WARNINGS, CAUTIONS, AND 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.

TRADEMARK INFORMATION

DEXRON® is a registered trademark of General Motors Corporation.
1000 Series™ is a registered trademark of General Motors Corporation.
2000 Series™ is a registered trademark of General Motors Corporation.
TranSynd™ is a registered trademark of Castrol, Ltd.
2400 Series™ is a registered trademark of General Motors Corporation.
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Allison 1000/2000/2400 Series transmissions provide many advantages for the driver who must “stop and go” or change speeds frequently. Driving is easier, safer, and more efficient.

The 1000/2000/2400 Series transmissions are rugged and designed to provide long, trouble-free service. This handbook will help you gain maximum benefits from your ALLISON-equipped vehicle.
1000 / 2000 / 2400 SERIES TRANSMISSION — LEFT-FRONT VIEW

Figure 1. 1000/2000/2400 Series Transmission — Left-Front View
Figure 2. 1000/2000/2400 Series Transmission — Right-Rear View
A BRIEF DESCRIPTION OF THE ALLISON
1000/2000/2400 SERIES TRANSMISSIONS

The 1000/2000/2400 Series transmissions are fully automatic, torque-converter driven, electronically controlled transmissions best suited for light-medium duty, on-highway applications. Each transmission series contains features which have been designed for specific vocational needs.

- 1000 Series™ — These models are best suited for light duty on-highway applications. The 1000 Series™ transmissions have park pawls.

- 2000 and 2400 Series — These models are best suited for single-axle medium duty on-highway applications. The 2400 Series™ transmissions have park pawls; the 2000 Series™ transmissions do not have park pawls.

The park pawl exists but cannot be engaged in some vehicle configurations using 1000 Series™ and 2400 Series™ transmissions (e.g., some rear engine vehicles with air brakes). For these configurations, the P (Park) position is not used.

A provision to mount a Power Takeoff (PTO) is available on all models. The PTO drive gear is optional.

All models have up to five forward ranges and one reverse. All clutches are hydraulically-actuated, spring-released, and have automatic compensation for wear. Gearing is helical type, arranged in planetary sets. Electronic controls provide automatic gear selection in each drive range and automatic engagement of the torque converter (lockup) clutch.

ELECTRONIC CONTROL SYSTEM

The 1000/2000/2400 Series control system consists of five major components connected by customer-furnished wiring harnesses — Transmission Control Module (TCM), engine throttle position sensor (or direct electronic communication), three speed sensors, NSBU switch, and control valve module (which contains solenoid valves and a pressure switch module). The throttle position sensor (or engine-to-transmission communication link), speed sensors, pressure switch module, and NSBU switch transmit information to the TCM. The TCM processes this information and then sends signals to actuate specific solenoids located on the control valve module in the transmission. These solenoids control both oncoming and offgoing clutch pressures to provide closed-loop shift control by matching rpm during a shift to a previously established desired profile that is programmed into the TCM.

The 1000/2000/2400 Series electronic control system has the “adaptive shifting” feature. Adaptive shifting helps optimize shift quality by monitoring critical characteristics of clutch engagement and making on-going adjustments to improve subsequent shifts. The transmission shift calibration is based on several different types of shifts, e.g., full throttle, part throttle, closed throttle — upshifts, downshifts,
etc. Each shift is associated with specific speed and throttle position parameters. In order to optimize each type of shift for normal driving, shift controls must experience operation and shifting in a wide variety of operating conditions.

A “drive in” period under varied driving conditions is required before the Adaptive Controls can be expected to optimize each and every shift. In general, shift quality will begin to converge to their “adapted” level after five typical shifts of a particular shift type.

**TORQUE CONVERTER**

The torque converter consists of three elements — pump, turbine, and stator. The pump is the input element and is driven directly by the engine. The turbine is the output element and is hydraulically driven by the pump. The stator is the 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.

All 1000/2000/2400 Series torque converters contain a torque converter (lockup) clutch. When engaged, this clutch causes the torque converter pump and turbine to be locked together, thus enabling them to rotate in unison at engine speed. This condition, commonly referred to as “torque converter clutch operation,” thus provides direct drive through the transmission. This type of operation maximizes engine braking and enhances fuel economy. The torque converter (lockup) clutch is regulated by the shift controls to engage automatically. The torque converter clutch releases at lower speeds or when the TCM detects conditions requiring it to be released. The torque converter clutch contains a damping mechanism which reduces the transmittal of engine-induced torsional vibrations into and beyond the transmission.

**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 five forward speeds and one reverse speed. The clutches are applied and released hydraulically in response to electronic signals from the TCM to the appropriate solenoids.

**COOLER CIRCUIT**

The transmission fluid is cooled by a remote-mounted oil cooler. The bottom of the transmission torque converter housing provides for the direct mounting of a control main filter and includes two ports to facilitate the attachment of the oil cooler lines.
Figure 3. 1000 Series™ Transmission Cross Section
2000 Series™ — CROSS SECTION

Figure 4. 2000 Series™ Transmission Cross Section
Same as 1000 Series™ except as shown

Figure 5. 2400 Series™ Transmission Cross Section
1000 Series™ — CROSS SECTION
with Optional Converter Housing and Rear Cover

Figure 6. 1000 Series™ Transmission Cross Section With Optional Converter Housing and Rear Cover
DESCRIPTION OF AVAILABLE TYPES

The 1000/2000/2400 Series transmissions use lever-type shift selectors. The shift positions on the shift selector can vary according to the shift selector installed.

OPERATION OF THE SHIFT SELECTOR

The shift selector is used by the operator to select the following ranges.

- Park (P) for transmissions with park pawls
- Auto-Apply Parking Brake (PB) for vehicles with automatically engaged parking brakes
- Reverse (R)
- Neutral (N)
- Drive (D)*
- Fourth Range (4)**
- Third Range (3)**
- Second Range (2)**
- First Range (1)

* The shift selector position representing this gear range may be labeled “5” (for the highest gear in the range), “OD” (for Overdrive), “D” (for the normal Drive position), or “1–5” (for the complete gear range).

** In 5 speed calibrations, one of these ranges will not be available.

Ranges are selected by moving the lever to the desired selector position (P, PB, R, N, D, 4, 3, 2, or 1). Five speed transmission models have five forward ranges, first through fifth. Four speed models have four forward ranges, first through fourth. When a forward range has been selected, the transmission automatically upshifts through each range. As the vehicle slows, the transmission will downshift automatically through each range.

The following tables list the shift selector positions and corresponding ranges for all 1000/2000/2400 Series models.
### All 1000 and 2400 Models With P (Park) Position

<table>
<thead>
<tr>
<th>Shift Selector Position</th>
<th>Range</th>
<th>Shift Selector Position</th>
<th>Range</th>
<th>Shift Selector Position</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>P (Park)</td>
<td>Neutral*</td>
<td>P (Park)</td>
<td>Neutral*</td>
<td>P (Park)</td>
<td>Neutral*</td>
</tr>
<tr>
<td>R (Reverse)</td>
<td>Reverse</td>
<td>R (Reverse)</td>
<td>Reverse</td>
<td>R (Reverse)</td>
<td>Reverse</td>
</tr>
<tr>
<td>N (Neutral)</td>
<td>Neutral</td>
<td>N (Neutral)</td>
<td>Neutral</td>
<td>N (Neutral)</td>
<td>Neutral</td>
</tr>
<tr>
<td>D (Drive)***</td>
<td>1–5</td>
<td>D (Drive)***</td>
<td>1–5</td>
<td>D (Drive)***</td>
<td>1–5 (1–4)**</td>
</tr>
<tr>
<td>4 (Fourth)</td>
<td>1–4</td>
<td>4 (Fourth)</td>
<td>1–4</td>
<td>3 (Third)</td>
<td>1–3</td>
</tr>
<tr>
<td>3 (Third)</td>
<td>1–3</td>
<td>2 (Second)</td>
<td>1–2</td>
<td>2 (Second)</td>
<td>1–2</td>
</tr>
<tr>
<td>1 (First)</td>
<td>1</td>
<td>1 (First)</td>
<td>1</td>
<td>1 (First)</td>
<td>1</td>
</tr>
</tbody>
</table>

* With Park Pawl engaged  
** 1–4 in Trailering Mode or 4 Speed Calibration  
*** The shift selector position representing this gear range may be labeled “5” (for the highest gear in the range), “OD” (for Overdrive), “D” (for the normal Drive position), or “1–5” (for the complete gear range).

### All 1000 and 2400 Models Without P (Park) Position

<table>
<thead>
<tr>
<th>Shift Selector Position</th>
<th>Range</th>
<th>Shift Selector Position</th>
<th>Range</th>
<th>Shift Selector Position</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>R (Reverse)</td>
<td>Reverse</td>
<td>R (Reverse)</td>
<td>Reverse</td>
<td>R (Reverse)</td>
<td>Reverse</td>
</tr>
<tr>
<td>N (Neutral)</td>
<td>Neutral</td>
<td>N (Neutral)</td>
<td>Neutral</td>
<td>N (Neutral)</td>
<td>Neutral</td>
</tr>
<tr>
<td>D (Drive)***</td>
<td>1–5</td>
<td>D (Drive)***</td>
<td>1–5</td>
<td>D (Drive)***</td>
<td>1–5 (1–4)**</td>
</tr>
<tr>
<td>4 (Fourth)</td>
<td>1–4</td>
<td>4 (Fourth)</td>
<td>1–4</td>
<td>3 (Third)</td>
<td>1–3</td>
</tr>
<tr>
<td>3 (Third)</td>
<td>1–3</td>
<td>2 (Second)</td>
<td>1–2</td>
<td>2 (Second)</td>
<td>1–2</td>
</tr>
<tr>
<td>1 (First)</td>
<td>1</td>
<td>1 (First)</td>
<td>1</td>
<td>1 (First)</td>
<td>1</td>
</tr>
</tbody>
</table>

* With Park Pawl engaged  
** 1–4 in Trailering Mode or 4 Speed Calibration  
*** The shift selector position representing this gear range may be labeled “5” (for the highest gear in the range), “OD” (for Overdrive), “D” (for the normal Drive position), or “1–5” (for the complete gear range).
There are several features of the 1000/2000/2400 Series transmissions that can inhibit transmission shifting. See the SHIFT INHIBITS paragraph of this manual.

With an Allison-equipped vehicle, selecting the right moment to upshift or downshift during changing road and traffic conditions is not necessary. The Allison 1000/2000/2400 Series transmission does it for you. However, knowledge of the ranges and when to select them will make vehicle control and your job even easier.
**RANGE SELECTION — ALL 1000 AND 2400 MODELS WITH P (PARK) POSITIONS**

**WARNING:** For vehicles containing 1000 and 2400 models with P (Park) positions, each time you park the vehicle or leave the operator’s station with the engine running, do the following.

- Bring the vehicle to a complete stop using the service brake.
- Ensure that the engine is at low idle rpm.
- Put the transmission in P (Park).
- Engage the P (Park) range by slowly releasing the service brake.
- Apply the emergency brake and/or parking brake, if present, and make sure it is properly engaged.
- If the operator’s station will be unoccupied with the engine running, chock the wheels and take any other steps necessary to keep the vehicle from moving.

