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Allison Transmission

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DRIVING TRANSMISSION TECHNOLOGY®

1000/2000 OPERATOR'S MANUAL

PUPIL TRANSPORT/SHUTTLE SERIES

DECEMBER 2009

Operator's Manual

2009 DECEMBER

OM3758EN

Allison Transmission

VOCATIONAL MODELS

Pupil Transport/Shuttle Series (PTS)

1000 and 2000 Product Families
Includes Allison 4th Generation Controls and Model Year 2009 Prognostics

1000 PTS	2200 PTS	2500 PTS
2100 PTS	2350 PTS	2550 PTS

Allison Transmission

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www.allisontransmission.com

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TRADEMARK USAGE

The following trademarks are the property of the companies indicated:

- Allison DOC® is a Registered Trademark of Allison Transmission, Inc.

IMPORTANT SAFETY INFORMATION

IT IS YOUR RESPONSIBILITY to be completely familiar with the warnings and cautions in this manual. These warnings and cautions advise of specific methods or actions that can result in personal injury, equipment damage, or cause the equipment to become unsafe. These warnings and cautions are not exhaustive. Allison Transmission could not possibly know, evaluate, or advise the service trade of all conceivable procedures by which service might be performed or of the possible hazardous consequences of each procedure. Accordingly, ANYONE WHO USES A SERVICE PROCEDURE OR TOOL WHICH IS NOT RECOMMENDED BY ALLISON TRANSMISSION MUST first be thoroughly satisfied that neither personal safety nor equipment safety will be jeopardized by the service methods used.

Vehicle manufacturers integrate Allison transmissions into vehicles used for a variety of vocations and services. The vehicle manufacturer is responsible for identifying the specific operating conditions to which the vehicle will be subjected and to communicate the appropriate means for preventing unintended vehicle movement within those conditions, in order to ensure vehicle and operator safety. The vehicle owner and operator should be aware of and follow the vehicle manufacturer's operating instructions and warnings related to parking and preventing unintended vehicle movement.

Proper service and repair is important to the safe and reliable operation of the equipment. The service procedures recommended by Allison Transmission (or the vehicle manufacturer) and described in this manual are effective methods for performing service and diagnostic operations. Some procedures require using specially designed tools. Use special tools when and in the manner recommended.

The WARNINGS, CAUTIONS, and NOTES in this manual apply only to the Allison transmission and not to other vehicle systems which may interact with the transmission. Be sure to review and observe any vehicle system information provided by the vehicle manufacturer and/or body builder at all times the Allison transmission is being serviced.

WARNINGS, CAUTIONS, NOTES

Three types of headings are used in this manual to attract your attention:

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

CAUTION: A caution is used when an operating procedure, practice, etc., which, 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.

PUPIL TRANSPORT/SHUTTLE SERIES

1.0 INTRODUCTION

1.1 KEEPING THAT ALLISON ADVANTAGE

Allison **Pupil Transport/Shuttle Series (PTS)** transmissions provide many advantages for the driver who must stop and go or change speeds frequently. Driving is easier, safer, and more efficient.

The **Pupil Transport/Shuttle Series** transmissions are rugged and designed to provide long, trouble-free service. This manual will help you gain maximum benefits from your **Allison**-equipped vehicle.

Abbreviations

ABS	Anti-lock Brake System
DOC	Diagnostic Optimized Connection
DTC	Diagnostic Trouble Code
FTA	Federal Transit Authority
GCW	Gross Combined Weight—Laden weight of tractor/trailer or train.
IMS	Internal Mode Switch
MIL	Malfunction Indicator Lamp (OBD-II)
NSBU Switch	Neutral Start Backup Switch (EPA mandated specification for vehicle diagnostics)
OBD II	On Board Diagnostics; second generation.
OEM	Original Equipment Manufacturer
PC	Personal Computer—Needed to run a version of Allison DOC® For PC–Service Tool
PSM	Pressure Switch Manifold
PTO	Power Takeoff
PTS	Pupil Transport/Shuttle Series
SIL	Service Information Letter
TCM	Transmission Control Module (also commonly referred to as the “computer” for Allison 4th Generation Controls)
TPS	Throttle Position Sensor (Potentiometer for signaling the position of the engine fuel control lever)

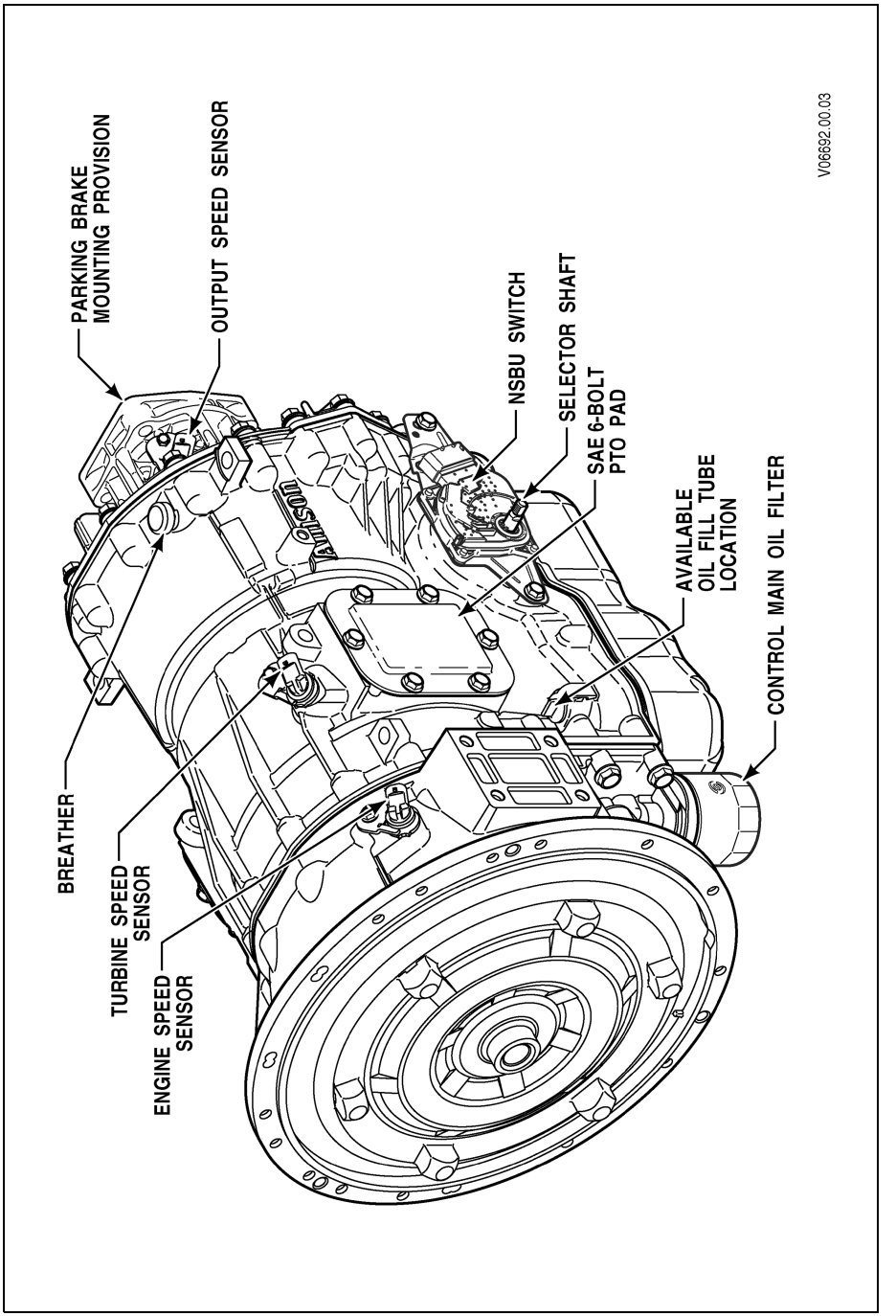

Figure 1–1. Pupil Transport/Shuttle Series — Left-Front View (Prior to Allison 4th Generation Controls)

