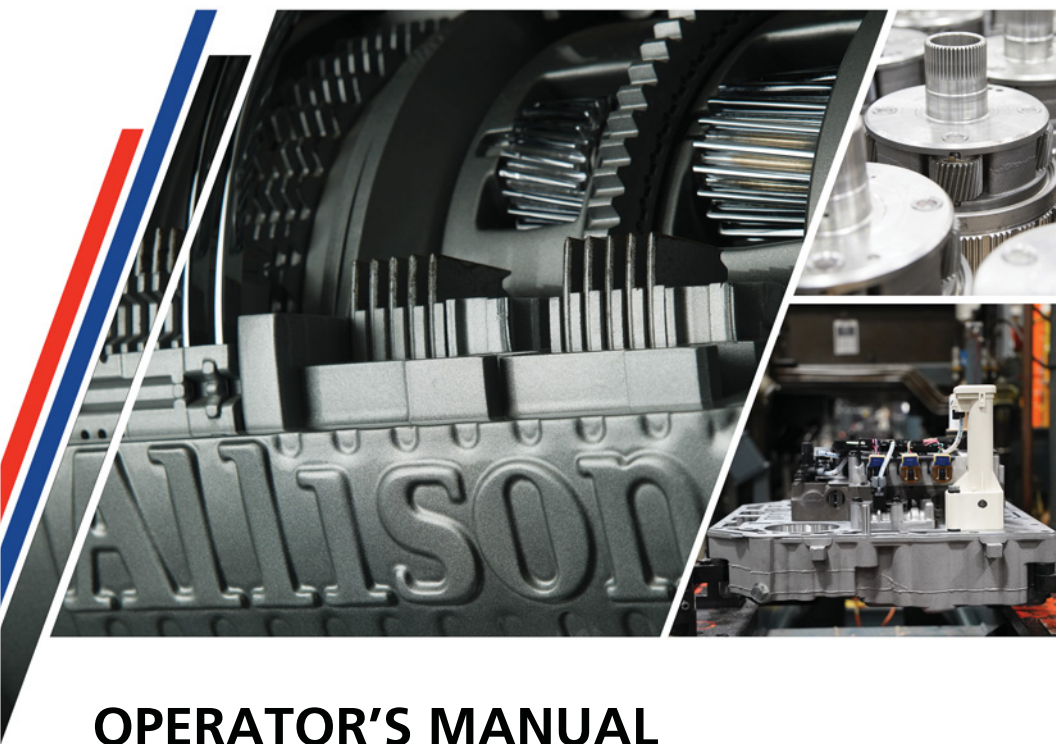


9-Speed Transmission



OPERATOR'S MANUAL

OM8888EN



Operator's Manual

2023 AUGUST

OM8888EN

Allison Transmission

9-Speed

2906	2909 RDS	2919 MH	2959	2967 MH
2906 HS	2909 SP	2919 PTS	2959 HS	2967 SP
2906 PTS	2916	2919 RDS	2959 MH	2969
2906 RDS	2916 HS	2919 SP	2959 PTS	2969 HS
2907 MH	2916 PTS	2956	2959 RDS	2969 MH
2907 SP	2916 RDS	2956 HS	2959 SP	2969 PTS
2909	2917 MH	2956 PTS	2966	2969 RDS
2909 HS	2917 SP	2956 RDS	2966 HS	2969 SP
2909 MH	2919	2957 MH	2966 PTS	T 2906
2909 PTS	2919 HS	2957 SP	2966 RDS	T 2916



Allison
Transmission.

Allison Transmission, Inc.
P.O. Box 894 Indianapolis, Indiana 46206-0894
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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 or equipment manufacturers (collectively hereinafter "manufacturer(s)") integrate Allison transmissions into vehicles or equipment used for a variety of vocations and services. The manufacturer is responsible for identifying the specific operating conditions to which the vehicle or equipment will be subjected and to communicate the appropriate means for preventing unintended vehicle or equipment movement within those conditions, in order to ensure vehicle or equipment safety and operator safety. The vehicle or equipment owner and operator should be aware of and follow the manufacturer's operating instructions and warnings related to parking and preventing unintended vehicle or equipment 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 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 or equipment systems which may interact with the transmission. Be sure to review and observe any vehicle or equipment system information provided by the 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.

ABBREVIATIONS AND ACRONYMS

• ABMS	Acceleration Based Mode Switch
• ABS	Anti-lock Brake System
• COTP	Converter Over-temp Torque Protection
• DMD	Display Mode/Diagnostic
• DOC	Diagnostic Optimized Connection
• DSS	Dynamic Shift Sensing
• DTC	Diagnostic Trouble Code
• DTCs	Diagnostic Trouble Codes
• GCW	Gross Combined Weight—Laden weight of tractor/trailer or train.
• HS	Highway Series
• INT	International Series
• KOH	Potassium Hydroxide
• LBSS	Load-Based Shift Scheduling
• LRTP	Low Range Torque Protection
• MH	Motorhome Series
• MIL	Malfunction Indicator Lamp
• OBD II	On Board Diagnostics; second generation.
• OEM	Original Equipment Manufacturer
• PC	Personal Computer
• PTO	Power Takeoff
• PTS	Pupil Transport/Shuttle Series
• RDS	Rugged Duty Series
• RII	Range Inhibited Indicator
• rpm	Revolutions Per Minute
• SAE	Society of Automotive Engineers
• SEM	Shift Energy Management
• SESS	Super Economy Shift Schedule
• SP	Specialty Series
• TCM	Transmission Control Module
• TCMs	Transmission Control Modules
• TPS	Throttle Position Sensor

• TRS	Transmission Range Sensor
• VAC	Vehicle Acceleration Control

TRADEMARK USAGE

The following trademarks are the property of the companies indicated:

- Allison DOC[®] is a Registered Trademark of Allison Transmission, Inc.
- DynActive[®] is a Registered Trademark of Allison Transmission, Inc.
- FuelSense[®] is a Registered Trademark of Allison Transmission, Inc.
- TES 295[®] is a Registered Trademark of Allison Transmission, Inc.
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ISO 14000

As a responsible corporate citizen, Allison Transmission, Inc. is dedicated to protecting human health, natural resources and the global environment. End-users and service personnel are responsible for understanding and complying with all applicable environmental laws, safety regulations and Allison Transmission's policies and standards. The following recommendations concern the treatment and disposal of hazardous materials resulting from servicing an Allison Transmission product.

1. All lubricants/fluids used in the operation or storage of a transmission are to be treated as hazardous waste. These fluids are to be separated and discarded per current local statutes/regulations for the purpose of recycling, treatment, storage and/or disposal.
2. Oil soaked components (e.g., filters, seals, clutch packs, etc.) are to be treated as hazardous waste and are to be handled and discarded per current local statutes/regulations.
3. Exhausted electronic components (e.g., transmission control modules (TCM), pressure switches, speed sensors, etc.) are to be treated as electronic waste and are to be handled and discarded per current local statutes/regulations.

LIST OF WARNINGS

This manual contains the following warnings—

IT IS YOUR RESPONSIBILITY TO BE FAMILIAR WITH ALL OF THEM.



WARNING: This product can expose you to chemicals including lead, which is known to the State of California to cause cancer and birth defects or other reproductive harm.

For more information go to www.p65Warnings.ca.gov/product.

- **Without the SAE J1939 communication datalink, the shift selector cannot display the selected transmission range. Vehicle operation will be affected.**
- **Assuming proper installation of direction signal wire 134, most Allison shift selectors may still be used to command transmission direction changes in these circumstances. Due to the failure of the SAE J1939 datalink communication, however, the shift selector cannot display the selected range. When this condition exists, it is advisable to slowly and carefully apply the throttle each time a change of direction has been selected in order to verify the direction of operation before accelerating the vehicle.**
- **If you leave the vehicle and the engine is running, the vehicle can move unexpectedly and you or others could be injured. If you must leave the engine running, do not leave the vehicle until you have completed all of the following procedures:**
 - **Put the transmission in N (Neutral) or P (Park)**
 - **Be sure the engine is at low idle (below 1000 rpm)**
 - **Apply the park brake and emergency brakes and make sure they are properly engaged**
 - **Chock the wheels and take any other steps necessary to keep the vehicle from moving.**
- **The vehicle service brakes, parking brake or emergency brake must be applied whenever N (Neutral) is selected to prevent unexpected vehicle movement. Selecting N (Neutral) does not apply the vehicle brakes unless an auxiliary system to apply the parking brake is installed by the OEM.**

LIST OF WARNINGS (cont'd)

This manual contains the following warnings—

IT IS YOUR RESPONSIBILITY TO BE FAMILIAR WITH ALL OF THEM.

- 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.
- 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.

LIST OF WARNINGS (cont'd)

This manual contains the following warnings—

IT IS YOUR RESPONSIBILITY TO BE FAMILIAR WITH ALL OF THEM.

- For vehicles containing 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.

- 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 RANGE INHIBITED INDICATOR LIGHT section of this manual.
- 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.
- **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.

LIST OF WARNINGS (cont'd)

This manual contains the following warnings—

IT IS YOUR RESPONSIBILITY TO BE FAMILIAR WITH ALL OF THEM.

- **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.**
- **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.**
- **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.**
- **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.**

LIST OF WARNINGS (cont'd)

This manual contains the following warnings—

IT IS YOUR RESPONSIBILITY TO BE FAMILIAR WITH ALL OF THEM.

- For vehicles containing 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 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.

- For vehicles containing 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.

LIST OF WARNINGS (cont'd)

This manual contains the following warnings—

IT IS YOUR RESPONSIBILITY TO BE FAMILIAR WITH ALL OF THEM.

- **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 2906 HS, RDS, INT, 2909 HS, MH, RDS, SP, INT, 2956 HS, PTS (School Bus), RDS, INT, 2959 HS, PTS (School Bus), RDS, MH, SP, INT, 2907 MH, SP, 2957 MH, SP transmissions, do not exceed 25,855 lb (57 000 kg) GCW or the OEM vehicle rating, whichever is less.
 - For 2916 HS, RDS, PTS (Shuttle), INT, 2919 HS, RDS, MH, SP, INT, 2966 HS, RDS, INT, 2969 MH, SP, HS, RDS, INT, 2917 MH, SP, 2967 MH, SP transmissions, do not exceed 13,608 lb (30 000 kg) GCW or the OEM vehicle rating, whichever is less.
 - For 2906 PTS (Shuttle) and 2956 PTS (Shuttle) transmissions, do not exceed 19,958 lb (44 000 kg) GCW or the OEM vehicle rating, whichever is less.
 - For 2916, 2919, 2966, 2969 PTS (School Bus) transmissions, do not exceed 14,969 lb (33 000 kg) GCW or the OEM rating, whichever is less.
 - For T2906 transmissions, do not exceed 15,000 lb (33 070 kg) GCW or the OEM rating, whichever is less.
 - For T2916 transmissions, do not exceed 13,500 lb (29 762 kg) GCW or the OEM rating, whichever is less.
- **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 this signal is activated, the TCM may not respond to shift selector requests, since operating limitations are being placed on the transmission. Direction changes may not occur.**

LIST OF WARNINGS (cont'd)

This manual contains the following warnings—

IT IS YOUR RESPONSIBILITY TO BE FAMILIAR WITH ALL OF THEM.

- 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.
- 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.
- 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 engine is above low idle rpm. 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.
- 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.
- 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.

LIST OF WARNINGS (cont'd)

This manual contains the following warnings—

IT IS YOUR RESPONSIBILITY TO BE FAMILIAR WITH ALL OF THEM.

- 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.
- If you leave the vehicle and the engine is running, the vehicle can move unexpectedly and you or others could be injured. **DO NOT** leave the vehicle with the engine running unless you have taken all of the following precautions:
 - Shift the transmission to N (Neutral), P (Park) or PB (Auto-Apply Parking Brake).
 - Make sure that the engine is at low idle (500–800 rpm).
 - Apply the park brake or emergency brake and make sure it is properly engaged.
 - Chock the wheels and take any other steps necessary to keep the vehicle from moving.