If this procedure is not followed, the vehicle can move suddenly and cause injury and/or property damage.

**P**

Use P (Park) for the following.

- to turn on or turn off the engine
- to check vehicle accessories
- to operate the engine in idle for longer than five minutes
- for stationary operation of the power takeoff (if your vehicle is equipped with a PTO)

This position places the transmission in N (Neutral) and engages the park pawl.

**WARNING:** R (Reverse) may not be obtained due to an active inhibitor. The range selected may not be obtained, resulting in unexpected vehicle motion. To help avoid injury and/or property damage, always apply the service brakes when selecting R (Reverse). Check for the RANGE INHIBIT(ED) light or the CHECK TRANS light. See the SHIFT INHIBITS paragraph of this manual.

**WARNING:** To help avoid injury and/or property damage caused by movement of the vehicle, do not make shifts from R (Reverse) to N (Neutral) without applying the service brakes, parking brake, or emergency brake. Selecting N (Neutral) does not apply vehicle brakes unless an auxiliary system to apply a parking brake is installed.

(continued on next page)
### RANGE SELECTION — ALL 1000 AND 2400 MODELS WITH P (PARK) POSITIONS

(cons’d)

| **R** | R (Reverse) is used to back the vehicle. Completely stop the vehicle and let the engine return to idle before shifting from a forward range to R (Reverse) or from R (Reverse) to a forward range. The reverse warning signal is activated when the shift selector is in this position. |
| **N** | This position places the transmission in N (Neutral). Used for starting engine and stationary operation. |

**CAUTION:** Do not idle in R (Reverse) for more than five minutes. Extended idling in R (Reverse) may cause transmission overheating and damage. Always select P (Park) whenever time at idle exceeds five minutes.

**WARNING:** To help avoid injury or property damage caused by sudden movement of the vehicle, do not make shifts from N (Neutral) to a forward range or from N (Neutral) to R (Reverse) without applying the service brakes, parking brake, or emergency brake.

**WARNING:** If you let the vehicle coast in N (Neutral), there is no engine braking and you could lose control. Coasting can also cause severe transmission damage. To help avoid injury and/or property damage, do not allow the vehicle to coast in N (Neutral).

**WARNING:** D (Drive) and other forward ranges may not be obtained due to an active inhibitor. The range selected may not be obtained, resulting in unexpected vehicle motion. To help avoid injury and/or property damage, always apply the service brakes when selecting D (Drive) or other forward ranges. Check for the RANGE INHIBIT(ED) light or the CHECK TRANS light. See the SHIFT INHIBITS paragraph of this manual.

(continued on next page)
### WARNING:
To help avoid injury and/or property damage caused by movement of the vehicle, do not make shifts from a forward range to N (Neutral) without applying the service brakes, parking brake, or emergency brake. Selecting N (Neutral) does not apply vehicle brakes unless an auxiliary system to apply a parking brake is installed.

### CAUTION:
Do not idle in D (Drive) or any forward range for more than five minutes. Extended idling in D (Drive) may cause transmission overheating and damage. Always select P (Park) if time at idle is longer than five minutes.

### NOTE:
Turn off the vehicle HIGH IDLE switch, if present, before shifting from N (Neutral) to D (Drive) or R (Reverse). D (Drive) or R (Reverse) will not be attained unless the shift is made with the engine at idle.

<table>
<thead>
<tr>
<th>D*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use D (Drive) for normal driving. The transmission will initially attain first range when D (Drive) is selected. As vehicle speed increases, the transmission will upshift automatically through each available range up to 4 (Fourth Range) or 5 (Fifth Range). As the vehicle slows, the transmission will downshift automatically.</td>
</tr>
</tbody>
</table>

* The shift selector position representing this gear range may be labeled “5” (for the highest gear in the range), “OD” (for Overdrive), “D” (for the normal Drive position), or “1–5” (for the complete gear range).

### WARNING:
The transmission incorporates a hold feature to prohibit upshifting above the range selected during normal driving. For downhill operation, select a lower transmission range. If the engine-governed speed is exceeded in the held range, however, the transmission may upshift to the next higher range. To help avoid injury and/or property damage due to loss of vehicle control, use the vehicle brakes to prevent exceeding engine governed speed in the held range.

(continued on next page)
WARNING: If you just downshift or just use service brakes when going downhill, you can lose control and cause injury and/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.

<table>
<thead>
<tr>
<th>4*</th>
<th>Use 4 (Fourth Range) or 3 (Third Range) for city traffic and braking on steep downgrades.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3*</td>
<td>* 3 for shift selectors with P,R,N,D,3,2,1</td>
</tr>
<tr>
<td></td>
<td>Actual ranges available depend on programming by vehicle manufacturer.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3*</th>
<th>Use 3 (Third Range) or 2 (Second Range) for heavy city traffic and braking on steeper downgrades.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2*</td>
<td>* 3 for shift selectors with P,R,N,D,4,3,1</td>
</tr>
<tr>
<td></td>
<td>Actual ranges available depend on programming by vehicle manufacturer.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1</th>
<th>Use 1 (First Range) range for the following.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• when pulling through mud and deep snow</td>
</tr>
<tr>
<td></td>
<td>• when maneuvering in tight spaces</td>
</tr>
<tr>
<td></td>
<td>• while driving up or down very steep grades</td>
</tr>
<tr>
<td></td>
<td>First range provides the vehicle with its maximum driving torque and maximum engine braking effect.</td>
</tr>
</tbody>
</table>
WARNING: For vehicles containing 1000 and 2400 models without P (Park) positions, each time you park the vehicle or leave the operator’s station with the engine running, do the following.

- Bring the vehicle to a complete stop using the service brake.
- Ensure that the engine is at low idle rpm.
- Put the transmission in N (Neutral).
- Apply the emergency brake and/or parking brake and make sure they are properly engaged.
- If the operator’s station will be unoccupied with the engine running, chock the wheels and take any other steps necessary to keep the vehicle from moving.

If this procedure is not followed, the vehicle can move suddenly and cause injury and/or property damage.

WARNING: R (Reverse) may not be obtained due to an active inhibitor. The range selected may not be obtained, resulting in unexpected vehicle motion. To help avoid injury and/or property damage, always apply the service brakes when selecting R (Reverse). Check for the RANGE INHIBIT(ED) light or the CHECK TRANS light. See the SHIFT INHIBITS paragraph of this manual.

WARNING: To help avoid injury and/or property damage caused by movement of the vehicle, do not make shifts from R (Reverse) to N (Neutral) without applying the service brakes, parking brake, or emergency brake. Selecting N (Neutral) does not apply vehicle brakes unless an auxiliary system to apply a parking brake is installed.

CAUTION: Do not idle in R (Reverse) for more than five minutes. Extended idling in R (Reverse) may cause transmission overheating and damage. Always select N (Neutral) whenever time at idle exceeds five minutes.

R (Reverse) is used to back the vehicle. Completely stop the vehicle and let the engine return to idle before shifting from a forward range to R (Reverse) or from R (Reverse) to a forward range. The reverse warning signal is activated when the shift selector is in this position.
### RANGE SELECTION — ALL 1000 AND 2400 MODELS
**WITHOUT P (PARK) POSITIONS (cont’d)**

<table>
<thead>
<tr>
<th>![Warning Icon]</th>
<th><strong>WARNING:</strong> To help avoid injury or property damage caused by sudden movement of the vehicle, do not make shifts from <strong>N</strong> (Neutral) to a forward range or from <strong>N</strong> (Neutral) to <strong>R</strong> (Reverse) without applying the service brakes, parking brake, or emergency brake.</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Warning Icon]</td>
<td><strong>WARNING:</strong> If you let the vehicle coast in <strong>N</strong> (Neutral), there is no engine braking and you could lose control. Coasting can also cause severe transmission damage. To help avoid injury and/or property damage, do not allow the vehicle to coast in <strong>N</strong> (Neutral).</td>
</tr>
</tbody>
</table>
| **N** | Use **N** (Neutral) for the following.  
- to turn on or turn off the engine  
- to check vehicle accessories  
- to operate the engine in idle for longer than five minutes  
- for stationary operation of the power takeoff (if your vehicle is equipped with a PTO) |
| ![Warning Icon] | **WARNING:** **D** (Drive) and other forward ranges may not be obtained due to an active inhibitor. The range selected may not be obtained, resulting in unexpected vehicle motion. To help avoid injury and/or property damage, always apply the service brakes when selecting **D** (Drive) or other forward ranges. Check for the **RANGE INHIBITED** light or the **CHECK TRANS** light. See the **SHIFT INHIBITS** paragraph of this manual. |
| ![Warning Icon] | **WARNING:** To help avoid injury and/or property damage caused by movement of the vehicle, do not make shifts from a forward range to **N** (Neutral) without applying the service brakes, parking brake, or emergency brake. Selecting **N** (Neutral) does not apply vehicle brakes unless an auxiliary system to apply a parking brake is installed. |

(continued on next page)
### RANGE SELECTION — ALL 1000 AND 2400 MODELS
**WITHOUT P (PARK) POSITIONS (cont’d)**

<table>
<thead>
<tr>
<th>CAUTION:</th>
<th>Do not idle in <strong>D</strong> (Drive) or any forward range for more than five minutes. Extended idling in <strong>D</strong> (Drive) may cause transmission overheating and damage. Always select <strong>N</strong> (Neutral) if time at idle is longer than five minutes.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NOTE:</strong></td>
<td>Turn off the vehicle HIGH IDLE switch, if present, before shifting from <strong>N</strong> (Neutral) to <strong>D</strong> (Drive) or <strong>R</strong> (Reverse). <strong>D</strong> (Drive) or <strong>R</strong> (Reverse) will not be attained unless the shift is made with the engine at idle.</td>
</tr>
</tbody>
</table>
| **D*** | Use **D** (Drive) for normal driving. The transmission will initially attain first range when **D** (Drive) is selected. As vehicle speed increases, the transmission will upshift automatically through each available range up to **4** (Fourth Range) or **5** (Fifth Range). As the vehicle slows, the transmission will downshift automatically.  
  * The shift selector position representing this gear range may be labeled “5” (for the highest gear in the range), “OD” (for Overdrive), “D” (for the normal Drive position), or “1–5” (for the complete gear range). |
| **WARNING:** | The transmission incorporates a hold feature to prohibit upshifting above the range selected during normal driving. For downhill operation, select a lower transmission range. If the engine-governed speed is exceeded in the held range, however, the transmission may upshift to the next higher range. To help avoid injury and/or property damage due to loss of vehicle control, use the vehicle brakes to prevent exceeding engine governed speed in the held range. |

(continued on next page)
### RANGE SELECTION — ALL 1000 AND 2400 MODELS
**WITHOUT P (PARK) POSITIONS (cont’d)**

