, damaged, or does not meet specifications, replace pump cover 14.
17. Measure the pump body gear-cavity depth. Maximum allowed depth is 15.215 mm (0.599 inch).

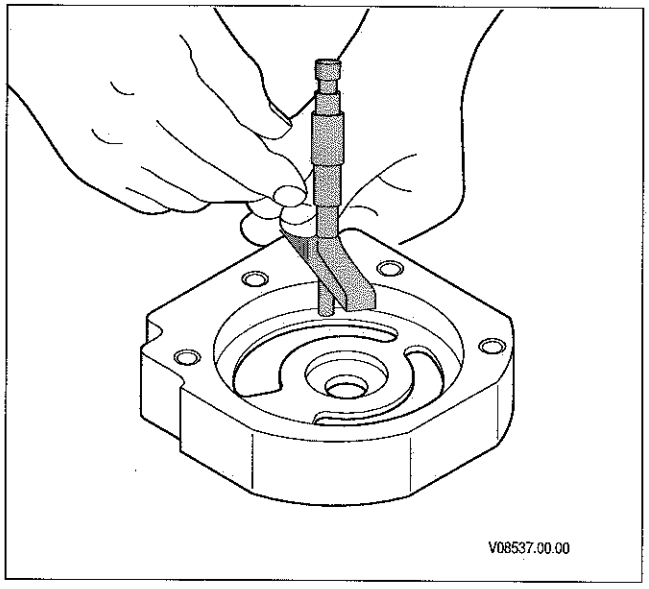

Figure 5–22. Measuring Scavenge Pump Gear-Cavity Depth

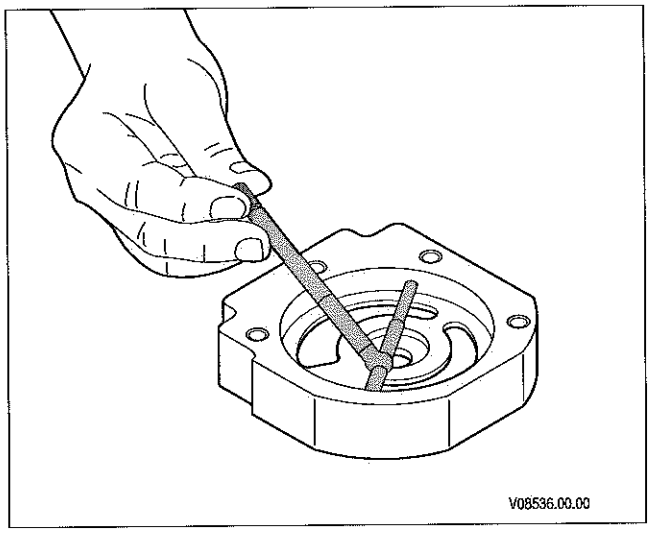

Figure 5–23. Measuring Scavenge Pump Gear-Cavity Diameter

18. Measure the pump body gear-cavity diameter. Maximum allowed ID is 95.43 mm (3.757 inch).

19. If the pump body gear-cavity is worn, damaged, or does not meet specifications, replace the pump body.

20. Measure the OD of the outer pump gear. Minimum allowable OD is 95.20 mm (3.748 inch).

21. Measure the width of the drive and driven pump gears. Minimum allowable width is 15.08 mm (0.594 inch).

22. Install gear set 15 into pump body 17. Measure the pump gear side clearance. Maximum allowed side clearance is 0.13 mm (0.005 inch).

23. Measure gear tooth tip clearance. Maximum allowed clearance is 0.13 mm (0.005 inch).

24. Measure driven-gear to pump body (diametrical) clearance. Maximum allowed diametrical clearance is 0.23 mm (0.009 inch).

25. Remove gear set 15 from pump body 17.

26. If any measurement does not meet specifications, replace gear set 15 or pump body 17 and repeat measurements in Steps (16) through (24).

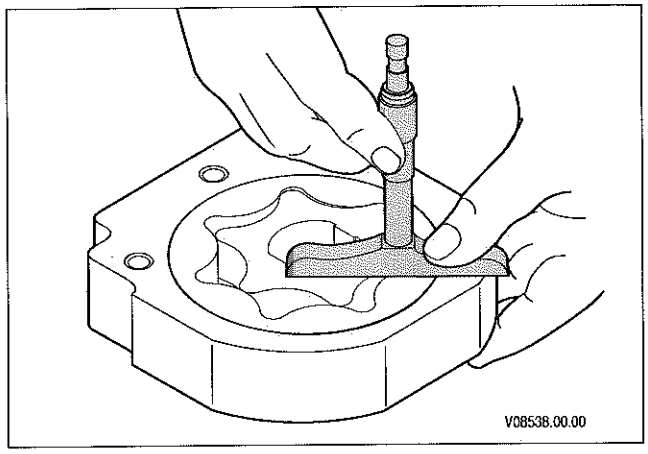

Figure 5–24. Measuring Scavenge Pump Gear Side Clearance

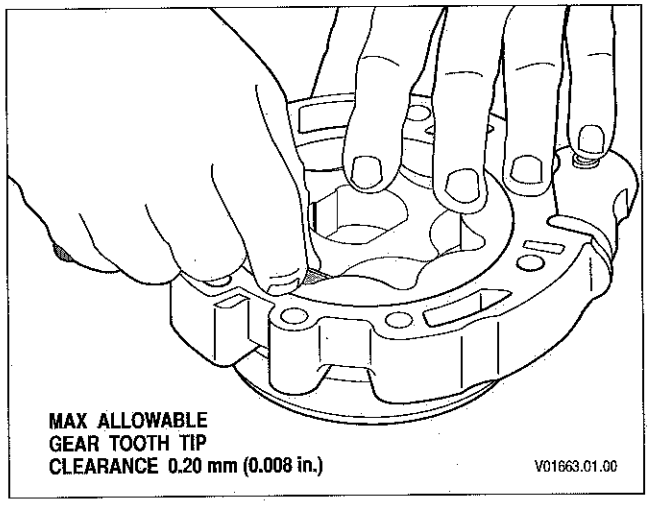

Figure 5–25. Measuring Scavenge Pump Gear Tooth Tip Clearance

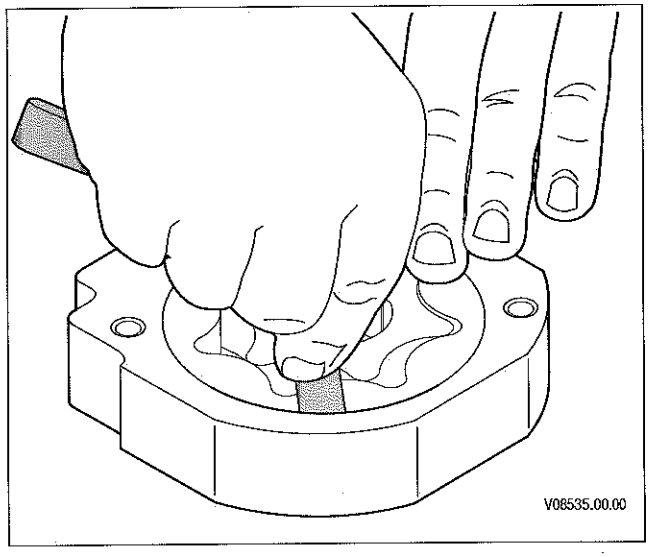

Figure 5–26. Measuring Scavenge Pump Driven Gear To Pump Body Diametrical Clearance

b. Assembly *(Foldout 19,C)*

1. If removed, install NEW bearings 9 and 10 into driven gear 11 using a press and tools J 47028 and J 8092. Install bearing with driver against numbered bearing cage.
2. Install bearings 9 and 10 to a depth of 3 mm (0.118 inch).
3. Install new O-rings 5 and 6 onto shaft 4.
4. Install thrust washer 16 into pump body 17.
5. Lubricate pump gear set 15 and install the gear set into pump body 17.
6. Position pump cover14 on pump body 17 and install four bolts 19. Tighten bolts 19 to 24–29 N·m (18–21 lb ft).
7. Align the flats on the driven gear hub with the flats on the inner gear set. Slide driven gear assembly 8 into pump assembly 13.
8. Install a NEW gasket 18, pump assembly 13, and driven gear assembly 8 into pump housing 3.
9. Retain the pump assembly to the pump housing with three bolts 7. Tighten bolts 7 to 24–29 N·m (18–21 lb ft).
10. Install thrust washer 12 into pump housing 3.
11. Insert shaft into pump housing 3 with the hole in the shaft aligned with the hole in the pump housing.
12. Install pin 2 into pump housing 3 through the hole in shaft 4.
13. Press pin 2 flush to 0.25 mm (0.010 inch) below the pump housing gasket surface.

5–16. TRANSFER CASE MODULE

a. Disassembly of Transfer Case Module *(Foldouts 14, 15, 16)*

WARNING!

The transfer case module assembly weighs approximately 270 kg (595 lb). Use proper lifting and handling equipment to prevent injury.

NOTE:

Refer to Foldout 15 for Steps (1) through (4).

1. If not previously done, install transfer case assembly 1 on the transmission overhaul stand. Position the transfer case so that the front output is upward. Begin the transfer case disassembly by loosening yoke nut 42 installed on front output shaft 57. Loosen the nut by installing a large reaction tool (for leverage) and an impact wrench. Leave the nut installed on the front output shaft.
2. Remove fifteen bolts 45. Remove front output housing 49 by lifting with a chain hoist and eye bolts in output yoke 44. Remove gasket 50.
3. Remove C7 clutch housing assembly 58.
4. Rotate the fixture so that the rear output end is upward.

NOTE:

Refer to Foldout 16 for Steps (5) through (11).

5. Loosen rear output shaft nut 81 by following the same procedure explained in Step (1). Leave the nut installed on the rear output shaft.
6. Remove six bolts 75 and nine bolts 82. Remove rear output housing 74 by lifting with a chain hoist and eye bolts. Remove gasket 73.
7. Remove P4 carrier assembly 57.
8. Remove fifteen bolts 23 and two bolts 24. Remove C6 clutch housing assembly 17. Remove C6 housing gasket 22. Note where the different length bolts were removed so that reassembly will be correct.
9. Remove five bolts 50, holding rear idler cover 49 onto the transfer case. Remove rear idler cover 49, gasket 47, and O-ring 48. Use small pry bars at locations provided in order to remove the cover.
10. Remove controls cover 43 after removing ten bolts 44. Remove gasket 42. Removing the controls cover provides access to the control valve body 29 and its wiring.

11. Remove the bolts securing the rear transfer case to transfer case holding fixture J 38572.

NOTE:
Refer to Foldout 14,B for Steps (12) through (14).

12. Remove fifteen bolts 17, fastening the rear transfer case 8 to the front transfer case 7.
13. Thread an eye bolt in the center of rear transfer case 8, to lift it.
14. Use a soft face mallet to separate the rear and front transfer cases. Pry points at opposite ends of the case halves are also provided to accomplish separation.
15. Lift and remove the rear transfer case; removal of the rear transfer case exposes drive gear 19 (Foldout 15), idler gear 39, driven gear 80, and control valve body 29 (Foldout 16). Remove gasket 16 (Foldout 15) and replace it during assembly.
16. Remove the output speed sensor and solenoid wiring harness connectors. Remove two bolts 46 and output speed sensor 45 (Foldout 16).
17. Remove control valve assembly 29 after removing six bolts 41 holding the control valve body on the transfer case.
18. Remove driven gear 80, idler gear 39, and drive gear 19 (Foldout 15).
19. Rotate the remaining assembly, front output end upward.
20. Remove eight bolts 4, and then remove lube charging pump 5.
21. Remove shim pack A. Shim pack A is critical to drive gear end play; keep the shim pack intact for assembly.
22. Remove eight bolts 71 and manifold assembly 72.
23. Remove shim pack C and keep it intact for assembly. Shim pack C is used to set up driven gear end play.
24. Remove five bolts 22, then remove front idler cover 23, O-ring 24, shim pack B (keeping it intact), and gasket 28. Use pry bars as in removal of rear idler cover.
25. Remove nut 88, securing electrical harness connector 31 to connector plate 29. Remove four bolts 32, holding connector plate 29 to the transfer case. Remove connector plate 29, followed by the harness and gasket 30.
26. Remove the suction hose fitting (not shown) from the transfer case. The fitting is sealed with an O-ring, and provides a pilot for the screen which filters the fluid returning to the main transmission sump from the transfer case sump. Replace the filter screen during the overhaul.
27. Inspect bearing races 17, 37, and 78 on front transfer case 14 for wear and damage; likewise, inspect bearing races 21, 41, and 82 on rear transfer case 2 (Foldout 16).
28. If the bearing races must be replaced, drive them out by using a hammer and a drift.
29. During the race installation, temporarily install the lube charging pump or the manifold with the appropriate shim pack to locate the race in the housing. Since the race does not have an actual seat in the housing, locating the race correctly is essential for proper gear end play.
30. Reinstall the races in the housing. For the drive and driven gear races, use special tools J 38568-1 and J 35921-1. For the idler gear race, use J 38568-2 and J 8092.
31. Remove two lube passage plugs 33 (Foldout 15); removal of the lube plugs provides access to orifice plugs 34.
32. Remove two orifice plugs 34. Inspect lube orifices for obstructions. Remove any obstructions.
33. Install orifice plugs 34, and lube passage plugs 33. Tighten the orifice plugs to 12–14 N·m (9–10 lb ft). Tighten lube passage plugs to 24–29 N·m (18–21 lb ft).
34. Remove lube passage plug 25 (Foldout 16) and orifice plug 26. Inspect lube orifice for obstructions and remove any that are found.

35. Install orifice plug 26 and tighten to 12–14 N·m (9–10 lb ft). Install lube passage plug 25 and tighten to 24–29 N·m (18–21 lb ft).

b. Disassembly of C6 Clutch *(Foldout 16)*

1. Remove retaining ring 6 holding C6 clutch plates and C6 clutch hub in the C6 clutch housing.

2. Remove C6 clutch hub 7 by lifting it out along with five C6 clutch friction plates 10, four C6 clutch steel reaction plates 11, and backplate 9. One steel reaction plate 11 will remain in C6 clutch housing 19. Inspect clutch hub splines for wear and damage. Replace hub if it is damaged.

3. Remove the remaining steel reaction plate 11 from C6 clutch housing 19.

4. Separate backplate 9, five friction plates 10, and five reaction plates 11.

5. Inspect friction plates 10 for wear, damage, and the following specifications: minimum allowable thickness: 3.68 mm (0.145 inch), maximum cone permitted: 0.40 mm (0.016 inch), and minimum allowable oil groove depth: 0.20 mm (0.008 inch); if any of the above specifications are not met, replace the part.

6. Inspect steel reaction plates 11 for wear, damage, and the following specifications: minimum thickness allowed: 2.36 mm (0.093 inch), maximum allowable cone 0.40 mm (0.016 inch); if any of the above specifications are not met, replace the part.

7. Inspect backplate 9 for burrs, wear, damage, flatness, and the following specifications: minimum thickness 7.90 mm (0.311 inch), and maximum cone 0.40 mm (0.016 inch).

8. Remove retaining ring 12 after using tool J 38573 to compress the C6 piston return spring assembly.

9. Release the piston spring force, remove the special tool and check sealring bores in housing 19 for wear, nicks, and other damage. Remove spring retainer assembly 13.

10. Remove piston 14 by firmly striking the housing against a flat surface. Remove sealrings 15 and 16 from piston 14.

11. Inspect thrust bearing 8 for wear and damage. If damaged, remove thrust bearing 8 from the C6 housing.

NOTE:

Bearing 8 must be replaced in any MD 3070 before S/N 6510072173. Refer to SIL 29-WT-96.

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12. Measure the C6 clutch housing bushing 21 by using a telescope gauge and an outside micrometer. The maximum allowable ID is 36.18 mm (1.424 inch). If bushing 21 is worn or damaged, remove it from the C6 housing.

c. Assembly of C6 Clutch *(Foldout 16)*

1. Inspect C6 clutch housing 19 for groove wear. Maximum allowable groove wear is 2.29 mm (0.090 inch).

2. If removed, install bushing 21 using tools J 38569 and J 8092.

NOTE:

Bearing 8 must be replaced in any MD 3070 before S/N 6510072173. Refer to SIL 29-WT-96.

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3. If removed, install thrust bearing 8 over C6 housing sleeve. Machined tangs on the thrust bearing help make sure that the bearing is installed in the proper direction.

4. Inspect piston 14 for sealring groove damage. Correct the damage with crocus cloth or soft stone. Replace the part if damage cannot be corrected.

CAUTION:

Incorrect lip-type sealring installation can cause improper transmission operation or failure.

5. Install NEW external sealring 15 and internal sealring 16 in piston 14. For internal sealring 16, use proper lip position. Lube internal and external sealring bores in the C6 clutch

housing, and also lube the sealrings on the piston.

6. Install piston 14; use soft face mallet to seat the piston.
7. Inspect spring retainer assembly 13 for missing or broken springs. Refer to Section 7 for the spring specifications. Replace spring assembly 13 if specifications are not met.
8. Install spring assembly 13.
9. Install retaining ring 12 after using tools J 38573-1 and J 38573-3 to compress spring assembly 13. Remove special tools.
10. Install C6 clutch hub 7 hub into the C6 housing.
11. Install five reaction plates 11, and five friction plates 10 alternately, starting with a reaction plate 11, and finishing with a friction plate 10.
12. Install backplate 9.
13. Install retaining ring 6.

d. Disassembly of C7 Clutch *(Foldout 15)*

1. Remove retaining ring 60.
2. Remove the C7 clutch hub 59 along with C7 clutch pack. The C7 clutch pack consists of backplate 61, five friction plates 62, and five steel reaction plates 63 stacked in alternating order.
3. Inspect C7 friction plates 62 for minimum allowable thickness—2.21 mm (0.087 inch), minimum oil groove depth allowed—0.20 mm (0.008 inch), and maximum cone permitted—0.25 mm (0.010 inch).
4. Inspect C7 reaction plate 63 for minimum allowable thickness—2.06 mm (0.081 inch), maximum cone permitted—0.25 mm (0.010 inch).
5. Inspect backplate 61 for minimum thickness allowed—8.67 mm (0.341 inch), wear, flatness, and damage.
6. Remove C7 piston 64. Remove internal and external sealrings 66 and 65 from piston 64.
7. Measure the C7 clutch housing bushing and replace bushing 68 if required. The maximum allowable bushing ID measurement is 47.26 mm (1.861 inch).
8. Inspect pressure-relief ball 69 and make sure that the ball moves freely; minimum required movement is 1.00 mm (0.040 inch).
9. Remove three sealrings 70 from C7 clutch housing 67.

e. Assembly of C7 Clutch Housing *(Foldout 15)*

1. Inspect C7 clutch housing 67 for damage to sealring groove and piston seal surfaces, and housing spline wear. Replace the C7 clutch housing if it is damaged.
2. Install three new sealrings 70 into C7 clutch housing 67.
3. If bushing 68 was removed, install the bushing using tools J 38569 and J 8092.
4. Install ball 69 if it was removed. Make sure that it moves freely.
5. Inspect piston 64 for sealring groove damage and burrs.

CAUTION:
Incorrect lip-type sealring installation can cause improper transmission operation or failure.

