

# OPERATOR'S MANUAL



# Operator's Manual

2003 DECEMBER

OM3750EN

## Allison Transmission

### VOCATIONAL MODELS

Highway Series (HS) Transmissions  
(WTEC III Controls)

3000 and 4000 Product Families

3000 HS

4000 HS

4500 HS



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## NOTES

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- Allison DOC™ is a trademark of General Motors Corporation.
- DEXRON® is a registered trademark of the General Motors Corporation.
- TranSynd™ is a trademark of Castrol Ltd.



## WARNINGS, CAUTIONS, NOTES

**IT IS YOUR RESPONSIBILITY** to be completely familiar with the warnings and cautions described in this handbook. 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. The vehicle manufacturer is responsible for providing information related to the operation of vehicle systems (including appropriate warnings, cautions, and notes). 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 OR THE VEHICLE MANUFACTURER MUST** first be thoroughly satisfied that neither personal safety nor equipment safety will be jeopardized by the service methods selected.

Proper service and repair is important to the safe, reliable operation of the equipment. The service procedures recommended by Allison Transmission (or the vehicle manufacturer) and described in this handbook are effective methods for performing service operations. Some of these service operations require the use of tools specially designed for the purpose. The special tools should be used when and as recommended.

Three types of headings are used in this manual to attract your attention. These warnings and cautions advise of specific methods or actions that can result in personal injury, damage to the equipment, or cause the equipment to become unsafe.



**WARNING:** A warning is used when an operating procedure, practice, etc., if not correctly followed, could result in personal injury or loss of life.



**CAUTION:** A caution is used when an operating procedure, practice, etc., if not strictly observed, could result in damage to or destruction of equipment.



**NOTE:** A note is used when an operating procedure, practice, etc., is essential to highlight.

# INTRODUCTION



## KEEPING THAT ALLISON ADVANTAGE



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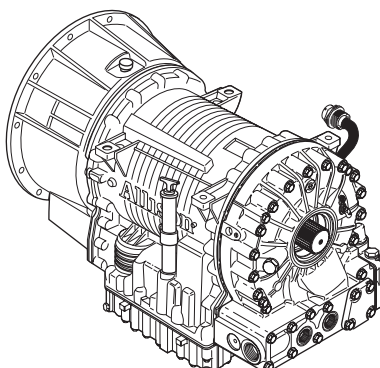
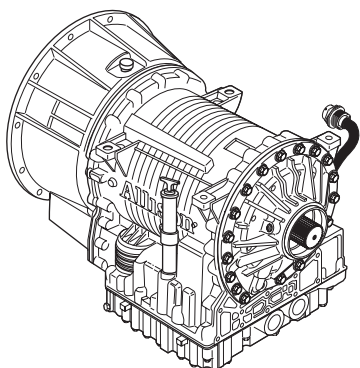
**Highway Series (HS)** transmissions are rugged and designed to provide long, trouble-free service. All HS transmissions are available with optional retarders.

This handbook will help the operator gain the maximum benefits from an HS transmission-equipped vehicle.

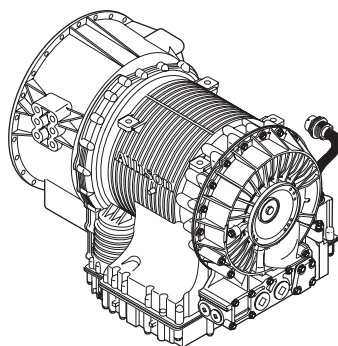
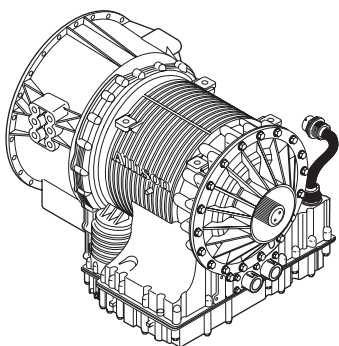


## Abbreviations

ABS	Anti-lock brake system
ATD	Allison Transmission Division
DOC	Diagnostic Optimized Connection
ECU	Electronic Control Unit
EMI	Electromagnetic interference
FCC	Federal Communications Commision
HS	Highway Series
KOH	Potassium Hydroxide
MIL	Military specifications
OEM	Original equipment manufacturer
OLS	Oil level sensor
RFI/EMI	Radio frequency interference/electromagnetic interference
TAN	Total acid number
TIR	Total indicated runout
TPS	Throttle position sensor
VIM	Vehicle interface module



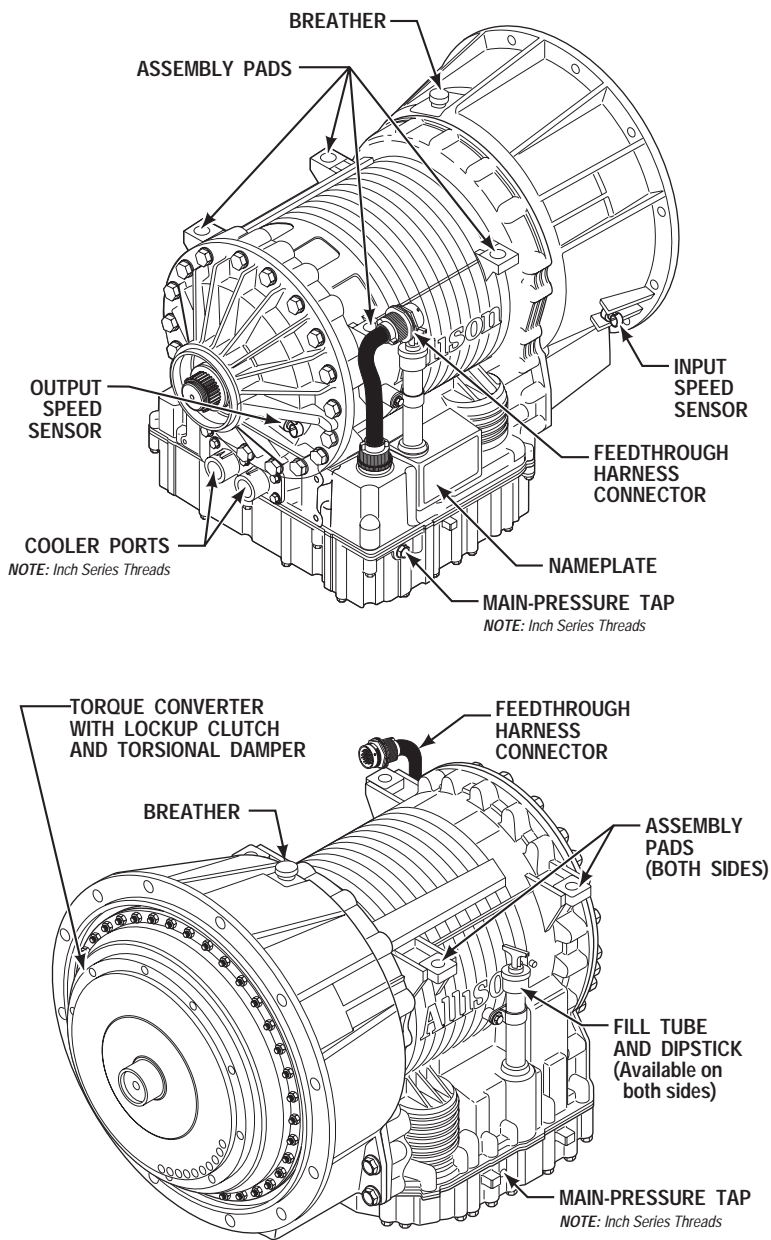
**TYPICAL 3000 HS  
TRANSMISSIONS**



**TYPICAL 4000 HS AND 4500 HS  
TRANSMISSIONS**

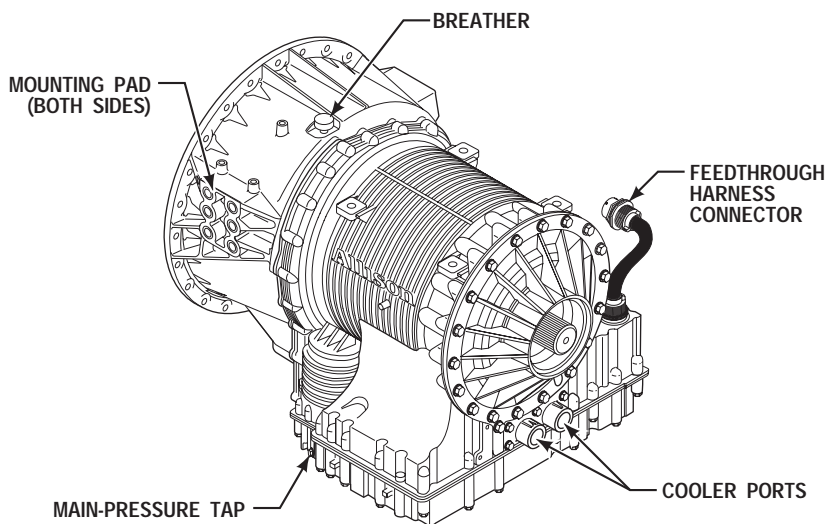
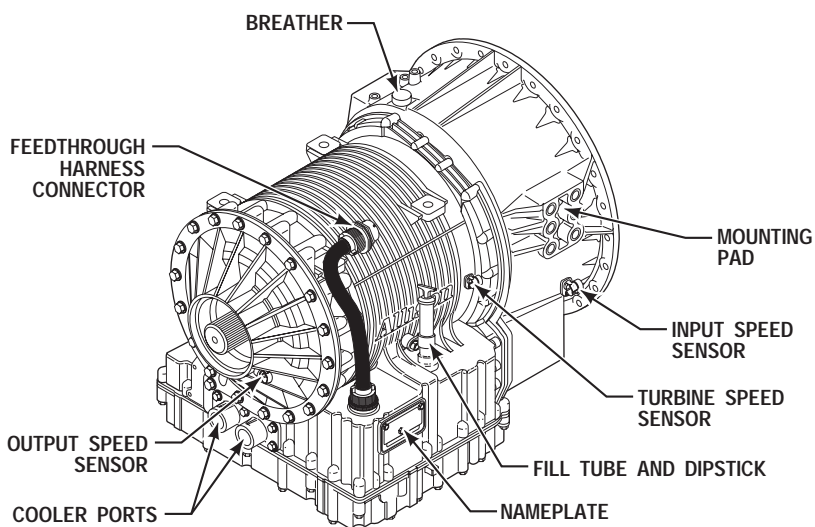
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**Figure 1. Highway Series (HS) Transmissions**