<table>
<thead>
<tr>
<th>4*</th>
<th>Use 4 (Fourth Range) or 3 (Third Range) for city traffic and braking on steep downgrades.</th>
</tr>
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<tbody>
<tr>
<td>3*</td>
<td>* 3 for shift selectors with R,N,D,3,2,1</td>
</tr>
<tr>
<td></td>
<td>Actual ranges available depend on programming by vehicle manufacturer.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3*</th>
<th>Use 3 (Third Range) or 2 (Second Range) for heavy city traffic and braking on steeper downgrades.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2*</td>
<td>* 3 for shift selectors with R,N,D,4,3,1</td>
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<tr>
<td></td>
<td>Actual ranges available depend on programming by vehicle manufacturer.</td>
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<tr>
<th>1</th>
<th>Use 1 (First Range) range for the following.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• when pulling through mud and deep snow</td>
</tr>
<tr>
<td></td>
<td>• when maneuvering in tight spaces</td>
</tr>
<tr>
<td></td>
<td>• while driving up or down very steep grades</td>
</tr>
<tr>
<td></td>
<td>First range provides the vehicle with its maximum driving torque and maximum engine braking effect.</td>
</tr>
</tbody>
</table>
**RANGE SELECTION — ALL 2000 MODELS WITH AUTO-APPLY PARKING BRAKE**

<table>
<thead>
<tr>
<th><strong>WARNING:</strong> For vehicles containing 2000 models with auto-apply parking brake, each time you park the vehicle or leave the operator’s station with the engine running, do the following.</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Bring the vehicle to a complete stop using the service brake.</td>
</tr>
<tr>
<td>• Ensure that the engine is at low idle rpm.</td>
</tr>
<tr>
<td>• Put the transmission in <strong>PB</strong> (Auto-Apply Parking Brake). Make sure that the parking brake is properly engaged.</td>
</tr>
<tr>
<td>• Apply the emergency brake, if present, and make sure it is properly engaged.</td>
</tr>
<tr>
<td>• If the operator’s station will be unoccupied with the engine running, chock the wheels and take any other steps necessary to keep the vehicle from moving.</td>
</tr>
</tbody>
</table>

If this procedure is not followed, the vehicle can move suddenly and cause injury and/or property damage.

---

**PB**

Use **PB** (Auto-Apply Parking Brake) for the following.

- to turn on or turn off the engine
- to check vehicle accessories
- to operate the engine in idle for longer than five minutes
- for stationary operation of the power takeoff (if your vehicle is equipped with a PTO)

This position places the transmission in **N** (Neutral) and engages the parking brake.

---

**WARNING:** **R** (Reverse) may not be obtained due to an active inhibitor. The range selected may not be obtained, resulting in unexpected vehicle motion. To help avoid injury and/or property damage, always apply the service brakes when selecting **R** (Reverse). Check for the **RANGE INHIBIT(ED)** light or the **CHECK TRANS** light. See the SHIFTS INHIBITS paragraph of this manual.

---

**WARNING:** To help avoid injury and/or property damage caused by movement of the vehicle, do not make shifts from **R** (Reverse) to **N** (Neutral) without applying the service brakes, parking brake, or emergency brake. Selecting **N** (Neutral) does not apply vehicle brakes unless an auxiliary system to apply a parking brake is installed.

(continued on next page)
<table>
<thead>
<tr>
<th><strong>WARNING:</strong> To help avoid injury or property damage caused by sudden movement of the vehicle, do not make shifts from N (Neutral) to a forward range or from N (Neutral) to R (Reverse) without applying the service brakes, parking brake, or emergency brake.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CAUTION:</strong> Do not idle in R (Reverse) for more than five minutes. Extended idling in R (Reverse) may cause transmission overheating and damage. Always select PB (Auto-Apply Parking Brake) whenever time at idle exceeds five minutes.</td>
</tr>
<tr>
<td><strong>WARNING:</strong> If you let the vehicle coast in N (Neutral), there is no engine braking and you could lose control. Coasting can also cause severe transmission damage. To help avoid injury and/or property damage, do not allow the vehicle to coast in N (Neutral).</td>
</tr>
<tr>
<td><strong>WARNING:</strong> D (Drive) and other forward ranges may not be obtained due to an active inhibitor. The range selected may not be obtained, resulting in unexpected vehicle motion. To help avoid injury and/or property damage, always apply the service brakes when selecting D (Drive) or other forward ranges. Check for the RANGE INHIBIT(ED) light or the CHECK TRANS light. See the SHIFT INHIBITS paragraph of this manual.</td>
</tr>
</tbody>
</table>

R (Reverse) is used to back the vehicle. Completely stop the vehicle and let the engine return to idle before shifting from a forward range to R (Reverse) or from R (Reverse) to a forward range. The reverse warning signal is activated when the shift selector is in this position.

This position places the transmission in N (Neutral). Used for starting engine and stationary operation.
### WARNING:

To help avoid injury and/or property damage caused by movement of the vehicle, do not make shifts from a forward range to N (Neutral) without applying the service brakes, parking brake, or emergency brake. Selecting N (Neutral) does not apply vehicle brakes unless an auxiliary system to apply a parking brake is installed.

### CAUTION:

Do not idle in D (Drive) or any forward range for more than five minutes. Extended idling in D (Drive) may cause transmission overheating and damage. Always select PB (Auto-Apply Parking Brake) if time at idle is longer than five minutes.

### NOTE:

Turn off the vehicle HIGH IDLE switch, if present, before shifting from N (Neutral) to D (Drive) or R (Reverse). D (Drive) or R (Reverse) will not be attained unless the shift is made with the engine at idle.

### D*

Use D (Drive) for normal driving. The transmission will initially attain first range when D (Drive) is selected. As vehicle speed increases, the transmission will upshift automatically through each available range up to 4 (Fourth Range) or 5 (Fifth Range). As the vehicle slows, the transmission will downshift automatically.

* The shift selector position representing this gear range may be labeled “5” (for the highest gear in the range), “OD” (for Overdrive), “D” (for the normal Drive position), or “1–5” (for the complete gear range).

### WARNING:

The transmission incorporates a hold feature to prohibit upshifting above the range selected during normal driving. For downhill operation, select a lower transmission range. If the engine-governed speed is exceeded in the held range, however, the transmission may upshift to the next higher range. To help avoid injury and/or property damage due to loss of vehicle control, use the vehicle brakes to prevent exceeding engine governed speed in the held range.

(continued on next page)
**WARNING:** If you just downshift or just use service brakes when going downhill, you can lose control and cause injury and/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.

| **4*** | Use 4 (Fourth Range) or 3 (Third Range) for city traffic and braking on steep downgrades. |
| * 3 for shift selectors with PB,R,N,D,3,2,1 |
| **3*** | Actual ranges available depend on programming by vehicle manufacturer. |

| **3*** | Use 3 (Third Range) or 2 (Second Range) for heavy city traffic and braking on steeper downgrades. |
| * 3 for shift selectors with PB,R,N,D,4,3,1 |
| **2*** | Actual ranges available depend on programming by vehicle manufacturer. |

| **1** | Use 1 (First Range) for the following. |
| • when pulling through mud and deep snow |
| • when maneuvering in tight spaces |
| • while driving up or down very steep grades |
| First range provides the vehicle with its maximum driving torque and maximum engine braking effect. |
### RANGE SELECTION — ALL 2000 MODELS WITHOUT AUTO-APPLY PARKING BRAKE

**WARNING:** For vehicles containing 2000 models without auto-apply parking brake, each time you park the vehicle or leave the operator’s station with the engine running, do the following.

- Bring the vehicle to a complete stop using the service brake.
- Ensure that the engine is at low idle rpm.
- Put the transmission in **N** (Neutral).
- Apply the emergency brake and/or parking brake and make sure they are properly engaged.
- If the operator’s station will be unoccupied with the engine running, chock the wheels and take any other steps necessary to keep the vehicle from moving.

If this procedure is not followed, the vehicle can move suddenly and cause injury and/or property damage.

**WARNING:** **R** (Reverse) may not be obtained due to an active inhibitor. The range selected may not be obtained, resulting in unexpected vehicle motion. To help avoid injury and/or property damage, always apply the service brakes when selecting **R** (Reverse). Check for the **RANGE INHIBIT(ED)** light or the **CHECK TRANS** light. See the SHIFT INHIBITS paragraph of this manual.

**WARNING:** To help avoid injury and/or property damage caused by movement of the vehicle, do not make shifts from **R** (Reverse) to **N** (Neutral) without applying the service brakes, parking brake, or emergency brake. Selecting **N** (Neutral) does not apply vehicle brakes unless an auxiliary system to apply a parking brake is installed.

**CAUTION:** Do not idle in **R** (Reverse) for more than five minutes. Extended idling in **R** (Reverse) may cause transmission overheating and damage. Always select **N** (Neutral) whenever time at idle exceeds five minutes.

| **R** | **R** (Reverse) is used to back the vehicle. Completely stop the vehicle and let the engine return to idle before shifting from a forward range to **R** (Reverse) or from **R** (Reverse) to a forward range. The reverse warning signal is activated when the shift selector is in this position. |

(continued on next page)
Use N (Neutral) for the following.

- to turn on or turn off the engine
- to check vehicle accessories
- to operate the engine in idle for longer than five minutes
- for stationary operation of the power takeoff (if your vehicle is equipped with a PTO)

**WARNING:**

To help avoid injury or property damage caused by sudden movement of the vehicle, do not make shifts from N (Neutral) to a forward range or from N (Neutral) to R (Reverse) without applying the service brakes, parking brake, or emergency brake.

**WARNING:**

If you let the vehicle coast in N (Neutral), there is no engine braking and you could lose control. Coasting can also cause severe transmission damage. To help avoid injury and/or property damage, do not allow the vehicle to coast in N (Neutral).

**WARNING:**

D (Drive) and other forward ranges may not be obtained due to an active inhibitor. The range selected may not be obtained, resulting in unexpected vehicle motion. To help avoid injury and/or property damage, always apply the service brakes when selecting D (Drive) or other forward ranges. Check for the RANGE INHIBIT(ED) light or the CHECK TRANS light. See the SHIFT INHIBITS paragraph of this manual.

**WARNING:**

To help avoid injury and/or property damage caused by movement of the vehicle, do not make shifts from a forward range to N (Neutral) without applying the service brakes, parking brake, or emergency brake. Selecting N (Neutral) does not apply vehicle brakes unless an auxiliary system to apply a parking brake is installed.

**CAUTION:**

Do not idle in D (Drive) or any forward ranges for more than five minutes. Extended idling in D (Drive) may cause transmission overheating and damage. Always select N (Neutral) if time at idle is longer than five minutes.

(continued on next page)
NOTE: Turn off the vehicle HIGH IDLE switch, if present, before shifting from N (Neutral) to D (Drive) or R (Reverse). D (Drive) or R (Reverse) will not be attained unless the shift is made with the engine at idle.

D* Use D (Drive) for normal driving. The transmission will initially attain first range when D (Drive) is selected. As vehicle speed increases, the transmission will upshift automatically through each available range up to 4 (Fourth Range) or 5 (Fifth Range). As the vehicle slows, the transmission will downshift automatically.