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1.0 INTRODUCTION

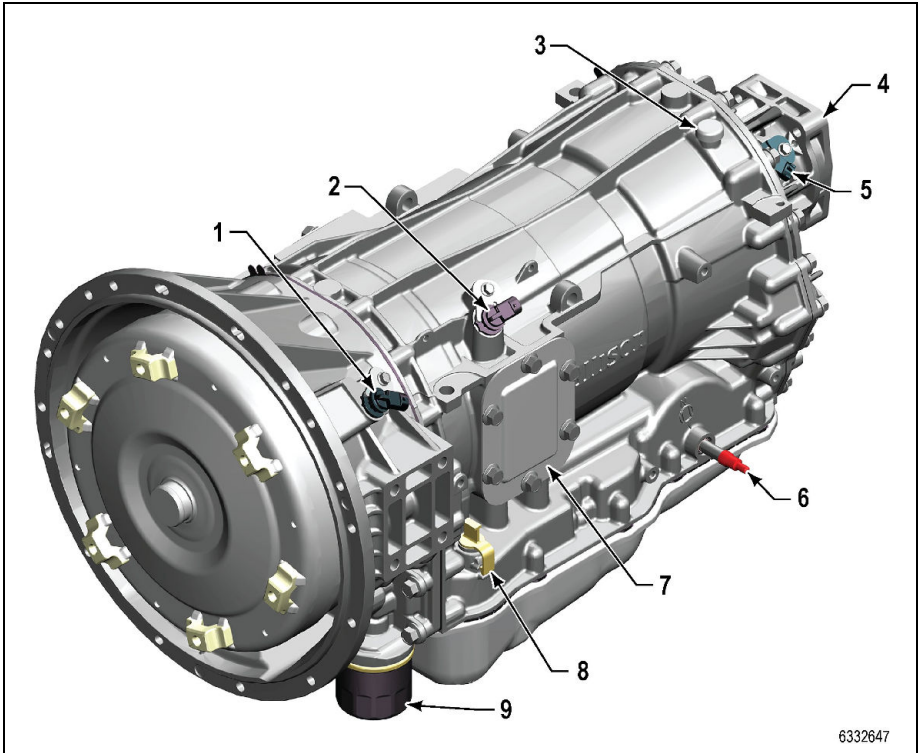
1.1 KEEPING THAT ALLISON ADVANTAGE



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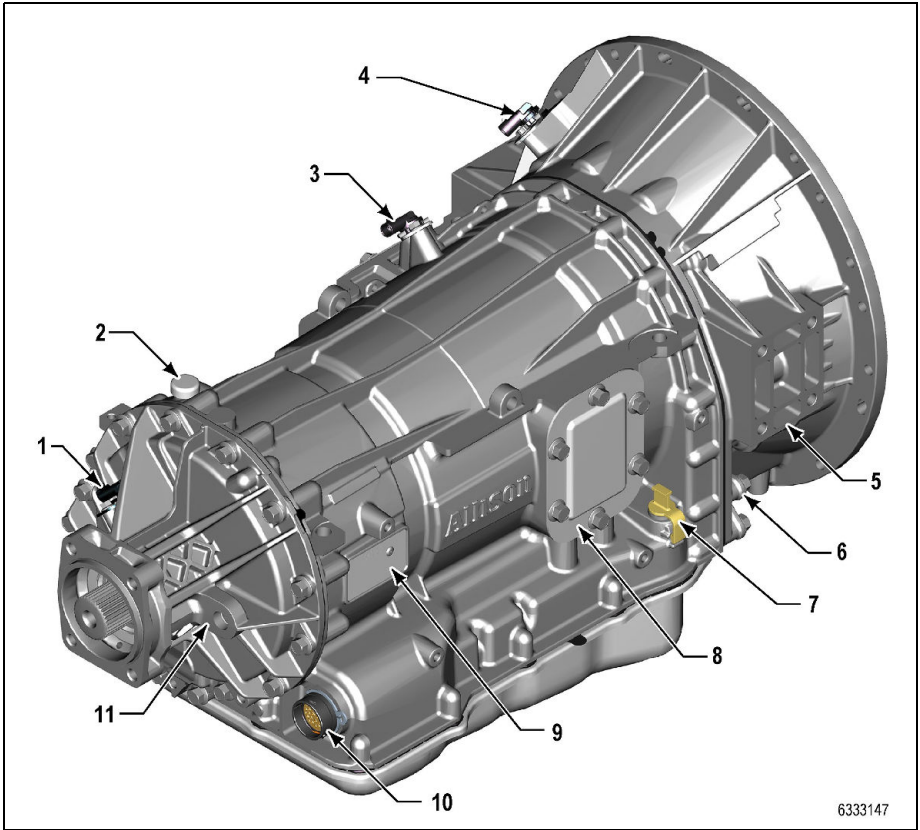
Allison transmissions provide many advantages for the driver who must “stop and go” or change speeds frequently. Driving is easier, safer and more efficient.

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



- | | |
|--|--|
| (1) - Engine Speed Sensor | (5) - Output Speed Sensor |
| (2) - Turbine Speed Sensor | (6) - Selector Shaft |
| (3) - Breather | (7) - SAE 6-Bolt PTO Pad |
| (4) - Parking Brake Mounting Provision | (8) - Available Oil Fill Tube Location |
| | (9) - Control Main Oil Filter |

Figure 1-1. Left-Front View



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- | | |
|--|--|
| (1) – Output Speed Sensor | (7) – Available Oil Fill Tube Location |
| (2) – Breather | (8) – SAE 6-Bolt PTO Pad |
| (3) – Turbine Speed Sensor | (9) – Nameplate with 10-digit Serial Number |
| (4) – Engine Speed Sensor | (10) – 29-Way Transmission Harness Connector |
| (5) – Mounting Pad (SAE #3 Housing Only) | (11) – Optional Tachograph Provision |
| (6) – Cooler Ports | |

Figure 1–2. Right-Rear View

1.2 A BRIEF DESCRIPTION OF THE ALLISON 9-SPEED TRANSMISSIONS

1.2.1 Introduction.

Allison Transmissions are fully automatic, torque-converter driven, electronically controlled transmissions best suited for light-medium duty, on-highway applications. Each transmission series (HS, MH, PTS, RDS, SP and INT) contains features which have been designed for specific vocational needs.

The park pawl exists but cannot be engaged in some vehicle configurations using 2916, 2917, 2919, 2966, 2967 and 2969 transmissions (e.g., some rear engine vehicles with air brakes). For these configurations, the **P** (Park) position is not used.

A provision to mount a PTO is available on all transmissions. The PTO drive gear is optional.

All transmissions are capable of up to nine forward ranges, dependent on TCM calibration, 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.

1.2.2 Vocational Model Nomenclature.

The first digit of the nomenclature (2) indicates the series. The second digit (9) indicates number of ranges in the transmission. The third digit indicates (0) close ratio and no park pawl or (1) close ratio with park pawl or (5) wide ratio and no park pawl or (6) wide ratio with park pawl. The fourth digit indicates the max input torque capacity in lb-ft (6) 660, (7) 700 or (9) 900. The T at the beginning of the code indicates an automatic transmission outside North America.

1.3 ELECTRONIC CONTROL SYSTEM

The transmission 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
- Transmission Range Sensor (TRS)
- 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 TPS (or engine-to-transmission communication link), speed sensors, pressure switch manifold and TRS 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 transmission 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.

Allison Transmission 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 four helical, constant mesh planetary gear sets and shafts provides the mechanical gear ratios and direction of travel for the vehicle. 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 SHIFT SELECTOR OVERVIEW

The 9-Speed transmission has push button shift selectors or lever-type shift selectors available depending on transmission model. The shift position on the shift selector can vary depending on lever-type shift selector installed.

2.2 OPERATION OF THE SHIFT SELECTOR

The shift selector is used by the operator to select **R** (Reverse), **N** (Neutral) or a range of forward gears. When a forward gear range has been selected, the transmission starts in the lowest gear of the range and, as conditions permit, automatically upshifts through all gears until the highest gear in the selected range is in use. Some selectors may also be equipped with a **P** (Park) or **PB** (Auto-Apply Parking Brake) position.

The 9-Speed has the option of two shift control systems. The first is a Shift-by-Cable system that mechanically shifts the transmission by turning a shift selector shaft on the transmission. This system must be used when a park pawl is specified.

Mechanical Shift-by-Cable shift selectors for these models typically have positions for two forward ranges. Since the transmission may be capable of nine forward gears, it is possible that a mechanical shift selector will not have a selector position for each gear. The actual gear selections on the shift selector will depend upon the selector design, customer/user preference and shift calibration which is programmed in the Transmission Control Module (TCM).

The second is a Shift-by-Wire system that electronically commands the shifts of the transmission using a push button shift selector or bump lever shift selector.

Some selector manufacturers offer electronic/electric or air/hydraulic shift control systems for the 9-Speed. Contact the manufacturer regarding the operation of the selector used with one of these shift control systems, including those that use an Allison push button shift selector.

2.2.1 Shift-By-Cable System.

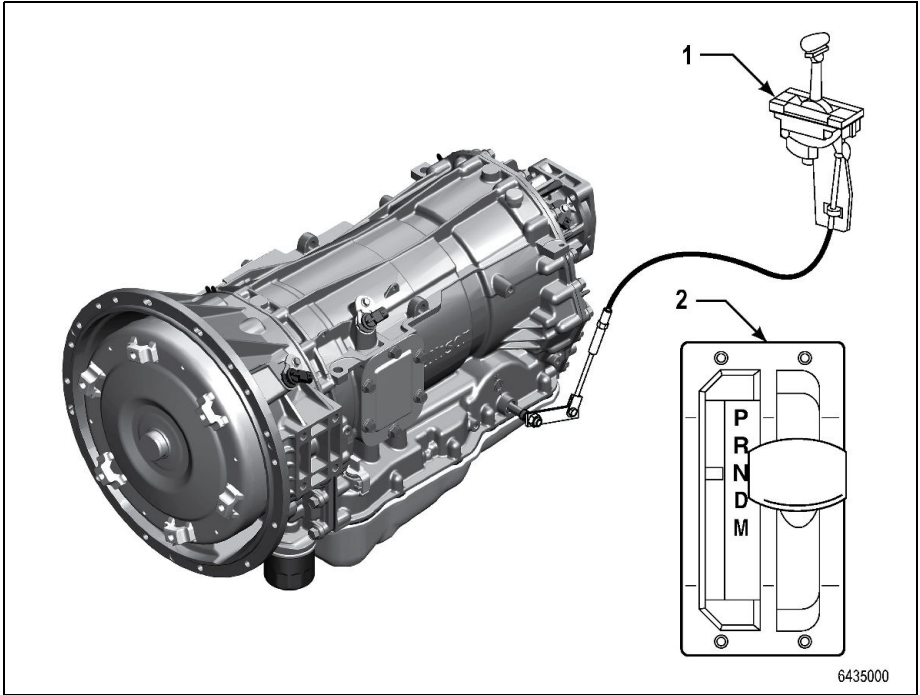


Figure 2–1. Typical Lever-Type Shift Selector

The Shift-by-Cable system mechanically shifts the transmission by turning a shift selector shaft on the transmission. This system must be used when a park pawl is specified. Mechanical Shift-by-Cable shift selectors for these models typically have positions for two forward ranges. Since the transmission may be capable of nine forward gears, it is possible that a mechanical shift selector will not have a selector position for each gear. The actual gear selections on the shift selector will depend upon the selector design, customer/user preference and shift calibration which is programmed in the Transmission Control Module (TCM).

For normal driving, the shift selector is placed in Drive or the highest forward range – typically 9th. The transmission will upshift and downshift automatically through all available forward gears as determined by the shift calibration and vehicle operating conditions. A typical shift selector range layout for a 9-speed transmission is illustrated in [Table 2–1](#).

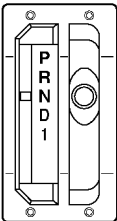
[Figure 2–1](#) illustrates a common arrangement of gates in the selector which differentiate the various range positions, including a position for **P** (Park). Additional information in the figure describes the following:

- Which gears are available for each selector position
- When the transmission is in **C** (Converter) mode or **L** (Lock) mode
- The typical vehicle operation for the position selected

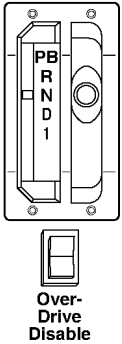
Note that the selection of a specific gear range limits operation.

For each transmission configuration, several gear range options are possible. The ability to prevent upshifts above specific intermediate ranges will determine which of the combinations is selected for any individual vehicle application.

**Table 2–1. Range Selection – 9-1
Transmission with Park Pawl, Engaged with Shift
Selector P (Park) Position**

	Selector Position	Gear Ranges	Vehicle Operation
	P (Park)	(Neutral)*	Park pawl is activated. Parking the vehicle and starting the engine.
	R (Reverse)	Reverse	Backing the vehicle.
	N (Neutral)	Neutral	Starting engine and stationary operation.
	D (Drive)**	1C-[1L]-(2C)***-2L-3L-4L-5L-6L-7L-8L-9L	Normal driving.
	1 (First Range)	1C-[1L]	Pulling through mud/snow and braking on very steep downgrades.
<p>* With Park Pawl engaged. ** The shift selector position representing this gear range may be labeled “8” or “9” (for the highest gear in the range), “OD” (for Overdrive), “D” (for the normal Drive position), or “1-9” (for the complete gear range). *** Indicating 2nd gear start - calibration dependent.</p>			

**Table 2–2. Range Selection – 8-2
Transmission with Park Brake, Engaged with Shift Selector
PB (Auto-Apply Parking Brake) Position**

	Selector Position	Gear Ranges	Vehicle Operation
	PB (Auto-Apply Parking Brake)	Neutral*	Park brake is activated. Parking the vehicle and starting the engine.
	R (Reverse)	Reverse	Backing the vehicle.
	N (Neutral)	Neutral	Starting engine and stationary operation.
	D (Drive)**	1C-[1L]-(2C)***-2L-3L-4L-5L-6L-7L-8L-9L	Normal driving.
		1C-[1L]-(2C)***-2L-3L-4L-5L-6L	Normal driving (with Overdrive Disable switch ON).
1 (First Range)	1C-[1L]	Pulling through mud/snow and braking on very steep downgrades.	

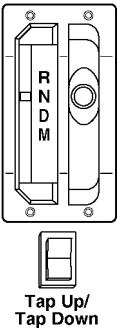
NOTE: When used with the Overdrive Disable input function (which in this example holds the transmission in 6th range when activated), this calibration can be used to attain holds for all ranges. The vehicle manufacturer is responsible for installing a monitor, light or other means to alert the operator when this function is enabled because the range identified on the shift selector will not coincide with the actual range selection of the transmission.