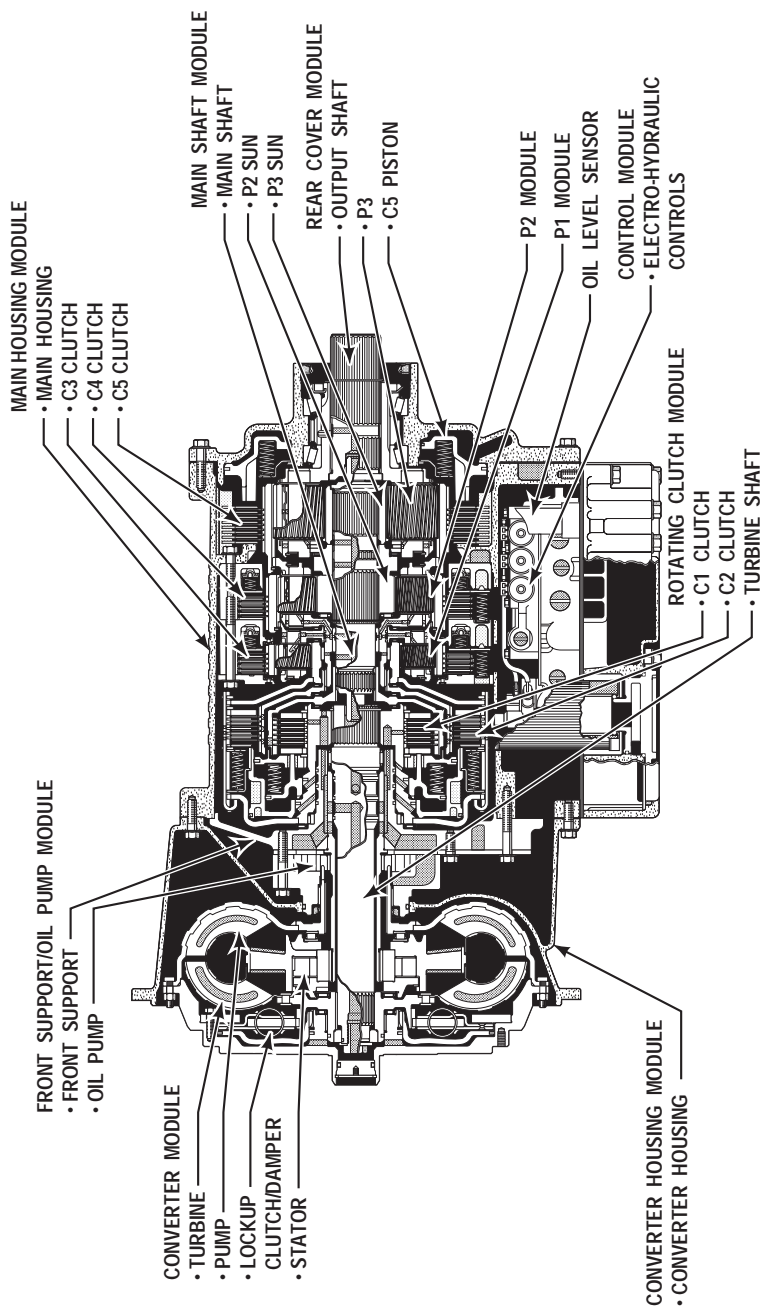
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**Figure 2. 3000 HS**



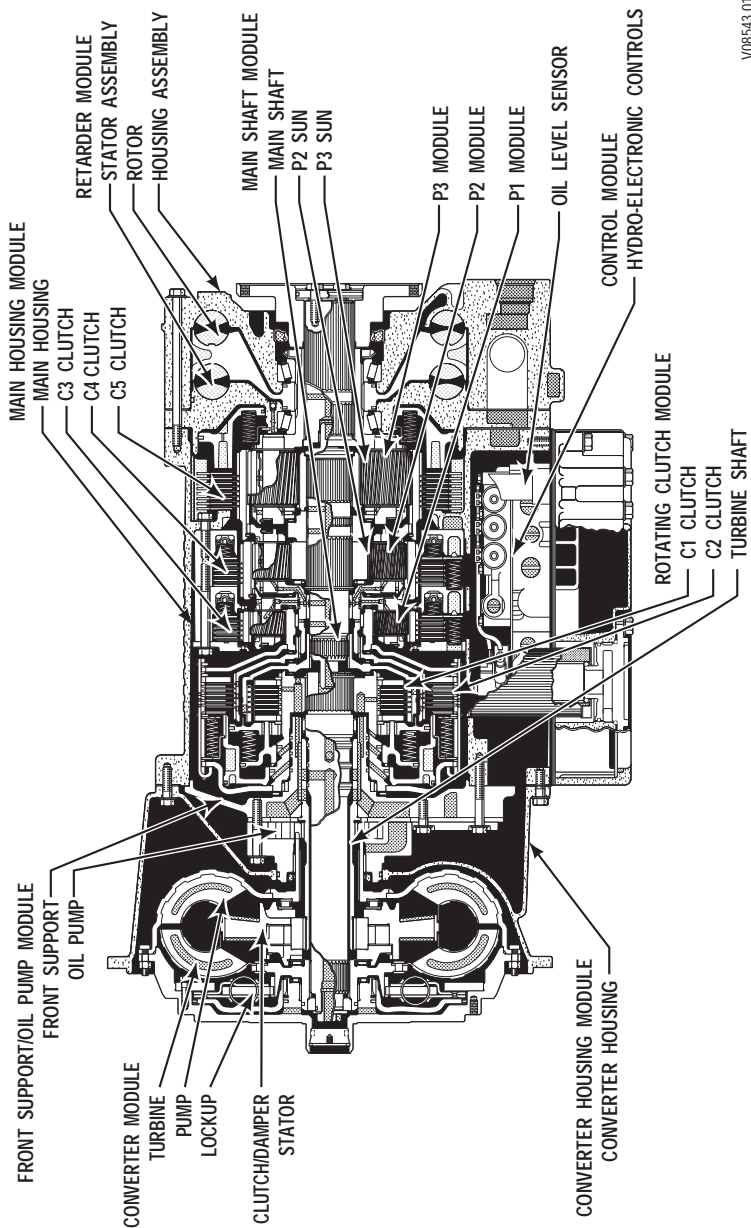
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**Figure 3. 4000 HS and 4500 HS**



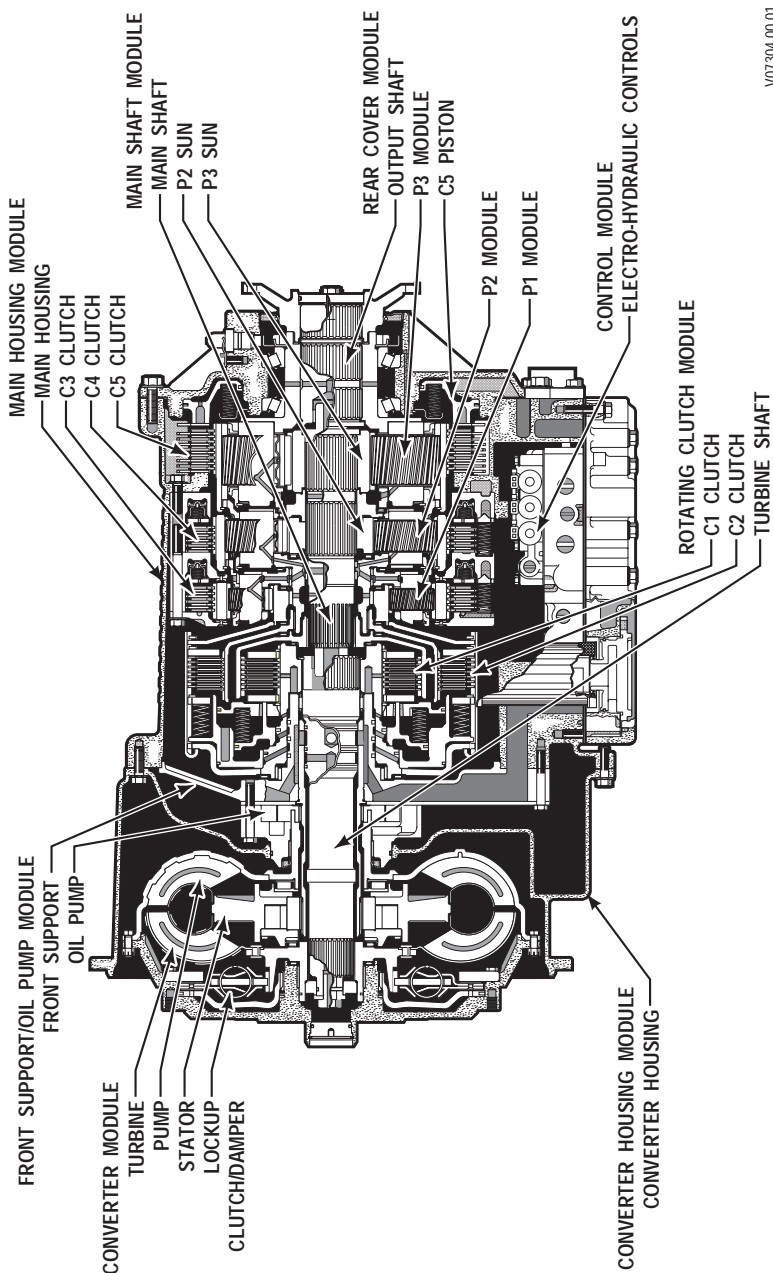
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Figure 4. 3000 HS — Cross Section



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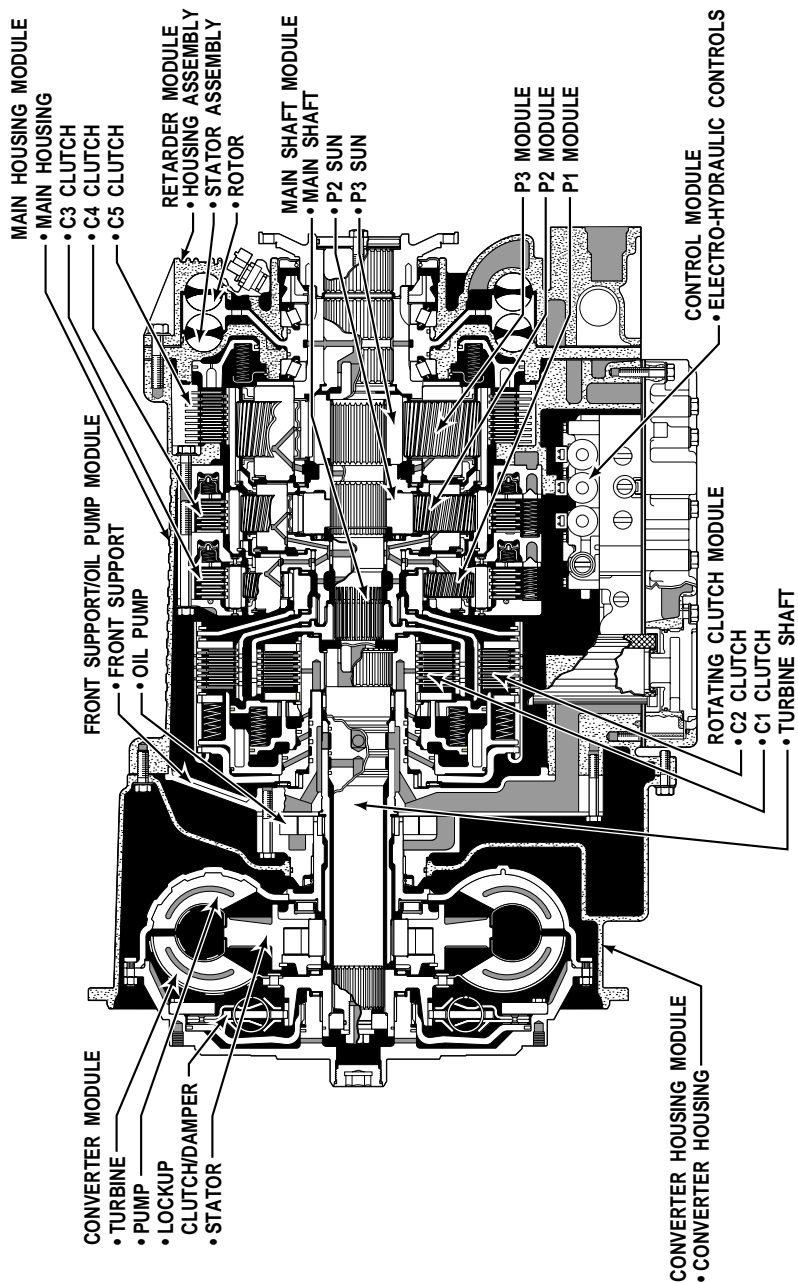
Figure 5. 3000 HS with Retarder — Cross Section



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Figure 6. 4000 HS and 4500 HS — Cross Section





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Figure 7. 4000 HS and 4500 HS with Retarder — Cross Section

## **A BRIEF DESCRIPTION OF THE ALLISON HS TRANSMISSIONS**

Included in the Allison HS family are the 3000 HS, 4000 HS, and 4500 HS transmissions. The transmissions described in this handbook include:

- The WTEC III control system
- A torque converter with lockup and torsion damper
- Three planetary gear sets.

These transmissions (refer to Figure 5 and Figure 7) may also contain an integral retarder.