* The shift selector position representing this gear range may be labeled “5” (for the highest gear in the range), “OD” (for Overdrive), “D” (for the normal Drive position), or “1–5” (for the complete gear range).

WARNING: The transmission incorporates a hold feature to prohibit upshifting above the range selected during normal driving. For downhill operation, select a lower transmission range. If the engine-governed speed is exceeded in the held range, however, the transmission may upshift to the next higher range. To help avoid injury and/or property damage due to loss of vehicle control, use the vehicle brakes to prevent exceeding engine governed speed in the held range.

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**RANGE SELECTION — ALL 2000 MODELS WITHOUT AUTO-APPLY PARKING BRAKE (cont’d)**

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<td>• while driving up or down very steep grades</td>
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<tr>
<td></td>
<td>First range provides the vehicle with its maximum driving torque and maximum engine braking effect.</td>
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</tbody>
</table>
MAXIMUM VEHICLE LOADING

**WARNING**: Operation with excessive loads can cause transmission damage and unexpected vehicle movement. To help avoid injury, property damage and/or transmission damage, do not exceed the following.

- For 1000 Series™ and 2400 Series™ transmissions, do not exceed 11 800 kg (26,000 lb) GCW or the OEM vehicle rating, whichever is less.
- For 2000 Series™ transmissions, do not exceed 13 600 kg (30,000 lb) GCW or the OEM rating, whichever is less.

PREVENT MAJOR PROBLEMS

Minor problems can be kept from becoming major problems if you notify an Allison Transmission distributor or dealer when any of these conditions occur.

- Shifting feels abnormal
- 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 or **RANGE INHIBIT(ED)** light comes on frequently

TURNING ON/OFF THE VEHICLE

Before turning on or off the engine, the driver must verify that one of the following ranges has been selected and engaged.

- **P** (Park)
- **PB** (Auto-Apply Parking Brake)
- **N** (Neutral) if **P** (Park) or **PB** (Auto-Apply Parking Brake) are not available

The vehicle should not start unless these ranges have been selected. If the vehicle starts in any range other than those specified, seek service immediately.
Transmission operation at cold ambient temperatures may require preheating or the use of a lower viscosity transmission fluid. See the FLUID RECOMMENDATIONS paragraph in this manual.

Even when the engine is warm and capable of full-throttle output, the transmission should not be taken out of P (Park), PB (Auto-Apply Parking Brake), or N (Neutral) for at least thirty seconds to allow for buildup of transmission fluid pressure.

**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 a forward range 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.

The position of the accelerator pedal influences the timing at which automatic shifting occurs. When the pedal is fully depressed, upshifts will occur automatically at high engine speeds. A partially depressed position of the pedal will cause the upshifts to occur at lower engine speeds. An electronic throttle position signal tells the TCM how much the operator has depressed the pedal. Excessive throttle position may inhibit the directional shift.

**PRIMARY/SECONDARY SHIFT SCHEDULES**

The points at which shifts occur depend upon predetermined speeds and other operating conditions. A transmission ”shift calibration” includes several sets of shift points which may be used according to current or anticipated operating conditions. Some shift schedules may be inhibited as a result of operating conditions, such as engine or transmission fluid temperature. Shift schedules may be changed through selection of a remote (usually dash-mounted) switch — which is typically associated with a change in anticipated vehicle operation.

The TCM includes the capacity for two separate and distinct shift calibrations (customer-selectable), one for use in “Primary Mode” of operation and one in “Secondary Mode.”

*Primary* — This shift schedule is typically used for all normal vehicle operations.

*Secondary* — This is an alternate shift schedule that the TCM uses upon request. Not all vehicles will be equipped with a secondary shift. The request can be interlocked with a vehicle component, or be operator-controlled via a dash-mounted switch.

Your vehicle may have a dash-mounted light that illuminates when the secondary mode is active.
**KICKDOWN**

Some vehicles have a “kickdown” feature that allows the operator to choose between an “Economy” primary shift schedule and “Performance” secondary shift schedule. The throttle pedal will have a detent feel when full-throttle is achieved using “Economy” shift points. When the operator “steps through” this detent, the function is activated and “Performance” shift points are achieved.

**OUTPUT SPEED INDICATOR**

Your vehicle may contain a light or other indicator that is activated when a preset output speed has been exceeded in the vehicle, transmission, or auxiliary equipment. The output speed may occur in either the forward or reverse direction. This indicator may be used to alert the operator that a specific overspeed condition has occurred or to indicate the attainment of a minimum or maximum operating speed.

**RANGE INHIBIT(ED) LIGHT**

The red or amber RANGE INHIBIT(ED) warning light is located on or near the shift selector. The purpose of this indicator is to alert the operator that transmission operation is being inhibited and that range shifts being requested by the operator may not occur. When certain operating conditions are detected by the TCM, the controls will command the transmission to be locked in the range currently in use. If the torque converter clutch is applied when the condition is detected, the clutch will be disengaged concurrently with the activation of the RANGE INHIBIT(ED) light.

Each time the engine is started, the RANGE INHIBIT(ED) light will illuminate, then turn off after two seconds. If the light does not illuminate during ignition, or if the light remains on after ignition, the transmission system should be checked immediately.

For the conditions under which shift inhibits occur, see the SHIFT INHIBITS paragraph in this manual.

**CHECK TRANS OR MALFUNCTION INDICATOR LIGHT**

The red or amber CHECK TRANS light or Malfunction Indicator Light (MIL) of some type is located on the dash panel. For vehicles which are compliant to industry On Board Diagnostics II (OBD II) requirements, an MIL Light will be present. For vehicles which are not compliant to industry OBD II requirements, a CHECK TRANS light will be present.

Each time the engine is started, the CHECK TRANS or MIL light will illuminate, then turn off after two seconds. If the light does not illuminate during ignition, or if the light remains on after ignition, the transmission system should be checked immediately.
Illumination of the CHECK TRANS light at any time after start-up indicates that a problem has been detected. The TCM will register a diagnostic code and shifts may be restricted. Depending upon the severity of the problem, operation may continue in order to reach service assistance. The TCM may not respond to shift selector requests since upshifts and downshifts may be restricted and direction changes may not occur.

Illumination of the MIL Light at any time after start-up may indicate a problem with the engine or transmission.

**SHIFT INHIBITS**

The transmission control system will inhibit shifting to protect the transmission from some types of abusive operation, in response to diagnostic trouble codes, and to satisfy transmission feature/option requirements. These shift inhibits fall within the following types.

- Above-idle neutral-to-range shifts
- Forward/reverse directional shifts
- Transmission problems
- Auxiliary equipment operation

**Above-Idle Neutral-to-Range Shifts**

> **WARNING:** To help avoid injury or property damage caused by sudden movement of the vehicle, do not make shifts from N (Neutral) to a forward range 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.

Above-idle (greater than 900 rpm) shifts from N (Neutral) to R (Reverse) or N (Neutral) to a forward range are normally inhibited (except in emergency vehicles or some other type of specialized equipment).

When these shifts are inhibited, the RANGE INHIBIT(ED) light will illuminate. See the RANGE INHIBIT(ED) LIGHT paragraph in this manual for further information.
Forward/Reverse Directional Shifts

**WARNING:** To help avoid injury or property damage caused by sudden movement of the vehicle, do not make shifts from \textbf{N} (Neutral) to a forward range or \textbf{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 \textbf{N} (Neutral) to a forward range or \textbf{R} (Reverse) only when the throttle is closed.

Forward/reverse directional changes are typically not permitted if appreciable output shaft speed is detected.

When these shifts are inhibited, the \textbf{RANGE INHIBIT(ED)} light will illuminate. See the \textbf{RANGE INHIBIT(ED) LIGHT} paragraph in this manual for further information.

**Transmission Problems**

Lights such as a \textbf{RANGE INHIBIT(ED)}, \textbf{CHECK TRANS}, and a flashing \textbf{PRNDL} display will be illuminated when the transmission detects a problem. An illuminated \textbf{RANGE INHIBIT(ED)} light or a flashing \textbf{PRNDL} display indicates that the TCM has locked the transmission into a forward range or \textbf{R} (Reverse). Shifts from \textbf{N} (Neutral)-to-\textbf{D} (Drive), \textbf{N} (Neutral)-to-\textbf{R} (Reverse) and directional shifts will be inhibited. The locked range allows the vehicle to reach service assistance. The transmission will remain locked until the problem has been corrected. With the exception of diagnostic trouble code (DTC) U2105, the \textbf{CHECK TRANS} light will be illuminated when the TCM has registered a DTC. When a U2105 is registered, the \textbf{CHECK TRANS} light may not be illuminated in earlier models. Depending upon the severity of the problem, operation may continue to allow the vehicle to reach service assistance by locking the transmission in the range currently in use. The TCM may inhibit up shifts, down shifts and directional change shifts. See the \textbf{DIAGNOSTIC CODES AND TOOLS} paragraph in this manual for further information.

An illuminated Malfunction Indicator Light (MIL) may indicate a problem with the transmission or engine.

See the \textbf{RANGE INHIBIT(ED) LIGHT} and \textbf{CHECK TRANS OR MALFUNCTION INDICATOR LIGHT} paragraphs in this manual for further information.

**Auxiliary equipment operation** — The TCM will prevent shifts from \textbf{P} (Park), \textbf{PB} (Auto-Apply Parking Brake), or \textbf{N} (Neutral)-to-range when auxiliary equipment is in operation (e.g., a wheelchair lift). For some vehicles such as buses, shifts from \textbf{P} (Park), \textbf{PB} (Auto-Apply Parking Brake), or \textbf{N} (Neutral)-to-range will be prevented unless the brake pedal is depressed.
USING THE ENGINE TO SLOW THE VEHICLE

WARNING: The transmission incorporates a hold feature to prohibit upshifting above the range selected during normal driving. For downhill operation, select a lower transmission range. If the engine-governed speed is exceeded in the held range, however, the transmission may upshift to the next higher range. To help avoid injury and/or property damage due to loss of vehicle control, use the vehicle brakes to prevent exceeding engine governed speed in the held range.

WARNING: If you just downshift or just use service brakes when going downhill, you can lose control and cause injury and/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.

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 other retarding devices to slow the vehicle. When a lower speed is reached, the TCM will automatically downshift the transmission. 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 preselect a lower range before reaching the grade. If engine-governed speed is exceeded, the transmission will upshift automatically to the next range.

RANGE PRESELECTION

Range preselection means selecting a lower range to match driving conditions you encounter or expect to encounter. 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.

NOTE: Preselecting during normal operation may result in reduced fuel economy.
Manual range downshifts will not occur until a calibration value of output speed is reached. When a range downshift is manually selected and the transmission output speed is above the calibration value, the transmission will stay in the range it was in even though a lower range was requested. Apply the vehicle service brakes or some retarding device to reduce the transmission output speed to the calibration value and then the shift to the lower range will occur.

Two shift schedules are used with range preselection: hold upshift and preselect downshift.