* With Auto-Apply Parking Brake engaged

** The shift selector position representing this gear range may be labeled “8” or “9” (for the highest gear in the range), “OD” (for Overdrive), “D” (for the normal Drive position), or “1-9” (for the complete gear range).

*** Indicating 2nd gear start - calibration dependent.

**Table 2-3. Range Selection – 9-M
Transmission With No Parking Provision. With Tap Up / Tap Down Switch**

	Selector Position	Gear Ranges	Vehicle Operation
	R (Reverse)	Reverse	Backing the vehicle.
	N (Neutral)	Neutral	Starting engine and stationary operation.
	D (Drive)*	1C-[1L]-(2C)**-2L- 3L-4L-5L-6L-7L- 8L-9L	Normal driving.
	M (Manual)	1C-[1L]-(2C)**-2L- 3L-4L-5L-6L-7L- 8L-9L	Selectable for all driving conditions
<p>* The shift selector position representing this gear range may be labeled “8” or “9” (for the highest gear in the range), “OD” (for Overdrive), “D” (for the normal Drive position), or “1-9” (for the complete gear range). ** Indicating 2nd gear start - calibration dependent.</p>			

2.2.2 Shift-By-Wire System.

The Shift-by-Wire system electronically commands the shifts of the transmission using a push button shift selector or bump lever shift selector.

Some selector manufacturers offer electronic/electric or air/hydraulic shift control systems for the 9-Speed. Contact the manufacturer regarding the operation of the selector used with one of these shift control systems, including those that use an Allison push button shift selector.

Table 2–4. Shift-By-Wire Common Range Selections

Shifter Position	Ranges Available	Vehicle Operation
R (Reverse)	Reverse	Backing the vehicle.
N (Neutral)	Neutral	Starting engine and stationary operation.
D (Drive)	1C-{1L}-(2C)*-2L-3L-4L-5L-6L-7L-8L-9L	Normal driving.
M (Manual)	1C-{1L}-(2C)*-2L-3L-4L-5L-6L-7L-8L-9L	When road conditions, load or traffic conditions make it desirable to restrict automatic shifting to a lower range.**
<p>* If configured with the second gear start option, the transmission will start in second gear in these ranges.</p> <p>** Lower ranges provide greater engine braking for going down grades – the lower the range, the greater the braking effect. Always select lower ranges when using the retarder or engine brake to descend grades.</p>		

2.3 DESCRIPTION OF AVAILABLE TYPES

2.3.1 Shift-By-Cable (Range Selection with a Mechanical Cable).

This shifter option mechanically shifts the transmission by turning a shift selector shaft on the transmission. Mechanical Shift-by-Cable shift selectors for these models typically have positions for two forward ranges. Since the transmission may be capable of nine forward gears, it is possible that a mechanical shift selector will not have a selector position for each gear. The actual gear selections on the shift selector will depend upon the selector design, customer/user preference and shift calibration which is programmed in the Transmission Control Module (TCM).

- **P (Park)**; Park pawl (if available) is engaged. As an alternative, this position may be labeled **PB** (Auto-Apply Parking Brake) if the transmission is equipped with a brake that is activated by this position on the selector. These positions are not available on all shift selectors. Starting the engine is permitted in either of these positions.
- **R (Reverse)**
- **N (Neutral)**; Selected prior to starting the engine.
- **NUMBERED POSITIONS FOR TWO FORWARD GEARS**; The highest number will typically be 9. When the shift selector is moved to this position, the transmission shifts to first gear for starting, then automatically upshifts through the gears until the selected gear is attained. When the shift selector is moved to any of the lower numbered

positions, the transmission is inhibited from shifting above the selected gear. Selecting a lower gear in this manner, permits the operator to reduce shifting when driving in city traffic or to increase engine braking during downhill operation.

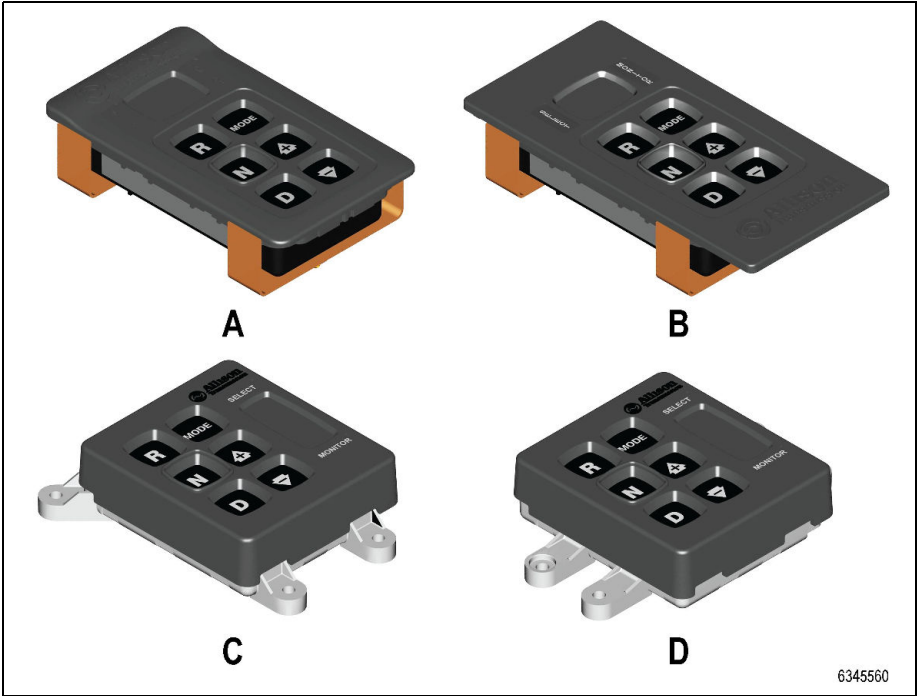
2.3.2 Shift-By-Wire.

This shifter option electronically commands the shifts of the transmission using a push button shift selector or bump lever shift selector. Refer to [2.2 OPERATION OF THE SHIFT SELECTOR](#).

2.3.2.1 Keypad Push Button Shift Selector

This type of shift selector is available in four different styles (Refer to [Figure 2-2](#)). The function of the keypad buttons are identical on all types.

Refer to [Figure 2-3](#), which illustrates the standard push button shift selector, for items in the discussion which follows.



- (A) – Standard
- (B) – Common
- (C) – Compact
- (D) – Alternate Compact

Figure 2-2. Keypad Push Button Shift Selectors



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- | | |
|-------------------------------|------------------------|
| (1) – Display (Range Select) | (4) – MODE Button |
| (2) – Service Indicator | (5) – UPSHIFT Button |
| (3) – Display (Range Monitor) | (6) – DOWNSHIFT Button |

Figure 2–3. Keypad Push Button Shift Selectors Features

R (Reverse): selects Reverse gear

N (Neutral): selects Neutral. The area around the N button is a raised ridge so the driver can identify the push buttons by touch, without looking at the display. It is not necessary to press this button prior to starting the vehicle.

D (Drive): selects the highest available forward range. The transmission shifts to the starting gear and will automatically upshift through the gears, as operating conditions permit, until the highest available gear is attained.

UPSHIFT and DOWNSHIFT Arrow Buttons:

These buttons are used to change the Range Selected to a higher or lower forward range:

- One press of the **DOWNSHIFT** button sets range SELECT to the same range as the current range attained, shown in the MONITOR position on the display. Referred to as Express Preselect.
- Each subsequent press of the **DOWNSHIFT** button decreases the range selected by one range
- One press of the **UPSHIFT** button increases the range selected by one range.
- If the **UPSHIFT** or **DOWNSHIFT** button is held continuously, the selected range will continue to change up or down until the button is released or until the highest or lowest possible range of gears is selected.

MODE: Pressing the **MODE** button invokes a secondary shift schedule or a special operating function. The function of the **MODE** button is determined when the Input/Output Package is selected during definition of the TCM calibration.

Backlighting: Backlighting of keypads can be controlled using a J1939 message or can be configured to be hardwired.

Select and Monitor: During normal operation with **D** (Drive) selected, the SELECT section of the display shows the highest attainable forward range for the shift schedule in use. The MONITOR section displays the gear range that has been commanded in the transmission. **R** (Reverse) and **N** (Neutral) are likewise displayed when appropriately selected and in use. The display of any other character in the SELECT or MONITOR section denotes a nonstandard operating condition.

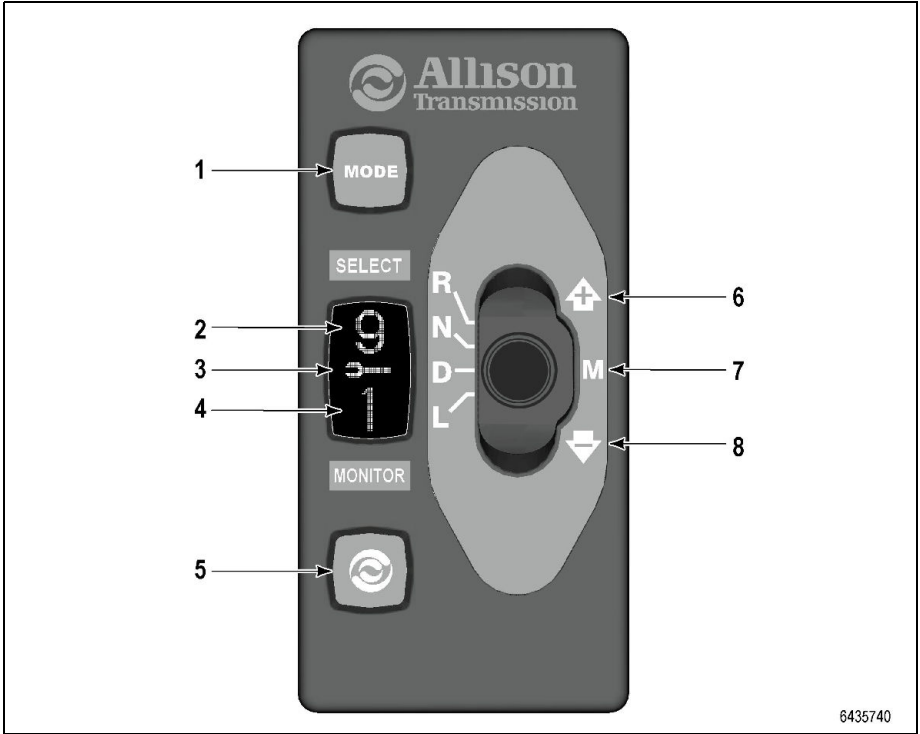
Diagnostic Functions: Pressing the **UPSHIFT** and **DOWNSHIFT** buttons simultaneously with the transmission in Neutral invokes a service or diagnostic function. The function invoked depends upon whether the transmission is equipped with Prognostics is enabled in the TCM calibration, as shown in [Table 2-5](#):

Table 2-5.

Prognostics Enabled?	Simultaneous Press of UPSHIFT & DOWNSHIFT Buttons				
	1st Press	2nd Press	3rd Press	4th Press	5th Press
Yes	Prognostics	Prognostics	Diagnostics	Hardware Level	Normal Range Display
No	Diagnostics	Hardware Level	Normal Range Display		

2.3.2.2 Bump Lever Shift Selector

Refer to Figure 2–4, which illustrates the bump lever shift selector, for items in the discussion which follows.



- (1) – MODE Button
- (2) – Display (Range Select)
- (3) – Service Indicator
- (4) – Display (Range Monitor)
- (5) – Allison Logo (Display Mode Button)
- (6) – UPSHIFT Button
- (7) – Manual Select
- (8) – DOWNSHIFT Button

Figure 2–4. Bump Lever Shift Selector (Knob Removed)

R (Reverse): selects Reverse gear.

N (Neutral): must be selected prior to starting the engine

D (Drive): selects the highest available forward range. Transmission shifts to starting gear and will automatically upshift through the gears, as operating conditions permit, until the highest available gear is attained.

L (Low): selects the lowest available forward range. The transmission will automatically downshift to the lowest range using the preselect downshift schedule. Once attained, the transmission will hold the low range until another range is selected.

M (Manual): moving the lever from the Drive position into the Manual Select position allows the operator to select a lower or higher forward gear range. The Manual Select position is accessible only from the Drive position.

- Initially moving the lever to M sets the Range Selected to the same forward range as the current Range Attained, shown in the MONITOR position on the display. Referred to as Express Preselect.
- Each DOWNSHIFT (-) bump decreases the Range Selected by one forward range.
- Each UPSHIFT (+) bump increases the Range Selected by one forward gear range.
- These are momentary bump positions – when the operator releases the lever, the lever returns to the Drive position.

Detent: The bump lever selector features a detent to prevent inadvertent shifting between **R** (Reverse), **N** (Neutral), **D** (Drive) and **L** (Low). To release the lever from any of these positions, the detent must first be unlocked by depressing the finger release button on the shifter handle.

Select and Monitor: During normal operation with **D** (Drive) selected, the SELECT section of the display shows the highest attainable forward range for the shift schedule in use. The MONITOR section displays the gear range that has been commanded in the transmission. **R** (Reverse) and **N** (Neutral) are likewise displayed when appropriately selected and in use. The display of any other character in the SELECT or MONITOR section denotes a nonstandard operating condition.