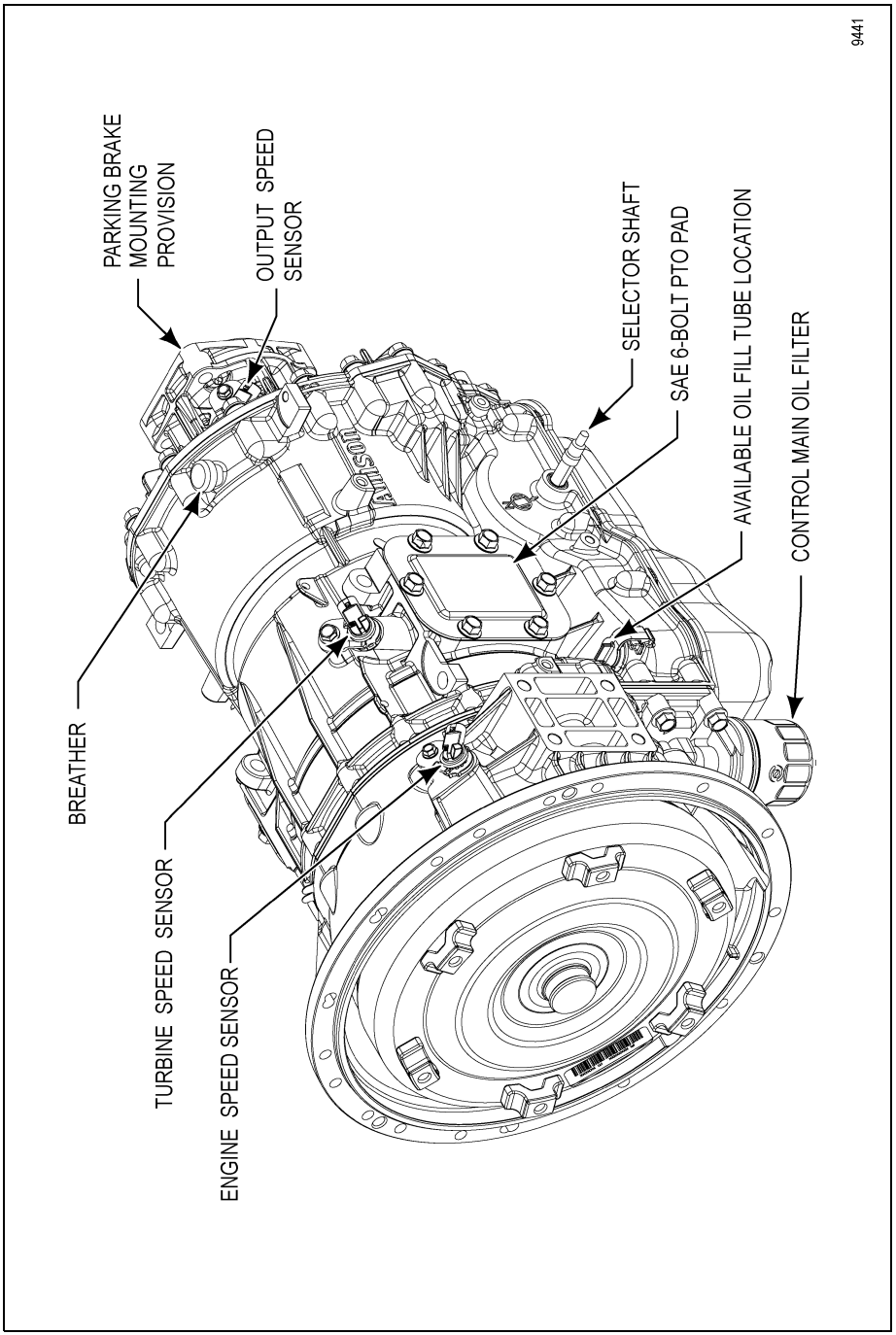

Figure 1–2. Pupil Transport/Shuttle Series — Left-Front View (Allison 4th Generation Controls)

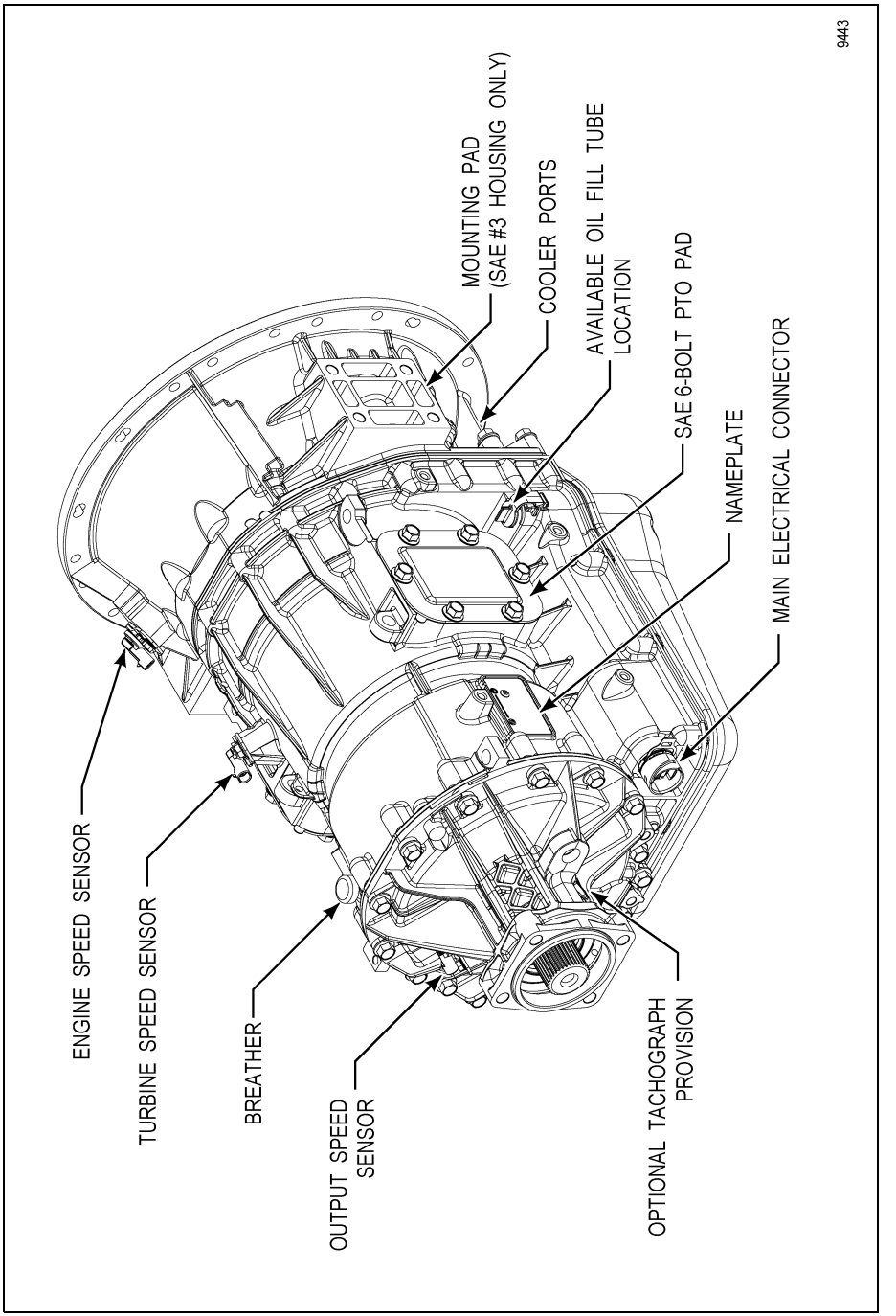

Figure 1–3. Pupil Transport/Shuttle Series — Right-Rear View

1.2 A BRIEF DESCRIPTION OF THE ALLISON 1000 AND 2000 PRODUCT FAMILIES TRANSMISSIONS

The Pupil Transport/Shuttle Series PTS transmissions are fully automatic, torque-converter driven, electrically 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 Product Family**– This transmission is best suited for light duty on-highway applications. The 1000 transmission has a park pawl.
- **2000 Product Family**– These transmissions are best suited for single-axle medium duty on-highway applications. The 2200 PTS, 2350 PTS, and 2550 PTS transmissions have a park pawl; the 2100 PTS, 2300 PTS, and 2500 PTS transmissions do not have park pawls.

The park pawl exists but cannot be engaged in some vehicle configurations using 1000 PTS, 2200 PTS, 2350 PTS, and 2550 PTS transmissions (e.g., some rear engine vehicles with air brakes). For these configurations, the **P** (Park) position is not used.

All transmissions have up to five forward ranges (six forward ranges available in 2350 PTS and 2550 PTS) 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.

1.3 ELECTRONIC CONTROL SYSTEM

The Pupil Transport/Shuttle Series PTS control system consists of five major components connected by customer-furnished wiring harnesses. The five major components are:

- Transmission Control Module (TCM)
- Engine Throttle Position Sensor (TPS) or direct electronic communication of throttle information
- Engine, turbine, and output speed sensors
- Neutral Start Backup (NSBU) switch or internal mode switch
- Control valve body

The control valve body contains solenoids and a pressure switch manifold to position and monitor control valve operation. The pressure switch manifold also contains a thermistor to monitor sump fluid temperature. The throttle position sensor (or engine-to-transmission communication link), speed sensors, pressure switch manifold, and NSBU switch or Internal Mode

Switch (IMS) communicate information to the TCM. The TCM processes this information and then sends signals to actuate specific solenoids located within the control valve body in the transmission. These solenoids control both oncoming and off-going clutch pressures to provide closed-loop shift control by matching engine rpm during a shift to a previously established desired profile that is programmed into the TCM.

The Pupil Transport/Shuttle Series (PTS) electronic control system has an “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 following several shifts of a particular shift type.

1.4 TORQUE CONVERTER

The torque converter consists of four elements – pump, turbine, stator, and torque converter (lockup) clutch. 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 Pupil Transport/Shuttle Series (PTS) torque converters contain a torque converter (lockup) clutch. When engaged, this clutch causes the torque converter pump and turbine to be locked together, enabling them to rotate in unison at engine speed. This condition, commonly referred to as “torque converter clutch operation,” 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.

1.5 PLANETARY GEARS AND CLUTCHES

A series of three helical, constant mesh 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.

1.6 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.

2.0 SHIFT SELECTORS

2.1 DESCRIPTION OF AVAILABLE TYPES

The Pupil Transport/Shuttle Series PTS transmissions use lever-type shift selectors. The shift positions on the shift selector can vary according to the shift selector installed.

2.2 OPERATION OF THE SHIFT SELECTOR

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

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

Ranges are selected by moving the lever to the desired selector position (**P**, **PB**, **R**, **N**, **D**, **4**, **3**, **2**, or **1**). Six speed transmission models have six forward ranges, first through sixth. 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

*The shift selector position representing this gear range may be labeled “5” or “6” (for the highest gear in the range), “OD” (for Overdrive), “D” (for the normal Drive position), “1–5” or “1–6” (for the complete gear range).

** In calibrations with five forward ranges, one of these selector positions will not be available. In calibrations with six forward ranges, two of these selector positions will not be available.

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 Pupil Transport/Shuttle Series transmissions.

Table 2–1. All 1000 PTS, 2200 PTS, 2350 PTS and 2550 PTS Transmissions With P (Park) Position

Shift Selector Position	Range	Shift Selector Position	Range	Shift Selector Position	Range
P (Park)	Neutral *	**P** (Park)	Neutral *	**P** (Park)	Neutral *
R (Reverse)	Reverse	**R** (Reverse)	Reverse	**R** (Reverse)	Reverse
N (Neutral)	Neutral	**N** (Neutral)	Neutral	**N** (Neutral)	Neutral
D (Drive) **	1–5 (1–6)***	**D** (Drive) **	1–5 (1–6)***	**D** (Drive) **	1–5 (1–4)†
4 (Fourth Range)	1–4	**4** (Fourth Range)	1–4	**3** (Third Range)	1–3
3 (Third Range)	1–3	**2** (Second Range)	1–2	**2** (Second Range)	1–2
1 (First Range)	1	**1** (First Range)	1	**1** (First Range)	1

* With Park Pawl engaged.
** The shift selector position representing this gear range may be labeled “5” or “6” (for the highest gear in the range), “OD” (for Overdrive), “D” (for the normal Drive position), or “1–5” or “1–6” (for the complete gear range).
***Calibration dependent.
†1–4 in Trailering Mode or 4-Speed Calibration.