### **WTEC III ELECTRONIC CONTROL SYSTEM**

The WTEC III control system is standard on all HS transmissions. The system consists of five major components connected by OEM furnished wiring harnesses. The five major components are:

- Electronic control unit (ECU)
- Engine throttle position sensor (engine-to-transmission communication link)
- Three speed sensors
- Remote shift selector
- Control module (which contains solenoid valves, a pressure switch, and oil level sensor).

The ECU receives information from the following:

- Throttle position sensor (or direct engine-to-transmission communication link)
- Speed sensors
- Pressure switch
- Shift selector

The ECU processes this information and then sends signals to actuate specific solenoids located in the transmission control module. These solenoids control both oncoming and offgoing clutch pressures to provide closed-loop shift control by matching rpm during a shift to a desired profile programmed into the ECU.

A feature of WTEC III controls is “autodetect.” Autodetect is active within the first several engine starts, depending upon the component or sensor being detected. These engine start cycles begin from when the transmission is installed during vehicle manufacture. Autodetect searches for the presence of the following transmission components or data inputs:

**Transmission Components**

Retarder	Present, Not Present
Oil Level Sensor (OLS)	Present, Not Present
Throttle	Analog, J 1587, J 1939
Engine Coolant Temperature	Analog, J 1939, J 1587

Seek help from the nearest Allison Transmission service outlet when any of the above components are present, but are not responding properly.

Another feature of the HS transmission is its ability to adapt or “learn” as it operates. Each shift is measured electronically, stored, and used by the ECU to adapt or “learn” the optimum conditions for future shifts.



**NOTE:** If the shift quality of low mileage vehicles, or vehicles with new or recalibrated ECUs is unacceptable, follow the procedure in SIL 16-WT-96 to properly restore good shift quality.



**NOTE:** Allison WTEC III electronic control systems are designed and manufactured to comply with all FCC and other guidelines regarding radio frequency interference/electromagnetic interference (RFI/EMI) for transportation electronics. Manufacturers, assemblers, and installers of radio-telephone or other two-way communication radios have the sole responsibility to correctly install and integrate those devices into Allison HS Transmission-equipped vehicles to customer satisfaction.

The ECU is programmed to provide the most suitable operating characteristics for a specific application. This handbook does not attempt to describe all of the possible combinations. The information contained herein describes only the operating characteristics most frequently requested by the vehicle manufacturer.

**TORQUE CONVERTER**

The torque converter consists of the following three elements:

- Pump — input element driven directly by the engine
- Turbine — output element hydraulically driven by the pump
- Stator — reaction (torque multiplying) element

When the pump turns faster than the turbine, the torque converter is multiplying torque. When the turbine approaches the speed of the pump, the stator starts to rotate with the pump and turbine. When this occurs, torque multiplication stops and the torque converter functions as a fluid coupling.

The lockup clutch is located inside the torque converter and consists of the following elements:

- Piston and backplate — driven by the engine
- Clutch plate/damper (located between the piston and the backplate) — splined to the converter turbine

The lockup clutch/torsional damper is engaged and released in response to electronic signals from the ECU. Lockup clutch engagement provides a direct drive from the engine to the transmission gearing. This eliminates converter slippage and provides maximum fuel economy and vehicle speed. The lockup clutch releases at lower speeds or when the ECU detects conditions requiring it to be released.

The torsional damper absorbs engine torsional vibration to prevent transmitting vibrations through the powertrain.

## **PLANETARY GEARS AND CLUTCHES**

A series of three helical planetary gear sets and shafts provides the mechanical gear ratios and direction of travel for the vehicle. The planetary gear sets are controlled by five multiplate clutches that work in pairs to produce up to six forward speeds and one reverse speed. The clutches are applied and released hydraulically in response to electronic signals from the ECU to the appropriate solenoids.

## **COOLER CIRCUIT**

The transmission fluid is cooled by an integral (transmission-mounted) or remote-mounted oil cooler. Connections to the cooling circuit are located at the front or rear of the transmission to facilitate installation of remote cooler lines. On retarder models, only the rear cooler ports may be used. The integral cooler is mounted on the lower rear portion of the transmission, replacing the remote cooler manifold. Integral cooler oil ports are internal requiring coolant to be routed to and from the cooler.

A new feature has been added on all retarder-equipped transmissions. The retarder housing now allows addition of either a remote or integral cooler for transmission sump fluid in addition to retarder out fluid. A cover is placed over the sump cooling ports when the provision is not used.

## **RETARDER**

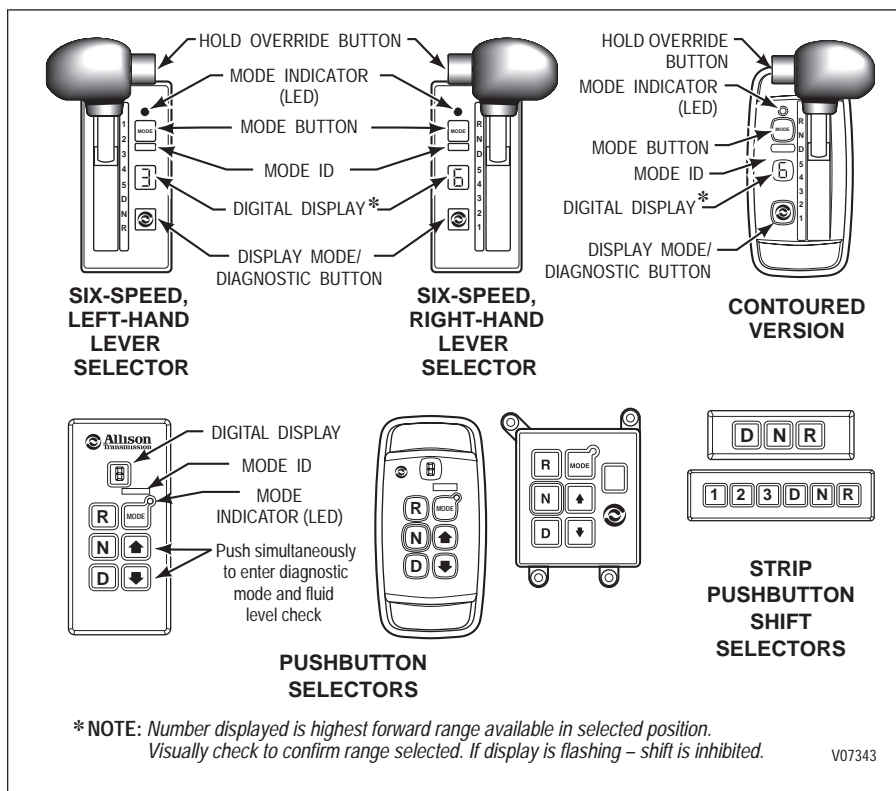
The self-contained retarder is at the output of the transmission and consists of a vaned rotor which rotates in a vaned cavity. The rotor is splined to and driven by the output shaft. An external accumulator holds transmission fluid until the retarder is activated. When the retarder is activated, the fluid in the accumulator is pressurized by the vehicle air system and directed into the retarder cavity. The interaction of the fluid with the rotating and stationary vanes causes the retarder rotor and hence the output shaft speed, to decrease and slow the vehicle or to limit speed on a downhill grade. Refer to the Driving Tips section, USING THE HYDRAULIC RETARDER, for additional information.

When the retarder is deactivated, the retarder cavity is evacuated and the accumulator is recharged with fluid.



# SHIFT SELECTORS

## DESCRIPTION OF AVAILABLE TYPES



**Figure 8. WTEC III Shift Selectors**

## INTRODUCTION

Vehicle manufacturers may choose different types of shift selectors for their vehicles. The shift selector in your Allison-equipped vehicle will be similar to the lever style or one of the pushbutton styles shown above.

With an Allison-equipped vehicle, it is not necessary to select the right moment to upshift or downshift during changing road and traffic conditions. The Allison HS

transmission does it for you. However, knowledge of the shift selector positions, ranges available, and when to select them, make vehicle control and your job even easier. Select lower ranges when descending long grades (with or without retarder) to reduce wear on service brakes. Refer to the Range Selection table at the end of this Section for related information.

## LEVER SHIFT SELECTOR

**General Description.** The lever shift selector is an electro-mechanical control. Typical lever positions are:

- **R** (Reverse)
- **N** (Neutral)
- **D** (Drive)
- Some number of lower forward range positions.

HS transmissions can be programmed to have four, five, or six forward ranges. Shift selector positions should agree with the programming of the transmission electronic control unit.

The lever selector includes a:

- Hold override button
- **MODE** button
- Digital display
- Display mode/diagnostic button.

**Hold Override Button.** The lever shift selector has three locked positions to prevent accidentally selecting **R** (Reverse), **N** (Neutral), and **D** (Drive). Select **R**, **N**, or **D** by pressing the hold override button and moving the lever to the desired position. Once **D** (Drive) is selected, lower forward range positions may be selected without pressing the hold override button.

**MODE Button.** The **mode** button can allow the driver to enable a secondary shift schedule or other special function that has been programmed into the electronic control unit at the request of the OEM. For example, an emergency vehicle OEM may have provided a secondary shift schedule for improved fuel economy. The name of the special function (ECONOMY) appears on the MODE ID label adjacent to the **MODE** button. Pressing the **MODE** button activates the ECONOMY shift schedule and illuminates the MODE INDICATOR (LED). Another special functions which can be activated by the **MODE** button is D1 selection. The **MODE** button is also used to view diagnostic code information. After viewing the first diagnostic code which appears in the digital display, press the **MODE** button to view the 2nd diagnostic code logged. Repeat this procedure to view the 3rd, 4th, and 5th code positions. The code displayed is active if the MODE INDICATOR (LED) is illuminated.





**NOTE:** Visually check the digital display whenever the lever is moved to be sure the range selected is shown. **N** should appear in the digital display if the **N** (Neutral) button is pressed.

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**Digital Display.** During normal operation, if **D** (Drive) is selected, the digital display shows the highest forward range attainable for the shift schedule in use.

Abnormal operation is also indicated by the digital display as follows:

- When all segments of the digital display are illuminated for more than 12 seconds, the ECU did not complete initialization.
- When the digital display is blank, there is no power to the selector.
- When the display shows a “ $\swarrow$ ” (caterpillar), a selector-related fault code has been logged.
- Conditions which illuminate the CHECK TRANS light disable the shift selector and the digital display displays the range actually attained. Refer to the Driving Tips section, CHECK TRANS LIGHT, for a detailed explanation.

The transmission will not shift into range if a CHECK TRANS code is active. When the display shows either **R** or **D** has been requested and the display is flashing, the requested range has not been achieved due to an inhibit function.

Some inhibit functions are vehicle-related and do not result in diagnostic codes. Some examples are mentioned in the Range Selection tables at the end of this Section.

Check for active codes if no other inhibit function has been located. Once **D** (Drive) is attained, the transmission will shift into the lowest range programmed for the **D** (Drive) position, usually first-range.

**Display Mode/Diagnostic Button.** The Display Mode/Diagnostic button allows access to optional fluid level check information and diagnostic code information. Press the Display Mode/Diagnostic button once to obtain transmission fluid level information and a second time to obtain diagnostic code information.

## PUSHBUTTON SHIFT SELECTOR

**General Description.** The pushbutton shift selector has **R**, **N**, **D**,  $\downarrow$ ,  $\uparrow$ , a **MODE** button, and a digital display.

**R Pushbutton.** Press this button to select Reverse.

**N Pushbutton.** Press this button to select Neutral.

**D Pushbutton.** Press this button to select Drive. The highest forward range available will appear in the digital display window. The transmission will start out in the lowest available forward range and advance automatically to the highest range.

↓, ↑ (**Arrow**) **Buttons.** When a lower range is desired, after **D** (Drive) has been pressed, press the ↓ (Down) arrow button until the desired range is shown in the display window. Likewise, if the transmission is held in a low range by the ↓ (Down) arrow, press the ↑ (Up) arrow to request the next higher range. Continuous pressing of either the ↑ (Up) or ↓ (Down) arrow buttons will request the highest or lowest range available.