Backlighting: The **MODE** button and the Display Mode Button with the Allison logo are continually backlit during normal vehicle operation.

Diagnostic Functions: Pressing the Allison Logo (Display Mode Button) with the transmission in **N** (Neutral) invokes a service or diagnostic function. The function invoked depends upon whether the transmission is equipped with Prognostics is enabled in the TCM calibration, as shown in [Table 2–6](#):

Table 2-6.


Prognostics Enabled?	Press of the Allison Logo (Display Mode Button)				
	1st Press	2nd Press	3rd Press	4th Press	5th Press
Yes	Prognostics	Prognostics	Diagnostics	Hardware Level	Normal Range Display
No	Diagnostics	Hardware Level	Normal Range Display		

2.3.3 Selector Display Descriptions for Active Diagnostic Trouble Codes (DTCs) and Inhibits.


RANGE SELECT Blank: With an active DTC, the SELECT display on the shift selector is blank. The MONITOR display indicates the range in which the transmission is locked. The **CHECK TRANS** light is also activated. Refer to [7.0 DIAGNOSTICS](#).

RANGE SELECT Flashing: The flashing display indicates a requested shift is either temporarily or permanently inhibited. The inhibit may clear if the cause of the inhibit clears within 3 seconds of the shift request. Otherwise, the operator must re-select the desired range. Refer to [3.10 CHECK TRANS OR MALFUNCTION INDICATOR LIGHT \(MIL\)](#).

Wrench Icon (TRANS SERVICE (Transmission Service)) Illuminated: This indicator is only functional if prognostics are enabled in the TCM controls calibration. This indicator is illuminated upon the detection of a service issue relating to filter or fluid life. The appearance of the indicator (lit steadily or flashing) varies for each of the conditions monitored by the system. Refer to [3.10 CHECK TRANS OR MALFUNCTION INDICATOR LIGHT \(MIL\)](#).

 **All Segments Illuminated:** If all segments of the display are on for more than 12 seconds, the TCM has not completed initialization. A DTC is associated with this condition. It is normal for all segments to illuminate for a brief time during initialization of the selector and controls.

SELECT/MONITOR BOTH BLANK: This condition indicates either a lack of power to the selector or the SAE J1939 communication datalink has failed. Continuous blank indicates loss of power to the selector. If the blank display changes to a double cat-eye display, other conditions exist. Refer to double cat-eye discussion below.

 **Double Cat-Eyes:** This display indicates a failure of the SAE J1939 communication link and may be accompanied by a DTC. The cat-eyes are

illuminated in both the SELECT and MONITOR locations after approximately 12 seconds of blank display.



WARNING: Without the SAE J1939 communication datalink, the shift selector cannot display the selected transmission range. Vehicle operation will be affected.

2.3.4 Selector Display is Inoperative.

In the event communication with the SAE J1939 datalink is lost, limited communication between the TCM and the Allison keypad push button and lever shift selectors continues through direction signal wire 134. This limited communication allows the operator to select **D** (Drive), **N** (Neutral) or **R** (Reverse) in order to get the vehicle to a service location. Operator requests for range upshifts and downshifts will not be recognized, and the shift selector display will not display the selected transmission range due to the lack of a SAE J1939 datalink signal, but displays double cat-eyes.



WARNING: Assuming proper installation of direction signal wire 134, most Allison shift selectors may still be used to command transmission direction changes in these circumstances. Due to the failure of the SAE J1939 datalink communication, however, the shift selector cannot display the selected range. When this condition exists, it is advisable to slowly and carefully apply the throttle each time a change of direction has been selected in order to verify the direction of operation before accelerating the vehicle.

2.3.5 Non-Allison Supplied Shifter Systems.

Some selector manufacturers offer electronic/electric or air/hydraulic shift control systems for the 9-Speed. Contact the manufacturer regarding the operation of the selector used with one of these shift control systems, including those that use an Allison push button shift selector.



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

- Put the transmission in **N** (Neutral) or **P** (Park)
- Be sure the engine is at low idle (below 1000 rpm)
- Apply the park brake and emergency brakes and make sure they are properly engaged
- Chock the wheels and take any other steps necessary to keep the vehicle from moving.



WARNING: The vehicle service brakes, parking brake or emergency brake must be applied whenever **N** (Neutral) is selected to prevent unexpected vehicle movement. Selecting **N** (Neutral) does not apply the vehicle brakes unless an auxiliary system to apply the parking brake is installed by the OEM.

2.4 RANGE SELECTION—ALL 9-SPEED TRANSMISSIONS WITH P (Park) POSITION






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.

Table 2–7. ALL 9-SPEED TRANSMISSIONS WITH P (Park) POSITION





ALL 9-SPEED TRANSMISSIONS WITH P (Park) POSITION

PARK







Table 2–7. ALL 9-SPEED TRANSMISSIONS WITH P (Park) POSITION (cont'd)

ALL 9-SPEED TRANSMISSIONS WITH P (Park) POSITION	
	<p>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.</p>
	<p>WARNING: For vehicles containing transmissions with P (Park) selector position, follow this procedure each time the operator's station will be unoccupied with the engine running:</p> <ol style="list-style-type: none"> 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. <p>If this procedure is not followed, the vehicle can move unexpectedly and cause injury and/or property damage.</p>
	<p>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.</p>



**Table 2-7. ALL 9-SPEED TRANSMISSIONS WITH P (Park)
POSITION (cont'd)**

ALL 9-SPEED TRANSMISSIONS WITH P (Park) POSITION	
	<p>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.</p> <p>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.</p>
P	<p>Use P (Park) for the following:</p> <ul style="list-style-type: none"> • 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) <p>This position places the transmission in N (Neutral) and engages the park pawl.</p>
REVERSE	
	<p>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 RANGE INHIBITED INDICATOR LIGHT section of this manual.</p>
	<p>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.</p>
	<p>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.</p>
R	<p>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.</p>
NEUTRAL	




**Table 2–7. ALL 9-SPEED TRANSMISSIONS WITH P (Park)
POSITION (cont'd)**

ALL 9-SPEED TRANSMISSIONS WITH P (Park) POSITION	
	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 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 9 (Ninth Range). As the vehicle slows, the transmission will downshift automatically.
MANUAL SELECT	

**Table 2–7. ALL 9-SPEED TRANSMISSIONS WITH P (Park)
POSITION (cont'd)**

ALL 9-SPEED TRANSMISSIONS WITH P (Park) POSITION	
	<p>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.</p>
	<p>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.</p>
1	<p>Use 1 (First Range) for the following:</p> <ul style="list-style-type: none"> • When pulling through mud and deep snow • When maneuvering in tight spaces • While driving up or down very steep grades <p>1 (First Range) provides the vehicle with its maximum driving torque and maximum engine braking effect.</p>
<p>* The shift selector position representing this gear range may be labeled “9” (for the highest gear in the range), “OD” (for Overdrive) or “D” (for the normal Drive position)</p>	

2.5 RANGE SELECTION—ALL 9-SPEED SERIES TRANSMISSIONS WITH PB (AUTO-APPLY PARKING BRAKE) POSITION

ALL 9-SPEED SERIES TRANSMISSIONS WITH PB (AUTO-APPLY PARKING BRAKE) POSITION	
PARKING BRAKE	
	<p>WARNING: For vehicles containing 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:</p> <ol style="list-style-type: none"> 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 brakes and make sure they are properly engaged. 5. Chock the wheels and take any other steps necessary to keep the vehicle from moving. <p>If this procedure is not followed, the vehicle can move unexpectedly and cause injury and/or property damage.</p>
PB	<p>Use PB (Auto-Apply Parking Brake) for the following:</p> <ul style="list-style-type: none"> • 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) <p>This position places the transmission in N (Neutral) and engages the park pawl.</p>
REVERSE	
	<p>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 RANGE INHIBITED INDICATOR LIGHT section of this manual.</p>
	<p>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.</p>

ALL 9-SPEED SERIES 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** 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 9-SPEED SERIES 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 **9 (Ninth 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.



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.

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 "9" (for the highest gear in the range), "OD" (for Overdrive) or "D" (for the normal Drive position).

2.6 RANGE SELECTION—ALL 9-SPEED TRANSMISSIONS WITHOUT EITHER P (PARK) OR PB (AUTO-APPLY PARKING BRAKE) POSITIONS

ALL 9-SPEED TRANSMISSIONS WITHOUT EITHER P (PARK) OR PB (AUTO-APPLY PARKING BRAKE) POSITIONS	
PARKING	
	<p>WARNING: For vehicles containing 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:</p> <ol style="list-style-type: none"> 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. <p>If this procedure is not followed, the vehicle can move unexpectedly and cause injury and/or property damage.</p>
REVERSE	
	<p>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 RANGE INHIBITED INDICATOR LIGHT section of this manual.</p>
	<p>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.</p>
	<p>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.</p>
R	<p>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.</p>

ALL 9-SPEED TRANSMISSIONS WITHOUT EITHER P (PARK) OR PB (AUTO-APPLY PARKING BRAKE) POSITIONS

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



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.

ALL 9-SPEED TRANSMISSIONS WITHOUT EITHER P (PARK) OR PB (AUTO-APPLY PARKING BRAKE) POSITIONS

D*

Use **D** (Drive) for normal driving. The transmission will initially attain **1** (First Range) when **D** (Drive) is selected. As vehicle speed increases, the transmission will upshift automatically through each available range up to **9** (Ninth Range). As the vehicle slows, the transmission will downshift automatically. The shift selector position representing this gear range may be labeled “8” or “9” (for the highest gear in the range), “OD” (for Overdrive), “D” (for the normal Drive position), “1–8” or “1–9”(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.

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 “9” (for the highest gear in the range), “OD” (for Overdrive) or “D” (for the normal Drive position)

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 2906 HS, RDS, INT, 2909 HS, MH, RDS, SP, INT, 2956 HS, PTS (School Bus), RDS, INT, 2959 HS, PTS (School Bus), RDS, MH, SP, INT, 2907 MH, SP, 2957 MH, SP transmissions, do not exceed 25,855 lb (57 000 kg) GCW or the OEM vehicle rating, whichever is less.
- For 2916 HS, RDS, PTS (Shuttle), INT, 2919 HS, RDS, MH, SP, INT, 2966 HS, RDS, INT, 2969 MH, SP, HS, RDS, INT, 2917 MH, SP, 2967 MH, SP transmissions, do not exceed 13,608 lb (30 000 kg) GCW or the OEM vehicle rating, whichever is less.
- For 2906 PTS (Shuttle) and 2956 PTS (Shuttle) transmissions, do not exceed 19,958 lb (44 000 kg) GCW or the OEM vehicle rating, whichever is less.
- For 2916, 2919, 2966, 2969 PTS (School Bus) transmissions, do not exceed 14,969 lb (33 000 kg) GCW or the OEM rating, whichever is less.
- For T2906 transmissions, do not exceed 15,000 lb (33 070 kg) GCW or the OEM rating, whichever is less.
- For T2916 transmissions, do not exceed 13,500 lb (29 762 kg) 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 [6.5 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

3.5.1 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.

3.5.2 Dynamic Shift Sensing (DSS).

Vehicles equipped with DSS do not require the operator to change selection of primary and secondary shift schedules manually and no longer require a dash-mounted OEM-installed switch or Mode button for shift schedule selection. This is because DSS *automatically* selects the appropriate shift schedule based on vehicle load and operating conditions.

DSS selects between Economy and Performance shift schedules based on the vehicle's current estimated payload (determined by acceleration rate and requested power) and the grade on which the vehicle is operating. This optimizes fuel economy while maintaining performance on vehicles so equipped.

DSS has been optimized to include a Super Economy Shift Schedule (SESS). This enhancement allows earlier up-shift under cruising conditions to further improve fuel economy. Cruise is defined as driving with low to no acceleration at a given road speed.

Fuel economy enhancement features available on some former models are improved with the current controls due to the use of an inclinometer (a device that senses road grade) contained in current TCMs.

3.5.3 Skip Shifting Capability.

This transmission feature commands the transmission to skip certain ranges during a shift to attain the most efficient range during acceleration or deceleration. These can be scheduled based on DynActive's evaluation to prevent the engine's interaction with the governor during quick accelerations or for fuel economy purposes based on the active DynActive flat ground economy bias. Skip powered downshifts are evaluated and scheduled based on desired performance, the active DynActive economy bias and acceleration among other inputs. The selected DynActive Economy bias will impact how skip shifts are scheduled based on vehicle performance and driver input.

3.5.4 Allison Transmission FuelSense 2.0.

Vehicles equipped with an Allison Transmission and a FuelSense 2.0 package will save fuel when compared to vehicles without the package, depending on the duty cycle.

With the introduction of FuelSense 2.0 packages, more descriptive feature designations have been created. Refer to [Table 3-1](#) for FuelSense 2.0 features and package designations.