Table 2–2. All 2100 PTS, 2300 PTS, and 2500 PTS Transmissions With PB (Auto-Apply Parking Brake) Position

Shift Selector Position	Range	Shift Selector Position	Range	Shift Selector Position	Range
PB (Auto-Apply Parking Brake)	Neutral*	**PB** (Auto-Apply Parking Brake)	Neutral*	**PB** (Auto-Apply Parking Brake)	Neutral*
R (Reverse)	Reverse	**R** (Reverse)	Reverse	**R** (Reverse)	Reverse

Table 2–2. All 2100 PTS, 2300 PTS, and 2500 PTS Transmissions With PB (Auto-Apply Parking Brake) Position *(cont'd)*

N (Neutral)	Neutral	**N** (Neutral)	Neutral	**N** (Neutral)	Neutral
D (Drive)**	1–5	**D** (Drive)**	1–5	**D** (Drive)**	1–5 (1–4)***
4 (Fourth Range)	1–4	**4** (Fourth Range)	1–4	**3** (Third Range)	1–3
3 (Third Range)	1–3	**2** (Second Range)	1–2	**2** (Second Range)	1–2
1 (First Range)	1	**1** (First Range)	1	**1** (First Range)	1

* With Auto-Apply Parking Brake engaged
** 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).
*** 1–4 in Trailering Mode or 4-Speed Calibration.

Table 2–3. All 1000 and 2000 Product Families Transmissions Without Either P (Park) or PB (Auto-Apply Parking Brake) Positions

Shift Selector Position	Range	Shift Selector Position	Range	Shift Selector Position	Range
R (Reverse)	Reverse	**R** (Reverse)	Reverse	**R** (Reverse)	Reverse
N (Neutral)	Neutral	**N** (Neutral)	Neutral	**N** (Neutral)	Neutral
D (Drive) **	1–5 (1–6) ***	**D** (Drive)**	1–5 (1–6) ***	**D** (Drive)**	1–5 (1–4)†
4 (Fourth Range)	1–4	**4** (Fourth Range)	1–4	**3** (Third Range)	1–3
3 (Third Range)	1–3	**2** (Second Range)	1–2	**2** (Second Range)	1–2
1 (First Range)	1	**1** (First Range)	1	**1** (First Range)	1

** The shift selector position representing this gear range may be labeled "5" or "6" (for the highest gear in the range), "OD" (for Overdrive), "D" (for the normal Drive position), or "1–5" or "1–6" (for the complete gear range).
*** Calibration dependent.
†1–4 in Trailering Mode or 4-Speed Calibration.

There are several features of the Pupil Transport/Shuttle Series transmissions that can inhibit transmission shifting. See the 3.12 SHIFT INHIBITS section 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 Pupil Transport/Shuttle 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.

2.3 RANGE SELECTION—ALL 1000 AND 2000 PRODUCT FAMILIES TRANSMISSIONS WITH P (Park) POSITION

Table 2–4. ALL 1000 AND 2000 PRODUCT FAMILIES TRANSMISSIONS WITH P (PARK) POSITION

	PARK
	**WARNING:** The following steps in this section provide general vehicle guidelines regarding the use and operation of a park pawl. Vehicle manufacturers integrate Allison transmissions into vehicles used for a variety of vocations and services. The vehicle manufacturer is responsible for identifying the specific operating conditions to which the vehicle will be subjected and to communicate the appropriate means for preventing unintended vehicle movement within those conditions, in order to ensure vehicle and operator safety. The vehicle owner and operator should be aware of and follow the vehicle manufacturer's operating instructions and warnings related to parking and preventing unintended vehicle movement.

Table 2–4. ALL 1000 AND 2000 PRODUCT FAMILIES TRANSMISSIONS WITH P (PARK) POSITION *(cont'd)*

WARNING: For vehicles containing 1000 AND 2000 Product Families Transmissions with P (Park) selector position, follow this procedure each time the operator's station will be unoccupied with the engine running:

1. Bring the vehicle to a complete stop using the service brake.
2. Make sure the engine is at low idle rpm or turned off.
3. Move the gear selector to **P** (Park), then slowly release the service brake. Releasing the brake too quickly, especially on a steep grade, may prevent the park pawl from engaging. If the vehicle moves, immediately reapply the service brake and repeat the prior steps.
4. Apply the vehicle's parking/emergency brake and make sure it is properly engaged.
5. When parked facing downhill, turn the front wheels toward the curb. When parked facing uphill, turn the front wheels away from the curb. When no curb, turn the front wheels away from the street.
6. If operating the vehicle when not in the operator's seat (such as in a tow truck) or when parking on steep grades, chock the wheels and take any other steps necessary to keep the vehicle from moving and follow any specific vehicle operating manuals or warnings.

WARNING!Failure to follow this procedure, may result in unintended vehicle movement which could result in death, serious personal injury or property damage.

CAUTION: Attempting to engage P (PARK) with the vehicle in motion (approximately 1.6 km/hr [1 mph] or higher) will result in ratcheting of the engagement mechanism and lack of engagement of the park pawl. The transmission may sustain damage as a result.

CAUTION: If the vehicle has four-wheel-drive and the transfer case is in NEUTRAL, the vehicle may be free to roll even if the PARK position is selected. Be certain that the transfer case is in "high" drive range, not in NEUTRAL, whenever the vehicle is parked.

If the vehicle is equipped with a two-speed axle or two-speed transfer case which is engaged in "low", even very slow 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. Be certain that the axle or transfer case is in "high" drive range whenever the vehicle is parked and the park pawl is engaged.

Table 2–4. ALL 1000 AND 2000 PRODUCT FAMILIES TRANSMISSIONS WITH P (PARK) POSITION *(cont'd)*

P	Use **P** (Park) for the following: • To turn the engine on or off • To check vehicle accessories • To operate the engine at idle for longer than five minutes • For stationary operation of the Power Takeoff (PTO) (if your vehicle is equipped with a PTO) This position places the transmission in **N** (Neutral) and engages the park pawl.
REVERSE	
	**WARNING: R** (Reverse) may not be obtained due to an active inhibitor. Check for the illumination of the **RANGE INHIBIT(ED)** light or **CHECK TRANS (MIL)** light. See the 3.12 SHIFT INHIBITS section of this manual.
	**WARNING:** To help avoid injury and/or property damage caused by unexpected vehicle movement, 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) can cause transmission overheating and damage. Always select **P** (Park) whenever time at idle exceeds five minutes.
R	**R** (Reverse) is used to back up 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.
NEUTRAL	
	**WARNING:** To help avoid injury and/or property damage caused by unexpected vehicle movement, do not make shifts to or from **N** (Neutral) without manually or automatically applying an appropriate vehicle brake.
	**WARNING:** DO NOT allow the vehicle to "coast" in **N** (Neutral). There is no engine braking in **N** (Neutral). You could lose control of the vehicle, causing property damage or personal injury. Coasting in neutral can cause severe transmission damage.

Table 2–4. ALL 1000 AND 2000 PRODUCT FAMILIES TRANSMISSIONS WITH P (PARK) POSITION *(cont'd)*

N	This position places the transmission in **N** (Neutral). Used for starting the engine and stationary operation.
DRIVE	
	**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 movement. To help avoid injury and/or property damage, always apply the service brake when selecting **D** (Drive) or other forward ranges. Check for the **RANGE INHIBIT(ED)** light or the **CHECK TRANS** light.
	**WARNING:** To help avoid injury and/or property damage caused by unexpected vehicle movement, 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) can cause transmission overheating and damage. Always select **P** (Park) whenever time at idle exceeds 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.
MANUAL SELECT	
	**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 will upshift to the next higher range to prevent engine damage. 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.

Table 2–4. ALL 1000 AND 2000 PRODUCT FAMILIES TRANSMISSIONS WITH P (PARK) POSITION *(cont'd)*

	**WARNING:** 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 can help you 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 will upshift to the next higher range to prevent engine damage. This will reduce engine 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[**] **3**[**]	Use **4** (Fourth Range) or **3** (Third Range) for city traffic and braking on steep downgrades. Actual ranges available depend on programming by vehicle manufacturer.
3[***] **2**[***]	Use **3** (Third Range) or **2** (Second Range) for heavy city traffic and braking on steeper downgrades. 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 **1** (First Range) provides the vehicle with its maximum driving torque and maximum engine braking effect.

[*] The shift selector position representing this gear range may be labeled "5" or "6" (for the highest gear in the range), "OD" (for Overdrive), "D" (for the normal Drive position), "1–5" or "1–6" (for the complete gear range)
[**] **3** for shift selectors with **P, R, N, D, 3, 2, 1**
[***] **3** for shift selectors with **P, R, N, D, 4, 3, 1**

2.4 RANGE SELECTION—ALL 2000 PRODUCT FAMILY TRANSMISSIONS WITH PB (AUTO-APPLY PARKING BRAKE) POSITION

ALL 2000 PRODUCT FAMILY TRANSMISSIONS WITH PB (AUTO-APPLY PARKING BRAKE) POSITION	
PARKING BRAKE	
	**WARNING:** For vehicles containing 2100 PTS, 2300 PTS, and 2500 PTS transmissions with **PB** (Auto-Apply Parking Brake) selector position, follow this procedure each time the operator's station will be unoccupied with the engine running. 1. Bring the vehicle to a complete stop using the service brake. 2. Make sure the engine is at low idle rpm. 3. Put the transmission in **PB** (Auto-Apply Parking Brake). Make sure the parking brake is properly engaged. 4. Apply the emergency brake and make sure it is properly engaged. 5. 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 unexpectedly 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 at 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.
REVERSE	
	**WARNING: R** (Reverse) may not be obtained due to an active inhibitor. Check for the illumination of the **RANGE INHIBIT(ED)** light or **CHECK TRANS (MIL)** light. See the 3.12 SHIFT INHIBITS section of this manual.
	**WARNING:** To help avoid injury and/or property damage caused by unexpected vehicle movement, 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.