6. Install new sealrings 65 and 66 into C7 piston 64. Be sure that sealring lips are properly positioned. Lube the sealring areas on the piston, and seal bore areas in C7 clutch housing 67.
7. Install piston 64 into C7 clutch housing 67. Be sure it is properly seated.
8. Inspect C7 clutch hub 59 splines for wear and damage. Replace hub if damage is not repairable. Install C7 clutch hub 59 into C7 clutch housing 67.
9. Install five friction plates 62 and five reaction plates 63 into housing 67 in alternating order, starting with a reaction plate 63 and finishing with a friction plate 62.
10. Install backplate 61 into C7 clutch housing 67.
11. Install retaining ring 60 into C7 clutch housing 67.

f. Disassembly of Oil Pump *(Foldout 15)*

1. Remove pressure relief valve plug 8.
2. Remove spring 7, and then remove pressure relief valve 6.
3. Remove locating pins from front cover 83 by driving them out using a small punch and a hammer.
4. Separate front cover 83 from the rest of the pump assembly.
5. Remove drive gear 84 from housing 87, then remove driven gear 85 and reversing ring 86. Note the orientation of drive and driven gears.

g. Assembly of Oil Pump *(Foldout 15)*

1. Use a depth gauge to measure pump cavity depth in pump rear cover 87.
2. Using an outside micrometer, measure the driven gear width and the drive gear width.
3. Determine each gear side clearance by subtracting the gear width from the pump cavity depth. The specified side clearance is 0.125 mm (0.005 inch).
4. If not within the specification, replace components as required.
5. Install reversing gear 86.
6. Install driven and drive gears 85 and 84 in the same orientation as they were removed to match wear pattern in rear pump cover 87.
7. The groove in reversing ring 86 indexes with the notch in the pump front cover.
8. Install pump front cover 83, aligning the holes with the locating pins in housing 87. Drive the locating pins into the cover from the back of the pump housing. Use a small punch to slightly countersink the pins.
9. Install pressure relief valve 6, and spring 7 into bore in the pump housing.
10. Install a NEW washer onto plug 8, then install the plug and tighten it to 12–14 N·m (9–10 lb ft).

h. Disassembly of P4 Carrier *(Foldout 16)*

1. Remove P4 sun gear 63 by lifting it out of the P4 carrier assembly 56.
2. Remove one setscrew 58 by using an Allen wrench or socket.
3. Push spindle 59 out from the P4 carrier.
4. Remove pinion gears 61, along with upper and lower thrust washers 62, and uncaged needle bearings 60.
5. Repeat Steps (2) through (4) to remove the remaining two pinion gears 61.

i. Assembly of P4 Carrier *(Foldout 16)*

1. Inspect thrust surfaces on each of three pinion gears 61 for wear and damage. Also inspect inside bore and gear tooth areas.
2. Inspect three upper and three lower thrust washers 62 for wear and damage.
3. Install three lower thrust washers 62 into each of three pinion slots in P4 carrier 57. Each washer has a machined tang which indexes with the notch in the P4 carrier housing.
4. Apply a generous amount of lube to the inside bore of each pinion gear. Install needle bearings 60 into each of three pinions 61. Use the spindle to make sure that the needle bearings are properly aligned.
5. Install pinion 61 and needle bearing 60 assembly into P4 carrier 57 with bottom thrust washer 62 already in place.
6. Install upper thrust washer 62, aligning the washer indexing tab with the notch in P4 carrier 57.
7. Inspect spindle 59 for wear and damage. Make sure that the fluid holes are free of obstructions.
8. Install spindle 59 into P4 carrier 57, aligning the setscrew pilot on the spindle with the hole in the housing.
9. Install one of three setscrews 58, and tighten to 25–35 N·m (18–26 lb ft). Swage set screw bore, using a chisel and a hammer.
10. Repeat Steps (6) through (9) to install the remaining two pinion gears 61.
11. Install sun gear 63 into P4 carrier assembly 57.

j. Disassembly of Drive, Idler, and Driven Gears *(Foldout 15)*

1. Inspect bearings 18, 20, 38, 40, 79, and 81 per guidelines explained in Paragraph 3–5e. If any of bearings 18 and 20 installed on drive gear 19, bearings 38 and 40 installed on idler gear 39, or bearings 79 and 81 installed on driven gear 80 requires replacement, use the procedure in the next step.
2. To remove bearing 18 from drive gear 19, install a large split bearing puller on the bearing. Using appropriate tool(s) and fixture(s), remove the bearing by pressing the gear out.
3. To remove bearings 20, 38, 40, 79, or 81, follow the procedure in Step (2).

k. Assembly of Drive, Idler, and Driven Gears *(Foldout 15)*

1. Inspect drive gear 19, idler gear 39, and driven gear 80 for tooth wear and damage. Refer to Paragraph 3–5i for gear inspection guidelines.
2. If removed, install bearing 18 on drive gear 19 using tool J 38579-1 and press. Repeat the same procedure to install bearing 20 on drive gear 19, or bearings 79 and 81 on driven gear 80.
3. If removed, install bearing 38 on gear 39 using tool J 38579-2 and appropriate press. Repeat the same procedure to install bearing 40 on gear 39.

l. Disassembly of the Front Output Housing and Front Output Shaft *(Foldout 15)*

1. Remove front output shaft nut 42 and washer 43.
2. Press front output shaft 57 out of front output yoke 44, and remove front output yoke 44.
3. Remove output seal 46 by using a hammer and a chisel or tool J 24171-A. Be careful not to damage the seal bore area.
4. Remove output shaft bearing 47.
5. Inspect bearing races 48 and 55 for pitting, scoring, and damage. If the bearing race(s) needs replacement, remove it by using a hammer and a drift or a hammer and tool J 3940.
6. Remove shims 51, 52, or 53, and output bearing spacer 54 from output shaft 57.
7. If bearing 56 on output shaft 57 is damaged, remove bearing 56. To remove bearing 56, install a split bearing puller on the bearing, and position the bearing and the puller on a press table. Press the output shaft out using an appropriate press.

m. Assembly of the Front Output Housing and Front Output Shaft *(Foldout 15)*

1. Inspect front output housing 49 for scoring and burrs.
2. If removed, install new bearing races 48 and 55. To install the bearing races, use tool J 38568-3 and a press. Press each bearing race until it bottoms in the output housing.
3. Position bearing 47 in output housing 49.
4. Install output seal 46 in the output housing using tools J 38547 and J 35921-1.
5. Inspect output yoke 44 for scoring of seal surface. Minimum seal surface diameter allowed is 76.20 mm (3.00 inch). If the yoke does not meet the required specification, replace the yoke.
6. Inspect output shaft 57 for spline damage and scoring. If necessary, replace the output shaft.
7. If removed, install bearing 56 on output shaft 57. To install the bearing, use tool J 38579-2. Position the bearing and tool J 38579-2 on the press table, and then carefully press the output shaft 57 into the bearing until it is fully seated.
8. Place output yoke 44 on a press table.
9. Position output housing 49 on the yoke.
10. Place bearing spacer 54 and shims 51, 52, or 53 on output shaft 57; the number of shims could be one or more.
11. Install output shaft 57 into front output housing 49 through bearing 47, output seal 46, and into yoke 44. Once all the components are properly aligned, press shaft 57. Rotate housing 49 during this procedure to help the shaft and its related components seat properly.

12. Install output washer 43 and output nut 42.
13. Perform the bearing preload procedure as explained in Paragraph 5–16**p** which uses the rear output housing as an example.

n. Disassembly of the Rear Output Housing
(Foldout 16)

1. Remove retaining ring 64 to remove P4 ring gear 65.
2. Remove P4 ring gear 65 from rear output housing 74.
3. Remove output nut 81 and washer 80.
4. Remove rear output shaft 66 by pressing it out from rear output yoke 79.
5. Remove yoke 79. Check yoke sealing area for nicks, burrs, or damage.
6. Remove output seal 78 by using tool J 24171-A. Be careful not to damage the seal bore areas.
7. Remove output shaft bearing 77 if it is damaged.
8. Inspect bearing races 76 and 68 for pitting, scoring, and damage. If the bearing races need replacement, remove each bearing race by using tool J 3940 or a hammer and a drift.
9. Remove shims 70, 71, or 72, and bearing spacer 69 from output shaft 66.
10. If bearing 67 on shaft 66 is damaged, replace it. To remove bearing 67, position the bearing on the press table and install split bearing puller. Using a press, press rear output shaft 66 out.

o. Assembly of the Rear Output Housing
(Foldout 16)

1. Inspect rear output housing 74 for scoring and burrs.
2. If removed, install bearing races 76 and 68 into rear output housing 74 by using tool J 3940 or a hammer and a drift.
3. Position bearing 77 into the output housing.
4. Install output seal 78 into the output housing by using tool J 38547 and J 35921-1.
5. Inspect output yoke 79 seal area for nicks, burrs, and damage. Measure yoke seal surface; minimum allowable seal journal OD is 76.20 mm (3.00 inch). If the yoke does not meet the required specification, replace the yoke.
6. Place output yoke 79 on a press table.
7. Position output housing 74 on the yoke.
8. Inspect rear output shaft 66 for spline damage and scoring, and if required, replace the rear output shaft.
9. If removed, install new bearing 67 on output shaft 66. To install bearing 67, use tool J 38579-2. Position the bearing and tool J 38579-2 on the press table, and then carefully press output shaft 66 into the bearing until it is fully seated.
10. Install bearing spacer 69, and shims 70, 71, or 72 onto output shaft 66.
11. Press rear output shaft 66 into yoke 79 passing through bearing 77 and output seal 78, making sure that the output housing 74 spins freely.
12. Install washer 80 and output shaft nut 81 but do not tighten.
13. Place P4 ring gear 65 in housing 74.
14. Install retaining ring 64.
15. Follow bearing preload procedure explained in Paragraph 5–16**p**.

p. Output Housing Bearing Preload Procedure
(Foldout 16)

1. Install rear output housing 74 on the rear transfer case half 2.
2. Remove output shaft nut 81.
3. Install washer 80 on the output shaft after coating both sides with sealant.
4. Lube the threads on the output shaft.
5. Install output shaft nut 81 and tighten it to 610–815 N·m (450–600 lb ft).
6. Install a dial indicator to read up and down shaft movements.
7. You may need to place a shim or a smooth washer on the output shaft to get true readings.

8. Bottom the output shaft by applying downward force while slightly rotating the output yoke.

9. The shaft is bottomed when the dial indicator shows no more down movement. Zero the dial indicator at this point.

10. Using a chain hoist and a scale, apply an upward force of 734–778 N (165–175 lbs) on the output shaft. While force is applied, slightly rotate the yoke.

11. Check the dial indicator for movement.

12. If the indicator readings are not within the specified limits, add or remove shims and check preload again. End play must be 0.025–0.127 mm (0.001–0.005 inch).

13. If the indicator readings are within the specified limits, coat both sides of washer 80 with sealant and install the washer. Repeat Step (5) from above.

q. Disassembly of C7 Control Valve Body *(Foldout 16)*

1. Begin C7 valve body disassembly by removing pins 34 and 40 securing the C7 signal valve solenoid 35 and C7 control valve 31 in body 30. Remove the pins by driving them out from the top toward the bottom (machined face).

2. Remove stop 33, spring 32, and valve 31 from body 30.

3. Remove solenoid 35 and O-rings 36 and 37.

4. Remove solenoid regulator valve 38.

5. Check the valves and bores for wear, scoring, and damage.

r. Assembly of C7 Control Valve Body Assembly *(Foldout 16)*

1. Insert solenoid regulator valve 38 in the bore of body 30 and inspect for smooth movement.

2. Inspect solenoid filter screen for damage or debris.

3. Replace solenoid O-rings 36 and 37 during overhaul.

4. Insert solenoid 35 into valve body 30.

5. Insert valve 31, followed by spring 32 and valve stop 33.

6. Push in on stop 33 to compress spring 32 and insert a small cylindrical punch through the top hole in body 30 to hold these parts in position.

7. Install pin 34 by starting it in the hole opposite where the punch has been inserted. Tap the pin into position. The punch will be displaced as the pin is installed.

8. Install pin 40 which retains solenoid 35. Insert the smooth (not ridged) end of the pin into the mating hole at the bottom face of body 30. Tap the pin into position flush with the bottom of body 30. Use a small diameter punch to slightly countersink pin 40.

s. Assembly of Transfer Case Module *(Foldouts 14, 15, 16)*

1. Lube bearing races 17, 37, and 78 (Foldout 15), installed in front transfer case housing 14.

2. One side of drive gear 19 has a shorter shoulder than the other side. Install drive gear 19 so that the side with the shorter shoulder is toward the front of the transmission.

3. Install idler gear 39 with its threaded hole toward the front of the transmission.

4. Install driven gear 80 into front transfer case 14 in the same orientation as it was removed.

5. Install output speed sensor 45 (Foldout 16).

6. Install two bolts 46 and tighten them to 24–29 N·m (18–21 lb ft).

7. Install C7 control valve body assembly 29.

8. Install six bolts 41, and tighten them to 24–29 N·m (18–21 lb ft).

9. Install new transfer case gasket 16 (Foldout 15).

10. Install rear transfer case 2 (Foldout 16) onto the front transfer case. If necessary, use soft face mallet to seat the case half.

11. Install fifteen bolts 17 (Foldout 14,B). Tighten the bolts to 60–75 N·m (44–55 lb ft).

NOTE:

Follow Steps (12) through (27) for drive gear bearing preload procedure. The procedure must be performed with all case-to-case bolts installed, but with the C6 housing and the rear output housing removed.

12. Install test fixtures where C6 housing and rear output housing would normally be installed. A plate with the same diameter as C6 housing and the same hole pattern and size is to be used as the test fixture and to be installed in the place of C6 housing. Likewise, a plate with the same diameter and hole pattern and size as the rear output housing is to be used in place of the rear output housing. When special fixture plates are not available, use washers or spacers under the bolt heads that retain the C6 housing and rear output housing.
13. Rotate the assembly so that the front side of the transfer case is up.
14. Install guide pins to facilitate installation of shims 10, 11, and 12 (Foldout 15).
15. Install shims 10, 11, and 12 (shim pack A); there may be more than or fewer than three shims.
16. Install lube charging pump 5. Install eight bolts 4 securing the pump to the case. Tighten bolts 4 to 60–75 N·m (44–55 lb ft).
17. Install guide pins in two manifold bolt holes in front transfer case 14.
18. Install manifold shims 75, 76, and 77 (shim pack C).
19. Install manifold 73.
20. Install eight bolts 71 and tighten them to 60–75 N·m (44–55 lb ft) Two bolts will replace guide pins.
21. Rotate the transfer case assembly so that the rear side is up.
22. Install special tool J 39623 into drive gear assembly 19.
23. Install a dial indicator, making sure that the end of the indicator rests squarely on the raised center area of the tool.
24. Bottom the assembly by applying downward force and rotating tool J 39623.
25. Zero the dial indicator when there is no more downward movement.
26. Apply 734–778 N (165–175 lbs) of upward force using a hoist and a scale.
27. Record the dial indicator reading and add or remove shims if the reading is not within the specified limits; the allowable end play is 0.025–0.127 mm (0.001–0.005 inch).

NOTE:

Follow Steps (28) through (34) for driven gear bearing preload procedure.

28. Install special tool J 39623 into driven gear assembly 80 (Foldout 15).
29. Install a dial indicator, making sure that the end of the indicator rests on the raised center area of the tool.
30. Bottom the assembly by applying downward force and rotating tool J 39623.
31. Zero the dial indicator when there is no more downward movement.
32. Apply 734–778 N (165–175 lbs) of upward force using a hoist and a scale.
33. Record the dial indicator reading and add or remove shims if the reading is not within the specified limits; the allowable end play is 0.025–0.127 mm (0.001–0.005 inch).
34. If the preload reading is not within the specified limit, add or remove the shims, and recheck the preload.

NOTE:

Follow Steps (35) through (53) for idler gear bearing preload procedure.

NOTE:

Both idler covers must be installed and tightened to establish the idler gear position before bearing preload is checked.

35. Install guide pins in two rear idler cover bolt holes.
36. Install new gasket 47 (Foldout 16) over guide pins. Install new O-ring 48 on rear idler cover 49.
37. Lube O-ring and install cover 49 over guide pins. Install five bolts 50 and tighten them to 60–75 N·m (44–55 lb ft). Two bolts replace the guide pins.
38. Rotate the transfer case assembly so that the front side is up.
39. Install guide pins to ease installation of the front idler cover.
40. Install a new gasket 28 (Foldout 15) over the guide pins and onto the transfer case.
41. Install shims 25, 26, and 27 (shim pack B) over the guide pins.
42. Install a new O-ring 24 on cover 23.
43. Lube the O-ring.
44. Install idler cover 23 and tap it lightly with a soft-faced mallet to seat it in position.
45. Install five bolts 22 and tighten them to 60–75 N·m (44–55 lb ft). Two bolts replace the guide pins.
46. Remove front idler cover bolts 22, cover 23, shim pack B, and gasket 28 to start the idler gear bearing preload check.
47. Install the handle of tool J 39623 into the threaded hole of idler gear 39.
48. Mount the dial indicator.
49. Bottom the idler gear assembly by slightly rotating tool J 39623 while applying downward force.
50. Zero the dial indicator.
51. Use a chain hoist and apply 734–778 N (165–175 lbs) of upward force.
52. Read dial indicator to determine bearing preload.
53. If preload is not within the specified limits, add or remove shims and repeat Steps (41)–(53). The allowable end play is 0.025–0.127 mm (0.001–0.005 inch).
54. When preload is within the specified limits, remove the special tools.
55. Install guide pins to ease installation of the front idler cover.
56. Install a new gasket 28 over the guide pins, and onto the transfer case.
57. Install shims 25, 26, and 27 (shim pack B).
58. Install a new idler cover O-ring 24.
59. Lube the O-ring.
60. Install idler cover 23, and tap it lightly for installation.
61. Install five bolts 22 and tighten them to 60–75 N·m (44–55 lb ft). Two bolts replace the guide pins.
62. Install a new O-ring on main wiring harness connector 31.
63. Install harness connector assembly 31 on connector plate 29 and tighten nut 88 to 2.73–4.09 N·m (24–36 lb inch).
64. Place a new gasket 30 on the connector plate, carefully rotating wiring harness through the gasket.
65. Position the harness connector through the transfer case, and the connector plate.
66. Install four bolts 32 and tighten them to 5–8 N·m (4–6 lb ft).
67. Install a new O-ring 2 (Figure 5–27) on suction hose fitting 3. Lube the O-ring.
68. Lube the metal boss of filter screen 1 and position it in fitting 3
69. Carefully thread the fitting into the transfer case.
70. Tighten the jam nut on fitting 3 to 100–120 N·m (74–89 lb ft).
71. Install C7 clutch assembly 58 (Foldout 15) into the transfer case.
72. Install guide pins in two front output housing bolt holes.
73. Install a new output housing gasket 50.
74. Position front output housing 49 on the transfer case.
75. Install fifteen bolts 45 and tighten them to 60–75 N·m (44–55 lb ft). Two bolts will replace guide pins.
76. Rotate the assembly so that the rear side is up.

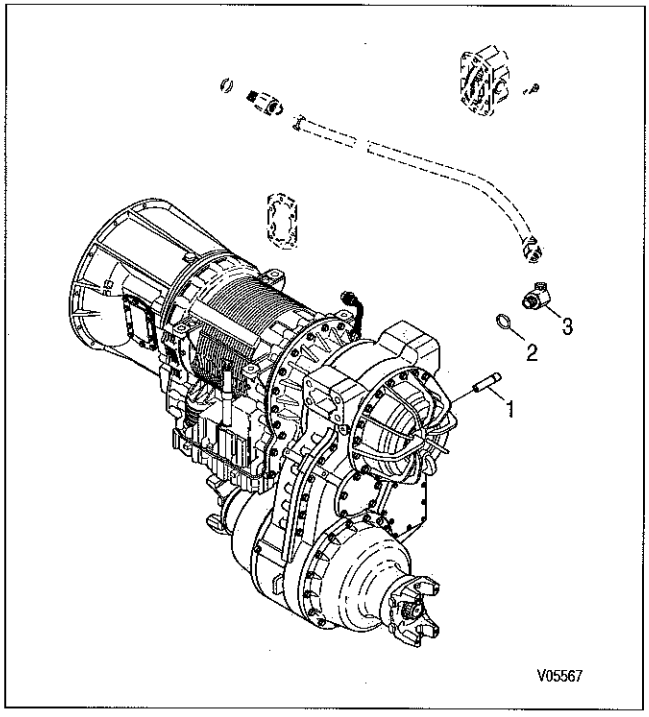

Figure 5–27. Transfer Case Fitting And Screen Installation

77. Reconnect main wiring harness connector 31 to speed sensor 45 (Foldout 16) and solenoid 35, making sure that each connector locks in place.
78. Install a new control cover gasket 42.
79. Install control cover 43.
80. Install ten bolts 44, and tighten them to 24–29 N·m (18–21 lb ft).
81. If not previously done, remove test fixtures which were installed during drive and driven gear bearing preload.
82. Position P4 carrier assembly 56 on the transfer case.
83. Install two guide bolts to facilitate installation of rear output housing 74.
84. Install a new gasket 73.
85. Carefully install rear output housing assembly 74 onto the transfer case.
86. Install six bolts 75 and nine bolts 82. Tighten them to 60–75 N·m (44–55 lb ft) Two bolts will replace guide bolts.
87. Install guide bolts in two C6 cover bolt holes.
88. Install a new gasket 22.
89. Position C6 clutch housing assembly 5 on the transfer case.
90. Install fifteen bolts 23 and two bolts 24. Tighten them to 60–75 N·m (44–55 lb ft). Two bolts will replace guide bolts.
91. Perform selective shim measurement before installing transfer case into the main transmission as explained in Paragraph 6–2I.