Table 3–1. FuelSense 2.0 Features and Package Designations

Former Terminology	FuelSense 2.0 Terminology	FuelSense 2.0	FuelSense 2.0 Plus	FuelSense 2.0 Max
Low Speed Shift Calibrations	EcoCal	X	X	X
Load-Based Shift Scheduling (LBSS)	Dynamic Shift Sensing (DSS)	X	X	X
Acceleration Based Mode Switch (ABMS)				
Vehicle Acceleration Control (VAC)	Acceleration Rate Management			X

3.5.4.1 FuelSense 2.0 Terminology Descriptions

- **EcoCal:** EcoCal describes lower engine speed shift schedules designed to match the engine and duty cycle, maintain optimum engine speed, perform torque converter lockup as soon as possible and provide necessary performance without shift cycling.
- **Dynamic Shift Sensing:** Dynamic Shift Sensing is a feature that automatically selects between EcoCal and higher speed shift schedules based on the vehicle’s actual payload and the grade on which it’s operating.
- **Neutral at Stop:** Neutral at Stop is a feature that reduces or eliminates the load on the engine while the vehicle is stopped, thus reducing fuel usage and emissions.
- **Acceleration Rate Management:** Acceleration Rate Management is an engine management function where the TCM manages engine torque to limit vehicle acceleration to a calibrated rate. This function will allow full torque from the engine if the vehicle is unable to reach the calibrated acceleration rate, such as on steep grades or when the vehicle is heavy. This function may be used for the following:
 - To improve fuel efficiency.
 - To reduce tire wear.
 - To reduce acceleration aggressiveness.
 - To provide for consistent acceleration in loaded and unloaded conditions.

- **DynActive Shifting:** DynActive Shifting is a continuously-variable method of shift scheduling. Instead of using a shift point table with defined shift points (such as 2000 rpm S1 performance), DynActive Shifting chooses the most efficient shift point based on the current environmental and vehicle conditions. DynActive achieves the best fuel economy for a specified level of performance. Vehicle information such as torque, speed, grade, mass, etc. are constantly analyzed to pick the most efficient shift speed. DynActive Shifting is required in all FuelSense 2.0 packages.

3.5.4.2 FuelSense 2.0 Driver Indicator (with FuelSense 2.0 Package)



NOTE: The TCM software must be configured to enable FuelSense 2.0 in order for the FuelSense 2.0 driver indicator initialization screen to appear.

Vehicles equipped with a FuelSense 2.0 package will include a display of the FuelSense 2.0 logo. At the discretion of the OEM, vehicles not equipped with an Allison shift selector display can provide the FuelSense 2.0 message on a dash display. The Allison shift selector will display the “Allison Transmission” initialization screen followed by a “FuelSense 2.0” screen upon vehicle startup (refer to [Figure 3–1](#)).

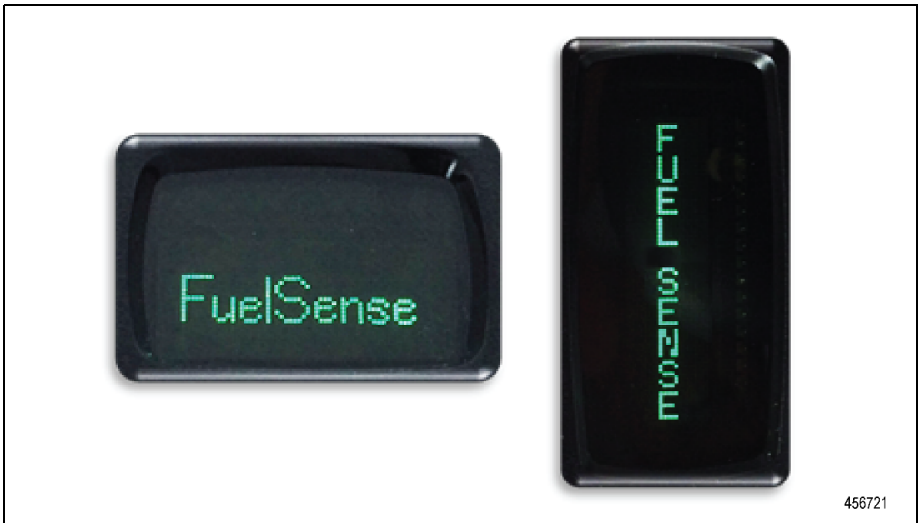


Figure 3–1. FuelSense 2.0 Display

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 [7.0 DIAGNOSTICS](#) section.

3.9 RANGE INHIBIT(ED) INDICATOR LIGHT

3.9.1 Range Inhibited Indicator Light (RII).



When certain transmission operational conditions are detected, the transmission controls temporarily limit transmission shifts until the conditions have been cleared. When this type of situation is detected, the TCM will activate the **RANGE INHIBITED INDICATOR (RII)** light or which is used to alert the operator to the following:

- Shifts from **N** (Neutral)-to-**D** (Drive) or **N** (Neutral)-to-**R** (Reverse) are being inhibited.
- Directional changes are being inhibited.
- The transmission is in Neutral even though a forward range or **R** (Reverse) is being selected.

Use and indication of the active shift inhibit are the responsibility of the vehicle manufacturer. A common use of this signal is to activate an RII light. It is also possible to flash the PRNDL using the vehicle's communication protocol.

In addition, the transmission controls Converter Over-Temperature Torque Protection feature flashes the RII indicator when the controls detect excessive and sustained slip across the converter. This condition indicates the potential for converter damage due to high heat generation. In this situation, transmission shifts are not inhibited. The controls automatically deactivate the RII indicator when the condition no longer exists.



WARNING: When this signal is activated, the TCM may not respond to shift selector requests, since operating limitations are being placed on the transmission. Direction changes may not occur.

3.9.1.1 Converter Over-Temp Torque Protection (COTP)

- Purpose
 - Alerts the driver to a torque converter over-temperature condition.
 - Limits the time that the torque converter can be stalled at full power to prevent torque converter damage (*if the vehicle is equipped to limit engine rpm* by SEM or LRTP) while maintaining an acceptable level of driver control during normal operation.

Engine rpm cannot be controlled for non-SEM applications. Only SEM or LRTP equipped vehicles will be able to offer torque limits. On vehicles without SEM or LRTP, only the **RANGE INHIBIT(ED)** light will be flashed.
- Functionality
 - Converter slip speed is controlled via engine torque limiting to regulate converter temperatures to acceptable levels.
 - **RANGE INHIBIT(ED)** light flashes 1 second before and during torque reduction.
- Criteria for activating COTP
 - First level of COTP (**RANGE INHIBIT(ED)** light flashes)
 - Difference of at least 1400 rpm or greater between engine speed and transmission input speed
 - 25% throttle or greater
 - Less than 100 rpm transmission output speed
 - All conditions above must be maintained for at least sixteen seconds to activate first level of COTP (less if initial converter temp predicted hot)
 - Second level of COTP (Engine Speed will be limited to 900 rpm and **RANGE INHIBIT(ED)** light flashes)

- Difference of at least 1400 rpm or greater between engine speed and transmission input speed
- 25% throttle or greater
- Less than 100 rpm transmission output speed
- Twenty-three seconds total of throttle and output conditions being met

Once you exit the COTP condition, a software counter will count back sixteen seconds before full engine rpm is available.

3.9.1.2 Converter Over-Temp Warning Protection

This transmission controls feature warns the operator of potential torque converter damage from the heat that is generated by excessive full-throttle or part-throttle stall operation. Stall conditions typically occur when a driver uses the service brakes to control vehicle speed while simultaneously using the throttle to maintain an elevated engine speed. Converter Over-Temperature Warning Protection is included in all 9-Speed calibrations.

When the transmission controls detect a high temperature condition in the converter, the controls warn the operator by activating the Sump Over-Temp warning if this indicator is installed by the vehicle builder.



NOTE: (Only SEM or LRTP equipped vehicles will be able to offer torque limits. Otherwise, only the range inhibit light will be flashed.)

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

- Above-idle **N** (Neutral)-to-range shifts
- Forward/reverse directional shifts
- Transmission problems
- Auxiliary equipment operation

3.9.2 Above-Idle Neutral-To-Range Shifts.

Above-idle (greater than 900 rpm in current Allison 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\(ED\) INDICATOR LIGHT](#) section in this manual for further information.

3.9.3 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\(ED\) INDICATOR LIGHT](#) section in this manual for further information.

3.9.4 Transmission Problems. Lights such as the **RANGE INHIBIT(ED)**, **CHECK TRANS**, **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:

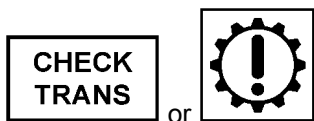
- Engine speed too high
- Throttle percentage incorrect
- Output speed movement

See the [3.9 RANGE INHIBIT\(ED\) INDICATOR LIGHT](#) 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 **5** (Fifth Range) or **7** (Seventh Range), **N** (Neutral) or **R** (Reverse).

3.9.5 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.

3.10 CHECK TRANS OR MALFUNCTION INDICATOR LIGHT (MIL)



The red or amber Check Transmission (**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 may indicate a problem with the engine or transmission, refer to section [7.0 DIAGNOSTICS](#) for more information.



CAUTION: Do not drive the vehicle for any longer than one-half hour after the MIL or **CHECK TRANS** indicator illuminates. Continued operation of the vehicle for more than thirty minutes after the Check Trans or Malfunction Indicator Light illuminates is not recommended. This thirty-minute window is intended to allow the operator to reach service assistance.

3.11 DIAGNOSTIC CODES OVERVIEW

Refer to detailed information in the [7.0 DIAGNOSTICS](#) section.

3.12 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.

3.13 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 calibrated value of output speed is reached. When a range downshift is manually selected and the transmission output speed is above the calibrated 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 calibrated value and then the shift to the lower range will occur.

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

3.13.1 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.

3.13.2 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.

3.14 REVERSE

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

3.15 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.

3.16 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 engine is above low idle rpm. 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.

3.17 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.

3.18 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 [6.0 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.

3.19 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.

3.20 PARK PAWL

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.



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.

3.20.1 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.

3.21 PARKING/LEAVING VEHICLE WITH ENGINE RUNNING



WARNING: For vehicles containing 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 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 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 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.

3.22 TOWING OR PUSHING



CAUTION: Failure to lift the drive wheels off the road, disconnect the driveline or remove the axle shafts before towing or pushing 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.

3.23 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 POWER TAKEOFF OPERATION

4.1 POWER TAKEOFF (PTO) SYSTEMS (RDS, MH, SP, T-Models and INT)

Three types of PTO systems may be used with the 9-Speed transmission:

- **Transmission-Mounted Turbine-Driven PTO** — A transmission-mounted turbine-driven PTO drive provides both an infinitely-variable PTO drive ratio and a protective hydraulic cushion against abrupt loading/unloading (during “converter mode” operation) and engine-driven PTO speed control (during “torque converter clutch mode” operation).
- **Flywheel-Driven PTO** — A flywheel-driven PTO, often called a “sandwich PTO,” mounts between the engine and transmission. The PTO is normally driven directly by the engine.

4.2 TURBINE-DRIVEN POWER TAKEOFF (PTO)

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

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

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

- **Constant-drive PTO** — Used in applications which require full-time PTO operation. The PTO driven gear is in constant mesh with the drive gear and cannot be disengaged.
- **Clutch shift PTO** — Used in applications which require only part-time operation of the PTO or the capability to engage or disengage the driven equipment. Clutch shift PTO engagement/disengagement provision is accomplished by a hydraulic clutch mechanism in the PTO assembly.

The PTO can be engaged or disengaged at any time (except when the PTO is controlled by the TCM).

4.2.2 PTO Engagement—Slide Engagement Internal To PTO.



CAUTION: Only use “constant-mesh” PTOs. DO NOT use “manual shift” PTOs which engage/disengage with the PTO drive gear in the transmission or the transmission may be damaged. Only use PTOs where the sliding gear is within the PTO.



WARNING: If you leave the vehicle and the engine is running, the vehicle can move unexpectedly and you or others could be injured. DO NOT leave the vehicle with the engine running unless you have taken all of the following precautions:

- Shift the transmission to **N** (Neutral), **P** (Park) or **PB** (Auto-Apply Parking Brake).
- Make sure that the engine is at low idle (500–800 rpm).
- Apply the park brake or emergency brake and make sure it is properly engaged.
- Chock the wheels and take any other steps necessary to keep the vehicle from moving.

Engage the PTO drivetrain as follows:

1. With the vehicle stopped, put the shift selector in a forward range while keeping the service brakes applied.
2. Set the engine speed at idle.
3. Engage the PTO. If gears do not engage, release the brakes momentarily to allow slight vehicle movement. Engage the PTO. Repeat as needed until the PTO is engaged.
4. Shift to **N** (Neutral) and operate the PTO as needed.

Disengage the PTO drivetrain as follows:

1. Idle the engine.
2. Set the brake.
3. Place the shift selector in a drive range, stopping the PTO-driven equipment.
4. Disengage the PTO.
5. Operate the vehicle in the normal manner.

4.2.3 PTO Engagement—Clutch Driven. The PTO will engage only when the PTO switch is on, the throttle position is low and engine speed and output speed are within user-specified limits. If the PTO is controlled by the TCM, your vehicle may have a light on the dash that illuminates when the PTO is engaged.



CAUTION: Some vehicles “creep” in range at low vehicle speeds while maintaining a specified engine speed for PTO operation (e.g., paint strippers and feedlot trucks). DO NOT use the vehicle brakes to control vehicle speed during PTO operation. Use ONLY throttle to control both engine and vehicle speed when the transmission is in reverse or a forward range. Applying BOTH brakes and throttle will cause the transmission to overheat. Extended operation at elevated temperatures will damage the transmission.