ALL 2000 PRODUCT FAMILY TRANSMISSIONS WITH PB (AUTO-APPLY PARKING BRAKE) POSITION	
	**CAUTION:** Do not idle in **R** (Reverse) for more than five minutes. Extended idling in **R** (Reverse) can cause transmission overheating and damage. Always select **P** (Park) 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.
NEUTRAL	
	**WARNING:** To help avoid injury and/or property damage caused by unexpected vehicle movement, do not make shifts to or from **N** (Neutral) without manually or automatically applying an appropriate vehicle brake.
	**WARNING:** DO NOT allow the vehicle to “coast” in **N** (Neutral). There is no engine braking in **N** (Neutral). You could lose control of the vehicle, causing property damage or personal injury. Coasting in neutral can cause severe transmission damage.
N	This position places the transmission in **N** (Neutral). Used for starting the engine and stationary operation.
DRIVE	
	**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 movement. To help avoid injury and/or property damage, always apply the service brake when selecting **D** (Drive) or other forward ranges. Check for the **RANGE INHIBIT(ED)** light or the **CHECK TRANS** (MIL) light.
	**WARNING:** To help avoid injury and/or property damage caused by unexpected vehicle movement, 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) can cause transmission overheating and damage. Always select **P** (Park) whenever time at idle exceeds 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.

ALL 2000 PRODUCT FAMILY TRANSMISSIONS WITH PB (AUTO-APPLY PARKING BRAKE) POSITION	
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” or “6” (for the highest gear in the range), “OD” (for Overdrive), “D” (for the normal Drive position), “1–5” or “1–6” (for the complete gear range).
MANUAL SELECT	
	**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 will upshift to the next higher range to prevent engine damage. 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:** 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 can help you 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 will upshift to the next higher range to prevent engine damage. This will reduce engine 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* **3***	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** Actual ranges available depend on programming by vehicle manufacturer.

ALL 2000 PRODUCT FAMILY TRANSMISSIONS WITH PB (AUTO-APPLY PARKING BRAKE) POSITION	
3* **2***	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** Actual ranges available depend on programming by vehicle manufacturer.
1	Use **1** (First Range) 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.

2.5 RANGE SELECTION—ALL 1000 AND 2000 PRODUCT FAMILIES TRANSMISSIONS WITHOUT EITHER P (PARK) OR PB (AUTO-APPLY PARKING BRAKE) POSITIONS

ALL 1000 AND 2000 PRODUCT FAMILIES TRANSMISSIONS WITHOUT EITHER P (PARK) OR PB (AUTO-APPLY PARKING BRAKE) POSITIONS	
PARKING	
	**WARNING:** For vehicles containing 1000 and 2000 Product Families transmissions without either P (Park) or PB (Auto-Apply Parking Brake) selector positions, each time you park the vehicle or leave the operator's station with the engine running, do the following: 1. Bring the vehicle to a complete stop using the service brake. 2. Make sure the engine is at low idle rpm. 3. Put the transmission in **N** (Neutral). 4. Apply the emergency brake and/or parking brake and make sure they are properly engaged. 5. 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 the procedure is not followed, the vehicle may move suddenly and cause injury and/or property damage.

ALL 1000 AND 2000 PRODUCT FAMILIES TRANSMISSIONS WITHOUT EITHER P (PARK) OR PB (AUTO-APPLY PARKING BRAKE) POSITIONS	
REVERSE	
	**WARNING: R** (Reverse) may not be obtained due to an active inhibitor. Check for the illumination of the **RANGE INHIBIT(ED)** light or **CHECK TRANS (MIL)** light. See the 3.12 SHIFT INHIBITS section of this manual.
	**WARNING:** To help avoid injury and/or property damage caused by unexpected vehicle movement, 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) can cause transmission overheating and damage. Always select **P** (Park) 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.
NEUTRAL	
	**WARNING:** To help avoid injury and/or property damage caused by unexpected vehicle movement, do not make shifts to or from **N** (Neutral) without manually or automatically applying an appropriate vehicle brake.
	**WARNING:** DO NOT allow the vehicle to “coast” in **N** (Neutral). There is no engine braking in **N** (Neutral). You could lose control of the vehicle, causing property damage or personal injury. Coasting in neutral can cause severe transmission damage.
N	Use **N** (Neutral) for the following: • To turn on or turn off the engine • To check vehicle accessories • To operate the engine at idle for longer than five minutes • For stationary operation of the power takeoff (if your vehicle is equipped with a PTO
DRIVE	

ALL 1000 AND 2000 PRODUCT FAMILIES TRANSMISSIONS WITHOUT EITHER P (PARK) OR PB (AUTO-APPLY PARKING BRAKE) POSITIONS	
	**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 movement. To help avoid injury and/or property damage, always apply the service brake when selecting **D** (Drive) or other forward ranges. Check for the **RANGE INHIBIT(ED)** light or the **CHECK TRANS** (MIL) light.
	**WARNING:** To help avoid injury and/or property damage caused by unexpected vehicle movement, 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) can cause transmission overheating and damage. Always select **P** (Park) whenever time at idle exceeds 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” or “6” (for the highest gear in the range), “OD” (for Overdrive), “D” (for the normal Drive position), “1–5” or “1–6”(for the complete gear range).
MANUAL SELECT	
	**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 will upshift to the next higher range to prevent engine damage. 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.

ALL 1000 AND 2000 PRODUCT FAMILIES TRANSMISSIONS WITHOUT EITHER P (PARK) OR PB (AUTO-APPLY PARKING BRAKE) POSITIONS	
	**WARNING:** 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 can help you 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 will upshift to the next higher range to prevent engine damage. This will reduce engine 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* **3***	Use **4** (Fourth Range) or **3** (Third Range) for city traffic and braking on steep downgrades. ***3** for shift selectors with **R, N, D, 3, 2, 1** Actual ranges available depend on programming by vehicle manufacturer.
3* **2***	Use **3** (Third Range) or **2** (Second Range) for heavy city traffic and braking on steeper downgrades. ***3** for shift selectors with **R, N, D, 4, 3, 1** Actual ranges available depend on programming by vehicle manufacturer.
1	Use **1** (First Range) 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.

3.0 DRIVING TIPS

3.1 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 PTS, 2100 PTS, and 2200 PTS transmission, do not exceed 11 800 kg (26,000 lb) GCW or the OEM vehicle rating, whichever is less.
- For 2350 PTS and 2550 PTS transmissions, do not exceed 13 600 kg (30,000 lb) GCW or the OEM rating, whichever is less.
- For 2300 PTS and 2500 PTS transmissions, do not exceed 15 000 kg (33,000 lb) GCW or the OEM rating, whichever is less.

3.2 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.
- **SERVICE TRANS** light remains illuminated, if present.

3.3 TURNING THE VEHICLE ON/OFF

Before turning on or off the engine, the driver must verify that the service brake is engaged and one of the following selector positions has been selected and engaged:

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

NOTE: The vehicle should not start unless one of these selector positions has been selected. If the vehicle starts in any other selector position, seek service immediately.

Transmission operation at cold ambient temperatures may require preheating or the use of a lower viscosity transmission fluid. See the 5.5 FLUID RECOMMENDATIONS section 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.

3.4 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 and service brakes are applied.

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

3.5 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 schedule. 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.

3.6 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.

3.7 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 that a minimum or maximum operating speed was attained.

3.8 DIAGNOSTIC CODES

See detailed information in the 6.0 DIAGNOSTICS section.

3.9 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 3.12 SHIFT INHIBITS section in this manual.

3.10 CHECK TRANS OR MALFUNCTION INDICATOR LIGHT (MIL)

The red or amber **CHECK TRANS** indicator or Malfunction Indicator Light (MIL) is located on the dash panel. A MIL is present on vehicles that meet industry On-Board Diagnostics II (OBD II) requirements. A **CHECK TRANS** indicator is present on vehicles not subject to industry OBD II requirements.

Each time the engine is started, the **CHECK TRANS** indicator or MIL will illuminate, then turn off after two seconds. If the indicator does not illuminate during ignition, or if the indicator remains on after ignition, the transmission system should be checked immediately.

Illumination of the MIL or **CHECK TRANS** indicator at any time after start-up indicates that a problem has been detected. The TCM will register a DTC 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 or **CHECK TRANS** indicator at any time after start-up may indicate a problem with the engine or transmission, refer to the 6.0 DIAGNOSTICS section for more information on diagnostic codes.

3.11 DIAGNOSTIC CODES OVERVIEW

Refer to detailed information in the 6.0 DIAGNOSTICS section.

3.12 SHIFT INHIBITS

The transmission control system inhibits shifting to protect the transmission from some types of abusive operation, in response to Diagnostic Trouble Codes (DTCs), 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

3.12.1 Above-Idle Neutral-to-Range Shifts.

Above-idle (greater than 900 rpm in Allison 4th Generation transmissions, and greater than 1000 rpm in previous transmissions) 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).

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 and service brakes are applied.

When these shifts are inhibited, the **RANGE INHIBIT(ED)** light illuminates. See the 3.9 RANGE INHIBIT(ED) LIGHT section in this manual for further information.

3.12.2 Forward/Reverse Directional Shifts.

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

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 and service brakes are applied.

When these shifts are inhibited, the **RANGE INHIBIT(ED)** light illuminates. See the 3.9 RANGE INHIBIT(ED) LIGHT section in this manual for further information.