5–17. CONTROL VALVE MODULE (Foldouts 17,A; 17,B; and 17,C)

CAUTION:

- **To help prevent transmission damage protect control module parts during removal, cleaning, inspection, and installation. Keep them in clean containers until they are installed.**
- **Control valve module assembly springs and other parts can be mistakenly interchanged. Tag each part with its item number as it is removed and use Valve Tray Set J 33163 to simplify correct valve body reassembly.**
- **Control valve module parts fit together closely and have specific operating clearances. They can bind if damaged. These parts depend upon smooth sealing surfaces and may leak if the sealing surface is scratched. Valves, when dry, must move freely by their own weight in their bores. Carefully handle all such parts.**

NOTE:

The following SILs affect the control module and should be consulted for detail service and parts information:

27-WT-93	**1991–1992 Controls Differences and Serviceability**
9-WT-96	**Filter Cover Seal Change**
7-WT-98	**TransID**
19-WT-99	**Oil Level Sensor**
01-WT-00	**Suction Filter**
26-WT-02	**Coated Threaded Fasteners**
8–WT–05	**Suction Filter/Face Seal**

a. Removal of Filters

NOTE:

- **For 3000 Product Family units with S/Ns before 6510069120, proceed to Step (1).**
- **For 3000 Product Family units beginning with S/N 6510069120, skip Steps (1) and (2) and proceed to Step (3).**

1. If not previously removed, remove two filter covers 178 (Foldout 17,A), two square cut seals 179, two O-rings 180, and two filters 181.
2. Remove bolt 5 and two bolts 7. Remove suction housing 4, seal 6, suction filter assembly 3, and gasket 2. Clean suction filter 3 and discard it, if damaged.
3. If not previously removed, remove two filter covers 183 (Foldout 17,B), two gaskets 184, two O-rings 185, two O-rings 186, and two filters 187.
4. Remove bolts 8, two bolts 10, and face seal 9. Remove suction housing/filter assembly 6 and gasket 5. Discard suction housing/filter 6, if damaged.

b. Removal of Electrical Components and Sensors

NOTE:

Refer to Troubleshooting Manual TS2470EN (WTEC II Controls) or TS2973EN (WTEC III Controls) for inspection and repair procedures.

NOTE:

- **For 3000 Product Family units with S/Ns before 6510032369, go to Step (1).**
- **For 3000 Product Family units with S/Ns between 6510032369 and 6510096670, skip Steps (1)–(3) and go to Step (4).**
- **For 3000 Product Family units beginning with S/N 6510096671, skip Steps (1)–(6) and go to Step (7).**

1. Remove four bolts 9 (Foldout 17,A) and wiring harness cover plate 8.
2. Disconnect all connectors. Remove three bolts 10 and internal harness assembly 11. Remove two bolts 104 and turbine speed sensor 105. The turbine speed sensor should have a resistance of 300 ± 30 Ohms.
3. If present, remove two bolts 147 and oil level sensor assembly 148. Clean the oil level sensor with a soft clean cloth. Refer to Troubleshooting Manual TS2470EN for proper sensor operation. Proceed to Paragraph **c.**
4. Remove four bolts 11 (Foldout 17,B) and wiring harness cover plate 12.
5. Disconnect all connectors. Remove three bolts 13 and feedthrough harness assembly 14.
6. Remove two bolts 112 and turbine speed sensor 113. The turbine speed sensor should have a resistance of 300 ± 30 Ohms. If present, remove two bolts 155 and oil level sensor assembly 156. Clean the oil level sensor with a soft clean cloth.Proceed to Paragraph **c.**
7. If present, remove two bolts 160 (Foldout 17,C) and oil level sensor assembly 161. Clean the oil level sensor with a soft clean cloth. Refer to Troubleshooting Manual TS2470EN or TS2973EN for proper sensor operation.
8. Disconnect all connectors. Remove three bolts 10 and feedthrough harness assembly 11.
9. Remove two bolts 117 and turbine speed sensor 118. The turbine speed sensor should have a resistance of 300 ± 30 Ohms.

c. Disassembly of the Rotating Clutch Solenoid Body *(Foldout 17,A)*

1. Remove seal 46.
2. Remove three bolts 45 and rotating clutch solenoid body assembly 47.

NOTE:

Solenoid retention pins 61, 81, and 125 must be removed from the BOTTOM of the solenoid bodies. Note the grooved end of pin for positive retention.

3. Remove three solenoid retention pins 61 from bottom of solenoid body.

4. Remove two solenoids 55, each with O-rings 56 and 57. Remove one solenoid 58 with O-rings 59 and 60. Remove three valves 54, and three springs 53. Check resistance of each solenoid by using chart in Figure 5–15.
5. If present, remove valve retention pin 67, stop 66, spring 65, and valve 64.
6. Remove two bolts 52 and pressure switch assembly 48. Maximum resistance of pressure switch assembly 48 (closed) must not exceed 2 Ohms. Minimum resistance of pressure switch assembly 48 (open) must be at least 20,000 Ohms. The switch should close between 159–255 kPa (23–37 psi).
7. If present, remove three screens 62 from body 63.

d. Disassembly of the Stationary Clutch Solenoid Body *(Foldout 17,A)*

1. Remove eight bolts 68 and stationary clutch solenoid body assembly 70.
2. Remove two seals 69.
3. Remove three solenoid retention pins 81 from bottom of solenoid body 71.
4. Remove three each of solenoids 75, small O-rings 77, large O-rings 76, valves 78, and springs 79. Check resistance of each solenoid by using the chart in Figure 5–15.
5. Remove valve retention pin 80.
6. Remove stop 74, spring 73, and valve 72.
7. Remove solenoid separator plate 107.
8. If present, remove three screens 82 from body 71.

e. Disassembly of C6 Control Valve Body *(Foldout 17,A)*

NOTE:
C6 control valve body is only in 3700, 3700 SP, and MD 3070PT transmission models.

1. Remove five bolts 84 to remove C6 valve body cover plate 85.
2. Remove C6 valve body cover plate 85.
3. Remove C6 valve body 87.
4. Remove retaining pin 95, holding C6 regulator valve solenoid 90.
5. Remove regulator valve solenoid 90 with O-rings 91 and 92. Remove regulator valve 89 and spring 88. Check valve and bore for damage.
6. Remove retaining pin 95, holding C6 interlock valve solenoid 99.
7. Remove interlock valve solenoid 99 with O-rings 100 and 101. Remove interlock valve 102 and spring 103.
8. Inspect interlock valve 102 and its bore for nicks, wear, and damage.

f. Disassembly of Main Valve Body *(Foldout 17,A)*

1. Remove two bolts 106 and main valve body assembly 108.
2. If damaged, remove indexing pin 130.
3. Remove solenoid retention pin 125 from bottom of control valve body 129.
4. Remove solenoid 126 with O-rings 127 and 128. Check resistance of the solenoid by using the chart in Figure 5–15.
5. Remove valve retention pin 109.
6. Remove stop 112, spring 111, and lockup relay valve 110.
7. Remove valve retention pin 113.
8. Remove stop 116, spring 115, and lube regulator valve 114.

WARNING!
Springs 119 and 123 are highly compressed. Be extremely careful during disassembly. Personal injury can occur if the spring force is not controlled.

9. Install spring compressor J 35924 (Figure 5–28). Compress spring 119, remove valve retention pin 117, and carefully remove compressor J 35924 after turning handle counter-clockwise to release spring force.

10. Remove stop 120, spring 119, and main regulator valve 118.
11. Remove valve retention pin 121.
12. Remove stop 124, spring 123, and control main valve 122.
13. Remove valve retention pin 130.
14. Remove stop 134, spring 133, and C2 latch valve 132.
15. Remove valve retention pin 135.
16. Remove stop 138, spring 137, and exhaust back valve 136.
17. Remove valve retention pin 139.
18. Remove stop 142, spring 141, and C1 latching valve 140.
19. Remove valve retention pin 143.
20. Remove stop 146, spring 145, and converter regulator valve 144. Inspect stop 146 for battering. Replace the stop if it is battered. For transmission S/Ns between 6510004324 and 6510058500, also replace separator plate 157 and gasket 156 using part numbers specified in SIL 24-WT-95.
21. Remove gasket 156, separator plate 157, and gasket 158.

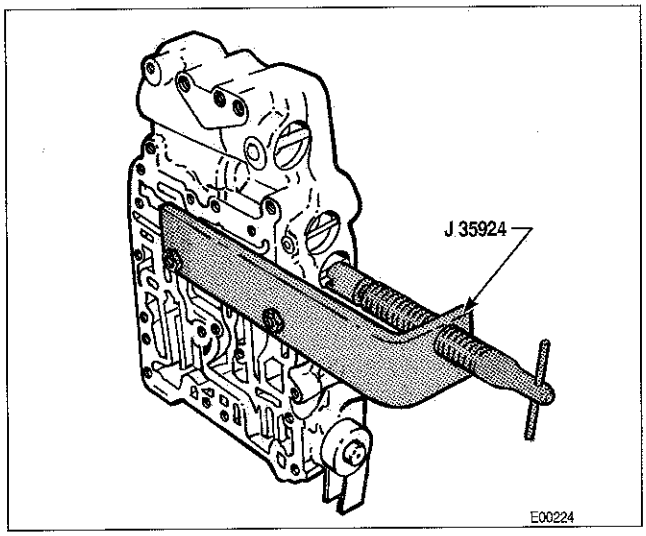

Figure 5–28. Use of Tool to Release Main-Pressure Valve Spring Force

g. Disassembly of the Channel Plate *(Foldout 17,A)*

1. If damaged, remove two pins 161 or 169.
2. Remove drain plug 163 and O-ring 164 or drain plug 174 and O-ring 175.
3. Remove eight pressure tap plug assemblies 165 with O-ring 166 or nine plugs 171 with O-ring 172.
4. Remove O-rings from all plugs.

h. Assembly of the Channel Plate *(Foldout 17,A)*

1. Install new O-rings on all plugs.
2. Install eight pressure tap plugs 165 or nine plugs 171. Tighten plugs to 10–13 N·m (7–10 lb ft).

NOTE:

A new, longer drain plug is available for improved clamp load distribution and as a repair for channel plates with damaged threads. Refer to SIL 5-WT-98 for details.

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3. Install drain plug 163 or 174. Tighten plug to 25–32 N·m (18–24 lb ft).
4. If removed, install two pins 161 or 169.
5. Install gasket 158, separator plate 157, and gasket 156.

i. Assembly of the Main Valve Body *(Foldout 17,A)*

1. Install converter regulator valve 144, spring 145, and stop 146.
2. Install valve retention pin 143.
3. Install C1 latching valve 140, spring 141, and stop 142.
4. Install valve retention pin 139.
5. Install exhaust-back valve 136, spring 137, and stop 138.
6. Install valve retention pin 135.

7. Install C2 latch valve 132, spring 133, and stop 134.
8. Install valve retention pin 131.
9. Install control main valve 122, spring 123, and stop 124.
10. Install valve retention pin 121.
11. Install main regulator valve 118, spring 119, and stop 120.
12. Install spring compressor J 35924 (Figure 5–28). Compress spring 119, install valve retention pin 117, and remove J 35924 after turning handle counter-clockwise until the tool clears pin 117.
13. Install lube regulator valve 114, spring 115, and stop 116.
14. Install valve retention pin 113.
15. Install lockup relay valve 110, spring 111, and stop 112.
16. Install valve retention pin 109.
17. Install O-rings 127 and 128 on solenoid 126 and install solenoid.
18. Install solenoid retention pin 125 from bottom of main valve body assembly.
19. Install indexing pin 130, if removed.
20. Install main valve body assembly 108
21. Install solenoid separator plate 107.

j. Assembly of C6 Control Valve Body *(Foldout 17,A)*

1. Insert interlock valve 102 in the bore and check it for free movement. After making sure that valve 102 moves freely, install spring 103.
2. Inspect solenoid filter screen 96, if present, for debris and damage. Replace it if necessary.
3. Install new O-rings 100 and 101 on interlock valve solenoid 99, and install the solenoid.
4. Insert regulator valve 89 in the bore and check it for free movement. After making sure that valve 89 moves freely, install spring 88.
5. Install new O-rings 91 and 92 on regulator valve solenoid 90.
6. Install regulator valve solenoid 90 in its bore.
7. Insert solenoid retention pins 95, smooth end first, from the bottom (separator plate side) of body 87 into body 87. Seat pins using hammer and countersink the pins.
8. Place the valve body on the control module.
9. Install C6 valve body cover plate 85.
10. Install five bolts 84. Tighten the bolts to 10–13 N·m (7–10 lb ft).

k. Assembly of the Stationary Clutch Solenoid Body *(Foldout 17,A)*

1. Install valve 72, spring 73, and stop 74. Install valve retention pin 80.
2. Install three each of springs 79, solenoid regulator valve 78, O-rings 76 and 77, and solenoids 75.
3. As valve bores are filled, install solenoid retention pins 81 from bottom of solenoid body.
4. Install two seals 69.
5. Install stationary clutch solenoid body assembly 70 and eight bolts 68. Tighten bolts 68 to 10–13 N·m (7–10 lb ft).

l. Assembly of the Rotating Clutch Solenoid Body *(Foldout 17,A)*

1. Install valve 64 with stem toward the outside. Then install spring 65 and stop 66. Install valve retention pin 67.
2. Install three springs 53, three solenoid regulator valves 54, two solenoids 55 with O-rings 56 and 57, and one solenoid 58 with O-rings 59 and 60.
3. Install solenoid retention pins 61 from bottom of rotating clutch solenoid body.
4. Install pressure switch assembly 48 and two bolts 52. Tighten bolts to 5–8 N·m (4–6 lb ft).
5. Install seal 46.

6. Install rotating clutch solenoid body assembly 47 and three bolts 45. Tighten bolts 45 to 10–13 N·m (7–10 lb ft).

7. Install oil level sensor assembly 148 and two bolts 147. Tighten bolts to 10–13 N·m (7–10 lb ft).

8. Install turbine speed sensor 105 and two bolts 104. Tighten bolts to 10–13 N·m (7–10 lb ft).

m. Installation of the Wiring Harness Assembly and Cover Plate *(Foldout 17,A)*

NOTE:

- **For 3000 Product Family units with S/Ns before 6510032369, proceed to Step (1).**
- **For 3000 Product Family units with S/Ns between 6510032369 and 6510096670, skip Steps (1)–(8) and proceed to Step (9).**
- **For units starting with S/N 6510096671, skip Steps (1)–(15) and proceed to Step (16).**

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1. Install 24-way internal connector 16 (Foldout 17,A), two internal seals 15 and bolt 17 onto standoff bracket 12. Tighten bolt 17 to 1.3–2.7 N·m (12–24 lb inch).

2. Install wiring harness assembly 11 and three bolts 10. Tighten bolts to 2–3 N·m (18–27 lb inch).

3. Reconnect all connectors.

4. Install wiring harness cover plate 8 and four bolts 9. Tighten bolts finger tight.

5. Install gasket 2, seal 6, suction filter 3, filter housing 4, bolt 5 and two bolts 7. Tighten bolts finger tight.

6. Evenly tighten cover plate bolts 9, suction filter bolts 5 and 7, and main valve body bolts 106. Tighten all bolts to 10–13 N·m (7–10 lb ft).

7. Proceed to Section 6.

8. Install feedthrough harness assembly 14 (Foldout 17,B) and three bolts 13. Tighten bolts to 2–3 N·m (18–27 lb inch).

9. If present and not previously installed, install oil level assembly 156 and two bolts 155. Tighten bolts to 10–13 N·m (7–10 lb ft).

10. Reconnect all connectors.

11. Install wiring harness cover plate 12 and four bolts 11. Tighten bolts finger tight.

12. Install gasket 5, seal 9, suction filter 6, filter housing 7, bolt 8 and two bolts 10. Tighten bolts finger tight.

13. Evenly tighten cover plate bolts 11, suction filter bolts 8 and 10, and main valve body bolts 114. Tighten all bolts to 10–13 N·m (7–10 lb ft).

14. Proceed to Section 6.

15. Install feedthrough harness assembly 11 (Foldout 17,C) and three bolts 10. Tighten bolts to 2–3 N·m (18–27 lb inch).

16. If present and not previously installed, install oil level assembly 161 and two bolts 160. Tighten bolts to 10–13 N·m (7–10 lb ft).

17. Reconnect all connectors.

18. Install four bolts 9. Tighten bolts finger tight.

19. Install gasket 5, seal 7, filter assembly 6, and three bolts 8. Tighten bolts finger tight.

20. Evenly tighten bolts 9, suction filter bolts 8, and main valve body bolts 119. Tighten all bolts to 10–13 N·m (7–10 lb ft).

NOTES

6–1. SCOPE

a. Section. This section covers the assembly of 3000 Product Family transmissions. Assembly procedures include PTO provisions and retarders. The assembly sequence is continuous and includes all models.

b. Procedures. When a procedure does not apply to your specific model, go to the next applicable procedure.

c. Illustrations. Illustrations will not always show your model, but when an operation is identical for all models, the correct procedure is shown.

d. General Information. Refer to Section 3 for general information as follows:

Paragraph	Description
3–2	Tools, Equipment
3–3	Replacement Parts
3–4	Careful Handling
3–6	Assembly Procedures

e. Foldouts. Refer to Foldouts 7 through 19 for disassembled views and torque specifications.

NOTE:
All parts must be cleaned and lubricated before assembly.

6–2. ASSEMBLY OF TRANSMISSION

a. Assembly of C3/C4 Clutch

1. Mount holding fixture J 35926 onto the main housing.
2. Attach a hoist and lift the fixture and main housing.
3. Mount the fixture and main housing on repair stand J 29109. Make sure the main housing centerline is horizontal.
4. Install C3/C4 clutch assembly 1 (Figure 6–1) through the input end of main housing 2, aligning the tabs on the clutch assembly with the slot in the main housing.
5. Install two bolts 3, 180 degrees from each other, to hold clutch assembly 1 in place.
6. Rotate the repair stand so the transmission housing output end is up and install the remaining ten bolts 3. Tighten all bolts to 51–61 N·m (38–45 lb ft).

b. Installation of the Rotating Clutch Module *(Figure 6–2)*

1. Rotate the repair stand so the input end of the main housing is up.
2. Using a hoist and an M16 eye bolt, insert rotating clutch module 1 in the front of the main housing.

c. Installation of the Front Support/Charging Pump Module *(Figure 6–3)*

1. Lower front support and charging pump module 3 over the top of the turbine shaft.

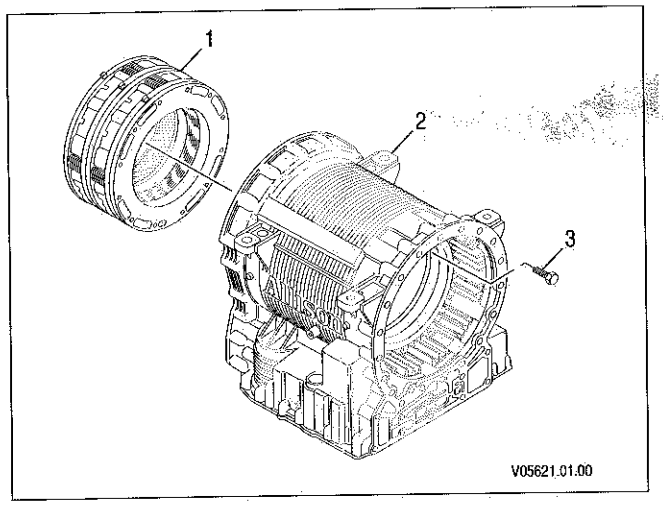


Figure 6–1. C3/C4 Clutch Module Installation

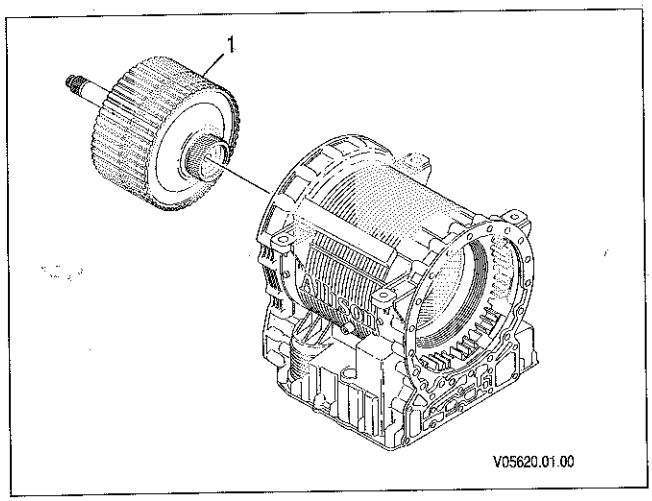


Figure 6–2. Rotating Clutch Module Installation

2. Align bolt holes in front support 3 with the threaded holes in the main housing.

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

d. Installation of the P1 Planetary Module *(Figure 6–4)*

1. Rotate the repair stand so the rear of the main housing is up.

2. Install P1 planetary module 1—consisting of the P1 carrier and P2 ring gear.

3. Mesh the P1 pinion gears with the P1 ring gear inside the C3/C4 clutch assembly.

e. Installation of the P2 Planetary Module *(Figure 6–5)*

1. Install P2 planetary module 1—consisting of the P2 carrier and the P3 ring gear.

2. Mesh the P2 pinions with the P2 ring gear during installation.

f. Installation of the C5 Clutch Pack *(Figure 6–5).* Install the C5 clutch pack in the main housing—eight steel reaction plates 2 and seven friction plates 3, stacked alternately, starting with a steel reaction plate. Stack all plates so plate cone faces the same direction. Steel plates mesh with the main housing and reaction plates mesh with the P3 ring gear.

g. Installation of the Main Shaft *(Figure 6–6).* Install main shaft 1 as assembled in Section 5, without selective shim 2 and thrust bearing 3 (does not apply to 3700 SP and MD 3070PT models).