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

4.2.4 PTO Operation. The transmission operates in either converter mode or torque converter clutch mode. In converter mode, the torque converter (lockup) clutch is not engaged and the PTO is driven through the torque converter. In converter mode the speed is always less than engine speed and the torque is always greater than input torque. In torque converter clutch mode, the torque converter (lockup) clutch is engaged, the PTO drivetrain is driven at engine rpm.

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

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

- If the transmission is in **D** (Drive) or **R** (Reverse), the PTO output speed is zero.

- If the transmission is in **N** (Neutral), **P** (Park) or **PB** (Auto-Apply Parking Brake), the PTO output will rotate.

In some vehicles, the transmission shifts into **N** (Neutral) regardless of the shift selector position under the following conditions:

- The PTO is requested
- The transmission output speed is near zero
- The throttle position is near zero

To reselect a range after the PTO is turned off, the operator must shift into **N** (Neutral), then shift to the desired range.



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



CAUTION: When PTO disengagement occurs due to an overspeed condition, the PTO will automatically re-engage at a lower, user-specified speed. Re-engaging the PTO at a high speed can cause re-engagement shock that could damage a high-inertia PTO-driven system. PTO re-engagement speed parameters must be set by qualified, Allison trained personnel.

4.2.5 PTO Overspeed Protection. All 9-Speed-equipped vehicles with PTO request have engagement and operational speed limits programmed into the TCM to help protect PTO equipment. The PTO deactivates when operational speeds (either engine or transmission output) are exceeded. When the PTO is disengaged due to overspeed, the PTO will be automatically re-engaged at a user specified speed, which is relatively low.

5.0 PROGNOSTICS

5.1 9-SPEED SERVICE PROGNOSTICS

This feature of the transmission system provides a constant monitor of the following transmission operating parameters when available in the Allison calibration and enabled:

1. Oil Life
2. Filter Life

The default state is Prognostics OFF. If Prognostics is available in the TCM calibration it can be enabled in one of the following ways:

- When the TCM calibration is defined
- With Allison DOC program. An Allison Authorized Distributor or Dealer will need to perform this task.
- With the shift selector if allowed in the calibration via prognostics

Allow Enable/Disable via shift selector:

- Set the vehicle brakes to prevent movement of the vehicle
- Move the shift selector through the following sequence of range positions: **N-D-N-R-N-D-N-R-N-D-N-R-N**
- Pause no more than three (3) seconds between consecutive shifts

If desired, Prognostics may be disabled using either Allison DOC (performed by an Allison Authorized Distributor or Dealer) and/or the shift selector if allowed. Additionally, individual Prognostics operating parameters have independent enable/disable options in the controls calibration which can be switched on or off as specified by the customer. All Prognostics operating parameters, Oil Life and Fluid Filter Life are defaulted to enabled when Prognostics is enabled.

Once the Prognostics feature has been enabled, the following transmission operating parameters can be monitored by the system. Status of each of these monitors is broadcast as an SAE J1939 message which can be made available to the operator on a J1939-based dash display. The dash display

and its interface to the J1939 communication network are supplied and installed by the vehicle builder.

When a specified threshold is detected for any of these serviceable conditions, the **TRANS SERVICE** indicator is illuminated to alert the operator. Refer to [5.4 TRANS SERVICE INDICATOR](#) for details regarding this indicator.

Failure to attend to the service condition and reset the **TRANS SERVICE** indicator within a defined operating period will result in illumination of the **CHECK TRANS** light – indicating the increased probability that the service condition will develop into a more serious condition. The **CHECK TRANS** light is discussed in more detail in [3.10 CHECK TRANS OR MALFUNCTION INDICATOR LIGHT \(MIL\)](#).

The process for resetting the **TRANS SERVICE** indicator varies, as described in each of the following discussions. The Allison DOC diagnostics program may be used to review the current status of any of these features and a history of indicator resets.

5.2 OIL LIFE MONITOR

The display message indicates the calculated remaining life of the transmission fluid. This value is based on the established life for the required baseline fluid. The value is continuously adjusted for the cumulative effects of such operating parameters as operating time, output shaft revolutions and shift frequency.

The display denotes the percentage of the fluid life which remains. New fluid is displayed as OIL LIFE 99%.

The **TRANS SERVICE** indicator illuminates when the remaining fluid life reaches approximately 1-2 percent indicating the required change of the transmission fluid. The **TRANS SERVICE** indicator is lit steadily upon each initialization of the TCM and remains on for approximately two minutes after the initial selection of a drive range, until service is performed and the indicator is reset.

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** light (in addition to the **TRANS SERVICE** light). Any time this light is illuminated, the TCM registers a Diagnostic Trouble Code (DTC), which requires the use of Allison DOC to clear the code.

The **TRANS SERVICE** indicator can be reset by one of the following methods:

- Allison DOC

- Selecting **N-D-N-D-N-R-N** on the shift selector, with the ignition on and the engine not running if allowed in the calibration via Prognostics: Allow reset via shift selector sequence. Pause less than 3 seconds between each selector movement.
- Sending a message over the SAE J1939 communication interface if allowed in the calibration via Prognostics: Allow reset via J1939 command.

More details are provided in applicable vehicle manufacturer's owner's manual for your specific transmission model.

A historical record of the last six (6) resets, including mileage at the time of each reset, may be viewed using the Allison DOC diagnostics program.



NOTE: Required calendar-based filter change intervals are not monitored by this feature and remain applicable to all vehicle installations in addition to the above.

5.3 FILTER LIFE MONITOR

The display message indicates the operating status of the fluid filter, based on the accumulated hours of operation and mileage on the transmission since the previous filter change. The feature is not functional at transmission sump temperatures below 40° C (105° F).

An acceptable filter life condition will display as OIL FILTER OK whereas an unacceptable filter life condition is displayed as REPLACE FILTER.

The **TRANS SERVICE** indicator will flash when the filter has reached the end of its designated life indicating the required change of the transmission fluid. The **TRANS SERVICE** indicator will flash for two minutes after the initial selection of a **D** (Drive), until service is performed and the indicator is reset.

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** light (in addition to the **TRANS SERVICE** light). Any time this light is illuminated, the TCM registers a Diagnostic Trouble Code (DTC), which requires the use of Allison DOC to clear the code.

The **TRANS SERVICE** indicator can be reset by one of the following methods:

- Allison DOC
- Selecting **N-R-N-R-N-D-N** on the shift selector, with the ignition on and the engine not running if allowed in the calibration via Prognostics: Allow reset via shift selector sequence. Pause less than 3 seconds between each selector movement.

- Sending a message over the SAE J1939 communication interface if allowed in the calibration via Prognostics: Allow reset via J1939 command.

More details are provided in applicable Allison service literature for your specific transmission model.

In addition to viewing DTCs, Allison DOC may also be used to display the amount of transmission operation from the initial service indication until the service reset.



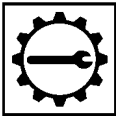
NOTE: Required calendar-based filter change intervals are not monitored by this feature and remain applicable to all vehicle installations in addition to the above.

5.4 TRANS SERVICE INDICATOR

5.4.1 Shift-By-Cable Trans Service Indicator.



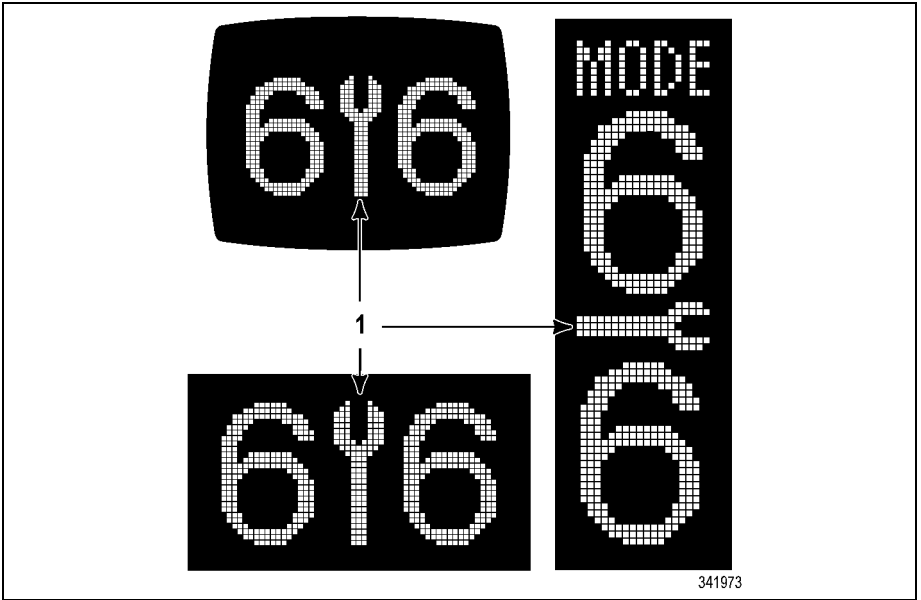
or



The Transmission Service (**TRANS SERVICE**) indicator is illuminated when a specified threshold has been reached for the transmission oil, filter or clutches. The purpose of **TRANS SERVICE** indicator is to alert the vehicle operator that a transmission service condition exists. The **TRANS SERVICE** indicator is illuminated differently for each of the two service conditions, as described above.

5.4.2 Shift-By-Wire Trans Service Indicator.

A wrench icon between the Select and Monitor displays on the face of the selector serves as the **TRANS SERVICE** indicator on the keypad pushbutton and bump lever shift selectors. Refer to [Figure 5-1](#).



(1) - Wrench Icon

Figure 5-1. TRANS SERVICE

6.0 CARE AND MAINTENANCE

6.1 PERIODIC INSPECTIONS AND CARE

6.1.1 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

6.1.2 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.

6.1.3 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 Allison Authorized 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.

6.2 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.

6.3 TRANSMISSION FLUID CHECK



WARNING: For vehicles containing 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 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 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 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.

6.3.1 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.

6.3.2 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.

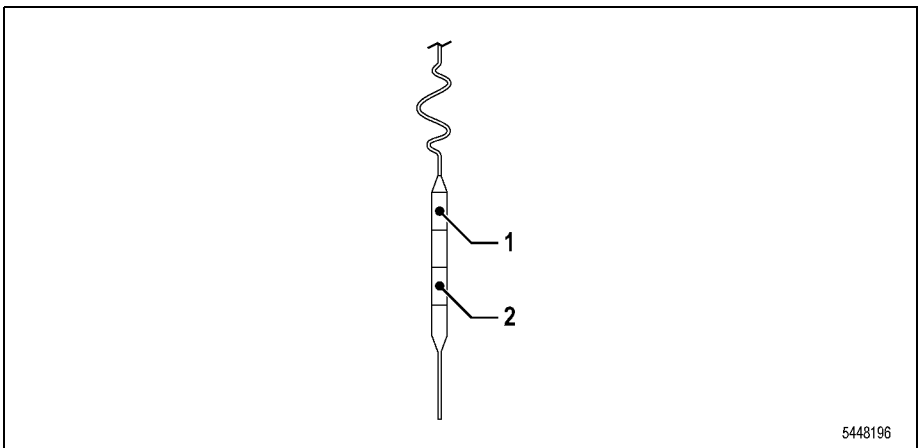


CAUTION: The fluid level rises as fluid temperature rises. **DO NOT** fill the transmission above the COLD band if the transmission fluid is below normal operating temperatures. During operation, an overfull transmission can become overheated, leading to transmission damage.

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) depending on the type of parking options equipped on the transmission as explained in the warnings above.
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), **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 band (refer to [Figure 6-1](#)), the transmission may be operated until the fluid is hot enough to perform a HOT CHECK. If the fluid level is not within the COLD band, add or drain fluid as necessary to bring it to the middle of the COLD 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.



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(1) – HOT Band

(2) – COLD Band

Figure 6-1. Typical Dipstick Markings

6.3.3 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)

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) depending on the type of parking options equipped on the transmission as explained in the warnings above.
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 band on the dipstick (refer to [Figure 6-1](#)). The width of the HOT 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 band, add or drain as necessary to bring the fluid level to within the HOT band.

6.3.4 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.

6.4 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.

6.5 FLUID RECOMMENDATIONS

Hydraulic fluids (oils) used in the transmission are important influences on transmission performance, reliability and durability. Any fluids meeting TES 295 or TES 668 specifications are acceptable for use in the 9-Speed transmissions.

To make sure the fluid is qualified for use in Allison transmissions, check for a TES 295 or TES 668 fluid license or approval numbers on the container or consult the lubricant manufacturer. Consult your Allison Authorized Distributor or Dealer 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), **PB** (Auto-Apply Parking Brake) (if available) or **N** (Neutral) for a minimum of 20 minutes before attempting range operation.

Table 6–1. Transmission Fluid Operating Temperature Requirements

Viscosity Grade	Ambient Temperature Below Which Preheat is Required	
	Celsius	Fahrenheit
Allison TES 295 or TES 668 Approved	-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 6–1](#). As the transmission reaches normal operating temperature, all shift ranges and the torque converter clutch mode begin to function.

6.6 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.

6.6.1 Frequency.



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.

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.

The following table is given only as a general guide for fluid and filter change intervals.



NOTE: Refer to [Table 6–2](#) for Filter Type/Part Number Information and Fluid Capacity Information.