3.12.3 Transmission Problems. Lights such as the **RANGE INHIBIT(ED)**, **CHECK TRANS**, or **MIL**, and a flashing **PRNDL** display are illuminated when the transmission detects a functional concern.

An illuminated **RANGE INHIBIT(ED)** light or a flashing **PRNDL** display indicates the TCM has detected a condition in which directional shifts are not allowed to be made. This inhibited state can be a self-clearing or lasting condition depending on the amount of time the condition is present.

The following conditions may cause an inhibited state:

- Engine speed too high
- Throttle percentage incorrect
- Output speed movement

See the 3.9 RANGE INHIBIT(ED) LIGHT or 3.10 CHECK TRANS OR MALFUNCTION INDICATOR LIGHT (MIL) section in this manual for further information.

Depending on the severity of the DTC, the transmission may default to an operating state predefined by the TCM such as Limp Home. Limp Home mode temporarily limits normal transmission operation until the vehicle can be driven to a service location and the severity of the problem is determined. The transmission remains in the Limp Home mode until the problem has been corrected. Following an engine restart, the transmission may obtain **3** (Third Range),**N** (Neutral), or **R** (Reverse).. Refer to the Sales and Service Directory (SA2229EN) for the current listing of Allison Transmission authorized distributor and service dealers.

3.12.4 Auxiliary Equipment Operation. The TCM prevents shifts from **P** (Park), **PB** (Auto-Apply Parking Brake), or **N** (Neutral)-to-range when auxiliary equipment is in operation (such as a wheelchair lift). For some vehicles, such as buses, shifts from **P** (Park), **PB** (Auto-Apply Parking Brake), or **N** (Neutral)-to-range are prevented unless the brake pedal is pressed.

3.13 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 will upshift to the next higher range to prevent engine damage. 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: 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 can help you 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 will upshift to the next higher range to prevent engine damage. This will reduce engine 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 the engine-governed speed is exceeded, the transmission will upshift automatically to the next range.

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

3.14 RANGE PRESELECTION

Range preselection means selecting a lower range to match driving conditions encountered or expect to be encountered. Learning to take advantage of

preselected shifts will give you better control on slick or icy roads and on downgrades.

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

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.

3.14.1 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.

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 will upshift to the next higher range to prevent engine damage. 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.

3.14.2 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.

3.15 REVERSE

Putting the transmission into **R** (Reverse) may activate vehicle backup lights and/or reverse warning devices.

3.16 DRIVING ON SNOW OR ICE

If possible, reduce your vehicle speed and select a lower range before losing traction. Select the range that will not exceed the speed expected to be maintained. Accelerate or decelerate very gradually to prevent the loss of traction. It is very important to decelerate gradually when a lower range is selected. It is important that you reach the selected lower range before attempting to accelerate. This will avoid an unexpected downshift during acceleration.

NOTE: If ABS is activated, the lockup clutch is automatically disengaged.

3.17 ROCKING OUT

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

CAUTION: If the wheels are stuck and not turning, do not apply full power for more than 10 seconds in either **D** (Drive) or **R** (Reverse). Full power for more than 10 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 allowing 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.

3.18 OPERATING TEMPERATURES

To properly operate the transmission, adhere to the following minimum and maximum transmission operating temperatures:

Sump, minimum continuous	40°C (100°F)
Sump, maximum intermittent	121°C (250°F)
To cooler, maximum intermittent	149°C (300°F)

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

3.19 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 can cause transmission overheating and damage.

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

CAUTION: The engine should never be operated for more than 10 seconds at full throttle with the transmission in range and the output stalled. Prolonged operation of this type will cause the transmission fluid temperature to become excessively high and will cause severe 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 5.0 CARE AND MAINTENANCE section of this manual.
- Safely 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 service management.

3.20 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 can 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 parking brake with the engine running and the transmission in range can cause an overheating failure of the transmission. The vehicle can contain a buzzer or dash-mounted light to alert the operator when the ignition switch is “ON”, the parking brake is applied, and the transmission selector is in range.

3.21 PARK PAWL

A park pawl is standard on 1000 PTS, 2200 PTS, 2350 PTS, and 2550 PTS transmissions and is not available on 2100 PTS, 2300 PTS, and 2500 PTS 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 PTS, 2200 PTS, 2350

PTS, and 2550 PTS transmissions (e.g., some rear engine vehicles with air brakes). For these configurations, the **P** (Park) position is not used.

WARNING: To help avoid injury and/or property damage caused by unexpected vehicle movement, 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. Repeated park pawl ratcheting can cause transmission damage.

WARNING: If the vehicle has four-wheel-drive and the transfer case is in Neutral, the vehicle can 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.

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 can produce appreciable transmission output shaft speed. Even the slightest vehicle motion can deter engagement of the park pawl in such cases. To help avoid injury and/or property damage caused by unexpected vehicle movement, be certain that the axle or transfer case is in “high” drive range whenever the vehicle is parked and the park pawl is engaged.

3.21.1 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 alleviate torque lock, do the following:

1. Taking the vehicle’s weight into consideration, push the vehicle uphill a small amount to release the pressure on the park pawl and permit a shift out of P (Park).
2. Shift the transmission out of **P** (Park) while applying the service brakes.
3. Release the parking brake.

3.22 PARKING/LEAVING VEHICLE WITH ENGINE RUNNING

WARNING: For vehicles containing 1000 and 2000 Product Families transmissions with **P** (Park) selector position, follow this procedure each time the operator's station will be unoccupied with the engine running:

1. Bring the vehicle to a complete stop using the service brake.
2. Make sure the engine is at low idle rpm or turned off.
3. Move the gear selector to **P** (Park), then slowly release the service brake. Releasing the brake too quickly, especially on a steep grade, may prevent the park pawl from engaging. If the vehicle moves, immediately reapply the service brake and repeat the prior steps.
4. Apply the vehicle's parking/emergency brake and make sure it is properly engaged.
5. If operating the vehicle when not in the operator's seat (such as in a tow truck) or when parking on steep grades, besides engaging the park pawl and applying the parking brake also chock the wheels and take any other steps necessary to keep the vehicle from moving and follow any specific vehicle operating manuals or warnings.

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

WARNING: For vehicles containing 1000 and 2000 Product Families transmissions with **PB** (Auto-Apply Parking Brake) selector position, follow this procedure each time the operator's station will be unoccupied with the engine running:

1. Bring the vehicle to a complete stop using the service brake.
2. Make sure the engine is at low idle rpm.
3. Put the transmission in **PB** (Auto-Apply Parking Brake).
4. Apply the emergency brakes and make sure they are properly engaged.
5. 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 unexpectedly and cause injury and/or property damage.

WARNING: For vehicles containing 1000 and 2000 Product Families transmissions without either **P** (Park) or **PB** (Auto-Apply Parking Brake) selector positions, each time you park the vehicle or leave the operator's station with the engine running, do the following:

1. Bring the vehicle to a complete stop using the service brake.
2. Make sure the engine is at low idle rpm.
3. Put the transmission in **N** (Neutral).
4. Apply the emergency brakes and/or parking brake and make sure they are properly engaged.
5. 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 unexpectedly and cause injury and/or property damage.

3.23 TOWING OR PUSHING

CAUTION: Failure to lift the drive 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.

3.24 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.

4.0 PROGNOSTICS

4.1 1000 AND 2000 PRODUCT FAMILIES SERVICE PROGNOSTICS

Prognostics are used to predict the need for transmission maintenance. Service prognostics were introduced with MY09 vehicles and require the use of Allison-approved TES 295 fluids and Control Main Filter P/N 29539579. MY09 Prognostics were offered as a package to Original Equipment Manufacturers (OEMs) as an option (refer to the following caution for vehicles not equipped for Prognostics). Starting in January 2010, the Service Prognostics package requires the use of Allison approved TES 295 or TES 389* fluids and Control Main Filter P/N 29539579. Transmission operating parameters monitored by the prognostics feature are:

1. Oil Life Monitor
2. Filter Life Monitor
3. Transmission Health Monitor

NOTE: If you are unable to determine whether your vehicle has Prognostics enabled, consult with your OEM service department or an authorized Allison distributor or dealer.

When a specified service threshold is detected for one of these parameters, the **TRANS SERVICE** indicator is illuminated to alert the operator to the need for action. Failure to attend to the service condition and reset the **TRANS SERVICE** indicator within a defined operating period will result in the illumination of the **CHECK TRANS** indicator (in addition to the **TRANS SERVICE** light), indicating the increased probability that the service condition may/will develop into a more serious condition.

The process for resetting the **TRANS SERVICE** indicator varies for each feature and is described in each of the following sections. Use the Allison

* TES 389 fluids can only be used with Prognostics on January 2010 (or later) transmissions and calibrated TCMs.

DOC® For PC–Service Tool to review the current status of any of these features and a history of indicator resets.

CAUTION: Transmission Prognostics features may be turned **ON** or **OFF** by a special transmission calibration and **REQUIRES** the use of Allison approved TES 295 and TES 389 fluids. If any other fluids are used, prognostic features must be turned **OFF**. Prognostic information will not be accurate with the use of any other transmission fluids and could result in improper maintenance activities resulting in transmission damage. If Prognostics is not programmed or is turned **OFF**, the kilometers (miles)/hours/months method of determining fluid and filter change intervals will apply. See charts in the 5.0 CARE AND MAINTENANCE section of this book or visit *www.allisontransmission.com* for a list of Allison-approved TES fluids or read Service Tips 1099 (current revision) for details.

4.2 OIL LIFE MONITOR

The **TRANS SERVICE** indicator will be illuminated, denoting a required change of the transmission fluid, when the remaining fluid life reaches approximately 2 percent (the parameter begins at 100 percent moving downward towards the lowest threshold). The **TRANS SERVICE** indicator will be lit steadily upon each initialization of the TCM, and will remain on steady for approximately two minutes after the initial selection of a drive range, until service is performed and the indicator is reset.