**Hold Upshift** — This shift schedule keeps the transmission from shifting above the selected range. This shift schedule permits upshifts to occur if an engine overspeed condition could result by the transmission remaining (by operator selection) in a range lower than its highest range. When the hold feature is activated, transmission upshift points occur at engine speeds which are higher than normal upshifts in order to “hold” the transmission from upshifting beyond the current range.

**WARNIMG:** The transmission incorporates a hold feature to prohibit upshifting above the range selected during normal driving. For downhill operation, select a lower transmission range. If the engine no load governed speed is exceeded in the held range, however, the transmission may upshift to the next higher range. To help avoid injury and/or property damage due to loss of vehicle control, use the vehicle brakes to prevent exceeding engine governed speed in the held range.

**Preselect Downshift** — This shift schedule is used when the driver preselects a lower range. The operator may preselect any range below D (Drive) on the shift selector at any time. When a range has been “preselected” in this manner, shift points to and from ranges above the preselected range are higher than the normal shift points. The transmission will downshift when an engine overspeed condition will not result after the shift. Shifts below the preselected range are not affected.

**REVERSE**

Putting the transmission into R (Reverse) may activate vehicle back-up lights and/or reverse warning devices.

To achieve R (Reverse) range in some European transit and tour buses, an instrument panel-mounted switch must be pressed simultaneously with the R (Reverse) shift selector button.
REFUSE PACKER STEP SWITCH

When personnel are on the rear step of a refuse packer, the transmission will operate in 1 (First Range) and N (Neutral) only.

- An operator request to upshift beyond first range or to shift to R (Reverse) is ignored by the TCM.
- If the transmission is in R (Reverse), the TCM will cause the transmission to shift to N (Neutral).
- If the transmission is in a forward range higher than 1 (First Range), the TCM will invoke “preselect downshifts” until first range is attained.

TWO-SPEED AXLE
(Some 1000/2000/2400 Series Applications)

The two-speed axle may be shifted while the vehicle is moving. However, the axle or vehicle manufacturer’s recommendations should be followed for shifting the axle. It is recommended that axle shifts be made with the transmission in the highest range, or vehicle stopped, to prevent a transmission shift from coinciding with an axle shift.

DRIVING ON SNOW OR ICE

Here is where all of your ability as a professional driver comes into focus regardless of what transmission you have. If possible, reduce your speed and select a lower range before you lose traction. Select the range that will not exceed the speed you expect to maintain. Accelerate or decelerate very gradually to prevent losing 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 a forward range 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.

**CAUTION:** 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. Shift to D (Drive) and apply steady, light throttle (never full throttle). When the vehicle has rocked forward as far as it will go, apply and hold the vehicle service brakes. Allow the engine to return to idle; then select R (Reverse). Release the brakes and apply a steady, light throttle and allow the vehicle to rock in R (Reverse) as far as it will go. 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.

**OPERATING TEMPERATURES**

To ensure proper operation of the transmission, adhere to the following minimum and maximum transmission operating temperatures.

<table>
<thead>
<tr>
<th></th>
<th>Sump, minimum continuous</th>
<th>Sump, maximum intermittent</th>
<th>To cooler, maximum intermittent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>40˚C (100˚F)</td>
<td>121˚C (250˚F)</td>
<td>149˚C (300˚F)</td>
</tr>
</tbody>
</table>

Your transmission may have a converter-out transmission temperature gauge near the “to-cooler” port on the transmission converter housing.

**HIGH FLUID TEMPERATURE**

**CAUTION:** Always select P (Park), PB (Auto-Apply Parking Brake), or N (Neutral) whenever time at idle exceeds five minutes. Extended idling in any other ranges may cause transmission overheating and damage.

**CAUTION:** Sustained use of the park brake with the engine running and the transmission in gear can cause an overheating failure of the transmission. The vehicle may contain a buzzer or dash-mounted light to alert the operator when the ignition switch is “on,” the park brake is applied, and the transmission selector is in range.

**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 result in severe overheat damage to the transmission.
Your vehicle may have a dash indicator or other alarm that turns on when the transmission sump temperature or to-cooler temperature exceeds specified limits.

If the transmission overheats during normal operations, do the following.

- Check the fluid level in the transmission. See the CARE AND MAINTENANCE section of this manual.

- 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 high temperature in either the engine or transmission persists, stop the engine and have the overheating condition investigated by maintenance personnel.

**PARKING BRAKE**

For shift selectors with a **PB** (Auto-Apply Parking Brake) position, selecting **PB** (Auto-Apply Parking Brake) places the transmission in N (Neutral) and automatically engages the parking brake. For shift selectors without a **PB** (Auto-Apply Parking Brake) position, the parking brake must be manually engaged. Your vehicle may have an indicator light that illuminates when the parking brake is applied.

**CAUTION:** Do not apply the transmission-mounted parking brake with the vehicle in motion: transmission and/or driveline damage may result. In the event of a dynamic brake apply, recheck the torque of all brake mounting bolts to verify the integrity of the mount.

**CAUTION:** Sustained use of the park brake with the engine running and the transmission in gear can cause an overheating failure of the transmission. The vehicle may contain a buzzer or dash-mounted light to alert the operator when the ignition switch is “on,” the park brake is applied, and the transmission selector is in range.
**PARK PAWL**

A park pawl is standard on 1000 Series™ and 2400 Series™ transmissions and is not available on 2000 Series™ transmissions. The park pawl effectively grounds the transmission output shaft, thereby preventing rotation of the driveline. Provided the vehicle is stationary, selecting **P** (Park) on the shift selector places the transmission in **N** (Neutral) and engages the park pawl. The park pawl exists but cannot be engaged in some vehicle configurations using 1000 Series™ and 2400 Series™ transmissions (e.g., some rear engine vehicles with air brakes). For these configurations, the **P** (Park) position is not used.

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**WARNING:** To help avoid injury and/or property damage caused by unexpected movement of the vehicle, do not attempt to engage **P** (Park) with the vehicle in motion (2 km/hr (1 mph) or higher). If you attempt to engage **P** (Park) with the vehicle in motion (2 km/hr (1 mph) or higher), the park pawl will ratchet, will not engage, and will not hold the vehicle.

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**WARNING:** If the vehicle has four-wheel-drive and the transfer case is in Neutral, the vehicle may be free to roll even if the **P** (Park) position is selected. To help avoid injury and/or property damage caused by unexpected movement of the vehicle, be certain that the transfer case is in “high” drive range, not Neutral, whenever the vehicle is parked.

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**WARNING:** If the vehicle is equipped with a two-speed axle or two-speed transfer case which is engaged in “low,” even very low vehicle speeds may produce appreciable transmission output shaft speed. Engagement of the park pawl in such cases may be deterred by even the slightest vehicle motion. To help avoid injury and/or property damage caused by unexpected movement of the vehicle, be certain that the axle or transfer case is in “high” drive range whenever the vehicle is parked and the park pawl is engaged.

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**Torque Lock** — If the vehicle is parked on an incline and **P** (Park) is properly engaged, the weight of the vehicle may generate an excessive amount of torque on the park pawl in the transmission. In this situation, it may be difficult to shift the transmission out of the **P** (Park) position. This condition is commonly called “torque lock.”

To drive a vehicle with torque lock, do the following.

- Push the vehicle uphill a small amount to release the pressure on the park pawl and permit the shift out of **P** (Park).
- Shift the transmission out of **P** (Park) while applying the service brakes.
- Release the parking brake.
PARKING/LEAVING VEHICLE WITH ENGINE RUNNING

**WARNING:** For vehicles containing 1000 and 2400 models with P (Park) positions, each time you park the vehicle or leave the operator’s station with the engine running, do the following.

- Bring the vehicle to a complete stop using the service brake.
- Ensure that the engine is at low idle rpm.
- Put the transmission in P (Park).
- Engage the P (Park) range by slowly releasing the service brake.
- Apply the emergency brake and/or parking brake, if present, and make sure it is properly engaged.
- If the operator’s station will be unoccupied with the engine running, chock the wheels and take any other steps necessary to keep the vehicle from moving.

If this procedure is not followed, the vehicle can move suddenly and cause injury and/or property damage.

**WARNING:** For vehicles containing 1000 and 2400 models without P (Park) positions, each time you park the vehicle or leave the operator’s station with the engine running, do the following.

- Bring the vehicle to a complete stop using the service brake.
- Ensure that the engine is at low idle rpm.
- Put the transmission in N (Neutral).
- Apply the emergency brake and/or parking brake and make sure they are properly engaged.
- If the operator’s station will be unoccupied with the engine running, chock the wheels and take any other steps necessary to keep the vehicle from moving.

If this procedure is not followed, the vehicle can move suddenly and cause injury and/or property damage.
**WARNING:** For vehicles containing 2000 models with auto-apply parking brake, each time you park the vehicle or leave the operator’s station with the engine running, do the following.

- Bring the vehicle to a complete stop using the service brake.
- Ensure that the engine is at low idle rpm.
- Put the transmission in **PB** (Auto-Apply Parking Brake). Make sure that the parking brake is properly engaged.
- Apply the emergency brake, if present, and make sure it is properly engaged.
- If the operator’s station will be unoccupied with the engine running, chock the wheels and take any other steps necessary to keep the vehicle from moving.

If this procedure is not followed, the vehicle can move suddenly and cause injury and/or property damage.

**WARNING:** For vehicles containing 2000 models without auto-apply parking brake, each time you park the vehicle or leave the operator’s station with the engine running, do the following.

- Bring the vehicle to a complete stop using the service brake.
- Ensure that the engine is at low idle rpm.
- Put the transmission in **N** (Neutral).
- Apply the emergency brake and/or parking brake and make sure they are properly engaged.
- If the operator’s station will be unoccupied with the engine running, chock the wheels and take any other steps necessary to keep the vehicle from moving.

If this procedure is not followed, the vehicle can move suddenly and cause injury and/or property damage.
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, lift the drive wheels off the road, disconnect the driveline, or remove the axle shafts from the drive wheels. When the axle shafts are removed, be sure to cover the wheel openings to prevent loss of lubricant and entry of dust and dirt. An auxiliary air supply will usually be required to release the vehicle brake system.

SURGING NATURAL GAS ENGINES

**NOTE:** Engine surging or engine speed cycling may occur on natural gas powered equipment. This condition typically occurs when the transmission is being operated in a hold position with throttle applied and the engine speed above full load engine governed speed. Surging may also occur at closed and part throttle. This condition is an engine characteristic and NOT a transmission concern.
POWER TAKEOFF (PTO) SYSTEMS

Three types of PTO systems may be used with the 1000/2000/2400 Series transmissions.

- **Transmission-Mounted Converter-Driven PTO** — A transmission-mounted converter-driven PTO drive provides both an infinitely-variable PTO drive ratio and a protective hydraulic cushion against abrupt loading/unloading (during “converter mode” operation) and engine-driven PTO speed control (during “torque converter clutch mode” operation).