**NOTE:** Fluid level information is displayed after pressing both the ↑ (Up) and ↓ (Down) arrow buttons simultaneously. Press both buttons again simultaneously to obtain diagnostic data.





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Access fluid level data and diagnostic codes by pressing the ↑ (Up) and ↓ (Down) arrow buttons simultaneously. Refer to the Care And Maintenance section, FLUID LEVEL CHECK USING PUSHBUTTON OR LEVER SHIFT SELECTOR, for more information about fluid level data. Refer to the Driving Tips section, DIAGNOSTIC CODES and DIAGNOSTIC CODE DISPLAY PROCEDURE, for more information about diagnostic codes and display procedure.






**MODE Button and Digital Display.** This is the same function as described previously in LEVER SHIFT SELECTOR, **MODE Button** paragraph.

## RANGE SELECTION



### PUSHBUTTON AND LEVER SHIFT SELECTORS WITH DIGITAL DISPLAY

Description of Available Ranges	
	<p><b>WARNING:</b> If you leave the vehicle and the engine is running, the vehicle can move unexpectedly and you or others could be injured. If you must leave the engine running, do not leave the vehicle until you have completed all of the following procedures:</p> <ul style="list-style-type: none"> <li>• Put the transmission in <b>N</b> (Neutral)</li> <li>• Be sure the engine is at low idle (500–800 rpm)</li> <li>• Apply the parking brakes and emergency brake and make sure they are properly engaged</li> <li>• Chock the wheels and take any other steps necessary to keep the vehicle from moving.</li> </ul>
	<p><b>WARNING:</b> <b>R</b> (Reverse) may not be attained due to an active inhibitor. Always apply the service brakes when selecting <b>R</b> (Reverse) to prevent unexpected vehicle movement and because a service brake inhibit may be present. When the “<b>R</b>” is flashing, it indicates the shift to <b>R</b> (Reverse) is inhibited. Check for active diagnostic codes if <b>R</b> (Reverse) is not attained. See DOWNSHIFT AND DIRECTION CHANGE INHIBITOR FEATURE in the DRIVING TIPS section.</p>
	<p><b>CAUTION:</b> Do not idle in <b>R</b> (Reverse) for more than five minutes. Extended idling in <b>R</b> (Reverse) can cause transmission overheating and damage. Always select <b>N</b> (Neutral) whenever time at idle exceeds five minutes.</p>
	<p><b>NOTE:</b> Visually check the digital display window whenever a button is pushed or the lever is moved to be sure the range selected is shown (i.e., if the <b>N</b> (Neutral) button is pressed, “<b>N</b>” should appear in the digital display). A flashing display indicates the range selected was not attained due to an active inhibit.</p>
<b>R</b>	<p>Completely stop the vehicle and let the engine return to idle before shifting from a forward range to <b>R</b> (Reverse) or from <b>R</b> (Reverse) to a forward range. The digital display will display “<b>R</b>” when <b>R</b> (Reverse) is selected.</p>

## PUSHBUTTON AND LEVER SHIFT SELECTORS WITH DIGITAL DISPLAY *(cont'd)*

Description of Available Ranges	
	<b>WARNING:</b> When starting the engine, make sure the service brakes are applied. Failure to apply the service brakes can result in unexpected vehicle movement.
	Vehicle service brakes, parking brake, or emergency brake must be applied whenever <b>N</b> (Neutral) is selected to prevent unexpected vehicle movement. Selecting <b>N</b> (Neutral) does not apply vehicle brakes, unless an auxiliary system to apply the parking brake is installed (see the Operator's Manual for the vehicle).
	<b>WARNING:</b> If you let the vehicle coast in <b>N</b> (Neutral), there is no engine braking and you could lose control. Coasting can also cause severe transmission damage. To help avoid injury and property damage, do not allow the vehicle to coast in <b>N</b> (Neutral).
<b>N</b>	Use <b>N</b> (Neutral) when starting the engine, to check vehicle accessories, and for extended periods of engine idle operation (longer than five minutes). For vehicles equipped with the pushbutton selector, <b>N</b> (Neutral) is selected by the ECU during start-up. For vehicles equipped with the lever selector, the vehicle will not start unless <b>N</b> (Neutral) has been selected. If the vehicle starts in any range other than <b>N</b> (Neutral), seek service immediately. The digital display will show “ <b>N</b> ” when <b>N</b> (Neutral) is selected. Always select <b>N</b> (Neutral) before turning off the vehicle engine.
	<b>WARNING:</b> <b>D</b> (Drive) may not be attained due to an active inhibitor. Always apply the service brakes when selecting <b>D</b> (Drive) to prevent unexpected vehicle movement and because a service inhibit may be present. When “ <b>D</b> ” is flashing, it indicates the shift to <b>D</b> (Drive) is inhibited. Check for active diagnostic codes if <b>D</b> (Drive) is not attained. See DOWNSHIFT AND DIRECTION CHANGE INHIBITOR FEATURE in the DRIVING TIPS section.
	<b>CAUTION:</b> Do not idle in <b>D</b> (Drive) or any forward range for more than five minutes. Extended idling in <b>D</b> (Drive) can cause transmission overheating and damage. Always select <b>N</b> (Neutral) whenever time at idle exceeds five minutes.

## PUSHBUTTON AND LEVER SHIFT SELECTORS WITH DIGITAL DISPLAY *(cont'd)*

Description of Available Ranges	
	<p><b>NOTE:</b> Turn off the vehicle HIGH IDLE switch, if present, before shifting from <b>N</b> (Neutral) to <b>D</b> (Drive) or <b>R</b> (Reverse). <b>D</b> (Drive) or <b>R</b> (Reverse) will not be attained unless the shift is made with the engine at idle. Also, be aware of other interlocks that would prevent attaining <b>D</b> (Drive) or <b>R</b> (Reverse). Examples are “wheelchair lift not stored” and “service brakes not applied” (service brake interlock present).</p>
<b>D</b>	<p>The transmission will initially attain first-range when <b>D</b> (Drive) is selected (except for those units programmed to start in second-range). As vehicle speed increases, the transmission will upshift automatically through each range. As the vehicle slows, the transmission will downshift automatically through each range. The digital display will show the highest range available in <b>D</b> (Drive).</p>
	<p><b>WARNING:</b> If you just downshift or just use service brakes when going downhill, you can lose control and cause injury and property damage. To help avoid loss of control, use a combination of downshift, braking, and other retarder devices. Downshift to a lower transmission range increases engine braking and helps to maintain control. The transmission has a feature to prevent automatic upshifting above the lower range selected. However, during downhill operation, if engine governed speed is exceeded in the lower range, the transmission may upshift to the next higher range. This will reduce braking and could cause loss of control. Apply the vehicle brakes or other retarding device to prevent exceeding engine governed speed in the lower range selected.</p>

**PUSHBUTTON AND LEVER SHIFT SELECTORS  
WITH DIGITAL DISPLAY (cont'd)**

Description of Available Ranges	
5* 4* 3 2	<p>Lower ranges provide greater engine braking for going down grades (the lower the range, the greater the braking effect). Occasionally, it may be desirable to restrict automatic shifting to a lower range because of:</p> <ul style="list-style-type: none"><li>• Road conditions</li><li>• Load</li><li>• Traffic conditions</li><li>• Etc.</li></ul> <p>The pushbutton shift selector arrow buttons access individual forward ranges. Push the ↑ (Up) or ↓ (Down) arrow for the desired range. The digital display shows the range chosen. Even though a lower range is selected, the <b>transmission may not downshift</b> until vehicle speed is reduced (this prevents excessive engine speed in the lower range).</p>
1	<p>First-range provides the vehicle with its maximum driving torque and engine braking effect. Use first-range when:</p> <ul style="list-style-type: none"><li>• Pulling through mud and deep snow</li><li>• Maneuvering in tight spaces</li><li>• Driving up or down steep grades.</li></ul> <p>For vehicles equipped with the pushbutton selector, push the ↓ (Down) arrow until first-range appears in the select window.</p>
* Actual ranges available depend on programming by vehicle manufacturer.	



## DRIVING TIPS

### CHECK TRANS LIGHT

The electronic control system is programmed to inform the operator of a problem with the transmission system and automatically take action to protect the operator, vehicle, and transmission. When the Electronic Control Unit (ECU) detects a problem condition, the ECU:

- Restricts shifting
- Turns on the CHECK TRANS light on the instrument panel
- Registers a diagnostic code.



**NOTE:** For some problems, diagnostic codes may be registered without the ECU activating the CHECK TRANS light. Your Allison Transmission authorized service outlet should be consulted whenever there is a transmission-related concern. They have the equipment to check for diagnostic codes and to correct problems which arise.

Each time the engine is started, the CHECK TRANS light will illuminate, then turn off after a few seconds. This momentary lighting is to show that the status light circuits are working properly. If the CHECK TRANS light does not illuminate during ignition, or if the light remains on after ignition, the system should be checked immediately.

Continued illumination of the CHECK TRANS light during vehicle operation (other than start-up) indicates that the ECU has signaled a diagnostic code. Illumination of the CHECK TRANS light is accompanied by a flashing display from the shift selector. The shift selector display will show the actual range attained and the transmission will not respond to shift selector requests.

Indications from the shift selector are provided to inform the operator the transmission is not performing as designed and is operating with reduced capabilities. Before turning off the ignition, the transmission may be operated for a short time in the selected range in order to “limp home” for service assistance. Service should be performed immediately in order to minimize the potential for damage to the transmission.



When the CHECK TRANS light comes on and the ignition switch is turned off, the transmission will remain in **N** (Neutral) until the condition causing the CHECK TRANS light is corrected.

Generally, while the CHECK TRANS light is on, upshifts and downshifts will be restricted and **direction changes will not occur**. Lever and pushbutton shift selectors **do not respond** to any operator shift requests while the CHECK TRANS light is illuminated. The lockup clutch is disengaged when transmission shifting is restricted or during any critical transmission malfunction.

## DIAGNOSTIC CODES

Diagnostic codes are numerical indications relating to a malfunction in transmission operation.

Each code consists of a two-digit main code and a two-digit subcode. These codes are logged in a list in the ECU memory with the most severe or most recent code listed first. A maximum of five codes (numbered d1–d5) may be listed in memory at one time. As codes are added, the oldest non-active code is dropped from the list. If all codes are active, the code with the lowest priority that is not included on the severity list is dropped from the list.

Diagnostic codes and code information may be accessed through the pushbutton and lever shift selectors or the Allison DOC™ for PC diagnostic tool.

The ECU separately stores the active and historical (non-active) codes. An active code is any code that is current in the ECU decision-making process.

Historical codes are codes that are retained in the ECU's memory and will not necessarily affect the ECU decision-making process. Historical codes are useful in determining if a problem:

- Is isolated
- Is intermittent
- Results from a previous malfunction.

When the diagnostic mode is entered, the first code (position d1) is displayed as follows:

- Code 13 12 is displayed as d,1,1,3,1,2 (each item appears for about one second)
- d,1 is the first position
- Main codes are listed first and provide the general condition or area of a fault detected by the ECU.
- Subcodes are listed second and provide specific areas or conditions within the main code that cause the fault.

- Example — Code 13 12:
  - 13 (main code) indicates a problem with ECU voltage
  - 12 (subcode) indicates the problem is caused by low voltage.

Pressing the **MODE** button momentarily displays code positions d2 through d5.

After a fixed number of ignition cycles, a code may be deleted from memory if it has not recurred. The shift selector diagnostic mode will end automatically after two minutes without operator input.

If the mode indicator (LED) is illuminated, the displayed code is active. If the mode indicator (Figure 8) is not illuminated, the displayed code is not active. An illuminated mode indicator during normal operation signifies secondary mode operation.

## DIAGNOSTIC CODE DISPLAY PROCEDURE

Diagnostic codes can be read and cleared by two methods:

- Allison DOC™ for PC diagnostic tool. Refer to Allison Transmission publication number GN3434EN, Allison DOC™ for PC User Guide, for specific instructions on how to use this diagnostic tool.
- With the pushbutton or lever shift selector.