The **TRANS SERVICE** indicator can be reset with the Allison DOC® For PC–Service Tool. It may also be reset by selecting **N-D-N-D-N-R-N** on the shift selector, pausing briefly (less than 3 seconds) between each selector movement, with the ignition on and the engine not running. More details are provided in applicable Allison service literature for your specific transmission model.

Failure to perform maintenance and reset the **TRANS SERVICE** indicator within the next 100 hours of transmission operation will result in the illumination of the **CHECK TRANS** indicator (in addition to the **TRANS SERVICE** light). Any time this light is illuminated, the TCM will register a diagnostic code, which will require the use of Allison DOC® For PC–Service Tool to clear the code.

In addition to viewing diagnostic codes, the Allison DOC® For PC–Service Tool may also be used to display the amount of transmission operation from the initial service indication until the service reset.

4.3 FILTER LIFE MONITOR

The **TRANS SERVICE** indicator flashes beginning with the first TCM initialization after reaching the time and mileage parameters, indicating that the filter has reached the end of its designed life. The indicator continues to flash for two minutes after **D** (Drive) has been selected. Thereafter, the indicator illuminates and flashes upon each TCM initialization, continuing to flash for two minutes after the selection of **D** (Drive) each time, until service is performed and the indicator is reset.

The **TRANS SERVICE** indicator can be reset with the Allison DOC® For PC–Service Tool. It may also be reset by selecting **N-D-N-D-N-R-N** on the shift selector, pausing briefly (less than 3 seconds) between each selector movement, with the ignition on and the engine not running. More details are provided in applicable Allison service literature for your specific transmission model.

Failure to perform maintenance and reset the **TRANS SERVICE** indicator after an additional 100 hours of transmission operation will result in the illumination of the **CHECK TRANS** indicator (in addition to the **TRANS SERVICE** light). Any time this light is illuminated, the TCM will register a DTC, which requires the use of Allison DOC® For PC–Service Tool to clear the code.

In addition to viewing diagnostic codes, the Allison DOC® For PC–Service Tool may also be used to display the amount of transmission operation from the initial service indication until the service reset.

4.4 TRANSMISSION HEALTH MONITOR

The **TRANS SERVICE** indicator will be illuminated, indicating the need for clutch maintenance, when the remaining clutch life reaches approximately 10 percent, or if the running clearance exceeds a maximum value which may indicate a non-wear-related issue. The indicator will be lit steadily upon initialization of the TCM, and will remain on steady at all times, continuing to operate in this manner until service is performed and the indicator is reset. If reset does not occur within 100 hours, the **CHECK TRANS** indicator will be illuminated (in addition to the **TRANS SERVICE** light) and the TCM will register a DTC.

The indicator will reset automatically upon elimination of the clutch clearance condition which initiated it. The indicator can also be reset using the Allison DOC® For PC–Service Tool if necessary.

The Allison DOC® For PC–Service Tool may be used to display the amount of transmission operation from the initial service indication until the service reset.

5.0 CARE AND MAINTENANCE

5.1 PERIODIC INSPECTIONS AND CARE

5.1.1 Transmission Inspection.

CAUTION: Do not spray steam, water, or cleaning solution directly at electrical connectors or the breather. Fluids forced into electrical connectors can cause false codes and cross-talk. Steam, water, or cleaning solution forced into the breather will contaminate the transmission fluid. Seal all openings, the breather, and electrical connections before spraying steam, water, or cleaning solution on the transmission.

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 the following:

- 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 damaged electrical connectors
- Worn or out-of-phase driveline U-joints and slip fittings
- Clogged or dirty breather

5.1.2 Vehicle Inspection. Check the vehicle cooling system occasionally for evidence of transmission fluid (which would indicate a faulty oil cooler) and for blocked or restricted air flow through the radiator or transmission cooler.

5.1.3 Welding.

CAUTION: When welding on the vehicle:

- DO NOT WELD on the vehicle without disconnecting all control system wiring harness connectors from the TCM.
- DO NOT WELD on the vehicle without disconnecting TCM battery power and ground leads.
- DO NOT WELD on any control components.
- DO NOT CONNECT welding cables to any control components.
- PROTECT CONTROL COMPONENTS FROM SPARKS AND HEAT DURING WELDING.

A label describing on-vehicle welding precautions (ST2067EN) 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 warning label.

5.2 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 fluid level is too high, the fluid aerates—causing the transmission to shift erratically and overheat. Fluid may be expelled through the breather or dipstick tube when the fluid level is too high.

5.3 TRANSMISSION FLUID CHECK

WARNING: For vehicles containing 1000 PTS, 2200 PTS, 2350 PTS, and 2550 PTS transmissions with **P** (Park) selector position, follow this procedure each time the operator's station will be unoccupied with the engine running:

1. Bring the vehicle to a complete stop using the service brake.
2. Make sure the engine is at low idle rpm.
3. Put the transmission in **P** (Park).
4. Engage the park pawl by slowly releasing the service brake.
5. If a parking brake is present, apply the parking brake. Make sure the parking brake is properly engaged.
6. Apply the emergency brakes and make sure they are properly engaged.
7. 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 unexpectedly and cause injury and/or property damage.

WARNING: For vehicles containing 2100 PTS, 2300 PTS, and 2500 PTS transmissions with **PB** (Auto-Apply Parking Brake) selector position, follow this procedure each time the operator's station will be unoccupied with the engine running:

1. Bring the vehicle to a complete stop using the service brake.
2. Make sure the engine is at low idle rpm.
3. Put the transmission in **PB** (Auto-Apply Parking Brake).
4. Apply the emergency brakes and make sure they are properly engaged.
5. 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 unexpectedly and cause injury and/or property damage.

WARNING: For vehicles containing 1000 and 2000 Product Families transmissions without either **P** (Park) or **PB** (Auto-Apply Parking Brake) selector positions, each time you park the vehicle or leave the operator's station with the engine running, do the following:

1. Bring the vehicle to a complete stop using the service brake.
2. Make sure the engine is at low idle rpm.
3. Put the transmission in **N** (Neutral).
4. Apply the emergency brakes and/or parking brake and make sure they are properly engaged.
5. 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 unexpectedly and cause injury and/or property damage.

5.3.1 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 service management.

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

Check the fluid level as follows:

1. Bring the vehicle to a complete stop on a level surface using the service brake.
2. Make sure the engine is at low idle rpm (with fast idle disabled).
3. Put the transmission in **P** (Park), **PB** (Auto-Apply Parking Brake), or **N** (Neutral).

4. Apply any other parking brake, if present, and make sure it is properly engaged.
5. Chock the wheels and take any other steps necessary to keep the vehicle from moving.
6. Run the engine at 1000–1500 rpm for at least one minute to purge air from the system. 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.
7. With the engine running, remove the dipstick from the tube and wipe the dipstick clean.
8. Insert the dipstick into the tube and remove. Check the fluid level reading. Repeat the check procedure to verify the reading.
9. If the fluid level is within the “COLD CHECK” band (refer to Figure 5–1), 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.
10. 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.

5.3.3 Hot Check Procedure.

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

NOTE: 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.

Operate the transmission in **D** (Drive) until the following normal operating temperatures are reached:

- **Sump temperature**—71°C–93°C (160°F–200°F)
- **Converter-out temperature**—82°C–104°C (180°F–220°F)

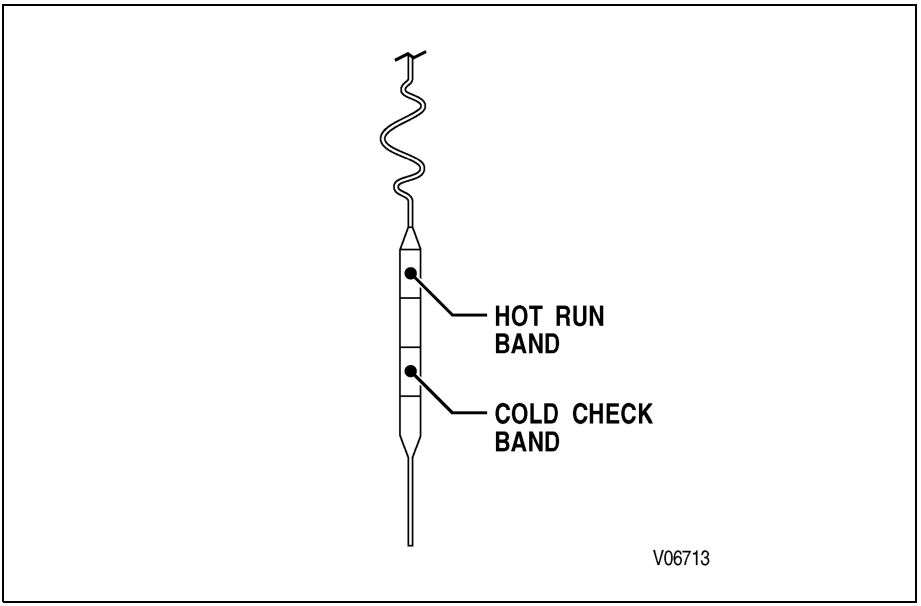

Figure 5–1. Typical Dipstick Markings

Check the fluid level as follows:

1. Bring the vehicle to a complete stop on a level surface using the service brake.
2. Make sure the engine is at low idle rpm (with fast idle disabled).
3. Put the transmission in **P** (Park), **PB** (Auto-Apply Parking Brake), or **N** (Neutral).
4. Apply any other parking brake, if present, and make sure it is properly engaged.
5. Chock the wheels and take any other steps necessary to keep the vehicle from moving.
6. With the engine running, remove the dipstick from the tube and wipe the dipstick clean.
7. Insert the dipstick into the tube and remove. Check the fluid level reading. Repeat the check procedure to verify the reading.

NOTE: Safe operating level is within the “HOT RUN” band on the dipstick (refer to Figure 5–1). The width of the “HOT RUN” band represents approximately 1.0 liter (1.06 quart) of fluid at normal operating sump temperature.

8. 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.