- **Split-Shaft PTO** — A split-shaft PTO, a chassis-mounted component, is typically used in applications which require full engine power being available to either propel the vehicle or to power auxiliary equipment through the PTO drive — but not both simultaneously. In both cases, the transmission output shaft delivers power to the split-shaft transfer case. The split-shaft transfer case is then shifted to deliver this power to either the driveline or PTO drive.

- **Flywheel-Driven PTO** — A flywheel-driven PTO, often called a “sandwich PTO,” mounts between the engine and transmission. The PTO is normally driven directly by the engine.

CONVERTER-DRIVEN POWER TAKEOFF (PTO)

The following pertains to Transmission-Mounted Converter-Driven PTOs only.

**PTO Configuration** — The PTO is mounted on the left and/or right side of the transmission housing. The PTO drivetrain consists of a large drive gear in the transmission, an idler gear arrangement, and a smaller driven gear in the PTO. The drive gear is integral to the transmission rotating clutch housing, which rotates at the same speed as the torque converter turbine. With this drive configuration, the PTO rotates in the same direction as the engine.

Two types of transmission-mounted PTOs may be used with these transmission models.

- **A constant-drive PTO** is used in applications which require full-time PTO operation. The PTO driven gear is in constant mesh with the drive gear and cannot be disengaged.
• **Clutch drive and sliding gear PTOs** are used in applications which require only part-time operation of the PTO or the capability to engage or disengage the driven equipment. For clutch drive PTOs, the following applies: 1) the engagement/disengagement provision is facilitated by a hydraulic clutch mechanism in the PTO assembly; 2) the PTO can be engaged or disengaged at any time (except at engine speeds that exceed drive speed limits imposed on the driven equipment).

**CAUTION:** Do not use or install a sliding gear PTO where the sliding gear meshes directly with the PTO drive gear. The PTO drive gear may be damaged when the sliding gear slides into the PTO drive gear, producing metal particles that can cause transmission damage.

**PTO Engagement — Sliding Gear PTOs**

**CAUTION:** Never engage the sliding gear PTO by clashing the gear teeth. This may damage the PTO unit. Stop the clashing by releasing the vehicle brakes and allowing the vehicle to move slightly or by moving the shift selector from a drive range to **N** (Neutral) and back to a drive range.

Engage the PTO drivetrain as follows.
• Turn the PTO switch on.
• Set the engine speed at idle.
• Place shift selector lever in **D** (Drive).
• Shift the PTO power shift clutch lever to “drive.”
• Bring the engine up to speed.
• Shift to **N** (Neutral).

Disengage the PTO drivetrain as follows.
• Stop the vehicle.
• Idle the engine.
• Set the brake.
• Place the shift selector in a drive range.
• Stop the PTO-driven equipment.
• Disengage the power takeoff.
• Return the transmission shift selector to **N** (Neutral).
• Turn the PTO switch to off.

**PTO Engagement — Clutch Driven**

The PTO will engage only when the PTO switch is on, the throttle position is low, and engine speed and output speed are within user-specified limits. Your vehicle may have a light on the dash that illuminates when the PTO is engaged.
PTO Operation

**CAUTION:** Do not exceed the engagement and operational speed limits imposed on the driven equipment during the operation of the PTO. Exceeding the speed limits produces high hydraulic pressure in the PTO that can damage the PTO components. Consult the vehicle manufacturer’s literature for these speed limits.

**CAUTION:** Some vehicles “creep” in range at low vehicle speeds while maintaining a specified engine speed for PTO operation (e.g., paint strippers and feed lot trucks). For PTO operation at low speeds, do not use the brakes to limit vehicle speed while using the throttle to maintain an engine speed above idle when the transmission is in range. Such operation will cause the transmission to overheat. Extended operation at elevated temperatures will result in transmission damage.

The transmission operates in either converter mode or torque converter clutch mode. In converter mode, the torque converter (lockup) clutch is not engaged and the PTO is driven through the torque converter, producing a torque at the PTO drive gear that is always greater than the input torque. In torque converter clutch mode, the torque converter (lockup) clutch is engaged, the PTO drivetrain is driven at a speed proportional to the engine speed.

The PTO drive is normally in continuous converter mode operation when the transmission is in P (Park), PB (Auto-Apply Parking Brake), and R (Reverse). Torque converter clutch operation in N (Neutral) is available for some applications. If the PTO is used with the transmission in D (Drive) or another forward range, transmission shifts (both converter/torque converter clutch mode shifts and shifts between gears) are based on the automatic shift sequence of the transmission shift controls. PTO drive gear speed will be affected each time a shift occurs.

With the vehicle stopped and the engine at idle, PTO output speed is dependent upon the transmission gear selection.

- If the transmission is in D (Drive) or R (Reverse), the PTO output speed is zero.
- If the transmission is in N (Neutral), P (Park), or PB (Auto-Apply Parking Brake), the PTO output will rotate slowly.

In some vehicles, the transmission will shift into N (Neutral) regardless of the shift selector position under the following conditions.

- the PTO is enabled
- the transmission output speed is near zero
- the throttle position is near zero

To reselect a range, the operator must shift into N (Neutral), then shift to the desired range.
PTO Overspeed Protection

**CAUTION:** Do not exceed the engagement and operational speed limits imposed on the driven equipment during the operation of the PTO. Exceeding the speed limits produces high hydraulic pressure in the PTO-driven components that can damage the PTO-driven components. Consult the vehicle manufacturer’s literature for these speed limits.

**CAUTION:** When the PTO is disengaged due to overspeed, the PTO will be automatically re-engaged at user specified speed, which is typically relatively low. The resultant re-engagement shock could cause damage to a high-inertia PTO system.

All 1000/2000/2400 Series-equipped vehicles with PTO enable have engagement and operational speed limits programmed into the TCM to help protect PTO equipment. The PTO will deactivate when operational speeds (either engine or transmission output) are exceeded. When the PTO is disengaged due to overspeed, the PTO will be automatically re-engaged at a user specified speed, which is typically relatively low. After the speed has been reduced, the operator may manually engage the PTO by repeating the engagement process.

**SPLIT-SHAFT POWER TAKEOFF (PTO)**

For many split-shaft PTOs, holding the transmission in direct drive at all engine speeds is desirable. In this manner, the automatic range shifts are eliminated, thereby eliminating rapid torque changes which would occur at the driven equipment during a shift in the transmission. Such a condition, for instance, could create an undesirable pressure surge (and directional control problem) at the nozzle-end of a fire hose.

**NOTE:** Unlike most Allison on-highway transmission models, the 1000/2000/2400 Series transmission models **do not** have a controls provision which supports this type of split-shaft PTO application. The output of a split-shaft PTO driven by these models will, therefore, be subjected to transmission range shifts and will experience rapid speed and torque changes with each occurrence.
PERIODIC INSPECTIONS AND CARE

Transmission Inspection

**CAUTION:** When cleaning the transmission, do not spray steam, water, or cleaning solution directly at the vent assembly. Spraying steam, water, or cleaning solution at the vent assembly can force the water or cleaning solution into the transmission and contaminate the transmission fluid.

Clean and inspect the exterior of the transmission at regular intervals. Severity of service and operating conditions determine the frequency of these inspections. Inspect the transmission for:

- loose bolts — transmission and mounting components
- fluid leaks — repair immediately
- loose, dirty, or improperly adjusted throttle sensor or shift selector linkage
- damaged or loose hoses
- worn, frayed, or improperly routed electrical harnesses
- worn or frayed electrical connections
- worn or out-of-phase driveline U-joints and slip fittings
- clogged or dirty vent assembly
**Vehicle Inspection**

Check the vehicle cooling system occasionally for evidence of transmission fluid which would indicate a faulty oil cooler.

**Welding**

<table>
<thead>
<tr>
<th>CAUTION: When welding on the vehicle:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• DO NOT WELD on the vehicle without disconnecting from the TCM all control system wiring harness connectors.</td>
</tr>
<tr>
<td>• DO NOT WELD on the vehicle without disconnecting TCM battery power and ground leads.</td>
</tr>
<tr>
<td>• DO NOT WELD on any control components.</td>
</tr>
<tr>
<td>• DO NOT CONNECT welding cables to any control components.</td>
</tr>
<tr>
<td>• PROTECT CONTROL COMPONENTS FROM SPARKS AND HEAT DURING WELDING.</td>
</tr>
</tbody>
</table>

A label describing on-vehicle welding precautions is available from your authorized Allison service dealer and should be installed in a conspicuous place. A vehicle used in a vocation that requires frequent modifications or repairs involving welding must have an on-vehicle welding label (SA2607).

**IMPORTANCE OF PROPER TRANSMISSION FLUID LEVEL**

Transmission fluid cools, lubricates, and transmits hydraulic power. Always maintain proper fluid level. If fluid level is too low, the torque converter and clutches do not receive an adequate supply of fluid and the transmission overheats. If the level is too high, the fluid aerates — causing the transmission to shift erratically and overheat. Fluid may be expelled through the vent assembly or dipstick tube when the fluid level is too high.
TRANSMISSION FLUID CHECK

**WARNING:** For vehicles containing 1000 and 2400 models with P (Park) positions, each time you park the vehicle or leave the operator’s station with the engine running, do the following.

- Bring the vehicle to a complete stop using the service brake.
- Ensure that the engine is at low idle rpm.
- Put the transmission in P (Park).
- Engage the P (Park) range by slowly releasing the service brake.
- Apply the emergency brake and/or parking brake, if present, and make sure it is properly engaged.
- If the operator’s station will be unoccupied with the engine running, chock the wheels and take any other steps necessary to keep the vehicle from moving.

If this procedure is not followed, the vehicle can move suddenly and cause injury and/or property damage.

**WARNING:** For vehicles containing 1000 and 2400 models without P (Park) positions, each time you park the vehicle or leave the operator’s station with the engine running, do the following.

- Bring the vehicle to a complete stop using the service brake.
- Ensure that the engine is at low idle rpm.
- Put the transmission in N (Neutral).
- Apply the emergency brake and/or parking brake and make sure they are properly engaged.
- If the operator’s station will be unoccupied with the engine running, chock the wheels and take any other steps necessary to keep the vehicle from moving.

If this procedure is not followed, the vehicle can move suddenly and cause injury and/or property damage.
**Fluid Check Procedure.** 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 cause undue wear of transmission parts, make valves stick, and clog passages. Check the fluid level using the following procedure and report any abnormal fluid levels to your maintenance persons.

**WARNING:** For vehicles containing 2000 models with auto-apply parking brake, each time you park the vehicle or leave the operator’s station with the engine running, do the following.

- Bring the vehicle to a complete stop using the service brake.
- Ensure that the engine is at low idle rpm.
- Put the transmission in **PB** (Auto-Apply Parking Brake). Make sure that the parking brake is properly engaged.
- Apply the emergency brake, if present, and make sure it is properly engaged.
- If the operator’s station will be unoccupied with the engine running, chock the wheels and take any other steps necessary to keep the vehicle from moving.

If this procedure is not followed, the vehicle can move suddenly and cause injury and/or property damage.