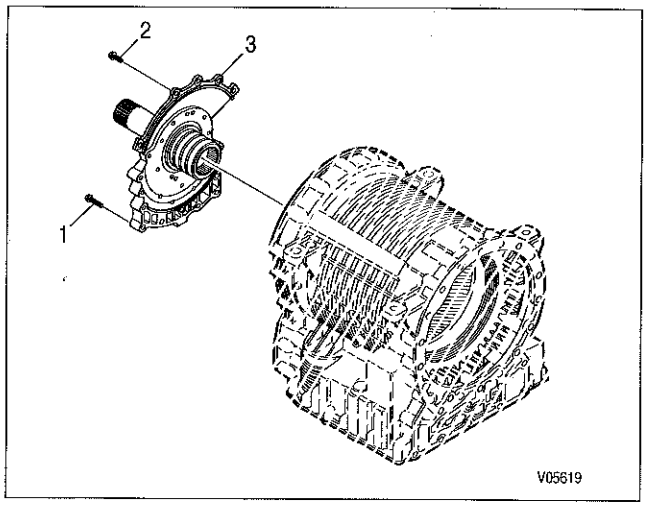


Figure 6–3. Front Support/Oil Pump Module Installation

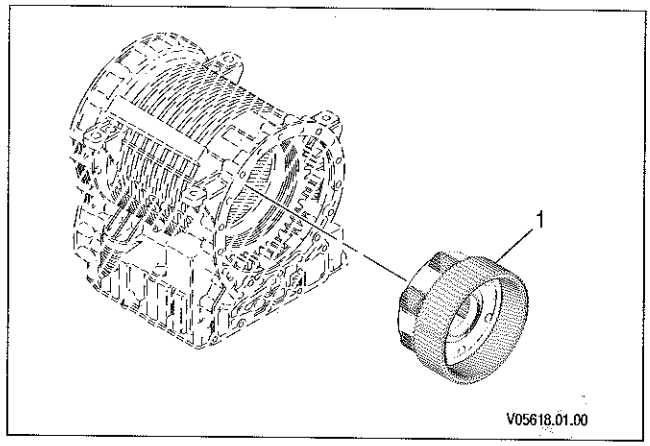


Figure 6–4. P1 Planetary Module Installation

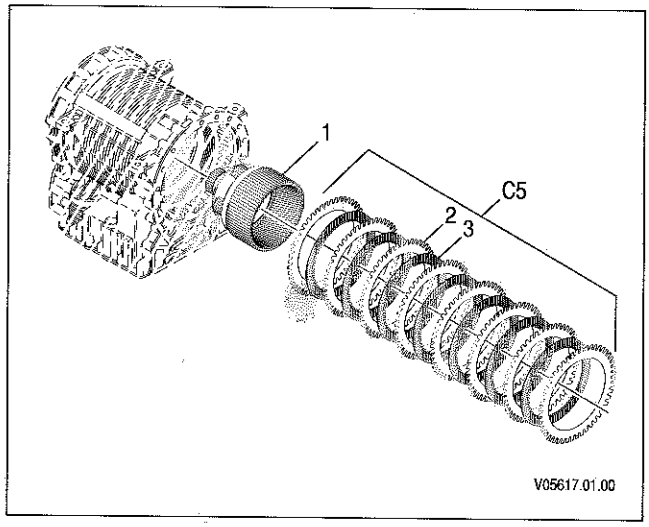


Figure 6–5. P2 Planetary Module and C5 Clutch Pack Installation

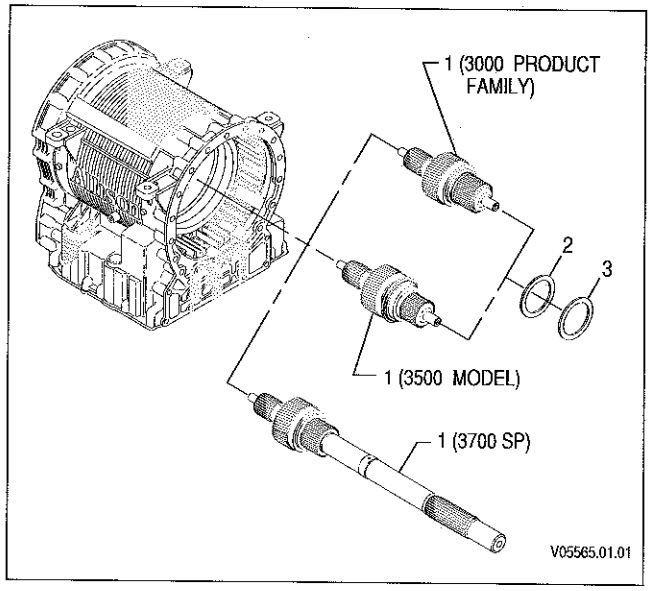
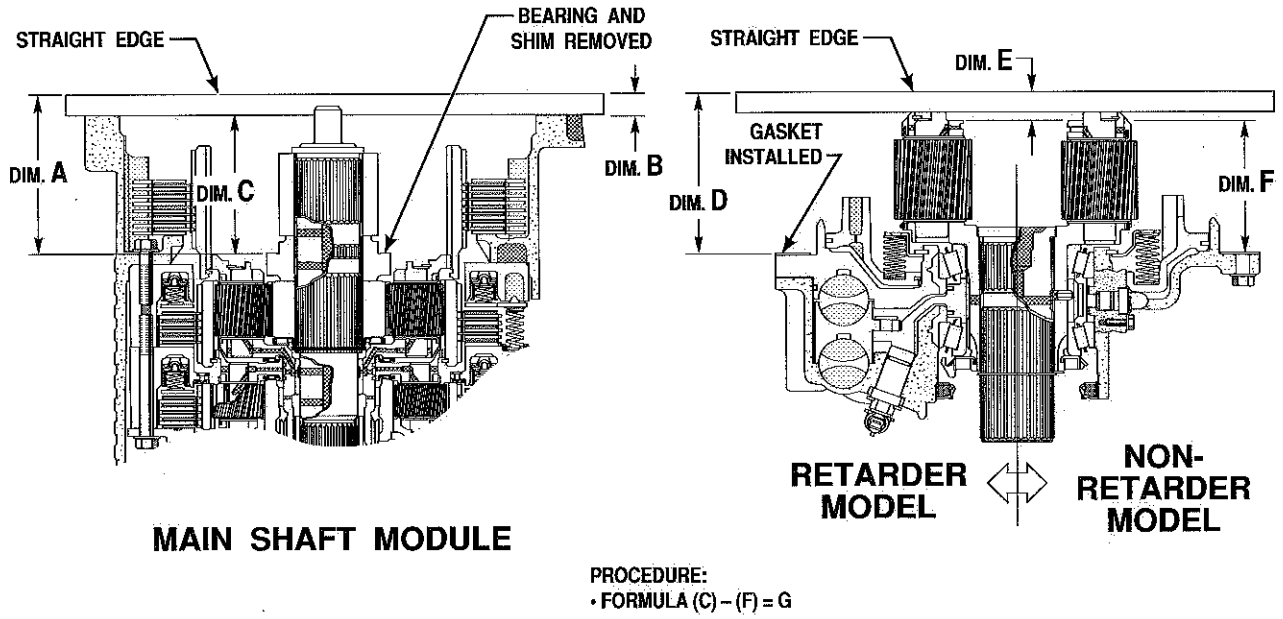


Figure 6–6. Main Shaft Installation

h. Main Shaft Selective Shim Measurement For Close Ratio Models *(Figure 6–7)*

1. Place a straight edge across the retarder or rear cover mounting surface of the main housing.
2. Measure dimension **A**, from top of the straight edge to the selective shim thrust surface on the main shaft bearing spacer.
3. Measure dimension **B**, thickness of straight edge. Subtract dimension **B** from dimension **A**—the remainder is dimension **C**.
4. Place the retarder or rear cover module output end down (facing the bench top). Install an **uncompressed** gasket on the retarder mounting surface and place a straight edge across the P3 planetary carrier.
5. Measure dimension **D**, from top of the straight edge to the mounting gasket.
6. Measure dimension **E** from the top of the straightedge to the thrust bearing contact surface on the P3 planetary carrier. Subtract dimension **E** from dimension **D**—the remainder is dimension **F**.
7. Dimension **G** is the remainder of **C** minus **F** and determines the thickness of the selective shim.
8. Install the proper thickness selective shim and the thrust bearing.



PROCEDURE:
• FORMULA (C) – (F) = G

DIM. G	USE P/N	SHIM ID
4.574–4.843 mm 0.180–0.190 in.	29503218	1 NOTCH
4.844–5.113 mm 0.192–0.201 in.	29503219	2 NOTCHES
5.114–5.383 mm 0.202–0.212 in.	29503220	3 NOTCHES
5.384–5.653 mm 0.213–0.223 in.	29503221	4 NOTCHES
5.654–5.923 mm 0.224–0.233 in.	29503222	5 NOTCHES
5.924–6.193 mm 0.234–0.244 in.	29503223	6 NOTCHES
6.194–6.463 mm 0.245–0.254 in.	29503224	7 NOTCHES

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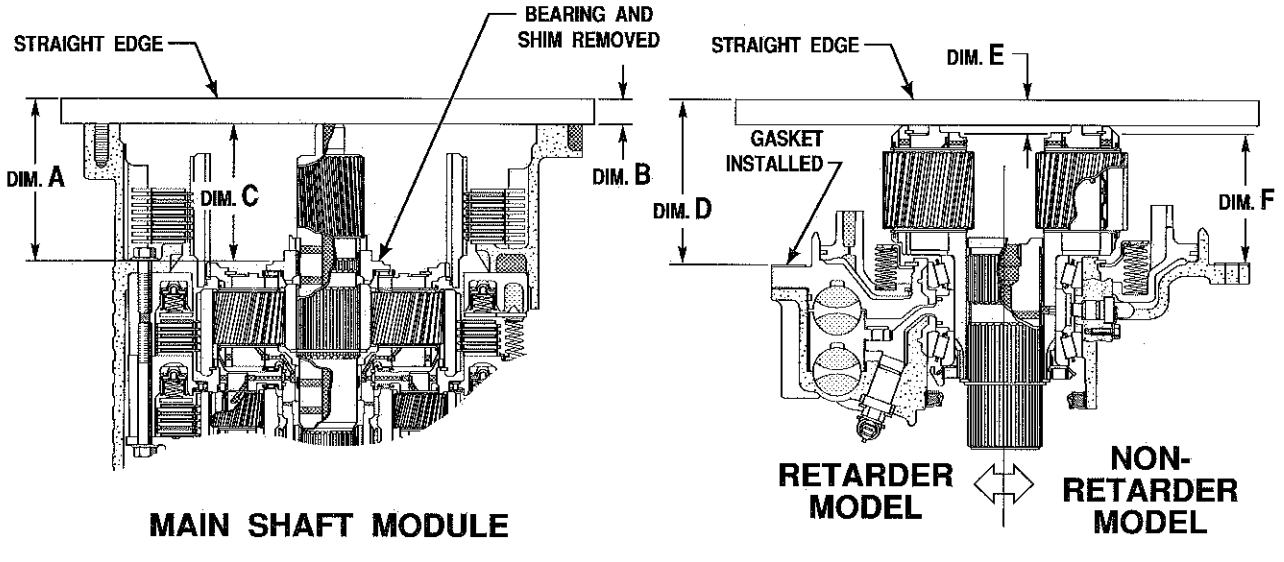
Figure 6–7. Main Shaft Selective Shim Measurement (Close Ratio Models)—3000 Product Family Except 3700 SP and MD 3070PT

i. Main Shaft Selective Shim Measurement (Wide Ratio Models) *(Figure 6–8)*

1. Place a straight edge across the retarder or rear cover mounting surface of the main housing.
2. Measure dimension **A**, from top of the straight edge to the selective shim thrust surface on the main shaft bearing spacer.
3. Measure dimension **B**, thickness of straight edge. Subtract dimension **B** from dimension **A**—the remainder is dimension **C**.
4. Place retarder or rear cover output end down (facing the bench top). Install an uncompressed gasket on the retarder or rear cover mounting surface and place a straight edge across the P3 planetary carrier.
5. Measure dimension **D** from top of the straight edge to the rear cover mounting gasket.
6. Measure dimension **E** from the top of the straightedge to the thrust bearing contact surface on the P3 planetary carrier. Subtract dimensions **E** from dimension **D**—the remainder is dimension **F**.
7. Dimension **G** is the remainder of **C** minus **F** and determines the thickness of the selective shim.
8. Install the proper thickness selective shim and the thrust bearing.



PROCEDURE:
• FORMULA (C) – (F) = G

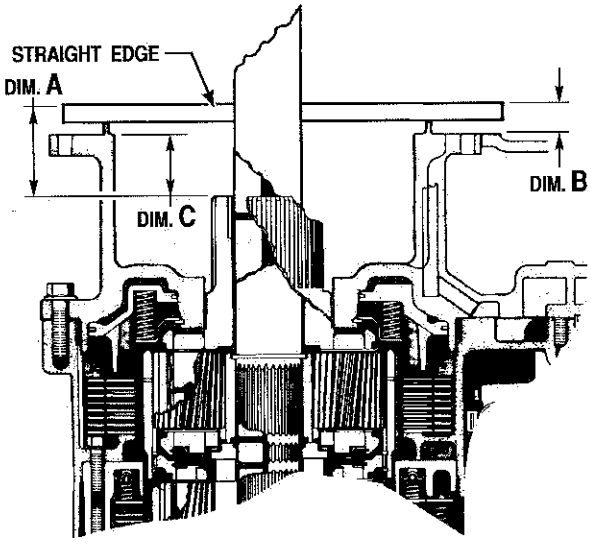
DIM. G	USE P/N	SHIM ID
4.574–4.843 mm 0.180–0.190 in.	29503226	1 NOTCH
4.844–5.113 mm 0.192–0.201 in.	29503227	2 NOTCHES
5.114–5.383 mm 0.202–0.212 in.	29503228	3 NOTCHES
5.384–5.653 mm 0.213–0.223 in.	29503229	4 NOTCHES
5.654–5.923 mm 0.224–0.233 in.	29503230	5 NOTCHES
5.924–6.193 mm 0.234–0.244 in.	29503231	6 NOTCHES
6.194–6.463 mm 0.245–0.254 in.	29503232	7 NOTCHES

V06747

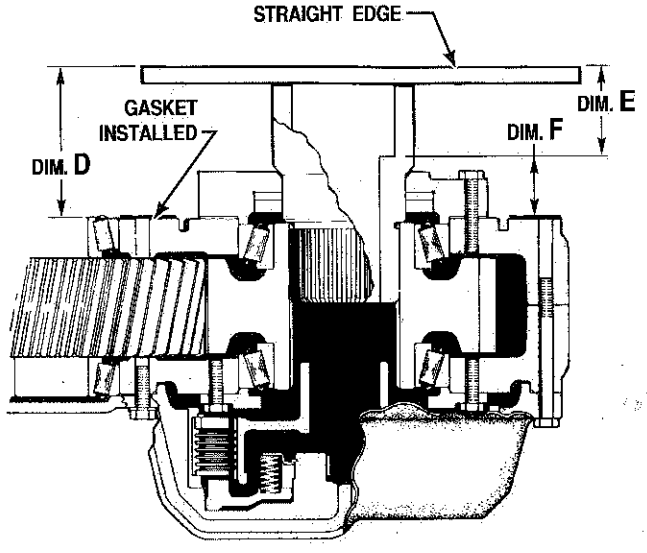
Figure 6–8. Main Shaft Selective Shim Measurement (Wide Ratio)—3500 and MD 3560

j. Main Shaft Selective Shim Measurement For 3700 SP and MD 3070PT (*Figure 6–9*)

1. Place a straight edge across the transfer case mounting surface of the adapter housing (gasket removed). Also, be sure that there is no selective shim in place at this time.
2. Measure dimension **A** from the top of the straight edge to the shoulder where the selective shim will rest.
3. Measure dimension **B**, from the top of the straight edge to the face where the gasket rests. Subtract dimension **B** from dimension **A**—the remainder is dimension **C**.
4. Place transfer case rear output end down (facing the bench top). Install a NEW gasket on the front main transfer case mounting surface and place straight edge across the transmission shaft adapter.
5. Measure dimension **D** from the top of the straight edge to the transfer case mounting gasket.
6. Measure dimension **E** from the top of the straight edge to the step inside the adapter coupling. Subtract dimension **E** from dimension **D**—the remainder is dimension **F**.
7. Dimension **G** is the remainder of **C** minus **F**, and determines the thickness of the selective shim.



TRANSMISSION ASSEMBLY



TRANSFER CASE MODULE

PROCEDURE:
• FORMULA (C) – (F) = G

DIM. G	USE P/N	SHIM ID
0.899–1.169 mm 0.035–0.046 in.	29503226	1 NOTCH
1.169–1.439 mm 0.046–0.057 in.	29503227	2 NOTCHES
1.439–1.709 mm 0.057–0.067 in.	29503228	3 NOTCHES
1.709–1.979 mm 0.067–0.078 in.	29503229	4 NOTCHES
1.979–2.249 mm 0.078–0.089 in.	29503230	5 NOTCHES
2.249–2.519 mm 0.089–0.099 in.	29503231	6 NOTCHES
2.519–2.874 mm 0.099–0.113 in.	29503232	7 NOTCHES

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Figure 6–9. Main Shaft Selective Shim Measurement For 3700 SP and MD 3070PT

8. Coat the selected shim with a generous coating of lube (petrolatum) and insert shim inside the transmission shaft adapter.

NOTE:

- **Go to Step k. for units with retarder built before 1/98.**
- **Go to Step l. for units with retarder built starting 1/98.**

k. Installation of Retarder Module (Units Built Before 1/98) *(Foldout 13,A)*

NOTE:

Former transmission main case P/N 29535311 has been completely cancelled. Current transmission main case now has an additional drilled and tapped bolt hole. If transmission is equipped with a non-sump cooling integral cooler, rework must be performed when replacing a transmission main case before S/N 6510262246 with main case P/N 29536861. Rework is required due to possible interference between stator bolt and threaded hole in main case. Refer to SIL 13-WT-00 for rework procedures.

1. Install a NEW retarder gasket 1 on the transmission main housing.
2. Install guide bolts to ease the installation of retarder module 5 and to keep gasket 1 in place.

WARNING!

The retarder module assembly weighs approximately 64 kg (141 lb). Use care to prevent injury to personnel while handling the retarder module assembly.

3. Place retarder module 5 on the transmission main housing using a hoist and sling as a lifting fixture. If used, install the rear support bracket.
4. Install twelve M12 x 1.75 x 165 mm bolts at locations marked A (Figure 6–10). Install six M12 x 1.75 x 190 mm bolts marked C. Tighten the eighteen M12 bolts to 90–110 N·m (66–81 lb ft). Install seven M10 x 1.5 x 180 mm bolts at locations marked B. Tighten the M10 bolts to 51–61 N·m (38–45 lb ft). Three bolts not mentioned were installed and tightened in Section 5.
5. Retighten spanner nut 54 (Foldout 13,A) to 74–88 N·m (55–65 lb ft). If only one tang is aligned with a bearing retainer nut slot, continue to torque the bearing retainer nut (but do not exceed the tightening torque or drag torque limits) until two or more tangs can be bent up into slots on the bearing retainer nut.