### Pushbutton Shift Selector.

*To begin the Diagnostic Process:*

1. Bring the vehicle to a stop at a safe location.
2. Apply the parking brake.

*To Display Stored Codes:*

1. Simultaneously press the ↑ (Up) and ↓ (Down) arrow buttons once on the shift selector (refer to Figure 8) to access the diagnostic display mode — press the buttons twice if a transmission oil level sensor is installed.
2. Observe the digital display for codes (codes will appear one digit at a time).
3. Press the **MODE** button to see the next code — repeat for subsequent codes.



**NOTE:** Be sure to record all codes displayed before they are cleared. This is essential for troubleshooting.

---

*To Clear Active Indicators and Resume Vehicle Operation:*

1. Press and hold the **MODE** button for approximately three seconds until the mode indicator (LED) flashes.
2. Release the **MODE** button and active indicators such as the CHECK TRANS light will not be illuminated. Some codes are self-clearing and others require ignition cycles to clear.

**Lever Shift Selector.**

*To Begin the Diagnostic Process:*

1. Bring the vehicle to a stop at a safe location.
2. Apply the parking brake.

*To Display Stored Codes:*

1. Press the **DISPLAY MODE** button on the shift selector (refer to Figure 8) once to access the diagnostic display mode — press the button twice if a transmission oil level sensor is installed.
2. Observe the digital display for codes (codes will appear one digit at a time).
3. Press the **MODE** button to see the next code — repeat for subsequent codes.



**NOTE:** Be sure to record all codes displayed before they are cleared. This is essential for troubleshooting.

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*To Clear Active Indicators and Resume Vehicle Operation:*

1. Press and hold the **MODE** button for approximately three seconds until the mode indicator (LED) flashes.
2. Begin operating as normal — have the transmission checked at the earliest opportunity by an Allison Transmission distributor or dealer.



**NOTE:** If the condition that caused the code is still present, the code will again become active.

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## ACCELERATOR CONTROL



**WARNING:** To help avoid injury or property damage caused by sudden movement of the vehicle, do not make shifts from **N** (Neutral) to **D** (Drive) or **R** (Reverse) when the throttle pedal is depressed. If you shift while the throttle pedal is depressed too far, the transmission will only engage if the throttle pedal is released in the next three seconds. This may cause a sudden movement of the vehicle. Leaving the throttle pedal depressed longer than three seconds causes the transmission to remain in **N** (Neutral). Avoid this condition by making shifts from **N** (Neutral) to **D** (Drive) or **R** (Reverse) only when the throttle is closed.

The position of the accelerator pedal influences the timing at which automatic shifting occurs. An electronic throttle position signal tells the ECU how much the operator has depressed the pedal. When the pedal is fully depressed, upshifts will occur automatically at high engine speeds. A partially depressed position of the pedal will cause upshifts to occur at lower engine speeds. Excessive throttle position affects directional changes — shifts from **N** (Neutral) to **D** (Drive) or **R** (Reverse).

## DOWNSHIFT AND DIRECTION CHANGE INHIBITOR FEATURE



**NOTE:** Turn off the vehicle HIGH IDLE switch, if present, before shifting from **N** (Neutral) to **D** (Drive) or **R** (Reverse). The shift from **N** (Neutral) to **D** (Drive) or **R** (Reverse) is inhibited when engine speed is above idle.

There is no speed limitation on upshifting, but there is a limitation on downshifting and for shifts which cause a direction change such as **D** (Drive) to **R** (Reverse) or **R** (Reverse) to **D** (Drive).

Manual range downshifts will not occur until a calibration output speed (preset) is reached. When a range downshift is manually selected and the transmission output speed is above the calibration speed, the transmission will stay in the range it was in even though a lower range was requested. Apply the vehicle service brakes or a retarding device to reduce the transmission output speed to the calibration speed and then the shift to the lower range will occur.

- Directional shifts, **D** (Drive) to **R** (Reverse) or **R** (Reverse) to **D** (Drive), will not occur if selected when throttle position, engine speed, or transmission output speed is above the calibration limit for a calibration time period. The current calibration time period for engine speed is 0.5 seconds and for throttle position and output speed is three seconds.
- Shifts from **N** (Neutral) to **D** (Drive) or **R** (Reverse) are also inhibited when the ECU has been programmed (by input/output function) to detect that auxiliary equipment is in operation and the shift should not be allowed.
- When a directional shift is inhibited, the ECU will put the transmission in **N** (Neutral) and the digital display, if present, will flash the letter of the range selected (**D** or **R**). Reselect **D** (Drive) or **R** (Reverse) when engine throttle, engine speed, and transmission output speed are below the calibration value.
  - With a pushbutton selector, depress the desired pushbutton again.
  - With a lever selector, move the lever to **N** (Neutral) and then to the desired range.
- When a direction change shift is requested and engine throttle, engine speed, and transmission output speed drop below the calibration value during the calibration time interval, the shift to **D** (Drive) or **R** (Reverse) will occur.
  - For example, if the transmission output speed was just above the calibration limit when **R** (Reverse) was selected, but dropped below the limit during the next three seconds, the shift to **R** (Reverse) would occur (assuming the engine was at idle and the throttle was closed).

## USING THE ENGINE TO SLOW THE VEHICLE



**WARNING:** If you just downshift or just use service brakes when going downhill, you can lose control and cause injury or property damage. To help avoid loss of control, use a combination of downshifting, braking, and other retarding devices. Downshifting to a lower transmission range increases engine braking and helps you to maintain control. The transmission has a feature to, prevent automatic upshifting above the lower range selected. However, during downhill operation, if engine governed speed is exceeded in the lower range, the transmission may upshift to the next higher range. This will reduce braking and could cause a loss of control. Apply the vehicle brakes or other retarding device to prevent exceeding engine governed speed in the lower range selected.

Engine braking provides good speed control for going down grades. When the vehicle is heavily loaded, or the grade is steep, it may be desirable to pre-select a lower range before reaching the grade. If engine-governed speed is exceeded, the transmission will upshift automatically to the next range.

To use the engine as a braking force, select the next lower range. If the vehicle is exceeding the maximum speed for this range, use the service brakes and/or retarder to slow the vehicle. When a lower speed is reached, the ECU will automatically downshift the transmission.

## USING THE HYDRAULIC RETARDER



**WARNING: DO NOT USE THE RETARDER DURING INCLEMENT WEATHER OR WHEN ROAD SURFACES ARE SLIPPERY.**

De-energize the retarder at the master control switch. To help avoid injury or property damage caused by loss of vehicle control, be ready to apply vehicle brakes or other retarding device if the transmission retarder does not apply. If a retarder is present but is not detected by “autodetect”, the retarder will not function. Be sure to check for proper retarder function periodically. Whenever the retarder does not apply, seek service help immediately. On vehicles which have the primary retarder control based upon closed throttle position, brake pedal position, or brake apply pressure, always manually disable the retarder controls during inclement weather or slippery road conditions.

Regardless of the type of Allison retarder controls on your vehicle, the following safety features are common to each configuration:

- The retarder can be disabled when inclement weather or slippery road conditions are present.
- Vehicle brake lights should always be on when the retarder is applied (periodically verify that they are working).
- Anti-lock brake systems send a signal to the transmission ECU to indicate that the brake system is activated.



**NOTE:** The retarder is automatically disabled and the lockup clutch is disengaged whenever the vehicle anti-lock brake system (ABS) is active. However, in case the ABS system malfunctions, it is recommended that the retarder enable switch, if present, be disabled.

A hydraulic retarder is available on all of the models covered in this manual. The retarder is activated and controlled in various ways. The control depends upon the vehicle type and particular duty cycle. Both manual and automatic controls are available. Automatic controls are applied by the ECU. Some types of controls and the amount of retarder application are shown in Types of Retarder Control table that follows.

The presence of a retarder must be “autodetected” as part of the WTEC III control system.



**NOTE:** If your transmission has a retarder but it is not functioning, it may not have been “autodetected” during vehicle manufacture. Go immediately to your nearest Allison Transmission service outlet to have “autodetect” reset or the retarder enabled using the Allison DOC™ for PC diagnostic tool.



**NOTE:** When reduced retarder performance is observed, be sure the transmission fluid level is within the operating band on the dipstick (refer to Figure 9). Low fluid level is a common cause for retarder performance complaints.



**NOTE:** The retarder requires about one second to reach full capacity requested. Be sure to anticipate this delay when using the retarder. Anticipation will prevent unnecessary service brake applications during non-emergency stops.

Types of Retarder Control

Type	Description	Amount of Application
Manual	Separate apply pedal	Zero to Full apply
	Hand lever *	Six levels based on lever position
Automatic	Auto “Full On” *	“Full On” when closed throttle sensed
Brake Pressure Apply **	Single pressure switch	Off or “Full On” (based on brake pressure)
	Three pressure switches	1/3, 2/3, or “Full On” (based on brake pressure)
Pedal Position **	Special brake pedal	1/3, 2/3, or “Full On” (based on pedal position)



### Types of Retarder Control (cont'd)

Type	Description	Amount of Application
Combinations of the above systems **	Auto “half-on” plus pressure switch *	Half capacity at closed throttle or “Full On” with brake pressure
	Auto “ $\frac{1}{3}$ on” plus two pressure switches *	$\frac{1}{3}$ , capacity at closed throttle or $\frac{2}{3}$ and “Full On” with brake pressure
	Hand lever plus pressure switch *	6 levels of modulation with lever, or “Full On” with brake pressure
	Foot pedal plus pressure switch	Full modulation with separate pedal, or “Full On” with brake pressure
	Hand lever plus interface for special pedal *	6 levels of modulation with lever, or 3 levels of modulation based on pedal position

\* These control systems may apply the retarder at high speed on grades when the vehicle has road speed limiting and the retarder is enabled.

\*\* For retarder apply systems integrated with the service brake system, the retarder is most effective when applied with light brake pedal pressure for 1–2 seconds to allow the retarder to fully charge. Added pedal pressure can be applied when more aggressive braking is desired.



**NOTE:** When the transmission fluid or engine water temperature (engine water is an OEM option) exceeds programmed limits, retarder capacity is automatically gradually reduced to minimize or avoid possible system overheating.

Contact your vehicle manufacturer to understand how the retarder controls have been integrated into your vehicle.



**CAUTION:** Observe the following cautions when driving a vehicle equipped with a retarder:

- THE RETARDER WORKS ONLY WHEN THE ENGINE IS AT CLOSED THROTTLE.
- OBSERVE TRANSMISSION AND ENGINE TEMPERATURE LIMITS AT ALL TIMES. Select the lowest possible transmission range to increase the cooling system capacity and total retardation available.
- In the event of OVERHEATING, DECREASE THE USE OF THE RETARDER; USE THE SERVICE BRAKES TO SLOW THE VEHICLE.
- OBSERVE THE RETARDER/SUMP “OVERTEMP” LIGHT to be sure it responds properly to retarder temperature.



**NOTE:** Transmission fluid level must be set correctly for highest retarder effectiveness. As much as 2 liters (2 quarts) too high or too low can reduce retarder effectiveness and increase transmission temperature.

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## RANGE PRESELECTION

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**NOTE:** Preselecting during normal operation may result in reduced fuel economy.

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Range preselection means selecting a lower range to match driving conditions encountered or expect to be encountered. Learning to take advantage of preselected shifts will give you better control on slick or icy roads and on downgrades.

Downshifting to a lower range increases engine braking. The selection of a lower range often prevents cycling between that range and the next higher range on a series of short up-and-down hills.

## COLD WEATHER STARTS

All HS transmissions are programmed to restrict full operation until specific fluid temperatures are reached. Refer to the following table for temperature restrictions.