**WARNING:** For vehicles containing 2000 models without auto-apply parking brake, each time you park the vehicle or leave the operator’s station with the engine running, do the following.

- Bring the vehicle to a complete stop using the service brake.
- Ensure that the engine is at low idle rpm.
- Put the transmission in **N** (Neutral).
- Apply the emergency brake and/or parking brake and make sure they are properly engaged.
- If the operator’s station will be unoccupied with the engine running, chock the wheels and take any other steps necessary to keep the vehicle from moving.

If this procedure is not followed, the vehicle can move suddenly and cause injury and/or property damage.
Cold Check Procedure. 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 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.

- Park vehicles containing 1000 and 2400 models with P (Park) positions as follows:
  — Bring the vehicle to a complete stop on a level surface using the service brake.
  — Ensure that the engine is at low idle rpm.
  — Put the transmission in P (Park).
  — Engage the P (Park) range by slowly releasing the service brake.
  — Apply the emergency brake and/or parking brake, if present, and make sure it is properly engaged.

- Park vehicles containing 1000 and 2400 models without P (Park) positions as follows:
  — Bring the vehicle to a complete stop on a level surface using the service brake.
  — Ensure that the engine is at low idle rpm.
  — Put the transmission in N (Neutral).
  — Apply the emergency brake and/or parking brake and make sure they are properly engaged.

- Park vehicles containing 2000 models with auto-apply parking brakes as follows:
  — Bring the vehicle to a complete stop on a level surface using the service brake.
  — Ensure that the engine is at low idle rpm.
  — Put the transmission in PB (Auto-Apply Parking Brake). Make sure that the parking brake is properly engaged.
  — Apply the emergency brake, if present, and make sure it is properly engaged.
• Park vehicles containing 2000 models without auto-apply parking brakes as follows:
  — Bring the vehicle to a complete stop on a level surface using the service brake.
  — Ensure that the engine is at low idle rpm.
  — Put the transmission in N (Neutral).
  — Apply the emergency brake and/or parking brake and make sure they are properly engaged.

• Chock the wheels and take any other steps necessary to keep the vehicle from moving.

• Run the engine for at least one minute. Apply the service brakes and shift to D (Drive), then to N (Neutral), and then shift to R (Reverse) to fill the hydraulic system. Finally, shift to P (Park) or PB (Auto-Apply Parking Brake), if available, or N (Neutral) and allow the engine to idle (500–800 rpm). Slowly release the service brakes.

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

• Insert the dipstick into the tube and remove. Check the fluid level reading. Repeat the check procedure to verify the reading.

• If the fluid level is within the “COLD CHECK” band (Figure 7), the transmission may be operated until the fluid is hot enough to perform a “HOT RUN” check. If the fluid level is not within the “COLD CHECK” band, add or drain as necessary to bring it to the middle of the “COLD CHECK” band.

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

![Figure 7. Typical Dipstick Markings](image-url)
Hot Check Procedure

CAUTION: When performing the Hot Check procedure, the fluid must be hot to ensure an accurate check and help prevent transmission damage. The fluid level rises as temperature increases. During operation, an overfull transmission can become overheated, leading to transmission damage.

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

- Park vehicles containing 1000 and 2400 models with **P** (Park) positions as follows:
  - Bring the vehicle to a complete stop on a level surface using the service brake.
  - Ensure that the engine is at low idle rpm.
  - Put the transmission in **P** (Park).
  - Engage the **P** (Park) range by slowly releasing the service brake.
  - Apply the emergency brake and/or parking brake, if present, and make sure it is properly engaged.

- Park vehicles containing 1000 and 2400 models without **P** (Park) positions as follows:
  - Bring the vehicle to a complete stop on a level surface using the service brake.
  - Ensure that the engine is at low idle rpm.
  - Put the transmission in **N** (Neutral).
  - Apply the emergency brake and/or parking brake and make sure they are properly engaged.

- Park vehicles containing 2000 models with auto-apply parking brakes as follows:
  - Bring the vehicle to a complete stop on a level surface using the service brake.
  - Ensure that the engine is at low idle rpm.
  - Put the transmission in **PB** (Auto-Apply Parking Brake). Make sure that the parking brake is properly engaged.
  - Apply the emergency brake, if present, and make sure it is properly engaged.
• Park vehicles containing 2000 models without auto-apply parking brakes as follows:
  — Bring the vehicle to a complete stop on a level surface using the service brake.
  — Ensure that the engine is at low idle rpm.
  — Put the transmission in N (Neutral).
  — Apply the emergency brake and/or parking brake and make sure they are properly engaged.

• Chock the wheels and take any other steps necessary to keep the vehicle from moving.

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

• Insert the dipstick into the tube and remove. Check fluid level reading. Repeat the check procedure to verify the reading.

**NOTE:** Safe operating level is within the “HOT RUN” band on the dipstick. See Figure 7. The width of the “HOT RUN” band represents approximately 1.0 liter (1.06 quart) of fluid at normal operating sump temperature.

• If the fluid level is not within the “HOT RUN” band, add or drain as necessary to bring the fluid level to within the “HOT RUN” band.

**Consistency of Readings.** Always check the fluid level at least twice using the procedure described above. Consistency (repeatable readings) is important to maintaining proper fluid level. If inconsistent readings persist, check the transmission vent assembly to be sure it is clean and unclogged. If readings are still inconsistent, contact your nearest Allison distributor or dealer.

**KEEPING FLUID CLEAN**

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

**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 to fail.
FLUID RECOMMENDATIONS

Hydraulic fluids (oils) used in the transmission are important influences on transmission performance, reliability, and durability. Any fluids meeting DEXRON®-III specifications are acceptable for use in the 1000, 2000, and 2400 Series transmissions. TranSynd™ fluids fully meet the DEXRON®-III specifications.

To ensure the fluid is qualified for use in Allison transmissions, check for a DEXRON®-III fluid license or approval 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 to use, duty cycle, preheat capabilities, and/or geographical location must be taken into consideration. The table below lists the minimum fluid temperatures at which the transmission may be safely operated without preheating the fluid. Preheat with auxiliary heating equipment or by running the equipment or vehicle with the transmission in P (Park) or PB (Auto-Apply Parking Brake), if available, or N (Neutral) for a minimum of 20 minutes before attempting range operation.

<table>
<thead>
<tr>
<th>Transmission Fluid Operating Temperature Requirements</th>
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<tbody>
<tr>
<td>Viscosity Grade</td>
</tr>
<tr>
<td>DEXRON®-III</td>
</tr>
<tr>
<td>TranSynd™</td>
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</tbody>
</table>

(Ref. SIL 13-TR-90)

Some shift ranges and the torque converter clutch mode may not be reached during cold weather operation. As the transmission reaches normal operating temperature, all shift ranges and the torque converter clutch mode will begin to function.

TRANSMISSION FLUID AND FILTER CHANGE INTERVALS

**CAUTION:** Transmission fluid and filter change frequency is determined by the severity of transmission service. To help avoid transmission damage, more frequent changes may be necessary than recommended in the general guidelines when operating conditions create high levels of contamination or overheating.
Frequency. The following table is given only as a general guide for fluid and filter change intervals.

<table>
<thead>
<tr>
<th></th>
<th>SEVERE VOCATION*</th>
<th>GENERAL VOCATION*</th>
<th>CITY TRANSIT*</th>
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<tbody>
<tr>
<td>Oil</td>
<td>Control Main Filter</td>
<td>Oil</td>
<td>Control Main Filter</td>
</tr>
<tr>
<td>Required Initial Filter Change Interval (All fluids)</td>
<td>8000 km (5000 miles)</td>
<td>8000 km (5000 miles)</td>
<td>8000 km (5000 miles)</td>
</tr>
<tr>
<td></td>
<td>40 000 km (25,000 miles) 12 Months</td>
<td>40 000 km (25,000 miles) 12 Months</td>
<td>80 000 km (50,000 miles) 24 Months</td>
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<tr>
<td>Recommended Fluid and Filter Change Intervals (Non-TES295 Fluids)</td>
<td>80 000 km (50,000 miles) 24 Months</td>
<td>80 000 km (50,000 miles) 24 Months</td>
<td>160 000 km (100,000 miles) 48 Months</td>
</tr>
<tr>
<td>Modified Fluid and Filter Change Intervals (Mixture of TES295 and non-TES295 Fluids)</td>
<td>40 000 km (25,000 miles) 12 Months</td>
<td>40 000 km (25,000 miles) 12 Months</td>
<td>80 000 km (50,000 miles) 24 Months</td>
</tr>
</tbody>
</table>

* NOTE 1:
- Vocations qualifying as Severe are refuse and shuttle transit.
- Test Engineering Specification 295 (TES295) fluids include TranSynd™ and equivalents.
- Change fluid/filters after recommended distance or months have elapsed, whichever comes first. See the TRANSMISSION FLUID AND FILTER CHANGE PROCEDURE paragraph in this manual.

NOTE 2:
- The transmission sump filter is permanent and does not require replacement except at overhaul.
- If there is an externally mounted filter in the transmission cooler circuit, the filter should be replaced at the same intervals recommended for the Control Main Filter.
- If there is an Allison High-Efficiency External Filter and Filter Element in the transmission cooler circuit, the filter may be used until the Change Filter light indicates the filter is contaminated or until the filter has been in use for 3 years, whichever comes first. No mileage restrictions apply.
Abnormal Conditions. Transmissions used in high cycle rate applications should use fluid analysis to be certain that a proper fluid change interval is established. Transmission fluid must be changed whenever there is evidence of dirt or a high temperature condition. A high temperature condition is indicated by the transmission fluid being discolored or having a strong odor, or by fluid analysis. Local conditions, severity of operation, or duty cycle may require more or less frequent fluid or filter change intervals.

Fluid Analysis. Transmission protection and fluid change intervals can be optimized by monitoring fluid oxidation according to the tests and limits shown in the following table. Fluid oxidation can be monitored through a fluid analysis firm and/or by using an oil analysis kit.

- Fluid analysis firms—Consult your local telephone directory for fluid analysis firms. To ensure 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.

- Oil analysis kits, part number 29537805, are available through your normal Allison Transmission parts source.

Refer to the Technician’s Guide for Automatic Transmission Fluid, GN2055EN, for additional information.

### Fluid Oxidation Measurement Limits

<table>
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<tr>
<th>Test</th>
<th>Limit</th>
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<tr>
<td>Viscosity</td>
<td>±25% change from new fluid</td>
</tr>
<tr>
<td>Total Acid Number</td>
<td>+3.0* change from new fluid</td>
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<tr>
<td>Solids</td>
<td>2% by volume maximum</td>
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</tbody>
</table>

* mg of KOH required to neutralize a gram of fluid.

TRANSMISSION FLUID CONTAMINATION

Fluid Examination. 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.

Water. Obvious water contamination of the transmission fluid or transmission fluid in the cooler water (in heat exchanger) indicates a leak between the water and fluid areas of the cooler. Inspect and pressure test the cooler to confirm the leak. Replace leaking coolers.