NOTE: Change fluid and filters at or before recommended mileage, months or hours have elapsed, whichever occurs first.



NOTE: 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. Allison recommends that customers use fluid analysis as the primary method for determining fluid change intervals. In the absence of a fluid analysis program the fluid change intervals listed in the charts should be used.

Table 6–2. Recommended Filter Change/Fluid Intervals

9-Speed Fluid And Filter Change Interval Recommendations			
		Prognostics Turned Off or Not Calibrated in TCM	Prognostics Turned On
	Duty Cycle	Allison Approved TES 668 and/or TES 295 Fluid	Allison Approved TES 668 and/or TES 295 Fluid
Fluid	General*	150,000 Miles (240,000 km) 4,000 Hours 48 Months	When indicated by controller or 48 months, whichever occurs first
	Severe**	75,000 Miles (120,000 km) 3,000 Hours 36 Months	
Spin-On Control Main Filter	General*	50,000 Miles (80,000 km) 2,000 Hours 24 Months	When indicated by controller or 48 months, whichever occurs first
	Severe**	50,000 Miles (80,000 km) 2,000 Hours 24 Months	
Internal Filter	All	Overhaul	Overhaul

* General Vocation: All vocations not classified as Severe
 ** Severe Vocation: On/Off Highway, City Transit, Shuttle Transit

6.6.2 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.

6.6.3 Fluid Analysis. Transmission protection and fluid change intervals can be optimized by monitoring fluid oxidation according to the tests and limits shown in Table 6–3. Fluid oxidation can be monitored through a fluid analysis firm and/or by using an oil analysis kit. Allison 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 Table 6–2 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 parts source.

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

Table 6–3. 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.	

6.7 TRANSMISSION FLUID CONTAMINATION

6.7.1 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.

6.7.2 Water. Obvious water contamination of the transmission fluid requires inspecting and pressure testing the cooler (heat exchanger) for leaks between the water and fluid areas. Engine oil or transmission fluid in the water side of the cooler (heat exchanger) is another sign of a leak. Be sure to locate the correct source of contamination.

6.7.3 Engine Coolant.



CAUTION: Engine coolant in the transmission hydraulic system requires immediate action to prevent malfunction and possible serious transmission damage. Completely disassemble, inspect and clean the transmission. Remove all traces of the coolant and varnish deposits resulting from engine coolant contamination. Replace the torque converter, all seals, gaskets, bearings, friction clutch plates, solenoids and all rusted parts.

Any trace of glycol or greater than 0.2 percent water contamination requires complete disassembly and cleanup of the transmission and replacement of seals, gaskets, clutch plates and bearings. Solenoid resistance should be measured and checked against the specifications. Solenoids not within specification should be replaced. Refer to SIL 18-TR-98.

6.7.4 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.

6.8 TRANSMISSION FLUID AND FILTER CHANGE PROCEDURE

6.8.1 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 [6.7.1 Fluid Examination](#) paragraph in this section.

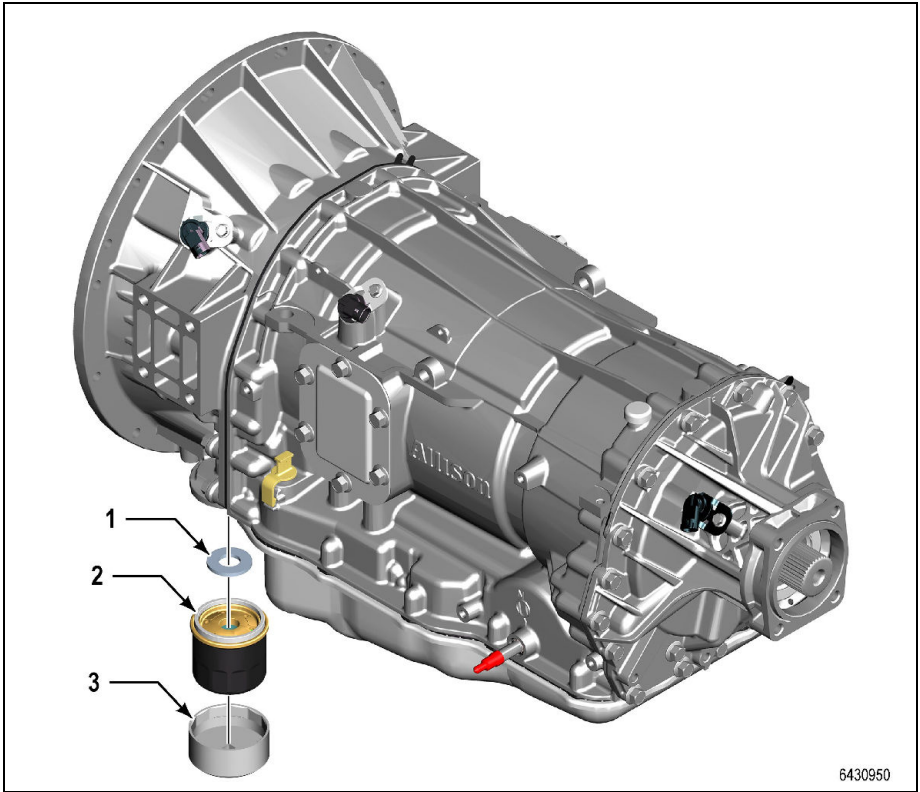
6.8.2 Replace Control Main Filter.

1. Using a standard strap-type filter wrench or the J-45023-A Control Main Filter Wrench, remove the control main filter (Figure 6-2) 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-A Control Main Filter Wrench 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).



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- (1) – Magnet
- (2) – Filter

- (3) – J-45023-A Control Main Filter Wrench

Figure 6–2. Replacing the Control Main Filter

6.8.3 Refill Transmission. Refer to [Table 6–4](#) for fluid refill quantities. 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 procedure described in [6.3 TRANSMISSION FLUID CHECK](#).



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

Table 6–4. Transmission Fluid Capacity

Sump	Initial Fill*		Refill **	
	Liters	Quarts	Liters	Quarts
Standard	15.0	15.9	7.6	8.0

* Fluid fill capacity is dependent of vehicle configuration. Final fluid capacity must be determined by dipstick level (refer to TRANSMISSION FLUID CHECK)

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

Initial Fill — the minimum quantity required to facilitate start-up of a transmission after disassembly and rebuild. Before operating each transmission, a "top-off" operation with the engine running is required in order to properly fill all external circuit components and to establish proper fluid level.

Refill — the minimum quantity required to facilitate start-up of a transmission after a drain and refill procedure. Before operating transmission, a "top-off" operation with the engine running is required in order to properly fill all external circuit components and to establish proper fluid level.

6.9 BREATHER

6.9.1 Location and Purpose. The vent assembly (breather) is located at the top left-rear of the transmission main housing (refer to [Figure 1–2](#)). The vent assembly 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 the vent assembly (breather). Spraying steam, water or cleaning solution at the vent assembly can force the water or cleaning solution into the transmission and contaminate the transmission fluid. Seal all openings and the vent assembly (breather) before spraying steam, water or cleaning solutions on the transmission.

6.9.2 Maintenance. The amount of dust and dirt encountered determines the frequency of vent assembly (breather) cleaning. Use care when cleaning the transmission.

7.0 DIAGNOSTICS

7.1 DIAGNOSTICS

Diagnostic features are provided with the transmission control system to assist in troubleshooting of malfunctions and the monitoring of specific operating parameters. These features include a **CHECK TRANS** light at the operators station and a PC-based diagnostic program, Allison DOC. When a malfunction is detected in the control system, a series of diagnostic codes are used to identify and clarify the nature of the malfunction.

7.2 CHECK TRANS or MALFUNCTION INDICATOR LIGHT

The electronic control system is programmed to inform the operator of a problem with the transmission system and automatically take action to protect the operator, vehicle and transmission. To do this, the TCM turns on the **CHECK TRANS** light or the **MIL** (Malfunction Indicator Light — used in OBD-II applications) on the instrument panel, which notifies the operator that a DTC has been stored.

Each time the engine is started, the TCM illuminates the **CHECK TRANS** light or the **MIL**, then turns it off after a few seconds. This is a circuit check to verify that the lamp and wiring are in proper working order. Illumination of the **CHECK TRANS** light or the **MIL** at any time after start-up indicates that the TCM has set a DTC. Use Allison DOC to verify that the TCM has set a DTC. While the **CHECK TRANS** light is on, upshifts and downshifts may be restricted and direction changes (D–R, R–D) may not occur. The torque converter clutch may be inhibited when transmission shifting is restricted or during any critical transmission malfunction.

The 9-Speed transmission DTCs are latching DTCs. When a failure condition is detected, the DTC set by the TCM remains active for the entire time the ignition is on. When the ignition is turned off and then on again, the transmission DTCs reset and the TCM rechecks for the failure condition. If the failure condition is not present, the previously set DTC remains in history; the **CHECK TRANS** light or the **MIL** turns off after the circuit check and the transmission will function normally unless another failure occurs. This feature allows the vehicle to be driven to a service center.

7.3 ALLISON DOC

Allison DOC is a PC-based diagnostic tool for use with 9-Speed transmissions. The Allison DOC is a full feature diagnostic software application supporting the Allison transmission control systems. When installed on the user's own PC, it allows the technician to acquire data from the transmission's control system and, using the troubleshooting manuals embedded in the software, conduct systematic troubleshooting of transmission complaints. Refer to the Allison DOC User Guide, GN7588EN, for complete information.



NOTE: For the latest Allison DOC information, refer to allisontransmission.com → PARTS + SERVICE → ELECTRONICS DIAGNOSTICS + TOOLS.

7.4 DIAGNOSTIC CODES

Illumination of the **CHECK TRANS** light at any time after the start-up bulb check indicates that the TCM has registered a diagnostic code. As many as five codes may be recorded in memory, listed in the order of newest to oldest. Diagnostic codes may be accessed through Allison DOC and may be displayed at any transmission output shaft speed.

7.4.1 Shift-by-Wire Diagnostics.

Shift-by-Wire diagnostic codes may also be accessed by the Allison shift selector. The process for displaying diagnostic codes on the selector display depends upon the style of the shift selector:

- Keypad pushbutton selectors: simultaneously press the UPSHIFT and DOWNSHIFT arrows on the selector
- Bump lever selectors: depress the button with the Allison logo
- Prognostics functions are enabled in the TCM controls calibration, the Prognostics readouts are displayed next.
- Diagnostics codes are then displayed. Up to five DTCs may be displayed one at a time from the selector once the diagnostic display mode has been initiated by the operator. Each code remains on the display until the next code, if present, is accessed by depressing the **MODE** button. Active codes are displayed first, newest to oldest, followed by any inactive codes that are still in memory. Each DTC is 5 characters in length. The DTC status active or inactive is shown below the DTC (refer to [Figure 7-1](#)).



Figure 7–1. DTC Display

7.4.2 Reading DTCs With Prognostics Package On.

To read DTCs with prognostics on using the keypad push button shift selector:

- Simultaneously press the ↑ (Upshift) and ↓ (Downshift) arrows three times to enter diagnostic mode.
- Press the **MODE** button to read the next code in the queue, if any.

To read DTCs with prognostics on using the bump-shift lever selector:

- Press the **DISPLAY MODE/DIAGNOSTIC** (DMD) three times to enter diagnostic mode.
- Press the **MODE** button to read the next code in the queue, if any.

7.4.3 Reading DTCs With Prognostics Package Off.

To read DTCs with prognostics off using the keypad push button shift selector:

- Simultaneously press the ↑ (Upshift) and ↓ (Downshift) arrows once to enter diagnostic mode.
- Press the **MODE** button to read the next code in the queue, if any.

To read DTCs with prognostics off using the bump-shift lever selector:

- Press the **DISPLAY MODE/DIAGNOSTIC** (DMD) once to enter diagnostic mode.
- Press the **MODE** button to read the next code in the queue, if any.

7.4.4 Exiting Diagnostic Mode.

Any of the following methods may be used to exit the diagnostic display mode:

- With keypad pushbutton shift selectors: Simultaneously depress the UPSHIFT and DOWNSHIFT arrows or press any range button, **D** (Drive), **N** (Neutral) or **R** (Reverse). If the shift is not inhibited by an active code, the TCM will command the transmission to shift to the selected range.
- With bump lever shift selectors: Momentarily press the Allison logo button or move the shift selector to any shift position other than the one

selected when the diagnostic display mode was activated. If the shift is inhibited due to a service condition, the TCM will continue to command the current transmission range attained and the bump lever should be returned to its previous position.

- Wait until time-out, approximately ten minutes. The system will automatically return to the normal operating mode.
- Turn off the vehicle engine with the ignition switch, which turns off power to the TCM.

7.4.5 Clearing DTCs.

While in diagnostic mode, clear all active codes by pressing and holding the **MODE** button for approximately three seconds until the MODE message flashes. Release the **MODE** button. The MODE message should not remain illuminated if the active DTC shown in the display has cleared.

To clear all stored DTCs, press and hold the **MODE** button for ten seconds. The MODE message flashes a second time indicating all codes are cleared from the queue.



NOTE: Any codes that cause the **CHECK TRANS** light are considered severe enough to warrant immediate attention from a qualified repair facility. Schedule repair as soon as possible.



NOTE: If an active DTC is cleared while the transmission is locked in range because of the diagnostic response to an active DTC, the transmission remains in that locked range even after clearing the active DTC. **N** (Neutral) must be manually selected or the ignition must be cycled.