NOTE:

DO NOT reuse a tang once it has been bent. Replace locknut retainer 53, if necessary.

6. Install output shaft oil seal 55 using tool J 39928.

l. Installation of Retarder Module (3000 Product Family Units Built Starting 1/98) *(Foldout 13,B)*

NOTE:

Former transmission main case P/N 29535311 has been completely cancelled. Current transmission main case now has an additional drilled and tapped bolt hole. If transmission is equipped with a non-sump cooling integral cooler, rework must be performed when replacing a transmission main case before S/N 6510262246 with main case P/N 29536861. Rework is required due to possible interference between stator bolt and threaded hole in main case. Refer to SIL 13-WT-00 for rework procedures.

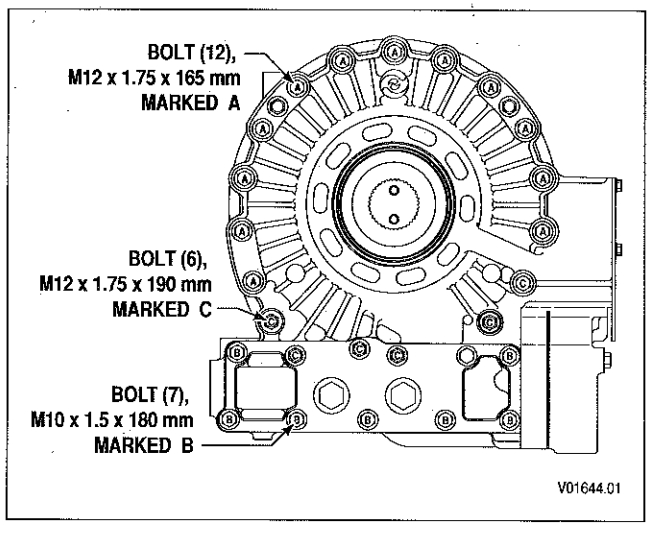


Figure 6–10. Retarder Module Bolts (Units Built Before 1/98)

NOTE:

- **For units before S/N 6510262246 go to Step (1).**
- **For units starting with S/N 6510262246 go to Step (5).**

1. Install a NEW retarder gasket 1 on the transmission main housing.
2. Install guide bolts to ease the installation of retarder module 5 and to keep gasket 1 in place.

WARNING!

The retarder module assembly weighs approximately 64 kg (141 lb). Use care to prevent injury to personnel while handling the retarder module assembly.

3. Place retarder module 5 on the transmission main housing using a hoist and sling as a lifting fixture. If used, install the rear support bracket.
4. Install fourteen M12 x 1.75 x 130 mm bolts at locations marked A (Figure 6–11). Install four M12 x 1.75 x 190 mm bolts marked C. Tighten the eighteen M12 bolts to 90–110 N·m (66–81 lb ft). Install seven M10 x 1.5 x 180 mm bolts at locations marked B. Tighten the M10 bolts to 51–61 N·m (38–45 lb ft). Three bolts not mentioned were installed and tightened in Section 5.
5. Install fourteen M12 x 1.75 x 130 mm bolts marked A (Figure 6–12). Install four M12 x 1.75 x 190 mm marked C. Tighten eighteen M12 bolts 90–110 N·m (66–81 lb ft). Install four M10 x 1.5 x 182 mm bolts marked B. Tighten M10 bolts to 51–61 N·m (38–45 lb ft). Also four M10 x 1.5 x 192 mm bolts, gasket 94, jumper manifold 95 or manifold 96 (Foldout 13,C). Tighten M10 bolts to 51–61 N·m (38–45 lb ft).
6. Retighten retainer nut 62 (Foldout 13,B) to 74–88 N·m (55–65 lb ft). If only one tang is aligned with a bearing retainer nut slot, continue to torque the bearing retainer nut (but do not exceed the tightening torque or drag torque limits) until two or more tangs can be bent up into slots on the bearing retainer nut.

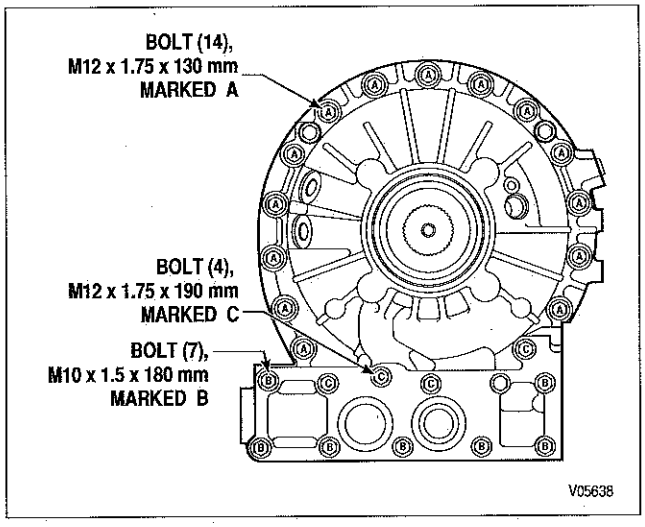


Figure 6–11. Retarder Module Bolts (Units Built Starting 1/98)

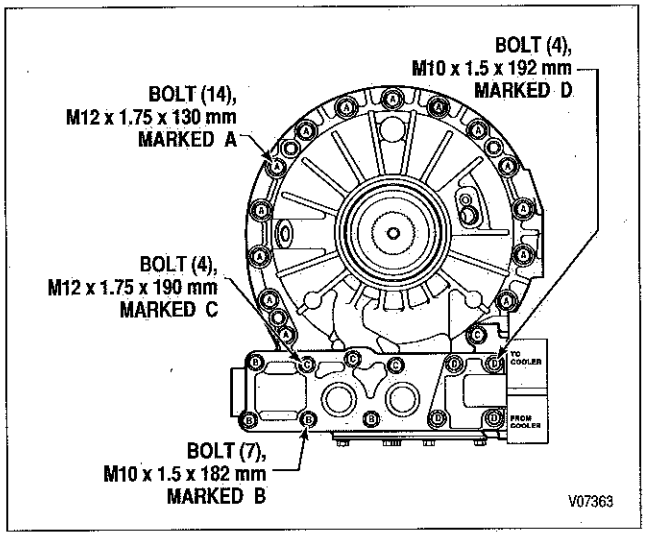


Figure 6–12. Retarder Module Bolts (Starting With S/N 6510262246)

NOTE:

DO NOT reuse a tang once it has been bent. Replace locknut retainer 61, if necessary.

7. Install output shaft oil seal 63 using tool J 39928.

m. Installation of Rear Cover Module

(Figure 6–13)

1. Install a NEW rear cover gasket 1 on main housing 4.

2. Install guide bolts to ease rear cover 2 installation and keep gasket 1 in place.

3. Place rear cover module 2 on main housing 4 using a hoist and sling as a lifting fixture. Install rear support bracket, if used.

4. Install nineteen bolts 3. Tighten bolts to 90–110 N·m (66–81 lb ft).

5. Install output shaft oil seal 5 using tool J 39928.

n. Installation of Transfer Case Adapter Housing *(Figure 6–14)*

1. Install a new adapter housing gasket 2.

2. Inspect adapter housing 3 for cracks, nicks, or burrs. Remove the burrs and nicks with crocus cloth or soft stone.

3. Install adapter housing 3 by installing fifteen bolts 8 and three bolts 5. Torque to 90–110 N·m (66–81 lb ft).

4. Install three bolts 6, two bolts 7, and four bolts 4. Tighten bolts to 51–61 N·m (38–45 lb ft).

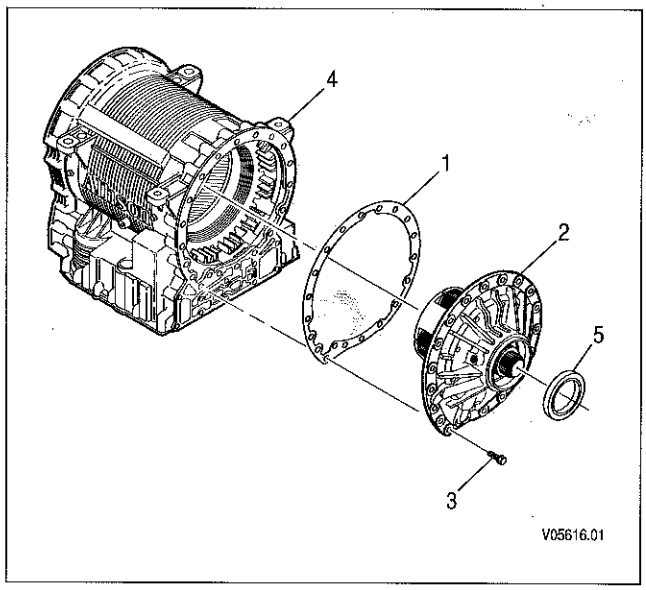


Figure 6–13. Rear Cover Module Installation

o. Installation of Transfer Case Module *(Figure 6–15)*

1. Install a NEW gasket 4.

2. Be sure that selective shim 1 is located inside shaft adapter 5.

3. Mount J 38572 on transfer case 3.

WARNING!

The transfer case module assembly weights approximately 270 kg (595 lb).

4. Use hoist and J 38572 to lift transfer case 3.

5. Install transmission shaft adapter 5 into transfer case 3.

6. Install transfer case 3 into the main transmission, and install nineteen bolts 2.

7. Beginning with S/N 6510205652 (Foldout 18,B) the transfer case housing, C6 housing and gasket have been changed to use improved transfer case retaining bolt 27 (bolt 7 in Figure 6–15), a stepped and knurled-shank bolt. Install bolt 27 passing through C6 housing into the adapter housing. If reusing the former housings, install bulge-bolt 28 passing through C6 housing into the adapter housing (SIL 16-WT-00). Tighten bolt 27 or 28 to 51–61 N·m (38–45 lb ft).

8. Tighten bolts 2 to 51–61 N·m (38–45 lb ft).

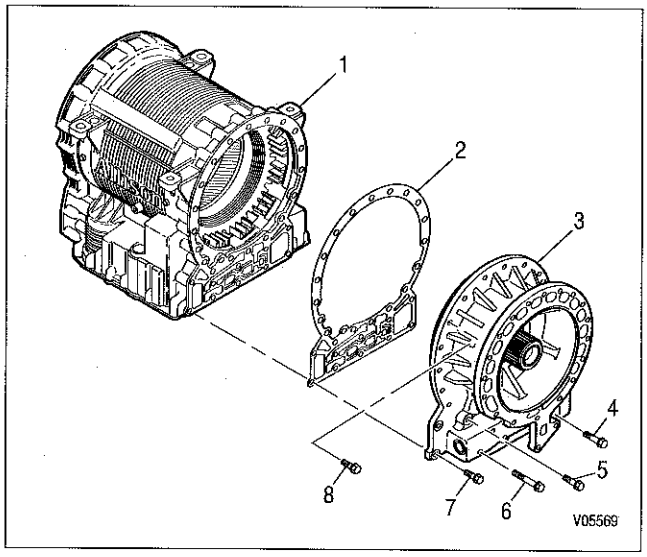


Figure 6–14. Transfer Case Adapter Housing Installation

p. Installation of the Converter Housing Module *(Figure 6–16)*

1. Place transmission input end up. Install a new converter housing gasket 2 on main housing module 4.
2. Install guide bolts to ease converter housing 1 installation and keep gasket 2 in place.
3. Lower converter housing 1 onto main housing 4. If the transmission is PTO equipped, rotate the PTO drive gear to align the gear tangs with the charging pump.
4. Install three bolts 3 into the inside of converter housing 1. Use mechanical fingers, or a similar tool, when installing these bolts.
5. Remove the two guide bolts and install the remaining seventeen bolts 3. Tighten all bolts to 51–61 N·m (38–45 lb ft).

q. Installation of the Torque Converter Module *(Figure 6–17)*

1. The torque converter is installed over the turbine shaft which rotates inside the stator shaft or ground sleeve. The splines on the ground sleeve engage the converter stator race. The splines on the turbine shaft engage the converter turbine. The end of the turbine shaft is threaded and machined to accept the converter retaining bolt and lockup sealring.
2. The splines of the ground sleeve and turbine shaft must engage with their respective splines in the torque converter module. The tangs on the converter pump hub must engage the charging pump tangs or the PTO oil pump drive hub.
3. Using hoist and sling, install torque converter module 6 into the converter housing module (Figure 6–17, View A).
4. Ensure the torque converter is properly seated. If PTO equipped, rotate the PTO gear to engage the pump hub with the charging pump.
5. Hold the turbine and turbine shaft stationary by using one of the methods listed below:
   - Insert a screwdriver into the vanes on the rotating clutch module (Figure 6–17, View B).
   - If the control module is in place, remove the plug(s), if present, from the fill tube hole or from cooler ports before applying lockup air pressure. Apply air pressure through the lockup pressure tap (Figure 4–7, View D) and use a heel bar, screwdriver, and bolts. Insert the heel bar into a torque converter housing bolt hole. Insert two bolts into the flexplate adapter bolt holes. Then place a screwdriver at an angle to prevent converter rotation (Figure 6–17, View C).
6. Install converter end play gauge J 38548 and tighten the attaching bolt to 27–34 N·m (20–25 lb ft).

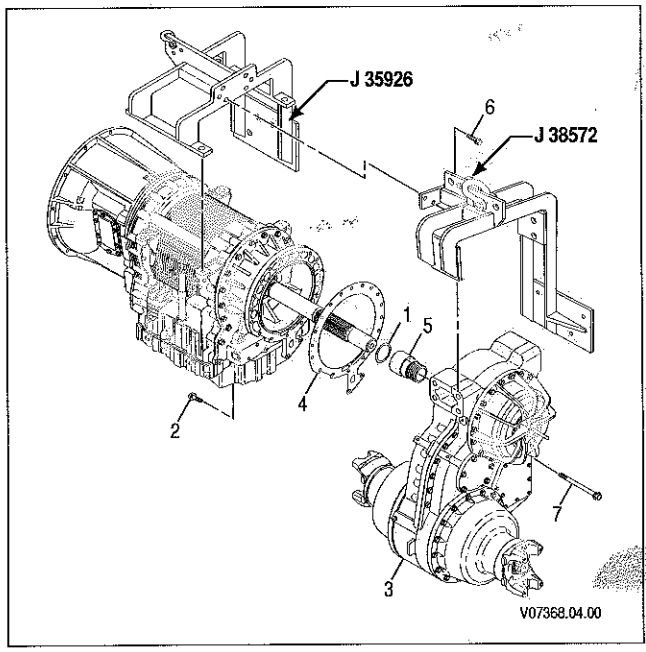


Figure 6–15. Transfer Case Module Installation

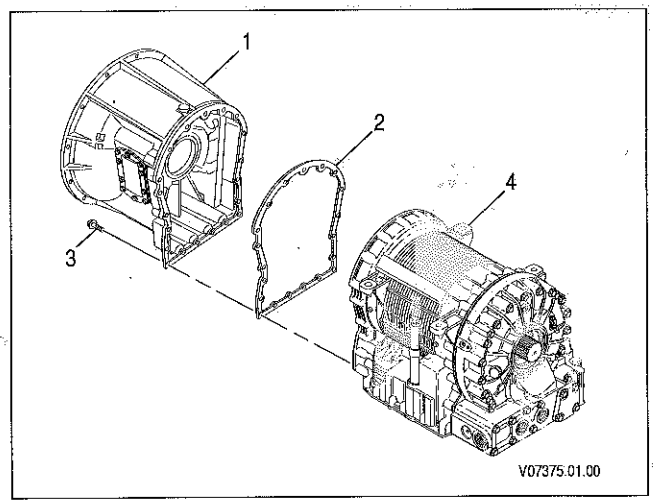


Figure 6–16. Converter Housing Module Installation

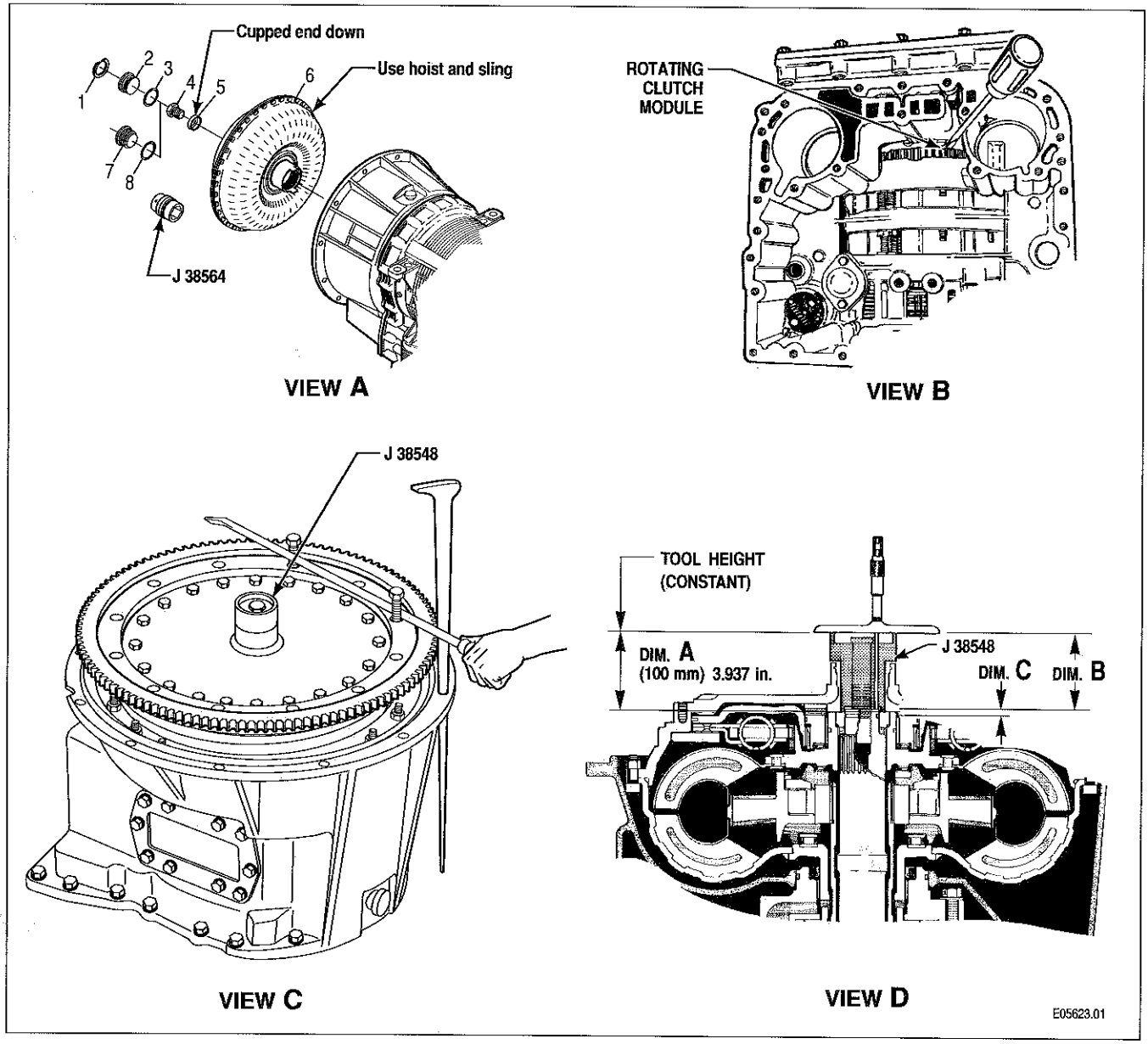


Figure 6–17. Torque Converter Module Installation and Selective Shim Measurement

Table 6–1. Torque Converter Selective Shims

Dimension "C"	Use P/N	Shim Step Dimension
0.4093–0.6597 mm (0.0161–0.0260 in.)	29505688	0.000 mm; NO STEP
0.6598–0.8377 mm (0.0261–0.0330 in.)	29505681	0.178–0.228 mm (0.007–0.009 in.)
0.8378–1.0157 mm (0.0331–0.0400 in.)	29505682	0.356–0.406 mm (0.014–0.016 in.)
1.0158–1.1937 mm (0.0401–0.0470 in.)	29505683	0.534–0.584 mm (0.021–0.023 in.)
1.1938–1.3707 mm (0.0471–0.0540 in.)	29505684	0.711–0.761 mm (0.028–0.030 in.)
1.3708–1.5487 mm (0.0541–0.0610 in.)	29505685	0.889–0.939 mm (0.035–0.037 in.)
1.5488–1.6823 mm (0.0611–0.0662 in.)	29505686	1.067–1.117 mm (0.042–0.044 in.)