NOTE: Cooler water can also be contaminated by engine oil; be sure to locate the correct source of cooler water contamination.
a. Engine Coolant

**CAUTION:** Engine coolant in the transmission hydraulic system requires immediate action to prevent malfunction and possible serious damage. Completely disassemble, inspect, and clean the transmission. Remove all traces of the coolant, and varnish deposits resulting from engine coolant contamination. Replace friction clutch plates contaminated with engine coolant (ethylene glycol).

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

**CAUTION:** After flushing the cooler, be sure to check the external cooler circuit restriction. If circuit pressure drop is above specification, the cooler has excessive trapped particles and must be replaced. Excessive pressure drop impedes transmission cooling which may cause transmission overheating and damage.

**NOTE:** When equipment to flush the oil cooler is not available, install a filter in the cooler line between the oil cooler and the transmission “from cooler” port. The cooler circuit pressure drop specifications must still be met (see AS64–071 or AS64–072 in the Allison Sales Tech Data book). Frequent initial changes of this filter element may be required as debris is flushed out of the oil cooler circuit. Closely monitoring change in cooler circuit pressure drop will indicate when a filter change is needed.

**TRANSMISSION FLUID AND FILTER CHANGE PROCEDURE**

**Drain Fluid**

- Drain the fluid when the transmission is at normal operating sump temperature — 71°C–93°C (160°F–200°F). Hot fluid flows quicker and drains more completely.

- Remove the drain plug from the oil pan and allow the fluid to drain into a suitable container.

- Examine the fluid as described in the TRANSMISSION FLUID CONTAMINATION paragraph in this Section.
Replace Control-Main Filter (Figure 8)

1. Using a standard strap-type filter wrench or the J 45023, remove the control-main filter by rotating it in the counterclockwise direction.

2. Remove the magnet from the filter attachment tube or from the top of the filter element.

3. Clean any metal debris from the magnet. Report any metal pieces larger than dust to your maintenance personnel.

4. Reinstall the magnet onto the filter attachment tube.

5. Lubricate the gasket on the control-main filter with transmission fluid.

6. Install, by hand, the control-main filter until the gasket on the control-main filter touches the converter housing or cooler manifold.

Figure 8. Replacing the Main Control Filter
7. Using the J 45023 or by hand, turn the filter ONE FULL TURN ONLY after gasket contact.

8. Reinstall the drain plug and sealing washer. Tighten the drain plug to 30–40 N·m (22–30 lb ft).

Refill Transmission. The amount of refill fluid is less than the amount used for the initial fill. Fluid remains in the external circuits and transmission cavities after draining the transmission.

After refill, check the fluid level using the TRANSMISSION FLUID CHECK paragraph of this Manual.

### Transmission Fluid Capacity

<table>
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<tr>
<th>Transmission</th>
<th>Sump</th>
<th>Initial Fill*</th>
<th>Refill*</th>
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<tr>
<td>1000/2000/2400</td>
<td>Standard</td>
<td>14</td>
<td>14.8</td>
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<tr>
<td></td>
<td>Shallow</td>
<td>12</td>
<td>12.7</td>
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* Approximate quantities, do not include external lines and cooler hose.

### VENT ASSEMBLY

**Location and Purpose.** The vent assembly is located at the top left-rear of the transmission main housing. The vent assembly prevents air pressure buildup within the transmission and its passage must be kept clean and open.

**Maintenance.** The amount of dust and dirt encountered will determine the frequency of vent assembly cleaning. Use care when cleaning the transmission.

**CAUTION:** When cleaning the transmission, do not spray steam, water, or cleaning solution directly at the vent assembly. Spraying steam, water, or cleaning solution at the vent assembly can force the water or cleaning solution into the transmission and contaminate the transmission fluid.
DIAGNOSTIC CODES AND TOOLS

Diagnostic features are provided with the transmission control system to assist in the troubleshooting of malfunctions. These features include a red or amber CHECK TRANS light or some type of Malfunction Indicator Light (MIL), a PC-based diagnostic program, and an optional hand-held scan tool. The CHECK TRANS and MIL lights are located on the dash panel. For vehicles which are compliant to industry On Board Diagnostics II (OBD II) requirements, an MIL Light will be present. For vehicles which are not compliant to industry OBD II requirements, a CHECK TRANS light will be present. The PC-based diagnostic program can troubleshoot all transmissions. The hand-held scan tool can troubleshoot only some transmissions.

Illumination of the CHECK TRANS light at any time after start-up indicates that the TCM has registered a diagnostic trouble code (DTC). Diagnostic codes are used to identify and clarify the nature of the malfunction. Diagnostic codes are read and cleared through the PC-based diagnostic program or the hand-held scan tool.

Illumination of the MIL Light at any time after start-up may indicate a problem with the engine or transmission.

For further information, consult an authorized Allison Transmission distributor or service dealer. Reference the Sales and Service Directory (SA2229) for the current listing of Allison Transmission authorized distributor and service dealers.
OWNER ASSISTANCE

The satisfaction and goodwill of the owners of Allison transmissions are of primary concern to Allison Transmission Division (ATD), 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).

Reference the Sales and Service Directory (SA2229) for the current listing of Allison Transmission authorized distributor and service dealers.

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 ATD dealers are associated with an ATD 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 ATD 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 equipped with electronic controls, also provide the TCM assembly number)
- 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:

Manager, Warranty Administration – PF9
Allison Transmission
P.O. Box 894
Indianapolis, IN 46206-0894
Phone: (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. This service literature provides fully illustrated instructions for the operation, maintenance, service, overhaul, and parts support of your transmission. To ensure that you get maximum performance and service life from your unit, 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

1000/2000/2400 Series Service Literature

<table>
<thead>
<tr>
<th>Title</th>
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<tbody>
<tr>
<td>Automatic Transmission Fluid Technician’s Guide</td>
<td>GN2055EN</td>
</tr>
<tr>
<td>* Mechanic’s Tips</td>
<td>MT3190EN</td>
</tr>
<tr>
<td>* Operator’s Manual</td>
<td>OM3063EN</td>
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<tr>
<td>Parts Catalog</td>
<td>PC3062EN</td>
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<td>Parts Catalog CD-ROM</td>
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<tr>
<td>Principles of Operation</td>
<td>PO3065EN</td>
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<td>Retail Literature Catalog</td>
<td>GN2798EN</td>
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<tr>
<td>Service Manual</td>
<td>SM3191EN</td>
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<tr>
<td>Electronic Troubleshooting Manual</td>
<td>TS3192EN</td>
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<tr>
<td>Worldwide Sales and Service Directory</td>
<td>SA2229EN</td>
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* Also Available On The Internet At [www.allisontransmission.com](http://www.allisontransmission.com)
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
336-292-9240

Western Branch Diesel, Inc.
3504 Shipwright Street
Portsmouth, VA 23703
757-484-6230

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**

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<tr>
<th>Company</th>
<th>Address</th>
<th>Phone</th>
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<tr>
<td>Caribe Detroit Diesel-Allison</td>
<td>Division of GT Corporation</td>
<td>787-750-5000</td>
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<tr>
<td></td>
<td>Ceramic Ind. Park, Campo Rico Ave., Block C</td>
<td></td>
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<tr>
<td></td>
<td>Carolina, Puerto Rico 00982</td>
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<tr>
<td>Inland Diesel, Inc.</td>
<td>13015 West Custer Avenue</td>
<td>262-781-7100</td>
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<td>Butler, WI 53007-0916</td>
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<tr>
<td>Central Detroit Diesel-Allison, Inc.</td>
<td>9200 Liberty Drive</td>
<td>816-781-8070</td>
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<tr>
<td>Interstate Detroit Diesel</td>
<td>2501 East 80th Street</td>
<td>612-854-5511</td>
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<td></td>
<td>Minneapolis, MN 55425</td>
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<tr>
<td>Clarke Detroit Diesel-Allison, Inc.</td>
<td>3133 East Kemper Road</td>
<td>513-771-2200</td>
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<tr>
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<td>Cincinnati, OH 45241</td>
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<tr>
<td>Inland Detroit Diesel-Allison, Inc.</td>
<td>210 Alexandra Way</td>
<td>630-871-1111</td>
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<td>Florida Detroit Diesel-Allison, Inc.</td>
<td>5105 Bowden Road</td>
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<td>Jacksonville, FL 32216</td>
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<tr>
<td>Williams Detroit Diesel-Allison</td>
<td>Midwest, Inc.</td>
<td>330-225-7751</td>
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**SOUTHWESTERN REGION**

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<tr>
<td>Detroit Diesel-Allison De Mexico S.A. De C.V.</td>
<td>Av. Ejercito Nacional #843</td>
<td>525-901-3057</td>
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<tr>
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<td>Colonia Granada, Mexico D.F.</td>
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<td>C.P. 11520</td>
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<tr>
<td>United Engines, Inc.</td>
<td>5555 West Reno Avenue</td>
<td>405-947-3321</td>
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<td>Oklahoma City, OK 73127</td>
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<tr>
<td>Stewart &amp; Stevenson Power, Inc.</td>
<td>5840 Dahlia Street</td>
<td>303-287-7441</td>
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<td>Commerce City, CO 80022</td>
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<tr>
<td>Stewart &amp; Stevenson Services, Inc.</td>
<td>2707 North Loop West</td>
<td>713-868-7700</td>
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<tr>
<td></td>
<td>Houston, TX 77008</td>
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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

Sierra Detroit Diesel-Allison, Inc.
1755 Adams Avenue
San Leandro, CA 94577-1001
510-635-8991

Williams Detroit Diesel-Allison Southwest, Inc.
2602 S. 19th Avenue
Phoenix, AZ 85009
602-257-0561

Smith Detroit Diesel-Allison, Inc.
250 West 3900 South
Salt Lake City, UT 84107
801-262-2631

CANADIAN REGION

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

Midwest Detroit Diesel-Allison Ltd.
1460 Waverley Street
Winnipeg, Manitoba R3T OP6
204-452-8244

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

Waterous Detroit Diesel-Allison (Div. of Integrated Power Systems Corp.)
10025 - 51 Avenue
Edmonton, Alberta T6E OA8
780-437-3550

Harper Detroit Diesel Ltd.
10 Diesel Drive
Toronto, Ontario M8W 2T8
416-259-3281
<table>
<thead>
<tr>
<th>Region</th>
<th>Address</th>
<th>Phone</th>
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</table>
| **EASTERN REGION** | 19 Oaklynn Drive  
P. O. Box 400  
Columbus, NJ 08022-0400  
609-298-2541 |               |                |
| **WESTERN REGION** | 39465 Paseo Padre Parkway  
Suite 2400  
Fremont, CA 94538  
510-498-5208 |               |                |
| **CENTRAL REGION** | P. O. Box 894, Speed Code PF06  
Indianapolis, IN 46206  
317-242-2327 |               |                |
| **CANADIAN REGION** | P. O. Box 5160, Station A  
London, Ontario N6A 4N5  
519-452-5256 |               |                |
| **SOUTHWESTERN REGION** | Phone: 936-321-4248  
Fax: 936-321-4278 |               |                |