**Minimum Fluid Operating Temperatures**

Sump Fluid Temperature	CHECK TRANS Light	Operation
-32°C (-25°F) to -7°C (19°F)	OFF	Neutral, Reverse, Second
-7°C (19°F)	OFF	Full operation in all ranges



**NOTE:** When sump temperature is below 10°C (50°F) and transmission fluid is C4 (**not DEXRON® or TranSynd™**), follow these procedures when making directional shift changes:

- To shift from forward to reverse, select **N** (Neutral) and then **R** (Reverse).
- To shift from reverse to forward, select **N** (Neutral) and then **D** (Drive) or other forward range.

Failure to follow these procedures may cause illumination of the CHECK TRANS light and the transmission will be restricted to **N** (Neutral).

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Transmission operation at cold ambient temperatures may require preheating or the use of a lower viscosity transmission fluid. Refer to **RECOMMENDED AUTOMATIC TRANSMISSION FLUID AND VISCOSITY GRADE** in the Care And Maintenance section.

## DRIVING ON SNOW OR ICE



**WARNING:** Using the retarder on wet or slippery roads may cause loss of traction on the drive wheels — your vehicle may slide out of control. To help avoid injury or property damage, turn the retarder enable to OFF when driving on wet or slippery roads.



**NOTE:** The retarder is automatically disabled whenever the vehicle ABS is active. However, in case the antilock brake system (ABS) malfunctions, it is recommended that the retarder enable switch, if present, be disabled.

If possible, reduce vehicle speed and select a lower range before losing traction. Select the range that will not exceed the speed expected to be maintained.

Accelerate or decelerate very gradually to prevent the loss of traction. It is very important to slow gradually when a lower range is selected. It is important that you reach the lower range selected before attempting to accelerate. This will avoid an unexpected downshift during acceleration.

## ROCKING OUT



**WARNING:** To help avoid injury or property damage caused by sudden movement of the vehicle, do not make shifts from **N** (Neutral) to **D** (Drive) or **R** (Reverse) when the throttle is open. The vehicle will lurch forward or rearward and the transmission can be damaged. Avoid this condition by making shifts from **N** (Neutral) to a forward range or **R** (Reverse) only when the throttle is closed and the service brakes are applied.



**CAUTION:** DO NOT make **N** (Neutral) to **D** (Drive) or directional shift changes when the engine rpm is above idle. Also, if the wheels are stuck and not turning, do not apply full power for more than 30 seconds in either **D** (Drive) or **R** (Reverse). Full power for more than 30 seconds under these conditions will cause the transmission to overheat. If the transmission overheats, shift to **N** (Neutral) and operate the engine at 1200–1500 rpm until it cools (2–3 minutes).

If the vehicle is stuck in deep sand, snow, or mud, it may be possible to rock it out using the following procedure:

1. Shift to **D** (Drive) and apply steady, light throttle (**never full throttle**).
2. When the vehicle has rocked forward as far as it will go, apply and hold the vehicle service brakes.
3. When engine has returned to idle, select **R** (Reverse).
4. Release the brakes and apply a steady, light throttle allowing the vehicle to rock in **R** (Reverse) as far as it will go.
5. Again, apply and hold the service brakes and allow the engine to return to idle.

This procedure may be repeated in **D** (Drive) and **R** (Reverse) if each directional shift continues to move the vehicle a greater distance. **Never** make **N** (Neutral)-to-**D** (Drive) or directional shift changes when the engine rpm is above idle.

## HIGH FLUID TEMPERATURE

The transmission is considered to be overheated when any of the following temperatures are exceeded:

Sump fluid	121°C (250°F)
Fluid to cooler	149°C (300°F)
Retarder out fluid	165°C (330°F)

If the transmission overheats during normal operations, check the fluid level in the transmission. Refer to the fluid level check procedures described in the Care And Maintenance section.



**CAUTION:** The engine should never be operated for more than 30 seconds at full throttle with the transmission in range and the output stalled. Prolonged operation of this type will cause the transmission fluid temperature to become excessively high and will cause severe overhear damage to the transmission.

If the engine temperature gauge indicates a high temperature, the transmission is probably overheated. Stop the vehicle and check the cooling system. If it appears to be functioning properly, run the engine at 1200–1500 rpm with the transmission in **N** (Neutral). This should reduce the transmission and engine temperatures to normal operating levels in 2 or 3 minutes. If temperatures do not decrease, reduce the engine rpm.

If the engine temperature indicates a high temperature, an engine or radiator problem is indicated. If high temperature in either the engine or transmission persists, stop the engine and have the overheating condition investigated by maintenance personnel.

## PARKING BRAKE



**WARNING:** If you leave the vehicle and the engine is running, the vehicle can move unexpectedly and you or others could be injured. If you must leave the engine running, **DO NOT LEAVE** the vehicle until you have completed all of the following procedures:

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

The parking brake is only intended to secure an unattended vehicle with the engine ignition **OFF**. Always maintain the vehicle parking brake system according to the manufacturer's specifications. The parking brake may not have sufficient capacity to restrain a vehicle with the engine running and the transmission in a forward or reverse-range. When the vehicle is unattended and the engine is in operation, the transmission **must be in N** (Neutral) with the **brakes fully applied** and the **wheels chocked**.

## TOWING OR PUSHING



**CAUTION:** Failure to lift the driving wheels off the road, disconnect the driveline, or remove the axle shafts before pushing or towing can cause serious transmission damage.

The engine cannot be started by pushing or towing. Before pushing or towing a vehicle do one of the following:

- Disconnect the driveline.
- Lift the drive wheels off the road.
- Remove the axle shafts from the drive wheels.

An auxiliary air supply will usually be required to actuate the vehicle brake system.

When the axle shafts are removed, be sure to cover the wheel openings to prevent loss of lubricant and entry of dust and dirt.

## TURNING OFF THE VEHICLE

Always select **N** (Neutral) prior to turning off the vehicle engine.

## CRUISE CONTROL OPERATION

Operating an Allison WTEC III-equipped vehicle on cruise control may cause the transmission to shift cycle if the cruise control speed setting is set too close to a scheduled shift point. One of the following actions may eliminate shift cycling:

- Select a different shift schedule by pushing the **MODE** button (refer to Figure 8 on the shift selector).
- Select a lower range by pushing the ↓ (Down) arrow or moving the lever on the shift selector.
- Change the cruise control setting away from the shift point.

Some vehicles equipped with an engine brake and an Allison WTEC III-equipped transmission will have the engine brake controlled by the ECU. This is done so the transmission will automatically select a lower range when the engine brake is turned on and the throttle is near idle position.

Operating a vehicle on cruise control with the engine brake turned on and controlled by the transmission ECU, may cause an unwanted application of the engine brake when the cruise control decelerates for downhill grades. Eliminate this condition by turning off the engine brake while operating the vehicle on cruise control.



## CARE AND MAINTENANCE

### PERIODIC INSPECTIONS

Allison HS transmissions require minimum maintenance. However, careful attention to the fluid level and connections for the electronic and hydraulic circuits is very important.

For easier inspection, the transmission should be kept clean. Make the following regular periodic inspections:

- For loose bolts and leaking fluid around fittings, lines, and transmission openings
- The condition of the electrical harnesses.
- The engine cooling system for evidence of transmission fluid which would indicate a faulty oil cooler.
- Breather (refer to Figure 2 and Figure 3) is clean and free from dirt or debris.

Report any abnormal condition to maintenance personnel.

### PREVENT MAJOR PROBLEMS

Help the WTEC III control system oversee the operation of the transmission.

Minor problems can be kept from becoming major problems if an Allison Transmission distributor or dealer is notified when one of these conditions occur:

- Shifting feels odd
- Transmission leaks fluid
- Unusual transmission-related sounds (changes in sound caused by normal engine thermostatic fan cycling, while climbing a long grade with a heavy load, have been mistaken for transmission-related sounds)
- CHECK TRANS light comes on frequently

### IMPORTANCE OF PROPER FLUID LEVEL

It is important that the proper fluid level be maintained at all times because the transmission fluid cools, lubricates, and transmits hydraulic power. If the fluid level is too low, the converter and clutches do not receive an adequate supply of fluid. If fluid level is too high, the fluid can aerate. Aerated fluid can cause the transmission to shift erratically or overheat.

HS transmissions have an oil level sensor (OLS) that allows the operator to obtain an indication of fluid level from the shift selector. However, no oil level sensor diagnostics take place unless the OLS is “autodetected” by the WTEC III control system.

Frequently check for the presence of oil level diagnostics if the transmission is known to contain an OLS. If an OLS is not detected during a fixed number of engine starts, the WTEC III system concludes that no OLS is present. If an OLS is known to be present, but has not been detected, then troubleshooting of the OLS circuit is required. After the OLS circuit is repaired, reset “autodetect” or manually select the OLS function using Allison DOC™ for PC diagnostic tool. Refer to Allison Transmission publication number TS2973EN, WTEC III Troubleshooting Manual, for detailed troubleshooting procedures.



**NOTE:** To correctly check the transmission fluid level using the dipstick, the transmission fluid must be at operating temperature. The oil level sensor method of checking the fluid level compensates for transmission fluid temperature between 60°C–104°C (140°F–220°F). Any temperature below 60°C (140°F) or above 104°C (220°F) will result in an **Invalid for Display** condition.

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## FLUID LEVEL CHECK USING PUSHBUTTON OR LEVER SHIFT SELECTOR

HS transmissions are equipped with an oil level sensor that is able to read fluid level information.



**NOTE:** Pushbutton and lever selectors can display one character at a time.

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1. Park the vehicle on a level surface, shift to **N** (Neutral), and apply the parking brake.
2. **Pushbutton shift selector**—Simultaneously press the ↑ (Up) and ↓ (Down) arrow buttons.
3. **Lever shift selector**—Press the display mode button one time.





**NOTE:** The fluid level check may be delayed until the following conditions are met:

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

The indication of a delayed fluid level check is a “—” in the display window followed by a numerical countdown display. The countdown, starting at 8, indicates the time remaining in the two minutes setting period.

- **Correct Fluid Level** — “o,L” is displayed (“o,L” represents “Fluid (Oil) Level Check Mode”), followed by “o,K.” The “o,K” display indicates the fluid is within the correct fluid level zone. The sensor display and the transmission dipstick may not agree exactly because the oil level sensor compensates for fluid temperature.



**NOTE:** Fluid level diagnostic displays occur one character at a time.

- **Low Fluid Level** — “o,L” is displayed (“o,L” represents “Fluid (Oil) Level Check Mode”), followed by “Lo” (“Lo” represents “Low Oil Level”) and the number of quarts the transmission fluid is low. Example: “2” indicates 2 additional quarts of fluid will bring the fluid level within the middle of the “oK” zone.
- **High Fluid Level** — “o,L” is displayed (“o,L” represents “Fluid (Oil) Level Check Mode”), followed by “HI” (“HI” represents “High Oil Level”) and the number of quarts the transmission is overfilled. Example: “1” indicates 1 quart of fluid above the full transmission level.
- **Invalid for Display** — “o,L” is displayed (“o,L” represents “Fluid (Oil) Level Check Mode”), followed by “—” and a numerical display. The numerical display is a fault code and indicates conditions are not proper to receive the fluid level information, or that there is a system malfunction. The fault codes that may be encountered are shown in the following table, Fluid Level Fault Codes.

**Fluid Level Fault Codes**

Display	Cause of Code
o,L, —, 0, X	Settling time too short
o,L, —, 5, 0	Engine speed (rpm) too low
o,L, —, 5, 9	Engine speed (rpm) too high

### Fluid Level Fault Codes (cont'd)

Display	Cause of Code
o,L, —, 6, 5	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*
* Report sensor failure display to a distributor or dealer in your area (check the telephone directory for an Allison Transmission distributor or dealer).	



**CAUTION:** A low or high fluid level can cause overheating and irregular shift patterns. Incorrect fluid level can damage the transmission.



**NOTE:** To exit the fluid level display mode, press any range button on the pushbutton shift selector, or press the display mode (diagnostic) button once on the lever shift selector.

## FLUID LEVEL CHECK USING DIAGNOSTIC TOOLS

The transmission must be equipped with the oil level sensor to be able to read fluid level information.