NOTE:

Dimension C shown in Table 6–1 includes a correction due to internal deflection caused by the 27–34 N·m (20–25 lb ft) bolt torque applied to gauge J 38548. Accurate torque value is critical to selection of the proper shim.

7. Measure from top of tool J 38548 to face of turbine shaft and record it as dimension **B**. Subtract dimension **B** from dimension **A**—dimension **A** is the height of tool J 38548, 100.00 mm (3.937 inch) to determine dimension **C** (Figure 6–17, View D).
8. Use Dimension **C** and Table 6–1 to determine proper selective shim part number. Remove tool J 38548 and continue with installation of the torque converter.

NOTE:

- **For units before S/N 6510165560, go to Step (9).**
- **For units beginning with S/N 6510165560, skip Steps (9)–(11) and go to Step (12).**

9. Install selective shim 5 with the shim step side toward the turbine shaft. Install bolt 4, converter bolt tightening tool J 38564, and retaining ring 1 (Figure 6–17, View A).
10. Prevent turbine shaft rotation as in Step (5). Tighten bolt 4 to 100–120 N·m (74–89 lb ft).
11. If present, remove retaining ring 1 and tool J 38564. Install O-ring 3 on converter end plug 2. Install the end plug. Aligning retaining ring 1 so that the sharp edge faces outward, install the retaining ring.
12. Install selective shim 5 with the shim step side toward the turbine shaft. Install bolt 4 and converter bolt tightening tool J 38564 (Figure 6–17, View A).
13. Prevent turbine shaft rotation as in Step (5). Tighten bolt 4 to 100–120 N·m (74–89 lb ft).
14. Remove tool J 38564. Install O-ring 8 on threaded converter end plug 7. Use a ¾ inch Allen socket to install end plug 7 and tighten it to 50–60 N·m (37–44 lb ft).
15. Install converter shipping brackets (Foldout 10,A), or equivalent, to retain the torque converter to the transmission. Tighten the shipping bracket bolts to 51–61 N·m (38–45 lb ft).

r. Installation of the Control Module
(Figure 6–18)

WARNING!

Transmissions installed in overhaul stands must be positioned vertically before installing control module. Failure to do so could result in personal injury.

1. Position transmission in overhaul stand vertically.

WARNING!

The control module assembly weighs approximately 25 kg (56 lb). The control module assembly used in an MD 3070PT weighs approximately 29 kg (65 lb).

2. Install a new control module gasket 2 over the dowel pins on control module 1.

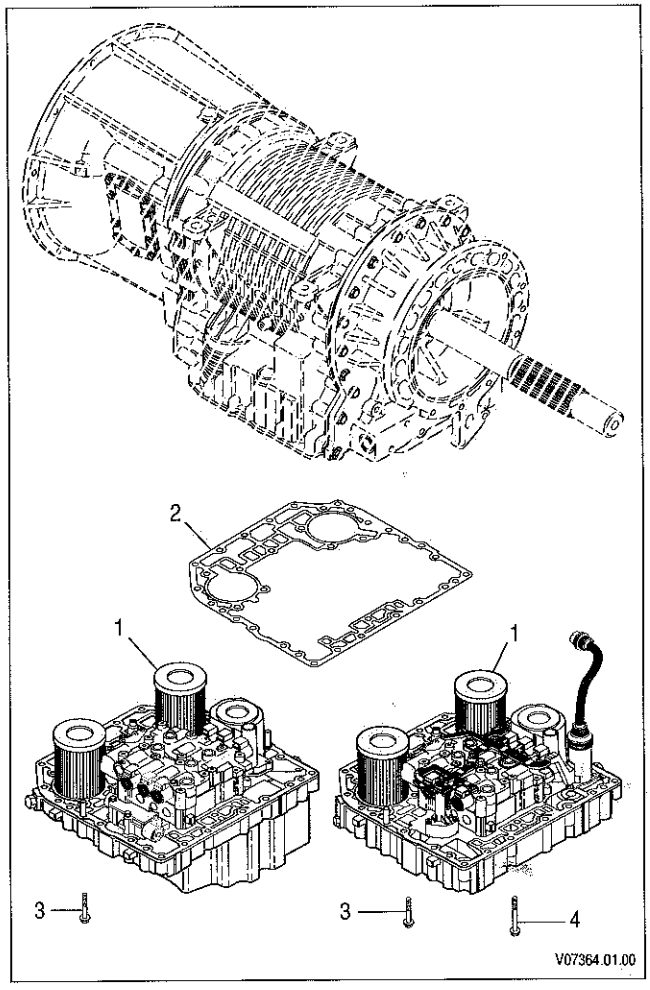


Figure 6–18. Control Module Installation

3. Guide control module 1 onto the main housing using the dowel pins. Install one bolt 176 (Foldout 17,A) in the top center bolt hole.

NOTE:

Main and lube filters are interchangeable. However, the filters for a two inch sump are a different length than those for a four inch sump. The filters in the seven inch sump are the same as in the two inch sump.

NOTE:

- **For units before S/N 6510032369, go to Step (4).**
- **For units beginning with S/N 6510032369, and later, skip Step (4) and go to Step (5).**

---

4. Install two square cut seals 179 (Foldout 17,A), two O-rings 180, two filters 181, and two filter covers 178. Install remaining thirty-one bolts 176 and/or 177. Tighten all bolts to 51–61 N·m (38–45 lb ft).

5. Install two filter covers 183 (Foldout 17,B), two gaskets 184, two O-rings 185, two O-rings 186, and two filters 187. Install remaining thirty-one bolts 188 and/or 189. Tighten all bolts to 51–61 N·m (38–45 lb ft).

s. Installation of Power Takeoff(s)
(Figure 6–19)

1. If removed, install PTO studs 4.

2. Install PTO gasket 3 and PTO assembly 2. Insert bolt 1 into each of the 6 o'clock and 12 o'clock positions. Install the remaining six bolts. Tighten bolts to 51–61 N·m (38–45 lb ft).

t. Installation of Integral Oil Cooler
(Foldout 19,A)

NOTE:

- **For units without retarder, go to Step 1.**
- **For units with retarder, skip Steps 1–5 and go to Step 6.**

---

1. Install two M10 guide bolts at rear of main housing where cooler housing attaches. Slide gasket 5 and cooler housing 7 onto the guide bolts. Be sure the housing and gasket are properly aligned.

2. Install nine bolts 15 and nine washers 16 (two will replace the guide bolts) which fasten the cooler housing to the main housing. Tighten the bolts to 51–61 N·m (38–45 lb ft).

3. Install plate assembly 27 with four lubed O-rings 28 in place. Push the plate assembly in until the O-rings are seated in their mating bores in the cooler housing.

4. Install two O-rings 26. Install two guide bolts at rear of cooler housing where cover 23 attaches. Slide gasket 22 and cover 23 into position over the guide bolts.

5. Install two bolts 24 and seventeen bolts 25 (two will replace the guide bolts). Tighten the two bolts 24 to 90–110 N·m (66–81 lb ft) and the seventeen bolts 25 to 51–61 N·m (38–45 lb ft).

6. Install two M10 guide bolts at rear of retarder housing where cooler housing attaches. Slide gasket 6 and cooler housing 7 onto the guide bolts. Be sure the housing and gasket are properly aligned.

7. Install bolt 12, washer 11, six bolts 15 and six washers 16 which fasten the cooler housing to the retarder housing. Tighten the bolts to 51–61 N·m (38–45 lb ft). Install three bolts 13 and three washers 14. Tighten the three bolts 13 to 100–120 N·m (74–88 lb ft).

8. Install plate assembly 27 with four lubed O-rings 28 in place. Push the plate assembly in until the O-rings are seated in their mating bores in the cooler housing.

9. Install two O-rings 26. Install two guide bolts at rear of cooler housing where cover 23 attaches. Slide gasket 22 and cover 23 into position over the guide bolts.

10. Install two bolts 24 and seventeen bolts 25 (two will replace the guide bolts). Tighten the two bolts 24 to 90–110 N·m (66–81 lb ft) and the seventeen bolts 25 to 51–61 N·m (38–45 lb ft).

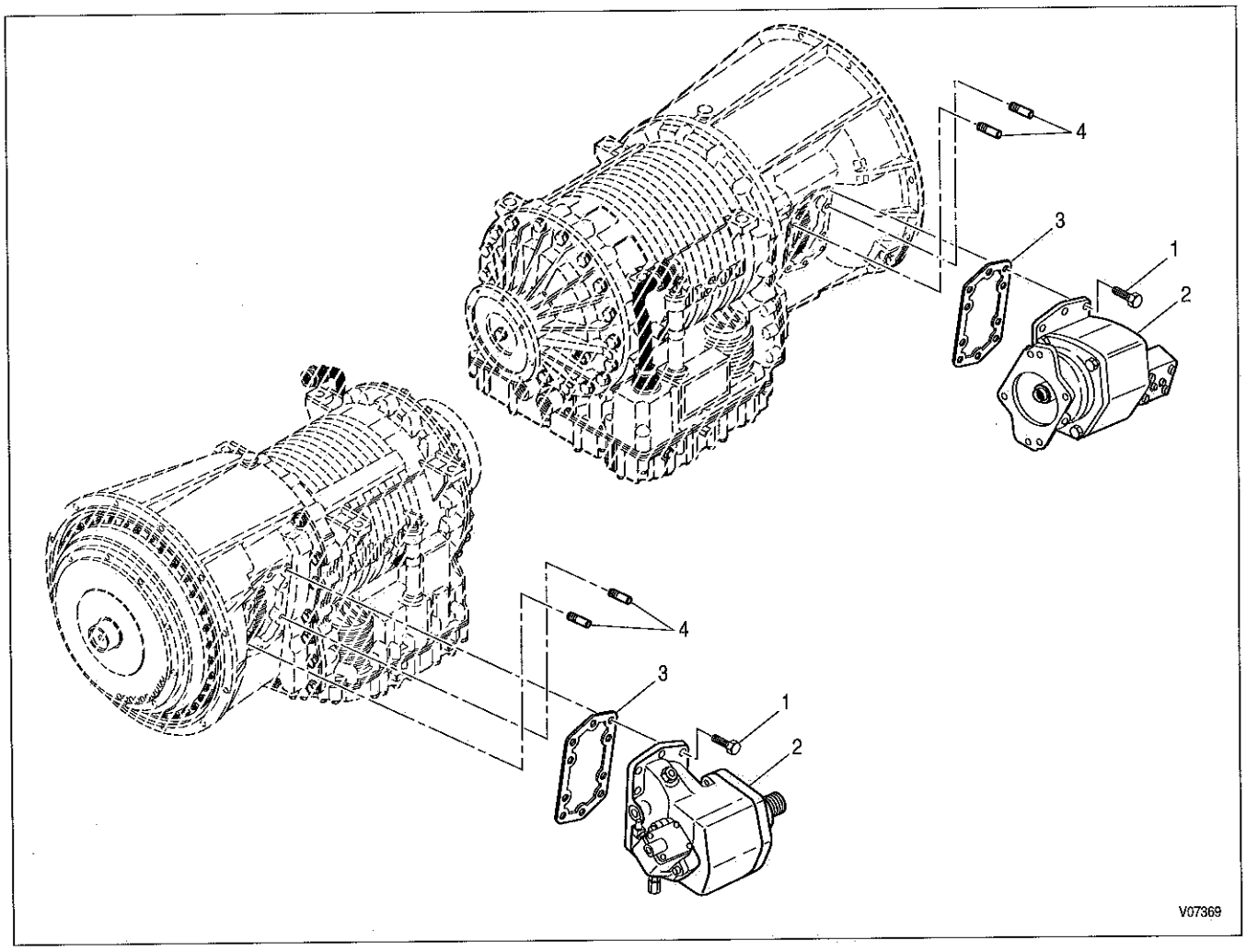


Figure 6–19. Power Takeoff(s) Installation

u. Installation of Integral Retarder Sump Oil Cooler *(Foldout 19,B)*

1. Rotate the transmission so that the retarder is facing up.
2. Install two headless guide bolts into the retarder housing.
3. Install gasket 4 over the headless guide bolts.
4. Install cooler manifold 16 over the headless guide bolts.
5. Install three M12 x 1.75 x 218 bolts 8. Tighten bolts to 100–120 N·m (74–88 lb ft).
6. Remove the two headless guide bolts.
7. Install eight M10 x 1.5 x 210 bolts 9. Tighten bolts to 51–61 N·m (38–45 lb ft).
8. Rotate the transmission so that the breather is facing up.
9. Install two headless guide bolts into each manifold to cooler mating surface.
10. Install gaskets 6 over the headless guide bolts.

WARNING!

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.

11. Install cooler 7 over the headless guide bolts and install two M10 x 1.5 x 60 bolts 1 so that the cooler is retained to the cooler manifold. Do not install bolts into the inlet or outlet hose adapter bolt holes. Tighten bolts finger-tight.
12. Remove the two headless guide bolts.

13. Install two gaskets 3.
14. Align and install two inlet or outlet hose adapters 2.
15. Install the remaining fourteen M10 x 1.5 x 60 bolts.
16. Evenly tighten sixteen M10 x 1.5 x 60 bolts 43 to 51–61 N·m (38–45 lb ft).
17. 1nstall six bolts 5. Tighten bolts to 30–35 N·m (22–26 lb ft)
18. Install water inlet and outlet hoses.
19. If used, install the retarder accumulator hose onto the fitting on cooler manifold 16.

v. Installation of Speed Sensors

NOTE:

- **Beginning December 1, 2004, the output speed sensor is re-oriented 45 degrees to accommodate the GT connector system.**
- **For units without retarder, go to Step (1).**
- **For units with retarder (built before 1/98), skip Step (1) and go to Step (2).**
- **For units with retarder (built starting 1/98), skip Steps (1) and (2) and go to Step (3).**

1. Install output speed sensor assembly 29 (Foldout 13,D), O-ring 30, retainer 31, and bolt 32 into the rear cover assembly 21. Tighten bolt 32 to 24–29 N·m (18–21 lb ft). Skip to next **NOTE**.
2. Install output speed sensor assembly 36 (Foldout 13,A), O-ring 37, retainer 38 and bolt 39. Tighten bolt 39 to 24–29 N·m (18–21 lb ft). Install cover 70 and four bolts 71. Tighten bolts 71 to 39 to 24–29 N·m (18–21 lb ft). Skip to next **NOTE**.
3. Install output speed sensor assembly 40 (Foldout 13,B), O-ring 41, retainer 42, and bolt 43 into the retarder housing. Tighten bolt 43 to 24–29 N·m (18–21 lb ft).

NOTE:

- **For models without PTO, go to Step (4).**
- **For models with PTO, skip Step (4) and go to Step (5).**

4. Install input speed sensor assembly 3 (Foldout 8,A), O-ring 4, retainer 5, and bolt 6 into the converter housing module. Tighten bolt 6 to 24–29 N·m (18–21 lb ft).
5. Install input speed sensor assembly 19 (Foldout 8,B), O-ring 20, retainer 21, and bolt 22 into the converter housing module. Tighten bolt 22 to 24–29 N·m (18–21 lb ft).

w. Installation of Common Externally-Mounted Parts *(Figure 6–20)*

1. Install transmission breather 1, if not previously installed. Tighten breather to 12–16 N·m (9–12 lb ft).
2. Install fill tube seal 20, fill tube 21, bracket 23, and screw 22. Tighten screw to 24–29 N·m (18–21 lb ft). Install dipstick 24.
3. If not previously removed, remove and discard expander plug 2. Install seal 4 and plug 3. Plug 3 is fully seated when the underside of the plug head contacts seal 4.
4. If transmission has rear cooler ports, install new cooler port gasket 19. Install remote cooler port manifold 18 and six bolts 16. Tighten bolts to 51–61 N·m (38–45 lb ft).
5. For a transmission which uses front cooler ports, install gasket 19, cover plate 17, and six bolts 16. Tighten the bolts to 51–61 N·m (38–45 lb ft).

CAUTION:

The bolts to be used with cooler port manifold 18 are longer than those used with remote cooler port cover 17. DO NOT use the short cover bolts to install a cooler port manifold or the main housing will be damaged.

6. Install parking brake assembly 5. Install four bolts 6. Tighten the bolts to 228–266 N·m (168–196 lb ft).
7. If not installed, position slinger 30 (Foldout 18,A) so that the hollow side is away from the output seal.
8. Press slinger 30, pressing on the slinger ID only, onto yoke 14 or flange 15. Do not use more than 5 kN (1100 lbs) force.
9. Lubricate the output seal lip with a thin coat of petrolatum or transmission fluid.
10. Install output flange 14 or yoke 15.

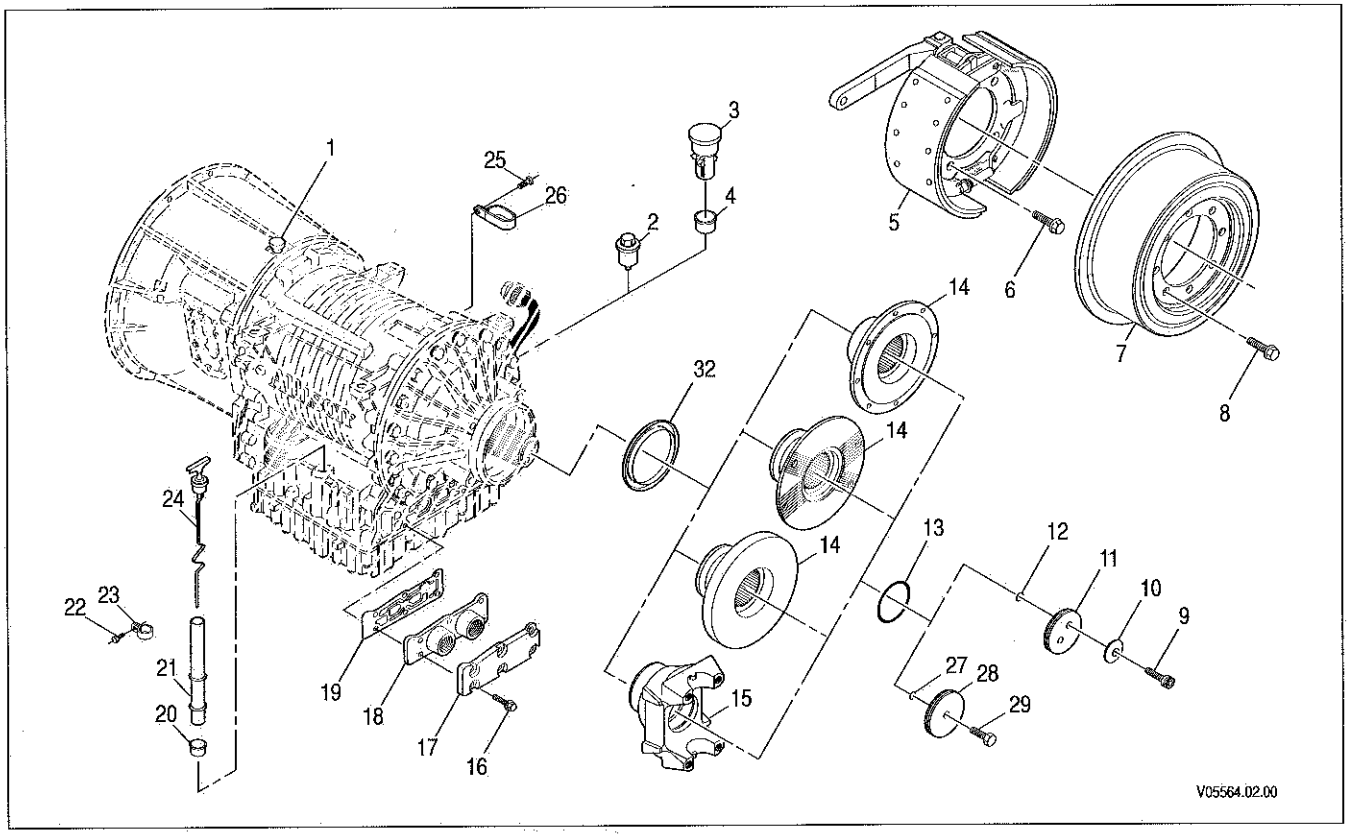


Figure 6–20. Externally-Mounted Parts Installation

11. Install lubricated O-ring 13 on retainer plug 11 or 28.

NOTE:

A service kit is recommended which improves the clamp load on parts retained by the two output flange bolts. The kit contains Allen-Head bolts, belleville washers, O-rings and an instruction sheet.