NOTE: Some codes will self-clear once the conditions that caused the active code are not present. These codes will be stored as inactive in the DTC queue. Some DTCs require an ignition cycle before they can be cleared from active status.



NOTE: If the condition(s) that caused the active code are still present, the code becomes active again.

After a fixed number of ignition cycles, a diagnostic code will automatically disappear from memory if it has not reoccurred. Ignition cycle counts, which indicate the age of a stored code, and event counts, which indicate the

frequency of code occurrence, are available for reference – but accessible only with Allison DOC.

7.4.6 Diagnostic Trouble Codes.

Table 7–1. Diagnostic Trouble Codes for 9-Speed Transmissions

DTC	Description	CHECK TRANS Light
P0122	Pedal Position Sensor Circuit Low Voltage	Yes
P0123	Pedal Position Sensor Circuit High Voltage	Yes
P0218	Transmission Fluid Over Temperature Condition	No
P0600	Solenoid Controller Serial Peripheral Interface Communication Bus Off	Yes
P0602	TCM Not Programmed	Yes
P0603	Internal Control Module Keep Alive Memory Error	No
P0604	Control Module Random Access Memory (RAM)	No
P0607	Control Module Performance	No
P060C	Internal Control Module Main Processor Performance	No
P0614	Torque Control Data Mismatch - ECM/TCM	Yes
P0634	TCM Internal Temperature Too High	Yes
P0642	Sensor Reference Voltage "3" Circuit Fault	Yes
P0652	Sensor Reference Voltage "4" Circuit Fault	Yes
P0657	Actuator Supply Circuit Voltage 1 Open (HSD 1)	Yes
P0658	Actuator Supply Circuit Voltage 1 Low (HSD 1)	Yes
P0659	Actuator Supply Circuit Voltage 1 High (HSD 1)	Yes
P0701	Transmission Control System Performance	No
P0703	Brake Switch Circuit	Yes
P0706	Transmission Range Sensor Start In Wrong Range	Yes
P0707	Transmission Range Sensor Circuit Low	Yes
P0708	Transmission Range Sensor Circuit High	Yes
P0711	Transmission Fluid Temperature Sensor Circuit Performance	Yes
P0712	Transmission Fluid Temperature Sensor Circuit Low	Yes
P0713	Transmission Fluid Temperature Sensor Circuit High	Yes

Table 7–1. Diagnostic Trouble Codes for 9-Speed Transmissions (cont'd)

DTC	Description	CHECK TRANS Light
P0715	Turbine Shaft Speed Sensor Circuit	Yes
P0716	Turbine Shaft Speed Sensor Circuit Performance	Yes
P0717	Turbine Shaft Speed Sensor Circuit No Signal	Yes
P071A	Neutral At Stop Input	Yes
P0720	Output Shaft Speed Sensor Circuit	Yes
P0721	Output Shaft Speed Sensor Circuit Performance	Yes
P0722	Output Shaft Speed Sensor Circuit No Signal	Yes
P0725	Engine Speed Sensor Circuit	Yes
P0726	Engine Speed Sensor Circuit Performance	Yes
P0727	Engine Speed Sensor Circuit No Signal	Yes
P0729	Incorrect 6th Gear Ratio	Yes
P0731	Incorrect 1st Gear Ratio	Yes
P0732	Incorrect 2nd Gear Ratio	Yes
P0733	Incorrect 3rd Gear Ratio	Yes
P0734	Incorrect 4th Gear Ratio	Yes
P0735	Incorrect 5th Gear Ratio	Yes
P0736	Incorrect Reverse Ratio	Yes
P0741	Torque Converter Clutch (TCC) System Stuck Off	Yes
P076F	Incorrect 7th Gear Ratio	Yes
P0776	Pressure Control Solenoid (PCS) 2 Stuck Off	Yes
P0777	Pressure Control Solenoid (PCS) 2 Stuck On	Yes
P0796	Pressure Control Solenoid (PCS) 3 Stuck Off	Yes
P0797	Pressure Control Solenoid (PCS) 3 Stuck On	Yes
P07CE	Neutral At Stop Not Functioning	Yes
P07D9	Incorrect 8th Gear Ratio	Yes
P07F6	Incorrect 9th Gear Ratio	Yes
P0837	Four Wheel Drive (4WD) Switch Circuit Range/Performance	Yes
P0842	Transmission Fluid Pressure Switch 1 Circuit Low	Yes

Table 7–1. Diagnostic Trouble Codes for 9-Speed Transmissions (cont'd)

DTC	Description	CHECK TRANS Light
P0843	Transmission Fluid Pressure Switch 1 Circuit High	Yes
P0847	Transmission Fluid Pressure Switch 2 Circuit Low	Yes
P0848	Transmission Fluid Pressure Switch 2 Circuit High	Yes
P085D	Requested Direction Mismatch with Gear Shift Module 1	Yes
P085E	Requested Direction Mismatch with Gear Shift Module 2	Yes
P0872	Transmission Fluid Pressure Switch 3 Circuit Low	Yes
P0873	Transmission Fluid Pressure Switch 3 Circuit High	Yes
P0877	Transmission Fluid Pressure Switch 4 Circuit Low	Yes
P0878	Transmission Fluid Pressure Switch 4 Circuit High	Yes
P0880	TCM Power Input Signal	No
P0881	TCM Power Input Signal Performance	No
P0882	TCM Power Input Signal Low	Yes
P0883	TCM Power Input Signal High	Yes
P088B	Transmission Filter Maintenance Required	Yes
P0894	Unexpected Mechanical Gear Disengagement	Yes
P0897	Transmission Fluid Deteriorated	Yes
P0960	Main Pressure Modulation Solenoid Control Circuit Open	Yes
P0961	Main Pressure Modulation Solenoid System Performance	Yes
P0962	Main Pressure Modulation Solenoid Control Circuit Low	Yes
P0963	Main Pressure Modulation Solenoid Control Circuit High	Yes
P0964	Pressure Control Solenoid (PCS) 2 Control Circuit Open	Yes
P0965	Pressure Control Solenoid (PCS) 2 System Performance	Yes
P0966	Pressure Control Solenoid (PCS) 2 Control Circuit Low	Yes
P0967	Pressure Control Solenoid (PCS) 2 Control Circuit High	Yes
P0968	Pressure Control Solenoid (PCS) 3 Control Circuit Open	Yes
P0969	Pressure Control Solenoid (PCS) 3 System Performance	Yes
P0970	Pressure Control Solenoid (PCS) 3 Control Circuit Low	Yes
P0971	Pressure Control Solenoid (PCS) 3 Control Circuit High	Yes

Table 7–1. Diagnostic Trouble Codes for 9-Speed Transmissions (cont'd)

DTC	Description	CHECK TRANS Light
P0973	Shift Solenoid 1 Control Circuit Low	Yes
P0974	Shift Solenoid 1 Control Circuit High	Yes
P0976	Shift Solenoid 2 Control Circuit Low	Yes
P0977	Shift Solenoid 2 Control Circuit High	Yes
P097A	Shift Solenoid 1 Control Circuit Open	Yes
P097B	Shift Solenoid 2 Control Circuit Open	Yes
P1790	Gear Shift Module 1 Calibration Invalid	Yes
P1891	Throttle Position Sensor PWM Signal Low	Yes
P1892	Throttle Position Sensor PWM Signal High	Yes
P2637	Torque Management Feedback Signal A	Yes
P2641	Torque Management Feedback Signal B	Yes
P2669	Actuator Supply Circuit Voltage 2 Open (HSD 2)	Yes
P2670	Actuator Supply Circuit Voltage 2 Low (HSD 2)	Yes
P2671	Actuator Supply Circuit Voltage 2 High (HSD 2)	Yes
P2684	Actuator Supply Circuit Voltage 3 Open (HSD 3)	Yes
P2685	Actuator Supply Circuit Voltage 3 Low (HSD 3)	Yes
P2686	Actuator Supply Circuit Voltage 3 High (HSD 3)	Yes
P2714	Pressure Control Solenoid (PCS) 4 Stuck Off	Yes
P2715	Pressure Control Solenoid (PCS) 4 Stuck On	Yes
P2718	Pressure Control Solenoid (PCS) 4 Control Circuit Open	Yes
P2719	Pressure Control Solenoid (PCS) 4 System Performance	Yes
P2720	Pressure Control Solenoid (PCS) 4 Control Circuit Low	Yes
P2721	Pressure Control Solenoid (PCS) 4 Control Circuit High	Yes
P2723	Pressure Control Solenoid (PCS) 1 Stuck Off	Yes
P2724	Pressure Control Solenoid (PCS) 1 Stuck On	Yes
P2727	Pressure Control Solenoid (PCS) 1 Control Circuit Open	Yes
P2728	Pressure Control Solenoid (PCS) 1 System Performance	Yes
P2729	Pressure Control Solenoid (PCS) 1 Control Circuit Low	Yes

Table 7–1. Diagnostic Trouble Codes for 9-Speed Transmissions (cont'd)

DTC	Description	CHECK TRANS Light
P2730	Pressure Control Solenoid (PCS) 1 Control Circuit High	Yes
P2732	Pressure Control Solenoid (PCS) 5 Stuck Off	Yes
P2733	Pressure Control Solenoid (PCS) 5 Stuck On	Yes
P2736	Pressure Control Solenoid (PCS) 5 Control Circuit Open	Yes
P2737	Pressure Control Solenoid (PCS) 5 System Performance	Yes
P2738	Pressure Control Solenoid (PCS) 5 Control Circuit Low	Yes
P2739	Pressure Control Solenoid (PCS) 5 Control Circuit High	Yes
P2761	Torque Converter Clutch (TCC) Pressure Control Solenoid (PCS) Control Circuit/Open	Yes
P2762	Torque Converter Clutch (TCC) Pressure Control Solenoid (PCS) Control Circuit Range/Performance	Yes
P2763	Torque Converter Clutch (TCC) Pressure Control Solenoid (PCS) Control Circuit High	Yes
P2764	Torque Converter Clutch (TCC) Pressure Control Solenoid (PCS) Control Circuit Low	Yes
P2793	Gear Shift Direction Circuit	Yes
P27B2	Internal Control Module Transmission Range Control Performance	Yes
P27B4	Internal Control Module Transmission Gear Direction Control Performance	Yes
P27B6	Internal Control Module Transmission Speed Sensor Performance	Yes
P2801	Transmission Range Sensor 2 Performance	Yes
P2802	Transmission Range Sensor 2 Circuit Low	Yes
P2803	Transmission Range Sensor 2 Circuit High	Yes
P2805	Transmission Range Sensor 1/2 Correlation	Yes
U0073	CAN Communication Bus 1 Off	Yes
U0074	CAN Communication Bus 2 Off	Yes
U0100	Lost Communications with ECM A	Yes
U0103	Lost Communication with Gear Shift Module 1	Yes

Table 7–1. Diagnostic Trouble Codes for 9-Speed Transmissions (cont'd)

DTC	Description	CHECK TRANS Light
U0304	Gear Shift Module 1 Incompatible	Yes
U0400	Invalid CAN Communications Error	Yes
U0404	Gear Shift Module 1 Invalid Data	Yes
U1401	TCM Imposter Broadcasting J1939 TSC1 Message to Engine	No
U1402	TCM Imposter Broadcasting J1939 TSC1 Message to Compression Brake	No
U1403	TCM Imposter Broadcasting J1939 TSC1 Message to Exhaust Brake	No

8.0 CUSTOMER SERVICE

8.1 OWNER ASSISTANCE

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

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

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

Normally, any situation that arises in connection with the sale, operation or service of your transmission will be handled by the distributor or dealer in your area. Check the telephone directory for the Allison Transmission service outlet nearest you or use Allison Transmission's Sales and Service Locator tool on the Allison Transmission website at allisontransmission.com.

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, Inc. dealers are associated with an Allison Transmission, Inc. distributor. If the problem originates with a dealer, explain the matter to a management member of the distributorship with whom the dealer has a service agreement. The dealer will provide the 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 Allison 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 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
Attn: 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.

8.2 SERVICE LITERATURE

Allison service literature provides fully illustrated instructions for operation, maintenance, troubleshooting, service, overhaul and parts support for your transmission. For maximum performance and service life from your unit, you may order additional publications via phone, email or web.

Electronic versions of the publications can be found on the Allison HUB under *Publications* ⇒ *Allison ePubs*.

TOLL FREE: 844-829-3595
INTERNATIONAL: 613-271-3842
allisontransmission@gilmore.ca
allisontransmissionpublications.com

For more information about Allison products please visit
allisontransmission.com.

8.3 ALLISON TRANSMISSION DISTRIBUTORS



NOTE: Go to allisontransmission.com/sales-service-locator for a complete and up-to-date listing of Allison Transmission Service Centers.

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A World of Support

From our headquarters in Indianapolis, Indiana, USA, to our manufacturing plants in Hungary and India, to approximately 1,600 Allison Authorized Distributors and Dealers around the globe, you are never far from the products, training, service and support you demand.

Our support starts from the moment an Allison transmission is specified. We work with you to ensure that the model and ratings fit your engine to create a tailored package of powerful performance and reliable efficiency. When you need parts or service, you can count on global access to factory-trained specialists and Allison Genuine Parts™.



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