1. Park the vehicle on a level surface and shift to **N** (Neutral). Apply the parking brake and/or emergency brakes.
2. Obtain fluid level information by following the procedure in the Allison DOC™ For PC User Guide, GN3433EN or by using the OEM-supplied auxiliary display.
3. Fluid level information may be delayed when certain conditions are not met. The Allison DOC™ for PC diagnostic tool will display a message showing which conditions have not been met. These conditions are:
  - Settling time too short
  - Engine speed (rpm) too low
  - Engine speed (rpm) too high
  - **N** (Neutral) must be selected
  - Sump fluid temperature too low (below 60°C or 140°F)
  - Sump fluid temperature too high (above 104°C or 220°F)
  - Output shaft rotation

## MANUAL FLUID CHECK PROCEDURE

Refer to Figure 2 and Figure 3 for the location of the fill tube and dipstick.



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

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

Clean around the end of the fill tube before removing the dipstick (refer to Figure 9). This will aid in preventing dirt or foreign matter from entering the hydraulic system, which can cause:

- Valves to stick
- Undue wear of transmission parts
- Clogged passages.

Check the fluid level using the procedures in **COLD CHECK** and **HOT CHECK**. Report an abnormal fluid level to maintenance personnel.

### COLD CHECK

The Cold Check determines if the transmission has enough fluid to be operated safely until a Hot Check can be made.



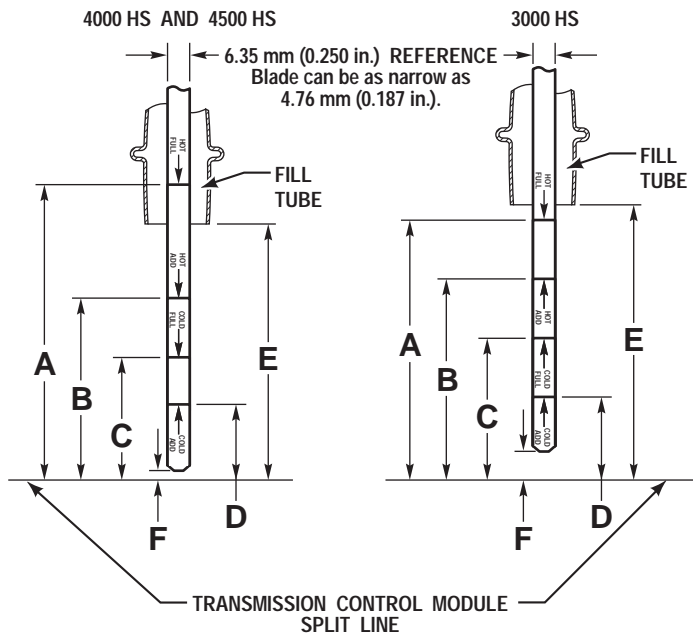
**NOTE:** The correct fluid level **can not be determined** unless the transmission is in a level position.



**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.



**CAUTION:** The fluid level rises as fluid temperature rises. DO NOT fill the transmission above the “**COLD CHECK**” band if the transmission fluid is below normal operating temperatures. During operation, an overfull transmission can become overheated, leading to transmission damage.



OIL SUMP	TRANSMISSION/SUMP DESCRIPTION	DIMENSION A	DIMENSION B	DIMENSION C	DIMENSION D	DIMENSION E	DIMENSION F**
4.00 in.***	4000 HS AND 4500 HS	106.7 mm (4.20 in.)	76.2 mm (3.00 in.)	66.0 mm (2.60 in.)	*	132.6 mm (5.22 in.)	13.8 mm (0.54 in.)
4.00 in.***	3000 HS	101.6 mm (4.00 in.)	63.5 mm (2.50 in.)	45.7 mm (1.80 in.)	*	86.6 mm (3.41 in.)	5.9 mm (0.23 in.)

**NOTE:** Calibrate level marking locations with respect to transmission control module split line and fill tube.

Scale none.

\*Dimension determined by installation.

\*\*Reference dimension only. Actual dimension to be determined by installation.

\*\*\*Reference drawing AS66-60.

\*\*\*\*Reference drawing AS67-60.

V07310.01.00

**Figure 9. Standard HS Transmission Dipstick Markings**

A cold check may be made after initial start-up and the presence of transmission fluid has been confirmed (the sump fluid temperature is then typically 16°–49°C (60°–120°F). To perform a COLD CHECK, do the following:

1. Start the engine and run it at idle (500–800 rpm) in **N** (Neutral) for about one minute. Shift to **D** (Drive) and then to **R** (Reverse) to clear the hydraulic circuits of air. Shift to **N** (Neutral) and leave engine at idle.
2. Move the vehicle to a level surface, put transmission in **N** (Neutral), and set the parking brake.
3. With the engine idling (500–800 rpm), shift to **D** (Drive) and then to **R** (Reverse) to clear air from the hydraulic circuits.
4. Shift to **N** (Neutral) and leave engine at idle.
5. Remove the dipstick and wipe it clean. Insert the dipstick into the fill tube, pushing down until it stops.
6. Remove the dipstick and observe the fluid level. If the fluid on the dipstick is within the COLD RUN band, the level is satisfactory. If the fluid level is **not** within this band, add or drain fluid as necessary to bring the level within the COLD RUN band.
7. Perform a Hot Check at the first opportunity after normal operating temperature (71°–93°C; 160°–200°F) is reached.



**CAUTION: DO NOT** operate the transmission for extended periods of time until a Hot Check has verified proper fluid level. Transmission damage can result from extended operation at improper fluid level conditions.



**CAUTION:** Obtain an accurate fluid level by imposing the following conditions:

- Engine is idling (500–800 rpm) in **N** (Neutral)
- Transmission fluid is at the proper temperature
- The vehicle is on a level surface.

## HOT CHECK

The transmission fluid **must be hot** to obtain an accurate check, because the fluid level rises as temperature increases.

To perform a HOT CHECK, do the following:

1. Be sure fluid has reached normal operating temperature (71°–93°C; 160°–200°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 allow the engine to idle (500–800 rpm).
3. Remove the dipstick and wipe it clean. Insert the dipstick into the fill tube, pushing down until it stops.
4. Remove the dipstick and observe the fluid level. The safe operating level is anywhere within the HOT RUN band on the dipstick.
5. If the level is not within this band, add or drain fluid as necessary to bring the level within the HOT RUN band.
6. Be sure fluid level checks are consistent. Check level more than once and if readings are not consistent, check to be sure the transmission breather is clean and not clogged. If readings are still not consistent, contact your nearest Allison distributor or dealer.

## RECOMMENDED AUTOMATIC TRANSMISSION FLUID AND VISCOSITY GRADE

- Hydraulic fluids used in the transmission are important influences on transmission performance, reliability, and durability. TranSynd™ and DEXRON®-III fluids are recommended for on-highway applications. TranSynd™ and DEXRON®-III fluids are recommended for all HS applications.
- TranSynd™ is a full synthetic transmission fluid developed by Allison Transmission and Castrol Ltd. This fluid meets Allison specifications for Severe Duty and Extended Drain Intervals. TranSynd™ is fully qualified to the Allison TES 295 specifications and is available through Allison distributors and dealerships.
- To be sure a fluid is qualified for use in Allison transmissions check for the DEXRON®-III license numbers on the container or consult the lubricant manufacturer. Consult your Allison Transmission dealer or distributor before using other fluid types.



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

- When choosing the optimum viscosity grade of fluid, duty cycle, preheat capabilities, and/or geographical location must be taken into consideration. The Transmission Fluid Operating Temperature Requirements table lists the minimum fluid temperatures at which the transmission may be safely operated without preheating. 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.

## Transmission Fluid Operating Temperature Requirements

SAE Viscosity Grade* or Fluid Type	Minimum Operating Temperature	
	Celsius	Fahrenheit
MIL-PRF-46167	-32	-25
SAE 0W-20 or TranSynd™	-30	-22
DEXRON® III	-25	-13
SAE 10W	-20	-4
SAE 15W-40	-15	5
SAE 30W	0	32
SAE 40W	10	50
* SAE "W" designation indicates winter weight based on cold temperature properties.		

## KEEPING FLUID CLEAN



**CAUTION:** Containers or fillers that have been used for antifreeze solution or engine coolant must NEVER be used for transmission fluid. Antifreeze and coolant solutions contain ethylene glycol which, if put into the transmission, can cause the clutch plates and some seals to fail.

It is absolutely necessary that transmission fluid be clean. The fluid **must be handled** in clean containers to prevent foreign material from entering the transmission.

## FLUID AND INTERNAL FILTER CHANGE INTERVAL RECOMMENDATIONS



**CAUTION:** Transmission fluid and filter change frequency is determined by the severity of transmission service. To help avoid transmission damage, more frequent changes can be necessary than recommended in the general guidelines when operating conditions create high levels of contamination or overheating.

Refer to the following tables for guidelines for fluid and filter change intervals.

## Recommended Fluid/Filter Change For 3000 HS Transmissions\*

**NOTE:** Severe and General Vocations — Local conditions, severity of operation, or duty cycle may require more or less frequent fluid change intervals that differ from the published recommended fluid change intervals of Allison Transmission. Transmission protection and fluid change intervals can be optimized by using fluid analysis. Filters **must be changed** at or before recommended intervals. Flushing machines are not recommended or recognized due to variations and inconsistencies with 100 percent removal of used fluid.

SEVERE VOCATION**				GENERAL VOCATION***			
Fluid	Filters			Fluid	Filters		
	Main	Internal	Lube/ Auxiliary		Main	Internal	Lube/ Auxiliary
Schedule 1 — Non-TranSynd™/Non-TES 295 Fluid							
12,000 Miles (20 000 km) 6 Months 500 Hours	12,000 Miles (20 000 km) 6 Months 500 Hours	Overhaul	12,000 Miles (20 000 km) 6 Months 500 Hours	25,000 Miles (40 000 km) 12 Months 1000 Hours	25,000 Miles (40 000 km) 12 Months 1000 Hours	Overhaul	25,000 Miles (40 000 km) 12 Months 1000 Hours
Schedule 2† — TranSynd™/TES 295 Fluid							
75,000 Miles (120 000 km) 36 Months 3000 Hours	75,000 Miles (120 000 km) 36 Months 3000 Hours	Overhaul	75,000 Miles (120 000 km) 36 Months 3000 Hours	150,000 Miles (240 000 km) 48 Months 4000 Hours	75,000 Miles (120 000 km) 36 Months 3000 Hours	Overhaul	75,000 Miles (120 000 km) 36 Months 3000 Hours
* Change fluid/filters after recommended mileage, months, or hours have elapsed, whichever comes first.							
** HS with retarders, on/off highway							
*** HS transmissions without retarders, on highway only.							
† Recommendations in Schedule 2 are based on the transmission containing 100 percent TranSynd™ fluid and Allison Transmission Gold Series filters.							



## Recommended Fluid/Filter Change For 4000 HS and 4500 HS Transmissions\*

**NOTE:** Severe and General Vocations — Local conditions, severity of operation, or duty cycle may require more or less frequent fluid change intervals that differ from the published recommended fluid change intervals of Allison Transmission. Transmission protection and fluid change intervals can be optimized by using fluid analysis. Filters **must be changed** at or before recommended intervals. Flushing machines are not recommended or recognized due to variations and inconsistencies with 100 percent removal of used fluid.

SEVERE VOCATION**				GENERAL VOCATION***					
Fluid	Filters			Fluid	Filters				
	Main	Internal	Lube/Auxiliary		Main	Internal	Lube/Auxiliary		
Schedule 1 — Non-TranSynd™/Non-TES 295 Fluid									
12,000 Miles (20 000 km) 6 Months 500 Hours	12,000 Miles (20 000 km) 6 Months 500 Hours	Overhaul	12,000 Miles (20 000 km) 6 Months 500 Hours	25,000 Miles (40 000 km) 12 Months 1000 Hours	25,000 Miles (40 000 km) 12 Months 1000 Hours	Overhaul	25,000 Miles (40 000 km) 12 Months 1000 Hours		
Schedule 2† — TranSynd™/TES 295 Fluid									
4 Inch Control Module (3.5 Inch Approximately) — Requires Filter Kit P/N 29540494									
75,000 Miles (120 000 km) 36 Months 3000 Hours	75,000 Miles (120 000 km) 36 Months 3000 Hours		Overhaul	75,000 Miles (120 000 km) 36 Months 3000 Hours	150,000 Miles (240 000 km) 48 Months 4000 Hours		75,000 Miles (120 000 km) 36 Months 3000 Hours	Overhaul	75,000 Miles (120 000 km) 36 Months 3000 Hours

\* Change fluid/filters after recommended mileage, months, or hours have elapsed, whichever comes first.