12. Insert two bolts 9 through belleville washers 10 and retainer plug 11 or one bolt 29 through retainer plug 28.

13. Install an O-ring 12 over the threaded end of each bolt 9 or O-ring 27 over bolt 29, so that the O-ring seats against the retainer plug.

14. Install retainer plug 11 or 28 into the yoke or flange. Tighten bolts 9 to 30–35 N·m (22–26 lb ft). Tighten bolt 29 to 70–80 N·m (51–60 lb ft.)

15. If used, install brake drum 7 and two bolts 8. Tighten bolts to 56–66 N·m (41–49 lb ft).

NOTE:

If you have a 3700 SP or MD 3070PT model transmission, complete Steps (13) and (14). Refer to Figure 6–21.

16. Replace gasket 9 (thin coated metal type), and install scavenge pump 7. Install nine bolts 8. Tighten bolts 8 to 51–61 N·m (38–45 lb ft).

17. Install O-ring 4 and fitting 3 into scavenge pump 7. Tighten jam nut to 100–120 N·m (74–88 lb ft.)

x. Removal of Transmission From Repair Stand *(Figure 6–22).* Using a hoist, remove the transmission and holding fixture from the repair stand and prepare for vehicle installation.

NOTE:

Refer to Mechanic's Tips MT2159EN or MT3004EN for preparing the transmission for installation and installing the transmission into the vehicle.

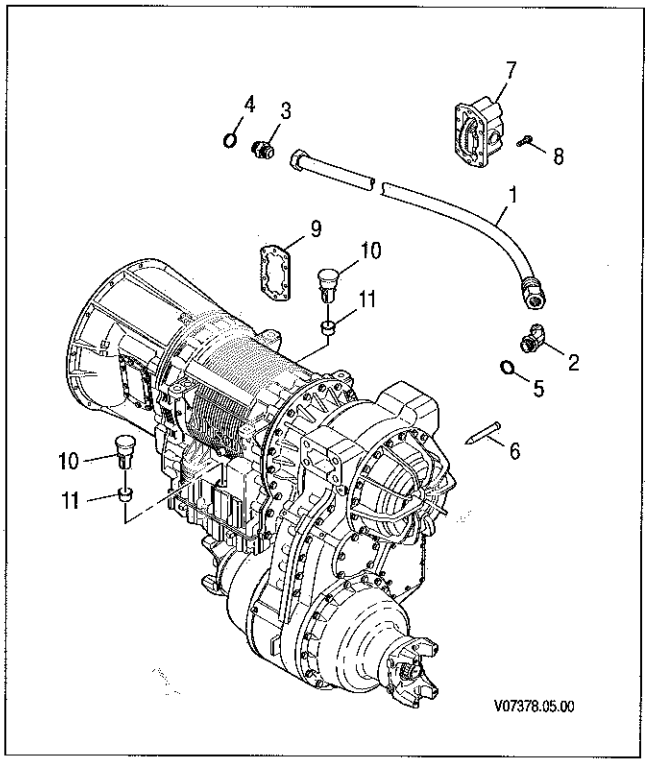


Figure 6–21. 3700 SP and MD 3070PT—Scavenge Pump Installation

CAUTION:

Whenever a transmission is overhauled, exchanged, or has undergone repairs, the Electronic Control Unit (ECU) must be "RESET TO UNADAPTED SHIFTS". This will cause the ECU to erase previous adaptive information and begin to adapt in Fast Adaptive Mode from the base calibration. Use the Allison DOC™ (refer to the Allison DOC™ User's Guide for instructions) to "RESET TO UNADAPTED SHIFTS".

WARNING!

Transmission dry weights are as follows:

- **Base transmission 243 kg (535 lbs)**
- **With Retarder 279 kg (615 lbs)**
- **With PTO provision 261 kg (575 lbs)**
- **With Retarder and PTO provision 297 kg (655 lbs)**
- **With PTO, Retarder, and Integral Sump Cooler 336.5 kg (740 lb)**
- **3700 SP and MD 3070PT 530 kg (1170 lbs)**

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

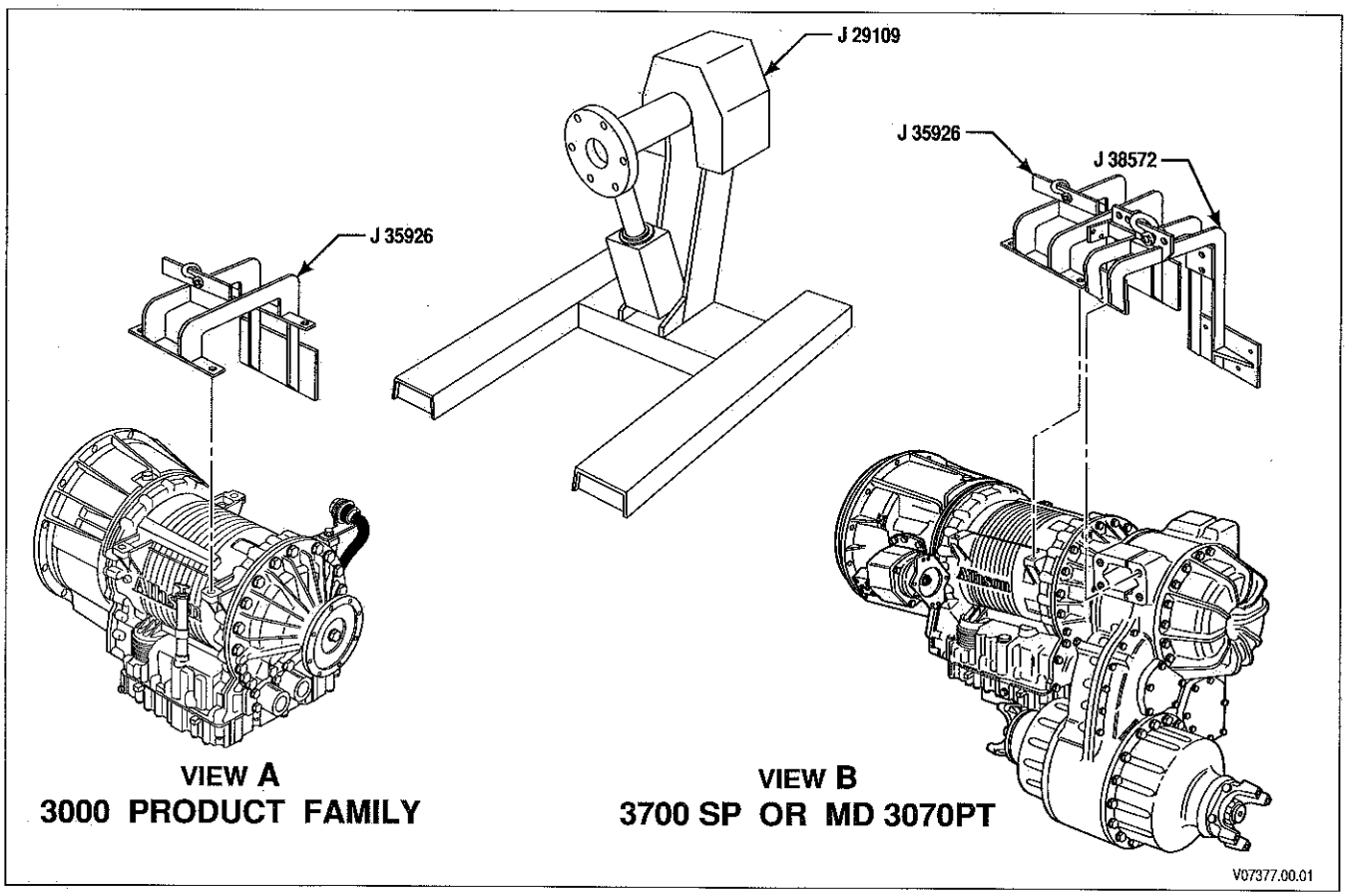


Figure 6–22. Removing Transmission From Repair Stand

SECTION 7—WEAR LIMITS AND SPRING DATA

7–1. WEAR LIMITS DATA

a. Maximum Variations. Wear limits information in this Section shows the maximum wear at which components are expected to function satisfactorily. Table 7–1 lists the Wear Limits Data and is referenced to the exploded views (Foldouts 7 through 19) in the back of this manual.

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. Springs should be replaced 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 7 through 19) 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 PC2150EN to determine which spring is used in your specific assembly number.

Table 7–1. Wear Limits Data

Illustration	Description	Wear Limit mm	Wear Limit (inches)
Foldout 7	TORQUE CONVERTER MODULE		
9	Cover Bushing, Maximum ID	61.51	2.422
11	Piston, Minimum Thickness	5.71	0.225
13	Lockup Clutch Friction Plate Flatness, Maximum Distortion	0.51	0.020
13	Lockup Clutch Friction Material, Minimum Thickness Per Side	0.625	0.025
13, 18	Turbine-To-Damper Spline Wear, Maximum Movement	0.38	0.015
14	Backplate Wear Surface, Minimum Thickness	8.58	0.338
14	Backplate, Maximum Cone	0.15	0.006
16	Turbine Hub Hook-Type Sealring, Maximum ID When Installed In Cover 7 Bore	56.75	2.234
18	Turbine Hub, Minimum OD	61.34	2.415
23	Stator Thrust Plate, Minimum Thickness	11.68	0.460
24	Stator Thrust Washer Wear From Unworn Surface of Thrust Washer	0.25	0.010
34	Converter Pump Hub, Minimum OD	74.999	2.9527
Foldout 8,B	TORQUE CONVERTER HOUSING MODULE —WITH PTO		
6	Bearing Retainer Bushing, Maximum ID	75.23	2.962
7	Bearing Retainer Bearing Bore, Maximum ID	140.06	5.514
10, 17	Oil Pump Drive Hub Seals, When Installed in Seal Ring Bore, Maximum End Gap	0.57	0.022
14	Oil Pump Drive Hub, Maximum Tang Wear	0.38	0.015
23	Converter Housing Bearing Bore, Maximum ID	140.03	5.513

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

Illustration	Description	Wear Limit mm	Wear Limit (inches)
Foldout 9,A	FRONT SUPPORT AND CHARGING PUMP MODULE		
8	Pump Housing Bushing, Maximum ID	75.23	2.962
9	Pump Housing Gear Cavity, Maximum Depth	17.93	0.706
9	Pump Housing Gear Cavity, Maximum ID	127.30	5.012
9, 10	Driven Gear-To-Pump Housing, Maximum Diametrical Clearance	0.36	0.014
10	Drive/Driven Gear, Maximum Gear Tooth Tip Clearance	0.20	0.008
10	Driven Gear, Minimum OD	126.95	4.998
10	Drive/Driven Gear, Minimum Width	17.81	0.701
10, 14	Gear-To-Plate Maximum Side Clearance	0.13	0.005
11	Pump Drive Gear Bushing, Maximum ID	57.30	2.256
14	Wear Plate, Minimum Thickness	4.70	0.185
16, 17	Ground Sleeve Oil Pump Bushing Journal, Minimum OD	57.04	2.246
20	Front Support Sleeve, Minimum Dimension	98.83	3.891
23	Front Support Seal, Maximum End Gap	0.57	0.022
Foldout 9,B	ROTATING CLUTCH MODULE		
7	Turbine Shaft Bushing ID, Maximum	20.19	0.795
10	Turbine Shaft Seal, Maximum End Gap	0.46	0.018
11	Drum, Maximum Spline Wear	0.38	0.015
13	Rotating Clutch Hub Bushing, Maximum ID	99.25	3.907
29, 33	C1 Clutch Apply/Backplate Flatness, Maximum Distortion	0.15	0.006
29, 33	C1 Clutch Apply/Backplate, Minimum Thickness (Pre S/N 6510164169)	6.20	0.244
29	C1 Clutch Apply, Minimum Thickness (Post S/N 6510164169)	4.20	0.165
32	C1 Clutch Backplate, Minimum Thickness At ID (Post S/N 6510164169)	8.20	0.323
30, 39	C1, C2 Friction Plate, Maximum Cone	0.40	0.016
30, 39	C1, C2 Friction Plate, Minimum Thickness	2.21	0.087
30, 39	C1, C2 Friction Plate, Minimum Oil Groove Depth	0.20	0.008
31, 38	C1, C2 Steel Reaction Plate, Maximum Cone	0.40	0.016
31, 38	C1, C2 Steel Reaction Plate, Minimum Thickness	2.36	0.093 *
35, 37	C1, C2 Drive Hub, Maximum Spline Wear	0.38	0.015
40	C2 Clutch Pressure Plate, Maximum Cone	0.45	0.018
40	C2 Clutch Pressure Plate, Minimum Thickness	6.25	0.246
44	P1 Sun Gear Drive Hub Bushing, Maximum ID	68.22	2.685

* 0.0965 For MD 3070PT Model

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

Illustration	Description	Wear Limit mm	Wear Limit (inches)
Foldout 10,A	MAIN HOUSING MODULE		
4	Backplate Flatness, Maximum Distortion	0.15	0.006
4	C3 Backplate, Maximum Step Wear	0.13	0.005
5, 16	C3, C4 Wear Plate Flatness, Maximum Distortion	0.15	0.006
5, 16	C3, C4 Wear Plate, Minimum Thickness At Wear Point	2.81	0.111
7	P1 Ring Gear, Maximum Spline Wear	0.38	0.015
8, 19, 38	C3, C4, C5 Friction Plate Cone, Maximum Distortion	0.40	0.016
8, 19	C3, C4 Friction Plate, Minimum Thickness	2.21	0.087
8, 19	C3, C4 Friction Plate, Maximum Friction Material Erosion Around Lubrication Slots	4.00	0.157
8, 19	C3, C4 Friction Plate, Minimum Oil Groove Depth	0.20	0.008
9, 18, 37	C3, C4, C5 Reaction Steel Plate Cone, Maximum Distortion	0.40	0.016
9, 18, 37	C3, C4, C5 Reaction Steel Plate, Minimum Thickness	2.36	0.093
11, 21	C3, C4 Piston Return Plate Cone, Maximum Distortion	0.40	0.016
11, 21	C3, C4 Piston Return Plate, Minimum Thickness	3.41	0.135
17, 24	C3, C4 Clutch Housing Flatness, Maximum Distortion	0.15	0.006
27	Main Housing Clutch Plate Splines, Maximum Wear	1.15	0.045
38	C5 Friction Plate, Minimum Thickness	2.90	0.114
38	C5 Friction Plate, Minimum Oil Groove Depth	0.20	0.008
Foldout 10,B and 11,A	MAIN SHAFT MODULE (3000, 3500, MD 3060, and MD 3560)		
9, 8	Main Shaft Pilot, Minimum OD	19.98	0.787
9, 8	Main Shaft P2 Bushing Journal, Minimum OD	42.97	1.692
9, 8	Main Shaft Splines, Maximum Wear	0.38	0.015
Foldout 11, B	MAIN SHAFT MODULE (3700 SP and MD 3070PT)		
8	Main Shaft Pilot (Front), Minimum OD	19.98	0.787
8	Main Shaft P2 Bushing Journal, Minimum OD	42.97	1.692
8	Main Shaft C6 Bushing Journal, Minimum OD	35.92	1.414
8	Main Shaft P3 Bushing Journal, Minimum OD	52.98	2.086
9	Main Shaft Splines, Maximum Wear	0.38	0.015
Foldout 12,A	P1 PLANETARY MODULE		
9, 12	P1 Pinion Thrust Washer, Minimum Thickness	1.39	0.054
9, 12	P1 Pinion Thrust Washer, Maximum Step Wear	0.12	0.005
10	Pinion, Maximum End Play	0.94	0.037
14	P2 Ring Gear, Maximum Spline Wear	0.38	0.015

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

Illustration	Description	Wear Limit mm	Wear Limit (inches)
Foldout 12,B	P2 PLANETARY MODULE		
2	P2 Carrier Seal, Maximum End Gap	0.59	0.023
7	P2 Carrier Bushing, Maximum ID	43.20	1.701
8, 11	P2 Pinion Thrust Washer, Minimum Thickness	1.39	0.054
8, 11	P2 Pinion Thrust Washer, Maximum Step Wear	0.12	0.005
10	Pinion, Maximum End Play	0.94	0.037
15	P3 Ring Gear, Maximum Spline Wear	0.38	0.015
Foldout 13,A; 13,B; 13,C	RETARDER AND P3 PLANETARYMODULE		
8	Output Shaft Bushing, Maximum ID	20.19	0.795
9	Output Shaft, Maximum Spline Wear	0.38	0.015
17, 20	P3 Pinion Thrust Washer, Minimum Thickness	1.39	0.054
17, 20	P3 Pinion Thrust Washer, Maximum Step Wear	0.12	0.005
18	Pinion, Maximum End Play	0.94	0.037
29	Retainer Ball, Minimum Movement (N/A To Foldout 13,B and 13,C)	0.50	0.020
32, 33	Rotor Hub, Maximum Spline Wear	0.38	0.015
30, 31, 33, 34	Retarder Rotor Sealring, Maximum ID	95.67	3.767
Foldout 13,D	REAR COVER AND P3 PLANETARY MODULE		
7	Output Shaft Bushing, Maximum ID	20.19	0.795
8	Output Shaft, Maximum Spline Wear	0.38	0.015
17, 20	P3 Pinion Thrust Washer, Minimum Thickness	1.39	0.054
17, 20	P3 Pinion Thrust Washer, Maximum Step Wear	0.12	0.005
18	Pinion, Maximum End Play	0.94	0.037
Foldout 15	C7 CLUTCH HOUSING		
44	Yoke Journal Seal Wear, Minimum Diameter	76.20	3.000
61	C7 Backplate, Minimum Thickness	8.67	0.341
62	C7 Friction Plate, Minimum Thickness	2.21	0.087
62	C7 Friction Plate, Minimum Oil Groove Depth	0.20	0.008
62	C7 Friction Plate, Maximum Cone	0.25	0.010
63	C7 Reaction Plate, Minimum Thickness	2.06	0.081
63	C7 Reaction Plate, Maximum Cone	0.25	0.010
68	Bushing, Maximum ID	47.26	1.861
69	Ball, Free Movement	1.00	0.040

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

Illustration	Description	Wear Limit mm	Wear Limit (inches)
Foldout 16	C6 CLUTCH HOUSING		
9	Backplate, Minimum Thickness	7.90	0.311
9	Backplate, Maximum Cone	0.40	0.016
10	C6 Friction Plate, Minimum Thickness	3.68	0.145
10	C6 Friction Plate, Minimum Oil Groove Depth	0.20	0.008
11	C6 Reaction Plate, Minimum Thickness	2.36	0.093
11	C6 Reaction Plate, Maximum Cone	0.40	0.016
19	C6 Housing, Maximum Groove Wear	2.29	0.090
21	C6 Housing Bushing	36.18	1.424
Foldout 18,A	OUTPUT FLANGE AND YOKE		
1, 7	Journal Seal Wear, Minimum Diameter	89.78	3.535
Foldout 18,B	TRANSFER CASE ADAPTER HOUSING AND P3 MODULE		
6	P3 Carrier Bushing, Maximum ID	53.22	2.095
8, 11	P3 Pinion Thrust Washer, Minimum Thickness	1.39	0.054
8, 11	P3 Pinion Thrust Washer, Maximum Step Wear	0.12	0.005
9	Pinion, Maximum End Play	0.94	0.037
Foldout 19,C	SCAVENGE PUMP		
12, 16	Scavenge Pump Thrust Washer, Minimum Thickness	2.47	0.097