5.3.4 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 breather to be sure it is clean and unclogged. If readings are still inconsistent, contact your nearest Allison distributor or dealer.

5.4 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 and some seals to fail.

5.5 FLUID RECOMMENDATIONS

Hydraulic fluids (oils) used in the transmission are important influences on transmission performance, reliability, and durability. Any fluids meeting Schedule 1 TES 389 or TES 295 specifications are acceptable for use in the 1000 and 2000 Product Families transmissions.

To make sure the fluid is qualified for use in Allison transmissions, check for a Schedule 1 TES 389 or TES 295 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 geographic 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 5–1. Transmission Fluid Operating Temperature Requirements

	Ambient Temperature Below Which Preheat is Required	
Viscosity Grade	**Celsius**	**Fahrenheit**
TES 389	–25°	–13°
Allison approved TES 295	–35°	–31°

Shifting is inhibited and torque converter clutch mode is not reached until the transmission fluid operating temperature requirements have been met. Refer to Table 5–1 . As the transmission reaches normal operating temperature, all shift ranges and the torque converter clutch mode begin to function.

5.6 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 can be necessary than recommended in the general guidelines when operating conditions create high levels of contamination or overheating.

5.6.1 Frequency. New vehicles delivered from the OEM with a mixture of Allison-approved TES 295 fluid and non-TES 295 fluids, or Schedule 1 TES 389 Allison Transmission approved fluids, must follow fluid/filter change recommendations outlined in Schedule 1. If the customer fills the transmission with Allison approved TES 295 fluid, the change recommendations of Schedule 1 must be followed.

Upon the next oil change, if the customer reinstalls Allison approved TES 295 fluid, the fluid/filter change recommendations outlined in Schedule 2 may be used. The recommendations in Schedule 2 are based upon Allison fluid change procedures and the transmission containing 100 percent concentration of Allison approved TES 295 fluid. For transmissions that contain a mixture of Allison approved TES 295 fluid and non-TES 295 fluids, refer to Schedule 1.

New vehicles delivered from the OEM with Allison approved TES 295 fluids and Allison Prognostics, beginning with MY09 must follow fluid/filter change recommendation outlined in Schedule 3. Allison Prognostics must only be used with Allison approved TES 295 fluid and Allison Control Main Filter P/N 29539579.

NOTE: Fluid Exchanging Machines are not recommended or recognized due to variation and inconsistencies that may not guarantee removal of 100 percent of the used fluid.

Allison Transmission requires an initial filter change for the Spin-On Control Main Filter during the first 16 000 km (10,000 miles) or 400 hours of service, whichever comes first. Refer to the Recommended Fluid and Filter Change Intervals schedules for recommendations. The transmission sump filter is permanent and does not require replacement except at overhaul.

Severe Vocations are defined as vehicles experiencing duty cycles that require stopping more than once in a mile. General Vocations include all other vocations. Local conditions, severity of operation, or duty cycle may require more or less frequent fluid change intervals that differ from the published recommended fluid change intervals of Allison Transmission.

The following tables are given only as a general guide for fluid and filter change intervals.

Table 5–2. Schedule 1. Recommended Fluid and Filter Change Intervals (Allison Approved Non-TES 295 Fluids)

Vocation	Fluid*	Filters		
		Control Main**	Internal	Lube/Auxiliary
General	80 000 km (50,000 Miles) 24 Months 2000 Hours	80 000 km (50,000 Miles) 24 Months 2000 hours	Overhaul	80 000 km (50,000 Miles) 24 Months 2000 hours
Severe	20 000 km (12,000 Miles) 6 Months 500 hours	20 000 km (12,000 Miles) 6 Months 500 hours	Overhaul	20 000 km (12,000 Miles) 6 Months 500 hours

*Allison approved non-TES 295 fluid is defined as the quantity of oil remaining in the transmission after a standard fluid change combined with the quantity of Allison approved TES 295 fluid that is required to fill the transmission to the proper level. A mixture of Allison approved TES 295 fluid vs. non-TES 295 fluids other than as defined in this paragraph does not meet the requirements that permit the eligibility for the recommendations given in Schedule 2.

**Control Main Spin-on Filters Only—Initial 16 000 km (10,000 miles) or first engine oil change, whichever comes first.

Table 5–3. Schedule 2. Recommended Fluid and Filter Change Intervals (100 Percent Concentration of Allison Approved TES 295 Fluids)

Vocation	Fluid	Filters		
		Control Main*	Internal	Lube/Auxiliary
General	240 000 km (150,000 Miles) 48 Months 4000 hours	80 000 km (50,000 Miles) 24 Months 2000 hours	Overhaul	80 000 km (50,000 Miles) 24 Months 2000 hours
Severe	120 000 km (75,000 Miles) 36 Months 3000 hours	80 000 km (50,000 Miles) 24 Months 2000 hours	Overhaul	80 000 km (50,000 Miles) 24 Months 2000 hours

*Control Main Spin-on Filter Only—Initial 16 000 km (10,000 miles), or 400 hours, whichever comes first.

Table 5–4. Schedule 3. Recommended Fluid and Filter Change Intervals (Allison Prognostics "ON" Beginning in MY09 Using 100 Percent Concentration of Allison Approved TES 295 Fluids)

Vocation	Fluid*	Filters		
		Control Main**	Internal	Lube/Auxiliary
General or Severe	Change fluid when indicated by controller or 48 months, whichever comes first.	Change filter when indicated by controller or 48 months, whichever comes first.	Overhaul	Change filter when indicated by controller or 48 months, whichever comes first.

*MY09 Allison Prognostics must only be used with Allison approved TES 295 fluid.
**Allison Prognostics must only be used with Allison Control Main Spin-on Filter P/N 29539579. Control Main Spin-on Filters Only—Initial 16 000 km (10,000 miles) or 400 hours, whichever comes first.

Table 5–5. Schedule 4. Recommended Fluid and Filter Change Intervals (Allison Prognostics "ON" Beginning in MY2010 Using a Mixture of Allison Approved TES 295 and TES 389 Fluids or 100 Percent of Allison Approved TES 389 Fluids)

Vocation	Fluid*	Filters		
		Control Main**	Internal	Lube/Auxiliary
General or Severe	Change fluid when indicated by controller or 24 months, whichever comes first.	Change filter when indicated by controller or 24 months, whichever comes first.	Overhaul	Change filter when indicated by controller or 24 months, whichever comes first.

*MY10 Allison Prognostics can use TES 389 or a mixture of Allison approved TES 389 and TES 295 fluids

**Allison Prognostics must only be used with Allison Control Main Spin-on Filter P/N 29539579. Control Main Spin-on Filters Only—Initial 16 000 km (10,000 miles) or 400 hours, whichever comes first.

5.6.2 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.

5.6.3 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. Allison Transmission recommends that customers use fluid analysis as the primary method for determining fluid and filter change intervals. In the absence of a fluid analysis program the fluid change intervals listed in Schedules 1, 2, 3 or 4 should be followed.

- Fluid analysis firms—Consult your local telephone directory for fluid analysis firms. To make sure fluid analysis is consistent and accurate, use only one fluid analysis firm. Refer to the Technician's Guide for Automatic Transmission Fluid, GN2055EN, for additional information.
- Oil analysis kits, P/N 29537805, are available through your normal Allison Transmission parts source.

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

Table 5–6. Fluid Oxidation Measurement Limits

Test	Limit
Viscosity	±25 percent change from new fluid
Total Acid Number	+3.0 * change from new fluid
*mg of KOH required to neutralize a gram of fluid.	

5.7 TRANSMISSION FLUID CONTAMINATION

5.7.1 Fluid Examination. At each fluid change, examine the drained fluid for evidence of dirt or water. A normal amount of condensation (not to exceed 0.2 percent maximum) will appear in the fluid during operation.

5.7.2 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.

5.7.3 Engine Coolant.

CAUTION: If the transmission fluid is contaminated by water, not to exceed 0.2 percent maximum by volume, or any trace of ethylene glycol, disassemble the transmission and replace the following:

- Seals
- Gaskets
- Clutch/Friction plates
- Bearings
- Torque converters that cannot be disassembled
- Components that have rusted
- Solenoids that do not meet resistance specifications
- Pressure switch manifold (PSM)
- Internal Mode Switch (IMS)

Remove all traces of ethylene glycol and varnish deposits. Failure to follow this procedure decreases transmission reliability and durability.

5.7.4 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 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 can cause overheating and transmission 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 AS64–072 in the Allison 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.

5.8 TRANSMISSION FLUID AND FILTER CHANGE PROCEDURE

5.8.1 Drain Fluid.

1. Drain the fluid when the transmission is at normal operating sump temperature of 71–93°C (160–200°F). Hot fluid flows quicker and drains more completely.
2. Remove the drain plug from the oil pan and allow the fluid to drain into a suitable container.
3. Examine the fluid as described in the 5.7 TRANSMISSION FLUID CONTAMINATION paragraph in this Section.

5.8.2 Replace Control Main Filter.

1. Using a standard strap-type filter wrench or the J–45023 Filter Wrench tool, remove the control main filter (Figure 5–2) 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.
7. Using the J–45023 Filter Wrench tool or by hand, turn the filter ONE FULL TURN ONLY after gasket contact.

CAUTION: Turning the control-main filter more than ONE FULL TURN after gasket contact will damage the filter.