\*\* HS transmissions with retarders, on/off highway.

\*\*\* HS transmissions without retarders, on highway only.

† Recommendations in Schedules 2 are based on the transmission containing 100 percent TranSynd™ fluid and Allison Transmission Gold Series filters.



**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.

## Fluid Analysis

Transmission protection and fluid change intervals may be optimized by monitoring fluid oxidation according to the tests and limits shown in the Fluid Oxidation Measurement Limits table. Consult your local telephone directory for fluid analysis firms. To be sure of consistent and accurate fluid analysis, use only one fluid analysis firm. Refer to Technician's Guide for Automatic Transmission Fluid, GN2055EN, for additional information.

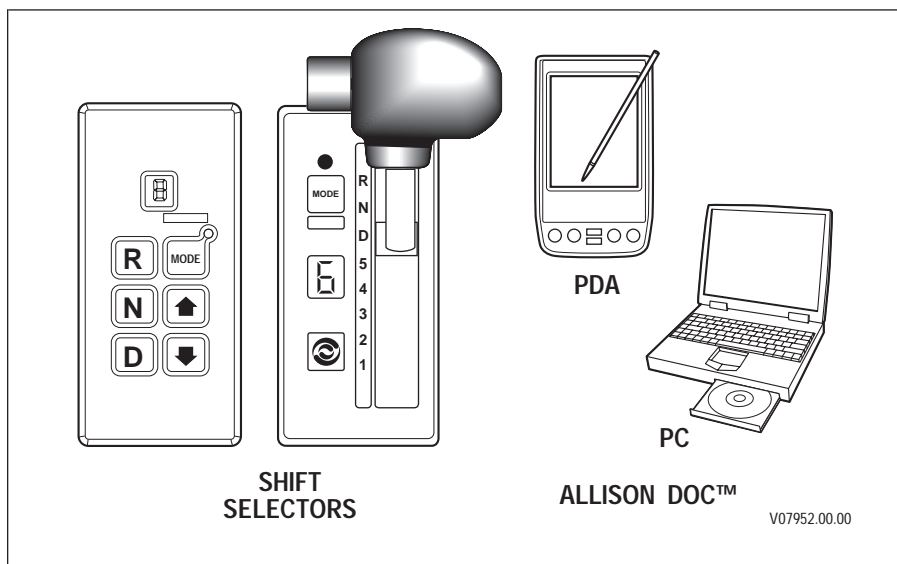
### Fluid Oxidation Measurement Limits

Test	Limit
Viscosity	$\pm 25$ percent change from new fluid
Total Acid Number (TAN)	+3.0* change from new fluid
* mg of potassium hydroxide (KOH) to neutralize a gram of fluid.	



## DIAGNOSIS

### DIAGNOSTIC CODES



**Figure 10. Shift Selectors/PDA/Allison DOC™ For PC Diagnostic Tool**

Poor performance may activate a code without illuminating the **CHECK TRANS** light. Continued illumination of the **CHECK TRANS** light during vehicle operation (not start-up) indicates the ECU has signaled a diagnostic code. Up to five diagnostic codes may be recorded. Diagnostic codes may be read and cancelled by using the Allison DOC™ for PC diagnostic tool or shift selectors shown in Figure 10. Refer to Allison Transmission publication number GN3433EN, Allison DOC™ for PC User Guide, for instructions on how to use the diagnostic tool. Code reading, clearing methods, and complete code descriptions are presented in Allison Transmission publication number TS2973EN, WTEC III Troubleshooting Manual.

## CUSTOMER SERVICE



### OWNER ASSISTANCE

The satisfaction and goodwill of the owners of Allison transmissions are of primary concern to Allison Transmission, its distributors, and their dealers.

There are Allison transmission 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).

Refer to Worldwide Sales and Service Directory (SA2229EN) for the current listing of Allison Transmission authorized distributor and service dealers. This directory is available from SGI, Inc.

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 the 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 resolved readily at the distributor level without additional assistance, **contact the Allison Transmission Regional Office responsible for the local distributor.** You will be assisted by a member of the Regional Service Manager’s staff, depending on the nature of your problem.

For prompt assistance, please have the following information available.

- Name and location of authorized distributor or dealer
- Type and make of equipment
- Transmission model number, serial number, and assembly number (if applicable). This data is available on the nameplate located on the right side of the transmission. Also provide the ECU identification number which may be located elsewhere in the vehicle.
- Transmission delivery date and accumulated miles and/or hours of operation
- Nature of problem
- Chronological summary of unit’s history

**Step Three** — If you contacted a regional office and you are still not satisfied, **present the entire matter to the Home Office by writing to the following address or calling the phone number below:**

Allison Transmission  
Manager, Warranty Administration – PF9  
P.O. Box 894  
Indianapolis, IN 46206-0894  
1-800-524-2303

The inclusion of all pertinent information will assist the Home Office in expediting the matter. If an additional review by the Home Office of all the facts involved indicates that some further action can be taken, the Regional Office will be advised.

When contacting the Regional or 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 the above steps be followed in sequence when experiencing a problem.

Your purchase of an Allison Transmission product is greatly appreciated, and it is our sincere desire to assure complete satisfaction.

# SERVICE LITERATURE

Additional service literature is available as shown in the service literature table. This service literature provides fully illustrated instructions for the operation, maintenance, service, overhaul, and parts support of your transmission. To be sure that you get maximum performance and service life from your unit, you may order publications from:

S&G, Inc.  
Attn: Allison Literature Fulfillment Desk  
8350 Allison Avenue  
Indianapolis, IN 46268  
TOLL FREE: 888-666-5799  
INTERNATIONAL: 317-471-4995

Available Service Literature

Transmission Model	3000 HS	4000 HS and 4500 HS
Automatic Transmission Fluid Technician's Guide	GN2055EN	GN2055EN
Mechanic's Tips	MT3004EN	MT3004EN
Operator's Manual	OM3750EN	OM3750EN
Parts Catalog	PC2150EN	PC2456EN
Parts Catalog CD-ROM	CD2150EN	CD2456EN
Principles of Operation	PO2454EN	PO2454EN
Service Manual	SM2148EN	SM2457EN
Electronic Troubleshooting Manual	TS2973EN	TS2973EN
Worldwide Sales and Service Directory	SA2229EN	SA2229EN



# **ALLISON TRANSMISSION DISTRIBUTORS**

## **EASTERN REGION**

Atlantic Detroit Diesel-Allison, LLC  
180 Route 17 South  
Lodi, NJ 07644  
201-489-5800

Penn Detroit Diesel-Allison, Inc.  
8330 State Road  
Philadelphia, PA 19136-2986  
215-335-0500

Covington Detroit Diesel-Allison  
8015 Piedmont Triad Parkway  
Greensboro, NC 27409  
663-292-9240

Western Branch Diesel, Inc.  
3504 Shipwright Street  
Portsmouth, VA 23703  
757-673-7000

Johnson & Towers, Inc.  
2021 Briggs Road  
Mount Laurel, NJ 08054  
856-234-6990

Williams Detroit Diesel-Allison  
Southeast, Inc.  
2849 Moreland Avenue, S.E  
Atlanta, GA 30315-0037  
404-366-1070

New England Detroit Diesel-Allison, Inc.  
90 Bay State Road  
Wakefield, MA 01880-1095  
781-246-1810

## **CENTRAL REGION**

Caribe Detroit Diesel-Allison  
Division of GT Corporation  
Ceramic Ind. Park, Campo Rico Ave.,  
Block C  
Carolina, Puerto Rico 00982  
787-750-5000

Inland Detroit Diesel-Allison, Inc.  
210 Alexandra Way  
Carol Stream, IL 60188  
630-871-1111

Central Detroit Diesel-Allison, Inc.  
9200 Liberty Drive  
Liberty, MO 64068  
816-781-8070

Inland Diesel, Inc.  
13015 West Custer Avenue  
Butler, WI 53007-0916  
262-781-7100

Clarke Detroit Diesel-Allison, Inc.  
3133 East Kemper Road  
Cincinnati, OH 45241  
513-771-2200

Interstate Detroit Diesel  
2501 East 80th Street  
Minneapolis, MN 55425  
952-854-5511

Florida Detroit Diesel-Allison, Inc.  
5105 Bowden Road  
Jacksonville, FL 32216  
904-737-7330

Williams Detroit Diesel-Allison  
Midwest, Inc.  
1176 Industrial Parkway  
North Brunswick, OH 44212-2342  
330-225-7751

## **SOUTHWESTERN REGION**

Detroit Diesel-Allison De Mexico S.A. de C.V. Av. Santa Rosa No. 58 Col. Ampliacion Norte Tlalnepantla, Estado de Mexico C.P. 54160 (525)6-333-1800	Stewart & Stevenson Services, Inc. 2707 North Loop West Houston, TX 77008 713-868-7700
Stewart & Stevenson Power, Inc. 5840 Dahlia Street Commerce City, CO 80022 303-287-7441	United Engines, LLC 5555 West Reno Avenue Oklahoma City, OK 73127 405-947-3321

## **WESTERN REGION**

Pacific Detroit Diesel-Allison Company 7215 South 228th Street Kent, WA 98032 253-854-0505	Valley Detroit Diesel-Allison, Inc. 425 South Hacienda Boulevard City of Industry, CA 91745-1123 626-333-1243
Smith Detroit Diesel-Allison, Inc. 250 West 3900 South Salt Lake City, UT 84107 801-415-5000	Williams Detroit Diesel-Allison Southwest, Inc. 2602 S. 19th Avenue Phoenix, AZ 85009 602-257-0561
Stewart & Stevenson 1755 Adams Avenue San Leandro, CA 94577-1001 510-635-8991	



## CANADIAN REGION

Detroit Diesel-Allison  
British Columbia Ltd.  
9300 192nd Street  
Surrey, British Columbia V4N 3R8  
604-888-1211

Detroit Diesel-Allison Canada East  
Div. of Integrated Power Systems Corp  
2997 Rue Watt  
Ste. Foy, Quebec G1X 3W1  
418-651-5371

Harper Detroit Diesel Ltd.  
10 Diesel Drive  
Toronto, Ontario M8W 2T8  
416-259-3281

Midwest Detroit Diesel-Allison Ltd.  
1460 Waverley Street  
Winnipeg, Manitoba R3T 0P6  
204-452-8244

Waterous Detroit Diesel-Allison (Div.  
of Integrated Power Systems Corp)  
10025 51st Avenue  
Edmonton, Alberta T6E 0A8  
780-437-3550

## **ALLISON TRANSMISSION REGIONAL OFFICES**

### **EASTERN REGION**

P.O. Box 400  
Columbus, NJ 08022-0400  
609-298-2541

### **CENTRAL REGION**

P. O. Box 894, Speed Code PF06  
Indianapolis, IN 46206-0894  
317-242-2327

### **SOUTHWESTERN REGION**

Av. Ejercito Nacional No. 843  
Colonia Granada  
Mexico, D.F. C.P. 11520  
525-901-3057  
Texas Office: 936-321-4248  
Fax: 936-321-4278

### **WESTERN REGION**

39465 Paseo Padre Parkway Suite 3500  
Fremont, CA 94538  
510-498-5208

### **CANADIAN REGION**

P. O. Box 5160 Station A  
London, Ontario N6A 4N5  
519-452-5256

## NOTES

## NOTES

## NOTES