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.
7	25	Stator	29500064	No Code	N/A Convoluted	N/A	N/A	17.8 (0.70)	3.3 (0.13)	0.7–1.6 (0.16–0.36)
9,B	21	C2 Return	29503215	No Code	12*	2. 04* (0.080)	13.00* (0.512)	45.3** (1.78)	37.0 (1.46)	4823–5379** (1084–1209)
9,B	25	C1 Return	23045586	No Code	10*	2.19* (0.086)	16.00* (0.630)	45.2** (1.78)	27.5 (1.08)	5763–6369** (1296–1432)
10,A	10	C3 Return	29505570	No Code	11*	1.70* (0.067)	12.00* (0.472)	38.9** (1.53)	24.5 (0.96)	232–256** (52.2–57.6)
10,A	12	C3 Retainer	29505861	No Code	4*	2.59* (0.102)	13.26* (0.522)	12.8** (0.50)	11.0 (0.43)	11310–14610** (2543–3284)
10,A	20	C4 Return	29505570	No Code	11*	1.70* (0.067)	12.00* (0.472)	38.9** (1.53)	24.5 (0.96)	232–256** (52.2–57.6)
10,A	22	C4 Retainer	29505861	No Code	4*	2.59* (0.102)	13.26* (0.522)	12.8** (0.50)	11.0 (0.43)	11310–14610** (2543–3284)
13,A/13,B	23/23	C5 Retainer	29507780	No Code	9.5*	1.83* (0.072)	14.35* (0.565)	39.2** (1.54)	25.0 (0.98)	3044–3364** (684–756)
13,A	46	Retarder	6880775	Yellow/ Red Stripe	12	1.93 (0.076)	16.61 (0.654)	53.85 (2.12)	35.31 (1.39)	73–89 (16.5–20.1)
13,A	46	Retarder	29512751	Silver (End)	10.5	2.16 (0.085)	19.05 (0.75)	61.5 (2.42)	25.9 (1.02)	177.5–196.3 (39.9–44.1)
13,A	46	Retarder	29515101	Green	16.0	3.78 (0.149)	36.6 (1.44)	106.7 (4.20)	73.66 (2.90)	120.1–146.7 (27.0–33.0)
13,A/13,B	46/55	Retarder	29515692	None	11.4	4.12 (0.162)	36.17 (1.42)	114.3 (4.50)	91.1 (3.59)	200.0–226.6 (44.96–50.94)
13,A	92	Retarder Control Low, 27 psi	29510494	Solid Orange	7	1.60 (0.063)	15.50 (0.610)	27.8 (1.09)	18.0 (0.71)	44–50.9 (9.9–11.4)

* Individual Springs
** For the complete Spring Assembly

Table 7–2. Spring Data *(cont'd)*

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.
13,A	92	Retarder Control Medium, 36 psi	29510495	Solid Silver	7.5	1.40 (0.055)	15.09 (0.594)	30.8 (1.21)	18.0 (0.71)	32.5–35.9 (7.3–8.05)
13,A	92	Retarder Control High, 45 psi	29510496	Solid Blue	8	1.14 (0.045)	14.59 (0.574)	36.0 (1.42)	18.0 (0.71)	19.8–21.9 (4.5–4.9)
13,B	78	Retarder Control Low, 54 psi	29529300	White/ Black Stripe	8.52	1.27 (0.050)	13.46 (0.530)	33.02 (1.30)	16.51 (0.650)	34.22–37.86 (7.69–8.51)
13,B	78	Retarder Control Medium, 64 psi	29529299	Yellow/ Red Stripe	9.25	1.04 (0.041)	12.19 (0.480)	37.8 (1.49)	16.51 (0.650)	23.44–25.94 (5.27–5.83)
13,B	78	Retarder Control High, 76 psi	29529298	Pink/ White Ends	8.23	0.94 (0.037)	12.19 (0.480)	31.47 (1.24)	16.51 (0.650)	9.39–10.37 (2.11–2.33)
13,D/18,B	23/16	C5 Retainer	29500867	No Code	11.5*	2.16* (0.085)	16.00* (0.630)	52.1** (2.05)	33.0 (1.30)	3034–3498** (682.1–786.4)
16	13	C6 Spring Retainer Assembly	29501191	No Code	10	1.84 (0.072)	12.70 (0.500)	35.10 (1.382)	26.20 (1.032)	2109–2331** (474–524)
17,A	53, 79, 88, 103	Solenoid Regulator	29502195	No Code	4	0.67 (0.026)	11.05 † (0.435)	6.5 (0.26)	3.45 (0.14)	3.2–4.2 (0.72–0.94)
17,B	60, 75 84, 109	Solenoid Regulator	29502195	No Code	4	0.67 (0.026)	11.05 † (0.435)	6.5 (0.26)	3.45 (0.14)	3.2–4.2 (0.72–0.94)
17,C	61, 76 89, 110	Solenoid Regulator	29502195	No Code	4	0.67 (0.026)	11.05 † (0.435)	6.5 (0.26)	3.45 (0.14)	3.2–4.2 (0.72–0.94)
17,A/17,B 17,C	65/96 97	Accumulator Relay	29507455	Silver	12.8	1.28 (0.050)	11.68 (0.460)	43.6 (1.72)	20.0 (0.79)	47.3–52.3 (10.6–11.8)
17,A/17,B 17,C	73/103 104	Overdrive	23049332	Orange	12	0.76 (0.030)	7.75 (0.305)	26.6 (1.05)	12.5 (0.49)	12.4–15.2 (2.79–3.42)

* Individual Springs
** For the complete Spring Assembly
† OD at larger end

Table 7–2. Spring Data *(cont'd)*

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.
17,A/17,B 17,C	111/119 120	Lockup Relay	23049326	No Code	10	1.37 (0.054)	14.10 (0.555)	42.1 (1.66)	17.0 (0.67)	49.2–60.2 (11.06–13.53)
17,A/17,B 17,C	115/123 124	Lube Regulator	23049327	Red	13	1.22 (0.048)	11.10 (0.437)	46.3 (1.82)	23.5 (0.93)	46.5–51.3 (10.5–11.5)
17,A/17,B 17,C	119/127 128	Main Regulator	29500963	Lt. Blue	15	2.87 (0.113)	22.0 (0.866)	98.5 (3.88)	54.6 (2.15)	305–337 (68.6–75.8)
17,A/17,B 17,C	123/131 132	Control Main	23049325	Orange	10	1.83 (0.072)	14.8 (0.583)	44.6 (1.76)	24.2 (0.95)	131–145 (29.5–32.6)
17,A/17,B 17,C	133/141 142	C2 Latch	29501071	Lt. Green	11	1.32 (0.052)	11.43 (0.450)	41.3 (1.63)	19.0 (0.75)	64.1–78.3 (14.4–17.6)
17,A/17,B 17,C	137/145 146	Exhaust Back	23049391	No Code	17	0.61 (0.024)	7.80 (0.307)	29.2 (1.15)	18.2 (0.72)	2.40–2.94 (0.54–0.66)
17,A/17,B 17,C	141/149 150	C1 Latch	6885065	Blue	12	1.37 (0.054)	16.26 (0.640)	46.2 (1.82)	29.2 (1.15)	16.7–18.9 (3.75–4.25)
17,A/17,B 17,C	145/153 154	Converter Regulator	29507456	Pink	10.2	1.53 (0.060)	11.00 (0.433)	30.3 (1.19)	22.8 (0.90)	53.7–59.3 (12.1–13.3)

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.

8–2. SERVICE LITERATURE

Additional service literature is available. This service literature provides fully illustrated instructions for operation, maintenance, service, overhaul, and parts support for your transmission. To ensure that you get maximum performance and service life from your transmission, you may order publications from:

SGI, Inc.
Attn: Allison Literature Fulfillment Desk
8350 Allison Avenue
Indianapolis, IN 46268
Toll Free: 888-666-5799
International: 317-471-4995

Table 8–1. Service Literature

Literature Type	3000 Product Family	3700 SP and MD 3070PT
Allison DOC™ For PC	GN3433EN	GN3433EN
*Mechanic's Tips (WTEC III Controls)	MT3004EN	—
*Mechanic's Tips (WTEC II Controls)	MT2159EN	MT2923EN
*Operator's Manual (WTEC III Controls)	OM2995EN	—
*Operator's Manual (WTEC II Controls)	OM2157EN	OM2683EN
*Emergency Vehicle Series Operator's Manual	OM3761EN	—
*Highway Series Operator's Manual	OM3757EN	—
*Rugged Duty Series Operator's Manual	OM3759EN	—
*Motorhome Series Operator's Manual	OM3364EN	—
*Pupil Transportation/Shuttle Series Operator's Manual	OM3758EN	—
*Bus Series Operator's Manual	OM3765EN	—
*Parts Catalog	PC2150EN	PC2150EN
Parts Catalog on CD-ROM	CD2150EN	CD2150EN
Principles of Operation	PO2454EN	PO2454EN
Troubleshooting Manual (WTEC III Controls)	TS2973EN	TS2973EN
Troubleshooting Manual (WTEC II Controls)	TS2470EN	TS2470EN
Worldwide Sales and Service Directory	SA2229EN	SA2229EN
* Also Available On The Internet At ***www.allisontransmission.com***		

Legend For Foldout 1 Is On The Opposite Side Of This Page.

Legend For Foldout 1

1 — Lockup clutch and damper assembly

2 — Converter turbine

3 — Converter pump

4 — Converter housing

5 — Front Support

6 — Rotating clutch module

7 — C2 clutch

8 — Main case module

9 — C3 clutch

10 — P1 planetary module

11 — C4 clutch

12 — P2 planetary module

13 — C5 clutch

14 — P3 planetary module

15 — Rear cover module

16 — Output shaft

17 — Main shaft module

18 — Control valve module

19 — C1 clutch

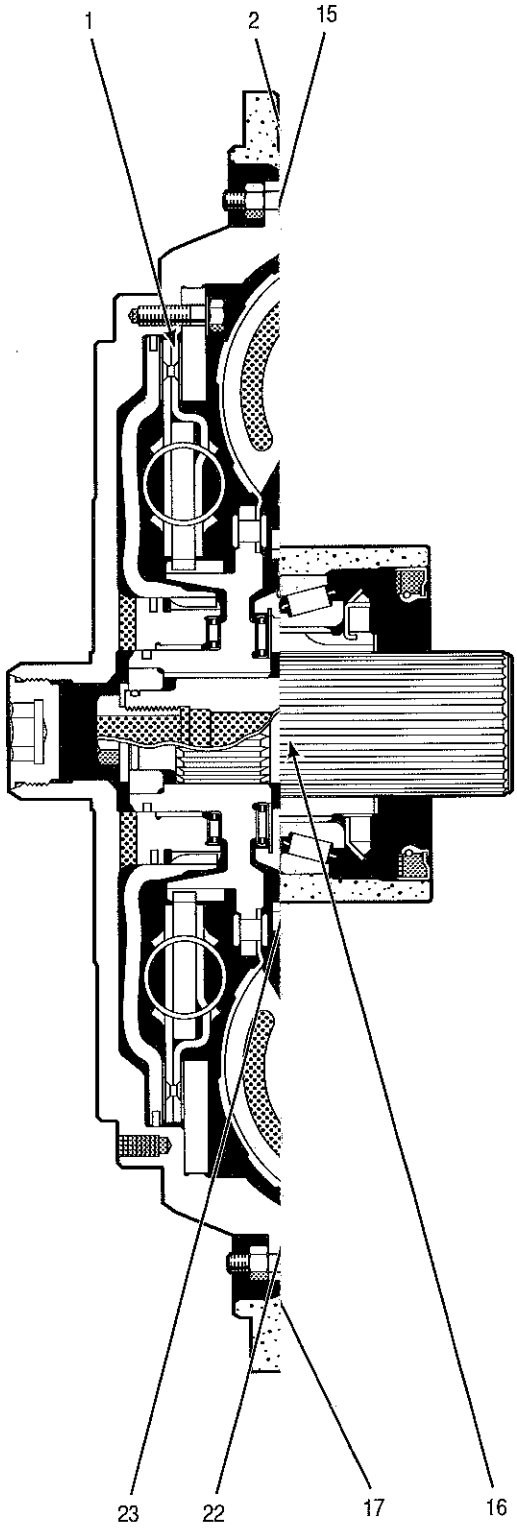
20 — Oil pump

21 — Ground sleeve

22 — Converter stator

23 — Turbine shaft

FOLDOUT 1



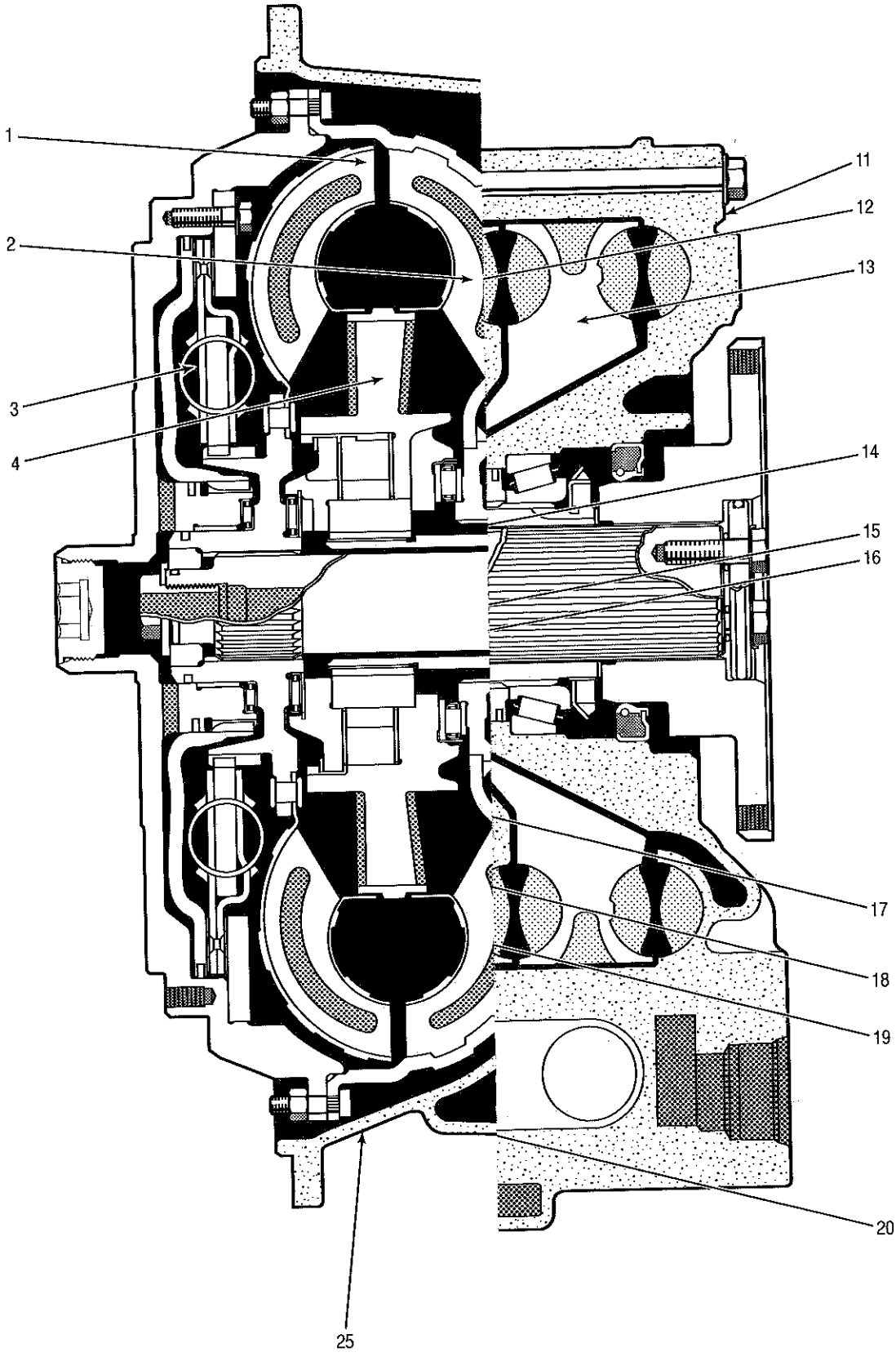
V03348.01

Legend For Foldout 2 Is On The Opposite Side Of This Page.

Legend For Foldout 2

1 — Converter turbine
2 — Converter pump
3 — Lockup clutch and damper assembly
4 — Converter stator
5 — Front Support
6 — Oil pump
7 — Main housing module
8 — C3 clutch
9 — C4 clutch
10 — C5 clutch
11 — Retarder housing
12 — Retarder stator
13 — Retarder rotor
14 — Main shaft module
15 — P2 sun gear
16 — P3 sun gear
17 — P3 planetary module
18 — P2 planetary module
19 — P1 planetary module
20 — Control valve module
21 — Oil level sensor
22 — C2 clutch
23 — C1 clutch
24 — Turbine shaft
25 — Converter housing

FOLDOUT 2



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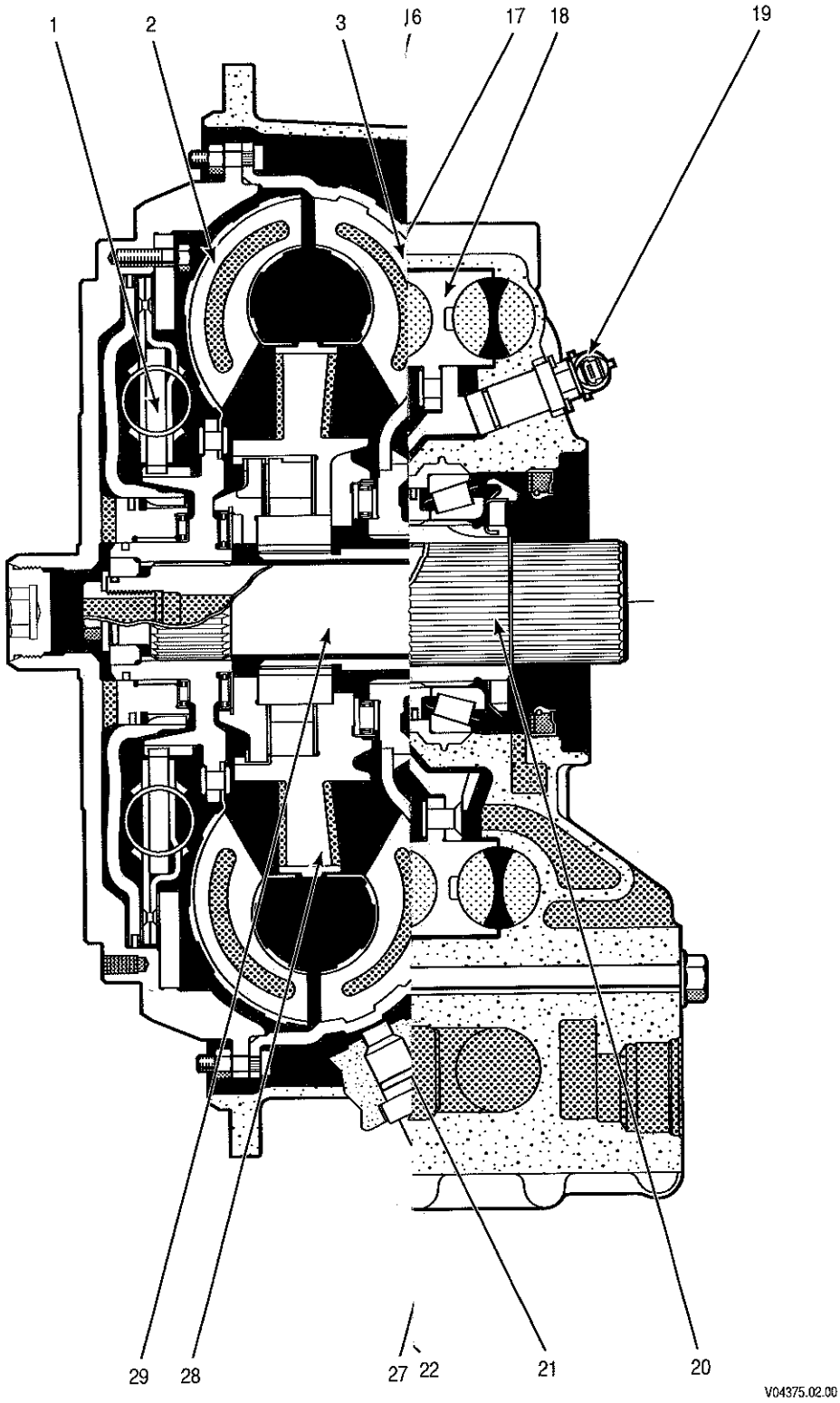
Legend For Foldout 3 Is On The Opposite Side Of This Page.

Legend For Foldout 3

1 — Lockup clutch and damper assembly
2 — Converter turbine
3 — Converter pump
4 — Converter housing
5 — PTO gear assembly
6 — Front support
7 — Rotating clutch module
8 — C2 clutch
9 — Main housing module
10 — C3 clutch
11 — P1 planetary module
12 — C4 clutch
13 — P2 planetary module
14 — C5 clutch
15 — P3 planetary module
16 — Retarder housing
17 — Stator assembly
18 — Rotor assembly
19 — Speed sensor
20 — Rear output shaft
21 — Main shaft module
22 — Oil level sensor
23 — Control valve module
24 — C1 clutch
25 — Oil pump
26 — Oil pump drive hub
27 — Ground sleeve
28 — Converter stator
29 — Turbine shaft

FOLDOUT 3



Foldout 3. 3000 Product