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

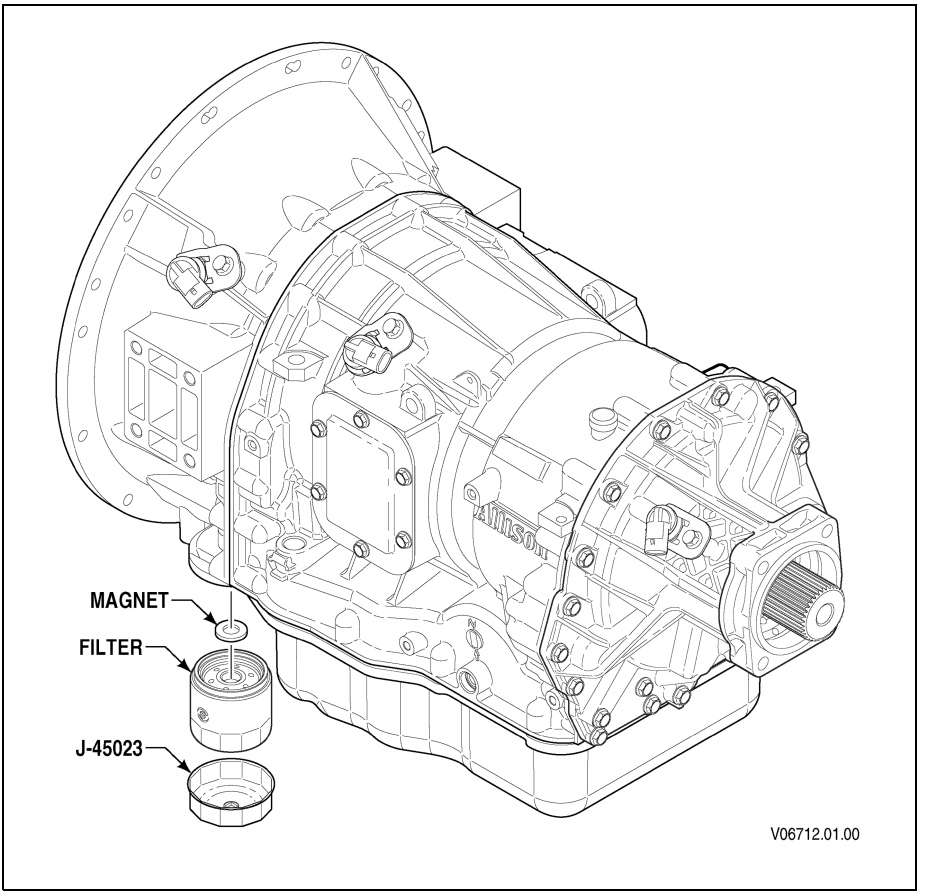

Figure 5–2. Replacing the Control Main Filter

5.8.3 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 5.3 TRANSMISSION FLUID CHECK paragraph of this Manual.

NOTE: Quantities listed are approximations and do not include external lines and cooler hose.

Table 5–7. Transmission Fluid Capacity

Transmission	Sump	Initial Fill*		Refill*	
		Liters	Quarts	Liters	Quarts
1000 and 2000 Product Families	Standard	14	14.8	10	10.6
	Shallow	12	12.7	7	7.4

*Approximate quantities, do not include external lines and cooler hose.

5.9 BREATHER

Location and Purpose. The breather is located at the top left-rear of the transmission main housing (refer to Figure 1–3). The breather prevents air pressure buildup within the transmission and its passage must be kept clean and open.

CAUTION: Do not spray steam, water, or cleaning solution directly at electrical connectors or the breather. Fluids forced into electrical connectors can cause false codes and cross-talk. Steam, water, or cleaning solution forced into the breather will contaminate the transmission fluid. Seal all openings, the breather, and electrical connections before spraying steam, water, or cleaning solution on the transmission.

Maintenance. The amount of dust and dirt encountered determines the frequency of breather cleaning. Use care when cleaning the transmission.

PUPIL TRANSPORT/SHUTTLE SERIES

6.0 DIAGNOSTICS

6.1 DIAGNOSTIC CODES AND TOOLS

The illumination of the **CHECK TRANS** indicator or **MIL** any time after start-up indicates that the TCM has registered a DTC. DTCs are used to identify the nature of a malfunction.

Use any Allison DOC® diagnostic tool to access DTCs and troubleshoot transmission complaints.

The following Allison DOC® diagnostic tools are available:

- Allison DOC® For PC–Service Tool – full feature service tool.
- Allison DOC® For Fleets–Service Tool – diagnostic only.

For more information regarding Allison DOC® diagnostic tools, please visit *www.allisontransmission.com*– Click on “Service” and then click on “Diagnostic Tools”.

For additional help, **contact an authorized Allison Transmission distributor or service dealer or the Allison Technical Assistance Center at 800-252-5283.** Refer to the Sales and Service Directory (SA2229EN) or use the Allison Transmission Sales and Service Locator Tool on the Allison Transmission web site at *www.allisontransmission.com* for current Allison Transmission authorized distributors and service dealers.

7.0 CUSTOMER SERVICE

7.1 OWNER ASSISTANCE

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

As an owner of an Allison transmission, you have service locations throughout the world that are eager to meet your parts and service needs with:

- Expert service by trained personnel.
- Emergency service 24 hours a day in many areas.
- Complete parts support.
- Sales teams to help determine your transmission requirements.
- Product information and literature.

Normally, any situation that arises in connection with the sale, operation, or service of your transmission will be handled by the distributor or dealer in your area. Check the telephone directory for the Allison Transmission service outlet nearest you or use Allison Transmission's Sales and Service Locator tool on the Allison Transmission web site at *www.allisontransmission.com*. You may also refer to Allison Transmission's Worldwide Sales and Service Directory (SA2229EN).

We recognize, however, that despite the best intentions of everyone concerned, misunderstandings may occur. To further assure your complete satisfaction, we have developed the following three-step procedure to be followed in the event a problem has not been handled satisfactorily.

Step One—Discuss your problem with a member of management from the distributorship or dealership. Frequently, complaints are the result of a breakdown in communication and can be resolved quickly by a member of management. If you have already discussed the problem with the Sales or Service Manager, contact the General Manager. All Allison Transmission dealers are associated with an Allison Transmission distributor. If the problem originates with a dealer, explain the matter to a management member of the distributorship with whom the dealer has his service agreement. The

dealer will provide his Allison Transmission distributor's name, address, and telephone number on request.

Step Two—When it appears the problem cannot be readily resolved at the distributor level without additional assistance, **contact the Allison Technical Assistance Center at 800-252-5283.** They will place you in contact with the Regional Customer Support Manager for your area.

For prompt assistance, please have the following information available:

- Name and location of authorized distributor or dealer.
- Type and make of vehicle/equipment.
- Transmission model number, serial number, and assembly number (if equipped with electronic controls, also provide the Transmission Control Module (TCM) assembly number).
- Transmission delivery date and accumulated miles and/or hours of operation.
- Nature of problem.
- Chronological summary of your transmission's history.

Step Three—If you are still not satisfied after contacting the Regional Customer Support Manager, **present the entire matter to the Home Office by writing to the following address:**

Allison Transmission
Manager, Warranty Administration
PO Box 894, Mail Code PF9
Indianapolis, IN 46206-0894

The inclusion of all pertinent information will assist the Home Office in expediting the matter.

When contacting the Home Office, please keep in mind that ultimately the problem will likely be resolved at the distributorship or dealership using their facilities, equipment, and personnel. Therefore, it is suggested that **Step One** be followed when experiencing a problem.

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

7.2 SERVICE LITERATURE

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

Allison Transmission distributor or *www.allisontransmission.com/publications/*
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7.3 ALLISON TRANSMISSION DISTRIBUTORS

NOTE: For a complete and up-to-date listing of Allison Transmission Service Centers, go to *www.allisontransmission.com/locator/*

EASTERN REGION

Atlantic Detroit Diesel-Allison, LLC
19 C Chapin Road
Pine Brook, NJ 07058
973-575-0309

Covington Power Services
8015 Piedmont Triad Parkway
Greensboro, NC 27409
336-292-9240

Detroit Diesel-Allison Canada East
Attn: Div. of Integrated Power Systems Corp.
2997 Avenue (rue) Watt
Quebec, Quebec G1X 3W1
418-651-5371

Florida Detroit Diesel-Allison, Inc.
2277 N.W. 14th Street
Miami, FL 33125-0068
305-638-5300

Harper Power Products, Inc
10 Diesel Drive
Toronto, Ontario M8W 2T8
416-259-3281

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

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

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

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

W.W. Williams S.E., Inc.
3077 Moreland Avenue
Conley, GA 30288
404-366-1070

CENTRAL REGION

Central Power Systems & Services, Inc.
9200 Liberty Drive
Liberty, MO 64068
816-781-8070

Clarke Power Services, Inc.
3133 East Kemper Road
Cincinnati, OH 45241
513-771-2200

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

Interstate PowerSystems, Inc.
2501 American Boulevard, East
Minneapolis, MN 55425
952-854-5511

Stewart & Stevenson Power Products, LLC
1000 Louisiana, Suite 5900
Houston, TX 77002
713-751–2600

United Engines, LLC
5555 West Reno Street
Oklahoma City, OK 73127
405-947-3321

Waterous Power Systems (A Division of Integrated Power Systems Corp.)
10025 – 51 Avenue
Edmonton, Alberta T6E OA8
780-437-8200

W.W. Williams M.W., Inc.
1176 Industrial Parkway, North
Brunswick, OH 44212-2342
330-225-7751

MEXICO REGION

Detroit Diesel-Allison de Mexico
S.A.de C.V.
Av. Santa Rosa No. 58 Col.
Ampliacion Norte
San Juan Ixtacala, Tlalnepantla C.P.
54160, Estado de Mexico
525-5-5333-1800

WESTERN REGION

ABC Transmissions, Ltd
9357 – 193rd Street
Surrey, British Columbia V4N 4E7
604-888-1211

Allison West
14775 Wicks Boulevard
San Leandro, CA 94577–6779
510–351–6101

Pacific Power Products Company
7215 South 228th Street
Kent, WA 98032
253-854-0505

Smith Power Products, Inc.
3065 West California Avenue
Salt Lake City, UT 84104
801-415-5000

Stewart & Stevenson Power Products, LLC
5170 E 58th Place
Commerce City, CO 80022
303-287-7441

Valley Power Systems, Inc
425 South Hacienda Boulevard
City of Industry, CA 91745-1123
626-333-1243

W.W. Williams S.W., Inc.
2602 S. 19th Avenue
Phoenix, AZ 85009
602-257-0561

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